THE SEMICONDUCTOR DATA LIBRARY

MOTOROLA Semiconductor Products Inc.

FIRST EDITION

REFERENCE VOLUME

MASTER INDEX
MASTER SELECTION GUIDES
OUTLINE DRAWINGS
HARDWARE AND PACKAGING
APPLICATION NOTE INDEX

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FIRST EDITION

prepared by
Technical Information Center

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One of the major problems facing workers in the electronics field is the identification and selection of semiconductor devices. Type numbers assigned to the semiconductors are of little value since they indicate neither device parameters nor applications. Because it is difficult even to identify the many thousands of device type numbers, let alone evaluate their merits for a particular application, engineers often limit their designs to a few well-known device types — despite the fact that newer or more suitable devices may be available. To help alleviate this problem, the Motorola Semiconductor Data Library has been developed.

The Motorola Semiconductor Data Library identifies and characterizes all semiconductor devices with 1N- - -, 2N- - -, and 3N- - - numbers registered with the Electronics Industries Association at the time the library was printed, as well as a broad line of devices with special in-house type numbers. (It provides complete data sheet specifications for a wide range of discrete semiconductors, and short-form specifications for integrated circuits.) And in addition, to simplify the selection of the most useful semiconductor type numbers, it contains carefully prepared selector guides with recommended devices for specific applications. Properly used, it can be a valuable aid for the design engineer, the component engineer, and the purchasing agent in narrowing the broad categories of potentially usable components to those best suited for a specific project.

COMPOSITION OF THE LIBRARY

The Semiconductor Data Library is divided into three volumes, organized as follows:

REFERENCE VOLUME

The reference volume is a self-contained compendium of semiconductor devices and integrated circuits information. This volume enables the user to locate and select devices for most any application or specific circuit. It also contains package and hardware information as well as applications information. Once a preliminary selection of a potentially suitable device has been made, consult Volumes I or II for detailed specifications for that particular device.

EIA Registered Device Index — Complete numerical index of all EIA registered device types, with major electrical specifications.

Non-Registered Device Index — Complete numerical index of all in-house non-registered Motorola device types, with major electrical specifications.

Microcircuits Components — Unencapsulated transistors, diodes, passive devices, and integrated circuits for use in hybrid circuits. (Includes processing, packaging, and inspection criteria.)

Master Selection Guides — Grouping of preferred devices by major device categories for quick preselection of devices best suited for specific applications. Includes semiconductor devices and ICs.

Military Device Listing — A complete list of Motorola devices that comply with Military Specifications.

Hardware and Packaging Information — Device mounting hardware, heat sinks and special device packaging.

Dimensioned Device Outlines — Dimensioneddrawings of package outlines with JEDEC and Motorola cross reference. (Includes leadform drawings on specific packages.)

Application Note Catalog — Selection guide listing application note by application category. Also a brief summary of the available application note contents and how to order application notes.

To meet the requirements of a practical up-to-date reference, the Reference Volume of the Semiconductor Library will be completely updated and published twice a year, with supplementary publications quarterly.

VOLUME I

This volume contains complete data sheets for Motorola-manufactured devices with EIA-registered type numbers up to 1N4999 and 2N4999. Data sheets are in numerical sequence according to device type number except for those data sheets that cover several devices with differing type numbers. A numerical index in front of the book permits the user to quickly locate the page number of the data sheet for any device characterized in the book.

Since most of the device type numbers in the "below 5000" category have already been utilized by existing product, it is expected that this book will require little updating in the next few years. Accordingly, this volume will be reprinted only as required by the demand, and modifications will be made only when reprinting is required.

VOLUME II

This volume contains data sheets for all Motorola-manufactured, EIA registered devices with type numbers 1N5000 and 2N5000 and up, as well as those with 3N- - - type numbers. In addition, all active data sheets for devices with special Motorola type numbers (not registered with EIA) are included.

Because this book contains the detailed data for all the most recently developed semiconductors, it will be updated through the publication of supplements. Two supplements will be published during the life of this edition.

How to Use The Semiconductor Data Library

The library is designed to serve several specific functions;

1. To permit quick identification (together with major specifications) of EIA registered semiconductor devices with units with special Motorola type numbers.
2. To permit quick selection of the most suitable devices for a specific circuit application.
3. To permit quick selection of the devices that best meet a given set of electrical specifications.
4. To provide complete characterization of a broad line of components, encompassing most semiconductor categories, for a detailed comparison of device types.

The following examples illustrate several ways of using this library.

Problem: Device Identification

Known: Device Type Number

Information Needed: Device function, applications, major specifications.

Procedure: Consult the Master Index of the Reference Volume and locate the type number of the device in question in the alpha-numeric listing of the master index. The information given in this index lists not only the type of device it is, but also provides the major electrical specifications for the device. In addition, it indicates whether or not the device is manufactured by Motorola and, if not, whether Motorola can supply an electrically suitable equivalent. Complete data for Motorola manufactured devices can then be obtained, if required, from the other two volumes of your Semiconductor Data Library.

Problem: Device Preselection

Known: a) Intended circuit application for a particular device

b) Approximate electrical specifications of a desired device.

Information Needed: a) What devices are available for a specific circuit function?

b) What device types will best match a required set of electrical characteristics?

Procedure: Consult the Master Selection Guide section of the Reference Volume. This section contains product categories, i.e., power transistors, zener diodes, etc., and by specific market segments, including communications, consumer and military. An index to the individual selector guides is given at the beginning of the section for quick access to the pertinent guides. Complete data for Motorola manufactured devices can then be obtained, if required, from the other two volumes of your Semiconductor Data Library.

CATALOGUE DE SEMICONDUCTEURS

Identifier et ensuite choisir les dispositifs semiconducteurs constituent l'un des grands problèmes que rencontrent ceux qui travaillent dans le domaine de l électronique. Les différents dispositifs sont désignés par des chiffres ne donnant aucune indication sur leurs paramètres et sur leurs applications. La difficulté pour les techniciens et ingénieurs d'identifier plusieurs milliers de dispositifs les amènent à utiliser, lors de la conception de circuits, des dispositifs bien connus alors que d'autres dispositifs mieux adaptés sont disponibles. Afin de pallier cet inconvénient, Motorola a donc institué ce catalogue de semiconducteurs.

Le Catalogue de Semiconducteurs de Motorola identifie et caractérise les dispositifs semiconducteurs enregistrés auprès de l'Association des Industries Electroniques (EIA) par les symboles 1N---, 2N---, et 3N--- ainsi que les dispositifs propres à Motorola avec des numéros spéciaux. (Ce catalogue contient les spécifications complètes pour tous les semiconducteurs discrets, et des spécifications abrégées pour les circuits integrés.) De plus, afin de simplifier le choix des dispositifs les plus utiles, il contient également un "guide" mettant en évidence les dispositifs destinés à des applications bien spécifiques. Son utilisation adéquate peut donc être un outil de travail très utile pour l'ingénieur de circuit, l'ingénieur de composants, et l'acheteur en leur permettant de limiter le nombre de composants possible convenent le mieux pour un projet bien determiné.

INDEX DU CATALOGUE

Le Catalogue de Semiconducteurs comprend trois volumes:

VOLUME DE REFERENCE

Le volume de référence résume les renseignements sur les dispositifs semiconducteurs et circuits intégrés. Ce volume permet donc à l'utilisateur de déterminer et de choisir les dispositifs pour la majorité des applications; il contient également des renseignements sur les boitiers et sur les systèmes de montage. Une fois le choix du dispositif effectué, il suffit de consulter les Volumes I et II pour obtenir toutes les données concernant ce dispositif.

Index des Dispositifs Homologués par EIA

Cet index fournit également les données électriques principales.

Index des Dispositifs Non-Homologués

Cet index fournit une liste complète des dispositifs Motorola non-homologués, avec leurs données électriques principales.

Composants Micro-circuits

Transistors et diodes non-encapsulés, éléments passifs et circuits intégrés pour utilisation en circuits hybrides (y compris processus, mise en boitier et critères d'inspection.)

Guide

Les dispositifs les plus utilisés y sont groupés par catégories principales pour un choix rapide des composants les mieux adaptés à certaines applications (y compris dispositifs discrets et circuits intégrés.)

Liste des Dispositifs Militaires

Cette liste fournit tous les dispositifs Motorola homologués par les Spécifications Militaires.

Boitiers et Modes de Montage

Fournit les modes de montage, les radiateurs et les boitiers spéciaux.

Dimension des Boitiers

Dessin et dimension des boitiers homologués par JEDEC et Motorola (y compris les dessins pour former les tiges.)

Catalogue de Notes d'Applications

Fournit une liste complète des notes d'applications groupées par catégories, également un résumé des notes d'applications disponibles et la marche à suivre pour les obtenir.

Il est évident qu'afin de garder ce catalogue à jour, le Volume de Référence sera complètement révisé et publié deux fois par an, avec des additions supplémentaires publiées tous les trimestres.

VOLUME I

Ce volume est constitué par les spécifications pour les composants faits par Motorola avec les numéros homologués par EIA jusqu'à 1N4999 et 2N4999. Ces spécifications sont classées par ordre numérique sauf les spécifications qui se rapportent à plusieurs types de dispositifs. Un index numérique en première page permet à l'utilisateur de déterminer rapidemente le numéro de la page pour chaque dispositif décrit dans ce catalogue.

Il est probable que les dispositifs portant un numéro en-dessous de 5000 nécessiteront peu de mise à jour puisque tous ces numéros sont déjà utilisés. En conséquence, ce volume ne sera réimprimé que sur demande et les modifications apparaîtront uniquement lors de cette nouvelle édition.

VOLUME II

Ce volume est constitué par toutes les spécifications pour les dispositifs faits par Motorola, homologués par EIA avec numéros 1N5000, 2N5000, etc. ainsi que ceux avec les numéros 3N---. De plus, les spécifications de dispositifs avec numéros spéciaux de Motorola (non homologués par EIA) y sont incluses.

Ce catalogue sera mis à jour à l'aide d'éditions supplémentaires, car il contient toutes les données détaillées des dispositifs semiconducteurs les plus récents. Deux suppléments seront publiés pendant la durée de vie de cette édition.

Méthode d'Utilisation du Catalogue de Semiconducteurs

Ce catalogue a pour but:

1. D'identifier rapidement, grâce aux spécifications principales, si le dispositif est homologué par EIA ou s'il s'agit d'un type spécial Motorola.
2. De sélectionner rapidement le dispositif le mieux adapté à un circuit.
3. De sélectionner rapidement un dispositif en fonction des spécifications électriques.
4. De fournir les données complètes de tout l'ensemble des composants Motorola — donc la majorité des dispositifs semiconducteurs — afin de pouvoir comparer tous les types de dispositifs.

Exemples de méthodes d'utilisation;

Question: Identifier le dispositif
Donnée: Type de dispositif
Renseignements Requis: Fonction du dispositif, applications et spécifications principales.

Méthode: Consulter l'Index du Volume de Référence et déterminer le numéro du dispositif en question parmi la liste numérique de l'index. Ce renseignement ainsi obtenu indique non seulement le type de dispositif mais également fournit les spécifications électriques principales de ce dispositif. De plus, le fabricant y sera précisé et le catalogue indiquera si Motorola peut fournir les dispositifs équivalents. Les deux autres volumes de ce catalogue vont maintenant fournir toutes les données sur les dispositifs faits par Motorola.

Question: Choix du Dispositif

Données:

a) Application probable du circuit pour un dispositif connu.
b) Spécifications électriques approximatives du dispositif en question.

Renseignements Requis:

a) Quels sont les dispositifs disponibles pour la fonction précise de ce circuit?
b) Quel type de dispositif va répondre à des caractéristiques électriques prédéterminées?

Méthode: Consulter le Guide dans le Volume de Référence qui est catégorisé par produits, c'est-à-dire transistors de puissance, diodes zener, etc., et par marchés, y compris communications, grand public, et militaire. Ces différentes catégories apparaissent en première page pour faciliter la sélection du Guide. Nous pouvons maintenant obtenir toutes les données sur les dispositifs faits par Motorola en utilisant les deux autres volumes du Catalogue de Semiconducteurs.

DIE HALBLEITER DATENBIBLIOTHEK

Eines der Hauptprobleme für Fachleute in der Elektronik-Industrie besteht in der Bestimmung und Selektion von Halbleitertypen. Die meisten Typenbezeichnungen geben wenig oder keine Auskunft über Parameter oder Anwendungen von speziellen Halbleitern. Viele tausend verschiedene Halbleitertypen sind heute erhältlich. Es ist fast unmöglich, auch nur einen geringen Prozentsatz aller Typen genau zu kennen. Somit bringen die meisten Ingenieure und Techniker nur die bekanntesten und gebräuchlichsten Halbleitertypen zur Anwendung, auch wenn neuere und bessere Elemente zur Verfügung stehen.

Um diesem Problem Abhilfe zu schaffen hat Motorola die meisten Halbleitertypen in eine Halbleitersammlung zusammengefasst. Diese Halbleitersammlung umfasst alle 1N, 2N und 3N Typen, die durch die "Electronics Industries Association" registriert sind. Weiterhin sind eine grosse Anzahl von Motorola In-Haus Typen in dieser Sammlung zusammengefasst. Vollständige Spezifikationen einer grossen Anzahl von diskreten Halbleitern und Kurzspezifikationen von integrierten Schaltkreisen sind vorhanden.

Zusätzlich sind, zur Vereinfachung der Aufsuche der meist gebrauchten Halbleitertypennummern, Nachschlagetabellen mit Vorzugstypen für bestimmte Anwendungen in der Sammlung enthalten.

Die Halbleitersammlung kann dem Entwicklungs und Komponent-Ingenieur sowie dem Einkäufer von Halbleitern gute Dienste leisten im Aufsuchen der best möglichen Elemente für eine bestimmte Anwendung.

ZUSAMMENSETZUNG DER HALBLEITERSAMMLUNG

Die Halbleitersammlung besteht aus drei Teilen, die folgendermassen zusammengefasst sind:

REFERENZ-BAND

Der Referenz-Band besteht aus einer übersichtlichen Zusammenfassung von Halbleitern und integrierten Schaltungen. Mit Hilfe dieses Referenzbandes lassen sich Halbleiter und integrierte Schaltungen für spezielle Anwendungszwecke leicht auffinden. Gehäuse-, Anwendungs- und Montagezubehörinformation sind ebenso im Referenzband angegeben. Nach der Wahl eines Halbleiters oder einer integrierten Schaltung aus dem Referenzband kann Band I oder Band II für die speziellen Daten zur Hilfe gezogen werden.

EIA Registriertes Halbleiter-Verzeichnis

Vollständiges numerisches Verzeichnis aller EIA registrierter Halbleiter Typen, mit den hauptsächlichen elektrischen Spezifikationen.

Nicht Registriertes Halbleiter-Verzeichnis

Vollständiges numerisches Verzeichnis aller nicht registrierter In-Haus Motorola Halbleiter Typen, mit den hauptsächlichen elektrischen Spezifikationen.

Mikroschaltkreis-Komponenten

Nicht eingekapselte Transistoren, Dioden, passive Elemente und integrierte Schaltkreise für den Gebrauch in hybriden Kreisen. (Prozess-, Einkapselung- und Inspektions-Kriterien sind inbegriffen.)

Hauptnachschlagewerk

Zusammenfassung in Gruppen der bevorzugten Hauptelementkategorien für schnelle Vorselektion der Elemente die am besten für gegebene Anwendungen in Frage kommen. Dieses Dokument enhält Halbleiterelemente und integrierte Kreise.

Militärelementen-Liste

Dies ist eine vollständige Liste von Motorola Bausteinen die Militärspezifikationen erfüllen.

Montagezubehör und Einkapselung Information

Bauelement-Montagezubehör, Kühlelemente und Spezial-Elementeneinkapselung.

Vermasste Elementen-Grundrisse

Vermasste Zeichnungen von Gehäusegrundrissen mit JEDEC und Motorola Gegenüberstellung. (Zeichnungen der Anschlussformen von gegebenen Gehäusen sind inbegriffen.)

Awendungsbericht-Katalog

Nachschlagliste der Anwendungsberichte welche in Anwendungskategorien zusammengefasst sind. Eine kurze Zusammenfassung des Inhalts der verfügbaren Berichte ist gegeben und ebenfalls wie sie bestellt werden können.

Um den Anforderungen eines praktischen, auf den letzten Stand gebrachten Nachschlagewerkes zu genügen wird der Referenz-Band der Halbleiterbibliothek zweimal im Jahr vollständig überarbeitet und publiziert. Zusätzliche Veröffentlichungen werden vierteljährlich herausgegeben.

BAND I

Dieser Band enthält vollständige Datenblätter der von Motorola fabrizierten Elemente mit EIA registrierten Nummern bis zu 1N4999 und 2N4999. Die Datenblätter sind in numerischer Ordnung gemäss der Bauelemente-Typennummer eingereiht. Ausnahme sind solche Datenblätter welche spezielle Elemente mit wechselnden Typennummern behandeln. Ein numerisches Verzeichnis am anfang des Bandes erlaubt dem Benützer ein schnelles Auffinden der Datenblätter für alle Elemente, die im Buch aufgeführt sind.

Weil die meisten Elemente-Typennummern in der Kategorie bis 5000 schon von bestehenden Produkten aufgebraucht wurden, ist erwartet, dass dieser Band in den nächsten Jahren wenig Ueberarbeitung verlangt. Dementsprechend wird dieses Buch nur neu gedruckt wenn die Nachfrage es verlangt und Modifikationen werden nur bei einer Neuauflage vorgenommen.

BAND II

Dieser Band enthält Datenblätter der von Motorola hergestellten EIA registrierten Elemente mit der Typennummer 1N5000 und 2N5000 und aufwärts und ebenfalls solche mit den 3N- - Typennummern. Alle aktiven Datenblätter für Elemente mit speziellen Motorola Typennummern (nicht EIA registriert) sind zusätzlich hier einbezogen.

Weil dieser Band die detaillierten Daten für alle der erst kürzlich entwickelten Halbleiter enthält, wird er durch Publikationen von Zusatzbüchern auf den letzten Stand gebracht. Zwei Zusatzbücher werden während der "Lebensdauer" dieser Ausgabe veröffentlicht werden.

Wie wird "Die Halbleiter Datenbibliothek" gebraucht

Die Bibliothek ist zusammengestellt worden um mehrere spezielle Funktionen zu erfüllen:

1. Erlaubt schnelle Bestimmung (zusammen mit Hauptspezifikationen) von EIA registrierten Halbleitern und Bausteinen mit speziellen Motorola Typennummern.
2. Erlaubt schnelle Selektion der best geeignetsten Elemente für eine bestimmte Schaltungsanwendung.
3. Erlaubt schnelle Selektion von Elementen welche am besten gegebene elektrische Spezifikationen erfüllen.
4. Liefert vollständige Charakterisation einer breiten Komponentenlinie, welche die meisten Halbleiter-Kategorien einschliesst. Erlaubt einen detaillierten Vergleich der Elementtypen.

Die nachfolgenden Beispiele veranschaulichen mehrere Wege um diese Bibliothek zu gebrauchen.

Problem: Elementen-Bestimmung
Bekannt: Elemente-Typennummer
Benötigte Information: Elementefunktion, Anwendung, Hauptspezifikationen

Vorgang: Im Hauptverzeichnis des Referenzbandes sind die Typennummern des zu untersuchenden Elementes in der alphanumerischen Liste aufgefuhrt. Die Information, die in diesem Verzeichnis gegeben ist, besteht nicht nur aus dem Elemententyp sondern auch die elektrischen Hauptspezifikationen sind gegeben. Zusätzlich ist angegeben ob das Element von Motorola hergestellt wird und, im Fall dass dies verneint wird, ob Motorola ein elektrisch vergleichbares Bauelement liefern kann. Wenn benötigt, können die vollständigen Daten der von Motorola hergestellten Halbleiter von den zwei anderen Bänden der Halbleiter Bibliothek erhalten werden.

Problem: Elementen-Vorbestimmung
Bekannt:

a) Vorgesehene Schaltkreisanwendung für ein bestimmtes Element.
b) Ungefähre elektrische Spezifikationen eines gewünschten Typs.

Benötigte Information:

a) Welche Elemente sind für eine bestimmte Kreisfunktion verfügbar?
b) Welche Elementtypen erfüllen am besten die erforderlichen elektrischen Charakteristiken?

Vorgang: Das Hauptnachschlagwerk des Referenzbandes wird aufgeschlagen. Dieses Kapitel enthält Produktkategorien, z.B. Leistungstransistoren, Zenerdioden etc. eingereiht in bestimmte Marktsegmente, einschliesslich Fernmeldewesen, Verbraucherindustrie und Militärbereich. Ein "Index" zu den einzelnen "Auswahl-Führern" ist am anfang dieses Kapitels gegeben, was zum schnellen Auffinden der zutreffenden "Führer" hilft. Vollständige Daten der von Motorola hergestellten Elemente können, wenn benötigt, von den zwei anderen Bänden entnommen werden.

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NUMERICAL INDEX

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DEVICE OPTION

This section provides ordering information for Motorola's broad line of non-standard devices with variations in voltage and tolerance. It also includes the method for specifying matched sets and zener clipper diodes.

NON-STANDARD ZENER DIODES SPECIAL VOLTAGE AND TOLERANCE RATINGS

JEDEC "1N" type numbers denote a specific Zener voltage, power rating, and tolerance. For example, JEDEC type 1N4728 is a standard 1 watt diode, rated at 3.3 volts ±10%. A suffix "A" on this type number indicates a ±5% voltage tolerance.

Special Motorola devices, with a choice of voltages and tolerances are also available. The following diagram explains the Motorola coding system:

	M	XXXX	Z	
Power Rating (Watts)	Motorola	Nominal Zener Voltage (Volts) (4 Characters Max Excluding Decimal)	Zener Diode	Tolerance (±%) (omit for ±20% units)

For example, the code for a special 10 watt Zener diode with a voltage of 41 volts and a tolerance of ±1% would be: 10M41Z1.

Following is a list of other standard Motorola symbols for special Zener orders (X's indicate nominal Zener voltage):

BASIC MOTOROLA TYPE	DEVICE DESCRIPTION
¼MXXXAZ5	250 mW Alloy Glass, ±5%
¼MXXXZ5	250 mW Glass, ±5%
.4MXXXAZ5	400 mW Alloy Glass, ±5%
.4MXXXZ10	400 mW Glass, ±10%
.5MXXXZS10	500 mW Surmetic, ±10%
	1 Watt Flangeless, ±5%
1MXXXAZ10	1 Watt Alloy Flangeless, ±10%
1MXXXZ10	1 Watt Flangeless, ±10%
1MXXXZS5	1 Watt Surmetic, ±5%
1.5MXXXZ	1.5 Watt, ±20%
5MXXXZS5	5 Watt Surmetic, ±5%
10MXXXAZ5	10 Watt Alloy Stud, ±5%
10MXXXZ10	10 Watt Stud, ±10%
50MXXXAZ10	50 Watt Alloy TO-3, ±10%
50MXXXASZ5	50 Watt Alloy Stud, ±5%
50MXXXZ	50 Watt TO-3, ±20%
50MXXXSZ5	50 Watt Stud, ±5%

For reverse polarities (10 W and 50W), insert "R" before tolerance, ie., 50M110SZR5.

1N5518 thru 1N5546 — This series may be ordered in ±2% and ±1% tolerance by adding the following suffix:

C = ±2%   D = ±1%

For example, the 1N5518D would be the same as the 1N5518B except V_Z = 3.3 ±1%.

MATCHED SETS OF ZENER DIODES

Zener diodes can also be obtained in sets consisting of two or more matched devices. The method for specifying such matched sets is similar to the one described for specifying units with a special voltage and/or tolerance except that two extra suffixes are added to the code number described above.

These units are marked with code letters to identify the matched sets and in addition, each unit in a set is marked with the same serial number which is different for each set being ordered.

	M		Z			
Power Rating (Watts)	Motorola	Nominal Voltage (each device) (4 Characters Max Excluding Decimal)	Zener Diodes	Tolerance per device (±%) (omit for ±20% units)	Code* (A-Not used)	Overall Tolerance of set (±1%)

*Code

- B — Two devices in series
- C — Three devices in series
- D — Four devices in series
- E — Five devices in series
- F — Six devices in series
- G — Seven devices in series
- H — Eight devices in series
- P — Two devices in parallel (not recommended)
- X — Two devices; one standard polarity, the other reverse polarity. (10 and 50 watts only)

i.e., 10M51Z5B1 is for two 10 watt zeners, each of 51 volts, ±5%, matched to a total voltage of 102 volts ±1%.

ORDERING OF MATCHED SETS

Order per instructions in "Matched Sets of Zener Diodes" or else specify the following:

- Type of matched set (series or parallel)
- Number of units per set
- Device type (with proper suffix to indicate tolerance
- Number of sets required
- Total voltage and overall tolerance of the set

ADDITIONAL NOTES

Consult factory for pricing and ordering information on special sets. For example: 1)Sets with overall tolerance different from those shown; 2) Matched sets of temperature compensated devices; 3) Sets which require basic device types within the set to be different from each other; 4) Sets with device type nominal voltages outside the range of the Zener family involved; 5) Tight tolerance temperature compensated diodes.

ZENER CHIPS (MZC)

1. The nomenclature for Zener Chips is as follows:

M	Z	C			
Motorola	Zener	C = Chip	Nominal Voltage	Series (A or B)	Tolerance (± %)

BASIC TYPE MOTOROLA NOMENCLATURE — **DEVICE DESCRIPTION**

MZCXXAX	Zener Chip — "A" Series, High Level
MZCXXBX	Zener Chip — "B" Series, Low Level

2. Chips are sold in increments of ten (10) only
3. Chips are **not** sold as matched sets or clippers.
4. A "-1" suffix will cause all chips ordered to be supplied in Deka-Pak.

UNIBLOC SERIES ZENER DIODES (MZ92)

The nomenclature for Unibloc Series Zener Diodes is as follows:

M	Z	92	XX	V
Motorola	Zener	Series	Nominal Voltage	Non Suffix = 20% A Suffix = 10% B Suffix = 5% C Suffix = 2% D Suffix = 1%

ZENER CLIPPERS

Special clipper diodes with opposing Zener junctions built into the devices are available by using the following nomenclatures:

X	M	XXX	Z	Z	X
Power Rating (Watts)		Nominal Voltage	Zener Diode	Clipper	Tolerance for each of the two Zener Voltages (Is not a matching requirement. Omit for ±20% Units.)

This nomenclature is applicable to all packages and power ratings as restricted in the above paragraphs.

ORDERING INFORMATION

Order using the above nomenclature or else specify the device type, nominal voltage and tolerance required.

NUMERICAL INDEX

1N--- TYPE NUMBERS

The following table provides a numerical index and short-form specifications for EIA-registered 1N type numbers.

KEY

RECTIFIERS

V_R = DC Blocking Voltage
V_F = Average Forward Voltage Drop
I_O = Average Rectifier Forward Current
I_R = Average Reverse Current
I_{FSM} = Peak Surge Current

ZENER DIODES

V_Z(Nom) = Nominal Zener Breakdown Voltage (Volts)
I_{ZT} = Test Current for Zener Voltage (mA)
Tol = Tolerance for Specified Nominal Zener Breakdown Voltage
P_D = Maximum Power Dissipation
M = Milliwatts
W = Watts

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R volts	V_F volts	I_O (Amps)	I_R mA	I_{FSM}	V_Z (nom)	I_{ZT} mA	Tol $V_{Z\pm\%}$	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV Volts	V_F Volts	@ I_F	I_R	t_{rr} (μs)	V_Z (nom)	T_C %/°C	I_{ZT} mA	Temp Range

TYPE: Numerical Listing of Registered Type Numbers

MATERIAL: S = Silicon, G = Germanium, SE = Selenium

REPLACEMENT: Type number of recommended replacement or of nearest electrical equivalent fully characterized in this book.

REF.: Reference device number indicates specific Data Sheet on which device is characterized.

SHADING INDICATES SIGNAL DIODES

PRV = Peak Reverse Voltage
V_F @ I_F = Maximum Forward Voltage at Indicated Forward current – M = Milliamp, A = amp
I_R = Reverse Current – M = milliamp, * = microamp, N = nanoamp
t_{rr} = Reverse Recovery Time

SHADING INDICATES REFERENCE DIODES

V_Z(Nom) = Nominal Zener Breakdown Voltage (Volts)
T_C = Average Temperature Coefficient over Temperature Range
I_{ZT} = Test Current for Zener Voltage (mA)
Temp Range = Operating Range of Average T_C

The codes listed below define the listed device and indicates the appropriate specification column heading.

R – Rectifiers, Fast Recovery DZ – Diode, Zener
DR – Diode, Reference DS – Diode, Signal

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: @ I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N23H		Microwave Mixer - to 9000 MHz: NF = 6.0 dB											
1N34	G			DS	60	1.0	8.5M	15*					
1N34A	G			DS	60	1.0	5.0M	30*					
1N35	G			DS	50			2.0M					
1N38	G			DS	100	1.0	7.5M	25*					
1N38A	G			DS	100	1.0	4.0M	6.0*					
1N38B	G			DS	100	1.0	4.0M	6.0*					
1N39	G			DS	200	1.0	5.0M	40*					
1N39A	G			DS	200	1.0	5.0M	40*					
1N39B	G			DS	200	1.0	4.0M	650*					
1N40	G			DS	25								
1N41	G			DS	25								
1N42	G			DS	50								
1N43	G			DS	60	1.0	5.0M	20*					
1N44	G			DS	115	1.0	3.0M	410*					
1N45	G			DS	75	1.0	3.0M	410*					
1N46	G			DS	50	1.0	3.0M	1.5M					
1N47	G			DS		1.0	5.0M	400*					
1N48	G			DS	85	1.0	4.0M	833*					
1N49	G			DS	50	1.0	4.0M						
1N50	G			DS	50	1.0	4.0M						
1N51	G			DS	50	1.0	2.5M						
1N52	G			DS	85	1.0	4.0M	150*					
1N52A	G			DS	50	1.0	5.0M	100*					
1N53	S	Microwave Ka-band Mixer: f = 34,860 MHz; NF = 13.1 to 9.0 dB											
1N53A	S	Microwave Ka-band Mixer: f = 34,860 MHz; NF = 13.1 to 9.0 dB											
1N53B	S	Microwave Ka-band Mixer: f = 34,860 MHz; NF = 13.1 to 9.0 dB											
1N53C	S	Microwave Ka-band Mixer: f = 34,860 MHz; NF = 13.1 to 9.0 dB											
1N53D	S	Microwave Ka-band Mixer: f = 34,860 MHz; NF = 13.1 to 9.0 dB											
1N54	G			DS	35	1.0	5.0M	10*					
1N54A	G			DS	50	1.0	5.0M	7.0*					
1N55	G			DS	150	1.0	3.0M	0.3M					
1N55A	G			DS	150	1.0	4.0M	500*					
1N55B	G			DS	190	1.0	5.0M	500*					
1N56	G			DS	30	1.0	15M	300*					
1N56A	G			DS	40	1.0	15M	300*					
1N57	G			DS	80	1.0	3.6M	300*					
1N58	G			DS	100	1.0	5.0M	800*					
1N58A	G			DS	100	1.0	4.0M	600*					
1N59	G			DS	250	1.0	3.0M	800*					
1N60	G			DS	50	1.0	5.0M	40*					
1N60A	G			DS	40								
1N61	G			DS	130	1.0	5.0M	300*					
1N62	G			DS	110	1.0	5.0M	700*					
1N63	G			DS	125	1.0	4.0M	50*					
1N63A	G			DS	100	1.0	4.0M	50*					
1N64	G			DS	20								
1N65	G			DS	85	1.0	2.5M	200*					
1N66	G			DS	60	1.0	5.0M	50*					
1N66A	G			DS	60	1.0	5.0M	50*					
1N67	G			DS	80	1.0	4.0M	5.0*					
1N67A	G			DS	100	1.0	4.0M	5.0*					
1N68	G			DS	100	1.0	3.0M	625*					
1N68A	G			DS	130	1.0	3.0M	625*					
1N69	G			DS	75	1.0	5.0M	50*					
1N69A	G			DS	60	1.0	5.0M	30*					
1N70	G			DS	125	1.0	3.0M	25*					
1N70A	G			DS	100	1.0	3.0M	25*					
1N71	G			DS	40	1.0	15M	0.3M					
1N73	G			DS		1.7	15M	0.05M					
1N74	G			DS		1.8	15M	0.05M					
1N75	G			DS	125	1.0	2.5M	50*					
1N76	S	Microwave X-band Detector f = 9,375 MHz, V_O = 5.0 mV to 16 mV											
1N76A	S	Microwave X-band Detector f = 9,375 MHz, V_O = 5.0 mV to 16 mV											
1N77A		Photosensitive Device; V_F = 10 V @ 10 mA, I_R(dark) = 30 µA @ 50 V											
1N77B		Photosensitive Device; V_F = 10 V @ 10 mA, I_R(dark) = 30 µA @ 50 V											
1N78	S	Microwave Ku-band Mixer: f = 16,000 MHz; NF = 12 to 7.5 dB											
1N78A	S	Microwave Ku-band Mixer: f = 16,000 MHz; NF = 12 to 7.5 dB											
1N78B	S	Microwave Ku-band Mixer: f = 16,000 MHz; NF = 12 to 7.5 dB											
1N78C	S	Microwave Ku-band Mixer: f = 16,000 MHz; NF = 12 to 7.5 dB											
1N78D	S	Microwave Ku-band Mixer: f = 16,000 MHz; NF = 12 to 7.5 dB											
1N78E	S	Microwave Ku-band Mixer: f = 16,000 MHz; NF = 12 to 7.5 dB											
1N78F	S	Microwave Ku-band Mixer: f = 16,000 MHz; NF = 12 to 7.5 dB											
1N79		Meter Rectifier - to 3,000 MHz											
1N81	G			DS	50	1.0	3.0M	10*					
1N81A	G			DS	40	1.0	3.0M	10*					
1N82	S	Microwave Mixer - to 1,000 MHz; NF = 16 to 14 dB											
1N82A	S	Microwave Mixer - to 1,000 MHz; NF = 16 to 14 dB											
1N82AG	S	Microwave Mixer - to 1,000 MHz; NF = 16 to 14 dB											
1N82G	S	Microwave Mixer - to 1,000 MHz; NF = 16 to 14 dB											
1N83	G			DS	225	1.0	5.0M	30*					
1N84	G			DS	12	1.0	60M	0.1M					
1N85		Photosensitive Device; I_R(dark) = 20 µA @ 90 V, Sensitivity = 0.35 µA/mW @ 90 V											

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	V_F (volts) / V_F (volts) @	I_O (Amps) / I_F	I_R (mA) / I_R	I_{FSM} / t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	I_{ZT} mA / T_C %/°C	Tol V_Z±% / I_{ZT} mA	P_D / Temp Range
1N86	G			DS	70	1.0	4.0M	50*					
1N87	S			DS	23	0.25	0.1M	30*					
1N87A	S			DS	23	0.25	0.1M	10*					
1N88	G			DS	85	1.0	2.5M	0.1M					
1N89	G			DS	100	1.0	3.5M	8.0*					
1N90	G			DS	75	1.0	5.0M	800*					
1N91	G		1N91	R	100	0.5	0.15	4.0	25				
1N92	G		1N91	R	200	0.5	0.1	2.0	25				
1N93	G		1N91	R	300	0.5	0.075	1.3	25				
1N94	G			R	380	0.7	0.5	0.8	25				
1N95	G			DS	75	1.0	10M	800*					
1N96	G			DS	75	1.0	20M	800*					
1N96A	G			DS	60	1.0	40M	500*					
1N97	G			DS	100	1.0	10M	100*					
1N98	G			DS	100	1.0	20M	100*					
1N98A	G			DS	250	1.0	40M	100*					
1N99	G			DS	100	1.0	10M	50*					
1N100	G			DS	100	1.0	20M	50*					
1N100A	G			DS	80	1.0	40M	0.05M					
1N101	G			DS	150	1.0	10M	10*					
1N102	G			DS	75	1.0	15M	3.0*					
1N103	G			DS	12	1.0	30M	0.1M					
1N104	G			DS	12	1.0	30M	0.1M					
1N105	S	Microwave Switch: BV = 500 V, P_D = 8.0 W											
1N106	G			DS	300	1.0	20M	70*					
1N107	G			DS	10	1.0	150M	200*					
1N108	G			DS	50	1.0	50M	200*					
1N109	G			DS	15	1.0	1.0M	0.1M					
1N110	G	Microwave Mixer - to 1,000 MHz, NF = 10 dB											
1N111	G			DS	70	1.0	5.0M	25*					
1N112	G			DS	70	1.0	5.0M	50*					
1N113	G			DS	70	1.0	2.5M	25*					
1N114	G			DS	70	1.0	2.5M	50*					
1N115	G			DS	70	1.0	2.5M	100*					
1N116	G			DS	75	1.0	5.0M	100*					
1N117	G			DS	75	1.0	10M	100*					
1N118	G			DS	75	1.0	20M	100*					
1N118A	G			DS	60	1.0	40M	0.1M					
1N119	G			DS	60	1.0	5.0M		0.5				
1N120	G			DS	60	1.0	5.0M		0.5				
1N124	G	Microwave Mixer - to 1,000 MHz, NF = 10 to 8.0 dB											
1N124A	G	Microwave Mixer - to 1,000 MHz, NF = 10 to 8.0 dB											
1N126	G			DS	75	1.0	5.0M	50*					
1N126A	G			DS	75	1.0	25M	50*					
1N127	G			DS	125	1.0	3.0M	25*					
1N127A	G			DS	125	1.0	25M	25*					
1N128	G			DS	50	1.0	3.0M	10*					
1N128A	G			DS	40	1.0	3.0M	10*					
1N132	G			DS	25								
1N133	G			DS	5.0	0.5	3.0M	300*					
1N134		UHF Detector: f = 400 MHz											
1N137A	S			DS	36	1.0	3.0M	0.03*					
1N137B	S			DS	36	1.0	20M	0.03*					
1N138A	S			DS	18	1.0	5.0M	0.01*					
1N138B	S			DS	18	1.0	40M	0.01*					
1N139	G			DS	40	1.0	20M	1.5M					
1N140	G			DS	70	1.0	40M	300*					
1N141	G			DS	70	1.0	20M	50*					
1N142	G			DS	100	1.0	5.0M	100*					
1N143	G			DS	100	1.0	40M	100*					
1N144	G			DS	30	1.0	100M	200*					
1N145	G			DS	30	1.0	40M	100*					
1N147	G	UHF Mixer: f = 900 MHz; NF = 10 to 9.0 dB											
1N147A	G	UHF Mixer: f = 900 MHz; NF = 10 to 9.0 dB											
1N149	S	Microwave X-band Mixer: f = 9,375 MHz; NF = 8.3 dB											
1N150	S	Microwave C-band Mixer: f = 6,750 MHz; NF = 9.8 dB											
1N151	G			R	100	0.7	0.5	2.4	25				
1N152	G			R	200	0.7	0.5	1.9	25				
1N153	G			R	300	0.7	0.5	1.2	25				
1N155	S	Microwave Detector: f = 9,000 MHz											
1N155A	S	Microwave Detector: f = 9,000 MHz											
1N156	S	Microwave X-band Mixer: f = 9,375 MHz											
1N158	G			R	380	1.4	0.5	0.8	25				
1N160	S	Microwave C-band Mixer: f = 6,750 MHz; NF = 11.4 dB											
1N173A	S	UHF Mixer - to 1,000 MHz; NF = 13 dB											
1N188		Photosensitive Device; $I_{R(dark)}$ = 20 μA @ 40 V, Sensitivity = 10 μA/mW											
1N189		Photosensitive Device; R_D = 4,000 ohm, Sensitivity = 0.083%/fc											
1N190	G			DS	3.0	0.75	10M	0.8M					
1N191	G			DS	90	1.0	5.0M		0.5				
1N192	G			DS	70	1.0	5.0M		0.5				
1N193	S			DS	40	2.0	1.0M	40*	0.5				
1N194	S			DS	40	2.0	1.5M	10*	0.2				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N194A	S			DS	40	1.0	1.0M	10*	0.2				
1N195	S			DS	40	2.0	2.0M	10*	0.3				
1N196	S			DS	40	2.0	1.0M	10*	0.1				
1N198	G			DS	80	1.0	4.0M	10*					
1N198A	G			DS	80	1.0	4.0M	10*					
1N198B	G			DS	80	1.0	4.0M	10*	0.3				
1N200	S			DS	6.8	1.0	50M						
1N201	S			DS	8.2	1.0	35M						
1N202	S			DS	10	1.0	30M						
1N203	S			DS	12	1.0	23M						
1N204	S			DS	15	1.0	17M						
1N205	S			DS	18	1.0	12M	0.1*					
1N206	S			DS	22	1.0	9.0M	0.1*					
1N207	S			DS	27	1.0	7.0M	0.1*					
1N208	S			DS	33	1.0	5.5M	0.1*					
1N209	S			DS	39	1.0	4.5M	0.1*					
1N210	S			DS	47	1.0	3.5M	0.1*					
1N211	S			DS	56	1.0	2.7M	1.0*					
1N212	S			DS	68	1.0	2.0M	1.0*					
1N213	S			DS	82	1.0	1.5M	1.0*					
1N214	S			DS	100	1.0	1.2M	1.0*					
1N215	S			DS	120	1.0	0.9M	1.0*					
1N216	S			DS	150	1.0	0.7M	5.0*					
1N217	S			DS	180	4.0	6.5M	5.0*					
1N218	S			DS	220	4.0	6.0M	5.0*					
1N219	S			DS	270	4.0	3.0M	5.0*					
1N220	S			DS	330	4.0	2.2M	5.0*					
1N221	S			DS	390	4.0	2.0M	5.0*					
1N222	S			DS	470	4.0	1.5M	5.0*					
1N225	S	.5M8.7ZZS10	&	DZ						10	0.2		150M
1N225A	S	.5M9.1ZZS5	&	DZ						9.1	0.2	5.0	150M
1N226	S	.5M10.5ZZS10	&	DZ						12	0.2		150M
1N226A	S	.5M10ZZS5	&	DZ						10	0.2	5.0	150M
1N227	S	.5M12.7ZZS10	&	DZ						14.5	0.2		150M
1N227A	S	.5M12ZZS5	&	DZ							0.2	5.0	150M
1N228	S	.5M15.7ZZS10	&	DZ						18	0.2		150M
1N228A	S	.5M15ZZS5	&	DZ							0.2	5.0	150M
1N229	S	.5M19ZZS10	&	DZ						21	0.2		150M
1N229A	S	.5M18ZZS5	&	DZ							0.2	5.0	150M
1N230	S	.5M23.5ZZS5	&	DZ						27	0.2		150M
1N231	S	.5M28.5ZZS10	&	DZ						32	0.2		150M
1N232	S	.5M34.5ZZS10	&	DZ						39	0.2		150M
1N233	S	.5M41ZZS10	&	DZ						45	0.2		150M
1N234	S	.5M48.5ZZS10	&	DZ						54	0.2		150M
1N235	S	.5M58ZZS10	&	DZ						64	0.2		150M
1N236	S	.5M71ZZS10	&	DZ						80	0.2		150M
1N237	S	.5M87.5ZZS10	&	DZ						100	0.2		150M
1N238	S	.5M105ZZS10	&	DZ						120	0.2		150M
1N239	S	.5M127.5ZZS5	&	DZ						145	0.2		150M
1N248	S	1N248A		R	50	1.5	10	5.0	200				
1N248A	S	1N248B	1N248B	R	50	1.5	20	5.0	250				
1N248B	S		1N248B	R	50	1.5	20	5.0	250				
1N248C	S		1N248B	R	39	1.2	20	3.8	350				
1N249	S	1N249A	1N249B	R	100	1.5	10	5.0	200				
1N249A	S	1N249B	1N248B	R	100	1.5	20	5.0	250				
1N249B	S		1N248B	R	100	1.5	20	5.0	250				
1N249C	S		1N248B	R	77	1.2	20	3.6	350				
1N250	S	1N250A		R	200	1.5	10	5.0	200				
1N250A	S	1N250B	1N248B	R	200	1.5	20	5.0	250				
1N250B	S		1N248B	R	200	1.5	20	5.0	250				
1N250C	S		1N248B	R	154	1.2	20	3.4	350				
1N251	S			DS	30	1.0	5.0M	0.1*	0.15				
1N252	S			DS	20	1.0	10M	0.1*	0.15				
1N253	S	MR1121	MR1120	R	95	1.5	1.0	0.1	4.0				
1N254	S	MR1122	MR1120	R	190	1.5	0.4		1.5				
1N255	S	MR1124	MR1120	R	380	1.5	0.4		1.5				
1N256	S	MR1126	MR1120	R	570	1.5	0.2		1.0				
1N259	S	Microwave Mixer pair - to 9,000 MHz											
1N263	G	Microwave X-band Mixer: f = 9,375 MHz; NF = 7.5 dB											
1N264	S	Microwave Mixer pair: f = 3,000 MHz											
1N265	G			DS	90	1.0	3.2M	100*					
1N266	G			DS	60	1.0	4.0M	75*					
1N267	G			DS	25	1.0	3.5M	12*					
1N268	G			DS	30	1.0	2.5M	20*					
1N269	G	Microwave S-band Mixer: NF = 7.5 dB											
1N270	G			DS	80	1.0	200M	100*					
1N273	G			DS	30	1.0	100M	20*					
1N276	G			DS	50	1.0	40M	100*	0.3				
1N277	G			DS	100	1.0	100M	75*					
1N278	G			DS	50	1.0	20M	125*					
1N279	G			DS	30	1.0	100M	200*					
1N281	G			DS	60	1.0	100M	30*					

& See page 1-3 for ordering information.

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	ZENER DIODES: V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES: PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (μs)	REFERENCE DIODES: V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N282	G			DS		1.0	40M	20M					
1N283	G			DS	20	1.0	200M	20*					
1N285		UHF Mixer; NF = 12.5 dB											
1N286	S	Microwave X-K band Mixer; NF = 11.3 dB											
1N286A	S	Microwave X-K band Mixer; NF = 11.3 dB											
1N287	G			DS	60	1.0	20M	1.5M					
1N288	G			DS	85	1.0	40M	350*					
1N289	G			DS	85	1.0	20M	50*					
1N290	G			DS	120	1.0	5.0M	100*					
1N291	G			DS	120	1.0	40M	100*					
1N292	G			DS	75	1.0	100M	200*					
1N294	G			DS	60	1.0	5.0M	10*					
1N294A	G			DS	60	1.0	5.0M	10*					
1N295	G			DS	40			200*					
1N295A	G			DS	40			200*					
1N296	G			DS	40			200M					
1N297	G			DS	80	1.0	3.5M	10*					
1N297A	G			DS	80	1.0	3.5M	10*					
1N298	G			DS	70	2.0	30M						
1N298A	G			DS	30	2.0	30M	250*					
1N299	G			DS		0.5	3.0M	200M					
1N300	S			DS	15	1.0	15M	0.001*					
1N300A	S			DS	15	1.0	30M	0.001*					
1N300B	S			DS	15	1.0	50M	0.001*					
1N301	S			DS	70	1.0	5.0M	0.05*					
1N301A	S			DS	70	1.0	18M	0.05*					
1N301B	S			DS	70	1.0	50M	0.01*					
1N302	S			DS	225	1.0	1.0M	0.2*					
1N302A	S			DS	225	1.0	5.0M	0.2*					
1N303	S			DS	125	1.0	3.0M	0.1*					
1N303A	S			DS	125	1.0	12M	0.1*					
1N303B	S			DS	125	1.0	50M	0.1*					
1N304	S			DS	55	1.5	2.0M	2.0*					
1N305	G			DS	60	0.8	100M	20*					
1N306	G			DS	15	0.8	100M	2.0*					
1N307	G			DS	125	1.0	100M	5.0*					
1N308	G			DS	8.0	1.0	300M	500*					
1N309	G			DS	40	1.0	100M	100*					
1N310	G			DS	125	1.0	40M	20*					
1N311	S	Microwave Mixer - to 12,000 MHz; NF = 10.5 dB											
1N312	G			DS	60	1.0	70M	50*					
1N313	G			DS	125	1.0	40M	10*					
1N314	G			DS				0.05M					
1N315	G			R	300	0.48	0.075	0.3	25				
1N315A	G			R	200	0.48	0.1	0.16	25				
1N316	S	1N4001	1N4001	R	50	2.0	0.2		2.0				
1N317	S	1N4002	1N4001	R	100	2.0	0.2		2.0				
1N318	S	1N4003	1N4001	R	200	2.0	0.2		2.0				
1N319	S	1N4004	1N4001	R	350	2.0	0.2		2.0				
1N320	S	1N4005	1N4001	R	500	2.0	0.2		2.0				
1N321	S	1N4007	1N4001	R	850	1.2	0.25	1.0	10				
1N322	S			R	850	1.2	0.25	1.0	10				
1N323	S			R	50	2.0	0.4		2.0				
1N324	S			R	100	2.0	0.4		2.0				
1N325	S			R	200	2.0	0.4		2.0				
1N326	S			R	350	2.0	0.4		2.0				
1N327	S			R	500	2.0	0.4		2.0				
1N328	S			R	850	1.2	0.4	0.06	10				
1N329	S			R	1000	1.2	0.4	0.06	10				
1N330	S			DS	32	1.0	3.0M	0.03*					
1N331	S			DS	16	1.0	5.0M	0.01*					
1N332	S	MR1124	MR1120	R	400	2.0	0.4	0.2	10				
1N333	S	MR1124	MR1120	R	400	2.0	0.2	0.2	5.0				
1N334	S	MR1123	MR1120	R	300	2.0	0.4	0.2	10				
1N335	S	MR1123	MR1120	R	300	2.0	0.2	0.2	5.0				
1N336	S	MR1122	MR1120	R	200	2.0	0.4	0.1	10				
1N337	S	MR1122	MR1120	R	200	2.0	0.2	0.1	5.0				
1N338	S	MR1121	MR1120	R	100	2.0	1.0	0.2	20				
1N339	S	MR1121	MR1120	R	100	2.0	0.4	0.1	10				
1N340	S	MR1121	MR1120	R	100	2.0	0.2	0.1	5.0				
1N341	S	MR1124	MR1120	R	400	2.0	0.4	0.5	10				
1N342	S	MR1124	MR1120	R	400	2.0	0.2	0.5	5.0				
1N343	S	MR1123	MR1120	R	300	2.0	0.4	0.5	10				
1N344	S	MR1123	MR1120	R	300	2.0	0.2	0.5	5.0				
1N345	S	MR1122	MR1120	R	200	2.0	0.4	0.5	10				
1N346	S	MR1122	MR1120	R	200	2.0	0.2	0.5	5.0				
1N347	S	MR1121	MR1120	R	100	2.0	1.0	0.5	20				
1N348	S	MR1121	MR1120	R	100	2.0	0.4	0.5	10				
1N349	S	MR1121	MR1120	R	100	2.0	0.2	0.5	5.0				
1N350	S			DS	70	1.0	20M	0.03*					
1N351	S			DS	120	1.0	20M	0.03*					
1N352	S			DS	170	1.0	20M	0.05*					

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N353	S			DS	225	1.0	20M	0.1*					
1N354	S			DS	325	1.0	20M	0.1*					
1N355	G			DS	100	1.0	4.0M	50*					
1N358	S	Microwave L-X-band Detector											
1N358A	S	Microwave L-X-band Detector											
1N359	S	1N4001	1N4001	R	50	2.0	0.1		2.0				
1N360	S	1N4002	1N4001	R	100	2.0	0.1		2.0				
1N361	S	1N4003	1N4001	R	200	2.0	0.1		2.0				
1N362	S	1N4004	1N4001	R	350	2.0	0.1		2.0				
1N363	S	1N4005	1N4001	R	500	2.0	0.1		2.0				
1N364	S	1N4007	1N4001	R	850	1.2	0.1	0.06	10				
1N365	S	1N4007	1N4001	R	1000	1.2	0.1	0.06	10				
1N367	G			DS	15								
1N368	G			R	200	0.5	0.1	0.3	25				
1N368A	G			R	200	0.5	0.1	0.16	25				
1N369	S	Microwave S-X-band Detector											
1N369A	S	Microwave L-X-band Detector											
1N370	S	1N5221B	1N5221	DZ						1.8	20	±20	200M
1N371	S	1N5221A	1N5221	DZ						2.4	20	±20	200M
1N372	S	1N5225A	1N5221	DZ						2.9	15	±20	200M
1N373	S	1N5227A	1N5221	DZ						3.5	10	±20	200M
1N374	S	1N5229A	1N5221	DZ						4.1	10	10	200M
1N375	S	1N5230A	1N5221	DZ						4.8	10	5.0	200M
1N376	S	1N5233A	1N5221	DZ						5.8	10	5.0	200M
1N377	S	1N5236A	1N5221	DZ						7.1	13	5.0	200M
1N378	S	1N5238A	1N5221	DZ						8.75	14	0.2	200M
1N379	S	1N5240A	1N5221	DZ						10.5	15	0.2	200M
1N380	S	1N5243A	1N5221	DZ						12.8	14	0.2	200M
1N381	S	1N5246A	1N5221	DZ						15.8	15	0.2	200M
1N382	S	1N5249A	1N5221	DZ						19	10	0.2	200M
1N383	S	1N5252A	1N5221	DZ						23.5	15	0.2	200M
1N384	S	1N5255A	1N5221	DZ						28.5	12	0.2	200M
1N385	S	1N5258A	1N5221	DZ						34.5	13	0.2	200M
1N386	S	1N5260A	1N5221	DZ						41	10	0.2	200M
1N387	S	1N5261A	1N5221	DZ						48.5	11	0.2	200M
1N388	S	1N5264A	1N5221	DZ						58	10	0.2	200M
1N389	S	1N5266A	1N5221	DZ						71	14	0.2	200M
1N390	S	1N5269A	1N5221	DZ						87.5	15	0.2	200M
1N391	S	1N5271A	1N5221	DZ						105	15	0.2	200M
1N392	S	1N5274A	1N5221	DZ						127.5	14	0.2	200M
1N393	S	1N5277A	1N5221	DZ						157.5	14	0.2	200M
1N394	S	1N5280A	1N5221	DZ						190	10	0.2	200M
1N395	S	.5M115ZSB10	&	DZ						235	15	0.1	200M
1N396	S	.5M140ZSB10	&	DZ						285	12	0.1	200M
1N397	S	.5M170ZSB10	&	DZ						345	13	0.1	200M
1N398	S	.5M205ZSB10	&	DZ						410	10	0.1	200M
1N399	S	.5M160ZSC10	&	DZ						485	11	0.1	200M
1N400	S	.5M195ZSC10	&	DZ						580	10	0.1	200M
1N401	S			DS	1.5								
1N402	S			DS	2.0								
1N403	S			DS	2.5								
1N404	S			DS	3.1								
1N405	S			DS	3.7	1.0	225M						
1N406	S			DS	4.3	1.0	200M						
1N407	S			DS	5.2	1.0	170M						
1N408	S			DS	6.2	1.0	130M						
1N411B	S	MR1810 SB		R	50	1.5	50	25	525				
1N412B	S	MR1811 SB		R	100	1.5	50	25	525				
1N413B	S	MR1813 SB		R	200	1.5	50	25	525				
1N415B	S	Microwave X-band Mixer; NF = 11.4 to 6.5 dB											
1N415C	S	Microwave X-band Mixer; NF = 11.4 to 6.5 dB											
1N415D	S	Microwave X-band Mixer; NF = 11.4 to 6.5 dB											
1N415E	S	Microwave X-band Mixer; NF = 11.4 to 6.5 dB											
1N415F	S	Microwave X-band Mixer; NF = 11.4 to 6.5 dB											
1N415G	S	Microwave X-band Mixer; NF = 11.4 to 6.5 dB											
1N415H	S	Microwave Mixer - to 9000 MHz; NF = 6.0 dB											
1N416B	S	Microwave S-band Mixer; NF = 10.3 to 5.5 dB											
1N416C	S	Microwave S-band Mixer; NF = 10.3 to 5.5 dB											
1N416D	S	Microwave S-band Mixer; NF = 10.3 to 5.5 dB											
1N416E	S	Microwave S-band Mixer; NF = 10.3 to 5.5 dB											
1N416F	S	Microwave S-band Mixer; NF = 10.3 to 5.5 dB											
1N416G	S	Microwave S-band Mixer; NF = 10.3 to 5.5 dB											
1N417	G			DS	60				0.3				
1N418	G			DS	60	1.0	7.0M		0.3				
1N419	G			DS	80	1.0	125M		0.3				
1N429	S		1N429	DR						6.2		7.5	
1N430	S	1N3156	1N3154	DR						8.4	0.002	10	-55/100
1N430A	S	1N3157	1N3154	DR						8.4	0.001	10	-55/100
1N430B	S	1N3157A	1N3154	DR						8.4	0.001	10	-55/150
1N431	S			DS	68	0.55	15M						
1N432	S			DS	40	1.0	10M	5.0N					
1N432A	S			DS	40	1.0	20M	5.0N					
1N433	S			DS	145	1.0	3.0M	0.1*					

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N433A	S			DS	145	1.0	10M	0.1*					
1N434	S			DS	180	1.0	2.0M	0.1*					
1N434A	S			DS	180	1.0	7.0M	0.1*					
1N435	G			DS	40			0.3M					
1N440	S	1N4002	1N4001	R	100	1.5	0.3	0.3					
1N440B	S	1N4002	1N4001	R	100	1.5		0.3	15				
1N441	S	1N4003	1N4001	R	200	1.5	0.3	0.75					
1N441B	S	1N4003	1N4001	R	200	1.5			15				
1N442	S	1N4004	1N4001	R	300	1.5	0.3	1.0					
1N442B	S	1N4004	1N4001	R	300	1.5		0.001	15				
1N443	S	1N4004	1N4001	R	400	1.5	0.3	1.5					
1N443B	S	1N4004	1N4001	R	400	1.5			15				
1N444	S	1N4005	1N4001	R	500	1.5	0.3	1.75					
1N444B	S	1N4005	1N4001	R	500	1.5			15				
1N445	S	1N4005	1N4001	R	600	1.5	0.3	2.0					
1N445B	S	1N4005	1N4001	R	600	1.5		0.002	15				
1N446	S	Microwave K-Ka-band Detector											
1N447	G			DS	30	1.0	25M	20*					
1N448	G			DS	100	1.0	25M	30*					
1N449	G			DS	30	1.0	50M	10*					
1N450	G			DS	100	1.0	50M	30*					
1N451	G			DS	150	1.0	50M	150*					
1N452	G			DS	30	1.0	100M	30*					
1N453	G			DS	100	1.0	100M	30*					
1N454	G			DS	50	1.0	200M	50*					
1N455	G			DS	30	1.0	300M	30*					
1N456	S			DS	25	1.0	40M	25N					
1N456A	S			DS	25	1.0	100M	25N					
1N457	S			DS	60	1.0	20M	25N					
1N457A	S			DS	60	1.0	100M	25N					
1N458	S			DS	125	1.0	2.0M	25N					
1N458A	S			DS	125	1.0	100M	25N					
1N459	S			DS	175	1.0	3.0M	25N					
1N459A	S			DS	175	1.0	100M	25N					
1N460	S			DS	90	1.0	5.0M	0.1*					
1N460A	S			DS	90	1.0	15M	0.1*					
1N461	S			DS	25	1.0	15M	0.5*					
1N461A	S			DS	25	1.0	100M	0.5*					
1N462	S			DS	60	1.0	5.0M	0.5*					
1N462A	S			DS	60	1.0	100M	0.5*					
1N463	S			DS	175	1.0	1.0M	0.5*					
1N463A	S			DS	175	1.0	100M	0.5*					
1N464	S			DS	125	1.0	3.0M	0.5*					
1N464A	S			DS	125	1.0	100M	0.5*					
1N465	S	1N5223A	1N5221	DZ						3.2	5.0		200M
1N465A	S	1N5223B	1N5221	DZ						2.7	5.0	5.0	200M
1N465B	S	.5M2.7ZS1		DZ						2.7	5.0	1.0	200M
1N466	S	1N5226A	1N5221	DZ						3.9	5.0		200M
1N466A	S	1N5226B	1N5221	DZ						3.3	5.0	5.0	200M
1N466B	S	.5M3.3ZS1		DZ						3.3	5.0	1.0	200M
1N467	S	1N5228B	1N5221	DZ						4.5	5.0		200M
1N467A	S	1N5228B	1N5221	DZ						3.9	5.0	5.0	200M
1N467B	S	.5M3.9ZS1		DZ						3.9	5.0	1.0	200M
1N468	S	1N5230A	1N5221	DZ						5.4	5.0		200M
1N468A	S	1N5230B	1N5221	DZ						4.7	5.0	5.0	200M
1N468B	S	.5M4.7ZS1		DZ						4.7	5.0	1.0	200M
1N469	S	1N5232B	1N5221	DZ						6.4	5.0		200M
1N469A	S	1N5232B	1N5221	DZ						5.6	5.0	5.0	200M
1N469B	S	.5M5.6ZS1		DZ						5.6	6.0	1.0	200M
1N470	S	1N5235B	1N5221	DZ						8.0	5.0		200M
1N470A	S	1N5235B	1N5221	DZ						6.8	5.0	5.0	200M
1N470B	S	.5M6.8ZS1	&	DZ						6.8	5.0	1.0	200M
1N471	S	.5M3.4ZZS10	&	DZ						3.9	5.0		200M
1N471A	S	.5M3.3ZZS5	&	DZ						3.3	5.0	5.0	200M
1N472	S	.5M4.1ZZS10	&	DZ						4.5	5.0		200M
1N472A	S	.5M3.9ZZS5	&	DZ						3.9	5.0	5.0	200M
1N473	S	.5M4.8ZZS10	&	DZ						5.4	5.0		200M
1N473A	S	.5M4.7ZZS5	&	DZ						4.7	5.0	5.0	200M
1N474	S	.5M5.8ZZS10	&	DZ						6.4	5.0		200M
1N474A	S	.5M5.6ZZS5	&	DZ						5.6	5.0	5.0	200M
1N475	S	.5M7.1ZZS10	&	DZ						8.0	5.0		150M
1N475A	S	.5M6.8ZZS5	&	DZ						6.8	5.0	5.0	200M
1N476	G			DS	90	1.0	2.5M	11*					
1N477	G			DS	90	1.0	2.5M	11*					
1N478	G			DS	90	1.0	5.0M	7.0*					
1N479	G			DS	90	1.0	5.0M	7.0*					
1N480	G			DS	60	1.0	5.0M		0.5				
1N481	G			R*	200	0.5	0.1	1.9	25				
1N482	S			DS	36	1.1	100M	0.25*					
1N482A	S			DS	36	1.0	100M	25N					
1N482B	S			DS	36	1.0	100M	25N					
1N483	S			DS	70	1.0	100M	25N					

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_{Z}±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N483A	S			DS	70	1.0	100M	25N					
1N483B	S			DS	70	1.0	100M	25N					
1N484	S			DS	130	1.1	100M	0.25*					
1N484A	S			DS	130	1.0	100M	25N					
1N484B	S			DS	130	1.0	100M	25N					
1N485	S			DS	180	1.1	100M	0.25*					
1N485A	S			DS	180	1.0	100M	25N					
1N485B	S			DS	180	1.0	100M	25N					
1N486	S			DS	225	1.1	100M	0.25*					
1N486A	S			DS	225	1.0	100M	0.05*					
1N486B	S			DS	225	1.0	100M	0.05*					
1N487	S			DS	300	1.1	100M	0.25*					
1N487A	S			DS	300	1.0	100M	0.1*					
1N487B	S			DS	300	1.0	100M	0.1*					
1N488	S			DS	380	1.1	100M	0.25*					
1N488A	S			DS	380	1.0	100M	0.1*					
1N488B	S			DS	380	1.0	100M	0.1*					
1N490	G			DS	90	1.0	5.0M		0.5				
1N497	G			DS	30	1.0	100M	20*					
1N498	G			DS	60	1.0	100M	25*					
1N499	G			DS	75	1.0	100M	30*					
1N500	G			DS	80	1.0	100M	40*					
1N501	G			DS	100	1.0	100M	40*					
1N502	G			DS	120	1.0	100M	50*					
1N503	S			R	50	1.2	0.33	0.5					
1N504	S			R	100	1.2	0.33	0.5					
1N505	S			R	200	1.2	0.33	0.5					
1N506	S			R	300	1.2	0.33	0.5					
1N507	S			R	400	1.2	0.33	0.25					
1N508	S			R	600	1.2	0.33	0.25					
1N509	S			R	800	1.2	0.33	0.25					
1N510	S			R	1000	1.2	0.33	0.25					
1N511	S			R	50	1.2	1.0	0.5					
1N512	S			R	100	1.2	1.0	0.5					
1N513	S			R	200	1.2	1.0	0.5					
1N514	S			R	300	1.2	1.0	0.5					
1N515	S			R	400	1.2	1.0	0.25					
1N516	S			R	600	1.2	1.0	0.25					
1N517	S			R	800	1.2	1.0	0.25					
1N518	S			R	1000	1.2	1.0	0.25					
1N519	S			R	50	1.2	1.25	0.5					
1N520	S			R	100	1.2	1.25	0.5					
1N521	S			R	200	1.2	1.25	0.5					
1N522	S			R	300	1.2	1.25	0.5					
1N523	S			R	400	1.2	1.25	0.25					
1N524	S			R	600	1.2	1.25	0.25					
1N525	S			R	800	1.2	1.25	0.25					
1N526	S			R	1000	1.2	1.25	0.25					
1N527	G			DS	10	0.3	1.0M	50*					
1N530	S	1N4002	1N4001	R	100	2.0	0.3	0.003	3.0				
1N531	S	1N4003	1N4001	R	200	2.0	0.3		3.0				
1N532	S	1N4004	1N4001	R	300	2.0	0.3	0.01	3.0				
1N533	S			R	400	2.0	0.3	0.015	3.0				
1N534	S	1N4005	1N4001	R	500	2.0	0.3		3.0				
1N535	S	1N4005	1N4001	R	600	2.0	0.3	0.02	3.0				
1N536	S	1N4001	1N4001	R	50	0.5	0.25	0.4	15				
1N537	S	1N4002	1N4001	R	100	0.4	0.25	0.5	15				
1N538	S	1N4003	1N4001	R	200	0.3	0.25	0.5	15				
1N539	S	1N4004	1N4001	R	300	0.5	0.25	0.3	15				
1N540	S	1N4004	1N4001	R	400	0.5	0.25	0.3	15				
1N541	G			DS	45	2.2	10M	18*					
1N542	G			DS									
1N543	S			R	1000	10	0.005	0.1					
1N543A	S			R	1000	8.0	0.025	0.1					
1N544	S			R	1000	10	0.015	0.1					
1N544A	S			R	1000	10	0.075	0.1					
1N547	S	1N4005	1N4001	R	600	1.1	0.25	0.35	15				
1N548	S			R	900	1.1	0.3	0.35	15				
1N549	S			R	1200	1.1	0.3	0.35	15				
1N550	S	MR1121	MR1120	R	100	1.5	0.5		4.0				
1N551	S	MR1122	MR1120	R	200	1.5	0.5	0.001	4.0				
1N552	S	MR1123	MR1120	R	300	1.5	0.5		4.0				
1N553	S	MR1124	MR1120	R	400	1.5	0.5		4.0				
1N554	S	MR1125	MR1120	R	500	1.5	0.5		4.0				
1N555	S			R	600	1.5	0.5	0.005	4.0				
1N560	S	1N4006	1N4001	R	800	1.75	0.25	0.015	2.0				
1N561	S	1N4007	1N4001	R	1000	1.75	0.25	0.02	2.0				
1N562	S	MR1128	MR1120	R	800	1.75	0.4	0.015	3.0				
1N563	S	MR1130	MR1120	R	1000	1.75	0.4	0.02	3.0				
1N566	G			DS	220	1.0	20M	0.2M					
1N567	G			DS	100	1.0	150M	0.15M	0.3				
1N568	G			DS	7.0	0.32	5.0M	0.1M	0.08				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N569	G			DS	12	0.5	250M	0.05M					
1N570	S			R	1250	10	37.5	0.1					
1N571	G			DS		1.0	200M	100*	4.0				
1N573	G			R	380	0.15	0.25						
1N574	G			R	380	0.15	0.3						
1N575	G			R	380	0.3	0.35						
1N575A	G			R	380	0.15	0.35						
1N576A	G			R	380	0.15	0.4						
1N581	G			R	380	0.15	0.25						
1N582	G			R	380	0.15	0.3						
1N583	G			R	380	0.15	0.35						
1N584	G			R	380	0.15	0.4						
1N588	S			R	1500	1.75	0.1	0.1	5.0				
1N589	S	MR991A	MR990A	R	1500	1.75	0.25	0.1	10				
1N590	S			R	1500	8.0	0.075	0.1					
1N591	S			R	1500	8.0	0.075	0.1					
1N596	S	1N4005	1N4001	R	600	3.0	0.125	0.025	1.0				
1N597	S	1N4006	1N4001	R	800	3.0	0.125	0.025	1.0				
1N598	S	1N4007	1N4001	R	1000	3.0	0.125	0.025	1.0				
1N599	S	1N4001	1N4001	R	50	1.5	0.3	0.025	2.0				
1N599A	S	1N4001	1N4001	R	50	1.5	0.3	0.001	2.0				
1N600	S	1N4002	1N4001	R	100	1.5	0.3	0.025	2.0				
1N600A	S	1N4002	1N4001	R	100	1.5	0.3	0.001	2.0				
1N601	S	1N4003	1N4001	R	150	1.5	0.3	0.025	2.0				
1N601A	S	1N4003	1N4001	R	150	1.5	0.3	0.001	2.0				
1N602	S	1N4003	1N4001	R	200	1.5	0.3	0.025	2.0				
1N602A	S	1N4003	1N4001	R	200	1.5	0.3	0.001	2.0				
1N603	S	1N4004	1N4001	R	300	1.5	0.3	0.025	2.0				
1N603A	S	1N4004	1N4001	R	300	1.5	0.3	0.001	2.0				
1N604	S	1N4004	1N4001	R	400	1.5	0.3	0.025	2.0				
1N604A	S	1N4004	1N4001	R	400	1.5	0.3		2.0				
1N605	S	1N4005	1N4001	R	500	1.5	0.3	0.025	2.0				
1N605A	S	1N4005	1N4001	R	500	1.5	0.3	0.002	2.0				
1N606	S	1N4005	1N4001	R	600	1.5	0.3	0.025	2.0				
1N606A	S	1N4005	1N4001	R	600	1.5	0.3		2.0				
1N607	S			R	50	1.5	0.8	0.025	3.0				
1N607A	S	MR1120	MR1120	R	50	1.5	0.8	0.001	3.0				
1N608	S			R	100	1.5	0.8	0.025	3.0				
1N608A	S	MR1121	MR1120	R	100	1.5	0.8	0.001	3.0				
1N609	S			R	150	1.5	0.8	0.025	3.0				
1N609A	S	MR1122	MR1120	R	150	1.5	0.8	0.001	3.0				
1N610	S			R	200	1.5	0.8	0.025	3.0				
1N610A	S	MR1122	MR1120	R	200	1.5	0.8	0.001	3.0				
1N611	S			R	300	1.5	0.8	0.025	3.0				
1N611A	S	MR1123	MR1120	R	300	1.5	0.8	0.001	3.0				
1N612	S			R	400	1.5	0.8	0.025	3.0				
1N612A	S	MR1124	MR1120	R	400	1.5	0.8	1.5	3.0				
1N613	S			R	500	1.5	0.8	0.025	3.0				
1N613A	S	MR1125	MR1120	R	500	1.5	0.8	0.002	3.0				
1N614	S			R	600	1.5	0.8	0.025	3.0				
1N614A	S	MR1126	MR1120	R	600	1.5	0.8	2.5	3.0				
1N615	G			R	300		0.075	1.2	25				
1N616	G			DS	20	1.0	8.0M	0.4M					
1N617	G			DS	115	1.0	3.0M	11*					
1N618	G			DS	115	1.0	5.0M	7.0*					
1N619	S			DS	30	1.0	3.0M	0.08*					
1N622	S			DS	150	1.0	7.0M	0.16*					
1N625	S			DS		1.5	4.0M	1.0*	1.0				
1N626	S			DS		1.5	4.0M	1.0*	1.0				
1N627	S			DS		1.5	4.0M	1.0*	1.0				
1N628	S			DS		1.5	4.0M	1.0*	1.0				
1N629	S			DS		1.5	4.0M	1.0*	1.0				
1N630	S	Microwave L-X-band Detector											
1N631	G			DS	60				0.3				
1N632	G			DS	60	1.0	7.0M		0.3				
1N633	G			DS	80	1.0	125M		0.3				
1N634	G			DS	100	1.0	50M	45*					
1N635	G			DS	150	1.0	50M	175*					
1N636	G			DS	60	1.0	2.5M	10*					
1N643	S			DS	175	1.0	10M	1.0*	0.3				
1N643A	S			DS	175	1.0	100M	1.0*	0.3				
1N645	S	1N4003	1N4001	DS	225	1.0	400M	0.2*					
1N645A	S	1N4003	1N4001	DS	225	1.0	400M	0.05*					
1N646	S	1N4004	1N4001	DS	300	1.0	400M	0.2*					
1N647	S	1N4004	1N4001	DS	400	1.0	400M	0.2*					
1N648	S	1N4005	1N4001	DS	500	1.0	400M	0.2*					
1N649	S	1N4005	1N4001	DS	600	1.0	400M	0.2*					
1N658	S			DS	100	1.0	100M	0.05*	0.3				
1N658A	S			DS	120	1.0	100M	25N	0.3				
1N659	S			DS	50	1.0	6.0M	5.0*	0.3				
1N659A	S			DS	60	1.0	10M	25N	0.3				
1N660	S			DS	100	1.0	6.0M	5.0*	0.3				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N660A	S			DS	120	1.0	10M	25N	0.3				
1N661	S			DS	200	1.0	6.0M	10*	0.3				
1N661A	S			DS	240	1.0	10M	25N	0.3				
1N662	S			DS	80	1.0	10M	1.0*	0.5				
1N662A	S			DS	80	1.0	100M	1.0*	0.3				
1N663	S			DS	80	1.0	100M	5.0*	0.5				
1N663A	S			DS	80	1.0	100M	0.1*	0.3				
1N664	S	1N5237A	1N5221	DZ						8.2	10	10	250M
1N665	S	1N5242A	1N5221	DZ						12	10	10	0.25W
1N666	S	1N5245B	1N5221	DZ						15	5.0	5.0	0.25W
1N667	S	1N5248A	1N5221	DZ						18	5.0	10	0.25W
1N668	S	1N5251A	1N5221	DZ						22	5.0	10	0.25W
1N669	S	1N5254A	1N5221	DZ						27	5.0	10	0.25W
1N670	S	1N5266B	1N5221	DZ						68	1.0	5.0	250M
1N671	S	1N5271A	1N5221	DZ						100	1.0	10	0.25W
1N672	S	1N5276A	1N5221	DZ						150	1.0	10	0.25W
1N673	S		1N5221	DS	350	1.0	250M	1.0*					
1N674	S	1N5230A	1N5221	DZ						4.7	20	10	250M
1N675	S	1N5234B	1N5221	DZ						6.2	20	5.0	250M
1N676	S	1N4002	1N4001	R	100	1.0	0.075	0.2	3.0				
1N677	S	1N4002	1N4001	R	100	1.0	0.15	0.2	5.0				
1N678	S	1N4003	1N4001	R	200	1.0	0.075	0.2	3.0				
1N679	S	1N4003	1N4001	R	200	1.0	0.15	0.2	5.0				
1N681	S	1N4004	1N4001	R	300	1.0	0.075	0.2	3.0				
1N682	S	1N4004	1N4001	R	300	1.0	0.15	0.2	5.0				
1N683	S	1N4004	1N4001	R	400	1.0	0.075	0.2	3.0				
1N684	S	1N4004	1N4001	R	400	1.0	0.15	0.2	5.0				
1N685	S	1N4005	1N4001	R	500	1.0	0.075	0.2	3.0				
1N686	S	1N4005	1N4001	R	500	1.0	0.15	0.2	5.0				
1N687	S	1N4005	1N4001	R	600	1.0	0.075	0.2	3.0				
1N689	S	1N4005	1N4001	R	600	1.0	0.15	0.2	5.0				
1N690	S			DS	36	1.0	400M	0.25*	0.8				
1N691	S			DS	70	1.0	400M	0.25*	0.8				
1N692	S			DS	100	1.0	400M	0.25*	0.8				
1N693	S			DS	130	1.0	400M	0.25*	0.8				
1N695	G			DS	20	1.0	100M	2.0*	0.3				
1N695A	G			DS	25	0.5	10M	2.0*	0.3				
1N696	S			DS	30	1.0	10M	15N	5.0				
1N697	S			DS		1.0	0.25A	1.0*					
1N698	G			DS	25	0.65	30M	160*	0.5				
1N699	G			DS	80	1.0	100M		0.3				
1N701	S	1N5240B *	1N5221	DZ						10.5	10		250M
1N702	S	1N5223A *	1N5221	DZ						3.2	5.0		250M
1N702A	S	1N5223B *	1N5221	DZ						2.9	5.0		250M
1N703	S	1N5227A *	1N5221	DZ						3.9	5.0		250M
1N703A	S	1N5227B *	1N5221	DZ						3.67	5.0		250M
1N704	S	1N5229A *	1N5221	DZ						4.5	5.0		250M
1N704A	S	1N5229B *	1N5221	DZ						4.3	5.0		250M
1N705	S	1N5230A *	1N5221	DZ						5.4	5.0		250M
1N705A	S	1N5230B *	1N5221	DZ						5.12	5.0		250M
1N706	S	1N5232A *	1N5221	DZ						6.4	5.0		250M
1N706A	S	1N5232B *	1N5221	DZ						6.1	5.0		250M
1N707	S	1N5236A *	1N5221	DZ						8.0	5.0		250M
1N707A	S	1N5236B *	1N5221	DZ						7.55	5.0		250M
1N708	S	1N5232A *	1N5221	DZ							25	10	250M
1N708A	S	1N5232B *	1N5221	DZ							25	5.0	250M
1N709	S	1N5234A *	1N5221	DZ							25	10	250M
1N709A	S	1N5234B *	1N5221	DZ							25	5.0	250M
1N710	S	1N5235A *	1N5221	DZ							25	10	250M
1N710A	S	1N5235B *	1N5221	DZ							25	5.0	250M
1N711	S	1N5236A *	1N5221	DZ							25	10	250M
1N711A	S	1N5236B *	1N5221	DZ							25	5.0	250M
1N712	S	1N5237A *	1N5221	DZ							25	10	250M
1N712A	S	1N5237B *	1N5221	DZ							25	5.0	250M
1N713	S	1N5239A *	1N5221	DZ							12	10	250M
1N713A	S	1N5239B *	1N5221	DZ							12	5.0	250M
1N714	S	1N5240A *	1N5221	DZ							12	10	250M
1N714A	S	1N5240B *	1N5221	DZ							12	5.0	250M
1N715	S	1N5241A *	1N5221	DZ							12	10	250M
1N715A	S	1N5241B *	1N5221	DZ							12	5.0	250M
1N716	S	1N5242A *	1N5221	DZ							12	10	250M
1N716A	S	1N5242B *	1N5221	DZ							12	5.0	250M
1N717	S	1N5243A *	1N5221	DZ							12	10	250M
1N717A	S	1N5243B *	1N5221	DZ							12	5.0	250M
1N718	S	1N5245A *	1N5221	DZ							12	10	250M
1N718A	S	1N5245B *	1N5221	DZ							12	5.0	250M
1N719	S	1N5246A *	1N5221	DZ							12	10	250M
1N719A	S	1N5246B *	1N5221	DZ							12	5.0	250M
1N720	S	1N5248A *	1N5221	DZ							12	10	250M
1N720A	S	1N5248B *	1N5221	DZ							12	5.0	250M
1N721	S	1N5250A *	1N5221	DZ							4.0	10	250M
1N721A	S	1N5250B *	1N5221	DZ							4.0	5.0	250M

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N722	S	1N5251A *	1N5221	DZ						22	4.0	10	250M
1N722A	S	1N5251B *	1N5221	DZ						22	4.0	5.0	250M
1N723	S	1N5252A *	1N5221	DZ						24	4.0	10	250M
1N723A	S	1N5252B *	1N5221	DZ						24	4.0	5.0	250M
1N724	S	1N5254A *	1N5221	DZ						27	4.0	10	250M
1N724A	S	1N5254B *	1N5221	DZ						27	4.0	5.0	250M
1N725	S	1N5256A *	1N5221	DZ						30	4.0	10	250M
1N725A	S	1N5256B *	1N5221	DZ						30	4.0	5.0	250M
1N726	S	1N5257A *	1N5221	DZ						33	4.0	10	250M
1N726A	S	1N5257B *	1N5221	DZ						33	4.0	5.0	250M
1N727	S	1N5258A *	1N5221	DZ						36	4.0	10	250M
1N727A	S	1N5258B *	1N5221	DZ						36	4.0	5.0	250M
1N728	S	1N5259A *	1N5221	DZ						39	4.0	10	250M
1N728A	S	1N5259B *	1N5221	DZ						39	4.0	5.0	250M
1N729	S	1N5260A *	1N5221	DZ						43	4.0	10	250M
1N729A	S	1N5260B *	1N5221	DZ						43	4.0	5.0	250M
1N730	S	1N5261A *	1N5221	DZ						47	4.0	10	250M
1N730A	S	1N5261B *	1N5221	DZ						47	4.0	5.0	250M
1N731	S	1N5262A *	1N5221	DZ						51	4.0	10	250M
1N731A	S	1N5262B *	1N5221	DZ						51	4.0	5.0	250M
1N732	S	1N5263A *	1N5221	DZ						56	4.0	10	250M
1N732A	S	1N5263B *	1N5221	DZ						56	4.0	5.0	250M
1N733	S	1N5265A *	1N5221	DZ						62	2.0	10	250M
1N733A	S	1N5265B *	1N5221	DZ						62	2.0	5.0	250M
1N734	S	1N5266A *	1N5221	DZ						68	2.0	10	250M
1N734A	S	1N5266B *	1N5221	DZ						68	2.0	5.0	250M
1N735	S	1N5267A *	1N5221	DZ						75	2.0	10	250M
1N735A	S	1N5267B *	1N5221	DZ						75	2.0	5.0	250M
1N736	S	1N5268A *	1N5221	DZ						82	2.0	10	250M
1N736A	S	1N5268B *	1N5221	DZ						82	2.0	5.0	250M
1N737	S	1N5270A *	1N5221	DZ						91	1.0	10	250M
1N737A	S	1N5270B *	1N5221	DZ						91	1.0	5.0	250M
1N738	S	1N5271A *	1N5221	DZ						100	1.0	10	250M
1N738A	S	1N5271B *	1N5221	DZ						100	1.0	5.0	250M
1N739	S	1N5272A *	1N5221	DZ						110	1.0	10	250M
1N739A	S	1N5272B *	1N5221	DZ						110	1.0	5.0	250M
1N740	S	1N5273A *	1N5221	DZ						120	1.0	10	250M
1N740A	S	1N5273B *	1N5221	DZ						120	1.0	5.0	250M
1N741	S	1N5274A *	1N5221	DZ						130	1.0	10	250M
1N741A	S	1N5274B *	1N5221	DZ						130	1.0	5.0	250M
1N742	S	1N5276A *	1N5221	DZ						150	1.0	10	250M
1N742A	S	1N5276B *	1N5221	DZ						150	1.0	5.0	250M
1N743	S	1N5277A *	1N5221	DZ						160	1.0	10	250M
1N743A	S	1N5277B *	1N5221	DZ						160	1.0	5.0	250M
1N744	S	1N5279A *	1N5221	DZ						180	1.0	10	250M
1N744A	S	1N5279B *	1N5221	DZ						180	1.0	5.0	250M
1N745	S	1N5281A *	1N5221	DZ						200	1.0	0	250M
1N745A	S	1N5281B *	1N5221	DZ						200	1.0	5.0	250M
1N746	S		1N702	DZ						3.3	20	10	400M
1N746A	S		1N702	DZ						3.3	20	5.0	400M
1N747	S		1N702	DZ						3.6	20	10	400M
1N747A	S		1N702	DZ						3.6	20	5.0	400M
1N748	S		1N702	DZ						3.9	20	10	400M
1N748A	S		1N702	DZ						3.9	20	5.0	400M
1N749	S		1N702	DZ						4.3	20	10	400M
1N749A	S		1N702	DZ						4.3	20	5.0	400M
1N750	S		1N702	DZ						4.7	20	10	400M
1N750A	S		1N702	DZ						4.7	20	5.0	400M
1N751	S		1N702	DZ						5.1	20	10	400M
1N751A	S		1N702	DZ						5.1	20	5.0	400M
1N752	S		1N702	DZ						5.6	20	10	400M
1N752A	S		1N702	DZ						5.6	20	5.0	400M
1N753	S		1N702	DZ						6.2	20	10	400M
1N753A	S		1N702	DZ						6.2	20	5.0	400M
1N754	S		1N702	DZ						6.8	20	10	400M
1N754A	S		1N702	DZ						6.8	20	5.0	400M
1N755	S		1N702	DZ						7.5	20	10	400M
1N755A	S		1N702	DZ						7.5	20	5.0	400M
1N756	S		1N702	DZ						8.2	20	10	400M
1N756A	S		1N702	DZ						8.2	20	5.0	400M
1N757	S		1N702	DZ						9.1	20	10	400M
1N757A	S		1N702	DZ						9.1	20	5.0	400M
1N758	S		1N702	DZ						10.0	20	10	400M
1N758A	S		1N702	DZ						10.0	20	5.0	400M
1N759	S		1N702	DZ						12.0	20	10	400M
1N759A	S		1N702	DZ						12.0	20	5.0	400M
1N761	S	1N5230A *	1N5221	DZ						5.4	10		250M
1N762	S	1N5232B *	1N5221	DZ						6.4	10		250M
1N763	S	1N5238B *	1N5221	DZ						8.0	10		250M
1N764	S	1N5238A *	1N5221	DZ						10.0	10		250M
1N765	S	1N5240A *	1N5221	DZ						12.0	5.0		250M
1N766	S	1N5243A *	1N5221	DZ						14.5	5.0		250M

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N767	S	1N5246A *	1N5221	DZ						18	5.0		250M
1N768	S	1N5249A *	1N5221	DZ						21	5.0		250M
1N769	S	1N5252A *	1N5221	DZ						27	5.0		250M
1N770	G			DS	20	0.42	5.0M	40*	0.35				
1N771	G			DS	80	1.0	100M	25*					
1N771A	G			DS	80	1.0	200M	25*					
1N771B	G			DS	80	1.0	400M	25*					
1N772	G			DS	70	1.0	100M	50*					
1N772A	G			DS	70	1.0	200M	50*					
1N773	G			DS	65	1.0	100M	10*					
1N773A	G			DS	65	1.0	200M	10*					
1N774	G			DS	60	1.0	100M	15*					
1N774A	G			DS	60	1.0	200M	15*					
1N775	G			DS	60	1.0	100M	20*					
1N776	G			DS	20	1.0	50M	200*					
1N777	G			DS	60	1.0	100M	25*	3.5				
1N778	S			DS	100	1.0	10M	0.5*	0.3				
1N779	S			DS	175	1.0	10M	0.5*	0.3				
1N781	G			DS	40	0.45	10M	5.0*	0.5				
1N781A	G			DS	40	0.45	10M	5.0*	0.5				
1N789	S			DS		1.0	10M	1.0*	0.5				
1N790	S			DS		1.0	10M	5.0*	0.25				
1N791	S			DS		1.0	50M	5.0*	0.5				
1N792	S			DS		1.0	100M	5.0*	0.5				
1N793	S			DS		1.0	10M	1.0*	0.5				
1N794	S			DS		1.0	10M	5.0*	0.25				
1N795	S			DS		1.0	50M	5.0*	0.5				
1N796	S			DS		1.0	100M	5.0*	0.5				
1N797	S			DS		1.0	10M	1.0*	0.5				
1N798	S			DS		1.0	10M	5.0*	0.25				
1N799	S			DS		1.0	50M	5.0*	0.5				
1N800	S			DS		1.0	100M	5.0*	0.5				
1N801	S			DS		1.0	10M	1.0*	0.5				
1N802	S			DS		1.0	50M	5.0*	0.5				
1N803	S			DS		1.0	10M	5.0*	0.5				
1N804	S			DS		1.0	50M	10*	0.5				
1N805	G			DS	40	1.0	3.0M	100*					
1N806	S			DS	100	1.0	4.0M	0.5*	0.3				
1N807	S			DS	180	1.0	4.0M	0.5*	0.3				
1N808	S			DS	100	1.0	100M	1.0*	0.3				
1N809	S			DS	200	1.0	100M	1.0*	0.3				
1N810	S			DS	50	1.0	10M	1.0*	50				
1N811	S			DS	20	1.0	1.0M	1.0*	0.25				
1N812	S			DS	30	1.0	1.0M	0.1*	0.25				
1N813	S			DS	15	1.0	5.0M	0.5*	0.25				
1N814	S			DS	40	1.0	2.0M	0.1*	0.25				
1N815	S			DS	15	1.5	100M	0.5*	0.25				
1N816	S			DS	6.0	1.0	100M	0.1*					
1N817	S			DS	200	1.5	6.0M	20*	1.0				
1N818	S			DS	80	1.5	30M	0.25*	0.5				
1N819	S			DS	80	1.0	200M	25N					
1N821	S		1N821	DR						6.2	0.01	7.5	-55/100
1N821A	S		1N821	DR						6.2	0.01	7.5	-55/100
1N822	S			DR						6.2	0.01	7.5	-55/100
1N823	S		1N821	DR						6.2	0.005	7.5	-55/100
1N823A	S		1N821	DR						6.2	0.005	7.5	-55/100
1N824	S			DR						6.2	0.005	7.5	-55/100
1N825	S		1N821	DR						6.2	0.002	7.5	-55/100
1N825A	S		1N821	DR						6.2	0.002	7.5	-55/100
1N826	S	1N825	1N821	DR						6.5	0.002	7.5	-55/100
1N827	S		1N821	DR						6.2	0.001	7.5	-55/100
1N827A	S		1N821	DR						6.2	0.001	7.5	-55/100
1N828	S	1N827	1N821	DR						6.5	0.001	7.5	-55/100
1N829	S		1N821	DR						6.2	0.0005	7.5	-55/100
1N830	S	Micro-min. UHF Detector											
1N830A	S	Micro-min. UHF Detector											
1N831	S	Microwave S-band Mixer; NF = 8.3 to 6.5 dB											
1N831A	S	Microwave S-band Mixer; NF = 8.3 to 6.5 dB											
1N831B	S	Microwave S-band Mixer; NF = 8.3 to 6.5 dB											
1N832	S	Microwave X-band Mixer; NF = 9.5 to 7.0 dB											
1N832A	S	Microwave X-band Mixer; NF = 9.5 to 7.0 dB											
1N832B	S	Microwave X-band Mixer; NF = 9.5 to 7.0 dB											
1N832D		Microwave Mixer - to 12,000 MHz; NF = 6.0 dB											
1N833	S	Microwave X-band Detector											
1N833A	S	Microwave X-band Detector											
1N835	G			DS	30	0.5	5.0M	20*	0.5				
1N836	G			DS	5.0								
1N837	S			DS		1.0	150M	0.1*	0.5				
1N837A	S			DS		1.0	150M	0.1*	0.3				
1N838	S			DS		1.0	150M	0.1*	0.5				
1N839	S			DS		1.0	150M	0.1*	0.5				
1N840	S			DS		1.0	150M	0.1*	0.3				
1N841	S			DS		1.0	150M	0.1*	0.3				

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N842	S			DS		1.0	150M	0.1*	0.3				
1N843	S			DS		1.0	150M	0.1*	0.3				
1N844	S			DS		1.0	200M	0.1*	0.5				
1N845	S			DS		1.0	200M	0.1*	0.5				
1N846	S	1N4001	1N4001	R	50	0.6	200M	20*					
1N847	S	1N4002	1N4001	R	100	0.6	200M	20*					
1N848	S	1N4003	1N4001	R	200	0.6	200M	20*					
1N849	S	1N4004	1N4001	R	300	0.6	200M	20*					
1N850	S	1N4004	1N4001	R	400	0.6	200M	20*					
1N851	S	1N4005	1N4001	R	500	0.6	200M	20*					
1N852	S	1N4005	1N4001	R	600	0.6	200M	20*					
1N853	S	1N4006	1N4001	R	700	0.6	200M	20*					
1N854	S	1N4006	1N4001	R	800	0.6	200M	20*					
1N855	S	1N4007	1N4001	R	900	0.6	200M	20*					
1N856	S	1N4007	1N4001	R	1.0K	0.6	200M	20*					
1N857	S	1N4001	1N4001	R	50	0.6	150M	20*					
1N858	S	1N4002	1N4001	R	100	0.6	150M	20*					
1N859	S	1N4003	1N4001	R	200	0.6	150M	20*					
1N860	S	1N4004	1N4001	R	300	0.6	150M	20*					
1N861	S	1N4004	1N4001	R	400	0.6	150M	20*					
1N862	S	1N4005	1N4001	R	500	0.6	150M	20*					
1N863	S	1N4005	1N4001	R	600	0.6	150M	20*					
1N864	S	1N4006	1N4001	R	700	0.6	150M	20*					
1N865	S	1N4006	1N4001	R	800	0.6	150M	20*					
1N866	S	1N4007	1N4001	R	900	0.6	150M	20*					
1N867	S	1N4007	1N4001	R	1.0K	0.6	150M	20*					
1N868	S	1N4001	1N4001	R	50	0.6	100M	20*					
1N869	S	1N4002	1N4001	R	100	0.6	100M	20*					
1N870	S	1N4003	1N4001	R	200	0.6	100M	20*					
1N871	S	1N4004	1N4001	R	300	0.6	100M	20*					
1N872	S	1N4004	1N4001	R	400	0.6	100M	20*					
1N873	S	1N4005	1N4001	R	500	0.6	100M	20*					
1N874	S	1N4005	1N4001	R	600	0.6	100M	20*					
1N875	S	1N4006	1N4001	R	700	0.6	100M	20*					
1N876	S	1N4006	1N4001	R	800	0.6	100M	20*					
1N877	S	1N4007	1N4001	R	900	0.6	100M	20*					
1N878	S	1N4007	1N4001	R	1.0K	0.6	100M	20*					
1N879	S	1N4001	1N4001	R	50	0.6	50M	20*					
1N880	S	1N4002	1N4001	R	100	0.6	50M	20*					
1N881	S	1N4003	1N4001	R	200	0.6	50M	20*					
1N882	S	1N4004	1N4001	R	300	0.6	50M	20*					
1N883	S	1N4004	1N4001	R	400	0.6	50M	20*					
1N884	S	1N4005	1N4001	R	500	0.6	50M	20*					
1N885	S	1N4005	1N4001	R	600	0.6	50M	20*					
1N886	S	1N4006	1N4001	R	700	0.6	50M	20*					
1N887	S	1N4006	1N4001	R	800	0.6	50M	20*					
1N888	S	1N4007	1N4001	R	900	0.6	50M	20*					
1N889	S	1N4007	1N4001	R	1.0K	0.6	50M	20*					
1N890	S			DS	60	1.0	20M	25N					
1N891	S			DS		1.0	50M	0.1*	0.3				
1N892	S			DS		1.0	50M	0.1*	0.3				
1N893	S			DS		1.0	50M	0.1*	0.3				
1N894	G			DS	5.0								
1N895	G			DS	5.0								
1N896	G			DS	5.0								
1N897	S			DS	2.5	1.0	5.0M	0.1*	1.0				
1N898	S			DS	2.5	1.0	100M	5.0*	0.3				
1N899	S			DS	85	1.0	5.0M	0.1*	0.3				
1N900	S			DS	85	1.0	50M	0.1*	0.3				
1N901	S			DS	85	1.0	100M	0.5*	0.3				
1N902	S			DS	170	1.0	10M	1.0*	0.3				
1N903	S			DS	40	1.0	10M	0.1*	4.0				
1N903A	S			DS	40	1.0	20M	0.1*	4.0				
1N904	S			DS	30	1.0	10M	0.1*	4.0				
1N904A	S			DS	30	1.0	20M	0.1*	4.0				
1N905	S			DS	20	1.0	10M	0.1*	4.0				
1N905A	S			DS	20	1.0	20M	0.1*	4.0				
1N906	S			DS	20	1.0	10M	0.1*	4.0				
1N906A	S			DS	20	1.0	20M	0.1*	4.0				
1N907	S			DS	30	1.0	10M	0.1*	4.0				
1N907A	S			DS	30	1.0	20M	0.1*	4.0				
1N908	S			DS	40	1.0	10M	0.1*	4.0				
1N908A	S			DS	40	1.0	20M	0.1*	4.0				
1N909	G			DS	50	1.0	100M	10*					
1N910	G			DS	30	1.0	100M	10*					
1N911	G			DS	20	1.0	100M	10*					
1N912	S			DS	10	0.62	1.0M	1.0*					
1N912A	S			DS	10	0.62	1.0M	1.0*					
1N913	S			DS	10	0.62	1.0M	5.0*					
1N913A	S			DS	10	0.62	1.0M	1.0*					
1N914	S			DS	75	1.0	10M	5.0*	4.0				
1N914A	S			DS	75	1.0	20M	5.0*	4.0				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N914B	S			DS	75	1.0	100M	5.0*	4.0				
1N915	S			DS	50	1.0	50M	5.0*	10				
1N916	S			DS	75	1.0	10M	5.0*	4.0				
1N916A	S			DS	75	1.0	20M	5.0*	4.0				
1N916B	S			DS	75	1.0	30M	5.0*	4.0				
1N917	S			DS	30	1.0	10M	0.05*	3.0				
1N918	S	Microwave Ku-band Mixer											
1N919	S			DS	150	1.0	100M	0.5*	0.3				
1N920	S			DS	36	1.0	500M	0.25*	0.3				
1N921	S			DS	70	1.0	500M	0.25*	0.3				
1N922	S			DS	100	1.0	500M	0.25*	0.3				
1N923	S			DS	130	1.0	500M	0.25*	0.3				
1N925	S			DS	32	1.0	5.0M	1.0*	0.15				
1N926	S			DS	32	1.0	5.0M	0.1*	0.15				
1N927	S			DS	52	1.0	10M	0.1*	0.15				
1N928	S			DS	96	1.0	10M	0.1*	0.15				
1N929	S			DS	20	1.0	20M	0.1*					
1N930	S			DS	50	1.0	20M	0.1*					
1N931	S			DS	100	1.0	20M	0.1*					
1N932	S			DS	200	1.0	20M	0.1*					
1N933	G			DS	100	1.0	14M	10*	0.4				
1N934	S			DS	60	1.0	30M	25N	1.0				
1N935	S		1N935	DR						9.0	0.01	7.5	0/75
1N935A	S		1N935	DR						9.0	0.01	7.5	-55/100
1N935B	S		1N935	DR						9.0	0.01	7.5	-55/150
1N936	S		1N935	DR						9.0	0.005	7.5	0/75
1N936A	S		1N935	DR						9.0	0.005	7.5	-55/100
1N936B	S		1N935	DR						9.0	0.005	7.5	-55/150
1N937	S		1N935	DR						9.0	0.002	7.5	0/75
1N937A	S		1N935	DR						9.0	0.002	7.5	-55/100
1N937B	S		1N935	DR						9.0	0.002	7.5	-55/150
1N938	S		1N935	DR						9.0	0.001	7.5	0/75
1N938A	S		1N935	DR						9.0	0.001	7.5	-55/100
1N938B	S		1N935	DR						9.0	0.001	7.5	-55/150
1N939	S		1N935	DR						9.0	0.0005	7.5	0/75
1N939A	S		1N935	DR						9.0	0.0005	7.5	-55/100
1N939B	S		1N935	DR						9.0	0.0005	7.5	-55/150
1N940	S			DR						9.0	0.0002	7.5	0/75
1N940A	S			DR						9.0	0.0002	7.5	-55/100
1N940B	S			DR						9.0	0.0002	7.5	-55/150
1N941	S		1N941	DR						11.7	0.01	7.5	0/75
1N941A	S		1N941	DR						11.7	0.01	7.5	-55/100
1N941B	S		1N941	DR						11.7	0.01	7.5	-55/150
1N942	S		1N941	DR						11.7	0.005	7.5	0/75
1N942A	S		1N941	DR						11.7	0.005	7.5	-55/100
1N942B	S		1N941	DR						11.7	0.005	7.5	-55/150
1N943	S		1N941	DR						11.7	0.002	7.5	0/75
1N943A	S		1N941	DR						11.7	0.002	7.5	-55/100
1N943B	S		1N941	DR						11.7	0.002	7.5	-55/150
1N944	S		1N941	DR						11.7	0.001	7.5	0/75
1N944A	S		1N941	DR						11.7	0.001	7.5	-55/100
1N944B	S		1N941	DR						11.7	0.001	7.5	-55/150
1N945	S		1N941	DR						11.7	0.0005	7.5	0/75
1N945A	S		1N941	DR						11.7	0.0005	7.5	-55/100
1N945B	S		1N941	DR						11.7	0.0005	7.5	-55/150
1N946	S			DR						11.7	0.0002	7.5	0/75
1N946A	S			DR						11.7	0.0002	7.5	-55/100
1N946B	S			DR						11.7	0.0002	7.5	-55/150
1N947	S			DS		1.0	400M	2.0*					
1N948	S			DS	36	1.5	100M	0.25*	1.0				
1N949	G			DS	50	0.39	10M	10*					
1N950 thru 1N956	S	Varactor Diodes, see Table on Page 1-94											
1N957	S		1N957	DZ						6.8	18.5	20	400M
1N957A	S		1N957	DZ						6.8	18.5	10	400M
1N957B	S		1N957	DZ						6.8	18.5	5.0	400M
1N958	S		1N957	DZ						7.5	16.5	20	400M
1N958A	S		1N957	DZ						7.5	16.5	10	400M
1N958B	S		1N957	DZ						7.5	16.5	5.0	400M
1N959	S		1N957	DZ						8.2	15	20	400M
1N959A	S		1N957	DZ						8.2	15	10	400M
1N959B	S		1N957	DZ						8.2	15	5.0	400M
1N960	S		1N957	DZ						9.1	14	20	400M
1N960A	S		1N957	DZ						9.1	14	10	400M
1N960B	S		1N957	DZ						9.1	14	5.0	400M
1N961	S		1N957	DZ						10	12.5	20	400M
1N961A	S		1N957	DZ						10	12.5	10	400M
1N961B	S		1N957	DZ						10	12.5	5.0	400M
1N962	S		1N957	DZ						11	11.5	20	400M
1N962A	S		1N957	DZ						11	11.5	10	400M
1N962B	S		1N957	DZ						11	11.5	5.0	400M

1N963–1N990

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (µs)	V_Z(nom)	TC %/°C	I_{ZT} mA	Temp Range
1N963	S		1N957	DZ						12	10.5	20	400M
1N963A	S		1N957	DZ						12	10.5	10	400M
1N963B	S		1N957	DZ						12	10.5	5.0	400M
1N964	S		1N957	DZ						13	9.5	20	400M
1N964A	S		1N957	DZ						13	9.5	10	400M
1N964B	S		1N957	DZ						13	9.5	5.0	400M
1N965	S		1N957	DZ						15	8.5	20	400M
1N965A	S		1N957	DZ						15	8.5	10	400M
1N965B	S		1N957	DZ						15	8.5	5.0	400M
1N966	S		1N957	DZ						16	7.8	20	400M
1N966A	S		1N957	DZ						16	7.8	10	400M
1N966B	S		1N957	DZ						16	7.8	5.0	400M
1N967	S		1N957	DZ						18	7.0	20	400M
1N967A	S		1N957	DZ						18	7.0	10	400M
1N967B	S		1N957	DZ						18	7.0	5.0	400M
1N968	S		1N957	DZ						20	6.2	20	400M
1N968A	S		1N957	DZ						20	6.2	10	400M
1N968B	S		1N957	DZ						20	6.2	5.0	400M
1N969	S		1N957	DZ						22	5.6	20	400M
1N969A	S		1N957	DZ						22	5.6	10	400M
1N969B	S		1N957	DZ						22	5.6	5.0	400M
1N970	S		1N957	DZ						24	5.2	20	400M
1N970A	S		1N957	DZ						24	5.2	10	400M
1N970B	S		1N957	DZ						24	5.2	5.0	400M
1N971	S		1N957	DZ						27	4.6	20	400M
1N971A	S		1N957	DZ						27	4.6	10	400M
1N971B	S		1N957	DZ						27	4.6	5.0	400M
1N972	S		1N957	DZ						30	4.2	20	400M
1N972A	S		1N957	DZ						30	4.2	10	400M
1N972B	S		1N957	DZ						30	4.2	5.0	400M
1N973	S		1N957	DZ						33	3.8	20	400M
1N973A	S		1N957	DZ						33	3.8	10	400M
1N973B	S		1N957	DZ						33	3.8	5.0	400M
1N974	S		1N957	DZ						36	3.4	20	400M
1N974A	S		1N957	DZ						36	3.4	10	400M
1N974B	S		1N957	DZ						36	3.4	5.0	400M
1N975	S		1N957	DZ						39	3.2	20	400M
1N975A	S		1N957	DZ						39	3.2	10	400M
1N975B	S		1N957	DZ						39	3.2	5.0	400M
1N976	S		1N957	DZ						43	3.0	20	400M
1N976A	S		1N957	DZ						43	3.0	10	400M
1N976B	S		1N957	DZ						43	3.0	5.0	400M
1N977	S		1N957	DZ						47	2.7	20	400M
1N977A	S		1N957	DZ						47	2.7	10	400M
1N977B	S		1N957	DZ						47	2.7	5.0	400M
1N978	S		1N957	DZ						51	2.5	20	400M
1N978A	S		1N957	DZ						51	2.5	10	400M
1N978B	S		1N957	DZ						51	2.5	5.0	400M
1N979	S		1N957	DZ						56	2.2	20	400M
1N979A	S		1N957	DZ						56	2.2	10	400M
1N979B	S		1N957	DZ						56	2.2	5.0	400M
1N980	S		1N957	DZ						62	2.0	20	400M
1N980A	S		1N957	DZ						62	2.0	10	400M
1N980B	S		1N957	DZ						62	2.0	5.0	400M
1N981	S		1N957	DZ						68	1.8	20	400M
1N981A	S		1N957	DZ						68	1.8	10	400M
1N981B	S		1N957	DZ						68	1.8	5.0	400M
1N982	S		1N957	DZ						75	1.7	20	400M
1N982A	S		1N957	DZ						75	1.7	10	400M
1N982B	S		1N957	DZ						75	1.7	5.0	400M
1N983	S		1N957	DZ						82	1.5	20	400M
1N983A	S		1N957	DZ						82	1.5	10	400M
1N983B	S		1N957	DZ						82	1.5	5.0	400M
1N984	S		1N957	DZ						91	1.4	20	400M
1N984A	S		1N957	DZ						91	1.4	10	400M
1N984B	S		1N957	DZ						91	1.4	5.0	400M
1N985	S		1N957	DZ						100	1.3	20	400M
1N985A	S		1N957	DZ						100	1.3	10	400M
1N985B	S		1N957	DZ						100	1.3	5.0	400M
1N986	S		1N957	DZ						110	1.1	20	400M
1N986A	S		1N957	DZ						110	1.1	10	400M
1N986B	S		1N957	DZ						110	1.1	5.0	400M
1N987	S		1N957	DZ						120	1.0	20	400M
1N987A	S		1N957	DZ						120	1.0	10	400M
1N987B	S		1N957	DZ						120	1.0	5.0	400M
1N988	S		1N957	DZ						130	0.95	20	400M
1N988A	S		1N957	DZ						130	0.95	10	400M
1N988B	S		1N957	DZ						130	0.95	5.0	400M
1N989	S		1N957	DZ						150	0.85	20	400M
1N989A	S		1N957	DZ						150	0.85	10	400M
1N989B	S		1N957	DZ						150	0.85	5.0	400M
1N990	S		1N957	DZ						160	0.80	20	400M

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N990A	S		1N957	DZ						160	0.80	10	400M
1N990B	S		1N957	DZ						160	0.80	5.0	400M
1N991	S		1N957	DZ						180	0.68	20	400M
1N991A	S		1N957	DZ						180	0.68	10	400M
1N991B	S		1N957	DZ						180	0.68	5.0	400M
1N992	S		1N957	DZ						200	0.65	20	400M
1N992A	S		1N957	DZ						200	0.65	10	400M
1N992B	S		1N957	DZ						200	0.65	5.0	400M
1N993	S			DS	20	1.2	10M	1.0*	4.0				
1N994	G			DS	6.5	1.0	10M	30*	2.0				
1N995	G			DS	15	0.5	10M	10*	6.0				
1N996	G			DS	20	0.8	40M	15*	0.3				
1N997	S			DS	35	1.0	10M	25N	0.15				
1N998	S			DS	150	1.0	200M	1.0N					
1N999	S			DS	100	1.0	50M	1.0N	4.0				
1N1005	G			R	380	0.15	0.25						
1N1007	G			R	380	0.3	0.35						
1N1008	S			R	380	0.3	0.4						
1N1013	G			R	380	0.15	0.25						
1N1016	G			R	380	0.15	0.4						
1N1021	G			R	380	0.15	0.25						
1N1022	G			R	380	0.15	0.3						
1N1023	G			R	380	0.15	0.35						
1N1024	G			R	380	0.15	0.4						
1N1028	S			R	50	1.5	0.25		15				
1N1029	S			R	100	1.5	0.25		15				
1N1030	S			R	150	1.5	0.25		15				
1N1031	S			R	200	1.5	0.25		15				
1N1032	S			R	300	1.5	0.25		15				
1N1033	S			R	400	1.5	0.25		15				
1N1034	S			R	50	1.5	0.5		15				
1N1035	S			R	100	1.5	0.5		15				
1N1036	S			R	150	1.5	0.5		15				
1N1037	S			R	200	1.5	0.5		15				
1N1038	S			R	300	1.5	0.5		15				
1N1039	S			R	400	1.5	0.5		15				
1N1040	S			R	50	1.5	0.5		15				
1N1041	S			R	100	1.5	0.5		15				
1N1042	S			R	150	1.5	0.5		15				
1N1043	S			R	200	1.5	0.5		15				
1N1044	S			R	300	1.5	0.5		15				
1N1045	S			R	400	1.5	0.5		15				
1N1046	S			R	50	1.5	0.5		15				
1N1047	S			R	100	1.5	0.5		15				
1N1048	S			R	150	1.5	0.5		15				
1N1049	S			R	200	1.5	0.5		15				
1N1050	S			R	300	1.5	0.5		15				
1N1051	S			R	400	1.5	0.5		15				
1N1052	S			R	50	1.5	0.5		20				
1N1053	S			R	100	1.5	0.5		20				
1N1054	S			R	150	1.5	0.5		20				
1N1055	S			R	200	1.5	0.5		20				
1N1056	S			R	300	1.5	0.5		20				
1N1057	S			R	400	1.5	0.5		20				
1N1058	S			R	50	1.5	1.5		20				
1N1059	S			R	100	1.5	1.5		20				
1N1060	S			R	150	1.5	1.5		20				
1N1061	S			R	200	1.5	1.5		20				
1N1062	S			R	300	1.5	1.5		20				
1N1063	S			R	400	1.5	1.5		20				
1N1064	S			R	50	1.5	1.5		20				
1N1065	S			R	100	1.5	1.5		20				
1N1066	S			R	150	1.5	1.5		20				
1N1067	S			R	200	1.5	1.5		20				
1N1068	S			R	300	1.5	1.5		20				
1N1069	S			R	400	1.5	1.5		20				
1N1070	S			R	50	1.5	1.5		20				
1N1071	S			R	100	1.5	1.5		20				
1N1072	S			R	150	1.5	1.5		20				
1N1073	S			R	200	1.5	1.5		20				
1N1074	S			R	300	1.5	1.5		20				
1N1075	S			R	400	1.5	1.5		20				
1N1076	S			R	50	1.5	5.0		50				
1N1077	S			R	100	1.5	5.0		50				
1N1078	S			R	150	1.5	5.0		50				
1N1079	S			R	200	1.5	5.0		50				
1N1080	S			R	300	1.5	5.0		50				
1N1081	S	1N4002	1N4001	R	100	1.5	0.25		15				
1N1082	S	1N4003	1N4001	R	200	1.5	0.25		15				
1N1083	S	1N4004	1N4001	R	300	1.5	0.25		15				
1N1084	S	1N4004	1N4001	R	400	1.5	0.25		15				
1N1085	S			R	100	1.5	0.6		24				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts)	@ I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N1086	S			R	200	1.5	0.6		24				
1N1087	S			R	300	1.5	0.6		24				
1N1088	S			R	400	1.5	0.6		24				
1N1089	S			R	100	1.5	2.0		24				
1N1090	S			R	200	1.5	2.0		24				
1N1091	S			R	300	1.5	2.0		24				
1N1092	S			R	400	1.5	2.0		24				
1N1093	G			DS	15	0.4	5.0M	25*	0.5				
1N1095	S	1N4005	1N4001	R	500	0.5	0.425	0.3	15				
1N1096	S	1N4005	1N4001	R	600	0.5	0.4	0.3	15				
1N1100	S	1N4002	1N4001	R	100	1.2	0.25	0.2	15				
1N1101	S	1N4003	1N4001	R	200	1.2	0.25	0.2	15				
1N1102	S	1N4004	1N4001	R	300	1.2	0.25	0.2	15				
1N1103	S	1N4004	1N4001	R	400	1.2	0.25	0.2	15				
1N1104	S	1N4005	1N4001	R	500	1.2	0.25	0.2	15				
1N1105	S	1N4005	1N4001	R	600	1.2	0.25	0.2	15				
1N1108	S			R	800	3.0	0.225		13.5				
1N1109	S			R	1200	4.5	0.212		12.7				
1N1110	S			R	1600	6.0	0.2		12				
1N1111	S			R	2000	7.5	0.187		11.2				
1N1112	S			R	2400	9.0	0.175		10.5				
1N1113	S			R	2800	10.5	0.162		9.7				
1N1115	S	MR1121 *	MR1120	R	100	0.65	0.6	0.4	15				
1N1116	S	MR1122 *	MR1120	R	200	0.65	0.6	0.3	15				
1N1117	S	MR1123 *	MR1120	R	300	0.65	0.6	0.3	15				
1N1118	S	MR1124 *	MR1120	R	400	0.65	0.6	0.3	15				
1N1119	S	MR1125 *	MR1120	R	500	0.65	0.6	0.3	15				
1N1120	S	MR1126 *	MR1120	R	600	0.65	0.6	0.3	15				
1N1124	S	*		R	200	1.1		0.3	25				
1N1124A	S	1N1124 *		R	200		3.3	0.3	25				
1N1125	S	*		R	300	1.1		0.3	25				
1N1125A	S	1N1125 *		R	300		3.3	0.3	25				
1N1126	S	*		R	400	1.1	1.0	0.3	25				
1N1126A	S	1N1126 *		R	400		3.3	0.3	25				
1N1127	S	*		R	500	1.1	1.0	0.3	25				
1N1127A	S	1N1126 *		R	500		3.3	0.3	25				
1N1128	S	*		R	600	1.1	1.0	0.3	25				
1N1128A	S	1N1126 *		R	600		3.3	0.3	25				
1N1130	S			R	1500	15	0.3	0.05					
1N1131	S			R	1500	15	0.3	0.05					
1N1132	S	Microwave S-X-band Mixer; NF = 9.5 dB											
1N1133	S			R	1500	15	0.085	0.025	3.5				
1N1134	S			R	1500	7.5	0.115	0.025	3.5				
1N1135	S			R	1800	18	0.075	0.025	3.5				
1N1136	S			R	1800	9.0	0.095	0.025	3.5				
1N1137	S			R	2400	24	0.057	0.025	3.5				
1N1138	S			R	2400	12	0.070	0.025	3.5				
1N1139	S			R	3600	27	0.075	0.025	3.5				
1N1140	S			R	3600	18	0.075	0.025	3.5				
1N1141	S			R	4800	36	0.070	0.025	3.5				
1N1142	S			R	4800	24	0.057	0.025	3.5				
1N1143	S			R	6000	45	0.057	0.025	3.5				
1N1143A	S			R	6000	30	0.075	0.025	3.5				
1N1144	S			R	7200	54	0.057	0.025	3.5				
1N1145	S			R	7200	36	0.070	0.025	3.5				
1N1146	S			R	8000	60	0.050	0.025	3.5				
1N1147	S			R	12K	60	0.050	0.025	3.5				
1N1148	S			R	14K	52	0.057	0.025	3.5				
1N1149	S			R	16K	60	0.050	0.025	3.5				
1N1150	S			R	1600		0.75		8.0				
1N1150A	S			R	1600	6.5	0.375	1.0	10				
1N1157	S			R	50		20		200				
1N1158	S			R	100		20						
1N1159	S			R	200		20						
1N1160	S			R	300		20						
1N1161	S			R	50		35		350				
1N1162	S			R	100		35		350				
1N1163	S			R	200		35		350				
1N1164	S			R	300		35		350				
1N1165	S			R	50		100		1000				
1N1166	S			R	100		100		1000				
1N1167	S			R	200		100		1000				
1N1168	S			R	300		100		1000				
1N1169	S	1N4004	1N4001	R			0.5						
1N1169A	S	1N4004	1N4001	R	400		0.5	3.5					
1N1170	G			DS	50	1.0	4.0M	5.0*					
1N1171	S			R	50		20						
1N1172	S			R	100		20						
1N1173	S			R	200		20						
1N1174	S			R	300		20						
1N1175	S			R	50		35		350				
1N1176	S			R	100		35		350				

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	ZENER DIODES V_Z(nom)	I_{ZT} mA	Tol $V_{Z\pm\%}$	P_D
					SIGNAL DIODES PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	REFERENCE DIODES V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N1177	S			R	200		35		350				
1N1178	S			R	300		35		350				
1N1179	S			R	50		100		1000				
1N1180	S			R	100		100		1000				
1N1181	S			R	200		100		1000				
1N1182	S			R	300		100		1000				
1N1183	S		1N1183	R	50	1.7	35	10	500				
1N1184	S		1N1183	R	100	1.7	35	10	500				
1N1185	S		1N1183	R	150	1.7	35	10	500				
1N1186	S		1N1183	R	200	1.7	35	10	500				
1N1187	S		1N1183	R	300	1.7	35	10	500				
1N1188	S		1N1183	R	400	1.7	35	10	500				
1N1189	S		1N1183	R	500	1.7	35	10	500				
1N1189A	S			R	500	1.2	40	2.0	800				
1N1190	S		1N1183	R	600	1.7	35	10	500				
1N1190A	S			R	600	1.2	40	1.8	800				
1N1191	S			R	50	2.35	18	5.0	220				
1N1191A	S			R	50	2.0	22	2.5	500				
1N1192	S			R	100	2.35	18	5.0	220				
1N1192A	S			R	100	2.0	22	2.5	500				
1N1193	S			R	150	2.35	18	5.0	220				
1N1193A	S			R	150	2.0	22	2.5	500				
1N1194	S			R	200	2.35	18	5.0	220				
1N1194A	S			R	200	2.0	22	2.5	500				
1N1195	S			R	300	2.35	18	5.0	220				
1N1195A	S			R	300	0.6	20	3.2	350				
1N1196	S			R	400	2.35	18	5.0	220				
1N1196A	S			R	400	0.6	20	2.5	350				
1N1197	S			R	500	2.35	18	5.0	220				
1N1197A	S			R	500	0.6	20	2.2	350				
1N1198	S			R	600	2.35	18	5.0	220				
1N1198A	S			R	600	0.6	20	1.5	350				
1N1199	S	*		R	50		12	10					
1N1199A	S	1N1199 *		R	50	1.35	12	3.0	240				
1N1199B	S			R	50	1.2	12	0.9	250				
1N1200	S	*		R	100		12	10					
1N1200A	S	1N1200 *		R	100	1.35	50	2.5	240				
1N1200B	S			R	100	1.2	12	0.9	250				
1N1201	S	*		R	150		12	10					
1N1201A	S	1N1201 *		R	150	1.35	50	2.25	240				
1N1201B	S			R	150	1.2	12	0.9	250				
1N1202	S	*		R	200		12	10					
1N1202A	S	1N1202 *		R	200	1.35	50	2.0	240				
1N1202B	S			R	200	1.2	12	0.9	250				
1N1203	S	*		R	300		12	10					
1N1203A	S	1N1203 *		R	300	1.35	50	1.75	240				
1N1203B	S			R	300	1.2	12	0.9	250				
1N1204	S	*		R	400		12	10					
1N1204A	S	1N1204 *		R	400	1.35	50	1.5	240				
1N1204B	S			R	400	1.2	12	0.9	250				
1N1205	S	*		R	500		12	10					
1N1205A	S	1N1205 *		R	500	1.35	50	1.25	240				
1N1205B	S			R	500	1.2	12	0.9	250				
1N1206	S	*		R	600		12	10					
1N1206A	S	1N1206 *		R	600	1.35	50	1.0	240				
1N1206B	S			R	600	1.2	12	0.9	250				
1N1217	S	1N4001	1N4001	R	50	1.0	1.6	1.5	20				
1N1217A	S	1N4001	1N4001	R	50	1.5	1.6	0.05					
1N1217B	S			R	50	1.7	1.35	0.3	25				
1N1218	S	1N4002	1N4001	R	100	1.0	1.6	1.5	20				
1N1218A	S	1N4002	1N4001	R	100	1.5	1.6	0.05					
1N1218B	S			R	100	1.7	1.35	0.3	25				
1N1219	S	1N4003	1N4001	R	150	1.0	1.6	1.5	20				
1N1219A	S	1N4003	1N4001	R	150	1.5	1.6	0.05					
1N1219B	S			R	150	1.7	1.35	0.3	25				
1N1220	S	1N4003	1N4001	R	200	1.0	1.6	1.5	20				
1N1220A	S	1N4003	1N4001	R	200	1.5	1.6	0.05					
1N1220B	S			R	200	1.7	1.35	0.3	25				
1N1221	S	1N4004	1N4001	R	300	1.0	1.6	1.5	20				
1N1221A	S	1N4004	1N4001	R	300	1.5	1.6	0.05					
1N1221B	S			R	300	1.7	1.35	0.3	25				
1N1222	S	1N4004	1N4001	R	400	1.0	1.6	1.5	20				
1N1222A	S	1N4004	1N4001	R	400	1.5	1.6	0.05					
1N1222B	S			R	400	1.7	1.35	0.3	25				
1N1223	S	1N4005	1N4001	R	500	1.0	1.6	1.5	20				
1N1223A	S	1N4005	1N4001	R	500	1.5	1.6	0.05					

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_{Z}±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N1223B	S			R	500	1.7	1.35	0.3	25				
1N1224	S	1N4005	1N4001	R	600	1.0	1.6	1.5	20				
1N1224A	S	1N4005	1N4001	R	600	1.5	1.6	0.05					
1N1224B	S			R	600	1.62	1.25	0.3	25				
1N1225	S	1N4006	1N4001	R	700	1.0	1.6	1.5	20				
1N1225A	S	1N4006	1N4001	R	700	1.55	1.1	0.5	25				
1N1225B	S			R	700	1.62	1.25	0.3	25				
1N1226	S	1N4006	1N4001	R	800	1.0	1.6	1.5	20				
1N1226A	S	1N4006	1N4001	R	800	1.50	1.1	0.5	25				
1N1226B	S			R	800	1.58	1.15	0.3	25				
1N1227	S			R	50	1.0	1.6	1.5	20				
1N1227A	S	MR1120	MR1120	R	50	1.5	1.6	0.05					
1N1228	S			R	100	1.0	1.6	1.5	20				
1N1228A	S	MR1121	MR1120	R	100	1.5	1.6	0.05					
1N1229	S			R	150	1.0	1.6	1.5	20				
1N1229A	S	MR1122	MR1120	R	150	1.5	1.6	0.05					
1N1230	S			R	200	1.0	1.6	1.5	20				
1N1230A	S	MR1122	MR1120	R	200	1.5	1.6	0.05					
1N1231	S			R	300	1.0	1.6	1.5	20				
1N1231A	S	MR1123	MR1120	R	300	1.5	1.6	0.05					
1N1232	S			R	400	1.0	1.6	1.5	20				
1N1232A	S	MR1124	MR1120	R	400	1.5	1.6	0.05					
1N1233	S			R	500	1.0	1.6	1.5	20				
1N1233A	S	MR1125	MR1120	R	500	1.5	1.6	0.05					
1N1234	S			R	600	1.0	1.6	1.5	20				
1N1234A	S	MR1126	MR1120	R	600	1.5	1.6	0.05					
1N1235	S			R	700	1.0	1.6	1.5	20				
1N1236	S			R	800	1.0	1.6	1.5	20				
1N1237	S			R	1600		0.75		8.0				
1N1238	S			R	1600		0.75		8.0				
1N1239	S			R	2800		0.5		5.0				
1N1240	S			R	50	1.0	0.25	0.5	5.0				
1N1241	S			R	100	1.0	0.25	0.5	5.0				
1N1242	S			R	200	1.0	0.25	0.5	5.0				
1N1243	S			R	300	1.0	0.2	0.5	5.0				
1N1244	S			R	400	1.0	0.15	0.5					
1N1244A	S			R	400	1.0	0.2	0.5	5.0				
1N1245	S			R	500	1.0	0.13	0.4					
1N1246	S			R	600	1.0	0.115	0.3					
1N1247	S			R	700	1.0	0.1	0.2					
1N1248	S			R	800	1.0	0.08	0.1					
1N1249	S			R	900	1.0	0.065	0.1					
1N1250	S			R	1000	1.0	0.05	0.1					
1N1251	S	1N4001	1N4001	R	50	1.0	0.25	0.5	5.0				
1N1252	S	1N4002	1N4001	R	100	1.0	0.25	0.5	5.0				
1N1253	S	1N4003	1N4001	R	200	1.0	0.25	0.5	5.0				
1N1254	S	1N4004	1N4001	R	300	1.0	0.2	0.5	5.0				
1N1255	S	1N4004	1N4001	R	400	1.0	0.15	0.5					
1N1255A	S			R	400	1.0	0.2	0.5	5.0				
1N1256	S			R	500	1.0	0.13	0.4					
1N1257	S			R	600	1.0	0.115	0.3					
1N1258	S			R	700	1.0	0.1	0.2					
1N1259	S			R	800	1.0	0.08	0.1					
1N1260	S			R	900	1.0	0.065	0.1					
1N1261	S			R	1000	1.0	0.05	0.1					
1N1262	S			R	4500		0.25		2.5				
1N1263	S			R	50		150		1500				
1N1263A	S			R	50		200		2000				
1N1264	S			R	100		150		1500				
1N1264A	S			R	100		200		2000				
1N1265	S			R	200		150		1500				
1N1265A	S			R	200		200		2000				
1N1266	S			R	300		150		1500				
1N1266A	S			R	300		200		2000				
1N1267	S			R	50		150		1500				
1N1267A	S			R	50		200		2000				
1N1268	S			R	100		150		1500				
1N1268A	S			R	100		200		2000				
1N1269	S			R	200		150		1500				
1N1269A	S			R	200		200		2000				
1N1270	S			R	300		150		1500				
1N1270A	S			R	300		200		2000				
1N1271	S			R	50		160	40					
1N1272	S			R	100		160	40					
1N1273	S			R	150		160	40					
1N1274	S			R	200		160	40					
1N1275	S			R	300		160	40					
1N1276	S			R	400		160	40					
1N1277	S			R	500		160	40					
1N1281	S			R	50		160	40					
1N1282	S			R	100		160	40					
1N1283	S			R	150		160	40					
1N1284	S			R	200		160	40					

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	ZENER DIODES: V_Z(nom)	I_{ZT} mA	Tol $V_{Z\pm\%}$	P_D
					SIGNAL DIODES: PRV (volts)	V_F @ I_F (volts)		I_R	t_{rr} (µs)	REFERENCE DIODES: V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N1285	S			R	300		160	40					
1N1286	S			R	400		160	40					
1N1287	S			R	500		160	40					
1N1291	S			R	50		160	40					
1N1292	S			R	100		160	40					
1N1293	S			R	150		160	40					
1N1294	S			R	200		160	40					
1N1295	S			R	300		160	40					
1N1296	S			R	400		160	40					
1N1297	S			R	500		160	40					
1N1301	S			R	50	0.63	17.5	15	300				
1N1302	S			R	100	0.63	17.5	5.0	300				
1N1304	S			R	200	0.63	17.5	5.0	300				
1N1306	S			R	300	0.63	17.5	5.0	300				
1N1313	S	MZ92-8.8A	MZ92-2.4,A,B							8.8	0.2	10	150M
1N1313A	S	MZ92-8.8B	MZ92-2.4,A,B							8.8	0.2	5.0	150M
1N1314	S	MZ92-10.5A	MZ92-2.4,A,B							10.5	0.2	10	150M
1N1314A	S	MZ92-10.5B	MZ92-2.4,A,B							10.5	0.2	5.0	150M
1N1315	S	MZ92-12.8A	MZ92-2.4,A,B							12.8	0.2	10	150M
1N1315A	S	MZ92-12.8B	MZ92-2.4,A,B							12.8	0.2	5.0	150M
1N1316	S	MZ92-15.8A	MZ92-2.4,A,B							15.8	0.2	10	150M
1N1316A	S	MZ92-15.8B	MZ92-2.4,A,B							15.8	0.2	5.0	150M
1N1317	S	MZ92-19A	MZ92-2.4,A,B							19	0.2	10	150M
1N1317A	S	MZ92-19B	MZ92-2.4,A,B							19	0.2	5.0	150M
1N1318	S	MZ92-23.5A	MZ92-2.4,A,B							23	0.2	10	150M
1N1318A	S	MZ92-23.5B	MZ92-2.4,A,B							23	0.2	5.0	150M
1N1319	S	MZ92-28.5A	MZ92-2.4,A,B							28	0.2	10	150M
1N1319A	S	MZ92-28.5B	MZ92-2.4,A,B							28	0.2	5.0	150M
1N1320	S	MZ92-34.5A	MZ92-2.4,A,B							34.5	0.2	10	150M
1N1320A	S	MZ92-34.5B	MZ92-2.4,A,B							34.5	0.2	5.0	150M
1N1321	S	MZ92-41A	MZ92-2.4,A,B							41	0.2	10	150M
1N1321A	S	MZ92-41B	MZ92-2.4,A,B							41	0.2	5.0	150M
1N1322	S	MZ92-48.5A	MZ92-2.4,A,B							48.5	0.2	10	150M
1N1322A	S	MZ92-48.5B	MZ92-2.4,A,B							48.5	0.2	5.0	150M
1N1323	S	MZ92-58A	MZ92-2.4,A,B							58	0.2	10	150M
1N1323A	S	MZ92-58B	MZ92-2.4,A,B							58	0.2	5.0	150M
1N1324	S	MZ92-71A	MZ92-2.4,A,B							71	0.2	10	150M
1N1325	S	MZ92-87.5A	MZ92-2.4,A,B							89.5	0.2	10	150M
1N1326	S	MZ92-105A	MZ92-2.4,A,B							105	0.2	10	150M
1N1327	S	MZ92-127.5A	MZ92-2.4,A,B							127	0.2	10	150M
1N1329	S			R	1500	1.3	0.1	0.02	2.0				
1N1330	S			R	50		240	50					
1N1331	S			R	100		240	50					
1N1332	S			R	150		240	50					
1N1333	S			R	200		240	50					
1N1334	S			R	300		240	50					
1N1335	S			R	400		240	50					
1N1336	S			R	500		240	50					
1N1341	S	*		R	50	1.6	6.0	4.0	150				
1N1341A	S	MR1120*	MR1120	R	50	1.4	6.0	3.0	150				
1N1341B	S			R	50	1.2	6.0	0.45	160				
1N1342	S	*		R	100	1.6	6.0	4.0	150				
1N1342A	S	MR1121*	MR1120	R	100	1.4	6.0	2.5	150				
1N1342B	S			R	100	1.2	6.0	0.45	160				
1N1343	S	*		R	150	1.6	6.0	4.0	150				
1N1343A	S	MR1122*	MR1120	R	150	1.4	6.0	2.25	150				
1N1343B	S			R	150	1.2	6.0	0.45	160				
1N1344	S	*		R	200	1.6	6.0	4.0	150				
1N1344A	S	MR1122*	MR1120	R	200	1.4	6.0	2.0	150				
1N1344B	S			R	200	1.2	6.0	0.45	160				
1N1345	S	*		R	300	1.6	6.0	4.0	150				
1N1345A	S	MR1123*	MR1120	R	300	1.4	6.0	1.75	150				
1N1345B	S			R	300	1.2	6.0	0.45	160				
1N1346	S	*		R	400	1.6	6.0	4.0	150				
1N1346A	S	MR1124*	MR1120	R	400	1.4	6.0	1.5	150				
1N1346B	S			R	400	1.2	6.0	0.45	160				
1N1347	S	*		R	500	1.6	6.0	4.0	150				
1N1347A	S	MR1125*	MR1120	R	500	1.4	6.0	1.25	150				
1N1347B	S			R	500	1.2	6.0	0.45	160				
1N1348	S	*		R	600	1.6	6.0	4.0	150				
1N1348A	S	MR1126*	MR1120	R	600	1.4	6.0	1.0	150				
1N1348B	S			R	600	1.2	6.0	0.45	160				
1N1351	S	1N2974A *	1N2970	DZ						10	500	10	10W
1N1351A	S	1N2974B *	1N2970	DZ						10	500	5.0	10W
1N1352	S	1N2975A *	1N2970	DZ						11	500	10	10W
1N1352A	S	1N2975B *	1N2970	DZ						11	500	5.0	10W
1N1353	S	1N2976A *	1N2970	DZ						12	500	10	10W
1N1353A	S	1N2976B *	1N2970	DZ						12	500	5.0	10W
1N1354	S	1N2977A *	1N2970	DZ						13	500	10	10W
1N1354A	S	1N2977B *	1N2970	DZ						13	500	5.0	10W
1N1355	S	1N2979A *	1N2970	DZ						15	500	10	10W
1N1355A	S	1N2979B *	1N2970	DZ						15	500	5.0	10W

Replacement * denotes exact device type replacement available on request.

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N1356	S	1N2980A *	1N2970	DZ						16	500	10	10W
1N1356A	S	1N2980B *	1N2970	DZ						16	500	5.0	10W
1N1357	S	1N2982A *	1N2970	DZ						18	150	10	10W
1N1357A	S	1N2982B *	1N2970	DZ						18	150	5.0	10W
1N1358	S	1N2984A *	1N2970	DZ						20	150	10	10W
1N1358A	S	1N2984B *	1N2970	DZ						20	150	5.0	10W
1N1359	S	1N2985A *	1N2970	DZ						22	150	10	10W
1N1359A	S	1N2985B *	1N2970	DZ						22	150	5.0	10W
1N1360	S	1N2986A *	1N2970	DZ						24	150	10	10W
1N1360A	S	1N2986B *	1N2970	DZ						24	150	5.0	10W
1N1361	S	1N2988A *	1N2970	DZ						27	150	10	10W
1N1361A	S	1N2988B *	1N2970	DZ						27	150	5.0	10W
1N1362	S	1N2989A *	1N2970	DZ						30	150	10	10W
1N1362A	S	1N2989B *	1N2970	DZ						30	150	5.0	10W
1N1363	S	1N2990A *	1N2970	DZ						33	150	10	10W
1N1363A	S	1N2990B *	1N2970	DZ						33	150	5.0	10W
1N1364	S	1N2991A *	1N2970	DZ						36	150	10	10W
1N1364A	S	1N2991B *	1N2970	DZ						36	150	5.0	10W
1N1365	S	1N2992A *	1N2970	DZ						39	150	10	10W
1N1365A	S	1N2992B *	1N2970	DZ						39	150	5.0	10W
1N1366	S	1N2993A *	1N2970	DZ						43	150	10	10W
1N1366A	S	1N2993B *	1N2970	DZ						43	150	5.0	10W
1N1367	S	1N2995A *	1N2970	DZ						47	150	10	10W
1N1367A	S	1N2995B *	1N2970	DZ						47	150	5.0	10W
1N1368	S	1N2997A *	1N2970	DZ						51	150	10	10W
1N1368A	S	1N2997B *	1N2970	DZ						51	150	5.0	10W
1N1369	S	1N2999A *	1N2970	DZ						56	150	10	10W
1N1369A	S	1N2999B *	1N2970	DZ						56	150	5.0	10W
1N1370	S	1N3000A *	1N2970	DZ						62	50	10	10W
1N1370A	S	1N3000B *	1N2970	DZ						62	50	5.0	10W
1N1371	S	1N3001A *	1N2970	DZ						68	50	10	10W
1N1371A	S	1N3001B *	1N2970	DZ						68	50	5.0	10W
1N1372	S	1N3002A *	1N9270	DZ						75	50	10	10W
1N1372A	S	1N3002B *	1N9270	DZ						75	50	5.0	10W
1N1373	S	1N3003A *	1N2970	DZ						82	50	10	10W
1N1373A	S	1N3003B *	1N2970	DZ						82	50	5.0	10W
1N1374	S	1N3004A *	1N2970	DZ						91	50	10	10W
1N1374A	S	1N3004B *	1N2970	DZ						91	50	5.0	10W
1N1375	S	1N3005A *	1N2970	DZ						100	50	10	10W
1N1375A	S	1N3005B *	1N2970	DZ						100	50	5.0	10W
1N1376	S			R	50		240	50					
1N1377	S			R	100		240	50					
1N1378	S			R	150		240	50					
1N1379	S			R	200		240	50					
1N1380	S			R	300		240	50					
1N1381	S			R	400		240	50					
1N1382	S			R	500		240	50					
1N1396	S	MR1810SB	MR1210	R	50	1.55	70	15	1200				
1N1397	S	MR1811SB	MR1210	R	100	1.55	70	15	1200				
1N1398	S	MR1812SB	MR1210	R	150	1.55	70	15	1200				
1N1399	S	MR1813SB	MR1210	R	200	1.55	70	15	1200				
1N1400	S	MR1815SB	MR1210	R	300	1.55	70	15	1200				
1N1401	S	MR1817SB	MR1210	R	400	1.55	70	15	1200				
1N1402	S	MR1818SB	MR1210	R	500	1.55	70	15	1200				
1N1403	S	MR1819SB	MR1210	R	600	1.55	70	15	1200				
1N1406	S	1N4005	1N4001	R	600	5.0	0.1	0.1	3.5				
1N1407	S	1N4006	1N4001	R	800	5.0	1.0	0.1	3.5				
1N1408	S	1N4007	1N4001	R	1000	5.0	1.0	0.1	3.5				
1N1409	S	MR991A	MR990A	R	1200	5.0	0.1	0.1	3.5				
1N1410	S	MR991A	MR990A	R	1500	6.25	0.1	0.1	3.5				
1N1411	S	MR992A	MR990A	R	1800	7.5	0.1	0.1	3.5				
1N1412	S	MR992A	MR990A	R	2000	6.25	0.1	0.1	3.5				
1N1413	S	MR993A	MR990A	R	2400	7.5	0.1	0.1	3.5				
1N1414	S			R	400	1.25	10	1.0	100				
1N1415	S			DS		1.1	1.0	1.0*					
1N1416	S	1N2972B	1N2970	DZ						8.2	200	5.0	10W
1N1417	S	1N2976B	1N2970	DZ						12	200	5.0	10W
1N1418	S	1N2979B	1N2970	DZ						15	100	5.0	10W
1N1419	S	1N2982B	1N2970	DZ						18	100	5.0	10W
1N1420	S	1N2985B	1N2970	DZ						22	100	5.0	10W
1N1421	S	1N2988B	1N2970	DZ						27	50	5.0	10W
1N1422	S	1N3001B	1N2970	DZ						68	20	5.0	10W
1N1423	S	1N3005B	1N2970	DZ						100	20	5.0	10W
1N1424	S	1N3011B	1N2970	DZ						150	10	5.0	10W
1N1425	S	1N4738A	1N2970	DZ						8.2	20	5.0	1.0W
1N1426	S	1N4742A	1N2970	DZ						12	20	5.0	1.0W
1N1427	S	1N4744A	1N2970	DZ						15	10	5.0	1.0W
1N1428	S	1N4746A	1N2970	DZ						18	10	5.0	1.0W
1N1429	S	1N4748A	1N2970	DZ						22	10	5.0	1.0W
1N1430	S	1N4750A	1N2070	DZ						27	5.0	5.0	1.0W
1N1431	S	1N4760A	1N2070	DZ						68	2.0	5.0	1.0W
1N1432	S	1N4764A	1N2070	DZ						100	2.0	5.0	1.0W

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N1433	S	1M150ZS5		DZ						150	1.0	5.0	10W
1N1434	S	1N1183	1N1183	R	50	1.2	30	5.0					
1N1435	S	1N1184	1N1183	R	100	1.2	30	5.0					
1N1436	S	1N1186	1N1183	R	200	1.2	30	5.0					
1N1437	S	1N1188	1N1183	R	400	1.2	30	5.0					
1N1438	S	1N1190	1N1183	R	600	1.2	30	5.0					
1N1440	S			R	200	1.2	0.75	0.5	30				
1N1441	S			R	300	1.2	0.75	0.5	30				
1N1442	S			R	400	1.2	0.75	0.5	30				
1N1443	S	1N4007	1N4001	R	1000	1.0	1.6	1.5	20				
1N1443A	S			R	1000	1.45	1.1	0.5	25				
1N1443B	S			R	1000	1.55	1.1	0.3	25				
1N1444	S	MR1130	MR1120	R	1000	1.0	1.6	1.5	20				
1N1445	S			R	360	2.0	0.2	4.0					
1N1446	S			R	100	2.0		2.0					
1N1447	S			R	200	2.0		2.0					
1N1448	S			R	300	1.4		2.0					
1N1449	S			R	400	2.0		2.0					
1N1450	S			R	100	1.4		5.0					
1N1451	S			R	200	1.4		5.0					
1N1452	S			R	300	1.4		5.0					
1N1453	S			R	400	1.4		5.0					
1N1454	S			R	100	1.5	25	25					
1N1455	S			R	200	1.5	25	25					
1N1456	S			R	300	1.5	25	25					
1N1457	S			R	400	1.5	25	25					
1N1458	S			R	100	1.5	35	25					
1N1459	S			R	200	1.5	35	25					
1N1460	S			R	300	1.5	35	25					
1N1461	S			R	400	1.5	35	25					
1N1462	S			R	100	1.5	50	50					
1N1463	S			R	200	1.5	50	50					
1N1464	S			R	300	1.5	50	50					
1N1465	S			R	400	1.5	50	50					
1N1466	S	MR1221FB	MR1220	R	100	1.5	75	50					
1N1467	S	MR1223FB	MR1220	R	200	1.5	75	50					
1N1468	S	MR1225FB	MR1220	R	300	1.5	75	50					
1N1469	S	MR1227FB	MR1220	R	400	1.5	75	50					
1N1470	S			R	100	1.5	100	100					
1N1471	S			R	200	1.5	100	100					
1N1472	S			R	300	1.5	100	100					
1N1473	S			R	400	1.5	100	100					
1N1474	S			R	100	1.5	150	100					
1N1475	S			R	200	1.5	150	100					
1N1476	S			R	300	1.5	150	100					
1N1477	S			R	400	1.5	150	100					
1N1478	S	MR1241FB	MR1240	R	100	1.5	200	100					
1N1479	S	MR1243FB	MR1240	R	200	1.5	200	100					
1N1480	S	MR1245FB	MR1240	R	300	1.5	200	100					
1N1481	S	MR1247FB	MR1240	R	400	1.5	200	100					
1N1482	S	1N3995A	1N3993	DZ						4.7	200	5.0	10W
1N1483	S	1N3998A	1N3993	DZ						6.2	200	5.0	10W
1N1484	S	1N4732A	1N4728	DZ						4.7	50	5.0	1.0W
1N1485	S	1N4735A	1N4728	DZ						6.2	20	5.0	1.0W
1N1486	S	1N4005	1N4001	R	500		0.5	3.5					
1N1487	S	1N4002	1N4001	R	100	0.55	0.25	0.4	15				
1N1488	S	1N4003	1N4001	R	200	0.55	0.25	0.3	15				
1N1489	S	1N4004	1N4001	R	300	0.55	0.25	0.3	15				
1N1490	S	1N4004	1N4001	R	400	0.55	0.25	0.3	15				
1N1491	S	1N4005	1N4001	R	500	0.55		0.3	15				
1N1492	S	1N4005	1N4001	R	600	0.55		0.3	15				
1N1507	S	1N4730 *	1N4728	DZ						3.9	35	10	750M
1N1507A	S	1N4730A *	1N4728	DZ						3.9	35	5.0	750M
1N1508	S	1N4732 *	1N4728	DZ						4.7	30	10	750M
1N1508A	S	1N4732A *	1N4728	DZ						4.7	30	5.0	750M
1N1509	S	1N4734 *	1N4728	DZ						5.6	25	10	750M
1N1509A	S	1N4734A *	1N4728	DZ						5.6	25	5.0	750M
1N1510	S	1N4736 *	1N4728	DZ						6.8	22	10	750M
1N1510A	S	1N4736A *	1N4728	DZ						6.8	22	5.0	750M
1N1511	S	1N4738 *	1N4728	DZ						8.2	18	10	750M
1N1511A	S	1N4738A *	1N4728	DZ						8.2	18	5.0	750M
1N1512	S	1N4740 *	1N4728	DZ						10	15	10	750M
1N1512A	S	1N4740A *	1N4728	DZ						10	15	5.0	750M
1N1513	S	1N4742 *	1N4728	DZ						12	12	10	750M
1N1513A	S	1N4742A *	1N4728	DZ						12	12	5.0	750M
1N1514	S	1N4744 *	1N4728	DZ						15	10	10	750M
1N1514A	S	1N4744A *	1N4728	DZ						15	10	5.0	750M
1N1515	S	1N4746 *	1N4728	DZ						18	8.0	10	750M
1N1515A	S	1N4746A *	1N4728	DZ						18	8.0	5.0	750M
1N1516	S	1N4748 *	1N4728	DZ						22	6.0	10	750M
1N1516A	S	1N4748A *	1N4728	DZ						22	6.0	5.0	750M
1N1517	S	1N4750 *	1N4728	DZ						27	5.0	10	750M

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	ZENER DIODES: V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES: PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	REFERENCE DIODES: V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N1517A	S	1N4750A *	1N4728	DZ						27	5.0	5.0	750M
1N1518	S	1N4730 *	1N4728	DZ						3.9	50	10	1.0W
1N1518A	S	1N4730A *	1N4728	DZ						3.9	50	5.0	1.0W
1N1519	S	1N4732 *	1N4728	DZ						4.7	40	10	1.0W
1N1519A	S	1N4732A *	1N4728	DZ						4.7	40	5.0	1.0W
1N1520	S	1N4734 *	1N4728	DZ						5.6	35	10	1.0W
1N1520A	S	1N4734A *	1N4728	DZ						5.6	35	5.0	1.0W
1N1521	S	1N4736 *	1N4728	DZ						6.8	30	10	1.0W
1N1521A	S	1N4736A *	1N4728	DZ						6.8	30	5.0	1.0W
1N1522	S	1N4738 *	1N4728	DZ						8.2	25	10	1.0W
1N1522A	S	1N4738A *	1N4728	DZ						8.2	25	5.0	1.0W
1N1523	S	1N4740 *	1N4728	DZ						10	20	10	1.0W
1N1523A	S	1N4740A *	1N4728	DZ						10	20	5.0	1.0W
1N1524	S	1N4742 *	1N4728	DZ						12	15	10	1.0W
1N1524A	S	1N4742A *	1N4728	DZ						12	15	5.0	1.0W
1N1525	S	1N4744 *	1N4728	DZ						15	13	10	1.0W
1N1525A	S	1N4744A *	1N4728	DZ						15	13	5.0	1.0W
1N1526	S	1N4746 *	1N4728	DZ						18	10	10	1.0W
1N1526A	S	1N4746A *	1N4728	DZ						18	10	5.0	1.0W
1N1527	S	1N4748 *	1N4728	DZ						22	9.0	10	1.0W
1N1527A	S	1N4748A *	1N4728	DZ						22	9.0	5.0	1.0W
1N1528	S	1N4750 *	1N4728	DZ						27	7.0	10	1.0W
1N1528A	S	1N4750A *	1N4728	DZ						27	7.0	5.0	1.0W
1N1530	S	1N3156 *	1N3154	DR						8.4	0.002	10	-55/100
1N1530A	S	1N3157 *	1N3154	DR						8.4	0.002	10	-55/100
1N1537	S	MR1120 *	MR1120	R	50	1.5	1.6	0.05					
1N1538	S	MR1121 *	MR1120	R	100	1.5	1.6	0.05					
1N1539	S	MR1122 *	MR1120	R	150	1.5	1.6	0.05					
1N1540	S	MR1122 *	MR1120	R	200	1.5	1.6	0.05					
1N1541	S	MR1123 *	MR1120	R	300	1.5	1.6	0.05					
1N1542	S	MR1124 *	MR1120	R	400	1.5	1.6	0.05					
1N1543	S	MR1125 *	MR1120	R	500	1.5	1.6	0.05					
1N1544	S	MR1126 *	MR1120	R	600	1.5	1.6	0.05					
1N1551	S	MR1121	MR1120	R	100	1.4		1.0					
1N1552	S	MR1122	MR1120	R	200	1.4		1.0					
1N1553	S	MR1123	MR1120	R	300	1.4		1.0					
1N1554	S	MR1124	MR1120	R	400	1.4		1.0					
1N1555	S	MR1125	MR1120	R	500	1.4		1.0					
1N1556	S			R	100	1.4		1.0					
1N1557	S			R	200	1.4		1.0					
1N1558	S			R	300	1.4		1.0					
1N1559	S			R	400	1.4		1.0					
1N1560	S			R	500	1.4		1.0					
1N1561	G			DS	25	0.4	12M	25*					
1N1562	G			DS	25	0.4	8.0M	25*					
1N1563	S			R	100	1.5	1.0	0.003	70				
1N1563A	S			R	100	1.5	1.5	0.003	70				
1N1564	S			R	200	1.5	1.0	0.003	70				
1N1564A	S			R	200	1.5	1.5	0.003	70				
1N1565	S			R	300	1.5	1.0	0.003	70				
1N1565A	S			R	300	1.5	1.5	0.003	70				
1N1566	S			R	400	1.5	1.0	0.003	70				
1N1566A	S			R	400	1.5	1.5	0.003	70				
1N1567	S			R	500	1.2	1.0	0.005	70				
1N1567A	S			R	500	1.5	1.5	0.003	70				
1N1568	S			R	600	1.2	1.0	0.005	70				
1N1568A	S			R	600	1.5	1.5	0.003	70				
1N1569	S			R	100	1.5	1.0	0.005	70				
1N1570	S			R	200	1.5	1.0	0.005	70				
1N1571	S			R	300	1.5	1.0	0.005	70				
1N1572	S			R	400	1.5	1.0	0.005	70				
1N1573	S			R	500	1.5	1.0	0.005	70				
1N1574	S			R	600	1.5	1.0	0.005	70				
1N1575	S			R	100	1.5	3.5	0.005	70				
1N1576	S			R	200	1.5	3.5	0.005	70				
1N1577	S			R	300	1.5	3.5	0.005	70				
1N1578	S			R	400	1.5	3.5	0.005	70				
1N1579	S			R	500	1.5	3.5	0.005	70				
1N1580	S			R	600	1.5	3.5	0.005	70				
1N1581	S	MR1120	MR1120	R	50	1.5	3.0	5.0	40				
1N1582	S	MR1121	MR1120	R	100	1.5	3.0	5.0	40				
1N1583	S	MR1122	MR1120	R	200	1.5	3.0	5.0	40				
1N1584	S	MR1123	MR1120	R	300	1.5	3.0	5.0	40				
1N1585	S	MR1124	MR1120	R	400	1.5	3.0	5.0	40				
1N1586	S	MR1125	MR1120	R	500	1.5	3.0	5.0	40				
1N1587	S	MR1126	MR1120	R	600	1.5	3.0	5.0	40				
1N1588	S	1N3993 *	1N3993	DZ						3.9	150	10	3.5W
1N1588A	S	1N3993A *	1N3993	DZ						3.9	150	5.0	3.5W
1N1589	S	1N3995 *	1N3993	DZ						4.7	125	10	3.5W
1N1589A	S	1N3995A *	1N3993	DZ						4.7	125	5.0	3.5W
1N1590	S	1N3997 *	1N3993	DZ						5.6	110	10	3.5W
1N1590A	S	1N3997A *	1N3993	DZ						5.6	110	5.0	3.5W

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	V_F (volts) / V_F @ I_F (volts)	I_O (Amps) /	I_R (mA) / I_R	I_{FSM} / t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	I_{ZT} mA / T_C %/°C	Tol V_Z±% / I_{ZT} mA	P_D / Temp Range
1N1591	S	1N2970RA *	1N2970	DZ						6.8	100	10	3.5W
1N1591A	S	1N2970RB *	1N2970	DZ						6.8	100	5.0	3.5W
1N1592	S	1N2972RA *	1N2970	DZ						8.2	80	10	3.5W
1N1592A	S	1N2972RB *	1N2970	DZ						8.2	80	5.0	3.5W
1N1593	S	1N2974RA *	1N2970	DZ						10	70	10	3.5W
1N1593A	S	1N2974RB *	1N2970	DZ						10	70	5.0	3.5W
1N1594	S	1N2976RA *	1N2970	DZ						12	50	10	3.5W
1N1594A	S	1N2976RB *	1N2970	DZ						12	50	5.0	3.5W
1N1595	S	1N2979RA *	1N2970	DZ						15	40	10	3.5W
1N1595A	S	1N2979RB *	1N2970	DZ						15	40	5.0	3.5W
1N1596	S	1N2982RA *	1N2970	DZ						18	35	10	3.5W
1N1596A	S	1N2982RB *	1N2970	DZ						18	35	5.0	3.5W
1N1597	S	1N2985RA *	1N2970	DZ						22	30	10	3.5W
1N1597A	S	1N2985RB *	1N2970	DZ						22	30	5.0	3.5W
1N1598	S	1N2988RA *	1N2970	DZ						27	25	10	3.5W
1N1598A	S	1N2988RB *	1N2970	DZ						27	25	5.0	3.5W
1N1599	S	1N3993 *	1N3993	DZ						3.9	500	10	10W
1N1599A	S	1N3993A *	1N3993	DZ						3.9	500	5.0	10W
1N1600	S	1N3995 *	1N3993	DZ						4.7	400	10	10W
1N1600A	S	1N3995A *	1N3993	DZ						4.7	400	5.0	10W
1N1601	S	1N3997 *	1N3993	DZ						5.6	350	10	10W
1N1601A	S	1N3997A *	1N3993	DZ						5.6	350	5.0	10W
1N1602	S	1N2970RA *	1N2970	DZ						6.8	300	10	10W
1N1602A	S	1N2970RB *	1N2970	DZ						6.8	300	5.0	10W
1N1603	S	1N2972RA *	1N2970	DZ						8.2	250	10	10W
1N1603A	S	1N2972RB *	1N2970	DZ						8.2	250	5.0	10W
1N1604	S	1N2974RA *	1N2970	DZ						10	200	10	10W
1N1604A	S	1N2974RB *	1N2970	DZ						10	200	5.0	10W
1N1605	S	1N2976RA *	1N2970	DZ						12	170	10	10W
1N1605A	S	1N2976RB *	1N2970	DZ						12	170	5.0	10W
1N1606	S	1N2979RA *	1N2970	DZ						15	140	10	10W
1N1606A	S	1N2979RB *	1N2970	DZ						15	140	5.0	10W
1N1607	S	1N2982RA *	1N2970	DZ						18	110	10	10W
1N1607A	S	1N2982RB *	1N2970	DZ						18	110	5.0	10W
1N1608	S	1N2985RA *	1N2970	DZ						22	90	10	10W
1N1608A	S	1N2985RB *	1N2970	DZ						22	90	5.0	10W
1N1609	S	1N2988RA *	1N2970	DZ						27	70	10	10W
1N1609A	S	1N2988RB *	1N2970	DZ						27	70	5.0	10W
1N1610	S	Microwave S-X-band Detector											
1N1611	S	Microwave C-X-band Detector											
1N1611A	S	Microwave C-X-band Detector											
1N1611B	S	Microwave C-X-band Detector											
1N1612	S	MR1120 *	MR1120	R	50	1.5	5.0	1.0					
1N1613	S	MR1121 *	MR1120	R	100	1.5	5.0	1.0					
1N1614	S	MR1122 *	MR1120	R	200	1.5	5.0	1.0					
1N1615	S	MR1124 *	MR1120	R	400	1.5	5.0	1.0					
1N1616	S	MR1126 *	MR1120	R	600	1.5	5.0	1.0					
1N1617	S	1N4002	1N4001	R	100	1.2	1.5		60				
1N1618	S	1N4003	1N4001	R	200	1.2	1.5		60				
1N1619	S	1N4004	1N4001	R	300	1.2	1.5		60				
1N1620	S	1N4004	1N4001	R	400	1.2	1.5		60				
1N1621	S			R	100	1.2	10		80				
1N1622	S			R	200	1.2	10		80				
1N1623	S			R	300	1.2	10		80				
1N1624	S			R	400	1.2	10		80				
1N1625	Se			R	48	1.0		0.015	0.005				
1N1625A	Se			R	48	1.0		0.015	0.01				
1N1626	Se			R	96	2.0		0.015	0.005				
1N1626A	Se			R	96	2.0		0.015	0.01				
1N1627	Se			R	48	1.0		0.027	0.08				
1N1628	Se			R	96	2.0		0.027	0.08				
1N1629	Se			R	144	3.0		0.027	0.08				
1N1630	Se			R	192	4.0		0.027	0.08				
1N1631	Se			R	240	5.0		0.027	0.08				
1N1632	Se			R	288	6.0		0.027	0.08				
1N1633	Se			R	336	7.0		0.027	0.08				
1N1634	Se			R	384	8.0		0.027	0.08				
1N1635	Se			R	48	1.0		0.108	0.25				
1N1636	Se			R	96	2.0		0.108	0.25				
1N1637	Se			R	144	3.0		0.108	0.25				
1N1638	Se			R	192	4.0		0.108	0.25				
1N1639	Se			R	240	5.0		0.108	0.25				
1N1640	Se			R	48	1.0	0.028	0.240	0.55				
1N1641	Se			R	96	2.0	0.028	0.240	0.55				
1N1642	Se			R	144	3.0	0.028	0.240	0.55				
1N1644	S			R	50	0.5	0.25	0.4	15				
1N1645	S			R	100	0.5	0.25	0.4	15				
1N1646.	S			R	150	0.5	0.25	0.3	15				
1N1647	S			R	200	0.5	0.25	0.3	15				
1N1648	S			R	250	0.5	0.25	0.3	15				
1N1649	S			R	300	0.5	0.25	0.3	15				
1N1650	S			R	350	0.5	0.25	0.3	15				

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol $V_{Z\pm\%}$ / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N1651	S			R	400	0.5	0.25	0.3	15				
1N1652	S			R	500	0.5	0.25	0.3	15				
1N1653	S			R	600	0.5	0.25	0.3	15				
1N1660	S			R	50		160	40					
1N1661	S	MR1221SB	MR1220	R	100		160	40					
1N1662	S	MR1222SB	MR1220	R	150		160	40					
1N1663	S	MR1223SB	MR1220	R	200		160	40					
1N1664	S	MR1225SB	MR1220	R	300		160	40					
1N1665	S	MR1227SB	MR1220	R	400		160	40					
1N1666	S	MR1228SB	MR1220	R	500		160	40					
1N1670	S			R	50		240	50					
1N1671	S			R	100		240	50					
1N1672	S			R	150		240	50					
1N1673	S			R	200		240	50					
1N1674	S			R	300		240	50					
1N1675	S			R	400		240	50					
1N1676	S			R	500		240	50					
1N1680	S			R	150	1.1	50	25	700				
1N1681	S			R	250	1.1	50	25	700				
1N1682	S			R	300	1.1	50	25	700				
1N1683	S			R	350	1.1	50	25	700				
1N1684	S			R	400	1.1	50	25	700				
1N1685	S			R	450	1.1	50	25	700				
1N1686	S			R	500	1.1	50	25	700				
1N1687	S			R	600	1.1	50	25	700				
1N1688	S			R	700	1.1	50	25	700				
1N1689	S			R	800	1.1	50	25	700				
1N1690	S			R	900	1.1	50	25	700				
1N1691	S			R	1000	1.1	50	25	700				
1N1692	S	1N4002	1N4001	R	100	0.6	0.25	0.5	20				
1N1693	S	1N4003	1N4001	R	200	0.6	0.25	0.5	20				
1N1694	S	1N4004	1N4001	R	300	0.6	0.25	0.5	20				
1N1695	S	1N4004	1N4001	R	400	0.6	0.25	0.5	20				
1N1696	S	1N4005	1N4001	R	500	0.6		0.5	20				
1N1697	S	1N4005	1N4001	R	600	0.6		0.5	20				
1N1698	S			R	6600	33	0.062						
1N1699	S			R	10K	37	0.058						
1N1700	S			R	12K	45	0.05						
1N1701	S	1N4001	1N4001	R	50	1.3	0.3	0.2	8.0				
1N1702	S	1N4002	1N4001	R	100	1.3	0.3	0.2	8.0				
1N1703	S	1N4003	1N4001	R	200	1.3	0.3	0.2	8.0				
1N1704	S	1N4004	1N4001	R	300	1.3	0.3	0.2	8.0				
1N1705	S	1N4004	1N4001	R	400	1.3	0.3	0.2	8.0				
1N1706	S	1N4005	1N4001	R	500	1.3	0.3	0.2	8.0				
1N1707	S	1N4001	1N4001	R	50	1.15	0.5	0.2	10				
1N1708	S	1N4002	1N4001	R	100	1.15	0.5	0.2	10				
1N1709	S	1N4003	1N4001	R	200	1.15	0.5	0.2	10				
1N1710	S	1N4004	1N4001	R	300	1.15	0.5	0.2	10				
1N1711	S	1N4004	1N4001	R	400	1.15	0.5	0.2	10				
1N1712	S	1N4005	1N4001	R	500	1.15	0.5	0.2	10				
1N1730	S	1N4007	1N4001	R	1000	5.0		0.1	2.5				
1N1730A	S			R	1000		0.35		6.0				
1N1731	S	MR991A	MR990A	R	1500	5.0		0.1	2.5				
1N1731A	S			R	1500		0.35		6.0				
1N1732	S	MR992A	MR990A	R	2000	9.0		0.1	2.5				
1N1732A	S			R	2000		0.35		6.0				
1N1733	S	MR994A	MR990A	R	3000	12		0.1	2.5				
1N1733A	S			R	3000		0.35		6.0				
1N1734	S	MR996A	MR990A	R	5000	18		0.1	2.5				
1N1734A	S			R	5000		0.35		6.0				
1N1735	S	1N821 *	1N821	DR						6.2	0.8	7.5	-55/150
1N1736	S	1N941A *	1N941	DR						12.4	0.8	7.5	-55/150
1N1736A	S	1N942A *	1N941	DR						12.4	0.4	7.5	-55/150
1N1737	S	1N4060 *	1N429	DR						18.6	0.8	7.5	-55/150
1N1737A	S	1N4060A *	1N429	DR						18.6	0.4	7.5	-55/150
1N1738	S	1N4062 *	1N429	DR						24.8	0.8	7.5	-55/150
1N1738A	S	1N4062A *	1N429	DR						24.8	0.4	7.5	-55/150
1N1739	S	1N4064 *	1N429	DR						31	0.8	7.5	-55/150
1N1739A	S	1N4064A *	1N429	DR						31	0.4	7.5	-55/150
1N1740	S	1N4066 *	1N429	DR						37.2	0.8	7.5	-55/150
1N1740A	S	1N4066A *	1N429	DR						37.2	0.4	7.5	-55/150
1N1741	S	1N4067 *	1N429	DR						43.4	0.8	7.5	-55/150
1N1741A	S	1N4067A *	1N429	DR						43.4	0.4	7.5	-55/150
1N1742	S	1N4069 *	1N429	DR						49.6	0.8	7.5	-55/150
1N1742A	S	1N4069A *	1N429	DR						49.6	0.4	7.5	-55/150
1N1743	S	1N2974A	1N2970	DZ						10	250	10	10W
1N1744	S	1N4740	1N4728	DZ						10	25	10	1.0W
1N1745	S			R	1500	15	0.32	0.2	3.5				
1N1746	S			R	1500	7.5	0.5	0.2	3.5				
1N1747	S			R	1800	18	0.31	0.2	3.5				
1N1748	S			R	1800	9.0	0.38	0.2	3.5				
1N1749	S			R	2400	24	0.37	0.2	3.5				

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol $V_Z \pm\%$	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N1750	S			R	2400	12	0.32	0.2	3.5				
1N1751	S			R	3600	27	0.42	0.2	3.5				
1N1752	S			R	3600	18	0.41	0.2	3.5				
1N1753	S			R	4800	36	0.38	0.2	3.5				
1N1754	S			R	4800	24	0.37	0.2	3.5				
1N1755	S			R	6000	45	0.33	0.2	3.5				
1N1756	S			R	6000	30	0.41	0.2	3.5				
1N1757	S			R	7200	54	0.33	0.2	3.5				
1N1758	S			R	7200	36	0.38	0.2	3.5				
1N1759	S			R	8000	60	0.29	0.2	3.5				
1N1760	S			R	12K	60	0.29	0.2	3.5				
1N1761	S			R	14K	52	0.34	0.2	3.5				
1N1762	S			R	16K	60	0.29	0.2	3.5				
1N1763	S	1N4004	1N4001	R	400	3.0	0.5	0.1	35				
1N1763A	S			R	400	1.2	1.0	0.5	25				
1N1764	S	1N4005	1N4001	R	500	3.0	0.5	0.1	35				
1N1764A	S			R	500	1.2	1.0	0.5	25				
1N1765	S	1N4734 *	1N4728	DZ						5.6	100	10	1.0W
1N1765A	S	1N4734A *	1N4728	DZ						5.6	100	5.0	1.0W
1N1766	S	1N4735 *	1N4728	DZ						6.2	100	10	1.0W
1N1766A	S	1N4735A *	1N4728	DZ						6.2	100	5.0	1.0W
1N1767	S	1N4736 *	1N4728	DZ						6.8	100	10	1.0W
1N1767A	S	1N4736A *	1N4728	DZ						6.8	100	5.0	1.0W
1N1768	S	1N4737 *	1N4728	DZ						7.5	100	10	1.0W
1N1768A	S	1N4737A *	1N4728	DZ						7.5	100	5.0	1.0W
1N1769	S	1N4738 *	1N4728	DZ						8.2	100	10	1.0W
1N1769A	S	1N4738A *	1N4728	DZ						8.2	100	5.0	1.0W
1N1770	S	1N4739 *	1N4728	DZ						9.1	50	10	1.0W
1N1770A	S	1N4739A *	1N4728	DZ						9.1	50	5.0	1.0W
1N1771	S	1N4740 *	1N4728	DZ						10	50	10	1.0W
1N1771A	S	1N4740A *	1N4728	DZ						10	50	5.0	1.0W
1N1772	S	1N4741 *	1N4728	DZ						11	50	10	1.0W
1N1772A	S	1N4741A *	1N4728	DZ						11	50	5.0	1.0W
1N1773	S	1N4742 *	1N4728	DZ						12	50	10	1.0W
1N1773A	S	1N4742A *	1N4728	DZ						12	50	5.0	1.0W
1N1774	S	1N4743 *	1N4728	DZ						13	50	10	1.0W
1N1174A	S	1N4743A *	1N4728	DZ						13	50	5.0	1.0W
1N1775	S	1N4744 *	1N4728	DZ						15	50	10	1.0W
1N1775A	S	1N4744A *	1N4728	DZ						15	50	5.0	1.0W
1N1776	S	1N4745 *	1N4728	DZ						16	50	10	1.0W
1N1776A	S	1N4745A *	1N4728	DZ						16	50	5.0	1.0W
1N1777	S	1N4746 *	1N4728	DZ						18	50	10	1.0W
1N1777A	S	1N4746A *	1N4728	DZ						18	50	5.0	1.0W
1N1778	S	1N4747 *	1N4728	DZ						20	15	10	1.0W
1N1778A	S	1N4747A *	1N4728	DZ						20	15	5.0	1.0W
1N1779	S	1N4748 *	1N4728	DZ						22	15	10	1.0W
1N1779A	S	1N4748A *	1N4728	DZ						22	15	5.0	1.0W
1N1780	S	1N4749 *	1N4728	DZ						24	15	10	1.0W
1N1780A	S	1N4749A *	1N4728	DZ						24	15	5.0	1.0W
1N1781	S	1N4750 *	1N4728	DZ						27	15	10	1.0W
1N1781A	S	1N4750A *	1N4728	DZ						27	15	5.0	1.0W
1N1782	S	1N4751 *	1N4728	DZ						30	15	10	1.0W
1N1782A	S	1N4751A *	1N4728	DZ						30	15	5.0	1.0W
1N1783	S	1N4752 *	1N4728	DZ						33	15	10	1.0W
1N1783A	S	1N4752A *	1N4728	DZ						33	15	5.0	1.0W
1N1784	S	1N4753 *	1N4728	DZ						36	15	10	1.0W
1N1784A	S	1N4753A *	1N4728	DZ						36	15	5.0	1.0W
1N1785	S	1N4754 *	1N4728	DZ						39	15	10	1.0W
1N1785A	S	1N4754A *	1N4728	DZ						39	15	5.0	1.0W
1N1786	S	1N4755 *	1N4728	DZ						43	15	10	1.0W
1N1786A	S	1N4755A *	1N4728	DZ						43	15	5.0	1.0W
1N1787	S	1N4756 *	1N4728	DZ						47	15	10	1.0W
1N1787A	S	1N4756A *	1N4728	DZ						47	15	5.0	1.0W
1N1788	S	1N4757 *	1N4728	DZ						51	15	10	1.0W
1N1788A	S	1N4757A *	1N4728	DZ						51	15	5.0	1.0W
1N1789	S	1N4758 *	1N4728	DZ						56	15	10	1.0W
1N1789A	S	1N4758A *	1N4728	DZ						56	15	5.0	1.0W
1N1790	S	1N4759 *	1N4728	DZ						62	5.0	10	1.0W
1N1790A	S	1N4759A *	1N4728	DZ						62	5.0	5.0	1.0W
1N1791	S	1N4760 *	1N4728	DZ						68	5.0	10	1.0W
1N1791A	S	1N4760A *	1N4728	DZ						68	5.0	5.0	1.0W
1N1792	S	1N4761 *	1N4728	DZ						75	5.0	10	1.0W
1N1792A	S	1N4761A *	1N4728	DZ						75	5.0	5.0	1.0W
1N1793	S	1N4762 *	1N4728	DZ						82	5.0	10	1.0W
1N1793A	S	1N4762A *	1N4728	DZ						82	5.0	5.0	1.0W
1N1794	S	1N4763 *	1N4728	DZ						91	5.0	10	1.0W
1N1794A	S	1N4763A *	1N4728	DZ						91	5.0	5.0	1.0W
1N1795	S	1N4764 *	1N4728	DZ						100	5.0	10	1.0W
1N1795A	S	1N4764A *	1N4728	DZ						100	5.0	5.0	1.0W
1N1796	S	1M110ZS10*	1N4728	DZ						110	5.0	10	1.0W
1N1796A	S	1M110ZS5 *	1N4728	DZ						110	5.0	5.0	1.0W
1N1797	S	1M120ZS10*	1N4728	DZ						120	5.0	10	1.0W

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	ZENER DIODES V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES PRV (volts)	V_F (volts)	@ I_F	I_R	t_{rr} (µs)	REFERENCE DIODES V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N1797A	S	1M120ZS5 *	1N4728	DZ						120	5.0	5.0	1.0W
1N1798	S	1M130ZS10 *	1N4728	DZ						130	5.0	10	1.0W
1N1798A	S	1M130ZS5 *	1N4728	DZ						130	5.0	5.0	1.0W
1N1799	S	1M150ZS10 *	1N4728	DZ						150	5.0	10	1.0W
1N1799A	S	1M150ZS5 *	1N4728	DZ						150	5.0	5.0	1.0W
1N1800	S	1M160ZS10 *	1N4728	DZ						160	5.0	10	1.0W
1N1800A	S	1M160ZS5 *	1N4728	DZ						160	5.0	5.0	1.0W
1N1801	S	1M180ZS10 *	1N4728	DZ						180	5.0	10	1.0W
1N1801A	S	1M180ZS5 *	1N4728	DZ						180	5.0	5.0	1.0W
1N1802	S	1M200ZS10 *	1N4728	DZ						200	5.0	10	1.0W
1N1802A	S	1M200ZS5 *	1N4728	DZ						200	5.0	5.0	1.0W
1N1803	S	1N3997R *	1N3993	DZ						5.6	5.0	10	10W
1N1803A	S	1N3997RA *	1N3993	DZ						5.6	1000	5.0	10W
1N1804	S	1N3998R *	1N3993	DZ						6.2	1000	10	10W
1N1804A	S	1N3998RA *	1N3993	DZ						6.2	1000	5.0	10W
1N1805	S	1N2970A *	1N2970	DZ						6.8	1000	10	10W
1N1805A	S	1N2970B *	1N2970	DZ						6.8	1000	5.0	10W
1N1806	S	1N2971A *	1N2970	DZ						7.5	1000	10	10W
1N1806A	S	1N2971B *	1N2970	DZ						7.5	1000	5.0	10W
1N1807	S	1N2972A *	1N2970	DZ						8.2	1000	10	10W
1N1807A	S	1N2972B *	1N2970	DZ						8.2	1000	5.0	10W
1N1808	S	1N2973A *	1N2970	DZ						9.1	1000	10	10W
1N1808A	S	1N2973B *	1N2970	DZ						9.1	500	5.0	10W
1N1809	S	1N3007A *	1N2970	DZ						110	50	10	10W
1N1809A	S	1N3007B *	1N2970	DZ						110	50	5.0	10W
1N1810	S	1N3008A *	1N2970	DZ						120	50	10	10W
1N1810A	S	1N3008B *	1N2970	DZ						120	50	5.0	10W
1N1811	S	1N3009A *	1N2970	DZ						130	50	10	10W
1N1811A	S	1N3009B *	1N2970	DZ						130	50	5.0	10W
1N1812	S	1N3011A *	1N2970	DZ						150	50	10	10W
1N1812A	S	1N3011B *	1N2970	DZ						150	50	5.0	10W
1N1813	S	1N3012A *	1N2970	DZ						160	50	10	10W
1N1813A	S	1N3012B *	1N2970	DZ						160	50	5.0	10W
1N1814	S	1N3014A *	1N2970	DZ						180	50	10	10W
1N1814A	S	1N3014B *	1N2970	DZ						180	50	5.0	10W
1N1815	S	1N3015A *	1N2970	DZ						200	50	10	10W
1N1815A	S	1N3015B *	1N2970	DZ						200	50	5.0	10W
1N1816	S	1N2977A *	1N2970	DZ						13	500	10	10W
1N1816A	S	1N2977B *	1N2970	DZ						13	500	5.0	10W
1N1817	S	1N2979A *	1N2970	DZ						15	500	10	10W
1N1817A	S	1N2979B *	1N2970	DZ						15	500	5.0	10W
1N1818	S	1N2980A *	1N2970	DZ						16	500	10	10W
1N1818A	S	1N2980B *	1N2970	DZ						16	500	5.0	10W
1N1819	S	1N2982A *	1N2970	DZ						18	500	10	10W
1N1819A	S	1N2982B *	1N2970	DZ						18	500	5.0	10W
1N1820	S	1N2984A *	1N2970	DZ						20	250	10	10W
1N1820A	S	1N2984B *	1N2970	DZ						20	250	5.0	10W
1N1821	S	1N2985A *	1N2970	DZ						22	250	10	10W
1N1821A	S	1N2985B *	1N2970	DZ						22	250	5.0	10W
1N1822	S	1N2986A *	1N2970	DZ						24	250	10	10W
1N1822A	S	1N2986B *	1N2970	DZ						24	250	5.0	10W
1N1823	S	1N2988A *	1N2970	DZ						27	250	10	10W
1N1823A	S	1N2988B *	1N2970	DZ						27	250	5.0	10W
1N1824	S	1N2989A *	1N2970	DZ						30	250	10	10W
1N1824A	S	1N2989B *	1N2970	DZ						30	250	5.0	10W
1N1825	S	1N2990A *	1N2970	DZ						33	150	10	10W
1N1825A	S	1N2990B *	1N2970	DZ						33	150	5.0	10W
1N1826	S	1N2991A *	1N2970	DZ						36	150	10	10W
1N1826A	S	1N2991B *	1N2970	DZ						36	150	5.0	10W
1N1827	S	1N2992A *	1N2970	DZ						39	150	10	10W
1N1827A	S	1N2992B *	1N2970	DZ						39	150	5.0	10W
1N1828	S	1N2993A *	1N2970	DZ						43	150	10	10W
1N1828A	S	1N2993B *	1N2970	DZ						43	150	5.0	10W
1N1829	S	1N2995A *	1N2970	DZ						47	150	10	10W
1N1829A	S	1N2995B *	1N2970	DZ						47	150	5.0	10W
1N1830	S	1N2997A *	1N2970	DZ						51	150	10	10W
1N1830A	S	1N2997B *	1N2970	DZ						51	150	5.0	10W
1N1831	S	1N2999A *	1N2970	DZ						56	150	10	10W
1N1831A	S	1N2999B *	1N2970	DZ						56	150	5.0	10W
1N1832	S	1N3000A *	1N2970	DZ						62	50	10	10W
1N1832A	S	1N3000B *	1N2970	DZ						62	50	5.0	10W
1N1833	S	1N3001A *	1N2970	DZ						68	50	10	10W
1N1833A	S	1N3001B *	1N2970	DZ						68	50	5.0	10W
1N1834	S	1N3002A *	1N2970	DZ						75	50	10	10W
1N1834A	S	1N3002B *	1N2970	DZ						75	50	5.0	10W
1N1835	S	1N3003A *	1N2970	DZ						82	50	10	10W
1N1835A	S	1N3003B *	1N2970	DZ						82	50	5.0	10W
1N1836	S	1N3004A *	1N2970	DZ						91	50	10	10W
1N1836A	S	1N3004B *	1N2970	DZ						91	50	5.0	10W
1N1838	G	Microwave X-Ku-band Mixer; NF = 32 dB											
1N1839	S			R	6.8		0.085		0.26				
1N1840	S			R	10		0.077		0.23				

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	V_F (volts) / V_F (volts) @	I_O (Amps) / I_F	I_R (mA) / I_R	I_{FSM} / t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	I_{ZT} mA / T_C %/°C	Tol $V_{Z\pm\%}$ / I_{ZT} mA	P_D / Temp Range
1N1841	S			R	15		0.063		0.19				
1N1842	S			R	22		0.05		0.15				
1N1843	S			R	33		0.04		0.12				
1N1844	S			R	47		0.03		0.095				
1N1845	S			R	68		0.023	0.001	0.072				
1N1846	S			R	100		0.016	0.001	0.050				
1N1847	S			R	150		0.011	0.003	0.035				
1N1848	S			R	220		0.009	0.005	0.028				
1N1849	S			R	330			0.005	0.024				
1N1850	S			R	470		0.006	0.005	0.020				
1N1851	S			R	6.8		0.085		0.26				
1N1852	S			R	10		0.077		0.23				
1N1853	S			R	15		0.063		0.190				
1N1854	S			R	22		0.05		0.150				
1N1855	S			R	33		0.04		0.120				
1N1856	S			R	47		0.03		0.095				
1N1857	S			R	68		0.023	0.001	0.072				
1N1858	S			R	100		0.016	0.001	0.050				
1N1859	S			R	150		0.011	0.003	0.035				
1N1860	S			R	220		0.009	0.005	0.028				
1N1861	S			R	330			0.005	0.024				
1N1862	S			R	470		0.006	0.005	0.020				
1N1863	S			R	6.8		0.085		0.260				
1N1864	S			R	10		0.077		0.230				
1N1865	S			R	15		0.063		0.190				
1N1866	S			R	22		0.05		0.150				
1N1867	S			R	33		0.04		0.120				
1N1868	S			R	47		0.03		0.095				
1N1869	S			R	68		0.023	0.001	0.072				
1N1870	S			R	100		0.016	0.001	0.050				
1N1871	S			R	150		0.011	0.003	0.035				
1N1872	S			R	220		0.009	0.005	0.028				
1N1873	S			R	330			0.005	0.024				
1N1874	S			R	470		0.006	0.005	0.020				
1N1875	S	1N4738	1N4728	DZ						8.2	25	10	1.0W
1N1876	S	1N4740	1N4728	DZ						10	25	10	1.0W
1N1877	S	1N4742	1N4728	DZ						12	25	10	1.0W
1N1878	S	1N4744	1N4728	DZ						15	25	10	1.0W
1N1879	S	1N4746	1N4728	DZ						18	25	10	1.0W
1N1880	S	1N4748	1N4728	DZ						22	8.0	10	1.0W
1N1881	S	1N4750	1N4728	DZ						27	8.0	10	1.0W
1N1882	S	1N4752	1N4728	DZ						33	8.0	10	1.0W
1N1883	S	1N4754	1N4728	DZ						39	8.0	10	1.0W
1N1884	S	1N4756	1N4728	DZ						47	8.0	10	1.0W
1N1885	S	1N4758	1N4728	DZ						56	8.0	10	1.0W
1N1886	S	1N4760	1N4728	DZ						68	3.0	10	1.0W
1N1887	S	1N4762	1N4728	DZ						82	3.0	10	1.0W
1N1888	S	1N4764	1N4728	DZ						100	3.0	10	1.0W
1N1889	S	1M120ZS10	1N4728	DZ						120	3.0	10	1.0W
1N1890	S	1M150ZS10	1N4728	DZ						150	3.0	10	1.0W
1N1891	S	1N2972A	1N2970	DZ						8.2	25	10	10W
1N1892	S	1N2974A	1N2970	DZ						10	25	10	10W
1N1893	S	1N2976A	1N2970	DZ						10	25	10	10W
1N1894	S	1N2979A	1N2970	DZ						15	25	10	10W
1N1895	S	1N2982A	1N2970	DZ						18	25	10	10W
1N1896	S	1N2985A	1N2970	DZ						22	8.0	10	10W
1N1897	S	1N2988A	1N2970	DZ						27	8.0	10	10W
1N1898	S	1N2990A	1N2970	DZ						33	8.0	10	10W
1N1899	S	1N2992A	1N2970	DZ						39	8.0	10	10W
1N1900	S	1N2995A	1N2970	DZ						47	8.0	10	10W
1N1901	S	1N2999A	1N2970	DZ						56	8.0	10	10W
1N1902	S	1N3001A	1N2970	DZ						68	3.0	10	10W
1N1903	S	1N3003A	1N2970	DZ						82	3.0	10	10W
1N1904	S	1N3005A	1N2970	DZ						100	3.0	10	10W
1N1905	S	1N3008A	1N2970	DZ						120	3.0	10	10W
1N1906	S	1N3011A	1N2970	DZ						150	3.0	10	10W
1N1907	S	1N4001	1N4001	R	50	1.0	1.5	0.01	30				
1N1908	S	1N4002	1N4001	R	100	1.0	1.5	0.01	30				
1N1909	S	1N4003	1N4001	R	200	1.0	1.5	0.01	30				
1N1910	S			R	300	1.0	1.5	0.01	30				
1N1911	S	1N4004	1N4001	R	400	1.0	1.5	0.01	30				
1N1912	S	1N4005	1N4001	R	500	1.0	1.5	0.01	30				
1N1913	S	1N4005	1N4001	R	600	1.0	1.5	0.01	30				
1N1914	S	1N4006	1N4001	R	700	1.0	1.5	0.01	30				
1N1915	S	1N4006	1N4001	R	800	1.0	1.5	0.01	30				
1N1916	S	1N4007	1N4001	R	900	1.0	1.5	0.01	30				
1N1917	S			R	50	1.0	4.0	0.01	30				
1N1918	S			R	100	1.0	4.0	0.01	30				
1N1919	S			R	200	1.0	4.0	0.01	30				
1N1920	S			R	300	1.0	4.0	0.01	30				
1N1921	S			R	400	1.0	4.0	0.01	30				
1N1922	S			R	500	1.0	4.0	0.01	30				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol $V_{Z\pm\%}$ / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N1923	S			R	600	1.0	4.0	0.01	30				
1N1924	S			R	700	1.0	4.0	0.01	30				
1N1925	S			R	800	1.0	4.0	0.01	30				
1N1926	S			R	900	1.0	4.0	0.01	30				
1N1927	S	1N5228A	1N5221	DZ						3.9	5.0	10	200M
1N1928	S	1N5230A	1N5221	DZ						4.7	5.0	10	200M
1N1929	S	1N5232A	1N5221	DZ						5.6	5.0	10	200M
1N1930	S	1N5235A	1N5221	DZ						6.8	5.0	10	200M
1N1931	S	1N5237A	1N5221	DZ						8.2	5.0	10	200M
1N1932	S	1N5240A	1N5221	DZ						10	5.0	10	200M
1N1933	S	1N5242A	1N5221	DZ						12	1.0	10	200M
1N1934	S	1N5245A	1N5221	DZ						15	1.0	10	200M
1N1935	S	1N5248A	1N5221	DZ						18	1.0	10	200M
1N1936	S	1N5251A	1N5221	DZ						22	1.0	10	200M
1N1937	S	1N5254A	1N5221	DZ						27	1.0	10	200M
1N1938	S	1N5257A	1N5221	DZ						33	0.2	10	200M
1N1939	S	1N5259A	1N5221	DZ						39	0.2	10	200M
1N1940	S	1N5261A	1N5221	DZ						47	0.2	10	200M
1N1941	S	1N5263A	1N5221	DZ						56	0.2	10	200M
1N1942	S	1N5266A	1N5221	DZ						68	0.2	10	200M
1N1943	S	1N5268A	1N5221	DZ						82	0.2	10	200M
1N1944	S	1N5271A	1N5221	DZ						100	0.2	10	200M
1N1945	S	1N5273A	1N5221	DZ						120	0.2	10	200M
1N1946	S	1N5276A	1N5221	DZ						150	0.1	10	200M
1N1947	S	1N5279A	1N5221	DZ						180	0.1	10	200M
1N1948	S	.5M110ZSB10		DZ						220	0.1	10	200M
1N1949	S	.5M135ZSB10		DZ						270	0.1	10	200M
1N1950	S	.5M165ZSB10		DZ						330	0.1	10	200M
1N1951	S	.5M195ZSB10		DZ						390	0.1	10	200M
1N1952	S	.5M155ZSC10		DZ						470	0.1	10	200M
1N1953	S	.5M185ZSC10		DZ						560	0.1	10	200M
1N1954	S	1N5228A	1N5221	DZ						3.9	5.0	10	400M
1N1955	S	1N5230A	1N5221	DZ						4.7	5.0	10	400M
1N1956	S	1N5232A	1N5221	DZ						5.6	5.0	10	400M
1N1957	S	1N5235A	1N5221	DZ						6.8	5.0	10	400M
1N1958	S	1N5237A	1N5221	DZ						8.2	5.0	10	400M
1N1959	S	1N5240A	1N5221	DZ						10	5.0	10	400M
1N1960	S	1N5242A	1N5221	DZ						12	1.0	10	400M
1N1961	S	1N5245A	1N5221	DZ						15	1.0	10	400M
1N1962	S	1N5248A	1N5221	DZ						18	1.0	10	400M
1N1963	S	1N5251A	1N5221	DZ						22	1.0	10	400M
1N1964	S	1N5254A	1N5221	DZ						27	1.0	10	400M
1N1965	S	1N5257A	1N5221	DZ						33	0.2	10	400M
1N1966	S	1N5259A	1N5221	DZ						39	0.2	10	400M
1N1967	S	1N5261A	1N5221	DZ						47	0.2	10	400M
1N1968	S	1N5263A	1N5221	DZ						56	0.2	10	400M
1N1969	S	1N5266A	1N5221	DZ						68	0.2	10	400M
1N1970	S	1N5268A	1N5221	DZ						82	0.2	10	400M
1N1971	S	1N5271A	1N5221	DZ						100	0.2	10	400M
1N1972	S	1N5273A	1N5221	DZ						120	0.2	10	400M
1N1973	S	1N5276A	1N5221	DZ						150	0.1	10	400M
1N1974	S	1N5279A	1N5221	DZ						180	0.1	10	400M
1N1975	S	.5M110ZSB10	&	DZ						220	0.1	10	400M
1N1976	S	.5M135ZSB10	&	DZ						270	0.1	10	400M
1N1977	S	.5M165ZSB10	&	DZ						330	0.1	10	400M
1N1978	S	.5M195ZSB10	&	DZ						390	0.1	10	400M
1N1979	S	.5M155ZSC10	&	DZ						470	0.1	10	400M
1N1980	S	.5M185ZSC10	&	DZ						560	0.1	10	400M
1N1981	S	1N5228A	1N5221	DZ						3.9	5.0	10	150M
1N1982	S	1N5230A	1N5221	DZ						4.7	5.0	10	150M
1N1983	S	1N5232A	1N5221	DZ						5.6	5.0	10	150M
1N1984	S	1N5235A	1N5221	DZ						6.8	5.0	10	150M
1N1985	S	1N5237A	1N5221	DZ						8.2	5.0	10	150M
1N1986	S	1N5240A	1N5221	DZ						10	5.0	10	150M
1N1987	S	1N5242A	1N5221	DZ						12	1.0	10	150M
1N1988	S	1N5245A	1N5221	DZ						15	1.0	10	150M
1N1989	S	1N5248A	1N5221	DZ						18	1.0	10	150M
1N1990	S	1N5251A	1N5221	DZ						22	1.0	10	150M
1N1991	S	1N5254A	1N5221	DZ						27	1.0	10	150M
1N1992	S	1N5257A	1N5221	DZ						33	0.2	10	150M
1N1993	S	1N5259A	1N5221	DZ						39	0.2	10	150M
1N1994	S	1N5261A	1N5221	DZ						47	0.2	10	150M
1N1995	S	1N5263A	1N5221	DZ						56	0.2	10	150M
1N1996	S	1N5266A	1N5221	DZ						68	0.2	10	150M
1N1997	S	1N5268A	1N5221	DZ						82	0.2	10	150M
1N1998	S	1N5271A	1N5221	DZ						100	0.2	10	150M
1N1999	S	1N5273A	1N5221	DZ						120	0.2	10	150M
1N2000	S	1N5276A	1N5221	DZ						150	0.1	10	150M
1N2001	S	1N5279A	1N5221	DZ						180	0.1	10	150M
1N2002	S	.5M110ZSB10&		DZ						220	0.1	10	150M
1N2003	S	.5M135ZSB10&		DZ						270	0.1	10	150M
1N2004	S	.5M165ZSB10&		DZ						330	0.1	10	150M

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS V_R (volts) / SIGNAL DIODES PRV (volts)	RECTIFIERS V_F (volts) / SIGNAL DIODES V_F (volts) @	RECTIFIERS I_O (Amps) / SIGNAL DIODES I_F	RECTIFIERS I_R (mA) / SIGNAL DIODES I_R	RECTIFIERS I_{FSM} / SIGNAL DIODES t_{rr} (µs)	ZENER DIODES V_Z(nom) / REFERENCE DIODES V_Z(nom)	ZENER DIODES I_{ZT} mA / REFERENCE DIODES T_C %/°C	ZENER DIODES Tol V_Z±% / REFERENCE DIODES I_{ZT} mA	ZENER DIODES P_D / REFERENCE DIODES Temp Range
1N2005	S	.5M195ZSB10	&	DZ						390	0.1	10	150M
1N2006	S	.5M155ZSC10	&	DZ						470	0.1	10	150M
1N2007	S	.5M185ZSC10	&	DZ						560	0.1	10	150M
1N2008	S	1N3005A *	1N2970	DZ						100	50	10	10W
1N2009	S	1N3007A *	1N2970	DZ						110	50	10	10W
1N2010	S	1N3008A *	1N2970	DZ						120	50	10	10W
1N2011	S	1N3009A *	1N2970	DZ						130	50	10	10W
1N2012	S	1N3011A *	1N2970	DZ						150	50	10	10W
1N2013	S			R	50	1.2	0.25	0.25	10				
1N2014	S			R	100	1.2	0.25	0.25	10				
1N2015	S			R	150	1.2	0.25	0.25	10				
1N2016	S			R	200	1.2	0.25	0.25	10				
1N2017	S			R	250	1.2	0.25	0.25	10				
1N2018	S			R	300	1.2	0.25	0.25	10				
1N2019	S			R	350	1.2	0.25	0.25	10				
1N2020	S			R	400	1.2	0.25	0.25	10				
1N2021	S	1N1185	1N1183	R	150	1.5	10	5.0	110				
1N2022	S	1N1187	1N1183	R	250	1.5	10	5.0	110				
1N2023	S	1N1187	1N1183	R	300	1.5	10	5.0	110				
1N2024	S	1N1188	1N1183	R	350	1.5	10	5.0	110				
1N2025	S	1N1188	1N1183	R	400	1.5	10	5.0	110				
1N2026	S	MR1120	MR1120	R	50	2.0	1.0	0.5	25				
1N2027	S	MR1122	MR1120	R	200	2.0	1.0	0.5	25				
1N2028	S	MR1123	MR1120	R	300	2.0	1.0	0.5	25				
1N2029	S	MR1124	MR1120	R	400	2.0	1.0	0.5	25				
1N2030	S	MR1125	MR1120	R	500	2.0	1.0	0.5	25				
1N2031	S	MR1126	MR1120	R	600	2.0	1.0	0.5	25				
1N2032	S	1N4732*	1N4728	DZ						4.4	10	5.0	750M
1N2033	S	1N4734*	1N4728	DZ						5.6	10	5.0	750M
1N2034	S	1N4736*	1N4728	DZ						6.6	10	5.0	750M
1N2035	S	1N4739*	1N4728	DZ						8.8	10	5.0	750M
1N2036	S	1N4740*	1N4728	DZ						10.5	5.0	5.0	750M
1N2037	S	1N4743*	1N4728	DZ						12.8	5.0	5.0	750M
1N2038	S	1N4745*	1N4728	DZ						15.8	5.0	5.0	750M
1N2039	S	1N4747*	1N4728	DZ						19	5.0	5.0	750M
1N2040	S	1N4749*	1N4728	DZ						23.5	5.0	5.0	750M
1N2041	S	1N3995*	1N3993	DZ						4.9	1.0	5.0	10W
1N2042	S	1N3997*	1N3993	DZ						5.8	1.0	5.0	10W
1N2043	S	1N2970RA *	1N2970	DZ						6.6	1.0	5.0	10W
1N2044	S	1N2973RA *	1N2970	DZ						8.8	500	5.0	10W
1N2045	S	1N2974RB *	1N2970	DZ						10.5	500	5.0	10W
1N2046	S	1N2977RA *	1N2970	DZ						12.8	500	5.0	10W
1N2047	S	1N2980RA *	1N2970	DZ						15.8	500	5.0	10W
1N2048	S	1N2983RA *	1N2970	DZ						19	500	5.0	10W
1N2049	S	1N2986RA *	1N2970	DZ						23.5	150	5.0	10W
1N2054	S	MR1230SB	MR1230	R	50	1.6	250	55	4500				
1N2055	S	MR1231SB	MR1230	R	100	1.6	250	55	4500				
1N2056	S	MR1232SB	MR1230	R	150	1.6	250	55	4500				
1N2057	S	MR1233SB	MR1230	R	200	1.6	250	55	4500				
1N2058	S	MR1234SB	MR1230	R	250	1.6	250	55	4500				
1N2059	S	MR1235SB	MR1230	R	300	1.6	250	55	4500				
1N2060	S	MR1236SB	MR1230	R	350	1.6	250	55	4500				
1N2061	S	MR1237SB	MR1230	R	400	1.6	250	55	4500				
1N2062	S	MR1238SB	MR1230	R	450	1.6	250	55	4500				
1N2063	S	MR1238SB	MR1230	R	500	1.6	250	55	4500				
1N2064	S	MR1239SB	MR1230	R	600	1.6	250	55	4500				
1N2065	S			R	700	1.6	250	55	4500				
1N2066	S			R	800	1.6	250	55	4500				
1N2067	S			R	900	1.6	250	55	4500				
1N2068	S			R	1000	1.6	250	55	4500				
1N2069	S	1N4003	1N4001	R	200	0.6	0.75	0.2	22				
1N2069A	S	1N4003	1N4001	R	200	0.5	0.75	0.05	22				
1N2070	S	1N4004	1N4001	R	400	0.6	0.75	0.2	22				
1N2070A	S	1N4004	1N4001	R	400	0.5	0.75	0.05	22				
1N2071	S	1N4005	1N4001	R	600	0.6	0.75	0.2	22				
1N2071A	S	1N4005	1N4001	R	600	0.5	0.75	0.05	22				
1N2072	S	1N4001	1N4001	R	50	1.1	0.625	0.25	30				
1N2073	S	1N4002	1N4001	R	100	1.1	0.625	0.25	30				
1N2074	S	1N4003	1N4001	R	150	1.1	0.625	0.25	30				
1N2075	S	1N4003	1N4001	R	200	1.1	0.625	0.25	30				
1N2076	S	1N4004	1N4001	R	250	1.1	0.625	0.25	30				
1N2077	S	1N4004	1N4001	R	300	1.1	0.625	0.25	30				
1N2078	S	1N4004	1N4001	R	400	1.1	0.625	0.25	30				
1N2079	S	1N4005	1N4001	R	500	1.1	0.625	0.25	30				
1N2080	S	1N4001	1N4001	R	50	0.75	0.5	0.35	15				
1N2081	S	1N4002	1N4001	R	100	0.75	0.5	0.35	15				
1N2082	S	1N4003	1N4001	R	200	0.75	0.5	0.35	15				
1N2083	S	1N4004	1N4001	R	300	0.75	0.5	0.35	15				
1N2084	S	1N4004	1N4001	R	400	0.75	0.5	0.35	15				
1N2085	S	1N4005	1N4001	R	500	0.75	0.5	0.35	15				
1N2086	S			R	600	0.75	0.5	0.35	15				
1N2088	S			R	500	1.2	0.75	0.5	30				

Replacement * denotes exact device type replacement available on request.

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	ZENER DIODES V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (μs)	REFERENCE DIODES V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N2089	S			R	600	1.2	0.75	0.5	30				
1N2090	S			R	50	0.5	0.5	0.25	15				
1N2091	S			R	100	0.5	0.5	0.25	15				
1N2092	S			R	200	0.5	0.5	0.25	15				
1N2093	S			R	300	0.5	0.5	0.25	15				
1N2094	S			R	400	0.5	0.5	0.25	15				
1N2095	S			R	500	0.5	0.5	0.25	15				
1N2096	S			R	600	0.5	0.5	0.25	15				
1N2102	S	Microwave L-S-band Detector											
1N2103	S	1N4001	1N4001	R	50	1.2	0.75	0.3	10				
1N2104	S	1N4002	1N4001	R	100	1.2	0.75	0.3	10				
1N2105	S	1N4003	1N4001	R	200	1.2	0.75	0.3	10				
1N2106	S	1N4004	1N4001	R	300	1.2	0.75	0.3	10				
1N2107	S	1N4004	1N4001	R	400	1.2	0.75	0.3	10				
1N2108	S	1N4005	1N4001	R	500	1.2	0.75	0.3	10				
1N2109	S			R	50	1.2	2.0	0.3	10				
1N2110	S			R	100	1.2	2.0	0.3	10				
1N2111	S			R	200	1.2	2.0	0.3	10				
1N2112	S			R	300	1.2	2.0	0.3	10				
1N2113	S			R	400	1.2	2.0	0.3	10				
1N2114	S			R	500	1.2	2.0	0.3	10				
1N2115	S	1N4004	1N4001	R	365	0.8	0.2	0.25	10				
1N2116	S			R	400	1.4	0.5	0.4	15				
1N2117	S	1N4006	1N4001	R	720	1.3	0.75	0.010	15				
1N2127	S	Microwave L-X-band Detector											
1N2127A	S	Microwave L-X-band Detector											
1N2128	S	MR1200FL	MR1200	R	50	2.0	60	10	700				
1N2128A	S	MR1200FL	MR1200	R	50	2.0	60	10	900				
1N2129	S	MR1201FL	MR1200	R	100	2.0	60	10	700				
1N2129A	S	MR1201FL	MR1200	R	100	2.0	60	10	900				
1N2130	S	MR1202FL	MR1200	R	150	2.0	60	10	700				
1N2130A	S	MR1202FL	MR1200	R	150	2.0	60	10	900				
1N2131	S	MR1203FL	MR1200	R	200	2.0	60	10	700				
1N2131A	S	MR1203FL	MR1200	R	200	2.0	60	10	900				
1N2132	S	MR1204FL	MR1200	R	250	2.0	60	10	700				
1N2132A	S	MR1204FL	MR1200	R	250	2.0	60	10	900				
1N2133	S	MR1205FL	MR1200	R	300	2.0	60	10	700				
1N2133A	S	MR1205FL	MR1200	R	300	2.0	60	10	900				
1N2134	S	MR1206FL	MR1200	R	350	2.0	60	10	700				
1N2134A	S	MR1206FL	MR1200	R	350	2.0	60	10	900				
1N2135	S	MR1207FL	MR1200	R	400	2.0	60	10	700				
1N2135A	S	MR1207FL	MR1200	R	400	2.0	60	10	900				
1N2136	S			R	450	2.0	60	10	700				
1N2136A	S			R	450	2.0	60	10	900				
1N2137	S			R	500	2.0	60	10	700				
1N2137A	S			R	500	2.0	60	10	900				
1N2138	S			R	600	2.0	60	10	700				
1N2138A	S			R	600	2.0	60	10	900				
1N2139	S			R	20K	60	0.052	0.2	3.5				
1N2146	S			DS	120	1.1	500M	1.0*	0.1				
1N2147	S			R	50	1.2	6.0	0.5	150				
1N2147A	S			R	50	1.0	6.0	0.1	150				
1N2148	S			R	100	1.2	6.0	0.5	150				
1N2148A	S			R	100	1.0	6.0	0.1	150				
1N2149	S			R	200	1.2	6.0	0.5	150				
1N2149A	S			R	200	1.0	6.0	0.1	150				
1N2150	S			R	300	1.2	6.0	0.5	150				
1N2150A	S			R	300	1.0	6.0	0.1	150				
1N2151	S			R	400	1.2	6.0	0.5	150				
1N2151A	S			R	400	1.0	6.0	0.1	150				
1N2152	S			R	500	1.2	6.0	0.5	150				
1N2152A	S			R	500	1.0	6.0	0.1	150				
1N2153	S			R	600	1.2	6.0	0.5	150				
1N2153A	S			R	600	1.0	6.0	0.1	150				
1N2154	S	1N1183	1N1183	R	50	0.6	25	5.0	300				
1N2155	S	1N1184	1N1183	R	100	0.6	25	4.5	300				
1N2156	S	1N1186	1N1183	R	200	0.6	25	4.0	300				
1N2157	S	1N1187	1N1183	R	300	0.6	25	3.5	300				
1N2158	S	1N1188	1N1183	R	400	0.6	25	3.0	300				
1N2159	S	1N1189	1N1183	R	500	0.6	25	2.5	300				
1N2160	S	1N1190	1N1183	R	600	0.6	25	2.0	300				
1N2163	S		1N2163	DR						9.4	0.05	10	0/+70
1N2163A	S		1N2163	DR						9.4	0.05	10	0/+70
1N2164	S		1N2163	DR						9.4	0.05	10	-55/+125
1N2164A	S		1N2163	DR						9.4	0.05	10	-55/+125
1N2165	S		1N2163	DR						9.4	0.05	10	-55/+185
1N2165A	S		1N2163	DR						9.4	0.05	10	-55/+185
1N2166	S		1N2163	DR						9.4	0.001	10	0/+70
1N2166A	S		1N2163	DR						9.4	0.001	10	0/+70
1N2167	S		1N2163	DR						9.4	0.001	10	-55/+125
1N2167A	S		1N2163	DR						9.4	0.001	10	-55/+125

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{surge} (Amps) / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(min) / REFERENCE DIODES: TC %/°C	ZENER DIODES: V_Z(nom) * / V_Z(max) / REFERENCE DIODES: V_Z	ZENER DIODES: Tol V_Z % / REFERENCE DIODES: T(min) °C	ZENER DIODES: P_D / REFERENCE DIODES: T(max) °C
1N2168	S		1N2163	DR						9.4	0.001	10	-55/+185
1N2168A	S		1N2163	DR						9.4	0.001	10	-55/+185
1N2169	S		1N2163	DR						9.4	0.0005	10	0/+70
1N2169A	S		1N2163	DR						9.4	0.0005	10	0/+70
1N2170	S		1N2163	DR						9.4	0.0005	10	-55/+125
1N2170A	S		1N2163	DR						9.4	0.0005	10	-55/+125
1N2171	S		1N2163	DR						9.4	0.0005	10	-55/+185
1N2171A	S		1N2163	DR						9.4	0.0005	10	-55/+185
1N2172	S			R	50	1.5	50	0.25	525				
1N2173	S			R	100	1.5	50	0.25	525				
1N2174	S			R	200	1.5	50	0.25	525				
1N2175		Photosensitive Device; $I_{R(dark)}$ = 0.5 μA @ 50 V, Sensitivity = 0.22 μA/mW/cm^2											
1N2176	S			R	50	1.1	3.0	0.3	15				
1N2177	S			R	100	1.1	3.0	0.3	15				
1N2178	S			R	150	1.1	3.0	0.3	15				
1N2179	S			R	200	1.1	3.0	0.3	15				
1N2180	S			R	300	1.1	3.0	0.3	15				
1N2181	S			R	400	1.1	3.0	0.3	15				
1N2182	S			R	500	1.1	3.0	0.3	15				
1N2183	S			R	600	1.1	3.0	0.3	15				
1N2184	S			R	50	1.5	3.0	5.0	40				
1N2185	S			R	100	1.5	3.0	5.0	40				
1N2186	S			R	150	1.5	3.0	5.0	40				
1N2187	S			R	200	1.5	3.0	5.0	40				
1N2188	S			R	300	1.5	3.0	5.0	40				
1N2189	S			R	400	1.5	3.0	5.0	40				
1N2190	S			R	500	1.5	3.0	5.0	40				
1N2191	S			R	600	1.5	3.0	5.0	40				
1N2192	S			R	800	1.5	3.0	5.0	40				
1N2193	S			R	1000	1.5	3.0	5.0	40				
1N2194	S			R	50	1.25	6.0	10	100				
1N2195	S			R	100	1.25	6.0	10	100				
1N2196	S			R	150	1.25	6.0	10	100				
1N2197	S			R	200	1.25	6.0	10	100				
1N2198	S			R	300	1.25	6.0	10	100				
1N2199	S			R	400	1.25	6.0	10	100				
1N2200	S			R	500	1.25	6.0	10	100				
1N2201	S			R	600	1.25	6.0	10	100				
1N2202	S			R	800	1.25	6.0	10	100				
1N2203	S			R	1000	1.25	6.0	10	100				
1N2204	S			R	50	1.25	12	10	200				
1N2205	S			R	100	1.25	12	10	200				
1N2206	S			R	150	1.25	12	10	200				
1N2207	S			R	200	1.25	12	10	200				
1N2208	S			R	300	1.25	12	10	200				
1N2209	S			R	400	1.25	12	10	200				
1N2210	S			R	500	1.25	12	10	200				
1N2211	S			R	600	1.25	12	10	200				
1N2212	S			R	800	1.25	12	10	200				
1N2213	S			R	1000	1.25	12	10	200				
1N2214	S	1M5.5ZS1	&	DZ						5.6	35		1.0W
1N2217	S	MR1120	MR1120	R	50		1.5	0.003	20				
1N2218	S	MR1125	MR1120	R	500	1.2	0.4	0.003	20				
1N2219	S			R	500		1.5	0.003	20				
1N2220	S	MR1126	MR1120	R	600	1.2	0.4	0.003	20				
1N2221	S			R	600		1.5	0.003	20				
1N2222	S	MR1128	MR1120	R	800	1.2	0.3	0.003	20				
1N2222A	S			R	800	1.2	0.3	0.003	20				
1N2223	S			R	800		1.0	0.003	20				
1N2223A	S			R	800		1.0	0.003	20				
1N2224	S	MR1130	MR1120	R	1000	1.2	0.3	0.003	20				
1N2224A	S			R	1000	1.2	0.3	0.003	20				
1N2225	S			R	1000		1.0	0.003	20				
1N2225A	S			R	1000		1.0	0.003	20				
1N2226	S			R	1200	1.2	0.3	0.003	20				
1N2226A	S			R	1200	1.2	0.3	0.003	20				
1N2227	S			R	1200		1.0	0.003	20				
1N2227A	S			R	1200		1.0	0.003	20				
1N2228	S	MR1120	MR1120	R	50	1.2	1.0	0.003	100				
1N2228A	S	MR1120	MR1120	R	50	1.2	1.6	0.003	100				
1N2229	S			R	50		5.0	0.003	100				
1N2229A	S			R	50		5.0	0.003	100				
1N2230	S	MR1122	MR1120	R	200	1.2	1.0	0.003	100				
1N2230A	S	MR1122	MR1120	R	200	1.2	1.6	0.003	100				
1N2231	S			R	200		5.0	0.003	100				
1N2231A	S	MR1123	MR1120	R	200		5.0	0.003	100				
1N2232	S	MR1123	MR1120	R	300	1.2	1.0	0.003	100				
1N2232A	S			R	300	1.2	1.6	0.003	100				
1N2233	S			R	300		5.0	0.003	100				
1N2233A	S			R	300		5.0	0.003	100				
1N2234	S	MR1124	MR1120	R	400	1.2	1.0	0.003	100				
1N2234A	S	MR1124	MR1120	R	400	1.2	1.6	0.003	100				

& See page 1-3 for ordering information.

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1N2235–1N2285

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	V_F (volts) / V_F (volts) @	I_O (Amps) / I_F	I_R (mA) / I_R	I_{FSM} / t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	I_{ZT} mA / T_C %/°C	Tol V_Z±% / I_{ZT} mA	P_D / Temp Range
1N2235	S			R	400		5.0	0.003	100				
1N2235A	S			R	400		5.0	0.003	100				
1N2236	S	MR1125	MR1120	R	500	1.2	1.0	0.003	100				
1N2236A	S	MR1125	MR1120	R	500	1.2	1.6	0.003	100				
1N2237	S			R	500		5.0	0.003	100				
1N2237A	S			R	500		5.0	0.003	100				
1N2238	S	MR1126	MR1120	R	600	1.2	1.0	0.003	100				
1N2238A	S	MR1126	MR1120	R	600	1.2	1.6	0.003	100				
1N2239	S			R	600		5.0	0.003	100				
1N2239A	S			R	600		5.0	0.003	100				
1N2240	S	MR1128	MR1120	R	800	1.2	1.5	0.003	100				
1N2240A	S	MR1128	MR1120	R	800	1.2	1.5	0.003	100				
1N2241	S			R	800		5.0	0.003	100				
1N2241A	S			R	800		5.0	0.003	100				
1N2242	S	MR1130	MR1120	R	1000	1.2	1.5	0.003	100				
1N2242A	S	MR1130	MR1120	R	1000	1.2	1.6	0.003	100				
1N2243	S			R	1000		5.0	0.003	100				
1N2243A	S			R	1000		5.0	0.003	100				
1N2244	S			R	1200	1.2	1.5	0.003	100				
1N2244A	S			R	1200	1.2	1.6	0.003	100				
1N2245	S			R	1200		5.0	0.003	100				
1N2245A	S			R	1200		5.0	0.003	100				
1N2246	S			R	50	1.2	3.0	0.005	200				
1N2246A	S			R	50	1.2	3.0	0.003	200				
1N2247	S			R	50		10	0.005	200				
1N2247A	S			R	50		10	0.003	200				
1N2248	S			R	100	1.2	3.0	0.005	200				
1N2248A	S			R	100	1.2	3.0	0.003	200				
1N2249	S			R	100		10	0.005	200				
1N2249A	S			R	100		10	0.003	200				
1N2250	S			R	200	1.2	3.0	0.005	200				
1N2250A	S			R	200	1.2	3.0	0.003	200				
1N2251	S			R	200		5.0	0.005	200				
1N2251A	S			R	200		10	0.003	200				
1N2252	S			R	300	1.2	3.0	0.005	200				
1N2252A	S			R	300	1.2	3.0	0.003	200				
1N2253	S			R	300		10	0.005	200				
1N2253A	S			R	300		10	0.003	200				
1N2254	S			R	400	1.2	3.0	0.005	200				
1N2254A	S			R	400	1.2	3.0	0.003	200				
1N2255	S			R	400		10	0.005	200				
1N2255A	S			R	400		10	0.003	200				
1N2256	S			R	500	1.2	3.0	0.005	200				
1N2256A	S			R	500	1.2	3.0	0.003	200				
1N2257	S			R	500		10	0.005	200				
1N2257A	S			R	500		10	0.005	200				
1N2258	S			R	600	1.2	3.0	0.005	200				
1N2258A	S			R	600	1.2	3.0	0.003	200				
1N2259	S			R	600		10	0.005	200				
1N2259A	S			R	600		10	0.003	200				
1N2260	S			R	800	1.2	3.0	0.003	200				
1N2260A	S			R	800	1.2	3.0	0.005	200				
1N2261	S			R	800		10	0.01	200				
1N2261A	S			R	800		10	0.005	200				
1N2262	S			R	1000	1.2	3.0	0.010	200				
1N2262A	S			R	1000	1.2	3.0	0.005	200				
1N2263	S			R	1000		10	0.01	200				
1N2263A	S			R	1000		10	0.005	200				
1N2264	S			R	1200	1.2	3.0	0.010	200				
1N2264A	S			R	1200	1.2	3.0	0.005	200				
1N2265	S			R	1200		10	0.01	200				
1N2265A	S			R	1200		10	0.005	200				
1N2266	S	MR1120	MR1120	R	50	1.2	0.3	0.003	20				
1N2267	S			R	50		1.0	0.003	20				
1N2268	S	MR1125	MR1120	R	500	1.2	0.3	0.003	20				
1N2269	S			R	500		1.0	0.003	20				
1N2270	S	MR1126	MR1120	R	600	1.2	0.3	0.003	20				
1N2271	S			R	600		1.0	0.003	20				
1N2272	S	MR1120	MR1120	R	50	1.2	6.0	1.0	400				
1N2273	S	MR1121	MR1120	R	100	1.2	6.0	1.0	400				
1N2274	S	MR1122	MR1120	R	200	1.2	6.0	1.0	400				
1N2275	S	MR1123	MR1120	R	300	1.2	6.0	1.0	400				
1N2276	S	MR1124	MR1120	R	400	1.2	6.0	1.0	400				
1N2277	S	MR1125	MR1120	R	500	1.2	6.0	1.0	400				
1N2278	S	MR1126	MR1120	R	600	1.2	6.0	1.0	400				
1N2279	S	MR1128	MR1120	R	800	1.2	6.0	1.0	400				
1N2280	S			R	1000	1.2	6.0	1.0	400				
1N2281	S			R	1200	1.2	6.0	1.0	400				
1N2282	S			R	300	1.5	20	5.0	400				
1N2283	S			R	400	1.5	20	5.0	400				
1N2284	S			R	500	1.5	20	5.0	400				
1N2285	S			R	600	1.5	20	5.0	400				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N2286	S			R	800	1.5	20	5.0	400				
1N2287	S			R	1000	1.5	20	5.0	400				
1N2288	S			R	1200	1.5	20	5.0	400				
1N2289	S			R	100		1.5	0.003	20				
1N2289A	S			R	100		1.5	0.003	20				
1N2290	S			R	100		5.0	0.003	100				
1N2290A	S			R	100		5.0	0.003	100				
1N2291	S			R	200		1.5	0.003	20				
1N2291A	S			R	200		1.5	0.003	20				
1N2292	S			R	300		1.5	0.003	20				
1N2292A	S			R	300		1.5	0.003	20				
1N2293	S			R	400		1.5	0.003	20				
1N2293A	S			R	400		1.5	0.003	20				
1N2294	S			R	50	1.1	22	10	160				
1N2295	S			R	100	1.1	22	10	160				
1N2296	S			R	150	1.1	22	10	160				
1N2297	S			R	200	1.1	22	10	160				
1N2298	S			R	250	1.1	22	10	160				
1N2299	S			R	300	1.1	22	10	160				
1N2300	S			R	350	1.1	22	10	160				
1N2301	S			R	400	1.1	22	10	160				
1N2302	S			R	50	1.1	22	10	160				
1N2303	S			R	100	1.1	22	10	160				
1N2304	S			R	150	1.1	22	10	160				
1N2305	S			R	200	1.1	22	10	160				
1N2306	S			R	250	1.1	22	10	160				
1N2307	S			R	300	1.1	22	10	160				
1N2308	S			R	350	1.1	22	10	160				
1N2309	S			R	400	1.1	22	10	160				
1N2310	S			R	50	1.1	35	20	300				
1N2311	S			R	100	1.1	35	20	300				
1N2312	S			R	150	1.1	35	20	300				
1N2313	S			R	200	1.1	35	20	300				
1N2314	S			R	250	1.1	35	20	300				
1N2315	S			R	300	1.1	35	20	300				
1N2316	S			R	350	1.1	35	20	300				
1N2317	S			R	400	1.1	35	20	300				
1N2318	S			R	50	1.1	35	20	300				
1N2319	S			R	100	1.1	35	20	300				
1N2320	S			R	150	1.1	35	20	300				
1N2321	S			R	200	1.1	35	20	300				
1N2322	S			R	250	1.1	35	20	300				
1N2323	S			R	300	1.1	35	20	300				
1N2324	S			R	350	1.1	35	20	300				
1N2325	S			R	400	1.1	35	20	300				
1N2326	G			DS	1.0	0.150	2.0M						
1N2327	S			DS	300	3.3	400M	1.5*					
1N2328	S			DS	300	3.3	400M	1.5*					
1N2348	S	MR1120	MR1120	R	50	1.1	3.0	0.3	15				
1N2349	S	MR1121	MR1120	R	100	1.1	3.0	0.3	15				
1N2350	S	MR1122	MR1120	R	150	1.1	3.0	0.3	15				
1N2357	S			R	1400		0.4	0.001	15				
1N2358	S			R	1500		0.4	0.001	15				
1N2359	S			R	1600		0.4	0.001	15				
1N2360	S			R	1800		0.4	0.001	15				
1N2361	S			R	2000		0.4	0.001	15				
1N2362	S			R	1400		1.0	0.001	15				
1N2362A	S			R	1400		5.0	0.001	20				
1N2362B	S			R	1400		10	0.001	25				
1N2363	S			R	1400		1.0	0.001	15				
1N2363A	S			R	1400		5.0	0.001	20				
1N2363B	S			R	1400		10	0.001	25				
1N2364	S			R	1500		1.0	0.001	15				
1N2364A	S			R	1500		5.0	0.001	20				
1N2364B	S			R	1500		10	0.001	25				
1N2365	S			R	1500		1.0	0.001	15				
1N2365A	S			R	1500		5.0	0.001	20				
1N2365B	S			R	1500		10	0.001	25				
1N2366	S			R	1600		1.0	0.001	15				
1N2366A	S			R	1600		5.0	0.001	20				
1N2366B	S			R	1600		10	0.001	25				
1N2367	S			R	1600		1.0	0.001	15				
1N2367A	S			R	1600		5.0	0.001	20				
1N2367B	S			R	1600		10	0.001	25				
1N2368	S			R	1800		1.0	0.001	15				
1N2368A	S			R	1800		5.0	0.001	20				
1N2368B	S			R	1800		10	0.001	25				
1N2369	S			R	1800		1.0	0.001	15				
1N2369A	S			R	1800		5.0	0.001	20				
1N2369B	S			R	1800		10	0.001	25				
1N2370	S			R	2000		1.0	0.001	15				
1N2370A	S			R	2000		5.0	0.001	20				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	ZENER DIODES V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (μs)	REFERENCE DIODES V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N2370B	S			R	2000		10	0.001	25				
1N2371	S			R	2000		1.0	0.001	15				
1N2371A	S			R	2000		5.0	0.001	20				
1N2371B	S			R	2000		10	0.001	25				
1N2372	S			R	1000	2.0	0.2	0.5	12				
1N2373	S	1N4005	1N4001	R	600	3.0	0.1	0.250	12				
1N2374	S	1N4007	1N4001	R	1000	3.0	0.1	0.250	12				
1N2375	S	MR991A	MR990A	R	1500	4.5	0.1	0.250	12				
1N2376	S	MR992A	MR990A	R	2000	7.5	0.1	0.250	12				
1N2377	S	MR993A	MR990A	R	2400	9.0	0.075	0.250	12				
1N2378	S	MR994A	MR990A	R	3000	9.0	0.075	0.250	12				
1N2379	S	MR995A	MR990A	R	4000	15.0	0.05	0.250	12				
1N2380	S	1N2383	1N1730	R	6000	22.5	0.05	0.250	12				
1N2381	S	1N2385	1N1730	R	10K	37.5	0.025	0.250	12				
1N2382	S		1N1730	R	4000	18	0.15	0.2	6.0				
1N2382A	S			R	4000	6.0	0.35	0.2	6.0				
1N2383	S		1N1730	R	6000	27	0.1	0.2	6.0				
1N2383A	S			R	6000	9.0	0.35	0.2	6.0				
1N2384	S		1N1730	R	8000	27	0.07	0.2	6.0				
1N2384A	S			R	8000	12	0.275	0.2	6.0				
1N2385	S			R	10K	39	0.07	0.2	6.0				
1N2385A	S			R	10K	15	0.2	0.2	6.0				
1N2386	G			DS	5.0								
1N2387	S	1N4751*	1N4728	DZ						30	8.0	10	1.0W
1N2389	S			R	1600	4.8	0.6	0.5	15				
1N2390	S			R	50	1.2	1.5	0.3	35				
1N2391	S			R	100	1.2	1.5	0.3	35				
1N2392	S			R	200	1.2	1.5	0.3	35				
1N2393	S			R	300	1.2	1.5	0.3	35				
1N2394	S			R	400	1.2	1.5	0.3	35				
1N2395	S			R	500	1.2	1.5	0.3	35				
1N2396	S			R	600	1.2	1.5	0.3	35				
1N2397	S			R	700	1.2	1.5	0.3	35				
1N2398	S			R	800	1.2	1.5	0.3	35				
1N2399	S			R	50	1.2	1.5	0.3	35				
1N2400	S			R	100	1.2	1.5	0.3	35				
1N2401	S			R	200	1.2	1.5	0.3	35				
1N2402	S			R	300	1.2	1.5	0.3	35				
1N2403	S			R	400	1.2	1.5	0.3	35				
1N2404	S			R	500	1.2	1.5	0.3	35				
1N2405	S			R	600	1.2	1.5	0.3	35				
1N2406	S			R	700	1.2	1.5	0.3	35				
1N2407	S			R	800	1.2	1.5	0.3	35				
1N2408	S			R	50	1.2	1.5	0.3	35				
1N2409	S			R	100	1.2	1.5	0.3	35				
1N2410	S			R	200	1.2	1.5	0.3	35				
1N2411	S			R	300	1.2	1.5	0.3	35				
1N2412	S			R	400	1.2	1.5	0.3	35				
1N2413	S			R	500	1.2	1.5	0.3	35				
1N2414	S			R	600	1.2	1.5	0.3	35				
1N2415	S			R	700	1.2	1.5	0.3	35				
1N2416	S			R	800	1.2	1.5	0.3	35				
1N2417	S			R	50	1.2	1.5	0.3	35				
1N2418	S			R	100	1.2	1.5	0.3	35				
1N2419	S			R	200	1.2	1.5	0.3	35				
1N2420	S			R	300	1.2	1.5	0.3	35				
1N2421	S			R	400	1.2	1.5	0.3	35				
1N2422	S			R	500	1.2	1.5	0.3	35				
1N2423	S			R	600	1.2	1.5	0.3	35				
1N2424	S			R	700	1.2	1.5	0.3	35				
1N2425	S			R	800	1.2	1.5	0.3	35				
1N2482	S	1N4003	1N4001	R	200	1.2	0.75	0.5	30				
1N2483	S	1N4004	1N4001	R	400	1.2	0.75	0.5	30				
1N2484	S	1N4005	1N4001	R	500	1.2	0.75	0.5	30				
1N2485	S	1N4003	1N4001	R	200	1.2	0.75	0.5	30				
1N2486	S	1N4004	1N4001	R	300	1.2	0.75	0.5	30				
1N2487	S	1N4004	1N4001	R	400	1.2	0.75	0.5	30				
1N2488	S	1N4005	1N4001	R	500	1.2	0.75	0.5	30				
1N2489	S	1N4005	1N4001	R	600	1.2	0.75	0.5	30				
1N2490	S			R	1600	4.8	0.5	0.5	15				
1N2491	S	MR1120	MR1120	R	50	1.5	6.0	2.0	150				
1N2492	S	MR1121	MR1120	R	100	1.5	6.0	2.0	150				
1N2493	S	MR1122	MR1120	R	200	1.5	6.0	2.0	150				
1N2494	S	MR1123	MR1120	R	300	1.5	6.0	2.0	150				
1N2495	S	MR1124	MR1120	R	400	1.5	6.0	2.0	150				
1N2496	S	MR1125	MR1120	R	500	1.5	6.0	2.0	150				
1N2497	S	MR1126	MR1120	R	600	1.5	6.0	2.0	150				
1N2498	S	1N2974A *	1N2970	DZ						10	500	10	10W
1N2498A	S	1N2974B *	1N2970	DZ						10	500	5.0	10W
1N2499	S	1N2975A *	1N2970	DZ						11	500	10	10W
1N2499A	S	1N2975B *	1N2970	DZ						11	500	5.0	10W
1N2500	S	1N2976A *	1N2970	DZ						12	500	10	10W

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	V_F (volts) / V_F @	I_O (Amps) / I_F	I_R (mA) / I_R	I_{FSM} / t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	I_{ZT} mA / T_C %/°C	Tol V_Z±% / I_{ZT} mA	P_D / Temp Range
1N2500A	S	1N2976B *	1N2970	DZ						12	500	5.0	10W
1N2501	S	1N4006	1N4001	R	800	1.7	0.15	0.2	2.5				
1N2502	S	1N4007	1N4001	R	1000	1.7	0.15	0.2	2.5				
1N2503	S			R	1200	1.7	0.15	0.2	2.5				
1N2504	S			R	1500	1.7	0.15	0.2	2.5				
1N2505	S	1N4006	1N4001	R	800	1.7	0.3	0.2	2.5				
1N2506	S	1N4006	1N4001	R	1000	1.7	0.3	0.2	2.5				
1N2507	S			R	1200	1.7	0.3	0.2	2.5				
1N2508	S			R	1500	1.7	0.3	0.2	2.5				
1N2509	S	Microwave C-band Mixer; NF = 10 dB											
1N2510	S	Microwave X-band Mixer; NF = 9.5 dB											
1N2512	S			R	100	1.1		0.002	30				
1N2513	S			R	200	1.1		0.002	30				
1N2514	S			R	300	1.1		0.002	30				
1N2515	S			R	400	1.1		0.002	30				
1N2516	S			R	500	1.1		0.002	30				
1N2517	S			R	600	1.1		0.002	30				
1N2518	S			R	100	1.1		0.002	30				
1N2519	S			R	200	1.1		0.002	30				
1N2520	S			R	300	1.1		0.002	30				
1N2521	S			R	400	1.1		0.002	30				
1N2522	S			R	500	1.1		0.002	30				
1N2523	S			R	600	1.1		0.002	30				
1N2524	S			R	50	1.2	2.5	0.5	50				
1N2525	S			R	100	1.2	2.5	0.5	50				
1N2526	S			R	200	1.2	2.5	0.5	50				
1N2527	S			R	300	1.2	2.5	0.5	50				
1N2528	S			R	400	1.2	2.5	0.5	50				
1N2529	S			R	500	1.2	2.5	0.5	50				
1N2530	S			R	600	1.2	2.5	0.5	50				
1N2531	S			R	700	1.2	2.5	0.5	50				
1N2532	S			R	800	1.2	2.5	0.5	50				
1N2533	S			R	900	1.2	2.5	0.5	50				
1N2534	S			R	1000	1.2	2.5	0.5	50				
1N2535	S			R	50	1.0	2.5	0.1	50				
1N2536	S			R	100	1.0	2.5	0.1	50				
1N2537	S			R	200	1.0	2.5	0.1	50				
1N2538	S			R	300	1.0	2.5	0.1	50				
1N2539	S			R	400	1.0	2.5	0.1	50				
1N2540	S			R	500	1.0	2.5	0.1	50				
1N2541	S			R	600	1.0	2.5	0.1	50				
1N2542	S			R	700	1.0	2.5	0.1	50				
1N2543	S			R	800	1.0	2.5	0.1	50				
1N2544	S			R	900	1.0	2.5	0.1	50				
1N2545	S			R	1000	1.0	2.5	0.1	50				
1N2546	S			R	50	1.5	2.5	1.0	50				
1N2547	S			R	100	1.5	2.5	1.0	50				
1N2548	S			R	200	1.5	2.5	1.0	50				
1N2549	S			R	300	1.5	2.5	1.0	50				
1N2550	S			R	400	1.5	2.5	1.0	50				
1N2551	S			R	500	1.5	2.5	1.0	50				
1N2552	S			R	600	1.5	2.5	1.0	50				
1N2553	S			R	700	1.5	2.5	1.0	50				
1N2554	S			R	800	1.5	2.5	1.0	50				
1N2555	S			R	900	1.5	2.5	1.0	50				
1N2556	S			R	1000	1.5	2.5	1.0	50				
1N2557	S			R	700	1.2	6.0	0.5	150				
1N2558	S			R	800	1.2	6.0	0.5	150				
1N2559	S			R	900	1.2	6.0	0.5	150				
1N2560	S			R	1000	1.2	6.0	0.5	150				
1N2561	S			R	700	1.0	6.0	0.1	150				
1N2562	S			R	800	1.0	6.0	0.1	150				
1N2563	S			R	900	1.0	6.0	0.1	150				
1N2564	S			R	1000	1.0	6.0	0.1	150				
1N2565	S			R	50	1.5	6.0	1.0	150				
1N2566	S			R	100	1.5	6.0	1.0	150				
1N2567	S			R	200	1.5	6.0	1.0	150				
1N2568	S			R	300	1.5	6.0	1.0	150				
1N2569	S			R	400	1.5	6.0	1.0	150				
1N2570	S			R	500	1.5	6.0	1.0	150				
1N2571	S			R	600	1.5	6.0	1.0	150				
1N2572	S			R	700	1.5	6.0	1.0	150				
1N2573	S			R	800	1.5	6.0	1.0	150				
1N2574	S			R	900	1.5	6.0	1.0	150				
1N2575	S			R	1000	1.5	6.0	1.0	150				
1N2576	S			R	50	1.2	12	1.0	250				
1N2577	S			R	100	1.2	12	1.0	250				
1N2578	S			R	200	1.2	12	1.0	250				
1N2579	S			R	300	1.2	12	1.0	250				
1N2580	S			R	400	1.2	12	1.0	250				
1N2581	S			R	500	1.2	12	1.0	250				
1N2582	S			R	600	1.2	12	1.0	250				

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N2583	S			R	700	1.2	12	1.0	250				
1N2584	S			R	800	1.2	12	1.0	250				
1N2585	S			R	900	1.2	12	1.0	250				
1N2586	S			R	1000	1.2	12	1.0	250				
1N2587	S			R	50	1.0	12	0.2	250				
1N2588	S			R	100	1.0	12	0.2	250				
1N2589	S			R	200	1.0	12	0.2	250				
1N2590	S			R	300	1.0	12	0.2	250				
1N2591	S			R	400	1.0	12	0.2	250				
1N2592	S			R	500	1.0	12	0.2	250				
1N2593	S			R	600	1.0	12	0.2	250				
1N2594	S			R	700	1.0	12	0.2	250				
1N2595	S			R	800	1.0	12	0.2	250				
1N2596	S			R	900	1.0	12	0.2	250				
1N2597	S			R	1000	1.0	12	0.2	250				
1N2598	S			R	50	1.5	12	2.0	250				
1N2599	S			R	100	1.5	12	2.0	250				
1N2600	S			R	200	1.5	12	2.0	250				
1N2601	S			R	300	1.5	12	2.0	250				
1N2602	S			R	400	1.5	12	2.0	250				
1N2603	S			R	500	1.5	12	2.0	250				
1N2604	S			R	600	1.5	12	2.0	250				
1N2605	S			R	700	1.5	12	2.0	250				
1N2606	S			R	800	1.5	12	2.0	250				
1N2607	S			R	900	1.5	12	2.0	250				
1N2608	S			R	1000	1.5	12	2.0	250				
1N2609	S	1N4001	1N4001	R	50	1.1	0.75	0.3	30				
1N2610	S	1N4002	1N4001	R	100	1.1	0.75	0.3	30				
1N2611	S	1N4003	1N4001	R	200	1.1	0.75	0.3	30				
1N2612	S	1N4004	1N4001	R	300	1.1	0.75	0.3	30				
1N2613	S	1N4004	1N4001	R	400	1.1	0.75	0.3	30				
1N2614	S	1N4005	1N4001	R	500	1.1	0.75	0.3	30				
1N2615	S	1N4005	1N4001	R	600	1.1	0.75	0.3	30				
1N2616	S	1N4006	1N4001	R	800	1.1	0.75	0.3	30				
1N2617	S	1N4007	1N4001	R	1000	1.1	0.75	0.3	30				
1N2618	S			R	1200	1.1	0.75	0.3	30				
1N2619	S			R	1500	1.1	0.75	0.3	30				
1N2620	S		1N2620	DR						9.7	0.01	10	0/75
1N2620A	S		1N2620	DR						9.7	0.01	10	-55/100
1N2620B	S		1N2620	DR						9.7	0.01	10	-55/150
1N2621	S		1N2620	DR						9.7	0.005	10	0/75
1N2621A	S		1N2620	DR						9.7	0.005	10	-55/100
1N2621B	S		1N2620	DR						9.7	0.005	10	-55/150
1N2622	S		1N2620	DR						9.7	0.002	10	0/75
1N2622A	S		1N2620	DR						9.7	0.002	10	-55/100
1N2622B	S		1N2620	DR						9.7	0.002	10	-55/150
1N2623	S		1N2620	DR						9.7	0.001	10	0/75
1N2623A	S		1N2620	DR						9.7	0.001	10	-55/100
1N2623B	S		1N2620	DR						9.7	0.001	10	-55/150
1N2624	S		1N2620	DR						9.7	0.0005	10	0/75
1N2624A	S		1N2620	DR						9.7	0.0005	10	-55/100
1N2624B	S		1N2620	DR						9.7	0.0005	10	-55/150
1N2625	S	1N937	1N935	DR						9.7	0.0002	10	0/75
1N2625A	S	1N937A	1N935	DR						9.4	0.0002	10	-55/100
1N2625B	S	1N937B	1N935	DR						9.4	0.0002	10	-55/150
1N2626	S	1N938	1N935	DR						9.4	0.0001	10	0/75
1N2626A	S	1N938A	1N935	DR						9.4	0.0001	10	-55/100
1N2626B	S	1N938B	1N935	DR						9.4	0.0001	10	-55/150
1N2627 } 1N2628 }		Varactor Diodes, see Table on Page 1-94											
1N2629	G			DS	5.0								
1N2630	S			R	1500	2.25	0.085	0.5	5.0				
1N2631	S			R	1600	3.0	0.6	0.5	5.0				
1N2632	S			R	2800	6.0	0.2	0.5	5.0				
1N2633	S			R	1600	3.0	0.6	0.5	5.0				
1N2634	S			R	1600	3.0	0.6	0.5	5.0				
1N2635	S			R	1500	2.25	0.085	0.5	5.0				
1N2636	S			R	1500	2.25	0.085	0.5	5.0				
1N2637	S			R		28.0	0.25	0.5	5.0				
1N2638	S			R	100	1.3	1.5	0.3	15				
1N2641	S			R	200	1.3	1.5	0.3	15				
1N2644	S			R	300	1.3	1.5	0.3	15				
1N2647	S			R	400	1.3	1.5	0.3	15				
1N2650	S			R	600	2.6	1.5	0.3	15				
1N2653	S			R	800	2.6	1.5	0.3	15				
1N2656	S			R	1200	3.9	1.5	0.8	15				
1N2659	S			R	1600	5.2	1.5	0.8	15				
1N2662	S			R	2000	6.5	1.5	0.8	15				
1N2664	S			R	2400	7.8	1.5	0.8	15				
1N2666	S			R	3200	10.4	1.5	0.8	15				
1N2667	S			R	4000	13	1.5	0.8	15				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol $V_Z\pm\%$	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N2668	S			R	4800	15.6	1.5	0.8	15				
1N2669	S			R	100	1.3	3.6	0.3	15				
1N2673	S			R	200	1.3	3.6	0.3	15				
1N2677	S			R	300	1.3	3.6	0.3	15				
1N2681	S			R	400	1.3	3.6	0.3	15				
1N2685	S			R	600	2.6	3.6	0.3	15				
1N2687	S			R	800	2.6	3.6	0.3	15				
1N2689	S			R	900	3.9	3.6	0.8	15				
1N2690	S			R	1200	3.9	3.6	0.8	15				
1N2691	S			R	1600	5.2	3.6	0.8	15				
1N2692	S			R	100	1.3	7.2	0.3	15				
1N2694	S			R	200	1.3	7.2	0.3	15				
1N2696	S			R	300	1.3	7.2	0.3	15				
1N2698	S			R	400	1.3	7.2	0.3	15				
1N2700	S			R	600	2.6	7.2	0.3	15				
1N2701	S			R	800	2.6	7.2	0.3	15				
1N2702	S			R	100	1.3	3.0	0.2	15				
1N2705	S			R	200	1.3	3.0	0.2	15				
1N2708	S			R	300	1.3	3.0	0.2	15				
1N2711	S			R	400	1.3	3.0	0.2	15				
1N2714	S			R	600	2.6	3.0	0.2	15				
1N2717	S			R	800	2.6	3.0	0.2	15				
1N2720	S			R	1200	3.9	3.0	0.8	15				
1N2722	S			R	1600	5.2	3.0	0.8	15				
1N2723	S			R	2000	6.5	3.0	0.8	15				
1N2724	S			R	2400	7.8	3.0	0.8	15				
1N2725	S			R	100	1.3	3.0	0.3	15				
1N2728	S			R	200	1.3	3.0	0.3	15				
1N2731	S			R	300	1.3	3.0	0.3	15				
1N2734	S			R	400	1.3	3.0	0.3	15				
1N2737	S			R	600	2.6	3.0	0.3	15				
1N2738	S			R	800	2.6	3.0	0.3	15				
1N2739	S			R	1200	3.9	3.0	0.8	15				
1N2740	S			R	100	1.3	3.6	0.3	15				
1N2742	S			R	200	1.3	3.6	0.3	15				
1N2744	S			R	300	1.3	3.6	0.3	15				
1N2746	S			R	400	1.3	3.6	0.3	15				
1N2748	S			R	600	2.6	3.6	0.3	15				
1N2749	S			R	800	2.6	3.6	0.3	15				
1N2750	S			R	100	1.3	3.0	0.3	15				
1N2753	S			R	200	1.3	3.0	0.3	15				
1N2756	S			R	300	1.3	3.0	0.3	15				
1N2759	S			R	400	1.3	3.0	0.3	15				
1N2762	S			R	600	2.6	3.0	0.3	15				
1N2763	S			R	800	2.6	3.0	0.3	15				
1N2764	S			R	1200	3.9	3.0	0.8	15				
1N2765	S	1N823A	1N821	DR						6.8	0.005	7.5	-55/100
1N2765A	S	1N825A	1N821	DR						6.8	0.0025	7.5	-55/100
1N2766	S	1N1736A	1N429	DR						13.6	0.005	7.5	-55/100
1N2766A	S	1N1736A	1N429	DR						13.6	0.0025	7.5	-55/100
1N2767	S	1N4061	1N429	DR						20.4	0.005	7.5	-55/100
1N2767A	S	1N4061A	1N429	DR						20.4	0.0025	7.5	-55/100
1N2768	S	1N4063	1N429	DR						27.2	0.005	7.5	-55/100
1N2768A	S	1N4063A	1N429	DR						27.2	0.0025	7.5	-55/100
1N2769	S	1N4065	1N429	DR						34.0	0.005	7.5	-55/100
1N2769A	S	1N4065A	1N429	DR						34.0	0.0025	7.5	-55/100
1N2770	S	1N4067	1N429	DR						40.8	0.005	7.5	-55/100
1N2770A	S	1N4067A	1N429	DR						40.8	0.0025	7.5	-55/100
	S												
1N2772	S			R	700	1.8	0.5		15				
1N2773	S			R	800	1.8	0.5		15				
1N2774	S			R	900	1.8	0.5		15				
1N2775	S			R	1000	1.8	0.5		15				
1N2776	S			R	1100	1.8	0.5		15				
1N2777	S			R	1200	1.8	0.5		15				
1N2778	S			R	1300	1.8	0.5		15				
1N2779	S			R	1400	1.8	0.5		15				
1N2780	S			R	1500	1.8	0.5		15				
1N2781	S			R	1600	1.8	0.5		15				
1N2782	S			DS	5.0			2.0*					
1N2783	S	1N3000A	1N2970	DZ						62		10	6.0W
1N2784	S			R	200	1.5	8.0	5.0	200				
1N2785	S			R	400	1.5	8.0	5.0	200				
1N2786	S			R	200	1.2	10	10.0	180				
1N2787	S			R	400	1.2	10	10.0	180				
1N2788	S			R	200	1.3	12.5	5.0	340				
1N2789	S			R	400	1.3	12.5	5.0	340				
1N2790	S	1N3156	1N3154	DR						8.5	0.002	10	-55/100
1N2791	S			DS		1.3	50M	0.05*	4.0				
1N2793	S	1N1183	1N1183	R	50	1.25	5.0	5.0	75				

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	ZENER DIODES V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	REFERENCE DIODES V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N2794	S	1N1184	1N1183	R	100	1.25	5.0	5.0	75				
1N2795	S	1N1185	1N1183	R	150	1.25	5.0	5.0	75				
1N2796	S	1N1186	1N1183	R	200	1.25	5.0	5.0	75				
1N2797	S	1N1187	1N1183	R	250	1.25	5.0	5.0	75				
1N2798	S	1N1187	1N1183	R	300	1.25	5.0	5.0	75				
1N2799	S	1N1188	1N1183	R	350	1.25	5.0	5.0	75				
1N2800	S	1N1188	1N1183	R	400	1.25	5.0	5.0	75				
1N2801	G			DS	20	0.36	5.0M	2.0*	500				
1N2802	S	Microwave X-band Mixer; NF = 7.5 dB											
1N2803	S			R	400	1.2	250	36	3500				
1N2804	S		1N2804	DZ						6.8	1850	20	50W
1N2804A	S		1N2804	DZ						6.8	1850	10	50W
1N2804B	S		1N2804	DZ						6.8	1850	5.0	50W
1N2805	S		1N2804	DZ						7.5	1700	20	50W
1N2805A	S		1N2804	DZ						7.5	1700	10	50W
1N2805B	S		1N2804	DZ						7.5	1700	5.0	50W
1N2806	S		1N2804	DZ						8.2	1500	20	50W
1N2806A	S		1N2804	DZ						8.2	1500	10	50W
1N2806B	S		1N2804	DZ						8.2	1500	5.0	50W
1N2807	S		1N2804	DZ						9.1	1370	20	50W
1N2807A	S		1N2804	DZ						9.1	1370	10	50W
1N2807B	S		1N2804	DZ						9.1	1370	5.0	50W
1N2808	S		1N2804	DZ						10	1200	20	50W
1N2808A	S		1N2804	DZ						10	1200	10	50W
1N2808B	S		1N2804	DZ						10	1200	5.0	50W
1N2809	S		1N2804	DZ						11	1100	20	50W
1N2809A	S		1N2804	DZ						11	1100	10	50W
1N2809B	S		1N2804	DZ						11	1100	5.0	50W
1N2810	S		1N2804	DZ						12	1000	20	50W
1N2810A	S		1N2804	DZ						12	1000	10	50W
1N2810B	S		1N2804	DZ						12	1000	5.0	50W
1N2811	S		1N2804	DZ						13	960	20	50W
1N2811A	S		1N2804	DZ						13	960	10	50W
1N2811B	S		1N2804	DZ						13	960	5.0	50W
1N2812	S		1N2804	DZ						14	890	20	50W
1N2812A	S		1N2804	DZ						14	890	10	50W
1N2812B	S		1N2804	DZ						14	890	5.0	50W
1N2813	S		1N2804	DZ						15	830	20	50W
1N2813A	S		1N2804	DZ						15	830	10	50W
1N2813B	S		1N2804	DZ						15	830	5.0	50W
1N2814	S		1N2804	DZ						16	780	20	50W
1N2814A	S		1N2804	DZ						16	780	10	50W
1N2814B	S		1N2804	DZ						16	780	5.0	50W
1N2815	S		1N2804	DZ						17	740	20	50W
1N2815A	S		1N2804	DZ						17	740	10	50W
1N2815B	S		1N2804	DZ						17	740	5.0	50W
1N2816	S		1N2804	DZ						18	700	20	50W
1N2816A	S		1N2804	DZ						18	700	10	50W
1N2816B	S		1N2804	DZ						18	700	5.0	50W
1N2817	S		1N2804	DZ						19	660	20	50W
1N2817A	S		1N2804	DZ						19	660	10	50W
1N2817B	S		1N2804	DZ						19	660	5.0	50W
1N2818	S		1N2804	DZ						20	630	20	50W
1N2818A	S		1N2804	DZ						20	630	10	50W
1N2818B	S		1N2804	DZ						20	630	5.0	50W
1N2819	S		1N2804	DZ						22	570	20	50W
1N2819A	S		1N2804	DZ						22	570	10	50W
1N2819B	S		1N2804	DZ						22	570	5.0	50W
1N2820	S		1N2804	DZ						24	520	20	50W
1N2820A	S		1N2804	DZ						24	520	10	50W
1N2820B	S		1N2804	DZ						24	520	5.0	50W
1N2821	S		1N2804	DZ						25	500	20	50W
1N2821A	S		1N2804	DZ						25	500	10	50W
1N2821B	S		1N2804	DZ						25	500	5.0	50W
1N2822	S		1N2804	DZ						27	460	20	50W
1N2822A	S		1N2804	DZ						27	460	10	50W
1N2822B	S		1N2804	DZ						27	460	5.0	50W
1N2823	S		1N2804	DZ						30	420	20	50W
1N2823A	S		1N2804	DZ						30	420	10	50W
1N2823B	S		1N2804	DZ						30	420	5.0	50W
1N2824	S		1N2804	DZ						33	380	20	50W
1N2824A	S		1N2804	DZ						33	380	10	50W
1N2824B	S		1N2804	DZ						33	380	5.0	50W
1N2825	S		1N2804	DZ						36	350	20	50W
1N2825A	S		1N2804	DZ						36	350	10	50W
1N2825B	S		1N2804	DZ						36	350	5.0	50W
1N2826	S		1N2804	DZ						39	320	20	50W
1N2826A	S		1N2804	DZ						39	320	10	50W
1N2826B	S		1N2804	DZ						39	320	5.0	50W
1N2827	S		1N2804	DZ						43	290	20	50W
1N2827A	S		1N2804	DZ						43	290	10	50W
1N2827B	S		1N2804	DZ						43	290	5.0	50W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N2828	S		1N2804	DZ						45	280	20	50W
1N2828A	S		1N2804	DZ						45	280	10	50W
1N2828B	S		1N2804	DZ						45	280	5.0	50W
1N2829	S		1N2804	DZ						47	270	20	50W
1N2829A	S		1N2804	DZ						47	270	10	50W
1N2829B	S		1N2804	DZ						47	270	5.0	50W
1N2830	S		1N2804	DZ						50	250	20	50W
1N2830A	S		1N2804	DZ						50	250	10	50W
1N2830B	S		1N2804	DZ						50	250	5.0	50W
1N2831	S		1N2804	DZ						51	245	20	50W
1N2831A	S		1N2804	DZ						51	245	10	50W
1N2831B	S		1N2804	DZ						51	245	5.0	50W
1N2832	S		1N2804	DZ						56	220	20	50W
1N2832A	S		1N2804	DZ						56	220	10	50W
1N2832B	S		1N2804	DZ						56	220	5.0	50W
1N2833	S		1N2804	DZ						62	200	20	50W
1N2833A	S		1N2804	DZ						62	200	10	50W
1N2833B	S		1N2804	DZ						62	200	5.0	50W
1N2834	S		1N2804	DZ						68	180	20	50W
1N2834A	S		1N2804	DZ						68	180	10	50W
1N2834B	S		1N2804	DZ						68	180	5.0	50W
1N2835	S		1N2804	DZ						75	170	20	50W
1N2835A	S		1N2804	DZ						75	170	10	50W
1N2835B	S		1N2804	DZ						75	170	5.0	50W
1N2836	S		1N2804	DZ						82	150	20	50W
1N2836A	S		1N2804	DZ						82	150	10	50W
1N2836B	S		1N2804	DZ						82	150	5.0	50W
1N2837	S		1N2804	DZ						91	140	20	50W
1N2837A	S		1N2804	DZ						91	140	10	50W
1N2837B	S		1N2804	DZ						91	140	5.0	50W
1N2838	S		1N2804	DZ						100	120	20	50W
1N2838A	S		1N2804	DZ						100	120	10	50W
1N2838B	S		1N2804	DZ						100	120	5.0	50W
1N2839	S		1N2804	DZ						105	120	20	50W
1N2839A	S		1N2804	DZ						105	120	10	50W
1N2839B	S		1N2804	DZ						105	120	5.0	50W
1N2840	S		1N2804	DZ						110	110	20	50W
1N2840A	S		1N2804	DZ						110	110	10	50W
1N2840B	S		1N2804	DZ						110	110	5.0	50W
1N2841	S		1N2804	DZ						120	100	20	50W
1N2841A	S		1N2804	DZ						120	100	10	50W
1N2841B	S		1N2804	DZ						120	100	5.0	50W
1N2842	S		1N2804	DZ						130	95	20	50W
1N2842A	S		1N2804	DZ						130	95	10	50W
1N2842B	S		1N2804	DZ						130	95	5.0	50W
1N2843	S		1N2804	DZ						140	90	20	50W
1N2843A	S		1N2804	DZ						140	90	10	50W
1N2843B	S		1N2804	DZ						140	90	5.0	50W
1N2844	S		1N2804	DZ						160	80	20	50W
1N2844A	S		1N2804	DZ						160	80	10	50W
1N2844B	S		1N2804	DZ						160	80	5.0	50W
1N2845	S		1N2804	DZ						180	68	20	50W
1N2845A	S		1N2804	DZ						180	68	10	50W
1N2845B	S		1N2804	DZ						180	68	5.0	50W
1N2846	S		1N2804	DZ						200	65	20	50W
1N2846A	S		1N2804	DZ						200	65	10	50W
1N2846B	S		1N2804	DZ						200	65	5.0	50W
1N2847	S			R	100	2.0	1.5	0.3	15				
1N2848	S			R	200	2.0	1.5	0.2	15				
1N2849	S			R	300	2.0	1.5	0.2	15				
1N2850	S			R	400	2.0	1.5	0.2	15				
1N2851	S			R	500	2.0	1.5	0.2	15				
1N2852	S			R	600	2.0	1.5	0.2	15				
1N2855	S			R	600	1.2	250	25	3500				
1N2856	S			R	800	1.2	250	20	4500				
1N2857	S			R	1000	1.2	250	15	4500				
1N2858	S	1N4001	1N4001	R	50	1.2	0.75	0.3	40				
1N2858A	S			R	50	1.2	1.0	0.3	25				
1N2859	S	1N4002	1N4001	R	100	1.2	0.75	0.3	40				
1N2859A	S			R	100	1.2	1.0	0.3	25				
1N2860	S	1N4003	1N4001	R	200	1.2	0.75	0.3	40				
1N2860A	S			R	200	1.2	1.0	0.3	25				
1N2861	S	1N4004	1N4001	R	300	1.2	0.75	0.2	40				
1N2861A	S			R	300	1.2	1.0	0.3	25				
1N2862	S	1N4004	1N4001	R	400	1.2	0.75	0.2	40				
1N2862A	S			R	400	1.2	1.0	0.3	25				
1N2863	S	1N4005	1N4001	R	500	1.2	0.75	0.2	40				
1N2863A	S			R	500	1.2	1.0	0.3	25				
1N2864	S	1N4005	1N4001	R	600	1.2	0.75	0.2	40				
1N2864A	S			R	600	1.2	1.0	0.3	25				
1N2865	S			R	1000	2.5	0.7	0.1	7.0				
1N2866	S			R	1500	2.5	0.7	0.1	7.0				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N2867	S			R	1000	2.5	0.7	0.1	7.0				
1N2868	S			R	1500	2.5	0.7	0.1	7.0				
1N2878	S	1N4006	1N4001	DS	700	2.0	250M	0.5*					
1N2879	S	1N4006	1N4001	DS	700	2.0	250M	0.5*					
1N2880	S	1N4007	1N4001	DS	1.0K	2.0	250M	0.5*					
1N2881	S	1N4007	1N4001	DS	1.0K	2.0	250M	0.5*					
1N2882	S	1N4007	1N4001	DS	500	3.0	250M	0.5*					
1N2883	S	1N4007	1N4001	DS	500	3.0	250M	0.5*					
1N2884	S	MR991A	MR990A	DS	400	4.0	250M	0.5*					
1N2885	S	MR991A	MR990A	DS	400	4.0	250M	0.5*					
1N2886	S	MR991A	MR990A	DS	500	3.0	250M	0.5*					
1N2887	S	MR991A	MR990A	DS	500	3.0	250M	0.5*					
1N2888	S			DS	750	5.0	250M	0.5*					
1N2889	S	MR992A	MR990A	DS	750	5.0	250M	0.5*					
1N2890	S	MR992A	MR990A	DS	2.0K	4.0	250M	0.5*					
1N2891	S	MR992A	MR990A	DS	2.0K	4.0	250M	0.5*					
1N2892	S	MR993A	MR990A	DS	100	6.0	250M	0.5*					
1N2893	S	MR993A	MR990A	DS	100	6.0	250M	0.5*					
1N2894	S	MR994A	MR990A	DS	450	7.0	250M	0.5*					
1N2895	S	MR994A	MR990A	DS	450	7.0	250M	0.5*					
1N2896	S	MR994A	MR990A	DS	500	5.0	250M	0.5*					
1N2897	S	MR994A	MR990A	DS	500	5.0	250M	0.5*					
1N2898	S	MR995A	MR990A	DS	800	8.0	250M	0.5*					
1N2899	S	MR995A	MR990A	DS	800	8.0	250M	0.5*					
1N2900	S	MR995A	MR990A	DS	3.0K	6.0	250M	0.5*					
1N2901	S	MR995A	MR990A	DS	3.0K	6.0	250M	0.5*					
1N2902	S			DS	150	9.0	250M	0.5*					
1N2903	S			DS	150	9.0	250M	0.5*					
1N2904	S			DS	500	7.0	250M	0.5*					
1N2905	S			DS	500	7.0	250M	0.5*					
1N2906	S			DS	500	10	250M	0.5*					
1N2907	S			DS	500	10	250M	0.5*					
1N2908	S			DS	850	11	250M	0.5*					
1N2909	S			DS	850	11	250M	0.5*					
1N2910	S			DS	4.0K	8.0	250M	0.5*					
1N2911	S			DS	4.0K	8.0	250M	0.5*					
1N2912	S			DS	200	12	250M	0.5*					
1N2913	S			DS	200	12	250M	0.5*					
1N2914	S			DS	500	9.0	250M	0.5*					
1N2915	S			DS	500	9.0	250M	0.5*					
1N2916	S			DS	550	13	250M	0.5*					
1N2917	S			DS	550	13	250M	0.5*					
1N2918	S			DS	5.0K	10	250M	0.5*					
1N2919	S			DS	5.0K	10	250M	0.5*					
1N2920	S			DS	500	11	250M	0.5*					
1N2921	S			DS	500	11	250M	0.5*					
1N2922	S			DS	6.0K	12	250M	0.5*					
1N2923	S			DS	6.0K	12	250M	0.5*					
1N2924	S			DS	500	13	250M	0.5*					
1N2925	S			DS	500	13	250M	0.5*					
1N2926		Microwave X-K band Detector											
1N2926A		Microwave X-K band Detector											
1N2927,A thru 1N2934,A		Tunnel Diodes, see Table on Page 1-104											
1N2937	S	1N2996A	1N2970	DZ						45	25	5.0	10W
1N2938	S			DZ						0.9	100	15	2.0W
1N2939,A thru 1N2941,A		Tunnel Diodes, see Table on Page 1-104											
1N2969		Tunnel Diode, see Table on Page 1-104											
1N2969A		Tunnel Diode, see Table on Page 1-104											
1N2970	S		1N2970	DZ						6.8	370	20	10W
1N2970A	S		1N2970	DZ						6.8	370	10	10W
1N2970B	S		1N2970	DZ						6.8	370	5.0	10W
1N2971	S		1N2970	DZ						7.5	335	20	10W
1N2971A	S		1N2970	DZ						7.5	335	10	10W
1N2971B	S		1N2970	DZ						7.5	335	5.0	10W
1N2972	S		1N2970	DZ						8.2	305	20	10W
1N2972A	S		1N2970	DZ						8.2	305	10	10W
1N2972B	S		1N2970	DZ						8.2	305	5.0	10W
1N2973	S		1N2970	DZ						9.1	275	20	10W
1N2973A	S		1N2970	DZ						9.1	275	10	10W
1N2973B	S		1N2970	DZ						9.1	275	5.0	10W
1N2974	S		1N2970	DZ						10	250	20	10W
1N2974A	S		1N2970	DZ						10	250	10	10W
1N2974B	S		1N2970	DZ						10	250	5.0	10W
1N2975	S		1N2970	DZ						11	230	20	10W
1N2975A	S		1N2970	DZ						11	230	10	10W
1N2975B	S		1N2970	DZ						11	230	5.0	10W
1N2976	S		1N2970	DZ						12	210	20	10W
1N2976A	S		1N2970	DZ						12	210	10	10W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N2976B	S		1N2970	DZ						12	210	5.0	10W
1N2977	S		1N2970	DZ						13	190	20	10W
1N2977A	S		1N2970	DZ						13	190	10	10W
1N2977B	S		1N2970	DZ						13	190	5.0	10W
1N2978	S		1N2970	DZ						14	180	20	10W
1N2978A	S		1N2970	DZ						14	180	10	10W
1N2978B	S		1N2970	DZ						14	180	5.0	10W
1N2979	S		1N2970	DZ						15	170	20	10W
1N2979A	S		1N2970	DZ						15	170	10	10W
1N2979B	S		1N2970	DZ						15	170	5.0	10W
1N2980	S		1N2970	DZ						16	155	20	10W
1N2980A	S		1N2970	DZ						16	155	10	10W
1N2980B	S		1N2970	DZ						16	155	5.0	10W
1N2981	S		1N2970	DZ						17	145	20	10W
1N2981A	S		1N2970	DZ						17	145	10	10W
1N2981B	S		1N2970	DZ						17	145	5.0	10W
1N2982	S		1N2970	DZ						18	140	20	10W
1N2982A	S		1N2970	DZ						18	140	10	10W
1N2982B	S		1N2970	DZ						18	140	5.0	10W
1N2983	S		1N2970	DZ						19	130	20	10W
1N2983A	S		1N2970	DZ						19	130	10	10W
1N2983B	S		1N2970	DZ						19	130	5.0	10W
1N2984	S		1N2970	DZ						20	125	20	10W
1N2984A	S		1N2970	DZ						20	125	10	10W
1N2984B	S		1N2970	DZ						20	125	5.0	10W
1N2985	S		1N2970	DZ						22	115	20	10W
1N2985A	S		1N2970	DZ						22	115	10	10W
1N2985B	S		1N2970	DZ						22	115	5.0	10W
1N2986	S		1N2970	DZ						24	105	20	10W
1N2986A	S		1N2970	DZ						24	105	10	10W
1N2986B	S		1N2970	DZ						24	105	5.0	10W
1N2987	S		1N2970	DZ						25	100	20	10W
1N2987A	S		1N2970	DZ						25	100	10	10W
1N2987B	S		1N2970	DZ						25	100	5.0	10W
1N2988	S		1N2970	DZ						27	95	20	10W
1N2988A	S		1N2970	DZ						27	95	10	10W
1N2988B	S		1N2970	DZ						27	95	5.0	10W
1N2989	S		1N2970	DZ						30	85	20	10W
1N2989A	S		1N2970	DZ						30	85	10	10W
1N2989B	S		1N2970	DZ						30	85	5.0	10W
1N2990	S		1N2970	DZ						33	75	20	10W
1N2990A	S		1N2970	DZ						33	75	10	10W
1N2990B	S		1N2970	DZ						33	75	5.0	10W
1N2991	S		1N2970	DZ						36	70	20	10W
1N2991A	S		1N2970	DZ						36	70	10	10W
1N2991B	S		1N2970	DZ						36	70	5.0	10W
1N2992	S		1N2970	DZ						39	65	20	10W
1N2992A	S		1N2970	DZ						39	65	10	10W
1N2992B	S		1N2970	DZ						39	65	5.0	10W
1N2993	S		1N2970	DZ						43	60	20	10W
1N2993A	S		1N2970	DZ						43	60	10	10W
1N2993B	S		1N2970	DZ						43	60	5.0	10W
1N2994	S		1N2970	DZ						45	55	20	10W
1N2994A	S		1N2970	DZ						45	55	10	10W
1N2994B	S		1N2970	DZ						45	55	5.0	10W
1N2995	S		1N2970	DZ						47	55	20	10W
1N2995A	S		1N2970	DZ						47	55	10	10W
1N2995B	S		1N2970	DZ						47	55	5.0	10W
1N2996	S		1N2970	DZ						50	50	20	10W
1N2996A	S		1N2970	DZ						50	50	10	10W
1N2996B	S		1N2970	DZ						50	50	5.0	10W
1N2997	S		1N2970	DZ						51	50	20	10W
1N2997A	S		1N2970	DZ						51	50	10	10W
1N2997B	S		1N2970	DZ						51	50	5.0	10W
1N2998	S		1N2970	DZ						52	50	20	10W
1N2998A	S		1N2970	DZ						52	50	10	10W
1N2998B	S		1N2970	DZ						52	50	5.0	10W
1N2999	S		1N2970	DZ						56	45	20	10W
1N2999A	S		1N2970	DZ						56	45	10	10W
1N2999B	S		1N2970	DZ						56	45	5.0	10W
1N3000	S		1N2970	DZ						62	40	20	10W
1N3000A	S		1N2970	DZ						62	40	10	10W
1N3000B	S		1N2970	DZ						62	40	5.0	10W
1N3001	S		1N2970	DZ						68	37	20	10W
1N3001A	S		1N2970	DZ						68	37	10	10W
1N3001B	S		1N2970	DZ						68	37	5.0	10W
1N3002	S		1N2970	DZ						75	33	20	10W
1N3002A	S		1N2970	DZ						75	33	10	10W
1N3002B	S		1N2970	DZ						75	33	5.0	10W
1N3003	S		1N2970	DZ						82	30	20	10W
1N3003A	S		1N2970	DZ						82	30	10	10W
1N3003B	S		1N2970	DZ						82	30	5.0	10W

1N3004-1N3031

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol $V_{Z\pm\%}$	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N3004	S		1N2970	DZ						91	28	20	10W
1N3004A	S		1N2970	DZ						91	28	10	10W
1N3004B	S		1N2970	DZ						91	28	5.0	10W
1N3005	S		1N2970	DZ						100	25	20	10W
1N3005A	S		1N2970	DZ						100	25	10	10W
1N3005B	S		1N2970	DZ						100	25	5.0	10W
1N3006	S		1N2970	DZ						105	25	20	10W
1N3006A	S		1N2970	DZ						105	25	10	10W
1N3006B	S		1N2970	DZ						105	25	5.0	10W
1N3007	S		1N2970	DZ						110	23	20	10W
1N3007A	S		1N2970	DZ						110	23	10	10W
1N3007B	S		1N2970	DZ						110	23	5.0	10W
1N3008	S		1N2970	DZ						120	20	20	10W
1N3008A	S		1N2970	DZ						120	20	10	10W
1N3008B	S		1N2970	DZ						120	20	5.0	10W
1N3009	S		1N2970	DZ						130	19	20	10W
1N3009A	S		1N2970	DZ						130	19	10	10W
1N3009B	S		1N2970	DZ						130	19	5.0	10W
1N3010	S		1N2970	DZ						140	18	20	10W
1N3010A	S		1N2970	DZ						140	18	10	10W
1N3010B	S		1N2970	DZ						140	18	5.0	10W
1N3011	S		1N2970	DZ						150	17	20	10W
1N3011A	S		1N2970	DZ						150	17	10	10W
1N3011B	S		1N2970	DZ						150	17	5.0	10W
1N3012	S		1N2970	DZ						160	16	20	10W
1N3012A	S		1N2970	DZ						160	16	10	10W
1N3012B	S		1N2970	DZ						160	16	5.0	10W
1N3013	S		1N2970	DZ						175	14	20	10W
1N3013A	S		1N2970	DZ						175	14	10	10W
1N3013B	S		1N2970	DZ						175	14	5.0	10W
1N3014	S		1N2970	DZ						180	14	20	10W
1N3014A	S		1N2970	DZ						180	14	10	10W
1N3014B	S		1N2970	DZ						180	14	5.0	10W
1N3015	S		1N2970	DZ						200	12	20	10W
1N3015A	S		1N2970	DZ						200	12	10	10W
1N3015B	S		1N2970	DZ						200	12	5.0	10W
1N3016	S		1N3016	DZ						6.8	37	20	1.0W
1N3016A	S		1N3016	DZ						6.8	37	10	1.0W
1N3016B	S		1N3016	DZ						6.8	37	5.0	1.0W
1N3017	S		1N3016	DZ						7.5	34	20	1.0W
1N3017A	S		1N3016	DZ						7.5	34	10	1.0W
1N3017B	S		1N3016	DZ						7.5	34	5.0	1.0W
1N3018	S		1N3016	DZ						8.2	31	20	1.0W
1N3018A	S		1N3016	DZ						8.2	31	10	1.0W
1N3018B	S		1N3016	DZ						8.2	31	5.0	1.0W
1N3019	S		1N3016	DZ						9.1	28	20	1.0W
1N3019A	S		1N3016	DZ						9.1	28	10	1.0W
1N3019B	S		1N3016	DZ						9.1	28	5.0	1.0W
1N3020	S		1N3016	DZ						10	25	20	1.0W
1N3020A	S		1N3016	DZ						10	25	10	1.0W
1N3020B	S		1N3016	DZ						10	25	5.0	1.0W
1N3021	S		1N3016	DZ						11	23	20	1.0W
1N3021A	S		1N3016	DZ						11	23	10	1.0W
1N3021B	S		1N3016	DZ						11	23	5.0	1.0W
1N3022	S		1N3016	DZ						12	21	20	1.0W
1N3022A	S		1N3016	DZ						12	21	10	1.0W
1N3022B	S		1N3016	DZ						12	21	5.0	1.0W
1N3023	S		1N3016	DZ						13	19	20	1.0W
1N3023A	S		1N3016	DZ						13	19	10	1.0W
1N3023B	S		1N3016	DZ						13	19	5.0	1.0W
1N3024	S		1N3016	DZ						15	17	20	1.0W
1N3024A	S		1N3016	DZ						15	17	10	1.0W
1N3024B	S		1N3016	DZ						15	17	5.0	1.0W
1N3025	S		1N3016	DZ						16	15.5	20	1.0W
1N3025A	S		1N3016	DZ						16	15.5	10	1.0W
1N3025B	S		1N3016	DZ						16	15.5	5.0	1.0W
1N3026	S		1N3016	DZ						18	14	20	1.0W
1N3026A	S		1N3016	DZ						18	14	10	1.0W
1N3026B	S		1N3016	DZ						18	14	5.0	1.0W
1N3027	S		1N3016	DZ						20	12.5	20	1.0W
1N3027A	S		1N3016	DZ						20	12.5	10	1.0W
1N3027B	S		1N3016	DZ						20	12.5	5.0	1.0W
1N3028	S		1N3016	DZ						22	11.5	20	1.0W
1N3028A	S		1N3016	DZ						22	11.5	10	1.0W
1N3028B	S		1N3016	DZ						22	11.5	5.0	1.0W
1N3029	S		1N3016	DZ						24	10.5	20	1.0W
1N3029A	S		1N3016	DZ						24	10.5	10	1.0W
1N3029B	S		1N3016	DZ						24	10.5	5.0	1.0W
1N3030	S		1N3016	DZ						27	9.5	20	1.0W
1N3030A	S		1N3016	DZ						27	9.5	10	1.0W
1N3030B	S		1N3016	DZ						27	9.5	5.0	1.0W
1N3031	S		1N3016	DZ						30	8.5	20	1.0W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F @ (volts)	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N3031A	S		1N3016	DZ						30	8.5	10	1.0W
1N3031B	S		1N3016	DZ						30	8.5	5.0	1.0W
1N3032	S		1N3016	DZ						33	7.5	20	1.0W
1N3032A	S		1N3016	DZ						33	7.5	10	1.0W
1N3032B	S		1N3016	DZ						33	7.5	5.0	1.0W
1N3033	S		1N3016	DZ						36	7.0	20	1.0W
1N3033A	S		1N3016	DZ						36	7.0	10	1.0W
1N3033B	S		1N3016	DZ						36	7.0	5.0	1.0W
1N3034	S		1N3016	DZ						39	6.5	20	1.0W
1N3034A	S		1N3016	DZ						39	6.5	10	1.0W
1N3034B	S		1N3016	DZ						39	6.5	5.0	1.0W
1N3035	S		1N3016	DZ						43	6.0	20	1.0W
1N3035A	S		1N3016	DZ						43	6.0	10	1.0W
1N3035B	S		1N3016	DZ						43	6.0	5.0	1.0W
1N3036	S		1N3016	DZ						47	5.5	20	1.0W
1N3036A	S		1N3016	DZ						47	5.5	10	1.0W
1N3036B	S		1N3016	DZ						47	5.5	5.0	1.0W
1N3037	S		1N3016	DZ						51	5.0	20	1.0W
1N3037A	S		1N3016	DZ						51	5.0	10	1.0W
1N3037B	S		1N3016	DZ						51	5.0	5.0	1.0W
1N3038	S		1N3016	DZ						56	4.5	20	1.0W
1N3038A	S		1N3016	DZ						56	4.5	10	1.0W
1N3038B	S		1N3016	DZ						56	4.5	5.0	1.0W
1N3039	S		1N3016	DZ						62	4.0	20	1.0W
1N3039A	S		1N3016	DZ						62	4.0	10	1.0W
1N3039B	S		1N3016	DZ						62	4.0	5.0	1.0W
1N3040	S		1N3016	DZ						68	3.7	20	1.0W
1N3040A	S		1N3016	DZ						68	3.7	10	1.0W
1N3040B	S		1N3016	DZ						68	3.7	5.0	1.0W
1N3041	S		1N3016	DZ						75	3.3	20	1.0W
1N3041A	S		1N3016	DZ						75	3.3	10	1.0W
1N3041B	S		1N3016	DZ						75	3.3	5.0	1.0W
1N3042	S		1N3016	DZ						82	3.0	20	1.0W
1N3042A	S		1N3016	DZ						82	3.0	10	1.0W
1N3042B	S		1N3016	DZ						82	3.0	5.0	1.0W
1N3043	S		1N3016	DZ						91	2.8	20	1.0W
1N3043A	S		1N3016	DZ						91	2.8	10	1.0W
1N3043B	S		1N3016	DZ						91	2.8	5.0	1.0W
1N3044	S		1N3016	DZ						100	2.5	20	1.0W
1N3044A	S		1N3016	DZ						100	2.5	10	1.0W
1N3044B	S		1N3016	DZ						100	2.5	5.0	1.0W
1N3045	S		1N3016	DZ						110	2.3	20	1.0W
1N3045A	S		1N3016	DZ						110	2.3	10	1.0W
1N3045B	S		1N3016	DZ						110	2.3	5.0	1.0W
1N3046	S		1N3016	DZ						120	2.0	20	1.0W
1N3046A	S		1N3016	DZ						120	2.0	10	1.0W
1N3046B	S		1N3016	DZ						120	2.0	5.0	1.0W
1N3047	S		1N3016	DZ						130	1.9	20	1.0W
1N3047A	S		1N3016	DZ						130	1.9	10	1.0W
1N3047B	S		1N3016	DZ						130	1.9	5.0	1.0W
1N3048	S		1N3016	DZ						150	1.7	20	1.0W
1N3048A	S		1N3016	DZ						150	1.7	10	1.0W
1N3048B	S		1N3016	DZ						150	1.7	5.0	1.0W
1N3049	S		1N3016	DZ						160	1.6	20	1.0W
1N3049A	S		1N3016	DZ						160	1.6	10	1.0W
1N3049B	S		1N3016	DZ						160	1.6	5.0	1.0W
1N3050	S		1N3016	DZ						180	1.4	20	1.0W
1N3050A	S		1N3016	DZ						180	1.4	10	1.0W
1N3050B	S		1N3016	DZ						180	1.4	5.0	1.0W
1N3051	S		1N3016	DZ						200	1.2	20	1.0W
1N3051A	S		1N3016	DZ							1.2	10	1.0W
1N3051B	S		1N3016	DZ							1.2	5.0	1.0W
1N3052	S			R	12K	70	0.1	0.2	6.0				
1N3053	S			R	14K	75	0.1	0.2	6.0				
1N3054	S			R	16K	80	0.1	0.2	6.0				
1N3055	S			R	18K	85	0.1	0.2	6.0				
1N3056	S			R	20K	90	0.1	0.2	6.0				
1N3057	S			R	22K	95	0.1	0.2	6.0				
1N3058	S			R	24K	100	0.1	0.2	6.0				
1N3059	S			R	26K	105	0.1	0.2	6.0				
1N3060	S			R	28K	120	0.1	0.2	6.0				
1N3061	S			R	30K	125	0.1	0.2	6.0				
1N3062	S			DS	75	1.0	20M	0.1*	2.0				
1N3063	S			DS	75	0.85	10M	0.1*	2.0				
1N3064	S			DS	75	1.0	10M	0.1*	4.0				
1N3065	S			DS	75	1.0	20M	0.1*	2.0				
1N3066	S			DS	75	1.0	10M	0.1*	2.0				
1N3067	S			DS	30	1.0	5.0M	0.1*	2.0				
1N3068	S			DS	30	1.0	5.0M	0.1*	50				
1N3069	S			DS	65	1.0	50M	0.1*	50				
1N3070	S			DS	200	1.0	100M	0.1*	50				
1N3071	S			DS	200	1.0	100M	0.1*	50				

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts)	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: @ I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol $V_{Z\pm\%}$ / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N3072	S	1N4001	1N4001	R	50	1.5	0.2	0.5	10				
1N3073	S	1N4002	1N4001	R	100	1.5	0.2	0.5	10				
1N3074	S	1N4003	1N4001	R	150	1.5	0.2	0.5	10				
1N3075	S	1N4003	1N4001	R	200	1.5	0.2	0.5	10				
1N3076	S	1N4004	1N4001	R	250	1.5	0.2	0.5	10				
1N3077	S	1N4004	1N4001	R	300	1.5	0.2	0.5	10				
1N3078	S	1N4004	1N4001	R	350	1.5	0.2	0.5	10				
1N3079	S	1N4004	1N4001	R	400	1.5	0.2	0.5	10				
1N3080	S	1N4005	1N4001	R	500	1.5	0.2	0.5	10				
1N3081	S	1N4005	1N4001	R	600	1.5	0.2	0.5	10				
1N3082	S	1N4003	1N4001	R	200	1.25	0.5	0.2	15				
1N3083	S	1N4004	1N4001	R	400	1.25	0.5	0.2	15				
1N3084	S	1N4005	1N4001	R	600	1.25	0.5	0.2	15				
1N3085	S	MR1221SB	MR1220	R	100	1.1	150	40	1500				
1N3086	S	MR1223SB	MR1220	R	200	1.1	150	40	1500				
1N3087	S	MR1225SB	MR1200	R	300	1.1	150	40	1500				
1N3088	S	MR1227SB	MR1200	R	400	1.1	150	40	1500				
1N3089	S	MR1228SB	MR1200	R	500	1.1	150	40	1500				
1N3090	S	MR1229SB	MR1220	R	600	1.1	150	40	1500				
1N3091	S			R	800	1.1	150	40	1500				
1N3092	S			R	1000	1.1	150	40	1500				
1N3093	G	X-band Switch											
1N3097	G		1N3016	DS	30	0.5	10M	4.0*	0.5				
1N3098,A	S	1N3046A		DZ						120	3.0	20/10	1.0W
1N3099,A	S	1N3048A		DZ						150	3.0	20/10	1.0W
1N3100,A	S	1N3050A		DZ						180	3.0	20/10	1.0W
1N3101,A	S	1N3051A		DZ						220	3.0	20/10	1.0W
1N3102,A	S	1N3008A	1N2970	DZ						120	3.0	20/10	10W
1N3103,A	S	1N3011A	1N2970	DZ						150	3.0		10W
1N3104,A	S	1N3014A	1N2970	DZ						180	3.0		10W
1N3105,A	S	1N3015A	1N2970	DZ						220	3.0		10W
1N3106	S			R	800	1.6	0.75	0.3	30				
1N3107	S			R	1200	3.2	0.5	0.3	15				
1N3108	S			R	800	1.6	1.5	0.3	30				
1N3109	S			R	1200	3.2	0.7	0.3	15				
1N3110	G			DS	8.0	0.45	5.0M	20*					
1N3111	S	MR1220SB	MR1220	R	50	1.1	150	40	1500				
1N3112	S	1N4737A	1N4728	DZ						7.4	120	5.0	1.0W
1N3113 thru 1N3120		Tunnel Diodes, see Table on Page 1-104											
1N3121	G			DS	50	0.25	0.1M	3.5*	0.5				
1N3122	G			DS	20	0.3	1.0M	4.5*					
1N3123	S			DS	40	1.5	10M	0.1*	4.0				
1N3124	S			DS	40	1.0	20M	0.1*	4.0				
1N3125	G			DS	40	0.4	5.0M	100*	0.3				
1N3128 thru 1N3130		Tunnel Diodes, see Table on Page 1-104											
1N3138		Tunnel Diode, see Table on Page 1-104											
1N3139	S			R	50	1.55	70	15	1200				
1N3140	S			R	100	1.55	70	15	1200				
1N3141	S			R	150	1.55	70	15	1200				
1N3142	S			R	200	1.55	70	15	1200				
1N3143	G	Microwave C-X-band Detector											
1N3144	G			DS	20	0.3	1.0M	20*	0.5				
1N3145	G			DS	65	0.45	10M	25*					
1N3146	G			DS	20	1.0	50M	100*	2.0				
1N3147	S			DS	45	1.0	100M		1.0				
1N3148	S	1N3155A	1N3154	DR						8.5	0.005	10	-55/100
1N3149		Tunnel Diode, see Table on Page 1-104											
1N3149A		Tunnel Diode, see Table on Page 1-104											
1N3150		Tunnel Diode, see Table on Page 1-104											
1N3151	S			R	7200	27	0.1	250	12				
1N3154	S		1N3154	DR						8.8	0.01	10	-55/100
1N3154A	S		1N3154	DR						8.8	0.01	10	-55/100
1N3155	S		1N3154	DR						8.8	0.005	10	-55/100
1N3155A	S		1N3154	DR						8.8	0.005	10	-55/100
1N3156	S		1N3154	DR						8.8	0.002	10	-55/100
1N3156A	S		1N3154	DR						8.8	0.002	10	-55/100
1N3157	S		1N3154	DR						8.8	0.001	10	-55/100
1N3157A	S		1N3154	DR						8.8	0.001	10	-55/100
1N3159	G			DS	15	0.45	10M		0.3				
1N3160	G			DS	60	1.0	5.0M	12*					
1N3161	S	MR1230SB	MR1230	R	50	1.30	240	16	3000				
1N3162	S	MR1231SB	MR1230	R	100	1.30	240	16	3000				
1N3163	S	MR1232SB	MR1230	R	150	1.30	240	16	3000				
1N3164	S	MR1233SB	MR1230	R	200	1.30	240	16	3000				
1N3165	S	MR1234SB	MR1230	R	250	1.30	240	16	3000				
1N3166	S	MR1235SB	MR1230	R	300	1.30	240	16	3000				
1N3167	S	MR1236SB	MR1230	R	350	1.30	240	16	3000				
1N3168	S	MR1237SB	MR1230	R	400	1.30	240	16	3000				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N3169	S	MR1238SB	MR1230	R	500	1.30	240	16	3000				
1N3170	S	MR1239SB	MR1230	R	600	1.30	240	16	3000				
1N3171	S			R	700	1.92	240	16	3000				
1N3171A	S			R	700	1.9	240	16	3000				
1N3172	S			R	800	1.92	240	16	3000				
1N3172A	S			R	800	1.9	240	16	3000				
1N3173	S			R	900	1.92	240	16	3000				
1N3173A	S			R	900	1.9	240	16	3000				
1N3174	S			R	1000	1.92	240	16	3000				
1N3174A	S			R	1000	1.9	240	16	3000				
1N3175	S			R	1200	1.4	240	15	3000				
1N3176	S			R	1400	1.4	240	15	3000				
1N3177	S			R	1600	1.4	240	15	3000				
1N3179	S			DS	200	1.0	100M	10*					
1N3180	S			DS	110	1.5	500M	5.0*					
1N3181	S	1N5237A	1N5221	DZ						7.7	14	10	0.6
1N3182	Varactor Diode, see Table on Page 1-94												
1N3183	S			R	350	1.0	0.5		4.0				
1N3184	S			R	500	1.0	0.5		4.0				
1N3185	S			R	700	2.0	0.5		4.0				
1N3186	S			R	1000	2.0	0.5		4.0				
1N3187	S			R	1500	3.0	0.5		4.0				
1N3188	S			R	2000	4.0	0.5		4.0				
1N3189	S	1N4003	1N4001	R	200	1.1	1.0	0.2	30				
1N3190	S	1N4004	1N4001	R	400	1.1	1.0	0.2	30				
1N3191	S	1N4005	1N4001	R	600	1.1	1.0	0.2	30				
1N3192	S			DS	200	1.0	100M	10*					
1N3193	S	1N4003	1N4001	R	200	1.2	0.75	0.2	40				
1N3194	S	1N4004	1N4001	R	400	1.2	0.75	0.2	40				
1N3195	S	1N4005	1N4001	R	600	1.2	0.75	0.2	40				
1N3196	S	1N4006	1N4001	R	800	1.2	0.75	0.2	40				
1N3197	G			DS	30	1.0	150M	50*	0.3				
1N3198	S	1N5221B	1N5221	DZ						2.25	10	2.0	0.4
1N3199	S	1N3155	1N3154	DR						8.8	0.005	10	50/100
1N3200	S	1N3156	1N3154	DR						8.8	0.003	10	50/100
1N3201	S	1N3156	1N3154	DR						8.8	0.002	10	50/100
1N3202	S	1N3157	1N3154	DR						8.8	0.001	10	50/100
1N3203	G			DS	25	0.5	35M	50*	0.3				
1N3206	S			DS	80	1.0	10M	5.0*	4.0				
1N3207	S			DS	50	1.0	150M	0.05*	6.0				
1N3208	S		1N3189	R	50	1.5	15	10	250				
1N3209	S		1N3189	R	100	1.5	15	10	250				
1N3210	S		1N3189	R	200	1.5	15	10	250				
1N3211	S		1N3189	R	300	1.5	15	10	250				
1N3212	S		1N3189	R	400	1.5	15	10	250				
1N3213	S		1N248B	R	500	1.5	15	10	250				
1N3214	S		1N248B	R	600	1.5	15	10	250				
1N3215	S			DS	80	0.7	1.0M	10*	0.25				
1N3217 thru 1N3222	Tunnel Diodes, see Table on Page 1-104												
1N3223	S			DS	150	1.5	4.0M	20*	800				
1N3225	G			DS	40	1.0	5.0M	33*	0.5				
1N3227	S			R	100	3.3	0.5	0.250	12.5				
1N3228	S			R	200	3.3	0.5	0.250	12.5				
1N3229	S			R	400	3.3	0.5	0.250	12.5				
1N3230	S			R	600	3.3	0.5	0.250	12.5				
1N3231	S			R	800	3.3	0.5	0.250	12.5				
1N3232	S			R	1000	3.3	0.5	0.250	12.5				
1N3233	S			R	1200	3.3	0.5	0.250	12.5				
1N3234	S			R	1500	3.3	0.5	0.250	12.5				
1N3235	S			R	1800	3.3	0.5	0.250	12.5				
1N3236	S			R	2000	3.3	0.5	0.250	12.5				
1N3237	S			R	50	2.2	0.75	0.250	15.0				
1N3238	S			R	100	2.2	0.75	0.250	15.0				
1N3239	S			R	200	2.2	0.75	0.250	15.0				
1N3240	S			R	400	2.2	0.75	0.250	15.0				
1N3241	S			R	600	2.2	0.75	0.250	15.0				
1N3242	S			R	800	2.2	0.75	0.250	15.0				
1N3243	S			R	1000	2.2	0.75	0.250	15.0				
1N3244	S			R	1200	2.2	0.75	0.250	15.0				
1N3245	S			R	1500	2.2	0.75	0.250	15.0				
1N3246	S			R	50	1.1	1.0	0.250	20.0				
1N3247	S			R	100	1.1	1.0	0.250	20.0				
1N3248	S			R	200	1.1	1.0	0.250	20.0				
1N3249	S			R	400	1.1	1.0	0.250	20.0				
1N3250	S			R	600	1.1	1.0	0.250	20.0				
1N3251	S			R	800	1.1	1.0	0.250	20.0				
1N3252	S			R	1000	1.1	1.0	0.250	20.0				
1N3253	S	1N4003	1N4001	R	200	1.2	0.75	0.2	40				
1N3254	S	1N4004	1N4001	R	400	1.2	0.75	0.2	40				
1N3255	S	1N4005	1N4001	R	600	1.2	0.75	0.2	40				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	V_F (volts) / V_F @	I_O (Amps) / I_F	I_R (mA) / I_R	I_{FSM} / t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	I_{ZT} mA / T_C %/°C	Tol $V_{Z\pm\%}$ / I_{ZT} mA	P_D / Temp Range
1N3256	S	1N4006	1N4001	R	800	1.2	0.5	0.2	40				
1N3257	S			DS	80	1.0	30M	0.025*	300				
1N3258	S			DS	80	1.0	100M	0.025*	400				
1N3260	S	MR1220SB	MR1220	R	50	1.6	160	12	2000				
1N3261	S	MR1221SB	MR1220	R	100	1.6	160	12	2000				
1N3262	S	MR1222SB	MR1220	R	150	1.6	160	12	2000				
1N3263	S	MR1223SB	MR1220	R	200	1.6	160	12	2000				
1N3264	S	MR1224SB	MR1220	R	250	1.6	160	12	2000				
1N3265	S	MR1225SB	MR1220	R	300	1.6	160	12	2000				
1N3266	S	MR1226SB	MR1220	R	350	1.6	160	12	2000				
1N3267	S	MR1227SB	MR1220	R	400	1.6	160	12	2000				
1N3268	S	MR1228SB	MR1220	R	500	1.6	160	12	2000				
1N3269	S	MR1229SB	MR1220	R	600	1.6	160	12	2000				
1N3270	S			R	700	1.6	160	12	2000				
1N3271	S			R	800	1.6	160	12	2000				
1N3272	S			R	900	1.6	160	12	2000				
1N3273	S			R	1000	1.6	160	12	2000				
1N3274	S			R	1200	1.4	160	12	2000				
1N3275	S			R	1400	1.4	160	12	2000				
1N3276	S			R	1600	1.4	160	12	2000				
1N3277	S			R	200	1.3	0.75		25				
1N3278	S			R	400	1.3	0.75		25				
1N3279	S			R	600	1.3	0.75		25				
1N3280	S			R	800	1.3	0.75		25				
1N3281	S			R	1000	1.3	0.75		25				
1N3282	S		1N3213	R	1000	3.7	0.1		2.5				
1N3283	S		1N3213	R	1500	3.7	0.1		2.5				
1N3284	S		1N3213	R	2000	3.7	0.1		2.5				
1N3285	S		1N3213	R	2500	3.7	0.1		2.5				
1N3286	S		1N3213	R	3000	3.7	0.1		2.5				
1N3287	G			DS	6.0	0.312	1.0M	15*					
1N3288	S			R	100	1.5	100	200	1600				
1N3288A	S	MR1811R		R	100	1.5	100	24	2300				
1N3289	S			R	200	1.5	100	300	1600				
1N3289A	S	MR1813R		R	200	1.5	100	24	2300				
1N3290	S			R	300	1.5	100	400	1600				
1N3290A	S	MR1815R		R	300	1.5	100	24	2300				
1N3291	S			R	400	1.5	100	525	1600				
1N3291A	S	MR1817R		R	400	1.5	100	24	2300				
1N3292	S			R	500	1.5	100	650	1600				
1N3292A	S			R	500	1.5	100	21	1600				
1N3292B	S	MR1818SB		R	500	1.5	100	21	2300				
1N3293	S			R	600	1.5	100	800	1600				
1N3293A	S	MR1819SB		R	600	1.5	100	17	2300				
1N3294	S			R	800	1.5	100	1050	1600				
1N3294A	S			R	800	1.5	100	13	2300				
1N3295	S			R	1000	1.5	100	1300	1600				
1N3295A	S			R	1000	1.5	100	11	2300				
1N3296	S			R	1200	1.5	100	1600	1600				
1N3296A	S			R	1200	1.5	100	9.0	2300				
1N3297	S			R	1400	1.5	100	1800	1600				
1N3297A	S			R	1400	1.5	100	7.0	2300				
1N3298	S			DS	70	0.9	500M	0.2*	20				
1N3298A	S			DS	70	0.9	0.5A	0.2*					
1N3299 thru 1N3304,A		4-Layer Diodes, see Table on Page 1-108											
1N3305	S		1N2804	DZ						6.8	1850	20	50W
1N3305A	S		1N2804	DZ						6.8	1850	10	50W
1N3305B	S		1N2804	DZ						6.8	1850	5.0	50W
1N3306	S		1N2804	DZ						7.5	1700	20	50W
1N3306A	S		1N2804	DZ						7.5	1700	10	50W
1N3306B	S		1N2804	DZ						7.5	1700	5.0	50W
1N3307	S		1N2804	DZ						8.2	1500	20	50W
1N3307A	S		1N2804	DZ						8.2	1500	10	50W
1N3307B	S		1N2804	DZ						8.2	1500	5.0	50W
1N3308	S		1N2804	DZ						9.1	1370	20	50W
1N3308A	S		1N2804	DZ						9.1	1370	10	50W
1N3308B	S		1N2804	DZ						9.1	1370	5.0	50W
1N3309	S		1N2804	DZ						10	1200	20	50W
1N3309A	S		1N2804	DZ						10	1200	10	50W
1N3309B	S		1N2804	DZ						10	1200	5.0	50W
1N3310	S		1N2804	DZ						11	1100	20	50W
1N3310A	S		1N2804	DZ						11	1100	10	50W
1N3310B	S		1N2804	DZ						11	1100	5.0	50W
1N3311	S		1N2804	DZ						12	1000	20	50W
1N3311A	S		1N2804	DZ						12	1000	10	50W
1N3311B	S		1N2804	DZ						12	1000	5.0	50W
1N3312	S		1N2804	DZ						13	960	20	50W
1N3312A	S		1N2804	DZ						13	960	10	50W
1N3312B	S		1N2804	DZ						13	960	5.0	50W
1N3313	S		1N2804	DZ						14	890	20	50W
1N3313A	S		1N2804	DZ						14	890	10	50W
1N3313B	S		1N2804	DZ						14	890	5.0	50W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol $V_{Z\pm\%}$	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N3314	S		1N2804	DZ						15	830	20	50W
1N3314A	S		1N2804	DZ						15	830	10	50W
1N3314B	S		1N2804	DZ						15	830	5.0	50W
1N3315	S		1N2804	DZ						16	780	20	50W
1N3315A	S		1N2804	DZ						16	780	10	50W
1N3315B	S		1N2804	DZ						16	780	5.0	50W
1N3316	S		1N2804	DZ						17	740	20	50W
1N3316A	S		1N2804	DZ						17	740	10	50W
1N3316B	S		1N2804	DZ						17	740	5.0	50W
1N3317	S		1N2804	DZ						18	700	20	50W
1N3317A	S		1N2804	DZ						18	700	10	50W
1N3317B	S		1N8204	DZ						18	700	5.0	50W
1N3318	S		1N2804	DZ						19	660	20	50W
1N3318A	S		1N2804	DZ						19	660	10	50W
1N3318B	S		1N2804	DZ						19	660	5.0	50W
1N3319	S		1N2804	DZ						20	630	20	50W
1N3319A	S		1N2804	DZ						20	630	10	50W
1N3319B	S		1N2804	DZ						20	630	5.0	50W
1N3320	S		1N2804	DZ						22	570	20	50W
1N3320A	S		1N2804	DZ						22	570	10	50W
1N3320B	S		1N2804	DZ						22	570	5.0	50W
1N3321	S		1N2804	DZ						24	520	20	50W
1N3321A	S		1N2804	DZ						24	520	10	50W
1N3321B	S		1N2804	DZ						24	520	5.0	50W
1N3322	S		1N2804	DZ						25	500	20	50W
1N3322A	S		1N2804	DZ						25	500	10	50W
1N3322B	S		1N2804	DZ						25	500	5.0	50W
1N3323	S		1N2804	DZ						27	460	20	50W
1N3323A	S		1N2804	DZ						27	460	10	50W
1N3323B	S		1N2804	DZ						27	460	5.0	50W
1N3324	S		1N2804	DZ						30	420	20	50W
1N3324A	S		1N2804	DZ						30	420	10	50W
1N3324B	S		1N2804	DZ						30	420	5.0	50W
1N3325	S		1N2804	DZ						33	380	20	50W
1N3325A	S		1N2804	DZ						33	380	10	50W
1N3325B	S		1N2804	DZ						33	380	5.0	50W
1N3326	S		1N2804	DZ						36	350	20	50W
1N3326A	S		1N2804	DZ						36	350	10	50W
1N3326B	S		1N2804	DZ						36	350	5.0	50W
1N3327	S		1N2804	DZ						39	320	20	50W
1N3327A	S		1N2804	DZ						39	320	10	50W
1N3327B	S		1N2804	DZ						39	320	5.0	50W
1N3328	S		1N2804	DZ						43	290	20	50W
1N3328A	S		1N2804	DZ						43	290	10	50W
1N3328B	S		1N2804	DZ						43	290	5.0	50W
1N3329	S		1N2804	DZ						45	280	20	50W
1N3329A	S		1N2804	DZ						45	280	10	50W
1N3329B	S		1N2804	DZ						45	280	5.0	50W
1N3330	S		1N2804	DZ						47	270	20	50W
1N3330A	S		1N2804	DZ						47	270	10	50W
1N3330B	S		1N2804	DZ						47	270	5.0	50W
1N3331	S		1N2804	DZ						50	250	20	50W
1N3331A	S		1N2804	DZ						50	250	10	50W
1N3331B	S		1N2804	DZ						50	250	5.0	50W
1N3332	S		1N2804	DZ						51	245	20	50W
1N3332A	S		1N2804	DZ						51	245	10	50W
1N3332B	S		1N2804	DZ						51	245	5.0	50W
1N3333	S		1N2804	DZ						52	240	20	50W
1N3333A	S		1N2804	DZ						52	240	10	50W
1N3333B	S		1N2804	DZ						52	240	5.0	50W
1N3334	S		1N2804	DZ						56	220	20	50W
1N3334A	S		1N2804	DZ						56	220	10	50W
1N3334B	S		1N2804	DZ						56	220	5.0	50W
1N3335	S		1N2804	DZ						62	200	20	50W
1N3335A	S		1N2804	DZ						62	200	10	50W
1N3335B	S		1N2804	DZ						62	200	5.0	50W
1N3336	S		1N2804	DZ						68	180	20	50W
1N3336A	S		1N2804	DZ						68	180	10	50W
1N3336B	S		1N2804	DZ						68	180	5.0	50W
1N3337	S		1N2804	DZ						75	170	20	50W
1N3337A	S		1N2804	DZ						75	170	10	50W
1N3337B	S		1N2804	DZ						75	170	5.0	50W
1N3338	S		1N2804	DZ						82	150	20	50W
1N3338A	S		1N2804	DZ						82	150	10	50W
1N3338B	S		1N2804	DZ						82	150	5.0	50W
1N3339	S		1N2804	DZ						91	140	20	50W
1N3339A	S		1N2804	DZ						91	140	10	50W
1N3339B	S		1N2804	DZ						91	140	5.0	50W
1N3340	S		1N2804	DZ						100	120	20	50W
1N3340A	S		1N2804	DZ						100	120	10	50W
1N3340B	S		1N2804	DZ						100	120	5.0	50W
1N3341	S		1N2804	DZ						105	120	20	50W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N3341A	S		1N2804	DZ						105	120	10	50W
1N3341B	S		1N2804	DZ						105	120	5.0	50W
1N3342	S		1N2804	DZ						110	110	20	50W
1N3342A	S		1N2804	DZ						110	110	10	50W
1N3342B	S		1N2804	DZ						110	110	5.0	50W
1N3343	S		1N2804	DZ						120	100	20	50W
1N3343A	S		1N2804	DZ						120	100	10	50W
1N3343B	S		1N2804	DZ						120	100	5.0	50W
1N3344	S		1N2804	DZ						130	95	20	50W
1N3344A	S		1N2804	DZ						130	95	10	50W
1N3344B	S		1N2804	DZ						130	95	5.0	50W
1N3345	S		1N2804	DZ						140	90	20	50W
1N3345A	S		1N2804	DZ						140	90	10	50W
1N3345B	S		1N2804	DZ						140	90	5.0	50W
1N3346	S		1N2804	DZ						150	85	20	50W
1N3346A	S		1N2804	DZ						150	85	10	50W
1N3346B	S		1N2804	DZ						150	85	5.0	50W
1N3347	S		1N2804	DZ						160	80	20	50W
1N3347A	S		1N2804	DZ						160	80	10	50W
1N3347B	S		1N2804	DZ						160	80	5.0	50W
1N3348	S		1N2804	DZ						175	70	20	50W
1N3348A	S		1N2804	DZ						175	70	10	50W
1N3348B	S		1N2804	DZ						175	70	5.0	50W
1N3349	S		1N2804	DZ						180	68	20	50W
1N3349A	S		1N2804	DZ						180	68	10	50W
1N3349B	S		1N2804	DZ						180	68	5.0	50W
1N3350	S		1N2804	DZ						200	65	20	50W
1N3350A	S		1N2804	DZ						200	65	10	50W
1N3350B	S		1N2804	DZ						200	65	5.0	50W
1N3353	G	Backward Diode											
1N3354	S			R	10	1.2	3.0	0.020	30				
1N3355	S			R	15	1.2	3.0	0.020	30				
1N3356	S			R	25	1.2	3.0	0.010	30				
1N3357	S			R	50	1.2	3.0	0.010	30				
1N3358	S			R	75	1.2	3.0	0.010	30				
1N3359	S			R	100	1.2	3.0	0.010	30				
1N3360	S			R	150	1.2	3.0	0.010	30				
1N3361	S			R	200	1.2	3.0	0.010	30				
1N3362	S			R	300	1.2	3.0	0.010	30				
1N3363	S			R	400	1.2	3.0	0.010	30				
1N3364	S			R	500	1.2	3.0	0.010	30				
1N3365	S			R	600	1.2	3.0	0.010	30				
1N3366	S			R	700	1.2	3.0	0.010	30				
1N3367	S			R	800	2.0	3.0	0.010	30				
1N3368	S			R	900	2.0	3.0	0.010	30				
1N3369	S			R	1000	2.5	3.0	0.025	30				
1N3370	S			R	1200	2.5	3.0	0.025	30				
1N3371	S			R	1500	2.5	3.0	0.025	30				
1N3372	S			R	10	1.0	20	0.315	200				
1N3373	S			R	25	1.0	20	0.315	200				
1N3374	S			R	50	1.0	20	0.315	200				
1N3375	S			R	100	1.0	20	0.315	200				
1N3376	S			R	150	1.0	20	0.315	200				
1N3377	S			R	200	1.0	20	0.315	200				
1N3378	S			R	300	1.0	20	0.315	200				
1N3379	S			R	400	1.0	20	0.315	200				
1N3380	S			R	500	1.0	20	0.315	200				
1N3381	S			DS	15	1.0	500M	10*					
1N3382	S			DS	15	1.0	500M	10*					
1N3383	S			DS	50	1.0	500M	10*					
1N3384	S			DS	75	1.0	500M	15*					
1N3385	S			DS	100	1.0	500M	20*					
1N3386	S			DS	150	1.0	500M	20*					
1N3387	S			DS	200	1.0	500M	20*					
1N3388	S			DS	250	1.0	500M	25*					
1N3389	S			DS	300	1.0	500M	25*					
1N3390	S			DS	400	1.0	500M	25*					
1N3391	S			DS	500	1.0	500M	25*					
1N3392	S			DZ						1.5	50	10	500M
1N3393	S	.5M1.8ZZS10	&	DZ						1.8	50	10	500M
1N3394	S	.5M2.2ZZS10	&	DZ						2.2	50	10	500M
1N3395	S	.5M2.7ZZS10	&	DZ						2.7	50	10	500M
1N3396	S	.5M3.3ZZS10	&	DZ						3.3	30	10	500M
1N3397	S	.5M3.9ZZS10	&	DZ						3.9	30	10	500M
1N3398	S	.5M4.7ZZS10	&	DZ						4.7	30	10	500M
1N3399	S	.5M5.6ZZS10	&	DZ						5.6	20	10	500M
1N3400	S	.5M6.8ZZS10	&	DZ						6.8	20	10	500M
1N3401	S	.5M8.2ZZS10	&	DZ						8.2	10	10	500M
1N3402	S	.5M10ZZS10	&	DZ						10	10	10	500M
1N3403	S	.5M12ZZS10	&	DZ						12	10	10	500M
1N3404	S	.5M15AAS10	&	DZ						15	10	10	500M
1N3405	S	.5M18ZZS10	&	DZ						18	10	10	500M

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol $V_{Z\pm\%}$	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N3406	S	.5M22ZZS10	&	DZ						22	3.0	10	500M
1N3407	S	.5M27ZZS10	&	DZ						27	3.0	10	500M
1N3408	S	.5M33ZZS10	&	DZ						33	3.0	10	500M
1N3409	S	.5M39ZZS10	&	DZ						39	1.5	10	500M
1N3410	S	.5M47ZZS10	&	DZ						47	1.5	10	500M
1N3411	S	1N5234A	1N5221	DZ						6.2	1.0	10	500M
1N3412	S	1N5235A	1N5221	DZ						6.8	1.0	10	500M
1N3413	S	1N5236A	1N5221	DZ						7.5	1.0	10	500M
1N3414	S	1N5237A	1N5221	DZ						8.2	1.0	10	500M
1N3415	S	1N5240A	1N5221	DZ						10	1.0	10	500M
1N3416	S	1N5242A	1N5221	DZ						12	1.0	10	500M
1N3417	S	1N5245A	1N5221	DZ						15	1.0	10	500M
1N3418	S	1N5248A	1N5221	DZ						18	1.0	10	500M
1N3419	S	1N5251A	1N5221	DZ						22	1.0	10	500M
1N3420	S	1N5254A	1N5221	DZ						27	1.0	10	500M
1N3421	S	1N5256A	1N5221	DZ						30	1.0	10	500M
1N3422	S	1N5257A	1N5221	DZ						33	1.0	10	500M
1N3423	S	1N5259A	1N5221	DZ						39	1.0	10	500M
1N3424	S	1N5261A	1N5221	DZ						47	1.0	10	500M
1N3425	S	1N5263A	1N5221	DZ						56	1.0	10	500M
1N3426	S	1N5266A	1N5222	DZ						68	1.0	10	500M
1N3427	S	1N5268A	1N5221	DZ						82	1.0	10	500M
1N3428	S	1N5271A	1N5221	DZ						100	1.0	10	500M
1N3429	S	1N5273A	1N5221	DZ						120	1.0	10	500M
1N3430	S	1N5276A	1N5221	DZ						150	1.0	10	500M
1N3431	S	1N5279A	1N5221	DZ						180	1.0	10	500M
1N3432	S	1N5281A	1N5221	DZ						220	1.0	10	500M
1N3433	S	1N4738	1N4728	DZ						8.2	25	10	2.0W
1N3434	S	1N4740	1N4728	DZ						10.0	25	10	2.0W
1N3435	S	1N4742	1N4728	DZ						12.0	25	10	2.0W
1N3436	S	1N4744	1N4728	DZ						15.0	25	10	2.0W
1N3437	S	1N4746	1N4728	DZ						18.0	25	10	2.0W
1N3438	S	1N4748	1N4728	DZ						22.0	7.5	10	2.0W
1N3439	S	1N4750	1N4728	DZ						27.0	7.5	10	2.0W
1N3440	S	1N4752	1N4728	DZ						33.0	7.5	10	2.0W
1N3441	S	1N4754	1N4728	DZ						39.0	7.5	10	2.0W
1N3442	S	1N4756	1N4728	DZ						47.0	7.5	10	2.0W
1N3443	S	1N4735	1N4728	DZ						6.2	2.0	10	2.0W
1N3444	S	1N4736	1N4728	DZ						6.8	2.0	10	2.0W
1N3445	S	1N4738	1N4728	DZ						8.2	2.0	10	2.0W
1N3446	S	1N4740	1N4728	DZ						10	2.0	10	2.0W
1N3447	S	1N4742	1N4728	DZ						12	2.0	10	2.0W
1N3448	S	1N4744	1N4728	DZ						15	2.0	10	2.0W
1N3449	S	1N4746	1N4728	DZ						18	2.0	10	2.0W
1N3450	S	1N4748	1N4728	DZ						22	2.0	10	2.0W
1N3451	S	1N4750	1N4728	DZ						27	2.0	10	2.0W
1N3452	S	1N4751	1N4728	DZ						30	2.0	10	2.0W
1N3453	S	1N4752	1N4728	DZ						33	2.0	10	2.0W
1N3454	S	1N4754	1N4728	DZ						39	2.0	10	2.0W
1N3455	S	1N4756	1N4728	DZ						47	2.0	10	2.0W
1N3456	S	1N4758	1N4728	DZ						56	2.0	10	2.0W
1N3457	S	1N4760	1N4728	DZ						68	2.0	10	2.0W
1N3458	S	1N4762	1N4728	DZ						82	2.0	10	2.0W
1N3459	S	1N4764	1N4728	DZ						100	2.0	10	2.0W
1N3460	S	1M120ZS10	1N4728	DZ						120	2.0	10	2.0W
1N3461	S	1M150ZS10	1N4728	DZ						150	2.0	10	2.0W
1N3462	S	1M180ZS10	1N4728	DZ						180	2.0	10	2.0W
1N3463	S	1M200ZS5	1N4728	DZ						220	2.0	10	2.0W
1N3464	S			R	8500	30.0	0.1	0.001	2.0				
1N3465	G			DS	60	1.0	200M	20*					
1N3466	G			DS	40	1.0	200M	15*					
1N3467	G			DS	15	0.5	20M	15*	2.0				
1N3468	G			DS	15	0.5	20M	60*	2.0				
1N3469	G			DS	35	0.5	600M	15*					
1N3470	G			DS	35	0.5	600M	30*					
1N3471	S			DS	40	1.0	10M	20N	2.0				
1N3473	S			R	200	1.4	0.75	0.5	20				
1N3474	S			R	400	1.4	0.75	0.5	20				
1N3475	S			R	600	1.4	0.75	0.5	20				
1N3476	S			R	800	1.4	0.5	0.5	20				
1N3477	S	1N5221A	1N5221	DZ						2.2	5.0	10	250M
1N3477A	S	1N5221B	1N5221	DZ						2.2	5.0	5.0	250M
1N3478	S			DS	200	1.0	500M	10*					
1N3479	S			DS	400	1.0	500M	10*					
1N3480	S			DS	600	1.0	500M	10*					
1N3481	G	RF Power Switch: $P_{i(max)}$ = 10 mW, f = 9,000 MHz											
1N3482	G	RF Power Switch: $P_{i(max)}$ = 10 mW, f = 9,000 MHz											
1N3483	G			DS	8.0	0.6	10M	30*					
1N3484	G			DS	75	0.45	10M	4.0*					
1N3485	S			DS	175	1.0	10M	25N	0.05				
1N3486	S			R	1000	2.0	0.4	0.05	10				
1N3487	S			R	1200	2.0	0.4	0.05	10				

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N3488		Varactor Diode, see Table on Page 1-94											
1N3489 thru 1N3490		4-Layer Diodes, see Table on Page 1-108											
1N3491	S			R	50	1.7	18	1.0	300				
1N3492	S			R	100	1.7	18	1.0	300				
1N3493	S			R	200	1.7	18	1.0	300				
1N3494	S			R	300	1.7	18	1.0	300				
1N3495	S			R	400	1.7	18	1.0	300				
1N3496	S	1N823 *	1N821	DR						6.2	0.005	7.5	-55/100
1N3497	S	1N825 *	1N821	DR						6.2	0.002	7.5	-55/100
1N3498	S	1N827 *	1N821	DR						6.2	0.001	7.5	-55/100
1N3499	S	1N829 *	1N821	DR						6.2	0.0005	7.5	-55/100
1N3500	S	1N821 *	1N821	DR						6.2	0.01	7.5	-55/100
1N3501	S	MZ640 *	MZ600	DR						6.35	0.01	7.5	-55/100
1N3502	S	MZ620 *	MZ600	DR						6.35	0.01	7.5	-55/100
1N3503	S	MZ610 *	MZ600	DR						6.35	0.005	7.5	-55/100
1N3504	S	MZ605 *	MZ600	DR						6.35	0.002	7.5	-55/100
1N3506	S	1N5226B *	1N5221	DZ						3.3	20	5.0	20
1N3507	S	1N5227B *	1N5221	DZ						3.6	20	5.0	20
1N3508	S	1N5228B *	1N5221	DZ						3.9	20	5.0	20
1N3509	S	1N5229B *	1N5221	DZ						4.3	20	5.0	20
1N3510	S	1N5230B *	1N5221	DZ						4.7	20	5.0	20
1N3511	S	1N5231B *	1N5221	DZ						5.1	20	5.0	20
1N3512	S	1N5232B *	1N5221	DZ						5.6	20	5.0	20
1N3513	S	1N5234B *	1N5221	DZ						6.2	20	5.0	20
1N3514	S	1N5235B *	1N5221	DZ						6.8	20	5.0	20
1N3515	S	1N5236B *	1N5221	DZ						7.5	10	5.0	10
1N3516	S	1N5237B *	1N5221	DZ						8.2	10	5.0	10
1N3517	S	1N5239B *	1N5221	DZ						9.1	10	5.0	10
1N3518	S	1N5240B *	1N5221	DZ						10	10	5.0	10
1N3519	S	1N5241B *	1N5221	DZ						11	10	5.0	10
1N3520	S	1N5242B *	1N5221	DZ						12	10	5.0	10
1N3521	S	1N5243B *	1N5221	DZ						13	10	5.0	10
1N3522	S	1N5245B *	1N5221	DZ						15	5.0	5.0	5.0
1N3523	S	1N5246B *	1N5221	DZ						16	5.0	5.0	5.0
1N3524	S	1N5248B*	1N5221	DZ						18	5.0	5.0	5.0
1N3525	S	1N5250B*	1N5221	DZ						20	5.0	5.0	5.0
1N3526	S	1N5251B*	1N5221	DZ						22	5.0	5.0	5.0
1N3527	S	1N5252B*	1N5221	DZ						24	5.0	5.0	5.0
1N3528	S	1N5254B*	1N5221	DZ						27	4.0	5.0	4.0
1N3529	S	1N5256B*	1N5221	DZ						30	4.0	5.0	4.0
1N3530	S	1N5257B*	1N5221	DZ						33	3.0	5.0	3.0
1N3531	S	1N5258B*	1N5221	DZ						36	3.0	5.0	3.0
1N3532	S	1N5259B*	1N5221	DZ						39	3.0	5.0	3.0
1N3533	S	1N5260B*	1N5221	DZ						43	2.0	5.0	2.0
1N3534	S	1N5261B*	1N5221	DZ						47	2.0	5.0	2.0
1N3535	S			DS									
1N3536	S			DS									
1N3537	S	1M12ZZS10	&	DZ						12	25	8.3	1.0W
1N3538	S			DS	150		2.5M	2.0*					
1N3539	S	Backward Diode											
1N3539A	S	Backward Diode											
1N3540	S	Backward Diode											
1N3540A	S	Backward Diode											
1N3541	S	Backward Diode											
1N3541A	S	Backward Diode											
1N3542	S	Backward Diode											
1N3542A	S	Backward Diode											
1N3543	S	Backward Diode											
1N3543A	S	Backward Diode											
1N3544	S	1N4002	1N4001	R	100	1.5	0.6	0.2	15				
1N3545	S	1N4003	1N4001	R	200	1.5	0.6	0.2	15				
1N3546	S	1N4004	1N4001	R	300	1.5	0.6	0.2	15				
1N3547	S	1N4004	1N4001	R	400	1.5	0.6	0.2	15				
1N3548	S	1N4005	1N4001	R	500	1.5	0.6	0.2	15				
1N3549	S	1N4005	1N4001	R	600	1.5	0.6	0.2	15				
1N3550	S			DS	180	1.0	50M		1.5				
1N3551 thru 1N3552		Varactor Diodes, see Table on Page 1-94											
1N3553	S	1N821 *	1N821	DR						6.3	0.01	7.5	-55/100
1N3554 thru 1N3557		Varactor Diodes, see Table on Page 1-94											
1N3558	S	Matched Pair of 1N751A's, Zener Diode											
1N3559	G			DS	24	1.0	200M	20*					
1N3560 thru 1N3562		Tunnel Diodes, see Table on Page 1-104											
1N3563	S			R	1000	1.2	0.4	0.2	40				
1N3564	G			DS	15	1.0	40M						
1N3565	S			DS	6.0	2.0	2.0A	25M					
1N3566	S			R	800	2.25	1.0	0.5	20				

Replacement * denotes exact device type replacement available on request.

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS V_R (volts) / SIGNAL DIODES PRV (volts)	V_F (volts) / V_F @ (volts)	I_O (Amps) / I_F	I_R (mA) / I_R	I_{FSM} / t_{rr} (µs)	ZENER DIODES V_Z(nom) / REFERENCE DIODES V_Z(nom)	I_{ZT} mA / T_C %/°C	Tol V_Z±% / I_{ZT} mA	P_D / Temp Range
1N3567	S			DS	50	1.0	100M	0.05*	2.0				
1N3568	S			DS	80	1.0	20M	1.0*	2.0				
1N3569	S	MR1121 *	MR1120	R	100	1.3	3.5	0.4	35				
1N3570	S	MR1123 *	MR1120	R	200	1.3	3.5	0.4	35				
1N3571	S	MR1123 *	MR1120	R	300	1.3	3.5	0.4	35				
1N3572	S	MR1124 *	MR1120	R	400	1.3	3.5	0.4	35				
1N3573	S	MR1125 *	MR1120	R	500	1.3	3.5	0.4	35				
1N3574	S	MR1126 *	MR1120	R	600	1.3	3.5	0.4	35				
1N3575	S			DS	60	0.74	1.0M	0.75N					
1N3576	S			DS	125	0.74	1.0M	0.75N					
1N3577	S			DS	175	0.74	1.0M	0.75N					
1N3578	S			DS	225	0.74	1.0M	0.75N					
1N3579	S			DS	275	0.74	1.0M	0.75N					
1N3580	S		1N2163	DR						11.7	0.01	7.5	0/75
1N3580A	S		1N2163	DR						11.7	0.01	7.5	-55/100
1N3580B	S		1N2163	DR						11.7	0.01	7.5	-55/150
1N3581	S		1N2163	DR						11.7	0.005	7.5	0/75
1N3581A	S		1N2163	DR						11.7	0.005	7.5	-55/100
1N3581B	S		1N2163	DR						11.7	0.005	7.5	-55/150
1N3582	S		1N2163	DR						11.7	0.002	7.5	0/75
1N3582A	S		1N2163	DR						11.7	0.002	7.5	-55/100
1N3582B	S		1N2163	DR						11.7	0.002	7.5	-55/150
1N3583	S		1N2163	DR						11.7	0.001	7.5	0/75
1N3583A	S		1N2163	DR						11.7	0.001	7.5	-55/100
1N3583B	S		1N2163	DR						11.7	0.001	7.5	-55/150
1N3584	S	1N945 *	1N941	DR						11.7	0.0005	7.5	0/75
1N3584A	S	1N945A *	1N941	DR						11.7	0.0005	7.5	-55/100
1N3584B	S	1N945B *	1N941	DR						11.7	0.0005	7.5	-55/150
1N3585	S	MR1240SB	MR1240	R	50	1.25	400	25	8000				
1N3586	S	MR1241SB	MR1240	R	100	1.25	400	25	8000				
1N3587	S	MR1243SB	MR1240	R	200	1.25	400	25	8000				
1N3588	S	MR1245SB	MR1240	R	300	1.25	400	25	8000				
1N3589	S	MR1247SB	MR1240	R	400	1.25	400	25	8000				
1N3590	S	MR1248SB	MR1240	R	500	1.25	400	25	8000				
1N3591	S	MR1249SB	MR1240	R	600	1.25	400	25	8000				
1N3592	G			DS	30	0.35	2.0M	4.0*	0.04				
1N3593	S			DS	40	1.0	10M	25N	10				
1N3594	S			DS	60	1.0	50M	0.1M	6.0				
1N3595	S			DS	125	1.0	200M	1.0M	3.0				
1N3596	S			DS	20	1.0	30M	0.1*	4.0				
1N3597	S			DS	150	1.2	400M	0.1*	0.3				
1N3598	S			DS	50	0.85	10M	0.1*	4.0				
1N3599	S			DS	150	1.0	100M	0.1*	50				
1N3600	S			DS	50	1.0	200M	100*	6.0				
1N3601	S			DS	75	1.0	10M	0.1*	5.0				
1N3602	S			DS	50	1.0	20M	0.1*	5.0				
1N3603	S			DS	30	1.0	30M	0.1*	5.0				
1N3604	S			DS	75	1.0	50M	0.05*	2.0				
1N3605	S			DS	40	0.55	0.1M	0.05*	2.0				
1N3606	S			DS	75	0.55	0.1M	0.05*	2.0				
1N3607	S			DS	75	1.0	50M	0.05*	2.0				
1N3608	S			DS	40	0.55	0.1M	0.05*	2.0				
1N3609	S			DS	75	0.55	0.1M	0.05*	2.0				
1N3611	S	1N4003	1N4001	DS	200	1.0	750M	10*					
1N3612	S	1N4004	1N4001	DS	400	1.0	750M	10*					
1N3613	S	1N4005	1N4001	DS	600	1.0	750M	10*					
1N3614	S	1N4006	1N4001	DS	800	1.0	750M	10*					
1N3615	S	MR1120	MR1120	R	50	1.2	16	3.0	300				
1N3616	S	MR1121	MR1120	R	100	1.2	16	2.5	300				
1N3617	S	MR1122	MR1120	R	150	1.2	16	2.25	300				
1N3618	S	MR1122	MR1120	R	200	1.2	16	2.0	300				
1N3619	S	MR1123	MR1120	R	300	1.2	16	1.75	300				
1N3620	S	MR1124	MR1120	R	400	1.2	16	1.5	300				
1N3621	S	MR1125	MR1120	R	500	1.2	16	1.25	300				
1N3622	S	MR1126	MR1120	R	600	1.2	16	1.0	300				
1N3623	S	MR1128	MR1120	R	800	1.2	16	0.75	300				
1N3624	S	MR1130	MR1120	R	1000	1.2	16	0.6	300				
1N3625	S			DS	225	1.0	40M	0.5*	0.5				
1N3626	G			DS	50	0.5	10M	1.0M	0.45				
1N3627, 1N3628		Varactor Diodes, see Table on Page 1-94											
1N3629	S			R	100	1.0	0.75	0.01	30				
1N3630	S			R	200	1.0	0.75	0.01	30				
1N3631	S			R	300	1.0	0.75	0.01	30				
1N3632	S			R	400	1.0	0.75	0.01	30				
1N3633	S			R	500	1.0	0.75	0.01	30				
1N3634	S			R	600	1.0	0.75	0.01	30				
1N3635	S			R	700	1.0	0.75	0.01	30				
1N3636	S			R	800	1.0	0.75	0.01	30				
1N3637	S			R	900	1.0	0.75	0.01	30				
1N3638	S			R	1000	1.0	0.75	0.01	30				

Replacement * denotes exact device type replacement available on request.

1N3639–1N3689

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	ZENER DIODES: V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES: PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	REFERENCE DIODES: V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N3639	S	1N4003	1N4001	R	200	1.2	0.75	0.2	40				
1N3640	S	1N4004	1N4001	R	400	1.2	0.75	0.2	40				
1N3641	S	1N4005	1N4001	R	600	1.2	0.75	0.2	40				
1N3642	S	1N4006	1N4001	R	800	1.2	0.75	0.2	40				
1N3643	S			DS	1000	5.0	250M	5.0*					
1N3644	S			DS	1500	5.0	250M	5.0*					
1N3645	S			DS	1000	5.0	250M	5.0*					
1N3646	S			DS	2500	5.0	250M	5.0*					
1N3647	S			DS	3000	5.0	250M	5.0*					
1N3648	S			R	10K	23	0.35	0.5	30				
1N3649	S	MR1128	MR1120	R	800	1.1	1.0	0.005	25				
1N3650	S	MR1130	MR1120	R	1000	1.1	1.0	0.005	25				
1N3653	S			DS	90	1.0	400M	25N	4.0				
1N3654	S			DS	90	1.0	50M	25N	4.0				
1N3655	S	Microwave S-band Mixer:			NF = 8.3 to 6.0 dB								
1N3655A	S	Microwave S-band Mixer:			NF = 8.3 to 6.0 dB								
1N3655B	S	Microwave S-band Mixer:			NF = 8.3 to 6.0 dB								
1N3656	S			DS	200	1.2	500M	0.01M					
1N3657	S			DS	400	1.2	500M	0.01M					
1N3658	S			DS	600	1.2	500M	0.01M					
1N3659	S			R	50	1.4	25	5.0	400				
1N3660	S			R	100	1.4	25	4.5	400				
1N3661	S			R	200	1.4	25	4.0	400				
1N3662	S			R	300	1.4	25	3.5	400				
1N3663	S			R	400	1.4	25	3.0	400				
1N3664	S			R	500	1.4	25	2.5	400				
1N3665	S			R	600	1.4	25	2.0	400				
1N3666	G			DS	80	1.0	200M	25*	0.3				
1N3667	S			R	500	1.2	1.5	1.2	30				
1N3668	S			DS	30	1.0	5.0M	0.1*	0.15				
1N3669	S			DS	70	1.1	400M	0.25*	0.2				
1N3670	S	MR1128	MR1120	R	700	2.05	12	3.0	200				
1N3670A	S	MR1128	MR1120	R	700	1.5	12	0.9	240				
1N3671	S	MR1128	MR1120	R	800	2.05	12	2.0	200				
1N3671A	S	MR1128	MR1120	R	800	1.3	12	0.8	240				
1N3672	S	MR1130	MR1120	R	900	2.05	12	2.0	200				
1N3672A	S	MR1130	MR1120	R	900	1.15	12	0.7	240				
1N3673	S	MR1130	MR1120	R	1000	2.05	12	1.0	200				
1N3673A	S	MR1130	MR1120	R	1000	1.0	12	0.6	240				
1N3675	S	1N4736 *	1N4728	DZ						6.8	19	20	750M
1N3675A	S	1N4736 *	1N4728	DZ						6.8	19	10	750M
1N3675B	S	1N4736A *	1N4728	DZ						6.8	19	5.0	750M
1N3676	S	1N4737 *	1N4728	DZ						7.5	17	20	750M
1N3676A	S	1N4737 *	1N4728	DZ						7.5	17	10	750M
1N3676B	S	1N4737A *	1N4728	DZ						7.5	17	5.0	750M
1N3677	S	1N4738 *	1N4728	DZ						8.2	15	20	750M
1N3677A	S	1N4738 *	1N4728	DZ						8.2	15	10	750M
1N3677B	S	1N4738A *	1N4728	DZ						8.2	15	5.0	750M
1N3678	S	1N4739 *	1N4728	DZ						9.1	14	20	750M
1N3678A	S	1N4739 *	1N4728	DZ						9.1	14	10	750M
1N3678B	S	1N4739A *	1N4728	DZ						9.1	14	5.0	750M
1N3679	S	1N4740 *	1N4728	DZ						10	13	20	750M
1N3679A	S	1N4740 *	1N4728	DZ						10	13	10	750M
1N3679B	S	1N4740A *	1N4728	DZ						10	13	5.0	750M
1N3680	S	1N4741 *	1N4728	DZ						11	12	20	750M
1N3680A	S	1N4741 *	1N4728	DZ						11	12	10	750M
1N3680B	S	1N4741A *	1N4728	DZ						11	12	5.0	750M
1N3681	S	1N4742 *	1N4728	DZ						12	11	20	750M
1N3681A	S	1N4742 *	1N4728	DZ						12	11	10	750M
1N3681B	S	1N4742A *	1N4728	DZ						12	11	5.0	750M
1N3682	S	1N4743 *	1N4728	DZ						13	9.5	20	750M
1N3682A	S	1N4743 *	1N4728	DZ						13	9.5	10	750M
1N3682B	S	1N4743A *	1N4728	DZ						13	9.5	5.0	750M
1N3683	S	1N4744 *	1N4728	DZ						15	8.5	20	750M
1N3683A	S	1N4744 *	1N4728	DZ						15	8.5	10	750M
1N3683B	S	1N4744A *	1N4728	DZ						15	8.5	5.0	750M
1N3684	S	1N4745 *	1N4728	DZ						16	7.8	20	750M
1N3684A	S	1N4745 *	1N4728	DZ						16	7.8	10	750M
1N3684B	S	1N4745A *	1N4728	DZ						16	7.8	5.0	750M
1N3685	S	1N4746 *	1N4728	DZ						18	7.0	20	750M
1N3685A	S	1N4746 *	1N4728	DZ						18	7.0	10	750M
1N3685B	S	1N4746A *	1N4728	DZ						18	7.0	5.0	750M
1N3686	S	1N4747 *	1N4728	DZ						20	6.2	20	750M
1N3686A	S	1N4747 *	1N4728	DZ						20	6.2	10	750M
1N3686B	S	1N4747A *	1N4728	DZ						20	6.2	5.0	750M
1N3687	S	1N4748 *	1N4728	DZ						22	5.6	20	750M
1N3687A	S	1N4748 *	1N4728	DZ						22	5.6	10	750M
1N3687B	S	1N4748A *	1N4728	DZ						22	5.6	5.0	750M
1N3688	S	1N4749 *	1N4728	DZ						24	5.2	20	750M
1N3688A	S	1N4749 *	1N4728	DZ						24	5.2	10	750M
1N3688B	S	1N4749A *	1N4728	DZ						24	5.2	5.0	750M
1N3689	S	1N4750 *	1N4728	DZ						27	4.6	20	750M

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	V_F (volts) / V_F @	I_O (Amps) / I_F	I_R (mA) / I_R	I_{FSM} / t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	I_{ZT} mA / T_C %/°C	Tol V_Z±% / I_{ZT} mA	P_D / Temp Range
1N3689A	S	1N4750 *	1N4728	DZ						27	4.6	10	750M
1N3689B	S	1N4750A *	1N4728	DZ						27	4.6	5.0	750M
1N3690	S	1N4751 *	1N4728	DZ						30	4.2	20	750M
1N3690A	S	1N4751 *	1N4728	DZ						30	4.2	10	750M
1N3690B	S	1N4751A *	1N4728	DZ						30	4.2	5.0	750M
1N3691	S	1N4752 *	1N4728	DZ						33	3.8	20	750M
1N3691A	S	1N4752 *	1N4728	DZ						33	3.8	10	750M
1N3691B	S	1N4752A *	1N4728	DZ						33	3.8	5.0	750M
1N3692	S	1N4753 *	1N4728	DZ						36	3.4	20	750M
1N3692A	S	1N4753 *	1N4728	DZ						36	3.4	10	750M
1N3692B	S	1N4753A *	1N4728	DZ						36	3.4	5.0	750M
1N3693	S	1N4754 *	1N4728	DZ						39	3.2	20	750M
1N3693A	S	1N4754 *	1N4728	DZ						39	3.2	10	750M
1N3693B	S	1N4754A *	1N4728	DZ						39	3.2	5.0	750M
1N3694	S	1N4755 *	1N4728	DZ						43	3.0	20	750M
1N3694A	S	1N4755 *	1N4728	DZ						43	3.0	10	750M
1N3694B	S	1N4755A *	1N4728	DZ						43	3.0	5.0	750M
1N3695	S	1N4756 *	1N4728	DZ						47	2.7	20	750M
1N3695A	S	1N4756 *	1N4728	DZ						47	2.7	10	750M
1N3695B	S	1N4756A *	1N4728	DZ						47	2.7	5.0	750M
1N3696	S	1N4757 *	1N4728	DZ						51	2.5	20	750M
1N3696A	S	1N4757 *	1N4728	DZ						51	2.5	10	750M
1N3696B	S	1N4757A *	1N4728	DZ						51	2.5	5.0	750M
1N3697	S	1N4758 *	1N4728	DZ						56	2.2	20	750M
1N3697A	S	1N4758 *	1N4728	DZ						56	2.2	10	750M
1N3697B	S	1N4758A *	1N4728	DZ						56	2.2	5.0	750M
1N3698	S	1N4759 *	1N4728	DZ						62	2.0	20	750M
1N3698A	S	1N4759 *	1N4728	DZ						62	2.0	10	750M
1N3698B	S	1N4759A *	1N4728	DZ						62	2.0	5.0	750M
1N3699	S	1N4760 *	1N4728	DZ						68	1.8	20	750M
1N3699A	S	1N4760 *	1N4728	DZ						68	1.8	10	750M
1N3699B	S	1N4760A *	1N4728	DZ						68	1.8	5.0	750M
1N3700	S	1N4761 *	1N4728	DZ						75	1.7	20	750M
1N3700A	S	1N4761 *	1N4728	DZ						75	1.7	10	750M
1N3700B	S	1N4761A *	1N4728	DZ						75	1.7	5.0	750M
1N3701	S	1N4762 *	1N4728	DZ						82	1.5	20	750M
1N3701A	S	1N4762 *	1N4728	DZ						82	1.5	10	750M
1N3701B	S	1N4762A *	1N4728	DZ						82	1.5	5.0	750M
1N3702	S	1N4763 *	1N4728	DZ						91	1.4	20	750M
1N3702A	S	1N4763 *	1N4728	DZ						91	1.4	10	750M
1N3702B	S	1N4763A *	1N4728	DZ						91	1.4	5.0	750M
1N3703	S	1N4764 *	1N4728	DZ						100	1.3	20	750M
1N3703A	S	1N4764 *	1N4728	DZ						100	1.3	10	750M
1N3703B	S	1N4764A *	1N4782	DZ						100	1.3	5.0	750M
1N3704	S	1M110ZS10 *	1N4728	DZ						110	1.1	20	750M
1N3704A	S	1M110ZS10 *	1N4728	DZ						110	1.1	10	750M
1N3704B	S	1M110ZS5 *	1N4728	DZ						110	1.1	5.0	750M
1N3705	S	1M120ZS10 *	1N4728	DZ						120	1.0	20	750M
1N3705A	S	1M120ZS10 *	1N4728	DZ						120	1.0	10	750M
1N3705B	S	1M120ZS5 *	1N4728	DZ						120	1.0	5.0	750M
1N3706	S	1M130ZS10 *	1N4728	DZ						130	0.95	20	750M
1N3706A	S	1M130ZS10 *	1N4728	DZ						130	0.95	10	750M
1N3706B	S	1M130ZS5 *	1N4728	DZ						130	0.95	5.0	750M
1N3707	S	1M150ZS10 *	1N4728	DZ						150	0.85	20	750M
1N3707A	S	1M150ZS10 *	1N4728	DZ						150	0.85	10	750M
1N3707B	S	1M150ZS5 *	1N4728	DZ						150	0.85	5.0	750M
1N3708	S	1M160ZS10 *	1N4728	DZ						160	0.80	20	750M
1N3708A	S	1M160ZS10 *	1N4728	DZ						160	0.80	10	750M
1N3708B	S	1M160ZS5 *	1N4728	DZ						160	0.80	5.0	750M
1N3709	S	1M180ZS10 *	1N4728	DZ						180	0.68	20	750M
1N3709A	S	1M180ZS10 *	1N4728	DZ						180	0.68	10	750M
1N3709B	S	1M180ZS5 *	1N4728	DZ						180	0.68	5.0	750M
1N3710	S	1M200ZS10 *	1N4728	DZ						200	0.65	20	750M
1N3710A	S	1M200ZS10 *	1N4728	DZ						200	0.65	10	750M
1N3710B	S	1M200ZS5 *	1N4728	DZ						200	0.65	5.0	750M
1N3711	S			R	6000	11	0.15	0.025	5.0				
1N3712 thru 1N3721		Tunnel Diodes, see Table on Page 1-104											
1N3722	S			DS	50	1.0	20M	0.1*	10				
1N3723	S			R	1000	2.2	0.75	0.005	12				
1N3724	S			R	1200	2.2	0.75	0.005	12				
1N3725	S			R	1400	2.2	0.75	0.005	12				
1N3726	S			R	1600	2.2	0.75	0.005	12				
1N3727	S			R	1800	2.2	0.75	0.005	12				
1N3728	S			DS	550	1.2	400M	0.1*					
1N3729	S			DS	600	1.0	5.0M	0.1*	0.5				
1N3730	S			DS	80	1.0	750M	0.1*	15				
1N3731	S			DS	80	1.0	100M	5.0*	3.0				
1N3732	S		1N4728	DZ						5.1	40	5.0	1.0W
1N3733	S	Microwave S-band Mixer											
1N3734	S	Photosensitive Device; BV = 100 V, Sensitivity = 0.05 μA/fc											

Replacement * denotes exact device type replacement available on request.

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts)	RECTIFIERS: V_F (volts)	RECTIFIERS: I_O (Amps)	RECTIFIERS: I_R (mA)	RECTIFIERS: I_{FSM}	ZENER DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA	ZENER DIODES: Tol V_Z±%	ZENER DIODES: P_D
					SIGNAL DIODES: PRV (volts)	SIGNAL DIODES: V_F (volts) @	SIGNAL DIODES: I_F	SIGNAL DIODES: I_R	SIGNAL DIODES: t_{rr} (µs)	REFERENCE DIODES: V_Z(nom)	REFERENCE DIODES: T_C %/°C	REFERENCE DIODES: I_{ZT} mA	REFERENCE DIODES: Temp Range
1N3735	S	MR1231SB	MR1230	R	100	1.3	250	16	4500				
1N3736	S	MR1233SB	MR1230	R	200	1.3	250	16	4500				
1N3737	S	MR1235SB	MR1230	R	300	1.3	250	16	4500				
1N3738	S	MR1237SB	MR1230	R	400	1.3	250	16	4500				
1N3739	S	MR1238SB	MR1230	R	500	1.3	250	13	4500				
1N3740	S	MR1239SB	MR1230	R	600	1.3	250	12	4500				
1N3741	S			R	800	1.3	250	9.0	4500				
1N3742	S			R	1000	1.3	250	7.0	4500				
1N3743	S			R	1200	1.3	250	7.0	4500				
1N3744	S			R	1400	1.3	250	7.0	4500				
1N3745	S	Microwave X-band Mixer; NF = 9.5 dB											
1N3746	S	Microwave X-band Mixer; NF = 8.5 dB											
1N3747	S	Microwave X-band Mixer; NF = 7.5 dB											
1N3748	S			R	200	1.5	0.5		20				
1N3749	S			R	400	1.5	0.5		20				
1N3750	S			R	600	1.5	0.5		20				
1N3751	S			R	800	1.5	0.5		20				
1N3752	S			R	1000	1.5	0.5		20				
1N3753	G			DS	55	1.0	150M	5.0*					
1N3754	S			R	100	1.2	0.15	0.3	15				
1N3755	S			R	200	1.2	0.15	0.3	15				
1N3756	S			R	400	1.2	0.15	0.3	15				
1N3757	S			R	200	1.0	1.0		30				
1N3758	S			R	400	1.0	1.0		30				
1N3759	S			R	600	1.0	1.0		30				
1N3760	S			R	800	1.0	1.0		30				
1N3761	S			R	1000	1.0	1.0		30				
1N3762	S			R	5300	12	0.065	0.005	15				
1N3763	S	1N2767A		DR						20	0.002	10	-55/100
1N3764	S			R	3000	6.5	0.2	0.1	8.0				
1N3765	S			R	700	1.8	35	5.0	400				
1N3766	S			R	800	1.8	35	4.0	400				
1N3767	S			R	900	1.8	35	3.0	400				
1N3768	S			R	1000	1.8	35	2.0	400				
1N3769	G			DS	90	0.5	25M	5.0*					
1N3770		Varactor Diode, see Table on Page 1-94											
1N3771, 1N3772		4-Layer Diodes, see Table on Page 1-108											
1N3773	G			DS	25	0.35	2.0M	4.0*	40				
1N3774	S			DZ						1.15	10	2.0	0.34W
1N3775	S			R	1500	2.2	3.3	0.1	15				
1N3776	S			DZ						10	25	10	6.0W
1N3777	S			DS	40	1.1	10M	0.1*	4.0				
1N3778	S	Microwave C-X-band Detector											
1N3779	S	1N821A	1N821	DR						6.5	0.015	7.5	-55/100
1N3780	S	1N821A	1N821	DR						6.5	0.01	7.5	-55/100
1N3781	S	1N823A	1N821	DR						6.5	0.005	7.5	-55/100
1N3782	S	1N825A	1N821	DR						6.5	0.002	7.5	-55/100
1N3783	S	1N827A	1N821	DR						6.5	0.001	7.5	-55/100
1N3784	S	1N829A	1N821	DR						6.5	0.0005	7.5	-55/100
1N3785	S		1N3785	DZ						6.8	55	20	1.5W
1N3785A	S		1N3785	DZ						6.8	55	10	1.5W
1N3785B	S		1N3785	DZ						6.8	55	5.0	1.5W
1N3786	S		1N3785	DZ						7.5	50	20	1.5W
1N3786A	S		1N3785	DZ						7.5	50	10	1.5W
1N3786B	S		1N3785	DZ						7.5	50	5.0	1.5W
1N3787	S		1N3785	DZ						8.2	46	20	1.5W
1N3787A	S		1N3785	DZ						8.2	46	10	1.5W
1N3787B	S		1N3785	DZ						8.2	46	5.0	1.5W
1N3788	S		1N3785	DZ						9.1	41	20	1.5W
1N3788A	S		1N3785	DZ						9.1	41	10	1.5W
1N3788B	S		1N3785	DZ						9.1	41	5.0	1.5W
1N3789	S		1N3785	DZ						10	37	20	1.5W
1N3789A	S		1N3785	DZ						10	37	10	1.5W
1N3789B	S		1N3785	DZ						10	37	5.0	1.5W
1N3790	S		1N3785	DZ						11	34	20	1.5W
1N3790A	S		1N3785	DZ						11	34	10	1.5W
1N3790B	S		1N3785	DZ						11	34	5.0	1.5W
1N3791	S		1N3785	DZ						12	31	20	1.5W
1N3791A	S		1N3785	DZ						12	31	10	1.5W
1N3791B	S		1N3785	DZ						12	31	5.0	1.5W
1N3792	S		1N3785	DZ						13	29	20	1.5W
1N3792A	S		1N3785	DZ						13	29	10	1.5W
1N3792B	S		1N3785	DZ						13	29	5.0	1.5W
1N3793	S		1N3785	DZ						15	25	20	1.5W
1N3793A	S		1N3785	DZ						15	25	10	1.5W
1N3793B	S		1N3785	DZ						15	25	5.0	1.5W
1N3794	S		1N3785	DZ						16	23	20	1.5W
1N3794A	S		1N3785	DZ						16	23	10	1.5W
1N3794B	S		1N3785	DZ						16	23	5.0	1.5W
1N3795	S		1N3785	DZ						18	21	20	1.5W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	ZENER DIODES V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (µs)	REFERENCE DIODES V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N3795A	S		1N3785	DZ						18	21	10	1.5W
1N3795B	S		1N3785	DZ						18	21	5.0	1.5W
1N3796	S		1N3785	DZ						20	19	20	1.5W
1N3796A	S		1N3785	DZ						20	19	10	1.5W
1N3796B	S		1N3785	DZ						20	19	5.0	1.5W
1N3797	S		1N3785	DZ						22	17	20	1.5W
1N3797A	S		1N3785	DZ						22	17	10	1.5W
1N3797B	S		1N3785	DZ						22	17	5.0	1.5W
1N3798	S		1N3785	DZ						24	16	20	1.5W
1N3798A	S		1N3785	DZ						24	16	10	1.5W
1N3798B	S		1N3785	DZ						24	16	5.0	1.5W
1N3799	S		1N3785	DZ						27	14	20	1.5W
1N3799A	S		1N3785	DZ						27	14	10	1.5W
1N3799B	S		1N3785	DZ						27	14	5.0	1.5W
1N3800	S		1N3785	DZ						30	12	20	1.5W
1N3800A	S		1N3785	DZ						30	12	10	1.5W
1N3800B	S		1N3785	DZ						30	12	5.0	1.5W
1N3801	S		1N3785	DZ						33	11	20	1.5W
1N3801A	S		1N3785	DZ						33	11	10	1.5W
1N3801B	S		1N3785	DZ						33	11	5.0	1.5W
1N3802	S		1N3785	DZ						36	10	20	1.5W
1N3802A	S		1N3785	DZ						36	10	10	1.5W
1N3802B	S		1N3785	DZ						36	10	5.0	1.5W
1N3803	S		1N3785	DZ						39	10	20	1.5W
1N3803A	S		1N3785	DZ						39	10	10	1.5W
1N3803B	S		1N3785	DZ						39	10	5.0	1.5W
1N3804	S		1N3785	DZ						43	9.0	20	1.5W
1N3804A	S		1N3785	DZ						43	9.0	10	1.5W
1N3804B	S		1N3785	DZ						43	9.0	5.0	1.5W
1N3805	S		1N3785	DZ						47	8.0	20	1.5W
1N3805A	S		1N3785	DZ						47	8.0	10	1.5W
1N3805B	S		1N3785	DZ						47	8.0	5.0	1.5W
1N3806	S		1N3785	DZ						51	7.4	20	1.5W
1N3806A	S		1N3785	DZ						51	7.4	10	1.5W
1N3806B	S		1N3785	DZ						51	7.4	5.0	1.5W
1N3807	S		1N3785	DZ						56	6.7	20	1.5W
1N3807A	S		1N3785	DZ						56	6.7	10	1.5W
1N3807B	S		1N3785	DZ						56	6.7	5.0	1.5W
1N3808	S		1N3785	DZ						62	6.0	20	1.5W
1N3808A	S		1N3785	DZ						62	6.0	10	1.5W
1N3808B	S		1N3785	DZ						62	6.0	5.0	1.5W
1N3809	S		1N3785	DZ						68	5.5	20	1.5W
1N3809A	S		1N3785	DZ						68	5.5	10	1.5W
1N3809B	S		1N3785	DZ						68	5.5	5.0	1.5W
1N3810	S		1N3785	DZ						75	5.0	20	1.5W
1N3810A	S		1N3785	DZ						75	5.0	10	1.5W
1N3810B	S		1N3785	DZ						75	5.0	5.0	1.5W
1N3811	S		1N3785	DZ						82	4.5	20	1.5W
1N3811A	S		1N3785	DZ						82	4.5	10	1.5W
1N3811B	S		1N3785	DZ						82	4.5	5.0	1.5W
1N3812	S		1N3785	DZ						91	4.1	20	1.5W
1N3812A	S		1N3785	DZ						91	4.1	10	1.5W
1N3812B	S		1N3785	DZ						91	4.1	5.0	1.5W
1N3813	S		1N3785	DZ						100	3.7	20	1.5W
1N3813A	S		1N3785	DZ						100	3.7	10	1.5W
1N3813B	S		1N3785	DZ						100	3.7	5.0	1.5W
1N3814	S		1N3785	DZ						110	3.4	20	1.5W
1N3814A	S		1N3785	DZ						110	3.4	10	1.5W
1N3814B	S		1N3785	DZ						110	3.4	5.0	1.5W
1N3815	S		1N3785	DZ						120	3.1	20	1.5W
1N3815A	S		1N3785	DZ						120	3.1	10	1.5W
1N3815B	S		1N3785	DZ						120	3.1	5.0	1.5W
1N3816	S		1N3785	DZ						130	2.9	20	1.5W
1N3816A	S		1N3785	DZ						130	2.9	10	1.5W
1N3816B	S		1N3785	DZ						130	2.9	5.0	1.5W
1N3817	S		1N3785	DZ						150	2.5	20	1.5W
1N3817A	S		1N3785	DZ						150	2.5	10	1.5W
1N3817B	S		1N3785	DZ						150	2.5	5.0	1.5W
1N3818	S		1N3785	DZ						160	2.3	20	1.5W
1N3818A	S		1N3785	DZ						160	2.3	10	1.5W
1N3818B	S		1N3785	DZ						160	2.3	5.0	1.5W
1N3819	S		1N3785	DZ						180	2.1	20	1.5W
1N3819A	S		1N3785	DZ						180	2.1	10	1.5W
1N3819B	S		1N3785	DZ						180	2.1	5.0	1.5W
1N3820	S		1N3785	DZ						200	1.9	20	1.5W
1N3820A	S		1N3785	DZ						200	1.9	10	1.5W
1N3820B	S		1N3785	DZ						200	1.9	5.0	1.5W
1N3821	S		1N3821	DZ						3.3	76	10	1.0W
1N3821A	S		1N3821	DZ						3.3	76	5.0	1.0W
1N3822	S		1N3821	DZ						3.6	69	10	1.0W
1N3822A	S		1N3821	DZ						3.6	69	5.0	1.0W
1N3823	S		1N3821	DZ						3.9	64	10	1.0W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N3823A	S		1N3821	DZ						3.9	64	5.0	1.0W
1N3824	S		1N3821	DZ						4.3	58	10	1.0W
1N3824A	S		1N3821	DZ						4.3	58	5.0	1.0W
1N3825	S		1N3821	DZ						4.7	53	10	1.0W
1N3825A	S		1N3821	DZ						4.7	53	5.0	1.0W
1N3826	S		1N3821	DZ						5.1	49	10	1.0W
1N3826A	S		1N3821	DZ						5.1	49	5.0	1.0W
1N3827	S		1N3821	DZ						5.6	45	10	1.0W
1N3827A	S		1N3821	DZ						5.6	45	5.0	1.0W
1N3828	S		1N3821	DZ						6.2	41	10	1.0W
1N3828A	S		1N3821	DZ						6.2	41	5.0	1.0W
1N3829	S		1N3821	DZ						6.8	37	10	1.0W
1N3829A	S		1N3821	DZ						6.8	37	5.0	1.0W
1N3830	S		1N3821	DZ						7.5	34	10	1.0W
1N3830A	S		1N3821	DZ						7.5	34	5.0	1.0W
1N3831 thru 1N3846		4-Layer Diodes, see Table on Page 1-108											
1N3847 thru 1N3860		Tunnel Diodes, see Table on Page 1-104											
1N3861	G	Tunnel Rectifier											
1N3862	G	Tunnel Rectifier											
1N3863	G	Tunnel Rectifier											
1N3864	S			DS	125	1.5	200M	1.0N	0.9				
1N3865	G			DS	80		100M	15*	0.5				
1N3866	S			R	200	1.5	1.0	0.05	25				
1N3867	S			R	400	1.5	1.0	0.05	25				
1N3868	S			R	600	1.5	1.0	0.05	25				
1N3869	S			R	1000	3.0	0.5	0.05	10				
1N3870	S			R	1500	3.0	0.5	0.05	10				
1N3871	S			R	2500	6.0	0.25	0.05	5.0				
1N3872	S			DS	90	1.0	150M	0.1*	15				
1N3873	S			DS	50	1.14	0.2A	0.1*	4.0				
1N3874	S			R	50	1.5	6.0	3.0	75				
1N3875	S			R	100	1.5	6.0	3.0	75				
1N3876	S			R	200	1.5	6.0	3.0	75				
1N3877	S			R	300	1.5	6.0	3.0	75				
1N3878	S			R	400	1.5	6.0	3.0	75				
1N3879	S		1N3879	.R	50	1.5	6.0	3.0	150				
1N3880	S		1N3879	.R	150	1.5	6.0	3.0	150				
1N3881	S		1N3879	.R	200	1.5	6.0	3.0	150				
1N3882	S		1N3879	.R	300	1.5	6.0	3.0	150				
1N3883	S		1N3879	.R	400	1.5	6.0	3.0	150				
1N3884	S			R	50	1.5	12	3.0	150				
1N3885	S			R	100	1.5	12	3.0	150				
1N3886	S			R	200	1.5	12	3.0	150				
1N3887	S			R	300	1.5	12	3.0	150				
1N3888	S			R	400	1.5	12	3.0	150				
1N3889	S		1N3889	.R	50	1.5	12	3.0	200				
1N3890	S		1N3889	.R	100	1.5	12	3.0	200				
1N3891	S		1N3889	.R	200	1.5	12	3.0	200				
1N3892	S		1N3889	.R	300	1.5	12	3.0	200				
1N3893	S		1N3889	.R	400	1.5	12	3.0	200				
1N3894	S			DS	400	1.0	400M	0.2*					
1N3895	S			DS	350	1.0	200M	0.5*					
1N3896	S			DZ						0.77	50	5.0	250M
1N3897	S			DZ						1.5	30	5.0	250M
1N3898	S	1N5221B	1N5221	DZ						2.0	20	5.0	250M
1N3899	S		1N3899	.R	50	1.5	20	6.0	250				
1N3900	S		1N3899	.R	100	1.5	20	6.0	250				
1N3901	S		1N3899	.R	200	1.5	20	6.0	250				
1N3902	S		1N3899	.R	300	1.5	20	6.0	250				
1N3903	S		1N3899	.R	400	1.5	20	6.0	250				
1N3904	S			R	50	1.5	20	6.0	225				
1N3905	S			R	100	1.5	20	6.0	225				
1N3906	S			R	200	1.5	20	6.0	225				
1N3907	S			R	300	1.5	20	6.0	225				
1N3908	S			R	400	1.5	20	6.0	225				
1N3909	S		1N3909	.R	50	1.5	30	10	300				
1N3910	S		1N3909	.R	100	1.5	30	10	300				
1N3911	S		1N3909	.R	200	1.5	30	10	300				
1N3912	S		1N3909	.R	300	1.5	30	10	300				
1N3913	S		1N3909	.R	400	1.5	30	10	300				
1N3914	S			R	50	1.5	30	10	300				
1N3915	S			R	100	1.5	30	10	300				
1N3916	S			R	200	1.5	30	10	300				
1N3917	S			R	300	1.5	30	10	300				
1N3918	S			R	400	1.5	30	10	300				
1N3919	S			R	1000	2.0	5.0	0.5	100				
1N3920	S			R	1500	2.0	5.0	0.5	100				
1N3921	S			R	2000	2.0	5.0	0.5	100				

.R t_{rr} @ 200 ns

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N3922	S			R	2500	2.0	5.0	0.5	100				
1N3923	S			R	3000	2.0	5.0	0.5	100				
1N3924	S			R	1000	2.0	10	0.5	100				
1N3925	S			R	1500	2.0	10	0.5	100				
1N3926	S			R	2000	2.0	10	0.5	100				
1N3927	S			R	2500	2.0	10	0.5	100				
1N3928	S			R	3000	2.0	10	0.5	100				
1N3929	S			DS	1000	2.0	1.0A	10*					
1N3930	S			DS	1500	2.0	1.0A	10*					
1N3931	S			DS	2000	2.0	1.0A	10*					
1N3932	S			DS	1500	2.0	1.0A	10*					
1N3933	S			DS	3000	2.0	1.0A	10*					
1N3934	S			R	1200	2.5	1.0	0.4	50				
1N3935 thru 1N3937		4-Layer Diodes, see Table on Page 1-108											
1N3938	S			R	200	1.1	2.0	0.4	30				
1N3939	S			R	400	1.1	2.0	0.2	30				
1N3940	S			R	600	1.1	2.0	0.2	30				
1N3941	S			R	800	1.5	2.0	0.2	30				
1N3942	S			R	1000	1.5	2.0	0.2	30				
1N3943	S			DS	3.0	2.5	300M	100*					
1N3944	G			DS	15	0.75	10M	2.5*	12				
1N3945 thru 1N3947		Varactor Diodes, see Table on Page 1-94											
1N3948		Tunnel Diode, see Table on Page 1-104											
1N3949	S	1N2984B	1N2970	DZ						20	250	5.0	10W
1N3950	S	1N3796B	1N3785	DZ						20	19	5.0	1.5W
1N3951	S	1.5M25Z5&		DZ						25	15	5.0	1.5W
1N3952	S			DS	130	0.74	10M	25N					
1N3953	G			DS	40	0.5	35M	50*	300				
1N3954	S			DS	50	1.0	200M	0.1*	4.0				
1N3955	S			R	100	1.3	70	15	1200				
1N3956	S			DS	40	0.55	100*	0.05*	2.0				
1N3957	S			DS	1000	1.0	400M	10*					
1N3958	S	1N3880	1N4933	R	100	1.3	3.5	0.4	35				
1N3959	S	1N3881	1N4933	R	200	1.3	3.5	0.4	35				
1N3960	S	1N3882	1N4933	R	300	1.3	3.5	0.4	35				
1N3961	S	1N3883	1N4933	R	400	1.3	3.5	0.4	35				
1N3962	S	MR1366	1N4933	R	500	1.3	3.5	0.4	35				
1N3963	S	MR1366	1N4933	R	600	1.3	3.5	0.4	35				
1N3964	S			R	200	1.6	22	1.0	200				
1N3965	S			R	400	1.6	22	1.0	200				
1N3966	S			R	600	1.6	22	1.0	200				
1N3967	S			R	800	1.6	22	1.0	200				
1N3968	S			R	200	1.6	50	2.0	600				
1N3969	S			R	400	1.6	50	2.0	600				
1N3970	S			R	600	1.6	50	2.0	600				
1N3971	S			R	800	1.6	50	2.0	600				
1N3972	S			R	200	1.5	104	5.0	1500				
1N3973	S			R	400	1.5	104	5.0	1500				
1N3974	S			R	600	1.5	104	5.0	1500				
1N3975	S			R	800	1.5	104	5.0	1500				
1N3976	S			R	200	1.5	250	10	4000				
1N3977	S			R	400	1.5	250	10	4000				
1N3978	S			R	600	1.5	250	10	4000				
1N3979	S			R	800	1.5	250	10	4000				
1N3981	S			DS	200	1.0	900M	0.01M					
1N3982	S			DS	400	1.0	900M	0.01M					
1N3983	S			DS	600	1.0	900M	0.01M					
1N3984	S	1N3997A	1N3993	DZ						5.5	1000	5.0	10W
1N3985	S	1N3998A	1N3993	DZ						6.0	1000	5.0	10W
1N3986	S	1N3998A	1N3993	DZ						6.2	805	5.0	10W
1N3987	S			R	700	1.4	6.0	0.9	150				
1N3988	S	MR1128	MR1120	R	800	1.4	6.0	0.8	150				
1N3989	S	MR1130	MR1120	R	900	1.4	6.0	0.7	150				
1N3990	S	MR1130	MR1120	R	1000	1.4	6.0	0.6	150				
1N3991	G			DS	35	0.55	30M	1.0M	1.0				
1N3992	S			DS	4000	5.0	250M	5.0*					
1N3993	S		1N3993	DZ						3.9	640	10	10W
1N3993A	S		1N3993	DZ						3.9	640	5.0	10W
1N3994	S		1N3993	DZ						4.3	580	10	10W
1N3994A	S		1N3993	DZ						4.3	580	5.0	10W
1N3995	S		1N3993	DZ						4.7	530	10	10W
1N3995A	S		1N3993	DZ						4.7	530	5.0	10W
1N3996	S		1N3993	DZ						5.1	490	10	10W
1N3996A	S		1N3993	DZ						5.1	490	5.0	10W
1N3997	S		1N3993	DZ						5.6	445	10	10W
1N3997A	S		1N3993	DZ						5.6	445	5.0	10W
1N3998	S		1N3993	DZ						6.2	405	10	10W
1N3998A	S		1N3993	DZ						6.2	405	5.0	10W

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol $V_Z \pm\%$	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N3999	S		1N3993	DZ						6.8	370	10	10W
1N3999A	S		1N3993	DZ						6.8	370	5.0	10W
1N4000	S		1N3993	DZ						7.5	335	10	10W
1N4000A	S		1N3993	DZ						7.5	335	5.0	10W
1N4001	S		1N4001	R	50	1.1	1.0	0.03	30				
1N4002	S		1N4001	R	100	1.1	1.0	0.03	30				
1N4003	S		1N4001	R	200	1.1	1.0	0.03	30				
1N4004	S		1N4001	R	400	1.1	1.0	0.03	30				
1N4005	S		1N4001	R	600	1.1	1.0	0.03	30				
1N4006	S		1N4001	R	800	1.1	1.0	0.03	30				
1N4007	S		1N4001	R	1000	1.1	1.0	0.03	30				
1N4008	G			DS	12	0.5	10M	0.1M	70				
1N4009	S			DS	25	1.0	30M	0.1M	4.0				
1N4010	S	1N821	1N821	DR						6.2	0.01	7.5	25/100
1N4011	S			R	1000	1.1	0.5	0.2	30				
1N4012	S			R	700	1.3	12	1.0	200				
1N4013	S			R	800	1.3	12	1.0	200				
1N4014	S			R	900	1.3	12	1.0	200				
1N4015	S			R	1000	1.3	12	1.0	200				
1N4016	S	1N2972	1N2970	DZ						8.2	150	20	5.0W
1N4016A	S	1N2972A	1N2970	DZ						8.2	150	10	5.0W
1N4016B	S	1N2972B	1N2970	DZ						8.2	150	5.0	5.0W
1N4017	S	1N2973	1N2970	DZ						9.1	135	20	5.0W
1N4017A	S	1N2973A	1N2970	DZ						9.1	135	10	5.0W
1N4017B	S	1N2973B	1N2970	DZ						9.1	135	5.0	5.0W
1N4018	S	1N2974	1N2970	DZ						10	125	20	5.0W
1N4018A	S	1N2974A	1N2970	DZ						10	125	10	5.0W
1N4018B	S	1N2974B	1N2970	DZ						10	125	5.0	5.0W
1N4019	S	1N2975	1N2970	DZ						11	115	20	5.0W
1N4019A	S	1N2975A	1N2970	DZ						11	115	10	5.0W
1N4019B	S	1N2975B	1N2970	DZ						11	115	5.0	5.0W
1N4020	S	1N2976	1N2970	DZ						12	105	20	5.0W
1N4020A	S	1N2976A	1N2970	DZ						12	105	10	5.0W
1N4020B	S	1N2976B	1N2970	DZ						12	105	5.0	5.0W
1N4021	S	1N2977	1N2970	DZ						13	95	20	5.0W
1N4021A	S	1N2977A	1N2970	DZ						13	95	10	5.0W
1N4021B	S	1N2977B	1N2970	DZ						13	95	5.0	5.0W
1N4022	S	1N2979	1N2970	DZ						15	85	20	5.0W
1N4022A	S	1N2979A	1N2970	DZ						15	85	10	5.0W
1N4022B	S	1N2979B	1N2970	DZ						15	85	5.0	5.0W
1N4023	S	1N2980	1N2970	DZ						16	80	20	5.0W
1N4023A	S	1N2980A	1N2970	DZ						16	80	10	5.0W
1N4023B	S	1N2980B	1N2970	DZ						16	80	5.0	5.0W
1N4024	S	1N2982	1N2970	DZ						18	70	20	5.0W
1N4024A	S	1N2982A	1N2970	DZ						18	70	10	5.0W
1N4024B	S	1N2982B	1N2970	DZ						18	70	5.0	5.0W
1N4025	S	1N2984	1N2970	DZ						20	65	20	5.0W
1N4025A	S	1N2984A	1N2970	DZ						20	65	10	5.0W
1N4025B	S	1N2984B	1N2970	DZ						20	65	5.0	5.0W
1N4026	S	1N2985	1N2970	DZ						22	55	20	5.0W
1N4026A	S	1N2985A	1N2970	DZ						22	55	10	5.0W
1N4026B	S	1N2985B	1N2970	DZ						22	55	5.0	5.0W
1N4027	S	1N2986	1N2970	DZ						24	50	20	5.0W
1N4027A	S	1N2986A	1N2970	DZ						24	50	10	5.0W
1N4027B	S	1N2986B	1N2970	DZ						24	50	5.0	5.0W
1N4028	S	1N2988	1N2970	DZ						27	45	20	5.0W
1N4028A	S	1N2988A	1N2970	DZ						27	45	10	5.0W
1N4028B	S	1N2988B	1N2970	DZ						27	45	5.0	5.0W
1N4029	S	1N2989	1N2970	DZ						30	42	20	5.0W
1N4029A	S	1N2989A	1N2970	DZ						30	42	10	5.0W
1N4029B	S	1N2989B	1N2970	DZ						30	42	5.0	5.0W
1N4030	S	1N2990	1N2970	DZ						33	38	20	5.0W
1N4030A	S	1N2990A	1N2970	DZ						33	38	10	5.0W
1N4030B	S	1N2990B	1N2970	DZ						33	38	5.0	5.0W
1N4031	S	1N2991	1N2970	DZ						36	35	20	5.0W
1N4031A	S	1N2991A	1N2970	DZ						36	35	10	5.0W
1N4031B	S	1N2992B	1N2970	DZ						36	35	5.0	5.0W
1N4032	S	1N2992	1N2970	DZ						39	32	20	5.0W
1N4032A	S	1N2992A	1N2970	DZ						39	32	10	5.0W
1N4032B	S	1N2992B	1N2970	DZ						39	32	5.0	5.0W
1N4033	S	1N2993	1N2970	DZ						43	29	20	5.0W
1N4033A	S	1N2993A	1N2970	DZ						43	29	10	5.0W
1N4033B	S	1N2993B	1N2970	DZ						43	29	5.0	5.0W
1N4034	S	1N2995	1N2970	DZ						47	27	20	5.0W
1N4034A	S	1N2995A	1N2970	DZ						47	27	10	5.0W
1N4034B	S	1N2995B	1N2970	DZ						47	27	5.0	5.0W
1N4035	S	1N2997	1N2970	DZ						51	25	20	5.0W
1N4035A	S	1N2997A	1N2970	DZ						51	25	10	5.0W
1N4035B	S	1N2997B	1N2970	DZ						51	25	5.0	5.0W
1N4036	S	1N2999	1N2970	DZ						56	22	20	5.0W
1N4036A	S	1N2999A	1N2970	DZ						56	22	10	5.0W
1N4036B	S	1N2999B	1N2970	DZ						56	22	5.0	5.0W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol $V_{Z}\pm\%$ / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N4037	S	1N3000	1N2970	DZ						62	20	20	5.0W
1N4037A	S	1N3000A	1N2970	DZ						62	20	10	5.0W
1N4037B	S	1N3000B	1N2970	DZ						62	20	5.0	5.0W
1N4038	S	1N3001	1N2970	DZ						68	18	20	5.0W
1N4038A	S	1N3001A	1N2970	DZ						68	18	10	5.0W
1N4038B	S	1N3001B	1N2970	DZ						68	18	5.0	5.0W
1N4039	S	1N3002	1N2970	DZ						75	17	20	5.0W
1N4039A	S	1N3002A	1N2970	DZ						75	17	10	5.0W
1N4039B	S	1N3002B	1N2970	DZ						75	17	5.0	5.0W
1N4040	S	1N3003	1N2970	DZ						82	15	20	5.0W
1N4040A	S	1N3003A	1N2970	DZ						82	15	10	5.0W
1N4040B	S	1N3003B	1N2970	DZ						82	15	5.0	5.0W
1N4041	S	1N3004	1N2970	DZ						91	14	20	5.0W
1N4041A	S	1N3004A	1N2970	DZ						91	14	10	5.0W
1N4041B	S	1N3004B	1N2970	DZ						91	14	5.0	5.0W
1N4042	S	1N3005	1N2970	DZ						100	13	20	5.0W
1N4042A	S	1N3005A	1N2970	DZ						100	13	10	5.0W
1N4042B	S	1N3005B	1N2970	DZ						100	13	5.0	5.0W
1N4043	S			DS	25	1.0	275	0.1*	2.0				
1N4044	S	MR1230SB	MR1230	R	50	1.35	275	15	5000				
1N4045	S	MR1231SB	MR1230	R	100	1.35	275	15	5000				
1N4046	S	MR1232SB	MR1230	R	150	1.35	275	15	5000				
1N4047	S	MR1233SB	MR1230	R	200	1.35	275	15	5000				
1N4048	S	MR1234SB	MR1230	R	250	1.35	275	15	5000				
1N4049	S	MR1235SB	MR1230	R	300	1.35	275	15	5000				
1N4050	S	MR1237SB	MR1230	R	400	1.35	275	15	5000				
1N4051	S	MR1238SB	MR1230	R	500	1.35	275	15	5000				
1N4052	S	MR1239SB	MR1230	R	600	1.35	275	15	5000				
1N4053	S			R	700	1.35	275	15	5000				
1N4054	S			R	800	1.35	275	15	5000				
1N4055	S			R	900	1.35	275	15	5000				
1N4056	S			R	1000	1.35	275	15	5000				
1N4057	S		1N429	DR						12.4	0.005	10	-55/100
1N4057A	S		1N429	DR						12.4	0.002	10	-55/100
1N4058	S		1N429	DR						14.6	0.005	10	-55/100
1N4058A	S		1N429	DR						14.6	0.002	10	-55/100
1N4059	S		1N429	DR						16.8	0.005	10	-55/100
1N4059A	S		1N429	DR						16.8	0.002	10	-55/100
1N4060	S		1N429	DR						18.5	0.005	10	-55/100
1N4060A	S		1N429	DR						18.5	0.002	10	-55/100
1N4061	S		1N429	DR						21	0.005	10	-55/100
1N4061A	S		1N429	DR						21	0.002	10	-55/100
1N4062	S		1N429	DR						23	0.005	10	-55/100
1N4062A	S		1N429	DR						23	0.002	10	-55/100
1N4063	S		1N429	DR						27	0.005	10	-55/100
1N4063A	S		1N429	DR						27	0.002	10	-55/100
1N4064	S		1N429	DR						30	0.005	10	-55/100
1N4064A	S		1N429	DR						30	0.002	10	-55/100
1N4065	S		1N429	DR						33	0.005	10	-55/100
1N4065A	S		1N429	DR						33	0.002	10	-55/100
1N4066	S		1N429	DR						37	0.005	7.5	-55/100
1N4066A	S		1N429	DR						37	0.002	7.5	-55/100
1N4067	S		1N429	DR						43	0.005	7.5	-55/100
1N4067A	S		1N429	DR						43	0.002	7.5	-55/100
1N4068	S		1N429	DR						47	0.005	7.5	-55/100
1N4068A	S		1N429	DR						47	0.002	7.5	-55/100
1N4069	S		1N429	DR						51	0.005	7.5	-55/100
1N4069A	S		1N429	DR						51	0.002	7.5	-55/100
1N4070	S		1N429	DR						56	0.005	7.5	-55/100
1N4070A	S		1N429	DR						56	0.002	7.5	-55/100
1N4071	S		1N429	DR						62	0.005	7.5	-55/100
1N4071A	S		1N429	DR						62	0.002	7.5	-55/100
1N4072	S		1N429	DR						68	0.005	5.0	-55/100
1N4072A	S		1N429	DR						68	0.002	5.0	-55/100
1N4073	S		1N429	DR						75	0.005	5.0	-55/100
1N4073A	S		1N429	DR						75	0.002	5.0	-55/100
1N4074	S		1N429	DR						82	0.005	5.0	-55/100
1N4074A	S		1N429	DR						82	0.002	5.0	-55/100
1N4075	S		1N429	DR						87	0.005	5.0	-55/100
1N4075A	S		1N429	DR						87	0.002	5.0	-55/100
1N4076	S		1N429	DR						91	0.005	5.0	-55/100
1N4076A	S		1N429	DR						91	0.002	5.0	-55/100
1N4077	S		1N429	DR						100	0.002	5.0	-55/100
1N4077A	S		1N429	DR						100	0.002	5.0	-55/100
1N4078	S		1N429	DR						105	0.005	2.5	-55/100
1N4078A	S		1N429	DR						105	0.002	2.5	-55/100
1N4079	S		1N429	DR						110	0.005	2.5	-55/100
1N4079A	S		1N429	DR						110	0.002	2.5	-55/100
1N4080	S		1N429	DR						120	0.005	2.5	-55/100
1N4080A	S		1N429	DR						120	0.002	2.5	-55/100
1N4081	S		1N429	DR						130	0.005	2.5	-55/100
1N4081A	S		1N429	DR						130	0.002	2.5	-55/100

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N4082	S		1N429	DR						140	0.005	25	-55/100
1N4082A	S		1N429	DR						140	0.002	25	-55/100
1N4083	S		1N429	DR						150	0.005	25	-55/100
1N4083A	S		1N429	DR						150	0.002	25	-55/100
1N4084	S		1N429	DR						175	0.005	25	-55/100
1N4084A	S		1N429	DR						175	0.002	25	-55/100
1N4085	S		1N429	DR						200	0.005	25	-55/100
1N4085A	S		1N429	DR						200	0.002	25	-55/100
1N4086	S			DS	70	1.0	200M	0.25M	200				
1N4087	S			DS	50	0.975	30M	90N	2.5				
1N4088	G			DS	30	1.0	100M	0.2M					
1N4089	S			R*	400	1.2	400	0.2	75				
1N4090	G	Backward Diode											
1N4091		Varactor Diode, see Table on Page 1-94											
1N4092	S			DS		1.0	5.0M	1.0*					
1N4093	S			DS	50	1.0	5.0M	1.0					
1N4094	S	1N2624B	1N2620	DR						9.6			
1N4095	S	1N5231A	1N5221	DZ						5.0	5.0	10	330M
1N4096	S	1N4763A	1N4728	DZ						90	8.0	5.0	3.0W
1N4097	S	1N4764A	1N4728	DZ						100	5.0	5.0	3.0W
1N4098	S	1M150ZS5	1N4728	DZ						150	5.0	5.0	3.0W
1N4099	S		1N4099	DZ						6.8	0.25	5.0	250M
1N4100	S		1N4099	DZ						7.5	0.25	5.0	250M
1N4101	S		1N4099	DZ						8.2	0.25	5.0	250M
1N4102	S		1N4099	DZ						8.7	0.25	5.0	250M
1N4103	S		1N4099	DZ						9.1	0.25	5.0	250M
1N4104	S		1N4099	DZ						10	0.25	5.0	250M
1N4105	S		1N4099	DZ						11	0.25	5.0	250M
1N4106	S		1N4099	DZ						12	0.25	5.0	250M
1N4107	S		1N4099	DZ						13	0.25	5.0	250M
1N4108	S		1N4099	DZ						14	0.25	5.0	250M
1N4109	S		1N4099	DZ						15	0.25	5.0	250M
1N4110	S		1N4099	DZ						16	0.25	5.0	250M
1N4111	S		1N4099	DZ						17	0.25	5.0	250M
1N4112	S		1N4099	DZ						18	0.25	5.0	250M
1N4113	S		1N4099	DZ						19	0.25	5.0	250M
1N4114	S		1N4099	DZ						20	0.25	5.0	250M
1N4115	S		1N4099	DZ						22	0.25	5.0	250M
1N4116	S		1N4099	DZ						24	0.25	5.0	250M
1N4117	S		1N4099	DZ						25	0.25	5.0	250M
1N4118	S		1N4099	DZ						27	0.25	5.0	250M
1N4119	S		1N4099	DZ						28	0.25	5.0	250M
1N4120	S		1N4099	DZ						30	0.25	5.0	250M
1N4121	S		1N4099	DZ						33	0.25	5.0	250M
1N4122	S		1N4099	DZ						36	0.25	5.0	250M
1N4123	S		1N4099	DZ						39	0.25	5.0	250M
1N4124	S		1N4099	DZ						43	0.25	5.0	250M
1N4125	S		1N4099	DZ						47	0.25	5.0	250M
1N4126	S		1N4099	DZ						51	0.25	5.0	250M
1N4127	S		1N4099	DZ						56	0.25	5.0	250M
1N4128	S		1N4099	DZ						60	0.25	5.0	250M
1N4129	S		1N4099	DZ						62	0.25	5.0	250M
1N4130	S		1N4099	DZ						68	0.25	5.0	250M
1N4131	S		1N4099	DZ						75	0.25	5.0	250M
1N4132	S		1N4099	DZ						82	0.25	5.0	250M
1N4133	S		1N4099	DZ						87	0.25	5.0	250M
1N4134	S		1N4099	DZ						91	0.25	5.0	250M
1N4135	S		1N4099	DZ						100	0.25	5.0	250M
1N4136	S			R	200	1.6	70	16	750				
1N4137	S			R	400	1.6	70	12	750				
1N4138	S			R	600	1.6	70	8.0	750				
1N4139	S	1N4719	1N4719	R	50	1.0	3.0	0.1	300				
1N4140	S	1N4720	1N4719	R	100	1.0	3.0	0.1	300				
1N4141	S	1N4721	1N4719	R	200	1.0	3.0	0.1	300				
1N4142	S	1N4722	1N4719	R	400	1.0	3.0	0.1	300				
1N4143	S	1N4723	1N4719	R	600	1.0	3.0	0.1	300				
1N4144	S	1N4724	1N4719	R	800	1.0	3.0	0.1	300				
1N4145	S	1N4725	1N4719	R	1000	1.0	3.0	0.1	300				
1N4146	S			R	1200	1.0	3.0	0.1	300				
1N4147	S			DS	30	1.0	30M	0.1*	10				
1N4148	S			DS	75	1.0	10M	25N	4.0				
1N4149	S			DS	75	1.0	10M	25N	4.0				
1N4150	S			DS	50	1.0	200M	0.1*	6.0				
1N4151	S			DS	50	1.0	50M	50N	2.0				
1N4152	S			DS	30	0.88	20M	50N	2.0				
1N4153	S			DS	50	0.88	20M	50N	2.0				
1N4154	S			DS	25	1.0	30M	0.1*	4.0				
1N4155	S			DS	400	1.0	100M	0.1*	10				
1N4156	S			DS	20	1.84	0.1A	50N					
1N4157	S			DS	20	2.66	0.1A	50N					
1N4158	S	1N4736	1N4728	DZ						6.8	37	20	1.0W
1N4158A	S	1N4736	1N4728	DZ						6.8	37	10	1.0W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N4158B	S	1N4736A	1N4728	DZ						6.8	37	5.0	1.0W
1N4159	S	1N4737	1N4728	DZ						7.5	34	20	1.0W
1N4159A	S	1N4737	1N4728	DZ						7.5	34	10	1.0W
1N4159B	S	1N4737A	1N4728	DZ						7.5	34	5.0	1.0W
1N4160	S	1N4738	1N4728	DZ						8.2	31	20	1.0W
1N4160A	S	1N4738	1N4728	DZ						8.2	31	10	1.0W
1N4160B	S	1N4738A	1N4728	DZ						8.2	31	5.0	1.0W
1N4161	S	1N4739	1N4728	DZ						9.1	28	20	1.0W
1N4161A	S	1N4739	1N4728	DZ						9.1	28	10	1.0W
1N4161B	S	1N4739A	1N4728	DZ						9.1	28	5.0	1.0W
1N4162	S	1N4740	1N4728	DZ						10	25	20	1.0W
1N4162A	S	1N4740	1N4728	DZ						10	25	10	1.0W
1N4162B	S	1N4740A	1N4728	DZ						10	25	5.0	1.0W
1N4163	S	1N4741	1N4728	DZ						11	23	20	1.0W
1N4163A	S	1N4741	1N4728	DZ						11	23	10	1.0W
1N4163B	S	1N4741A	1N4728	DZ						11	23	5.0	1.0W
1N4164	S	1N4742	1N4728	DZ						12	21	20	1.0W
1N4164A	S	1N4742	1N4728	DZ						12	21	10	1.0W
1N4164B	S	1N4742A	1N4728	DZ						12	21	5.0	1.0W
1N4165	S	1N4743	1N4728	DZ						13	19	20	1.0W
1N4165A	S	1N4743	1N4728	DZ						13	19	10	1.0W
1N4165B	S	1N4743A	1N4728	DZ						13	19	5.0	1.0W
1N4166	S	1N4744	1N4728	DZ						15	17	20	1.0W
1N4166A	S	1N4744	1N4728	DZ						15	17	10	1.0W
1N4166B	S	1N4744A	1N4728	DZ						15	17	5.0	1.0W
1N4167	S	1N4745	1N4728	DZ						16	16	20	1.0W
1N4167A	S	1N4745	1N4728	DZ						16	16	10	1.0W
1N4167B	S	1N4745A	1N4728	DZ						16	16	5.0	1.0W
1N4168	S	1N4746	1N4728	DZ						18	14	20	1.0W
1N4168A	S	1N4746	1N4728	DZ						18	14	10	1.0W
1N4168B	S	1N4746A	1N4728	DZ						18	14	5.0	1.0W
1N4169	S	1N4747	1N4728	DZ						20	13	20	1.0W
1N4169A	S	1N4747	1N4728	DZ						20	13	10	1.0W
1N4169B	S	1N4747A	1N4728	DZ						20	13	5.0	1.0W
1N4170	S	1N4748	1N4728	DZ						22	12	20	1.0W
1N4170A	S	1N4748	1N4728	DZ						22	12	10	1.0W
1N4170B	S	1N4748A	1N4728	DZ						22	12	5.0	1.0W
1N4171	S	1N4749	1N4728	DZ						24	11	20	1.0W
1N4171A	S	1N4749	1N4728	DZ						24	11	10	1.0W
1N4171B	S	1N4749A	1N4728	DZ						24	11	5.0	1.0W
1N4172	S	1N4750	1N4728	DZ						27	9.5	20	1.0W
1N4172A	S	1N4750	1N4728	DZ						27	9.5	10	1.0W
1N4172B	S	1N4750A	1N4728	DZ						27	9.5	5.0	1.0W
1N4173	S	1N4751	1N4728	DZ						30	8.5	20	1.0W
1N4173A	S	1N4751	1N4728	DZ						30	8.5	10	1.0W
1N4173B	S	1N4751A	1N4728	DZ						30	8.5	5.0	1.0W
1N4174	S	1N4752	1N4728	DZ						33	7.5	20	1.0W
1N4174A	S	1N4752	1N4728	DZ						33	7.5	10	1.0W
1N4174B	S	1N4752A	1N4728	DZ						33	7.5	5.0	1.0W
1N4175	S	1N4753	1N4728	DZ						36	7.0	20	1.0W
1N4175A	S	1N4753	1N4728	DZ						36	7.0	10	1.0W
1N4175B	S	1N4753A	1N4728	DZ						36	7.0	5.0	1.0W
1N4176	S	1N4754	1N4728	DZ						39	6.5	20	1.0W
1N4176A	S	1N4754	1N4728	DZ						39	6.5	10	1.0W
1N4176B	S	1N4754A	1N4728	DZ						39	6.5	5.0	1.0W
1N4177	S	1N4755	1N4728	DZ						43	6.0	20	1.0W
1N4177A	S	1N4755	1N4728	DZ						43	6.0	10	1.0W
1N4177B	S	1N4755A	1N4728	DZ						43	6.0	5.0	1.0W
1N4178	S	1N4756	1N4728	DZ						47	5.5	20	1.0W
1N4178A	S	1N4756	1N4728	DZ						47	5.5	10	1.0W
1N4178B	S	1N4756A	1N4728	DZ						47	5.5	5.0	1.0W
1N4179	S	1N4757	1N4728	DZ						51	5.0	20	1.0W
1N4179A	S	1N4757	1N4728	DZ						51	5.0	10	1.0W
1N4179B	S	1N4757A	1N4728	DZ						51	5.0	5.0	1.0W
1N4180	S	1N4758	1N4728	DZ						56	4.5	20	1.0W
1N4180A	S	1N4758	1N4728	DZ						56	4.5	10	1.0W
1N4180B	S	1N4758A	1N4728	DZ						56	4.5	5.0	1.0W
1N4181	S	1N4759	1N4728	DZ						62	4.0	20	1.0W
1N4181A	S	1N4759	1N4728	DZ						62	4.0	10	1.0W
1N4181B	S	1N4759A	1N4728	DZ						62	4.0	5.0	1.0W
1N4182	S	1N4760	1N4728	DZ						68	3.7	20	1.0W
1N4182A	S	1N4760	1N4728	DZ						68	3.7	10	1.0W
1N4182B	S	1N4760A	1N4728	DZ						68	3.7	5.0	1.0W
1N4183	S	1N4761	1N4728	DZ						75	3.3	20	1.0W
1N4183A	S	1N4761	1N4728	DZ						75	3.3	10	1.0W
1N4183B	S	1N4761A	1N4728	DZ						75	3.3	5.0	1.0W
1N4184	S	1N4762	1N4728	DZ						82	3.0	20	1.0W
1N4184A	S	1N4762	1N4728	DZ						82	3.0	10	1.0W
1N4184B	S	1N4762A	1N4728	DZ						82	3.0	5.0	1.0W
1N4185	S	1N4763	1N4728	DZ						91	2.8	20	1.0W
1N4185A	S	1N4763	1N4728	DZ						91	2.8	10	1.0W
1N4185B	S	1N4763A	1N4728	DZ						91	2.8	5.0	1.0W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	V_F (volts) / V_F @	I_O (Amps) / I_F	I_R (mA) / I_R	I_{FSM} / t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	I_{ZT} mA / T_C %/°C	Tol V_Z±% / I_{ZT} mA	P_D / Temp Range
1N4186	S	1N4764	1N4728	DZ						100	2.5	20	1.0W
1N4186A	S	1N4764	1N4728	DZ						100	2.5	10	1.0W
1N4186B	S	1N4764A	1N4728	DZ						100	2.5	5.0	1.0W
1N4187	S	1M110ZS10 &	1N4728	DZ						110	2.3	20	1.0W
1N4187A	S	1M110ZS10 &	1N4728	DZ						110	2.3	10	1.0W
1N4187B	S	1M110ZS5 &	1N4728	DZ						110	2.3	5.0	1.0W
1N4188	S	1M120ZS10 &	1N4728	DZ						120	2.0	20	1.0W
1N4188A	S	1M120ZS10 &	1N4728	DZ						120	2.0	10	1.0W
1N4188B	S	1M120ZS5 &	1N4728	DZ						120	2.0	5.0	1.0W
1N4189	S	1M130ZS10 &	1N4728	DZ						130	1.9	20	1.0W
1N4189A	S	1M130ZS10 &	1N4728	DZ						130	1.9	10	1.0W
1N4189B	S	1M130ZS5 &	1N4728	DZ						130	1.9	5.0	1.0W
1N4190	S	1M150ZS10 &	1N4728	DZ						150	1.7	20	1.0W
1N4190A	S	1M150ZS10 &	1N4728	DZ						150	1.7	10	1.0W
1N4190B	S	1M150ZS5 &	1N4728	DZ						150	1.7	5.0	1.0W
1N4191	S	1M160ZS10 &	1N4728	DZ						160	1.6	20	1.0W
1N4191A	S	1M160ZS10 &	1N4728	DZ						160	1.6	10	1.0W
1N4191B	S	1M160ZS5 &	1N4728	DZ						160	1.6	5.0	1.0W
1N4192	S	1M180ZS10 &	1N4728	DZ						180	1.4	20	1.0W
1N4192A	S	1M180ZS10 &	1N4728	DZ						180	1.4	10	1.0W
1N4192B	S	1M180ZS5 &	1N4728	DZ						180	1.4	5.0	1.0W
1N4193	S	1M200ZS10 &	1N4728	DZ						200	1.2	20	1.0W
1N4193A	S	1M200ZS10 &	1N4728	DZ						200	1.2	10	1.0W
1N4193B	S	1M200ZS5 &	1N4728	DZ						200	1.2	5.0	1.0W
1N4194	S	1N2970	1N2970	DZ						6.8	370	20	10W
1N4194A	S	1N2970A	1N2970	DZ						6.8	370	10	10W
1N4194B	S	1N2970B	1N2970	DZ						6.8	370	5.0	10W
1N4195	S	1N2971	1N2970	DZ						7.5	335	20	10W
1N4195A	S	1N2971A	1N2970	DZ						7.5	335	10	10W
1N4195B	S	1N2971B	1N2970	DZ						7.5	335	5.0	10W
1N4196	S	1N2972	1N2970	DZ						8.2	305	20	10W
1N4196A	S	1N2972A	1N2970	DZ						8.2	305	10	10W
1N4196B	S	1N2972B	1N2970	DZ						8.2	305	5.0	10W
1N4197	S	1N2973	1N2970	DZ						9.1	275	20	10W
1N4197A	S	1N2973A	1N2970	DZ						9.1	275	10	10W
1N4197B	S	1N2973B	1N2970	DZ						9.1	275	5.0	10W
1N4198	S	1N2974	1N2970	DZ						10	250	20	10W
1N4198A	S	1N2974A	1N2970	DZ						10	250	10	10W
1N4198B	S	1N2974B	1N2970	DZ						10	250	5.0	10W
1N4199	S	1N2975	1N2970	DZ						11	230	20	10W
1N4199A	S	1N2975A	1N2970	DZ						11	230	10	10W
1N4199B	S	1N2975B	1N2970	DZ						11	230	5.0	10W
1N4200	S	1N2976	1N2970	DZ						12	210	20	10W
1N4200A	S	1N2976A	1N2970	DZ						12	210	10	10W
1N4200B	S	1N2976B	1N2970	DZ						12	210	5.0	10W
1N4201	S	1N2977	1N2970	DZ						13	190	20	10W
1N4201A	S	1N2977A	1N2970	DZ						13	190	10	10W
1N4201B	S	1N2977B	1N2970	DZ						13	190	5.0	10W
1N4202	S	1N2978	1N2970	DZ						14	180	20	10W
1N4202A	S	1N2978A	1N2970	DZ						14	180	10	10W
1N4202B	S	1N2978B	1N2970	DZ						14	180	5.0	10W
1N4203	S	1N2979	1N2970	DZ						15	170	20	10W
1N4203A	S	1N2979A	1N2970	DZ						15	170	10	10W
1N4203B	S	1N2979B	1N2970	DZ						15	170	5.0	10W
1N4204	S	1N2980	1N2970	DZ						16	155	20	10W
1N4204A	S	1N2980A	1N2970	DZ						16	155	10	10W
1N4204B	S	1N2980B	1N2970	DZ						16	155	5.0	10W
1N4205	S	1N2981	1N2970	DZ						17	145	20	10W
1N4205A	S	1N2981A	1N2970	DZ						17	145	10	10W
1N4205B	S	1N2981B	1N2970	DZ						17	145	5.0	10W
1N4206	S	1N2982	1N2970	DZ						18	140	20	10W
1N4206A	S	1N2982A	1N2970	DZ						18	140	10	10W
1N4206B	S	1N2982B	1N2970	DZ						18	140	5.0	10W
1N4207	S	1N2983	1N2970	DZ						19	130	20	10W
1N4207A	S	1N2983A	1N2970	DZ						19	130	10	10W
1N4207B	S	1N2983B	1N2970	DZ						19	130	5.0	10W
1N4208	S	1N2984	1N2970	DZ						20	125	20	10W
1N4208A	S	1N2984A	1N2970	DZ						20	125	10	10W
1N4208B	S	1N2984B	1N2970	DZ						20	125	5.0	10W
1N4209	S	1N2985	1N2970	DZ						22	115	20	10W
1N4209A	S	1N2985A	1N2970	DZ						22	115	10	10W
1N4209B	S	1N2985B	1N2970	DZ						22	115	5.0	10W
1N4210	S	1N2986	1N2970	DZ						24	105	20	10W
1N4210A	S	1N2986A	1N2970	DZ						24	105	10	10W
1N4210B	S	1N2986B	1N2970	DZ						24	105	5.0	10W
1N4211	S	1N2987	1N2970	DZ						25	100	20	10W
1N4211A	S	1N2987A	1N2970	DZ						25	100	10	10W
1N4211B	S	1N2987B	1N2970	DZ						25	100	5.0	10W
1N4212	S	1N2988	1N2970	DZ						27	95	20	10W
1N4212A	S	1N2988A	1N2970	DZ						27	95	10	10W
1N4212B	S	1N2988B	1N2970	DZ						27	95	5.0	10W
1N4213	S	1N2989	1N2970	DZ						30	85	20	10W

& See page 1-3 for ordering information

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N4213A	S	1N2989A	1N2970	DZ						30	85	10	10W
1N4213B	S	1N2989B	1N2970	DZ						30	85	5.0	10W
1N4214	S	1N2990	1N2970	DZ						33	75	20	10W
1N4214A	S	1N2990A	1N2970	DZ						33	75	10	10W
1N4214B	S	1N2990B	1N2970	DZ						33	75	5.0	10W
1N4215	S	1N2991	1N2970	DZ						36	70	20	10W
1N4215A	S	1N2991A	1N2970	DZ						36	70	10	10W
1N4215B	S	1N2991B	1N2970	DZ						36	70	5.0	10W
1N4216	S	1N2992	1N2970	DZ						39	65	20	10W
1N4216A	S	1N2992A	1N2970	DZ						39	65	10	10W
1N4216B	S	1N2992B	1N2970	DZ						39	65	5.0	10W
1N4217	S	1N2993	1N2970	DZ						43	60	20	10W
1N4217A	S	1N2993A	1N2970	DZ						43	60	10	10W
1N4217B	S	1N2993B	1N2970	DZ						43	60	5.0	10W
1N4218	S	1N2994	1N2970	DZ						45	55	20	10W
1N4218A	S	1N2994A	1N2970	DZ						45	55	10	10W
1N4218B	S	1N2994B	1N2970	DZ						45	55	5.0	10W
1N4219	S	1N2995	1N2970	DZ						47	55	20	10W
1N4219A	S	1N2995A	1N2970	DZ						47	55	10	10W
1N4219B	S	1N2995B	1N2970	DZ						47	55	5.0	10W
1N4220	S	1N2996	1N2970	DZ						50	50	20	10W
1N4220A	S	1N2996A	1N2970	DZ						50	50	10	10W
1N4220B	S	1N2996B	1N2970	DZ						50	50	5.0	10W
1N4221	S	1N2997	1N2970	DZ						51	50	20	10W
1N4221A	S	1N2997A	1N2970	DZ						51	50	10	10W
1N4221B	S	1N2997B	1N2970	DZ						51	50	5.0	10W
1N4222	S	1N2998	1N2970	DZ						52	50	20	10W
1N4222A	S	1N2998A	1N2970	DZ						52	50	10	10W
1N4222B	S	1N2998B	1N2970	DZ						52	50	5.0	10W
1N4223	S	1N2999	1N2970	DZ						56	45	20	10W
1N4223A	S	1N2999A	1N2970	DZ						56	45	10	10W
1N4223B	S	1N2999B	1N2970	DZ						56	45	5.0	10W
1N4224	S	1N3000	1N2970	DZ						62	40	20	10W
1N4224A	S	1N3000A	1N2970	DZ						62	40	10	10W
1N4224B	S	1N3000B	1N2970	DZ						62	40	5.0	10W
1N4225	S	1N3001	1N2970	DZ						68	37	20	10W
1N4225A	S	1N3001A	1N2970	DZ						68	37	10	10W
1N4225B	S	1N3001B	1N2970	DZ						68	37	5.0	10W
1N4226	S	1N3002	1N2970	DZ						75	33	20	10W
1N4226A	S	1N3002A	1N2970	DZ						75	33	10	10W
1N4226B	S	1N3002B	1N2970	DZ						75	33	5.0	10W
1N4227	S	1N3003	1N2970	DZ						82	30	20	10W
1N4227A	S	1N3003A	1N2970	DZ						82	30	10	10W
1N4227B	S	1N3003B	1N2970	DZ						82	30	5.0	10W
1N4228	S	1N3004	1N2970	DZ						91	28	20	10W
1N4228A	S	1N3004A	1N2970	DZ						91	28	10	10W
1N4228B	S	1N3004B	1N2970	DZ						91	28	5.0	10W
1N4229	S	1N3005	1N2970	DZ						100	25	20	10W
1N4229A	S	1N3005A	1N2970	DZ						100	25	10	10W
1N4229B	S	1N3005B	1N2970	DZ						100	25	5.0	10W
1N4230	S	1N3006	1N2970	DZ						105	25	20	10W
1N4230A	S	1N3006A	1N2970	DZ						105	25	10	10W
1N4230B	S	1N3006B	1N2970	DZ						105	25	5.0	10W
1N4231	S	1N3007	1N2970	DZ						110	23	20	10W
1N4231A	S	1N3007A	1N2970	DZ						110	23	10	10W
1N4231B	S	1N3007B	1N2970	DZ						110	23	5.0	10W
1N4232	S	1N3008	1N2970	DZ						120	20	20	10W
1N4232A	S	1N3008A	1N2970	DZ						120	20	10	10W
1N4232B	S	1N3008B	1N2970	DZ						120	20	5.0	10W
1N4233	S	1N3009	1N2970	DZ						130	19	20	10W
1N4233A	S	1N3009A	1N2970	DZ						130	19	10	10W
1N4233B	S	1N3009B	1N2970	DZ						130	19	5.0	10W
1N4234	S	1N3010	1N2970	DZ						140	18	20	10W
1N4234A	S	1N3010A	1N2970	DZ						140	18	10	10W
1N4234B	S	1N3010B	1N2970	DZ						140	18	5.0	10W
1N4235	S	1N3011	1N2970	DZ						150	17	20	10W
1N4235A	S	1N3011A	1N2970	DZ						150	17	10	10W
1N4235B	S	1N3011B	1N2970	DZ						150	17	5.0	10W
1N4236	S	1N3012	1N2970	DZ						160	16	20	10W
1N4236A	S	1N3012A	1N2970	DZ						160	16	10	10W
1N4236B	S	1N3012B	1N2970	DZ						160	16	5.0	10W
1N4237	S	1N3013	1N2970	DZ						175	14	20	10W
1N4237A	S	1N3013A	1N2970	DZ						175	14	10	10W
1N4237B	S	1N3013B	1N2970	DZ						175	14	5.0	10W
1N4238	S	1N3014	1N2970	DZ						180	14	20	10W
1N4238A	S	1N3014A	1N2970	DZ						180	14	10	10W
1N4238B	S	1N3014B	1N2970	DZ						180	14	5.0	10W
1N4239	S	1N3015	1N2970	DZ						200	12	20	10W
1N4239A	S	1N3015A	1N2970	DZ						200	12	10	10W
1N4239B	S	1N3015B	1N2970	DZ						200	12	5.0	10W
1N4240	S	10M5.0AZ2 &		DZ						400	5.0	2.0	10W
1N4241	S	10M6.0AZ1 &		DZ						350	6.0	2.0	10W

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol $V_{Z\pm\%}$	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N4242	S			DS	40	1.0	20M	0.1N	2.0				
1N4243	S			DS	40	1.0	10M	0.1N	2.0				
1N4244	S			DS	10	1.0	20M	0.1*	0.75				
1N4245	S	1N4003	1N4001	R	200	1.64	1.0	0.05	25				
1N4246	S	1N4004	1N4001	R	400	1.64	1.0	0.05	25				
1N4247	S	1N4005	1N4001	R	600	1.64	1.0	0.05	25				
1N4248	S	1N4006	1N4001	R	800	1.64	1.0	0.05	25				
1N4249	S	1N4007	1N4001	R	1000	1.64	1.0	0.05	25				
1N4250	S	1N4006	1N4001	R	800		0.5	0.05	10				
1N4251	S	1N4007	1N4001	R	1000		0.5	0.05	10				
1N4252	S			R	1200		0.5	0.05	10				
1N4253	S			R	1500		0.5	0.05	10				
1N4254	S	MR991A	MR990A	R	1500	4.8	0.25	0.05	6.25				
1N4255	S	MR992A	MR990A	R	2000	4.8	0.25	0.05	6.25				
1N4256	S	MR993A	MR990A	R	2500	4.8	0.25	0.05	6.25				
1N4257	S	MR994A	MR990A	R	3000	4.8	0.25	0.05	6.25				
1N4258	S	1N2970	1N2970	DZ						6.8	370	20	10W
1N4258A	S	1N2970A	1N2970	DZ						6.8	370	10	10W
1N4258B	S	1N2970B	1N2970	DZ						6.8	370	5.0	10W
1N4259	S	1N2971	1N2970	DZ						7.5	335	20	10W
1N4259A	S	1N2971A	1N2970	DZ						7.5	335	10	10W
1N4259B	S	1N2971B	1N2970	DZ						7.5	335	5.0	10W
1N4260	S	1N2972	1N2970	DZ						8.2	305	20	10W
1N4260A	S	1N2972A	1N2970	DZ						8.2	305	10	10W
1N4260B	S	1N2972B	1N2970	DZ						8.2	305	5.0	10W
1N4261	S	1N2973	1N2970	DZ						9.1	275	20	10W
1N4261A	S	1N2973A	1N2970	DZ						9.1	275	10	10W
1N4261B	S	1N2973B	1N2970	DZ						9.1	275	5.0	10W
1N4262	S	1N2974	1N2970	DZ						10	250	20	10W
1N4262A	S	1N2974A	1N2970	DZ						10	250	10	10W
1N4262B	S	1N2974B	1N2970	DZ						10	250	5.0	10W
1N4263	S	1N2975	1N2970	DZ						11	230	20	10W
1N4263A	S	1N2975A	1N2970	DZ						11	230	10	10W
1N4263B	S	1N2975B	1N2970	DZ						11	230	5.0	10W
1N4264	S	1N2976	1N2970	DZ						12	210	20	10W
1N4264A	S	1N2976A	1N2970	DZ						12	210	10	10W
1N4264B	S	1N2976B	1N2970	DZ						12	210	5.0	10W
1N4265	S	1N2977	1N2970	DZ						13	190	20	10W
1N4265A	S	1N2977A	1N2970	DZ						13	190	10	10W
1N4265B	S	1N2977B	1N2970	DZ						13	190	5.0	10W
1N4266	S	1N2979	1N2970	DZ						15	170	20	10W
1N4266A	S	1N2979A	1N2970	DZ						15	170	10	10W
1N4266B	S	1N2979B	1N2970	DZ						15	170	5.0	10W
1N4267	S	1N2980	1N2970	DZ						16	155	20	10W
1N4267A	S	1N2980A	1N2970	DZ						16	155	10	10W
1N4267B	S	1N2980B	1N2970	DZ						16	155	5.0	10W
1N4268	S	1N2982	1N2970	DZ						18	140	20	10W
1N4268A	S	1N2982A	1N2970	DZ						18	140	10	10W
1N4268B	S	1N2982B	1N2970	DZ						18	140	5.0	10W
1N4269	S	1N2984	1N2970	DZ						20	125	20	10W
1N4269A	S	1N2984A	1N2970	DZ						20	125	10	10W
1N4269B	S	1N2984B	1N2970	DZ						20	125	5.0	10W
1N4270	S	1N2985	1N2979	DZ						22	115	20	10W
1N4270A	S	1N2985A	1N2970	DZ						22	115	10	10W
1N4270B	S	1N2985B	1N2970	DZ						22	115	5.0	10W
1N4271	S	1N2986	1N2970	DZ						24	105	20	10W
1N4271A	S	1N2986A	1N2970	DZ						24	105	10	10W
1N4271B	S	1N2986B	1N2970	DZ						24	105	5.0	10W
1N4272	S	1N2988	1N2970	DZ						27	95	20	10W
1N4272A	S	1N2988A	1N2970	DZ						27	95	10	10W
1N4272B	S	1N2988B	1N2970	DZ						27	95	5.0	10W
1N4273	S	1N2989	1N2970	DZ						30	85	20	10W
1N4273A	S	1N2989A	1N2970	DZ						30	85	10	10W
1N4273B	S	1N2989B	1N2970	DZ						30	85	5.0	10W
1N4274	S	1N2990	1N2970	DZ						33	75	20	10W
1N4274A	S	1N2990A	1N2970	DZ						33	75	10	10W
1N4274B	S	1N2990B	1N2970	DZ						33	75	5.0	10W
1N4275	S	1N2991	1N2970	DZ						36	70	20	10W
1N4275A	S	1N2991A	1N2970	DZ						36	70	10	10W
1N4275B	S	1N2991B	1N2970	DZ						36	70	5.0	10W
1N4276	S	1N2992	1N2970	DZ						39	65	20	10W
1N4276A	S	1N2992A	1N2970	DZ						39	65	10	10W
1N4276B	S	1N2992B	1N2970	DZ						39	65	5.0	10W
1N4277	S	1N2993	1N2970	DZ						43	60	20	10W
1N4277A	S	1N2993A	1N2970	DZ						43	60	10	10W
1N4277B	S	1N2993B	1N2970	DZ						43	60	5.0	10W
1N4278	S	1N2995	1N2970	DZ						47	55	20	10W
1N4278A	S	1N2995A	1N2970	DZ						47	55	10	10W
1N4278B	S	1N2995B	1N2970	DZ						47	55	5.0	10W
1N4279	S	1N2997	1N2970	DZ						51	55	20	10W
1N4279A	S	1N2997A	1N2970	DZ						51	55	10	10W
1N4279B	S	1N2997B	1N2970	DZ						51	55	5.0	10W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N4280	S	1N2999	1N2970	DZ						56	45	20	10W
1N4280A	S	1N2999A	1N2970	DZ						56	45	10	10W
1N4280B	S	1N2999B	1N2970	DZ						56	45	5.0	10W
1N4281	S	1N3000	1N2970	DZ						62	40	20	10W
1N4281A	S	1N3000A	1N2970	DZ						62	40	10	10W
1N4281B	S	1N3000B	1N2970	DZ						62	40	5.0	10W
1N4282	S	1N3001	1N2970	DZ						68	37	20	10W
1N4282A	S	1N3001A	1N2970	DZ						68	37	10	10W
1N4282B	S	1N3001B	1N2970	DZ						68	37	5.0	10W
1N4283	S	1N3002	1N2970	DZ						75	33	20	10W
1N4283A	S	1N3002A	1N2970	DZ						75	33	10	10W
1N4283B	S	1N3002B	1N2970	DZ						75	33	5.0	10W
1N4284	S	1N3003	1N2970	DZ						82	30	20	10W
1N4284A	S	1N3003A	1N2970	DZ						82	30	10	10W
1N4284B	S	1N3003B	1N2970	DZ						82	30	5.0	10W
1N4285	S	1N3004	1N2970	DZ						91	28	20	10W
1N4285A	S	1N3004A	1N2970	DZ						91	28	10	10W
1N4285B	S	1N3004B	1N2970	DZ						91	28	5.0	10W
1N4286	S	1N3005	1N2970	DZ						100	25	20	10W
1N4286A	S	1N3005A	1N2970	DZ						100	25	10	10W
1N4286B	S	1N3005B	1N2970	DZ						100	25	5.0	10W
1N4287	S	1N3007	1N2970	DZ						110	23	20	10W
1N4287A	S	1N3007A	1N2970	DZ						110	23	10	10W
1N4287B	S	1N3007B	1N2970	DZ						110	23	5.0	10W
1N4288	S	1N3008	1N2970	DZ						120	20	20	10W
1N4288A	S	1N3008A	1N2970	DZ						120	20	10	10W
1N4288B	S	1N3008B	1N2970	DZ						120	20	5.0	10W
1N4289	S	1N3009	1N2970	DZ						130	19	20	10W
1N4289A	S	1N3009A	1N2970	DZ						130	19	10	10W
1N4289B	S	1N3009B	1N2970	DZ						130	19	5.0	10W
1N4290	S	1N3011	1N2970	DZ						150	17	20	10W
1N4290A	S	1N3011A	1N2970	DZ						150	17	10	10W
1N4290B	S	1N3011B	1N2970	DZ						150	17	5.0	10W
1N4291	S	1N3012	1N2970	DZ						160	16	20	10W
1N4291A	S	1N3012A	1N2970	DZ						160	16	10	10W
1N4291B	S	1N3012B	1N2970	DZ						160	16	5.0	10W
1N4292	S	1N3014	1N2970	DZ						180	14	20	10W
1N4292A	S	1N3014A	1N2970	DZ						180	14	10	10W
1N4292B	S	1N3014B	1N2970	DZ						180	14	5.0	10W
1N4293	S	1N3015	1N2970	DZ						200	12	20	10W
1N4293A	S	1N3015A	1N2970	DZ						200	12	10	10W
1N4293B	S	1N3015B	1N2970	DZ						200	12	5.0	10W
1N4294	S	Microwave S-band Mixer											
1N4295	S			DR						10	0.012	10	-55/150
1N4295A	S			DR						10	0.012	10	-55/150
1N4296	S			DR						10	0.012	20	-55/150
1N4296A	S			DR						10	0.012	20	-55/150
1N4297	S			DR						8.8	0.01	200	0/75
1N4297A	S			DR						8.8	0.01	200	-55/100
1N4297B	S			DR						8.8	0.01	200	-55/150
1N4298	S			DR						8.8	0.005	200	0/75
1N4298A	S			DR						8.8	0.005	200	-55/100
1N4298B	S			DR						8.8	0.005	200	-55/150
1N4299	S			DR						11.3	0.01	150	0/75
1N4299A	S			DR						11.3	0.01	150	-55/100
1N4299B	S			DR						11.3	0.01	150	-55/150
1N4300	S			DR						11.3	0.01	150	0/75
1N4300A	S			DR						11.3	0.005	150	-55/100
1N4300B	S			DR						11.3	0.005	150	-55/150
1N4301	S			DR						8.8	0.005	1000	0/50
1N4301A	S			DR						8.8	0.01	1000	-55/50
1N4301B	S			DR						8.8	0.01	1000	-55/50
1N4302	S			DR						8.8	0.01	1000	0/50
1N4302A	S			DR						8.8	0.005	1000	-55/100
1N4302B	S			DR						8.8	0.005	1000	-55/150
1N4303	S			DR						11.3	0.005	1000	0/75
1N4303A	S			DR						11.3	0.01	750	-55/50
1N4303B	S			DR						11.3	0.01	750	-55/50
1N4304	S			DR						11.3	0.005	750	0/50
1N4304A	S			DR						11.3	0.005	750	-55/50
1N4304B	S			DR						11.3	0.005	750	-55/50
1N4305				DS	75	0.575	0.25M	0.1*	2.0				
1N4306	S			DS	50	1.0	50M	50N	2.0				
1N4307	S			DS	50	1.0	50M	50N	2.0				
1N4308	S			DS	80	1.0	200M	0.1*	2.0				
1N4309	S			DS	40	1.0	400M	0.1*	2.0				
1N4310	S			DS	60	1.0	400M	0.1*	2.0				
1N4311	S			DS	80	1.0	300M	0.1*	2.0				
1N4312	S			DS	120	1.0	200M	0.1*	2.0				
1N4313	S			DS	80	1.0	100M	0.1*	4.0				
1N4314	S			DS	80	1.0	200M	0.1*	2.0				
1N4315	S			DS	40	1.0	400M	0.1*	2.0				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS V_R (volts) / SIGNAL DIODES PRV (volts)	RECTIFIERS V_F (volts) / SIGNAL DIODES V_F (volts) @	RECTIFIERS I_O (Amps) / SIGNAL DIODES I_F	RECTIFIERS I_R (mA) / SIGNAL DIODES I_R	RECTIFIERS I_{FSM} / SIGNAL DIODES t_{rr} (μs)	ZENER DIODES V_Z(nom) / REFERENCE DIODES V_Z(nom)	ZENER DIODES I_{ZT} mA / REFERENCE DIODES T_C %/°C	ZENER DIODES Tol V_Z±% / REFERENCE DIODES I_{ZT} mA	ZENER DIODES P_D / REFERENCE DIODES Temp Range
1N4316	S			DS	60	1.0	400M	0.1*	2.0				
1N4317	S			DS	80	1.0	300M	0.1*	2.0				
1N4318	S			DS	120	1.0	200M	0.1*	2.0				
1N4319	S			DS	80	1.0	100M	0.1*	4.0				
1N4320	S			DS	640			1.0*					
1N4321	S	5M50ZS10&	1N4728	DZ						50	15	10	3.0W
1N4322	S			DS	50	1.0	0.2A	0.1*	6.0				
1N4323	S	1N4736	1N4728	DZ						6.8	37	20	1.0W
1N4323A	S	1N4736	1N4728	DZ						6.8	37	10	1.0W
1N4323B	S	1N4736A	1N4728	DZ						6.8	37	5.0	1.0W
1N4324	S	1N4737	1N4728	DZ						7.5	34	20	1.0W
1N4324A	S	1N4737	1N4728	DZ						7.5	34	10	1.0W
1N4324B	S	1N4737A	1N4728	DZ						7.5	34	5.0	1.0W
1N4325	S	1N4738	1N4728	DZ						8.2	31	20	1.0W
1N4325A	S	1N4738	1N4728	DZ						8.2	31	10	1.0W
1N4325B	S	1N4738A	1N4728	DZ						8.2	31	5.0	1.0W
1N4326	S	1N4739	1N4728	DZ						9.1	28	20	1.0W
1N4326A	S	1N4739	1N4728	DZ						9.1	28	10	1.0W
1N4326B	S	1N4739A	1N4782	DZ						9.1	28	5.0	1.0W
1N4327	S	1N4740	1N4728	DZ						10	25	20	1.0W
1N4327A	S	1N4740	1N4728	DZ						10	25	10	1.0W
1N4327B	S	1N4740A	1N4728	DZ						10	25	5.0	1.0W
1N4328	S	1N4741	1N4728	DZ						11	23	20	1.0W
1N4328A	S	1N4741	1N4728	DZ						11	23	10	1.0W
1N4328B	S	1N4741A	1N4728	DZ						11	23	5.0	1.0W
1N4329	S	1N4742	1N4728	DZ						12	21	20	1.0W
1N4329A	S	1N4742	1N4728	DZ						12	21	10	1.0W
1N4329B	S	1N4742A	1N4728	DZ						12	21	5.0	1.0W
1N4330	S	1N4743	1N4728	DZ						13	19	20	1.0W
1N4330A	S	1N4743	1N4728	DZ						13	19	10	1.0W
1N4330B	S	1N4743A	1N4728	DZ						13	19	5.0	1.0W
1N4331	S	1N4744	1N4728	DZ						15	17	20	1.0W
1N4331A	S	1N4744	1N4728	DZ						15	17	10	1.0W
1N4331B	S	1N4744A	1N4728	DZ						15	17	5.0	1.0W
1N4332	S	1N4745	1N4728	DZ						16	16	20	1.0W
1N4332A	S	1N4745	1N4728	DZ						16	16	10	1.0W
1N4332B	S	1N4745A	1N4728	DZ						16	16	5.0	1.0W
1N4333	S	1N4746	1N4728	DZ						18	14	20	1.0W
1N4333A	S	1N4746	1N4728	DZ						18	14	10	1.0W
1N4333B	S	1N4746A	1N4728	DZ						18	14	5.0	1.0W
1N4334	S	1N4747	1N4728	DZ						20	13	20	1.0W
1N4334A	S	1N4747	1N4728	DZ						20	13	10	1.0W
1N4334B	S	1N4747A	1N4728	DZ						20	13	5.0	1.0W
1N4335	S	1N4748	1N4728	DZ						22	12	20	1.0W
1N4335A	S	1N4748	1N4728	DZ						22	12	10	1.0W
1N4335B	S	1N4748A	1N4728	DZ						22	12	5.0	1.0W
1N4336	S	1N4749	1N4728	DZ						24	11	20	1.0W
1N4336A	S	1N4749	1N4728	DZ						24	11	10	1.0W
1N4336B	S	1N4749A	1N4728	DZ						24	11	5.0	1.0W
1N4337	S	1N4750	1N4728	DZ						27	9.5	20	1.0W
1N4337A	S	1N4750	1N4728	DZ						27	9.5	10	1.0W
1N4337B	S	1N4750A	1N4728	DZ						27	9.5	5.0	1.0W
1N4338	S	1N4751	1N4728	DZ						30	8.5	20	1.0W
1N4338A	S	1N4751	1N4728	DZ						30	8.5	10	1.0W
1N4338B	S	1N4751A	1N4728	DZ						30	8.5	5.0	1.0W
1N4339	S	1N4752	1N4728	DZ						33	7.5	20	1.0W
1N4339A	S	1N4752	1N4728	DZ						33	7.5	10	1.0W
1N4339B	S	1N4752A	1N4728	DZ						33	7.5	5.0	1.0W
1N4340	S	1N4753	1N4728	DZ						36	7.0	20	1.0W
1N4340A	S	1N4753	1N4728	DZ						36	7.0	10	1.0W
1N4340B	S	1N4753A	1N4728	DZ						36	7.0	5.0	1.0W
1N4341	S	1N4754	1N4728	DZ						39	6.5	20	1.0W
1N4341A	S	1N4754	1N4728	DZ						39	6.5	10	1.0W
1N4341B	S	1N4754A	1N4728	DZ						39	6.5	5.0	1.0W
1N4342	S	1N4755	1N4728	DZ						43	6.0	20	1.0W
1N4342A	S	1N4755	1N4728	DZ						43	6.0	10	1.0W
1N4342B	S	1N4755A	1N4728	DZ						43	6.0	5.0	1.0W
1N4343	S	1N4756	1N4728	DZ						47	5.5	20	1.0W
1N4343A	S	1N4756	1N4728	DZ						47	5.5	10	1.0W
1N4343B	S	1N4756A	1N4728	DZ						47	5.5	5.0	1.0W
1N4344	S	1N4757	1N4728	DZ						51	5.0	20	1.0W
1N4344A	S	1N4757	1N4728	DZ						51	5.0	10	1.0W
1N4344B	S	1N4757A	1N4728	DZ						51	5.0	5.0	1.0W
1N4345	S	1N4758	1N4728	DZ						56	4.5	20	1.0W
1N4345A	S	1N4758	1N4728	DZ						56	4.5	10	1.0W
1N4345B	S	1N4758A	1N4728	DZ						56	4.5	5.0	1.0W
1N4346	S	1N4759	1N4728	DZ						62	4.0	20	1.0W
1N4346A	S	1N4759	1N4728	DZ						62	4.0	10	1.0W
1N4346B	S	1N4759A	1N4728	DZ						62	4.0	5.0	1.0W
1N4347	S	1N4760	1N4728	DZ						68	3.7	20	1.0W
1N4347A	S	1N4760	1N4728	DZ						68	3.7	10	1.0W
1N4347B	S	1N4760A	1N4728	DZ						68	3.7	5.0	1.0W

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N4348	S	1N4761	1N4728	DZ						75	3.3	20	1.0W
1N4348A	S	1N4761	1N4728	DZ						75	3.3	10	1.0W
1N4348B	S	1N4761A	1N4728	DZ						75	3.3	5.0	1.0W
1N4349	S	1N4762	1N4728	DZ						82	3.0	20	1.0W
1N4349A	S	1N4762	1N4728	DZ						82	3.0	10	1.0W
1N4349B	S	1N4762A	1N4728	DZ						82	3.0	5.0	1.0W
1N4350	S	1N4763	1N4728	DZ						91	2.8	20	1.0W
1N4350A	S	1N4763	1N4728	DZ						91	2.8	10	1.0W
1N4350B	S	1N4763A	1N4728	DZ						91	2.8	5.0	1.0W
1N4351	S	1N4764	1N4728	DZ						100	2.5	20	1.0W
1N4351A	S	1N4764	1N4728	DZ						100	2.5	10	1.0W
1N4351B	S	1N4764A	1N4728	DZ						100	2.5	5.0	1.0W
1N4352	S	1M110ZS10 &	1N4728	DZ						110	2.3	20	1.0W
1N4352A	S	1M110ZS10 &	1N4728	DZ						110	2.3	10	1.0W
1N4352B	S	1M110ZS5 &	1N4728	DZ						110	2.3	5.0	1.0W
1N4353	S	1M120ZS10 &	1N4728	DZ						120	2.0	20	1.0W
1N4353A	S	1M120ZS10 &	1N4728	DZ						120	2.0	10	1.0W
1N4343B	S	1M120ZS5 &	1N4728	DZ						120	2.0	5.0	1.0W
1N4354	S	1M130ZS10 &	1N4728	DZ						130	1.9	20	1.0W
1N4354A	S	1M130ZS10 &	1N4728	DZ						130	1.9	10	1.0W
1N4354B	S	1M130ZS5 &	1N4728	DZ						130	1.9	5.0	1.0W
1N4355	S	1M150ZS10 &	1N4728	DZ						150	1.7	20	1.0W
1N4355A	S	1M150ZS10 &	1N4728	DZ						150	1.7	10	1.0W
1N4355B	S	1M150ZS5 &	1N4728	DZ						150	1.7	5.0	1.0W
1N4356	S	1M160ZS10 &	1N4728	DZ						160	1.6	20	1.0W
1N4356A	S	1M160ZS10 &	1N4728	DZ						160	1.6	10	1.0W
1N4356B	S	1M160ZS5 &	1N4728	DZ						160	1.6	5.0	1.0W
1N4357	S	1M180ZS10 &	1N4728	DZ						180	1.4	20	1.0W
1N4357A	S	1M180ZS10 &	1N4728	DZ						180	1.4	10	1.0W
1N4357B	S	1M180ZS5 &	1N4728	DZ						180	1.4	5.0	1.0W
1N4358	S	1M200ZS10 &	1N4728	DZ						200	1.2	20	1.0W
1N4358A	S	1M200ZS10 &	1N4728	DZ						200	1.2	10	1.0W
1N4358B	S	1M200ZS5 &	1N4728	DZ						200	1.2	5.0	1.0W
1N4359	S			DS	200								
1N4360	S	1N4370A*	1N746	DZ						2.4	10	5.0	0.25W
1N4361	S	1N4007	1N4001	R	900	1.3	0.5	0.5	20				
1N4362	S			DS	100	0.9	0.1A	10N					
1N4363	S			DS	120	1.0	0.2A	0.1*	40				
1N4364	S	1N4002	1N4001	R	100	1.5	0.75	0.1	20				
1N4365	S	1N4003	1N4001	R	200	1.5	0.75	0.1	20				
1N4366	S	1N4004	1N4001	R	300	1.5	0.75	0.1	20				
1N4367	S	1N4004	1N4001	R	400	1.5	0.75	0.1	20				
1N4368	S	1N4005	1N4001	R	500	1.5	0.75	0.1	20				
1N4369	S	1N4005	1N4001	R	600	1.5	0.75	0.1	20				
1N4370	S		1N746	DZ						2.4	20	10	0.4W
1N4370A	S		1N746	DZ						2.4	20	5.0	0.4W
1N4371	S		1N746	DZ						2.7	20	10	0.4W
1N4371A	S		1N746	DZ						2.7	20	5.0	0.4W
1N4372	S		1N746	DZ						3.0	20	10	0.4W
1N4372A	S		1N746	DZ						3.0	20	5.0	0.4W
1N4373	S			DS	80	1.0	10M	5.0*	4.0				
1N4374	S	MR991A	MR990A	R	1500	1.75	0.75	0.1	15				
1N4375	S			DS	50	1.0	20M	10N	6.0				
1N4376	S			DS	10	1.1	50M	0.1*	0.75				
1N4377	S			R	25K	30	0.75	0.1	50				
1N4378	S	Photosensitive Device; $I_{(dark)}$ = 10 nA, Sensitivity = 9.0 mA @ V_{CE} = 5.0 V, H = 9.0 mW/cm^2											
1N4379	S	Microwave S-band Detector											
1N4380	S			DS	50	1.4	570M	50N	1.8				
1N4381	G			DS	25	0.35	2.0M	0.1M	0.1				
1N4382	S			DS	55	1.0	0.3A	0.1*	6.5				
1N4383	S	1N4003	1N4001	R	200	1.3	1.0	0.275	50				
1N4384	S	1N4004	1N4001	R	400	1.3	1.0	0.25	50				
1N4385	S	1N4005	1N4001	R	600	1.3	1.0	0.225	50				
1N4387 } 1N4388 }		Varactor Diodes, see Table on Page 1-94											
1N4389	S			DS	5.0	1.0	2.0M	0.1M					
1N4390	S			DS	20	1.0	5.0M	0.2*	0.5				
1N4391	S			DS	20	1.0	2.0M	0.2*	0.5				
1N4392	S			DS	15	1.0	2.0M	1.0*	0.5				
1N4393, A,B thru 1N4399, A,B		Tunnel Diodes, see Table on Page 1-104											
1N4400	S	1N4736	1N4728	DZ						6.8	37	20	1.0W
1N4401	S	1N4737	1N4728	DZ						7.5	34	20	1.0W
1N4402	S	1N4738	1N4728	DZ						8.2	31	20	1.0W
1N4403	S	1N4739	1N4728	DZ						9.1	28	20	1.0W
1N4404	S	1N4740	1N4728	DZ						10	25	20	1.0W
1N4405	S	1N4741	1N4728	DZ						11	23	20	1.0W

Replacement * denotes exact device type replacement available on request.

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N4406	S	1N4742	1N4728	DZ						12	21	20	1.0W
1N4407	S	1N4743	1N4728	DZ						13	19	20	1.0W
1N4408	S	1N4744	1N4728	DZ						15	17	20	1.0W
1N4409	S	1N4745	1N4728	DZ						16	19	20	1.0W
1N4410	S	1N4746	1N4728	DZ						18	14	20	1.0W
1N4411	S	1N4747	1N4728	DZ						20	13	20	1.0W
1N4412	S	1N4748	1N4728	DZ						22	12	20	1.0W
1N4413	S	1N4749	1N4728	DZ						24	11	20	1.0W
1N4414	S	1N4750	1N4728	DZ						27	9.5	20	1.0W
1N4415	S	1N4751	1N4728	DZ						30	8.5	20	1.0W
1N4416	S	1N4752	1N4728	DZ						33	7.5	20	1.0W
1N4417	S	1N4753	1N4728	DZ						36	7.0	20	1.0W
1N4418	S	1N4754	1N4728	DZ						39	6.5	20	1.0W
1N4419	S	1N4755	1N4728	DZ						43	6.0	20	1.0W
1N4420	S	1N4756	1N4728	DZ						47	5.5	20	1.0W
1N4421	S	1N4757	1N4728	DZ						51	5.0	20	1.0W
1N4422	S	1N4758	1N4728	DZ						56	4.5	20	1.0W
1N4423	S	1N4759	1N4728	DZ						62	4.0	20	1.0W
1N4424	S	1N4760	1N4728	DZ						68	3.7	20	1.0W
1N4425	S	1N4761	1N4728	DZ						75	3.3	20	1.0W
1N4426	S	1N4762	1N4728	DZ						82	3.0	20	1.0W
1N4427	S	1N4763	1N4728	DZ						91	2.8	20	1.0W
1N4428	S	1N4764	1N4728	DZ						100	2.5	20	1.0W
1N4429	S	1M110ZS10	1N4728	DZ						110	2.3	20	1.0W
1N4430	S	1M120ZS10 &	1N4728	DZ						120	2.0	20	1.0W
1N4431	S	1M130ZS10 &	1N4728	DZ						130	1.9	20	1.0W
1N4432	S	1M150ZS10 &	1N4728	DZ						150	1.7	20	1.0W
1N4433	S	1M160ZS10 &	1N4728	DZ						160	1.6	20	1.0W
1N4434	S	1M180ZS10 &	1N4728	DZ						180	1.4	20	1.0W
1N4435	S	1M200ZS10 &	1N4728	DZ						200	1.2	20	1.0W
1N4436	S			R	200	1.2	10	1.0	100				
1N4437	S			R	400	1.2	10	1.0	100				
1N4438	S			R	600	1.0	10	1.0	100				
1N4439	S			R	800	1.2	10	1.0	100				
1N4440	S			R	1000	1.2	10	1.0	100				
1N4441	S			R	1500	4.0	0.025	0.001	3.0				
1N4442	S			DS	30	1.0	0.1A	1.0N	1.0				
1N4443	S			DS	50	1.0	0.1A	2.0N	0.6				
1N4444	S			DS	50	1.0	0.1A	50N	7.0				
1N4445	S			DS	100	1.0	0.1A	50N	4.0				
1N4446	S			DS	75	1.0	20M	25N	4.0				
1N4447	S			DS	75	1.0	20M	25N	4.0				
1N4448	S			DS	75	0.72	5.0M	25N	4.0				
1N4449	S			DS	75	0.73	5.0M	25N	4.0				
1N4450	S			DS	30	0.92	0.1A	50N	4.0				
1N4451	S			DS	30	0.875	0.1A	50N	10				
1N4452	S			DS	30	1.2	1.0A	50N	50				
1N4453	S			DS	20	0.92	0.1A	50N					
1N4454	S			DS	75	1.0	10M	0.1*	2.0				
1N4455	S			DS	50	0.7	5.0M	0.1*					
1N4456	S			DS	35	1.0	0.15A	0.2*	1.5				
1N4457	S			DS	50	1.0	0.2A	0.2*	1.5				
1N4458	S			R	800	1.5	5.0	0.5	150				
1N4459	S			R	1000	1.5	5.0	0.5	150				
1N4460	S	1N4735A	1N4728	DZ						6.2	40	5.0	1.5W
1N4461	S	1N4736A	1N4728	DZ						6.8	37	5.0	1.5W
1N4462	S	1N4737A	1N4728	DZ						7.5	34	5.0	1.5W
1N4463	S	1N4738A	1N4728	DZ						8.2	31	5.0	1.5W
1N4464	S	1N4739A	1N4728	DZ						9.1	28	5.0	1.5W
1N4465	S	1N4740A	1N4728	DZ						10	25	5.0	1.5W
1N4466	S	1N4741A	1N4728	DZ						11	23	5.0	1.5W
1N4467	S	1N4742A	1N4728	DZ						12	21	5.0	1.5W
1N4468	S	1N4743A	1N4728	DZ						13	19	5.0	1.5W
1N4469	S	1N4744A	1N4728	DZ						15	17	5.0	1.5W
1N4470	S	1N4745A	1N4728	DZ						16	16	5.0	1.5W
1N4471	S	1N4746A	1N4728	DZ						18	14	5.0	1.5W
1N4472	S	1N4747A	1N4728	DZ						20	13	5.0	1.5W
1N4473	S	1N4748A	1N4728	DZ						22	12	5.0	1.5W
1N4474	S	1N4749A	1N4728	DZ						24	11	5.0	1.5W
1N4475	S	1N4750A	1N4728	DZ						27	9.5	5.0	1.5W
1N4476	S	1N4751A	1N4728	DZ						30	8.5	5.0	1.5W
1N4477	S	1N4752A	1N4728	DZ						33	7.5	5.0	1.5W
1N4478	S	1N4753A	1N4728	DZ						36	7.0	5.0	1.5W
1N4479	S	1N4754A	1N4728	DZ						39	6.5	5.0	1.5W
1N4480	S	1N4755A	1N4728	DZ						43	6.0	5.0	1.5W
1N4481	S	1N4756A	1N4728	DZ						47	5.5	5.0	1.5W
1N4482	S	1N4757A	1N4728	DZ						51	5.0	5.0	1.5W
1N4483	S	1N4758A	1N4728	DZ						56	4.5	5.0	1.5W
1N4484	S	1N4759A	1N4728	DZ						62	4.0	5.0	1.5W
1N4485	S	1N4760A	1N4728	DZ						68	3.7	5.0	1.5W
1N4486	S	1N4761A	1N4728	DZ						75	3.3	5.0	1.5W
1N4487	S	1N4762A	1N4728	DZ						82	3.0	5.0	1.5W

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N4488	S	1N4763A	1N4728	DZ						91	2.8	5.0	1.5W
1N4489	S	1N4764A	1N4728	DZ						100	2.5	5.0	1.5W
1N4490	S	1M110ZS5 &	1N4728	DZ						110	2.3	5.0	1.5W
1N4491	S	1M120ZS5 &	1N4728	DZ						120	2.0	5.0	1.5W
1N4492	S	1M130ZS5 &	1N4728	DZ						130	1.9	5.0	1.5W
1N4493	S	1M150ZS5 &	1N4728	DZ						150	1.7	5.0	1.5W
1N4494	S	1M160ZS5 &	1N4728	DZ						160	1.6	5.0	1.5W
1N4495	S	1M180ZS5 &	1N4728	DZ						180	1.4	5.0	1.5W
1N4496	S	1M200ZS5 &	1N4728	DZ						200	1.2	5.0	1.5W
1N4497	S			R	1600	3.0	0.75	0.1	35				
1N4498	S			R	3000	5.0	0.75	0.1	35				
1N4499	S	1N4735A	1N4728	DZ						6.2		5.0	1.0W
1N4500	S			DS	80	1.0	0.3A	0.1*	4.0				
1N4501	S			DR						7.4	0.01		-55/100
1N4502	G			DS	20	0.3	3.0M	10*					
1N4503	S	1N4752	1N4728	DZ						33	20	10	3.0W
1N4504	S	1N5388A	1N5333	DZ						200	4.0	10	3.0W
1N4505	S			R	6000	8.5	0.1	0.1	20				
1N4506	S			R	200	1.4	12	2.5	240				
1N4507	S			R	400	1.4	12	2.5	240				
1N4508	S			R	600	1.4	12	2.5	240				
1N4509	S			R	800	1.4	12	2.0	240				
1N4510	S			R	1000	1.4	12	1.75	240				
1N4511	S			R	1200	1.4	12	1.5	240				
1N4512	S			DS	10	0.777	5.0M	10N					
1N4513	S			R	2000	4.5	0.25	0.1	20				
1N4514	S			R	800	1.0	1.1	0.1	50				
1N4517	S			R	200	1.2	2.0	0.1	100				
1N4523	G			DS	15	1.0	0.1A	30*	8.0				
1N4524	G			DS	10	0.65	10M	12*	3.0				
1N4525	S			R	200	1.4	35	3.5	500				
1N4526	S			R	400	1.4	35	3.5	500				
1N4527	S			R	600	1.4	35	3.5	500				
1N4528	S			R	800	1.4	35	3.0	500				
1N4529	S			R	1000	1.4	35	2.5	500				
1N4530	S			R	1200	1.4	35	2.0	500				
1N4531	S			DS	75	1.0	10M	25N	4.0				
1N4532	S			DS	75	1.0	10M	0.1*	2.0				
1N4533	S			DS	40	0.88	20M	50N	2.0				
1N4534	S			DS	50	0.88	20M	50N	2.0				
1N4535	S	.5M3.4ZZS5		DZ						3.45	5.0	5.0	0.5W
1N4536	S			DS	25	1.0	30M	0.1*	2.0				
1N4537	S			R	1500	1.85	3.0	0.3	15				
1N4538	S			R	2000	1.85	3.0	0.3	15				
1N4539	S			R	2500	1.85	3.0	0.3	15				
1N4540	S			R	3000	1.85	3.0	0.3	15				
1N4541	S			DS	225	1.0	0.4A	20N					
1N4542	S			DS	400	1.0	0.4A	20N					
1N4543	S			DS	600	1.0	0.4A	20N					
1N4544	S			DS	800	1.0	0.4A	20N					
1N4545	S			DS	1000	1.0	400M	0.02*					
1N4546	S			R	25K	30	1.0	0.1	50				
1N4547	S			DS	25	1.0	25M	10N					
1N4548	S			DS	25	1.0	30M	0.1*	4.0				
1N4549	S		1N2804	DZ						3.9	3.2	20	50W
1N4549A	S		1N2804	DZ						3.9	3.2	10	50W
1N4549B	S		1N2804	DZ						3.9	3.2	5.0	50W
1N4550	S		1N2804	DZ						4.3	2900	20	50W
1N4550A	S		1N2804	DZ						4.3	2900	10	50W
1N4550B	S		1N2804	DZ						4.3	2900	5.0	50W
1N4551	S		1N2804	DZ						4.7	2600	20	50W
1N4551A	S		1N2804	DZ						4.7	2600	10	50W
1N4551B	S		1N2804	DZ						4.7	2600	5.0	50W
1N4552	S		1N2804	DZ						5.1	2400	20	50W
1N4552A	S		1N2804	DZ						5.1	2400	10	50W
1N4552B	S		1N2804	DZ						5.1	2400	5.0	50W
1N4553	S		1N2804	DZ						5.6	2200	20	50W
1N4553A	S		1N2804	DZ						5.6	2200	10	50W
1N4553B	S		1N2804	DZ						5.6	2200	5.0	50W
1N4554	S		1N2804	DZ						6.2	2000	20	50W
1N4554A	S		1N2804	DZ						6.2	2000	10	50W
1N4554B	S		1N2804	DZ						6.2	2000	5.0	50W
1N4555	S		1N2804	DZ						6.8	1800	20	50W
1N4555A	S		1N2804	DZ						6.8	1800	10	50W
1N4555B	S		1N2804	DZ						6.8	1800	5.0	50W
1N4556	S		1N2804	DZ						7.5	1600	20	50W
1N4556A	S		1N2804	DZ						7.5	1600	10	50W
1N4556B	S		1N2804	DZ						7.5	1600	5.0	50W
1N4557	S		1N2804	DZ						3.9	3200	20	50W
1N4557A	S		1N2804	DZ						3.9	3200	10	50W
1N4557B	S		1N2804	DZ						3.9	3200	5.0	50W
1N4558	S		1N2804	DZ						4.3	2900	20	50W

& See page 1-3 for ordering information.

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{surge} (Amps)	V_Z (min)	V_Z (nom) * / V_Z (max)	Tol V_Z %	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts)	@ I_F	I_R	t_{rr} (μs)	TC %/°C	V_Z	T (min) °C	T (max) °C
1N4558A	S		1N2804	DZ						4.3	2900	10	50W
1N4558B	S		1N2804	DZ						4.3	2900	5.0	50W
1N4559	S		1N2804	DZ						4.7	2800	20	50W
1N4559A	S		1N2804	DZ						4.7	2800	10	50W
1N4559B	S		1N2804	DZ						4.7	2800	5.0	50W
1N4560	S		1N2804	DZ						5.1	2400	20	50W
1N4560A	S		1N2804	DZ						5.1	2400	10	50W
1N4560B	S		1N2804	DZ						5.1	2400	5.0	50W
1N4561	S		1N2804	DZ						5.6	2200	20	50W
1N4561A	S		1N2804	DZ						5.6	2200	10	50W
1N4561B	S		1N2804	DZ						5.6	2200	5.0	50W
1N4562	S		1N2804	DZ						6.2	2000	20	50W
1N4562A	S		1N2804	DZ						6.2	2000	10	50W
1N4562B	S		1N2804	DZ						6.2	2000	5.0	50W
1N4563	S		1N2804	DZ						6.8	1800	20	50W
1N4563A	S		1N2804	DZ						6.8	1800	10	50W
1N4563B	S		1N2804	DZ						6.8	1800	5.0	50W
1N4564	S		1N2804	DZ						7.5	1600	20	50W
1N4564A	S		1N2804	DZ						7.5	1600	10	50W
1N4564B	S		1N2804	DZ						7.5	1600	5.0	50W
1N4565	S		1N4549	DR						6.4	0.01	0.5	0/75
1N4565A	S		1N4549	DR						6.4	0.01	0.5	-55/100
1N4566	S		1N4549	DR						6.4	0.005	0.5	0/75
1N4566A	S		1N4549	DR						6.4	0.005	0.5	-55/100
1N4567	S		1N4549	DR						6.4	0.002	0.5	0/75
1N4567A	S		1N4549	DR						6.4	0.002	0.5	-55/100
1N4568	S		1N4549	DR						6.4	0.001	0.5	0/76
1N4568A	S		1N4549	DR						6.4	0.001	0.5	-55/100
1N4569	S		1N4549	DR						6.4	0.0005	0.5	0/75
1N4569A	S		1N4549	DR						6.4	0.0005	0.5	-55/100
1N4570	S		1N4549	DR						6.4	0.01	1.0	0/75
1N4570A	S		1N4549	DR						6.4	0.01	1.0	-55/100
1N4571	S		1N4549	DR						6.4	0.005	1.0	0/75
1N4571A	S		1N4549	DR						6.4	0.005	1.0	-55/100
1N4572	S		1N4549	DR						6.4	0.002	1.0	0/75
1N4572A	S		1N4549	DR						6.4	0.002	1.0	-55/100
1N4573	S		1N4549	DR						6.4	0.001	1.0	0/75
1N4573A	S		1N4549	DR						6.4	0.001	1.0	-55/100
1N4574	S		1N4549	DR						6.4	0.0005	1.0	0/75
1N4574A	S		1N4549	DR						6.4	0.0005	1.0	-55/100
1N4575	S			DR						6.4	0.01	2.0	0/75
1N4575A	S			DR						6.4	0.01	2.0	-55/100
1N4576	S			DR						6.4	0.005	2.0	0/75
1N4576A	S			DR						6.4	0.005	2.0	-55/100
1N4577	S			DR						6.4	0.002	2.0	0/75
1N4577A	S			DR						6.4	0.002	2.0	-55/100
1N4578	S			DR						6.4	0.001	2.0	0/75
1N4578A	S			DR						6.4	0.001	2.0	-55/100
1N4579	S			DR						6.4	0.0005	2.0	0/75
1N4579A	S			DR						6.4	0.0005	2.0	-55/100
1N4580	S			DR						6.4	0.01	4.0	0/75
1N4580A	S			DR						6.4	0.01	4.0	-55/100
1N4581	S			DR						6.4	0.005	4.0	0/75
1N4581A	S			DR						6.4	0.005	4.0	-55/100
1N4582	S			DR						6.4	0.002	4.0	0/75
1N4582A	S			DR						6.4	0.002	4.0	-55/100
1N4583	S			DR						6.4	0.0001	4.0	0/75
1N4583A	S			DR						6.4	0.0001	4.0	-55/100
1N4584	S			DR						6.4	0.0005	4.0	0/75
1N4584A	S			DR						6.4	0.0005	4.0	-55/100
1N4585	S			R	800	1.3	1.0	0.2	50				
1N4586	S			R	1000	1.3	1.0	0.2	50				
1N4587	S	MR1221SB	MR1220	R	100	1.35	150	9.5	3000				
1N4588	S	MR1223SB	MR1220	R	200	1.35	150	9.5	3000				
1N4589	S	MR1225SB	MR1220	R	300	1.35	150	9.0	3000				
1N4590	S	MR1227SB	MR1220	R	400	1.35	150	9.0	3000				
1N4591	S	MR1228SB	MR1220	R	500	1.35	150	8.0	3000				
1N4592	S	MR1229SB	MR1220	R	600	1.35	150	6.5	3000				
1N4593	S			R	800	1.35	150	5.5	3000				
1N4594	S			R	1000	1.35	150	4.5	3000				
1N4595	S			R	1200	1.35	150	4.0	3000				
1N4596	S			R	1400	1.35	150	3.5	3000				
1N4597	S			R	5000	5.0	0.025		1.0				
1N4598 } 1N4599 }		Varactor Diodes, see Table on Page 1-94											
1N4600	S	Microwave Mixer: f = 13,300 MHz, NF = 9.5 dB											
1N4601	S	Microwave Mixer: f = 13,300 MHz, NF = 8.8 dB											
1N4602	S	Microwave Mixer: f = 13,300 MHz, NF = 8.0 dB											
1N4603	S	Microwave Mixer: f = 16,000 MHz, NF = 9.5 dB											
1N4604	S	Microwave Mixer: f = 16,000 MHz, NF = 8.8 dB											
1N4605	S	Microwave Mixer: f = 16,000 MHz, NF = 8.0 dB											

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts)	@ I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N4606	S			DS	70	1.0	0.2A	0.25*	6.0				
1N4607	S			DS	70	0.95	250M	0.25*	10				
1N4608	S			DS	70	0.96	350M	0.25*	10				
1N4609	S	Varactor Diode, see Table on Page 1-94											
1N4610	S			DS	55	1.1	0.3A	0.1*	2.0				
1N4611	S	1N4576A *	1N4549	DR						6.6	0.005	2.0	-50/175
1N4611A	S	1N4577A *	1N4549	DR						6.6	0.002	2.0	-50/175
1N4611B	S	1N4578A *	1N4549	DR						6.6	0.001	2.0	-50/175
1N4611C	S	1N4579A *	1N4549	DR						6.6	0.0005	2.0	-50/175
1N4612	S	1N4581A *	1N4549	DR						6.6	0.005	5.0	-50/175
1N4612A	S	1N4582A *	1N4549	DR						6.6	0.002	5.0	-50/175
1N4612B	S	1N4583A *	1N4549	DR						6.6	0.001	5.0	-50/175
1N4612C	S	1N4584A *	1N4549	DR						6.6	0.0005	5.0	-50/175
1N4613	S	1N4581A *	1N4549	DR						6.6	0.005	10	-50/175
1N4613A	S	1N4582A *	1N4549	DR						6.6	0.002	10	-50/175
1N4613B	S	1N4583A *	1N4549	DR						6.6	0.001	10	-50/175
1N4613C	S	1N4584A *	1N4549	DR						6.6	0.0005	10	-50/175
1N4614	S	MZ4614	1N4099	DZ						1.8	0.25	5.0	0.25W
1N4615	S	MZ4615	1N4099	DZ						2.0	0.25	5.0	0.25W
1N4616	S	MZ4616	1N4099	DZ						2.2	0.25	5.0	0.25W
1N4617	S	MZ4617	1N4099	DZ						2.4	0.25	5.0	0.25W
1N4618	S	MZ4618	1N4099	DZ						2.7	0.25	5.0	0.25W
1N4619	S	MZ4619	1N4099	DZ						3.0	0.25	5.0	0.25W
1N4620	S	MZ4620	1N4099	DZ						3.3	0.25	5.0	0.25W
1N4621	S	MZ4621	1N4099	DZ						3.6	0.25	5.0	0.25W
1N4622	S	MZ4622	1N4099	DZ						3.9	0.25	5.0	0.25W
1N4623	S	MZ4623	1N4099	DZ						4.3	0.25	5.0	0.25W
1N4624	S	MZ4624	1N4099	DZ						4.7	0.25	5.0	0.25W
1N4625	S	MZ4625	1N4099	DZ						5.1	0.25	5.0	0.25W
1N4626	S	MZ4626	1N4099	DZ						5.6	0.25	5.0	0.25W
1N4627	S	MZ4627	1N4099	DZ						6.2	0.25	5.0	0.25W
1N4628	S	1N4736A	1N4728	DZ						6.8	19	5.0	0.6W
1N4629	S	1N4737A	1N4728	DZ						7.5	17	5.0	0.6W
1N4630	S	1N4738A	1N4728	DZ						8.2	15	5.0	0.6W
1N4631	S	1N4739A	1N4728	DZ						9.1	14	5.0	0.6W
1N4632	S	1N4740A	1N4728	DZ						10	13	5.0	0.6W
1N4633	S	1N4741A	1N4728	DZ						11	12	5.0	0.6W
1N4634	S	1N4742A	1N4728	DZ						12	11	5.0	0.6W
1N4635	S	1N4743A	1N4728	DZ						13	9.5	5.0	0.6W
1N4636	S	1N4744A	1N4728	DZ						15	8.5	5.0	0.6W
1N4637	S	1N4745A	1N4728	DZ						16	7.8	5.0	0.6W
1N4638	S	1N4746A	1N4728	DZ						18	7.0	5.0	0.6W
1N4639	S	1N4747A	1N4728	DZ						20	6.2	5.0	0.6W
1N4640	S	1N4748A	1N4728	DZ						22	6.0	5.0	0.6W
1N4641	S	1N4749A	1N4728	DZ						24	5.2	5.0	0.6W
1N4642	S	1N4750A	1N4728	DZ						27	4.6	5.0	0.6W
1N4643	S	1N4751A	1N4728	DZ						30	4.2	5.0	0.6W
1N4644	S	1N4752A	1N4728	DZ						33	3.8	5.0	0.6W
1N4645	S	1N4753A	1N4728	DZ						36	3.4	5.0	0.6W
1N4646	S	1N4754A	1N4728	DZ						39	3.2	5.0	0.6W
1N4647	S	1N4755A	1N4728	DZ						43	3.0	5.0	0.6W
1N4648	S	1N4756A	1N4728	DZ						47	2.7	5.0	0.6W
1N4649	S	1N4728A	1N4728	DZ						3.3	10	5.0	1.0W
1N4650	S	1N4729A	1N4728	DZ						3.6	10	5.0	1.0W
1N4651	S	1N4730A	1N4728	DZ						3.9	64	5.0	1.0W
1N4652	S	1N4731A	1N4728	DZ						4.3	58	5.0	1.0W
1N4653	S	1N4732A	1N4728	DZ						4.7	53	5.0	1.0W
1N4654	S	1N4733A	1N4728	DZ						5.1	49	5.0	1.0W
1N4655	S	1N4734A	1N4728	DZ						5.6	45	5.0	1.0W
1N4656	S	1N4735A	1N4728	DZ						6.2	41	5.0	1.0W
1N4657	S	1N4736A	1N4728	DZ						6.8	37	5.0	1.0W
1N4658	S	1N4737A	1N4728	DZ						7.5	34	5.0	1.0W
1N4659	S	1N4738A	1N4728	DZ						8.2	31	5.0	1.0W
1N4660	S	1N4739A	1N4728	DZ						9.1	28	5.0	1.0W
1N4661	S	1N4740A	1N4728	DZ						10	25	5.0	1.0W
1N4662	S	1N4741A	1N4728	DZ						11	23	5.0	1.0W
1N4663	S	1N4742A	1N4728	DZ						12	21	5.0	1.0W
1N4664	S	1N4743A	1N4728	DZ						13	19	5.0	1.0W
1N4665	S	1N4744A	1N4728	DZ						15	17	5.0	1.0W
1N4666	S	1N4745A	1N4728	DZ						16	16	5.0	1.0W
1N4667	S	1N4746A	1N4728	DZ						18	14	5.0	1.0W
1N4668	S	1N4747A	1N4728	DZ						20	13	5.0	1.0W
1N4669	S	1N4748A	1N4728	DZ						22	12	5.0	1.0W
1N4670	S	1N4749A	1N4728	DZ						24	11	5.0	1.0W
1N4671	S	1N4750A	1N4728	DZ						27	9.5	5.0	1.0W
1N4672	S	1N4751A	1N4728	DZ						30	8.5	5.0	1.0W
1N4673	S	1N4752A	1N4728	DZ						33	7.5	5.0	1.0W
1N4674	S	1N4753A	1N4728	DZ						36	7.0	5.0	1.0W
1N4675	S	1N4754A	1N4728	DZ						39	6.5	5.0	1.0W
1N4676	S	1N4755A	1N4728	DZ						43	6.0	5.0	1.0W
1N4677	S	1N4756A	1N4728	DZ						47	5.5	5.0	1.0W

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F @ (volts)	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N4678	S	MZ4678		DZ						1.8	105	5.0	250
1N4679	S	MZ4679		DZ						2.0	105	5.0	250
1N4680	S	MZ4680		DZ						2.2	105	5.0	250
1N4681	S	MZ4681		DZ						2.4	105	5.0	250
1N4682	S	MZ4682		DZ						2.7	105	5.0	250
1N4683	S	MZ4683		DZ						3.0	105	5.0	250
1N4684	S	MZ4684		DZ						3.3	105	5.0	250
1N4685	S	MZ4685		DZ						3.6	105	5.0	250
1N4686	S	MZ4686		DZ						3.9	105	5.0	250
1N4687	S	MZ4687		DZ						4.3	105	5.0	250
1N4688	S	MZ4688		DZ						4.7	105	5.0	250
1N4689	S	MZ4689		DZ						5.1	105	5.0	250
1N4690	S	MZ4690		DZ						5.6	105	5.0	250
1N4691	S	MZ4691		DZ						6.2	105	5.0	250
1N4692	S	MZ4692		DZ						6.8	105	5.0	250
1N4693	S	MZ4693		DZ						7.5	105	5.0	250
1N4694	S	MZ4694		DZ						8.2	105	5.0	250
1N4695	S	MZ4695		DZ						8.7	105	5.0	250
1N4696	S	MZ4696		DZ						9.1	105	5.0	250
1N4697	S	MZ4697		DZ						10	105	5.0	250
1N4698	S	MZ4698		DZ						11	105	5.0	250
1N4699	S	MZ4699		DZ						12	105	5.0	250
1N4700	S	MZ4700		DZ						13	105	5.0	250
1N4701	S	MZ4701		DZ						14	105	5.0	250
1N4702	S	MZ4702		DZ						15	105	5.0	250
1N4703	S	MZ4703		DZ						16	105	5.0	250
1N4704	S	MZ4704		DZ						17	105	5.0	250
1N4705	S	MZ4705		DZ						18	105	5.0	250
1N4706	S	MZ4706		DZ						19	105	5.0	250
1N4707	S	MZ4707		DZ						20	105	5.0	250
1N4708	S	MZ4708		DZ						22	105	5.0	250
1N4709	S	MZ4709		DZ						24	105	5.0	250
1N4710	S	MZ4710		DZ						25	105	5.0	250
1N4711	S	MZ4711		DZ						27	105	5.0	250
1N4712	S	MZ4712		DZ						28	105	5.0	250
1N4713	S	MZ4713		DZ						30	105	5.0	250
1N4714	S	MZ4714		DZ						33	105	5.0	250
1N4715	S	MZ4715		DZ						36	105	5.0	250
1N4716	S	MZ4716		DZ						39	105	5.0	250
1N4717	S	MZ4717		DZ						40	105	5.0	250
1N4718	S			DS	50	1.2	0.75A	50*	180				
1N4719	S			R	50	1.0	3.0	1.5	300				
1N4720	S			R	100	1.0	3.0	1.5	300				
1N4721	S			R	200	1.0	3.0	1.5	300				
1N4722	S			R	400	1.0	3.0	1.5	300				
1N4723	S			R	600	1.0	3.0	1.5	300				
1N4724	S			R	800	1.0	3.0	1.5	300				
1N4725	S			R	1000	1.0	3.0	1.5	300				
1N4726	S			DS	20	0.85	10M	0.1*					
1N4727	S			DS	20	0.85	10M	0.1*					
1N4728	S		1N4728	DZ						3.3	76	10	1.0W
1N4728A	S		1N4728	DZ						3.3	76	5.0	1.0W
1N4729	S		1N4728	DZ						3.6	69	10	1.0W
1N4729A	S		1N4728	DZ						3.6	69	5.0	1.0W
1N4730	S		1N4728	DZ						3.9	64	10	1.0W
1N4730A	S		1N4728	DZ						3.9	64	5.0	1.0W
1N4731	S		1N4728	DZ						4.3	58	10	1.0W
1N4731A	S		1N4728	DZ						4.3	58	5.0	1.0W
1N4732	S		1N4728	DZ						4.7	53	10	1.0W
1N4732A	S		1N4728	DZ						4.7	53	5.0	1.0W
1N4733	S		1N4728	DZ						5.1	49	10	1.0W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N4733A	S		1N4728	DZ						5.1	49	5.0	1.0W
1N4734	S		1N4728	DZ						5.6	45	10	1.0W
1N4734A	S		1N4728	DZ						5.6	45	5.0	1.0W
1N4735	S		1N4728	DZ						6.2	41	10	1.0W
1N4735A	S		1N4728	DZ						6.2	41	5.0	1.0W
1N4736	S		1N4728	DZ						6.8	37	10	1.0W
1N4736A	S		1N4728	DZ						6.8	37	5.0	1.0W
1N4737	S		1N4728	DZ						7.5	34	10	1.0W
1N4737A	S		1N4728	DZ						7.5	34	5.0	1.0W
1N4738	S		1N4728	DZ						8.2	31	10	1.0W
1N4738A	S		1N4728	DZ						8.2	31	5.0	1.0W
1N4739	S		1N4728	DZ						9.1	28	10	1.0W
1N4739A	S		1N4728	DZ						9.1	28	5.0	1.0W
1N4740	S		1N4728	DZ						10	25	10	1.0W
1N4740A	S		1N4728	DZ						10	25	5.0	1.0W
1N4741	S		1N4728	DZ						11	23	10	1.0W
1N4741A	S		1N4728	DZ						11	23	5.0	1.0W
1N4742	S		1N4728	DZ						12	21	10	1.0W
1N4742A	S		1N4728	DZ						12	21	5.0	1.0W
1N4743	S		1N4728	DZ						13	19	10	1.0W
1N4743A	S		1N4728	DZ						13	19	5.0	1.0W
1N4744	S		1N4728	DZ						15	17	10	1.0W
1N4744A	S		1N4728	DZ						15	17	5.0	1.0W
1N4745	S		1N4728	DZ						16	15.5	10	1.0W
1N4745A	S		1N4728	DZ						16	15.5	5.0	1.0W
1N4746	S		1N4728	DZ						18	14	10	1.0W
1N4746A	S		1N4728	DZ						18	14	5.0	1.0W
1N4747	S		1N4728	DZ						20	12.5	10	1.0W
1N4747A	S		1N4728	DZ						20	12.5	5.0	1.0W
1N4748	S		1N4728	DZ						22	11.5	10	1.0W
1N4748A	S		1N4728	DZ						22	11.5	5.0	1.0W
1N4749	S		1N4728	DZ						24	10.5	10	1.0W
1N4749A	S		1N4728	DZ						24	10.5	5.0	1.0W
1N4750	S		1N4728	DZ						27	9.5	10	1.0W
1N4750A	S		1N4728	DZ						27	9.5	5.0	1.0W
1N4751	S		1N4728	DZ						30	8.5	10	1.0W
1N4751A	S		1N4728	DZ						30	8.5	5.0	1.0W
1N4752	S		1N4728	DZ						33	7.5	10	1.0W
1N4752A	S		1N4728	DZ						33	7.5	5.0	1.0W
1N4753	S		1N4728	DZ						36	7.0	10	1.0W
1N4753A	S		1N4728	DZ						36	7.0	5.0	1.0W
1N4754	S		1N4728	DZ						39	6.5	10	1.0W
1N4754A	S		1N4728	DZ						39	6.5	5.0	1.0W
1N4755	S		1N4728	DZ						43	6.0	10	1.0W
1N4755A	S		1N4728	DZ						43	6.0	5.0	1.0W
1N4756	S		1N4728	DZ						47	5.5	10	1.0W
1N4756A	S		1N4728	DZ						47	5.5	5.0	1.0W
1N4757	S		1N4728	DZ						51	5.0	10	1.0W
1N4757A	S		1N4728	DZ						51	5.0	5.0	1.0W
1N4758	S		1N4728	DZ						56	4.5	10	1.0W
1N4758A	S		1N4728	DZ						56	4.5	5.0	1.0W
1N4759	S		1N4728	DZ						62	4.0	10	1.0W
1N4759A	S		1N4728	DZ						62	4.0	5.0	1.0W
1N4760	S		1N4728	DZ						68	3.7	10	1.0W
1N4760A	S		1N4728	DZ						68	3.7	5.0	1.0W
1N4761	S		1N4728	DZ						75	3.3	10	1.0W
1N4761A	S		1N4728	DZ						75	3.3	5.0	1.0W
1N4762	S		1N4728	DZ						82	3.0	10	1.0W
1N4762A	S		1N4728	DZ						82	3.0	5.0	1.0W
1N4763	S		1N4728	DZ						91	2.8	10	1.0W
1N4763A	S		1N4728	DZ						91	2.8	5.0	1.0W
1N4764	S		1N4728	DZ						100	2.5	10	1.0W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol $V_{Z\pm\%}$	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N4764A	S		1N4728	DZ						100	2.4	5.0	1.0W
1N4765	S		1N4549	DR						9.1	0.01	0.5	0/75
1N4765A	S		1N4549	DR						9.1	0.01	0.5	-55/100
1N4766	S		1N4549	DR						9.1	0.005	0.5	0/75
1N4766A	S		1N4549	DR						9.1	0.005	0.5	-55/100
1N4767	S		1N4549	DR						9.1	0.002	0.5	0/75
1N4767A	S		1N4549	DR						9.1	0.002	0.5	-55/100
1N4768	S		1N4549	DR						9.1	0.001	0.5	0/75
1N4768A	S		1N4549	DR						9.1	0.001	0.5	-55/100
1N4769	S		1N4549	DR						9.1	0.0005	0.5	0/75
1N4769A	S		1N4549	DR						9.1	0.0005	0.5	-55/100
1N4770	S		1N4549	DR						9.1	0.01	1.0	0/75
1N4770A	S		1N4549	DR						9.1	0.01	1.0	-55/100
1N4771	S		1N4549	DR						9.1	0.005	1.0	0/75
1N4771A	S		1N4549	DR						9.1	0.005	1.0	-55/100
1N4772	S		1N4549	DR						9.1	0.002	1.0	0/75
1N4772A	S		1N4549	DR						9.1	0.002	1.0	-55/100
1N4773	S		1N4549	DR						9.1	0.001	1.0	0/75
1N4773A	S		1N4549	DR						9.1	0.001	1.0	-55/100
1N4774	S		1N4549	DR						9.1	0.0005	1.0	0/75
1N4774A	S		1N4549	DR						9.1	0.0005	1.0	-55/100
1N4775	S		1N4549	DR						8.5	0.01	0.5	0/75
1N4775A	S		1N4549	DR						8.5	0.01	0.5	-55/100
1N4776	S		1N4549	DR						8.5	0.005	0.5	0/75
1N4776A	S		1N4549	DR						8.5	0.005	0.5	-55/100
1N4777	S		1N4549	DR						8.5	0.002	0.5	0/75
1N4777A	S		1N4549	DR						8.5	0.002	0.5	-55/100
1N4778	S		1N4549	DR						8.5	0.001	0.5	0/75
1N4778A	S		1N4549	DR						8.5	0.001	0.5	-55/100
1N4779	S		1N4549	DR						8.5	0.0005	0.5	0/75
1N4779A	S		1N4549	DR						8.5	0.0005	0.5	-55/100
1N4780	S		1N4549	DR						8.5	0.01	1.0	0/75
1N4780A	S		1N4549	DR						8.5	0.01	1.0	-55/100
1N4781	S		1N4549	DR						8.5	0.005	1.0	0/75
1N4781A	S		1N4549	DR						8.5	0.005	1.0	-55/100
1N4782	S		1N4549	DR						8.5	0.002	1.0	0/75
1N4782A	S		1N4549	DR						8.5	0.002	1.0	-55/100
1N4783	S		1N4549	DR						8.5	0.001	1.0	0/75
1N4783A	S		1N4549	DR						8.5	0.001	1.0	-55/100
1N4784	S		1N4549	DR						8.5	0.0005	1.0	0/75
1N4784A	S		1N4549	DR						8.5	0.0005	1.0	-55/100
1N4786 thru 1N4815		Varactor Diodes, see Table on Page 1-94											
1N4816	S	1N4001	1N4001	R	50	1.3	1.5	0.25	50				
1N4817	S	1N4002	1N4001	R	100	1.3	1.5	0.25	50				
1N4818	S	1N4003	1N4001	R	200	1.3	1.5	0.25	50				
1N4819	S	1N4004	1N4001	R	300	1.3	1.5	0.25	50				
1N4820	S	1N4004	1N4001	R	400	1.3	1.5	0.25	50				
1N4821	S	1N4005	1N4001	R	500	1.3	1.5	0.25	50				
1N4822	S	1N4005	1N4001	R	600	1.3	1.5	0.25	50				
1N4823	S			R	100	1.25	1.0	1.0	35				
1N4824	S			R	200	1.25	1.0	1.0	35				
1N4825	S			R	400	1.25	1.0	1.0	35				
1N4826	S			R	600	1.25	1.0	1.0	35				
1N4827	G			DS	30	1.0	40M	15*	0.2				
1N4828	S			DS	20	1.1	0.1A	0.1*					
1N4829	S			DS	20	1.87	0.1A	0.1*					
1N4830	S			DS	20	2.69	0.1A	0.1*					
1N4831	S	1N4739	1N4728	DZ						9.1	28	20	1.2W
1N4831A	S	1N4739	1N4728	DZ						9.1	28	10	1.2W
1N4831B	S	1N4739A	1N4728	DZ						9.1	28	5.0	1.2W
1N4832	S	1N4740	1N4728	DZ						10	25	20	1.2W
1N4832A	S	1N4740	1N4728	DZ						10	25	10	1.2W
1N4832B	S	1N4740A	1N4728	DZ						10	25	5.0	1.2W
1N4833	S	1N4741	1N4728	DZ						11	23	20	1.2W
1N4833A	S	1N4741	1N4728	DZ						11	23	10	1.2W
1N4833B	S	1N4741A	1N4728	DZ						11	23	5.0	1.2W
1N4834	S	1N4742	1N4728	DZ						12	21	20	1.2W
1N4834A	S	1N4742	1N4728	DZ						12	21	10	1.2W
1N4834B	S	1N4742A	1N4728	DZ						12	21	5.0	1.2W
1N4835	S	1N4743	1N4728	DZ						13	19	20	1.2W
1N4835A	S	1N4743	1N4728	DZ						13	19	10	1.2W
1N4835B	S	1N4743A	1N4728	DZ						13	19	5.0	1.2W
1N4836	S	1N4744	1N4728	DZ						15	17	20	1.2W
1N4836A	S	1N4744	1N4728	DZ						15	17	10	1.2W
1N4836B	S	1N4744A	1N4728	DZ						15	17	5.0	1.2W
1N4837	S	1N4745	1N4728	DZ						16	16	20	1.2W
1N4837A	S	1N4745	1N4728	DZ						16	16	10	1.2W
1N4837B	S	1N4745A	1N4728	DZ						16	16	5.0	1.2W
1N4838	S	1N4746	1N4728	DZ						18	14	20	1.2W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts)	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: @ I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N4838A	S	1N4746	1N4728	DZ						18	14	10	1.2W
1N4838B	S	1N4746A	1N4728	DZ						18	14	5.0	1.2W
1N4839	S	1N4747	1N4728	DZ						20	19	20	1.2W
1N4839A	S	1N4747	1N4728	DZ						20	19	10	1.2W
1N4839B	S	1N4747A	1N4728	DZ						20	19	5.0	1.2W
1N4840	S	1N4748	1N4728	DZ						22	11	20	1.2W
1N4840A	S	1N4748	1N4728	DZ						22	11	10	1.2W
1N4840B	S	1N4748A	1N4728	DZ						22	11	5.0	1.2W
1N4841	S	1N4749	1N4728	DZ						24	11	20	1.2W
1N4841A	S	1N4749	1N4728	DZ						24	11	10	1.2W
1N4841B	S	1N4749A	1N4728	DZ						24	11	5.0	1.2W
1N4842	S	1N4750	1N4728	DZ						27	9.3	20	1.2W
1N4842A	S	1N4750	1N4728	DZ						27	9.3	10	1.2W
1N4842B	S	1N4750A	1N4728	DZ						27	9.3	5.0	1.2W
1N4843	S	1N4751	1N4728	DZ						30	8.3	20	1.2W
1N4843A	S	1N4751	1N4728	DZ						30	8.3	10	1.2W
1N4843B	S	1N4751A	1N4728	DZ						30	8.3	5.0	1.2W
1N4844	S	1N4752	1N4728	DZ						33	7.5	20	1.2W
1N4844A	S	1N4752	1N4728	DZ						33	7.5	10	1.2W
1N4844B	S	1N4752A	1N4728	DZ						33	7.5	5.0	1.2W
1N4845	S	1N4753	1N4728	DZ						36	7.0	20	1.2W
1N4845A	S	1N4753	1N4728	DZ						36	7.0	10	1.2W
1N4845B	S	1N4753A	1N4728	DZ						36	7.0	5.0	1.2W
1N4846	S	1N4754	1N4728	DZ						39	6.5	20	1.2W
1N4846A	S	1N4754	1N4728	DZ						39	6.5	10	1.2W
1N4846B	S	1N4754A	1N4728	DZ						39	6.5	5.0	1.2W
1N4847	S	1N4755	1N4728	DZ						43	5.8	20	1.2W
1N4847A	S	1N4755	1N4728	DZ						43	5.8	10	1.2W
1N4847B	S	1N4755A	1N4728	DZ						43	5.8	5.0	1.2W
1N4848	S	1N4756	1N4728	DZ						47	5.3	20	1.2W
1N4848A	S	1N4756	1N4728	DZ						47	5.3	10	1.2W
1N4848B	S	1N4756A	1N4728	DZ						47	5.3	5.0	1.2W
1N4849	S	1N4757	1N4728	DZ						51	5.0	20	1.2W
1N4849A	S	1N4757	1N4728	DZ						51	5.0	10	1.2W
1N4849B	S	1N4757A	1N4728	DZ						51	5.0	5.0	1.2W
1N4850	S	1N4758	1N4728	DZ						56	4.5	20	1.2W
1N4850A	S	1N4758	1N4728	DZ						56	4.5	10	1.2W
1N4850B	S	1N4758A	1N4728	DZ						56	4.5	5.0	1.2W
1N4851	S	1N4759	1N4728	DZ						62	4.0	20	1.2W
1N4851A	S	1N4759	1N4728	DZ						62	4.0	10	1.2W
1N4851B	S	1N4759A	1N4728	DZ						62	4.0	5.0	1.2W
1N4852	S	1N4760	1N4728	DZ						68	3.7	20	1.2W
1N4852A	S	1N4760	1N4728	DZ						68	3.7	10	1.2W
1N4852B	S	1N4760A	1N4728	DZ						68	3.7	5.0	1.2W
1N4853	S	1N4761	1N4728	DZ						75	3.3	20	1.2W
1N4853A	S	1N4761	1N4728	DZ						75	3.3	10	1.2W
1N4853B	S	1N4761A	1N4728	DZ						75	3.3	5.0	1.2W
1N4854	S	1N4762	1N4728	DZ						82	3.0	20	1.2W
1N4854A	S	1N4762	1N4728	DZ						82	3.0	10	1.2W
1N4854B	S	1N4762A	1N4728	DZ						82	3.0	5.0	1.2W
1N4855	S	1N4763	1N4728	DZ						91	2.8	20	1.2W
1N4855A	S	1N4763	1N4728	DZ						91	2.8	10	1.2W
1N4855B	S	1N5763A	1N4728	DZ						91	2.8	5.0	1.2W
1N4856	S	1N5764	1N4728	DZ						100	2.5	20	1.2W
1N4856A	S	1N5764	1N4728	DZ						100	2.5	10	1.2W
1N4856B	S	1N5764A	1N4728	DZ						100	2.5	5.0	1.2W
1N4857	S	1M110ZS10 &	1N4728	DZ						110	2.3	20	1.2W
1N4857A	S	1M110ZS10 &	1N4728	DZ						110	2.3	10	1.2W
1N4857B	S	1M110ZS5 &	1N4728	DZ						110	2.3	5.0	1.2W
1N4858	S	1M120ZS10 &	1N4728	DZ						120	1.2	20	1.2W
1N4858A	S	1M120ZS10 &	1N4728	DZ						120	1.2	10	1.2W
1N4858B	S	1M120ZS5 &	1N4728	DZ						120	1.2	5.0	1.2W
1N4859	S	1M130ZS10 &	1N4728	DZ						130	1.9	20	1.2W
1N4859A	S	1M130ZS10 &	1N4728	DZ						130	1.9	10	1.2W
1N4859B	S	1M130ZS5 &	1N4728	DZ						130	1.9	5.0	1.2W
1N4860	S	1M150ZS10 &	1N4728	DZ						150	1.7	20	1.2W
1N4860A	S	1M150ZS10 &	1N4728	DZ						150	1.7	10	1.2W
1N4860B	S	1M150ZS5 &	1N4728	DZ						150	1.7	5.0	1.2W
1N4861	S			DS	50	1.2	0.1A	2.0N	1.0				
1N4862	S			DS	50	1.1	0.1A	5.0N	1.0				
1N4863	S			DS	50	1.2	0.1A	50N	7.0				
1N4864	S			DS	80	1.1	0.1A	0.1*	9.0				
1N4865	S			R	1500	2.4	1.25	0.6	150				
1N4866	S			R	2500	3.6	1.25	0.6	150				
1N4867	S			R	3000	4.8	1.25	0.6	150				
1N4868	S			R	5000	8.4	1.25	0.6	150				
1N4869	S			R	7500	12	1.25	0.6	150				
1N4870	S			R	10K	16	1.25	0.6	150				
1N4871	S			R	12K	18	1.25	0.6	150				
1N4872	S			R	15K	23	1.25	0.6	150				
1N4873	S			R	20K	30	1.25	0.6	150				
1N4874	S			R	25K	38	1.25	0.6	150				

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts)	RECTIFIERS: V_F (volts)	RECTIFIERS: I_O (Amps)	RECTIFIERS: I_R (mA)	RECTIFIERS: I_{FSM}	ZENER DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA	ZENER DIODES: Tol V_Z±%	ZENER DIODES: P_D
					SIGNAL DIODES: PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (μs)	REFERENCE DIODES: V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N4875	S			R	30K	46	1.25	0.6	150				
1N4876	S			R	40K	60	1.25	0.6	150				
1N4877	S			R	50K	76	1.25	0.6	150				
1N4878	S			R	100	1.3	100	5.0	1500				
1N4879	S	MR1221SB	MR1220	R	100	1.3	160	10	2200				
1N4880	S			R	100	1.2	250	10	4000				
1N4881	S	1N4747	1N4728	DZ						40	20	10	3.0W
1N4882	S	1N4753	1N4728	DZ						20	36	10	3.0W
1N4883	S	1N4742A	1N4728	DZ						65	12	5.0	3.0W
1N4884	S	1N4747A	1N4728	DZ						40	20	5.0	3.0W
1N4885 } 1N4886 }		Varactor Diodes, see Table on Page 1-94											
1N4887	S			R	75K	115	1.25	0.6	150				
1N4888	S			DS	12	1.0	20M	50N					
1N4889	S	1N3000B	1N2970	DZ						62	20	5.0	5.0W
1N4890	S	MZ640 *	MZ600	DR						6.35	0.001	7.5	25/100
1N4890A	S	MZ640 *	MZ600	DR						6.35	0.001	7.5	-55/100
1N4891	S	MZ640 *	MZ600	DR						6.35	0.0005	7.5	25/100
1N4891A	S	MZ640 *	MZ600	DR						6.35	0.0005	7.5	-55/100
1N4892	S	MZ620 *	MZ600	DR						6.35	0.001	7.5	25/100
1N4892A	S	MZ620 *	MZ600	DR						6.35	0.001	7.5	-55/100
1N4893	S	MZ620 *	MZ600	DR						6.35	0.0005	7.5	25/100
1N4893A	S	MZ620 *	MZ600	DR						6.35	0.0005	7.5	-55/100
1N4894	S	MZ610 *	MZ600	DR						6.35	0.001	7.5	25/100
1N4894A	S	MZ610 *	MZ600	DR						6.35	0.001	7.5	-55/100
1N4895	S	MZ610 *	MZ600	DR						6.35	0.0005	7.5	25/100
1N4895A	S	MZ610 *	MZ600	DR						6.35	0.0005	7.5	-55/100
1N4896	S		1N4765	DR						12.8	0.01	0.5	25/100
1N4896A	S		1N4765	DR						12.8	0.01	0.5	-55/100
1N4897	S		1N4765	DR						12.8	0.005	0.5	25/100
1N4897A	S		1N4765	DR						12.8	0.005	0.5	-55/100
1N4898	S		1N4765	DR						12.8	0.002	0.5	25/100
1N4898A	S		1N4765	DR						12.8	0.002	0.5	-55/100
1N4899	S		1N4765	DR						12.8	0.001	0.5	25/100
1N4899A	S		1N4765	DR						12.8	0.001	0.5	-55/100
1N4900	S		1N4765	DR						12.8	0.01	1.0	25/100
1N4900A	S		1N4765	DR						12.8	0.01	1.0	-55/100
1N4901	S		1N4765	DR						12.8	0.005	1.0	25/100
1N4901A	S		1N4765	DR						12.8	0.005	1.0	-55/100
1N4902	S		1N4765	DR						12.8	0.002	1.0	25/100
1N4902A	S		1N4765	DR						12.8	0.002	1.0	-55/100
1N4903	S		1N4765	DR						12.8	0.001	1.0	25/100
1N4903A	S		1N4765	DR						12.8	0.001	1.0	-55/100
1N4904	S		1N4765	DR						12.8	0.01	2.0	25/100
1N4904A	S		1N4765	DR						12.8	0.01	2.0	-55/100
1N4905	S		1N4765	DR						12.8	0.005	2.0	25/100
1N4905A	S		1N4765	DR						12.8	0.005	2.0	-55/100
1N4906	S		1N4765	DR						12.8	0.002	2.0	25/100
1N4906A	S		1N4765	DR						12.8	0.002	2.0	-55/100
1N4907	S		1N4765	DR						12.8	0.001	2.0	25/100
1N4907A	S		1N4765	DR						12.8	0.001	2.0	-55/100
1N4908	S		1N4765	DR						12.8	0.01	4.0	25/100
1N4908A	S		1N4765	DR						12.8	0.01	4.0	-55/100
1N4909	S		1N4765	DR						12.8	0.005	4.0	25/100
1N4909A	S		1N4765	DR						12.8	0.005	4.0	-55/100
1N4910	S		1N4765	DR						12.8	0.002	4.0	25/100
1N4910A	S		1N4765	DR						12.8	0.002	4.0	-55/100
1N4911	S		1N4765	DR						12.8	0.001	4.0	25/100
1N4911A	S		1N4765	DR						12.8	0.001	4.0	-55/100
1N4912	S		1N4765	DR						12.8	0.01	7.5	25/100
1N4912A	S		1N4765	DR						12.8	0.01	7.5	-55/100
1N4913	S		1N4765	DR						12.8	0.005	7.5	25/100
1N4913A	S		1N4765	DR						12.8	0.005	7.5	-55/100
1N4914	S		1N4765	DR						12.8	0.002	7.5	25/100
1N4914A	S		1N4765	DR						12.8	0.002	7.5	-55/100
1N4915	S		1N4765	DR						12.8	0.001	7.5	25/100
1N4915A	S		1N4765	DR						12.8	0.001	7.5	-55/100
1N4916	S		1N4765	DR						19.2	0.01	0.5	25/100
1N4916A	S		1N4765	DR						19.2	0.01	0.5	-55/100
1N4917	S		1N4765	DR						19.2	0.005	0.5	25/100
1N4917A	S		1N4765	DR						19.2	0.005	0.5	-55/100
1N4918	S		1N4765	DR						19.2	0.002	0.5	25/100
1N4918A	S		1N4765	DR						19.2	0.002	0.5	-55/100
1N4919	S		1N4765	DR						19.2	0.01	1.0	25/100
1N4919A	S		1N4765	DR						19.2	0.01	1.0	-55/100
1N4920	S		1N4765	DR						19.2	0.005	1.0	25/100
1N4920A	S		1N4765	DR						19.2	0.005	1.0	-55/100
1N4921	S		1N4765	DR						19.2	0.002	1.0	25/100
1N4921A	S		1N4765	DR						19.2	0.002	1.0	-55/100
1N4922	S		1N4765	DR						19.2	0.01	2.0	25/100
1N4922A	S		1N4765	DR						19.2	0.01	2.0	-55/100

Replacement * denotes exact device type replacement available on request.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol $V_Z \pm\%$	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N4923	S		1N4765	DR						19.2	0.005	2.0	25/100
1N4923A	S		1N4765	DR						19.2	0.005	2.0	-55/100
1N4924	S		1N4765	DR						19.2	0.002	2.0	25/100
1N4924A	S		1N4765	DR						19.2	0.002	2.0	-55/100
1N4925	S		1N4765	DR						19.2	0.01	4.0	25/100
1N4925A	S		1N4765	DR						19.2	0.01	4.0	-55/100
1N4926	S		1N4765	DR						19.2	0.005	4.0	25/100
1N4926A	S		1N4765	DR						19.2	0.005	4.0	-55/100
1N4927	S		1N4765	DR						19.2	0.002	4.0	25/100
1N4927A	S		1N4765	DR						19.2	0.002	4.0	-55/100
1N4928	S		1N4765	DR						19.2	0.001	4.0	25/100
1N4928A	S		1N4765	DR						19.2	0.001	4.0	-55/100
1N4929	S		1N4765	DR						19.2	0.01	7.5	25/100
1N4929A	S		1N4765	DR						19.2	0.01	7.5	-55/100
1N4930	S		1N4765	DR						19.2	0.005	7.5	25/100
1N4930A	S		1N4765	DR						19.2	0.005	7.5	-55/100
1N4931	S		1N4765	DR						19.2	0.002	7.5	25/100
1N4931A	S		1N4765	DR						19.2	0.002	7.5	-55/100
1N4932	S		1N4765	DR						19.2	0.001	7.5	25/100
1N4932A	S		1N4765	DR						19.2	0.001	7.5	-55/100
1N4933	S		1N4933	·R	50	1.2	1.0	0.3	30				
1N4934	S		1N4933	·R	100	1.2	1.0	0.3	30				
1N4935	S		1N4933	·R	200	1.2	1.0	0.3	30				
1N4936	S		1N4933	·R	400	1.2	1.0	0.3	30				
1N4937	S		1N4933	·R	600	1.2	1.0	0.3	30				
1N4938	S			DS	200	1.0	0.1A	0.1*	50				
1N4939	G	Microwave Ka-band Mixer, NF = 10.5 dB											
1N4940	G	Microwave Ka-band Mixer, f = 9,375 MHz, NF = 6.5 dB											
1N4941		Varactor Diode, see Table on Page 1-94											
1N4942	S			DS	200	1.5	3.0	0.5M	150N				
1N4943	S			DS	300	1.5	3.0	0.5M	150N				
1N4944	S			DS	400	1.5	3.0	0.5M	150N				
1N4945	S			DS	500	1.5	3.0	0.5M	150N				
1N4946	S			DS	600	1.5	3.0	0.5M	250N				
1N4947	S			DS	800	1.5	3.0	0.5M	300N				
1N4948	S			DS	1000	1.5	3.0	0.5M	500N				
1N4950	S			DS	25	0.53	1.0M	0.1M					
1N4951	S			DS	20	0.85	1.0M	0.1*					
1N4952	S			DS	50	0.85	1.0M	0.1*					
1N4954	S	1N5342B	1N5333	DZ						6.8	175	5.0	3.0W
1N4955	S	1N5343B	1N5333	DZ						7.5	175	5.0	3.0W
1N4956	S	1N5344B	1N5333	DZ						8.2	150	5.0	3.0W
1N4957	S	1N5346B	1N5333	DZ						9.1	150	5.0	3.0W
1N4958	S	1N5347B	1N5333	DZ						10	125	5.0	3.0W
1N4959	S	1N5348B	1N5333	DZ						11	120	5.0	3.0W
1N4960	S	1N5349B	1N5333	DZ						12	100	5.0	3.0W
1N4961	S	1N5350B	1N5333	DZ						13	100	5.0	3.0W
1N4962	S	1N5352B	1N5333	DZ						15	75	5.0	3.0W
1N4963	S	1N5353B	1N5333	DZ						16	5.0	5.0	3.0W
1N4964	S	1N5355B	1N5333	DZ						18	65	5.0	3.0W
1N4965	S	1N5357B	1N5333	DZ						20	65	5.0	3.0W
1N4966	S	1N5358B	1N5333	DZ						22	50	5.0	3.0W
1N4967	S	1N5359B	1N5333	DZ						24	50	5.0	3.0W
1N4968	S	1N5361B	1N5333	DZ						27	50	5.0	3.0W
1N4969	S	1N5363B	1N5333	DZ						30	40	5.0	3.0W
1N4970	S	1N5364B	1N5333	DZ						33	40	5.0	3.0W
1N4971	S	1N5365B	1N5333	DZ						36	30	5.0	3.0W
1N4972	S	1N5366B	1N5333	DZ						39	30	5.0	3.0W
1N4973	S	1N5367B	1N5333	DZ						43	30	5.0	3.0W
1N4974	S	1N5368B	1N5333	DZ						47	25	5.0	3.0W
1N4975	S	1N5369B	1N5333	DZ						51	25	5.0	3.0W
1N4976	S	1N5370B	1N5333	DZ						56	20	5.0	3.0W
1N4977	S	1N5372B	1N5333	DZ						62	20	5.0	3.0W
1N4978	S	1N5373B	1N5333	DZ						68	20	5.0	3.0W
1N4979	S	1N5374B	1N5333	DZ						75	20	5.0	3.0W
1N4980	S	1N5375B	1N5333	DZ						82	15	5.0	3.0W
1N4981	S	1N5377B	1N5333	DZ						91	15	5.0	3.0W
1N4982	S	1N5378B	1N5333	DZ						100	12	5.0	3.0W
1N4983	S	1N5379B	1N5333	DZ						110	12	5.0	3.0W
1N4984	S	1N5380B	1N5333	DZ						120	10	5.0	3.0W
1N4985	S	1N5381B	1N5333	DZ						130	19	5.0	3.0W
1N4986	S	1N5383B	1N5333	DZ						150	8.0	5.0	3.0W
1N4987	S	1N5384B	1N5333	DZ						160	8.0	5.0	3.0W
1N4988	S	1N5386B	1N5333	DZ						180	5.0	5.0	3.0W
1N4989	S	1N5388B	1N5333	DZ						200	5.0	5.0	3.0W
1N4990	S	5M110ZSB5		DZ						220	5.0	5.0	3.0W
1N4991	S	5M180ZSB5		DZ						240	5.0	5.0	3.0W
1N4992	S	5M135ZSB5		DZ						270	5.0	5.0	3.0W
1N4993	S	5M150ZSB5		DZ						300	4.0	5.0	3.0W
1N4994	S	5M165ZSB5		DZ						330	4.0	5.0	3.0W
1N4995	S	5M180ZSB5		DZ						360	3.0	5.0	3.0W
1N4996	S	5M195ZSB5		DZ						390	3.0	5.0	3.0W

·R t_{rr} @ 200 ns

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N4997	S		1N4719	R	50	1.0	3.0	2.0	300				
1N4998	S		1N4719	R	100	1.0	3.0	2.0	300				
1N4999	S		1N4719	R	200	1.0	3.0	2.0	300				
1N5000	S		1N4719	R	400	1.0	3.0	2.0	300				
1N5001	S		1N4719	R	600	1.0	3.0	1.0	300				
1N5002	S		1N4719	R	800	1.0	3.0	1.0	300				
1N5003	S		1N4719	R	1000	1.0	3.0	1.0	300				
1N5004	S			R	100	1.3	1.0	1.0	35				
1N5005	S			R	200	1.3	1.0	1.0	35				
1N5006	S			R	400	1.3	1.0	1.0	35				
1N5007	S			R	600	1.3	1.0	1.0	35				
1N5008	S	1N4728	1N4728	DZ						3.3	189	10	2.5W
1N5008A	S	1N4728A	1N4728	DZ						3.3	189	5.0	2.5W
1N5009	S	1N4729	1N4728	DZ						3.6	173	10	2.5W
1N5009A	S	1N4729A	1N4728	DZ						3.6	173	5.0	2.5W
1N5010	S	1N4730	1N4728	DZ						3.9	160	10	2.5W
1N5010A	S	1N4730A	1N4728	DZ						3.9	160	5.0	2.5W
1N5011	S	1N4731	1N4728	DZ						4.3	145	10	2.5W
1N5011A	S	1N4731A	1N4728	DZ						4.3	145	5.0	2.5W
1N5012	S	1N4732	1N4728	DZ						4.7	133	10	2.5W
1N5012A	S	1N4732A	1N4728	DZ						4.7	133	5.0	2.5W
1N5013	S	1N4733	1N4728	DZ						5.1	122	10	2.5W
1N5013A	S	1N4733A	1N4728	DZ						5.1	122	5.0	2.5W
1N5014	S	1N4734	1N4728	DZ						5.6	111	10	2.5W
1N5014A	S	1N4734A	1N4728	DZ						5.6	111	5.0	2.5W
1N5015	S	1N4735	1N4728	DZ						6.2	104	10	2.5W
1N5015A	S	1N4735A	1N4728	DZ						6.2	104	5.0	2.5W
1N5016	S	1N4736	1N4728	DZ						6.8	92	10	2.5W
1N5016A	S	1N4736A	1N4728	DZ						6.8	92	5.0	2.5W
1N5017	S	1N4737	1N4728	DZ						7.5	83	10	2.5W
1N5017A	S	1N4737A	1N4728	DZ						7.5	83	5.0	2.5W
1N5018	S	1N4738	1N4728	DZ						8.2	76	10	2.5W
1N5018A	S	1N4738A	1N4728	DZ						8.2	76	5.0	2.5W
1N5019	S	1N4739	1N4728	DZ						9.1	69	10	2.5W
1N5019A	S	1N4739A	1N4728	DZ						9.1	69	5.0	2.5W
1N5020	S	1N4740	1N4728	DZ						10	62	10	2.5W
1N5020A	S	1N4740A	1N4728	DZ						10	62	5.0	2.5W
1N5021	S	1N4741	1N4728	DZ						11	57	10	2.5W
1N5021A	S	1N4741A	1N4728	DZ						11	57	5.0	2.5W
1N5022	S	1N4742	1N4728	DZ						12	52	10	2.5W
1N5022A	S	1N4742A	1N4728	DZ						12	52	5.0	2.5W
1N5023	S	1N4743	1N4728	DZ						13	48	10	2.5W
1N5023A	S	1N4743A	1N4728	DZ						13	48	5.0	2.5W
1N5024	S	1M14ZS10		DZ						14	45	10	2.5W
1N5024A	S	1M14ZS5		DZ						14	45	5.0	2.5W
1N5025	S	1N4744	1N4728	DZ						15	42	10	2.5W
1N5025A	S	1N4744A	1N4728	DZ						15	42	5.0	2.5W
1N5026	S	1N4745	1N4728	DZ						16	39	10	2.5W
1N5026A	S	1N4745A	1N4728	DZ						16	39	5.0	2.5W
1N5027	S	1M17ZS10		DZ						17	37	10	2.5W
1N5027A	S	1M17ZS5		DZ						17	37	5.0	2.5W
1N5028	S	1N4746	1N4728	DZ						18	35	10	2.5W
1N5028A	S	1N4746A	1N4728	DZ						18	35	5.0	2.5W
1N5029	S	1M19ZS10		DZ						19	33	10	2.5W
1N5029A	S	1M19ZS5		DZ						19	33	5.0	2.5W
1N5030	S	1N4747	1N4728	DZ						20	31	10	2.5W
1N5030A	S	1N4747A	1N4728	DZ						20	31	5.0	2.5W
1N5031	S	1N4748	1N4728	DZ						22	28	10	2.5W
1N5031A	S	1N4748A	1N4728	DZ						22	28	5.0	2.5W
1N5032	S	1N4749	1N4728	DZ						24	26	10	2.5W
1N5032A	S	1N4749A	1N4728	DZ						24	26	5.0	2.5W
1N5033	S	1M25ZS10		DZ						25	25	10	2.5W
1N5033A	S	1M25ZS5		DZ						25	25	5.0	2.5W
1N5034	S	1N4750	1N4728	DZ						27	23	10	2.5W
1N5034A	S	1N4750A	1N4728	DZ						27	23	5.0	2.5W
1N5035	S	1N4751	1N4728	DZ						30	21	10	2.5W
1N5035A	S	1N4751A	1N4728	DZ						30	21	5.0	2.5W
1N5036	S	1N4752	1N4728	DZ						33	19	10	2.5W
1N5036A	S	1N4752A	1N4728	DZ						33	19	5.0	2.5W
1N5037	S	1N4753	1N4728	DZ						36	17	10	2.5W
1N5037A	S	1N4753A	1N4728	DZ						36	17	5.0	2.5W
1N5038	S	1N4754	1N4728	DZ						39	16	10	2.5W
1N5038A	S	1N4754A	1N4728	DZ						39	16	5.0	2.5W
1N5039	S	1N4755	1N4728	DZ						43	15	10	2.5W
1N5039A	S	1N4755A	1N4728	DZ						43	15	5.0	2.5W
1N5040	S	1M45ZS10		DZ						45	14	10	2.5W
1N5040A	S	1M45ZS5		DZ						45	14	5.0	2.5W
1N5041	S	1N4756	1N4728	DZ						47	13	10	2.5W
1N5041A	S	1N4756A	1N4728	DZ						47	13	5.0	2.5W
1N5042	S	1M50ZS10		DZ						50	12	10	2.5W
1N5042A	S	1M50ZS5		DZ						50	12	5.0	2.5W
1N5043	S	1N4757	1N4728	DZ						51	12	10	2.5W

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N5043A	S	1N4757A	1N4728	DZ						51	12	5.0	2.5W
1N5044	S	1M52ZS10	1N4728	DZ						52	12	10	2.5W
1N5044A	S	1M52ZS5	1N4728	DZ						52	12	5.0	2.5W
1N5045	S	1N4758	1N4728	DZ						56	11	10	2.5W
1N5045A	S	1N4758A	1N4728	DZ						56	11	5.0	2.5W
1N5046	S	1N4759	1N4728	DZ						62	10	10	2.5W
1N5046A	S	1N4759A	1N4728	DZ						62	10	5.0	2.5W
1N5047	S	1N4760	1N4728	DZ						68	9.2	10	2.5W
1N5047A	S	1N4760A	1N4728	DZ						68	9.2	5.0	2.5W
1N5048	S	1N4761	1N4728	DZ						75	8.3	10	2.5W
1N5048A	S	1N4761A	1N4728	DZ						75	8.3	5.0	2.5W
1N5049	S	1N4762	1N4728	DZ						82	7.6	10	2.5W
1N5049A	S	1N4762A	1N4728	DZ						82	7.6	5.0	2.5W
1N5050	S	1N4763	1N4728	DZ						91	6.9	10	2.5W
1N5050A	S	1N4763A	1N4728	DZ						91	6.9	5.0	2.5W
1N5051	S	1N4764	1N4728	DZ						100	6.2	10	2.5W
1N5051A	S	1N4764A	1N4728	DZ						100	6.2	5.0	2.5W
1N5052	S	1N4006	1N4001	R	700	1.3	1.5	0.5	50				
1N5053	S	1N4006	1N4001	R	800	1.3	1.5	0.5	50				
1N5054	S	1N4007	1N4001	R	1000	1.3	1.5	0.5	50				
1N5055	S			R	100	1.4	1.0	0.25	30				
1N5056	S			R	200	1.4	1.0	0.25	30				
1N5057	S			R	300	1.4	0.8	0.25	30				
1N5058	S			R	400	1.4	0.8	0.25	30				
1N5059	S	1N4003	1N4001	R	200	1.0	1.5	0.3	100				
1N5060	S	1N4004	1N4001	R	400	1.0	1.5	0.3	100				
1N5061	S	1N4005	1N4001	R	600	1.0	1.5	0.2	100				
1N5062	S	1N4006	1N4001	R	800	1.0	1.25	0.2	100				
1N5063	S	1N4736A	1N4728	DZ						6.8	75	5.0	3.0W
1N5064	S	1N4737A	1N4728	DZ						7.5	75	5.0	3.0W
1N5065	S	1N4738A	1N4728	DZ						8.2	75	5.0	3.0W
1N5066	S	1N4739A	1N4728	DZ						9.1	75	5.0	3.0W
1N5067	S	1N4740A	1N4728	DZ						10	75	5.0	3.0W
1N5068	S	1N4741A	1N4728	DZ						11	70	5.0	3.0W
1N5069	S	1N4743A	1N4728	DZ						13	50	5.0	3.0W
1N5070	S	1M14ZS5		DZ						14	50	5.0	3.0W
1N5071	S	1N4744A	1N4728	DZ						15	50	5.0	3.0W
1N5072	S	1N4745A	1N4728	DZ						16	50	5.0	3.0W
1N5073	S	1N4746A	1N4728	DZ						18	40	5.0	3.0W
1N5074	S	1N4748A	1N4728	DZ						22	30	5.0	3.0W
1N5075	S	1N4749A	1N4728	DZ						24	30	5.0	3.0W
1N5076	S	1N4750A	1N4728	DZ						27	25	5.0	3.0W
1N5077	S	1N4751A	1N4728	DZ						30	25	5.0	3.0W
1N5078	S	1N4752A	1N4728	DZ						33	20	5.0	3.0W
1N5079	S	1N4753A	1N4728	DZ						36	20	5.0	3.0W
1N5080	S	1N4754A	1N4728	DZ						39	20	5.0	3.0W
1N5081	S	1M40ZS5		DZ						40	20	5.0	3.0W
1N5082	S	1N4755A	1N4728	DZ						43	15	5.0	3.0W
1N5083	S	1M45ZS5		DZ						45	15	5.0	3.0W
1N5084	S	1N4756A	1N4728	DZ						47	15	5.0	3.0W
1N5085	S	1M50ZS5		DZ						50	15	5.0	3.0W
1N5086	S	1N4757A	1N4728	DZ						51	15	5.0	3.0W
1N5087	S	1N4758A	1N4728	DZ						56	10	5.0	3.0W
1N5088	S	1M60ZS5		DZ						60	10	5.0	3.0W
1N5089	S	1N4759A	1N4728	DZ						62	10	5.0	3.0W
1N5090	S	1N4760A		DZ						68	10	5.0	3.0W
1N5091	S	1M70ZS5		DZ						70	10	5.0	3.0W
1N5092	S	1N4761A	1N4728	DZ						75	10	5.0	3.0W
1N5093	S	1M80ZS5		DZ						80	10	5.0	3.0W
1N5094	S	1N4762A	1N4728	DZ						82	10	5.0	3.0W
1N5095	S	1N4763A	1N4728	DZ						91	8.0	5.0	3.0W
1N5096	S	1M110ZS5 &	1N4728	DZ						110	5.0	5.0	3.0W
1N5097	S	1M120ZS5 &	1N4728	DZ						120	5.0	5.0	3.0W
1N5098	S	1M130ZS5 &	1N4728	DZ						130	5.0	5.0	3.0W
1N5099	S	1M140ZS5 &	1N4728	DZ						140	5.0	5.0	3.0W
1N5100	S	1M160ZS5 &	1N4728	DZ						160	4.0	5.0	3.0W
1N5101	S	1M170ZS5 &	1N4728	DZ						170	4.0	5.0	3.0W
1N5102	S	1M180ZS5 &	1N4728	DZ						180	4.0	5.0	3.0W
1N5103	S	1M190ZS5 &	1N4728	DZ						190	4.0	5.0	3.0W
1N5104	S	1M200ZS5 &	1N4728	DZ						200	3.0	5.0	3.0W
1N5105	S	1M110ZSB5 &	1N4728	DZ						220	3.0	5.0	3.0W
1N5106	S	1M120ZSB5 &	1N4728	DZ						240	3.0	5.0	3.0W
1N5107	S	1M130ZSB5 &	1N4728	DZ						260	3.0	5.0	3.0W
1N5108	S	1M135ZSB5 &	1N4728	DZ						270	3.0	5.0	3.0W
1N5109	S	1M140ZSB5 &	1N4728	DZ						280	3.0	5.0	3.0W
1N5110	S	1M150ZSB5 &	1N4728	DZ						300	3.0	5.0	3.0W
1N5111	S	1M160ZSB5 &	1N4728	DZ						320	2.0	5.0	3.0W
1N5112	S	1M165ZSB5 &	1N4728	DZ						330	2.0	5.0	3.0W
1N5113	S	1M170ZSB5 &	1N4728	DZ						340	2.0	5.0	3.0W
1N5114	S	1M180ZSB5 &	1N4728	DZ						360	2.0	5.0	3.0W
1N5115	S	1M190ZSB5 &	1N4728	DZ						380	2.0	5.0	3.0W
1N5116	S	1M195ZSB5 &	1N4728	DZ						390	2.0	5.0	3.0W

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N5117	S	1M200ZSB5 &		DZ						400	2.0	5.0	3.0W
1N5118	S	1N5341B	1N5333	DZ						14	100	5.0	5.0W
1N5119	S	5M40ZS5 &		DZ						40	30	5.0	5.0W
1N5120	S	5M45ZS5 &		DZ						45	30	5.0	5.0W
1N5121	S	5M50ZS5 &		DZ						50	25	5.0	5.0W
1N5122	S	1N5371B	1N5333	DZ						60	20	5.0	5.0W
1N5123	S	5M70ZS5 &		DZ						70	20	5.0	5.0W
1N5124	S	5M80ZS5 &		DZ						80	15	5.0	5.0W
1N5125	S	5M90ZS5 &		DZ						90	15	5.0	5.0W
1N5126	S	1N5382B	1N5333	DZ						140	8.0	5.0	5.0W
1N5127	S	1N5385B	1N5333	DZ						170	8.0	5.0	5.0W
1N5128	S	1N5387B	1N5333	DZ						190	5.0	5.0	5.0W
1N5129	S	5M130ZSB5 &		DZ						260	5.0	5.0	5.0W
1N5130	S	5M140ZSB5 &		DZ						280	4.0	5.0	5.0W
1N5131	S	5M160ZSB5 &		DZ						320	4.0	5.0	5.0W
1N5132	S	5M170ZSB5 &		DZ						340	4.0	5.0	5.0W
1N5133	S	5M190ZSB5 &		DZ						380	3.0	5.0	5.0W
1N5134	S	5M200ZSB5 &		DZ							3.0	5.0	5.0W
1N5136 thru 1N5148		Varactor Diodes, see Table on Page 1-94											
1N5136A thru 1N5148A		Varactor Diodes, see Table on Page 1-94											
1N5150A 1N5152A 1N5153A		Varactor Diodes, see Table on Page 1-94											
1N5155A 1N5156 thru 1N5157		Varactor Diodes, see Table on Page 1-94											
1N5158 thru 1N5160		4-Layer Diodes, see Table on Page 1-108											
1N5163	S	Harmonic Generator											
1N5164		Harmonic Generator											
1N5165,A thru 1N5167,A		Hot Carrier Diodes											
1N5168		Hot Carrier Diode											
1N5169		Hot Carrier Diode											
1N5170	S			R	15	1.2	2.0	0.025	200				
1N5171	S			R	50	1.2	2.0	0.025	200				
1N5172	S			R	100	1.2	2.0	0.025	200				
1N5173	S			R	300	1.2	2.0	0.025	200				
1N5174	S			R	400	1.2	2.0	0.025	200				
1N5175	S			R	500	1.2	2.0	0.025	200				
1N5176	S			R	600	1.2	2.0	0.025	200				
1N5177	S			R	800	1.2	2.0	0.025	200				
1N5178	S			R	1000	1.2	2.0	0.025	200				
1N5179	S			DS		2.8	1.0	50	200				
1N5180	S			R	100	1.25	4.0	100	100				
1N5181	S			R	4000		0.6	0.02					
1N5182	S			R	5000		0.6	0.02					
1N5183	S			R	7500		0.6	0.02					
1N5184	S			R	10000		0.6	0.02					
1N5185	S			R	50	1.1	3.0	0.100	80				
1N5185A	S			R	50	1.1	4.0	0.022	80				
1N5186	S			R	100	1.1	3.0	0.100	80				
1N5186A	S			R	100	1.1	4.0	0.022	80				
1N5187	S			R	200	1.1	3.0	0.100	80				
1N5187A	S			R	200	1.1	4.0	0.022	80				
1N5188	S			R	400	1.1	3.0	0.100	80				
1N5188A	S			R	400	1.1	4.0	0.022	80				

& See page 1-3 for ordering information.

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N5189	S			R	500	1.1	3.0	0.100	80				
1N5189A	S			R	500	1.1	4.0	0.022	80				
1N5190	S			R	600	1.1	3.0	0.100	80				
1N5190A	S			R	600	1.1	4.0	0.022	80				
1N5197	S			R	50		2.0	0.1					
1N5198	S			R	100		2.0	0.1					
1N5199	S			R	200		2.0	0.1					
1N5200	S			R	400		2.0	0.1					
1N5201	S			R	600		2.0	0.1					
1N5206	S			R	400	1.1	2.0	0.003	25				
1N5207	S			R	400	1.25	4.0	0.005	100				
1N5211	S			R	200	1.2	1.0	0.2	50				
1N5212	S			R	400	1.2	1.0	0.2	50				
1N5213	S			R	600	1.2	1.0	0.2	50				
1N5214	S			R	800	1.2	0.75	0.2	50				
1N5215	S			R	200	1.2	1.0	0.2	50				
1N5216	S			R	400	1.2	1.0	0.2	50				
1N5217	S			R	600	1.2	1.0	0.2	50				
1N5218	S			R	800	1.2	0.75	0.2	50				
1N5219	S			DS	30	1.0	50	50	0.002				
1N5220	S			DS	30	1.2	50	50					
1N5221	S		1N5221	DZ						2.4	20	10	500M
1N5221A	S		1N5221	DZ						2.4	20	10	500M
1N5221B	S		1N5221	DZ						2.4	20	5.0	500M
1N5222	S		1N5221	DZ						2.5	20	10	500M
1N5222A	S		1N5221	DZ						2.5	20	10	500M
1N5222B	S		1N5221	DZ						2.5	20	5.0	500M
1N5223	S		1N5221	DZ						2.7	20	10	500M
1N5223A	S		1N5221	DZ						2.7	20	10	500M
1N5223B	S		1N5221	DZ						2.7	20	5.0	500M
1N5224	S		1N5221	DZ						2.8	20	10	500M
1N5224A	S		1N5221	DZ						2.8	20	10	500M
1N5224B	S		1N5221	DZ						2.8	20	5.0	500M
1N5225	S		1N5221	DZ						3.0	20	10	500M
1N5225A	S		1N5221	DZ						3.0	20	10	500M
1N5225B	S		1N5221	DZ						3.0	20	5.0	500M
1N5226	S		1N5221	DZ						3.3	20	10	500M
1N5226A	S		1N5221	DZ						3.3	20	10	500M
1N5226B	S		1N5221	DZ						3.3	20	5.0	500M
1N5227	S		1N5221	DZ						3.6	20	10	500M
1N5227A	S		1N5221	DZ						3.6	20	10	500M
1N5227B	S		1N5221	DZ						3.6	20	5.0	500M
1N5228	S		1N5221	DZ						3.9	20	10	500M
1N5228A	S		1N5221	DZ						3.9	20	10	500M
1N5228B	S		1N5221	DZ						3.9	20	5.0	500M
1N5229	S		1N5221	DZ						4.3	20	10	500M
1N5229A	S		1N5221	DZ						4.3	20	10	500M
1N5229B	S		1N5221	DZ						4.3	20	5.0	500M
1N5230	S		1N5221	DZ						4.7	20	10	500M
1N5230A	S		1N5221	DZ						4.7	20	10	500M
1N5230B	S		1N5221	DZ						4.7	20	5.0	500M
1N5231	S		1N5221	DZ						5.1	20	10	500M
1N5231A	S		1N5221	DZ						5.1	20	10	500M
1N5231B	S		1N5221	DZ						5.1	20	5.0	500M
1N5232	S		1N5221	DZ						5.6	20	10	500M
1N5232A	S		1N5221	DZ						5.6	20	10	500M
1N5232B	S		1N5221	DZ						5.6	20	5.0	500M
1N5233	S		1N5221	DZ						6.0	20	10	500M
1N5233A	S		1N5221	DZ						6.0	20	10	500M
1N5233B	S		1N5221	DZ						6.0	20	5.0	500M
1N5234	S		1N5221	DZ						6.2	20	10	500M
1N5234A	S		1N5221	DZ						6.2	20	10	500M

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F @ (volts)	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol $V_{Z\pm\%}$ / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N5234B	S		1N5221	DZ						6.2	20	5.0	500M
1N5235	S		1N5221	DZ						6.8	20	10	500M
1N5235A	S		1N5221	DZ						6.8	20	10	500M
1N5235B	S		1N5221	DZ						6.8	20	5.0	500M
1N5236	S		1N5221	DZ						7.5	20	10	500M
1N5236A	S		1N5221	DZ						7.5	20	10	500M
1N5236B	S		1N5221	DZ						7.5	20	5.0	500M
1N5237	S		1N5221	DZ						8.2	20	10	500M
1N5237A	S		1N5221	DZ						8.2	20	10	500M
1N5237B	S		1N5221	DZ						8.2	20	5.0	500M
1N5238	S		1N5221	DZ						8.7	20	10	500M
1N5238A	S		1N5221	DZ						8.7	20	10	500M
1N5238B	S		1N5221	DZ						8.7	20	5.0	500M
1N5239	S		1N5221	DZ						9.1	20	10	500M
1N5239A	S		1N5221	DZ						9.1	20	10	500M
1N5239B	S		1N5221	DZ						9.1	20	5.0	500M
1N5240	S		1N5221	DZ						10	20	10	500M
1N5240A	S		1N5221	DZ						10	20	10	500M
1N5240B	S		1N5221	DZ						10	20	5.0	500M
1N5241	S		1N5221	DZ						11	20	10	500M
1N5241A	S		1N5221	DZ						11	20	10	500M
1N5241B	S		1N5221	DZ						11	20	5.0	500M
1N5242	S		1N5221	DZ						12	20	10	500M
1N5242A	S		1N5221	DZ						12	20	10	500M
1N5242B	S		1N5221	DZ						12	20	5.0	500M
1N5243	S		1N5221	DZ						13	9.5	10	500M
1N5243A	S		1N5221	DZ						13	9.5	10	500M
1N5243B	S		1N5221	DZ						13	9.5	5.0	500M
1N5244	S		1N5221	DZ						14	9.0	10	500M
1N5244A	S		1N5221	DZ						14	9.0	10	500M
1N5244B	S		1N5221	DZ						14	9.0	5.0	500M
1N5245	S		1N5221	DZ						15	8.5	10	500M
1N5245A	S		1N5221	DZ						15	8.5	10	500M
1N5245B	S		1N5221	DZ						15	8.5	5.0	500M
1N5246	S		1N5221	DZ						16	7.8	10	500M
1N5246A	S		1N5221	DZ						16	7.8	10	500M
1N5246B	S		1N5221	DZ						16	7.8	5.0	500M
1N5247	S		1N5221	DZ						17	7.4	10	500M
1N5247A	S		1N5221	DZ						17	7.4	10	500M
1N5247B	S		1N5221	DZ						17	7.4	5.0	500M
1N5248	S		1N5221	DZ						18	7.0	10	500M
1N5248A	S		1N5221	DZ						18	7.0	10	500M
1N5248B	S		1N5221	DZ						18	7.0	5.0	500M
1N5249	S		1N5221	DZ						19	6.6	10	500M
1N5249A	S		1N5221	DZ						19	6.6	10	500M
1N5249B	S		1N5221	DZ						19	6.6	5.0	500M
1N5250	S		1N5221	DZ						20	6.2	10	500M
1N5250A	S		1N5221	DZ						20	6.2	10	500M
1N5250B	S		1N5221	DZ						20	6.2	5.0	500M
1N5251	S		1N5221	DZ						22	5.6	10	500M
1N5251A	S		1N5221	DZ						22	5.6	10	500M
1N5251B	S		1N5221	DZ						22	5.6	5.0	500M
1N5252	S		1N5221	DZ						24	5.2	10	500M
1N5252A	S		1N5221	DZ						24	5.2	10	500M
1N5252B	S		1N5221	DZ						24	5.2	5.0	500M
1N5253	S		1N5221	DZ						25	5.0	10	500M
1N5253A	S		1N5221	DZ						25	5.0	10	500M
1N5253B	S		1N5221	DZ						25	5.0	5.0	500M
1N5254	S		1N5221	DZ						27	4.6	10	500M
1N5254A	S		1N5221	DZ						27	4.6	10	500M
1N5254B	S		1N5221	DZ						27	4.6	5.0	500M
1N5255	S		1N5221	DZ						28	4.5	10	500M
1N5255A	S		1N5221	DZ						28	4.5	10	500M
1N5255B	S		1N5221	DZ						28	4.5	5.0	500M
1N5256	S		1N5221	DZ						30	4.2	10	500M
1N5256A	S		1N5221	DZ						30	4.2	10	500M
1N5256B	S		1N5221	DZ						30	4.2	5.0	500M
1N5257	S		1N5221	DZ						33	3.8	10	500M
1N5257A	S		1N5221	DZ						33	3.8	10	500M
1N5257B	S		1N5221	DZ						33	3.8	5.0	500M
1N5258	S		1N5221	DZ						36	3.4	10	500M
1N5258A	S		1N5221	DZ						36	3.4	10	500M
1N5258B	S		1N5221	DZ						36	3.4	5.0	500M
1N5259	S		1N5221	DZ						39	3.2	10	500M
1N5259A	S		1N5221	DZ						39	3.2	10	500M
1N5259B	S		1N5221	DZ						39	3.2	5.0	500M
1N5260	S		1N5221	DZ						43	3.0	10	500M
1N5260A	S		1N5221	DZ						43	3.0	10	500M
1N5260B	S		1N5221	DZ						43	3.0	5.0	500M
1N5261	S		1N5221	DZ						47	2.7	10	500M
1N5261A	S		1N5221	DZ						47	2.7	10	500M
1N5261B	S		1N5221	DZ						47	2.7	5.0	500M

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	ZENER DIODES: V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES: PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (μs)	REFERENCE DIODES: V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N5262	S		1N5221	DZ						51	2.5	10	500M
1N5262A	S		1N5221	DZ						51	2.5	10	500M
1N5262B	S		1N5221	DZ						51	2.5	5.0	500M
1N5263	S		1N5221	DZ						56	2.2	10	500M
1N5263A	S		1N5221	DZ						56	2.2	10	500M
1N5263B	S		1N5221	DZ						56	2.2	5.0	500M
1N5264	S		1N5221	DZ						60	2.1	10	500M
1N5264A	S		1N5221	DZ						60	2.1	10	500M
1N5264B	S		1N5221	DZ						60	2.1	5.0	500M
1N5265	S		1N5221	DZ						62	2.0	10	500M
1N5265A	S		1N5221	DZ						62	2.0	10	500M
1N5265B	S		1N5221	DZ						62	2.0	5.0	500M
1N5266	S		1N5221	DZ						68	1.8	10	500M
1N5266A	S		1N5221	DZ						68	1.8	10	500M
1N5266B	S		1N5221	DZ						68	1.8	5.0	500M
1N5267	S		1N5221	DZ						75	1.7	10	500M
1N5267A	S		1N5221	DZ						75	1.7	10	500M
1N5267B	S		1N5221	DZ						75	1.7	5.0	500M
1N5268	S		1N5221	DZ						82	1.5	10	500M
1N5268A	S		1N5221	DZ						82	1.5	10	500M
1N5268B	S		1N5221	DZ						82	1.5	5.0	500M
1N5269	S		1N5221	DZ						87	1.4	10	500M
1N5269A	S		1N5221	DZ						87	1.4	10	500M
1N5269B	S		1N5221	DZ						87	1.4	5.0	500M
1N5270	S		1N5221	DZ						91	1.4	10	500M
1N5270A	S		1N5221	DZ						91	1.4	10	500M
1N5270B	S		1N5221	DZ						91	1.4	5.0	500M
1N5271	S		1N5221	DZ						100	1.3	10	500M
1N5271A	S		1N5221	DZ						100	1.3	10	500M
1N5271B	S		1N5221	DZ						100	1.3	5.0	500M
1N5272	S		1N5221	DZ						110	1.1	10	500M
1N5272A	S		1N5221	DZ						110	1.1	10	500M
1N5272B	S		1N5221	DZ						110	1.1	5.0	500M
1N5273	S		1N5221	DZ						120	1.0	10	500M
1N5273A	S		1N5221	DZ						120	1.0	10	500M
1N5273B	S		1N5221	DZ						120	1.0	5.0	500M
1N5274	S		1N5221	DZ						130	0.95	10	500M
1N5274A	S		1N5221	DZ						130	0.95	10	500M
1N5274B	S		1N5221	DZ						130	0.95	5.0	500M
1N5275	S		1N5221	DZ						140	0.90	10	500M
1N5275A	S		1N5221	DZ						140	0.90	10	500M
1N5275B	S		1N5221	DZ						140	0.90	5.0	500M
1N5276	S		1N5221	DZ						150	0.85	10	500M
1N5276A	S		1N5221	DZ						150	0.85	10	500M
1N5276B	S		1N5221	DZ						150	0.85	5.0	500M
1N5277	S		1N5221	DZ						160	0.80	10	500M
1N5277A	S		1N5221	DZ						160	0.80	10	500M
1N5277B	S		1N5221	DZ						160	0.80	5.0	500M
1N5278	S		1N5221	DZ						170	0.74	10	500M
1N5278A	S		1N5221	DZ						170	0.74	10	500M
1N5278B	S		1N5221	DZ						170	0.74	5.0	500M
1N5279	S		1N5221	DZ						180	0.68	10	500M
1N5279A	S		1N5221	DZ						180	0.68	10	500M
1N5279B	S		1N5221	DZ						180	0.68	5.0	500M
1N5280	S		1N5221	DZ						190	0.66	10	500M
1N5280A	S		1N5221	DZ						190	0.66	10	500M
1N5280B	S		1N5221	DZ						190	0.66	5.0	500M
1N5281	S		1N5221	DZ						200	0.65	10	500M
1N5281A	S		1N5221	DZ						200	0.65	10	500M
1N5281B	S		1N5221	DZ						200	0.65	5.0	500M
1N5282	S			DS	55	1.3	500M	0.1*	0.004				
1N5283 thru 1N5314		Current Regulator Diodes, See Data Sheet											
1N5315	S			DS	75	0.49	0.1M	0.05*	0.004				
1N5316	S			DS	75	0.49	0.1M	0.05*	0.004				
1N5317	S			DS	55	1.17	500M	0.1*	0.004				
1N5318	S			DS	50	0.87	200M	0.1*	0.004				
1N5319	S			DS	25	1.0	100M	100*	0.004				
1N5320	S			R	100		1.0		20				
1N5324	S			R	15000	24	0.010	0.025	0.75				
1N5326	S			R	100		12		200				

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TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N5329	S			R	100		0.135	0.150	10				
1N5330	S			R	100		0.540	0.150	15				
1N5331	S			R	1200		12		240				
1N5332	S			R	1200		35		500				
1N5333	S		1N5333	DZ						3.3	380	20	5.0
1N5333A	S		1N5333	DZ						3.3	380	10	5.0
1N5333B	S		1N5333	DZ						3.3	380	5	5.0
1N5334	S		1N5333	DZ						3.6	350	20	5.0
1N5334A	S		1N5333	DZ						3.6	350	10	5.0
1N5334B	S		1N5333	DZ						3.6	350	5	5.0
1N5335	S		1N5333	DZ						3.9	320	20	5.0
1N5335A	S		1N5333	DZ						3.9	320	10	5.0
1N5335B	S		1N5333	DZ						3.9	320	5	5.0
1N5336	S		1N5333	DZ						4.3	290	20	5.0
1N5336A	S		1N5333	DZ						4.3	290	10	5.0
1N5336B	S		1N5333	DZ						4.3	290	5	5.0
1N5337	S		1N5333	DZ						4.7	260	20	5.0
1N5337A	S		1N5333	DZ						4.7	260	10	5.0
1N5337B	S		1N5333	DZ						4.7	260	5	5.0
1N5338	S		1N5333	DZ						5.1	240	20	5.0
1N5338A	S		1N5333	DZ						5.1	240	10	5.0
1N5338B	S		1N5333	DZ						5.1	240	5	5.0
1N5339	S		1N5333	DZ						5.6	220	20	5.0
1N5339A	S		1N5333	DZ						5.6	220	10	5.0
1N5339B	S		1N5333	DZ						5.6	220	5	5.0
1N5340	S		1N5333	DZ						6.0	200	20	5.0
1N5340A	S		1N5333	DZ						6.0	200	10	5.0
1N5340B	S		1N5333	DZ						6.0	200	5	5.0
1N5341	S		1N5333	DZ						6.2	200	20	5.0
1N5341A	S		1N5333	DZ						6.2	200	10	5.0
1N5341B	S		1N5333	DZ						6.2	200	5	5.0
1N5342	S		1N5333	DZ						6.8	175	20	5.0
1N5342A	S		1N5333	DZ						6.8	175	10	5.0
1N5342B	S		1N5333	DZ						6.8	175	5	5.0
1N5343	S		1N5333	DZ						7.5	175	20	5.0
1N5343A	S		1N5333	DZ						7.5	175	10	5.0
1N5343B	S		1N5333	DZ						7.5	175	5	5.0
1N5344	S		1N5333	DZ						8.2	150	20	5.0
1N5344A	S		1N5333	DZ						8.2	150	10	5.0
1N5344B	S		1N5333	DZ						8.2	150	5	5.0
1N5345	S		1N5333	DZ						8.7	150	20	5.0
1N5345A	S		1N5333	DZ						8.7	150	10	5.0
1N5345B	S		1N5333	DZ						8.7	150	5	5.0
1N5346	S		1N5333	DZ						9.1	150	20	5.0
1N5346A	S		1N5333	DZ						9.1	150	10	5.0
1N5346B	S		1N5333	DZ						9.1	150	5	5.0
1N5347	S		1N5333	DZ						10	125	20	5.0
1N5347A	S		1N5333	DZ						10	125	10	5.0
1N5347B	S		1N5333	DZ						10	125	5	5.0
1N5348	S		1N5333	DZ						11	125	20	5.0
1N5348A	S		1N5333	DZ						11	125	10	5.0
1N5348B	S		1N5333	DZ						11	125	5	5.0
1N5349	S		1N5333	DZ						12	100	20	5.0
1N5349A	S		1N5333	DZ						12	100	10	5.0
1N5349B	S		1N5333	DZ						12	100	5	5.0
1N5350	S		1N5333	DZ						13	100	20	5.0
1N5350A	S		1N5333	DZ						13	100	10	5.0
1N5350B	S		1N5333	DZ						13	100	5	5.0
1N5351	S		1N5333	DZ						14	100	20	5.0
1N5351A	S		1N5333	DZ						14	100	10	5.0
1N5351B	S		1N5333	DZ						14	100	5	5.0
1N5352	S		1N5333	DZ						15	75	20	5.0
1N5352A	S		1N5333	DZ						15	75	10	5.0
1N5352B	S		1N5333	DZ						15	75	5	5.0
1N5353	S		1N5333	DZ						16	75	20	5.0
1N5353A	S		1N5333	DZ						16	75	10	5.0
1N5353B	S		1N5333	DZ						16	75	5	5.0
1N5354	S		1N5333	DZ						17	70	20	5.0
1N5354A	S		1N5333	DZ						17	70	10	5.0
1N5354B	S		1N5333	DZ						17	70	5	5.0
1N5355	S		1N5333	DZ						18	65	20	5.0
1N5355A	S		1N5333	DZ						18	65	10	5.0

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	V_F (volts) / V_F @ (volts)	I_O (Amps) / I_F	I_R (mA) / I_R	I_{FSM} / t_{rr} (μs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	I_{ZT} mA / T_C %/°C	Tol V_Z±% / I_{ZT} mA	P_D / Temp Range
1N5355B	S		1N5333	DZ						18	65	5	5.0
1N5356	S		1N5333	DZ						19	65	20	5.0
1N5356A	S		1N5333	DZ						19	65	10	5.0
1N5356B	S		1N5333	DZ						19	65	5	5.0
1N5357	S		1N5333	DZ						20	65	20	5.0
1N5357A	S		1N5333	DZ						20	65	10	5.0
1N5357B	S		1N5333	DZ						20	65	5	5.0
1N5358	S		1N5333	DZ						22	50	20	5.0
1N5358A	S		1N5333	DZ						22	50	10	5.0
1N5358B	S		1N5333	DZ						22	50	5	5.0
1N5359	S		1N5333	DZ						24	50	20	5.0
1N5359A	S		1N5333	DZ						24	50	10	5.0
1N5359B	S		1N5333	DZ						24	50	5	5.0
1N5360	S		1N5333	DZ						25	50	20	5.0
1N5360A	S		1N5333	DZ						25	50	10	5.0
1N5360B	S		1N5333	DZ						25	50	5	5.0
1N5361	S		1N5333	DZ						27	50	20	5.0
1N5361A	S		1N5333	DZ						27	50	10	5.0
1N5361B	S		1N5333	DZ						27	50	5	5.0
1N5362	S		1N5333	DZ						28	50	20	5.0
1N5362A	S		1N5333	DZ						28	50	10	5.0
1N5362B	S		1N5333	DZ						28	50	5	5.0
1N5363	S		1N5333	DZ						30	40	20	5.0
1N5363A	S		1N5333	DZ						30	40	10	5.0
1N5363B	S		1N5333	DZ						30	40	5	5.0
1N5364	S		1N5333	DZ						33	40	20	5.0
1N5364A	S		1N5333	DZ						33	40	10	5.0
1N5364B	S		1N5333	DZ						33	40	5	5.0
1N5365	S		1N5333	DZ						36	30	20	5.0
1N5365A	S		1N5333	DZ						36	30	10	5.0
1N5365B	S		1N5333	DZ						36	30	5	5.0
1N5366	S		1N5333	DZ						39	30	20	5.0
1N5366A	S		1N5333	DZ						39	30	10	5.0
1N5366B	S		1N5333	DZ						39	30	5	5.0
1N5367	S		1N5333	DZ						43	30	20	5.0
1N5367A	S		1N5333	DZ						43	30	10	5.0
1N5367B	S		1N5333	DZ						43	30	5	5.0
1N5368	S		1N5333	DZ						47	25	20	5.0
1N5368A	S		1N5333	DZ						47	25	10	5.0
1N5368B	S		1N5333	DZ						47	25	5	5.0
1N5369	S		1N5333	DZ						51	25	20	5.0
1N5369A	S		1N5333	DZ						51	25	10	5.0
1N5369B	S		1N5333	DZ						51	25	5	5.0
1N5370	S		1N5333	DZ						56	20	20	5.0
1N5370A	S		1N5333	DZ						56	20	10	5.0
1N5370B	S		1N5333	DZ						56	20	5	5.0
1N5371	S		1N5333	DZ						60	20	20	5.0
1N5371A	S		1N5333	DZ						60	20	10	5.0
1N5371B	S		1N5333	DZ						60	20	5	5.0
1N5372	S		1N5333	DZ						62	20	20	5.0
1N5372A	S		1N5333	DZ						62	20	10	5.0
1N5372B	S		1N5333	DZ						62	20	5	5.0
1N5373	S		1N5333	DZ						68	20	20	5.0
1N5373A	S		1N5333	DZ						68	20	10	5.0
1N5373B	S		1N5333	DZ						68	20	5	5.0
1N5374	S		1N5333	DZ						75	20	20	5.0
1N5374A	S		1N5333	DZ						75	20	10	5.0
1N5374B	S		1N5333	DZ						75	20	5	5.0
1N5375	S		1N5333	DZ						82	15	20	5.0
1N5375A	S		1N5333	DZ						82	15	10	5.0
1N5375B	S		1N5333	DZ						82	15	5	5.0
1N5376	S		1N5333	DZ						87	15	20	5.0
1N5376A	S		1N5333	DZ						87	15	10	5.0
1N5376B	S		1N5333	DZ						87	15	5	5.0
1N5377	S		1N5333	DZ						91	15	20	5.0
1N5377A	S		1N5333	DZ						91	15	10	5.0
1N5377B	S		1N5333	DZ						91	15	5	5.0
1N5378	S		1N5333	DZ						100	12	20	5.0
1N5378A	S		1N5333	DZ						100	12	10	5.0
1N5378B	S		1N5333	DZ						100	12	5	5.0
1N5379	S		1N5333	DZ						110	12	20	5.0
1N5379A	S		1N5333	DZ						110	12	10	5.0
1N5379B	S		1N5333	DZ						110	12	5	5.0
1N5380	S		1N5333	DZ						120	10	20	5.0
1N5380A	S		1N5333	DZ						120	10	10	5.0
1N5380B	S		1N5333	DZ						120	10	5	5.0
1N5381	S		1N5333	DZ						130	10	20	5.0
1N5381A	S		1N5333	DZ						130	10	10	5.0
1N5381B	S		1N5333	DZ						130	10	5	5.0
1N5382	S		1N5333	DZ						140	8.0	20	5.0
1N5382A	S		1N5333	DZ						140	8.0	10	5.0
1N5382B	S		1N5333	DZ						140	8.0	5	5.0

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F (volts) @	I_F	I_R	t_{rr} (µs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N5383	S		1N5333	DZ						150	8.0	20	5.0
1N5383A	S		1N5333	DZ						150	8.0	10	5.0
1N5383B	S		1N5333	DZ						150	8.0	5	5.0
1N5384	S		1N5333	DZ						160	8.0	20	5.0
1N5384A	S		1N5333	DZ						160	8.0	10	5.0
1N5384B	S		1N5333	DZ						160	8.0	5	5.0
1N5385	S		1N5333	DZ						170	8.0	20	5.0
1N5385A	S		1N5333	DZ						170	8.0	10	5.0
1N5385B	S		1N5333	DZ						170	8.0	5	5.0
1N5386	S		1N5333	DZ						180	5.0	20	5.0
1N5386A	S		1N5333	DZ						180	5.0	10	5.0
1N5386B	S		1N5333	DZ						180	5.0	5	5.0
1N5387	S		1N5333	DZ						190	5.0	20	5.0
1N5387A	S		1N5333	DZ						190	5.0	10	5.0
1N5387B	S		1N5333	DZ						190	5.0	5	5.0
1N5388	S		1N5333	DZ						200	5.0	20	5.0
1N5388A	S		1N5333	DZ						200	5.0	.10	5.0
1N5388B	S		1N5333	DZ						200	5.0	5	5.0
1N5389	S			R	40,000	80	0.100	0.10	10				
1N5390		Hot Carrier Diode											
1N5391	S			R	50		1.5		50				
1N5392	S			R	100		1.5		50				
1N5393	S			R	200		1.5		50				
1N5394	S			R	300		1.5		50				
1N5395	S			R	400		1.5		50				
1N5396	S			R	500		1.5		50				
1N5397	S			R	600		1.5		50				
1N5398	S			R	800		1.5		50				
1N5399	S			R	1000		1.5		50				
1N5400	S			R	50		3.0		200				
1N5401	S			R	100		3.0		200				
1N5402	S			R	200		3.0		200				
1N5403	S			R	300		3.0		200				
1N5404	S			R	400		3.0		200				
1N5405	S			R	500		3.0		200				
1N5406	S			R	600		3.0		200				
1N5407	S			R	800		3.0		200				
1N5408	S			R	1000		3.0		200				
1N5409	S			R	175		40		1000				
1N5410	S			R	175		12		200				
1N5411	S	Diac (Trigger Diode)											
1N5412	S			DS	30	0.500	0.1M	100N	0.002				
1N5413	S			DS	55	0.500	0.1M	100N	0.002				
1N5414	S			DS	75	0.500	0.1M	100N	0.002				
1N5415	S			R	50				200				
1N5416	S			R	100				200				
1N5417	S			R	200				200				
1N5418	S			R	400				200				
1N5419	S			R	500				200				
1N5420	S			R	600				200				
1N5421 thru 1N5425		Varactor Diodes, see Table on Page 1-94											
1N5426	S			DS		1.0	40M	1.0*					
1N5427	S			DS		1.0	10M	0.10*	0.004				
1N5428	S			DS		1.0	100M	0.10*	0.050				
1N5429	S			DS		1.0	200M	0.005*					
1N5430	S			DS		1.0	200M	0.10*	0.004				
1N5431	S			DS		1.3	500M	0.10*	0.004				
1N5432	S			DS		1.3	50M	0.050*	0.75N				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol V_Z±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N5433	S			R	600		2.0		25				
1N5434	S			R	600		2.0		60				
1N5435	S			R	600		12		200				
1N5436													
1N5437		Microwave Mixers											
1N5438													
1N5439													
thru		Varactor Diodes, see Table on Page 1-94											
1N5476													
1N5477	S			R	6000		0.6	0.350	80				
1N5478	S			R	7200		0.6	0.350	80				
1N5479	S			R	8400		0.6	0.350	80				
1N5480	S			R	9600		0.6	0.350	80				
1N5481	S			R	12000		0.6	0.350	80				
1N5482	S			R	2400		1.0	0.350	80				
1N5483	S			R	3600		1.0	0.350	80				
1N5484	S			R	4800		1.0	0.350	80				
1N5485	S			R	6000		1.0	0.350	80				
1N5518	S		1N5518	DZ						3.3	20	20	400M
1N5518A	S		1N5518	DZ						3.3	20	10	400M
1N5518B	S		1N5518	DZ						3.3	20	5.0	400M
1N5518C	S			DZ						3.3	20	2.0	400M
1N5518D	S			DZ						3.3	20	1.0	400M
1N5519	S		1N5518	DZ						3.6	20	20	400M
1N5519A	S		1N5518	DZ						3.6	20	10	400M
1N5519B	S		1N5518	DZ						3.6	20	5.0	400M
1N5519C	S			DZ						3.6	20	2.0	400M
1N5519D	S			DZ						3.6	20	1.0	400M
1N5520	S		1N5518	DZ						3.9	20	20	400M
1N5520A	S		1N5518	DZ						3.9	20	10	400M
1N5520B	S		1N5518	DZ						3.9	20	5.0	400M
1N5520C	S			DZ						3.9	20	2.0	400M
1N5520D	S			DZ						3.9	20	1.0	400M
1N5521	S		1N5518	DZ						4.3	20	20	400M
1N5521A	S		1N5518	DZ						4.3	20	10	400M
1N5521B	S		1N5518	DZ						4.3	20	5.0	400M
1N5521C	S			DZ						4.3	20	2.0	400M
1N5521D	S			DZ						4.3	20	1.0	400M
1N5522	S		1N5518	DZ						4.7	10	20	400M
1N5522A	S		1N5518	DZ						4.7	10	10	400M
1N5522B	S		1N5518	DZ						4.7	10	5.0	400M
1N5522C	S			DZ						4.7	10	2.0	400M
1N5522D	S			DZ						4.7	10	1.0	400M
1N5523	S		1N5518	DZ						5.1	5.0	20	400M
1N5523A	S		1N5518	DZ						5.1	5.0	10	400M
1N5523B	S		1N5518	DZ						5.1	5.0	5.0	400M
1N5523C	S			DZ						5.1	5.0	2.0	400M
1N5523D	S			DZ						5.1	5.0	1.0	400M
1N5524	S		1N5518	DZ						5.6	3.0	20	400M
1N5524A	S		1N5518	DZ						5.6	3.0	10	400M
1N5524B	S		1N5518	DZ						5.6	3.0	5.0	400M
1N5524C	S			DZ						5.6	3.0	2.0	400M
1N5524D	S			DZ						5.6	3.0	1.0	400M
1N5525	S		1N5518	DZ						6.2	1.0	20	400M
1N5525A	S		1N5518	DZ						6.2	1.0	10	400M
1N5525B	S		1N5518	DZ						6.2	1.0	5.0	400M
1N5525C	S			DZ						6.2	1.0	2.0	400M
1N5525D	S			DZ						6.2	1.0	1.0	400M
1N5526	S		1N5518	DZ						6.8	1.0	20	400M
1N5526A	S		1N5518	DZ						6.8	1.0	10	400M
1N5526B	S		1N5518	DZ						6.8	1.0	5.0	400M
1N5526C	S			DZ						6.8	1.0	2.0	400M
1N5526D	S			DZ						6.8	1.0	1.0	400M
1N5527	S		1N5518	DZ						7.5	1.0	20	400M
1N5527A	S		1N5518	DZ						7.5	1.0	10	400M
1N5527B	S		1N5518	DZ						7.5	1.0	5.0	400M
1N5527C	S			DZ						7.5	1.0	2.0	400M
1N5527D	S			DZ						7.5	1.0	1.0	400M
1N5528	S		1N5518	DZ						8.2	1.0	20	400M
1N5528A	S		1N5518	DZ						8.2	1.0	10	400M
1N5528B	S		1N5518	DZ						8.2	1.0	5.0	400M
1N5528C	S			DZ						8.2	1.0	2.0	400M
1N5528D	S			DZ						8.2	1.0	1.0	400M
1N5529	S		1N5518	DZ						9.1	1.0	20	400M
1N5529A	S		1N5518	DZ						9.1	1.0	10	400M
1N5529B	S		1N5518	DZ						9.1	1.0	5.0	400M

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	ZENER DIODES V_Z(nom)	I_{ZT} mA	Tol $V_{Z\pm\%}$	P_D
					SIGNAL DIODES PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (µs)	REFERENCE DIODES V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N5529C	S			DZ						9.1	1.0	2.0	400M
1N5529D	S			DZ						9.1	1.0	1.0	400M
1N5530	S		1N5518	DZ						10	1.0	20	400M
1N5530A	S		1N5518	DZ						10	1.0	10	400M
1N5530B	S		1N5518	DZ						10	1.0	5.0	400M
1N5530C	S			DZ						10	1.0	2.0	400M
1N5530D	S			DZ						10	1.0	1.0	400M
1N5531	S		1N5518	DZ						11	1.0	20	400M
1N5531A	S		1N5518	DZ						11	1.0	10	400M
1N5531B	S		1N5518	DZ						11	1.0	5.0	400M
1N5531C	S			DZ						11	1.0	2.0	400M
1N5531D	S			DZ						11	1.0	1.0	400M
1N5532	S		1N5518	DZ						12	1.0	20	400M
1N5532A	S		1N5518	DZ						12	1.0	10	400M
1N5532B	S		1N5518	DZ						12	1.0	5.0	400M
1N5532C	S			DZ						12	1.0	2.0	400M
1N5532D	S			DZ						12	1.0	1.0	400M
1N5533	S		1N5518	DZ						13	1.0	20	400M
1N5533A	S		1N5518	DZ						13	1.0	10	400M
1N5533B	S		1N5518	DZ						13	1.0	5.0	400M
1N5533C	S			DZ						13	1.0	2.0	400M
1N5533D	S			DZ						13	1.0	1.0	400M
1N5534	S		1N5518	DZ						14	1.0	20	400M
1N5534A	S		1N5518	DZ						14	1.0	10	400M
1N5534B	S		1N5518	DZ						14	1.0	5.0	400M
1N5534C	S			DZ						14	1.0	2.0	400M
1N5534D	S			DZ						14	1.0	1.0	400M
1N5535	S		1N5518	DZ						15	1.0	20	400M
1N5535A	S		1N5518	DZ						15	1.0	10	400M
1N5535B	S		1N5518	DZ						15	1.0	5.0	400M
1N5535C	S			DZ						15	1.0	2.0	400M
1N5535D	S			DZ						15	1.0	1.0	400M
1N5536	S		1N5518	DZ						16	1.0	20	400M
1N5536A	S		1N5518	DZ						16	1.0	10	400M
1N5536B	S		1N5518	DZ						16	1.0	5.0	400M
1N5536C	S			DZ						16	1.0	2.0	400M
1N5536D	S			DZ						16	1.0	1.0	400M
1N5537	S		1N5518	DZ						17	1.0	20	400M
1N5537A	S		1N5518	DZ						17	1.0	10	400M
1N5537B	S		1N5518	DZ						17	1.0	5.0	400M
1N5537C	S			DZ						17	1.0	2.0	400M
1N5537D	S			DZ						17	1.0	1.0	400M
1N5538	S		1N5518	DZ						18	1.0	20	400M
1N5538A	S		1N5518	DZ						18	1.0	10	400M
1N5538B	S		1N5518	DZ						18	1.0	5.0	400M
1N5538C	S			DZ						18	1.0	2.0	400M
1N5538D	S			DZ						18	1.0	1.0	400M
1N5539	S		1N5518	DZ						19	1.0	20	400M
1N5539A	S		1N5518	DZ						19	1.0	10	400M
1N5539B	S		1N5518	DZ						19	1.0	5.0	400M
1N5539C	S			DZ						19	1.0	2.0	400M
1N5539D	S			DZ						19	1.0	1.0	400M
1N5540	S		1N5518	DZ						20	1.0	20	400M
1N5540A	S		1N5518	DZ						20	1.0	10	400M
1N5540B	S		1N5518	DZ						20	1.0	5.0	400M
1N5540C	S			DZ						20	1.0	2.0	400M
1N5540D	S			DZ						20	1.0	1.0	400M
1N5541	S		1N5518	DZ						22	1.0	20	400M
1N5541A	S		1N5518	DZ						22	1.0	10	400M
1N5541B	S		1N5518	DZ						22	1.0	5.0	400M
1N5541C	S			DZ						22	1.0	2.0	400M
1N5541D	S			DZ						22	1.0	1.0	400M
1N5542	S		1N5518	DZ						24	1.0	20	400M
1N5542A	S		1N5518	DZ						24	1.0	10	400M
1N5542B	S		1N5518	DZ						24	1.0	5.0	400M
1N5542C	S			DZ						24	1.0	2.0	400M
1N5542D	S			DZ						24	1.0	1.0	400M
1N5543	S		1N5518	DZ						25	1.0	20	400M
1N5543A	S		1N5518	DZ						25	1.0	10	400M
1N5543B	S		1N5518	DZ						25	1.0	5.0	400M
1N5543C	S			DZ						25	1.0	2.0	400M
1N5543D	S			DZ						25	1.0	1.0	400M
1N5544	S		1N5518	DZ						28	1.0	20	400M
1N5544A	S		1N5518	DZ						28	1.0	10	400M
1N5544B	S		1N5518	DZ						28	1.0	5.0	400M

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	RECTIFIERS: V_F (volts) / SIGNAL DIODES: V_F (volts) @	RECTIFIERS: I_O (Amps) / SIGNAL DIODES: I_F	RECTIFIERS: I_R (mA) / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} / SIGNAL DIODES: t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: T_C %/°C	ZENER DIODES: Tol V_Z±% / REFERENCE DIODES: I_{ZT} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
1N5544C	S			DZ						28	1.0	2.0	400M
1N5544D	S			DZ						28	1.0	1.0	400M
1N5545	S		1N5518	DZ						30	1.0	20	400M
1N5545A	S		1N5518	DZ						30	1.0	10	400M
1N5545B	S		1N5518	DZ						30	1.0	5.0	400M
1N5545C	S			DZ						30	1.0	2.0	400M
1N5545D	S			DZ						30	1.0	1.0	400M
1N5546	S		1N5518	DZ						33	1.0	20	400M
1N5546A	S		1N5518	DZ						33	1.0	10	400M
1N5546B	S		1N5518	DZ						33	1.0	5.0	400M
1N5546C	S			DZ						33	1.0	2.0	400M
1N5546D	S			DZ						33	1.0	1.0	400M
1N5550	S			R	200	1.0	3.0	0.025	150				
1N5551	S			R	400	1.0	3.0	0.025	150				
1N5552	S			R	600	1.0	3.0	0.025	150				
1N5553	S			R	800	1.1	3.0	0.025	150				
1N5554	S			R	1000	1.1	3.0	0.025	150				
1N5555 thru 1N5558	Transient Suppressors, see Table on Page 1-110												
1N5559	S			DZ						6.8	37	20	1.0W
1N5559A	S			DZ						6.8	37	10	1.0W
1N5559B	S			DZ						6.8	37	5.0	1.0W
1N5560	S			DZ						7.5	34	20	1.0W
1N5560A	S			DZ						7.5	34	10	1.0W
1N5560B	S			DZ						7.5	34	5.0	1.0W
1N5561	S			DZ						8.2	31	20	1.0W
1N5561A	S			DZ						8.2	31	10	1.0W
1N5561B	S			DZ						8.2	31	5.0	1.0W
1N5562	S			DZ						9.1	28	20	1.0W
1N5562A	S			DZ						9.1	28	10	1.0W
1N5562B	S			DZ						9.1	28	5.0	1.0W
1N5563	S			DZ						10	25	20	1.0W
1N5563A	S			DZ						10	25	10	1.0W
1N5563B	S			DZ						10	25	5.0	1.0W
1N5564	S			DZ						11	23	20	1.0W
1N5564A	S			DZ						11	23	10	1.0W
1N5564B	S			DZ						11	23	5.0	1.0W
1N5565	S			DZ						12	21	20	1.0W
1N5565A	S			DZ						12	21	10	1.0W
1N5565B	S			DZ						12	21	5.0	1.0W
1N5566	S			DZ						13	19	20	1.0W
1N5566A	S			DZ						13	19	10	1.0W
1N5566B	S			DZ						13	19	5.0	1.0W
1N5567	S			DZ						15	17	20	1.0W
1N5567A	S			DZ						15	17	10	1.0W
1N5567B	S			DZ						15	17	5.0	1.0W
1N5568	S			DZ						16	15	20	1.0W
1N5568A	S			DZ						16	15	10	1.0W
1N5568B	S			DZ						16	15	5.0	1.0W
1N5569	S			DZ						18	14	20	1.0W
1N5569A	S			DZ						18	14	10	1.0W
1N5569B	S			DZ						18	14	5.0	1.0W
1N5570	S			DZ						20	12	20	1.0W
1N5570A	S			DZ						20	12	10	1.0W
1N5570B	S			DZ						20	12	5.0	1.0W
1N5571	S			DZ						22	11	20	1.0W
1N5571A	S			DZ						22	11	10	1.0W
1N5571B	S			DZ						22	11	5.0	1.0W
1N5572	S			DZ						24	10	20	1.0W
1N5572A	S			DZ						24	10	10	1.0W
1N5572B	S			DZ						24	10	5.0	1.0W
1N5573	S			DZ						27	9.5	20	1.0W
1N5573A	S			DZ						27	9.5	10	1.0W
1N5573B	S			DZ						27	9.5	5.0	1.0W
1N5574	S			DZ						30	8.5	20	1.0W
1N5574A	S			DZ						30	8.5	10	1.0W
1N5574B	S			DZ						30	8.5	5.0	1.0W
1N5575	S			DZ						33	7.5	20	1.0W
1N5575A	S			DZ						33	7.5	10	1.0W
1N5575B	S			DZ						33	7.5	5.0	1.0W
1N5576	S			DZ						36	7.0	20	1.0W
1N5576A	S			DZ						36	7.0	10	1.0W
1N5576B	S			DZ						36	7.0	5.0	1.0W
1N5577	S			DZ						39	6.5	20	1.0W
1N5577A	S			DZ						39	6.5	10	1.0W
1N5577B	S			DZ						39	6.5	5.0	1.0W
1N5578	S			DZ						43	6.0	20	1.0W

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TYPE	MATERIAL	REPLACEMENT	PAGE NUMBER	IDENTIFICATION	RECTIFIERS: V_R (volts) / SIGNAL DIODES: PRV (volts)	V_F (volts) / V_F @	I_O (Amps) / I_F	I_R (mA) / I_R	I_{FSM} / t_{rr} (µs)	ZENER DIODES: V_Z(nom) / REFERENCE DIODES: V_Z(nom)	I_{ZT} mA / T_C %/°C	Tol V_Z±% / I_{ZT} mA	P_D / Temp Range
1N5578A	S			DZ						43	6.0	10	1.0W
1N5578B	S			DZ						43	6.0	5.0	1.0W
1N5579	S			DZ						47	5.5	20	1.0W
1N5579A	S			DZ						47	5.5	10	1.0W
1N5579B	S			DZ						47	5.5	5.0	1.0W
1N5580	S			DZ						51	5.0	20	1.0W
1N5580A	S			DZ						51	5.0	10	1.0W
1N5580B	S			DZ						51	5.0	5.0	1.0W
1N5581	S			DZ						56	4.5	20	1.0W
1N5581A	S			DZ						56	4.5	10	1.0W
1N5581B	S			DZ						56	4.5	5.0	1.0W
1N5582	S			DZ						62	4.0	20	1.0W
1N5582A	S			DZ						62	4.0	10	1.0W
1N5582B	S			DZ						62	4.0	5.0	1.0W
1N5583	S			DZ						68	3.7	20	1.0W
1N5583A	S			DZ						68	3.7	10	1.0W
1N5583B	S			DZ						68	3.7	5.0	1.0W
1N5584	S			DZ						75	3.3	20	1.0W
1N5584A	S			DZ						75	3.3	10	1.0W
1N5584B	S			DZ						75	3.3	5.0	1.0W
1N5585	S			DZ						82	3.0	20	1.0W
1N5585A	S			DZ						82	3.0	10	1.0W
1N5585B	S			DZ						82	3.0	5.0	1.0W
1N5586	S			DZ						91	2.8	20	1.0W
1N5586A	S			DZ						91	2.8	10	1.0W
1N5586B	S			DZ						91	2.8	5.0	1.0W
1N5587	S			DZ						100	2.5	20	1.0W
1N5587A	S			DZ						100	2.5	10	1.0W
1N5587B	S			DZ						100	2.5	5.0	1.0W
1N5588	S			DZ						110	2.3	20	1.0W
1N5588A	S			DZ						110	2.3	10	1.0W
1N5588B	S			DZ						110	2.3	5.0	1.0W
1N5589	S			DZ						120	2.0	20	1.0W
1N5589A	S			DZ						120	2.0	10	1.0W
1N5589B	S			DZ						120	2.0	5.0	1.0W
1N5590	S			DZ						130	1.9	20	1.0W
1N5590A	S			DZ						130	1.9	10	1.0W
1N5590B	S			DZ						130	1.9	5.0	1.0W
1N5591	S			DZ						150	1.7	20	1.0W
1N5591A	S			DZ						150	1.7	10	1.0W
1N5591B	S			DZ						150	1.7	5.0	1.0W
1N5592	S			DZ						160	1.6	20	1.0W
1N5592A	S			DZ						160	1.6	10	1.0W
1N5592B	S			DZ						160	1.6	5.0	1.0W
1N5593	S			DZ						180	1.4	20	1.0W
1N5593A	S			DZ						180	1.4	10	1.0W
1N5593B	S			DZ						180	1.4	5.0	1.0W
1N5594	S			DZ						200	1.2	20	1.0W
1N5594A	S			DZ						200	1.2	10	1.0W
1N5594B	S			DZ						200	1.2	5.0	1.0W
1N5595	S			R	5000	7.4	1.15	0.30	30				
1N5596	S			R	7500	11	0.87	0.30	30				
1N5597	S			R	10,000	14.5	0.70	0.30	30				
1N5598	S			R	15,000	23	0.47	0.30	30				
1N5599	S			R	2500	3.7	2.1	0.75	100				
1N5600	S			R	5000	7.4	1.4	0.75	100				
1N5601	S			R	7500	11	0.92	0.75	100				
1N5602	S			R	2500	5.0	4.6	1.0	200				
1N5603	S			R	5000	9.0	3.5	1.0	200				
1N5604	S			R	7500	12	2.3	1.0	200				
1N5605	S			DS	70	1.0	20M	25N					
1N5606	S			DS	150	1.0	7.0M	25N					
1N5607	S			DS	200	1.0	3.0M	25N					
1N5608	S			DS	120	1.0	100M	50N					
1N5609	S			DS	120	1.0	6.0M	5.0*					
1N5610 thru 1N5613		Transient Suppressors, See Table on Page 1-110											
1N5614	S			R	200	1.2	1.0	0.0025	50				
1N5615	S			R	200	1.2	1.0	0.0025	50				
1N5616	S			R	400	1.2	1.0	0.0025	50				
1N5617	S			R	400	1.2	1.0	0.0025	50				
1N5618	S			R	600	1.2	1.0	0.0025	50				
1N5619	S			R	600	1.2	1.0	0.0025	50				
1N5620	S			R	800	1.2	1.0	0.0025	50				
1N5621	S			R	800	1.2	1.0	0.0025	50				
1N5622	S			R	1000	1.2	1.0	0.0025	50				
1N5623	S			R	1000	1.2	1.0	0.0025	50				

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R (volts)	V_F (volts)	I_O (Amps)	I_R (mA)	I_{FSM}	V_Z(nom)	I_{ZT} mA	Tol $V_{Z\pm\%}$	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV (volts)	V_F @ (volts)	I_F	I_R	t_{rr} (μs)	V_Z(nom)	T_C %/°C	I_{ZT} mA	Temp Range
1N5624	S			R	200	0.95	3.0	0.3	125				
1N5625	S			R	400	0.95	3.0	0.3	125				
1N5626	S			R	600	0.95	3.0	0.3	125				
1N5627	S			R	800	0.95	3.0	0.3	125				
1N5629,A thru 1N5665,A	Transient Suppressors, see Table on Page 1-110												
1N5666A thru 1N5678A	Voltage Regulator Diodes												
1N5679	S			R	50	1.1	1.0	0.01	50				
1N5680	S			R	100	1.1	1.0	0.01	50				
1N5711 thru 1N5713	Hot Carrier Diodes												
1N5720	S			DS	30	1.0	50M	500N	0.01				
1N5721	S			DS	15	1.0	50M	500N	0.01				
1N5726	S			DS	60	1.1	500M	200N	0.01				
1N5727	S			DS	50	1.1	500M	100N	0.01				
1N5728B,C,D	S			DR						4.7	-1.0	-65	+200
1N5729B,C,D	S			DR						5.1	-0.2	-65	+200
1N5730B,C,D	S			DR						5.6	1.2	-65	+200
1N5731B,C,D	S			DR						6.2	2.3	-65	+200
1N5732B,C,D	S			DR						6.8	3.0	-65	+200
1N5733B,C,D	S			DR						7.5	4.0	-65	+200
1N5734B,C,D	S			DR						8.2	5.0	-65	+200
1N5735B,C,D	S			DR						9.1	6.0	-65	+200
1N5736B,C,D	S			DR						10	7.0	-65	+200
1N5737B,C,D	S			DR						11	8.0	-65	+200
1N5738B,C,D	S			DR						12	9.0	-65	+200
1N5739B,C,D	S			DR						13	10.5	-65	+200
1N5740B,C,D	S			DR						15	12.5	-65	+200
1N5741B,C,D	S			DR						16	13	-65	+200
1N5742B,C,D	S			DR						18	15	-65	+200
1N5743B,C,D	S			DR						20	17	-65	+200
1N5744B,C,D	S			DR						22	19	-65	+200
1N5745B,C,D	S			DR						24	21	-65	+200
1N5746B,C,D	S			DR						27	23.5	-65	+200
1N5747B,C,D	S			DR						30	26	-65	+200
1N5748B,C,D	S			DR						33	29	-65	+200
1N5749B,C,D	S			DR						36	31	-65	+200
1N5750B,C,D	S			DR						39	34	-65	+200
1N5751B,C,D	S			DR						43	37	-65	+200
1N5752B,C,D	S			DR						47	40	-65	+200
1N5753B,C,D	S			DR						51	44	-65	+200
1N5754B,C,D	S			DR						56	47	-65	+200
1N5755B,C,D	S			DR						62	51	-65	+200
1N5756B,C,D	S			DR						68	56	-65	+200
1N5757B,C,D	S			DR						75	60	-65	+200
1N5763	S			R	33	1.2	300	10	4500				
1N5767	S			DS		1.0	100M	1.0*					

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VARACTOR DIODES

INDEX AND SHORT-FORM SPECIFICATIONS

The following table provides a numerical index and short-form specifications for varactor diodes with EIA-registered type numbers.

KEY

		CAPACITANCE							
TYPE	REF.	C_J C_T* pF	C Tol %	$\frac{C\ (max)}{C\ (min)}$	Voltage Range V_1 Volts	Voltage Range V_2 Volts	BV_R Volts	Q @ f GHz	P_D @ 25°C Watts

- Numerical Listing of Registered Type Numbers
- Reference device number indicates specific Data Sheet on which device is characterized
- Nominal Capacitance usually C_J (junction capacitance) With *, specified value is C_T (total capacitance) $C_T = C_J + C_C$
- Tolerance of capacitance listed in preceding column
- Effective tuning Ratio (Capacitance at Voltage V_1 divided by capacitance at Voltage V_2)
- Voltage range over which the tuning range is measured
- Reverse Breakdown Voltage
- Figure of Merit at this specified frequency
- Power Dissipation at 25°C

VARACTOR DIODES INDEX

TYPE	REF.	CAPACITANCE C_J C_T* pF	C Tol %	C (max) / C (min)	Voltage Range V_1 Volts	V_2 Volts	BV_R Volts	Q @	f GHz	P_D @ 25°C Watts
1N950		35		2.51	4.0	130	130	7.0	0.05	
1N951		50		2.4	4.0	80	80	7.0	0.05	
1N952		70		2.43	4.0	60	60	7.0	0.05	
1N953		100		2.4	4.0	25	25	7.0	0.05	
1N954		35		2.51	4.0	25	25	7.0	0.05	
1N955		50		2.4	4.0	25	25	7.0	0.05	
1N956		70		2.43	4.0	25	25	7.0	0.05	
1N2627		2.75		1.75	0	5.0	5.0	10	1.0	
1N2628		2.5		1.5	0	5.0	5.0	14	1.0	
1N3182		33					20	65	0.05	0.163
1N3488		56					15	7.0	0.05	
1N3551	1N5472A	50	6.0	1.38	4.0	8.0	11	30	0.05	
1N3552	1N5447A	21.5	6.0				22	25	0.05	
1N3554	1N5141A	12					100			
1N3555	1N5144	20					100	60	0.05	
1N3556	1N5148	47					100	50	0.10	
1N3557	1N5144	24					210	75	0.05	
1N3627	1N5477A	21.3		2.45	4.0	20	20	25	0.05	
1N3628	1N5452A	50		2.5	4.0	20	20	30	0.05	
1N3770		2.0					5.5			
1N3945	1N5447A	20		1.5	4.0	20	20	7.0	0.05	0.50
1N3946	1N5457A	71					9.0	7.0	0.05	0.50
1N3947	1N5474A	70					9.0	9.0	0.05	
1N4091	1N5461A	4.2		2.5			6.0			0.30
1N4387	1N4387	35					150	150	0.05	20
1N4388	1N4388	20					100	200	0.05	10
1N4598		22		4.04	4.0	90	90	50	0.05	0.25
1N4599		47		5.0	2.0	100	110	100	0.05	0.50
1N4609		22		2.64	4.0	35	35	60	0.05	0.25
1N4786	1N5441A	6.8	20	2.56	0	4.0	25	15	0.05	0.50
1N4786A	1N5441A	6.8	10	2.56	0	4.0	25	15	0.05	0.50
1N4786B	1N5441B	6.8	5.0	2.56	0	4.0	25	15	0.05	0.50
1N4786C	1N5441C	6.8	2.0	2.56	0	4.0	25	15	0.05	0.50
1N4786D	1N5441D	6.8	1.0	2.56	0	4.0	25	15	0.05	0.50
1N4787	1N5442A	8.2	20	2.56	0	4.0	25	15	0.05	0.50
1N4787A	1N5442A	8.2	10	2.56	0	4.0	25	15	0.05	0.50
1N4787B	1N5442B	8.2	5.0	2.56	0	4.0	25	15	0.05	0.50
1N4787C	1N5442C	8.2	2.0	2.56	0	4.0	25	15	0.05	0.50
1N4787D	1N5442D	8.2	1.0	2.56	0	4.0	25	15	0.05	0.50
1N4788	1N5443A	10	20	2.50	0	4.0	25	15	0.05	0.50
1N4788A	1N5443A	10	10	2.50	0	4.0	25	15	0.05	0.50
1N4788B	1N5443B	10	5.0	2.50	0	4.0	25	15	0.05	0.50
1N4788C	1N5443C	10	2.0	2.50	0	4.0	25	15	0.05	0.50
1N4788D	1N5443D	10	1.0	2.50	0	4.0	25	15	0.05	0.50
1N4789	1N5444A	12	20	2.49	0	4.0	25	15	0.05	0.50
1N4789A	1N5444A	12	10	2.49	0	4.0	25	15	0.05	0.50
1N4789B	1N5444B	12	5.0	2.49	0	4.0	25	15	0.05	0.50
1N4789C	1N5444C	12	2.0	2.49	0	4.0	25	15	0.05	0.50
1N4789D	1N5444D	12	1.0	2.49	0	4.0	25	15	0.05	0.50
1N4790	1N5445A	15	20	2.49	0	4.0	25	15	0.05	0.50
1N4790A	1N5445A	15	10	2.49	0	4.0	25	15	0.05	0.50
1N4790B	1N5445B	15	5.0	2.49	0	4.0	25	15	0.05	0.50
1N4790C	1N5445C	15	2.0	2.49	0	4.0	25	15	0.05	0.50
1N4790D	1N5445D	15	1.0	2.49	0	4.0	25	15	0.05	0.50
1N4791	1N5446A	18	20	2.48	0	4.0	20	15	0.05	0.50
1N4791A	1N5446A	18	10	2.48	0	4.0	20	15	0.05	0.50
1N4791B	1N5446B	18	5.0	2.48	0	4.0	20	15	0.05	0.50
1N4791C	1N5446C	18	2.0	2.48	0	4.0	20	15	0.05	0.50
1N4791D	1N5446D	18	1.0	2.48	0	4.0	20	15	0.05	0.50
1N4792	1N5448A	22	20	2.46	0	4.0	20	15	0.05	0.50
1N4792A	1N5448A	22	10	2.46	0	4.0	20	15	0.05	0.50
1N4792B	1N5448B	22	5.0	2.46	0	4.0	20	15	0.05	0.50
1N4792C	1N5448C	22	2.0	2.46	0	4.0	20	15	0.05	0.50
1N4792D	1N5448D	22	1.0	2.46	0	4.0	20	15	0.05	0.50
1N4793	1N5449A	27	20	2.46	0	4.0	20	15	0.05	0.50
1N4793A	1N5449A	27	10	2.46	0	4.0	20	15	0.05	0.50
1N4793B	1N5449B	27	5.0	2.46	0	4.0	20	15	0.05	0.50
1N4793C	1N5449C	27	2.0	2.46	0	4.0	20	15	0.05	0.50
1N4793D	1N5449D	27	1.0	2.46	0	4.0	20	15	0.05	0.50

VARACTOR DIODES INDEX (continued)

1N4794–1N4807D

TYPE	REF.	CAPACITANCE C_J C_T* pF	C Tol %	C (max) / C (min)	Voltage Range V_1 Volts	V_2 Volts	BV_R Volts	Q	@ f GHz	P_D @ 25°C Watts
1N4794	1N5450A	33	20	2.46	0	4.0	20	15	0.05	0.50
1N4794A	1N5450A	33	10	2.46	0	4.0	20	15	0.05	0.50
1N4794B	1N5450B	33	5.0	2.46	0	4.0	20	15	0.05	0.50
1N4794C	1N5450C	33	2.0	2.46	0	4.0	20	15	0.05	0.50
1N4794D	1N5450D	33	1.0	2.46	0	4.0	20	15	0.05	0.50
1N4795	1N5451A	39	20	2.44	0	4.0	20	15	0.05	0.50
1N4795A	1N5451A	39	10	2.44	0	4.0	20	15	0.05	0.50
1N4795B	1N5451B	39	5.0	2.44	0	4.0	20	15	0.05	0.50
1N4795C	1N5451C	39	2.0	2.44	0	4.0	20	15	0.05	0.50
1N4795D	1N5451D	39	1.0	2.44	0	4.0	20	15	0.05	0.50
1N4796	1N5452A	47	20	2.43	0	4.0	20	15	0.05	0.50
1N4796A	1N5452A	47	10	2.43	0	4.0	20	15	0.05	0.50
1N4796B	1N5452B	47	5.0	2.43	0	4.0	20	15	0.05	0.50
1N4796C	1N5452C	47	2.0	2.43	0	4.0	20	15	0.05	0.50
1N4796D	1N5452D	47	1.0	2.43	0	4.0	20	15	0.05	0.50
1N4797	1N5453A	56	20	2.42	0	4.0	15	15	0.05	0.50
1N4797A	1N5453A	56	10	2.42	0	4.0	15	15	0.05	0.50
1N4797B	1N5453B	56	5.0	2.42	0	4.0	15	15	0.05	0.50
1N4797C	1N5453C	56	2.0	2.42	0	4.0	15	15	0.05	0.50
1N4797D	1N5453D	56	1.0	2.42	0	4.0	15	15	0.05	0.50
1N4798	1N5454A	68	20	2.40	0	4.0	15	15	0.05	0.50
1N4798A	1N5454A	68	10	2.40	0	4.0	15	15	0.05	0.50
1N4798B	1N5454B	68	5.0	2.40	0	4.0	15	15	0.05	0.50
1N4798C	1N5454C	68	2.0	2.40	0	4.0	15	15	0.05	0.50
1N4798D	1N5454D	68	1.0	2.40	0	4.0	15	15	0.05	0.50
1N4799	1N5455A	82	20	2.36	0	4.0	15	15	0.05	0.50
1N4799A	1N5455A	82	10	2.36	0	4.0	15	15	0.05	0.50
1N4799B	1N5455B	82	5.0	2.36	0	4.0	15	15	0.05	0.50
1N4799C	1N5455C	82	2.0	2.36	0	4.0	15	15	0.05	0.50
1N4799D	1N5455D	82	1.0	2.36	0	4.0	15	15	0.05	0.50
1N4800	1N5456A	100	20	2.33	0	4.0	15	15	0.05	0.50
1N4800A	1N5456A	100	10	2.33	0	4.0	15	15	0.05	0.50
1N4800B	1N5456B	100	5.0	2.33	0	4.0	15	15	0.05	0.50
1N4800C	1N5456C	100	2.0	2.33	0	4.0	15	15	0.05	0.50
1N4800D	1N5456D	100	1.0	2.33	0	4.0	15	15	0.05	0.50
1N4801	1N5139	6.8	20	2.56	0	4.0	100	15	0.05	0.50
1N4801A	1N5139A	6.8	10	2.56	0	4.0	100	15	0.05	0.50
1N4801B	1N5139B	6.8	5.0	2.56	0	4.0	100	15	0.05	0.50
1N4801C	1N5139C	6.8	2.0	2.56	0	4.0	100	15	0.05	0.50
1N4801D	1N5139D	6.8	1.0	2.56	0	4.0	100	15	0.05	0.50
1N4802	1N5462A	8.2	20	2.58	0	4.0	100	15	0.05	0.50
1N4802A	1N5462A	8.2	10	2.58	0	4.0	100	15	0.05	0.50
1N4802B	1N5462B	8.2	5.0	2.58	0	4.0	100	15	0.05	0.50
1N4802C	1N5462C	8.2	2.0	2.58	0	4.0	100	15	0.05	0.50
1N4802D	1N5462D	8.2	1.0	2.58	0	4.0	100	15	0.05	0.50
1N4803	1N5140	10	20	2.50	0	4.0	100	15	0.05	0.50
1N4803A	1N5140A	10	10	2.50	0	4.0	100	15	0.05	0.50
1N4803B	1N5140B	10	5.0	2.50	0	4.0	100	15	0.05	0.50
1N4803C	1N5140C	10	2.0	2.50	0	4.0	100	15	0.05	0.50
1N4803D	1N5140D	10	1.0	2.50	0	4.0	100	15	0.05	0.50
1N4804	1N5141	12	20	2.49	0	4.0	100	15	0.05	0.50
1N4804A	1N5141A	12	10	2.49	0	4.0	100	15	0.05	0.50
1N4804B	1N5141B	12	5.0	2.49	0	4.0	100	15	0.05	0.50
1N4804C	1N5141C	12	2.0	2.49	0	4.0	100	15	0.05	0.50
1N4804D	1N5141D	12	1.0	2.49	0	4.0	100	15	0.05	0.50
1N4805	1N5142	15	20	2.49	0	4.0	100	15	0.05	0.50
1N4805A	1N5142A	15	10	2.49	0	4.0	100	15	0.05	0.50
1N4805B	1N5142B	15	5.0	2.49	0	4.0	100	15	0.05	0.50
1N4805C	1N5142C	15	2.0	2.49	0	4.0	100	15	0.05	0.50
1N4805D	1N5142D	15	1.0	2.49	0	4.0	100	15	0.05	0.50
1N4806	1N5143	18	20	2.48	0	4.0	90	15	0.05	
1N4806A	1N5143A	18	10	2.48	0	4.0	90	15	0.05	
1N4806B	1N5143B	18	5.0	2.48	0	4.0	90	15	0.05	
1N4806C	1N5143C	18	2.0	2.48	0	4.0	90	15	0.05	
1N4806D	1N5143D	18	1.0	2.48	0	4.0	90	15	0.05	
1N4807	1N5144	22	20	2.46	0	4.0	90	15	0.05	0.50
1N4807A	1N5144A	22	10	2.46	0	4.0	90	15	0.05	0.50
1N4807B	1N5144B	22	5.0	2.46	0	4.0	90	15	0.05	0.50
1N4807C	1N5144C	22	2.0	2.46	0	4.0	90	15	0.05	0.50
1N4807D	1N5144D	22	1.0	2.46	0	4.0	90	15	0.05	0.50

VARACTOR DIODES INDEX (continued)

TYPE	REF.	CAPACITANCE C_J C_T* pF	C Tol %	C (max) / C (min)	Voltage Range V_1 Volts	V_2 Volts	BV_R Volts	Q @ f	GHz	P_D @ 25°C Watts
1N4808	1N5145	27	20	2.46	0	4.0	65	15	0.05	0.50
1N4808A	1N5145A	27	10	2.46	0	4.0	65	15	0.05	0.50
1N4808B	1N5145B	27	5.0	2.46	0	4.0	65	15	0.05	0.50
1N4808C	1N5145C	27	2.0	2.46	0	4.0	65	15	0.05	0.50
1N4808D	1N5145D	27	1.0	2.46	0	4.0	65	15	0.05	0.50
1N4809	1N5146	33	20	2.46	0	4.0	60	15	0.05	0.50
1N4809A	1N5146A	33	10	2.46	0	4.0	60	15	0.05	0.50
1N4809B	1N5146B	33	5.0	2.46	0	4.0	60	15	0.05	0.50
1N4809C	1N5146C	33	2.0	2.46	0	4.0	60	15	0.05	0.50
1N4809D	1N5146D	33	1.0	2.46	0	4.0	60	15	0.05	0.50
1N4810	1N5147	39	20	2.44	0	4.0	55	15	0.05	0.50
1N4810A	1N5147A	39	10	2.44	0	4.0	55	15	0.05	0.50
1N4810B	1N5147B	39	5.0	2.44	0	4.0	55	15	0.05	0.50
1N4810C	1N5147C	39	2.0	2.44	0	4.0	55	15	0.05	0.50
1N4810D	1N5147D	39	1.0	2.44	0	4.0	55	15	0.05	0.50
1N4811	1N5148	47	20	2.43	0	4.0	50	15	0.05	0.50
1N4811A	1N5148A	47	10	2.43	0	4.0	50	15	0.05	0.50
1N4811B	1N5148B	47	5.0	2.43	0	4.0	50	15	0.05	0.50
1N4811C	1N5148C	47	2.0	2.43	0	4.0	50	15	0.05	0.50
1N4811D	1N5148D	47	1.0	2.43	0	4.0	50	15	0.05	0.50
1N4812	1N5148	56	20	2.42	0	4.0	40	15	0.05	0.50
1N4812A	1N5148A	56	10	2.42	0	4.0	40	15	0.05	0.50
1N4812B	1N5148B	56	5.0	2.42	0	4.0	40	15	0.05	0.50
1N4812C	1N5148C	56	2.0	2.42	0	4.0	40	15	0.05	0.50
1N4812D	1N5148D	56	1.0	2.42	0	4.0	40	15	0.05	0.50
1N4813	1N5454A	68	20	2.40	0	4.0	30	15	0.05	0.50
1N4813A	1N5454A	68	10	2.40	0	4.0	30	15	0.05	0.50
1N4813B	1N5454B	68	5.0	2.40	0	4.0	30	15	0.05	0.50
1N4813C	1N5454C	68	2.0	2.40	0	4.0	30	15	0.05	0.50
1N4813D	1N5454D	68	1.0	2.40	0	4.0	30	15	0.05	0.50
1N4814		82	20	2.36	0	4.0	20	15	0.05	0.50
1N4814A		82	10	2.36	0	4.0	20	15	0.05	0.50
1N4814B		82	5.0	2.36	0	4.0	20	15	0.05	0.50
1N4814C		82	2.0	2.36	0	4.0	20	15	0.05	0.50
1N4814D		82	1.0	2.36	0	4.0	20	15	0.05	0.50
1N4815		100	20	2.33	0	4.0	20	15	0.05	0.50
1N4815A		100	10	2.33	0	4.0	20	15	0.05	0.50
1N4815B		100	5.0	2.33	0	4.0	20	15	0.05	0.50
1N4815C		100	2.0	2.33	0	4.0	20	15	0.05	0.50
1N4815D		100	1.0	2.33	0	4.0	20	15	0.05	0.50
1N4885		35		2.57	6.0	150	150			20
1N4886		35		2.57	6.0	120	120			20
1N4941		0.4		2.0	0	6.0	6.0	2000	10	0.1
1N5136		1.0*	20	2.2	4.0	60	60	350	0.05	0.4
1N5136A		1.0*	10	2.2	4.0	60	60	350	0.05	0.4
1N5137		2.2*	20	2.2	4.0	60	60	350	0.05	0.4
1N5137A		2.2*	10	2.2	4.0	60	60	350	0.05	0.4
1N5138		3.3*	20	2.4	4.0	60	60	350	0.05	0.4
1N5138A		3.3*	10	2.4	4.0	60	60	350	0.05	0.4
1N5139	1N5139	6.8*	10	2.9	4.0	60	60	350	0.05	0.4
1N5139A	1N5139A	6.8*	5.0	2.9	4.0	60	60	350	0.05	0.4
1N5140	1N5140	10*	10	3.0	4.0	60	60	300	0.05	0.4
1N5140A	1N5140A	10*	5.0	3.0	4.0	60	60	300	0.05	0.4
1N5141	1N5141	12*	10	3.0	4.0	60	60	300	0.05	0.4
1N5141A	1N5141A	12*	5.0	3.0	4.0	60	60	300	0.05	0.4
1N5142	1N5142	15*	10	3.0	4.0	60	60	250	0.05	0.4
1N5142A	1N5142A	15*	5.0	3.0	4.0	60	60	250	0.05	0.4
1N5143	1N5143	18*	10	3.0	4.0	60	60	250	0.05	0.4
1N5143A	1N5143A	18*	5.0	3.0	4.0	60	60	250	0.05	0.4
1N5144	1N5144	22*	10	3.4	4.0	60	60	200	0.05	0.4
1N5144A	1N5144A	22*	5.0	3.4	4.0	60	60	200	0.05	0.4
1N5145	1N5145	27*	10	3.4	4.0	60	60	200	0.05	0.4
1N5145A	1N5145A	27*	5.0	3.4	4.0	60	60	200	0.05	0.4
1N5146	1N5146	33*	10	3.4	4.0	60	60	200	0.05	0.4
1N5146A	1N5146A	33*	5.0	3.4	4.0	60	60	200	0.05	0.4
1N5147	1N5147	39*	10	3.4	4.0	60	60	200	0.05	0.4
1N5147A	1N5147A	39*	5.0	3.4	4.0	60	60	200	0.05	0.4
1N5148	1N5148	47*	10	3.4	4.0	60	60	200	0.05	0.4
1N5148A	1N5148A	47*	5.0	3.4	4.0	60	60	200	0.05	0.4
1N5149	1N5149	11.5*					80	800	0.05	10
1N5150	1N5149	11.5*					80	800	0.05	14
1N5150A	1N5150A	12	10				80	800	0.05	29.2
1N5151	1N5151	5.8*					75	1100	0.05	5.5
1N5152	1N5151	5.8*					75	1100	0.05	5.5
1N5152A	1N5150A	6.0	10				75	1100	0.05	11.7
1N5153	1N5151	5.8*					75	1100	0.05	5.5

VARACTOR DIODES INDEX (continued)

1N5153A–1N5450D

TYPE	REF.	CAPACITANCE C_J C_T* pF	C Tol %	C (max) / C (min)	Voltage Range V_1 Volts	V_2 Volts	BV_R Volts	Q	@ f GHz	P_D @ 25°C Watts
1N5153A	1N5150A	6.4	10				75	1100	0.05	11.7
1N5154	1N5154	2.1*					35	1700	0.05	3.5
1N5155	1N5154	2.1*					35	1700	0.05	3.5
1N5155A	1N5150A	1.9	10				35	1700	0.05	8.75
1N5156	1N5156	0.8	25				20	3600	0.05	3.25*
1N5157	1N5156	0.8	25				20	3600	0.05	3.25*
1N5421		210	20	4.1	4.0	100	210	200	0.025	0.25
1N5422		340	20	4.1	4.0	100	210	200	0.025	0.25
1N5423		680	20	4.1	4.0	100	210	150	0.025	0.25
1N5424		680	20	4.2	4.0	100	115	300	0.010	0.25
1N5425		1370	20	4.2	4.0	100	115	200	0.010	0.25
1N5439		3.3*	20	2.3	2.0	30	30	450	0.05	0.4
1N5439A		3.3*	10	2.3	2.0	30	30	450	0.05	0.4
1N5439B		3.3*	5.0	2.3	2.0	30	30	450	0.05	0.4
1N5439C		3.3*	2.0	2.3	2.0	30	30	450	0.05	0.4
1N5439D		3.3*	1.0	2.3	2.0	30	30	450	0.05	0.4
1N5440		4.7*	20	2.4	2.0	30	30	450	0.05	0.4
1N5440A		4.7*	10	2.4	2.0	30	30	450	0.05	0.4
1N5440B		4.7*	5.0	2.4	2.0	30	30	450	0.05	0.4
1N5440C		4.7*	2.0	2.4	2.0	30	30	450	0.05	0.4
1N5440D		4.7*	1.0	2.4	2.0	30	30	450	0.05	0.4
1N5441	1N5441A	6.8*	20	2.5	2.0	30	30	450	0.05	0.4
1N5441A	1N5441A	6.8*	10	2.5	2.0	30	30	450	0.05	0.4
1N5441B	1N5441B	6.8*	5.0	2.5	2.0	30	30	450	0.05	0.4
1N5441C	1N5441C	6.8*	2.0	2.5	2.0	30	30	450	0.05	0.4
1N5441D	1N5441D	6.8*	1.0	2.5	2.0	30	30	450	0.05	0.4
1N5442		8.2*	20	2.5	2.0	30	30	450	0.05	0.4
1N5442A	1N5442A	8.2*	10	2.5	2.0	30	30	450	0.05	0.4
1N5442B	1N5442B	8.2*	5.0	2.5	2.0	30	30	450	0.05	0.4
1N5442C	1N5442C	8.2*	2.0	2.5	2.0	30	30	450	0.05	0.4
1N5442D	1N5442D	8.2*	1.0	2.5	2.0	30	30	450	0.05	0.4
1N5443		10*	20	2.6	2.0	30	30	400	0.05	0.4
1N5443A	1N5443A	10*	10	2.6	2.0	30	30	400	0.05	0.4
1N5443B	1N5443B	10*	5.0	2.6	2.0	30	30	400	0.05	0.4
1N5443C	1N5443C	10*	2.0	2.6	2.0	30	30	400	0.05	0.4
1N5443D	1N5443D	10*	1.0	2.6	2.0	30	30	400	0.05	0.4
1N5444		12*	20	2.6	2.0	30	30	400	0.05	0.4
1N5444A	1N5444A	12*	10	2.6	2.0	30	30	400	0.05	0.4
1N5444B	1N5444B	12*	5.0	2.6	2.0	30	30	400	0.05	0.4
1N5444C	1N5444C	12*	2.0	2.6	2.0	30	30	400	0.05	0.4
1N5444D	1N5444D	12*	1.0	2.6	2.0	30	30	400	0.05	0.4
1N5445		15*	20	2.6	2.0	30	30	400	0.05	0.4
1N5445A	1N5445A	15*	10	2.6	2.0	30	30	400	0.05	0.4
1N5445B	1N5445B	15*	5.0	2.6	2.0	30	30	400	0.05	0.4
1N5445C	1N5445C	15*	2.0	2.6	2.0	30	30	400	0.05	0.4
1N5445D	1N5445D	15*	1.0	2.6	2.0	30	30	400	0.05	0.4
1N5446		18*	20	2.6	2.0	30	30	350	0.05	0.4
1N5446A	1N5446A	18*	10	2.6	2.0	30	30	350	0.05	0.4
1N5446B	1N5446B	18*	5.0	2.6	2.0	30	30	350	0.05	0.4
1N5446C	1N5446C	18*	2.0	2.6	2.0	30	30	350	0.05	0.4
1N5446D	1N5446D	18*	1.0	2.6	2.0	30	30	350	0.05	0.4
1N5447		20*	20	2.6	2.0	30	30	350	0.05	0.4
1N5447A	1N5447A	20*	10	2.6	2.0	30	30	350	0.05	0.4
1N5447B	1N5447B	20*	5.0	2.6	2.0	30	30	350	0.05	0.4
1N5447C	1N5447C	20*	2.0	2.6	2.0	30	30	350	0.05	0.4
1N5447D	1N5447D	20*	1.0	2.6	2.0	30	30	350	0.05	0.4
1N5448		22*	20	2.6	2.0	30	30	350	0.05	0.4
1N5448A	1N5448A	22*	10	2.6	2.0	30	30	350	0.05	0.4
1N5448B	1N5448B	22*	5.0	2.6	2.0	30	30	350	0.05	0.4
1N5448C	1N5448C	22*	2.0	2.6	2.0	30	30	350	0.05	0.4
1N5448D	1N5448D	22*	1.0	2.6	2.0	30	30	350	0.05	0.4
1N5449		27*	20	2.6	2.0	30	30	350	0.05	0.4
1N5449A	1N5449A	27*	10	2.6	2.0	30	30	350	0.05	0.4
1N5449B	1N5449B	27*	5.0	2.6	2.0	30	30	350	0.05	0.4
1N5449C	1N5449C	27*	2.0	2.6	2.0	30	30	350	0.05	0.4
1N5449D	1N5449D	27*	1.0	2.6	2.0	30	30	350	0.05	0.4
1N5450		33*	20	2.6	2.0	30	30	350	0.05	0.4
1N5450A	1N5450A	33*	10	2.6	2.0	30	30	350	0.05	0.4
1N5450B	1N5450B	33*	5.0	2.6	2.0	30	30	350	0.05	0.4
1N5450C	1N5450C	33*	2.0	2.6	2.0	30	30	350	0.05	0.4
1N5450D	1N5450D	33*	1.0	2.6	2.0	30	30	350	0.05	0.4

VARACTOR DIODES INDEX (continued)

TYPE	REF.	CAPACITANCE C_J C_T* pF	C Tol %	C (max) / C (min)	Voltage Range V_1 Volts	V_2 Volts	BV_R Volts	Q	@ f GHz	P_D @ 25°C Watts
1N5451		39*	20	2.6	2.0	30	30	300	0.05	0.4
1N5451A	1N5451A	39*	10	2.6	2.0	30	30	300	0.05	0.4
1N5451B	1N5451B	39*	5.0	2.6	2.0	30	30	300	0.05	0.4
1N5451C	1N5451C	39*	2.0	2.6	2.0	30	30	300	0.05	0.4
1N5451D	1N5451D	39*	1.0	2.6	2.0	30	30	300	0.05	0.4
1N5452		47*	20	2.6	2.0	30	30	250	0.05	0.4
1N5452A	1N5452A	47*	10	2.6	2.0	30	30	250	0.05	0.4
1N5452B	1N5452B	47*	5.0	2.6	2.0	30	30	250	0.05	0.4
1N5452C	1N5452C	47*	2.0	2.6	2.0	30	30	250	0.05	0.4
1N5452D	1N5452D	47*	1.0	2.6	2.0	30	30	250	0.05	0.4
1N5453		56*	20	2.6	2.0	30	30	200	0.05	0.4
1N5453A	1N5453A	56*	10	2.6	2.0	30	30	200	0.05	0.4
1N5453B	1N5453B	56*	5.0	2.6	2.0	30	30	200	0.05	0.4
1N5453C	1N5453C	56*	2.0	2.6	2.0	30	30	200	0.05	0.4
1N5453D	1N5453D	56*	1.0	2.6	2.0	30	30	200	0.05	0.4
1N5454		68*	20	2.7	2.0	30	30	175	0.05	0.4
1N5454A	1N5454A	68*	10	2.7	2.0	30	30	175	0.05	0.4
1N5454B	1N5454B	68*	5.0	2.7	2.0	30	30	175	0.05	0.4
1N5454C	1N5454C	68*	2.0	2.7	2.0	30	30	175	0.05	0.4
1N5454D	1N5454D	68*	1.0	2.7	2.0	30	30	175	0.05	0.4
1N5455		82*	20	2.7	2.0	30	30	175	0.05	0.4
1N5455A	1N5455A	82*	10	2.7	2.0	30	30	175	0.05	0.4
1N5455B	1N5455B	82*	5.0	2.7	2.0	30	30	175	0.05	0.4
1N5455C	1N5455C	82*	2.0	2.7	2.0	30	30	175	0.05	0.4
1N5455D	1N5455D	82*	1.0	2.7	2.0	30	30	175	0.05	0.4
1N5456		100*	20	2.7	2.0	30	30	175	0.05	0.4
1N5456A	1N5456A	100*	10	2.7	2.0	30	30	175	0.05	0.4
1N5456B	1N5456B	100*	5.0	2.7	2.0	30	30	175	0.05	0.4
1N5456C	1N5456C	100*	2.0	2.7	2.0	30	30	175	0.05	0.4
1N5456D	1N5456D	100*	1.0	2.7	2.0	30	30	175	0.05	0.4
1N5457		120*	20	2.7	2.0	30	30	150	0.05	0.4
1N5457A		120*	10	2.7	2.0	30	30	150	0.05	0.4
1N5457B		120*	5.0	2.7	2.0	30	30	150	0.05	0.4
1N5457C		120*	2.0	2.7	2.0	30	30	150	0.05	0.4
1N5457D		120*	1.0	2.7	2.0	30	30	150	0.05	0.4
1N5458		3.9*	20	2.5	2.0	30	30	600	0.05	0.4
1N5458A		3.9*	10	2.5	2.0	30	30	600	0.05	0.4
1N5458B		3.9*	5.0	2.5	2.0	30	30	600	0.05	0.4
1N5458C		3.9*	2.0	2.5	2.0	30	30	600	0.05	0.4
1N5458D		3.9*	1.0	2.5	2.0	30	30	600	0.05	0.4
1N5459		4.7*	20	2.6	2.0	30	30	600	0.05	0.4
1N5459A		4.7*	10	2.6	2.0	30	30	600	0.05	0.4
1N5459B		4.7*	5.0	2.6	2.0	30	30	600	0.05	0.4
1N5459C		4.7*	2.0	2.6	2.0	30	30	600	0.05	0.4
1N5459D		4.7*	1.0	2.6	2.0	30	30	600	0.05	0.4
1N5460		5.6*	20	2.6	2.0	30	30	600	0.05	0.4
1N5460A		5.6*	10	2.6	2.0	30	30	600	0.05	0.4
1N5460B		5.6*	5.0	2.6	2.0	30	30	600	0.05	0.4
1N5460C		5.6*	2.0	2.6	2.0	30	30	600	0.05	0.4
1N5460D		5.6*	1.0	2.6	2.0	30	30	600	0.05	0.4
1N5461		6.8*	20	2.7	2.0	30	30	600	0.05	0.4
1N5461A	1N5461A	6.8*	10	2.7	2.0	30	30	600	0.05	0.4
1N5461B	1N5461A	6.8*	5.0	2.7	2.0	30	30	600	0.05	0.4
1N5461C	1N5461A	6.8*	2.0	2.7	2.0	30	30	600	0.05	0.4
1N5461D	1N5461A	6.8*	1.0	2.7	2.0	30	30	600	0.05	0.4
1N5462		8.2*	20	2.8	2.0	30	30	600	0.05	0.4
1N5462A	1N5462A	8.2*	10	2.8	2.0	30	30	600	0.05	0.4
1N5462B	1N5462B	8.2*	5.0	2.8	2.0	30	30	600	0.05	0.4
1N5462C	1N5462C	8.2*	2.0	2.8	2.0	30	30	600	0.05	0.4
1N5462D	1N5462D	8.2*	1.0	2.8	2.0	30	30	600	0.05	0.4
1N5463		10*	20	2.8	2.0	30	30	550	0.05	0.4
1N5463A	1N5463A	10*	10	2.8	2.0	30	30	550	0.05	0.4
1N5463B	1N5463B	10*	5.0	2.8	2.0	30	30	550	0.05	0.4
1N5463C	1N5463C	10*	2.0	2.8	2.0	30	30	550	0.05	0.4
1N5463D	1N5463D	10*	1.0	2.8	2.0	30	30	550	0.05	0.4
1N5464		12*	20	2.8	2.0	30	30	550	0.05	0.4
1N5464A	1N5464A	12*	10	2.8	2.0	30	30	550	0.05	0.4
1N5464B	1N5464B	12*	5.0	2.8	2.0	30	30	550	0.05	0.4
1N5464C	1N5464C	12*	2.0	2.8	2.0	30	30	550	0.05	0.4
1N5464D	1N5464D	12*	1.0	2.8	2.0	30	30	550	0.05	0.4

VARACTOR DIODES INDEX (continued)

1N5465–1N5476D

TYPE	REF.	CAPACITANCE C_J / C_T* pF	C Tol %	C (max) / C (min)	Voltage Range V_1 Volts	Voltage Range V_2 Volts	BV_R Volts	Q	@ f GHz	P_D @ 25°C Watts
1N5465		15*	20	2.8	2.0	30	30	550	0.05	0.4
1N5465A	1N5465A	15*	10	2.8	2.0	30	30	550	0.05	0.4
1N5465B	1N5465B	15*	5.0	2.8	2.0	30	30	550	0.05	0.4
1N5465C	1N5465C	15*	2.0	2.8	2.0	30	30	550	0.05	0.4
1N5465D	1N5465D	15*	1.0	2.8	2.0	30	30	550	0.05	0.4
1N5466		18*	20	2.9	2.0	30	30	500	0.05	0.4
1N5466A	1N5466A	18*	10	2.9	2.0	30	30	500	0.05	0.4
1N5466B	1N5466B	18*	5.0	2.9	2.0	30	30	500	0.05	0.4
1N5466C	1N5466C	18*	2.0	2.9	2.0	30	30	500	0.05	0.4
1N5466D	1N5466D	18*	1.0	2.9	2.0	30	30	500	0.05	0.4
1N5467		20*	20	2.9	2.0	30	30	500	0.05	0.4
1N5467A	1N5467A	20*	10	2.9	2.0	30	30	500	0.05	0.4
1N5467B	1N5467B	20*	5.0	2.9	2.0	30	30	500	0.05	0.4
1N5467C	1N5467C	20*	2.0	2.9	2.0	30	30	500	0.05	0.4
1N5467D	1N5467D	20*	1.0	2.9	2.0	30	30	500	0.05	0.4
1N5468		22*	20	2.9	2.0	30	30	500	0.05	0.4
1N5468A	1N5468A	22*	10	2.9	2.0	30	30	500	0.05	0.4
1N5468B	1N5468B	22*	5.0	2.9	2.0	30	30	500	0.05	0.4
1N5468C	1N5468C	22*	2.0	2.9	2.0	30	30	500	0.05	0.4
1N5468D	1N5468D	22*	1.0	2.9	2.0	30	30	500	0.05	0.4
1N5469		27*	20	2.9	2.0	30	30	500	0.05	0.4
1N5469A	1N5469A	27*	10	2.9	2.0	30	30	500	0.05	0.4
1N5469B	1N5469B	27*	5.0	2.9	2.0	30	30	500	0.05	0.4
1N5469C	1N5469C	27*	2.0	2.9	2.0	30	30	500	0.05	0.4
1N5469D	1N5469D	27*	1.0	2.9	2.0	30	30	500	0.05	0.4
1N5470		33*	20	2.9	2.0	30	30	500	0.05	0.4
1N5470A	1N5470A	33*	10	2.9	2.0	30	30	500	0.05	0.4
1N5470B	1N5470B	33*	5.0	2.9	2.0	30	30	500	0.05	0.4
1N5470C	1N5470C	33*	2.0	2.9	2.0	30	30	500	0.05	0.4
1N5470D	1N5470D	33*	1.0	2.9	2.0	30	30	500	0.05	0.4
1N5471		39*	20	2.9	2.0	30	30	450	0.05	0.4
1N5471A	1N5471A	39*	10	2.9	2.0	30	30	450	0.05	0.4
1N5471B	1N5471B	39*	5.0	2.9	2.0	30	30	450	0.05	0.4
1N5471C	1N5471C	39*	2.0	2.9	2.0	30	30	450	0.05	0.4
1N5471D	1N5471D	39*	1.0	2.9	2.0	30	30	450	0.05	0.4
1N5472		47*	20	2.9	2.0	30	30	400	0.05	0.4
1N5472A	1N5472A	47*	10	2.9	2.0	30	30	400	0.05	0.4
1N5472B	1N5472B	47*	5.0	2.9	2.0	30	30	400	0.05	0.4
1N5472C	1N5472C	47*	2.0	2.9	2.0	30	30	400	0.05	0.4
1N5472D	1N5472D	47*	1.0	2.9	2.0	30	30	400	0.05	0.4
1N5473		56*	20	2.9	2.0	30	30	300	0.05	0.4
1N5473A	1N5473A	56*	10	2.9	2.0	30	30	300	0.05	0.4
1N5473B	1N5473B	56*	5.0	2.9	2.0	30	30	300	0.05	0.4
1N5473C	1N5473C	56*	2.0	2.9	2.0	30	30	300	0.05	0.4
1N5473D	1N5473D	56*	1.0	2.9	2.0	30	30	300	0.05	0.4
1N5474		68*	20	2.9	2.0	30	30	250	0.05	0.4
1N5474A	1N5474A	68*	10	2.9	2.0	30	30	250	0.05	0.4
1N5474B	1N5474B	68*	5.0	2.9	2.0	30	30	250	0.05	0.4
1N5474C	1N5474C	68*	2.0	2.9	2.0	30	30	250	0.05	0.4
1N5474D	1N5474D	68*	1.0	2.9	2.0	30	30	250	0.05	0.4
1N5475		82*	20	2.9	2.0	30	30	225	0.05	0.4
1N5475A	1N5475A	82*	10	2.9	2.0	30	30	225	0.05	0.4
1N5475B	1N5475B	82*	5.0	2.9	2.0	30	30	225	0.05	0.4
1N5475C	1N5475C	82*	2.0	2.9	2.0	30	30	225	0.05	0.4
1N5475D	1N5475D	82*	1.0	2.9	2.0	30	30	225	0.05	0.4
1N5476		100*	20	2.9	2.0	30	30	200	0.05	0.4
1N5476A	1N5476A	100*	10	2.9	2.0	30	30	200	0.05	0.4
1N5476B	1N5476B	100*	5.0	2.9	2.0	30	30	200	0.05	0.4
1N5476C	1N5476C	100*	2.0	2.9	2.0	30	30	200	0.05	0.4
1N5476D	1N5476D	100*	1.0	2.9	2.0	30	30	200	0.05	0.4

VARACTOR DIODES INDEX (continued)

TYPE	REF.	CAPACITANCE C_J C_T* pF	C Tol %	C (max) / C (min)	Voltage Range V_1 Volts	V_2 Volts	BV_R Volts	Q	@ f GHz	P_D @ 25°C Watts
1N5681	1N5461A	6.8	20	3.1	4.0	40	45	600	0.05	0.4
1N5681A	1N5461A	6.8	10	3.1	4.0	40	45	600	0.05	0.4
1N5681B	1N5461B	6.8	5.0	3.1	4.0	40	45	600	0.05	0.4
1N5682	1N5462A	8.2	20	3.1	4.0	40	45	600	0.05	0.4
1N5682A	1N5462A	8.2	10	3.1	4.0	40	45	600	0.05	0.4
1N5682B	1N5462B	8.2	5.0	3.1	4.0	40	45	600	0.05	0.4
1N5683	1N5463A	10	20	3.2	4.0	40	45	550	0.05	0.4
1N5683A	1N5463A	10	10	3.2	4.0	40	45	550	0.05	0.4
1N5683B	1N5463B	10	5.0	3.2	4.0	40	45	550	0.05	0.4
1N5684	1N5464A	12	20	3.2	4.0	40	45	550	0.05	0.4
1N5684A	1N5464A	12	10	3.2	4.0	40	45	550	0.05	0.4
1N5684B	1N5464B	12	5.0	3.2	4.0	40	45	550	0.05	0.4
1N5685	1N5465A	15	20	3.2	4.0	40	45	550	0.05	0.4
1N5685A	1N5465A	15	10	3.2	4.0	40	45	550	0.05	0.4
1N5685B	1N5465B	15	5.0	3.2	4.0	40	45	550	0.05	0.4
1N5686	1N5457A	18	20	3.2	4.0	40	45	500	0.05	0.4
1N5686A	1N5457A	18	10	3.2	4.0	40	45	500	0.05	0.4
1N5686B	1N5457B	18	5.0	3.2	4.0	40	45	500	0.05	0.4
1N5687	1N5458A	22	20	3.3	4.0	40	45	500	0.05	0.4
1N5687A	1N5458A	22	10	3.3	4.0	40	45	500	0.05	0.4
1N5687B	1N5458B	22	5.0	3.3	4.0	40	45	500	0.05	0.4
1N5688	1N5469A	27	20	3.3	4.0	40	45	500	0.05	0.4
1N5688A	1N5469A	27	10	3.3	4.0	40	45	500	0.05	0.4
1N5688B	1N5469B	27	5.0	3.3	4.0	40	45	500	0.05	0.4
1N5689	1N5470A	33	20	3.3	4.0	40	45	500	0.05	0.4
1N5689A	1N5470A	33	10	3.3	4.0	40	45	500	0.05	0.4
1N5689B	1N5470B	33	5.0	3.3	4.0	40	45	500	0.05	0.4
1N5690	1N5471A	39	20	3.3	4.0	40	45	450	0.05	0.4
1N5690A	1N5471A	39	10	3.3	4.0	40	45	450	0.05	0.4
1N5690B	1N5471B	39	5.0	3.3	4.0	40	45	450	0.05	0.4
1N5691	1N5472A	47	20	3.3	4.0	40	45	400	0.05	0.4
1N5691A	1N5472A	47	10	3.3	4.0	40	45	400	0.05	0.4
1N5691B	1N5472B	47	5.0	3.3	4.0	40	45	400	0.05	0.4
1N5692	1N5473A	56	20	3.3	4.0	40	45	300	0.05	0.4
1N5692A	1N5473A	56	10	3.3	4.0	40	45	300	0.05	0.4
1N5692B	1N5473B	56	5.0	3.3	4.0	40	45	300	0.05	0.4
1N5693	1N5474A	68	20	3.3	4.0	40	45	250	0.05	0.4
1N5693A	1N5474A	68	10	3.3	4.0	40	45	250	0.05	0.4
1N5693B	1N5474B	68	5.0	3.3	4.0	40	45	250	0.05	0.4
1N5694	1N5475A	82	20	3.3	4.0	40	45	225	0.05	0.4
1N5694A	1N5475A	82	10	3.3	4.0	40	45	225	0.05	0.4
1N5694B	1N5475B	82	5.0	3.3	4.0	40	45	225	0.05	0.4
1N5695	1N5476A	100	20	3.3	4.0	40	45	200	0.05	0.4
1N5695A	1N5476A	100	10	3.3	4.0	40	45	200	0.05	0.4
1N5695B	1N5476B	100	5.0	3.3	4.0	40	45	200	0.05	0.4
1N5696	1N5461A	6.8	20	2.7	2.0	60	65	450	0.05	0.4
1N5696A	1N5461A	6.8	10	2.7	2.0	60	65	450	0.05	0.4
1N5696B	1N5461B	6.8	5.0	2.7	2.0	60	65	450	0.05	0.4
1N5697	1N5462A	8.2	20	2.7	2.0	60	65	450	0.05	0.4
1N5697A	1N5462A	8.2	10	2.7	2.0	60	65	450	0.05	0.4
1N5697B	1N5462B	8.2	5.0	2.7	2.0	60	65	450	0.05	0.4
1N5698	1N5463A	10	20	2.8	2.0	60	65	400	0.05	0.4
1N5698A	1N5463A	10	10	2.8	2.0	60	65	400	0.05	0.4
1N5698B	1N5463B	10	5.0	2.8	2.0	60	65	400	0.05	0.4
1N5699	1N5464A	12	20	2.8	2.0	60	65	400	0.05	0.4
1N5699A	1N5464A	12	10	2.8	2.0	60	65	400	0.05	0.4
1N5699B	1N5464B	12	5.0	2.8	2.0	60	65	400	0.05	0.4
1N5700	1N5465A	15	20	2.8	2.0	60	65	400	0.05	0.4
1N5700A	1N5465A	15	10	2.8	2.0	60	65	400	0.05	0.4
1N5700B	1N5465B	15	5.0	2.8	2.0	60	65	400	0.05	0.4
1N5701	1N5467A	18	20	2.8	2.0	60	65	375	0.05	0.4
1N5701A	1N5467A	18	10	2.8	2.0	60	65	375	0.05	0.4
1N5701B	1N5467B	18	5.0	2.8	2.0	60	65	375	0.05	0.4
1N5702	1N5468A	22	20	3.2	2.0	60	65	375	0.05	0.4
1N5702A	1N5468A	22	10	3.2	2.0	60	65	375	0.05	0.4
1N5702B	1N5468B	22	5.0	3.2	2.0	60	65	375	0.05	0.4
1N5703	1N5469A	27	20	3.2	2/0	60	65	350	0.05	0.4
1N5703A	1N5469A	27	10	3.2	2.0	60	65	350	0.05	0.4
1N5703B	1N5469B	27	5.0	3.2	2.0	60	65	350	0.05	0.4
1N5704	1N5470A	33	20	3.2	2.0	60	65	350	0.05	0.4

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1N5704A–1N5710B

TYPE	REF.	CAPACITANCE C_J C_T* pF	C Tol %	$\frac{C (max)}{C (min)}$	Voltage Range V_1 Volts	V_2 Volts	BV_R Volts	Q	@ f GHz	P_D @ 25°C Watts
1N5704A	1N5470A	33	10	3.2	2.0	60	65	350	0.05	0.4
1N5704B	1N5470B	33	5.0	3.2	2.0	60	65	350	0.05	0.4
1N5705	1N5471A	39	20	3.2	2.0	60	65	325	0.05	0.4
1N5705A	1N5471A	39	10	3.2	2.0	60	65	325	0.05	0.4
1N5705B	1N5471B	39	5.0	3.2	2.0	60	65	325	0.05	0.4
1N5706	1N5472A	47	20	3.2	2.0	60	65	300	0.05	0.4
1N5706A	1N5472A	47	10	3.2	2.0	60	65	300	0.05	0.4
1N5706B	1N5472B	47	5.0	3.2	2.0	60	65	300	0.05	0.4
1N5707	1N5473A	56	20	3.2	2.0	60	65	225	0.05	0.4
1N5707A	1N5473A	56	10	3.2	2.0	60	65	225	0.05	0.4
1N5707B	1N5473B	56	5.0	3.2	2.0	60	65	225	0.05	0.4
1N5708	1N5474A	68	20	3.2	2.0	60	65	175	0.05	0.4
1N5708A	1N5474A	68	10	3.2	2.0	60	65	175	0.05	0.4
1N5708B	1N5474B	68	5.0	3.2	2.0	60	65	175	0.05	0.4
1N5709	1N5475A	82	20	3.2	2.0	60	65	150	0.05	0.4
1N5709A	1N5475A	82	10	3.2	2.0	60	65	150	0.05	0.4
1N5709B	1N5475B	82	5.0	3.2	2.0	60	65	150	0.05	0.4
1N5710	1N5476A	100	20	3.2	2.0	60	65	150	0.05	0.4
1N5710A	1N5476A	100	10	3.2	2.0	60	65	150	0.05	0.4
1N5710B	1N5476B	100	5.0	3.2	2.0	60	65	150	0.05	0.4

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TUNNEL DIODES

Index and Short-Form Specifications

This table contains a numerical listing and short-form specifications for tunnel diodes with EIA-registered 1N numbers.

KEY

TYPE	MATERIAL	I_P (mA)	I_P/I_V	V_P (mV)	C C_J* (pF)	f (GHz)
Numerical Listing of Registered Type Numbers	S = Silicon G = Germanium GA = Gallium Arsenide	Peak Current	Ratio of Peak Current to Valley Current	Forward Voltage measured at the Peak Point	Total Capacitance *Junction Capacitance	Resistive Cutoff Frequency

TUNNEL DIODES INDEX

TYPE	MATERIAL	I_P (mA)	I_P/I_V	V_P (mV)	C C_J* (pF)	f (GHz)
1N2927	S	0.10	2.5	75	80	
1N2927A	S	0.10	3.2	70	80	
1N2928	S	0.47	2.5	80	100	
1N2928A	S	0.47	3.2	74	100	
1N2929	S	1.0	2.5	80	150	
1N2929A	S	1.0	3.2	75	150	
1N2930	S	4.7	2.5	85	250	
1N2930A	S	4.7	3.2	79	250	
1N2931	S	10	2.5	85	400	
1N2931A	S	10	3.2	80	400	
1N2932	S	22	2.5	90	1200	
1N2932A	S	22	3.2	82	1200	
1N2933	S	47	2.5	90	1800	
1N2933A	S	47	3.2	83	1800	
1N2934	S	100	2.5	90	2500	
1N2934A	S	100	3.2	85	2500	
1N2939	G	1.0	10	65	15	2.2
1N2939A	G	1.0	7.0	60	10	
1N2940	G	1.0	7.7	65	10	2.2
1N2940A	G	1.0	4.4	65	7.0	
1N2941	G	4.7	7.9	65	50	2.6
1N2941A	G	4.7	4.4	65	30	
1N2969	G	2.2	7.6	65	25	2.5
1N2969A	G	2.2	4.5	65	15	
1N3113	GA	1.0	10		10	
1N3114	GA	2.2	10		10	
1N3115	GA	2.2	10		10	
1N3116	GA	4.7	10		15	
1N3117	GA	4.7	9.0		15	
1N3118	GA	10	10	160	20*	
1N3119	GA	10			20	
1N3120	GA	22	10			
1N3128	G	5.0	8.0	65	15	
1N3129	G	20	8.0	90	20	
1N3130	G	50	8.0	120	25	
1N3138	GA	50	13	260	30	
1N3149	G	10	7.7	65	90	2.6
1N3149A	G	10	4.4	65	50	
1N3150	G	22	7.6	65	125	2.2
1N3217	G	0.47	4.7		8.0	
1N3218	G	1.0	5.0		10	
1N3218A	G	1.0	5.0		5.0	
1N3219	G	2.2	5.0		20	
1N3219A	G	2.2	5.0		10	
1N3220	G	4.7	4.7		30	
1N3221	G	10	5.0	65	100	2.6
1N3221A	G	10	6.0		35	
1N3222	G	22	5.1		150	
1N3560	G	1.0	5.0	55	20	1.3
1N3561	G	1.0	8.0	55	20	1.3
1N3562	G	5.0	6.0	55	85	1.3
1N3712	G	1.0	5.0	65	10	2.3
1N3713	G	1.0	7.0	65	5.0	3.2
1N3714	G	2.2	4.2	65	25*	2.2
1N3715	G	2.2	7.0	65	10	3.0
1N3716	G	4.7	4.0	65	50	1.8
1N3717	G	4.7	7.6	65	25	3.4
1N3718	G	10	4.1	65	90	1.6
1N3719	G	10	7.0	65	50	
1N3720	G	22	4.2	65	150	1.6

TUNNEL DIODES INDEX (continued)

TYPE	MATERIAL	I_P (mA)	I_P/I_V	V_P (mV)	C C_J* (pF)	f (GHz)
1N3721	G	22	7.0	65	100	2.6
1N3847	G	5.0	6.0		25	
1N3848	G	10	6.0		25	
1N3849	G	20	6.0		30	
1N3850	G	50	6.0		40	
1N3851	G	100	6.0		40	
1N3852	G	5.0	8.0	70	15	
1N3853	G	10	8.0	75	15	
1N3854	G	20	8.0	85	20	
1N3855	G	50	8.0	105	25	
1N3856	G	100	8.0	115	25	
1N3857	G	5.0	8.0	70	8.0	
1N3858	G	10	8.0	75	8.0	
1N3859	G	20	8.0	85	10	
1N3860	G	50	8.0	105	12	
1N3948	S	4.7	3.5	80		
1N4393	S	0.10	2.5	75	80	
1N4393A	S	0.10	3.2	70	80	
1N4393B	S	0.10	3.5	65	80	
1N4394	S	0.22	2.5	80	90	
1N4394A	S	0.22	3.2	72	90	
1N4394B	S	0.22	3.6	67	90	
1N4395	S	0.47	2.5	80	100	
1N4395A	S	0.47	3.2	74	100	
1N4395B	S	0.47	3.5	69	100	
1N4396	S	1.0	2.5	80	150	
1N4396A	S	1.0	3.2	75	150	
1N4396B	S	1.0	3.5	70	150	
1N4397	S	2.2	2.5	80	200	
1N4397A	S	2.2	3.2	77	200	
1N4397B	S	2.2	3.5	73	200	
1N4398	S	4.7	2.5	85	250	
1N4398A	S	4.7	3.2	79	250	
1N4398B	S	4.7	3.5	74	250	
1N4399	S	10	2.5	85	400	
1N4399A	S	10	3.2	80	400	
1N4399B	S	10	3.5	75	400	

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4-LAYER DIODES

INDEX AND SHORT-FORM SPECIFICATIONS

This table contains a numerical listing and short-form specifications with EIA-registered 1N numbers.

KEY

TYPE	REPLACE-MENT	REF.	$V_{(BR)F}$ (volts)		I_H (mA)		V_F @	I_F	I_F (mA)	P_D
			(min)	(max)	(min)	(max)	(volts)	(mA)	(max)	(mW)

- TYPE: Numerical listing of Registered Type Numbers
- REPLACEMENT: Type number of recommended replacement or nearest electrical equivalent fully characterized in this book
- REF.: Reference device number indicates specific Data Sheet on which device is characterized
- $V_{(BR)F}$: Forward Breakover (Switching) Voltage required to switch the device from the "blocking" state to the "on" state (in volts dc)
- I_H: Holding Current — the value of current required to hold the diode in the conducting state
- V_F @ I_F: Forward Voltage — the forward voltage across the device at a specified forward current, I_F
- I_F: Forward Current — the continuous or dc value of forward current during the "on" state
- P_D: Steady state power dissipation

4-LAYER DIODES INDEX

1N3299–1N5160

TYPE	REPLACEMENT	REF.	$V_{(BR)F}$ (volts) (min)	$V_{(BR)F}$ (volts) (max)	I_H (mA) (min)	I_H (mA) (max)	V_F (volts)	@ I_F (mA)	I_F (mA) (max)	P_D (mW)
1N3299			36	44	1.0	15				150
1N3300			14.4	21.6	1.0	15	1.5	30	200	400
1N3300A			16.2	19.8	1.0	15	1.5	30	200	400
1N3301			17.6	26.4	1.0	15	1.5	30	200	400
1N3301A			19.8	24.2	1.0	15	1.5	30	200	400
1N3302			21.6	32.4	5.0	20	1.5	30	200	400
1N3302A			24.3	29.7	5.0	20	1.5	30	200	400
1N3303			26.4	39.6	5.0	20	1.5	30	200	400
1N3303A			29.7	36.3	5.0	20	1.5	30	200	400
1N3304			31.2	46.8	5.0	20	1.5	30	200	400
1N3304A			35.1	42.9	5.0	20	1.5	30	200	400
1N3489			16	24	1.0	6.0				150
1N3489A			16	24	1.0	6.0				150
1N3490			16	24	14	45				150
1N3771						4.0	1.2			
1N3772						50	1.2			
1N3831			16	24	0.5	15	1.2	15	150	150
1N3832			21	29	0.5	15	1.2	15	150	150
1N3833			26	34	0.5	15	1.2	15	150	150
1N3834			31	39	0.5	15	1.2	15	150	150
1N3835			36	44	0.5	15	1.2	15	150	150
1N3836			41	49	0.5	15	1.2	15	150	150
1N3837			46	54	0.5	15	1.2	15	150	150
1N3838			90	110	0.5	15	1.2	15	150	150
1N3839			16	24	14	50	1.2	50	150	150
1N3840			21	29	14	50	1.2	50	150	150
1N3841			26	34	14	50	1.2	50	150	150
1N3842			31	39	14	50	1.2	50	150	150
1N3843			36	44	14	50	1.2	50	150	150
1N3844			41	49	14	50	1.2	50	150	150
1N3845			46	54	14	50	1.2	50	150	150
1N3846			90	110	14	50	1.2	50	150	150
1N3935				30		30				
1N3936				20		8.0				
1N3937				100		3.5				
1N5158	1N5158	1N5158	8.0	10	1.0	20	1.5	150	150	150
1N5159	1N5159	1N5158	9.0	11	1.0	20	1.5	150	150	150
1N5160	1N5160	1N5158	10	12	1.0	20	1.5	150	150	150

TRANSIENT SUPPRESSOR DIODES

INDEX AND SHORT FORM SPECIFICATIONS

The following table provides a numerical index and short-form specifications for voltage transient suppressor diodes with EIA-registered type numbers.

KEY

TYPE	REPLACEMENT	REFERENCE	$V_{(BR)R}$	I_R	V_{RM}	V_R	i_R	TC
Numerical Listing of Registered Type Numbers.	Type number of recommended replacement or of nearest electrical equivalent fully characterized in this book	Reference device number indicates specific Data Sheet on which device is characterized	Breakdown Voltage	Reverse Current	Reverse Voltage (working) @ $T_A = 25°C$	Peak Reverse Voltage during Reverse Surge	Maximum Surge Current	Temperature Coefficient of Breakdown Voltage

TYPE	MATERIAL	REPLACEMENT	REFERENCE	$V_{(BR)R}$ Volts (min)	@ I_R mAdc	V_{RM} Volts (wkg)	V_R Volts	i_R (surge) AMP (max)	TC %/°C (max)
1N5555	S	1N2991B	1N2970	33	0.005	21.5	30.5		0.093
1N5556	S	1N2995B	1N2970	43.7	0.005	28.5	40.3		0.094
1N5557	S	1N2997B	1N2970	54	0.005	34.5	49		0.096
1N5558	S	1N3015B	1N2970	191	0.005	124	175		0.100
1N5610	S	1N2991B	1N2970	33	1.0		30.5	32	+0.1
1N5611	S	1N2995B	1N2970	43.7	1.0		40.3	24	+0.1
1N5612	S	1N2997B	1N2970	54	1.0		49	19	+0.1
1N5613	S	1N3015B	1N2970	191	1.0		175	5.7	+0.1
1N5629	S	1N2970A	1N2970	6.12	10	5.5	10.8	139	0.057
1N5629A	S	1N2970B	1N2970	6.45	10	5.8	10.5	143	0.057
1N5630	S	1N2971A	1N2970	6.75	10	6.05	11.7	128	0.061
1N5630A	S	1N2971B	1N2970	7.13	10	6.40	11.3	132	0.061
1N5631	S	1N2972A	1N2970	7.38	10	6.63	12.5	120	0.065
1N5631A	S	1N2972B	1N2970	7.79	10	7.02	12.1	124	0.065
1N5632	S	1N2973A	1N2970	8.19	1.0	7.37	13.8	109	0.068
1N5632A	S	1N2973B	1N2970	8.65	1.0	7.78	13.4	112	0.068
1N5633	S	1N2974A	1N2970	9.0	1.0	8.10	15	100	0.073
1N5633A	S	1N2974B	1N2970	9.5	1.0	8.55	1.45	103	0.073
1N5634	S	1N2975A	1N2970	9.9	1.0	8.92	16.2	93	0.075
1N5634A	S	1N2975B	1N2970	10.5	1.0	9.40	15.6	96	0.075
1N5635	S	1N2976A	1N2970	10.8	1.0	9.72	17.3	87	0.078
1N5635A	S	1N2976B	1N2970	11.4	1.0	10	16.7	90	0.078
1N5636	S	1N2977A	1N2970	11.7	1.0	10.5	19	79	0.081
1N5636A	S	1N2977B	1N2970	12.4	1.0	11.1	18.2	82	0.081
1N5637	S	1N2979A	1N2970	13.5	1.0	12.1	22	68	0.084
1N5637A	S	1N2979B	1N2970	14.3	1.0	12.8	21.2	71	0.084
1N5638	S	1N2980A	1N2970	14.4	1.0	12.9	23.5	64	0.086
1N5638A	S	1N2980B	1N2970	15.2	1.0	13.6	22.5	67	0.086
1N5639	S	1N2982A	1N2970	16.2	1.0	14.5	26.5	56.5	0.088
1N5639A	S	1N2982B	1N2970	17.1	1.0	15.3	25.2	59.5	0.088
1N5640	S	1N2984A	1N2970	18	1.0	16.2	29.1	51.5	0.090
1N5640A	S	1N2984B	1N2970	19	1.0	17.1	27.7	54	0.090
1N5641	S	1N2985A	1N2970	19.8	1.0	17.8	31.9	47	0.092
1N5641A	S	1N2985B	1N2970	20.9	1.0	18.8	30.6	49	0.092
1N5642	S	1N2986A	1N2970	21.6	1.0	19.4	34.7	43	0.094
1N5642A	S	1N2986B	1N2970	22.8	1.0	20.5	33.2	45	0.094
1N5643	S	1N2988A	1N2970	24.3	1.0	21.8	39.1	38.5	0.096
1N5643A	S	1N2988B	1N2970	25.7	1.0	23.1	37.5	40	0.096
1N5644	S	1N2989A	1N2970	27	1.0	24.3	43.5	34.5	0.097
1N5644A	S	1N2989B	1N2970	28.5	1.0	25.6	41.4	36	0.097
1N5645	S	1N2990A	1N2970	29.7	1.0	26.8	47.7	31.5	0.098
1N5645A	S	1N2990B	1N2970	31.4	1.0	28.2	45.7	33	0.098
1N5646	S	1N2991A	1N2970	32.4	1.0	29.1	52	29	0.099
1N5646A	S	1N2991B	1N2970	34.2	1.0	30.8	49.9	30	0.099
1N5647	S	1N2992A	1N2970	35.1	1.0	31.6	56.4	26.5	0.100
1N5647A	S	1N2992B	1N2970	37.1	1.0	33.3	53.9	28	0.100
1N5648	S	1N2993A	1N2970	38.7	1.0	34.8	61.9	24	0.101
1N5648A	S	1N2993B	1N2970	40.9	1.0	36.8	59.3	25.3	0.101
1N5649	S	1N2995A	1N2970	42.3	1.0	38.1	67.8	22.2	0.101
1N5649A	S	1N2995B	1N2970	44.7	1.0	40.2	64.8	23.2	0.101
1N5650	S	1N2997A	1N2970	45.9	1.0	41.3	73.5	20.4	0.102
1N5650A	S	1N2997B	1N2970	48.5	1.0	43.6	70.1	21.4	0.102
1N5651	S	1N2999A	1N2970	50.4	1.0	45.4	80.5	18.6	0.103
1N5651A	S	1N2999B	1N2970	53.2	1.0	47.8	77	19.5	0.103
1N5652	S	1N3000A	1N2970	55.8	1.0	50.2	89	16.9	0.104
1N5652A	S	1N3000B	1N2970	58.9	1.0	53	85	17.7	0.104
1N5653	S	1N3001A	1N2970	61.2	1.0	55.1	98	15.3	0.104
1N5653A	S	1N3001B	1N2970	64.6	1.0	58.1	92	16.3	0.104
1N5654	S	1N3002A	1N2970	67.5	1.0	60.7	108	13.9	0.105
1N5654A	S	1N3002B	1N3970	71.3	1.0	64.1	103	14.6	0.105
1N5655	S	1N3003A	1N2970	73.8	1.0	66.4	118	12.7	0.105
1N5655A	S	1N3003B	1N2970	77.9	1.0	70.1	113	13.3	0.105
1N5656	S	1N3004A	1N2970	81.9	1.0	73.7	131	11.4	0.106
1N5656A	S	1N3004B	1N2970	86.5	1.0	77.8	125	12	0.106
1N5657	S	1N3005A	1N2970	90	1.0	81	144	10.4	0.106
1N5657A	S	1N3005B	1N2970	95	1.0	85.5	137	11	0.106
1N5658	S	1N3007A	1N2970	99	1.0	89.2	158	9.5	0.107
1N5658A	S	1N3007B	1N2970	105	1.0	94	152	9.9	0.107
1N5659	S	1N3008A	1N2970	108	1.0	97.2	173	8.7	0.107
1N5659A	S	1N3008B	1N2970	114	1.0	102	165	9.1	0.107
1N5660	S	1N3009A	1N2970	117	1.0	105	187	8.0	0.107
1N560A	S	1N3009B	1N2970	124	1.0	111	179	8.4	0.107
1N5661	S	1N3011A	1N2970	135	1.0	121	215	7.0	0.108
1N5661A	S	1N3011B	1N2970	143	1.0	128	207	7.2	0.108
1N5662	S	1N3012A	1N2970	144	1.0	130	230	6.5	0.108
1N5662A	S	1N3012B	1N2970	152	1.0	136	219	6.8	0.108
1N5663	S	1N3013A	1N2970	153	1.0	138	244	6.2	0.108
1N5663A	S	1N3013B	1N2970	162	1.0	145	234	6.4	0.108
1N5664	S	1N3014A	1N2970	162	1.0	146	258	5.8	0.108
1N5664A	S	1N3014B	1N2970	171	1.0	154	246	6.1	0.108
1N5665	S	1N3015A	1N2970	180	1.0	162	287	5.2	0.108
1N5665A	S	1N3015B	1N2970	190	1.0	171	274	5.5	0.108

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LIGHT-EMITTING DIODE

KEY

This table contains a numerical listing and short-form specifications for light-emitting diodes with EIA-registered 1N numbers

MAXIMUM RATINGS								ELECTRICAL/OPTICAL CHARACTERISTICS				
								Light Output				
TYPE	MATERIAL	P_D @ 25°C	Ref. Point	T °C	Ref Point	V_R (Volts)	I_F (mA)	B Brightness C1 @ I_F mA	CP Candlepower mcd @ I_F mA	P_o Radiated μW @ I_F mA	λP nM	V_F (Volts)

- TYPE: Alpha-Numerical Listings
- MATERIAL: GA — Gallium Arsenide; GAP — Gallium Arsenide Phosphide; GP — Gallium Phosphide
- Power Dissipation @ 25°C. Units: M = Milliwatts, W = Watts. Ref. Point: A,C,J,S Indicates — Ambient, Case, Junction or Stud
- Maximum Temperature. Ref. Point: J = Junction, S = Storage Junction
- Reverse Voltage
- Forward Current — Continuous
- B = Brightness in Footlamberts
- CP = Candlepower in Millicandela
- P_O = Power Output Radiated in Microwatts
- Peak Emission Wavelength
- Forward Voltage

LIGHT-EMITTING DIODE

TYPE	MATERIAL	MAXIMUM RATINGS						ELECTRICAL/OPTICAL CHARACTERISTICS				
								Light Output				
		P_D @ 25°C	Ref Point	T °C	Ref Point	V_R (volts)	I_F mA	B Brightness fL@ I_F mA	CP Candlepower mcd @ I_F mA	P_o Radiated μW @ I_F mA	λP nM	V_F (volts)
1N5765	GAP	85M	C	100	S		50				700	2.0

2N... & 3N
INDEX

INDEX

NUMERICAL INDEX

The following table provides a numerical index and short-form specifications for EIA-registered 2N and 3N type numbers.

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KEY

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS					ELECTRICAL CHARACTERISTICS										
						P_D @ 25°C	Ref Point	T_J °C	V_{CBO} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min) (max)	@ I_C	Units	$V_{CE(SAT)}$ (volts)	@ I_C	Units	h_{f-}	Subscript	f_-	Units	Subscript

Collector-Emitter Saturation Voltage at Specified Collector Current
I_C Units:
A = Amp
M = milliamp

Numerical Listing of 2N and 3N Registered Type Numbers

S = Silicon
G = Germanium

P = PNP
N = NPN

Type number of recommended replacement or of nearest electrical equivalent fully characterized in this book

Reference device number indicates specific Data Sheet on which device is characterized

Common-Emitter DC Short-Circuit Forward-Current Transfer Ratio at Specified Collector Current
I_C Units: **A** = Amp
M = milliamp
***** = microamp
N = nanoamp

Maximum Collector-Emitter Voltage (Subscript Identifies Condition)

Subscript:
0 = V_{CEO} = Base Open
R = V_{CER} = Specified Resistance
S = V_{CES} = Base Shorted
V = V_{CEV} = Used when only voltage bias is used
X = V_{CEX} = Base-Emitter Back Biased
U = V_{CE} = Termination Undefined

APPLICATION CODE

A = Amplifier
AH = Amplifier, High frequency
AHP = Amplifier, High frequency power
AL = Amplifier, Light sensitive
AM = Amplifier, Multiple device
AP = Amplifier, Power
RD = Radiation Detector
S = Switch
SC = Switch, Chopper
SH = Switch, High speed
SHP = Switch, High speed power
SP = Switch, Power

Small-Signal Forward-Current Transfer Ratio (**E**, **B** or **C** defines the parameter)
E = h_{fe} = Common-Emitter Current Transfer Ratio
B = h_{fb} = Common-Base Current Transfer Ratio
C = h_{fc} = Common-Collector Current Transfer Ratio

CUTOFF FREQUENCY

Units: **K** = **KHz**
M = **MHz**
G = **GHz**

(**B**, **E**, **M** or **T** Indicate the Parameter)
B = f_{hfb} = f_{ab} = Common-Base Cutoff Frequency
E = f_{hfe} = f_{ae} = Common-Emitter Cutoff Frequency
M = f_{max} = Maximum Frequency of Oscillations
T = f_T = Current Gain - Bandwidth Product

Power Dissipation at 25°C
Units: M = milliwatts
W = Watts
Ref. Point: A, C, J, S, Indicates Ambient, Case, Junction or Stud

Maximum Collector - Base Voltage

Maximum Operating Junction Temperature

						MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N21		P			S	0.12W	A	85	100											
2N22	G	P			S	145M	A	55	100	100	O						2.0	B		
2N23	G	P			S	105M	A	55	40	50	O						2.0	B		
2N24	G	P			A	145M	A	50	30	30	O						2.2	B		
2N25	G	P			AH	200M	A	60	50	50	O						2.5	B	3.0M	B
2N26	G	P			S	90M	A	55	30	40	O									
2N27		N			A	50M	A	85	35								0.95	B	1.0M	B
2N28		N			A	50M	A	85	30								0.94	B	0.5M	B
2N29		N			A	50M	A	85	35								0.96	B	1.0M	B
2N30	G	P			A	100M	A	40	35										3.0M	B
2N31	G	P			A	100M	A	40	35										3.0M	B
2N32	G	P			S	50M	A		40											
2N32A	G	P			S	50M	A		40											
2N33	G	P			AH	30M	A		8.5											
2N34	G	P	2N1191	2N1191	A	50M	A		25											
2N34A	G	P			A	50M	A		25											
2N35	G	P			A	50M	A		25											
2N35A	G	N																		
2N36	G	P	2N1191	2N1191	A	50M	A	50	20											
2N37	G	P	2N1191	2N1191	A	50M	A	20									30	E		
2N38	G	P	2N1191	2N1191	A	50M	A										15	E		
2N38A	G	P			A	50M	A	20	20											
2N41	G	P			A	50M	A		25											
2N43	G	P			A	240M	A	85	45	30	O	34		20M			30	E	500K	B
2N43A	G	P	2N525	2N524	A	240M	A	85	45	30	O	34	65	20M			30	E	500K	B
2N44	G	P	2N524	2N524	A	240M	A	85	45	30	O	18	43	20M					500K	B
2N45	G	P	2N524	2N524	A	240M	A	85	45	30	O	18		20M					500K	B
2N46	G	P			A	50M	A		25											
2N47	G	P	2N1191	2N1191	A	50M			35											
2N48	G	P			A	50M			35											
2N49	G	P	2N1191	2N1191	A	50M			35											
2N50	G				S	50M	A	50	15											
2N51	G				S	0.1W	A	50	50											
2N52	G				S	0.12W	A	50	50											
2N53	G				S	0.1W	A	50	50											
2N54	G	P	2N1191	2N1191	A	0.2W	A	60	45											
2N55	G	P	2N1191	2N1191	A	0.2W	A	60	45											
2N56	G	P	2N1191	2N1191	A	0.2W	A	60	45											
2N57	G	P			AP	20W	C		60											
2N59	G	P	2N1193	2N1191	A	180M	A	85	25	25	O									
2N59A	G	P	2N1193	2N1191	A	180M	A	85	40	40	O									
2N59B	G	P	2N1193	2N1191	A	180M	A	85	50	50	O									
2N59C	G	P	2N1193	2N1191	A	180M	A	85	60	60	O									
2N60	G	P	2N1193	2N1191	A	180M	A	85	25	25	O									
2N60A	G	P	2N1193	2N1191	A	180M	A	85	40	40	O									
2N60B	G	P	2N1193	2N1191	A	180M	A	85	50	50	O									
2N60C	G	P	2N1193	2N1191	A	180M	A	85	60	60	O									
2N61	G	P	2N1192	2N1191	A	180M	A	85	25	25	O									
2N61A	G	P	2N1191	2N1191	A	180M	A	85	40	40	O									
2N61B	G	P	2N1191	2N1191	A	180M	A	85	50	50	O									
2N61C	G	P	2N1191	2N1191	A	180M	A	85	60	60	O									
2N62	G	P	2N1191	2N1191	A	50M			35											
2N63	G	P	2N1191	2N1191	A	102M	A	85	44	44	S									
2N64	G	P	2N1191	2N1191	A	102M	A	85	30	30	S									
2N65	G	P	2N1193	2N1191	A		A	85	24	24	S									
2N66		P			AP	27.5W	C	80	60	40										
2N67		P			S	0.1W	A	85	50											
2N68	G	P			AP	2.0W	A	70	25											
2N71		P			AP	1.0W	A	60	75	50	U									
2N72	G	P			S	50M	A		40											
2N73		P			SC	0.2W	A			50	U									
2N74		P			S	0.2W	A			50	U									
2N75		P			S	0.2W	A			20	U									
2N76	G	P	2N319	2N319	A	5.0M	J	60	20										500K	B
2N77	G	P	2N1191	2N1191	A	35M	A		25											
2N78	G	N			AH	65M	A	85	15	15	O	45	135	1.0M			0.97	B	5.0M	B
2N78A	G	N			AH	65M	A	85	20	15	O	45	135	1.0M			0.97	B	5.0M	B
2N79	G	P	2N1191	2N1191	A	35M	A		35											
2N80	G	P			A	50M	A		25											
2N81	G	P	2N1191	2N1191	A	50M	A	100		20	O						20	E		
2N82	G	P	2N1191	2N1191	A	35M	A	71	20			20	60	1.0M						
2N94	G	N			AH	150M	A	85	20	20	R	20	80	1.0M			7.5		2.0M	B
2N94A	G	N			AH	150M	A	85	20	20	R	20	80	1.0M			5.0		5.0M	B
2N95		N			AP	2.5W	A	70	25											
2N96	G	P			A	50M	A		30										500K	B
2N97	G	N			A	50M	A	75	30								5.0	E	0.5M	B
2N97A	G	N			A	50M	A	85	40								5.0	E	0.5M	B
2N98	G	N			A	50M	A	75	40								19	E	0.8M	B
2N98A	G	N			A	50M	A	85	40								24	E	0.8M	B
2N99	G	N			A	50M	A	75	40								19	E	2.0M	B
2N100		N			A	25M	A	50	25								99	E	2.5M	B
2N101	G	P			AP	1.0W	A	70	25											
2N102	G	N			AP	1.0W	A	70	25											
2N103	G	N			A	50M	A	75	35								1.5	E		
2N104	G	P	2N650	2N650	A	150M	A	70	30											
2N105	G	P			A	35M	A	50	35											
2N106	G	P	2N1191	2N1191	A	102M	A	85	6.0											
2N107	G	P	2N464	2N464	A	50M	A	60	12	6.0	O						0.95	B		

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TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N108	G	P			A	50M	A													
2N109	G	P	2N1192	2N1191	A	165M	A	71	35	25	O	65	115	50M	0.15	50M	50	E		
2N110	G	P			S	0.2W	A	85	50						2.5	18M				
2N111	G	P			AH	150M	A	85	30	15	O	15		1.0M						
2N111A	G	P			AH	150M	A	85	30	15	O	15		1.0M						
2N112	G	P			AH	150M	A	85	30	15	O	15		1.0M						
2N112A	G	P			AH	150M	A	85	30	15	O	15		1.0M						
2N113	G	P			AH	96M	A	85	10											
2N114	G	P			AH	96M	A	85	10											
2N115	G	P			SP	50W	C	75	32	32	R		110	30M						
2N117	S	N			SH	150M	C	150	30								0.9	B	1.0M	B
2N118	S	N			SH	150M	C	150	30								0.95	B	2.0M	B
2N118A	S	N			SH	150M	C	150	45											
2N119	S	N			SH	150M	C	150	30								0.974	B	2.0M	B
2N120	S	N			AH	150M	C	175	45			76	333				0.987	B		
2N122	S	N			AP	8.75W	C	150	120			3.0		100M						
2N123	G	P			SH	50M	J	85	20	15	O						0.98	B	5.0M	B
2N124	G	N			S	50M	A	75	10			12	24	5.0M	0.3	5.0M			0.3M	
2N125	G	N			S	50M	A	75	10			24	48	5.0M	0.3	5.0M			5.0M	
2N126	G	N			S	50M	A	75	10			48	100	5.0M	0.3	5.0M			5.0M	
2N127	G	N			S	50M	A	75	10			100	200	5.0M	0.3	5.0M			5.0M	
2N128	G	P			AH	30M	A	85	10	4.5	U						19	E	45M	M
2N129	G	P			AH	30M	A	85	10	4.5	U						11.5	E	30M	M
2N130	G	P	2N1191	2N1191	A	85M	A	85	44											
2N130A	G	P	2N650	2N650	A	100M	A	85	45	40	O						14	E		
2N131	G	P	2N1192	2N1191	A	85M	A	85	30											
2N131A	G	P	2N651	2N650	A	100M	A	85	45	30	O						27	E		
2N132	G	P	2N1192	2N1191	A	85M	A	85	24											
2N132A	G	P	2N651	2N650	A	100M	A	85	35	20	O									
2N133	G	P	2N1192	2N1191	A	85M	A	85	30											
2N133A	G	P	2N651	2N650	A	100M	A	85	35	20	O									
2N135	G	P			AH	100M	A	85	20	12	R						20	E	4.5M	B
2N136	G	P			AH	100M	A	85	20	12	R						40	E	6.5M	B
2N137	G	P			AH	100M	A	85	10	6.0	R						60	E	10M	B
2N138	G	P			A	50M	A	50	24											
2N138A	G	P			A	150M	A	85	45	30	O	10		50M						
2N138B	G	P			A	100M	A	85	45											
2N139	G	P			A	80M	A	70	16											
2N140	G	P			A	80M	A	70	16											
2N141	G	P			AP	1.5W	A	25	60	30										
2N142	G	N			AP	1.5W	A	25	60	30										
2N143	G	P			AP	1.0W	A	25	60	30										
2N144	G	N			AP	1.0W	A	25	60	30										
2N145	G	N			AH	65M	A	75		20	U									
2N146	G	N			AH	65M	A	75		20	U									
2N147	G	N			AH	65M	A	75		20	U									
2N148	G	N			AH	65M	A	75		16	U									
2N148A	G	N			AH	65M	A	75		32	U									
2N149	G	N			AH	65M	A	75		16	U									
2N149A	G	N			AH	65M	A	75		32	U									
2N150	G	N			AH	65M	A	75		16	U									
2N150A	G	N			AH	65M	A	75		32	U									
2N155	G	P	2N176	2N176	AP	1.5W	A	85	30			24		0.5A	0.65	0.5A				
2N156	G	P	2N176	2N176	AP	1.5W	A	85	30			24		0.5A	0.6	1.0A			145K	B
2N157	G	P	2N1531	2N1529	AP	1.5W	A	85	60			20		0.5A					100K	B
2N157A	G	P	2N1532	2N1529	AP	1.5W	A	85	90			20		0.5A					100K	B
2N158	G	P	2N2139	2N2137	AP	1.5W	A	85	60			21		0.5A	0.75	1.0A			145K	B
2N158A	G	P	2N2141	2N2137	AP	1.5W	A	95	80	60	O	21		0.5A	0.75	1.0A			4.0K	E
2N160	S	N	2N2217		A	0.15W	A		40			9.0	19							
2N160A	S	N	2N2217		A	0.15W	A		40			9.0	19							
2N161	S	N	2N2217		A	0.15W	A		40			19	39							
2N161A	S	N	2N2217		A	0.15W	A		40			19	39							
2N162	S	N	2N2221	2N2218	A	0.15W	A		40			19	199							
2N162A	S	N	2N2221	2N2218	A	0.15W	A		40			19	199							
2N163	S	N	2N2221	2N2218	A	0.15W	A		40			39	199							
2N163A	S	N	2N2221	2N2218	A	0.15W	A		40			39	199							
2N166	G	N			AH	25M	A	50		6.0	O									
2N167	G	N			AH	75M	A	85	30	30	O						0.952	B	5.0M	B
2N167A	G	N			SH	75M	A	85	30	30	O	17	90	8.0M			0.952	B	5.0M	B
2N168	G	N			AH	55M	A	75	15	15	O						20	E		
2N168A	G	N			AH	65M	A	85	15	15	O						20	E		
2N169	G	N			AH	65M	A	85	15	15	O						30	E		
2N169A	G	N			A	65M	A	85	25	25	O						30	E		
2N170	G	N			AH	25M	A	50		6.0	O									
2N172	G	N			AH	65M	A	75		16	U									
2N173	G	P		2N277	AP	10W	C	95	60	50	S	35	70	5.0A	1.0	12A				
2N174	G	P		2N174	SP	100W	C	95	80	70	S	25	50	5.0A	0.9	12A				
2N174A	G	P		2N174	SP	100W	C	95	80	70	S	40	80	1.2A	0.7	12A			100K	B
2N175	G	P	2N1192	2N1191	AH	50M	A	71	10											
2N176	G	P		2N176	AH	90W	C	80	40	30	R	25		0.5A	0.4	3.0A			4.0K	E
2N178	G	P		2N178	A	40W	C	90	30	30	R	15	45	0.5A	0.6	3.0A			5.0K	E
2N179	G	P	2N176	2N176	A															
2N180	G	P	2N1192	2N1191	A	0.15W	A	75	30											
2N181	G	P	2N1192	2N1191	A	0.25W	A	75	30											
2N182	G	N			S	0.1W	A	75	25											
2N183	G	N			S	0.1W	A	75	25											
2N184	G	N			S	0.1W	A	75	25											

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N185	G	P	2N650	2N650	A	150M	A	50	20								35	E		
2N186	G	P	2N1191	2N1191	A	100M	A	85	25	25	R								800K	B
2N186A	G	P	2N1191	2N1191	A	200M	A	85	25	25	R								800K	B
2N187	G	P	2N1191	2N1191	A	100M	A	85	25	25	R								1.0M	B
2N187A	G	P	2N1191	2N1191	A	200M	A	85	25	25	R								1.0M	B
2N188	G	P	2N1191	2N1191	A	100M	A	85	25	25	R								1.2M	B
2N188A	G	P	2N1191	2N1191	A	200M	A	85	25	25	R								1.2M	B
2N189	G	P	2N1191	2N1191	A	75M	A	85	25	25	R								800K	B
2N190	G	P	2N1191	2N1191	A	75M	A	85	25	25	R								1.0M	B
2N191	G	P	2N1192	2N1191	A	75M	A	85	25	25	R								1.2M	B
2N192	G	P	2N1193	2N1191	A	75M	A	85	25	25	R								1.5M	B
2N193	G	N			AH	150M	A	85	18	18	R						4.0		2.0M	B
2N194	G	N			AH	50M	A	75	15	15	R						4.8		2.0M	B
2N194A	G	N			AH	50M	A	75	20	20	R						5.0		2.0M	B
2N206	G	P			A	75M	A		30											
2N207	G	P	2N1191	2N1191	A	50M	A	65	12	12	V						35	E		
2N207A	G	P	2N1193	2N1191	A	50M	A	65	12	12	V						35	E		
2N207B	G	P	2N1190	2N1189	A	50M	A	65	12	12	V						35	E		
2N211	G	N			AH	50M	A	75	10	10	R						3.8		2.0M	E
2N212	G	N			AH	150M	A	85	18	18		10		1.0M			10	E	4.0M	B
2N213	G	N			A	50M	A	75	40	25	R				0.6	100M	70	E		
2N213A	G	N			A	150M	A	85	40	25	R				1.0	100M	100	E	10K	E
2N214	G	N			A	125M	A	75	40			50	100	35M					600K	B
2N215	G	P	2N1189	2N1189	A	150M	A	70	30											
2N216	G	N			AH	50M	A	75	15								3.9	E	2.0M	B
2N217	G	P	2N1192	2N1191	A	150M	A	71	35	25	O	65	115	50M	0.15	50M				
2N218	G	P			A	80M	A	70	16											
2N219	G	P			A	80M	A	70	16											
2N220	G	P	2N1189	2N1189	A	50M	A	71	10											
2N223	G	P	2N1193	2N1191	A	100M	A	65		18	V						39	E		
2N224	G	P	2N1192	2N1191	A	250M	A	75	25			60	120	100M	0.25	100M				
2N225	G	P	2N1193	2N1191	A	250M	A	75	25			60	120	100M	0.25	100M				
2N226	G	P	2N1192	2N1191	A	250M	A	75	30			35	105	100M	0.25	100M				
2N227	G	P	2N1192	2N1192	A	250M	A	75	30			35	105	100M	0.25	100M				
2N228	G	P			A	50M	A	75	25			50	100	35M					600K	B
2N229	G	N			A	50M	A	75	10										550K	B
2N230	G	P			AP	15W	C	85	60	30	U	60	106	0.5A	0.8	2.0A			12K	E
2N231	G	P			AH	9.0M	A	55	4.5	4.5	V						19	E	30M	M
2N232	G	P			AH	9.0M	A	55	4.5	4.5	V						9.0	E	20M	M
2N233	G	N			AH	50M	A	75	10								3.0	E		
2N233A	G	N			AH	50M	A	75	10								3.5	E		
2N234	G	P	2N554	2N178	AP			90		25	R									
2N234A	G	P	2N555	2N178	AP	25W	C	90		25	R									
2N235	G	P	2N350A	2N350A	AP			90		40	U				0.8	1.0A				
2N235A	G	P		2N235A	AP	25W	C	90		40	U				0.8	1.0A				
2N235B	G	P		2N235B	AP	25W	C	85	50	35	R				0.8	1.0A			5.0K	E
2N236	G	P	2N350A	2N350A	AP			95		35	R				1.0	3.0A				
2N236A	G	P	2N351A	2N350A	AP	25W	C	95		35	R				1.0	3.0A				
2N236B	G	P	2N376A	2N350A	AP	25W		95	50	35	R				1.0	3.0A			5.0K	E
2N237	G	P			A	150M	A	55	45								0.98	B	500K	B
2N238	G	P	2N1192	2N1191	A	50M	A	60	20											
2N240	G	P			S	25M	A	85	6.0	6.0	S				0.1	8.0M	16	E	25M	T
2N241	G	P	2N321	2N319	A	100M	A	85	25	25	R								1.3M	B
2N241A	G	P	2N321	2N319	A	200M	A	85	25	25	R								1.3M	B
2N242	G	P		2N242	A	20W	C	85	45	45	R								5.0K	B
2N243	S	N			A	750M	C	150	60								0.9	B		
2N244	S	N			A	750M	C	150	60								0.961	B		
2N247	G	P			AH	80M	A		40											
2N248	G	P			A			75	25											
2N249	G	P			A	350M	A	60	25								30	E		
2N250	G	P	2N3611	2N3611	AP	12W	C	80	30			30		500M					8.0K	E
2N250A	G	P	2N3611	2N3611	AP	90W	C	100	40	35	V	25	100	3.0A	0.7	3.0A			200K	T
2N251	G	P	2N1530	2N1529	AP	12W	C	80	60			30		500M					8.0K	E
2N251A	G	P	2N3616	2N3615	AP	90W	C	100	60	55	V	25	100	3.0A	0.7	3.0A			200K	T
2N252	G	P			AH	30M	C	55		16	O									
2N253	G	N			AH	65M	C	75		12	O									
2N254	G	N			AH	65M	C	75		20	O									
2N255	G	P			AP	1.5W	A	85	15											
2N255A	G	P			AP	20W	C	85	15	15	R									
2N256	G	P	2N555	2N554	AP	1.5W	A	85	30											
2N256A	G	P	2N178	2N178	AP	20W	C	85	30	25	R									
2N257	G	P			AP	25W	C	85	40										7.0K	
2N258	S	P	2N2906	2N2906	A	250M	A	160	30	30	O						15	E		
2N259	S	P	2N2906	2N2906	A	250M	A	160	30	30	O						32	E		
2N260	S	P	2N2906	2N2906	A	0.2W	A	150	10											
2N260A	S	P	2N2906	2N2906	A	0.2W	A	150	30											
2N261	S	P	2N2906	2N2906	A	0.2W	A	150	75											
2N262	S	P	2N2906	2N2906	A	0.2W	A	150	10											
2N262A	S	P	2N2906	2N2906	A	0.2W	A	150	30											
2N263	S	N	2N2907	2N2907	A	150M	A	150	45	30	O	45	150	10M	1.5	10M	39	E	20M	B
2N264	S	N	2N2906	2N2906	A	125M	A	150	45	30	O	20	55	10M	1.5	10M	0.95	B	10M	B
2N265	G	P	2N1175	2N1413	A	75M	A	85		25	R								1.5M	B
2N266	G	P			A	75M	A	85		18	R								800K	B
2N267	G	P			AH	80M	A		40											
2N268	G	P	2N1530	2N1529	AP	25W	C	85	80										6.0K	
2N268A	G	P			SP	10W	C	90	80	60	V	20		2.0A	1.0	2.0A				
2N269	G	P			S	120M	A	85	25	24	O									
2N270	G	P	2N1193	2N1191	A	150M	A	50	25											

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TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
						P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N271	G	P			AH	150M	A	85	30	10	O									
2N271A	G	P			AH	150M	A	85	30	10	O									
2N272	G	P	2N298A	2N298A	A	150M	A	85	30	24	O						60	E		
2N273	G	P	2N298A	2N298A	A	150M	A	85	45	25	S	30		50M						
2N274	G	P	2N298A	2N298A	AH	120M	A	100	40	40	O	20	175	1.5M			20	E		
2N277	G	P		2N277	AP	70W	C	95	40	40	S	35	70	5.0A						
2N278	G	P		2N277	AP	70W	C	95	50	45	S	35	70	5.0A	1.0	12A				
2N279	G	P	2N650	2N650	A	125M	A	75		20							20	E		
2N280	G	P	2N650	2N650	A	125M	A	75		20							30	E		
2N281	G	P	2N651	2N650	A	167M	C	75	16	16	R	45	120						0.35M	B
2N282	G	P	2N651	2N650	A															
2N283	G	P	2N650	2N650	S	125M	A	75	20	20							30	E		
2N284	G	P			S	125M	A	75	32	32		15							0.35M	B
2N284A	G	P			S	125M	A	75	60	60		15							0.35M	B
2N285	G	P	2N285A	2N285A	AP	25W	C	95		35	R				0.5	1.0A				
2N285A	G	P		2N285A	AP	25W	C	95		35	R				0.5	1.0A				
2N290	G	P			AP	55W	C	95	70											
2N291	G	P	2N1191	2N1191	A	180M	A	50	25								30	E		
2N292	G	N			AH	65M	A	85	15	15	O	6.0	44							
2N293	G	N			AH	65M	A	85	15	15	O	6.0	55							
2N296	G	P	2N1531	2N1529	A	20W	C	85	60			19		1.0A	1.0	1.0A			4.0K	B
2N297	G	P	2N297A	2N297A	AP	35W	C	95	60	50	S	40	100	0.5A	1.0	2.0A			5.0K	E
2N297A	G	P		2N297A	AP	35W	C	95	60	50	S	40	100	0.5A	1.0	2.0A			5.0K	E
2N299	G	P			AH	20M	A	85	5.0	4.5	V								90M	M
2N300	G	P			AH	20M	A	85	5.0	4.5	V						11	E	85M	M
2N301	G	P		2N301	AP	11W	A	85	40											
2N301A	G	P		2N301A	AP	11W	A	85	60											
2N302	G	P			AH	150M	A	85	30	10	O						45	E	7.0M	B
2N303	G	P			AH	150M	A	85	30	10	O						75	E	14M	B
2N306	G	N			A	50M	A	75	20	15	R				0.5	0.1A	25	E	0.6M	B
2N307	G	P		2N307	AP	25W	C	75	35	35	R	20		0.2A	1.0	0.2A			3.0K	E
2N307A	G	P		2N307A	AP	25W	C	75	35	35	R	20		0.2A	0.8	1.0A			3.5K	E
2N308	G	P			AH	30M	A	55		20	O									
2N309	G	P			AH	30M	A	55		20	O									
2N310	G	P			AH	30M	A	55		30	O									
2N311	G	P			SP	75M	A	85	15	15	O	25	75	10M	0.075	10M				
2N312	G	N			SP	75M	A	85	15	15	O	25	75	10M	0.075	10M				
2N315	G	P			S	100M	A	85	20	15	O	15	30	100M	0.15	100M				
2N315A	G	P			S	150M	A	100	30	20	O	20	50	100M	0.15	100M				
2N315B	G	P			S	150M	A	100	30	20	O	20	50	100M	0.15	100M				
2N316	G	P			S	100M	A	85	20	10	O	20	50	200M	0.18	200M				
2N316A	G	P			S	150M	A	100	30	15	O	20	50	200M	0.18	200M				
2N317	G	P			S	100M	A	85	20	6.0	O	20	60	400M	0.2	400M				
2N317A	G	P			S	150M	A	100	25	10	O	20	60	400M	0.2	400M				
2N318	G	P			AL	50M	A		12											
2N319	G	P		2N319	A	225M	A	85		20	R									
2N320	G	P		2N319	A	225M	A	85		20	R									
2N321	G	P		2N319	A	225M	A	85		20	R									
2N322	G	P		2N322	A	140M	A	60	18	18	R	34	65	20M					1.0M	B
2N323	G	P		2N322	A	140M	A	60	18	18	R	53	125	20M					1.5M	B
2N324	G	P		2N322	A	140M	A	60	18	18	R	72	198	20M					2.0M	B
2N325	G	P	2N3611	2N3611	A	12W	C	85	35	35	S	30	60	500M	0.6	500M			150K	B
2N326	G	N			A	7.0W	C	85	35	35	S	30	60	500M	0.6	500M			150K	B
2N327	S	P	2N2906	2N2904	A	350M	A	160	50								9.0	E		
2N327A	S	P	2N2906	2N2904	AM	385M	A	160	50	40	O	9.0	22	3.0M	0.3	5.0M				
2N327B	S	P	2N2906	2N2904	AM	385M	A	200	50	40	O	9.0	22	3.0M	0.3	5.0M				
2N328	S	P		2N2904	A	350M	A	160	35								18	E		
2N328A	S	P		2N2904	AM	385M	A	160	50	35	O	18	44	3.0M	0.5	10M				
2N328B	S	P		2N2904	AM	385M	A	200	50	35	O	18	44	3.0M	0.5	10M				
2N329	S	P		2N2904	A	350M	A	160	30								36	E		
2N329A	S	P		2N2904	AM	385M	A	160	50	30	O	36	88	3.0M	0.6	15M				
2N329B	S	P		2N2904	AM	385M	A	200	50	30	O	36	88	3.0M	0.6	15M				
2N330	S	P		2N2904	A	350M	A	160	45								9.0	E		
2N330A	S	P	2N2906	2N2904	AM	385M	A	160	50	30	O									
2N331	G	P		2N331	A	200M	A	71	30											
2N332	S	N	2N2221	2N2218	AH	150M	A	175	45			9.0	20				0.9	B		
2N332A	S	N	2N2218	2N2218	A	500M	A	175	45	45	O				1.0	5.0M	0.9	B	2.5M	B
2N333	S	N	2N2221	2N2218	AH	150M	A	175	45			18	40				0.948	B		
2N333A	S	N	2N2218	2N2218	A	500M	A	175	45	45	O				1.0	5.0M	0.948	B	2.5M	B
2N334	S	N	2N2221	2N2218	AH	150M	A	175	45			18	86				0.948	B		
2N334A	S	N	2N2218	2N2218	A	500M	A	175	45	45	O				1.0	5.0M	0.948	B	8.0M	B
2N334B	S	N	2N2218	2N2218	A	500M	A	175	60	60	O	15	85	1.0M	1.0	5.0M	18	E	8.0M	B
2N335	S	N	2N2221	2N2218	AH	150M	A	175	45			36	86				0.973	B		
2N335A	S	N	2N2218	2N2218	A	500M	A	175	45	45	O				1.0	5.0M	0.973	B	2.5M	B
2N335B	S	N	2N2218	2N2218	A	500M	A	175	60	60	O	28	90	1.0M	1.0	5.0M	37	E	2.5M	B
2N336	S	N	2N2221	2N2218	AH	150M	A	175	45			76	333				0.987	B		
2N336A	S	N	2N2218	2N2218	A	500M	A	175	45	45	O				1.0	5.0M	0.987	B	2.5M	B
2N337	S	N	2N2221	2N2218	S	125M	C	150	45			20	55	10M					10M	B
2N337A	S	N	2N2218	2N2218	A	500M	A	175	45			20	55	10M			19	E	15M	B
2N338	S	N	2N2221	2N2218	S	125M	C	150	45			45	150	10M					20M	B
2N338A	S	N	2N2218	2N2218	A	500M	A	175	45			45	150	10M			39	E	25M	B
2N339	S	N			A	1.0W	C	150	55	55	O						0.9	B		
2N339A	S	N			AH	3.0W	A	200	60	60	O	20	80				25	E	10M	T
2N340	S	N			A	1.0W	C	150	85	85	O						0.9	B		
2N340A	S	N			AH	3.0W	A	200	85	85	O	20	80				25	E	10M	T
2N341	S	N			A	1.0W	C	150	125	85	O						0.9	B		
2N341A	S	N			AH	3.0W	A	200	125	125	O	20	80				25	E	10M	T

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS: P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS: h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N342	S	N			A	1.0W	C	150	60	60	O						0.9	B		
2N342A	S	N			A	1.0W	C	150	85	85	O						0.9	B		
2N342B	S	N			A	750M	A	175	85	85	O						9.0	E		
2N343	S	N			A	1.0W	C	150	60	60	O						0.966	B		
2N343A	S	N			A	1.0W	C	150	60	60	O						0.966	B		
2N343B	S	N			A	750M	A	175	65	65	O						28	E		
2N344	G	P			AH	20M	A	55	5.0	5.0	V						11	E	30M	M
2N345	G	P			AH	20M	A	55	5.0	5.0	V						25	E	30M	M
2N346	G	P			AH	20M	A	55	5.0	5.0	V						10	E	60M	M
2N350	G	P		2N350	AP	10W	A	100	50	40	O	20	60	700M						
2N350A	G	P		2N350	AP	90W	J	100	50	40	S	20	60	0.7A	1.75	3.0A			5.0K	E
2N351	G	P		2N351A	AP	10W	A	100	50	40	O	25	90	700M						
2N351A	G	P		2N350A	AP	90W	J	100	50	40	S	25	90	0.7A	1.75	4.0A			5.0K	E
2N352	G	P	2N1536	2N1529	AP	25W	C	100		40	R	30	140	1.0A					10K	E
2N353	G	P	2N1536	2N1529	AP	30W	C	100		40	R	40	150	1.0A					7.0K	E
2N354	S	P	2N2906	2N2904	AH	150M	A	140	25	25	U						9.0	E	8.0M	M
2N355	S	P	2N2906	2N2904	S	150M	A	140	10	10	U				0.15	5.0M	9.0	E	8.0M	M
2N356	G	N			S	100M	A	85	20	18	O	20	50	100M	0.2	100M				
2N356A	G	N			S	150M	A	100	30	20	O	20	50	100M	0.2	100M				
2N357	G	N			S	100M	A	85	20	15	O	20	50	200M	0.2	200M				
2N357A	G	N			S	150M	A	100	30	20	O	25	75	200M	0.2	200M				
2N358	G	N			S	100M	A	85	20	12	O	20	50	300M	0.2	300M				
2N358A	G	N			S	150M	A	100	30	15	O	25	75	300M	0.2	300M				
2N359	G	P		2N359	A	170M	A	85	25	18	R	100	300	50M						
2N360	G	P	2N1192	2N1191	A	170M	A	85	32	30	R	50	150	50M						
2N361	G	P	2N1191	2N1191	A	170M	A	85	32	30	R	25	75	50M						
2N362	G	P	2N1192	2N1191	A	170M	A	85	25	18	O						50	E		
2N363	G	P	2N1192	2N1191	A	170M	A	85	32	28	O						25	E		
2N364	G	N			S	150M	A	100	30								9.0	E	1.0M	B
2N365	G	N			S	150M	A	100	30								19	E	1.0M	B
2N366	G	N			S	150M	A	100	30								49	E	1.0M	B
2N367	G	P	2N1191	2N1191	S	100M	A	75	30								9.0	E	300K	B
2N368	G	P	2N1191	2N1191	S	100M	A	75	30								19	E	400K	B
2N369	G	P	2N1191	2N1191	S	100M	A	75	30								49	E	500K	B
2N370	G	P	2N3324	2N3323	AH	80M	A	71	24											
2N371	G	P	2N3324	2N3323	AH	80M	A	71	24											
2N372	G	P	2N3324	2N3323	AH	80M	A	71	24											
2N373	G	P			AH	80M	A	71	25											
2N374	G	P	2N3325	2N3323	AH	80M	A	71	25											
2N375	G	P		2N375	AP	58W	C	95	80	60	S	35	90	1.0A	1.0	2.0A			7.0K	E
2N376	G	P		2N350	AP	10W	A	100	50	40	O	35	120	700M						
2N376A	G	P		2N350A	AP	90W	J	100	50	40	S	35	120	0.7A	1.75	5.0A			5.0K	E
2N377	G	N			S	150M	A	100	25	20	V	20	60	30M	0.5	200M			5.0M	B
2N377A	G	N			S	150M	A	100	40	40	V	20	60	30M						
2N378	G	P		2N378	SP	50W	C	100	20			40	80	2.0A	1.0	2.0A			5.0K	E
2N379	G	P		2N378	SP	50W	C	100	40			20	70	2.0A	1.0	2.0A			5.0K	E
2N380	G	P		2N378	SP	50W	C	100	30			30	70	2.0A	1.0	2.0A			5.0K	E
2N381	G	P		2N381	A	0.2W	A	100	50	25	R	35	65	20M			35	E		
2N382	G	P		2N381	A	0.2W	A	100	50	25	R	60	95	20M			70	E		
2N383	G	P		2N381	A	0.2W	A	100	50	25	R	75	120	20M			90	E		
2N384	G	P	2N3325	2N3323	AH	120M	A	100	40	40	O	20	175	1.5M						
2N385	G	N			S	150M	A	100	25	25	R	30	110	30M					4.0M	B
2N385A	G	N			S	150M	A	100	40	40	V	30	110	30M					4.0M	B
2N386	G	P			AP	500M	C	100	60	60	V	20		2.5A					7.0K	E
2N387	G	P			AP	500M	C	100	80	80	V	20		2.5A					6.0K	E
2N388	G	N			S	150M	A	100	25	20	R	60	180	30M					5.0M	B
2N388A	G	N			S	150M	A	100	40	40	V	60	200	0.30M					5.0M	B
2N389	S	N	2N5068	2N5068	AP	85W	C	200		60	R	12	60	1.0A						
2N389A	S	N	2N5068	2N5068	AP	85W	C	200		60	R	12	60	1.0A	0.75	1.0A			1.0M	T
2N392	G	P	2N1550	2N1539	AP	48W	C	95	60	40	R	60	150	3.0A	0.5	3.0A				
2N393	G	P	2N967	2N960	S	25M	A	100	6.0	6.0	S	20		50M	0.07	8.0M	40	E	25M	T
2N394	G	P			SH	150M	A	85	10	10	O	20	150	10M					4.0M	B
2N394A	G	P			SH	150M	A	85	10	30	O	30	120	10M					4.0M	B
2N395	G	P			SH	200M	A	100	30	15	R	20	150	10M	0.2	50M			3.0M	B
2N396	G	P			SH	200M	A	100	30	20	R	30	150	10M	0.2	50M			5.0M	B
2N396A	G	P			SH	200M	A	100	30	20	O	30	150	10M	0.2	50M			5.0M	B
2N397	G	P			SH	200M	A	100	30	15	R	40	150	10M	0.2	50M			10M	B
2N398	G	P		2N398	SP	50M	A	55	105	105	S	20		5.0M						
2N398A	G	P		2N398	A	150M	A	100	105	105	S	20		5.0M	0.35	5.0M	20	E		
2N398B	G	P	2N2043	2N2042	SP	250M	A	100	105	105	S	20		5.0M	0.25	5.0M	40	E	1.0M	B
2N399	G	P	2N351A	2N350A	AP	25W	C	90		35	R				1.0	1.2A				
2N400	G	P	2N350A	2N350A	AP	35W	C	95	25	20	O	40	300	0.5A	0.8	1.0A	25	E	3.0K	E
2N401	G	P	2N3611	2N3611	AP	25W	C	90		35	R				1.0	1.2A				
2N402	G	P	2N1191	2N1191	A	180M	A	85	25	20	O									
2N403	G	P	2N1191	2N1191	A	180M	A	85	25	20	O									
2N404	G	P			S	150M	A	85	25											
2N404A	G	P			S	150M	A	100	40	35	O	30		12M	0.15	12M			4.0M	B
2N405	G	P	2N322	2N322	A	150M	A	71	20											
2N406	G	P	2N322	2N322	A	150M	A	71	20											
2N407	G	P	2N324	2N322	A	150M	A	71	20											
2N408	G	P	2N324	2N322	A	150M	A	71	20											
2N409	G	P			AH	80M	A	71	13											
2N410	G	P			AH	80M	A	71	13											
2N411	G	P			AH	80M	A	71	13											
2N412	G	P			AH	80M	A	71	13											
2N413	G	P			AH	150M	A	85	30	18	O									
2N413A	G	P			AH	150M	A	85	30	15	O									
2N414	G	P			AH	150M	A	85	30	15	O									

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
						P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N414A	G	P			AH	150M	A	85	30	15	0									
2N414B	G	P			AH	0.2W	A	100	30	24	V						40	E	4.0M	B
2N414C	G	P			AH	0.2W	A	100	30	24	V						40	E	4.0M	B
2N415	G	P			AH	150M	A	85	30	10	0									
2N415A	G	P			AH	150M	A	85	30	10	0									
2N416	G	P			AH	150M	A	85	30	12	0									
2N417	G	P			AH	150M	A	85	30	10	0									
2N418	G	P	2N1537	2N1529	SP	25W	C	100	100	75	R	40		4.0A	2.0	4.0A				
2N419	G	P			AP	35W	C	95	25	20	0	50	350	0.5A	0.8	1.5A	25	E	3.0K	E
2N420	G	P	2N1535	2N1529	SP	25W	C	100	65	40	R	40		4.0A	2.0	4.0A				
2N420A	G	P	2N1537	2N1529	SP	25W	C	100	90	65	R	40		4.0A	2.0	4.0A				
2N422	G	P	2N651	2N650	A	150M	A	85	35	20	0									
2N422A	G	P	2N5069	2N5069	A	175M	A	100	35	20	0						30	E	1.5M	B
2N424	S	N	2N5069	2N5069	AP	85W	C	200		80	R	12	60	1.0A						
2N424A	S	N			AP	85W	C	200		80	R	12	60	1.0A	0.75	1.0A			1.0M	T
2N425	G	P			S	175M	A	85	30	20	0	20	40		0.32	100M			2.5M	B
2N426	G	P			S	175M	A	85	30	10	0	30	60		0.32	100M			3.0M	B
2N427	G	P			S	175M	A	85	30	15	0	40	80		0.32	150M			5.0M	B
2N428	G	P			S	175M	A	85	30	12	0	60			0.32	200M			10M	B
2N428A	G	P			S	0.15W	A	100	30	18	0	80			0.32	0.2A			10M	B
2N438	G	N			S	0.1W	A	85	30	25	0	20		50M					2.5M	B
2N438A	G	N			S	0.15W	A	85	30	25	0	20		50M					2.5M	B
2N439	G	N			S	0.1W	A	85	30	20	0	30		50M					5.0M	B
2N439A	G	N			S	0.15W	A	85	30	20	0	30		50M					5.0M	B
2N440	G	N			S	0.1W	A	85	30	15	0	40		50M					10M	B
2N440A	G	N			S	0.15W	A	85	30	15	0	40		50M		50M			10M	B
2N441	G	P		2N441	AP	50W	C	95	40	40	S	20	40	5.0A						
2N442	G	P		2N441	AP	50W	C	95	50	45	S	20	40	5.0A						
2N443	G	P		2N441	AP	50W	C	95	60	50	S	20	40	5.0A	1.0	12A				
2N444	G	N			A	100M	A	85	15	15	0								0.5M	B
2N444A	G	N			A	150M	A	100	40	25	0	20	40	20M			15	E	0.5M	B
2N445	G	N			A	100M	A	85	15	12	0								0.5M	B
2N445A	G	N			A	150M	A	100	30	18	0	40	160	20M			35	E	2.0M	B
2N446	G	N			S	100M	A	85	15	10	0								5.0M	B
2N446A	G	N			S	150M	A	100	30	15	0	60	250	20M			60	E	5.0M	B
2N447	G	N			S	100M	A	85	15	6.0	0								5.0M	B
2N447A	G	N			S	150M	A	100	30	12	0	80	300	20M			85	E	9.0M	B
2N447B	G	N			S	150M	A	100	25	12	0	80	300	20M			150	E	9.0M	B
2N448	G	N			AH	65M	A	85	15	15	0	8.0	51	1.0M						
2N449	G	N			AH	65M	A	85	15	15	0	34		1.0M						
2N450	G	P			SH	150M	A	85	20	12	0	30		10M	0.2	10M			5.0M	B
2N456	G	P	2N456A	2N456A	AP	50W	C	95	40	40	X				1.0	5.0A				
2N456A	G	P		2N456A	AP	150W	C		40	40	0	30	90	5.0A	0.5	5.0A			4.0K	E
2N456B	G	P			AP	150W	C	100	40	30	0	30	90	5.0A	0.5	5.0A			200K	T
2N457	G	P			AP	50W		95	60	60	X				1.0	5.0A				
2N457A	G	P		2N456A	AP	150W	C		60	60	0	30	90	5.0A	0.5	5.0A			4.0K	E
2N457B	G	P			AP	150W	C	100	60	40	0	30	90	5.0A	0.5	5.0A			200K	T
2N458	G	P			AP	50W		95	80	80	X				1.0	5.0A				
2N458A	G	P		2N456A	AP	150W	C		80	80	0	30	90	5.0A	0.5	5.0A			4.0K	E
2N458B	G	P			AP	150W	C	100	80	45	0	30	90	5.0A	0.5	5.0A			200K	T
2N459	G	P		2N376A	SP	50W	C	100	60			20	70	2.0A	1.0	2.0A			5.0K	E
2N459A	G	P		2N376A	SP	106W	C	110	105	60	0	40	70	2.0A	0.3	2.0A			5.0K	E
2N460	G	P		2N460	A	0.2W	A	100	45			16	32							
2N461	G	P		2N460	A	0.2W	A	100	45			32	100							
2N462	G	P			S	150M	A	75	40			20		200M					500K	B
2N463	G	P	2N1551	2N1539	AP	37.5W	C	100	60	60		20	60	2.0A					4.0K	E
2N464	G	P		2N464	A	150M	A	85	45	40	0									
2N465	G	P		2N464	A	150M	A	85	45	30	0									
2N466	G	P		2N464	A	150M	A	85	35	20	0									
2N467	G	P		2N464	A	150M	A	85	35	15	0									
2N469	G	P			AL	50M	A	75	6.0			10		1.0M						
2N469A	G	P			AL	50M	A	85	20	15	R						30	E		
2N470	S	N	2N2221	2N2218	AH	0.2W	A	200	15	15	0				1.5	5.0M	10	E	8.0M	T
2N471	S	N	2N2221	2N2218	A	0.2W	A	200	30	30	0				1.5	5.0M	10	E	8.0M	T
2N471A	S	N	2N2221	2N2218	A	0.2W	A	200	30	30	0				1.0	5.0M	10	E	8.0M	T
2N472	S	N	2N2221	2N2218	AH	0.2W	A	200	45	45	0				1.5	5.0M	10	E	8.0M	T
2N472A	S	N	2N2221	2N2218	A	0.2W	A	200	45	45	0				1.0	5.0M	10	E	8.0M	T
2N473	S	N	2N2221	2N2218	A	0.2W	A	200	15	15	0				1.5	5.0M	20	E	8.0M	T
2N474	S	N	2N2221	2N2218	A	0.2W	A	200	30	30	0				1.5	5.0M	20	E	8.0M	T
2N474A	S	N	2N2221	2N2218	A	0.2W	A	200	30	30	0	10			1.0	5.0M	20	E	8.0M	T
2N475	S	N	2N2221	2N2218	A	0.2W	A	200	45	45	0				1.5	5.0M	20	E	8.0M	T
2N475A	S	N	2N2221	2N2218	A	0.2W	A	200	45	45	0	10			1.0	5.0M	20	E	8.0M	T
2N476	S	N	2N2221	2N2218	A	0.2W	A	200	15	15	0				1.5	5.0M	30	E	12M	T
2N477	S	N	2N2221	2N2218	A	0.2W	A	200	30	30	0				1.5	5.0M	30	E	12M	T
2N478	S	N	2N2221	2N2218	AH	0.2W	A	200	15	15	0				1.5	5.0M	40	E	20M	T
2N479	S	N	2N2221	2N2218	AH	0.2W	A	200	30	30	0				1.5	5.0M	40	E	20M	T
2N479A	S	N	2N2221	2N2218	A	0.2W	A	200	30	30	0	10			1.0	5.0M	40	E	20M	T
2N480	S	N	2N2221	2N2218	AH	0.2W	A	200	45	45	0				1.5	5.0M	40	E	20M	T
2N480A	S	N	2N2221	2N2218	A	0.2W	A	200	45	45	0	10			1.0	5.0M	40	E	20M	T
2N481	G	P			AH	150M	A	85	12	12	0									
2N482	G	P			AH	150M	A	85	12	12	0									
2N483	G	P			AH	150M	A	85	12	12	0									
2N484	G	P			AH	150M	A	85	12	12	0									
2N485	G	P			AH	150M	A	85	12	12	0									
2N486	G	P			AH	150M	A	85	12	12	0									
2N487	G	P			A	100M	A	85	18	18	R	20		1.0M			10	E	10M	T

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N489 thru 2N494	Unijunction Transistors, see Table on Page 2-86																			
2N495	S	P			AH	150M	A	140	25	25	U						15	E	8.0M	M
2N496	S	P			S	150M	A	140	10	10	U	15		15M	0.15	5.0M	9.0	E	7.2M	T
2N497	S	N	2N4238	2N4237	A	4.0W	C	200	60	60	0	12	36	200M						
2N497A	S	N	2N4238	2N4238	A	5.0W	C	200	60	60	0	12	36	200M						
2N498	S	N	2N4239	2N4237	A	4.0W	C	200	100	100	0	12	36	200M						
2N498A	S	N	2N5681	2N5681	A	5.0W	C	200	100	100	0	12	36	200M						
2N499	G	P		2N499	AH	30M	A	85	30	18	0								120M	T
2N499A	G	P		2N499	AH	60M	A	100	30	18	0						20	E	120M	T
2N500	G	P	2N3323	2N3323	AH	50M	A	85	20	15										
2N501	G	P			SH	60M	A	100	15	12	S	20		10M	0.2	10M			90M	T
2N501A	G	P			SH	60M	A	100	15	12	S	30		10M	0.2	10M			90M	T
2N502	G	P		2N499	AH	60M	A	85	20	20	S						9.0	E	220M	T
2N502A	G	P		2N499	AH	75M	A	100	30	30	S						15	E	220M	T
2N502B	G	P		2N499	AH	75M	A	100	30	30	S						20	E		
2N503	G	P	2N3284	2N3283	AH	25M	A	85	20	20	S						9.0	E	168M	T
2N504	G	P	2N3323	2N3323	AH	30M	A	85	35	25	S	20	200	10M			16	E	50M	M
2N506	G	P			A	50M	A	85	40			25	50	50M	0.6	50M			600K	B
2N507	G	N			A	50M	A	85	40			25	50	50M	0.6	50M			600K	B
2N508	G	P		2N322	A	200M	A	100	18	18	R	99	198	20M					2.5M	B
2N508A	G	P		2N508A	A	0.2W	A	100	30	30	S	100	200	20M			75	E	2.5M	B
2N509	G	P			AH	225M	A	100	30								0.96	B	400M	T
2N511	G	P	2N1554	2N1539	AP	150W	C		40			20	60	10A	0.5	10A			260K	T
2N511A	G	P	2N1555	2N1539	AP	150W	C		60			20	60	10A	0.5	10A			260K	T
2N511B	G	P	2N1556	2N1539	SP	150W	C		80			20	60	10A	0.5	10A			260K	T
2N512	G	P	2N1558	2N1539	AP	150W	C		40			20	60	15A	0.75	15A			260K	T
2N512A	G	P	2N1559	2N1539	AP	150W	C		60			20	60	15A	0.75	15A			260K	T
2N512B	G	P	2N1560	2N1539	SP	150W	C		80			20	60	15A	0.5	10A			260K	T
2N513	G	P	2N1163	2N1162	AP	150W	C		40			20	60	20A	1.25	20A			300K	T
2N513A	G	P	2N1165	2N1162	AP	150W	C		60			20	60	20A	1.25	20A			260K	T
2N513B	G	P	2N1167	2N1162	SP	150W	C		80			20	60	20A	0.5	10A			260K	T
2N514	G	P	2N1163	2N1162	SP	80W	C	95	40	40	X				1.25	25A				
2N514A	G	P	2N1165	2N1162	SP	80W	C	95	60	60	X				1.25	25A				
2N514B	G	P	2N1167	2N1162	SP	80W	C	95	80	80	X				1.25	25A				
2N515	G	N			AH	50M	A	75	20	18	R						4.0	E	2.0M	B
2N516	G	N			AH	50M	A	75	20	18	R						4.0	E	2.0M	B
2N517	G	N			AH	50M	A	75	20	18	R						4.0	E	2.0M	B
2N518	G	P			S	0.15W	A	85	45	12	0	60		10M	0.15	10M			10M	B
2N519	G	P			S	100M	A	85	15	15	0						15	E	0.5M	B
2N519A	G	P			S	150M	A	100	25	18	0	20	50	20M			15	E	0.5M	B
2N520	G	P			S	100M	A	85	15	12	0						20	E	3.0M	B
2N520A	G	P			S	150M	A	100	25	15	0	40	170	20M			40	E	2.0M	B
2N521	G	P			S	100M	A	85	15	10	0						35	E	8.0M	B
2N521A	G	P			S	150M	A	100	25	12	0	60	250	20M			70	E	8.0M	B
2N522	G	P			S	100M	A	85	15	8.0	0						60	E	15M	B
2N522A	G	P			S	150M	A	100	25	10	0	80	320	20M			100	E	15M	B
2N523	G	P			S	100M	A	85	15	6.0	0						80	E	21M	B
2N523A	G	P			S	150M	A	100	20	6.0	0	100	400	20M			125	E	21M	B
2N524	G	P		2N524	A	225M	A	100	45	30	R	25	42	20M	0.13	20M	16	E	800K	B
2N524A	G	P		2N524	A	225M	A	100	45	30	R	25	42	20M	0.13	20M	18	E	0.8M	B
2N525	G	P		2N524	A	225M	A	100	45	30	R	34	65	20M	0.13	20M	30	E	1.0M	B
2N525A	G	P		2N524	A	225M	A	100	45	30	R	34	65	20M	0.13	20M	30	E	1.0M	B
2N526	G	P		2N524	A	225M	A	100	45	30	R	53	90	20M	0.13	20M	44	E	1.3M	B
2N526A	G	P		2N524	A	225M	A	100	45	30	R	53	90	20M	0.13	20M	44	E	1.3M	B
2N527	G	P		2N524	A	225M	A	100	45	30	R	72	121	20M	0.13	20M	60	E	1.5M	B
2N527A	G	P		2N524	A	225M	A	100	45	30	R	72	121	20M	0.13	20M	60	E	1.5M	B
2N528	G	P				2.5W	C	100	40	40		20		0.5A						
2N529	G	P				100M	A	85	15	15	0									
2N530	G	P				100M	A	85	15	15	0									
2N531	G	P				100M	A	85	15	15	0									
2N532	G	P				100M	A	85	15	15	0									
2N533	G	P				100M	A	85	15	15	0									
2N534	G	P	2N1189	2N1189	A	25M	A	65	50	50	U						35	E		
2N535	G	P	2N1192	2N1191	A	50M	A	85	20	20	U						35	E		
2N535A	G	P	2N1192	2N1191	A	50M	A	85	20	20	U						35	E		
2N535B	G	P			A	50M	A	85	20	20	U						35	E		
2N536	G	P	2N1193	2N1191	S	50M	A	85	20	20	U	100		30M	0.13	10M			1.0M	B
2N537	G	P			AH			100	30						4.0	70M	0.9	B		
2N538	G	P	2N2140	2N2137	SP	34W	J	95	80	60		20	50	2.0A	0.6	2.0A				
2N538A	G	P	2N2140	2N2137	SP	34W	J	95	80	60		20	50	2.0A	0.6	2.0A				
2N539	G	P	2N2145	2N2137	SP	34W	J	95	80	55		30	75	2.0A	0.6	2.0A				
2N539A	G	P	2N2145	2N2137	SP	11W	J	95	80	55		30	75	2.0A	0.6	2.0A				
2N540	G	P	2N1551	2N1539	SP	34W	J	95	80	55		45	113	2.0A	0.6	2.0A				
2N540A	G	P	2N1551	2N1539	SP	34W	J	95	80	55		45	113	2.0A	0.6	2.0A				
2N541	S	N	2N2221	2N2218	AH	0.2W	A	200	15	15	U				1.5	5.0M	80	E	10M	T
2N541A	S	N	2N2221	2N2218	A	0.2W	A	200	15	15	0	20			1.0	5.0M	80	E	8.0M	T
2N542	S	N	2N2221	2N2218	AH	0.2W	A	200	30	30	U				1.5	5.0M	80	E	10M	T
2N542A	S	N	2N2221	2N2218	A	0.2W	A	200	30	30	0	20			1.0	5.0M	80	E	10M	T
2N543	S	N	2N2221	2N2218	AH	0.2W	A	200	50	50	U				1.5	5.0M	80	E	10M	T
2N543A	S	N	2N2221	2N2218	A	0.2W	A	200	45	45	0	20			1.0	5.0M	80	E	10M	T
2N544	G	P			AH	80M	A	71	34											
2N545	S	N	2N4238	2N4237	AH	5W	C	200	60	60	0	15	80	0.5A	5.0	0.5A				
2N546	S	N	2N4237	2N4237	AH	5W	C	200	30	30	0	15	80	0.5A	3.0	0.5A				
2N547	S	N	2N4238	2N4237	AH	5W	C	200	60	60	0	20	80	0.5A	5.0	0.5A			4.0M	T
2N548	S	N	2N4237	2N4237	AH	5W	C	200	30	30	0	20	80	0.5A	3.0	0.5A			4.0M	T
2N549	S	N	2N4238		AH	5W	C	200	60	60	0	20	80	0.2A	4.0	0.2A			4.0M	T

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2N550–2N635

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	$V_{CE—}$ (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	$h_{f—}$	Subscript	f— Units	Subscript
2N550	S	N	2N4237	2N4237	AH	5W	C	200	30	30	0	20	80	0.2A	4.0	0.2A			4.0M	T
2N551	S	N			AH	5W	C	200	60	60	0	20	80	50M	2.0	50M			3.0M	T
2N552	S	N			AH	5W	C	200	30	30	0	20	80	50M	2.0	50M			3.0M	T
2N553	G	P			SP	35W	C	95	80			40	80	500M	0.9	3.0A				
2N554	G	P		2N178	AP	40W	J	90												
2N555	G	P		2N178	AP	10W	J	90	40										5.0K	B
2N556	G	N			S	100M	A	85	25	20	X	35	70	1.0M	0.5	200M				
2N557	G	N			S	100M	A	85	20	20	X	20		1.0M	0.5	200M				
2N558	G	N			S	100M	A	75	15	15	X	60		1.0M	0.75	200M				
2N559	G	P		2N5591	S	0.15W	A	100	15	15					0.3	10M				
2N560	S	N			S	500M	A	150		60	S	20		100M	0.5	10M				
2N561	G	P			A	50W	A	100	80	50	0	20	50	4.0A						
2N563	G	P	2N650	2N650	S	150M	A	85	30	25	0	10	30							
2N564	G	P	2N650	2N650	S	120M	A	85	30	25	0	10	30							
2N565	G	P	2N651	2N650	S	150M	A	85	30	25	0	30	50							
2N566	G	P	2N651	2N650	S	120M	A	85	30	25	0	30	50							
2N567	G	P	2N651	2N650	S	150M	A	85	30	25	0	50	70							
2N568	G	P	2N651	2N650	S	120M	A	85	30	25	0	50	70							
2N569	G	P	2N1193	2N1191	S	150M	A	85	30	20	0	70	100							
2N570	G	P	2N1192	2N1191	S	120M	A	85	30	20	0	70	100							
2N571	G	P	2N1193	2N1191	S	150M	A	85	30	10	0	100								
2N572	G	P	2N1193	2N1191	S	120M	A	85	30	10	0	100								
2N573	G	P			A	0.2W	A	100	40	25	0	30	300	50M						
2N574	G	P	2N1550	2N1539	SP	180W	J	100	60	55	0	9.0	22	10A	0.2	10A				
2N574A	G	P	2N1551	2N1539	SP	180W	J	100	80	60	0	9.0	22	10A	0.2	10A				
2N575	G	P	2N1554	2N1539	SP	180W	J	100	60	50	0	19	42	10A	0.5	25A				
2N575A	G	P	2N1555	2N1539	SP	180W	J	100	80	55	0	19	42	10A	0.5	25A				
2N576	G	N			S	200M	A	100	20	20	R	20	60	400M	0.4	400M			2.0M	B
2N576A	G	N			S	200M	A	100	40	20	R	20	60	400M	0.4	400M			5.0M	B
2N577	G	P			AL	25M	A	55	25											
2N578	G	P			S	120M	A	71	20			10		400M	0.3	400M			3.0M	B
2N579	G	P			S	120M	A	71	20			20		400M	0.3	400M			5.0M	B
2N580	G	P			S	120M	A	71	20			30		400M	0.3	400M			10M	B
2N581	G	P			S	80M	A	71	18			20		20M		20M			4.0M	B
2N582	G	P			S	120M	A	71	25			40		20M	0.3	100M			14M	B
2N583	G	P			S	80M	A	71	18			20		20M		20M			4.0M	B
2N584	G	P			S	120M	A	71	25			40		20M	0.3	100M			14M	B
2N585	G	P			S	120M	A	71	25			20		20M	0.2	20M			3.0M	B
2N586	G	P	2N1191	2N1191	S	250M	A	85	45			35		250M	0.5	250M				
2N587	G	N			S	150M	A	100	40	20	R	20		200M	0.5	200M				
2N588	G	P	2N3324	2N3323	AH	30M	A	85	15	15	S								200M	M
2N588A	G	P			AH	60M	A	85	15	15	S	30		10M	0.2	10M			200M	M
2N589	G	P	2N1532	2N1529	AP	90W	C	100	100	75	S	20	40	3.0A	1.5	3.0A			5.0K	E
2N591	G	P	2N1192	2N1191	A	50M	A	71	32	32	0									
2N592	G	P			S	125M	A	85	20	20	0	20								
2N593	G	P			S	125M	A	85	40	30	0	30								
2N594	G	N			S	100M	A	85	20	20	0	20							1.5M	E
2N595	G	N			S	100M	A	85	15	15	0	35							3.0M	E
2N596	G	N			S	100M	A	85	10	10	0	50							5.0M	E
2N597	G	P	2N3427	2N3427	S	250M	A	100	45	40	S	40		100M	0.2	10M			3.0M	B
2N598	G	P	2N3427	2N3427	S	250M	A	100	35	35	S	70	225	100M	0.2	10M			5.6M	T
2N599	G	P	2N3428	2N3427	S	250M	A	100	30	20	S	100		100M	0.2	10M			10M	T
2N600	G	P	2N3427	2N3427	SP	750M	C	100	35	35	S	70	225	100M	0.2	10M			5.6M	T
2N601	G	P	2N3428	2N3427	SP	750M	C	100	30	20	S	100		100M	0.2	10M			10M	T
2N602	G	P			SH	120M	A	85	20	20	0	20	80		0.25	10M			10M	T
2N603	G	P			SH	120M	A	85	30	20	0	30	100		0.25	15M			30M	T
2N604	G	P			SH	120M	A	85	30	20	0	40	140		0.25	20M			50M	T
2N605	G	P			AH	0.12W	A	85	15	15	0									
2N606	G	P			AH	0.12W	A	85	15	15	0									
2N607	G	P			AH	0.12W	A	85	15	15	0									
2N608	G	P			AH	0.12W	A	85	15	15	0									
2N609	G	P	2N1193	2N1191	A	180M	A	85	25	15	0									
2N610	G	P	2N1193	2N1191	A	180M	A	85	25	15	0									
2N611	G	P	2N1192	2N1191	A	180M	A	85	25	15	0									
2N612	G	P	2N1191	2N1191	A	180M	A	85	25	15	0									
2N613	G	P	2N1191	2N1191	A	180M	A	85	25	15	0									
2N614	G	P			AH	180M	A	85	20	15	0									
2N615	G	P			AH	180M	A	85	20	15	0									
2N616	G	P			AH	180M	A	85	15	12	0									
2N617	G	P			AH	180M	A	85	15	12	0									
2N618	G	P		2N375	AP	90W	C	95	80	60	S	60	140	1.0A	0.8	2.0A			5.0K	E
2N619	S	N			A	175M	A	160	50	40	0	9.0	22	5.0M	0.5	8.0M			200K	B
2N620	S	N	2N2222A	2N2218	A	175M	A	160	50	35	0	18	44	5.0M	0.4	8.0M			250K	B
2N621	S	N	2N2222A	2N2218	A	175M	A	160	50	30	0	36	88	5.0M	0.3	8.0M			300K	B
2N622	S	N	2N2222A	2N2218	AM	385M	A	160	50	30	0								300K	B
2N624	G	P			AH	100M	A	100	30	20	S						20	E	20M	E
2N625	G	N			S	1500M	C	100	40	30	S	20		500M	1.0	500M				
2N626	G	P																		
2N627	G	P			AP	90W	C	100	40	30	S	10	30	10A	1.0	10A			5.0K	E
2N628	G	P			AP	90W	C	100	60	45	S	10	30	10A	1.0	10A			5.0K	E
2N629	G	P			AP	90W	C	100	80	60	S	10	30	10A	1.0	10A			5.0K	E
2N630	G	P			AP	90W	C	100	100	75	S	10	30	10A	1.0	10A			5.0K	E
2N631	G	P	2N1194	2N1191	A	167M	A	85	25	20	R									
2N632	G	P	2N1193	2N1191	A	167M	A	85	36	20	R									
2N633	G	P	2N1192	2N1191	A	167M	A	85	35	30	R									
2N634	G	N			SH	150M	A	85	20	20	0	15		200M					5.0M	B
2N634A	G	N			S	2.5M	J	85	25	20	R	40	120	10M	0.2	10M			5.0M	B
2N635	G	N			SH	150M	A	85	20	20	0	25		200M					10M	B

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N635A	G	N			S	2.5M	J	85	25	20	R	80	240	10M	0.2	10M			10M	B
2N636	G	N			SH	150M	A	85	20	20	O	35		200M					15M	B
2N636A	G	N			S	2.5M	J	85	25	15	R	100	300	10M	0.15	10M			15M	B
2N637	G	P	MP277		SP	60W	C	100		35	R	30	60	3.0A	1.5	3.0A				
2N637A	G	P	MP278		SP	60W	C	100		65	R	30	60	3.0A	1.5	3.0A				
2N637B	G	P	MP279		SP	60W	C	100		75	R	30	60	3.0A	1.5	3.0A				
2N638	G	P	MP1338		SP	60W	C	100		35	R	20	40	3.0A	2.0	3.0A				
2N638A	G	P	MP1338A		SP	60W	C	100		65	R	20	40	3.0A	2.0	3.0A				
2N638B	G	P	MP1338B		SP	60W	C	100		75	R	20	40	3.0A	2.0	3.0A				
2N639	G	P	MP259		SP	37W	C	100		35	R	15		3.0A	2.5	3.0A				
2N639A	G	P	MP260		SP	37W	C	100		65	R	15		3.0A	2.5	3.0A				
2N639B	G	P	MP261		SP	37W	C	100		75	R	15		3.0A	2.5	3.0A				
2N640	G	P			A	80M	A	71	34											
2N641	G	P			A	80M	A	71	34											
2N642	G	P			A	80M	A	71	34											
2N643	G	P	2N2955	2N2955	S	120M	A	71	30			20		10M					20M	T
2N644	G	P	2N2955	2N2955	S	120M	A	71	30			20		10M					20M	T
2N645	G	P	2N2955	2B2955	S	120M	A	71	30			20		10M					20M	T
2N646	G	N			A	100M	A	85	25	25	O	50	150	30M						
2N647	G	N			A	100M	A	71	25	25	O									
2N649	G	N			A	100M	A	71	20	18	O									
2N650	G	P		2N650	A	0.2W	A	100	45	30	R	30		10M	0.25	50M	30	E	0.75M	E
2N650A	G	P		2N650	A	0.2W	A	100	45	30	R	33		10M	0.25	50M	30	E	0.75M	B
2N651	G	P		2N650	A	0.2W	A	100	45	30	R	45		10M	0.25	50M	50	E	1.0M	E
2N651A	G	P		2N650	A	0.2W	A	100	45	30	R	45		10M	0.25	50M	50	E	1.0M	B
2N652	G	P		2N650	A	0.2W	A	100	45	30	R	80		10M	0.25	50M	100	E		
2N652A	G	P		2N650	A	0.2W	A	100	45	30	R	80		10M	0.25	50M	100	E		
2N653	G	P		2N653	A	0.2W	A	100	30	25	R	20		10M			30	E		
2N654	G	P		2N653	A	0.2W	A	100	30	25	R	40		10M			50	E		
2N655	G	P		2N653	A	0.2W	A	100	30	25	R	70		10M			100	E		
2N656	S	N	2N4238	2N4237	A	4.0W	C	200	60	60	O	30	90	200M						
2N656A	S	N	2N4238	2N4237	A	5.0W	C	200	60	60	O	30	90	200M						
2N657	S	N	2N5681	2N5681	A	4.0W	C	200	100	100	O	30	90	200M						
2N657A	S	N	2N5681	2N5681	A	5.0W	C	200	100	100	O	30	90	200M						
2N658	G	P			S	167M	A	85	25	16	O	25	80		3.45	150M			2.5M	B
2N659	G	P			S	167M	A	85	25	14	O	40	110		3.5	250M			5.0M	B
2N660	G	P			S	167M	A	85	25	11	O	60	150		3.5	400M			10M	B
2N661	G	P			S	167M	A	85	25	9.0	O	80			3.5	550M			15M	B
2N662	G	P			S	167M	A	85	25	11	O	30			3.4	180M			4.0M	B
2N663	G	P			SP	35W	C	100	50	25	O	25	75	500M	1.0	3.0A			15K	E
2N665	G	P		2N665	SP	35W	C	95	80	40	O	40	80	500M	0.9	3.0A			20K	E
2N669	G	P		2N176	AP	62.5W	C	100	40	30	S		250	0.5A					3.0K	E
2N670	G	P	2N3428	2N3427	A	300M	A	85	40	40	V	40	250	1.0A	0.35	1.0A			500K	B
2N671	G	P	2N3428	2N3427	A	800M	C	85	40	40	V	40	250	1.0A	0.35	1.0A			500K	B
2N672	G	P	2N3428	2N3427	A	300M	A	85	25	25	S				0.2	400M				
2N673	G	P	2N3428	2N3427	A	800M	C	85	25	25	S				0.2	400M				
2N674	G	P	2N3428	2N3427	A	300M	A	85	75	75	V	40	250	1.0A	0.35	1.0A			400K	B
2N675	G	P	2N3428	2N3427	A	800M	C	85	75	75	V	40	250	1.0A	0.35	1.0A			400K	B
2N677	G	P	MP439		AP	90W	C	100	50	30	S	20	60	10A	1.0	10A				
2N677A	G	P	MP439A		AP	90W	C	100	60	40	S	20	60	10A	1.0	10A				
2N677B	G	P	MP439B		AP	90W	C	100	90	70	S	20	60	10A	1.0	10A				
2N677C	G	P	MP439C		AP	90W	C	100	100	80	S	20	60	10A	1.0	10A				
2N678	G	P	MP327		AP	90W	C	100	50	20	O	50	100	10A	1.0	10A				
2N678A	G	P	MP328		AP	90W	C	100	60	30	O	50	100	10A	1.0	10A				
2N678B	G	P	MP329		AP	90W	C	100	90	60	O	50	100	10A	1.0	10A				
2N678C	G	P	MP330		AP	90W	C	100	100	70	O	50	100	10A	1.0	10A				
2N679	G	N			S	150M	A	85	25	20	X	20		30M	0.3	100M			2.0M	B
2N680	G	P	2N1191	2N1191	A	150M	A	75	20	20	S	18	165	50M	0.75	50M	15	E		
2N681 thru 2N692	Thyristors, see Table on Page 2-66																			
2N694	G	P			AH	0.1W	A	100	30	15	O	10		2.0M			0.9	B	340M	T
2N695	G	P			SH	75M	A	100	15	15	S	25		10M	1.0	50M				
2N696	S	N		2N696	S	600M	A	175	60	40	R	20	60	150M	1.5	150M			40M	T
2N696A	S	N	2N2218	2N2218	S	800M	A	300	60	35	O	20	60	150M	1.5	150M	15	E	40M	T
2N697	S	N		2N696	S	600M	A	175	60	40	R	40	120	150M	1.5	150M			40M	T
2N697A	S	N	2N2218	2N2218	S	800M	A	300	60	35	O	40	120	150M	1.5	150M	25	E	50M	T
2N698	S	N	2N3498	2N3498	S	800M	A	200	120	80	R	20	60	150M	1.2	50M	15	E	40M	T
2N699	S	N		2N699	S	600M	A	175	120	80	R	40	120	150M	5.0	150M	35	E	50M	T
2N699A	S	N	2N3498	2N3498	S	800M	A	300	120	80	R	40	120	150M	5.0	150M	35	E	50M	T
2N699B	S	N	2N3498	2N3498	S	870M	A	200	120	100	R	40	120	150M	1.2	50M	35	E	60M	T
2N700	G	P		2N700	AH	75M	A	100	25	20	S	1.5		2.0M			4.0	E	270M	T
2N700A	G	P		2N700	AH	75M	A	100	25	25	O	1.5		6.0M			4.0	E	360M	T
2N702	S	N		2N702	SH	300M	A	175	25	25	O	20	60	10M	0.5	10M			70M	T
2N703	S	N		2N702	SH	300M	A	175	25	25	O	40	100	10M	0.5	10M			70M	T
2N705	G	P		2N705	SH	300M	C	100	15	15	S	25		10M	0.3	10M				
2N705A	G	P			SH	150M	A	100	15	15	S	25		10M	0.3	10M				
2N706	S	N		2N706	SH	300M	A	175	25	20	R	20		10M	0.6	10M			200M	T
2N706A	S	N		2N706	SH	300M	A	175	25	20	R	20	60	10M	0.6	10M			200M	T
2N706B	S	N		2N706	SH	300M	A	175	25	15	O	20	60	10M	0.4	10M			200M	T
2N706C	S	N	2N835	2N834	SH	360M	A	200	40	20	R	20	60	10M	0.4	10M			200M	T
2N707	S	N		2N707	AHP	300M	A	175	56	28	R	9.0		10M	0.6	10M				
2N707A	S	N		2N707	AH	500M	A	175	70	40	O	9.0	50	10M	0.6	10M			70M	T
2N708	S	N		2N708	SH	360M	A	200	40	20	R	30	120	10M	0.4	10M			300M	T
2N708A	S	N	2N834	2N834	SH	360M	A	200	50	30	R	40	120	10M	0.15	10M			300M	T
2N709	S	N		MM709	SH	300M	A	200	15	6.0	O	20	120	10M	0.3	3.0M			600M	T
2N709A	S	N			SH	300M	A	200	15	6.0	O	30	90	10M	0.3	3.0M			800M	T
2N710	G	P			SH	300M	C	100	15	15	S	25		10*	0.5	10M				

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TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N710A	G	P			SH	150M	A	100	15	15	S	25		10M	0.5	10M				
2N711	G	P		2N711	SH	150M	A	100	12	12	S	20	250	10M	0.5	10M			150M	T
2N711A	G	P		2N711	SH	150M	A	100	15	7.0	O	25	150	10M	0.55	50M			150M	T
2N711B	G	P		2N711	SH	150M	A	100	18	7.0	O	30	150	10M	0.25	10M			150M	T
2N715	S	N	2N2221	2N2218	AH	500M	A	175	50	35	O	10	50	15M	1.2	15M			70M	E
2N716	S	N	2N2221	2N2218	AH	500M	A	175	70	40	O	10	50	15M	1.2	15M			70M	E
2N717	S	N	2N2221	2B2218	AH	400M	A	175	60	40	R	20	60	150M	1.5	150M			40M	T
2N718	S	N		2N718	AH	400M	A	175	60	40	R	40	120	150M	1.5	150M			50M	T
2N718A	S	N		2N718A	AH	500M	A	200	75	50	R	40	120	150M	1.5	150M	30	E	60M	T
2N719	S	N	2N3498	2N3498	AH	400M	A	175	120	80	R	20	60	150M	5.0	150M	15	E	40M	T
2N719A	S	N	2N3498	2N3498	AH	500M	A	200	120	80	R	20	60	150M	1.2	50M	15	E	40M	T
2N720	S	N	2N3498	2N3498	AH	400M	A	175	120	80	R	40	120	150M	5.0	150M	35	E	50M	T
2N720A	S	N		2N720A	S	500M	A	200	120	100	R	40	120	150M	5.0	150M	30	E	50M	T
2N721	S	P		2N721	AH	400M	A	200	50	50	R	20	45	150M	1.5	150M	15	E	50M	T
2N721A	S	P	2N2905	2N2904	AH	500M	A	200	50	50	R	20	45	150M	0.5	150M	15	E	50M	T
2N722	S	P		2N722	AH	400M	A	175	50	50	R	30	90	150M	1.5	150M	25	E	60M	T
2N722A	S	P	2N2837	2N2800	AH	500M	A	200	50	50	R	30	90	150M	0.5	150M	25	E	60M	T
2N725	G	P			SH	150M	A	100	15	12	S	20		10M						
2N726	S	P		2N727	A	300M	A	175	25	20	O	15	45	10M	0.6	10M	15	E	140M	T
2N727	S	P		2N727	A	300M	A	175	25	20	O	30	120	10M	0.6	10M	30	E	140M	T
2N728	S	N	2N2539	2N2537	SH	4.0M	A	175	15	15	O	20	200	10M	0.7	10M			100M	T
2N729	S	N	2N2539	2N2537	SH	4.0M	A	175	30	30	O	20	200	10M	0.7	10M			100M	T
2N730	S	N	2N2218	2N2218	A	500M	A	175	60	40	R	20	60	150M	1.5	150M			40M	T
2N731	S	N		2N731	A	500M	A	175	60	40	R	40	120	150M	1.5	150M			25M	T
2N734	S	N	2N2221	2N2218	A	500M	A	175	80	60	O	15	50	5.0M	1.0	10M	20	E		
2N734A	S	N	2N2218A	2N2218	A	0.5W	A	200	80	60	O	15	50	5.0M	0.5	10M	20	E	30M	T
2N735	S	N		2N735	A	500M	A	175	80	60	O	30	100	5.0M	1.0	10M	40	E		
2N735A	S	N	2N2218A	2N2218	A	0.5W	A	200	80	60	O	30	100	5.0M	0.5	10M	40	E	60M	T
2N736	S	N	2N2222	2N735	A	500M	A	175	80	60	O	60	200	5.0M	1.0	10M	80	E		
2N736A	S	N	2N2222	2N2218	A	500M	A	175	80	60	O	60	200	5.0M	0.6	10M	80	E	100M	T
2N736B	S	N	2N2896	2N2895	A	0.5W	A	200	80	60	O	60	200	5.0M	0.5	10M	80	E	100M	T
2N738	S	N	2N2896	2N2895	A	500M	A	175	125	80	O	15	50	5.0M	1.0	10M	20	E		
2N738A	S	N	2N2896	2N2895	A	0.5W	A	200	125	80	O	15	50	5.0M	0.5	10M	20	E	30M	T
2N739	S	N		2N735	A	500M	A	175	125	80	O	30	100	5.0M	1.0	10M	40	E		
2N739A	S	N	2N2896	2N2895	A	0.5W	A	200	125	80	O	30	100	5.0M	0.5	10M	40	E	60M	T
2N740	S	N		2N735	A	0.5W	A	200	125	80	O	60	200	5.0M			80	E		
2N740A	S	N	2N2896	2N2895	A	0.5W	A	200	125	80	O	60	200	5.0M	0.5	10M	80	E	100M	T
2N741	G	P		2N741	AH	150M	A	100	15	15	S	10		5.0M			20	E		
2N741A	G	P		2N741	AH	150M	A	100	20	20	S	10		5.0M			20	E	300M	T
2N742	S	N	2N2218	2N2218	S	0.5W	A	200	60	60	O	25		10M	0.5	10M				
2N742A	S	N	2N2218	2N2218	S	0.5W	A	200	60	60	O	25		10M	0.5	10M				
2N743	S	N		2N743	SH	300M	A	200	20	12	O	20	60	10M	0.35	10M			200M	T
2N743A	S	N	2N2369	2N2369	SH	0.36W	A	200	40	15	O	20	60	10M					500M	T
2N744	S	N		2N744	SH	300M	A	175	20	12	O	40	120	10M	0.35	10M			300M	T
2N744A	S	N	2N2369	2N2369	SH	0.36W	A	200	40	15	O	40	120	10M					500M	T
2N745	S	N	2N2221	2N2218	A	0.15W	A	175	45	30	O	20	55	10M			19	E	10M	B
2N746	S	N	2N2221	2N2218	A	0.15W	A	175	45	30	O	45	150	10M			39	E	10M	B
2N747	S	N	2N2221	2N2218	S	200M	A	175	25	25	O	30	90	10M	0.6	5.0M				
2N748	S	N	2N2221	2N2218	S	200M	A	175	30	30	O	20	40	10M	0.5	5.0M				
2N749	S	N	2N2221	2N2218	AH	200M	A	175	45	25	O	15	55	10M			30	E	50M	B
2N751	S	N	2N2221	2N2218	AH	200M	A	175	20	20	O	30	150	10M			10	E	20M	B
2N752	S	N	2N2221	2N2218	AH	0.5W	A	200	85	45	O				1.2	15M	40	E	200M	T
2N753	S	N		2N706	SH	300M	A	175		20	R	40	120	10M	0.6	10M			200M	T
2N754	S	N		2N3019	AH	0.3W	A	175	60	60	R	20	80	5.0M	0.8	10M			30M	T
2N755	S	N		2N3019	AH	0.3W	A	175	100	80	R	20	80	5.0M	0.8	10M			30M	T
2N756	S	N	2N2218	2N2218	A	0.5W	A	200	45	45	O				1.0	10M	12	E	50M	B
2N756A	S	N		2N3019	A	0.5W	A	200	60	60	O				1.0	10M	12	E	50M	B
2N757	S	N	2N2218	2N2218	A	0.5W	A	200	45	45	O				1.0	10M	18	E	50M	B
2N757A	S	N		2N3019	A	0.5W	A	200	60	60	O				1.0	10M	18	E	50M	B
2N758	S	N	2N2218	2N2218	A	0.5W	A	200	45	45	O				1.0	10M	18	E	50M	B
2N758A	S	N		2N3019	A	0.5W	A	200	60	60	O				1.0	10M	18	E	50M	B
2N758B	S	N		2N3019	A	0.5W	A	200	60	60	O	12		1.0M	0.5	10M	18	E	50M	B
2N759	S	N	2N2218	2N2218	A	0.5W	A	200	45	45	O				1.0	10M	36	E	50M	B
2N759A	S	N	2N3019	2N3019	A	0.5W	A	200	60	60	O				1.0	10M	36	E	50M	B
2N759B	S	N	2N3019	2N3019	A	0.5W	A	200	60	60	O	25		1.0M	0.5	10M	36	E	50M	B
2N760	S	N	2N2218	2N2218	A	0.5W	A	200	45	45	O				1.0	10M	76	E	50M	B
2N760A	S	N	2N3019	2N3019	A	0.5W	A	200	60	60	O				1.0	10M	76	E	50M	B
2N760B	S	N	2N3019	2N3019	A	0.5W	A	200	60	60	O	50		1.0M	0.5	10M	76	E	50M	B
2N761	S	N	2N2218A	2N2218A	A	0.5W	A	200	50	30	O	20	55	10M	1.0	10M	19	E	50M	B
2N762	S	N	2N2218A	2N2218	A	0.5W	A	200	50	30	O	45	150	10M	1.0	10M	39	E	50M	B
2N764 thru 2N767		Thyristors, see Table on Page 2-66																		
2N768	G	P	2N961	2N956	SH	35M	A	100	12	10	S	25		2.0M	0.13	2.0M			125M	T
2N769	G	P	2N961	2N956	SH	35M	A	100	12	7.0	O	25		20M	0.25	10M			100M	T
2N770	S	N	2N3014	2N3013	SH	150M	A	150	20	15	O	12	60	20M	0.25	10M			75M	T
2N771	S	N	2N3014	2N3013	SH	150M	A	150	20	15	O	30	150	20M	0.25	10M			100M	T
2N772	S	N	2N3014	2N3013	SH	150M	A	150	25	25	O	20		10M	0.25	10M			75M	T
2N773	S	N	2N3014	2N3013	AH	150M	A	150	20	15	O	4.0	16	1.5M			6.0	E		
2N774	S	N	2N3014	2N3013	AH	150M	A	150	20	15	O	7.0	30	1.5M			11	E		
2N775	S	N	2N3014	2N3013	AH	150M	A	150	20	15	O	20	80	1.5M			28	E		
2N776	S	N	2N3014	2N3013	AH	150M	A	150	20	15	O	4.0	16	1.5M			6.0	E		
2N777	S	N	2N3014	2N3013	AH	150M	A	150	20	15	O	7.0	30	1.5M			11	E		
2N778	S	N	2N3014	2N3013	AH	150M	A	150	20	15	O	20	80	1.5M			28	E		
2N779	G	P	2N964	2N960	SH	60M	A	100	15	15	S	50	200	10M	0.16	10M			320M	T
2N779A	G	P	2N964	2N960	SH	60M	A	100	15	15	S	50	200	10M	0.125	10M			320M	T
2N779B	G	P	2N964	2N960	SH	150M	A	100	15	15	S	50	200	10M	0.125	10M			320M	T
2N780	S	N	2N2220		A	1.0W	C	175	45	45		35	140	500*	1.0	10M			60M	T

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N781	G	P			SH	150M	A	100	15	15	S	25		10M	0.16	10M				
2N782	G	P			SH	150M	A	100	12	12	S	20		10M	0.20	10M				
2N783	S	N	2N834	2N834	SH	300M		175	40	20	R	20	60	10M	0.25	10M			200M	T
2N784	S	N	2N834	2N834	SH	300M	A	175	30	15	R	25		10M	0.19	10M			200M	T
2N784A	S	N	2N834	2N834	SH	350M	A	200	40	20	R	25	150	10M	0.65	100M			300M	T
2N785	G	P			A	50M	A	85	12	12	S						40	E		
2N789	S	N	2N3946	2N3946	A	150M	A	175	45	30	O				1.0	5.0M	9.0	E	1.0M	B
2N790	S	N	2N3946	2N3946	A	150M	A	175	45	30	O				1.0	5.0M	18	E	2.0M	B
2N791	S	N	2N3946	2N3946	A	150M	A	175	45	30	O				1.0	5.0M	18	E	8.0M	B
2N792	S	N	2N3946	2N3946	A	150M	A	175	45	30	O				1.0	5.0M	36	E	2.0M	B
2N793	S	N	2N3946	2N3946	A	150M	A	175	45	30	O				1.0	5.0M	76	E	2.0M	B
2N794	G	P			SH	120M	A	85	13			30		10M	0.3	10M			25M	T
2N795	G	P			SH	120M	A	85	13			30		10M	0.5	40M			35M	T
2N796	G	P			SH	120M	A	85	13			50		10M	0.5	40M			50M	T
2N797	G	N			SH	150M	A	100	20	7.0	O	40		10M	0.14	10M			600M	T
2N799	G	P			S	75M	A	85	25	12	O	30		12M	0.15	12M			4.0M	B
2N800	G	P			S	75M	A	85	25	12	O	30			0.15	12M			4.0M	B
2N801	G	P			S	75M	A	85	30	18	O	30	60							
2N802	G	P			S	75M	A	85	30	18	O	30	60							
2N803	G	P			S	75M	A	85	30	15	O	40	80							
2N804	G	P			S	75M	A	85	30	15	O	40	80							
2N805	G	P			S	75M	A	85	30	12	O	60								
2N806	G	P			S	75M	A	85	30	12	O	60								
2N807	G	P			S	70M	A	85	25	14	V	40		20M	0.2	20M			14M	B
2N808	G	P			S	70M	A	85	25	14	V	40		20M	0.2	20M			14M	B
2N809	G	P			AH	75M	A	85	30	15	O	25	110	25M			30	E	3.0M	B
2N810	G	P			AH	75M	A	85	30	15	O	25	110	25M			30	E	3.0M	B
2N811	G	P			AH	75M	A	85	30	12	O	45	180	45M			50	E	5.0M	B
2N812	G	P			AH	75M	A	85	30	12	O	45	180	45M			50	E	5.0M	B
2N813	G	P			AH	75M	A	85	30	10	O	55	220	55M			70	E	15M	B
2N814	G	P			AH	75M	A	85	30	10	O	55	220	55M			70	E	15M	B
2N815	G	N			S	75M	A	85	25	15	O	60	180	30M	0.75	200M				
2N816	G	N			S	75M	A	85	25	15	O	60	180	30M	0.75	200M				
2N817	G	N			S	75M	A	85	30	15	O	20		50M	0.25	50M				
2N818	G	N			S	75M	A	85	30	15	O	20		50M	0.25	50M				
2N819	G	N			S	75M	A	85	30	20	O	30		50M	0.25	50M				
2N820	G	N			S	75M	A	85	30	20	O	30		50M	0.25	50M				
2N821	G	N			S	75M	A	85	30	25	O	40		50M	0.25	50M				
2N822	G	N			S	75M	A	85	30	25	O	40		50M	0.25	50M				
2N823	G	N			S	75M	A	85	25	12	O	40		20M	0.15	12M			4.0M	B
2N824	G	P			AH	70M	A	85	30	18	O								2.0M	B
2N825	G	P			S	70M	A	85	30	20	O	40	40						2.5M	B
2N826	G	P			S	70M	A	85	30	20	O	20	40						2.5M	B
2N827	G	P		2N827	SH	150M	A	100	20	20	S	100		10M	0.25	10M			250M	T
2N828	G	P		2N828	SH	150M	A	100	15	15	S	25		10M	0.2	10M			300M	T
2N828A	G	P		2N828A	SH	150M	A	100	15	15	S	25		10M	0.2	10M			300M	T
2N829	G	P		2N828A	SH	150M	A	100	15	15	S	50		10M	0.2	10M			300M	T
2N834	S	N		2N834	SH	300M	A	175	40	30	S	25		10M	0.25	10M			350M	T
2N834A	S	N			SH	360M	A	200	40	30	S	25		10M	0.25	10M			500M	T
2N835	S	N		2N834	SH	0.3W	A	175	25	20	O	20		10M	0.3	10M			300M	T
2N837	G	P			SH	150M	A	100	12	12	S	30		10M	0.25	10M				
2N838	G	P		2N838	SH	150M	A	100	30	30	S	30		10M	0.18	10M			300M	T
2N839	S	N	2N2222	2N2218	AH	0.3W	A	175	45	45	O	15	50	10M	2.0	10M	20	E	30M	T
2N840	S	N		2N840	AH	0.3W	A	175	45	45	O	30	100	10M	2.0	10M	40	E	30M	T
2N841	S	N		2N840	AH	0.3W	A	175	45	45	O	60	400	10M	2.0	10M	80	E	40M	T
2N842	S	N	2N2221	2N2218	AH	0.3W	A	175	45	45	O	20	55	10M	1.2	10M	20	E	30M	T
2N843	S	N	2N2222	2N2218	AH	0.3W	A	175	45	45	O	45	150	10M	1.2	10M	40	E	40M	T
2N844	S	N	2N2896	2N2895	AH	0.3W	A	175	60	60	R	40	120	5.0M	0.8	10M			50M	T
2N845	S	N	2N2896	2N2895	AH	0.3W	A	175	100	80	R	40	120	5.0M	0.8	10M			50M	T
2N846	G	P	2N960	2N960	SH	60M	A	100	15	15	S	25	125	10M	0.18	10M			320M	T
2N846A	G	P	2N960	2N960	SH	60M	A	100	15	15	S	25	125	10M	0.14	10M			320M	T
2N846B	G	P	2N960	2N960	SH	150M	A	100	15	15	S	25	125	10M	0.14	10M			320M	T
2N847	S	N	2N835	2N834	S	0.2W	A	175	20	15	O				1.5	10M				
2N848	S	N	2N834	2N834	S	0.2W	A	175	40	25	O				1.5	10M				
2N849	S	N	2N835	2N834	SH	300M	A	175	25	15	O	20	60	10M	0.6	10M			600M	T
2N850	S	N	2N834	2N834	SH	300M	A	175	25	15	O	40	120	10M	0.6	10M			600M	T
2N851	S	N	2N835	2N834	SH	300M	A	175	20	12	O	20	60	10M					300M	T
2N852	S	N	2N834	2N834	SH	300M	A	175	20	12	O	40	120	10M					300M	T
2N858	S	P	2N2906	2N2904	S	150M	A	140	40	40	O	10	60	5.0M	0.15	5.0M	15	E	5.0M	T
2N859	S	P	2N2906	2N2904	S	150M	A	140	40	40	O	25	100	5.0M	0.15	5.0M	30	E	6.0M	T
2N860	S	P	2N2906	2N2904	S	150M	A	140	25	25	O	10	40	5.0M	0.15	5.0M	15	E	6.5M	T
2N861	S	P	2N2906	2N2904	S	150M	A	140	25	25	O	25	75	5.0M	0.15	5.0M	30	E	7.5M	T
2N862	S	P	2N2906	2N2904	S	150M	A	140	15	15	O	12	48	5.0M	0.15	5.0M	20	E	8.0M	T
2N863	S	P	2N2906	2N2904	S	150M	A	140	15	15	O	25	100	5.0M	0.15	5.0M	40	E	10M	T
2N864	S	P	2N2906	2N2904	S	150M	A	140	6.0	6.0	O	20	100	5.0M	0.1	5.0M	25	E	16M	T
2N864A	S	P	2N2906	2N2904	S	300M	A		6.0	6.0	O	20	250	5.0M	0.1	5.0M	25	E	16M	T
2N865	S	P	2N2906	2N2904	S	150M	A	140	10	6.0	O	45	125	5.0M	0.1	5.0M	100	E	24M	T
2N865A	S	P	2N2906	2N2904	S	300M	A		10	10	O	45	400	5.0M	0.1	5.0M	100	E	24M	T
2N866	S	N	2N2906	2N2904	S	500M	A	175	30	20	R	15	45	150M	1.5	150M			40M	T
2N867	S	N	2N2906	2N2904	S	500M	A	175	30	20	R	30	90	150M	1.5	150M			50M	T
2N869	S	P		2N869	AH	360M	A	200	25	18	O	20	120	10M	1.0	10M			100M	T
2N869A	S	P		2N869A	S	360M	A	200	25	18	O	40	120	30M	0.15	10M			400M	T
2N870	S	N			AH	500M	A	200	100	80	R	40	120	150M	1.2	50M	30	E	50M	T
2N871	S	N	2N2895	2N2895	AH	500M	A	200	100	80	R	100	300	150M	1.2	50M	50	E	60M	T
2N876 thru 2N901	Thyristors, see Table on Page 2-66																			
2N902	S	N	2N2221	2N2218	A	150M	A	175	45	30	O				1.0	5.0M	9.0	E	1.0M	

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N903	S	N	2N2221	2N2218	A	150M	A	175	45	30	O				1.0	5.0M	18	E	2.0M	
2N904	S	N	2N2221	2N2218	A	150M	A	175	45	30	O				1.0	5.0M	18	E	8.0M	
2N905	S	N	2N2221	2N2218	A	150M	A	175	45	30	O				1.0	5.0M	36	E	2.0M	
2N906	S	N	2N2221	2N2218	A	150M	A	175	45	30	O				1.0	5.0M	76	E	2.0M	
2N907	S	N	2N2221	2N2218	A	0.15W	A	175	45	30	O	20	55	10M			19	E	12M	T
2N908	S	N	2N2221	2N2218	A	0.15W	A	175	45	30	O	45	150	10M			39	E	25M	T
2N909	S	N	2N2222	2N2218	A	400M	A	175	60	30	R	110	350	50M	0.5	10M	40	E	50M	T
2N910	S	N		2N910	A	500M	A	200	100	80	R	75		10M	0.4	10M	76	E	60M	T
2N911	S	N		2N910	A	500M	A	200	100	80	R	35		10M	0.4	10M	36	E	50M	T
2N912	S	N	2N2895	2N2895	A	500M	A	200	100	80	R	15		10M	0.4	10M	18	E	40M	T
2N914	S	N		2N914	SH	360M	A	200	40	20	R	30	120	10M	0.7	200M			300M	T
2N914A	S	N	2N2369	2N2369	SH	360M	A	200	40	20	R	30	120	10M	0.4	200M			300M	T
2N915	S	N		2N915	AH	360M	A	200	70	50	O	50	200	10M	1.0	10M	50	E	250M	T
2N915A	S	N			AHP	1.2W	C	200	70	50	O	50	250	5.0M	0.2	10M	50	E	600M	T
2N916	S	N		2N916	AH	360M	A	200	45	25	O	50	200	10M	0.5	10M	50	E	300M	T
2N916A	S	N	2N918	2N918	AH	360M	A	200	45	25	O	50	200	10M	0.5	10M	50	E	300M	T
2N916B	S	N			AHP	1.2W	C	200	60	30	O	50	200	10M	0.2	10M	50	E	500M	T
2N917	S	N	2N918	2N918	AH	200M	A	200	30	15	O	20	200	3.0M	0.5	3.0M			500M	T
2N917A	S	N	2N918	2N918	AH	200M	A	200	30	15	O	20	200	3.0M	0.4	10M			600M	T
2N918	S	N		2N918	AH	200M	A	200	30	15	O	20		3.0M	0.4	10M			600M	T
2N919	S	N	2N834	2N834	SH	0.36W	A	200	25	15	O	20	60	10M	0.2	10M			200M	T
2N920	S	N	2N834	2N834	SH	0.36W	A	200	25	15	O	40	120	10M	0.2	10M			200M	T
2N921	S	N	2N834	2N834	SH	0.36W	A	200	50	20	O	20	60	10M	0.3	10M			200M	T
2N922	S	N	2N834	2N834	SH	0.36W	A	200	50	20	O	40	120	10M	0.3	10M			200M	T
2N923	S	P	2N2906	2N2904	A	0.25W	A	200	40	25	O				0.5	5.0M	12	E	0.8M	B
2N924	S	P	2N2906	2N2904	A	0.25W	A	200	40	25	O				0.5	5.0M	24	E	0.8M	B
2N925	S	P	2N2906	2N2904	A	0.25W	A	200	50	40	O				0.5	5.0M	10	E	0.8M	B
2N926	S	P	2N2906	2N2904	A	0.25W	A	200	50	40	O				0.5	5.0M	20	E	0.8M	B
2N927	S	P	2N2906	2N2904	A	0.25W	A	200	70	60	O				0.5	5.0M	8.0	E	0.8M	B
2N928	S	P	2N2906	2N2904	A	0.25W	A	200	70	60	O				0.5	5.0M	18	E	0.8M	B
2N929	S	N		2N929	A	600M	C	175	45	45	O	40	120	10*	1.0	10M	150	E	1.0M	E
2N929A	S	N		2N929	A	0.5W	A	200	60	45	O	40	120	10*	0.5	10M	60	E	45M	T
2N930	S	N		2N929	A	600M	C	175	45	45	O	100	300	10*	1.0	10M	150	E	1.0M	E
2N930A	S	N		2N929	A	0.5W	A	200	60	45	O	100	300	10*	0.5	10M	150	E	45M	T
2N930B	S	N	2N930A	2N929	A	500M	A		60	45	O	100	300	10*	0.5	10M	150	E	45M	T
2N934	G	P	2N965	2N960	SH	150M	A	85	13	12		40		40M	0.3	40M			35M	T
2N935	S	P	2N2907A	2N2904	A	0.25W	A	160	50	40	O	9.0	22		0.3	5.0M				
2N936	S	P	2N2907A	2N2904	A	0.25W	A	160	50	35	O	18	44		0.5	5.0M				
2N937	S	P	2N2907A	2N2904	A	0.25W	A	160	50	30	O	36	88		0.6	5.0M				
2N938	S	P	2N2907A	2N2904	A	0.25W	A	175	40	35	O				0.3	5.0M	9.0	E	1.0M	B
2N939	S	P	2N2907A	2N2904	A	0.25W	A	175	40	35	O				0.3	5.0M	18	E	2.0M	B
2N940	S	P	2N2907A	2N2904	A	0.25W	A	175	40	35	O				0.3	5.0M	36	E	2.0M	B
2N941	S	P	2N2907A	2N2904	SC	0.25W	A	175	25	8	U	10		1.0M			25	E	16M	T
2N942	S	P	2N2907A	2N2904	SC	0.25W	A	175	25	8	U	10		1.0M			25	E	10M	T
2N943	S	P	2N2907A	2N2904	SC	0.25W	A	175	40	18	O	10			0.003		25	E	1.0M	B
2N944	S	P	2N2907A	2N2904	SC	0.25W	A	175	40	18	O	10			0.004		25	E	1.0M	B
2N945	S	P	2N2907A	2N2904	SC	0.25W	A	175	50	50	O	10			0.005		25	E	1.0M	B
2N946	S	P	2N2907A	2N2904	SC	0.25W	A	175	80	80	O	10			0.005		25	E	1.0M	B
2N947	S	N	2N834	2N834	S	360M	A	150	20	15	R	20		10M	0.4	5.0M			200M	T
2N948 thru 2N951	Thyristors, see Table on Page 2-66																			
2N955	G	N			SH	150M	A	100	12	8.0	O	30		30M	0.5	30M				
2N955A	G	N			SH	150M	A	100	12	8.0	O	30		30M	0.3	30M				
2N956	S	N		2N718A	AH	500M	A	200	75	50	R	100	300	150M	1.5	150M	50	E	70M	T
2N957	S	N	2N2501	2N2501	AH	250M	A	150	40	20	O	45		10M	1.5	10M			200M	T
2N958	S	N	2N835	2N834	SH	0.25W	C	150	25	15	O	20		10M	0.2	10M			200M	T
2N959	S	N	2N835	2N834	SH	0.25W	C	150	25	15	O	40		10M	0.2	10M			200M	T
2N960	G	P		2N960	SH	150M	A	100	15	15	S	20		10M	0.2	10M			300M	T
2N961	G	P		2N960	SH	150M	A	100	12	12	S	20		10M	0.2	10M			300M	T
2N962	G	P		2N960	SH	150M	A	100	12	12	S	20		10M	0.2	10M			300M	T
2N963	G	P		2N963	SH	150M	A	100	12	12	S	20		10M	0.2	10M			250M	T
2N964	G	P		2N960	SH	150M	A	100	15	15	S	40		10M	0.18	10M			300M	T
2N964A	G	P		2N964A	SH	150M	A	100	15	15	S	40		10M	0.18	10M			300M	T
2N965	G	P		2N960	SH	150M	A	100	12	12	S	40		10M	0.18	10M			300M	T
2N966	G	P		2N960	SH	150M	A	100	12	12	S	40		10M	0.18	10M			300M	T
2N967	G	P		2N963	SH	150M	A	100	12	12	S	40		10M	0.2	10M			250M	T
2N968	G	P		2N963	SH	150M	A	100	15	15	S	17		10M	0.25	10M			300M	T
2N969	G	P		2N963	SH	150M	A	100	12	12	S	17		10M	0.25	10M			300M	T
2N970	G	P		2N963	SH	150M	A	100	12	12	S	17		10M	0.25	10M			300M	T
2N971	G	P		2N963	SH	150M	A	100	7.0	7.0	S	17		10M	0.25	10M			300M	T
2N972	G	P		2N963	SH	150M	A	100	15	15	S	40		10M	0.25	10M			300M	T
2N973	G	P		2N963	SH	150M	A	100	12	12	S	40		10M	0.25	10M			300M	T
2N974	G	P		2N963	SH	150M	A	100	12	12	S	40		10M	0.25	10M			300M	T
2N975	G	P		2N963	SH	150M	A	100	7.0	7.0	S	40		10M	0.25	10M			300M	T
2N976	G	P	2N964	2N960	SH	100M	A	100	15	10	O	30		20M	0.17	20M			249M	T
2N977	G	P	2N964	2N960	SH	150M	A	100	15	10	O	50		40M	0.2	40M			400M	T
2N978	S	P		2N978	AH	330M	A	150	30	20	O	15	60	150M	1.5	150M			40M	T
2N979	G	P			SH	60M	A	100	20	15	O	30		10M	0.25	10M			100M	T
2N980	G	P			SH	60M	A	100	20	12	O	30		10M	0.25	10M			100M	T
2N981	S	N	2N720A	2N720A	A	0.5W	A	200	80	80	O	3.6		1.0M	3.0	10M	36	E	50M	B
2N982	G	P			SH	60M	A	100	20	15	O	50		10M	0.125	10M				
2N983	G	P			SH	60M	A	100	15	15	O	40		10M	0.15	10M				
2N984	G	P			SH	60M	A	100	15	10	O	50		10M	0.18	10M				
2N985	G	P		2N985	SH	150M	A	100	15	7.0	O	40		10M	0.15	10M			300M	T
2N986	S	N	2N2895	2N2895	AL	500M	A	200	100	80	R									
2N987	G	P			AH	0.1W	A	100	40	40	O	40	250	1.0M			40	E		
2N988	S	N	2N2221	2N2218	AH	0.3W	A	175	20	10	O	20	120	10M	0.5	10M			300M	T
2N989	S	N	2N2221	2N2218	AH	0.3W	A	175	20	10	O	20	120	10M	0.5	10M			300M	T
2N990	G	P			AH	67M	A	75	20	20	R	40		1.0M			40	E	44M	T
2N991	G	P			AH	67M	A	75	20	20	R	40		1.0M			40	E	44M	T

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N992	G	P			AH	67M	A	75	20	20	R	40		1.0M			40	E		
2N993	G	P			AH	67M	A	75	20	20	R	40		1.0M			40	E	44M	T
2N994	G	P			SH	200M	A	150	15	6.0	O	45	140	10M	0.18	10M				
2N995	S	P		2N869	AH	360M	A	200	20	15	O	35	140	20M	0.2	20M			100M	T
2N995A	S	P	2N3250	2N3250	AH	360M	A	200	20	15	O	35	140	20M	0.2	20M			100M	T
2N996	S	P		2N996	AH	360M	A	200	15	12	O	35		20M	0.3	60M			100M	T
2N997	S	N	2N720A	2N720A	A	500M	A	175	75	40	O	35		100*	1.6	100M				
2N998	S	N		2N998	AL	500M	A	200	100	60	O				1.2	50M	1000	E		
2N999	S	N			AL	500M	A	200	60	60	O				1.6	100M				
2N1000	G	N			S	150M	A	100	40	25	O	40		10M	0.25	100M			7.0M	E
2N1003	G	P			AH	120M	A	100	35	20	U						10	E		
2N1004	G	P			AH	120M	A	100	35	20	U						10	E		
2N1005	S	N	2N2242	2N2242	A	150M	A	175	15	15	O	10	25	10M	0.6	10M				
2N1006	S	N	2N2242	2N2242	A	150M	A	175	15	15	O	25	150	10M	0.6	10M				
2N1007	G	P			AP	35W	C	95	25	20	O	50	250	1.0A	1.0	2.0A	25	E	60K	T
2N1008	G	P		2N1008	A	0.3W	C	85	20	15	R				0.25	0.1A	40	E		
2N1008A	G	P		2N1008	A	0.3W	C	85	40	35	R				0.25	0.1A	40	E		
2N1008B	G	P		2N1008	A	0.3W	C	85	60	55	R				0.25	0.1A	40	E		
2N1009	G	P			A	0.4W	C	85	35	35	R				0.25	0.1A	40	E	7.5K	E
2N1010	G	N			A	20M	A	55	10	10	O									
2N1011	G	P		2N1011	AP	35W	C	95	80	80	S	30	75	3.0A	1.5	3.0A	20	E	5.0K	E
2N1012	G	N			S	150M	A	100	40	22	O	40		100M	0.2	100M			3.0M	E
2N1014	G	P			AP	50W	C	100	100	65	O	20	50	4.0A	0.8	4.0A			0.5M	B
2N1015	S	N	2N3713	2N3713	SP	150W	C	150	30	30	V	10		2.0A	1.5	2.0A				
2N1015A	S	N	2N3713	2N3713	SP	150W	C	150	60	60	V	10		2.0A	1.5	2.0A				
2N1015B	S	N	2N5758		SP	150W	C	150	100	100	V	10		2.0A	1.5	2.0A				
2N1015C	S	N	2N5760		SP	150W	C	150	150	150	V	10		2.0A	1.5	2.0A				
2N1015D	S	N	MJ410	MJ410	SP	150W	C	150	200	200	V	10		2.0A	1.5	2.0A				
2N1015E	S	N	MJ411	MJ410	SP	150W	C	150	250	250	V	10		2.0A	1.5	2.0A				
2N1015F	S	N	MJ411	MJ410	SP	150W	C	150	300	300	V	10		2.0A	1.5	2.0A				
2N1016	S	N	2N3713	2N3713	SP	150W	C	150	30	30	V	10		5.0A	2.5	5.0A				
2N1016A	S	N	2N3713	2N3713	SP	150W	C	150	60	60	V	10		5.0A	2.5	5.0A				
2N1016B	S	N	2N3713		SP	150W	C	150	100	100	V	10		5.0A	2.5	5.0A				
2N1016C	S	N	2N5758		SP	150W	C	150	150	150	V	10		5.0A	2.5	5.0A				
2N1016D	S	N	2N5760	MJ3430	SP	150W	C	150	200	200	V	10		5.0A	2.5	5.0A				
2N1016E	S	N	MJ3430	MJ3430	SP	150W	C	150	250	250	V	10		5.0A	2.5	5.0A				
2N1016F	S	N	MJ3430	MJ3430	SP	150W	C	150	300	300	V	10		5.0A	2.5	5.0A				
2N1017	G	P			S	150M	A	85	30	10	O	70		20M	2.6	200M			15M	B
2N1018	G	P			S	200M	A	100	30	6.0	O	70		70M	2.6	200M			20M	B
2N1021	G	P		2N1021	AP	50W	C	95	100	100	X	23	70	1.0A	1.0	5.0A				
2N1021A	G	P			AP	150W	C	100	100	50	O	30	90	5.0A	0.5	5.0A			200K	T
2N1022	G	P		2N1021	AP	50W	C	95	120	120	X	23	70	5.0A	1.0	5.0A				
2N1022A	G	P			AP	150W	C	100	120	55	O	30	90	5.0A	0.5	5.0A			200K	T
2N1023	G	P	2N3323	2N3323	A	120M	A	100	40	40	O	20	175	1.5M						
2N1024	S	P	2N3250	2N3250	A	0.25W	A	175	18	15	U						9.0	E	1.0M	B
2N1025	S	P	2N3250	2N3250	A	0.25W	A	175	40	35	U						9.0	E	1.0M	B
2N1026	S	P	2N3250	2N3250	A	0.25W	A	175	40	35	U						18	E	2.0M	B
2N1027	S	P	2N3250	2N3250	A	0.25W	A	175	18	15	U						18	E	4.0M	B
2N1028	S	P			A	0.25W	A	175	12	10	U						9.0	E	7.2M	T
2N1029	G	P	2N1553	2N1539	AP	90W	C	100	50	20	O	20	60	10A	1.0	10A				
2N1029A	G	P	2N1554	2N1539	AP	90W	C	100	60	30	O	20	60	10A	1.0	10A				
2N1029B	G	P	2N1555	2N1539	AP	90W	C	100	90	60	O	20	60	10A	1.0	10A				
2N1029C	G	P	2N1556	2N1539	AP	90W	C	100	100	70	O	20	60	10A	1.0	10A				
2N1030	G	P	2N1557	2N1539	AP	90W	C	100	50	20	O	50	100	10A	1.0	10A				
2N1030A	G	P	2N1558	2N1539	AP	90W	C	100	60	30	O	50	100	10A	1.0	10A				
2N1030B	G	P	2N1559	2N1539	AP			100	90	60	O	50	100	10A	1.0	10A				
2N1030C	G	P	2N1560	2N1539	AP			100	100	70	O	50	100	10A	1.0	10A				
2N1031	G	P	2N1553	2N1539	AP	90W	C	100	50	30	S	20	60	10A	1.0	10A	10	E	2.0K	E
2N1031A	G	P	2N1554	2N1539	AP	90W	C	100	60	40	S	20	60	10A	1.0	10A	10	E	2.0K	E
2N1031B	G	P	2N1555	2N1539	AP	90W	C	100	90	70	S	20	60	10A	1.0	10A	10	E	2.0K	E
2N1031C	G	P	2N1556	2N1539	AP	90W	C	100	100	80	S	20	60	10A	1.0	10A	10	E	2.0K	E
2N1032	G	P			AP	90W	C	100	50	30	S	50	100	10A	1.0	10A	25	E	2.0K	E
2N1032A	G	P			AP	90W	C	100	60	40	S	50	100	10A	1.0	10A	25	E	2.0K	E
2N1032B	G	P			AP	90W	C	100	90	70	S	50	100	10A	1.0	10A	25	E	2.0K	E
2N1032C	G	P			AP	90W	C	100	100	80	S	50	100	10A	1.0	10A	25	E	2.0K	E
2N1034	S	P			A	250M	A	160	50	40	O				0.5	8.0M	9.0	E	150K	B
2N1035	S	P			A	250M	A	160	50	35	O				0.4	8.0M	18	E	200K	B
2N1036	S	P			A	250M	A	160	50	30	O				0.3	8.0M	34	E	300K	B
2N1037	S	P			A	250M	A	160	50	35	O				0.5	8.0M	9.0	E	150K	B
2N1038	G	P		2N1038	AP	20W	C	95	40	40	V	20	60	1.0A	0.25	1.0A	18	E	8.0K	E
2N1039	G	P		2N1038	AP	20W	C	95	60	60	V	20	60	1.0A	0.25	1.0A	18	E	8.0K	E
2N1040	G	P		2N1038	AP	20W	C	95	80	80	V	20	60	1.0A	0.25	1.0A	18	E	8.0K	E
2N1041	G	P		2N1038	AP	20W	C	95	100	100	V	20	60	1.0A	0.25	1.0A	18	E	8.0K	E
2N1042	G	P	2N1042	2N1042	AP	20W	C	100	40	40	V	20	60	3.0A	0.75	3.0A	2.0	E	250K	T
2N1043	G	P	2N1042	2N1042	AP	20W	C	100	60	60	V	20	60	3.0A	0.25	1.0A			250K	T
2N1044	G	P	2N1042	2N1042	AP	20W	C	100	80	80	V	20	60	3.0A	0.25	1.0A			250K	T
2N1045	G	P	2N1042	2N1042	AP	20W	C	100	100	100	V	20	60	3.0A	0.25	1.0A			250K	T
2N1046	G	P			AHP	50W	C	100	100	50	O	40		5.0A	0.2	500M			15M	T
2N1046A	G	P			AHP	50W	C	100	130	50	O	40		5.0A	0.4	5.0A			15M	T
2N1046B	G	P			AHP	50W	C	100	130	50	O	20		10A	0.4	5.0A			15M	T
2N1047	S	N		2N4912	AP	40W	C	200	80			12	36	500M	7.5	500M				
2N1047A	S	N		2N4912	AP	40W	C	200	80	80	O	12	36	500M	7.5	500M			75K	E
2N1047B	S	N		2N4912	AP	40W	C	200	80	80	O	12	36	500M	2.0	500M			125K	E
2N1047C	S	N		2N4912	AP	40W	C	200	80	80	O	12	36	500M	1.0	500M			125K	E
2N1048	S	N		2N5759	AP	40W	C	200	120			12	36	500M	7.5	500M				
2N1048A	S	N		2N5759	AP	40W	C	200	120	120	O	12	36	500M	7.5	500M			75K	E
2N1048B	S	N		2N5759	AP	40W	C	200	120	120	O	12	36	500M	2.0	500M			125K	E
2N1048C	S	N		2N5759	AP	40W	C	200	120	120	O	12	36	500M	1.0	500M			125K	E

						MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N1049	S	N	2N4912		AP	40W	C	200	80			30	90	500M	7.5	500M				
2N1049A	S	N	2N4912		AP	40W	C	200	80	80	O	30	90	500M	7.5	500M			75K	E
2N1049B	S	N	2N4912		AP	40W	C	200	80	80	O	30	90	500M	2.0	500M			125K	E
2N1049C	S	N	2N4912		AP	40W	C	200	80	80	O	30	90	500M	1.0	500M			125K	E
2N1050	S	N	2N5759		AP	40W	C	200	120			30	90	500M	7.5	500M				
2N1050A	S	N	2N5759		AP	40W	C	200	120	120	O	30	90	500M	7.5	500M			75K	E
2N1050B	S	N	2N5759		AP	40W	C	200	120	120	O	30	90	500M	2.0	500M			125K	E
2N1050C	S	N	2N5759		AP	40W	C	200	120	80	O	30	90	500M	1.0	500M			125K	E
2N1051	S	N	2N2218	2N2218	AH	0.5W	A	150	40	40	O	25		50M	3.0	50M	30	E	80M	T
2N1052	S	N	2N2218	2N2218	AH	6.0M	A	200	200	200	V	20	80	0.2A	5.0	0.2A				
2N1054	S	N	2N2218	2N2218	AH	0.8W	A	200	125	115	O	20		0.2A			15	E	8.0M	T
2N1055	S	N	2N2218	2N2218	AH	5.5M	A	200	100	100	O	20	80	50M	2.0	50M			3.0M	T
2N1056	G	P	2N2043	2N2042	A	240M	A	100	70	50	R	18	43	20M	0.13	20M			500K	B
2N1057	G	P	2N1924	2N1924	A	240M	A	100	45	45	V	34	90	20M	0.13	20M			500K	B
2N1058	G	N				50M		75	20	20	R						10	B	4.0M	B
2N1059	G	N			A	180M		75	40	15	R			10M					10K	E
2N1060	S	N	2N2501	2N2501	SH	0.25W	A	150	40	40	O	17		5.0M	0.3	5.0M				
2N1065	G	P			A	0.12W	A	85	40	20	O	20	80		0.25	10M			10M	T
2N1066	G	P	2N3323	2N3323	AH	120M	A	100	40	40	O	20	175	1.5M						
2N1067	S	N	2N4237	2N4237	SP	5.0W	C	175	60	30	O	15	75	200M	2.0	200M			0.75M	B
2N1068	S	N	2N4237	2N4237	SP	10W	C	175	60	30	O	15	75	750M	2.0	200M			0.75M	B
2N1069	S	N	2N5067	2N5067	SP	50W	C	175	60	45	O	20	50	1.5A	1.33	0.5A			0.5M	B
2N1070	S	N	2N5067	2N5067	SP	50W	C	175	60	45	O	20	50	1.5A	0.5	1.5A			0.5M	B
2N1072	S	N	2N3766	2N3766	SP	2.0W	A	150	75	30	O	20		0.75A	2.0	0.75A				
2N1073	G	P		2N1073	AP			110	40	40	R	20	60	5.0A	1.0	5.0A				
2N1073A	G	P		2N1073	AP			110	80	80	R	20	60	5.0A	1.0	5.0A				
2N1073B	G	P		2N1073	AP			110	120	120	R	20	60	5.0A	1.0	5.0A				
2N1074	S	N	2N2218	2N2218	A	250M	A	160	50	40	O						9.0	E	200K	B
2N1075	S	N	2N2218	2N2218	A	250M	A	160	50	35	O						18	E	250K	B
2N1076	S	N	2N2218	2N2218	A	250M	A	160	50	30	O						36	E	300K	B
2N1077	S	N	2N2218	2N2218	A	250M	A	160	50	35	O				1.0	8.0M	9.0	E	200K	B
2N1078	G	P			AP	20W	C	85	60	60	S	40		0.5A	1.0	1.0A				
2N1079	S	N	2N5068	2N5067	AHP	60W	C	200	60	60	S	20	80	1.0A	3.0	1.0A	20	E	10M	T
2N1080	S	N	2N4914	2N4913	AHP	60W	C	200	60	60	S	20	80	2.0A	5.0	2.0A	20	E	10M	T
2N1081	S	N	2N2221	2N2218	S	6.0M	A	200	40	40	O	20	100	0.5A	4.0	0.5A				
2N1082	S	N	2N2221	2N2218	AH	0.2W	A	200	25	25	S	10	50	10M			10	E	17M	T
2N1086	G	N			AH	65M	A	85	9.0	9.0	O	17	195	1.0M						
2N1086A	G	N			AH	65M	A	85	9.0	9.0	O	17	195	1.0M						
2N1087	G	N			AH	65M	A	85	9.0	9.0	O	17	195	1.0M						
2N1090	G	N			S	120M	A	85	25			30		20M	0.2	20M			5.0M	B
2N1091	G	N			S	120M	A	85	25			40		20M	0.3	200M			10M	B
2N1092	S	N	2N4237	2N4237	SP	2.0W	A	175	60	30	O	15	75	200M	2.0	200M			0.75M	B
2N1093	G	P			A	150M	A	95	30	15	O	50	150	20M	0.2	20M	40	E	5.0M	B
2N1094	G	P			AH	0.15W	A	100	30	15	O	15		4.0M			0.96	B	560M	T
2N1097	G	P	2N1414	2N1413	A	200M	A	100	18	18	R	34	90	20M					1.0M	B
2N1098	G	P	2N1414	2N1413	A	200M	A	100	18	18	R	25	90	20M					1.0M	B
2N1099	G	P		2N277	AP	50W	C	95	80	70	S	35	70	5.0A	0.7	12A				
2N1100	G	P		2N173	AP	50W	C	95	100	65	O	25	50	5.0A	0.7	12A				
2N1101	G	N			A	180M		75	20	15	R	25	50	35M	0.5	100M			10K	E
2N1102	G	N			A	180M		75	40	25	R	25	50	35M	0.5	100M			10K	E
2N1103	S	N	2N2221	2N2218	A	125M	A	150	45	35	O	30	65	10M	1.5	10M	20	E	10M	B
2N1104	S	N	2N2221	2N2218	A	125M	A	150	45	35	O	45	150	10M	1.5	10M	40	E	20M	B
2N1105	S	N	MM3005	MM3005	A	800M	A	200	60	60	O	12	36	200M	5.0	200M				
2N1106	S	N	MM3007	MM3005	A	800M	A	200	100	100	O	12	36	200M	5.0	200M				
2N1107	G	P			AH	30M	C		16										40M	B
2N1108	G	P			AH	30M	C		16										35M	B
2N1109	G	P			AH	30M	C		16										35M	B
2N1110	G	P			AH	30M	C		16										35M	B
2N1111	G	P			AH	30M	C		16										35M	B
2N1114	G	N			S	150M		100	25	15	R	40	180	20M					7.0M	B
2N1115	G	P			S	150M	A	85	20	15	O				0.35	60M			5.0M	B
2N1115A	G	P			S	150M	A	85	20	15	O				0.35	60M			5.0M	B
2N1116	S	N	MM3005	MM3005	AH	600M	C	200	60	60	O	40	150	0.5A	5.0	0.5A			6.0M	T
2N1117	S	N	MM3005	MM3005	AH	600M	C	200	60	60	O	40	150	0.2A	4.0	0.2A			4.0M	T
2N1118	S	P	2N3250	2N3250	AH	150M	A	140	25	25	U						15	E	8.0M	M
2N1118A	S	P	2N3250	2N3250	AH	150M	A	140	25	25	U		25	15M			15	E	8.0M	M
2N1119	S	P	2N3546	2N3546	S	150M	A	140	10	10	U	15		15M	0.15	5.0M			7.2M	T
2N1120	G	P		2N1120	AP	45W	C	95	80	70	S	20	50	10A	1.0	10A	30	E	3.0K	E
2N1121	G	N			AH	65M	C	85	15	15	O	34		1.0M						
2N1122	G	P	2N961	2N956	SH	25M	A	100	12	11	S	25		10M	0.1	8.0M	35	E	40M	
2N1122A	G	P	2N960	2N956	SH	25M	A	100	15	14	S	25		10M	0.1	8.0M	35	E	40M	
2N1123	G	P	2N3427	2N3427	SH	10M	C	100	45	40	S	40		100M	0.2	10M			3.0M	B
2N1124	G	P	2N651	2N650	A	300M	A	85	40	35	V				0.2	100M	40	E	400K	B
2N1125	G	P	2N651	2N650	SH	300M	A	85	40	40	V	50	150	500M	0.3	500M			1.0M	B
2N1126	G	P	2N651	2N650	S	1.0W	C	85	40	35	V				0.2	100M	40	E	400K	B
2N1127	G	P	2N3428	2N3427	S	1.0W	C	85	40	40	V	50	150	500M	0.3	500M			1.0M	B
2N1128	G	P	2N1192	2N1191	A	150M	A	85	25	18	S						70	E		
2N1129	G	P	2N3427	2N3427	A	150M	A	85	25	25	V	100	200	100M	0.25	100M				
2N1130	G	P	2N1193	2N1191	A	150M	A	85	30			50	165	100M	0.25	100M				
2N1131	S	P		2N1131	S	600M	A	175	50	35	O	20	45	150M	1.5	150M	15	E	50M	T
2N1131A	S	P		2N1131	S	0.6W	A	175	60	40	O	20	45	0.15A	1.5	0.15A	15	E	50M	T
2N1132	S	P		2N722	S	600M	A	175	50	35	O	30	90	150M	1.5	150M	25	E	60M	T
2N1132A	S	P		2N722	S	0.6W	A	175	60	40	O	30	90	0.15A	1.5	0.15A	25	E	60M	T
2N1132B	S	P			S	0.6W	A	175	70	45	O	30	90	0.15A	1.5	0.15A	25	E	60M	T
2N1135	S	P	2N2369	2N2369	S	100M	A	140	12	12	O								5.6M	T
2N1135A	S	P	2N2369	2N2369	S	100M	A	140	12	12	O								5.6M	T
2N1136	G	P			AP			100	60	35	R	50	100	3.0A	1.0	3.0A			4.0K	E
2N1136A	G	P			AP			100	90	35	R	50	100	3.0A	1.0	3.0A			4.0K	E

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N1136B	G	P			AP			100	100	75	R	50	100	3.0A	1.0	3.0A			4.0K	E
2N1137	G	P			AP			100	60	25	O	75	150	3.0A	1.0	3.0A				
2N1137A	G	P			AP			100	90	55	O	75	150	3.0A	1.0	3.0A				
2N1137B	G	P			AP			100	100	65	O	75	150	3.0A	1.0	3.0A				
2N1138	G	P			AP			100	60	25	O	100	200	3.0A	1.0	3.0A				
2N1138A	G	P			AP			100	90	55	O	100	200	3.0A	1.0	3.0A				
2N1138B	G	P			AP			100	100	65	O	100	200	3.0A	1.0	3.0A				
2N1139	S	N	2N742	2N742	SH	6.6M	A	175	15	15	O	20	200	10M	0.7	10M			100M	T
2N1141	G	P		2N1141	AH	750M	C	100	35			10		10M	2.0	50M	12	E		
2N1141A	G	P			AH	750M	C	100	35	25	S	15		10M	2.0	50M	0.94	B	500M	T
2N1142	G	P		2N1141	AH	750M	C	100	30			10		10M	2.0	50M	0.98	B	600M	B
2N1142A	G	P			AH	750M	C	100	30	25	S	15		10*	2.0	50M	0.94	B	400M	T
2N1143	G	P		2N1141	AH	750M	C	100	25			10		10M	2.0	50M	0.98	B	480M	B
2N1143A	G	P			AH	750M	C	100	30	25	S	15		10M	2.0	50M	0.94	B	400M	T
2N1144	G	P	2N321	2N319	A	175M	A	85	16	16	R	34	90	20M					1.0M	B
2N1145	G	P	2N1414	2N1413	A	175M	A	85	16	16	R	25	90	20M					1.0M	B
2N1146	G	P			SP	87W	C	95	40	20	O	60	150	5.0A	1.0	15A			0.15M	E
2N1146A	G	P			SP	87W	C	95	60	30	O	60	150	5.0A	1.0	15A			0.15M	E
2N1146B	G	P			SP	87W	C	95	80	40	O	60	150	5.0A	1.0	15A			0.15M	E
2N1146C	G	P			SP	87W	C	95	100	50	O	60	150	5.0A	1.0	15A			0.15M	E
2N1147	G	P			SP	87W	C	95	40	20	O	60	150	5.0A	1.0	15A			0.15M	E
2N1147A	G	P			SP	87W	C	95	60	30	O	60	150	5.0A	1.0	15A			0.15M	E
2N1147B	G	P			SP	87W	C	95	80	40	O	60	150	5.0A	1.0	15A			0.15M	E
2N1147C	G	P			SP	87W	C	95	100	50	O	60	150	5.0A	1.0	15A			0.15M	E
2N1149	S	N	2N2221	2N2218	A	150M	A	175	45			9.0	20	25M			0.9	B	4.0M	B
2N1150	S	N	2N2221	2N2218	A	150M	A	175	45			18	40	25M			0.948	B	5.0M	B
2N1151	S	N	2N2221	2N2218	A	150M	A	175	45			18	90	25M			0.948	B	8.0M	B
2N1152	S	N	2N2221	2N2218	A	150M	A	175	45			36	90	25M			0.973	B	6.0M	B
2N1153	S	N	2N2221	2N2218	A	150M	A	175	45			76	333	25M			0.987	B	7.0M	B
2N1154	S	N	2N2221	2N2218	A	750M	C	150	50			9.0		60M			0.9	B		
2N1155	S	N	2N2221	2N2218	A	750M	C	150	80			9.0		50M			0.9	B		
2N1156	S	N	2N2221	2N2218	A	750M	C	150	120			9.0		40M			0.9	B		
2N1157	G	P	MP501	MP500	SP	187W	J	100	60	45	O	38	84	10A	0.8	40A			75K	T
2N1157A	G	P	MP502	MP500	SP	187W	J	100	80	50	O	38	84	10A	0.8	40A			75K	T
2N1158	G	P	2N1143	2N1141	AH	60M	A	100	20	20	S						5.7	E		
2N1158A	G	P	2N1142	2N1141	AH	75M	A	100	20	20	S						9.0	E		
2N1159	G	P	2N3616	2N3615	SP	35W	C	95	80	60	O	30	75	3.0A	1.0	3.0A				
2N1160	G	P	2N3616	2N3615	SP	35W	C	95	80	60	O	20	50	5.0A	1.0	5.0A				
2N1162	G	P		2N1162	SP	90W	C	100	50	35	S	15	65	25A	0.8	25A			1.0K	E
2N1162A	G	P		2N1162	SP	90W	C	100	50	35	S	15	65	25A	0.8	25A			3.0K	E
2N1163	G	P		2N1162	SP	90W	C	100	50	35	S	15	65	25A	0.8	25A			1.0K	E
2N1163A	G	P		2N1162	SP	90W	C	100	50	35	S	15	65	25A	0.8	25A			3.0K	E
2N1164	G	P		2N1162	SP	90W	C	100	80	60	S	15	65	25A	0.8	25A			1.0K	E
2N1164A	G	P		2N1162	SP	90W	C	100	80	60	S	15	65	25A	0.8	25A			3.0K	E
2N1165	G	P		2N1162	SP	90W	C	100	80	60	S	15	65	25A	0.8	25A			1.0K	E
2N1165A	G	P		2N1162	SP	90W	C	100	80	60	S	15	65	25A	0.8	25A			3.0K	E
2N1166	G	P		2N1162	SP	90W	C	100	100	75	S	15	65	25A	0.8	25A			1.0K	E
2N1166A	G	P		2N1162	SP	90W	C	100	100	75	S	15	65	25A	0.8	25A			3.0K	E
2N1167	G	P		2N1162	SP	90W	C	100	100	75	S	15	65	25A	0.8	25A			1.0K	E
2N1167A	G	P		2N1162	SP	90W	C	100	100	75	S	15	65	25A	0.8	25A			3.0K	E
2N1168	G	P	2N3614	2N3611	AP	45W	C	95	50	30	R									
2N1169	G	N			S	120M	A	71	40	20	O	20		200M	0.3	200M			4.5M	B
2N1170	G	N			S	120M	A	71	40	20	O	20		200M	0.3	200M			4.5M	B
2N1171	G	P			S	170M	A	85	30	12	O	30	90	30M					10M	B
2N1172	G	P	2N2137	2N2137	SP			95	40	30	O	30	90	100M						
2N1173	G	N			S	0.25W	A	100	35	20	O	50	200	10M	0.075	10M	50	E		
2N1174	G	P			S	0.25W	A	100	35	20	O	50	200	10M	0.075	10M	50	E		
2N1175	G	P		2N1413	A	200M	A	85	35	25	R	70	140	20M					1.5M	B
2N1176	G	P	2N1189	2N1189	A	0.3W	C	85	10	10	R				0.3	0.1A	20	E		
2N1177	G	P	2N2957	2N2955	AH	80M	A	71	30											
2N1178	G	P	2N2955	2N2955	AH	80M	A	71	30											
2N1179	G	P	2N2956	2N2955	AH	80M	A	71	30											
2N1180	G	P	2N2956	2N2955	AH	80M	A	71	30											
2N1182	G	P	2N2140	2N2137	SP	106W	C	100	50	60	O	30	85	0.5A	0.9	2.0A			5.0K	E
2N1183	G	P	2N2140	2N2137	SP	7.5W	C	100	45	20	O	20	60	400M	0.5	400M			500K	B
2N1183A	G	P	2N2140	2N2137	SP	7.5W	C	100	60	30	O	20	60	400M	0.5	400M			500K	B
2N1183B	G	P	2N2141	2N2137	SP	7.5W	C	100	80	40	O	20	60	400M	0.5	400M			500K	B
2N1184	G	P	2N2144	2N2137	SP	7.5W	C	100	45	20	O	40	120	400M	0.5	400M			500K	B
2N1184A	G	P	2N2145	2N2137	SP	7.5W	C	100	60	30	O	40	120	400M	0.5	400M			500K	B
2N1184B	G	P	2N2146	2N2137	SP	7.5W	C	100	80	40	O	40		400M	0.5	400M			500K	B
2N1185	G	P		2N1185	A	200M	A	100	45	30	R	130		10M			190	E	1.7M	B
2N1186	G	P		2N1185	A	200M	A	100	60	45	R	33		10M			30	E	0.75M	B
2N1187	G	P		2N1185	A	200M	A	100	60	45	R	45		10M			50	E	1.0M	B
2N1188	G	P		2N1185	A	200M	A	100	60	45	R	80		10M			100	E	1.2M	B
2N1189	G	P		2N1189	A	200M	A	100	45	30	R	60		10M	0.22	50M	75	E	1.7M	B
2N1190	G	P		2N1189	A	200M	A	100	45	30	R	100		10M	0.22	50M	125	E	2.2M	B
2N1191	G	P		2N1191	A	200M	A	100	40	25	R	20	80	10M			30	E		
2N1192	G	P		2N1191	A	200M	A	100	40	25	R	40	135	10M			50	E		
2N1193	G	P		2N1191	A	200M	A	100	40	25	R	70	300	10M			100	E		
2N1194	G	P		2N1191	A	200M	A	100	40	25	R	125	600	10M			190	E		
2N1195	G	P		2N1141	AH	225M	A	100	30								0.96	B	400M	T
2N1196	S	P			AH	0.35W	A	200	70	70	O	5.0	30	2.0M			0.85	B		
2N1197	S	P			AH	0.35W	A	200	70	70	O	5.0	30	2.0M			0.85	B		
2N1198	G	N			SH	65M	A	85	25	25	O	17	90	8.0M			0.952	B	5.0M	B
2N1199	S	N	2N835	2N834	SH	150M	A	150	20	15	O	12	60	20M	0.25	10M			75M	T
2N1199A	S	N	2N835	2N834	SH	150M	A	150	20	15	O	12	60	20M	0.25	10M			75M	T
2N1200	S	N			AH	100M	A	150	20	15	O	7.0	200	1.5M			9.0	E		
2N1201	S	N			AH	100M	A	150	20	15	O	7.0	200	1.5M			9.0	E		

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS: P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS: h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N1202	G	P	2N2145	2N2137	SP	34W	J	95	80	60	O	40	120	500M	0.3	500M			200K	T
2N1203	G	P	2N2146	2N2137	SP	34W	J	95	120	70	O	25	75	2.0A	0.6	2.0A			200K	T
2N1204	G	P		2N1204	SH	200M	A	100	20	15	O	15		400M	0.5	200M			220M	T
2N1204A	G	P		2N1204	SH	200M	A	100	20	15	O	25		200M	0.4	200M			220M	T
2N1206	S	N	2N3020	2N3019	AH	3.0W	A	200	60	60	O	20	80				25	E	10M	T
2N1207	S	N	2N3500	2N3498	AH	3.0W	A	200	125	125	O	20	80				25	E	10M	T
2N1208	S	N	2N5477	2N5477	AP	45W	C	200	60	60	O	15		2.0A	5.0	2.0A				
2N1209	S	N	2N5477	2N5477	AHP	45W	C	200	45	45	O	20	80	2.0A	5.0	2.0A			3.0M	T
2N1210	S	N	2N4232	2N4321	AHP	30W	C	175	60	60	O	15	75	2.0A	2.0	2.0A			3.0M	T
2N1211	S	N	2N4233	2N4321	AHP	30W	C	175	80	80	V	15	75	2.0A	2.0	2.0A			3.0M	T
2N1212	S	N	2N5477	2N5477	AHP	45W	C	200	60	60	O	12	36	1.0A	5.0	1.0A			3.0M	T
2N1213	G	P			SH	75M	A	71	25											
2N1214	G	P			SH	75M	A	71	25											
2N1215	G	P			SH	75M	A	71	25											
2N1216	G	P			SH	75M	A	71	25											
2N1217	G	N			SH	75M	A	85	20	20	O	40	100	500*					6.0M	B
2N1218	G	N			AP	20W	C	90	45	45	R	30	120	1.0A	1.0	1.0A			7.0K	E
2N1219	S	P	2N3250	2N3250	A	0.25W	A	175	30	25	O	18		5.0M					5.0M	B
2N1220	S	P	2N3250	2N3250	A	0.25W	A	175	30	25	O	9.0		5.0M					2.0M	B
2N1221	S	P	2N3250	2N3250	A	0.25W	A	175	30	25	O						18	E	5.0M	B
2N1222	S	P	2N3250	2N3250	A	0.25W	A	175	30	25	O						9.0	E	2.0M	B
2N1223	S	P	2N3250	2N3250	A	0.25W	A	175	40	40	O						6.0	E		
2N1224	G	P			SH	120M	A	85	40											
2N1225	G	P			AH	120M	A	85	40											
2N1226	G	P			AH	120M	A	85	60											
2N1227	G	P	2N3611	2N3611	AP	50W	C	95	35	20	O	50	350	0.5A	0.8	1.5A	25	E	3.0K	E
2N1228	S	P	2N2904	2N2904	S	0.4W	A	160	15	15	O				0.2	10M	14	E		
2N1229	S	P	2N2904	2N2904	S	0.4W	A	160	15	15	O				0.2	10M	28	E		
2N1230	S	P	2N2904	2N2904	S	0.4W	A	160	35	35	O				0.2	10M	14	E		
2N1231	S	P	2N2904	2N2904	S	0.4W	A	160	35	35	O				0.2	10M	28	E		
2N1232	S	P	2N2905A	2N2904	S	0.4W	A	160	60	60	O				0.2	10M	14	E		
2N1233	S	P	2N2905A	2N2904	S	0.4W	A	160	60	60	O				0.2	10M	28	E		
2N1234	S	P	2N3495	2N3494	S	0.4W	A	160	110	110	O				0.2	10M	14	E		
2N1235	S	N	2N5759		AP	85W	C	200	120	120	R	12	60	1.0A	5.0	1.0A			50K	E
2N1238	S	P	2N3467	2N3467	S	1.0W	A	160	15	15	O				0.2	10M	14	E		
2N1239	S	P	2N3467	2N3467	S	1.0W	A	160	15	15	O				0.2	10M	28	E		
2N1240	S	P	2N3467	2N3467	S	1.0W	A	160	35	35	O				0.2	10M	14	E		
2N1241	S	P	2N3467	2N3467	S	1.0W	A	160	35	35	O				0.2	10M	28	E		
2N1242	S	P	2N3763	2N3763	S	1.0W	A	160	60	60	O				0.2	10M	14	E		
2N1243	S	P	2N3763	2N3763	S	1.0W	A	160	60	60	O				0.2	10M	28	E		
2N1244	S	P			S	1.0W	A	160	110	110	O				0.2	10M	14	E		
2N1245	G	P			AP	20W	C	85	30	25	R	50		0.5A						
2N1246	G	P			AP	20W	C	85	30	25	R	50		0.5A						
2N1247	S	N	2N2222	2N2219	A	30M	A	150	6.0	6.0	O	15		5.0*						
2N1248	S	N	2N2222	2N2219	A	30M	A	150	6.0	6.0	O	15		20*						
2N1249	S	N	2N2222	2N2219	A	30M	A	150	6.0	6.0	O	20		30*						
2N1250	S	N	2N4914	2N4913	AP	85W	C	200	60	60	O	15		2.0A	5.0	2.0A				
2N1251	G	N			A	150M		85	20	15	R				0.5	100M	70	E	7.5K	E
2N1252	S	N	2N2537	2N2537	S	600M	A	175	30	20	R	15	45	150M	1.5	150M			40M	T
2N1252A	S	N	2N2537	2N2537	S	800M	A	300	60	30	O	15	45	150M	1.5	150M			40M	T
2N1253	S	N	2N2537	2N2537	S	600M	A	175	30	20	R	30	90	150M	1.5	150M			50M	T
2N1253A	S	N	2N2537	2N2537	S	800M	A	300	60	30	O	30	90	150M	1.5	150M			50M	T
2N1254	S	P	MM869B	2N869A	SH	275M	A	200	30	30	O	25	50	10M	0.3	10M			30M	T
2N1255	S	P	MM869B	2N869A	SH	275M	A	200	30	30	O	40	80	10M	0.3	10M			50M	T
2N1256	S	P			SH	275M	A	200	40	40	O	25	50	10M	0.3	10M			30M	T
2N1257	S	P			SH	275M	A	200	40	40	O	40	80	10M	0.3	10M			50M	T
2N1258	S	P	MM869B	2N869A	SH	275M	A	200	30	30	O	75	150	10M	0.6	10M			50M	T
2N1259	S	P			SH	275M	A	200	50	50	O	25	100	10M	0.3	10M			40M	T
2N1260	S	N	2N5479	2N5477	AP	85W	C	200	120	120	R	12	60	1.0A	10	1.0A			50K	E
2N1261	G	P	2N1531	2N1529	SP	34W	J	95	80	45		20	50	2.0A	0.6	2.0A			200K	T
2N1262	G	P	2N1531	2N1529	SP	34W	J	95	80	45	O	30	75	2.0A	0.6	2.0A			200K	T
2N1263	G	P	2N3617	2N3615	SP	34W	J	95	80	45	O	45	113	2.0A	0.6	2.0A			200K	T
2N1264	G	P	2N1191	2N1191	AH	50M	A	75	20								15	E		
2N1265	G	P	2N1192	2N1191	AH	50M	A	85	12	10	R				0.5	100M	25	E	600K	B
2N1266	G	P	2N1191	2N1191	AH	80M	A	85	10								10	E		
2N1267	S	N	2N2481	2N2481	AH	150M	A	150	20	15	O	4.0	16	1.5M			6.0	E		
2N1268	S	N	2N2481	2N2481	AH	150M	A	150	20	15	O	7.0	30	1.5M			11	E		
2N1269	S	N	2N2481	2N2481	AH	150M	A	150	20	15	O	20	80	1.5M			28	E		
2N1270	S	N	2N2481	2N2481	AH	150M	A	150	20	15	O	4.0	16	1.5M			6.0	E		
2N1271	S	N	2N2481	2N2481	AH	150M	A	150	20	15	O	7.0	30	1.5M			11	E		
2N1272	S	N	2N2481	2N2481	AH	150M	A	150	20	15	O	20	80	1.5M			28	E		
2N1273	G	P			A	250M	A	100	15	15	R	27	165	50M	1.0	100M	20	E		
2N1274	G	P			A	250M	A	100	25	25	R	27	165	50M	1.0	100M	20	E		
2N1275	S	P			AM	250M	A	160	100	80	O	9.0	25	1.0M	0.3	5.0M			100K	B
2N1276	S	N	2N2501	2N2501	A	150M	A	150	40	30	O				1.0	5.0M	9.0	E	15M	B
2N1277	S	N	2N2501	2N2501	A	150M	A	150	40	30	O				1.0	5.0M	18	E	15M	B
2N1278	S	N	2N2501	2N2501	A	150M	A	150	40	30	O				1.0	5.0M	37	E	15M	B
2N1279	S	N	2N2501	2N2501	A	150M	A	150	40	30	O				1.0	5.0M	76	E	15M	B
2N1280	G	P			S	0.2W	A	85	16	16	O	40		20M					5.0M	B
2N1281	G	P			S	0.2W	A	85	16	12	O	60		20M					7.0M	B
2N1282	G	P			S	0.2W	A	85	16	6.0	O	70		20M					10M	B
2N1284	G	P			S	0.15W	A	85	20	15	O	30	150	10M	0.2	10M			5.0M	B
2N1285	G	P			AH	240M	A	71	40	40	V	30	100	1.5M						
2N1287	G	P	2N651	2N650	A	0.3W	C	85	25	25	R				0.5	20M	40	E		
2N1287A	G	P	2N652	2N650	A	0.3W	C	85	25	25	R				0.5	20M	60	E		
2N1288	G	N			SH	75M	A	100	15	10	R	50	300	10M	0.3	10M				
2N1289	G	N			SH	75M	A	85	20	15	O	50	300	10M	0.3	10M			40M	B
2N1291	G	P	2N1529	2N1529	AP	20W	C	85	35	30	S	40		0.5A	1.0	1.0A				

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N1292	G	N			AP	25W	C	100	35	30	S	30		0.5A	1.0	1.0A				
2N1293	G	P	2N1531	2N1529	AP	20W	C	85	60	60	S	40		0.5A	1.0	1.0A				
2N1294	G	N			AP	25W	C	100	60	45	S	30		0.5A	1.0	1.0A				
2N1295	G	P	2N1532	2N1529	AP	20W	C	85	80	80	S	40		0.5A	1.0	1.0A				
2N1296	G	N			AP	25W	C	100	80	60	S	30		0.5A	1.0	1.0A				
2N1297	G	P	2N1533	2N1529	AP	20W	C	85	100	100	S	40		0.5A	1.0	1.0A				
2N1298	G	N			AP	25W	C	100	100	80	S	30		0.5A	1.0	1.0A				
2N1299	G	N			S	150M		100	40	20	R	35	110	50M	0.17	15M			4.0M	B
2N1300	G	P			SH	150M	A	85	13	12	O	30		10M					25M	T
2N1301	G	P			SH	150M	A	85	13	12	O	30		10M					35M	T
2N1302	G	N			S	150M	A	85	25			20		10M	0.2	10M			3.0M	B
2N1303	G	P	2N1192	2N1191	S	150M	A	85	30			20		10M	0.2	10M			3.0M	B
2N1304	G	N			S	150M	A	85	25			40	200	10M	0.2	10M			5.0M	B
2N1305	G	P			S	150M	A	85	30			40	200	10M	0.2	10M			5.0M	B
2N1306	G	N			S	150M	A	85	25			60	300	10M	0.2	10M			10M	B
2N1307	G	P			S	150M	A	85	30			60	300	10M	0.2	10M			10M	B
2N1308	G	N			S	150M	A	85	25			80		10M	0.2	10M			15M	B
2N1309	G	P			S	150M	A	85	30			80		10M	0.2	10M			15M	B
2N1309A	G	P			S	0.15W	A	85	35	15	O	80		10M	0.2	10M			15M	B
2N1310	G	N			AL	120M	A	85	90			20		5.0M						
2N1311	S	N			AL	120M	A	85	75	75		15		5.0M						
2N1312	G	N			S	120M	A	85	50	50		20		20M		20M				
2N1313	G	P			S	0.18W	A	100	30	15	O	40	125		0.28	0.3A			6.0M	B
2N1314	G	P	2N3611	2N3611	AP	125W	C	90	40	40	R	20	55	1.0A						
2N1315	G	P	2N3611	2N3611	AP	125W	C	90	32	16		45	135	1.0A						
2N1316	G	P			S	0.2W	A	85	30	15	O	50	200						10M	B
2N1317	G	P			S	0.2W	A	85	20	12	O	45	180						10M	B
2N1318	G	P			S	0.2W	A	85	10	6.0	O	40	150						10M	B
2N1319	G	P			S	120M	A	71	20	20	V	15		0.4A	0.3	0.4A			3.0M	T
2N1320	G	P			AP	20W	C	85	35	30	S	40		0.5A	1.0	1.0A				
2N1321	G	N			AP	25W	C	100	35	30	S	30		0.5A	1.0	1.0A				
2N1322	G	P			AP	20W	C	85	60	60	S	40		0.5A	1.0	1.0A				
2N1323	G	N			AP	25W	C	100	60	45	S	30		0.5A	1.0	1.0A				
2N1324	G	P			AP	20W	C	85	80	80	S	40		0.5A	1.0	1.0A				
2N1325	G	N			AP	25W	C	100	80	60	S	30		0.5A	1.0	1.0A				
2N1326	G	P			AP	20W	C	85	100	100	S	40		0.5A	1.0	1.0A				
2N1327	G	N			AP	25W	C	100	100	80	S	30		0.5A	1.0	1.0A				
2N1328	G	P			AP	20W	C	85	35	30	S	40		0.5A	1.0	1.0A				
2N1329	G	N			AP	25W	C	100	35	30	S	30		0.5A	1.0	1.0A				
2N1330	G	N			AP	25W	C	100	60	45	S	30		0.5A	1.0	1.0A				
2N1331	G	P			AP	20W	C	85	80	80	S	40		0.5A	1.0	1.0A				
2N1332	G	N			AP	25W	C	100	80	60	S	30		0.5A	1.0	1.0A				
2N1333	G	P			AP	20W	C	85	100	100	S	40		0.5A	1.0	1.0A				
2N1334	G	N			AP	25W	C	100	100	80	S	30		0.5A	1.0	1.0A				
2N1335	S	N	2N3019	2N3019	AHP	0.8W	A	175	120	45	O	10	150	30M					70M	T
2N1336	S	N	2N3019	2N3019	AHP	0.8W	A	175	120	45	O	10	150	30M					70M	T
2N1337	S	N	2N3019	2N3019	AHP	0.8W	A	175	120	45	O	10	150	30M					70M	T
2N1338	S	N	2N2193	2N2192	AHP	0.8W	A	175	80	25	O	10	150	30M					70M	T
2N1339	S	N	2N3019	2N3019	AHP	0.8W	A	175	120	50	O	10	150	30M					70M	T
2N1340	S	N	2N3019	2N3019	AHP	0.8W	A	175	120	50	O	10	150	30M					70M	T
2N1341	S	N	2N3019	2N3019	AHP	0.8W	A	175	120	50	O	10	150	30M					70M	T
2N1342	S	N	2N3019	2N3019	AHP	0.8W	A	175	150	65	O	10	150	30M					70M	T
2N1343	G	P			S	0.15W	A	85	20	16	O	15		50M					4.0M	B
2N1344	G	P			S	0.15W	A	85	15	10	O	60		20M					7.0M	B
2N1345	G	P			S	0.15W	A	85	10	8.0	O	30	100	0.4A					10M	B
2N1346	G	P			S	0.15W	A	85	12	10	O	40	250	0.35M	0.13	12M			10M	B
2N1347	G	P			S	0.15W	A	85	20	12	O	30		10M	0.2	10M			5.0M	B
2N1352	G	P	2N651	2N650	A	0.15W	A	85	30	20	O	40	100							
2N1353	G	P			S	0.2W	A	85	15	10	O	25	150	10M	0.2	50M			1.5M	B
2N1354	G	P			S	0.2W	A	85	30	15	O	25	150	10M	0.2	50M			3.0M	B
2N1355	G	P			S	0.2W	A	85	30	20	O	30	150	10M	0.2	50M			5.0M	B
2N1356	G	P			S	0.2W	A	100	30	20	O	40	140	10M	0.2	50M			5.0M	B
2N1357	G	P			S	0.2W	A	85	30	15	O	40	150	10M	0.2	50M			10M	B
2N1358	G	P		2N174	SP	90W		95	80	40	O	40	80	1.2A	0.7	12A			100K	B
2N1358A	G	P		2N174	SP	150W	C	100	100	60	O	40	80	1.2A	0.7	12A			100K	B
2N1359	G	P		2N375	AP	90W	J	100	50	40	S	35	90	1.0A	0.1	2.0A			5.0K	E
2N1360	G	P		2N375	AP	90W	J	100	50	40	S	60	140	1.0A	1.0	2.0A			5.0K	E
2N1361	G	P			S	0.15W	A	100	25	20	O	40	100	25M					4.0M	B
2N1361A	G	P			S	0.2W	A	100	25	20	O	40	100	25M					4.0M	B
2N1362	G	P		2N375	AP	90W	J	100	100	75	S	35	90	1.0A	1.0	2.0A			5.0K	E
2N1363	G	P		2N375	AP	90W	J	100	100	75	S	60	140	1.0A	1.0	2.0A			5.0K	E
2N1364	G	P		2N375	AP	90W	J	100	120	100	S	35	90	1.0A	1.0	2.0A			5.0K	E
2N1365	G	P		2N375	AP	90W	J	100	120	100	S	60	140	1.0A	1.0	2.0A			5.0K	E
2N1366	G	N			A	100M	A	85	18	18	R	20		1.0M			10	E	5.0M	T
2N1367	G	N			A	100M	A	85	18	18	R	10		1.0M			5.0	E	2.5M	T
2N1370	G	P			A	250M	A	100	25	25	R	45	165	50M	1.0	100M	40	E		
2N1371	G	P			A	250M	A	100	45	45	R	45	165	50M	1.0	100M	40	E		
2N1372	G	P			A	250M	A	100	25	25	R	27	105	50M	1.0	100M	20	E		
2N1373	G	P			A	250M	A	100	45	45	R	27	105	50M	1.0	100M	20	E		
2N1374	G	P			A	250M	A	100	25	25	R	45	165	50M	1.0	100M	40	E		
2N1375	G	P			A	250M	A	100	45	45	R	45	165	50M	1.0	100M	40	E		
2N1376	G	P			A	250M	A	100	25	25	R	67	165	50M	1.0	100M	60	E		
2N1377	G	P			A	250M	A	100	45	45	R	67	165	50M	1.0	100M	60	E		
2N1378	G	P			A	250M	A	100	12	12	R	85	330	50M	1.0	100M	75	E		
2N1379	G	P			A	250M	A	100	25	25	R	85	330	50M	1.0	100M	75	E		
2N1380	G	P			A	250M	A	100	12	12	R	27	330	50M	1.0	100M	20	E		
2N1381	G	P			A	250M	A	100	25	25	R	27	330	50M	1.0	100M	20	E		
2N1382	G	P			A	250M	A	100	25	25	R	45	165	50M	1.0	100M	40	E		

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N1383	G	P			A	250M	A	100	25	25	R	27	165	50M	1.0	100M	20	E		
2N1384	G	P			SH	240M	A	85	30	30	O	20		200M					20M	T
2N1385	G	P			SH	750M	A	100	25	10	O	10		10M					250M	T
2N1386	S	N	2N2222	2N2218	S	300M	A	175	25	25	O	30	90	10M	0.6	5.0M				
2N1387	S	N	2N2222	2N2218	S	300M	A	175	30	30	O	20	40	10M	0.5	5.0M				
2N1388	S	N	2N2222	2N2218	AH	300M	A	175	45	25	O	15	55	10M			30	E	50M	B
2N1389	S	N	2N2222	2N2218	AH	300M	A	175	50	50	O				0.8	5.0M			24M	T
2N1390	S	N	2N2222	2N2218	AH	300M	A	175	20	20	O	30	150	10M			10	E	20M	B
2N1391	G	N			A	150M	A	100	25	18	O	40	160	20M			35	E	3.0M	E
2N1392	G	P			AL	50M	A	85	20	20	R									
2N1393	G	P			AL	50M	A	85	20	10	R									
2N1394	G	P			AL	50M	A	85	10	6.0	R									
2N1395	G	P	2N2955	2N2955	AH	120M	A	100	40	40	O	50	175	1.5M					30M	B
2N1396	G	P	2N3323	2N3323	AH	120M	A	100	40	40	O	50	175	1.5M					30M	B
2N1397	G	P	2N3323	2N3323	AH	120M	A	100	40	40	O	50	175	1.5M					120M	B
2N1398	G	P			AH	50M	A	85	30	20	O	10		0.5M	0.75	10M			140M	T
2N1399	G	P			AH	50M	A	85	30	20	O	3.5		0.5M	0.75	10M			140M	T
2N1400	G	P			AH	50M	A	85	30	20	O	5.0	12	0.5M	0.75	10M			100M	T
2N1401	G	P			AH	50M	A	85	30	20	O	5.0		0.5M	0.75	10M			120M	T
2N1402	G	P			AH	50M	A	85	30	20	O	3.5	12	1.5M	0.75	10M			100M	T
2N1403	G	P			AH	250M	A	100	15	12	O	25	250	7.0M	0.75	10M			200M	T
2N1404	G	P			S	150M	A	85	25						0.15	12M			4.0M	B
2N1404A	G	P			S	150M	A	85	25	15	O	30	200	12M	0.15	12M			3.0M	T
2N1405	G	P			AH	75M	A	100	30	20	O	10	200	2.0M			10	E	250M	T
2N1406	G	P			AH	75M	A	100	30	20	O	10	200	2.0M			10	E	250M	T
2N1407	G	P			AH	75M	A	100	30	20	O	10	200	2.0M			10	E	200M	T
2N1408	G	P		2N1408	S	150M	A	100	50	50	S	10					10	E		
2N1409	S	N	2N2537	2N2537	SH	600M	A	200	30	25	O	15	45	150M					200M	T
2N1409A	S	N	2N2537	2N2537	SH	800M	A	200	30	25	O	15	45	150M					200M	T
2N1410	S	N	2N2537	2N2537	SH	600M	A	200	45	30	O	39	90	150M					130M	T
2N1410A	S	N	2N2537	2N2537	SH	800M	A	200	30	30	O	30	90	150M					130M	T
2N1411	G	P	2N962	2N956	S	25M	A	85	5.0	5.0	S	20		50M	0.45	10M			25M	T
2N1412	G	P		2N1412	SP	70W	C	95	100	65	O	25	50	5.0A	0.7	12A				
2N1413	G	P		2N1413	S	200M	A	85	35	25	R	25	42	20M			20	E	800K	B
2N1414	G	P		2N1413	S	200M	A	85	35	25	R	34	65	20M			30	E	1.0M	B
2N1415	G	P		2N1413	S	200M	A	85	35	25	R	53	90	20M			44	E	1.3M	B
2N1416	G	P	2N1193	2N1191	A	100M	A	65		18	U						39	E		
2N1417	S	N			A	0.15W	A	150	15	15	O						30	E		
2N1418	S	N			A	0.15W	A	150	30	30	O						30	E		
2N1419	G	P	2N1164	2N1162	SP	87W	C	95	80	40	O	40	100	25A	0.7	25A				
2N1420	S	N		2N718	AH	600M	A	175	60	30	R	100	300	150M.	1.5	150M			50M	T
2N1420A	S	N	2N2219	2N2218	AH	800M	A	200	60	40	R	100	300	150M	1.5	150M			60M	T
2N1421	S	N	2N5477	2N5477	AHP	30W	C	200	60	60	S	20	80	1.0A	3.0	1.0A	20	E	10M	T
2N1422	S	N	2N5477	2N5477	AHP	30W	C	200	60	60	S	20	80	1.0A	3.0	1.0A	20	E	10M	T
2N1423	S	N	2N5477	2N5477	AHP	60W	C	200	60	60	S	20	80	2.0A	5.0	2.0A	20	E	10M	T
2N1424	S	N	2N5477	2N5477	AHP	60W	C	200	60	60	S	20	80	2.0A	5.0	2.0A	20	E	10M	T
2N1425	G	P			A	80M	A	85	24										10M	B
2N1426	G	P			A	80M	A	85	24								17	E	10M	B
2N1427	G	P	2N962	2N956	SH	25M	A	100	6.0	6.0	S	20		50M	0.2	50M	40	E	50M	T
2N1428	S	P	2N869	2N869	S	100M	A	140	6.0	6.0	O	12		5.0M	0.1	5.0M	25	E	16M	T
2N1429	S	P	2N869	2N869	S	100M	A	140	6.0	6.0	O	12		5.0M	0.1	5.0M	25	E	16M	T
2N1430	G	P			SP	70W	C	110	120	100	O	30	90	5.0A	0.4	10A			0.6M	T
2N1431	G	N			A	180M	A	75	20	15	R	75	150	35M					10K	E
2N1432	G	P			A	100M	A	100	45	45	R						30	E		
2N1433	G	P			AP			95	80	50	O	20	50	2.0A	1.5	2.0A			5.0K	E
2N1434	G	P			AP			95	80	50	O	45	115	2.0A	1.0	2.0A			5.0K	E
2N1435	G	P			AP			95	80	50	O	30	75	2.0A	0.6	2.0A			5.0K	E
2N1436	G	P			SH	50M	A	100	15	12	S	20		10M	0.2	10M				
2N1437	G	P			AP	23W	C	95	100	90	S	20		0.5A	1.0	1.0A			4.0K	E
2N1438	G	P			AP	23W	C	95	100	90	S	20		0.5A	1.0	1.0A			4.0K	E
2N1439	S	P	2N2907A	2N2904	A	0.4W	A	200	50	50	O				0.25	5.0M	9.0	E	0.5M	B
2N1440	S	P	2N2907A	2N2904	A	0.4W	A	200	60	50	O				0.25	5.0M	9.0	E	1.0M	B
2N1441	S	P	2N2907A	2N2904	A	0.4W	A	200	50	35	O				0.25	5.0M	18	E	1.0M	B
2N1442	S	P	2N2907A	2N2904	A	0.4W	A	200	50	30	O				0.25	5.0M	30	E	1.0M	B
2N1443	S	P	2N2907	2N2904	A	0.4W	A	200	50	15	O				0.25	5.0M	50	E	1.0M	B
2N1444	S	N	2N2410	2N2910	SH	0.5W	A	150	60	20	O	20		0.25A	1.5	0.25A				
2N1445	S	N	2N3500	2N3498	AP	4.0W	C	200	120	120	O	20	80	200M	4.0	200M			75K	E
2N1446	G	P	2N1191	2N1191	A	0.2W	A	85	45	25	O	16	45	20M			16	E	0.8M	B
2N1447	G	P	2N1191	2N1191	A	0.2W	A	85	45	25	O	35	65	20M			30	E	1.5M	B
2N1448	G	P	2N1192	2N1191	A	0.2W	A	85	45	25	O	50	90	20M			45	E	2.0M	B
2N1449	G	P	2N1189	2N1189	A	0.2W	A	85	45	25	O	70	125	20M			60	E	2.5M	B
2N1450	G	P	2N2955	2N2955	S	0.12W	A	85	30	20	O	20		10M	0.25	10M				
2N1451	G	P	2N464	2N464	A	0.2W	A	85	45	20	O	20	65	20M						
2N1452	G	P	2N1191	2N1191	A	0.2W	A	85	45	20	O	30	90	20M						
2N1453	G	P			AP			90	30	20	O	40	90	1.0A	1.0	3.0A			5.0K	E
2N1454	G	P			AP			90	30	20	O	70	150	1.0A	1.0	3.0A			5.0K	E
2N1455	G	P			AP			90	60	40	O	40	90	1.0A	1.0	3.0A			5.0K	E
2N1456	G	P			AP			90	60	40	O	70	150	1.0A	1.0	3.0A			5.0K	E
2N1457	G	P			AP			90	80	60	O	40	90	1.0A	1.0	3.0A			5.0K	E
2N1458	G	P			AP			90	80	60	O	70	150	1.0A	1.0	3.0A			5.0K	E
2N1461	G	P			AP			90	30	20	O	40	90	1.0A	1.0	3.0A			5.0K	E
2N1462	G	P			AP			90	30	20	O	70	150	1.0A	1.0	3.0A			5.0K	E
2N1463	G	P			AP			90	60	40	O	40	90	1.0A	1.0	3.0A			5.0K	E
2N1464	G	P			AP			90	60	40	O	70	150	1.0A	1.0	3.0A			5.0K	E
2N1465	G	P			AP	20W	C	85	120	70	O	20		0.5A	0.75	1.0A			4.0K	E
2N1466	G	P			AP	20W	C	85	120	70	O	20		0.5A	0.75	1.0A			4.0K	E
2N1469	S	P	2N2906	2N2904	A	0.25W	A	175	40	35	U						36	E	2.0M	B
2N1470	S	N	2N5068	2N5067	AP	55W	C	200	60	60	S	15		1.0A	3.0	1.0A				

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N1471	G	P			S	200M	A	85	12	15	R						100	E	3.0M	B
2N1472	S	N	2N834	2N834	SH	150M	A	150	25	25	O	20		10M	0.25	10M			75M	T
2N1473	G	N			S	167M	A	75	40	20	O	25	50	400M					4.0M	B
2N1474	S	P	2N2906A	2N2904	A	0.25W	A	175	60	60	U						12	E	1.0M	B
2N1474A	S	P	2N2906A	2N2904	A	0.25W	A	175	60	60	U						18	E	2.0M	B
2N1475	S	P	2N2906A	2N2904	A	0.25W	A	175	60	60	U						36	E	1.0M	B
2N1476	S	P	2N4928	2N4928	A	0.25W	A	175	100	100	U						12	E	1.0M	B
2N1477	S	P	2N4928	2N4928	A	0.25W	A	175	100	100	U						30	E	1.0M	B
2N1478	G	P	2N3427	2N3427	S	250M	A	100	30	20	S	40		100M	0.2	10M			3.0M	B
2N1479	S	N	2N4237	2N4237	SP	5.0W	C	200	60	60	V	20	60	200M	1.4	200M				
2N1480	S	N	2N4238	2N4237	SP	5.0W	C	200	100	100	V	20	60	200M	1.4	200M				
2N1481	S	N	2N4237	2N4237	SP	5.0W	C	200	60	60	V	35	100	200M	1.4	200M				
2N1482	S	N	2N4238	2N4237	SP	5.0W	C	200	100	100	V	35	100	200M	1.4	200M				
2N1483	S	N	2N4231	2N4231	SP	25W	C	200	60	60	V	20	60	750M	2.0	750M				
2N1484	S	N	2N4232	2N4231	SP	25W	C	200	100	100	V	20	60	750M	2.0	750M				
2N1485	S	N	2N4231	2N4231	SP	25W	C	200	60	60	V	35	100	750M	0.75	750M				
2N1486	S	N	2N4232	2N4231	SP	25W	C	200	100	100	V	35	100	750M	0.75	750M				
2N1487	S	N	2N4913	2N4913	SP	75W	C	200	60	60	V	15	45	200M	3.0	1.5A				
2N1488	S	N	2N4914	2N4913	SP	75W	C	200	100	100	V	15	45	200M	3.0	1.5A				
2N1489	S	N	2N4913	2N4913	SP	75W	C	200	60	60	V	25	75	1.5A	1.0	1.5A				
2N1490	S	N	2N4914	2N4913	SP	75W	C	200	100	100	V	25	75	1.5A	1.0	1.5A				
2N1491	S	N	2N2218	2N2218	AH	3.0W	C	175	30								15	E		
2N1492	S	N	2N2192	2N2192	AH	3.0W	C	175	60								15	E		
2N1493	S	N	2N3500	2N3498	AH	3.0W	C	175	100			4.0					15	E		
2N1494	G	P		2N1204	SH	400M	A	100	20	15	O	15		400M	0.5	200M			220M	T
2N1494A	G	P		2N1204	SH	400M	A	100	20	15	O	25		200M	0.4	200M			220M	T
2N1495	G	P		2N1204	SH	300M	A	100	40	25	O	25		200M	0.3	200M			150M	T
2N1495A	G	P			SH	0.25W	A	100	40	25	O	25		0.2A	0.3	0.2A			150M	T
2N1496	G	P		2N1204	SH	500M	A	100	40	25	O	25		200M	0.3	200M			150M	T
2N1499	G	P			SH	25M	A	85	20	15	S	20		10M	0.2	10M				
2N1499A	G	P			SH	60M	A	100	20	20	S	30		10M	0.2	10M			100M	T
2N1499B	G	P			SH	75M	A	100	30	20	O	40		10M	0.2	10M			150M	T
2N1500	G	P			SH	60M	A	100	15	12	S	20		10M	0.2	10M			120M	T
2N1501	G	P	2N2144	2N2137	SP	34W	J	95	60	40		25	100	2.0A	0.6	2.0A			200K	T
2N1502	G	P	2N2143	2N2137	SP	34W	J	95	40	40		25	100	2.0A	0.6	2.0A			200K	T
2N1504	G	P			AP	25W	C	95	80	60	O	21		0.5A	0.75	1.0A			4.0K	E
2N1505	S	N	2N2219A	2N2218	AHP	0.8W	A	175	50	20	O	7.0	100	0.1A	2.0	0.15A			70M	T
2N1506	S	N	2N2219A	2N2218	AHP	0.8W	A	175	60	20	O	10	100	0.1A	1.5	0.15A			140M	T
2N1506A	S	N	2N3444	2N3252	AHP	0.8W	A	200	80	50	O	10	100	0.1A	0.6	0.15A			140M	T
2N1507	S	N	2N2219	2N2218	S	600M	A	175	60	30	R	100	300	150M	1.5	150M			50M	T
2N1508	S	N	2N3019	2N3019	S	1.0W	A	175	100	55	O	20	60	600M	3.6	600M			50M	T
2N1509	S	N	2N3019	2N3019	S	1.0W	A	175	60	35	O	20	60	600M	3.6	600M			50M	T
2N1510	G	N			AL	75M	A	85	75	70	R	8.0	90	1.0M	0.8	4.0M				
2N1511	S	N	2N4913	2N4913	SP	75W	C	200	60	60	V	4.0		6.0A	7.2	6.0A			0.3M	T
2N1512	S	N	2N4914	2N4913	SP	75W	C	200	100	100	V	7.0		6.0A	6.0	6.0A			0.3M	T
2N1513	S	N	2N4913	2N4913	SP	75W	C	200	60	60	V	7.0		6.0A	6.0	6.0A			0.3M	T
2N1514	S	N	2N4914	2N4913	SP	75W	C	200	100	100	V								0.3M	T
2N1516	G	P			AH	83M	A	75	25			20		1.0M						
2N1518	G	P	MP943		SP	50W	C	95	50	40		15	60	15A	0.7	25A				
2N1519	G	P	MP943A		SP	50W	C	95	80	60		15	60	15A	0.7	25A				
2N1520	G	P			SP	50W	C	95	50	40		17	68	15A	0.6	35A				
2N1521	G	P			SP	50W	C	95	80	60		17	68	15A	0.6	35A				
2N1522	G	P			SP	50W	C	95	50	40	B	25	100	15A	0.5	50A				
2N1523	G	P			SP	50W	C	95	80	60	B	25	100	15A	0.5	50A				
2N1524	G	P	2N3325	2N3323	AH	80M	A	85	24								17	E		
2N1525	G	P	2N3325	2N3323	AH	80M	A	85	24								17	E		
2N1526	G	P	2N3325	2N3323	AH	80M	A	85	24								27	E		
2N1527	G	P	2N3325	2N3323	AH	80M	A	85	24								27	E		
2N1528	S	N	2N2218	2N2218	AH	150M	A	175	25	25	S						10	E		
2N1529	G	P		2N1529	AP	90W	C	100	40	30	S	20	40	3.0A	1.5	3.0A				
2N1529A	G	P		2N1529	AP	90W	C	100	40	20	O	20	40	3.0A	1.5	3.0A			5.0K	E
2N1530	G	P		2N1529	AP	90W	C	100	60	45	S	20	40	3.0A	1.5	3.0A				
2N1530A	G	P		2N1529	AP	90W	C	100	60	30	O	20	40	3.0A	1.5	3.0A			5.0K	E
2N1531	G	P		2N1529	AP	90W	C	100	80	60	S	20	40	3.0A	1.5	3.0A				
2N1531A	G	P		2N1529	AP	90W	C	100	80	40	O	20	40	3.0A	1.5	3.0A			5.0K	E
2N1532	G	P		2N1529	AP	90W	C	100	100	75	S	20	40	3.0A	1.5	3.0A				
2N1532A	G	P		2N1529	AP	90W	C	100	100	50	O	20	40	3.0A	1.5	3.0A			5.0K	E
2N1533	G	P		2N1529	AP	90W	C	100	120	90	S	20	40	3.0A	1.5	3.0A				
2N1534	G	P		2N1529	AP	90W	C	100	40	30	S	35	70	3.0A	1.2	3.0A				
2N1534A	G	P		2N1529	AP	90W	C	100	40	20	O	35	70	3.0A	1.2	3.0A			5.0K	E
2N1535	G	P		2N1529	AP	90W	C	100	60	45	S	35	70	3.0A	1.2	3.0A				
2N1535A	G	P		2N1529	AP	90W	C	100	60	30	O	35	70	3.0A	1.2	3.0A			5.0K	E
2N1536	G	P		2N1529	AP	90W	C	100	80	60	S	35	70	3.0A	1.2	3.0A				
2N1536A	G	P		2N1529	AP	90W	C	100	80	40	O	35	70	3.0A	1.2	3.0A			5.0K	E
2N1537	G	P		2N1529	AP	90W	C	100	100	75	S	35	70	3.0A	1.2	3.0A				
2N1537A	G	P		2N1529	AP	90W	C	100	100	50	O	35	70	3.0A	1.2	3.0A			5.0K	E
2N1538	G	P		2N1529	AP	90W	C	100	120	90	S	35	70	3.0A	1.2	3.0A				
2N1539	G	P		2N1539	AP	90W	C	100	40	30	S	50	100	3.0A	0.3	3.0A				
2N1539A	G	P		2N1539	AP	90W	C	100	40	20	O	50	100	3.0A	0.3	3.0A			3.0K	E
2N1540	G	P		2N1539	AP	90W	C	100	60	45	S	50	100	3.0A	0.3	3.0A				
2N1540A	G	P		2N1539	AP	90W	C	100	60	30	O	50	100	3.0A	0.3	3.0A			3.0K	E
2N1541	G	P		2N1539	AP	90W	C	100	80	60	S	50	100	3.0A	0.3	3.0A				
2N1541A	G	P		2N1539	AP	90W	C	100	80	40	O	50	100	3.0A	0.3	3.0A			3.0K	E
2N1542	G	P		2N1539	AP	90W	C	100	100	75	S	50	100	3.0A	0.3	3.0A				
2N1542A	G	P		2N1539	AP	90W	C	100	100	50	O	50	100	3.0A	0.3	3.0A			3.0K	E
2N1543	G	P		2N1539	AP	90W	C	100	120	90	S	50	100	3.0A	0.3	3.0A				
2N1544	G	P		2N1539	AP	90W	C	100	40	30	S	75	150	3.0A	0.2	3.0A			1.0K	E
2N1544A	G	P		2N1539	AP	90W	C	100	40	30	S	75		3.0A	0.2	3.0A			3.0K	E

2N1545–2N1641

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N1545	G	P		2N1539	AP	90W	C	100	60	45	S	75	150	3.0A	0.2	3.0A			1.0K	E
2N1545A	G	P		2N1539	AP	90W	C	100	60	45	S	75		3.0A	0.2	3.0A			3.0K	E
2N1546	G	P		2N1539	AP	90W	C	100	80	60	S	75	150	3.0A	0.2	3.0A			1.0K	E
2N1546A	G	P		2N1539	AP	90W	C	100	80	60	S	75		3.0A	0.2	3.0A			3.0K	E
2N1547	G	P		2N1539	AP	90W	C	100	100	75	S	75	150	3.0A	0.2	3.0A			1.0K	E
2N1547A	G	P		2N1539	AP	90W	C	100	100	75	S	75		3.0A	0.2	3.0A			3.0K	E
2N1548	G	P		2N1539	AP	90W	C	100	120	90	S	75	150	3.0A	0.2	3.0A			1.0K	E
2N1549	G	P		2N1539	AP	90W	C	100	40	30	S	10	30	10A	1.0	10A				
2N1549A	G	P		2N1539	AP	90W	C	100	40	30	S	10	30	10A	1.0	10A			5.0K	E
2N1550	G	P		2N1539	AP	90W	C	100	60	45	S	10	30	10A	1.0	10A				
2N1550A	G	P		2N1539	AP	90W	C	100	60	45	S	10	30	10A	1.0	10A			5.0K	E
2N1551	G	P		2N1539	AP	90W	C	100	80	60	S	10	30	10A	1.0	10A				
2N1551A	G	P		2N1539	AP	90W	C	100	80	60	S	10	30	10A	1.0	10A			5.0K	E
2N1552	G	P		2N1539	AP	90W	C	100	100	75	S	10	30	10A	1.0	10A				
2N1552A	G	P		2N1539	AP	90W	C	100	100	75	S	10	30	10A	1.0	10A			5.0K	E
2N1553	G	P		2N1539	AP	90W	C	100	40	30	S	30	60	10A	0.5	10A			1.0K	E
2N1553A	G	P		2N1539	AP	90W	C	100	40	20	O	30	60	10A	0.5	10A			3.0K	E
2N1554	G	P		2N1539	AP	90W	C	100	60	45	S	30	60	10A	0.5	10A			1.0K	E
2N1554A	G	P		2N1539	AP	90W	C	100	60	30	O	30	60	10A	0.5	10A			3.0K	E
2N1555	G	P		2N1539	AP	90W	C	100	80	60	S	30	60	10A	0.5	10A			1.0K	E
2N1555A	G	P		2N1539	AP	90W	C	100	80	40	O	30	60	10A	0.5	10A			3.0K	E
2N1556	G	P		2N1539	AP	90W	C	100	100	75	S	30	60	10A	0.5	10A			1.0K	E
2N1556A	G	P		2N1539	AP	90W	C	100	100	50	O	30	60	10A	0.5	10A			3.0K	E
2N1557	G	P		2N1539	AP	90W	C	100	40	30	S	50	100	10A	0.4	10A			1.0K	E
2N1557A	G	P		2N1539	AP	90W	C	100	40	20	O	50	100	10A	0.5	10A			3.0K	E
2N1558	G	P		2N1539	AP	90W	C	100	60	45	S	50	100	10A	0.4	10A			1.0K	E
2N1558A	G	P		2N1539	AP	90W	C	100	60	30	O	50	100	10A	0.5	10A			3.0K	E
2N1559	G	P		2N1539	AP	90W	C	100	80	60	S	50	100	10A	0.4	10A			1.0K	E
2N1559A	G	P		2N1539	AP	90W	C	100	80	40	O	50	100	10A	0.5	10A			3.0K	E
2N1560	G	P		2N1539	AP	90W	C	100	100	75	S	50	100	10A	0.4	10A			1.0K	E
2N1560A	G	P		2N1539	AP	90W	C	100	100	50	O	50	100	10A	0.5	10A			3.0K	E
2N1561	G	P		2N1561	AH	250M	A	100	25	15	O				3.0	200M				
2N1562	G	P		2N1561	AH	250M	A	100	25	15	O				4.0	200M				
2N1564	S	N	2N2218	2N2218	A	600M	A	175	80	60	O	15	50	5.0M	1.0	10M	20	E		
2N1565	S	N	2N2218	2N2218	A	600M	A	175	80	60	O	30	100	5.0M	1.0	10M	40	E		
2N1566	S	N	2N2219	2N2218	A	600M	A	175	80	60	O	60	200	5.0M	1.0	10M	80	E		
2N1566A	S	N	2N2219	2N2218	A	600M	A	175	80	60	O	60	200	5.0M	0.95	10M	80	E	100M	T
2N1572	S	N	2N3020	2N3019	A	600M	A	175	125	80	O	15	50	5.0M	1.0	10M	20	E		
2N1573	S	N	2N3020	2N3019	A	600M	A	175	125	80	O	30	100	5.0M	1.0	10M	40	E		
2N1574	S	N	2N3019	2N3019	A	600M	A	175	125	80	O	60	200	5.0M	1.0	10M	80	E		
2N1585	G	N			A	750M	A	100	25	10	O	20		10M						
2N1586	S	N	2N706A	2N706	A	125M	A	85	15	10	O	5.0	27	1.0M	1.5	5.0M	9.0	E	5.0M	B
2N1587	S	N	2N2501	2N2501	A	125M	A	85	30	20	O	5.0	27	1.0M	1.5	5.0M	9.0	E	5.0M	B
2N1588	S	N	2N2221	2N2218	A	125M	A	85	60	40	O	5.0	27	1.0M	1.5	5.0M	9.0	E	5.0M	B
2N1589	S	N	2N835	2N834	A	125M	A	85	15	10	O	20	75	1.0M	1.5	5.0M	25	E	5.0M	B
2N1590	S	N	2N2501	2N2501	A	125M	A	85	30	20	O	20	75	1.0M	1.5	5.0M	25	E	5.0M	B
2N1591	S	N	2N2221	2N2218	A	125M	A	85	60	40	O	20	75	1.0M	1.5	5.0M	25	E	5.0M	B
2N1592	S	N	2N2222	2N2218	A	125M	A	85	15	10	O	40	210	1.0M	1.5	5.0M	70	E	5.0M	B
2N1593	S	N	2N2222	2N2218	A	125M	A	85	30	20	O	40	210	1.0M	1.5	5.0M	70	E	5.0M	B
2N1594	S	N	2N2222	2N2218	A	125M	A	85	60	40	O	40	210	1.0M	1.5	5.0M	70	E	5.0M	B
2N1595 thru 2N1604	Thyristors, see Table on Page 2-66																			
2N1605	G	N			S	150M	A	100	25	24	O	40		20M	0.15	12M			4.0M	B
2N1605A	G	N			S	0.2W	A	100	40	40		40		20M	0.15	12M			4.0M	B
2N1606	S	P	2N3546	2N3546	SH	100M	A	140	10	10	S	6.0	30	15M	0.15	5.0M			7.2M	T
2N1607	S	P	2N3546	2N3546	SH	100M	A	140	10	10	S	6.0	30	15M	0.15	5.0M			10M	T
2N1608	S	P	2N3546	2N3546	SH	100M	A	140	10	10	S	6.0	30	15M	0.15	5.0M			25M	T
2N1609	G	P	2N2140	2N2137	AP			95	80	60	O	30	75	100M	1.0	500M				
2N1610	G	P	2N2145	2N2137	AP			95	80	60	O	50	125	100M	0.6	500M				
2N1611	G	P	2N2138	2N2137	AP			95	60	40	O	30	75	100M	1.0	500M				
2N1612	G	P	2N2143	2N2137	AP			95	60	40	O	50	125	100M	0.6	500M				
2N1613	S	N		2N718A	S	800M	A	200	75	50	R	40	120	150M	1.5	150M	30	E	60M	T
2N1613A	S	N	2N2218	2N2218	S	1.0W	A	200	75	50	R	40	120	150M	1.0	150M	30	E	60M	T
2N1613B	S	N	2N3019	2N3019	S	1.0W	A	200	120	55	R	40	120	150M	0.2	150M	30	E	60M	T
2N1614	G	P	2N1924	2N1924	S	240M	A	100	65	40	R	18	43	20M	0.13	20M			500K	B
2N1615	S	N	2N3500	2N3498	AH	5.5M	A	200	100	100	O	25		5.0M	5.0	50M			2.0M	T
2N1616	S	N	2N5477	2N5477	AHP	60W	C	175	60	60	O	15	75	2.0A	2.0	2.0A			3.0M	T
2N1616A	S	N	2N5477	2N5477	AP	85W	C	200	60	60	O	20	60	2.0A	1.0	2.0A			3.0M	T
2N1617	S	N	2N5477	2N5477	AHP	60W	C	175	80	80	V	15	75	2.0A	2.0	2.0A			3.0M	T
2N1617A	S	N	2N5477	2N5477	AP	85W	C	200	80	70	O	20	60	2.0A	1.0	2.0A			3.0M	T
2N1618	S	N	2N5477	2N5477	AHP	60W	C	175	100	100	V	15	75	2.0A	2.0	2.0A			3.0M	T
2N1618A	S	N	2N5477	2N5477	AP	85W	C	200	100	80	O	20	60	2.0A	1.0	2.0A			3.0M	T
2N1620	S	N	2N5458		AHP	60W	C	175	100	100	V	15	75	2.0A	2.0	2.0A			3.0M	T
2N1622	G	N			A	0.12W	A	85	90	90	S	40		5.0M		5.0M				
2N1623	S	P	2N2906	2N2904	A	250M	A	160	50	20	O	9.0	40	1.0M	0.3	5.0M			100K	B
2N1624	G	N			S	0.15W	A	100	25	20	R	60	180	30M					5.0M	B
2N1631	G	P	2N3325	2N3323	AH	80M	A	85	34								40	E		
2N1632	G	P	2N3325	2N3323	AH	80M	A	85	34								40	E		
2N1633	G	P			AH	80M	A	85	34								27	E		
2N1634	G	P			AH	80M	A	85	34								27	E		
2N1635	G	P			AH	80M	A	85	34								40	E		
2N1636	G	P			AH	80M	A	85	34								40	E		
2N1637	G	P	2N3325	2N3323	AH	80M	A	85	34								40	E		
2N1638	G	P	2N3325	2N3323	AH	80M	A	85	34								70	E		
2N1639	G	P	2N3325	2N3323	AH	80M	A	85	34								40	E		
2N1640	S	P	2N5230	2N5229	SC	250M	A	160	30	20	U	6.0		100*						
2N1641	S	P	2N5230	2N5229	SC	250M	A	160	30	10	U	10		100*						

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N1642	S	P			SC	250M	A	160	30	6.0	U	15		100*						
2N1643	S	P			A	250M	A	160	25	25	U	10	25	100*						
2N1644	S	N	2N2218	2N2218	S	2.0W	C	175	60	40	R	40	120	150M	1.5	150M			50M	T
2N1645	G	P			AHP	1.0W	A	100	35	20	O	20		0.2A	4.0	0.2A	25	E	450M	T
2N1646	G	N			SH	150M	A	100	15	12	S	20		10M						
2N1647	S	N	2N5477	2N5477	AHP	40W	C	175	80	80	V	15	45	0.5A	3.0	1.0A			3.0M	T
2N1648	S	N	2N5479	2N5477	AHP	40W	C	175	120	80	O	15	45	0.5A	3.0	1.0A			2.0M	T
2N1649	S	N	2N5477	2N5477	AHP	40W	C	175	80	80	V	30	90	0.5A	3.0	1.0A			3.0M	T
2N1650	S	N	2N5477	2N5477	AHP	40W	C	175	120	80	O	30		0.5A	3.0	1.0A			2.0M	T
2N1651	G	P		2N1651	AP	100W	C	110	60	60	S	35	140	10A	0.65	25A	20	E		
2N1652	G	P		2N1651	AP	100W	C	110	100	100	S	35	140	10A	0.65	25A	20	E		
2N1653	G	P		2N1651	AP	100W	C	110	120	120	S	35	140	10A	0.65	25A	20	E		
2N1654	S	N	MM3006	MM3005	AP	250M	A	160	100	80	O	20	45	1.0M	0.3	5.0M			100K	B
2N1655	S	N	MM3007	MM3005	AP	250M	A	160	125	100	O	10	22	1.0M	0.3	5.0M			100K	B
2N1656	S	N	MM3007	MM3005	AP	250M	A	160	125	100	O	20	45	1.0M	0.3	5.0M			100K	B
2N1657	S	N	MM3005	MM3005	AP		C	200	60	60	S	7.5	30	0.85A	4.5	0.85A			2.0M	B
2N1660	S	N			AP	85W	C	200	60	60	R	45	135	1.0A	4.0	1.0A			25M	T
2N1661	S	N			AP	85W	C	200	80	80	R	45	135	1.0A	4.0	1.0A			25M	T
2N1662	S	N			AP	85W	C	200	100	100	R	45	135	1.0A	4.0	1.0A			25M	T
2N1663	S	N			SH	150M	A	150	20	15	O	30	150	20M	0.25	10M			100M	T
2N1664	G	P			A	0.2W	A	100	45	40	R	45	120	10M	0.5	0.1A	50	E	0.1M	B
2N1665	G	P			AH	150M	A	85	15	12	O	5.0	100	10M					300M	T
2N1666	G	P	2N3616	2N3615	SP	30W	C	90	80	60	V	15	30	6.0A	0.5	6.0A			2.0K	E
2N1667	G	P	2N3618	2N3615	SP	30W	C	90	60	48	X	35	80	6.0A	0.5	6.0A			2.0K	E
2N1668	G	P	2N3616	2N3615	SP	30W	C	90	60	48	X	20	45	6.0A	0.5	6.0A			2.0K	E
2N1669	G	P	2N3616	2N3615	SP	30W	C	90	80	60	X	20	65	6.0A	0.5	6.0A			2.0K	E
2N1670	G	P			S	0.12W	A	85	100			15		10M						
2N1671	Unijunction Transistor, see Table on Page 2-86																			
2N1672	G	N			AL	120M	A	85	40	40	X	20		1.0M			15	E	2.0M	B
2N1672A	G	N			AL	120M	A	85	40	40	X	20		1.0M			15	E	2.0M	B
2N1673	G	P			AH	80M	A	85	35								20	E		
2N1674	S	N			A	0.2W	A	200	45	45	O				1.5	5.0M	50	E	20M	T
2N1675	S	N			SHP	50W	C	150	100	100	S	25	100	1.0A	2.5	5.0A			120M	T
2N1676	S	P			SC	100M	A	140	4.5	4.5	U				0.1	5.0M			16M	T
2N1677	S	P			SC	100M	A	140	4.5	4.5	U				0.1	5.0M	25	E	16M	T
2N1678	G	P			S	120M	A	85	60	60	S	25		20M		20M			25M	B
2N1679	S	N	2N5335	2N5334	S	1.0W	A	175	100	55	O	40	120	600M	3.6	600M			50M	T
2N1680	S	N	2N5334	2N5334	S	1.0W	A	175	60	35	O	40	120	600M	3.6	600M			50M	T
2N1681	G	P			S	0.18W	C	100	30	15	O	30	120	10M	0.1	10M			5.0M	B
2N1682	S	N			S	500M	A	175	25	20	R	20		10M	0.6	10M			200M	T
2N1683	G	P			SH	150M	A	85	13	12	O	50		40M	12	1.0A			50M	T
2N1684	G	P			S	100M	A	100	25	25	X				0.15	12M			4.0M	B
2N1685	G	P			S	100M	A	100	25	20	R	60	180	30M		100M			8.0M	B
2N1686 thru 2N1689	Thyristors, see Table on Page 2-66																			
2N1690	S	N	2N4912	2N4910	AP	40W	C	200	80	80	O	20	60	500M	7.5	500M			90K	E
2N1691	S	N	2N5050	2N5050	AP	40W	C	200	120	120	O	20	60	500M	7.5				90K	E
2N1692	G	P		2N1561	AH	350M	A	100	25	15	O				3.0	200M				
2N1693	G	P		2N1561	AH	350M	A	100	25	25	S				4.0	200M				
2N1694	G	N			S	75M	A	85	20	20	O	17	50	1.0M					3.0M	B
2N1699	G	P			AH	100M	A	100	40	40	X	20	175	1.5M			20	E		
2N1700	S	N	2N4237	2N4237	S	5.0W	C	200	60	60	V	20	80	100M	12.5	2.5A			0.4M	B
2N1701	S	N	2N4910	2N4910	S	25W	C	200	60	60	V	20	80	300M	20	5.0A			0.35M	B
2N1702	S	N	2N5067	2N5067	S	75W	C	200	60	60	V	15	60	800M	20	5.0A			0.3M	B
2N1703	S	N	2N5067	2N5067	S	75W	C	200	60	60	V	15	60	800M					0.3M	B
2N1704	S	N	2N2218	2N2218	S	3.3M	J	175	45	45	O	50	200	1.0M	1.0	10M	40	E	5.0M	B
2N1705	G	P		2N1705	A	0.2W	A	100	18	12	R						70	E		
2N1706	G	P		2N1705	A	0.2W	A	100	25	18	R	60	120	20M			50	E		
2N1707	G	P		2N1705	A	0.2W	A	100	30	25	R	30	150	10M			40	E		
2N1708	S	N		2N1708	SH	1.0W	C	175	25	12	O	20		10M	0.22	10M			200M	T
2N1708A	S	N			SH	300M	A	175	40	20	R	30	120	10M	0.22	10M			300M	T
2N1709	S	N			AHP	15W	C	175	75	30	O	7.5	75	0.35A	5.0	1.0A			175M	T
2N1710	S	N		2N718A	AHP	15W	C	175	60	30	O	4.0	100	0.35A	5.0	1.0A			140M	T
2N1711	S	N			S	800M	A	200	75	50	R	100	300	150M	1.5	150M	50	E	70M	T
2N1711A	S	N	2N2219A	2N2218A	AH	1.0W	A	200	75	50	R	100	300	150M	1.0	150M	50	E	70M	T
2N1711B	S	N	2N2219A	2N2218A	AH	1.0W	A	200	120	55	R	100	300	150M	0.2	150M	50	E	70M	T
2N1713	G	P				80M	A	85	30	12	O	20		1.5M			40	E	100M	B
2N1714	S	N	2N4237	2N4237	AP	20W	C	175	90	60	O	20	60	200M	2.0	200M			16M	T
2N1715	S	N	2N5681	2N5681	AP	20W	C	175	150	100	O	20	60	200M	2.0	200M			16M	T
2N1716	S	N	2N4237	2N4237	AP	20W	C	175	90	60	O	40	120	200M	2.0	200M			16M	T
2N1717	S	N			AP	20W	C	175	150	100	O	40	120	200M	2.0	200M			16M	T
2N1718	S	N	2N3766	2N3766	AP	20W	C	175	90	60	O	20	60	200M	2.0	200M			16M	T
2N1719	S	N	2N3767	2N3766	AP	20W	C	175	150	100	O	20	60	200M	2.0	200M			16M	T
2N1720	S	N	2N3766	2N3766	AP	20W	C	175	90	60	O	40	120	200M	2.0	200M			16M	T
2N1721	S	N	2N3767	2N3766	AP	20W	C	175	150	100	O	40	120	200M	2.0	200M			16M	T
2N1722	S	N	2N5427	2N5427	AP	50W	C	175	120	80	O	20	90	2.0A	1.0	2.0A			10M	T
2N1722A	S	N			AP	50W	C	175	180	120	O	30	90	2.0A	0.6	2.0A			10M	T
2N1723	S	N	2N5428	2N5427	AP	50W	C	175	120	80	O	50	150	2.0A	1.0	2.0A			10M	T
2N1724	S	N		2N1724	AP	50W	C	175	120	80	O	20	90	2.0A	1.0	2.0A			10M	T
2N1724A	S	N	2N1724A	2N1724	AP	50W	C	175	180	120	O	30	90	2.0A	0.6	2.0A			10M	T
2N1725	S	N		2N1724	AP	50W	C	175	120	80	O	50	150	2.0A	1.0	2.0A			10M	T
2N1726	G	P	2N3323	2N3323	AH	60M	A	100	20	20	S	50		1.0M					100M	M
2N1727	G	P	2N3324	2N3323	AH	60M	A	100	20	20	S	20		1.0M					100M	M
2N1728	G	P	2N3324	2N3323	AH	60M	A	100	20	20	S	20		1.0M					100M	M
2N1729	G	P			S	150M	A	85	25	15	X	30		100M	0.35	200M				
2N1730	G	N			S	150M	A	85	20	15	X	30		100M	0.35	200M				
2N1731	G	P			A	150M	A	85	30	30	X	40		10M					5.0M	B

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N1732	G	N			A	150M	A	85	30	30	X	40		10M					5.0M	B
2N1742	G	P		2N499	AH	60M	A	125	20	20	S	10		2.0M						
2N1743	G	P	2N3284	2N3283	AH	60M	A	125	20	20	S	10		2.0M						
2N1744	G	P	2N3284	2N3283	AH	60M	A	125	20	20	S	10		2.0M						
2N1745	G	P	2N3285	2N3283	AH	60M	A	100	20	20	S	10		2.0M						
2N1746	G	P	2N3323	2N3323	AH	60M	A	100	20	20	S	10		1.0M					100M	M
2N1747	G	P	2N3324	2N3323	AH	60M	A	100	20	20	S	10		1.0M						
2N1748	G	P	2N3324	2N3323	AH	60M	A	100	25	25	S						30	E	80M	T
2N1748A	G	P	2N3323	2N3323	AH	60M	A	100	25	25	S						50	E	100M	T
2N1749	G	P	2N3323	2N3323	AH	75M	A	100	40	40	S						30	E	80M	T
2N1750	G	P			A	15M	A	75	14	6.0	S	18	40	500*					30M	M
2N1751	G	P		2N2832	AP			110	80	80	S	30	90	20A	0.5	20A	20	E	1.5M	B
2N1752	G	P	2N3325	2N3323	A	60M	A	100	12	12	S						50	E	50M	M
2N1753	G	P			AH	30M	A	85	30	18	O	50	220	100*						
2N1754	G	P			SH	50M	A	85	13	13	S	20		10M	0.2	10M				
2N1755	G	P	2N2137	2N2137	SP	28W	C	95	40	35	S	30	75	0.5A	0.7	3.0A			15K	E
2N1756	G	P	2N2138	2N2137	SP	28W	C	95	60	50	S	30	75	0.5A	0.7	3.0A				
2N1757	G	P	2N2139	2N2137	SP	28W	C	95	80	65	S	30	75	0.5A	0.7	3.0A			15K	E
2N1758	G	P	2N2140	2N2137	SP	28W	C	95	100	75	S	30	75	0.5A	0.7	3.0A			15K	E
2N1759	G	P	2N2142	2N2137	SP	28W	C	95	40	35	S	60	150	0.5A	0.5	3.0A			15K	E
2N1760	G	P	2N2143	2N2137	SP	28W	C	95	60	50	S	60	150	0.5A	0.5	3.0A			15K	E
2N1761	G	P	2N2144	2N2137	SP	28W	C	95	80	65	S	60	150	0.5A	0.5	3.0A			15K	E
2N1762	G	P	2N2145	2N2137	SP	28W	C	95	100	75	S	60	150	0.5A	0.5	3.0A			15K	E
2N1763	S	N			S	0.3W	A	175	40	25	O				1.5	10M				
2N1764	S	N	2N2369A	2N2369A	S	0.3W	A	175	20	15	O				1.5	10M				
2N1765	Thyristors, see Table on Page 2-66																			
2N1768	S	N	2N4231	2N4231	S	40W	C	200	60	40	O	35	100	750M	0.75	750M			600K	B
2N1769	S	N	2N4233	2N4231	S	40W	C	200	100	55	O	35	100	750M	0.75	750M			600K	B
2N1770 thru 2N1778	Thyristors, see Table on Page 2-66																			
2N1779	G	P			S	100M	A	100	25	20	R	20	60	30M						
2N1780	S	P	2N3798	2N3798	S	100M	A	100	25	25	R	30	110	30M					4.0M	B
2N1781	G	P			S	100M	A	100	25	25	X	40		20M	0.15	12M			4.0M	B
2N1782	G	P			S	100M	A	100	30	20	X	30	150	10M	0.20	50M			5.0M	B
2N1783	G	P			S	100M	A	100	30	15	O	20		10M	0.32	200M	30	E	5.0M	B
2N1784	G	P			S	100M	A	100	30	20	O	20		10M	0.32	200M			10M	B
2N1785	G	P	2N3324	2N3323	AH	45M	A	85	10	10	S	40		1.0M					50M	M
2N1786	G	P	2N3323	2N3323	AH	45M	A	85	10	10	S	15		1.0M					50M	M
2N1787	G	P	2N3324	2N3323	AH	45M	A	85	15	15	S	25		1.0M					50M	M
2N1788	G	P	2N3324	2N3323	AH	50M	A	100	35	35	S	50		1.0M					100M	M
2N1789	G	P	2N3325	2N3323	AH	60M	A	100	35	35	S	20		1.0M					100M	M
2N1790	G	P	2N3323	2N3323	AH	60M	A	100	35	35	S	40		1.0M					100M	M
2N1792 thru 2N1807	Thyristors, see Table on Page 2-66																			
2N1808	G	N			S	150M	A	85	25						0.15	12M			4.0M	B
2N1809	S	N	2N5885	2N5883	SP	250W	C	175	50	50	V	10		10A	1.5	10A				
2N1810	S	N	2N5629	2N5629	SP	250W	C	175	100	100	V	10		10A	1.5	10A				
2N1811	S	N	2N5629	2N5629	SP	250W	C	175	150	150	V	10		10A	1.5	10A				
2N1812	S	N			SP	250W	C	175	200	200	V	10		10A	1.5	10A				
2N1813	S	N			SP	250W	C	175	250	250	V	10		10A	1.5	10A				
2N1814	S	N			SP	250W	C	175	300	300	V	10		10A	1.5	10A				
2N1816	S	N	2N5302	2N5301	SP	250W	C	175	50	50	V	10		15A	1.5	15A				
2N1817	S	N	2N5303	2N5301	SP	250W	C	175	100	100	V	10		15A	1.5	15A				
2N1818	S	N			SP	250W	C	175	150	150	V	10		15A	1.5	15A				
2N1819	S	N			SP	250W	C	175	200	200	V	10		15A	1.5	15A				
2N1820	S	N			SP	250W	C	175	250	250	V	10		15A	1.5	15A				
2N1821	S	N			SP	250W	C	175	300	300	V	10		15A	1.5	15A				
2N1823	S	N	2N5685	2N5685	SP	250W	C	175	50	50	V	10		20A	1.5	20A				
2N1824	S	N	2N5686	2N5685	SP	250W	C	175	100	100	V	10		20A	1.5	20A				
2N1825	S	N			SP	250W	C	175	150	150	V	10		20A	1.5	20A				
2N1826	S	N			SP	250W	C	175	200	200	V	10		20A	1.5	20A				
2N1827	S	N			SP	250W	C	175	250	250	V	10		20A	1.5	20A				
2N1828	S	N			SP	250W	C	175	300	300	V	10		20A	1.5	20A				
2N1830	S	N	2N5685	2N5685	SP	250W	C	175	50	50	V	10		25A	1.5	25A				
2N1831	S	N	2N5686	2N5685	SP	250W	C	175	100	100	V	10		25A	1.5	25A				
2N1832	S	N			SP	250W	C	175	150	150	V	10		25A	1.5	25A				
2N1833	S	N			SP	250W	C	175	200	200	V	10		25A	1.5	25A				
2N1834	S	N			SP	250W	C	175	250	250	V	10		25A	1.5	25A				
2N1835	S	N			SP	250W	C	175	300	300	V	10		25A	1.5	25A				
2N1837	S	N	2N2218	2N2218	SH	800M	A	300	80	30	O	40	120	150M	0.8	150M			140M	T
2N1837A	S	N	2N2218	2N2218	SH	0.8W	A	175	80	30	O	40	120	0.15A	0.8	0.15A			140M	T
2N1837B	S	N	2N2218	2N2218	SH	0.8W	A	200	80	30	O	40	120	0.15A	0.8	0.15A			140M	T
2N1838	S	N	2N2218	2N2218	SH	0.6W	A	175	45	20	O	40	150	0.1A	1.4	0.1A			90M	T
2N1839	S	N	2N2218	2N2218	SH	0.6W	A	175	45	20	O	12	50	0.1A	1.4	0.15A			90M	T
2N1840	S	N	2N2218	2N2218	SH	0.6W	A	175	25	15	O	10	100	0.15A	1.4	0.15A			90M	T
2N1841	S	N	2N5334	2N5334	AHP	2.0W	A	150	100	50	O	15	50	15M	1.0	1.0A			60M	E
2N1842 thru 2N1850	Thyristors, see Table on Page 2-66																			
2N1853	G	P			SH	150M	A	85	18	6.0	O	30		6.0M	0.2	6.0M				
2N1854	G	P			SH	150M	A	85	18	6.0	O	40		20M	0.2	20M			40M	T
2N1864	G	P	2N3324	2N3323	AH	60M	A	100	20	20	S	10		1.0M			20	E	50M	M
2N1865	G	P	2N3325	2N3323	AH	60M	A	100	20	20	S	40		1.0M						
2N1866	G	P	2N3323	2N3323	AH	60M	A	100	35	35	S	40		1.0M						
2N1867	G	P	2N3324	2N3323	AH	60M	A	100	35	35	S	10		1.0M						
2N1868	G	P	2N3325	2N3323	AH	60M	A	100	20	20	S	10		2.0M						

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N1869 thru 2N1885	Thyristors, see Table on Page 2-66																			
2N1886	S	N	2N4911	2N4910	AHP	20W	C	175	60	60	0	20	80	0.5A	5.0	1.0A			2.0M	T
2N1889	S	N	2N3498	2N3498	AH	800M	A	200	100	80	R	40	120	150M	5.0	150M	30	E	50M	T
2N1890	S	N	2N3499	2N3498	AH	800M	A	200	100	80	R	100	300	150M	5.0	150M	50	E	60M	T
2N1891	G	N			SH	150M	A	85	25	15	0	25		100M	0.15	100M			5.0M	B
2N1892	G	P			S	150M	A	85	30	15	0	40	200	10M	0.2	10M	30	E	5.0M	B
2N1893	S	N		2N1893	AH	800M	A	200	120	100	R	40	120	150M	5.0	150M	30	E	50M	T
2N1893A	S	N	2N3498	2N3498	AHP	0.8W	A	200	140	80	0	40	120	0.15A	2.0	0.15A	30	E	100M	T
2N1894	S	N	2N4238	2N4237	AP			200	60	60	R	12	60	1.0A	5.0	1.0A				
2N1895	S	N	2N4239	2N4237	AP			200	80	80	R	12	60	1.0A	10	1.0A				
2N1896	S	N	2N5336	2N5336	AP			200	60	60	R	45	135	1.0A	4.0	1.0A			25M	T
2N1897	S	N	2N5336	2N5336	AP			200	80	80	R	45	135	1.0A	4.0	1.0A			25M	T
2N1898	S	N	2N5338	2N5336	AP			200	100	100	R	45	135	1.0A	4.0	1.0A			25M	T
2N1899	S	N			SHP	125W	C	150	140	50	O	10	30	10A	1.0	10A			50M	T
2N1900	S	N			AHP	125W	C	150	140	50	O	8.0		10A	2.0	10A			50M	T
2N1901	S	N			SHP	125W	C	150	140	50	O	20	60	10A	1.0	10A			50M	T
2N1902	S	N			SHP	125W	C	150	140	50	O	10	30	10A	1.0	10A			50M	T
2N1903	S	N			AHP	125W	C	150	140	50	O	8.0		10A	2.0	10A			50M	T
2N1904	S	N			SHP	125W	C	150	140	50	O	20	60	10A	1.0	10A			50M	T
2N1905	G	P	2N2832	2N2832	AP	30W	C	100	100	50	O	50	150	1.0A	1.0	5.0A	30	E		
2N1906	G	P	2N2832	2N2832	AP	30W	C	100	130	60	O	75	250	1.0A	5.0	5.0A	50	E		
2N1907	G	P	MP1907		AHP	60W	C	100	100	40	O				1.0	15A			10M	T
2N1907A	G	P			AHP	60W	C		100	40	O	30	170	10A	0.7	10A	2.0	E		
2N1908	G	P	MP1910		AHP	60W	C	100	130	50	0				1.0	15A			10M	T
2N1908A	G	P			AHP	60W	C		130	50	0	30	170	10A	0.7	10A	2.0	E		
2N1909 thru 2N1916	Thyristors, see Table on Page 2-66																			
2N1917	S	P			SC	0.25W	A	175	25	8.0	0						25	E	16M	T
2N1918	S	P			SC	0.25W	A	175	25	8.0	0						25	E	10M	T
2N1919	S	P			SC	0.25W	A	175	40	18	0				0.003				1.0M	B
2N1920	S	P			SC	0.25W	A	175	40	18	0				0.004				1.0M	B
2N1921	S	P			SC	0.25W	A	175	50	50	0				0.005				1.0M	B
2N1922	S	P			SC	0.25W	A	175	80	80	0				0.005				1.0M	B
2N1923	S	N	2N3498	2N3498	A	750M	A	150	85	85	0	4.0	90		7.0	20M	28	E		
2N1924	G	P		2N1924	A	225M	A	100	60	40	R	34	65	20M	0.11	20M	30	E	1.0M	B
2N1925	G	P		2N1924	A	225M	A	100	60	40	R	53	90	20M	0.11	20M	44	E	1.3M	B
2N1926	G	P		2N1924	A	225M	A	100	60	40	R	72	121	20M	0.11	20M	60	E	1.5M	B
2N1929 thru 2N1935	Thyristors, see Table on Page 2-66																			
2N1936	S	N	MJ7000	MJ7000	AP	150W	C	175	125	60	0	7.0	50	10A	0.75	10A	15	E	4.0M	T
2N1937	S	N	MJ7000	MJ7000	AP	150W	C	175	125	80	0	7.0	50	10A	0.75	10A	15	E	4.0M	T
2N1940	G	P			AHP	3.5W	C	100	30	15	0	5.0		40M	1.8	200M				
2N1941	S	N	2N2219A	2N2218	A	0.6W	A	175	45	30	R	30	150	10M	1.5	5.0M	40	E	60M	T
2N1942	G	P			S	0.2W	A	85	20	10	0	20	60	0.2A					5.0M	B
2N1943	S	N	2N3020	2N3019	A	800M	A	200	60	60	0	30	90	200M	5.0	200M	12	E		
2N1944	S	N	2N2219A	2N2218	S	0.6W	A	175	20	20	R	150	450	1.0M			100	E	60M	T
2N1945	S	N	2N2219A	2N2218	S	0.6W	A	175	30	30	R	150	450	1.0M			100	E	60M	T
2N1946	S	N	2N2219A	2N2218	S	0.6W	A	175	40	40	R	150	450	1.0M			100	E	60M	T
2N1947	S	N			S	0.6W	A	175	20	20	R	500	800	0.1A			100	E	60M	T
2N1948	S	N			S	0.6W	A	175	30	30	R	500	800	0.1A			100	E	60M	T
2N1949	S	N			S	0.6W	A	175	40	40	R	500	800	0.1A			100	E	60M	T
2N1950	S	N			S	0.6W	A	175	20	20	R	250	500	0.1A			75	E	60M	T
2N1951	S	N			S	0.6W	A	175	30	30	R	250	500	0.1A			75	E	60M	T
2N1952	S	N			S	0.6W	A	175	40	40	R	250	500	0.1A			75	E	60M	T
2N1953	S	N	2N2218	2N2218	A	0.6W	A	175	20	20	S	15	150	10M			28	E	40M	T
2N1954	G	P	2N651	2N650	S	200M	A	100	60	20	0	30	120	20M	0.3	20M				
2N1955	G	P	2N1190	2N1189	S	200M	A	100	60	18	0	50	200	20M	0.175	20M				
2N1956	G	P	2N651	2N650	S	200M	A	100	60	16	0	30	120	20M	0.175	20M				
2N1957	G	P	2N1187	2N1175	S	200M	A	100	60	14	0	30	120	20M	0.175	20M				
2N1958	S	N	2N2537	2N2537	SH	600M	A	175	60	40	R	20	60	150M	0.45	150M			100M	T
2N1958A	S	N	2N2537	2N2537	SH	600M	A	175	60	40	R	20	60	150M	0.45	150M			100M	T
2N1959	S	N		2N1959	SH	600M	A	175	60	40	R	40	120	150M	0.45	150M	1.0	E		
2N1959A	S	N	2N2537	2N2537	SH	600M	A	175	60	40	R	40	120	150M	0.45	150M			100M	T
2N1960	G	P			SH	150M	A	100	15	15		25		10M	0.16	10M				
2N1961	G	P			SH	150M	A	100	12	12	S	20		10M	0.20	10M				
2N1962	S	N	2N2537	2N2537	SH	400M	A	175	40	20	R	20	60	10M	0.25	10M			200M	T
2N1963	S	N	2N2537	2N2537	SH	400M	A	175	30	15	R	25		10M	0.16	10M			200M	T
2N1964	S	N	2N2539	2N2537	SH	400M	A	175	60	40	R	20	60	150M	0.45	150M			100M	T
2N1965	S	N	2N2539	2N2537	SH	0.4W	A	175	60	40	R	40	120	0.15A	0.45	0.15A			100M	T
2N1966	G	P			AL	0.12W	A	75	35	15	R									
2N1967	G	P			AL	0.12W	A	75	35	15	R									
2N1968	G	P			AL	0.12W	A	75	35	18	R									
2N1969	G	P			S	150M	A	85	30	15	0	50	200	200*					10M	B
2N1970	G	P		2N1970	AP	150W	C	100	100	50	B	17	40	5.0A	1.0	12A			5.0K	E
2N1971	G	P	2N2140	2N2137	AP			100	80	40	0	25	60	0.5A	0.9	3.0A			15K	E
2N1972	S	N	2N2219	2N2218	AH	600M	A	175	60	30	R	110	350	50M	2.0	50M	40	E	50M	T
2N1973	S	N	2N2219	2N2218	A	800M	A	200	100	80	R	75		10M	1.2	50M	76	E	60M	T
2N1974	S	N	2N3498	2N3498	A	800M	A	200	100	80	R	35		10M	1.2	50M	36	E	50M	T
2N1975	S	N	2N3498	2N3498	A	800M	A	200	100	80	R	15		10M	1.2	50M	18	E	40M	T
2N1978	S	N			AHP	30W	C	200	60	40	R	20		500M	1.5	1.0A			40M	T
2N1980	G	P		2N1970	AP	170W	C	100	50	30	0	50	100	5.0A	0.5	5.0A			3.0K	E
2N1981	G	P		2N1970	AP	170W	C	100	70	40	0	50	100	5.0A	0.5	5.0A			3.0K	E
2N1982	G	P		2N1970	AP	170W	C	100	90	50	0	50	100	5.0A	0.5	5.0A			3.0K	E
2N1983	S	N	2N2218	2N1983	A	600M	A	150	50	25	0						70	E	40M	T

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TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
						P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N1984	S	N		2N1983	A	600M	A	150	50	25	0						35	E	40M	T
2N1985	S	N	2N2218	2N2218	A	600M	A	150	50	25	0						15	E	40M	T
2N1986	S	N	2N2219	2N2218	AH	600M	A	150	50	25	0	60	240	150M	1.5	150M			40M	T
2N1987	S	N	2N2218	2N2218	AH	600M	A	150	50	25	0	20	80	150M	1.5	150M			40M	T
2N1988	S	N	2N2218A	2N2218A	AH	600M	A	150	100	45	0	35	120	30M	2.0	30M	20	E	40M	T
2N1989	S	N	2N2218A	2N2218A	AH	600M	A	150	100	45	0	20	60	30M	2.0	30M	10	E	40M	T
2N1990	S	N		2N1990	SP	600M	A	150	100			20		30M	0.5	2.0M				
2N1991	S	P		2N1131	AH	600M	A	150	30	20	0	15	60	150M	1.5	150M			40M	T
2N1992	S	N	2N2221	2N2218	SH	0.35W	A	200	15	15	0	30	120	1.0M	0.25	10M			300M	T
2N1993	G	N			S	150M	A	100	30	18	0	50	300	10M	0.2	10M			3.0M	B
2N1994	G	N			S	150M	A	85	30	15	0	15		10M	0.25	200M			3.0M	B
2N1995	G	N			S	150M	A	85	25	15	0	25		10M	0.25	200M			5.0M	B
2N1996	G	N			S	150M	A	85	20	15	0	35		10M	0.25	200M			8.0M	B
2N1997	G	P			S	250M	A	100	45	15	0	40	200	100M	0.2	10M			3.0M	B
2N1998	G	P			S	250M	A	100	35	15	0	70	225	100M	0.2	10M			5.6M	T
2N1999	G	P			S	250M	A	100	30	15	0	100	350	100M	0.2	10M			10M	T
2N2000	G	P			S	300M	A	100	50	15	0	50	300	100M	0.35	500M			2.0M	B
2N2001	G	P			S	300M	A	100	30	15	0	100		100M	0.2	100M			6.0M	B
2N2002	S	P	2N5230	2N5229	SC	0.25W	A	200	30	5.0	0									
2N2003	S	P	2N5230	2N5229	SC	0.25W	A	200	30	5.0	0									
2N2004	S	P	2N5231	2N5229	SC	0.25W	A	175	50	15	0	12		1.0M			15	E	0.5M	B
2N2005	S	P	2N5231	2N5229	SC	0.25W	A	200	50	15	0									
2N2006	S	P			SC	0.25W	A	200	60	35	0									
2N2007	S	P			SC	0.25W	A	200	60	35	0									
2N2008	S	N	2N3500	2N3498	A	800M	A	200	175	110	0	30	90	10M	2.5	25M	20	E	40M	T
2N2009 thru 2N2014	Thyristors, see Table on Page 2-66																			
2N2015	S	N	2N5881	2N5879	A	150W	C	200	100	50	0	15	50	5.0A	1.25	5.0A	12	E	12K	E
2N2016	S	N	2N5882	2N5879	A	150W	C	200	130	65	0	15	50	5.0A	1.25	5.0A	12	E	12K	E
2N2017	S	N	2N2405	2N1893	A	1.0W	A	200	60	60	0	50	200	200M			30	E		
2N2018	S	N	2N5051	2N5050	AHP	20W	C	175	150	150	V	20	60	0.5A	6.0	1.0A			2.0M	T
2N2019	S	N	2N5052	2N5050	AHP	20W	C	175	200	200	V	20	60	0.5A	6.0	1.0A			2.0M	T
2N2020	S	N	2N5050	2N5050	AHP	20W	C	175	150	125	O	40	90	0.5A	6.0	1.0A			3.0M	T
2N2021	S	N	2N5051	2N5050	AHP	20W	C	175	200	140	O	40	90	0.5A	6.0	1.0A			3.0M	T
2N2022	G	P			SH	0.15W	A	100	15	12	S	25	150	10M	1.2	50M			250M	T
2N2023 thru 2N2031	Thyristors, see Table on Page 2-66																			
2N2032	S	N	2N4232	2N4231	AHP	45W	C	200	45	45	O	20		2.0A	5.0	2.0A			3.0M	T
2N2033	S	N	2N3020	2N3019	SP	5.0W	C	200	80	60	O	20	60	500M	0.4	500M			1.0M	T
2N2034	S	N	2N4238	2N4237	SP	14W	C	200	80	60	O	20	60	1.0A	0.3	1.0A			1.0M	T
2N2035	S	N	2N4232	2N4231	SP	17W	C	200	80	60	O	20	60	1.5A	0.45	1.5A			1.0M	T
2N2036	S	N	2N4232	2N4231	SP	17.5W	C	200	80	60	O	20	60	2.0A	1.0	2.0A			1.0M	T
2N2038	S	N	2N2218	2N2218	AH	0.6W	A	200	45	45	O	12	36	0.2A	6.0	0.2A			2.0M	T
2N2039	S	N	2N3020	2N3019	AH	0.6W	A	200	75	75	O	12	36	0.2A	6.0	0.2A			2.0M	T
2N2040	S	N	2N3053	2N3053	AH	0.6W	A	200	45	45	O	30	90	0.2A	6.0	0.2A			2.0M	T
2N2041	S	N	2N3020	2N3019	AH	0.6W	A	200	75	75	O	30	90	0.2A	6.0	0.2A			2.0M	T
2N4042,A	G	P		2N2042	A	200M	A	100	105	105	S	20	50	5.0M	0.75	100M	20	E	0.5M	B
2N4043,A	G	P		2N2042	A	200M	A	100	105	105	S	40	100	5.0M	0.75	100M	45	E	0.75M	B
2N2044 thru 2N2047	Thyristors, see Table on Page 2-66																			
2N2048	G	P	2N2955	2N2955	SH	150M	A	100	20	15	O	50	300	10M	0.14	10M			150M	T
2N2048A	G	P		2N2955	SH	150M	A	100	30	20	O	50	300	10M	0.14	10M			7.5K	E
2N2049	S	N	2N2219A	2N2218A	A	800M	A	200	75	50	R	100	300	150M	0.4	10M	75	E	50M	T
2N2059	G	P			S	60M	A	100	10	8.0	S	20		10M	0.2	10M			50M	T
2N2060	S	N		2N2060	AM	500M	A	200	100	80	R	50	150	10M	1.2	50M	50	E	60M	T
2N2060A	S	N		2N2060	AM	0.5W	A	200	100	60	O	50	150	10M	0.6	50M	50	E	60M	T
2N2060B	S	N							100											
2N2061	G	P			S	40W	C	85	20	10	O	10	60	0.5A	2.0	0.5A			2.0K	E
2N2061A	G	P			SP	90W	C	100	20	15	O	20	60	2.0A	1.0	5.0A			5.0K	E
2N2062	G	P			S	40W	C	85	20	10	O	20	200	2.0A	1.0	2.0A			2.0K	E
2N2062A	G	P			SP	90W	C	100	10	15	O	50	140	2.0A	0.7	5.0A			1.0K	E
2N2063	G	P			S	35W	C	95	40	15	O	10	200	2.0A	2.0	2.0A			2.0K	E
2N2063A	G	P			SP	90W	C	100	40	20	O	20	60	2.0A	1.0	5.0A			5.0K	E
2N2064	G	P			S	35W	C	95	40	15	O	20	200	2.0A	1.0	2.0A			2.0K	E
2N2064A	G	P			SP	90W	C	100	40	20	O	50	140	2.0A	0.7	5.0A			1.0K	E
2N2065	G	P			S	35W	C	95	80	25	O	10	200	2.0A	2.0	2.0A			2.0K	E
2N2065A	G	P			SP	90W	C	100	20	40	O	20	60	2.0A	1.0	5.0A			5.0K	E
2N2066	G	P			S	35W	C	95	80	25	O	20	200	2.0A	1.0	2.0A			2.0K	E
2N2066A	G	P			SP	90W	C	100	80	40	O	50	140	2.0A	0.7	5.0A			1.0K	E
2N2067	G	P	2N1536	2N1529	S	28W	C	95	40	25	O	20	100	0.5A	0.7	1.0A			7.0K	E
2N2068	G	P	2N1531	2N1529	S	28W	C	95	80	55	O	20	100	0.5A	0.7	1.0A			7.0K	E
2N2069	G	P	2N1539	2N1539	S	70W	C	95	40	30	S	30	200	5.0A	1.5	12A			1.5K	E
2N2070	G	P	2N1541	2N1539	S	70W	C	95	80	60	S	30	200	5.0A	1.5	12A			1.5K	E
2N2071	G	P	MP1539		S	70W	C	95	40	30	S	30	200	5.0A	1.5	12A			1.5K	E
2N2072	G	P	MP1541		S	70W	C	95	80	60	S	30	200	5.0A	1.5	12A			1.5K	E
2N2074	Thyristors, see Table on Page 2-66																			
2N2075	G	P		2N2075	AP	170W	C	110	80	80	S	20	40	5.0A	0.7	12A			5.0K	E
2N2075A	G	P		2N2075	AP	170W	C	110	80	80	S	20	40	5.0A	0.7	12A			5.0K	E
2N2076	G	P		2N2075	AP	170W	C	110	70	70	S	20	40	5.0A	0.7	12A			5.0K	E
2N2076A	G	P		2N2075	AP	170W	C	110	70	70	S	20	40	5.0A	0.7	12A			5.0K	E
2N2077	G	P		2N2075	AP	170W	C	110	50	50	S	20	40	5.0A	0.9	12A			5.0K	E
2N2077A	G	P		2N2075	AP	170W	C	110	50	50	S	20	40	5.0A	0.9	12A			5.0K	E
2N2078	G	P		2N2075	AP	170W	C	110	40	40	S	20	40	5.0A	0.9	12A			5.0K	E
2N2078A	G	P		2N2075	AP	170W	C	110	40	40	S	20	40	5.0A	0.9	12A			5.0K	E
2N2079	G	P		2N2075	AP	170W	C	110	80	80	S	35	70	5.0A	0.7	12A			5.0K	E

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N2079A	G	P		2N2075	AP	170W	C	110	80	80	S	35	70	5.0A	0.7	12A			5.0K	E
2N2080	G	P		2N2075	AP	170W	C	110	70	70	S	35	70	5.0A	0.7	12A			5.0K	E
2N2080A	G	P		2N2075	AP	170W	C	110	70	70	S	35	70	5.0A	0.7	12A			5.0K	E
2N2081	G	P		2N2075	AP	170W	C	110	50	50	S	35	70	5.0A	0.9	12A			5.0K	E
2N2081A	G	P		2N2075	AP	170W	C	110	50	50	S	35	70	5.0A	0 9	12A			5.0K	E
2N2082	G	P		2N2075	AP	170W	C	110	40	40	S	35	70	5.0A	0.9	12A			5.0K	E
2N2082A	G	P		2N2075	AP	170W		110	40	40	S	35	70	5.0A	0.9	12A			5.0K	E
2N2083	G	P			A	60M	A	85	30			25		1.0M					30M	T
2N2084	G	P			AH	125M	A	100	40	20	O	40	250	1.0M			40	E		
2N2085	G	N			A	150M	A	100	33	23	X	50	300	10M		10M	20	E	6.0M	B
2N2086	S	N	2N3020	2N3019	SH	600M	A	175	120	80	R	20		150M	0.7	150M			150M	T
2N2087	S	N	2N3020	2N3019	SH	600M	A	175	120	80	R	40	120	150M	0.5	150M			150M	T
2N2089	G	P			AH	0.1W	A	85	20	20	R	40		1.0M			40	E	44M	T
2N2090	G	P			AH	0.1W	A	85	20	20	R	40		1.0M			40	E	44M	T
2N2091	G	P			AH	0.1W	A	85	20	20	R	40		1.0M			40	E	44M	T
2N2092	G	P			AH	0.1W	A	85	20	20	R	40		1.0M			40	E	44M	T
2N2093	G	P			AH	0.1W	A	85	25	25	R	40		1.0M			40	E	30M	T
2N2095	G	P			AHP	1.0W	A	100	30	15	O								500M	T
2N2096	G	P		2N1204	SH	250M	A	100	25	12	O	15		400M	0.6	200M				
2N2097	G	P		2N1204	SH	250M	A	100	40	20	O	20		400M	0.5	200M				
2N2098	G	P			AH	1.0W	A	100	30	15	O								500M	T
2N2099	G	P		2N1204	SH	250M	A	100	25	12	O	15		400M	0.6	200M				
2N2100	G	P		2N1204	SH	250M	A	100	40	20	O	20		400M	0.5	200M				
2N2100A	G	P		2N1204	SH	300M	A	100	40	20	O	20		400M	0 5	200M				
2N2101	S	N	2N5477	2N5477	AP	75W	C	200	60	40	O	15	60	1.0A	5.0	1.0A			25K	T
2N2102	S	N			SH	5.0W	C	200	120	80	R	35		10M	0.5	150M	35	E		
2N2102A	S	N			SH	1.0W	A	200	120	65	O	40	120	150M	0.3	150M	30	E		
2N2104	S	P	2N3052	2N3052	SH	3.5W	C	200	50	35	O	25	80	150M	1.5	150M			60M	T
2N2105	S	P	2N3052	2N3052	SH	3.5W	C	200	50	35	O	15	40	150M	1.5	150M			50M	T
2N2106	S	N	2N3020	2N2019	A	1.0W	A	150	60	60	R	12	36	200M	5.0	200M				
2N2107	S	N	2N3020	2N3019	A	1.0W	A	150	60	60	R	30	90	200M	2.0	200M				
2N2108	S	N	2N3020	2N3019	A	1.0W	A	150	60	60	R	75	200	200M	2.0	200M				
2N2109	S	N	2N5885	2N5883	SP	250W	C	175	50	50	V	10		10A	1.5	10A				
2N2110	S	N	2N5629	2N5629	SP	250W	C	175	100	100	V	10		10A	1.5	10A				
2N2111	S	N	2N5631	2N5629	SP	250W	C	175	150	150	V	10		10A	1.5	10A				
2N2112	S	N			SP	250W	C	175	200	200	V	10		10A	1.5	10A				
2N2113	S	N			SP	250W	C	175	250	250	V	10		10A	1.5	10A				
2N2114	S	N			SP	250W	C	175	300	300	V	10		10A	1.5	10A				
2N2116	S	N	2N5302	2N5301	SP	250W	C	175	50	50	V	10		15A	1.5	15A				
2N2117	S	N			SP	250W	C	175	100	100	V	10		15A	1.5	15A				
2N2118	S	N			SP	250W	C	175	150	150	V	10		15A	1.5	15A				
2N2119	S	N			SP	250W	C	175	200	200	V	10		15A	1.5	15A				
2N2120	S	N			SP	250W	C	175	250	250	V	10		15A	1.5	15A				
2N2121	S	N			SP	250W	C	175	300	300	V	10		15A	1.5	15A				
2N2123	S	N			SP	250W	C	175	50	50	V	10		20A	1.5	20A				
2N2124	S	N			SP	250W	C	175	100	100	V	10		20A	1.5	20A				
2N2125	S	N			SP	250W	C	175	150	150	V	10		20A	1.5	20A				
2N2126	S	N			SP	250W	C	175	200	200	V	10		20A	1.5	20A				
2N2127	S	N			SP	250W	C	175	250	250	V	10		20A	1.5	20A				
2N2128	S	N			SP	250W	C	175	300	300	V	10		20A	1.5	20A				
2N2130	S	N			SP	250W	C	175	50	50	V	10		25A	1.5	25A				
2N2131	S	N			SP	250W	C	175	100	100	V	10		25A	1.5	25A				
2N2132	S	N			SP	250W	C	175	150	150	V	10		25A	1.5	25A				
2N2133	S	N			SP	250W	C	175	200	200	V	10		25A	1.5	25A				
2N2134	S	N			SP	250W	C	175	250	250	V	10		25A	1.5	25A				
2N2135	S	N			SP	250W	C	175	300	300	V	10		25A	1.5	25A				
2N2137	G	P		2N2137	AP	62.5W	C	100	30	30	S	30	60	0.5A	0.5	2.0A			12K	E
2N2137A	G	P		2N2137	AP	62.5W	C	100	30	20	O	30	60	0.5A	0.5	2.0A			12K	E
2N2138	G	P		2N2137	AP	62.5W	C	100	45	45	S	30	60	0.5A	0.5	2.0A			12K	E
2N2138A	G	P		2N2137	AP	62.5W	C	100	45	30	O	30	60	0.5A	0.5	2.0A			12K	E
2N2139	G	P		2N2137	AP	62.5W	C	100	60	60	S	30	60	0.5A	0.5	2.0A			12K	E
2N2139A	G	P		2N2137	AP	62.5W	C	100	60	45	O	30	60	0.5A	0.5	2.0A			12K	E
2N2140	G	P		2N2137	AP	62.5W	C	100	75	75	S	30	60	0.5A	0.5	2.0A			12K	E
2N2140A	G	P		2N2137	AP	62.5W	C	100	75	60	O	30	60	0.5A	0.5	2.0A			12K	E
2N2141	G	P		2N2137	AP	62.5W	C	100	90	90	S	30	60	0.5A	0.5	2.0A			12K	E
2N2141A	G	P		2N2137	AP	62.5W	C	100	90	65	O	30	60	0.5A	0.5	2.0A			12K	E
2N2142	G	P		2N2137	AP	62.5W	C	100	30	30	S	50	100	0.5A	0.5	2.0A			12K	E
2N2142A	G	P		2N2137	AP	62.5W	C	100	30	20	O	50	100	0.5A	0.5	2.0A			12K	E
2N2143	G	P		2N2137	AP	62.5W	C	100	45	45	S	50	100	0.5A	0.5	2.0A			12K	E
2N2143A	G	P		2N2137	AP	62.5W	C	100	45	30	O	50	100	0.5A	0.5	2.0A			12K	E
2N2144	G	P		2N2137	AP	62.5W	C	100	60	60	S	50	100	0.5A	0.5	2.0A			12K	E
2N2144A	G	P		2N2137	AP	62.5W	C	100	60	45	O	50	100	0.5A	0.5	2.0A			12K	E
2N2145	G	P		2N2137	AP	62.5W	C	100	75	75	S	50	100	0.5A	0.5	2.0A			12K	E
2N2145A	G	P		2N2137	AP	62.5W	C	100	75	60	O	50	100	0.5A	0.5	2.0A			12K	E
2N2146	G	P		2N2137	AP	62.5W	C	100	90	90	S	50	100	0.5A	0.5	2.0A			12K	E
2N2146A	G	P		2N2137	AP	62.5W	C	100	90	65	O	50	100	0.5A	0.5	2.0A			12K	E
2N2147	G	P	2N2832	2N2832	AP	12.5W	C	100	75	50	O	100	300	1.0A	1.0	4.0A	75	E	3.0M	T
2N2148	G	P	2N2832	2N2800	AP	12.5W	C	100	60	40	O	40	160	1.0A	1.0	4.0A	30	E	2.0M	T
2N2150	S	N	2N5477	2N5477	AHP	30W	C	175	125	80	O	20	60	1.0A	1.0	1.0A	20	E	10M	T
2N2151	S	N	2N5477	2N5477	AHP	30W	C	175	125	80	O	40	120	1.0A	1.0	1.0A	40	E	10M	T
2N2152	G	P		2N2137	AP	170W	C	110	45	45	S	50	100	5.0A	0.1	5.0A			2.0K	E
2N2152A	G	P			AP	170W	C	110	45	30	O	50	100	5.0A	0.1	5.0A			2.0K	E
2N2153	G	P		2N2137	AP	170W	C	110	60	60	S	50	100	5.0A	0.1	5.0A			2.0K	E
2N2153A	G	P			AP	170W	C	110	60	45	O	50	100	5.0A	0.1	5.0A			2.0K	E
2N2154	G	P		2N2137	AP	170W	C	110	75	75	S	50	100	5.0A	0.1	5.0A			2.0K	E
2N2154A	G	P			AP	170W	C	110	75	60	O	50	100	5.0A	0.1	5.0A			2.0K	E
2N2155	G	P			AP	170W	C	110	90	90	S	50	100	5.0A	0.1	5.0A			2.0K	E
2N2155A	G	P			AP	170W	C	110	90	65	O	50	100	5.0A	0.1	5.0A			2.0K	E

2N2156–2N2229

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N2156	G	P		2N2137	AP	170W	C	110	45	45	S	80	160	5.0A	0.1	5.0A			2.0K	E
2N2156A	G	P		2N2137	AP	170W	C	110	45	30	O	80	160	5.0A	0.1	5.0A			2.0K	E
2N2157	G	P		2N2137	AP	170W	C	110	60	60	S	80	160	5.0A	0.1	5.0A			2.0K	E
2N2157A	G	P		2N2137	AP	170W	C	110	60	45	O	80	160	5.0A	0.1	5.0A			2.0K	E
2N2158	G	P		2N2137	AP	170W	C	110	75	75	S	80	160	5.0A	0.1	5.0A			2.0K	E
2N2158A	G	P			AP	170W	C	110	75	60	O	80	160	5.0A	0.1	5.0A			2.0K	E
2N2159	G	P			AP	170W	C	110	90	90	S	80	160	5.0A	0.1	5.0A			2.0K	E
2N2159A	G	P			AP	170W	C	110	90	65	O	80	160	5.0A	0.1	5.0A			2.0K	E
2N2160	Unijunction Transistors, see Table on Page 2-86																			
2N2161	S	N	2N2222	2N2218	SH	200M	A	150	55	35	O	60	160	10M	1.5	10M	75	E		
2N2162	S	P	2N2946	2N2944	SC	150M	A	140	30	30	O								14M	T
2N2163	S	P	2N2945	2N2944	SC	150M	A	140	15	15	O								14M	T
2N2164	S	P	2N2944	2N2944	SC	150M	A	140	12	8.0	O								24M	T
2N2165	S	P	2N2946	2N2944	SC	150M	A	140	30	30	O								10M	T
2N2166	S	P	2N2945	2N2944	SC	150M	A	140	15	15	O								10M	T
2N2167	S	P	2N2944	2N2944	SC	150M	A	140	12	8.0	O								16M	T
2N2168	G	P			SH	60M	A	100	20	15	O	50		10M	0.125	10M				
2N2169	G	P			SH	60M	A	100	15	15	O	40		10M	0.15	10M				
2N2170	G	P			SH	60M	A	100	15	10	O	20		10M	0.18	10M				
2N2171	G	P		2N381	A	0.2W	A	100	50	25	R	110	250	20M			120	E		
2N2172	G	P			S	200M	A	85	20	15	O	30	150	10M	0.2	10M	0.97	B	5.0M	B
2N2173	G	P			SH	240M	A	100	25	15	O	30		200M	0.4	200M				
2N2175	S	P			A	0.1W	A	175	6.0	6.0	O	30		20*					10M	T
2N2176	S	P			A	0.1W	A	175	6.0	6.0	O	30		20*					10M	T
2N2177	S	P			A	0.1W	A	160	6.0	6.0	O	15		5.0*			50	E	8.0M	B
2N2178	S	P			A	0.1W	A	160	6.0	6.0	O	15		5.0*			50	E	8.0M	B
2N2180	G	P			SH	50M	A	100	15	6.0	O	100		10M	0.08	10M	120	E	60M	T
2N2181	S	P	2N2945	2N2944	SC	150M	A	140	25	25	O	10		5.0M					6.0M	T
2N2182	S	P	2N2945	2N2944	SC	150M	A	140	25	25	O	10		5.0M					6.0M	T
2N2183	S	P	2N2944	2N2944	SC	150M	A	140	15	10	O	10		5.0M					6.0M	T
2N2184	S	P	2N2944	2N2944	SC	150M	A	140	15	10	O	10		5.0M					6.0M	T
2N2185	S	P	2N2946	2N2944	SC	150M	A	140	30	30	O								6.5M	T
2N2186	S	P	2N2946	2N2944	SC	150M	A	140	30	30	O								6.5M	T
2N2187	S	P	2N2946	2N2944	SC	150M	A	140	30	30	O								6.5M	T
2N2188	G	P	2N3323	2N3323	AH	125M	A	85	40	25	O	40	160	1.5M			40	E	60M	T
2N2189	G	P	2N3323	2N3323	AH	125M	A	85	40	25	O	60	180	1.5M			40	E	102M	T
2N2190	G	P	2N3323	2N3323	AH	125M	A	85	60	25	O	40	160	1.5M			40	E	60M	T
2N2191	G	P	2N3323	2N3323	AH	125M	A	85	60	25	O	60	180	1.5M			60	E	102M	T
2N2192	S	N		2N2192	SH	800M	A	200	60	40	O	100	300	150M	0.35	150M				
2N2192A	S	N		2N2192	SH	800M	A	200	60	40	O	100	300	150M	0.25	150M				
2N2192B	S	N		2N2192	SH	800M	A	200	60	40	O	100	300	150M	0.18	150M				
2N2193	S	N		2N2192	SH	800M	A	200	80	50	O	40	120	150M	0.35	150M				
2N2193A	S	N		2N2192	SH	800M	A	200	80	50	O	40	120	150M	0.25	150M				
2N2193B	S	N		2N2192	SH	800M	A	200	80	50	O	40	120	150M	0.18	150M				
2N2194	S	N		2N2192	SH	800M	A	200	60	40	O	20	60	150M	0.35	150M				
2N2194A	S	N		2N2192	SH	800M	A	200	60	40	O	20	60	150M	0.25	150M				
2N2194B	S	N		2N2192	SH	800M	A	200	60	40	O	20	60	150M	0.18	150M				
2N2195	S	N		2N2192	SH	800M	A	200	45	25	O	20		150M	0.35	150M				
2N2195A	S	N		2N2192	SH	800M	A	200	45	25	O	20		150M	0.25	150M				
2N2195B	S	N		2N2192	SH	800M	A	200	45	25	O	20		150M	0.18	150M				
2N2196	S	N	2N3766	2N3766	AP	2.0W	A	175	80	60	R	30	90	0.2A	2.0	0.2A	30	E		
2N2197	S	N	2N3766	2N3766	AP	2.0W	A	175	80	60	R	75	200	0.2A	2.0	0.2A	30	E		
2N2198	S	N			AH	5.5M	A	200	80	80	O	35	55	0.1A	6.0	0.2A			4.0M	T
2N2199	G	P			AH	75M	A	100	15	10	O	9.0		3.0M			20	E	120M	T
2N2200	G	P			AH	75M	A	100	15	10	O	9.0		3.0M					120M	T
2N2201	S	N	2N5681	2N5681	A	1.0W	C	175	120	100	O	25	90	200M	1.7	200M	30	E		
2N2202	S	N	2N5681	2N5681	A	1.0W	C	175	120	100	O	25	90	200M	1.7	200M	30	E		
2N2203	S	N	2N5681	2N5681	A	1.0W	C	175	120	100	O	25	90	200M	1.7	200M	30	E		
2N2204	S	N	2N5681	2N5681	A	1.0W	C	175	120	100	O	25	90	200M	1.7	200M	30	E		
2N2205	S	N	2N835	2N834	SH	1.0W	C	175	25	12	O	20		10M	0.22	10M	2.0	E		
2N2206	S	N	2N835	2N834	SH	1.0W	C	175	25	12	O	40	120	10M	0.22	10M	2.0	E		
2N2207	G	P			AH	0.26W	A	75	70	50	R	36	370	10M					140M	B
2N2208	G	P			AH	120M	A	85	40	10	O	15		1.5M			30	E		
2N2209	G	P			S	150M	A	85	30	12	O	50		24M	0.15	12M			6.0M	B
2N2210	G	P	2N2075	2N2075	AP	75W	C	100	100	65		25	50	5.0A	0.6	12A			5.0K	E
2N2211	G	P			AP	90W	C	100	80	60	S	60	140	1.0A	0.8	2.0A			5.0K	E
2N2212	G	P		2N2212	AHP	100W	C	110	120	120	R	50	120	5.0A	1.0	5.0A	30	E	0.45M	T
2N2214	S	N	2N835	2N834	SH	0.25W	C	150	25	15	O	25		10M	0.2	10M			200M	T
2N2216	S	P	2N3498	2N3498	SH	3.0W	C	200	150	100	O	25	120	50M	5.0	50M			50M	T
2N2217	S	N	2N2218	2N2218	SH	0.8W	A	175	60	30	O	20	60	150M	0.4	150M			250M	T
2N2218	S	N		2N2218	SH	0.8W	A	175	60	30	O	40	120	150M	0.4	150M			250M	T
2N2218A	S	N		2N2218	SH	0.8W	A	175	75	40	O	40	120	0.15A	0.3	0.15A	30	E	250M	T
2N2219	S	N		2N2218	SH	0.8W	A	175	60	30	O	100	300	150M	0.4	150M			250M	T
2N2219A	S	N		2N2218	SH	0.8W	A	175	75	40	O	100	200	0.15A	0.3	0.15A	50	E	300M	T
2N2220	S	N	2N2222	2N2218	SH	0.5W	A	175	60	30	O	20	60	150M	9.4	150M			250M	T
2N2221	S	N		2N2218	SH	0.5W	A	175	60	30	O	40	120	150M	0.4	150M			250M	T
2N2221A	S	N		2N2218	SH	0.5W	A	175	75	40	O	40	120	0.15A	0.3	0.15A	30	E	250M	T
2N2222	S	N		2N2218	SH	0.5W	A	175	60	30	O	100	300	150M	0.4	150M			250M	T
2N2222A	S	N		2N2218	SH	0.5W	A	175	75	40	O	100	300	0.15A	0.3	0.15A	50	E	300M	T
2N2222B	S	N	2N222A	2N2218	SH	1.8W	C		75	40	O	100	300	150M	0.3	150M	50	E	300M	T
2N2223	S	N		2N2060	AM	500M	A	200	100	80	R	50	200	10M	1.2	50M	40	E	50M	T
2N2223A	S	N		2N2060	AM	500M	A	200	100	80	R	50	200	10M	1.2	50M	40	E	50M	T
2N2224	S	N		2N2224	SH	0.8W	A	175	65	40	O	35	115	10M	0.4	150M			250M	T
2N2225	G	P			S	200M	A	100	15	4.0	O	100	300	100M	0.2	50M			25M	B
2N2226	S	N	2N6057	2N6057	AP	150W	C	150	50	50	V	100	500	9.0A	3.5	9.0A	50	E	7.0K	E
2N2227	S	N	2N6057	2N6057	AP	150W	C	150	100	100	V	100	500	9.0A	3.5	9.0A	50	E	7.0K	E
2N2228	S	N			AP	150W	C	150	150	150	V	100	500	9.0A	3.5	9.0A	50	E	7.0K	E
2N2229	S	N			AP	150W	C	150	200	200	V	100	500	9.0A	3.5	9.0A	50	E	7.0K	E

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
						P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N2230	S	N		MJ4033	AP	150W	C	150	50	50	V	350		9.0A	3.5	9.0A	100	E	4.0K	E
2N2231	S	N		MJ4035	AP	150W	C	150	100	100	V	350		9.0A	3.5	9.0A	100	E	4.0K	E
2N2232	S	N			AP	150W	C	150	150	150	V	350		9.0A	3.5	9.0A	100	E	4.0K	E
2N2233	S	N			AP	150W	C	150	200	200	V	350		9.0A	3.5	9.0A	100	E	4.0K	E
2N2234	S	N			SHP	12.5W	C	150	40	20	O	15	60	100M	0.25	100M			50M	T
2N2235	S	N			SHP	12.5W	C	150	40	20	O	40	125	100M	0.25	100M			100M	T
2N2236	S	N	2N2218	2N2218	SH	575M	A	150	40	20	O	15	60	100M	0.25	100M			50M	T
2N2237	S	N	2N2218	2N2218	SH	575M	A	150	40	20	O	40	125	100M	0.25	100M				
2N2238	G	P			AH	0.3W	A	100	30	30	S	10		10M			25	E	400M	T
2N2239	S	N	2N4232	2N4231	A	1.0W	A	150	60	50	R	30	200	200M	3.0	200M				
2N2240	S	N	2N2218	2N2218	SH	0.6W	A	200	25	20	O	40	100	1.0M	1.0	50M			50M	T
2N2241	S	N	2N2219A	2N2218	SH	0.6W	A	200	25	20	O	100	200	1.0M	1.0	50M			50M	T
2N2242	S	N		2N2242	SH	360M	A	200	40	15	O	40	120	10M	0.7	100M			250M	T
2N2243	S	N	2N3019	2N3019	SH	0.8W	A	200	120	80	O	40	120	0.15A	0.35	0.15A			50M	T
2N2243A	S	N	2N3019	2N3019	SH	0.8W	A	200	120	80	O	40	120	0.15A	0.25	0.15A			50M	T
2N2244	S	N			A	0.5W	A	200	20	20	O	5.0	15	2.0*	0.2	1.0M	40	E	60M	T
2N2245	S	N			A	0.5W	A	200	20	20	O	10	30	2.0*	0.2	1.0M	80	E	60M	T
2N2246	S	N			A	0.5W	A	200	20	20	O	5.0	15	2.0*	0.2	1.0M	40	E	60M	T
2N2247	S	N			A	0.5W	A	200	45	45	O	5.0	15	2.0*	0.2	1.0M	40	E	60M	T
2N2248	S	N			A	0.5W	A	200	45	45	O	10	30	2.0*	0.2	1.0M	80	E	60M	T
2N2249	S	N			A	0.5W	A	200	45	45	O	20	60	2.0*	0.2	1.0M	150	E	60M	T
2N2250	S	N			A	0.5W	A	200	25	20	O	5.0	15	2.0*	0.2	1.0M	40	E	60M	T
2N2251	S	N			A	0.5W	A	200	25	20	O	10	30	2.0*	0.2	1.0M	80	E	60M	T
2N2252	S	N			A	0.5W	A	200	25	20	O	20	60	2.0*	0.2	1.0M	150	E	60M	T
2N2253	S	N			A	0.5W	A	200	45	50	O	5.0	15	2.0*	0.2	1.0M	40	E	60M	T
2N2254	S	N			A	0.5W	A	200	45	50	O	10	30	2.0*	0.2	1.0M	80	E	60M	T
2N2255	S	N			A	0.5W	A	200	45	50	O	20	60	2.0*	Q.2	1.0M	150	E	60M	T
2N2256	S	N		2N2256	SH	300M	A	175	7.0	7.0	S	17		10M						
2N2257	S	N		2N2256	SH	300M	A	175	7.0	7.0	S	40		10M						
2N2258	G	P		2N2256	SH	150M	A	100	7.0	7.0	S	17		10M						
2N2259	G	P		2N2256	SH	150M	A	100	7.0	7.0	S	40		10M						
2N2260 thru 2N2262	Thyristors, see Table on Page 2-66																			
2N2266	G	P	2N2145	2N2137	SP	50W	J	125	100	55		40	120	500M	0.75	5.0A			200K	T
2N2267	G	P	2N2145	2N2137	SP	50W	J	125	120	55		40	120	500M	0.75	5.0A			200K	T
2N2268	G	P	2N2145	2N2137	SP	50W	J	125	100	55		40	120	500M	0.75	5.0A			200K	T
2N2269	G	P	2N2145	2N2137	SP	50W	J	125	120	55		40	120	500M	0.75	5.0A			200K	T
2N2270	S	N			A	5.0W	C	200	60	45	O	30		1.0M	0.9	150M	50	E		
2N2271	G	P			A	0.25W	A	100	20	15	R	50	100	35M					10K	E
2N2272	S	N	2N929	2N929	SH	360M	A	200	40	20	R	80	240	10M	0.7	200M	3.0	E		
2N2273	G	P		2N2273	AH	100M	A	100	25	15	O	20	150	1.0M						
2N2274	S	P	2N2946	2N2944	SC	150M	A	140	25	25	O	10		5.0M					6.0M	T
2N2275	S	P	2N2946	2N2944	SC	150M	A	140	25	25	O	10		5.0M					6.0M	T
2N2276	S	P	2N2944	2N2944	SC	150M	A	140	15	10	O	10		5.0M					6.0M	T
2N2277	S	P	2N2944	2N2944	SC	150M	A	140	15	10	O	10		5.0M					6.0M	T
2N2278	S	P	2N2945	2N2944	SC	150M	A	140	15	15	O								7.6M	T
2N2279	S	P	2N2945	2N2944	SC	150M	A	140	15	15	O								7.6M	T
2N2280	S	P	2N2944	2N2944	SC	150M	A	140	10	6.0	O				0.1	5.0M			16M	T
2N2281	S	P	2N2944	2N2944	SC	150M	A	140	10	6.0	O				0.1	5.0M			16M	T
2N2282	G	P			AHP	5.0W	C	110	60	30	O	15		3.0A	0.4	1.0A	40	E	20M	T
2N2283	G	P			AHP	5.0W	C	110	100	60	O	15		3.0A	0.4	1.0A	40	E	20M	T
2N2284	G	P			AHP	5.0W	C	110	200	100	O	15		3.0A	0.4	1.0A	40	E	20M	T
2N2285	G	P		2N1651	AP	100W	C	110	60	30	O	35	140	10A	0.65	25A			0.6M	T
2N2286	G	P		2N1651	AP	100W	C	110	100	60	O	35	140	10A	0.65	25A			0.6M	T
2N2287	G	P		2N1651	AP	100W	C	110	120	80	O	35	140	10A	0.65	25A			0.6M	T
2N2288	G	P		2N2288	AP	60W	C	110	40	40	R	20	60	5.0A	1.0	5.0A	25	E	0.45M	T
2N2289	G	P		2N2288	AP	60W	C	110	80	80	R	20	60	5.0A	1.0	5.0A	25	E	0.45M	T
2N2290	G	P		2N2288	AP	60W	C	110	120	120	R	20	60	5.0A	1.0	5.0A	25	E	0.45M	T
2N2291	G	P		2N2291	AP	60W	C	110	40	30	O	50	120	5.0A	1.0	5.0A	50	E	0.45M	T
2N2292	G	P		2N2291	AP	60W	C	110	80	70	O	50	120	5.0A	1.0	5.0A	50	E	0.45M	T
2N2293	G	P		2N2291	AP	60W	C	110	120	70	O	50	120	5.0A	1.0	5.0A	50	E	0.45M	T
2N2294	G	P			SP	70W	C	110	40	30	O	50	120	5.0A	1.0	5.0A	50	E	0.45M	T
2N2295	G	P			SP	70W	C	110	80	50	O	50	120	5.0A	1.0	5.0A	50	E	0.45M	T
2N2296	G	P			SP	70W	C	110	120	70	O	50	120	5.0A	1.0	5.0A	50	E	0.45M	T
2N2297	S	N			AH	800M	A	200	80	35	O	40	120	150M	0.2	150M			60M	T
2N2303	S	P		2N702	AH	600M	A	175	50	50	R	75	200	150M	1.5	150M	75	E	60M	T
2N2304	S	N	2N4910	2N4910	AP	25W	C	200	60	60	V	20	80	300M	0.9	300M				
2N2305	S	N	2N5068	2N5067	AP	75W	C	200	60	60	V	15	60	800M	1.2	600M				
2N2306	S	N			SHP	13W	C	175	75	50	O	12	75	0.35A	2.0	1.0A			175M	T
2N2307	Unijunction Transistors, see Table on Page 2-86																			
2N2308	S	N	2N4912	2N4910	AP	25W	C	200	100	80	O	20	60	1.0A	1.0	1.0A	15	E	30K	E
2N2309	S	N	2N2218	2N2218	A	600M	A	200	30	30	O	25	125	0.2M			40	E		
2N2310	S	N	2N3020	2N3019	A	350M	A	200	60	60	O	12	36	200M	5.0	200M				
2N2311	S	N			A	350M	A	200	100	100	O	12	36	200M	5.0	200M				
2N2312	S	N	2N3020	2N3019	A	350M	A	200	60	60	O	30	90	200M	5.0	200M				
2N2313	S	N			A	350M	A	200	100	100	O	30	90	200M	5.0	200M				
2N2314	S	N	2N2221A	2N2218	A	350M	A	200	60	40	R	20	60	150M	5.0	150M	15	E	40M	T
2N2315	S	N	2N2221A	2N2218	A	350M	A	200	60	40	R	40	120	150M	1.5	150M	25	E	50M	T
2N2316	S	N	2N3020	2N3019	A	350M	A	200	120	80	R	40	120	150M	5.0	150M	30	E	50M	T
2N2317	S	N	2N2193	2N2192	A	350M	A	200	75	50	R	40	120	150M	1.5	150M	30	E	60M	T
2N2318	S	N	2N929	2N929	SH	360M	A	200	30	25	S	15		0.1M	0.35	20M			300M	T
2N2319	S	N	2N929	2N929	SH	300M	A	200	30	25	S	15		0.1M	0.35	20M			300M	T
2N2320	S	N	2N929	2N929	SH	600M	A	200	30	25	S	15		0.1M	0.35	20M			300M	T
2N2322 thru 2N2329	Thyristors, see Table on Page 2-66																			
2N2330	S	N		2N2330	SC	0.8W	A	150	30	20	O	50		10M					100M	T

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N2331	S	N		2N2330	SC	0.5W	A	150	30	20	O	50		10M					100M	T
2N2332	S	P	2N5230	2N5229	SC	0.15W	A	200	15	15	O									
2N2333	S	P	2N5229	2N5229	SC	0.15W	A	200	15	5.0	O									
2N2334	S	P	2N5230	2N5229	SC	0.15W	A	200	30	15	O									
2N2335	S	P	2N5230	2N5229	SC	0.15W	A	200	30	15	O									
2N2336	S	P	2N5231	2N5229	SC	0.15W	A	200	50	35	O									
2N2337	S	P	2N5231	2N5229	SC	0.15W	A	200	50	35	O									
2N2338	S	N	2N5877	2N5875	AP	150W	C	200	60	40	O	7.0		6.0A	1.5	3.0A	12	E	15K	E
2N2339	S	N	2N4910	2N4910	AP	40W	C	200	60	40	O	6.0		1.5A	1.5	0.3A	12	E	0.7M	T
2N2340	S	N	2N4237		AHP	15W	C	175	50	40	O	10	40	750M	4.0	750M			550K	E
2N2341	S	N	2N5334		AHP	15W	C	175	50	40	O	40	100	750M	4.0	750M			350K	E
2N2342	S	N	2N4337		AHP	15W	C	175	100	40	O	10	40	750M	3.0	750M			550K	E
2N2343	S	N	2N5334		AHP	15W	C	175	100	40	O	40	100	750M	2.5	750M			350K	E
2N2344 thru 2N2348	Thyristors, see Table on Page 2-66																			
2N2349	S	N	2N929	2N929	A	150M	A	200	40	24	O	120	250	10M	1.5	10M	60	E		
2N2350	S	N	2N2222A	2N2218	SH	400M	A	200	60	40	O	100	300	150M	0.35	150M	2.5	E		
2N2350A	S	N	2N2222A	2N2218	SH	400M	A	200	60	40	O	100	300	150M	0.25	150M	2.5	E		
2N2351	S	N	2N2193	2N2192	SH	400M	A	200	80	50	O	40	120	150M	0.35	150M	2.5	E		
2N2351A	S	N	2N2193	2N2192	SH	400M	A	200	80	50	O	40	120	150M	0.25	150M	2.5	E		
2N2352	S	N	2N2194	2N2192	SH	400M	A	200	60	40	O	20	60	150M	0.35	150M	2.5	E		
2N2352A	S	N	2N2194	2N2192	SH	400M	A	200	60	40	O	20	60	150M	0.25	150M	2.5	E		
2N2353	S	N	2N2221	2N2218	SH	400M	A	200	45	25	O	20		150M	0.35	150M	2.5	E		
2N2353A	S	N	2N2221	2N2218	SH	400M	A	200	45	25	O	20		150M	0.25	150M	2.5	E		
2N2354	G	N			A	0.18W	A	85	20	15	R	50	150	35M						
2N2356	S	N			SC	0.6W	A	200	25	7.0	O								50M	T
2N2356A	S	N			SC	0.6W	A	200	25	7.0	O								50M	T
2N2357	G	P		2N2357	SP	170W	C	110	60	30	O	30	90	20A	0.9	50A	20	E	0.6M	T
2N2358	G	P		2N2357	SP	170W	C	110	100	60	O	30	90	20A	0.9	50A	20	E	0.6M	T
2N2359	G	P		2N2357	SP	170W	C	110	120	80	O	30	90	20A	0.9	50A	20	E	0.6M	T
2N2360	G	P	2N3283	2N3283	AH	60M	A	125	20	20	O	10		2.0M						
2N2361	G	P	2N3284	2N3283	AH	60M	A	125	20	20	O	10		2.0M						
2N2362	G	P	2N3284	2N3283	AH	60M	A	100	20	20	S	10		2.0M						
2N2363	G	P			AH	75M	A	100	30	20	O	10	200	2.0M			10	E	250M	T
2N2364	S	N	2N3020	2N3019	SH	400M	A	200	120	80	O	40	120	150M	0.35	150M			50M	T
2N2364A	S	N			SH	400M	A	200	120	80	O	40	120	150M	0.25	150M			50M	T
2N2368	S	N		2N2368	SH	360M	A	200	40	40	S	20	60	10M	0.25	10M			400M	T
2N2369	S	N		2N2369	SH	360M	A	200	40	40	S	40	120	10M	0.25	10M			500M	T
2N2369A	S	N		2N2369	SH	360M	A	200	40	40	S		120	10M	0.2	10M			500M	T
2N2370	S	P			L	0.2W	A	200	15	15	O	15		25*			15	E		
2N2371	S	P			L	0.2W	A	200	15	15	O	20		25*			20	E		
2N2372	S	P			L	0.15W	A	200	15	15	O	15		25*			15	E		
2N2373	S	P			L	0.15W	A	200	15	15	O	20		25*			20	E		
2N2374	G	P			A	250M	A	100	35	35	S	100	300	100M			100	E		
2N2375	G	P			A	250M	A	100	35	35	S	35	110	100M			35	E		
2N2376	G	P	2N1193	2N1191	A	250M	A	100	35	35	S	35	110	100M			35	E		
2N2377	S	P	2N3250	2N3250	AH	150M	A	140	25	25	O	10	100	5.0M			15	E	8.0M	T
2N2378	S	P			AH	150M	A	140	10	10	O	15		15M					7.2M	T
2N2379	G	P			SP	150W	C	95	100	80	S	25	37	5.0A	1.0	15A			4.0K	E
2N2380	S	N	2N2193	2N2192	SH	600M	A	175	80	40	O	20	120	150M	1.3	150M			100M	T
2N2380A	S	N	2N2193	2N2192	SH	600M	A	175	80	40	O	20	120	150M	1.3	150M	60	E	100M	T
2N2381	G	P		2N2381	SH	300M	A	100	30	15	O	40		200M	0.40	200M			300M	T
2N2382	G	P		2N2381	SH	300M	A	100	45	20	O	40		200M	0.40	200M			300M	T
2N2383	S	N	2N4914	2N4913	AP	85W	C	180	80	60	O	20	60	1.5A	1.0	1.5A	15	E	30K	E
2N2384	S	N	2N4914	2N4913	AP	85W	C	180	80	60	O	20	60	1.5A	1.0	1.5A	15	E	30K	E
2N2386,A	Field-Effect Transistors, see Table on Page 2-78																			
2N2387	S	N			A	300M	A	175	45	45	O	40	120	10*	1.0	10M	60	E	30M	T
2N2388	S	N			A	300M	A	175	45	45	O	100	300	10*	1.0	10M	150	E	30M	T
2N2389	S	N	2N2193	2N2192	A	450M	A	200	75	50	R	40	120	150M	1.5	150M	30	E	60M	T
2N2390	S	N	2N3019	2N3019	A	450M	A	200	75	50	R	100	300	150M	1.5	150M	50	E	70M	T
2N2391	S	P	2N3250	2N3250	A	300M	A	175	25	20	O	15	45	10M	0.6	10M	15	E	140M	T
2N2392	S	P	2N3250	2N3250	A	300M	A	175	25	20	O	30	90	10M	0.6	10M	30	E	140M	T
2N2393	S	P	2N2905	2N2904	A	450M	A	175	50	35	O	20	45	150M	1.5	150M	15	E	50M	T
2N2394	S	P	2N2905	2N2904	A	450M	A	175	50	35	O	30	90	150M	1.5	150M	25	E	60M	T
2N2395	S	N	2N2219	2N2218	A	450M	A	200	60	40	O	20	60	150M	1.0	150M			40M	T
2N2396	S	N	2N2219	2N2218	A	450M	A	200	60	40	O	40	120	150M	1.0	150M			50M	T
2N2397	S	N	2N2369A	2N2369A	SH	300M	A	200	35	15	O	25	120	10M	0.30	10M			200M	T
2N2398	G	P	2N3284	2N3283	AH	60M	A	100	20	20	S	10		2.0M						
2N2399	G	P	2N3284	2N3283	AH	60M	A	100	20	20	S	10		2.0M						
2N2400	G	P	2N964	2N960	SH	150M	A	100	12	7.0	O	30		10M	0.22	10M			150M	T
2N2401	G	P	2N964	2N960	SH	150M	A	100	15	10	O	50		10M	0.2	10M			200M	T
2N2402	G	P	2N2956	2N2955	SH	150M	A	100	18	12	O	60		10M	0.2	10M			250M	T
2N2403	S	N			S	1.0W	A	200	60	60	O	20	60	0.6A	1.5	0.6A			147M	T
2N2404	S	N			S	1.0W	A	200	60	60	O	40	120	0.6A	1.5	0.6A			147M	T
2N2405	S	N		2N1893	A	5.0W	C		120	90	O	60	200	150M	0.5	150M	50	E		
2N2410	S	N		2N2410	SH	800M	A	200	60	30	O	30	120	10M					200M	T
2N2411	S	P		2N2411	SH	300M	A	200	25	20	O	20	60	10M	0.2	10M			140M	T
2N2412	S	P		2N2411	SH	300M	A	200	25	20	O	40	120	10M	0.2	10M			140M	T
2N2413	S	N	2N2221	2N2218	AH	300M	A	175	40	18	O	30	120	10M	0.4	10M			300M	T
2N2414	S	N			AL	500M	A	200	60	40	R	50	250	10M	1.2	50M	50	E	50M	T
2N2415	G	P		2N2415	AH	75M	A	100	15	10	O	10	200	2.0M			15	E	500M	T
2N2416	G	P		2N2415	AH	75M	A	100	15	10	O	8.0	20	2.0M			10	E	400M	T
2N2417 thru 2N2422	Unijunction Transistors, see Table on Page 2-86																			
2N2423	G	P		2N2423	SP	90W	C	100	100	80	V	20	100	2.0A	1.5	5.0A			3.0K	E
2N2424	S	P	2N3250	2N3250	S	375M	A	160	40	5.0	O	30	200	5.0M	0.3	15M			15M	B

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N2425	S	P	2N3250A	2N3250	A	375M	A	160	50	10	O	25	110	5.0M	0.3	15M			10M	B
2N2426	G	N			A	150M	A	100	40	25	R				0.5	100M	35	E	25K	E
2N2427	S	N			AH	0.5W	A	200	40	40	O	20	60	10*			40	E	50M	T
2N2428	G	P	2N652	2N650	A	0.5W	A	75	32	32	S	50	150	2.0M			80	E	10K	E
2N2429	G	P	2N652	2N650	A	0.5W	A	75	32	32	S	65	300	2.0M			130	E	10K	E
2N2430	G	N			A	0.28W	A	75	32	32	R	60	210	0.1A					10K	E
2N2431	G	P			A	0.55W	A	90	32	32	R	60	175	0.3A					10K	E
2N2432	S	N			SC	300M	A	175	30	30	O	50		1.0M	0.15	10M			20M	T
2N2432A	S	N			SC	300M	A	175	45	45	O	50		1.0M					20M	T
2N2433	S	N	2N2193	2N2192	SH	500M	A	200	75	45	O	40	120	150M	1.5	150M	30	E	80M	T
2N2434	S	N			SH	500M	A	200	75	45	O	100	300	150M	1.5	150M	50	E	90M	T
2N2435	S	N	2N3020	2N3019	SH	500M	A	200	120	80	O	40	120	150M	3.0	150M	30	E	80M	T
2N2436	S	N	2N3019	2N3019	SH	500M	A	200	120	80	O	100	300	150M	3.0	150M	50	E	90M	T
2N2437	S	N	2N3020	2N3019	AH	500M	A	200	100	75	O	15		10M	0.2	10M	18	E	70M	T
2N2438	S	N	2N3019	2N3019	AH	500M	A	200	100	75	O	35		10M	0.4	50M	36	E	80M	T
2N2439	S	N	2N3019	2N3019	AH	500M	A	200	100	75	O	75		10M	0.4	50M	76	E	90M	T
2N2440	S	N	2N3019	2N3019	SH	300M	A	200	120	80	O	100	300	150M	0.4	50M	50	E	90M	T
2N2443	S	N	2N3500	2N3498	AH	800M	A	200	120	100	O	50	150	50M	1.2	50M	45	E	50M	T
2N2444	G	P			AP	85W	C	110	80	80	O	90	120	3.0A	1.0	5.0A	50	E	4.5M	T
2N2445	G	P			AP	90W	C	100	100	50	O	30	60	10A	1.0	10A	30	E	0.1M	T
2N2446	G	P			SP	90W	C	100	60	50	S	15	45	5.0A	1.5	7.0A			3.0K	E
2N2447	G	P	2N1187	2N1175	A	75M	A	85	45	24	O						25	E		
2N2448	G	P	2N1187	2N1175	A	75M	A	85	45	24	O						25	E		
2N2449	G	P	2N652	2N650	A	75M	A	85	35	20	O						50	E		
2N2450	G	P	2N652	2N650	A	75M	A	85	35	20	O						50	E		
2N2451	G	P			SH	25M	A	85	6.0	5.0	O	25		10M	0.1	10M	40	E	80M	T
2N2452	S	N			AL	500M	A	200	100	80	R									
2N2453	S	N		2N2453	AM	0.5W	A	200	60	30	O	150	600	1.0M	1.0	5.0M	150	E	60M	T
2N2453A	S	N		2N2453	AM	0.5W	A	200	80	50	O	150	600	1.0M	1.0	5.0M	150	E	60M	T
2N2454	Thyristors, see Table on Page 2-66																			
2N2455	G	P			SH	150M	A	100	15	15	S	20	100	2.0M	0.19	10M	30	E	600M	T
2N2456	G	P			SH	150M	A	100	15	15	S	20	100	2.0M	0.19	10M	30	E	1.0G	T
2N2459	S	N			A	0.4W	A	200	100	60	O	10		0.1M	0.3	10M	40	E	100M	T
2N2460	S	N			A	0.4W	A	200	100	60	O	20		0.1M	0.3	10M	70	E	120M	T
2N2461	S	N			A	0.4W	A	200	100	60	O	40		0.1M	0.3	10M	115	E	140M	T
2N2462	S	N			A	0.4W	A	200	100	60	O	60		0.1M	0.3	10M	160	E	160M	T
2N2463	S	N			A	0.5W	A	200	100	60	O	10		0.1M	0.3	10M	40	E	100M	T
2N2464	S	N			A	0.5W	A	200	100	60	O	20		0.1M	0.3	10M	70	E	120M	T
2N2465	S	N			A	0.5W	A	200	100	60	O	40		0.1M	0.3	10M	115	E	140M	T
2N2466	S	N			A	0.5W	A	200	100	60	O	60		0.1M	0.3	10M	160	E	160M	T
2N2467	G	P			AP	5.0W	C	110	60	30	O	30	90	0.5A	0.4	1.0A	40	E	20M	T
2N2468	G	P			AP	5.0W	C	110	100	60	O	30	90	0.5A	0.4	1.0A	40	E	20M	T
2N2469	G	P			AP	5.0W	C	110	200	100	O	30	90	0.5A	0.4	1.0A	40	E	20M	T
2N2472	S	N	2N3500	2N3498	AP	1.0W	A	175	120	100	O	30	90	0.2A	1.7	0.2A	30	E	10M	T
2N2473	S	N	2N3500	2N3498	AP	1.0W	A	175	120	100	O	30	90	0.2A	1.7	0.2A	30	E	10M	T
2N2474	S	P			AP	250M	A	160	30	15	O	8.0		100*	0.126	10M	8.0	E		
2N2475	S	N	2N835	2N834	SH	300M	A	200	15	6.0	O	20	20	50M			6.0	E		
2N2476	S	N		2N2476	SH	2.0W	C	200	60	20	O	20		150M	0.4	150M			250M	T
2N2477	S	N		2N2476	SH	2.0W	C	200	60	20	O	40		150M	0.4	150M			250M	T
2N2478	S	N	2N2218	2N2218	SH	600M	A	175	120	40	O	30		150M	0.7	150M			200M	T
2N2479	S	N	2N2218	2N2218	SH	600M	A	175	80	40	O	30	120	150M	0.85	150M	60	E	150M	T
2N2480	S	N		2N2060	AM	0.3W	A	200	75	40	O	30	350	1.0M	1.3	50M			50M	T
2N2480A	S	N		2N2060	AM	0.3W	A	200	80	40	O	50	200	1.0M	1.2	50M	50	E	50M	T
2N2481	S	N		2N2481	SH	1.2W	C	200	40	15	O	40	120	10M	0.25	10M			300M	T
2N2482	G	N			AH	150M	A		20	15	S	25	200	2.0M			15	E		
2N2483	S	N	MM2483	MM2483	A	360M	A	200	60	60	O	40	120	10*	0.35	1.0M	80	E	12M	T
2N2484	S	N	MM2484	MM2484	A	360M	A	200	60	60	O	100	500	10*	0.35	1.0M	150	E	15M	T
2N2484A	S	N			A	360M	A	200	60	60	O	100	500	10*	0.35	1.0M	150	E	60M	T
2N2485	S	N			AHP	8.8W	C	200	120	120	O	10		0.5A					100M	T
2N2486	S	N			AHP	8.8W	C	200	140	140	O	10		0.5A					100M	T
2N2487	G	P			SH	60M	A	100	15	10	O	20		10M	0.175	40M			360M	T
2N2488	G	P			SH	60M	A	100	15	10	O	20		50M	0.175	15M			360M	T
2N2489	G	P			SH	60M	A	100	20	15	O	20		10M	0.18	10M			300M	T
2N2490	G	P		2N2490	SP	170W	C	110	70	60	S	20	40	5.0A	0.7	12A			5.0K	E
2N2491	G	P		2N2490	SP	170W	C	110	60	50	S	35	70	5.0A	0.7	12A			5.0K	E
2N2492	G	P		2N2490	SP	170W	C	110	80	70	S	25	50	5.0A	0.5	12A			5.0K	E
2N2493	G	P		2N2490	SP	170W	C	110	100	85	S	25	50	5.0A	0.5	12A			5.0K	E
2N2494	G	P			AH	83M	A	75	20	20	V	25		1.0M						
2N2495	G	P			AH	125M	A	100	40	40	S	25		1.0M						
2N2496	G	P			AH	100M	A	100	40	20	V	25		1.0M						
2N2497 thru 2N2500	Field-Effect Transistors, see Table on Page 2-78																			
2N2501	S	N		2N2501	SH	0.36W	A	200	40	20	O	50	150	10M	0.2	10M			350M	T
2N2502 thru 2N2508	Thyristors, see Table on Page 2-66																			
2N2509	S	N			AH	1.2W	C	200	125	80	O	25		10*	1.0	5.0M			45M	T
2N2510	S	N			AH	1.2W	C	200	100	65	O	150	500	10M	1.0	5.0M			45M	T
2N2511	S	N			AH	1.2W	C	200	80	50	O	240	750	10M	1.0	5.0M			45M	T
2N2512	G	P			AH	0.15W	A	75	70	70	R	20		1 0M			40	E	140M	T
2N2514	S	N			A	0.4W	A	200	80	60	O	15	50	5.0M	0.5	10M	20	E	30M	T
2N2515	S	N			A	0.4W	A	200	80	60	O	30	100	5.0M	0.5	10M	40	E	60M	T
2N2516	S	N			A	0.4W	A	200	80	60	O	60	200	5.0M	0.5	10M	80	E	100M	T
2N2517	S	N			A	0.4W	A	200	125	80	O	15	50	5.0M	0.5	10M	20	E	30M	T
2N2518	S	N			A	0.4W	A	200	125	80	O	30	100	5.0M	0.5	10M	40	E	60M	T
2N2519	S	N			A	0.4W	A	200	125	80	O	60	200	5.0M	0.5	10M	80	E	100M	T
2N2520	S	N			A	0.4W	A	200	60	60	O	12		1.0M	0.5	10M	18	E	50M	B
2N2521	S	N			A	0.4W	A	200	60	60	O	25		1.0M	0.5	10M	36	E	50M	B

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N2522	S	N			A	0.4W	A	200	60	60	O	50		1.0M	0.5	10M	76	E	50M	B
2N2523	S	N			A	0.4W	A	200	60	45	O	40	120	10*	0.5	10M	60	E	45M	T
2N2524	S	N			A	0.4W	A	200	60	45	O	100	300	10*	0.5	10M	150	E	45M	T
2N2525	S	N			AHP	25W	C	200	100	80	O	10		0.35A	0.8	1.0A			154M	T
2N2526	G	P		2N2526	SHP	85W	C	110	80	80	O	20	50	3.0A	0.8	10A			30K	T
2N2527	G	P		2N2526	SHP	85W	C	110	120	120	O	20	50	3.0A	0.8	10A			30K	T
2N2528	G	P		2N2526	SHP	85W	C	110	160	160	O	20	50	3.0A	0.8	10A			30K	T
2N2529	S	N	2N929	2N929	A	150M	A	175	45	40	O	10	20	1.0M	2.0	10M	12	E	6.0M	B
2N2530	S	N	2N929	2N929	A	150M	A	175	45	40	O	12	35	1.0M	2.0	10M	18	E	10M	B
2N2531	S	N	2N929	2N929	A	150M	A	175	45	40	O	20	80	1.0M	2.0	10M	36	E	12M	B
2N2532	S	N	2N929	2N929	A	150M	A	175	45	40	O	45	185	1.0M	2.0	10M	76	E	16M	B
2N2533	S	N	2N929	2N929	A	150M	A	175	45	40	O	20	55	10M	1.5	10M	19	E	10M	B
2N2534	S	N	2N929	2N929	A	150M	A	175	45	40	O	45	150	10M	1.5	10M	39	E	20M	B
2N2535	G	P			A	10W	C	100	60	30	O	40	120	0.4A	0.5	1.0A	15	E	8.0K	E
2N2536	G	P			A	10W	C	100	80	40	O	40	120	0.4A	0.5	1.0A	15	E	8.0K	E
2N2537	S	N		2N2537	SH	0.8W	A	200	60	30	O	50	150	150M	0.45	150M			250M	T
2N2538	S	N		2N2537	SH	0.8W	A	200	60	30	O	100	300	150M	0.45	150M			250M	T
2N2539	S	N		2N2537	SH	0.5W	A	200	60	30	O	50	150	150M	0.45	150M			250M	T
2N2540	S	N		2N2537	SH	0.5W	A	200	60	30	O	100	300	150M	0.45	150M			250M	T
2N2541	G	P			S	215M	A	100	30	14	O	60	250	50M	0.25	50M			10M	B
2N2542 thru 2N2550	Thyristors, see Table on Page 2-66																			
2N2551	S	P			A	0.4W	A	200	150	150	O	15	45	0.1A	1.2	0.1A				
2N2552	G	P		2N2552	AP	20W	C	100	40	40	V	20	60	1.0A	0.25	1.0A	18	E	225K	T
2N2553	G	P		2N2552	AP	20W	C	100	60	60	V	20	60	1.0A	0.25	1.0A	18	E	225K	T
2N2554	G	P		2N2552	AP	20W	C	100	80	80	V	20	60	1.0A	0.25	1.0A	18	E	225K	T
2N2555	G	P		2N2552	AP	20W	C	100	100	100	V	20	60	1.0A	0.25	1.0A	18	E	225K	T
2N2556	G	P		2N2556	AP	20W	C	100	40	40	V	20	60	1.0A	0.25	1.0A	18	E	225K	T
2N2557	G	P		2N2556	AP	20W	C	100	60	60	V	20	60	1.0A	0.25	1.0A	18	E	225K	T
2N2558	G	P		2N2556	AP	20W	C	100	80	80	V	20	60	1.0A	0.25	1.0A	18	E	225K	T
2N2559	G	P		2N2556	AP	20W	C	100	100	100	V	20	60	1.0A	0.25	1.0A	18	E	225K	T
2N2560	G	P		2N2560	AP	20W	C	100	40	40	V	20	60	3.0A	0.75	3.0A	25	E	250K	T
2N2561	G	P		2N2560	AP	20W	C	100	60	60	V	20	60	3.0A	0.75	3.0A	25	E	250K	T
2N2562	G	P		2N2560	AP	20W	C	100	80	80	V	20	60	3.0A	0.75	3.0A	25	E	250K	T
2N2563	G	P		2N2560	AP	20W	C	100	100	100	V	20	60	3.0A	0.75	3.0A	25	E	250K	T
2N2564	G	P		2N2564	AP	20W	C	100	40	40	V	20	60	3.0A	0.75	3.0A	25	E	250K	T
2N2565	G	P		2N2564	AP	20W	C	100	60	60	V	20	60	3.0A	0.75	3.0A	25	E	250K	T
2N2566	G	P		2N2564	AP	20W	C	100	80	80	V	20	60	3.0A	0.75	3.0A	25	E	250K	T
2N2567	G	P		2N2564	AP	20W	C	100	100	100	V	20	60	3.0A	0.75	3.0A	25	E	250K	T
2N2568	G	N			AHP	1.0W	C	100	32	32	S	10	60	40M	0.75	100M			600M	T
2N2569	S	N			SC	300M	A	200	20	5.0	O	50		100*					100M	T
2N2570	S	N			SC	300M	A	200	20	5.0	O	50		100*					100M	T
2N2571	S	N			SC	300M	A	200	20	15	O	50		100M					100M	T
2N2572	S	N			SC	300M	A	200	20	15	O	50		100M						
2N2573 thru 2N2579	Thyristors, see Table on Page 2-66																			
2N2580	S	N			SP	150W	C	150	400	400	O	10	40	5.0A	0.7	5.0A			30K	E
2N2581	S	N			SP	150W	C	150	400	400	O	25	65	5.0A	1.0	10A			30K	E
2N2582	S	N			SP	150W	C	150	500	500	O	10	40	5.0A	0.7	5.0A			30K	E
2N2583	S	N			SP	150W	C	150	500	500	O	25	65	5.0A	1.0	10A			30K	E
2N2584	S	N			SP	150W	C	150	600	600	O	10	40	5.0A	0.7	5.0A			30K	E
2N2585	S	N			SP	150W	C	150	600	600	O	25	65	5.0A	1.0	10A			30K	E
2N2586	S	N			A	300M	A	175	60	45	O	120	360	10*	0.5	10M	150	E	1.5K	T
2N2587	G	P			AH	150M	A	100	30	30	S	15	100	8.0M	0.5	50M	0.95	B	320M	T
2N2588	G	P			AH	150M	A	100	40	20	O	50	150	1.5M			50	E	75M	T
2N2589	S	N			SP	150W	C	200	150	150	O	17	51	7.0A	1.05	7.0A	5.0	E	0.25M	T
2N2590	S	P			AH	0.4W	A	200	100	60	O	10		0.1M	0.4	10M	40	E	50M	T
2N2591	S	P			AH	0.4W	A	200	100	60	O	20		0.1M	0.4	10M	70	E	70M	T
2N2592	S	P			AH	0.4W	A	200	100	60	O	40		0.1M	0.4	10M	115	E	90M	T
2N2593	S	P			AH	0.4W	A	200	100	60	O	60		0.1M	0.4	10M	160	E	110M	T
2N2594	S	N	2N5336	2N5336	A	5.0W	C	200	80	90	R	50	150	100M	1.0	200M	15	E	40M	T
2N2595	S	P	2N3496	2N3494	AH	0.4W	A	200	80	60	O	15	60	5.0M	0.5	10M	20	E	30M	T
2N2596	S	P	2N3496	2N3494	AH	0.4W	A	200	80	60	O	30	120	5.0M	0.5	10M	40	E	40M	T
2N2597	S	P	2N3496	2N3494	AH	0.4W	A	200	80	60	O	60	240	5.0M	0.5	10M	80	E	60M	T
2N2598	S	P	2N3497	2N3494	AH	0.4W	A	200	125	80	O	15	60	5.0M	0.5	10M	20	E	30M	T
2N2599	S	P	2N3497	2N3494	AH	0.4W	A	200	125	80	O	30	120	5.0M	0.5	10M	40	E	40M	T
2N2599A	S	P	2N3497	2N3494	AH	0.4W	A	200	125	100	O	30	120	5.0M	0.5	10M	40	E	40M	T
2N2600	S	P	2N3497	2N3494	AH	0.4W	A	200	125	80	O	60	240	5.0M	0.5	10M	80	E	60M	T
2N2600A	S	P	2N3497	2N3494	AH	0.4W	A	200	125	100	O	60	240	5.0M	0.5	10M	80	E	60M	T
2N2601	S	P	2N3798	2N3798	AH	0.4W	A	200	60	60	O	12		1.0M	0.5	10M	18	E	20M	T
2N2602	S	P	2N3798	2N3798	AH	0.4W	A	200	60	60	O	25		1.0M	0.5	10M	36	E	40M	T
2N2603	S	P	2N3799	2N3798	AH	0.4W	A	200	60	60	O	50		1.0M	0.5	10M	76	E	60M	T
2N2604	S	P		2N2604	AH	0.4W	A	200	60	45	O	40		10*	0.5	10M	60	E	30M	T
2N2605	S	P	2N3798	2N2798	AH	0.4W	A	200	60	45	O	100		10*	0.5	10M	150	E	30M	T
2N2605A	S	P			AH	0.4W	A	200	60	45	O	50	200	1.0*	0.25	10M	200	E	45M	T
2N2606 thru 2N2609	Field-Effect Transistors, see Table on Page 2-78																			
2N2610	S	N	2N929	2N929	A	0.15W	A	150	45	40	O				1.0	5.0M	4.5	E		
2N2611	S	N	2N3766	2N3766	AP	2.0W	A	175	120	100	O	7.0	36	0.2A	1.7	0.2A	12	E	4.0M	T
2N2612	G	P	2N1559	2N1539	AP	75W	C	100	65	65	V	85	250	10A	1.0	10A				
2N2613	G	P	2N1193	2N1191	A	120M	A	100	30	25	R						120	E	4.0M	B
2N2614	G	P	2N1193	2N1191	A	120M	A	100	40	35	R						100	E	4.0M	B
2N2615	S	N			AL	300M	A	200	30	15	O	20	200	3.0M	0.5	3.0M			500M	T
2N2616	S	N	2N1559	2N1539	AL	300M	A	200	30	15	O	20	200	3.0M	0.4	10M			600M	T
2N2617	S	P	2N3250	2N3250	A	0.25W	A	150	25			15	80	20M			25	E		

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N2618	S	N	2N2219	2N2218	AH	0.6W	A	200	60	40	O	25		10M			30	E	200M	T
2N2619	Thyristors, see Table on Page 2-66																			
2N2620	Field-Effect Transistors, see Table on Page 2-78																			
2N2621	G	P			AH	150M	J	100	15	15	S	15		1.0M						
2N2622	G	P			AH	150M	J	100	24	24	S	15		1.0M						
2N2623	G	P			AH	150M	J	100	32	32	S	20		1.0M						
2N2624	G	P			AH	150M	J	100	15	15	S	20		1.0M						
2N2625	G	P			AH	150M	J	100	24	24	S	15		1.0M						
2N2626	G	P			AH	150M	J	100	32	32	S	20		1.0M						
2N2627	G	P			AH	150M	J	100	15	15	S	15		1.0M						
2N2628	G	P			AH	150M	J	100	24	24	S	15		1.0M						
2N2629	G	P			AH	150M	J	100	32	32	S	10		1.0M						
2N2630	G	P			SH	300M	A	100	18	10	O	25		100M	0.45	100M	3.0	E		
2N2631	S	N	2N3553	2N3375	A	8.75W	C	200	80	80	V	8.0		200M						
2N2632	S	N	2N5477	2N5477	AP	40W	C	175	90	60	O	40	120	1.0A	0.25	1.0A	40	E	20M	T
2N2633	S	N	2N5477	2N5477	AP	40W	C	175	120	80	O	40	120	1.0A	0.25	1.0A	40	E	20M	T
2N2634	S	N	2N5479	2N5477	AP	40W	C	175	150	100	O	40	120	1.0A	0.25	1.0A	40	E	20M	T
2N2635	G	P		2N2635	SH	150M	A	100	30	12	O	45	300	50M	0.2	10M			150M	T
2N2636	G	P			SP	100W	C	110	100	60	O	20	80	25A	0.65	25A			0.6M	T
2N2637	G	P			SP	100W	C	110	100	60	O	20	80	25A	0.65	25A			0.6M	T
2N2638	G	P			SP	100W	C	110	100	60	O	20	80	25A	0.65	25A			0.6M	T
2N2639	S	N		2N2639	AM	300M	A	200	45	45	O	50	300	10*	1.0	10M	65	E	35M	T
2N2640	S	N		2N2639	AM	300M	A	200	45	45	O	50	300	10*	1.0	10M	65	E	35M	T
2N2641	S	N		2N2639	AM	300M	A	200	45	45	O	50	300	10*	1.0	10M	65	E	35M	T
2N2642	S	N		2N2639	AM	300M	A	200	45	45	O	100	300	10*	1.0	10M	130	E	35M	T
2N2643	S	N		2N2639	AM	300M	A	200	45	45	O	100	300	10*	1.0	10M	130	E	35M	T
2N2644	S	N		2N2639	AM	300M	A	200	45	45	O	100	300	10*	1.0	10M	130	E	35M	T
2N2645	S	N			AM	500M	A	200	75	50	R	100	300	150M	0.4	10M	75	E	50M	T
2N2646 2N2647	Unijunction Transistors, see Table on Page 2-86																			
2N2648	G	P			S	5.0W	C	100	35	10	O	80	500	1.0A	0.4	1.0A			10M	T
2N2649	S	N			AHP	8.7W	C	200	65	65	O	10		0.5A					100M	T
2N2650	S	N			AHP	8.7W	C	200	140	140	O	10		0.5A					100M	T
2N2651	S	N	2N2501	2N2501	SH	360M	A	200	40	20	O	25		10M	0.25	10M			350M	T
2N2652	S	N		2N2652	AM	0.3W	A	200	100	60	O	50	200	1.0M	1.2	50M	50	E	60M	T
2N2652A	S	N		2N2652	AM	0.3W	A	200	100	60	O	50	200	1.0M	1.2	50M	50	E	60M	T
2N2653	Thyristors, see Table on Page 2-66																			
2N2654	G	P			AH	0.1W	A	75	25			25		1.0M						
2N2655	S	N	2N5681	2N5681	AP	15W	C	200	100	100	O	30	90	0.2A	2.0	0.2A	30	E	0.25M	E
2N2656	S	N	2N2222	2N2218	AH	0.36W	A	200	25	15	O	40	160	0.1M	0.5	10M			250M	T
2N2657	S	N	2N5336	2N5336	SP	1.25W	A	200	80	60	O	40	120	1.0A	0.5	1.0A			20M	T
2N2658	S	N	2N5336	2N5336	SP	1.25W	A	200	100	80	O	40	120	1.0A	0.5	1.0A			20M	T
2N2659	G	P			AP	15W	C	100	50	50	V	30	90	500M	0.2	500M	30	E	280K	T
2N2660	G	P			AP	15W	C	100	70	70	V	30	90	500M	0.2	500M	30	E	280K	T
2N2661	G	P			AP	15W	C	100	90	90	V	30	90	500M	0.2	500M	30	E	280K	T
2N2662	G	P			AP	15W	C	100	50	50	V	30	90	500M	0.2	500M	30	E	280K	T
2N2663	G	P			AP	15W	C	100	70	70	V	30	90	500M	0.2	500M	30	E	280K	T
2N2664	G	P			AP	15W	C	100	90	90	V	30	90	500M	0.2	500M	30	E	280K	T
2N2665	G	P			AP	15W	C	100	50	50	V	50	150	500M	0.2	500M	50	E	300K	T
2N2666	G	P			AP	15W	C	100	70	70	V	50	150	500M	0.2	500M	50	E	300K	T
2N2667	G	P			AP	15W	C	100	90	90	V	50	150	500M	0.2	500M	50	E	300K	T
2N2668	G	P			AP	15W	C	100	50	50	V	50	150	500M	0.2	500M	50	E	300K	T
2N2669	G	P			AP	15W	C	100	70	70	V	50	150	500M	0.2	500M	50	E	300K	T
2N2670	G	P			AP	15W	C	100	70	70	V	50	150	500M	0.2	500M	50	E	300K	T
2N2671	G	P			AH	0.1W	A	75	25			40		1.0M						
2N2672	G	P			AH	0.1W	A	90	25			40		1.0M						
2N2672A	G	P			AH	0.1W	A	90	32	32	S	40		1.0M						
2N2673	S	N	2N2222A	2N2218	A	250M	A	200	60	45	O	8.0	22	1.0M	1.5	5.0M	9.0	E	2.5M	B
2N2674	S	N	2N2222A	2N2218	A	250M	A	200	60	45	O	12	40	1.0M	1.5	5.0M	18	E	5.0M	B
2N2675	S	N	2N2222A	2N2218	A	250M	A	200	60	45	O	22	76	1.0M	1.5	5.0M	37	E	10M	B
2N2676	S	N	2N2222A	2N2218	A	250M	A	200	60	45	O	45	290	1.0M	1.5	5.0M	76	E	10M	B
2N2677	S	N	2N2221A	2N2218	A	250M	A	200	45	35	O	20	55	1.0M	1.5	5.0M	19	E	10M	B
2N2678	S	N	2N2221A	2N2218	A	250M	A	200	45	35	O	45	150	1.0M	1.5	5.0M	39	E	20M	B
2N2679 thru 2N2690	Thyristors, see Table on Page 2-66																			
2N2691	G	P			SP	100W	C	110	100	80	O	30	100	20A	0.65	20A			6.0M	T
2N2691A	G	P			SP	170W	C	125	120	80	O	50	100	20M						
2N2692	S	N	2N929	2N929	SH	300M	A	175	45	30	O	90	360	100*	0.12	100*			42M	T
2N2693	S	N	2N929	2N929	SH	300M	A	175	45	30	O	40		10*	0.12	100*			42M	T
2N2694	S	N	2N929	2N929	SH	300M	A	175	45	20	O	20		10*	0.12	100*			42M	T
2N2695	S	P			S	360M	A	200	25	25	O	30	130	50M	0.25	50M	25	E	100M	T
2N2696	S	P		2N2696	S	360M	A	200	25	25	O	30	130	50M	0.25	50M	25	E	100M	T
2N2697	S	N	2N5478	2N5471	SP	18W	C	200	80	60	O	40	120	1.0A	0.5	1.0A			20M	T
2N2698	S	N	2N5478	2N5471	SP	18W	C	200	100	80	O	40	120	1.0A	0.5	1.0A			20M	T
2N2699	G	P	2N964	2N960	SH	150M	A	100	15	8.0	O	40	200	10M	0.18	10M			300M	T
2N2706	G	P			A	0.5W	A	75	32	32	S	65	120	20M			80	E	1.3M	B
2N2707	G	N,P	Matched Pair; 2N2430 (NPN) and 2N2706 (PNP)																	
2N2708	S	N			AH	200M	A	200	35	20	O	30	200	2.0M			30	E		
2N2709	S	P	2N2800	2N2800	A	240M	A	160	50	35	O	10	22	0.2M	0.4	8.0M			200K	B
2N2710	S	N		2N2710	SH	360M	A	200	40	20	O	40		10M	0.25	10M			500M	T
2N2711	S	N	MPS2711	MPS2711	A	0.2W	A	125	18	18	O	30	90	2.0M			30	E		
2N2712	S	N	MPS2712	MPS2711	A	0.2W	A	125	18	18	O	75	225	2.0M			80	E		
2N2713	S	N	MPS2713	MPS2713	A	0.2W	A	125	18	18	O	30	90	2.0M	0.3	50M	30	E		
2N2714	S	N	MPS2714	MPS2713	A	0.2W	A	125	18	18	O	75	225	2.0M	0.3	50M	80	E		
2N2715	S	N	MPS2715		A	0.2W	A	125	18	18	O	30	90	2.0M			30	E		
2N2716	S	N	MPS2716		A	0.2W	A	125	18	18	O	75	225	2.0M			80	E		
2N2717	G	P			SH	0.1W	A	75	20	15	O	50		30M	0.35	10M			300M	T

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N2718	G	P			SH	240M	A	100	20	12	O	25		170M	0.27	170M			150M	T
2N2719	S	N			SH	300M	A	175	25	8.0	O	30		60M	0.40	60M			200M	T
2N2720	S	N		2N2720	AM	0.3W	A	200	80	60	O	30	120	0.1M	1.0	10M	30	E	80M	T
2N2721	S	N		2N2720	AM	0.3W	A	200	80	60	O	30	120	0.1M	1.0	10M	30	E	80M	T
2N2722	S	N		2N2722	AM	0.3W	A	200	45	45	O	50	250	1.0*	1.0	10M	100	E	100M	T
2N2723	S	N		2N2723	AL	0.5W	A	200	80	60	O	2K	10K	10M	1.0	10M	1500	E	100M	T
2N2724	S	N		2N2723	AL	0.5W	A	200	80	60	O	7K	50K	10M	1.0	10M	5000	E	100M	T
2N2725	S	N		2N2723	AL	0.5W	A	200	45	45	O	2K	10K	0.1M	1.0	10M	1500	E	100M	T
2N2726	S	N	2N3440		AHP	1.0W	A	200	200	200	R	30	90	0.2A	2.0	0.2A	30	E	15M	T
2N2727	S	N			AHP	1.0W	A	200	200	200	R	75	150	0.2A	2.0	0.2A	75	E	15M	T
2N2728	G	P		2N2728	SHP	170W	C	110	15	5.0	O	40	130	20A	0.1	50A			3.0K	E
2N2729	S	N			AH	300M	A	200	30	15	O	20	200	3.0M	0.4	10M			600M	T
2N2730	G	P	MP506	MP500	SP	170W	C	110	80	60	O	30	120	25A	0.25	25A			200K	T
2N2731	G	P	MP505	MP500	SP	170W	C	110	60	45	O	30	120	25A	0.25	25A			200K	T
2N2732	G	P	MP504	MP500	SP	170W	C	110	40	30		30	120	25A	0.25	25A			200K	T
2N2733	G	P	MP506	MP500	SP	140W	C	110	80	60	O	30	120	25A	0.25	25A			200K	T
2N2734	G	P	MP505	MP500	SP	140W	C	110	60	45	O	30	120	25A	0.25	25A			200K	T
2N2735	G	P	MP504	MP500	SP	140W	C	110	40	30	O	30	120	25A	0.25	25A			200K	T
2N2736	G	P	MP506	MP500	SP	140W	C	110	80	60	O	30	120	25A	0.25	25A			200K	T
2N2737	G	P	MP505	MP500	SP	140W	C	110	60	45	O	30	120	25A	0.25	25A			200K	T
2N2738	G	P	MP504	MP500	SP	140W	C	110	40	30	O	30	120	25A	0.25	25A			200K	T
2N2739	S	N	2N5885	2N5883	SP	200W	C	175	50	50	V	10		10A	1.5	10A				
2N2740	S	N	2N5629	2N5629	SP	200W	C	175	100	100	V	10		10A	1.5	10A				
2N2741	S	N	2N5631	2N5629	SP	200W	C	175	150	150	V	10		10A	1.5	10A				
2N2742	S	N			SP	200W	C	175	200	200	V	10		10A	1.5	10A				
2N2743	S	N			SP	200W	C	175	250	250	V	10		10A	1.5	10A				
2N2744	S	N			SP	200W	C	175	300	300	V	10		10A	1.5	10A				
2N2745	S	N	2N5885	2N5883	SP	200W	C	175	50	50	V	10		15A	1.5	15A				
2N2746	S	N	2N5886	2N5883	SP	200W	C	175	100	100	V	10		15A	1.5	15A				
2N2747	S	N			SP	200W	C	175	150	150	V	10		15A	1.5	15A				
2N2748	S	N			SP	200W	C	175	200	200	V	10		15A	1.5	15A				
2N2749	S	N			SP	200W	C	175	250	250	V	10		15A	1.5	15A				
2N2750	S	N			SP	200W	C	175	300	300	V	10		15A	1.5	15A				
2N2751	S	N	2N5685	2N5685	SP	200W	C	175	50	50	V	10		20A	1.5	20A				
2N2752	S	N	2N5686	2N5685	SP	200W	C	175	100	100	V	10		20A	1.5	20A				
2N2753	S	N			SP	200W	C	175	150	150	V	10		20A	1.5	20A				
2N2754	S	N			SP	200W	C	175	200	200	V	10		20A	1.5	20A				
2N2755	S	N			SP	200W	C	175	250	250	V	10		20A	1.5	20A				
2N2756	S	N			SP	200W	C	175	300	300	V	10		20A	1.5	20A				
2N2757	S	N			SP	200W	C	175	50	50	V	10		10A	1.5	10A				
2N2758	S	N			SP	200W	C	175	100	100	V	10		10A	1.5	10A				
2N2759	S	N			SP	200W	C	175	150	150	V	10		10A	1.5	10A				
2N2760	S	N			SP	200W	C	175	200	200	V	10		10A	1.5	10A				
2N2761	S	N			SP	200W	C	175	250	250	V	10		10A	1.5	70A				
2N2762	S	N			SP	200W	C	175	300	300	V	10		10A	1.5	10A				
2N2763	S	N			SP	200W	C	175	50	50	V	10		15A	1.5	15A				
2N2764	S	N			SP	200W	C	175	100	100	V	10		15A	1.5	15A				
2N2765	S	N			SP	200W	C	175	150	150	V	10		15A	1.5	15A				
2N2766	S	N			SP	200W	C	175	200	200	V	10		15A	1.5	15A				
2N2767	S	N			SP	200W	C	175	250	250	V	10		15A	1.5	15A				
2N2768	S	N			SP	200W	C	175	300	300	V	10		15A	1.5	15A				
2N2769	S	N			SP	200W	C	175	50	50	V	10		20A	1.5	20A				
2N2770	S	N			SP	200W	C	175	100	100	V	10		20A	1.5	20A				
2N2771	S	N			SP	200W	C	175	150	150	V	10		20A	1.5	20A				
2N2772	S	N			SP	200W	C	175	200	200	V	10		20A	1.5	20A				
2N2773	S	N			SP	200W	C	175	250	250	V	10		20A	1.5	20A				
2N2774	S	N			SP	200W	C	175	300	300	V	10		20A	1.5	20A				
2N2775	S	N			SP	200W	C	175	50	50	V	10		25A	1.5	25A				
2N2776	S	N			SP	200W	C	175	100	100	V	10		25A	1.5	25A				
2N2777	S	N			SP	200W	C	175	150	150	V	10		25A	1.5	25A				
2N2778	S	N			SP	200W	C	175	200	200	V	10		25A	1.5	25A				
2N2779	S	N			SP	200W	C	175	250	250	V	10		25A	1.5	25A				
2N2780	S	N			SP	200W	C	175	300	300	V	10		25A	1.5	25A				
2N2781	S	N			AHP	200W	C	175	75	30	O	7.5	75	0.35A	5.0	1.0A			75M	T
2N2782	S	N			AHP	200W	C	175	100	40	O	7.5	75	0.35A	5.0	1.0A			75M	T
2N2783	S	N			AHP	200W	C	175	100	40	O	7.5	75	0.35A	5.0	1.0A			75M	T
2N2784	S	N			SH	300M	A	200	15	6.0	O	20		30M	0.26	3.0M			1.0G	T
2N2785	S	N		2N2785	AL	500M	A	175	60	40	O	2K	20K	0.1A	1.0	15M	600	E	10M	T
2N2786	G	P			AH	1.5W	C	90	35	20	O	33	200	0.1A						
2N2786A	G	P			AH	1.5W	C	90	35	20	O	33	200	0.1A						
2N2787	S	N	2N2218	2N2218	SH	800M	A	175	75	35	O	20	50	150M	0.4	150M	15	E	250M	T
2N2788	S	N	2N2218A	2N2218	SH	800M	A	175	75	35	O	40	120	150M	0.4	150M	30	E	250M	T
2N2789	S	N	2N2219A	2N2218	SH	800M	A	175	75	35	O	100	300	150M	0.4	150M	80	E	250M	T
2N2790	S	N	2N2218	2N2218	SH	500M	A	175	75	35	O	20	60	150M	0.4	150M	15	E	250M	T
2N2791	S	N	2N2221A	2N2218	SH	500M	A	175	75	35	O	40	120	150M	0.4	150M	30	E	250E	T
2N2792	S	N	2N2222A	2N2218	SH	500M	A	175	75	35	O	100	300	150M	0.4	150M	80	E	250E	T
2N2793	G	P			AHP	170W	C	110	75	60	O	50	100	15A	0.45	50A	20	E	2.0K	E
2N2794	Field-Effect Transistors, see Table on Page 2-78																			
2N2795	G	P			SH	75M	A	100	25	15	O	50		50M	0.125	50M			300M	T
2N2796	G	P			SH	75M	A	100	20	12	O	30		50M	0.25	50M			300M	T
2N2797	G	P			SH	75M	A	100	40	20	O	40		50M	0.2	50M			150M	T
2N2798	G	P			SH	75M	A	100	60	25	O	20		50M	0.25	50M			120M	T
2N2799	G	P			SH	75M	A	100	30	15	O	20		50M	0.25	50M			120M	T
2N2800	S	P		2N2800	SH	0.8W	A	200	50	35	O	30	90	150M	0.4	150M			120M	T
2N2801	S	P		2N2800	SH	0.8W	A	200	50	35	O	75	225	150M	0.4	150M			120M	T
2N2802	S	P			AM	250M	A	200	25	20	O	20	120	100*	0.5	10M	20	E	60M	T
2N2803	S	P			AM	250M	A	200	25	20	O	20	120	100*	0.5	10M	20	E	60M	T
2N2804	S	P			AP	250M	A	200	25	20	O	20	120	100*	0.5	10M	20	E	60M	T

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N2805	S	P			AM	250M	A	200	25	20	O	40	120	100*	0.5	10M	40	E	60M	T
2N2806	S	P			AM	250M	A	200	25	20	O	40	120	100*	0.5	10M	40	E	60M	T
2N2807	S	P			AP	250M	A	200	25	20	O	40	120	100*	0.5	10M	40	E	60M	T
2N2808	S	N			AH	300M	A	200	30	10	O	20	120	2.0M	0.25	4.0M	20	E	1.0G	T
2N2808A	S	N			AH	200M	A	200	30	10	O	20	120	2.0M	0.25	4.0M	7.0	E	1.5G	T
2N2809	S	N			AH	200M	A	200	30	15	O	20	120	2.0M	0.25	4.0M	20	E	600M	T
2N2809A	S	N			AH	200M	A	200	30	15	O	20	120	2.0M	0.25	4.0M	20	E	1.0G	T
2N2810	S	N			AH	200M	A	200	24	10	O	20	120	2.0M	0.25	4.0M	20	E	600M	T
2N2810A	S	N			AH	200M	A	200	24	10	O	20	120	2.0M	0.25	4.0M	20	E	1.0G	T
2N2811	S	N	2N5477	2N5477	AP	70W	J	200	80	60	O	20	60	5.0A	0.5	5.0A	20	E	15M	T
2N2812	S	N	2N5478	2N5477	AP	70W	J	200	80	60	O	40	120	5.0A	0.5	5.0A	40	E	15M	T
2N2813	S	N	2N5477	2N5477	AP	70W	J	200	120	80	O	20	60	5.0A	0.5	5.0A	20	E	15M	T
2N2814	S	N	2N5478	2N5477	AP	70W	J	200	120	80	O	40	120	5.0A	0.5	5.0A	40	E	15M	T
2N2815	S	N	MJ7000	MJ7000	SP	200W	C	200	80	80	O	10	50	10A	1.5	10A			0.6M	T
2N2816	S	N	MJ7000	MJ7000	SP	200W	C	200	100	100	O	10	50	10A	1.5	10A			0.6M	T
2N2817	S	N			SP	200W	C	200	150	150	O	10	50	10A	1.5	10A			0.6M	T
2N2818	S	N			SP	200W	C	200	200	200	O	10	50	10A	1.5	10A			0.6M	T
2N2819	S	N	MJ7000	MJ7000	SP	200W	C	200	80	80	O	10	50	15A	1.5	15A			0.6M	T
2N2820	S	N	MJ7000	MJ7000	SP	200W	C	200	100	100	O	10	50	15A	1.5	15A			0.6M	T
2N2821	S	N			SP	200W	C	200	150	150	O	10	50	15A	1.5	15A			0.6M	T
2N2822	S	N			SP	200W	C	200	200	200	O	10	50	15A	1.5	15A			0.6M	T
2N2823	S	N	MJ7000	MJ7000	SP	200W	C	200	80	80	O	10	40	20A	1.1	20A			0.6M	T
2N2824	S	N	MJ7000	MJ7000	SP	200W	C	200	100	100	O	10	40	20A	1.1	20A			0.6M	T
2N2825	S	N			SP	200W	C	200	150	150	O	10	40	20A	1.1	20A			0.6M	T
2N2826	G	P			AP	4.5W	C	95		15	O	75	200	100M	1.0	500M				
2N2827	G	P			AP	4.5W	C	95		30	O	75	200	100M	1.0	500M				
2N2828	S	N			SP	40W	C	200	80	60	O	20	60	0.5A	0.4	0.5A			1.0M	T
2N2829	S	N	2N5477	2N5477	SP	40W	C	200	80	60	O	20	60	1.0A	0.3	1.0A			1.0M	T
2N2831	S	N	2N2221	2N2218	AH	360M	A	200	40	12	O	25		10M	0.25	10M	40	E	250M	T
2N2832	G	P		2N2832	SP	85W	C	110	80	50	O	25	100	10A	0.5	20A			10M	T
2N2833	G	P		2N3832	SP	85W	C	110	120	75	O	25	100	10A	0.5	20A			10M	T
2N2834	G	P		2N2832	SP	85W	C	110	140	100	O	25	100	10A	0.5	20A				
2N2835	G	P			A	16W	C	90	32	32	R	30	100	1.0A	0.4	1.0A			0.3M	B
2N2836	G	P	2N3612	2N3611	AP	37.5W	C	100	55	55	R	30	100						250K	B
2N2837	S	P		2N2800	SH	0.5W	A	200	50	35	O	30	90	150M	0.4	150M			120M	T
2N2838	S	P		2N2800	SH	0.5W	A	200	50	35	O	75	225	150M	0.4	150M			120M	T
2N2840	Unijunction Transistors, see Table on Page 2-86																			
2N2841 thru 2N2844	Field-Effect Transistors, see Table on Page 2-78																			
2N2845	S	N		2N2845	S	360M	A	200	60	30	O	30	120	150M	0.4	150M			250M	T
2N2846	S	N		2N2845	S	800M	A	200	60	30	O	30	120	150M	0.4	150M			250M	T
2N2847	S	N		2N2845	S	360M	A	200	60	20	O	40	140	150M	0.4	150M			250M	T
2N2848	S	N		2N2845	S	800M	A	200	60	20	O	40	140	150M	0.4	150M			250M	T
2N2849	S	N	2N5337	2N5336	SH	850M	A	200	100	80	O	100	300	1.0A	0.4	1.0A			30M	T
2N2850	S	N	2N5336	2N5336	SH	850M	A	200	100	80	O	40	120	1.0A	0.25	1.0A			30M	T
2N2851	S	N	2N5336	2N5336	SH	850M	A	200	100	80	O	40	120	1.0A	0.4	1.0A			30M	T
2N2852	S	N	2N5335	2N5334	SH	850M	A	200	100	80	O	20	60	1.0A	0.4	1.0A			30M	T
2N2853	S	N	2N5336	2N5336	SH	850M	A	200	60	40	O	40		1.0A	1.5	5.0A			30M	T
2N2854	S	N	2N5337	2N5336	SH	850M	A	200	60	40	O	100	300	1.0A	0.4	1.0A			30M	T
2N2855	S	N	2N5336	2N5336	SH	850M	A	200	60	40	O	40	120	1.0A	0.4	1.0A			30M	T
2N2856	S	N	2N5334	2N5334	SH	850M	A	200	60	40	O	20	60	1.0A	0.4	1.0A			30M	T
2N2857	S	N		2N2857	AH	200M	A	200	30	15	O	30	150	3.0M			50	E	1.0G	T
2N2858	S	N	2N5335	2N5334	SP	0.6W	C	200	100	80	O	20	60	1.0A	0.3	1.0A			1.0M	T
2N2859	S	N	2N5338	2N5336	SP	0.6W	C	200	120	100	O	20	60	1.0A	0.3	1.0A			1.0M	T
2N2860	G	P			SH	150M	A	100	18	7.0	O	40		40M	0.4	36M			250M	T
2N2861	S	P	2N3798	2N3798	A	300M	A	200	25	20	O	30	120	10*	0.2	10M	50	E	60M	T
2N2862	S	P	2N3798	2N3798	A	300M	A	200	25	20	O	12	120	10*	0.2	10M	25	E	45M	T
2N2863	S	N	2N2219	2N2218	AH	800M	A	200	60	25	O	30	200	200M	1.0	500M			150M	T
2N2864	S	N	2N2219	2N2218	AH	800M	A	200	60	25	O	20	200	200M	1.0	500M			150M	T
2N2865	S	N			AH	200M	A	200	25	13	O	20	200	4.0M	0.4	10M	20	E	600M	T
2N2866	S	N	2N5477	2N5477	AHP	40W	C	175	120	80	O	20	60	0.5A	0.75	1.0A			10M	T
2N2867	S	N	2N5478	2N5477	AHP	40W	C	175	120	80	O	40	120	0.5A	0.75	1.0A			10M	T
2N2868	S	N	2N3252	2N3252	SH	0.8W	A	200	60	40	O	40	120	0.15A	0.25	0.15A			50M	T
2N2869	G	P	MP2015		AP	30W	C	100	60	50	O	50	165	1.0A	0.75	10A			200K	T
2N2870	G	P	MP2016		AP	30W	C	100	80	50	O	50	165	1.0A	0.5	10A			200K	T
2N2871	S	P			SC	0.4W	A	200	60	60	O	15		1.0M					0.2M	T
2N2872	S	P			SC	0.4W	A	200	110	110	O	15		1.0M					0.2M	T
2N2873	G	P			AH	115M	A	100	35	35	V	40		1.0M			40	E	300M	T
2N2874	S	N			AHP	2.0W	A	175	75	40	O	7.5	75	0.35A	5.0	1.0A			140M	T
2N2875	S	P	2N6182	2N6182	AHP	20W	C	200	60	50	O	15	60	1.5A	1.5	0.5A	20	E	25M	E
2N2876	S	N			AH	17.5W	C	200	80	60	O	5.0		2.5A	1.0	2.5A			150M	T
2N2877	S	N	2N5477	2N5477	AHP	53W	C	200	80	60	O	20	60	1.0A	0.25	1.0A	20	E	30M	T
2N2878	S	N	2N5478	2N5477	AHP	53W	C	200	80	60	O	40	120	1.0A	0.25	1.0A	40	E	50M	T
2N2879	S	N	2N5477	2N5477	AHP	53W	C	200	100	80	O	20	60	1.0A	0.25	1.0A	20	E	30M	T
2N2880	S	N	2N5478	2N5477	AHP	53W	C	200	100	80	O	40	120	1.0A	0.25	1.0A	40	E	50M	T
2N2881	S	P	2N4235	2N4234	AP	8.5W	C	200	60	60	O	20	60	0.5A	0.4	0.5A	10	E	25K	E
2N2882	S	P	2N4236	2N4234	AP	8.5W	C	200	100	100	O	20	60	0.5A	0.4	0.5A	10	E	25K	E
2N2883	S	N	2N3553	2N3375	AHP	800M	A	200	40	20	O	20		100M	0.5	100M			400M	T
2N2884	S	N	2N3553	2N3375	AHP	800M	A	200	40	20	O	20		100M	0.5	100M			400M	T
2N2885	S	N			SH	0.15W	A	175	40	15	O	30	120	10M	0.4	10M			300M	T
2N2886	S	N	2N2219	2N2218	A	800M	A	200	50	40	O	22	45	5.0M	1.2	8.0M				
2N2887	S	N			AHP	25W	C	200	100	80	O	15	80	0.35A	1.2	1.0A			140M	T
2N2888 2N2889	Thyristors, see Table on Page 2-66																			
2N2890	S	N	2N3507	2N3506	AP	800M	A	200	100	80	O	30	90	1.0A	0.5	1.0A	30	E	30M	T
2N2891	S	N	2N3507	2N3506	SP	800M	A	200	100	80	O	50	150	1.0A	0.5	1.0A	50	E	30M	T
2N2892	S	N	2N5477	2N5477	SP	30W	C	200	100	80	O	30	90	1.0A	0.5	1.0A	30	E	30M	T

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N2893	S	N	2N5478	2N5477	SP	30W	C	200	100	80	O	50	150	1.0A	0.5	1.0A	50	E	30M	T
2N2894	S	P		2N2894	S	360M	A	200	12	12	O	40	150	30M	0.15	10M			400M	T
2N2894A	S	P	MM2894A	MM2894A	SP	360M	A	200	12	12	S	40		30M					800M	T
2N2895	S	N		2N2895	S	500M	A	200	120	65	O	40	120	150M	0.6	150M	50	E	120M	T
2N2896	S	N		2N2895	S	500M	A	200	140	90	O	60	200	150M	0.6	150M	50	E	120M	T
2N2897	S	N		2N2895	S	500M	A	200	60	45	O	50	200	150M	1.0	150M	50	E	120M	T
2N2898	S	N			S	500M	A	200	120	65	O	40	120	150M	0.6	150M	50	E	120M	T
2N2899	S	N			S	500M	A	200	140	90	O	60	200	150M	0.6	150M	50	E	120M	T
2N2900	S	N			S	500M	A	200	60	45	O	50	200	150M	1.0	150M	50	E	120M	T
2N2901	S	N			SC	0.36W	A	200	20	10	O	30		10M	0.15	10M			300M	T
2N2902	S	N	2N5430	2N5427	AP	40W	C	200	120	120	O	30	90	500M	7.5	500M	30	E	2.0M	T
2N2903	S	N		2N2903	AM	600M	C	200	60	30	O	125	625	1.0M	1.0	5.0M	150	E	60M	T
2N2903A	S	N		2N2903	AM	600M	C	200	60	30	O	125	625	1.0M	1.0	5.0M	150	E	60M	T
2N2904	S	P		2N2904	SH	3.0W	C	200	60	40	O	40	120	150M	0.4	150M			200M	T
2N2904A	S	P		2N2904	SH	3.0W	C	200	60	60	O	40	120	150M	0.4	150M			200M	T
2N2905	S	P		2N2904	SH	3.0W	C	200	60	40	O	100	300	150M	0.4	150M			200M	T
2N2905A	S	P		2N2904	SH	3.0W	C	200	60	60	O	100	300	150M	0.4	150M			200M	T
2N2906	S	P		2N2904	SH	1.8W	C	200	60	40	O	40	120	150M	0.4	150M			200M	T
2N2906A	S	P		2N2904	SH	1.8W	C	200	60	60	O	40	120	150M	0.4	150M			200M	T
2N2907	S	P		2N2904	SH	1.8W	C	200	60	40	O	100	300	150M	0.4	150M			200M	T
2N2907A	S	P		2N2904	SH	1.8W	C	200	60	60	O	100	300	150M	0.4	150M			200M	T
2N2908	S	N	2N5069	2N5067	AP	75W	C	200	80	80	R	12	60	1.0A	10	1.0A	10	E	1.0M	E
2N2909	S	N	2N2221A	2N2218	SH	0.4W	A	200	60	40	O	40	120	0.15A	0.25	0.15A			50M	T
2N2910	S	N	2N3409	2N3409	AM	0.3W	A	200	45	25	O	70		0.1M	1.0	10M	50	E	11M	T
2N2911	S	N	2N3766	2N3766	SP	5.0W	C	200	150	125	O	20	60	1.0A	0.3	1.0A			1.0M	T
2N2912	G	P		2N2912	SP	75W	C	110	15	6.0	O	75		10A	0.5	25A			20M	T
2N2913	S	N		2N2913	AM	300M	A	200	45	45	O	60	240	10*	0.35	1.0M			60M	T
2N2914	S	N		2N2913	AM	300M	A	200	45	45	O	150	600	10*	0.35	1.0M			60M	T
2N2915	S	N		2N2213	AM	300M	A	200	45	45	O	60	240	10*	0.35	1.0M			60M	T
2N2915A	S	N			A	300M	A	200	45	45	O						240	E	60M	T
2N2916	S	N		2N2913	AM	300M	A	200	45	45	O	150	600	10*	0.35	1.0M			60M	T
2N2916A	S	N			A	300M	A	200	45	45	O						600	E	60M	T
2N2917	S	N		2N2913	AM	0.3W	A	200	45	45	O	60	240	10*	0.35	1.0M			60M	T
2N2918	S	N		2N2913	AM	0.3W	A	200	45	45	O	150	600	10*	0.35	1.0M			60M	T
2N2919	S	N		2N2913	AM	0.3W	A	200	60	60	O	60	240	10*	0.35	1.0M			60M	T
2N2919A	S	N			A	300M	A	200	60	60	O						240	E	60M	T
2N2920	S	N		2N2913	AM	0.3W	A	200	60	60	O	150	600	10*	0.35	1.0M			60M	T
2N2920A	S	N			A	300M	A	200	60	60	O						600	E	60M	T
2N2921	S	N			A	0.2W	A	125	25	25	O						35	E		
2N2922	S	N	MPS6512	MPS6512	A	0.2W	A	125	25	25	O						55	E		
2N2923	S	N	MPS2923	MPS2923	A	0.2W	A	125	25	25	O						90	E		
2N2924	S	N	MPS2924	MPS2923	A	0.2W	A	125	25	25	O						150	E		
2N2925	S	N	MPS2925	MPS2923	A	0.2W	A	125	25	25	O						235	E		
2N2926	S	N	MPS2926	MPS2926	A	0.2W	A	125	18	18	O						35	E		
2N2927	S	P		2N2696	S	800M	A	200	25	25	O	30	130	50M	0.25	50M	25	E	100M	T
2N2928	G	P			AH	150M	A	100	15	13	O	0.8	200	2.0M			0.10		400M	T
2N2929	G	P		2N2929	AH	750M	C	100	25	10	O	10	100	10M	0.5	50M	10	E	800M	T
2N2930	G	P	2N3427	2N3427	S	250M	A	100	30	12	O	60	420	10M	0.25	100M			4.0M	B
2N2931	S	N			A	50M	A	125	5.0	5.0	O	50		50M	0.45	50M	30	E	20M	T
2N2932	S	N			A	50M	A	125	5.0	5.0	O	70		50M	0.45	50M	70	E	20M	T
2N2933	S	N			A	50M	A	125	5.0	5.0	O	50		50M	0.45	50M	45	E	20M	T
2N2934	S	N			A	50M	A	125	45	30	O	50		50M	0.45	50M	30	E	20M	T
2N2935	S	N			A	50M	A	125	45	30	O	70		50M	0.45	50M	70	E	20M	T
2N2936	S	N	2N930A	2N929	A	300M	A	175	60	55	O	100	300	10*	0.3	2.0M	150	E	30M	T
2N2937	S	N	2N930A	2N929	A	300M	A	175	60	55	O	100	300	10*	0.3	2.0M	150	E	30M	T
2N2938	S	N	2N2369A	2N2369A	SH	300M	A	200	25	13	O	30		50M	0.4	50M			500M	T
2N2939	S	N	2N2193	2N2192	AHP	0.8W	A	300	75	60	O	60	240	0.15A	0.75	0.15A			150M	T
2N2940	S	N	2N3019	2N3019	AHP	0.8W	A	300	120	80	O	60	240	0.15A	0.75	0.15A			150M	T
2N2941	S	N	2N3501	2N3498	AHP	0.8W	A	200	150	100	O	60	240	0.15A					150M	T
2N2942	G	P			SH	150M	A	100	50	25	O	50		10M	0.15	10M			150M	T
2N2943	G	P			SH	150M	A	100	30	15	O	30		10M	0.2	10M			120M	T
2N2944	S	P		2N2944	SC	400M	A	175	15	10	O	80		1.0M					10M	T
2N2944A	S	P			SC	400M	A	200	15	10	O	100		1.0M					15M	T
2N2945	S	P		2N2944	SC	400M	A	175	25	20	O	40		1.0M					5.0M	T
2N2945A	S	P			SC	400M	A	200	25	20	O	100		1.0M					10M	T
2N2946	S	P		2N2944	SC	400M	A	175	40	35	O	30		1.0M					3.0M	T
2N2946A	S	P			SC	400M	A	200	40	35	O	50		1.0M					5.0M	T
2N2947	S	N		2N2947	AP	25W	C	175	60	60	S	2.5	55	0.4A	0.5	1.0A			100M	T
2N2948	S	N		2N2947	AP	25W	C	175	40	40	S	2.5	100	0.4A	0.5	1.0A			100M	T
2N2949	S	N		2N2949	AP	6.0W	C	175	60	60	S	5.0	100	40M	0.5	0.4A			100M	T
2N2950	S	N		2N2949	AP	6.0W	C	175	60	60	S	5.0	100	40M	0.5	0.4A			100M	T
2N2951	S	N		2N2951	AP	3.0W	C	175	60	60	S	20	150	10M	0.5	0.15A			200M	T
2N2952	S	N		2N2951	AP	1.8W	C	175	60	60	S	20	150	10M	0.5	0.15A			200M	T
2N2953	G	P	2N1194	2N1191	A	120M	A	100	30	25	R	100		50M			200	E		
2N2954	S	N	2N834	2N834	SH	200M	A	200	30	20	O	25	300	2.0M			25	E	300M	T
2N2955	G	P		2N2955	SH	0.15W	A	100	40			20	60	50M	0.2	10M			200M	T
2N2956	G	P		2N2955	SH	0.15W	A	100	40			40	120	50M	0.18	10M			250M	T
2N2957	G	P		2N2955	SH	0.15W	A	100	40			60		10M	0.15	10M			300M	T
2N2958	S	N		2N2958	SH	3.0W	C	200	60	20	O	40	120	150M	0.5	150M			250M	T
2N2959	S	N		2N2958	SH	3.0W	C	200	60	20	O	100	300	150M	0.5	150M			250M	T
2N2960	S	N	2N2219A	2N2218	SH	3.0W	C	200	60	30	O	100	300	150M	0.5	150M			250M	T
2N2961	S	N	2N2219A	2N2218	SH	3.0W	C	200	60	30	O	100	300	150M	0.5	150M			250M	T
2N2962	G	P			AP	350M	A	100	40	18	O								660M	T
2N2963	G	P			AP	350M	A	100	40	18	O								660M	T
2N2964	G	P			AP	350M	A	100	30	15	O								660M	T
2N2965	G	P			AHP	350M	A	100	30	15	O								660M	T
2N2966	G	P	2N3283	2N3283	AH	60M	A	100	20	20	O	8.0	100	3.0M					500M	T
2N2967	S	N	2N929	2N929	SH	300M	A	200	12	6.0	O	20	120	10M	0.3	3.0M			400M	T

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
						P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min)	(max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N2968	S	P	2N3250	2N3250	S	150M	A	140	30	10	O	15		100*	0.6	10M			8.0M	T
2N2969	S	P	2N3250	2N3250	S	150M	A	140	30	10	O	15		100*	0.6	10M			8.0M	T
2N2970	S	P	2N3250	2N3250	S	150M	A	140	30	20	O	10		100*	0.8	10M			4.0M	T
2N2971	S	P	2N3250	2N3250	S	150M	A	140	30	20	O	10		100*	0.8	10M			4.0M	T
2N2972	S	N		2N2913	AM	0.25W	A	200	45	45	O	60	240	10*	0.35	1.0M			60M	T
2N2973	S	N		2N2913	AM	0.25W	A	200	45	45	O	150	600	10*	0.35	1.0M			60M	T
2N2974	S	N		2N2913	AM	0.25W	A	200	45	45	O	60	240	10*	0.35	1.0M			60M	T
2N2975	S	N		2N2913	AM	0.25W	A	200	45	45	O	150	600	10*	0.35	1.0M			60M	T
2N2976	S	N		2N2913	AM	250M	A	200	45	45	O	60	240	10*	0.35	1.0M			60M	T
2N2977	S	N		2N2913	AM	250M	A	200	45	45	O	150	600	10*	0.35	1.0M			60M	T
2N2978	S	N		2N2913	AM	250M	A	200	60	60	O	60	240	10*	0.35	1.0M			60M	T
2N2979	S	N		2N2913	AM	0.25W	A	200	60	60	O	150	600	10*	0.35	1.0M			60M	T
2N2980	S	N	2N2060A	2N2060	AM	0.25W	A	200	100	60	O	25	75	10*	1.2	50M	50	E	60M	T
2N2981	S	N	2N2223	2N2060	AM	0.25W	A	200	100	60	O	50	200	10M	1.2	50M	40	E	50M	T
2N2982	S	N	2N2223A	2N2060	AM	0.25W	A	200	100	60	O	50	200	10M	1.2	50M	40	E	50M	T
2N2983	S	N	2N5335	2N5334	AP	1.0W	A	175	155	80	O	20	60	500M	0.6	1.0A	20	E	60M	T
2N2984	S	N	2N5682	2N5681	AP	1.0W	A	175	185	120	O	20	60	500M	0.8	200M	20	E	60M	T
2N2985	S	N	2N5338	2N5336	AP	1.0W	A	175	155	80	O	40	120	500M	0.8	200M	40	E	60M	T
2N2986	S	N			AP	1.0W	A	175	185	120	O	40	120	500M	0.8	200M	40	E	60M	T
2N2987	S	N	2N5335	2N5334	AP	1.0W	A	200	95	80	O	25	75	200M	0.8	200M	25	E	30M	T
2N2988	S	N	2N5681	2N5681	AP	1.0W	A	200	155	100	O	25	75	200M	0.8	200M	25	E	30M	T
2N2989	S	N	2N5337	2N5336	AP	1.0W	A	200	95	80	O	60	120	200M	0.8	200M	50	E	30M	T
2N2990	S	N	2N5339	2N5336	AP	1.0W	A	200	155	100	O	60	120	200M	0.8	200M	50	E	30M	T
2N2991	S	N	2N5447	2N5447	AP	2.0W	A	200	95	80	O	25	75	200M	0.8	200M	25	E	30M	T
2N2992	S	N	2N5479	2N5477	AP	2.0W	A	200	155	100	O	20		1.0M	0.8	200M	25	E	30M	T
2N2993	S	N	2N5478	2N5477	AP	2.0W	A	200	95	80	O	60	120	200M	0.8	200M	50	E	30M	T
2N2994	S	N	2N5480	2N5477	AP	2.0W	A	200	155	100	O	60	120	200M	0.8	200M	50	E	30M	T
2N2995	S	N			AHP	1.5W	A	175	120	100	O	25	90	0.2A	1.7	0.2A	30	E	10M	T
2N2996	G	P			AH	75M	A	100	15	10	O	25	500	4.0M			35	E	400M	T
2N2997	G	P			AH	75M	A	100	30	15	O	40	500	4.0M			50	E	400M	T
2N2998	G	P			AH	75M	A	100	15	12	O	15	300	3.0M			20	E	600M	T
2N2999	G	P	2N3283	2N3283	AH	75M	A	100	15	10	O	10		3.0M			15	E	1.4G	T
2N3001 thru 2N3008	Thyristors, see Table on Page 2-66																			
2N3009	S	N		2N3009	SH	360M	A	200	40	15	O	30	120	30M	0.18	30M			350M	T
2N3010	S	N		2N3010	SH	300M	A	200	15	6.0	O	25	125	10M	0.25	10M			600M	T
2N3011	S	N		2N3011	SH	360M	A	200	30	12	O	30	120	10M	0.2	10M			400M	T
2N3013	S	N		2N3009	SH	360M	A	200	40	15	O	30	120	30M	0.18	30M			350M	T
2N3014	S	N		2N3009	SH	360M	A	200	40	20	O	30	120	30M	0.18	10M			350M	T
2N3015	S	N		2N3015	SH	800M	A	200	60	30	O	30	120	150M	0.4	150M			250M	T
2N3016	S	N			AHP	3.33W	C	150	100	50	O	60	150	1.0A	0.75	1.0A			200M	T
2N3017	S	N			AHP	3.33W	C	150	100	50	O	60	150	1.0A	0.75	5.0A			200M	T
2N3018	S	N			AHP	25W	C	150	100	50	O	60	150	1.0A	0.75	5.0A			200M	T
2N3019	S	N		2N3019	AH	0.8W	A	200	140	80	O	100	300	0.15A	0.2	0.15A	80	E	100M	T
2N3020	S	N		2N3019	AH	0.8W	A	200	140	80	O	40	120	0.15A	0.2	0.15A	30	E	80M	T
2N3021	S	P		2N3021	SHP	25W	C	175	30	30	O	20	60	1.0A	1.5	3.0A			60M	T
2N3022	S	P		2N3021	SHP	25W	C	175	45	45	O	20	60	1.0A	1.5	3.0A			60M	T
2N3023	S	P		2N3021	SHP	25W	C	175	60	60	O	20	60	1.0A	1.5	3.0A			60M	T
2N3024	S	P		2N3021	SHP	25W	C	175	30	30	O	50	180	1.0A	1.0	3.0A			60M	T
2N3025	S	P		2N3021	SHP	25W	C	175	45	45	O	50	180	1.0A	1.0	3.0A			60M	T
2N3026	S	P		2N3021	SHP	25W	C	175	60	60	O	50	180	1.0A	1.0	3.0A			60M	T
2N3027 thru 2N3032	Thyristors, see Table on Page 2-66																			
2N3033	S	N			AL	300M	A	175	100	100	R				1.0	100M				
2N3034	S	N			AL	300M	A	175	70	70	R				1.0	100M				
2N3035	S	N			AL	300M	A	175	50	50	R				1.0	100M				
2N3036	S	N			A	800M	A	200	120	80	O	50	150	150M	0.25	150M	40	E	50M	T
2N3037	S	N	2N3036	2N3036	A	360M	A	175	120	70	O	40	120	150M	0.2	10M	30	E	50M	T
2N3038	S	N			A	360M	A	175	100	60	O	80	240	150M	0.2	10M	60	E	50M	T
2N3039	S	P			A	360M	A	175	50	35	O	20	80	150M			20	E	50M	T
2N3040	S	P			A	360M	A	175	40	30	O	40	160	150M	0.2	10M	40	E	50M	T
2N3043	S	N		2N3043	AM	250M	A	200	45	45	O	100	300	10*	1.0	10M	130	E	30M	T
2N3044	S	N		2N3043	AM	250M	A	200	45	45	O	100	300	10*	1.0	10M	130	E	30M	T
2N3045	S	N		2N3043	A	250M	A	200	45	45	O	100	300	10*	1.0	10M	130	E	30M	T
2N3046	S	N		2N3043	AM	250M	A	200	45	45	O	50	200	10*	1.0	10M	65	E	30M	T
2N3047	S	N		2N3043	AM	250M	A	200	45	45	O	50	200	10*	1.0	10M	65	E	30M	T
2N3048	S	N		2N3043	A	250M	A	200	45	45	O	50	200	10*	1.0	10M	65	E	30M	T
2N3049	S	P		MD3250AF	AM	250M	A	200	25	20	O	20	120	10*	0.2	10M	30	E	60M	T
2N3050	S	P		MD3250AF	AM	250M	A	200	25	20	O	20	120	10*	0.2	10M	30	E	60M	T
2N3051	S	P		MD3250AF	A	250M	A	175	25	20	O	20	120	10*	0.2	10M	30	E	60M	T
2N3052	S	N			SH	250M	A	175	35	15	O	25	130	10M	0.25	10M			200M	T
2N3053	S	N		2N3053	SH	5.0W	C	200	60	40	O	50	250	0.15A	1.4	0.15A			100M	T
2N3053A	S	N			SP	5.0W	C	200	80	60	O	50	250	150M	0.3	150M	25	E	100M	T
2N3054	S	N	2N3054A	2N3054	AP	25W	C	200	90	60	R	25	100	0.5A	1.0	0.5A	25	E	30K	E
2N3054A	S	N	2N3054A		AP	75W	C		90	60	R	25	100	0.5A	1.0	0.5A	25	E	30K	E
2N3055	S	N		2N3055	AP	115W	C	200	100	70	R	20	70	4.0A	1.1	4.0A	15	E	20K	E
2N3056	S	N			AH	0.4W	A	200	100	60	O	40	120	0.15A	0.25	0.15A	30	E	80M	T
2N3056A	S	N			AH	0.4W	A	200	140	80	O	40	120	0.15A	0.2	0.15A	30	E	80M	T
2N3057	S	N			AH	0.4W	A	200	100	60	O	100	300	0.15A	0.25	0.15A	80	E	100M	T
2N3057A	S	N			AH	0.4W	A	200	140	80	O	100	300	0.15A	0.2	0.15A	80	E	100M	T
2N3058	S	P			A	400M	A	200	6.0	6.0	O	40	120	100N			40	E		
2N3059	S	P			A	400M	A	200	10	10	O	100	300	10*			100	E		
2N3060	S	P			A	400M	A	200	70	60	O	30	90	1.0M			30	E		
2N3061	S	P			A	400M	A	200	70	60	O	60	180	1.0M			60	E		
2N3062	S	P			A	400M	A	200	90	80	O	20	80	1.0M			20	E		
2N3063	S	P			A	400M	A	200	90	80	O	50	150	1.0M			50	E		
2N3064	S	P			A	400M	A	200	110	100	O	15	45	1.0M			15	E		

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TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N3065	S	P			A	400M	A	200	110	100	O	30	90	1.0M			30	E		
2N3066,A thru 2N3071	Field-Effect Transistors, see Table on Page 2-78																			
2N3072	S	P		2N3072	S	800M	A	200	60	60	O	30	130	50M	0.25	50M	25	E	130M	T
2N3073	S	P		2N3072	S	360M	A	200	60	60	O	30	130	50M	0.25	50M	25	E	130M	T
2N3074	G	P			AH	0.14W	A	85	30	25	S	25	300	3.5M						
2N3075	G	P			AH	0.14W	A	85	35	25	S	20	250	3.0M						
2N3076	S	N	MJ7000	MJ7000	SHP	125W	C	175	140	50	O	30	90	7.0A	1.0	10A	60	E	50M	T
2N3077	S	N			A	0.36W	A	200	80	60	O	100	400	10*	0.35	1.0M	120	E	15M	T
2N3078	S	N			A	0.36W	A	200	80	60	O	40	120	10*	0.35	1.0M	50	E	15M	T
2N3079	S	N	2N5241	2N5241	SP	178W	C	150	200	200	O	7.0	40	5.0A	0.7	5.0A			30K	E
2N3080	S	N	2N5241	2N5241	SP	178W	C	150	300	300	O	7.0	40	5.0A	0.7	5.0A			30K	E
2N3081	S	P	2N2193	2N2192	SH	600M	A	200	70	50	O	20		500M	0.3	150M			150M	T
2N3082	S	N			SC	0.5W	A	200	25	7.0	O	100		0.25M					100M	T
2N3083	S	N			SC	0.5W	A	200	25	7.0	O	100		0.25M					100M	T
2N3084 thru 2N3089,A	Field-Effect Transistors, see Table on Page 2-78																			
2N3091 thru 2N3106	Thyristors, see Table on Page 2-66																			
2N3107	S	N			S	0.8W	A	200	100	60	O	100	300	0.15A	1.0	1.0A	60	E	70M	T
2N3108	S	N			S	800M	A	200	100	60	O	40	120	150M	0.25	150M			60M	T
2N3109	S	N			S	0.8W	A	200	80	40	O	100	300	0.15A	1.0	1.0A	60	E	70M	T
2N3110	S	N	2N2193	2N2193	S	800M	A	200	80	40	O	40	120	150M	0.25	150M			60M	T
2N3112 2N3113	Field-Effect Transistors, see Table on Page 2-78																			
2N3114	S	N		2N3114	AH	800M	A	200	150	150	O	30	120	30M	1.0	50M	25	E	40M	T
2N3115	S	N		2N2958	SH	0.4W	A	200	60	20	O	40	120	0.15A	0.5	0.15A			250M	T
2N3116	S	N		2N2958	SH	0.4W	A	200	60	20	O	100	300	0.15A	0.5	0.15A			250M	T
2N3117	S	N	2N930A	2N929	A	360M	A	200	60	60	O	250	500	10*	0.35	1.0M	400	E	60M	T
2N3118	S	N			AH	1.0W	A	200	85	60	O	50	275	25M					250M	T
2N3119	S	N	2N3501	2N3498	SH	1.0W	A	200	100	80	O	50	200	100M	0.5	100M			250M	T
2N3120	S	P			S	800M	A	200	45	45	O	30	130	50M	0.25	50M	25	E	130M	T
2N3121	S	P			S	360M	A	200	45	45	O	30	130	50M	0.25	50M	25	E	130M	T
2N3122	S	N	2N2219A	2N2218	A	800M	A	200	50	30	O	25	100	300M	1.5	300M			60M	T
2N3123	S	N	2N2219A	2N2218	SH	0.8W	A	175	60	30	O	100	300	0.15A	0.4	0.15A			400M	T
2N3124	G	P		2N3124	AP	90W	C	100	40	30	S	50	100	10A	0.5	10A	20	E	2.5K	E
2N3125	G	P		2N3124	AP	90W	C	100	80	80	S	30	75	3.0A	1.5	3.0A	10	E	5.0K	E
2N3126	G	P		2N3124	AP	90W	C	100	100	75	S	10	30	10A	1.0	10A	10	E	6.0K	E
2N3127	G	P		2N3127	AH	0.1W	A	100	30	20	O	20	75	3.0M	0.3	5.0M	20	E	400M	T
2N3128	S	N			A	0.15W	A	150	20	20	O	50	150	0.1M	0.25	1.0M	75	E	60M	T
2N3129	S	N			A	0.15W	A	150	45	45	O	100	300	10N	0.25	1.0M	160	E	60M	T
2N3130	S	N			A	0.15W	A	150	60	60	O	60	180	10N	0.25	1.0M	110	E	60M	T
2N3131	S	N			SH	0.15W	A	150	40	15	O	30	120	10M	0.25	10M			250M	T
2N3132	G	P		2N3132	SP	90W	C	100	100	70	S	40	200	2.0A	1.5	5.0A			3.0K	E
2N3133	S	P		2N3133	SH	0.6W	A	200	50	35	O	40	120	0.15A	0.6	0.15A			200M	T
2N3134	S	P		2N3133	SH	0.6W	A	200	50	35	O	100	300	0.15A	0.6	0.15A			200M	T
2N3135	S	P		2N3133	SH	0.4W	A	200	50	35	O	40	120	0.15A	0.6	0.15A			200M	T
2N3136	S	P		2N3133	SH	0.4W	A	200	50	35	O	100	300	0.15A	0.6	0.15A			200M	T
2N3137	S	N			AH	600M	A	200	40	20	O				0.3	50M			500M	T
2N3138	S	N	2N5477	2N5477	AHP	20W	C	200	65	65	O	10		1.0A					100M	T
2N3139	S	N			AHP	20W	C	200	140	140	O	10		1.0A					100M	T
2N3140	S	N	2N5477	2N5477	AHP	20W	C	200	65	65	O	10		1.0A					100M	T
2N3141	S	N			AHP	20W	C	200	140	140	O	10		1.0A					100M	T
2N3142	S	N	2N5477	2N5477	AHP	25W	C	200	65	65	O	10		1.0A					100M	T
2N3143	S	N			AHP	25W	C	200	140	140	O	10		1.0A					100M	T
2N3144	S	N	2N5477	2N5477	AHP	25W	C	200	65	65	O	10		1.0A					100M	T
2N3145	S	N			AHP	25W	C	200	140	140	O	10		1.0A					100M	T
2N3146	G	P	2N3616	2N3615	AP	150W	C	100	150	140	V	30	90	5.0A	0.4	5.0A	20	E	200K	T
2N3147	G	P	2N3616	2N3615	AP	150W	C	100	180	160	V	30	90	5.0A	0.4	5.0A	20	E	200K	T
2N3148	G	P			S	0.45M	A	100	11	6.0	O	70		20M	0.2	50M	80	E	25M	T
2N3149	S	N			SP	300W	C	200	80	80	O	10		50A	1.5	50A			0.1M	T
2N3150	S	N			SP	300W	C	200	100	100	O	10		50A	1.5	50A			0.1M	T
2N3151	S	N			SP	300W	C	200	150	150	O	10		50A	1.5	50A			0.1M	T
2N3152	S	N			SH	25M	C	200	120	120	O	40		30M			20	E	200M	T
2N3153	S	N			SC	0.3W	A	200	15	15	O								30M	T
2N3154	G	P			SP	37.5W	C	100	40	25	O	60	180	0.5A	1.1	3.0A			15K	E
2N3155	G	P			SP	37.5W	C	100	60	40	O	60	180	0.5A	1.1	3.0A			15K	E
2N3156	G	P			SP	37.5W	C	100	80	55	O	60	180	0.5A	1.1	3.0A			15K	E
2N3157	G	P			SP	37.5W	C	100	100	65	O	60	180	0.5A	1.1	3.0A			15K	E
2N3158	G	P			SP	37.5W	C	100	40	25	O	30	75	0.5A	1.4	3.0A			10K	E
2N3159	G	P			SP	37.5W	C	100	60	40	O	30	75	0.5A	1.4	3.0A			10K	E
2N3160	G	P			SP	37.5W	C	100	80	55	O	30	75	0.5A	1.4	3.0A			10K	E
2N3161	G	P			SP	37.5W	C	100	100	65	O	30	75	0.5A	1.4	3.0A			10K	E
2N3162	S	N	2N3411	2N3409	AM	300M	A	200	45	25	O	50	200	10M	0.5	10M			300M	T
2N3163	S	P		2N4182	AHP	85W	C	200	40	40	O	12	36	1.0A	0.75	1.0A	10	E	1.0M	T
2N3164	S	P		2N4182	AHP	85W	C	200	60	60	O	12	36	1.0A	0.75	1.0A	10	E	1.0M	T
2N3165	S	P		2N4182	AHP	85W	C	200	80	80	O	12	36	1.0A	0.75	1.0A	10	E	1.0M	T
2N3166	S	P		2N4184	AHP	85W	C	200	100	100	O	12	36	1.0A	0.75	1.0A	10	E	1.0M	T
2N3167	S	P	2N4901	2N4901	AHP	85W	C	200	40	40	O	12	36	1.0A	0.75	1.0A	10	E	1.0M	T
2N3168	S	P	2N4902	2N4901	AHP	85W	C	200	60	60	O	12	36	1.0A	0.75	1.0A	10	E	1.0M	T
2N3169	S	P	2N4903	2N4901	AHP	85W	C	200	80	80	O	12	36	1.0A	0.75	1.0A	10	E	1.0M	T
2N3170	S	P	2N6226		AHP	85W	C	200	100	100	O	12	36	1.0A	0.75	1.0A	10	E	1.0M	T
2N3171	S	P			AHP	75W	C	200	40	40	O	12	36	1.0A	0.75	1.0A	10	E	1.0M	T
2N3172	S	P			AHP	75W	C	200	60	60	O	12	36	1.0A	0.75	1.0A	10	E	1.0M	T
2N3173	S	P			AHP	75W	C	200	80	80	O	12	36	1.0A	0.75	1.0A	10	E	1.0M	T

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N3174	S	P			AHP	75W	C	200	100	100	O	12	36	1.0A	0.75	1.0A	10	E	1.0M	T
2N3175	S	P	2N6182	2N6182	AHP	85W	C	200	40	40	O	10	30	2.0A	1.0	2.0A	10	E	1.0M	T
2N3176	S	P	2N6182	2N6182	AHP	85W	C	200	60	60	O	10	30	2.0A	1.0	2.0A	10	E	1.0M	T
2N3177	S	P	2N6182	2N6182	AHP	85W	C	200	80	80	O	10	30	2.0A	1.0	2.0A	10	E	1.0M	T
2N3178	S	P	2N6184	2N6182	AHP	85W	C	200	100	100	O	10	30	2.0A	1.0	2.0A	10	E	1.0M	T
2N3179	S	P	2N4901	2N4901	AHP	85W	C	200	40	40	O	10	30	2.0A	1.0	2.0A	10	E	1.0M	T
2N3180	S	P	2N4902	2N4901	AHP	85W	C	200	60	60	O	10	30	2.0A	1.0	2.0A	10	E	1.0M	T
2N3181	S	P	2N4903	2N4901	AHP	85W	C	200	80	80	O	10	30	2.0A	1.0	2.0A	10	E	1.0M	T
2N3182	S	P	2N6226		AHP	85W	C	200	100	100	O	10	30	2.0A	1.0	2.0A	10	E	1.0M	T
2N3183	S	P	2N3183		AHP	75W	C	200	40	40	O	10	30	2.0A	1.0	2.0A	10	E	1.0M	T
2N3184	S	P	2N3184		AHP	75W	C	200	60	60	O	10	30	2.0A	1.0	2.0A	10	E	1.0M	T
2N3185	S	P	2N3185		AHP	75W	C	200	80	80	O	10	30	2.0A	1.0	2.0A	10	E	1.0M	T
2N3186	S	P	2N6226		AHP	75W	C	200	100	100	O	10	30	2.0A	1.0	2.0A	10	E	1.0M	T
2N3187	S	P	2N6182	2N6182	AHP	85W	C	200	40	40	O	10	30	3.0A	0.9	3.0A	10	E	1.0M	T
2N3188	S	P	2N6182	2N6182	AHP	85W	C	200	60	60	O	10	30	3.0A	0.9	3.0A	10	E	1.0M	T
2N3189	S	P	2N6182	2N6182	AHP	85W	C	200	80	80	O	10	30	3.0A	0.9	3.0A	10	E	1.0M	T
2N3190	S	P	2N6184	2N6182	AHP	85W	C	200	100	100	O	10	30	3.0A	0.9	3.0A	10	E	1.0M	T
2N3191	S	P	2N4901	2N4901	AHP	85W	C	200	40	40	O	10	30	3.0A	0.9	3.0A	10	E	1.0M	T
2N3192	S	P	2N4902	2N4901	AHP	85W	C	200	60	60	O	10	30	3.0A	0.9	3.0A	10	E	1.0M	T
2N3193	S	P	2N4903	2N4901	AHP	85W	C	200	80	80	O	10	30	3.0A	0.9	3.0A	10	E	1.0M	T
2N3194	S	P	2N6226	2N6226	AHP	85W	C	200	100	100	O	10	30	3.0A	0.9	3.0A	10	E	1.0M	T
2N3195	S	P	2N3195		AHP	75W	C	200	40	40	O	10	30	3.0A	0.9	3.0A	10	E	1.0M	T
2N3196	S	P	2N3196		AHP	75W	C	200	60	60	O	10	30	3.0A	0.9	3.0A	10	E	1.0M	T
2N3197	S	P	2N3197		AHP	75W	C	200	80	80	O	10	30	3.0A	0.9	3.0A	10	E	1.0M	T
2N3198	S	P	2N3198		AHP	75W	C	200	100	100	O	10	30	3.0A	0.9	3.0A	10	E	1.0M	T
2N3199	S	P	2N6192	2N6190	AHP	40W	C	200	40	40	O	20	60	1.0A	0.3	1.0A	10	E	1.0M	T
2N3200	S	P	2N6192	2N6190	AHP	40W	C	200	60	60	O	20	60	1.0A	0.3	1.0A	10	E	1.0M	T
2N3201	S	P	2N6192	2N6190	AHP	40W	C	200	80	80	O	20	60	1.0A	0.3	1.0A	10	E	1.0M	T
2N3202	S	P	2N3202		AHP	8.8W	C	200	40	40	O	20	60	1.0A	0.3	1.0A	10	E	1.0M	T
2N3203	S	P	2N3203		AHP	8.8W	C	200	60	60	O	20	60	1.0A	0.3	1.0A	10	E	1.0M	T
2N3204	S	P	2N3204		AHP	8.8W	C	200	80	80	O	20	60	1.0A	0.3	1.0A	10	E	1.0M	T
2N3205	S	P	2N6182	2N6182	AHP	40W	C	200	40	40	O	20	60	0.5A	0.4	0.5A	10	E	1.0M	T
2N3206	S	P	2N6182	2N6182	AHP	40W	C	200	60	60	O	20	60	0.5A	0.4	0.5A	10	E	1.0M	T
2N3207	S	P	2N3207		AHP	40W	C	200	100	100	O	20	60	0.5A	0.4	0.5A	10	E	1.0M	T
2N3208	S	P	2N3208		AHP	8.8W	C	200	40	40	O	20	60	0.5A	0.4	0.5A	10	E	1.0M	T
2N3209	S	P		2N3209	S	0.36W	A	200	20	20	O	30	120	30M	0.2	30M			400M	T
2N3210	S	N		2N3210	SH	0.36W	A	200	40	15	O	30	120	10M	0.75	0.2A			300M	T
2N3211	S	N		2N3211	SH	0.36W	A	200	40	15	O	50	150	10M	0.2	10M			350M	T
2N3212	G	P			AP	14W	C	110	100	80	O	30	90	3.0A	0.5	5.0A	3.0	E		
2N3213	G	P			AP	14W	C	110	80	60	O	30	90	3.0A	0.5	5.0A	3.0	E		
2N3214	G	P			AP	14W	C	110	60	40	O	30	90	3.0A	0.5	5.0A	3.0	E		
2N3215	G	P			AP	14W	C	110	40	30	O	25	100	3.0A	0.5	5.0A	3.0	E		
2N3216	G	P			S	150M	A	100	20	10	O	60		200M	0.22	200M			10M	T
2N3217	S	P	2N2944	2N2944	SC	400M	A	200	15	10	O								1.0M	T
2N3218	S	P	2N2945	2N2944	SC	400M	A	200	25	20	O								1.0M	T
2N3219	S	P	2N2945	2N2944	SC	400M	A	200	40	35	O								1.0M	T
2N3220	S	N	2N5477	2N5477	AHP	6.0W	C	175	100	80	O	20	60	1.0A	1.25	1.0A	20	E	10M	T
2N3221	S	N	2N5477	2N5477	AHP	6.0W	C	175	100	80	O	40	120	1.0A	1.25	1.0A	40	E	10M	T
2N3222	S	N	2N5477	2N5477	AHP	6.0W	C	175	80	60	O	20	60	1.0A	1.25	1.0A	20	E	10M	T
2N3223	S	N	2N5479	2N5477	AHP	6.0W	C	175	80	60	O	40	120	1.0A	1.25	1.0A	40	E	10M	T
2N3224	S	P	2N3498	2N3498	AH	0.7W	A	200	100	100	O	20	60	50M			20	E	60M	T
2N3225	S	P	2N3498	2N3498	AH	0.7W	A	200	100	100	O	40	120	50M			40	E	80M	T
2N3226	S	N	2N5873	2N5871	AP	75W	C	200	35	35	O	20	50	2.0A	1.2	2.7A	20	E	30K	E
2N3227	S	N		2N2369	SH	0.36W	A	200	40	20	O	100	300	10M	0.25	10M			500M	T
2N3228	Thyristors, see Table on Page 2-66																			
2N3229	S	N			AHP	17.5W	C	200	105	60	O	5.0		2.5A	1.0	2.5A			150M	T
2N3230	S	N			SHP	25W	C	200	80	60	O	2K	20K	2.0A	1.4	2.0A			40M	T
2N3231	S	N			SHP	25W	C	200	100	80	O	2K	20K	2.0A	1.4	2.0A			40M	T
2N3232	S	N		2N3232	AHP	117W	C	200	80	60	O	18	55	3.0A	2.5	3.0A	10	E	1.0M	E
2N3233	S	N	2N3233		AHP	117W	C	200	110	100	O	18	55	3.0A	2.5	3.0A	10	E	1.0M	E
2N3234	S	N	2N5760		AHP	117W	C	200	160	160	O	18	55	3.0A	2.5	3.0A	10	E	1.0M	E
2N3235	S	N	2N3235	2N3232	AHP	117W	C	200	65	55	O	20	70	4.0A	1.1	4.0A	10	E	1.0M	E
2N3236	S	N	2N3236		AHP	150W	C	200	90	90	O	17	60	5.0A	1.1	5.0A	10	E	1.0M	E
2N3237	S	N	2N3237		AHP	200W	C	200	90	75	O	12	36	10A	2.0	10A	10	E	1.0M	E
2N3238	S	N	2N3239		AHP	150W	C	200	80	80	O	8.5	25	10A	3.0	10A	10	E	1.0M	E
2N3239	S	N	2N5882	2N5879	AHP	150W	C	200	80	80	O	8.5	25	10A	1.0	10A	10	E	1.0M	E
2N3240	S	N	2N5631	2N5629	AHP	150W	C	200	160	160	O	8.5	25	10A	1.0	10A	10	E	1.0M	E
2N3241	S	N	2N2219	2N2218	A	0.5W	A	175	30	25	O	50	300	10M			70	E	50M	T
2N3241A	S	N			A	500M	A	175	30	25	O						175	E	100M	T
2N3242	S	N			A	0.5W	A	175	30	25	O	75		10M			100	E	50M	T
2N3242A	S	N			A	500M	A	175	40	40	O						200	E	100M	T
2N3244	S	P		2N3244	SH	1.0W	A	200	40	40	O	50	150	0.5A	0.3	0.15A			175M	T
2N3245	S	P		2N3244	SH	1.0W	A	200	50	50	O	30	90	0.5A	0.35	0.15A			150M	T
2N3246	S	N	2N930A	2N929	SH	0.35W	A	200	60	45	O	200	600	10*	0.5	5.0M	200	E	60M	T
2N3247	S	N	2N930A	2N929	SH	0.15W	A	150	60	45	O	200	600	10*	0.5	5.0M	200	E	60M	T
2N3248	S	P		2N3248	SH	0.36W	A	200	15	12	O	50	150	0.1M	0.125	10M			250M	T
2N3249	S	P		2N3248	SH	0.36W	A	200	15	12	O	100	300	0.1M	0.125	10M			300M	T
2N3250	S	P		2N3250	SH	0.36W	A	200	50	40	O	50	150	10M	0.25	10M	50	E	250M	T
2N3250A	S	P		2N3250	SH	0.36W	A	200	60	60	O	50	150	10M	0.25	10M	50	E	250M	T
2N3251	S	P		2N3250	SH	0.36W	A	200	50	40	O	100	300	10M	0.25	10M	100	E	300M	T
2N3251A	S	P		2N3250	SH	0.36W	A	200	60	60	O	100	300	10M	0.25	10M	100	E	300M	T
2N3252	S	N		2N3252	SH	1.0W	A	200	60	30	O	30	90	0.5A	0.3	0.15A			200M	T
2N3253	S	N		2N3252	SH	1.0W	A	200	75	40	O	25	75	375M	0.35	0.15A			175M	T
2N3254 thru 2N3259	Thyristors, see Table on Page 2-66																			
2N3260	S	N			SP	200W	C	200	200	200	O	10	40	20A	1.5	20A			0.6M	T
2N3261	S	N			SH	0.3W	A	175	40	15	O	40	150	10M	0.35	0.1A			600M	T

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TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N3262	S	N			SH	8.75W	C	200	100	80	O	40		0.5A	0.6	1.0A			150M	T
2N3263	S	N			SP	75W	C	200	150	90	O	20	55	15A	1.0	20A			20M	T
2N3264	S	N			SP	75W	C	200	120	60	O	20	80	15A	1.6	20A			20M	T
2N3265	S	N			SP	125W	C	200	150	90	O	20	55	15A	1.0	20A			20M	T
2N3266	S	N			SP	125W	C	200	120	60	O	20	80	15A	1.6	20A			20M	T
2N3267	G	P			AH	75M	A	100	15	8.0	O	10	500	3.0M			15	E	900M	T
2N3268	S	N			A	0.15W	A	200	45	45	O	12	80	10M	1.0	5.0M	40	E	2.5M	B
2N3269 thru 2N3276	Thyristors, see Table on Page 2-66																			
2N3277 2N3278	Field-Effect Transistors, see Table on Page 2-78																			
2N3279	G	P		2N3279	AH	0.1W	A	100	30	20	O	10	70	3.0M	0.3	5.0M	10	E	400M	T
2N3280	G	P		2N3279	AH	0.1W	A	100	30	20	O	10	70	3.0M	0.3	5.0M	10	E	400M	T
2N3281	G	P		2N3279	AH	0.1W	A	100	30	15	O	10	100	3.0M	0.5	5.0M	10	E	300M	T
2N3282	G	P		2N3279	AH	0.1W	A	100	30	15	O	10	100	3.0M	0.5	5.0M	10	E	300M	T
2N3283	G	P		2N3283	AH	0.1W	A	100	25	25	S	10		3.0M			10	E	250M	T
2N3284	G	P		2N3283	AH	0.1W	A	100	25	25	S	10		3.0M			10	E	250M	T
2N3285	G	P		2N3283	AH	0.1W	A	100	20	20	S	5.0		3.0M			5.0	E	250M	T
2N3286	G	P		2N3283	AH	0.1W	A	100	20	20	S	5.0		3.0M			5.0	E	250M	T
2N3287	S	N		2N3287	AH	0.2W	A	200	40	20	O	15	100	2.0M	0.3	5.0M	15	E	350M	T
2N3288	S	N		2N3287	AH	0.2W	A	200	40	20	O	15	100	2.0M	0.3	5.0M	15	E	350M	T
2N3289	S	N		2N3287	AH	0.2W	A	200	30	15	O	10	150	2.0M	0.4	5.0M	10	E	300M	T
2N3290	S	N		2N3287	AH	0.2W	A	200	30	15	O	10	150	2.0M	0.4	5.0M	10	E	300M	T
2N3291	S	N		2N3291	AH	0.2W	A	200	25	25	S	10		2.0M			10	E	250M	T
2N3292	S	N		2N3291	AH	0.2W	A	200	25	25	S	10		2.0M			10	E	250M	T
2N3293	S	N		2N3291	AH	0.2W	A	200	20	20	S	10		2.0M			10	E	250M	T
2N3294	S	N		2N3291	AH	0.2W	A	200	20	20	S	10		2.0M			10	E	250M	T
2N3295	S	N		2N3295	AHP	800M	A	175	60	60	S	20	60	10M	0.5	0.15A			200M	T
2N3296	S	N		2N3296	AHP	700M	A	175	60	60	S	5.0	50	40M	0.5	0.4A			100M	T
2N3297	S	N		2N3297	AHP	25W	C	175	60	60	S	6.0	60	0.4A	0.5	1.0A			50M	T
2N3298	S	N		2N3298	AHP	1.0W	C	175	25	15	O	80	240	10M					200M	T
2N3299	S	N		2N3299	SH	0.8W	A	200	60	30	O	40	120	0.15A	0.22	0.15A			250M	T
2N3300	S	N		2N3299	SH	0.8W	A	200	60	30	O	100	300	0.15A	0.22	0.15A			250M	T
2N3301	S	N		2N3299	SH	0.36W	A	200	60	30	O	40	120	0.15A	0.22	0.15A			250M	T
2N3302	S	N		2N3299	SH	0.36W	A	200	60	30	O	100	300	0.15A	0.22	0.15A			250M	T
2N3303	S	N		2N3303	SH	0.6W	A	200	25	12	O	30	120	0.3A	0.33	0.3A			450M	T
2N3304	S	P		2N3304	S	0.3W	A	200	6.0	6.0	O	30	120	10M	0.16	10M			500M	T
2N3305	S	P			A	0.6W	A	200	50	40	O	40	120	0.1M	0.2	10M	40	E	20M	T
2N3306	S	P			A	0.6W	A	200	50	40	O	100	300	0.1M	0.2	10M	70	E	20M	T
2N3307	S	P		2N3307	AH	0.2W	A	200	40	35	O	40	250	2.0M	0.4	3.0M	40	E	300M	T
2N3308	S	P		2N3307	AH	0.2W	A	200	30	25	O	25	250	2.0M	0.4	3.0M	25	E	300M	T
2N3309	S	N	2N3553	2N3375	AHP	3.5W	C	175	50	50	S	5.0	100	30M	0.5	0.25A			300M	T
2N3309A	S	N	2N3553	2N3375	AHP	5.0W	C	200	60	60	S	8.0	80	50M	0.5	0.25A			300M	T
2N3310	S	N			AHP	0.3W	A	200	35	15	O	10		20M	0.5	20M			300M	T
2N3311	G	P		2N3311	AP	170W	C	110	30	30	S	60	120	3.0A	0.1	3.0A	30	E	1.0K	E
2N3312	G	P		2N3311	AP	170W	C	110	45	45	S	60	120	3.0A	0.1	3.0A	30	E	1.0K	E
2N3313	G	P		2N3311	AP	170W	C	110	60	60	S	60	120	3.0A	0.1	3.0A	30	E	1.0K	E
2N3314	G	P		2N3311	AP	170W	C	110	30	30	S	100	200	3.0A	0.1	3.0A	40	E	1.0K	E
2N3315	G	P		2N3311	AP	170W	C	110	45	45	S	100	200	3.0A	0.1	3.0A	40	E	1.0K	E
2N3316	G	P		2N3311	AP	170W	C	110	60	60	S	100	200	3.0A	0.1	3.0A	40	E	1.0K	E
2N3317	S	P			SC	0.15W	A	140	30	30	O								6.4M	T
2N3318	S	P			SC	0.15W	A	140	15	15	O								7.6M	T
2N3319	S	P			SC	0.15W	A	140	10	6.0	O								12M	T
2N3320	G	P			SH	60M	A	100	15	10	O	50		20M	0.19	40M			600M	T
2N3321	G	P			SH	60M	A	100	12	7.0	O	100		10M	0.12	10M			600M	T
2N3322	G	P			SH	60M	A	100	12	7.0	O	30		40M	0.25	20M			600M	T
2N3323	G	P		2N3323	AH	0.15W	A	100	35	35	S	30	200	3.0M			30	E	200M	T
2N3324	G	P		2N3323	AH	0.15W	A	100	35	35	S	30	200	3.0M			30	E	200M	T
2N3325	G	P		2N3323	AH	0.15W	A	100	35	35	S	30	200	3.0M			30	E	200M	T
2N3326	S	N	2N2218A	2N2218	SH	0.8W	A	175	60	45	O	40	120	0.15A	0.4	0.15A			250M	T
2N3327	S	N			AHP	20W	C	200	65	65	O	10		0.5A					100M	T
2N3328 thru 2N3336	Field-Effect Transistors, see Table on Page 2-78																			
2N3337	S	N	2N3287	2N3287	AH	0.3W	A	200	40	40	O	30	300	4.0M			30	E	400M	T
2N3338	S	N	2N3289	2N3287	AH	0.3W	A	200	40	40	O	30	300	4.0M			30	E	400M	T
2N3339	S	N	2N3288	2N3287	AH	0.3W	A	200	40	40	O	30	300	4.0M			30	E	400M	T
2N3340	S	N			S	0.4W	A	175	30	20	O	40		10*	0.2	10*			70M	T
2N3341	S	P			S	0.4W	A	175	30	20	O	40		10*	0.25	10*			50M	T
2N3342	S	P			S	0.25W	A	175	20	8.0	O	30		5.0M	0.1	5.0M				
2N3343	S	P			SC	0.25W	A	175	25	8.0	O	20		0.25M					2.0M	T
2N3344	S	P			SC	0.25W	A	175	30	30	O	25		1.0M					2.0M	T
2N3345	S	P			SC	0.25W	A	175	50	50	O	15		1.0M					2.0M	T
2N3346	S	P			SC	0.25W	A	175	50	50	O	25		1.0M					2.0M	T
2N3347	S	P			AM	300M	A	175	60	45	O	40	300	10*	0.5	10M	60	E	60M	T
2N3348	S	P			AM	300M	A	175	60	45	O	40	300	10*	0.5	10M	60	E	60M	T
2N3349	S	P			AM	300M	A	175	60	45	O	40	300	10*	0.5	10M	60	E	60M	T
2N3350	S	P			AM	300M	A	175	60	45	O	100	300	10*	0.5	10M	150	E	60M	T
2N3351	S	P			AM	300M	A	175	60	45	O	100	300	10*	0.5	10M	150	E	60M	T
2N3352	S	P			AM	300M	A	175	60	45	O	100	300	10*	0.5	10M	150	E	60M	T
2N3353 thru 2N3364	Thyristors, see Table on Page 2-66																			
2N3365 thru 2N3370	Field-Effect Transistors, see Table on Page 2-78																			
2N3371	G	P			AH	150M	A	100	25	10	O	20	300	12M			25	E	320M	T

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N3374	S	N	2N3500	2N3498	AHP	5.0W	C	200	80	80	O	10		0.17A	0.3	0.15A			230M	T
2N3375	S	N		2N3375	AHP	11.6W	C	200	65	40	O	10	100	0.25A	1.0	0.25A			400M	T
2N3376 thru 2N3387	Field-Effect Transistors, see Table on Page 2-78																			
2N3388	S	N			S	0.6W	A	175	125	100	O	60		2.5M	1.0	2.5M			36M	T
2N3389	S	N			S	0.6W	A	175	195	160	O	60		7.0M	1.0	7.0M			36M	T
2N3390	S	N	MPS6521	MPS6512	A	0.2W	A	125	25	25	O	400	800	2.0M			400	E		
2N3391	S	N	MPS6515	MPS6512	A	0.2W	A	125	25	25	O	250	500	2.0M			250	E		
2N3391A	S	N	MPS6520	MPS6512	A	0.2W	A	125	25	25	O	250	500	2.0M			250	E		
2N3392	S	N	MPS3392	MPS3392	A	0.2W	A	125	25	25	O	150	300	2.0M			150	E		
2N3393	S	N	MPS3393	MPS3392	A	0.2W	A	125	25	25	O	90	180	2.0M			90	E		
2N3394	S	N	MPS3394	MPS3392	A	0.2W	A	125	25	25	O	55	110	2.0M			55	E		
2N3395	S	N	MPS3395	MPS3392	A	0.2W	A	125	25	25	O	150	500	2.0M			150	E		
2N3396	S	N	MPS3396		A	0.2W	A	125	25	25	O	90	500	2.0M			90	E		
2N3397	S	N	MPS3397		A	0.2W	A	125	25	25	O	55	500	2.0M			55	E		
2N3398	S	N	MPS3398		A	0.2W	A	125	25	25	O	55	800	2.0M			55	E		
2N3399	G	P			AH	80M	A	100	20			10		1.5M					400M	T
2N3400	G	P			SH	0.15W	A	100	20	20	O	50	300	10M	0.15	10M			150M	T
2N3401	S	P			SC	0.25W	A	150	25	25	O				0.25	5.0M	4.0	E	0.1M	B
2N3402	S	N	MPS6513	MPS6512	A	0.56W	A	150	25	25	O	75	225	2.0M	0.3	50M	75	E		
2N3403	S	N	MPS6515	MPS6512	A	0.56W	A	150	25	25	O	180	540	2.0M	0.3	50M	180	E		
2N3404	S	N			A	0.56W	A	150	50	50	O	75	225	2.0M	0.3	50M	75	E		
2N3405	S	N			A	0.56W	A	150	50	50	O	180	540	2.0M	0.3	50M	100	E		
2N3406	Unijunction Transistors, see Table on Page 2-86																			
2N3407	S	N			AH	0.2W	A	200	35	18	O	10	100	10M			10	E	300M	T
2N3408	S	P			AH	4.0W	A	200	40	25	O	10	100	40M			10	E	200M	T
2N3409	S	N		MD3409	AM	0.5W	A	200	60	30	O	30	120	0.1M	0.15	10M			250M	T
2N3410	S	N		MD3409	AM	0.5W	A	200	60	30	O	20	100	10*	0.15	10M			250M	T
2N3411	S	N			AM	0.5W	A	200	60	30	O	20	100	10*	0.15	10M			250M	T
2N3412	G	P			A	60M	A	100	20	20	S	30	200	10M	0.2	10M	25	E	100M	T
2N3413	S	P			A	0.4W	A	200	150	150	O	10	45	50M	1.2	0.1A			0.25M	T
2N3414	S	N	MPS6513	MPS6512	A	0.36W	A	160	25	25	O	75	225	2.0M	0.3	50M	75	E		
2N3415	S	N	MPS6515	MPS6512	A	0.36W	A	160	25	25	O	180	540	2.0M	0.3	50M	180	E		
2N3416	S	N	MPS6515	MPS6512	A	0.36W	A	160	50	50	O	75	225	2.0M	0.3	50M	75	E		
2N3417	S	N	MPS6515	MPS6512	A	0.36W	A	160	50	50	O	180	540	2.0M	0.3	50M	100	E		
2N3418	S	N	2N5334	2N5334	SP	0.8W	A	175	85	60	O	20	60	1.0A	0.25	1.0A			40M	T
2N3419	S	N	2N5335	2N5334	SP	0.8W	A	175	125	80	O	20	60	1.0A	0.25	1.0A			40M	T
2N3420	S	N	2N5336	2N5336	SP	0.8W	A	175	85	60	O	40	120	1.0A	0.25	1.0A			40M	T
2N3421	S	N	2N5336	2N5336	SP	0.8W	A	175	125	80	O	40	120	1.0A	0.25	1.0A			40M	T
2N3422	Thyristors, see Table on Page 2-66																			
2N3423	S	N			AM	0.3W	A	200	30	15	O	20	200	3.0M	0.4	10M			600M	T
2N3424	S	N			AM	0.3W	A	200	30	15	O	20	200	3.0M	0.4	10M			600M	T
2N3425	S	N		2N3425	AHP	0.3W	A	200	40	15	O	30	120	10M	0.4	10M	20	E	300M	T
2N3426	S	N			SH	0.6W	A	200	25	12	O	30	120	0.3A	0.33	0.3A			450M	T
2N3427	G	P		2N3427	A	0.2W	A	100	45	30	R	100	350	0.1A	0.2	0.1A	200	E	4.0M	T
2N3428	G	P		2N3427	A	0.2W	A	100	45	30	R	150	400	0.1A	0.19	0.1A	350	E	5.0M	T
2N3429	S	N	2N5877	2N5875	SP	150W	C	175	50	50	O	10	35	5.0A	1.0	5.0A			20K	E
2N3430	S	N	2N5632	2N5632	SP	150W	C	175	100	100	O	10	35	5.0A	1.0	5.0A			20K	E
2N3431	S	N	2N5634	2N5632	SP	150W	C	175	150	150	O	10	35	5.0A	1.0	5.0A			20K	E
2N3432	S	N			SP	150W	C	175	200	200	O	10	35	5.0A	1.0	5.0A			20K	E
2N3433	S	N			SP	150W	C	175	250	250	O	10	35	5.0A	1.0	5.0A			20K	E
2N3434	S	N			SP	150W	C	175	300	300	O	10	35	5.0A	1.0	5.0A				
2N3435	S	N			AHP	1.0W	A	200	80	60	O	50	200	10M					140M	T
2N3436 thru 2N3438	Field-Effect Transistors, see Table on Page 2-78																			
2N3439	S	N	2N3439	2N3439	AH	1.0W	A	200	450	350	O	40	160	20M			25	E	15M	T
2N3440	S	N	2N3440	2N3439	AH	1.0W	A	200	300	250	O	40	160	20M			25	E	15M	T
2N3441	S	N	2N3441		AP	25W	C	200	160	140	O	20	80	0.5A	6.0	2.7A	15	E	0.2M	T
2N3442	S	N	2N3442		AP	100W	C	200	160	140	O	20	70	3.0A	5.0	10A	12	E	80K	T
2N3443	G	P			AH	0.3W	A	100	20	15	O	20	150	10M			20	E	750M	T
2N3444	S	N		2N3252	SH	1.0W	A	200	80	50	O	20	60	0.5A	0.35	0.15A			150M	T
2N3445	S	N	2N3445	2N3445	AP	115W	C	200	80	60	O	20	60	3.0A	1.5	3.0A	20	E	10M	T
2N3446	S	N	2N3446	2N3445	AP	115W	C	200	100	80	O	20	60	3.0A	1.5	3.0A	20	E	10M	T
2N3447	S	N	2N3447	2N3445	AP	115W	C	200	80	60	O	40	120	5.0A	1.5	5.0A	40	E	10M	T
2N3448	S	N	2N3448	2N3445	AP	115W	C	200	100	80	O	40	120	5.0A	1.5	5.0A	40	E	10M	T
2N3449	G	P			SH	150M	A	100	15	6.0	O	20		10M	0.2	2.0M			300M	T
2N3450	S	N			SH	0.6W	A	200	120	60	O	40	120	0.15A	0.5	0.15A			100M	T
2N3451	S	P			SH	0.3W	A	200	6.0	6.0	O	30	120	10M	0.16	10M			500M	T
2N3452 thru 2N3460	Field-Effect Transistors, see Table on Page 2-78																			
2N3461	G	P			AP	5.0W	C	110	60	30	O	90	150	0.5A	0.4	1.0A	40	E	10K	E
2N3462	S	N			A	0.3W	A	200	50	35	O	100	300	10*	0.35	5.0M	150	E	10M	T
2N3463	S	N			A	0.3W	A	200	60	45	O	120	360	10*	0.35	1.0M	150	E	45M	T
2N3464	S	N	2N5334		AHP	5.0W	C	200	60	40	O	35	100	0.2A	1.0	0.2A	30	E	50M	T
2N3465 2N3466	Field-Effect Transistors, see Table on Page 2-78																			
2N3467	S	P		2N3467	SH	1.0W	A	200	40	40	O	40	120	0.5A	0.3	0.15A			175M	T
2N3468	S	P		2N3467	SH	1.0W	A	200	50	50	O	25	75	0.5A	0.35	0.15A			150M	T
2N3469	S	N	2N5337	2N5336	AHP	1.25W	A	200	35	25	O	100	350	0.5A	0.5	1.0A	100	E	20M	T
2N3470	S	N	2N6057		AP	150W	C	150	50	50	O	100	500	9.0A	3.5	9.0A	50	E	7.0K	E
2N3471	S	N	2N6059		AP	150W	C	150	100	100	O	100	500	9.0A	3.5	9.0A	50	E	7.0K	E
2N3472	S	N			AP	150W	C	150	150	150	O	100	500	9.0A	3.5	9.0A	50	E	7.0K	E
2N3473	S	N			AP	150W	C	150	200	200	O	100	500	9.0A	3.5	9.0A	50	E	7.0K	E
2N3474	S	N	2N6055		AP	150W	C	150	50	50	O	700	10K	4.0A	3.5	9.0A	100	E	4.0K	E
2N3475	S	N			AP	150W	C	150	100	100	O	700	10K	4.0A	3.5	9.0A	100	E	4.0K	E

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TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N3476	S	N			AP	150W	C	150	150	150	O	700	10K	4.0A	3.5	9.0A	100	E	4.0K	E
2N3477	S	N			AP	150W	C	150	200	200	O	700	10K	4.0A	3.5	9.0A	100	E	4.0K	E
2N3478	S	N			AH	0.2W	A	200	30	15	O	25	150	2.0M			25	E	750M	T
2N3479 thru 2N3484	Unijunction Transistors, see Table on Page 2-86																			
2N3485	S	P		2N2904	SH	2.0W	C	200	60	40	O	40	120	0.15A	0.4	0.15A			200M	T
2N3485A	S	P		2N2904	SH	2.0W	C	200	60	60	O	40	120	0.15A	0.4	0.15A			200M	T
2N3486	S	P		2N2904	SH	2.0W	C	200	60	40	O	100	300	0.15A	0.4	0.15A			200M	T
2N3486A	S	P		2N2904	SH	2.0W	C	200	60	60	O	100	300	0.15A	0.4	0.15A			200M	T
2N3487	S	N	2N3487	2N3487	AP	115W	C	200	80	60	O	20	60	3.0A	0.3	1.0A	20	E	10M	T
2N3488	S	N	2N3488	2N3487	AP	115W	C	200	100	80	O	20	60	3.0A	0.3	1.0A	20	E	10M	T
2N3489	S	N	2N3489	2N3487	AP	115W	C	200	120	100	O	15	45	3.0A	0.3	1.0A	20	E	10M	T
2N3490	S	N	2N3490	2N3487	AP	115W	C	200	80	60	O	40	120	5.0A	0.3	1.0A	40	E	10M	T
2N3491	S	N	2N3491	2N3487	AP	115W	C	200	100	80	O	40	120	5.0A	0.3	1.0A	40	E	10M	T
2N3492	S	N	2N3492	2N3487	AP	115W	C	200	120	100	O	30	90	5.0A	0.3	1.0A	40	E	10M	T
2N3493	S	N			SH	0.15W	A	200	12	8.0	O	40	120	0.5M	0.15	10*			400M	T
2N3494	S	P		2N3494	AH	0.6W	A	200	80	80	O	35		0.1A	0.3	10M	40	E	200M	T
2N3495	S	P		2N3494	AH	0.6W	A	200	120	120	O	35		0.1M	0.35	10M	40	E	150M	T
2N3496	S	P		2N3494	AH	0.4W	A	200	80	80	O	35		0.1A	0.3	10M	40	E	200M	T
2N3497	S	P		2N3494	AH	0.4W	A	200	120	120	O	35		0.1M	0.35	10M	40	E	150M	T
2N3498	S	N		2N3498	AH	1.0W	A	200	100	100	O	40	120	0.15A	0.2	10M	50	E	150M	T
2N3499	S	N		2N3498	AH	1.0W	A	200	100	100	O	100	300	0.15A	0.2	10M	75	E	150M	T
2N3500	S	N		2N3498	AH	1.0W	A	200	150	150	O	40	120	0.15A	0.2	10M	50	E	150M	T
2N3501	S	N		2N3498	AH	1.0W	A	200	150	150	O	100	300	0.15A	0.2	10M	75	E	150M	T
2N3502	S	P	2N2905	2N2904	SH	0.7W	A	200	45	45	O	115	300	50M	0.25	50M	135	E	200M	T
2N3503	S	P	2N2905A	2N2904	SH	0.7W	A	200	60	60	O	115	300	50M	0.25	50M	135	E	200M	T
2N3504	S	P	2N2907	2N2904	SH	0.4W	A	200	45	45	O	115	300	50M	0.25	50M	135	E	200M	T
2N3505	S	P	2N2907A	2N2904	SH	0.4W	A	200	60	60	O	115	300	50M	0.25	50M	135	E	200M	T
2N3506	S	N		2N3506	SH	1.0W	A	200	60	40	O	40	200	1.5A	1.0	1.5A			60M	T
2N3507	S	N		2N3506	SH	1.0W	A	200	80	50	O	30	150	1.5A	1.0	1.5A			60M	T
2N3508	S	N		2N3508	SH	0.4W	A	200	40	20	O	40	120	10M	0.25	10M			500M	T
2N3509	S	N		2N3508	SH	0.4W	A	200	40	20	O	100	300	10M	0.25	10M			500M	T
2N3510	S	N		2N3510	SH	0.36W	A	200	40	10	O	25	150	0.15A	0.25	10M	20	E	350M	T
2N3511	S	N		2N3510	SH	0.36W	A	200	40	15	O	30	120	0.15A	0.25	10M	20	E	450M	T
2N3512	S	N	2N2537	2N2537	SH	0.8W	A	200	60	35	O	10		0.5A	1.0	0.5A			250M	T
2N3513	S	N	2N2480A	2N2060	AM	0.25W	A	200	80	40	O	50	200	1.0M	1.2	50M	50	E	50M	T
2N3514	S	N	2N2480A	2N2060	AM	0.25W	A	175	80	40	O	50	200	1.0M	1.2	50M	50	E	50M	T
2N3515	S	N			AM	0.25W	A	175	80	40	O	50	200	1.0M	1.2	50M	50	E	50M	T
2N3516	S	N			AM	0.25W	A	200	100	60	O	50	200	1.0M	1.2	50M	50	E	60M	T
2N3517	S	N			AM	0.25W	A	175	100	60	O	50	200	1.0M	1.2	50M	50	E	60M	T
2N3518	S	N			AM	0.25W	A	175	100	60	O	50	200	1.0M	1.2	50M	50	E	60M	T
2N3519	S	N			AM	0.25W	A	175	60	30	O	150	600	1.0M	1.0	5.0M	150	E	60M	T
2N3520	S	N			AM	0.25W	A	175	60	30	O	150	600	1.0M	1.0	5.0M	150	E	60M	T
2N3521	S	N			AM	0.3W	A	200	70	55	O	100	300	10*	1.0	10M			30M	T
2N3522	S	N			AM	0.25W	A	200	70	55	O	100	300	10*	1.0	10M			30M	T
2N3523	S	N			AM	0.25W	A	175	70	55	O	100	300	10*	1.0	10M			30M	T
2N3524	S	N			AM	0.25W	A	175	70	55	O	100	300	10*	1.0	10M			30M	T
2N3525	Thyristors, see Table on Page 2-66																			
2N3526	S	N			AH	0.8W	A	200	130	120	O	30	120	30M	1.0	50M	25	E	40M	T
2N3527	S	P			A	0.4W	A	200	30	30	O	25	75	0.1N		0.1N	100	E	5.0M	T
2N3528 thru 2N3541	Thyristors, see Table on Page 2-66																			
2N3543	S	N			AHP	60W	C	200	65	60	O	10	80	4.5A	1.0	4.5A			150M	T
2N3544	S	N		2N3544	AH	0.3W	A	175	25	25	S	25		10M					600M	T
2N3545	S	P	2N3798	2N3798	SH	0.36W	A	200	20	20	O	40	120	10M	0.2	10M			250M	T
2N3546	S	P		2N3546	SH	0.36W	A	200	15	12	O	30	120	10M	0.15	10M			700M	T
2N3547	S	P	2N3799	2N3799	A	0.36W	A	200	60	60	O	100	500	1.0M	1.0	10M	120	E	45M	T
2N3548	S	P			A	0.4W	A	200	60	45	O	100	300	10*	1.0	10M	150	E	60M	T
2N3549	S	P			A	0.4W	A	200	60	60	O	100	500	10*	1.0	10M	150	E	60M	T
2N3550	S	P			A	0.4W	A	200	60	45	O	200	600	10*	0.9	5.0M	300	E	60M	T
2N3551	S	N			SHP	40W	C	175	115	60	O	20	90	10A	1.0	10A			40M	T
2N3552	S	N			SHP	40W	C	175	140	80	O	20	90	10A	1.0	10A			40M	T
2N3553	S	N	2N3553	2N3375	AHP	7.0W	C	200	65	40	O	10	100	0.25A	1.0	0.25A			400M	T
2N3554	S	N			SH	0.8W	A	200	60	30	O	25	100	0.75A	0.7	0.75A			150M	T
2N3555 thru 2N3562	Thyristors, see Table on Page 2-66																			
2N3563	S	N			AH	0.2W	A	125	30	12	O	20	200	8.0M			20	E	600M	T
2N3564	.S	N			AH	0.2W	A	125	30	15	O	20	500	15M	0.3	20M	20	E	400M	T
2N3565	S	N	MPS6514	MPS6512	A	0.2W	A	125	30	25	O	150	600	1.0M			120	E	40M	T
2N3566	S	N	MPS6514	MPS6512	A	0.3W	A	125	40	30	O	150	600	10M	1.0	0.1A			40M	T
2N3567	S	N	MPS6530	MPS6530	A	0.3W	A	125	80	40	O	40	120	0.15A	0.25	0.15A			60M	T
2N3568	S	N			A	0.3W	A	125	80	60	O	40	120	0.15A	0.25	0.15A			60M	T
2N3569	S	N	MPS6531	MPS6530	A	0.3W	A	125	80	40	O	100	300	0.15A	0.25	0.15A			60M	T
2N3570	S	N			AH	0.2W	A	200	30	15	O	20	150	5.0M			20	E	1.5G	T
2N3571	S	N			AH	0.2W	A	200	25	15	O	20	200	5.0M			20	E	1.5G	T
2N3572	S	N			AH	0.2W	A	200	25	13	O	20	300	5.0M			20	E	1.0G	T
2N3573 thru 2N3575	Field-Effect Transistors, see Table on Page 2-78																			
2N3576	S	P	2N3251	2N3250	SH	0.36W	A	200	20	15	O	40	120	10M	0.15	10M			400M	T
2N3577	S	N			AHP	85W	C	175	100	80	O	12	60	1.0A	5.25	1.0A	12	E	10M	T
2N3578	Field-Effect Transistors, see Table on Page 2-78																			
2N3579	S	P	2N3799	2N3798	AH	0.4W	A	200	60	60	O	30	120	1.0M	0.5	5.0M	30	E	80M	T
2N3580	S	P	2N3799	2N3798	AH	0.4W	A	200	60	60	O	60	240	1.0M	0.5	5.0M	60	E	80M	T
2N3581	S	P	2N3799	2N3798	AH	0.4W	A	200	50	40	O	50	150	0.1M	0.5	5.0M	50	E	30M	T

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N3582	S	P	2N3799	2N3798	AH	0.4W	A	200	50	40	O	100	300	0.1M	0.5	5.0M	100	E	30M	T
2N3583	S	N	2N3583		AHP	35W	C	200	250	175	O	40	200	0.5A	5.0	1.0A	25	E	10M	T
2N3584	S	N	2N3584		SP	35W	C	200	330	250	O	8.0	140	1.0A	0.75	1.0A			10M	T
2N3585	S	N	2N3585		SP	35W	C	200	440	300	O	8.0	140	1.0A	0.75	1.0A			10M	T
2N3586	S	P			SC	125M	A	200	45	45	O								0.1M	T
2N3587	S	N			AM	0.3W	A	200	60	45	O	80	500	1.0M	1.0	10M			80M	T
2N3588	G	P			AM	0.1W	A	85	25			20		1.0M					200M	T
2N3589	S	N	2N3738	2N3738	AHP	2.0W	A	175	200	200	R	30	90	0.2A	2.0	0.2A	30	E	15M	T
2N3590	S	N	2N6233	2N6233	AHP	2.0W	A	175	200	200	R	75	150	0.2A	2.0	0.2A	75	E	15M	T
2N3591	S	N			AHP	1.0W	A	175	200	200	R	30	90	0.2A	2.0	0.2A	30	E	15M	T
2N3592	S	N			AHP	1.0W	A	175	200	200	R	75	150	0.2A	2.0	0.2A	75	E	15M	T
2N3593	S	N			AHP	1.0W	A	175	200	200	R	30	90	0.2A	2.0	0.2A	30	E	15M	T
2N3594	S	N			AHP	1.0W	A	175	200	200	R	75	150	0.2A	2.0	0.2A	75	E	15M	T
2N3595	S	N			AHP	1.5W	A	175	200	200	R	30	90	0.2A	2.0	0.2A	30	E	15M	T
2N3596	S	N			AHP	1.5W	A	175	200	200	R	75	150	0.2A	2.0	0.2A	75	E	15M	T
2N3597	S	N	MJ7000	MJ7000	SHP	100W	C	200	60	40	O	40	120	10A	0.5	10A	75	E	30M	T
2N3598	S	N	MJ7000	MJ7000	SHP	100W	C	200	80	60	O	40	120	10A	0.5	10A	75	E	30M	T
2N3599	S	N	MJ7000	MJ7000	SHP	100W	C	200	100	80	O	40	120	10A	0.5	10A	75	E	30M	T
2N3600	S	N			AH	0.2W	A	200	30	15	O	20	150	3.0M			40	E	850M	T
2N3601	G	P			SP	0.286W	C	100	100	40	O	60	180	1.0A	0.2	0.1A	50	E	20M	T
2N3602	G	P			SP	0.286W	C	100	100	40	O	60	180	1.0A	0.2	0.1A	50	E	20M	T
2N3603	G	P			SP	0.286W	C	100	130	55	O	60	180	1.0A	0.2	0.1A	50	E	20M	T
2N3604	G	P			SP	0.286W	C	100	130	55	O	60	180	1.0A	0.2	0.1A	50	E	20M	T
2N3605	S	N	MPS3646	MPS3646	S	0.2W	A	150	18	14	O	30		10M	0.25	10M			300M	T
2N3605A	S	N			S	320M	A	120	40	15	O	30	120	10M	0.25	10M			300M	T
2N3606	S	N	MPS3646	MPS3646	S	0.2W	A	150	18	14	O	30		10M	0.25	10M			300M	T
2N3606A	S	N			S	320M	A	120	40	15	O	30	120	10M	0.25	10M			300M	T
2N3607	S	N	MPS3646	MPS3646	S	0.2W	A	150	18	14	O	30		10M	0.25	10M			300M	T
2N3608 thru 2N3610	Field-Effect Transistors, see Table on Page 2-78																			
2N3611	G	P		2N3611	AP	85W	C	110	40	30	S	35	70	3.0A	0.25	3.0A	40	E	0.3M	T
2N3612	G	P		2N3611	AP	85W	C	110	60	45	S	35	70	3.0A	0.25	3.0A	40	E	0.3M	T
2N3613	G	P		2N3611	AP	85W	C	110	40	30	S	60	120	3.0A	0.25	3.0A	60	E	0.3M	T
2N3614	G	P		2N3611	AP	85W	C	110	60	45	S	60	120	3.0A	0.25	3.0A	60	E	0.3M	T
2N3615	G	P		2N3615	AP	85W	C	110	80	60	S	30	60	3.0A	0.25	3.0A	40	E	0.3M	T
2N3616	G	P		2N3615	AP	85W	C	110	100	75	S	30	60	3.0A	0.25	3.0A	40	E	0.3M	T
2N3617	G	P		2N3615	AP	85W	C	110	80	60	S	45	90	3.0A	0.25	3.0A	60	E	0.3M	T
2N3618	G	P		2N3615	AP	85W	C	110	100	75	S	45	90	3.0A	0.25	3.0A	60	E	0.3M	T
2N3619	S	N			AHP	7.5W	C	175	75	40	O	40		1.0A	0.75	1.0A			200M	T
2N3620	S	N			AHP	7.5W	C	175	75	40	O	40		1.0A	1.0	3.0A			200M	T
2N3621	S	N			AHP	30W	C	175	75	40	O	40		1.0A	1.25	5.0A			200M	T
2N3622	S	N			AHP	30W	C	175	75	40	O	40		1.0A	1.25	5.0A			200M	T
2N3623	S	N			AHP	7.5W	C	175	75	40	O	40		1.0A	0.75	1.0A			200M	T
2N3624	S	N			AHP	7.5W	C	175	75	40	O	40		1.0A	1.0	3.0A			200M	T
2N3625	S	N			AHP	30W	C	175	75	40	O	40		1.0A	1.25	5.0A			200M	T
2N3626	S	N			AHP	30W	C	175	75	40	O	40		1.0A	1.25	5.0A			200M	T
2N3627	S	N			AHP	7.5W	C	175	100	50	O	40		1.0A	0.75	1.0A			200M	T
2N3628	S	N			AHP	7.5W	C	175	100	50	O	40		1.0A	1.0	3.0A			200M	T
2N3629	S	N			AHP	30W	C	175	100	50	O	40		1.0A	1.25	5.0A			200M	T
2N3630	S	N			AHP	30W	C	175	100	50	O	40		1.0A	1.25	5.0A			200M	T
2N3631	Field-Effect Transistors, see Table on Page 2-78																			
2N3632	S	N	2N3632	2N3375	AHP	23W	C	200	65	40	O	10	150	0.25A	1.0	1.0A			250M	T
2N3633	S	N			SH	0.3W	A	200	15	6.0	O	50	150	10M	0.21	3.0M			1.3G	T
2N3634	S	P		2N3634	AH	1.0W	A	200	140	140	O	50	150	50M			40	E	150M	T
2N3635	S	P		2N3634	AH	1.0W	A	200	140	140	O	100	300	50M			80	E	200M	T
2N3636	S	P		2N3634	AH	1.0W	A	200	175	175	O	50	150	50M			40	E	150M	T
2N3637	S	P		2N3634	AH	1.0W	A	200	175	175	O	100	300	50M			80	E	200M	T
2N3638	S	P			SH	0.3W	A	125	25	25	O	30		50M	0.25	50M	25	E	100M	T
2N3638A	S	P			SH	0.3W	A	125	25	25	O	100		50M	0.25	50M	100	E	150M	T
2N3639	S	P	MPS3639	MPS3639	SH	0.2W	A	125	6.0	6.0	O	30	120	10M	0.16	10M			500M	T
2N3640	S	P	MPS3640	MPS3640	SH	0.2W	A	125	12	12	O	30	120	10M	0.2	10M			500M	T
2N3641	S	N	MPS6530	MPS6530	AHP	0.35W	A	125	60	30	O	40	120	0.15A	0.22	0.15A			250M	T
2N3642	S	N	MPS6530	MPS6530	AHP	0.35W	A	125	60	45	O	40	120	0.15A	0.22	0.15A			250M	T
2N3643	S	N	MPS6531	MPS6530	AHP	0.35W	A	125	60	30	O	100	300	0.15A	0.22	0.15A			250M	T
2N3644	S	P			SH	0.3W	A	125	45	45	O	80	240	50M	0.25	50M			200M	T
2N3645	S	P			SH	0.3W	A	125	60	60	O	80	240	50M	0.25	50M			200M	T
2N3646	S	N	MPS3646	MPS3646	SH	0.2W	A	125	40	15	O	30	120	30M	0.2	30M			350M	T
2N3647	S	N		2N3510	SH	0.4W	A	200	40	10	O	25	150	0.15A	0.25	10M	20	E	350M	T
2N3548	S	N		2N3510	SH	0.4W	A	200	40	15	O	30	120	0.15A	0.25	10M	20	E	450M	T
2N3649 thru 2N3658	Thyristors, see Table on Page 2-66																			
2N3659	S	N			AH	4.0W	C	200	220	170	O	20		10M			20	E	50M	T
2N3660	S	P	2N3719		AHP	5.0W	C	200	40	30	O	25	100	0.5A	1.2	0.5A			25M	T
2N3661	S	P	2N3720		AHP	5.0W	C	200	60	50	O	25	100	0.5A	1.2	0.5A			25M	T
2N3662	S	N			AH	0.2W	A	125	18	12	O	20		8.0M					700M	T
2N3663	S	N			AH	0.2W	A	125	30	12	O	20		8.0M					700M	T
2N3664	S	N		2N3664	AHP	5.0W	C	200	60	60	S	8.0	80	50M	0.75	0.25A			300M	T
2N3665	S	N	2N5335	2N5334	S	5.0W	C	200	120	80	O	40	120	0.15A	0.5	0.15A			60M	T
2N3666	S	N			S	5.0W	C	200	120	80	O	100	300	0.15A	0.5	0.15A			60M	T
2N3667	S	N	2N5881	2N5879	SP	117W	C	200	50	50	O	15	60	8.0A	1.5	8.0A			0.5M	T
2N3668 thru 2N3670	Thyristors, see Table on Page 2-66																			
2N3671	S	P			S	0.6W	A	200	60	50	O	75	225	0.15A	0.4	0.15A			200M	T
2N3672	S	P			S	0.4W	A	200	60	50	O	75	225	0.15A	0.4	0.15A			200M	T
2N3673	S	P			S	0.35W	A	200	60	50	O	75	225	0.15A	0.4	0.15A			200M	T

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TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N3675	S	N	2N4238	2N4237	SP	8.8W	C	200	90	55	O	12	60	1.0A	0.8	1.0A			1.0M	T
2N3676	S	N	2N4239	2N4237	SP	8.8W	C	200	90	90	O	12	60	1.0A	0.8	1.0A			1.0M	T
2N3677	S	P			SC	0.4W	A	200	30	20	O								5.0M	T
2N3678	S	N	2N3019	2N3019	SH	0.8W	A	200	75	55	O	40	120	0.15A	0.4	0.15A			250M	T
2N3679	Unijunction Transistors, see Table on Page 2-86																			
2N3680	S	N			AM	0.3W	A	200	60	50	O	150	600	10*	0.7	10M	300	E	60M	T
2N3681	S	N			AH	0.2W	A	200	10	7.0	O	20	220	2.0M	0.37	4.0M	20	E	1.0G	T
2N3682	S	N			AH	0.36W	A	200	40	15	O	40	120	10M			45	E	600M	T
2N3683	S	N			AH	0.2W	A	200	30	12	O	20	150	8.0M			30	E	1.0G	T
2N3684,A thru 2N3687,A	Field-Effect Transistors, see Table on Page 2-78																			
2N3688	S	N			AH	0.2W	A	125	40	40	O	30		4.0M					400M	T
2N3689	S	N			AH	0.2W	A	125	40	40	O	30		4.0M					400M	T
2N3690	S	N			AH	0.2W	A	125	40	40	O	30		4.0M					400M	T
2N3691	S	N	MPS6512	MPS6512	A	0.2W	A	125	35	20	O	40	160	10M	0.7	10M	40	E	200M	T
2N3692	S	N	MPS6513	MPS6512	A	0.2W	A	125	35	20	O	100	400	10M	0.7	10M	100	E	200M	T
2N3693	S	N			AH	0.2W	A	125	45	45	O	40	160	10M					200M	T
2N3694	S	N			AH	0.2W	A	125	45	45	O	100	400	10M					200M	T
2N3695 thru 2N3698	Field-Effect Transistors, see Table on Page 2-78																			
2N3700	S	N	2N3019	2N3019	AH	0.5W	A	200	140	80	O	100	300	0.15A	0.2	0.15A	80	E	100M	T
2N3701	S	N	2N3019	2N3019	AH	0.5W	A	200	140	80	O	40	120	0.15A	0.2	0.15A	30	E	80M	T
2N3702	S	P	2N3250	2N3250	A	0.3W	A	150	40	25	O	60	300	50M	0.25	50M			100M	T
2N3703	S	P	2N3251	2N3250	A	0.3W	A	150	50	30	O	30	150	50M	0.25	50M			100M	T
2N3704	S	N	2N2222A	2N2218	A	0.36W	A	150	50	30	O	100	300	50M	0.6	0.1A			100M	T
2N3705	S	N	2N2222A	2N2218	A	0.36W	A	150	50	30	O	50	150	50M	0.8	0.1A			100M	T
2N3706	S	N	2N930	2N929	A	0.36W	A	150	40	20	O	30	600	50M	1.0	0.1A			100M	T
2N3707	S	N			A	0.25W	A	150	30	30	O	100	400	0.1M	1.0	10M	100	E		
2N3708	S	N			A	0.25W	A	150	30	30	O	45	660	1.0M	1.0	10M	45	E		
2N3709	S	N			A	0.25W	A	150	30	30	O	45	165	1.0M	1.0	10M	45	E		
2N3710	S	N			A	0.25W	A	150	30	30	O	90	330	1.0M	1.0	10M	90	E		
2N3711	S	N			A	0.25W	A	150	30	30	O	180	660	1.0M	1.0	10M	180	E		
2N3712	S	N		2N3712	AH	0.8W	A	200	150	150	O	30	150	30M	2.0	50M	25	E	40M	T
2N3713	S	N	2N3713	2N3713	AHP	150W	C	200	80	60	O	25	75	1.0A	1.0	5.0A	25	E	30K	E
2N3714	S	N	2N3714	2N3713	AHP	150W	C	200	100	80	O	25	75	1.0A	1.0	5.0A	25	E	30K	E
2N3715	S	N	2N3715	2N3713	AHP	150W	C	200	80	60	O	50	150	1.0A	0.8	5.0A	25	E	30K	E
2N3716	S	N	2N3716	2N3713	AHP	150W	C	200	100	80	O	50	150	1.0A	0.8	5.0A	25	E	30K	E
2N3717	S	N			AHP	7.5W	C	200	60	60	S	2.0	100	0.5A	1.0	0.5A			250M	T
2N3718	S	N			AHP	10W	C	200	60	60	S	2.0	100	0.5A	1.0	0.5A			250M	T
2N3719	S	P	2N3719	2N3719	SHP	6.0W	C	200	40	40	O	25	180	1.0A	1.5	0.3A			60M	T
2N3720	S	P	2N3720	2N3719	SHP	6.0W	C	200	60	60	O	25	180	1.0A	1.5	3.0A			60M	T
2N3721	S	N	MP3731		A	0.2W	A	125	18	18	O						60	E		
2N3722	S	N		2N3722	S	0.8W	A	200	80	60	O	40	150	0.1A	0.22	0.1A			300M	T
2N3723	S	N		2N3722	SH	0.8W	A	200	100	80	O	40	150	0.1A	0.25	10M			300M	T
2N3724	S	N	MM3724	MM3724	SH	0.8W	A	200	50	30	O	60	150	0.1A	0.2	0.1A			300M	T
2N3724A	S	N			SH	1W	A		50	30	O	60	150	100M	0.2	100M				
2N3725	S	N	MM3725	MM3724	SH	0.8W	A	200	80	50	O	60	150	0.1A	0.26	0.1A			300M	T
2N3725A	S	N			SH	1W	A		80	50	O	60	150	100M	0.26	100M	3	E		
2N3726	S	P			AM	0.4W	A	200	45	45	O	135	350	1.0M	0.25	50M	135	E	200M	T
2N3727	S	P			AM	0.4W	A	200	45	45	O	135	350	1.0M	0.25	50M	135	E	200M	T
2N3728	S	N			AM	0.45W	A	200	60	30	O	80	280	0.15A	0.22	0.15A	50	E	250M	T
2N3729	S	N			AM	0.45W	A	200	60	30	O	80	280	0.15A	0.22	0.15A	50	E	250M	T
2N3730	G	P			AP	10W	A	100	200	200	S									
2N3731	G	P			AP	5.0W	A	100	320	320	S	15		6.0A						
2N3732	G	P			AP	3.0W	A	100	100	100	S	35	500	0.7A					1.0M	T
2N3733	S	N		2N3733	AHP	23W	C	200	65	40	O	10	150	0.25A	1.0	1.0A			250M	T
2N3734	S	N		2N3734	SH	1.0W	A	200	50	30	O	30	120	1.0A	0.2	10M			300M	T
2N3734A	S	N	2N5334	2N5334	SH	1.0W	A		50	30	O	30	120	1.0A	0.9	1.0A	2.5	E		
2N3735	S	N		2N3734	SH	1.0W	A	200	75	50	O	20	80	1.0A	0.2	10M			250M	T
2N3735A	S	N			SH	1.0W	A		75	50	O	20	80	1.0A	0.9	1.0A	2.5	E		
2N3736	S	N		2N3734	SH	0.5W	A	200	50	30	O	30	120	1.0A	0.2	10M			300M	T
2N3736A	S	N			SH	0.5W	A		50	30	O	30	120	1.0A	0.9	1.0A	2.5	E		
2N3737	S	N		2N3734	SH	0.5W	A	200	75	50	O	20	80	1.0A	0.2	10M			250M	T
2N3737A	S	N			SH	0.5W	A		75	50	O	20	80	1.0A	0.9	1.0A	2.5	E		
2N3738	S	N	2N3738	2N3738	AP	20W	C	175	250	225	O	40	200	0.1A	2.5	0.25A	35	E	15M	T
2N3739	S	N	2N3739	2N3738	AP	20W	C	175	325	300	O	40	200	0.1A	2.5	0.25A	35	E	15M	T
2N3740,A	S	P	2N3740,A	2N3740	AP	25W	C	200	60	60	O	30	100	0.25A	0.6	1.0A	25	E	4.0M	T
2N3741,A	S	P	2N3741,A	2N3740	AP	25W	C	200	80	80	O	30	100	0.25A	0.6	1.0A	25	E	4.0M	T
2N3742	S	N		2N3742	AH	1.0W	A	200	300	300	O	20	200	30M	1.0	10M	20	E	30M	T
2N3743	S	P		2N3743	AH	1.0W	A	200	300	300	O	25	250	30M	5.0	10M	30	E	30M	T
2N3744	S	N	2N5346	2N5346	AHP	30W	C	200	60	40	O	20	60	1.0A	0.25	1.0A	20	E	30M	T
2N3745	S	N	2N5346	2N5346	AHP	30W	C	200	80	60	O	20	60	1.0A	0.25	1.0A	20	E	30M	T
2N3746	S	N	2N5346	2N5346	AHP	30W	C	200	100	80	O	20	60	1.0A	0.25	1.0A	20	E	30M	T
2N3747	S	N	2N5347	2N5346	AHP	30W	C	200	60	40	O	40	120	1.0A	0.25	1.0A	40	E	40M	T
2N3748	S	N	2N5347	2N5346	AHP	30W	C	200	80	60	O	40	120	1.0A	0.25	1.0A	40	E	40M	T
2N3749	S	N	2N5348	2N5346	AHP	30W	C	200	100	80	O	40	120	1.0A	0.25	1.0A	40	E	40M	T
2N3750	S	N	2N5348	2N5346	AHP	30W	C	200	60	40	O	100	300	1.0A	0.25	1.0A	100	E	50M	T
2N3751	S	N	2N5348	2N5346	AHP	30W	C	200	80	60	O	100	300	1.0A	0.25	1.0A	100	E	50M	T
2N3752	S	N	2N5348	2N5346	AHP	30W	C	200	100	80	O	100	300	1.0A	0.25	1.0A	100	E	50M	T
2N3753 thru 2N3761	Thyristors, see Table on Page 2-66																			
2N3762	S	P		2N3762	SH	1.0W	A	200	40	40	O	30	120	1.0A	0.1	10M			180M	T
2N3763	S	P		2N3762	SH	1.0W	A	200	60	60	O	20	80	1.0A	0.1	10M			150M	T
2N3764	S	P		2N3762	SH	0.5W	A	200	40	40	O	30	120	1.0A	0.1	10M			180M	T
2N3765	S	P		2N3762	SH	0.5W	A	200	60	60	O	20	80	1.0A	0.1	10M			150M	T

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N3766	S	N	2N3766	2N3766	AP	20W	C	175	80	60	O	40	160	0.5A	2.5	1.0A	40	E	15M	T
2N3767	S	N	2N3767	2N3766	AP	20W	C	175	100	80	O	40	160	0.5A	2.5	1.0A	40	E	15M	T
2N3770	G	P			AH	50M	A	100	10	6.0	O	10	200	1.0M			10	E	100M	T
2N3771	S	N	2N3771	2N3771	AP	150W	C	200	50	40	O	15	60	15A	2.0	15A	40	E	0.2M	T
2N3772	S	N	2N3772	2N3771	AP	150W	C	200	100	60	O	15	60	10A	1.4	10A	40	E	0.2M	T
2N3773	S	N	2N3773		AP	150W	C	200	160	140	O	15	60	8.0A	1.4	8.0A	40	E	0.2M	T
2N3774	S	P	2N4234	2N4234	SP	5.0W	C	200	40	40	O	20	60	0.2A	0.2	0.2A			1.0M	T
2N3775	S	P	2N4235	2N4234	SP	5.0W	C	200	60	60	O	20	60	0.2A	0.2	0.2A			1.0M	T
2N3776	S	P	2N4236	2N4234	SP	5.0W	C	200	80	80	O	20	60	0.2A	0.2	0.2A			1.0M	T
2N3777	S	P	2N5679	2N5679	SP	5.0W	C	200	100	100	O	20	60	0.2A	0.2	0.2A			1.0M	T
2N3778	S	P	2N4234	2N4234	SP	5.0W	C	200	40	40	O	10	40	0.2A	0.2	0.2A			1.0M	T
2N3779	S	P	2N4235	2N4234	SP	5.0W	C	200	60	60	O	10	40	0.2A	0.2	0.2A			1.0M	T
2N3780	S	P	2N4236	2N4234	SP	5.0W	C	200	80	80	O	10	40	0.2A	0.2	0.2A			1.0M	T
2N3781	S	P	2N5679	2N5679	SP	5.0W	C	200	100	100	O	10	40	0.2A	0.2	0.2A			1.0M	T
2N3782	S	P	2N4234	2N4234	SP	5.0W	C	200	40	40	O	10	60	1.0A	0.75	1.0A			1.0M	T
2N3783	G	P		2N3783	AH	0.15W	A	100	30	20	O	20	200	3.0M	0.25	5.0M	20	E	0.8G	T
2N3784	G	P		2N3783	AH	0.15W	A	100	30	20	O	20	200	3.0M	0.25	5.0M	20	E	0.7G	T
2N3785	G	P		2N3783	AH	0.15W	A	100	15	12	O	15	200	3.0M	0.35	5.0M	15	E	0.7G	T
2N3788	S	N			AP	100W	C	200	400	325	O	20	180	0.50A					50K	E
2N3789	S	P		2N3789	AP	150W	C	200	60	60	O	25	90	1.0A	1.0	5.0A	25	E	30K	E
2N3790	S	P		2N3789	AP	150W	C	200	60	80	O	25	90	1.0A	1.0	5.0A	25	E	30K	E
2N3791	S	P		2N3789	AP	150W	C	200	60	60	O	50	180	1.0A	1.0	5.0A	25	E	30K	E
2N3792	S	P		2N3789	AP	150W	C	200	80	80	O	50	180	1.0A	1.0	5.0A	25	E	30K	E
2N3793	S	N	MPS6530	MPS6530	A	0.25W	A	125	40	20	O	20	120	10M	0.4	10M			100M	T
2N3794	S	N	MPS6531	MPS6530	A	0.25W	A	125	40	20	O	100	600	10M	0.4	10M			100M	T
2N3795	S	P			SP	5.0W	C	200	120	120	O	12	36	10M	0.2	10M			0.5M	T
2N3796 2N3797	Field-Effect Transistors, see Table on Page 2-78																			
2N3798,A	S	P		2N3798	A	0.36W	A	200	60	60	O	150	450	0.5M	0.2	0.1M	150	E	30M	T
2N3799,A	S	P		2N3798	A	0.36W	A	200	60	60	O	300	900	0.5M	0.2		300	E	30M	T
2N3800	S	P		2N3800	A	0.25W	A	200	60	60	O	150	450	0.1M	0.2	0.1M	150	E	100M	T
2N3801	S	P		2N3800	A	0.25W	A	200	60	60	O	300	900	0.1M	0.2	0.1M	300	E	100M	T
2N3802	S	P		2N3800	AM	0.25W	A	200	60	60	O	150	450	0.1M	0.2	0.1M	150	E	100M	T
2N3803	S	P		2N3800	AM	0.25W	A	200	60	60	O	300	900	0.1M	0.2	0.1M	300	E	100M	T
2N3804	S	P		2N3800	AM	0.25W	A	200	60	60	O	150	450	0.1M	0.2	0.1M	150	E	100M	T
2N3804A	S	P		2N3800	AM	0.25W	C		60	60	O	150	450	100*	0.2	100*	150	E	30M	T
2N3805	S	P		2N3800	AM	0.25W	A	200	60	60	O	300	900	0.1M	0.2	0.1M	300	E	100M	T
2N3805A	S	P		2N3800	AM	0.25W	C		60	60	O	300	900	100*	0.2	100*	300	E	30M	T
2N3806	S	P		2N3800	A	0.5W	A	200	60	60	O	150	450	0.1M	0.2	0.1M	150	E	100M	T
2N3807	S	P		2N3800	A	0.5W	A	200	60	60	O	300	900	0.1M	0.2	0.1M	300	E	100M	T
2N3808	S	P		2N3800	AM	0.5W	A	200	60	60	O	150	450	0.1M	0.2	0.1M	150	E	100M	T
2N3809	S	P		2N3800	AM	0.5W	A	200	60	60	O	300	900	0.1M	0.2	0.1M	300	E	100M	T
2N3810	S	P		2N3800	AM	0.5W	A	200	60	60	O	150	450	0.1M	0.2	0.1M	150	E	100M	T
2N3810A	S	P		2N3800	AM	0.50W	A		60	60	O	150	450	100*	0.2	100*	150	E	30M	T
2N3811	S	P		2N3800	AM	0.5W	A	200	60	60	O	300	900	0.1M	0.2	0.1M	300	E	100M	T
2N3811A	S	P		2N3800	AM	0.50W	A		60	60	O	300	900	100*	0.2	100*	300	E	30M	T
2N3812	S	P		2N3800	AM	350M	A	200	60	60	O	150	450	0.1M	0.2	0.1M	150	E	100M	T
2N3813	S	P		2N3800	AM	350M	A	200	60	60	O	300	900	0.1M	0.2	0.1M	300	E	100M	T
2N3814	S	P		2N3800	AM	350M	A	200	60	60	O	150	450	0.1M	0.2	0.1M	150	E	100M	T
2N3815	S	P		2N3800	AM	350M	A	200	60	60	O	300	900	0.1M	0.2	0.1M	300	E	100M	T
2N3816	S	P		2N3800	AM	350M	A	200	60	60	O	150	450	0.1M	0.2	0.1M	150	E	100M	T
2N3816A	S	P		2N3800	AM	0.25W	C		60	60	O	150	450	100*	0.2	100*	150	E	30M	T
2N3817	S	P		2N3800	AM	350M	A	200	60	60	O	300	900	0.1M	0.2	0.1M	300	E	100M	T
2N3817A	S	P		2N3800	AM	0.25W	C		60	60	O	300	900	100*	0.2	100*	300	E	30M	T
2N3818	S	N		2N3818	AHP	25W	C	175	60	60	S	5.0	50	400M	0.5	1.0A	3.0	E		
2N3819 thru 2N3824	Field-Effect Transistors, see Table on Page 2-78																			
2N3825	S	N	MPS3398		AH	0.25W	A	150	30	15	O	20		2.0M	0.25	2.0M			200M	T
2N3826	S	N	MPS3826		AH	0.2W	A	150	60	45	O	40	160	10M					200M	T
2N3827	S	N	MPS3827		AH	0.2W	A	150	60	45	O	100	400	10M					200M	T
2N3828	S	N	MPS6565	MPS6565	AH	0.3W	A	150	40	40	O	30	200	12M					360M	T
2N3829	S	P	2N3250	2N3250	SH	0.36W	A	200	35	20	O	30	120	30M	0.18	10M			350M	T
2N3830	S	N	2N2193	2N2192	SH	1.0W	A	200	80	50	O	30		0.15A	0.3	0.15A			200M	T
2N3831	S	N	2N2193	2N2192	SH	1.0W	A	200	70	40	O	35		0.15A	0.3	0.15A			200M	T
2N3832	S	N			SH	0.2W	A	200	15	6.0	O	25	125	2.0M	0.4	10M			800M	T
2N3833	S	N			AHP				25	15	O	20		30M			2.5	E		
2N3834	S	N			AHP				25	15	O	20		30M			2.5	E		
2N3835	S	N			AHP				25	15	O	20		30M			2.5	E		
2N3836	S	N			SHP	1.0W	A	200	80	60	O	2K	20K	2.0A	1.8	5.0A			40M	T
2N3837	S	N			SHP	1.0W	A	200	100	80	O	2K	20K	2.0A	1.8	5.0A			40M	T
2N3838	S	N,P		2N3838	SH	0.25W	A	200	60	40	O	100	300	0.15A	0.4	0.15A	60	E	200M	T
2N3839	S	N	2N3839	2N3839	AH	200M	A	200	30	15	O	30		3.0M					2.0G	T
2N3840	S	P			SC	0.4W	A	200	50	50	O	30		0.2M	0.1	5.0M			6.0M	T
2N3841	S	P			SC	0.3W	A	200	100	100	O	15		0.2M	0.12	5.0M			1.5M	T
2N3842	S	P			SC	0.3W	A	200	120	120	O	10		1.0M		5.0M			1.0M	T
2N3843	S	N	MPS6512	MPS6512	AH	0.2W	A	125	30	30	O	20	40	2.0M					60M	T
2N3843A	S	N	MPS6512	MPS6512	AH	0.2W	A	125	30	30	O	20	40	2.0M					60M	T
2N3844	S	N	MPS6512	MPS6512	AH	0.2W	A	125	30	30	O	35	70	2.0M					90M	T
2N3844A	S	N	MPS6512	MPS6512	AH	0.2W	A	125	30	30	O	35	70	2.0M					90M	T
2N3845	S	N	MPS6512	MPS6512	AH	0.2W	A	125	30	40	O	60	120	2.0M					126M	T
2N3845A	S	N	MPS6513	MPS6512	AH	0.2W	A	125	30	30	O	60	120	2.0M					126M	T
2N3846	S	N			AP	4.0W	A	175	300	200	O	10	60	10A	0.75	10A	50	E	10M	T
2N3847	S	N			AP	4.0W	A	175	400	300	O	10	60	10A	0.75	10A	50	E	10M	T
2N3848	S	N			AP	4.0W	A	175	300	300	O	10	60	15A	1.0	15A	50	E	10M	T
2N3849	S	N			AP	4.0W	A	175	400	300	O	10	60	15A	1.0	15A	50	E	10M	T
2N3850	S	N			SHP	30W	C	200	100	80	O	50	150	1.0A	0.25	1.0A			20M	T
2N3851	S	N			SHP	30W	C	200	100	80	O	30	90	1.0A	0.25	1.0A			20M	T
2N3852	S	N			SHP	30W	C	200	60	40	O	50	150	1.0A	0.25	1.0A			20M	T
2N3853	S	N			SHP	30W	C	200	60	40	O	30	90	1.0A	0.25	1.0A			20M	T
2N3854	S	N	MPS6512	MPS6512	AH	0.2W	A	150	18	18	O	35	70	2.0M					100M	T
2N3854A	S	N	MPS6512	MPS6512	AH	0.2W	A	150	30	30	O	35	70	2.0M					100M	T
2N3855	S	N	MPS6512	MPS6512	AH	0.2W	A	150	18	18	O	60	120	2.0M					130M	T
2N3855A	S	N	MPS6512	MPS6512	AH	0.2W	A	150	30	30	O	60	120	2.0M					130M	T

2N3856–2N3961

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N3856	S	N	MPS6513	MPS6512	AH	0.2W	A	150	18	18	O	100	200	2.0M					140M	T
2N3856A	S	N	MPS6513	MPS6512	AH	0.2W	A	150	30	30	O	100	200	2.0M					140M	T
2N3857	S	P			A	0.6W	A	200	45	45	O	50	200	1.0M	0.1	10M	45	E	4.0M	T
2N3858	S	N	MPS6512	MPS6512	AH	0.2W	A	125	30	30	O	60	120	2.0M					90M	T
2N3858A	S	N	MPS6566	MPS6565	AH	200M	A	100	60	60	O	45		1.0M					90M	T
2N3859	S	N	MPS6513	MPS6512	AH	0.2W	A	125	30	30	O	100	200	2.0M					90M	T
2N3859A	S	N	MPS6566	MPS6565	A	200M	A	100	60	60	O	75		1.0M					90M	T
2N3860	S	N	MPS6514	MPS6512	AH	0.2W	A	125	30	30	O	150	300	2.0M					90M	T
2N3861	S	N			AP	2.0W	A	175	530	530	V	30	200	25M	1.5	25M	20	E	50M	T
2N3862	S	N	2N930	2N930	S	0.36W	A	200	50	20	O	50	150	10M	0.25	10M			600M	T
2N3863	S	N	2N3715	2N3713	SP	117W	C	200	70	50	O	30	90	3.0A	1.0	3.0A			0.5M	T
2N3864	S	N	2N5758	2N5758	SP	117W	C	200	110	90	O	30	90	3.0A	1.0	3.0A			0.5M	T
2N3865	S	N	2N3760		SP	117W	C	200	160	150	O	30	90	3.0A	1.0	3.0A			0.5M	T
2N3866	S	N		2N3866	AHP	5.0W	C	200	55	30	O	10	200	50M	1.0	0.1A			500	T
2N3866A	S	N			A	5.0W	C		55	30	O	25	200	0.05A	1.0	0.1A			800M	T
2N3867	S	P	2N3867		SH	1.0W	A	200	40	40	O	40	200	1.5A	0.75	1.5A			60M	T
2N3868	S	P	2N3868		SH	1.0W	A	200	60	60	O	30	150	1.5A	0.75	1.5A			60M	T
2N3869	S	N			AHP	2.5W	C	175	40	20	O	20	150	30M	0.7	0.45A			0.4G	T
2N3870 thru 2N3873	Thyristors, see Table on Page 2-66																			
2N3876	S	N	2N6274		AP	150W	C	175	140	50	O	25	150	10A	1.0	10A	80	E	50M	T
2N3877	S	N	2N4410	2N4409	A	0.2W	A	150	70	70	O	20	250	2.0M						
2N3877A	S	N	2N4410	2N4409	A	0.2W	A	150	85	85	O	20	250	2.0M						
2N3878	S	N	2N5428	2N5427	AHP	35W	C	200	120	50	O	40	200	0.5A	2.0	4.0A	40	E	40M	T
2N3879	S	N			SP	35W	C	200	120	75	O	12	100	4.0A	1.2	4.0A			40M	T
2N3880	S	N			AH	0.2W	A	200	30	15	O	30	200	3.0M			50	E	1.2G	T
2N3881	S	N			AH	0.6W	A	200	60	35	O				1.5	0.15A	50	E	70M	T
2N3882	Field-Effect Transistors, see Table on Page 2-78																			
2N3883	G	P		2N3883	SH	0.3W	A	100	25	15	O	30		0.2A	0.5	0.2A			100M	T
2N3884 thru 2N3899	Thyristors, see Table on Page 2-66																			
2N3900	S	N	2N5088	2N5088	A	0.2W	A	125	18	18	O	250	500	2.0M			170	E		
2N3900A	S	N	2N5088	2N5088	A	0.2W	A	125	18	18	O	250	500	2.0M			170	E		
2N3901	S	N	2N5088	2N5088	A	0.2W	A	125	18	18	O	350	700	2.0M			350	E		
2N3902	S	N	2N3902	2N3902	SP	100W	C	150	400	400	O	20	100	1.0A	2.5	2.5A			40K	E
2N3903	S	N		2N3903	SH	0.31W	A	135	60	40	O	50	150	10M	0.2	10M	50	E	250M	T
2N3904	S	N		2N3903	SH	0.31W	A	135	60	40	O	100	300	10M	0.2	10M	100	E	300M	T
2N3905	S	P		2N3905	SH	0.31W	A	135	40	40	O	50	150	10M	0.25	10M	50	E	200M	T
2N3906	S	P		2N3905	SH	0.31W	A	135	40	40	O	100	300	10M	0.25	10M	100	E	250M	T
2N3907	S	N	2N2915	2N2913	AM	0.3W	A	200	60	45	O	60	300	10*	0.35	1.0M			60M	T
2N3908	S	N	2N2916	2N2913	AM	0.3W	A	200	60	60	O	100	500	10*	0.35	1.0M			60M	T
2N3909,A	Field-Effect Transistors, see Table on Page 2-78																			
2N3910	S	P			SC	0.5W	A	200	60	50	O	40	160	1.0M	0.3	10M			4.0M	T
2N3911	S	P			SC	0.5W	A	200	60	40	O	60	240	1.0M	0.3	10M			8.0M	T
2N3912	S	P			SC	0.5W	A	200	60	30	O	90		1.0M	0.3	10M			10M	T
2N3913	S	P			SC	0.4W	A	200	60	50	O	40	160	1.0M	0.3	10M			4.0M	T
2N3914	S	P			SC	0.4W	A	200	60	40	O	60	240	1.0M	0.3	10M			8.0M	T
2N3915	S	P			SC	0.4W	A	200	60	30	O	90		1.0M	0.3	10M			10M	T
2N3916	S	N			AP	5.0W	C	150	150	150	O	40	200	0.15A	5.0	0.15A	30	E	50M	T
2N3917	S	N			AP	20W	C	150	80	40	O	30	120	1.0A	1.2	1.0A	15	E	50M	T
2N3918	S	N			AP	20W	C	150	80	40	O	100	300	1.0A	1.2	1.0A	30	E	50M	T
2N3919	S	N			SP	15W	C	150	120	60	O	40	120	2.0A	1.2	10A			80M	T
2N3920	S	N			SP	15W	C	150	120	60	O	100	300	2.0A	1.2	10A			80M	T
2N3921 2N3922	Field-Effect Transistors, see Table on Page 2-78																			
2N3923	S	N			AH	0.8W	A	200	150	150	O	30	120	25M	1.0	25M	20	E	40M	T
2N3924	S	N		2N3924	AHP	7.0W	C	200	36	18	O								250M	T
2N3925	S	N		2N3924	AHP	10W	C	200	36	18	O								250M	T
2N3926	S	N		2N3924	AHP	11.6W	C	200	36	18	O								250M	T
2N3927	S	N		2N3924	AHP	23.2W	C	200	36	18	O								200M	T
2N3928	S	N			SHP	7.5W	C	175	80	40	O	20	300	1.5A	5.0	1.5A			200M	T
2N3929	S	N			SHP	30W	C	175	80	40	O	20	300	1.5A	5.0	1.5A			200M	T
2N3930	S	P			A	0.4W	A	200	180	180	O	80	300	10M	0.25	10M	100	E	40M	T
2N3931	S	P			A	0.7W	A	200	180	180	O	80	300	10M	0.25	10M	100	E	40M	T
2N3932	S	N			AH	0.2W	A	200	30	20	O	40	150	2.0M			50	E	750M	T
2N3933	S	N			AH	0.2W	A	200	40	30	O	60	200	2.0M			60	E	750M	T
2N3934 2N3935	Field-Effect Transistors, see Table on Page 2-78																			
2N3936 thru 2N3940	Thyristors, see Table on Page 2-66																			
2N3941	S	N			AM	0.75W	C	200	60	45	O	400		10*			300	E	200M	T
2N3942	S	N			AM	0.75W	C	200	60	45	O	400		10*			300	E	200M	T
2N3943	S	N			AM	0.5W	C	200	60	45	O	400		10*			300	E	200M	T
2N3944	S	N			AM	0.5W	C	200	60	45	O	400		10*			300	E	200M	T
2N3945	S	N	2N5334	2N5334	S	5.0W	C	200	70	50	O	40	250	0.15A	0.5	0.15A			60M	T
2N3946	S	N		2N3946	SH	360M	A	200	60	40	O	50	150	10M	0.3	50M	50	E	250M	T
2N3947	S	N		2N3946	SH	360M	A	200	60	40	O	100	300	10M	0.3	50M	100	E	300M	T
2N3948	S	N		2N3948	AHP	1.0W	A	200	36	20	O	15		50M					700M	T
2N3950	S	N		2N3950	AHP	70W	C	200	65	35	O								150M	T
2N3953	S	N			AH	0.2W	A	200	15	12	O	30	360	2.0M			40	E	1.3G	T
2N3954																				
2N3954,A 2N3955,A 2N3956 thru 2N3958	Field-Effect Transistors, see Table on Page 2-78																			
2N3959	S	N		2N3959	SH	400M	A	200	20	12	O	40	200	10M	0.3	30M	13	E	1.3G	T
2N3960	S	N		2N3959	SH	400M	A	200	20	12	O	40	200	10M	0.3	30M	16	E	1.6G	T
2N3961	S	N		2N3375	AHP	10W	C	200	65	40	O								400M	T

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N3962	S	P			A	0.36W	A	200	60	60	O	100	300	10*	0.25	10M	100	E	40M	T
2N3963	S	P			A	0.36W	A	200	80	80	O	100	300	10*	0.25	10M	100	E	40M	T
2N3964	S	P			A	0.36W	A	200	45	45	O	250	500	10*	0.25	10M	250	E	50M	T
2N3965	S	P			A	0.36W	A	200	60	60	O	250	500	10*	0.25	10M	250	E	50M	T
2N3966 thru 2N3972	Field-Effect Transistors, see Table on Page 2-78																			
2N3973	S	N	2N4400	2N4400	S	0.36W	A	150	60	30	O	35	100	10M	0.3	0.15A			200M	T
2N3974	S	N	2N4401	2N4400	S	0.36W	A	150	60	30	O	55	200	10M	0.3	0.15A			200M	T
2N3975	S	N	2N4400	2N4400	S	0.36W	A	150	60	30	O	35	100	10M	0.3	0.15A			200M	T
2N3976	S	N	2N4401	2N4400	S	0.36W	A	150	60	30	O	55	200	10M	0.3	0.15A			200M	T
2N3977	S	P			SC	0.4W	A	200	15	10	O	40		5.0M	0.1	5.0M			1.0M	T
2N3978	S	P			SC	0.4W	A	200	25	20	O	30		5.0M	0.15	5.0M			1.0M	T
2N3979	S	P			SC	0.4W	A	200	40	35	O	20		5.0M	0.15	5.0M			1.0M	T
2N3980	Unijunction Transistors, see Table on Page 2-86																			
2N3981	S	N	2N2219	2N2218	SH	0.8W	A	200	60	30	O	30	120	0.15A	0.4	0.15A			250M	T
2N3982	S	N	2N2218	2N2218	SH	0.8W	A	200	50	20	O	40	140	0.15A	0.4	0.15A			250M	T
2N3983	S	N			AH	0.2W	A	150	30	12	O	30		4.0M					500M	T
2N3984	S	N			AH	0.2W	A	150	30	12	O	20		4.0M					400M	T
2N3985	S	N			AH	0.2W	A	150	30	12	O	20		4.0M					300M	T
2N3986 thru 2N3992	Thyristors, see Table on Page 2-66																			
2N3993	Field-Effect Transistors, see Table on Page 2-78																			
2N3994	Field-Effect Transistors, see Table on Page 2-78																			
2N3995	G	P	2N2929	2N2929	AH	0.3W	A	100	20	12	O	40	200	2.0M			150	E	0.6G	T
2N3996	S	N	2N5346	2N5346	SHP	2.0W	A	200	100	80	O	40	120	1.0A	0.25	1.0A			40M	T
2N3997	S	N	2N5346	2N5346	SHP	2.0W	A	200	100	80	O	80	240	1.0A	0.25	1.0A			40M	T
2N3998	S	N	2N5477	2N5346	SHP	2.0W	A	200	100	80	O	40	120	1.0A	0.25	1.0A			40M	T
2N3999	S	N	2N5478	2N5346	SHP	2.0W	A	200	100	80	O	80	240	1.0A	0.25	1.0A			40M	T
2N4000	S	N	2N3019	2N3019	SHP	1.0W	A	200	100	80	O	30	120	0.5A	0.3	0.5A			40M	T
2N4001	S	N	2N3500	2N3498	SHP	1.0W	A	200	120	100	O	40	120	0.5A	0.3	0.5A			40M	T
2N4002	S	N	MJ7000	MJ7000	AP	4.0W	A		100	80	O	20	80	15A			30	E	30M	B
2N4003	S	N	MJ7000	MJ7000	AP	4.0W	A		120	100	O	20	80	15A			30	E	30M	B
2N4004	S	N			AP	1.2W	A		100	80	O	30	150	10A					30M	B
2N4005	S	N			AP	1.2W	A		120	100	O	30	150	10A					30M	B
2N4006	S	P			A	400M	A	200	10	6.0	O						40	E	20M	T
2N4007	S	P			S	400M	A	200	20	15	O						30	E	15M	T
2N4008	S	P			S	400M	A	200	35	30	O						20	E	15M	T
2N4009	Matched Pair 2N4006																			
2N4010	Matched Pair 2N4007																			
2N4011	Matched Pair 2N4008																			
2N4012	S	N		2N4012	AP	11.6W	C	200	65	40	O	4.0	40	1.0A	1.0	0.25A			400M	T
2N4013	S	N			SH	360M	A	200	60	40	O		150	100M					300M	T
2N4014	S	N			SH	360M	A	200	80	50	O		150	100M					300M	T
2N4015	S	P			AM	0.4W	A	200	60	60	O	135	350	1.0M	0.25	50M	135	E	200M	T
2N4016	S	P			AM	0.4W	A	200	60	60	O	135	350	1.0M	0.25	50M	135	E	200M	T
2N4017	S	P			A	600M	A	200	80	80	O	100	500	1.0M					40M	T
2N4018	S	P			A	400M	A	200	60	60	O						100	E	7.0M	E
2N4019	S	P			A	400M	A	200	45	45	O						250	E	50M	T
2N4020	S	P			AM	0.4W	A	200	45	45	O	250	500	10*	0.25	10M	250	E	50M	T
2N4021	S	P			AM	0.4W	A	200	60	60	O	100	350	10*	0.25	10M	100	E	40M	T
2N4022	S	P			AM	0.4W	A	200	60	60	O	250	500	10*	0.25	10M	250	E	50M	T
2N4023	S	P			AM	0.4W	A	200	45	45	O	250	500	10*	0.25	10M	250	E	50M	T
2N4024	S	P			AM	0.4W	A	200	60	60	O	100	350	10*	0.25	10M	100	E	40M	T
2N4025	S	P			AM	0.4W	A	200	60	60	O	250	500	10*	0.25	10M	250	E	50M	T
2N4026	S	P			A	0.5W	A	200	60	60	O	40	120	0.1A	1.0	1.0A			100M	T
2N4027	S	P			A	0.5W	A	200	80	80	O	40	120	0.1A	0.5	0.5A			100M	T
2N4028	S	P			A	0.5W	A	200	60	60	O	100	300	0.1A	1.0	1.0A			150M	T
2N4029	S	P			A	0.5W	A	200	80	80	O	100	300	0.1A	0.5	0.5A			150M	T
2N4030	S	P			A	0.8W	A	200	60	60	O	40	120	0.1A	1.0	1.0A			100M	T
2N4031	S	P			A	0.8W	A	200	80	80	O	40	120	0.1A	0.5	0.5A			100M	T
2N4032	S	P			A	0.8W	A	200	60	60	O	100	300	0.1A	1.0	1.0A			150M	T
2N4033	S	P			A	0.8W	A	200	80	80	O	100	300	0.1A	0.5	0.5A			150M	T
2N4034	S	P			SH	0.36W	A	200	40	40	O	70	200	10M	0.13	1.0M	50	E	400M	T
2N4035	S	P			SH	0.36W	A	200	40	40	O	150	300	10M	0.13	1.0M	150	E	450M	T
2N4036	S	P	MM4036		S	7.0W	A	200	90	65	O	40	140	0.15A					60M	T
2N4037	S	P	MM4037		S	1.0W	A	200	60	40	O	50	250	0.15A					60M	T
2N4038 2N4039	Field-Effect Transistors, see Table on Page 2-78																			
2N4040	S	N			AHP	17.5W	C	200	60	40	O	10	80	0.1A	2.0	1.0A			400M	T
2N4041	S	N			AHP	10W	C	200	60	40	O	10	80	75M	2.0	0.5A			400M	T
2N4042	S	N			AM	0.3W	C	200	60	60	O	200	600	10*	0.35	1.0M			200M	T
2N4043	S	N			AM	0.3W	C	200	45	45	O	80	800	10*	0.35	1.0M			150M	T
2N4044	S	N			AM	0.4W	C	200	60	60	O	200	600	10*	0.35	1.0M			200M	T
2N4045	S	N			AM	0.4W	C	200	45	45	O	80	800	10*	0.35	1.0M			150M	T
2N4046	S	N	2N3052	2N3052	SH	800M	A	200	50	30	O		150	100M					250M	T
2N4047	S	N	2N2193	2N2192	SH	800M	A	200	80	50	O		150	100M					250M	T
2N4048	G	P		2N4048	AP	170W	C	110	45	30	O	60	180	15A	0.30	60A			2.0K	E
2N4049	G	P		2N4048	AP	170W	C	110	60	45	O	60	180	15A	0.30	60A			2.0K	E
2N4050	G	P		2N4048	AP	170W	C	110	75	60	O	60	180	15A	0.30	60A			2.0K	E
2N4051	G	P		2N4048	AP	170W	C	110	45	30	O	120	240	15A	0.30	60A			2.0K	E
2N4052	G	P		2N4048	AP	170W	C	110	60	45	O	120	240	15A	0.30	60A			2.0K	E
2N4053	G	P		2N4048	AP	170W	C	110	75	60	O	120	240	15A	0.30	60A			2.0K	E
2N4054	S	N	MJ400	MJ400	AP	6.25W	C	150	300	300	O	30	90	50M	5.0	75M			15M	T
2N4055	S	N	MJ400	MJ400	AP	6.25W	C	150	250	250	O	30	90	50M	5.0	75M			15M	T
2N4056	S	N	MJ400	MJ400	AP	6.25W	C	150	200	200	O	30	90	50M	5.0	75M			15M	T
2N4057	S	N	MJ400	MJ400	AP	6.25W	C	150	150	150	O	30	90	50M	5.0	75M			15M	T
2N4058	S	P	MPS6522	MPS6516	A	0.25W	A	150	30	30	O	100	400	0.1M	0.7	10M	100	E		
2N4059	S	P	MPS6516	MPS6516	A	0.25W	A	150	30	30	O	45	660	1.0M	0.7	10M	45	E		

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TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N4060	S	P	MPS6516	MPS6516	A	0.25W	A	150	30	30	O	45	165	1.0M	0.7	10M	45	E		
2N4061	S	P	MPS6517	MPS6516	A	0.25W	A	150	30	30	O	90	330	1.0M	0.7	10M	90	E		
2N4062	S	P	MPS6518	MPS6516	A	0.25W	A	150	30	30	O	180	660	1.0M	0.7	10M	180	E		
2N4063	S	N	2N3439	2N3439	AP	10W	C	200	450	350	O	40	160	0.02A					15M	E
2N4064	S	N	2N3440	2N3439	AP	10W	C	200	300	250	O	40	160	0.02A					15M	E
2N4065 thru 2N4067	Field-Effect Transistors, see Table on Page 2-78																			
2N4068	S	N			AH	500M	A	175	150	150	O	30		30M					50M	T
2N4069	S	N			AP	1.0W	C	175	150	150	O	30		0.03A	0.68				50M	T
2N4070	S	N	2N3448	2N3445	AP	115W	C	200	100	80	O	40	120	5.0A	1.5	5.0A	40	E	10M	T
2N4072	S	N		2N4072	AHP	1.5W	C	200	40	20	O	10		25A					550M	T
2N4073	S	N		2N4072	AHP	1.5W	C	200	40	20	O	10		25A					550M	T
2N4074	S	N			AH	400M	A	175	40	40	O						400	E		
2N4075	S	N	2N3764	2N3762	AP	30W	C	200		80	O	30	90						30M	T
2N4076	S	N			AP	30W	C	200		80	O	50	150						30M	T
2N4080	S	P			AHP	300M	A	200	20	15	O	20		3.0M					1.0G	T
2N4081	S	N			AH	200M	A		40	40	O	40	180	2.0M			40	E	600M	T
2N4082 thru 2N4085	Field-Effect Transistors, see Table on Page 2-8																			
2N4086	S	N	MPS6514	MPS6512	A	200M	A		12	12	O	150	300	2.0M			150	E		
2N4087	S	N	MPS6515	MPS6512	A	200M	A		12	12	O	250	500	2.0M			250	E		
2N4087A	S	N	MPS6515	MPS6512	A	200M	A		12	12	O	250	500	2.0M			250	E		
2N4088 thru 2N4095	Field-Effect Transistors, see Table on Page 2-78																			
2N4096 thru 2N4098	Thyristors, see Table on Page 2-66																			
2N4099	S	N			AM	300M	A	200	55	55	O	175		1.0M					150M	T
2N4100	S	N			AM	400M	A	200	55	55	O	175		1.0M					150M	T
2N4101 thru 2N4103	Thyristors, see Table on Page 2-66																			
2N4104	S	N			AH	300M	A	175	60	60	O						1400	E	540M	T
2N4106	G	P	MP2060	MPS2060	A	1.6W	A		25			70	350	5.0M						
2N4108 thru 2N4110	Thyristors, see Table on Page 2-66																			
2N4111	S	N	2N5428	2N5427	AP	30W	C		100	60	O	40	120	2.0A					70M	T
2N4112	S	N			AP	30W	C		100	60	O	100	300	2.0A					80M	T
2N4113	S	N	2N5428	2N5427	AP	30W	C		120	80	O	40	120	2.0A					70M	T
2N4114	S	N			AP	3.0W	A		120	80	O	100	300	2.0A					80M	E
2N4115	S	N	2N5428	2N5427	AP	37W	C		120	80	O	40	120	2.0A					70M	E
2N4116	S	N			AP	37W	C		120	80	O	100	300	2.0A					80M	E
2N4117,A thru 2N4120,A	Field-Effect Transistors, see Table on Page 2-78																			
2N4121	S	P	2N3905	2N3905	AH	200M	A	125	40	40	O	70		10M			50	E	400M	T
2N4122	S	P	2N3906	2N3905	AH	200M	A	125	40	40	O	150		10M			150	E	450M	T
2N4123	S	N		2N4123	SH	310M	A	135	40	30	O	50	150	2.0M	0.3	50M	50	E	250M	T
2N4124	S	N		2N4123	SH	310M	A	135	30	25	O	120	360	2.0M	0.3	50M	120	E	300M	T
2N4125	S	P		2N4125	SH	310M	A	135	30	30	O	50	150	2.0M	0.4	50M	50	E	200M	T
2N4126	S	P		2N4125	SH	310M	A	135	25	25	O	120	360	2.0M	0.4	50M	120	E	250M	T
2N4127	S	N			AP	25W	C		60	40	O	10	80	0.2A					300M	T
2N4128	S	N			AP	40W	C		60	40	O	10	80	0.2A					200M	T
2N4130	S	N	2N5869	2N5867	AP	120W	C		80	65	O	10	60	2.0A					1.25M	E
2N4131	S	N			AP	60W	C		90	80	O	10	80	1.0A					150M	E
2N4132	S	N			AHP	7.5W	C	175	90	80	O	10	80	0.2A	0.5	0.6A			200M	T
2N4133	S	N			AHP	3.0W	C	175	90	80	O	10	80	0.2A	0.5	0.6A			200M	T
2N4134	S	N			AH	200M	A	200	30	30	O						200	E	350M	T
2N4135	S	N			AH	200M	A	200	30	30	O						200	E	425M	T
2N4136	Pair of 2N2430 and 2N2431																			
2N4137	S	N			SP	360M	A	200	40	40	O	40	120	10M					500M	T
2N4138	S	N			SC	300M	A	200	30	30	O	50		1.0M					20M	T
2N4139	Field-Effect Transistors, see Table on Page 2-78																			
2N4140	S	N	2N4400	2N4400	AH	300M	A	125	60	30	O		120	150M					250M	T
2N4141	S	N	2N4401	2N4400	AH	300M	A	125	60	30	O		300	150M					250M	T
2N4142	S	P	2N4402	2N4402	AH	300M	A	125	60	40	O		120	150M					200M	T
2N4143	S	P	2N4403	2N4402	AH	300M	A	125	60	40	O		300	150M					200M	T
2N4144 thru 2N4149	Thyristors, see Table on Page 2-66																			
2N4150	S	N	2N5337	2N5336	AP	5W	C		100	80	O	40	120	5.0A					15M	T
2N4151 thru 2N4204	Thyristors, see Table on Page 2-66																			
2N4207	S	P			SH	300M	A	200	6.0	6.0	O	50	120	10M					650M	T
2N4208	S	P			SH	300M	A	200	12	12	O	30	120	10M					700M	T
2N4209	S	P			SH	300M	A	200	15	15	O	50	120	10M					850M	T
2N4210	S	N	MJ7000	MJ7000	AP	100W	C		80	60	O	20	100	10A					10M	T
2N4211	S	N	MJ7000	MJ7000	AP	100W	C		100	80	O	20	100	10A					10M	T
2N4212 thru 2N4219	Thyristors, see Table on Page 2-66																			
2N4220,A thru 2N4224,A	Field-Effect Transistors, see Table on Page 2-78																			
2N4225	S	N	2N5334	2N5334	AP	5.0W	C		100	40	O	40	150	1.0A					150M	T
2N4226	S	N	2N5334	2N5334	AP	5.0W	C		200	60	O	40	150	1.0A					150M	T
2N4227	S	N	2N4400	2N4400	S	300M	A	125	60	30	O		150	150M					250M	T

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N4228	S	P	2N4402	2N4402	AH	300M	A	125	60	40	O		150	150M					200M	T
2N4231	S	N	2N4231	2N4231	AP	35W	C	200		40	O	25	100	1.5A	0.7	1.5A			1.0M	T
2N4232	S	N	2N4232	2N4231	AP	35W	C	200		60	O	25	100	1.5A	0.7	1.5A			1.0M	T
2N4233	S	N	2N4233	2N4231	AP	35W	C	200		80	O	25	100	1.5A	0.7	1.5A			1.0M	T
2N4234	S	P	2N4234	2N4234	SP	1.0W	A	200	40	40	O	30	150	250M	0.6	1.0A			3.0M	T
2N4235	S	P	2N4235	2N4234	SP	1.0W	A	200	60	60	O	30	150	250M	0.6	1.0A			3.0M	T
2N4236	S	P	2N4236	2N4234	SP	1.0W	A	200	80	80	O	30	150	250M	0.6	1.0A			3.0M	T
2N4237	S	P	2N4327	2N4237	AP	5.0W	C	175	50	40	O	40	160	500M	2.5	1.0A	40	E	10M	T
2N4238	S	P	2N4328	2N4237	AP	5.0W	C	175	80	60	O	40	160	500M	2.5	1.0A	40	E	2.0M	T
2N4239	S	P	2N4329	2N4237	AP	5.0W	C	175	100	60	O	40	160	500M	2.5	1.0A	40	E	2.0M	T
2N4240	S	N	2N4240		AP	35W	C		440	300	O	30	240	0.75A					2.0M	T
2N4241	G	P			A	37.5W	C		32	20	O	60	300	300M	0.35	5.0A				
2N4242	G	P			AP	105W	A		80	60	O	40	80	5.0A					500K	T
2N4243	G	P			AP	105W	A		60	45	O	40	80	5.0A					500K	T
2N4244	G	P			AP	105W	A		40	30	O	40	80	5.0A					500K	T
2N4245	G	P			AP	105W	A		80	60	O	60	120	5.0A					500K	T
2N4246	G	P			AP	105W	A		60	45	O	60	120	5.0A					500K	T
2N4247	G	P			AP	105W	A		40	30	O	60	120	5.0A					500K	T
2N4248	S	P	2N5086	2N5086	A	200M	A	125	40	40	O						50	E	40M	T
2N4249	S	P	2N5086	2N5086	A	200M	A	125	60	60	O						100	E	40M	T
2N4250	S	P	2N5087	2N5086	A	200M	A	125	40	40	O						250	E	40M	T
2N4251	S	N			S	250M	A	200	15	10	O	100		10M					1300M	T
2N4252	S	N			AH	200M	A	175	30	18	O	50		2.0M					600M	T
2N4253	S	N			AH	200M	A	175	30	18	O	30		2.0M					600M	T
2N4254	S	N	MPS6547	MPS6546	A	200M	A	175	30	18	O	50		2.0M						
2N4255	S	N	MPS6547	MPS6546	A	200M	A	175	30	18	O	30		2.0M						
2N4256	S	N	2N3904	2N3903	A	200M	A		30	30	S		500	2.0M						
2N4257	S	P			SH	200M	A	125	6.0	6.0	O	30	120	10M					500M	T
2N4275A	S	P			SH	0.5W	C	125	6.0	6.0	O	30	120	10M	0.15	10M			500M	T
2N4258	S	P			SH	200M	A	125	12	12	O	30	120	10M					700M	T
2N4258A	S	P			SH	0.5W	C	125	12	12	O	30	120	10M	0.15	10M			500M	T
2N4259	S	N			AH	175M	A	175	40	30	O						70	E		
2N4260	S	P		2N4260	SH	200M	A	200	15	15	O	30	150	10M	15	10M	16	E	1500M	T
2N4261	S	P		2N4260	SH	200M	A	200	5.0	15	O	30	150	15A	15	10M	20	E	2000M	T
2N4262	S	N			AP	1.5W	C		25	10	O	75		0.3A					600M	T
2N4263	S	N			AP	1.5W	C		25	10	O	75		0.3A					800M	T
2N4264	S	N		2N4264	S	310M	A	135	30	15	O	40	160	10M					300M	T
2N4265	S	P		2N4264	SH	310M	A	135	30	12	O	100	400	15A	0.22	10M			300M	T
2N4267 2N4268	Field-Effect Transistors, see Table on Page 2-78																			
2N4269	S	N			A	360M	A	200	200	140	O		200	10M						
2N4270	S	N			A	580M	A	200	200	140	O		200	10M						
2N4271	S	N	2N5682	2N5681	AP	5.0W	C		175	140	O	20	140	0.2A					20M	T
2N4272	S	N	2N5682	2N5681	AP	5.0W	C		175	140	O	20	140	1.0A					10M	T
2N4273	S	N			AP	25W	C		175	140	O	20	140	1.0A					10M	T
2N4274	S	N			SH	280M	A	125	30	12	O	18		100M					400M	T
2N4275	S	N			SH	280M	A	125	40	15	O	18		100M					400M	T
2N4276	G	P		2N4276	AP	170W	C	110	30	20	O	60	180	15A	0.15	15A			2.0K	E
2N4277	G	P		2N4276	AP	170W	C	110	30	20	O	120	240	15A	0.15	15A			2.0K	E
2N4278	G	P		2N4276	AP	170W	C	110	45	30	O	60	180	15A	0.15	15A			2.0K	E
2N4279	G	P		2N4276	AP	170W	C	110	45	30	O	120	240	15A	0.15	15A			2.0K	E
2N4280	G	P		2N4276	AP	170W	C	110	60	45	O	60	180	15A	0.15	15A			2.0K	E
2N4281	G	P		2N4276	AP	170W	C	110	60	45	O	120	240	15A	0.15	15A			2.0K	E
2N4282	G	P		2N4276	AP	170W	C	110	75	60	O	60	180	15A	0.15	15A			2.0K	E
2N4283	G	P		2N4276	AP	170W	C	110	75	60	O	120	240	15A	0.15	15A			2.0K	E
2N4284	S	P			A	250M	A	165	25	25	O		600	1.0M						
2N4285	S	P			A	250M	A	165	35	35	O		600	1.0M						
2N4286	S	N	MPS6515		A	250M	A	150	30	25	O						600	E	40M	T
2N4287	S	N	MPS6566		A	250M	A	150	45	45	O						600	E	40M	T
2N4288	S	P	MPS6518	MPS6516	A	250M	A	150	30	25	O						600	E	40M	T
2N4289	S	P	2N5086		A	250M	A	150	60	45	O						600	E	40M	T
2N4290	S	P	MPS6533	MPS6530	A	250M	A	150	30	20	O						600	E	40M	T
2N4291	S	P	MPS6534	MPS6530	A	250M	A	150	40	30	O						600	E	40M	T
2N4292	S	N	MPS918	MPS918	A	200M	A	150	30	15	O	20		3.0M					600M	T
2N4293	S	N	MPS918	MPS918	A	200M	A	150	30	15	O						60	E	600M	T
2N4294	S	N	2N4264	2N4264	SH	200M	A	150	30	12	O	30	120	10M					400M	T
2N4295	S	N	2N4264	2N4264	SH	200M	A	150	40	15	O	40	120	10M					500M	T
2N4296	S	N	2N3738	2N3738	SP	20W	C		350	250	O	50	150	0.05A					20M	T
2N4297	S	N	2N3738	2N3738	AP	20W	C		350	250	O	75	300	0.05A					20M	T
2N4298	S	N	2N3739	2N3739	AP	20W	C		500	350	O	25	75	0.05A					20M	T
2N4299	S	N	2N3739	2N3739	AP	20W	C		500	350	O	50	150	0.05A					20M	T
2N4300	S	N	2N5336	2N5336	AP	15W	C		100	80	O	30	120	1.0A					30M	T
2N4301	S	N	2N5477	2N5477	AP	50W	C		100	80	O	30	120	5.0A					40M	T
2N4302 thru 2N4304	Field-Effect Transistors, see Table on Page 2-78																			
2N4305	S	N	2N5337	2N5336	AP	1.5W	A		120	80	O	50	150	1.0A						
2N4306	S	N			AP	4.0W	A		120	80	O	50	150	1.0A						
2N4307	S	N	2N5337	2N5336	AP	1.5W	A		100	60	O	50	150	1.0A						
2N4308	S	N			AP	4.0W	A		100	60	O	50	150	1.0A						
2N4309	S	N	2N5337	2N5336	AP	1.5W	A		120	80	O	50	150	1.0A						
2N4310	S	N			AP	4.0W	A		120	80	O	40	120	1.0A						
2N4311	S	N	2N5337	2N5336	AP	1.5W	A		100	60	O	40	120	1.0A						
2N4312	S	N			AP	4.0W	A		100	60	O	40	120	1.0A						
2N4313	S	P			SC	200M	A	125	12	12	O	30	120	30M					700M	T
2N4314	S	P			AP	1.0W	A		90	65	O	50	250	0.15A					200M	T
2N4316 thru 2N4319	Thyristors, see Table on Page 2-66																			

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N4338 thru 2N4343	Field-Effect Transistors, see Table on Page 2-78																			
2N4346					AP	5.0W	A			60	0									
2N4347	S	N	2N4347		AP	100W	C		140	120	0	15	60	2.0A						
2N4348	S	N	2N4348		AP	120W	C		140	120	0	15	60	5.0A						
2N4350	S	N			AP	7.0W	C		65	40	0	10	200	0.35A					300M	T
2N4351 2N4352 2N4353	Field-Effect Transistors, see Table on Page 2-78																			
2N4354	S	P			A	350M	A	125	60	60	0	25		0.1M					500M	T
2N4355	S	P			A	350M	A	125	60	60	0	60		0.1M					500M	T
2N4356	S	P			A	350M	A	125	80	80	0	25		0.1M					500M	T
2N4357	S	P			A	400M	A	200	240	240	0	80	300	10M	0.5	10M	100	E	40M	T
2N4358	S	P			A	400M	A	200	240	240	0	80	300	10M	0.5	10M	100	E	40M	T
2N4359	S	P			A	360M	A	200	45	45	0	50	600	1.0M	0.25	10M	50	E		
2N4360	Field-Effect Transistors, see Table on Page 2-78																			
2N4361 thru 2N4380	Thyristors, see Table on Page 2-66																			
2N4381 2N4382	Field-Effect Transistors, see Table on Page 2-78																			
2N4383	S	N			AH	800M	A	200	40	30	0						1000	E	120M	T
2N4384	S	N			AH	500M	A	200	40	30	0						1000	E	120M	T
2N4385	S	N			AH	800M	A	200	40	30	0						1000	E	120M	T
2N4386	S	N			AH	500M	A	200	40	30	0						1000	E	120M	T
2N4387	S	P	2N3740	2N3740		20W	A	200	40	40	0	25	100	500M						
2N4388	S	P	2N3740	2N3740		20W	A	200	60	60	0	25	100	500M						
2N4389	S	P			SH	200M	A	125	12	12	0	30	180	10M	0.15	10M	4.0	E		
2N4390	S	N			S	500M	A	175	120	120	0	20		2.0M					50M	T
2N4391 thru 2N4393	Field-Effect Transistors, see Table on Page 2-78																			
2N4395	S	N	2N3715	2N3713	AP	62.5W	C		60	40	0	50	170	2.0A					4M	T
2N4396	S	N	2N3715	2N3713	AP	62.5W	C		80	60	0	40	170	2.0A					4M	T
2N4397	S	N			AM	200M	A		40	40	0	40	180	2.0M			40	E	600M	T
2N4398	S	P	2N4398	2N4398	AP	200W	C	200	40	40	0	15	60	15A	1.0	15A	40	E	4M	T
2N4399	S	P	2N4399	2N4398	AP	200W	C	200	60	60	0	15	60	15A	1.0	15A	40	E	4M	T
2N4400	S	N		2N4400	SH	310M	A	135	60	40	0	50	150	150M	0.4	150M	20	E	200M	T
2N4401	S	N		2N4400	SH	310M	A	135	60	40	0	100	300	150M	0.4	150M	40	E	250M	T
2N4402	S	P		2N4402	SH	310M	A	135	40	40	0	50	150	150M	0.4	150M	30	E	150M	T
2N4403	S	P		2N4402	SH	310M	A	135	40	40	0	100	300	150M	0.4	150M	60	E	200M	T
2N4404	S	P		2N4404	A	5.0W	C		80	80	0	40	120	150M	0.15	10M			200M	T
2N4405	S	P		2N4404	A	5.0W	C		80	80	0	100	300	150M	0.15	10M			200M	T
2N4406	S	P		2N4406	A	5.0W	C		80	80	0	30	120	500M	0.2	150M			150M	T
2N4407	S	P		2N4406	A	5.0W	C		80	80	0	80	240	500M	0.2	150M			150M	T
2N4409	S	N		2N4409	S	310M	A	135	80	50	0	60	400	1.0M	0.2	1.0M				
2N4410	S	N		2N4409	S	310M	A	135	120	80	0	60	400	1.0M	0.2	1.0M				
2N4411	S	P			S	150M	A	200	15	12	0	40		0.5M					400M	T
2N4412	S	N			AH	600M	A	200	40	30	0						1000	E	100M	T
2N4412A	S	P			AH	600M	A	200	60	60	0						120	E	20M	T
2N4413	S	P			AH	400M	A	200	40	30	0						1000	E	100M	T
2N4413A	S	P			AH	400M	A	200	60	60	0						120	E	20M	T
2N4414	S	P			AH	600M	A	200	40	30	0						1000	E	100M	T
2N4414A	S	P			AH	600M	A	200	60	60	0						100	E	20M	T
2N4415	S	P			AH	400M	A	200	40	30	0						1000	E	100M	T
2N4415A	S	P			AH	400M	A	200	60	60	0						100	E	20M	T
2N4416 2N4416A 2N4417	Field-Effect Transistors, see Table on Page 2-78																			
2N4418	S	N	2N4264	2N4264	S	250M	A	125	40	40	S	40	120	10M					500M	T
2N4419	S	N	2N4264	2N4264	S	250M	A	125	30	30	S	30		10M					400M	T
2N4420	S	N	MPS3646	MPS3646	S	250M	A	125	40	40	S	30	120	30M					350M	T
2N4421	S	N	MPS3646	MPS3646	S	250M	A	125	30	30	S	25		30M					300M	T
2N4422	S	N	MPS3646	MPS3646	S	250M	A	125	40	40	S	30	120	30M					350M	T
2N4423	S	N	MPS3640	MPS3646	S	250M	A	125	12	12	S	40	150	30M					400M	T
2N4424	S	N	MPS3711	MPS3707	S	360M	A	150	40	40	0						180	E		
2N4425	S	N			S	560M	A	150	40	40	0	180		2M						
2N4427	S	N		2N4427	AP	3.5W	C		40	20	0	10	200	0.1A					500M	T
2N4428	S	N		2N4428	AP	3.5W	C		55	35	0	20	200	0.05A					700M	T
2N4429	S	N			AP	5.0W	C		55	35	0	20	200	0.05A					700M	T
2N4430	S	N			AP	10W	C		55	40	0	20	200	0.1A					600M	T
2N4431	S	N			AP	18W	C		55	40	0	20	200	0.1A					600M	T
2N4432	S	N			AH	600M	A		50	30	0	40	130	6.0M			45	E		
2N4432A	S	N			AH	600M	A		50	30	0	80	150	6.0M			90	E		
2N4436	S	N			AHP	200M	A	125	60	30	0	40	120	150M	0.22	150M			250M	T
2N4437	S	N			AHP	200M	A	125	60	30	0	100	300	150M	0.22	150M			250M	T
2N4438	S	N			A	1.0W	A	200	300	300	0	40	120	50M	1.0	100M			30M	T
2N4439	S	N			A	1.0W	A	200	300	300	0	100	240	50M	1.0	100M			30M	T
2N4440	S	N			AP	11.6W	C		65	40	0	10	200	0.125A					400M	T
2N4441 thru 2N4444	Thyristors, see Table on Page 2-66																			
2N4445 thru 2N4448	Field-Effect Transistors, see Table on Page 2-78																			
2N4449	S	N			SH	0.3W	A			40	0	40		10M	0.18	10M			500M	T
2N4450	S	N			SH	0.3W	C	200	60	30	0	75		10M	0.22	150M			250M	T

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_{-} Units	Subscript
2N4451	S	P			S	0.3W	A			12	0	40		30M	0.25	30M			400M	T
2N4452	S	P			S	0.35W	A	200	45	45	0	115	300	50M	0.4	15M	135	E	200M	T
2N4453	S	P			S	0.3W	A			18	0	40		30M	0.25	30M			400M	T
2N4576	S	N	2N3716	2N3713	AHP	150W	C	200	100	80	0	50	150	1.0A	0.8	5.0A	25	E	30K	E
2N4851																				
thru	Unijunction Transistors, see Table on Page 2-86																			
2N4853																				
2N4854	Complementary Pair				SH	300M	A	200	60	40	0	50		1.0M					200M	T
2N4855					SH	300M	A	200	60	40	0	25		1.0M					200M	T
2N4856																				
thru	Field-Effect Transistors, see Table on Page 2-78																			
2N4861																				
2N4862	S	N			AP			200	140	120	0	50	150	0.5A	0.2	0.5A	50	E	50M	T
2N4863	S	N			AP			200	140	120	0	50	150	0.5A	0.2	0.5A	50	E	50M	T
2N4864	S	N			AP			200	140	120	0	50	150	0.5A	0.2	0.5A	50	E	50M	T
2N4865	S	N			SP	350W	C	200	100	80	0	10	40	70A	1.5	50A			10M	T
2N4866	S	N			SP	350W	C	200	140	120	0	10	40	70A	1.5	50A			10M	T
2N4867,A																				
thru	Field-Effect Transistors, see Table on Page 2-78																			
2N4869,A																				
2N4870																				
2N4871	Unijunction Transistors, see Table on Page 2-86																			
2N4872	S	P			SH	700M	C	200	12	12	0	50	120	10M	0.13	1.0M	9.0	E		
2N4873	S	N			SH	360M	A	200	40	15	0	110	150	10M	0.2	10M	7.0	E		
2N4874	S	N			AH	720M	A	175	30	20	0						200	E	900M	T
2N4875	S	N			AH	720M	A	175	40	25	0						200	E	800M	T
2N4876	S	N			AH	720M	A	175	40	30	0						200	E	650M	T
2N4877	S	N	2N4877	2N4877	AP	10W	C	200		60	0	20	100	4.0A	1.0	4.0A			4.0M	T
2N4878	S	N			AM	300M	C		60	60	0	200	600	10*	0.35	1.0M			200M	T
2N4879	S	N			AM	300M	C		55	55	0	150	600	10*	0.35	1.0M			150M	T
2N4880	S	N	2N5401		AM	300M	C		45	45	0	80	800	10*	0.35	1.0M			150M	T
2N4881																				
thru	Field-Effect Transistors, see Table on Page 2-78																			
2N4886																				
2N4888	S	P			A	300M	A	125	150	150	0	40	400	10M	0.5	10M			30M	T
2N4889	S	P			A	300M	A	125	150	150	0	80	300	10M	0.5	10M			40M	T
2N4890	S	P		2N4890	S	1.0W	A		60	40	0	50	250	150M	1.4	150M	5.0	E		
2N4891																				
thru	Unijunction Transistors, see Table on Page 2-86																			
2N4894																				
2N4895	S	N			SP	4.0W	C	200	120	60	0	40	120	2.0A	1.0	5.0A	2.5	E		
2N4896	S	N	2N4337		SP	4.0W	C	200	120	60	0	100	300	2.0A	1.0	5.0A	4.0	E		
2N4897	S	N			SP	4.0W	C	200	150	80	0	40	120	2.0A	1.0	5.0A	2.5	E		
2N4898	S	P	2N4898	2N4898	AP	25W	C	200	40	40	0	20	100	0.5A	0.6	1.0A	25	E	3.0M	T
2N4899	S	P	2N4899	2N4898	AP	25W	C	200	60	60	0	20	100	0.5A	0.6	1.0A	25	E	3.0M	T
2N4900	S	P	2N4900	2N4898	AP	25W	C	200	80	80	0	20	100	0.5A	0.6	1.0A	25	E	3.0M	T
2N4901	S	P	2N4901	2N4901	AP	87.5W	C	200	40	40	0	20	80	1.0A	0.4	1.0A	20	E	4.0M	T
2N4902	S	P	2N4902	2N4901	AP	87.5W	C	200	60	60	0	20	80	1.0A	0.4	1.0A	20	E	4.0M	T
2N4903	S	P	2N4903	2N4901	AP	87.5W	C	200	80	80	0	20	80	1.0A	0.4	1.0A	20	E	4.0M	T
2N4904	S	P	2N4904	2N4904	AP	87.5W	C	200	40	40	0	25	100	2.5A	1.0	2.5A	40	E	4.0M	T
2N4905	S	P	2N4905	2N4904	AP	87.5W	C	200	60	60	0	25	100	2.5A	1.0	2.5A	40	E	4.0M	T
2N4906	S	P	2N4906	2N4904	AP	87.5W	C	200	80	80	0	25	100	2.5A	1.0	2.5A	40	E	4.0M	T
2N4907	S	P	2N4907		AP	150W	C	200		40	0	20	80	4.0A	0.75	4.0A			4.0M	T
2N4908	S	P	2N4908		AP	150W	C	200		60	0	20	80	4.0A	0.75	4.0A			4.0M	T
2N4909	S	P	2N4909		AP	150W	C	200		80	0	20	80	4.0A	0.75	4.0A			4.0M	T
2N4910	S	N	2N4910	2N4910	AP	25W	C	200	40	40	0	20	100	0.5A	0.6	1.0A	25	E	3.0M	T
2N4911	S	N	2N4911	2N4910	AP	25W	C	200	60	60	0	20	100	0.5A	0.6	1.0A	25	E	3.0M	T
2N4912	S	N	2N4912	2N4910	AP	25W	C	200	80	80	0	20	100	0.5A	0.6	1.0A	25	E	3.0M	T
2N4913	S	N	2N4913	2N4913	AP	87.5W	C	200	40	40	0	25	100	2.5A	1.0	2.5A	20	E	4.0M	T
2N4914	S	N	2N4914	2N4913	AP	87.5W	C	200	60	60	0	25	100	2.5A	1.0	2.5A	20	E	4.0M	T
2N4915	S	N	2N4915	2N4913	AP	87.5W	C	200	80	80	0	25	100	2.5A	1.0	2.5A	20	E	4.0M	T
2N4916	S	P			SH	500M	C	125	30	30	0	70	200	10M	0.14	10M			400M	T
2N4917	S	P			SH	500M	C	125	30	30	0	150	300	10M	0.14	10M			450M	T
2N4918	S	P	2N4918	2N4918	AP	30W	C	150	40	40	0	20	100	0.5A	0.6	1.0A	25	E	3.0M	T
2N4919	S	P	2N4919	2N4918	AP	30W	C	150	60	60	0	20	100	0.5A	0.6	1.0A	25	E	3.0M	T
2N4920	S	P	2N4920	2N4918	AP	30W	C	150	80	80	0	20	100	0.5A	0.6	1.0A	25	E	3.0M	T
2N4921	S	N	2N4921	2N4921	AP	30W	C	150	40	40	0	20	100	0.5A	0.6	1.0A	25	E	3.0M	T
2N4922	S	N	2N4922	2N4921	AP	30W	C	150	60	60	0	20	100	0.5A	0.6	1.0A	25	E	3.0M	T
2N4923	S	N	2N4923	2N4921	AP	30W	C	150	80	80	0	20	100	0.5A	0.6	1.0A	25	E	3.0M	T
2N4924	S	N		2N4924	AH	1.0W	A	175	100	100	0	40	200	150M	0.4	50M			100M	T
2N4925	S	N		2N4924	AH	1.0W	A	175	150	150	0	40	200	150M	0.4	50M			100M	T
2N4926	S	N		2N4926	AH	1.0W	A	175	200	200	0	20	200	30M	2.0	30M	25	E	300M	T
2N4927	S	N		2N4926	AH	1.0W	A	175	250	250	0	20	200	30M	2.0	30M	25	E	300M	T
2N4928	S	P		2N4928	A	3.0W	C		100	100	0	25	200	10M	0.5	10M			100M	T
2N4929	S	P		2N4928	A	5.0W	C		150	150	0	25	200	10M	0.5	10M			100M	T
2N4930	S	P		2N4928	A	5.0W	C		200	200	0	20	200	10M	5.0	10M			20M	T
2N4931	S	P		2N4928	A	5.0W	C		250	250	0	20	200	10M	5.0	10M			20M	T
2N4932	S	N	2N5477	2N5477	AP	70W	C		50	25	0	10	100	1.0A					100M	T
2N4933	S	N	2N5477	2N5477	AP	70W	C		70	35	0	10	100	1.0A					100M	T
2N4934	S	N			AH	200M	A		40	30	0	40	170	2.0M					700M	T
2N4935	S	N			AH	200M	A		50	40	0	60	200	2.0M					700M	T
2N4936	S	N			AH	200M	A		50	40	0	60	250	2.0M			70	E	700M	T
2N4937	S	P		2N4937	AM	600M	A	200	50	40	0	50	250	1.0M			50	E	300M	T
2N4938	S	P		2N4937	AM	600M	A	200	50	40	0	50	250	1.0M			50	E	300M	T
2N4939	S	P		2N4937	AM	600M	A	200	50	40	0	50	250	1.0M			50	E	300M	T
2N4940	S	P		2N4937	AM	600M	A	200	50	40	0	50	250	1.0M			50	E	300M	T
2N4941	S	P		2N4937	AM	600M	A	200	50	40	0	50	250	1.0M			50	E	300M	T
2N4942	S	P		2N4937	AM	600M	A	200	50	40	0	50	250	1.0M			50	E	300M	T

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TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N4943	S	N			AP	800M	A		120	80	0	100	300	150M	0.25	150M			45M	T
2N4944	S	N			A	600M	C	125	80	40	0	40	100	150M	0.25	150M			60M	T
2N4945	S	N			A	600M	C	125	80	60	0	40	100	150M	0.25	150M			60M	T
2N4946	S	N			A	600M	C	125	80	40	0	100	300	150M	0.25	150M			60M	T
2N4947																				
2N4948	Unijunction Transistors, see Table on Page 2-86																			
2N4949																				
2N4950	S	N	MJ7000	MJ7000	SP	300W	C		80	60	0	10		50A	1.5	50A			100K	T
2N4951	S	N			A	360M	A	150	60	30	0	60	200	150M	0.3	150M			250M	T
2N4952	S	N			A	360M	A	150	60	30	0	100	300	150M	0.3	150M			250M	T
2N4953	S	N			A	360M	A	150	60	30	0	200	600	150M	0.3	150M			250M	T
2N4954	S	N			A	360M	A	150	40	30	0	60	600	150M	0.3	150M			250M	T
2N4955	S	N			AL	750M	C	125	30	25	0	60	600	10*	0.35	1.0M	150	E	60M	T
2N4956	S	N			AM	750M	C	125	30	25	0	60	600	10*	0.35	1.0M	150	E	60M	T
2N4957	S	P		2N4957	A	200M	A	200	30	30	0	20	40	2.0M					1200M	T
2N4958	S	P		2N4957	A	200M	A	200	30	30	0	20	40	2.0M					1000M	T
2N4959	S	P		2N4957	A	200M	A	200	30	30	0	20	40	2.0M					1000M	T
2N4960	S	N			A	800M	A	200	60	60	0	100	300	150M	0.7	10M			250M	T
2N4961	S	N			A	500M	A	200	80	80	0	100	300	150M	0.7	10M			250M	T
2N4962	S	N			A	800M	A	200	60	60	0	100	300	150M	0.7	10M			250M	T
2N4963	S	N			A	500M	A	200	80	80	0	100	300	150M	0.7	10M			250M	T
2N4964	S	P			A	200M	A		50	40	0	30	120	10*	0.4	10M	40	E		
2N4965	S	P			A	200M	A		50	40	0	80	400	10*	0.4	10M	100	E		
2N4966	S	N			A	200M	A		50	40	0	40	200	10*	0.4	10M	40	E		
2N4967	S	N			A	200M	A		50	40	0	100	600	10*	0.4	10M	100	E		
2N4968	S	N			A	200M	A		30	25	0	40	200	10*	0.4	10M	40	E		
2N4969	S	N			SH	200M	A		50	30	0	40	120	150M	0.4	150M			150M	T
2N4970	S	N			SH	200M	A		50	30	0	100	350	150M	0.4	150M				
2N4971	S	P			SH	200M	A		50	40	0	40	120	150M	0.4	150M				
2N4972	S	P			SH	200M	A		50	40	0	100	300	150M	0.4	150M				
2N4973	S	P			AH	200M	A		20	15	0	20		3.0M	0.5	10M				
2N4974	S	P		2N4974	AL	800M	A	200	40	30	0	5000	9000	1.0*			25000	E	175M	T
2N4975	S	P		2N4974	AL	800M	A	200	40	30	0	1000	4000	1.0*			15000	E	175M	T
2N4976	S	N			AHP	5.0W	C		55	30	0	20	250	50M					1000M	T
2N4977																				
thru	Field-Effect Transistors, see Table on Page 2-78																			
2N4979																				
2N4980	S	P			SC	400M	A		30	30	0	60	300	1.0M					10M	T
2N4981	S	P			SC	400M	A		50	50	0	40	200	1.0M					5.0M	T
2N4982	S	P			SC	400M	A		70	70	0	30	150	1.0M					3.0M	T
2N4983																				
thru	Thyristors, see Table on Page 2-66																			
2N4993																				
2N4994	S	N				200M	A		60	45	0	40	160	10M						
2N4995	S	N			AH	200M	A		60	45	0	100	400	10M						
2N4996	S	N			AH	200M	A		30	18	0	50		2M						
2N4997	S	N			AH	200M	A		30	18	0	30	150	2M						
2N4998	S	N	2N5347	2N5346	AP	35W	C	200	100	80	0	30	90	1.0A	5.0	3.0A	20	E	50M	T
2N4999	S	P	2N6186	2N6186	AP	35W	C	200	100	80	0	30	90	1.0A	5.0	3.0A	20	E	50M	T
2N5000	S	N	2N5348	2N5346	AP	35W	C	200	100	80	0	70	200	1.0A	5.0	3.0A	50	E	60M	T
2N5001	S	P	2N6187	2N6186	AP	35W	C	200	100	80	0	70	200	1.0A	5.0	3.0A	50	E	60M	T
2N5002	S	N	2N5347	2N5346	AP	58W	C	200	100	80	0	30	90	2.5A	1.5	5.0A	20	E	60M	T
2N5003	S	P	2N6186	2N6186	AP	58W	C	200	100	80	0	30	90	2.5A	1.5	5.0A	20	E	60M	T
2N5004	S	N	2N5348	2N5346	AP	58W	C	200	100	80	0	70	200	2.5A	1.5	5.0A	50	E	70M	T
2N5005	S	P	2N6187	2N6186	AP	58W	C	200	100	80	0	70	200	2.5A	1.5	5.0A	50	E	70M	T
2N5006	S	N			AP	118W	C	200	100	80	0	30	90	5.0A	1.5	10A	20	E	30M	T
2N5007	S	P			AP	118W	C	200	100	80	0	30	90	5.0A	1.5	10A	20	E	30M	T
2N5008	S	N			AP	118W	C	200	100	80	0	70	200	5.0A	1.5	10A	50	E	40M	T
2N5009	S	P			AP	118W	C	200	100	80	0	70	200	5.0A	1.5	10A	50	E	40M	T
2N5010	S	N			A	2.0W	C		500	500	R	30	180	25M	1.4	25M				
2N5011	S	N			A	2.0W	C		600	600	R	30	180	25M	1.5	25M				
2N5012	S	N			A	2.0W	C		700	700	R	30	180	25M	1.6	25M				
2N5013	S	N			A	2.0W	C		800	800	R	30	180	20M	1.6	20M				
2N5014	S	N			A	2.0W	C		900	900	R	30	180	20M	1.6	20M				
2N5015	S	N			A	2.0W	C		1000	1000	R	30	180	20M	1.8	20M				
2N5016	S	N	2N5016	2N5016	AHP				65	30	0	10	200	0.5A					500M	T
2N5017	S	N			AHP				65	30	0	10	200	0.5A					500M	T
2N5018																				
thru	Field-Effect Transistors, see Table on Page 2-78																			
2N5021																				
2N5022	S	P			SH	1.0W	A		50	50	0	25	100	500M	0.2	100M				
2N5023	S	P			SH	1.0W	A		30	30	0	40	100	500M	0.17	100M				
2N5024	S	N	2N5024		SH	200M	A		20	10	0	25		10M			13	E	1300M	T
2N5025	S	N			AHP	45W	C	300	75	75	0	20		2.0A	1.0	2.0A				
2N5026	S	N			AHP	45W	C	300	90	90	0	20		2.0A	1.0	2.0A				
2N5027	S	N			S	320M	A	120		30	0	50	150	150M	0.45	150M				
2N5028	S	N			S	320M	A	120		30	0	100	300	150M	0.45	150M				
2N5029	S	N				320M	A	120		15	0	40	120	10M	0.25	10M				
2N5030	S	N				320M	A	120		12	0	30		10M	0.25	10M				
2N5031	S	N		2N5031	AH	200M	A		15	10	0	25	300	1.0M						
2N5032	S	N		2N5031	AH	200M	A		15	10	0	25	300	1.0M						
2N5033	Field-Effect Transistors, see Table on Page 2-78																			
2N5034	S	N	2N5877	2N5875	AP	83W	C	150	55	45	R	20	70	2.5A	2.5	6.0A	15	E		
2N5035	S	N	2N5877	2N5875	AP	83W	C	150	55	45	R	20	70	3.0A	3.0	8.0A	15	E		
2N5036	S	N	2N5877	2N5875	AP	83W	C	150	70	60	R	20	70	2.5A	2.5	6.0A	15	E		
2N5037	S	N	2N5877	2N5875	AP	83W	C	150	70	60	R	20	70	3.0A	3.0	8.0A	15	E		
2N5038	S	N			SP	140W	C	200	150	150	V	20	100	12A	2.5	20A				
2N5039	S	N			SP	140W	C	200	120	120	V	20	100	10A	2.5	20A				
2N5040	S	P			A	300M	A	125	25	25	0	30	600	150M	1.0	0.5A			100M	T
2N5041	S	P			A	300M	A	125	40	40	0	40	150	150M	0.5	0.5A			80M	T

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	P_D @ 25°C *@ 75°C	Ref Point	T_J °C	V_{CB} (volts)	$V_{CE—}$ (volts)	Subscript	h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	$h_{f—}$	Subscript	$f_—$ Units	Subscript
						MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
2N5042	S	P			A	800M	A	200	40	40	0	40	150	150M	1.1	0.5A			100M	T
2N5043	G	P			A	30M	A	125	15	7.0	0		150	3.0M						
2N5044	G	P			A	30M	A	125	15	7.0	0		150	3.0M						
2N5045 thru 2N5047	Field-Effect Transistors, see Table on Page 2-78																			
2N5048	S	N			SP	100W	C	175	120	100	0	15	60	10A	2.0	10A			10M	T
2N5049	S	N			SP	100W	C	175	60	50	0	15	60	10A	2.5	10A			10M	T
2N5050	S	N	2N5050	2N5050	AP	40W	C	200		120	0	35	105	0.5A	0.9	0.5A			20M	T
2N5051	S	N	2N5051	2N5050	AP	40W	C	200		150	0	35	105	0.5A	0.9	0.5A			20M	T
2N5052	S	N	2N5052	2N5050	AP	40W	C	200		200	0	35	105	0.5A	0.9	0.5A			20M	T
2N5053	S	N			AH	200M	A	200	30	15	0	25	150	2.0M					1300M	T
2N5054	S	N			AH	200M	A	200	30	15	0	25	150	2.0M					1300M	T
2N5055	S	P			SH	200M	A	125	12	12	0	30	100	30M	0.13	1.0M				
2N5056	S	P			SH	360M	A	200	15	15	0	30	100	30M	0.13	1.0M				
2N5057	S	P			SH	360M	A	200	15	15	0	40	100	30M	0.13	1.0M				
2N5058	S	N			A	1.0W	C	200	300	300	0	35	150	30M						
2N5059	S	N			A	1.0W	C	200	250	250	0	30	150	30M						
2N5060 thru 2N5064	Thyristors, see Table on Page 2-66																			
2N5065	S	N			SH	2.5W	C	200	25	15	0	50	120	300M	0.23	100M			550M	T
2N5066	S	N			SC	400M	A		30	20	0								5.0M	T
2N5067	S	N	2N5067	2N5067	AP	87.5W	C	200	40	40	0	20	80	1.0A	0.4	1.0A	20	E	4.0M	T
2N5068	S	N	2N5068	2N5067	AP	87.5W	C	200	60	60	0	20	80	1.0A	0.4	1.0A	20	E	4.0M	T
2N5069	S	N	2N5069	2N5067	AP	87.5W	C	200	80	80	0	20	80	1.0A	0.4	1.0A	20	E	4.0M	T
2N5070	S	N		2N5070	AHP	70W	C		65	30	0	10	100	3.0A					100M	T
2N5071	S	N	2N5071		AHP	70W	C		65	30	0	10	100	3.0A					100M	T
2N5072	S	N			AHP	125W	C		100	100	R	15	60	3.0A	1.0	10A			40M	T
2N5073	S	N			AH	600M	A		180	120	0	30	120	200M					40M	T
2N5074	S	N			AP	70W	C	200	200	200	0	30	110	0.5A	2.0	3.0A	30	E	40M	T
2N5075	S	N			AP	70W	C	200	200	200	0	90	250	0.5A	2.0	3.0A	30	E	40M	T
2N5076	S	N			AP	70W	C	200	250	250	0	30	110	0.5A	2.0	3.0A	30	E	40M	T
2N5077	S	N			AP	70W	C	200	250	250	0	90	250	0.5A	2.0	3.0A	30	E	40M	T
2N5078	Field-Effect Transistors, see Table on Page 2-78																			
2N5079	S	N			A	1.8W	C		60	30	0	100	300	150M	0.2	150M			400M	T
2N5080	S	N			A	1.8W	C		60	30	0	200	500	150M	0.2	150M			500M	T
2N5081	S	N			AH	1.2W	C		70	50	0	100	400	1.0M	0.2	10M	100	E	600M	T
2N5082	S	N			AH	1.2W	C		60	30	0	100	400	1.0M	0.2	10M	100	E	600M	T
2N5083	S	N			SP	35W	C	200	120	60	0	40	120	2.0A	1.0	10A			50M	T
2N5084	S	N			SP	35W	C	200	120	60	0	100	300	2.0A	1.0	10A			80M	T
2N5085	S	N			SP	35W	C	200	150	80	0	40	120	2.0A	1.0	10A			50M	T
2N5086	S	P		2N3586	A	310M	A	135	50	50	0	150	500	0.1M	0.3	10M	150	E	40M	T
2N5087	S	P		2N3586	A	310M	A	135	50	50	0	250	800	0.1M	0.3	10M	250	E	40M	T
2N5088	S	N		2N5088	A	310M	A	135	35	30	0	300	900	0.1M	0.5	10M	350	E	50M	T
2N5089	S	N		2N5088	A	310M	A	135	30	25	0	400	1200	0.1M	0.5	10M	450	E	50M	T
2N5090	S	N		2N5090	AHP	4.0W		200	55	30	0	10	200	50M	1.0	100M			500M	T
2N5091	S	P			A			175	350	300	0	40	250	25M	3.0	25M			20M	T
2N5092	S	N			A			175	400	350	0	50	300	25M	0.5	25M			50M	T
2N5093	S	P			A			175	400	350	0	40	250	25M	3.0	25M			20M	T
2N5094	S	P			A			175	450	400	0	40	250	25M	3.0	25M			20M	T
2N5095	S	N			A			175	500	400	0	50	300	25M	0.5	25M			50M	T
2N5096	S	P			A			175	500	450	0	40	250	25M	3.0	25M			20M	T
2N5097	S	N			A			175	600	450	0	50	300	25M	0.5	25M			50M	T
2N5098	S	N			A			175	700	500	0	50	300	25M	0.5	25M			50M	T
2N5099	S	N			A			175	800	550	0	50	300	25M	0.5	25M			50M	T
2N5100	S	P			A			175	450	400	0	40	250	25M	3.0	25M			20M	T
2N5101	S	N			A			175	500	400	0	50	300	25M	0.5	25M			50M	T
2N5102	S	N			AHP	70W	C		90	50	R	10	100	500M					150M	T
2N5103 thru 2N5105	Field-Effect Transistors, see Table on Page 2-78																			
2N5106	S	N			A	800M	A	200	60	30	0	100	300	150M	0.22	150M			250M	T
2N5107	S	N			A	360M	A	200	60	30	0	100	300	150M	0.22	150M			250M	T
2N5108	S	N		2N5108	AHP	3.5W	C		55	55	R								1.2G	T
2N5109	S	N		2N5109	AHP	*2.5W	C		40	20	0	70	210	50M					1.2G	T
2N5110	S	P			AP	5.0W	C	175	40	40	0	15	60	500M	0.9	500M	10	E	1.0M	T
2N5111	S	P			AP	5.0W	C	175	80	80	0	15	60	500M	0.9	500M	10	E	1.0M	T
2N5112	S	P			AP	34W	C	175	40	40	0	15	60	500M	0.9	500M	10	E	1.0M	T
2N5113	S	P			AP	34W	C	175	80	80	0	15	60	500M	0.9	500M	10	E	1.0M	T
2N5114 thru 2N5116	Field-Effect Transistors, see Table on Page 2-78																			
2N5117	S	P			AM	400M	C		45	45	0	100	300	0.010M						
2N5118	S	P			AM	400M	C		45	45	0	100	300	0.010M						
2N5119	S	P			AM	400M	C		45	45	0	50	800	0.0.0M						
2N5120	S	P			AM	300M	C		45	45	0	100	300	0.010M						
2N5121	S	P			AM	300M	C		45	45	0	100	300	0.010M						
2N5122	S	P			AM	300M	C		45	45	0	50	800	0.010M						
2N5123	S	P			AM	400M	C		45	45	0	100	300	0.010M						
2N5124	S	P			AM	400M	C		45	45	0	100	300	0.010M						
2N5125	S	P			AM	400M	C		45	45	0	50	800	0.010M						
2N5126	S	N	MPS6539		A	200M	A	125	20	20	0	20	350	4M	2.0	10M	15	E		
2N5127	S	N	MPS918		A	200M	A	125	20	12	0	15	300	2M	0.3	10M	12	E		
2N5128	S	N	2N5220		A	200M	A	125	15	12	0	35	350	50M	0.25	150M			150M	T
2N5129	S	N	2N5220		A	300M	A	125	15	12	0	35	350	50M	0.25	150M			150M	T
2N5130	S	N	MPS3563		A	200M	A	125	30	12	0	15	250	8M	0.6	10M	12	E		
2N5131	S	N	2N5223		A	200M	A	125	20	15	0	30	500	10M	1.0	10M	25	E		
2N5132	S	N	MPS6539		A	200M	A	125	20	20	0	30	400	10M	2.0	10M	20	E		
2N5133	S	N	MPS2714		A	200M	A	125	20	18	0	60	1000	1.0M	0.4	1.0M	50	E		
2N5134	S	N	2N5224		SH	200M	A	125	20	10	0	20	150	10M	0.2	10M				
2N5135	S	N	2N5225		A	300M	A	125	30	25	0	50	600	10M	1.0	100M				
2N5136	S	N	MPS3706		A	220M	A	125	30	20	0	20	400	150M	0.25	150M				
2N5137	S	N	MPS6560		A	300M	A	125	30	20	0	20	400	150M	0.25	150M				
2N5138	S	P	MPS6516		A	200M	A	125	30	30	0	50	800	100*	0.3	10M	40	E		
2N5139	S	P	MPS6516		SH	200M	A	125	20	20	0	40		1.0M	0.15	1.0M				
2N5140	S	P	MPS6518		SH	200M	A	125	5.0	5.0	0	20	140	10M	0.2	10M				

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
						P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N5141	S	P			SH	200M	A	125	6.0	6.0	0	30		30M	0.2	10M				
2N5142	S	P			SH	300M	A	125	20	20	0	30		50M	0.5	50M				
2N5143	S	P			SH	200M	A	125	20	20	0	30		50M	0.5	50M				
2N5144	S	N			SH	360M	A	200	50	30	0	60	150	100M	0.2	100M			300M	T
2N5145	S	N			SH	800M	A	200	50	30	0	60	150	100M	0.2	100M			300M	T
2N5146	S	P		2N5146	A	400M	A		40	40	0	20		1.0A	1.0	1.0A			150M	T
2N5147	S	P	2N6190	2N6190	AP	1.0W	A	200	100	80	0	30	90	1.0A	5.0	3.0A	20	E	50M	T
2N5148	S	N	2N5336	2N5335	AP	1.0W	A	200	100	80	0	30	90	1.0A	5.0	3.0A	20	E	50M	T
2N5149	S	P	2N6191	2N6190	AP	1.0W	A	200	100	80	0	70	200	1.0A	5.0	3.0A	50	E	60M	T
2N5150	S	N	2N5337	2N5335	AP	1.0W	A	200	100	80	0	70	200	1.0A	5.0	3.0A	50	E	60M	T
2N5151	S	P	2N6190	2N6190	AP	1.0W	A	200	100	80	0	30	90	2.5A	1.5	5.0A	20	E	60M	T
2N5152	S	N	2N5336	2N5335	AP	1.0W	A	200	100	80	0	30	90	2.5A	1.5	5.0A	20	E	60M	T
2N5153	S	P	2N6191	2N6190	AP	1.0W	A	200	100	80	0	70	200	2.5A	1.5	5.0A	50	E	70M	T
2N5154	S	N	2N5337	2N5335	AP	1.0W	A	200	100	80	0	70	200	2.5A	1.5	5.0A	50	E	70M	T
2N5155	G	P		2N5155	SP			110	140	120	0	25	100	8.0A	0.9	25A			100G	T
2N5156	G	P			SP	93W	C	100	100	60	0	25	60	5.0A	1.0	10A			150G	T
2N5157	G	P	2N5157	2N3902	SP			150	700	500	0	30	90	1.0A	2.5	3.5A			2.8M	T
2N5158 2N5159	Field-Effect Transistors, see Table on Page 2-78																			
2N5160	S	P		2N5160	AHP	5.0W	C		60	40	0	10		50M					500M	T
2N5161	S	P		2N5161	AHP	20W	C		60	40	0	10		250M						
2N5162	S	P		2N5161	AHP	50W	C		60	40	0	10		2.0A						
2N5163	Field-Effect Transistors, see Table on Page 2-78																			
2N5164,R thru 2N5171,R	Thyristors, see Table on Page 2-66																			
2N5172	S	N			A	200M	A		25	25	0	100	500	10M	0.25	10M	100	E		
2N5174	S	N			A	200M	A		90	75	0	40	600	10M	0.95	10M	40	E		
2N5175	S	N			A	200M	A		130	100	0	55	160	10M	0.95	10M	55	E		
2N5176	S	N			A	200M	A		130	100	0	140	300	10M	0.95	10M	140	E		
2N5177	S	N			AHP	40W	C	200	60	35	0	10	150	100M					200M	T
2N5178	S	N			AHP	70W	C	200	60	35	0	10	150	200M					200M	T
2N5179	S	N		2N5179	AH	200M	A		20	12	0	25	250	3.0M	0.4	10M	25	E	900M	T
2N5180	S	N			AH	180M	A		30	15	0	20	200	2.0M					650M	T
2N5181	S	N			AH	180M	A		45			27		1.0M					400M	T
2N5182	S	N			AH	180M	A		35			27		1.0M					400M	T
2N5183	S	N			AH	500M	A		18	18	0	75		10M			70	E	62.5M	T
2N5184	S	N			AH	500M	A			120	0	10		50M						
2N5185	S	N			AH	1.0W	A			120	0	10		50M					50M	T
2N5186	S	N			SH	300M	A		10	5.0	S	25		10M	0.3	10M				
2N5187	S	N			SH	1.0W	A		25	25	S	30		10M	0.25	10M				
2N5188	S	N			SH	800M	A		60	55	S	25		150M	0.5	150M				
2N5189	S	N			SH	1.0W	A		60	55	S	15		1.0M	1.0	1.0A				
2N5190	S	N	2N5190	2N5190	AP	40W	C	150	40	40	0	25	100	1.5A	1.4	4.0A	20	E		
2N5191	S	N	2N5191	2N5190	AP	40W	C	150	60	60	0	25	100	1.5A	1.4	4.0A	20	E		
2N5192	S	N	2N5192	2N5190	AP	40W	C	150	80	80	0	20	80	1.5A	1.4	4.0A	20	E		
2N5193	S	P	2N5193	2N5193	AP	40W	C	150	40	40	0	25	100	1.5A	1.4	4.0A	20	E		
2N5194	S	P	2N5194	2N5193	AP	40W	C	150	60	60	0	25	100	1.5A	1.4	4.0A	20	E		
2N5195	S	P	2N5195	2N5193	AP	40W	C	150	80	80	0	20	80	1.5A	1.4	4.0A	20	E		
2N5196 thru 2N5199	Field-Effect Transistors, see Table on Page 2-78																			
2N5200	S	N			A	1.2W	C	250	20	20	0	50	150	10M	0.5	50M			900M	T
2N5201	S	N			A	1.2W	C	250	20	20	0	75	150	10M	0.5	50M			1100M	T
2N5202	S	N	2N5427	2N5427	SP	35W	C	200	100	75	V	10	100	4.0A	1.2	4.0A			60M	T
2N5204 thru 2N5207	Thyristors, see Table on Page 2-66																			
2N5208	S	P		2N5208	AH	310M	A		30	25	0	20	120	2.0M						
2N5209	S	N		2N5209	A	310M	A		50	50	0	100	300	0.1M	0.7	10M	150	E		
2N5210	S	N		2N5209	A	310M	A		50	50	0	200	600	0.1M	0.7	10M	250	E		
2N5211	S	N			AHP	3.0W	C	200	80	80	0	10	60	0.2A	0.5	0.54A			200M	T
2N5212	S	N			AHP	7.5W	C	200	80	80	0	10	60	0.2A	0.5	0.54A			200M	T
2N5213	S	N			AHP	7.5W	C	200	70	40	0	10	80	0.2A	0.5	0.5A			350M	T
2N5214	S	N			AHP	60W	C	200	95	95	S	10	75	1.0A	1.5	4.5A			150M	T
2N5215	S	N			AHP	23W	C	200	70	70	0	10	80	0.5A	0.5	1.0A			400M	T
2N5216	S	N			AHP	25W	C	200	80	80	0	10	60	0.5A	1.2	1.5A			350M	T
2N5217	S	N			AHP	7.5W	C	200	80	80	0	10	80	0.2A	0.5	0.5A			350M	T
2N5218	S	N			AP			200	220	200	0	15	120	5.0A	0.6	5.0A	40	E	40M	T
2N5219	S	N		2N5219	A	310M	A		20	15	0	35	500	2.0M	0.4	10M	35	E		
2N5220	S	N		2N5220	A	310M	A		15	15	0	30	600	50M	0.5	150M	30	E		
2N5221	S	P		2N5221	A	310M	A		15	15	0	30	600	50M	0.5	150M	30	E		
2N5222	S	N		2N5222	A	310M	A		20	15	0	20	1500	4.0M	1.0	4.0M	20	E		
2N5223	S	N		2N5223	A	310M	A		25	20	0	50	800	2.0M	0.7	10M	50	E		
2N5224	S	N		2N5224	SH	310M	A		25	12	0	40	400	10M	0.35	10M				
2N5225	S	N		2N5225	A	310M	A		25	25	0	30	600	50M	0.8	100M	30	E		
2N5226	S	P		2N5226	A	310M	A		25	25	0	30	600	50M	1.0	100M	30	E		
2N5227	S	P		2N5227	A	310M	A		30	30	0	50	700	2.0M	0.4	10M	50	E		
2N5228	S	P		2N5228	SH	310M	A		5.0	5.0	0	30		10M	0.4	10M				
2N5229	S	P			SC	2.0W	C		15	10	0	50		100*						
2N5230	S	P			SC	2.0W	C		30	20	0	50		100*						
2N5231	S	P			SC	2.0W	C		50	30	0	50		100*						
2N5232	S	N			A	330M	A		70	50	0	250	500	2.0M	0.125	10M	250	E		
2N5233	S	N			A	330M	A		80	60	0	100	300	10M	0.125	10M	100	E		
2N5234	S	N			A	330M	A		80	60	0	250	500	10M	0.125	10M	250	E		
2N5235	S	N			A	330M	A		80	60	0	400	800	10M	0.125	10M	400	E		
2N5236	S	N			AH	1.0W	C	200	40	20	0	30	120	50M	0.2	50M			500M	T
2N5237	S	N	2N5337	2N5335	SP			200	150	120	0	40	120	5.0A	0.6	5.0A	2.5	E	25M	T
2N5238	S	N			SP			200	200	170	0	40	120	5.0A	0.6	5.0A	2.5	E	25M	T
2N5239	S	N			AP	100W	C	200	300		0	20	80	2.0A	5.0	4.5A	20	E	5.0M	T
2N5240	S	N			AP	100W	C	200	375		0	20	80	2.0A	5.0	4.5A	20	E	5.0M	T
2N5241	S	N	2N5241	2N5241	SP			150	400	400	0	15	35	2.5A	2.5	5.0A			2.5M	T
2N5242	S	P			SH	0.5W	A			20	0	25	100	500M	0.38	500M			170M	T
2N5243	S	P			SH	0.5W	A			30	0	25	100	500M	0.38	500M			170M	T

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TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N5244	S	P			SH	1.0W	C	200		40	0	150	300	10M	0.12	10M			450M	T
2N5245 thru 2N5248	Field-Effect Transistors, see Table on Page 2-78																			
2N5249	S	N			A	330M	A		70	50	0	400	800	2.0M	0.125	10M	400	E		
2N5249A	S	N			A	330M	A		70	50	0	400	800	2.0M	0.125	10M	400	E		
2N5252	S	N			A	7.0W	C		300	300	0	40	120	100M	1.0	200M			30M	T
2N5253	S	N			A	7.0W	C		300	300	0	80	250	100M	1.0	200M			30M	T
2N5254	S	P			AL	0.8W	C	125	40	40	0	50	750	0.1M	0.25	10M	70	E	40M	T
2N5255	S	P			AM	0.8W	C	125	40	40	0	150	750	0.10M	0.25	10M			40M	T
2N5256	S	P			AM	0.8W	C	125	40	40	0	150	750	0.10M	0.25	10M			40M	T
2N5257 thru 2N5261	Thyristors, see Table on Page 2-66																			
2N5262	S	N			SH	1.0W	A		75	50	0	35		100M	0.8	1.0A				
2N5264	S	N			SP	87W	C	200	400	180	0	30	300	1.0A	1.25	7.0A			50M	T
2N5265 thru 2N5270	Field-Effect Transistors, see Table on Page 2-78																			
2N5271	S	N			SH	600M	A													
2N5272	S	N			SH	360M	A		40	40	S	100	400	10M	0.25	10M			500M	T
2N5273 thru 2N5275	Thyristors, see Table on Page 2-66																			
2N5276	S	N			S	360M	A		25	15	0	30	90	1.0M	0.2	20M			600M	T
2N5277 2N5278	Field-Effect Transistors, see Table on Page 2-78																			
2N5279	S	N			AH	5.0W	C		400			40	160	20M	0.5	50M			15M	T
2N5280	S	N			AH	15W	C	175	400			40	160	20M	0.5	50M			15M	T
2N5281	S	P			A			175	175	150	0	20	200	1.0M	2.0	10M			20M	T
2N5282	S	P			A			175	325	300	0	20	200	1.0M	2.0	10M			20M	T
2N5284	S	N	2N5346	2N5346	AP			200	120	80	0	30	90	2.5A	0.75	2.5A	20	E	60M	T
2N5285	S	N	2N5347	2N5346	AP			200	120	80	0	70	200	2.5A	0.75	2.5A	50	E	70M	T
2N5286	S	P	2N6188	2N6186	AP			200	100	100	0	30	90	2.5A	0.75	2.5A	20	E	60M	T
2N5287	S	P			AP			200	100	100	0	70	200	2.5A	0.75	2.5A	50	E	70M	T
2N5288	S	N	2N5349	2N5346	AP			200	120	100	0	30	90	5.0A	0.9	5.0A	20	E	30M	T
2N5289	S	N			AP			200	120	100	0	70	200	5.0A	0.9	5.0A	50	E	40M	T
2N5290	S	P			AP			200	100	100	0	30	90	5.0A	0.9	5.0A	20	E	30M	T
2N5291	S	P			AP			200	100	100	0	70	200	5.0A	0.9	5.0A	50	E	40M	T
2N5292	S	P			SH	1.0W	C	200		12	S	40	100	30M	0.12	10M			800M	T
2N5293	S	N	2N4922	2N4921	AP	36W	C	150	80	75	R	30	120	0.5A	2.0	3.6A	15	E		
2N5294	S	N	2N4922	2N4921	AP	36W	C	150	80	75	R	30	120	0.5A	2.0	3.6A	15	E		
2N5295	S	N	2N5190	2N5190	AP	36W	C	150	60	50	R	30	120	1.0A	2.0	3.6A	20	E		
2N5296	S	N	2N5190	2N5190	AP	36W	C	150	60	50	R	30	120	1.0A	2.0	3.6A	20	E		
2N5297	S	N	2N5190	2N5190	AP	36W	C	150	80	70	R	20	80	1.5A	2.0	3.6A	25	E		
2N5298	S	N	2N5190	2N5190	AP	36W	C	150	80	70	R	20	80	1.5A	2.0	3.6A	25	E		
2N5301	S	N	2N5301	2N5301	AP	200W	C	200	40	40	0	15	60	15A	0.75	10A	40	E		
2N5302	S	N	2N5303	2N5301	AP	200W	C	200	60	60	0	15	60	15A	0.75	10A	40	E		
2N5303	S	N	2N5303	2N5301	AP	200W	C	200	80	80	0	15	60	10A	1.0	10A	40	E		
2N5305	S	N			AL	450M	A		25	25	0	2K	20K	2.0M	1.4	200M	2000	E	60M	T
2N5306	S	N			AL	400M	A		25	25	0	7K	70K	2.0M	1.4	200M	7000	E	60M	T
2N5306A	S	N			A	400M	A		25	25	0	7K	70K	2.0M	1.4	200M	7K	E		
2N5307	S	N			AL	400M	A		40	40	0	2K	20K	2.0M	1.4	200M	2000	E	60M	T
2N5308	S	N			AL	400M	A		40	40	0	7K	70K	2.0M	1.4	200M	7000	E	60M	T
2N5308A	S	N			A	400M	A		40	40	0	7K	70K	2.0M	1.4	200M	7K	E		
2N5309	S	N			A	330M	A		70	50	0	60	120	10*	0.125	10M	66	E		
2N5310	S	N			A	330M	A		70	50	0	100	300	10*	0.125	10M	110	E		
2N5311	S	N			A	330M	A		70	50	0	250	500	10*	0.125	10M				
2N5312	S	P			AP	50W	C	200	80	80	0	30	90	10A	1.5	10A	30	E	30M	T
2N5313	S	N			AP	50W	C	200	80	80	0	30	90	10A	1.5	10A	30	E	30M	T
2N5314	S	P			AP	50W	C	200	100	100	0	30	90	10A	1.5	10A	30	E	30M	T
2N5315	S	N			AP	50W	C	200	100	100	0	30	90	10A	1.5	10A	30	E	30M	T
2N5316	S	P			AP	50W	C	200	80	80	0	30	90	5.0A	0.6	5.0A	30	E	30M	T
2N5317	S	N			AP	50W	C	200	80	80	0	30	90	5.0A	0.6	5.0A	30	E	30M	T
2N5318	S	P			AP	50W	C	200	100	100	0	30	90	5.0A	0.6	5.0A	30	E	30M	T
2N5319	S	N			AP	50W	C	200	100	100	0	30	90	5.0A	0.6	5.0A	30	E	30M	T
2N5320	S	N			SP	10W	C	200	100	75	0	30	130	500M	0.5	500M			50M	T
2N5321	S	N			SP	10W	C	200	75	50	0	40	250	500M	0.8	500M			50M	T
2N5322	S	P			SP	10W	C	200	100	75	0	30	130	500M	0.7	500M			50M	T
2N5323	S	P			SP	10W	C	200	75	50	0	40	250	500M	1.2	500M			50M	T
2N5324	G	P		2N5324	SP	56W	C	110	250	150	0	20	60	5.0A	0.5	10A			2.0M	T
2N5325	G	P		2N5324	SP	56W	C	110	325	200	0	20	60	5.0A	0.5	10A			2.0M	T
2N5326	S	N			SP	400W*	C	200	100	80	0	50	150	1.0A	1.0	5.0A				
2N5327	S	N			SP	450W*	C	200	100	80	0	100	300	1.0A	0.3	3.0A				
2N5328	S	N			SP	450W*	C	200	100	80	0	100	300	1.0A	0.6	5.0A				
2N5329	S	N			SP	1000W*	C	200	150	90	0	40	120	10A	1.8	20A				
2N5330	S	N			SP	1000W*	C	200	150	90	0	40	120	10A	0.6	10A				
2N5331	S	N			SP	1000W*	C	200	150	90	0	40	120	10A	0.6	10A				
2N5332	S	P			SH	360M	A		20	12	0	20	80	1.0M	0.2	20M			600M	T
2N5333	S	P			AP	1.0W	A	200	100	80	0	30	120	1.0A	1.0	2.0A	30	E	30M	T
2N5334	S	N	2N5334	2N5334	SP	6.0W	C	200	60	60	0	30	150	1.0A	0.7	2.0A			40M	T
2N5335	S	N	2N5335	2N5334	SP	6.0W	C	200	80	80	0	30	150	1.0A	0.7	2.0A			40M	T
2N5336	S	N	2N5336	2N5336	SP	6.0W	C	200	80	80	0	30	120	2.0A	0.7	2.0A			30M	T
2N5337	S	N	2N5337	2N5336	SP	6.0W	C	200	80	80	0	60	240	2.0A	0.7	2.0A			30M	T
2N5338	S	N	2N5338	2N5336	SP	6.0W	C	200	100	100	0	30	120	2.0A	0.7	2.0A			30M	T
2N5339	S	N	2N5339	2N5336	SP	6.0W	C	200	100	100	0	60	240	2.0A	0.7	2.0A			30M	T
2N5344	S	P	2N5344	2N5344	SP	40W	C	200	250	250	0	25	100	500M	3.0	1.0A			60M	T
2N5345	S	P	2N5345	2N5344	SP	40W	C	200	300	300	0	25	100	500M	3.0	1.0A			60M	T
2N5346	S	N	2N5346	2N5346	SP	60W	C	200	80	80	0	30	120	2.0A	0.7	2.0A			30M	T

*Pulsed

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N5347	S	N	2N5347	2N5346	SP	60W	C	200	80	80	0	30	120	2.0A	0.7	2.0A			30M	T
2N5348	S	N	2N5348	2N5346	SP	60W	C	200	100	100	0	60	240	2.0A	0.7	2.0A			30M	T
2N5349	S	N	2N5349	2N5346	SP	60W	C	200	100	100	0	60	240	2.0A	0.7	2.0A			30M	T
2N5350	S	N			SP	350W	C	200	125	100	0	10	40	70A	5.0	90A			10M	T
2N5351	S	N			SP	350W	C	200	180	150	0	10	40	70A	5.0	90A			10M	T
2N5354	S	P			A	360M	A		25	25	0	40	120	50M	0.25	50M	32	E		
2N5355	S	P			A	360M	A		25	25	0	100	300	50M	0.25	50M	80	E		
2N5356	S	P			A	360M	A		25	25	0	250	500	50M	0.25	50M	200	E		
2N5357	S	P	2N5345	2N5357	SP	30W	C	200	300	300	0	25	100	500M	0.3	100M			50M	T
2N5358																				
thru	Field-Effect Transistors, see Table on Page 2-78																			
2N5364																				
2N5365	S	P			A	360M	A		40	40	0	40	120	50M	0.25	50M	32	E		
2N5366	S	P			A	360M	A		40	40	0	100	300	50M	0.25	50M	80	E		
2N5367	S	P			A	360M	A		40	40	0	250	500	50M	0.25	50M	200	E		
2N5368	S	N			A	360M	A	150	60	30	0	60	200	150M	0.3	150M			250M	T
2N5369	S	N			A	360M	A	150	60	30	0	100	300	150M	0.3	150M			250M	T
2N5370	S	N			A	360M	A	150	60	30	0	200	600	150M	0.3	150M			250M	T
2N5371	S	N			A	360M	A	150	40	30	0	60	600	150M	0.3	150M			250M	T
2N5372	S	P			A	360M	A	150	60	30	0	40	120	150M	0.3	150M			150M	T
2N5373	S	P			A	360M	A	150	60	30	0	100	300	150M	0.3	150M			150M	T
2N5374	S	P			A	360M	A	150	60	30	0	200	400	150M	0.3	150M			150M	T
2N5375	S	P			A	360M	A	150	40	30	0	40	400	150M	0.3	150M			150M	T
2N5376	S	N			A	360M	A	150	60	30	0	100	500	0.010M	0.2	10M	120	E	300M	T
2N5377	S	N			A	360M	A	150	60	30	0	40	200	0.010M	0.2	10M	100	E	300M	T
2N5378	S	P			A	360M	A	150	40	30	0	100	500	0.010M	0.2	10M	120	E	200M	T
2N5379	S	P			A	360M	A	150	40	30	0	40	200	0.010M	0.2	10M	100	E	200M	T
2N5380	S	P			AP	360M	A	150	60	40	0	50	150	10 M	0.2	10 M	50	E	250 M	T
2N5381	S	P			AP	360M	A	150	60	40	0	100	300	10 M	0.2	10 M	100	E	300 M	T
2N5382	S	P			AP	360M	A	150	40	40	0	150	150	10 M	0.25	10 M	50	E	200 M	T
2N5383	S	N			AP	360M	A	150	40	40	0	100	300	10 M	0.25	10 M	100	E	250 M	T
2N5384	S	P	2N6186	2N6186	A	2.0W	A	200	100	80	0	20	80	2.0A	1.4	5.0A	20	E	30M	T
2N5385	S	P	2N6186	2N6186	A	2.0W	A	200	100	80	0	20	80	2.0A	1.4	5.0A	20	E	30M	T
2N5386	S	P	2N3490		A	3.5W	A	200	100	80	0	20	80	6.0A	1.4	12A	20	E	30M	T
2N5387	S	N			A	3.5W	A	200	200	200	0	25	100	2.0A	2.2	7.0A	20	E	15M	T
2N5388	S	N			A	3.5W	A	200	250	250	0	25	100	2.0A	2.2	7.0A	20	E	15M	T
2N5389	S	N			A	3.5W	A	200	300	300	0	25	100	2.0A	2.2	7.0A	20	E	15M	T
2N5390	S	N			AL	1.0W	C	200	120	80	0	2K	20K	2.0A	2.5	5.0A			40M	T
2N5391																				
thru	Field-Effect Transistors, see Table on Page 2-78																			
2N5398																				
2N5399	S	N			SH	360M	A		25	15	0	30	90	1.0M	0.2	20M			600M	T
2N5400	S	P		2N5400	A	310M	A		130	120	0	40	180	10M	0.25	50M	30	E	100M	T
2N5401	S	P		2N5400	A	310M	A		160	150	0	60	240	10M	0.25	50M	40	E	100M	T
2N5404	S	P	2N6190	2N6190	AP	1.0W	A	200	80	80	0	20	60	2.0A	0.6	2.0A	20	E	40M	T
2N5405	S	P	2N6192	2N6190	AP	1.0W	A	200	100	100	0	20	60	2.0A	0.6	2.0A	20	E	40M	T
2N5406	S	P	2N6191	2N6190	AP	1.0W	A	200	80	80	0	40	120	2.0A	0.6	2.0A	40	E	40M	T
2N5407	S	P	2N6193	2N6190	AP	1.0W	A	200	100	100	0	40	120	2.0A	0.6	2.0A	40	E	40M	T
2N5408	S	P	2N6186	2N6186	AP	30W	C	200	80	80	0	20	60	2.0A	0.6	2.0A	20	E	40M	T
2N5409	S	P	2N6188	2N6186	AP	30W	C	200	100	100	0	20	60	2.0A	0.6	2.0A	20	E	40M	T
2N5410	S	P	2N6187	2N6186	AP	30W	C	200	80	80	0	40	120	2.0A	0.6	2.0A	40	E	40M	T
2N5411	S	P	2N6189	2N6186	AP	30W	C	200	100	100	0	40	120	2.0A	0.6	2.0A	40	E	40M	T
2N5412	S	N			AP	100W	C	175	80	60	0	10	160	2.0A	1.0	10A	20	E		
2N5413	S	N			SH	1.0W	A		60	40	0	25	100	2.0A	0.25	150M				
2N5414	S	N			SH	1.0W	A		80	50	0	25	100	2.0A	0.25	150M				
2N5415	S	P			AH	10W	C		200			30	150	50M					15M	T
2N5416	S	P			AH	10W	C		350			30	120	50M					15M	T
2N5417	S	N			SH	500M	A		40	35	0	80	250	150M	0.55	150M			250M	T
2N5418	S	N			A	360M	A		25	25	0	40	120	50M	0.25	50M	25	E		
2N5419	S	N			A	360M	A		25	25	0	100	300	50M	0.25	50M	70	E		
2N5420	S	N			A	360M	A		25	25	0	250	500	50M	0.25	50M	150	E		
2N5421	S	N			AHP	3.0W	C		36	18	0	10	60	0.1A	0.5	0.2A			300M	T
2N5422	S	N			AHP	5.0W	C		36	18	0	10	60	0.5A	0.5	0.5A			300M	T
2N5423	S	N			AHP	12W	C		36	18	0	20	70	1.0A	0.5	1.0A			300M	T
2N5424	S	N			AHP	20W	C		36	18	0	20	100	2.0A	0.5	2.0A			250M	T
2N5424A	S	N			AH	20W	C		36	18	0	20	100	2.0A	0.5	2.0A			250M	
2N5425	S	N			AH				60	60	0	500		5.0A	2.5	5.0A	500	E		
2N5426	S	N			AH				60	60	0	1000		5.0A	2.2	5.0A	1000	E		
2N5427	S	N	2N5427	2N5427	SP	35W	C	200	80	80	0	30	120	2.0A	0.7	2.0A			30M	T
2N5428	S	N	2N5428	2N5427	SP	35W	C	200	80	80	0	60	240	2.0A	0.7	2.0A			30M	T
2N5429	S	N	2N5429	2N5427	SP	35W	C	200	100	100	0	30	120	2.0A	0.7	2.0A			30M	T
2N5430	S	N	2N5430	2N5427	SP	35W	C	200	100	100	0	60	240	2.0A	0.7	2.0A			30M	T
2N5431	Unijunction Transistors, see Table on Page 2-86																			
2N5432																				
2N5433	Field-Effect Transistors, see Table on Page 2-78																			
2N5434																				
2N5435	G	P		2N5435	SP	120W	C	110	80	60	0	20	60	25A	0.75	60A				
2N5436	G	P		2N5435	SP	120W	C	110	110	90	0	20	60	25A	0.75	60A				
2N5437	G	P		2N5435	SP	120W	C	110	140	120	0	20	60	25A	0.75	60A				
2N5438	G	P		2N5435	SP	120W	C	110	80	60	0	40	120	25A	0.50	60A				
2N5439	G	P		2N5435	SP	120W	C	110	110	90	0	40	120	25A	0.50	60A				
2N5440	G	P		2N5435	SP	120W	C	110	140	120	0	40	120	25A	0.50	60A				
2N5447	S	N			A	360M	A		40	25	0	60	300	50M	0.25	50M				
2N5448	S	N			A	360M	A		50	30	0	30	150	50M	0.25	50M				
2N5449	S	N			A	360M	A		50	30	0	100	300	50M	0.6	100M				
2N5450	S	N			A	360M	A		50	30	0	50	150	50M	0.8	100M				
2N5451	S	N			A	360M	A		40	20	0	30	600	50M	1.0	100M				
2N5452																				
thru	Field-Effect Transistors, see Table on Page 2-78																			
2N5454																				

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N5455	S	P			SH	340M	A	200	15	15	0	30	120	30M	0.50	300M			450M	T
2N5456	S	P			SH	340M	A	200	25	25	0	30	120	30M	0.55	300M			450M	T
2N5457 thru 2N5465	Field-Effect Transistors, see Table on Page 2-78																			
2N5466	S	N			AP			200	500	400	0	15	60	3.0A	0.5	3.0A	25	E		
2N5467	S	N			AP			200	700	400	0	15	60	3.0A	0.5	3.0A	25	E		
2N5468	S	N			AP			200	500	400	0	15	60	3.0A	0.5	3.0A	25	E		
2N5469	S	N			AP			200	700	400	0	15	60	3.0A	0.5	3.0A	25	E		
2N5470	S	N			AH	3.5W	C		55	55	R									
2N5471 thru 2N5476	Field-Effect Transistors, see Table on Page 2-78																			
2N5477	S	N	2N5477	2N5477	SP	60W	C	200	80	80	0	30	120	2.0A	0.7	2.0A			30M	T
2N5478	S	N	2N5478	2N5477	SP	60W	C	200	80	80	0	60	240	2.0A	0.7	2.0A			30M	T
2N5479	S	N	2N5479	2N5477	SP	60W	C	200	100	100	0	30	120	2.0A	0.7	2.0A			30M	T
2N5480	S	N	2N5480	2N5477	SP	60W	C	200	100	100	0	60	240	2.0A	0.7	2.0A			30M	T
2N5481	S	N			AHP	5.0W	C		50	30	0	20		50M						
2N5482	S	N			AHP	10W	C		50	30	0	20		50M						
2N5483	S	N			AHP	20W	C		45	30	0	20		100M						
2N5484 thru 2N5486	Field-Effect Transistors, see Table on Page 2-78																			
2N5487	S	N			SP	15W	C	200	120	80	0	100	300	1.0A	0.25	1.0A				
2N5488	S	N			SP	15W	C	200	150	100	0	40	120	1.0A	0.25	1.0A				
2N5489	S	N	MJ7201	MJ7200	AP			200	100	100	0	15	50	40A	1.5	40A	10	E		
2N5490	S	N	MJE5978	2N5977	AP	50W	C	150	60			20	100	2.0A	2.0	6.5A	20	E	0.8M	T
2N5491	S	N	MJE5978	2N5977	AP	50W	C	150	60			20	100	2.0A	2.0	6.5A	20	E	0.8M	T
2N5492	S	N	MJE5979	2N5977	AP	50W	C	150	75			20	100	2.0A	2.0	6.5A	25	E	0.8M	T
2N5493	S	N	MJE5979	2N5977	AP	50W	C	150	75			20	100	2.0A	2.0	6.5A	25	E	0.8M	T
2N5494	S	N	MJE5977	2N5977	AP	50W	C	150	60			20	100	2.0A	2.0	6.5A	30	E	0.8M	T
2N5495	S	N	MJE5977	2N5977	AP	50W	C	150	60			20	100	2.0A	2.0	6.5A	30	E	0.8M	T
2N5496	S	N	MJE5979	2N5977	AP	50W	C	150	90			20	100	2.0A	2.0	7.0A	30	E	0.8M	T
2N5497	S	N	MJE5979	2N5977	AP	50W	C	150	90			20	100	2.0A	2.0	7.0A	30	E	0.8M	T
2N5498	S	N			AP	200W	C	200	150	130	0	10	50	15A	1.5	15A	25	E		
2N5515 thru 2N5524	Field-Effect Transistors, see Table on Page 2-78																			
2N5525	S	N			AL	360M	A		40	30	0	5000		10M	1.0	50M	5000	E	200M	T
2N5526	S	N			AL	360M	A		40	30	0	1000		10M	1.0	50M	1000	E	200M	T
2N5527	S	N			AP	5.0W	C	200	60	40	0	40	200	3.0A	1.25	3.0A	20	E	200M	T
2N5528	S	N			AP	35W	C	200	60	40	0	40	200	3.0A	1.25	3.0A	20	E	200M	T
2N5529	S	N			AP	35W	C	200	60	40	0	40	200	3.0A	1.25	3.0A	20	E	200M	T
2N5530	S	N			AP	35W	C	200	60	40	0	40	200	3.0A	1.25	3.0A	20	E	200M	T
2N5531	S	N			AP	5.0W	C	200	90	75	0	30	150	3.0A	1.25	3.0A	20	E	200M	T
2N5532	S	N			AP	35W	C	200	90	75	0	30	150	3.0A	1.25	3.0A	15	E	200M	T
2N5533	S	N			AP	35W	C	200	90	75	0	30	150	3.0A	1.25	3.0A	15	E	200M	T
2N5534	S	N			AP	35W	C	200	90	75	0	30	150	3.0A	1.25	3.0A	15	E	200M	T
2N5535	S	N			AP	50W	C	200	60	50	0	30	150	10A	1.25	5.0A	25	E	150M	T
2N5536	S	N			AP	50W	C	200	60	50	0	30	150	10A	1.25	5.0A	25	E	150M	T
2N5537	S	N			AP	50W	C	200	90	75	0	20	150	10A	1.25	5.0A	20	E	150M	T
2N5538	S	N			AP	50W	C	200	90	75	0	20	150	10A	1.25	5.0A	20	E	150M	T
2N5539	S	N	MJ7000	MJ7000	SP			200	175	130	0	25	75	10A	3.0	20A			20M	T
2N5540	S	N			SP			200	325	300	0	20	60	5.0A	2.5	10A			20M	T
2N5541	S	N			SP			200	175	130	0	30	90	5.0A	2.5	10A			20M	T
2N5542	S	N			SP			200	175	130	0	30	90	5.0A	2.5	10A			20M	T
2N5543 thru 2N5549			Field-Effect Transistors, see Table on Page 2-78																	
2N5550	S	N		2N5550	A	310M	A		160	140	0	60	250	10M	0.25	50M			100M	T
2N5551	S	N		2N5550	A	310M	A		180	160	0	80	250	10M	0.20	50M			100M	T
2N5552	S	N			SP	15W	C	200	120	80	0	50	150	5.0A	0.5	5.0A				
2N5555 thru 2N5558			Field-Effect Transistors, see Table on Page 2-78																	
2N5559	S	N	2N5633	2N5632	SP			200	150	120	X	20	60	4.0A	0.75	4.0A				
2N5560	S	N						200	175	120	X	30	90	15A	0.8	15A				
2N5561 thru 2N5566			Field-Effect Transistors, see Table on Page 2-78																	
2N5567 thru 2N5574	Thyristors, See Table on Page 2-66																			
2N5581	S	N		2N5581	SH	2.0W	C		75	40	0	40	120	150M	0.3	150M			250M	
2N5582	S	N		2N5581	SH	2.0W	C		75	40	0	100	300	150M	0.3	150M			300M	
2N5583	S	N		2N5583	SH	5.0W	C		30	30	0	25	100	100M	0.8	100M			1.3G	
2N5584	S	N			SP			200	225	180	0	40	120	10A	1.8	20A				
2N5589	S	N		2N5589	AP	15W	C		36	18	0	5.0		100M					200M	
2N5590	S	N		2N5890	AP	30W	C		36	18	0	5.0		250M					200M	
2N5591	S	N		2N5891	AP	70W	C		36	18	0	5.0		200M					200M	
2N5592 thru 2N5594			Field-Effect Transistors, see Table on Page 2-78																	

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
						P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N5595	S	N			AP	30W	C	200	55	30	0	20		50M					1.5G	T
2N5596	S	N			AP	40W	C	200	55	30	0	20		50M					1.5G	T
2N5597	S	P			AP	20W	C	200	80	60	0	70	200	1.0A	0.46	1.0A	50	E	60M	T
2N5598	S	N			AP	20W	C	200	80	60	0	70	200	1.0A	0.46	1.0A	50	E	60M	T
2N5599	S	P			AP	20W	C	200	100	80	0	30	90	1.0A	0.46	1.0A	20	E	50M	T
2N5600	S	N			AP	20W	C	200	100	80	0	30	90	1.0A	0.46	1.0A	20	E	50M	T
2N5601	S	P			AP	20W	C	200	100	80	0	70	200	1.0A	0.46	1.0A	50	E	60M	T
2N5602	S	N			AP	20W	C	200	100	80	0	70	200	1.0A	0.46	1.0A	50	E	60M	T
2N5603	S	P			AP	20W	C	200	120	100	0	30	90	1.0A	0.46	1.0A	20	E	50M	T
2N5604	S	N			AP	20W	C	200	120	100	0	30	90	1.0A	0.46	1.0A	20	E	50M	T
2N5605	S	P			AP	25W	C	200	80	60	0	70	200	2.5A	0.75	2.5A	50	E	70M	T
2N5606	S	N			AP	25W	C	200	80	60	0	70	200	2.5A	0.75	2.5A	50	E	70M	T
2N5607	S	P			AP	25W	C	200	100	80	0	30	90	2.5A	0.75	2.5A	20	E	60M	T
2N5608	S	N			AP	25W	C	200	100	80	0	30	90	2.5A	0.75	2.5A	20	E	60M	T
2N5609	S	P			AP	25W	C	200	100	80	0	70	200	2.5A	0.75	2.5A	50	E	70M	T
2N5610	S	N			AP	25W	C	200	100	80	0	70	200	2.5A	0.75	2.5A	50	E	70M	T
2N5611	S	P			AP	25W	C	200	120	100	0	30	90	2.5A	1.45	2.5A	20	E	60M	T
2N5612	S	N			AP	25W	C	200	120	100	0	30	90	2.5A	0.75	2.5A	20	E	60M	T
2N5613	S	P			AP	58W	C	200	80	60	0	70	200	2.5A	0.75	2.5A	50	E	70M	T
2N5614	S	N			AP	58W	C	200	80	60	0	70	200	2.5A	0.75	2.5A	50	E	70M	T
2N5615	S	P			AP	58W	C	200	100	80	0	30	90	2.5A	0.75	2.5A	20	E	60M	T
2N5616	S	N			AP	58W	C	200	100	80	0	30	90	2.5A	0.75	2.5A	20	E	60M	T
2N5617	S	P			AP	58W	C	200	100	80	0	70	200	2.5A	0.75	2.5A	50	E	70M	T
2N5618	S	N			AP	58W	C	200	100	80	0	70	200	2.5A	0.75	2.5A	50	E	70M	T
2N5619	S	P			AP	58W	C	200	120	100	0	30	90	2.5A	0.75	2.5A	20	E	60M	T
2N5620	S	N			AP	58W	C	200	120	100	0	30	90	2.5A	0.75	2.5A	20	E	60M	T
2N5621	S	P			AP	116W	C	200	80	60	0	70	200	5.0A	0.9	5.0A	50	E	40M	T
2N5622	S	N			AP	116W	C	200	80	60	0	70	200	5.0A	0.9	5.0A	50	E	40M	T
2N5623	S	P			AP	116W	C	200	100	80	0	30	90	5.0A	0.9	5.0A	20	E	30M	T
2N5624	S	N			AP	116W	C	200	100	80	0	30	90	5.0A	0.9	5.0A	20	E	30M	T
2N5625	S	P			AP	116W	C	200	100	80	0	70	200	5.0A	0.9	5.0A	50	E	40M	T
2N5626	S	N			AP	116W	C	200	100	80	0	70	200	5.0A	0.9	5.0A	50	E	40M	T
2N5627	S	P			AP	116W	C	200	120	100	0	30	90	5.0A	0.9	5.0A	20	E	30M	T
2N5628	S	N			AP	116W	C	200	120	100	0	30	90	5.0A	0.9	5.0A	20	E	30M	T
2N5629	S	N	2N5626	2N5629	AP	200W	C	200	100	100	0	25	100	8.0A	2.0	16A	15	E	1.0M	T
2N5630	S	N	2N5630	2N5629	AP	200W	C	200	120	120	0	20	80	8.0A	2.0	16A	15	E	1.0M	T
2N5631	S	N	2N5631	2N5629	AP	200W	C	200	140	140	0	15	60	8.0A	2.0	16A	15	E	1.0M	T
2N5632	S	N	2N5632	2N5632	AP	150W	C	200	100	100	0	25	100	5.0A	2.0	10A	15	E	1.0M	T
2N5633	S	N	2N5633	2N5632	AP	150W	C	200	120	120	0	20	180	5.0A	2.0	10A	15	E	1.0M	T
2N5634	S	N	2N5634	2N5632	AP	150W	C	200	140	140	0	15	60	5.0A	2.0	10A	15	E	1.0M	T
2N5635	S	N		2N5635	A	7.5W	C		60	35	0	5.0		100M					500M	T
2N5636	S	N		2N5635	A	15W	C		60	35	0	5.0		200M					450M	T
2N5637	S	N		2N5635	A	30W	C		60	35	0	5.0		500M					400M	T
2N5638 thru 2N5640			Field-Effect Transistors, see Table on Page 2-78																	
2N5641	S	N		2N5641	A	15W	C		65	35	0	5.0		100M					300M	T
2N5642	S	N		2N5641	A	30W	C		65	35	0	5.0		200M					250M	T
2N5643	S	N		2N5641	A	60W	C		65	35	0	5.0		200M					200M	T
2N5644	S	N		2N5644	AP	3.5W	C		36	18	0	15		100M					400M	T
2N5645	S	N		2N4545	AP	12W	C		36	18	0	15		500M					400M	T
2N5646	S	N		2N4546	AP	30W	C		36	18	0	15		1.0A					400M	T
2N5647 thru 2N5649			Field-Effect Transistors, see Table on Page 2-78																	
2N5650	S	N			AH	150M	A		20	15	0	30	300	3.0M					2.0G	T
2N5651	S	N			AH	150M	A		20	15	0	30	300	3.0M					2.0G	T
2N5652	S	N			AH	150M	A		20	15	0	30	300	3.0M					2.0G	T
2N5653			Field-Effect Transistors, see Table on Page 2-78																	
2N5654			Field-Effect Transistors, see Table on Page 2-78																	
2N5655	S	N	2N5655	2N5655	AP	20W	C	150	275	250	0	30	250	100M	1.0	100M	20	E		
2N5656	S	N	2N5656	2N5655	AP	20W	C	150	325	300	0	30	250	100M	1.0	100M	20	E		
2N5657	S	N	2N5657	2N5655	AP	20W	C	150	375	350	0	30	250	100M	1.0	100M	20	E		
2N5658	S	N			SP	30W	C	200	120	80	0	50	150	5.0A	1.0	1.0A			30M	T
2N5659	S	N			SP	30W	C	200	120	80	0	50	150	5.0A	1.0	1.0A			30M	T
2N5660	S	N	2N6233	2N6233	SP			200	250	200	0	40	150	500M	0.4	1.0A			20M	T
2N5661	S	N	2N6234	2N6233	SP			200	400	300	0	40	150	500M	0.4	1.0A			20M	T
2N5662	S	N			SP			200	250	200	0	40	150	500M	0.4	1.0A			20M	T
2N5663	S	N			SP			200	400	300	0	40	150	500M	0.4	1.0A			20M	T
2N5664	S	N	2N6233	2N6233	SP			200	250	200	0	40	120	1.0A	0.4	3.0A			20M	T

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_{-} Units	Subscript
2N5665	S	N	2N6234	2N6233	SP			200	400	300	0	40	120	1.0A	0.4	3.0A			20M	T
2N5666	S	N			SP			200	250	200	0	40	120	1.0A	0.4	3.0A			20M	T
2N5667	S	N			SP			200	400	300	0	40	120	1.0A	0.4	3.0A			20M	T
2N5668 thru 2N5670			Field-Effect Transistors, see Table on Page 2-78																	
2N5675	S	P			AP	1.0W	A	200	125	100	0	50	150	0.5A	2.0	2.0A	40	E		
2N5676	S	P			AP	2.0W	A	200	125	100	0	50	150	0.5A	2.0	2.0A	40	E		
2N5677	S	P			SP			200	125	100	0	30	90	5.0A	2.5	10A				
2N5678	S	P			SP			200	125	100	0	25	75	10A	3.0	20A				
2N5679	S	P	2N5679	2N5679	AP	10W	C	200	100	100	0	40	150	250M	0.6	250M	40	E	30M	T
2N5680	S	P	2N5680	2N5679	AP	10W	C	200	120	120	0	40	150	250M	0.6	250M	40	E	30M	T
2N5681	S	N	2N5681	2N5681	AP	10W	C	200	100	100	0	40	150	250M	0.6	250M	40	E	30M	T
2N5682	S	N	2N5682	2N5681	AP	10W	C	200	120	120	0	40	150	250M	0.6	250M	40	E	30M	T
2N5683	S	P	2N5683	2N5683	AP	300W	C	200	60	60	0	15	60	25A	5.0	50A	15	E	2.0M	T
2N5684	S	P	2N5684	2N5683	AP	300W	C	200	80	80	0	15	60	25A	5.0	50A	15	E	2.0M	T
2N5685	S	N	2N5685	2N5685	AP	300W	C	200	60	60	0	15	60	25A	5.0	50A	15	E	2.0M	T
2N5686	S	N	2N5686	2N5685	AP	300W	C	200	80	80	0	15	60	25A	5.0	50A	15	E	2.0M	T
2N5687	S	N			AP	5.0W	C		40	20	0	15		50M						
2N5688	S	N			AP	10W	C		40	20	0	15		50M						
2N5689	S	N			AP	25W	C		60	40	0	15		100M						
2N5690	S	N			AP	50W	C		50	30	0	10		100M						
2N5691	S	N			AP	88W	C		50	30	0	10		100M						
2N5692	G	P		2N5692	AP	125W	C	110	50	30	0	20	65	25A	0.75	60A			200M	T
2N5693	G	P		2N5693	SP	125W	C	110	80	60	0	20	65	25A	0.75	60A			200M	T
3N5694	G	P		2N5694	SP	125W	C	110	100	80	0	20	65	25A	0.75	60A			200M	T
2N5695	G	P		2N5695	SP	125W	C	110	120	100	0	20	65	25A	0.75	60A			200M	T
2N5696	G	P		2N5696	SP	125W	C	110	140	120	0	20	65	25A	0.75	60A			200M	T
2N5697	S	N			AP	3.5W	C		40	18	0	30		40M						
2N5698	S	N			AP	5.0W	C		40	18	0	30		40M						
2N5699	S	N			AP	10W	C		40	18	0	15		50M						
2N5700	S	N			AP	35W	C		40	18	0	30		50M						
2N5701	S	N			AP	35W	C		40	18	0	30		50M						
2N5702	S	N			AP	880M	C		40	18	0	15		50M						
2N5703	S	N			AP	750M	C		40	18	0	15		50M						
2N5704	S	N			AP	25W	C		40	18	0	15		50M						
2N5705	S	N			AP	44W	C		36	18	0	15		100M						
2N5706	S	N			AP	80W	C		36	18	0	15		100M						
2N5707	S	N			AP	70W	S	200	70	50	0	5.0	50	100M					50M	T
2N5708	S	N			AP	100W	S	200	70	50	0	5.0	50	100M					50M	T
2N5709	S	N			AP	140W	S	200	70	50	0	5.0	50	200M					50M	T
2N5710	S	N			AP	3.5W	C		40	20	0	20		10M						
2N5711	S	N			AP	10W	C		60	36	0	20		50M						
2N5712	S	N			AP	25W	C		60	40	0	10		100M						
2N5713	S	N			A	45W	C		60	40	0	10		10M						
2N5714	S	N			A	45W	C		60	40	0	10		10M						
2N5715	S	N			AP	6.0W	S		50	3.0	0	20	200	50M					3.5W	T
2N5716 thru 2N5718			Field-Effect Transistors, see Table on Page 2-78																	
2N5729	S	N	2N5336	2N5336	SP			200	100	80	0	30	300	2.0A	1.5	5.0A	1.5	E	30M	T
2N5730	S	N	2N5346	2N5346	SP			200	100	80	0	30	300	2.0A	1.2	5.0A	1.5	E	30M	T
2N5731	S	N	2N5347	2N5346	SP			200	100	80	0	30	300	5.0A	1.5	10A	1.5	E	30M	T
2N5732	S	N			SP			200	100	80	0	30	300	5.0A	1.2	10A	1.5	E	30M	T
2N5733	S	N	MJ7000	MJ7000	SP			200	100	80	0	30	300	10A	1.2	20A	1.5	E	30M	T
2N5734	S	N			SP			200	100	80	0	30	300	10A	1.2	20A	1.5	E	30M	T
2N5735	S	N			SH	360M	A		60	30	0	40	120	150M	0.4	150M			200M	T
2N5736	S	N			SH	360M	A		60	30	0	100	300	150M	0.4	150M			200M	T
2N5737	S	P			AP			200	60	60	0	20	80	5.0A	0.5	5.0A	20	E	10M	T
2N5738	S	P			AP			200	100	100	0	20	80	5.0A	0.5	5.0A	20	E	10M	T
2N5739	S	P			AP			200	60	60	0	20	80	5.0A	0.5	5.0A	20	E	10M	T
2N5740	S	P			AP			200	100	100	0	20	80	5.0A	0.5	5.0A	20	E	10M	T
2N5741	S	P			AP			200	60	60	0	20	80	10A	1.5	10A	20	E	10M	T
2N5742	S	P			AP			200	100	100	0	20	80	10A	1.5	10A	20	E	10M	T
2N5743	S	P			AP			200	60	60	0	20	80	10A	1.5	10A	20	E	10M	T
2N5744	S	P			AP			200	100	100	0	20	80	10A	1.5	10A	20	E	10M	T
2N5745	S	P	2N5745	2N5745	AP	200W	C	200	80	80	0	15	60	10A	1.0	10A	40	E	2.0M	T
2N5754 thru 2N5757	Thyristors, See Table on Page 2-66																			
2N5758	S	N	2N5758	2N5758	AP	150W	C	200	100	100	0	25	100	3.0A	1.0	3.0A	15	E	1.0M	T
2N5759	S	N	2N5759	2N5758	AP	150W	C	200	120	120	0	20	80	3.0A	1.0	3.0A	15	E	1.0M	T
2N5760	S	N	2N5760	2N5758	AP	150W	C	200	140	140	0	15	60	3.0A	1.0	3.0A	15	E	1.0M	T
2N5761	S	N			AH	250M	A		20	15	0	30	300	10M			18.5	E		
2N5762	S	N			AH	300M	A		20	15	0	30	300	15M			16.5	E		
2N5763	S	P			SP	400M	A		65	60	0	70		10M	0.4	150M			200M	T
2N5764	S	N			AH	10W	S		55	25	0	20		0.10A						

2N5765-2N5870

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N5765	S	N			AH	19W	S		55	25	0	20		0.10A						
2N5766	S	N			AH	5.0W	S		55	25	0	20		0.05A						
2N5767	S	N			AH	10W	S		55	25	0	20		0.10A						
2N5768	S	N			AH	20W	S		55	25	0	20		0.10A						
2N5777	S	N		2N5777	RD	200M	A	100	25	25	0									
2N5778	S	N		2N5777	RD	200M	A	100	40	40	0	Photo Darlington Amplifiers								
2N5779	S	N		2N5777	RD	200M	A	100	25	25	0	See Data Sheet for Details								
2N5780	S	N		2N5777	RD	200M	A	100	40	40	0									
2N5781	S	P	2N3720	2N3719	AP	10W	C	200	80	80	R	4.0		3.2A	2.0	3.2A	25	E	8.0M	T
2N5782	S	P	2N3720	2N3719	AP	10W	C	200	65	65	R	4.0		3.2A	2.0	3.2A	25	E	8.0M	T
2N5783	S	P			AP	10W	C	200	45	45	R	4.0		3.2A	2.0	3.2A	25	E	8.0M	T
2N5784	S	N			AP	10W	C	200	80	80	R	4.0		3.2A	2.0	3.2A	25	E	2.5M	T
2N5785	S	N			AP	10W	C	200	65	65	R	4.0		3.2A	2.0	3.2A	25	E	2.5M	T
2N5786	S	N			AP	10W	C	200	45	45	R	4.0		3.2A	2.0	3.2A	25	E	2.5M	T
2N5793	S	N			SH	500M	A		75	40	0	40	120	150M	0.9	300M				
2N5794	S	N			SH	500M	A		75	40	0	100	300	150M	0.9	300M				
2N5795	S	N			SH	500M	A		60	60	0	40	120	150M	1.6	500M				
2N5796	S	N			SH	500M	A		60	60	0	100	300	150M	1.6	500M				
2N5797 thru 2N5803			Field-Effect Transistors, see Table on Page 2-78																	
2N5804	S	N			SP			200	300	300	X	10	100	5.0A	2.0	5.0A			15M	T
2N5805	S	N			SP			200	375	375	X	10	100	5.0A	2.0	5.0A			15M	T
2N5806 thru 2N5809			Thyristors, See Table on Page 2-66																	
2N5810	S	N			A	500M	A	135	35	25	0	60	200	2.0M	0.75	500M				
2N5811	S	N			A	500M	A	135	35	25	0	60	200	2.0M	0.75	500M				
2N5812	S	N			A	500M	A	135	35	25	0	150	500	2.0M	0.75	500M				
2N5813	S	P			A	500M	A	135	35	25	0	150	500	2.0M	0.75	500M				
2N5814	S	N			A	500M	A	135	50	40	0	60	120	2.0M	0.75	500M				
2N5815	S	P			A	500M	A	135	50	40	0	60	120	2.0M	0.75	500M				
2N5816	S	N			A	500M	A	135	50	40	0	100	200	2.0M	0.75	500M				
2N5817	S	P			A	500M	A	135	50	40	0	100	200	2.0M	0.75	500M				
2N5818	S	N			A	500M	A	135	50	40	0	150	300	2.0M	0.75	500M				
2N5819	S	P			A	500M	A	135	50	40	0	150	300	2.0M	0.75	500M				
2N5820	S	N			A	500M	A	135	70	60	0	60	120	2.0M	0.75	500M				
2N5821	S	P			A	500M	A	135	70	60	0	60	120	2.0M	0.75	500M				
2N5822	S	N			A	500M	A	135	70	60	0	100	200	2.0M	0.75	500M				
2N5823	S	P			A	500M	A	135	70	60	0	100	200	2.0M	0.75	500M				
2N5824	S	N			A	360M	A	125	50	40	0	60	120	2.0M	0.125	10M	60	E		
2N5825	S	N			A	360M	A	125	50	40	0	100	200	2.0M	0.125	10M	100	E		
2N5826	S	N			A	360M	A	125	50	40	0	150	300	2.0M						
2N5827	S	N			A	360M	A	125	50	40	0	250	500	2.0M						
2N5828	S	N			A	360M	A	125	50	40	0	400	800	2.0M						
2N5829	S	P		2N5829	AH	200M	A	125	30	30	0	20	150	2.0M						
2N5830	S	N			A	310M	A	135	120	100	O	80	500	10M	0.25	50M	60	E		
2N5831	S	N			A	310M	A	135	160	140	O	80	250	10M	0.25	50M	60	E		
2N5832	S	N			A	310M	A	135	160	140	O	175	500	10M	0.25	50M	125	E		
2N5833	S	N			A	310M	A	135	200	180	O	50	250	10M	0.25	50M	50	E		
2N5834	S	P			SP	5.0W	A													
2N5835	S	N			SH	200M	A	125	15	10	0	25		10M						
2N5836	S	N		2N5835	SH	2.0W	C		15	10	0	25		50M						
2N5837	S	N		2N5835	SH	2.0W	C		10	5.0	0	25		100M						
2N5838	S	N	2N5838	2N5835	SP			200	275	275	X	8.0	40	3.0A	1.0	3.0A	5.0	E		
2N5839	S	N	2N5839		SP			200	300	300	X	10	50	2.0A	1.5	2.0A	5.0	E		
2N5840	S	N	2N5840		SP			200	375	375	X	10	50	2.0A	1.5	2.0A	5.0	E		
2N5841	S	N			SH	350M	C													
2N5842	S	N			SH	350M	C													
2N5843	S	P		2N5843	AM	500M	A		50	40	O	50	150	0.1M						
2N5844	S	P		2N5844	AM	500M	A		50	40	O	100	300	0.1M						
2N5845	S	N			S	1.2W	C		50	40	O	25	150	500M	0.6	500M			100M	T
2N5845A	S	N			S	1.2W	C		50	40	O	35	150	500M	0.5	500M			250M	T
2N5846	S	N		2N5846	AH	10W	C		36	18	O	5.0		250M						
2N5847	S	N			AW	20W	C													
2N5848	S	N			AP	50W	C		48	24	0	3.0		1.2A						
2N5849	S	N			AP	100W	C		48	24	0	3.0		2.4A						
2N5851	S	N		2N5851	S	500M	C		30	15	O	40		10M					800M	T
2N5852	S	N		2N5851	S	500M	C		30	15	O	40		10M					1100M	T
2N5853	S	P			AP	66W	C	200	100	80	O	30	90	5.0A	0.9	5.0A	20	E	15M	T
2N5854	S	N			AP	66W	C	200	100	80	O	30	90	5.0A	0.9	5.0A	20	E	20M	T
2N5855	S	P			A	750M	A		60	60	O	50	300	150M	0.4	150M	1.0	E		
2N5856	S	N			A	750M	A		60	60	O	50	300	150M	0.4	150M	1.0	E		
2N5857	S	P			A	750M	A		80	80	O	50	300	150M	0.4	150M	1.0	E		
2N5858	S	N			A	750M	A		80	80	O	50	300	150M	0.4	150M	1.0	E		
2N5862	S	N				80W		200	65	35	0	5.0		3.0A						
2N5864	S	P		2N5864	A	1.25W	A		90	70	O	50	500	150M	0.9	300M	50	E	50M	T
2N5865	S	P		2N5865	S	1.25W	A		70	50	O	40	200	150M	1.25	500M			100M	T
2N5867	S	P	2N5867	2N5867	AP	87.5W	C	200	60	60	O	20	100	1.5A	2.0	3.0A	20	E	4.0M	T
2N5868	S	P	2N5868	2N5867	AP	87.5W	C	200	80	80	O	20	100	1.5A	2.0	3.0A	20	E	4.0M	T
2N5869	S	N	2N5869	2N5867	AP	87.5W	C	200	60	60	O	20	100	1.5A	2.0	3.0A	20	E	4.0M	T
2N5870	S	N	2N5870	2N5867	AP	87.5W	C	200	80	80	O	20	100	1.5A	2.0	3.0A	20	E	4.0M	T

						MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS								
TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	P_D @ 25°C * 100°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	h_{FE} (min)	(max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N5871	S	P	2N5871	2N5871	AP	100W	C	200	60	60	O	20	100	2.5A	2.0	5.0A	20	E	4.0M	T
2N5872	S	P	2N5872	2N5871	AP	100W	C	200	80	80	O	20	100	2.5A	2.0	5.0A	20	E	4.0M	T
2N5873	S	N	2N5873	2N5871	AP	100W	C	200	60	60	O	20	100	2.5A	2.0	5.0A	20	E	4.0M	T
2N5874	S	N	2N5874	2N5871	AP	100W	C	200	80	80	O	20	100	2.5A	2.0	5.0A	20	E	4.0M	T
2N5875	S	P	2N5875	2N5875	AP	150W	C	200	60	60	O	20	100	4.0A	3.0	8.0A	20	E	4.0M	T
2N5876	S	P	2N5876	2N5875	AP	150W	C	200	80	80	O	20	100	4.0A	3.0	8.0A	20	E	4.0M	T
2N5877	S	N	2N5877	2N5875	AP	150W	C	200	60	60	O	20	100	4.0A	3.0	8.0A	20	E	4.0M	T
2N5878	S	N	2N5878	2N5875	AP	150W	C	200	80	80	O	20	100	4.0A	3.0	8.0A	20	E	4.0M	T
2N5879	S	P	2N5879	2N5879	AP	160W	C	200	60	60	O	20	100	6.0A	4.0	12A	20	E	4.0M	T
2N5880	S	P	2N5880	2N5879	AP	160W	C	200	80	80	O	20	100	6.0A	4.0	12A	20	E	4.0M	T
2N5881	S	N	2N5881	2N5879	AP	160W	C	200	60	60	O	20	100	6.0A	4.0	12A	20	E	4.0M	T
2N5882	S	N	2N5882	2N5879	AP	160W	C	200	80	80	O	20	100	6.0A	4.0	12A	20	E	4.0M	T
2N5883	S	P	2N5883	2N5883	AP	200W	C	200	60	60	O	20	100	10A	4.0	20A	20	E	4.0M	T
2N5884	S	P	2N5884	2N5883	AP	200W	C	200	80	80	O	20	100	10A	4.0	20A	20	E	4.0M	T
2N5885	S	N	2N5885	2N5883	AP	200W	C	200	60	60	O	20	100	10A	4.0	20A	20	E	4.0M	T
2N5886	S	N	2N5886	2N5883	AP	200W	C	200	80	80	O	20	100	10A	4.0	20A	20	E	4.0M	T
2N5887	G	P	2N5887	2N5887	AP	57W	C	110	20	15	O	15	350	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5888	G	P	2N5888	2N5887	AP	57W	C	110	30	25	O	15	350	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5889	G	P	2N5889	2N5887	AP	57W	C	110	30	25	O	30	70	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5890	G	P	2N5892	2N5887	AP	57W	C	110	45	35	O	30	70	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5891	G	P	2N5891	2N5877	AP	57W	C	110	60	45	O	30	70	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5892	G	P	2N5892	2N5877	AP	57W	C	110	75	60	O	30	70	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5893	G	P	2N5893	2N5877	AP	57W	C	110	30	25	O	60	120	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5894	G	P	2N5894	2N5877	AP	57W	C	110	45	35	O	60	120	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5895	G	P	2N5895	2N5877	AP	57W	C	110	60	45	O	60	120	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5896	G	P	2N5896	2N5877	AP	57W	C	110	75	60	O	60	120	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5897	G	P	2N5897	2N5877	AP	57W	C	110	30	25	O	100	200	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5898	G	P	2N5898	2N5877	AP	57W	C	110	45	35	O	100	200	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5899	G	P	2N5899	2N5877	AP	57W	C	110	60	45	O	100	200	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5900	G	P	2N5900	2N5877	AP	57W	C	110	75	60	O	100	200	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5901	G	P	2N5901	2N5877	AP	57W	C	110	30	25	O	175	350	0.5A	0.35	5.0A	12.5	E	0.25M	T
2N5902 thru 2N5909			Field-Effect Transistors, see Table on Page 2-78																	
2N5913	S	N			AH				36	14	O									
2N5914	S	N			AH				36	14	O									
2N5915	S	N			AH				36	14	O									
2N5916	S	N			AH				55	24	O	20		50M						
2N5917	S	N			AH				55	24	O	20		50M						
2N5918	S	N			AH				60	24	O									
2N5919	S	N			AH				65	30	O									
2N5920	S	N			AH				50	50	R									
2N5921	S	N			AH	14.5W	C		50	50	R									
2N5926	S				SP	*200W	C	200	150	120	O	10	40	50A	0.6	50A				
2N5927	S	N			SP	*200W	C	200	150	120	O	10	40	70A	0.75	70A				
2N5928	S	N			SP	*200W	C	200	120	120	O	10	40	100A	1.0	100A				
2N5929	S	N			SP	100W	C	200	90	80	X	20	100	10A	2.0	10A			30M	T
2N5930	S	N			SP	100W	C	200	130	120	X	20	100	10A	2.0	10A			30M	T
2N5931	S	N			SP	100W	C	200	170	160	X	20	100	10A	2.0	10A			30M	T
2N5932	S	N			SP	100W	C	200	70	60	X	20	100	10A	2.0	20A			30M	T
2N5933	S	N			SP	100W	C	200	110	100	X	20	100	20A	2.0	20A			30M	T
2N5934	S	N			SP	100W	C	200	150	140	X	20	100	20A	2.0	20A			30M	T
2N5935	S	N			SP	100W	C	200	90	80	X	20	100	30A	2.0	30A			30M	T
2N5936	S	N			SP	100W	C	200	130	120	X	20	100	30A	2.0	30A			30M	T
2N5937	S	N			SP	100W	C	200	70	160	X	20	100	30A	2.0	30A			30M	T
2N5938	S	N			AP	2.5W	A	200	60	50	O	30	150	1.0A	0.75	3.0A	20	E		
2N5939	S	N			AP	2.0W	A	200	80	80	O	40	200	5.0A	1.0	10A	30	E		
2N5940	S	N			AP	2.0W	A	200	70	70	O	40	200	5.0A	1.0	10A	30	E		
2N5941	S	N		2N5941	AH	80W	C		65	35	O	10		0.500A					50M	T
2N5942	S	N		2N5942	AH	140W	C		65	35	O	10		1.0A					50M	T
2N5943	S	N		2N5943	A	3.5W	C		40	30	O	25	300	50M	0.2	100M	25	E		
2N5944	S	N			AP	5.0W	C		36	16	O	20		0.1A						
2N5945	S	N			AP	15W	C		36	16	O	20		0.2A						
2N5946	S	N			AP	37.5W	C		36	16	O	20		0.5A						
2N5947	S	N		2N5947	A	16W	C		40	30	O	25	250	75M	0.35	200M	25	E		
2N5949 thru 2N5953			Field Effect Transistors, See Table on Page 2-78																	
2N5961	S	N			AH	625M	A		60	60	O	150	700	10M	0.2	10M	150	E	100M	T
2N5962	S	N			AH	625M	A		45	45	O	600	1.4K	10M	0.2	10M	600	E	100M	T
2N5963	S	N			AH	625M	A		30	30	O	1.2K	2.2K	10M	0.2	10M	1200	E	150M	T
2N5964	S	N			AH	700M	A	135	160	150	O	50	250	10M	0.2	10M	50	E	100M	T
2N5965	S	N			AH	700M	A	135	200	180	O	50	250	10M	0.2	10M	50	E	100M	T
2N5970	S	N	2N5970		SP	*85.5W	C	200	80	60	O	20	60	5.0A	1.0	5.0A			4.0M	T
2N5971	S	N	2N5971		SP	*85.5W	C	200	80	60	O	50	150	5.0A	0.7	5.0A			4.0M	T
2N5972	S	N	2N5972		SP	*85.5W	C	200	100	70	O	25	75	5.0A	1.0	5.0A			4.0M	T
2N5973	S	N	2N5973		SP	*85.5W	C	200	120	80	O	25	75	0.5A	1.0	5.0A			4.0M	T
2N5980	S	P			AP	90W	C	150	60	40	O	20	120	4.0A	0.6	4.0A	20	E	2.0M	T
2N5981	S	P			AP	90W	C	150	80	60	O	20	120	4.0A	0.6	4.0A	20	E	2.0M	T
2N5982	S	P			AP	90W	C	150	100	80	O	20	120	4.0A	0.6	4.0A	20	E	2.0M	T
2N5983	S	N			AP	90W	C	150	60	40	O	20	120	4.0A	0.6	4.0A	20	E	2.0M	T
2N5984	S	N			AP	90W	C	150	80	60	O	20	120	4.0A	0.6	4.0A	20	E	2.0M	T
2N5985	S	N			AP	90W	C	150	100	80	O	20	120	4.0A	0.6	4.0A	20	E	2.0M	T
2N5992	S	N			AP	35.7W	C		65	30	O									
2N5993	S	N			AP	35.7W	C		36	18	O									
2N5994	S	N			AP	35.7W	C		65	30	O									
2N5995	S	N			AP	10.7W	C		36	14	O									
2N5996	S	N			AP	35.7W	C		36	18	O									
2N6000	S	N			A	800M	C	125	35	25	O	100	300	10M	0.080	10M	70	E	350M	T
2N6001	S	P			A	800M	C	125	35	25	O	100	300	10M	0.100	10M	85	E	700M	T
2N6002	S	N			A	800M	C	125	35	25	O	250	500	10M	0.080	10M	175	E	450M	T
2N6003	S	P			A	800M	C	125	35	25	O	250	500	10M	0.100	10M	235	E	800M	T

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TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C *@ 75°C **@100°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N6004	S	N			A	800M	C	125	50	40	O	100	300	10M	0.080	10M	70	E	350M	T
2N6005	S	P			A	800M	C	125	50	40	O	100	300	10M	0.100	10M	85	E	700M	T
2N6006	S	N			A	800M	C	125	50	40	O	250	500	10M	0.080	10M	175	E	450M	T
2N6007	S	P			A	800M	C	125	50	40	O	250	500	10M	0.200	10M	235	E	800M	T
2N6010	S	N			A	1.0W	C	150	50	40	O	100	300	10M	0.050	10M	65	E	330M	T
2N6011	S	P			A	1.0W	C	150	50	40	O	100	300	10M	0.080	10M	90	E	240M	T
2N6012	S	N			A	1.0W	C	150	50	40	O	250	500	10M	0.050	10M	155	E	420M	T
2N6013	S	P			A	1.0W	C	150	50	40	O	250	500	10M	0.080	10M	225	E	360M	T
2N6014	S	N			A	1.0W	C	150	70	60	O	100	300	10M	0.050	10M	65	E	330M	T
2N6015	S	P			A	1.0W	C	150	70	60	O	100	300	10M	0.080	10M	90	E	240M	T
2N6016	S	N			A	1.0W	C	150	70	60	O	250	500	10M	0.050	10M	155	E	420M	T
2N6017	S	P			A	1.0W	C	150	70	60	O	250	500	10M	0.080	10M	255	E	360M	T
2N6021	S	P	2N4920	2N4918	A	36W	C	150	80	70	O	30	120	0.5A	1.0	0.5A	15	E	0.8M	T
2N6022	S	P	2N4920	2N4918	A	36W	C	150	80	70	O	30	120	0.5A	1.0	0.5A	15	E	0.8M	T
2N6023	S	P	2N4918	2N4918	A	36W	C	150	60	40	O	30	120	1.0A	1.0	1.0A	20	E	0.8M	T
2N6024	S	P	2N4918	2N4918	A	36W	C	150	60	40	O	30	120	1.0A	1.0	1.0A	20	E	0.8M	T
2N6025	S	P	2N4919	2N4918	A	36W	C	150	80	60	O	20	80	1.5A	1.0	1.5A	25	E	0.8M	T
2N6026	S	P	2N4919	2N4918	A	36W	C	150	80	60	O	20	80	1.5A	1.0	1.5A	25	E	0.8M	T
2N6027 2N6028	Programmable Unijunctions, See Table on Page 2-88																			
2N6029	S	P			AP	200W	C	200	100	100	0	25	100	8.0A	2.0	16A	15	E	1.0M	T
2N6030	S	P			AP	200W	C	200	120	120	0	20	80	8.0A	2.0	16A	15	E	1.0M	T
2N6031	S	P			AP	200W	C	200	140	140	0	15	60	8.0A	2.0	16A	15	E	1.0M	T
2N6032	S	N			SP	*80W	C	200	120	90	0	10	50	50A	1.3	50A			50M	T
2N6033	S	N			SP	*80W	C	200	150	120	0	10	50	40A	1.0	40A			50M	T
2N6046	S	N			SP	114W	C	200	70	60	0	20	100	20A	2.0	20A			30M	T
2N6047	S	N			SP	114W	C	200	110	100	0	20	100	20A	2.0	20A			30M	T
2N6048	S	N			SP	114W	C	200	150	140	0	20	100	20A	2.0	20A			30M	T
2N6049	S	P			AP	75W	C	200	90	55	0	25	100	500M	2.0	4.0A	25	E	3.0M	T
2N6055	S	N			AP	100W	C	200	60	60	0	750	18000	4.0A	2.0	4.0A	300	E	4.0M	T
2N6056	S	N			AP	100W	C	200	80	80	0	750	18000	4.0A	2.0	4.0A	300	E	4.0M	T
2N6060	S	N			AP	*150W	C	200	100	100	0	20	120	20A	1.0	20A	40	E	10M	T
2N6061	S	P			AP	*150W	C	200	100	100	0	20	120	20A	1.1	20A	40	E	20M	T
2N6062	S	N			AP	*150W	C	200	100	100	0	20	120	20A	1.0	20A	40	E	10M	T
2N6063	S	P			AP	*150W	C	200	100	100	0	20	120	20A	1.1	20A	40	E	20M	T
2N6064	G	P	2N6064	2N6064	SP	56 W	C	110	80	80	O	20	50	3.0 A	0.8	10 A	10	E		
2N6065	G	P	2N6065	2N6064	SP	56 W	C	110	120	120	O	20	50	3.0 A	0.8	10 A	10	E		
2N6066	G	P	2N6066	2N6064	SP	56 W	C	110	160	160	O	20	50	3.0 A	0.8	10 A	10	E		
2N6067	S	P			S	625M	A		50	40	O	50	200	100 M	0.3	100 M			150 M	T
2N6068 thru 2N6075	Thyristors, See Table on Page 2-66																			
2N6076	S	P			A	360M	A		25	25	0	100	500	10M	0.25	10M				
2N6077	S	N	2N6077		SP	**25.7W	C	200	300	300	X	12	70	1.2A	0.5	1.2A			1.0M	T
2N6078	S	N	2N6078		SP	**25.7W	C	200	275	275	X	12	70	1.2A	0.5	1.2A			1.0M	T
2N6079	S	N	2N6079		SP	**25.7W	C	200	375	375	X	12	50	1.2A	0.5	1.2A			1.0M	T
2N6080	S	N		2N6080	A	12W	C		36	18	0	5.0		0.25A						
2N6081	S	N		2N6080	A	13W	C		36	18	0	5.0		0.5A						
2N6082	S	N		2N6082	A	50W	C		36	18	0	5.0		1.0A						
2N6083	S	N		2N6082	A	50W	C		36	18	0	5.0		1.0A						
2N6084	S	N		2N6082	A	75 W	C		36	18	O	5.0		1.0 A						
2N6085	S	N			A	0.75W	C		45	45	O	60	240	10 *	0.35	1.0 M			60 M	T
2N6086	S	N			A	0.75W	C		45	45	O	150	600	10 *	0.35	1.0 M			60 M	T
2N6087	S	N			A	0.75W	C		45	45	O	60	240	10 *	0.35	1.0 M			60 M	T
2N6088	S	N			A	0.75W	C		45	45	O	150	600	10 *	0.35	1.0 M			60 M	T
2N6089	S	N			A	0.75W	C		45	45	O	60	240	10 *	0.35	1.0 M			60 M	T
2N6090	S	N			A	0.75W	C		45	45	O	150	600	10 *	0.35	1.0 M			60 M	T
2N6091	S	N			A	0.75W	C		60	60	O	60	240	10 *	0.35	1.0 M			60 M	T
2N6092	S	N			A	0.75W	C		60	60	O	150	600	10 *	0.35	1.0 M			60 M	T
2N6093	S	N			AH	*83.3W	C		70	35	O	20		5.0 A					100 M	T
2N6098	S	N	2N5983	2N5983	AP	75 W	C	150	70	60	O	20	80	4.0 A	2.5	10 A	15	E	0.8 M	T
2N6099	S	N	2N5983	2N5983	AP	75 W	C	150	70	60	O	20	80	4.0 A	2.5	10 A	15	E	0.8 M	T
2N6100	S	N	2N5991	2N5986	AP	75 W	C	150	80	70	O	20	80	5.0 A	2.5	10 A	15	E	0.8 M	T
2N6101	S	N	2N5991	2N5986	AP	75 W	C	150	80	70	O	20	80	5.0 A	2.5	10 A	15	E	0.8 M	T
2N6102	S	N			AP	75 W	C	150	45	40	O	15	60	8.0 A	2.5	16 A	15	E	0.8 M	T
2N6103	S	N			AP	75 W	C	150	45	40	O	15	60	8.0 A	2.5	16 A	15	E	0.8 M	T
2N6104	S	N			AH	*36 W	C		65	30	O									
2N6105	S	N			AH	*36 W	C		65	30	O									
2N6106	S	P			A	40 W	C	150	80	70	O	30	150	2.0 A	2.0	6.5 A	20	E	10 M	E
2N6107	S	P			A	40 W	C	150	80	70	O	30	150	2.0 A	2.0	6.5 A	20	E	10 M	E
2N6108	S	P			A	40 W	C	150	60	50	O	30	150	2.5 A	2.0	6.5 A	20	E	10 M	E
2N6109	S	P			A	40 W	C	150	60	50	O	30	150	2.5 A	2.0	6.5 A	20	E	10 M	E
2N6110	S	P			A	40 W	C	150	40	30	O	30	150	3.0 A	2.0	6.5 A	20	E	10 M	E
2N6111	S	P			A	40 W	C	150	40	30	O	30	150	3.0 A	2.0	6.5 A	20	E	10 M	E
2N6112	S	N			AH	360M	C		50	30	0	185	600	2.0M	0.3	10M	185	E	160M	T
2N6116 thru 2N6120	Programmable Unijunction Transistors, See Table on Page 2-88																			
2N6121	S	N			AP	40W	C	150	45	45	0	25	100	1.5A	0.6	1.5A	25	E	2.5M	T
2N6122	S	N			AP	40W	C	150	60	60	0	25	100	1.5A	0.6	1.5A	25	E	2.5M	T
2N6123	S	N			AP	40W	C	150	80	80	0	20	80	1.5A	0.6	1.5A	25	E	2.5M	T
2N6124	S	P			AP	40W	C	150	45	45	0	25	100	1.5A	0.6	1.5A	25	E	2.5M	T
2N6125	S	P			AP	40W	C	150	60	60	0	25	100	1.5A	0.6	1.5A	25	E	2.5M	T
2N6126	S	P			AP	40W	C	150	80	80	0	20	80	1.5A	0.6	1.5A	25	E	2.5M	T
2N6127	S	P			AP	*67W	C	200	100	80	0	30	120	5.0A	2.2	10A	20	E	40M	T
2N6128	S	N			AP	*67W	C	200	100	80	0	30	120	5.0A	2.2	10A	20	E	50M	T
2N6129	S	N			AP	50W	C	150	40	40	0	20	100	2.5A	1.4	7.0A	25	E	2.5M	T
2N6130	S	N			AP	50W	C	150	60	60	0	20	100	2.5A	1.4	7.0A	25	E	2.5M	T
2N6131	S	N			AP	50W	C	150	80	80	0	20	100	2.5A	2.0	7.0A	25	E	2.5M	T
2N6132	S	P			AP	50W	C	150	40	40	0	20	100	2.5A	1.4	7.0A	25	E	2.5M	T
2N6133	S	P			AP	50W	C	150	60	60	0	20	100	2.5A	1.4	7.0A	25	E	2.5M	T
2N6134	S	P			AP	50W	C	150	80	80	0	20	100	2.5A	1.8	7.0A	25	E	2.5M	T

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C *@ 75°C **@100°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
2N6135	S	N			AH	5.0W	C		35	25	0	25	250	80M			25	E	1.1G	T
2N6136	S	N			AH	60W	C		36	18	0	20		1.0A						
2N6137																				
2N6138			Programmable Unijunction Transistors, See Table on Page 2-88.																	
2N6166	S	N			AH	117W	C		65	35	0	5.0		500M						
2N6175	S	N			AP	20W	C		300	250	0	30		20M			25	E	21M	T
2N6176	S	N			AP	20W	C		350	300	0	30		20M			25	E	21M	T
2N6177	S	N			AP	20W	C		450	350	0	30		50M			25	E	21M	T
2N6178	S	N			SP	**10W	C	150	100	75	X	30	130	0.5A	0.5	0.5A			50M	T
2N6179	S	N			SP	**10W	C	150	75	50	X	40	250	0.5A	0.8	0.5A			50M	T
2N6180	S	P			SP	**10W	C	150	100	75	X	30	130	0.5A	0.7	0.5A			50M	T
2N6181	S	P			SP	**10W	C	150	75	50	X	40	250	0.5A	1.2	0.5A			50M	T
2N6182	S	P			SP	60W	C	200	80	80	0	30	120	2.0A	0.7	2.0A			30M	T
2N6183	S	P			SP	60W	C	200	80	80	0	60	240	2.0A	0.7	2.0A			30M	T
2N6184	S	P			SP	60W	C	200	100	100	0	30	120	2.0A	0.7	2.0A			30M	T
2N6185	S	P			SP	60W	C	200	100	100	0	60	240	2.0A	0.7	2.0A			30M	T
2N6197	S	N			AHP	10W	C		60	35	0									
2N6198	S	N			AHP	25W	C		60	35	0									
2N6199	S	N			AHP	50W	C		60	35	0									
2N6200	S	N			AHP	85W	C		60	35	0									
2N6201	S	N			AHP	140W	C		60	35	0									
2N6202	S	N			AHP	10W	C		60	33	0									
2N6203	S	N			AHP	20W	C		60	33	0									
2N6204	S	N			AHP	40W	C		60	33	0									
2N6205	S	N			AHP	80W	C		60	33	0									
2N6206	S	N			AHP	10W	C		50	30	0									
2N6207	S	N			AHP	20W	C		50	30	0									
2N6208	S	N			AHP	40W	C		50	30	0									
2N6211	S	P			SP	**20W	C	200	275	275	X	10	100	1.0A	1.4	1.0A			5.0M	T
2N6212	S	P			SP	**20W	C	200	350	350	X	10	100	1.0A	1.6	1.0A			5.0M	T
2N6213	S	P			SP	**20W	C	200	400	400	X	10	100	1.0A	2.0	1.0A			5.0M	T
2N6226	S	P			AP	150W	C	200	100	100	0	25	100	3.0A	1.0	3.0A	15	E	1.0M	T
2N6227	S	P			AP	150W	C	200	120	120	0	20	80	3.0A	1.0	3.0A	15	E	1.0M	T
2N6228	S	P			AP	150W	C	200	140	140	0	15	60	3.0A	1.0	3.0A	15	E	1.0M	T
2N6229	S	P			AP	150W	C	200	100	100	0	25	100	5.0A	1.0	7.5A	15	E	1.0M	T
2N6230	S	P			AP	150W	C	200	120	120	0	20	80	5.0A	1.0	7.5A	15	E	1.0M	T
2N6231	S	P			AP	150W	C	200	140	140	0	15	60	5.0A	1.0	7.5A	15	E	1.0M	T
2N6233	S	N			SP	50W	C	200	250	225	0	25	125	1.0A	0.5	1.0A			20M	T
2N6234	S	N			SP	50W	C	200	300	275	0	25	125	1.0A	0.5	1.0A			20M	T
2N6235	S	N			SP	50W	C	200	350	325	0	25	125	1.0A	0.5	1.0A			20M	T
2N6246	S	P			AP	125W	C	200	110	105	R			15A	2.5	15A	25	E	10M	T
2N6247	S	P			AP	125W	C	200	90	85	R			15A	3.5	15A	25	E	10M	T
2N6248	S	P			AP	125W	C	200	70	65	R			15A	3.5	15A	25	E	10M	T
2N6249	S	N			SP	100W	C	200	300	225	X	12	50	10A	1.0	10A			2.5M	T
2N6250	S	N			SP	100W	C	200	375	300	X	10	50	10A	1.5	10A			2.5M	T
2N6251	S	N			SP	100W	C	200	450	400	X	8.0	50	10A	1.5	10A			2.5M	T
2N6253	S	N			AP	115W	C	200	55	45	0	20	70	3.0A	4.0	15A	10	E	0.8M	T
2N6254	S	N			AP	150W	C	200	100	80	0	20	70	5.0A	4.0	15A	10	E	0.8M	T
2N6257	S	N			AP	150W	C	200	50	40	0	15	75	8.0A	1.5	8.0A	40	E	0.2M	T
2N6258	S	N			AP	250W	C	200	100	80	0	20	60	15A	0.75	15A	40	E	0.4M	T
2N6259	S	N			AP	250W	C	200	170	150	0	15	60	8.0A	1.0	8.0A	40	E	0.2M	T
2N6260	S	N			AP	29W	C	200	50	40	0	20	100	1.5A	1.5	1.5A	25	E	0.8M	T
2N6261	S	N			AP	50W	C	200	90	80	0	25	100	1.5A	0.5	1.5A	25	E	0.8M	T
2N6262	S	N			AP	150W	C	200	170	150	0	20	70	3.0A	0.5	3.0A	10	E	0.8M	T
2N6263	S	N			AP	20W	C	200	140	120	0	20	100	0.5A	1.2	0.5A	25	E	3.2M	T
2N6264	S	N			AP	50W	C	200	170	150	0	20	60	1.0A	0.5	1.0A	25	E	0.8M	T
2N6265	S	N			AHP	*7.5W	C		50	50	R									
2N6266	S	N			AHP	**14.8W	C		50	50	R									
2N6267	S	N			AHP	**21W	C		50	50	R									
2N6268	S	N			AH	**6.25W	C		45	45	R									
2N6269	S	N			AH				45	45	R									

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C Units	$V_{CE(SAT)}$ (volts)	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
3N22		N			AH			85	15								0.96	B		
3N34	S	N				125M			30											
3N35	S	N				125M			30	30	O						25	E		
3N35A	S	N				125M			30	30	O						10	E		
3N39 thru 3N44	Reference Amplifiers, see Table on Page 2-84																			
3N45	G	P			SP	75W	C	100	60	35		30	120	5.0A	0.4	5.0A	30	E	600K	
3N46	G	P			SP	75W	C	100	80	50		20	80	5.0A	0.4	5.0A			300K	
3N47	G	P			SP	75W	C	100	40	25		30	120	5.0A	0.4	5.0A	30	E	500K	
3N48	G	P			SP	75W	C	100	60	40		20	80	5.0A	0.4	5.0A			300K	
3N49	G	P			SP	94W	C	100	60	35		30	120	5.0A	0.4	5.0A	30	E	600K	
3N50	G	P			SP	94W	C	100	80	50		20	80	5.0A	0.4	5.0A			300K	
3N51	G	P			SP	94W	C	100	40	25		30	120	5.0A	0.4	5.0A	30	E	500K	
3N52	G	P			SP	94W	C	100	60	40		20	80	5.0A	0.4	5.0A			300K	
3N58 thru 3N60	Thyristors, see Table on Page 2-66																			
3N62	S	N			SC				10						V_{off} = 200 µV					
3N63	S	N			SC				10						V_{off} = 100 µV					
3N64	S	N			SC				10						V_{off} = 50 µV					
3N65	S	N			SC										V_{off} = 200 µV					
3N66	S	N			SC										V_{off} = 100 µV					
3N67	S	N			SC										V_{off} = 50 µV					
3N68	S	N			SC				10						V_{off} = 200 µV					
3N68A	S	N				100M	A	200	10											
3N69	S	N			SC				10						V_{off} = 100 µV					
3N70	S	N			SC				10						V_{off} = 50 µV					
3N71	S	N			SC	100M		200	15	8.0	O	40		2.0M	V_{off} = 50 µV				100M	T
3N72	S	N			SC	100M		200	15	8.0	O	40		2.0M	V_{off} = 100 µV				100M	T
3N73	S	N			SC	100M		200	15	8.0	O	40		2.0M	V_{off} = 100 µV				100M	T
3N74	S	N			SC	300M		175	50						V_{off} = 50 µV				30M	T
3N75	S	N			SC	300M		175	50						V_{off} = 100 µV				30M	T
3N76	S	N			SC	300M		175	50						V_{off} = 200 µV				30M	T
3N77	S	N			SC	300M		175	40						V_{off} = 50 µV				30M	T
3N78	S	N			SC	200M		175	40						V_{off} = 100 µV				30M	T
3N79	S	N			SC	300M		175	40						V_{off} = 200 µV				30M	T
3N80 thru 3N86	Thyristors, see Table on Page 2-66																			
3N87	S	N			SC	200M	A		20	10	O	5.0		0.5M	V_{off} = 50 µV				100M	T
3N88	S	N			SC	200M	A		20	10	O	5.0		0.5M	V_{off} = 100 µV				100M	T
3N89	Field-Effect Transistors, see Table on Page 2-78																			
3N90	S	P			SC	300M	A	200	50						V_{off} = 50 µV				6.0M	T
3N91	S	P			SC	300M	A	200	50						V_{off} = 100 µV				6.0M	T
3N92	S	P			SC	300M	A	200	50						V_{off} = 200 µV				6.0M	T
3N93	S	P			SC	300M	A	200	50						V_{off} = 50 µV				6.0M	T
3N94	S	P			SC	300M	A	200	50						V_{off} = 100 µV				6.0M	T
3N95	S	P			SC	300M	A	200	50						V_{off} = 200 µV				6.0M	T
3N96 thru 3N99	Field-Effect Transistors, see Table on Page 2-78																			
3N100	S	P			SC	300M	A	200	20						V_{off} = 50 µV					
3N101	S	P			SC	300M	A	200	30						V_{off} = 50 µV					
3N102	S	P			SC	300M	A	200	40						V_{off} = 50 µV					
3N103	S	P			SC	300M	A	200	50						V_{off} = 50 µV					
3N104	S	P			SC	300M	A	200	60						V_{off} = 50 µV					
3N105	S	P			SC	300M	A	200	20						V_{off} = 250 µV					
3N106	S	P			SC	300M	A	200	40						V_{off} = 250 µV					
3N107	S	P			SC	300M	A	200	60						V_{off} = 250 µV					
3N108	S	P			SC	300M	A	200	50										12M	T
3N109	S	P			SC	300M	A	200	50										12M	T
3N110	S	P			SC	300M	A	200	50										12M	T
3N111	S	P			SC	300M	A	200	50										12M	T
3N112	S	P			SC	200M	A	200	50											
3N113	S	P			SC	200M	A	200	50											
3N114	S	P			SC	300M	A	200	30										12M	T
3N115	S	P			SC	300M	A	200	30										12M	T
3N116	S	P			SC	300M	A	200	30										12M	T
3N117	S	P			SC	300M	A	200	50										12M	T
3N118	S	P			SC	300M	A	200	50										12M	T
3N119	S	P			SC	300M	A	200	50										12M	T
3N120	S	N			SC	200M	A	200	30											

TYPE	MATERIAL	POLARITY	REPLACEMENT	REF.	USE	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} (volts)	V_{CE-} (volts)	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} (min)	h_{FE} (max)	@ I_C	Units	$V_{CE(SAT)}$ (volts)	@ I_C	Units	h_{f-}	Subscript	f_-	Units	Subscript
3N121	S	N			SC	200M	A	125	30												40M		T
3N123	S	P			SC	100M	A	200	30												6.0M		E
3N124 thru 3N126	Field-Effect Transistors, see Table on Page 2-78																						
3N127	S	N			SC	200M	A	200	30	20	0												
3N128	Field-Effect Transistors, see Table on Page																						
3N129	S	P			SC	300M	A		20												2.0M		E
3N130	S	P			SC	300M	A		30												2.0M		E
3N131	S	P			SC	300M	A		40												2.0M		E
3N132	S	P			SC	300M	A		50												2.0M		E
3N133	S	P			SC	300M	A		60												2.0M		E
3N134	S	P			SC	300M	A		20												2.0M		E
3N135	S	P			SC	300M	A		40												2.0M		E
3N136	S	P			SC	300M	A		60												2.0M		E
3N138 thru 3N143	Field-Effect Transistors, see Table on Page 2-78																						
3N145 thru 3N186	Field-Effect Transistors, see Table on Page 2-78																						
3N188 thru 3N191	Field-Effect Transistors, see Table on Page 2-78																						
3N192 3N193	Field-Effect Transistors, See Table on Page 2-78																						

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THYRISTORS

This table contains a numerical listing and short-form specifications for thyristors with EIA-registered 2N and 3N numbers. Specific types of thyristors listed include silicon controlled rectifiers, gate-controlled switches, and silicon controlled switches.

KEY

TYPE	REPLACE-MENT	REFERENCE	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} Volts	T_J T_C(1) °C	I_{GT} mA	V_{GT} Volts
Numerical Listing of Registered Type Numbers. *Device with gate turn-off characteristics	Type number of recommended replacement or of nearest electrical equivalent fully characterized in this book	Reference device number indicates specific Data Sheet on which device is characterized	On-State (RMS) Current	Peak Forward Blocking Voltage Peak Reverse Blocking Voltage	Maximum Junction Temperature, Maximum Case Temperature(1)	Gate Trigger Current	Gate Trigger Voltage

TYPE	REPLACEMENT	REF.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} volts	T_J T_C(1) °C	I_{GT} mA	V_{GT} volts
2N681	2N681	2N681	25	25	125	40	2.0
2N681A	2N681	2N681	28	25	125	40	2.0
2N682	2N682	2N681	25	50	125	40	2.0
2N682A	2N682	2N681	28	50	125	40	2.0
2N683	2N683	2N681	25	100	125	40	2.0
2N683A	2N683	2N681	28	100	125	40	2.0
2N684	2N684	2N681	25	150	125	40	2.0
2N684A	2N684	2N681	28	150	125	40	2.0
2N685	2N685	2N681	25	200	125	40	2.0
2N685A	2N685	2N681	28	200	125	40	2.0
2N686	2N686	2N681	25	250	125	40	2.0
2N686A	2N686	2N681	28	250	125	40	2.0
2N687	2N687	2N681	25	300	125	40	2.0
2N687A	2N687	2N681	28	300	125	40	2.0
2N688	2N688	2N681	25	400	125	40	2.0
2N688A	2N688	2N681	28	400	125	40	2.0
2N689	2N689	2N681	25	500	125	40	2.0
2N689A	2N689	2N681	28	500	125	40	2.0
2N690	2N690	2N681	25	600	125	40	2.0
2N690A	2N690	2N681	25	600	125	40	2.0
2N691			25	700	125	40	2.0
2N692			25	800	125	40	2.0
2N764*			0.39	30	125	1.0	1.0
2N765*			0.20	60	125	1.0	1.0
2N766*			0.20	100	125	1.0	1.0
2N767*			0.20	200	125	1.0	1.0
2N876	2N4212	2N4212	0.35	15	150	0.2	0.8
2N877	2N4212	2N4212	0.35	30	150	0.2	0.8
2N878	2N4213	2N4212	0.35	60	150	0.2	0.8
2N879	2N4214	2N4212	0.35	100	150	0.2	0.8
2N880	2N4215	2N4212	0.35	150	150	0.2	0.8
2N881	2N4216	2N4212	0.35	200	150	0.2	0.8
2N882			0.35	300	150	0.2	0.8
2N883			0.35	400	150	0.2	0.8
2N884	2N4212	2N4212	0.35	15	150	0.02	0.6
2N885	2N4213	2N4212	0.35	30	150	0.02	0.6
2N886	2N4214	2N4212	0.35	60	150	0.02	0.6
2N887	2N4214	2N4212	0.35	100	150	0.02	0.6
2N888	2N4215	2N4212	0.35	150	150	0.02	0.6
2N889	2N4216	2N4212	0.35	200	150	0.02	0.6
2N890			0.35	300	150	0.02	0.6
2N891			0.35	400	150	0.02	0.6
2N892*			0.250	15	125	0.05	0.70
2N893*			0.250	15	125	0.05	0.70
2N894*			0.250	30/15	125	0.05	0.70
2N895*			0.250	30/15	125	0.05	0.70
2N896*			0.250	60/15	125	0.05	0.70
2N897*			0.250	60/15	125	0.05	0.70
2N898*			0.250	100/15	125	0.05	0.70
2N899*			0.250	100/15	125	0.05	0.70
2N900*			0.250	200/15	125	0.05	0.70
2N901*			0.250	200/15	125	0.05	0.70
2N948	2N4212	2N4212	0.26	30	150	0.02	1.0
2N949	2N4213	2N4212	0.26	60	150	0.02	1.0
2N950	2N4214	2N4212	0.26	100	150	0.02	1.0
2N951	2N4215	2N4212	0.26	200	150	0.02	1.0
2N1595	2N1595	2N1595	1.6	50	125	10	3.0
2N1595A	2N1595	2N1595	1.6	50	150	2.0	2.0
2N1596		2N1595	1.6	100	125	10	3.0
2N1596A	2N1596	2N1595	1.6	100	150	2.0	2.0
2N1597	2N1597	2N1595	1.6	200	125	10	3.0
2N1597A	2N1597	2N1595	1.6	200	150	2.0	2.0
2N1598	2N1598	2N1595	1.6	300	125	10	3.0
2N1598A	2N1598	2N1595	1.6	300	150	2.0	2.0
2N1599	2N1599	2N1595	1.6	400	125	10	3.0
2N1599A	2N1599	2N1595	1.6	400	150	2.0	2.0
2N1600	2N4168	2N4151	4.0	50	125	10	3.0
2N1600A	2N4168	2N4151	4.0	50	125	4.5	3.0
2N1601	2N4169	2N4151	4.0	100	125	10	3.0

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THYRISTOR INDEX (continued)

TYPE	REPLACEMENT	REF.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} volts	T_J T_C(1) °C	I_{GT} mA	V_{GT} volts
2N1602	2N4170	2N4151	4.0	200	125	10	3.0
2N1603	2N4171	2N4151	4.0	300	125	10	3.0
2N1604	2N4172	2N4151	4.0	400	125	10	3.0
2N1686*			0.5	30	125	1.0	1.0
2N1687*			0.5	60	125	1.0	1.0
2N1688*			0.5	100	125	1.0	1.0
2N1689*			0.5	200	125	1.0	1.0
2N1765	2N1765		0.5	400	85	10	1.5
2N1770	2N4167	2N4151	4.7	25	125	15	2.0
2N1770A			4.7	25	150	15	2.0
2N1771	2N4168	2N4151	4.7	50	125	15	2.0
2N1771A			4.7	50	150	15	2.0
2N1772	2N4169	2N4151	4.7	100	125	15	2.0
2N1772A			4.7	100	150	15	2.0
2N1773	2N4170	2N4151	4.7	150	125	15	2.0
2N1773A			4.7	150	150	15	2.0
2N1774	2N4170	2N4151	4.7	200	125	15	2.0
2N1774A			4.7	200	150	15	2.0
2N1775	2N4171	2N4151	4.7	250	125	15	2.0
2N1775A			4.7	250	150	15	2.0
2N1776	2N4171	2N4151	4.7	300	125	15	2.0
2N1776A			4.7	300	150	15	2.0
2N1776B			4.7	300	150	15	2.0
2N1777	2N4172	2N4151	4.7	400	125	15	2.0
2N1777A			7.0	400	150	15	2.0
2N1778	2N4173	2N4151	7.4	500	125	15	2.0
2N1778A			7.0	500	150	15	2.0
2N1792	2N1792		110	60	125	75	3.0
2N1793	2N1793		110	120	125	75	3.0
2N1794	2N1794		110	180	125	75	3.0
2N1795	2N1795		110	240	125	75	3.0
2N1796	2N1796		110	300	125	75	3.0
2N1797	2N1797		110	360	125	75	3.0
2N1798	2N1798		110	480	125	75	3.0
2N1799			110	600	125	75	3.0
2N1800	2N1800		110	720	125	75	3.0
2N1801	2N1801		110	840	125	75	3.0
2N1802	2N1802		110	960	125	75	3.0
2N1803	2N1803		110	1080	125	90	3.0
2N1804	2N1804		110	1200	125	90	3.0
2N1805	2N1805		110	500	125	75	3.0
2N1806	2N1806		110	600	125	75	3.0
2N1807	2N1807		110	700	125	75	3.0
2N1842		2N1842	16	25	100	80	2.0
2N1842A		2N1842A	16	25	125	80	2.0
2N1842B	2N1842A	2N1842A	20	25	125	75	3.0
2N1843		2N1842	16	50	100	80	2.0
2N1843A		2N1842A	16	50	125	80	2.0
2N1843B	2N1843A	2N1842A	20	50	125	75	3.0
2N1844		2N1842	16	100	100	80	2.0
2N1844A		2N1842A	16	100	125	80	2.0
2N1844B	2N1844A	2N1842A	20	100	125	75	3.0
2N1845		2N1842	16	150	100	80	2.0
2N1845A		2N1842A	16	150	125	80	2.0
2N1845B	2N1845A	2N1842A	20	150	125	75	3.0
2N1846		2N1842	16	200	100	80	2.0
2N1846A		2N1842A	16	200	125	80	2.0
2N1846B	2N1846A	2N1842A	20	200	125	75	3.0
2N1847		2N1842	16	250	100	80	2.0
2N1847A		2N1842A	16	250	125	80	2.0
2N1847B	2N1847A	2N1842A	20	250	125	75	3.0
2N1848		2N1842	16	300	100	80	2.0
2N1848A		2N1842A	16	300	125	80	2.0
2N1848B	2N1848A	2N1842A	20	300	125	75	3.0
2N1849		2N1842	16	400	100	80	2.0
2N1849A		2N1842A	16	400	125	80	2.0
2N1849B	2N1849A	2N1842A	20	400	125	75	3.0
2N1850		2N1842	16	500	100	80	2.0
2N1850A		2N1842A	16	500	125	80	2.0

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TYPE	REPLACEMENT	REF.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} volts	T_J T_C(1) °C	I_{GT} mA	V_{GT} volts
2N1850B	2N1850A	2N1842A	20	500	125	75	3.0
2N1869	2N4212	2N4212	1.25	15	150	0.2	0.8
2N1869A			1.25	15	150	0.2	0.8
2N1870	2N4213	2N4212	1.25	30	150	0.2	0.8
2N1870A			1.25	30	150	0.2	0.8
2N1871	2N4214	2N4212	1.25	60	150	0.2	0.8
2N1871A			1.25	60	150	0.2	0.8
2N1872	2N4214	2N4212	1.25	100	150	0.2	0.8
2N1872A			1.25	100	150	0.2	0.8
2N1873	2N4215	2N4212	1.25	150	150	0.2	0.8
2N1873A			1.25	150		0.2	0.8
2N1874	2N4216	2N4212	1.25	200	150	0.2	0.8
2N1874A			1.25	200	150	0.2	0.8
2N1875	2N4212	2N4212	1.25	15	150	0.020	0.6
2N1875A			1.25	15	150	0.020	0.6
2N1876	2N4213	2N4212	1.25	30	150	0.020	0.6
2N1876A			1.25	30	150	0.020	0.6
2N1877	2N4214	2N4212	1.25	60	150	0.020	0.6
2N1877A			1.25	60	150	0.020	0.6
2N1878	2N4214	2N4212	1.25	100	150	0.020	0.6
2N1878A			1.25	100	150	0.020	0.6
2N1879	2N4215	2N4212	1.25	150	150	0.020	0.6
2N1879A			1.25	150	150	0.020	0.6
2N1880	2N4216	2N4212	1.25	200	150	0.020	0.6
2N1880A			1.25	200	150	0.020	0.6
2N1881	2N4212	2N4212	1.0	30	150	2.0	2.0
2N1882	2N4213	2N4212	1.0	60	150	2.0	2.0
2N1883	2N4214	2N4212	1.0	100	150	2.0	2.0
2N1884	2N4215	2N4212	1.0	150	150	2.0	2.0
2N1885	2N4216	2N4212	1.0	200	150	2.0	2.0
2N1909	2N1909		70	25	125	75	3.0
2N1910	2N1910		70	50	125	75	3.0
2N1911	2N1911		70	100	125	75	3.0
2N1912	2N1912		70	150	125	75	3.0
2N1913	2N1913		70	200	125	75	3.0
2N1914	2N1914		70	250	125	75	3.0
2N1914A			70	250	125	75	3.0
2N1914B			70	250	125	75	3.0
2N1915	2N1915		70	300	125	75	3.0
2N1916	2N1916		70	400	125	75	3.0
2N1929	2N4191	2N4151	0.75	25	125	15	2.0
2N1930	2N4192	2N4151	0.75	50	125	15	2.0
2N1931	2N4193	2N4151	0.75	100	125	15	2.0
2N1932	2N4194	2N4151	0.75	150	125	15	2.0
2N1933	2N4194	2N4151	0.75	200	125	15	2.0
2N1934	2N4195	2N4151	0.75	250	125	15	2.0
2N1935	2N4195	2N4151	0.75	300	125	15	2.0
2N2009	2N4212	2N4212	1.3	25	150	0.2	1.0
2N2010	2N4213	2N4212	1.3	50	150	0.2	1.0
2N2011	2N4214	2N4212	1.3	100	150	0.2	1.0
2N2012	2N4216	2N4212	1.3	200	150	0.2	1.0
2N2013			1.3	300	150	0.2	1.0
2N2014			1.3	400	150	0.2	1.0
2N2023	2N2023		70	25	150	75	3.0
2N2024	2N2024		70	50	150	75	3.0
2N2025	2N2025		70	100	150	75	3.0
2N2026	2N2026		70	150	150	75	3.0
2N2027	2N2027		70	200	150	75	3.0
2N2028	2N2028		70	250	150	75	3.0
2N2029	2N2029		70	300	150	75	3.0
2N2030	2N2030		70	400	150	75	3.0
2N2031			110	50	125	75	3.0
2N2044			150	200	125	80	3.0
2N2045			150	300	125	80	3.0
2N2046			150	400	125	80	3.0
2N2047			150	500	125	80	3.0
2N2074	2N4213	2N4212	1.0	50	150	0.2	0.65
2N2260*			200	30	100	0.25	
2N2261*			200	30	100	0.5	

TYPE	REPLACEMENT	REF.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} volts	T_J T_C(1) °C	I_{GT} mA	V_{GT} volts
2N2262*			200	30	100	5.0	
2N2322	2N2322	2N2322	1.6	25	125	0.2	0.8
2N2322A			1.6	25	125	0.02	0.6
2N2323	2N2322	2N2322	1.6	50	125	0.2	0.8
2N2323A			1.6	50	125	0.02	0.6
2N2324	2N2324	2N2322	1.6	100	125	0.2	0.8
2N2324A			1.6	100	125	0.02	0.6
2N2325	2N2325	2N2322	1.6	150	125	0.2	0.8
2N2325A			1.6	150	125	0.02	0.6
2N2326	2N2326	2N2322	1.6	200	125	0.2	0.8
2N2326A			1.6	200	125	0.02	0.6
2N2327			1.6	250	125	0.2	0.8
2N2327A			1.6	250	125	0.02	0.6
2N2328			1.6	300	125	0.2	0.8
2N2328A			1.6	300	125	0.02	0.6
2N2329			1.6	400	125	0.2	0.8
2N2329A			1.6	400	125	0.02	0.6
2N2344	MCR1906-1	MCR1906-1	1.6	25	100	0.02	0.8
2N2345	MCR1906-2	MCR1906-1	1.6	50	100	0.02	0.8
2N2346	MCR1906-3	MCR1906-1	1.6	100	100	0.02	0.8
2N2347	MCR1906-4	MCR1906-1	1.6	150	100	0.02	0.8
2N2348	MCR1906-4	MCR1906-1	1.6	200	100	0.02	0.8
2N2503			225	50	125	100	2.5
2N2504			225	100	125	100	2.5
2N2505			225	200	125	100	2.5
2N2506			225	300	125	100	2.5
2N2507			225	400	125	100	2.5
2N2508			225	500	125	100	2.5
2N2542			230	50	125	125	3.0
2N2543			230	100	125	125	3.0
2N2544			230	200	125	125	3.0
2N2545			230	300	125	125	3.0
2N2546			230	400	125	125	3.0
2N2547			230	500	125	125	3.0
2N2548			230	600	125	125	3.0
2N2549			150	800	125	125	3.0
2N2550			150	1000	125	125	3.0
2N2573	2N2573	2N2573	25	25	125	40	3.5
2N2574	2N2574	2N2573	25	50	125	40	3.5
2N2575	2N2575	2N2573	25	100	125	40	3.5
2N2576	2N2576	2N2573	25	200	125	40	3.5
2N2577	2N2577	2N2573	25	300	125	40	3.5
2N2578	2N2578	2N2573	25	400	125	40	3.5
2N2579	2N2579	2N2573	25	500	125	40	3.5
2N2619	2N4174	2N4151	7.4	600	125	45	2.0
2N2653	2N4172	2N4151	3.0	400	105	35	3.0
2N2679			0.35	30	150	0.02	0.7
2N2679A			0.35	30	150	0.02	0.7
2N2680	MCR103	MCR201	0.35	60	150	0.02	0.7
2N2680A			0.35	60	150	0.02	0.7
2N2681	MCR204	MCR201	0.35	100	150	0.02	0.7
2N2681A			0.35	100	150	0.02	0.70
2N2682	MCR206	MCR201	0.35	200	150	0.02	0.7
2N2682A			0.35	200	150	0.02	0.70
2N2683	MCR202	MCR201	0.28	30	125	0.02	0.8
2N2683A			0.28	30	125	0.02	0.80
2N2684	MCR203	MCR201	0.28	60	125	0.02	0.8
2N2684A			0.28	60	125	0.02	0.80
2N2685	MCR204	MCR201	0.28	100	125	0.02	0.8
2N2685A			0.28	100	125	0.02	0.80
2N2686	MCR206	MCR201	0.28	200	125	0.02	0.8
2N2686A			0.28	200	125	0.02	0.80
2N2687	MCR202	MCR201	0.28	30	125	0.2	1.0
2N2688	MCR203	MCR201	0.28	60	125	0.2	1.0
2N2689	MCR204	MCR201	0.28	100	125	0.2	1.0
2N2690	MCR206	MCR201	0.28	200	125	0.2	1.0
2N2888	MCR1907-4	MCR1907-1	25	200	125	40	1.5

TYPE	REPLACEMENT	REF.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} volts	T_J T_C(1) °C	I_{GT} mA	V_{GT} volts
2N2889	MCR1907-4	MCR1907	25	250	125	40	1.5
2N3001	MCR202	MCR201	0.35	30	150	0.02	0.7
2N3002	MCR203	MCR201	0.35	60	150	0.02	0.7
2N3003	MCR204	MCR201	0.35	100	150	0.02	0.7
2N3004	MCR206	MCR201	0.35	200	150	0.02	0.7
2N3005	MCR202	MCR201	0.35	30	150	0.2	0.8
2N3006	MCR203	MCR201	0.35	60	150	0.2	0.8
2N3007	MCR204	MCR201	0.35	100	150	0.2	0.8
2N3008	MCR206	MCR201	0.35	200	150	0.2	0.8
2N3027	MCR202	MCR201	0.5	30	150	0.2	0.8
2N3028	MCR203	MCR201	0.5	60	150	0.2	0.8
2N3029	MCR204	MCR201	0.5	100	150	0.2	0.8
2N3030	MCR202	MCR201	0.5	30	150	0.02	0.6
2N3031	MCR203	MCR201	0.5	60	150	0.02	0.6
2N3032	MCR204	MCR201	0.5	100	150	0.02	0.6
2N3091			110	600	125	70	2.0
2N3092			110	700	125	70	2.0
2N3093			110	800	125	70	2.0
2N3094			110	900	125	70	2.0
2N3095			110	1000	125	70	2.0
2N3096			110	1100	125	70	2.0
2N3097			110	1200	125	70	2.0
2N3098			110	1300	125	70	2.0
2N3099			110	600	125	70	2.0
2N3100			110	700	125	70	2.0
2N3101			110	800	125	70	2.0
2N3102			110	900	125	70	2.0
2N3103			110	1000	125	70	2.0
2N3104			110	1100	125	70	2.0
2N3105			110	1200	125	70	2.0
2N3106			110	1300	125	70	2.0
2N3228	2N4154	2N4151	3.2	200	100	15	2.0
2N3254	MCR202	MCR201	0.25	15	150	0.02	0.75
2N3255	MCR202	MCR201	0.25	30	150	0.02	0.75
2N3256	MCR203	MCR201	0.25	60	150	0.02	0.75
2N3257	MCR202	MCR201	0.25	15	150	0.2	0.75
2N3258	MCR202	MCR201	0.25	30	150	0.2	0.75
2N3259	MCR203	MCR201	0.25	60	150	0.2	0.75
2N3269	2N4169	2N4151	8.0	100	150	0.2	0.8
2N3270	2N4170	2N4151	8.0	200	150	0.2	0.8
2N3271	2N4171	2N4151	8.0	300	150	0.2	0.8
2N3272	2N4171	2N4151	8.0	400	150	0.2	0.8
2N3273			2.2	100	150	0.2	0.8
2N3274			2.2	200	150	0.2	0.8
2N3275			2.2	300	150	0.2	0.8
2N3276			2.2	400	150	0.2	0.8
2N3353			400	50	125	200	4.0
2N3354			400	100	125	200	4.0
2N3355			400	200	125	200	4.0
2N3356			400	300	125	200	4.0
2N3357			400	400	125	200	4.0
2N3358			400	500	125	200	4.0
2N3359			400	600	125	200	4.0
2N3360			400	700	125	200	4.0
2N3361			400	800	125	200	4.0
2N3362			400	900	125	200	4.0
2N3363			400	1000	125	200	4.0
2N3364			400	1200	125	200	4.0
2N3422			196	600	125	150	3.0
2N3525	2N4156	2N4151	3.2	400	100	15	2.0
2N3528	2N4186	2N4151	1.3	200	100	15	2.0
2N3529	2N4188	2N4151	1.3	400	100	15	2.0
2N3530			400	50	125	300	4.0
2N3531			400	100	125	300	4.0
2N3532			400	200	125	300	4.0
2N3533			400	300	125	300	4.0
2N3534			400	400	125	300	4.0
2N3535			400	500	125	300	4.0
2N3536			400	600	125	300	4.0

TYPE	REPLACEMENT	REF.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} volts	T_J T_C(1) °C	I_{GT} mA	V_{GT} volts
2N3537			400	700	125	300	4.0
2N3538			400	800	125	300	4.0
2N3539			400	900	125	300	4.0
2N3540			400	1000	125	300	4.0
2N3541			400	1200	125	300	4.0
2N3555			1.6	30	150	0.020	0.7
2N3556			1.6	60	150	0.020	0.7
2N3557			1.6	100	150	0.020	0.7
2N3558			1.6	200	150	0.020	0.7
2N3559			1.6	30	150	0.20	0.8
2N3560			1.6	60	150	0.20	0.8
2N3561			1.6	100	150	0.20	0.8
2N3562			1.6	200	150	0.20	0.8
2N3649			16	50	120	180	3.0
2N3650			16	100	120	180	3.0
2N3651			16	200	120	180	3.0
2N3652			16	300	120	180	3.0
2N3653			16	400	120	180	3.0
2N3654			16	50	120	180	3.0
2N3655			16	100	120	180	3.0
2N3656			16	200	120	180	3.0
2N3657			16	300	120	180	3.0
2N3658			16	400	120	180	3.0
2N3668	MCR649P-3	MCR649-1	13	100	100	40	2.0
2N3669	MCR649P-4	MCR649-1	13	200	100	40	2.0
2N3670	MCR649P-6	MCR649-1	13	400	100	40	2.0
2N3753			7.5	50	120	100	3.0
2N3754			7.5	100	120	100	3.0
2N3755			7.5	200	120	100	3.0
2N3756			7.5	300	120	100	3.0
2N3757			7.5	400	120	100	3.0
2N3758			7.5	500	120	100	3.0
2N3759			7.5	600	120	100	3.0
2N3760			7.5	700	120	100	3.0
2N3761			7.5	800	120	100	3.0
2N3870	2N3870	2N3870	22	100	100	40	2.0
2N3871	2N3871	2N3870	22	200	100	40	2.0
2N3872	2N3872	2N3870	22	400	100	40	2.0
2N3873	2N3873	2N3870	22	600	100	40	2.0
2N3884			175	50	125	300	4.0
2N3885			175	100	125	300	4.0
2N3886			175	200	125	300	4.0
2N3887			175	300	125	300	4.0
2N3888			175	400	125	300	4.0
2N3889			175	500	125	300	4.0
2N3890			175	600	125	300	4.0
2N3891			175	700	125	300	4.0
2N3892			175	800	125	300	4.0
2N3893			175	900	125	300	4.0
2N3894			175	1000	125	300	4.0
2N3895			175	1200	125	300	4.0
2N3896	2N3896	2N3870	22	100	100	40	2.0
2N3897	2N3897	2N3870	22	200	100	40	2.0
2N3898	2N3898	2N3870	22	400	100	40	2.0
2N3899	2N3899	2N3870	22	600	100	40	2.0
2N3936			7.0	100	125	60	3.2
2N3937			7.0	200	125	60	3.2
2N3938			7.0	300	125	60	3.2
2N3939			7.0	400	125	60	3.2
2N3940			7.0	500	125	60	3.2
2N3986			70	500	125	150	3.0
2N3987			70	600	125	150	3.0
2N3988			70	700	125	150	3.0
2N3989			70	800	125	150	3.0
2N3990			70	900	125	150	3.0
2N3991			70	1000	125	150	3.0
2N3992			70	1100	125	150	3.0
2N4096	2N4213	2N4212	0.2	50	125	0.2	0.8
2N4097	2N4214	2N4212	0.2	100	125	0.2	0.8

TYPE	REPLACEMENT	REF.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} volts	T_J T_C(1) °C	I_{GT} mA	V_{GT} volts
2N4098	2N4216	2N4212	0.2	50	125	0.2	0.8
2N4101	2N4166	2N4151	3.2	600	100	15	2.0
2N4102	2N4166	2N4151	1.3	600	100	15	2.0
2N4103	MCR649P-8	MCR649-1	8.0	600	100	40	2.0
2N4108	2N4213	2N4212		50	125		
2N4109	2N4214	2N4212		100	125		
2N4110	2N4216	2N4212		200	125		
2N4144	MCR1906-1	MCR1906-1	0.250	15	150	1.0	0.8
2N4145	MCR1906-1	MCR1906-1	0.250	30	150	1.0	0.8
2N4146	MCR1906-2	MCR1906-1	0.250	60	150	1.0	0.8
2N4147	MCR1906-3	MCR1906-1	0.250	100	150	1.0	0.8
2N4148	MCR1906-4	MCR1906-1	0.250	150	150	1.0	0.8
2N4149	MCR1906-4	MCR1906-1	0.250	200	150	1.0	0.8
2N4151	2N4151	2N4151	8.0	25	100	20	1.5
2N4152	2N4152	2N4151	8.0	50	100	20	1.5
2N4153	2N4153	2N4151	8.0	100	100	20	1.5
2N4154	2N4154	2N4151	8.0	200	100	20	1.5
2N4155	2N4155	2N4151	8.0	300	100	20	1.5
2N4156	2N4156	2N4151	8.0	400	100	20	1.5
2N4157	2N4157	2N4151	8.0	500	100	20	1.5
2N4158	2N4158	2N4151	8.0	600	100	20	1.5
2N4159	2N4159	2N4151	8.0	25	100	20	1.5
2N4160	2N4160	2N4151	8.0	50	100	20	1.5
2N4161	2N4161	2N4151	8.0	100	100	20	1.5
2N4162	2N4162	2N4151	8.0	200	100	20	1.5
2N4163	2N4163	2N4151	8.0	300	100	20	1.5
2N4164	2N4164	2N4151	8.0	400	100	20	1.5
2N4165	2N4165	2N4151	8.0	500	100	20	1.5
2N4166	2N4166	2N4151	8.0	600	100	20	1.5
2N4167	2N4167	2N4151	8.0	25	100	20	1.5
2N4168	2N4168	2N4151	8.0	50	100	20	1.5
2N4169	2N4169	2N4151	8.0	100	100	20	1.5
2N4170	2N4170	2N4151	8.0	200	100	20	1.5
2N4171	2N4171	2N4151	8.0	300	100	20	1.5
2N4172	2N4172	2N4151	8.0	400	100	20	1.5
2N4173	2N4173	2N4151	8.0	500	100	20	1.5
2N4174	2N4174	2N4151	8.0	600	100	20	1.5
2N4175	2N4175	2N4151	8.0	25	100	20	1.5
2N4176	2N4176	2N4151	8.0	50	100	20	1.5
2N4177	2N4177	2N4151	8.0	100	100	20	1.5
2N4178	2N4178	2N4151	8.0	200	100	20	1.5
2N4179	2N4179	2N4151	8.0	300	100	20	1.5
2N4180	2N4180	2N4151	8.0	400	100	20	1.5
2N4181	2N4181	2N4151	8.0	500	100	20	1.5
2N4182	2N4182	2N4151	8.0	600	100	20	1.5
2N4183	2N4183	2N4151	8.0	25	100	20	1.5
2N4184	2N4184	2N4151	8.0	50	100	20	1.5
2N4185	2N4185	2N4151	8.0	100	100	20	1.5
2N4186	2N4186	2N4151	8.0	200	100	20	1.5
2N4187	2N4187	2N4151	8.0	300	100	20	1.5
2N4188	2N4188	2N4151	8.0	400	100	20	1.5
2N4189	2N4189	2N4151	8.0	500	100	20	1.5
2N4190	2N4190	2N4151	8.0	600	100	20	1.5
2N4191	2N4191	2N4151	8.0	25	100	20	1.5
2N4192	2N4192	2N4151	8.0	50	100	20	1.5
2N4193	2N4193	2N4151	8.0	100	100	20	1.5
2N4194	2N4194	2N4151	8.0	200	100	20	1.5
2N4195	2N4195	2N4151	8.0	300	100	20	1.5
2N4196	2N4196	2N4151	8.0	400	100	20	1.5
2N4197	2N4197	2N4151	8.0	500	100	20	1.5
2N4198	2N4198	2N4151	8.0	600	100	20	1.5
2N4199	2N4199	2N4199	100*	300	105	50	1.5
2N4200	2N4200	2N4199	100*	400	105	50	1.5
2N4201	2N4201	2N4199	100*	500	105	50	1.5
2N4202	2N4202	2N4199	100*	600	105	50	1.5
2N4203	2N4203	2N4199	100*	700	105	50	1.5
2N4204	2N4204	2N4199	100*	800	105	50	1.5
2N4212	2N4212	2N4212	1.6	25	125	0.1	1.5
2N4213	2N4213	2N4212	1.6	50	125	0.1	1.5

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THYRISTOR INDEX (continued)

TYPE	REPLACEMENT	REF.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} volts	T_J $T_C^{(1)}$ °C	I_{GT} mA	V_{GT} volts
2N4214	2N4214	2N4212	1.6	100	125	0.1	1.5
2N4215	2N4215	2N4212	1.6	150	125	0.1	1.5
2N4216	2N4216	2N4212	1.6	200	125	0.1	1.5
2N4217			1.0	250	125		
2N4218			1.0	300	125		
2N4219			1.0	400	125		
2N4316	MCR3918-3	MCR3918	9.2	100	150	15	1.2
2N4317	MCR3918-4	MCR3918	9.2	200	150	15	1.2
2N4318	MCR3918-5	MCR3918	9.2	300	150	15	1.2
2N4319	MCR3918-6	MCR3918	9.2	400	150	15	1.2
2N4361	2N4361	2N4361	70	100		250	5.0
2N4362	2N4362	2N4361	70	200		250	5.0
2N4363	2N4363	2N4361	70	400		250	5.0
2N4364	2N4364	2N4361	70	600		250	5.0
2N4365	2N4365	2N4361	70	800		250	5.0
2N4366	2N4366	2N4361	70	1000		250	5.0
2N4367	2N4367	2N4361	70	1200		250	5.0
2N4368	2N4368	2N4361	70	1400		250	5.0
2N4369			70	1600		250	5.0
2N4370			70	1800		250	5.0
2N4371	2N4371	2N4361	70	100		250	5.0
2N4372	2N4372	2N4361	70	200		250	5.0
2N4373	2N4373	2N4361	70	400		250	5.0
2N4374	2N4374	2N4361	70	600		250	5.0
2N4375	2N4375	2N4361	70	800		250	5.0
2N4376	2N4376	2N4361	70	1000		250	5.0
2N4377	2N4377	2N4361	70	1200		250	5.0
2N4378	2N4378	2N4361	70	1400		250	5.0
2N4379			70	1600		250	5.0
2N4380			70	1800		250	5.0
2N4441	2N4441	2N4441	8.0	50	100	30	1.5
2N4442	2N4442	2N4441	8.0	200	100	30	1.5
2N4443	2N4443	2N4441	8.0	400	100	30	1.5
2N4444		2N4441	8.0	600	100	30	1.5
2N4983			0.175	30	125	0.50	6.0
2N4984			0.200	30	150	0.15	7.5
2N4985			0.200	30	150	0.30	7.5
2N4986			0.175	30	125	0.20	7.0
2N4987			0.175	30	125	0.50	6.0
2N4988			0.200	30	150	0.15	7.5
2N4989			0.200	30	150	0.30	7.5
2N4990			0.175	30	125	0.20	7.0
2N4991	MBS4991	MBS4991	0.175		125	0.50	6.0
2N4992	MBS4992	MBS4991	0.200		150	0.12	7.5
2N4993	2N4993	2N4993	0.200		150	0.50	6.0
2N5060	2N5060	2N5060	0.8	30	125	0.2	0.8
2N5061	2N5061	2N5060	0.8	60	125	0.2	0.8
2N5062	2N5062	2N5060	0.8	100	125	0.2	0.8
2N5063	2N5053	2N5060	0.8	150	125	0.2	0.8
2N5064	2N5064	2N5060	0.510	200	125	350	1.2
2N5164	2N5164	2N5164	13	50	100	75	0.2
2N5165	2N5165	2N5164	13	200	100	75	0.2
2N5166	2N5166	2N5164	13	400	100	75	0.2
2N5167	2N5167	2N5164	13	600	100	75	0.2
2N5168	2N5168	2N5164	13	50	100	75	0.2
2N5169	2N5169	2N5164	13	200	100	75	0.2
2N5170	2N5170	2N5164	13	400	100	75	0.2
2N5171	2N5171	2N5164	13	600	100	75	0.2
2N5204			200	600		80	3.0
2N5205			200	600		80	3.0
2N5206			200	600		80	3.0
2N5207			200	600		80	3.0
2N5257			200	400	105	800	3.0
2N5258			200	600	105	800	3.0
2N5259			200	800	105	800	3.0
2N5260			200	1000	105	800	3.0
2N5261			200	1200	105	800	3.0
2N5273			25	200	125	150	3.5
2N5274			25	400	125	150	3.5
2N5275			25	600	125	150	3.5

THYRISTOR INDEX (continued)

TYPE	REPLACEMENT	REF.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} volts	T_J $T_C^{(1)}$ °C	I_{GT} mA	V_{GT} volts
2N5567	2N5567		10	200	100	100	4.0
2N5568	2N5568		10	400	100	100	4.0
2N5569	2N5569		10	200	100	100	4.0
2N5570	2N5570		10	400	100	100	4.0
2N5571	2N5571		15	200	100	150	4.0
2N5572	2N5572		15	400	100	150	4.0
2N5573	2N5573		15	200	100	150	4.0
2N5574	2N5574		15	400	100	150	4.0
2N5754			2.5	100	100	60	3.0
2N5755			2.5	200	100	60	3.0
2N5756			2.5	400	100	60	3.0
2N5757			2.5	600	100	60	3.0
2N5806			25	200	115(1)	±120	±4.0
2N5807			25	400	115(1)	±120	±4.0
2N5808			25	500	115(1)	±120	±4.0
2N5809			25	600	115(1)	±120	±4.0
2N6068	2N6068	2N6068	4.0	25	110	60	2.5
2N6069	2N6069	2N6068	4.0	50	110	60	2.5
2N6070	2N6070	2N6068	4.0	100	110	60	2.5
2N6071	2N6071	2N6068	4.0	200	110	60	2.5
2N6072	2N6072	2N6068	4.0	300	110	60	2.5
2N6073	2N6073	2N6068	4.0	400	110	60	2.5
2N6074	2N6074	2N6068	4.0	500	110	60	2.5
2N6075	2N6075	2N6068	4.0	600	110	60	2.5
2N6139	2N6139	2N6139	10	200	100	125	2.5
2N6140	2N6140	2N6139	10	400	100	125	2.5
2N6141	2N6141	2N6139	10	600	100	125	2.5
2N6142	2N6142	2N6139	10	200	100	125	2.5
2N6143	2N6143	2N6139	10	400	100	125	2.5
2N6144	2N6144	2N6139	10	600	100	125	2.5
2N6145	2N6145		15	200	150	150	4.0
2N6146	2N6146		15	400	150	150	4.0
2N6147	2N6147		15	600	150	150	4.0
2N6148	2N6148	2N6148	10	200	100	125	2.5
2N6149	2N6149	2N6148	10	400	100	125	2.5
2N6150	2N6150	2N6148	10	600	100	125	2.5
2N6151	2N6151	2N6151	10	200	100	100	2.5
2N6152	2N6152	2N6151	10	400	100	100	2.5
2N6153	2N6153	2N6151	10	600	100	100	2.5
2N6154	2N6154	2N6151	10	200	100	100	2.5
2N6155	2N6155	2N6151	10	400	100	100	2.5
2N6156	2N6156	2N6151	10	600	100	100	2.5
2N6157	2N6157	2N6157	30	200	125	200	3.4
2N6158	2N6158	2N6157	30	400	125	200	3.4
2N6159	2N6159	2N6157	30	600	125	200	3.4
2N6160	2N6160	2N6157	30	200	125	200	3.4
2N6161	2N6161	2N6157	30	400	125	200	3.4
2N6162	2N6162	2N6157	30	600	125	200	3.4
2N6163	2N6163	2N6157	30	200	125	200	3.4
2N6164	2N6164	2N6157	30	400	125	200	3.4
2N6165	2N6165	2N6157	30	600	125	200	3.4
2N6167	2N6167		240	100	100	75	2.5
2N6168	2N6168		240	200	100	75	2.5
2N6169	2N6169		240	400	100	75	2.5
2N6170	2N6170		240	600	100	75	2.5
2N6171	2N6171	2N3870	350	100	100	80	3.0
2N6172	2N6172	2N3870	350	200	100	80	3.0
2N6173	2N6173	2N3870	350	400	100	80	3.0
2N6174	2N6174	2N3870	350	600	100	80	3.0
2N6236	2N6236	2N6236		30	110	500*	1.0
2N6237	2N6237	2N6236		50	110	500*	1.0
2N6238	2N6238	2N6236		100	110	500*	1.0
2N6239	2N6239	2N6236		200	110	500*	1.0
2N6240	2N6240	2N6236		400	110	500*	1.0
2N6241	2N6241	2N6236		600	110	500*	1.0

TYPE	REPLACEMENT	REF.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} volts	T_J T_C(1) °C	I_{GT} mA	V_{GT} volts
3N58			0.064	40	150	0.001	0.65
3N59			0.064	40	150	0.001	0.65
3N60			0.064	40	150	0.001	0.65
3N80			0.127	40	150	0.001	0.65
3N81			0.127	65	150	0.001	0.65
3N82			0.127	100	150	0.001	0.65
3N83			0.032	70	125	0.15	0.80
3N84			0.111	40	125	0.01	0.65
3N85			0.111	100	125	0.01	0.65
3N86			0.127	65	150	0.001	0.65

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FIELD-EFFECT TRANSISTORS

INDEX AND SHORT-FORM SPECIFICATIONS

This table contains a numerical listing and short-form specifications for field-effect transistors with EIA-registered 2N and 3N numbers.

KEY

TYPE	POLARITY	CONST.	NEAREST EQUIV.	REF.	I_{DSS} Min mA	I_{DSS} Max mA (*nA)	I_{GSS} I_{DGO}* nA	Breakdown Voltage $V_{(BR)}$ Volts	Breakdown Voltage Sub-script	y_{fs} Min µmhos	y_{fs} Max µmhos	C_{iss} pF	NF dB µV*/$\sqrt{Hz}$	@ f	Units	NOTE D = Dual MP = Matched Pair

- **TYPE:** Numerical Listing of Registered Type Numbers
- **POLARITY:** N = n-channel; P = p-channel
- **CONST.:** J = Junction FET; M = MOS FET
- **NEAREST EQUIV.:** Type number of nearest electrical equivalent fully characterized in this book
- **REF.:** Reference device number indicates specific Data Sheet on which device is characterized
- **I_{DSS}:** Minimum and Maximum Drain Current with gate connected to source
- **I_{GSS} / I_{DGO}*:** Maximum Gate Current (leakage) with drain connected to source; *Maximum leakage from drain to gate with source open
- **Breakdown Voltage:** Minimum Breakdown Voltage (Subscript defines conditions)
  - GS = Gate to source, drain connection not specified
  - GSS = Gate to source, drain connected to source
  - GD = Gate to drain, source connection not specified
  - GDS = Gate to drain, source connected to drain
  - DGO = Drain to gate, source open
  - DGS = Drain to gate, source connected to drain
  - DS = Drain to source, gate connection not specified
  - DSX = Drain to source, gate biased to cutoff or beyond
- **y_{fs}:** Minimum and Maximum Forward Transadmittance
- **C_{iss}:** Maximum Input Capacitance
- **NF @ f:** Noise Figure in dB or *, µV / $\sqrt{Hz}$ at a specified frequency
  - frequency units:
    - H = Hz
    - K = kHz
    - M = MHz

TYPE	POLARITY	CONST.	NEAREST EQUIVALENT	REF.	I_{DSS} Min mA	I_{DSS} Max mA	I_{GSS} I_{DGO}* nA	Breakdown Voltage $V_{(BR)}$ Volts	Breakdown Voltage Sub-script	y_{fs} Min µmhos	y_{fs} Max µmhos	C_{iss} pF	NF dB µV*/√Hz	@ f	Units	NOTE
					*nA					*mmhos						
2N2386	P	J	2N5266-9	2N5265			10	20	GS	1000		50				
2N2386A	P	J	2N5267-70	2N5265	1.0	15	10	20	DGO	2200	5000	10				
2N2497	P	J	2N5267	2N5265	1.0	5.0	10	20	GD	1000	2000	32	3.0	1.0	K	
2N2498	P	J	2N5268	2N5265	2.0	6.0	10	20	GD	1500	3000	32	3.0	1.0	K	
2N2499	P	J	2N5269-70	2N5265	5.0	15	10	20	GD	2000	4000	32	4.0	1.0	K	
2N2500	P	J	2N5267-8	2N5265	1.0	6.0	10	20	GS	1000	2000	32	1.0	1.0	K	
2N2606	P	J	2N5473-4	2N5471	0.1	0.5	1.0	30	GDS	110		6.0	3.0	1.0	K	
2N2607	P	J	2N5475-6	2N5471	0.3	1.5	3.0	30	GDS	330		10	3.0	1.0	K	
2N2608	P	J	2N5266-8	2N5265	0.9	4.5	10	30	GDS	1000		17	3.0	1.0	K	
2N2609	P	J	2N5268-70	2N5265	2.0	10	30	30	GDS	2500		30	3.0	1.0	K	
2N2620	N	J					100	50	DGO							
2N2794	P	J			1.5	5.0	10	20	DGO							
2N2841	P	J	2N5471-2	2N5471	0.025	0.125	1.0			60		6.0	3.0	1.0	K	
2N2842	P	J	2N5472-3	2N5471	0.065	0.325	3.0			180		10	3.0	1.0	K	
2N2843	P	J	2N5265	2N5265	0.2	1.0	10			540		17	3.0	1.0	K	
2N2844	P	J	2N5265-7	2N5265	1.0	2.2	30			1400		30	3.0	1.0	K	
2N3066	N	J	MFE2095	MFE2093	0.8	4.0	1.0	50	DGO	400	1000	10	3,0	1.0	K	
2N3066A	N	J			0.8	4.0	1.0	50	DGO	400	1000	10	0.25	1.0	K	
2N3067	N	J	MFE2093-4	MFE2093	0.2	1.0	1.0	50	DGO	400		18	3.0	1.0	K	
2N3067A	N	J			0.2	1.0	1.0	50	DGO	300	1000	10	0.25	1.0	K	
2N3068	N	J	MFE2093	MFE2093	0.05	0.25	1.0	50	DGO	200		18	3.0	1.0	K	
2N3068A	N	J	MFE2093	MFE2093	0.05	0.25	1.0	50	DGO	200	1000	10	0.25	1.0	K	
2N3069	N	J	2N4220A-2A	2N4220	2.0	10	1.0	50	DGO	1000		15	3.0	1.0	K	
2N3069A	N	J			2.0	10	1.0	50	DGO	1000	2500	15	0.25	1.0	K	
2N3070	N	J	2N4220A	2N4220	0.5	2.5	1.0	50	DGO	750		15	3.0	1.0	K	
2N3070A	N	J			0.5	2.5	1.0	50	DGO	750	2500	15	0.25	1.0	K	
2N3071	N	J	2N4220A	2N4220	0.1	0.6	1.0	50	DGO	500	2500	15	3.0	1.0	K	
2N3084	N	J	MFE2095	MFE2093	0.8	3.0	0.1	15	DGO	400	2000	14				
2N3085	N	J	MFE2095	MFE2093	0.8	3.0	0.1	15	DGO	400	2000	14				
2N3086	N	J	MFE2095	MFE2093	0.8	3.0	1.0	30	DGS	400	2000	14				
2N3087	N	J	MFE2095	MFE2093	0.8	3.0	1.0	30	DGS	400	2000	14				
2N3088	N	J	MFE2094-5	MFE2093	0.5	2.0	1.0	10	DGS	300	2000	14	3.0			
2N3088A	N	J	MFE2094-5	MFE2093	0.5	2.0	1.0	10	DGS	300	2000	14	0.5	10	H	
2N3089	N	J	MFE2094-5	MFE2093	0.5	2.0	1.0	10	DGS	300	2000	14	3.0			
2N3089A	N	J	MFE2094-5	MFE2093	0.5	2.0	1.0	10	DGS	300	2000	14	0.5	10	H	
2N3112	P	J	2N5471-3	2N5471	0.035	0.175	0.05	20	GDS	50	115	3.5				
2N3113	P	J	2N5471-3	2N5471	0.035	0.175	0.05	20	GDS	50	115	2.0				
2N3277	P	J	2N5473-4	2N5471	0.15	0.5	0.4	25	DGO	100		3.0				
2N3278	P	J	2N5475	2N5471	0.4	0.9	0.4	25	DGO	150		3.0				
2N3328	P	J	2N5473-5	2N5471	1.0		1.0	20	GSS	100		3.0	3.0			
2N3329	P	J	2N5266-7	2N5265	1.0	3.0	10	20	GSS	1000	2000	20	3.0			
2N3330	P	J	2N5267-8	2N5265	2.0	6.0	10	20	GSS	1500	3000	20	3.0			
2N3331	P	J	2N5269-70	2N5265	5.0	15	10	20	GSS	2000	4000	20	4.0			
2N3332	P	J	2N5267-8	2N5265	1.0	6.0	10	20	GSS	1000	2200	20	1.0			
2N3333	P	J			0.3	1.0	10	20	GSS	600	1800	30				Dual
2N3334	P	J			0.3	1.0	10	20	GSS	600	1800	30				Dual
2N3335	P	J			0.3	1.0	10	20	GSS	600	1800	30				Dual
2N3336	P	J			0.3	1.0	10	20	GSS	600	1800	30				Dual
2N3365	N	J	2N4220A 1A	2N4220	0.8	4.0	5.0	40	DGO	250	1000	15				
2N3366	N	J	MFE2093-4	MFE2093	0.2	1.0	5.0	40	DGO	250	1000	15				
2N3367	N	J	MFE2093	MFE2093	0.005	0.25	5.0	40	DGO	100	1000	15				
2N3368	N	J	2N4221A-2A	2N4220	2.0	12	5.0	40	DGO	1000	4000	20				
2N3369	N	J	2N4220A	2N4220	0.5	2.5	5.0	40	DGO	600	2500	20				
2N3370	N	J	MFE2093	MFE2093	0.1	0.6	5.0	40	DGO	300	2500	20				
2N3376	P	J	2N5265-8	2N5265	0.6	6.0	3.0	30	DGS	800		5.0				
2N3377	P	J	2N5265-8	2N5265	0.6	6.0	3.0	30	DGS	800	2300	4.0				
2N3378	P	J	2N5268	2N5265	3.0	6.0	3.0	30	DGS	1500	2300	5.0				
2N3379	P	J	2N5268	2N5265	3.0	6.0	3.0	30	DGS	1500	2300	4.0				
2N3380	P	J	2N5268-70	2N5265	3.0	20	3.0	30	DGS	1500	3000	4.0				
2N3381	P	J	2N5268-70	2N5265	3.0	20	3.0	30	DGS	1500	3000	4.0				
2N3382	P	J	2N3994	2N3993	3.0	30	15	30	DGS	4500	12500					
2N3383	P	J	2N3994	2N3993	3.0	30	15	30	DGS	4500	12500					
2N3384	P	J	2N3993	2N3993	15	30	15	30	DGS	7500	12500					
2N3385	P	J	2N3993	2N3993	15	30	15	30	DGS	7500	12500					
2N3386	P	J	2N3993	2N3993	13	50	15	30	DGS	7500	12500					
2N3387	P	J	2N3993	2N3993	13	50	15	30	DGS	5000	10000					
2N3436	N	J	2N4222A	2N4220	3.0	15	0.5	50	DGO	2500	10000	18	2.0			
2N3437	N	J	2N4220A	2N4220	0.8	4.0	0.5	50	DGO	1500	6000	18	2.0			
2N3438	N	J	2N4222A	2N4220	0.2	1.0	0.5	50	DGO	800	4500	18	2.0			
2N3452	N	J	MFE2095	MFE2093	0.8	4.0	0.1	50	DGO	200	1200	6.0	2.0			
2N3453	N	J	MFE2094	MFE2093	0.2	1.0	0.1	50	DGO	150	900	6.0	2.0			
2N3454	N	J	MFE2093	MFE2093	0.05	0.25	0.1	50	DGO	100	600	6.0	2.0			
2N3455	N	J	MFE2095	MFE2093	0.8	4.0	0.04	50	DGO	400	1200	5.0	4.0			
2N3456	N	J	MFE2094	MFE2093	0.2	1.0	0.04	50	DGO	300	900	5.0	4.0			
2N3457	N	J	MFE2093	MFE2093	0.05	0.25	0.04	50	DGO	150	600	5.0	4.0			
2N3458	N	J	2N4222A	2N4220	3.0	15	0.25	50	DGO	2500	10000	18	6.0			
2N3459	N	J	2N4220A	2N4220	0.8	4.0	0.25	50	DGO	1500	6000	18	4.0			
2N3460	N	J	2N4220A	2N4220	0.2	1.0	0.25	50	DGO	800	4500	18	4.0			
2N3465	N	J	MFE2095	MFE2093	1.0	5.0	1.0	40	DGO	400	1200	15	5.0			
2N3466	N	J	MFE2095	MFE2093	1.0	5.0	1.0	40	DGO	400	1200	15	5.0			
2N3573	P	J	2N5471-2	2N5471	0.02	0.1	0.6	25	GSS	100	300	6.0	3.0			
2N3574	P	J	2N5472-4	2N5471	0.075	0.375	0.6	25	GSS	200	600	6.0	3.0			
2N3575	P	J	2N5474-5	2N5471	0.2	1.0	0.6	25	GSS	300	900	6.0	3.0			
2N3578	P	J	2N5266-8	2N5265	0.9	4.5	15	20	GSS	1200	3500	65				
2N3608	P	M	2N4352	2N4352	30	0.025										
2N3609	P	M	MFE3020-1	MFE3020	35	0.02										
2N3610	P	M	2N4352	2N4352	10	0.02										
2N3631	N	M	2N3797	2N3796	2.0	10		20	DSX	1400	2800	7.5				
2N3684	N	J	2N4221A	2N4221	2.5	7.5	0.1	50	GS	2000	3000	4.0	0.5			

FIELD-EFFECT TRANSISTORS INDEX (continued)

TYPE	POLARITY	CONST.	NEAREST EQUIVALENT	REF.	I_{DSS} Min mA	I_{DSS} Max mA	I_{GSS}, I_{DGO}* nA	Breakdown Voltage $V_{(BR)}$ Volts	Breakdown Voltage Sub-script	y_{fs} Min µmhos	y_{fs} Max µmhos	C_{iss} pF	NF dB µV*/√Hz	@ f	Units	NOTE
					*nA					*mmhos						
2N3684A	N	J	2N4221A		2.5	7.5	0.1	50	GSS			4.0	0.5	100	H	
2N3685	N	J	2N4220A	2N4221	1.0	3.0	0.1	50	GS	1500	2500	4.0	0.5			
2N3685A	N	J	2N4220A		1.0	3.0	0.1	50	GSS			4.0	0.5	100	H	
2N3686	N	J	2N4220A	2N4221	0.4	1.2	0.1	50	GS	1000	2000	4.0	0.5			
2N3686A	N	J	2N4220A		0.4	1.2	0.1	50	GSS			4.0	0.5	100	H	
2N3687	N	J	2N5358	2N5358	0.1	0.5	0.1	50	GS	500	1500	4.0	0.15*			
2N3687A	N	J	2N4220A		0.1	0.5	0.1	50	GSS			4.0	0.5	100	H	
2N3695	P	J	2N5267	2N5265	1.25	3.75	0.1	30	GS	1000	1750	5.0	0.2*			
2N3696	P	J	2N5266	2N5265	0.5	1.5	0.1	30	GS	750	1250	5.0	0.2*			
2N3697	P	J	2N5265	2N5265	0.2	0.6	0.1	30	GS	500	1000	5.0	0.2*			
2N3698	P	J	2N5265	2N5265	0.05	0.25	0.1	30	GS	250	750	5.0	0.2*			
2N3796	N	M	2N3796	2N3796	0.5	3.0	0.001	25	DSX	900	1800	6.0	4.0			
2N3797	N	M	2N3797	2N3796	2.0	6.0	0.001	20	DSX	1500	3000	8.0	4.0			
2N3819	N	J	MPF102	MPF102	2.0	20	2.0	25	GSS	2000	6500	8.0				
2N3820	P	J	2N5460-2	2N5460	0.3	15	20	20	GSS	800	5000	32				
2N3821	N	J	2N3821	2N3821	0.5	2.5	0.1	50	GSS	1500	4500	6.0	5.0	10	H	
2N3822	N	J	2N3822	2N3821	2.0	10	0.1	50	GSS	3000	6500	6.0	5.0	10	H	
2N3823	N	J	2N3823	2N3823	4.0	20	0.5	30	DGS	3500	6500	6.0	2.5	100	M	
2N3824	N	J	2N3824	2N3821			0.1	50	GSS			6.0				
2N3882	P	M	MFE3003	MFE3003	0.25		0.1	30	DS	1000	2400	4.0	3.0			
2N3909	P	J	2N5460-2	2N5460	0.3	15	10	20	DGS	1000	5000	32				
2N3909A	P	J	2N5460-2		1.0	15	10	20	GSS	2000		9.0				
2N3921	N	J	MMF1,2	MMF1	1.0	10	0.25	50	GSS	1500	7500	18	2.0	1.0	K	Dual
2N3922	N	J	MMF3,4	MMF1	1.0	10	0.25	50	GSS	1500	7500	18	2.0	1.0	K	Dual
2N3934	N	J	MMF1,2	MMF1	0.25	1.3	0.1	50	GSS	300	900	7.0	2.0	100	H	Dual
2N3935	N	J	MMF5,6	MMF1	0.25	1.3	0.1	50	GSS	300	900	7.0	2.0	100	H	Dual
2N3954	N	J	MMF1,2	MMF1	0.5	5.0	0.1	50	GSS	1000		4.0	0.5	100	H	Dual
2N3954A	N	J	MMF1,2	MMF1	0.5	5.0	0.1	50	GSS	1000		4.0	0.5	100	H	
2N3955	N	J	MMF1,2	MMF1	0.5	5.0	0.1	50	GSS	1000		4.0	0.5	100	H	Dual
2N3955A	N	J	MMF1,2	MMF1	0.5	5.0	0.1	50	GSS	1000		4.0	0.5	100	H	
2N3956	N	J	MMF5,6	MMF1	0.5	5.0	0.1	50	GSS	1000		4.0	0.5	100	H	Dual
2N3957	N	J	MMF5,6	MMF1	0.5	5.0	0.1	50	GSS	1000		4.0	0.5	100	H	Dual
2N3958	N	J	MMF5,6	MMF1	0.5	5.0	0.1	50	GSS	1000		4.0	0.5	100	H	Dual
2N3966	N	J	2N4221	2N4220	2.0		0.1	30	DGS			6.0				
2N3967	N	J	2N4221A-2A	2N4220	2.5	10	0.1	30	DGS	1600	2400	5.0				
2N3967A	N	J	2N4221A-2A	2N4220	2.5	10	0.1	30	GSS	1600	2400	5.0	1.5	100	H	
2N3968	N	J	2N4221A	2N4220	1.0	5.0	0.1	30	DGS	1400	2000	5.0				
2N3968A	N	J	2N4221A	2N4220	1.0	5.0	0.1	30	GSS	1400	2000	5.0	1.5	100	H	
2N3969	N	J	2N4220A	2N4220	0.4	2.0	0.1	30	DGS	950	1450	5.0				
2N3969A	N	J	2N4220A	2N4220	0.4	2.0	0.1	30	GSS	950	1450	5.0	1.5	100	H	
2N3970	N	J	2N4091	2N4091	50	150	0.25*	40	DGS			25				
2N3971	N	J	2N4091-2	2N4091	25	75	0.25*	40	DGS			25				
2N3972	N	J	2N4093	2N4091	5.0	30	0.25*	40	DGS			25				
2N3993	P	J	2N3993	2N3993	10		1.2*	25	GSS	6000	12000	16				
2N3994	P	J	2N3994	2N3993	2.0		1.2*	25	GSS	4000	10000	16				
2N4038	N	M	2N3796	2N3796		0.1		15	DSX							
2N4039	N	M	2N3796	2N3796	0.1	1.5		15	DSX							
2N4065	P	M	2N4352	2N4352		0.005	0.0025	25	GSS			4.5				
2N4066	P	M	2N4066	2N4066			0.0025	25	GSS			7.0				
2N4067	P	M	2N4067	2N4066		1.0*		30	DSS	2500		7.0				
2N4082	N	J	MMF1,2	MMF1	0.25	1.3	0.1	50		300		7.0				Dual
2N4083	N	J	MMF3,4	MMF1	0.25	1.3	0.1	50		300		7.0				Dual
2N4084	N	J	MMF1,2	MMF1	1.0	10	0.25	50		1500		18				Dual
2N4085	N	J	MMF3,4	MMF1	1.0	10	0.25	50		1500		18				Dual
2N4088	P	J	MPF161	MPF161	5.0	15	0.1	30	GSS	1000	1600	10	1.5	1.0	K	
2N4089	P	J	MPF161	MPF161	2.0	8.0	0.1	30	GSS	800	1300	10	1.5	1.0	K	
2N4090	P	J	MPF161	MPF161	0.4	2.5	0.1	30	GSS	500	900	10	1.5	1.0	K	
2N4091	N	J	2N4091	2N4091	30		0.2*	40	DGO			16				
2N4091A	N	J	2N4091	2N4091	30		0.04	50	GSS			16				
2N4092	N	J	2N4092	2N4091	15		0.2*	40	DGO			16				
2N4092A	N	J	2N4092	2N4091	15		0.04	50	GSS			16				
2N4093	N	J	2N4093	2N4091	8.0		0.2*	40	DGO			16				
2N4093A	N	J	2N4093	2N4091	8.0		0.04	50	GSS			16				
2N4094	N	J	2N4091	2N4091	75			40	GSS			32				
2N4095	N	J	2N4092	2N4091	20			40	GSS			32				
2N4117	N	J	MFE2093	MFE2093	0.03	0.09	0.01	40	GSS	70	210	3.0				
2N4117A	N	J	MFE2093	MFE2093	0.03	0.09	0.001	40	DGO			3.0				
2N4118	N	J	MFE2093	MFE2093	0.08	0.24	0.01	40	GSS	80	250	3.0				
2N4118A	N	J	MFE2093	MFE2093	0.08	0.24	0.001	40	DGO			3.0				
2N4119	N	J	MFE2093	MFE2093	0.2	0.6	0.01	40	GSS	100	330	3.0				
2N4119A	N	J	MFE2093	MFE2093	0.2	0.6	0.001	40	DGO			3.0				
2N4120	P	M	2N4352	2N4352		500*	0.0025	30	DSS	700		0.7				
2N4139	N	J	2N4222A	2N4221	8.0	11	1.0	50	DGO			18				
2N4220	N	J	2N4220	2N4220	0.5	3.0	0.1	30	GSS	1000	4000	6.0				
2N4220A	N	J	2N4220A	2N4220	0.5	3.0	0.1	30	GSS	1000	4000	6.0	2.5	1.0	H	
2N4221	N	J	2N4221	2N4220	2.0	6.0	0.1	30	GSS	2000	5000	6.0				
2N4221A	N	J	2N4221A	2N4220	2.0	6.0	0.1	30	GSS	2000	5000	6.0	2.5	1.0	H	
2N4222	N	J	2N4222	2N4220	5.0	15	0.1	30	GSS	2500	6000	6.0				
2N4222A	N	J	2N4222A	2N4220	5.0	15	0.1	30	GSS	2500	6000	6.0	2.5	1.0	H	
2N4223	N	J	2N4223	2N4220	3.0	18	0.25	30	GSS	3000	7000	6.0	5.0	200	M	
2N4224	N	J	2N4224	2N4223	2.0	20	0.5	30	GSS	2000	7500	6.0				
2N4267	P	M	2N4352	2N4223		0.001	0.005	30	GSS			15				
2N4268	P	M	2N4352	2N4352		0.001	0.005	30	GSS			15				
2N4302	N	J	2N5457	2N4352		5.0	1.0	30	DGO			6.0				
2N4303	N	J	2N5458	2N5457		10	1.0	30	DGO			6.0				
2N4304	N	J	2N5457-9	2N5457		15	1.0	30	DGO			6.0				
2N4338	N	J	2N4220A	2N4220	0.2	0.6	0.1	50	DGO			6.0				
2N4339	N	J	2N4220A	2N4220	0.5	1.5	0.1	50	DGO			6.0				
2N4340	N	J	2N4220A-1A	2N4220	1.2	3.6	0.1	50	DGO			6.0				
2N4341	N	J	2N4221A-2A	2N4220	3.0	9.0	0.1	50	DGO			6.0				
2N4342	P	J	2N4342	2N4340	4.0	12	10	25	DGO			5.0				

TYPE	POLARITY	CONST.	NEAREST EQUIVALENT	REF.	I_{DSS} Min mA	I_{DSS} Max mA	I_{GSS} I_{DGO}* nA	Breakdown Voltage $V_{(BR)}$ Volts	Breakdown Voltage Sub-script	y_{fs} Min µmhos	y_{fs} Max µmhos	C_{iss} pF	NF dB µV*/√Hz	@ f	Units	NOTE
					*nA					*mmhos						
2N4343	P	J			10	30	10	25	DGO			5.0				
2N4351	N	M		2N4351		0.01	0.01	25	DSS	1000		5.5				
2N4352	P	M	2N4352	2N4352		0.005	0.01	25	DSS	1000		6.5				
2N4353	P	M	2N4352	2N4352				3.0	GSS	1000	4000	12				
2N4360	P	J	2N4360	2N4360	3.0	30	10	20	GSS	2000	8000	20	5.0	100	H	
2N4382	P	J	2N3994	2N3993	10	30	1.0	25	GSS			5.0				
2N4391	N	J	2N4391	2N4391	50	100	0.1	40	GSS							
2N4392	N	J	2N4392	2N4391	25	75	0.1	40	GSS							
2N4393	N	J	2N4393	2N4391	5.0	30	0.1	40	GSS							
2N4416	N	J	2N4416	2N4416	5.0	15		30	GSS			4.0				
2N4416A	N	J	2N4416	2N4416	5.0	15	0.1	35	GSS	4500	7500	4.0	4.0	400	M	
2N4417	N	J	2N4416	2N4416	5.0	15		30	GSS			3.5				
2N4445	N	J	MFE2012	MFE2010			3.0	25	GSS			50				
2N4446	N	J	MFE2012	MFE2010			3.0	25	GSS			50				
2N4447	N	J	MFE2012	MFE2010			3.0	20	GSS			50				
2N4448	N	J	MFE2012	MFE2010			3.0	20	GSS			50				
2N4856	N	J	2N4091	2N4091	50		0.25	40	GSS			18				
2N4856A	N	J	2N4091	2N4091	50		0.25	40	GSS			10				
2N4857	N	J	2N4092	2N4091	20	100	0.25	40	GSS			18				
2N4857A	N	J	2N4092	2N4091	20	100	0.25	40	GSS			10				
2N4858	N	J	2N4093	2N4091	8.0	80	0.25	40	GSS			18				
2N4858A	N	J	2N4093	2N4091	8.0	80	0.25	40	GSS			10				
2N4859	N	J	2N4091	2N4091	50		0.25	30	GSS			18				
2N4859A	N	J	2N4091	2N4091	50		0.25	30	GSS			10				
2N4860	N	J	2N4092	2N4091	20	100	0.25	30	GSS			18				
2N4860A	N	J	2N4092	2N4091	20	100	0.25	30	GSS			10				
2N4861	N	J	2N4093	2N4091	8.0	80	0.25	30	GSS			15				
2N4861A	N	J	2N4093	2N4091	8.0	80	0.25	30	GSS			10				
2N4867	N	J	2N4220A	2N4220	0.4	1.2	0.25	40	GSS	700	2000	25	1.0	1.0	K	
2N4867A	N	J	2N4220A	2N4220	0.4	1.2	0.25	40	GSS	700	2000	25	1.0	1.0	K	
2N4868	N	J	2N4220A	2N4220	1.0	3.0	0.25	40	GSS	1000	3000	25	1.0	1.0	K	
2N4868A	N	J	2N4220A	2N4220	1.0	3.0	0.25	40	GSS	1000	3000	25	1.0	1.0	K	
2N4869	N	J	2N4221A2A	2N4220	2.5	7.5	0.25	40	GSS	1300	4000	25	1.0	1.0	K	
2N4869A	N	J	2N4221A2A	2N4220	2.5	7.5	0.25	40	GSS	1300	4000	25	1.0	1.0	K	
2N4881	N	J			0.4	2.0	2.0	100	GSS			15				
2N4882	N	J			1.5	7.5	2.0	100	GSS			15				
2N4883	N	J			0.4	2.0	1.0	100	GSS			15				
2N4884	N	J			1.5	7.5	1.0	100	GSS			15				
2N4885	N	J			0.4	2.0	1.0	75	GSS			15				
2N4886	N	J			1.5	7.5	1.0	75	GSS			15				
2N4977	N	J	MFE2009	MFE2007	50		0.5	30	GSS			35				
2N4978	N	J	MFE2008	MFE2007	15		0.5	30	GSS			35				
2N4979	N	J	MFE2007	MFE2007	7.5		0.5	30	GSS			35				
2N5018	P	J	2N3993	2N3993	10		2.0	30	GSS			45				
2N5019	P	J	2N3993	2N3993	5.0		2.0	30	GSS			45				
2N5020	P	J	2N5265-6	2N5265	0.3	1.2	1.0	25	GSS			25				
2N5021	P	J	2N5266-7	2N5265	1.0	3.5	1.0	25	GSS			25				
2N5033	P	J	2N5265-7	2N5265	0.3	3.5	10	20	GSS	1000	5000	25	2.0	1.0	K	
2N5045	N	J	MMF5,6	MMF1	0.5	8.0	0.25					8.0				
2N5046	N	J	MMF5,6	MMF1	0.5	8.0	0.25					8.0				
2N5047	N	J	MMF5,6	MMF1	0.5	8.0	0.25					8.0				
2N5078	N	J	2N4416	2N4416	4.0	25	0.25	30	GSS	4500	10000	6.0	3.0	200	M	
2N5103	N	J	2N3823	2N3823	1.0	8.0	0.1	25	GSS	2000	8000	5.0	1.5	100	H	
2N5104	N	J	2N3823	2N3823	2.0	6.0	0.1	25	GSS	3500	7500	5.0	1.5	100	H	
2N5105	N	J	2N3823	2N3823	5.0	15	0.1	25	GSS	5000	10000	5.0	1.5	100	H	
2N5114	P	J			30	90	0.5	30	GSS			25				
2N5115	P	J			15	60	0.5	30	GSS			25				
2N5116	P	J	2N3993	2N3993	5.0	25	0.5	30	GSS			25				
2N5158	N	J	MFE2012	MFE2010			1.0	40	GSS			50				
2N5159	N	J	MFE2012	MFE2010			1.0	40	GSS			50				
2N5163	N	J	MPF102	MPF102	1.0	40	10	25	GSS	2000	9000	12				
2N5196	N	J	MMF1,2	MMF1	0.7	7.0	0.025	50	GSS	1000	4000	6.0	1.0	100	H	
2N5197	N	J	MMF1,2	MMF1	0.7	7.0	0.025	50	GSS	1000	4000	6.0	1.0	100	H	
2N5198	N	J	MMF3,4	MMF1	0.7	7.0	0.025	50	GSS	1000	4000	6.0	1.0	100	H	
2N5199	N	J	MMF5,6	MMF1	0.7	7.0	0.025	50	GSS	1000	4000	6.0	1.0	100	H	
2N5245	N	J	2N5486	2N5484	5.0	15	1.0	30	GSS	4500	7500	4.5	2.0	100	M	
2N5246	N	J	2N5485	2N5484	1.5	7.0	1.0	30	GSS	3000	6000	4.5				
2N5247	N	J	2N5486	2N5484	8.0	24	1.0	30	GSS	4500	8000	4.5				
2N5248	N	J	MPF102	MPF102	4.0	20	5.0	30	GSS	3500	6500	6.0				
2N5265	P	J	2N5265	2N5265	0.5	1.0	2.0	60	GSS	900	2700	7.0	2.5	100	H	
2N5266	P	J	2N5266	2N5265	0.8	1.6	2.0	60	GSS	1000	3000	7.0	2.5	100	H	
2N5267	P	J	2N5267	2N5265	1.5	3.0	2.0	60	GSS	1500	3500	7.0	2.5	100	H	
2N5268	P	J	2N5268	2N5265	2.5	5.0	2.0	60	GSS	2000	4000	7.0	2.5	100	H	
2N5269	P	J	2N5269	2N5265	4.0	8.0	2.0	60	GSS	2200	4500	7.0	2.5	100	H	
2N5270	P	J	2N5270	2N5265	7.0	14.0	2.0	60	GSS	2500	5000	7.0	2.5	100	H	
2N5277	N	J	2N3822	2N3821	2.5	12.5	5.0	150	GSS	2000	5000	25	3.0	1.0	K	
2N5278	N	J	2N5364	2N5358	10	25	5.0	150	GSS	3000	6000	25	3.0	1.0	K	
2N5358	N	J	2N5358	2N5358	0.5	1.0	0.1	40	GSS	1000	3000	6.0	2.5	100	H	
2N5359	N	J	2N5359	2N5358	0.8	1.6	0.1	40	GSS	1200	3600	6.0	2.5	100	H	
2N5360	N	J	2N5360	2N5358	1.5	3.0	0.1	40	GSS	1400	4200	6.0	2.5	100	H	
2N5361	N	J	2N5361	2N5358	2.5	5.0	0.1	40	GSS	1500	4500	6.0	2.5	100	H	
2N5362	N	J	2N5362	2N5358	4.0	8.0	0.1	40	GSS	2000	5500	6.0	2.5	100	H	
2N5363	N	J	2N5363	2N5358	7.0	14	0.1	40	GSS	2500	6000	6.0	2.5	100	H	
2N5364	N	J	2N5364	2N5358	9.0	18	0.1	40	GSS	2700	6500	6.0	2.5	100	H	
2N5391	N	J	2N5358	2N5358	0.5	1.5	0.2	70	GSS	1500	4500	18	1.0	100	H	
2N5392	N	J	2N5360	2N5358	1.0	3.0	0.2	70	GSS	2000	6000	18	1.0	100	H	
2N5393	N	J	2N5360	2N5358	2.5	4.5	0.2	70	GSS	3000	6500	18	1.0	100	H	
2N5394	N	J	2N5361	2N5358	4.0	6.0	0.2	70	GSS	4000	7000	18	1.0	100	H	
2N5395	N	J	2N5362	2N5358	5.5	8.0	0.2	70	GSS	4500	7000	18	1.0	100	H	
2N5396	N	J	2N5362	2N5358	7.5	10	0.2	70	GSS	4500	7500	18	1.0	100	H	
2N5397	N	J	MFE2001	MFE2000	10	30	0.1	25	GSS	6000	10000	5.0	3.5	450	M	
2N5398	N	J	MFE2001	MFE2000	5.0	40	0.1	25	GSS	5500	10000	5.5				
2N5432	N	J	MFE2012	MFE2012	150		0.2	25	GSS			30				
2N5433	N	J	MFE2012	MFE2012	100		0.2	25	GSS			30				
2N5434	N	J	MFE2012	MFE2012	30		0.2	25	GSS			30				

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TYPE	POLARITY	CONST.	NEAREST EQUIVALENT	REF.	I_{DSS} Min mA	I_{DSS} Max mA	I_{GSS} I_{DGO}* nA	Breakdown Voltage $V_{(BR)}$ Volts	Breakdown Voltage Sub-script	Y_{fs} Min µmhos	Y_{fs} Max µmhos	C_{iss} pF	NF dB µV*/√Hz	@ f	Units	NOTE
					* nA					*mmhos						
2N5452	N	J	MMF1,2	MMF1	0.5	5.0	0.1	50	GSS	1000	3000	4.0	0.02*	1.0K		
2N5453	N	J	MMF1,2	MMF1	0.5	5.0	0.1	50	GSS	1000	3000	4.0	0.02*	1.0K		
2N5454	N	J	MMF3,4	MMF1	0.5	5.0	0.1	50	GSS	1000	3000	4.0	0.02*	1.0K		
2N5457	N	J	2N5457	2N5457	1.0	5.0	1.0	25	GSS	1000	5000	7.0				
2N5458	N	J	2N5458	2N5457	2.0	9.0	1.0	25	GSS	1500	5500	7.0				
2N5459	N	J	2N5459	2N5457	4.0	16	1.0	25	GSS	2000	6000	7.0				
2N5460	P	J	2N5460	2N5460	1.0	5.0	5.0	40	GSS	1000	4000	7.0	2.5	100	H	
2N5461	P	J	2N5461	2N5460	2.0	9.0	5.0	40	GSS	1500	5000	7.0	2.5	100	H	
2N5462	P	J	2N5462	2N5460	4.0	16	5.0	40	GSS	2000	6000	7.0	2.5	100	H	
2N5463	P	J	2N5463	2N5460	1.0	5.0	5.0	60	GSS	1000	4000	7.0	2.5	100	H	
2N5464	P	J	2N5464	2N5460	2.0	9.0	5.0	60	GSS	1500	5000	7.0	2.5	100	H	
2N5465	P	J	2N5465	2N5460	4.0	16	5.0	60	GSS	2000	6000	7.0	2.5	100	H	
2N5471	P	J	2N5471	2N5471	0.02	0.06	0.5	40	GSS	60	180	5.0	2.5	1.0	K	
2N5472	P	J	2N5472	2N5471	0.05	0.12	0.5	40	GSS	90	225	5.0	2.5	1.0	K	
2N5473	P	J	2N5473	2N5471	0.10	0.25	0.5	40	GSS	120	300	5.0	2.5	1.0	K	
2N5474	P	J	2N5474	2N5471	0.20	0.50	0.5	40	GSS	160	400	5.0	2.5	1.0	K	
2N5475	P	J	2N5475	2N5471	0.40	1.0	0.5	40	GSS	200	500	5.0	2.5	1.0	K	
2N5476	P	J	2N5476	2N5471	0.80	2.0	0.5	40	GSS	260	650	5.0	2.5	1.0	K	
2N5484	N	J	2N5484	2N5484	1.0	5.0	1.0	25	GSS	3000	6000	5.0	3.0	100	M	
2N5485	N	J	2N5485	2N5484	4.0	10	1.0	25	GSS	3500	7000	5.0	2.0	100	M	
2N5486	N	J	2N5486	2N5484	8.0	20	1.0	25	GSS	4000	8000	5.0	2.0	100	M	
2N5505	P	J					0.25	30	GSS	1000	3500	16	2.0	1.0	K	Dual
2N5506	P	J					0.25	30	GSS	1000	3500	16	2.0	1.0	K	Dual
2N5507	P	J					0.25	30	GSS	1000	3500	16	2.0	1.0	K	Dual
2N5508	P	J					0.25	30	GSS	1000	3500	16	2.0	1.0	K	Dual
2N5509	P	J					0.25	30	GSS	1000	3500	16	2.0	1.0	K	Dual
2N5510	P	J					0.25	30	GSS	500	3000	16	2.0	1.0	K	Dual
2N5511	P	J					0.25	30	GSS	500	3000	16	2.0	1.0	K	Dual
2N5512	P	J					0.25	30	GSS	500	3000	16	2.0	1.0	K	Dual
2N5513	P	J					0.25	30	GSS	500	3000	16	2.0	1.0	K	Dual
2N5514	P	J					0.25	30	GSS	500	3000	16	2.0	1.0	K	Dual
2N5515	N	J			0.5	7.5	0.25	40	GSS	1000	4000	25	2.0	1.0	H	Dual
2N5516	N	J			0.5	7.5	0.25	40	GSS	1000	4000	25	2.0	1.0	H	Dual
2N5517	N	J			0.5	7.5	0.25	40	GSS	1000	4000	25	2.0	1.0	H	Dual
2N5518	N	J			0.5	7.5	0.25	40	GSS	1000	4000	25	2.0	1.0	H	Dual
2N5519	N	J			0.5	7.5	0.25	40	GSS	1000	4000	25	2.0	1.0	H	Dual
2N5520	N	J			0.5	7.5	0.25	40	GSS	1000	4000	25	1.0	1.0	H	Dual
2N5521	N	J			0.5	7.5	0.25	40	GSS	1000	4000	25	1.0	1.0	H	Dual
2N5522	N	J			0.5	7.5	0.25	40	GSS	1000	4000	25	1.0	1.0	H	Dual
2N5523	N	J			0.5	7.5	0.25	40	GSS	1000	4000	25	1.0	1.0	H	Dual
2N5524	N	J			0.5	7.5	0.25	40	GSS	1000	4000	25	1.0	1.0	H	Dual
2N5543	N	J	2N3822	2N3819	2.0	10	1000			750	3000	10				
2N5544	N	J	2N3822	2N3819	2.0	10	1000			750	3000	10				
2N5545	N	J	MMF1-6	MMF1	0.5	8.0	0.1			1500	6000	6.0	3.5	10	H	Dual
2N5546	N	J	MMF1-6	MMF1	0.5	8.0	0.1			1500	6000	6.0	5.0	10	H	Dual
2N5547	N	J	MMF1-6	MMF1	0.5	8.0	0.1			1500	6000	6.0				Dual
2N5548	P	M	MFE3003	MFE3001		10*	0.05			3500	6500	10				
2N5549	N	J	2N4093	2N4088	10	60	0.25	40	GSS	6000	15000	8.0				
2N5555	N	J		2N5555	15		1.0	25	GSS			5.0				
2N5556	N	J		2N5556	0.5	2.5	0.1	30	GSS	1500	6500	6.0	1.0	10	H	
2N5557	N	J		2N5556	2.0	5.0	0.1	30	GSS	1500	6500	6.0	1.0	10	H	
2N5558	N	J		2N5556	4.0	10	0.1	30	GSS	1500	6500	6.0	1.0	10	H	
2N5561	N	J			1.0	10	0.1	50	GSS			7.0	1.0	10	H	MP
2N5562	N	J			1.0	10	0.1	50	GSS			7.0	1.0	10	H	MP
2N5563	N	J			1.0	10	0.1	50	GSS			7.0	1.0	10	H	MP
2N5564	N	J			5.0	30	0.1	40	GSS			12	1.0	10	H	MP
2N5565	N	J			5.0	30	0.1	40	GSS			12	1.0	10	H	MP
2N5566	N	J			5.0	30	0.1	40	GSS			12	1.0	10	H	MP
2N5592	N	J		2N5592	1.0	10	0.25	50	GSS			20	2.6	10	H	
2N5593	N	J		2N5592	1.0	10	0.25	50	GSS			20	6.0	10	H	
2N5594	N	J		2N5592	1.0	10	0.25	50	GSS			20	10	10	H	
2N5638	N	J				50	1.0	30	GSS				10			
2N5639	N	J				25	1.0	30	GSS				10			
2N5640	N	J				5.0	1.0	30	GSS				10			
2N5647	N	J			0.3	0.6	0.01	50	GSS			3.0	1.0	1.0	K	
2N5648	N	J	2N5556	2N5555	0.5	1.0	0.01	50	GSS			3.0	1.0	1.0	K	
2N5649	N	J	2N5556	2N5555	0.8	1.6	0.01	50	GSS			3.0	1.0	1.0	K	
2N5653	N	J	2N5556	2N5555	40		1.0	30	GSS			10	2.5			
2N5654	N	J			15		1.0	30	GSS			10	2.5			
2N5668	N	J		2N5668	1.0	5.0	2.0	25	GSS			7.0	2.5	100	M	
2N5669	N	J		2N5668	4.0	10	2.0	25	GSS			7.0	2.5	100	M	
2N5670	N	J		2N5669	8.0	20	2.0	25	GSS			7.0	2.5	100	M	
2N5797	P	J			0.02	0.10	3.0	40	GSS	60*	225*	5.0				MP
2N5798	P	J			0.08	0.40	3.0	40	GSS	100*	440*	5.0				MP
2N5799	P	J			0.25	1.00	3.0	40	GSS	160*	500*	5.0				MP
2N5800	P	J			0.70	2.00	3.0	40	GSS	250*	700*	5.0				MP
2N5801	N	J			2.0	15	0.1	-40	GSS			15	1.0	100	H	MP
2N5802	N	J			10	40	0.1	-40	GSS			15	1.0	100	H	MP
2N5803	N	J			30	80	0.1	-40	GSS			15	1.0	100	H	MP
2N5902	N	J			0.03	0.5	0.005	-40	GSS	70	250	3.0	3.0	100	H	MP
2N5903	N	J			0.03	0.5	0.005	-40	GSS	70	250	3.0	3.0	100	H	MP
2N5904	N	J			0.03	0.5	0.005	-40	GSS	70	250	3.0	3.0	100	H	MP
2N5905	N	J			0.03	0.5	0.005	-40	GSS	70	250	3.0	3.0	100	H	MP
2N5906	N	J			0.03	0.5	0.002	-40	GSS	70	250	3.0	1.0	100	H	MP
2N5907	N	J			0.03	0.5	0.002	-40	GSS	70	250	3.0	1.0	100	H	MP
2N5908	N	J			0.03	0.5	0.002	-40	GSS	70	250	3.0	1.0	100	H	MP
2N5909	N	J			0.03	0.5	0.002	-40	GSS	70	250	3.0	1.0	100	H	
2N5949	N	M			12	18	-1.0	30	GSS	3.0	7.5	6.0	2.0	1.0	K	
2N5950	N	M			10	15	-1.0	30	GSS	3.0	7.5	6.0	2.0	1.0	K	
2N5951	N	M			7.0	13	-1.0	30	GSS	3.0	6.5	6.0	2.0	1.0	K	
2N5952	N	M			4.0	8.0	-1.0	30	GSS	1.0	6.5	6.0	2.0	1.0	K	
2N5953	N	M			2.5	5.0	-1.0	30	GSS	1.0	6.5	6.0	2.0	1.0	K	

TYPE	POLARITY	CONST.	NEAREST EQUIVALENT	REF.	I_{DSS} Min mA	I_{DSS} Max mA	I_{GSS} / I_{DGO}* nA	Breakdown Voltage $V_{(BR)}$ Volts	Breakdown Voltage Sub-script	y_{fs} Min µmhos	y_{fs} Max µmhos	C_{ISS} pF	NF dB µV*/√Hz	@ f	Units	NOTE
					* nA					*mmhos						
3N89	P	J			0.5	2.5	5.0	30		450	1300	3.0				
3N96	P	J			0.5	2.5	5.0	30		450	1300	4.0				Dual
3N97	P	J			0.5	2.5	5.0	30		450	1300	4.0				Dual
3N98	N	M	MFE3004-5	MFE3004	3.5	7.7	0.05	32		1000	3000	7.0				
3N99	N	M	MFE3004-5	MFE3004	5.0	10.5	0.05	32		1000	4500	7.0				
3N124	N	J	3N124	3N124	0.2	2.0	0.25	50	GSS	500	2000	14	4.0	1.0	K	
3N125	N	J	3N125	3N124	1.5	4.5	0.25	50	GSS	800	2400	14	4.0	1.0	K	
3N126	N	J	3N126	3N124	3.0	9.0	0.25	50	GSS	1200	3600	14	4.0	1.0	K	
3N128	N	M	MFE3004-5	MFE3004	5.0	25	0.05			5000	12000	7.0	5.0	200	M	
3N138	N	M	MFE3004-5	MFE3004			0.010	45	GD			5.0				
3N139	N	M	MFE3004-5	MFE3004	5.0	25	1.0	45	GD	3000	7500	7.0				
3N140	N	M	3N140	3N140	5.0	30	1.0	20	DS			7.0	4.5	200	M	
3N141	N	M	MFE3006-7	MFE3006	5.0	30	1.0	20	DS			7.0				
3N142	N	M	MFE3004-5	MFE3004	5.0	50	5.0	20	DS			10				
3N143	N	M	MFE3004-5	MFE3004	10	50	1.0					7.0				
3N145	P	M	2N4352	2N4352				30	DB							
3N146	P	M	3N157A	3N157				30	DB							
3N147	P	M						30	DB							
3N148	P	M						30	DB							
3N149	P	M	3N157A-8A	3N157				30	DB							
3N150	P	M	3N157A-8A	3N157				30	DB							
3N151	P	M			-5.0*							12	10	100	H	
3N152	N	M	MFE3004-5	MFE3004	5.0	30	1.0						3.5	200	M	
3N153	N	M	MFE3004-5	MFE3004			0.05					8.0				
3N154	N	M	MFE3004-5	MFE3004	10	25	0.05						5.0	200	M	
3N155	P	M	3N155	3N155		1.0	1.0	35	DSS	1000	4000	5.0				
3N155A	P	M	3N155A	3N155		0.25	1.0	35	DSS	1000	4000	5.0				
3N156	P	M	3N156	3N155		1.0	1.0	35	DSS	1000	4000	5.0				
3N156A	P	M		3N155		0.25	1.0	35	DSS	1000	4000	5.0				
3N157	P	M	3N157	3N157		1.0	0.010	35	DSS	1000	4000	5.0				
3N157A	P	M	3N157A	3N157		0.25	0.010	50	DSS	1000	4000	5.0				
3N158	P	M	3N158	3N157		1.0	0.010	35	DSS	1000	4000	5.0				
3N158A	P	M	3N158A	3N157		0.25	0.010	50	DSS	1000	4000	5.0				
3N159	N	M	MFE3007	MFE3007	5.0	30	1.0			7000	18000	7.0	3.5	200	M	
3N160	P		MFE3003	MFE3001		10*	0.01			3500	6500	10				
3N161	P		MFE3003	MFE3001		10*				3500	6500	10				
3N162	P	M	MFE3003	MFE3001		150*						20				
3N163	P	M	MFE3003	MFE3001		0.2*	0.01					2.5				
3N164	P	M				0.4*	0.01					2.5				
3N165	P	M				0.2*	0.01					3.0				
3N166	P	M				0.2*	0.01					3.0				
3N167	P	M				-0.5*						35				
3N168	P	M				-1.0*						35				
3N169	N	M	3N169			10*						5.0				
3N170	N	M	3N169			10*						5.0				
3N171	N	M	3N169			10*						5.0				
3N172	P	M				0.4*						3.5				
3N173	P	M				10*						3.5				
3N174	P	M	2N4352	2N4352		5.0*	0.0025					4.0				
3N175	N	M				5.0*	0.2					5.0				
3N176	N	M				10*	0.2					5.0				
3N177	N	M				25*	0.2					7.0				
3N178	P	M				0.5*	0.2					3.5				
3N179	P	M				1.0*						4.5				
3N180	P	M				1.0*						5.0				
3N181	P	M				0.5*						25				
3N182	P	M				2.5*						25				
3N183	P	M				10*						30				
3N184	P	M				2.0*						9.0				
3N185	P	M				5.0*						10				
3N186	P	M				10*						11				
3N188	P	M				0.2*						4.5				
3N189	P	M				0.2*						4.5				
3N190	P	M				0.2*	0.01					4.5				
3N191	P	M				0.2*	0.01					4.5				
3N192	N	M			3.0	30	-1.0	-6.0	GSSR	8000	24000	6.0				
3N193	N	M			1.0	20	-1.0	-6.0	GSSR	6000	22000	7.0				
3N200	N	J			0.5	12	-50	6.5	GSS							Dual
3N201	N	J			6.0	30	-10	6.0	GSS	8.0	20		4.5	200	M	Dual
3N202	N	J			6.0	30	-10	6.0	GSS	8.0	20		4.5	200	M	Dual
3N203	N	J			3.0	15	-10	6.0	GSS	7.0	15		6.0	45	M	Dual

REFERENCE AMPLIFIERS

INDEX AND SHORT-FORM SPECIFICATIONS

This table contains a numerical listing and short-form specifications for reference amplifiers with EIA-registered 3N numbers. In addition, short-form specifications are also provided for special house numbered reference amplifiers.

KEY

TYPE	REF.	V_{REF} (volts)	Tol ±%	ΔV_{REF} (volts) / *TC (%/°C)	I_{ZT} (mA)	Z_{ZT} (ohms)	T_1 °C	T_2 °C
Numerical Listing of Registered Type Numbers		Nominal Reference Voltage	Tolerance of Nominal Reference Voltage				Temperature Range over which ΔV_{REF} is specified / *Maximum Operating Temperature	

Reference device number indicates specific Data Sheet on which device is characterized.

Maximum Voltage Variation over the Temperature Range from T_1 to T_2

*Temperature Coefficient $\frac{\Delta V_1 \, 100}{V \, (T_2 - T_1)}$

Maximum Zener Impedance

Zener Test Current

REFERENCE AMPLIFIER INDEX

TYPE	REF.	V_{REF} (volts)	Tol ±%	ΔV_{REF} (volts) / *TC (%/°C)	I_{ZT} (mA)	Z_{ZT} (ohms)	T_1 °C	T_2 °C
3N39		9.0	9.0	0.005*	5.0			71*
3N40		9.0	9.0	0.003*	5.0			71*
3N41		9.0	9.0	0.002*	5.0			71*
3N42		9.0	9.0	0.005*	5.0			100*
3N43		9.0	9.0	0.003*	5.0			100*
3N44		9.0	9.0	0.002*	5.0			100*
3N44A		9.0	10	0.001*	5.0			150*
MCA1911	MCA1911	6.8	10	0.051	5.0	40	0	75
MCA1912	MCA1911	6.8	10	0.025	5.0	40	0	75
MCA1913	MCA1911	6.8	10	0.010	5.0	40	0	75
MCA1914	MCA1911	6.8	10	0.005	5.0	40	0	75
MCA1921	MCA1911	6.8	5.0	0.105	5.0	40	-55	100
MCA1922	MCA1911	6.8	5.0	0.052	5.0	40	-55	100
MCA1923	MCA1911	6.8	5.0	0.020	5.0	40	-55	100
MCA1924	MCA1911	6.8	5.0	0.010	5.0	40	-55	100
MCA1931	MCA1911	6.8	5.0	0.139	5.0	40	-55	150
MCA1932	MCA1911	6.8	5.0	0.069	5.0	40	-55	150
MCA1933	MCA1911	6.8	5.0	0.026	5.0	40	-55	150
MCA1934	MCA1911	6.8	5.0	0.013	5.0	40	-55	150
MCA2011	MCA1911	8.6	10	0.060	5.0	40	0	75
MCA2012	MCA1911	8.6	10	0.030	5.0	40	0	75
MCA2013	MCA1911	8.6	10	0.012	5.0	40	0	75
MCA2014	MCA1911	8.6	10	0.006	5.0	40	0	75
MCA2021	MCA1911	8.6	5.0	0.124	5.0	40	-55	100
MCA2022	MCA1911	8.6	5.0	0.062	5.0	40	-55	100
MCA2023	MCA1911	8.6	5.0	0.024	5.0	40	-55	100
MCA2024	MCA1911	8.6	5.0	0.012	5.0	40	-55	100
MCA2031	MCA1911	8.6	5.0	0.164	5.0	40	-55	150
MCA2032	MCA1911	8.6	5.0	0.082	5.0	40	-55	150
MCA2033	MCA1911	8.6	5.0	0.032	5.0	40	-55	150
MCA2034	MCA1911	8.6	5.0	0.016	5.0	40	-55	150
MCA2111	MCA1911	9.5	10	0.071	5.0	40	0	75
MCA2112	MCA1911	9.5	10	0.035	5.0	40	0	75
MCA2113	MCA1911	9.5	10	0.014	5.0	40	0	75
MCA2114	MCA1911	9.5	10	0.007	5.0	40	0	75
MCA2121	MCA1911	9.5	5.0	0.147	5.0	40	-55	100
MCA2122	MCA1911	9.5	5.0	0.073	5.0	40	-55	100
MCA2123	MCA1911	9.5	5.0	0.028	5.0	40	-55	100
MCA2124	MCA1911	9.5	5.0	0.014	5.0	40	-55	100
MCA2131	MCA1911	9.5	5.0	0.194	5.0	40	-55	150
MCA2132	MCA1911	9.5	5.0	0.097	5.0	40	-55	150
MCA2133	MCA1911	9.5	5.0	0.038	5.0	40	-55	150
MCA2134	MCA1911	9.5	5.0	0.019	5.0	40	-55	150
MCA2211	MCA1911	11.0	10	0.082	5.0	40	0	75
MCA2212	MCA1911	11.0	10	0.041	5.0	40	0	75
MCA2213	MCA1911	11.0	10	0.016	5.0	40	0	75
MCA2214	MCA1911	11.0	10	0.008	5.0	40	0	75
MCA2221	MCA1911	11.0	5.0	0.170	5.0	40	-55	100
MCA2222	MCA1911	11.0	5.0	0.085	5.0	40	-55	100
MCA2223	MCA1911	11.0	5.0	0.034	5.0	40	-55	100
MCA2224	MCA1911	11.0	5.0	0.017	5.0	40	-55	100
MCA2231	MCA1911	11.0	5.0	0.225	5.0	40	-55	150
MCA2232	MCA1911	11.0	5.0	0.112	5.0	40	-55	150
MCA2233	MCA1911	11.0	5.0	0.044	5.0	40	-55	150
MCA2234	MCA1911	11.0	5.0	0.022	5.0	40	-55	150

UNIJUNCTION TRANSISTORS

This table contains a numerical listing and short-form specifications for unijunction transistors with EIA-registered 2N numbers.

KEY

TYPE	REPLACEMENT	REF	P_D (mW)	R_{BB}	η	I_V(Min) mA	I_P(Max) (μA)	I_{EO}@ V_{B2E} (μA @ V Max)	$V_{EB1\ (sat)}$ I_E @ 50 mA
Numerical Listing of Registered Type Numbers	Type number of nearest electrical equivalent fully characterized in this book	Reference device number indicates specific Data Sheet on which device is characterized	Power Dissipation @ 25°C	Interbase Resistance	Intrinsic Standoff Ratio	Valley Current	Peak Point Current	Emitter Reverse Current at indicated V_{B2E}	Emitter Saturation Voltage

TYPE	REPLACEMENT	REF.	P_D (mW)	R_{BB} (kΩ)	η	I_V(min) (mA)	I_P(max) (μA)	I_{EO} @ V_{B2E} (μA @ V max)	$V_{EB1(SAT)}$ I_E @ 50 mA
2N489			450	6.8	0.62	8.0	20	12 @ 60	5.0
2N489A			450	6.8	0.62	8.0	15	12 @ 60	4.0
2N489B			450	6.8	0.62	8.0	6.0	0.2 @ 60	4.0
2N490			450	9.1	0.62	8.0	20	12 @ 60	5.0
2N490A			450	9.1	0.62	8.0	15	12 @ 60	4.0
2N490B			450	9.1	0.62	8.0	6.0	0.2 @ 60	4.0
2N490C			450	9.1	0.51				
2N491			450	6.8	0.68	8.0	20	12 @ 60	5.0
2N491A			450	6.8	0.68	8.0	15	12 @ 60	4.3
2N491B			450	6.8	0.68	8.0	6.0	0.2 @ 60	4.3
2N492			450	9.1	0.68	8.0	20	12 @ 60	5.0
2N492A			450	9.1	0.68	8.0	15	12 @ 60	4.3
2N492B			450	9.1	0.68	8.0	6.0	0.2 @ 60	4.3
2N492C			450	9.1	0.56				
2N493			450	6.8	0.75	8.0	20	12 @ 60	5.0
2N493A			450	6.8	0.75	8.0	15		
2N493B			450	6.8	0.75	8.0	6.0	0.2 @ 60	5.0
2N494			450	9.1	0.75	8.0	20	12 @ 60	5.0
2N494A			450	9.1	0.75	8.0	15	12 @ 60	4.6
2N494B			450	9.1	0.75	8.0	6.0	0.2 @ 60	4.6
2N494C			450	9.1	0.62	8.0	2.0	0.02 @ 60	4.6
2N1671			450	9.1	0.62	8.0	25	12 @ 30	5.0
2N1671A			450	9.1	0.62	8.0	25	12 @ 30	5.0
2N1671B			450	9.1	0.62	8.0	6.0	0.2 @ 30	5.0
2N1671C			450	4.1 -9.1					
2N2160			450	4.0 -12	0.47 -0.80	8.0	25	12 @ 30	
2N2417			390	0.68	0.62	8.0	20	12 @ 60	5.0
2N2417A			390	0.68	0.62	8.0	20	12 @ 60	4.0
2N2417B			300	6.8	0.51 -0.62	8.0	6.0	0.2 @ 30	4.0
2N2418			390	0.68	0.62	8.0	20	12 @ 60	5.0
2N2418A			390	9.1	0.62	8.0	20	12 @ 60	4.0
2N2418B			300	9.1	0.51 - 0.62	8.0	6.0	0.2 @ 60	4.0
2N2419			390	4.7 -6.8	0.68	8.0	20	12 @ 60	5.0
2N2419A			390	6.8	0.68	8.0	20	12 @ 60	4.3
2N2419B			300	6.8	0.56 -0.68	8.0	6.0	0.2 @ 30	4.3
2N2420			390	9.1	0.68	8.0	20	12 @ 60	5.0
2N2420A			390	9.1	0.68	8.0	20	12 @ 60	4.3
2N2420B			300	9.1	0.56 -0.68	8.0	6.0	0.2 @ 30	4.3
2N2421			390	6.8	0.75	8.0	20	12 @ 60	5.0
2N2421A			390	6.8	0.75	8.0	20	12 @ 60	4.6
2N2421B			300	6.8	0.62 -0.75	0.2	6.0	0.2 @ 30	4.6
2N2422			390	9.1	0.75	8.0	20	12 @ 60	5.0
2N2422A			390	9.1	0.75	8.0	20	12 @ 60	4.6
2N2422B			300	9.1	0.62 -0.75	8.0	6.0	0.2 @ 30	
2N2646	2N2646	2N2646	300	4.7 (min)	0.56	4.0	25	12 @ 30	2.0
2N2647	2N2647	2N2646	300	4.7 (min)	0.68	8.0	2.0	0.2 @ 30	2.0
2N2840			300	4.7 -9.1	0.4 -0.85	0.70	10	1.0 @ 30	
2N3406			450			8.0			
2N3479			400	4.7 -9.1	0.47 -0.62	6.0	20	12 @ 30	5.0
2N3480			400	9.1	0.75	4.0	15	12 @ 30	5.0
2N3481			400	9.1	0.85	6.0	15	12 @ 30	5.0
2N3482			400	4.7 -6.8	0.51 -0.62	8.0	2.0	0.02 @ 30	5.0
2N3483			400	9.1	0.72	8.0	2.0	1.0 @ 30	5.0
2N3484			400	9.1	0.85	8.0	2.0	0.2 @ 30	5.0
2N3679			250	9.1	0.80	4.2			
2N3980	2N3980	2N3980	360	8.0					
2N4851	2N4851	2N4851	300	4.7 (min)	0.56 (min)	2.0	2.0	0.1 @ 30	2.5
2N4852	2N4852	2N4851	300	4.7 (min)	0.70 (min)	4.0	2.0	0.1 @ 30	2.5
2N4853	2N4853	2N4851	300	4.7 (min)	0.70 (min)	6.0	0.4	0.05 @ 30	2.5
2N4870	2N4870	2N4870	300	4.0 (min)	0.56 (min)	2.0	5.0	0.05 @ 30	2.5
2N4871		2N4870	300	4.0 (min)	0.70 (min)	4.0	5.0	0.05 @ 30	2.5
2N4891	MU4891	MU4891	300	4.0 (min)	0.55 (min)	2.0	5.0	0.01 @ 30	4.0
2N4892	MU4892	MU4891	300	4.0 (min)	0.51 (min)	4.0	2.0	0.01 @ 30	4.0
2N4893	MU4893	MU4891	300	4.0 (min)	0.55 (min)	2.0	2.0	0.01 @ 30	4.0
2N4894	MU4894	MU4891	300	4.0 (min)	0.74 (min)	2.0	1.0	0.01 @ 30	4.0
2N4947			360	4.0 -9.1	0.51 -0.69	4.0	2.0	0.01 @ 30	2.5
2N4948	2N4948	2N4948	360	4.0 (min)	0.55 (min)	2.0	2.0	0.01 @ 30	2.5
2N4949	2N4949	2N4948	360	4.0 (min)	0.74 (min)	2.0	1.0	0.01 @ 30	2.5
2N5431	2N5431	2N5431	360	6.0 -8.5	0.72 -0.80	2.0	4.0		3.0
2N6114			300	5.5/8.2	0.58/0.62	1.0	5.0	0.01 5.0	1.5
2N6115			300	5.0/2.5	0.58/0.62	1.0	15	0.1 5.0	1.5

2

2

PROGRAMMABLE UNIJUNCTION TRANSISTORS

KEY

TYPE	Numerical Listings of 2N Registered Type Numbers
REPLACEMENT	Type number of recommended replacement or of nearest electrical equivalent fully characterized in this book
REFERENCE	Reference device number indicates specific Data Sheet on which device is characterized
I_P	Peak Current
I_{GAO}	Gate to Anode Leakage Current
I_V	Valley Current
V_{GKF}	Gate to Cathode Forward Voltage
P_F	Forward Power Dissipation @ 25°C
V_O	Peak Output Voltage
V_F	Forward Voltage
I_T	DC Forward Anode Current
I_{TRM}	Repetitive Peak Forward Current
T_{stg}	Storage Temperature Range

PROGRAMMABLE UNIJUNCTION TRANSISTORS – PUT

TYPE	Replacement	REF.	I_P Peak Current R_G = 10 kΩ µA (Max)	I_P Peak Current R_G = 1.0 MΩ µA (Max)	I_{GAO} Leakage Current @ 40 V nA (Max)	I_V Valley Current R_G = 10 kΩ µA (Min)	I_V Valley Current R_G = 1.0MΩ µA (Max)	V_{GKF} Gate to Cathode Forward Voltage Volts (Max)	P_F mW	V_O Min Output Voltage Volts	V_F Forward Voltage V_F Volts	@ I_F mA	I_T DC Anode Current mA (Max)	I_T(pulse) Peak Anode Current 20 µs *10 µs 1.0% DC Amp (Max)	T_{stg} Storage Temp. Range °C
2N6027	2N6027	2N6027	5.0	2.0	10	70	50	+ 40	300	6.0	1.5	50	150	2.0	-55to
2N6028	2N6028	2N6027	1.0	0.15	10	25	25	+ 40	300	6.0	1.5	50	150	2.0	+150°C
2N6116	2N6116	2N6116	5.0	2.0	5.0	70	50	40	250	6.0	1.5	50	200	2.0	-65°C
2N6117	2N6117	2N6116	2.0	0.3	5.0	50	50	40	250	6.0	1.5	50	200	2.0	to
2N6118	2N6118	2N6116	1.0	0.15	5.0	50	25	40	250	6.0	1.5	50	200	2.0	+200°C
2N6119	2N6116	2N6116	5.0	2.0	10	70	50	40	400	9.0	1.0	50	300	8.0*	-55°C to
2N6120	2N6118	2N6116	1.0	0.15	10	25	25	40	400	9.0	1.0	50	300	8.0*	+150°C
2N6137			5.0	2.0	10	70	50	40	400	9.0	1.0	50	300	8.0*	-55°C to
2N6138			5.0	2.0	10	70	50	100	400	9.0	1.0	50	300	8.0*	+150°C

IN-HOUSE
NON-REGISTERED DEVICES

3

INDEX

3

RECTIFIERS,

ZENER DIODES, SIGNAL DIODES

and REFERENCE DIODES

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house, non-registered rectifiers, zener diodes, signal diodes and reference diodes.

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KEY

RECTIFIERS

V_R = DC Blocking Voltage
V_F = Average Forward Voltage Drop
I_O = Average Rectifier Forward Current
I_R = Average Reverse Current
I_{FSM} = Peak Surge Current

ZENER DIODES

V_Z(Nom) = Nominal Zener Breakdown Voltage (Volts)
I_{ZT} = Test Current for Zener Voltage (mA)
Tol = Tolerance for Specified Nominal Zener Breakdown Voltage
P_D = Maximum Power Dissipation
M = Milliwatts
W = Watts

TYPE	MATERIAL	REPLACEMENT	REF.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R Volts	V_F Volts	I_O Amps	I_R mA	I_{FSM}	V_Z (nom)	I_{ZT} mA	Tol $V_{Z\pm\%}$	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV Volts	V_F Volts	@ I_F	I_R	t_{rr} (μs)	V_Z (nom)	T_C %/°C	I_{ZT} mA	Temp Range

TYPE: Numerical Listing of Registered Type Numbers

MATERIAL: S = Silicon, G = Germanium, SE = Selenium

REPLACEMENT: Type number of recommended replacement or of nearest electrical equivalent fully characterized in this book.

REF.: Reference device number indicates specific Data Sheet on which device is characterized.

SHADING INDICATES SIGNAL DIODES

PRV = Peak Reverse Voltage
V_F @ I_F = Maximum Forward Voltage at Indicated Forward current – M = Milliamp, A = amp
I_R = Reverse Current – M = milliamp, * = microamp, N = nanoamp
t_{rr} = Reverse Recovery Time

SHADING INDICATES REFERENCE DIODES

V_Z(Nom) = Nominal Zener Breakdown Voltage (Volts)
T_C = Average Temperature Coefficient over Temperature Range
I_{ZT} = Test Current for Zener Voltage (mA)
Temp Range = Operating Range of Average T_C

The codes listed below define the listed device and indicates the appropriate specification column heading.
. R – Rectifiers, Fast Recovery
DZ – Diode, Zener
DR – Diode, Reference
DS – Diode, Signal

DIODE, RECTIFIER INDEX

Type	MATERIAL	Replacement	Ref.	IDENTIFICATION	RECTIFIERS V_R Volts / SIGNAL DIODES PRV Volts	V_F Volts / V_F Volts @	I_O Amp / I_F	I_R mA / I_R	I_{FSM} Amp / t_{rr} μs	ZENER DIODES V_Z(Nom) / REFERENCE DIODES V_Z (Nom)	I_{ZT} mA / TC %/°C	Tol V_Z ±% / I_{zt} mA	P_D / Temp Range
¼M2.4AZ			¼M2.4AZ	DZ						2.4	10	20	25W
¼M2.7AZ			¼M2.4AZ	DZ						2.7	10	20	25W
¼M3.0AZ			¼M2.4AZ	DZ						3.0	10	20	25W
¼M3.3AZ			¼M2.4AZ	DZ						3.3	10	20	25W
¼M3.6AZ			¼M2.4AZ	DZ						3.6	10	20	25W
¼M3.9AZ			¼M2.4AZ	DZ						3.9	10	20	25W
¼M4.3AZ			¼M2.4AZ	DZ						4.3	10	20	25W
¼M4.7AZ			¼M2.4AZ	DZ						4.7	10	20	25W
¼M5.1AZ			¼M2.4AZ	DZ						5.1	10	20	25W
¼M5.6AZ			¼M2.4AZ	DZ						5.6	10	20	25W
¼M6.2AZ			¼M2.4AZ	DZ						6.2	10	20	25W
¼M6.8Z			¼M2.4AZ	DZ						6.8	9.2	20	25W
¼M7.5Z			¼M2.4AZ	DZ						7.5	8.3	20	25W
¼M8.2Z			¼M2.4AZ	DZ						8.2	7.6	20	25W
¼M9.1Z			¼M2.4AZ	DZ						9.1	6.9	20	25W
¼M10Z			¼M2.4AZ	DZ						10	6.3	20	25W
¼M11Z			¼M2.4AZ	DZ						11	5.7	20	25W
¼M12Z			¼M2.4AZ	DZ						12	5.2	20	25W
¼M13Z			¼M2.4AZ	DZ						13	4.8	20	25W
¼M14Z			¼M2.4AZ	DZ						14	4.5	20	25W
¼M15Z			¼M2.4AZ	DZ						15	4.2	20	25W
¼M16Z			¼M2.4AZ	DZ						16	3.9	20	25W
¼M17Z			¼M2.4AZ	DZ						17	3.7	20	25W
¼M18Z			¼M2.4AZ	DZ						18	3.5	20	25W
¼M19Z			¼M2.4AZ	DZ						19	3.3	20	25W
¼M20Z			¼M2.4AZ	DZ						20	3.1	20	25W
¼M22Z			¼M2.4AZ	DZ						22	2.8	20	25W
¼M24Z			¼M2.4AZ	DZ						24	2.6	20	25W
¼M25Z			¼M2.4AZ	DZ						25	2.5	20	25W
¼M27Z			¼M2.4AZ	DZ						27	2.3	20	25W
¼M30Z			¼M2.4AZ	DZ						30	2.1	20	25W
¼M33Z			¼M2.4AZ	DZ						33	1.9	20	25W
¼M36Z			¼M2.4AZ	DZ						36	1.7	20	25W
¼M39Z			¼M2.4AZ	DZ						39	1.6	20	25W
¼M43Z			¼M2.4AZ	DZ						43	1.5	20	25W
¼M45Z			¼M2.4AZ	DZ						45	1.4	20	25W
¼M47Z			¼M2.4AZ	DZ						47	1.3	20	25W
¼M50Z			¼M2.4AZ	DZ						50	1.2	20	25W
¼M52Z			¼M2.4AZ	DZ						52	1.2	20	25W
¼M56Z			¼M2.4AZ	DZ						56	1.1	20	25W
¼M62Z			¼M2.4AZ	DZ						62	1.0	20	25W
¼M68Z			¼M2.4AZ	DZ						68	0.92	20	25W
¼M75Z			¼M2.4AZ	DZ						75	0.83	20	25W
¼M82Z			¼M2.4AZ	DZ						82	0.76	20	25W
¼M91Z			¼M2.4AZ	DZ						91	0.69	20	25W
¼M100Z			¼M2.4AZ	DZ						100	0.63	20	25W
¼M105Z			¼M2.4AZ	DZ						105	0.60	20	25W
¼M110Z			¼M2.4AZ	DZ						110	0.57	20	25W
¼M120Z			¼M2.4AZ	DZ						120	0.52	20	25W
¼M130Z			¼M2.4AZ	DZ						130	0.48	20	25W

Type	MATERIAL	Replacement	Ref.	IDENTIFICATION	RECTIFIERS: V_R Volts / SIGNAL DIODES: PRV Volts	RECTIFIERS: V_F Volts / SIGNAL DIODES: V_F Volts	RECTIFIERS: I_O Amp / SIGNAL DIODES: @ I_F	RECTIFIERS: I_R mA / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} Amp / SIGNAL DIODES: t_{rr} μs	ZENER DIODES: V_Z(Nom) / REFERENCE DIODES: V_Z (Nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: TC %/°C	ZENER DIODES: Tol V_Z ±% / REFERENCE DIODES: I_{zt} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
¼M140Z			¼M2.4AZ	DZ						140	0.45	20	25W
¼M150Z			¼M2.4AZ	DZ						150	0.42	20	25W
¼M175Z			¼M2.4AZ	DZ						175	0.36	20	25W
¼M200Z			¼M2.4AZ	DZ						200	0.31	20	25W
1M3.3AZ10			1N3821	DZ						3.3	76	10	1.0W
1M3.6AZ10			1N3821	DZ						3.6	69	10	1.0W
1M3.9AZ10			1N3821	DZ						3.9	64	10	1.0W
1M4.3AZ10			1N3821	DZ						4.3	58	10	1.0W
1M4.7AZ10			1N3821	DZ						4.7	53	10	1.0W
1M5.1AZ10			1N3821	DZ						5.1	49	10	1.0W
1M5.6AZ10			1N3821	DZ						5.6	45	10	1.0W
1M6.2AZ10			1N3821	DZ						6.2	41	10	1.0W
1M6.8AZ10			1N3821	DZ						6.8	37	10	1.0W
1M7.5AZ10			1N3821	DZ						7.5	34	10	1.0W
1M6.8Z			1N3821	DZ						6.8	37	10	1.0W
1M7.5Z			1N3821	DZ						7.5	34	10	1.0W
1M8.2Z			1N3821	DZ						8.2	31	10	1.0W
1M9.1Z			1N3821	DZ						9.1	28	10	1.0W
1M10Z			1N3821	DZ						10	25	10	1.0W
1M11Z			1N3821	DZ						11	23	10	1.0W
1M12Z			1N3821	DZ						12	21	10	1.0W
1M13Z			1N3821	DZ						13	19	10	1.0W
1M15Z			1N3821	DZ						15	17	10	1.0W
1M16Z			1N3821	DZ						16	15.5	10	1.0W
1M18Z			1N3821	DZ						18	14	10	1.0W
1M20Z			1N3821	DZ						20	12.5	10	1.0W
1M22Z			1N3821	DZ						22	11.5	10	1.0W
1M24Z			1N3821	DZ						24	10.5	10	1.0W
1M27Z			1N3821	DZ						27	9.5	10	1.0W
1M30Z			1N3821	DZ						30	8.5	10	1.0W
1M33Z			1N3821	DZ						33	7.5	10	1.0W
1M36Z			1N3821	DZ						36	7.0	10	1.0W
1M39Z			1N3821	DZ						39	6.5	10	1.0W
1M43Z			1N3821	DZ						43	6.0	10	1.0W
1M47Z			1N3821	DZ						47	5.5	10	1.0W
1M51Z			1N3821	DZ						51	5.0	10	1.0W
1M56Z			1N3821	DZ						56	4.5	10	1.0W
1M62Z			1N3821	DZ						62	4.0	10	1.0W
1M68Z			1N3821	DZ						68	3.7	10	1.0W
1M75Z			1N3821	DZ						75	3.3	10	1.0W
1M82Z			1N3821	DZ						82	3.0	10	1.0W
1M91Z			1N3821	DZ						91	2.8	10	1.0W
1M100Z			1N3821	DZ						100	2.5	10	1.0W
1M110Z			1N3821	DZ						110	2.3	10	1.0W
1M120Z			1N3821	DZ						120	2.0	10	1.0W
1M130Z			1N3821	DZ						130	1.9	10	1.0W
1M150Z			1N3821	DZ						150	1.7	10	1.0W
1M160Z			1N3821	DZ						160	1.6	10	1.0W
1M180Z			1N3821	DZ						180	1.4	10	1.0W
1M200Z			1N3821	DZ						200		10	1.0W
1M3.3ZS10			1N4728	DZ						3.3	76	10	1.0W
1M3.6ZS10			1N4728	DZ						3.6	69	10	1.0W
1M3.9ZS10			1N4728	DZ						3.9	64	10	1.0W
1M4.3ZS10			1N4728	DZ						4.3	58	10	1.0W
1M4.7ZS10			1N4728	DZ						4.7	53	10	1.0W
1M5.1ZS10			1N4728	DZ						5.1	49	10	1.0W
1M5.6ZS10			1N4728	DZ						5.6	45	10	1.0W
1M6.2ZS10			1N4728	DZ						6.2	41	10	1.0W
1M6.8ZS10			1N4728	DZ						6.8	37	10	1.0W
1M7.5ZS10			1N4728	DZ						7.5	34	10	1.0W

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Type	MATERIAL	Replacement	Ref.	IDENTIFICATION	RECTIFIERS: V_R Volts / SIGNAL DIODES: PRV Volts	V_F Volts / V_F @	I_O Amp / I_F	I_R mA / I_R	I_{FSM} Amp / t_{rr} μs	ZENER DIODES: V_Z(Nom) / REFERENCE DIODES: V_Z (Nom)	I_{ZT} mA / TC %/°C	Tol V_Z ±% / I_{zt} mA	P_D / Temp Range
1M8.2ZS10			1N4728	DZ						8.2	31	10	1.0W
1M9.1ZS10			1N4728	DZ						9.1	28	10	1.0W
1M10ZS10			1N4728	DZ						10	25	10	1.0W
1M11ZS10			1N4728	DZ						11	23	10	1.0W
1M12ZS10			1N4728	DZ						12	21	10	1.0W
1M13ZS10			1N4728	DZ						13	19	10	1.0W
1M15ZS10			1N4728	DZ						15	17	10	1.0W
1M16ZS10			1N4728	DZ						16	15.5	10	1.0W
1M18ZS10			1N4728	DZ						18	14	10	1.0W
1M20ZS10			1N4728	DZ						20	12.5	10	1.0W
1M22ZS10			1N4728	DZ						22	11.5	10	1.0W
1M24ZS10			1N4728	DZ						24	10.5	10	1.0W
1M27ZS10			1N4728	DZ						27	9.5	10	1.0W
1M30ZS10			1N4728	DZ						30	8.5	10	1.0W
1M33ZS10			1N4728	DZ						33	7.5	10	1.0W
1M36ZS10			1N4728	DZ						36	7.0	10	1.0W
1M39ZS10			1N4728	DZ						39	6.5	10	1.0W
1M43ZS10			1N4728	DZ						43	6.0	10	1.0W
1M47ZS10			1N4728	DZ						47	5.5	10	1.0W
1M51ZS10			1N4728	DZ						51	5.0	10	1.0W
1M56ZS10			1N4728	DZ						56	4.5	10	1.0W
1M62ZS10			1N4728	DZ						62	4.0	10	1.0W
1M68ZS10			1N4728	DZ						68	3.7	10	1.0W
1M75ZS10			1N4728	DZ						75	3.3	10	1.0W
1M82ZS10			1N4728	DZ						82	3.0	10	1.0W
1M91ZS10			1N4728	DZ						91	2.8	10	1.0W
1M100ZS10			1N4728	DZ						100	2.5	10	1.0W
1M110ZS10			1N4728	DZ						110	2.3	10	1.0W
1M120ZS10			1N4728	DZ						120	2.0	10	1.0W
1M130ZS10			1N4728	DZ						130	1.9	10	1.0W
1M150ZS10			1N4728	DZ						150	1.7	10	1.0W
1M160ZS10			1N4728	DZ						160	1.6	10	1.0W
1M180ZS10			1N4728	DZ						180	1.4	10	1.0W
1M200ZS10			1N4728	DZ						200	1.2	10	1.0W
MPZ5-16A	S	MPZ5-16		DZ						14	400		350W
MPZ5-16B	S	MPZ5-16		DZ						14	400		350W
MPZ5-32A	S	MPZ5-16		DZ						28	400		350W
MPZ5-32B	S	MPZ5-16		DZ						28	400		350W
MPZ5-32C	S	MPZ5-16		DZ						28	400		350W
MPZ5-180A	S	MPZ5-16		DZ						165	400		350W
MPZ5-180B	S	MPZ5-16		DZ						165	400		350W
MPZ5-180C	S	MPZ5-16		DZ						165	400		350W
MR810	S		MR810	.R	50	1.1	1.0	0.01	30				
MR811	S		MR810	.R	100	1.1	1.0	0.01	30				
MR812	S		MR810	.R	200	1.1	1.0	0.01	30				
MR813	S		MR810	.R	300	1.1	1.0	0.01	30				
MR814	S		MR810	.R	400	1.1	1.0	0.01	30				
MR816	S		MR810	.R	500	1.1	1.0	0.01	30				
MR817	S		MR810	.R	800	1.1	1.0	0.01	30				
MR818	S		MR810	.R	1000	1.1	1.0	0.01	30				
MR820	S		MR820	.R	50	1.0	5.0	0.25	300				
MR821	S		MR820	.R	100	1.0	5.0	0.25	300				
MR822	S		MR820	.R	200	1.0	5.0	0.25	300				
MR824	S		MR820	.R	400	1.0	5.0	0.25	300				
MR826	S		MR820	.R	600	1.0	5.0	0.25	300				
MR830			MR830	.R	50	1.1	3.0	0.05	100				
MR831			MR830	.R	100	1.1	3.0	0.05	100				
MR832			MR830	.R	200	1.1	3.0	0.05	100				
MR834			MR830	.R	400	1.1	3.0	0.05	100				
MR836			MR830	.R	600	1.1	3.0	0.05	100				

.R t_{rr} 200 ns
MR810 series 750 ns

DIODE, RECTIFIER INDEX (continued)

Type	MATERIAL	Replacement	Ref.	IDENTIFICATION	RECTIFIERS: V_R Volts / SIGNAL DIODES: PRV Volts	V_F Volts / V_F @ Volts	I_O Amp / I_F	I_R mA / I_R	I_{FSM} Amp / t_{rr} µs	ZENER DIODES: V_Z(Nom) / REFERENCE DIODES: V_Z (Nom)	I_{ZT} mA / TC %/°C	Tol V_Z ±% / I_{zt} mA	P_D / Temp Range
MR840			MR830	.R	50	1.2	3.0	0.075	100				
MR841			MR830	.R	100	1.2	3.0	0.075	100				
MR842			MR830	.R	200	1.2	3.0	0.075	100				
MR844			MR830	.R	400	1.2	3.0	0.075	100				
MR846			MR830	.R	600	1.2	3.0	0.075	100				
MR850	S		MR850	.R	50	1.25	3.0	0.01	100				
MR851	S		MR850	.R	100	1.25	3.0	0.01	100				
MR852	S		MR850	.R	200	1.25	3.0	0.01	100				
MR854	S		MR850	.R	400	1.25	3.0	0.01	100				
MR856	S		MR850	.R	600	1.25	3.0	0.01	100				
MR860	S		MR860	.R	50	1.4	40	0.05	350				
MR861	S		MR860	.R	100	1.4	40	0.05	350				
MR862	S		MR860	.R	200	1.4	40	0.05	350				
MR864	S		MR860	.R	400	1.4	40	0.05	350				
MR866	S		MR860	.R	600	1.4	40	0.05	350				
MR870			MR870	.R	50	1.4	50	0.05	400				
MR871			MR870	.R	100	1.4	50	0.05	400				
MR872			MR870	.R	200	1.4	50	0.05	400				
MR874			MR870	.R	400	1.4	50	0.05	400				
MR876			MR870	.R	600	1.4	50	0.05	400				
MR990A	S		MR990A	R	1000	1.7	0.25	0.1	15				
MR991A	S		MR990A	R	1500	1.7	0.25	0.1	15				
MR992A	S		MR990A	R	2000	1.7	0.25	0.1	15				
MR993A	S		MR990A	R	2500	1.7	0.25	0.1	15				
MR994A	S		MR900A	R	3000	1.7	0.25	0.1	15				
MR995A	S		MR990A	R	4000	1.7	0.25	0.1	15				
MR996A	S		MR990A	R	5000	1.7	0.25	0.1	15				
MR1120	S		MR1120	R	50	1.0	12	0.5	300				
MR1121	S		MR1120	R	100	1.0	12	0.5	300				
MR1122	S		MR1120	R	200	0.55	12	0.5	300				
MR1123	S		MR1120	R	300	0.55	12	0.5	300				
MR1124	S		MR1120	R	400	0.55	12	0.5	300				
MR1125	S		MR1120	R	500	0.55	12	0.5	300				
MR1126	S		MR1120	R	600	0.55	12	0.5	300				
MR1128	S		MR1120	R	800	0.55	12	0.5	300				
MR1130	S		MR1120	R	1000	0.55	12	0.5	300				
MR1200	S		MR1200	R	50	0.4	50	10	500				
MR1201	S		MR1200	R	100	0.4	50	10	500				
MR1202	S		MR1200	R	150	0.4	50	10	500				
MR1203	S		MR1200	R	200	0.4	50	10	500				
MR1204	S		MR1200	R	250	0.4	50	10	500				
MR1205	S		MR1200	R	300	0.4	50	10	500				
MR1206	S		MR1200	R	350	0.4	50	10	500				
MR1207	S		MR1200	R	400	0.4	50	10	500				
MR1210	S		MR1210	R	50	0.4	80	15	2000				
MR1211	S		MR1210	R	100	0.4	80	15	2000				
MR1212	S		MR1210	R	150	0.4	80	15	2000				
MR1213	S		MR1210	R	200	0.4	80	15	2000				
MR1214	S		MR1210	R	250	0.4	80	15	2000				
MR1215	S		MR1210	R	300	0.4	80	15	2000				

.R t_{rr} 200 ns
MR840 series 1000 ns

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DIODE, RECTIFIER INDEX (continued)

Type	MATERIAL	Replacement	Ref.	IDENTIFICATION	RECTIFIERS: V_R Volts / SIGNAL DIODES: PRV Volts	V_F Volts / V_F Volts @	I_O Amp / I_F	I_R mA / I_R	I_{FSM} Amp / t_{rr} µs	ZENER DIODES: V_Z(Nom) / REFERENCE DIODES: V_Z (Nom)	I_{ZT} mA / TC %/°C	Tol V_Z ±% / I_{zt} mA	P_D / Temp Range
MR1216	S		MR1210	R	350	0.4	80	15	2000				
MR1217	S		MR1210	R	400	0.4	80	15	2000				
MR1218	S		MR1210	R	500	0.4	80	15	2000				
MR1219	S		MR1210	R	600	0.4	80	15	2000				
MR1220	S		MR1220	R	50	0.4	160	20	3600				
MR1221	S		MR1220	R	100	0.4	160	20	3600				
MR1222	S		MR1220	R	150	0.4	160	20	3600				
MR1223	S		MR1220	R	200	0.4	160	20	3600				
MR1224	S		MR1220	R	250	0.4	160	20	3600				
MR1225	S		MR1220	R	300	0.4	160	20	3600				
MR1226	S		MR1220	R	350	0.4	160	20	3600				
MR1227	S		MR1220	R	400	0.4	160	20	3600				
MR1230	S		MR1230	R	50	0.4	240	35	5000				
MR1231	S		MR1230	R	100	0.4	240	35	5000				
MR1232	S		MR1230	R	150	0.4	240	35	5000				
MR1233	S		MR1230	R	200	0.4	240	35	5000				
MR1234	S		MR1230	R	250	0.4	240	35	5000				
MR1235	S		MR1230	R	300	0.4	240	35	5000				
MR1236	S		MR1230	R	350	0.4	240	35	5000				
MR1237	S		MR1230	R	400	0.4	240	35	5000				
MR1240	S		MR1240	R	50	0.4	400	50	8000				
MR1241	S		MR1240	R	100	0.4	400	50	8000				
MR1242	S		MR1240	R	150	0.4	400	50	8000				
MR1243	S		MR1240	R	200	0.4	400	50	8000				
MR1244	S		MR1240	R	250	0.4	400	50	8000				
MR1245	S		MR1240	R	300	0.4	400	50	8000				
MR1246	S		MR1240	R	350	0.4	400	50	8000				
MR1247	S		MR1240	R	400	0.4	400	50	8000				
MR1260	S		MR1260	R	50	0.4	650	100	12,000				
MR1261	S		MR1260	R	100	0.4	650	100	12,000				
MR1262	S		MR1260	R	150	0.4	650	100	12,000				
MR1263	S		MR1260	R	200	0.4	650	100	12,000				
MR1264	S		MR1260	R	250	0.4	650	100	12,000				
MR1265	S		MR1260	R	300	0.4	650	100	12,000				
MR1266	S		MR1260	R	350	0.4	650	100	12,000				
MR1267	S		MR1260	R	400	0.4	650	100	12,000				
MR1290	S		MR1290	R	50	0.4	1000	200	18,000				
MR1291	S		MR1290	R	100	0.4	1000	200	18,000				
MR1292	S		MR1290	R	150	0.4	1000	200	18,000				
MR1293	S		MR1290	R	200	0.4	1000	200	18,000				
MR1294	S		MR1290	R	250	0.4	1000	200	18,000				
MR1295	S		MR1290	R	300	0.4	1000	200	18,000				
MR1296	S		MR1290	R	350	0.4	1000	200	18,000				
MR1297	S		MR1290	R	400	0.4	1000	200	18,000				
MR1337-1	S		MR1337	.R	50	1.1	1000	0.25	30				
MR1337-2	S		MR1337	.R	100	1.1	1000	0.25	30				
MR1337-3	S		MR1337	.R	200	1.1	1000	0.25	30				
MR1337-4	S		MR1337	.R	300	1.1	1000	0.25	30				
MR1337-5	S		MR1337	.R	400	1.1	1000	0.25	30				
MR1366	S		1N4933	.R	600	1.2	6.0	0.015	150				
MR1376	S		1N4933	.R	600	1.4	12	0.015	200				
MR1386	S		1N4933	.R	600	1.4	20	0.025	250				
MR1396	S		1N4933	.R	600	1.4	30	0.025	300				
MR1810	S		MR1210	R	50	0.4	80	15	2000				
MR1811	S		MR1210	R	100	0.4	80	15	2000				
MR1812	S		MR1210	R	150	0.4	80	15	2000				
MR1813	S		MR1210	R	200	0.4	80	15	2000				
MR1814	S		MR1210	R	250	0.4	80	15	2000				
MR1815	S		MR1210	R	300	0.4	80	15	2000				

.R t_{rr} 200 ns

DIODE, RECTIFIER INDEX (continued)

Type	MATERIAL	Replacement	Ref.	IDENTIFICATION	RECTIFIERS: V_R Volts / SIGNAL DIODES: PRV Volts	RECTIFIERS: V_F Volts / SIGNAL DIODES: V_F Volts @	RECTIFIERS: I_O Amp / SIGNAL DIODES: I_F	RECTIFIERS: I_R mA / SIGNAL DIODES: I_R	RECTIFIERS: I_{FSM} Amp / SIGNAL DIODES: t_{rr} μs	ZENER DIODES: V_Z(Nom) / REFERENCE DIODES: V_Z (Nom)	ZENER DIODES: I_{ZT} mA / REFERENCE DIODES: TC %/°C	ZENER DIODES: Tol V_Z ±% / REFERENCE DIODES: I_{zt} mA	ZENER DIODES: P_D / REFERENCE DIODES: Temp Range
MR1816	S		MR1210	R	350	0.4	80	15	2000				
MR1817	S		MR1210	R	400	0.4	80	15	2000				
MR1818	S		MR1210	R	500	0.4	80	15	2000				
MR1819	S		MR1210	R	600	0.4	80	15	2000				
MR2064	S		MR2064	R	50	1.2	1.0	25	30				
MR2065	S		MR2064	R	100	1.2	1.0	25	30				
MR2066	S		MR2064	R	200	1.2	1.0	25	30				
MR2067	S		MR2064	R	400	1.2	1.0	25	30				
MR2068	S		MR2064	R	600	1.2	1.0	25	30				
MR2069	S		MR2069	R	50								
MR2070	S		MR2069	R	100	0.5	3.0	1.0	300				
MR2071	S		MR2069	R	200	0.5	3.0	1.0	300				
MR2072	S		MR2069	R	300	0.5	3.0	1.0	300				
MR2073	S		MR2069	R	400	0.5	3.0	1.0	300				
MR2074	S		MR2069	R	500	0.5	3.0	1.0	300				
MR2075	S		MR2069	R	600	0.5	3.0	1.0	300				
MR2080HA	S		MR2084HA	R	50	0.5	750	4.0	12,000				
MR2081HA	S		MR2084HA	R	100	0.5	750	4.0	12,000				
MR2082HA	S		MR2084HA	R	200	0.5	750	4.0	12,000				
MR2083HA	S		MR2084HA	R	300	0.5	750	4.0	12,000				
MR2084HA	S		MR2084HA	R	400	0.5	750	4.0	12,000				
MR2100HA	S		MR2100HA	R	50	0.5	1100	5.0	18,000				
MR2101HA	S		MR2100HA	R	100	0.5	1100	5.0	18,000				
MR2102HA	S		MR2100HA	R	200	0.5	1100	5.0	18,000				
MR2103HA	S		MR2100HA	R	300	0.5	1100	5.0	18,000				
MR2104HA	S		MR2100HA	R	400	0.5	1100	5.0	18,000				
MR2261	S		MR2261	R	10	1.5	25	1.0	300				
MR2262	S		MR2261	R	20	1.5	25	1.0	300				
MR2263	S		MR2261	R	30	1.5	25	1.0	300				
MR2264	S		MR2261	R	40	1.5	25	1.0	300				
MR2265	S		MR2261	R	50	1.5	25	1.0	300				
MR2266	S		MR2261	R	800	1.1	1.0	0.01	30				
MR2271	S		MR2271	R	300	1.1	1.0	0.025	30				
MR2272	S		MR2272	R	400	1.1	1.0	0.01	30				
MR2273	S		MR2266	R	200	1.1	1.0	0.01	30				
MR2369	S		MR2369	R	50	1.0	3.0	1.0	300				
MR2370	S		MR2369	R	100	1.0	3.0	1.0	300				
MR2371	S		MR2369	R	200	1.0	3.0	1.0	300				
MR2372	S		MR2369	R	300	1.0	3.0	1.0	300				
MR2373	S		MR2369	R	400	1.0	3.0	1.0	300				
MR2374	S		MR2369	R	500	1.0	3.0	1.0	300				
MR2375	S		MR2369	R	600	1.0	3.0	1.0	300				
MR9600	S		MR9600	R	25	1.3	0.8	0.5	15				
MR9601	S		MR9600	R	50	1.3	0.8	0.5	15				
MR9602	S		MR9600	R	100	1.3	0.8	0.5	15				
MR9603	S		MR9600	R	200	1.3	0.8	0.5	15				
MR9604	S		MR9600	R	400	1.3	0.8	0.5	15				
MRA130	S		MRA130	R	50	0.5	150	1.5	3000				
MRA131	S		MRA130	R	100	0.5	150	1.5	3000				
MRA132	S		MRA130	R	200	0.5	150	1.5	3000				
MRA133	S		MRA130	R	300	0.5	150	1.5	3000				
MRA134	S		MRA130	R	400	0.5	150	1.5	3000				
MRA160	S		MRA160	R	50	0.5	300	3.0	6000				
MRA161	S		MRA160	R	100	0.5	300	3.0	6000				
MRA162	S		MRA160	R	200	0.5	300	3.0	6000				
MRA163	S		MRA160	R	300	0.5	300	3.0	6000				
MRA164	S		MRA160	R	400	0.5	300	3.0	6000				
MRA330	S		MRA330	R	50	0.5	100	1.0	2000				
MRA331	S		MRA330	R	100	0.5	100	1.0	2000				
MRA332	S		MRA330	R	200	0.5	100	1.0	2000				

DIODE, RECTIFIER INDEX(continued)

Type	MATERIAL	Replacement	Ref.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R Volts	V_F Volts	I_O Amp	I_R mA	I_{FSM} Amp	V_Z(Nom)	I_{ZT} mA	Tol V_Z ±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV Volts	V_F @ Volts	I_F	I_R	t_{rr} μs	V_Z (Nom)	TC %/°C	I_{zt} mA	Temp Range
MRA333	S		MRA330	R	300	0.5	100	1.0	2000				
MRA334	S		MRA330	R	400	0.5	100	1.0	2000				
MRA360	S		MRA360	R	50	0.5	220	3.0	5000				
MRA361	S		MRA360	R	100	0.5	220	3.0	5000				
MRA362	S		MRA360	R	200	0.5	220	3.0	5000				
MRA363	S		MRA360	R	300	0.5	220	3.0	5000				
MRA364	S		MRA360	R	400	0.5	220	3.0	5000				
MSD6100	S		MSD6100	R	100	0.7	200	5.0	500				
MSD6101	S		MSD6101	R	50	0.57	200	0.1	500				
MSD6102	S		MSD6102	R	70	1.0	200	0.1	500				
MSD6150	S		MSD6150	R	70	1.0	200	0.1	500				
MSD7000	S		MSD7000	R	100	0.55			500				
MZ70-2.4,A,B			MZ70-2.4	DZ						2.4	20	10	400M
MZ70-2.5,A,B			MZ70-2.4	DZ						2.5	20	10	400M
MZ70-2.7,A,B			MZ70-2.4	DZ						2.7	20	10	400M
MZ70-2.8,A,B			MZ70-2.4	DZ						2.8	20	10	400M
MZ70-3.0,A,B			MZ70-2.4	DZ						3.0	20	10	400M
MZ70-3.3,A,B			MZ70-2.4	DZ						3.3	20	10	400m
MZ70-3.6,A,B			MZ70-2.4	DZ						3.6	20	10	400m
MZ70-3.9,A,B			MZ70-2.4	DZ						3.9	20	10	400m
MZ70-4.3,A,B			MZ70-2.4	DZ						4.3	20	10	400m
MZ70-4.7,A,B			MZ70-2.4	DZ						4.7	20	10	400m
MZ70-5.1,A,B			MZ70-2.4	DZ						5.1	20	10	400m
MZ70-5.6,A,B			MZ70-2.4	DZ						5.6	20	10	400m
MZ70-6.0,A,B			MZ70-2.4	DZ						6.0	20	10	400m
MZ70-6.2,A,B			MZ70-2.4	DZ						6.2	20	10	400m
MZ70-6.8,A,B			MZ70-2.4	DZ						6.8	20	10	400m
MZ70-7.5,A,B			MZ70-2.4	DZ						7.5	20	10	400m
MZ70-8.2,A,B			MZ70-2.4	DZ						8.2	20	10	400m
MZ70-8.7,A,B			MZ70-2.4	DZ						8.7	20	10	400m
MZ70-9.1,A,B			MZ70-2.4	DZ						9.1	20	10	400m
MZ70-10,A,B			MZ70-2.4	DZ						10	20	10	400m
MZ70-11,A,B			MZ70-2.4	DZ						11	20	10	400m
MZ70-12,A,B			MZ70-2.4	DZ						12	20	10	400m
MZ70-13,A,B			MZ70-2.4	DZ						13	9.5	10	400m
MZ70-14,A,B			MZ70-2.4	DZ						14	9.0	10	400m
MZ70-15,A,B			MZ70-2.4	DZ						15	8.5	10	400m
MZ70-16,A,B			MZ70-2.4	DZ						16	7.8	10	400m
MZ70-17,A,B			MZ70-2.4	DZ						17	7.4	10	400m
MZ70-18,A,B			MZ70-2.4	DZ						18	7.0	10	400m
MZ70-19,A,B			MZ70-2.4	DZ						19	6.6	10	400m
MZ70-20,A,B			MZ70-2.4	DZ						20	6.2	10	400m
MZ70-22,A,B			MZ70-2.4	DZ						22	5.6	10	400m
MZ70-24,A,B			MZ70-2.4	DZ						24	5.2	10	400m
MZ70-25,A,B			MZ70-2.4	DZ						25	5.0	10	400m
MZ70-27,A,B			MZ70-2.4	DZ						27	4.6	10	400m
MZ70-28,A,B			MZ70-2.4	DZ						28	4.5	10	400m
MZ70-30,A,B			MZ70-2.4	DZ						30	4.2	10	400m
MZ70-33,A,B			MZ70-2.4	DZ						33	3.8	10	400m
MZ70-36,A,B			MZ70-2.4	DZ						36	3.4	10	400m
MZ70-39,A,B			MZ70-2.4	DZ						39	3.2	10	400m
MZ70-43,A,B			MZ70-2.4	DZ						43	3.0	10	400m
MZ70-47,A,B			MZ70-2.4	DZ						47	2.7	10	400m
MZ70-51,A,B			MZ70-2.4	DZ						51	2.5	10	400m
MZ70-56,A,B			MZ70-2.4	DZ						56	2.2	10	400m
MZ70-60,A,B			MZ70-2.4	DZ						60	2.1	10	400m
MZ70-62,A,B			MZ70-2.4	DZ						62	2.0	10	400m
MZ70-68,A,B			MZ70-2.4	DZ						68	1.8	10	400m
MZ70-75,A,B			MZ70-2.4	DZ						75	1.7	10	400m
MZ70-82,A,B			MZ70-2.4	DZ						82	1.5	10	400m

DIODE, RECTIFIER INDEX (continued)

Type	MATERIAL	Replacement	Ref.	IDENTIFICATION	RECTIFIERS: V_R Volts / SIGNAL DIODES: PRV Volts	V_F Volts / V_F @ Volts	I_O Amp / I_F	I_R mA / I_R	I_{FSM} Amp / t_{rr} µs	ZENER DIODES: V_Z(Nom) / REFERENCE DIODES: V_Z (Nom)	I_{ZT} mA / TC %/°C	Tol V_Z ±% / I_{zt} mA	P_D / Temp Range
MZ70-87,A,B			MZ70-2.4	DZ						87	1.4	10	400m
MZ70-91,A,B			MZ70-2.4	DZ						91	1.4	10	400m
MZ70-100,A,B			MZ70-2.4	DZ						100	1.3	10	400m
MZ70-110,A,B			MZ70-2.4	DZ						110	1.1	10	400m
MZ70-120,A,B			MZ70-2.4	DZ						120	1.0	10	400m
MZ70-130,A,B			MZ70-2.4	DZ						130	0.95	10	400m
MZ70-140,A,B			MZ70-2.4	DZ						140	0.90	10	400m
MZ70-150,A,B			MZ70-2.4	DZ						150	0.85	10	400m
MZ70-160,A,B			MZ70-2.4	DZ						160	0.80	10	400m
MZ70-170,A,B			MZ70-2.4	DZ						170	0.74	10	400m
MZ70-180,A,B			MZ70-2.4	DZ						180	0.68	10	400m
MZ70-190,A,B			MZ70-2.4	DZ						190	0.66	10	400m
MZ70-200,A,B			MZ70-2.4	DZ						200	0.65	10	400m
MZ500-1	S		MZ500-1	DZ						2.4	20		400M
MZ500-2	S		MZ500-1	DZ						2.7	20		400M
MZ500-3	S		MZ500-1	DZ						3.0	20		400M
MZ500-4	S		MZ500-1	DZ						3.3	20		400M
MZ500-5	S		MZ500-1	DZ						3.6	20		400M
MZ500-6	S		MZ500-1	DZ						3.9	20		400M
MZ500-7	S		MZ500-1	DZ						4.3	20		400M
MZ500-8	S		MZ500-1	DZ						4.7	20		400M
MZ500-9	S		MZ500-1	DZ						5.1	20		400M
MZ500-10	S		MZ500-1	DZ						5.6	20		400M
MZ500-11	S		MZ500-1	DZ						6.2	20		400M
MZ500-12	S		MZ500-1	DZ						6.8	20		400M
MZ500-13	S		MZ500-1	DZ						7.5	20		400M
MZ500-14	S		MZ500-1	DZ						8.2	20		400M
MZ500-15	S		MZ500-1	DZ						9.1	20		400M
MZ500-16	S		MZ500-1	DZ						10	20		400M
MZ500-17	S		MZ500-1	DZ						11	20		400M
MZ500-18	S		MZ500-1	DZ						12	20		400M
MZ500-19	S		MZ500-1	DZ						13	9.5		400M
MZ500-20	S		MZ500-1	DZ						15	8.5		400M
MZ500-21	S		MZ500-1	DZ						16	7.8		400M
MZ500-22	S		MZ500-1	DZ						18	7.0		400M
MZ500-23	S		MZ500-1	DZ						20	6.2		400M
MZ500-24	S		MZ500-1	DZ						22	5.6		400M
MZ500-25	S		MZ500-1	DZ						24	5.2		400M
MZ500-26	S		MZ500-1	DZ						27	4.6		400M
MZ500-27	S		MZ500-1	DZ						30	4.2		400M
MZ500-28	S		MZ500-1	DZ						33	3.8		400M
MZ500-29	S		MZ500-1	DZ						36	3.4		400M
MZ500-30	S		MZ500-1	DZ						39	3.2		400M
MZ500-31	S		MZ500-1	DZ						43	3.0		400M
MZ500-32	S		MZ500-1	DZ						47	2.7		400M
MZ500-33	S		MZ500-1	DZ						51	2.5		400M
MZ500-34	S		MZ500-1	DZ						56	2.2		400M
MZ500-35	S		MZ500-1	DZ						62	2.0		400M
MZ500-36	S		MZ500-1	DZ						68	1.8		400M
MZ500-37	S		MZ500-1	DZ						75	1.7		400M
MZ500-38	S		MZ500-1	DZ						82	1.5		400M
MZ500-39	S		MZ500-1	DZ						91	1.4		400M
MZ500-40	S		MZ500-1	DZ						100	1.3		400M
MZ1000-1	S	MZ1000	MZ1000-1	DZ						3.3	76		1.5W
MZ1000-2	S	MZ1000	MZ1000-1	DZ						3.6	69		1.5W
MZ1000-3	S	MZ1000	MZ1000-1	DZ						3.9	64		1.5W
MZ1000-4	S	MZ1000	MZ1000-1	DZ						4.3	58		1.5W
MZ1000-5	S	MZ1000	MZ1000-1	DZ						4.7	53		1.5W
MZ1000-6	S	MZ1000	MZ1000-1	DZ						5.1	49		1.5W
MZ1000-7	S	MZ1000	MZ1000-1	DZ						5.6	45		1.5W

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Type	MATERIAL	Replacement	Ref.	IDENTIFICATION	RECTIFIERS: V_R Volts / SIGNAL DIODES: PRV Volts	V_F Volts / V_F Volts	I_O Amp / @ I_F	I_R mA / I_R	I_{FSM} Amp / t_{rr} μs	ZENER DIODES: V_Z(Nom) / REFERENCE DIODES: V_Z (Nom)	I_{ZT} mA / TC %/°C	Tol V_Z ±% / I_{zt} mA	P_D / Temp Range
MZ1000-8	S	MZ1000	MZ1000-1	DZ						6.2	41		1.5W
MZ1000-9	S	MZ1000	MZ1000-1	DZ						6.8	37		1.5W
MZ1000-10	S	MZ1000	MZ1000-1	DZ						7.5	34		1.5W
MZ1000-11	S	MZ1000	MZ1000-1	DZ						8.2	31		1.5W
MZ1000-12	S	MZ1000	MZ1000-1	DZ						9.1	28		1.5W
MZ1000-13	S	MZ1000	MZ1000-1	DZ						10	25		1.5W
MZ1000-14	S	MZ1000	MZ1000-1	DZ						11	23		1.5W
MZ1000-15	S	MZ1000	MZ1000-1	DZ						12	21		1.5W
MZ1000-16	S	MZ1000	MZ1000-1	DZ						13	19		1.5W
MZ1000-17	S	MZ1000	MZ1000-1	DZ						15	17		1.5W
MZ1000-18	S	MZ1000	MZ1000-1	DZ						16	15.5		1.5W
MZ1000-19	S	MZ1000	MZ1000-1	DZ						18	14		1.5W
MZ1000-20	S	MZ1000	MZ1000-1	DZ						20	12.5		1.5W
MZ1000-21	S	MZ1000	MZ1000-1	DZ						22	11.5		1.5W
MZ1000-22	S	MZ1000	MZ1000-1	DZ						24	10.5		1.5W
MZ1000-23	S	MZ1000	MZ1000-1	DZ						27	9.5		1.5W
MZ1000-24	S	MZ1000	MZ1000-1	DZ						30	8.5		1.5W
MZ1000-25	S	MZ1000	MZ1000-1	DZ						33	7.5		1.5W
MZ1000-26	S	MZ1000	MZ1000-1	DZ						36	7.0		1.5W
MZ1000-27	S	MZ1000	MZ1000-1	DZ						39	6.5		1.5W
MZ1000-28	S	MZ1000	MZ1000-1	DZ						43	6.0		1.5W
MZ1000-29	S	MZ1000	MZ1000-1	DZ						47	5.5		1.5W
MZ1000-30	S	MZ1000	MZ1000-1	DZ						51	5.0		1.5W
MZ1000-31	S	MZ1000	MZ1000-1	DZ						56	4.5		1.5W
MZ1000-32	S	MZ1000	MZ1000-1	DZ						62	4.0		1.5W
MZ1000-33	S	MZ1000	MZ1000-1	DZ						68	3.7		1.5W
MZ1000-34	S	MZ1000	MZ1000-1	DZ						75	3.3		1.5W
MZ1000-35	S	MZ1000	MZ1000-1	DZ						82	3.0		1.5W
MZ1000-36	S	MZ1000	MZ1000-1	DZ						91	2.8		1.5W
MZ1000-37	S	MZ1000	MZ1000-1	DZ						100	2.5		1.5W
MZ4614	S	1N4099	1N4099	DZ						1.8	0.25	5.0	250M
MZ4615	S	1N4099	1N4099	DZ						2.0	0.25	5.0	250M
MZ4616	S	1N4099	1N4099	DZ						2.2	0.25	5.0	250M
MZ4617	S	1N4099	1N4099	DZ						2.4	0.25	5.0	250M
MZ4618	S	1N4099	1N4099	DZ						2.7	0.25	5.0	250M
MZ4619	S	1N4099	1N4099	DZ						3.0	0.25	5.0	250M
MZ4620	S	1N4099	1N4099	DZ						3.3	0.25	5.0	250M
MZ4621	S	1N4099	1N4099	DZ						3.6	0.25	5.0	250M
MZ4622	S	1N4099	1N4099	DZ						3.9	0.25	5.0	250M
MZ4623	S	1N4099	1N4099	DZ						4.3	0.25	5.0	250M
MZ4624	S	1N4099	1N4099	DZ						4.7	0.25	5.0	250M
MZ4625	S	1N4099	1N4099	DZ						5.1	0.25	5.0	250M
MZ4626	S	1N4099	1N4099	DZ						5.6	0.25	5.0	250M
MZ4627	S	1N4099	1N4099	DZ						6.2	0.25	5.0	250M
MZC2.4A10	S		MZC2.4A10	DZ						2.4	21	10	5.0W
MZC2.5A10	S		MZC2.4A10	DZ						2.5	20	10	5.0W
MZC2.7A10	S		MZC2.4A10	DZ						2.7	19	10	5.0W
MZC2.8A10	S		MZC2.4A10	DZ						2.8	18	10	5.0W
MZC3.0A10	S		MZC2.4A10	DZ						3.0	17	10	5.0W
MZC3.3A10	S		MZC2.4A10	DZ						3.3	15	10	5.0W
MZC3.6A10	S		MZC2.4A10	DZ						3.6	14	10	5.0W
MZC3.9A10	S		MZC2.4A10	DZ						3.9	13	10	5.0W
MZC4.3A10	S		MZC2.4A10	DZ						4.3	12	10	5.0W
MZC4.7A10	S		MZC2.4A10	DZ						4.7	11	10	5.0W
MZC5.1A10	S		MZC2.4A10	DZ						5.1	9.8	10	5.0W
MZC5.6A10	S		MZC2.4A10	DZ						5.6	8.9	10	5.0W
MZC6.0A10	S		MZC2.4A10	DZ						6.0	8.3	10	5.0W
MZC6.2A10	S		MZC2.4A10	DZ						6.2	8.1	10	5.0W
MZC6.8A10	S		MZC2.4A10	DZ						6.8	7.3	10	5.0W
MZC7.5A10	S		MZC2.4A10	DZ						7.5	6.7	10	5.0W

DIODE, RECTIFIER INDEX (continued)

Type	MATERIAL	Replacement	Ref.	IDENTIFICATION	RECTIFIERS V_R Volts / SIGNAL DIODES PRV Volts	V_F Volts / V_F Volts @	I_O Amp / I_F	I_R mA / I_R	I_{FSM} Amp / t_{rr} μs	ZENER DIODES V_Z(Nom) / REFERENCE DIODES V_Z (Nom)	I_{ZT} mA / TC %/°C	Tol V_Z ±% / I_{zt} mA	P_D / Temp Range
MZC8.2A10	S		MZC2.4A10	DZ						8.2	6.1	10	5.0W
MZC8.7A10	S		MZC2.4A10	DZ						8.7	5.7	10	5.0W
MZC9.1A10	S		MZC2.4A10	DZ						9.1	5.5	10	5.0W
MZC10A10	S		MZC2.4A10	DZ						10	5.0	10	5.0W
MZC11A10	S		MZC2.4A10	DZ						11	4.5	10	5.0W
MZC12A10	S		MZC2.4A10	DZ						12	4.2	10	5.0W
MZC13A10	S		MZC2.4A10	DZ						13	3.8	10	5.0W
MZC14A10	S		MZC2.4A10	DZ						14	3.6	10	5.0W
MZC15A10	S		MZC2.4A10	DZ						15	3.1	10	5.0W
MZC16A10	S		MZC2.4A10	DZ						16	2.9	10	5.0W
MZC17A10	S		MZC2.4A10	DZ						17	2.8	10	5.0W
MZC18A10	S		MZC2.4A10	DZ						18	2.6	10	5.0W
MZC19A10	S		MZC2.4A10	DZ						19	2.5	10	5.0W
MZC20A10	S		MZC2.4A10	DZ						20	2.3	10	5.0W
MZC22A10	S		MZC2.4A10	DZ						22	2.1	10	5.0W
MZC24A10	S		MZC2.4A10	DZ						24	2.0	10	5.0W
MZC25A10	S		MZC2.4A10	DZ						25	1.9	10	5.0W
MZC27A10	S		MZC2.4A10	DZ						27	1.8	10	5.0W
MZC28A10	S		MZC2.4A10	DZ						28		10	5.0W
MZC30A10	S		MZC2.4A10	DZ						30	1.7	10	5.0W
MCZ33A10	S		MZC2.4A10	DZ						33	1.5	10	5.0W
MZC36A10	S		MZC2.4A10	DZ						36	1.4	10	5.0W
MZC39A10	S		MZC2.4A10	DZ						39	1.3	10	5.0W
MZC43A10	S		MZC2.4A10	DZ						43	1.2	10	5.0W
MZC47A10	S		MZC2.4A10	DZ						47	1.1	10	5.0W
MZC51A10	S		MZC2.4A10	DZ						51	0.98	10	5.0W
MZC56A10	S		MZC2.4A10	DZ						56	0.89	10	5.0W
MZC60A10	S		MZC2.4A10	DZ						60	0.83	10	5.0W
MZC62A10	S		MZC2.4A10	DZ						62	0.81	10	5.0W
MZC68A10	S		MZC2.4A10	DZ						68	0.74	10	5.0W
MZC75A10	S		MZC2.4A10	DZ						75	0.67	10	5.0W
MZC82A10	S		MZC2.4A10	DZ						82	0.61	10	5.0W
MZC87A10	S		MZC2.4A10	DZ						87	0.57	10	5.0W
MZC91A10	S		MZC2.4A10	DZ						91	0.55	10	5.0W
MZC100A10	S		MZC2.4A10	DZ						100	0.50	10	5.0W
MZC110A10	S		MZC2.4A10	DZ						110	0.45	10	5.0W
MZC120A10	S		MZC2.4A10	DZ						120	0.42	10	5.0W
MZC130A10	S		MZC2.4A10	DZ						130	0.38	10	5.0W
MZC140A10	S		MZC2.4A10	DZ						140	0.36	10	5.0W
MZC150A10	S		MZC2.4A10	DZ						150	0.33	10	5.0W
MZC160A10	S		MZC2.4A10	DZ						160	0.31	10	5.0W
MZC170A10	S		MZC2.4A10	DZ						170	0.29	10	5.0W
MZC180A10	S		MZC2.4A10	DZ						180	0.28	10	5.0W
MZC190A10	S		MZC2.4A10	DZ						190	0.26	10	5.0W
MZC200A10	S		MZC2.4A10	DZ						200	0.25	10	5.0W
MZC1.8B10	S		MZC2.4A10	DZ						1.8		10	5.0W
MZC2.0B10	S		MZC2.4A10	DZ						2.0		10	5.0W
MZC2.2B10	S		MZC2.4A10	DZ						2.2		10	5.0W
MZC2.4B10	S		MZC2.4A10	DZ						2.4		10	5.0W
MZC2.7B10	S		MZC2.4A10	DZ						2.7		10	5.0W
MZC3.0B10	S		MZC2.4A10	DZ						3.0		10	5.0W
MZC3.3B10	S		MZC2.4A10	DZ						3.3		10	5.0W
MZC3.6B10	S		MZC2.4A10	DZ						3.6		10	5.0W
MZC3.9B10	S		MZC2.4A10	DZ						3.9		10	5.0W
MZC4.3B10	S		MZC2.4A10	DZ						4.3		10	5.0W
MZC4.7B10	S		MZC2.4A10	DZ						4.7		10	5.0W
MZC5.1B10	S		MZC2.4A10	DZ						5.1		10	5.0W
MZC5.6B10	S		MZC2.4A10	DZ						5.6		10	5.0W
MZC6.2B10	S		MZC2.4A10	DZ						6.2		10	5.0W
MZC6.8B10	S		MZC2.4A10	DZ						6.8		10	5.0W

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Type	MATERIAL	Replacement	Ref.	IDENTIFICATION	RECTIFIERS					ZENER DIODES			
					V_R Volts	V_F Volts	I_O Amp	I_R mA	I_{FSM} Amp	V_Z(Nom)	I_{ZT} mA	Tol V_Z ±%	P_D
					SIGNAL DIODES					REFERENCE DIODES			
					PRV Volts	V_F @ Volts	I_F	I_R	t_{rr} µs	V_Z (Nom)	TC %/°C	I_{zt} mA	Temp Range
MZC7.5B10	S		MZC2.4A10	DZ						7.5		10	5.0W
MZC8.2B10	S		MZC2.4A10	DZ						8.2		10	5.0W
MZC8.7B10	S		MZC2.4A10	DZ						8.7		10	5.0W
MZC9.1B10	S		MZC2.4A10	DZ						9.1		10	5.0W
MZC10B10	S		MZC2.4A10	DZ						10		10	5.0W
MZC11B10	S		MZC2.4A10	DZ						11		10	5.0W
MZC12B10	S		MZC2.4A10	DZ						12		10	5.0W
MZC13B10	S		MZC2.4A10	DZ						13		10	5.0W
MZC14B10	S		MZC2.4A10	DZ						14		10	5.0W
MZC15B10	S		MZC2.4A10	DZ						15		10	5.0W
MZC16B10	S		MZC2.4A10	DZ						16		10	5.0W
MZC17B10	S		MZC2.4A10	DZ						17		10	5.0W
MZC18B10	S		MZC2.4A10	DZ						18		10	5.0W
MZC19B10	S		MZC2.4A10	DZ						19		10	5.0W
MZC20B10	S		MZC2.4A10	DZ						20		10	5.0W
MZC22B10	S		MZC2.4A10	DZ						22		10	5.0W
MZC24B10	S		MZC2.4A10	DZ						24		10	5.0W
MZC25B10	S		MZC2.4A10	DZ						25		10	5.0W
MZC27B10	S		MZC2.4A10	DZ						27		10	5.0W
MZC28B10	S		MZC2.4A10	DZ						28		10	5.0W
MZC30B10	S		MZC2.4A10	DZ						30		10	5.0W
MZC33B10	S		MZC2.4A10	DZ						33		10	5.0W
MZC36B10	S		MZC2.4A10	DZ						36		10	5.0W
MZC39B10	S		MZC2.4A10	DZ						39		10	5.0W
MZC43B10	S		MZC2.4A10	DZ						43		10	5.0W
MZC47B10	S		MZC2.4A10	DZ						47		10	5.0W
MZC51B10	S		MZC2.4A10	DZ						51		10	5.0W
MZC56B10	S		MZC2.4A10	DZ						56		10	5.0W
MZC60B10	S		MZC2.4A10	DZ						60		10	5.0W
MZC62B10	S		MZC2.4A10	DZ						62		10	5.0W
MZC68B10	S		MZC2.4A10	DZ						68		10	5.0W
MZC75B10	S		MZC2.4A10	DZ						75		10	5.0W
MZC82B10	S		MZC2.4A10	DZ						82		10	5.0W
MZC87B10	S		MZC2.4A10	DZ						87		10	5.0W
MZC91B10	S		MZC2.4A10	DZ						91		10	5.0W
MZC100B10	S		MZC2.4A10	DZ						100		10	5.0W
MZC110B10	S		MZC2.4A10	DZ						110		10	5.0W
MZC120B10	S		MZC2.4A10	DZ						120		10	5.0W
MZC130B10	S		MZC2.4A10	DZ						130		10	5.0W
MZC140B10	S		MZC2.4A10	DZ						140		10	5.0W
MZC150B10	S		MZC2.4A10	DZ						150		10	5.0W
MZC160B10	S		MZC2.4A10	DZ						160		10	5.0W
MZC170B10	S		MZC2.4A10	DZ						170		10	5.0W
MZC180B10	S		MZC2.4A10	DZ						180		10	5.0W
MZC190B10	S		MZC2.4A10	DZ						190		10	5.0W
MZC200B10	S		MZC2.4A10	DZ						200		10	5.0W

HOT-CARRIER DIODES

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house non-registered hot-carrier diodes.

KEY

Type	Ref.	$V_{(BR)R}$ I_R = 10μA Volts Min	C_T V_R = 0V, F = 1.0MHz(1) V_R = 20V, F = 1.0MHz(2) pF Max	I_R V_R = 3.0V(3) V_R = 25V(4) V_R = 35V(5) μA Max	V_F I_F = 10mA Volts Max	NF dB Max	τ ps Max
Alpha-numerical Listings							

- Type: Alpha-numerical Listings
- Ref.: Reference device number indicates specific Data Sheet on which device is characterized.
- $V_{(BR)R}$: Reverse Breakdown Voltage
- C_T: Diode Capacitance
- I_R: Reverse Leakage
- V_F: Forward Voltage
- NF: Noise Figure
- τ: Minority Carrier Lifetime

HOT-CARRIER DIODES

Type	Ref.	$V_{(BR)R}$ I_R = 10μA Volts min	C_T V_R = 0V, F = 1.0MHz(1) V_R = 20V, F = 1.0MHz(2) pF Max	I_R V_R = 3.0V(3) V_R = 25V(4) V_R = 35V(5) μA Max	V_F I_F = 10mA Volts Max	NF dB Max	τ ps Max
MBD101	MDB101	4.0	1.0(1)	0.25(3)	0.6	7.0	
MBD102	MBD102	4.0	1.0(1)	0.25(3)	0.6	7.0	
MBD501	MBD501	50	1.0(2)	0.20(4)	1.2		100
MBD502	MBD502	50	1.0(2)	0.20(4)	1.2		
MBD701	MBD501	70	1.0(2)	0.20(5)	1.2		100
MBD702	MBD502	70	1.0(2)	0.20(5)	1.2		

HOT-CARRIER RECTIFIERS

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house non-registered hot-carrier rectifiers.

KEY

Type	Ref.	V_{RRM} Volts	I_O TC = 50°C Amp	I_{FSM} Amp	I_R TC = 25°C mA	V_F I_F @ 25 Amp TC = 25°C Volts
Alpha-numerical Listings						
Reference Device Number indicates specific data sheet on which device is characterized						
Peak Reverse Voltage						
Average Forward Current						
Peak Surge Current						
Reverse Current						
Forward Voltage Drop						

HOT-CARRIER RECTIFIERS

Type	Ref.	V_{RRM} Volts	I_O TC = 50°C Amp	I_{FSM} Amp	I_R TC = 25°C mA	V_F I_F @ 25 Amp TC = 25°C Volts
MBD5300	MBD5300	20	5.0	500	20	0.50
MBD5400	MBD5400	20	25	600	30	IF = 75 Amp 0.75
MBD5500	MBD5500	20	50	800	200	IF = 100 Amp 0.65
MBD5550	MBD5550	20	50	800	120	IF = 100 Amp 0.65
MBD5550A	MBD5550	20	50	800	75	IF = 100 Amp 0.75

RECTIFIER ASSEMBLIES

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house non-registered rectifier assemblies.

KEY

Type	Material	Ref.	V_{RRM} Volts	I_{FSM} Amp	I_{FRM} Amp	I_O Amp @ °C
Alpha-numerical Listings	S – Silicon G – Germanium	Reference Device number indicates specific data sheet on which device is characterized	Peak Reverse Voltage	Peak Surge Current	Peak Forward Current	DC Output Current Amp @ °C

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RECTIFIER ASSEMBLIES

Type	Material	Ref.	V_{RRM} Volts	I_{FSM} Amp	I_{FRM} Amp	I_O Amp	@ °C
MDA920-1	S	MDA920	25	32	5.0	1.0	75
MDA920-2	S	MDA920	50	32	5.0	1.0	75
MDA920-3	S	MDA920	100	32	5.0	1.0	75
MDA920-4	S	MDA920	200	32	5.0	1.0	75
MDA920-5	S	MDA920	300	32	5.0	1.0	75
MDA920-6	S	MDA920	400	32	5.0	1.0	75
MDA920-7	S	MDA920	600	32	5.0	1.0	75
MDA922-1	S	MDA922-1	25	60		1.8	55
MDA922-2	S	MDA922-1	50	60		1.8	55
MDA922-3	S	MDA922-1	100	60		1.8	55
MDA922-4	S	MDA922-1	200	60		1.8	55
MDA922-5	S	MDA922-1	300	60		1.8	55
MDA922-6	S	MDA922-1	400	60		1.8	55
MDA922-7	S	MDA922-1	600	60		1.8	55
MDA922-8	S	MDA922-1	800	60		1.8	55
MDA922-9	S	MDA922-1	1000	60		1.8	55
MDA930-1	S	MDA920	25	32	5.0	0.5	75
MDA930-2	S	MDA920	50	32	5.0	0.5	75
MDA930-3	S	MDA920	100	32	5.0	0.5	75
MDA930-4	S	MDA920	200	32	5.0	0.5	75
MDA930-5	S	MDA920	300	32	5.0	0.5	75
MDA930-6	S	MDA920	400	32	5.0	0.5	75
MDA930-7	S	MDA920	600	32	5.0	0.5	75
MDA940-1	S	MDA920	25	32	5.0	1.0	75
MDA940-2	S	MDA920	50	32	5.0	1.0	75
MDA940-3	S	MDA920	100	32	5.0	1.0	75
MDA940-4	S	MDA920	200	32	5.0	1.0	75
MDA940-5	S	MDA920	300	32	5.0	1.0	75
MDA940-6	S	MDA920	400	32	5.0	1.0	75
MDA940-7	S	MDA920	600	32	5.0	1.0	75
MDA942-1	S	MDA942	50	25	6.0	1.5	55
MDA942-2	S	MDA942	100	25	6.0	1.5	55
MDA942-3	S	MDA942	200	25	6.0	1.5	55
MDA942-4	S	MDA942	300	25	6.0	1.5	55
MDA942-5	S	MDA942	400	25	6.0	1.5	55
MDA942-6	S	MDA942	600	25	6.0	1.5	55
MDA950-1	S	MDA920	25	32	5.0	1.0	75
MDA950-2	S	MDA920	50	32	5.0	1.0	75
MDA950-3	S	MDA920	100	32	5.0	1.0	75
MDA950-4	S	MDA920	200	32	5.0	1.0	75
MDA950-5	S	MDA920	300	32	5.0	1.0	75
MDA950-6	S	MDA920	400	32	5.0	1.0	75
MDA950-7	S	MDA920	600	32	5.0	1.0	75
MDA952-1	S	MDA942	50	150	35	6.0	55
MDA952-2	S	MDA942	100	150	35	6.0	55
MDA952-3	S	MDA942	200	150	35	6.0	55
MDA952-4	S	MDA942	300	150	35	6.0	55
MDA952-5	S	MDA942	400	150	35	6.0	55
MDA952-6	S	MDA942	600	150	35	6.0	55
MDA952FR-1	S	MDA952FR-1	50	150		6.0	55

RECTIFIER ASSEMBLIES (continued)

Type	Material	Ref.	V_{RRM} Volts	I_{FSM} Amp	I_{FRM} Amp	I_O Amp	@ °C
MDA952FR-2	S	MDA952FR-1	100	150		6.0	55
MDA952FR-3	S	MDA952FR-1	200	150		6.0	55
MDA952FR-4	S	MDA952FR-1	300	150		6.0	55
MDA952FR-5	S	MDA952FR-1	400	150		6.0	55
MDA960-1	S	MDA960	50	100	15	2.5	55
MDA960-2	S	MDA960	100	100	15	2.5	55
MDA960-3	S	MDA960	200	100	15	2.5	55
MDA962-1	S	MDA960	50	250	60	10	55
MDA962-2	S	MDA942	100	250	60	10	55
MDA962-3	S	MDA942	200	250	60	10	55
MDA962-4	S	MDA942	300	250	60	10	55
MDA962-5	S	MDA942	400	250	60	10	55
MDA970-1	S	MDA960	50	150	25	4.0	55
MDA970-2	S	MDA960	100	150	25	4.0	55
MDA970-3	S	MDA960	200	150	25	4.0	55
MDA972-1	S	MDA942	35	250	60	16	55
MDA972-2	S	MDA942	70	250	60	16	55
MDA972-3	S	MDA942	140	250	60	16	55
MDA972-4	S	MDA942	210	250	60	16	55
MDA972-5	S	MDA942	280	250	60	16	55
MDA980-1	S	MDA980-1	50	300		12	55
MDA980-2	S	MDA980-1	100	300		12	55
MDA980-3	S	MDA980-1	200	300		12	55
MDA980-4	S	MDA980-1	300	300		12	55
MDA980-5	S	MDA980-1	400	300		12	55
MDA980-6	S	MDA980-1	600	300		12	55
MDA990-1	S	MDA980-1	50	300		27	55
MDA990-2	S	MDA980-1	100	300		27	55
MDA990-3	S	MDA980-1	200	300		27	55
MDA990-4	S	MDA980-1	300	300		27	55
MDA990-5	S	MDA980-1	400	300		27	55
MDA990-6	S	MDA980-1	600	300		27	55
MDA1330H	S	MDA1330H	5000	25		1.0	40
MAA1331H	S	MDA1330H	10,000	25		1.0	40
MDA1332H	S	MDA1330H	5000	250		2.5	40
MDA1333H	S	MDA1330H	10,000	250		2.5	40
MDA1491-1	S	MDA942	50	25	6.0	1.5	55
MDA1491-2	S	MDA942	100	25	6.0	1.5	55
MDA1491-3	S	MDA942	200	25	6.0	1.5	55
MDA1491-4	S	MDA942	300	25	6.0	1.5	55
MDA1491-5	S	MDA942	400	25	6.0	1.5	55
MDA1491-6	S	MDA942	600	25	6.0	1.5	55
MDA1505-1	S	MDA942	50	200	45	8.0	55
MDA1505-2	S	MDA942	100	200	45	8.0	55
MDA1505-3	S	MDA942	200	200	45	8.0	55
MDA1505-4	S	MDA942	300	200	45	8.0	55
MDA1505-5	S	MDA942	400	200	45	8.0	55
MDA1505-6	S	MDA942	600	200	45	8.0	55
MDA1591-1	S	MDA942	50	100	25	4.0	55
MDA1591-2	S	MDA942	100	100	25	4.0	55
MDA1591-3	S	MDA942	200	100	25	4.0	55
MDA1591-4	S	MDA942	300	100	25	4.0	55
MDA1591-5	S	MDA942	400	100	25	4.0	55
MDA1591-6	S	MDA942	600	100	25	4.0	55

VARACTOR DIODES

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house non-registered varactor diodes.

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KEY

Type	Ref.	CAPACITANCE				BV_R	Q @ f	P_D @ 25°C
		C_J C_T*	$\frac{C(max)}{C(min)}$	Voltage Range				
				V_1	V_2			
		pF		Volts	Volts	Volts	GHz	Watts

- **Type:** Numerical Listing of Registered Type Numbers
- **Ref.:** Reference device number Indicates specific Data Sheet on which device is characterized
- **C_J / C_T*:** Nominal Capacitance usually C_J (junction capacitance) With *, specified value is C_r (total capacitance) $Cr = C_J + C_C$
- **C(max)/C(min):** Effective tuning Ratio (Capacitance at Voltage V_1 divided by capacitance at Voltage V_2)
- **V_1, V_2:** Voltage range over which the tuning range is measured
- **BV_R:** Reverse Breakdown Voltage
- **Q @ f:** Figure of Merit at this specified frequency
- **P_D:** Power Dissipation at 25°C

VARACTOR DIODES INDEX

Type	Ref.	CAPACITANCE C_J C_T* pF	C(max)/C(min)	Voltage Range V_1 Volts	V_2 Volts	BV_R Volts	Q	@ f GHz	P_D @ 25°C Watts
BB105A	BB105A	2.8*	5.0	3.0	25	30	225	100M	0.4
BB105B	BB105A	2.3*	6.0	3.0	25	30	225	100M	0.4
BB105G	BB105A	2.8*	6.0	3.0	25	30	150	100M	0.4
MV104	MV104	42*				32	100	100M	
MV109	MV109	32*				30	280	50M	400mW
MV830	MV830	16.5*	2.0	4.0	25	30	30	0.05	0.4
MV831	MV830	19.8*	2.0	4.0	25	30	25	0.05	0.4
MV832	MV830	24.2*	2.1	4.0	25	30	25	0.05	0.4
MV833	MV830	29.7*	2.1	4.0	25	30	25	0.05	0.4
MV834	MV830	36.3*	2.12	4.0	25	30	20	0.05	0.4
MV835	MV830	42.9*	2.12	4.0	25	30	20	0.05	0.4
MV836	MV830	51.7*	2.15	4.0	25	30	15	0.05	0.4
MV837	MV830	61.6*	2.15	4.0	25	30	15	0.05	0.4
MV838	MV830	74.8*	2.18	4.0	25	30	15	0.05	0.4
MV839	MV830	90.2*	2.18	4.0	25	30	10	0.05	0.4
MV840	MV830	110*	2.18	4.0	25	30	10	0.05	0.4
MV1401	MV1401	633*	14	1.0	10	12	200	0.013	0.4
MV1403	MV1401		14	1.0	10	12	200	0.013	0.4
MV1404	MV1401		14	1.0	10	12	200	0.013	0.4
MV1405	MV1401		14	1.0	10	12	200	0.013	0.4
MV1620	MV1620	7.5*	3.2	2.0	20	20	300	0.05	2.0
MV1622	MV1620	9.0*	3.2	2.0	20	20	300	0.05	2.0
MV1624	MV1620	11*	32	2.0	20	20	300	0.05	2.0
MV1626	MV1620	13.2*	3.2	2.0	20	20	300	0.05	2.0
MV1628	MV1620	16.5*	3.2	2.0	20	20	250	0.05	2.0
MV1630	MV1620	19.8*	3.2	2.0	20	20	250	0.05	2.0
MV1632	MV1620	22.0*	3.2	2.0	20	20	250	0.05	2.0
MV1634	MV1620	24.2*	3.2	2.0	20	20	250	0.05	2.0
MV1636	MV1620	29.7*	3.2	2.0	20	20	200	0.05	2.0
MV1638	MV1620	36.3*	3.2	2.0	20	20	200	0.05	2.0
MV1640	MV1620	42.9*	3.2	2.0	20	20	200	0.05	2.0
MV1642	MV1620	51.7*	3.2	2.0	20	20	200	0.05	2.0
MV1644	MV1620	61.6*	3.2	2.0	20	20	150	0.05	2.0
MV1646	MV1620	74.8*	3.2	2.0	20	20	150	0.05	2.0
MV1648	MV1620	90.2*	3.2	2.0	20	20	150	0.05	2.0
MV1650	MV1620	110*	3.2	2.0	20	20	150	0.05	2.0
MV1652	MV1652	135*	2.6	2.0	20	20	350	0.02	0.4
MV1654	MV1652	165*	2.6	2.0	20	20	250	0.02	0.4
MV1656	MV1652	198*	2.6	2.0	20	20	200	0.02	0.4
MV1658	MV1652	220*	2.6	2.0	20	20	200	0.02	0.4
MV1660	MV1652	242*	2.6	2.0	20	20	150	0.02	0.4
MV1662	MV1652	275*	2.3	2.0	15	15	150	0.02	0.4
MV1664	MV1652	300*	2.3	2.0	15	15	100	0.02	0.4
MV1666	MV1652	363*	2.3	2.0	15	15	100	0.02	0.4
MV1804	1N4387	35				150	150	0.05	20
MV1805C	MV805C	30*				80			18
MV1806	1N4388	20*				100	200	0.05	10
MV1806C	1N5149	11.5*				80	800	0.05	10
MV1807C	1N5149	11.5*				80	800	0.05	14
MV1809C	MV1809C	14.4*				75			9.0
MV1809C1	MV1809C	13.2*				75			14
MV1810A	1N5154	2.1*				35	1700	0.05	3.5
MV1810B	1N5155	2.1*				35	1700	0.05	3.5
MV1812A	1N5156	1.0*				20	3600	0.05	3.25*
MV1812B	1N5157	0.6*				20	3600	0.05	3.25*
MV1816A	MV1816B	3.7*				75			7.5
MV1816A1	MV1816B	3.4*				75			11.5
MV1816B	MV1816B	3.6*				75			7.5
MV1816B1	MV1816B	3.3*				75			11.5
MV1817A	MV1817B	1.3*				35			5.0

VARACTOR DIODES (continued)

Type	Ref.	CAPACITANCE C_J C_T* pF	C(max)/C(min)	Voltage Range V_1 Volts	V_2 Volts	BV_R Volts	Q	@ f GHz	P_D @ 25°C Watts
MV1817A1	MV1817B	1.2*				35			7.0
MV1817B	MV1817B	1.2*				35			5.0
MV1817B1	MV1817B	1.1*				35			7.0
MV1858D	MV1858D	1.3*	2.7	4.0	60	60			5.0
MV1860D	MV1858D	2.64*	3.1	4.0	60	60			5.0
MV1862D	MV1858D	3.63*	3.3	4.0	60	60			5.0
MV1863D	MV1858D	5.17*	3.3	4.0	60	60			5.0
MV1864D	MV1858D	7.5*	2.4	4.0	60	60			5.0
MV1865D	MV1858D	9.02*	3.4	4.0	60	60			5.0
MV1866	MV1866	11*		4.0	60	60	700	50M	2.0
MV1868	MV1866	13.2*		4.0	60	60	700	50M	2.0
MV1868D	MV1858D	13.2*	3.5	4.0	60	60			5.0
MV1870	MV1866	16.5*		4.0	60	60	700	50M	2.0
MV1870D	MV1858D	16.5*	3.5	4.0	60	60			5.0
MV1871	MV1866	19.8*		4.0	60	60	700	50M	2.0
MV1872	MV1866	25.2*		4.0	60	60	700	50M	2.0
MV1874	MV1866	29.7*		4.0	60	60	700	50M	2.0
MV1876	MV1866	36.3*		4.0	60	60	700	50M	2.0
MV1877	MV1866	42.9*		4.0	60	60	700	50M	2.0
MV1878	MV1866	51.7		4.0	60	60	700	50M	2.0
MV2101	MV2101	7.5*	32	2.0	30	30	450	0.05	0.28
MV2102	MV2101	90*	3.2	2.0	30	30	450	0.05	0.28
MV2103	MV2101	11*	3.2	2.0	30	30	400	0.05	0.28
MV2104	MV2101	13.2*	3.2	2.0	30	30	400	0.05	0.28
MV2105	MV2101	16.5*	3.2	2.0	30	30	400	0.05	0.28
MV2106	MV2101	19.8*	3.2	2.0	30	30	350	0.05	0.28
MV2107	MV2101	24.2*	3.2	2.0	30	30	350	0.05	0.28
MV2108	MV2101	29.7*	3.2	2.0	30	30	300	0.05	0.28
MV2109	MV2101	36.3*	3.2	2.0	3.0	30	200	0.05	0.28
MV2110	MV2101	42.9*	3.2	2.0	3.0	30	150	0.05	0.28
MV2111	MV2101	51.7*	3.2	2.0	3.0	30	150	0.05	0.28
MV2112	MV2101	61.6*	3.3	2.0	3.0	30	150	0.05	0.28
MV2113	MV2101	74.8*	3.3	2.0	3.0	30	150	0.05	0.28
MV2114	MV2101	90.2*	3.3	2.0	3.0	30	100	0.05	0.28
MV2115	MV2101	110*	3.3	2.0	3.0	30	100	0.05	0.28
MV2201	MV2201	8.0*	2.3	1.0	10	25	300	0.05	0.28
MV2203	MV2201	11.5*	2.4	1.0	10	25	200	0.05	0.28
MV2205	MV2201	17*	2.5	1.0	10	25	200	0.05	0.28
MV2209	MV2201	37*	2.5	1.0	10	25	150	0.05	0.28
MV2301	MV2301	135*	2.3	2.0	20	20	250	0.02	0.5
MV2302	MV2301	165*	2.3	2.0	20	20	250	0.02	0.5
MV2303	MV2301	198*	2.3	2.0	20	20	200	0.02	0.5
MV2304	MV2301	220*	2.3	2.0	20	20	200	0.02	0.5
MV2305	MV2301	242*	2.3	2.0	20	20	150	0.02	0.5
MV2306	MV2301	275*	2.3	2.0	20	20	150	0.02	0.5
MV2307	MV2301	300*	2.3	2.0	20	20	100	0.02	0.5
MV2308	MV2301	363*	2.3	2.0	20	20	100	0.02	0.5
MV3102	MV3102	25*				30	300	50M	0.4
MV3103	MV3102	26*				30	200	50M	0.4
MV3140	MV3140	2.3*	4.5	3.0	25	30	150	0.1	0.4
MV3141	MV3140	3.2*	4.0	3.0	25	30	150	0.1	0.4
MV3142	MV3140	3.2*	3.5	3.0	25	30	50	0.1	0.4
MV3501	MV3501	7.5*				30	225	100M	0.4
MV3502	MV3501	9.0*				30	225	100M	0.4
MV3503	MV3501	11*				30	200	100M	0.4
MV3504	MV3501	13.2*				30	200	100M	0.4
MV3505	MV3501	16.5*				30	200	100M	0.4
MV3506	MV3501	19.8*				30	175	100M	0.4
MV3507	MV3501	24.2*				30	175	100M	0.4

SWITCHING DIODES

The following table contains an alpha-numerical listing and short-form specifications for Motorola in-house non registered switching diodes.

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KEY

SWITCHING DIODES

Type	Ref.	$V_{(BR)}$ @ $I_{(BR)}$ Volts Min / μA	V_F @ I_F Volts Min. / Max / mA	I_R @ V_R μA Max / Volts	C_c $V_R = 0$ pF	t_{rr} *Typical ns Max
Alpha-numerical Listings						
Reference decive number indicates specific Data Sheet on which device is characterized						
Breakdown Voltage						
Forward Voltage						
Reverse Current						
Capacitance						
Reverse Recovery Time						

SWITCHING DIODES

Type	Ref.	$V_{(BR)}$ Volts Min	@ $I_{(BR)}$ μA	V_F Volts Min.	V_F Volts Max	I_F mA	I_R μA Max	V_R Volts	C_c $V_R = 0$ pF	t_{rr} *Typical ns Max
MMD70	MMD70	50	100	0.75	1.2	100	0.1	30	2.5	15
MMD6050	MMD6050	70	100	0.55	0.7	100	0.1	50	2.0	5.0
MMD6100	MMD6050	70	100	0.55	0.7	100	0.1	50	2.0	5.0
MMD6150	MMD6050	70	100	0.55	0.7	100	0.1	50	2.0	5.0
MMD7000	MMD6050	70	100	0.55	0.7	100	0.1	50	2.0	5.0
MMD7001	MMD7001	40	10		1.05	300	0.1	30	3.5	3.2*

PIN SWITCHING DIODES

The following tables contain an alpha-numerical listing and short-form specifications for Motorola in-house non-registered PIN switching diodes.

KEY

Type	Ref.	$V_{(BR)R}$ $I_R = 10\mu Adc$ Volts Min	R_S I_F = *10mA I_F = 100mAdc(1) F = 1.0GHz(1) I_F =150mAdc(2) F = 3.0GHz(2) ohm Max	C_T V_R = 20V*(3) V_R = 50V(3) F = 1.0MHz(3) V_R = 250V(4) F = 1.0MHz(4) pF Max	τ I_F = 50mAdc ns Typ	L_S F = 3.0 GHz* F = 2.50MHz nH Typ	C_c F = 1.0MHz F_T = 1.0MHz pF Typ	θ_{JC} °C/W Max

- Type: Alpha-numerical Listings
- Ref.: Reference device number indicates specific Data Sheet on which device is characterized.
- $V_{(BR)R}$: Reverse Breakdown Voltage
- R_S: Series Resistance
- C_T: Total Device Capacitance
- τ: Minority Carrier Lifetime
- L_S: Series Inductance
- C_c: Case Capacitance
- θ_{JC}: Thermal Resistance, Junction to Case

PIN SWITCHING DIODES

Type	Ref.	$V_{(BR)R}$ $I_R = 10\mu Adc$ Volts Min	R_S I_F = *10mA I_F = 100mA(1) F = 1.0GHz(1) I_F = 150mA(2) F = 3.0GHz(2) ohm Max	C_T V_R = 20V*(3) V_R = 50V(3) F = 1.0MHz(3) V_R = 250V(4) F = 1.0MHz(4) pF Max	τ I_F = 50mA ns Typ	L_S F = 3.0GHz F = 2.50MHz nH Typ	C_c F = 1.0MHz F_T = 1.0MHz* pF Typ	θ_{JC} °C/W Max
MPN3201	MPN3201	150	1.0 (1)	0.44(3)	150	0.85	0.18	25
MPN3202	MPN3201	200	1.0 (2)	0.40(3)	150	0.85	0.18	25
MPN3208	MPN3208	800	0.4 (2)	4.0 (4)		0.55*	1.1*	4.0
MPN3209	MPN3208	900	0.4 (2)	4.0 (4)		0.55*	1.1*	4.0
MPN3401	MPN3401	35	0.7*	1.0*		3.0	0.1	
MPN3402	MPN3401	35	0.6*	2.0*		3.0	0.1	

LIGHT-EMITTING DIODES

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house non registered light-emitting diodes.

KEY

Type	Material	MAXIMUM RATINGS P_D @ 25°C	Ref. Point	T °C	Ref. Point	V_R Volts	I_F mA	ELECTRICAL/OPTICAL CHARACTERISTICS LIGHT OUTPUT B Brightness f_L @ I_F mA	CP Candle Power mcd @ I_F mA	P_O Radiated µW @I_F mA	λP Å	V_F Volts

- Type: Alpha-numerical Listings
- Material: GA – Gallium Arsenide; GAP – Gallium Arsenide Phosphide; GP – Gallium Phosphide
- P_D: Power Dissipation @ 25°C. Units: M = Milliwatts, W = Watts. Ref. Point: A, C, J, S Indicates – Ambient, Case, Junction or Stud
- T: Maximum Temperature. Ref. Point: J = Junction, S = Storage Junction
- V_R: Reverse Voltage
- I_F: Forward Current – Continuous
- B = Brightness in Footlamberts
- CP = Candlepower in Millicandela
- P_O = Power Output Radiated in Microwatts
- λP: Peak Emission Wavelength
- V_F: Forward Voltage

LIGHT-EMITTING DIODES

Type	Material	Use (1)	MAXIMUM RATINGS P_D @ 25°C	Ref. Point	T °C	Ref. Point	V_R Volts	I_F mA	ELECTRICAL/OPTICAL CHARACTERISTICS LIGHT OUTPUT B Brightness f_L	@ I_F mA	CP Candle Power mcd	@ I_F mA	P_O Radiated µW	@ I_F mA	λP Å	V_F Volts
MLED50	GAP	VLED	120m	A	85	J	3.0	50	750	20					6600	1.6
MLED55	GAP	VLED	120m	A	85	J	3.0	50			0.3	20			6600	2.0
MLED60	GA	ILED	120m	A	85	J	3.0	80					550	50	9000	1.2
MLED90	GA	ILED	120m	A	85	J	3.0	80					350	50	9000	1.2
MLED600	GAP	VLED	120m	A	85	J	4.0	50	1100	50					6600	1.6
MLED610	GAP	VLED	350m	A	125	J	4.0	75	1100	50					6600	1.6
MLED630	GAP	ILED	150m	A	85	J	4.0	75	1100	50					6600	1.6
MLED900	GA	ILED	120m	A	85	J	3.0	80					550	50	9000	1.2
MLED910	GA	ILED	350m	A	125	J	3.0	150					150	50	9000	1.2
MLED930	GA	ILED	250m	A	125	J	3.0	150					650	100	9000	1.2

(1) VLED = Visible Light Emitting Diode
ILED = Infrared Light Emitting Diode

OPTOELECTRONIC DEVICES

The following tables contain an alpha-numerical listing and short-form specifications for Motorola in-house non-registered optoelectronic devices.

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KEY

Type	Material	Polarity	Ref.	Use	MAXIMUM RATINGS P_D @ 25°C	Ref. Point	T_J °C	V_{CB} Volts	V_{CE} Volts	Subscript	ELECTRICAL CHARACTERISTICS S_{RCEO} Sensitivity mA/mW/cm2 nA/mW/cm2* μ/mW/cm2**	I_{CEO} Dark Current nA	$t_r + t_f$ ns* μs	I_L Light Current μA* mA

Type: Alpha-numerical Listings

Material:
S – Silicon
G – Germanium
GA– Gallium Arsenide
GAP– Gallium Arsenide Phosphide

Polarity:
N = n-channel
P = p-channel

Ref.: Reference device number indicates specific Data Sheet on which device is characterized.

Use:
RD = Radiation Detector
OC = Optical Coupler
VLED = Visible Light Emitting Diode
ILED = Infrared Light Emitting Diode

P_D: Power Dissipation at 25°C
Unites: M = milliwatts
W = watts
Ref. Point: A, C, J, S, Indicates Ambient, Case, Junction or Stud.

T_J: Maximum Operating Junction Temperature

V_{CB}: Maximum Collector – Base Voltage

V_{CE}: Maximum Collector-Emitter Voltage (Subscript Identifiers Condition)

O = Vceo, Base Open
R = Vcer, Specified Resistance
S = Vces, Base Shorted
V = Vcev, Used when only Voltage bias is used
X = Vcex, Base-Emitter Back Biased
U = Vce, Termination Undefined

S_{RCEO}: Collector-Emitter Radiation Sensitivity IC Units,
mA/mW/cm2
nA/mW/cm2*
μA/mV/cm2**

I_{CEO}: Collector Dark Current IC Unit na

$t_r + t_f$:
tr = Photo Current Rise Time
t_f = Photo Current Fall Time
IC Units = ns*, μs

I_L: Collection Light Current I_C Units μA* mA

OPTOELECTRONIC DEVICES

Type	Material	Polarity	Ref.	Use	MAXIMUM RATINGS P_D @ 25°C	Ref Point	T_J °C	V_{CB} Volts	V_{CE} Volts	Subscript	ELECTRICAL CHARACTERISTICS S_{RCEO} Sensitivity mA/mW/cm2 nA/mW/cm2* μ/mW/cm2**	I_{CEO} Dark Current nA	$t_r + t_f$ ns* μs	I_L Light Current μA* mA
MRD14B	S	N	2N5777	RD	200m	A	100	18	12	0	1.0	100	400	2.0
MRD100	S	N		RD	50m	A	85	80	40	0	0.04	100	6.5	0.2
MRD150	S	N		RD	50m	A	85	80	40	0	0.04	100	6.5	0.2
MRD200	S	N		RD	50m	A	125		50	0	0.25	25	6.5	1.25
MRD210	S	N		RD	50m	A	125		50	0	0.05	25	6.5	0.25
MRD250	S	N		RD	50m	A	125		50	0	0.1	25	6.5	0.5
MRD300	S	N		RD	250m	A	200	80	50	0		25	6.5	4.0
MRD310	S	N		RD	250m	A	200	80	50	0		25	6.5	1.0
MRD450	S	N		RD	100m	A	85		40	0	0.2	100	6.5	1.0
MRD500	S			RD	100m	A	200				1.2**	2.0	1.0*	6.0*
MRD510	S			RD	100m	A	200				0.3**	2.0	1.0*	1.5*
MRD600	S	N		RD	50m	A	125		50	0	0.04	25	6.5	0.2
MRD601	S	N		RD	50m	A	125		50	0	0.025	25	4.8	0.5
MRD602	S	N		RD	50m	A	125		50	0	0.1	25	4.8	2.0
MRD603	S	N		RD	50m	A	125		50	0	0.2	25	4.8	4.0
MRD604	S	N		RD	50m	A	125		50	0	0.35	25	4.8	7.0
MRD810	S	N		RD	250m	A	125		35	0	0.2	50	11	1.0
MRD3050	S	N		RD	400m	A	200	40	30	0	0.02	100	5.5	0.1
MRD3051	S	N		RD	400m	A	200	40	30	0	0.04	100	5.5	0.2
MRD3052	S	N		RD	400m	A	200	40	30	0	0.02	100	5.5	0.1
MRD3053	S	N		RD	400m	A	200	40	30	0	0.05	100	5.5	0.25
MRD3054	S	N		RD	400m	A	200	40	30	0	0.125	100	5.5	0.625
MRD3055	S	N		RD	400m	A	200	40	30	0	0.3	100	5.5	1.5
MRD3056	S	N		RD	400m	A	200	40	30	0	0.4	100	5.5	2.0
MRD6039D	S			RD	200m	A	100				14*	2.0		0.15*
MRD6039T	S			RD	200m	A	100		6.0	0	300*	10		3.0*
											DC Current Transfer % Ratio V_{CE} = 10, I_L = 10ma Min / Typ	Isolation Voltage Vdc	$t_r + t_f$ μs Typ	Frequency Response kHz Typ
MOC1000	GAP	N		OC	250m	A	100	70	30	0	20 / 60	1500	5.6	300

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THYRISTORS

The following tables contain an alpha-numerical listing and short-form specifications for Motorola in-house non registered thyristors.

KEY

TYPE	REPLACEMENT	REFERENCE	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} Volts	T_J T_C(1) °C	I_{GT} mA	V_{GT} Volts
Numerical Listing of Registered Type Numbers. * Device with gate turn-off characteristics							
	Type number of recommended replacement or of nearest electrical equivalent fully characterized in this book						
		Reference device number indicates specific Data Sheet on which device is characterized					
			On-State (RMS) Current				
				Peak Forward Blocking Voltage Peak Reverse Blocking Voltage			
					Maximum Junction Temperature, Maximum Case Temperature(1)		
						Gate Trigger Current	
							Gate Trigger Voltage

THYRISTOR INDEX

Type	Replacement	Ref.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} Volts	T_J T_C (1) °C	I_{GT} mA	V_{GT} Volts
MAC1-1	MAC1-1	MAC1	10	25	100	40	2.0
MAC1-2	MAC1-2	MAC1	10	50	100	40	2.0
MAC1-3	MAC1-3	MAC1	10	100	100	40	2.0
MAC1-4	MAC1-4	MAC1	10	200	100	40	2.0
MAC1-5	MAC1-5	MAC1	10	300	100	40	2.0
MAC1-6	MAC1-6	MAC1	10	400	100	40	2.0
MAC1-7	MAC1-7	MAC1	10	500	100	40	2.0
MAC1-8	MAC1-8	MAC1	10	600	100	40	2.0
MAC2-1	2N6139	2N6139	10	25	100	40	2.0
MAC2-2	2N6139	2N6139	10	50	100	40	2.0
MAC2-3	2N6139	2N6139	10	100	100	40	2.0
MAC2-4	2N6139	2N6139	10	200	100	40	2.0
MAC2-5	2N6140	2N6139	10	300	100	40	2.0
MAC2-6	2N6140	2N6139	10	400	100	40	2.0
MAC2-7	2N6141	2N6139	10	500	100	40	2.0
MAC2-8	2N6141	2N6139	10	600	100	40	2.0
MAC3-1	2N6148	2N6139	10	25	100	40	2.0
MAC3-2	2N6148	2N6139	10	50	100	40	2.0
MAC3-3	2N6148	2N6139	10	100	100	40	2.0
MAC3-4	2N6148	2N6139	10	200	100	40	2.0
MAC3-5	2N6149	2N6139	10	300	100	40	2.0
MAC3-6	2N6150	2N6139	10	400	100	40	2.0
MAC3-7	2N6150	2N6139	10	500	100		2.0
MAC3-8	2N6150	2N6139	10	600	100	40	2.0
MAC4-1	MAC4-1	MAC4-1	10	25	100	50	2.5
MAC4-2	MAC4-2	MAC1	10	50	100	50	2.5
MAC4-3	MAC4-3	MAC1	10	100	100	50	2.5
MAC4-4	MAC4-4	MAC1	10	200	100	50	2.5
MAC4-5	MAC4-5	MAC1	10	300	100	50	2.5
MAC4-6	MAC4-6	MAC1	10	400	100	50	2.5
MAC4-7	MAC4-7	MAC1	10	500	100	50	2.5
MAC4-8	MAC4-8	MAC1	10	600	100	50	2.5
MAC5-1	MAC5-1	MAC1	10	25	100	50	2.5
MAC5-2	MAC5-2	MAC1	10	50	100	50	2.5
MAC5-3	MAC5-3	MAC1	10	100	100	50	2.5
MAC5-4	MAC5-4	MAC1	10	200	100	50	2.5
MAC5-5	MAC5-5	MAC1	10	300	100	50	2.5
MAC5-6	MAC5-6	MAC1	10	400	100	50	2.5
MAC5-7	MAC5-7	MAC1	10	500	100	50	2.5
MAC5-8	MAC5-8	MAC1	10	600	100	50	2.5
MAC6-1	MAC6-1	MAC1	10	25	100	50	2.5
MAC6-2	MAC6-2	MAC1	10	50	100	50	2.5
MAC6-3	MAC6-3	MAC1	10	100	100	50	2.5
MAC6-4	MAC6-4	MAC1	10	200	100	50	2.5
MAC6-5	MAC6-5	MAC1	10	300	100	50	2.5
MAC6-6	MAC6-6	MAC1	10	400	100	50	2.5
MAC6-7	MAC6-7	MAC1	10	500	100	50	2.5
MAC6-8	MAC6-8	MAC1	10	600	100	50	2.5
MAC10-1	MAC10-1	MAC10-1	10	25	100	50	2.0
MAC10-2	MAC10-2	MAC10-1	10	50	100	50	2.0

THYRISTOR INDEX (continued)

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Type	Replacement	Ref.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} Volts	T_J T_C (1) °C	I_{GT} mA	V_{GT} Volts
MAC10-3	MAC10-3	MAC10-1	10	100	100	50	2.0
MAC10-4	MAC10-4	MAC10-1	10	200	100	50	2.0
MAC10-5	MAC10-5	MAC10-1	10	300	100	50	2.0
MAC10-6	MAC10-6	MAC10-1	10	400	100	50	2.0
MAC10-7	MAC10-7	MAC10-1	10	500	100	50	2.0
MAC10-8	MAC10-8	MAC10-1	10	600	100	50	2.0
MAC11-1	MAC11-1	MAC10-1	10	25	100	50	2.0
MAC11-2	MAC11-2	MAC10-1	10	50	100	50	2.0
MAC11-3	MAC11-3	MAC10-1	10	100	100	50	2.0
MAC11-4	MAC11-4	MAC10-1	10	200	100	50	2.0
MAC11-5	MAC11-5	MAC10-1	10	300	100	50	2.0
MAC11-6	MAC11-6	MAC10-1	10	400	100	50	2.0
MAC11-7	MAC11-7	MAC10-1	10	500	100	50	2.0
MAC11-8	MAC11-8	MAC10-1	10	600	100	50	2.0
MAC35-1	2N6157	2N6157	25	25	125	60	2.0
MAC35-2	2N6157	2N6157	25	50	125	60	2.0
MAC35-3	2N6157	2N6157	25	100	125	60	2.0
MAC35-4	2N6157	2N6157	25	200	125	60	2.0
MAC35-5	2N6158	2N6157	25	300	125	60	2.0
MAC35-6	2N6158	2N6157	25	400	125	60	2.0
MAC35-7	2N6159	2N6157	25	600	125	60	2.0
MAC36-1	2N6160	2N6157	25	25	125	60	2.0
MAC36-2	2N6160	2N6157	25	50	125	60	2.0
MAC36-3	2N6160	2N6157	25	100	125	60	2.0
MAC36-4	2N6160	2N6157	25	200	125	60	2.0
MAC36-5	2N6161	2N6157	25	300	125	60	2.0
MAC36-6	2N6161	2N6157	25	400	125	60	2.0
MAC36-7	2N6162	2N6157	25	600	125	60	2.0
MAC37-1	MAC37-1	MAC37-1	25	25	110	75	3.0
MAC37-2	MAC37-2	MAC37-1	25	50	110	75	3.0
MAC37-3	MAC37-3	MAC37-1	25	100	110	75	3.0
MAC37-4	MAC37-4	MAC37-1	25	200	110	75	3.0
MAC37-5	MAC37-5	MAC37-1	25	300	110	75	3.0
MAC37-6	MAC37-6	MAC37-1	25	400	110	75	3.0
MAC37-7	MAC37-7	MAC37-1	25	500	110	75	3.0
MAC38-1	MAC38-1	MAC37-1	25	25	110	75	3.0
MAC38-2	MAC38-2	MAC37-1	25	50	110	75	3.0
MAC38-3	MAC38-3	MAC37-1	25	100	110	75	3.0
MAC38-4	MAC38-4	MAC37-1	25	200	110	75	3.0
MAC38-5	MAC38-5	MAC37-1	25	300	110	75	3.0
MAC38-6	MAC38-6	MAC37-1	25	400	110	75	3.0
MAC38-7	MAC38-7	MAC37-1	25	500	110	75	3.0
MAC77-1	2N6068	2N6068	4.0	25	110	30	2.0
MAC77-2	2N6069	2N6068	4.0	50	110	30	2.0
MAC77-3	2N6070	2N6068	4.0	100	110	30	2.0
MAC77-4	2N6071	2N6068	4.0	200	110	30	2.0
MAC77-5	2N6072	2N6068	4.0	300	110	30	2.0
MAC77-6	2N6073	2N6068	4.0	400	110	30	2.0
MAC77-7	2N6074	2N6068	4.0	500	110	30	2.0
MAC77-8	2N6075	2N6068	4.0	600	110	30	2.0
MCR051	MCR051	MCR051	0.25	15	125	0.2	0.8
MCR052	MCR053	MCR051	0.25	30	125	0.2	0.8
MCR053	MCR053	MCR051	0.25	60	125	0.2	0.8
MCR054	MCR054	MCR051	0.25	100	125	0.2	0.8
MCR101	MCR101	MCR101	0.8	15	85	0.1	1.7
MCR102	MCR102	MCR101	0.8	30	85	0.1	1.7
MCR103	MCR103	MCR101	0.8	60	85	0.1	1.7
MCR104	MCR104	MCR101	0.8	100	85	0.1	1.7
MCR106-1	MCR106-1	MCR106-1	4.0	30	110	0.5	1.0
MCR106-2	MCR106-2	MCR106-1	4.0	60	110	0.5	1.0

Type	Replacement	Ref.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} Volts	T_J T_C (1) °C	I_{GT} mA	V_{GT} Volts
MCR106-3	MCR106-3	MCR106-1	4.0	100	110	0.5	1.0
MCR106-4	MCR106-4	MCR106-1	4.0	200	110	0.5	1.0
MCR115	MCR115	MCR115	0.8	150	110	0.2	0.8
MCR120	MCR120	MCR120	0.8	200	110	0.2	0.8
MCR154-10	MCR154-10	MCR154	1800	100	125	30	0.25
MCR154-20	MCR154-20	MCR154	1800	200	125	30	0.25
MCR154-30	MCR154-30	MCR154	1800	300	125	30	0.25
MCR154-40	MCR154-40	MCR154	1800	400	125	30	0.25
MCR154-50	MCR154-50	MCR154	1800	500	125	30	0.25
MCR154-60	MCR154-60	MCR154	1800	600	125	30	0.25
MCR155-10	MCR155-10	MCR154	1800	100	125	30	0.25
MCR155-20	MCR155-20	MCR154	1800	200	125	30	0.25
MCR155-30	MCR155-30	MCR154	1800	300	125	30	0.25
MCR155-40	MCR155-40	MCR154	1800	400	125	30	0.25
MCR155-50	MCR155-50	MCR154	1800	500	125	30	0.25
MCR155-60	MCR155-60	MCR154	1800	600	125	30	0.25
MCR156-10	MCR156-10	MCR154	1800	100	125	30	0.25
MCR156-20	MCR156-20	MCR154	1800	200	125	30	0.25
MCR156-30	MCR156-30	MCR154	1800	300	125	30	0.25
MCR156-40	MCR156-40	MCR154	1800	400	125	30	0.25
MCR156-50	MCR156-50	MCR154	1800	500	125	30	0.25
MCR156-60	MCR156-60	MCR154	1800	600	125	30	0.25
MCR157-10	MCR157-10	MCR154	1800	100	125	30	0.25
MCR157-20	MCR157-20	MCR154	1800	200	125	30	0.25
MCR157-30	MCR157-30	MCR154	1800	300	125	30	0.25
MCR157-40	MCR157-40	MCR154	1800	400	125	30	0.25
MCR157-50	MCR157-50	MCR154	1800	500	125	30	0.25
MCR157-60	MCR157-60	MCR154	1800	600	125	30	0.25
MCR201	MCR201	MCR201	0.5	15	110	0.2	0.8
MCR202	MCR202	MCR201	0.5	30	110	0.2	0.8
MCR203	MCR203	MCR201	0.5	60	110	0.2	0.8
MCR204	MCR204	MCR201	0.5	100	110	0.2	0.8
MCR205	MCR205	MCR201	0.5	150	110	0.2	0.8
MCR206	MCR206	MCR201	0.5	200	110	0.2	0.8
MCR406-1	MCR406-1	MCR406	4.0	30	110	0.2	0.8
MCR406-2	MCR406-2	MCR406	4.0	60	110	0.2	0.8
MCR406-3	MCR406-3	MCR406	4.0	100	110	0.2	0.8
MCR406-4	MCR406-4	MCR406	4.0	200	110	0.2	0.8
MCR407-1	MCR407-1	MCR407	4.0	30	110	0.5	1.0
MCR407-2	MCR407-2	MCR407	4.0	60	110	0.5	1.0
MCR407-3	MCR407-3	MCR407	4.0	100	110	0.5	1.0
MCR407-4	MCR407-4	MCR407	4.0	200	110	0.5	1.0
MCR649-1	MCR649-1	MCR649	20	25	100	80	3.5
MCR649-2	MCR649-2	MCR649	20	50	100	80	3.5
MCR649-3	MCR649-3	MCR649	20	100	100	80	3.5
MCR649-4	MCR649-4	MCR649	20	200	100	80	3.5
MCR649-5	MCR649-5	MCR649	20	300	100	80	3.5
MCR649-6	MCR649-6	MCR649	20	400	100	80	3.5
MCR649-7	MCR649-7	MCR649	20	500	100	80	3.5
MCR729-5	MCR729-5	MCR729	2.0	50	105	50	1.5
MCR729-6	MCR729-6	MCR729	2.0	50	105	50	1.5
MCR729-7	MCR729-7	MCR729	2.0	50	105	50	1.5
MCR729-8	MCR729-8	MCR729	2.0	50	105	50	1.5
MCR729-9	MCR729-9	MCR729	2.0	50	105	50	1.5
MCR729-10	MCR729-10	MCR729	2.0	50	105	50	1.5
MCR1336-5	MCR1336-5	MCR1336	2.0	300	105	40	1.25
MCR1336-6	MCR1336-6	MCR1336	2.0	400	105	40	1.25
MCR1336-7	MCR1336-7	MCR1336	2.0	500	105	40	1.25
MCR1336-8	MCR1336-8	MCR1336	2.0	600	105	40	1.25
MCR1336-9	MCR1336-9	MCR1336	2.0	700	105	40	1.25

THYRISTOR INDEX (continued)

Type	Replacement	Ref.	$I_{T(RMS)}$ Amp	V_{DRM}/V_{RRM} Volts	T_J T_C (1) °C	I_{GT} mA	V_{GT} Volts
MCR1336-10	MCR1336-10	MCR1336	2.0	800	105	40	1.25
MCR1718-5	MCR1718-5	MCR1718	25	300	125	50	1.5
MCR1718-6	MCR1718-6	MCR1718	25	400	125	50	1.5
MCR1718-7	MCR1718-7	MCR1718	25	500	125	50	1.5
MCR1718-8	MCR1718-8	MCR1718	25	600	125	50	1.5
MCR1906-1	MCR1906-1	MCR1906	1.6	25	100	1.0	1.0
MCR1906-2	MCR1906-2	MCR1906	1.6	50	100	1.0	1.0
MCR1906-3	MCR1906-3	MCR1906	1.6	100	100	1.0	1.0
MCR1906-4	MCR1906-4	MCR1906	1.6	200	100	1.0	1.0
MCR1907-1	MCR1907-1	MCR1907	25	35	125	30	1.5
MCR1907-2	MCR1907-2	MCR1907	25	75	125	30	1.5
MCR1907-3	MCR1907-3	MCR1907	25	150	125	30	1.5
MCR1907-4	MCR1907-4	MCR1907	25	300	125	30	1.5
MCR1907-5	MCR1907-5	MCR1907	25	400	125	30	1.5
MCR1907-6	MCR1907-6	MCR1907	26	500	125	30	1.5
MCR2315-1	MCR2315-1	MCR2315	8.0	25	100	40	1.5
MCR2315-2	MCR2315-2	MCR2315	8.0	50	100	40	1.5
MCR2315-3	MCR2315-3	MCR2315	8.0	100	100	40	1.5
MCR2315-4	MCR2315-4	MCR2315	8.0	200	100	40	1.5
MCR2315-5	MCR2315-5	MCR2315	8.0	300	100	40	1.5
MCR2315-6	MCR2315-6	MCR2315	8.0	400	100	40	1.5
MCR2614L-1	MCR2614L-1	MCR2315	8.0	25	100	40	1.5
MCR2614L-2	MCR2614L-2	MCR2315	8.0	50	100	40	1.5
MCR2614L-3	MCR2614L-3	MCR2315	8.0	100	100	40	1.5
MCR2614L-4	MCR2614L-4	MCR2315	8.0	200	100	40	1.5
MCR2614L-5	MCR2614L-5	MCR2315	8.0	300	100	40	1.5
MCR2614L-6	MCR2614L-6	MCR2315	8.0	400	100	40	1.5
MCR3818-1	MCR3818-1	MCR3818-1	20	25	100	40	1.5
MCR3818-2	MCR3818-2	MCR3818-1	20	50	100	40	1.5
MCR3818-3	MCR3818-3	MCR3818-1	20	100	100	40	1.5
MCR3818-4	MCR3818-4	MCR3818-1	20	200	100	40	1.5
MCR3818-5	MCR3818-5	MCR3818-1	20	300	100	40	1.5
MCR3818-6	MCR3818-6	MCR3818-1	20	400	100	40	1.5
MCR3818-7	MCR3818-7	MCR3818-1	20	500	100	40	1.5
MCR3818-8	MCR3818-8	MCR3818-1	20	600	100	40	1.5
MCR3918-1	MCR3918-1	MCR3818-1	20	25	100	40	1.5
MCR3918-2	MCR3918-2	MCR3818-1	20	50	100	40	1.5
MCR3918-3	MCR3918-3	MCR3818-1	20	100	100	40	1.5
MCR3918-4	MCR3918-4	MCR3818-1	20	200	100	40	1.5
MCR3918-5	MCR3918-5	MCR3818-1	20	300	100	40	1.5
MCR3918-6	MCR3918-6	MCR3818-1	20	400	100	40	1.5
MCR3918-7	MCR3918-7	MCR3818-1	20	500	100	40	1.5
MCR3918-8	MCR3918-8	MCR3818-1	20	600	100	40	1.5
MCR3835-1	MCR3835-1	MCR3835-1	35	25	100	40	1.5
MCR3835-2	MCR3835-2	MCR3835-1	35	50	100	40	1.5
MCR3835-3	MCR3835-3	MCR3835-1	35	100	100	40	1.5
MCR3835-4	MCR3835-4	MCR3835-1	35	200	100	40	1.5
MCR3835-5	MCR3835-5	MCR3835-1	35	300	100	40	1.5
MCR3835-6	MCR3835-6	MCR3835-1	35	400	100	40	1.5
MCR3835-7	MCR3835-7	MCR3835-1	35	500	100	40	1.5
MCR3835-8	MCR3835-8	MCR3835-1	35	600	100	40	1.5
MCR3935-1	MCR3935-1	MCR3835-1	35	25	100	40	1.5
MCR3935-2	MCR3935-2	MCR3835-1	35	50	100	40	1.5
MCR3935-3	MCR3935-3	MCR3835-1	35	100	100	40	1.5
MCR3935-4	MCR3935-4	MCR3835-1	35	200	100	40	1.5
MCR3935-5	MCR3935-5	MCR3835-1	35	300	100	40	1.5
MCR3935-6	MCR3935-6	MCR3835-1	35	400	100	40	1.5
MCR3935-7	MCR3935-7	MCR3835-1	35	500	100	40	1.5
MCR3935-8	MCR3935-8	MCR3835-1	35	600	100	40	1.5

BILATERAL TRIGGER DIACS

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house non registered bilateral trigger diacs.

3

KEY

Type	Replacement	Ref.	$V_{(BR)}$ Volts Nom	ΔV Volts Min	$I_{(BR)}$ μA Max	I_{Pulse} @ 30μs, 120 Hz Amp Max

Alpha-Numerical Listings

Type number of recommended replacement of nearest electrical equivalent fully characterized in this book

Reference device number indicates specific Data Sheet on which device is characterized.

Breakdown Voltage (both directions)

Switchback (Delta) Voltage (both directions)

Breakdown Current (both directions)

Peak Pulse Current

BILATERAL TRIGGER DIACS

Type	Replacement	Ref.	$V_{(BR)}$ Volts Nom	ΔV Volts Min	$I_{(BR)}$ μA Max	I_{Pulse} @ 30μs, 120 Hz Amp Max
MPT20	1N5758	1N5758	20	5.0	100	2.0
MPT28	1N5760	1N5758	28	7.0	50	2.0
MPT32	1N5761	1N5758	32	7.0	50	2.0

TRIGGERS

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house non registered bidirectional switch.

KEY

BIDIRECTIONAL SWITCH

Type	Ref.	V_S Min	V_S Max	$\lvert V_{S1} - V_{S2} \rvert$ Max	I_S Max	I_H Max	V_F Max

Type: Alpha-Numerical Listings

Ref.: Reference device number indicates specific Data Sheet on which device is characterized.

V_S: Switching Voltage

$\lvert V_{S1} - V_{S2} \rvert$: Switching Voltage Differential

I_S: Switching Current

I_H: Holding Current

V_F: Forward On-State Voltage

BIDIRECTIONAL SWITCH

Type	Ref.	V_S Min	V_S Max	$V_{S1} - V_{S2}$ Max	I_S Max	I_H Max	V_F Max
MBS100	MBS100	3.0	5.0	0.35	400	1.0	2.0
MBS4991	MBS4991	6.0	10	0.5	350	1.5	1.7
MBS4992	MBS4991	7.5	9.0	0.2	120	0.5	1.7

UNIDIRECTIONAL SWITCH

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house non registered unidirectional switch.

3

KEY

Type	Replacement	Ref	V_S Volts Min	V_S Volts Max	I_S μA Max	I_H mA	V_F $I_F = 150$ mA	I_B μA	P_D mW	V_R Volts Max	V_O Volts Min	I_F (rep) $T_A = 100°C$ $t_p = 10\mu s$ 1.0% duty cycle Amp

- Type: Alpha-Numerical Listings
- Replacement: Type Number of recommended replacement or of nearest electrical equivalent fully characterized in this book
- Ref: Reference device number indicates specific Data Sheet on which device is characterized.
- V_S: Switching Voltage
- I_S: Switching Current
- I_H: Holding Current
- V_F: Forward On-State Voltage
- I_B: Forward Blocking Current
- P_D: Power Dissipation
- V_R: Reverse Voltage
- V_O: Pulse Peak Voltage
- I_F (rep): Peak Recurrent Forward Current

UNIDIRECTIONAL SWITCH

Type	Replacement	Ref	V_S Volts Min	V_S Volts Max	I_S μA Max	I_H mA	V_F $I_F = 150$ mA	I_B @ 50V μA	P_D mW	V_R Volts Max	V_O Volts Min	I_F (rep) $T_A = 100°C$ $t_p = 10\mu s$ 1.0% duty cycle Amp
MUS4987	MUS4987	MUS4987	6.0	10	500	1.5	1.5	1.0	300	30	3.5	1.0
MUS4988	MUS4987	MUS4987	7.5	9.0	150	0.5	1.5	0.1	350	30	3.5	1.0

UNIJUNCTION TRANSISTORS

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house non registered unijunction transistors.

KEY

Type	Ref.	P_D mW	R_{BB} kΩ Min	Max	η Min	Max	I_V Min mA	I_P Max μA	I_{EO} @ V_{EB2} μA @ M max	V_{EB1}(sat) V @ 50 mA

- Type: Numerical Listing of Registered Type Numbers
- Ref.: Reference device number indicates specific Data Sheet on which device is characterized
- P_D: Power Dissipation @ 25°C
- R_{BB}: Interbase Resistance
- η: Intrinsic Standoff Ratio
- I_V: Valley Current
- I_P: Peak Point Current
- I_{EO}: Emitter Reverse Current at indicated V_{B2E}
- V_{EB1}(sat): Emitter Saturation Voltage

UNIJUNCTION TRANSISTORS INDEX

Type	Ref.	P_D mW	R_{BB} kΩ Min	Max	η Min	Max	I_V Min mA	I_P Max μA	I_{EO} @ V_{EB2} μA @ V Max	V_{EB1}(sat) V @ 50 mA
MU10	MU10	300	4.0	10	0.50	0.85	1.0	5.0	1.0 @ 30	2.0
MU20	MU10	300	4.7	9.1	0.56	0.85	1.0	2.0	0.2 @ 30	2.0
MU851	MU851	200	4.7	9.1	0.56	0.75	2.0	2.0	0.1 @ 30	2.5
MU852	MU851	200	4.7	9.1	0.70	0.85	4.0	2.0	0.1 @ 30	2.5
MU853	MU851	200	4.7	9.1	0.70	0.85	4.0	0.4	0.05 @ 30	2.5
MU4891	MU4891	300	4.0	9.1	0.55	0.82	2.0	5.0	0.01 @ 30	4.0
MU4892	MU4891	300	4.0	9.1	0.51	0.69	2.0	2.0	0.01 @ 30	4.0
MU4893	MU4891	300	4.0	12	0.55	0.82	2.0	2.0	0.01 @ 30	4.0
MU4894	MU4891	300	4.0	12	0.74	0.86	2.0	1.0	0.01 @ 30	4.0

PROGRAMMABLE UNIJUNCTION TRANSISTORS – PUT

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house non-registered programmable unijunction transistors.

KEY

Type	Replacement	Ref.	I_P Peak Current R_G = 10 kΩ µA Max	I_P Peak Current R_G = 1.0 MΩ µA Max	I_{GAO} Leakage Current @ 40 V nA Max	I_V Valley Current R_G = 10 kΩ µA Min	I_V Valley Current R_G = 1.0MΩ µA Max	V_{GKF} Gate to Cathode Forward Voltage Volts Max	P_F mW	V_O Min Output Voltage Volts	V_F Forward Voltage V_F @ I_F Volts	mA	I_T DC Anode Current mA Max	$I_{T(pulse)}$ Peak Anode Current 20 µs 1.0% DC Amp Max	T_{stg} Storage Temp. Range °C

- Type: Alpha-numerical Listings
- Replacement: Type number of recommended replacement of nearest electrical equivalent fully characterized in this book
- Ref.: Reference device number indicates specific data sheet on which device is characterized.
- Peak Current
- Gate to Anode Leakage Current
- Valley Current
- Gate to Cathode Forward Voltage
- Forward Power Dissipation @ 25°C
- Peak Output Voltage
- Forward Voltage
- DC Forward Anode Current
- Repetitive Peak Forward Current
- Storage Temperature Range

PROGRAMMABLE UNIJUNCTION TRANSISTORS – PUT

Type	Replacement	Ref.	I_P Peak Current R_G = 10 kΩ µA Max	I_P Peak Current R_G = 1.0 MΩ µA Max	I_{GAO} Leakage Current @ 40 V nA Max	I_V Valley Current R_G = 10 kΩ µA Min	I_V Valley Current R_G = 1.0MΩ µA Max	V_{GKF} Gate to Cathode Forward Voltage Volts Max	P_F mW	V_O Min Output Voltage Volts	V_F Forward Voltage V_F @ I_F Volts	mA	I_T DC Anode Current mA Max	$I_{T(pulse)}$ Peak Anode Current 20 µs 1.0% DC Amp Max	T_{stg} Storage Temp. Range °C
MPU131	MPU131	MPU131	5.0	2.0	5.0	70	50	40	375	6.0	1.5	50	200	2.0	-65 to +150
MPU132	MPU132	MPU131	2.0	0.30	5.0	50	50	40	375	6.0	1.5	50	200	2.0	-65 to +150
MPU133	MPU133	MPU131	1.0	0.15	5.0	50	25	40	375	6.0	1.5	50	200	2.0	-65 to +150
MPU231	2N6116	2N6116	5.0	2.0	5.0	70	50	40	250	6.0	1.5	50	200	2.0	-65 to +200
MPU232	2N6117	2N6116	2.0	0.30	5.0	50	50	40	250	6.0	1.5	50	200	2.0	-65 to +200
MPU233	2N6118	2N6116	1.0	0.15	5.0	50	25	40	250	6.0	1.5	50	200	2.0	-65 to +200

TRANSISTORS

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house non-registered transistors.

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KEY

Collector-Emitter Saturation Voltage at Specified Collector Current

I_C Units:
A = Amp
m = milliamp

TYPE	MATERIAL	POLARITY	REPLACE-MENT	REF.	USE	MAXIMUM RATINGS					ELECTRICAL CHARACTERISTICS									
						P_D @ 25°C	Ref Point	T_J °C	V_{CBO} (volts)	V_{CE} – (volts)	Subscript	h_{FE} (min) (max)	@ I_C	Units	$V_{CE(SAT)}$ (volts)	@ I_C	Units	h_f –	Subscript	f –	Units	Subscript

Numerical Listing of 2N and 3N Registered Type Numbers

S = Silicon
G = Germanium

P = PNP
N = NPN

Type number of recommended replacement or of nearest electrical equivalent fully characterized in this book

Reference device number indicates specific Data Sheet on which device is characterized

APPLICATION CODE

A = Amplifier
AH = Amplifier, High frequency
AHP = Amplifier, High frequency power
AL = Amplifier, Light sensitive
AM = Amplifier, Multiple device
AP = Amplifier, Power
ASM = Amplifier Switch Multiple device
S = Switch
SC = Switch, Chopper
SH = Switch, High speed
SHP = Switch, High speed power
SP = Switch, Power

Power Dissipation at 25°C
Units: m = milliwatts
W = Watts
Ref. Point: A, C, J, S, Indicates Ambient, Case, Junction or Stud

Common-Emitter DC Short-Circuit Forward-Current Transfer Ratio at Specified Collector Current

I_C Units: A = Amp
m = milliamp
* = microamp
N = nanoamp

Maximum Collector-Emitter Voltage (Subscript Identifies Condition)

Subscript:
O = V_{CEO} = Base Open
R = V_{CER} = Specified Resistance
S = V_{CES} = Base Shorted
V = V_{CEV} = Used when only voltage bias is used
X = V_{CEX} = Base-Emitter Back Biased
U = V_{CE} = Termination Undefined

Small-Signal Forward-Current Transfer Ratio (E, B or C defines the parameter)
E = h_{fe} = Common-Emitter Current Transfer Ratio
B = h_{fb} = Common-Base Current Transfer Ratio
C = h_{fc} = Common-Collector Current Transfer Ratio

CUTOFF FREQUENCY

Units: k = KHz
M = MHz
G = GHz

(B, E, M or T Indicate the Parameter)
B = f_{hfb} = f_{ab} = Common-Base Cutoff Frequency
E = f_{hfe} = f_{ae} = Common-Emitter Cutoff Frequency
M = f_{max} = Maximum Frequency of Oscillations
T = f_T = Current Gain - Bandwidth Product

Maximum Collector - Base Voltage

Maximum Operating Junction Temperature

TRANSISTOR INDEX

Type	MATERIAL	POLARITY	Ref.	Use	P_D @ 25°C	Ref. Point	T_J °C	V_{CB} Volts	V_{CE-} Volts	Subscript	h_{FE} Min	Max	@ I_C Units	$V_{CE(SAT)}$ Volts	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
						MAXIMUM RATINGS					ELECTRICAL CHARACTERISTICS								
AF139	G	P	AF139	AH	60m	A	100	20	15	0	10		1.5m					450M	T
AF239	G	P	AF239	AH	60m	A	100	20	15	0	15		1.5m					600M	T
MA100	G	P	MA100	A	200m	A	100	60	60	S	30		10m			50	E	1.0M	B
MA200	G	P	MA200	A	150m	A	100	105	105	0	20		5.0m	0.35	5.0m			1.0M	B
MA201	G	P	MA200	A	150m	A	100	105	105	0	20		5.0m	0.35	5.0m			1.0M	B
MA202	G	P	MA200	A	150m	A	100	105	105	0	40		5.0m	0.35	5.0m			1.0M	B
MA203	G	P	MA200	A	150m	A	100	105	105	0	40		5.0m	0.35	5.0m			1.0M	B
MA204	G	P	MA200	A	150m	A	100	90	90	0	20		5.0m	0.35	5.0m			1.0M	B
MA205	G	P	MA200	A	150m	A	100	75	75	0	20		5.0m	0.35	5.0m			1.0M	B
MA206	G	P	MA200	A	150m	A	100	60	60	0	20		5.0m	0.35	5.0m			1.0M	B
MA881	G	P	MA881	AS	200m	A	100	60	60	S	30		10m			30	E	0.75M	B
MA882	G	P	MA881	AS	200m	A	100	60	60	S	40		10m			50	E	1.0M	B
MA883	G	P	MA881	AS	200m	A	100	60	60	S	75		10m			100	E	1.25M	B
MA884	G	P	MA881	AS	200m	A	100	60	60	S	125		10m			190	E	1.75M	B
MA885	G	P	MA881	AS	200m	A	100	50	50	S						15	E	0.5M	B
MA886	G	P	MA881	AS	200m	A	100	50	50	S						30	E	0.75M	B
MA887	G	P	MA881	AS	200m	A	100	50	50	S						50	E	1.0M	B
MA888	G	P	MA881	AS	200m	A	100	50	50	S						100	E	1.25M	B
MA889	G	P	MA881	AS	200m	A	100	50	50	S						190	E	1.75M	B
MA1702	G	P	MA1702	AS	200m	A	100	45	30	R	200		100m	0.26	200m	500	E	7.0M	B
MA1703	G	P	MA1702	AS	200m	A	100	25	25	R	100	350	100m			200	E	3.0M	B
MA1704	G	P	MA1702	AS	200m	A	100	25	25	R	150	400	100m			350	E	5.0M	B
MA1705	G	P	MA1702	AS	200m	A	100	25	25	R	200		100m			500	E	6.0M	B
MA1706	G	P	MA1702	AS	200m	A	100	15	15	R	100	350	100m			200	E	3.0M	B
MA1707	G	P	MA1702	AS	200m	A	100	15	15	R	150	400	100m			350	E	4.0M	B
MA1708	G	P	MA1702	AS	200m	A	100	15	15	R	200		100m			500	E	5.0M	B
MD708	S	N	MD708	SM	400m	A	200	40	15	0	40	200	10m	0.2	10m			300M	T
MD708A	S	N	MD708	SM	400m	A	200	40	15	0	40	200	10m	0.2	10m			300M	T
MD708AF	S	N	MD708	SM	350m	A	200	40	15	0	40	200	10m	0.2	10m			300M	T
MD708B	S	N	MD708	SM	400m	A	200	40	15	0	40	200	10m	0.2	10m			300M	T
MD708BF	S	N	MD708	SM	350m	A	200	40	15	0	40	200	10m	0.2	10m			300M	T
MD708F	S	N	MD708	SM	350m	A	200	40	15	0	40	200	10m	0.2	10m			300M	T
MD918	S	N	MD918	AM	400m	A	200	30	15	0	50		1.0m	0.2	10m			600M	T
MD918A	S	N	MD918	AM	400m	A	200	30	15	0	50		1.0m	0.2	10m			600M	T
MD918AF	S	N	MD918	AM	350m	A	200	30	15	0	50		1.0m	0.2	10m			600M	T
MD918B	S	N	MD918	AM	400m	A	200	30	15	0	50		1.0m	0.2	10m			600M	T
MD918BF	S	N	MD918	AM	350m	A	200	30	15	0	50		1.0m	0.2	10m			600M	T
MD918F	S	N	MD918	AM	350m	A	200	30	15	0	50		1.0m	0.2	10m			600M	T
MD982	S	P	MD982	AM	0.6W	A	200	60	50	0	40		150m	0.5	150m			200M	T
MD984	S	P	MD984	AS	3.0W	C	200	40	20	0	25		10m	0.3	10m	2.5	E	250M	T
MD985	S	N/P	MD985	SM	600m	A	200	60	30	0	25		10m	0.5	150m			200M	T
MD985F	S	N/P	MD985	SM	350m	A	200	60	30	0	25		10m	0.5	150m			200M	T
MD986	S	N/P	MD986	SM	600m	A	200	60	30	0	25		10m	0.5	150m			200M	T
MD986F	S	N/P	MD986	SM	350m	A	200	60	30	0	25		10m	0.5	150m			200M	T
MD1120	S	N	MD1120	A	350mW	A	200	60	30	0	50	200	10m	0.1	10m	2.5	E	250M	T
MD1121	S	N	MD1120	A	350mW	A	200	60	30	0	50	200	10m	0.1	10m	2.5	E	250M	T
MD1122	S	N	MD1120	A	350mW	A	200	60	30	0	50	200	10m	0.1	10m	2.5	E	250M	T
MD1123	S	P	MD1123	AM	0.6W	A	200	60	40	0	50	200	10m	0.25	10m			200M	T
MD1129	S	N	MD1129	AM	600m	A	200	60	30	0	100	300	100*	0.1	10m			200M	T
MD1129F	S	N	MD1129	AM	350m	A	200	60	30	0	100	300	100*	0.1	10m			200M	T

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Type	MATERIAL	POLARITY	Ref.	Use	P_D @ 25°C	Ref. Point	MAXIMUM RATINGS T_J °C	V_{CB} Volts	V_{CE-} Volts	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} Min	h_{FE} Max	@ I_C Units	$V_{CE(SAT)}$ Volts	@ I_C Units	h_{f-}	Subscript	f– Units	Subscript
MD1130	S	P	MD1130	AM	600m	A	200	60	40	0	100	300	100*	0.25	10m			200M	T
MD1130F	S	P	MD1130	AM	350m	A	200	60	40	0	100	300	100*	0.25	10m			200M	T
MD1132	S	N	MD1132	A	300m	A	200	30	15	0	50		1.0m	0.4	10m	6.0	E		
MD2218	S	N	MD2218	ASM	500m	A	200	60	30	0	40	120	150m	0.4	150m			200M	T
MD2218A	S	N	MD2218	ASM	500m	A	200	75	40	0	40	120	150m	0.3	150m			200M	T
MD2218AF	S	N	MD2218	ASM	250m	A	200	75	40	0	40	120	150m	0.3	150m			200M	T
MD2218F	S	N	MD2218	ASM	250m	A	200	60	30	0	40	120	150m	0.4	150m			200M	T
MD2219	S	N	MD2219	ASM	500m	A	200	60	30	0	100	300	150m	0.4	150m			250M	T
MD2219A	S	N	MD2219	ASM	500m	A	200	75	40	0	100	300	150m	0.3	150m			250M	T
MD2219AF	S	N	MD2219	ASM	250m	A	200	75	40	0	100	300	150m	0.3	150m			250M	T
MD2219F	S	N	MD2219	ASM	250m	A	200	60	30	0	100	300	150m	0.4	150m			250M	T
MD2369	S	N	MD2369	SM	500m	A	200	40	15	0	40	120	10m	0.25	10m			500M	T
MD2369A	S	N	MD2369	SM	500m	A	200	40	15	0	40	120	10m	0.25	10m			500M	T
MD2369AF	S	N	MD2369	SM	250m	A	200	40	15	0	40	120	10m	0.25	10m			500M	T
MD2369B	S	N	MD2369	SM	500m	A	200	40	15	0	40	120	10m	0.25	10m			500M	T
MD2904	S	P	MD2904	ASM	500m	A	200	60	40	0	40	120	150m	0.4	150m			200M	T
MD2904A	S	P	MD2904	ASM	500m	A	200	60	60	0	40	120	150m	0.4	150m			200M	T
MD2904AF	S	P	MD2904	ASM	250m	A	200	60	60	0	40	120	150m	0.4	150m			200M	T
MD2904F	S	P	MD2904	ASM	250m	A	200	60	40	0	40	120	150m	0.4	150m			200M	T
MD2905	S	P	MD2905	ASM	500m	A	200	60	40	0	100	300	150m	0.4	150m			200M	T
MD2905A	S	P	MD2905	ASM	500m	A	200	60	60	0	100	300	150m	0.4	150m			200M	T
MD2905AF	S	P	MD2905	ASM	250m	A	200	60	60	0	100	300	150m	0.4	150m			200M	T
MD2905F	S	P	MD2905	ASM	250m	A	200	60	40	0	100	300	150m	0.4	150m			200M	T
MD3250	S	P	MD3250	AM	500m	A	200	50	40	0	50	150	100*	0.25	10m	50	E	200M	T
MD3250A	S	P	MD3250	AM	500m	A	200	50	40	0	50	150	100*	0.25	10m	50	E	200M	T
MD3250AF	S	P	MD3250	AM	250m	A	200	50	40	0	50	150	100*	0.25	10m	50	E	200M	T
MD3250F	S	P	MD3250	AM	250m	A	200	50	40	0	50	150	100*	0.25	10m	50	E	200M	T
MD3251	S	P	MD3250	AM	500m	A	200	50	40	0	100	300	100*	0.25	10m	100	E	250M	T
MD3251A	S	P	MD3250	AM	500m	A	200	50	40	0	100	300	100*	0.25	10m	100	E	250M	T
MD3251AF	S	P	MD3250	AM	250m	A	200	50	40	0	100	300	100*	0.25	10m	100	E	250M	T
MD3251F	S	P	MD3250	AM	250m	A	200	50	40	0	100	300	100*	0.25	10m	100	E	250M	T
MD3409	S	N	MD3409	AM	0.6W	A	200	60	30	0	40	160	1.0m	0.15	10m	2.5	E		
MD3410	S	N	MD3409	AM	0.6W	A	200	60	30	0	40	160	1.0m	0.15	10m	2.5	E		
MD3467	S	P	MD3467	SM	500m	A	200	40	40	0	20		500m	0.5	500m			150M	T
MD3467F	S	P	MD3467	SM	250m	A	200	40	40	0	20		500m	0.5	500m			150M	T
MD3725	S	N	MD3725	SM	500m	A	200	65	40	0	50	150	100m	0.26	100m			250M	T
MD3725F	S	N	MD3725	SM	250m	A	200	65	40	0	50	150	100m	0.26	100m			250M	T
MD3762	S	P	MD3762	SM	500m	A	200	40	40	0	20		1.0A	1.0	1.0A			150M	T
MD3762F	S	P	MD3762	SM	250m	A	200	40	40	0	20		1.0A	1.0	1.0A			150M	T
MD4957	S	P	MD4957	AM	200m	A	200	30	30	0	20	150	2.0m			20	E	1.0G	T
MD5000	S	P	MD5000	AM	300m	A	200	20	15	0	20		3.0m	0.4	10m			600m	T
MD5000A	S	P	MD5000	AM	300m	A	200	20	15	0	20		3.0m	0.4	10m			600m	T
MD5000B	S	P	MD5000	AM	300m	A	200	20	15	0	20		3.0m	0.4	10m			600M	T
MD6001	S	N/P	MD6001	ASM	500m	A	200	60	30	0	40	120	150m	0.4	150m			200M	T
MD6001F	S	N/P	MD6001	ASM	250m	A	200	60	30	0	40	120	150m	0.4	150m			200M	T
MD6002	S	N/P	MD6001	ASM	500m	A	200	60	30	0	100	300	150m	0.4	150m			200M	T
MD6002F	S	N/P	MD6001	ASM	250m	A	200	60	30	0	100	300	150m	0.4	150m			200M	T
MD6003	S	N/P	MD6001	AM	500m	A	200	50	30	0	70		150m	0.4	150m			200M	T
MD6003F	S	N/P	MD6001	AM	250m	A	200	50	30	0	70		150m	0.4	150m			200M	T
MD6100	S	N/P	MD6100	AM	500m	A	200	60	45	0	100		100*	0.2	100*			30M	T
MD8001	S	N	MD8001	AM	300m	A	200		40	0	100		1.0m						
MD8002	S	N	MD8001	AM	300m	A	200		50	0	100		1.0m						
MD8003	S	N	MD8001	AM	300m	A	200		60	0	100		1.0m						
MHQ2221	S	N	MHQ2221	ASM	0.65W	A	200	60	40	0	40		150m	0.4	150m			350M	T
MHQ2222	S	N	MHQ2221	ASM	0.65W	A	200	60	40	0	100		150m	0.4	150m			350M	T
MHQ2369	S	N	MHQ2369	ASM	0.5W	A	200	40	15	0	40		10m	0.25	10m			550M	T
MHQ2483	S	N	MHQ2383	AM	0.6W	A	200	35	25	0	150		1.0m	0.35	1.0m			175M	T
MHQ2484	S	N	MHQ2384	AM	0.6W	A	200	35	30	0	300		1.0m	0.35	10m			175M	T
MHQ2906	S	P	MHQ2906	ASM	0.7W	A	200	60	40	0	40		150m	0.4	150m			350M	T
MHQ2907A	S	P	MHQ2907A	ASM	0.7W	A	200	60	60	0	100		150m	0.4	150m			350M	T

Type	MATERIAL	POLARITY	Ref.	Use	P_D @ 25°C	Ref. Point	T_J °C	V_{CB} Volts	V_{CE-} Volts	Subscript	h_{FE} Min	Max	@ I_C Units	$V_{CE(SAT)}$ Volts	@ I_C Units	h_{f-}	Subscript	f– Units	Subscript
							MAXIMUM RATINGS				ELECTRICAL CHARACTERISTICS								
MHQ3250	S	P	MHQ3250	ASM	0.6W	A	200	60	40	0	50	200	10m	0.25	10m			400M	T
MHQ3251A	S	P	MHQ3250	ASM	0.6W	A	200	60	60	0	100	300	10m	0.25	10m			400M	T
MHQ3467	S	P	MHQ3467	ASM	0.9W	C	200	40	40	0	20		500m	0.5	500m				
MHQ3546	S	P	MHQ3546	ASM	0.5W	A	200	15	12	0	25		50m	0.25	50m			1000M	T
MHQ3798	S	P	MHQ3798	AM	0.5W	A	200	60	40	0	150		100*	0.2	100*			325M	T
MHQ3799	S	P	MHQ3798	AM	0.5W	A	200	60	60	0	300		100*	0.2	100*			325M	T
MHQ6001	S	N/P	MHQ6001	ASM	0.65W	A	200	60	30	0	40		150m	0.4	150m			400M	T
MHQ6002	S	N/P	MHQ6001	ASM	0.65W	A	200	60	30	0	100		150m	0.4	150m			400M	T
MHQ6100	S	N/P	MHQ6100	AM	0.5W	A	200	60	40	0	75		1.0m	0.25	1.0m			175M	T
MHQ6100A	S	N/P	MHQ6100	AM	0.5W	A	200	60	50	0	150		1.0m	0.25	1.0m			175M	T
MJ400	S	N	MJ400	AP	6.67W	C	175	350	325	0	30	300	50m	5.0	50m			15M	T
MJ410	S	N	MJ410	AP	*100W	C	150	200	200	0	30	90	1.0A	0.8	1.0A			2.5M	T
MJ411	S	N	MJ410	AP	*100W	C	150	300	300	0	30	90	1.0A	0.8	1.0A			2.5M	T
MJ413	S	N	MJ413	SP	125W	C	150	400	400	X	20	80	500m	0.8	500m			2.5M	T
MJ420	S	N	MJ420	AP	2.5	C	175	275	250	0	25	250	30m	5.0	30m			15M	T
MJ421	S	N	MJ420	AP	2.5	C	175	350	325	0	25	250	30m	5.0	30m			15M	T
MJ423	S	N	MJ413	SP	125W	C	150	400	400	X	30	90	1.0A	0.8	1.0A			2.5M	T
MJ424	S	N	MJ424	AP	*100W	C	150	700	350	0	30	90	1.0A	0.8	1.0A			2.5M	T
MJ425	S	N	MJ424	AP	*100W	C	150	700	400	0	30	90	1.0A	0.8	1.0A			2.5M	T
MJ431	S	N	MJ413	SP	125W	C	150	400	400	X	15	35	2.5A	0.7	2.5A			2.5M	T
MJ450	S	P	MJ450	ASP	150W	C	200	40	40	0	20		10A	1.0	10A			2.0M	T
MJ480	S	N	MJ480	AP	87.5W	C	200	40	40	0	30	200	1.0A	1.0	1.0A			4.0M	T
MJ481	S	N	MJ480	AP	87.5W	C	200	60	60	0	30	200	1.0A	1.0	1.0A			4.0M	T
MJ490	S	P	MJ490	AP	87.5W	C	200	40	40	0	30	200	1.0A	0.4	1.0A			4.0M	T
MJ491	S	P	MJ490	AP	87.5W	C	200	60	60	0	30	200	1.0A	0.4	1.0A			4.0M	T
MJ500	S	P	MJ500	ASP	60W	C	200	60	60	0	25	180	2.0A	0.7	2.0A			30M	T
MJ501	S	P	MJ500	ASP	60W	C	200	80	80	0	25	180	2.0A	0.7	2.0A			30M	T
MJ802	S	N	MJ802	AP	200W	C	200	100	100	R	25	100	7.5A	0.8	7.5A			2.0M	T
MJ900	S	P	MJ900	AP	90W	C	200	60	60	0	1000		3.0A	2.0	3.0A	1.0	E		
MJ901	S	P	MJ900	AP	90W	C	200	80	80	0	1000		3.0A	2.0	3.0A	1.0	E		
MJ1000	S	N	MJ900	AP	90W	C	200	60	60	0	1000		3.0A	2.0	3.0A	1.0	E		
MJ1001	S	N	MJ900	AP	90W	C	200	80	80	0	1000		3.0A	2.0	3.0A	1.0	E		
MJ1800	S	N	MJ1800	AP	100W	C	150		250	0	40	120	400m						
MJ2249	S	N	MJ2249	ASP	20W	C	175	60	60	0	25	200	500m	1.0	500m			10M	T
MJ2250	S	N	MJ2249	ASP	20W	C	175	80	80	0	25	200	500m	1.0	500m			10M	T
MJ2251	S	N	MJ2250	AP	10W†	C	150		225	0	25	200	50m					10M	T
MJ2252	S	N	MJ2250	AP	10W†	C	150		300	0	25	200	50m					10M	T
MJ2253	S	P	MJ2253	ASP	25W	C	200	70	60	0	20	100	250m	0.3	500m			3.0M	T
MJ2254	S	P	MJ2253	ASP	25W	C	200	90	80	0	20	100	250m	0.3	500m			3.0M	T
MJ2267	S	P	MJ2267	ASP	150W	C	200	40	40	0	20	100	4.0A	1.0	4.0A			3.0M	T
MJ2268	S	P	MJ2267	ASP	150W	C	200	55	55	0	20	100	4.0A	1.0	4.0A			3.0M	T
MJ2500	S	P	MJ2500	AP	150W	C	200	60	60	0	1000		5.0A	2.0	5.0A				
MJ2501	S	P	MJ2500	AP	150W	C	200	80	80	0	1000		5.0A	2.0	5.0A				
MJ2801	S	N	MJ2801	ASP	115W	C	200	50	40	0	15	60	8.0A	1.5	8.0A			1.0M	T
MJ2840	S	N	MJ2840	AP	150W	C	200	60	60	0	20	100	3.0A					2.0M	T
MJ2841	S	N	MJ2840	AP	150W	C	200	80	80	0	20	100	4.0A					2.0M	T
MJ2901	S	P	MJ2901	ASP	115W	C	200	50	40	0	15	60	8.0A	1.5	8.0A			1.0M	T
MJ2940	S	P	MJ2940	AP	150W	C	200	60	60	0	20	100	3.0A					4.0M	T
MJ2941	S	P	MJ2940	AP	150W	C	200	80	80	0	20	100	4.0A					4.0M	T
MJ3000	S	N	MJ2500	AP	150W	C	200	60	60	0	1000		5.0A	2.0	5.0A				
MJ3001	S	N	MJ2500	AP	150W	C	200	80	80	0	1000		5.0A	2.0	5.0A				
MJ3026	S	N	MJ3026	AP	80W	C	150		275	0	25		250m						
MJ3027	S	N	MJ3026	AP	80W	C	150		300	0	25		250m						
MJ3028	S	N	MJ3208	AP	100W	C	150		300	0	25		0.3A						
MJ3029	S	N	MJ2029	AP	125W	C	150		250	0	25		0.3A	2.0	3.0A				
MJ3030	S	N	MJ2029	AP	125W	C	150		325	0	30		0.4A	2.0	3.0A				
MJ3101	S	N	MJ2249	ASP	20W	C	175	50	40	0	25	200	0.5A	1.0	500m			10M	T
MJ3201	S	N	MJ3201	AP	15W	C	175	225	225	0	30	200	50m	5.0	50m			15M	T
MJ3202	S	N	MJ3201	AP	15W	C	175	300	300	0	30	200	50m	5.0	50m			15M	T
MJ3430	S	N	MJ3430	AP	125W	C	150	400	300	0	15	45	2.5A	0.9	2.5A			2.5M	T

*75°C

						MAXIMUM RATINGS					ELECTRICAL CHARACTERISTICS								
Type	MATERIAL	POLARITY	Ref.	Use	P_D @25°C	Ref. Point	T_J °C	V_{CB} Volts	V_{CE-} Volts	Subscript	h_{FE} Min	Max	@ I_C Units	$V_{CE(SAT)}$ Volts	@ I_C Units	h_{f-}	Subscript	f– Units	Subscript
MJ3701	S	P	MJ3701	ASP	25W	C	200	50	40	O	20	100	250m	0.3	500m			3.0M	T
MJ4000	S	N	MJ4000	AP	75W	C	200	60	60	O	1000		1.5A	2.0	1.5A				
MJ4001	S	N	MJ4000	AP	75W	C	200	80	80	O	1000		1.5A	2.0	1.5A				
MJ4010	S	P	MJ4000	AP	75W	C	200	60	60	O	1000		1.5A	2.0	1.5A				
MJ4011	S	P	MJ4000	AP	75W	C	200	80	80	O	1000		1.5A	2.0	1.5A				
MJ4030	S	P	MJ4030	AP	150W	C	200	60	60	O	1000		10A	2.5	10A				
MJ4031	S	P	MJ4030	AP	150W	C	200	80	80	O	1000		10A	2.5	10A				
MJ4032	S	P	MJ4030	AP	150W	C	200	100	100	O	1000		10A	2.5	10A				
MJ4033	S	N	MJ4030	AP	150W	C	200	60	60	O	1000		10A	2.5	10A				
MJ4034	S	N	MJ4030	AP	150W	C	200	80	80	O	1000		10A	2.5	10A				
MJ4035	S	N	MJ4030	AP	150W	C	200	100	100	O	1000		10A	2.5	10A				
MJ4502	S	P	MJ4502	AP	200W	C	200	100	100	R	25	100	7.5A	0.8	7.5A			2.0M	T
MJ6700	S	P	MJ6700	ASP	60W	C	200	60	60	O	25	180	2.0A	0.7	2.0A			30M	T
MJ6701	S	P	MJ6701	ASP	60W	C	200	80	80	O	25	180	2.0A	0.7	2.0A			30M	T
MJ7000	S	N	MJ7000	ASP	150W	C	200	100	100	O	20	100	10A	1.0	10A			30M	T
MS7200	S	N	MJ7200	ASP	300W	C	200	100	80	O	20	100	20A	1.0	20A			20M	T
MJ7201	S	N	MJ7200	ASP	300W	C	200	120	100	O	20	100	20A	1.0	20A			20M	T
MJ8100	S	P	MJ8100	ASP	10W	C	200	60	60	O	25	180	2.0A	0.7	2.0A			30M	T
MJ8101	S	P	MJ8100	ASP	10W	C	200	80	80	O	25	180	2.0A	0.7	2.0A			30M	T
MJ8400	S	N	MJ8400	AP	125W	C	150		600	O				2.0	3.0A				
MJ9000	S	N	MJ9000	AP	125W	C	150		325	O				2.0	6.0A				
MJC007	S	P	MJC007	AP			200		50	O	20	180	1.0A					30M	T
MJC043	S	P	MJC007	AP			200		60	O	30	180	0.25A					30M	T
MJC044	S	N	MJC007	AP			200		60	O	30	180	0.25A					30M	T
MJC067	S	P	MJC007	AP			200		60	O	30	180	2.0A					30M	T
MJC069	S	P	MJC007	AP			200		60	O	20	180	10A					30M	T
MJC070	S	N	MJC007	AP			200		60	O	20	180	10A					30M	T
MJC076	S	N	MJC007	AP			200		50	O	20	180	1.0A					30M	T
MJC082	S	N	MJC007	AP			200		60	O	30	180	2.0A					30M	T
MJE105	S	P	MJE105	AP	65W	C	150	50	50	O	25	100	2.0A						
MJE205	S	N	MJE205	AP	65W	C	150	50	50	O	25	100	2.0A						
MJE340	S	N	MJE340	AP	20.8W	C	150		300	O	30	240	50m						
MJE341	S	N	MJE341	AP	20.8W	C	150	175	150	O	25	200	50m	1.0	50m	25	E	15M	T
MJE344	S	N	MJE341	AP	20.8W	C	150	200	200	O	30	300	50m	1.0	50m	25	E	15M	T
MJE370.	S	P	MJE370	AP	25W	C	150	30	30	O	25		1.0A						
MJE371	S	P	MJE371	AP	40W	C	150	40	40	O	40		1.0A						
MJE520	S	N	MJE520	AP	25W	C	150	30	30	O	25		1.0A						
MJE521	S	N	MJE521	AP	40W	C	150	40	40	O	40		1.0A						
MJE700	S	P	MJE700	AP	40W	C	125	60	60	O	750		1.5A	2.5	1.5A	1.0	E		
MJE701	S	P	MJE700	AP	40W	C	125	60	60	O	750		2.0A	2.8	2.0A	1.0	E		
MJE702	S	P	MJE700	AP	40W	C	125	80	80	O	750		1.5A	2.5	1.5A	1.0	E		
MJE703	S	P	MJE700	AP	40W	C	125	80	80	O	750		2.0A	2.8	2.0A	1.0	E		
MJE710	S	P	MJE710	APS	1.25W	A	150	40	40	O	40		150m	0.15	150m				
MJE711	S	P	MJE710	APS	1.25W	A	150	60	60	O	40		150m	0.15	150m				
MJE712	S	P	MJE710	APS	1.25W	A	150	80	80	O	40		150m	0.15	150m				
MJE720	S	N	MJE720	APS	1.25W	A	150	40	40	O	40		150m	0.15	150m				
MJE721	S	N	MJE720	APS	1.25W	A	150	60	60	O	40		150m	0.15	150m				
MJE722	S	N	MJE720	APS	1.25W	A	150	80	80	O	40		150m	0.15	150m				
MJE800	S	N	MJE700	AP	40W	C	125	60	60	O	750		1.5A	2.5	1.5A	1.0	E		
MJE801	S	N	MJE700	AP	40W	C	125	60	60	O	750		2.0A	2.8	2.0A	1.0	E		
MJE802	S	N	MJE700	AP	40W	C	125	80	80	O	750		1.5A	2.5	1.5A	1.0	E		
MJE803	S	N	MJE700	AP	40W	C	125	80	80	O	750		2.0A	2.8	2.0A	1.0	E		
MJE1090	S	P	MJE1090	AP	70W	C	150	60	60	O	750		3.0A	2.5	3.0A	1.0	E		
MJE1091	S	P	MJE1090	AP	70W	C	150	60	60	O	750		4.0A	2.8	4.0A	1.0	E		
MJE1092	S	P	MJE1090	AP	70W	C	150	80	80	O	750		3.0A	2.5	3.0A	1.0	E		
MJE1093	S	P	MJE1090	AP	70W	C	150	80	80	O	750		4.0A	2.8	4.0A	1.0	E		
MJE1100	S	N	MJE1090	AP	70W	C	150	60	60	O	750		3.0A	2.5	3.0A	1.0	E		
MJE1101	S	N	MJE1090	AP	70W	C	150	60	60	O	750		4.0A	2.8	4.0A	1.0	E		
MJE1102	S	N	MJE1090	AP	70W	C	150	80	80	O	750		3.0A	2.5	3.0A	1.0	E		
MJE1103	S	N	MJE1090	AP	70W	C	150	80	80	O	750		4.0A	2.8	4.0A	1.0	E		

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Type	MATERIAL	POLARITY	Ref.	Use	P_D @ 25°C	Ref. Point	T_J °C	V_{CB} Volts	V_{CE-} Volts	Subscript	h_{FE} Min	h_{FE} Max	@ I_C Units	$V_{CE(SAT)}$ Volts	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
						MAXIMUM RATINGS					ELECTRICAL CHARACTERISTICS								
MJE1290	S	P	MJE1290	ASP	90W	C	150	40	40	0	20	100	5.0A	1.8	15A	25	E	3.0M	T
MJE1291	S	P	MJE1290	ASP	90W	C	150	60	60	0	20	100	5.0A	1.8	15A	25	E	3.0M	T
MJE1660	S	N	MJE1290	ASP	90W	C	150	40	40	0	20	100	5.0A	1.8	15A	25	E	3.0M	T
MJE1661	S	N	MJE1290	ASP	90W	C	150	60	60	0	20	100	5.0A	1.8	15A	25	E	3.0M	T
MJE2010	S	P	MJE2010	ASP	80W	C	150	40	40	0	25	125	1.0A	1.0	3.5A	20	E	3.0M	T
MJE2011	S	P	MJE2010	ASP	80W	C	150	60	60	0	25	125	1.0A	1.0	3.5A	20	E	3.0M	T
MJE2020	S	N	MJE2010	ASP	80W	C	150	40	40	0	25	125	1.0A	1.0	3.5A	20	E	3.0M	T
MJE2021	S	N	MJE2010	ASP	80W	C	150	60	60	0	25	125	1.0A	1.0	3.5A	20	E	3.0M	T
MJE2360	S	N	MJE2360	AP	30W	C	150	375	350	0	25	200	50m	1.5	100m			10M	T
MJE2361	S	N	MJE2360	AP	30W	C	150	375	350	0	50	250	50m	1.5	100m			10M	T
MJE2370	S	P	MJE2370	ASP	40W	C	150	40	40	0	40	200	0.2A	0.7	1.0A	20	E	3.0M	T
MJE2371	S	P	MJE2370	ASP	40W	C	150	60	60	0	40	200	0.2A	0.7	1.0A	20	E	3.0M	T
MJE2480	S	N	MJE2480	ASP	60W	C	150	40	40	0	20	100	1.5A	0.7	1.5A			2.0M	T
MJE2481	S	N	MJE2480	ASP	60W	C	150	60	60	0	20	100	1.5A	0.7	1.5A			2.0M	T
MJE2482	S	N	MJE2480	ASP	60W	C	150	40	40	0	20	100	2.5A	0.7	1.5A			2.0M	T
MJE2483	S	N	MJE2480	ASP	60W	C	150	60	60	0	20	100	2.5A	0.7	1.5A			2.0M	T
MJE2490	S	P	MJE2490	ASP	60W	C	150	40	40	0	20	100	1.0A	0.6	1.0A	20	E	3.0M	T
MJE2491	S	P	MJE2490	ASP	60W	C	150	60	60	0	20	100	1.0A	0.6	1.0A	20	E	3.0M	T
MJE2520	S	N	MJE2520	ASP	40W	C	150	40	40	0	10		1.0A	0.7	1.0A	20	E	3.0M	T
MJE2521	S	N	MJE2520	ASP	40W	C	150	60	60	0	10		1.0A	0.7	1.0A	20	E	3.0M	T
MJE2522	S	N	MJE2520	ASP	40W	C	150	40	40	0	20	100	1.0A	0.6	1.0A	20	E	3.0M	T
MJE2523	S	N	MJE2520	ASP	40W	C	150	60	60	0	20	100	1.0A	0.6	1.0A	20	E	3.0M	T
MJE2801	S	N	MJE2801	AP	90W	C	150	60	60	0	25	100	3.0A						
MJE2901	S	P	MJE2901	AP	90W	C	150	60	60	0	25	100	3.0A						
MJE2955	S	P	MJE2955	ASP	90W	C	150	70	60	0	20	70	4.0A	1.1	4.0A			2.0M	T
MJE3054	S	N	MJE3054	ASP	40W	C	150	90	55	0	25	100	0.5A	1.0	0.5A	25	E	30K	E
MJE3055	S	N	MJE3055	ASP	90W	C	150	70	60	0	20	70	4.0A	1.1	4.0A			2.0M	T
MJE3370	S	P	MJE3370	AP	25W	C	150	30	30	0	25		1.0A						
MJE3371	S	P	MJE3371	AP	40W	C	150	40	40	0	40		1.0A						
MJE3439	S	N	MJE3439	AP	15W	C	150	450	350	0	40	160	20m	0.5	50m	25	E	15M	T
MJE3440	S	N	MJE3439	AP	15W	C	150	350	250	0	40	160	20m	0.5	50m	25	E	15M	T
MJE3520	S	N	MJE3520	AP	25W	C	150	30	30	0	25		1.0A						
MJE3521	S	N	MJE3520	AP	40W	C	150	40	40	0	40		1.0A						
MJE3738	S	N	MJE3738	AP	30W	C	150	250	225	0	40	200	100m	2.5	250m			10M	T
MJE3739	S	N	MJE3739	AP	30W	C	150	325	300	0	40	200	100m	2.5	250m			10M	T
MJE3740	S	P	MJE3740	SP	40W	C	150	60	60	0	30	100	250m	0.6	1.0A			4.0M	T
MJE3741	S	P	MJE3740	SP	40W	C	150	80	80	0	30	100	250m	0.6	1.0A			4.0M	T
MM380	G	P	MM380	AH	250m	A	100	25	10	0	15		3.0m	0.15	10m			400M	T
MM404	G	P	MM404	S	150m	A	100	25	24	S	30		12m	0.15	12m	135	E	4.0M	B
MM404R	G	P	MM404	S	150m	A	100	40	35	S	30		12m	0.15	12m	135	E	4.0M	B
MM1139	G	P	MM1139	AH	125m	A	100	30	15	0	15		2.0m					400M	T
MM1552	S	N	MM1552	AHP	80W	C	200	65	35	0	5.0		3.0A						
MM1553	S	N	MM1552	AHP	80W	C	200	100	70	0	15		2.0A						
MM1619	S	N	MM1619	AHP	50W	C	200	48	24	0	3.0		1.0A						
MM1620	S	N	MM1619	AHP	100W	C	200	48	24	0	3.0		2.4A						
MM1812	S	N	MM1812	AH	5.0W	C	200	175	175	0	35	200	10m	0.3	10m	50	E		
MM1941	S	N	MM1942	AH	300m	A	175	30	30	S	25		10m					600M	T
MM2258	S	N	MM2258	AH	1.0W	A	200	120	120	0	50		10m	0.4	25m			150M	T
MM2259	S	N	MM2258	AH	1.0W	A	200	175	175	0	35		10m	0.4	25m			150M	T
MM2260	S	N	MM2258	AH	1.0W	A	200	175	175	0	50		10m	0.4	25m			150M	T
MM2483	S	N		A	1.2W	C	200	60	60	0	175		1.0m			2.4	E		
MM2484	S	N		A	1.2W	C	200	60	60	0	250		1.0m			3.0	E		
MM2894A	S	P	MM2894	SH	360m	A	200	12	12	0	40	120	30m	0.19	30m			800M	T
MM3000	S	N	MM3000	AH	1.0W	A	200		100	0	20		10m					150M	T
MM3001	S	N	MM3000	AH	1.0W	A	200		150	0	20		10m					150M	T
MM3002	S	N	MM3000	AH	1.0W	A	200		200	0	20		10m					150M	T
MM3003	S	N	MM3000	AH	1.0W	A	200		250	0	20		10m					150M	T
MM3004	S	N	MM3005	AH	1.1W	A	200		25	0	70		150m					50M	T
MM3005	S	N	MM3005	AS	1.0W	A	200	80	60	0	50	250	150m	0.35	150m			50M	T

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Type	MATERIAL	POLARITY	Ref.	Use	P_D @ 25°C	Ref. Point	T_J °C	V_{CB} Volts	V_{CE-} Volts	Subscript	h_{FE} Min	h_{FE} Max	@ I_C Units	$V_{CE(SAT)}$ Volts	@ I_C Units	h_{f-}	Subscript	f– Units	Subscript
							MAXIMUM RATINGS				ELECTRICAL CHARACTERISTICS								
MM3006	S	N	MM3005	AS	1.0W	A	200	100	80	0	50	250	200m	0.35	150m			50M	T
MM3007	S	N	MM3005	AS	1.0W	A	200	120	100	0	50	250	250m	0.35	150m			50M	T
MM3008	S	N	MM3008	AH	1.0W	A	200		120	0	30		1.0m					50M	T
MM3009	S	N	MM3008	AH	1.0W	A	200		180	0	30		1.0m					50M	T
MM3724	S	N	MM2724	SH	1.0W	A	200		30	0	25	150	500m	0.6	500m			200M	T
MM3725	S	N	MM2724	SH	1.0W	A	200		50	0	25	150	500m	0.6	500m			200M	T
MM3726	S	P	MM3726	SH	1.0W	A	200		50	0	30	120	500m	0.6	500m			200M	T
MM3903	S	N	MM3903	AS	360m	A	200	60	40	0	50	150	10m	0.2	10m	50	E	250M	T
MM3904	S	N	MM3903	AS	360m	A	200	60	40	0	100	300	10m	0.2	10m	100	E	300M	T
MM3905	S	P	MM3905	AS	360m	A	200	40	40	0	50	150	10m	0.25	10m	50	E	200M	T
MM3906	S	P	MM3905	AS	360m	A	200	40	40	0	100	300	10m	0.25	10m	100	E	250M	T
MM4000	S	P	MM4000	AH	600m	A	200	100	100	0	20		10m	0.6	10m				
MM4001	S	P	MM4000	AH	1.0W	A	200	150	150	0	20		10m	0.6	10m				
MM4002	S	P	MM4000	AH	1.0W	A	200	200	200	0	20		10m	5.0	10m				
MM4003	S	P	MM4000	AH	1.0W	A	200	250	250	0	20		10m	5.0	10m				
MM4005	S	P	MM4005	AH	1.0W	A	200	60	60	0	40		1.0m					50M	T
MM4006	S	P	MM4005	AH	1.0W	A	200	80	80	0	40		1.0m					50M	T
MM4007	S	P	MM4005	AH	1.0W	A	200	100	100	0	40		1.0m					50M	T
MM4008	S	P	MM4008	AH	1.0W	A	200	60	60	0	75		10m						
MM4009	S	P	MM4008	AH	1.0W	A	200	80	80	0	75		10m						
MM4010	S	P	MM4008	AH	1.0W	A	200	100	100	0	75		10m						
MM4018	S	P	MM4018	AH	5.0W	C	200	40	20	0	10		50m					900M	T
MM4019	S	P	MM4019	AH	5.0W	C	200	60	40	0	10		250m					750M	T
MM4026	S	P		S	0.5W	A	200	60	60	0	40	120	100m	0.15	150m	1.0	E		
MM4027	S	P		S	0.5W	A	200	80	80	0	100	300	100m	0.15	150m	1.5	E		
MM4028	S	P		S	0.5W	A	200	60	60	0	40	120	100m	0.15	150m	1.0	E		
MM4029	S	P		S	0.5W	A	200	80	80	0	100	300	100m	0.15	150m	1.5	E		
MM4030	S	P		S	0.8W	A	200	60	60	0	40	120	0.1A	0.15	0.15A	1.0	E		
MM4031	S	P		S	0.8W	A	200	80	80	0	100	300	0.1A	0.15	0.15A	1.5	E		
MM4032	S	P		S	0.8W	A	200	60	60	0	40	120	0.1A	0.15	0.15A	1.0	E		
MM4033	S	P		S	0.8W	A	200	80	80	0	100	300	0.1A	0.15	0.15A	1.5	E		
MM4036	S	P		S	5.0W	C	200	90	65	0	40	140	0.15A	0.65	0.15A	3.0	E		
MM4037	S	P		S	1.0W	C	200	60	40	0	50	250	0.15A	1.4	0.15A	3.0	E		
MM4049	S	P	MM4049	AH	200m	A	200	15	10	0	20	80	25m					4.0G	T
MM4052	S	P	MM4052	SC	0.5W	A	200	30	30	0	20		10m			20	E	12M	T
MM4208	S	P	MM4208	SH	360m	A	200	12	12	0	30	120	10m	0.18	10m			850M	T
MM4208A	S	P	MM4208	SH	360m	A	200	15	15	0	30	120	10m	0.18	10m			850M	T
MM4209	S	P	MM4208	SH	360m	A	200	12	12	0	50	120	10m	0.18	10m			850M	T
MM4209A	S	P	MM4208	SH	360m	A	200	15	15	0	50	120	10m	0.18	10m			850M	T
MM4261H	S	P	MM4261H	S	200m	A	200	15	15	0	30	150	10m	0.5	10m			2.0G	T
MM5000	G	P	MM5000	AH	150m	A	100	30	15	0	30		3.0m					800M	T
MM5001	G	P	MM5000	AH	150m	A	100	30	15	0	30		3.0m					800M	T
MM5002	G	P	MM5000	AH	150m	A	100	30	15	0	30		3.0m					800M	T
MM5005	S	P	MM5005	SAH	1.5W	A	200	80	60	0	50	250	150m	0.5	150m			30M	T
MM5006	S	P	MM5005	SAH	1.5W	A	200	100	80	0	50	250	200m	0.5	150m			30M	T
MM5007	S	P	MM5005	SAH	1.5W	A	200	120	100	0	50	250	250m	0.5	150m			30M	T
MM8000	S	N	MM8000	AH	3.5W	C	200	40	30	0	30		50m					700M	T
MM8001	S	N	MM8000	AH	3.5W	C	200	40	30	0	30		50m					900M	T
MM8003	S	N	MM8003	AH	5.0W	C	200	40	30	0	30		50m					1200M	T
MM8006	S	N	MM8006	AH	200m	A	200	15	10	0	25		1.0m	0.35	80m			1000M	T
MM8007	S	N	MM8006	AH	200m	A	200	15	10	0	25		1.0m	0.35	80m			1000M	T
MM8008	S	N	MM8008	A	3.5W	C	200	35	30	0				0.3	100m			1100M	T
MM8009	S	N	MM8009	AH	3.5W	C	200	55	50	0				0.5	100m			1000M	T
MM8010	S	N	MM8008	A	3.5W	C	200	35	30	0				0.3	100m			1100M	T
MM8011	S	N	MM8008	A	3.5W	C	200	35	30	0				0.3	100m			1100M	T
MM8016	S	N		AH	0.31W	A	200	35	30	0	300	900	100m	0.5	10m			50M	T
MMCM918	S	N	MMCM918	A	200m	A	200	30	15	0	20		3.0m	0.4	10m			600M	T
MMCM930	S	N	MMCM930	A	200m	A	200	60	45	0	150		1.0m	0.35	1.0m			60M	T
MMCM2222	S	N	MMCM2222	SAH	200m	A	200	60	30	0	100	300	150m	0.4	150m			200M	T
MMCM2369	S	N	MMCM2369	SH	200m	A	200	40	15	0	40	120	10m	0.25	10m			500M	T

Type	MATERIAL	POLARITY	Ref.	Use	P_D @ 25°C	Ref. Point	T_J °C	V_{CB} Volts	V_{CE-} Volts	Subscript	h_{FE} @ I_C Min	Max	Units	$V_{CE(SAT)}$ @ I_C Volts	Units	h_{f-}	Subscript	f– Units	Subscript
						MAXIMUM RATINGS					ELECTRICAL CHARACTERISTICS								
MMCM2484	S	N	MMCM2484	A	200m	A	200	60	60	0	250		1.0m	0.35	1.0m			60M	T
MMCM2907	S	P	MMCM2907	SAH	200m	A	200	60	40	0	100	300	150m	0.4	150m			200M	T
MMT70	S	N	MMT70	A	225m	A	135	25	20	0	150		2.0m						
MMT71	S	P	MMT71	A	225m	A	135	25	20	0	150		2.0m						
MMT72	S	N	MMT72	SH	225m	A	135		10	0	30		10m					400M	T
MMT73	S	P	MMT73	SH	225m	A	135		8.0	0	30		10m	0.2	10m			400M	T
MMT74	S	N		A	225m	A	135	20	12	0	25		3.0m					700M	T
MMT75	S	P		SAH	225m	A	135	30	20	0	50	400	10m						
MMT76	S	N		SAH	225m	A	135	30	20	0	50	400	10m						
MMT806	S	N	MMT806	SH	225m	A	135	8.0	5.0	0	50		100*	0.1	100*			1200M	T
MMT807	S	N	MMT807	AH	225m	A	135	8.0	5.0	0	25		1.0m	0.125	1.0m			1200M	T
MMT808	S	P	MMT808	SH	225m	A	135	8.0	5.0	0	50		100*	0.1	100*			1200M	T
MMT809	S	P	MMT809	AH	225m	A	135	8.0	5.0	0	25		1.0m	0.125	1.0m			1200M	T
MMT918	S	N	MMCM918	A	225m	A	135	30	15	0	20		3.0m	0.4	10m			600M	T
MMT930	S	N	MMCM930	A	225m	A	135	60	45	0	150		1.0m	0.35	1.0m			60M	T
MMT2222	S	N	MMCM2222	SH	225m	A	135	60	30	0	100	300	150m	0.4	150m			200M	T
MMT2369	S	N	MMCM2369	SH	225m	A	135	40	15	0	40	120	10m	0.25	10m			500M	T
MMT2484	S	N	MMCM2484	A	225m	A	135	60	60	0	250		1.0m	0.35	1.0m			60M	T
MMT2857	S	N	MMCM2857	A	225m	A	135	30	15	0	30		3.0m					1000M	T
MMT2907	S	P	MMT2907	SAH	225m	A	135	60	40	0	100	300	150m	0.4	150m			200M	T
MMT3014	S	N	MMT3014	SH	225m	A	135	40	20	0	50	200	30m	0.22	30m			350M	T
MMT3546	S	P	MMT3546	SH	225m	A	135	15	12	0	30		10m	0.15	10m			700M	T
MMT3798	S	P	MMT3798	A	225m	A	135	60	60	0	150		1.0m	0.25	1.0m	275	E	40M	T
MMT3799	S	P	MMT3798	A	225m	A	135	60	60	0	300		1.0m	0.25	1.0m	475	E	40M	T
MMT3903	S	N	MMT3903	SAH	225m	A	135	60	40	0	50	150	10m	0.2	10m	100	E	250M	T
MMT3904	S	N	MMT3903	SAH	225m	A	135	60	40	0	100	300	10m	0.2	10m	200	E	300M	T
MMT3905	S	P	MMT3905	SAH	225m	A	135	40	40	0	50	150	10m	0.25	10m	100	E	200M	T
MMT3906	S	P	MMT3905	SAH	225m	A	135	40	40	0	100	300	10m	0.25	10m	200	E	250M	T
MMT3960	S	N	MMT3960	SH	225m	A	135	5.0	3.0	0	100	200	10m	0.2	10m			1600M	T
MMT3960A	S	N	MMT3960A	SH	225m	A	135	15	8.0	0	30	200	10m	0.2	10m			1600M	T
MMT8015	S	N	MMT8015	A	200m	A	135	15	10	0	25	300	1.0m	0.35	10m			1000M	T
MP110	G	P	MP110	AP	106W	C	110		65	X	74	250	1.0A	0.5	2.0A			320k	T
MP110B	G	P	MP110B	AP	106W	C	110	90	40	0	55		5.0A	0.5	5.0A			500k	T
MP500	G	P	MP500	AP	170W	C	110	45	30	0	30	60	15A	0.2	15A			2.0k	E
MP500A	G	P	MP500	AP	170W	C	110	45	30	0	30	60	15A	0.2	15A			2.0k	E
MP501	G	P	MP500	AP	170W	C	110	60	45	0	30	60	15A	0.2	15A			2.0k	E
MP501A	G	P	MP500	AP	170W	C	110	60	45	0	30	60	15A	0.2	15A			2.0k	E
MP502	G	P	MP500	AP	170W	C	110	70	60	0	30	60	15A	0.2	15A			2.0k	E
MP502A	G	P	MP500	AP	170W	C	110	70	60	0	30	60	15A	0.2	15A			2.0k	E
MP504	G	P	MP500	AP	170W	C	110	45	30	0	50	100	15A	0.2	15A			2.0k	E
MP504A	G	P	MP500	AP	170W	C	110	45	30	0	50	100	15A	0.2	15A			2.0k	E
MP505	G	P	MP500	AP	170W	C	110	60	45	0	50	100	15A	0.2	15A			2.0k	E
MP505A	G	P	MP500	AP	170W	C	110	60	45	0	50	100	15A	0.2	15A			2.0k	E
MP506	G	P	MP500	AP	170W	C	110	70	60	0	50	100	15A	0.2	15A			2.0k	E
MP506A	G	P	MP500	AP	170W	C	110	70	60	0	50	100	15A	0.2	15A			2.0k	E
MP525	G	P	MP525	AP	106W	C	110		60	X	30	150	3.0A						
MP600	G	P	MP600	SP	85W	C	110	75	50	0	50		5.0A	0.75	25A				
MP601	G	P	MP600	SP	85W	C	110	75	60	0	50		5.0A	0.75	25A				
MP602	G	P	MP600	SP	85W	C	110	90	70	0	50		5.0A	0.75	25A				
MP603	G	P	MP600	SP	85W	C	110	90	80	0	50		5.0A	0.75	25A				
MP800	G	P	MP800	AP	250W	C	110		60	0	15		150A	0.3	150A				
MP801	G	P	MP800	AP	250W	C	110		45	0	15		150A	0.3	150A				
MP900	G	P	MP900	SP	250W	C	110	80	60	0	20		70A	0.5	150A				
MP901	G	P	MP900	SP	250W	C	110	110	90	0	20		70A	0.5	150A				
MP902	G	P	MP900	SP	250W	C	110	140	120	0	20		70A	0.5	150A				
MP1612	G	P	MP1612	AP	85W	C	110	100	100	0	25	100	10A	0.3	10A				
MP1612A	G	P	MP1612	AP	85W	C	110	140	140	0	25	100	10A	0.3	10A				
MP1612B	G	P	MP1612	AP	85W	C	110	160	160	0	25	100	10A	0.3	10A				
MP1613	G	P	MP1613	AP	85W	C	110	100	75	0	40		1.0A	0.25	3.0A				
MP2000A	G	P	MP2000A	SP	106W	C	110		30	0	25		8.0A	0.6	25A			210k	T

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Type	MATERIAL	POLARITY	Ref.	Use	P_D @ 25°C	Ref. Point	T_J °C	V_{CB} Volts	V_{CE-} Volts	Subscript	h_{FE} Min	Max	@ I_C Units	$V_{CE(SAT)}$ Volts	@ I_C Units	h_{f-}	Subscript	f– Units	Subscript
							MAXIMUM RATINGS				ELECTRICAL CHARACTERISTICS								
MP2060	G	P	MP2060	AP	85W	C	110	40	25	0	30	200	3.0A	0.25	3.0A			600k	T
MP2061	G	P	MP2060	AP	85W	C	110	60	35	0	30	200	3.0A	0.25	3.0A			600k	T
MP2062	G	P	MP2060	AP	85W	C	110	75	50	0	30	200	3.0A	0.25	3.0A			600k	T
MP2063	G	P	MP2060	AP	85W	C	110	90	60	0	30	200	3.0A	0.25	3.0A			600k	T
MP2100A	G	P	MP2000A	SP	106W	C	110		60	0	25		8.0A	0.6	25A			210k	T
MP2200A	G	P	MP2000A	SP	106W	C	110		80	0	25		8.0A	0.6	25A			210k	T
MP2300A	G	P	MP2000A	SP	106W	C	110		100	0	25		8.0A	0.6	25A			210k	T
MP2400A	G	P	MP2000A	SP	106W	C	110		120	0	25		8.0A	0.6	25A			210k	T
MP3730	G	P	MP3730	AP	56W	C	110	200	200	S	10	200	50m	0.5	50m			1.0M	T
MP3731	G	P	MP3730	AP	56W	C	110	320	320	S	10	200	50m	0.5	50m			1.0M	T
MPM200	S	N	MPM200	A	200m	A	200	20	20	0	15	200	3.0m					350M	T
MPM5006	S	N	MPM5006	A	310m	A	135	40	40	0	30		4.0m	2.0	10m	4.0	E		
MPQ3303	S	N	MPQ3303	SAM	2.5W	A	150	25	12	0	40	200	300m	0.33	300m			400M	T
MPQ3725	S	N	MPQ3725	SM	2.5W	A	150		40	0	35	200	100m	0.45	500m			250M	T
MPS404	S	P	MPS404	S	310m	A	135	25	24	0	30	400	12m	0.15	12m			4.0M	B
MPS404A	S	P	MPS404	S	310m	A	135	40	35	0	30	400	12m	0.15	12m			4.0M	B
MPS706	S	N	MPS706	SH	310m	A	135	25	20	R	20		10m	0.6	10m			200M	T
MPS706A	S	N	MPS706	SH	310m	A	135	25	20	R	20	60	10m	0.6	10m			200M	T
MPS834	S	N	MPS834	SH	310m	A	135	40	30	S	25		10m	0.25	10m			350M	T
MPS918	S	N	MPS918	A	310m	A	135	30	15	0	20		3.0m	0.4	10m			600M	T
MPS2369	S	N	MPS2369	SH	310m	A	135	40	15	0	40	120	10m	0.25	10m			500M	T
MPS2713	S	N	MPS2713	S	310m	A	135	18	18	0	30	90	2.0m	0.3	50m	30	E	250M	T
MPS2714	S	N	MPS2713	S	310m	A	135	18	18	0	75	225	2.0m	0.3	50m	80	E	250M	T
MPS3563	S	N	MPS918	AH	310m	A	135	30	12	0	20	200	8.0m	0.4	10m	20	E	600M	T
MPS3638	S	P	MPS3638	SAH	310m	A	135	25	25	0	30		50m	0.25	50m	25	E	100M	T
MPS3638A	S	P	MPS3638	SAH	310m	A	135	25	25	0	100		50m	0.25	50m	100	E	150M	T
MPS3640	S	P	MPS3640	S	310m	A	135	12	12	0	30	120	10m	0.2	10m			500M	T
MPS3646	S	N	MPS3646	SH	200m	A	125	40	15	0	30	120	30m	0.2	30m			350M	T
MPS3693	S	N	MPS3693	AH	310m	A	135	45	45	0	40	160	10m					200M	T
MPS3694	S	N	MPS3694	AH	310m	A	135	45	45	0	100	400	10m					200M	T
MPS3702	S	P	MPS3702	AH	310m	A	135	40	25	0	60	300	50m	0.25	50m			100M	T
MPS3703	S	P	MPS3702	AH	310m	A	135	50	30	0	30	150	50m	0.25	50m			100M	T
MPS3704	S	N	MPS3704	AH	310m	A	135	50	30	0	100	300	50m	0.6	100m			100M	T
MPS3705	S	N	MPS3704	AH	310m	A	135	50	30	0	50	150	50m	0.8	100m			100M	T
MPS3706	S	N	MPS3704	AH	310m	A	135	40	20	0	30	600	50m	1.0	100m			100M	T
MPS4354	S	P	MPS4354	APS	625M	A	150	60	60	0	50	500	10M	0.15	150M	200	E	100M	T
MPS4355	S	P	MPS4354	APS	625M	A	150	60	60	0	100	400	10M	0.15	150M	200	E	100M	T
MPS4356	S	P	MPS4354	APS	625M	A	150	80	80	0	50	250	10M	0.15	150M	200	E	100M	T
MPS5172	S	N	MPS5172	AH	210m	A	135	25	25	0	100	500	10m	0.25	10m			120M	T
MPS6507	S	N	MPS6507	A	210m	A	135	30	20	0	25		2.0m					880M	T
MPS6511	S	N	MPS6511	AH	310m	A	135	30	20	0	25		10m						
MPS6512	S	N	MPS6512	AH	310m	A	135	40	30	0	50	100	2.0m	0.5	50m			250M	T
MPS6513	S	N	MPS6512	AH	310m	A	135	40	30	0	90	180	2.0m	0.5	50m			250M	T
MPS6514	S	N	MPS6512	AH	310m	A	135	40	25	0	150	300	2.0m	0.5	50m			390M	T
MPS6515	S	N	MPS6512	AH	310m	A	135	40	25	0	250	500	2.0m	0.5	50m			390M	T
MPS6516	S	P	MPS6516	AH	310m	A	135	40	40	0	50	100	2.0m	0.5	50m			200M	T
MPS6517	S	P	MPS6516	AH	310m	A	135	40	40	0	90	180	2.0m	0.5	50m			200M	T
MPS6518	S	P	MPS6516	AH	310m	A	135	40	40	0	150	300	2.0m	0.5	50m			340M	T
MPS6519	S	P	MPS6516	AH	310m	A	135	25	25	0	250	500	2.0m	0.5	50m			340M	T
MPS6520	S	N	MPS6520	AH	310m	A	135	40	25	0	200	400	2.0m	0.5	50m			390M	T
MPS6521	S	N	MPS6520	AH	310m	A	135	40	25	0	300	600	2.0m	0.5	50m			480M	T
MPS6522	S	P	MPS6520	AH	310m	A	135	25	25	0	200	400	2.0m	0.5	50m			340M	T
MPS6523	S	P	MPS6520	AH	310m	A	135	25	25	0	300	600	2.0m	0.5	50m			420M	T
MPS6530	S	N	MPS6530	AH	310m	A	135	60	40	0	40	120	100m	0.5	100m			390M	T
MPS6531	S	N	MPS6530	AH	310m	A	135	60	40	0	90	270	100m	0.3	100m			390M	T
MPS6532	S	N	MPS6530	AH	310m	A	135	50	30	0	30		100m	0.5	100m			390M	T
MPS6533	S	P	MPS6530	AH	310m	A	135	40	40	0	40	120	100m	0.5	100m			260M	T
MPS6534	S	P	MPS6530	AH	310m	A	135	40	40	0	90	270	100m	0.3	100m			260M	T
MPS6535	S	P	MPS6530	AH	310m	A	135	30	30	0	30		100m	0.5	100m			260M	T
MPS6539	S	N	MPS6539	AH	310m	A	135	20	20	0	20		4.0m					500M	T

						MAXIMUM RATINGS					ELECTRICAL CHARACTERISTICS								
Type	MATERIAL	POLARITY	Ref.	Use	P_D @ 25°C	Ref. Point	T_J °C	V_{CB} Volts	V_{CE-} Volts	Subscript	h_{FE} Min	Max	@ I_C Units	$V_{CE(SAT)}$ Volts	@ I_C Units	h_{f-}	Subscript	f_- Units	Subscript
MPS6540	S	N	MPS6540	AH	310m	A	135	30	30	0	25		2.0m	0.5	10m			350M	T
MPS6542	S	N	MPS6542	AH	310m	A	135	30	20	0	25		2.0m					700M	T
MPS6543	S	N	MPS6543	AH	310m	A	135	35	25	0	25		4.0m	0.35	10m			750M	T
MPS6544	S	N	MPS6544	AH	310m	A	135	60	45	0	20		30m	0.5	30m				
MPS6545	S	N	MPS6544	AH	310m	A	135	60	45	0	20		30m	0.5	30m				
MPS6546	S	N	MPS6546	A	310m	A	135	35	25	0	20		2.0m	0.35	10m			600M	T
MPS6547	S	N	MPS6546	A	310m	A	135	35	25	0	20		2.0m	0.35	10m			600M	T
MPS6548	S	N	MPS6548	A	310m	A	135	30	25	0	25		4.0m	0.5	4.0m			650M	T
MPS6560	S	N	MPS6560	AH	500m	A	135	25	25	0	50	200	500m	0.5	500m			60M	T
MPS6561	S	N	MPS6560	AH	500m	A	135	20	20	0	50	200	350m	0.5	350m			60M	T
MPS6562	S	P	MPS6560	AH	500m	A	135	25	25	0	50	200	500m	0.5	500m			60M	T
MPS6563	S	P	MPS6560	AH	500m	A	135	20	20	0	50	200	350m	0.5	350m			60M	T
MPS6565	S	N	MPS6565	AH	310m	A	135	60	45	0	40	160	10m	0.4	10m	160	E	200M	T
MPS6566	S	N	MPS6565	AH	310m	A	135	60	45	0	100	400	10m	0.4	10m	160	E	200M	T
MPS6567	S	N	MPS6567	AH	310m	A	135		40	0	25		10m	0.5	10m				
MPS6568	S	N	MPS6568	AH	310m	A	135	20	20	0	20	200	4.0m	3.0	10m			375M	T
MPS6568A	S	N	MPS6568	AH	310m	A	135	20	20	0	20	200	4.0m	3.0	10m			375M	T
MPS6569	S	N	MPS6568	AH	310m	A	135	20	20	0	20	200	4.0m	3.0	10m			300M	T
MPS6570	S	N	MPS6568	AH	310m	A	135	20	20	0	20	200	4.0m	3.0	10m			300M	T
MPS6571	S	N	MPS6571	AH	310m	A	135	20	20	0	250	1000	100*	0.5	10m			50M	T
MPS-A05	S	N	MPS-A05	AH	500m	A	135	60	60	0	50		100m	0.25	100m			50M	T
MPS-A06	S	N	MPS-A05	AH	500m	A	135	80	80	0	50		100m	0.25	100m			50M	T
MPS-A09	S	N	MPS-A09	AH	310m	A	135	50	50	0	100	600	0.1m	0.9	10m			30M	T
MPS-A10	S	N	MPS-A10	AH	300m	A	135		40	0	40	400	5.0m					50M	T
MPS-A12	S	N	MPS-A12	AH	310m	A	135		20	0	20,000		10m	1.0	10m	35	E		
MPS-A13	S	N	MPS-A13	AH	500m	A	135	30	30	0	10,000		100m	1.5	100m			125M	T
MPS-A14	S	N	MPS-A13	AH	500m	A	135	30	30	0	20,000		100m	1.5	100m			125M	T
MPS-A16	S	N	MPS-A16	SH	350M	A	150		40	0	200	600	5.0M	0.25	10M			100M	T
MPS-A17	S	N	MPS-A16	SH	350M	A	150		40	0	200	600	5.0M	0.25	10M			100M	T
MPS-A18	S	N	MPS-A18	SH	310M	A	135	45	45	0	800		1.0M	0.1	10M			100M	T
MPS-A20	S	N	MPS-A20	AH	300m	A	135		40	0	40	400	5.0m	0.25	10m			125M	T
MPS-A42	S	N	MPS-A42	AH	625M	A	150	300	300	0	40		30M	0.5	20M			50M	T
MPS-A43	S	N	MPS-A42	AH	625M	A	150	200	200	0	50	200	30M	0.4	20M			50M	T
MPS-A55	S	P	MPS-A55	A	500m	A	135	60	60	0	50	125	100m	0.25	100m			50M	T
MPS-A56	S	P	MPS-A56	A	500m	A	135	80	80	0	50	125	100m	0.25	100m			50M	T
MPS-A65	S	P	MPS-A65	AH	500m	A	135	30	30	S	20,000		100m	1.5	100m			100M	T
MPS-A66	S	P	MPS-A65	AH	500m	A	135	30	30	S	40,000		100m	1.5	100m			100M	T
MPS-A70	S	P	MPS-A70	AH	300m	A	135		40	0	40	400	5.0m	0.25	10m			125M	T
MPS-A92	S	P	MPS-A92	AH	625M	A	150	300	300	0	25		30M	0.5	20M			50M	T
MPS-A93	S	P	MPS-A92	AH	625M	A	150	200	200	0	30	150	30M	0.4	20M			50M	T
MPS-H02	S	N	MPS-H02	AH	500m	A	135	20	20	0	20	200	4.0m					375M	T
MPS-H04	S	N	MPS-H04	AH	300m	A	135		80	0	30	120	1.5m	0.25	10m			80M	T
MPS-H05	S	N	MPS-H05	AH	300m	A	135		80	0	30	150	1.5m	0.25	10m			80M	T
MPS-H07	S	N	MPS-H07	AH	500m	A	135	30	30	0	20		3.0m					400M	T
MPS-H08	S	N	MPS-H07	AH	500m	A	135	30	30	0	20		3.0m					500M	T
MPS-H10	S	N	MPS-H10	AH	310m	A	135	30	25	0	60		4.0m	0.5	4.0m			650M	T
MPS-H11	S	N	MPS-H10	AH	310m	A	135	30	25	0	60		4.0m	0.5	4.0m			650M	T
MPS-H19	S	N	MPS-H19	AH	310M	A	135	30	25	0	45		4.0M					300M	T
MPS-H20	S	N	MPS-H20	AH	310m	A	135	40	30	0	25		4.0m					400M	T
MPS-H24	S	N	MPS-H24	AH	500m	A	135	40	30	0	30		8.0m					400M	T
MPS-H30	S	N	MPS-H30	AH	310m	A	135	20	20	0	20	200	4.0m	3.0	10m			300M	T
MPS-H31	S	N	MPS-H30	AH	310m	A	135	20	20	0	20	200	4.0m	3.0	10m			300M	T
MPS-H34	S	N	MPS-H34	AH	500m	A	135	45	45	0	15		20m	0.5	20m			500M	T
MPS-H37	S	N	MPS-H37	AH	310m	A	135		40	0	25		5.0m	0.5	10m			300M	T
MPS-H54	S	P	MPS-H54	AH	300m	A	135		80	0	30	120	1.5m	0.25	10m			80M	T
MPS-H55	S	P	MPS-H54	AH	300m	A	135		80	0	30	150	1.5m	0.25	10m			80M	T
MPS-H83	S	P	MPS-H83	AH	1.0W	A	150	300	300	0	40		30M	0.75	30M			60M	T
MPS-K10	S	N	MPS-A10	AH	300m	A	135		40	0	40	300	5.0m					50M	T
MPS-K11	S	N	MPS-A10	AH	300m	A	135		40	0	40	300	5.0m					50M	T
MPS-K12	S	N	MPS-A10	AH	300m	A	135		40	0	40	300	5.0m					50M	T

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Type	MATERIAL	POLARITY	Ref.	Use	P_D @ 25°C	MAXIMUM RATINGS Ref. Point	T_J °C	V_{CB} Volts	V_{CE-} Volts	Subscript	ELECTRICAL CHARACTERISTICS h_{FE} @ I_C Min	Max	Units	$V_{CE(SAT)}$ @ I_C Volts	Units	h_{f-}	Subscript	f– Units	Subscript
MPS-K20	S	N	MPS-A20	AH	300m	A	135		40	0	40	300	5.0m	0.25	10m			125M	T
MPS-K21	S	N	MPS-A20	AH	300m	A	135		40	0	40	300	5.0m	0.25	10m			125M	T
MPS-K22	S	N	MPS-A20	AH	300m	A	135		40	0	40	300	5.0m	0.25	10m			125M	T
MPS-K70	S	P	MPS-A70	AH	300m	A	135		40	0	40	300	5.0m	0.25	10m			125M	T
MPS-K71	S	P	MPS-A70	AH	300m	A	135		40	0	40	300	5.0m	0.25	10m			125M	T
MPS-K72	S	P	MPS-A70	AH	300m	A	135		40	0	40	300	5.0m	0.25	10m			125M	T
MPS-L01	S	N	MPS-L01	AH	310m	A	135	140	120	0	50	300	10m	0.2	10m			60M	T
MPS-L07	S	P	MPS-L07	SH	310m	A	135	6.0	6.0	0	30	120	10m	0.15	10m			500M	T
MPS-L08	S	P	MPS-L07	SH	310m	A	135	12	12	0	30	120	10m	0.15	10m			700M	T
MPS-L51	S	P	MPS-L51	AH	310m	A	135	100	100	0	40	250	50m	0.3	50m			60M	T
MPS-U01	S	N	MPS-U01	AH	1.0W	A	135	40	30	0	50		1.0A	0.5	1.0A			50M	T
MPS-U01A	S	N	MPS-U01	AH	1.0W	A	135	50	40	0	50		1.0A	0.5	1.0A			50M	T
MPS-U02	S	N	MPS-U02	AH	1.0W	A	135	60	40	0	50	300	150m	0.4	150m			150M	T
MPS-U03	S	N	MPS-U03	AH	1.0W	A	135	120	120	0	40		10m	0.5	200m			100M	T
MPS-U04	S	N	MPS-U03	AH	1.0W	A	135	180	180	0	40		10m	0.5	200m			100M	T
MPS-U05	S	N	MPS-U05	AH	1.0W	A	135	60	60	0	60		250m	0.4	250m			50M	T
MPS-U06	S	N	MPS-U05	AH	1.0W	A	135	80	80	0	60		250m	0.4	250m			50M	T
MPS-U07	S	N	MPS-U07	AH	1.0W	A	135	100	100	0	30		250m	0.4	250m			50M	T
MPS-U10	S	N	MPS-U10	AH	1.0W	A	150	300	300	0	40		10m	0.75	30m			60M	T
MPS-U45	S	N	MPS-U45	AH	1.0W	A	150	50	40	0	25,000	150,000	200m	1.5	1.0A			100M	T
MPS-U51	S	P	MPS-U51	AH	1.0W	A	135	40	30	0	50		1.0A	0.7	1.0A			50M	T
MPS-U51A	S	P	MPS-U51	AH	1.0W	A	135	50	40	0	50		1.0A	0.7	1.0A			50M	T
MPS-U52	S	P	MPS-U52	AH	1.0W	A	135	60	40	0	50	300	150m	0.4	150m			150M	T
MPS-U55	S	P	MPS-U55	AH	1.0W	A	150	60	60	0	50		250m	0.5	250m			50M	T
MPS-U56	S	P	MPS-U55	AH	1.0W	A	150	80	80	0	50		250m	0.5	250m			50M	T
MPS-U57	S	P	MPS-U57	AH	1.0W	A	150	100	100	0	30		250m	0.5	250m			50M	T
MPS-U60	S	P	MPS-U60	AH	10W	C	150	300	300	0	25		1.0M	0.75	20M			60M	T
MPS-U95	S	P	MPS-U95	AH	1.0W	A	150	50	40	0	4,000		1.0A	1.5	1.0A			320M	T
MQ2218	S	N	MD2218	SAM	400m	A	200	60	30	0	40	120	150m	0.4	150m			200M	T
MQ2219A	S	N	MD2219	SAM	400m	A	200	75	40	0	100	300	150m	0.3	150m			250M	T
MQ2904	S	P	MD2904	SAM	400m	A	200	60	40	0	40	120	150m	0.4	150m			200M	T
MQ2905A	S	P	MD2905	SAM	400m	A	200	60	60	0	100	300	150m	0.4	150m			200M	T
MQ3467	S	P	MD3467	SM	400m	A	200	40	40	0	20		500m	0.5	500m			150M	T
MQ3725	S	N	MD3725	SAM	400m	A	200	65	40	0	50	150	100m	0.26	100m			250M	T
MQ3762	S	P	MD3762	SAM	400m	A	200	40	40	0	20		1.0A	1.0	1.0A			150M	T
MQ3799	S	P	MD3799	AM	250m	A	200	60	60	0	300	900	100*	0.2	100*	500	E	100M	T
MQ3799A	S	P	MD3799	AM	250m	A	200	60	60	0	300	900	100*	0.2	100*	500	E	100M	T
MRF501	S	N	MRF501	AH	200m	A		25	15	0	30	250	1.0m					1000M	T
MRF502	S	N	MRF501	AH	200m	A		35	15	0	40	170	1.0m					1200M	T
MRF8004	S	N	MRF8004	AH	5.0W	C		60	30	0	10		400m						

FIELD-EFFECT TRANSISTORS INDEX

This table contains an alpha-numerical listing and short-form specifications for Motorola in-house non-registered field-effect transistors.

KEY

Type	Polarity	Const.	Ref.	I_{DSS} Min mA	I_{DSS} Max mA *nA	I_{GSS} I_{DGO}* nA	Breakdown Voltage $V_{(BR)}$ Volts	Breakdown Voltage Sub-script	Y_{fs} Min µmhos	Y_{fs} Max µmhos	C_{iss} pF	NF @ f dB µV*/√Hz	Units	NOTE: D = Dual MP = Matched Pair

- **Type**: Numerical Listing of Registered Type Numbers
- **Polarity**: N = n-channel; P = p-channel
- **Const.**: J = Junction FET; M = MOS FET
- **Ref.**: Reference device number indicates specific Data Sheet on which device is characterized
- **I_{DSS}**: Minimum and Maximum Drain Current with gate connected to source
- **I_{GSS} / I_{DGO}***: Maximum Gate Current (leakage) with drain connected to source; *Maximum leakage from drain to gate with source open
- **Y_{fs}**: Minimum and Maximum Forward Transadmittance
- **C_{iss}**: Maximum Input Capacitance
- **NF @ f**: Noise Figure in dB or*, µV / √Hz at a specified frequency
  - frequency units:
    - H = Hz
    - K = kHz
    - M = MHz
- **Breakdown Voltage**: Minimum Breakdown Voltage (Subscript defines conditions)
  - GS = Gate to source, drain connection not specified
  - GSS = Gate to source, drain connected to source
  - GD = Gate to drain, source connection not specified
  - GDS = Gate to drain, source connected to drain
  - DGO = Drain to gate, source open
  - DGS = Drain to gate, source connected to drain
  - DS = Drain to source, gate connection not specified
  - DSX = Drain to source, gate biased to cutoff or beyond

FIELD-EFFECT TRANSISTORS INDEX

Type	Polarity	Const.	Ref.	I_{DSS} Min mA	I_{DSS} Max mA *nA	I_{GSS} I_{DGO}* nA	Breakdown Voltage $V_{(BR)}$ Volts	Breakdown Voltage Sub-script	Yfs Min µmhos	Yfs Max µmhos	C_{ISS} pF	NF dB µV*/√Hz	@ f	Units	Note
MFE120	N	M	MFE120	2.0	18	20	25	DSX	8000	18,000	7.0	5.0	105	M	
MFE121	N	M	MFE120	5.0	30	20	25	DSX	10,000	20,000	6.0	5.0	60	M	
MFE122	N	M	MFE120	2.0	20	20	25	DSX	8000	18,000	7.0	5.0	200	M	
MFE2000	N	J	MFE2000	4.0	10	-200	-25	GSS	2500	6000	5.0	2.0	100	M	
MFE2001	N	J	MFE2000	8.0	20	-200	-25	GSS	4000	8000	5.0	2.0	100	M	
MFE2004	N	J	MFE2004	8.0		0.2	30	GSS			16				
MFE2005	N	J	MFE2004	15		0.2	30	GSS			16				
MFE2006	N	J	MFE2004	30		0.2	30	GSS			16				
MFE2007	N	J	MFE2007	8.0		2.0	25	GSS			30				
MFE2008	N	J	MFE2007	20		2.0	25	GSS			30				
MFE2009	N	J	MFE2007	50		2.0	25	GSS			30				
MFE2010	N	J	MFE2010	15		3.0	25	GSS			50				
MFE2011	N	J	MFE2010	40		3.0	25	GSS			50				
MFE2012	N	J	MFE2010	100		3.0	25	GSS			50				
MFE2093	N	J	MFE2093	0.1	0.7	-0.1	-50	GSS	250	500	6.0				
MFE2094	N	J	MFE2093	0.4	1.4	-0.1	-50	GSS	350	700	6.0				
MFE2095	N	J	MFE2093	1.0	3.0	-0.1	-50	GSS	400	800	6.0				
MFE3001	N	J	MFE3001	0.5	6.0	0.01	20	DSX	700	3500	5.0				
MFE3002	N	M	MFE3002		10*	0.1	15	DSS			5.0				
MFE3003	P	M	MFE3003		-10*	0.1	-15	DSS							
MFE3004	N	M	MFE3004	2.0	10	0.05	20	DSX	2000		4.5	4.5	200	M	
MFE3005	N	M	MFE3004	2.0	10	0.05	20	DSX	2000		4.5	4.5	400	M	
MFE3006	N	M	MFE3006	2.0	18	10	25	DSX	8000	18,000	6.0	4.0	100	M	
MFE3007	N	M	MFE3006	5.0	20	10	25	DSX	10,000	18,000	5.5	4.0	200	M	
MFE3008	N	M	MFE3006	2.0	20	10	25	DSX	8000	18,000	6.0				
MFE3020	P	M	MFE3020		10*	0.01	-25	DSS	500		7.0				
MFE3021	P	M	MFE3020		10*	0.01	-25	DSS	500		7.0				
MFE4007	P	J	MFE4007	0.5	1.0	2.0	40	GSS	900	2700	7.0	2.5	100	H	
MFE4008	P	J	MFE4007	0.8	1.6	2.0	40	GSS	1000	3000	7.0	2.5	100	H	
MFE4009	P	J	MFE4007	1.5	3.0	2.0	40	GSS	1500	3500	7.0	2.5	100	H	
MFE4010	P	J	MFE4007	2.5	5.0	2.0	40	GSS	2000	4000	7.0	2.5	100	H	
MFE4011	P	J	MFE4007	4.0	8.0	2.0	40	GSS	2200	4500	7.0	2.5	100	H	
MFE4012	P	J	MFE4007	7.0	14	2.0	40	GSS	2500	5000	7.0	2.5	100	H	
MMF1	N	J	MMF1	0.5	10	0.05	30	GSS	1500	6500	6.0	2.5	100	H	
MMF2	N	J	MMF1	0.5	10	0.05	30	GSS	1500	6500	6.0	2.5	100	H	
MMF3	N	J	MMF1	0.5	10	0.05	30	GSS	1500	6500	6.0	2.5	100	H	
MMF4	N	J	MMF1	0.5	10	0.05	30	GSS	1500	6500	6.0	2.5	100	H	
MMF5	N	J	MMF1	0.5	10	0.05	30	GSS	1500	6500	6.0	2.5	100	H	
MMF6	N	J	MMF1	0.5	10	0.05	30	GSS	1500	6500	6.0	2.5	100	H	
MMT3823	N	J	MMT3823	5.0	20	-1.0	-30	GSS	3000	8000	4.0	2.0	100	M	
MPF102	N	J	MPF102	2.0	20	-2.0	-25	GSS	2000	7500	7.0				
MPF108	N	J	MPF108	1.5	24	1.0	-25	GSS	2000	7500	6.5	2.5	1.0	K	
MPF109	N	J	MPF109	0.5	24	-1.0	-25	GSS	800	1600	7.0	2.5	1.0	K	
MPF111	N	J	MPF111	0.5	20	100	-20	GSS	500		4.5*				
MPF112	N	J	MPF112	1.0	25	100	-25	GSS	1000	7500	8.0*				
MPF120	N	M	MPF120	2.0	7.0	20	25	DSX	8000	18,000	7.0	5.0	105	M	Dual Gate
MPF121	N	M	MPF120	5.0	10	20	25	DSX	10,000	20,000	6.0	5.0	60	M	Dual Gate
MPF122	N	M	MPF120	2.0	9.0	20	25	DSX	8000	18,000	7.0	5.0	200	M	Dual Gate
MPF161	P	J	MPF161	0.5	14	10	40	GSS	800	6000	7.0	2.5	1.0	K	
MPF820	S	J	MPF820	10		5.0	25	GSS	20* typ		15*	4.0			
MPF1000	S	M	MPF1000	5.0	15	20	25	DSX	10,000	20,000	4.0*	7.0	850	M	Dual Gate

DEVICES FOR MILITARY APPLICATIONS

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SILICON ZENER DIODES ±5% SERIES

MIL-S-19500/127
1N746A JAN,JTX .. thru .. 1N759A JAN,JTX
MIL-S-19500/117
1N962B JAN,JTX .. thru .. 1N992B JAN,JTX
***MIL-S-19500/114**
1N2804B JAN,JTX .. thru .. 1N2811B JAN,JTX
1N2813B JAN,JTX ....
1N2814B JAN,JTX ....
1N2816B JAN,JTX ....
1N2818B JAN,JTX .. thru .. 1N2820B JAN,JTX
1N2822B JAN,JTX .. thru .. 1N2827B JAN,JTX
1N2829B JAN,JTX ....
1N2831B JAN,JTX .. thru .. 1N2838B JAN,JTX
1N2840B JAN,JTX .. thru .. 1N2846B JAN,JTX
***MIL-S-19500/124**
1N2970B JAN,JTX .. thru .. 1N2977B JAN,JTX
1N2979B JAN,JTX ....
1N2980B JAN,JTX ....
1N2982B JAN,JTX ....
1N2984B JAN,JTX .. thru .. 1N2986B JAN,JTX
1N2988B JAN,JTX .. thru .. 1N2993B JAN,JTX
1N2995B JAN,JTX ....
1N2997B JAN,JTX ....
1N2999B JAN,JTX .. thru .. 1N3005B JAN,JTX
1N3007B JAN,JTX .. thru .. 1N3009B JAN,JTX
1N3011B JAN,JTX ....
1N3012B JAN,JTX ....
1N3014B JAN,JTX ....
1N3015B JAN,JTX ....
MIL-S-19500/115
1N3016B JAN,JTX .. thru .. 1N3051B JAN,JTX
***MIL-S-19500/358**
1N3305B JAN,JTX .. thru .. 1N3312B JAN,JTX
1N3314B JAN,JTX ....
1N3315B JAN,JTX ....
1N3317B JAN,JTX ....
1N3319B JAN,JTX .. thru .. 1N3321B JAN,JTX
1N3323B JAN,JTX .. thru .. 1N3328B JAN,JTX
1N3330B JAN,JTX ....
1N3332B JAN,JTX ....
1N3334B JAN,JTX .. thru .. 1N3340B JAN,JTX
1N3342B JAN,JTX .. thru .. 1N3344B JAN,JTX
1N3346B JAN,JTX ....
1N3347B JAN,JTX ....
1N3349B JAN,JTX ....
1N3350B JAN,JTX ....
MIL-S-19500/115
1N3821A JAN,JTX .. thru .. 1N3828A JAN,JTX
****MIL-S-19500/272**
1N3993A JAN,JTX .. thru .. 1N4000A JAN,JTX
MIL-S-19500/435
1N4099 JAN,JTX .. thru .. 1N4135 JAN,JTX
MIL-S-19500/127
1N4370A JAN,JTX .. thru .. 1N4372A JAN,JTX
***MIL-S-19500/358B**
1N4549B JAN,JTX .. thru .. 1N4554B JAN,JTX
MIL-S-19500/435
1N4614 JAN,JTX .. thru .. 1N4627 JAN,JTX

*Reverse Polarities (Suffix RB) are available.
**Reverse Polarities (Suffix RA) are available.

DEVICES FOR MILITARY APPLICATIONS

The following tables list devices that comply with military specifications.

1N . . . Device Numbers

DIODES
- **Reference**
- **Zener**
- **Signal**

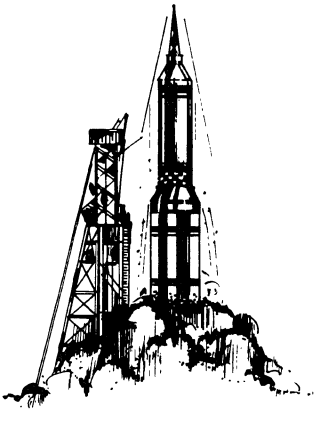
ASSEMBLIES

TC REFERENCE DIODES

MIL-S-19500	
1N429 JAN	/299
1N821 JAN,JTX	/159
1N823 JAN,JTX	/159
1N825 JAN,JTX	/159
1N827 JAN,JTX	/159
1N829 JAN,JTX	/159
1N935B JAN,JTX	/156
1N937B JAN,JTX	/156
1N938B JAN,JTX	/156
1N939B JAN,JTX	/156
1N941B JAN,JTX	/157
1N943B JAN,JTX	/157
1N944B JAN,JTX	/157
1N945B JAN,JTX	/157
1N3154 JAN,JTX	/158
1N3155 JAN,JTX	/158
1N3156 JAN,JTX	/158
1N3157 JAN,JTX	/158

DIODE ASSEMBLIES

MIL-S-19500	
1N1530A JAN	/320
1N1742A JAN	/298



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The following tables list devices that comply with military specifications.

2N . . . Device Numbers

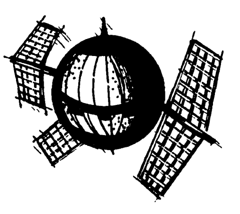
TRANSISTORS – Amplifier, Chopper, Multiple Device, Power, Switching and Unijunction
THYRISTORS

SWITCHING AND HIGH FREQUENCY TRANSISTORS

MIL-S-19500					
2N393 JAN	/77	2N2218A JAN,JTX	/251	2N3467 JAN	/348
2N499 JAN	/72	2N2219 JAN,JTX	/251	2N3468 JAN	/348
2N499A JAN	/72	2N2219A JAN,JTX	/251	2N3485A JAN,JTX	/392
2N501A JAN	/62	2N2221 JAN,JTX	/255	2N3486A JAN,JTX	/392
2N502A JAN	/112	2N2221A JAN,JTX	/255	2N3498 JAN,JTX	/366
2N502B JAN	/112	2N2222 JAN, JTX	/255	2N3499 JAN,JTX	/366
2N559 JAN,JTX	/152	2N2222A JAN, JTX	/255	2N3500 JAN,JTX	/366
2N703 JAN	/153	2N2369A JAN,JTX	/317	2N3501 JAN,JTX	/366
2N705 JAN	/86	2N2481 JAN,JTX	/268	2N3506 JAN,JTX	/349
2N706 JAN	/120	2N2857 JAN,JTX	/343	2N3507 JAN,JTX	/349
2N708 JAN,JTX	/312	2N2904 JAN,JTX	/290	2N3634 JAN,JTX	/357
2N718A JAN,JTX	/181	2N2904A JAN,JTX	/290	2N3635 JAN,JTX	/357
2N869A JAN,JTX	/283	2N2905 JAN,JTX	/290	2N3636 JAN,JTX	/357
2N914 JAN,JTX	/373	2N2905A JAN,JTX	/290	2N3637 JAN,JTX	/357
2N916 JAN	/271	2N2906 JAN,JTX	/291	2N3743 JAN,JTX	/397
2N929 JAN,JTX	/253	2N2906A JAN,JTX	/291	2N3763 JAN,JTX	/396
2N930 JAN,JTX	/253	2N2907 JAN,JTX	/291	2N3765 JAN,JTX	/396
2N962 JAN	/258	2N2907A JAN,JTX	/291	2N3959 JAN,JTX	/399
2N964 JAN	/258	2N3013 JAN,JTX	/287	2N3960 JAN,JTX	/399
2N1131 JAN	/177	2N3250A JAN,JTX	/323	2N4453 JAN,JTX	/283B
2N1132 JAN	/177	2N3251A JAN,JTX	/323	2N4930 JAN,JTX	/397
2N1613 JAN,JTX	/181	2N3253 JAN	/347	2N4931 JAN,JTX	/397
2N2218 JAN,JTX	/251	2N3444 JAN	/347	2N5581 JAN,JTX	/423
		2N3449 JAN	/338	2N5582 JAN,JTX	/423

POWER TRANSISTORS

MIL-S-19500					
2N174A JAN	/13	2N1554A JAN	/331	2N3716 JAN,JTX	/408
2N297A JAN	/36	2N1555A JAN	/331	2N3739 JAN,JTX	/402
2N665 JAN	/58	2N1556A JAN	/331	2N3740 JAN,JTX	/441
2N1011 JAN	/67	2N1557A JAN	/330	2N3741 JAN,JTX	/441
2N1046 JAN	/88	2N1558A JAN	/330	2N3791 JAN,JTX	/379
2N1120 JAN	/68	2N1559A JAN	/330	2N3792 JAN,JTX	/379
2N1165 JAN	/178	2N1560A JAN	/330	2N3867 JAN,JTX	/350
2N1358 JAN	/122	2N1651 JAN	/219	2N3868 JAN,JTX	/350
2N1412 JAN	/76	2N1652 JAN	/219	2N4399 JAN,JTX	/433
2N1412A JAN	/76	2N1653 JAN	/219	2N5156 JAN,JTX	/416
2N1549A JAN	/332	2N2079A JAN	/340	2N5302 JAN,JTX	/456
2N1550A JAN	/332	2N2528 JAN	/309	2N5303 JAN,JTX	/456
2N1551A JAN	/332	2N2834 JAN	/310	2N5745 JAN,JTX	/433
2N1552A JAN	/332	2N3055 JAN,JTX	/407		
2N1553A JAN	/331	2N3715 JAN,JTX	/408		



SILICON CONTROLLED RECTIFIERS

MIL-S-19500	
2N4199 JAN	/372
2N4200 JAN	/372
2N4201 JAN	/372
2N4202 JAN	/372
2N4203 JAN	/372
2N4204 JAN	/372

RF POWER TRANSISTORS

MIL-S-19500	
2N700A JAN	/123
2N918 JAN,JTX	/301
2N1142 JAN	/87
2N1195 JAN	/71
2N2273 JAN	/244
2N2708 JAN	/302
2N3127 JAN	/346
2N3375 JAN,JTX	/341
2N3553 JAN,JTX	/341
2N3866 JAN,JTX	/398
2N3866A JAN,JTX	/398

FIELD-EFFECT TRANSISTORS

MIL-S-19500	
2N3330 JAN,JTX	/378
2N3821 JAN,JTX	/375
2N3822 JAN,JTX	/375
2N3823 JAN,JTX	/375
2N4092 JAN,JTX	/431
2N4093 JAN,JTX	/431

MULTIPLE DEVICES

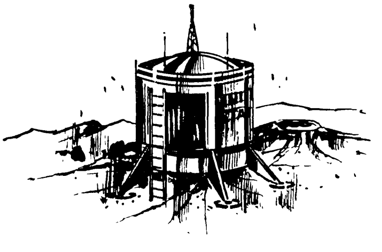
MIL-S-19500	
2N2060 JAN,JTX	/270
2N2639 JAN,JTX	/316
2N2642 JAN,JTX	/316
2N2919 JAN,JTX	/355
2N2920 JAN,JTX	/355
2N3810 JAN,JTX	/336
2N3811 JAN,JTX	/336
2N3838 JAN,JTX	/421
2N4854 JAN,JTX	/421

MILLIWATT TRANSISTORS

MIL-S-19500	
2N331 JAN	/4
2N398A JAN	/174
2N404 JAN	/20
2N404A JAN	/20
2N461 JAN	/45
2N464 JAN	/49
2N465 JAN	/49
2N466 JAN	/51
2N467 JAN	/49
2N526 JAN	/60
2N650A JAN	/175
2N651A JAN	/175
2N652A JAN	/175
2N1008B JAN	/196

UNIJUNCTION

MIL-S-19500	
2N4948 JAN,JTX	/388
2N4949 JAN,JTX	/388
2N5431 JAN,JTX	/425



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SELECTOR GUIDES

INDEX
SEMICONDUCTOR SELECTION GUIDES

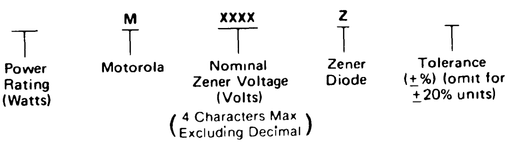
ZENER DIODE DEVICE OPTION

Motorola manufactures a complete line of zener diodes. The following pages describe the many device types available as standard products that are stocked at the factory warehouse and with distributors. Although Motorola standard zener diodes will handle most of the industry's needs, they represent only a small fraction of the devices that can be supplied. In cases where a non-standard set of specifications is required, the appropriate device can be selected and ordered from the following device options.

NON-STANDARD ZENER DIODES SPECIAL VOLTAGE AND TOLERANCE RATINGS

JEDEC "1N" type numbers denote a specific Zener voltage, power rating, and tolerance. For example, JEDEC type 1N4728 is a standard 1 watt diode, rated at 3.3 volts ±10%. A suffix "A" on this type number indicates a ±5% voltage tolerance.

Special Motorola devices, with a choice of voltages and tolerances are also available. The following diagram explains the Motorola coding system:



For example, the code for a special 10 watt Zener diode with a voltage of 41 volts and a tolerance of ±1% would be: 10M41Z1.

Following is a list of other standard Motorola symbols for special Zener orders (X's indicate nominal Zener voltage):

BASIC MOTOROLA TYPE	DEVICE DESCRIPTION
¼MXXXXAZ5	250 mW Alloy Glass, ±5%
¼MXXXXZ5	250 mW Glass, ±5%
.4MXXXXAZ5	400 mW Alloy Glass, ±5%
.4MXXXXZ10	400 mW Glass, ±10%
.5MXXXXZS10	500 mW Surmetic, ±10%
	1 Watt Flangeless, ±5%
1MXXXXAZ10	1 Watt Alloy Flangeless, ±10%
1MXXXXZ10	1 Watt Flangeless, ±10%
1MXXXXZS5	1 Watt Surmetic, ±5%
1.5MXXXXZ	1.5 Watt, ±20%
5MXXXXZS5	5 Watt Surmetic, ±5%
10MXXXXAZ5	10 Watt Alloy Stud, ±5%
10MXXXXZ10	10 Watt Stud, ±10%
50MXXXXAZ10	50 Watt Alloy TO-3, ±10%
50MXXXXASZ5	50 Watt Alloy Stud, ±5%
50MXXXXZ	50 Watt TO-3, ±20%
50MXXXXSZ5	50 Watt Stud, ±5%

For reverse polarities (10 W and 50W), insert "R" before tolerance, ie., 50M110SZR5.

1N5518 thru 1N5546 — This series may be ordered in ±2% and ±1% tolerance by adding the following suffix:

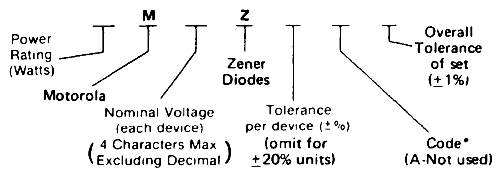
C = ±2%   D = ±1%

For example, the 1N5518D would be the same as the 1N5518B except V_Z = 3.3 ±1%.

MATCHED SETS OF ZENER DIODES

Zener diodes can also be obtained in sets consisting of two or more matched devices. The method for specifying such matched sets is similar to the one described for specifying units with a special voltage and/or tolerance except that two extra suffixes are added to the code number described above.

These units are marked with code letters to identify the matched sets and in addition, each unit in a set is marked with the same serial number which is different for each set being ordered.



*Code

- B — Two devices in series
- C — Three devices in series
- D — Four devices in series
- E — Five devices in series
- F — Six devices in series
- G — Seven devices in series
- H — Eight devices in series
- P — Two devices in parallel (not recommended)
- X — Two devices; one standard polarity, the other reverse polarity. (10 and 50 watts only)

i.e., 10M51Z5B1 is for two 10 watt zeners, each of 51 volts, ±5%, matched to a total voltage of 102 volts ±1%.

ORDERING OF MATCHED SETS

Order per instructions in "Matched Sets of Zener Diodes" or else specify the following:

- Type of matched set (series or parallel)
- Number of units per set
- Device type (with proper suffix to indicate tolerance
- Number of sets required
- Total voltage and overall tolerance of the set

ADDITIONAL NOTES

Consult factory for pricing and ordering information on special sets. For example: 1)Sets with overall tolerance different from those shown; 2) Matched sets of temperature compensated devices; 3) Sets which require basic device types within the set to be different from each other; 4) Sets with device type nominal voltages outside the range of the Zener family involved; 5) Tight tolerance temperature compensated diodes.

ZENER CHIPS (MZC)

1. The nomenclature for Zener Chips is as follows:

M	Z	C			
Motorola	Zener	C = Chip	Nominal Voltage	Series (A or B)	Tolerance (± %)

BASIC TYPE MOTOROLA NOMENCLATURE	DEVICE DESCRIPTION
MZCXXAX	Zener Chip — "A" Series, High Level
MZCXXBX	Zener Chip — "B" Series, Low Level

2. Chips are sold in increments of ten (10) only
3. Chips are **not** sold as matched sets or clippers.
4. A "-1" suffix will cause all chips ordered to be supplied in Deka-Pak.

UNIBLOC SERIES ZENER DIODES (MZ92)

The nomenclature for Unibloc Series Zener Diodes is as follows:

M	Z	92	XX	V
Motorola	Zener	Series	Nominal Voltage	Non Suffix = 20%
				A Suffix = 10%
				B Suffix = 5%
				C Suffix = 2%
				D Suffix = 1%

ZENER CLIPPERS

Special clipper diodes with opposing Zener junctions built into the devices are available by using the following nomenclatures:

X	M	XXX	Z	Z	X
Power Rating (Watts)		Nominal Voltage	Zener Diode	Clipper	Tolerance for each of the two Zener Voltages (Is not a matching requirement. Omit for ± 20% Units.)

This nomenclature is applicable to all packages and power ratings as restricted in the above paragraphs.

ORDERING INFORMATION

Order using the above nomenclature or else specify the device type, nominal voltage and tolerance required.

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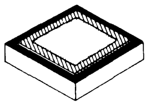
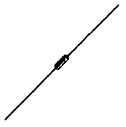
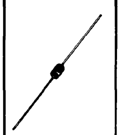
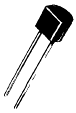
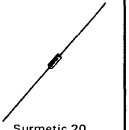
ZENER DIODES

The devices listed in the following tables represent a basic profile of the largest inventoried Zener diode line in the industry. These diodes may be employed where a nearly constant dc output voltage is required despite relatively large changes in input voltage or load resistance. Motorola's devices represent state-of-the-art with the superior capability of silicon-oxide passivated junction for low leakage, sharp breakdowns and long-term stability.

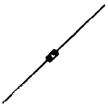
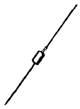
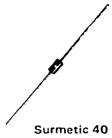
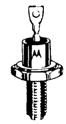
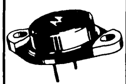
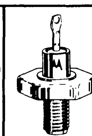
Nominal Zener Voltage	CHIPS (25 Mils Square) Cathode = Bottom Surface		250 MILLIWATT (400 mW Package) Cathode = Polarity Mark	400 MILLIWATT Cathode = Polarity Mark			500 MILLIWATT Cathode = Polarity Mark	
	 MZC		 CASE 51 (DO-7)	 CASE 51 (DO-7)		 CASE 205	 Surmetic CASE 182 (TO-92)	 Surmetic 20 CASE 51 (DO-7)
(NOTE 1, 6)	HIGH LEVEL (NOTE 7)	LOW LEVEL (NOTE 7)	INDUSTRIAL ±5% TOLERANCE LOW NOISE LOW LEVEL	CONSUMER INDUSTRIAL (NOTE 2, 3, 8)	INDUSTRIAL LOW VOLTAGE AVALANCHE	*CONSUMER INDUSTRIAL (NOTE 5a, 5b)	CONSUMER INDUSTRIAL (NOTE 3,5b)	CONSUMER INDUSTRIAL (NOTE 5a)
1.8		MZC1.8B10	MZ4614					
2.0		MZC2.0B10	MZ4615					
2.2		MZC2.2B10	MZ4616					
2.4	MZC2.4A10	MZC2.4B10	MZ4617	1N4370		MZ70-2.4	MZ92-2.4	1N5221
2.7	MZC2.7A10	MZC2.7B10	MZ4618	1N4371		MZ70-2.7	MZ92-2.7	1N5223
3.0	MZC3.0A10	MZC3.0B10	MZ4619	1N4372		MZ70-3.0	MZ92-3.0	1N5225
3.3	MZC3.3A10	MZC3.3B10	MZ4620	1N746	1N5518	MZ70-3.3	MZ92-3.3	1N5226
3.6	MZC3.6A10	MZC3.6B10	MZ4621	1N747	1N5519	MZ70-3.6	MZ92-3.6	1N5227
3.9	MZC3.9A10	MZC3.9B10	MZ4622	1N748	1N5520	MZ70-3.9	MZ92-3.9	1N5228
4.3	MZC4.3A10	MZC4.3B10	MZ4623	1N749	1N5521	MZ70-4.3	MZ92-4.3	1N5229
4.7	MZC4.7A10	MZC4.7B10	MZ4624	1N750	1N5522	MZ70-4.7	MZ92-4.7	1N5230
5.1	MZC5.1A10	MZC5.1B10	MZ4625	1N751	1N5523	MZ70-5.1	MZ92-5.1	1N5231
5.6	MZC5.6A10	MZC5.6B10	MZ4626	1N752	1N5524	MZ70-5.6	MZ92-5.6	1N5232
6.2	MZC6.2A10	MZC6.2B10	MZ4627	1N753	1N5525	MZ70-6.2	MZ92-6.2	1N5234
6.8	MZC6.8A10	MZC6.8B10	1N4099	1N754 1N957	1N5526	MZ70-6.8	MZ92-6.8	1N5235
7.5	MZC7.5A10	MZC7.5B10	1N4100	1N755 1N958	1N5527	MZ70-7.5	MZ92-7.5	1N5236
8.2	MZC8.2A10	MZC8.2B10	1N4101	1N756 1N959	1N5528	MZ70-8.2	MZ92-8.2	1N5237
9.1	MZC9.1A10	MZC9.1B10	1N4103	1N757 1N960	1N5529	MZ70-9.1	MZ92-9.1	1N5239
10	MZC10A10	MZC10B10	1N4104	1N758 1N961	1N5530	MZ70-10	MZ92-10	1N5240
11	MZC11A10	MZC11B10	1N4105	1N962	1N5531	MZ70-11	MZ92-11	1N5241
12	MZC12A10	MZC12B10	1N4106	1N759 1N963	1N5532	MZ70-12	MZ92-12	1N5242
13	MZC13A10	MZC13B10	1N4107	1N964	1N5533	MZ70-13	MZ92-13	1N5243
15	MZC15A10	MZC15B10	1N4109	1N965	1N5535	MZ70-15	MZ92-15	1N5245
16	MZC16A10	MZC16B10	1N4110	1N966	1N5536	MZ70-16	MZ92-16	1N5246
18	MZC18A10	MZC18B10	1N4112	1N967	1N5538	MZ70-18	MZ92-18	1N5248
20	MZC20A10	MZC20B10	1N4114	1N968	1N5540	MZ70-20	MZ92-20	1N5250
22	MZC22A10	MZC22B10	1N4115	1N969	1N5541	MZ70-22	MZ92-22	1N5251
24	MZC24A10	MZC24B10	1N4116	1N970	1N5542	MZ70-24	MZ92-24	1N5252
27	MZC27A10	MZC27B10	1N4118	1N971		MZ70-27	MZ92-27	1N5254
30	MZC30A10	MZC30B10	1N4120	1N972	1N5545	MZ70-30	MZ92-30	1N5256
33	MZC33A10	MZC33B10	1N4121	1N973	1N5546	MZ70-33	MZ92-33	1N5257
36	MZC36A10	MZC36B10	1N4122	1N974		MZ70-36	MZ92-36	1N5258
39	MZC39A10	MZC39B10	1N4123	1N975		MZ70-39	MZ92-39	1N5259
43	MZC43A10	MZC43B10	1N4124	1N976		MZ70-43	MZ92-43	1N5260
47	MZC47A10	MZC47B10	1N4125	1N977		MZ70-47	MZ92-47	1N5261
51	MZC51A10	MZC51B10	1N4126	1N978		MZ70-51	MZ92-51	1N5262
56	MZC56A10	MZC56B10	1N4127	1N979		MZ70-56	MZ92-56	1N5263
62	MZC62A10	MZC62B10	1N4129	1N980		MZ70-62	MZ92-62	1N5265
68	MZC68A10	MZC68B10	1N4130	1N981		MZ70-68	MZ92-68	1N5266
75	MZC75A10	MZC75B10	1N4131	1N982		MZ70-75	MZ92-75	1N5267
82	MZC82A10	MZC82B10	1N4132	1N983		MZ70-82	MZ92-82	1N5268
91	MZC91A10	MZC91B10	1N4134	1N984		MZ70-91	MZ92-91	1N5270
100	MZC100A10	MZC100B10	1N4135	1N985		MZ70-100	MZ92-100	1N5271
110	MZC110A10	MZC110B10		1N986		MZ70-110	MZ92-110	1N5272
120	MZC120A10	MZC120B10		1N987		MZ70-120	MZ92-120	1N5273
130	MZC130A10	MZC130B10		1N988		MZ70-130	MZ92-130	1N5274
150	MZC150A10	MZC150B10		1N989		MZ70-150	MZ92-150	1N5276
160	MZC160A10	MZC160B10		1N990		MZ70-160	MZ92-160	1N5277
180	MZC180A10	MZC180B10		1N991		MZ70-180	MZ92-180	1N5279
200	MZC200A10	MZC200B10		1N992		MZ70-200	MZ92-200	1N5281

NOTES:
1. The Zener Voltage is measured at approximately ¼ the rated power except for the MZ4614 and 1N4099 series. This series is measured with an I_{ZT} = 250 μAdc. The 1N4370 and 1N746 series is measured with an I_{ZT} = 20 mAdc
2. No suffix denotes ±10% tolerance. "A" suffix is ±5.0% tolerance. (1N4370-4372, 1N746-759; 1N3821-30, 1N3993-4000, 1N4728-64).
3. No suffix is ±20% tolerance; "A" suffix is ±10% tolerance, and "B" suffix is ±5.0% tolerance, (1N957-992; 1N3016-3051; 1N3785-3820; 1N2970&R-3015&R; 1N4549&R-4556&R; 1N4557&R-4564&R; 1N3305&R-3330&R; 1N5333-1N5338).

* Other Standard Voltages Available:
2 5, 2.8, 6.0, 8.7, 14, 17, 19, 25, 28, 60, 87, 140, 170, and 190.

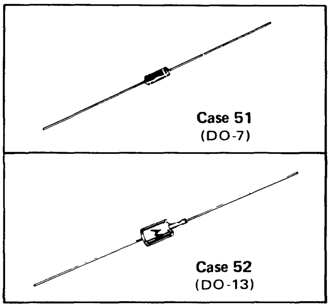
5

ZENER DIODES (continued)

1 WATT	1WATT	1-1/2 WATT	5 WATT	10 WATT	50 WATT		
Cathode - Polarity Mark	Cathode to Case	Cathode to Case	Cathode = Polarity Mark	Cathode to Case = 1N3993 series Anode to Case = 1N2970 series	Anode to Case		
 Surmetic 30 CASE 59 (DO-41)	 CASE 52 (DO-13)	 CASE 55	 Surmetic 40 CASE 17	 CASE 56 (DO-4)	 CASE 54 (TO-3)	 CASE 58 (DO-5)	Nominal Zener Voltage
CONSUMER INDUSTRIAL (NOTE 2)	CONSUMER INDUSTRIAL (NOTE 2, 3, 9)	INDUSTRIAL (NOTE 3)	INDUSTRIAL (NOTE 3)	INDUSTRIAL (NOTE 2, 3, 4, 10)	INDUSTRIAL (NOTE 3, 4)	INDUSTRIAL (NOTE 3, 4)	(NOTE 1, 6)
							1.8
							2.0
							2.2
							2.4
							2.7
							3.0
1N4728	1N3821		1N5333				3.3
1N4729	1N3822		1N5334				3.6
1N4730	1N3823		1N5335	1N3993&R	1N4557&R	1N4549&R	3.9
1N4731	1N3824		1N5336	1N3994&R	1N4558&R	1N4550&R	4.3
1N4732	1N3825		1N5337	1N3995&R	1N4559&R	1N4551&R	4.7
1N4733	1N3826		1N5338	1N3996&R	1N4560&R	1N4552&R	5.1
1N4734	1N3827		1N5339	1N3997&R	1N4561&R	1N4553&R	5.6
1N4735	1N3828		1N5341	1N3998&R	1N4562&R	1N4554&R	6.2
1N4736	1N3829 1N3016	1N3785	1N5342	1N3999&R 1N2970&R	1N4563&R 1N2804&R	1N4555&R 1N3305&R	6.8
1N4737	1N3830 1N3017	1N3786	1N5343	1N4000&R 1N2971&R	1N4564&R 1N2805&R	1N4556&R 1N3306&R	7.5
1N4738	1N3018	1N3787	1N5344	1N2972&R	1N2806&R	1N3307&R	8.2
1N4739	1N3019	1N3788	1N5346	1N2973&R	1N2807&R	1N3308&R	9.1
1N4740	1N3020	1N3789	1N5347	1N2974&R	1N2808&R	1N3309&R	10
1N4741	1N3021	1N3790	1N5348	1N2975&R	1N2809&R	1N3310&R	11
1N4742	1N3022	1N3791	1N5349	1N2976&R	1N2810&R	1N3311&R	12
1N4743	1N3023	1N3792	1N5350	1N2977&R	1N2811&R	1N3312&R	13
1N4744	1N3024	1N3793	1N5352	1N2979&R	1N2813&R	1N3314&R	15
1N4745	1N3025	1N3794	1N5353	1N2980&R	1N2814&R	1N3315&R	16
1N4746	1N3026	1N3795	1N5355	1N2982&R	1N2816&R	1N3317&R	18
1N4747	1N3027	1N3796	1N5357	1N2984&R	1N2818&R	1N3319&R	20
1N4748	1N3028	1N3797	1N5358	1N2985&R	1N2819&R	1N3320&R	22
1N4749	1N3029	1N3798	1N5359	1N2986&R	1N2820&R	1N3321&R	24
1N4750	1N3030	1N3799	1N5361	1N2988&R	1N2822&R	1N3323&R	27
1N4751	1N3031	1N3800	1N5363	1N2989&R	1N2823&R	1N3324&R	30
1N4752	1N3032	1N3801	1N5364	1N2990&R	1N2824&R	1N3325&R	33
1N4753	1N3033	1N3802	1N5365	1N2991&R	1N2825&R	1N3326&R	36
1N4754	1N3034	1N3803	1N5366	1N2992&R	1N2826&R	1N3327&R	39
1N4755	1N3035	1N3804	1N5367	1N2993&R	1N2827&R	1N3328&R	43
1N4756	1N3036	1N3805	1N5368	1N2996&R	1N2829&R	1N3330&R	47
1N4757	1N3037	1N3806	1N5369	1N2997&R	1N2831&R	1N3332&R	51
1N4758	1N3038	1N3807	1N5370	1N2999&R	1N2832&R	1N3334&R	56
1N4759	1N3039	1N3808	1N5372	1N3000&R	1N2833&R	1N3335&R	62
1N4760	1N3040	1N3809	1N5373	1N3001&R	1N2834&R	1N3336&R	68
1N4761	1N3041	1N3810	1N5374	1N3002&R	1N2835&R	1N3337&R	75
1N4762	1N3042	1N3811	1N5375	1N3003&R	1N2836&R	1N3338&R	82
1N4763	1N3043	1N3812	1N5377	1N3004&R	1N2837&R	1N3339&R	91
1N4764	1N3044	1N3813	1N5378	1N3005&R	1N2838&R	1N3340&R	100
1M110ZS10	1N3045	1N3814	1N5379	1N3007&R	1N2840&R	1N3342&R	110
1M120ZS10	1N3046	1N3815	1N5380	1N3008&R	1N2841&R	1N3343&R	120
1M130ZS10	1N3047	1N3816	1N5381	1N3009&R	1N2842&R	1N3344&R	130
1M150ZS10	1N3048	1N3817	1N5383	1N3011&R	1N2843&R	1N3346&R	150
1M160ZS10	1N3049	1N3818	1N5384	1N3012&R	1N2844&R	1N3347&R	160
1M180ZS10	1N3050	1N3819	1N5386	1N3014&R	1N2845&R	1N3349&R	180
1M200ZS10	1N3051	1N3820	1N5388	1N3015&R	1N2846&R	1N3350&R	200

4. R, RA &RB = Reverse Polarity Types Available.
5a. No suffix is ±10% tolerance, "A" suffix is ±10% tolerance, "B" suffix is ±5.0% tolerance.
5b. "C" suffix is ±2.0% tolerance, "D" suffix is ±1.0% tolerance.
6. Contact your Motorola Semiconductor Representative for information on intermediate voltages and tighter tolerances.
7. For a 5, 3, 2, or 1%, change the suffix "10" to the desired tolerance.
JAN/JANTX available ±5.0% only.
Reverse polarity available on 10W and 50W devices.
8. SIN746A to SIN973B NASA Types Available.
9. SIN3016B to SIN3051B NASA Types Available.
10. SIN2970B to SIN2985B and SIN2991B NASA Types Available

ZENER REFERENCE DIODES



For applications in which the output voltage must remain within narrow limits during changes in input voltage, load resistance, and temperature changes. These Temperature Compensated Zener Reference Diodes have low dynamic impedance and silicon oxide passivated junctions for long-term stability.

Motorola guarantees all reference diodes to fall within specified maximum voltage variations over the indicated temperature range at a specific test current. This method complies with JEDEC suggested Standard No. 5 and has been incorporated into all reference diode military specifications. Note that ratings are maximum only and do not reflect the actual voltage change exhibited by an individual unit. The temperature coefficient is shown for reference and should not be considered as a maximum rating. The reference diode temperature coefficient is not a linear characteristic, and therefore accurately reflects the voltage deviation at test temperature extremes only. Devices are tested at the various temperature points while exposed to an air environment which eliminates unwanted boundary effects prevalent in oil bath testing. Voltage-time stability, although, not specified is normally better than 100 PPM per 1000 hours of operation, however, for critical applications precision reference diodes are available with guaranteed voltage-time stability of less than 5 PPM per 1000 hours.

			AVERAGE TEMPERATURE COEFFICIENT OVER THE OPERATING TEMPERATURE RANGE										
			0.01 %/°C		0.005 %/°C		0.002 %/°C		0.001 %/°C		0.0005%/°C		
Reference Voltage	Test Current mAdc	Operating Temp. Range, °C	Device Type	ΔVz max Volts	Device Type	ΔVz max Volts	Device Type	ΔVz max Volts	Device Type	ΔVz max Volts	Device Type	ΔVz max Volts	Case Type
6.2 Δ	7.5	-55, 0, +25, +75, +100	*1N821,J,TX	0.096	*1N823,J,TX	0.048	*1N825,J,TX	0.019	*1N827,J,TX	0.009	*1N829,J,TX	0.005	51
6.2 Δ	7.5	-55, 0, +25, +75, +100	*1N821A	0.096	*1N823A	0.048	*1N825A	0.019	*1N827A	0.009	*1N829A	0.005	
6.4	0.5	0, +25, +75	1N4565	0.048	1N4566	0.024	1N4567	0.010	1N4568	0.005	1N4569	0.002	
	0.5	-55, 0, +25, +75, +100	1N4565A	0.099	1N4566A	0.050	1N4567A	0.020	1N4568A	0.010	1N4569A	0.005	
	1.0	0,+25, +75	1N4570	0.048	1N4571	0.024	1N4572	0.010	1N4573	0.005	1N4574	0.002	
	1.0	-55, 0, +25, +75, +100	1N4570A	0.099	1N4571A	0.050	1N4572A	0.020	1N4573A	0.010	1N4574A	0.005	
	2.0	0, +25, +75	1N4575	0.048	1N4576	0.024	1N4577	0.010	1N4578	0.005	1N4579	0.002	
	2.0	-55, 0, +25, +75, +100	1N4575A	0.099	1N4576A	0.050	1N4577A	0.020	1N4578A	0.010	1N4579A	0.005	
	4.0	0, +25, +75	1N4580	0.048	1N4581	0.024	1N4582	0.010	1N4583	0.005	1N4584	0.002	
	4.0	-55, 0, +25, +75, +100	1N4580A	0.099	1N4581A	0.050	1N4582A	0.020	1N4583A	0.010	1N4584A	0.005	
8.4	10.0	-55, 0, +25, +75, +100	*1N3154,J,TX	0.130	*1N3155,J,TX	0.065	*1N3156,J,TX	0.026	*1N3157,J,TX	0.013			
8.4	10.0	-55, 0, +25, +75, +100, +150	*1N3154A	0.172	*1N3155A	0.086	*1N3156A	0.034	*1N3157A	0.017			
8.5	0.5	0, +25, +75	1N4775	0.064	1N4776	0.032	1N4777	0.013	1N4778	0.006	1N4779	0.003	
	0.5	-55, 0, +25, +75, +100	1N4575A	0.132	1N4776A	0.066	1N4777A	0.026	1N4778A	0.013	1N4779A	0.007	
	1.0	0, +25, +75	1N4780	0.064	1N4781	0.032	1N4782	0.013	1N4783	0.006	1N4784	0.003	
	1.0	-55, 0, +25, +75, +100	1N4780A	0.132	1N4781A	0.066	1N4782A	0.026	1N4783A	0.013	1N4784A	0.007	
9.0	7.5	0,+25, +75	*1N935	0.067	*1N936	0.033	*1N937	0.013	*1N938	0.006	*1N939	0.003	
		-55, 0, +25, +75, +100	*1N935A	0.139	*1N936A	0.069	*1N937A	0.027	*1N938A	0.013	*1N939A	0.007	
		-55, 0, +25, +75, +100, +150	*1N935B,J,TX	0.184	*1N936B	0.092	*1N937B,J,TX	0.037	*1N938B,J,TX	0.018	*1N939B,J,TX	0.009	
9.1	0.5	0,+25, +75	1N4765	0.068	1N4766	0.034	1N4767	0.014	1N4768	0.007	1N4769	0.003	
		-55, 0, +25, +75, +100	1N4765A	0.141	1N4766A	0.070	1N4767A	0.028	1N4768A	0.014	1N4769A	0.007	
		0, +25, +75	1N4770	0.068	1N4771	0.034	1N4772	0.014	1N4773	0.007	1N4774	0.003	
		-55, 0, +25, +75, +100	1N4770A	0.141	1N4771A	0.070	1N4772A	0.028	1N4773A	0.014	1N4774A	0.007	
9.3	10.0	0, +25, +75	1N2620	0.070	1N2621	0.035	1N2622	0.014	1N2623	0.007	1N2624	0.003	52
		-55, 0, +25, +75, +100	1N2620A	0.144	1N2621A	0.072	1N2622A	0.029	1N2623A	0.014	1N2624A	0.007	
		-55, 0, +25, +75, +100, +150	1N2620B	0.191	1N2621B	0.095	1N2622B	0.038	1N2623B	0.019	1N2624B	0.010	
9.4±0.4	10.0	0, +25, +70			1N2163,A	0.033			1N2166,A	0.007	1N2169,A	0.004	
(Suffix "A"		-55, 0, +25, +75, +125			1N2164,A	0.086			1N2167,A	0.017	1N2170,A	0.009	
±0.2 V)		-55, 0, +, +75, +125, +185			1N2165,A	0.115			1N2168,A	0.023	1N2171,A	0.012	
11.7	7.5	0, +25, +75	*1N941	0.088	*1N942	0.044	*1N943	0.018	*1N944	0.009	*1N945	0.004	51
		-55, 0, +25, +75, +100	*1N941A	0.181	*1N942A	0.090	*1N943A	0.036	*1N944A	0.018	*1N945A	0.009	
		-55, 0, +25, +75, +100, +150	*1N941B,J,TX	0.239	*1N942B	0.120	*1N943B,J,TX	0.047	*1N944B,J,TX	0.024	*1N945B,J,TX	0.012	
11.7	7.5	0, +25, +75	1N3580	0.088	1N3581	0.044	1N3582	0.018	1N3583	0.009			52
		-55, 0, +25, +75, +100	1N3580A	0.181	1N3581A	0.090	1N3582A	0.036	1N3583A	0.018			
		-55, 0, +75, +100, +150	1N3580B	0.239	1N3581B	0.120	1N3582B	0.047	1N3583B	0.024			
12.8	0.5	+25, +75, +100	1N4896	0.096	1N4897	0.048	1N4898	0.019	1N4899	0.010			51
	0.5	-55, 0, +25, +75, +100	1N4896A	0.198	1N4897A	0.099	1N4898A	0.040	1N4899A	0.020			
	1.0	+25, +75, +100	1N4900	0.096	1N4901	0.048	1N4902	0.019	1N4903	0.010			
	1.0	-55, 0, +25, +75, +100	1N4900A	0.198	1N4901A	0.099	1N4902A	0.040	1N4903A	0.020			
	2.0	+25, +75, +100	1N4904	0.096	1N4905	0.048	1N4906	0.019	1N4907	0.010			
	2.0	-55, 0, +25, +75, +100	1N4904A	0.198	1N4905A	0.099	1N4906A	0.040	1N4907A	0.020			
	4.0	+25, +75, +100	1N4908	0.096	1N4909	0.048	1N4910	0.019	1N4911	0.010			
	4.0	-55, 0, +25, +75, +100	1N4908A	0.198	1N4909A	0.099	1N4910A	0.040	1N4911A	0.020			
	7.5	+25, +75, +100	1N4912	0.096	1N4913	0.048	1N4914	0.019	1N4915	0.010			
	7.5	-55, 0, +25, +75, +100	1N4912A	0.198	1N4913A	0.099	1N4914A	0.040	1N4915A	0.020			
19.2	0.5	+25, +75, +100	1N4916	0.144	1N4917	0.072	1N4918	0.029					51
	0.5	-55, 0, +25, +75, +100	1N4916A	0.298	1N4917A	0.149	1N4918A	0.060					
	1.0	+25, +75, +100	1N4919	0.144	1N4920	0.072	1N4921	0.029					
	1.0	-55, 0, +25, +75, +100	1N4919A	0.298	1N4920A	0.149	1N4921A	0.060					
	2.0	+25, +75, +100	1N4922	0.144	1N4923	0.072	1N4924	0.029					
	2.0	-55, 0, +25, +75, +100	1N4922A	0.298	1N4923A	0.149	1N4924A	0.060					
	4.0	+25, +75, +100	1N4925	0.144	1N4926	0.072	1N4927	0.029	1N4928	0.014			
	4.0	-55, 0, +25, +75, +100	1N4925A	0.298	1N4926A	0.149	1N4927A	0.060	1N4928A	0.030			
	7.5	+25, +75, +100	1N4929	0.144	1N4930	0.072	1N4931	0.029	1N4932	0.014			
	7.5	-55, 0, +25, +75, +100	1N4929A	0.298	1N4930A	0.149	1N4931A	0.060	1N4932A	0.030			

Δ Non-suffix – Z_{ZT} = 15 Ω, "A Suffix – Z_{ZT} = 10 Ω

* Radiation Resistant Devices Available; to order, specify MZ821, A or B in lieu of '1N' prefix. Not Applicable to J or TX devices.

5

PRECISION REFERENCE DIODES

CASE 51

Designed, manufactured, and tested for use in computers, inertial guidance systems, and precision equipment requiring ultra-high stability of voltage over changes of time and temperature. All precision testing equipment is housed in a double electrically shielded enclosure designed to eliminate reading errors caused by noise and interference. Equipment calibration is maintained relative to standard cells directly traceable to the National Bureau of Standards. A special power supply, having an absolute accuracy of ±0.003% is used. Voltage measurements are made in air using automated equipment having a 1.0 microvolt resolution and an overall accuracy of better than 1 PPM. This procedure negates the boundary effects problem prevalent in oil bath testing.

CERTIFIED TEST DATA

Every Motorola Precision Reference Diode is individually serialized and its test data recorded on a Certificate of Precision that accompanies the device when shipped. This data shows:

- Device voltages at each test temperature (+25, +75 and +100°C)
- Voltage stability within the measuring temperature range
- Actual device voltage at 168 hour intervals during verification test
- Voltage stability throughout the entire 1000 hour test period
- Certification of Precision
- All diodes are marked with the device type number, polarity band and serial number.

5

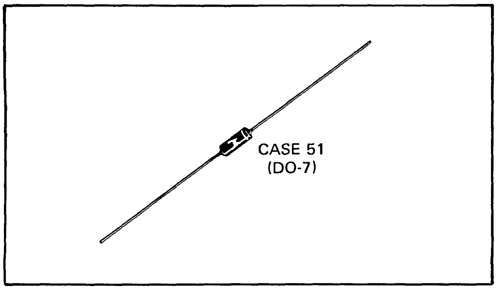
				CERTIFIED VOLTAGE TIME STABILITY OVER 1000 HOURS OF OPERATION (Parts / Million Change)									
Reference Voltage Volts	Test Current MA	Temperature Stability		<5 PPM/1000 HR		<10 PPM/1000 HR		<20 PPM/1000 HR		<40 PPM/1000 HR		<100 PPM/1000 HR	
		ΔV_Z(MV)	OP Temp Range °C	Device Type	Change µV Max	Device Type	Change µV Max	Device Type	Change µV Max	Device Type	Change µV Max	Device Type	Change µV Max
6.2±5%	7.5	2.5	25, 75, 100	MZ605	30	MZ610	60	MZ620	120	MZ640	240		
8.4±5%	10.0	3.5	25, 75, 100	MZ805	45	MZ810	90	MZ820	180	MZ840	360		
6.35±5%	7.5	2.5	25 to 100			1N4895	64	1N4893	127			1N4891 △	318
↓	↓	5.0	-55 to 100			1N4895A	64	1N4893A	127			1N4891A △	318
		5.0	25 to 100			1N4894	64	1N4892	127			1N4890 △	318
		10.0	-55 to 100			1N4894A	64	1N4892A	127			1N4890A △	318
6.2-6.5	7.5	3.0	25 to 100									1N3502	636
6.2-6.5	7.5	6.0	25 to 100					1N3504	127	1N3503	318	1N3501	636

The time stability of the MOTOROLA MZ605 series and MZ805 series is determined by the difference between any two readings taken at 168 hour intervals during the 1000–hour operating stability test. The time stability of the JEDEC registered 1N XXXX devices is determined by the difference between the zero hour reading and any subsequent measurement taken at 168 hour intervals during the 1000–hour stability test.

△ <50 PPM time stability on these devices

CURRENT REGULATOR DIODES

These diodes present a constant current regardless of the terminal voltage over a wide operating range and appears as a very high circuit impedance. These devices are useful for a number of electronic applications, including overcurrent protection, transistor biasing, linear ramp and stairstep generators, differential amplifiers, precision reference voltage sources, and linear-scale ohmmeters, to name a few.



Standard devices cover the range from 220 microamperes to 4.7 milliamperes; however, higher and lower currents are available on a custom basis. Devices can be operated in series to produce an extension of the dynamic voltage range or in parallel to extend the current range. In the latter case, the resultant pinch-off current is the summation of the individual currents.

In precision circuitry applications which must operate over a significant temperature range, the temperature coefficient of each device must be thoroughly evaluated by the design engineer. For variations in current, consult the Motorola Designer's Data Sheet, 1N5283 Series. Current regulation may be improved by 1) maintaining a low anode-to-cathode voltage, thus reducing the power dissipation and 2) reducing the junction-to-lead thermal resistance by maintaining short lead lengths, especially the cathode lead.

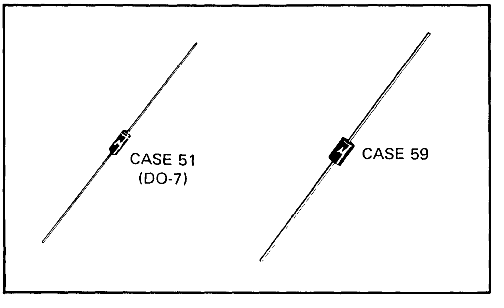
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
POV = 100 Volt max

Regulator Current ±10% V_T = 25 V Ip mA (nom)	Device Type	Minimum Knee Impedance @V_K = 6.0 V Z_K (MΩ)	Maximum Limiting Voltage @I_L = 0.8 Ip (min) V_L (Volts)
0.22	1N5283	2.75	1.00
0.24	1N5284	2.35	1.00
0.27	1N5285	1.95	1.00
0.30	1N5286	1.60	1.00
0.33	1N5287	1.35	1.00
0.39	1N5288	1.00	1.05
0.43	1N5289	0.870	1.05
0.47	1N5290	0.750	1.05
0.56	1N5291	0.560	1.10
0.62	1N5292	0.470	1.13
0.68	1N5293	0.400	1.15
0.75	1N5294	0.335	1.20
0.82	1N5295	0.290	1.25
0.91	1N5296	0.240	1.29
1.00	1N5297	0.205	1.35
1.10	1N5298	0.180	1.40
1.20	1N5299	0.155	1.45
1.30	1N5300	0.135	1.50
1.40	1N5301	0.115	1.55
1.50	1N5302	0.105	1.60
1.60	1N5303	0.092	1.65
1.80	1N5304	0.074	1.75
2.00	1N5305	0.061	1.85
2.20	1N5306	0.052	1.95
2.40	1N5307	0.044	2.00
2.70	1N5308	0.035	2.15
3.00	1N5309	0.029	2.25
3.30	1N5310	0.024	3.35
3.60	1N5311	0.020	2.50
3.90	1N5312	0.017	2.60
4.30	1N5313	0.014	2.75
4.70	1N5314	0.012	2.90
0.5±0.3	MCL1300	0.500	1.00
1.0±0.6	MCL1301	0.200	1.50
2.0±0.6	MCL1302	0.100	2.00
3.0±0.6	MCL1303	0.050	2.00
4.0±0.6	MCL1304	0.025	2.50

5

FORWARD REFERENCE DIODES

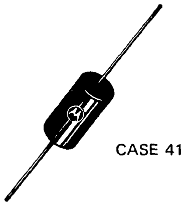
Constant voltage reference diodes designed for stable forward reference sources, transistor amplifier biasing and similar applications.



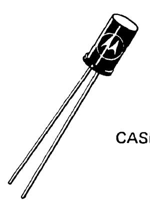
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Forward Reference Voltage Min	Forward Reference Voltage Max	Test Current I_F(mA)	Device Type	Leakage Current I_R µA	@ V_R Volts	Case
0.63	0.71	10.0	MZ2360	10	5.0	59 Surmetic
1.24	1.38	10.0	MZ2361	10	5.0	51 Surmetic
1.90	2.10	10.0	MZ2362	10	5.0	51
0.58	0.70	1.0	.4M.64FR10	0.1	4.0	Glass
1.29	1.43	10	.4M1.36FR5			
1.33	1.39	10	.4M1.36FR2			
1.94	2.14	10	.4M2.04FR5			
2.00	2.08	10	.4M2.04FR2			
0.58	0.70	1.0	1N816	↓	↓	↓

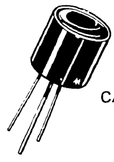
MOLDED ASSEMBLIES



CASE 41



CASE 53



CASE 57

V_Z Volts	I_{ZT} mA	Operating Range -55 to +25°C ΔV_Z Volts	Operating Range +25 to +100°C ΔV_Z Volts	Device Type	Temp. Coeff. For Ref. %/°C	Case
12.4	10	0.050	0.047	1N4057	0.005	41-8
		0.020	0.019	1N4057A	0.002	
14.6		0.058	0.055	1N4058	0.005	
		0.023	0.022	1N4058A	0.002	
16.8		0.067	0.063	1N4059	0.005	
		0.027	0.025	1N4059A	0.002	
18.5		0.074	0.069	1N4060	0.005	
		0.030	0.028	1N4060A	0.002	
21.0		0.084	0.079	1N4061	0.005	
		0.034	0.032	1N4061A	0.002	
23.0		0.092	0.086	1N4062	0.005	
		0.037	0.035	1N4062A	0.002	
27.0		0.108	0.101	1N4063	0.005	
		0.043	0.041	1N4063A	0.002	
30.0		0.120	0.113	1N4064	0.005	
		0.048	0.045	1N4064A	0.002	
33.0		0.132	0.124	1N4065	0.005	
		0.053	0.050	1N4065A	0.002	
37.0	7.5	0.148	0.139	1N4066	0.005	
		0.059	0.056	1N4066A	0.002	
43.0		0.172	0.161	1N4067	0.005	
		0.069	0.065	1N4067A	0.002	
47.0		0.188	0.176	1N4068	0.005	
		0.075	0.071	1N4068A	0.002	
51.0		0.204	0.191	1N4069	0.005	41-9
		0.082	0.077	1N4069A	0.002	
56.0		0.224	0.210	1N4070	0.005	
		0.090	0.084	1N4070A	0.002	
62.0		0.248	0.232	1N4071	0.005	
		0.099	0.093	1N4071A	0.002	
68.0	5.0	0.272	0.255	1N4072	0.005	
		0.109	0.102	1N4072A	0.002	
75.0		0.300	0.281	1N4073	0.005	
		0.120	0.113	1N4073A	0.002	
82.0		0.328	0.307	1N4074	0.005	
		0.131	0.123	1N4074A	0.002	
87.0		0.348	0.326	1N4075	0.005	
		0.139	0.131	1N4075A	0.002	
91.0		0.364	0.341	1N4076	0.005	
		0.146	0.137	1N4076A	0.002	
100		0.400	0.375	1N4077	0.005	
		0.160	0.150	1N4077A	0.002	

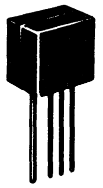
V_Z Volts	I_{ZT} mA	Operating Range -55 to +25°C ΔV_Z Volts	Operating Range +25 to +100°C ΔV_Z Volts	Device Type	Temp. Coeff. For Ref. %/°C	Case
105	2.5	0.420	0.394	1N4078	0.005	
		0.168	0.158	1N4078A	0.002	
110		0.440	0.413	1N4079	0.005	
		0.176	0.165	1N4079A	0.002	
120		0.480	0.450	1N4080	0.005	
		0.192	0.180	1N4080A	0.002	
130		0.520	0.488	1N4081	0.005	41-10
		0.208	0.195	1N4081A	0.002	
140		0.560	0.525	1N4082	0.005	
		0.224	0.210	1N4082A	0.002	
150		0.600	0.563	1N4083	0.005	
		0.240	0.225	1N4083A	0.002	
175		0.700	0.656	1N4084	0.005	
		0.280	0.263	1N4084A	0.002	
200		0.800	0.750	1N4085	0.005	
		0.320	0.300	1N4085A	0.002	

V_Z Volts	I_{ZT} mA	Temperature Range -55, +25, +100°C ΔV_Z Volts	Device Type	Temp. Coeff. For Ref. %/°C	Case
6.2	7.5	0.050	1N429(1)	0.01	53
6.2	7.5	0.050	1N1735	0.01	41-6
8.4	10	0.014	1N1530	0.002	57
8.4	10	0.007	1N1530A(1)	0.001	57
12.4	7.5	0.100	1N1736	0.01	41-3
12.4		0.050	1N1736A	0.005	41-3
18.6		0.150	1N1737	0.01	41-5
18.6		0.075	1N1737A	0.005	
24.8		0.200	1N1738	0.01	
24.8		0.100	1N1738A	0.005	
31.0		0.250	1N1739	0.01	41-4
31.0		0.125	1N1739A	0.005	
37.2		0.300	1N1740	0.01	
37.2		0.150	1N1740A	0.005	
43.4		0.350	1N1741	0.01	
43.4		0.175	1N1741A	0.005	
49.6		0.400	1N1742	0.01	
49.6		0.200	1N1742A(1)	0.005	

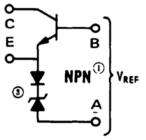
(1) Available as JAN devices.

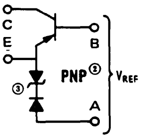
5

REFERENCE AMPLIFIERS



CASE
212-01





1 Add Suffix N to type number for NPN devices.
2 Add Suffix P to type number for PNP devices.
3 MCA1911 Series uses only zener diode and transistor.

. . . designed for use in regulated power supplies as a combination voltage reference element and error voltage amplifier, providing temperature compensation for excellent reference voltage stability. Available with either PNP or NPN transistors for versatility of circuit design. Operation over three different temperature ranges: 0 to 75°C, −55 to 100°C, −55 to 150°C.

Note: Basic type numbers are listed in the table; add suffix "P" or "N" to denote specific polarity.

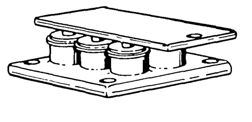
ELECTRICAL CHARACTERISTICS (I_{ZT} = 5.0 mA, V_{CEO} = 30 V)

V_{REF} Volts	Tolerance ±%	Test Temperature °C	ΔV_{REF} Volts	Device Type
6.8	10		0.051	MCA1911
			0.025	MCA1912
		0, +25, +75	0.010	MCA1913
			0.005	MCA1914
	5.0		0.105	MCA1921
		-55, 0, +25,	0.052	MCA1922
		+75, +100	0.020	MCA1923
			0.010	MCA1924
			0.139	MCA1931
		-55, 0, +25,	0.069	MCA1932
		+75, +100, +150	0.026	MCA1933
			0.013	MCA1934
8.6	10		0.060	MCA2011
			0.030	MCA2012
		0,+25, +75	0.012	MCA2013
			0.006	MCA2014
	5.0		0.124	MCA2021
		-55, 0, +25,	0.062	MCA2022
		+75, +100	0.024	MCA2023
			0.012	MCA2024
			0.164	MCA2031
		-55, 0, +25,	0.082	MCA2032
		+75, +100, +150	0.032	MCA2033
			0.016	MCA2034

V_{REF} Volts	Tolerance ±%	Test Temperature °C	ΔV_{REF} Volts	Device Type
9.5	10		0.071	MCA2111
			0.035	MCA2112
		0, +25, +75	0.014	MCA2113
			0.007	MCA2114
	5.0		0.147	MCA2121
		-55, 0, +25,	0.073	MCA2122
		+75, +100	0.028	MCA2123
			0.014	MCA2124
			0.194	MCA2131
		-55, 0, +25,	0.097	MCA2132
		+75, +100, +150	0.038	MCA2133
			0.019	MCA2134
11	10		0.082	MCA2211
			0.041	MCA2212
		0, +25, +75	0.016	MCA2213
			0.008	MCA2214
	5.0		0.170	MCA2221
		-55, 0, +25,	0.085	MCA2222
		+75, +100	0.034	MCA2223
			0.017	MCA2224
			0.225	MCA2231
		-55, 0, +25,	0.112	MCA2232
		+75, +100, +150	0.044	MCA2233
			0.022	MCA2234

SILICON POWER TRANSIENT SUPPRESSORS

Power Zener diodes designed for applications requiring protection of voltage sensitive electronic devices in danger of destruction by high energy voltage transients. Individual cells are matched to insure current sharing under high current pulse conditions.



Case 119

- Transient Power Dissipation: 40 kW
  Pulse Width: 0.1 ms
- DC Power Dissipation: 350 Watts @ $T_C = 25°C$
  (Derate 2.33 W/°C above 25°C)
- Operating Junction and Storage Temperature
  Range: −65°C to +175°C
- Polarity: Anode-to-Case is Standard
  Cathode-to-Case Available Upon Request

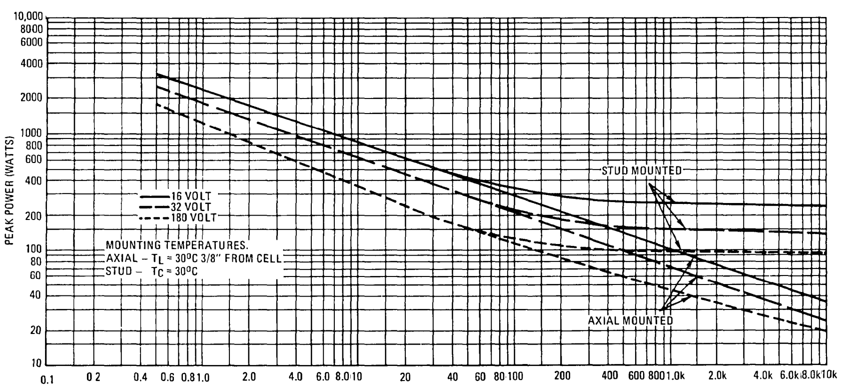
ELECTRICAL CHARACTERISTICS (T_A = 25°C) (V_F = 1 5 V max @ 10 A for all types)

Device Type	Nominal Operating Voltage (Note 1) $V_{OP(PK)}$ Vdc	$V_{OP(RMS)}$ V rms	Maximum Device Clamping Factor $CF = \frac{V_Z @ I_{Z(pulse)}}{V_Z @ I_{ZT}}$	Minimum Zener Voltage $V_{Z(min)}$ Vdc	@ I_{ZT} Adc	Maximum Zener Voltage Pulse Width = 1.0 ms $V_{Z(max)}$ Vdc	@ $I_{Z(pulse)}$ Adc	Maximum Reverse Current $I_{R(max)}$ @ $V_R = V_{OP(PK)}$ µAdc	Typical Capacitance C (typ) @ $V_R = V_{OP(PK)}$ µF
MPZ5-16A	14	10	1.25	16	0.4	24	200	50	0.025
-16B	14	10	1.25	16	0.4	20	200		0.025
-32A	28	20	1.25	32	0.2	50	100		0.011
-32B	28	20	1.25	32	0.2	45	100		0.011
-32C	28	20	1.25	32	0.2	40	100		0.011
-180A	165	117	1.14	180	0.03	250	20		0 0012
-180B	165	117	1.14	180	0.03	225	20		0.0012
-180C	165	117	1.14	180	0.03	205	20	50	0.0012

Although the MPZ Series is only offered in an array of six basic cells, special configurations are available with various power and/or voltage ratings (e.g., 1000 W dc and 200 V dc). In order to choose the correct suppressor, the determination must first be made of the energy magnitude, pulse width, and duty cycle of the transient involved. The following graph is presented to aid the design engineer in selecting the proper case outline and/or combination of basic cells suitable for his specific high-power surge applications. The data represents the surge capabilities of the basic cell (Case 60) both in an axial lead configuration and when mounted on a 7/16" stud base. All data shown reflects the device mounted to an infinite heat sink.

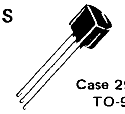
Application Note, AN-461, Transient Suppression with a Power Zener Diode, is available upon request. For more information, contact your nearest Motorola Sales Office or franchised distributor.

BASIC CELL MAXIMUM NON-REPETITIVE SURGE POWER



5

DUAL DIODES



Case 29-01
TO-92

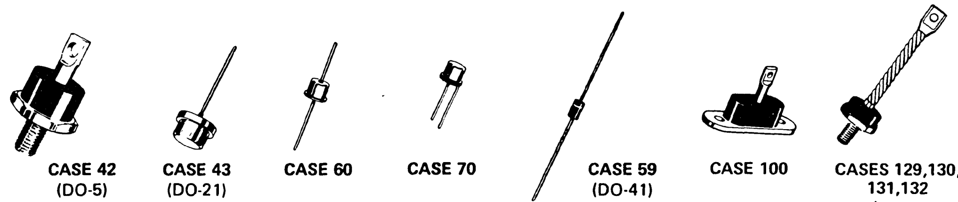
Dual diodes designed for use in low cost biasing, steering and voltage doubler applications including series, common cathode and common anode dual diodes.

Device Type	$V_{(BR)}$ Volts Min	@ $I_{(BR)}$ µA	I_R µA Max	@ V_R Volts	V_F Volts Min/Max	@ I_F mA	$C_{V_R = 0}$ pF Max	t_{rr} ns Max	Description
MSD6100	100	100	0.1	50	0.67/0.82	10	1.5	4.0	Switching
MSD6101	50	100	0.1	40	0.67/0.82	10	2.0	10	Discriminator
MSD6102	70	100	0.1	50	0.67/1.0	10	3.0	100	Common Cathode
MSD6150	70	100	0.1	50	–/1.0	10	8.0	100	Common Anode
MSD7000	100	100	0.2	50	0.67/0.82	10	1.5	15	Series
*MPA-10	60	100	0.1	40	0.8/1.3	500	5.0	10	Dual Eight Diode Array

SILICON RECTIFIERS

A DIGEST OF THE BROADEST LINE OF QUALITY RECTIFIERS AVAILABLE

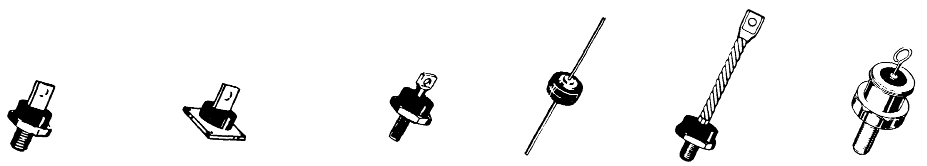
Reverse polarity available on all types except as noted
Reversed polarity units can be obtained by adding suffix "R" to standard type number, e.g., 1N3879R.



CASE 42 (DO-5) **CASE 43** (DO-21) **CASE 60** **CASE 70** **CASE 59** (DO-41) **CASE 100** **CASES 129,130, 131,132** Suffix "SB"

I_O, AVERAGE RECTIFIED FORWARD CURRENT		1.0 A	3.0 A		6.0 A	12 A	15 A	20 A	25 A	30 A	35 A	50 A	100 A		200 A	300 A	450 A
		Case 59	Case 60	Case 70	Case 194	Case 245	Case 42	Case 42	Case 43	Case 43	Case 42	Case 100	Case 167 Case 168 (2)	Case 189 (2)	Case 126 Case 130 Case 133 (2)	Case 127 Case 131 Case 134 (2)	Case 128 Case 132 Case 135 (2)
$V_{RM(REP)}$ MAX PEAK REPETITIVE REVERSE VOLTAGE	100 V	1N4002	1N4720	1N4998	MR751	MR1121 1N1200 1N1200A	1N3209	1N249B	1N3492 (MR323)	1N3660	1N1184	MR1201FL	MR1211	MR1811	MR1221	MR1231	MR1241
	200 V	1N4003	1N4721	1N4999	MR752	MR1122 1N1202 1N1202A	1N3210	1N250B	1N3493 (MR324)	1N3661	1N1186	MR1203FL	MR1213	MR1813	MR1223	MR1233	MR1243
	400 V	1N4004	1N4722	1N5000	MR754	MR1124 1N1204 1N1204A	1N3212	1N1196	1N3495 (MR326)	1N3663	1N1188	MR1207FL	MR1217	MR1817	MR1227	MR1237	MR1247
	600 V	1N4005	1N4723	1N5001	MR756	MR1126 1N1206 1N1206A	1N3214	1N1198	MR328		1N1190	MR1209FL	MR1219	MR1819	MR1229	MR1239	MR1249
	800 V	1N4006	1N4724	1N5002		MR1128 1N3988			MR330								
	1000 V	1N4007	1N4725	1N5003		MR1130 1N3990			MR331								

(1) Not available in reverse polarity.
(2) Add proper two letter suffix to type number to indicate desired package style, e.g., MR1243FL.

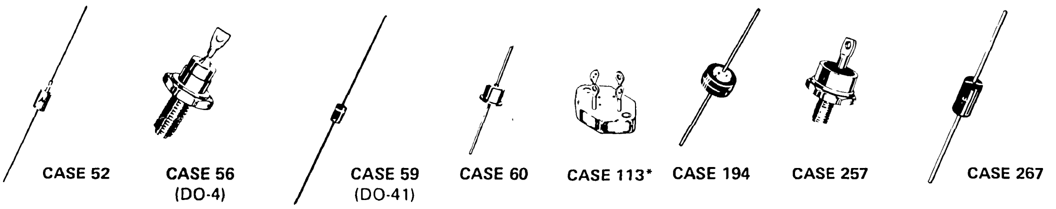


CASES 125,126,127,128 Suffix "SL" **CASES 133,134, 135,136** Suffix "FL" **CASES 167,189** Suffix "SL" **CASE 194** **CASES 168** Suffix "SB" **CASE 245** (DO-4)

5

FAST RECOVERY POWER RECTIFIERS

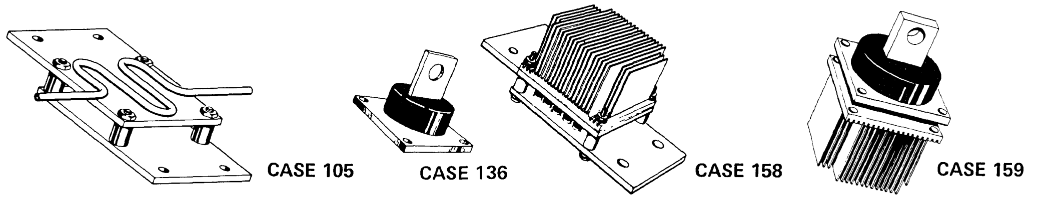
This digest represents the latest rectifier products that are recommended for new designs. It does not list all devices available from Motorola. For a more complete listing refer to the Products/Price Listing in this book.



I_O, AVERAGE RECTIFIED FORWARD CURRENT		PLASTIC				METAL								
		Axial Lead				Axial Lead			Stud Mounted					
		1.0 A		3.0 A	5.0 A	1.0 A	3.0 A		6.0 A	12 A	20 A	30 A	40 A	50 A
		Case 59-01 DO-41		Case 267-01	194	Case 52 DO-13	Case 60		Case 56B-01 DO-4		Case 257 DO-5			
	50V	1N4933	MR810	MR850	MR820	MR1337-1	MR830	MR840	1N3879	1N3889	1N3899	1N3909	MR860	MR870
	100V	1N4034	MR811	MR851	MR821	MR1337-2	MR831	MR841	1N3880	1N3890	1N3900	1N3910	MR861	MR871
	200V	1N4035	MR812	MR852	MR822	MR1337-3	MR832	MR842	1N3881	1N3891	1N3901	1N3911	MR862	MR872
V_{RRM}	300V	MR2271	MR813	–	–	MR1337-4	–	–	1N3882	1N3892	1N3902	1N3912	–	–
MAXIMUM PEAK	400V	1N4936	MR814	MR854	MR824	MR1337-5	MR834	MR844	1N3883	1N3893	1N3903	1N3913	MR864	MR874
REPETITIVE REVERSE	600V	1N4937	MR816	MR856	MR826	MR1337-7	MR836	MR846	MR1366	MR1376	MR1386	MR1396	MR866	MR876
VOLTAGE	800V	–	MR817	–	–	–	–	–	–	–	–	–	–	–
	1000V	–	MR818	–	–	–	–	–	–	–	–	–	–	–
	Fast Recovery	f=250kHz t_{rr}=0 2μs	f=50kHz t_{rr}=750 ns	f=250kHz t_{rr}=0.2μs		f=250kHz t_{rr}=200 ns	f=250kHz t_{rr}=0.2μs	f=50kHz t_{rr}=1.0μs	f=250kHz t_{rr}=0.2μs					

*See Molded Rectifier Bridge Assemblies — Page 5-17 for MDA952FR-Fast Recovery Bridge

5



CASE 105 CASE 136 CASE 158 CASE 159

I_O, AVERAGE RECTIFIED FORWARD CURRENT		700 A	750 A	1000 A	1100 A
		Case 136	Case 159	Case 105	Case 158
$V_{RM(REP)}$ MAX PEAK REPETITIVE REVERSE VOLTAGE	100 V	MR1261	MR2081HA	MR1291	MR2101HA
	200 V	MR1263	MR2082HA	MR1293	MR2102HA
	400 V	MR1267	MR2084HA	MR1297	MR2104HA
	600 V	MR1269		MR1299	
	800 V				
	1000 V				

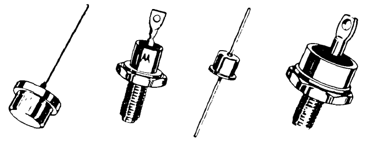
SILICON HIGH VOLTAGE SURMETIC RECTIFIERS

High-voltage, low-current rectifiers designed for applications where high-voltages in subminiature packages are required. These devices feature efficient high-temperature current-handling performance, high surge-current capabilities and surface passivation.

CASE 169

I_O, AVERAGE RECTIFIED FORWARD CURRENT		0.25 A
		Case 169
$V_{RM(REP)}$ MAX PEAK REPETITIVE REVERSE VOLTAGE	1000 V	MR990A
	1500 V	MR991A
	2000 V	MR992A
	2500 V	MR993A
	3000 V	MR994A
	4000 V	MR995A
	5000 V	MR996A

HOT-CARRIER POWER RECTIFIERS



CASE 43 (DO-21) CASE 56 CASE 60 CASE 257

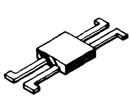
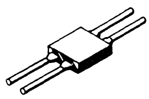
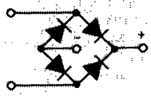
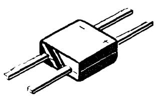
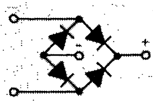
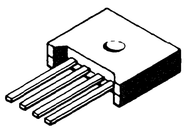
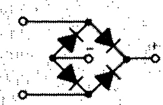
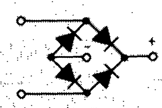
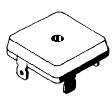
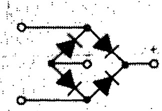
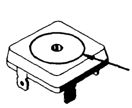
. . . utilizes the Schottky Barrier principle Barrier in a large area metal-to-silicon power diode. State of the art geometry features epitaxial construction with oxide passivation and metal overlay contact. Features are very low V_F and high-frequency capability.

		Forward Current		I_R	V_F	Case
Device Type	V_{RRM} Volts	I_O $T_C = 50°C$ Amp	I_{FSM} Amp	$T_C = 25°C$ mA	I_F @ 25 Amp $T_C = 25°C$ Volts	
MBD5300	20	5.0	500	30	0.50	60
MBD5400	20	25	600	30	I_F = 75 Amp 0.75	56A-01
MBD5500A	20	50	800	75	I_F = 100 Amp 0.75	43
MBD5500	20	50	800	120	I_F = 100 Amp 0.65	43
MBD5550A	20	50	800	75	I_F=100 Amp 0.75	257
MBD5550	20	50	800	120	I_F = 100 Amp 0.65	257

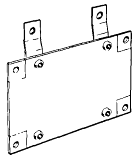
Note: Multi-Cell combinations providing increased current capability are available on special request.

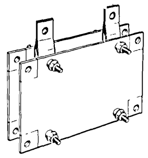
SILICON POWER RECTIFIER ASSEMBLIES

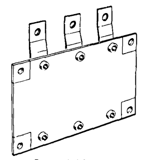
Low-cost, standard rectifier circuits in small, integral packages providing 1.0 to 27 Amp output current with V_{RRM} ratings to 1000 Volts. Round leads available on the MDA920 series by adding suffix "A" to device type number (i.e. MDA920A-1).

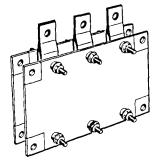
MIDA RECTIFIER ASSEMBLIES	CASE	DEVICE TYPE	V_{RRM} Volts	I_{TSM} Amp	I_{FRM} Amp	I_{out} Amp @ °C
  Case 108 Case 109	108 109	 Single-Phase Full-Wave Bridge MDA920-1 -2 -3 -4 -5 -6 -7	25 50 100 200 300 400 600	32	5.0	1.0 75
 Case 216-01	216 -01	 Single-Phase Full-Wave Bridge MDA922-1 -2 -3 -4 -5 -6 -7 -8 -9	25 50 100 200 300 400 600 800 1000	60	10	1.8 40
 Case 117	117	 Single-Phase Full-Wave Bridge MDA960-1 -2 -3	50 100 200	100	15	2.5 55
	117	 Single-Phase Full-Wave Bridge MDA970-1 -2 -3	50 100 200	150	25	4.0 55
 Case 179-01	179 -01	 Single-Phase Full-Wave Bridge MDA980-1 -2 -3 -4 -5 -6	50 100 200 300 400 600	300	– – – – – –	12 55
 Case 179-02	179 -02	 Single-Phase Full-Wave Bridge MDA990-1 -2 -3 -4 -5 -6	50 100 200 300 400 600	300	– – – – – –	27 55

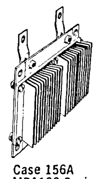
RECTIFIER ASSEMBLIES

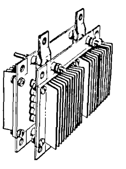

Case 154A
MRA130 Series

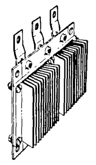

Case 155A
MRA130B Series

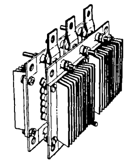

Case 154
MRA330 Series


Case 155
MRA330B Series


Case 156A
MRA160 Series

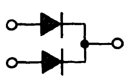
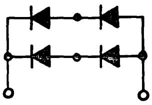

Case 157A
MRA160B Series

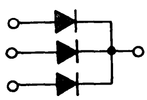
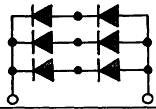

Case 156
MRA360 Series


Case 157
MRA360B Series

HIGH CURRENT RECTIFIER CIRCUITS

Motorola Multi-Cell II power rectifier diode circuits are air-cooled, integral-heatsink rectifier assemblies engineered for optimum diode/heatsink utilization.

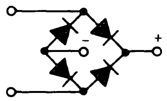
Device Type	V_{RRM} Volts	DC Output Current Amperes	Configuration
MRA130 MRA131 MRA132 MRA133 MRA134	50 100 200 300 400	300 @ 1500 LFM 75 Free Convection	Single-Phase Half-Wave Bridge 
MRA160 MRA161 MRA162 MRA163 MRA164	50 100 200 300 400	600 @ 1500 LFM 125 Free Convection	
MRA130B MRA131B MRA132B MRA133B MRA134B	50 100 200 300 400	300 @ 1500 LFM 75 Free Convection	Single-Phase Full-Wave Bridge 
MRA160B MRA161B MRA162B MRA163B MRA164B	50 100 200 300 400	600 @ 1500 LFM 125 Free Convection	

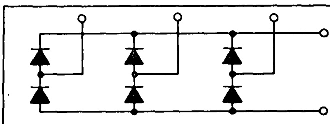
Device Type	V_{RRM} Volts	DC Output Current Amperes	Configuration
MRA330 MRA331 MRA332 MRA333 MRA334	50 100 200 300 400	300 @ 1500 LFM 75 Free Convection	Three-Phase Half-Wave Bridge 
MRA360 MRA361 MRA362 MRA363 MRA364	50 100 200 300 400	650 @ 1500 LFM 150 Free Convection	
MRA330B MRA331B MRA332B MRA333B MRA334B	50 100 200 300 400	300 @ 1500 LFM 75 Free Convection	Three-Phase Full-Wave Bridge 
MRA360B MRA361B MRA362B MRA363B MRA364B	50 100 200 300 400	650 @ 1500 LFM 150 Free Convection	

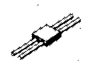
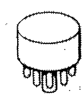
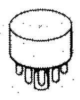
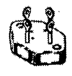
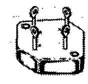
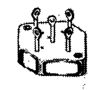
Bridge assembly is designated by a "B" suffix, i.e., MRA330B. Bridges are composed of one common cathode and one common anode assembly.

MOLDED RECTIFIER BRIDGE ASSEMBLIES

. . . individual hermetically-sealed rectifiers interconnected and encapsulated in molded assemblies for use as single-phase and three-phase full-wave bridge configurations, with output current range from 1.5 to 16 Amp, peak reverse voltage from 50 to 600 Volts. Series MDA952, MDA962 and MDA1505 for printed circuit insertion without solder lugs (Specify "A" Suffix).

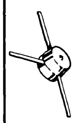

Single-Phase
Full-Wave Bridge


Three-Phase
Full-Wave Bridge

							
	Case 110	Case 111	Case 112	Case 112	Case 113	Case 115	Case 114
V_{RRM} Volts	1.5 Amp			4.0 Amp	6.0 Amp	10 Amp	8.0 Amp
50	MDA942-1	MDA942A-1	MDA1491-1	MDA1591-1	*MDA952-1	MDA962-1	MDA1505-1
100	-2	-2	-2	-2	-2	-2	-2
200	-3	-3	-3	-3	-3	-3	-3
300	-4	-4	-4	-4	-4	-4	-4
400	-5	-5	-5	-5	-5	-5	-5
600	-6	-6	-6	-6	-6	-6	-6

*Fast Recovery Bridge available (t_{rr} = 200 ns Max).
To order, specify MDA952FR-1 thru MDA952FR-5.

THYRISTORS

		SILICON CONTROLLED RECTIFIERS										
		0.25 AMP	0.5 AMP	0.8 AMP	1.6 AMP			4.0 AMP				
		 Case 28	 Case 22 TO-18	 Case 29	 Case 31 TO-5			 Plastic Case 77			 Plastic Case 90	
BLOCKING VOLTAGE (DC OR PEAK) VOLTS	15 V	MCR051	MCR201	MCR101	–	–	–	–	–	–	–	–
	25 V	–	–	–	–	2N2322	2N4212	–	–	–	–	–
	30 V	MCR052	MCR202	MCR102 2N5060	–	–	–	2N6236	MCR106-1	MCR107-1	MCR406-1	MCR407-1
	50 V	–	–	–	2N1595	2N2323	2N4213	2N6237	–	–	–	–
	60V	MCR053	MCR203	MCR103 2N5061	–	–	–	–	MCR106-2	MCR107-2	MCR406-2	MCR407-2
	100 V	MCR054	MCR204	MCR104 2N5062	2N1596	2N2324	2N4214	2N6238	MCR106-3	MCR107-3	MCR406-3	MCR407-3
	150 V	–	MCR205	MCR115 2N5063	–	2N2325	2N4215	–	–	–	–	–
	200 V	–	MCR206	MCR120 2N5064	2N1597	2N2326	2N4216	2N6239	MCR106-4	MCR107-4	MCR406-4	MCR407-4
	250 V	–	–	–	–	–	–	–	–	–	–	–
	300 V	–	–	–	2N1598	–	–	–	MCR106-5	MCR107-5	–	–
	400 V	–	–	–	2N1599	–	–	2N6240	MCR106-6	MCR107-6	–	–
	500 V	–	–	–	–	–	–	–	MCR106-7	MCR107-7	–	–
	600 V	–	–	–	–	–	–	2N6241	MCR106-8	–	–	–
$I_{T(AV)}$ (Amp) @ $\alpha = 180°$ @ T_C		–	0.5 @ 38°C	0.5 @ 49°C	1.0 @ 80°C	1.0 @ 85°C	1.0 @ 80°C	2.6 @ 90°C	2.6 @ 90°C	2.6 @ 90°C	2.6 @ 90°C	2.6 @ 90°C
I_{TSM} (Amp)		6.0	6.0	6.0	15	15	15	25	25	25	30	20
I^2t (A^2s)		0.15	0.15	0.15	0.5	0.5	0.5	2.6	2.6	2.6	3.6	1.6
I_{GT} @ 25°C (mA)		0.2	0.2	0.2	10	0.2	0.1	0.2	0.5	20	0.2	0.5
V_{GT} @ 25°C (V)		0.8	0.8	0.8	3.0	0.8	0.8	0.8	1.0	1.5	0.8	1.0
I_H @ 25°C (mA)		5.0	5.0	5.0	5.0 Typ	2.0	3.0	3.0	5.0	20	3.0	5.0
t_{gt} Typ (μs)		–	–	–	0.8	–	–	1.2	–	–	–	–
dv/dt Typ (V/μs)		–	–	–	–	–	–	10	10	10	10	10

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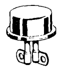
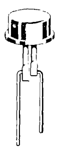
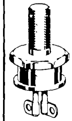
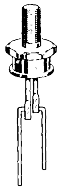
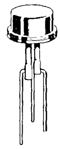
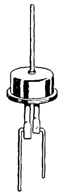
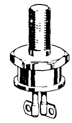
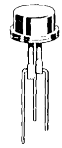
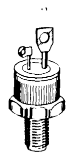
		SILICON CONTROLLED RECTIFIERS									
		8.0 AMP									16 AMP
											
		Plastic Case 90	Case 85	Case 85L	Case 86	Case 86L	Case 87L	Case 88L	Case 86	Case 87L	Case 263-01
BLOCKING VOLTAGE (DC OR PEAK) VOLTS	15 V	–	–	–	–	–	–	–	–	–	–
	25 V	MCR3000-1	2N4151	2N4159	2N4167	2N4175	2N4183	2N4191	MCR2315-1	MCR2614L-1	2N1842 2N1842A
	30 V	–	–	–	–	–	–	–	–	–	–
	50 V	2N4441 MCR3000-2	2N4152	2N4160	2N4168	2N4176	2N4184	2N4192	MCR2315-2	MCR2614L-2	2N1843 2N1843A
	60 V	–	–	–	–	–	–	–	–	–	–
	100 V	MCR3000-3	2N4153	2N4161	2N4169	2N4177	2N4185	2N4193	MCR2315-3	MCR2614L-3	2N1844 2N1844A
	150 V	–	–	–	–	–	–	–	–	–	2N1845 2N1845A
	200 V	2N4442 MCR3000-4	2N4154	2N4162	2N4170	2N4178	2N4186	2N4194	MCR2315-4	MCR2614L-4	2N1846 2N1846A
	250 V	–	–	–	–	–	–	–	–	–	2N1847 2N1847A
	300 V	MCR3000-5	2N4155	2N4163	2N4171	2N4179	2N4187	2N4195	MCR2315-5	MCR2614L-5	2N1848 2N1848A
	400 V	2N4443 MCR3000-6	2N4156	2N4164	2N4172	2N4180	2N4188	2N4196	MCR2315-6	MCR2614L-6	2N1849 2N1849A
	500 V	MCR3000-7	2N4157	2N4165	2N4173	2N4181	2N4189	2N4197	–	–	2N1850 2N1850A
	600 V	2N4444 MCR3000-8	2N4158	2N4166	2N4174	2N4182	2N4190	2N4198	–	–	–
$I_{T(AV)}$ (Amp) @α= 180°C @ T_C		5.0 @ 73°C	5.0 @ 83°C	5.0 @ 83°C	5.0 @ 83°C	5.0 @ 83°C	5.0 @ 83°C	5.0 @ 83°C	5.0 @ 75°C	5.0 @ 75°C	10 @ 35°C
I_{TSM} (Amp)		80	100	100	100	100	100	100	80	80	125
I^2t (A^2s)		25	40	40	40	40	40	40	40	40	60
I_{GT} @ 25°C (mA)		30	30	30	30	30	30	30	40	40	80
V_{GT} @ 25°C (V)		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0
I_H @ 25°C (mA)		4.0	30	30	30	30	30	30	50	50	20 Typ
t_{gt} Typ (μs)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
dv/dt Typ (V/μs)		50	50	50	50	50	50	50	50	50	30

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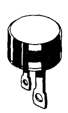
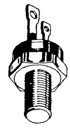
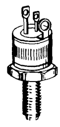
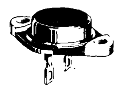
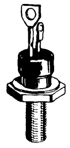
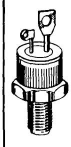
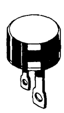
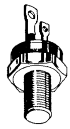
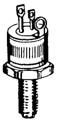
	SILICON CONTROLLED RECTIFIERS										
	20 AMP					25 AMP		35 AMP			
										
	Case 174 TO-203	Case 175	Case 235	Case 61 (1) TO-41		Case 64	Case 263-01	Case 174 TO-203	Case 175	Case 235
BLOCKING VOLTAGE (DC OR PEAK) VOLTS 15 V	–	–	–	–	–	–	–	–	–	–
25 V	MCR3818-1 (4)	MCR3918-1 (4)	–	MCR649-1	2N2573	MCR1907-1	2N681	MCR3835-1	MCR3935-1	–
30 V	–	–	–	–	–	–	–	–	–	–
50 V	2N5164 (4)	2N5168 (4)	–	MCR649-2	2N2574	MCR1907-2	2N682	MCR3835-2	MCR3935-2	–
60 V	–	–	–	–	–	–	–	–	–	–
100 V	MCR3818-3 (4)	MCR3918-3 (4)	2N6167	MCR649-3	2N2575	MCR1907-3	2N683	2N3870 MCR3835-3	2N3896 MCR3935-3	2N6171
150 V	–	–	–	–	–	–	2N684	–	–	–
200 V	2N5165 (4)	2N5169 (4)	2N6168	MCR649-4	2N2576	MCR1907-4	2N685	2N3871 MCR3835-4	2N3897 MCR3935-4	2N6172
250 V	–	–	–	–	–	–	2N686	–	–	–
300 V	MCR3818-5 (4)	MCR3918-5 (4)	–	MCR649-5	2N2577	MCR1907-5	2N687	MCR3835-5	MCR3935-5	–
400 V	2N5166 (4)	2N5170 (4)	2N6169	MCR649-6	2N2578	MCR1907-6	2N688	2N3872 MCR3835-6	2N3898 MCR3935-6	2N6173
500 V	MCR3818-7 (4)	MCR3918-7 (4)	–	MCR649-7	2N2579	–	2N689	MCR3835-7	MCR3935-7	–
600 V	2N5167 (4)	2N5171 (4)	2N6170	–	–	–	2N690	2N3873 MCR3835-8	2N3899 MCR3935-8	3N6174
$I_{T(AV)}$ (Amp) @ α = 180°C @ T_C	13 @ 67°C	13 @ 67°C	13 @ 67°C	13 @ 75°C	16 @ 85°C	16 @ 65°C	16 @ 65°C	22 @ 65°C	22 @ 65°C	22 @ 65°C
I_{TSM} (Amp)	240	240	240	260	260	150	150	350	350	350
I^2t (A^2s)	235	235	235	275	275	75	75	435	435	435
I_{GT} @ 25°C (mA)	40	40	40	80	40	30	25	40	40	40
V_{GT} @ 25°C (V)	1.5	1.5	1.5	3.5	3.5	1.5	3.0	1.6	1.6	1.6
I_H @ 25°C (mA)	50	50	50	20 Typ	20 Typ	12 Typ	20 Typ	50	50	50
t_{gt} Typ (µs)	1.0	1.0	1.0	–	–	0.5	–	1.5 Max	1.5 Max	1.5 Max
dv/dt Typ (V/µs)	50	50	50	–	30	30 Min	30	50	50	50

(1) Available without lugs – Case 54,TO-3 (Pin) Package
(4) Standard polarity is Anode-to-Case, reverse-polarity (Cathode-to-Case) may be signified by an "R" suffix.

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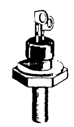
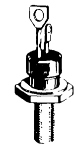
THYRISTORS (continued)

		PULSE MODULATOR SCR'S			
		100 AMP (Pulse)		300 AMP (Pulse)	1000 AMP (Pulse)
					
			Fast Switching Case 63		Fast Switching Case 64 TO-48
BLOCKING VOLTAGE (DC OR PEAK) VOLTS	15 V	–	–	–	–
	25 V	–	MCR846-1	–	–
	30 V	–	–	–	–
	50 V	–	MCR846-2	–	–
	60 V	–	–	–	–
	100 V	–	MCR846-3	–	–
	150 V	–	–	–	–
	200 V	–	MCR846-4	–	–
	250 V	–	–	–	–
	300 V	2N4199 2N4199JAN	–	MCR1336-5	MCR1718-5
	400 V	2N4200 2N4200JAN	–	MCR1336-6	MCR1718-6
	500 V	2N4201 2N4201JAN	–	MCR1336-7	MCR1718-7
	600 V	2N4202 2N4202JAN (2)(3)	–	MCR1336-8 (2)(3)	MCR1718-8
$I_{T(AV)}$ (Amp) @ α = 180°C @ T_C		–	–	–	–
I_{TSM} (Amp)		–	–	–	–
I^2t (A^2s)		–	35	–	250
I_{GT} @ 25°C (mA)		50	50	40	50
V_{GT} @ 25°C (V)		1.5	1.5	1.25	1.5
I_H @ 25°C (mA)		3.0 Min	25 Typ	50	15 Typ
t_{gt} Typ (μs)		0.4 Max	0.5	0.15	–
dv/dt Typ (V/μs)		250 Min	50 Min	250 Min	100

(2) 700V – 2N4203, 2N4203JAN and MCR1336-9 available
(3) 800V – 2N4204, 2N4204JAN, and MCR1336-10 available

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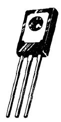
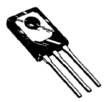
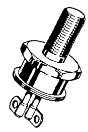
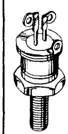
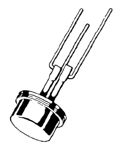
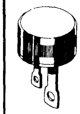
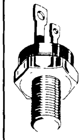
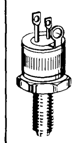
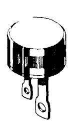
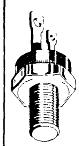
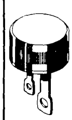
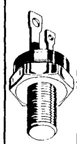
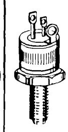
THYRISTORS (continued)

	TRIACS – SILICON BIDIRECTIONAL THYRISTORS										
	4.0 AMP	10 AMP							15 AMP		
	 Plastic Case 77	 Plastic Case 90		 Case 86		 Case 250	 Case 87L		 Case 174 TO-203	 Case 175	 Case 235
BLOCKING VOLTAGE (DC OR PEAK) VOLTS 25 V	2N6068	MAC10-1	MAC11-1	–	MAC5-1	–	–	MAC6-1	–	–	–
30 V	–	–	–	–	–	–	–	–	–	–	–
50 V	2N6069	MAC10-2	MAC11-2	–	MAC5-2	–	–	MAC6-2	–	–	–
60 V	–	–	–	–	–	–	–	–	–	–	–
100 V	2N6070	MAC10-3	MAC11-3	–	MAC5-3	–	–	MAC6-3	–	–	–
200 V	2N6071	2N6151 (MAC10-4)	2N6154 (MAC11-4)	2N6139	MAC5-4	2N6142	2N6148	MAC6-4	2N5571	2N5573	2N6145
300 V	2N6072	MAC10-5	MAC11-5	–	MAC5-5	–	–	MAC6-5	–	–	–
400 V	2N6073	2N6152 (MAC10-6)	2N6155 (MAC11-6)	2N6140	MAC5-6	2N6143	2N6149	MAC6-6	2N5572	2N5574	2N6146
500 V	2N6074	MAC10-7	MAC11-7	–	MAC5-7	–	–	MAC6-7	–	–	–
600 V	2N6075	2N6153 (MAC10-8)	2N6156 (MAC11-8)	2N6141	MAC5-8	2N6144	2N6150	MAC6-8	MAC40797	MAC40798	2N6147
I_{GT} @ 25°C MT2(+), G(+)	60	50	50	50	50	50	50	50	50	50	50
MT2(+), G(–)	–	75	–	75	–	75	75	–	80	80	80
MT2(–), G(–)	60	50	50	50	50	50	50	50	50	50	50
MT2(–), G(+)	–	75	–	75	–	75	75	–	80	80	80
V_{GT} @ 25°C MT2(+), G(+)	2.5	2.0	2.0	2.0	2.5	2.0	2.0	2.5	2.5	2.5	2.5
MT2(+), G(–)	–	2.5	–	2.5	–	2.5	2.5	–	2.5	2.5	2.5
MT2(–), G(–)	2.5	2.0	2.0	2.0	2.5	2.0	2.0	2.5	2.5	2.5	2.5
MT2(–), G(+)	–	2.5	–	2.5	–	2.5	2.5	–	2.5	2.5	2.5
I_{TSM} (Amp)	30	100	100	100	100	100	100	100	100	100	100

		TRIACS – SILICON BIDIRECTIONAL THYRISTORS				
		25 AMP		30 AMP		
		 Case 174 TO-203	 Case 175	 Case 174 TO-203	 Case 175	 Case 235
BLOCKING VOLTAGE (DC OR PEAK) VOLTS	25 V	MAC37-1	MAC38-1	–	–	–
	30 V	–	–	–	–	–
	50 V	MAC37-2	MAC38-2	–	–	–
	60 V	–	–	–	–	–
	100 V	MAC37-3	MAC38-3	–	–	–
	200 V	MAC37-4	MAC38-4	2N6157	2N6160	2N6163
	300 V	MAC37-5	MAC38-5	–	–	–
	400 V	MAC37-6	MAC38-6	2N6158	2N6161	2N6164
	500 V	MAC37-7	MAC38-7	–	–	–
	600 V	–	–	2N6159	2N6162	2N6165
I_{GT} @ 25°C						
MT2(+), G(+)		75	75	60	60	60
MT2(+), G(–)		–	–	70	70	70
MT2(–), G(–)		75	75	70	70	70
MT2(–), G(+)		–	–	100	100	100
V_{GT} @ 25°C						
MT2(+), G(+)		3.0	3.0	2.0	2.0	2.0
MT2(+), G(–)		–	–	2.1	2.1	2.1
MT2(–), G(–)		3.0	3.0	2.1	2.1	2.1
MT2(–), G(+)		–	–	2.5	2.5	2.5
I_{TSM} (Amp)		225	225	250	250	250

5

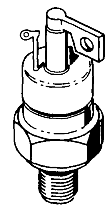
POWER THYRISTORS

High current thyristors above 35 Amperes are now available from Motorola to more fully encompass the needs of semiconductor users.

Construction features employ special materials and alloys which are carefully tested and selected to provide the reliability and performance demanded by the most sophisticated industrial application. These features are:

1. Large area single die
2. Hermetically sealed package using high quality ceramic
3. Fatigue-free, pressure-loaded die contact system

These Silicon Controlled Rectifiers are designed for high power industrial and consumer applications in power and speed controls such as welders, furnaces, motors, space heaters and other equipment where control of high current is needed.



CASE 246
(TO-83)

CASE 219
(TO-94)

5

SILICON CONTROLLED RECTIFIERS – SCR – 110 AMP RMS

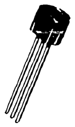
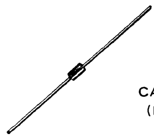
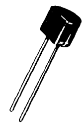
Device Type	Peak Reverse/ Forward Blocking Voltage V_{RRM}/V_{DRM}	Non-Repetitive Peak Reverse Blocking Voltage V_{RSM}	Peak Surge Current (1 Cycle) 60 Hz (AMP) I_{TSM}	Gate Trigger Current (mA) I_{GT}	Gate Trigger Voltage (Volts) V_{GT}	Holding Current Typical (mA) I_H	Forward "On" Voltage (I_T = 50 A, I_T = 500 A*, Peak, T_J = 25°C) (Volts) V_T	Forward Voltage Application Rate-Typ, Min* (V/μs) dv/dt	Case
2N4361	100	200	1600	200	3.0	30	1.6	500	219
2N4362	200	300							
2N4363	400	500							
2N4364	600	700							
2N4365	800	900							
2N4366	1000	1100							
2N4367	1200	1300							
2N4368	1400	1500							
2N4371	100	200							246
2N4372	200	300							
2N4373	400	500							
2N4374	600	700							
2N4375	800	900							
2N4376	1000	1100							
2N4377	1200	1300							
2N4378	1400	1500							
MCR154-10	100	200	1800	150			3.0*	200*	219
MCR154-20	200	300							
MCR154-30	300	400							
MCR154-40	400	500							
MCR154-50	500	600							
MCR154-60	600	650							
MCR155-10	100	200						100*	
MCR155-20	200	300							
MCR155-30	300	400							
MCR155-40	400	500							
MCR155-50	500	600							
MCR155-60	600	650							
MCR156-10	100	200						200*	246
MCR156-20	200	300							
MCR156-30	300	400							
MCR156-40	400	500							
MCR156-50	500	600							
MCR156-60	600	650							
MCR157-10	100	200						100*	
MCR157-20	200	300							
MCR157-30	300	400							
MCR157-40	400	500							
MCR157-50	500	600							
MCR157-60	600	650							

TRIGGERS

The ideal SCR or Triac complement is a trigger developed to meet design and cost considerations.

Motorola has the broadest line of signal triggers!

New unilateral switches for SCR triggering, bilateral switches for Triac control – there are more than 3 dozen signal thyristor devices available that enable the right metal or plastic device to be selected for any thyristor power control application.

 CASE 22 (TO-18)	 CASE 29 (TO-92)	 CASE 51 (DO-7)	 CASE 182

SILICON BIDIRECTIONAL SWITCH – SBS

Device Type	Case No./ Style	V_S Switching Voltage Vdc (Min)	(Max)	I_S Switching Current μAdc (Max)	I_H Holding Current mAdc (Max)	$\|V_{S1} - V_{S2}\|$ Switching Voltage Differential Vdc (Max)	V_F Forward ON-State Voltage (1) I_F = 175 mAdc (2) I_F = 200 mAdc Volts (Max)
MBS4991	29/12	6.0	10	500	1.5	0.5	1.7 (1)
MBS4992	29/12	7.5	9.0	120	0.5	0 2	1.7 (2)
2N4993	22/9	6.0	10	500	1.5	0.5	1.7 (2)
MBS100	29/12	3.0	5.0	400	1.0	0.350	2.0 (2)

SILICON UNIDIRECTIONAL SWITCH – SUS

Device Type	Case No./ Style	V_S Switching Voltage Volts (Min)	(Max)	I_S Switching Current μA (Max)	I_H Holding Current mA	V_F Forward Voltage I_F = 150 mA	I_B @ 5.0V Forward Blocking Current μA	P_D Power Dissipation mW	V_R Reverse Voltage Volts (Max)	V_O Peak Pulse Voltage Volts (Min)	$I_{F(rep)}$ Peak Recurrent Forward Current T_A = 100 °C, tp = 10 μs 1.0% duty cycle Amp
MUS4987	29-02/13	6.0	10	500	1.5	1.5	0.1	300	30	3.5	2.0
MUS4988	29-02/13	7.5	9.0	150	0.5	1.5	0.1	300	30	3.5	2.0

BILATERAL TRIGGER DIACS

Device Type	Case No.	V_S Switching Voltage (Both Directions) Volts (Nom)	I_S Switching Current (Both Directions) μA (Max)	ΔV Switchback Voltage (Both Directions) Volts (Min)	I_B Leakage Current (Both Directions) V = 14 V μA (Max)	I_{pulse} Peak Pulse Current @ 30 μs, 120 Hz Amp (Max)
1N5758/MPT20	182	20 ± 4.0	100	5.0	10	2.0
1N5759		24 ± 4.0	100	5.0		
1N5760/MPT28		28 ± 4.0	100	7.0		
1N5761/MPT32		32 ± 4.0	100	7.0		
1N5762		36 ± 4.0	100	7.0		
1N5758A		20 ± 2.0	25	5.0		
1N5759A		24 ± 2.0	25	5.0		
1N5760A		28 ± 2.0	25	7.0		
1N5761A		32 ± 2.0	25	7.0		
1N5762A		36 ± 2.0	25	7.0		

4-LAYER DIODES (PEAK PULSE CURRENT = 10 Amp @ PW = 50 μs Max, I_F = 150 mA Max)

Device Type	Case No.	V_S Switching Voltage Volts (Min)	(Max)	I_S Switching Current μA (Max)	I_H Holding Current T_A = 25°C mA (Min)	(Max)	I_{pulse} Peak Pulse Current @ 50 μs Amp (Max)
1N5158 (M4L3052)	51	8.0	10	50	1.0	20	10
1N5159 (M4L3053)		9.0	11				
1N5160 (M4L3054)		10	12				
M4L3055		11	13				
M4L3056		12	14				

UNIJUNCTIONS

Motorola Unijunction Transistors give you state-of-the-art leadership in technology and performance because

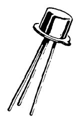
. . .the Annular process furnishes fast-response, long-time-delay advantage as well as superior reliability and stability in all applications.

. . .there are over 30 different metal and plastic Motorola UJTs to meet your top performance need in most any design from consumer to military.

. . .computerized testing ensures uniform results, faster deliveries and user confidence.

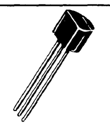
. . .ready availability meets any demand.

. . .applications assistance is yours for the asking, like AN-294, "Unijunction Transistor Timers and Oscillators," a valuable application note we'll send you.

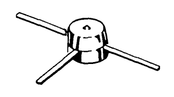


Case 22 (TO-18)

Case 22A



Plastic Case 29 (TO-92)



Case 28

UNIJUNCTION TRANSISTORS – UJT

Device Type	Case No./ Style	η Intrinsic Standoff Ratio (Min)	η Intrinsic Standoff Ratio (Max)	I_P Peak Point Emitter Current µA (Max)	I_{EB2O} Emitter Reverse Current µA (Max)	I_V Valley Point Current mA (Min)	V_{B2B1} Interbase Voltage Volts (Max)	P_D Power Dissipation mW (Max)
2N4870	29/9	0.56	0.75	5.0	1.0	2.0	35	300
2N4871	↓	0.70	0.85	5.0	1.0	4.0	35	↓
MU4891	↓	0.55	0.82	5.0	0.01	2.0	–	↓
MU4892	↓	0.51	0.69	2.0	↓	↓	–	↓
MU4893	↓	0.55	0.82	2.0	↓	↓	–	↓
MU4894	↓	0.74	0.86	1.0	↓	↓	–	↓
MU851	28/7	0.56	0.75	2.0	0.1	2.0	28	200
MU852	↓	0.70	0.85	2.0	0.1	4.0	↓	↓
MU853	↓	0.70	0.85	0.4	0.05	4.0	↓	↓
2N2646	22A/1	0.56	0.75	5.0	12	4.0	35	300
2N2647	↓	0.68	0.82	2.0	0.2	8.0	↓	300
2N3980	↓	0.68	0.82	2.0	0.01	1.0	↓	360
2N4851	↓	0.56	0.75	2.0	0.1	2.0	↓	300
2N4852	↓	0.70	0.85	2.0	0.1	4.0	↓	300
2N4853	↓	0.70	0.85	0.4	0.05	6.0	↓	300
2N4948	↓	0.55	0.82	2.0	0.01	2.0	–	360
JAN2N4948 (1)	↓	0.55	0.82	2.0	↓	↓	–	↓
2N4949	↓	0.74	0.86	1.0	↓	↓	–	↓
JAN2N4949 (1)	↓	0.74	0.86	1.0	↓	↓	–	↓
2N5431	↓	0.72	0.80	0.4	↓	↓	35	300
JAN2N5431 (2)	↓	0.72	0.80	0.4	↓	↓	35	300

COMPLEMENTARY UNIJUNCTION TRANSISTORS – CUJT

Device Type	Case No./ Style	η Intrinsic Standoff Ratio (Min)	η Intrinsic Standoff Ratio (Max)	I_P Peak Point Emitter Current µA (Max)	I_{EB2O} Emitter Reverse Current nA (Max)	I_V Valley Point Current mA (Min)	V_{B2B1} Interbase Voltage Volts (Max)	P_D Power Dissipation mW (Max)
2N6114	22A/1	0.58	0.62	5.0	10	1.0	30	300
2N6115	22A/1	0.58	0.62	15	100	1.0	30	300

PROGRAMMABLE UNIJUNCTION TRANSISTORS – PUT

Device Type	Case No./ Style	I_P Peak Current R_G = 10 kΩ µA (Max)	I_P Peak Current R_G = 1.0 MΩ µA (Max)	I_{GAO} Leakage Current @ 40 V nA (Max)	I_V Valley Current R_G = 10 kΩ µA (Min)	I_V Valley Current R_G = 1.0 MΩ µA (Max)	V_{GKF} Gate to Cathode Forward Voltage Volts (Max)	P_D mW	V_O Output Voltage Volts (Min)	V_F Forward Voltage V_F Volts	@ I_F mA	I_T DC Anode Current mA (Max)	I_T(pulse) Peak Anode Current 20 µs 1.0% DC Amp (Max)	t_r Pulse Rate of Rise ns	T_J Operating Junction Temp. Range °C
2N6027	29/16	5.0	2.0	10	70	50	40	300	6.0	1.5	50	150	5.0	40	-50 to +100
2N6028	29/16	1.0	0.15	10	25	25	↓	300	↓	↓	↓	150	5.0	40	
MPU131	29/10	5.0	2.0	5.0	70	50	↓	375	↓	↓	↓	200	2.0	80	
MPU132	29/10	2.0	0.3	5.0	50	50	↓	375	↓	↓	↓	↓	↓	↓	50 to +100
MPU133	29/10	1.0	0.15	5.0	50	25	↓	375	↓	↓	↓	↓	↓	↓	
2N6116/MPU231	22/6	5.0	2.0	5.0	70	50	↓	250	↓	↓	↓	↓	↓	↓	-50 to +125
2N6117/MPU232	22/6	2.0	0.3	5.0	50	50	↓	250	↓	↓	↓	↓	↓	↓	
2N6118/MPU233	22/6	1.0	0.15	5.0	50	25	↓	250	↓	↓	↓	↓	↓	↓	

(1) Meets the Requirements of MIL-S-19500/388 (2) Meets the Requirements of MIL-S-19500/425

FIELD EFFECT TRANSISTORS

Motorola offers a line of field-effect transistors encompassing the latest technology and covering the entire gamut of potential applications. Included is a wide variety of junction FETs and MOSFETs, with N- or P-channel polarity. These FETs include devices optimized for operation from dc to UHF in switching and amplifying applications.

Moreover, an exclusive silicon-nitride passivation process now being employed on all Motorola MOSFETs has greatly improved MOSFET threshold stability with aging and temperature change. This process also reduces susceptibility to damage from static-charge buildup during handling because of its increased voltage breakdown capability. All Motorola single-gate MOSFETs have transient gate breakdown voltages of greater than ±150 Vdc peak (typical).

The selection tables in this guide are designed to permit a rapid selection of specific field-effect transistors for a variety of applications.

Six tables cover the major application categories:

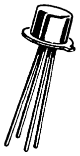
RF Amplifiers and Mixers **Table 1** . . . high performance single and dual gate devices specifically designed for RF applications	**Table 4** **General-Purpose Switches** . . . these devices are suitable for medium-speed switching applications.
Choppers **Table 2** . . . FETs have no offset voltage, and as a result, they are particularly well suited for chopper applications.	**Matched Pairs** **Table 5** . . . pairs of carefully matched devices for critical applications such as differential-amplifier service.
General-Purpose Amplifiers **Table 3** . . . N- and P-channel field-effect transistors designed for small-signal amplification at low and moderate frequencies (to 30 MHz)	**Table 6** **Micro-T Field-Effect Transistor** . . . where high density packaging is required.

The information in the tables is necessarily brief to simplify selection. Complete specifications for these devices are given in the data sheet section of the Motorola Semiconductor Data.* Volumes I and II.

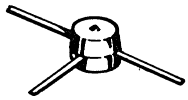
Ask for Motorola's new comprehensive Designer's Manual entitled, "Understanding and Designing with FET's."

5

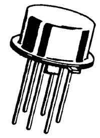
INDEX to MOTOROLA FIELD-EFFECT TRANSISTORS



TO-72
Case 20

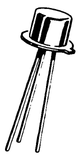


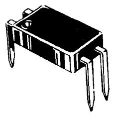
Case 28



TO-76
Case 642

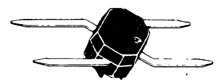
TO-18
Case 22





Case 206

TO-92
Case 29



Case 262

The following table lists the Motorola field-effect transistors with reference to selection tables. Package identification is included in this table only.

All TO-72 packages, except: † TO-18, ‡ TO-92, § TO-76, # Case 28, * Case 206 and ** Case 262

Device Type	Table	Device Type	Table	Device Type	Table	Device Type	Table	Device Type	Table
2N3330	3	2N4392†	2	2N5461‡	3	3N124	3,4	MFE3002	2
2N3796†	3	2N4393†	2	2N5462‡	3	3N125	3,4	MFE3003	2
2N3797†	3	2N4416	1	2N5463‡	3	3N126	3,4	MFE3004	1
2N3821	3	2N4856†	2	2N5464‡	3	3N140	1	MFE3005	1
2N3822	3	2N4856A†	2	2N5465‡	3	3N155	2,4	MFE3006	1
2N3823	1	2N4857†	2	2N5471	3	3N155A	2,4	MFE3007	1
2N3824	4	2N4857A†	2	2N5472	3	3N156	2,4	MFE3008	1
2N3909	3	2N4858†	2	2N5473	3	3N156A	2,4	MFE3020§	2
2N3909A	3	2N4858A†	2	2N5474	3	3N157	3	MFE3021§	2
2N3970†	2	2N4859†	2	2N5475	3	3N157A	3	MFE4007	3
2N3971†	2	2N4859A†	2	2N5476	3	3N158	3	MFE4008	3
2N3972†	2	2N4860†	2	2N5484‡	1,3	3N158A	3	MFE4009	3
2N3993	3	2N4860A†	2	2N5485‡	1,3	3N169	4	MFE4010	3
2N3994	3	2N4861†	2	2N5486‡	1,3	3N170	4	MFE4011	3
2N3994A	3	2N4861A†	2	2N5555‡	2,4	3N171	4	MFE4012	3
2N4066§	3	2N5265	3	2N5556	3	MFE120	1	MMF1	5
2N4067§	3	2N5266	3	2N5557	3	MFE121	1	MMF2	5
2N4091†	2	2N5267	3	2N5558	3	MFE122	1	MMF3	5
2N4092†	2	2N5268	3	2N5592	3	MFE2000	1	MMF4	5
2N4093†	2	2N5269	3	2N5593	3	MFE2001	1	MMF5	5
2N4220	3,4	2N5270	3	2N5594	3	MFE2004†	2	MMF6	5
2N4220A	3,4	2N5358	3	2N5638‡	2	MFE2005†	2	MMT3823#	6
2N4221	3,4	2N5359	3	2N5639‡	2	MFE2006†	2	MPF102‡	1,3
2N4221A	3,4	2N5360	3	2N5640‡	2	MFE2007†	2	MPF108‡	1
2N4222	3,4	2N5361	3	2N5653‡	2	MFE2008†	2	MPF109‡	3
2N4222A	3,4	2N5362	3	2N5654‡	2	MFE2009†	2	MPF111‡	3
2N4223	1	2N5363	3	2N5668‡	1	MFE2010†	2	MPF112‡	3
2N4224	1	2N5364	3	2N5669‡	1	MFE2011†	2	MPF120*	1
2N4342‡	3	2N5457‡	3	2N5670‡	1	MFE2012†	2	MPF121*	1
2N4351	4	2N5458‡	3	2N5716	3	MFE2093	3,4	MPF122*	1
2N4352	4	2N5459‡	3	2N5717	3	MFE2094	3,4	MPF161‡	3
2N4360‡	3	2N5460‡	3	2N5718	3	MFE2095	3,4	MPF820‡	1
2N4391†	2					MFE3001	3	MPF1000**	1,3

FIELD EFFECT TRANSISTORS (continued)

TABLE 1

RF AMPLIFIERS AND MIXERS

High performance single and dual gate devices specifically designed for RF applications. The transistors are listed first in order of decreasing specified test frequency; then in order of decreasing power gain (G_{ps}) and noise figure (NF).

Device Type	Test Frequency MHz	G_{ps} dB Min	G_c dB Min	NF dB Max	C_{rss} pF Max	C_{oss} pF Max	Comments
N-CHANNEL J FETs Depletion							
2N4416	400	10	–	4 0	0 8	2 0	
2N5486	400	10	–	4 0	1 0	2 0	
2N5485	400	10	–	4 0	1 0	2 0	
MFE2000	400	10	–	4.0	1.0	2 0	
MFE2001	400	10	–	4.0	1 0	2.0	
2N3823#	100	–	–	2 5	2 0	–	
2N4223	200	10	–	5 0	2 0	–	
2N4224	200	–	–	–	2 0	–	
2N5484	100	16	–	3 0	1 0	2 0	
2N5668	100	16	–	2.5	3 0	4 0	
2N5669	100	16	–	2 5	3 0	4 0	
2N5670	100	16	–	2 5	3.0	4 0	
MPF102	100	–	–	–	3 0	–	
MPF108	100	–	–	3 0	2 5	–	Box Sort, Color Coded 2 1 I_{DSS} Ratios
MPF820	100	–	–	4 0	3 5†	3.5†	
N-CHANNEL MOS FETs Depletion/Enhancement							
MPF1000	850	7 0	–	7 0†	0 02†	3 0	
MFE3005	400	10	–	4 5	0 2	–	
MPF122	244	–	12	–	0 023†	4.0	Dual Gate – Mixer
MFE122	244	–	12	–	0 023†	4.0	Dual Gate – Mixer
MFE3007	200	18	–	4 0	0 02†	3.5	Dual Gate
MPF121	200	17	–	5 0	0 023†	3.5	Dual Gate
MFE3008	200	14‡	10	–	0 02†	4.0	Dual Gate – Mixer
MFE121	200	17	–	5 0	0 023†	3 5	Dual Gate
3N140	200	16	–	4 5	0 03	–	Dual Gate
MFE3004	200	16	–	4 5	0.2	–	
MPF120	105	17	–	5 0	0 023†	4 0	Dual Gate
MFE120	105	17	–	5 0	0 023†	4 0	Dual Gate
MPF122	104	–	15	–	0 023†	4 0	Dual Gate – Mixer
MFE122	104	–	15	–	0 023†	4 0	Dual Gate – Mixer
MFE3006	100	20	–	4 5	0 02†	4 0	Dual Gate
MFE3008	100	14‡	14	–	0.02†	4 0	Dual Gate – Mixer
MPF121	60	20	–	5 0	0.023†	3 5	Dual Gate
MFE121	60	20	–	5.0	0.023†	3.5	Dual Gate

† Typical
‡ Conversion Gain, Output frequency = 30 MHz
# 2N3823JAN Available

TABLE 2

CHOPPERS

Because FETs have no offset voltage they are particularly well suited for chopper applications. Devices in this table are designed for low $r_{ds(on)}$, low C_{rss} and fast switching time. The FETs are listed first in order of decreasing $V_{(BR)GSS}$, increasing $r_{ds(on)}$, then in order of increasing C_{rss} and I_{DSS}.

Device Type	$V_{(BR)GSS}$ Volts Min	$r_{ds(on)}$ Ohms Max	C_{rss} pF Max	I_{DSS} mA Min	$I_{D(off)}$ nA Max
N-CHANNEL J FETs DEPLETION					
2N4856A	–40	25	4.0	50	0.25
2N4856	↓	25	8.0	50	0.25
2N4391	↓	30	3.5	50	0.1
2N4091	↓	30	5.0	30	0.2
2N3970	↓	30	6.0	50	0.25
2N4857A	↓	40	3.5	20	0.25
2N4857	↓	40	8.0	20	0.25
2N4092	↓	50	5.0	15	0.2
2N4392	↓	60	3.5	25	0.1
2N4858A	↓	60	3.5	8.0	0.25
2N3971	↓	60	6.0	25	0.25
2N4858	↓	60	8.0	8.0	0.25
2N4093	↓	80	5.0	8.0	0.2
2N4393	↓	100	3.5	5.0	0.1
2N3972	↓	100	6.0	5.0	0.25
2N4859A	–30	25	4.0	50	0.25
2N4859	↓	25	8.0	50	0.25
2N5638	↓	30	4.0	50	1000
MFE2006	↓	30	5.0	30	0.2
2N4860A	↓	40	3.5	20	0.25
2N4860	↓	40	8.0	20	0.25
2N5653	↓	50	3.5	40	1.0
MFE2005	↓	50	5.0	15	0.2
2N4861A	↓	60	3.5	8.0	0.25
2N5639	↓	60	4.0	25	1000

Device Type	$V_{(BR)GSS}$ Volts Min	$r_{ds(on)}$ Ohms Max	C_{rss} pF Max	I_{DSS} mA Min	$I_{D(off)}$ nA Max
2N4861	–30	60	8.0	8.0	0.25
MFE2004	↓	80	5.0	8.0	0.2
2N5654	↓	100	3.5	15	1.0
2N5640	↓	100	4.0	5.0	1000
MFE2012	–25	10	20	100	3.0
MFE2011	↓	15	20	40	3.0
MFE2009	↓	20	15	50	2.0
MFE2010	↓	25	20	15	3.0
MFE2008	↓	30	15	20	2.0
MFE2007	↓	40	15	8.0	3.0
2N5555§	↓	150	1.2	15	10
N-CHANNEL MOS FETs ENHANCEMENT					
MFE3002	±30	100	1.0	10†	–
3N169#	±25	200	1.3	10†	–
3N170#	↓	200	1.3	10†	–
3N171#	↓	200	1.3	10†	–
P-CHANNEL MOS FETs ENHANCEMENT					
3N155A*	±35	300	1.3	0.25†	–
3N156A*	↓	300	1.3	0.25†	–
3N155*	↓	600	1.3	1.0†	–
3N156*	↓	600	1.3	1.0†	–
MFE3003	±30	200	1.0	10†	–
MFE3020	-25	500	1.5	10†	–
MFE3021	-25	250	1.5	10†	–

†nA max *Designers Data Sheet # Low $V_{GS(th)}$, High Speed § High Speed, $t_{(on)}$ = 10 ns max ‡$V_{(BR)DSS}$

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FIELD EFFECT TRANSISTORS (continued)

TABLE 3

GENERAL-PURPOSE AMPLIFIERS

This table includes a wide selection of N- and P-channel field-effect transistors designed for small-signal amplification at low and moderate frequencies (to 30 MHz). The transistors are listed in order of increasing Gate-Source Breakdown Voltage [$V_{(BR)GSS}$], then in order of decreasing Zero-Gate Voltage Drain Current (I_{DSS}) and Forward Transfer Admittance (y_{fs}).

Device Type	Volts Min	I_{DSS} mA Min/Max	$\|y_{fs}\|$ µmhos Min/Max	Comments
N-CHANNEL J FETs DEPLETION				
MPF111	−20	0.5/20	500/−	
2N5486	−25	8.0/20	4000/8000	Formerly MPF107 77
2N5459		4.0/16	2000/6000	Formerly MFP105
2N5485		4.0/10	3500/7000	Formerly MPF106
2N5458		2.0/9.0	1500/5500	Formerly MPF104
MPF102		2.0/20	2000/7500	
MPF112		1.0/25	1000/7500	
2N5457		1.0/5.0	1000/5000	Formerly MPF103
2N5484		1.0/5.0	3000/6000	2:1 I_{DSS} Ratio
MPF109		0.5/24	800/6000	Box Sort, Color Coded
2N4222	−30	5.0/15	2500/6000	
2N4222A		5.0/15	2500/6000	Low Noise
2N5558		4.0/10	1500/6500	Low Noise
2N4221		2.0/6.0	2000/5000	
2N4221A		2.0/6.0	2000/5000	Low Noise
2N5557		2.0/5.0	1500/6500	Low Noise
2N4220		0.5/3.0	1000/4000	
2N4220A		0.5/3.0	1000/4000	Low Noise
2N5556		0.5/2.5	1500/6500	Low Noise
2N5364*	−40	9.0/18	2700/6500	
2N5363*		7.0/14	2500/6000	
2N5362*		4.0/8.0	2000/5500	
2N5361*		2.5/5.0	1500/4500	2:1 I_{DSS} Ratios
2N5360*		1.5/3.0	1400/3200	
2N5359*		0.8/1.6	1200/3600	
2N5718		0.8/4.0	500/2000	
2N5358*		0.5/1.0	1000/3000	
2N5717		0.2/1.0	400/1600	
2N5716		0.05/0.25	200/1000	
3N126	−50	3.0/9.0	1200/3600	Tetrode Connected
2N3822#		2.0/10	3000/6500	
3N125		1.5/4.5	800/2400	Tetrode Connected
2N5592		1.0/10	2000/7000	Low Noise
2N5593		1.0/10	2000/7000	Low Noise
2N5594		1.0/10	2000/7000	Low Noise
MFE2095		1.0/3.0	400/800	
2N3821		0.5/2.5	1500/4500	
MFE2094		0.4/1.4	350/700	
3N124		0.2/2.0	500/2000	Tetrode Connected
MFE2093		0.1/0.7	250/500	
N-CHANNEL MOS FETs Depletion/Enhancement				
MPF1000	±7.0	5.0/15	10,000/20,000	I_{GSS} = 20 mAdc (Max)
2N3797	±30	2.0/6.0	1500/3000	I_{GSS} = 1.0 pAdc (max)
MFE3001	±30	0.5/6.0	700/3500	
2N3796	±30	0.5/3.0	900/1800	I_{GSS} = 1.0 pAdc (max)

† nAdc
* Designers Data Sheet
#JAN and JANTX Available

Device Type	Volts Min	I_{DSS} mA Min/Max	$\|y_{fs}\|$ µmhos Min/Max	Comments
P-CHANNEL J FETs DEPLETION				
2N4360	+20	3.0/30	2000/8000	
2N3909A		1.0/15	2200/5000	
2N3909		0.3/15	1000/5000	
2N3330		−	1500/3000	
2N3993	+25	10/−	6000/12000	
2N4342		4.0/12	2000/6000	
2N3994A		2.0/−	5000/10000	
2N3994		2.0/−	4000/10000	
MFE4012*	+40	7.0/14	2500/5000	2:1 I_{DSS} Ratio,
2N5462		4.0/16	2000/6000	Formerly MPF153
MFE4011*		4.0/8.0	2200/4500	2:1 I_{DSS} Ratio,
2N5460		1.0/5.0	1000/4000	Formerly MPF151
2N5476		0.8/2.0	260/650	
MFE4008*		0.8/1.6	1000/3000	2:1 I_{DSS} Ratio,
MPF161		0.5/14	800/6000	2:1 I_{DSS} Ratio,
MFE4007		0.5/1.0	900/2700	2:1 I_{DSS} Ratio,
2N5475		0.4/1.0	200/500	2.5:1 I_{DSS} Ratio
2N5474		0.2/0.5	160/400	2.5:1 I_{DSS} Ratio
2N5473		0.1/0.25	120/300	2.5:1 I_{DSS} Ratio
2N5472		0.05/0.12	90/225	2.5:1 I_{DSS} Ratio
2N5471		0.02/0.06	60/180	2.5:1 I_{DSS} Ratio
2N5270*	+60	7.0/14	2500/5000	2:1 I_{DSS} Ratio,
2N5465		4.0/16	2000/6000	Formerly MPF156
2N5269*		4.0/8.0	2200/4500	2:1 I_{DSS} Ratio,
2N5268*		2.5/5.0	2000/4000	2:1 I_{DSS} Ratio,
2N5464		2.0/9.0	1500/5000	Formerly MPF155
2N5267*		1.5/3.0	1500/3500	2:1 I_{DSS} Ratio,
2N5463		1.0/5.0	1000/4000	Formerly MPF154
2N5266*		0.8/1.6	1000/3000	2:1 I_{DSS} Ratio,
2N5265*		0.5/1.0	900/2700	2:1 I_{DSS} Ratio,
P-CHANNEL MOS FETs ENHANCEMENT				
3N157*	±35	−/1.0†	1000/4000	
3N158*	±35	−/1.0†	1000/4000	
2N4066	±30	−/1.0†	1500/−	Dual
2N4067	±30	−/1.0†	2500/−	Dual
3N157A*	±50	−/0.25†	1000/4000	
3N158A*	±50	−/0.25†	1000/4000	

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FIELD EFFECT TRANSISTORS (continued)

TABLE 4
GENERAL-PURPOSE SWITCHES

The devices in this table have low feedback capacitances (C_{rss}) and relatively low drain-source resistance, [$r_{ds(on)}$], making them suitable for medium-speed switching applications. The transistors are listed first in order of decreasing Gate-Source Breakdown Voltage [$V_{(BR)GSS}$], then in order of increasing $r_{ds(on)}$, decreasing gate cutoff voltage [$V_{GS(off)}$ or $V_{GS(th)}$] and decreasing I_{DSS}.

Device Type	$V_{(BR)GSS}$ Volts Min	$r_{ds(on)}$ Ohms Max	$V_{GS(off)}$ $V_{GS(th)}$* Volts Max	I_{DSS} $I_{D(on)}$* mA Min	Comments
N-CHANNEL J FETs DEPLETION					
2N3824	−50	250	–	–	
3N126	↓	500	6.5	3.0	Tetrode Connected
3N125	↓	750	4.0	1.5	Tetrode Connected
3N124	↓	1000	2.5	0.2	Tetrode Connected
MFE2095	↓	1300	5.5	1.0	
MFE2094	↓	1600	4.5	0.4	
MFE2093	↓	2500	2.5	0.1	
2N4222	−30	300	8.0	5.0	
2N4222A	↓	300	8.0	5.0	Low Noise
2N4221	↓	400	6.0	2.0	
2N4221A	↓	400	6.0	2.0	Low Noise
2N4220	↓	500	4.0	0.5	
2N4220A	↓	500	4.0	0.5	Low Noise
2N5555	−25	150	–	15	High Speed $t_{(on)}$ = 10 ns max
N-CHANNEL MOS FETs					
2N4351	±30	300	5.0*	3.0*	Complement to 2N4352
3N169	±25	200	1.5*	10*	Low $V_{GS(th)}$, High Speed
3N170	↓	200	2.0*	10*	Low $V_{GS(th)}$, High Speed
3N171	↓	200	3.0*	10*	Low $V_{GS(th)}$, High Speed
P-CHANNEL MOS FETs					
3N156A†	±35	300	5.0*	5.0*	
3N155A†	↓	300	3.2*	5.0*	
3N156†	↓	600	5.0*	5.0*	
3N155†	↓	600	3.2*	5.0*	
2N4352	±30	600	5.0*	3.0*	Complement to 2N4351

†Designers Data Sheet

TABLE 5
MATCHED PAIRS

Each type number in this table represents a pair of devices carefully matched for critical applications such as differential-amplifier service. Each pair is packaged in a metal clip to maintain pair identity.

I_{DSS} mA Min/Max	$\|y_{fs}\|$ µmhos Min	$\|y_{os}\|$ µmhos Max	C_{rss} pF Max	NF dB Max	$V_{(BR)GSS}$ Volts Min
4.0/2.0	3500	35	2.0	2.5	30

MATCHING CHARACTERISTICS

Device Type	$\frac{\Delta\|V_{GS1}-V_{GS2}\|}{\Delta T}$ Max µV/°C	$\|V_{GS1}-V_{GS2}\|$ mV Max	$\|I_{G1}-I_{G2}\|$ nA Max	$\frac{\|y_{fs1}\|}{\|y_{fs2}\|}$ Min
MMF1	10	5.0	10	0.98
MMF2	10	↓	↓	0.98
MMF3	25	↓	↓	0.95
MMF4	25	↓	↓	↓
MMF5	50	↓	↓	↓
MMF6	50	↓	↓	↓

Note: See Index Table for package identification.

TABLE 6
MICRO-T FIELD-EFFECT TRANSISTOR N-CHANNEL

Field-Effect Transistor designed for RF amplifier applications where high density packaging is required.

N-CHANNEL J FET DEPLETION

Device Type	$V_{(BR)GSS}$ Volts Min	I_{DSS} mA Min/Max	C_{rss} pF Typ	$Re(y_{is})$ µmhos Typ	NF dB Typ	@ f MHz
MMT3823	−30	5.0/20	1.0	500	2.0	100

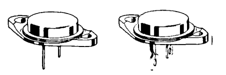
GERMANIUM POWER TRANSISTORS

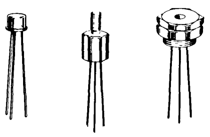
This selector guide reflects the "preferred" Motorola germanium power transistors and can be used as a quick reference to find the best device for your applications.

ALLOY TRANSISTORS

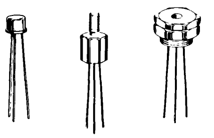
Low-cost devices featuring high current gain and low saturation voltage.

3-AMP

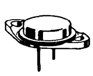
		h_{FE} ($I_C = 0.5$ A, $V_{CE} = 2.0$ V)	V_{CES}	30 V	45 V	60 V	75 V	90 V
			V_{CB}	30 V	45 V	60 V	75 V	90 V
 TO-3 (Case 11) TO-41(2) (Case 4-04)	HIGH-FREQUENCY DRIVER LOW I_{CBO} $P_D = 70$ W $f_T = 0.4$ MHz	30-60		2N2137	2N2138	2N2139	2N2140	2N2141
		50-100		2N2142	2N2143	2N2144	2N2145	2N2146

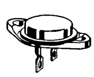
		h_{FE} ($I_C = 1.0$ A, $V_{CE} = 0.5$ V)	V_{CEO}	30 V	40 V	50 V	60 V	
			V_{CB}	40 V	60 V	80 V	100 V	
 (Case 180) (Case 183) (Case 184)	HIGH-FREQUENCY DRIVER $P_D = 20$ W	20-60		2N1038	2N1039	2N1040	2N1041	
				2N2552	2N2553	2N2554	2N2555	
				2N2556	2N2557	2N2558	2N2559	

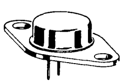
3.5-AMP

		h_{FE} ($I_C = 3.0$ A, $V_{CE} = 1.0$ V)	V_{CEO}	30 V	40 V	50 V	60 V	
			V_{CB}	40 V	60 V	80 V	100 V	
 (Case 180) (Case 183) (Case 184)	HIGH-FREQUENCY DRIVER $P_D = 20$ W	20-60		2N1042	2N1043	2N1044	2N1045	
				2N2560	2N2561	2N2562	2N2563	
				2N2564	2N2565	2N2566	2N2567	

5-AMP

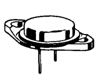
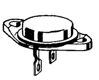
		h_{FE} ($I_C = 3.0$ A, $V_{CE} = 2.0$ V)	V_{CES}	30 V	45 V	60 V	75 V	90 V
			V_{CB}	40 V	60 V	80 V	100 V	120 V
 TO-3 (Case 11)	GENERAL-PURPOSE SWITCH AND AMPLIFIER $P_D = 106$ W $f_T = 0.25$ MHz	20-40		2N1529	2N1530	2N1531	2N1532	2N1533
		35-70		2N1534	2N1535	2N1536	2N1537	2N1538

		h_{FE} ($I_C = 3.0$ A, $V_{CE} = 2.0$ V)	V_{CES}	30 V	45 V	60 V	75 V	90 V
			V_{CB}	40 V	60 V	80 V	100 V	120 V
 TO-41(2) (Case 4-04)	HIGH-GAIN GENERAL-PURPOSE SWITCH AND AMPLIFIER $P_D = 106$ W $f_T = 0.35$ MHz	50-100		2N1539	2N1540	2N1541	2N1542	2N1543
		75-150		2N1544	2N1545	2N1546	2N1547	2N1548

		h_{FE} ($I_C = 0.5$ A, $V_{CE} = 2.0$ Vdc)	V_{CES}	20V	30 V	45 V	60 V	75 V
 TO-66 (Case 80-02)	ECONOMY LINE GENERAL-PURPOSE AMPLIFIER AND SWITCH $P_D = 57$W $f_T = 350$ kHz	• 15-350		2N5887	2N5888			
		• 30-70			2N5889	2N5890	2N5891	2N5892
		• 60-120			2N5893	2N5894	2N5895	2N5896
		• 100-200			2N5897	2N5898	2N5899	2N5900
		175-350			2N5901			

7-AMP

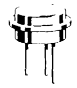
(See Notes on Page 28)

		h_{FE} ($I_C = 3.0$ A, $V_{CE} = 2.0$ V)	V_{CES}	30 V	45 V	60 V	60 V	75 V	75 V
			V_{CB}	40 V	60 V	75 V	80 V	90 V	100 V
 TO-3 (Case 11)  TO-41(2) (Case 4-04)	ECONOMY LINE GENERAL-PURPOSE AMPLIFIER AND SWITCH $P_D = 85$W $f_T = 0.3$ MHz	30-60					2N3615		2N3616
		35-70		2N3611	2N3612				
		45-90					2N3617		2N3618
		60-120		2N3613	2N3614				
		30-200		MP2060(4)	MP2061(4)	MP2062(4)		MP2063(4)	

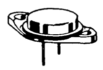
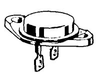
5

GERANIUM POWER TRANSISTORS (continued)

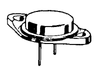
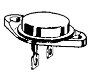
10-AMP

		h_{FE}				
 CASE 8	HIGH-VOLTAGE SWITCH $P_D = 56$ W $f_T = 300$ MHz	h_{FE} $I_C = 3.0$ A, $V_{CE} = 2.0$ V	V_{CEO}	80	120	160
			V_{CB}	80	120	160
		20-50		2N6064	2N6065	2N6066

15-AMP

		h_{FE}					
 TO-36 (Case 5)	GENERAL-PURPOSE SWITCH AND AMPLIFIER $P_D = 170$ W $f_T = 0.25$ MHz	h_{FE} $I_C = 5.0$ A, $V_{CE} = 2.0$ V	V_{CES}	40 V	50 V	70 V	80 V
			V_{CB}	40 V	50 V	70 V	80 V
		20-40		2N2078	2N2077	2N2076	2N2075
		35-70		2N2082	2N2081	2N2080	2N2079
 TO-3 (Case 11A)	HIGH-SPEED SWITCH AND AMPLIFIER $P_D = 106$ W $f_T = 0.40$ MHz	h_{FE} $I_C = 10$ A, $V_{CE} = 2.0$ V	V_{CES}	30 V	45 V	60 V	75 V
			V_{CB}	40 V	60 V	80 V	100 V
		10-30		2N1549	2N1550	2N1551	2N1552
 TO-41 (2) (Case 4-04)	HIGH-GAIN SWITCH AND AMPLIFIER $P_D = 106$ W $f_T = 0.35$ MHz	h_{FE} $I_C = 10$ A, $V_{CE} = 2.0$ V	V_{CES}	30 V	45 V	60 V	75 V
			V_{CB}	40 V	60 V	80 V	100 V
		30-60		2N1553	2N1554	2N1555	2N1556
		50-100		2N1557	2N1558	2N1559	2N1560

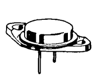
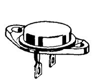
25-AMP

		h_{FE}				
 TO-3 (Case 11A)  TO-41 (3) (Case 4-04)	HIGH-GAIN SWITCH AND AMPLIFIER $P_D = 106$ W $f_T = 0.35$ MHz	h_{FE} $I_C = 25$ A, $V_{CE} = 1.0$ V	V_{CES}	35 V	60 V	75 V
			V_{CB}	50 V	80 V	100 V
		15-65		2N1162	2N1164	2N1166
				2N1163	2N1165	2N1167

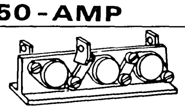
30-AMP

		h_{FE}					
 TO-36 (Case 5)	MEDIUM-CURRENT SWITCH $P_D = 170$ W $f_T = 0.25$ MHz	h_{FE} $I_C = 5.0$ A, $V_{CE} = 2.0$ V ($h_{FE} = 15$ min @ $I_C = 25$ A)	V_{CES}	45 V	60 V	75 V	90 V
			V_{CB}	45 V	60 V	75 V	90 V
		50-100		2N2152	2N2153	2N2154	2N2155
		80-160		2N2156	2N2157	2N2158	2N2159

60-AMP

		h_{FE}					
 CASE 7	HIGH-CURRENT — HIGH-GAIN SWITCH $P_D = 170$ W $f_T = 0.25$ MHz	h_{FE} $I_C = 15$ A, $V_{CE} = 2.0$ V ($h_{FE} = 12$ min @ $I_C = 50$ A)	V_{CES}	45 V	60 V	75 V	90 V
			V_{CB}	45 V	60 V	75 V	90 V
		30-60		MP500	MP501	MP502	MP503
		50-100		MP504	MP505	MP506	MP507
	HIGH-CURRENT — HIGH-GAIN SWITCH $P_D = 170$ W $f_T = 0.45$ MHz	h_{FE} $I_C = 15$ A, $V_{CE} = 2.0$ V ($h_{FE} = 15$ min @ $I_C = 60$ A)	V_{CES}	45 V	60 V	75 V	
			V_{CB}	45 V	60 V	75 V	
		60-120		2N4048	2N4049	2N4050	
		80-180		2N4051	2N4052	2N4053	
 TO-3 (Case 3A)  TO-41 (2) (Case 161)	ECONOMY LINE HIGH-CURRENT — HIGH-GAIN SWITCH $P_D = 170$ W $f_T = 0.4$ MHz	h_{FE} $I_C = 15$ A, $V_{CE} = 2.0$ V ($h_{FE} = 15$ min @ $I_C = 60$ A)	V_{CES}	30 V	45 V	60 V	75 V
			V_{CB}	30 V	45 V	60 V	75 V
		60-120		2N4276	2N4278	2N4280	2N4282
		80-180		2N4277	2N4279	2N4281	2N4283

150-AMP

		h_{FE}			
 CASE 118	"POWER-PAC" ASSEMBLY MEDIUM VOLTAGE SWITCH $P_D = 250$ W $\theta_{JC} = 0.33$°C/W	h_{FE} $I_C = 150$ A, $V_{CE} = 2.0$ V	V_{CES}	60 V	75 V
			V_{CEO}	45 V	60 V
		15 Min		MP801 (1)	MP800 (1)

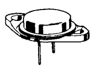
5

DIFFUSED BASE TRANSISTORS

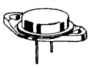
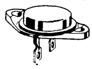
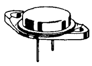
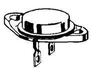
Features graded-base profile for:

- Low emitter-base resistance and high-temperature stability
- High breakdown voltage capability
- Higher frequency response, faster switching speeds

10-AMP

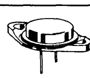
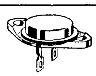
 TO-3 (Case 11A)	**HIGH-SPEED SWITCH** $P_D = 70$ W	h_{FE} $I_C = 5.0$ A, $V_{CE} = 2.0$ V	V_{CEO}	**30 V**	**50 V**	**70 V**	
			V_{CB}	**40 V**	**80 V**	**120 V**	
		50-120		2N2291	2N2292	2N2293	
		20-60	V_{CER}	**40 V**	**80 V**	**120 V**	
			V_{CB}	**40 V**	**80 V**	**120 V**	
				2N2288	2N2289	2N2290	

10-AMP

 TO-3 (Case 11A)  TO-41[2] (Case 4-04)	**HIGH-VOLTAGE SWITCH** $P_D = 85$ W $f_T = 0.7$ MHz	h_{FE} $I_C = 3.0$ A, $V_{CE} = 2.0$ V	V_{CEO}	**80 V**	**120 V**		**160 V**
			V_{CB}	**80 V**	**120 V**		**160 V**
		20-50		2N2526	2N2527		2N2528
 TO-3 (Case 11)  TO-41[3] (Case 4-04)	**HIGH-VOLTAGE MEDIUM-SPEED SWITCH** $P_D = 56$ W $f_T = 5.5$ MHz $f_T = 1.0$ MHz (MP3730, MP3731)	h_{FE}	†V_{CES} V_{CEO}	**200 V†**	**150 V**	**320 V†**	**200 V**
			V_{CB}		**250 V**		**325 V**
		20-60 $I_C = 5.0$ A, $V_{CE} = 2.0$ V			2N5324		2N5325
		15 Min $I_C = 2.25$ A, $V_{CE} = 4.0$ V		MP3730[4]			
		15 Min $I_C = 6.0$ A, $V_{CE} = 3.0$ V				MP3731[4]	

5

20-AMP

 TO-3 (Case 11A)  TO-41 (Case 4-04)	**HIGH-SPEED HIGH-VOLTAGE SWITCH** $P_D = 85$ W $f_T = 20$ MHz	h_{FE} $I_C = 10$ A, $V_{CE} = 2.0$ V	V_{CEO}	**50 V**	**50 V**	**75 V**	**75 V**	**100 V**	**100 V**
			V_{CB}	**80 V**	**100 V**	**120 V**	**140 V**	**140 V**	**160 V**
		25-100		2N2832[2]	MP1612[4]	2N2833[2]	MP1612A[4]	2N2834[2]	MP1612B[4]

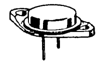
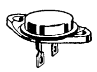
FOR MILITARY APPLICATIONS

JAN 2N174A	MIL-S-19500/13	JAN 2N1412	MIL-S-19500/76	JAN 2N1554A	MIL-S-19500/331
JAN 2N297A	MIL-S-19500/36	JAN 2N1412A	MIL-S-19500/76	JAN 2N1555A	MIL-S-19500/331
JAN 2N665	MIL-S-19500/58	JAN 2N1549A	MIL-S-19500/332	JAN 2N1556A	MIL-S-19500/331
JAN 2N1011	MIL-S-19500/67	JAN 2N1550A	MIL-S-19500/332	JAN 2N2079A	MIL-S-19500/340
JAN 2N1120	MIL-S-19500/68	JAN 2N1551A	MIL-S-19500/332	JAN 2N2528	MIL-S-19500/309
JAN 2N1165	MIL-S-19500/178	JAN 2N1552A	MIL-S-19500/332	JAN 2N2834	MIL-S-19500/310
JAN 2N1358	MIL-S-19500/122	JAN 2N1553A	MIL-S-19500/331		

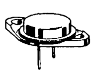
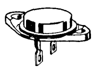
Also available as standard devices.

DIFFUSED BASE TRANSISTORS (continued)

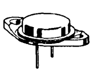
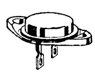
25-AMP

Package	Type	h_{FE}						
 TO-3 (Case 11A)	MEDIUM-CURRENT "ADE"[5] SWITCH HIGH-GAIN $P_D = 85$ W	h_{FE} $I_C = 5.0$ A, $V_{CE} = 2.0$ V	V_{CEO}	50 V	60 V	70 V	80 V	
			V_{CB}	75 V	75 V	90 V	90 V	
		50 Min		MP600[4]	MP601[4]	MP602[4]	MP603[4]	
 TO-41[2] (Case 4-04)	MEDIUM-CURRENT "ADE"[5] SWITCH HIGH-VOLTAGE $P_D = 106$ W $f_T = 0.4$ MHz	h_{FE} $I_C = 8.0$ A, $V_{CE} = 2.0$ V	V_{CEO}	30 V	60 V	80 V	100 V	120 V
			V_{CEX}	60 V	80 V	100 V	120 V	140 V
		25-100						2N5155
		25 Min		MP2000A[4]	MP2100A[4]	MP2200A[4]	MP2300A[4]	MP2400A[4]

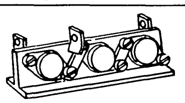
40-AMP

Package	Type	h_{FE}						
 CASE 3A (TO-3) 2N5692 Series;  CASE 161 (TO-41) MP5692 Series	HIGH-CURRENT FAST SWITCHING "ADE" SWITCH $P_D = 120$ W $f_T = 0.2$ MHz	h_{FE} $I_C = 25$ A, $V_{CE} = 2.0$ V	V_{CEO}	30 V	60 V	80 V	100 V	120 V
			V_{CB}	50 V	80 V	100 V	120 V	140 V
		10 Min $I_C = 40$ A, $V_{CE} = 2.0$ V		2N5692	2N5693	2N5694	2N5695	2N5696
				MP5692	MP5693	MP5694	MP5695	MP5696

60-AMP

Package	Type	h_{FE}				
 TO-3 (Case 3A);  TO-41[2] (Case 161)	HIGH-CURRENT — HIGH-VOLTAGE "ADE"[5] SWITCH $P_D = 120$ W $f_T = 1.0$ MHz	h_{FE} $I_C = 25$ A, $V_{CE} = 2.0$ V	V_{CEO}	60 V	90 V	120 V
			V_{CB}	80 V	110 V	140 V
		20-60 ($h_{FE} = 10$ min @ $I_C = 60$ A)		2N5435	2N5436	2N5437
		40-120 ($h_{FE} = 15$ min @ $I_C = 60$ A)		2N5438	2N5439	2N5440

150-AMP

Package	Type	h_{FE}				
 CASE 118	"POWER-PAC" ASSEMBLY HIGH VOLTAGE SWITCH $P_D = 250$ W $\theta_{JC} = 0.33$°C/W	h_{FE} $I_C = 150$ A, $V_{CE} = 2.0$ V	V_{CB}	80 V	110 V	140 V
			V_{CEO}	60 V	90 V	120 V
		20 Min		MP900	MP901	MP902

[1] For epoxy encapsulated "PAC" add "A" to device type (i.e. MP801A)
[2] TO-41, add the prefix "MP" in place of "2N" (i.e. MP2137)
[3] TO-41, order odd numbered devices (i.e. 2N1163)
[4] Special order for TO-41; contact your local Motorola Sales office
[5] Alloy Diffused Epitaxial Process

5

SILICON POWER TRANSISTORS

This Selector Guide is published by Motorola to help the designer choose the best silicon power transistors for his new equipment and find suitable replacements for devices used in older designs. It is a comprehensive listing of the industry's most complete line of PNP and NPN silicon power transistors, and contains over 200 devices rated at currents between 100 mA and 60 amperes, and at voltages up to 600 volts. The transistors are in fifteen popular cases, including two low-cost plastic packages and hermetically sealed cases capable of dissipating up to 300 watts.

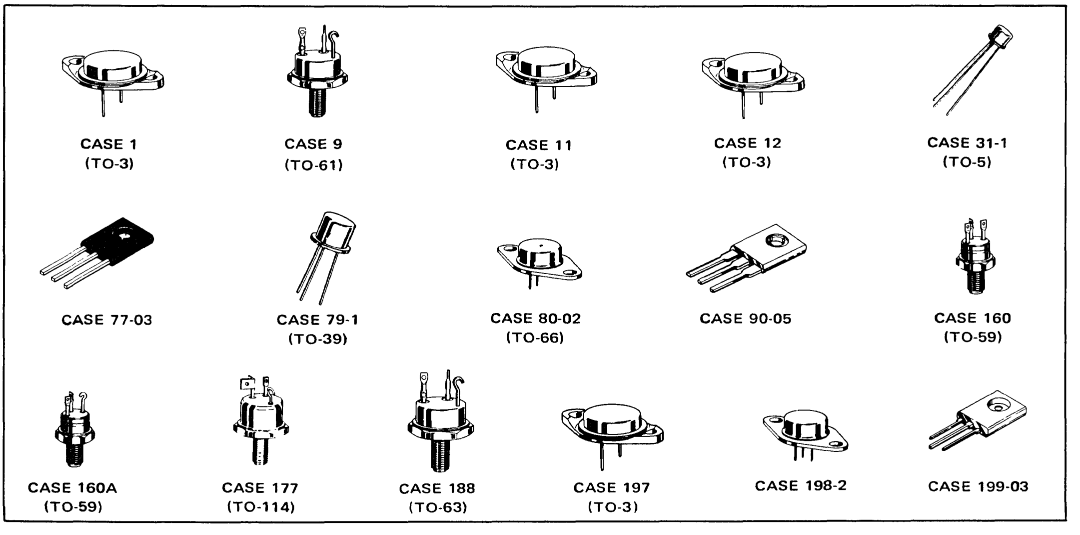


TABLE OF CONTENTS

The first table of the guide is a numerical-alphabetical index to all silicon power transistors manufactured by Motorola. The number of the selection table in which each device is further characterized is also listed.

COMPLEMENTARY TRANSISTORS

One reason for the wide use of Motorola power transistors is the design flexibility that results from the large number of "off the shelf" complementary transistors in the line. For convenience in choosing complements, a table of complementary power transistors is given following the index. A selection can be made from the complements on the basis of maximum collector current, case, and voltage.

SELECTION TABLES

The major part of this guide is composed of selection tables. These tables list all Motorola silicon power transistors in an order that makes it easy for the user to find a device that satisfies his requirements. Each table contains devices in the same package, and the table is separated first into NPN and PNP devices.

Within each table, the transistors are listed first in order of increasing breakdown voltage, then in increasing order of current and h_{FE}.

The tables list only the most basic characteristics of each device. For complete information on any Motorola power transistor refer to the individual data sheet or the appropriate pages in the Semiconductor Data Book or its supplements.

If a standard part listed in this selector guide does not fulfill all requirements, a special part might be desirable. Motorola has the production capability and flexibility to supply devices especially tailored to specific OEM application needs. Where suitable power transistors cannot be selected from this guide, inquiries should be made at the nearest Motorola sales office.

INDEX

Device Type	Table #	Device Type	Table #	Device Type	Table #	Device Type	Table #
2N1724	9	2N4905	1	2N5759	1	2N6230	1
2N1725	9	2N4906	1	2N5760	1	2N6231	1
2N3021	1	2N4910	4	2N5867	1	2N6233	4
2N3022	1	2N4911	4	2N5868	1	2N6234	4
2N3023	1	2N4912	4	2N5869	1	2N6235	4
2N3024	1	2N4913	1	2N5870	1	2N6274	1
2N3025	1	2N4914	1	2N5871	1	2N6275	1
2N3026	1	2N4915	1	2N5872	1	2N6276	1
2N3054	4	2N4918	5	2N5873	1	2N6277	1
2N3054A	4	2N4919	5	2N5874	1	2N6278	10
2N3055	1	2N4920	5	2N5875	1	2N6279	10
2N3232	1	2N4921	5	2N5876	1	2N6280	10
2N3235	1	2N4922	5	2N5877	1	2N6281	10
2N3439	2	2N4923	5	2N5878	1	2N6282	1
2N3440	2	2N5050	4	2N5879	1	2N6283	1
2N3441	4	2N5051	4	2N5880	1	2N6284	1
2N3442	1	2N5052	4	2N5881	1	2N6285	1
2N3445	1	2N5067	1	2N5882	1	2N6286	1
2N3446	1	2N5068	1	2N5883	1	2N6287	1
2N3447	1	2N5069	1	2N5884	1	2N6298	4
2N3448	1	2N5157	1	2N5885	1	2N6299	4
2N3487	9	2N5190	5	2N5886	1	2N6300	4
2N3488	9	2N5191	5	2N5974	6	2N6301	4
2N3489	9	2N5192	5	2N5975	6	BU105	1
2N3490	9	2N5193	5	2N5976	6	MJ105	1
2N3491	9	2N5194	5	2N5977	6	MJ400	4
2N3492	9	2N5195	5	2N5978	6	MJ410	1
2N3713	1	2N5241	1	2N5979	6	MJ411	1
2N3714	1	2N5301	1	2N5980	6	MJ413	1
2N3715	1	2N5302	1	2N5981	6	MJ420	2
2N3716	1	2N5303	1	2N5982	6	MJ421	2
2N3719	2	2N5334	3	2N5983	6	MJ423	1
2N3720	2	2N5335	3	2N5984	6	MJ424	1
2N3738	4	2N5336	3	2N5985	6	MJ425	1
2N3739	4	2N5337	3	2N5986	6	MJ430	2
2N3740	4	2N5338	3	2N5987	6	MJ431	1
2N3741	4	2N5339	3	2N5988	6	MJ440	2
2N3766	4	2N5344	4	2N5989	6	MJ450	1
2N3767	4	2N5345	4	2N5990	6	MJ480	1
2N3771	1	2N5346	8	2N5991	6	MJ481	1
2N3772	1	2N5347	8	2N6029	1	MJ490	1
2N3773	1	2N5348	8	2N6030	1	MJ491	1
2N3788	1	2N5349	8	2N6031	1	MJ500	8
2N3789	1	2N5427	4	2N6049	4	MJ501	8
2N3790	1	2N5428	4	2N6050	1	MJ802	1
2N3791	1	2N5429	4	2N6051	1	MJ900	1
2N3792	1	2N5430	4	2N6052	1	MJ901	1
2N3867	2	2N5477	8	2N6053	1	MJ1000	1
2N3868	2	2N5478	8	2N6054	1	MJ1001	1
2N3902	1	2N5479	8	2N6055	1	MJ1800	1
2N4231	4	2N5480	8	2N6056	1	MJ2249	4
2N4232	4	2N5629	1	2N6057	1	MJ2250	4
2N4233	4	2N5630	1	2N6058	1	MJ2251	4
2N4234	2	2N5631	1	2N6059	1	MJ2252	4
2N4235	2	2N5632	1	2N6182	8	MJ2253	4
2N4236	2	2N5633	1	2N6183	8	MJ2254	4
2N4237	2	2N5634	1	2N6184	8	MJ2267	1
2N4238	2	2N5655	5	2N6185	8	MJ2268	1
2N4239	2	2N5656	5	2N6186	8	MJ2500	1
2N4348	1	2N5657	5	2N6187	8	MJ2501	1
2N4398	1	2N5679	2	2N6188	8	MJ2801	1
2N4399	1	2N5680	2	2N6189	8	MJ2840	1
2N4877	3	2N5681	2	2N6190	3	MJ2841	1
2N4898	4	2N5682	2	2N6191	3	MJ2901	1
2N4899	4	2N5683	1	2N6192	3	MJ2940	1
2N4900	4	2N5684	1	2N6193	3	MJ2941	1
2N4901	1	2N5685	1	2N6226	1	MJ2955	1
2N4902	1	2N5686	1	2N6227	1	MJ3000	1
2N4903	1	2N5745	1	2N6228	1	MJ3001	1
2N4904	1	2N5758	1	2N6229	1	MJ3026	1

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COMPLEMENTARY POWER TRANSISTORS

I_C Max	Package	BV_{CEO}	NPN	PNP	Table
1.0 A	TO-5	100	2N5681	2N5679	2
		120	2N5682	2N5680	2
1.5 A	Case 77-03	40	MJE720	MJE710	5
		60	MJE721	MJE711	5
		80	MJE722	MJE712	5
3.0 A	TO-5	40	2N4237	2N4234	2
		60	2N4238	2N4235	2
		80	2N4239	2N4236	2
	Case 77-03	40	2N4921	2N4918	5
		60	2N4922	2N4919	5
		80	2N4923	2N4920	5
		30	MJE520	MJE370	5
	Case 199-04	30	MJE520K	MJE370K	7
	Case 77-03	30	MJE3520	MJE3370	5
	Case 199-04	40	MJE2520	MJE2370	7
		60	MJE2521	MJE2371	7
		40	MJE2522	MJE2490	7
		60	MJE2523	MJE2491	7
		40	MJE4921	MJE4918	7
		60	MJE4922	MJE4919	7
		80	MJE4923	MJE4920	7
4.0 A	TO-66	60	2N3766	2N3740	4
		80	2N3767	2N3741	4
		40	2N4910	2N4898	4
		60	2N4911	2N4899	4
		80	2N4912	2N4900	4
	Case 77-03	40	2N5190	2N5193	5
		60	2N5191	2N5194	5
		80	2N5192	2N5195	5
	TO-66	55	2N3054A	2N6049	4
	Case 77-03	40	MJE521	MJE371	5
		40	MJE3521	MJE3371	5
	Case 199-04	40	MJE521K	MJE371K	7
	Case 77-03	60	MJE700	MJE800	5
		60	MJE701	MJE801	5
		80	MJE702	MJE802	5
		80	MJE703	MJE803	5
	TO-3	40	MJ480	MJ490	1
		60	MJ481	MJ491	1
		60	MJ4000	MJ4010	1
		80	MJ4001	MJ4011	1
	Case 199-04	40	MJE5190	MJE5193	7
		60	MJE5191	MJE5194	7
		80	MJE5192	MJE5195	7
5.0 A	Case 90-05	50	MJE205	MJE105	6
	Case 199-04	50	MJE205K	MJE105K	7
	Case 90-05	60	MJE1100	MJE1090	6
		60	MJE1101	MJE1091	6
		80	MJE1102	MJE1092	6
		80	MJE1103	MJE1093	6
	TO-3	40	2N5067	2N4901	1
		60	2N5068	2N4902	1
		80	2N5069	2N4903	1
		40	2N4913	2N4904	1
		60	2N4914	2N4905	1
		80	2N4915	2N4906	1
		60	2N5869	2N5867	1
		80	2N5870	2N5868	1
	Case 90-05	40	2N5977	2N5974	6
		60	2N5978	2N5975	6
		80	2N5979	2N5976	6
	TO-39	80	2N5336	2N6190	3
		80	2N5337	2N6191	3
		100	2N5338	2N6192	3
		100	2N5339	2N6193	3

I_C Max	Package	BV_{CEO}	NPN	PNP	Table
5.0 A Contd.	Case 199-04	40	MJE5977	MJE5974	7
		60	MJE5978	MJE5975	7
		80	MJE5979	MJE5976	7
		40	MJE2020	MJE2010	7
		60	MJE2021	MJE2011	7
6.0 A	TO-3	100	2N5758	2N6226	1
		120	2N5759	2N6227	1
		140	2N5760	2N6228	1
7.0 A	TO-3	60	2N5873	2N5871	1
		80	2N5874	2N5872	1
8.0 A	TO-3	60	MJ1000	MJ900	1
		80	MJ1001	MJ901	1
		60	2N6053	2N6055	1
		80	2N6054	2N6056	1
	Case 80-02	60	2N6298	2N6300	4
		80	2N6299	2N6301	4
10 A	Case 90-05	60	MJE2801	MJE2901	6
		60	MJE3055	MJE2955	6
	Case 199-04	60	MJE2801K	MJE2901K	7
		60	MJE3055K	MJE2955K	7
	TO-3	60	2N3713	2N3789	1
		80	2N3714	2N3790	1
		60	2N3715	2N3791	1
		80	2N3716	2N3792	1
		60	2N3055	2N4908	1
		60	MJ2840	MJ2940	1
		80	MJ2841	MJ2941	1
		60	2N5877	2N5875	1
		80	2N5878	2N5876	1
		100	2N5632	2N6229	1
		120	2N5633	2N6230	1
		140	2N5634	2N6231	1
	TO-59	80	2N5477	2N6182	8
		80	2N5478	2N6183	8
		100	2N5479	2N6184	8
		100	2N5480	2N6185	8
		80	2N5346	2N6186	8
		80	2N5347	2N6187	8
		100	2N5348	2N6188	8
		100	2N5349	2N6189	8
	TO-3	60	MJ3000	MJ2500	1
		80	MJ3001	MJ2501	1
12 A	Case 90-05	40	2N5989	2N5986	6
		60	2N5990	2N5987	6
		80	2N5991	2N5988	6
	TO-3	60	2N6057	2N6050	1
		80	2N6058	2N6051	1
		100	2N6059	2N6052	1
15 A	Case 90-05	40	MJE1660	MJE1290	6
		60	MJE1661	MJE1291	6
	TO-3	40	MJ2801	MJ2901	1
		60	2N5881	2N5879	1
		80	2N5882	2N5880	1
		60	2N3055	MJ2955	1
16 A	TO-3	60	MJ4033	MJ4030	1
		80	MJ4034	MJ4031	1
		100	MJ4035	MJ4032	1
		100	2N5629	2N6029	1
		120	2N5630	2N6030	1
		140	2N5631	2N6031	1
20 A	TO-3	80	2N5303	2N5745	1
		60	2N6282	2N6285	1
		80	2N6283	2N6286	1
		100	2N6284	2N6287	1
25 A	TO-3	60	2N5885	2N5883	1
		80	2N5886	2N5884	1
30 A	TO-3	40	2N5301	2N4398	1
		60	2N5302	2N4399	1
		90	MJ802	MJ4502	1
50 A	TO-3	60	2N5685	2N5683	1
		80	2N5686	2N5684	1

TABLE 1 – TO-3

Case 1 Case 11 Case 12 Case 197

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} @ Min/Max	I_C Amp	$V_{CE(sat)}$ @ Volts Max	I_C Amp	P_D Watts	f_T MHz Min	Case
NPN									
MJ480	40	4.0	30/200	1.0	1.2	3.0	87.5	4.0	11
2N5067		5.0	20/180	1.0	1.5	5.0	87.5	4.0	11
2N4913		5.0	25/100	2.5	1.5	5.0	87.5	4.0	11
MJ2801		1.5	15/60	8.0	1.5	8.0	115	1.0	11
2N5301		30	15/60	15	3.0	30	200	2.0	12
2N3771		30	15/60	15	2.0	15	150	0.2	11
MJ3771		30	15/60	15	1.0	15	150	2.0	11
2N3235	55	10	20/70	4.0	1.1	4.0	115	1.0	11
MJ481	60	4.0	30/200	1.0	1.2	3.0	87.5	4.0	11
MJ4000		4.0	1000/–	1.5	2.0	1.5	75	–	11
2N5068		5.0	20/80	1.0	1.5	5.0	87.5	4.0	11
2N5869		5.0	20/100	1.5	1.0	2.0	87.5	4.0	11
2N4914		5.0	25/100	2.5	1.5	5.0	87.5	4.0	11
2N5873		7.0	20/100	2.5	1.0	4.0	100	4.0	11
2N3232		7.5	15/75	3.0	2.5	3.0	115	1.0	11
2N3445		7.5	20/60	3.0	1.5	3.0	115	10	11
2N3447		7.5	40/120	5.0	1.5	5.0	115	10	11
2N6055		8.0	750/18000	4.0	2.0	4.0	100	4.0	11
MJ1000		8.0	1000/–	3.0	2.0	3.0	90	–	11
2N3713		10	15/–	3.0	1.0	5.0	150	2.5	11
2N5877		10	20/100	4.0	1.0	5.0	150	4.0	11
MJ2840		10	20/100	3.0	–	–	150	2.0	11
2N3715		10	30/–	3.0	0.8	5.0	150	2.5	11
MJ3000		10	1000/–	5.0	2.5	3.0	150	–	11
2N6057		12	750/18000	6.0	2.0	6.0	150	4.0	11
2N3055		15	20/70	4.0	8.0	10	115	1.0	11
2N5881		15	20/100	6.0	1.0	7.0	160	4.0	11
MJ4033		16	1000/–	10	2.5	1.0	150	–	11
2N3772		20	15/60	10	1.4	10	150	0.2	11
MJ3772		20	15/60	10	1.0	10	150	2.0	11
2N6282		20	750/18000	10	2.0	10	160	4.0	11
2N5885		25	20/100	10	1.0	15	200	4.0	11
2N5302		30	15/60	15	3.0	30	200	2.0	12
2N5685		50	15/60	25	1.0	25	300	2.0	197
MJ4001	80	4.0	1000/–	1.5	2.0	1.5	75	–	11
2N5069		5.0	20/80	1.0	1.5	5.0	87.5	4.0	11
2N5870		5.0	20/100	1.5	1.0	2.0	87.5	4.0	11
2N4915		5.0	25/100	2.5	1.5	5.0	87.5	4.0	11
2N5874		7.0	20/100	2.5	1.0	4.0	100	4.0	11
2N3446		7.5	20/60	3.0	1.5	3.0	115	10	11
2N3448		7.5	40/120	5.0	1.5	5.0	115	10	11
2N6056		8.0	750/18000	4.0	2.0	4.0	100	4.0	11
MJ1001		8.0	1000/–	3.0	2.0	3.0	90	–	11
2N3714		10	15/–	3.0	1.0	5.0	150	2.5	11
2N5878		10	20/100	4.0	1.0	5.0	150	4.0	11
MJ2841		10	20/100	4.0	–	–	150	2.0	11
2N3716		10	30/–	3.0	0.8	5.0	150	2.5	11
MJ3001		10	1000/–	5.0	2.5	5.0	150	–	11
2N6058		12	750/18000	6.0	2.0	6.0	150	4.0	11
2N5882		15	20/100	6.0	1.0	7.0	160	4.0	11
2N5303		20	15/60	10	2.0	20	200	2.0	12
2N6283		20	750/18000	10	2.0	10	160	4.0	11
MJ4034		16	1000/–	10	2.5	10	150	–	11
2N5886		25	20/100	10	1.0	15	200	4.0	11
2N5686		50	15/60	25	1.0	25	300	2.0	197

TABLE 1 (continued)

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} Min/Max	@ I_C Amp	$V_{CE(sat)}$ Volts Max	@ I_C Amp	P_D Watts	f_T MHz Min	Case
NPN									
MJ802	90	30	25/100	7.5	0.8	7.5	200	–	12
2N5758	100	6.0	25/100	3.0	1.0	3.0	150	1.0	11
2N5632		10	25/100	5.0	2.0	10	150	1.0	11
2N6059		12	750/18000	6.0	2.0	6.0	150	4.0	11
2N5629		16	25/100	8.0	1.0	10	200	1.0	11
MJ4035		16	1000/–	10	2.5	10	150	–	11
2N6284		20	750/18000	10	2.0	10	160	4.0	11
2N6274		50	30/120	20	1.0	20	250	30	197
2N5759	120	6.0	20/80	3.0	1.0	3.0	150	1.0	11
2N4348		10	15/60	5.0	2.0	10	120	0.2	11
2N5633		10	20/80	5.0	2.0	10	150	1.0	11
2N5630		16	20/80	8.0	1.0	10	200	1.0	11
2N3442		10	20/70	3.0	5.0	10	117	–	11
2N6275		50	30/120	20	1.0	20	250	30	197
2N5760	140	6.0	15/60	3.0	1.0	3.0	150	1.0	11
2N5634		10	15/60	5.0	2.0	10	150	1.0	11
2N3773		16	15/60	8.0	4.0	16	150	0.8	11
2N5631		16	15/60	8.0	1.0	10	200	1.0	11
2N6276		50	30/120	20	1.0	20	250	30	197
2N6277	150	50	30/120	20	1.0	20	250	30	197
MJ410	200	5.0	30/90	1.0	0.8	1.0	100	2.5	11
MJ3029	250	3.5	30/–	0.4	–	–	125	–	11
MJ1800	250	5.0	40/120	0.4	–	–	100	–	11
MJ3026	275	2.0	25/–	0.25	–	–	80	–	11
MJ3027	300	2.0	25/–	0.25	–	–	80	–	11
MJ3028	300	3.5	25/–	0.3	–	–	100	–	11
MJ3430	300	5.0	15/45	2.5	0.9	2.5	125	2.5	11
MJ411	300	5.0	30/90	1.0	0.8	1.0	100	2.5	11
MJ431	325	10	15/35	2.5	0.7	2.5	125	2.5	11
2N3788		2.0	20/180	0.5	1.0	1.5	100	–	11
MJ3030		3.5	3.75/–	3.0	2.0	3.0	125	–	11
MJ423		10	30/90	1.0	0.8	1.0	125	2.5	11
MJ9000		10	–	–	2.0	6.0	125	–	11
MJ413		10	20/80	0.5	0.8	0.5	125	–	11
MJ424	350	5.0	30/90	1.0	0.8	1.0	100	2.5	11
2N3902	400	3.5	30/90	1.0	2.5	2.5	100	2.8	11
2N5241	400	5.0	15/35	2.5	0.7	2.5	125	2.5	11
MJ425	400	5.0	30/90	1.0	0.8	1.0	100	2.5	11
2N5157	500	3.5	30/90	1.0	2.5	3.5	100	2.8	11
MJ105	1400*	2.5	–	–	5.0	2.5	10	7.5#	11
MJ8400	1400*	4.0	–	–	2.0	3.0	125	–	11
BU105	1500*	2.5	–	–	5.0	2.5	10	7.5#	11
PNP									
2N3021	30	3.0	20/60	1.0	1.5	3.0	25	60	1
2N3024	30	3.0	50/180	1.0	1.0	3.0	25	60	1
MJ490	40	4.0	30/200	1.0	1.2	3.0	87.5	4.0	11
2N4901		5.0	20/80	1.0	1.5	5.0	87.5	4.0	11
MJ2267		5.0	20/100	4.0	1.0	4.0	150	3.0	11
2N4904		5.0	25/100	2.5	1.5	5.0		4.0	11
MJ2901		15	15/60	8.0	1.5	8.0		1.0	11
2N4398		30	15/60	15	2.0	20		4.0	12
MJ450		30	20/–	10	1.0	10		2.0	12
2N3022	45	3.0	20/60	1.0	1.5	3.0		60	1
2N3025	45	3.0	50/180	1.0	1.0	3.0		60	1
MJ2268	55	5.0	20/100	4.0	1.0	4.0		3.0	11
2N3023	60	3.0	20/60	1.0	1.5	3.0		60	1
2N3026		3.0	50/180	1.0	1.0	3.0		60	1
MJ491		4.0	30/200	1.0	1.2	3.0		4.0	11
MJ4010		4.0	1000/–	1.5	2.0	1.5		–	11
2N4902		5.0	20/80	1.0	1.5	5.0		4.0	11
2N5867		5.0	20/100	1.5	1.0	2.0		4.0	11
2N4905		5.0	25/100	2.5	1.5	5.0		4.0	11
2N5871		7.0	20/100	2.5	1.0	4.0		4.0	11

*BV_{CEX} #Typ

TABLE 1 (continued)

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} Min/Max	@ I_C Amp	$V_{CE(sat)}$ Volts Max	@ I_C Amp	P_D Watts	f_T MHz Min	Case
PNP									
2N6053	60	8.0	750/18000	4.0	2.0	4.0	100	4.0	11
MJ900		8.0	1000/–	3.0	2.0	3.0	90	–	11
2N3789		10	15/–	3.0	1.0	4.0	150	4.0	11
MJ2940		10	20/100	3.0	–	–	150	4.0	11
2N5875		10	20/100	4.0	1.0	5.0	150	4.0	11
2N3791		10	30/–	3.0	1.0	5.0	150	4.0	11
MJ2500		10	1000/–	5.0	2.5	5.0	150	–	11
2N6050		12	750/18000	6.0	2.0	6.0	150	4.0	11
MJ2955		15	20/70	4.0	1.1	4.0	150	4.0	11
2N5879		15	20/100	6.0	1.0	7.0	160	4.0	11
MJ4030		16	1000/–	10	2.5	10	150	–	11
2N6285		20	750/18000	10	2.0	10	160	4.0	11
2N5883		25	20/100	10	1.0	15	200	4.0	11
2N4399		30	15/60	15	2.0	20	200	4.0	12
2N5683		50	15/60	25	1.0	25	300	2.0	197
MJ4011	80	4.0	1000/–	1.5	2.0	1.5	75	–	11
2N4903		5.0	20/80	1.0	1.5	3.0	87.5	4.0	11
2N5868		5.0	20/100	1.5	1.0	2.0	87.5	4.0	11
2N4906		5.0	25/100	2.5	1.5	5.0	87.5	4.0	11
2N5872		7.0	20/100	2.5	1.0	4.0	100	4.0	11
2N6054		8.0	750/18000	4.0	2.0	4.0	100	4.0	11
MJ901		8.0	1000/–	3.0	2.0	3.0	90	–	11
2N3790		10	15/–	3.0	1.0	4.0	150	4.0	11
MJ2941		10	20/100	4.0	–	–	150	4.0	11
2N5876		10	20/100	4.0	1.0	5.0	150	4.0	11
2N3792		10	30/–	3.0	1.0	5.0	150	4.0	11
MJ2501		10	1000/–	5.0	2.5	5.0	150	–	11
2N6051		12	750/18000	6.0	2.0	6.0	150	4.0	11
2N5880		15	20/100	6.0	1.0	7.0	160	4.0	11
MJ4031		16	1000/–	10	2.5	10	150	–	11
2N5745		20	15/60	10	2.0	20	200	2.0	12
2N6286		20	750/18000	10	2.0	10	160	4.0	11
2N5884		25	20/100	10	1.0	15	200	4.0	11
2N5684		50	15/60	25	1.0	25	300	2.0	197
MJ4502	90	30	25/100	7.5	0.8	7.5	200	–	12
2N6226	100	6.0	25/100	3.0	1.0	3.0	150	1.0	11
2N6229		10	25/100	5.0	1.0	7.5	150	1.0	11
2N6052		12	750/18000	6.0	2.0	6.0	150	4.0	11
2N6029		16	25/100	8.0	1.0	10	200	1.0	11
MJ4032		16	1000/–	10	2.5	10	150	–	11
2N6287		20	750/18000	10	2.0	10	160	4.0	11
2N6227	120	6.0	20/80	3.0	1.0	3.0	150	1.0	11
2N6230	120	10	20/80	5.0	1.0	7.5	150	1.0	11
2N6030	120	16	20/80	8.0	1.0	10	200	1.0	11
2N6228	140	6.0	15/60	3.0	1.0	3.0	150	1.0	11
2N6231	140	10	15/60	5.0	1.0	7.5	150	1.0	11
2N6031	140	16	15/60	8.0	1.0	10	200	1.0	11

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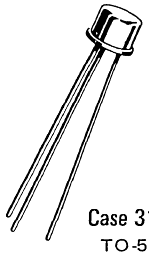
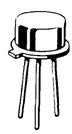
TABLE 2 – TO-5 Case 31 (1)



Case 31
TO-5

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} Min/Max	@ I_C Amp	$V_{CE(sat)}$ Volts Max	@ I_C Amp	P_D Watts	f_T MHz Min
NPN								
MJ440	40	1.0	25/150	0.25	0.5	0.75	6.0	3.0
2N4237	40	1.0	30/150	0.25	0.6	1.0	6.0	1.0
2N4238	60	1.0	30/150	0.25	0.6	1.0	6.0	1.0
2N4239	80	1.0	30/150	0.25	0.6	1.0	6.0	1.0
2N5681	100	1.0	40/150	0.25	0.6	0.25	10	30
2N5682	120	1.0	40/150	0.25	0.6	0.25	10	30
MJ420	250	0.1	25/250	0.03	5.0	0.03	0.8	15
2N3440	250	1.0	40/160	0.02	0.5	0.05	10	15
MJ421	325	0.1	25/250	0.03	5.0	0.03	0.8	15
2N3439	350	1.0	40/160	0.02	0.5	0.05	10	15
PNP								
MJ430	40	1.0	25/150	0.25	0.5	0.75	6.0	2.0
2N4234	40	1.0	30/150	0.25	0.6	1.0	6.0	3.0
2N3719	40	3.0	25/180	1.0	1.5	3.0	6.0	60
2N3867	40	3.0	40/200	1.5	1.3	2.5	6.0	60
2N4235	60	1.0	30/150	0.25	0.6	1.0	6.0	3.0
2N3720	60	3.0	25/180	1.0	1.5	3.0	6.0	60
2N3868	60	3.0	30/150	1.5	1.3	2.5	6.0	60
2N4236	80	1.0	30/150	0.25	0.6	1.0	6.0	3.0
2N5679	100	1.0	40/150	0.25	0.6	0.25	10	30
2N5680	120	1.0	40/150	0.25	0.6	0.25	10	30

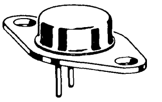
TABLE 3 – TO-39 Case 79(1)



Case 79
TO-39

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} Min/Max	@ I_C Amp	$V_{CE(sat)}$ Volts Max	@ I_C Amp	P_D Watts	f_T MHz Min
NPN								
2N5334	60	3.0	30/150	1.0	0.7	2.0	6.0	40
2N4877	60	4.0	20/100	4.0	1.0	4.0	10	4.0
2N5335	80	3.0	30/150	1.0	0.7	2.0	6.0	40
2N5336	80	5.0	30/120	2.0	1.2	5.0	6.0	30
2N5337	80	5.0	60/240	2.0	1.2	5.0	6.0	30
2N5338	100	5.0	30/120	2.0	1.2	5.0	6.0	30
2N5339	100	5.0	60/240	2.0	1.2	5.0	6.0	30
PNP								
MJ8100	60	5.0	25/180	2.0	1.2	5.0	10	30
MJ8101	80	5.0	25/180	2.0	1.2	5.0	10	30
2N6190	80	5.0	30/120	2.0	0.7	2.0	10	30
2N6191	80	5.0	60/240	2.0	0.7	2.0	10	30
2N6192	100	5.0	30/120	2.0	0,7	2.0	10	30
2N6193	100	5.0	60/240	2.0	0.7	2.0	10	30
MJ4645	200	1.0	20/–	0.5	1.0	0.5	5.0	40
MJ4646	300	1.0	20/–	0.5	1.2	0.5	5.0	40
MJ4647	400	1.0	20/–	0.5	1.5	0.5	5.0	30

TABLE 4 – TO-66 Case 80-02



Case 80
TO-66

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} @ Min/Max	I_C Amp	$V_{CE(sat)}$ @ Volts Max	I_C Amp	P_D Watts	f_T MHz Min
NPN								
2N4910	40	1.0	20/100	0.5	0.6	1.0	25	3.0
MJ3101	40	2.0	25/200	0.5	1.0	0.5	20	15
2N4231	40	4.0	25/150	1.5	2.0	3.0	35	4.0
2N3054	55	4.0	25/100	0.5	1.0	0.5	25	4.0
2N3054A	55	4.0	25/100	0.5	1.0	0.5	75	3.0
2N4911	60	1.0	20/100	0.5	0.6	1.0	25	3.0
MJ2249		2.0	25/200	0.5	1.0	0.5	20	15
2N3766		3.0	40/160	0.5	2.5	1.0	20	10
2N4232		4.0	25/150	1.5	2.0	3.0	35	4.0
2N6300		8.0	750/18000	4.0	2.0	4.0	75	4.0
2N4912	80	1.0	20/100	0.5	0.6	1.0	25	3.0
MJ2250		2.0	25/200	0.5	1.0	0.5	20	15
2N3767		3.0	40/160	0.5	2.5	1.0	20	10
2N4233		4.0	25/150	1.5	2.0	3.0	35	4.0
2N5427		7.0	30/120	2.0	1.2	7.0	40	30
2N5428		7.0	60/240	2.0	1.2	7.0	40	30
2N6301		8.0	750/18000	4.0	2.0	4.0	75	4.0
2N5429	100	7.0	30/120	2.0	1.2	7.0	40	30
2N5430	100	7.0	60/240	2.0	1.2	7.0	40	30
2N5050	125	2.0	25/100	0.75	1.0	0.75	40	10
2N3441	140	3.0	20/80	0.5	6.0	2.7	25	0.2
2N5051	150	2.0	25/100	0.75	1.0	0.75	40	10
2N5052	200	2.0	25/100	0.75	1.0	0.75	40	10
MJ2251	225	0.5	25/200	0.05	–	–	10*	10
MJ3201	225	0.1	30/200	0.05	5.0	0.05	15	15
2N3738	225	0.25	50/200	0.1	2.5	0.25	15	10
2N6233	225	5.0	25/125	1.0	0.5	1.0	50	20
2N6234	275	5.0	25/125	1.0	0.5	1.0	50	20
MJ3202	300	0.1	30/200	0.05	5.0	0.05	15	15
MJ2252	300	0.5	25/200	0.05	–	–	10*	10
2N3739	300	0.25	50/200	0.1	2.5	0.25	15	10
MJ400	325	0.25	30/300	0.05	5.0	0.05	6.67*	15
2N6235	325	5.0	25/125	1.0	0.5	1.0	50	20
PNP								
2N4898	40	1.0	20/100	0.5	0.6	1.0	25	3.0
MJ3701	40	3.0	20/100	0.25	0.6	1.0	25	3.0
2N6049	55	4.0	25/100	0.5	0.5	0.5	75	3.0
2N4899	60	1.0	20/100	0.5	0.6	1.0	25	3.0
2N3740	60	1.0	30/100	0.25	0.6	1.0	25	4.0
MJ2253	60	3.0	20/100	0.25	0.6	1.0	25	3.0
2N6298	60	8.0	750/18000	4.0	2.0	4.0	75	4.0
2N4900	80	1.0	20/100	0.5	0.6	1.0	25	3.0
2N3741	80	1.0	30/100	0.25	0.6	1.0	25	4.0
MJ2254	80	3.0	20/100	0.25	0.6	1.0	25	3.0
2N6299	80	8.0	750/18000	4.0	2.0	4.0	75	4.0
2N5344	250	1.0	25/100	0.5	3.0	1.0	40	60
2N5345	300	1.0	25/100	0.5	3.0	1.0	40	60

* @T_C = 70° C

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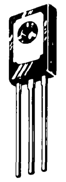
TABLE 5 — Case 77-03



Case 77

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} Min/Max	@ I_C Amp	$V_{CE(sat)}$ Volts Max	@ I_C Amp	P_D Watts	f_T MHz Min	Case Style
NPN									
MJE520	30	3.0	25/–	1.0	–	–	25	–	1
MJE3520	30	3.0	25/–	1.0	–	–	40	–	3
MJE720	40	1.5	40/–	0.15	0.15	0.15	2.0	–	1
2N4921	40	3.0	20/100	0.5	0.6	1.0	30	3.0	1
MJE521	40	4.0	40/–	1.0	–	–	40	–	1
MJE3521	40	4.0	40/–	1.0	–	–	40	–	3
2N5190	40	4.0	25/100	1.5	1.4	4.0	40	2.0	1
MJE721	60	1.5	40/–	0.15	0.15	0.15	20	–	1
2N4922	60	3.0	20/100	0.5	0.6	1.0	30	3.0	1
2N5191	60	4.0	25/100	1.5	1.4	4.0	40	2.0	1
MJE800	60	4.0	750/–	1.5	2.5	1.5	40	1.0	1
MJE801	60	4.0	750/–	2.0	2.8	2.0	40	1.0	1
MJE722	80	1.5	40/–	0.15	0.15	0.15	20	–	1
2N4923	80	3.0	20/100	0.5	0.6	1.0	30	3.0	1
2N5192	80	4.0	20/80	1.5	1.4	4.0	40	2.0	1
MJE802	80	4.0	750/–	1.5	2.5	1.5	40	1.0	1
MJE803	80	4.0	750/–	2.0	2.8	2.0	40	1.0	1
MJE341	150	0.5	25/200	0.05	1.0	0.05	20.8	15	1
MJE344	200	0.5	30/300	0.05	1.0	0.05	20.8	15	1
MJE3440	250	0.3	40/160	0.02	0.5	0.05	15	15	1
2N5655	250	0.5	30/250	0.1	1.0	0.1	20	10	1
MJE340	300	0.5	30/240	0.05	–	–	20.8	–	1
2N5656	300	0.5	30/250	0.1	1.0	0.1	20	10	1
MJE345	325	0.5	30/300	0.05	5.0	0.05	20.8	15	1
MJE3439	350	0.3	40/160	0.02	0.5	0.05	15	15	1
2N5657	350	0.5	30/250	0.1	1.0	0.1	20	10	1
PNP									
MJE370	30	3.0	25/–	1.0	–	–	25	–	1
MJE3370	30	3.0	25/–	1.0	–	–	25	–	3
MJE710	40	1.5	40/–	0.15	0.15	0.15	20	–	1
2N4918	40	3.0	20/100	0.5	0.6	1.0	30	3.0	1
MJE371	40	4.0	40/–	1.0	–	–	40	–	1
MJE3371	40	4.0	40/–	1.0	–	–	40	–	3
2N5193	40	4.0	25/100	1.5	1.2	4.0	40	2.0	1
MJE711	60	1.5	40/–	0.15	0.15	0.15	20	–	1
2N4919	60	3.0	20/100	0.5	0.6	1.0	30	3.0	1
2N5194	60	4.0	25/100	1.5	1.2	4.0	40	2.0	1
MJE700	60	4.0	750/–	1.5	2.5	1.5	40	1.0	1
MJE701	60	4.0	750/–	2.0	2.8	2.0	40	1.0	1
MJE712	80	1.5	40/–	0.15	0.15	0.15	20	–	1
2N4920	80	3.0	20/100	0.5	0.6	1.0	30	3.0	1
2N5195	80	4.0	20/80	1.5	1.2	4.0	40	2.0	1
MJE702	80	4.0	750/–	1.5	2.5	1.5	40	1.0	1
MJE703	80	4.0	750/–	2.0	2.8	2.0	40	1.0	1

TABLE 6 – Case 90-05

Case 90

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} Min/Max	@ I_C Amp	$V_{CE(sat)}$ Volts Max	@ I_C Amp	P_D Watts	f_T MHz Min
NPN								
2N5977	40	5.0	20/120	2.5	0.6	2.5	75	2.0
2N5983	40	8.0	20/120	4.0	0.6	4.0	90	2.0
2N5989	40	12	20/120	6.0	0.7	6.0	100	2.0
MJE1660	40	15	20/100	5.0	1.8	15	90	3.0
MJE205	50	5.0	25/100	2.0	–	–	65	–
2N5978	60	5.0	20/120	2.5	0.6	2.5	75	2.0
MJE1100	60	5.0	750/–	3.0	2.5	3.0	70	1.0
MJE1101	60	5.0	750/–	4.0	2.8	4.0	70	1.0
2N5984	60	8.0	20/120	4.0	0.6	4.0	90	2.0
MJE3055	60	10	20/70	4.0	8.0	10	90	2.0
MJE2801	60	10	25/100	3.0	–	–	90	–
MJE1661	60	15	20/100	5.0	1.8	15	90	3.0
2N5990	60	12	20/120	6.0	0.7	6.0	100	2.0
2N5979	80	5.0	20/120	2.5	0.6	2.5	75	2.0
MJE1102	80	5.0	750/–	3.0	2.5	3.0	70	1.0
MJE1103	80	5.0	750/–	4.0	2.8	4.0	70	1.0
2N5985	80	8.0	20/120	4.0	0.6	4.0	90	2.0
2N5991	80	12	20/120	6.0	0.7	6.0	100	2.0
PNP								
2N5974	40	5.0	20/120	2.5	0.6	2.5	75	2.0
2N5980	40	8.0	20/120	4.0	0.6	4.0	90	2.0
2N5986	40	12	20/120	6.0	0.7	6.0	100	2.0
MJE1290	40	15	20/100	5.0	1.8	15	90	3.0
MJE105	50	5.0	25/100	2.0	–	–	65	–
2N5975	60	5.0	20/120	2.5	0.6	2.5	75	2.0
MJE1090	60	5.0	750/–	3.0	2.5	3.0	70	1.0
MJE1091	60	5.0	750/–	4.0	2.8	4.0	70	1.0
2N5981	60	8.0	20/120	4.0	0.6	4.0	90	2.0
MJE2955	60	10	20/70	4.0	8.0	10	90	2.0
MJE2901	60	10	25/100	3.0	–	–	90	–
2N5987	60	12	20/120	6.0	0.7	6.0	100	2.0
MJE1291	60	15	20/100	5.0	1.8	15	90	3.0
2N5976	80	5.0	20/120	2.5	0.6	2.4	75	2.0
MJE1092	80	5.0	750/-	3.0	2.5	3.0	70	1.0
MJE1093	80	5.0	750/-	4.0	2.8	4.0	70	1.0
2N5982	80	8.0	20/120	4.0	0.6	4.0	90	2.0
2N5988	80	12	20/120	6.0	0.7	6.0	100	2.0

Case 199

TABLE 7 – Case 199-04

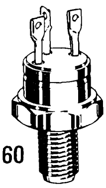
Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} Min/Max	@ I_C Amp	$V_{CE(sat)}$ Volts Max	@ I_C Amp	P_D Watts	f_T MHz Min
NPN								
MJE520K	30	3.0	25/–	1.0	–	–	40	–
MJE4921	40	3.0	20/100	0.5	0.6	1.0	40	3.0
MJE2522	40	3.0	20/100	1.0	0.6	1.0	40	3.0
MJE2520	40	3.0	40/200	0.2	0.7	1.0	40	3.0
MJE2480	40	4.0	20/100	1.5	0.7	1.5	60	2.0
MJE2482	40	4.0	20/100	2.5	0.7	1.5	60	2.0
MJE5190	40	4.0	25/100	1.5	0.6	1.5	60	2.0
MJE521K	40	4.0	40/–	1.0	–	–	60	–
MJE5977	40	5.0	20/120	2.5	0.6	2.5	75	2.0
MJE2020	40	5.0	25/125	1.0	1.0	3.5	80	3.0
MJE5983	40	8.0	20/120	4.0	0.6	4.0	90	2.0
MJE205K	50	5.0	25/100	2.0	–	–	65	–
MJE3054	55	4.0	25/100	0.5	1.0	0.5	40	–
MJE4922	60	3.0	20/100	0.5	0.6	1.0	40	3.0
MJE2523	60	3.0	20/100	1.0	0.6	1.0	40	3.0
MJE2521	60	3.0	40/200	0.2	0.7	1.0	40	3.0
MJE2481	60	4.0	20/100	1.5	0.7	1.5	60	2.0
MJE2483	60	4.0	20/100	2.5	0.7	1.5	60	2.0
MJE5191	60	4.0	25/100	1.5	0.6	1.5	60	2.0
MJE5978	60	5.0	20/100	2.5	0.6	2.5	75	2.0
MJE2021	60	5.0	25/125	1.0	1.0	3.5	80	3.0
MJE5984	60	8.0	20/120	4.0	0.6	4.0	90	2.0
MJE3055K	60	10	20/70	4.0	1.1	4.0	90	2.0
MJE2801K	60	10	25/100	3.0	–	–	90	–
MJE4923	80	3.0	20/100	0.5	0.6	1.0	40	3.0
MJE5192	80	4.0	20/80	1.5	0.6	1.5	60	2.0
MJE5979	80	5.0	20/120	2.5	0.6	2.5	75	2.0
MJE5985	80	8.0	20/120	4.0	0.6	4.0	90	2.0
MJE341K	150	0.5	25/200	0.05	1.0	0.05	30	15
MJE344K	200	0.5	30/300	0.05	1.0	0.05	30	15
MJE3738	225	0.5	40/200	0.1	2.5	0.25	30	10*
MJE5655	250	0.5	30/250	0.1	1.0	0.1	30	10
MJE5656	300	0.5	30/250	0.1	1.0	0.1	30	10
MJE340K	300	0.5	30/240	0.05	–	–	30	–
MJE3739	300	0.5	40/200	0.1	2.5	0.25	30	10*
MJE2360	350	0.5	25/200	0.05	1.5	0.1	30	10*
MJE5657	350	0.5	30/250	0.1	1.0	0.1	30	10
MJE2361	350	0.5	50/250	0.05	1.5	0.1	30	10*
PNP								
MJE370K	30	3.0	25/–	1.0	–	–	40	–
MJE4918	40	3.0	20/100	0.5	0.6	1.0	40	3.0
MJE2490	40	3.0	20/100	1.0	0.6	1.0	60	3.0
MJE2370	40	3.0	40/200	0.2	0.7	1.0	40	3.0
MJE5193	40	4.0	25/100	1.5	0.6	1.5	60	2.0
MJE371K	40	4.0	40/–	1.0	–	–	60	–
MJE5974	40	5.0	20/120	2.5	0.6	2.5	75	2.0
MJE2010	40	5.0	25/125	1.0	1.0	3.5	80	3.0
MJE5980	40	8.0	20/120	4.0	0.6	4.0	90	2.0
MJE105K	50	5.0	25/100	2.0	–	–	65	–
MJE4919	60	3.0	20/100	0.5	0.6	1.0	40	3.0
MJE2491	60	3.0	20/100	1.0	0.6	1.0	60	3.0
MJE2371	60	3.0	40/200	0.2	0.7	1.0	40	3.0
MJE5194	60	4.0	25/100	1.5	0.6	1.5	60	2.0
MJE3740	60	4.0	30/100	0.25	0.6	1.0	40	4.0

* Typ

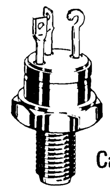
TABLE 7 (continued)

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} Min/Max	@ I_C Amp	$V_{CE(sat)}$ Volts Max	@ I_C Amp	P_D Watts	f_T MHz Min
NPN								
MJE5975	60	5.0	20/120	2.5	0.6	2.5	75	2.0
MJE2011	60	5.0	25/125	1.0	1.0	3.5	80	3.0
MJE5981	60	8.0	20/120	4.0	0.6	4.0	90	2.0
MJE2955K	60	10	20/70	4.0	1.1	4.0	90	2.0
MJE2901K	60	10	25/100	3.0	–	–	90	–
MJE4920	80	3.0	20/100	0.5	0.6	1.0	40	3.0
MJE5195	80	4.0	20/80	1.5	0.6	1.5	60	2.0
MJE3741	80	4.0	30/100	0.25	0.6	1.0	40	4.0
MJE5976	80	5.0	20/120	2.5	0.6	2.5	75	2.0
MJE5982	80	8.0	20/120	4.0	0.6	4.0	90	2.0

TABLE 8 – TO-59



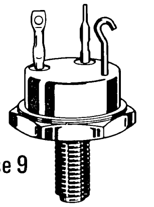
Case 160



Case 160A

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} Min/Max	@ I_C Amp	$V_{CE(sat)}$ Volts Max	@ I_C Amp	P_D Watts	f_T MHz Min	Case
NPN									
2N5346	80	7.0	30/120	2.0	1.2	7.0	60	30	160
2N5477	80	7.0	30/120	2.0	1.2	7.0	60	30	160A
2N5347	80	7.0	60/240	2.0	1.2	7.0	60	30	160
2N5478	80	7.0	60/240	2.0	1.2	7.0	60	30	160A
2N5348	100	7.0	30/120	2.0	1.2	7.0	60	30	160
2N5479	100	7.0	30/120	2.0	1.2	7.0	60	30	160A
2N5349	100	7.0	60/240	2.0	1.2	7.0	60	30	160
2N5480	100	7.0	60/240	2.0	1.2	7.0	60	30	160A
PNP									
MJ500	60	7.0	25/180	2.0	0.7	2.0	60	30	160A
MJ6700	60	7.0	25/180	2.0	0.7	2.0	60	30	160
MJ501	80	7.0	25/180	2.0	0.7	2.0	60	30	160A
MJ6701	80	7.0	25/180	2.0	0.7	2.0	60	30	160
2N6182	80	10	30/120	2.0	0.7	2.0	60	30	160A
2N6183	80	10	60/240	2.0	0.7	2.0	60	30	160A
2N6186	80	10	30/120	2.0	0.7	2.0	60	30	160
2N6187	80	10	60/240	2.0	0.7	2.0	60	30	160
2N6184	100	10	30/120	2.0	0.7	2.0	60	30	160A
2N6185	100	10	60/240	2.0	0.7	2.0	60	30	160A
2N6188	100	10	30/120	2.0	0.7	2.0	60	30	160
2N6189	100	10	60/240	2.0	0.7	2.0	60	30	160

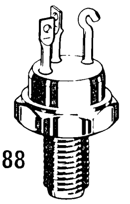
TABLE 9 – TO-61 Case 9



Case 9

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} @ Min/Max	I_C Amp	$V_{CE(sat)}$ @ Volts Max	I_C Amp	P_D Watts	f_T MHz Min	Case
NPN									
2N1724	80	5.0	20/90	2.0	1.0	2.0	115	10	9
2N1725	80	5.0	50/150	2.0	1.0	2.0	115	10	9
2N3487	80	7.5	20/60	3.0	1.2	3.0	115	10	9
2N3490	80	7.5	40/120	5.0	1.0	3.0	115	10	9
2N3488	100	7.5	20/60	3.0	1.2	3.0	115	10	9
2N3491	100	7.5	40/120	5.0	1.0	3.0	115	10	9
2N3489	120	7.5	15/45	3.0	1.2	3.0	115	10	9
2N3492	120	7.5	30/90	5.0	1.0	3.0	115	10	9

TABLE 10 – TO-63 Case 188



Case 188

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} @ Min/Max	I_C Amp	$V_{CE(sat)}$ @ Volts Max	I_C Amp	P_D Watts	f_T MHz Min	Case
NPN									
MJ7000	100	30	20/100	10	1.0	10	150	30	188
2N6278	100	50	30/120	20	1.2	20	250	30	188
2N6279	120	50	30/120	20	1.2	20	250	30	188
2N6280	140	50	30/120	20	1.2	20	250	30	188
2N6281	150	50	30/120	20	1.2	20	250	30	188

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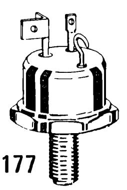
TABLE 11 – TO-114 Case 177



Case 177

Device Type	BV_{CEO} Volts Max	I_C Amp Max	h_{FE} @ Min/Max	I_C Amp	$V_{CE(sat)}$ @ Volts Max	I_C Amp	P_D Watts	f_T MHz Min	Case
NPN									
MJ7200	80	60	20/100	20	1.0	20	300	20	177
MJ7201	100	60	20/100	20	1.0	20	300	20	177

PLASTIC-ENCAPSULATED SMALL-SIGNAL TRANSISTORS

Plastic-Encapsulated Small-Signal Silicon Transistors for Industrial Applications

This Selector Guide is designed to help you select the right silicon plastic transistor for your applications. A wide range of device types in two basic package configurations are listed in this Selector Guide.

The TO-92 – is the most popular, high-volume plastic package and will meet most of your high-performance, low-cost requirements.

The Uniwatt Package – is designed for applications requiring greater power dissipation than available with the TO-92 package.

Motorola plastic-encapsulated transistors offer the features that the design of industrial electronics equipment requires – reliability, performance, convenience and economy.

RELIABILITY has been well proven by extensive environmental and life testing, and the use of hundreds of millions of these transistors in industrial and consumer applications. Industrial plastic transistors are encapsulated by a high-temperature pressure-molded process that produces a rugged one-piece package resistant to humidity and shock. Ask us for our new brochure entitled, "Some Plain Talk About Motorola's TO-92 Plastic Transistor Reliability."

PERFORMANCE is assured by careful design and testing. Geometric design and diffusion profiles are optimized to excel in specified applications such as high-speed switching, high-frequency amplification, and low-noise amplification.

Motorola plastic transistors are 100% performance tested on high-speed, computer-controlled equipment, before shipment, to assure conformance to specifications.

CONVENIENCE in use is enhanced by a number of package variations – the popular D-shaped, Unibloc package which can dissipate 350-625 mW at an ambient temperature of 25 °C, and Uniwatt package used for applications requiring up to 10 watts dissipation.

ECONOMY is a prime concern of the industrial designer. Motorola's highly efficient plastic product lines are the most advanced in the industry. Devices are produced by stripline techniques on highly mechanized equipment that reduces labor costs and provides high uniformity and quality.

Ask for Motorola's new comprehensive Designer's Manual entitled, "Motorola's Low-Cost Transistor Directory."

POWER DISSIPATION

Continuous package improvements have enhanced the power dissipation of Motorola's plastic encapsulated transistors. All devices in the nickel lead frame TO-92 package can now dissipate 350 mW in addition to the following:

P_D @ T_A = 25°C = 350 mW | P_D @ T_C = 25°C = 1.0 W
Derate above 25°C = 2.8 mW/°C | Derate above 25°C = 8.0 mW/°C
θ_{JA} = 0.125°C/mW | θ_{JC} = 0.357°C/mW
T_J = -65 to +150°C

All devices in the copper lead frame TO-92 package can now dissipate 625 mW in addition to the following:

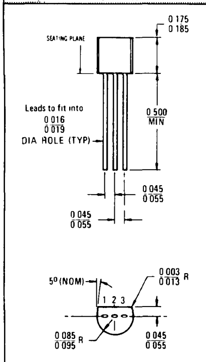
P_D @ T_A = 25°C = 625 mW | P_D @ T_C = 25°C = 1.5 W
Derate above 25°C = 5.0 mW/°C | Derate above 25°C = 12 mW/°C
θ_{JA} = 200°C/W | θ_{JC} = 83.3°C/W
T_J = -65 to +150°C

All devices in the Uniwatt package – Case 152 – can now dissipate 1.0 W in addition to the following:

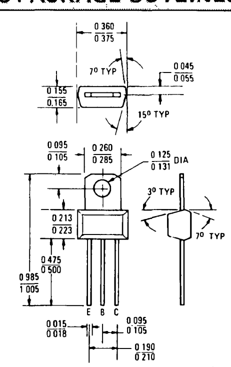
P_D @ T_A = 25°C = 1.0 W | P_D @ T_C = 25°C = 10 W
Derate above 25°C = 8.0 mW/°C | Derate above 25°C = 80 mW/°C
θ_{JA} = 125°C/W | θ_{JC} = 12.5°C/W
T_J = -55 to +150°C

5

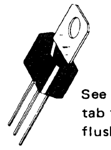
MOTOROLA PLASTIC PACKAGE OUTLINES



Case 29 (TO-92)
Low-Power package for all Unibloc devices



Collector connected to tab
Case 152
Medium-Power package for Uniwatt devices



See page 8-44, for tab formed for flush mounting.

TABLE OF CONTENTS

DESIGN STOCK

The transistor requirements of most small-signal industrial circuits can be met by a limited number of versatile devices. The ten inexpensive transistors listed below can satisfy most design requirements, while minimizing the number of transistors that must be stocked.

GENERAL-PURPOSE SWITCHES AND AMPLIFIERS

LOW-CURRENT – TO 100 mA

	NPN	PNP
LOW GAIN	2N3903	2N3905
HIGH GAIN	2N3904	2N3906

HIGH CURRENT – TO 500 mA
(these types generate Low Noise at Low Currents)

	NPN	PNP
LOW GAIN	2N4400	2N4402
HIGH GAIN	2N4401	2N4403

HIGH SPEED SATURATED SWITCHES

	NPN
LOW GAIN	2N4264
HIGH GAIN	2N4265

INDEX TO MOTOROLA PLASTIC-ENCAPSULATED SMALL-SIGNAL TRANSISTORS

This index includes all plastic-encapsulated small-signal transistors available from Motorola. For information on devices for which no Table Number is given, contact your nearest Motorola Sales Office.

Device	Table	Device	Table	Device	Table	Device	Table	Device	Table
2N3903	1,3,5	MPQ3303	8	MPS3707	–	MPS6561	3	MPS-H31	3
2N3904	1,3,5	MPQ3725	8	MPS3708	–	MPS6562	3	MPS-H32	3
2N3905	1,3,5	MPM5006	3	MPS3709	–	MPS6563	3	MPS-H34	3
2N3906	1,3,5	MPS404	1	MPS3710	–	MPS6565	3,5	MPS-H37	3
2N4123	1,3	MPS404A	1	MPS3711	–	MPS6566	3,5	MPS-H54	3
2N4124	1,3	MPS706	2	MPS3721	3	MPS6567	–	MPS-H55	3
2N4125	1,3	MPS706A	2	MPS4354	–	MPS6568	–	MPS-H83	3
2N4126	1,3	MPS708	–	MPS4355	–	MPS6568A	3	MPS-L01	6
2N4264	2	MPS834	2	MPS4356	–	MPS6569	–	MPS-L07	2
2N4265	2	MPS835	2	MPS5172	3	MPS6570	–	MPS-L08	2
2N4400	1,3	MPS918	–	MPS6507	–	MPS6571	5	MPS-L51	6
2N4401	1,3	MPS2369	2	MPS6511	3	MPS-A05	3	MPS-U01	7
2N4402	1,3	MPS2711	–	MPS6512	3	MPS-A06	3	MPS-U01A	7
2N4403	1,3	MPS2712	–	MPS6513	3	MPS-A09	3,5	MPS-U02	7
2N4409	6	MPS2713	–	MPS6514	3	MPS-A12	4	MPS-U03	7
2N4410	6	MPS2714	–	MPS6515	3	MPS-A13	4	MPS-U04	7
2N5086	3,5	MPS2923	–	MPS6516	3	MPS-A14	4	MPS-U05	7
2N5087	3,5	MPS2924	–	MPS6517	3	MPS-A16	3	MPS-U06	7
2N5088	3,5	MPS2925	–	MPS6518	3	MPS-A17	3	MPS-U07	7
2N5089	3,5	MPS2926	–	MPS6519	3	MPS-A20	3	MPS-U10	7
2N5208	–	MPS3390	–	MPS6520	5	MPS-A42	6	MPS-U45	7
2N5209	3,5	MPS3391	–	MPS6521	5	MPS-A43	6	MPS-U51	7
2N5210	3,5	MPS3391A	–	MPS6522	5	MPS-A55	3	MPS-U51A	7
2N5219	–	MPS3392	–	MPS6523	5	MPS-A56	3	MPS-U52	7
2N5220	–	MPS3393	–	MPS6530	3	MPS-A65	4	MPS-U55	7
2N5221	–	MPS3394	–	MPS6531	3	MPS-A66	4	MPS-U56	7
2N5222	–	MPS3395	–	MPS6532	3	MPS-A70	3	MPS-U57	7
2N5223	–	MPS3563	–	MPS6533	3	MPS-A92	6	MPS-U60	7
2N5224	–	MPS3638	1,3	MPS6534	3	MPS-A93	6	MPS-U95	7
2N5225	–	MPS3638A	1,3	MPS6535	3	MPS-H02	3		
2N5226	–	MPS3639	2	MPS6539	–	MPS-H04	3		
2N5227	–	MPS3640	2	MPS6540	–	MPS-H05	3		
2N5228	–	MPS3646	2	MPS6542	–	MPS-H07	3		
2N5400	6	MPS3693	3	MPS6543	–	MPS-H08	3		
2N5401	6	MPS3694	3	MPS6544	–	MPS-H10	3		
2N5550	6	MPS3702	–	MPS6545	–	MPS-H11	3		
2N5551	6	MPS3703	–	MPS6546	–	MPS-H19	3		
2N5845	1	MPS3704	–	MPS6547	–	MPS-H20	3		
2N5845A	–	MPS3705	–	MPS6548	–	MPS-H24	3		
2N6067	–	MPS3706	–	MPS6560	3	MPS-H30	3		

• New Device

PLASTIC ENCAPSULATED SMALL-SIGNAL TRANSISTORS (continued)

TABLE 1
GENERAL-PURPOSE SATURATED SWITCHING TRANSISTORS

The transistors in this table are characterized for general medium-voltage, medium-speed switching applications. These transistors also may be used as general-purpose amplifiers. All have base-emitter voltages of 4 to 6 volts, output capacitances of 4 to 20 pF, and power dissipation ratings of 350 mW. The devices are listed in order of decreasing breakdown voltage (BV_{CEO}), then in order of decreasing collector test current (I_C).

Device Type	BV_{CEO} Volts	Collector Test Current for h_{FE} I_C in mA	h_{FE} Min	$V_{CE(sat)}$ Volts Max	@ I_C mA	f_T MHz Min	@ I_C mA	Switching Times ns Max t_{on}	Switching Times ns Max t_{off}	@ I_C/I_B mA	Complement
NPN											
2N5845**	40	500	25	0.6	500	200	50	40	60	500/50	
2N5845A**	40	500	35	0.5	500	250	50	30	50	500/50	
2N4401	40	150	100	0.75	500	250	20	35	255	150/15	2N4403
2N4400	40	150	50	0.75	500	200	20	35	255	150/15	2N4402
2N3904	40	10	100	0.3	50	300	10	70	250	10/1.0	2N3906
2N3903	40	10	50	0.3	50	250	10	70	225	10/1.0	2N3905
2N4123	30	2.0	50	0.3	50	250	10	37*	136*	10/1.0	2N4125
2N4124	25	2.0	120	0.3	50	300	10	37*	136*	10/1.0	2N4126
PNP											
2N4403	40	150	100	0.75	500	200	20	35	255	150/15	2N3903
2N4402	40	150	50	0.75	500	150	20	35	255	150/15	2N4400
2N6067	40	100	50	0.3	100	150	50	40	80	500/50	
2N3906	40	10	100	0.4	50	250	10	70	300	10/1.0	2N3904
2N3905	40	10	50	0.4	50	200	10	70	260	10/1.0	2N3903
MPS404A‡	35	12	30	0.2	24	–	–	265	385	10/1.0	
2N4125	30	2.0	50	0.4	50	200	10	43*	155*	10/1.0	2N4123
MPS3638A	25	50	100	2.0	300	150	50	90	210	300/30	
MPS3638	25	50	30	1.0	300	100	50	90	210	300/30	
2N4126	25	2.0	120	0.4	50	250	10	43*	155*	10/1.0	2N4124
MPS404†	24	12	30	0.2	24	–	–	265	385	10/1.0	

*Typical †V_{EB} = 12 Vdc ‡V_{EB} = 24 Vdc **P_D = 625 mW @ T_A = 25°C

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TABLE 2
HIGH-SPEED SATURATED SWITCHING TRANSISTORS

The transistors listed in this table are optimized for high-speed saturated switching. They are heavily gold doped and otherwise processed to provide very short storage times and low capacitance. (Output capacitances below 6 pF). The power dissipation is rated at 350 mW. The transistors are listed in order of decreasing breakdown voltage (BV_{CEO}), then in order of decreasing collector test current (I_C).

Device Type	BV_{CEO} Volts	Collector Test Current for h_{FE} I_C in mA	h_{FE} Min	$V_{CE(sat)}$ Volts Max	@ I_C mA	f_T MHz Min	@ I_C mA	Switching Times ns Max t_{on}	Switching Times ns Max t_{off}	@ I_C/I_B mA
NPN										
MPS834	30	10	25	0.25	10	350	10	16	30	10/3.0
MPS835	20	10	20	0.3	10	300	10	20	35	10/3.0
2N4264	15	30	40	0.35	100	300	10	23	35	100/10
MPS3646	15	30	30	0.5	300	350	30	25	35	300/30
MPS2369	15	10	40	0.25	10	–	–	12	18	10/3.0
MPS706,A	15	10	20	0.6	10	200	10	40	75	10/–
2N4265	12	10	100	0.35	100	300	10	23	35	100/10
PNP										
MPS3640	12	10	30	0.2	10	500	10	40	32	50/5.0
MPS-L08	12	10	30	0.15	10	700	10	20	40	10/1.0
MPS3639	6.0	10	30	0.16	10	500	10	40	32	50/5.0
MPS-L07	6.0	10	30	0.15	10	500	10	20	40	10/1.0

PLASTIC ENCAPSULATED SMALL-SIGNAL TRANSISTORS (continued)

TABLE 3
GENERAL-PURPOSE AMPLIFIER TRANSISTORS

These general-purpose transistors are designed for small-signal amplification from dc to low radio frequencies. They are also useful as oscillators and general-purpose switches. The transistors are listed in order of decreasing breakdown voltage (BV_{CEO}), then in order of decreasing collector test current (I_C). P_D = 350 mW at T_A = 25°C unless otherwise specified.

Device Type	BV_{CEO} Volts	Collector Test Current for h_{FE} I_C in mA	h_{FE} Min/Max	f_T @ MHz Min	I_C mA	Complement
NPN						
MPS-A06*	80	10	50/–	50	100	MPS-A56
MPS-H05	80	1.5	30/150	80	1.5	MPS-H55
MPS-H04	80	1.5	30/120	80	1.5	MPS-H54
MPS-A05*	60	10	50/–	50	100	MPS-A55
2N5210	50	1.0	250/–	30	0.5	2N5087
2N5209	50	1.0	150/–	30	0.5	2N5086
MPS-A09	50	0.1	100/600	30	0.5	
MPS-H34*	45	20	15/–	500	15	
MPS6566	45	10	100/400	200	10	
MPS6565	45	10	40/160	200	10	
MPS-H34	45	7.0	40/–	500	15	
2N4400	40	150	100/300	200	20	2N4402
2N4401	40	150	50/150	250	20	2N4403
MPS6531	40	100	90/270	390†	50	MPS6534
MPS6530	40	100	40/120	390†	50	MPS6533
2N3904	40	10	100/300	300	10	2N3906
2N3903	40	10	50/150	250	10	2N3905
MPS-A16	40	5.0	200/600	100	5.0	
MPS-A17	40	5.0	200/600	80	5.0	
MPS-A20	40	5.0	40/400	125	5.0	
MPS-H37	40	5.0	25/–	300	5.0	
MPM5006	40	4.0	30/–	400	4.0	
MPS6532	30	100	30/–	390†	50	MPS6535
MPS-H24*	30	8.0	30/–	400	8.0	
MPS-H20	30	4.0	25/–	400	4.0	
MPS-H32*	30	4.0	27/200	300	4.0	
MPS-H07*	30	3.0	20/–	400	3.0	
MPS-H08*	30	3.0	20/–	500	3.0	
MPS6513	30	2.0	90/180	250†	2.0	MPS6517
2N4123	30	2.0	50/150	250	10	2N4125
MPS6512	30	2.0	50/100	250†	2.0	MPS6516
2N5088	30	1.0	350/–	50	0.5	
MPS5172	25	10	100/500	120†	2.0	
MPS-H10	25	4.0	60/–	650	4.0	
MPS-H11	25	4.0	60/–	650	4.0	
MPS-H19	25	4.0	45/–	300	4.0	
MPS6515	25	2.0	250/500	390†	2.0	MPS6519
MPS6514	25	2.0	150/300	390†	2.0	MPS6518
2N4124	25	2.0	120/360	300	10	2N4126
2N5089	25	1.0	450/–	50	0.5	
MPS6560*	20	500	50/200	60	10	MPS6562
MPS6561*	20	350	50/200	60	10	MPS6563
MPS6568	20	4.0	20/200	375	4.0	
MPS6568A	20	4.0	20/200	375	4.0	
MPS-H02*	20	4.0	20/200	375	4.0	
MPS-H30	20	4.0	20/200	300	4.0	
MPS-H31	20	4.0	20/200	300	4.0	
MPS3721	18	2.0	60/660‡			
PNP						
MPS4356	80	10	50/250	100	50	
MPS-A56*	80	10	50/–	50	100	MPS-A06
MPS-H54	80	1.5	30/120	80	1.5	MPS-H04
MPS-H55	80	1.5	30/150	80	1.5	MPS-H05
MPS4355	60	10	100/400	100	50	
MPS4354	60	10	50/500	100	50	
MPS-A55*	60	10	50/–	50	100	MPS-A05
2N5087	50	1.0	250/–	40	0.5	2N5210
2N5086	50	1.0	150/–	40	0.5	2N5209
2N4403	40	150	100/300	200	20	2N4401
2N4402	40	150	50/150	150	20	2N4400
MPS6534	40	100	90/270	260†	50	MPS6531
MPS6533	40	100	40/120	260†	50	MPS6530
2N3906	40	10	100/300	250	10	2N3904
2N3905	40	10	50/150	200	10	2N3903
MPS-A70	40	5.0	40/400	125	5.0	
MPS6518	40	2.0	150/300	340†	2.0	MPS6514
MPS6517	40	2.0	90/180	200†	2.0	MPS6513

† typical ‡ h_{fe} @ f = 1.0 kHz * P_D = 625 mW @ T_A = 25°C

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TABLE 3 (continued)
GENERAL-PURPOSE AMPLIFIER TRANSISTORS

Device Type	BV_{CEO} Volts	Collector Test Current for h_{FE} I_C in mA	h_{FE} Min/Max	f_T MHz Min	@ I_C mA	Complement
PNP						
MPS6516	40	2.0	50/100	200†	2.0	MPS6512
MPS6535	30	100	30/–	260†	50	MPS6532
MPS-H83*	30	2.5	20/–	600	2.5	
2N4125	30	2.0	50/150	200	10	2N4123
MPS3638A	25	50	100/–	150	50	
MPS3638	25	50	30/–	100	50	
MPS6519	25	2.0	250/500	340†	2.0	MPS6515
2N4126	25	2.0	120/360	250	10	2N4124
MPS6562*	20	500	50/200	60	10	MPS6560
MPS6563*	20	350	50/200	60	10	MPS6561

†Typical *P_D = 625 mW @ T_A = 25°C

TABLE 4
DARLINGTON AMPLIFIER TRANSISTORS

Darlington amplifiers are compound-connected transistors that provide extremely high current gain and input impedance. Power dissipation is rated at 625 mW. These devices are listed in order of decreasing breakdown voltage (BV_{CEO}), then in order of decreasing collector test current (I_C).

Device Type	BV_{CES} Volts	Collector Test Current for h_{FE} I_C in mA	h_{FE} Min	f_T MHz Min	@ I_C mA
NPN					
MPS-A14	30	10	10,000	125	10
MPS-A13	30	10	5,000	125	10
MPS-A12	20	10	20,000	–	–
PNP					
MPS-A66	30	10	75,000	100	10
MPS-A65	30	10	50,000	100	10

TABLE 5
LOW-NOISE AMPLIFIER TRANSISTORS

The small-signal transistors listed in this table are characterized for low-noise amplification at low frequencies. The power dissipation is rated at 350 mW. The transistors are listed in order of decreasing breakdown voltage (BV_{CEO}), then in order of decreasing collector test current (I_C).

Device Type	BV_{CEO} Volts	Collector Test Current for h_{FE} I_C in mA	h_{FE} Min/Max	Noise Figure NF dB Max	@ I_C µA	@ f Hz	f_T MHz Min	@ I_C mA
NPN								
2N5210	50	0.1	200/600	3.0	20	1.0 kHz	30	0.5
2N5209	50	0.1	100/300	4.0	20	1.0 kHz	30	0.5
MPS-A09	50	0.1	100/600	1.4*	100	1.0 kHz	30	0.5
MPS6566	45	10	100/400	4.0*	100	10 Hz-15.7 kHz	100	10
MPS6565	45	10	40/160	4.0*	100	10 Hz-15.7 kHz	40	10
2N3904	40	0.1	40/–	5.0	100	10 Hz-15.7 kHz	300	10
2N3903	40	0.1	20/-	6.0	100	10 Hz-15.7 kHz	300	10
2N5088	30	0.1	300/900	3.0	100	10 Hz-15.7 kHz	50	0.5
2N5089	25	0.1	400/1200	2.0	100	10 Hz-15.7 kHz	50	0.5
MPS6521	25	0.1	150/–	3.0	10	10 Hz-10 kHz	480*	10
MPS6520	25	0.1	100/–	3.0	10	10 Hz-10 kHz	480*	10
MPS6571	20	0.1	250/1000	1.2*	100	100 Hz	50	0.5
PNP								
2N5087	50	0.1	250/800	2.0	20	10 Hz-15.7 kHz	40	0.5
2N5086	50	0.1	150/500	3.0	20	10 Hz-15.7 kHz	40	0.5
2N3906	40	0.1	60/–	4.0	100	10 Hz-15.7 kHz	250	10
2N3905	40	0.1	30/–	5.0	100	10 Hz-15.7 kHz	200	10
MPS6523	25	0.1	150/–	3.0	10	10 Hz-15.7 kHz	420*	10
MPS6522	25	0.1	100/–	3.0	10	10 Hz-15.7 kHz	420*	10

*Typical

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PLASTIC ENCAPSULATED SMALL-SIGNAL TRANSISTORS (continued)

TABLE 6 HIGH-VOLTAGE TRANSISTORS

These high-voltage transistors are designed for driving neon bulbs and Nixie® indicator tubes, for direct line operation, and for other applications requiring high-voltage capability at relatively low collector current. See Table 7—Medium-Power (Uniwatt) Transistors also. Power Dissipation is rated at 350 mW. These devices are listed in order of decreasing breakdown voltage (BV_{CEO}), then in order of decreasing collector test current (I_C).

Device Type	BV_{CEO} Volts	Collector Test Current for h_{FE} I_C in mA	h_{FE} Min/Max	$V_{CE(sat)}$ Volts Max	@ I_C mA	f_T MHz Min/Max	@ I_C mA
NPN							
MPS-A42	300	10	40/ –	0.5	20	50/ –	10
MPS-A43	200	10	40/ –	0.4	20	50/ –	10
2N5551	160	10	80/250	0.15	10	100/300	10
2N5550	140	10	60/250	0.15	10	100/300	10
MPS-L01	120	10	50/300	0.2	10	60/ –	10
2N4410	80	1.0	60/400	0.2	1.0	60/300	10
2N4409	50	1.0	60/400	0.2	1.0	60/300	10
PNP							
MPS-A92	300	10	40/ –	0.5	20	50/ –	10
MPS-A93	200	10	40/ –	0.4	20	50/ –	10
2N5401	150	10	60/240	0.2	10	150/300	10
2N5400	120	10	40/180	0.2	10	100/400	10
MPS-L51	100	50	40/250	0.25	10	60/ –	10

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TABLE 7 MEDIUM-POWER (UNIWATT) TRANSISTORS

For applications requiring higher power dissipation than that of the standard Unibloc package, Motorola has developed the Uniwatt case. In this plastic-encapsulated package, which is slightly larger than the small-signal case, the collector is mounted on a metal tab that extends out of the plastic. The tab can be attached to a heat sink to conduct heat away from the junction. With a satisfactory sink, Uniwatt transistors can dissipate 5 to 8 watts. Without a heat sink, power dissipation at an ambient temperature of 25°C is 1 watt. The transistors are listed in order of decreasing collector test current (I_C).

Device Type	BV_{CEO} Volts	Collector Test Current for h_{FE} I_C in mA	h_{FE} Min/Max	$V_{CE(sat)}$ Volts Max	@ I_C mA	f_T MHz Min	@ I_C mA	P_D Watts $T_C = 25°C$	Complement	Comments
NPN										
MPS-U10	300	10	40/ –	0.75	30	60	10	1.0*	MPS-U60	High-Voltage Amplifier
MPS-U04	180	10	40/ –	0.5	200	100	50	5.0		High-Voltage Amplifier
MPS-U03	120	10	40/ –	0.5	200	100	50	5.0		High-Voltage Amplifier
MPS-U07	100	250	30/ –	0.4	250	50	200	10	MPS-U57	High-Voltage Amplifier
MPS-U06	80	250	100/ –	0.6	250	50	250	5.0	MPS-U56	General Purpose
MPS-U05	60	250	100/ –	0.6	250	50	250	5.0	MPS-U55	General Purpose
MPS-U45	40	200	25k/159k	1.5	1000	1000	200	10	MPS-U95	Darlington
MPS-U02	40	150	50/300	0.4	150	150	20	6.0	MPS-U52	General Purpose
MPS-U01A	40	100	60/ –	0.5	1000	50	50	8.0	MPS-U51A	Audio Transistor
MPS-U01	30	100	60/ –	0.5	1000	50	50	8.0	MPS-U51	Audio Transistor
PNP										
MPS-U60	300	10	30/–	0.75	20	60	10	10	MPS-U10	High-Voltage Amplifier
MPS-U57	100	250	30/ –	.0.5	250	50	200	10	MPS-U07	High-Voltage Amplifier
MPS-U56	80	250	100/ –	0.6	250	50	250	5.0	MPS-U06	General Purpose
MPS-U55	60	250	100/ –	0.6	250	50	250	5.0	MPS-U05	General Purpose
MPS-U95	40	200	25k/150k	1.5	1000	50	200	10	MPS-U45	Darlington
MPS-U52	40	150	50/300	0.4	150	150	20	6.0	MPS-U02	General Purpose
MPS-U51A	40	100	60/ –	0.7	1000	50	50	8.0	MPS-U01A	Audio Transistor
MPS-U51	30	100	60/ –	0.7	1000	50	50	8.0	MPS-U01	Audio Transistor

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SMALL-SIGNAL HERMETIC TRANSISTORS

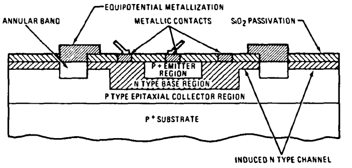
This Selector Guide covers Motorola's broad line of silicon annular and germanium mesa hermetic transistors. It includes over 500 proven transistors suitable for all low-level switching and amplifying applications: transistors with PNP and NPN polarities, breakdown voltages to 400 V, capacitances below 3.0 pF, and collector current ratings to 3.0 amperes. For maximum convenience, transistors are available in all popular metal cases, and in ceramic and metal packages containing two and four transistors. Many of the transistors are high-reliability devices that meet the requirements of military and aerospace specifications.

SILICON ANNULAR TRANSISTORS

Motorola small-signal silicon transistors have demonstrated exceptional long-term stability and reliability in the life test laboratory and in thousands of applications. Their reliability is well demonstrated by the extensive listings of JAN and JAN TX parts in this guide.

The variety, excellent characteristics and stability of Motorola transistors are made possible by such developments as Motorola's Annular process, which produces an annular band around the active geometry of transistors to eliminate channeling in the bulk material of the semiconductor material. This results in very low leakage and high reliability. Motorola's Field Relief Electrode (Equipotential Ring), stabilizes the surface of the transistor, and Motorola's Epitaxial Structure permits ultra-high speed devices and low collector resistance. In addition, the geometries of Motorola transistors are designed to provide optimum characteristics for the use intended.

CROSS SECTION OF AN ANNULAR TRANSISTOR STRUCTURE



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Germanium mesa small-signal transistors are a step forward in reliability. Bonding the transistor die directly to the header provides unparalleled mechanical strength not available in alloy or grown junction type devices. Improved stability and lower leakage currents are also important advantages of this unique method of fabricating germanium rf amplifier and switching transistors.

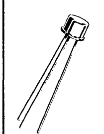
INDEX TO SELECTOR GUIDE

SELECTOR TABLES

SMALL-SIGNAL HERMETIC TRANSISTORS (continued)

TABLE 1 – SILICON AMPLIFIER TRANSISTORS
(600 mW to 1.0 W)

$h_{FE(min)}$		LOW CURRENT Normal Operation – μA Range			MEDIUM CURRENT Normal Operation – Low mA Range			HIGH CURRENT Normal Operation – Mid mA Range		
		BV_{CEO}			BV_{CEO}			BV_{CEO}		
		300 V	200 V	100 V	80 V	50 V	20 V	150 V	100 V	60 V
≈ 100	NPN			**2N3712**	2N3019 • **MM3019**	2N1711 **2N2219A**** 2N2192,A,B	2N1420 2N1890 2N1983 **2N2219**** 2N2959 2N3300	**2N3501****	**2N3499****	
≈ 100	PNP				• **2N4405** MM4010	**2N2905A**** MM4009	**2N2905**** 2N3134 MM4008	**2N3637****	**2N3635****	
≈ 50	NPN	**2N3742**	2N4926 **2N4927** MM3002 MM3003	• MM3008 • **MM3009**	2N2297 2N3020 2N3036 • **MM3020**	2N657 2N699 2N1613* 2N2102 2N2193,A,B **2N2218A**** 2N2224 2N3053 • **MM2193A** • **MM3053**	2N697 2N1984 **2N2218**** 2N2270 2N2789 2N2958 2N3110 2N3299 • **MM2270**	**2N3500**** 2N4925 MM1812 MM2258 MM2260	**2N3498**** 2N4924 • **MM3007**	• **MM3005** • **MM3006**
≈ 50	PNP	• 2N3743**	• **2N4930**** • 2N4931** • MM4003	• MM4002	2N3495 • **2N4404**	**2N2904A**** 2N3494 • MM4036	2N1132* **2N1132A** 2N2303 2N2801 **2N2904**** 2N3133 2N3671 • **2N4890** • MM4037	**2N3636****	**2N3634**** • MM4007 • MM4031 • **MM5007**	• 2N4407 • **2N5864** • MM4006 • MM4030 • MM4033 • **MM5005** • **MM5006**
≈ 20	NPN					2N1990 **2N2194,A,B** 2N2941	2N696 2N2194,A,B **2N2195,A,B** 2N2217 **2N2788** 2N3295	**2N3114** MM2259 MM3000 MM3001		2N657 2N1893 2N1990 2N2405 • **MM1893**
≈ 20	PNP				**2N4928** MM4000	2N3072 **2N3081**	2N1131* **2N1131A** 2N1991 2N2800 2N2927 2N3120		• **2N4929**** MM4001	• 2N4406 **2N5865** • MM4005 • MM4032



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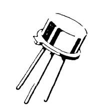

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*Motorola approved to supply JAN product
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Bold Face indicates Motorola preferred types chosen using performance and cost as criteria.

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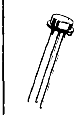
SMALL-SIGNAL HERMETIC TRANSISTORS (continued)

TABLE 2 – SILICON AMPLIFIER TRANSISTORS
(360 mW to 600 mW)

$h_{FE(min)}$		LOW CURRENT NORMAL OPERATION – µA RANGE			MEDIUM CURRENT NORMAL OPERATION – LOW mA RANGE			HIGH CURRENT NORMAL OPERATION – MID mA RANGE		
		BV_{CEO}			BV_{CEO}			BV_{CEO}		
		90 V	60 V	45 V	60 V	40 V	25 V	80 V	60 V	45 V
≈ 100	NPN		**2N2484 L.N.** MM2484 L N	2N930** L.N **2N930A L.N.** MM8016		2N843 2N956 **2N2222A**** 2N3303 **2N3947** 2N5582** ★ MM3904	**2N2222**** 2N2792 2N3116			
	PNP	2N3798A L N. **2N3799A L.N.**	2N3798 L N **2N3799 L.N.**	2N4359	**2N2907A**** **2N3251A**** 2N3486A** 2N3672	**2N2907**** 2N3136 **2N3251**** 2N3486 ★ MM3906				
≈ 50	NPN		2N2483	2N929** **2N929A**		2N707A 2N915 **2N2221A**** **2N3946** 2N5581** ★ MM3903	2N707 2N718 2N731 2N916* **2N2221**** 2N2791 2N3115 2N3298 2N3301	**2N720A** 2N740 2N2896	**2N718A**** 2N736 2N910 2N911 2N2895	2N841 2N2897
	PNP				**2N2906A**** **2N3250A**** 2N3485A** 2N3496 2N3497 2N3673	2N2838 **2N2906**** 2N3135 **2N3250**** 2N3485 ★ MM3905	2N727 2N995 2N2695			
≈ 25	NPN			■ **2N918**** ■ 2N917 ■ 2N2708JAN		2N2331 2N2952	2N717 2N2220 2N2790 2N3544 MM1941	2N739	2N735	2N840
	PNP			■ 2N3307 ■ **2N3308**	**2N3073** 2N3121	2N721 2N722 2N2837	2N726 2N869 2N978			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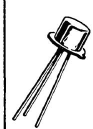
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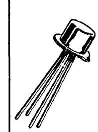
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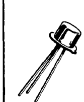
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Bold Face Indicates Motorola Preferred Types – Chosen using Performance and Cost as Criteria
L N. Recommended for Low Noise Applications

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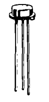
SMALL-SIGNAL HERMETIC TRANSISTORS (continued)

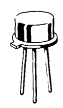
TABLE 3 – SILICON SWITCHING TRANSISTORS

$t_{on} + t_{off}$	Type	LOW CURRENT Specified Switching I_C 5 mA – 100 mA			MEDIUM CURRENT Specified Switching I_C 100 mA – 500 mA			HIGH CURRENT Specified Switching I_C 400 mA – 1.5 A		
		BV_{CEO}			BV_{CEO}			BV_{CEO}		
		20 V	15 V	10 V	50 V	40 V	30 V	50 V	40 V	30 V
< 50 ns	NPN	2N702 2N703* 2N834 □ 2N2206 □ 2N2319 **2N2501** 2N2710 **2N3227** □ 2N3508 □ 2N3509	**2N708**** 2N2368 2N2369 **2N2369A**** 2N3211 ★ 2N3511 □ 2N3648	2N743 2N744 2N2256 2N2257 2N3010 2N3011 ★ 2N3510 □ **2N3647** ★ MM1748 ★ MM1748A			**2N914**** ★ 2N3009 ★ 2N3013* ★ 2N3014			○ 2N3303
< 50 ns	PNP		MM4208A **MM4209A** Non Saturated Applications ■ 2N4260 ■ **2N4261** ■ MM4261H	MM4208 **MM4209**						
< 150 ns	NPN	2N753 2N835	**2N706*** 2N706A 2N706B 2N2242 **2N2481**** □ MM1744B	**2N709** □ 2N1708		○ 2N1959 ● **2N5859** ● 2N5860	○ 2N2476 ○ 2N2477 ○ 2N2537 ○ **2N2538** 2N2539 **2N2540** 2N2845 ○ 2N2846 **2N2847** ○ **2N2848** 2N3210 ○ 2N3512	○ 2N3444* ○ **2N3507**** ● 2N3735 □ 2N3737 ● **2N5861** ● MM3725	○ 2N2410 ○ 2N3253* ○ **2N3506****	○ 2N3015 ○ **2N3252** ● 2N3734 □ 2N3736 ● MM3724
< 150 ns	PNP	2N3209 **MM869B**	**2N869A****	2N2894 2N3304 2N3546 **MM2894A**	○ 2N2904A** ○ 2N2905A** 2N2906A** **2N2907A**** □ 2N3485A** □ 2N3486A**	○ 2N2904** ○ 2N2905** 2N2906** **2N2907**** □ 2N3485 □ 2N3486	2N3248 **2N3249**	○ 2N3468* ○ **2N3763**** □ 2N3765** ○ MM3726	○ **2N3467*** ○ 2N3762 □ 2N3764	
< 350 ns	NPN	★ MM3903 ★ MM3904				○ 2N2218A** ○ 2N2219A** 2N2221A** **2N2222A**** □ 2N5581** □ 2N5582**	○ 2N3299 ○ **2N3300** 2N3301 **2N3302**			
< 350 ns	PNP	○ 2N2800 ○ 2N2801 2N2837 2N2838 **2N3250,A**** **2N3251,A**** ★ MM3905 ★ MM3906				● **2N4890**	○ 2N3133 ○ **2N3134** 2N3135 **2N3136**	○ 2N3245 ● 2N4404 ● **2N4405** ● 2N4406 ● **2N4407**	○ **2N3244**	
< 1.0 s	NPN				(100 V) ○ 2N3498** ○ 2N3499** (150 V) ○ 2N3500** ○ **2N3501****		○ 2N2958 ○ **2N2959** 2N3115 **2N3116**			
< 1.0 s	PNP	(80 V) ○ 2N3494 (120 V) ○ **2N3495** (80 V) 2N3496 (120 V) **2N3497** (140 V) ○ 2N3634** (175 V) ○ 2N3635** (140 V) ○ 2N3636** (175 V) ○ **2N3637****			● MM4036	● MM4037		□ MM4026 □ MM4027 □ MM4028 □ **MM4029** ● MM4030 ● MM4031 ● MM4032 ● **MM4033**		

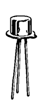

□ TO-46


TO-18

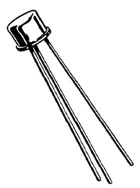

○ TO-5


● TO-39

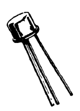

■ TO-72


★ TO-52

*Motorola approved to supply JAN product
**Motorola approved to supply JAN & JANTX Product
Bold Face indicates Motorola preferred types – chosen using performance and cost as the criteria.

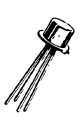


TO-5
Case 31 (1)



TO-18
Case 22 (1)

TO-46
Case 26



TO-72
Case 20 (10)

TO-12
Case 34A

TABLE 4 – CHOPPER TRANSISTORS

Transistors designed for chopper applications have low offset currents, low "on" voltage, high "off" resistance, and fast switching times. These devices are listed first in decreasing order of breakdown voltage (BV_{CEO}), then in order of decreasing maximum collector current (I_C max) and dc current gain (h_{FE}).

Device Type	BV_{ECO} Volts Min	I_C mA Max	h_{FE} Min	BV_{EBO} Volts Min	h_{FE} (Inv)	$V_{EC(off)}$ mVdc Max	f_T MHz Typ	$r_{ec(on)}$ Ohms Max	Package
NPN									
2N2330	20	500	50	7.0	–	3.0	250	–	TO-5
2N2331	20	500	50	7.0	–	3.0	250	–	TO-18
PNP									
2N2946	35	100	30	40	3.0	0.8	14	45	TO-46
MM4052	30	500	20	30	3.0	2.0	12*	2.0	TO-46
2N5231	30	100	50	50	15	0.8	14	10	TO-46
2N5230	20	100	50	30	15	0.5	14	8.0	TO-46
2N2945	20	100	40	25	4.0	0.5	14	35	TO-46
2N2944	10	100	80	15	6.0	0.3	16	20	TO-46
2N5229	10	100	50	15	15	0.5	14	6.0	TO-46

*Min

TABLE 5 – LOW-NOISE AMPLIFIER TRANSISTORS

These transistors are characterized for low-noise amplification at low frequencies. The transistors are listed first in order of decreasing breakdown voltage (BV_{CEO}), then in order of decreasing maximum collector current (I_C max) and dc current gain (h_{FE}).

Device Type	BV_{CEO} Volts Min	I_C mA Max	h_{FE} Min/Max	@ I_C mA	C_{ob} pF Max	NF dB Max	f_T MHz Typ	Package
NPN								
MM2484	60	50	100/500	0.01	6.0	3.0	70	TO-18
2N930A	45	30	100/300	0.01	6.0	3.0	70	TO-18
PNP								
2N3799A	90	50	300/900	0.5	4.0	2.5	100	TO-18
2N3798A	90	50	150/450	0.5	4.0	3.5	100	TO-18
2N3799	60	50	300/900	0.5	4.0	2.5	100	TO-18
2N3798	60	50	150/450	0.5	4.0	3.5	100	TO-18

TABLE 6 – DARLINGTON AMPLIFIER TRANSISTORS

Darlington amplifiers are compound-connected dual transistors used in applications requiring very high current gain and input impedance. The transistors are listed first in order of decreasing breakdown voltage (BV_{CEO}), then in order of decreasing maximum collector current (I_C max) and dc current gain (h_{FE}).

Device Type	BV_{CEO} Volts Min	I_C mA Max	h_{FE} Min/Max	& $V_{CE(sat)}$ Volts Max	@ I_C mA	C_{ob} pF Max	f_T MHz Typ	Package
NPN								
2N998	60	500	1600/8000	–	10	30	200	TO-72
2N2724	60	40	7000/50000	1.0	10	10	150	TO-72
2N2723	60	40	2000/10000	1.0	10	10	150	TO-72
2N2725	45	30	2000/10000	1.0	0.1	10	150	TO-72
2N2785	40	200	1200/–	1.0	10	30	150	TO-72
PNP								
2N4974	30	1000	15000/–	2.0	500	8.0	200	TO-12
2N4975	30	1000	5000/–	2.0	500	8.0	200	TO-12

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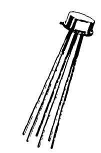
TABLE 7 – SILICON DUAL TRANSISTORS

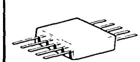
Devices Listed in Decending Order of Magnitude of h_{FE}

Dual In-House Numbers (MD) are Electrically Equivalent to the EIA Registered Counterpart

h_{FE_1}/h_{FE_2}	Low Noise-High Gain Amplifiers		General Purpose Amplifiers & Switches			Core Driver App	High Speed Switches and High Frequency Oscillators	
	BV_{CEO}		BV_{CEO}			BV_{CEO}	BV_{CEO}	
	60 V	40 V	60 V	40 V	30 V	40 V	15 V	12 V
0.9/1.0 10% NPN	2N2920** ○ 2N2979 2N2453A 2N2919** ○ 2N2978 MD8003	2N2642** 2N2722 2N2916 ○ 2N2975 ▪ 2N3043 2N2915 ○ 2N2974 2N2639** ▪ 2N3046 MD7002B MD7091 MD8001 MD8002	2N2652A 2N2060** 2N2060A 2N2223A 2N2720		2N2903A MD1129 ▪ MD1129F MD3410 MD3411 MD1121 MD1122		MD918A ▪ MD918AF MD1132 MD708A ▪ MD708AF MD2369A ▪ MD2369AF	
0.9/1.0 10% PNP	▪ 2N3817 2N3811** ○ 2N3805 ▪ 2N3816 2N3810** ○ 2N3804 "A" version of above have 5% h_{FE} match	MD7003B	2N4015 2N4016	2N3726 MD3251A ▪ MD3251AF MD1130 ▪ MD1130F 2N4937 ▪ 2N4940 MD3250A ▪ MD3250AF			MD5000A	
0.8/1.0 20% NPN		2N2643 2N2918 ○ 2N2977 ▪ 2N3044 2N2917 ○ 2N2976 2N2640 ▪ 2N3047 MD7002A MD7092	2N2652 2N2223 2N2721	2N2480A 2N2480	2N2903 MD1120 MD3409		MD918B ▪ MD918BF MD708B ▪ MD708BF	
0.8/1.0 20% PNP	▪ 2N3815 2N3809 ○ 2N3803 ▪ 2N3814 2N3808 ○ 2N3802	MD7003A		2N4938 ▪ 2N4941 MD1123			MD5000B	
> 0.8/1.0 20% or Unmatched NPN		2N2644 2N2914 ○ 2N2973 ▪ 2N3045 2N2453 2N2913 ○ 2N2972 2N2641 ▪ 2N3048 MD7002		2N5794 MD2219A ▪ MD2219AF 2N5793 MD2218A ▪ MD2218AF	MD2219 ▪ MD2219F MD7000 MD2218 ▪ MD2218F	MD3725 ▪ MD3725F	MD918 ▪ MD918F MD708 ▪ MD708F MD2369 ▪ MD2369F 2N3425	MD7005 MD7004
> 0.8/1.0 20% or Unmatched PNP	▪ 2N3813 2N3807 ○ 2N3801 ▪ 2N3812 2N3806 ○ 2N3800	MD7003 ○ MD7006	2N5796 MD2905A ▪ MD2905AF 2N5795 MD2904A ▪ MD2904AF	2N3727 MD2905 ▪ MD2905F MD3251 ▪ MD3251F 2N4939 ▪ 2N4942 MD2904 ▪ MD2904F MD3250 ▪ MD3250F MD7007 MD7007A	MD7001 MD984	MD3467 ▪ MD3467F MD3762 ▪ MD3762F	MD5000	
Complementary Pairs 1-NPN/1-PNP		MD6100		▪ 2N3838** 2N4854** 2N4885	MD985 ▪ MD985 MD6002 ▪ MD6002F MD6003 ▪ MD6003F MD7011 MD6001 ▪ MD6001F		MD986 ▪ MD986F	



○ CASE 655-01



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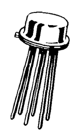

CASE 654-07

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**Motorola approved to supply JAN & JANTX product

Bold Face Motorola preferred types – chosen using performance and cost as criteria.

CASE 655 01 CASE 610 CASE 654 04 ▪

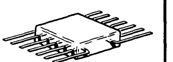
SMALL-SIGNAL HERMETIC TRANSISTORS (continued)

TABLE 8 – QUAD TRANSISTORS (Flat Pack)

Each quad transistor contains four similar transistors that can be used to reduce space requirements. These transistors are listed first in order of decreasing breakdown voltage (BV_{CEO}), then in order of decreasing maximum collector current ($I_{C\ max}$) and dc current gain (h_{FE}).

Device Type	BV_{CEO} Volts Min	I_C mA Max	h_{FE} Min/Max	& $V_{CE(sat)}$ Volts Max	@ I_C mA	t_{on} ns Max	t_{off} ns Max	f_T MHz Typ
NPN								
MQ2482	60	30	250/ –	0.35	1.0	–	–	70
MQ930	45	30	150/ –	0.35	1.0	–	–	70
MQ3725	40	1000	30/ –	0.52	500	45	75	300
MQ2219A	40	600	100/300	0.3	150	60	350	270
MQ2218	30	600	40/120	0.4	150	60	350	220
PNP								
MQ2905A	60	600	100/300	0.4	150	45	130	225
MQ3799	60	50	300/900	0.2	0.1	–	–	130
MQ3799A*	60	50	300/900	0.2	0.1	–	–	130
MQ3762 } 2N5146 }	40	1500	20/ –	1.0	1000	40	120	200
MQ3467	40	1000	20/ –	0.5	500	40	120	200
MQ2904	40	600	40/120	0.4	150	45	130	225
MQ3251	40	50	100/300	0.25	10	–	–	350

*Matched Quad



Case 607
TO-86

TABLE 9 – QUAD TRANSISTORS (Dual-in-Line-Ceramic)

Package count and associated assembly costs can be reduced significantly with quad-packaged transistors. Each low-cost device contains four transistors in a ceramic dual-in-line package. This package, which is similar to the one used for many I/C's, is hermetic and can be easily handled by most automatic insertion equipment.

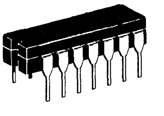
Either four matched transistors or a pair of PNP devices and a pair of NPN complements are available.

Device Type	BV_{CEO} Volts Min	I_C mA Max	h_{FE} Min/Max	& $V_{CE(sat)}$ Volts Max	@ I_C mA	t_{on} ns Max	t_{off} ns Max	f_T MHz Typ
NPN								
MHQ2221	40	500	40/ –	0.4	150	30	225	350
MHQ2222	40	500	100/ –	0.4	150	25	250	350
MHQ2484	30	50	300/ –	0.35	1.0	–	–	175
MHQ2483	25	50	150/ –	0.35	1.0	–	–	175
MHQ2369	15	500	40/ –	0.25	10	9.0#	15#	550
PNP								
MHQ2907A	60	600	100/ –	0.4	150	30#	100#	350
MHQ3251A	60	200	100/300	0.25	10	50#	225#	400
MHQ3799	60	50	300/ –	0.2	0.1	–	–	325
MHQ2906	40	600	40/ –	0.4	150	30#	100#	350
MHQ3250	40	200	50/200	0.25	10	50#	225#	400
MHQ3798	40	50	150/ –	0.2	0.1	–	–	325
MHQ3467	40	1.0	20/ –	0.5	500	40	120	–
MHQ3546	12	200	25/ –	0.25	50	15#	25#	1000

COMPLEMENTARY

Device Type	BV_{CEO} Volts Min	I_C mA Max	h_{FE} Min/Max	& $V_{CE(sat)}$ Volts Max	@ I_C mA	t_{on} ns Max	t_{off} ns Max	f_T NPN	f_T PNP
MHQ6100A	45	50	150/ –	0.25	1.0	–	–	175	130
MHQ6100	40	50	75/ –	0.25	1.0	–	–	175	130
MHQ6001	30	300	40/ –	0.4	150	–	–	400	
MHQ6002	30	300	100/ –	0.4	150	–	–	400	

#Typ

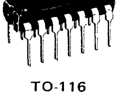


TO-116
Case 632-02
(Ceramic)

TABLE 10 – QUAD TRANSISTORS (Dual-in-Line-Plastic)

Each quad transistor contains four similar transistors that can be used to reduce space requirements. All the advantages of dual-in-line packaging at lower cost than ceramic packaging.

Device Type	BV_{CEO} Volts Min	I_C mA Max	h_{FE} Min/Max	& $V_{CE(sat)}$ Volts Max	@ I_C mA	t_{on} ns Max	t_{off} ns Max	f_T MHz Min	Package
NPN									
MPQ3725	40	500	25/–	0.45	500	35	60	250	TO-116
MPQ3303	12	1000	40/200	0.33	300	15	20	400	TO-116



TO-116
Case 605-5
(Plastic)

SMALL-SIGNAL HERMETIC TRANSISTORS (continued)

TABLE 11 – GERMANIUM MESA R. F. AMPLIFIERS

NOISE FIGURE (typ)	f_T	LOW CURRENT 1 mA - 50 mA, BV_{CEO} 35 V	LOW CURRENT, BV_{CEO} 25 V	LOW CURRENT, BV_{CEO} 15 V	MEDIUM CURRENT 25 mA - 100 mA, BV_{CEO} 35 V	MEDIUM CURRENT, BV_{CEO} 25 V	MEDIUM CURRENT, BV_{CEO} 15 V
< 3.0 dB	< 600 MHz						Usable to 500 mA △ 2N1561 △ **2N1562** ▲ 2N1692 ▲ **2N1693**
< 3.0 dB	> 600 MHz		■ 2N2415 ■ **2N2416** ■ 2N3279 ■ 2N3280 ■ 2N3281 ■ **2N3282** ■ 2N3783 ■ 2N3784 ■ **2N3785**			■ **2N2996** ■ 2N2997 ■ 2N2998	
< 6.0 dB	< 600 MHz				□ **2N499*** □ 2N499A* **2N502** 2N502A,B*		
< 6.0 dB	> 600 MHz	■ AF109R ■ AF139 ■ AF239	■ 2N3127* ■ 2N3283 ■ 2N3284 ■ 2N3285 ■ **2N3286**				2N1141,A 2N1142* 2N1142A 2N1143,A 2N1195* ● 2N1742
> 6.0 dB	< 600 MHz			■ **2N700** ■ 2N700A*		■ **2N705*** ■ **2N2273*** ■ 2N3323 ■ 2N3324 ■ 2N3325 ○ **MM2273**	

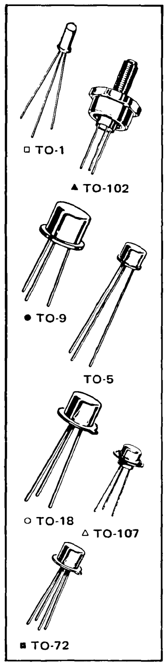
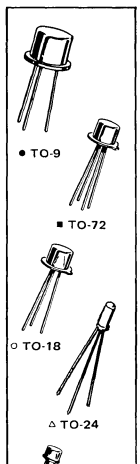


TABLE 12 – GERMANIUM MESA PNP SWITCHES

$t_{s(typ)}$	$I_{C(max)}$ to 55 mA, BV_{CEO} to 6.0 V	$I_{C(max)}$ to 150 mA, BV_{CEO} to 20 V	$I_{C(max)}$ to 150 mA, BV_{CEO} to 8.0 V	$I_{C(max)}$ to 175 mA, BV_{CEO} to 35 V	$I_{C(max)}$ to 175 mA, BV_{CEO} to 30 V	$I_{C(max)}$ to 550 mA, BV_{CEO} to 25 V
< 20 ns			□ **2N501** □ 2N501A* ○ 2N711A,B ○ 2N741,A ○ 2N779,A ○ 2N828,A ○ 2N829 ○ 2N837 ○ 2N838 ○ 2N960 ○ 2N961 ○ **2N962*** ○ 2N963 ○ 2N964* ○ 2N964A ○ 2N965 ○ 2N966 ○ **2N967** ○ 2N985			
< 50 ns				■ **MM2273**	○ **2N705*** ○ 2N710 ○ 2N711 ○ 2N827 ○ 2N968 ○ 2N969 ○ **2N970** ○ 2N971 ○ 2N972 ○ 2N973 ○ 2N974 ○ 2N975 ○ **2N2258** ○ 2N2259 ○ **2N2635** ○ **2N2955** ○ 2N2956 ○ 2N2957	**2N1204,A** 2N1494,A 2N1495 2N1496 **2N2096** 2N2097 2N2099 2N2100 **2N2381** 2N2382 2N3883
< 90 ns	○ 2N559*	● **2N1499,A,B** ● 2N1500 ● 2N1754 ● 2N2048				
< 200ns		△ **2N393*** 2N404* 2N404A* ○ **MM404** ○ **MM404A**				



*Motorola approved to supply JAN product
Bold Face Motorola preferred types – chosen using performance and cost as cirteria.

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SILICON RF TRANSISTORS

Motorola offers the industry's most complete selection of silicon RF transistors. In addition to NPN and PNP low-noise small-signal transistors and ultra-fast current-mode switches, Motorola can provide RF power transistors for all communications bands at frequencies to 1.0 GHz. Transistors are available for most applications in either polarity, NPN or PNP, with a wide range of power levels. Families of RF power transistors designed for optimum operation from a 12-volt supply are available for mobile communications applications.

Many of Motorola's RF power transistors are Balanced Emitter Transistors (BET). These multiple-emitter devices feature a thin-film nichrome resistor in series with each of the individual emitters. The effect of these resistors is to distribute the current equally among the emitters and reduce the localized heating that leads to second breakdown and destruction of the transistor. Thus the Balanced Emitter Transistors make ideal output devices by virtue of their ability to withstand large mismatches without danger of second breakdown.

This Selector Guide presents information on most of Motorola's small signal devices with f_T greater than 300 MHz and RF power devices with RF power outputs greater than 1.0 Watt at frequencies greater than 2.0 MHz. Other transistors for RF applications may be found in the Selector Guides for Small-Signal Hermetic Transistors and Plastic Encapsulated Small-Signal Silicon Transistors.

Four tables in this Selector Guide cover the major application categories:

RF Power Amplifiers **Table 1**
. . . a wide variety of devices for communications and general amplifier applications.

Low-Noise Small-Signal Amplifiers **Table 2**
. . . including devices designed specifically for CATV applications.

UHF and Microwave Oscillators **Table 3**
. . . provide high outputs at frequencies to 2.0 GHz.

High-Speed Current-Mode Switches **Table 4**
. . . ultra-fast switching for instrumentation applications.

INDEX

The following table is a numerical-alphabetical index to Silicon RF transistors manufactured by Motorola. The number of the selection table in which each device is further characterized is also listed.

5

Device Type	Package	Table	Device Type	Package	Table	Device Type	Package	Table	Device Type	Package	Table
2N2857*	TO-72	2,3	2N4428	TO-39	1	2N5842	TO-72	4	MM8001	TO-39	2
2N2947	TO-3	1	2N4957	TO-72	2	2N5846	TO-102	1	MM8006	TO-72	2
2N2948	TO-3	1	2N4958	TO-72	2	2N5847	145A-01	1	MM8007	TO-72	2
2N2949	TO-107	1	2N4959	TO-72	2	2N5848	145A-01	1	MM8008	TO-107	3
2N2950	TO-102	1	2N5016	TO-60	1	2N5849	145A-02	1	MM8009	TO-39	1,3
2N3137	TO-5	1	2N5024	TO-72	4	2N5851	TO-72	4	MM8010	TO-107	3
2N3287	TO-72	2	2N5031	TO-72	2	2N5852	TO-72	4	MM8011	TO-107	3
2N3288	TO-72	2	2N5032	TO-72	2	2N5862	145A-02	1	MRF501	TO-72	2
2N3289	TO-72	2	2N5070	TO-60	1	2N5941	211-01	1	MRF502	TO-72	2
2N3290	TO-72	2	2N5071	TO-60	1	2N5942	211-02	1	MRF8004	TO-39	1
2N3291	TO-72	2	2N5090	TO-60	1	2N5943	TO-39	2			
2N3292	TO-72	2	2N5108	TO-39	1,3	2N5947	144D-01	2			
2N3293	TO-72	3	2N5109	TO-39	2	2N6080	145A-01	1			
2N3294	TO-72	2	2N5160	TO-39	1	2N6081	145A-01	1			
2N3296	TO-102	1	2N5161	TO-60	1	2N6082	145A-01	1			
2N3297	TO-3	1	2N5162	TO-60	1	2N6083	145A-01	1			
2N3375*	TO-60	1	2N5179	TO-72	2,3	2N6084	145A-01	1			
2N3553*	TO-39	1	2N5583	TO-39	4	2N6094	211-01	1			
2N3632	TO-60	1	2N5589	144B-02	1	2N6095	211-01	1			
2N3839	TO-72	2	2N5590	145A-01	1	2N6096	211-01	1			
2N3866*	TO-39	1,2	2N5591	145A-01	1	2N6097	211-01	1			
2N3866A*	TO-39	1	2N5635	144B-02	1	2N6135	144D-04	2			
2N3924	TO-39	1	2N5636	144B-02	1	2N6136	145A-01	1			
2N3925	TO-102	1	2N5637	145A-01	1	2N6166	211-02	1			
2N3926	TO-60	1	2N5641	144B-02	1	2N6255	TO-39	1			
2N3927	TO-60	1	2N5642	145A-01	1	2N6256	249-01	1			
2N3948	TO-39	1	2N5643	145A-01	1	2N6304	TO-72	2			
2N3950	TO-60	1	2N5644	145A-01	1	2N6305	TO-72	2			
2N3959*	TO-18	4	2N5645	145A-01	1	MM1500	TO-107	3			
2N3960*	TO-18	4	2N5646	145A-01	1	MM1501	TO-107	3			
2N3961	TO-102	1	2N5829	TO-72	2	MM1553	145C-01	1			
2N4012	TO-60	1	2N5835	TO-72	4	MM4018	TO-39	1			
2N4072	TO-18	1	2N5836	TO-46	4	MM4019	TO-39	1			
2N4073	TO-5	1	2N5837	TO-46	4	MM4049	TO-72	4			
2N4427	TO-39	1	2N5841	TO-72	4	MM8000	TO-39	2			

*JAN and JANTX Type, also available

SILICON RF TRANSISTORS (continued)

TABLE 1 – RF POWER AMPLIFIERS

A wide variety of devices for communications and general amplifier applications. The transistors are listed first in order of increasing test frequency; then in order of increasing output power rating.

Device Type	Test Conditions f MHz	@ V_{CC} Volts	P_{out} Watts Min	Power Gain dB Min	BV_{CBO} Volts Min	Package
NPN						
MRF8004	27	12.5	3.5	10	60	TO-39
2N3296	30	30	3.0PEP	16	60	TO-102
2N3297	30	30	12PEP	10	60	TO-3
2N2948	30	25	15	7.0	40	TO-3
2N5070	30	28	25PEP	13	65	TO-60
2N5941	30	28	40PEP	13	65	211-01
2N5942	30	28	80PEP	13	65	211-02
2N5846	50	12 5	3 5	10	36	TO-102
2N2949	50	25	3.5	10	60	TO-107
2N2950	50	25	3.5	10	60	TO-102
2N5847	50	12.5	8.0	10	36	145A-01
2N2947	50	25	15	7 0	60	TO-3
2N5848	50	12.5	20	8.0	48	145A-01
2N5849	50	12.5	40	7.5	48	145A-02
2N3950	50	28	50	8.0	65	TO-60
2N4130	70	28	50	8.0	80	TO-3
2N5071	76	28	24	9.0	65	TO-60
2N3375†	100	28	7.5	8 8	65	TO-60
2N5862	150	27	75	7.0	65	145A-02
MM1553	150	44	75	8.2	100	145C-01
2N6166	150	28	100	4 5	65	211-02
2N4072	175	13.6	0.25	10	40	TO-18
2N4073	175	13.6	0.5	10	40	TO-5
2N4427	175	12	1.0	10	40	TO-39
2N3553†	175	28	2.5	10	65	TO-39
2N6255	175	12.5	3 0	7.8	36	TO-39
2N5589	175	13.6	3.0	8.2	36	144B-03
2N6080	175	12.5	4.0	12	36	145A-01
2N3924	175	13 6	4.0	6.0	36	TO-39
2N3961	175	28	4.0	9.0	65	TO-102
2N3925	175	13.6	5.0	5.9	36	TO-102
2N3926	175	13.6	7.0	5 5	36	TO-60
2N5641	175	28	7 0	8 4	65	144B-03
2N5590	175	13.6	10	5.2	36	145A-01
2N3927	175	13.6	12	4.8	36	TO-60
2N3632	175	28	13 5	5 9	65	TO-60
2N6081	175	12.5	15	6.3	36	145A-01
2N5642	175	28	20	8.2	65	145A-01
2N6082	175	12.5	25	6 2	36	145A-01
2N5591	175	13.6	25	4.4	36	145A-01
2N6083	175	12.5	30	5 7	36	145A-01
2N6084	175	12.5	40	4 5	36	145A-01
2N5643	175	28	40	7.6	65	145A-01
2N3137	250	20	0.4	6 0	40	TO-5
2N3866	400	28	1.0	10	55	TO-39
NPN (Continued)						
2N3866A	400	28	1.0	10	55	TO-39
2N3948	400	13.6	1.0	6.0	36	TO-39
2N5090	400	28	1.2	5.5	55	TO-60
2N5635	400	28	2.5	6.2	60	144B-03
2N5636	400	28	7 5	5.7	60	144B-03
2N5016	400	28	15	4 8	65	TO-60
2N5637	400	28	20	4.6	60	145A-01
2N6256	470	12.5	0.5	7.0	36	249-01
2N5644	470	12.5	1.0	7.0	36	145A-01
2N5944	470	12.5	2.0	9.0	36	244-01
2N5945	470	12.5	4.0	8.0	36	244-01
2N5645	470	12.5	4.0	6.0	36	145A-01
2N5946	470	12.5	10	6.0	36	244-01
2N5646	470	12.5	12	4.7	36	145A-01
2N6136	470	12.5	25	4.0	36	145A-01
2N4428	500	28	0.75	10	55	TO-39
MM8009	1000	28	0 9	4 5	55	TO-39
2N5108	1000	28	1.0	5.0	55	TO-39
2N4012	1000	28	2.5‡		65	TO-60
PNP						
MM4018	175	12.5	0.5	10	40	TO-39
MM4019	175	28	2.5	10	60	TO-39
2N6094	175	12.5	4.0	12	36	211-01
2N5161	175	28	7.5	8.8	60	TO-60
2N6095	175	12.5	15	6.3	36	211-01
2N6096	175	12.5	30	5.7	36	211-01
2N5162	175	28	30	6.0	60	TO-60
2N6097	175	12.5	40	4.5	36	211-01
2N5160	400	28	1.0	8.0	60	TO-39

†JAN Types Also Available
‡Tripler Output

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TABLE 2 – LOW-NOISE SMALL-SIGNAL AMPLIFIERS

Including devices designed specifically for CATV applications. The transistors are listed first in order of increasing test frequency, then in order of increasing noise figure.

Device Type	Test Conditions f MHz	& V_{CE} Volts	NF dB Max	Power Gain dB Min	f_T MHz Min	Package
NPN						
MM8000	200	15	2.7*	11.4*	700	TO-39
MM8001	200	15	2.7*	11.4*	900	TO-39
2N5109	200	15	3.0*	11	1200	TO-39
MRF502	200	6.0	4.0*	17*	800	TO-72
MRF501	200	6.0	4.5*	15*	600	TO-72
2N5179	200	6.0	4.5	15	900	TO-72
2N3287	200	10	6.0	17	350	TO-72
2N3288	200	10	6.0	17	350	TO-72
2N3289	200	10	7.0	17	300	TO-72
2N3290	200	10	7.0	17	300	TO-72
2N3294	200	10	7.0*	14	250	TO-72
2N5943	200	15	8.0	11.4*	1200	TO-39
2N3291	200	10	8.0	16	250	TO-72
2N5947	200	20	8.5	10	1100	144D-01
2N6135	200	18	9.0	10	1100	144D-04
NPN (Continued)						
2N3292	200	10	9.0	16	250	TO-72
2N5031	450	6.0	2.5	14	1000	TO-72
2N5032	450	6.0	3.0	14	1000	TO-72
2N3839	450	6.0	3.4	12.5	1000	TO-72
MM8006	450	6.0	3.8	14	1000	TO-72
2N2857†	450	6.0	4.5	12.5	1000	TO-72
2N6305	450	5.0	4.5	12	1200	TO-72
MM8007	450	6.0	5.0	12	1000	TO-72
2N6304	450	5.0	5.5	15	1400	TO-72
PNP						
2N5829	450	10	2.5	17	1200	TO-72
2N4957	450	10	3.0	17	1200	TO-72
2N4958	450	10	3.3	16	1000	TO-72
2N4959	450	10	3.8	15	1000	TO-72

*Typical
†JAN Type Also Available

SILICON RF TRANSISTORS (continued)

TABLE 3 – UHF and MICROWAVE OSCILLATORS

The transistors are listed first in order of increasing test frequency; then in order of increasing oscillator output power.

Device Type	Test Conditions f MHz	& V_{CE} Volts	P_{out} (Oscillator) mW Min	f_T MHz Min	BV_{CBO} Volts Min	Package
NPN						
2N3293	257	10	2.0	250	20	TO-72
2N5179	500	10	20	900	20	TO-72
2N2857†	500	10	30	1000	30	TO-72
MM1501	1500	20	150	1000*	30	TO-107
MM1500	1500	20	250	1500*	30	TO-107
MM8009	1680	20	300*	1000	55	TO-39
2N5108	1680	20	300*	1200	55	TO-39
MM8011	2000	20	100	1100*	35	TO-107
MM8010	2000	20	200	1100*	35	TO-107
MM8008	2000	20	300	1100*	35	TO-107

*Typical †JAN Type Also Available.

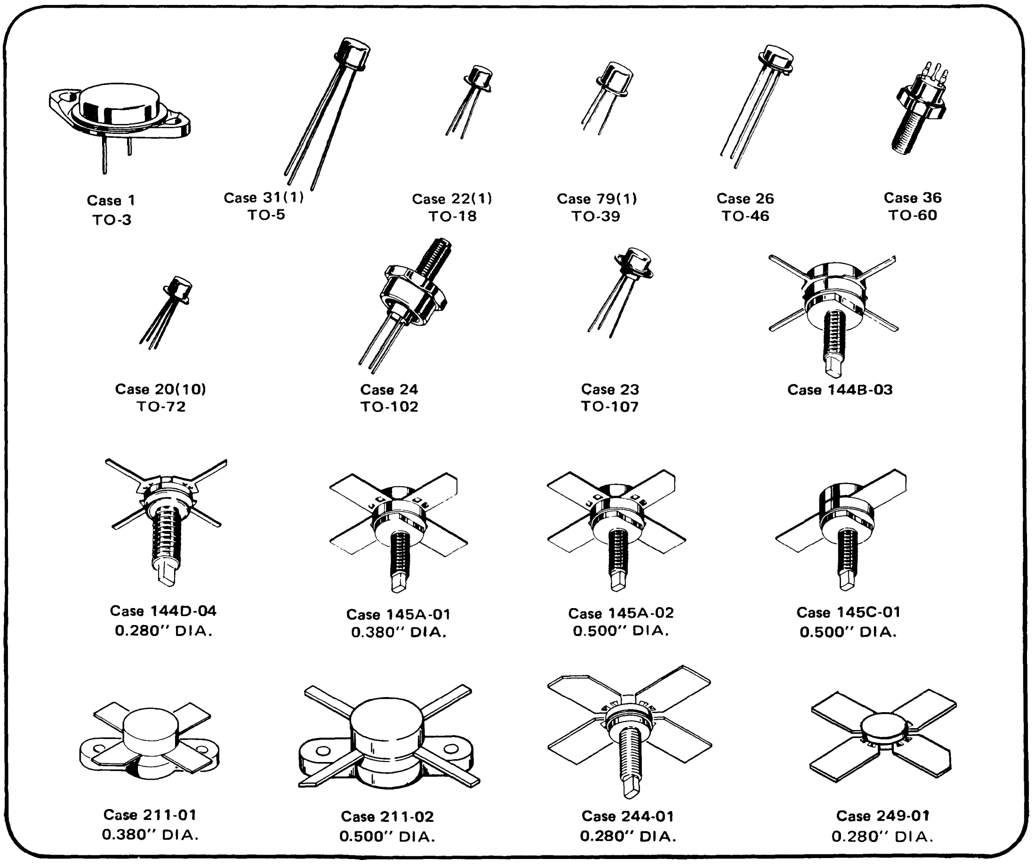
TABLE 4 – HIGH-SPEED CURRENT MODE SWITCHES

Ultra-fast switching for instrumentation applications is provided by these devices which feature high f_T and low $r_b'C_c$ over a wide range of collector current. The transistors are listed first in order of increasing collector current (test) and then in order of increasing f_T.

Device Type	Test Conditions I_C mA	& V_{CE} Volts	f_T MHz Min	$r_b'C_c$ ps Max	C_{cb} pF Max	Package
NPN						
2N5851	10	4.0	800	15	1.5	TO-72
2N5852	10	4.0	1100	15	1.5	TO-72
2N3959†	10	10	1300	25	2.5**	TO-18
2N5024	10	4.0	1300	50	1.5	TO-72
2N3960†	10	10	1600	40	2.5**	TO-18
2N5835	10	6.0	2500	5.0*	0.8	TO-72
2N5842	25	4.0	1700	40	1.5	TO-72
2N5841	25	4.0	2200	25	1.5	TO-72
2N5836	50	6.0	2000	6.0*	3.5	TO-46
2N5837	100	3.0	1700	6.0*	5.0	TO-46
PNP						
MM4049	25	5.0	4000	15	1.25**	TO-72
2N5583	100	10	1300	8.0*	5.0	TO-39

Typical
**C_{ob}
†JAN Types Also Available

RF transistors are available in a variety of packages for many applications.



MICROWAVE DEVICES

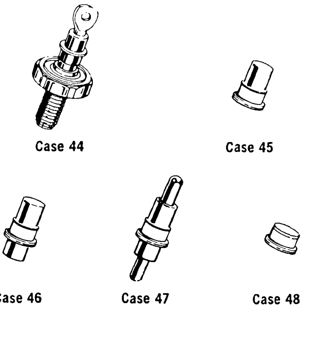
The Microwave Devices category includes a very broad line of step-recovery varactor multipliers, a wide range of microwave PIN switching diodes plus hot-carrier diodes for microwave mixer and detector applications.

Motorola's varactor multipliers provide high doubler and tripler efficiency over a wide range of microwave frequencies.

Table 1 — POWER VARACTOR MULTIPLIERS

BASIC DEVICE TYPE See Table 2 for Package Variations	JEDEC Variations	Maximum P_D @ $T_C = 75°C$ (1) @ $T_A = 75°C$ Watts	100% Functional Test f_{out} MHz	P_{out} min Watts	f_{in} MHz	P_{in} Watts	θ_{JC} °C/W Max	BV_R $I_R = 10\ \mu A$ Volts Min	R_S $V_R = 6.0$ V f = 50 MHz Ohms Typ	C_T $V_R = 6.0$ V f = 1.0 MHz pF Min	C_T pF Max
MV1812		3.3	10000	1.0	5000	2.6	38	20	1.0	0.5	1.0
	1N5156	3.3	10000	1.0	5000	2.6	38	20	1.0	0.5	1.0
	1N5157	3.3	10000	1.0	5000	2.6	38	20	1.0	0.5	1.0
MV1817-1		5.0	6400	0.25	800	1.0	25	35	0.8	0.9	1.1
MV1817		3.6	6400	0.20	800	1.0	35	35	0.8	0.8	1.2
MV1810-1		6.2	6000	2.0	2000	5.0	20	35	0.9	1.71	2.09
	1N5155A	6.2	6000	2.0	2000	5.0	20	35	0.9	1.71	2.09
MV1810		3.5	6000	2.0	2000	5.0	35	35	0.9	1.0	3.0
	1N5154	3.5	6000	2.0	2000	5.0	35	35	0.9	1.0	3.0
	1N5155	3.5	6000	2.0	2000	5.0	35	35	0.9	1.0	3.0
MV1811-1		8.2	4000	7.2	2000	12	15	35	0.5	4.5	5.5
MV1811		6.2	4000	5.0	2000	10	20	35	0.5	4.0	6.0
MV1816-1		8.2	2400	0.75	300	3.0	15	75	0.6	2.7	3.3
MV1816		5.3	2400	0.6	300	3.0	23	75	0.6	2.4	3.6
MV1809-1		14	2000	14.5	1000	25	9.0	75	0.25	10.8	13.2
MV1809		9.0	2000	10.4	1000	20	14	75	0.25	9.6	14.4
MV1808-1		8.4	2000	7.2	1000	12	15	75	0.5	5.4	6.6
	1N5152A	8.4	2000	7.2	1000	12	15	75	0.5	5.4	6.6
	1N5153A	8.4	2000	7.2	1000	12	15	75	0.5	5.4	6.6
MV1808		5.5	2000	6.0	1000	12	23	75	0.5	5.0	7.5
	1N5151	5.5	2000	6.0	1000	12	23	75	0.5	5.0	7.5
	1N5152	5.5	2000	6.0	1000	12	23	75	0.5	5.0	7.5
	1N5153	5.5	2000	6.0	1000	12	23	75	0.5	5.0	7.5
MV1807-1		21	1000	25.1	500	37	6.0	80	0.25	10.8	13.2
	1N5150A	21	1000	25.1	500	37	6.0	80	0.25	10.8	13.2
MV1807		14 (1)	1000	24	500	37	9.0	80	0.25	5.0	20
	1N5150	14 (1)	1000	24	500	37	9.0	80	0.25	5.0	20
MV1806		10 (1)	1000	11	500	20	9.0	80	0.25	5.0	20
	1N5149	10 (1)	1000	11	500	20	9.0	80	0.25	5.0	20
	1N4388	10	1000	11	500	20	9.0	100	0.25	—	20
MV1805		18 (1)	750	26	250	40	7.0	80	0.2	20	30
MV1804		20	450	15	150	30	5.0	150	0.7	—	35
	1N4387	20	450	15	150	30	5.0	150	0.7	—	35

Typical case capacitance for A, B, and C packages are 0.25 pF, 0.15 pF, and 0.47 pF respectively.



Case 44 Case 45 Case 46 Case 47 Case 48

Table 2 — PACKAGE CONFIGURATIONS AND DESCRIPTIONS

DEVICE TYPE	(A) (Pill) 48	(B) (Pill or Prongs) 46	(C) (Cartridge) 47	(D) 45	(J) (Stud) 44
MV1804			●		1N4387
MV1805			●		●
MV1806			1N5149		1N4388
MV1807 MV1807-1			1N5150 1N5150A		● ●
MV1808 MV1808-1	1N5151 ●	1N5152 1N5152A	1N5163 1N5153A	● ●	● ●
MV1809 MV1809-1			● ●		● ●
MV1810 MV1810-1	1N5154 ●	1N5155 1N5155A		● ●	
MV1811 MV1811-1	● ●	● ●	● ●	● ●	● ●
MV1812	1N5156	1N5157		●	
MV1816 MV1816-1	● ●	● ●		● ●	
MV1817 MV1817-1	● ●	● ●		● ●	

Key to columnar designations opposite type numbers: "●" indicates availability, specific type number (i.e., "1N5149") indicates availability of JEDEC-type. When ordering, follow type number by alphabetical identification of package type required (i.e., "MV1805C").

FIGURE 1 — Typical Doubling Performance

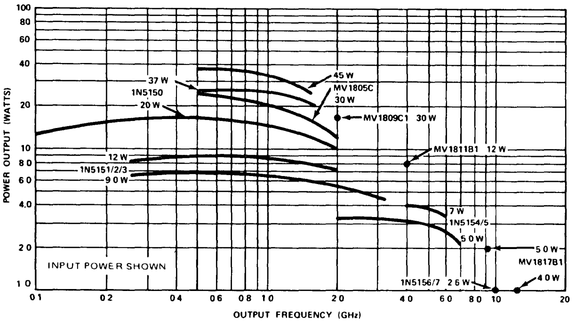
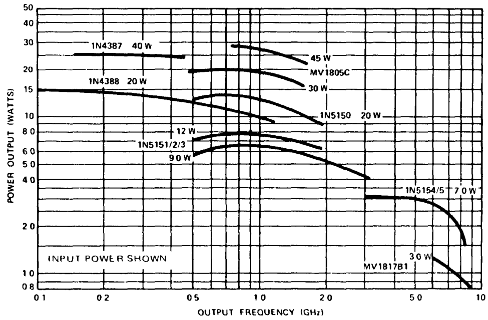


FIGURE 2 — Typical Tripling Performance



PIN SWITCHING DIODES

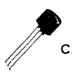

CASE 226

PIN switching diodes designed for VHF band switching and general-purpose switching. Supplied in the low-inductance Mini-L package and ideal for low-cost, high-volume requirements.

PIN SWITCHING DIODES

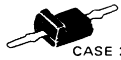
Device Type	ELECTRICAL CHARACTERISTICS				
	$V_{(BR)R}$ $I_R = 10\ \mu Adc$ Volts Min	R_S $I_F = 10\ mAdc$ ohm Max	C_T $V_R = 20\ V$ f = 1.0 MHz pF Max	L_S f = 250 MHz nH Typ	C_C f = 1.0 MHz pF Typ
MPN3401	35	0.7	1.0	3.0	0.1
MPN3402	35	0 6	2.0	3.0	0.1

DUAL EPICAP TUNING DIODE


CASE 29 (5)
TO-92

Device Type	C_T, Diode Capacitance $V_R = 3.0$ Vdc, f = 1.0 MHz pF		C_R, Capacitance Ratio C_3/C_{30} f = 1.0 MHz		Q, Figure of Merit $V_R = 3.0$ Vdc f = 100 MHz
	Min	Max	Min	Max	Min
MV104	37	42	2 5	2 8	100

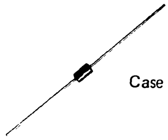
MINI-L ABRUPT JUNCTION TUNING DIODES

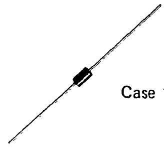

CASE 226

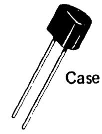
Device Type	C_T, Diode Capacitance $V_R = 4.0$ Vdc, f = 1.0 MHz pF Min/Max	C_R, Capacitance Ratio C2/C30 f = 1.0 MHz Min	Q, Figure of Merit $V_R = 4.0$ Vdc, f = 100 MHz Min
MV3501	6 1/7.5	2.7	225
MV3502	7 4/9 0	2 8	225
MV3503	9 0/11	2.8	200
MV3504	10 8/13.2	2.8	200
MV3505	13 5/16 5	2 9	200
MV3506	16 2/19.8	2 9	175
MV3507	19 8/24 2	2 9	175

EPICAP TUNING DIODES


Case 45


Case 51


Case 146


Case 182

Nominal Capacitance pF @ V_R = 4.0 V, f = 1.0 MHz	Device Type	Capacitance Ratio @ pF Min/Typ Min/Max*	V1/V2	Q @ 4.0 V, f = 50 MHz f = 100 MHz* f = 20 MHz† Min	Maximum Working Voltage	Case
1.0	MV1858D (1)	2.1/2.3	C4/C20	350*	60	45
2.2	MV1860D (2)	2.5/2.7	C4/C60	350*	60	45
3.3	MV1862D	2.6/2.8	C4/C60	300*	60	45
4.7	MV1863D	2.6/2.8	C4/C60	300*	60	45
6.8	MV1864D	2.7/2.9	C4/C60	300*	60	45
	1N5139 (3)	2.7/2.9	C4/C60	350	60	51
	1N5461A (4)	2.7/3.1*	C2/C30	600	30	51
	1N5441A (4)	2.5/3.1*	C2/C30	450	30	51
	MV2101	2.5/3.2*	C2/C30	450	30	182
	MV2201	1.9/2.3*	C1/C10	300	25	182
	MV1620	2.0/2.2	C2/C20	300	20	51
8.2	MV1865D	2.7/2.9	C4/C60	300*	60	45
	1N5462A (4)	2.8/3.1*	C2/C30	600	30	51
	1N5442A (4)	2.5/3.1*	C2/C30	450	30	51
	MV2102	2.5/3.2*	C2/C30	450	30	182
	MV1622	2.0/2.2	C2/C20	300	20	51
10	MV1866D	2.8/3.0	C4/C60	250*	60	45
	1N5140 (3)	2.8/3.0	C4/C60	300	60	51
	MV1866	3.0/3.1*	C4/C60	500	60	51
	1N5463A (4)	2.8/3.1*	C2/C30	550	30	51
	1N5443A (4)	2.6/3.1*	C2/C30	400	30	51
	MV2103	2.5/3.2*	C2/C30	400	30	182
	MV2203	2.0/2.4*	C1/C10	200	25	182
	MV1624	2.0/2.3	C2/C20	300	20	51
12	MV1868D	2.8/3.0	C4/C60	200*	60	45
	1N5141 (3)	2.8/3.0	C4/C60	300	60	51
	MV1868	3.0/3.1*	C4/C60	500	60	51
	1N5464A (4)	2.8/3.1*	C2/C30	550	30	51
	1N5444A (4)	2.6/3.1*	C2/C30	400	30	51
	MV2104	2.5/3.2*	C2/C30	400	30	182
	MV1626	2.0/2.3	C2/C20	300	20	51
15	MV1870D	2.8/3.0	C4/C60	200*	60	45
	1N1542 (3)	2.8/3.0	C4/C60	250	60	51
	MV1870	3.0/3.2*	C4/C60	400	60	51
	1N5465A (4)	2.8/3.1*	C2/C30	550	30	51
	1N5445A (4)	2.6/3.1*	C2/C30	400	30	51
	MV2105	2.5/3.2*	C2/C30	400	30	182
	MV830	1.8/2.0	C4/C25	30	30	51
	MV2205	2.1/2.5*	C1/C10	200	25	182
	MV1628	2.0/2.3	C2/C20	250	20	51
18	1N5143 (3)	2.8/3.0	C4/C60	250	60	51
	MV1871	3.0/3.2*	C4/C60	400	60	51
	1N5466A (4)	2.9/3.1*	C2/C30	500	30	51
	1N5446A (4)	2.6/3.1*	C2/C30	350	30	51
	MV2106	2.5/3.2*	C2/C30	350	30	182
	MV831	1.8/2.0	C4/C25	25	30	51
	MV1630	2.0/2.3	C2/C20	250	20	51
20	1N5467A (4)	2.9/3.1*	C2/C30	500	30	51
	1N5447A (4)	2.6/3.1*	C2/C30	350	30	51
	MV1632	2.0/2.3	C2/C20	250	20	51
22	1N5144 (3)	3.2/3.4	C4/C60	200	60	51
	MV1872	3.2/3.3*	C4/C60	400	60	51
	1N5468A (4)	2.9/3.2*	C2/C30	500	30	51
	1N5448A (4)	2.6/3.2*	C2/C30	350	30	51
	MV2107	2.5/3.2*	C2/C30	350	30	182
	MV832	1.8/2.1	C4/C25	25	30	51
	MV1634	2.0/2.3	C2/C20	250	20	51
27	1N5145 (3)	3.2/3.4	C4/C60	200	60	51
	MV1874	3.2/3.3*	C4/C60	300	60	51
	1N5469A (4)	2.9/3.2*	C2/C30	500	30	51
	1N5449A (4)	2.6/3.2*	C2/C30	350	30	51
	MV2108	2.5/3.2*	C2/C30	300	30	182
	MV833	1.8/2.1	C4/C25	25	30	51
	MV1636	2.0/2.3	C2/C20	200	20	51

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EPICAP TUNING DIODES (continued)

Nominal Capacitance pF @ V_R = 4.0 V, f = 1.0 MHz	Device Type	Capacitance Ratio @ pF Min/Typ Min/Max*	V1/V2	Q @ 4.0 V, f = 50 MHz f = 100 MHz* f = 20 MHz† Min	Maximum Working Voltage	Case
33	1N5146 (3)	3.2/3.4	C4/C60	200	60	51
	MV1876	3.2/3.4*	C4/C60	300	60	51
	1N5470A (4)	2.9/3.2*	C2/C30	500	30	51
	1N5450A (4)	2.6/3.2*	C2/C30	350	30	51
	MV2109	2.5/3.2*	C2/C30	200	30	182
	MV834	1.9/2.12	C4/C25	20	30	51
	MV2209	2.1/2.5*	C1/C10	150	25	182
	MV1638	2.0/2.4	C2/C20	200	20	51
39	1N5147 (3)	3.2/3.4	C4/C60	200	60	51
	MV1877	3.2/3.4*	C4/C60	300	60	51
	1N5471A (4)	2.9/3.2*	C2/C30	450	30	51
	1N5451A (4)	2.6/3.2*	C2/C30	300	30	51
	MV2110	2.5/3.2*	C2/C30	150	30	182
	MV835	1.9/2.12	C4/C25	20	30	51
	MV1640	2.0/2.4	C2/C20	200	20	51
47	1N5148 (3)	3.2/3.4	C4/C60	200	60	51
	MV1878	3.2/3.4*	C4/C60	300	60	51
	1N5472A (4)	2.9/3.2*	C2/C30	400	30	51
	1N5452A (4)	2.6/3.2*	C2/C30	250	30	51
	MV2111	2.5/3.2*	C2/C30	150	30	182
	MV836	1.9/2.15	C4/C25	15	30	51
	MV1642	2.0/2.4	C2/C20	200	20	51
56	1N5473A (4)	2.9/3.3*	C2/C30	300	30	51
	1N5453A (4)	2.6/3.3*	C2/C30	200	30	51
	MV2112	2.6/3.3*	C2/C30	150	30	182
	MV837	1.9/2.15	C4/C25	15	30	51
	MV1644	2.0/2.4	C2/C20	150	20	51
68	1N5474A (4)	2.9/3.3*	C2/C30	250	30	51
	IN5454A (4)	2.7/3.3*	C2/C30	175	30	51
	MV2113	2.6/3.3*	C2/C30	150	30	182
	MV838	2.0/2.18	C4/C25	15	30	51
	MV1646	2.0/2.4	C2/C20	150	20	51
82	1N5475A (4)	2.9/3.3*	C2/C30	225	30	51
	1N5455A (4)	2.7/3.3*	C2/C30	175	30	51
	MV2114	2.6/3.3*	C2/C30	100	30	182
	MV839	2.0/2.18	C4/C25	10	30	51
	MV1648	2.0/2.4	C2/C20	150	20	51
100	1N5476A (4)	2.9/3.3*	C2/C30	200	30	51
	1N5456A (4)	2.7/3.3*	C2/C30	175	30	51
	MV2115	2.6/3.3*	C2/C30	100	30	182
	MV840	2.0/2.18	C4/C25	10	30	51
	MV1650	2.0/2.4	C2/C20	150	20	51
120	MV1652	–/2.6	C2/C20	250†	20	146
	MV2301	2.3/–	C2/C20	250†	20	182
150	MV1654	–/2.6	C2/C20	250†	20	146
	MV2302	2.3/–	C2/C20	250†	20	182
180	MV1656	–/2.6	C2/C20	200†	20	146
	MV2303	2.3/–	C2/C20	200†	20	182
200	MV1658	–/2.6	C2/C20	200†	20	146
	MV2304	2.3/–	C2/C20	200†	20	182
220	MV1660	–/2.6	C2/C20	150†	20	146
	MV2305	2.3/–	C2/C20	150†	20	182
250	MV1662 (5)	–/2.3	C2/C20	150†	20	146
	MV2306	2.3/–	C2/C20	150†	20	182
270	MV1664 (5)	–/2.3	C2/C20	100†	20	146
	MV2307	2.3/–	C2/C20	100†	20	182
330	MV1666 (5)	–/2.3	C2/C20	100†	20	146
	MV2308	2.3/–	C2/C20	100†	20	182

(1) $C_T = \pm 30\%$
(2) $C_T = \pm 20\%$
(3) Add Suffix "A" for $\pm$50% C_T Tolerance
(4) Substitute "B" Suffix for $\pm$50% C_T. Tolerance "C" Suffix for $\pm$20% C_T.
(5) Capacitance Ratio is C2/C15

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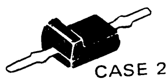
HYPER-ABRUPT JUNCTION TUNING DIODES

. . . designed with a capacitance change of greater than TEN TIMES for a bias change ranging from 2 to 10 volts. Provides tuning over broad frequency ranges, tuning AM radio broadcast band, general AFC and tuning applications in lower RF frequencies.

Device Type	C_T, Diode Capacitance V_R = 1.0 Vdc f = 1.0 MHz pF nom ±15%	C_T, Diode Capacitance V_R = 2.0 Vdc f = 1.0 MHz pF nom ±20%	C_R, Capacitance Ratio C_1/C_{10} f = 1.0 MHz Min	C_R, Capacitance Ratio C_2/C_{10} f = 1.0 MHz Min	Q, Figure of Merit V_R = 2.0 Vdc f = 1.0 MHz Min	Case
MV1401	550	–	14	–	200	146
MV1403	–	175	–	10	200	51
MV1404	–	120	–	10	200	51
MV1405	–	250	–	10	200	51



CASE 226

Device Type	C_T, Diode Capacitance V_R = 3.0 Vdc, V_R = 25 V* f = 1.0 MHz pF Min/Max	C_R, Capacitance Ratio C_3/C_{25} f = 1.0 MHz Min	Q, Figure of Merit V_R = 3.0 Vdc *f = 50 MHz f = 100 MHz Min
MV3102	20/25	4.5	300*
MV3103	19/26	4.0	200*
MV3140	–/2.3*	4.5	150
MV3141	–/3.2*	4.0	150
MV3142	–/3.2*	3.5	50
BB105A	2.3/2.8*	4.0	225
BB105B	2.0/2.3*	4.5	225
BB105G	1.8/2.8*	4.0	150

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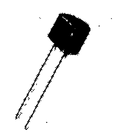
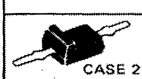
PLASTIC HOT-CARRIER DIODES

Hot-Carrier diodes are ideal for VHF and UHF mixer and detector applications as well as many higher microwave frequency applications. They provide stable electrical characteristics by eliminating the point-contact diode presently used in many applications. Motorola has the capability of supplying these devices in a variety of packages.

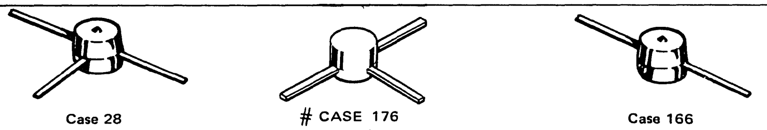
	Device Type	ELECTRICAL CHARACTERISTICS: $V_{(BR)R}$ Reverse Breakdown Voltage I_R = 10 μA Volts Min	C_T Diode Capacitance V_R = 0 V, f = 1.0 MHz (1) V_R = 20 V, f = 1.0 MHz (2) pF Max	V_F Forward Voltage I_F = 10 mA Volts Max	I_R Reverse Leakage V_R = 3.0 V (3) V_R = 25 V (4) V_R = 35 V (5) μA Max	NF Noise Figure dB Max	T_{rr} (Note 1) Reverse Recovery ps Max
 CASE 182-01	MBD101	4.0	1.0 (1)	0.6	0.25 (3)	7.0	—
	MBD501	50	1.0 (2)	1.2	0.20 (4)	—	100
	MBD701	70	1.0 (2)	1.2	0.20 (5)	—	100
 CASE 226	MBD102	4.0	1.0 (1)	0.6	0.25 (3)	7.0	—
	MBD502	50	1.0 (2)	1.2	0.20 (4)	—	100
	MBD702	70	1.0 (2)	1.2	0.20 (5)	—	100

Note 1: Krakauer method.

MICRO-T TRANSISTORS AND DIODES

The Micro-T package is a tiny (0.085 inch diameter) injection-molded plastic and ceramic package for applications requiring extremely high component mounting density. Micro-T transistors and diodes are also useful in hybrid circuits—being easier to mount than unencapsulated semiconductor chips, without special equipment and special operator training.

The following tables list the major characteristics of Motorola transistors and diodes in Micro-T packages. Devices are grouped in applications categories to simplify device selection. For more detailed information, refer to the individual data sheet.



Case 28   # CASE 176   Case 166

TABLE I – GENERAL-PURPOSE AMPLIFIER AND SWITCHING TRANSISTORS

Case 28 (1)

Device Type	V_{CEO} Volts Max	Collector Test Current for Optimum h_{FE} I_C in mA	h_{FE} Min/Max	$V_{CE(sat)}$ Volts Max	@ I_C mA	f_T MHz Min	@ I_C mA	Switching Times ns(Typ) t_d	t_r	t_s	t_f	@ $I_C/I_{B1}/I_{B2}$ mA
NPN												
MMT3904	40	10	100/300	0.2	10	300	10	24	13	125	11	10/1.0/1.0
MMT3903	40	10	50/150	0.2	10	250	10	24	13	125	11	10/1.0/1.0
MMT2222	30	150	100/300	0.4	150	200	20	t_{on} = 16, t_{off} = 160				150/15/15
#MMCM2222	30	150	100/300	0.4	150	200	20	t_{on} = 16, t_{off} = 160				150/15/15
MMT76	20	10	50/400	–	–	–	–	24	13	125	11	10/1.0/1.0
PNP												
MMT2907	40	150	100/300	0.4	150	200	50	t_{on} = 20, t_{off} = 150				150/15/15
#MMCM2907	40	150	100/300	0.4	150	200	50	t_{on} = 20, t_{off} = 150				150/15/15
MMT3906	40	10	100/300	0.25	10	250	10	25	18	140	15	10/1.0/1.0
MMT3905	40	10	50/150	0.25	10	200	10	25	18	140	15	10/1.0/1.0
MMT75	20	10	50/400	–	–	–	–	25	18	140	15	10/1.0/1.0

TABLE II – HIGH SPEED SATURATED SWITCHING TRANSISTORS

Case 28 (1)

Device Type	V_{CEO} Volts Max	Collector Test Current for Optimum h_{FE} I_C in mA	h_{FE} Min/Max	$V_{CE(sat)}$ Volts Max	@ I_C mA	f_T MHz Min	@ I_C mA	Switching Times ns (Max) t_d	t_r	t_s	t_f	@ I_C/I_B mA
NPN												
MMT2369	15	10	40/120	0.25	10	500	10	t_{on} = 12, t_{off} = 18				10/3.0
#MMCM2369	15	10	40/120	0.25	10	500	10	t_{on} = 12, t_{off} = 18				10/3.0
MMT3014	20	30	50/200	0.22	30	350	30	t_{on} = 16, t_{off} = 25				30/3.0
MMT72	10	10	30/–	0.3	10	400	10	t_{on} = 20, t_{off} = 30				10/3.0
PNP												
MMT3546	12	10	30/–	0.15	10	700	10	10	15	20	15	50/5.0
MMT73	3.0	10	30/–	0.2	10	400	10	t_{on} = 30, t_{off} = 30				10/1.0

TABLE III – HIGH-SPEED NON-SATURATED SWITCHING TRANSISTORS

Case 28 (1)

Device Type	V_{CEO} Volts Max	Collector Test Current for Optimum h_{FE} I_C in mA	h_{FE} Min/Max	$V_{CE(sat)}$ Volts Max	@ I_C mA	f_T MHz Min	@ I_C mA	Switching Times ns (Typ) t_d	t_r	t_s	t_f	@ I_C mA
NPN												
MMT3960A	8.0	10	30/200	0.2	10	1600	30	1.0	0.75	1.1	0.85	20
MMT3960	3.0	10	100/200	0.2	10	1600	30	–	0.65	–	0.75	–
MMT806	5.0	0.1	50/–	100	0.1	1200	1.0	1.0	1.5	1.0	2.0	1.0
PNP												
MMT808	5.0	0.1	50/–	100	0.1	1200	1.0	1.0	1.5	1.0	2.0	1.0

MICRO-T TRANSISTORS AND DIODES (continued)

TABLE IV – LOW NOISE AMPLIFIER TRANSISTORS

Case 28 (1)

Device Type	V_{CEO} Volts Max	Collector Test Current for Optimum h_{FE} I_C in mA	h_{FE} Min/Max	f_T @ MHz Min	I_C µA	NF @ dB Max	I_C and µA	f MHz
NPN								
MMT2484	60	1.0	250/–	60	500	3.0	10	10 Hz to 10 kHz
#MMCM2484	60	1.0	250/–	60	500	3.0	–	10 Hz to 10 kHz
MMT930	45	1.0	150/–	60	500	–	–	–
#MMCM930	45	1.0	150/–	60	500	–	–	–
MMT70	20	2.0	150/–	–	–	1.0*	10	10 Hz to 15.7 kHz
PNP								
MMT3799	60	0.1	300/900	40	500	2.5	100	10 Hz to 15.7 kHz
MMT3798	60	0.1	150/450	40	500	3.5	100	10 Hz to 15.7 kHz
MMT71	20	2.0	150/–	–	–	1.5*	100	–

*Typical

TABLE V – RF AMPLIFIER AND OSCILLATOR TRANSISTORS

Case 28 (1)

Device Type	V_{CEO} Volts Max	Collector Test Current for Optimum h_{FE} I_C in mA	h_{FE} Min	NF @ dB Max	I_C mA	f MHz	f_T @ MHz Min	I_C mA	Feedback Capacitance @ V_{CB} = 10 Vdc pF Max
NPN									
MMT2857	15	3.0	30	3.8*	1.5	450	1000	4.0	1.0
MMT918	15	3.0	20	6.0	1.0	60	600	10	1.7
#MMCM918	15	3.0	20	6.0	1.0	60	600	10	1.7
MMT8015	10	1.0	25	4.0	1.0	1000	1000	6.0	–
MMT74	12	3.0	25	4.0*	1.5	450	700	4.0	3.0
MMT807	5.0	1.0	25	2.0*	100	–	1200	1.0	0.55**
PNP									
MMT809	5.0	1.0	25	2.6*	100	–	1200	1.0	0.8**

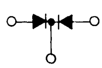
*Typical
**C_{ob} = V_{CB} = 0.5 Vdc

TABLE VI – N-CHANNEL JUNCTION FIELD-EFFECT TRANSISTORS

FOR RF AND MIXER APPLICATIONS

Device Type	$V_{(BR)GSS}$ Volts Min	I_{DSS} mA Min/Max	C_{iss} pF Typ	Re(y_{is}) µmhos Typ	NF @ Typ dB	f MHz	Case
MMT3823	-30	5.0/20	4.0	500	2.0	100	28 (5)

TABLE VII – SWITCHING DIODES



Device Type	$V_{(BR)}$ @ Volts Min	$I_{(BR)}$ µA	I_R @ µA Max	V_R Volts	V_F @ Volts Min/Max	I_F mA	C@V_R = 0 pF Max	t_{rr} ns Max	Case	Description
MMD70	50	100	0.1	30	0.75/1.2	100	2.5	15	166	Single
MMD6050	70	100	0.1	50	0.55/0.7	1.0	2.0	5.0	166	Single
MMD6100	70	100	0.1	50	0.55/0.7	1.0	2.0	5.0	28 (2)	Common-Cathode
MMD6150	70	100	0.1	50	0.55/0.7	1.0	2.0	5.0	28 (3)	Common-Anode
MMD7000	70	100	0.1	50	0.55/0.7	1.0	2.0	5.0	28 (4)	Series
MMD7001	45	10	0.1	30	–/1.05	300	3.5	3.2*	28 (4)	Series

*Typical

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There are many symbols and abbreviations used to classify the performance and characteristics of semiconductors. Often a particular symbol will have different meanings, depending on the product described. To aid the reader in the understanding of the data presented in this book, the following product-categorized glossary has been prepared. Standard terms that are common to all semiconductors or have obvious meanings have been omitted.

OPTOELECTRONIC DEFINITIONS, CHARACTERISTICS, AND RATINGS

BV_{CBO} Collector-Base Breakdown Voltage - The minimum dc breakdown voltage, collector to base, at stated collector current and ambient temperature. (Emitter open)

BV_{CEO} Collector-Emitter Breakdown Voltage The minimum dc breakdown voltage, collector to emitter, at stated collector current and ambient temperature. (Base open)

BV_{ECO} Emitter-Collector Breakdown Voltage The minimum dc breakdown voltage, emitter to collector, at stated emitter current and ambient temperature. (Base open)

Candela A photometric unit of luminous intensity (in lumens per steradian) defined as 1/60 the intensity of a one cm^2 blackbody radiator at platinum's solidification temperature (2,046°K).

E Luminous Flux Density (Illuminance) [lumens/ft.^{2} = ft. candles] - The radiation flux density of wavelength within the band of visible light.

H Radiation Flux Density (Irradiance) [mW cm^2] - The total incident radiation energy measured in power per unit area.

I_{CEO} Collector Dark Current The maximum current through the collector terminal of the device measured under dark conditions, ($H \approx 0$), with a stated collector voltage, load resistance, and ambient temperature. (Base open)

I_L Photometric unit of luminous intensity in Lumens/steradian (candela).

I_O Axial Intensity – The ratio of the flux emitted by a source and contained within an incremental on axis solid angle subtended by a sensor [units: lumens/steradian (photometric) or watts/steradian (radiometric)].

P_D Power Dissipation

S_{ICBO} Collector-Base Illumination Sensitivity (μA/lumen/ft.^{2} = μA/ft. candle) The ratio of photo-induced collector-base current to the incident luminous energy measured at the plane of the lens of the photo device under stated conditions of luminous flux density (E), collector voltage, base load resistance, and ambient temperature. (Emitter open)

S_{ICEO} Collector-Emitter Illumination Sensitivity (μA/lumen/ft.^{2} = μA/ft. candle) – The ratio of photo-induced, collector-emitter current to the incident luminous energy measured at the plane of the lens of the photodevice under stated conditions of luminous flux density (E), collector voltage, load resistance, and ambient temperature. (Base open)

S_{RCBO} Collector-Base Radiation Sensitivity (μA/mW/cm^2) -- The ratio of photo-induced collector-base current to the incident radiant energy measured at the plane of the lens of the photo device under stated conditions of radiation flux density (H), collector voltage, base load resistance, and ambient temperature. (Emitter open)

S_{RCEO} Collector-Emitter Radiation Sensitivity (mA/mW/cm^2) The ratio of photo-induced, collector-emitter current to the incident radiant energy measured at the plane of the lens of the photodevice under stated conditions of radiation flux density (H), collector voltage, load resistance, and ambient temperature. (Base open)

T_A Ambient Temperature

t_f Photo Current Fall Time The response time for the photo-induced current to fall from the 90% point to the 10% point after removal of the GaAs (gallium-arsenide) source pulse under stated conditions of collector voltage, load resistance and ambient temperature.

$t_{f(sat)}$ Photo Current Saturated Fall Time The response time for the photo-induced current to fall from the 90% point to the 10% point after removal of the saturating xenon light source pulse under stated conditions of collector voltage, load resistance, and ambient temperature.

T_J Junction Temperature

t_r Photo Current Rise Time The response time for the photo-induced current to rise from the 10% point to the 90% point when pulsed with the stated GaAs (gallium-arsenide) source under stated conditions of collector voltage, load resistance, and ambient temperature.

$t_{r(sat)}$ Photo Current Saturated Rise Time The response time for the photo-induced current to rise from the 10% point to the 90% point when driven into saturation by the stated xenon source under stated conditions of collector voltage, load resistance, and ambient temperature.

T_{stg} Storage Temperature

V_{CBO} Collector-Base Voltage The maximum allowable value of the collector-base voltage which can be applied to the device at the rated temperature. (Emitter open)

(continued)

OPTOELECTRONIC DEFINITIONS, CHARACTERISTICS, AND RATINGS (continued)

V_{ECO} Emitter-Collector Voltage – The maximum allowable value of emitter-collector voltage which can be applied to the device at the rated temperature. (Base open)

V_{CEO} Collector-Emitter Voltage – The maximum allowable value of collector-emitter voltage which can be applied to the device at the rated temperature. (Base open)

θ Angular Alignment – The axis of maximum sensitivity shall lie within a cone of this angle with reference to the central axis of the device.

$\lambda_S(\mu m)$ Wavelength of maximum sensitivity in micro meters.

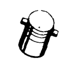
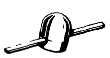
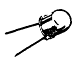
OPTOELECTRONICS

Optoelectronic devices are designed for use in computer, industrial and consumer equipment. Motorola's standard line of optoelectronic products include light emitters, all numeric displays, light detectors, and monolithic phototransistor and photodiode arrays. Also available from Motorola are custom phototransistor and light emitting diode (LED) arrays using discrete devices mounted on printed circuit boards and custom monolithic arrays of photodiodes and phototransistors.

Compactness, reliability and compatibility with integrated circuits keynote light emitting diode advantages — as well as perfect spectral matching of infrared (R) units to silicon detectors. They emit infrared or visible light when forward biased. Motorola offers nine red and infrared, fast switching types for flexibility in package, performance and price.

LIGHT EMITTING DIODES

Motorola visible red (660 nM) gallium arsenide phosphide emitters are available for use in panel and circuit condition indicators, light modulators, alphanumeric displays and film annotation.

Package	Device Type	Peak Emission Wavelength Typ nM	Brightness Typ fL	Forward Voltage Typ Volts	Instantaneous Axial Luminous Intensity Typ μcd
Actual Size Case 234-02	MLED50 (Clear) MLED55 (Diffusing Red)	660	750 @2mA	1.6	190 @ 20mA 100 @ 20mA
 Actual Size CASE 81A Low Profile Lens	MLED610 (Clear)	660	1100 @50 mA	1.6	—
 Actual Size Case 171(2)	MLED600 (Clear Red)	660	1100 @50 mA	1.6	—
 Case 247	MLED630 (Clear Red)	660	1100 @50 mA	1.6	—

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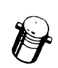
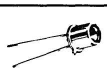
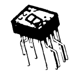
INFRARED EMITTING DIODES

Infrared (900 nM) gallium arsenide emitters are available from Motorola for use in light modulators, shaft or position encoders, punched card and tape readers, optical switching and logic circuits. They are spectrally matched for use with silicon detectors.

Package	Device Type	Peak Emission Wavelength Typ nM	Instantaneous Power Output Typ μW	Forward Voltage Typ Volts
Actual Size Case 234-02 Clear Plastic	MLED60 MLED90	900 900	550 @50 mA 350 @50 mA	1.2 1.2
 Actual Size Case 171(2)	MLED900	900	550 @50 mA	1.2
 Actual Size CASE 81A Low Profile Lens	MLED910	900	150 @50 mA	1.2
 Case 209-01	MLED930	900	650 @100 mA	1.2

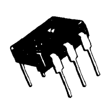
SEVEN SEGMENT VISIBLE READOUT

Visible red (660 nM) readouts are available for use as digital displays for calculators, instruments, computer peripheral and airborne equipment; and for film annotation.

Package	Device Type	Type of Display	I_o Axial Luminous Intensify-mcd Min	Typ	Forward Voltage (Per Segment) Typ Volts
Case 683  Case 683 Style A 	MOR10	7-Segment, Decimal Point on Right Character Size – 0.120 x 0.072	20	40	2.5

COUPLERS

Optoelectronic couplers are gallium-arsenide LEDs optically coupled to silicon photo transistors and designed for applications requiring electrical isolation, high current transfer ratios, small package size and low cost. They include interfacing and coupling systems, phase and feedback controls, solid-state relays and general-purpose switching circuits. They're offered in an economical, compact, dual in-line plastic package.

Package	Case Number	Type Number	DC Current Transfer Ratio % $V_{CE} = 10$ V & $I_C = 10$ mA Min	Typ	Isolation Voltage (Vdc)	Switching Times $= t_r + t_f$ (Typ μs)	Freq. Response Typ kHz
Case 673-02 	673-02	MOC1000	20	60	1500	5.6	300

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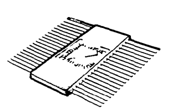
MONOLITHIC ARRAYS

Motorola standard monolithic linear photodiode and phototransistor arrays are on 0.005-inch center-to-center spacing. The active area is 0.005 inches by 0.0045 inches with 0.0005-inch space between elements. Used extensively in optical character recognition applications, monolithic arrays are available to meet your specific custom requirements – spacing, active area, number of elements, etc. Monolithic arrays are ideal for OCR applications requiring very high density spacing, exceptional alignment and high optical resolution.

Package	Device Type	Sensitivity @ H = 5 mW/cm^2 nA/mW/cm^2 (Note 1) Min	Dark Current @ H = 0 Max nA	Light Current @ H = 5 mW/cm^2 (Note 1) Typ μA
 Case 621	MRD6039D MRD6039T	14 300	2.0 10	0.15 3.0

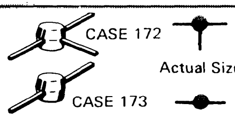
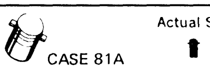
Note 1: H is radiation flux density emitted from a tungsten source at 2870 K.

LIGHT DETECTORS

Control light generated current flow with 24 different PIN photodiodes, phototransistors and photo Darlington's for optimized optical performance in dc to high frequency designs. Sensitive, fast and rugged, Motorola detectors are also available in custom arrays of discrete devices pre-assembled and pre-tested to your specifications. Motorola phototransistors are high quality passivated Annular devices providing a high order of stability and reliability. They are sensitive throughout the visible and near-infrared spectral range with peak sensitivity typically at a wavelength of 0.8 micrometers. Much faster than the conventional photocells or mechanical contacts, these phototransistors have rise and fall times in low microseconds when pulsed with a gallium arsenide light-emitting diode. The devices fall in two major categories, dependent on applications: (1) high density mounting (subminiature size) and (2) low density mounting (miniature size).

HIGH DENSITY NPN SILICON PHOTOTRANSISTORS

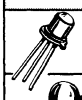
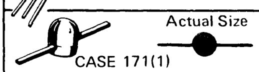
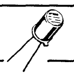
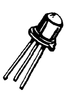
Subminiature NPN silicon phototransistors designed for use in card and tape readers, pattern and character recognition equipment, shaft encoders, or any design requiring radiation sensitivity, stable characteristics and high stability.

Package	Device Type	Sensitivity @ H = 20 mW/cm²* @ H = 5.0 mW/cm² mA/mW/cm² (Note 1) Min	Light Current @ H = 20 mW/cm² Min mA	Dark Current @ H = 0 Max nA	Switching Time = $t_r + t_f$ µs Max	Light Current @ H = 5.0 mW/cm² (Note 1) Min mA
 CASE 172	MRD 100	0.04	–	100	6.5	0.2
Actual Size CASE 173	MRD150	0.04	–	100	6.5	0.2
 Actual Size CASE 81A Low Profile Lens	MRD601	–	0.5	25	4.8**	–
	MRD602	–	2.0	↓	↓	–
	MRD603	–	4.0	↓	↓	–
	MRD604	–	7.0	↓	↓	–

Note 1: H is radiation flux density emitted from a tungsten source at 2870 K.
**Typ

LOW DENSITY NPN SILICON PHOTOTRANSISTORS

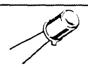
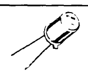
NPN silicon phototransistors designed for use in industrial inspection, processing and control systems, counters, sorters, switching and logic circuits or any design requiring radiation sensitivity, stable characteristics and moderate mounting density in arrays or single device applications.

Package	Device Type	Sensitivity @ H = 5.0 mW/cm² mA/mW/cm² (Note 1) Min	Light Current @ H = 20 mW/cm² Min mA	Dark Current @ H = 0 Max nA	Switching Time = $t_r + t_f$ µs Max	Light Current @ H = 5.0 mW/cm² (Note 1) Min mA
 CASE 82-01 TO-18	MRD300	0.8	4.0	25	6.5	4.0
	MRD310	0.2	1.0	25	6.5	1.0
 Actual Size CASE 171(1)	MRD450	0.2	–	100	6.5	1.0
 CASE 210 (2)	MRD810	0.2	–	50	11	1.0
 CASE 82-01 TO-18	MRD3050	0.02	–	100	5.5**	0.1
	MRD3051	0.04	–	↓	↓	0.2
	MRD3052	0.02/0.08*	–	↓	↓	0.1/0.4*
	MRD3053	0.05/0.2*	–	↓	↓	0.25/1.0*
	MRD3054	0.125/0.5*	–	↓	↓	0.625/2.5*
	MRD3055	0.3	–	↓	↓	1.5
	MRD3056	0.4	–	↓	↓	2.0

Note 1: H is radiation flux density emitted from a tungsten source at 2870 K.
* Min/Max
** Typ

PIN SILICON PHOTODIODES

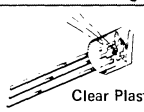
PIN silicon photodiodes are designed for application in laser detection, light demodulation, detection of radiation from visible and near infrared light emitting diodes, shaft or position encoders, switching and logic circuits; or any design requiring radiation sensitivity and stable characteristics. They are extremely high speed devices with typical response time of less than 1.0 ns.

Package	Device Type	Sensitivity @H = 5.0 mW/cm^2 μA/mW/cm^2 (Note 1) Min	Dark Current @ H = 0 Max nA	Response Time Typ ns	Light Current @ H = 5.0 mW/cm^2 (Note 1) Min μA
 Convex Lens CASE 209-1	MRD500	1.2	2.0	1.0	6.0
 Flat glass case CASE 210-1	MRD 510	0.3	2.0	1.0	1.5

Note 1: H is radiation flux density emitted from a tungsten source at 2870 K.

SILICON PHOTO DARLINGTON AMPLIFIERS

Motorola silicon photo Darlington amplifiers are designed for use where extremely high sensitivity is required. The TO-92 plastic side reading devices are the most economical detectors available from Motorola.

Package	Device Type	Sensitivity @ H = 2.0 mW/cm^2 mA/mW/cm^2 (Note 1) Typ	Dark Current @ H = 0 Max nA	Switching Time = $t_r + t_f$ Max μs	Light Current @ H = 2.0 mW/cm^2 Note 1 Typ mA
 CASE 29(14) TO-92 Clear Plastic	2N5777	2.0	100	400	4.0
	2N5778	2.0			4.0
	2N5779	4.0			8.0
	2N5780	4.0			8.0
	MRD14B	1.0			2.0

Note 1: H is radiation flux density emitted from a tungsten source at 2870 K.

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MOTOROLA MICROCIRCUIT COMPONENTS

For the manufacturer of hybrid microcircuits, almost 450 "standard" discrete active and passive unencapsulated chips are now available as off-the-shelf items from Motorola.

Included are silicon transistors (amplifiers, switches, general purpose, RF, FET, power and switching diode types), beam-lead microwave resistors and capacitors, thin-film inductors, and some 122 zener diode types.

All are detailed in the new Motorola Microcircuit Components Catalog, which includes introductory pages describing standard carrier packages, optional shipping methods for chips and wafers, plus vital inspection criteria.

STANDARD CHIP PROCESSING

The transistor and small-signal diode "chips" in Motorola's Standard Microcircuit Components line are produced on the same well-proven production lines that provide Motorola's standard encapsulated devices. They are subjected to the same rigid in-process controls used to insure the reliability and performance of the eventual packaged components.

The entire test and inspection sequence for chips is under the auspices of the Quality Control Department and provides independent quality assurance.

NON-STANDARD CHIP PROCESSING

The standard unencapsulated semiconductors described in the following tables meet a wide variety of application requirements. On special order, Motorola transistors other than those listed in the tables may be obtained in both wafer and chip form.

STANDARD PACKAGE AVAILABILITY

To accommodate customers with both small and large quantity requirements, Motorola supplies microcircuit components in two standard carriers, the Deka-Pak and the Multi-Pak.

The Deka-Pak holds 10 small-signal chips, and is ideal for prototype development.

The Multi-Pak is excellent for production use.
Two versions, both 2 inches square, are available:

a. 400 small-signal chips
b. 100 large chips such as power transistors

OPTIONAL PACKAGES

CHIPS — Various packaging and shipping carrier options are available on a negotiated basis. For more information on these options, please contact your Motorola sales representative.

a. K-PAK (1000-Chip Carrier)
b. STRAW-PAK Plastic Vial Bulk Shipment

WAFER — Motorola unencapsulated transistors may be obtained in wafer form.

a. Plastic Bag
b. Plastic Box

MICROCIRCUITS COMPONENTS

UNENCAPSULATED SWITCHING TRANSISTORS ($T_A = 25^oC$)

Device Type	BV_{CEO} @ I_C = 10 mA Volts Min	I_C Peak† mA	h_{FE} Min/Max	@ I_C mA	$V_{CE(sat)}$ Volts Max	@ I_C mA	C_{ob} pF Max	f_T MHz	t_d, t_r t_{on}* ns Max	t_s, t_f t_{off}* ns Max
NPN										
MMCS3507	50	3000	30/150	1500	1.0	1500	40	50	18,40	65,40
MMCS3735	50	1500	20/180	1000	0.5	500	9.0	200	10,45	35,35
MMCS3725	50	1000	60/150	100	0.42	500	10	200	45*	75*
MMCS3444	50	1000	20/60	500	0.6	500	12	150	18,40	50,35
MMCS3506	40	3000	40/200	1500	1.0	1500	40	50	18,40	65,40
MMCS3253	40	1000	25/75	500	0.6	500	12	150	18,40	50,35
MMCS3734	30	1500	30/120	1000	0.5	500	9.0	200	10,45	35,35
MMCS3724	30	1000	60/150	100	0.42	500	12	200	45*	75*
MMCS3252	30	1000	30/90	500	0.5	500	12	180	18,35	50,35
MMCS3227	20	500†	100/300	10	0.25	10	4.0	500	15*	20*
MMCS2369A	15	500†	40/120	10	0.25	10	4.0	500	15*	20*
MMCS2369	15	200	30/–	30	0.2	10	4.0	500	14*	20*
MMCS3959	12	30	40/200	10	0 2	1.0	2.5	1100	2.4,3.0(1)	1.6,3.3(1)
MMCS709	6.0	100	20/200	10	0.35	3.0	3.0	500	18*	18*
PNP										
MMCS3763	60	1500	20/80	1000	0.9	1000	18	120	10,40	95,40
MMCS3468	50	1000	25/75	500	0.6	500	25	140	10,30	80,30
MMCS3762	40	1500	30/120	1000	0.9	1000	18	150	10,40	95,40
MMCS3467	40	1000	40/120	500	0.5	500	25	160	10,30	80,30
MMCS4260	15	30	30/150	10	0.35	10	2.5	1000	1.0,0.5(1)	1.0,1.0(1)
MMCS2894	12	200	40/150	30	0.2	30	6.0	320	70*	100*
MMCS3546	12	200	30/120	10	0.15	10	6.0	700	48*	35*

UNENCAPSULATED SWITCHING AND AMPLIFIER TRANSISTORS

Device Type	BV_{CEO} Volts Min	@ I_C mA	I_C mA	h_{FE} Min/Max	@ I_C mA	$V_{CE(sat)}$ Volts Max	@ I_C mA	f_T MHz	t_d, t_r t_{on}* ns Max	t_s, t_f t_{off}* ns Max
NPN										
MMCS3500(1)	150	10	300	40/120	150	0.4	150	150	20,35	300,80
MMCS3501(1)	150	10	300	100/300	150	0.4	150	150	20,35	300,80
MMCS3498(1)	100	10	500	40/120	150	0.6	300	150	30,35	300,80
MMCS3499(1)	100	10	500	100/300	150	0.6	300	150	20,35	300,80
MMCS2193	50	25	1000	40/120	150	0.35	150	40	–,85	180,60
MMCS2192	40	25	1000	100/300	150	0.35	150	40	–,85	180,60
MMCS2221A	40	10	800	40/120	150	0.3	150	250	26*(1)	70*(1)
MMCS2222A	40	10	800	100/300	150	0.3	150	250	26*(1)	70*(1)
MMCS3903	40	10	200	50/150	10	0.2	10	200	40,40	200,60
MMCS3904	40	1.0	200	100/300	10	0.2	10	250	40,40	240,60
MMCS4400	40	1.0	600	50/150	150	0.4	150	180	18,25	260,35
MMCS4401	40	1.0	600	100/300	150	0.4	150	230	18,25	260,35
MMCS2221	30	10	800	40/120	150	0.4	150	100	26*(1)	70*(1)
MMCS2222	30	10	800	100/300	150	0.4	150	100	26*(1)	70*(1)
PNP										
MMCS3636(1)	175	10	1000	50/150	50	0.5	50	–	480*	720*
MMCS3637(1)	175	10	1000	100/300	50	0.5	50	–	480*	720*
MMCS3634(1)	140	10	1000	50/150	50	0.5	50	–	480*	720*
MMCS3635(1)	140	10	1000	100/300	50	0.5	50	–	480*	720*
MMCS2906A	60	10	600	40/120	150	0.4	150	–	26*(1)	70*(1)
MMCS2907A	60	10	600	100/300	150	0.4	150	–	26*(1)	70*(1)
MMCS3250A	60	10	200	50/150	10	0.25	10	–	40,40	200,60
MMCS3251A	60	10	200	100/300	10	0.25	10	–	40,40	240,60
MMCS2906	40	10	600	40/120	150	0.4	150	–	26*(1)	70*(1)
MMCS2907	40	10	600	100/300	150	0.4	150	–	26*(1)	70*(1)
MMCS3250	40	10	200	50/150	10	0.25	10	–	40,40	200,60
MMCS3251	40	10	200	100/300	10	0.25	10	–	40,40	240,60
MMCS3905	40	1.0	200	50/150	10	0.25	10	–	40,40	240,70
MMCS3906	40	1.0	200	100/300	10	0.25	10	–	40,40	250,85
MMCS4402	40	1.0	600	50/100	150	0.4	150	–	18,25	260,35
MMCS4403	40	1.0	600	100/300	150	0.4	150	–	18,25	260,35

*AC parameter values are as specified in the standard 2N data sheets. (encapsulated devices)

(1)Typical Switching Times

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MICROCIRCUIT COMPONENTS (continued)

UNENCAPSULATED SILICON AMPLIFIER TRANSISTORS (T_A = 25°C)

Device Type	BV_{CEO} Volts Min	@ I_C mA	I_C mA	h_{FE} Min/Max	@ I_C µA mA*	C_{ob} pF Max	NF dB Max	f Hz	f_T MHz
NPN									
MMCS910	60	30	–	75/–	10*	15	14	1 K	50
MMCS2483	60	10	50	75/–	100	6.0	5.0	10-15.7 K	60
MMCS2484	60	10	50	175/–	100	6.0	4.0	10-15.7 K	60
MMCS929	45	10	30	60/–	500	8.0	5.0	10-15.7 K	30
MMCS930	45	10	30	150/–	500	8.0	4.0	10-15.7 K	30
MMCS5088	30	1.0	50	300/900	100	–	4.0	10-15.7 K	40
MMCS918	15	3.0	50	20/–	3.0*	1.7	6.5	60 M	600
PNP									
MMCS3798	60	10	50	150/450	500	4.0	1.0 typ	1 K	24
MMCS3799	60	10	50	300/900	500	4.0	0.8 typ	1 K	24
MMCS5087	30	1.0	50	250/800	100	4.0	3.0	10-15.7 K	32

UNENCAPSULATED RF TRANSISTORS (T_A = 25°C)

Device Type	BV_{CEO} Volts Min	@ I_C mA	G_{pe} dB Typ	@ f MHz	P_{out} $P_{out(osc)}$* Watt Typ	P_{in} & Watt	V_{CE} & Volts	f MHz	NF dB Typ	@ f MHz	h_{FE} Min/Max	@ I_C mA	f_T MHz Typ Min **
NPN													
MMCS5636	35	200	7.0	400	8.4	2.0	28	400	–	–	5.0/ –	200	–
MMCS3866	30	5.0	11	400	1.3	0.1	28	400	–	–	10/200	50	800
MMCS0172	30	5.0	11.4	200	–	–	–	–	2.7	200	30/ –	50	1500
MMCS2857	15	3.0	15	450	0.035*	–	10	500	4.0	450	30/150	3.0	1500
MMCS0159	10	1.0	–	–	–	–	–	–	–	–	25/200	25	2000
PNP													
MMCS5160	40	5.0	8.0	400	1.2	0.16	28	400	–	–	10/ –	50	400 **
MMCS4957	30	10	18	450	–	–	–	–	3.2	450	20/ –	2.0	1000**
MMCS5583	30	10	–	–	–	–	–	–	–	–	25/ –	100	1000**

*AC parameter values are as specified in the standard 2N or MM data sheets (encapsulated devices).

UNENCAPSULATED FIELD-EFFECT TRANSISTORS (T_A = 25°C)

MOS FETS

Device Type	$V_{GS(th)}$ Volts Min/Max	$V_{BR(DSS)}$ Volts Min	I_{DSS} nA Max	$r_{ds(on)}$ Ohms Max	t_d, t_r ns Max	t_s, t_f ns Max
N-Channel						
MMCS0122	1.0/5.0	25	10	300	45,65	60,100
P-Channel						
MMCS0123	-1.0/-5.0	-25	-10	600	45,65	60,1000

These devices are passivated Field-Effect transistor chips
For more detailed characteristic data, please refer to the appropriate Motorola data sheet.

JUNCTION FETS

Device Type	$V_{BR(GSS)}$ Volts Min	I_{DSS} mA Min/Max	C_{rss} pF Max	$r_{DS(on)}$ Ohms Max
N-Channel				
MMCS0134	30	8.0/ –	5.0	100
MMCS0130	-25	2.0/20	3.0	–
MMCS0131	-25	1.0/16	3.0	–
P-Channel				
MMCS0125	40	0.5/14	2.0	–

UNENCAPSULATED SILICON POWER TRANSISTORS (T_A = 25°C)

Device Type	BV_{CEO} @ Volts Min	I_C mA	I_C Amp	h_{FE} Min/Max	I_C Amp	V_{CE} Volts	f_T MHz Min
NPN							
MJC044	60	100	1.0	30/180	0.250	1.0	30
MJC082	60	10	5.0	30/180	2.0	2.0	30
MJC070	60	10	25	20/180	10	3.0	30
MJC076	50	10	3.0	20/180	1.0	2.0	30
NPN							
MJC043	60	100	1.0	30/180	0.250	1.0	30
MJC067	60	10	5.0	30/180	2.0	2.0	30
MJC069	60	10	25	20/180	10	3.0	30
MJC007	50	10	3.0	20/180	1.0	2.0	30

UNENCAPSULATED HIGH-SPEED SWITCHING DIODES (T_A = 25°C)

Device Type	$V_{(BR)}$ @ $I_{(BR)}$ = 100 μA Volts Min	I_R @ μA Max	V_R Volts	I_R @ nA Max	V_R Volts	V_F @ I_F = 10 mA Min/Max	C @ V_R = 0 pF Max
MMCD914 (1)	100	5.0	75	25	20	−/1.0	4.0
MMCD6100 (2)	100	5.0	100	100	50	0.65/0.85	1.5

(1) Reverse recovery time = 5.0 ns @ I_F = 10 mA, V_R = 6.0 V, i_{rr} = 1.0 mA

(2) Reverse recovery time = 5.0 ns @ I_F = I_R = 10 mA, V_R = 5.0 V, i_{rr} = 1.0 mA

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UNENCAPSULATED THIN-FILM CAPACITORS

Device Type	Device Type	Capacity	Breakdown Voltage	Comments
MMCQ100-330	MMCQ100-330-1	33 pF	100 Vdc	Thin film capacitor chips for use for trimming production circuits and for building prototype circuits.
MMCQ100-390	MMCQ100-390-1	39 pF	100 Vdc	
MMCQ100-470	MMCQ100-470-1	47 pF	95 Vdc	
MMCQ100-560	MMCQ100-560-1	56 pF	90 Vdc	
MMCQ100-680	MMCQ100-680-1	68 pF	85 Vdc	
MMCQ100-820	MMCQ100-820-1	82 pF	80 Vdc	
MMCQ100-101	MMCQ100-101-1	100 pF	75 Vdc	
MMCQ100-121	MMCQ100-121-1	120 pF	65 Vdc	
MMCQ100-151	MMCQ100-151-1	150 pF	50 Vdc	
MMCQ100-181	MMCQ100-181-1	180 pF	40 Vdc	
MMCQ100-221	MMCQ100-221-1	220 pF	20 Vdc	
MMCQ101	MMCQ101-1	1.0 to 31 pF	100 Vdc	

SILICON ZENER DIODE CHIPS (T_A = 25°C unless otherwise noted)

V_F = 1.5 V Max @ I_F = 200 mA for all types.

Type Number (Note 1)	Nearest 1N Equivalent	Nominal Zener Voltage V_Z @ I_{ZT} = 250 µA Volts (Note 1)	Max Zener Impedance Z_{ZT} @ I_{ZT} = 250 µA Ohms	Max Reverse Leakage Current		
				I_R µA	@ V_R Volts Tolerance 10%	@ V_R Volts Tolerance 5.0%
MZC1.8B10	1N4614	1.8	1200	7.5	0.9	1.0
MZC2.0B10	1N4615	2.0	1250	5.0	0.9	1.0
MZC2.2B10	1N4616	2.2	1300	4.0	0.9	1.0
MZC2.4B10	1N4617	2.4	1400	2.0	0.9	1.0
MZC2.7B10	1N4618	2.7	1500	1.0	0.9	1.0
MZC3.0B10	1N4619	3.0	1600	0.8	0.9	1.0
MZC3.3B10	1N4620	3.3	1650	7.5	1.0	1.5
MZC3.6B10	1N4621	3.6	1700	7.5	1.5	2.0
MZC3.9B10	1N4622	3.9	1650	5.0	1.5	2.0
MZC4.3B10	1N4623	4.3	1600	4.0	1 5	2.0
MZC4.7B10	1N4624	4.7	1550	10	2.5	3.0
MZC5.1B10	1N4625	5.1	1500	10	2.5	3.0
MZC5.6B10	1N4626	5.6	1400	10	3.5	4.0
MZC6.2B10	1N4627	6.2	1200	10	4.5	5.0
MZC6.8B10	1N4099	6.8	200	10	4.8	5.2
MZC7.5B10	1N4100	7.5	200	10	5.5	5.7
MZC8.2B10	1N4101	8.2	200	1.0	6.0	6.3
MZC8.7B10	1N4102	8.7	200	1.0	6.2	6.6
MZC9.1B10	1N4103	9.1	300	1.0	6.7	6.9
MZC10B10	1N4104	10	400	1.0	7.0	7.6
MZC 11B10	1N4105	11	400	0.05	8.0	8.5
MZC 12B10	1N4106	12	300	0.05	8.7	9.1
MZC 13B10	1N4107	13	200	0.05	9.4	9.9
MZC 14B10	1N4108	14	200	0.05	9.5	10.7
MZC 15B10	1N4109	15	200	0.05	10.5	11.4
MZC 16B10	1N4110	16	200	0.05	11.4	12.2
MZC 17B10	1N4111	17	200	0.05	12.4	12.9
MZC 18B10	1N4112	18	200	0.05	13.3	13.7
MZC 19B10	1N4113	19	200	0.05	13.3	14.5
MZC 20B10	1N4114	20	200	0.01	14.3	15.2
MZC 22B10	1N4115	22	200	0.01	16.2	16.7
MZC 24B10	1N4116	24	200	0.01	17.1	18.5
MZC 25B10	1N4117	25	200	0.01	18.1	19.0
MZC 27B10	1N4118	27	200	0.01	20	20.5
MZC 28B10	1N4119	28	200	0.01	20	21.3
MZC 30B10	1N4120	30	200	0.01	22	22.6
MZC 33B10	1N4121	33	200	0.01	24	25.1
MZC 36B10	1N4122	36	200	0.01	26	27.4
MZC 39B10	1N4123	39	200	0.01	29	29.7
MZC 43B10	1N4124	43	250	0.01	31	32.7
MZC 47B10	1N4125	47	250	0.01	34	35.8
MZC 51B10	1N4126	51	300	0.01	37	38.8
MZC 56B10	1N4127	56	300	0.01	41	42.6
MZC 60B10	1N4128	60	300	0.01	44	45.6
MZC 62B10	1N4129	62	300	0.01	45	47.1
MZC 68B10	1N4130	68	400	0.01	49	51.7
MZC 75B10	1N4131	75	500	0.01	53	57.0
MZC 82B10	1N4132	82	600	0.01	59	62.3
MZC 87B10	1N4133	87	700	0.01	65	66.1
MZC 91B10	1N4134	91	800	0.01	66	69.2
MZC100B10	1N4135	100	1000	0.01	72	76.0
MZC110B10	–	110	1300	0.01	80	84.0
MZC120B10	–	120	1600	0.01	86	91.0
MZC130B10	–	130	1900	0.01	94	99.0
MZC140B10	–	140	2200	0.01	101	106
MZC150B10	–	150	2600	0.01	108	114
MZC160B10	–	160	3000	0.01	116	122
MZC170B10	–	170	3500	0.01	123	129
MZC180B10	–	180	4000	0.01	130	137
MZC190B10	–	190	4600	0.01	137	144
MZC200B10	–	200	5200	0.01	144	152

Note 2: The MZC2.4A10 Series is tested at a 50 Milliwatt dissipation level and not at the higher test currents of the nearest "1N" equivalents. This procedure is used to minimize correlation problems encountered when probe testing. Zener voltage is guaranteed correlated when the die is mounted on a 1" x 1" x 0.010" aluminum heat sink at T_A = 30°C ±1°C after 90 seconds.

SILICON ZENER DIODE CHIPS (T_A = 25°C unless otherwise noted)

V_F = 1.5 V Max @ I_F = 200 mA for all types.

Type Number (Note 1)	Nearest 1N Equivalent (Note 2)	Nominal Zener Voltage V_Z @ I_{ZT} Volts (Note 1)	Test Current I_{ZT} mA (Note 2)	Max Zener Impedance Z_{ZT} @ I_{ZT} Ohms	Max Reverse Leakage Current I_R μA	@ V_R Volts, Tolerance 10%	@ V_R Volts, Tolerance 5.0%	Max Zener Voltage Temp. Coeff. θ_{VZ} (%/°C) (For Reference Only)
MZC2.4A10	1N5221, 1N4370	2.4	21	53	100	0.95	1.0	-0.085
MZC2.5A10	1N5222	2.5	20	53	100	0.95	1.0	-0.085
MZC2.7A10	1N5223, 1N4371	2.7	19	52	75	0.95	1.0	-0.080
MZC2.8A10	1N5224	2.8	18	51	75	0.95	1.0	-0.080
MZC3.0A10	1N5225, 1N4372	3.0	17	50	50	0.95	1.0	-0.075
MZC3.3A10	1N5226, 1N746	3.3	15	47	25	0.95	1.0	-0.070
MZC3.6A10	1N5227, 1N747	3.6	14	43	15	0.95	1.0	-0.065
MZC3.9A10	1N5228, 1N748	3.9	13	35	10	0.95	1.0	-0.060
MZC4.3A10	1N5229, 1N749	4.3	12	29	5.0	0.95	1.0	±0.055
MZC4.7A10	1N5230, 1N750	4.7	11	24	5.0	1.9	2.0	±0.030
MZC5.1A10	1N5231, 1N751	5.1	9.8	21	5.0	1.9	2.0	±0.030
MZC5.6A10	1N5232, 1N752	5.6	8.9	25	5.0	2.9	3.0	+0.038
MZC6.0A10	1N5233	6.0	8.3	30	5.0	3.3	3.5	+0.038
MZC6.2A10	1N5234, 1N753	6.2	8.1	31	5.0	3.8	4.0	+0.045
MZC6.8A10	1N5235, 1N754	6.8	7.3	33	3.0	4.8	5.0	+0.050
MZC7.5A10	1N5236, 1N755	7.5	6.7	43	3.0	5.7	6.0	+0.058
MZC8.2A10	1N5237, 1N756	8.2	6.1	49	3.0	6.2	6.5	+0.062
MZC8.7A10	1N5238	8.7	5.7	52	3.0	6.2	6.5	+0.065
MZC9.1A10	1N5239, 1N757	9.1	5.5	54	3.0	6.7	7.0	+0.068
MZC 10A10	1N5240, 1N758	10	5.0	60	3.0	7.6	8.0	+0.075
MZC 11A10	1N5241, 1N962	11	4.5	66	2.0	8.0	8.4	+0.076
MZC 12A10	1N5242, 1N759	12	4.2	71	1.0	8.7	9.1	+0.077
MZC 13A10	1N5243, 1N964	13	3.8	74	0.5	9.4	9.9	+0.079
MZC 14A10	1N5244	14	3.6	33	0.1	9.5	10	+0.082
MZC 15A10	1N5245, 1N965	15	3.3	37	0.1	10.5	11	+0.082
MZC 16A10	1N5246, 1N966	16	3.1	42	0.1	11.4	12	+0.083
MZC 17A10	1N5247	17	2.9	47	0.1	12.4	13	+0.084
MZC 18A10	1N5248, 1N967	18	2.8	52	0.1	13.3	14	+0.085
MZC 19A10	1N5249	19	2.6	58	0.1	13.3	14	+0.086
MZC 20A10	1N5250, 1N968	20	2.5	65	0.1	14.3	15	+0.086
MZC 22A10	1N5251, 1N969	22	2.3	70	0.1	16.2	17	+0.087
MZC 24A10	1N5252, 1N970	24	2.1	92	0.1	17.1	18	+0.088
MZC 25A10	1N5253	25	2.0	100	0.1	18.1	19	+0.089
MZC 27A10	1N5254, 1N971	27	1.9	115	0.1	20	21	+0.090
MZC 28A10	1N5255	28	1.8	120	0.1	20	21	+0.091
MZC 30A10	1N5256, 1N972	30	1.7	140	0.1	22	23	+0.091
MZC 33A10	1N5257, 1N973	33	1.5	170	0.1	24	25	+0.092
MZC 36A10	1N5258, 1N974	36	1.4	200	0.1	26	27	+0.093
MZC 39A10	1N5259, 1N975	39	1.3	230	0.1	29	30	+0.094
MZC 43A10	1N5260, 1N976	43	1.2	280	0.1	31	33	+0.095
MZC 47A10	1N5261, 1N977	47	1.1	330	0.1	34	36	+0.095
MZC 51A10	1N5262, 1N978	51	0.98	390	0.1	37	39	+0.096
MZC 56A10	1N5263, 1N979	56	0.89	460	0.1	41	43	+0.096
MZC 60A10	1N5264	60	0.83	530	0.1	44	46	+0.097
MZC 62A10	1N5265, 1N980	62	0.81	560	0.1	45	47	+0.097
MZC 68A10	1N5266, 1N981	68	0.74	680	0.1	49	52	+0.097
MZC 75A10	1N5267, 1N982	75	0.67	800	0.1	53	56	+0.098
MZC 82A10	1N5268, 1N983	82	0.61	980	0.1	59	62	+0.098
MZC 87A10	1N5269	87	0.57	1050	0.1	65	68	+0.099
MZC 91A10	1N5270, 1N984	91	0.55	1150	0.1	66	69	+0.099
MZC100A10	1N5271, 1N985	100	0.50	1400	0.1	72	76	+0.110
MZC110A10	1N5272, 1N986	110	0.45	1700	0.1	80	84	+0.110
MZC120A10	1N5273, 1N987	120	0.42	2000	0.1	86	91	+0.110
MZC130A10	1N5274, 1N988	130	0.38	2300	0.1	94	99	+0.110
MZC140A10	1N5275	140	0.36	2700	0.1	101	106	+0.110
MZC150A10	1N5276, 1N989	150	0.33	3000	0.1	108	114	+0.110
MZC160A10	1N5277, 1N990	160	0.31	3400	0.1	116	122	+0.110
MZC170A10	1N5278	170	0.29	3900	0.1	123	129	+0.110
MZC180A10	1N5279, 1N991	180	0.28	4300	0.1	130	137	+0.110
MZC190A10	1N5280	190	0.26	4800	0.1	137	144	+0.110
MZC200A10	1N5281, 1N992	200	0.25	5200	0.1	144	152	+0.110

NOTE 1 – TOLERANCE AND VOLTAGE DESIGNATION

Tolerance Designation – The device type numbers listed have a tolerance of ±10%. For a ±5%, 3%, 2%, or 1%, change the suffix "10" to the desired tolerance.

Voltage Designation – To order devices with Zener voltages other than those listed, the Motorola type number should be modified as shown below.

CHIP DEVICES

M Z C 6.5 A or B 2

MOTOROLA — M
ZENER — Z
CHIP — C
NOMINAL VOLTAGE — 6.5
SERIES — A or B
TOLERANCE (±%) — 2

THIN-FILM RESISTORS

Nominal Resistance In Ohms	Part Number 5% Resistors	Part Number 10% Resistors
10	MMCR105-100	MMCR110-100
11	MMCR105-110	
12	MMCR105-120	MMCR110-120
13	MMCR105-130	
15	MMCR105-150	MMCR110-150
16	MMCR105-160	
18	MMCR105-180	MMCR110-180
20	MMCR105-200	
22	MMCR105-220	MMCR110-220
24	MMCR105-240	
27	MMCR105-270	MMCR110-270
30	MMCR105-300	
33	MMCR105-330	MMCR110-330
36	MMCR105-360	
39	MMCR105-390	MMCR110-390
43	MMCR105-430	
47	MMCR105-470	MMCR110-470
51	MMCR105-510	
56	MMCR105-560	MMCR110-560
62	MMCR105-620	
68	MMCR105-680	MMCR110-680
75	MMCR105-750	
82	MMCR105-820	MMCR110-820
91	MMCR105-910	
100	MMCR105-101	MMCR110-101
110	MMCR105-111	
120	MMCR105-121	MMCR110-121
130	MMCR105-131	
150	MMCR105-151	MMCR110-151
160	MMCR105-161	
180	MMCR105-181	MMCR110-181
200	MMCR105-201	
220	MMCR105-221	MMCR110-221
240	MMCR105-241	
270	MMCR105-271	MMCR110-271
300	MMCR105-301	
330	MMCR105-331	MMCR110-331
360	MMCR105-361	
390	MMCR105-391	MMCR110-391
430	MMCR105-431	
470	MMCR105-471	MMCR110-471
510	MMCR105-511	
560	MMCR105-561	MMCR110-561
620	MMCR105-621	
680	MMCR105-681	MMCR110-681
750	MMCR105-751	
820	MMCR105-821	MMCR110-821
910	MMCR105-911	
1000	MMCR105-102	MMCR110-102
1100	MMCR105-112	
1200	MMCR105-122	MMCR110-122
1300	MMCR105-132	
1500	MMCR105-152	MMCR110-152
1600	MMCR105-162	
1800	MMCR105-182	MMCR110-182
2000	MMCR105-202	
2200	MMCR105-222	MMCR110-222
2400	MMCR105-242	
2700	MMCR105-272	MMCR110-272
3000	MMCR105-302	

Nominal Resistance In Ohms	Part Number 5% Resistors	Part Number 10% Resistors
3300	MMCR105-332	MMCR110-332
3600	MMCR105-362	
3900	MMCR105-392	MMCR110-392
4300	MMCR105-432	
4700	MMCR105-472	MMCR110-472
5100	MMCR105-512	
5600	MMCR105-562	MMCR110-562
6200	MMCR105-622	
6800	MMCR105-682	MMCR110-682
7500	MMCR105-752	
8200	MMCR105-822	MMCR110-822
9100	MMCR105-912	
10,000	MMCR105-103	MMCR110-103
11,000	MMCR105-113	
12,000	MMCR105-123	MMCR110-123
13,000	MMCR105-133	
15,000	MMCR105-153	MMCR110-153
16,000	MMCR105-163	
18,000	MMCR105-183	MMCR110-183
20,000	MMCR105-203	
22,000	MMCR105-223	MMCR110-223
24,000	MMCR105-243	
27,000	MMCR105-273	MMCR110-273
30,000	MMCR105-303	
33,000	MMCR105-333	MMCR110-333
36,000	MMCR105-363	
39,000	MMCR105-393	MMCR110-393
43,000	MMCR105-433	
47,000	MMCR105-473	MMCR110-473
51,000	MMCR105-513	
56,000	MMCR105-563	MMCR110-563
62,000	MMCR105-623	
68,000	MMCR105-683	MMCR110-683
75,000	MMCR105-753	
82,000	MMCR105-823	MMCR110-823
91,000	MMCR105-913	
100,000	MMCR105-104	MMCR110-104

RESISTANCE VALUES

PART NUMBER	OHMS/□	END-TO-END RESISTANCE
MMCR100-025	25	2,750 Ohms
MMCR100 050	50	5,500 Ohms
MMCR100-100	100	11,000 Ohms
MMCR100-200	200	22,000 Ohms
MMCR100-300	300	33,000 Ohms

Each resistor chip is divided into 10 sections of 1 square, and 10 sections of 10 squares.

INTEGRATED CIRCUITS

INDEX
INTEGRATED CIRCUITS

DIGITAL INTEGRATED CIRCUITS

LINEAR INTEGRATED CIRCUITS

5

MECL 10,000 SERIES
INTEGRATED CIRCUITS

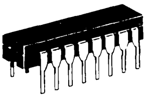
MC10,000 Series (-30 to +85°C)

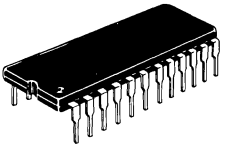
MECL 10,000 is Motorola's fourth family of emitter-coupled logic. Like MECL I, II, and III, this new family provides non-saturated switching for very high speed operation. The MECL 10,000 family is designed to fill the speed range between 4.0 ns MECL II and 1.0 ns MECL III.

The features of MECL II and MECL III have been optimized and combined to give MECL 10,000 an excellent speed-power product, relatively slow rise and fall times, and transmission-line drive capability. The combination of versatile logic functions and the 2.0 ns propagation delay make MECL 10,000 the optimum family for data handling and processing systems.

Circuit design with MECL 10,000 is similar to that for the MECL II and MECL III lines. The differential amplifier input and emitter-follower output permit high fanout, the wired-OR option, and complementary outputs. MECL III is directly compatible with MECL 10,000, and can be used to extend the speed capability of the MECL 10,000 series.

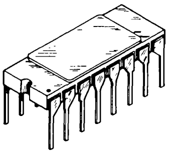
L SUFFIX
CERAMIC PACKAGE
CASE 620





P SUFFIX
PLASTIC PACKAGE
CASE 649

L SUFFIX
CERAMIC PACKAGE
CASE 690



5

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 0, V_{EE} = -5.2 V, T_A = 25°C)

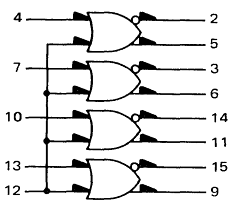
Function	Type -30 to +85°C	DC Output Loading Factor Each Output	Propagation Dealy t_{pd}, ns typ	Total Power Dissipation mW typ	Case
Quad Gate	MC10101	90	2.0	100	620
Quad 2-Input Gate	MC10102	90	2.0	100	620
Triple 2-3-2-Input Gate	MC10105	90	2.0	75	620
Triple 4-3-3-Input Gate	MC10106	90	2.0	75	620
Triple 2-Input Exclusive OR/Exclusive NOR	MC10107	90	2.5	115	620
Dual 4-5-Input OR/NOR Gate	MC10109	90	2.0	50	620
Dual 3-Input 3-Output OR Gate	MC10110	90	2.5	150	620
Dual 3-Input 3-Output NOR Gate	MC10111	90	2.5	150	620
Quad Line Receiver	MC10115	90	2.0	100	620
Triple Line Receiver	MC10116	90	2.0	60	620
Dual 2-Wide 2-3-Input OR-AND/OR-AND-INVERT Gate	MC10117	90	2.2	100	620
Dual 2-Wide 3-Input OR-AND Gate	MC10118	90	2.2	100	620
4-Wide 4-3-3-3-Input OR-AND Gate	MC10119	90	2.3	100	620
4-Wide OR-AND/OR-AND-INVERT Gate	MC10121	90	2.2	100	620
Dual Latch	MC10130	90	2.2	160	620
Dual Type D Master Slave Flip-Flop	MC10131	90	f = 150 MHz	225	620
Quad Latch	MC10133	90	4.5	310	620
➤ Dual Latch	MC10134	90	–	–	620
12-Bit Parity Generator-Checker	MC10160	90	–	320	620
Binary to 1-8 Decoder	MC10161	90	4.0	495	620
Binary to 1-8 Line Decoder	MC10162	90	4.0	495	620
8-Line Multiplexer	MC10164	90	6.0	495	620
Look-Ahead Carrier Block	MC10179	90	2.0 ($\overline{Cn}$,$\overline{P}$) 4.0 ($\overline{G}$)	250	620
4-Bit Arithmetic Logic Unit/Function Generator	MC10181	90	See Logic Diag.	600	649
➤ 64-Bit Random Access Memory	MCM10140	–	–	–	690
➤ 256-Bit Random Access Memory	MCM10144	–	–	–	690
➤ 64-Bit Random Access Memory	MCM10148	–	–	–	690

➤ To Be Announced

CASE	V_{CC} Pin No.	V_{EE} Pin No.
620	1,16	8
649	1,24	12
690	1,16	8

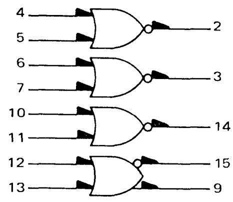
GATES

MC10101
Quad Gate



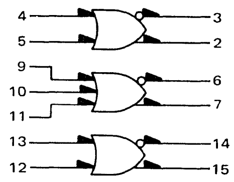
P_D = 25 mW typ/gate
t_{pd} = 2.0 ns typ

MC10102
Quad 2-Input Gate



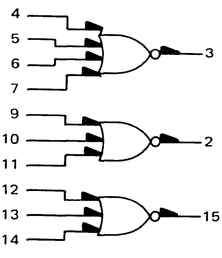
P_D = 25 mW typ/gate
t_{pd} = 2.0 ns typ

MC10105
Triple 2-3-2-Input Gate



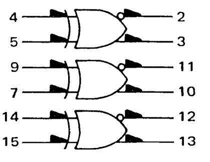
P_D = 25 mW typ/gate
t_{pd} = 2.0 ns typ

MC10106
Triple 4-3-3 Input Gate



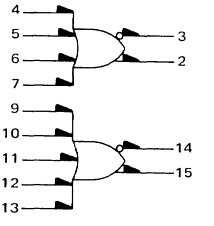
P_D = 75 mW typ (No Load)
t_{pd} = 2.0 ns typ

MC10107
Triple 2-Input Exclusive OR/Exclusive NOR



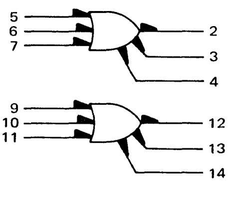
P_D = 115 mW typ
t_{pd} = 2.5 ns typ

MC10109
Dual 4-5-Input OR/NOR Gate



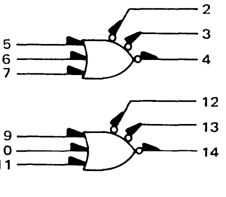
P_D = 50 mW typ/pkg (No Load)
t_{pd} = 2.0 ns typ

MC10110
Dual 3-Input 3-Output OR Gate



P_D = 75 mW typ/gate (Outputs Open)
t_{pd} = 2.5 ns typ (All Outputs Loaded)

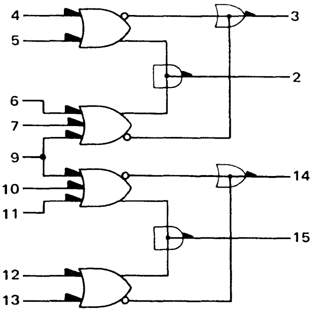
MC10111
Dual 3-Input 3-Output NOR Gate



V_{CC1} also Pin 15

P_D = 75 mW typ/gate (Outputs Open)
t_{pd} = 2.5 ns typ (All Outputs Loaded)

MC10117
Dual 2-Wide 2-3-Input OR-AND/OR-AND-INVERT Gate



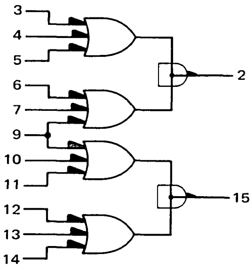
P_D = 100 mW typ/pkg
t_{pd} = 2.2 ns typ

(continued)

5

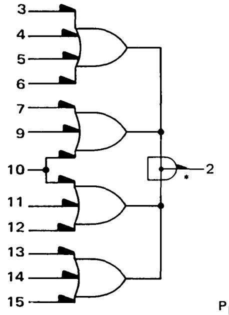
GATES (continued)

MC10118
Dual 2-Wide 3-Input
OR-AND Gate



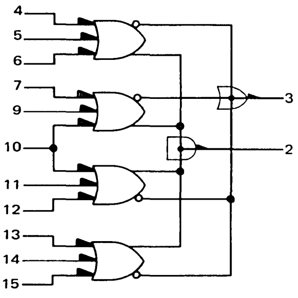
P_D = 100 mW typ/pkg
t_{pd} = 2.2 ns typ

MC10119
4-Wide 4-3-3-3 Input
OR-AND Gate



P_D = 100 mW typ
t_{pd} = 2.3 ns typ

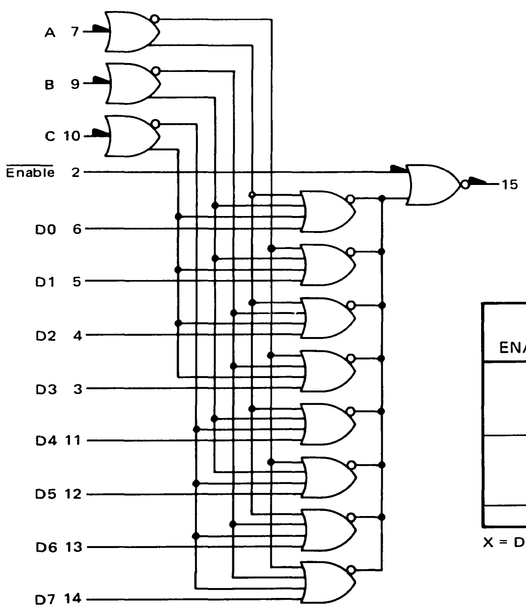
MC10121
4-Wide
OR-AND/OR-AND-INVERT
Gate



P_D = 100 mW typ
t_{pd} = 2.2 ns typ

DATA ROUTING FUNCTION

MC10164
8-Line Multiplexer



TRUTH TABLE

ENABLE	ADDRESS INPUTS C	B	A	DATA ROUTED FROM:
L	L	L	L	D0
L	L	L	H	D1
L	L	H	L	D2
L	L	H	H	D3
L	H	L	L	D4
L	H	L	H	D5
L	H	H	L	D6
L	H	H	H	D7
H	X	X	X	L

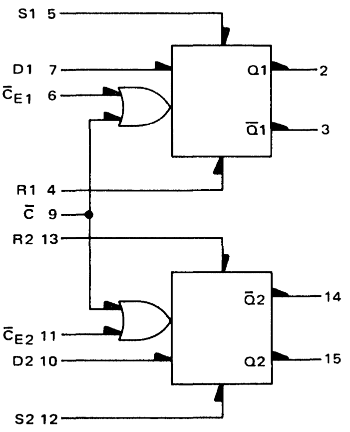
X = Don't Care

t_{pd} = 6.0 ns typ

5

LATCHES

MC10130
Quad Latch

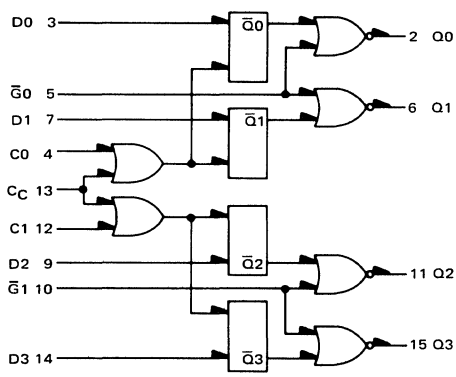


TRUTH TABLE

D	$\bar{C}$	$\bar{C}_E$	Q_{n+1}
L	L	L	L
L	L	H	Q_n
L	H	L	Q_n
L	H	H	Q_n
H	L	L	H
H	L	H	Q_n
H	H	L	Q_n
H	H	H	Q_n

P_D = 160 mW typ
t_{pd} = 2.2 ns typ

MC10133
Quad Latch

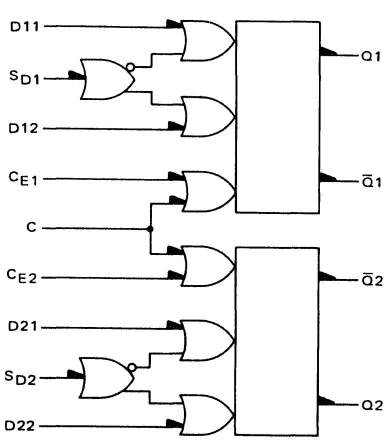


TRUTH TABLE

C	$\bar{G}$	D	Q_{n+1}
L	L	L	Q_n
L	L	H	Q_n
L	H	L	L
L	H	H	L
H	L	L	L
H	L	H	H
H	H	L	L
H	H	H	L

P_D = 310 mW typ
t_{pd} = 4.5 ns typ

MC10134
Dual Latch



TRUTH TABLE

D	C	C_E	Q_{n+1}
L	L	L	L
L	L	H	Q_n
L	H	L	Q_n
L	H	H	Q_n
H	L	L	H
H	L	H	Q_n
H	H	L	Q_n
H	H	H	Q_n

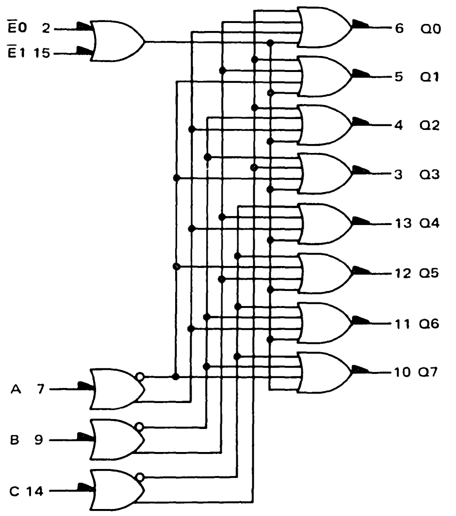
$D = (D_S \bullet D1) + (\bar{D}_S \bullet D2)$

5

MECL 10,000 LOGIC DIAGRAMS

DECODERS

MC10161
Binary To 1-8 Decoder



TRUTH TABLE

ENABLE INPUTS		INPUTS			OUTPUTS							
Ē1	Ē0	C	B	A	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7
L	L	L	L	L	L	H	H	H	H	H	H	H
L	L	L	L	H	H	L	H	H	H	H	H	H
L	L	L	H	L	H	H	L	H	H	H	H	H
L	L	L	H	H	H	H	H	L	H	H	H	H
L	L	H	L	L	H	H	H	H	L	H	H	H
L	L	H	L	H	H	H	H	H	H	L	H	H
L	L	H	H	L	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	L
H	L	X	X	X	H	H	H	H	H	H	H	H
L	H	X	X	X	H	H	H	H	H	H	H	H

X = Don't Care

P_D = 495 mW typ
t_{pd} = 4.0 ns typ

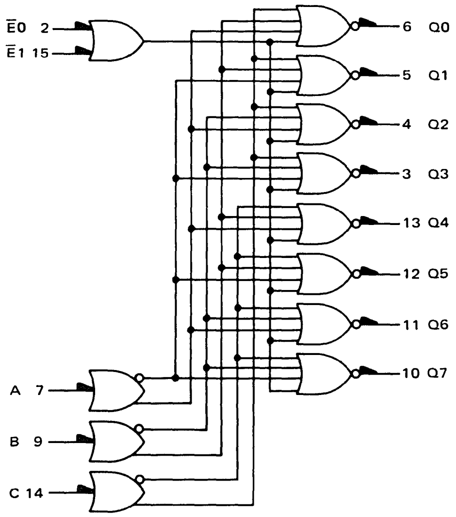
MC10162
Binary To One-Of-Eight
Line Decoder

TRUTH TABLE

INPUTS					OUTPUTS							
Ē0	Ē1	C	B	A	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7
L	L	L	L	L	H	L	L	L	L	L	L	L
L	L	L	L	H	L	H	L	L	L	L	L	L
L	L	L	H	L	L	L	H	L	L	L	L	L
L	L	L	H	H	L	L	L	H	L	L	L	L
L	L	H	L	L	L	L	L	L	H	L	L	L
L	L	H	L	H	L	L	L	L	L	H	L	L
L	L	H	H	L	L	L	L	L	L	L	H	L
L	L	H	H	H	L	L	L	L	L	L	L	H
H	L	X	X	X	L	L	L	L	L	L	L	L
L	H	X	X	X	L	L	L	L	L	L	L	L

X = Don't Care

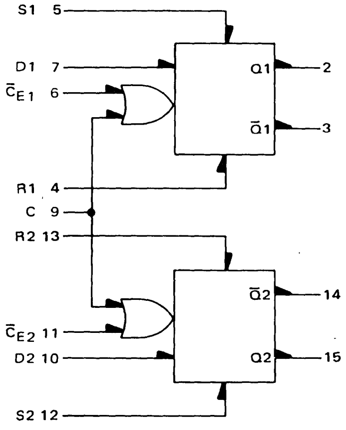
P_D = 495 mW typ
t_{pd} = 4.0 ns typ



5

FLIP-FLOP

MC10131
Dual Type D Master-Slave Flip-Flop



P_D = 225 mW typ/pkg
f = 150 MHz typ

R-S TRUTH TABLE

R	S	Q^{n+1}	$\bar{Q}^{n+1}$
L	L	Q^n	$\bar{Q}^n$
L	H	H	L
H	L	L	H
H	H	N.D.	N.D.

N.D. = Not Defined

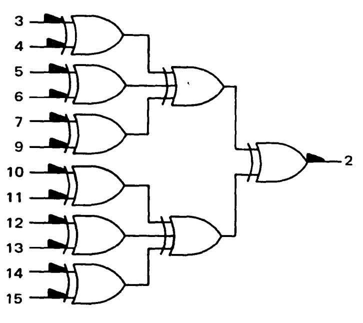
SEQUENTIAL TRUTH TABLE

D	$\bar{C}$	$\bar{C}_E$	Q_{n+1}
L	L	L	Q_n
L	L	H	L
L	H	L	Q_n
L	H	H	Q_n
H	L	L	Q_n
H	L	H	H
H	H	L	Q_n
H	H	H	Q_n

5

PARITY CHECKER

MC10160
12-Bit Parity Generator-Checker

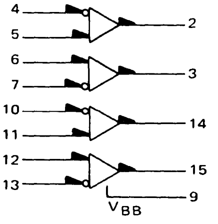


INPUT	OUTPUT
Sum of High Level Inputs	Pin 2
Even	Low
Odd	High

P_D = 320 mW typ

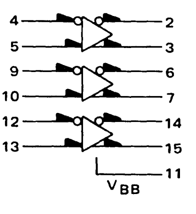
RECEIVERS

MC10115
Quad Line Receiver



P_D = 100 mW typ/pkg
t_{pd} = 2.0 ns typ

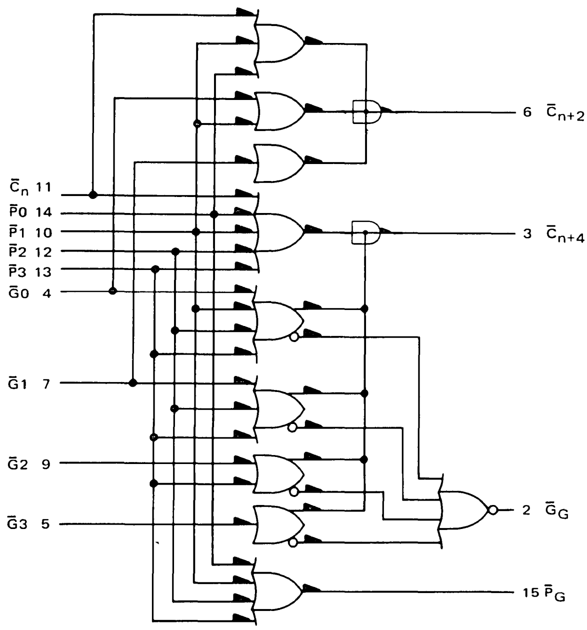
MC10116
Triple Line Receiver



P_D = 75 mW typ/pkg
t_{pd} = 2.0 ns typ

ADDER AND ARITHMETIC FUNCTIONS

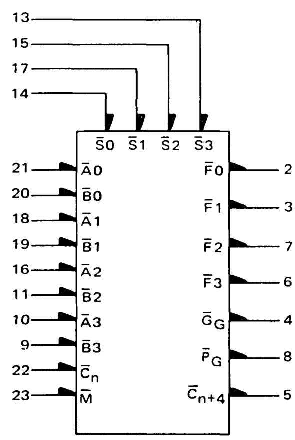
MC10179
Look-Ahead Carry Block



P_D = 250 mW typ/pkg
t_{pd} = 2.0 ns typ (Carry, Propagate)
4.0 ns typ (Generate)

MC10181
4-Bit Arithmetic Logic Unit/Function Generator

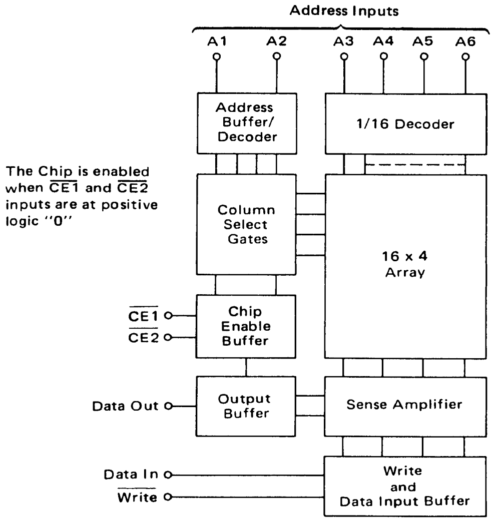
P_D = 600 mW/typ
t_{pd} (typ): A1 to F = 7 ns
C_n to C_n+4 = 3.1 ns
A1 to P_G = 3.0 ns
A1 to G_G = 4.5 ns
A1 to C_{n+4} = 4.9 ns



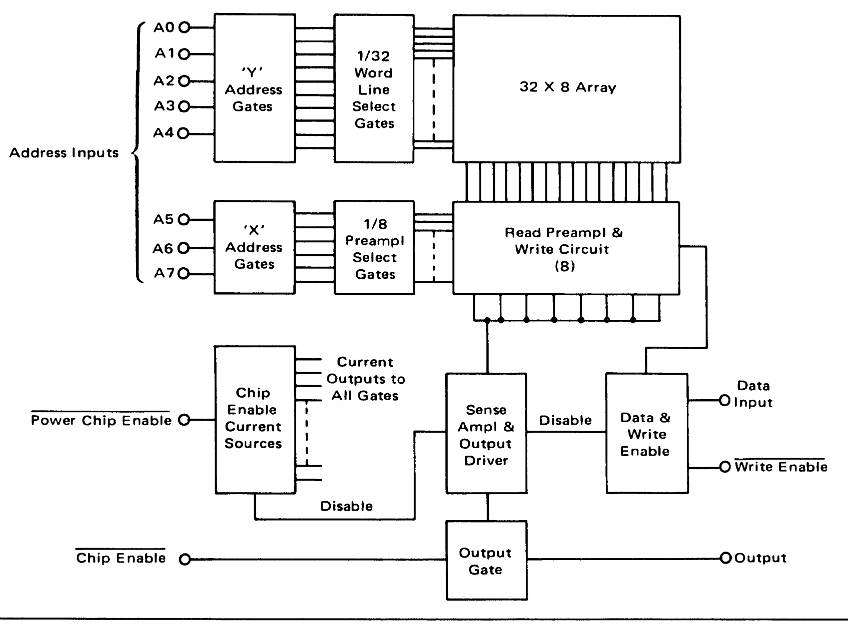
5

MEMORIES

MCM10140
MCM10148
64-Bit Random Access Memory



MCM10144
256-Bit Random Access Memory



5

MECL

INTEGRATED CIRCUITS

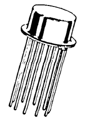
MECL

MC300 Series (−55° to +125°C)

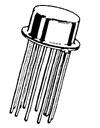
MC350 Series (0° to +75°C)

FEATURES

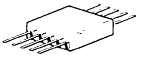
- Propagation delay typically 8 ns per logic decision
- Virtually constant noise immunity with ±20% power supply variation and over corresponding temperature range
- Simultaneous OR / NOR or AND / NAND outputs
- High fan-in and fan-out capabilities



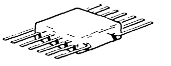
G SUFFIX
METAL PACKAGE
CASE 602B



G SUFFIX
METAL PACKAGE
CASE 604



F SUFFIX
CERAMIC PACKAGE
CASE 606
TO-91



F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86

The MECL series of integrated logic circuits forms a versatile set of monolithic digital building blocks representing all the necessary circuitry for the arithmetic portion of a computer. MECL circuits combine high speed with a systems-oriented design approach that permits implementation with the fewest possible number of individual devices. This represents both a cost saving and a potential increase in system reliability. The MECL circuits in this series are compatible with higher speed MECL lines, such as MECL II.

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FUNCTIONS AND CHARACTERISTICS (V_{CC} = 0, V_{EE} = -5.2 V, T_A = 25°C)

Function	Type ① -55 to +125°C	Type ① 0 to +75°C	DC Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Total Power Dissipation mW typ/pkg	Case
5-Input OR/NOR Gate	MC301	MC351	25	7.5	37	602B,606
R-S Flip-Flop	MC302	MC352A	25	11	42	602B,606
R-S Flip-Flop w/o Buffered Outputs	–	MC352	25	11	40	602B,606
Half-Adder	MC303	MC353	25	7.5	63	602B,606
Bias Driver	MC304	MC354	25	–	18	602B,606
5-Input Gate Expander	MC305	MC355	–	4.5	–	602B,606
3-Input OR/NOR Gate	MC306	MC356	25	7.5	37	602B,606
3-Input OR/NOR Gate	MC307	MC357	25	7.5	15	602B,606
AC-Coupled J-K Flip-Flop	MC308	MC358A	25	8.5	87	602B,606
Dual 2-Input NOR Gate	MC309	MC359	25	7.0	54	602B,606
Dual 2-Input NOR Gate	MC310	MC360	25	7.0	54	602B,606
Dual 2-Input NOR Gate	MC311	MC361	25	7.0	41	602B,606
Dual 3-Input NOR Gate (With Internal Bias)	MC312A	MC362A	25	7.5	70	602B,606
Dual 3-Input NOR Gate	MC312	MC362	25	7.5	54	604,607
Quad 2-Input NOR Gate	MC313F	MC363F	25	7.0	125	607
AC-Coupled J-K Flip-Flop	MC314	MC364	25	12	118	602B, 606
Line Driver	MC315	MC365	–	14	180②– 270③	602B, 606
Lamp Driver	MC316	MC366	–	–	135	602B, 606
Level Translator – MECL to Saturated Logic	MC317	MC367	7 (DTL)	27.5	63	602B, 606
Level Translator – Saturated Logic to MECL	MC318	MC368	25 (MECL)	17	105	602B, 606
Dual 4-Input Clock Driver/High-Speed Gate	–	MC369F	100	3.0	250	607
Dual 2-Input Clock Driver/High-Speed Gate	–	MC369G	100	3.0	250	602B

① G suffix denotes Metal Can. F suffix denotes Flat Package. (i.e., MC301G = Metal Can, MC301F = Flat Package.)
② With 93-ohm load for MC315 (each side)
③ With 50-ohm load for MC365 (each side)

MECL LOGIC DIAGRAMS

MECL — LOGIC DESCRIPTION

The logic diagrams shown describe the circuits of the MECL line and permit quick selection of circuits required to implement a particular logic system. Pertinent information, such as logic equations and truth tables, is provided to show line compatibility. Package pin numbers and loading factors for each device are specified on each logic diagram. The numbers at the ends of the terminals are package pin numbers. The numbers in parentheses indicate loading factors at each terminal.

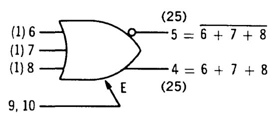
MECL circuits require a bias voltage that, for best results, should be obtained from a regulated, temperature-compensated, bias supply. A bias driver, type MC304 or MC354, is included in the MECL line to provide this function when the bias driver is not self-contained in a logic element.

5

GATES

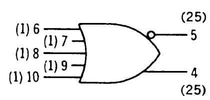
(For supply voltage pin connections, see data sheets)

MC306, MC307*, MC356, MC357* 3-INPUT GATE



*No pull-down resistors

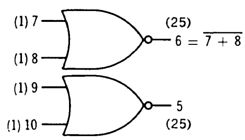
MC301, MC351 — 5-INPUT GATE



$5 = \overline{6+7+8+9+10}$

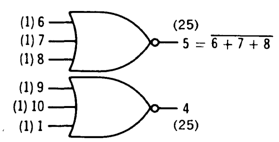
$4 = 6+7+8+9+10$

MC309, MC310*, MC311*, MC359, MC360*, MC361* — DUAL 2-INPUT GATE

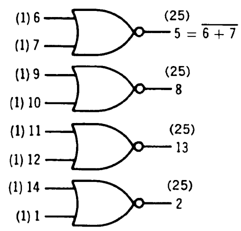


*Optional pull-down resistors

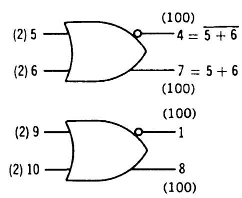
MC312A, MC362, MC362A DUAL 3-INPUT GATE



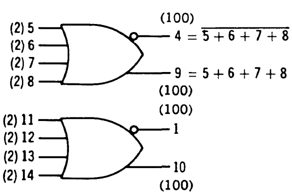
MC313F, MC363F — QUAD 2-INPUT GATE



MC369G — HIGH-SPEED CLOCK DRIVER OR DUAL 2-INPUT GATE



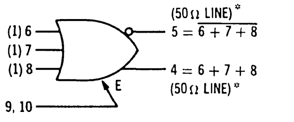
MC369F — HIGH-SPEED CLOCK DRIVER OR DUAL 4-INPUT GATE



MECL LOGIC DIAGRAMS

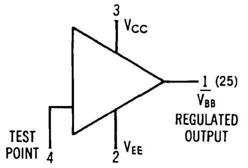
DRIVERS

MC315, MC365 — LINE DRIVER

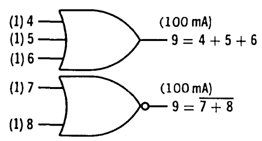


*93Ω line recommended for −55 to +125°C operation

MC304, MC354 — BIAS DRIVER



MC316, MC366 — LAMP DRIVER

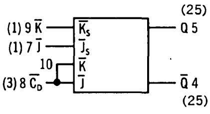


FLIP-FLOPS

MC308, MC314, MC358A, MC364 — AC-COUPLED J-K FLIP-FLOP

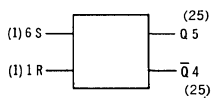
CLOCKED J-K OPERATION

$\overline{J}_S$	$\overline{K}_S$	$\overline{C}_D$	Q^{n+1}
ϕ	ϕ	0	Q^n
0	0	1	$\overline{Q}^n$
0	1	1	1
1	0	1	0
1	1	1	Q^n



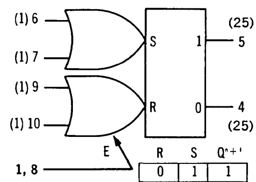
R-S OPERATION

R	S	Q^{n+1}
0	1	1
1	0	0
0	0	Q^n
1	1	N.D.



The $\overline{J}_S$ and $\overline{K}_S$ inputs refer to logic levels while the $\overline{C}_D$ input refers to dynamic logic swings. The $\overline{J}_S$ and $\overline{K}_S$ inputs would be changed to a logical "1" only while the $\overline{C}_D$ input is in a logic "1" state. ($\overline{C}_D$ maximum "1" level = V_{CC} − 0.6 volts)

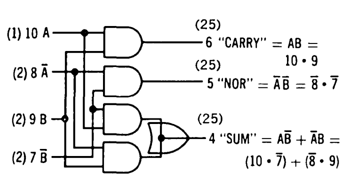
MC302, MC352, MC352A R-S FLIP-FLOP



R	S	Q^{n+1}
0	1	1
1	0	0
0	0	Q^n
1	1	N.D.

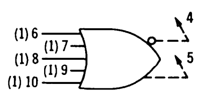
HALF ADDER

MC303, MC353 — HALF-ADDER



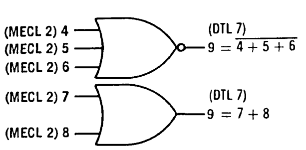
EXPANDER

MC305, MC355 — 5-INPUT EXPANDER

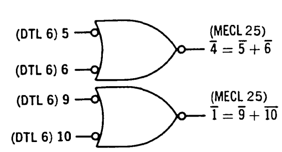


LEVEL TRANSLATORS

MC317, MC367 — LEVEL TRANSLATOR



MC318, MC368 — LEVEL TRANSLATOR



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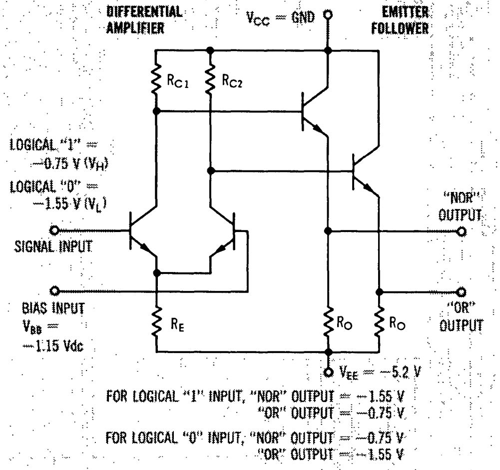
BASIC MECL GATE CIRCUIT



MAXIMUM RATINGS

Characteristic	Symbol	Rating	Unit
Ratings above which device life may be impaired:			
Power Supply Voltage (V_{CC} = 0 Vdc)	V_{EE}	−10	Vdc
Base Input Voltage (V_{CC} = 0 Vdc)	V_{in}	0 to V_{EE}	Vdc
Output Source Current	I_O	20	mAdc
Storage Temperature Range	T_{stg}	−65 to +150	°C
Rcommended maximum ratings above which performance may be degraded:			
Operating Temperature Range MC300 Series / MC350 Series	T_A	−55 to +125 / 0 to +75	°C
AC Fan-In (Expandable Gates)	m	18	—
AC Fan-Out* (Gates and FlipFlops)	n	15	—

*Although a minimum dc fan-out of 25 is guaranteed in each electrical specification, it is recommended that the maximum ac fan-out of 15 be used for high-speed operation.

CIRCUIT DESCRIPTION

The MECL line of monolithic integrated logic circuits designed as a non-saturating form of logic eliminates transistor storage time as a speed limiting characteristic, and permits extremely high-speed operation.

The typical MECL circuit consists of a differential-amplifier input, with emitter-follower output to restore dc levels. High fan-out operation is possible because of the high input impedance of the differential amplifier and the low output impedance of the emitter followers. Power-supply noise is virtually eliminated by the nearly constant current drain of the differential amplifier, even during the transition period. Basic gate design provides for simultaneous output of both the function and its complement.

POWER-SUPPLY CONNECTIONS

Any one of the power supply nodes, V_{BB}, V_{CC}, or V_{EE} may be used as ground; however, the manufacturer has found it most convenient to ground the V_{CC} node. In such a case: $V_{CC} = 0$, $V_{BB} = -1.15$ V, $V_{EE} = -5.2$ V, as shown in the schematic diagram above.

SYSTEM LOGIC SPECIFICATIONS

The output logic swing of 0.8 V then varies from a low state of $V_L = -1.55$ V to a high state of $V_H = -0.75$ V with respect to ground.

Positive logic is used when reference is made to logical "0's" or "1's". Then

$$\left.\begin{array}{l}\text{"0"} = -1.55\text{ V}\\ \text{"1"} = -0.75\text{ V}\end{array}\right\}\text{ typical}$$

Dynamic logic refers to a change of logic states. Dynamic "0" is a negative going voltage excursion and a dynamic "1" is a positive going voltage excursion.

CIRCUIT OPERATION

A fixed bias of −1.15 volts is applied to the "bias input" of the differential amplifier and the logic signals are applied to the "signal input". If a logical "0" is applied, the current through R_E is supplied by the fixed-biased transistor. A drop of 800 mV occurs across R_{C2}. The OR output then is −1.55 V, or one V_{BE}-drop below 800 mV. Since no current flows in the "signal input" transistor, the NOR output is a V_{BE}-drop below ground, or −0.75 volts. When a logical "1" level is applied to the "signal input", the current through R_{C2} is switched to the "signal input" transistor and a drop of 800 mV occurs across R_{C1}. The OR output then goes to −0.75 volts and the NOR output goes to −1.55 volts.

Note: Any unused input should be connected to V_{EE}.

BIAS VOLTAGE SOURCE

The bias voltage applied to the bias input is obtained from a regulated, temperature-compensated bias driver, type MC304 or MC354. The temperature characteristics of the bias driver compensate for any variations in circuit operating point over the temperature range or supply voltage changes, to insure that the threshold point is always in the center of the transfer characteristic curves. The bias driver can be used to drive up to 25 logic elements and should be employed for all elements except those with built-in bias networks.

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MECL II — INTEGRATED CIRCUITS

MECL II

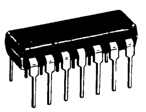
MC1000 Series (0 to +75°C)
MC1200 Series (−55 to +125°C)

The MECL II series of monolithic integrated logic circuits presents the system design engineer with an integrated circuit family designed to permit system implementation with the fewest possible number of individual units. This approach offers cost savings, reduced power supply requirements, smaller physical size and high reliability.

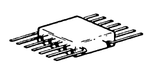
MECL II circuits feature the fastest propagation delay times with commensurate rise and fall times of any family of integrated circuits. This feature plus the constant current feature of MECL imposes fewer restrictions on design, layout and system fabrication than any other high-speed family.

FEATURES

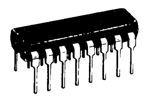
- Propagation typically 4 ns per logic decision
- Excellent noise immunity characteristics
- Simultaneous OR/NOR outputs
- High fan-in and fan-out capabilities
- Internally temperature compensated



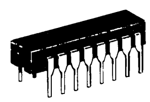
P SUFFIX
PLASTIC PACKAGE
CASE 646
TO-116



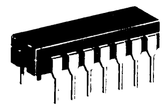
F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86



P SUFFIX
PLASTIC PACKAGE
CASE 648



L SUFFIX
CERAMIC PACKAGE
CASE 620



L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 0, V_{EE} = -5.2 V, T_A = 25°C)

Function	Type		DC Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Total Power Dissipation mW typ	Case ①
	-55 to + 125°C	0 to + 75°C				
Single 6-Input Gate, 3 OR Outputs w/Pulldowns 3 NOR Outputs w/Pulldowns	MC1201F,L	MC1001P	25	4.0	115	607, 632, 646
Single 6-Input Gate, 3 OR Outputs w/Pulldowns 3 NOR Outputs w/o Pulldowns	MC1202F,L	MC1002P	25	4.0	80	607, 632, 646
Single 6-Input Gate, 3 OR Outputs w/o Pulldowns 3 NOR Outputs w/o Pulldowns	MC1203F,L	MC1003P	25	4.0	40	607, 632, 646
Dual 4-Input Gate, 2 OR Outputs w/Pulldowns 2 NOR Outputs w/Pulldowns	MC1204F,L	MC1004P	25	4.0	95	607, 632, 646
Dual 4-Input Gate, 2 OR Outputs w/Pulldowns 2 NOR Outputs w/o Pulldowns	MC1205F,L	MC1005P	25	4.0	65	607, 632, 646
Dual 4-Input Gate, 2 OR Outputs w/o Pulldowns 2 NOR Outputs w/o Pulldowns	MC1206F,L	MC1006P	25	4.0	45	607, 632, 646
Triple 3-Input Gate, 3 NOR Outputs w/Pulldowns	MC1207F,L	MC1007P	25	4.0	110	607, 632, 646
Triple 3-Input Gate, 1 NOR Outputs w/Pulldowns 2 NOR Outputs w/o Pulldowns	MC1208F,L	MC1008P	25	4.0	75	607, 632, 646
Triple 3-Input Gate, 3 NOR Outputs w/o Pulldowns	MC1209F,L	MC1009P	25	4.0	60	607, 632, 646
Quad 2-Input Gate, 4 NOR Outputs w/Pulldowns	MC1210F,L	MC1010P	25	4.5	115	607, 632, 646
Quad 2-Input Gate, 2 NOR Outputs w/Pulldowns 2 NOR Outputs w/o Pulldowns	MC1211F,L	MC1011P	25	4.5	95	607, 632, 646

① Type numbers with F suffix use Case 607, Type numbers with L suffix use Case 632 or 620 as indicated. Type numbers with P suffix use Case 646 or 648 as indicated.

MECL II INTEGRATED CIRCUITS

FUNCTIONS AND CHARACTERISTICS (continued)

Function	Type -55 to +125°C	Type 0 to +75°C	DC Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Total Power Dissipation mW typ	Case ①
Quad 2-Input Gate, 4 NOR Outputs w/o Pulldowns	MC1212F,L	MC1012P	25	4.5	65	607, 632, 646
AC Coupled J-K Flip-Flop (85 MHz typ)	MC1213F,L	MC1013P	25	6.0	125	607, 632, 646
Dual R-S Flip-Flop (Positive Clock)	MC1214F,L	MC1014P	25	6.0	140	607, 632, 646
Dual R-S Flip-Flop (Negative Clock)	MC1215F,L	MC1015P	25	6.0	140	607, 632, 646
Dual R-S Flip-Flop (Single Rail)	MC1216F,L	MC1016P	25	6.0	140	607, 632, 646
Level Translator (Saturated Logic to MECL)	MC1217F,L	MC1017P	25 (MECL)	15	105	607, 632, 646
Level Translator (MECL to Saturated Logic)	MC1218F,L	MC1018P	7 (DTL)	19	55	607, 632, 646
Full Adder	MC1219F,L	MC1019P	25	3.0 or 8.0*	145	607, 632, 646
Quad Line Receiver	MC1220F,L	MC1020P	25	4.0	115	607, 632, 646
Full Subtractor	MC1221F,L	MC1021P	25	4.0 or 11*	145	607, 632, 646
Type D Flip-Flop	MC1222F,L	MC1022P	25	8.0	110	607, 632, 646
Dual 4-Input OR/NOR Clock Driver	MC1223L	MC1023F,P	25	2.0	250	607, 632, 646
Dual 2-Input Expandable Gate	MC1224F,L	MC1024P	25	4.0	95	607, 632, 646
Dual 4 and 5-Input Expander	MC1225F,L	MC1025P	–	–	–	607, 632, 646
Dual 3-4-Input Transmission Line and Clock Driver	MC1226F,L	MC1026P	25	2.0	140	607, 632, 646
AC Coupled J-K Flip-Flop (120 MHz typ)	MC1227L	MC1027F,P	25	4.0	250	607, 632, 646
Dual 4-Channel Data Selector	MC1228L	MC1028P	25	5.0	170	620, 648
Data Distributor	MC1229F,L	MC1029P	25	4.0	160	607, 632, 646
Quad Exclusive OR Gate	MC1230F,L	MC1030P	25	5.0	130	607, 632, 646
Quad Exclusive NOR Gate	MC1231F,L	MC1031P	25	5.0	130	607, 632, 646
100-MHz AC Coupled Dual J-K Flip-Flop	MC1232L	MC1032P	25	4.5	180	620, 648
Dual R-S Flip-Flop (Single Rail, Negative Clock)	MC1233F,L	MC1033P	25	6.0	140	607, 632, 646
Type D Flip-Flop	MC1234L	MC1034F,P	25	4.0	185	607, 632, 646
Triple Line Receiver	MC1235F,L	MC1035P	25	5.0	140	607, 632, 646
16-Bit Coincident Memory	MC1236L	MC1036F,P	5	17	250	607, 632, 646
16-Bit Coincident Memory w/o Pulldowns	MC1237L	MC1037F,P	5	17	250	607, 632, 646
8-Channel Data Selector	MC1238F,L	MC1038P	25	7.0 or 18*	150	607, 632, 646
Quad Level Translator (MECL to Saturated Logic)	MC1239L	MC1039P	7 (DTL)	12	200	620, 648
Quad Latch	MC1240L	MC1040F,P	25	8.0	250	607, 632, 646
Dual Binary to One-Of-Four Decoder	MC1242L	MC1042P	25	6.0	245	620, 648
3-Bit Binary to One-Of-Eight Line Decoder	MC1243L	MC1043F,P	25	6.0 or 11*	210	607, 632, 646
Binary to One-Of-Ten Line Decoder	MC1244L	MC1044P	25	6.0	245	620, 648
Decoder - Nixie ® Driver	MC1245L	MC1045P	–	–	178	620, 648
8-Bit Parity Checker and Generator	MC1246F,L	MC1046P	25	13 or 14*	205	607, 632, 646
Quad 2-Input AND Gates	MC1247F,L	MC1047P	25	5.0	130	607, 632, 646
Quad 2-Input NAND Gates	MC1248F,L	MC1048P	25	5.0	130	607, 632, 646
Dual Full Adder	MC1259L	MC1059P	25	9.0	375	620, 648
Quad 2-Input NOR Gate	MC1262L	MC1062P	25	2.0	320	620, 648
Quad 2-Input NOR Gate	MC1263F,L	MC1063P	25	2.0	320	632, 646
Triple Line Receiver	MC1266F,L	MC1066P	25	2.0	300	607, 632. 646
Quad MTTL to MECL Translator With Strobe	MC1267L	MC1067P	1	5.0	300	620, 648
Quad MECL to MTTL Translator With Totem-Pole Outputs	MC1268L	MC1068P	10 (MTTL)	7.0	340	620, 648
Quad Latch	MC1270L	MC1070F,P	25	8.0	200	607, 632, 646

① Type numbers with F suffix use Case 607, Type numbers with L suffix use Case 632 or 620 as indicated. Type numbers with P suffix use Case 646 or 648 as indicated.

*Propagation delay time is dependent on data path, see data sheet for details.

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MECL II LOGIC DIAGRAMS

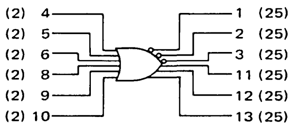
The logic diagrams shown describe the circuits of the MECL II line and permit quick selection of those circuits required to implement a particular logic system. Pertinent information, such as logic equations, truth tables, typical propagation delay time (t_{pd}), and typical power dissipation per package (P_D) is provided to show line compatibility. Package pin numbers and dc loading factors for each device are specified on each logic diagram. The numbers at the ends of the terminals are package pin numbers. The numbers in parenthesis indicate dc loading factors at each terminal.

MECL II circuits contain internal bias networks, insuring that the transition point is always in the center of the transfer characteristic curves over the temperature range.

GATES

(V_{CC} = pin 14, V_{EE} = pin 7 for Case 646, Case 632, and Case 607) (V_{CC} = pin 16, V_{EE} = pin 8 for Case 648 and Case 620)

MC1001, MC1002, MC1003
MC1201, MC1202, MC1203
6-Input Gate



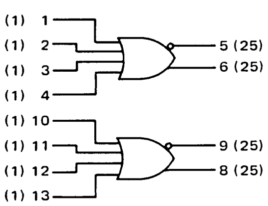
$1 = \overline{4+5+6+8+9+10}$

$11 = 4+5+6+8+9+10$

t_{pd} = 4.0 ns

P_D = MC1001/MC1201 – 115 mW
MC1002/MC1202 – 80 mW
MC1003/MC1203 – 40 mW

MC1004, MC1005, MC1006
MC1204, MC1205, MC1206
Dual 4-Input Gate



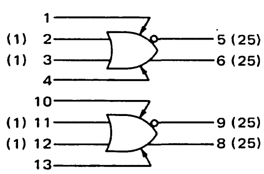
$5 = \overline{1+2+3+4}$

$6 = 1+2+3+4$

t_{pd} = 4.0 ns

P_D = MC1004/MC1204 – 95 mW
MC1005/MC1205 – 65 mW
MC1006/MC1206 – 45 mW

MC1024, MC1224
Dual 2-Input Expandable Gate



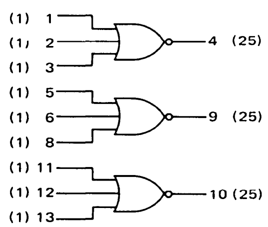
$5 = \overline{2+3}$

$6 = 2+3$

t_{pd} = 4.0 ns

P_D = 95 mW

MC1007, MC1008, MC1009
MC1207, MC1208, MC1209
Triple 3-Input Gate

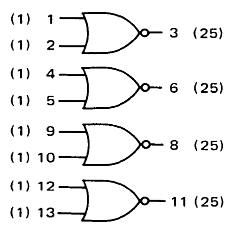


$4 = \overline{1+2+3}$

t_{pd} = 4.0 ns

P_D = MC1007/MC1207 – 110 mW
MC1008/MC1208 – 75 mW
MC1009/MC1209 – 60 mW

MC1010, MC1011, MC1012
MC1210, MC1211, MC1212
Quad 2-Input Gate

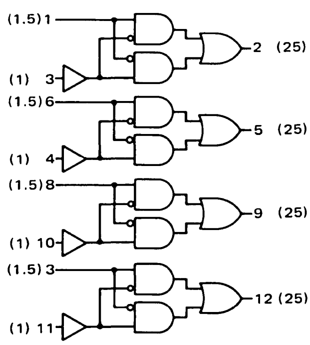


$3 = \overline{1+2}$

t_{pd} = 4.5 ns

P_D = MC1010/MC1210 – 115 mW
MC1011/MC1211 – 95 mW
MC1012/MC1212 – 65 mW

MC1030, MC1230
Quad Exclusive OR Gate

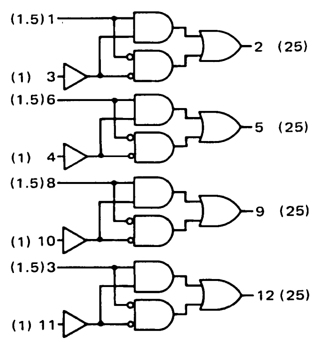


$2 = 1 \bullet \overline{3} + \overline{1} \bullet 3$

t_{pd} = 5.0 ns

P_D = 130 mW

MC1031, MC1231
Quad Exclusive NOR Gate



$2 = 1 \bullet 3 + \overline{1} \bullet \overline{3}$

t_{pd} = 5.0 ns

P_D = 130 mW

(continued)

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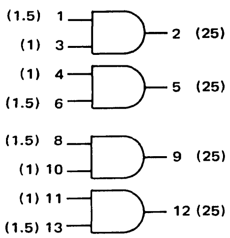
MECL II LOGIC DIAGRAMS

GATES (continued)

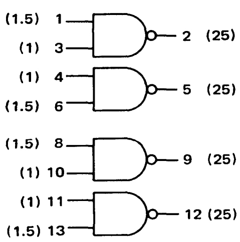
MC1047, MC1247
Quad 2-Input AND Gate



$2 = 1 \cdot 3$

$t_{pd} = 5.0$ ns
$P_D = 130$ mW

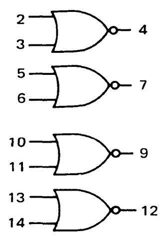
MC1048, MC1248
Quad 2-Input NAND Gate



$2 = \overline{1 \cdot 3}$

$t_{pd} = 5.0$ ns
$P_D = 130$ mW

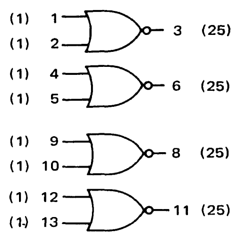
MC1062, MC1262
Quad 2-Input NOR Gate



$4 = \overline{2 + 3}$

$t_{pd} = 2.0$ ns
$P_D = 320$ mW

MC1063, MC1263
Quad 2-Input NOR Gate

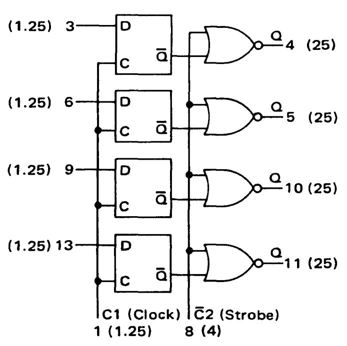


$3 = \overline{1 + 2}$

$t_{pd} = 2.0$ ns
$P_D = 320$ mW

LATCH

MC1040, MC1240
MC1070, MC1270
Quad Latch



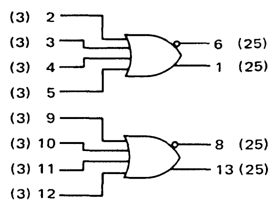
TRUTH TABLE

D	C1	$\bar{C}2$	Q^{n+1}
0	0	0	Q^n
1	0	0	Q^n
0	1	0	0
1	1	0	1
0	0	1	0
1	0	1	0
0	1	1	0
1	1	1	0

$t_{pd} = 8.0$ ns
$P_D = 250$ mW (MC1040/1240)
$= 200$ mW (MC1070/1270)

DRIVERS

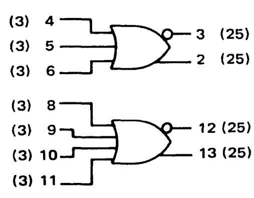
MC1023, MC1223
Dual 4-Input Clock Driver



$6 = \overline{2 + 2 + 4 + 5}$
$1 = 2 + 3 + 4 + 5$

$t_{pd} = 2.0$ ns
$P_D = 250$ mW

MC1026, MC1226
Dual 3-4 Input Transmission Line and Clock Driver



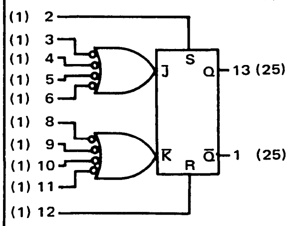
$3 = \overline{4 + 5 + 6}$
$2 = 4 + 5 + 6$

$t_{pd} = 2.0$ ns
$P_D = 140$ mW

MECL II LOGIC DIAGRAMS

FLIP-FLOPS

MC1013, MC1213
AC-Coupled J-K Flip-Flop
(85 MHz typ)



t_{pd} = 6.0 ns
P_D = 125 mW

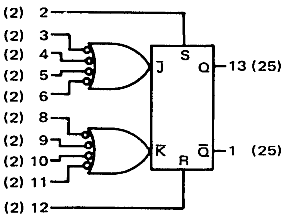
CLOCKED J-K OPERATION

$\bar{J}$	$\bar{K}$	$\bar{C}_D$	Q^n
ϕ	ϕ	0	Q^n
0	0	1	$\bar{Q}^n$
0	1	1	1
1	0	1	0
1	1	1	Q^n

The $\bar{J}$ and $\bar{K}$ inputs refer to logic levels while the $\bar{C}_D$ input refers to dynamic logic swings. The $\bar{J}$ and $\bar{K}$ inputs should be changed to a logical "1" only while the $\bar{C}_D$ input is in a logic "1" state. ($\bar{C}_D$ maximum "1" level = V_{CC} − 0.6 V.) Clock $\bar{C}_D$ is obtained by tying one $\bar{J}$ and one $\bar{K}$ input together.

R-S OPERATION

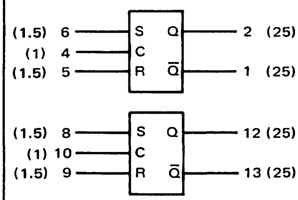
R	S	Q^{n+1}
0	1	1
1	0	0
0	0	Q^n
1	1	N.D.



t_{pd} = 4.0 ns
P_D = 250 mW

MC1027, MC1227
AC-Coupled J-K Flip-Flop
(120 MHz typ)

MC1014, MC1214
MC1015, MC1215
Dual Clocked R-S Flip-Flop



t_{pd} = 6.0 ns
P_D = 140 mW

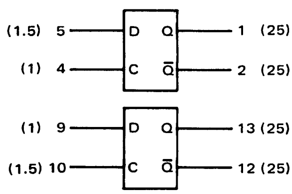
MC1014/1214

C	R	S	Q^{n+1}
1	0	0	Q^n
1	0	1	1
1	1	0	0
1	1	1	ND
0	ϕ	ϕ	Q^n

MC1015/1215

C	R	S	Q^{n+1}
0	0	0	Q^n
0	0	1	1
0	1	0	0
0	1	1	ND
1	ϕ	ϕ	Q^n

MC1016, MC1216
MC1033, MC1233
Dual Clocked Single Rail R-S Flip-Flop



t_{pd} = 6.0 ns
P_D = 140 mW

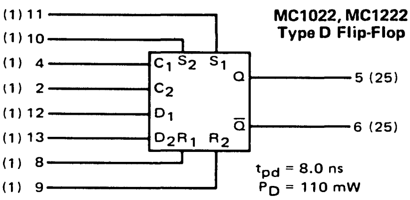
MC1016/1216

C	D	Q^{n+1}
0	0	Q^n
0	1	Q^n
1	0	0
1	1	1

MC1033/1233

C	D	Q^{n+1}
1	0	Q^n
1	1	Q^n
0	0	0
0	1	1

MC1022, MC1222
Type D Flip-Flop



t_{pd} = 8.0 ns
P_D = 110 mW

R-S TRUTH TABLE

	R	S	Q^{n+1}	$\bar{Q}^{n+1}$
Pin No.	8 or 9	10 or 11	5	6
	0	0	Q^n	$\bar{Q}^n$
	0	1	1	0
	1	0	0	1
	1	1	N.D.	N.D.

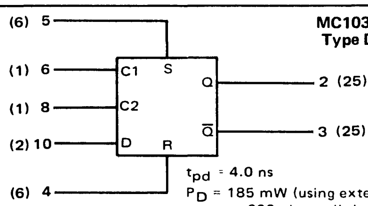
N.D. = Not Defined

CLOCKED TRUTH TABLE

	D	C	Q^{n+1}	$\bar{Q}^{n+1}$
Pin No.	12 or 13	2 or 4	5	6
	0	0	Q^n	$\bar{Q}^n$
	1	0	Q^n	$\bar{Q}^n$
	0	1*	0	1
	1	1*	1	0

*A "1" or Clock input is defined for this flip-flop as a change in level from a low input to a high input.

MC1034, MC1234
Type D Flip-Flop



t_{pd} = 4.0 ns
P_D = 185 mW (using external 600-ohm pull-down resistors)
240 mW (using internal pull-down resistors)

R-S TRUTH TABLE

	R	S	Q^{n+1}	Q^{n+1}
Pin No.	4	5	2	3
	0	0	Q^n	$\bar{Q}^n$
	0	1	1	0
	1	0	0	1
	1	1	N.D.	N.D.

N.D. = Not Defined

CLOCKED TRUTH TABLE

	D	C	Q^{n+1}	Q^{n+1}
Pin No.	10	6 or 8	2	3
	0	0	Q^n	$\bar{Q}^n$
	1	0	Q^n	$\bar{Q}^n$
	0	1*	0	1
	1	1*	1	0

*A "1" or Clock input is defined for this flip-flop as a change in level from a low input to a high input.

(continued)

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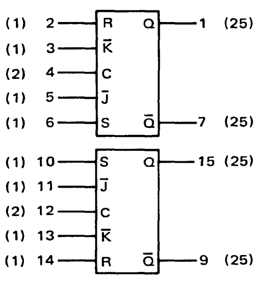
FLIP-FLOPS (continued)

MC1032, MC1232
100 MHz AC-Coupled Dual
J-K Flip-Flop



t_{pd} = 4.5 ns
P_D = 180 mW

R-S TRUTH TABLE

	R	S	Q^{n+1}
Pin No.	2 & 14	6 & 10	1 & 15
	0	0	Q^n
	0	1	1
	1	0	0
	1	1	N.D.

All $\bar{J}$-$\bar{K}$ inputs and Clock inputs are static
N.D. = Output state not defined

$\bar{J}_D$ - $\bar{K}_D$ TRUTH TABLE

	$\bar{J}_D$	$\bar{K}_D$	Q^{n+1}
Pin No.	*	*	1 & 15
	0	0	Q^n
	0	1	0
	1	0	1
	1	1	$\bar{Q}^n$

All Clock inputs and the R-S inputs are at a "0" Level

CLOCKED $\bar{J}$-$\bar{K}$ TRUTH TABLE

	$\bar{J}$	$\bar{K}$	Clock	Q^n
Pin No.	*	*	4 & 12	1 & 15
	ϕ	ϕ	0	Q^n
	0	0	1	$\bar{Q}^n$
	0	1	1	1
	1	0	1	0
	1	1	1	$\bar{Q}^n$

*Any $\bar{J}$ or $\bar{K}$ input
All other $\bar{J}$-$\bar{K}$ inputs and the R-S inputs are at a "0" Level
ϕ = Either logic level will result in the desired output.

The $\bar{J}$ and $\bar{K}$ inputs refer to logic levels while the clock input refers to dynamic logic swings. The $\bar{J}$ and $\bar{K}$ inputs should be changed to a logic "1" only while the clock input is in a logic "1" state (Clock maximum "1" level = V_{CC} -0.7 V).

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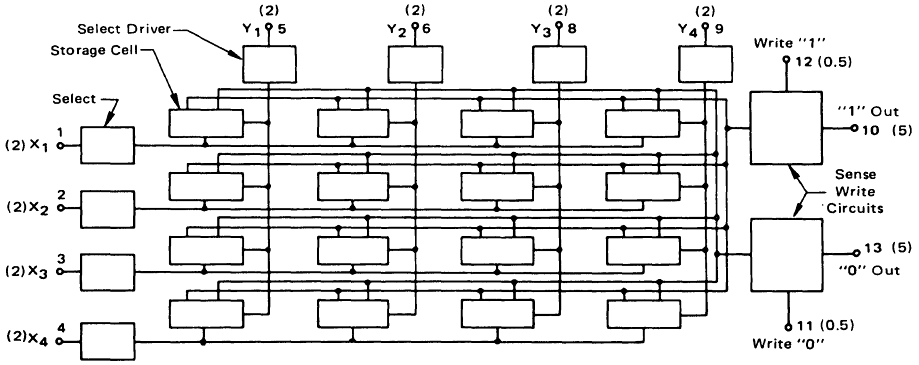
MEMORY

MC1036, MC1236
MC1037, MC1237
16-Bit Coincident Memory



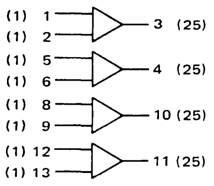
t_{pd} = 17 ns
P_D = 250 mW
Cycle Time = 50 ns typ

Maximum Power Supply Variation = ±10%

MECL II LOGIC DIAGRAMS

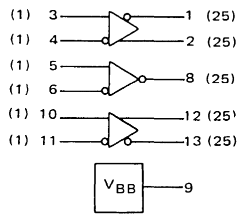
RECEIVERS

MC1020, MC1220
Quad Line Receiver



t_{pd} = 4.0 ns
P_D = 115 mW

MC1035, MC1235
Triple Line Receiver



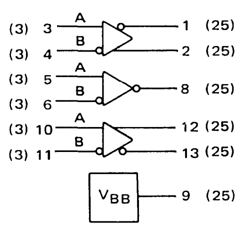
t_{pd} = 5.0 ns
P_D = 140 mW

TRUTH TABLE

INPUTS		OUTPUTS	
A	B	OR	NOR
1	V_{BB}	1	0
0	V_{BB}	0	1
V_{BB}	1	0	1
V_{BB}	0	1	0

5

MC1066, MC1266
Triple Line Receiver



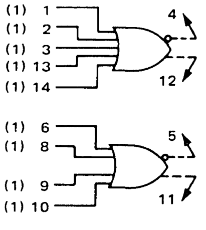
TRUTH TABLE

INPUTS		OUTPUTS	
A	B	OR	NOR
1	V_{BB}	1	0
0	V_{BB}	0	1
V_{BB}	1	0	1
V_{BB}	0	1	0

t_{pd} = 2.0 ns
P_D = 300 mW typ

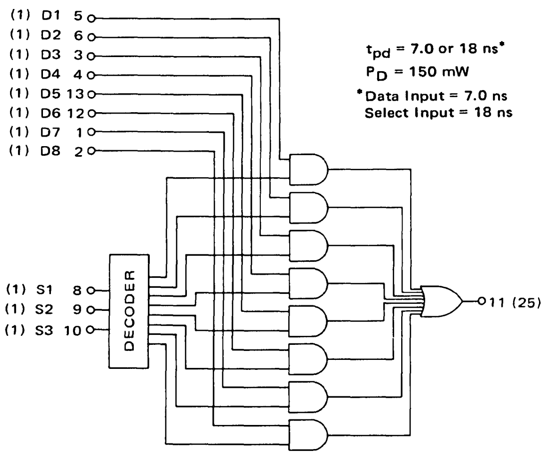
EXPANDER

MC1025, MC1225
Dual 4-5 Input Expander



DATA SELECTORS

MC1038, MC1238
8-Channel Data Selector

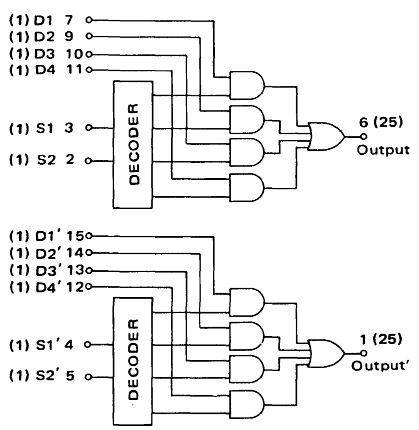


t_{pd} = 7.0 or 18 ns*
P_D = 150 mW
*Data Input = 7.0 ns
Select Input = 18 ns

Output Function:

$\overline{S1}\,\overline{S2}\,\overline{S3}\,D1 + \overline{S1}\,\overline{S2}\,S3\,D2 + \overline{S1}\,S2\,\overline{S3}\,D3 + \overline{S1}\,S2\,S3\,D4$
$+ S1\,\overline{S2}\,\overline{S3}\,D5 + S1\,\overline{S2}\,S3\,D6 + S1\,S2\,\overline{S3}\,D7 + S1\,S2\,S3\,D8$

MC1028, MC1228
Dual 4-Channel Data Selector

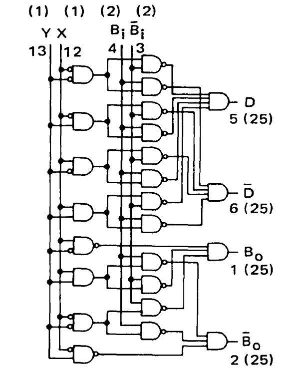


t_{pd} = 5.0 or 10 ns*
P_D = 170 mW
*Data Input = 5.0 ns
Select Input = 10 ns

Output Function: $\overline{S1}\,\overline{S2}\,D1 + S1\,\overline{S2}\,D2 + \overline{S1}\,S2\,D3 + S1\,S2\,D4$

SUBTRACTOR

MC1021, MC1221
Full Subtractor

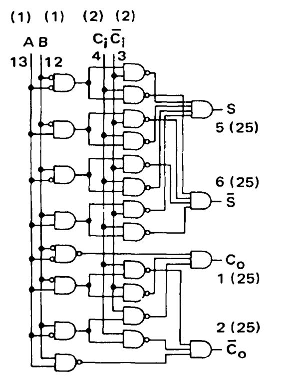


$D = YXB_i + Y\overline{X}\,\overline{B}_i + \overline{Y}X\overline{B}_i + \overline{Y}\,\overline{X}B_i$
$\overline{D} = \overline{Y}\,\overline{X}\,\overline{B}_i + YX\overline{B}_i + Y\overline{X}B_i + \overline{Y}XB_i$
$B_o = \overline{Y}\,\overline{X}B_i + Y\overline{X}\,\overline{B}_i + Y\overline{X}B_i + YXB_i$
$\overline{B}_o = \overline{Y}\,\overline{X}\,\overline{B}_i + \overline{Y}X\overline{B}_i + \overline{Y}XB_i + YX\overline{B}_i$

t_{pd} = 4.0 to 11 ns P_D = 145 mW

FULL ADDERS

MC1019, MC1219
Full Adder



$S = ABC_i + A\overline{B}\,\overline{C}_i + \overline{A}B\overline{C}_i + \overline{A}\,\overline{B}C_i$
$\overline{S} = \overline{A}\,\overline{B}\,\overline{C}_i + AB\overline{C}_i + A\overline{B}C_i + \overline{A}BC_i$
$C_o = ABC_i + AB\overline{C}_i + A\overline{B}C_i + \overline{A}BC_i$
$\overline{C}_o = \overline{A}\,\overline{B}\,\overline{C}_i + A\overline{B}\,\overline{C}_i + \overline{A}B\overline{C}_i + \overline{A}\,\overline{B}C_i$

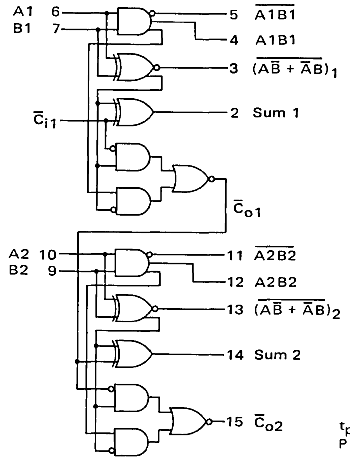
t_{pd} = 3.0 to 8.0 ns P_D = 145 mW

(continued)

MECL II LOGIC DIAGRAMS

FULL ADDERS (continued)

MC1059, MC1259
Dual Full Adder



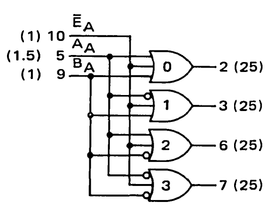
t_{pd} (Add delay) = 9.0 ns typ
P_D = 375 mW typ

TRUTH TABLE

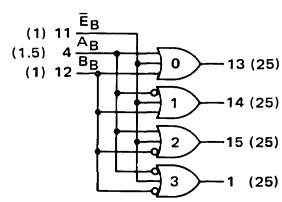
INPUTS			OUTPUTS			
A1	B1	$\overline{C}_{i1}$	A1 B1	A1 ⊕ B1	S1	$\overline{C}_{o1}$
0	0	0	0	1	1	1
1	0	0	0	0	0	0
0	1	0	0	0	0	0
1	1	0	1	1	1	0
0	0	1	0	1	0	1
1	0	1	0	0	1	1
0	1	1	0	0	1	1
1	1	1	1	1	0	0
A2	B2	$\overline{C}_{o1}$	A2 B2	A2 ⊕ B2	S1	$\overline{C}_{o2}$
0	0	1	0	1	0	1
1	0	0	0	0	0	0
0	1	0	0	0	0	0
1	1	0	1	1	1	0
1	1	1	1	1	0	0
0	1	1	0	0	1	1
1	0	1	0	0	1	1
0	0	0	0	1	1	1

DECODERS

MC1042, MC1242
Dual Binary To
One-Of-Four Decoder



2 = 10 + 9 + 5
3 = 10 + 9 + $\overline{5}$
6 = 10 + $\overline{9}$ + 5
7 = 10 + $\overline{9}$ + $\overline{5}$



13 = 11 + 12 + 4
14 = 11 + 12 + $\overline{4}$
15 = 11 + $\overline{12}$ + 4
1 = 11 + $\overline{12}$ + $\overline{4}$

t_{pd} = 6.0 ns
P_D = 245 mW

TRUTH TABLE

	INPUTS			OUTPUTS			
	$\overline{E}_A$	B_A	A_A	O_A	1_A	2_A	3_A
Pin No.	10	9	5	2	3	6	7
	0	0	0	0	1	1	1
	0	0	1	1	0	1	1
	0	1	0	1	1	0	1
	0	1	1	1	1	1	0
	1	*	*	1	1	1	1

	INPUTS			OUTPUTS			
	$\overline{E}_B$	B_B	A_B	O_B	1_B	2_B	3_B
Pin No.	11	12	4	13	14	15	1
	0	0	0	0	1	1	1
	0	0	1	1	0	1	1
	0	1	0	1	1	0	1
	0	1	1	1	1	1	0
	1	*	*	1	1	1	1

*Either state

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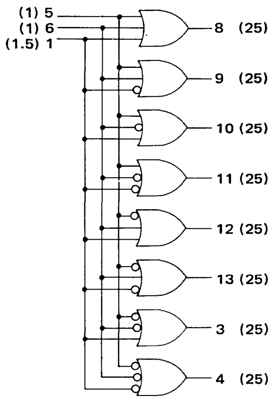
(continued)

DECODERS (continued)

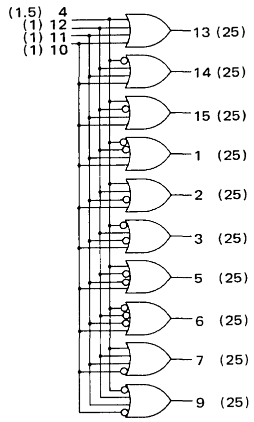
MC1043, MC1243
3-Bit Binary To 1-Of-8 Line Decoder



$8 = 5+6+1$
$9 = 5+6+\overline{1}$
$10 = 5+\overline{6}+1$
$11 = 5+\overline{6}+\overline{1}$
$12 = \overline{5}+6+1$
$13 = \overline{5}+6+\overline{1}$
$3 = \overline{5}+\overline{6}+1$
$4 = \overline{5}+\overline{6}+\overline{1}$

t_{pd} = 6.0 to 11ns
P_D = 210 mW

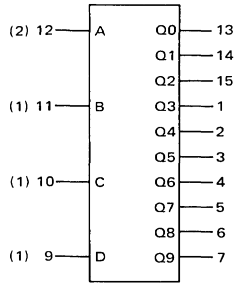
MC1044, MC1244
Binary To 1-Of-10 Line Decoder



$13 = 10 + 11 + 12 + 4$
$14 = 10 + 11 + 12 + \overline{4}$
$15 = 10 + 11 + \overline{12} + 4$
$1 = 10 + 11 + \overline{12} + \overline{4}$
$2 = 10 + \overline{11} + 12 + 4$
$3 = 10 + \overline{11} + 12 + \overline{4}$
$5 = 10 + \overline{11} + \overline{12} + 4$
$6 = 10 + \overline{11} + \overline{12} + \overline{4}$
$7 = \overline{10} + 11 + 12 + 4$
$9 = \overline{10} + 11 + 12 + \overline{4}$

t_{pd} = 6.0 ns
P_D = 245 mW

MC1045, MC1245
Decoder – Nixie (R) Driver



TRUTH TABLE

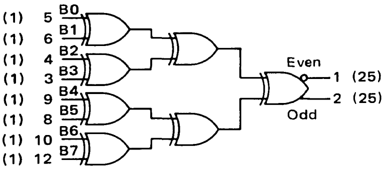
INPUTS				OUTPUTS									
D	C	B	A	Q9	Q8	Q7	Q6	Q5	Q4	Q3	Q2	Q1	Q0
0	0	0	0	1	1	1	1	1	1	1	1	1	0
0	0	0	1	1	1	1	1	1	1	1	1	0	1
0	0	1	0	1	1	1	1	1	1	1	0	1	1
0	0	1	1	1	1	1	1	1	1	0	1	1	1
0	1	0	0	1	1	1	1	1	0	1	1	1	1
0	1	0	1	1	1	1	1	0	1	1	1	1	1
0	1	1	0	1	1	1	0	1	1	1	1	1	1
0	1	1	1	1	1	0	1	1	1	1	1	1	1
1	0	0	0	1	0	1	1	1	1	1	1	1	1
1	0	0	1	0	1	1	1	1	1	1	1	1	1
*1	0	1	0	1	1	1	1	1	1	1	1	1	1
*1	0	1	1	1	1	1	1	1	1	1	1	1	1
1	1	0	0	Input States Not Allowed									
1	1	0	1										
1	1	1	0										
1	1	1	1										

* Zero suppression states

P_D = 178 mW typ

PARITY TREE

MC1046, MC1246
Eight-Bit Parity
Checker and Generator



t_{pd} = 13 ns
P_D = 205 mW

TRUTH TABLE

	INPUTS								OUTPUTS	
	B_0	B_1	B_2	B_3	B_4	B_5	B_6	B_7	ODD	EVEN
PIN NO	5	6	4	3	9	8	10	12	2	1
	0	0	0	0	0	0	0	0	0	1
	1	0	0	0	0	0	0	0	1	0
	0	1	0	0	0	0	0	0	1	0
	1	1	0	0	0	0	0	0	0	1
	ANY ODD NUMBER OF INPUTS = 1								1	0
	ANY EVEN NUMBER OF INPUTS = 1								0	1

FUNCTIONAL TRUTH TABLE*

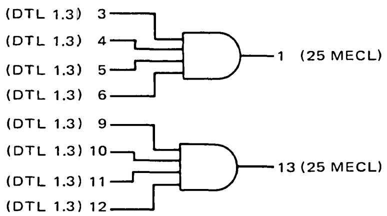
B_0	B_1	B_2	B_3	B_4	B_5	B_6	B_7	ODD	EVEN
0	0	0	0	0	0	0	0	0	1
0	1	1	0	0	1	1	1	1	0
1	1	0	1	1	1	0	1	0	1
1	0	1	1	1	0	1	0	1	0

*The Functional Truth Table is One Which Completely Exercises the Device.

MECL II LOGIC DIAGRAMS

TRANSLATORS

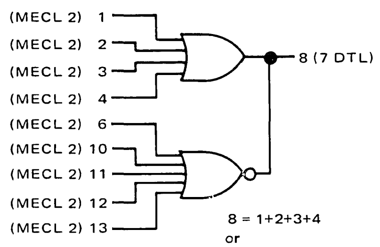
MC1017, MC1217
Level Translator



1 = 3 • 4 • 5 • 6

t_{pd} = 15 ns
P_D = 105 mW

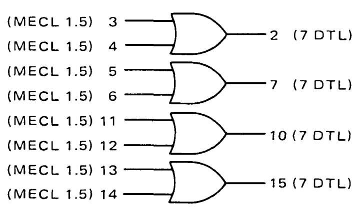
MC1018, MC1218
Level Translator



8 = 1+2+3+4
or
8 = $\overline{6+10+11+12+13}$

t_{pd} = 19 ns P_D = 55 mW

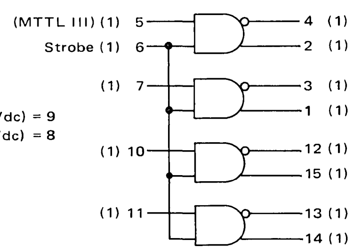
MC1039, MC1239
Quad Level Translator



2 = 3 + 4

t_{pd} = 12 ns
P_D = 200 mW

MC1067, MC1267
Quad MTTL to MECL Translator
With Strobe

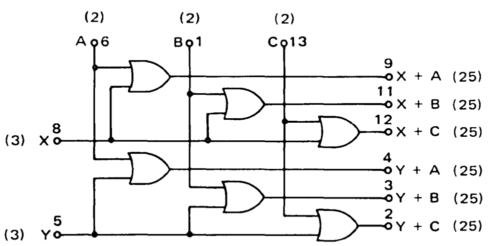


Gnd = 16
V_{CC} (+5.0 Vdc) = 9
V_{EE} (-5.2 Vdc) = 8

t_{pd} = 5.0 ns typ 2 = 5 • 6
P_D = 300 mW 4 = $\overline{5 \bullet 6}$

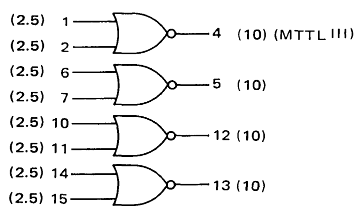
DATA DISTRIBUTOR

MC1029, MC1229
2 x 3 Data Distributor



t_{pd} = 4.0 ns
P_D = 160 mW

MC1068, MC1268
Quad MECL to MTTL Translator
(With Totem-Pole Outputs)

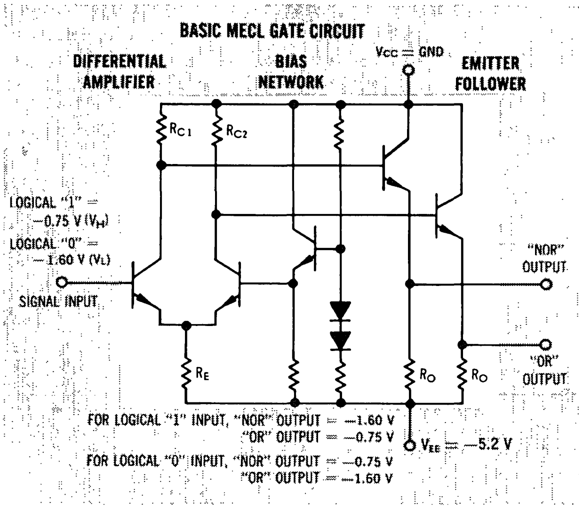


Gnd = 16 4 = $\overline{1+2}$
V_{CC} (+5.0 Vdc) = 9
V_{EE} (-5.2 Vdc) = 8

t_{pd} = 7.0 typ
P_D = 340 mW

5

MECL II INTEGRATED CIRCUITS



MAXIMUM RATINGS

Characteristic	Symbol	Rating	Unit
Ratings above which device life may be impaired:			
Power Supply Voltage ($V_{CC} = 0$)	V_{EE}	−10	Vdc
Input Voltage ($V_{CC} = 0$)	V_{in}	0 to V_{EE}	Vdc
Output Source Current	I_O	0 to 125	mAdc
Storage Temperature Range MC1000L / MC1200F	T_{stg}	−55 to +125 / −65 to +175	°C
Recommended maximum ratings above which performance may be degraded:			
Operating Temperature Range MC1000L / MC1200F	T_A	0 to +75 / −55 to +125	°C
AC Fan-In (Expandable Gates)	m	20	—
AC Fan-Out* (Gates and Flip-Flops)	n	15	—

*Although a minimum dc fan-out of 25 is guaranteed in each electrical specification, it is recommended that the maximum ac fan-out of 15 be used for high-speed operation.

5

CIRCUIT DESCRIPTION

The MECL II line of monolithic integrated logic circuits was designed as a non-saturating form of logic which eliminates transistor storage time as a speed limiting characteristic, and permits extremely high-speed operation.

The typical MECL II circuit comprises a differential-amplifier input with internal bias reference and with emitter-follower output to restore dc levels. High fan-out operation is possible because of the high input impedance of the differential amplifier and the low output impedance of the emitter followers. Power-supply noise is virtually eliminated by the nearly constant current drain of the differential amplifier, even during the transition period. Basic gate design provides for simultaneous output of both the function and its complement.

POWER-SUPPLY CONNECTIONS

As shown in the schematic diagram above, it is recommended that −5.2 V be applied at V_{EE} with V_{CC} = Gnd.

SYSTEM LOGIC SPECIFICATIONS

The nominal output logic swing of 0.85 V then varies from a low state of $V_L = -1.60$ V to a high state of $V_H = -0.75$ V with respect to ground.

If Positive logic is used when reference is made to logical "0's" or "1's", then

$$\left.\begin{array}{l}\text{"0"} = -1.60\ \text{V} \\ \text{"1"} = -0.75\ \text{V}\end{array}\right\}\ \text{typical}$$

Dynamic logic refers to a change of logic states. Dynamic "0" is a negative going voltage excursion and a dynamic "1" is a positive going voltage excursion.

CIRCUIT OPERATION

An internal bias of −1.175 V is applied to the "bias input" of the differential amplifier and the logic signals are applied to the "signal input". If a logical "0" is applied, the current through R_E is supplied by the internally biased transistor. A drop of 0.85 V occurs across R_{C2}. The OR output then is −1.60 V, or one V_{BE}-drop below 0.85 V. Since no current flows in the "signal input" transistor, the NOR output is a V_{BE}-drop below ground, or −0.75 V. When a logical "1" level is applied to the "signal input", the current through R_{C2} is switched to the "signal input" transistor and a drop of 0.85 V occurs across R_{C1}. The OR output then goes to −0.75 V and the NOR output goes to −1.60 V.

Note: Any unused input should be connected to V_{EE}.

BIAS VOLTAGE SOURCE

The bias voltage applied to the bias input is obtained from an internal regulated, temperature-compensated bias network. The temperature characteristics of the bias network compensate for any variations in circuit operating point over the temperature range or supply voltage changes, and insure that the threshold point is always in the center of the transfer characteristic curves.

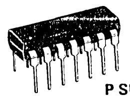
INTEGRATED CIRCUITS

MECL III

MC1600 Series (0 to +75°C)

The requirement for digital systems with ever higher performance has increased the need for high-speed integrated circuits. The industry has recognized that the only economical way to obtain high operating system speed is through the use of emitter-coupled logic. As the result of considerable effort in research and development, Motorola offers a state-of-the-art, emitter-coupled logic family with sub-nanosecond local propagation delays – MECL III .

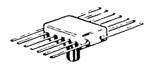
MECL III circuit design is similar to that used in the popular MECL II and MECL 10,000 families. In the MECL III line, as well as MECL 10,000, more advanced processing techniques are employed and the capability of driving low-impedance terminated lines is provided.



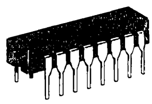
P SUFFIX
PLASTIC PACKAGE
CASE 646
TO-116

GENERAL FEATURES

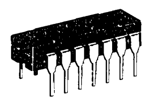
- Gate Switching Speeds of 1.0 ns
- Capability of Driving Terminated Lines with Impedance as Low as 50 Ohms
- Flip-Flop Toggle and Shifting Rate Greater Than 300 MHz
- Operation with Unused Inputs Left Open
- Multilayer Metalization for Optimum Performance
- New Packages with Improved Electrical and Thermal Characteristics
- Compatibility with MECL II* and MECL 10,000* Series



S SUFFIX
CERAMIC PACKAGE
CASE 617



L SUFFIX
CERAMIC PACKAGE
CASE 620



L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 0, V_{EE} = -5.2 V, T_A = 25° unless otherwise noted)

Function	0 to +75°C	Case	DC Output Loading Factor # Each Output High Z	Low Z	Propagation Delay 50-ohm Load t_{pd}, ns typ	Total Power Dissipation (No Load) P_D, mW typ
➤ Digital Mixer	MC1644	632,646	–	-	**250 MHz typ	450
➤ Prescaler-Binary Counter/TTL Translator	MC1646	632,646			**250 MHz typ	450
Voltage Controlled Oscillator	MC1648	632,646		-	*225 MHz typ	150
➤ Dual A/D Comparator	MC1650	617,620	70	7	–	260
➤ Dual A/D Comparator	MC1651	617,620	70	7	–	260
Binary Counter (High Z)	MC1654	620	70	7	*325 MHz typ	750 ⊔⊔
Dual 4-Input OR/NOR Gate (High Z)	MC1660	617,620	70	7	1.1	120
Dual 4-Input OR/NOR Gate (Low Z)	MC1661	617,620	70	7	1.1	120
Quad 2-Input NOR Gate (High Z)	MC1662	617,620	70	7	1.1	240
Quad 2-Input NOR Gate (Low Z)	MC1663	617,620	70	7	1.1	240
Quad 2-Input OR Gate (High Z)	MC1664	617,620	70	7	1.1	240
Quad 2-Input OR Gate (Low Z)	MC1665	617,620	70	7	1.1	240
Dual Clocked R-S Flip-Flop (High Z)	MC1666	617,620	70	7	1.8	220
Dual Clocked R-S Flip-Flop (High Z)	MC1667	617,620	70	7	1.8	230
Dual Clocked Latch (High Z)	MC1668	617,620	70	7	1 8	220
Dual Clocked Latch (Low Z)	MC1669	617,620	70	7	1.8	220
Master-Slave Type D Flip-Flop (High Z)	MC1670	617,620	70	7	**350 MHz typ	220
Master-Slave Type D Flip-Flop (Low Z)	MC1671	617,620	70	7	**350 MHz typ	220
Triple 2-Input Exclusive OR Gate (High Z)	MC1672	617,620	70	7	1.3	220
Triple 2-Input Exclusive OR Gate (Low Z)	MC1673	617,620	70	7	1.3	250
Triple 2-Input Exclusive NOR Gate (High Z)	MC1674	617,620	70	7	1.3	220
Triple 2-Input Exclusive NOR Gate (Low Z)	MC1675	617,620	70	7	1.3	250
Bi-Quinary Counter (High Z)	MC1678	620	70	7	*350 MHz typ	750 ⊔⊔
Bi-Quinary Counter (Low Z)	MC1679	620	70	7	*350 MHz typ	750 ⊔⊔
Random Access Memory (RAM) Cell (High Z)	MC1680	620	70	7	Read Delay 2 5 Write Delay 3.5	270
Random Access Memory (RAM) Cell (Low Z)	MC1681	620	70	7	Read Delay 2.5 Write Delay 3.5	300
Content Addressable Memory (CAM) Cell (High Z)	MC1682	620	70	7	Search Delay 2.8 Write Delay 4.0	270
Content Addressable Memory (CAM) Cell (Low Z)	MC1683	620	70	7	Search Delay 2.8 Write Delay 4.0	300
Content Addressable Random Access (CARAM) Memory Cell (High Z)	MC1684	620	70	7	Read Delay 2.5 Search Delay 2.8 Write Delay 4.0	270
Content Addressable Random Access (CARAM) Memory Cell (Low Z)	MC1685	620	70	7	Read Delay 2.5 Search Delay 2.8 Write Delay 4.0	300
Quad Line Receiver	MC1692	617,620	70	7	1.1	220
4-Bit Shift Register (High Z)	MC1694	620	70	7	*325 MHz typ	750 ⊔⊔

① L suffix denotes Dual In-Line Ceramic Package, S suffix denotes Ceramic Flat Package with a stud, P suffix denotes Dual In-Line Plastic Package. (i.e., MC1600L = Ceramic Dual In-Line Package, MC1600S = Ceramic Flat Package with a stud.

*Maximum Operating Frequency

**Toggle Frequency

➤ To Be Announced

⊔⊔ Requires heat sink – IERC LIC-14A2CB or equivalent

#DC Loading Factors are based on:

1. Full load output current, I_L = -25 mAdc max
2. Maximum input current, I_{in} = 350 µAdc (High Z)
   3.1 mAdc (Low Z)

MECL III LOGIC DIAGRAMS

Loading factors listed are dc unterminated.
Numbers at ends of terminals denote pin numbers for S package (Case 617).
Numbers in parenthesis denote pin numbers for L package (Case 620 unless noted as Case 632) and P package (Case 646) if noted as available.

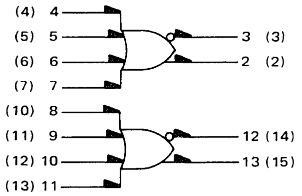
CASE	V_{CC} Pin No.	V_{EE} Pin No.
617	1, 14	Stud
620	1, 16	8

See individual drawing for devices with other Cases.

5

GATES

MC1660 (High Z)
MC1661 (Low Z)
Dual 4-Input OR/NOR Gate

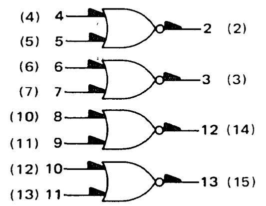


$3 = \overline{4+5+6+7}$
$2 = 4+5+6+7$

Input Loading Factor = 1
Output Loading Factor
Driving High Z Devices = 70
Driving Low Z Devices = 7

t_{pd} = 0.9 ns typ (510-ohm load)
1.1 ns typ (50-ohm load)
P_D = 120 mW typ/pkg (no load)

MC1662 (High Z)
MC1663 (Low Z)
Quad 2-Input NOR Gate

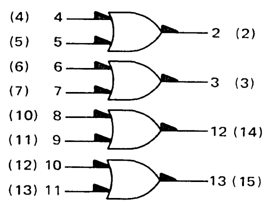


$2 = \overline{4+5}$

Input Loading Factor = 1
Output Loading Factor
Driving High Z Devices = 70
Driving Low Z Devices = 7

t_{pd} = 0.9 ns typ (510-ohm load)
1.1 ns typ (50-ohm load)
P_D = 240 mW typ/pkg (no load)

MC1664 (High Z)
MC1665 (Low Z)
Quad 2-Input OR Gate

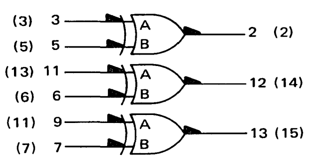


$2 = 4+5$

Input Loading Factor = 1
Output Loading Factor
Driving High Z Devices = 70
Driving Low Z Devices = 7

t_{pd} = 0.9 ns typ (510-ohm load)
1.1 ns typ (50-ohm load)
P_D = 240 mW typ/pkg (no load)

MC1672 (High Z)
MC1673 (Low Z)
Triple 2-Input Exclusive OR Gate



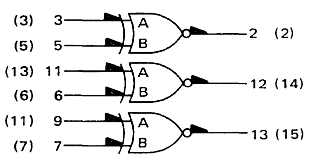
$2 = (3 \bullet \overline{5}) + (\overline{3} \bullet 5)$

DC Input Loading Factor
MC1672: A = 1.0
B = 0.75
MC1673: All Inputs = 1

DC Loading Factor = 70 (High Z)
7 (Low Z)

t_{pd} = 1.1 ns typ (510-ohm load)
= 1.3 ns typ (50-ohm load)
P_D = 220 mW typ/pkg (High Z)
250 mW typ/pkg (Low Z)

MC1674 (High Z)
MC1675 (Low Z)
Triple 2-Input Exclusive NOR Gate



$2 = (3 \bullet 5) + (\overline{3} \bullet \overline{5})$

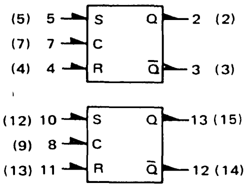
DC Input Loading Factor
MC1674: A = 1.0
B = 0.75
MC1675: All Inputs = 1

DC Loading Factor = 70 (High Z)
7 (Low Z)

t_{pd} = 1.1 ns typ (510-ohm load)
= 1.3 ns type (50-ohm load)
P_D = 220 mW typ/pkg (High Z)
= 250 mW typ/pkg (low Z)

FLIP-FLOPS

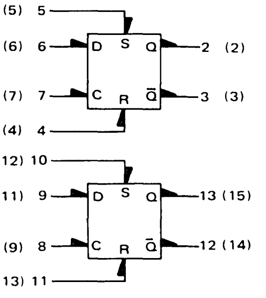
MC1666 (High Z)
MC1667 (Low Z)
Dual Clocked R-S Flip-Flop



Input Loading Factor
MC1666 = S, R = 1, C = 0.6
MC1667 = S, R, C = 1
Output Loading Factor
Driving High Z Devices = 70
Driving Low Z Devices = 7

t_{pd} = 1.6 ns typ (510-ohm load)
= 1.8 ns typ (50-ohm load)
P_D = 220 mW typ/pkg (no-load) High Z
230 mW typ/pkg (no-load– Low Z

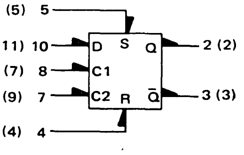
MC1668 (High Z)
MC1669 (Low Z)
Dual Clocked Latch



Input Loading Factor
MC1668 = D, S, R = 1, C = 0.6
MC1669 = S, R, D, C = 1
Output Loading Factor
Driving High Z Devices = 70
Driving Low Z Devices = 7

t_{pd} = 1.6 ns typ (510-ohm load)
= 1.8 ns typ (50-ohm load)
P_D = 220 mW typ/pkg (no-load)

MC1670 (High Z)
MC1671 (Low Z)
Master-Slave Type D Flip-Flop



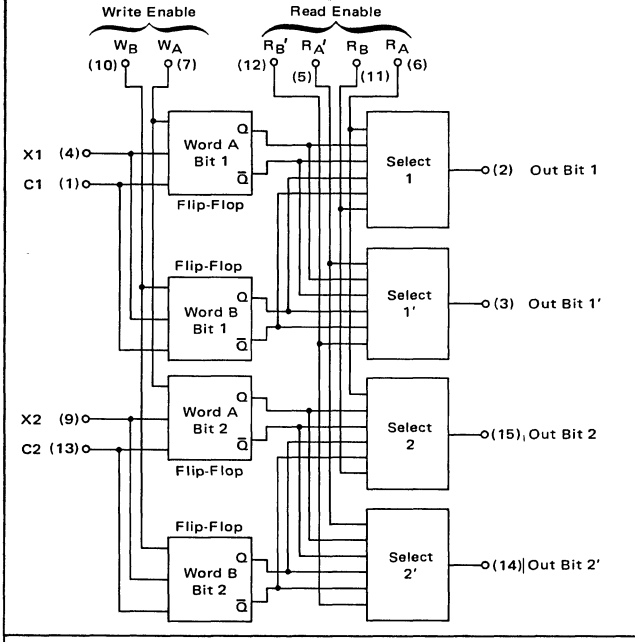
Input Loading Factor
MC1670 S, R = 1.5
D = 0.75
C1, C2 = 0.67
MC1671
S, R = 1.1
C1, C2, D = 1
Output Loading Factor
Driving High Z Devices = 70
Driving Low Z Devices = 7

f_{Tog} = 350 MHz typ
t_{pd} = 1.6 ns typ (510-ohm load)
1.8 ns typ (50-ohm load)
P_D = 220 mW typ/pkg (no load)

5

MEMORIES

MC1680 (High Z)
MC1681 (Low Z)
Random Access Memory (RAM) Cell



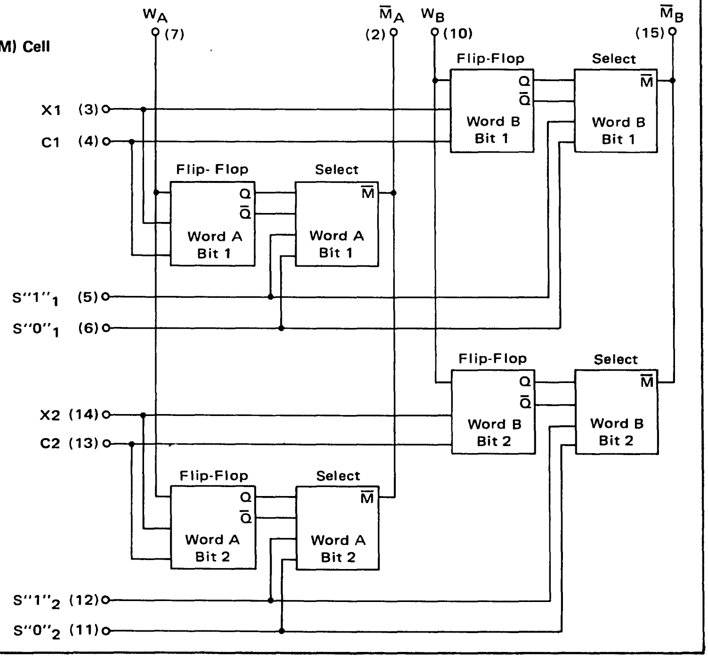
FLIP-FLOP TRUTH TABLE

W	X	Q_n
0	0	Q_n-1
0	1	Q_n-1
1	0	0
1	1	1

SELECTOR TRUTH TABLE

R_A	R_B	Q_A	Q_B	OUT
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

MC1682 (High Z)
MC1683 (Low Z)
Content Addressable Memory (CAM) Cell



FLIP-FLOP TRUTH TABLE

C	W	X	Q_n
0	0	0	Q_n-1
0	0	1	Q_n-1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

SELECTOR TRUTH TABLE

S"0"	S"1"	Q	$\overline{M}$
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

(continued)

5

MEMORIES (continued)

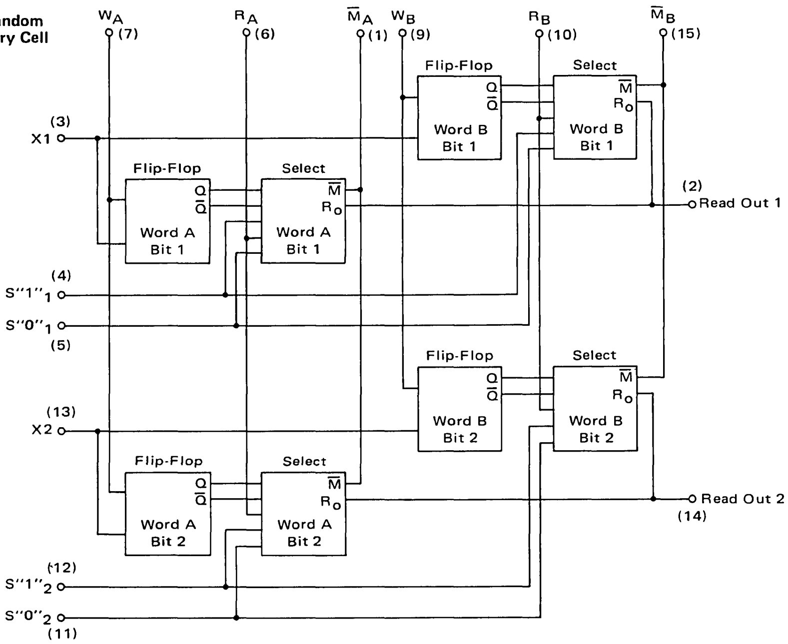
MC1684 (High Z)
MC1685 (Low Z)
Content Addressable Random Access (CARAM) Memory Cell

FLIP-FLOP TRUTH TABLE

W	X	Q
0	0	Q_{n-1}
0	1	Q_{n-1}
1	0	0
1	1	1

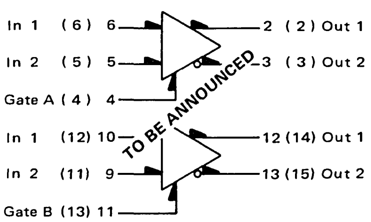
SELECTOR TRUTH TABLE

S0	S1	R	Q	$\overline{M}$	R_o
0	0	0	0	1	0
0	0	0	1	1	0
0	0	1	0	1	0
0	0	1	1	0	1
0	1	0	0	1	0
0	1	0	1	0	1
0	1	1	0	1	0
0	1	1	1	0	1
1	0	0	0	0	1
1	0	0	1	1	0
1	0	1	0	0	1
1	0	1	1	1	0
1	1	0	0	0	1
1	1	0	1	0	1
1	1	1	0	0	1
1	1	1	1	0	1



COMPARATOR

MC1650 (High Z)
MC1651 (Low Z)
Dual A/D Comparator

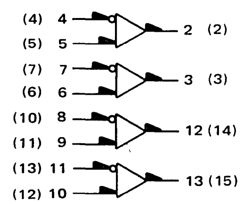


Case	Gnd	V_{CC}	V_{EE}
617	1,14	7,8	15
620	1,16	7,10	8

P_D = 260 mW typ/pkg (No load)
Output Loading Factor = 70

RECEIVER

MC1692
Quad Line Receiver



V_{BB} on pin (9) L package only.

Input Loading Factor = 1
Output Loading Factor = 70

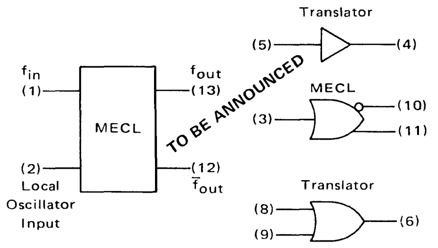
t_{pd} = 0.9 ns typ (510-ohm load)
1.1 ns typ (50-ohm load)
P_D = 220 mW typ/pkg (No load)

5

MECL III LOGIC DIAGRAMS

MIXER

MC1644
Digital Mixer

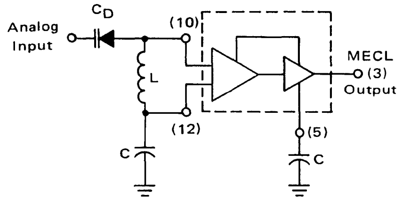


Cases 632 and 646
V_{CC} (+5.0 Vdc) = Pin 14
Gnd = Pin 7

Toggle Frequency = 250 MHz typ
P_D = 450 mW typ

OSCILLATOR

MC1648
Emitter Coupled Oscillator



Cases 632 and 646
V_{CC} (+5.0 Vdc) = Pins 1, 14; Gnd = Pins 7, 8
V_{EE} (-5.2 Vdc) = Pins 7, 8; Gnd = Pins 1, 14

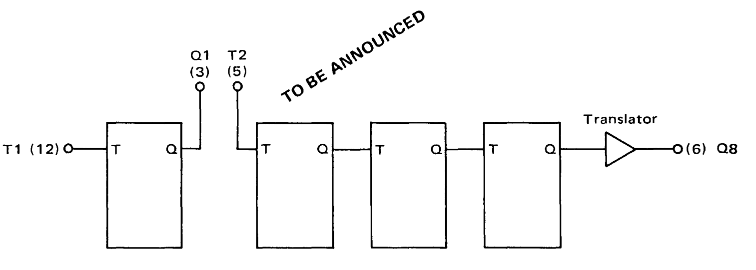
Maximum Operating Frequency = 225 MHz typ
P_D = 150 mW typ/pkg
(+5.0 Vdc Supply)

L, C, C_D are external components.
C_D is a varactor diode.

5

COUNTERS

MC1646
Prescaler-Binary Counter/Translator
(÷16 or 8)



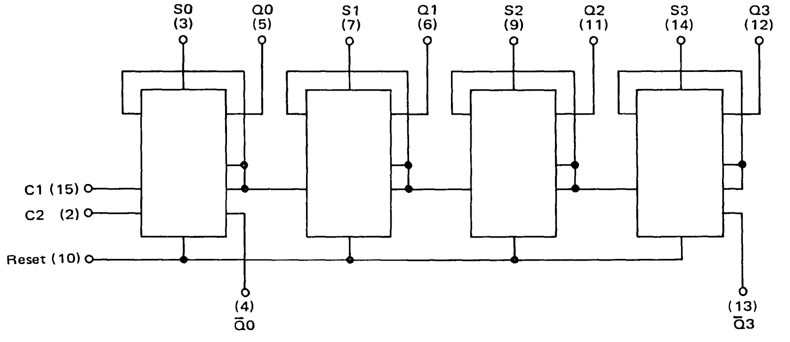
Cases 632 and 646
V_{CC} (+5.0 Vdc) = Pins 1, 14
Gnd = Pin 7

Maximum Toggle Frequency = 250 MHz typ
P_D = 450 mW typ

(continued)

COUNTERS (continued)

MC1654
Binary Counter

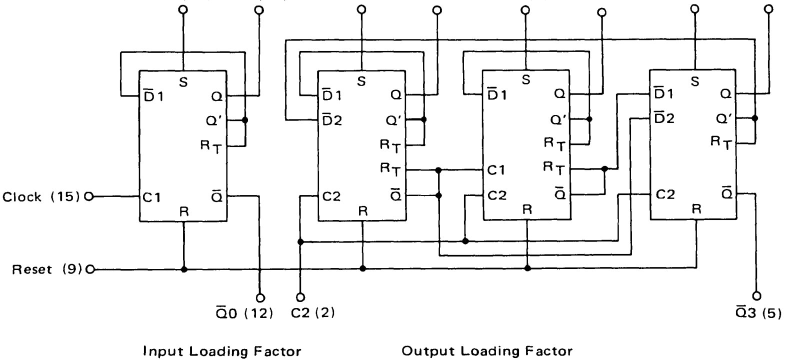


Input Loading Factor
MC1654: C = 1.70
S = 1.70
R = 2.70

*P_D = 750 mW typ/pkg
Operating Frequency = 325 MHz typ

*Requires special heat sink IERC-14A2CB or equivalent.

MC1678 (High Z)
MC1679 (Low Z)
BI-Quinary Counter



Input Loading Factor
MC1678: R = 2.40
C1 = 0.77
C2 = 1.23
S = 1.00
MC1679: R = 3.38
C2 = 1.97
C1,S = 1.00

Output Loading Factor
High Z = 70
Low Z = 7

*P_D = 750 mW typ
Toggle Frequency = 350 MHz typ

*Requires special heat sink IERC-14A2CB or equivalent.

5

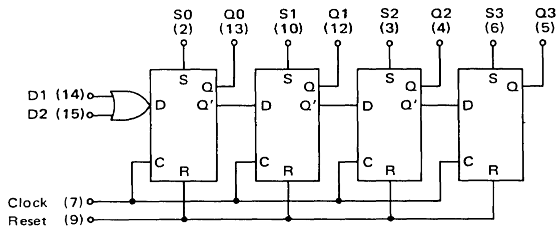
SHIFT REGISTER

MC1694
4-Bit Shift Register

FLIP-FLOP TRUTH TABLE

INPUTS				OUTPUT
D	C	R	S	Q_n
0	0	0	0	Q_{n-1}
0	0	0	0	1
0	0	1	0	0
0	0	1	1	*
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	*
1	0	0	0	Q_{n-1}
1	0	0	1	1
1	0	1	0	0
1	0	1	1	*
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	*

*Output State Undefined



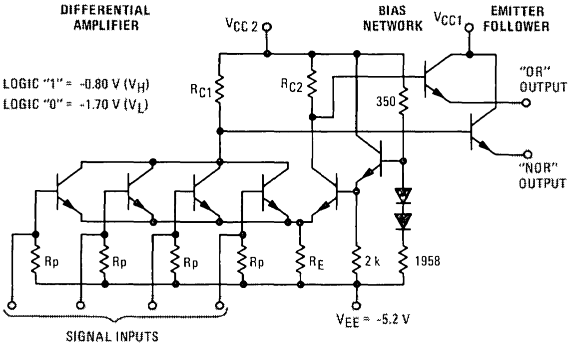
DC Input Loading Factors
Reset = 2.7 Set = 1.7
Clock = 1.7 Data = 1.7

DC Output Loading Factor = 70

Total Power Dissipation = 750 mW typ/pkg
Maximum Shift Frequency = 325 MHz typ

MECL III INTEGRATED CIRCUITS

BASIC HIGH INPUT IMPEDANCE MECL III GATE



MAXIMUM RATINGS

Characteristic	Symbol	Rating	Unit
Ratings above which device life may be impaired:			
Power Supply Voltage (V_{CC} = 0)	V_{EE}	-8	Vdc
Input Voltage (V_{CC} = 0)	V_{in}	0 to $V_{IL\ min}$	Vdc
Output Source Current	I_o	40	mAdc
Storage Temperature Range	T_{stg}	-55 to +125	°C
Recommended maximum ratings above which performance may be degraded:			
Operating Temperature Range	T_A	0 to +75	°C
DC Fan-Out* (Gates and Flip-Flops)	n	70	–

*AC fan-out is limited by desired system performance.

FOR LOGIC "1" INPUT,
"NOR" OUTPUT = -1.70 V
"OR" OUTPUT = -0.80 V

FOR LOGIC "0" INPUT,
"NOR" OUTPUT = -0.80 V
"OR" OUTPUT = -1.70 V

CIRCUIT DESCRIPTION

The MECL III line of monolithic integrated logic circuits designed for extremely high speed system operation, is similar to and compatible with MECL II, but employs more advanced processing and design techniques.

The typical MECL III circuit consists of a differential-amplifier input with internal bias reference and with emitter-follower output to restore dc levels. High fan-out operation is possible because of the high-input impedance of the differential amplifier and the low-output impedance of the emitter followers. Power-supply noise is virtually eliminated by the nearly constant current drain of the differential amplifier, even during the transition period. Basic gate design provides for simultaneous output of both the function and its complement.

POWER-SUPPLY CONNECTIONS As shown in the schematic diagram above, it is recommended that -5.2 V be applied at V_{EE} with V_{CC} = Gnd.

SYSTEM LOGIC SPECIFICATIONS The nominal output logic swing of 0.90 V then varies from a low state of V_L = -1.70 V to a high state of V_H = -0.80 V with respect to ground.

If Positive logic is used when reference is made to logic "0's" or "1's", then

$$\left.\begin{array}{l}\text{"0"} = -1.70\ \text{V} \\ \text{"1"} = -0.80\ \text{V}\end{array}\right\}\ \text{typical at } 25^{\circ}\text{C}$$

Dynamic logic refers to a change of logic states. Dynamic "0" is a negative-going voltage excursion and a dynamic "1" is a positive-going voltage excursion.

CIRCUIT OPERATION An internal bias of -1.300 V is applied to the "bias input" of the differential amplifier and the logic signals are applied to the "signal input". If a logic "0" is applied, the current through R_E is supplied by the internally biased transistor. A drop of 0.90 V occurs across R_{C2}. The OR output then is -1.70 V, or one V_{BE}-drop below 0.90 V. Since no current flows in the "signal input" transistor, the NOR output is a V_{BE}-drop below ground, or -0.80 V. When a logic "1" level is applied to the "signal input" the current through R_{C2} is switched to the "signal input" transistor and a drop of 0.90 V occurs across R_{C1}. The OR output then goes to -0.80 V and the NOR output goes to -1.70 V. Note: all unused inputs are internally connected to V_{EE}.

BIAS VOLTAGE SOURCE The bias voltage applied to the bias input is obtained from an internal regulated, temperature-compensated bias network. The temperature characteristics of the bias network compensate for any variations in circuit operating point over the temperature range or supply voltage changes, and insure that the threshold point is always in the center of the transfer characteristic curves.

DC LOADING DC Loading factors are based on:

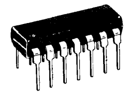
(1) Full Load Output Current, I_L = -25 mAdc max

(2) Maximum Input Current, I_{in} = 350 μAdc (High Z)
= 3.1 mAdc (Low Z)

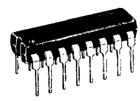
***MC660 Series (-30 to +75°C)**

Motorola's MHTL integrated circuits are especially designed to meet the requirements of industrial applications because of the outstanding noise immunity. MHTL circuits provide error-free operation in high noise environments far beyond the tolerance of other integrated circuit families. Multifunction packages and broad operating temperature range further tailor this device family to the industrial designer's requirements.

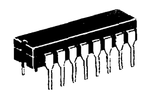
*MHTL cermaic dual in-line devices are available with specification over the -55°C to +125°C temperature range and/or with hi-rel processing on special order. See your Motorola representative for pricing.



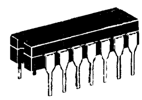
P SUFFIX
PLASTIC PACKAGE
CASE 646
TO-116



P SUFFIX
PLASTIC PACKAGE
CASE 648



L SUFFIX
CERAMIC PACKAGE
CASE 620



L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116

MAXIMUM RATINGS (T_A = 25°C)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}		Vdc
Continuous		18	
Pulsed, 1.0 s		20	
Input Voltage	V_{in}		Vdc
MC666 MDTL		-1.0 to +6.0	
MRTL		-4.0 to +4.0	
All Others		-1.0 to +18	
Output Current (into outputs)	–		mAdc
MC662		60	
MC663		28	
MC664		26	
MC669		–	
All Others		30	
Input Reverse Current @ 18 V	I_R	0.5	mAdc
Forward Current (individual) MC669P	I_F	30	mAdc
Operating Temperature Range	T_A	-30 to +75	°C
Storage Temperature Range	T_{stg}	-55 to +125	°C

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 15 V ± 1.0 Vdc, T_A = 25°C)

Function	Type ① -30 to +75°C	Cases	Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Power Dissipation P_D mW typ/pkg
Expandable Dual 4-Input Gate (active pullup)	MC660	632, 646	10	110	88/26 ②
Expandable Dual 4-Input Gate (passive pullup)	MC661	632, 646	10	125	88/26 ②
Expandable Dual 4-Input Line Driver	MC662	632, 646	30	140	180/26 ②
Dual J-K Flip-Flop	MC663	632, 646	9	3.0 MHz ③	200
Master-Slave R-S Flip-Flop	MC664	632, 646	8	3.0 MHz ③	160
Triple Level Translator	MC665	632, 646	MDTL = 8 MTTL III = 5.5 MRTL = 5	40	83 (MDTL) 104 (MRTL)
Triple Level Translator	MC666	632, 646	10	75	105
Dual Monostable Multivibrator	MC667	632, 646	10	140	240
Quad 2-Input Gate (passive pullup)	MC668	632, 646	10	125	176/52 ②
Dual 4-Input Expander	MC669	632, 646	–	–	–
Triple 3-Input Gate (passive pullup)	MC670	632, 646	10	125	132/39 ②
Triple 3-Input Gate (active pullup)	MC671	632, 646	10	110	132/39 ②
Quad 2-Input Gate (active pullup)	MC672	632, 646	10	110	176/52 ②
Dual 2-Input AND-OR-INVERT Gate	MC673	632, 646	10	110	160/50 ②
Dual 2-Input AND-OR-INVERT Gate	MC674	632, 646	10	125	160/50 ②
Dual Pulse Stretcher	MC675	632, 646	10	150 (pins 1,6) 110 (pins 5,6)	180
BCD-To-Decimal Decoder-Driver	MC676	620, 648	–	–	380
Hex Inverter With Strobe (active pullup)	MC677	620, 648	10	110	246/96 ②
Hex Inverter With Strobe (without output resistors)	MC678	620, 648	10	125	192/96 ②
Dual Lamp Driver	MC679	632, 646	125	0.5 μs typ	250/30 ②
Hex Inverter	MC680	632, 646	10	110	246/96 ②
Hex Inverter (open collector)	MC681	632, 646	10	125	192/96 ②
Quad Latch	MC682	620, 648	10	250	375
Quad 2-Input Exclusive OR	MC683	632, 646	10	–	380

① L suffix denotes Dual In-Line Ceramic Package, P denotes Dual In-Line Plastic Package (i.e., MC660L = Dual In-Line Ceramic, MC660P = Dual In-Line Plastic Package).

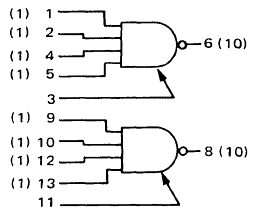
② Inputs High/Input Low ③ f_{Tog}

MHTL LOGIC DIAGRAMS

Numbers at ends of terminals represent pin numbers.
Numbers in parenthesis indicate loading.
(V_{CC} = Pin 14, Gnd = Pin 7 for Case 605 and 632; V_{CC} = Pin 16, Gnd = Pin 8 for Case 612 and 620.)

GATES

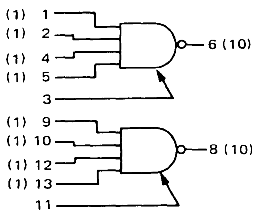
MC660
Expandable
Dual 4-Input NAND Gate
(active output pullup)



$6 = \overline{1 \cdot 2 \cdot 4 \cdot 5 \cdot [3]}$

t_{pd} = 110 ns typ
P_D = 88 mW typ/pkg (Inputs High)
26 mW typ/pkg (Input Low)

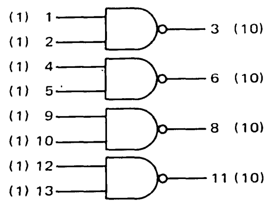
MC661
Expandable
Dual 4-Input NAND Gate
(passive output pullup)



$6 = \overline{1 \cdot 2 \cdot 4 \cdot 5 \cdot [3]}$

t_{pd} = 125 ns typ
P_D = 88 mW typ/pkg (Inputs High)
26 mW typ/pkg (Input Low)

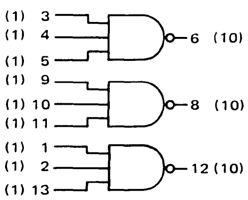
MC668
Quad 2-Input NAND Gate
(passive output pullup)



$3 = \overline{1 \cdot 2}$

t_{pd} = 125 ns typ
P_D = 176 mW typ/pkg (Inputs High)
52 mW typ/pkg (Input Low)

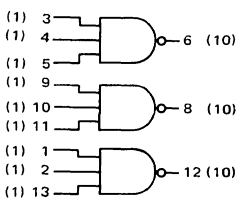
MC670
Triple 3-Input NAND Gate
(passive output pullup)



$6 = \overline{3 \cdot 4 \cdot 5}$

t_{pd} = 125 ns typ
P_D = 132 mW typ/pkg (Inputs High)
39 mW typ/pkg (Input Low)

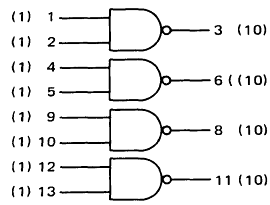
MC671
Triple 3-Input NAND Gate
(active output pullup)



$6 = \overline{3 \cdot 4 \cdot 5}$

t_{pd} = 110 ns typ
P_D = 132 mW typ/pkg (Inputs High)
39 mW typ/pkg (Input Low)

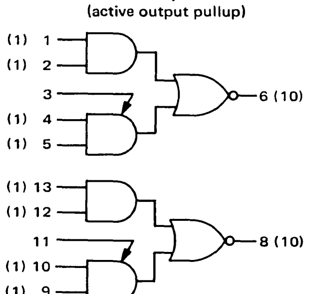
MC672
Quad 2-Input NAND Gate
(active output pullup)



$3 = \overline{1 \cdot 2}$

t_{pd} = 110 ns typ
P_D = 176 mW typ/pkg (Inputs High)
52 mW typ/pkg (Input Low)

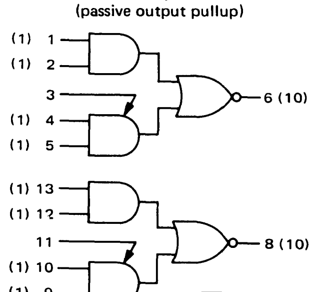
MC673
Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate
(active output pullup)



$6 = \overline{(1 \cdot 2) + ([3] \cdot 4 \cdot 5)}$

t_{pd} = 110 ns typ
P_D = 160 mW typ/pkg (Inputs High)
50 mW typ/pkg (Input Low)

MC674
Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate
(passive output pullup)



$6 = \overline{(1 \cdot 2) + ([3] \cdot 4 \cdot 5)}$

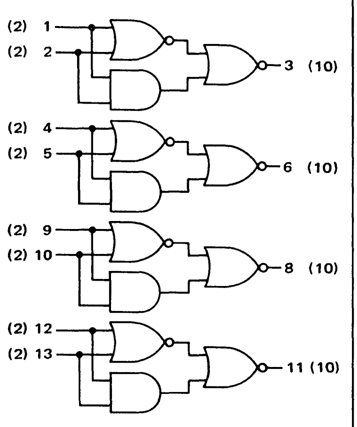
t_{pd} = 125 ns typ
P_D = 160 mW typ/pkg (Inputs High)
50 mW typ/pkg (Input Low)

(continued)

5

GATES (continued)

MC683
Quad 2-Input Exclusive OR

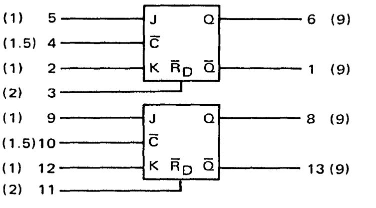


$3 = 1 \cdot \overline{2} + \overline{1} \cdot 2$

P_D = 380 mW typ/pkg

FLIP-FLOPS

MC663
Dual J-K Flip-Flop



f_{Tog} = 3.0 MHz typ
P_D = 200 mW typ/pkg

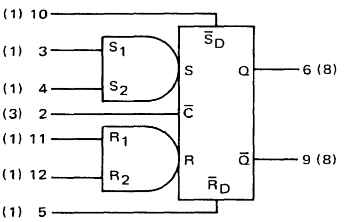
TRUTH TABLE

t_n		t_{n+1}	
J	K	Q	$\overline{Q}$
0	0	Q_n	$\overline{Q}_n$
1	0	1	0
0	1	0	1
1	1	$\overline{Q}_n$	Q_n

Direct input ($\overline{R}_D$) must be high.
0 = low state
1 = high state
t_n = time period prior to negative transition of clock pulse
t_{n+1} = time period subsequent to negative transition of clock pulse
Q_n = state of Q output in time period t_n

NOTE: A low state "0" at the direct reset $\overline{R}_D$ causes a low state "0" at the Q output and the complement at the $\overline{Q}$ output.

MC664
Master-Slave R-S Flip-Flop



f_{Tog} = 3.0 MHz typ
P_D = 160 mW typ/pkg

DIRECT INPUT OPERATION

$\overline{R}_D$	$\overline{S}_D$	Q	$\overline{Q}$
1	1	NC	NC
1	0	1	0
0	1	0	1
0	0	NA	NA

Clock Input($\overline{C}$)must be low

CLOCKED OPERATION

t_n				t_{n+1}
S_1	S_2	R_1	R_2	Q
0	X	0	X	Q_n
0	X	X	0	Q_n
X	0	0	X	Q_n
X	0	X	0	Q_n
0	X	1	1	0
X	0	1	1	0
1	1	0	X	1
1	1	X	0	1
1	1	1	1	U

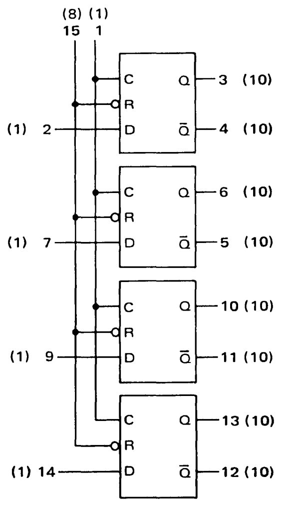
Direct inputs ($\overline{R}_D$, $\overline{S}_D$) must be high.

0 = low state
1 = high state
NC = No change
NA = Not allowed
X = state of input does not affect state of the circuit
U = indeterminate state
t_n = time period prior to negative transition of clock pulse
t_{n+1} = time period subsequent to negative transition of clock pulse
Q_n = state of Q output in time period t_n

(continued)

FLIP-FLOPS (continued)

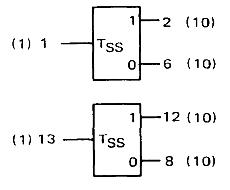
MC682
Quad Latch



t_{pd} = 250 ns typ
P_D = 375 mW typ/pkg

MULTIVIBRATOR

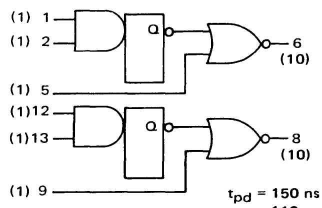
MC667
Dual Monostable Multivibrator



t_{pd} = 140 ns typ
P_D = 240 mW typ/pkg

PULSE STRETCHER

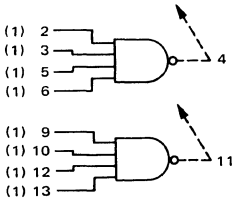
MC675
Dual Pulse Stretcher



t_{pd} = 150 ns typ (Pins 1, 6)
110 ns typ (Pins 5, 6)
P_D = 180 mW typ/pkg

EXPANDER

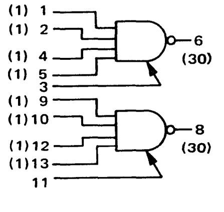
MC669
Dual 4-Input Expander



$4 = \overline{2 \cdot 3 \cdot 5 \cdot 6}$

DRIVERS

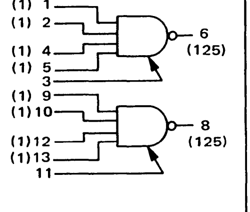
MC662
Expandable
Dual 4-Input Line Driver
(active output pullup)



$6 = \overline{1 \cdot 2 \cdot 4 \cdot 5 \cdot [3]}$

t_{pd} = 140 ns typ
P_D = 180 mW typ/pkg (Inputs High)
26 mW typ/pkg (Input Low)

MC679
Dual Lamp Driver



$6 = \overline{1 \cdot 2 \cdot 4 \cdot 5 \cdot [3]}$

t_{pd} = 0.5 μs typ
P_D = 250 mW (Inputs High)
30 mW (Input Low)

MHTL LOGIC DIAGRAMS

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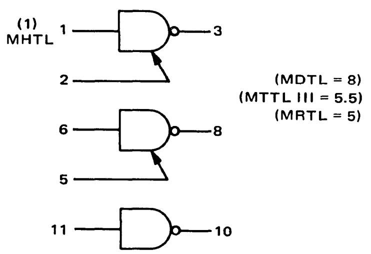
TRANSLATORS

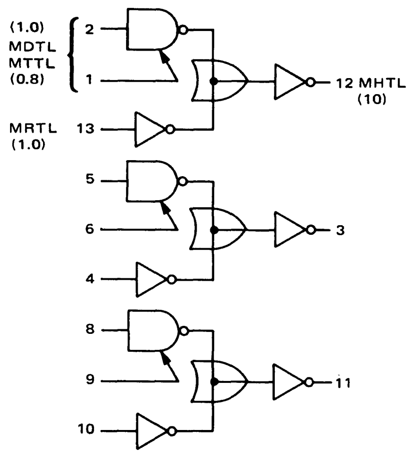
MC665
Triple Level Translator



$3 = \overline{1 \bullet [2]}$

t_{pd} = 40 ns typ
P_D = 83 mW typ/pkg (MDTL)
104 mW typ/pkg (MRTL)

MC666
Triple Level Translator

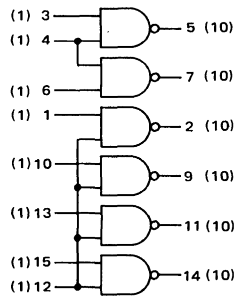


$12 = 2 \bullet [1] + 13$

t_{pd} = 75 ns typ
P_D = 105 mW typ/pkg

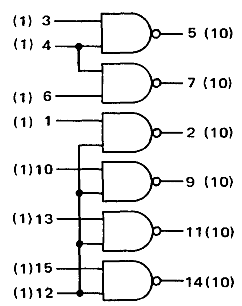
INVERTERS

MC677
Hex Inverter With/Strobe
(active pullup)



t_{pd} = 110 ns typ
P_D = 246 mW typ/pkg (Inputs High)
96 mW typ/pkg (Input Low)

MC678
Hex Inverter With/Strobe
(without output resistors)

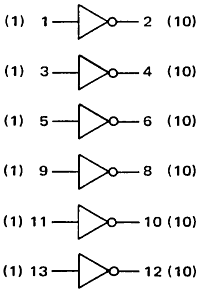


t_{pd} = 125 ns typ
P_D = 192 mW typ/pkg (Inputs High)
96 mW typ/pkg (Inputs Low)

(continued)

INVERTERS (continued)

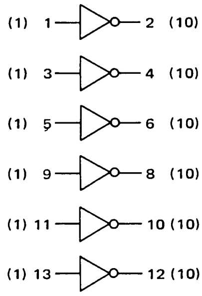
MC680
Hex Inverter
(active pullup)



$2 = \overline{1}$

t_{pd} = 110 ns typ
P_D = 246 mW typ/pkg (Inputs High)
96 mW typ/pkg (Input Low)

MC681
Hex Inverter
(Open Collector)

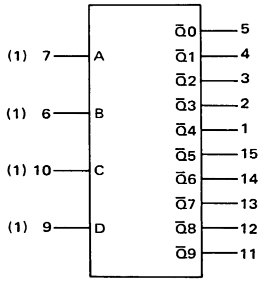


$2 = \overline{1}$

t_{pd} = 125 ns typ
P_D = 192 mW typ/pkg (Inputs High)
96 mW typ/pkg (Input Low)

DECODER

MC676
BCD-To-Decimal Decoder-Driver



Power Dissipation = 380 mW typ/pkg

5

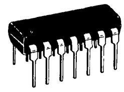
MTTL

MC5400/MC7400 SERIES INTEGRATED CIRCUITS

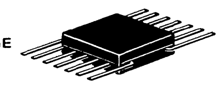
MTTL

MC5400 Series (–55 to +125°C)
MC7400 Series (0 to +70°C)

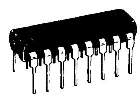
MC5400/MC7400 series integrated circuits comprise a family of transistor-transistor logic designed for general purpose digital applications. The family has a medium operating speed (15-30 MHz clock rate), good external noise immunity, high fan out, and the capability of driving capacitive loads of up to 600 pF.



P SUFFIX
PLASTIC PACKAGE
CASE 646
TO-116



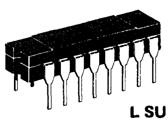
F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86



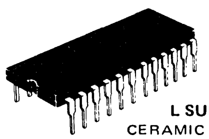
P SUFFIX
PLASTIC PACKAGE
CASE 648

MAXIMUM RATINGS

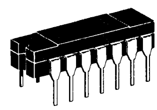
Rating	Value	Unit
Power Supply Voltage	7.0	Vdc
Input Voltage	5.5	Vdc
Operating Temperature Range MC5400 MC7400	-55 to +125 0 to +70	°C
Storage Temperature Range – Ceramic Plastic	-65 to +150 -55 to +125	°C



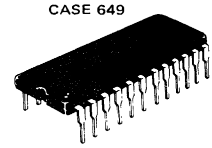
L SUFFIX
CERAMIC PACKAGE
CASE 620



L SUFFIX
CERAMIC PACKAGE
CASE 623



L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116



P SUFFIX
PLASTIC PACKAGE
CASE 649

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C)

Function	Type ① -55 to +125°C	Case	0 to +70°C	Case	Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Power Dissipation mW typ/pkg
Quad 2-Input NAND Gate	MC5400F,L	607, 632	MC7400F,L,P	607,632,646	10	10	40
Quad 2-Input NAND Gate (Open Collector)	MC5401F,L	607, 632	MC7401F,L,P	607,632,646	10	35	40
Quad 2-Input NOR Gate	MC5402F,L	607, 632	MC7402F,L,P	607,632,646	10	10	40
Quad 2-Input NAND Gate (Open Collector)	MC5403L	632	MC7403L,P	632,646	10	35	40
Hex Inverter	MC5404F,L	607, 632	MC7404F,L,P	607,632,646	10	13	60
Hex Inverter	MC5405L	632	MC7405L,P	632,646	10	35	60
Hex Inverter Buffer/Driver (Open Collector)	MC5406L	632	MC7406L,P	632,646	10	15	105
Quad 2-Input AND Gate	MC5408L	632	MC7408P	646	10	15	70
Quad 2-Input AND Gate (Open Collector)	MC5409L	632	MC7409P	646	10	15	70
Triple 3-Input NAND Gate	MC5410F,L	607,632	MC7410F,L,)	607,632,646	10	10	30
Hex Inverter Buffer/Driver (Open Collector)	MC5416L	632	MC7416L,P	632,646	10	15	105
Dual 4-Input NAND Gate	MC5420F,L	607, 632	MC7420F,L,P	607,632,646	10	10	20
Quad 2-Input Interface NAND Gate	MC5426L	632	MC7426L,P	632,646	10	17	40
8-Input NAND Gate	MC5430F,L	607, 632	MC7430F,L,P	607,632,646	10	10	10
Dual 4-Input NAND Buffer	MC5440F,L	607, 632	MC7440F,L,P	607,632,646	30	13	50
BCD-to-Decimal Decoder and High-Level Driver	MC5441AL	620	MC7441AL,P	620,648	–	–	105
BCD-to-Decimal Decoder	MC5442L	620	MC7442L,P	620,648	10	22/23#	140
Excess Three-to-Decimal Decoder	MC5443L	620	MC7443L,P	620,648	10	22/23#	140
Excess Three Gray-to-Decimal Decoder	MC5444L	620	MC7444L,P	620,648	10	22/23#	140
BCD to One-of-Ten Decoder/Driver	MC5445L	620	MC7445L,P	620,648	–	50 max	215

① F suffix denotes Flat Package. L suffix denotes Dual In-Line Ceramic Package. P suffix denotes Dual In-Line Plastic Package. (continued)

2 Logic Levels/3 Logic Levels.

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C)

Function	Type ① -55 to +125°C	Case	Type ① 0 to +70°C	Case	Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Power Dissipation mW typ/pkg
BCD-to-Seven Segment Decoder/Driver	MC5446L	620	MC7446L,P	620,648	BI/RBO 5	–	265
BCD-to-Seven Segment Decoder/Driver	MC5447L	620	MC7447L,P	620,648	BI/RBO 5	–	265
BCD-to-Seven Segment Decoder/Driver	MC5448L	620	MC7448L,P	620,648	BI/RBO = 5 a thru g = 4	–	265
BCD-to-Seven Segment Decoder/Driver	MC5449F	607	MC7449F	607	6	–	165
Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate	MC5450F,L	607, 632	MC7450F,L,P	607,632,646	10	13	28
Dual 2-Wide 2-Input AND-OR-INVERT Gate	MC5451F,L	607, 632	MC7451F,L,P	607,632,646	10	13	28
Expandable 4-Wide 2-Input AND-OR-INVERT Gate	MC5453F,L	607, 632	MC7453F,L,P	607,632,646	10	13	22
4-Wide 2-Input AND-OR-INVERT Gate	MC5454F,L	607, 632	MC7454F,L,P	607,632,646	10	13	22
Dual 4-Input Expander for AND-OR-INVERT Gates	MC5460F,L	607, 632	MC7460F,L,P	607,632,646	–	5.0	8.0
J-K Flip-Flop	MC5470L	632	MC7470L,P	632,646	10	30	65
J-K Flip-Flop	MC5472F,L	607, 632	MC7472F,L,P	607,632,646	10	30	40
Dual J-K Flip-Flop	MC5473F,L	607, 632	MC7473F,L,P	607,632,646	10	30	80
Quad Latch	–	–	MC7475P	648	10	30	160
Dual J-K Flip-Flop	–	–	MC7476P	648	10	30	80
Dual Type D Flip-Flop	MC5479F,L	607, 632	MC7479F,L,P	607,632,646	10	16	84
Gated Full Adder	MC5480L	632	MC7480L,P	632,646	S,$\bar{S}$ = 10 C_{out} = 5 A*,B*, = 3	10/55*	105
2-Bit Full Adder	MC15482F,L	607, 632	MC17482F,L,P	607,632,646	10	15/12*	165
2-Bit Full Adder	MC25482F,L	607, 632	MC27482F,L,P	607,632,646	10	25/12*	165
4-Bit Binary Full Adder	MC5483L	620	MC7483L,P	620,648	S = 10 C_{out} = 5	35	390
16-Bit Scratch Pad Memory Cell With Gated Inputs	MC5484L	620	–	–	I_{OL} = 40 mA } Open Collector	Write Mode: 25	250
	–	–	MC7484L,P	620,648	I_{OL} = 20 mA	Sense Mode: 15	
Decade Counter	MC5490F,L	607, 632	MC7490F,L,P	607,632,646	10	20/bit	160
8-Bit Shift Register	MC5491AL	632	MC7491AL,P	632,646	10	25	175
Divide-by-Twelve Counter	MC5492F,L	607, 632	MC7492F,L,P	607,632,646	10	60	160
4-Bit Binary Counter	MC5493L	632	MC7493L,P	632,646	10	20/bit	160
4-Bit Shift Register	MC5494L	620	MC7494P	648	–	25	175
4-Bit Shift Register	MC5495F,L	607, 632	MC7495F,L,P	607,632,646	10	25	250
5-Bit Shift Register	MC5496L	620	MC7496P	648	–	25	240
Dual J-K Flip-Flop	MC54107L	632	MC74107L,P	632,646	10	30	80
Monostable Multivibrator	MC54121F,L	607, 632	MC74121F,L,P	607,632,646	10	t_{pd+}, B to Q = 35	90
BCD to One-of-Ten Decoder/Driver	MC54145L	620	MC74145L,P	620,648	–	50 max	215
16-Channel Data Selector	MC54150L	623	MC74150P	649	–	8.5 to 35	200
8-Channel Data Selector	MC54151L	620	MC74151P	648	–	8.5 to 35	145
8-Bit Odd/Even Generator/Checker	MC54180L	632	MC74180P	646	10	15 to 30	170

① F suffix denotes Flat Package. L suffix denotes Dual In-Line Ceramic Package. P suffix denotes Dual In-Line Plastic Package.

*Add delay/Carry delay.

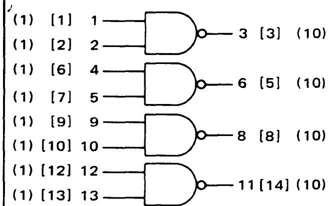
MTTL **MC5400/MC7400 SERIES LOGIC DIAGRAMS**

Numbers at ends of terminals represent pin numbers for devices in the dual in-line package.
Numbers in brackets represent pin numbers for devices in the flat package.
Numbers in parenthesis indicate loading.
Logic equations are for devices in the dual in-line package.

Flat Package: V_{CC} = Pin 4, Gnd = Pin 11. Dual In-Line Package: V_{CC} = Pin 14, Gnd = Pin 7 unless otherwise noted.

GATES

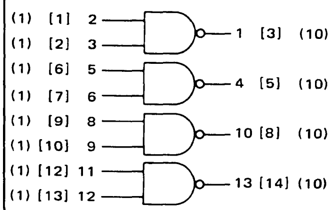
MC5400/MC7400
Quad 2-Input NAND Gate



$3 = \overline{1 \cdot 2}$

t_{pd} = 10 ns typ
P_D = 40 mW typ/pkg

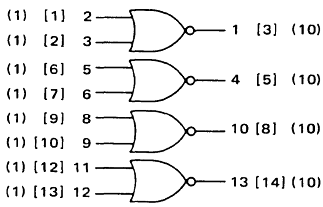
MC5401/MC7401
Quad 2-Input NAND Gate
(Open Collector Output)



$1 = \overline{2 \cdot 3}$

t_{pd} = 35 ns typ
P_D = 40 mW typ/pkg

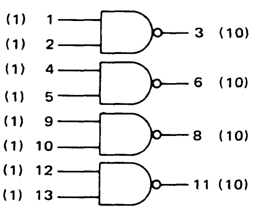
MC5402/MC7402
Quad 2-Input NOR Gate



$1 = \overline{2 + 3}$

t_{pd} = 10 ns typ
P_D = 40 mW typ/pkg

MC5403/MC7403
Quad 2-Input NAND Gate
(Open Collector Output)

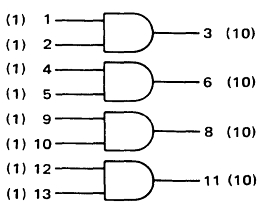


$3 = \overline{1 \cdot 2}$

t_{pd} = 35 ns typ
P_D = 40 mW typ/pkg

MC5408/MC7408
Quad 2-Input AND Gate

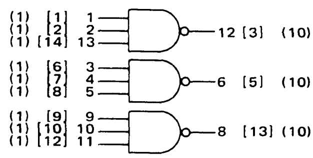
MC5409/MC7409
Quad 2-Input AND Gate
(Open Collector)



$3 = 1 \bullet 2$

t_{pd} = 15 ns typ
P_D = 70 mW typ/pkg

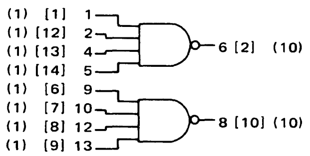
MC5410/MC7410
Triple 3-Input NAND Gate



$12 = \overline{1 \cdot 2 \cdot 13}$

t_{pd} = 10 ns typ
P_D = 30 mW typ/pkg

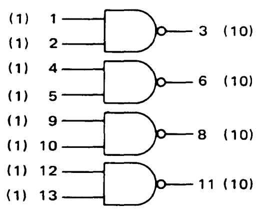
MC5420/MC7420
Dual 4-Input NAND Gate



$6 = \overline{1 \cdot 2 \cdot 4 \cdot 5}$

t_{pd} = 10 ns typ
P_D = 20 mW typ/pkg

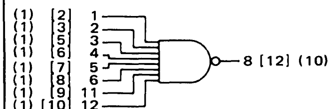
MC5426/MC7426
Quad 2-Input Interface NAND Gate



$3 = \overline{1 \cdot 2}$

t_{pd} = 17 ns typ
P_D = 40 mW typ/pkg

MC5430/MC7430
8-Input NAND Gate



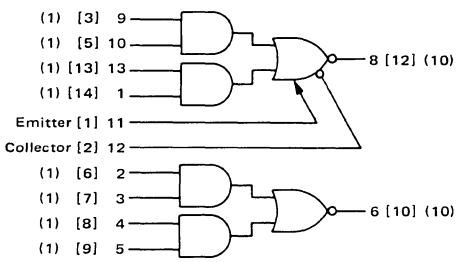
$8 = \overline{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 11 \cdot 12}$

t_{pd} = 10 ns typ
P_D = 10 mW typ/pkg

5

GATES (continued)

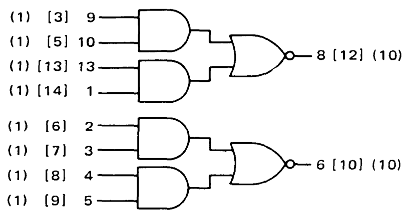
MC5450/MC7450
Expandable Dual 2-Wide 2-Input
AND-OR-INVERT Gate



$8 = \overline{(9 \cdot 10) + (13 \cdot 1)} + (\text{Expanders})$

t_{pd} = 13 ns typ
P_D = 28 mW typ/pkg

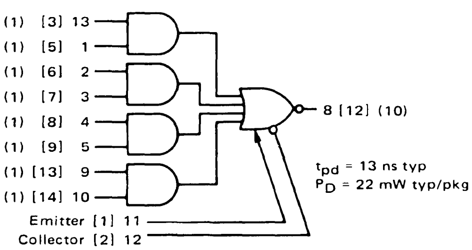
MC5451/MC7451
Dual 2-Wide 2-Input
AND-OR-INVERT Gate



$8 = \overline{(9 \cdot 10) + (13 \cdot 1)}$

t_{pd} = 13 ns typ
P_D = 28 mW typ/pkg

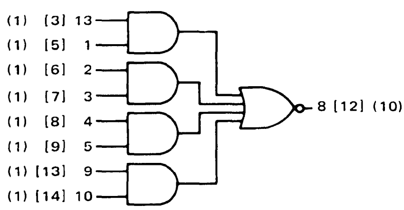
MC5453/MC7453
Expandable 4-Wide 2-Input
AND-OR-INVERT Gate



t_{pd} = 13 ns typ
P_D = 22 mW typ/pkg

$8 = \overline{(13 \cdot 1) + (2 \cdot 3) + (4 \cdot 5) + (9 \cdot 10)} + (\text{Expanders})$

MC5454/MC7454
4-Wide 2-Input
AND-OR-INVERT Gate

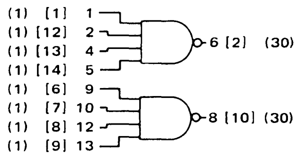


$8 = \overline{(13 \cdot 1) + (2 \cdot 3) + (4 \cdot 5) + (9 \cdot 10)}$

t_{pd} = 13 ns typ
P_D = 22 mW typ/pkg

BUFFER

MC5440/MC7440
Dual 4-Input NAND Buffer

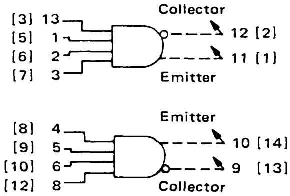


$6 = \overline{1 \cdot 2 \cdot 4 \cdot 5}$

t_{pd} = 13 ns typ
P_D = 50 mW typ/pkg

EXPANDER

MC5460/MC7460
Dual 4-Input Expander for
AND-OR-INVERT Gates



t_{pd} = 5.0 ns typ
P_D = 8.0 mW typ/pkg

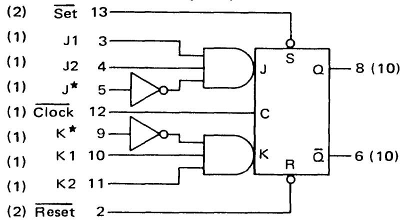
A maximum of 4 Expanders may be connected to the MC7450/MC5450 or MC7453/MC5453.

5

5

FLIP-FLOPS

MC5470/MC7470
J-K Flip-Flop

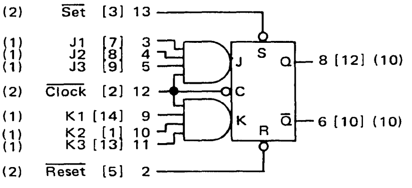


t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q}_n$

$J = J1 \bullet J2 \bullet \overline{J^{\star}}$
$K = K1 \bullet K1 \bullet \overline{K^{\star}}$

t_{pd} = 30 ns typ
P_D = 65 mW typ/pkg

MC5472/MC7472
J-K Flip-Flop

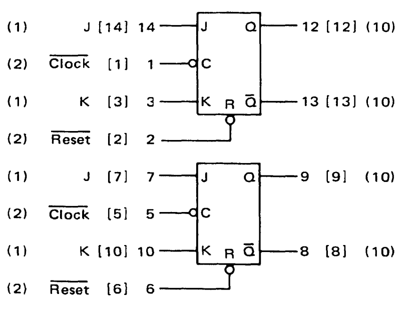


t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q}_n$

$J = J1 \bullet J2 \bullet J3$
$K = K1 \bullet K2 \bullet K3$

f = 20 MHz
P_D = 40 mW typ/pkg

MC5473/MC7473
Dual J-K Flip-Flop

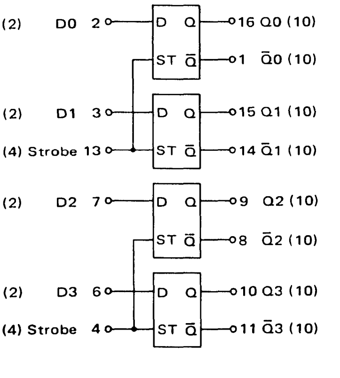


t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q}_n$

f = 15 MHz
P_D = 80 mW typ/pkg

V_{CC} = Pin 4, Gnd = Pin 11 for both packages.

MC7475
Quad Latch

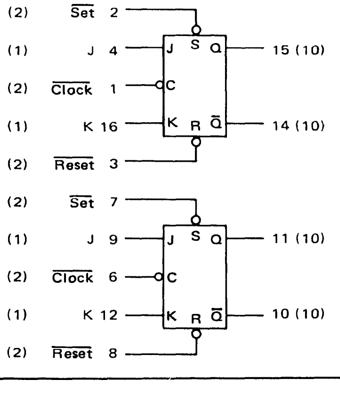


V_{CC} = Pin 5
Gnd = Pin 12

t_n	t_{n+1}	
D	Q	$\overline{Q}$
1	1	0
0	0	1

t_{pd} = 30 ns typ
P_D = 160 mW typ/pkg

MC7476
Dual J-K Flip-Flop



t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q}_n$

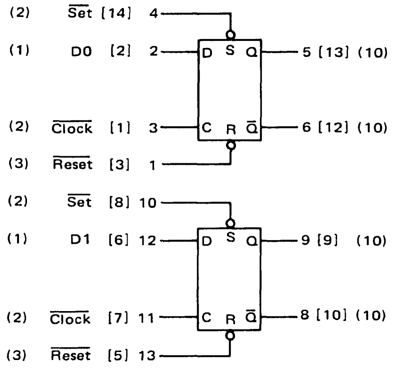
f = 15 MHz
P_D = 80 mW typ/pkg

16 Pin Package
V_{CC} = Pin 5, Gnd = Pin 13

(continued)

FLIP-FLOPS (continued)

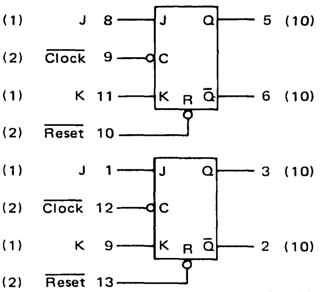
MC5479/MC7479
Dual Type D Flip-Flop



t_n	t_{n+1}	
D	Q	$\overline{Q}$
0	0	1
1	1	0

f = 30 MHz
P_D = 84 mW typ/pkg

MC54107/MC74107
Dual J-K Flip Flop



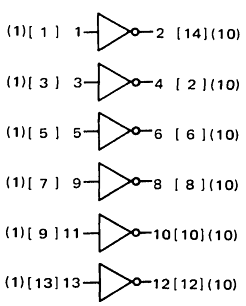
V_{CC} = Pin 14
Gnd = Pin 7

t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q}_n$

f = 15 MHz
P_D = 80 mW typ/pkg

INVERTERS

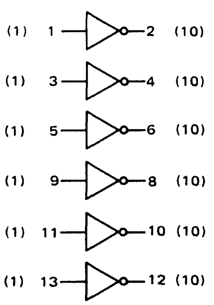
MC5404/MC7404
Hex Inverter



$2 = \overline{1}$

t_{pd} = 13 ns typ
P_D = 60 mW typ/pkg

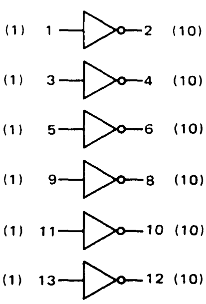
MC5405/MC7405
Hex Inverter
(Open Collector)



$2 = \overline{1}$

t_{pd} = 35 ns typ
P_D = 60 mW typ/pkg

MC5406/MC7406
MC5416/MC7416
Hex Inverter Buffer/Drivers
(Open Collector)



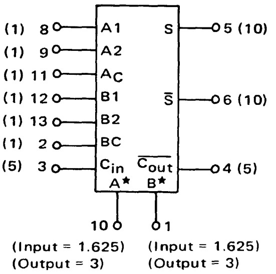
$2 = \overline{1}$

t_{pd} = 15 ns typ
P_D = 105 mW typ/pkg

5

ADDERS

MC5480/MC7480
Gated Full Adder



V_{CC} = Pin 7
Gnd = Pin 14

t_{pd} (Add Delay) = 55 ns typ
t_{pd} (Carry Delay = 10 ns typ
P_D = 105 mW typ/pkg

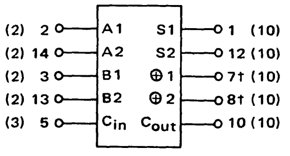
C_{in}	B	A	$\overline{C_{out}}$	$\bar{S}$	S
0	0	0	1	1	0
0	0	1	1	0	1
0	1	0	1	0	1
0	1	1	0	1	0
1	0	0	1	0	1
1	0	1	0	1	0
1	1	0	0	1	0
1	1	1	0	0	1

1. $A = \overline{A\star \bullet A_C}$, $B = \overline{B\star \bullet B_C}$

   where $A\star = \overline{A_1 \bullet A_2}$

   $B\star = \overline{B_1 \bullet B_2}$
2. When A★ (or B★) is used as an input, A1 and A2 (or B1 and B2) must be connected to ground.
3. When A1 and A2 (or B1 and B2) are used as inputs, A★ (or B★) must be open, or used to perform wired-OR logic

MC15482/MC17482
MC25482/MC27482
2-Bit Full Adder



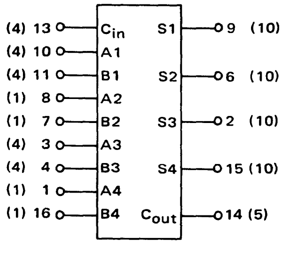
V_{CC} = Pin 4
Gnd = Pin 11

t_{pd} (Add Delay) = 15 ns
t_{pd} (Carry Delay) = 12 ns
P_D = 165 mW typ/pkg

INPUT				OUTPUT							
				C_{in} = 0			C_{in} = 1				
A1	B1	A2	B2	S1	S2	C_o	S1	S2	C_o	⊕1†	⊕2†
0	0	0	0	0	0	0	1	0	0	0	0
1	0	0	0	1	0	0	0	1	0	1	0
0	1	0	0	1	0	0	0	1	0	1	0
1	1	0	0	0	1	0	1	1	0	0	0
0	0	1	0	0	1	0	1	1	0	0	1
1	0	1	0	1	1	0	0	0	1	1	1
0	1	1	0	1	1	0	0	0	1	1	1
1	1	1	0	0	0	1	1	0	1	0	1
0	0	0	1	0	1	0	1	1	0	0	1
1	0	0	1	1	1	0	0	0	1	1	1
0	1	0	1	1	1	0	0	0	1	1	1
1	1	0	1	0	0	1	1	0	1	0	1
0	0	1	1	0	0	1	1	0	1	0	0
1	0	1	1	1	0	1	0	1	1	1	0
0	1	1	1	1	0	1	0	1	1	1	0
1	1	1	1	0	1	1	1	1	1	0	0

†Available only on MC25482/27482

MC5483/MC7483
4-Bit Binary Adder



V_{CC} = Pin 5
Gnd = Pin 12

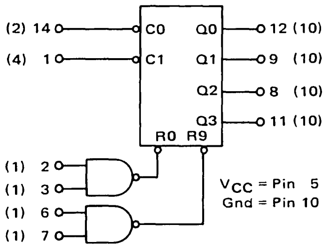
t_{pd} = 35 ns typ
P_D = 390 mW typ/pkg

INPUT				OUTPUT					
				When C_{in} = 0 / When C2 = 0			When C_{in} = 1 / When C2 = 1		
A1 / A3	B1 / B3	A2 / A4	B2 / B4	S1 / S3	S2 / S4	C2 / C_o	S1 / S3	S2 / S4	C2 / C_o
0	0	0	0	0	0	0	1	0	0
1	0	0	0	1	0	0	0	1	0
0	1	0	0	1	0	0	0	1	0
1	1	0	0	0	1	0	1	1	0
0	0	1	0	0	1	0	1	1	0
1	0	1	0	1	1	0	0	0	1
0	1	1	0	1	1	0	0	0	1
1	1	1	0	0	0	1	1	0	1
0	0	0	1	0	1	0	1	1	0
1	0	0	1	1	1	0	0	0	1
0	1	0	1	1	1	0	0	0	1
1	1	0	1	0	0	1	1	0	1
0	0	1	1	0	0	1	1	0	1
1	0	1	1	1	0	1	0	1	1
0	1	1	1	1	0	1	0	1	1
1	1	1	1	0	1	1	1	1	1

Input conditions at A1, A2, B1, B2, and C_{in} are used to determine outputs S1 and S2, and the value of the internal carry, C2. The values at C2, A3, B3, A4, and B4 are then used to determine outputs S3, S4, and C_{out}.

COUNTERS

MC5490/MC7490
Decade Counter



V_{CC} = Pin 5
Gnd = Pin 10

RESET/COUNT TRUTH TABLE

R0		R9		OUTPUT			
Pin 2	Pin 3	Pin 6	Pin 7	Q3	Q2	Q1	Q0
1	1	0	X	0	0	0	0
1	1	X	0	0	0	0	0
X	X	1	1	1	0	0	1
X	0	X	0	COUNT			
0	X	0	X	COUNT			
0	X	X	0	COUNT			
X	0	0	X	COUNT			

X = Don't care

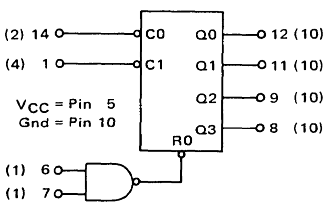
COUNT SEQUENCE TRUTH TABLE

COUNT	OUTPUT			
	Q3	Q2	Q1	Q0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

Q0 connected to $\overline{C}1$

t_{pd} = 20 ns typ/bit
P_D = 160 mW typ/pkg

MC5492/MC7492
Divide-by-Twelve Counter



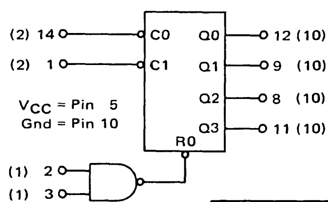
V_{CC} = Pin 5
Gnd = Pin 10

COUNT	OUTPUT			
	Q3	Q2	Q1	Q0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	1	0	0	0
7	1	0	0	1
8	1	0	1	0
9	1	0	1	1
10	1	1	0	0
11	1	1	0	1

Q0 connected to $\overline{C}1$

t_{pd} = 60 ns typ
P_D = 160 mW typ/pkg

MC5493/MC7493
4-Bit Binary Counter



V_{CC} = Pin 5
Gnd = Pin 10

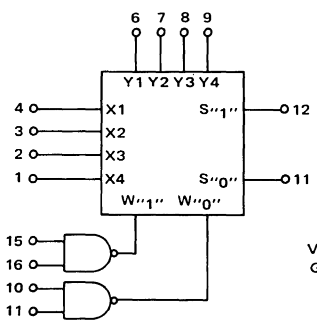
COUNT	OUTPUT			
	Q3	Q2	Q1	Q0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

Q0 connected to $\overline{C}1$

t_{pd} = 20 ns typ/bit
P_D = 160 mW typ/pkg

MEMORIES

MC5484/MC7484
16-Bit Scratch Pad Memory Cell With Gated Inputs



V_{CC} = Pin 5
Gnd = Pin 12

t_{pd}: Write Mode = 25 ns typ
Read Mode = 15 ns typ
P_D = 250 mW typ/pkg

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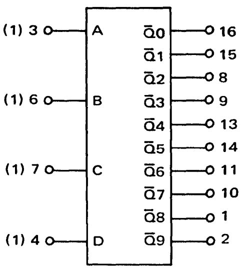
DECODERS

MC5441A/MC7441A
BCD-to-Decimal Decoder and High-Level Driver



V_{CC} = Pin 5
Gnd = Pin 12

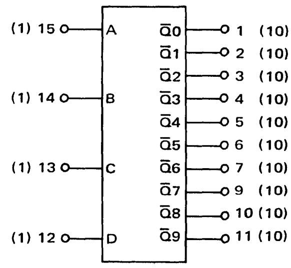
INPUT				OUTPUT									
D	C	B	A	9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	1	1	1	1	1	1	1	0
0	0	0	1	1	1	1	1	1	1	1	1	0	1
0	0	1	0	1	1	1	1	1	1	1	0	1	1
0	0	1	1	1	1	1	1	1	1	0	1	1	1
0	1	0	0	1	1	1	1	1	0	1	1	1	1
0	1	0	1	1	1	1	1	0	1	1	1	1	1
0	1	1	0	1	1	1	0	1	1	1	1	1	1
0	1	1	1	1	1	0	1	1	1	1	1	1	1
1	0	0	0	1	0	1	1	1	1	1	1	1	1
1	0	0	1	0	1	1	1	1	1	1	1	1	1

P_D = 105 mW typ/pkg

MC5442/MC7442
BCD-to-Decimal Decoder

MC5443/MC7443
Excess Three-to-Decimal Decoder

MC5444/MC7444
Excess Three Gray-to-Decimal Decoder

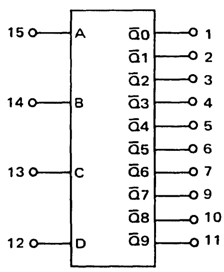


V_{CC} = Pin 16
Gnd = Pin 8

t_{pd}, 2 Logic Levels = 22 ns typ
3 Logic Levels = 23 ns typ
P_D = 140 mW typ/pkg

MC5442/MC7442 BCD INPUT				MC5443/MC7443 EXCESS 3 INPUT				MC5444/MC7444 EXCESS 3 GRAY INPUT				ALL TYPES DECIMAL OUTPUT									
D	C	B	A	D	C	B	A	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	0
0	0	0	1	0	1	0	0	0	1	1	0	1	1	1	1	1	1	1	1	0	1
0	0	1	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1
0	0	1	1	0	1	1	0	0	1	0	1	1	1	1	1	1	1	0	1	1	1
0	1	0	0	0	1	1	1	0	1	0	0	1	1	1	1	1	0	1	1	1	1
0	1	0	1	1	0	0	0	1	1	0	0	1	1	1	1	0	1	1	1	1	1
0	1	1	0	1	0	0	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1
0	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1
1	0	0	0	1	0	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1
1	0	0	1	1	1	0	0	1	0	1	0	0	1	1	1	1	1	1	1	1	1
1	0	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1
1	1	0	0	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1
1	1	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
1	1	1	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1

MC5445/MC7445
MC54145/MC74145
BCD to 1-of-10 Decoder/Driver

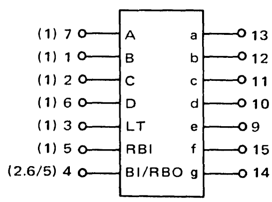


V_{CC} = Pin 16
Gnd = Pin 8

INPUT				OUTPUT									
D	C	B	A	9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	1	1	1	1	1	1	1	0
0	0	0	1	1	1	1	1	1	1	1	1	0	1
0	0	1	0	1	1	1	1	1	1	1	0	1	1
0	0	1	1	1	1	1	1	1	1	0	1	1	1
0	1	0	0	1	1	1	1	1	0	1	1	1	1
0	1	0	1	1	1	1	1	0	1	1	1	1	1
0	1	1	0	1	1	1	0	1	1	1	1	1	1
0	1	1	1	1	1	0	1	1	1	1	1	1	1
1	0	0	0	1	0	1	1	1	1	1	1	1	1
1	0	0	1	0	1	1	1	1	1	1	1	1	1
1	0	1	0	1	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1	1	1	1	1	1
1	1	0	0	1	1	1	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1	1	1	1	1	1
1	1	1	0	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1

t_{pd} = 50 ns max
P_D = 215 mW typ/pkg

MC5446/MC7446
MC5447/MC7447
MC5448/MC7448
BCD-to-Seven Segment Decoder/Drivers



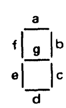
V_{CC} = Pin 16
Gnd = Pin 8

P_D = 265 mW typ/pkg

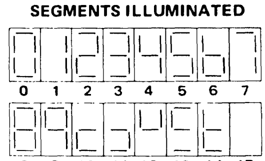
DIGIT OR FUNCTION	ALL TYPES							MC5446/MC7446 MC5447/MC7447 OUTPUT							MC5448/MC7448 OUTPUT						
	LT	RBI	D	C	B	A	BI/RBO	a	b	c	d	e	f	g	a	b	c	d	e	f	g
0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	0
1	1	X	0	0	0	1	1	1	0	0	1	1	1	1	0	1	1	0	0	0	0
2	1	X	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1	1	0	1
3	1	X	0	0	1	1	1	0	0	0	0	1	1	0	1	1	1	1	0	0	1
4	1	X	0	1	0	0	1	1	0	0	1	1	0	0	0	1	1	0	0	1	1
5	1	X	0	1	0	1	1	0	1	0	0	1	0	0	1	0	1	1	0	1	1
6	1	X	0	1	1	0	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1
7	1	X	0	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0	0
8	1	X	1	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1
9	1	X	1	0	0	1	1	0	0	0	1	1	0	0	1	1	1	0	0	1	1
10	1	X	1	0	1	0	1	1	1	1	0	0	1	0	0	0	0	1	1	0	1
11	1	X	1	0	1	1	1	1	1	0	0	1	1	0	0	0	1	1	0	0	1
12	1	X	1	1	0	0	1	1	0	1	1	1	0	0	0	1	0	0	0	1	1
13	1	X	1	1	0	1	1	0	1	1	0	1	0	0	1	0	0	1	0	1	1
14	1	X	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1
15	1	X	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
BI	X	X	X	X	X	X	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0
RBI	1	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0
LT	0	X	X	X	X	X	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1

X = Don't care

SEGMENT IDENTIFICATION



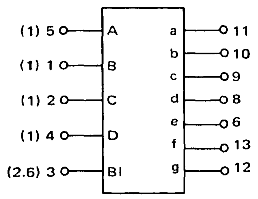
SEGMENTS ILLUMINATED



(continued)

DECODERS (continued)

MC5449/MC7449
BCD-to-Seven Segment Decoder/Driver



V_{CC} = Pin 16
Gnd = Pin 8

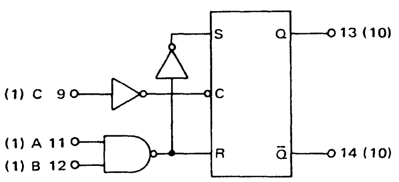
DIGIT OR FUNCTION	INPUT					OUTPUT						
	D	C	B	A	BI	a	b	c	d	e	f	g
0	0	0	0	0	1	1	1	1	1	1	1	0
1	0	0	0	1	1	0	1	1	0	0	0	0
2	0	0	1	0	1	1	1	0	1	1	0	1
3	0	0	1	1	1	1	1	1	1	0	0	1
4	0	1	0	0	1	0	1	1	0	0	1	1
5	0	1	0	1	1	1	0	1	1	0	1	1
6	0	1	1	0	1	0	0	1	1	1	1	1
7	0	1	1	1	1	1	1	1	0	0	0	0
8	1	0	0	0	1	1	1	1	1	1	1	1
9	1	0	0	1	1	1	1	1	0	0	1	1
10	1	0	1	0	1	0	0	0	1	1	0	1
11	1	0	1	1	1	0	0	1	1	0	0	1
12	1	1	0	0	1	0	1	0	0	0	1	1
13	1	1	0	1	1	1	0	0	1	0	1	1
14	1	1	1	0	1	0	0	0	1	1	1	1
15	1	1	1	1	1	0	0	0	0	0	0	0
BI	X	X	X	X	0	0	0	0	0	0	0	0

X = Don't care

P_D = 165 mW typ/pkg

SHIFT REGISTERS

MC5491A/MC7491A
8-Bit Shift Register



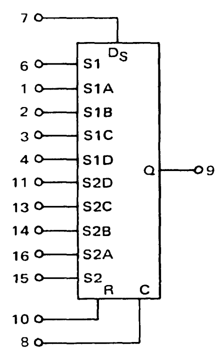
V_{CC} = Pin 5
Gnd = Pin 10

TRUTH TABLE
Synchronous Inputs

t_n		t_{n+8}	
A	B	Q	$\overline{Q}$
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

t_{pd} = 25 ns typ
P_D = 175 mW typ/pkg
f = 18 MHz typ

MC5494/MC7494
4-Bit Shift Register



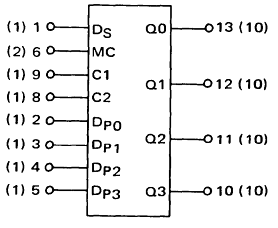
V_{CC} = Pin 5
Gnd = Pin 12

t_{pd}, Clock to Q = 25 ns typ
P_D = 175 mW typ/pkg
f_{Tog} = 10 MHz

(continued)

SHIFT REGISTERS (continued)

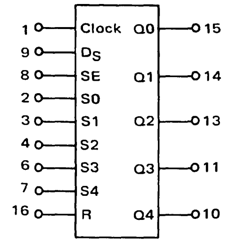
MC5495/MC7495
4-Bit Shift Register



V_{CC} = Pin 14
Gnd = Pin 7

t_{pd} = 25 ns typ
P_D = 250 mW typ/pkg
f = 31 MHz typ

MC5496/MC7496
5-Bit Shift Register



V_{CC} = Pin 5
Gnd = Pin 12

t_{pd}, Clock to Q4 = 25 ns typ
P_D = 240 mW typ/pkg
f_{Tog} = 10 MHz

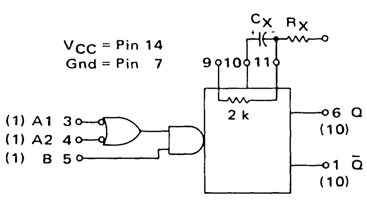
MULTIVIBRATORS

t_n INPUT			t_{n+1} INPUT			OUTPUT
A1	A2	B	A1	A2	B	
1	1	0	1	1	1	Inhibit
0	X	1	0	X	0	Inhibit
X	0	1	X	0	0	Inhibit
0	X	0	0	X	1	Triggering
X	0	0	X	0	1	Triggering
1	1	1	X	0	1	Triggering
1	1	1	0	X	1	Triggering
X	0	0	X	1	0	Inhibit
0	X	0	1	X	0	Inhibit
X	0	1	1	1	1	Inhibit
0	X	1	1	1	1	Inhibit
1	1	0	X	0	0	Inhibit
1	1	0	0	X	0	Inhibit

X = Don't care
t_n = Time period prior to input transition
t_{n+1} = Time period following input transition

MC54121/MC74121
Monostable Multivibrator

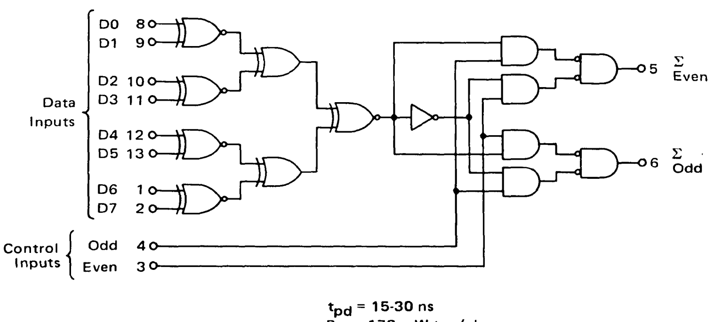
V_{CC} = Pin 14
Gnd = Pin 7



t_{pd}, B to Q = 35 ns typ
P_D = 90 mW typ/pkg (50% duty cycle)

PARITY FUNCTIONS

MC54180/MC74180
8-Bit Odd/Even Generator/Checker

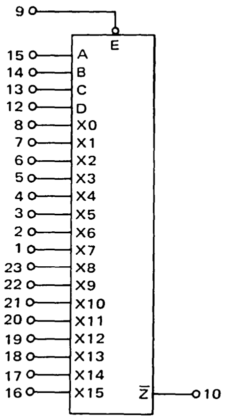


V_{CC} = Pin 14
Gnd = Pin 7

t_{pd} = 15-30 ns
P_D = 170 mW typ/pkg

DATA ROUTING FUNCTIONS

MC54150/MC74150
16-Channel Data Selector

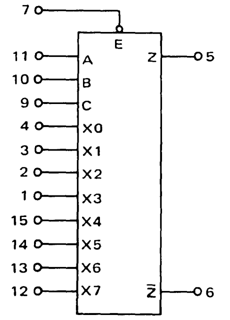


V_{CC} = Pin 24
Gnd = Pin 12

$$Z = E \bullet (\bar{A}\bar{B}\bar{C}\bar{D}\ X0 + A\bar{B}\bar{C}\bar{D}\ X1 + \bar{A}B\bar{C}\bar{D}\ X2 + AB\bar{C}\bar{D}\ X3 + \bar{A}\bar{B}C\bar{D}\ X4 + A\bar{B}C\bar{D}\ X5 + \ldots + ABCD\ X15)$$

t_{pd} = 8.5 to 35 ns typ
P_D = 200 mW typ/pkg

MC54151/MC74151
8-Channel Data Selector



V_{CC} = Pin 16
Gnd = Pin 8

$$Z = E \bullet (\bar{A}\bar{B}\bar{C}X0 + A\bar{B}\bar{C}X1 + \bar{A}B\bar{C}X2 + AB\bar{C}X3 + \bar{A}\bar{B}CX4 + A\bar{B}CX5 + \bar{A}BCX6 + ABCX7)$$

t_{pd} = 8.5 to 35 ns typ
P_D = 145 mW typ/pkg

5

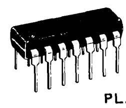
INTEGRATED CIRCUITS

MTTL I

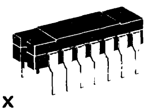
MC400 Series (0 to +75°C)

MC500 Series (-55 to +125°C)

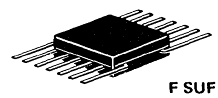
MTTL integrated circuits comprise a family of transistor-transistor logic designed for general purpose digital applications. The family has a medium operating speed (20 MHz clock rate), good external noise immunity, high fan out, and the capability of driving lines up to 600 pF capacitance.



P SUFFIX
PLASTIC PACKAGE
CASE 646
TO-116



L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116



F SUFFIX
CERAMIC FLAT PACKAGE
CASE 607
TO-86

MAXIMUM RATINGS

Rating	Value	Unit
Supply Voltage – Continuous MC500/550 Series MC400/450 Series	 +8.0 +7.0	Vdc
Supply Operating Voltage Range	4.5 to 6.0	Vdc
Input Voltage	+5.5	Vdc
Output Voltage	+5.5	Vdc
Operating Temperature Range MC500/550 Series MC400/450 Series	 -55 to +125 0 to +75	°C
Storage Temperature Range Ceramic Package Plastic Package	 -65 to +150 -55 to +125	°C
Maximum Junction Temperature MC500/550 Series MC400/450 Series	 +175 +150	°C
Thermal Resistance – Junction To Case (θ_{JC}) Ceramic Package Plastic Package	 0.09 0.15	°C/mW
Thermal Resistance – Junction To Ambient (θ_{JA}) Ceramic Package Plastic Package	 0.26 0.30	°C/mw

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C)

Function	Type ① Case 607,632,646 0 to +75°C	Type ① Case 607, 632 -55 to +125°C	Output Loading Factor Each Output MC400 Series	Output Loading Factor Each Output MC500 Series	Propagation Delay t_{pd} ns typ	Power Dissipation mW typ/pkg
Dual 4-Input NAND Gate	MC400 MC450	MC500 MC550	12 6	15 7	10	30
Expandable 4-Wide 2-2-2-3-Input AND-OR-INVERT Gate	MC401 MC451	MC501 MC551	12 6	15 7	12	30
8-Input NAND Gate	MC402 MC452	MC502 MC552	12 6	15 7	12	15
2-Wide 3-Input AND-OR-INVERT Gate with Gated Complement	MC403 MC453	MC503 MC553	12 6	15 7	11	35
Expandable 3-Wide 3-Input AND-OR-INVERT Gate	MC404 MC454	MC504 MC554	12 6	15 7	12	25
Expandable 2-Wide 4-Input AND-OR-INVERT Gate	MC405 MC455	MC505 MC555	12 6	15 7	12	20
Expandable 8-Input NAND Gate	MC406 MC456	MC506 MC556	12 6	15 7	18	15
Line Driver	MC407 MC457	MC507 MC557	12 6	15 7	25 @ 1000 pF Load	60
Quad 2-Input NAND Gate	MC408 MC458	MC508 MC558	12 6	15 7	10	60
4-Wide 3-2-2-3 Input Expander for AND-OR-INVERT Gates	MC409 MC459	MC509 MC559	12 6	15 7	–	–
Dual 4-Input Expander for AND-OR-INVERT Gates	MC410 MC460	MC510 MC560	12 6	15 7	–	–
Dual 4-Input Expander for NAND Gates	MC411 MC461	MC511 MC561	12 6	15 7	–	–

(continued)

① F suffix denotes Flat Package, L suffix denotes dual in-line Ceramic Package, P suffix denotes dual in-line Plastic Package, (i.e., MC401F = Flat Package, MC401L = Ceramic Package, MC401P - Plastic Package.)

MTTL I LOGIC DIAGRAMS

FUNCTIONS AND CHARACTERISTICS (continued)

Function	Type ① Case 607,632,646 0 to +75°C	Type ① Case 607, 632 -55 to +125°C	Output Loading Factor Each Output MC400 Series	Output Loading Factor Each Output MC500 Series	Propagation Delay t_{pd} ns typ	Power Dissipation mW typ/pkg
Triple 3-Input NAND Gate	MC412 MC462	MC512 MC562	12 6	15 7	10	45
R-S Flip-Flop	MC413 MC463	MC513 MC563	12 6	15 7	20/15*	30
Gated R-S Flip-Flop	MC414 MC464	MC514 MC564	12 6	15 7	20/7.5*	30
AND J-K Flip-Flop	MC415 MC465	MC515 MC565	12 6	15 7	13/25*	40
OR J-K Flip-Flop	MC416 MC466	MC516 MC566	12 6	15 7	13/25*	50
Triple 2-Input Buss Driver	MC419 MC469	MC519 MC569	– –	– –	50/15*	54
Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate	MC420 MC470	MC520 MC570	12 6	15 7	12	40
AC Coupled R-S Flip-Flop	MC421 MC471	MC521 MC571	12 6	15 7	18	30
Dual Type D Flip-Flop	MC422 MC472	MC522 MC572	12 6	15 7	16	84
Dual J-K Flip-Flop (separate clock)	MC423 MC473	MC523 MC573	13 7	16 8	10/12*	110
Dual J-K Flip-Flop (common clock)	MC424 MC474	MC524 MC574	13 7	16 8	10/12*	110
Dual 3-Input Pulse Shaper/Delay AND Gate	MC426 MC476	MC526 MC576	13 7	16 8	15	60
OR Expandable Dual 4-Input AND Gate	MC427 MC477	MC527 MC577	12 6	15 7	10	38
Dual 2-Wide 2-3 Input OR Expander	MC428 MC478	MC528 MC578	– –	– –	–	15
Hex Inverter	MC429 MC479	MC529 MC579	12 6	15 7	10	90

① F suffix denotes Flat Package, L suffix denotes dual in-line Ceramic Package, P suffix denotes dual in-line Plastic Package, (i.e., MC401F = Flat Package, MC401L = Ceramic Package, MC401P - Plastic Package.)

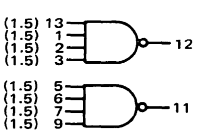
*t_{pd+}/t_{pd-}

5

Numbers at ends of terminals represent pin numbers.
Numbers in parenthesis indicate input loading factor.
For output loading capability, see Functions and Characteristics Table. V_{CC} = Pin 4, Gnd = Pin 10.

DRIVERS

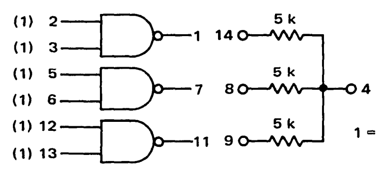
MC407/MC457
MC507/MC557
Dual 4-Input
Line Driver



t_{pd} = 25 ns typ
@ 1000 pF Load
P_D = 60 mW typ/pkg

$12 = \overline{1 \cdot 2 \cdot 3 \cdot 13}$

MC419/MC469
MC519/MC569
Triple 2-Input Buss Driver

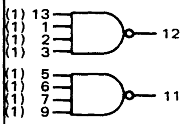


$1 = \overline{2 \cdot 3}$

Propagation Delay Time (using 5.0 k ohm pullup resistor):
t_{pd+} = 50 ns typ
t_{pd-} = 15 ns typ
P_D = 54 mW typ/pkg

GATES

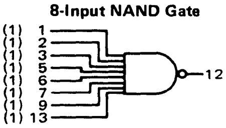
MC400/MC450 MC500/MC550
Dual 4-Input NAND Gate



$12 = \overline{1 \cdot 2 \cdot 3 \cdot 13}$

t_{pd} = 10 ns typ
P_D = 30 mW typ/pkg

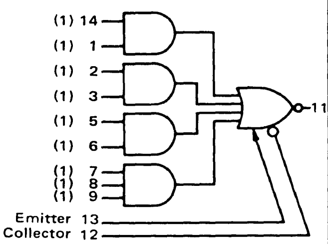
MC402/MC452 MC502/MC552
8-Input NAND Gate



$12 = \overline{1 \cdot 2 \cdot 3 \cdot 5 \cdot 6 \cdot 7 \cdot 9 \cdot 13}$

t_{pd} = 12 ns typ
P_D = 15 mW typ/pkg

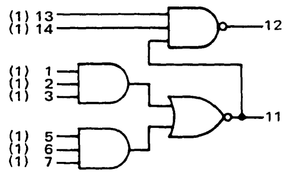
MC401/MC451 MC501/MC551
Expandable 4-Wide 2-2-2-3 Input AND-OR-INVERT Gate



$11 = \overline{(14 \cdot 1) + (2 \cdot 3) + (5 \cdot 6) + (7 \cdot 8 \cdot 9) + \ldots}$

t_{pd} = 12 ns typ
P_D = 30 mW typ/pkg

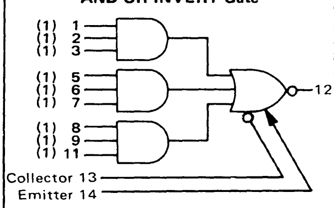
MC403/MC453 MC503/MC553
2-Wide 3-Input AND-OR-INVERT Gate with Gated Complement



$12 = \overline{11 \cdot 13 \cdot 14}$
$11 = \overline{(1 \cdot 2 \cdot 3) + (5 \cdot 6 \cdot 7)}$

t_{pd} = 11 ns typ
P_D = 35 mW typ/pkg

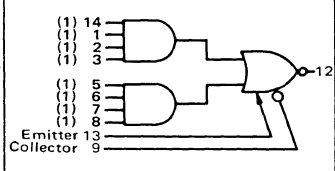
MC404/MC454 MC504/MC554
Expandable 3-Wide 3-Input AND-OR-INVERT Gate



$12 = \overline{(1 \cdot 2 \cdot 3) + (5 \cdot 6 \cdot 7) + (8 \cdot 9 \cdot 11) + \ldots}$

t_{pd} = 12 ns typ
P_D = 25 mW typ/pkg

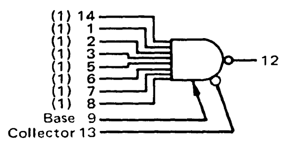
MC405/MC455 MC505/MC555
Expandable 2-Wide 4-Input AND-OR-INVERT Gate



$12 = \overline{(14 \cdot 1 \cdot 2 \cdot 3) + (5 \cdot 6 \cdot 7 \cdot 8) + \ldots}$

t_{pd} = 12 ns typ
P_D = 20 mW typ/pkg

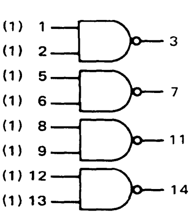
MC406/MC456 MC506/MC556
Expandable 8-Input NAND Gate



$12 = \overline{1 \cdot 3 \cdot 5 \cdot 7 \cdot 8 \cdot 14 \cdot \ldots}$

t_{pd} = 18 ns typ
P_D = 15 mW typ/pkg

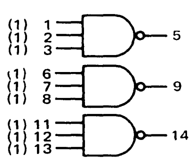
MC408/MC458 MC508/MC558
Quad 2-Input NAND Gate



$3 = \overline{1 \cdot 2}$

t_{pd} = 10 ns typ
P_D = 60 mW typ/pkg

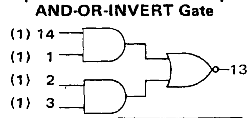
MC412/MC462 MC512/MC562
Triple 3-Input NAND Gate



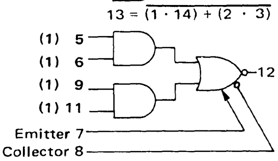
$5 = \overline{1 \cdot 2 \cdot 3}$

t_{pd} = 10 ns typ
P_D = 45 mW typ/pkg

MC420/MC470 MC520/MC570
Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate



$13 = \overline{(1 \cdot 14) + (2 \cdot 3)}$



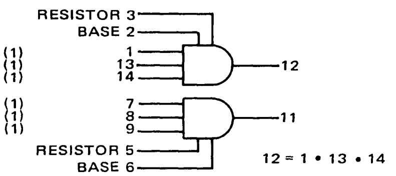
$12 = \overline{(5 \cdot 6) + (9 \cdot 11) + \ldots}$

t_{pd} = 12 ns typ
P_D = 40 mW typ/pkg

(continued)

GATES (continued)

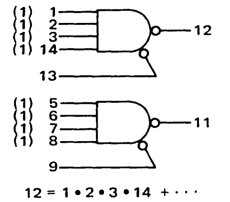
MC426/MC476
MC526/MC576
Dual 3-Input
Pulse Shaper/Delay AND Gate



12 = 1 • 13 • 14

t_{pd} = 15 ns typ
P_D = 60 mW typ/pkg

MC427/MC477
MC527/MC577
OR Expandable Dual
4-Input AND Gate

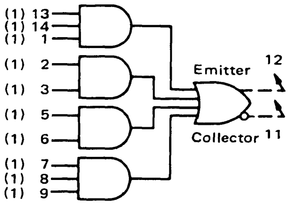


12 = 1 • 2 • 3 • 14 + · · ·

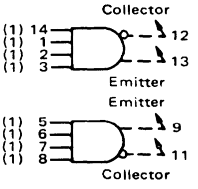
t_{pd} = 10 ns typ
P_D = 38 mW typ/pkg

EXPANDERS

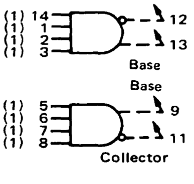
MC409/MC459
MC509/MC559
4-Wide 3-2-2-3 Input Expander
for AND-OR-INVERT Gates



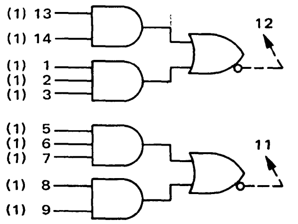
MC410/MC460
MC510/MC560
Dual 4-Input Expander
for AND-OR-INVERT Gates



MC411/MC461
MC511/MC561
Dual 4-Input Expander
for NAND Gates

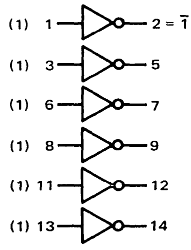


MC428/MC478
MC528/MC578
Dual 2-Wide 2-3 Input
OR Expander



INVERTER

MC429/MC479
MC529/MC579
Hex Inverter



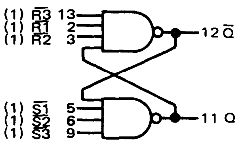
t_{pd} = 10 ns typ
P_D = 90 mW typ/pkg

5

MTTL I LOGIC DIAGRAMS

FLIP-FLOPS

MC413/MC463 MC513/MC563 R-S Flip-Flop

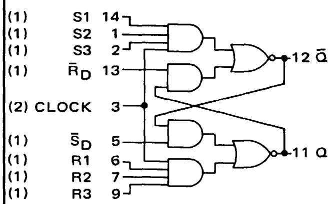


$\overline{R}$	$\overline{S}$	Q_{n+1}	$\overline{Q}_{n+1}$
0	0	Not allowed	
0	1	0	1
1	0	1	0
1	1	Q_n	$\overline{Q}_n$

Where $\overline{R} = \overline{R1} \cdot \overline{R2} \cdot \overline{R3}$
$\overline{S} = \overline{S1} \cdot \overline{S2} \cdot \overline{S3}$

t+ = 15 ns typ
t− = 20 ns typ
P_D = 30 mW typ/pkg

MC414/MC464 MC514/MC564 Gated R-S Flip-Flop

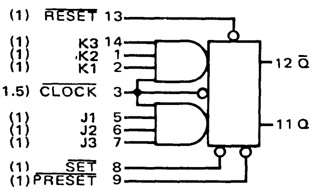


R_C	S_C	Q^{n+1}
0	0	Q^n
0	1	1
1	0	0
1	1	Indeterminate

Where $R_C = 6 \cdot 7 \cdot 9$
$S_C = 1 \cdot 2 \cdot 14$

t+ = 7.5 ns typ
t− = 20 ns typ
P_D = 30 mW typ/pkg

MC415/MC465 MC515/MC565 AND J-K Flip-Flop

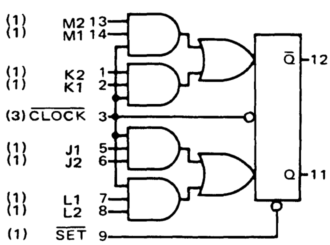


J	K	Q_n	Q_{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Where J = J1 · J2 · J3
K = K1 · K2 · K3

t_{pd-} = 25 ns typ
t_{pd+} = 13 ns typ
P_D = 40 mW typ/pkg

MC416/MC466 MC516/MC566 OR J-K Flip-Flop



J	L	K	M	Q_n	Q_{n+1}
0	0	X	X	0	0
1	X	X	X	0	1
X	1	X	X	0	1
X	X	0	0	1	1
X	X	1	X	1	0
X	X	X	1	1	0

X = Don't Care

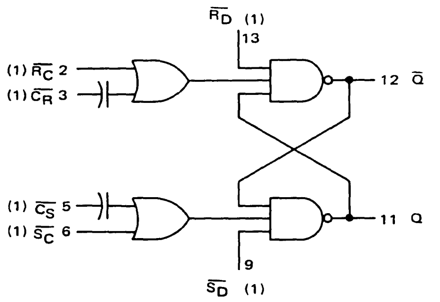
Where J = J1 · J2
L = L1 · L2
K = K1 · K2
M = M1 · M2

t_{pd-} = 25 ns typ
t_{pd+} = 13 ns typ
P_D = 50 mW typ/pkg

(continued)

FLIP-FLOPS (continued)

MC421/MC471
MC521/MC571
AC Coupled R-S Flip-Flop

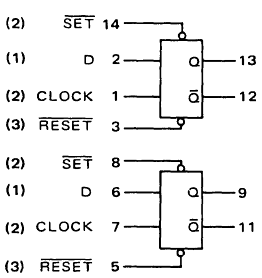


$\overline{S}$	$\overline{R}$	Q^{n+1}
0	0	Not Allowed
0	1	1
1	0	0
1	1	Q^n

Where: $\overline{\overline{S_C} \cdot \overline{C_S}} = \overline{S}$
$\overline{\overline{R_C} \cdot \overline{C_R}} = \overline{R}$

f = 10 MHz typ
P_D = 30 mW typ/pkg

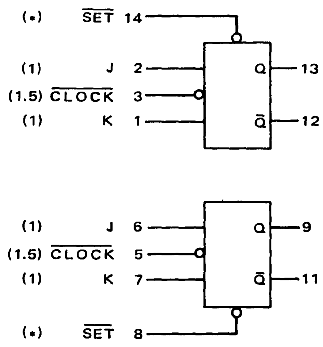
MC422/MC472
MC522/MC572
Dual Type D Flip-Flop



t_n	t_{n+1}	
D	Q	$\overline{Q}$
0	0	1
1	1	0

f = 30 MHz typ
P_D = 84 mW typ/pkg

MC423/MC473
MC523/MC573
Dual J-K Flip-Flop
(Separate Clock)

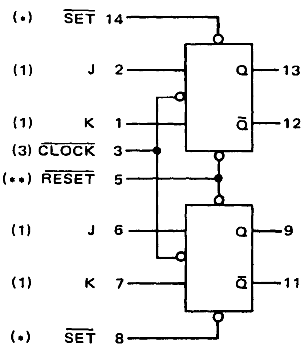


t_n		t_{n+1}	
J	K	Q	$\overline{Q}$
0	0	Q_n	$\overline{Q}_n$
0	1	0	1
1	0	1	0
1	1	$\overline{Q}_n$	Q_n

*MC423, MC473 = 1.7
*MC523, MC573 = 1.8

f = 45 MHz typ
P_D = 110 mW typ/pkg

MC424/MC474
MC524/MC574
Dual J-K Flip-Flop
(Common Clock)



t_n		t_{n+1}	
J	K	Q	$\overline{Q}$
0	0	Q_n	$\overline{Q}_n$
0	1	0	1
1	0	1	0
1	1	$\overline{Q}_n$	Q_n

*MC424, MC474 = 1.7
*MC524, MC574 = 1.8
**MC424, MC474 = 3.4
**MC524, MC574 = 3.6

f = 45 MHz typ
P_D = 110 mW typ/pkg

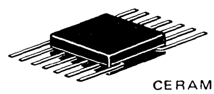
5

INTEGRATED CIRCUITS

MTTL II

MC2000 Series (0 to +75°C)
MC2100 Series (−55 to +125°C)

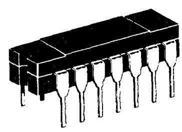
MTTL II integrated circuits comprise a family of transistor-transistor logic designed for general purpose digital applications. The family has a high operating speed (30-50 MHz clock rate), good external noise immunity, high fan out, and the capability of driving capacitive loads to 600 pF.



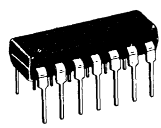
F SUFFIX
CERAMIC FLAT PACKAGE
CASE 607
TO-86

MAXIMUM RATINGS

Rating	Value	Unit
Supply Voltage-Continuous — MC2100 Series MC2000 Series	+8.0 +7.0	Vdc
Supply Operating Voltage Range	4.5 to 6.0	Vdc
Input Voltage	+5.5	Vdc
Output Voltage	+5.5	Vdc
Operating Temperature Range — MC2100 Series MC2000 Series	-55 to +125 0 to +75	°C
Storage Temperature Range — Ceramic Package — Plastic Package	-65 to +150 -55 to +125	°C
Maximum Junction Temperature — MC2100 Series MC2000 Series	+175 +150	°C
Thermal Resistance-Junction to Case (θ_{JC}) — Ceramic Package — Plastic Package	 0.09 0.15	°C/mW
Thermal Resistance-Junction to Ambient (θ_{JA}) — Ceramic Package — Plastic Package	 0.26 0.30	°C/mW



L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116



P SUFFIX
PLASTIC PACKAGE
CASE 646
TO-116

5

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C)

Function	Type ① Case 607,632,646 0 to +75°C	Type ① Case 607, 632 -55 to +125°C	Output Loading Factor Each Output MC2000 Series	Output Loading Factor Each Output MC2100 Series	Propagation Delay t_{pd} ns typ	Power Dissipation mW typ/pkg
Expandable 2-Wide 4-Input AND-OR-INVERT Gate	MC2000 MC2050	MC2100 MC2150	9 5	11 6	7.0	27
Quad 2-Input NAND Gate	MC2001 MC2051	MC2101 MC2151	9 5	11 6	6.0	88
4-Wide 3-2-2-3 Input Expander for AND-OR-INVERT Gates	MC2002 MC2052	MC2102 MC2152	9 5	11 6	–	28
Dual 4-Input NAND Gate	MC2003 MC2053	MC2103 MC2153	9 5	11 6	6.0	44
Expandable 4-Wide 2-2-2-3 Input AND-OR-INVERT Gate	MC2004 MC2054	MC2104 MC2154	9 5	11 6	7.0	36
8-Input NAND Gate	MC2005 MC2055	MC2105 MC2155	9 5	11 6	8.0	22
Dual 4-Input Expander for AND-OR-INVERT Gates	MC2006 MC2056	MC2106 MC2156	9 5	11 6	–	14
Triple 3-Input NAND Gate	MC2007 MC2057	MC2107 MC2157	9 5	11 6	6.0	66
Expandable 8-Input NAND Gate	MC2011 MC2061	MC2111 MC2161	9 9	11 6	11	22
Expandable 3-Wide 3-Input AND-OR-INVERT Gate	MC2012 MC2062	MC2112 MC2162	9 5	11 6	6.0	39
Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate	MC2013 MC2063	MC2113 MC2163	9 5	11 6	7.0	58
Quad 2-Input Lamp/ Line Driver	– MC2065	– MC2165	– 24	– 30	20	105
Hex Inverter	MC2016 MC2066	MC2116 MC2166	5 5	9 9	6.0	132
Dual J-K Flip-Flop (separate clock)	MC2023 MC2073	MC2123 MC2173	9 5	11 6	f = 70 MHz	110
Dual J-K Flip-Flop (common clock)	MC2024 MC2074	MC2124 MC2174	9 5	11 6	f = 70 MHz	110
AND J-K Flip-Flop	MC2025 MC2075	MC2125 MC2175	9 5	11 6	f = 50 MHz	50
OR J-K Flip-Flop	MC2026 MC2076	MC2126 MC2176	9 5	11 6	f = 50 MHz	60
OR J-K Flip-Flop	MC2028 MC2078	MC2128 MC2178	9 5	11 6	f = 35 MHz	60

① F suffix denotes Flat Package, L denotes Dual In-Line Ceramic Package, P denotes Plastic Package, (i.e., MC2000F = Flat Package, MC2100L = Dual In-Line Ceramic, MC2000P = Plastic Package.)

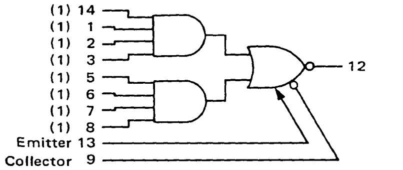
MTTL II LOGIC DIAGRAMS

Numbers at ends of terminals represent pin numbers.
Numbers in parenthesis indicate input loading factor.
For output loading capability, see Functions and Characteristics table.

V_{CC} = Pin 4, Gnd = Pin 10.

GATES

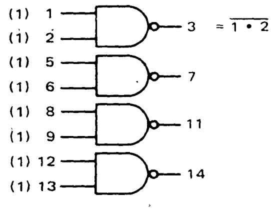
MC2000/MC2050 MC2100/MC2150 Expandable 2-Wide 4-Input AND-OR-INVERT Gate



$12 = \overline{(14 \cdot 1 \cdot 2 \cdot 3) + (5 \cdot 6 \cdot 7 \cdot 8) + (\text{Expander})}$

t_{pd} = 7.0 ns typ
P_D = 27 mW typ/pkg

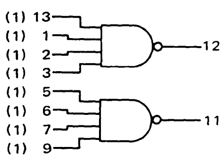
MC2001/MC2051 MC2101/MC2151 Quad 2-Input NAND Gate



$3 = \overline{1 \cdot 2}$

t_{pd} = 6.0 ns typ
P_D = 88 mW typ/pkg

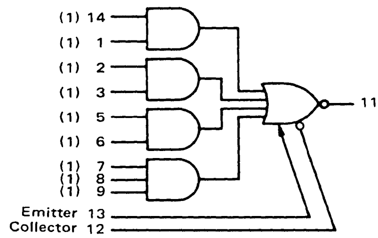
MC2003/MC2053 MC2103/MC2153 Dual 4-Input NAND Gate



$12 = \overline{1 \cdot 2 \cdot 3 \cdot 13}$

t_{pd} = 6.0 ns typ
P_D = 44 mW typ/pkg

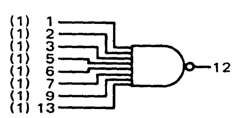
MC2004/MC2054 MC2104/MC2154 Expandable 4-Wide 2-2-2-3 Input AND-OR-INVERT Gate



$11 = \overline{(14 \cdot 1) + (2 \cdot 3) + (5 \cdot 6) + (7 \cdot 8 \cdot 9) + (\text{Expander})}$

t_{pd} = 7.0 ns typ
P_D = 36 mW typ/pkg

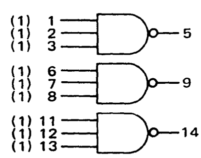
MC2005/MC2055 MC2105/MC2155 8-Input NAND Gate



$12 = \overline{1 \cdot 2 \cdot 3 \cdot 5 \cdot 6 \cdot 7 \cdot 9 \cdot 13}$

t_{pd} = 8.0 ns typ
P_D = 22 mW typ/pkg

MC2007/MC2057 MC2107/MC2157 Triple 3-Input NAND Gate



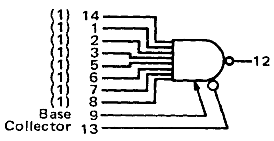
$5 = \overline{1 \cdot 2 \cdot 3}$

t_{pd} = 6.0 ns typ
P_D = 66 mW typ/pkg

5

GATES (continued)

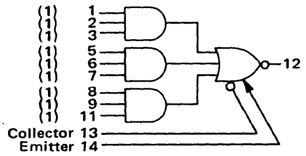
MC2011/MC2061 MC2111/MC2161 Expandable 8-Input NAND Gate



$12 = \overline{1 \cdot 2 \cdot 3 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot 14 \cdot Exp}$

t_{pd} = 11 ns typ
P_D = 22 mW typ/pkg

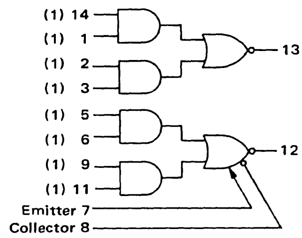
MC2012/MC2062 MC2112/MC2162 Expandable 3-Wide 3-Input AND-OR-INVERT Gate



$12 = \overline{(1 \cdot 2 \cdot 3) + (5 \cdot 6 \cdot 7) + (8 \cdot 9 \cdot 11) + Exp}$

t_{pd} = 6.0 ns typ
P_D = 39 mW typ/pkg

MC2013/MC2063 MC2113/MC2163 Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate

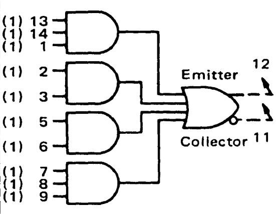


$13 = \overline{(1 \cdot 14) + (2 \cdot 3)}$
$12 = \overline{(5 \cdot 6) + (9 \cdot 11) + (Expander)}$

t_{pd} = 7.0 ns typ
P_D = 58 mW typ/pkg

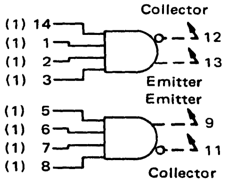
EXPANDERS

MC2002/MC2052 MC2102/MC2152 4-Wide 3-2-2-3 Input Expander for AND-OR-INVERT Gates



P_D = 28 mW typ/pkg

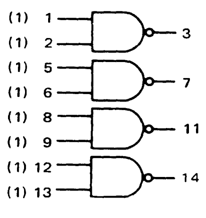
MC2006/MC2056 MC2106/MC2156 Dual 4-Input Expander for AND-OR-INVERT Gates



P_D = 14 mW typ/pkg

DRIVER

MC2165/MC2065 Quad 2-Input Lamp/Line Driver

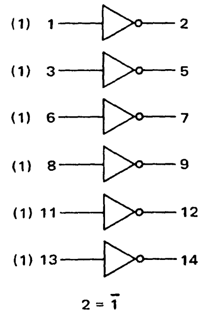


$3 = \overline{1 \cdot 2}$

t_{pd} = 20 ns typ
P_D = 105 mW typ/pkg

INVERTER

MC2016/MC2066 MC2116/MC2166 Hex Inverter

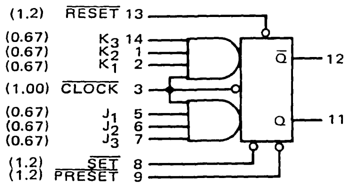


$2 = \overline{1}$

t_{pd} = 6.0 ns typ
P_D = 132 mW typ/pkg

FLIP-FLOPS

MC2025/MC2075, MC2125/MC2175 AND J-K Flip-Flop

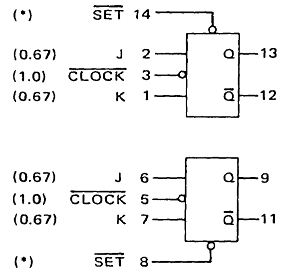


J	K	Q_n	Q_{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

$J = J_1 \cdot J_2 \cdot J_3$
$K = K_1 \cdot K_2 \cdot K_3$

f = 50 MHz typ
P_D = 50 mW typ/pkg

MC2023/MC2073 MC2123/MC2173 Dual J-K Flip-Flop (Separate Clock)



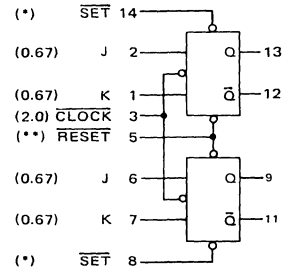
t_n		t_{n+1}	
J	K	Q	$\bar{Q}$
0	0	Q_n	$\bar{Q}_n$
0	1	0	1
1	0	1	0
1	1	$\bar{Q}_n$	Q_n

MC2000 Series
*1.15

MC2100 Series
*1.2

f = 70 MHz typ
P_D = 110 mW typ/pkg

MC2024/MC2074 MC2124/MC2174 Dual J-K Flip-Flop (Common Clock)

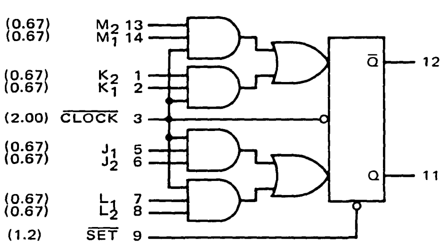


t_n		t_{n+1}	
J	K	Q	$\bar{Q}$
0	0	Q_n	$\bar{Q}_n$
0	1	0	1
1	0	1	0
1	1	$\bar{Q}_n$	Q_n

MC2000 Series
*1.15
**2.3
MC2100 Series
*1.2
**2.4

f = 70 MHz typ
P_D = 110 mW typ/pkg

MC2026/MC2076, MC2126/MC2176 OR J-K Flip-Flop



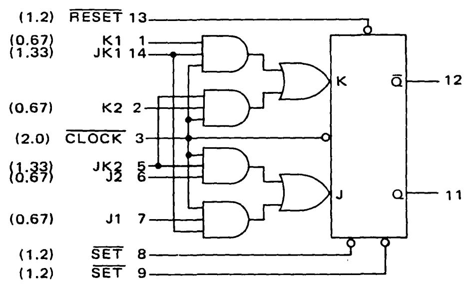
J	L	K	M	Q_n	Q_{n+1}
0	0	X	X	0	0
1	X	X	X	0	1
X	1	X	X	0	1
X	X	0	0	1	1
X	X	1	X	1	0
X	X	X	1	1	0

X = Don't Care

$J = J_1 \cdot J_2$
$L = L_1 \cdot L_2$
$K = K_1 \cdot K_2$
$M = M_1 \cdot M_2$

f = 50 MHz typ
P_D = 60 mW typ/pkg

MC2028/MC2078 MC2128/MC2178 OR J-K FLIP-FLOP



J1	J2	K1	K2	JK1	JK2	Q_{n+1}
X	X	X	X	0	0	Q_n
X	1	X	0	0	1	1
X	0	X	1	0	1	0
X	1	X	1	0	1	Q_n
1	X	0	X	1	0	1
0	X	1	X	1	0	0
1	X	1	X	1	0	Q_n
0	0	0	0	1	1	Q_n
X	1	0	0	1	1	1
1	X	0	0	1	1	1
0	0	X	1	1	1	0
0	0	1	X	1	1	0
1	X	1	X	1	1	Q_n
X	1	X	1	1	1	Q_n

X = Don't Care

f = 35 MHz typ
P_D = 60 mW typ/pkg

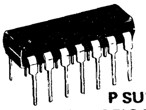
5

INTEGRATED CIRCUITS

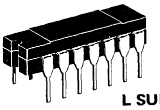
MTTL III

MC3000 Series (0 to +75°C)
MC3100 Series (-55 to +125°C)

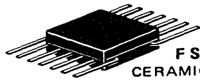
MTTL III integrated circuits comprise a family of transistor-transistor logic designed for general purpose digital applications. The family has a high operating speed (30-50 MHz clock rate), good external noise immunity, high fan-out, and the capability of driving lines up to 600 pF capacitance.



P SUFFIX
PLASTIC PACKAGE
CASE 646
TO-116



L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116



F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C)

Function	Type ①		Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Power Dissipation mW typ/pkg
	Case 607, 632, 646 0 to +75°C	Case 607, 632 -55°C to +125°C			
Quad 2-Input NAND Gate	MC3000	MC3100	10	6.0	88
Quad 2-Input AND Gate	MC3001	MC3101	10	9.0	112
Quad 2-Input NOR Gate	MC3002	MC3102	10	6.0	122
Quad 2-Input OR Gate	MC3003	MC3103	10	9.0	150
Quad 2-Input NAND Gate (Open Collector)	MC3004	MC3104	10	8.0	88
Triple 3-Input NAND Gate	MC3005	MC3105	10	6.0	66
Triple 3-Input AND Gate	MC3006	MC3106	10	9.0	84
Triple 3-Input NAND Gate (Open Collector)	MC3007	MC3107	10	8.0	66
Hex Inverter	MC3008	MC3108	10	6.0	140
Hex Inverter	MC3009	MC3109	10	8.0	90
Dual 4-Input NAND Gate	MC3010	MC3110	10	6.0	44
Dual 4-Input AND Gate	MC3011	MC3111	10	9.0	56
Dual 4-Input NAND Gate (Open Collector)	MC3012	MC3112	10	8.0	44
8-Input NAND Gate	MC3015	MC3115	10	8.0	22
8-Input NAND Gate	MC3016	MC3116	10	8.0	22
4-Wide 3-2-2-3 Input Expander For AND-OR-INVERT Gates	MC3018	MC3118	**	Δt_{pd1} = 0.4 Δt_{pd0} = 0.05	40
Triple 3-Input Expander For AND-OR Gates	MC3019	MC3119	**	Δt_{pd1} = 0.4 Δt_{pd0} = 0.05	25
Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate	MC3020	MC3120	10	6.0	62.5
Quad 2-Input Exclusive OR Gate	MC3021	MC3121	8	14	100
Quad 2-Input Exclusive NOR Gate	MC3022	MC3122	8	14	85
Dual 2-Wide 2-Input AND-OR-INVERT Gate	MC3023	MC3123	10	6.0	62.5
Dual 4-Input NAND Buffer Gate	MC3024	MC3124	30	6.0	90
Dual 4-Input NAND Power Gate	MC3025	MC3125	20	6.0	70
Dual 4-Input AND Power Gate	MC3026	MC3126	20	9.0	90
Dual 3-Input 3-Output AND Series Terminated Line Driver	MC3028	MC3128	*	9.0	56
Dual 3-Input 3-Output NAND Series Terminated Line Driver	MC3029	MC3129	*	6.0	44
Dual 4-Input Expander for AND-OR-INVERT Gates	MC3030	MC3130	**	Δt_{pd} = 1.0	15
Expandable 4-Wide 2-2-2-3 Input AND-OR Gate	MC3031	MC3131	10	10	87.5
Expandable 4-Wide 2-2-2-3 Input AND-OR-INVERT Gate	MC3032	MC3132	10	7.0	40
4-Wide 2-2-2-3 Input AND-OR-INVERT Gate	MC3033	MC3133	10	7.0	40
Expandable 2-Wide 4-Input AND-OR-INVERT Gate	MC3034	MC3134	10	7.0	30
AND J-K Flip-Flop	MC3050	MC3150	10	f = 40 MHz	80
AND Input J-K Flip-Flop	MC3051	MC3151	10	f = 50 MHz	50
AND Input $\overline{JJ}$-$\overline{K}$K Flip-Flop	MC3052	MC3152	10	f = 40 MHz	75
Double-Edge-Triggered Master-Slave Type D Flip-Flop	MC3053	MC3153	10	–	100
OR Input J-K Flip-Flop	MC3054	MC3154	10	f = 30 MHz	95
AND Input J-K Flip-Flop	MC3055	MC3155	10	f = 30 MHz	80
Dual Type D Flip-Flop	MC3060	MC3160	10	f = 30 MHz	120
Dual J-K Flip-Flop	MC3061	MC3161	10	f = 50 MHz	100
Dual J-K Flip-Flop	MC3062	MC3162	10	f = 50 MHz	100
Dual J-K Flip-Flop	MC3063	MC3163	10	f = 30 MHz	176

① F suffix denotes Flat Package, L suffix denotes Dual In-Line Ceramic Package, P suffix denotes Plastic Package, (i.e., MC3000F = Flat Package, MC3000L = Ceramic Package, MC3000P = Plastic Package).

*Direct Output = 10 minus the number of resistor-terminated outputs being used.

**Full output loading factor of the expandable gate is maintained.

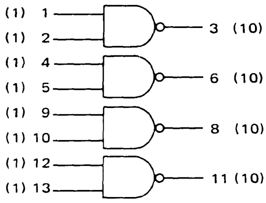
MTTL III LOGIC DIAGRAMS

Numbers at ends of terminals represent pin numbers.
Numbers in parenthesis indicate loading.

V_{CC} = Pin 14, Gnd = Pin 7.

GATES

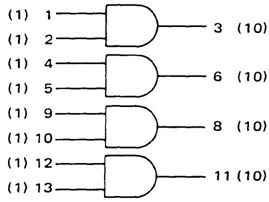
MC3000/MC3100
Quad 2-Input NAND Gate



$3 = \overline{1 \cdot 2}$

t_{pd} = 6.0 ns typ
P_D = 88 mW typ/pkg

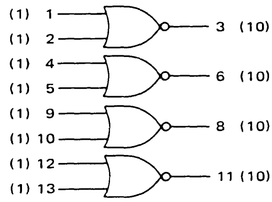
MC3001/MC3101
Quad 2-Input AND Gate



$3 = 1 \cdot 2$

t_{pd} = 9.0 ns typ
P_D = 112 mW typ/pkg

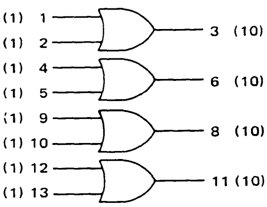
MC3002/MC3102
Quad 2-Input NOR Gate



$3 = \overline{1 + 2}$

t_{pd} = 6.0 ns typ
P_D = 122 mW typ/pkg

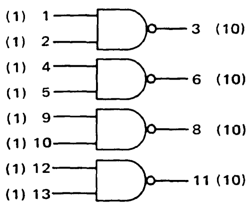
MC3003/MC3103
Quad 2-Input OR Gate



$3 = 1 + 2$

t_{pd} = 9.0 ns typ
P_D = 150 mW typ/pkg

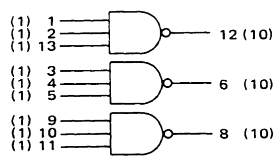
MC3004/MC3104
Quad 2-Input NAND Gate (Open Collector)



$3 = \overline{1 \cdot 2}$

t_{pd} = 8.0 ns typ
P_D = 88 mW typ/pkg

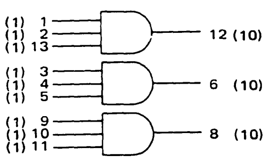
MC3005/MC3105
Triple 3-Input NAND Gate



$12 = \overline{1 \cdot 2 \cdot 13}$

t_{pd} = 6.0 ns typ
P_D = 66 mW typ/pkg

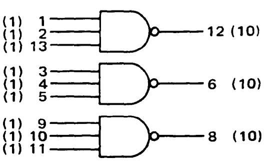
MC3006/MC3106
Triple 3-Input AND Gate



$12 = 1 \cdot 2 \cdot 13$

t_{pd} = 9 0 ns typ
P_D = 84 mW typ/pkg

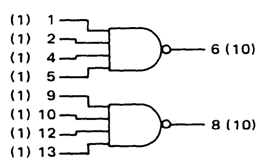
MC3007/MC3107
Triple 3-Input NAND Gate (Open Collector)



$12 = \overline{1 \cdot 2 \cdot 13}$

t_{pd} = 8.0 ns typ
P_D = 66 mW typ/pkg

MC3010/MC3110
Dual 4-Input NAND Gate



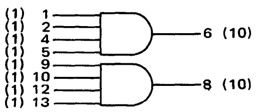
$6 = \overline{1 \cdot 2 \cdot 4 \cdot 5}$

t_{pd} = 6.0 ns typ
P_D = 44 mW typ/pkg

(continued)

GATES (continued)

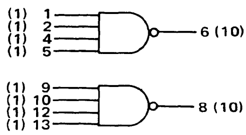
MC3011/MC3111
Dual 4-Input AND Gate



$6 = 1 \bullet 2 \bullet 4 \bullet 5$

t_{pd} = 9.0 ns typ
P_D = 56 mW typ/pkg

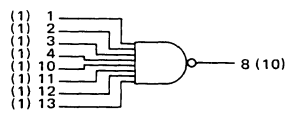
MC3012/MC3112
Quad 4-Input NAND Gate (Open Collector)



$6 = \overline{1 \bullet 2 \bullet 4 \bullet 5}$

t_{pd} = 8.0 ns typ
P_D = 44 mW typ/pkg

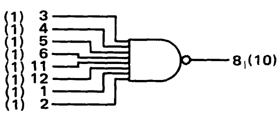
MC3015/MC3115
8-Input NAND Gate



$8 = \overline{1 \bullet 2 \bullet 3 \bullet 4 \bullet 10 \bullet 11 \bullet 12 \bullet 13}$

t_{pd} = 8.0 ns typ
P_D = 22 mW typ/pkg

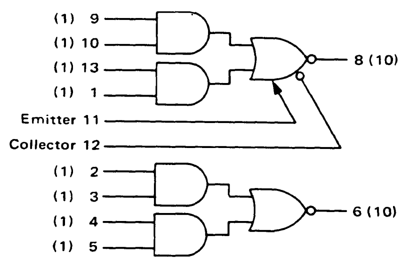
MC3016/MC3116
8-Input NAND Gate



$8 = \overline{3 \bullet 4 \bullet 5 \bullet 6 \bullet 11 \bullet 12 \bullet 1 \bullet 2}$

t_{pd} = 8.0 ns typ
P_D = 22 mW typ/pkg

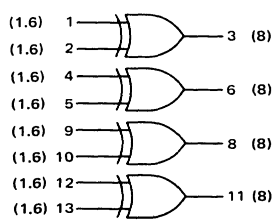
MC3020/MC3120
Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate



$8 = \overline{(9 \bullet 10) + (13 \bullet 1) + (\text{Expanders})}$

t_{pd} = 6.0 ns typ
P_D = 62.5 mW typ/pkg

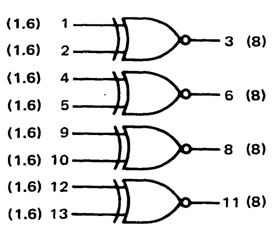
MC3021/MC3121
Quad 2-Input Exclusive OR Gate



$3 = 1 \bullet \overline{2} + \overline{1} \bullet 2$

t_{pd} = 14 ns typ
P_D = 100 mW typ/pkg

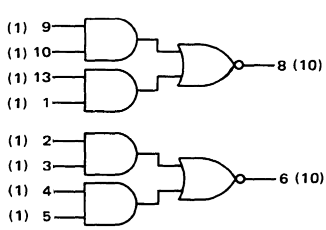
MC3022/MC3122
Quad 2-Input Exclusive NOR Gate



$3 = \overline{1} \bullet \overline{2} + 1 \bullet 2$

t_{pd} = 14 ns typ
P_D = 85 mW typ/pkg

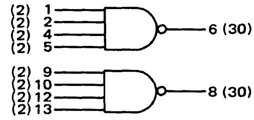
MC3023/MC3123
Dual 2-Wide 2-Input AND-OR-INVERT GATE



$8 = \overline{(9 \bullet 10) + (13 \bullet 1)}$

t_{pd} = 6.0 ns typ
P_D = 62.5 mW typ/pkg

MC3024/MC3124
Dual 4-Input NAND Buffer Gate



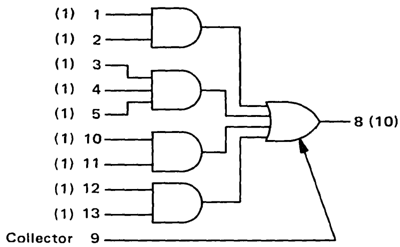
$6 = \overline{1 \bullet 2 \bullet 4 \bullet 5}$

typ = 6.0 ns typ
P_D = 90 mW typ/pkg

(continued)

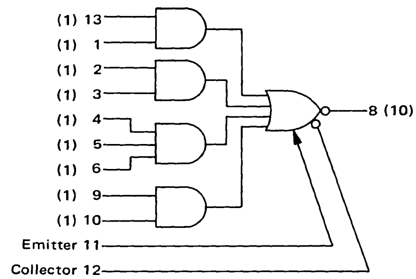
GATES (continued)

MC3031/MC3131
Expandable 4-Wide 2-2-2-3-Input AND-OR Gate



t_{pd} = 10 ns typ
P_D = 87.5 mW typ/pkg

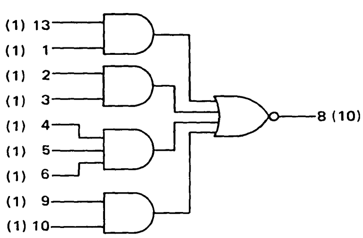
MC3032/MC3132
Expandable 4-Wide 2-2-2-3-Input AND-OR-INVERT Gate



$8 = \overline{(13 \bullet 1) + (2 \bullet 3) + (4 \bullet 5 \bullet 6) + (9 \bullet 10) + (\text{Expanders})}$

t_{pd} = 7 ns typ
P_D = 40 mW typ/pkg

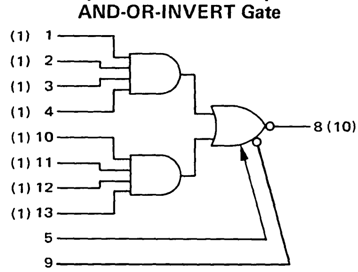
MC3033/MC3133
4-Wide 2-2-2-3-Input AND-OR-INVERT Gate



$8 = \overline{(13 \bullet 1) + (2 \bullet 3) + (4 \bullet 5 \bullet 6) + (9 \bullet 10)}$

t_{pd} = 7 ns typ
P_D = 40 mW typ/pkg

MC3034/MC3134
Expandable 2-Wide 4-Input AND-OR-INVERT Gate

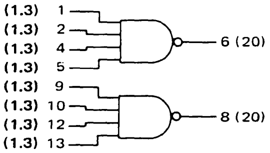


$8 = \overline{(1 \bullet 2 \bullet 3 \bullet 4) + (10 \bullet 11 \bullet 12 \bullet 13) + \text{Expanders}}$

t_{pd} = 7.0 ns typ
P_D = 30 mW typ/pkg

POWER GATES

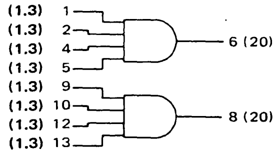
MC3025/MC3125
Dual 4-Input NAND Power Gate



$6 = \overline{1 \bullet 2 \bullet 4 \bullet 5}$

t_{pd} = 6.0 ns typ
P_D = 70 mW typ/pkg

MC3026/MC3126
Dual 4-Input AND Power Gate

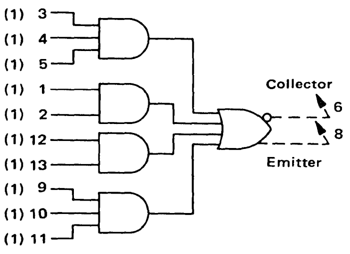


$6 = 1 \bullet 2 \bullet 4 \bullet 5$

t_{pd} = 9.0 ns typ
P_D = 90 mW typ/pkg

EXPANDERS

MC3018/MC3118
3-2-2-3 Input Expander For AND-OR-INVERT Gate



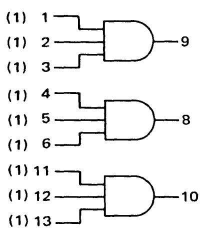
Full output loading factor of the expandable gate is maintained.

Propagation Delay Time:
Δt_{pd1} = +0.4 ns typ
Δt_{pd0} = 0.05 ns typ
When added to the expandable "AND-OR-INVERT" gate.

$\Delta t_{pd1/pF}$ = +0.3 ns/pF typ
$\Delta t_{pd0/pF}$ = +0.04 ns/pF typ
Caused by additional capacitance at expansion points.

P_D = 40 mW typ/pkg

MC3019/MC3119
Triple 3-Input Expander For AND-OR Gates



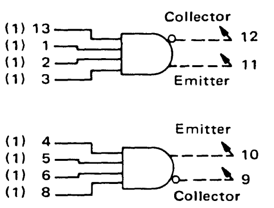
Full output loading factor of the expandable gate is maintained.

Propagation Delay Time:
Δt_{pd1} = +0.4 ns typ
Δt_{pd0} = +0.05 ns typ
When added to the expandable "AND-OR" gate.

Δt_{pd1}/pF = +0.3 ns/pF typ
Δt_{pd0}/pF = +0.04 ns/pF typ
Caused by additional capacitance at expansion points.

P_D = 25 mW typ/pkg

MC3030/MC3130
Dual 4-Input Expander for AND-OR-INVERT Gates



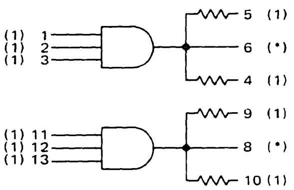
Full output loading factor of the expandable gate is maintained.
Δt_{pd} = +1.0 ns typ
When added to the expandable "AND OR-INVERT" gate.
Δt_{pd}/pF = +1.0 ns/pF typ
Caused by additional capacitance at expansion points.
P_D = 15 mW typ/pkg

5

MTTL III LOGIC DIAGRAMS

LINE DRIVERS

MC3028/MC3128
Dual 3-Input 3-Output AND
Series Terminated Line Driver

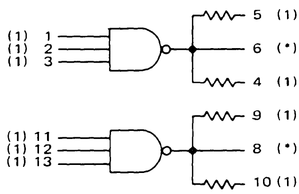


4, 5, 6, = 1 • 2 • 3

t_{pd} = 9.0 ns typ
P_D = 56 mW typ/pkg

*8 MINUS THE NUMBER OF RESISTOR-TERMINATED OUTPUTS BEING USED.

MC3029/MC3129
Dual 3-Input 3-Output NAND
Series Terminated Line Driver



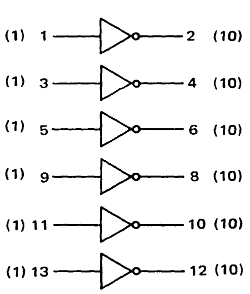
4, 5, 6 = $\overline{1 \cdot 2 \cdot 3}$

t_{pd} = 6.0 ns typ
P_D = 44 mW typ/pkg

*8 MINUS THE NUMBER OF RESISTOR-TERMINATED OUTPUTS BEING USED.

INVERTERS

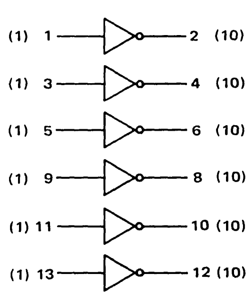
MC3008/MC3108
Hex Inverter



2 = $\overline{1}$

t_{pd} = 6.0 ns typ
P_D = 140 mW typ/pkg

MC3009/MC3109
Hex Inverter

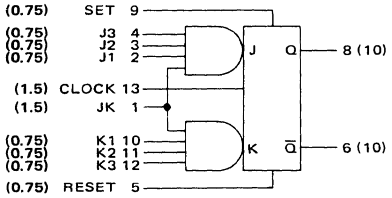


2 = $\overline{1}$

t_{pd} = 8.0 ns typ
P_D = 90 mW typ/pkg

FLIP-FLOPS

MC3050/MC3150
AND J-K Flip-Flop



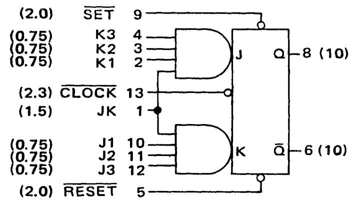
J	K	Q_n	Q_{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Where:
J = J1 • J2 • J3 • JK
K = K1 • K2 • K3 • JK

f = 40 MHz
P_D = 80 mW typ/pkg

MC3051/MC3151
AND J-K Flip-Flop

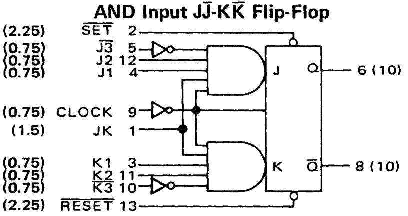
J	K	Q^n	Q^{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0



where
J = J1 • J2 • J3 • JK
K = K1 • K2 • K3 • JK

f = 50 MHz
P_D = 50 mW typ/pkg

MC3052/MC3152
AND Input J$\overline{J}$-K$\overline{K}$ Flip-Flop

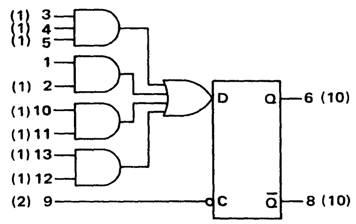


J	K	Q_n	Q_{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Where.
J = J1 • J2 • $\overline{J3}$ • JK
K = K1 • K2 • $\overline{K3}$ • JK

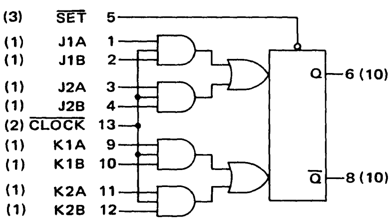
f = 40 MHz
P_D = 75 mW typ/pkg

MC3053/MC3153
Double-Edge-Triggered Master-Slave Type D Flip-Flop



P_D = 100 mW typ/pkg

MC3054/MC3154
OR Input J-K Flip-Flop

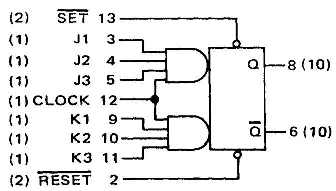


t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q}_n$

J = JIA • JIB + J2A • J2B
K = KIA • KIB + K2A • K2B

t_{pd} = 20 ns typ
f = 30 MHz typ
P_D = 95 mW typ/pkg

MC3055/MC3155
AND Input J-K Flip-Flop



t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q}_n$

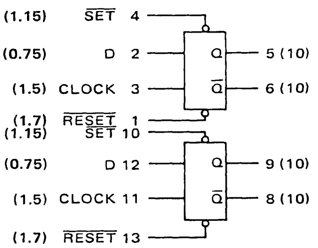
J = J1 • J2 • J3
K = K1 • K2 • K3

t_{pd} = 10 ns typ
f = 30 MHz typ
P_D = 80 mW typ/pkg

5

FLIP-FLOPS (continued)

MC3060/MC3160
Dual Type D Flip-Flop



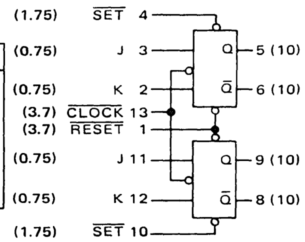
D	Q_n	Q_{n+1}
0	0	0
0	1	0
1	0	1
1	1	1

$Q_{n+1} = D_n$

f = 30 MHz
P_D = 120 mW typ/pkg

MC3061/MC3161
Dual J-K Flip-Flop

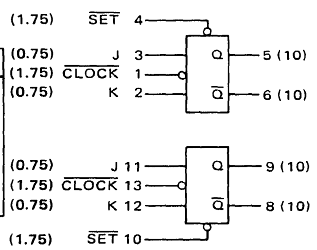
J	K	Q_n	Q_{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0



f = 50 MHz
P_D = 100 mW typ/pkg

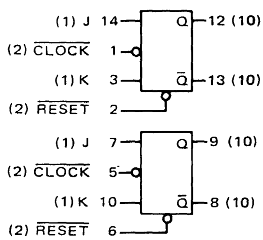
MC3062/MC3162
Dual J-K Flip-Flop

J	K	Q_n	Q_{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0



f = 50 MHz
P_D = 100 mW typ/pkg

MC3063/MC3163
DUAL J-K FLIP-FLOP



t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\bar{Q}_n$

P_D = 176 mW typ/pkg
t_{pd} = 10 ns typ
f = 30 MHz typ

MAXIMUM RATINGS

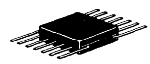
Rating	Value	Unit
Supply Voltage – Continuous MC3100 series MC3000 series	 +7.0 +7.0	 Vdc Vdc
Supply Operating Voltage Range	4.5 to 5.5	Vdc
Input Voltage	+5.5	Vdc
Output Voltage	+5.5	Vdc
Operating Temperature Range MC3100 series MC3000 series	 -55 to +125 0 to +75	 °C °C
Storage Temperature Range – Ceramic Package Plastic Package	 -65 to +175 -55 to +125	 °C °C

MTTL COMPLEX FUNCTIONS MTTL

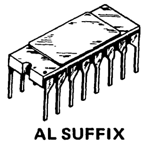
INTEGRATED CIRCUITS

The MTTL complex functions are designed for digital applications in the medium to high-speed range.

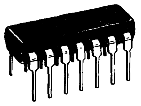
These MTTL devices provide significant reduction in package count and increased logic per function over devices in the basic MTTL and MDTL families.



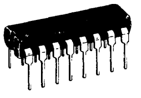
F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86



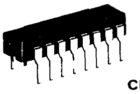
AL SUFFIX
CERAMIC PACKAGE
CASE 690



P SUFFIX
PLASTIC PACKAGE
CASE 646
TO-116

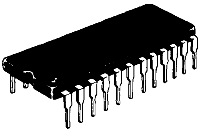


P SUFFIX
PLASTIC PACKAGE
CASE 648

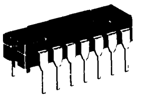


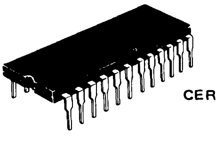
L SUFFIX
CERAMIC PACKAGE
CASE 620

P SUFFIX
PLASTIC PACKAGE
CASE 649



L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116





L SUFFIX
CERAMIC PACKAGE
CASE 623

5

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C)

All devices shown can be used with all MTTL and MDTL devices; however, the loading factors shown reflect use with other devices in the same MC-number series unless otherwise noted.

Function	Type ① -55 to +125°C	Case	Type ① 0 to +75°C	Case	Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Power Dissipation P_D mW typ/pkg
Dual 4-Channel Data Selector	MC4300F,L	607,632	MC4000F,L,P	607,632,646	10	Control Line = 18 Data Line = 11	150
BCD-to-Binary/Binary-to-BCD Number Converter	–	–	MC4001L,P	620,648	Open Collector I_{OL} = 16 mA	Address Time <45 ns	300
Dual Data Distributor	–	–	MC4002F,L,P	607,632,646	10	10.5	175
16-Bit Scratch Pad Memory Cell	MC4304F,L	607,632	MC4004F,L,P	607,632,646	I_{OL} = 40 mA	Write mode: 25 Sense mode: 15	250
16-Bit Scratch Pad Memory Cell	MC4305F,L	607,632	MC4005F,L,P	607,632,646	Open Collector I_{OL} = 20 mA	Write mode: 25 Sense mode: 15	250
Binary to One-of-Eight Line Decoder	MC4306F,L	607,632	MC4006F,L,P	607,632,646	10	14	100
Dual Binary to One-of-Four Line Decoder	MC4307L	620	MC4007L,P	620,648	10	14	125
8-Bit Parity Tree	MC4308F,L	607,632	MC4008F,L,P	607,632,646	10	15 to 30	150
Dual 4-Bit Parity Tree	MC4310F,L	607,632	MC4010F,L,P	607,632,646	10	9.5 to 22	125
4-Bit Shift Register	–	–	MC4012F,L,P	607,632,646	10	22/bit	180
Quad Type D Flip-Flop	–	–	MC4015L,P	620,648	10	16	190
Programmable Modulo-N Decade Counter	MC4316L	620	MC4016L,P	620,648	8	Clock to Q3 = 50 Clock to Bus = 35	250
Programmable Modulo-N Hexadecimal Counter	MC4318L	620	MC4018L,P	620,648	8	Clock to Q3 = 50 Clock to Bus = 35	250
Dual 4-Bit Comparator (Open Collector)	–	–	MC4021P	648	10	20	250
Dual 4-Bit Comparator	–	–	MC4022P	648	10	20	250
4-Bit Universal Counter	–	–	MC4023F,L,P	607,632,646	10	16/bit	200
Dual Voltage-Controlled Multivibrator	MC4324F,L	607,632	MC4024F,L,P	607,632,646	7	f_{max} = 30 MHz	150
Full Adder	MC4326F,L	607,632	MC4026F,L,P	607,632,646	15/12**	25/13#	90
Full Adder	MC4327F,L	607,632	MC4027F,L,P	607,632,646	7/6**	25/13#	90
Adder (Dependent Carry)	MC4328F,L	607,632	MC4028F,L,P	607,632,646	15/12**	25/13#	125
Adder (Dependent Carry)	MC4329F,L	607,632	MC4029F,L,P	607,632,646	7/6**	25/13#	125
Adder (Independent Carry)	MC4330F,L	607,632	MC4030F,L,P	607,632,646	15/12**	25/13#	125
Adder (Independent Carry)	MC4331F,L	607,632	MC4031F,L,P	607,632,646	7/6**	25/13#	125
Carry Decoder	MC4332F,L	607,632	MC4032F,L,P	607,632,646	–	Δt_{pd} = 4.0/decoder	20
Quad Latch (Open Collector)	MC4335F,L	607,632	MC4035F,L,P	607,632,646	7	25	140
Quad Latch	MC4337F,L	607,632	MC4037F,L,P	607,632,646	10	25	150

① F suffix denotes ceramic flat package, L suffix denotes ceramic dual in-line package, P suffix denotes plastic dual in-line package.

**MC4300 Series/MC4000 Series; loading specified for use with MTTL I devices. #Add delay/Carry delay

MTTL COMPLEX LOGIC FUNCTIONS

FUNCTIONS AND CHARACTERISTICS (continued)

Function	Type ① -55 to +125°C	Case	Type ① 0 to +75°C	Case	Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Power Dissipation P_D mW typ/pkg
Inverting/Non-Inverting One-of-Eight Decoder	–	–	MC4038P	648	Open Collector I_{OL} = 20 mA	Address Time <45 ns	240
Seven-Segment Character Generator	–	–	MC4039P	648			240
Binary to Two-of-Eight Decoder	–	–	MC4040P	648			200
Single-Error Hamming Code Detector and Generator	–	–	MC4041P	648			240
Quad Predriver	–	–	MC4042F,L,P	607,632,646	I_{OL} = 50 mA Open Collector	15	120
Dual Line Selector	–	–	MC4043F,L,P	607,632,646	I_{OL} = 400 mA Pulsed	20	70
Phase-Frequency Detector	MC4344F,L	607,632	MC4044F,L,P	607,632,646	10	9.0	85
Non-Inverting One-of-Eight Decoder	–	–	MC4048P	648	Open Collector I_{OL} = 16 mA	Address Time <50 ns	240
Counter-Latch-Decoder	MC4350L	620	MC4050L,P	620,648	Open Collector I_{OL} = 40 mA	f_{Tog} = 35 MHz	450
Counter-Latch-Decoder	–	–	MC4051P	648	Open Emitter 40 mA Sourcing Capability @ 10% Duty Cycle	f_{Tog} = 35 MHz	450
Dual Majority Logic Gate	–	–	MC4062P	646	–	Z = 20 $\overline{Z}$ = 11	75
			0 to +70°C				
BCD-to-Decimal Decoder and High-Level Driver	MC5441AL	620	MC7441AL,P	620,648	–	–	105
BCD-to-Decimal Decoder	MC5442L	620	MC7442L,P	620,648	10	2 Logic Levels = 22 3 Logic Levels = 23	140
Excess Three-to-Decimal Decoder	MC5443L	620	MC7443L,P	620,648	10	2 Logic Levels = 22 3 Logic Levels = 23	140
Excess Three Gray-to-Decimal Decoder	MC5444L	620	MC7444L,P	620,648	10	2 Logic Levels = 22 3 Logic Levels = 23	140
BCD to One-of-Ten Decoder/Driver	MC5445L	620	MC7445L,P	620,648	–	50 max	215
BCD-to-Seven Segment Decoder/Driver	MC5446L	620	MC7446L,P	620,648	BI/RBO = 5	–	265
BCD-to-Seven Segment Decoder/Driver	MC5447L	620	MC7447L,P	620,648	BI/RBO = 5	–	265
BCD-to-Seven Segment Decoder/Driver	MC5448L	620	MC7448L,P	620,648	BI/RBO = 5 a thru g = 4	–	265
BCD-to-Seven Segment Decoder/Driver	MC5449F	607	MC7449F	607	6	–	165
Quad Latch	–	–	MC7475P	648	10	30	160
Gated Full Adder	MC5480L	632	MC7480L,P	632,646	S,$\overline{S}$ = 10 $\overline{C}_{out}$ = 5 A*, B* = 3	55/10#	105
2-Bit Full Adder	MC15482F,L	607,632	MC17482F,L,P	607,632,646	10	15/12#	165
2-Bit Full Adder	MC25482F,L	607,632	MC27482F,L,P	607,632,646	10	15/12#	165
4-Bit Binary Full Adder	MC5483L	620	MC7483L,P	620,648	S = 10 C_{out} = 5	35	390
16-Bit Scratch Pad Memory Cell With Gated Inputs	MC5484L	620	–	–	I_{OL} = 40 mA Open Collector	Write Mode: 25 Sense Mode: 15	250
	–	–	MC7484L,P	620, 648	I_{OL} = 20 mA		
Decade Counter	MC5490F,L	607,632	MC7490F,L,P	607,632,646	10	20/bit	160
8-Bit Shift Register	MC5491AL	632	MC7491AL,P	632,646	10	25	175
Divide-by-Twelve Counter	MC5492F,L	607,632	MC7492F,L,P	607,632,646	10	60	160
4-Bit Binary Counter	MC5493L	632	MC7493L,P	632,646	10	20/bit	160
4-Bit Shift Register	MC5494L	620	MC7494P	648	–	25	175
4-Bit Shift Register	MC5495F,L	607,632	MC7495F,L,P	607,632,646	10	25	250
5-Bit Shift Register	MC5496L	620	MC7496L,P	620,648	–	25	240
Monostable Multivibrator	MC54121F,L	607,632	MC74121F,L,P	607,632,646	10	t_{pd+}, B to Q = 35	90
BCD to One-of-Ten Decoder/Driver	MC54145L	620	MC74145L,P	620,648	–	50 max	215
16-Channel Data Selector	MC54150L	623	MC74150P	649	–	8.5 to 35	200
8-Channel Data Selector	MC54151L	620	MC74151P	648	–	8.5 to 35	145
8-Bit Odd/Even Generator/Checker	MC54180L	632	MC74180P	646	10	15 to 30	170

① F suffix denotes ceramic flat package, L suffix denotes ceramic dual in-line package, P suffix denotes plastic dual in-line package.

#Add delay/Carry delay

5

MTTL COMPLEX LOGIC FUNCTIONS

FUNCTIONS AND CHARACTERISTICS (continued)

Function	Type ① -55 to +125°C	Case	Type ① 0 to +75°C	Case	Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Power Dissipation P_D mW typ/pkg
Quad Exclusive OR Gate	MC8241F,L	607,632	MC7241F,L,P	607,632,646	10	10	225
Quad Exclusive NOR Gate (Open Collector)	MC8242F,L	607,632	MC7242F,L,P	607,632,646	10	18	170
Binary to One-of-Eight Decoder	MC8250L	632	MC7250L,P	632,646	10	30	75
Binary to One-of-Ten Decoder	MC8251L	620	MC7251L,P	620,648	10	30	80
Universal 4-Bit Shift Register	MC9300L	620	MC8300L,P	620,648	6	25	300
BCD-to-Decimal Decoder	MC9301L	620	MC8301L,P	620,648	10	22	125
Dual Full Adder	MC9304L	620	MC8304L,P	620,648	$\overline{C}_{o1}, \overline{C}_{o2}$ = 7 S1, $\overline{S}2$ = 10 $\overline{S}1$, S2 = 9	8.0 to 28	110
Dual 4-Bit Latch	–	–	MC8308P	649	9	E to Q = 25	325
Dual 4-Channel Data Selector	MC9309L	620	MC8309L,P	620,648	Z, W = 10 $\overline{Z}, \overline{W}$ = 9	9.0 to 24	150
Presettable Decade Counter	MC9310L	620	MC8310L,P	620,648	6	14 to 35	300
One-of-16 Decoder	–	–	MC8311P	649	10	$\overline{E}$ to Q = 26 max	175
8-Channel Data Selector	MC9312L	620	MC8312L,P	620,648	Z = 20/10† $\overline{Z}$ = 18/9†	9.0 to 24	135
Presettable 4-Bit Binary Counter	MC9316L	620	MC8316L,P	620,648	6	14 to 35	300
Dual 8-Bit Shift Register	MC9328L	620	MC8328L,P	620,648	6	C to Q = 22 (t_{pd-}) 13 (t_{pd+}) $\overline{MR}$ to Q = 35	250
Retriggerable Monostable Multivibrator	MC9601F,L	607,632	MC8601F,L,P	607,632,646	MC9601 = 6 MC8601 = 8	25	75
Dual Retriggerable Resettable Monostable Multivibrator	MC9602L	620	MC8602L,P	620,648	MC9602 = 6 MC8602 = 8	25	160
			0 to +85°C				
64-Bit Random Access Memory	–	–	MCM4064L	620	Open Collector I_{OL} = 15 mA	Access Time <60 ns	6 mW/bit
			0 to +70°C				
Binary to BCD Number Converter	–	–	MCM4067AL	690	Open Collector I_{OL} = 12 mA	Address Time <50 ns	615
	–	–	MCM4068AL	690			
Hollerith-to ASCII Converter	–	–	MCM4069AL	690	Open Collector I_{OL} = 12 mA	Address Time <40 ns	615
	–	–	MCM4070AL	690			

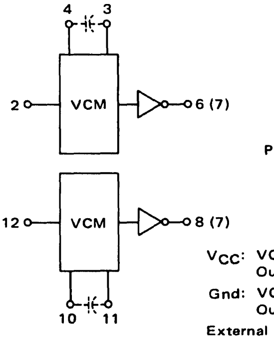
① F suffix denotes ceramic flat package, L suffix denotes ceramic dual in-line package, P suffix denotes plastic dual in-line package.
†High/Low

5

Numbers at ends of terminals represent pin numbers. Numbers in parenthesis indicate loading. Loading factors reflect use with other devices in the same MC-number series unless otherwise noted.

PHASE-LOCKED LOOP

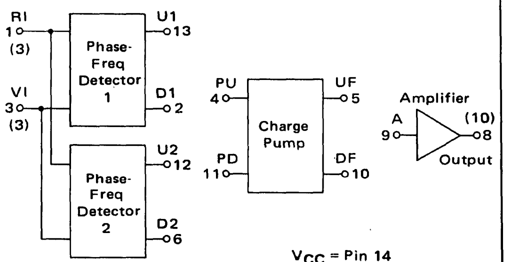
MC4024/MC4324
Dual Voltage-Controlled Multivibrator



P_D = 150 mW typ/pkg
f = 30 MHz typ

V_{CC}: VCM = 1, 13
Output Buffer = 14
Gnd: VCM = 5, 9
Output Buffer = 7
External Capacitor for Frequency Range Determination

MC4044/MC4344
Phase-Frequency Detector

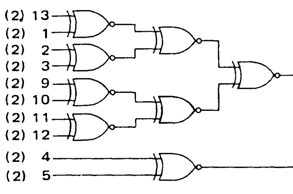


V_{CC} = Pin 14
Gnd = Pin 7

t_{pd} (thru phase detector) = 9.0 ns typ
P_D = 85 mW typ/pkg

PARITY FUNCTIONS

MC4008/MC4308
8-Bit Parity Tree

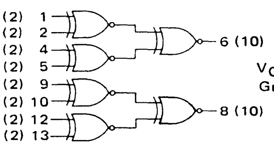


V_{CC} = Pin 14
Gnd = Pin 7

$8 = 1 \odot 2 \odot 3 \odot 9 \odot 10 \odot 11 \odot 12 \odot 13$
$6 = 4 \odot 5$
where $X \odot Y = \overline{X} \cdot \overline{Y} + X \cdot Y$

t_{pd} = 15-30 ns typ
P_D = 150 mW typ/pkg

MC4010/MC4310
Dual 4-Bit Parity Tree



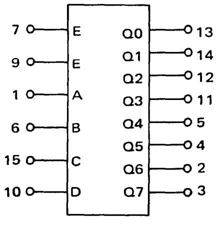
V_{CC} = Pin 14
Gnd = Pin 7

$6 = 1 \odot 2 \odot 4 \odot 5$

where $X \odot Y = \overline{X} \bullet \overline{Y} + X \bullet Y$

t_{pd} = 9.5-22 ns typ
P_D = 125 mW typ/pkg

MC4041
Single-Error Hamming Code Detector and Generator

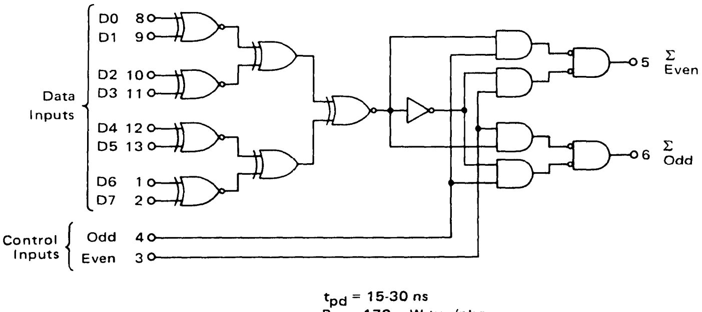


V_{CC} = Pin 16
Gnd = Pin 8

INPUT				OUTPUT							
D	C	B	A	7	6	5	4	3	2	1	0
0	0	0	0	1	1	1	1	1	1	1	0
0	0	0	1	0	0	1	1	1	0	0	1
0	0	1	0	0	0	1	0	0	1	0	1
0	0	1	1	1	1	1	0	0	0	1	0
0	1	0	0	0	0	0	1	0	0	1	1
0	1	0	1	1	1	0	1	0	1	0	0
0	1	1	0	1	1	0	0	1	0	0	0
0	1	1	1	0	0	0	0	1	1	1	1
1	0	0	0	0	0	0	0	0	0	0	1
1	0	0	1	1	1	0	0	0	1	1	0
1	0	1	0	1	1	0	1	1	0	1	0
1	0	1	1	0	0	0	1	1	1	0	1
1	1	0	0	1	1	1	0	1	1	0	0
1	1	0	1	0	0	1	0	1	0	1	1
1	1	1	0	0	0	1	1	0	1	1	1
1	1	1	1	1	1	1	1	0	0	0	0

P_D = 240 mW typ/pkg

MC54180/MC74180
8-Bit Odd/Even Generator/Checker

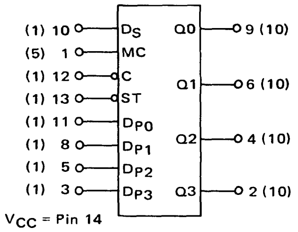


V_{CC} = Pin 14
Gnd = Pin 7

t_{pd} = 15-30 ns
P_D = 170 mW typ/pkg

SHIFT REGISTERS

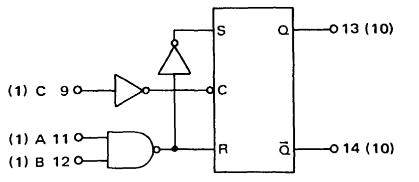
MC4012
4-Bit Shift Register



V_{CC} = Pin 14
Gnd = Pin 7

t_{pd} = 22 ns typ/bit
P_D = 180 mW typ/pkg

MC5491A/MC7491A
8-Bit Shift Register



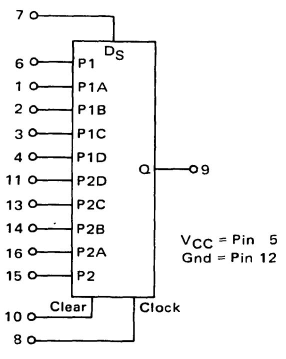
TRUTH TABLE
Synchronous Inputs

t_n		t_{n+8}	
A	B	Q	$\overline{Q}$
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

V_{CC} = Pin 5
Gnd = Pin 10

t_{pd} = 25 ns typ
P_D = 175 mW typ/pkg
f = 18 MHz typ

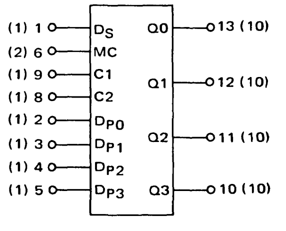
MC5494/MC7494
4-Bit Shift Register



V_{CC} = Pin 5
Gnd = Pin 12

t_{pd}, Clock to Q = 25 ns typ
P_D = 175 mW typ/pkg
f_{Tog} = 10 MHz

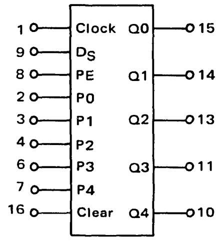
MC5495/MC7495
4-Bit Shift Register



V_{CC} = Pin 14
Gnd = Pin 7

t_{pd} = 25 ns typ
P_D = 250 mW typ/pkg
f = 31 MHz typ

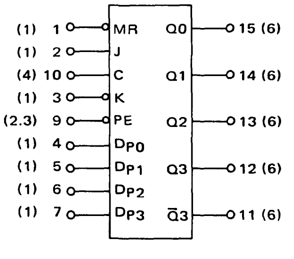
MC5496/MC7496
5-Bit Shift Register



V_{CC} = Pin 5
Gnd = Pin 12

t_{pd}, Clock to Q4 = 25 ns typ
P_D = 240 mW typ/pkg
f_{Tog} = 10 MHz

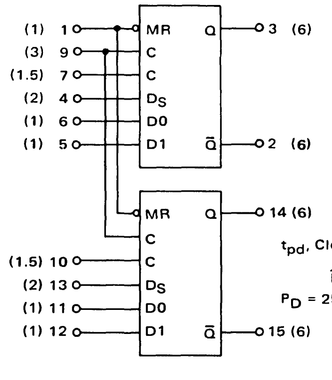
MC8300/MC9300
Universal 4-Bit Shift Register



V_{CC} = Pin 16
Gnd = Pin 8

t_{pd} = 25 ns typ
P_D = 300 mW typ/pkg

MC8328/MC9328
Dual 8-Bit Shift Register



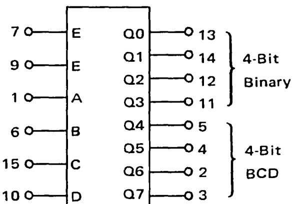
V_{CC} = Pin 16
Gnd = Pin 8

t_{pd}, Clock to Output = 22 ns typ (t_{pd-})
= 13 ns typ (t_{pd+})
$\overline{MR}$ to Output = 35 ns typ (t_{pd-} or t_{pd+})
P_D = 250 mW typ/pkg

COMPLEX LOGIC FUNCTIONS

DECODERS

MC4001
BCD-to-Binary/Binary-to-BCD Number Converter



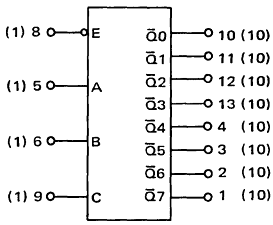
V_{CC} = Pin 16
Gnd = Pin 8

TRUTH TABLE (POSITIVE LOGIC)

INPUT				OUTPUT Binary to BCD				OUTPUT BCD to Binary			
D	C	B	A	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	0	0	0	1	0
0	0	1	1	0	0	1	1	0	0	1	1
0	1	0	0	0	1	0	0	0	1	0	0
0	1	0	1	1	0	0	0	0	1	0	1
0	1	1	0	1	0	0	1	0	1	1	0
0	1	1	1	1	0	1	0	0	1	1	1
1	0	0	0	1	0	1	1	0	1	0	1
1	0	0	1	1	1	0	0	0	1	1	0
1	0	1	0	1	0	0	0	0	1	1	1
1	0	1	1	1	0	0	1	1	0	0	0
1	1	0	0	1	1	1	0	1	0	0	1
1	1	0	1	1	1	1	1	0	0	1	0
1	1	1	0	1	0	1	1	0	0	1	0
1	1	1	1	0	1	0	0	0	0	0	0

P_D = 300 mW typ/pkg

MC4006/MC4306
Binary to 1-of-8 Line Decoder

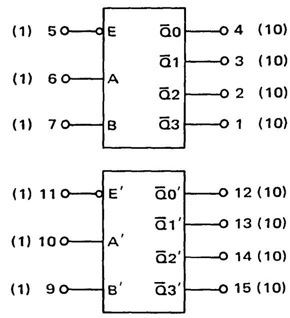


V_{CC} = Pin 14
Gnd = Pin 7

INPUT			OUTPUT							
C	B	A	7	6	5	4	3	2	1	0
0	0	0	1	1	1	1	1	1	1	0
0	0	1	1	1	1	1	1	1	0	1
0	1	0	1	1	1	1	1	0	1	1
0	1	1	1	1	1	1	0	1	1	1
1	0	0	1	1	1	0	1	1	1	1
1	0	1	1	1	0	1	1	1	1	1
1	1	0	1	0	1	1	1	1	1	1
1	1	1	0	1	1	1	1	1	1	1

t_{pd} = 14 ns typ
P_D = 100 mW typ/pkg

MC4007/MC4307
Dual Binary to 1-of-4 Line Decoder



INPUT		OUTPUT			
B	A	3	2	1	0
0	0	1	1	1	0
0	1	1	1	0	1
1	0	1	0	1	1
1	1	0	1	1	1

V_{CC} = Pin 16
Gnd = Pin 8

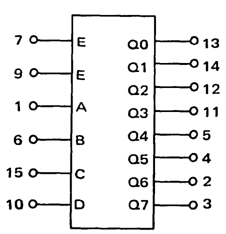
t_{pd} = 14 ns typ
P_D = 125 mW typ/pkg

5

MC4038
Inverting/Non-Inverting 1-of-8 Decoder

MC4040
Binary to 2-of-8 Decoder

MC4048
Non-Inverting 1-of-8 Decoder

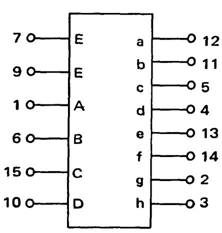


V_{CC} = Pin 16
Gnd = Pin 8

ALL TYPES INPUT				MC4038 OUTPUT								MC4040 OUTPUT								MC4048 OUTPUT							
D	C	B	A	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0
0	0	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0
0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0
0	1	0	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0
0	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0
0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0
0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1
1	0	0	1	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	0	0	0	0	0	0	1	0
1	0	1	0	0	0	1	0	0	0	0	0	1	0	1	1	1	0	1	1	0	0	0	0	0	1	0	0
1	0	1	1	0	0	0	1	0	0	0	0	1	0	1	1	0	1	1	1	0	0	0	0	1	0	0	0
1	1	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0	1	0	0	0	0
1	1	0	1	0	0	0	0	0	1	0	0	0	1	1	1	1	1	0	1	0	0	1	0	0	0	0	0
1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	1	1	0	1	0	0	0	0	0	0
1	1	1	1	0	0	0	0	0	0	0	1	0	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0

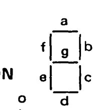
P_D = 240 mW typ/pkg – MC4038, MC4048
= 200 mW typ/pkg – MC4040

MC4039
7-Segment Character Generator



V_{CC} = Pin 16
Gnd = Pin 8

SEGMENT IDENTIFICATION



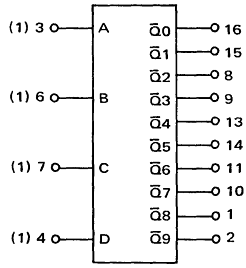
P_D = 240 mW typ/pkg

DIGIT	SEGMENTS ILLUMINATED	INPUT				OUTPUT							
		3	2	1	0	a	b	c	d	e	f	g	h
0	a,b,c,d,e,f	0	0	0	0	0	0	0	0	0	0	1	1
1	b,c	0	0	0	1	1	0	0	1	1	1	1	1
2	a,b,d,e,g	0	0	1	0	0	0	1	0	0	1	0	1
3	a,b,c,d,g	0	0	1	1	0	0	0	0	1	1	0	1
4	b,c,f,g	0	1	0	0	1	0	0	1	1	0	0	1
5	a,c,d,f,g	0	1	0	1	0	1	0	0	1	0	0	1
6	c,d,e,f,g	0	1	1	0	1	1	0	0	0	0	0	1
7	a,b,c	0	1	1	1	0	0	0	1	1	1	1	1
8	a,b,c,d,e,f,g	1	0	0	0	0	0	0	0	0	0	0	1
9	a,b,c,f,g	1	0	0	1	0	0	0	1	1	0	0	1
NONE		1	0	1	0	1	1	1	1	1	1	1	1
●	h (Ext.)	1	0	1	1	1	1	1	1	1	1	1	0
–	g	1	1	0	0	1	1	1	1	1	1	0	1
NONE		1	1	0	1	1	1	1	1	1	1	1	1
NONE		1	1	1	0	1	1	1	1	1	1	1	1
NONE		1	1	1	1	1	1	1	1	1	1	1	1

(continued)

DECODERS (continued)

MC5441A/MC7441A
BCD-to-Decimal Decoder and High-Level Driver



V_{CC} = Pin 5
Gnd = Pin 12

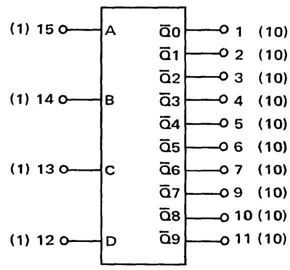
INPUT				OUTPUT									
D	C	B	A	9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	1	1	1	1	1	1	1	0
0	0	0	1	1	1	1	1	1	1	1	1	0	1
0	0	1	0	1	1	1	1	1	1	1	0	1	1
0	0	1	1	1	1	1	1	1	1	0	1	1	1
0	1	0	0	1	1	1	1	1	0	1	1	1	1
0	1	0	1	1	1	1	1	0	1	1	1	1	1
0	1	1	0	1	1	1	0	1	1	1	1	1	1
0	1	1	1	1	1	0	1	1	1	1	1	1	1
1	0	0	0	1	0	1	1	1	1	1	1	1	1
1	0	0	1	0	1	1	1	1	1	1	1	1	1

P_D = 105 mW typ/pkg

MC5442/MC7442
BCD-to-Decimal Decoder

MC5443/MC7443
Excess Three-to-Decimal Decoder

MC5444/MC7444
Excess Three Gray-to-Decimal Decoder

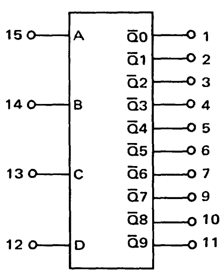


V_{CC} = Pin 16
Gnd = Pin 8

t_{pd}, 2 Logic Levels = 22 ns typ
3 Logic Levels = 23 ns typ
P_D = 140 mW typ/pkg

MC5442/MC7442 BCD INPUT				MC5443/MC7443 EXCESS 3 INPUT				MC5444/MC7444 EXCESS 3 GRAY INPUT				ALL TYPES DECIMAL OUTPUT									
D	C	B	A	D	C	B	A	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	0
0	0	0	1	0	1	0	0	0	1	1	0	1	1	1	1	1	1	1	1	0	1
0	0	1	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1
0	0	1	1	0	1	1	0	0	1	0	1	1	1	1	1	1	1	0	1	1	1
0	1	0	0	0	1	1	1	0	1	0	0	1	1	1	1	1	0	1	1	1	1
0	1	0	1	1	0	0	0	1	1	0	0	1	1	1	1	0	1	1	1	1	1
0	1	1	0	1	0	0	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1
0	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1
1	0	0	0	1	0	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1
1	0	0	1	1	1	0	0	1	0	1	0	0	1	1	1	1	1	1	1	1	1
1	0	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1
1	1	0	0	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1
1	1	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
1	1	1	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1

MC5445/MC7445
MC54145/MC74145
BCD to 1-of-10 Decoder/Driver

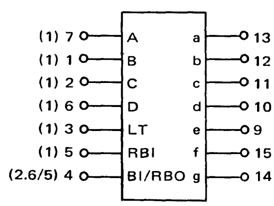


V_{CC} = Pin 16
Gnd = Pin 8

INPUT				OUTPUT									
D	C	B	A	9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	1	1	1	1	1	1	1	0
0	0	0	1	1	1	1	1	1	1	1	1	0	1
0	0	1	0	1	1	1	1	1	1	1	0	1	1
0	0	1	1	1	1	1	1	1	1	0	1	1	1
0	1	0	0	1	1	1	1	1	0	1	1	1	1
0	1	0	1	1	1	1	1	0	1	1	1	1	1
0	1	1	0	1	1	1	0	1	1	1	1	1	1
0	1	1	1	1	1	0	1	1	1	1	1	1	1
1	0	0	0	1	0	1	1	1	1	1	1	1	1
1	0	0	1	0	1	1	1	1	1	1	1	1	1
1	0	1	0	1	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1	1	1	1	1	1
1	1	0	0	1	1	1	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1	1	1	1	1	1
1	1	1	0	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1

t_{pd} = 50 ns max
P_D = 215 mW typ/pkg

MC5446/MC7446
MC5447/MC7447
MC5448/MC7448
BCD-to-Seven Segment Decoder/Drivers



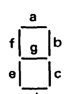
V_{CC} = Pin 16
Gnd = Pin 8

P_D = 265 mW typ/pkg

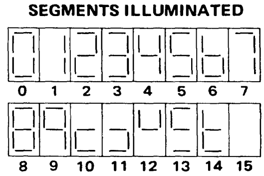
DIGIT OR FUNCTION	ALL TYPES							MC5446/MC7446 MC5447/MC7447 OUTPUT							MC5448/MC7448 OUTPUT						
	LT	RBI	D	C	B	A	BI/RBO	a	b	c	d	e	f	g	a	b	c	d	e	f	g
0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	0
1	1	X	0	0	0	1	1	1	0	0	1	1	1	1	0	1	1	0	0	0	0
2	1	X	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1	1	0	1
3	1	X	0	0	1	1	1	0	0	0	0	1	1	0	1	1	1	1	0	0	1
4	1	X	0	1	0	0	1	1	0	0	1	1	0	0	0	1	1	0	0	1	1
5	1	X	0	1	0	1	1	0	1	0	0	1	0	0	1	0	1	1	0	1	1
6	1	X	0	1	1	0	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1
7	1	X	0	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0	0
8	1	X	1	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1
9	1	X	1	0	0	1	1	0	0	0	1	1	0	0	1	1	1	0	0	1	1
10	1	X	1	0	1	0	1	1	1	1	0	0	1	0	0	0	0	1	1	0	1
11	1	X	1	0	1	1	1	1	1	0	0	1	1	0	0	0	1	1	0	0	1
12	1	X	1	1	0	0	1	1	0	1	1	1	0	0	0	1	0	0	0	1	1
13	1	X	1	1	0	1	1	0	1	1	0	1	0	0	1	0	0	1	0	1	1
14	1	X	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1
15	1	X	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
BI	X	X	X	X	X	X	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0
RBI	1	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0
LT	0	X	X	X	X	X	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1

X = Don't care

SEGMENT IDENTIFICATION



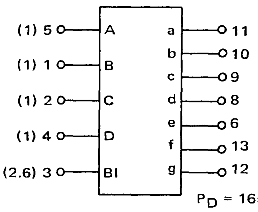
SEGMENTS ILLUMINATED



(continued)

DECODERS (continued)

MC5449/MC7449
BCD-to-Seven Segment Decoder/Driver



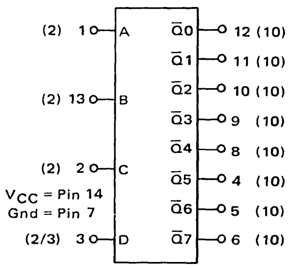
V_{CC} = Pin 16
Gnd = Pin 8

P_D = 165 mW typ/pkg

DIGIT OR FUNCTION	INPUT D	C	B	A	BI	OUTPUT a	b	c	d	e	f	g
0	0	0	0	0	1	1	1	1	1	1	1	0
1	0	0	0	1	1	0	1	1	0	0	0	0
2	0	0	1	0	1	1	1	0	1	1	0	1
3	0	0	1	1	1	1	1	1	1	0	0	1
4	0	1	0	0	1	0	1	1	0	0	1	1
5	0	1	0	1	1	1	0	1	1	0	1	1
6	0	1	1	0	1	0	0	1	1	1	1	1
7	0	1	1	1	1	1	1	1	0	0	0	0
8	1	0	0	0	1	1	1	1	1	1	1	1
9	1	0	0	1	1	1	1	1	0	0	1	1
10	1	0	1	0	1	0	0	0	1	1	0	1
11	1	0	1	1	1	0	0	1	1	0	0	1
12	1	1	0	0	1	0	1	0	0	0	1	1
13	1	1	0	1	1	1	0	0	1	0	1	1
14	1	1	1	0	1	0	0	0	1	1	1	1
15	1	1	1	1	1	0	0	0	0	0	0	0
BI	X	X	X	X	0	0	0	0	0	0	0	0

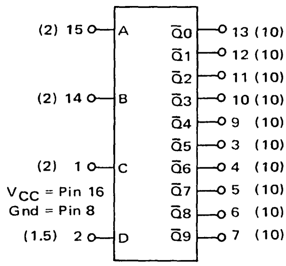
X = Don't care

MC7250/MC8250
Binary to One-of-Eight Decoder



V_{CC} = Pin 14
Gnd = Pin 7

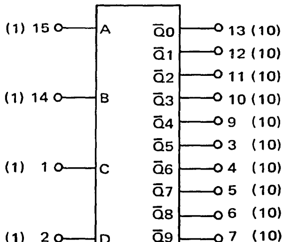
MC7251/MC8251
Binary to One-of-Ten Decoder



V_{CC} = Pin 16
Gnd = Pin 8

BOTH TYPES INPUT $\overline{E}$/D	C	B	A	MC8250/MC7250 OUTPUT 7	6	5	4	3	2	1	0	MC8251/MC7251 OUTPUT 9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
0	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1
0	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1
0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1
0	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1
0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
1	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1

MC8301/MC9301
BCD-to-Decimal Decoder

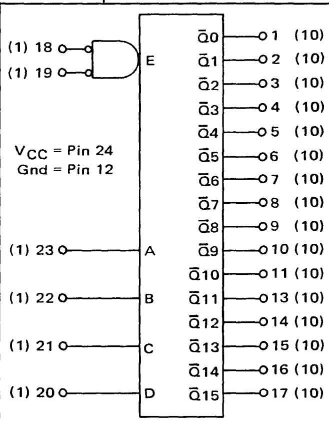


V_{CC} = Pin 16
Gnd = Pin 8

INPUT D	C	B	A	OUTPUT 9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	1	1	1	1	1	1	1	0
0	0	0	1	1	1	1	1	1	1	1	1	0	1
0	0	1	0	1	1	1	1	1	1	1	0	1	1
0	0	1	1	1	1	1	1	1	1	0	1	1	1
0	1	0	0	1	1	1	1	1	0	1	1	1	1
0	1	0	1	1	1	1	1	0	1	1	1	1	1
0	1	1	0	1	1	1	0	1	1	1	1	1	1
0	1	1	1	1	1	0	1	1	1	1	1	1	1
1	0	0	0	1	0	1	1	1	1	1	1	1	1
1	0	0	1	0	1	1	1	1	1	1	1	1	1
1	0	1	0	1	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1	1	1	1	1	1
1	1	0	0	1	1	1	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1	1	1	1	1	1
1	1	1	0	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1

t_{pd} = 22 ns typ
P_D = 125 mW typ/pkg

MC8311
1-of-16 Decoder



V_{CC} = Pin 24
Gnd = Pin 12

INPUT $\overline{E0}$	$\overline{E1}$	D	C	B	A	OUTPUT 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	X	X	X	X	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	0	X	X	X	X	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0	1	X	X	X	X	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
0	0	1	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
0	0	1	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
0	0	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
0	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
0	0	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
0	0	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

X = Don't care

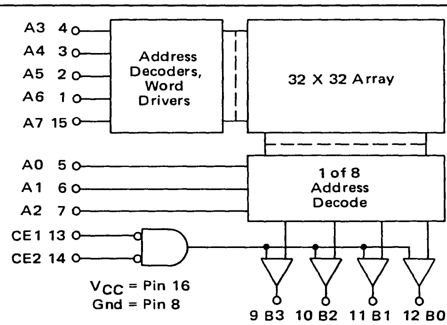
t_{pd} ($\overline{E}$ to Q) = 26 ns typ
P_D = 175 mW typ/pkg

MC54145/MC74145
BCD to 1-of-10 Decoder/Driver

See MC5445/MC7445

MCM4067, MCM4068
Binary-to-BCD Number Converter

MCM4069, MCM4070
Hollerith-to-ASCII Converter



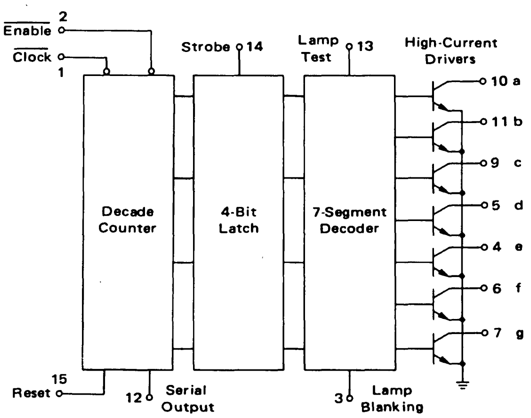
V_{CC} = Pin 16
Gnd = Pin 8

5

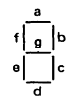
5

COUNTER-LATCH-DECODER

MC4050/MC4350
Monolithic Counter-Latch-Decoder



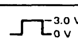
V_{CC} = Pin 16
Gnd = Pin 8



SEGMENT IDENTIFICATION

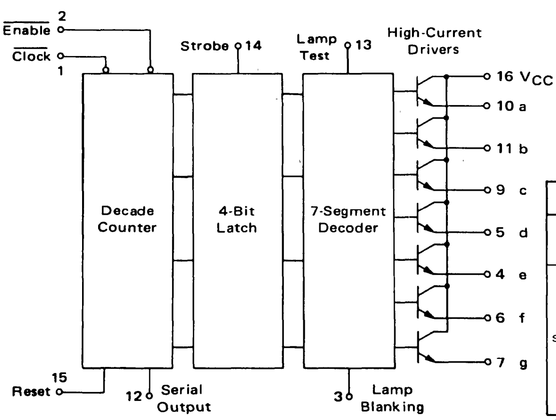
FUNCTION		INPUT						OUTPUT							
		$\bar{C}$	$\bar{E}$	R	S	LT	LB	S_{out}	a	b	c	d	e	f	g
Lamp Test		X	X	X	X	1	X	–	0	0	0	0	0	0	0
Lamp Blanking		X	X	X	X	0	1	–	1	1	1	1	1	1	1
Reset		X	X	1	1	0	0	0	1	1	1	1	1	1	1
$\overline{\text{Enable}}$		P	1	0	1	0	0	0	1	1	1	1	1	1	1
State Sequence	1	P1	0	0	1	0	0	0	1	0	0	1	1	1	1
	2	P2	0	0	1	0	0	0	0	0	1	0	0	1	0
	3	P3	0	0	1	0	0	0	0	0	0	0	1	1	0
	4	P4	0	0	1	0	0	0	1	0	0	1	1	0	0
	5	P5	0	0	1	0	0	0	0	1	0	0	1	0	0
	6	P6	0	0	1	0	0	0	0	1	0	0	0	0	0
	7	P7	0	0	1	0	0	0	0	0	0	1	1	1	1
	8	P8	0	0	1	0	0	0	0	0	0	0	0	0	0
	9	P9	0	0	1	0	0	1	0	0	0	0	1	0	0
	0	P10	0	0	1	0	0	0	0	0	0	0	0	0	1
	1	P11	0	0	1	0	0	0	1	0	0	1	1	1	1
Latch		P	0	0	0	0	0	0	1	0	0	1	1	1	1

P = any number of pulses may be applied
P_n = n pulses on the Clock input
X = Don't care

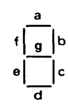


f_{Tog} = 35 MHz typ
P_D = 450 mW typ/pkg

MC4051
Monolithic Counter-Latch-Decoder



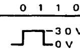
V_{CC} = Pin 16
Gnd = Pin 8



SEGMENT IDENTIFICATION

FUNCTION		INPUT						OUTPUT							
		$\bar{C}$	$\bar{E}$	R	S	LT	LB	S_{out}	a	b	c	d	e	f	g
Lamp Test		X	X	X	X	1	X	-	1	1	1	1	1	1	1
Lamp Blanking		X	X	X	X	0	1	–	0	0	0	0	0	0	0
Reset		X	X	1	1	0	0	0	0	0	0	0	0	0	0
$\overline{\text{Enable}}$		P	1	0	1	0	0	0	0	0	0	0	0	0	0
State Sequence	1	P1	0	0	1	0	0	0	0	1	1	0	0	0	0
	2	P2	0	0	1	0	0	0	1	1	0	1	1	0	1
	3	P3	0	0	1	0	0	0	1	1	1	1	0	0	1
	4	P4	0	0	1	0	0	0	0	1	1	0	0	1	1
	5	P5	0	0	1	0	0	0	1	0	1	1	0	1	1
	6	P6	0	0	1	0	0	0	1	0	1	1	1	1	1
	7	P7	0	0	1	0	0	0	1	1	1	0	0	0	0
	8	P8	0	0	1	0	0	1	1	1	1	1	1	1	1
	9	P9	0	0	1	0	0	0	1	1	1	1	0	1	1
	0	P10	0	0	1	0	0	0	1	1	1	1	1	1	0
	1	P11	0	0	1	0	0	0	0	1	1	0	0	0	0
Latch		P	0	0	0	0	0	0	0	1	1	0	0	0	0

P = any number of pulses may be applied
P_n = n pulses on the Clock input
X = Don't care

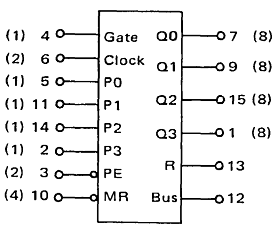


f_{Tog} = 35 MHz typ
P_D = 450 mW typ/pkg

COUNTERS

MC4016/MC4316
Programmable Modulo-N Decade Counter

MC4018/MC4318
Programmable Modulo-N Hexadecimal Counter



V_{CC} = Pin 16
Gnd = Pin 8

t_{pd}, Clock to Q3 = 50 ns typ
Clock to Bus = 35 ns typ
P_D = 250 mW typ/pkg

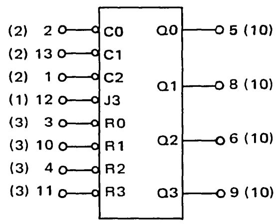
MC4016/MC4316

COUNT	OUTPUT			
	Q3	Q2	Q1	Q0
9	1	0	0	1
8	1	0	0	0
7	0	1	1	1
6	0	1	1	0
5	0	1	0	1
4	0	1	0	0
3	0	0	1	1
2	0	0	1	0
1	0	0	0	1
0	0	0	0	0

MC4018/MC4318

COUNT	OUTPUT			
	Q3	Q2	Q1	Q0
15	1	1	1	1
14	1	1	1	0
13	1	1	0	1
12	1	1	0	0
11	1	0	1	1
10	1	0	1	0
9	1	0	0	1
8	1	0	0	0
7	0	1	1	1
6	0	1	1	0
5	0	1	0	1
4	0	1	0	0
3	0	0	1	1
2	0	0	1	0
1	0	0	0	1
0	0	0	0	0

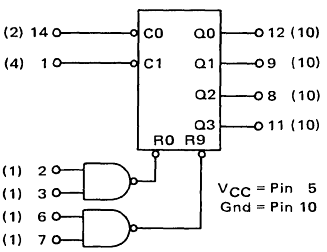
MC4023
4-Bit Universal Counter



V_{CC} = Pin 14
Gnd = Pin 7

t_{pd} = 16 ns typ/bit
P_D = 200 mW typ/pkg
f = 30 MHz typ

MC5490/MC7490
Decade Counter



V_{CC} = Pin 5
Gnd = Pin 10

RESET/COUNT TRUTH TABLE

R0		R9		OUTPUT			
Pin 2	Pin 3	Pin 6	Pin 7	Q3	Q2	Q1	Q0
1	1	0	X	0	0	0	0
1	1	X	0	0	0	0	0
X	X	1	1	1	0	0	1
X	0	X	0	COUNT			
0	X	0	X	COUNT			
0	X	X	0	COUNT			
X	0	0	X	COUNT			

X = Don't care.

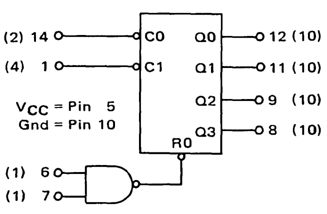
COUNT SEQUENCE TRUTH TABLE

COUNT	OUTPUT			
	Q3	Q2	Q1	Q0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

Q0 connected to $\overline{C}1$

t_{pd} = 20 ns typ/bit
P_D = 160 mW typ/pkg

MC5492/MC7492
Divide-by-Twelve Counter



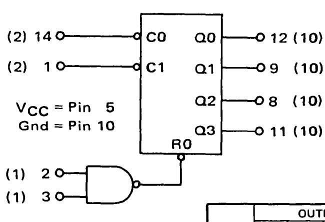
V_{CC} = Pin 5
Gnd = Pin 10

t_{pd} = 60 ns typ
P_D = 160 mW typ/pkg

COUNT	OUTPUT			
	Q3	Q2	Q1	Q0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	1	0	0	0
7	1	0	0	1
8	1	0	1	0
9	1	0	1	1
10	1	1	0	0
11	1	1	0	1

Q0 connected to $\overline{C}1$

MC5493/MC7493
4-Bit Binary Counter



V_{CC} = Pin 5
Gnd = Pin 10

t_{pd} = 20 ns typ/bit
P_D = 160 mW typ/pkg

COUNT	OUTPUT			
	Q3	Q2	Q1	Q0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

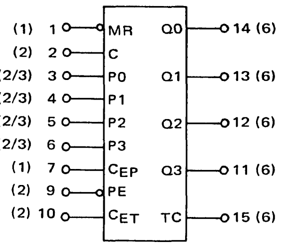
Q0 connected to $\overline{C}1$

(continued)

COUNTERS (continued)

MC8310/MC9310
Presettable Decade Counter

MC8316/MC9316
4-Bit Binary Counter



V_{CC} = Pin 16
Gnd = Pin 8

t_{pd} = 14 to 35 ns typ
f_{Tog} = 28 MHz typ
P_D = 300 mW typ/pkg

MC8310/MC9310

COUNT	OUTPUT			
	Q3	Q2	Q1	Q0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

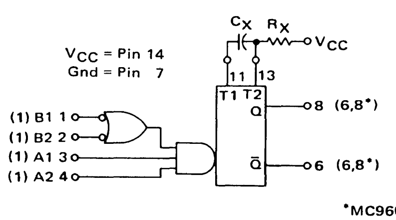
MC8316/MC9316

COUNT	OUTPUT			
	Q3	Q2	Q1	Q0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

MONOSTABLE MULTIVIBRATORS

MC8601/MC9601
Retriggerable Monostable Multivibrator

V_{CC} = Pin 14
Gnd = Pin 7

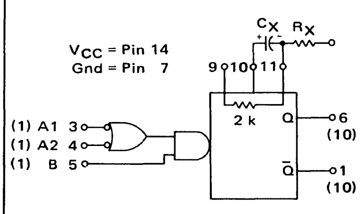


*MC9601, MC8601

t_{pd} = 25 ns typ
P_D = 75 mW typ/pkg

MC54121/MC74121
Monostable Multivibrator

V_{CC} = Pin 14
Gnd = Pin 7

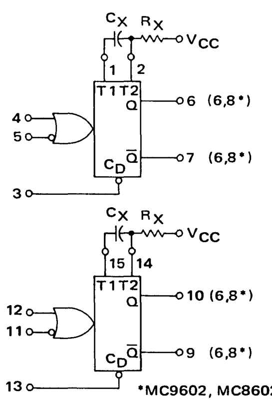


t_{pd}, B to Q = 35 ns typ
P_D = 90 mW typ/pkg (50% duty cycle)

t_n INPUT			t_{n+1} INPUT			OUTPUT
A1	A2	B	A1	A2	B	
1	1	0	1	1	1	Inhibit
0	X	1	0	X	0	Inhibit
X	0	1	X	0	0	Inhibit
0	X	0	0	X	1	Triggering
X	0	0	X	0	1	Triggering
1	1	1	X	0	1	Triggering
1	1	1	0	X	1	Triggering
X	0	0	X	1	0	Inhibit
0	X	0	1	X	0	Inhibit
X	0	1	1	1	1	Inhibit
0	X	1	1	1	1	Inhibit
1	1	0	X	0	0	Inhibit
1	1	0	0	X	0	Inhibit

X = Don't care
t_n = Time period prior to input transition
t_{n+1} = Time period following input transition

MC8602/MC9602
Dual Retriggerable Resettable Monostable Multivibrator



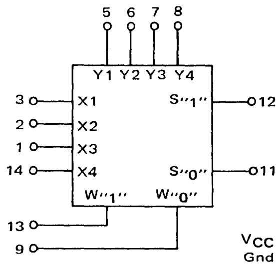
*MC9602, MC8602

V_{CC} = Pin 16
Gnd = Pin 8

t_{pd} = 25 ns typ
P_D = 160 mW typ/pkg

MEMORIES AND MAGNETIC MEMORY DRIVERS

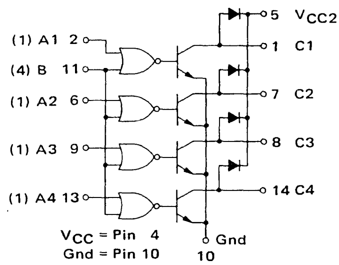
MC4004, MC4005, MC4304, MC4305
16-Bit Scratch Pad Memory Cell



V_{CC} = Pin 4
Gnd = Pin 10

t_{pd}: Write Mode = 25 ns typ
Read Mode = 15 ns typ
P_D = 250 mW typ/pkg

MC4042
Quad Predriver



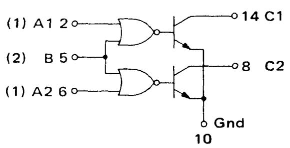
V_{CC} = Pin 4
Gnd = Pin 10
Substrate = Pin 3

TRUTH TABLE
(One gate only)

A1	B	C1
0	0	0
0	1	1
1	0	1
1	1	1

t_{pd} = 15 ns typ
P_D = 120 mW typ/pkg

MC4043
Dual Line Selector



V_{CC} = Pin 4
Gnd = Pin 10
Substrate = Pin 3

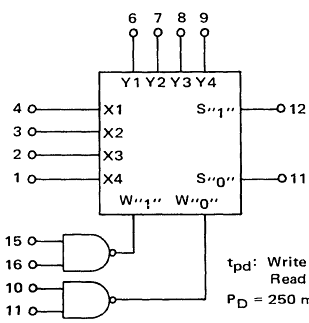
TRUTH TABLE
(One gate only)

A1	B	C1
0	0	0
0	1	1
1	0	1
1	1	1

Collectors of Output Transistors:
Gate 1 = Pin 1
Gate 2 = Pin 7

t_{pd} = 20 ns typ
P_D = 70 mW typ/pkg

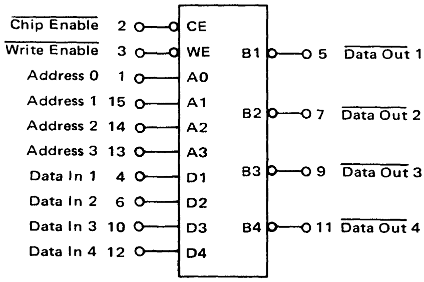
MC5484/MC7484
16-Bit Scratch Pad Memory Cell With Gated Inputs



V_{CC} = Pin 5
Gnd = Pin 12

t_{pd}: Write Mode = 25 ns typ
Read Mode = 15 ns typ
P_D = 250 mW typ/pkg

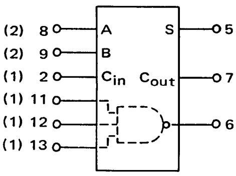
MCM4064
64-Bit Random Access Memory



V_{CC} = Pin 16
Gnd = Pin 8

ADDERS

MC4026/MC4326
MC4027/MC4327
Full Adder



V_{CC} = Pin 4
Gnd = Pin 10

Output Loading Factor:
MC4326 = 15 MTTL I Loads
MC4327 = 7 MTTL I Loads
MC4026 = 12 MTTL I Loads
MC4027 = 6 MTTL I Loads

INPUT			OUTPUT	
A	B	C_{in}	S	C_{out}
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

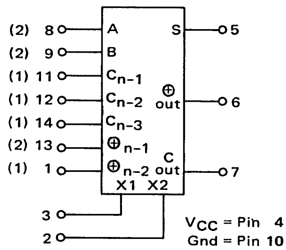
t_{pd} = (Add Delay) = 25 ns typ
t_{pd} (Carry Delay) = 13 ns typ
P_D = 90 mW typ/pkg

MC4028/MC4328
MC4029/MC4329
Dependent-Carry Fast Adder

MC4030/MC4330
MC4031/MC4331
Independent-Carry Fast Adder

t_{pd} = (Add Delay) = 25 ns typ
t_{pd} (Carry Delay) = 13 ns typ
P_D = 125 mW typ/pkg

Output Loading Factor:
MC4328, MC4330 = 15 MTTL I Loads
MC4329, MC4331 = 7 MTTL I Loads
MC4028, MC4030 = 12 MTTL I Loads
MC4029, MC4031 = 6 MTTL I Loads



V_{CC} = Pin 4
Gnd = Pin 10

CONDENSED TRUTH TABLE FOR THE Nth STAGE

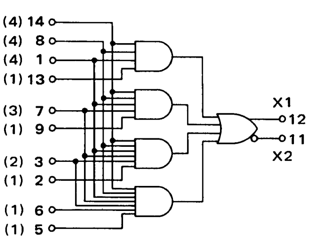
Pin Numbers 8	9	11	12,13	13, 14, 1	5	6	7		
A	B	C_{n-1}	Note 1	Note 2	S	$\oplus_{out}$	MC4330/4030 MC4331/4031 C_{out}	MC4328/4028 MC4329/4029 C_{out}	Comment Note 3
0	0	0	0	0	0	0	0	0	–
0	0	0	0	1	1	0	0	0	–
0	0	0	1	0	1	0	0	0	–
0	0	0	1	1	1	0	0	0	ϕ
0	0	1	0	0	1	0	0	0	–
0	0	1	0	1	1	0	0	0	ϕ
0	0	1	1	0	1	0	0	0	ϕ
0	0	1	1	1	1	0	0	0	ϕ
0	1	0	0	0	1	1	0	0	–
0	1	0	0	1	0	1	0	1	–
0	1	0	1	0	0	1	0	1	–
0	1	0	1	1	0	1	0	1	ϕ
0	1	1	0	0	0	1	0	1	–
0	1	1	0	1	0	1	0	1	ϕ
0	1	1	1	0	0	1	0	1	ϕ
0	1	1	1	1	0	1	0	1	ϕ
1	0	0	0	0	1	1	0	0	–
1	0	0	0	1	0	1	0	1	–
1	0	0	1	0	0	1	0	1	–
1	0	0	1	1	0	1	0	1	ϕ
1	0	1	0	0	0	1	0	1	–
1	0	1	0	1	0	1	0	1	ϕ
1	0	1	1	0	0	1	0	1	ϕ
1	0	1	1	1	0	1	0	1	ϕ
1	1	0	0	0	0	0	1	1	–
1	1	0	0	1	1	0	1	1	–
1	1	0	1	0	1	0	1	1	–
1	1	0	1	1	1	0	1	1	ϕ
1	1	1	0	0	1	0	1	1	–
1	1	1	0	1	1	0	1	1	ϕ
1	1	1	1	0	1	0	1	1	ϕ
1	1	1	1	1	1	0	1	1	ϕ

Note 1 This column represents the AND function whose inputs are pins 13 and 12, and is defined by the expression $(A_{n-1} \oplus B_{n-1})(C_{n-2})$.

Note 2 This column represents the AND function whose inputs are pins 13, 14, and 1, and is defined by the expression $(A_{n-1} \oplus B_{n-1})(A_{n-2} \oplus B_{n-2})(C_{n-3})$.

Note 3. ϕ = Don't Care. The "Don't Care" occurs for the MC4330-31/4030-31 only, because the C_n and the $\oplus_n$ from any one previous stage entering a given subsequent stage cannot be simultaneously at logic "1".

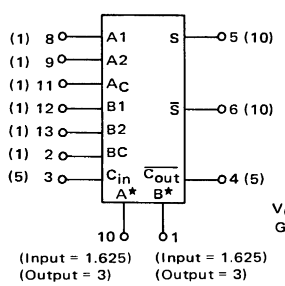
MC4032/MC4332
Carry Decoder



V_{CC} = Pin 4
Gnd = Pin 10

Δt_{pd} = 4.0 ns typ/decoder
1.0 ns typ/pF at expander nodes
P_D = 20 mW typ/pkg

MC5480/MC7480
Gated Full Adder



V_{CC} = Pin 7
Gnd = Pin 14

t_{pd} (Add Delay) = 55 ns typ
t_{pd} (Carry Delay = 10 ns typ
P_D = 105 mW typ/pkg

C_{in}	B	A	$\overline{C_{out}}$	$\bar{S}$	S
0	0	0	1	1	0
0	0	1	1	0	1
0	1	0	1	0	1
0	1	1	0	1	0
1	0	0	1	0	1
1	0	1	0	1	0
1	1	0	0	1	0
1	1	1	0	0	1

1. $A = \overline{A^{\star} \cdot A_C}$, $B = \overline{B^{\star} \cdot B_C}$

where $A^{\star} = \overline{A_1 \cdot A_2}$

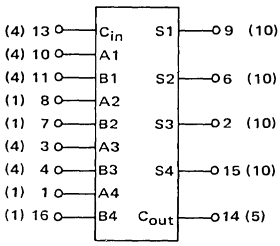
$B^{\star} = \overline{B_1 \cdot B_2}$

2. When A★ (or B★) is used as an input, A1 and A2 (or B1 and B2) must be connected to ground.
3. When A1 and A2 (or B1 and B2) are used as inputs, A★ (or B★) must be open, or used to perform wired-OR logic.

(continued)

ADDERS (continued)

MC5483/MC7483
4-Bit Binary Adder



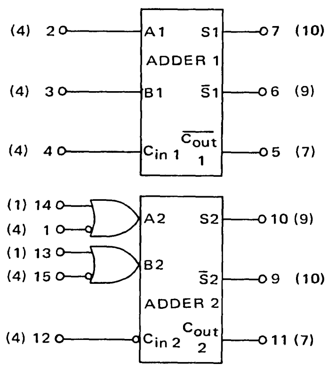
V_{CC} = Pin 5
Gnd = Pin 12

INPUT				OUTPUT					
				When C_{in} = 0 / When C2 = 0			When C_{in} = 1 / When C2 = 1		
A1 / A3	B1 / B3	A2 / A4	B2 / B4	S1 / S3	S2 / S4	C2 / C_o	S1 / S3	S2 / S4	C2 / C_o
0	0	0	0	0	0	0	1	0	0
1	0	0	0	1	0	0	0	1	0
0	1	0	0	1	0	0	0	1	0
1	1	0	0	0	1	0	1	1	0
0	0	1	0	0	1	0	1	1	0
1	0	1	0	1	1	0	0	0	1
0	1	1	0	1	1	0	0	0	1
1	1	1	0	0	0	1	1	0	1
0	0	0	1	0	1	0	1	1	0
1	0	0	1	1	1	0	0	0	1
0	1	0	1	1	1	0	0	0	1
1	1	0	1	0	0	1	1	0	1
0	0	1	1	0	0	1	1	0	1
1	0	1	1	1	0	1	0	1	1
0	1	1	1	1	0	1	0	1	1
1	1	1	1	0	1	1	1	1	1

Input conditions at A1, A2, B1, B2, and C_{in} are used to determine outputs S1 and S2, and the value of the internal carry, C2. The values at C2, A3, B3, A4, and B4 are then used to determine outputs S3, S4, and C_{out}

t_{pd} = 35 ns typ
P_D = 390 mW typ/pkg

MC8304/MC9304
Dual Full Adder



V_{CC} = Pin 16
Gnd = Pin 8

ADDER 1

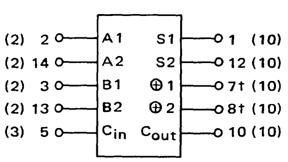
INPUT			OUTPUT		
$C_{in\,1}$	B1	A1	$\overline{C_o}$ 1	$\bar{S}1$	S1
0	0	0	1	1	0
0	0	1	1	0	1
0	1	0	1	0	1
0	1	1	0	1	0
1	0	0	1	0	1
1	0	1	0	1	0
1	1	0	0	1	0
1	1	1	0	0	1

t_{pd} = 8.0 to 28 ns typ
P_D = 110 mW typ/pkg

ADDER 2

INPUT					OUTPUT		
$\overline{C_{in}}$ 2	B2	A2	$\bar{B}2$	$\bar{A}2$	C_o 2	S2	$\bar{S}2$
0	0	0	0	0	1	1	0
0	0	0	0	1	1	0	1
0	0	0	1	0	1	0	1
0	0	0	1	1	0	1	0
0	0	1	0	0	1	1	0
0	0	1	0	1	1	1	0
0	0	1	1	0	1	0	1
0	0	1	1	1	1	0	1
0	1	0	0	0	1	1	0
0	1	0	0	1	1	0	1
0	1	0	1	0	1	1	0
0	1	0	1	1	1	0	1
0	1	1	0	0	1	1	0
0	1	1	0	1	1	1	0
0	1	1	1	0	1	1	0
0	1	1	1	1	1	1	0
1	0	0	0	0	1	0	1
1	0	0	0	1	0	1	0
1	0	0	1	0	0	1	0
1	0	0	1	1	0	0	1
1	0	1	0	0	1	0	1
1	0	1	0	1	1	0	1
1	0	1	1	0	0	1	0
1	0	1	1	1	0	1	0
1	1	0	0	0	1	0	1
1	1	0	0	1	0	1	0
1	1	0	1	0	1	0	1
1	1	0	1	1	0	1	0
1	1	1	0	0	1	0	1
1	1	1	0	1	1	0	1
1	1	1	1	0	1	0	1
1	1	1	1	1	1	0	1

MC15482/MC17482
MC25482/MC27482
2-Bit Full Adder



V_{CC} = Pin 4
Gnd = Pin 11

t_{pd} (Add Delay) = 15 ns
t_{pd} (Carry Delay) = 12 ns
P_D = 165 mW typ/pkg

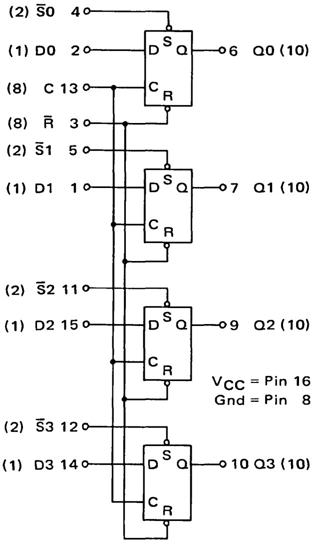
INPUT				OUTPUT							
				C_{in} = 0			C_{in} = 1				
A1	B1	A2	B2	S1	S2	C_o	S1	S2	C_o	⊕1†	⊕2†
0	0	0	0	0	0	0	1	0	0	0	0
1	0	0	0	1	0	0	0	1	0	1	0
0	1	0	0	1	0	0	0	1	0	1	0
1	1	0	0	0	1	0	1	1	0	0	0
0	0	1	0	0	1	0	1	1	0	0	1
1	0	1	0	1	1	0	0	0	1	1	1
0	1	1	0	1	1	0	0	0	1	1	1
1	1	1	0	0	0	1	1	0	1	0	1
0	0	0	1	0	1	0	1	1	0	0	1
1	0	0	1	1	1	0	0	0	1	1	1
0	1	0	1	1	1	0	0	0	1	1	1
1	1	0	1	0	0	1	1	0	1	0	1
0	0	1	1	0	0	1	1	0	1	0	0
1	0	1	1	1	0	1	0	1	1	1	0
0	1	1	1	1	0	1	0	1	1	1	0
1	1	1	1	0	1	1	1	1	1	0	0

†Available only on MC25482/27482

5

FLIP-FLOPS AND LATCHES

MC4015
Quad Type D Flip-Flop



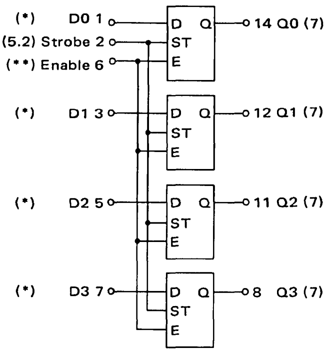
V_{CC} = Pin 16
Gnd = Pin 8

D	Q_{n-1}	Q_n
0	0	0
0	1	0
1	0	1
1	1	1

Q_{n-1} = time period prior to clock pulse
Q_n = time period following clock pulse

t_{pd} = 16 ns typ
P_D = 190 mW typ/pkg

MC4035/MC4335
Quad Latch
(Open Collector)

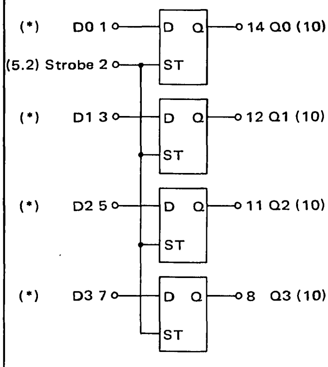


V_{CC} = Pin 4
Gnd = Pin 10

Two 5.0 kilohm pullup resistors are internally connected to V_{CC} and brought out on pins 9 and 13.

t_{pd} = 25 ns typ
P_D = 140 mW typ/pkg

MC4037/MC4337
Quad Latch

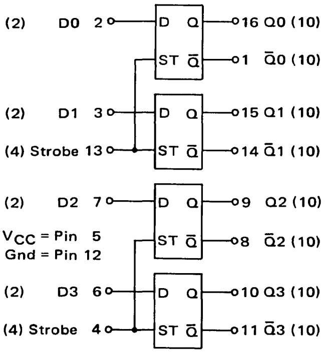


V_{CC} = Pin 4
Gnd = Pin 10

t_{pd} = 25 ns typ
P_D = 150 mW typ/pkg

All loading factors are for MTTL I loads.
*MC4035, MC4037 = 4.0; MC4335, MC4337 = 4.2 (Strobe High)
MC4035, MC4037 = 0.9; MC4335, MC4337 = 1.1 (Strobe Low)
**MC4035 = 3.6, MC4335 = 4.0

MC7475
Quad Latch

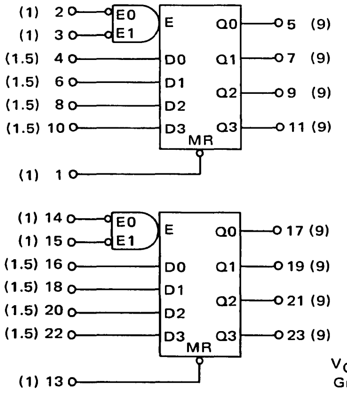


V_{CC} = Pin 5
Gnd = Pin 12

t_n	t_{n+1}	
D	Q	Q̄
1	1	0
0	0	1

t_{pd} = 30 ns typ
P_D = 160 mW typ/pkg

MC8308
Dual 4-Bit Latch



INPUTS							OUTPUTS			
$\overline{MR}$	Ē0	Ē1	D3	D2	D1	D0	Q3	Q2	Q1	Q0
1	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	1	0	0	0	1
1	0	0	0	0	1	0	0	0	1	0
1	0	0	0	1	0	0	0	1	0	0
1	0	0	1	0	0	0	1	0	0	0
1	0	0	0	0	1	1	0	0	1	1
1	0	0	0	1	0	1	0	1	0	1
1	0	0	1	0	0	1	1	0	0	1
1	0	0	0	1	1	0	0	1	1	0
1	0	0	1	0	1	0	1	0	1	0
1	0	0	1	1	0	0	1	1	0	0
1	0	0	0	1	1	1	0	1	1	1
1	0	0	1	0	1	1	1	0	1	1
1	0	0	1	1	0	1	1	1	0	1
1	0	0	1	1	1	0	1	1	1	0
1	0	0	1	1	1	1	1	1	1	1
1	0	1	X	X	X	X	LATCHED			
1	1	0	X	X	X	X	LATCHED			
1	1	1	X	X	X	X	LATCHED			
0	X	X	X	X	X	X	0	0	0	0

X = Don't Care

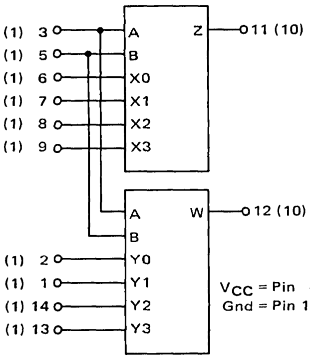
V_{CC} = Pin 24
Gnd = Pin 12

t_{pd} (E to Q) = 25 ns typ
P_D = 325 mW typ/pkg

5

DATA ROUTING FUNCTIONS

MC4000/MC4300
Dual 4-Channel Data Selector

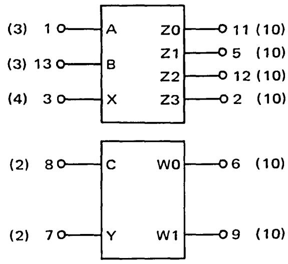


V_{CC} = Pin 4
Gnd = Pin 10

$Z = ABX0 + A\overline{B}X1 + \overline{A}BX2 + \overline{A}\,\overline{B}X3$
$W = ABY0 + A\overline{B}Y1 + \overline{A}BY2 + \overline{A}\,\overline{B}Y3$

t_{pd} = 11 ns typ
P_D = 150 mW typ/pkg

MC4002
Dual Data Distributor

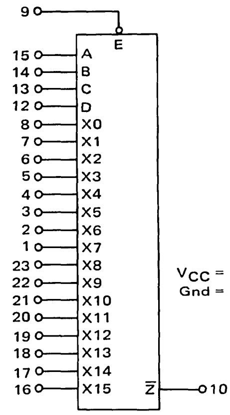


$Z0 = ABX$
$Z1 = A\overline{B}X$
$Z2 = \overline{A}BX$
$Z3 = \overline{A}\,\overline{B}X$
$W0 = \overline{C}Y$
$W1 = CY$

V_{CC} = Pin 4
Gnd = Pin 10

t_{pd} = 10.5 ns typ
P_D = 175 mW typ/pkg

MC54150/MC74150
16-Channel Data Selector

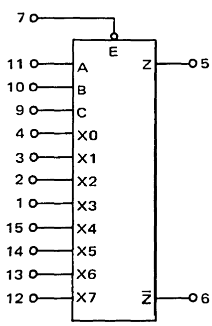


V_{CC} = Pin 24
Gnd = Pin 12

$Z = E \bullet (\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}\ X0 + A\overline{B}\,\overline{C}\,\overline{D}\ X1 + \overline{A}B\overline{C}\,\overline{D}\ X2 + AB\overline{C}\,\overline{D}\ X3 + \overline{A}\,\overline{B}C\overline{D}\ X4 + A\overline{B}C\overline{D}\ X5 + \ldots + ABCD\ X15)$

t_{pd} = 8.5 to 35 ns typ
P_D = 200 mW typ/pkg

MC54151/MC74151
8-Channel Data Selector

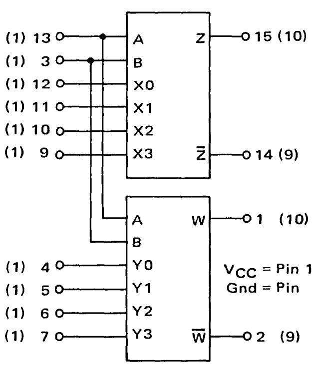


V_{CC} = Pin 16
Gnd = Pin 8

$Z = E \bullet (\overline{A}\,\overline{B}\,\overline{C}X0 + A\overline{B}\,\overline{C}X1 + \overline{A}B\overline{C}X2 + AB\overline{C}X3 + \overline{A}\,\overline{B}CX4 + A\overline{B}CX5 + \overline{A}BCX6 + ABCX7)$

t_{pd} = 8.5 to 35 ns typ
P_D = 145 mW typ/pkg

MC8309/MC9309
Dual 4-Channel Data Selector

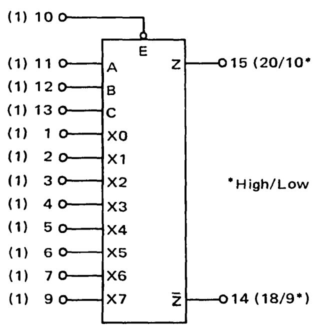


V_{CC} = Pin 16
Gnd = Pin 8

$Z = \overline{A}\,\overline{B}X0 + A\overline{B}X1 + \overline{A}BX2 + ABX3$
$\overline{Z} = \overline{A}\,\overline{B}\,\overline{X0} + A\overline{B}\,\overline{X1} + \overline{A}B\overline{X2} + AB\overline{X3}$
$W = \overline{A}\,\overline{B}Y0 + A\overline{B}Y1 + \overline{A}BY2 + ABY3$
$\overline{W} = \overline{A}\,\overline{B}\,\overline{Y0} + A\overline{B}\,\overline{Y1} + AB\overline{Y2} + AB\overline{Y3}$

t_{pd} = 9.0 to 24 ns typ
P_D = 150 mW typ/pkg

MC8312/MC9312
8-Channel Data Selector



V_{CC} = Pin 16
Gnd = Pin 8

$Z = E \bullet (\overline{A}\,\overline{B}\,\overline{C}X0 + A\overline{B}\,\overline{C}X1 + \overline{A}B\overline{C}X2 + AB\overline{C}X3 + \overline{A}\,\overline{B}CX4 + A\overline{B}CX5 + \overline{A}BCX6 + ABCX7)$
$\overline{Z} = E \bullet (\overline{A}\,\overline{B}\,\overline{C}\,\overline{X0} + A\overline{B}\,\overline{C}\,\overline{X1} + \overline{A}B\overline{C}\,\overline{X2} + AB\overline{C}\,\overline{X3} + \overline{A}\,\overline{B}C\overline{X4} + A\overline{B}C\overline{X5} + \overline{A}BC\overline{X6} + ABC\overline{X7})$

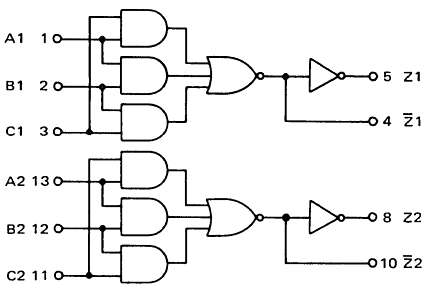
t_{pd} = 9.0 to 24 ns typ
P_D = 135 mW typ/pkg

5

MTTL COMPLEX LOGIC FUNCTIONS

MAJORITY LOGIC GATE

MC4062
Dual Majority Logic Gate



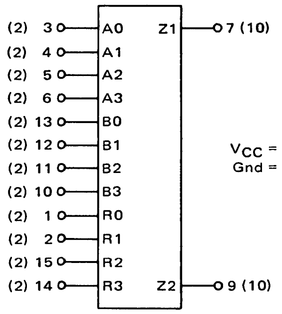
V_{CC} = Pin 14
Gnd = Pin 7

INPUT			OUTPUT	
A	B	C	Z	$\overline{Z}$
0	0	0	0	1
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	0

t_{pd} = 20 ns typ (Z Output)
11 ns typ ($\overline{Z}$ Output)
P_D = 75 mW typ/pkg

COMPARATORS

MC4021, MC4022
Dual 4-Bit Comparator



V_{CC} = Pin 16
Gnd = Pin 8

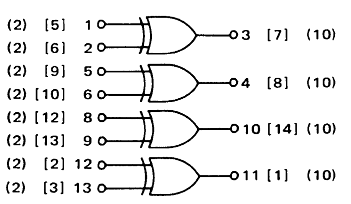
A0	A1	A2	A3	B0	B1	B2	B3	R0	R1	R2	R3	Z1	Z2
0	0	0	0	0	0	1	1	0	0	0	0	1	0
0	0	0	0	0	0	1	1	0	0	0	1	0	0
0	0	0	0	0	0	1	1	0	0	1	0	0	0
0	0	0	0	0	0	1	1	0	0	1	1	0	1
0	1	1	0	0	1	0	1	0	1	0	0	0	0
0	1	1	0	0	1	0	1	0	1	0	1	0	1
0	1	1	0	0	1	0	1	0	1	1	0	1	0
0	1	1	0	0	1	0	1	0	1	1	1	0	0
1	0	0	1	1	0	0	0	1	0	0	0	0	1
1	0	0	1	1	0	0	0	1	0	0	1	1	0
1	0	0	1	1	0	0	0	1	0	1	0	0	0
1	0	0	1	1	0	0	0	1	0	1	1	0	0
1	1	1	1	1	1	1	1	1	1	0	0	0	0
1	1	1	1	1	1	1	1	1	1	0	1	0	0
1	1	1	1	1	1	1	1	1	1	1	0	0	0
1	1	1	1	1	1	1	1	1	1	1	1	1	1

t_{pd} = 20 ns typ
P_D = 250 mW typ/pkg

5

EXCLUSIVE GATES

MC7241/MC8241
Quad Exclusive OR Gate

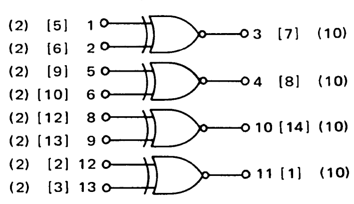


$3 = 1 \bullet \overline{2} + \overline{1} \bullet 2$

V_{CC} = Pin 14 [4] t_{pd} = 10 ns typ
Gnd = Pin 7 [11] P_D = 225 mW typ/pkg

Numbers at ends of terminals represent pin numbers for devices in the dual in-line package.
Numbers in brackets represent pin numbers for devices in the flat package.

MC7242/MC8242
Quad Exclusive NOR Gate
(Open Collector)



$3 = \overline{1} \bullet \overline{2} + 1 \bullet 2$

V_{CC} = Pin 14 [4] t_{pd} = 18 ns typ
Gnd = Pin 7 [11] P_D = 170 mW typ/pkg

Numbers at ends of terminals represent pin numbers for devices in the dual in-line package.
Numbers in brackets represent pin numbers for devices in the flat package.

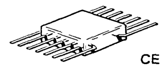
BEAM LEAD INTEGRATED CIRCUITS

MCBC5400 Series (-55 to +125°C)
MCB5400F Series (-55 to +125°C)

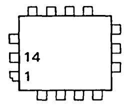
BEAM LEAD

MCBC5400/MCB5400F series integrated circuits comprise a family of transistor-transistor logic designed for general purpose digital applications. The family has a medium operating speed (15-30 MHz clock rate), good external noise immunity, high fan out, and the capability of driving capacitive loads of up to 600 pF.

This series is produced using beam lead sealed junction technology. These devices are particularly useful in highly reliable systems using hybrid beam lead assembly techniques or standard flat package assembly techniques.

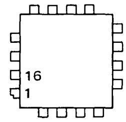


F SUFFIX
CERAMIC PACKAGE
CASE 607



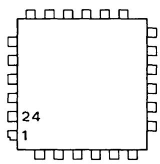
BEAM LEAD CHIP
(14 Lead)
(Geometry Side Down)

• (actual size)



BEAM LEAD CHIP
(16 Lead)
(Geometry Side Down)

• (actual size)



BEAM LEAD CHIP
(24 Lead)
(Geometry Side Down)

• (actual size)

MAXIMUM RATINGS

Rating	Value	Unit
Power Supply Voltage	7.0	Vdc
Input Voltage	5.5	Vdc
Operating Temperature Range	-55 to +125	°C
Storage Temperature Range — Ceramic	-65 to +150	°C

5

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C)

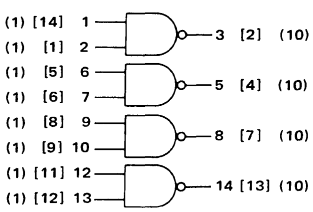
Function	Type: Chip -55° to + 125°C	Type: Case 607 -55° to +125°C	Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Power Dissipation mW typ/pkg
Quad 2-Input NAND Gate	MCBC5400	MCB5400F	10	10	40
Quad 2-Input NAND Gate (Open Collector Output)	MCBC5401	MCB5401F	10	35	40
Quad 2-Input NOR Gate	MCBC5402	MCB5402F	10	10	48
Hex Inverter	MCBC5404	MCB5404F	10	13	60
Hex Inverter (Open Collector)	MCBC5405	MCB5405F	10	35	60
Triple 3-Input NAND Gate	MCBC5410	MCB5410F	10	10	30
Dual 4-Input NAND Gate	MCBC5420	MCB5420F	10	10	20
8-Input NAND Gate	MCBC5430	MCB5430F	10	10	10
Dual 4-Input NAND Buffer	MCBC5440	MCB5440F	30	13	50
Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate	MCBC5450	MCB5450F	10	13	28
Dual 2-Wide 2-Input AND-OR-INVERT Gate	MCBC5451	MCB5451F	10	13	28
Expandable 4-Wide 2-Input AND-OR-INVERT Gate	MCBC5453	MCB5453F	10	13	22
4-Wide 2-Input AND-OR-Invert Gate	MCBC5454	MCB5454F	10	13	22
Dual 4-Input Expander for AND-OR-INVERT Gate	MCBC5460	MCB5460F	–	5.0	8.0
J-K Flip-Flop	MCBC5472	MCB5472F	10	30	40
Dual J-K Flip-Flop	MCBC5473	MCB5473F	10	30	80
Dual Type D Flip-Flop	MCBC5479	MCB5479F	10	16	84
4-Input AND Driver with NOR Strobe	–	MCB54140F	–	70	20

Numbers at ends of terminals represent flat package pin numbers.
Numbers in brackets denote beam number.
Numbers in parenthesis indicate loading.

NOTE: Beam numbers shown reflect the change of Beam 1 to the lower left corner (with the geometry face down) in accordance with EIA agreements.

GATES

MCBC5400/MCB5400F
Quad 2-Input NAND Gate

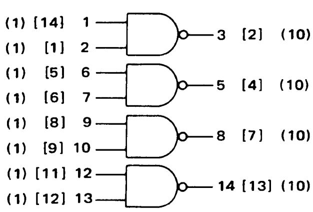


V_{CC} = 4 [3]
Gnd = 11 [10]

$3 = \overline{1 \bullet 2}$

t_{pd} = 10 ns typ
P_D = 40 mW typ/pkg

MCBC5401/MCB5401F
Quad 2-Input NAND Gate

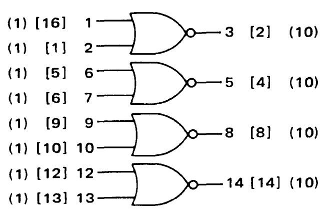


V_{CC} = 4 [3]
Gnd = 11 [10]

$3 = \overline{1 \bullet 2}$

t_{pd} = 35 ns typ
P_D = 40 mW typ/pkg

MCBC5402/MCB5402F
Quad 2-Input NOR Gate

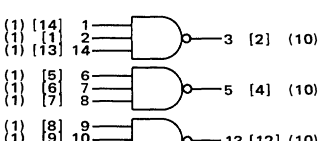


V_{CC} = 4 [3]
Gnd = 11 [11]

$3 = \overline{1 + 2}$

t_{pd} = 10 ns typ
P_D = 48 mW typ/pkg

MCBC5410/MCB5410F
Triple 3-Input NAND Gate

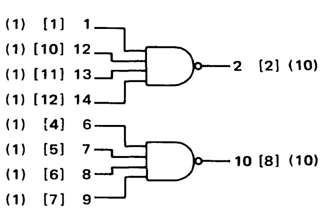


V_{CC} = 4 [3]
Gnd = 11 [10]

$3 = \overline{1 \bullet 2 \bullet 14}$

t_{pd} = 10 ns typ
P_D = 30 mW typ/pkg

MCBC5420/MCB5420F
Dual 4-Input NAND Gate

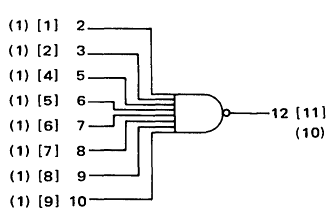


V_{CC} = 4 [3]
Gnd = 11 [9]

$2 = \overline{1 \bullet 12 \bullet 13 \bullet 14}$

t_{pd} = 10 ns typ
P_D = 20 mW typ/pkg

MCBC5430/MCB5430F
8-Input NAND Gate



V_{CC} = 4 [3]
Gnd = 11 [10]

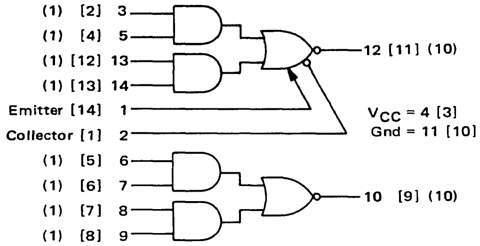
$12 = \overline{2 \bullet 3 \bullet 5 \bullet 6 \bullet 7 \bullet 8 \bullet 9 \bullet 10}$

t_{pd} = 10 ns typ
P_D = 10 mW typ/pkg

(continued)

GATES (continued)

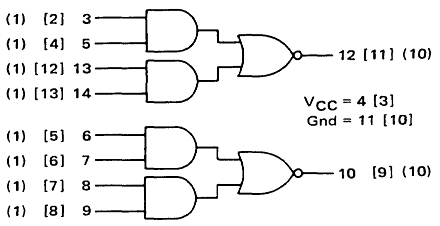
MCBC5450/MCB5450F
Expandable Dual
2-Wide 2-Input
AND-OR-INVERT Gate



$12 = \overline{(3 \bullet 5) + (13 \bullet 14) + (\text{Expanders})}$

t_{pd} = 13 ns typ
P_D = 28 mW typ/pkg

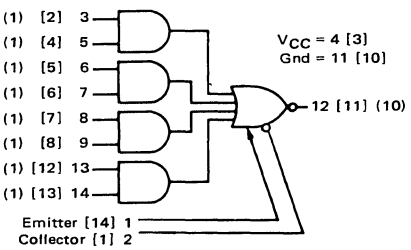
MCBC5451/MCB5451F
Dual 2-Wide 2-Input
AND-OR-INVERT Gate



$12 = \overline{(3 \bullet 5) + (13 \bullet 14)}$

t_{pd} = 13 ns typ
P_D = 28 mW typ/pkg

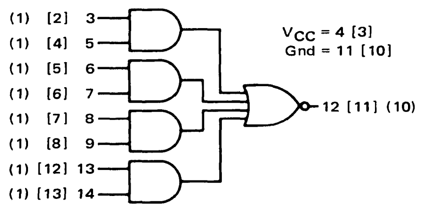
MCBC5453/MCB5453F
Expandable 4-Wide 2-Input
AND-OR-INVERT Gate



$12 = \overline{(3 \bullet 5) + (6 \bullet 7) + (8 \bullet 9) + (13 \bullet 14) + (\text{Expanders})}$

t_{pd} = 13 ns typ
P_D = 22 mW typ/pkg

MCBC5454/MCB5454F
4-Wide 2-Input
AND-OR-INVERT Gate



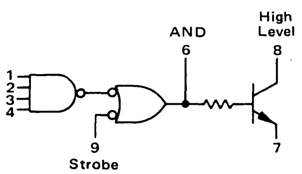
$12 = \overline{(3 \bullet 5) + (6 \bullet 7) + (8 \bullet 9) + (13 \bullet 14)}$

t_{pd} = 13 ns typ
P_D = 22 mW typ/pkg

5

DRIVER

MCB54140F
4-Input AND Driver with NOR Strobe

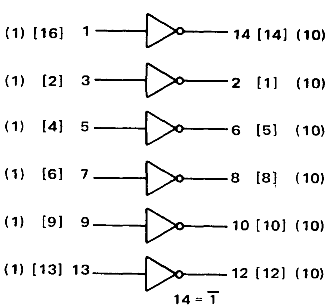


Positive Logic: $\overline{8} = 1 \bullet 2 \bullet 3 \bullet 4 + \overline{9}$
Negative Logic: $\overline{8} = (1 + 2 + 3 + 4)\overline{9}$

t_{pd} = 70 ns typ
P_D = 20 mW typ/pkg

INVERTERS

MCBC5404/MCB5404F
Hex Inverter

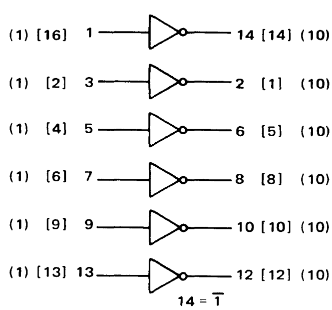


$14 = \overline{1}$

$V_{CC} = 4$ [3]
Gnd = 11 [11]

t_{pd} = 13 ns typ
P_D = 60 mW typ/pkg

MCBC5405/MCB5405F
Hex Inverter
(Open Collector)



$14 = \overline{1}$

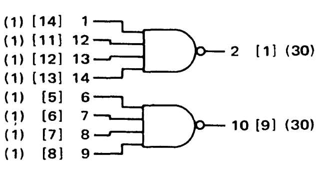
$V_{CC} = 4$ [3]
Gnd = 11 [11]

t_{pd} = 35 ns typ
P_D = 60 mW typ/pkg

5

BUFFER

MCBC5440/MCB5440F
Dual 4-Input NAND Buffer



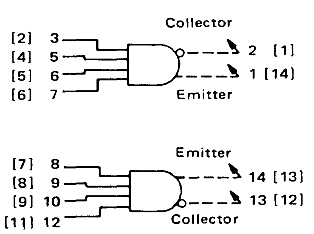
$2 = \overline{1 \cdot 12 \cdot 13 \cdot 14}$

$V_{CC} = 4$ [3]
Gnd = 11 [10]

t_{pd} = 13 ns typ
P_D = 50 mW typ/pkg

EXPANDER

MCBC5460/MCB5460F
Dual 4-Input Expander
for AND-OR-INVERT Gates



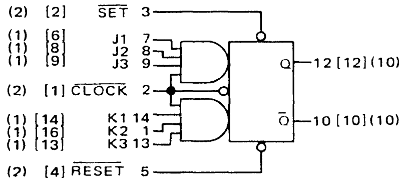
$V_{CC} = 4$ [3]
Gnd = 11 [10]

A maximum of 4 expanders may be connected to the MCBC5450/MCB5450F or MCBC5453/MCB5453F.

FLIP-FLOPS

MCBC5472/MCB5472F
J-K Flip-Flop

V_{CC} = 4 [3]
Gnd = 11 [11]

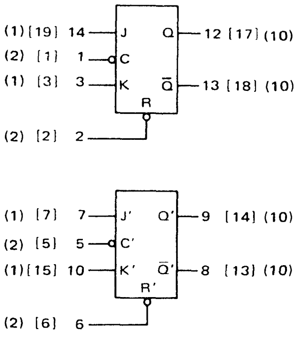


t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\bar{Q}_n$

J = J1 • J2 • J3
K = K1 • K2 • K3

f = 15 MHz
P_D = 40 mW typ/pkg

MCBC5473/MCB5473F
Dual J-K Flip-Flop

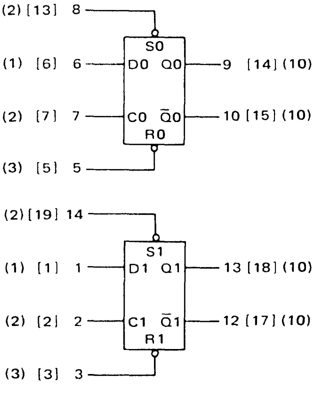


V_{CC} = Pin 4 [4]
Gnd = Pin 11 [16]

t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\bar{Q}_n$

f = 15 MHz typ
P_D = 80 mW typ/pkg

MCBC5479/MCB5479F
Dual Type D Flip-Flop



V_{CC} = Pin 4 [4]
Gnd = Pin 11 [16]

t_n	t_{n+1}	
D	Q	$\bar{Q}$
0	0	1
1	1	0

f = 30 MHz typ
P_D = 84 mW typ/pkg

5

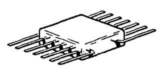
MCE54H00 / MCE74H00 SERIES
MCE5400 / MCE7400 SERIES
INTEGRATED CIRCUITS

MTTL

MCE54H00 Series, MCE5400 Series (-55 to +125°C)
MCE74H00 Series, MCE7400 Series (0 to +70°C)

DIELECTRICALLY ISOLATED INTEGRATED CIRCUITS

The Dielectrically Isolated Integrated Circuit (DIIC) MTTL family is designed specifically for use in military and space applications that require a high degree of reliability under severe radiation environments and post irradiation operation. The MTTL DIIC family utilizes nichrome resistors, post metalization passivation, monometallic interconnections, and very small high frequency transistor structures to enhance the radiation resistant qualities of this line.



F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86

5

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C)

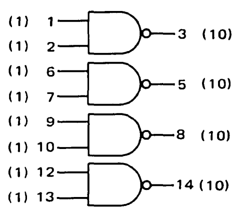
Function	MCE54H00/74H00 Series Type -55 to +125°C	MCE54H00/74H00 Series Type 0 to +70°C	Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Power Dissipation m/W typ/pkg
Quad 2-Input NAND Gate	MCE54H00	MCE74H00	10	6.0	80
Quad 2-Input NAND Gate (Open Collector Output)	MCE54H01	MCE74H01	10	8.0	80
Hex Inverter	MCE54H04	MCE74H04	10	6.0	120
Triple 3-Input NAND Gate	MCE54H10	MCE74H10	10	6.0	60
Dual 4-Input NAND Gate	MCE54H20	MCE74H20	10	6.0	40
11-Input NAND Gate	MCE54H31	MCE74H31	10	9.0	20
Dual 4-Input NAND Power Gate	MCE54H40	MCE74H40	30	6.0	80
Dual 2-Wide 2-Input AND-OR-INVERT Gate	MCE54H51	MCE74H51	10	6.0	58
4-Wide 2-Input AND-OR-INVERT Gate	MCE54H54A	MCE74H54A	10	6.0	40
Dual 2-Wide 2-3-Input AND-OR-INVERT Gate	MCE54H56	MCE74H56	10	6.0	58
4-Wide 3-3-2-3-Input AND-OR-INVERT Gate	MCE54H57	MCE74H57	10	6.0	40
Dual Type D Flip-Flop	MCE54H79	MCE74H79	10	16	140
Binary To One-Of-Eight Line Decoder	MCE54H146	MCE74H146	10	–	130
	MCE5400/7400 Series Type -55 to +125°C	MCE5400/7400 Series Type 0 to +70°C			
Dual J-K Flip-Flop	MCE54103	MCE74103	10	8.0	100

Numbers at ends of terminals represent pin numbers for devices in the flat package.
Numbers in parenthesis indicate loading.

Flat Package: V_{CC} = Pin 4, Gnd = Pin 11.

GATES

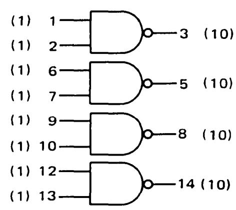
MCE54H00/MCE74H00
Quad 2-Input NAND Gate



$3 = \overline{1 \cdot 2}$

t_{pd} = 6.0 ns typ
P_D = 80 mW typ/pkg

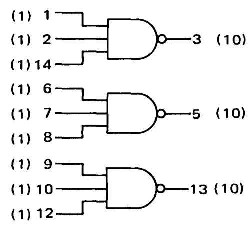
MCE54H01/MCE74H01
Quad 2-Input NAND Gate
(Open Collector Output)



$3 = \overline{1 \cdot 2}$

t_{pd} = 8.0 ns typ
P_D = 80 mW typ/pkg

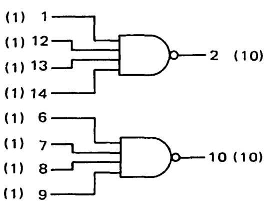
MCE54H10/MCE74H10
Triple 3-Input NAND Gate



$12 = \overline{1 \cdot 2 \cdot 13}$

t_{pd} = 6.0 ns typ
P_D = 60 mW typ/pkg

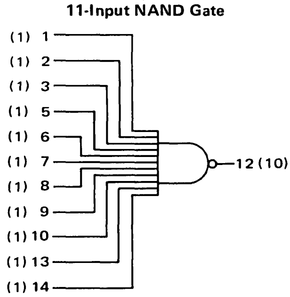
MCE54H20/MCE74H20
Dual 4-Input NAND Gate



$6 = \overline{1 \cdot 2 \cdot 4 \cdot 5}$

t_{pd} = 6.0 ns typ
P_D = 40 mW typ/pkg

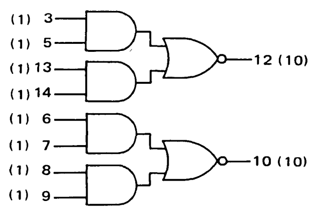
MCE54H31/MCE74H31
11-Input NAND Gate



$8 = \overline{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 11 \cdot 12}$

t_{pd} = 9.0 ns typ
P_D = 20 mW typ/pkg

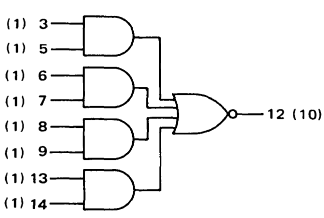
MCE54H51/MCE74H51
Dual 2-Wide 2-Input
AND-OR-INVERT Gate



$8 = \overline{(9 \cdot 10) + (13 \cdot 1)}$

t_{pd} = 6.0 ns typ
P_D = 58 mW typ/pkg

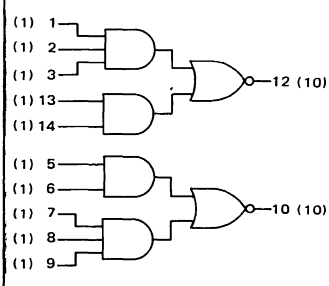
MCE54H54A/MCE74H54A
4-Wide 2-Input
AND-OR-INVERT Gate



$12 = \overline{(3 \cdot 5) + (6 \cdot 7) + (8 \cdot 9) + (13 \cdot 14)}$

t_{pd} = 6.0 ns typ
P_D = 40 mW typ/pkg

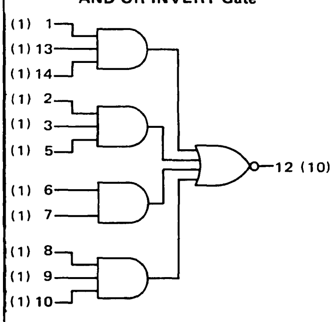
MCE54H56/MCE74H56
Dual 2-Wide 2-3-Input
AND-OR-INVERT Gate



$12 = \overline{(1 \cdot 2 \cdot 3) + (13 \cdot 14)}$

t_{pd} = 6.0 ns typ
P_D = 58 mW typ/pkg

MCE54H57/MCE74H57
4-Wide 3-3-2-3-Input
AND-OR-INVERT Gate



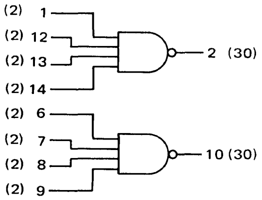
$12 = \overline{(1 \cdot 13 \cdot 14) + (2 \cdot 3 \cdot 5) + (6 \cdot 7) + (8 \cdot 9 \cdot 10)}$

t_{pd} = 6.0 ns typ
P_D = 40 mW typ/pkg

5

POWER GATE

MCE54H40/MCE74H40
Dual 4-Input NAND Buffer

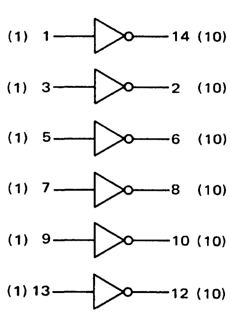


$2 = \overline{1 \bullet 12 \bullet 13 \bullet 14}$

t_{pd} = 6.0 ns typ
P_D = 80 mW typ/pkg

INVERTER

MCE54H04/MCE74H04
Hex Inverter

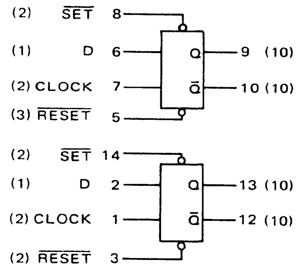


$14 = \overline{1}$

t_{pd} = 6.0 ns typ
P_D = 120 mW typ/pkg

FLIP-FLOPS

MCE54H79/MCE74H79
Dual Type D Flip-Flop

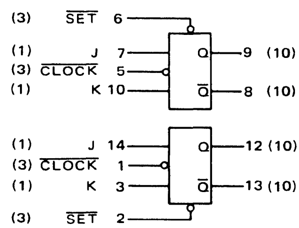


D	Q^n	Q^{n+1}
0	0	0
0	1	0
1	0	1
1	1	1

$Q^{n+1} = D^n$

f = 35 MHz
P_D = 140 mW typ/pkg

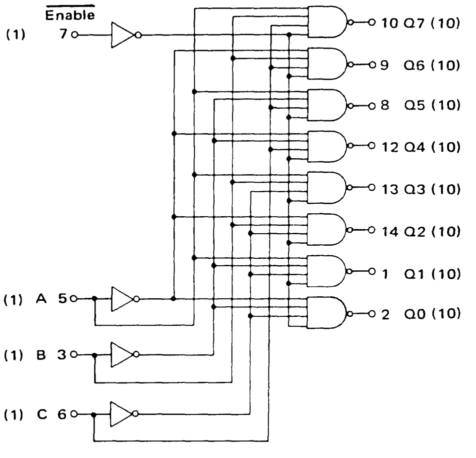
MCE54103/MCE74103
Dual J-K Flip-Flop



f = 50 MHz typ.
P_D = 100 mW typ/pkg.

DECODER

MCE54H146/MCE74H146
Binary to 1-of-8 Line Decoder



t_{pd} = 14 ns typ
P_D = 130 mW typ/pkg

5

MDTL

Dielectrically Isolated INTEGRATED CIRCUITS

MDTL

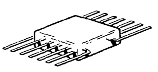
MCE930 Series (–55 to +125°)

The Dielectrically Isolated MDTL family is intended for use in military and space applications that require a high degree of reliability under severe radiation environments. In addition to dielectric isolation, this family of devices utilizes nichrome resistors throughout. A post-metalization passivation process further enhances the radiation resistance qualities of the family and very small high frequency transistor structures are used throughout.

Dielectrically Isolated MDTL has the same electrical specifications as the MC930 family and may be used interchangeably with it. This eliminates the need for redesigning existing equipment to gain radiation-resistance and allows the design engineer to utilize a familiar logic type for new systems.

MAXIMUM RATINGS

Rating	Value	Unit
Supply Voltage – Continuous Pulsed, < 1 second	8.0 12	Vdc
Output Current (into outputs) – Buffers, Power Gates – Continuous Pulsed, < 30 ms All other types	 150 300 30	mAdc
Input Forward Current	-10	mAdc
Input Reverse Current – Buffers, Power Gates All other types	 5.0 1.0	mAdc
Operating Temperature Range – MCE930 Series	 -55 to +125	°C
Storage Temperature Range	-65 to +150	°C



F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86

5

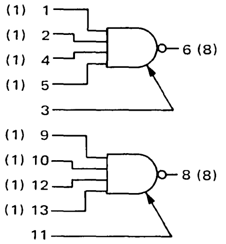
FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 Vdc, T_A = 25°C)

Function	Type Case 607 -55 to +125°C	Output Loading Factor Each Output	Total Power Dissipation mW typ/pkg
Expandable Dual 4-Input NAND Gate	MCE930	8.0	22
Expandable Dual 4-Input Buffer	MCE932	25	85
Dual 4-Input Expander	MCE933	–	–
Hex Inverter	MCE936	8	66
Expandable Dual 4-Input NAND Power Gate	MCE944	27	65
Clocked Flip-Flop	MCE945	10	60
Quad 2-Input NAND Gate	MCE946	8	44
Clocked Flip-Flop	MCE948	9.0	70
Triple 3-Input NAND Gate	MCE962	8.0	33

MDTL LOGIC DIAGRAMS

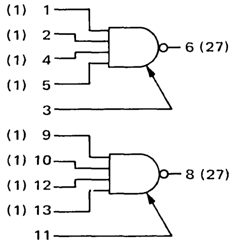
GATES

MCE930F
Expandable Dual 4-Input NAND Gate



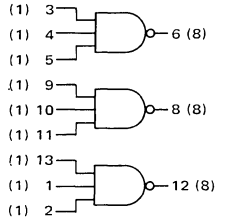
$6 = \overline{1 \bullet 2 \bullet 4 \bullet 5 \bullet [3]}$

MCE944F
Expandable Dual 4-Input NAND Power Gate



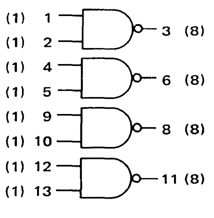
$6 = \overline{1 \bullet 2 \bullet 4 \bullet 5 \bullet [3]}$

MCE962F
Triple 3-Input NAND Gate



$6 = \overline{3 \bullet 4 \bullet 5}$

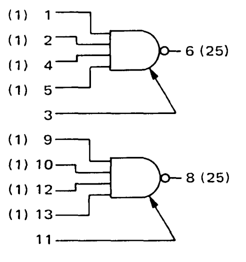
MCE946F
Quad 2-Input NAND Gate



$3 = \overline{1 \bullet 2}$

BUFFER

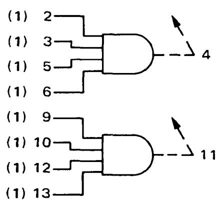
MCE932F
Expandable Dual 4-Input Buffer



$6 = \overline{1 \bullet 2 \bullet 4 \bullet 5 \bullet [3]}$

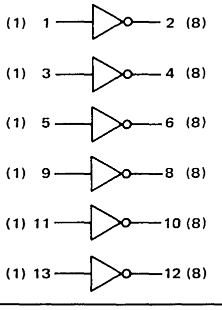
EXPANDER

MCE933F
Dual 4-Input Expander



INVERTER

MCE936F
Hex Inverter



$2 = \overline{1}$

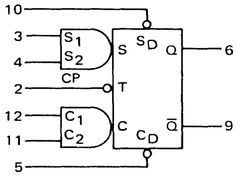
5

Numbers at ends of terminals represent pin numbers.
Numbers in parenthesis indicate loading.

V_{CC} = Pin 14, GND = Pin 7

FLIP-FLOPS

MCE945F
MCE948F
Clocked Flip-Flop



Input Loading Factor:
S and C = 2/3
S_D, C_D, T = 2

Output Loading Factor:
MCE945 = 10
MCE948 = 9

SYNCHRONOUS TRUTH TABLE

t_n				t_{n+1}
S_1	S_2	C_1	C_2	Q
0	X	0	X	Q_n
0	X	X	0	Q_n
X	0	0	X	Q_n
X	0	X	0	Q_n
0	X	1	1	0
X	0	1	1	0
1	1	0	X	1
1	1	X	0	1
1	1	1	1	U

0 – Low State (more negative)

1 – High State (more positive)

X – State of the input does not affect the state of the circuit.

U – Indeterminate State

J-K TRUTH TABLE
(Connect S_2 to $\overline{Q}$, C_2 to Q)

t_n		t_{n+1}
S_1	C_1	Q
0	0	Q_n
1	0	1
0	1	0
1	1	$\overline{Q}_n$

ASYNCHRONOUS TRUTH TABLE

S_D	C_D	Q	$\overline{Q}$
1	1	NC	NC
0	1	1	0
1	0	0	1
0	0	1	1

Asynchronous inputs, direct set (S_D) and direct clear (C_D), override the synchronous inputs; they are independent of all other inputs.

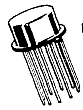
MDTL INTEGRATED CIRCUITS MDTL

MC830 Series (0 to +75°C)
MC930 Series (-55 to +125°)

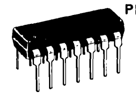
MAXIMUM RATINGS

Rating	Value	Unit
Supply Voltage —		Vdc
Operating	4.5 to 5.5	
Continuous	8.0	
Pulsed, < 1 second	12	
Output Current (Into Outputs with Outputs Low)		mAdc
Buffers, Power Gates — Continuous	100	
Pulsed, < 30 ms	300	
All other types — Continuous	30	
Pulsed, < 30 ms	90	
Input Forward Current —		mAdc
Continuous	-10	
Pulsed, < 30 ms	-30	
or		
Negative Voltage at Input —		Vdc
Continuous	-0.5	
Pulsed, < 30 ms	-1.5	
Input Reverse Current	1.0	mAdc
or		
Positive Voltage at Diode Input	5.5	Vdc
Operating Temperature Range		°C
MC930 Series	-55 to +125	
MC830 Series	0 to +75	
Storage Temperature Range		°C
Metal Can, Ceramic Package	-65 to +150	
Plastic Package	-55 to +125	
Maximum Junction Temperature		°C
MC930 Series	175	
MC830 Series	150	

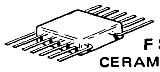
MDTL integrated circuits provide an excellent balance of speed, power dissipation, and noise immunity for general purpose digital applications. The line includes many multifunction types. Additional logic power is provided by the "wired OR" capability of the basic MDTL gate.



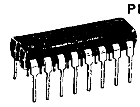
G SUFFIX
METAL PACKAGE
CASE 603-02
TO-100



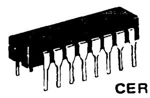
P SUFFIX
PLASTIC PACKAGE
CASE 646
TO-116



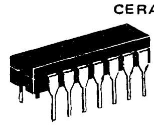
F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86



P SUFFIX
PLASTIC PACKAGE
CASE 648



L SUFFIX
CERAMIC PACKAGE
CASE 620



L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 Vdc, T_A = 25°C)

Function	Type ① 0 to +75°C	Case	Type ① -55 to +125°C	Case	Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Total Power Dissipation mW typ/pkg
Expandable Dual 4 Input NAND Gate	MC830	607,632,646	MC930	607,632	8	30	22
Expandable Dual 3-2 Input NAND Gate	MC830	603	MC930	603	8	30	22
Clocked Flip-Flop	MC831	603,607,632,646	MC931	603,607,632	7	40	55
Expandable Dual 4-Input Buffer	MC832	607,632,646	MC932	607,632	25	35	85
Expandable Dual 3-2 Input Buffer	MC832	603	MC932	603	25	35	85
Dual 4 Input Expander	MC833	607,632,646	MC933	607,632	–	–	–
Dual 4-3 Input Expander	MC833	603	MC933	603	–	–	–
Hex Inverter	MC834	607,632,646	MC934	607,632	8	30	66
Hex Inverter (without output resistors)	MC835	607,632,646	MC935	607,632	8	30	42
Hex Inverter	MC836	607,632,646	MC936	607,632	8	30	66
Hex Inverter	MC837	607,632,646	MC937	607,632	7	25	90
Decade Counter	MC838	607,632,646	MC938	607,632	8	30 MHz ③	150
Divide-by-Sixteen Counter	MC839	607,632,646	MC939	607,632	8	30 MHz ③	150
Hex Inverter (without input diodes)	MC840	607,632,646	MC940	607,632	8	30	66
Hex Inverter (without output resistors and input diodes)	MC841	607,632,646	MC941	607,632	8	30	42
4-Input AND Driver with NOR Strobe	MC843	603	MC943	603	250 mA	80	50
Expandable Dual 4-Input Power Gate	MC844	607,632,646	MC944	607,632	27	30	65
Expandable Dual 3-2 Input Power Gate	MC844	603	MC944	603	27	30	65
Clocked Flip-Flop	MC845	603,607,632,646	MC945	603,607,632	12/10 ②	40	60
Quad 2-Input NAND Gate	MC846	607,632,646	MC946	607,632	8	30	44
Quad Inverter	MC846	603	MC946	603	8	30	44
Quad 2-Input Gate Expander	MC847	607,632,646	MC947	607,632	–	–	–
Clocked Flip-Flop	MC848	603,607,632,646	MC948	603,607,632	11/9 ②	40	70
Quad 2-Input NAND Gate (2 k pullup resistor)	MC849	607,632,646	MC949	607,632	7	25	66
Quad Inverter (2 k pullup resistor)	MC849	603	MC949	603	7	25	60
Pulse Triggered Binary	MC850	603,607,632,646	MC950	603,607,632	10/8 ②	15	50
Monostable Multivibrator	MC851	603,607,632,646	MC951	603,607,632	10	40	30
Dual J-K Flip-Flop (common clock and C_D, separate S_D)	MC852	607,632,646	MC952	607,632	12/10 ②	40	120
Dual J-K Flip-Flop (separate clock and S_D, no C_D)	MC853	607,632,646	MC953	607,632	12/10 ②	40	120

(continued)

① F suffix denotes Ceramic Flat Package, G suffix denotes Metal Can, L suffix denotes Dual In-Line Ceramic Package, P suffix denotes Dual In-Line Plastic Package. (i.e., MC830G = Metal Can, MC830F = Flat Package, MC830L = Dual In-Line Ceramic Package, MC830P = Plastic Package)
② Fan-out for MC830 series type / Fan-out for MC930 series type.
③ Maximum counting frequency.

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MDTL (continued)

Function	Type ① 0 to +75°C	Case	Type ① -55 to +125°C	Case	Output Loading Factor Each Output	Propagation Delay t_{pd} ns typ	Total Power Dissipation mW typ/pkg
Dual J-K Flip-Flop (common clock and C_D, separate S_D, 2 k pullup resistor)	MC855	607,632,646	MC955	607,632	11/9 ②	40	140
Dual J-K Flip-Flop (separate clock and S_D, no C_D, 2 k pullup resistor)	MC856	607,632,646	MC956	607,632	11/9 ②	40	140
Quad 2-Input Buffer	MC857	607,632,646	MC957	607,632	25	35	170
Quad 2-Input NAND Power Gate	MC858	607,632,646	MC958	607,632	27	30	130
Expandable Dual 4-Input NAND Gate (2 k pullup resistor)	MC861	607,632,646	MC961	607,632	7	25	33
Expandable Dual 3-2 Input NAND Gate (2 k pullup resistor)	MC861	603	MC961	603	7	25	33
Triple 3-Input NAND Gate	MC862	607,646	MC962	607,632	8	30	33
Dual 2-Input NAND Gate plus Inverter	MC862	603	MC962	603	8	30	30
Triple 3-Input NAND Gate (2 k pullup resistor)	MC863	607,646	MC963	607,632	7	25	50
Dual 2-Input NAND Gate plus Inverter (2 k pullup resistor)	MC863	603	MC963	603	7	25	45
Dual 6-Input NAND Gate	MC1800	607,632,646	MC1900	607,632	8	30	22
Dual 5-Input NAND Gate (2k pullup resistor)	MC1801	607,632,646	MC1901	607,632	7	25	33
Expandable 8-Input NAND Gate	MC1802	607,632,646	MC1902	607,632	8	30	11
Expandable 8-Input NAND Gate (2 k pullup resistor)	MC1803	607,632,646	MC1903	607,632	7	25	16.5
10-Input NAND Gate	MC1804	607,632,646	MC1904	607,632	8	30	11
10-Input NAND Gate (2k pullup resistor)	MC1805	607,632,646	MC1905	607,632	7	25	16.5
Quad 2-Input AND Gate	MC1806	607,632,646	MC1906	607,632	8	35	72
Quad 2-Input AND Gate (2k pullup resistor)	MC1807	607,632,646	MC1907	607,632	7	30	85
Quad 2-Input OR Gate	MC1808	607,632,646	MC1908	607,632	8	35	97
Quad 2-Input OR Gate (2k pullup resistor)	MC1809	607,632,646	MC1909	607,632	7	30	115
Quad 2-Input NOR Gate	MC1810	607,632,646	MC1910	607,632	8	30	60
Quad 2-Input NOR Gate (2k pullup resistor)	MC1811	607,632,646	MC1911	607,632	7	25	72
Quad 2-Input Exclusive OR Gate	MC1812	607,632,646	MC1912	607,632	8	40	120
Quad Latch	MC1813	620,648	MC1913	620	7	35	220
Quad Latch	MC1814	607,632,646	MC1914	607,632	7	35	220
Parallel Gated Clocked Flip-Flop	MC1815	607,632,646	MC1915	607,632	12/10 ②	40	65
Parallel Gated Clocked Flip-Flop	MC1816	607,632,646	MC1916	607,632	11/9 ②	40	75
Quad 2-Input NAND Gate (without output resistor)	MC1818	607,632,646	MC1918	607,632	8	30	32
High Voltage Hex Inverter	MC1820	632,646	–	–	7	40	42

① F suffix denotes Ceramic Flat Package, G suffix denotes Metal Can, L suffix denotes Dual In-Line Ceramic Package, P suffix denotes Dual In-Line Plastic Package (i.e., MC830G = Metal Can, MC830F = Flat Package, MC830L = Dual In Line Ceramic Package, MC830P = Plastic Package)

② Fan-out for MC830 series type / Fan-out for MC930 series type.

③ Maximum counting frequency.

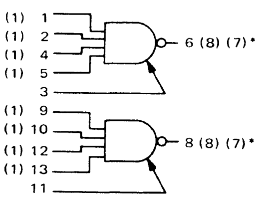
*Unless otherwise noted

Case	Gnd* Pin No.	V_{CC}* Pin No.
603	5	10
646	7	14
607	7	14
648	8	16
620	8	16
632	7	14

GATES

Numbers at ends of terminals represent pin numbers. Numbers in parenthesis indicate loading.

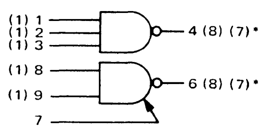
MC830/MC930
MC861/MC961
Expandable Dual 4-Input NAND Gate



$6 = \overline{1 \cdot 2 \cdot 4 \cdot 5 \cdot [3]}$

*Applies to MC861/MC961

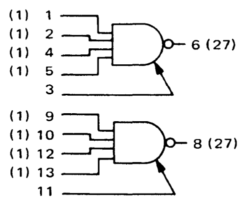
MC830G/MC930G
MC861G/MC961G
Expandable
Dual 3-2 Input NAND Gate



$4 = \overline{1 \cdot 2 \cdot 3}$

*Applies to MC861G/MC961G

MC844/MC944
Expandable
Dual 4-Input Power NAND Gate



$6 = \overline{1 \cdot 2 \cdot 4 \cdot 5 \cdot [3]}$

(continued)

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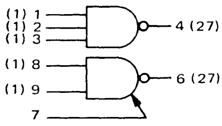
MDTL LOGIC DIAGRAMS

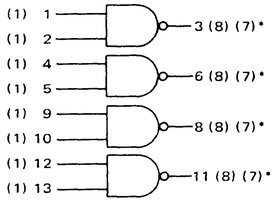
GATES (continued)

MC844G/MC944G
Expandable
Dual 3-2 Input NAND Power Gate



$4 = \overline{1 \cdot 2 \cdot 3}$

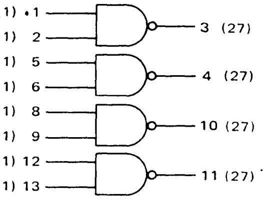
MC846/MC946
MC849/MC949
Quad 2-Input NAND Gate



$3 = \overline{1 \cdot 2}$

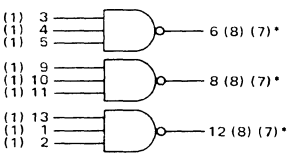
*Applies to MC849/MC949

MC858/MC958
Quad 2-Input NAND Power Gate



$3 = \overline{1 \cdot 2}$

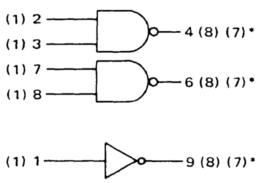
MC862/MC962
MC863/MC963
Triple 3-Input NAND Gate



$6 = \overline{3 \cdot 4 \cdot 5}$

*Applies to MC863/MC963

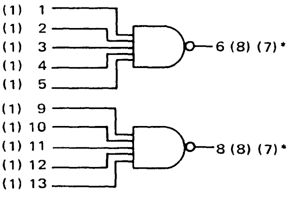
MC862G/MC962G
MC863G/MC963G
Dual 2-Input NAND Gate
Plus Inverter



$4 = \overline{2 \cdot 3}$
$6 = \overline{7 \cdot 8}$
$9 = \overline{1}$

*Applies to MC863G/MC963G

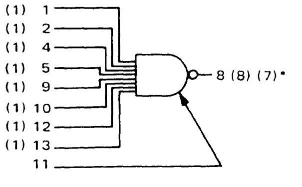
MC1800/MC1900
MC1801/MC1901
Dual 5-Input NAND Gate



$6 = \overline{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5}$

*Applies to MC1801/MC1901

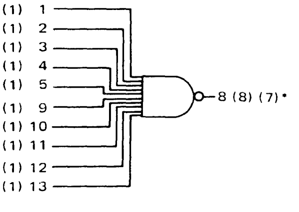
MC1802/MC1902
MC1803/MC1903
Expandable 8-Input NAND Gate



$8 = \overline{1 \cdot 2 \cdot 4 \cdot 5 \cdot 9 \cdot 10 \cdot 12 \cdot 13 \cdot [11]}$

*Applies to MC1803/MC1903

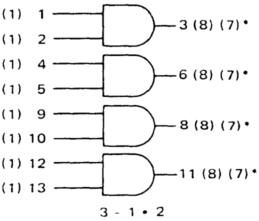
MC1804/MC1904
MC1805/MC1905
10-Input NAND Gate



$8 = \overline{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 9 \cdot 10 \cdot 11 \cdot 12 \cdot 13}$

*Applies to MC1805/MC1905

MC1806/MC1906
MC1807/MC1907
Quad 2-Input AND Gate



3 - 1 • 2

*Applies to MC1807/MC1907

(continued)

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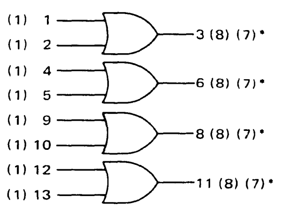
GATES (continued)

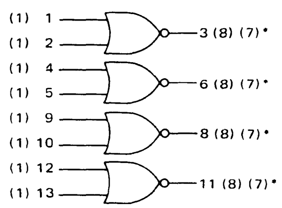
MC1808/MC1908
MC1809/MC1909
Quad 2-Input OR Gate



$3 = 1 + 2$

*Applies to MC1809/MC1909

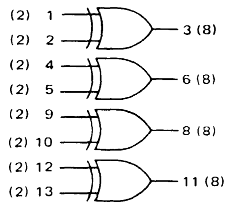
MC1810/MC1910
MC1811/MC1911
Quad 2-Input NOR Gate



$3 = \overline{1 + 2}$

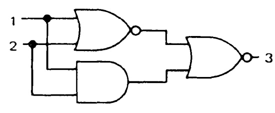
*Applies to MC1811/MC1911

MC1812/MC1912
Quad 2-Input Exclusive OR Gate

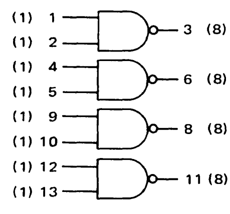


$3 = 1 \cdot \overline{2} + \overline{1} \cdot 2$

FUNCTIONAL LOGIC DIAGRAM



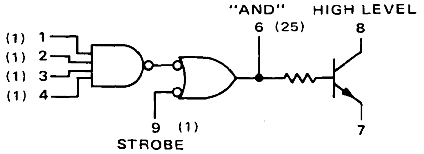
MC1818/MC1918
Quad 2-Input NAND Gate
(Without Output Resistors)



$3 = \overline{1 \cdot 2}$

DRIVER

MC843G/MC943G
4-Input AND Driver with NOR Strobe

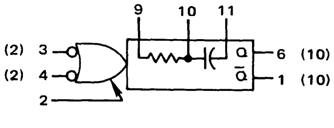


$\overline{8} = 1 \cdot 2 \cdot 3 \cdot 4 + \overline{9}$

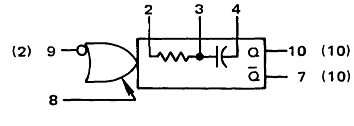
MULTIVIBRATOR

MC851/MC951
Monostable Multivibrator

F,L,P, PACKAGES



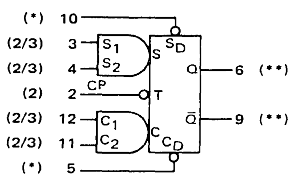
G PACKAGE
V_{CC} = Pin 6, Gnd = Pin 1



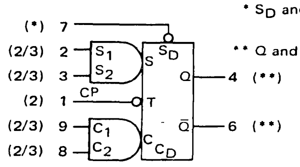
FLIP-FLOPS

MC831/MC931
MC845/MC945
MC848/MC948
Clocked Flip-Flop

F,L, & P PACKAGES



G PACKAGES



* S_D and C_D loading factor: ¾ for MC831/MC931 types; 2 for other clocked flip-flops

** Q and Q̄ loading factor: 7 for MC831/MC931 types; 12 for MC845 types; 10 for MC945 types; 11 for MC848 types; 9 for MC948 types

SYNCHRONOUS TRUTH TABLE

t_n				t_{n+1}
S_1	S_2	C_1	C_2	Q
0	X	0	X	Q_n
0	X	X	0	Q_n
X	0	0	X	Q_n
X	0	X	0	Q_n
0	X	1	1	0
X	0	1	1	0
1	1	0	X	1
1	1	X	0	1
1	1	1	1	U

0 — Low State (more negative)
1 — High State (more positive)
X — State of the input does not affect the state of the circuit.
U — Indeterminate State

J-K TRUTH TABLE
(Connect S_2 to $\overline{Q}$, C_2 to Q)

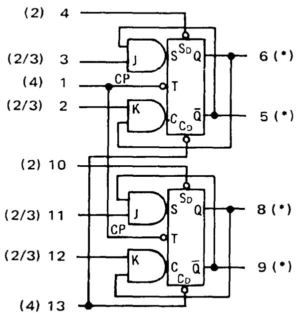
t_n		t_{n+1}
S_1	C_1	Q
0	0	Q_n
1	0	1
0	1	0
1	1	$\overline{Q}_n$

ASYNCHRONOUS TRUTH TABLE

S_D	C_D	Q	$\overline{Q}$
1	1	NC	NC
0	1	1	0
1	0	0	1
0	0	1	1

Asynchronous inputs, direct set (S_D) and direct clear (C_D), override the synchronous inputs; they are independent of all other inputs.

MC852/MC952
MC855/MC955
Dual J-K Flip-Flop



*Q and Q̄ loading factor:
12 – MC852
10 – MC952
11 – MC855
9 – MC955

ASYNCHRONOUS TRUTH TABLE
MC952/MC852 and MC955/MC855

S_D	C_D	Q	$\overline{Q}$
1	1	NC	NC
0	1	1	0
1	0	0	1
0	0	1	1

ASYNCHRONOUS TRUTH TABLE
MC953/MC853 and MC956/MC856

S_D	Q	$\overline{Q}$
1	NC	NC
0	1	0

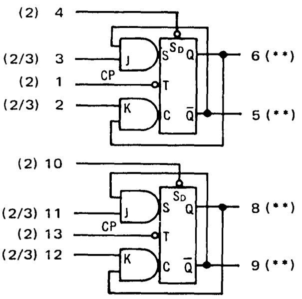
Asynchronous inputs, direct set (S_D) and direct clear (C_D), override the synchronous inputs; they are independent of all other inputs.

J-K TRUTH TABLE
All Types

t_n		t_{n+1}
J	K	Q
0	0	Q_n
1	0	1
0	1	0
1	1	$\overline{Q}_n$

J & K inputs must not change while clock is high.

MC853/MC953
MC856/MC956
Dual J-K Flip-Flop



**Q and Q̄ loading factor:
12 – MC853
10 – MC953
11 – MC856
9 – MC956

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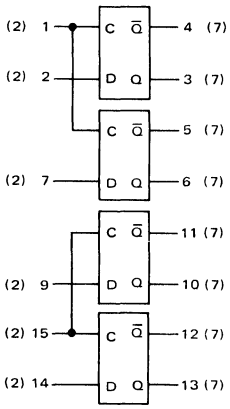
(continued)

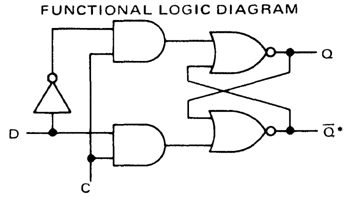
MDTL LOGIC DIAGRAMS

FLIP-FLOPS (continued)

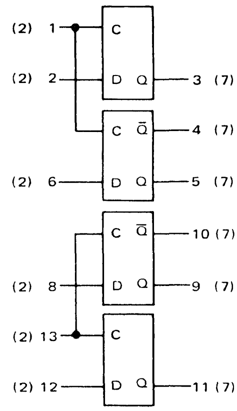
MC1813/MC1913
Quad Latch



FUNCTIONAL LOGIC DIAGRAM



MC1814/MC1914
Quad Latch



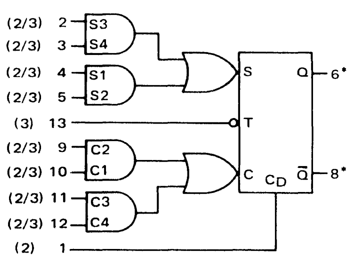
Information present at the Data Input D is transferred to the Q output when the clock is high, and the Q output will follow the state of the Data input as long as the clock remains high. Information present at the Q output will be retained as the clock goes low until such time as the clock is permitted to go high.

TRUTH TABLE

t_n	t_{n+1}	
D	Q	$\bar{Q}$*
1	1	0
0	0	1

*As applicable (see loading diagram)

MC1815/MC1915
MC1816/MC1916
Parallel Gated Clocked Flip-Flop



*Q and $\bar{Q}$ loading factor
12 - MC1815
10 - MC1915
11 - MC1816
9 - MC1916

SYNCHRONOUS TRUTH TABLE

t_n									t_{n+1}
C_D	C3	C4	C1	C2	S3	S4	S1	S2	Q
1	0	0	0	0	0	0	0	0	Q_n
1	1	1	0	0	0	0	0	0	0
1	0	0	1	1	0	0	0	0	0
1	1	1	1	1	0	0	0	0	0
1	0	0	0	0	1	1	0	0	1
1	1	1	0	0	1	1	0	0	U
1	0	0	1	1	1	1	0	0	U
1	1	1	1	1	1	1	0	0	U
1	0	0	0	0	0	0	1	1	1
1	1	1	0	0	0	0	1	1	U
1	0	0	1	1	0	0	1	1	U
1	1	1	1	1	0	0	1	1	U
1	0	0	0	0	1	1	1	1	1
1	1	1	0	0	1	1	1	1	U
1	0	0	1	1	1	1	1	1	U
1	1	1	1	1	1	1	1	1	U

0 — Low State (more negative)
1 — High State (more positive)
NC — No Change
U — Indeterminate State

J-K TRUTH TABLE
(Connect S2 and S4 to $\bar{Q}$, C2 and C4 to Q)

t_n				t_{n+1}
S1	S3	C1	C3	Q
0	0	0	0	Q_n
1	1	0	0	1
0	0	1	1	0
1	1	1	1	$\bar{Q}_n$

ASYNCHRONOUS TRUTH TABLE

C_D	Q	$\bar{Q}$
1	NC	NC
0	0	1

Asynchronous input, direct clear (C_D), overrides the synchronous inputs. Clocked operation will occur only when C_D is in the High State.

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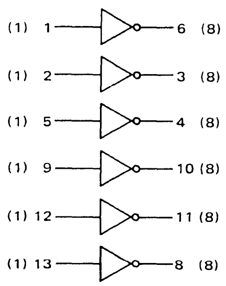
MDTL LOGIC DIAGRAMS

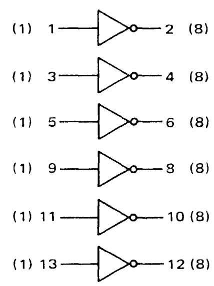
INVERTERS

MC834/MC934
Hex Inverter



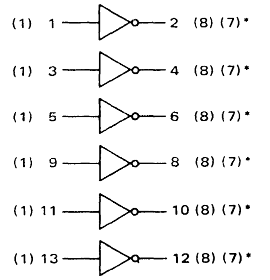
6 = $\overline{1}$

MC835/MC935
Hex Inverter
(Without Output Resistors)



2 = $\overline{1}$

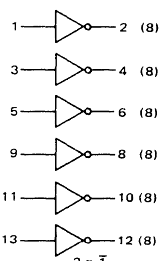
MC836/MC936
MC837/MC937
Hex Inverter



2 = $\overline{1}$

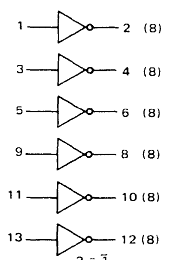
*Applies to MC837/MC937

MC840/MC940
Hex Inverter
(Without Input Diodes)



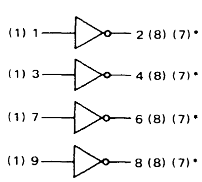
2 = $\overline{1}$

MC841/MC941
Hex Inverter
(Without Output Resistors and Input Diodes)



2 = $\overline{1}$

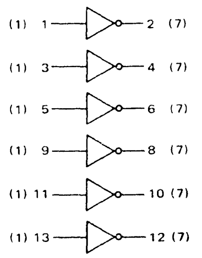
MC846G/MC946G
MC849G/MC949G
Quad Inverter



2 = $\overline{1}$

*Applies to MC849G/MC949G

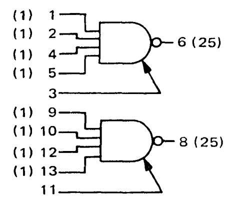
MC1820
High Voltage
Hex Inverter
(Without Output Resistors)



2 = $\overline{1}$

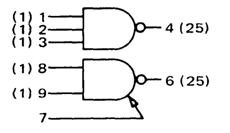
BUFFERS

MC832/MC932
Expandable Dual 4-Input Buffer



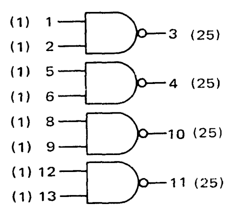
6 = $\overline{1 \cdot 2 \cdot 4 \cdot 5 \cdot [3]}$

MC832G/MC932G
Expandable Dual 3-2 Input Buffer



4 = $\overline{1 \cdot 2 \cdot 3}$

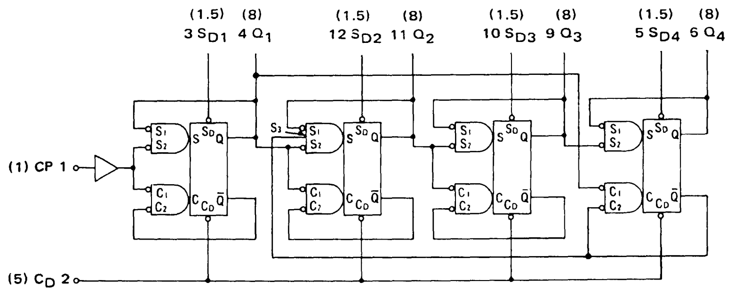
MC857/MC957
Quad 2-Input Buffers



3 = $\overline{1 \cdot 2}$

COUNTERS

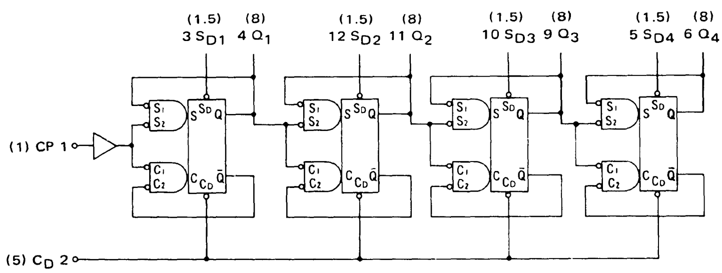
MC838/MC938
Decade Counter



DECODING LOGIC

0	$\bar{Q}_1$	$\bar{Q}_2$	$\bar{Q}_3$	$\bar{Q}_4$
1	Q_1	$\bar{Q}_2$	$\bar{Q}_3$	$\bar{Q}_4$
2	$\bar{Q}_1$	Q_2	$\bar{Q}_3$	
3	Q_1	Q_2	$\bar{Q}_3$	
4	$\bar{Q}_1$	$\bar{Q}_2$	Q_3	
5	Q_1	$\bar{Q}_2$	Q_3	
6	$\bar{Q}_1$	Q_2	Q_3	
7	Q_1	Q_2	Q_3	
8	$\bar{Q}_1$			Q_4
9	Q_1			Q_4

MC839/MC939
Divide-by-Sixteen Counter

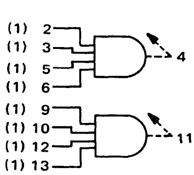


DECODING LOGIC

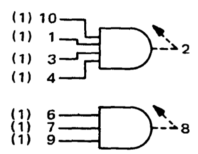
0	$\bar{Q}_1$	$\bar{Q}_2$	$\bar{Q}_3$	$\bar{Q}_4$
1	Q_1	$\bar{Q}_2$	$\bar{Q}_3$	$\bar{Q}_4$
2	$\bar{Q}_1$	Q_2	$\bar{Q}_3$	$\bar{Q}_4$
3	Q_1	Q_2	$\bar{Q}_3$	$\bar{Q}_4$
4	$\bar{Q}_1$	$\bar{Q}_2$	Q_3	$\bar{Q}_4$
5	Q_1	$\bar{Q}_2$	Q_3	$\bar{Q}_4$
6	$\bar{Q}_1$	Q_2	Q_3	$\bar{Q}_4$
7	Q_1	Q_2	Q_3	$\bar{Q}_4$
8	$\bar{Q}_1$	$\bar{Q}_2$	$\bar{Q}_3$	Q_4
9	Q_1	$\bar{Q}_2$	$\bar{Q}_3$	Q_4
10	$\bar{Q}_1$	Q_2	$\bar{Q}_3$	Q_4
11	Q_1	Q_2	$\bar{Q}_3$	Q_4
12	$\bar{Q}_1$	$\bar{Q}_2$	Q_3	Q_4
13	Q_1	$\bar{Q}_2$	Q_3	Q_4
14	$\bar{Q}_1$	Q_2	Q_3	Q_4
15	Q_1	Q_2	Q_3	Q_4

EXPANDERS

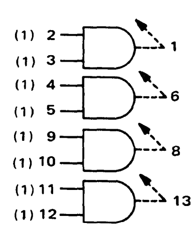
MC833/MC933
Dual 4-Input Expander



MC833G/MC933G
Dual 4-3 Input Expander



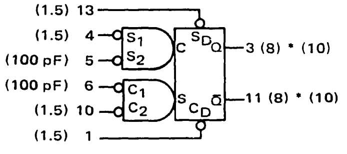
MC847/MC947
Quad 2-Input Gate Expander



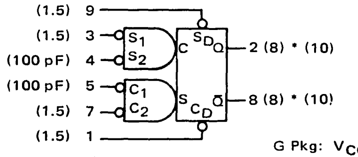
PULSE TRIGGERED BINARY

MC850/MC950
Pulse Triggered Binary

F,L, & P PACKAGES



G PACKAGE



G Pkg: V_{CC} = Pin 10, Gnd = Pin 6

*Applies to MC950

SYNCHRONOUS TRUTH TABLE

t_n				t_{n+1}
S_1	S_2	C_1	C_2	Q
0	0	0	0	U
1	X	1	X	Q_n
X	1	X	1	Q_n
0	1	1	0	Q_n
0	0	X	1	1
0	0	1	X	1
1	X	0	0	0
X	1	0	0	0

ASYNCHRONOUS TRUTH TABLE

S_D	C_D	Q	$\bar{Q}$
1	1	NC	NC
0	1	1	0
1	0	0	1
0	0	1	1

0 = low state (more negative)
1 = high state (more positive)
X = don't care
U = indeterminate state
NC = no change

SINGLE TRIGGER TRUTH TABLE
(Pins S_2 and C_1 tied together)

t_n		t_{n+1}
S_1	C_2	Q
0	0	U
1	0	0
0	1	1
1	1	Q_n

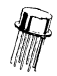
5

MEDIUM POWER INTEGRATED CIRCUITS

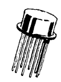
MRTL

MC700 series (+15 to +55°C)
MC800 series (0 to +75 and 0 to +100°C)
MC900 series (-55 to +125°C)

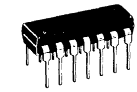
Medium-power MRTL integrated circuits provide a broad line of low-cost, multi-function, digital circuits. Typical gate speed is 12 ns, with power dissipation averages of 19 mW (input high) and 5.0 mW (inputs low) per logic node. Devices from the MC700 Series have loading factors normalized for compatibility with the low-power mW MRTL devices for ease in mixing the two power levels in a system.



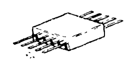
G SUFFIX
METAL PACKAGE
CASE 601
TO-99



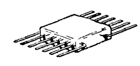
G SUFFIX
METAL PACKAGE
CASE 603-02
TO-100



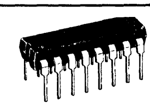
P SUFFIX
PLASTIC PACKAGE
CASE 646
TO-116



F SUFFIX
CERAMIC PACKAGE
CASE 606
TO-91



F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86



P SUFFIX
PLASTIC PACKAGE
CASE 648

5

FUNCTIONS AND CHARACTERISTICS

(V_{CC} = 3.0 V ±10% for MC900 Series and MC800F, G Series; 3.6 V ±10% for MC800P Series and MC700 Series, T_A = 25°C)

Function	Type ① MC700 Series +15 to +55°C	Case	Type ① MC800 Series 0 to +75°C	Case	Type ① MC800 Series 0 to +100°C	Case	Type ① MC900 Series -55 to +125°C	Case	Output Loading Factor Each Output: With mW MRTL	With MRTL	tp ns typ	Total Power Dissipation mW typ: MC700 and MC800P Series	MC800F,G and MC900 Series
Buffer	MC700	601,606			MC800	601,606	MC900	601,606	80	25	20	25/50 ②	16/45 ②
Counter Adapter	MC701	601			MC801	601	MC901	601	16	5	22	80	55
R-S Flip-Flop	MC702	601			MC802	601	MC902	601	13	4	14	32	22
3-Input NOR Gate	MC703	601,606			MC803	601,606	MC903	601,606	16	5	12	28/7.5 ②	19/5.0 ②
Half Adder	MC704	601,606			MC804	601,606	MC904	601,606	16	5	14	65	45
Half-Shift Register	MC705	601,606			MC805	601,606	MC905	601,606	13	4	22	75	53
Half-Shift Register (w/o inverter)	MC706	601,606			MC806	601,606	MC906	601,606	13	4	22	52	36
4-Input NOR Gate	MC707	601,606			MC807	601,606	MC907	601,606	16	5	12	30/7.5 ②	19/5.0 ②
Dual 2-Input NOR Gate	MC714	601,606			MC814	601,606	MC914	601,606	16	5	12	50/15 ②	38/10 ②
Dual 3-Input NOR Gate	MC715	603,606,646	MC815	646	MC815	603,606	MC915	603,606	16	5	12	55/15 ②	38/10 ②
J-K Flip-Flop			MC816	646	MC816	601,606	MC916	601,606	–	3	30	91/79 ③	62/54 ③
J-K Flip-Flop	MC723	601,606,646							10	–	30	91/79 ③	–
Quad 2-Input NOR Gate	MC724,A	607,646	MC824,A	646	MC824	607	MC924	607	16	5	12	100/30 ②	76/20 ②
Dual 4-Input NOR Gate	MC725	607,646	MC825	646	MC825	607	MC925	607	16	5	12	60/15 ②	38/10 ②
J-K Flip-Flop	MC726	603,606,646	MC826	646	MC826	603,606	MC926	603,606	16	5	35	100/86 ③	130/65 ③
Quad Inverter	MC727	603,606			MC827	603,606	MC927	603,606	16	5	12	87/30 ②	76/20 ②
5-Input NOR Gate	MC729	601,606			MC829	603,606	MC929	601,606	16	5	12	33/7.5 ②	19/5.0 ②
Quad Exclusive OR Gate	MC771	607,646	MC871	646	MC871	607	MC971	607	16	5	12	28	72
J-K Flip-Flop	MC774	601			MC874	601	MC974	601	16	5	35	100/86 ③	130/65 ③
Dual Half-Adder	MC775	607,646	MC875	646	MC875	607	MC975	607	16	5	20	120	90
Binary Up Counter	MC777	646	MC877	646					10	3	–	180	–
1 J-K Flip-Flop, 1 Expander, 2 Buffers	MC779	646	MC879	646					–	–	–	141/124 ④	–
Decade Up Counter	MC780	646	MC880	646					10	3	–	250	–
Dual Half-Shift Register	MC783	607,646	MC883	646	MC883	607	MC983	607	13	4	22	140	110
Dual Half-Shift Register (w/inverter)	MC784	607,646	MC884	646	MC884	607	MC984	607	13	4	22	100	75
Quad 2-Input Expander	MC785,A	607,646	MC885,A	646	MC885	607	MC985	607	–	–	12	20/– ②	17/– ②
Dual 4-Input Expander	MC786	607,646	MC886	646	MC886	607	MC986	607	–	–	12	20/– ②	17/– ②
1 J-K Flip-Flop, 1 Inverter, 2 Buffers	MC787	646	MC887	646					–	–	–	138/132 ④	–
Dual 3-Input Buffer, non-inverting	MC788	607,646	MC888	646	MC888	607	MC988	607	80	25	24	145/56 ②	128/42 ②
Hex Inverter	MC789,A	607,646	MC889,A	646	MC889	607	MC989	607	16	5	12	130/15 ②	76/20 ②
Dual J-K Flip-Flop	MC790	607,646	MC890	646	MC890	607	MC990	607	10	3	35	182/158 ③	124/108 ③
Dual J-K Flip-Flop	MC791	607,646	MC891	646	MC891	607	MC991	607	16	5	40	190/160 ③	155/130 ③
Triple 3-Input NOR Gate	MC792	607,646	MC892	646	MC892	607	MC992	607	16	5	12	82/24 ②	57/15 ②
Serial-Parallel Shift Register	MC794	646	MC894	646					16	5	55	225	–
Dual Full Adder	MC796	607,646	MC896	646	MC896	607	MC996	607	16	5	60	225	190
Dual Full Subtractor	MC797	607,646	MC897	646	MC897	607	MC997	607	16	5	60	225	190
Dual Buffer	MC799	603,606,646	MC899	646	MC899	603,606	MC999	603,606	80	25	15	50/90 ②	32/90 ②
Dual 4-Channel Data Selector	MC9701	648	MC9801	648					16	5	25	100	–
Dual J-K Flip-Flop	MC9702	646	MC9802	646					10	3	35	182/158 ③	–
4-Bit Parallel Full Adder	MC9704	648	MC9804	648					6	2	125	265	–
Dual 4-Channel Data Distributor	MC9707	648	MC9807	648					16	5	25	150	–
Quad Schmitt Trigger	MC9709	646	MC9809	646					16	5	30	95	–
Quad 2-Input AND Gate	MC9713	646	MC9813	646					16	5	28	100	–
Quad 2-Input NAND Gate	MC9714	646	MC9814	646					16	5	14 ⑤	145	–
Quad 2 Input OR Gate	MC9715	646	MC9815	646					16	5	14 ⑤	28/100 ②	–
Hex Expander	MC9719,A	607,646	MC9819,A	646	MC9819	607	MC9919	607	–	–	12	13/– ②	13/– ②

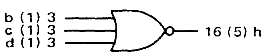
"A" suffix devices have insured capability to drive at least one MTTL load or two MDTL loads
① G Suffix denotes Metal Can, F suffix denotes Flat Package, P suffix denotes Plastic Package.
② Inputs High/Inputs Low
③ Only Clock Inputs High/Inputs Low
④ Only Clock Input high on flip-flop, other element Inputs High/Inputs Low
⑤ Operating Frequency (MHz)

MRTL LOGIC DIAGRAMS

The numbers in parenthesis indicate loading factors for medium-power MRTL devices. The numbers at the end of the terminals indicate the normalized loading factors used for compatability with the low-power mW MRTL devices when mixing the two power levels in a system. Pin numbers vary with the package types. The alpha pin designations shown on the logic diagrams, used in conjunction with the Package Information Table (following the logic diagrams), make it possible to ascertain pin numbers for a specific device and package.

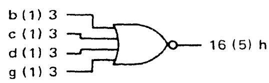
GATES

MC703, MC803, MC903
3-Input NOR Gate



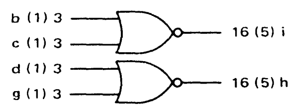
$h = \overline{b + c + d}$

MC707, MC807, MC907
4-Input NOR Gate



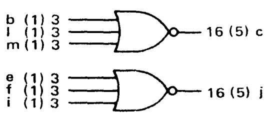
$h = \overline{b + c + d + g}$

MC714, MC814, MC914
Dual 2-Input NOR Gate



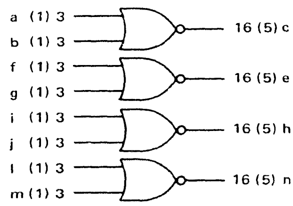
$i = \overline{b + c}$

MC715, MC815, MC915
Dual 3-Input NOR Gate



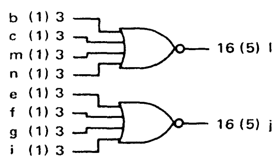
$c = \overline{b + l + m}$

MC724,A, MC824,A, MC924
Quad 2-Input NOR Gate



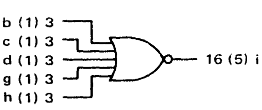
$c = \overline{a + b}$

MC725, MC825, MC925
Dual 4-Input NOR Gate



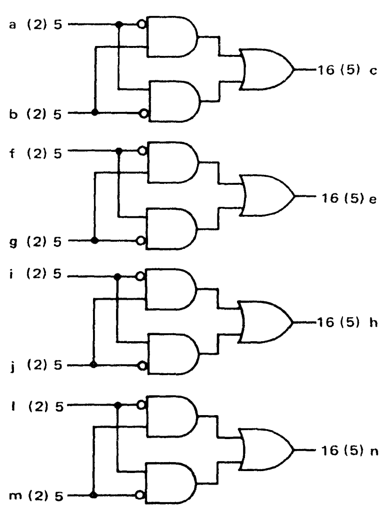
$l = \overline{b + c + m + n}$

MC729, MC829, MC929
5-Input NOR Gate



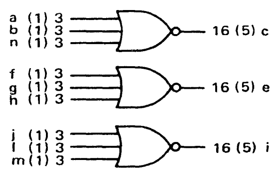
$i = \overline{b + c + d + g + h}$

MC771, MC871, MC971
Quad Exclusive OR Gate



$c = a \bullet \overline{b} + \overline{a} \bullet b$

MC792, MC892, MC992
Triple 3-Input NOR Gate



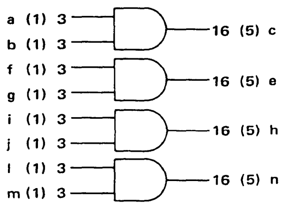
$c = \overline{a + b + d}$

5

(continued)

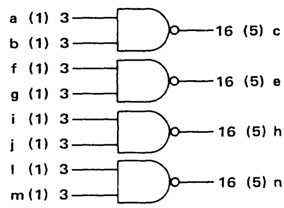
GATES (continued)

MC9713, MC9813
Quad 2-Input AND Gate



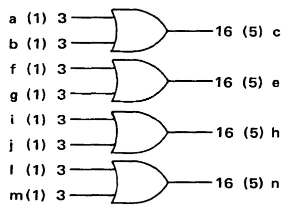
$c = a \bullet b$

MC9714, MC9814
Quad 2-Input NAND Gate



$c = \overline{a \bullet b}$

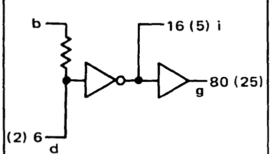
MC9715, MC9815
Quad 2-Input OR Gate



$c = a + b$

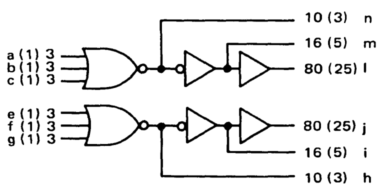
BUFFERS

MC700, MC800, MC900
Buffer



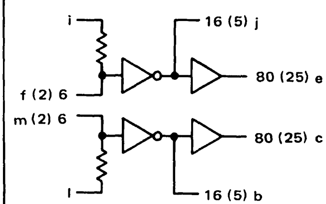
$i = \overline{d}$
$g = \overline{d}$

MC788, MC888, MC988
Dual 3-Input Buffer



$n = \overline{a + b + c}$
$m = a + b + c$
$l = a + b + c$

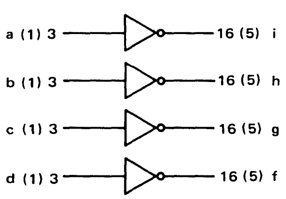
MC799, MC899, MC999
Dual Buffer



$j = \overline{f}$
$e = \overline{f}$

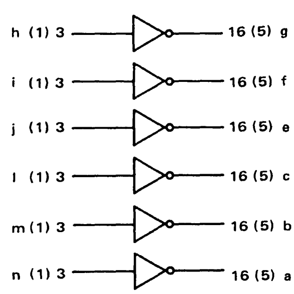
INVERTERS

MC727, MC827, MC927
Quad Inverter



$i = \overline{a}$

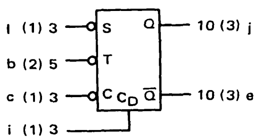
MC789,A, MC889,A, MC989
Hex Inverter



$a = \overline{n}$

FLIP-FLOPS

MC723, MC816, MC916
J-K Flip-Flop

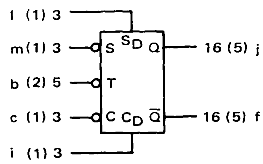


CLOCKED INPUT OPERATION(1)

t_n(2)		t_{n+1}(2)	
S	C	Q	$\overline{Q}$
1	1	Q_n(3)	$\overline{Q}_n$
1	0	1	0
0	1	0	1
0	0	$\overline{Q}_n$	Q_n(3)

1. Direct input (C_D) must be low.
2. The time period prior to the negative transition of the clock pulse is denoted t_n and the time period subsequent to this transition is denoted t_{n+1}.
3. Q_n is the state of the Q output in the time period t_n.

MC726, MC826, MC926
J-K Flip-Flop



CLOCKED INPUT OPERATION(1)

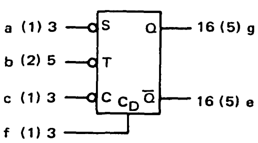
t_n(2)		t_{n+1}(2)	
S	C	Q	$\overline{Q}$
1	1	Q_n(3)	$\overline{Q}_n$
1	0	1	0
0	1	0	1
0	0	$\overline{Q}_n$	Q_n(3)

DIRECT INPUT OPERATION(1)

S_D	C_D	Q	$\overline{Q}$
0	0	(5)	(5)
1	0	1	0
0	1	0	1
1	1	1	1

1. Direct inputs (C_D and S_D) must be low.
2. The time period prior to the negative transition of the clock pulse is denoted t_n and the time period subsequent to this transition is denoted t_{n+1}.
3. Q_n is the state of the Q outout in the time period t_n.
4. Clock (T) to remain unchanged.
5. The output state will not change when the input state goes from $S_D = \overline{C}_D$ to $S_D = C_D = 0$. The output state cannot be predetermined in the case where the input goes from $S_D = C_D = 1$ to $S_D = C_D = 0$.

MC774, MC874, MC974
J-K Flip-Flop

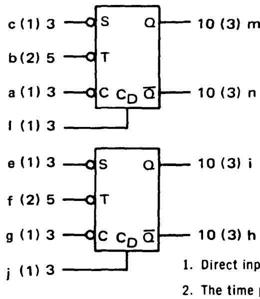


CLOCKED INPUT OPERATION(1)

t_n(2)		t_{n+1}(2)	
S	C	Q	$\overline{Q}$
1	1	Q_n(3)	$\overline{Q}_n$
1	0	1	0
0	1	0	1
0	0	$\overline{Q}_n$	Q_n(3)

1. Direct input (C_D) must be low.
2. The time period prior to the negative transition of the clock pulse is denoted t_n and the time period subsequent to this transition is denoted t_{n+1}.
3. Q_n is the state of the Q output in the time period t_n.

MC790, MC890, MC990
Dual J-K Flip-Flop



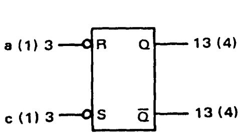
CLOCKED INPUT OPERATION(1)
(each Flip-Flop)

t_n(2)		t_{n+1}(2)	
S	C	Q	$\overline{Q}$
1	1	Q_n(3)	$\overline{Q}_n$
1	0	1	0
0	1	0	1
0	0	$\overline{Q}_n$	Q_n(3)

1. Direct input (C_D) must be low.
2. The time period prior to the negative transition of the clock pulse is denoted t_n and the time period subsequent to this transition is denoted t_{n+1}.
3. Q_n is the state of the Q output in the time period t_n.

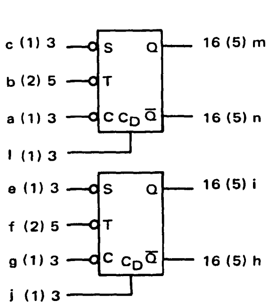
NOTE:
Clock pulse fall time must be within the range of 10 ns to 100 ns on all J-K Flip-Flops except MC926, MC826F, and MC826G which have a range of 10 ns to 200 ns.

MC702, MC802, MC902
R-S Flip-Flop



R	S	Q_{n+1}
0	0	Q_n
0	1	1
1	0	0
1	1	0

MC791, MC891, MC991
Dual J-K Flip-Flop



(continued)

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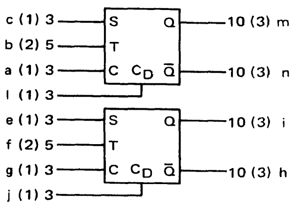
FLIP-FLOPS (continued)

MC9702, MC9802
Dual J-K Flip-Flop



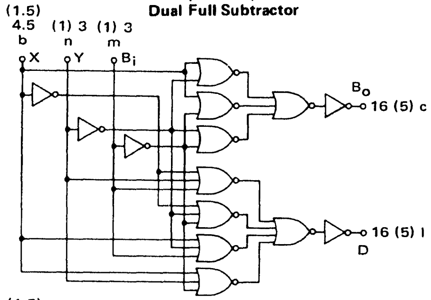
CLOCKED INPUT OPERATION ①

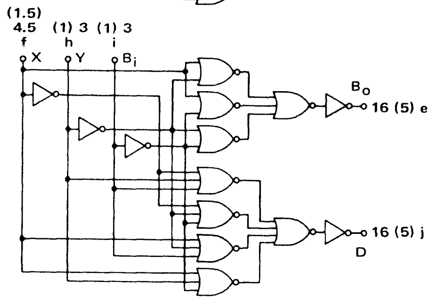
t_n ②		t_{n+1} ②	
S	C	Q	$\bar{Q}$
1	1	Q_n③	$\bar{Q}_n$
1	0	1	0
0	1	0	1
0	0	$\bar{Q}_n$	Q_n③

1. Preclear input (C_D) must be low
2. The time period prior to the negative transition of the clock pulse is denoted t_n and the time period subsequent to this transition is denoted t_{n+1}
3. Q_n is the state of the Q output in the time period t_n.
4. Clock pulse fall time must be <100 ns

FULL SUBTRACTOR

MC797, MC897, MC997
Dual Full Subtractor





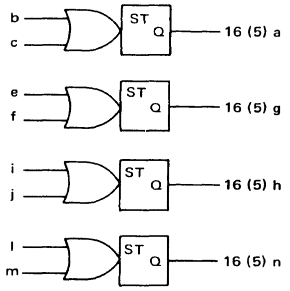
TRUTH TABLE

Input Logic Level			Output Logic Level	
X	Y	B_i	D	B_o
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

$D = YXB_i + \bar{Y}X\bar{B}_i + Y\bar{X}\bar{B}_i + \bar{Y}\bar{X}B_i$
$B_o = \bar{Y}\bar{X}B_i + Y\bar{X}\bar{B}_i + Y\bar{X}B_i + YXB_i$

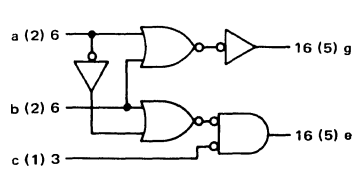
SCHMITT TRIGGER

MC9709, MC9809
Quad Schmitt Trigger



COUNTER ADAPTER

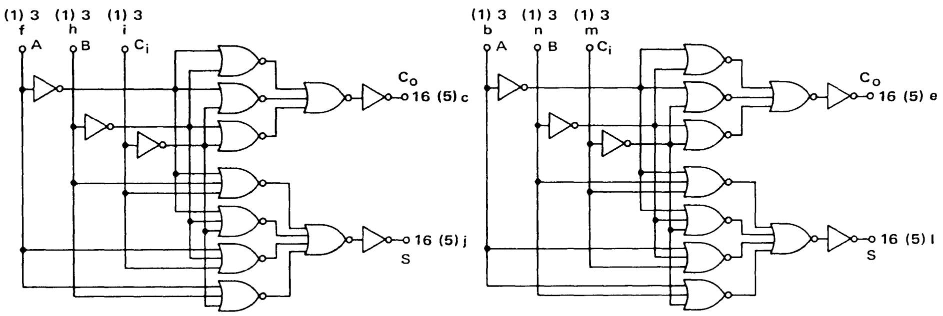
MC701, MC801, MC901
Counter Adapter



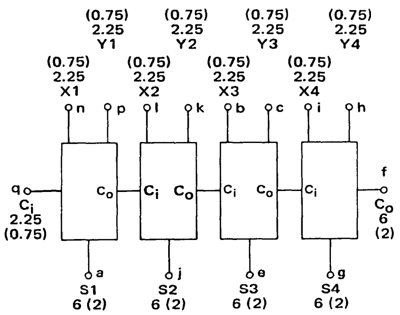
$g = a + b$
$e = (\bar{a} + b)\,\bar{c}$

FULL ADDERS

MC796, MC896, MC996
Dual Full Adder



MC9704, MC9804
4-Bit Parallel Full Adder



$C_o = ABC_i + AB\overline{C}_i + A\overline{B}C_i + \overline{A}BC_i$
$S = ABC_i + A\overline{B}\overline{C}_i + \overline{A}\overline{B}C_i + \overline{A}B\overline{C}_i$

TRUTH TABLE

Input Logic Level			Output Logic Level	
A	B	C_i	S	C_o
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

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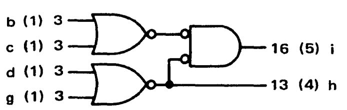
HALF ADDERS

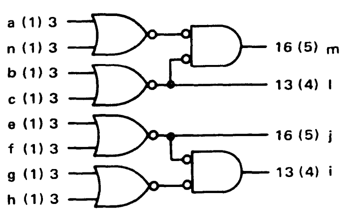
MC704, MC804, MC904
Half Adder



$i = (b + c)\ (d + g)$
$h = \overline{d + g}$

IF: $d = \overline{b}$, & $g = \overline{c}$
THEN: $h = b \bullet c$
$i = b \bullet \overline{c} + \overline{b} \bullet c$

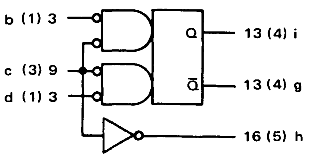
MC775, MC875, MC975
Dual Half Adder



IF: $b = \overline{a}$, & $c = \overline{n}$
THEN: $l = a \bullet n$, & $m = a \bullet \overline{n} + \overline{a} \bullet n$

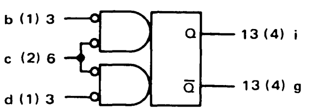
SHIFT REGISTERS

MC705, MC805, MC905
Half-Shift Register



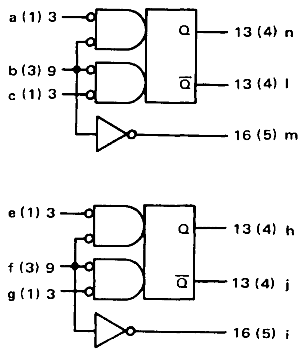
$i = \overline{g}\,(b + c)$
$g = \overline{i}\,(c + d)$

MC706, MC806, MC906
Half-Shift Register
(without inverter)



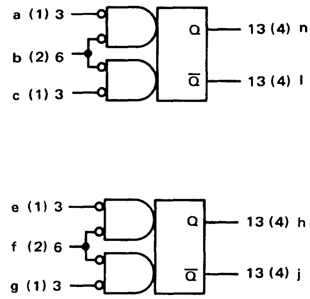
$i = \overline{g}\,(b + c)$
$g = \overline{i}\,(c + d)$

MC783, MC883, MC983
Dual Half-Shift Register



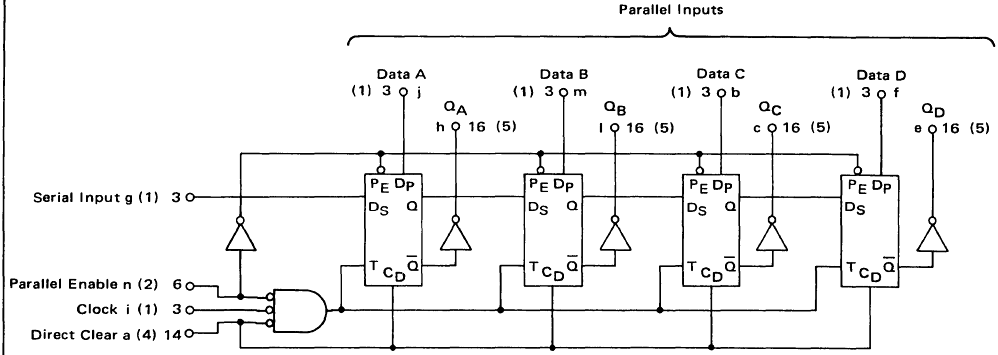
$n = \overline{l}\,(a + b)$
$l = \overline{n}\,(c + b)$

MC784, MC884, MC984
Dual Half-Shift Register
(without inverter)



$n = \overline{l}\,(a + b)$
$l = \overline{n}\,(c + b)$

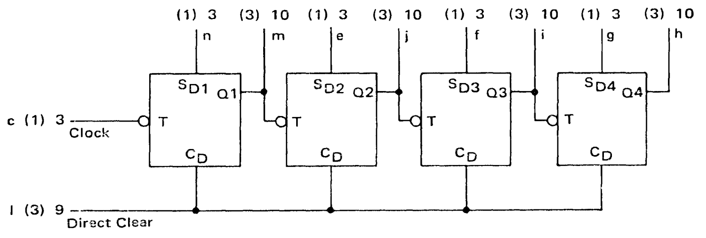
MC794, MC894
Serial-Parallel Shift Register



MRTL LOGIC DIAGRAMS

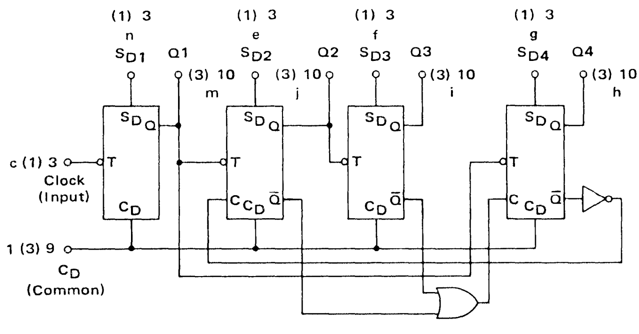
COUNTERS

MC777, MC877
Binary Up Counter



DECODING LOGIC	
0	$\bar{A}\ \bar{B}\ \bar{C}\ \bar{D}$
1	$A\ \bar{B}\ \bar{C}\ \bar{D}$
2	$\bar{A}\ B\ \bar{C}\ \bar{D}$
3	$A\ B\ \bar{C}\ \bar{D}$
4	$\bar{A}\ \bar{B}\ C\ \bar{D}$
5	$A\ \bar{B}\ C\ \bar{D}$
6	$\bar{A}\ B\ C\ \bar{D}$
7	$A\ B\ C\ \bar{D}$
8	$\bar{A}\ \bar{B}\ \bar{C}\ D$
9	$A\ \bar{B}\ \bar{C}\ D$
10	$\bar{A}\ B\ \bar{C}\ D$
11	$A\ B\ \bar{C}\ D$
12	$\bar{A}\ \bar{B}\ C\ D$
13	$A\ \bar{B}\ C\ D$
14	$\bar{A}\ B\ C\ D$
15	$A\ B\ C\ D$

MC780, MC880
Decade Up Counter



DECODING LOGIC

0	$\bar{A}$	$\bar{B}$	$\bar{C}$	$\bar{D}$
1	A	$\bar{B}$	$\bar{C}$	$\bar{D}$
2	$\bar{A}$	B	$\bar{C}$	$\bar{D}$
3	A	B	$\bar{C}$	$\bar{D}$
4	$\bar{A}$	$\bar{B}$	C	$\bar{D}$
5	A	$\bar{B}$	C	$\bar{D}$
6	$\bar{A}$	B	C	$\bar{D}$
7	A	B	C	$\bar{D}$
8	$\bar{A}$	$\bar{B}$	$\bar{C}$	D
9	A	$\bar{B}$	$\bar{C}$	D

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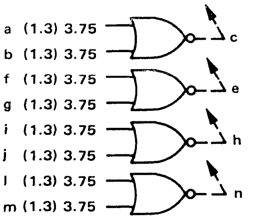
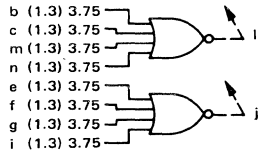
EXPANDERS

MC785,A, MC885,A, MC985
Quad 2-Input Expander



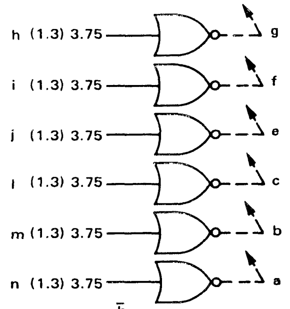
c = $\overline{a + b}$

MC786, MC886, MC986
Dual 4-Input Expander



l = $\overline{b + c + m + n}$

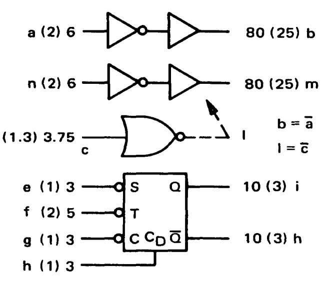
MC9719,A, MC9819,A, MC9919
Hex Expander



g = $\overline{h}$

MULTIFUNCTION DEVICES

MC779, MC879
(1 J-K Flip-Flop, 1 Expander, 2 Buffers)

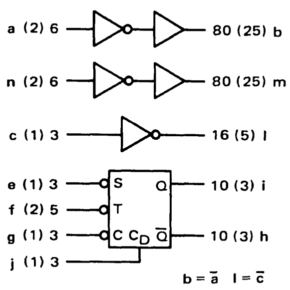


CLOCKED INPUT OPERATION①

t_n②		t_{n+1}②	
S	C	Q	$\bar{Q}$
1	1	Q_n③	$\bar{Q}_n$
1	0	1	0
0	1	0	1
0	0	$\bar{Q}_n$	Q_n③

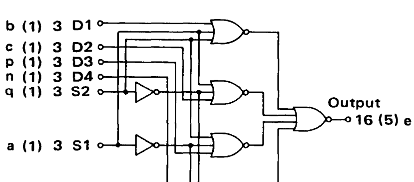
1. Direct input (C_D) must be low.
2. The time period prior to the negative transition of the clock pulse is denoted t_n and the time period subsequent to this transition is denoted t_{n+1}.
3. Q_n is the state of the Q output in the time period t_n.

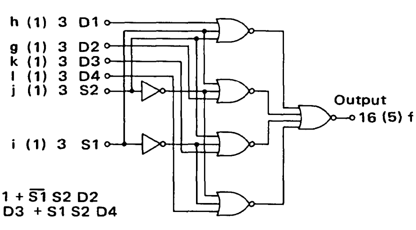
MC787, MC887
(1 J-K Flip-Flop, 1 Inverter, 2 Buffers)



DATA ROUTING FUNCTIONS

MC9701, MC9801
Dual 4-Channel Data Selector



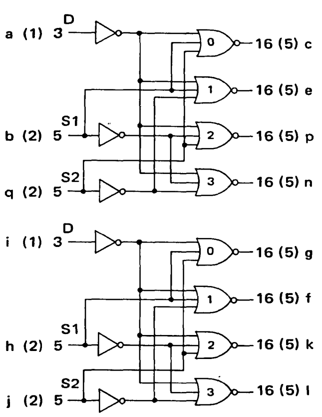


$\text{Output} = \bar{S1}\ \bar{S2}\ D1 + \bar{S1}\ S2\ D2 + S1\ \bar{S2}\ D3 + S1\ S2\ D4$

TRUTH TABLE

Input Select		Data Line
S1	S2	Selected
0	0	D1
0	1	D2
1	0	D3
1	1	D4

MC9707, MC9807
Dual 4-Channel Date Distributor



$c = a \cdot \bar{b} \cdot \bar{q}$

$e = a \cdot \bar{b} \cdot q$

$p = a \cdot b \cdot \bar{q}$

$n = a \cdot b \cdot q$

$g = i \cdot \bar{h} \cdot \bar{j}$

$f = i \cdot \bar{h} \cdot j$

$k = i \cdot h \cdot \bar{j}$

$l = i \cdot h \cdot j$

TRUTH TABLE

	INPUTS			OUTPUTS			
	D	S1	S2	0	1	2	3
Pin Numbers	a i	b h	q j	c g	e f	p k	n l
Level	0	*	*	0	0	0	0
	1	0	0	1	0	0	0
	1	0	1	0	1	0	0
	1	1	0	0	0	1	0
	1	1	1	0	0	0	1

*Either state.

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MRTL INTEGRATED CIRCUITS

MAXIMUM RATINGS ($T_A = 25^oC$)

Rating	Symbol	Value	Unit
Input Voltage	–	±4	Vdc
Power Supply Voltage (Pulsed ≤ 1 second)	–	+12	Vdc
Operating Temperature Range MC900 Series MC800F,G Series MC800P Series MC700 Series	T_A	 –55 to +125 0 to +100 0 to +75 +15 to +55	^oC
Storage Temperature Range Metal Can, Flat Package Plastic Package	T_{stg}	 –65 to +150 –55 to +125	^oC

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INSTRUCTIONS FOR USE OF PACKAGE INFORMATION TABLE

MC900, MC800, and MC700 Series Medium-Power MRTL devices are available in the packages pictured in the following table as indicated on the line following each device type number. Plastic packaged devices are available in the MC700/800 Series only.

Pin numbers for any of the following devices and packages may be determined by:

1. Find the device among the logic diagrams appearing on the preceding pages (grouped by function). Note the alpha pin designations for the device.
2. Find the device type number in the left hand columns of the "Package Information Table".
3. The letters in the columns following the type number and below the drawing of the desired package indicate the correct pin numbers for the specific package by their numbered positions beneath the package drawing. (These letters are the same as indicated on the logic diagram for the device.)
4. Notes: Blanks in an area following the type number and directly beneath a package indicate the device is not available in that package.
   A dash indicates this pin or lead is not connected nor otherwise utilized for this device and package.
   * indicates this pin number is the ground connection for this device and package.
   # indicates this pin number is the V_{CC} connection for this device and package.

PACKAGE INFORMATION TABLE

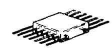
(See instructions on preceding page.)

P SUFFIX
PLASTIC PACKAGES

CASE 648
(16 pin)

CASE 646
TO-116
(14 pin)

F SUFFIX
CERAMIC PACKAGES



CASE 607
TO-86
(14 pin)

CASE 606
TO-91
(10 pin)

G SUFFIX
METAL PACKAGES

CASE 603-02
TO-100
(10 pin)

CASE 601
TO-99
(8 pin)

P SUFFIX – PLASTIC PACKAGES

Type No.		Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MC700	MC800	MC900																
MC701	MC801	MC901																
MC702	MC802	MC902																
MC703	MC803	MC903																
MC704	MC804	MC904																
MC705	MC805	MC905																
MC706	MC806	MC906																
MC707	MC807	MC907																
MC714	MC814	MC914																
MC715	MC815	MC915	–	b	c	*	e	f	–	–	i	j	#	l	m	n		
–	MC816	MC916	–	b	c	*	e	–	–	–	i	j	#	l	–	–		
MC723	–	–	–	b	c	*	e	–	–	–	i	j	#	l	–	–		
MC724,A	MC824,A	MC924	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC725	MC825	MC925	–	b	c	*	e	f	g	–	i	j	#	l	m	n		
MC726	MC826	MC926	–	b	c	*	–	f	–	–	i	j	#	l	n	–		
MC727	MC827	MC927																
MC729	MC829	MC929																
MC771	MC871	MC971	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC774	MC874	MC974																
MC775	MC875	MC975	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC777	MC877	–	–	–	c	*	e	f	g	h	i	j	#	l	m	n		
MC779	MC879	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC780	MC880	–	–	–	c	*	e	f	g	h	i	j	#	l	m	n		
MC783	MC883	MC983	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC784	MC884	MC984	a	b	c	*	e	f	g	h	–	j	#	l		n		
MC785,A	MC885,A	MC985	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC786	MC886	MC986	–	b	c	*	e	f	g	–	i	j	#	l	m	n		
MC787	MC887	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC788	MC888	MC988	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC789,A	MC889,A	MC989	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC790	MC890	MC990	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC791	MC891	MC991	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC792	MC892	MC992	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC794	MC894	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC796	MC896	MC996	–	b	c	*	e	f	–	h	i	j	#	l	m	n		
MC797	MC897	MC997	–	b	c	*	e	f	–	h	i	j	#	l	m	n		
MC799	MC899	MC999	–	b	c	*	e	f	–	–	i	j	#	l	m	–		
MC9701	MC9801	–	a	b	c	*	e	f	g	h	i	j	k	l	#	n	p	q
MC9702	MC9802	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC9704	MC9804	–	a	b	c	*	e	f	g	h	i	j	k	l	#	n	p	q
MC9707	MC9807	–	a	b	c	*	e	f	g	h	i	j	k	l	#	n	p	q
MC9709	MC9809	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC9713	MC9813	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC9714	MC9814	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC9715	MC9815	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC9719,A	MC9819,A	MC9919	a	b	c	*	e	f	g	h	i	j	#	l	m	n		

F SUFFIX – CERAMIC PACKAGES

Type No.		Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MC700	MC800	MC900	–	b	–	d	*	–	g	–	i	#				
MC701	MC801	MC901														
MC702	MC802	MC902														
MC703	MC803	MC903	–	b	c	d	*	–	–	h	–	#				
MC704	MC804	MC904	–	b	c	d	*	–	g	h	i	#				
MC705	MC805	MC905	–	b	c	d	*	–	g	h	i	#				
MC706	MC806	MC906	–	b	c	d	*	–	g	–	i	#				
MC707	MC807	MC907	–	b	c	d	*	–	g	h	–	#				
MC714	MC814	MC914	–	b	c	d	*	–	g	h	i	#				
MC715	MC815	MC915	b	l	m	c	*	e	f	i	j	#				
–	MC816	MC916	–	l	b	c	*	–	e	i	j	#				
MC723	–	–	–	l	b	c	*	–	e	i	j	#				
MC724,A	MC824,A	MC924	a	b	c	f	g	e	*	h	i	j	n	l	m	#
MC725	MC825	MC925	l	b	c	–	m	n	*	e	f	g	–	i	j	#
MC726	MC826	MC926	l	m	b	c	*	–	f	i	j	#				
MC727	MC827	MC927	a	b	c	d	*	f	g	h	i	#				
MC729	MC829	MC929	–	b	c	d	*	–	g	h	i	#				
MC771	MC871	MC971	a	b	c	f	g	e	*	h	i	j	n	l	m	#
MC774	MC874	MC974														
MC775	MC875	MC975	l	n	a	n	b	c	*	g	h	e	f	j	i	#
MC777	MC877	–														
MC779	MC879	–														
MC780	MC880	–														
MC783	MC883	MC983	n	m	l	c	b	a	*	e	f	g	j	i	h	#
MC784	MC884	MC984	l	–	n	a	b	c	*	e	f	g	j	–	h	#
MC785,A	MC885,A	MC985	a	b	c	f	g	e	*	h	i	j	n	l	m	#
MC786	MC886	MC986	l	b	c	–	m	n	*	e	f	g	–	i	j	#
MC787	MC887	–														
MC788	MC888	MC988	l	m	n	a	b	c	*	e	f	g	h	i	j	#
MC789,A	MC889,A	MC989	h	i	j	e	f	g	*	a	b	c	l	m	n	#
MC790	MC890	MC990	l	m	n	a	b	c	*	e	f	g	h	i	j	#
MC791	MC891	MC991	l	m	n	a	b	c	*	e	f	g	h	i	j	#
MC792	MC892	MC992	l	m	a	b	n	c	*	e	f	g	h	i	j	#
MC794	MC894	–														
MC796	MC896	MC996	j	i	h	–	f	c	*	e	b	–	n	m	l	#
MC797	MC897	MC997	l	m	n	–	b	c	*	e	f	–	h	i	j	#
MC799	MC899	MC999	i	f	j	e	*	c	m	l	b	#				
MC9701	MC9801	–														
MC9702	MC9802	–														
MC9704	MC9804	–														
MC9707	MC9807	–														
MC9709	MC9809	–														
MC9713	MC9813	–														
MC9714	MC9814	–														
MC9715	MC9815	–														
MC9719,A	MC9819,A	MC9919	h	i	j	e	f	g	*	a	b	c	l	m	n	#

G SUFFIX – METAL PACKAGES

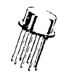
Type No.		Pin No.	1	2	3	4	5	6	7	8	9	10
MC700	MC800	MC900	b	–	d	*	g	–	i	#		
MC701	MC801	MC901	a	b	c	*	e	–	g	#		
MC702	MC802	MC902	a	–	c	*	e	–	g	#		
MC703	MC803	MC903	b	c	d	*	–	h	–	#		
MC704	MC804	MC904	b	c	d	*	g	h	i	#		
MC705	MC805	MC905	b	c	d	*	g	h	i	#		
MC706	MC806	MC906	b	c	d	*	g	–	i	#		
MC707	MC807	MC907	b	c	d	*	g	h	–	#		
MC714	MC814	MC914	b	c	d	*	g	h	i	#		
MC715	MC815	MC915	b	l	m	c	*	e	f	i	j	#
–	MC816	MC916	l	b	c	*	e	i	j	#		
MC723	–	–	l	b	c	*	e	i	j	#		
MC724,A	MC824,A	MC924										
MC725	MC825	MC925										
MC726	MC826	MC926	l	m	b	c	*	–	f	i	j	#
MC727	MC827	MC927	a	b	c	d	*	f	g	h	i	#
MC729	MC829	MC929	b	c	d	*	g	h	i	#		
MC771	MC871	MC971										
MC774	MC874	MC974	a	b	c	*	e	f	g	#		
MC775	MC875	MC975										
MC777	MC877	–										
MC779	MC879	–										
MC780	MC880	–										
MC783	MC883	MC983										
MC784	MC884	MC984										
MC785,A	MC885,A	MC985										
MC786	MC886	MC986										
MC787	MC887	–										
MC788	MC888	MC988										
MC789,A	MC889,A	MC989										
MC790	MC890	MC990										
MC791	MC891	MC991										
MC792	MC892	MC992										
MC794	MC894	–										
MC796	MC896	MC996										
MC797	MC897	MC997										
MC799	MC899	MC999	i	f	j	e	*	c	m	l	b	#
MC9701	MC9801	–										
MC9702	MC9802	–										
MC9704	MC9804	–										
MC9707	MC9807	–										
MC9709	MC9809	–										
MC9713	MC9813	–										
MC9714	MC9814	–										
MC9715	MC9815	–										
MC9719,A	MC9819,A	MC9919										

5

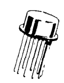
mW MRTL INTEGRATED CIRCUITS mW MRTL

MC708 series (+15 to +55°C)
MC808 series (0 to +75°C)
MC908 series (−55 to +125°C)

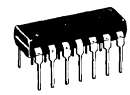
Low-power mW MRTL integrated circuits are designed for use where minimal system power consumption is desired. Typical gate speed is 27 ns, with typical power dissipation of 6.5 mW (input high) and 0.5 mW (inputs low) per logic node. Devices from the MC708 Series can be mixed with devices from the medium-power MC700 Series which has loading factors normalized for compatibility.



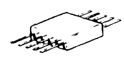
G SUFFIX
METAL PACKAGE
CASE 601
TO-99



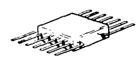
G SUFFIX
METAL PACKAGE
CASE 603-02
TO-100



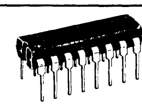
P SUFFIX
PLASTIC PACKAGE
CASE 646
TO-116



F SUFFIX
CERAMIC PACKAGE
CASE 606
TO-91



F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86



P SUFFIX
PLASTIC PACKAGE
CASE 648

FUNCTIONS AND CHARACTERISTICS

(V_{CC} = 3.0 V ± 10% for MC908 Series, 3.6 V ± 10% for MC808 Series and MC708 Series; T_A = 25°C)

Function	Type ① MC708 Series +15 to +55°C	Type ① MC808 Series 0 to +75°C	Case	Type ① MC908 Series -55 to +125°C	Case	Output Loading Factor Each Output All Series	tp ns typ	Total Power Dissipation mW typ/pkg MC708 Series & MC808 Series	Total Power Dissipation mW typ/pkg MC908 Series
Half Adder	MC708	MC808	601,606	MC908	601,606	4	60	19/12.5 ②	14/8.5 ②
2-Input Buffer	MC709	MC809	601,606	MC909	601,606	30	57	7.0/23 ②	5.5/16 ②
Dual 2-Input NOR Gate	MC710	MC810	601,606	MC910	601,606	4	27	10/2.5 ②	8.0/1.0 ②
4-Input OR/NOR Gate	MC711	MC811	601,606	MC911	601,606	4	60	8.0/5.5 ②	6.0/3.5 ②
Half Adder	MC712	MC812	601,606	MC912	601,606	4	66	15.5/10.5 ②	11.5/5.5 ②
Type D Flip-Flop	MC713	MC813	601,606	MC913	601,606	3	75	24/17.5 ③	17.5/13 ③
Quad 2-Input NOR Gate	MC717	MC817	607,646	MC917	607	4	27	20/5.0 ②	16/2.5 ②
Dual 3-Input NOR Gate	MC718	MC818	603,606,646	MC918	603,606	4	27	12/2.5 ②	9.5/1.0 ②
Dual 4-Input NOR Gate	MC719	MC819	607,646	MC919	607	4	27	13/2.5 ②	11/1.0 ②
J-K Flip-Flop	MC720	MC820	601,606	MC920	601,606	2	50	20.5/14.5 ④	15.5/10 ④
Dual 2-Input Gate Expander	MC721	MC821	601,606	MC921	601,606	–	27	3.0/– ②	3.0/– ②
J-K Flip-Flop	MC722	MC822	603,606,646	MC922	603,606	4	70	24/20 ④	17.5/13 ④
5-Input NOR Gate	MC728	MC828	601,606	MC928	601,606	4	27	7.5/1.0 ②	6.5/0.5 ②
Dual Exclusive OR/NOR Gate	MC764	MC864	646	–	–	4	–	25	–
Quad Latch	MC767,A	MC867,A	648	–	–	9	50	110	–
BCD-To-Decimal Decoder	MC770	MC870	648	–	–	7	36	100/– ②	–
Dual J-K Flip-Flop	MC776	MC876	607,646	MC976	607	2	50	41/29 ④	31/20 ④
Dual Type D Flip-Flop	MC778	MC878	607,646	MC978	607	3	60	48/35 ③	35/26 ③
Dual Buffer	MC781	MC881	601	MC981	601	30	57	14/46 ②	11/32 ②
J-K Flip-Flop	MC782	MC882	601	MC982	601	2	80	23/21 ④	15/13 ④
Triple 3-Input NOR Gate	MC793	MC893	607,646	MC993	607	4	27	18/3.5 ②	14/2.0 ②
Dual 2-Input Buffer	MC798	MC898	607,646	MC998	607	30	57	14/46 ②	11/32 ②
Hex Inverter	MC9718	MC9818	646	–	–	4	27	7.0/3.0 ②	–
Hex Expander	MC9720	MC9820	646	–	–	–	12	30/– ②	–
Quad 2-Input Expander	MC9721	MC9821	607,646	MC9921	607	–	27	20/– ②	20/– ②
Dual J-K Flip-Flop	MC9722	MC9822	646	–	–	4	75	24/– ④	–
Quad 2-Input AND Gate	MC9723	MC9823	646	–	–	4	50	12 ⑤	–
Quad 2-Input NAND Gate	MC9724	MC9824	646	–	–	4	50	20/5.0 ②	–
Quad 2-Input OR Gate	MC9725	MC9825	646	–	–	4	50	–/7.0 ②	–

"A" suffix devices have insured capability to drive at least one MTTL load or two MDTL loads.
① G suffix denotes Metal Can, F suffix denotes Flat Package, P suffix denotes Plastic Package.
② Inputs High/Inputs Low unless otherwise noted.
③ Direct Set and Direct Clear Low, All other Inputs High/All Inputs Low.
④ Only Clock Input High/All Inputs Low.
⑤ One Input High/One Input Low.

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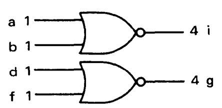
mW MRTL LOGIC DIAGRAMS

The numbers at the end of the terminals indicate loading factors for low-power mW MRTL devices. Pin numbers vary with the package types. The alpha pin designations shown on the logic diagrams, used in conjunction with the Package Information Table (following the logic diagrams), make it possible to ascertain pin numbers for a specific device and package.

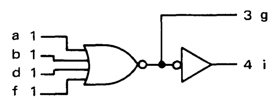
GATES

MC710, MC810, MC910
Dual 2-Input NOR Gate



$i = \overline{a + b}$

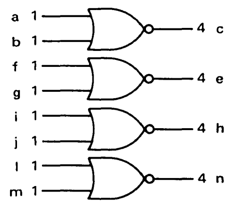
MC711, MC811, MC911
4-Input OR/NOR Gate



$g = \overline{a + b + d + f}$

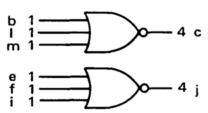
$i = a + b + d + f$

MC717, MC817, MC917
Quad 2-Input NOR Gate



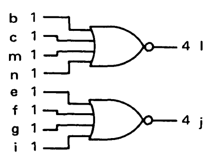
$c = \overline{a + b}$

MC718, MC818, MC918
Dual 3-Input NOR Gate



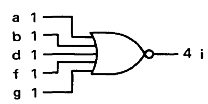
$c = \overline{b + l + m}$

MC719, MC819, MC919
Dual 4-Input NOR Gate



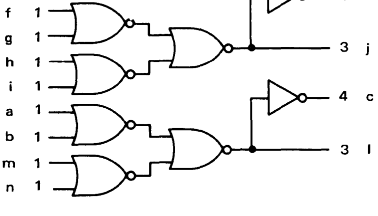
$l = \overline{b + c + m + n}$

MC728, MC828, MC928
5-Input NOR Gate



$i = \overline{a + b + d + f + g}$

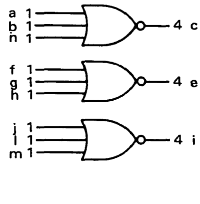
MC764, MC864
Dual Exclusive OR-NOR Gate



$l = (a + b) \cdot (m + n)$

$c = \bar{a} \cdot \bar{b} + \bar{m} \cdot \bar{n}$

MC793, MC893, MC993
Triple 3-Input NOR Gate



$c = \overline{a + b + n}$

(continued)

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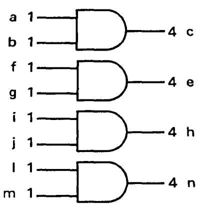
mW MRTL LOGIC DIAGRAMS

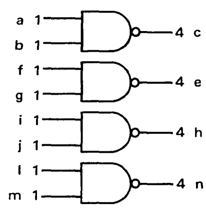
GATES (continued)

MC9723, MC9823
Quad 2-Input AND Gate



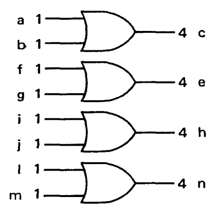
$c = a \bullet b$

MC9724, MC9824
Quad 2-Input NAND Gate



$c = \overline{a \bullet b}$

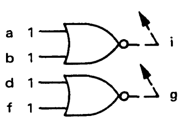
MC9725, MC9825
Quad 2-Input OR Gate



$c = a + b$

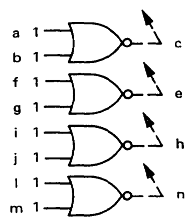
EXPANDERS

MC721, MC821, MC921
Dual 2-Input Expander



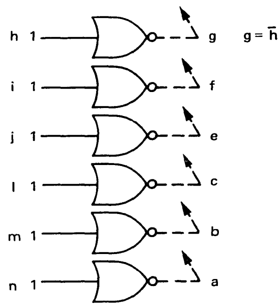
$i = \overline{a + b}$

MC9721, MC9821, MC9921
Quad 2-Input Expander



$c = \overline{a + b}$

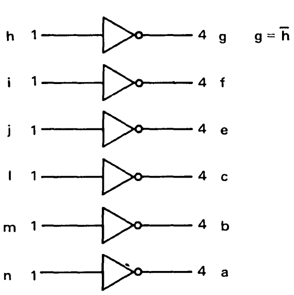
MC9720, MC9820, MC9920
Hex Expander



$g = \overline{h}$

INVERTER

MC9718, MC9818, MC9918
Hex Inverter

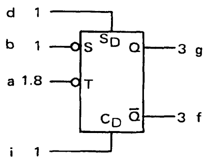


$g = \overline{h}$

5

FLIP-FLOPS

MC713, MC813, MC913
Type D Flip-Flop



DIRECT INPUT OPERATION ①

SD	CD	Q	Q̄
0	0	②	②
1	0	1	0
0	1	0	1
1	1	0	0

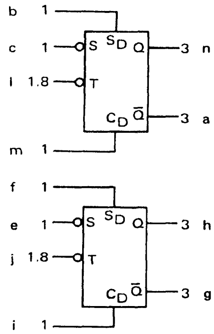
CLOCKED INPUT OPERATION ①

t_n	t_{n+1}	
S	Q	Q̄
1	1	0
0	0	1

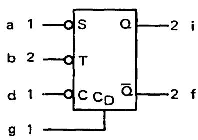
1. Clock (T input) must be high.
2. The output state will not change when the input state goes from $S_D = \bar{C}_D$ to $S_D = C_D = 0$. The output state cannot be predetermined in the case where the input goes from $S_D = C_D = 1$ to $S_D = C_D = 0$.
3. Direct inputs (S_D and C_D) must be low.

0 = low state
1 = high state
t_n = time period prior to negative transition of clock pulse
t_{n+1} = time period subsequent to negative transition of clock pulse

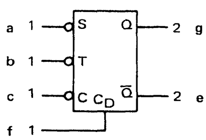
MC778, MC878, MC978
Dual Type D Flip-Flop



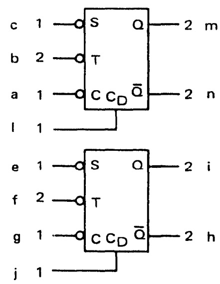
MC720, MC820, MC920
J-K Flip-Flop



MC782, MC882, MC982
J-K Flip-Flop



MC776, MC876, MC976
Dual J-K Flip-Flop



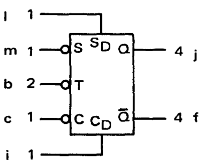
CLOCKED INPUT OPERATION

t_n		t_{n+1}	
S	C	Q	Q̄
1	1	Q_n	$\bar{Q}_n$
1	0	1	0
0	1	0	1
0	0	$\bar{Q}_n$	Q_n

Direct input (C_D) must be low.
0 = low state
1 = high state
t_n = time period prior to negative transition of clock pulse.
t_{n+1} = time period subsequent to negative transition of clock pulse.
Q_n = state of Q output in time period t_n.

NOTE: Clock pulse fall time must be within the range of 10 ns to 100 ns on all J-K Flip-Flops.

MC722, MC822, MC922
J-K Flip-Flop



DIRECT INPUT OPERATION ①

SD	CD	Q	Q̄
0	0	②	②
1	0	1	0
0	1	0	1
1	1	0	0

CLOCKED INPUT OPERATION ③

t_n		t_{n+1}	
S	C	Q	Q̄
1	1	Q_n	$\bar{Q}_n$
1	0	1	0
0	1	0	1
0	0	$\bar{Q}_n$	Q_n

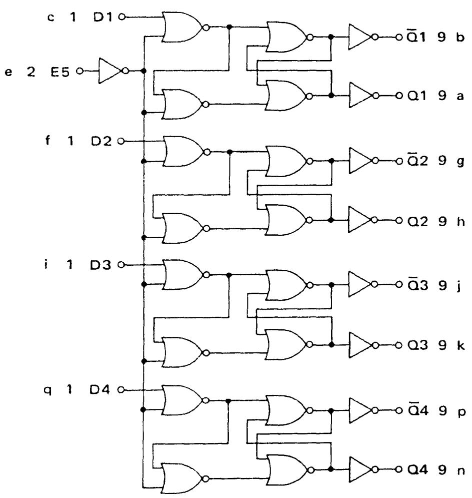
1. Clock (T) to remain unchanged.
2. The output state will not change when the input state goes from $S_D = \bar{C}_D$ to $S_D = C_D = 0$. The output state cannot be predetermined in the case where the input goes from $S_D = C_D = 1$ to $S_D = C_D = 0$.
3. Direct inputs (S_D and C_D) must be low.

0 = low state
1 = high state
t_n = time period prior to negative transition of clock pulse
t_{n+1} = time period subsequent to negative transition of clock pulse
Q_n = state of Q output in time period t_n

(continued)

FLIP-FLOPS (continued)

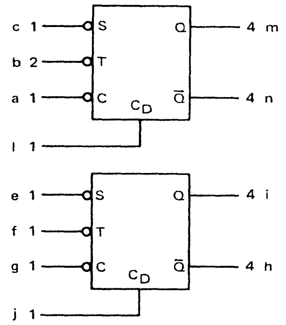
MC767,A, MC867,A
Quad Latch



TRUTH TABLE

E	D	Q_{n+1}	$\bar{Q}_{n+1}$
0	0	Q_n	$\bar{Q}_n$
0	1	Q_n	$\bar{Q}_n$
1	0	0	1
1	1	1	0

MC9722, MC9822
Dual J-K Flip-Flop



CLOCKED INPUT OPERATION ①

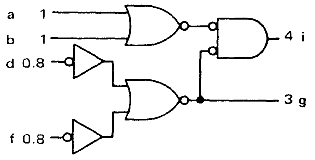
t_n ②		t_{n+1} ②	
S	C	Q	$\bar{Q}$
1	1	Q_n ③	$\bar{Q}_n$
1	0	1	0
0	1	0	1
0	0	$\bar{Q}_n$	Q_n ③

1. Direct input (C_D) must be low.
2. The time period prior to the negative transition of the clock pulse is denoted t_n and the time period subsequent to this transition is denoted t_{n+1}.
3. Q_n is the state of the Q output in the time period t_n.

5

HALF ADDERS

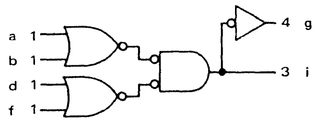
MC708, MC808, MC908
Half Adder



$i = (a + b)\,(\bar{d} + \bar{f})$

$g = \overline{\bar{d} + \bar{f}}$

MC712, MC812, MC912
Half Adder

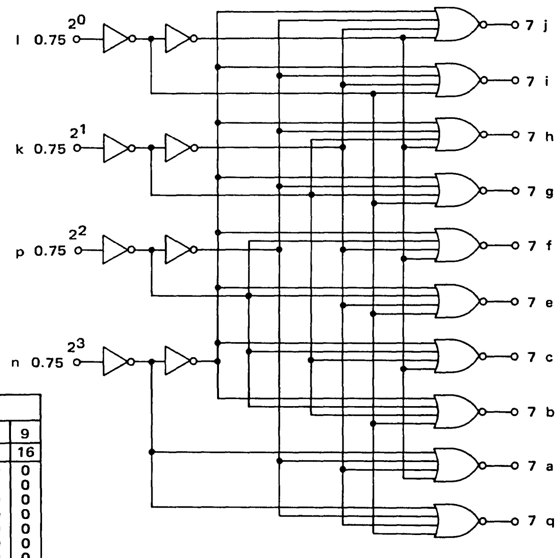


$g = \bar{a} \bullet \bar{b} + \bar{d} \bullet \bar{f}$

$i = (a + b)(d + f)$

DECODER

MC770, MC870
BCD-to-Decimal Decoder



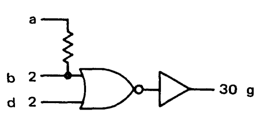
TRUTH TABLE

	INPUT (BCD)				OUTPUT (DECIMAL)									
Value	2^3	2^2	2^1	2^0	0	1	2	3	4	5	6	7	8	9
Pin No.	14	15	11	12	10	9	8	7	6	5	3	2	1	16
Logic Level	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	0	0	0	1	0	1	0	0	0	0	0	0	0	0
	0	0	1	0	0	0	1	0	0	0	0	0	0	0
	0	0	1	1	0	0	0	1	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	1	0	0	0	0	0
	0	1	0	1	0	0	0	0	0	1	0	0	0	0
	0	1	1	0	0	0	0	0	0	0	1	0	0	0
	0	1	1	1	0	0	0	0	0	0	0	1	0	0
	1	0	0	0	0	0	0	0	0	0	0	0	1	0
	1	0	0	1	0	0	0	0	0	0	0	0	0	1
	1	0	1	0	0	0	0	0	0	0	0	0	0	0
	1	0	1	1	0	0	0	0	0	0	0	0	0	0
	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	0	1	0	0	0	0	0	0	0	0	0	0
	1	1	1	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	0	0	0	0	0	0	0	0	0	0

5

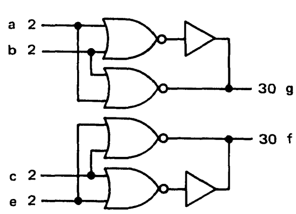
BUFFERS

MC709, MC809, MC909
Buffer



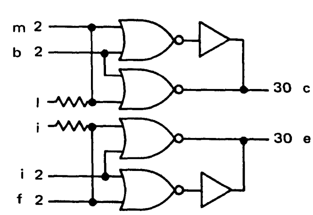
$g = \overline{b + d}$

MC781, MC881, MC981
Dual Buffers



$g = \overline{a + b}$

MC798, MC898, MC998
Dual Buffers



$c = \overline{b + m}$

mW MRTL INTEGRATED CIRCUITS

INSTRUCTIONS FOR USE OF PACKAGE INFORMATION TABLE

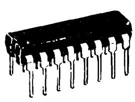
MC908, MC808, and MC708 Series Low-Power mW MRTL devices are available in the packages pictured in the following table as indicated on the line following each device type number. Plastic packaged devices are available in the MC708/808 Series only.

Pin numbers for any of the following devices and packages may be determined by:

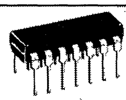
1. Locate the device as shown in the logic diagrams appearing on the preceding pages (grouped by function). Note the alpha pin designations for the device.
2. Find the device type number in the left hand columns of the "Package Information Table".
3. The letters in the columns following the type number and below the drawing of the desired package indicate the correct pin numbers for the specific package by their numbered positions beneath the package drawing. (These letters are the same as indicated on the logic diagram for the device.)
4. Notes: Blanks in an area following the type number and directly beneath a package indicate the device is not available in that package.
   A dash indicates this pin or lead is not connected nor otherwise utilized for this device and package.
   * indicates this pin number is the ground connection for this device and package.
   # indicates this pin number is the V_{CC} connection for this device and package.

PACKAGE INFORMATION TABLE

P SUFFIX PLASTIC PACKAGES



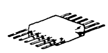
CASE 648 (16 pin)



CASE 648 TO-116 (14 pin)

Type No.		Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MC708	MC808	MC908																
MC709	MC809	MC909																
MC710	MC810	MC910																
MC711	MC811	MC911																
MC712	MC812	MC912																
MC713	MC813	MC913																
MC717	MC817	MC917	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC718	MC818	MC918	–	b	c	*	e	f	–	–	i	j	#	l	m	–		
MC719	MC819	MC919	–	b	c	*	e	f	g	–	i	j	#	l	m	n		
MC720	MC820	MC920																
MC721	MC821	MC921																
MC722	MC822	MC922	–	b	c	*	–	f	–	–	i	j	#	l	m	–		
MC728	MC828	MC928																
		Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MC764	MC864	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC767,A	MC867,A	–	a	b	c	*	e	f	g	h	i	j	k	–	#	n	p	q
MC770	MC870	–	a	b	c	*	e	f	g	h	i	j	k	l	#	n	p	q
MC776	MC876	MC976	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC778	MC878	MC978	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC781	MC881	MC981																
MC782	MC882	MC982																
MC793	MC893	MC993	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC798	MC898	MC998	–	b	c	*	e	f	–	–	i	j	#	l	m	–		
MC9718	MC9818	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC9720	MC9820	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC9721	MC9821	MC9921	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC9722	MC9822	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC9723	MC9823	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC9724	MC9824	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		
MC9725	MC9825	–	a	b	c	*	e	f	g	h	i	j	#	l	m	n		

F SUFFIX CERAMIC PACKAGES



CASE 607 TO-86 (14 pin)

CASE 606 TO-91 (10 pin)

Type No.		Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MC708	MC808	MC908	a	b	–	d	*	f	g	–	i	#				
MC709	MC809	MC909	a	b	–	d	*	–	g	–	–	#				
MC710	MC810	MC910	a	b	–	d	*	f	g	–	i	#				
MC711	MC811	MC911	a	b	–	d	*	f	g	–	i	#				
MC712	MC812	MC912	a	b	–	d	*	f	g	–	i	#				
MC713	MC813	MC913	a	b	–	d	*	f	g	–	i	#				
MC717	MC817	MC917	a	b	c	f	g	e	*	h	i	j	n	l	m	#
MC718	MC818	MC918	b	l	m	e	*	f	i	j	c	#				
MC719	MC819	MC919	l	b	c	–	m	n	*	e	f	g	–	i	j	#
MC720	MC820	MC920	a	b	–	d	*	f	g	–	i	#				
MC721	MC821	MC921	a	b	–	d	*	f	g	–	i	#				
MC722	MC822	MC922	l	m	b	c	*	–	f	i	j	#				
MC728	MC828	MC928	a	b	–	d	*	f	g	–	i	#				
		Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MC764	MC864	–														
MC767,A	MC867,A	–														
MC770	MC870	–														
MC776	MC876	MC976	l	m	n	a	b	c	*	e	f	g	h	i	j	#
MC778	MC878	MC978	l	m	n	a	b	c	*	e	f	g	h	i	j	#
MC781	MC881	MC981														
MC782	MC882	MC982														
MC793	MC893	MC993	a	b	f	g	h	e	*	i	j	l	m	c	n	#
MC798	MC898	MC998	l	m	–	–	b	c	*	e	j	–	–	i	f	#
MC9718	MC9818	–														
MC9720	MC9820	–														
MC9721	MC9821	MC9921	a	b	c	f	g	e	*	h	i	j	n	l	m	#
MC9722	MC9822	–														
MC9723	MC9823	–														
MC9724	MC9824	–														
MC9725	MC9825	–														

G SUFFIX METAL PACKAGES

CASE 603-02 TO-100 (10 pin)

CASE 601 TO-99 (8 pin)

Type No.		Pin No.	1	2	3	4	5	6	7	8	9	10
MC708	MC808	MC908	a	b	d	*	f	g	i	#		
MC709	MC809	MC909	a	b	d	*	–	g	–	#		
MC710	MC810	MC910	a	b	d	*	f	g	i	#		
MC711	MC811	MC911	a	b	d	*	f	g	i	#		
MC712	MC812	MC912	a	b	d	*	f	g	i	#		
MC713	MC813	MC913	a	b	d	*	f	g	i	#		
MC717	MC817	MC917										
MC718	MC818	MC918	b	l	m	c	*	e	f	i	j	#
MC719	MC819	MC919										
MC720	MC820	MC920	a	b	d	*	f	g	i	#		
MC721	MC821	MC921	a	b	d	*	f	g	i	#		
MC722	MC822	MC922	l	m	b	c	*	–	f	i	j	#
MC728	MC828	MC928	a	b	d	*	f	g	i	#		
		Pin No.	1	2	3	4	5	6	7	8	9	10
MC764	MC864	–										
MC767,A	MC867,A	–										
MC770	MC870	–										
MC776	MC876	MC976										
MC778	MC878	MC978										
MC781	MC881	MC981	a	b	c	*	e	f	g	#		
MC782	MC882	MC982	a	b	c	*	e	f	g	#		
MC793	MC893	MC993										
MC798	MC898	MC998										
MC9718	MC9818	–										
MC9720	MC9820	–										
MC9721	MC9821	MC9921										
MC9722	MC9822	–										
MC9723	MC9823	–										
MC9724	MC9824	–										
MC9725	MC9825	–										

MAXIMUM RATINGS (T_A = +25°C)

Rating	Symbol	Value	Unit
Input Voltage	–	±4	Vdc
Power Supply Voltage (Pulsed ≦ 1 second)	–	+12	Vdc
Operating Temperature Range MC908 Series MC808 Series MC708 Series	T_A	 −55 to +125 0 to +75 +15 to +55	°C
Storage Temperature Range Metal Packages, Flat Packages Plastic Packages	T_{stg}	 −65 to +150 −55 to +125	°C

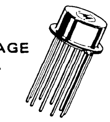
5

MOS

INTEGRATED CIRCUITS

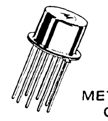
MOS

MC1100 Series Metal Gate, High-Threshold P-Channel MOS
MC2200 Series Metal Gate, Low-Threshold P-Channel MOS
MC2300 Series Silicon Gate, Low-Threshold P-Channel MOS

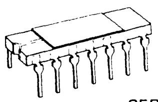


G SUFFIX
METAL PACKAGE
CASE 602A

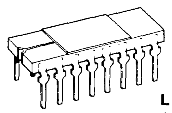
Motorola's MOS monolithic integrated circuits provide low-cost, high-complexity logic in functional blocks. These devices utilize the high component density and simplified processing available with the MOS technology.



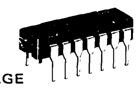
G SUFFIX
METAL PACKAGE
CASE 619-02



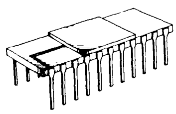
L SUFFIX
CERAMIC PACKAGE
CASE 637



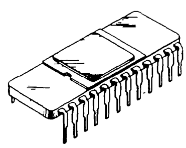
L SUFFIX
CERAMIC PACKAGE
CASE 638



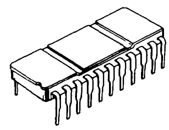
L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116



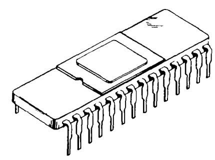
L SUFFIX
CERAMIC PACKAGE
CASE 677



L SUFFIX
CERAMIC PACKAGE
CASE 684



L SUFFIX
CERAMIC PACKAGE
CASE 694



L SUFFIX
CERAMIC PACKAGE
CASE 695

5

FUNCTIONS AND CHARACTERISTICS

Function	Type	Temperature	Case	Comments
High-Threshold, Metal Gate				
Triple 66-Bit Dynamic Shift Register	MC1141G	0 to +75°C	602A	Operating frequency = 10 kHz to 1.0 MHz, power dissipation = 1.0 mW/bit @ 1.0 MHz.
200-Bit Dynamic Shift Register	MC1142G	0 to +55°C	619-02	Operating frequency = 10 kHz to 1.0 MHz, power dissipation = 1.0 mW/bit @ 1.0 MHz.
8-Channel Multiplex Switch	MC1150L	0 to +75°C	638	High on/off resistance ratio, zero offset voltage, all channel blanking.
Dual 1-of-4 Channel Multiplex Switch	MC1151L	0 to +75°C	638	High on/off resistance ratio, zero offset voltage, all channel blanking.
General-Purpose Logic Element	MC1155L	0 to +75°C	632	Can be externally connected to form a variety of NAND, NOR and functional gate configurations.
Dual 100-Bit Static Shift Register	MC1160G	-55 to +85°C	602A	Operating frequency = dc to 2.0 MHz, non-inverting buffered outputs, independent input/output lines.
Dual 50-Bit Static Shift Register	MC1161G	-55 to +85°C	602A	Operating frequency = dc to 2.0 MHz, non-inverting buffered outputs, independent input/output lines.
Frequency Divider	MC1180L	0 to +70°C	632	Six stages of binary division; particularly suited for tone generation in electronic organs.
Resettable Rhythm Counter	MC1181L	0 to +70°C	620	Asynchronous binary counter designed for driving the count-address inputs of a rhythm generator.
Frequency Synthesizer	MC1183L	0 to +70°C	632	Provides the C9 thru G8 and C8 portions of the top octave synthesizer function for tone generation in electronic organ applications.
Frequency Synthesizer	MC1184L	0 to +70°C	632	Provides the F #8 thru C #8 portion of the top octave synthesizer function for tone generation in electronic organ applications.
2048-Bit Read Only Memory	MCM1110L	-25 to +85°C	684	Mask-programmable static ROM; may be organized as 512 words of 4 bits or 256 words of 8 bits. Output devices may be open drain for use with TTL devices or with pulldown resistors for use with other MOS devices.
2048-Bit Hollerith-to-ASCII Converter	MCM1111L	-25 to +85°C	684	Pre-programmed MCM1110L; 256 words of 8 bits, pulldown resistors in output buffer for compatibility with MOS devices.
2048-Bit Hollerith-to-ASCII Converter	MCM1112L	-25 to +85°C	684	Same as MCM1111L except open-drain output buffers for TTL compatibility.

(continued)

FUNCTIONS AND CHARACTERISTICS (continued)

Function	Type	Temperature	Case	Comments
High-Threshold, Metal Gate				
2240-Bit Read Only Memory	MCM1120L	-25 to +85°C	684 or 695	Mask-programmable static character generator ROM; 64 characters of 35 bits (5X7), seven address inputs, three row select inputs, and chip enable input. Open-drain or push-pull output buffers.
2240-Bit Row Select USASCII Character Generator	MCM1121L	-25 to +85°C	695	Pre-programmed MCM1120L; push-pull output buffers are MOS compatible.
2240-Bit Row Select USASCII Character Generator	MCM1122L	-25 to +85°C	695	Same as MCM1121L except open-drain output buffers that sink 1.6 mA minimum for TTL and DTL compatibility; can be wire ORed for memory expansion.
2240-Bit Read Only Memory	MCM1130L	-25 to +85°C	684 or 695	Mask-programmable static character generator ROM; 64 characters of 35 bits (5X7) or 32 characters of 70 bits (5X14), seven address inputs, five column select inputs, and chip enable input. Open-drain output buffers for TTL compatibility.
2240-Bit Column Select USASCII Character Generator	MCM1131L	-25 to +85°C	684	Pre-programmed MCM1130L; 64 characters of 35 bits (5X7).
2240-Bit Column Select USASCII Character Generator	MCM1132L	-25 to +85°C	695	Same as MCM1131L except only six address inputs and different package.
4096-Bit Read Only Memory	MCM1140L	-25 to +85°C	684	Mask-programmable static ROM; 512 words of 8 bits or 1024 words of 4 bits. Output buffers open-drain or with pulldown resistors.
4096-Bit Read Only Memory	MCM1141L	-25 to +85°C	684	Pre-programmed MCM1140L, 512 words of 8 bits, open-drain output buffers.
2560-Bit Read Only Memory	MCM1150L	-25 to +85°C	684	Mask-programmable static ROM; 512 words of 5 bits or 256 words of 10 bits. Output buffers open-drain or with pulldown resistors.
2560-Bit Read Only Memory	MCM1151L	-25 to +85°C	684	Pre-programmed MCM1150L; 256 words of 10 bits, open-drain output buffers, programmed for ASCII-to-Selectric and Selectric-to-ASCII code conversion.
64-Bit Random Access Memory	MCM1170L	0 to +75°C	637	Binary addressing, enable line for address expansion, single-phase clock, organized as 16 four-bit words.
1024-Bit Dynamic Random Access Memory	MCM1172L	0 to +70°C	694	Organized as 1024 one-bit words; power dissipation = 75 μW/bit, access time ≤350 ns, read cycle time ≥ 535 ns, write cycle time ≥860 ns.
1024-Bit Dynamic Random Access Memory	MCM1173L	0 to +70°C	684	Same as MCM1172L except package.
1024-Bit Dynamic Random Access Memory	MCM1175L	0 to +70°C	677	Organized as 1024 one-bit words; access time = 150 ns typ, read cycle time = 250 ns typ, write cycle time = 250 ns typ.
Low-Threshold, Metal Gate				
General-Purpose Logic Element	MC2255L	0 to +75°C	632	Can be externally connected to form a variety of NAND, NOR, and functional gate configurations.
Terminal Transmitter	MC2257L	0 to +75°C	684	Synchronous/asynchronous data communications adapter. Accepts parallel binary data in the form of characters and serially transmits the data to a modem.
Terminal Receiver	MC2259L	0 to +75°C	695	Synchronous/asynchronous data communications adapter that receives serial digital data from a modem, organizes the data into fixed word lengths corresponding to characters, and transfers these characters to a buffer register from which the character may be accessed in a parallel format.
Low Threshold, Silicon Gate				
Dual 100-Bit Shift Register	MC2360G	-55 to +85°C	602A	Operating frequency = dc to 5.0 MHz
Dual 128-Bit Shift Register	MC2361G	-55 to +85°C	602A	Operating frequency = dc to 5.0 MHz.
Dual 250-Bit Shift Register	MC2362G	-55 to +85°C	602A	Operating frequency = dc to 5.0 MHz.
Dual 256-Bit Shift Register	MC2363G	-55 to +85°C	602A	Operating frequency = dc to 5.0 MHz.
Dual 100-Bit Dynamic Shift Register	MC2380G	-55 to +125°C	619-02	Operating frequency guaranteed to 3 MHz, 0.4 mW/bit power dissipation @ 1 MHz, 40 pF clock input capacitance, open drain output devices.
Dual 100-Bit Dynamic Shift Register	MC2381G	-55 to +125°C	619-02	Same as MC2380G except pulldown resistor on output device.

Selectric is a registered trademark of IBM

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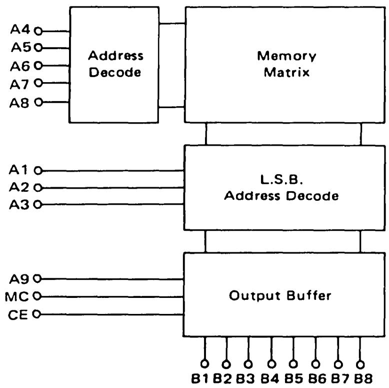
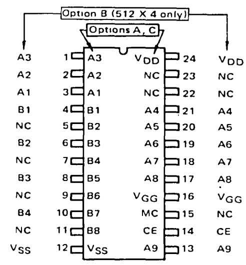
MEMORIES

MCM1110L
2048-Bit Read Only Memory

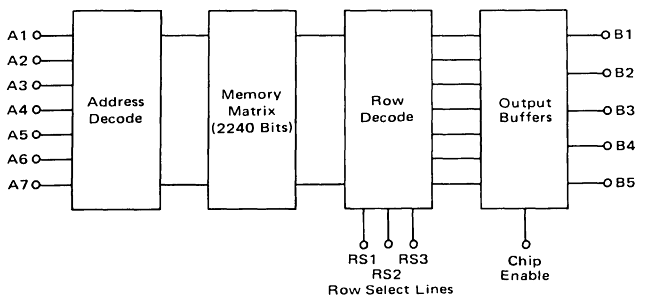
MCM1111L, MCM1112L
2048-Bit Hollerith-to-ASCII Converters

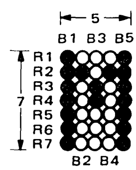




MCM1120L
2240-Bit Read Only Memory

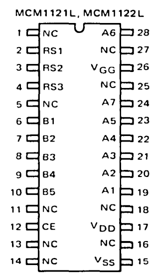
MCM1121L, MCM1122L
2240-Bit Row Select USASCII Character Generator





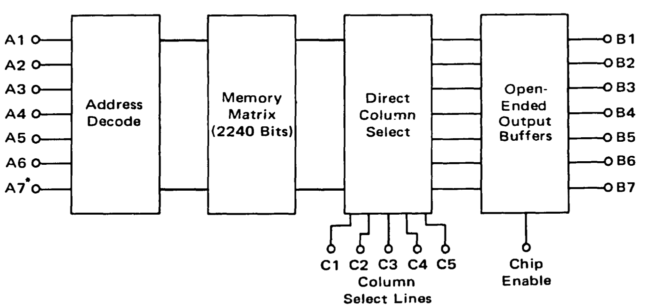
OUTPUT AND ROW SELECT ASSIGNMENTS

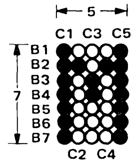
See MCM1120L data sheet for pin-out options.



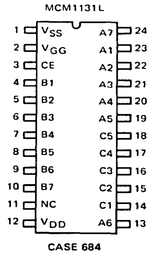
MCM1130L
2240-Bit Read Only Memory

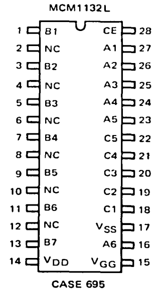
MCM1131L, MCM1132L
2240-Bit Column Select USASCII Character Generator





OUTPUT AND COLUMN SELECT ASSIGNMENTS





*Available on MCM1130L and MCM1131L only.

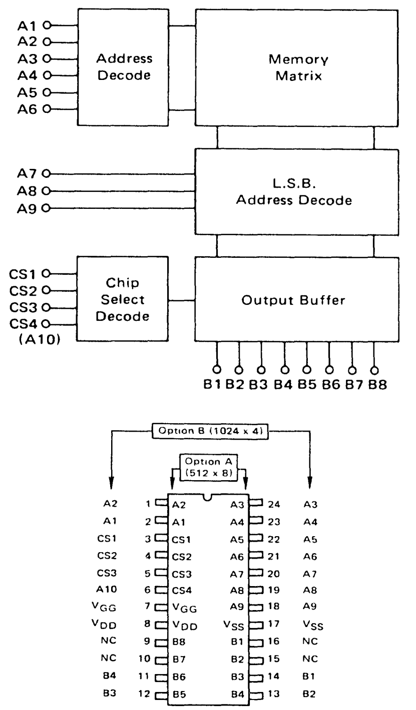
See MCM1130L data sheet for pin-out options.

(continued)

MEMORIES (continued)

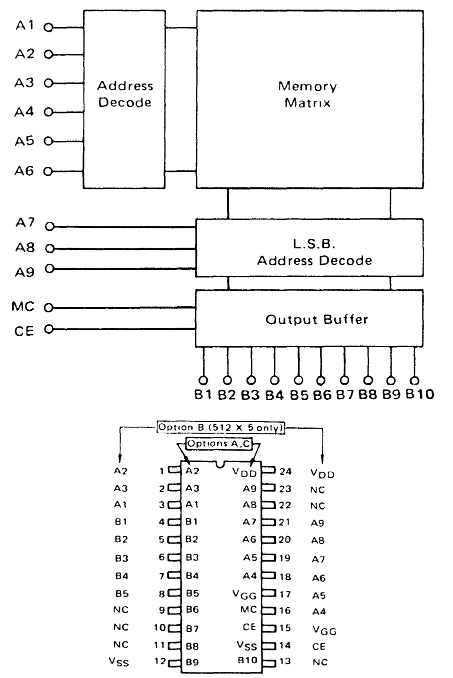
MCM1140L
4096-Bit Read Only Memory

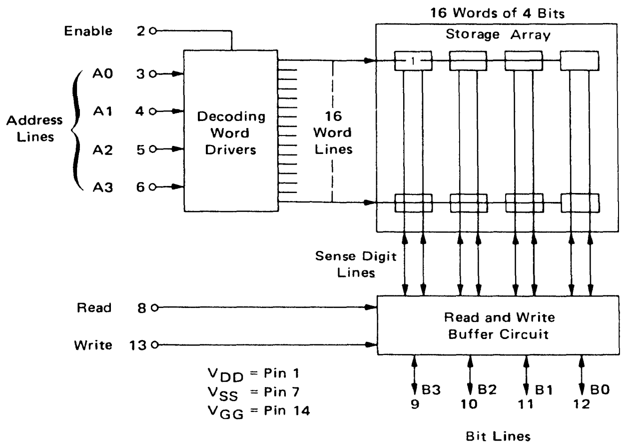
MCM1141L
4096-Bit Read Only Memory



MCM1150L
2560-Bit Read Only Memory

MCM1151L
ASCII-to-Selectric and Selectric-to-ASCII Code Converter



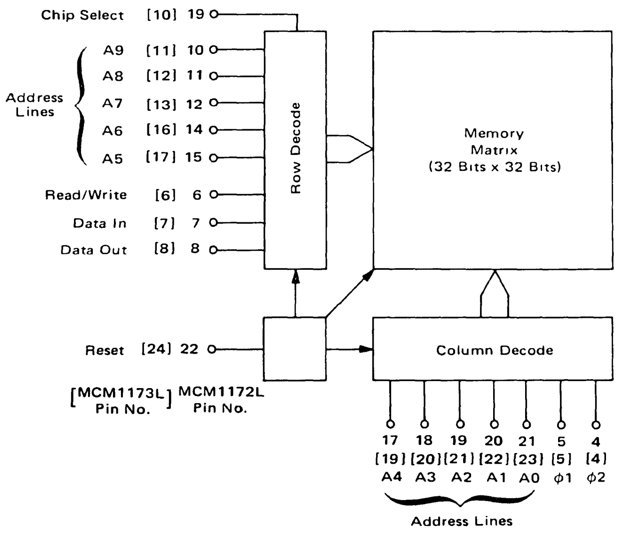


MCM1170L
64-Bit Random Access Memory

(continued)

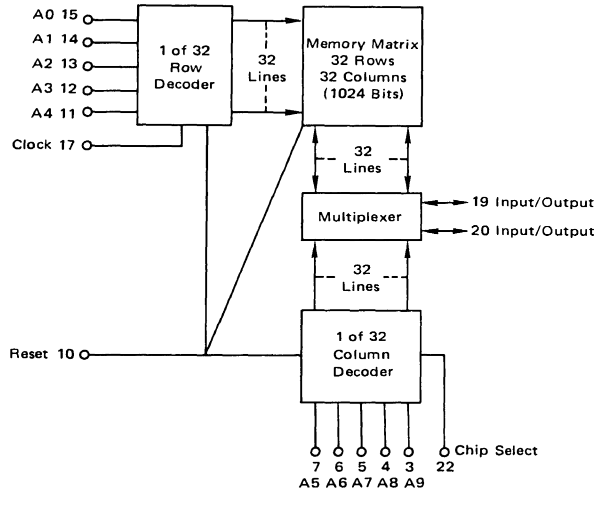
MEMORIES (continued)

MCM1172L, MCM1173L
1024-Bit Dynamic Random Access Memory



V_{DD} = Pin 16 [18]
V_{SS} = Pin 2 [3]
V_{SX} = Pin 1 [1]

MCM1175L
1024-Bit Dynamic Random Access Memory

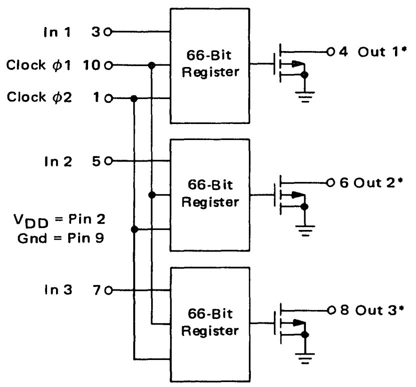


V_{SS} = Pin 2
V_{SX} = Pin 1
V_{DD1} = Pin 9
V_{DD2} = Pin 21

5

SHIFT REGISTERS

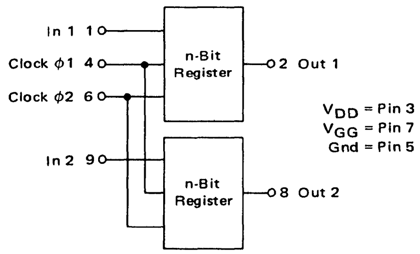
MC1141G
Triple 66-Bit Dynamic Shift Register



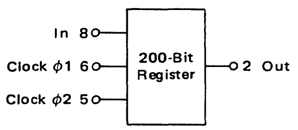
*13.3 kilohm external resistor to load supply.

MC1160G
Dual 100-Bit Static Shift Register

MC1161G
Dual 50-Bit Static Shift Register



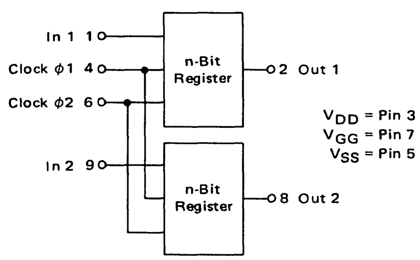
MC1142G
200-Bit Dynamic Shift Register



V_{DD} = Pin 1
V_{SS} = Pin 4

MC2360G
Dual 100-Bit Static Shift Register

MC2361G
Dual 128-Bit Static Shift Register



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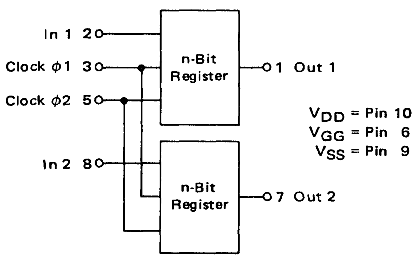
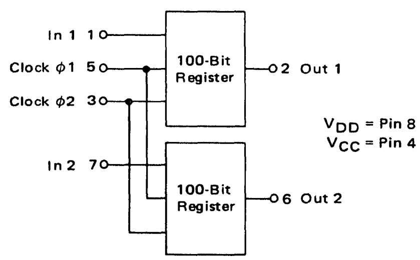
MC2362G
Dual 250-Bit Static Shift Register

MC2363G
Dual 256-Bit Static Shift Register



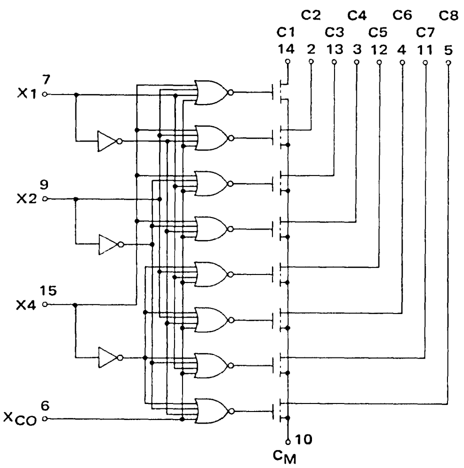
MC2380G, MC2381G
Dual 100-Bit Dynamic Shift Register



MOS LOGIC DIAGRAMS

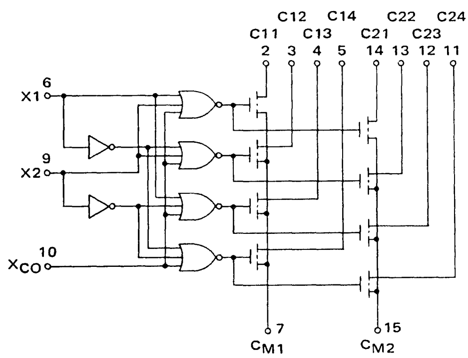
MULTIPLEX SWITCHES

MC1150L
8-Channel Multiplex Switch



V_{DD} = Pin 1
V_{GG} = Pin 16
V_{SS} = Pin 8

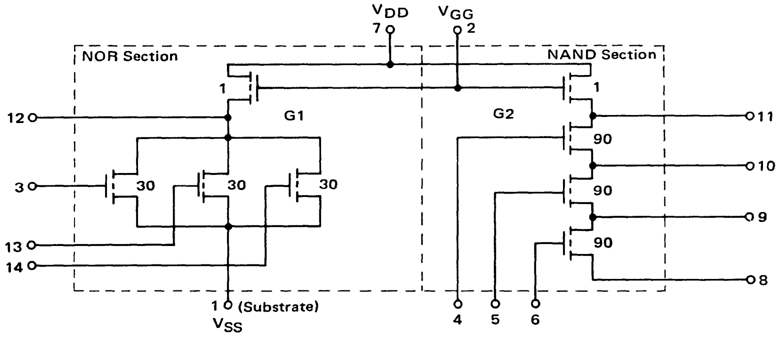
MC1151L
Dual 1-of-4 Channel Multiplex Switch



V_{DD} = Pin 1
V_{GG} = Pin 16
V_{SS} = Pin 8

GENERAL-PURPOSE LOGIC ELEMENTS

MC1155L, MC2255L
General Purpose Logic Elements

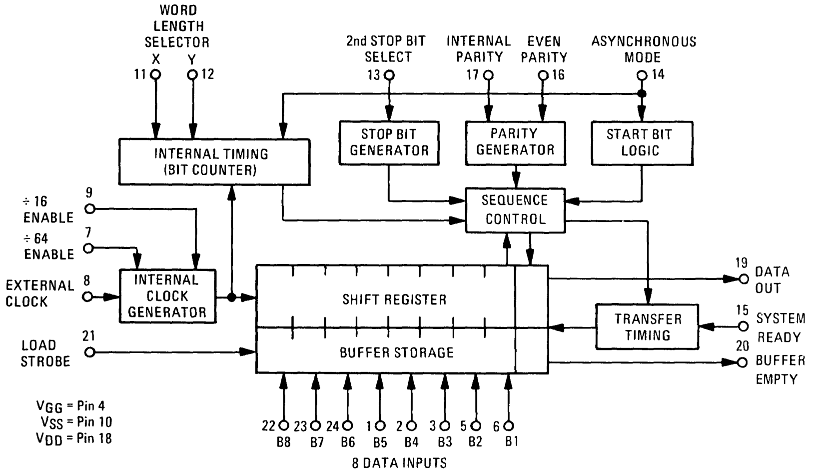


Numbers adjacent to MOS devices indicate the relative gain of each device.

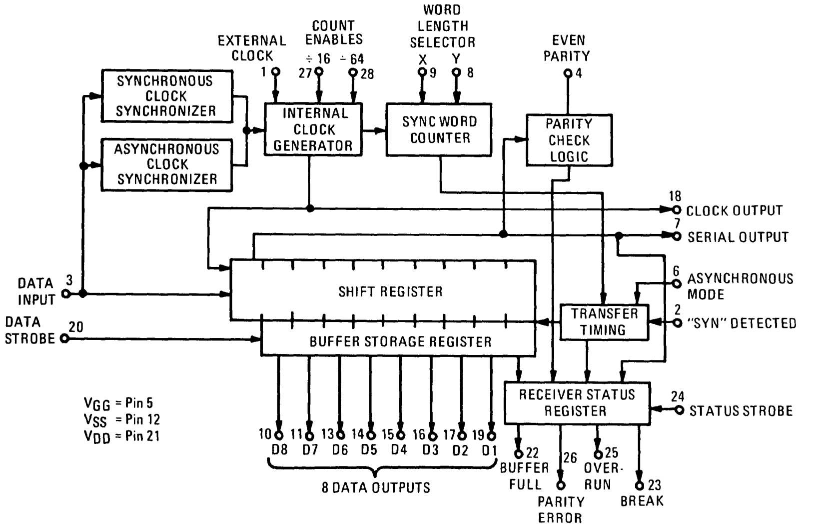
5

COMMUNICATIONS PERIPHERALS

MC2257L
Terminal Transmitter



MC2259L
Terminal Receiver



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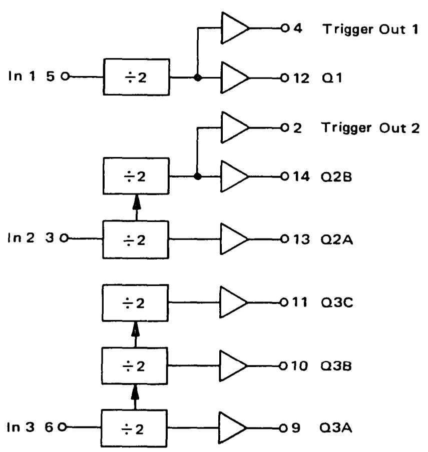
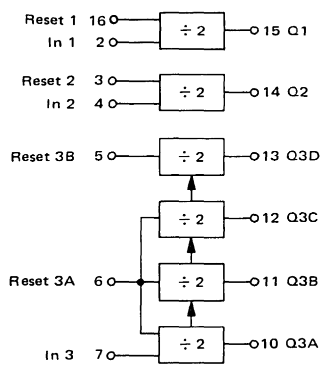
ELECTRONIC ORGAN APPLICATIONS

MC1180L
Frequency Divider



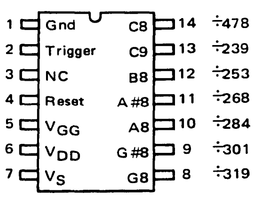
V_{DD} = Pin 1
V_S = Pin 7
Gnd = Pin 8

MC1181L
Resettable Rhythm Counter

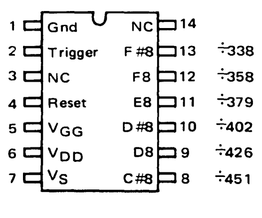


V_{DD} = Pin 8
V_{GG} = Pin 1
Gnd = Pin 9

MC1183L
Frequency Synthesizer



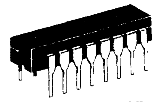
MC1184L
Frequency Synthesizer



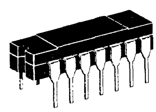
MCMOS INTEGRATED CIRCUITS MCMOS

MC14000 Series Complementary MOS

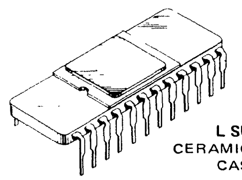
The MCMOS series of monolithic integrated logic circuits is designed to provide the system design engineer with a medium-speed integrated circuit family which approaches the ideal in performance. The low power dissipation and flexible power supply requirements of this family of devices greatly simplify power supply design, and the high noise immunity and large fanout capability reduce parts count and simplify printed circuit board layout.



L SUFFIX
CERAMIC PACKAGE
CASE 620



L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116



L SUFFIX
CERAMIC PACKAGE
CASE 684

FEATURES

- Quiescent Power Dissipation = 10 nW/pkg typical
- Noise Immunity = 45% of V_{DD} typical
- Supply Voltage Range = 3.0 Vdc to 18 Vdc (AL Series)
  3.0 Vdc to 16 Vdc (CL Series)
- Single or Multiple Supply Operation – Positive or Negative
- Fanout >50
- Output Logic Excursion Independent of Fanout
- Diode Protection on All Inputs

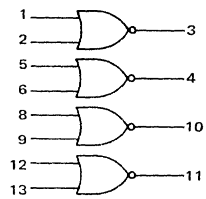
FUNCTION AND CHARACTERISTICS

Function	Type V_{DD} = 18 Vdc -55 to +125°C	Type V_{DD} = 16 Vdc -40 to +85°C	Case	Quiescent Power Dissipation nW typ/pkg AL Series	Quiescent Power Dissipation nW typ/pkg CL Series	Propagation Delay ns typ
Quad 2-Input NOR Gate	MC14001AL	MC14001CL	632	10	50	25
Dual 4-Input NOR Gate	MC14002AL	MC14002CL	632	10	50	25
Quad 2-Input NAND Gate	MC14011AL	MC14011CL	632	10	50	25
Dual 4-Input NAND Gate	MC14012AL	MC14012CL	632	10	50	25
Dual Type D Flip-Flop	MC14013AL	MC14013CL	632	50	200	80
Dual 4-Bit Static Shift Register	MC14015AL	MC14015CL	620	10 μW	10 μW	125
8-Bit Static Shift Register	MC14021AL	MC14021CL	620	3000	3000	100
Dual J-K Flip-Flop	MC14027AL	MC14027CL	620	50	200	75
Triple Gate (Dual 4-Input NAND Gate and 2-Input NOR/OR Gate or 8-Input AND/NAND Gate)	MC14501AL	MC14501CL	620	10	50	25
Quad Exclusive OR Gate	MC14507AL	MC14507CL	632	10	50	35
Dual 4-Bit Latch	MC14508AL	MC14508CL	684	1000	1000	75
8-Channel Data Selector	MC14512AL	MC14512CL	620	500	500	75
4-Bit Latch/4-to-16 Line Decoder (Low)	MC14514AL	MC14514CL	684	200	200	300
4-Bit Latch/4-to-16 Line Decoder (High)	MC14515AL	MC14515CL	684	200	200	300
4-Bit AND/OR Select (Quad 2-Channel Data Select or Quad Exclusive NOR Gate)	MC14519AL	MC14519CL	620	100	100	85
64-Bit Random Access Read-Write Memory	MCM14505AL	MCM14505CL	632	300	300	Read Cycle = 150 Write Cycle = 200

MCMOS LOGIC DIAGRAMS

GATES

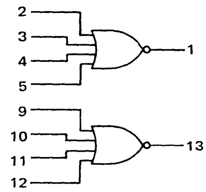
MC14001
Quad 2-Input NOR Gate



$3 = \overline{1+2}$

V_{DD} = Pin 14
V_{SS} = Pin 7

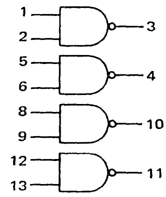
MC14002
Dual 4-Input NOR Gate



$1 = \overline{2+3+4+5}$

V_{DD} = Pin 14
V_{SS} = Pin 7

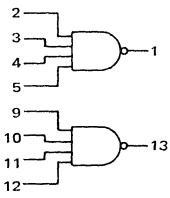
MC14011
Quad 2-Input NAND Gate



$3 = \overline{1 \bullet 2}$

V_{DD} = Pin 14
V_{SS} = Pin 7

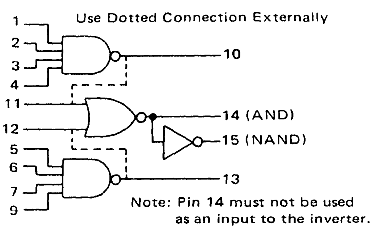
MC14012
Dual 4-Input NAND Gate



$1 = \overline{2 \bullet 3 \bullet 4 \bullet 5}$

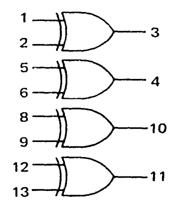
V_{DD} = Pin 14
V_{SS} = Pin 7

MC14501
Triple Gate
(Dual 4-Input NAND Gate and 2-Input NOR/OR Gate or 8-Input AND/NAND Gate)



V_{DD} = Pin 16
V_{SS} = Pin 8

MC14507
Quad Exclusive OR Gate



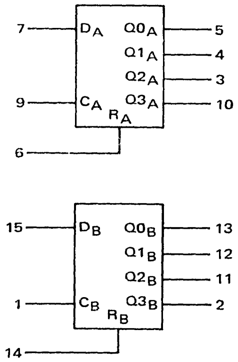
$3 = 1 \oplus 2$

V_{DD} = Pin 14
V_{SS} = Pin 7

5

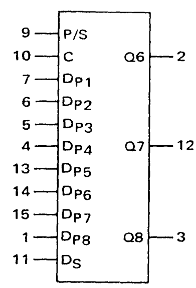
SHIFT REGISTERS

MC14015
Dual 4-Bit Static Shift Register



V_{DD} = Pin 16
V_{SS} = Pin 8

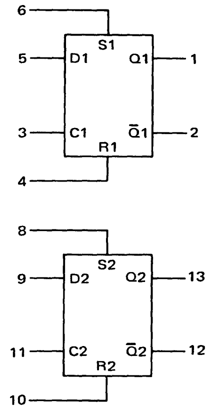
MC14021
8-Bit Static Shift Register



V_{DD} = Pin 16
V_{SS} = Pin 8

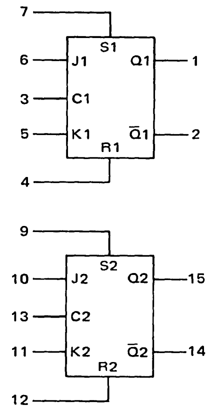
FLIP-FLOPS AND LATCHES

MC14013
Dual Type D Flip-Flop



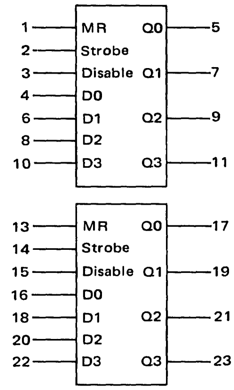
V_{DD} = Pin 14
V_{SS} = Pin 7

MC14027
Dual J-K Flip-Flop



V_{DD} = Pin 16
V_{SS} = Pin 8

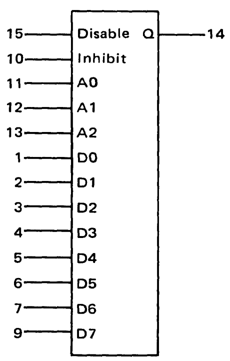
MC14508
Dual 4-Bit Latch



V_{DD} = Pin 24
V_{SS} = Pin 12

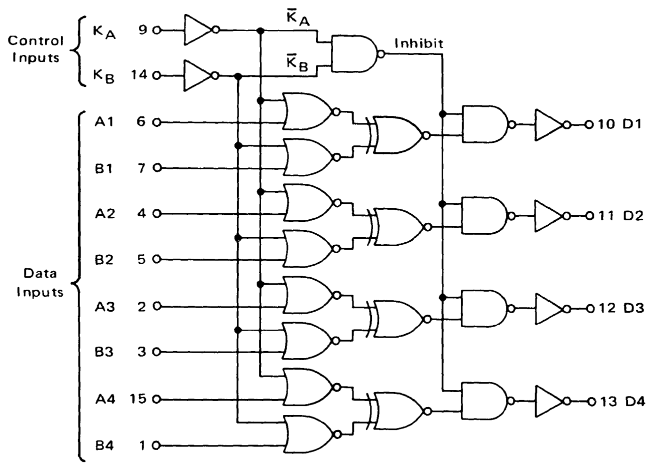
DATA ROUTING FUNCTIONS

MC14512
8-Channel Data Selector



V_{DD} = Pin 16
V_{SS} = Pin 8

MC14519
4-Bit AND/OR Select
or
Quad 2-Channel Data Select
or
Quad Exclusvie NOR Gate

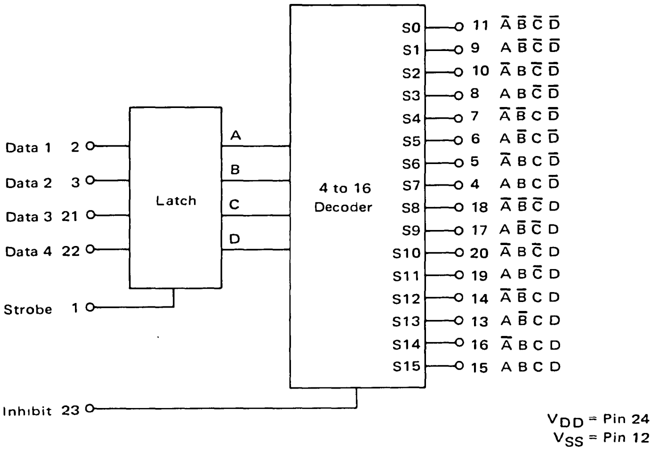


V_{DD} = Pin 16
V_{SS} = Pin 8

5

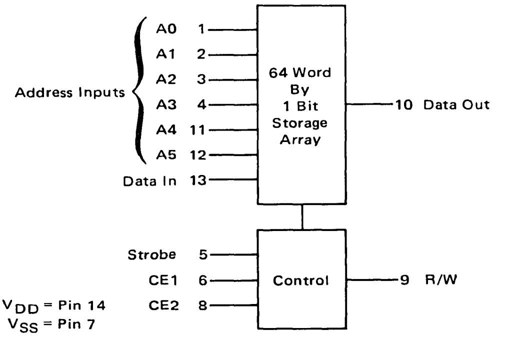
DECODERS

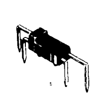
MC14514, MC14515
4-Bit Latch/4-to-16 Line Decoder



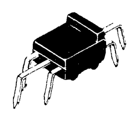
MEMORY

MCM14505
64-Bit Random Access Read-Write Memory





CASE 206A

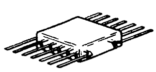


CASE 643A

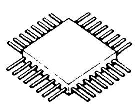
FUNCTIONAL CIRCUITS

Function	Temperature	Type	Case	Comments
Toggle Flip-Flop	-10 to +75°C	MFC4040	206A	Ideal for frequency-divider applications in electronic organs.
Dual Toggle Flip-Flop	-10 to +75°C	MFC6020	643A	
Dual Toggle Flip-Flop with Reset	-10 to +75°C	MFC6050	643A	For use in high-level, low-speed logic and timing systems.
3-Input "AND" Gate	-10 to +75°C	MFC6060	643A	For use in high-level, low-speed logic and timing systems.
R-S Flip-Flop	-10 to +75°C	MFC6080	643A	For use in high-level, low-speed logic and timing systems.
J-K Flip-Flop	-10 to +75°C	MFC8050	643A	For use in high-level, low-speed logic and timing systems.

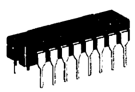
SPECIAL BIPOLAR LOGIC PRODUCTS for CUSTOM APPLICATIONS



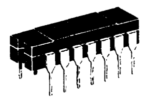
F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86



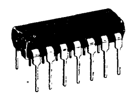
CERAMIC PACKAGE
CASE 618



L SUFFIX
CERAMIC PACKAGE
CASE 620

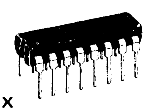


L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116

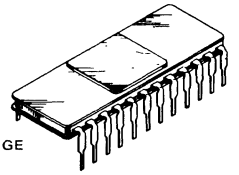


P SUFFIX
PLASTIC PACKAGE
CASE 646
TO-116

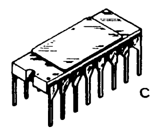
5



P SUFFIX
PLASTIC PACKAGE
CASE 648



L SUFFIX
CERAMIC PACKAGE
CASE 684



L SUFFIX
CERAMIC PACKAGE
CASE 690

(Additional mask-programmable memories are in the MOS device listing.)

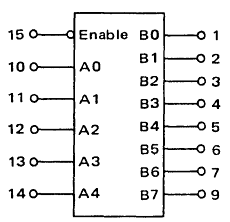
Function	Type	Temperature	Case	Comments
256-Bit Read Only Memory	MCM4002L	0 to +75°C	620	Bipolar read only memory organized as 32 eight-bit words. Compatible with MDTL and all MTTL lines. Open collectors or 2.0 kilohm pullup resistors at buffered output bit lines. Truth table and output option specified by user.
	MCM4002P	0 to +75°C	648	
1024-Bit Read Only Memory *	MCM4004AL	0 to +70°C	690	Bipolar read only memory organized as 256 four-bit words. Input loading of -0.25 mA maximum. Typical address time of 50 ns, typical chip select time of 25 ns. Open collectors or 2.0 kilohm pullup resistors at output bit lines. Truth table and output option specified by user.
1024-Bit Read Only Memory*	MCM4006AL	0 to +70°C	690	Same as MCM4004AL except input loading of -1.6 mA maximum, typical address time of 40 ns, typical chip select time of 20 ns.
512-Bit Programmable Read Only Memory	MCM5003AL	0 to +70°C	684	Bipolar programmable read only memory organized as 64 eight-bit words. Field programmable by "blowing" appropriate nichrome resistors to break metalization links. Ninth bit available for circuit testing. Open collector outputs.
	MCM5303AL	-55 to +125°C	684	
512-Bit Programmable Read Only Memory	MCM5004AL	0 to +70°C	684	Same as MCM5003AL except 2.0 kilohm pullup resistors on the collector outputs.
	MCM5304AL	-55 to +125°C	684	
128-Bit Read Only Memory	XC170	0 to +75°C	648	Bipolar read only memory organized as 16 eight-bit words. Compatible with MDTL and all MTTL lines. Open collectors at buffered output bit lines. Truth table specified by user.
128-Bit Read Only Memory	XC171	0 to +75°C	648	Same as XC170 except 2.0 kilohm pullup resistors on the collector outputs.
25-Gate Array	XC177	-55 to +125°C	607 618, 632,	Twenty-five gates with two custom layers of metalization required to complete the circuit and obtain the desired function. Compatible with MDTL and all MTTL lines.
		0 to +75°C	646, 648	

*Standard options of the MCM4004 and MCM4006 are available as MCM4067 and MCM4068 Binary-to-BCD Number Converters (from MCM4004) and MCM4069 and MCM4070 Hollerith-to-ASCII Converters (from MCM4006). Details are given on the MTTL Complex Functions device listing.

MEMORIES

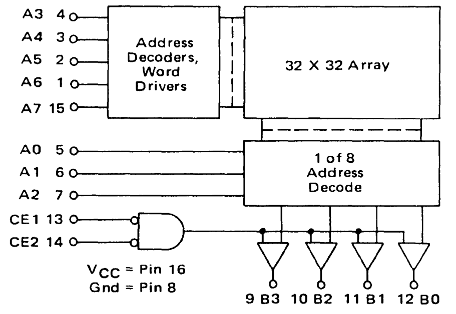
Numbers at end of terminals represent pin numbers.

MCM4002
256-Bit Read Only Memory

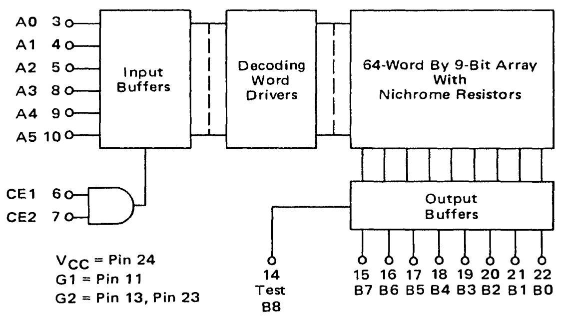


V_{CC} = Pin 16
Gnd = Pin 8

MCM4004, MCM4006
1024-Bit Read Only Memory



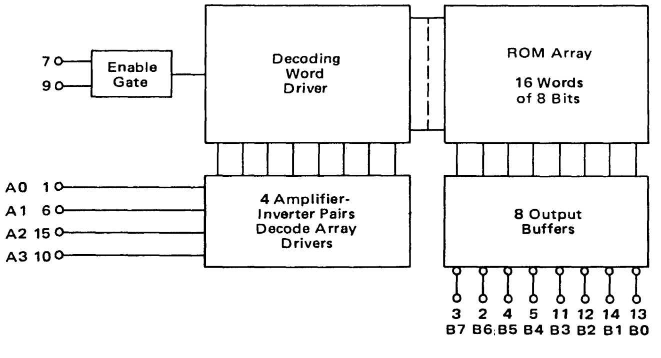
V_{CC} = Pin 16
Gnd = Pin 8



V_{CC} = Pin 24
G1 = Pin 11
G2 = Pin 13, Pin 23

MCM5303/MCM5003
MCM5304/MCM5004
512-Bit Programmable Read Only Memory

XC170, XC171
128-Bit Read Only Memory



V_{CC} = Pin 16
Gnd = Pin 8

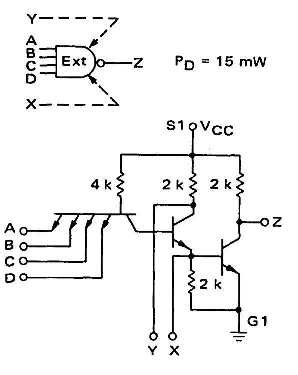
5

MULTI-GATE ARRAY

XC177
25-Gate Array
With Two Custom Layers of Metalization

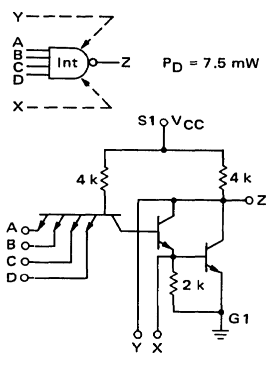
Two custom-designed layers of metalization provide both gating intraconnections and gate-to-gate interconnections for the XC177. Each gate may be used as any of the four configurations shown, providing a choice of the role each gate will play as well as the logic function design of the entire array.

External NAND Gate



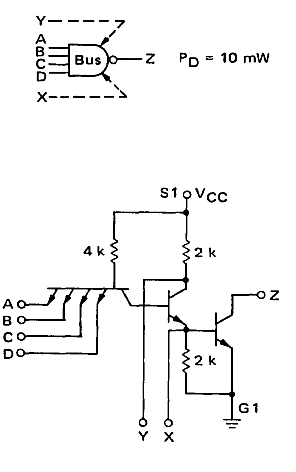
Use when interfacing with external circuitry for improved drive capability.

Internal NAND Gate

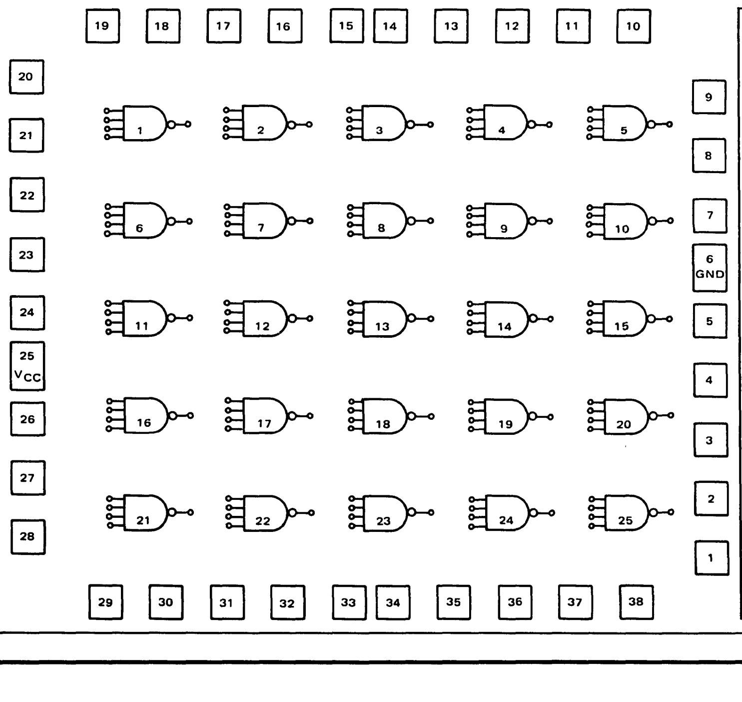


Use to perform logic within chip.

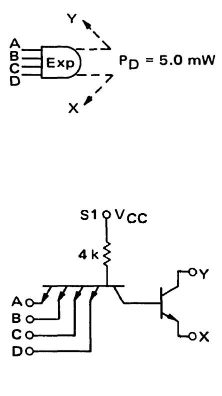
Bus Output NAND Gate



Use to accomplish the Wired-OR function with minimum power dissipation.



Gate Expander



Use to perform the AND-OR-INVERT function.

LINEAR INTEGRATED CIRCUITS LINEAR

APPLICATION SELECTOR GUIDE

LINEAR integrated circuits offer the design engineer a variety of functions for analog applications. This line includes devices for military, industrial, and consumer applications. Devices are available in a broad selection of operating characteristics and packaging. Refer to the last page of the Linear Selector Guide for package information.

At a Glance – MILITARY and INDUSTRIAL DEVICES

OPERATIONAL AMPLIFIERS

TYPE			SPECIFICATIONS TYPICAL AT T_A = +25°C						
-55 to +125°C	0 to +75°C	Case	A_{vol}, V/V	V_O, V_{pk}	I_{IB}, µA	$\|V_{IO}\|$ mV	SR, V/µs	f_C, MHz	Comments
MC1520	MC1420	602A	1,500	±4 0	0 8	5 0	5 0	10	z_O = 50 ohms, Diff Output
MC1530	MC1430	602B, 606, 646	5,000	±5 2	3 0	1 0	1 0	6.0	z_O = 25 ohms
MC1531	MC1431	602B, 606, 646	3,500	±5 2	0 025	3 0	1 0	6.0	z_O = 25 ohms
MC1533	MC1433	602B, 606, 632, 646	60,000	±13	0 5	1 0	2 0	0.2	V_{IO} Adjustable
MC1535	MC1435	602B, 607, 632, 646	7,000	±2 8	1.2	1 0	0 67	2 0	Dual Op-Ampl.
MC1536*	MC1436*,C	601	500,000	±23	0 008	2 0	2 0	1 0	Internally Compensated ±28-Volt Supply
MC1537	MC1437	632, 646	45,000	±14	0 2	1 0	0 25	1.0	Dual MC1709
MC1539*	MC1439*	601, 632, 646	120,000	±13	0 2	1 0	4 2	2 0	dV_{out}/dt = 34 @A_V = 100
MC1556	MC1456,C	601	200,000	±13	0 008	2 0	2 5	1 0	Internally Compensated
MC1558*	MC1458*,C	601, 626, 632, 646	200,000	±14	0 2	1 0	0 8	1.0	Dual MC1741,C
MC1709*	MC1709C*	601,606,626,632,646	45,000	±14	0.2	1.0	0 25	1.0	
MCB1709F†	–	665	45,000	±14	0.2	1 0	0 25	1.0	Beam-Lead MC1709
MC1712	MC1712C	601,606,632	3,600	±5 3	2 5	1.1	1 5	5 0	
MC1741*	MC1741C*	601,606,626,632,646	200,000	±14	0 2	1 0	0 8	1 0	Internally Compensated
MCB1741F†	–	665	200,000	±14	0.2	1.0	0.8	1.0	Beam-Lead MC1741
MC1748*	MC1748C*	601	200,000	±14	0.08	1 0	0 8	1 0	Noncompensated MC1741,C
MCB1748F†	–	606	200,000	±14	0.08	1.0	0.8	1.0	Noncompensated Beam Lead MC1741
MCH2870M	MCH2870C	614	200,000	±13	0.2	1 0	0.8	1 1	Load current ±300 mA Internally Compensated
MLM101A	MLM301A	601, 626	160,000	±14	0.03	0.7	1.0	11	
MLM107	MLM307	601	160,000	±14	0.03	0.7	0.5	1.0	Internally Compensated

Definitions: A_{vol} Open-Loop Voltage Gain; V_O Output Voltage Swing; I_{IB} Input Bias Current; V_{IO} Input Offset Voltage; SR Slew Rate @ Unity Gain; f_C Unity Gain Crossover Frequency

*Also available as a non-encapsulated chip, use MCC prefix. †Also available as a non-encapsulated beam-lead-device, use MCBC prefix

5

LINEAR/DIGITAL INTERFACE CIRCUITS

TYPE – Temperature Range				Typ–Input Threshold (V_{th}, mVdc)	Voltage Gain–Typ (A_V, V/V)	Response Time–Typ (t_R, ns)	Comments
-55 to +125°C	Case	0 to +75°C	Case				
MC1514	632	MC1414	632	21.5/18.5 ①	1700†	40	A dual differential comparator for level detection, low-level sensing, and memory applications
MC1540	602B,606, 632	MC1440	602B,606, 632	17	85	20	Designed to detect bipolar differential signals derived by a core memory with cycle times as short as 0.5 µs
MC1541	607,632	MC1441	607,632	17	75	30/15 ②	A dual-channel gated sense amplifier with separate wide-band differential input amplifiers
MC1543	632	–	–	20	-	10/3.0 ②	A MECL dual core-memory sense amplifier; adjustable threshold with excellent threshold stability
MC1544	620	MC1444	620	1.0	–	65/50 ②	AC-coupled 4-channel sense amplifier – ideal for plated-wire, thin-film, and other hi-speed low-level sensing applications.
MC1546	620	MC1446	620	0.5 ③	600	60/40 ②	A four-channel plated wire sense amplifier designed to convert ±3.0 mV (or ±4.0 mV) signals from plated wire memories to MTTL logic levels
MC1710*	601,606, 632	MC1710C*	601,606, 632	0	1700†	40	A differential comparator providing high accuracy and fast response time
MC1711*	603-02,606, 632	MC1711C*	603-02,606, 632	0	1500†	40	A dual differential comparator providing high accuracy and fast response time

Type	Temperature	Case	Input Threshold mV @ V_{ref} = 15 mV Min	Typ	Max	Common-Mode Input Firing Range (V)	Cycle Time Min (ns)	Comments
MC7520	0 to +70°C	620	11	15	19	±3.0	200	Sense amplifiers featuring dual input preamplifiers connected to a common output stage, each may be strobed independently
MC7521	0 to +70°C	620	8.0	15	22	±3.0	200	
MC7522	0 to +70°C	620	11	15	19	±3.0	200	Sense amplifiers providing dual input amplifiers connected to a common output stage, each may be strobed independently – features open collector output
MC7523	0 to +70°C	620	8.0	15	22	±3.0	200	
MC7524	0 to +70°C	620	11	15	19	±3.0	200	Sense amplifiers providing two independent sense channels, each may be strobed independently – separate AND gate outputs
MC7525	0 to +70°C	620	8.0	15	22	±3.0	200	

① -55°C/+125°C ② Diff. Mode/Com. Mode †A_{vol} ③ Input Offset Voltage, mV typ

*Also available as a non-encapsulated chip, use MCC prefix.

LINEAR/DIGITAL INTERFACE CIRCUITS (continued)

DIGITAL-TO-ANALOG CONVERTER			E_r	t_S	t_p	
TYPE	Temperature	Case	%(max)	ns(typ)	ns(max)	Comments
MC1406	0 to +75°C	632	0.7	200	50	6-Bit multiplying digital-to-analog converter

LINE DRIVER/RECEIVER SERIES			
TYPE	Temperature	Case	Comments
MC1488	0 to +75°C	632	EIA RS-232C Interface Circuit – Quad MDTL Line Driver
MC1489,A	0 to +75°C	632	EIA RS-232C Interface Circuit – Quad MDTL Line Receiver

LINE DRIVER/RECEIVER SERIES			Impedance-typ (kΩ @ 10 MHz)		t_p	Common-Mode Voltage		
						$CMVR_{in}$	$CMVR_O$	
TYPE	Temperature	Case	z_{in}	z_{out}	ns, max	(V-min)	(V-min)	Comments
MC1580	-55 to +125°C	632	5.0	5.0	18	±3.5	+3.0/-9.0	Dual line driver/receiver; bias driver for MECL, interfacing for MDTL, MRTL and MTTL
MC1581	-55 to +125°C	632	8.0	–	20	±3.5	–	Dual MECL line receiver
MC1582	-55 to +125°C	632	–	7.0	20	–	+9.0/-3.0	Dual MDTL and MTTL line driver
MC1583	-55 to +125°C	632	12①	–	40	±3.5	–	Dual saturated logic receiver (open-collector)
MC1584	-55 to +125°C	632	7.0	–	37	±3.5	–	Dual MDTL and MTTL receiver (active pullup)

① f = 5.0 MHz

HIGH-FREQUENCY CIRCUITS

TYPE													
-55 to +125°C	0 to +75°C	Case	V_{CC}, V_{EE} (Vdc)	Bandwidth (MHz)	V_{OS} Vp-p	$\|z_{in}\|$ kΩ	@ kHz	$\|z_o\|$ Ω	@ kHz	A_{VS} (dB)	G_T 60 MHz (dB)	Diff. Input and Output	AGC
MC1510	MC1410	601	±6.0	dc to 40	4.5	6.0	20	35	20	40 (fixed)	–	Yes	No
MC1545	MC1445	602A, 607, 632	±5.0	dc to 75	2.5	10	50	25	50	18 (fixed)	–	Yes	Yes
MC1550	–	602B, 606	+6.0	50	6.0	1.8	1.0 M	100 k	1.0 M	26 (AGC = 0)	25	No	Yes
MC1552	–	602B	+6.0	40 @ A_V = 34 dB 35 @ A_V = 40 dB	4.2	10	100	16	100	30 – 40 (fixed)	–	No	No
MC1553	–	602B	+6.0	35 @ A_V = 46 dB 15 @ A_V = 52 dB	4.2	10	100	16	100	46 – 52 (fixed)	–	No	No
MC1590	–	601	+12	100 @ A_V = 4 dB 60 @ A_V = 25 dB	7.0	3.0	1.0 M	100 k	1.0 M	44 (AGC = 0)	45	Yes	Yes
MC1733	MC1733C	603 632	±60	40 @ A_V = 52 dB 90 @ A_V = 40 dB 120 @ A_V = 20 dB	4.0	4.0 30 250	1.0 1.0 1.0	20	1.0	52 40 20	–	Yes	No

MULTIPLIERS, MODULATORS, AND DETECTORS

TYPE			Linearity Error	Input Voltage Range Min	
-55 to +125°C	0 to +70°C	Case	(Typ)	(Vdc)	Comments
MC1594	–	620	±0.3%	±10	A four-quadrant multiplier designed to operate with ±15-volt supplies; has internal level-shift circuitry and voltage regulator.
–	MC1494	620	±0.5%	±10	
MC1595*	–	632	X Input = 0.5% Y Input = 1.0%	±10	Applications include multiply, divide, square root, mean square, phase detector, frequency doubler, balanced modulator/demodulator, electronic gain control.
–	MC1495*	632	X Input = 1.0% Y Input = 2.0%	±10	
			Carrier Suppression Typ (dB) @ f (MHz)	Common-Mode Rejection Typ (CMRR, dB)	
MC1596	MC1496	602A, 632	65 0.5 50 10	85	Balanced modulator/demodulator designed for use where the output voltage is a product of an input voltage (signal) and a switching function (carrier).

*Also available as a non-encapsulated chip, use MCC prefix.

LINEAR INTEGRATED CIRCUITS

MILITARY and INDUSTRIAL DEVICES (continued)

REGULATORS

TYPE -55 to +125°C	TYPE 0°C to +70°C	Case	V_{in} Range (Vdc) Min	V_{in} Range (Vdc) Max	Input-Output Diff. (Vdc) Min	Input-Output Diff. (Vdc) Max	V_O Range (Vdc) Min	V_O Range (Vdc) Max	TC_{V_O} (%/°C - Typ)	V_{ref} (Vdc) Min	V_{ref} (Vdc) Max	I_B (mAdc - Max)	I_O (mAdc - Max)	P_D (W – Max) T_C +25°C	P_D (W – Max) T_A +25°C	Reg_{Line} (Max $\frac{\%V_O}{V_{in}}$)	Reg_{Load} ($\%V_O$ - Max)
POSITIVE VOLTAGE REGULATORS																	
–	MC1460	602A 614	9.0	20	3.0	20	2.5	17	±0.002	3.2	3.8	12	200 500	1.8 12	0.68 3.0	0.030	0.13 0.05
MC1560	–	602A 614	8.5	20	2.7	20	2.5	17	±0.002	3.2	3.8	9.0	200 500	1.8 12	0.68 3.0	0.015	0.13 0.05
–	MC1461	602A 614	9.0	35	3.0	35	2.5	32	±0.002	3.2	3.8	12	200 500	1.8 17.5	0.68 3.0	0.030	0.13 0.05
MC1561	–	602A 614	8.5	40	2.7	40	2.5	37	±0.002	3.2	3.8	9.0	200 500	1.8 17.5	0.68 3.0	0.015	0.13 0.05
–	MC1469†	602A 614	9.0	35	3.0	35	2.5	32	±0.002	3.2	3.8	12	200 500	1.8 17.5	0.68 3.0	0.030	0.13 0.05
MC1569†	–	602A 614	8.5	40	2.7	40	2.5	37	±0.002	3.4	3.6	9.0	200 500	1.8 17.5	0.68 3.0	0.015	0.13 0.05
–	MC1723C†	603-03 632	9.5	40	3.0	38	2.0	37	±0.002	6.80	7.50	4.0	150	–	0.8	0.030	0.20
MC1723†	–	603-03 632	9.5	40	3.0	38	2.0	37	±0.002	6.95	7.35	3.5	150	–	0.8	0.030	0.15
–	MFC4060*	206A	9.0	35	3.0	–	4.8	32	±0.005	3.8	4.6	–	200	–	1.0	0.03	0.2
–	MFC6030*	643A	9.0	35	3.0	–	4.8	32	±0.005	3.8	4.6	–	200	–	1.0	0.03	0.2
MLM105	–	601	8.5	50	3.0	30	4.5	40	0.002	1.6	2.0	2.0	20	–	0.68	0.06	0.05 ④
–	MLM305	601	8.5	40	3.0	30	4.5	30	0.0004	1.6	2.0	2.0	20	–	0.68	0.06	0.05 ④
MLM109K	–	11	7.0	25	2.0	30	4.7	5.3	0.02	–	–	10	1000	20	3.5	0.04	100 ④
–	MLM309K	11	7.0	25	2.0	30	4.8	5.2	0.02	–	–	10	1000	20	3.5	0.04	100 ④
NEGATIVE VOLTAGE REGULATORS																	
–	MC1463†	602A 614	-9.0	-35	-3.0	40	-3.8	-32	±0.002	-3.2	-3.8	14	200 500	1.8 9.0	0.68 2.4	0.030	0.13 0.05
MC1563†	–	602A 614	-8.5	-40	-2.7	35	-3.6	-37	±0.002	-3.4	-3.6	11	200 500	1.8 9.0	0.68 2.4	0.015	0.13 0.05
MULTI-PURPOSE REGULATORS																	
–	MC1466	632	① ②	①②	①	①	0	①	0.01	17.3	19.7	12	①	①	①	0.03	0.03% +3 mV 0.2% +1 mA ③
MC1566	–								0.006	18	19	8.5				0.01	0.01% +1 mV 0.1% +1 mA ③

*Temperature Range of -10 to +75°C

†Also avaiable as a non-encapsulated device, use MCC prefix.

① Limited only by the characteristics of the external series pass transistor, may be hundreds of volts or many amperes.

② An auxiliary voltage (27 Vdc nom), isolated from both the unregulated dc input voltage and Gnd, is required to bias the IC.

③ Current Load Regulation (max). ④ mV

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SPECIAL-PURPOSE CIRCUITS

POWER DRIVERS TYPE	Temperature	Case	BV_{CEO} (Vdc – Typ)	I_O – Typ (A)	h_{FE} – Typ	t_{on}/t_{off} (ns – Typ)	Comments
MCH2890	0 to +70°C	685	120 (min)	6.0	–	260/1800	Dual power driver for use with hammer, solenoids, relays, lamps, paper tape punches, etc.

POWER BOOSTER TYPE	Temperature	Case	Impedance – Typ Input (MΩ)	Impedance – Typ Output (Ω)	BW (MHz – Typ)	Current Gain Typ	Output Current (mAdc – Max)
MC1438	0 to +75°C	614	0.4	10	1.5	3,000	300
MC1538	-55 to +125°C	614	0.4	10	1.5	3,000	300

Comments

A high current gain amplifier (70 dB) with unity voltage gain capability.

TYPE -55 to +125°C	TYPE 0 to +70°C	Case	Output Power (W – Typ)	Voltage Gain – Typ (A_v, V/V)	Total Harmonic Distortion (% – Typ)	Comments
MC1554	MC1454	602B	1.0	10, 18, 36	0.4	A power amplifier device capable of single or split supply operation.

ZERO VOLTAGE SWITCH TYPE	Temperature	Case	Comments
MFC8070	-10 to +75°C	644A	For use in ac power switching with output capable of triggering triacs

At a Glance – CONSUMER DEVICES

HIGH-FREQUENCY CIRCUITS

TYPE	Temperature	Case	Small-Signal Voltage Gain (A_v,dB – Typ)	Supply Drain Current (mA – Typ)	Noise Figure (dB – Typ)	Comments
MC1330	0 to +75°C	626	34 ③	15	–	Low-level video detector for color and monochrome TV receivers: replaces 3rd IF, detector, video and AFC buffers.
MC1350	0 to +75°C	626	50 ①	14	9.0 @ 60 MHz	IF amplifier featuring wide-range AGC.
MC1352	0 to +75°C	646, 647	52 ①	27	8.5 @ 60 MHz	TV video IF amplifier with AGC and keyer circuit.
MC1353	0 to +75°C	646, 647	52 ①	27	8.5 @ 60 MHz	Identical to MC1352 except for opposite tuner AGC polarity.
MC1550	–55 to +125°C	602B, 606	25 @ 60 MHz ②	1.5	5.0 @ 60 MHz	Constant input impedance over entire AGC range, RF-IF amplifier for communications equipment.
MFC4010A	–10 to +75°C	206A	70	3.0	1.0 mV ④ @ 20 Hz to 20 kHz	Designed for AM/IF and low-level audio applications.
MFC8030	-10 to +75°C	644A	40 @ 10 MHz	Variable	7.0	Differential cascode amplifier, ideal general-purpose differential building block.

TYPE	Temperature	Case	Typical BV_{CEO} (Vdc)	V_{CC}, Supply Voltage (Vdc – Max)	Max Base Differential Voltage ($\|\Delta V_{BE}\|$,mV)	Max Base Differential Current ($\|\Delta I_B\|$,µA)	Comments
MFC8000	–10 to +75°C	644A	40	75	15	1.0	Dual differential amplifiers; designed for the input stage of stereo power amplifiers
MFC8001	–10 to +75°C	644A	50	75	15	1.0	
MFC8002	–10 to +75°C	644A	60	75	15	1.0	

SOUND IF AMPLIFIERS			Small-Signal Voltage Gain (A_v,dB – Typ)	Supply Drain Current (mA – Typ)	AM Rejection (dB – Typ)	Comments
TYPE	Temperature	Case				
MC1351	0 to +75°C	646, 647	65 ⑤	31	45	TV sound IF amplifier with quadrature detector and audio preamplifier
MC1357	0 to +75°C	646, 647	60 ⑤	15	45	TV sound IF with quadrature detector or FM radio IF amplifier
MC1358	–20 to +75°C	646, 647	>60 ⑥	33	51	TV sound IF with limiter, FM detector, audio driver, electronic attenuator

FM IF AMPLIFIERS			Input Signal 3 dB Limiting (mV [rms] – Typ)	Small-Signal Voltage Gain (A_v,dB – Typ)	AM Rejection (e_{in} = 1 V [rms]) (dB – Typ)	Comments
TYPE	Temperature	Case				
MFC6010	–10 to +75°C	643A	55	40 dB @ 10.7 MHz	40 dB	FM limiting IF amplifier designed for 10.7 MHz IF applications.
MC1355	0 to +75°C	646, 647	1.75	40 dB @ 10.7 MHz	60 dB	Four-stage limiting FM amplifier
MC1357	0 to +75°C	646, 647	0.6	53 dB @ 10.7 MHz	37 dB ⑦	TV sound IF with quadrature detector or FM radio IF amplifier suitable for automotive applications

① Power gain ② Transducer power gain ③ Conversion gain ④ Output noise voltage ⑤ IF voltage gain

⑥ Attenuator Volume Reduction Range ⑦ e_{in} = 10 mV (rms)

LOW-FREQUENCY CIRCUITS

AUDIO POWER AMPLIFIER CIRCUITS

TYPE	Temperature	Case	Output Power (W – Min)	Input Sensitivity @ Full P_O (mV – Max)	THD @ ½ Rated Pwr (% – Typ)	Comments
MC1306	0 to +75°C	626	0.5	270/360 ①	0.5	Complementary power amplifier and preamplifier
MFC4000B	–10 to +75°C	206A	0 25	42 ②	0.7	Designed for the output stage of battery-powered portable radios.
MFC6070	-10 to +55°C	643A	1.0	150	1.0	Designed for low-cost audio amplifiers in phonograph, TV and radio applications.
MFC8010	–10 to +55°C	644A	1.0	10 ②	1.0	Provides the complete audio system in TV, radio, and phonograph equipment, includes preamplifier
MFC9020	-10 to +75°C	641	2.0	200	1.0	Designed for the complete audio system in television, radio and phonograph equipment

DRIVER AND AUDIO PREAMPLIFIER CIRCUITS

TYPE	Temperature	Case	Open-Loop Voltage Gain (dB – Typ)	Power Supply Voltage (Vdc – Max)	Output Swing (V(rms) – Typ)	Comments
MC1303	0 to +75°C	632	80	±15	5.5	Dual monolithic stereo preamplifier, channel separation of 60 dB min at 10 kHz
MC1380	-40 to +75°C	627	49	18	30**	Designed to drive germanium power transistors in auto radios
MFC4050	–10 to +75°C	206A	42	18	30**	Audio driver designed for driving Class A PNP power output stage of up to 4 watts of audio power
MFC8020A	–10 to +75°C	644A	80	35	9.0 (V_{CC} = 32 Vdc)	Class B audio driver designed as a preamplifier and driver circuit for complementary output transistors, will drive ≦ 15 W
MFC8040	–10 to +75°C	644A	90	33	7 0 (V_{CC} = 30 Vdc)	Low noise audio preamplifier, input noise level of 1.0 µV typical

① A_{vol}, preamplifier/power amplifier ② Input sensitivity is externally adjustable. **mA(rms) output current

REGULATORS

TYPE 0°C to +70°C	Case	V_{in} Range (Vdc) Min	V_{in} Range (Vdc) Max	Input Output Diff. (Vdc) Min	Input Output Diff. (Vdc) Max	V_O Range (Vdc) Min	V_O Range (Vdc) Max	TCV_O (%/°C - Typ)	V_{ref} (Vdc) Min	V_{ref} (Vdc) Max	I_{IB} (mAdc - Max)	I_O (mAdc - Max)	P_D (W – Max) T_C +25°C	P_D (W – Max) T_A +25°C	Reg_{Line} (Max $\frac{\%V_O}{V_{in}}$)	Reg_{Load} (%V_O-Max)
POSITIVE VOLTAGE REGULATORS																
MC1460	602A 614	9 0	20	3 0	20	2 5	17	+0 002	3 2	3 8	12	200 500	1 8 12	0 68 3 0	0 030	0 13 0 05
MC1461	602A 614	9.0	35	3 0	35	2 5	32	±0 002	3 2	3 8	12	200 500	1 8 17 5	0 68 3 0	0.030	0.13 0.05
MC1469†	602A 614	9.0	35	3 0	35	2 5	32	±0 002	3 2	3 8	12	200 500	1 8 17 5	0 68 3 0	0 030	0 13 0.05
MC1723C†	603-03 632	9 5	40	3 0	38	2 0	37	±0 002	6 80	7 50	4 0	150	–	0 8	0.030	0 20
MFC4060*	206A	9.0	35	3.0	-	4 8	32	±0.005	3 8	4.8	-	200	–	1.0	0 03	0 2
MFC6030*	643A	9.0	35	3 0	--	4 8	32	±0.005	3 8	4.8	--	200	–	1 0	0 03	0 2
MLM305	601	8.5	40	3.0	30	4.5	30	0.0004	1.6	2.0	2.0	20	–	0.68	0.06	0.05 ④
MLM309K	11	7.0	25	2.0	30	4.8	52	0.02	–	–	10	1000	20	3.5	0.04	100 ④
NEGATIVE VOLTAGE REGULATORS																
MC1463†	602A 614	-9.0	-35	-3 0	40	-3.8	-32	±0.002	-3.2	-3 8	14	200 500	1 8 9.0	0 68 2 4	0 030	0 13 0.05
MULTI-PURPOSE REGULATORS																
MC1466	632	① ②	① ②	①	①	0	①	0.01	17.3	19.7	12	①	①	①	0 03	0.03% +3 mV 0 2% +1 mA ③

*Temperature Range of -10 to +75°C
† Also available as a non-encapsulated chip, use MCC prefix.

① Limited only by the characteristics of the external series pass transistor, may be hundreds of volts or many amperes

② An auxiliary voltage (27 Vdc nom), isolated from both the unregulated dc input voltage and Gnd, is required to bias the IC.

③ Current Load Regulation (max). ④ mV

SPECIAL-PURPOSE CIRCUITS

STEREO DEMODULATORS TYPE	Temperature	Case	Power Supply Voltage Range (Vdc – Typ)	THD – Typ (%)	P_D – Max (mW)	Comments
MC1304	0 to +75°C	646, 647	8.0-14	0.5	625	An FM multiplex stereo demodulator; derives the left and right channel audio information from the detected composite signal. MC1305 permits use of external stereo-channel separation control.
MC1305	0 to +75°C	646, 647	8.0-14	0.5	625	
MC1307	0 to +75°C	646, 647	8.0-14	0.5	625	Thrifty version of MC1304, without audio mute and stereo switch capabilities.
MC1310	-30 to +85°C	646	8.0-16	0.3	625	FM Stereo demodulator uses a phase-locked loop to regenerate the 38 kHz sub-carrier – thereby eliminating all coil adjustments.

CHROMA DEMODULATORS TYPE	Temperature	Case	Output Voltage Swing (Vp-p – Typ)	Output Differential Voltage (Vdc – Typ)	Output Voltage Temperature Coefficient (mV/°C – Typ)	Comments
MC1326	0 to +75°C	646, 647	10	0.3	3.0	Dual doubly balanced chroma demodulator with RGB matrix and luminance and blanking inputs.
MC1328	0 to +75°C	603-02, 646 647	10	0.3	3.0	Dual doubly balanced chroma demodulator.

TUNING INDICATOR TYPE	Temperature	Case	Drain Current (mA – Typ)	Saturation Voltage (Vdc – Typ)	Noise Inhibit (Vdc – Typ)	Threshold Lamp On Min/Max (Vdc)	Threshold Lamp Off Min/Max (Vdc)	Comments
MC1335	0 to +75°C	626	5.5	0.85	1.9	5.8/6.2	5.1/6.9	Designed for fine tuning of FM radios

TV SIGNAL PROCESSOR TYPE	Temperature	Case	Comments
MC1345	0 to +70°C	646	. . . with sync separator, advanced high-quality noise inverter AGC Keyer and AGC amplifier. Features one IF AGC output, two tuner AGC outputs and adjustable AGC delay

AUTOMATIC FREQUENCY CONTROL TYPE	Temperature	Case	
MC1364	0 to + 75°C	646, 686	High-gain AFT system – 18 mV input for rated output

TV COLOR PROCESSING CIRCUIT TYPE	Temperature	Case	
MC1398	–20 to +75°C	646	. . . includes complete Chroma IF amplifier, automatic chroma control, color killer, dc chroma control and injection lock reference system with dc hue conrtol. Low peripheral parts count.

ELECTRONIC ATTENUATOR TYPE	Temperature	Case	Voltage Gain (dB – Typ)	Attenuation Range (dB – Typ)	THD (% – Typ)	Power Supply Voltage Range (Vdc)	Comments
MFC6040	-10 to +75°C	643A	13	90	0.6†	9.0 to 18	Ideal for dc volume control and AGC audio amplifier applications.

ZERO VOLTAGE SWITCH TYPE	Temperature	Case	Comments
MFC8070	-10 to +75°C	644A	For use in ac power switching with output capable of triggering triacs

†At Unity Gain

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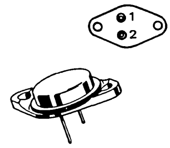
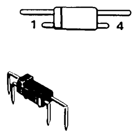
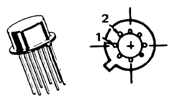
LINEAR IC PACKAGES



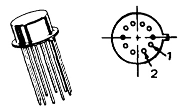
CASE 11 (TO-3)
No Suffix



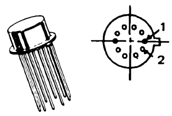
CASE 206A
No Suffix



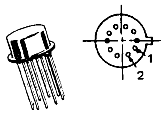
CASE 601 (TO-99)
Suffix G after type number



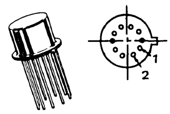
CASE 602A
Suffix G after type number



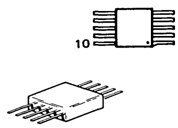
CASE 602B
Suffix G after type number



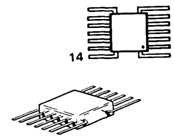
CASE 603-02 (TO-100)
Suffix G after type number



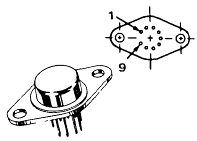
CASE 603-03
Suffix G after type number



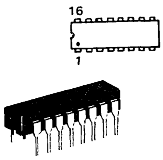
CASE 606 (TO-91)
Suffix F after type number



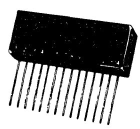
CASE 607 (TO-86)
Suffix F after type number



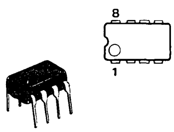
CASE 614
Suffix R after type number



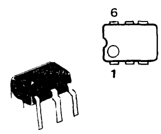
CASE 620
Suffix L after type number



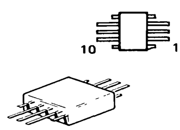
CASE 625
Suffix P after type number



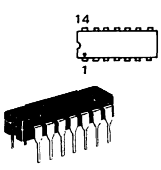
CASE 626
Suffix P after type number



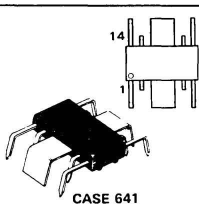
CASE 627
Suffix P after type number



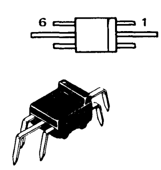
CASE 628
Suffix F after type number



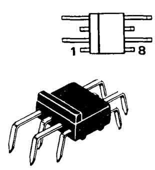
CASE 632 (TO-116)
Suffix L after type number



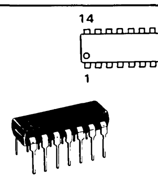
CASE 641
No Suffix



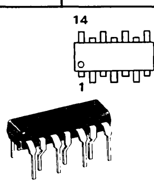
CASE 643A
No Suffix



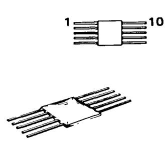
CASE 644A
No Suffix



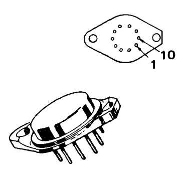
CASE 646
Suffix P after type number



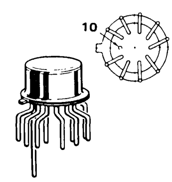
CASE 647
Suffix PQ after type number



CASE 665
Suffix F after type number



CASE 685
Suffix R after type number



CASE 686
Suffix G after type number

5

5

MICROCIRCUIT COMPONENTS

CONTENTS

6

MICROCIRCUIT COMPONENTS INDEX

TYPE	DEVICE IDENT.
MJC007 MJC043 MJC044 MJC067 MJC069 MJC070 MJC076 MJC082	SILICON POWER TRANSISTORS ↓
MMCD914 MMCD6100	SILICON SWITCHING DIODES ↓
MMCQ 100-300 to MMCQ 100-221 MMCQ 100-330-1 to MMCQ 100-221-1	THIN-FILM CAPACITORS ↓
MMCQ 101 MMCQ 101-1	THIN-FILM CAPACITORS ↓
MMCR100 MMCR105 MMCR110	THIN-FILM RESISTORS ↓
MMCS709	SILICON SWITCHING TRANSISTOR
MMCS910 MMCS918 MMCS929 MMCS930 MMCS0122 MMCS0123 MMCS0125 MMCS0130 MMCS0131 MMCS0134 MMCS0159 MMCS0172 MMCS2192 MMCS2193	SILICON AMPLIFIER TRANSISTORS ↓ SILICON FIELD-EFFECT TRANSISTORS ↓ SILICON NPN RF TRANSISTOR SILICON NPN RF TRANSISTOR SILICON SWITCHING & AMPLIFIER TRANSISTORS ↓

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MICROCIRCUIT COMPONENTS INDEX

TYPE	DEVICE IDENT.
MMCS2221	SILICON SWITCHING & AMPLIFIER TRANSISTORS
MMCS2221A	
MMCS2222	
MMCS2222A	
MMCS2369	SILICON SWITCHING TRANSISTOR
MMCS2369A	SILICON SWITCHING TRANSISTOR
MMCS2483	SILICON AMPLIFIER TRANSISTOR
MMCS2484	SILICON AMPLIFIER TRANSISTOR
MMCS2857	SILICON NPN RF TRANSISTOR
MMCS2894	SILICON SWITCHING TRANSISTOR
MMCS2906	SILICON SWITCHING & AMPLIFIER TRANSISTORS
MMCS2906A	
MMCS2907	
MMCS2907A	
MMCS3227	SILICON SWITCHING TRANSISTOR
MMCS3250	SILICON SWITCHING & AMPLIFIER TRANSISTORS
MMCS3250A	
MMCS3251	
MMCS3251A	
MMCS3252	SILICON SWITCHING TRANSISTORS
MMCS3253	
MMCS3444	
MMCS3467	
MMCS3468	
MMCS3498	SILICON SWITCHING & AMPLIFIER TRANSISTORS
MMCS3499	
MMCS3500	
MMCS3501	
MMCS3506	SILICON SWITCHING TRANSISTORS
MMCS3507	
MMCS3546	
MMCS3634	SILICON SWITCHING & AMPLIFIER TRANSISTORS
MMCS3635	
MMCS3636	
MMCS3637	
MMCS3724	SILICON SWITCHING TRANSISTORS
MMCS3725	
MMCS3734	
MMCS3735	
MMCS3762	
MMCS3763	
MMCS3798	SILICON AMPLIFIER TRANSISTOR
MMCS3799	SILICON AMPLIFIER TRANSISTOR

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MICROCIRCUIT COMPONENTS INDEX

TYPE	DEVICE IDENT.
MMCS3866	SILICON NPN RF TRANSISTOR
MMCS3903 MMCS3904 MMCS3905 MMCS3906	SILICON SWITCHING & AMPLIFIER TRANSISTORS
MMCS3959	SILICON SWITCHING TRANSISTOR
MMCS4260	SILICON SWITCHING TRANSISTOR
MMCS4400 MMCS4401 MMCS4402 MMCS4403	SILICON SWITCHING & AMPLIFIER TRANSISTORS
MMCS5087	SILICON AMPLIFIER TRANSISTOR
MMCS5088	SILICON AMPLIFIER TRANSISTOR
MMCS5636	SILICON NPN RF TRANSISTOR
MZC1.8B10 Thru MZC200B10	ZENER DIODES
MZC2.4A10 Thru MZC200A10	ZENER DIODES

THE TREND TOWARD HYBRID MICROCIRCUITRY

The electronics industry is increasingly turning to hybrid microcircuits for solutions to problems that have not been solved by conventional monolithic or discrete circuitry. The trend toward more use of hybrid circuits affects users in all segments of the industry, from aerospace to consumer equipment. Among the major reasons for using hybrid circuits are miniaturization, performance, economy, flexibility and reliability.

Hybrid microcircuits can be made very small, therefore, several microcircuits can be assembled in a conventional integrated circuit package, while others may require special packaging. A conventional circuit using discrete components can be converted to use microcircuit components at greater savings in space, and without the extensive changes in circuit design that would generally be required with monolithic circuitry. Hybrid circuits can incorporate inductors and passive components with high values.

An interesting characteristic of hybrid microcircuits is that they can be highly complex, and may incorporate power transistors, field-effect transistors, bipolar transistors, zener diodes and passive components.

Consequently, hybrids operate at higher power levels and can be manufactured to tighter tolerances. They also incorporate monolithic circuits, ensuring that a hybrid can always be more complex than any single monolithic chip.

Hybrid circuits can be less expensive than conventional discrete circuits due to fewer interconnections, and deposited components that can result in savings. The reduced number of soldered connections increases reliability, thus making them attractive for high-rel applications.

Hybrid circuits are more flexible than discrete circuits as they can be produced faster, and manufactured with a relatively small investment in equipment and training. This makes it possible for small equipment manufacturers to produce their own proprietary circuits.

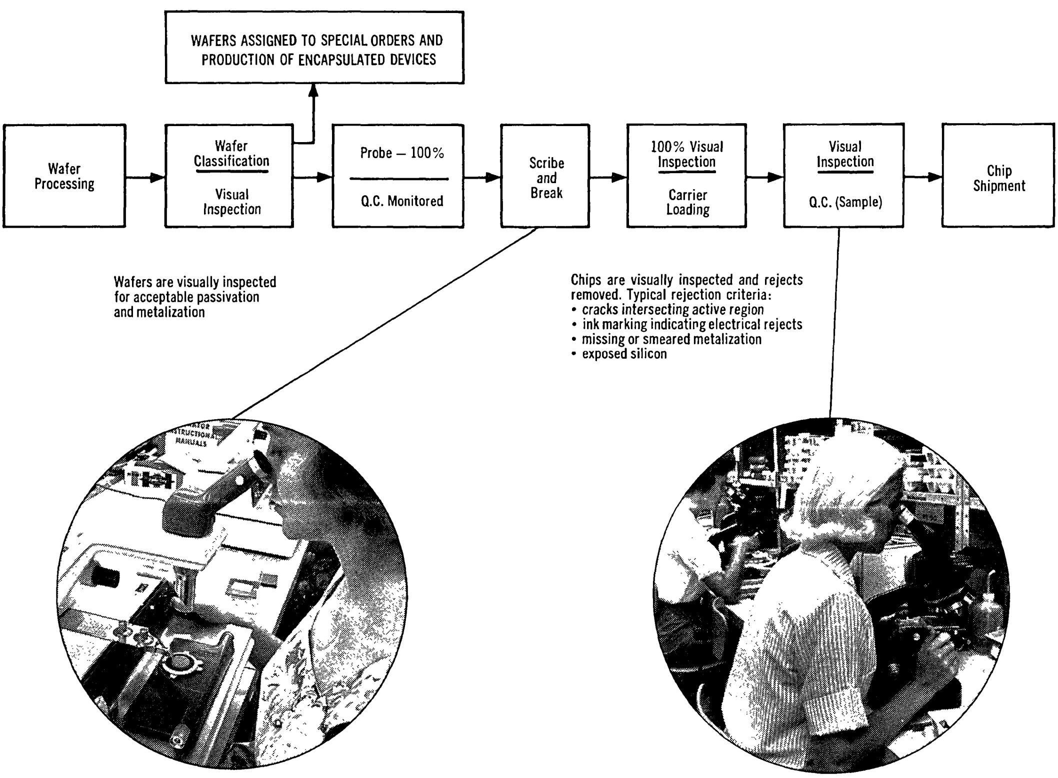
An area in which hybrid circuitry is especially useful is in microwave applications. Monolithic circuits are not useful above the VHF range, and discrete components may be too large for maximum efficiency. Hybrid circuits, on the other hand, are ideal as they are small and have minimum lead lengths. The ceramic substrates typical of hybrids provide excellent microwave isolation that often cannot be achieved with other techniques.

STANDARD CHIP PROCESSING

The transistor and small-signal diode "chips" in Motorola's Standard Microcircuit Components line are produced on the same well-proven production lines that provide Motorola's standard encapsulated devices. They are subjected to the same rigid in-process controls used to insure the reliability and performance of the eventual packaged components. In fact, as shown in the flow chart below, all wafer processing is completed before the wafers are assigned either for subsequent encapsulation or for additional special testing and handling involved in selling unencapsulated components.

As with standard encapsulated products, the entire test and inspection sequence for chips is under the auspices of the Quality Control Department, providing independent quality assurance completely disassociated from production control.

CHIP PROCESSING AND QUALITY CONTROL SEQUENCE



NON-STANDARD CHIP PROCESSING

The standard unencapsulated semiconductors described in the following sections meet a wide variety of application requirements. Nevertheless, there may be occasions when a designer can benefit from a non-standard device for a specific circuit. To satisfy these requirements, almost any device from Motorola's broad line of conventional packaged semiconductors may be obtained on a specially negotiated basis. Moreover, though the electrical specifications of these special chips are limited by certain test limitations, the customer can negotiate additional tests. Please contact your Motorola sales representative for more information.

On special order, Motorola transistors other than those listed in data sheets may be obtained in both wafer and chip form. The following tables list test limitations for these devices. The tests indicated can be made on a 100% basis. The tests can also be negotiated on a sampling basis.

Frequency and switching performance correspond to the inherent capability of a particular product line; dynamic specifications cannot be obtained by probing a chip. Such parameters are measured with the chip sealed in a standard encapsulated package and the resulting measurement includes the package parasitics.

TABLE I — Electrical Test Capability for 100% Probing of "Special" Unencapsulated Small-Signal and RF Transistors

Parameter	Test Condition	Limits
BV_{CBO}	10 μAdc-1.0 mAdc	0-300 V
BV_{CES}	10 μAdc-1.0 mAdc	0-300 V
BV_{CEO}	1.0 mAdc-10 mAdc	0-300 V
BV_{EBO}	10 μAdc-100 μAdc	0-300 V
I_{CBO}	0-200 V	10 nAdc
I_{CES}	0-200 V	10 nAdc
I_{EBO}	0-200 V	10 nAdc
h_{FE}	100 μAdc-500 mAdc	0-1000
$V_{CE(sat)}$	100 μAdc-500 mAdc*	0-10 V
$V_{BE(sat)}$	100 μAdc-500 mAdc*	0-10 V
V_f	0-500 mAdc	0-25 V

*Accuracy above 250 mAdc is not guaranteed due to contact resistances, etc.

TABLE II — Electrical Test Capability for 100% Wafer Probing of "Special" Unencapsulated Power Transistors

Parameter	Test Condition	Limits
BV_{EBO}	10 μAdc-10 mA	30 Vdc
BV_{CBO}	50 μAdc-5.0 mAdc	500 Vdc @ 1.0 mAdc
BV_{CES}	50 μAdc-1.0 mAdc	500 Vdc @ 1.0 mAdc
BV_{CEO}	1.0 mAdc-100 mAdc	500 Vdc @ 1.0 mAdc
h_{FE}	I_C = 50 mAdc-1.0 Adc V_{CE} = 1.0-20 Vdc	—

Minimum leakage currents will be the same as the minimum currents listed for the breakdown voltages above. On high voltage material (100 Vdc) we convert the breakdown voltage to leakage currents for test purposes. h_{FE} is test equipment limited, higher currents are correlated.

HANDLING PRECAUTIONS

Standard microcircuit components listed in the data sheets in this catalog are passivated devices, as are most special selections. However, many other unpackaged components, such as high power thyristors, silicon mesa power transistors and germanium power transistors, require special handling. Consequently their parameters cannot be guaranteed.

For passivated devices, although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published (or negotiated) specifications, provided three basic requirements are met in the customer's establishment.

1. Such devices are stored in an environment of no more than 30% relative humidity.

2. Devices are processed in a non-inert atmosphere not exceeding 100°C, or in an inert atmosphere not exceeding 400°C.

3. Processing equipment conforms to the minimum standards of equipment normally employed by semiconductor manufacturers.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

STANDARD CARRIER PACKAGES

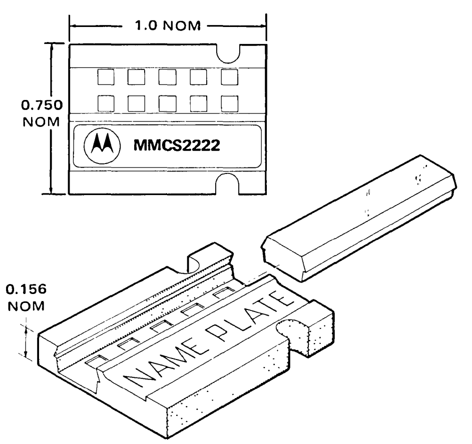
To accommodate customers with both small and large quantity requirements, Motorola supplies microcircuit components in two standard carriers, the Deka-Pak and the Multi-Pak. These carriers are shown in Figures 1 and 2. Both contain individual compartments to simplify user inventory recordkeeping and to protect the chips during storage.

The Deka-Pak holds 10 small-signal chips, and is ideal for prototype development.

The Multi-Pak is excellent for production use. Two versions, both 2 inches square, are available. One holds 400 small-signal chips, and the other is designed for 100 large chips such as power transistors.

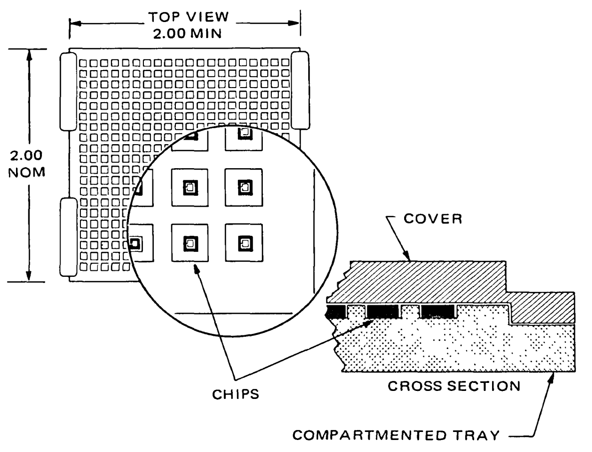
FIGURE 1 — DEKA-PAK

(10-chip carrier)



To accommodate the customer with limited quantity requirements, the Deka-Pak carrier contains individual compartments for 10 chips.

FIGURE 2 — MULTI-PAK



The Multi-Pak carrier is designed for production use. Two versions are available, one holding 400 small chips, and one holding 100 large chips such as those used for power transistors. All of the carriers are 2 inches square, and are vacuum sealed before shipment.

OPTIONAL SHIPPING METHODS

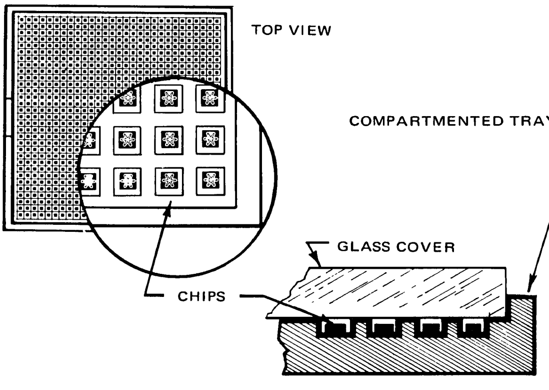
CHIP OPTIONS

For large quantity use, or special applications, shipping methods other than the standard Deka-Pak or Multi-Pak may be desired. Various packaging and shipping options are available on a negotiated basis. For more information on these options, please contact your Motorola sales representative.

TABLE I — Specification Options

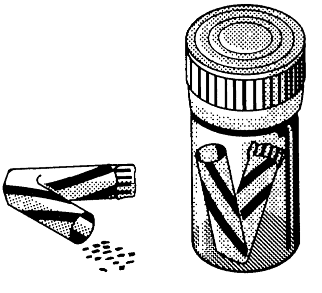
CHIPS	Shipping Options
1. 100% probed. Rejects inked but included in bulk shipment.	See Figure 4
2. 100% probed. Electrical and mechanical rejects removed.	See Figure 2 and Figure 3
3. Same as above, but sample tested in a package to meet negotiated acceptance criteria.	See Figure 2 and Figure 3

FIGURE 3 — K-PAK (1000-CHIP CARRIER)



This carrier holds 1000 chips. It is designed with individual compartments for each chip. The chips are placed in the carrier with the geometry side showing. (Very small chips may become inverted in transit.)

FIGURE 4 — STRAW-PAK PLASTIC VIAL BULK SHIPMENT



The Straw-Pak is a vial encompassing a straw that has one end closed. The chips are inserted in the straw, and then the straw is bent and placed in the plastic vial for shipment.

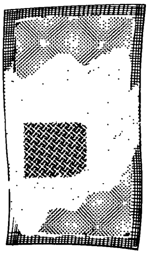
WAFER OPTIONS

Motorola unencapsulated transistors may be obtained in wafer form. The information in Table II gives the various specification verification and packaging options.

TABLE II — Specification Options

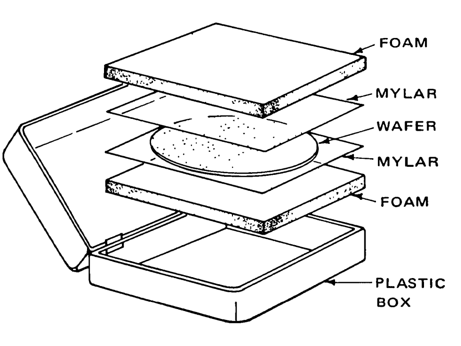
WAFERS	Shipping Options
1. Sample probed. Guaranteed minimum yield.	See Figure 6
2. 100% probed. Rejects inked.	See Figure 6
3. 100% probed. Rejects inked, scribed and broken. Wafer is placed between two sheets of mylar or filter paper and vacuum sealed in a plastic bag.	See Figure 5

FIGURE 5 — PLASTIC BAG SHIPMENT



Wafer is 100% probed. Rejects inked, scribed, and broken. Wafer is placed between two sheets of mylar and vacuum sealed in a plastic bag.

FIGURE 6 — WAFER SHIPMENT (UNSCRIBED)



Wafers are shipped between two layers of mylar, sandwiched between two layers of polyfoam pressed together in a plastic box. This prevents movement or damage to the wafer.

DEFINITION OF TERMS

Emitter-Base and Collector-Base Junctions. *The region where the base and collector, and the emitter and base meet. These junctions will be defined on the surface of the chip as an oxide step.*

Diffusion Window. *The opening etched through the oxide to permit the diffusion of the emitter and base.*

Active Junction. *A change in 'N' type to 'P' type doping or conversely, by a diffusion step. On discrete transistors there are 2 active junctions, the collector-base junction and the emitter-base junction.*

The Pre-Ohmic Window. *The opening etched through the oxide for metalization contact to the emitter and base regions.*

Pre-Ohmic Alignment. *The positioning of the oxide opening into which the metalization is placed.*

Passivated Region. *Any region covered by glass ($Si\ O_2$), nitride, or other protective dielectric.*

Expanded Contact. *Any pattern that has metalization crossing a diffused junction.*

Attached Foreign Material. *A foreign substance that cannot be removed when subjected to a nominal gas flow. Lint, silicon dust, etc. are not considered attached since they can be removed after die mount.*

INSPECTION CRITERIA

Visual inspection is performed with a microscope using 40X-80X magnification for Silicon-Power Chips and 100X-125X for other devices.

SCRIBING DEFECTS

Excess Chip. A chip shall be rejected if a portion of an adjacent chip with metalization is still attached to subject chip.

Scribe Line Limits. A chip shall be rejected if a scribe line touches or crosses an active junction area or a metalized region.

MECHANICAL DEFECTS

Inspect each chip to insure there are no cracks or breaks that:

Non-Expanded Contacts

(a) Touch the collector-base junction (NPN).
(b) Extend through the annular ring (PNP).

Expanded Contacts

(a) Touch the collector-base junction (NPN).
(b) Extend through the annular ring (PNP).
(c) Extend under any metalized bonding pad.

Inspect each chip to insure there are no cracks greater than one mil. in length in a passivated region and extending toward an active area. (Does not apply to Silicon Power devices.)

ALIGNMENT DEFECTS

Pre-Ohmic Alignment. The chip shall not contain emitter pre-ohmic windows that cross the emitter-base junctions or base pre-ohmic windows that touch the emitter-base junction or cross the collector-base junction.

Diffusion Window Alignment. No diffusion window shall touch another diffusion window.

Metalization Alignment. The metalization must be aligned so that at least 50% of the pre-ohmic window is covered with metalization.

FOREIGN MATERIAL DEFECTS

Bridged-Across Metal. A chip shall be rejected when attached foreign material bridges across normally separated metalized areas.

Particle Size Inside Active Area. A chip shall be rejected when attached foreign material greater than 2 mils. is found inside collector-base junction or on the emitter-base bonding pads.

OXIDE DEFECTS

Exposed Silicon on Junction. A chip shall be rejected if exposed silicon touches or crosses the collector-base junction or the emitter-base junction.

Exposed Silicon Touching Metal. A chip shall be rejected if exposed silicon touches or extends under the bonding pad metalization. (Expanded contacts only.)

Oxide Defect in Active Area. A chip shall be rejected if an oxide defect occurs inside or on the collector-base junction with a major dimension greater than 1 mil. (Does not apply to Silicon Power Devices.)

Oxide Defect Crossing or Touching. A chip shall be rejected if gross oxide defects, evidenced by alternately colored bands (rainbow effect), emit from two separate ohmic contacts and either touch or cross each other, or cross the collector-base junction. (Not applicable to line geometries with more than 18 fingers total.)

INSPECTION CRITERIA (continued)

Oxide Defect Under Bonding Pads. A chip shall be rejected if an oxide defect extends under 25% of the bonding pad.

Discontinuous Diffusion Lines. A chip shall be rejected if any diffusion line is broken or missing.

METALIZATION DEFECTS

Expanded Contacts (finger geometries).

Missing Metalization on Bonding Pads. A chip shall be rejected when 25% of the metalization is missing from a bonding pad.

Metalization Width at Oxide Step. Any chip shall be rejected if the metalization width of any finger is reduced greater than 25% at any oxide step. 75% of the metal width must remain.

Metalization Width In First 50 Percent of Finger. A chip shall be rejected if the finger metalization is narrower than 50% of its original design width or if the finger width is reduced greater than 50% due to a severe scratch or void in the first 50% of the finger. A severe scratch is one which exposes the underlying surface.

Fingers Isolated or Missing. A chip shall be rejected if any finger is not 100% continuous over the first 50% of the finger (from the bonding pad). For line geometries with more than 18 fingers, a chip shall be rejected if over 10% of the fingers do not have metalization covering the first 50% of each finger.

Bubbled Metalization. A chip shall be rejected if it exhibits any bubbled metalization on a bonding pad.

Lifted Metalization. A chip shall be rejected if it exhibits any lifted metalization. Slight undercutting causing a lifted appearance is not cause for rejection.

Bridged Metalization. A chip shall be rejected for bridged metal shorting any two normally separated metalized areas and if oxide is not clearly visible between the pre-ohmic window and any adjacent metalization not intended to make contact.

Metal Corrosion. A chip shall be rejected if it exhibits any corroded metal. Corrosion is a chemical reaction or process causing abnormalities in the metalization. A rough metalization surface is not to be considered corrosion.

Non-Expanded Contacts

Missing Metalization. A chip shall be rejected when more than 25% of the metalization is missing from a bonding pad.

Lifted Metalization. A chip shall be rejected if it exhibits any lifted metalization. Slight undercutting causing a lifted appearance is not cause for rejection.

Bubbled Metalization. A chip shall be rejected if it exhibits any bubbled metalization on a bonding pad.

Bridged Metalization. A chip shall be rejected for bridged metal shorting any two normally separated metalized areas.

Narrow Metal Widths In Relation To Design Width. A chip shall be rejected if the metalization is narrower than 50% of its original design width.

Metal Corrosion. A chip shall be rejected if it exhibits any corroded metal. Corrosion is a chemical reaction or process causing abnormalities in the metalization. A rough metalization surface is not to be considered corrosion.

METALIZED ANNULAR RING

Missing Metalization. A chip shall be rejected when a metalized annular ring is not 100% continuous.

Bridged Metalization. A chip shall be rejected for bridged metal shorting the metalized annular ring with any other metalized area.

RECOMMENDED INCOMING INSPECTION PROCEDURES

Motorola assures that the devices will meet the customers' incoming visual inspection when inspected to the visual criteria and LTPD limits specified in the data sheet. Inspection must be performed at the power and magnification indicated. Motorola guarantees dc parameters to LTPD limits specified in the data sheet.

Returned Components

It is suggested that the customer perform incoming inspection in the following sequence:

1. Visual
2. Test dc electrical parameters

A. If the lot fails visual inspection, containers must be closed and secured and the entire lot returned to Motorola with a detailed inspection report. In no case will Motorola accept rejected material that the customer has inspected 100%.

B. After the lot has passed incoming visual inspection, samples are selected and subjected to electrical tests of the dc parameters. If samples do not pass the electrical tests, they shall be packaged separately and identified with all the information from the original package of chips. The shipping container must be closed and secured. The entire lot together with the test samples and a detailed inspection report shall be returned to Motorola. In no case will Motorola accept rejected material that the customer has inspected 100%.

UNENCAPSULATED AMPLIFIER TRANSISTORS

. . . with passivated Annular construction that provides high reliability and consistent performance. These chips are identical to the chips used in packaged Motorola transistors with 2N prefixes; i.e., the MMCS910 chip is used in the Motorola 2N910 transistor. For more detailed characteristic data, please refer to the equivalent Motorola 2N. . . . data sheet.

- DC Current Gains to 300 Minimum
- Breakdown Voltages to 100 Volts
- Noise Figures as Low as 0.8 dB Typical

SILICON TRANSISTORS

MMCS910 MMCS918 MMCS929 MMCS930 MMCS2483 MMCS2484 MMCS3798 MMCS3799 MMCS5087 MMCS5088

MAXIMUM RATINGS

TYPE	V_{CEO} Volts	V_{CB} Volts	V_{EB} Volts	I_C mA	Geometry
NPN					
MMCS910	60	100	7.0	–	1
MMCS918	15	30	3.0	50	2
MMCS929	45	45	5.0	30	3
MMCS930	45	45	5.0	30	3
MMCS2483	60	60	6.0	50	3
MMCS2484	60	60	6.0	50	3
MMCS5088	30	35	4.5	50	5
PNP					
MMCS3798	60	60	5.0	50	4
MMCS3799	60	60	5.0	50	4
MMCS5087	30	50	3.0	50	4

Operating and Storage Junction Temperature Range −65 to +200°C

HANDLING PRECAUTIONS

Although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published specifications, provided three basic requirements are met in the customer's establishment.

1. Such devices are stored in an environment of no more than 30% relative humidity.

2. Devices are die-and-wire bonded in a noninert atmosphere not exceeding 100°C, or in an inert atmosphere not exceeding 400°C.

3. Processing equipment conforms to the minimum standards of equipment normally employed in semiconductor establishments.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

ELECTRICAL CHARACTERISTICS ($T_A = 25^oC$)

TYPE	BV_{CEO} Volts min	@ I_C mA	BV_{CBO} Volts min	@ I_C μA	BV_{EBO} Volts min	@ I_E μA	I_{CBO} nA max	@ V_{CB} Volts	h_{FE} min/max	@ I_C μA mA *	$V_{CE(sat)}$ Volts max	& $V_{BE(sat)}$ Volts max	@ I_C mA
NPN													
MMCS910	60	30	100	100	7.0	100	25	75	75/–	10*	0.4	0.8	10
MMCS918	15	3.0	30	1.0	3.0	10	10	15	20/–	3.0*	0.4	1.0	10
MMCS929	45	10	45	10	5.0	10	10	45	60/–	500	1.0	1.0	10
MMCS930	45	10	45	10	5.0	10	10	45	150/–	500	1.0	1.0	10
MMCS2483	60	10	60	10	6.0	10	10	45	75/–	100	0.35	–	1.0
MMCS2484	60	10	60	10	6.0	10	10	45	175/–	100	0.35	–	1.0
MMCS5088	30	1.0	35	100	4.5	10	50	20	300/900	100	0.5	–	10
PNP													
MMCS3798 ①	60	10	60	10	5.0	10	10	50	150/450	500	0.25	0.8	1.0
MMCS3799 ①	60	10	60	10	5.0	10	10	50	300/900	500	0.25	0.8	1.0
MMCS5087	30	1.0	50	100	3.0	10	50	35	250/800	100	0.3	–	10

AC* PARAMETERS

TYPE	C_{ob} pF max	C_{ib} pF max	$\lvert h_{fe} \rvert$ min	@ I_C mA	, V_{CE} Volts	, f MHz	NF dB max	@ f Hz
NPN								
MMCS910	15	85	2.5	50	10	20	14	1.0 K
MMCS918	1.7	2.0	6.0	4.0	10	100	6.5	60 M
MMCS929	8.0	–	1.0	0.5	5.0	30	5.0	10-15.7 K
MMCS930	8.0	–	1.0	0.5	5.0	30	4.0	10-15.7 K
MMCS2483	6.0	8.0	2.0	0.5	5.0	30	5.0	10-15.7 K
MMCS2484	6.0	8.0	2.0	0.5	5.0	30	4.0	10-15.7 K
MMCS5088	–	–	2.0	0.5	5.0	20	4.0	10-15.7 K
PNP								
MMCS3798 ①	4.0	–	0.8	0.5	5.0	30	1.0 typ	1.0 K
MMCS3799 ①	4.0	–	0.8	0.5	5.0	30	0.8 typ	1.0 K
MMCS5087	4.0	–	1.6	0.5	5.0	20	3.0	10-15.7 K

① SMALL-SIGNAL CHARACTERISTICS

(I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz.)

TYPE	h_{ie} k ohms min/max	h_{re} x 10^{-4} max	h_{oe} μmhos min/max
PNP			
MMCS3798	2.4/18	30	4.0/70
MMCS3799	8.0/48	30	4.0/70

*AC parameter values are as specified in the standard 2N data sheets. (encapsulated devices).

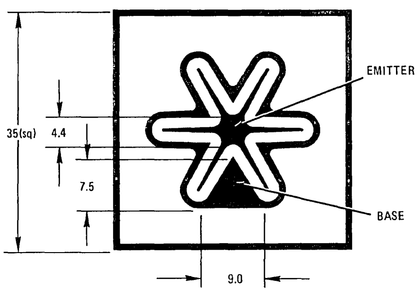
PARAMETER LIMITATIONS AND WARRANTY

Probe limitations allow 100% testing of low level dc parameters only. DC parameters have been selected to insure electrical characteristics to an LTPD of 10 and ac parameters to an LTPD of 20. Visual inspection is performed to an LTPD of 20. See "Visual Inspection Criteria" in General Information Section.

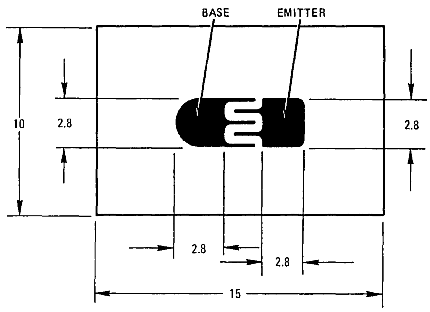
MECHANICAL INFORMATION

MATERIAL – SILICON
FRONT METALIZATION – ALUMINUM
BACK METALIZATION – GOLD (Collector Contact)

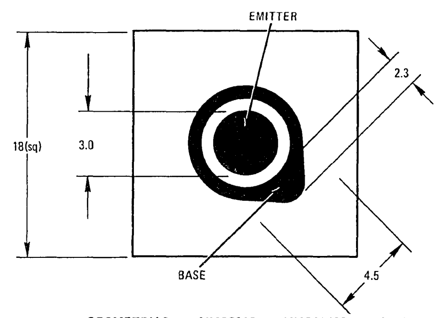
ALL DIMENSIONS ARE IN MILS



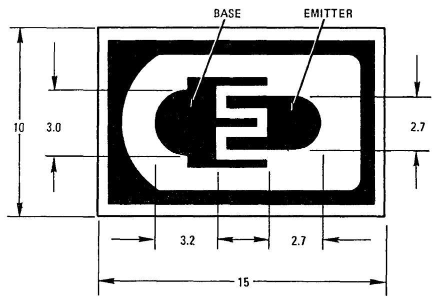
GEOMETRY 1 MMCS910 NPN



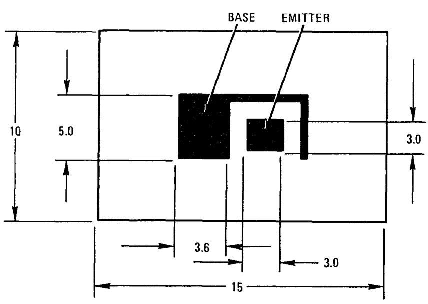
GEOMETRY 2 MMCS918 NPN



GEOMETRY 3 MMCS929 MMCS2483 NPN
MMCS930 MMCS2484



GEOMETRY 4 MMCS3798 MMCS3799 MMCS5087 PNP



GEOMETRY 5 MMCS5088 NPN

6

UNENCAPSULATED SWITCHING TRANSISTORS

. . . with passivated Annular construction that provides high reliability and consistent performance. These chips are identical to the chips used in packaged Motorola transistors with 2N prefixes; i.e., the MMCS709 chip is used in the Motorola 2N709 transistor. For more detailed characteristic data, please refer to the equivalent Motorola 2N. . . . data sheet.

- Breakdown Voltage to 80 Volts
- Switching Times as Low as 3.5 ns

SILICON TRANSISTORS

MMCS709, MMCS2369, MMCS2369A, MMCS2894, MMCS3227, MMCS3252, MMCS3253, MMCS3444, MMCS3467, MMCS3468, MMCS3506, MMCS3507, MMCS3546, MMCS3724, MMCS3725, MMCS3734, MMCS3735, MMCS3762, MMCS3763, MMCS3959, MMCS4260

MAXIMUM RATINGS

TYPE	V_{CEO} Volts	V_{CB} Volts	V_{EB} Volts	I_C Peak† mA	Geometry
NPN					
MMCS709	6.0	15	4.0	100	1
MMCS2369	15	40	4.5	500†	2
MMCS2369A	15	40	4.5	200	2
MMCS3227	20	40	6.0	500†	2
MMCS3252	30	60	5.0	1000	4
MMCS3253	40	75	5.0	1000	4
MMCS3444	50	80	5.0	1000	4
MMCS3506	40	60	5.0	3000	6
MMCS3507	50	80	5.0	3000	6
MMCS3724	30	50	6.0	1000	4
MMCS3725	50	80	6.0	1000	4
MMCS3734	30	50	5.0	1500	8
MMCS3735	50	75	5.0	1500	8
MMCS3959	12	20	4.5	30	9
PNP					
MMCS2894	12	12	4.0	200	3
MMCS3467	40	40	5.0	1000	5
MMCS3468	50	50	5.0	1000	5
MMCS3546	12	15	4.5	200	7
MMCS3762	40	40	5.0	1500	5
MMCS3763	60	60	5.0	1500	5
MMCS4260	15	15	4.5	30	10

Operating and Storage Junction Temperature Range -65 to +200°C

HANDLING PRECAUTIONS

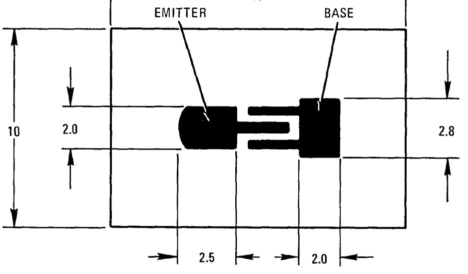
Although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published specifications, provided three basic requirements are met in the customer's establishment.

1. Such devices are stored in an environment of no more than 30% relative humidity.

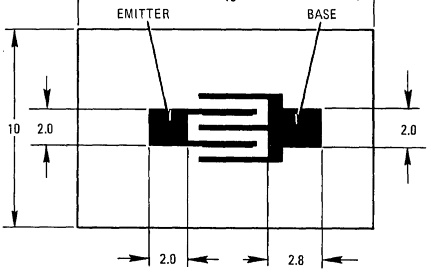
2. Devices are die-and-wire bonded in a non-inert atmosphere not exceeding 100°C, or in an inert atmosphere not exceeding 400°C.

3. Processing equipment conforms to the minimum standards of equipment normally employed in semiconductor establishments.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.



GEOMETRY 1 MMCS709 NPN



GEOMETRY 2 MMCS2369 MMCS2369A MMCS3227 NPN

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SWITCHING TRANSISTORS (continued)

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

TYPE	BV_{CEO} Volts min	@ I_C mA	BV_{CBO} Volts min	@ I_C µA	BV_{EBO} Volts min	@ I_E µA	I_{CBO} nA max	@ V_{CB} Volts	h_{FE} min/max	@ I_C mA	$V_{CE(sat)}$ Volts max	$V_{BE(sat)}$ Volts max	@ I_C mA
NPN													
MMCS709	6.0	10	15	10	4.0	10	50	5.0	20/200	10	0.35	0.85	3.0
MMCS2369	15	10	40	10	4.5	10	400	20	40/120	10	0.25	0.85	10
MMCS2369A	15	10	40	10	4.5	10	400	20	30/–	30	0.2	0.85	10
MMCS3227	20	10	40	10	6.0	10	200	20	100/300	10	0.25	0.85	10
MMCS3252	30	10	60	10	5.0	10	500	40	30/90	500	0.5	1.3	500
MMCS3253	40	10	75	10	5.0	10	500	60	25/75	500	0.6	1.3	500
MMCS3444	50	10	80	10	5.0	10	500	60	20/60	500	0.6	1.3	500
MMCS3506	40	10	60	100	5.0	10	1000	30	40/200	1500	1.0	1.4	1500
MMCS3507	50	10	80	100	5.0	10	1000	40	30/150	1500	1.0	1.4	1500
MMCS3724	30	10	50	10	6.0	10	500	40	60/150	100	0.42	1.2	500
MMCS3725	50	10	80	10	6.0	10	500	60	60/150	100	0.42	1.2	500
MMCS3734	30	10	50	10	5.0	10	200	25	30/120	1000	0.5	1.2	500
MMCS3735	50	10	75	10	5.0	10	200	40	20/80	1000	0.5	1.2	500
MMCS3959	12	10	20	10	4.5	10	50	10	40/200	10	0.2	–	1.0
PNP													
MMCS2894	12	10	12	10	4.0	10	10	6.0	40/150	30	0.2	1.2	30
MMCS3467	40	10	40	10	5.0	10	100	30	40/120	500	0.5	1.2	500
MMCS3468	50	10	50	10	5.0	10	100	30	25/75	500	0.6	1.2	500
MMCS3546	12	10	15	10	4.5	10	10	10	30/120	10	0.15	0.9	10
MMCS3762	40	10	40	10	5.0	10	100	30	30/120	1000	0.9	1.4	1000
MMCS3763	60	10	60	10	5.0	10	100	50	20/80	1000	0.9	1.4	1000
MMCS4260	15	10	15	10	4.5	10	50	12	30/150	10	0.35	1.0	10

AC* PARAMETERS

TYPE	C_{ob} pF max	C_{ib} pF max	$\|h_{fe}\|$ min	@ I_C mA	, V_{CE} Volts	, f MHz	t_d, t_r t_{on}* ns max	t_s, t_f t_{off}* ns max	Test Circuit Fig. No.
NPN									
MMCS709	3.0	2.0	5.0	5.0	4.0	100	18*	18*	1
MMCS2369	4.0	4.0	5.0	10	10	100	15*	20*	2
MMCS2369A	4.0	–	5.0	10	10	100	14*	20*	3
MMCS3227	4.0	4.0	5.0	10	10	100	15*	20*	2
MMCS3252	12	80	1.8	50	10	100	18,35	50,35	5
MMCS3253	12	80	1.5	50	10	100	18,40	50,35	5
MMCS3444	12	80	1.5	50	10	100	18,40	50,35	5
MMCS3506	40	300	2.5	100	5.0	20	18,40	65,40	7
MMCS3507	40	300	2.5	100	5.0	20	18,40	65,40	7
MMCS3724	12	70	2.0	50	10	100	45*	75*	9
MMCS3725	10	70	2.0	50	10	100	45*	75*	9
MMCS3734	9.0	80	2.0	50	10	100	10,45	35,35	10
MMCS3735	9.0	80	2.0	50	10	100	10,45	35,35	10
MMCS3959	2.5	2.5	11	5.0	4.0	100	2.4,3.0(1)	1.6,3.3(1)	12
PNP									
MMCS2894	6.0	6.0	3.2	30	10	100	70*	100*	4
MMCS3467	25	100	1.6	50	10	100	10,30	80,30	6
MMCS3468	25	100	1.4	50	10	100	10,30	80,30	6
MMCS3546	6.0	6.0	7.0	10	10	100	48*	35*	8
MMCS3762	18	95	1.5	50	10	100	10,40	95,40	11
MMCS3763	18	95	1.2	50	10	100	10,40	95,40	11
MMCS4260	2.5	2.5	10	5.0	4.0	100	1.0,0.5(1)	1.0,1.0(1)	13

*AC parameters are as specified in the standard 2N data sheets (encapsulated devices)

(1) Typical Switching Times

PARAMETER LIMITATIONS AND WARRANTY

Probe limitations allow 100% testing of low level dc parameters only. DC parameters have been selected to insure electrical characteristics to an LTPD of 10 and ac parameters to an LTPD of 20.

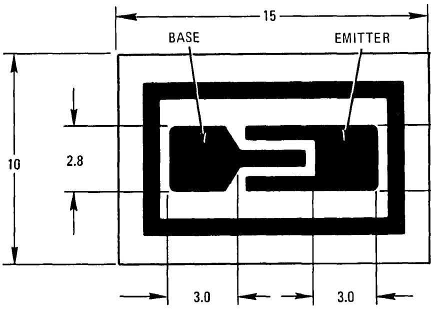
Visual Inspection is performed to an LTPD of 20. See "Visual Inspection Criteria" in General Information Section.

6

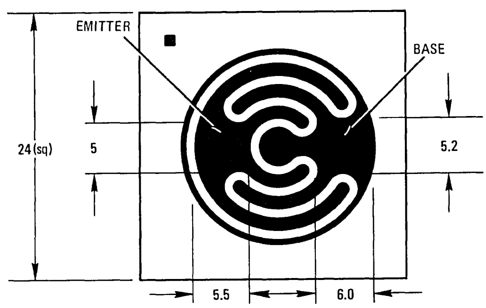
MECHANICAL INFORMATION

MATERIAL – SILICON
FRONT METALIZATION – ALUMINUM
BACK METALIZATION – GOLD (Collector Contact)

ALL DIMENSIONS ARE IN MILS



GEOMETRY 3 MMCS2894 PNP

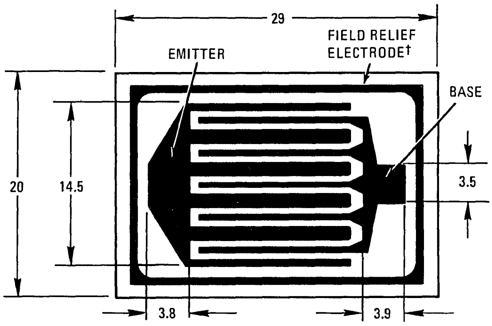


GEOMETRY 4 MMCS3252 MMCS3253 MMCS3444 MMCS3724 MMCS3725 NPN

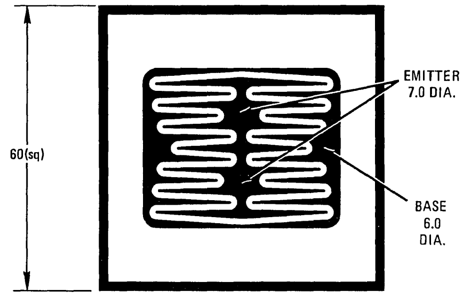
MECHANICAL INFORMATION

MATERIAL – SILICON
FRONT METALIZATION – ALUMINUM
BACK METALIZATION – GOLD (Collector Contact)

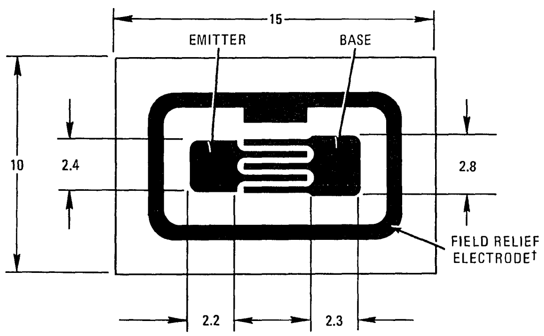
ALL DIMENSIONS ARE IN MILS



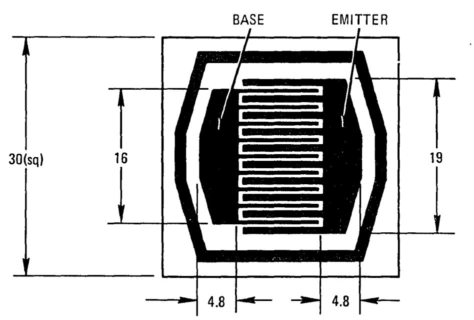
GEOMETRY 5 MMCS3467 MMCS3468 MMCS3762 MMCS3763 PNP



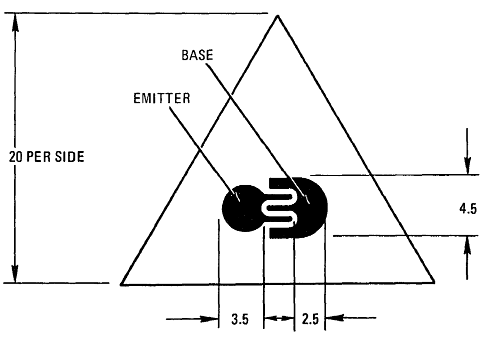
GEOMETRY 6 MMCS3506 MMCS3507 NPN



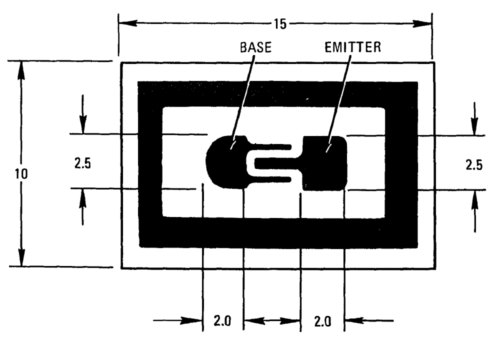
GEOMETRY 7 MMCS3546 PNP



GEOMETRY 8 MMCS3734 MMCS3735 NPN



GEOMETRY 9 MMCS3959 NPN



GEOMETRY 10 MMCS4260 PNP

†Patented by Motorola – Patent No. 3,302,076

6

TEST CIRCUITS

FIGURE 1 — TURN-ON AND TURN-OFF TIME TEST CIRCUIT

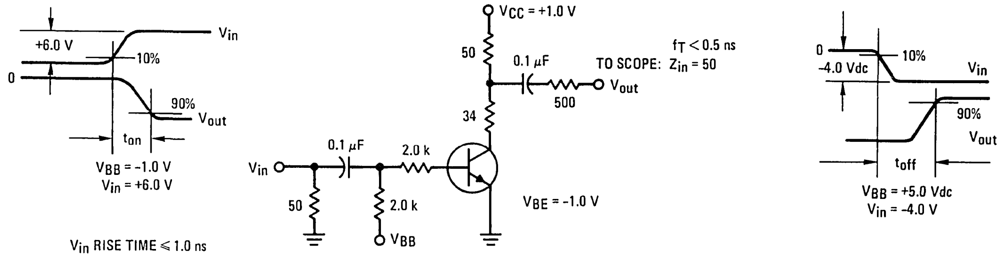
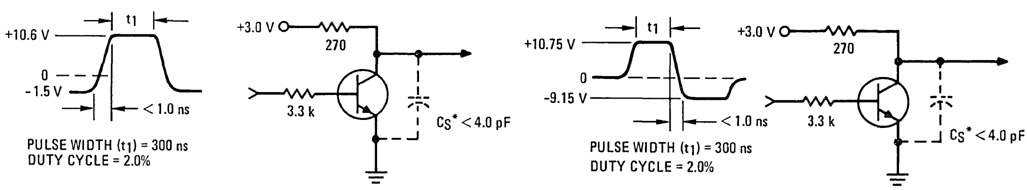


FIGURE 2 — SWITCHING TIME EQUIVALENT TEST CIRCUITS

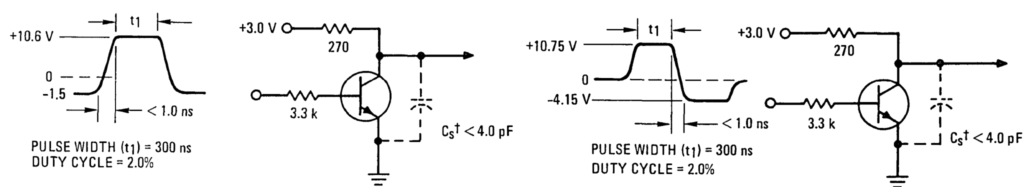
-ton CIRCUIT — 10 mA

-toff CIRCUIT — 10 mA



*Total shunt capacitance of test jig and connectors.

FIGURE 3 — SWITCHING TIME EQUIVALENT TEST CIRCUITS



†Total shunt capacitance of test jig and connectors.

FIGURE 4 — SWITCHING TIME TEST CIRCUIT

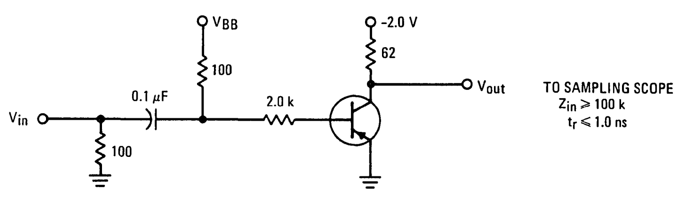


FIGURE 5 — EQUIVALENT CIRCUIT FOR MEASURING

DELAY AND RISE TIMES

STORAGE AND FALL TIMES

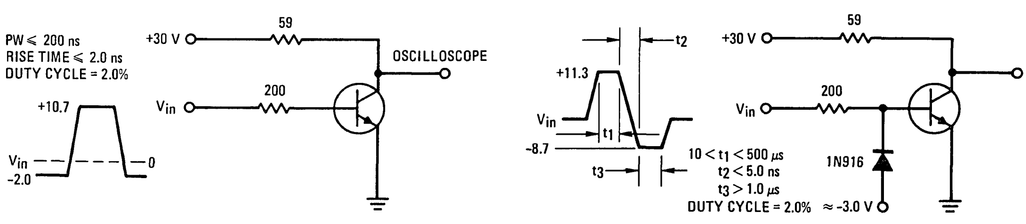


FIGURE 6 – EQUIVALENT TEST CIRCUIT

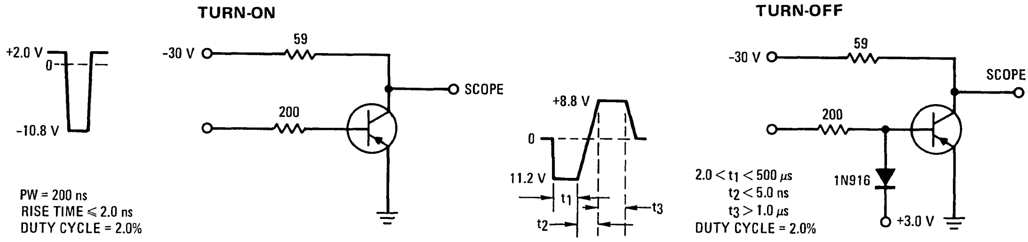


FIGURE 7 – EQUIVALENT CIRCUIT FOR MEASURING

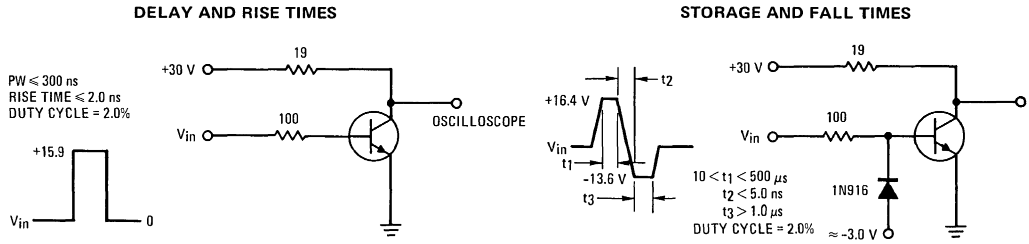


FIGURE 8 – SWITCHING TIME TEST CIRCUIT

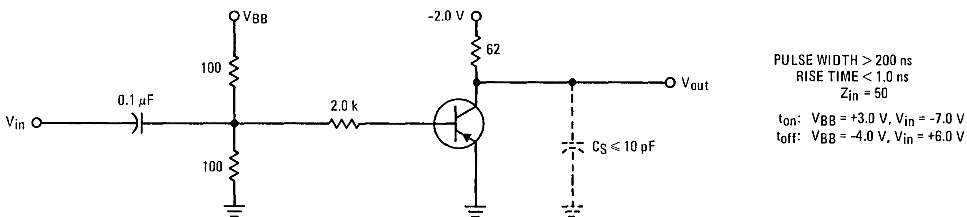


FIGURE 9 – SWITCHING TIMES TEST CIRCUIT

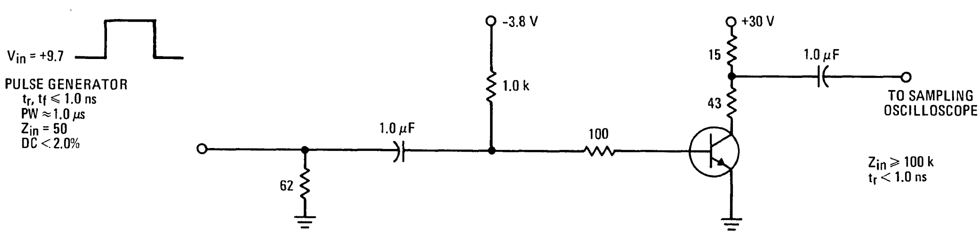


FIGURE 10 – SWITCHING TIME EQUIVALENT TEST CIRCUITS

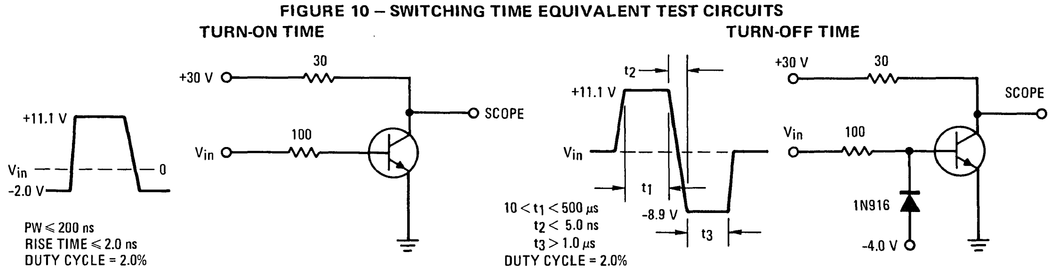


FIGURE 11 – SWITCHING TIME EQUIVALENT TEST CIRCUITS

TURN-ON TIME **TURN-OFF TIME**

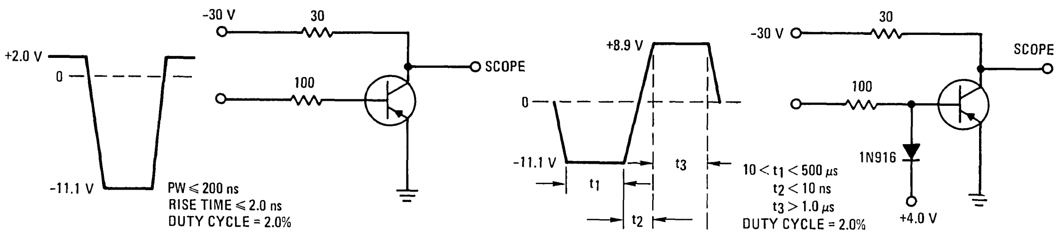
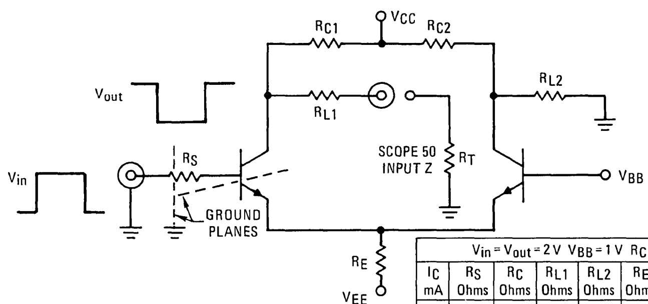


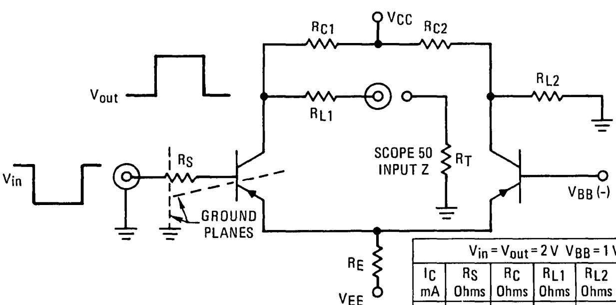
FIGURE 12 – TEST CIRCUIT



The test circuit is designed to simulate a series of cascaded identical circuits, with input Z equal to output Z.

	$V_{in} = V_{out} = 2\ V$ $V_{BB} = 1\ V$ $R_{C1} = R_{C2}$							$V_{in} = V_{out} = 1\ V$ $V_{BB} = 0.5\ V$ $R_{C1} = R_{C2}$						
I_C mA	R_S Ohms	R_C Ohms	R_{L1} Ohms	R_{L2} Ohms	R_E Ohms	V_{EE} Volts	V_{CC} Volts	R_S Ohms	R_C Ohms	R_{L1} Ohms	R_{L2} Ohms	R_E Ohms	V_{EE} Volts	V_{CC} Volts
1.0	2.0 k	6.0 k	3.0 k	3.0 k	10 k	10	16	1.0 k	6.0 k	1.2 k	1.2 k	24 k	24	32
5.0	360	3.56 k	400	450	2.0 k	10	47	175	1.0 k	200	250	3.0 k	15	27
10	160	1.0 k	200	250	3.0 k	30	26.3	75	300	100	150	3.0 k	30	17
20	62	300	100	150	1.0 k	20	16	25	150	25	75	1.0 k	20	11
30	28	157	66	116	1.0 k	30	13	8.0	77	0	50	1.0 k	30	9.0

FIGURE 13 – TEST CIRCUIT



The test circuit is designed to simulate a series of cascaded identical circuits, with input Z equal to output Z.

	$V_{in} = V_{out} = 2\ V$ $V_{BB} = 1\ V$ $R_{C1} = R_{C2}$							$V_{in} = V_{out} = 1\ V$ $V_{BB} = 0.5\ V$ $R_{C1} = R_{C2}$						
I_C mA	R_S Ohms	R_C Ohms	R_{L1} Ohms	R_{L2} Ohms	R_E Ohms	V_{EE} Volts	V_{CC} Volts	R_S Ohms	R_C Ohms	R_{L1} Ohms	R_{L2} Ohms	R_E Ohms	V_{EE} Volts	V_{CC} Volts
1.0	2.0 k	6.0 k	3.0 k	3.0 k	10 k	10	16	1.0 k	6.0 k	1.2 k	1.2 k	24 k	24	32
5.0	360	3.56 k	400	450	2.0 k	10	47	175	1.0 k	200	250	3.0 k	15	27
10	160	1.0 k	200	250	3.0 k	30	26.3	75	300	100	150	3.0 k	30	17
20	62	300	100	150	1.0 k	20	16	25	150	25	75	1.0 k	20	11
30	28	157	66	116	1.0 k	30	13	8.0	77	0	50	1.0 k	30	9.0

6

UNENCAPSULATED SWITCHING AND AMPLIFIER TRANSISTORS

. . . with passivated Annular construction that provides high reliability and consistent performance. These chips are identical to the chips used in packaged Motorola transistors with 2N prefixes; i.e., the MMCS2192 chip is used in the Motorola 2N2192 transistor. For more detailed characteristic data, please refer to the equivalent Motorola 2N. . . . data sheet.

- DC Current Gain to 100 Minimum
- Breakdown Voltages to 175 Volts
- f_T to 300 MHz

SILICON TRANSISTORS

MMCS2192, MMCS2193, MMCS2221, MMCS2221A, MMCS2222, MMCS2222A, MMCS2906, MMCS2906A, MMCS2907, MMCS2907A, MMCS3250, MMCS3250A, MMCS3251, MMCS3251A, MMCS3498, MMCS3499, MMCS3500, MMCS3501, MMCS3634, MMCS3635, MMCS3636, MMCS3637, MMCS3903, MMCS3904, MMCS3905, MMCS3906, MMCS4400, MMCS4401, MMCS4402, MMCS4403

MAXIMUM RATINGS

TYPE	V_{CEO} Volts	V_{CB} Volts	V_{EB} Volts	I_C mA	Geometry
NPN					
MMCS2192	40	60	5.0	1000	1
MMCS2193	50	80	8.0	1000	1
MMCS2221	30	60	5.0	800	2
MMCS2221A	40	75	6.0	800	2
MMCS2222	30	60	5.0	800	2
MMCS2222A	40	75	6.0	800	2
MMCS3498	100	100	6.0	500	1
MMCS3499	100	100	6.0	500	1
MMCS3500	150	150	6.0	300	1
MMCS3501	150	150	6.0	300	1
MMCS3903	40	60	6.0	200	6
MMCS3904	40	60	6.0	200	6
MMCS4400	40	60	6.0	600	7
MMCS4401	40	60	6.0	600	7
PNP					
MMCS2906	40	60	5.0	600	3
MMCS2906A	60	60	5.0	600	3
MMCS2907	40	60	5.0	600	3
MMCS2907A	60	60	5.0	600	3
MMCS3250	40	50	5.0	200	5
MMCS3250A	60	60	5.0	200	5
MMCS3251	40	50	5.0	200	5
MMCS3251A	60	60	5.0	200	5
MMCS3634	140	140	5.0	1000	4
MMCS3635	140	140	5.0	1000	4
MMCS3636	175	175	5.0	1000	4
MMCS3637	175	175	5.0	1000	4
MMCS3905	40	40	5.0	200	5
MMCS3906	40	40	5.0	200	5
MMCS4402	40	40	5.0	600	8
MMCS4403	40	40	5.0	600	8

Operating and Storage Junction Temperature Range −65 to +200°C

HANDLING PRECAUTIONS

Although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published specifications, provided three basic requirements are met in the customer's establishment.

1. Such devices are stored in an environment of no more than 30% relative humidity.

2. Devices are die-and-wire bonded in a noninert atmosphere not exceeding 100°C, or in an inert atmosphere not exceeding 400°C.

3. Processing equipment conforms to the minimum standards of equipment normally employed in semiconductor establishments.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

SWITCHING & AMPLIFIER TRANSISTORS (continued)

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

TYPE	BV_{CEO} Volts min	@ I_C mA	BV_{CBO} Volts min	@ I_C µA	BV_{EBO} Volts min	@ I_E µA	I_{CBO} nA max	@ V_{CB} Volts	h_{FE} min/max	@ I_C mA	$V_{CE(sat)}$ Volts max	$V_{BE(sat)}$ Volts max	@ I_C mA
NPN													
MMCS2192	40	25	60	100	5.0	100	10	30	100/300	150	0.35	1.3	150
MMCS2193	50	25	80	100	8.0	100	10	60	40/120	150	0.35	1.3	150
MMCS2221	30	10	60	10	5.0	10	10	50	40/120	150	0.4	1.3	150
MMCS2221A	40	10	75	10	6.0	10	10	60	40/120	150	0.3	1.2	150
MMCS2222	30	10	60	10	5.0	10	10	50	100/300	150	0.4	1.3	150
MMCS2222A	40	10	75	10	6.0	10	10	60	100/300	150	0.3	1.2	150
MMCS3498 ①	100	10	100	10	6.0	10	50	50	40/120	150	0.6	1.4	300
MMCS3499 ①	100	10	100	10	6.0	10	50	50	100/300	150	0.6	1.4	300
MMCS3500 ①	150	10	150	10	6.0	10	50	75	40/120	150	0.4	1.2	150
MMCS3501 ①	150	10	150	10	6.0	10	50	75	100/300	150	0.4	1.2	150
MMCS3903	40	1.0	60	10	6.0	10	50	30	50/150	10	0.2	0.85	10
MMCS3904	40	1.0	60	10	6.0	10	50	30	100/300	10	0.2	0.85	10
MMCS4400	40	1.0	60	100	6.0	100	100	35	50/150	150	0.4	0.95	150
MMCS4401	40	1.0	60	100	6.0	100	100	35	100/300	150	0.4	0.95	150
PNP													
MMCS2906	40	10	60	10	5.0	10	20	50	40/120	150	0.4	1.3	150
MMCS2906A	60	10	60	10	5.0	10	10	50	40/120	150	0.4	1.3	150
MMCS2907	40	10	60	10	5.0	10	20	50	100/300	150	0.4	1.3	150
MMCS2907A	60	10	60	10	5.0	10	10	50	100/300	150	0.4	1.3	150
MMCS3250	40	10	50	10	5.0	10	20	40	50/150	10	0.25	0.9	10
MMCS3250A	60	10	60	10	5.0	10	20	40	50/150	10	0.25	0.9	10
MMCS3251	40	10	50	10	5.0	10	20	40	100/300	10	0.25	0.9	10
MMCS3251A	60	10	60	10	5.0	10	20	40	100/300	10	0.25	0.9	10
MMCS3634 ①	140	10	140	100	5.0	10	100	100	50/150	50	0.5	0.9	50
MMCS3635 ①	140	10	140	100	5.0	10	100	100	100/300	50	0.5	0.9	50
MMCS3636 ①	175	10	175	100	5.0	10	100	100	50/150	50	0.5	0.9	50
MMCS3637 ①	175	10	175	100	5.0	10	100	100	100/300	50	0.5	0.9	50
MMCS3905	40	1.0	40	10	5.0	10	50	30	50/150	10	0.25	0.85	10
MMCS3906	40	1.0	40	10	5.0	10	50	30	100/300	10	0.25	0.85	10
MMCS4402	40	1.0	40	100	5.0	100	100	35	50/100	150	0.4	0.95	150
MMCS4403	40	1.0	40	100	5.0	100	100	35	100/300	150	0.4	0.95	150

AC* PARAMETERS

TYPE	C_{ob} / C_{cb}* pF max	C_{ib} / C_{eb}* pF max	$\|h_{fe}\|$ min	@ I_C mA	V_{CE} Volts	f MHz	t_d, t_r / t_{on}* ns max	t_s, t_f / t_{off}* ns max	Test Circuit Fig. No.
NPN									
MMCS2192	20	–	2.0	50	10	20	–,85	180,60	1
MMCS2193	20	–	2.0	50	10	20	–,85	180,60	1
MMCS2221	8.0	30	2.5	20	20	100	26*(1)	70*(1)	2
MMCS2221A	8.0	30	2.5	20	20	100	26*(1)	70*(1)	2
MMCS2222	8.0	30	2.5	20	20	100	26*(1)	70*(1)	2
MMCS2222A	8.0	30	2.5	20	20	100	26*(1)	70*(1)	2
MMCS3498 ①	10	80	1.5	20	20	100	20,35	300,80	–
MMCS3499 ①	10	80	1.5	20	20	100	20,35	300,80	–
MMCS3500 ①	8.0	80	1.5	20	20	100	20,35	300,80	–
MMCS3501 ①	8.0	80	1.5	20	20	100	20,35	300,80	–
MMCS3903	4.0	8.0	2.0	10	20	100	40,40	200,60	6
MMCS3904	4.0	8.0	2.5	10	20	100	40,40	240,60	6
MMCS4400	6.5*	30*	1.8	20	10	100	18,25	260,35	8
MMCS4401	6.5*	30*	2.3	20	10	100	18,25	260,35	8
PNP									
MMCS2906	8.0	30	2.0	50	20	100	26*(1)	70*(1)	3
MMCS2906A	8.0	30	2.0	50	20	100	26*(1)	70*(1)	3
MMCS2907	8.0	30	2.0	50	20	100	26*(1)	70*(1)	3
MMCS2907A	8.0	30	2.0	50	20	100	26*(1)	70*(1)	3
MMCS3250	6.0	8.0	2.3	10	20	100	40,40	200,60	4
MMCS3250A	6.0	8.0	2.3	10	20	100	40,40	200,60	4
MMCS3251	6.0	8.0	2.8	10	20	100	40,40	240,60	4
MMCS3251A	6.0	8.0	2.8	10	20	100	40,40	240,60	4
MMCS3634 ①	10	75	1.2	30	30	100	480*	720*	5
MMCS3635 ①	10	75	1.6	30	30	100	480*	720*	5
MMCS3636 ①	10	75	1.2	30	30	100	480*	720*	5
MMCS3637 ①	10	75	1.6	30	30	100	480*	720*	5
MMCS3905	4.5	10	1.6	10	20	100	40,40	240,70	7
MMCS3906	4.5	10	2.0	10	20	100	40,40	250,85	7
MMCS4402	8.5*	30*	1.3	20	10	100	18,25	260,35	9
MMCS4403	8.5*	30*	1.8	20	10	100	18,25	260,35	9

① SMALL-SIGNAL CHARACTERISTICS

(I_C = 10 mA, V_{CE} = 10 V, f = 1.0 kHz)

TYPE	h_{ie} k ohms min/max	h_{re} x 10^{-4} max	h_{oe} µmhos min/max
NPN			
MMCS3498	0.16/1.2	3.0	8.0/120
MMCS3499	0.2/1.5	4.8	16/240
MMCS3500	0.16/1.2	3.0	8.0/120
MMCS3501	0.2/1.5	4.8	16/240
PNP			
MMCS3634	80/720	3.6	–/240
MMCS3635	165/1400	3.6	–/240
MMCS3636	80/720	3.6	–/240
MMCS3637	165/1400	3.6	–/240

*AC parameter values are as specified in the standard 2N data sheets. (encapsulated devices)

(1) Typical Switching Times

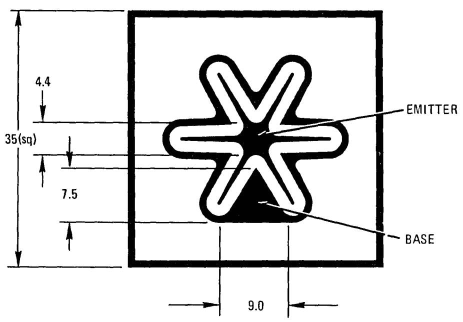
PARAMETER LIMITATIONS AND WARRANTY

Probe limitations allow 100% testing of low level dc parameters only. DC parameters have been selected to insure electrical characteristics to an LTPD of 10 and ac parameters to an LTPD of 20. Visual Inspection is performed to an LTPD of 20. See "Visual Inspection Criteria" in General Information Section.

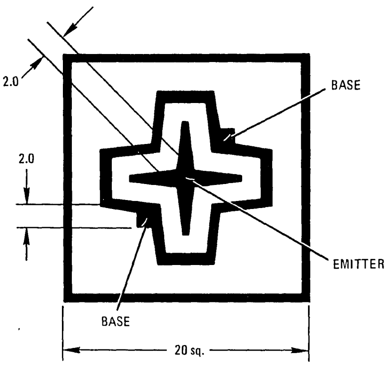
MECHANICAL INFORMATION

MATERIAL – SILICON
FRONT METALIZATION – ALUMINUM
BACK METALIZATION – GOLD (Collector Contact)

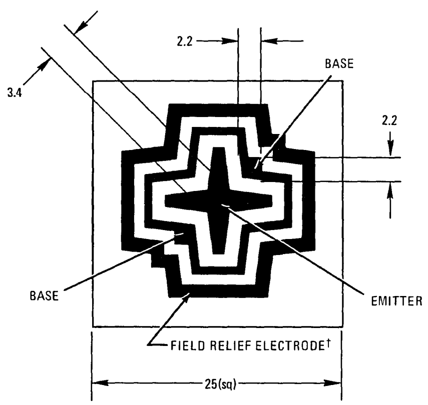
ALL DIMENSIONS ARE IN MILS



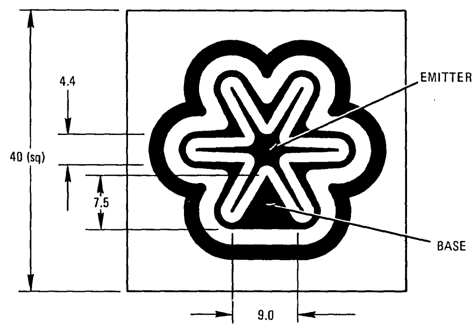
GEOMETRY 1 MMCS2192 MMCS3498 MMCS3500 NPN
MMCS2193 MMCS3499 MMCS3501



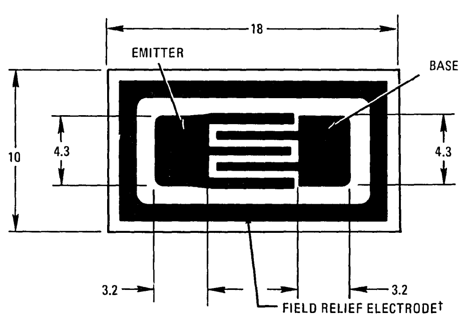
GEOMETRY 2 MMCS2221 MMCS2222 NPN
MMCS2221A MMCS2222A



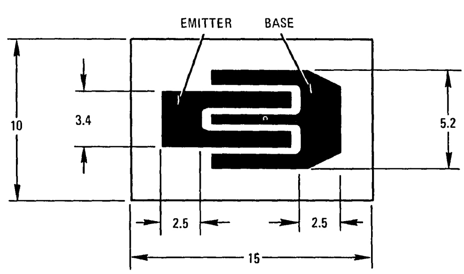
GEOMETRY 3 MMCS2906 MMCS2907 PNP
MMCS2906A MMCS2907A



GEOMETRY 4 MMCS3634 MMCS3636 PNP
MMCS3635 MMCS3637



GEOMETRY 5 MMCS3250 MMCS3251A PNP
MMCS3250A MMCS3905
MMCS3251 MMCS3906



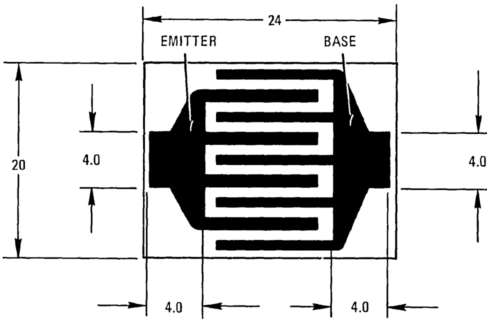
GEOMETRY 6 MMCS3903 MMCS3904 NPN

†Patented by Motorola – Patent No. 3,302,076.

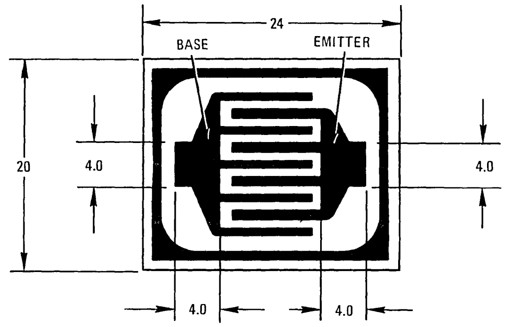
MECHANICAL INFORMATION

MATERIAL – SILICON
FRONT METALIZATION – ALUMINUM
BACK METALIZATION – GOLD (Collector Contact)

ALL DIMENSIONS ARE IN MILS



GEOMETRY 7 MMCS4400 MMCS4401 NPN



GEOMETRY 8 MMCS4402 MMCS4403 PNP

TEST CIRCUITS

FIGURE 1 – SWITCHING TIME TEST CIRCUIT

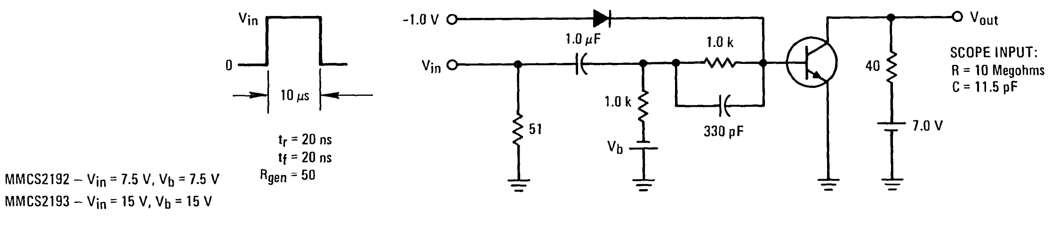
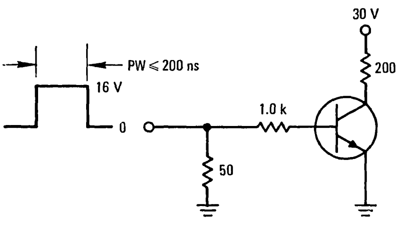


FIGURE 2 – SWITCHING TIME TEST CIRCUIT

TURN-ON TIME



TURN-OFF TIME

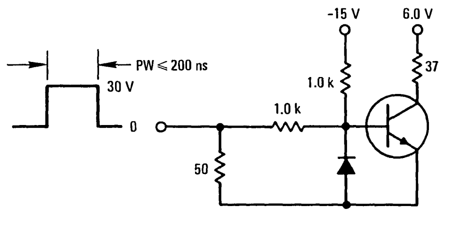


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FIGURE 3 – SATURATED SWITCHING TIME TEST CIRCUIT

TURN-ON **TURN-OFF**

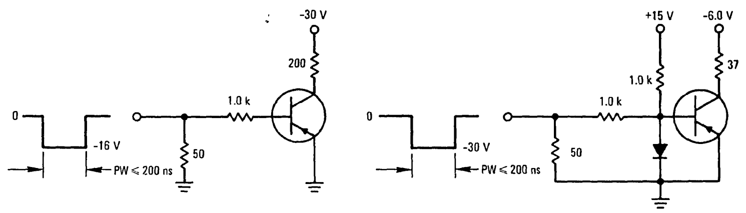
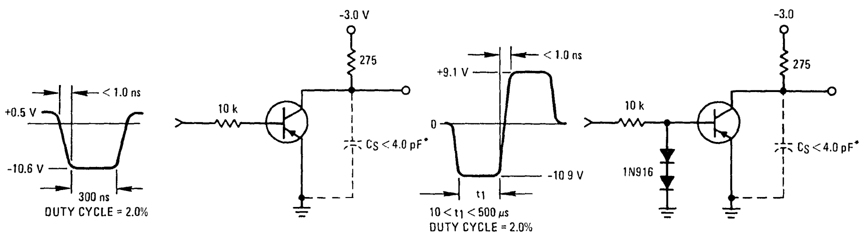


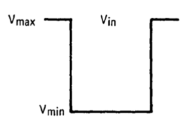
FIGURE 4 – EQUIVALENT TEST CIRCUIT

DELAY AND RISE TIME **STORAGE AND FALL TIME**



*Total shunt capacitance of test jig and connectors

FIGURE 5 – SWITCHING TIME TEST CIRCUIT



PW = 20 µs
DUTY CYCLE ≤ 2.0%
RISE TIME ≤ 20 ns

	V_{max}	V_{min}
TURN-ON	+4.0 V	-5.65 V
TURN-OFF	+4.1 V	-5.9 V

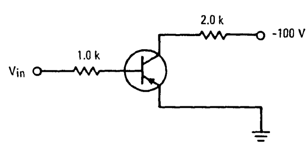
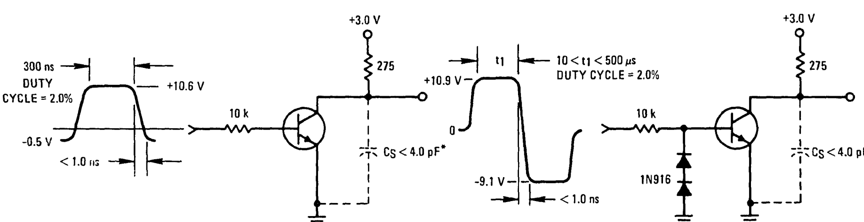


FIGURE 6 – EQUIVALENT TEST CIRCUIT

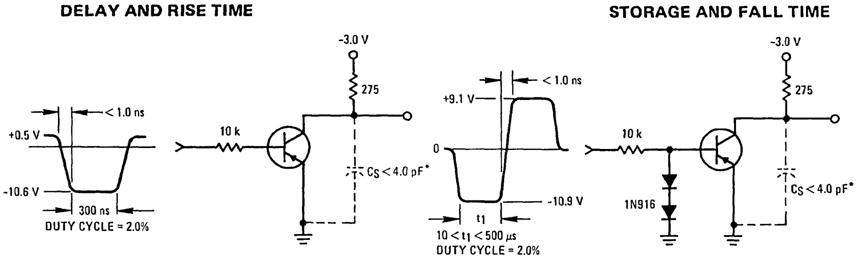
DELAY AND RISE TIME **STORAGE AND FALL TIME**



*Total shunt capacitance of test jig and connectors

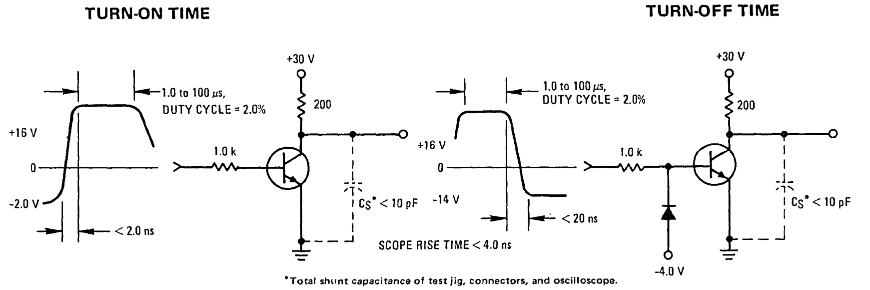
6

FIGURE 7 – EQUIVALENT TEST CIRCUIT



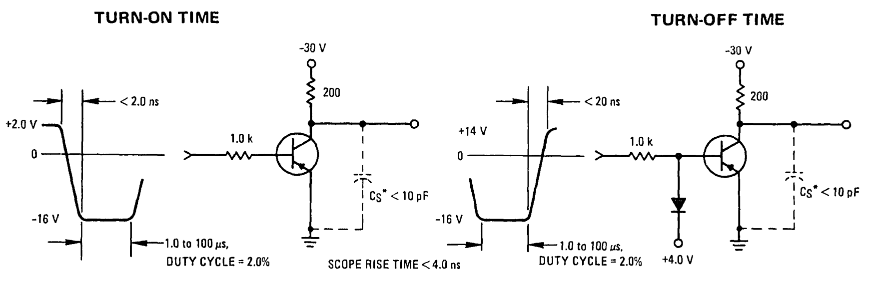
*Total shunt capacitance of test jig and connectors.

FIGURE 8 – SWITCHING TIME EQUIVALENT TEST CIRCUITS



*Total shunt capacitance of test jig, connectors, and oscilloscope.

FIGURE 9 – SWITCHING TIME EQUIVALENT TEST CIRCUIT



*Total shunt capacitance of test jig, connectors, and oscilloscope

UNENCAPSULATED NPN RF TRANSISTORS

These devices are passivated Silicon RF transistor chips. The MMCS2857, MMCS3866, and MMCS5636 chips are identical to the chips used in the packaged Motorola transistors with 2N prefixes; i.e., the MMCS2857 chip is used in the Motorola 2N2857 transistor. The MMCS0159 and MMCS0172 are electrically similar to the MM1605, MM1606, MM1607 series and MM8002 respectively.

- Power Outputs to 8.4 Watts Typical at 400 MHz
- f_T to 2000 MHz Typical

SILICON TRANSISTORS

MMCS0159
MMCS0172
MMCS2857
MMCS3866
MMCS5636

HANDLING PRECAUTIONS

Although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published specifications, provided three basic requirements are met in the customer's establishment.

1. Such devices are stored in an environment of no more than 30% relative humidity.
2. Devices are die-and-wire bonded in a non-inert atmosphere not exceeding 100°C, or in an inert atmosphere not exceeding 400°C.
3. Processing equipment conforms to the minimum standards of equipment normally employed in semiconductor establishments.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

MAXIMUM RATINGS

TYPE	V_{CEO} Volts	V_{CB} Volts	V_{EB} Volts	I_C mA	Geometry
NPN					
MMCS0159	10	20	3.0	70	1
MMCS0172	30	40	3.5	400	2
MMCS2857	15	30	2.5	40	3
MMCS3866	30	55	3.5	400	2
MMCS5636	35	60	4.0	400	4

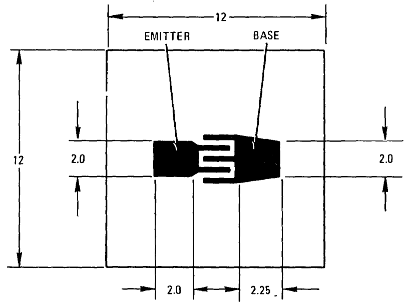
Operating and Storage Junction
Temperature Range -65 to +200°C

6

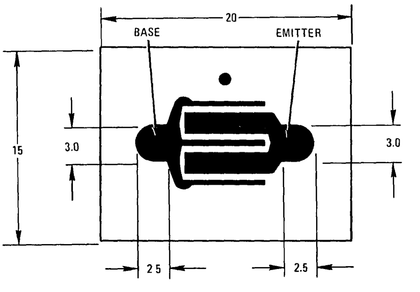
MECHANICAL INFORMATION

MATERIAL – SILICON
FRONT METALIZATION – ALUMINUM
BACK METALIZATION – GOLD (Collector Contact)

ALL DIMENSIONS ARE IN MILS



GEOMETRY 1 MMCS0159



GEOMETRY 2 MMCS0172 MMCS3866

NPN RF TRANSISTORS (continued)

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

TYPE	BV_{CEO} @ Volts min	I_C mA	BV_{CBO} @ Volts min	I_C µA	BV_{EBO} @ Volts min	I_E mA	I_{CBO} @ I_{CEO}* µA max	V_{CB} V_{CE}* Volts	h_{FE} @ min/max	I_C mA
NPN										
MMCS0159	10	1.0	20	100	3.0	0.1	0.01	4.0	25/200	25
MMCS0172	30	5.0	40	100	3.5	0.1	20*	28*	30/–	50
MMCS2857	15	3.0	30	1.0	2.5	0.01	0.01	15	30/150	3.0
MMCS3866	30	5.0	55	100	3.5	0.1	20*	28*	10/200	50
MMCS5636	35	200	50	100	4.0	5.0	1000	30	5.0/–	200

AC* PARAMETERS

TYPE	C_{cb} C_{ob}* pF max	f_T MHz typ	$r_b'C_c$ ps typ	G_{pe} @ dB typ	f MHz	P_{out} @ $P_{out(osc)}$* Watt typ	P_{in} & Watt	V_{CE} & Volts	f MHz	NF @ dB typ	f MHz
NPN											
MMCS0159	1.0	2000	15	–	–	–	–	–	–	–	–
MMCS0172	3.5*	1500	–	11.4	200	–	–	–	–	2.7	200
MMCS2857	1.0	1500	15	15	450	0.035*	–	10	500	4.0	450
MMCS3866	3.0*	800	–	11	400	1.3	0.1	28	400	–	–
MMCS5636	20	–	–	7.0	400	8.4	2.0	28	400	–	–

*AC parameter values are as specified in the standard 2N or MM data sheets. (encapsulated devices)

PARAMETER LIMITATIONS AND WARRANTY

Probe limitations allow 100% testing of low level dc parameters only. DC parameters have been selected to insure electrical characteristics to an LTPD of 10 and ac parameters to an LTPD of 20. Visual inspection is performed to an LTPD of 20. See "Visual Inspection Criteria" in General Information Section.

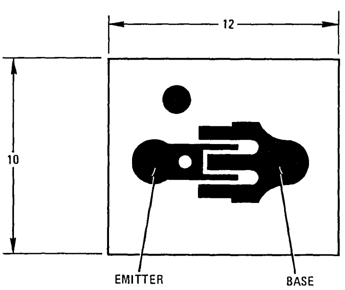
MECHANICAL INFORMATION

MATERIAL – SILICON

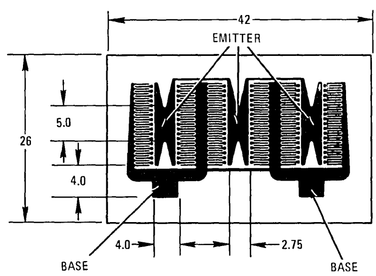
FRONT METALIZATION – ALUMINUM

BACK METALIZATION – GOLD (Collector Contact)

ALL DIMENSIONS ARE IN MILS



GEOMETRY 3 MMCS2857



GEOMETRY 4 MMCS5636

Microcircuit Components

UNENCAPSULATED PNP RF TRANSISTORS

These devices are passivated silicon high-frequency transistor chips. The MMCS5160 and MMCS5583 chips are identical to the chips used in the packaged Motorola transistors with 2N prefixes, i.e., the MMCS5160 chip is used in the Motorola 2N5160 transistor. The MMCS4957 is electrically similar to the 2N4957, 2N4958, 2N4959 Series.

- f_T to 1000 MHz Typical
- G_{pe} to 18 dB Typical
- P_{out} to 1.2 Watt Typical

UNENCAPSULATED SILICON PNP RF TRANSISTORS

MMCS4957
MMCS5160
MMCS5583

MAXIMUM RATINGS

TYPE	V_{CEO} Volts	V_{CB} Volts	V_{EB} Volts	I_C mA	Geometry
PNP					
MMCS4957	30	30	3.0	30	1
MMCS5160	40	60	4.0	400	2
MMCS5583	30	30	3.0	500	2

Operating and Storage Junction Temperature Range −65 to +200°C

HANDLING PRECAUTIONS

Although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published specifications, provided three basic requirements are met in the customer's establishment.

1. Such devices are stored in an environment of no more than 30% relative humidity.

2. Devices are die-and-wire bonded in a non-inert atmosphere not exceeding 100°C, or in an inert atmosphere not exceeding 400°C.

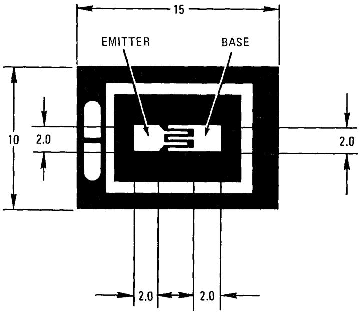
3. Processing equipment conforms to the minimum standards of equipment normally employed in semiconductor establishments.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

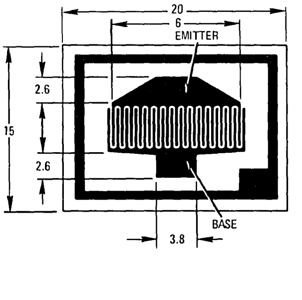
MECHANICAL INFORMATION

MATERIAL – SILICON
FRONT METALIZATION – ALUMINUM
BACK METALIZATION – GOLD (Collector Contact)

ALL DIMENSIONS ARE IN MILS



GEOMETRY 1 MMCS4957



GEOMETRY 2 MMCS5160, MMCS5583

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

TYPE	BV_{CEO} Volts min	@ I_C mA	BV_{CBO} Volts min	@ I_C μA	BV_{EBO} Volts min	@ I_E μA	I_{CBO} μA max	@ V_{CB} Volts	h_{FE} min	@ I_C mA	& V_{CE} Volts
PNP											
MMCS4957	30	1.0	30	100	3.0	100	0.1	20	20	2.0	10
MMCS5160	40	5.0	60	100	4.0	100	1.0	28	10	50	5.0
MMCS5583	30	10	30	10	3.0	100	0.05	20	25	100	2.0

AC* PARAMETERS

TYPE	C_{cb} pF max	f_T MHz min	$r_b'C_c$ ps typ	G_{pe} dB typ	@ f MHz	P_{out} Watt typ	@ P_{in} Watt	& V_{CE} Volts	& f MHz	NF dB typ	@ f MHz
PNP											
MMCS4957	0.8	1000	4.0	18	450	–	–	–	–	3.2	450
MMCS5160	4.0	400	–	8.0	400	1.2	0.16	28	400	–	–
MMCS5583	5.0	1000	8.0	–	–	–	–	–	–	–	–

*AC parameter values are as specified in the standard 2N or MM data sheets. (encapsulated devices)

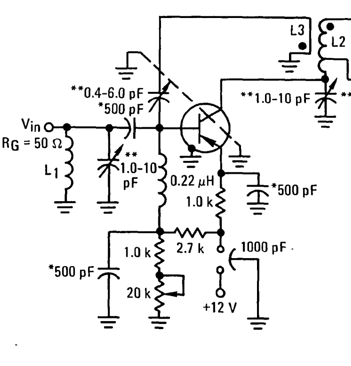
PARAMETER LIMITATIONS AND WARRANTY

Probe limitations allow 100% testing of low level dc parameters only. DC parameters have been selected to insure electrical characteristics to an LTPD of 10 and ac parameters to an LTPD of 20. Visual inspection is performed to an LTPD of 20. See "Visual Inspection Criteria" in General Information Section.

MECHANICAL INFORMATION

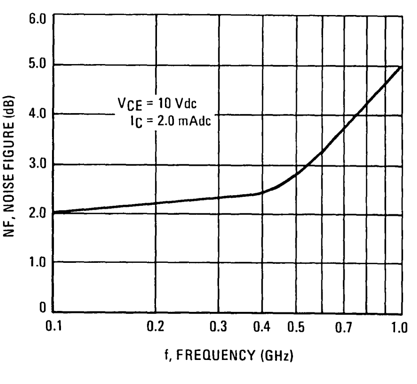
MATERIAL – SILICON
FRONT METALIZATION – ALUMINUM
BACK METALIZATION – GOLD (Collector Contact)

FIGURE 1 – NOISE FIGURE AND POWER GAIN TEST CIRCUIT



* Button type capacitors
** Variable air piston type capacitors
1. L1 – silver plated brass bar, 1.0 in. lg by 0.25 in O. D.
2. L2 – silver plated brass bar, 1.5 in. lg by 0.25 in O. D. Tap is 0.25 in. from collector.
3. L3 – 1/2 turn of AWG No. 16 wire 0.25 in. from and parallel to L2.
4. The noise source is a hot-cold body (AIL type 70 or equivalent) with a test receiver (AIL type 136 or equivalent).

FIGURE 2 – TYPICAL NOISE FIGURE versus FREQUENCY



MMCS4957

FIGURE 3 – COLLECTOR-BASE TIME CONSTANT

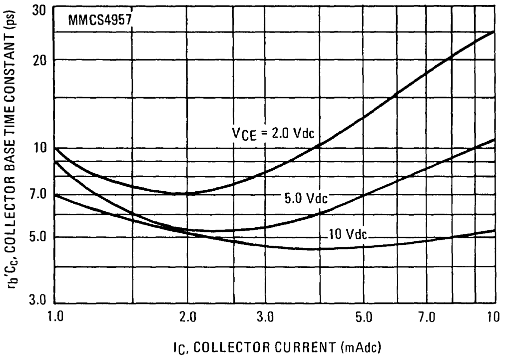


FIGURE 4 – CAPACITANCE

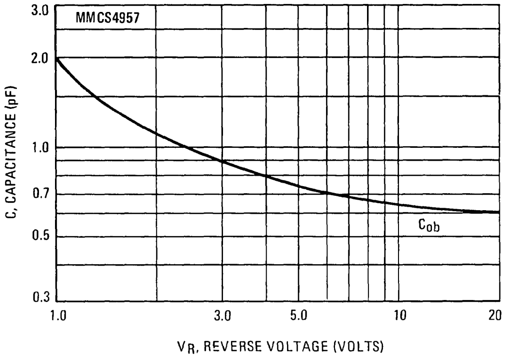


FIGURE 5 – CURRENT-GAIN–BANDWIDTH PRODUCT

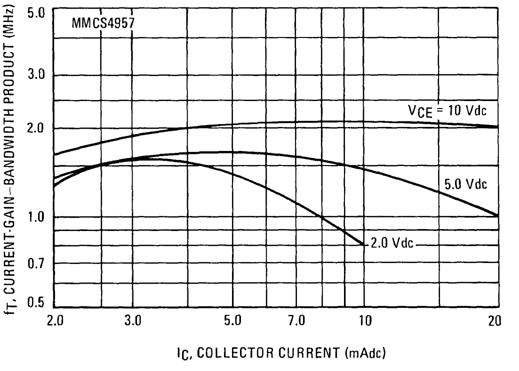


FIGURE 6 – OUTPUT POWER versus FREQUENCY

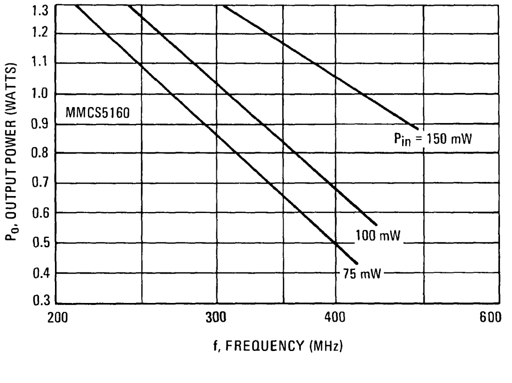


FIGURE 7 – OUTPUT POWER versus INPUT POWER

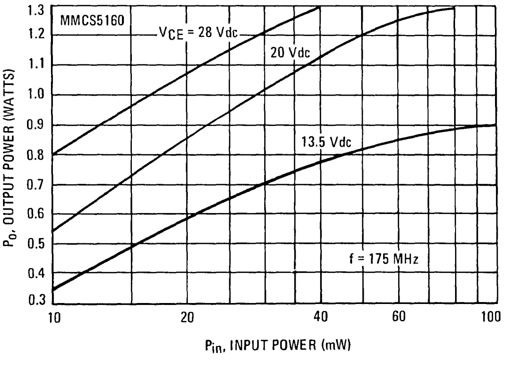


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FIGURE 8 — CURRENT-GAIN—BANDWIDTH PRODUCT

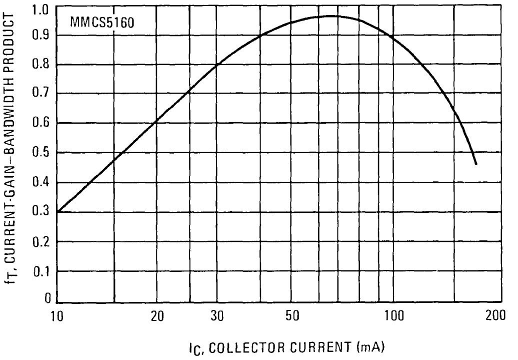


FIGURE 9 — CURRENT-GAIN—BANDWIDTH PRODUCT

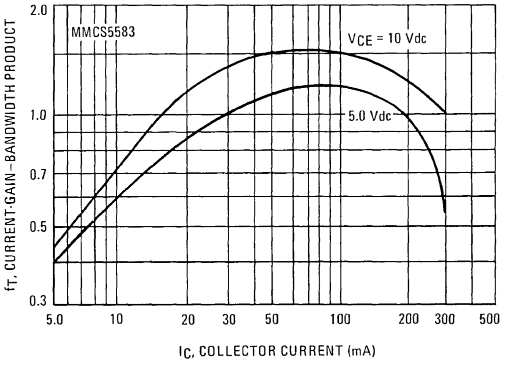


FIGURE 10 — COLLECTOR-BASE TIME CONSTANT

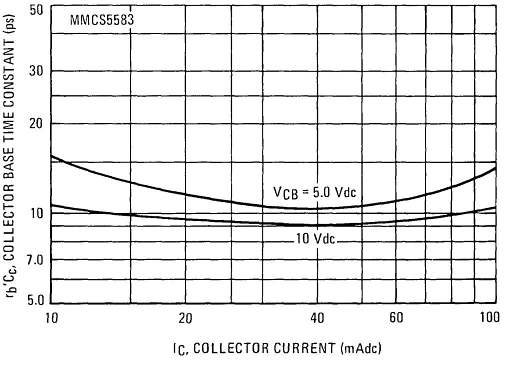
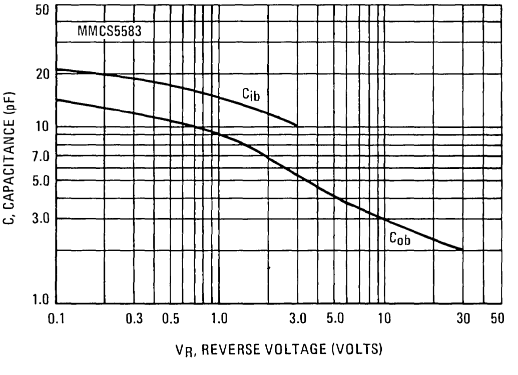


FIGURE 11 — CAPACITANCES



6

UNENCAPSULATED FIELD-EFFECT TRANSISTORS

These devices are passivated Field-Effect transistor chips electrically similar to those listed in Table 1. For more detailed characteristic data, please refer to the appropriate Motorola data sheet.

- MOS FETs are Silicon Nitride Passivated
- MOS and Junction Types
- P-Channel and N-Channel

SILICON TRANSISTORS

MMCS0122
MMCS0123
MMCS0125
MMCS0130
MMCS0131
MMCS0134

MAXIMUM RATINGS

MOS FETS

TYPE	V_{DS} Volts	V_{DG} Volts	V_{GS} Volts	I_D mA	Geometry	Application
N-Channel						
MMCS0122	25	±30	±30	30	1	Low Power Switch
P-Channel						
MMCS0123	25	±30	±30	30	1	Low Power Switch

JUNCTION FETS

TYPE	V_{DS} Volts	V_{DG} Volts	$V_{GS(r)}$ Volts	$I_{G(f)}$ mA	I_D mA	Geometry	Application
N-Channel							
MMCS0130	25	25	-25	10	20	2	VHF Amplifier and Mixer
MMCS0131	25	25	-25	10	20	3	General-Purpose Audio and Switching
MMCS0134	30	30	-30	10	–	4	Chopper
P-Channel							
MMCS0125	40	40	40	10	20	2	General-Purpose Amplifier

Operating and Storage Junction Temperature Range -65 to +200°C

TABLE 1 – CROSS REFERENCE CHART

DEVICE	ELECTRICAL CHARACTERISTICS SIMILAR TO:
MMCS0122	2N4351
MMCS0123	2N4352, 3N155, 3N155A, 3N156, 3N156A, 3N157, 3N157A, 3N158, 3N158A
MMCS0125	2N5460, 2N5461, 2N5462, 2N5463, 2N5464, 2N5465, MPF161, MFE4007, MFE4008, MFE4009, MFE4010, MFE4011, MFE4012
MMCS0130	2N3821, 2N3822, 2N3823, 2N3824, 2N4223, 2N4224, 2N5668, 2N5669, 2N5670, MPF102
MMCS0131	2N4220, 2N4220A, 2N4221, 2N4221A, 2N4222, 2N4222A, 2N5457, 2N5458, 2N5459
MMCS0134	2N4091, 2N4092, 2N4093, 2N4391, 2N4392, 2N4393, MFE2004, MFE2005, MFE2006

HANDLING PRECAUTIONS

Although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published specifications, provided three basic requirements are met in the customer's establishment.

1. Such devices are stored in an environment of no more than 30% relative humidity.

2. Devices are die-and-wire bonded in a noninert atmosphere not exceeding 100°C, or in an inert atmosphere not exceeding 400°C.

3. Processing equipment conforms to the minimum standards of equipment normally employed in semiconductor establishments.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

MOS FETS

TYPE	$V_{GS(th)}$ Volts min/max	$V_{DS(on)}$ Volts max	$I_{D(on)}$ mA min	$V_{BR(DSS)}$ Volts min	I_{GSS} pA typ	I_{DSS} nA max	$r_{ds(on)}$ Ohms max	$\lvert y_{fs} \rvert$ µmhos min	C_{iss} pF max	C_{rss} pF max	$C_{d(sub)}$ pF max	t_d, t_r ns max	t_s, t_f ns max
N-Channel													
MMCS0122	1.0/5.0	1.0	3.0	25	0.10	10	300	1000	5.0	1.3	5.0	45,65	60,100
P-Channel													
MMCS0123	-1.0/-5.0	-1.0	-3.0	-25	0.10	-10	600	1000	5.0	1.3	4.0	45,65	60,100

JUNCTION FETS

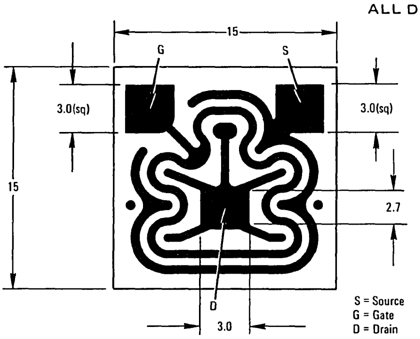
TYPE	$V_{BR(GSS)}$ Volts min	$V_{GS(off)}$ Volts min/max	I_{GSS} nA max	I_{DSS} mA min/max	V_{GS} Volts min/max	$\lvert y_{fs} \rvert$ µmhos typ/max	$\lvert y_{os} \rvert$ µmhos max	C_{iss} pF max	C_{rss} pF max	$r_{DS(on)}$ Ohms max
N-Channel										
MMCS0130	-25	0.2/8.0	-5.0	2.0/20	0.5/7.5	3000/7000	75	7.0	3.0	–
MMCS0131	-25	0.5/8.0	-5.0	1.0/16	0.5/7.5	1000/6000	50	7.0	3.0	–
MMCS0134	30	1.0/12	5.0	8.0/–	1.0/10	–	–	16	5.0	100
P-Channel										
MMCS0125	40	0.2/8.0	5.0	0.5/14	0.5/7.5	2500/6000	75	7.0	2.0	–

PARAMETER LIMITATIONS AND WARRANTY

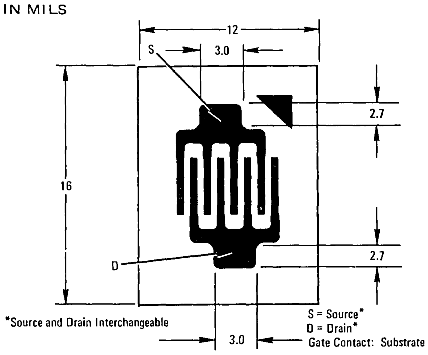
Probe limitations allow 100% testing of low level dc parameters only. DC parameters have been selected to insure electrical characteristics to an LTPD of 10 and ac parameters to an LTPD of 20. Visual inspection is performed to an LTPD of 20. See "Visual Inspection Criteria" in General Information Section.

MECHANICAL INFORMATION

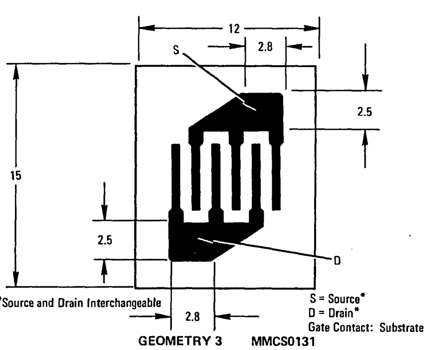
MATERIAL – SILICON
FRONT METALIZATION – ALUMINUM
BACK METALIZATION – GOLD (Substrate)
ALL DIMENSIONS ARE IN MILS



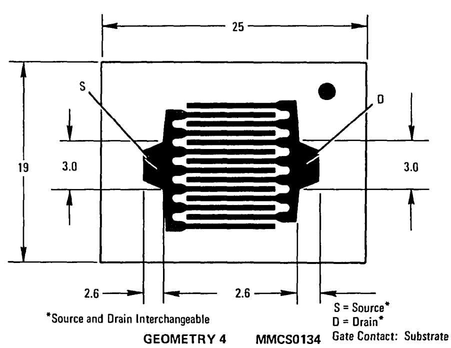
GEOMETRY 1 MMCS0122 MMCS0123



GEOMETRY 2 MMCS0125 MMCS0130



GEOMETRY 3 MMCS0131



GEOMETRY 4 MMCS0134

6

UNENCAPSULATED SILICON POWER TRANSISTORS

These devices are passivated Silicon power transistor chips suitable for collector currents to 25 amperes. Both NPN and PNP devices are available for maximum versatility and may be used in complementary circuitry.

- Collector Currents to 25 Amperes
- Breakdown Voltage to 60 Volts
- DC Current Gains to 30 Volts Minimum
- High f_T (30 MHz Minimum)

SILICON TRANSISTORS

MJC007
MJC043
MJC044
MJC067
MJC069
MJC070
MJC076
MJC082

MAXIMUM RATINGS

TYPE	V_{CEO} Volts	V_{EB} Volts	I_C Amp	Geometry
NPN				
MJC044	60	5.0	1.0	2
MJC076	50	5.0	3.0	1
MJC082	60	5.0	5.0	3
MJC070	60	5.0	25	4
PNP				
MJC043	60	5.0	1.0	2
MJC007	50	5.0	3.0	1
MJC067	60	5.0	5.0	3
MJC069	60	5.0	25	4

Operating and Storage Junction Temperature Range -65 to +200°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

TYPE	I_C Amp	BV_{EBO} Volts min	@ I_E µA	BV_{CEO} Volts min	@ I_C mA	BV_{CES} Volts min	@ I_C µA	h_{FE} min/max	@ I_C Amp	, V_{CE} Volts	f_T MHz min
NPN											
MJC044	1.0	5.0	500	60	100	60	100	30/180	0.250	1.0	30
MJC076	3.0	5.0	100	50	10	50	100	20/180	1.0	2.0	30
MJC082	5.0	5.0	100	60	10	60	100	30/180	2.0	2.0	30
MJC070	25	5.0	100	60	10	60	100	20/180	10	3.0	30
PNP											
MJC043	1.0	5.0	500	60	100	60	100	30/180	0.250	1.0	30
MJC007	3.0	5.0	100	50	10	50	100	20/180	1.0	2.0	30
MJC067	5.0	5.0	100	60	10	60	100	30/180	2.0	2.0	30
MJC069	25	5.0	100	60	10	60	100	20/180	10	3.0	30

PARAMETER LIMITATIONS AND WARRANTY

Probe limitations allow 100% testing of low level dc parameters only. Limits for all parameters listed for power transistor chips have been selected to insure the electrical characteristics to an LTPD of 20.

HANDLING PRECAUTIONS

Although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published specifications, provided three basic requirements are met in the customer's establishment.

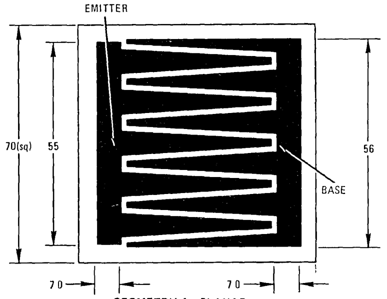
1. Such devices are stored in an environment of no more than 30% relative humidity.
2. Devices are die-and-wire bonded in an inert atmosphere not exceeding 400°C.
3. Processing equipment conforms to the minimum standards of equipment normally employed in semiconductor establishments.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

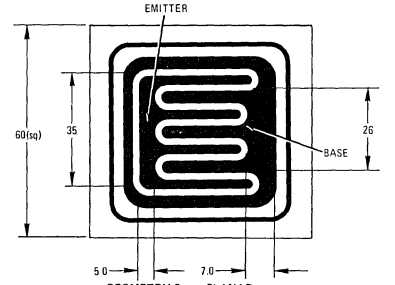
MECHANICAL INFORMATION

MATERIAL – SILICON
FRONT METALIZATION – ALUMINUM
BACK METALIZATION – GOLD (Collector Contact)

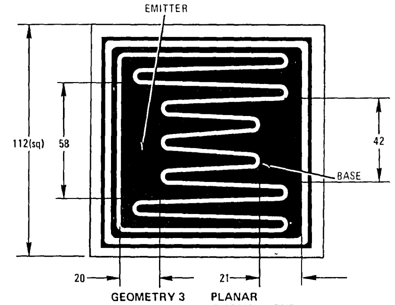
ALL DIMENSIONS ARE IN MILS



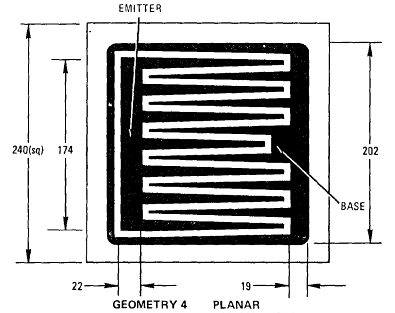
GEOMETRY 1 PLANAR
MJC007 PNP
MJC076 NPN



GEOMETRY 2 PLANAR
MJC043 PNP
MJC044 NPN



GEOMETRY 3 PLANAR
MJC067 PNP
MJC082 NPN



GEOMETRY 4 PLANAR
MJC069 PNP
MJC070 NPN

UNENCAPSULATED HIGH-SPEED SWITCHING DIODES

These devices are passivated High-Speed Switching diode chips. The MMCD914 has electrical characteristics similar to the 1N914. The MMCD6100 is the same chip as used in the Motorola MSD6100.

- Reverse Voltage to 100 Volts
- Forward Current to 225 mA
- Reverse Recovery Time of 4.0 ns

SILICON SWITCHING DIODES

MMCD914

MMCD6100

MAXIMUM RATINGS

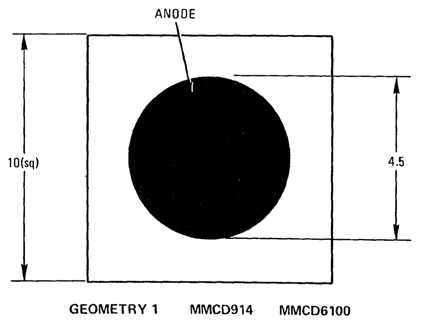
TYPE	V_R Volts	I_O mA	I_F mA	$I_{F(surge)}$ mA	T_J, T_{stg} ^oC	Geometry
MMCD914	75	75	225	500	-65 to +150	1
MMCD6100	100	–	200	500	-55 to +135	1

Operating and Storage Junction Temperature Range -65 to +200^{o}C

MECHANICAL INFORMATION

MATERIAL – SILICON
FRONT METALIZATION – ALUMINUM
BACK METALIZATION – GOLD (Cathode Contact)

ALL DIMENSIONS ARE IN MILS



GEOMETRY 1 MMCD914 MMCD6100

HANDLING PRECAUTIONS

Although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published specifications, provided three basic requirements are met in the customer's establishment.

1. Such devices are stored in an environment of no more than 30% relative humidity.
2. Devices are die-and-wire bonded in a noninert atmosphere not exceeding 100^{o}C, or in an inert atmosphere not exceeding 400^{o}C.
3. Processing equipment conforms to the minimum standards of equipment normally employed in semiconductor establishments.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

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ELECTRICAL CHARACTERISTICS (T_A = 25°C)

TYPE	$V_{(BR)}$ @ $I_{(BR)}$ = 100 μA Volts min	I_R @ μA max	V_R Volts	I_R @ nA max	V_R Volts	V_F @ I_F = 10 mA min/max	C @ V_R = 0 pF max
MMCD914 (1)	100	5.0	75	25	20	–/1.0	4.0
MMCD6100 (2)	100	5.0	100	100	50	0.65/0.85	1.5

(1) Reverse recovery time = 5.0 ns @ I_F = 10 mA, V_R = 6.0 V, i_{rr} = 1.0 mA

(2) Reverse recovery time = 5.0 ns @ I_F = I_R = 10 mA, V_R = 5.0 V, i_{rr} = 1.0 mA

PARAMETER LIMITATIONS AND WARRANTY

Probe limitations allow 100% testing of low level dc parameters only. DC parameters have been selected to insure electrical characteristics to an LTPD of 10 and ac parameters to an LTPD of 20.

GENERAL INFORMATION

MOTOROLA SPECIAL MICROCIRCUIT ZENER DIODE SELECTION

I **Special Microcircuit Component Selection**

Most standard zener diode devices are available in chip form to meet a wide variety of application requirements. Nonstandard chips are available on a negotiated basis. Special zero-temperature-compensated zener diode chips are also available upon request. Contact your local Motorola representative for more information.

II **General Features**

1. The MZC2.4A10 and MZC1.8B10 series have gold-backed metalization. All other chips have a chrome-silver-gold backing.
2. All zener diode chips have silicon-oxide-passivated junctions.
3. Zener chips are available in 10% (standard), 5%, 3%, 2% and 1% tolerances.
4. Most standard zener diode and current regulator chips are available.

III **Electrical Parameter Test Capability**

The following parameters may be tested on a 100% basis:

Zener Diodes	Current Regulators
1. V_Z	1. I_P
2. I_R	2. Z_T
3. Z_{ZT}	3. Z_K
4. Z_{ZK}	4. V_L
5. V_f	

IV **Policies**

1. Devices shipped in Bulk-Pak and Multi-Pak containers are equipped with a tamper-proof seal. No returns will be accepted once the "tamper-proof" seal has been broken, due to the possibility of mechanical damage.
2. Devices shipped in other than preferred packages (see "Packaging" section) require special negotiation to prevent negation of warranty.

V **Order Quantity Requirements**

1. Zener diode chips must be ordered in multiples of 10 to facilitate packaging and warehousing requirements.
2. All orders must state type of packaging required (see packaging section).

VI **Mounting and Handling**

1. General
   Both chip mounting and lead bonding should be carried out in a carefully controlled atmosphere for best results. Vacuum probes should be used for handling the chips. Handling should be minimized, and a cleaning operation must be performed as soon as possible prior to mounting. Also, extreme care should be taken when probing electrically to avoid scratching or cracking the chip.

   The mounting pads must be large enough to permit "scrubbing", and lead bonds must be "looped" from the chip to substrate to eliminate possible shorting.
2. Gold-Backed Chips (MZC Series)
   For chip mounting, a gold-silicon eutectic bond is normally used. Electrically conductive epoxies may also be used. Since fluxes are not used, the chip must be "scrubbed", either manually or ultrasonically, on a preheated mounting surface to get a reliable ohmic chip contact. Use of a solder preform during mounting minimizes the chip-mount thermal resistance; the preform usually is gold or gold-doped with arsenic or antimony. Power dissipation is dependent on the quality of the chip mount. Lead bonding is normally accomplished either by ultrasonic or thermal compression techniques using gold or aluminum wire.
3. Chrome-Silver-Gold-Backed Chips (Conventional Series)
   The chrome-silver-gold-backed chips used for conventional packaged zeners cannot be eutectically bonded. A solder bond is recommended, but electrically conductive epoxies may be used. Motorola uses a gold-germanium solder (12.5% germanium, 1% indium, balance gold); however, the customer may have others which work as well or better. Information specified for the MZC series also applies.

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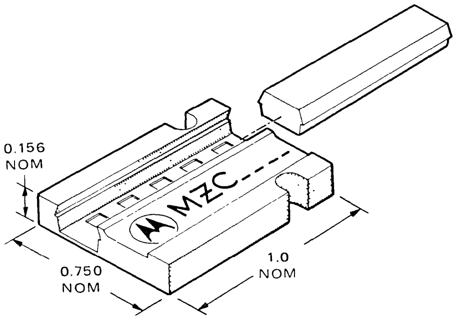
VII Packaging

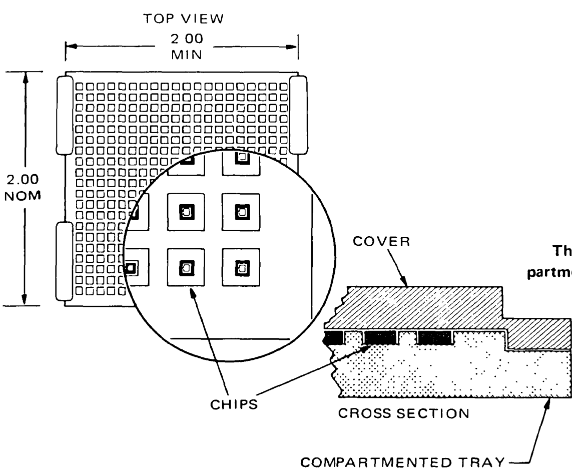
1. The carrier package options are available for 37-mil square or smaller chips (500 mW or less on a conventional series). Packaging of larger geometry chips must be negotiated.
2. Chips will be placed randomly in their carriers with either side up for visual inspection requirements.
3. Multi-pak and bulk-pak are shipped with "tamper proof" seals to insure that only qualified personnel will handle chips and to insure proper protection during transit.
4. The following types of packaging are available:



(A) Deka-Pak (10-chip carrier) — Preferred for orders of 30 or less:

Standard Chip Carrier Package

To accommodate the customer with limited quantity requirements, the 10-chip carrier contains individual compartments for the chips and affords ease of inventory for the user. The carrier protects the chips during storage and handling and permits visual inspection without removing the chips.



(B) Multi-Pak (400-chip carrier) — Preferred for orders of 40 or more:

The Multi-Pak carrier is designed with an individual compartment for each chip.

Features of this carrier include:

(a) visual inspection without removal from carrier.
(b) carrier usable in customer production area.
(c) storage container for unused chips.

(C) Bulk-Pak (5000 Chip Maximum)

Bulk Dice Packed in Freon® TF

Freon TF (Trichlorotrifluoroethane) is non-flammable, non-explosive, exceptionally pure, chemically stable and low in toxicity. Freon TF leaves a residue-free surface when parts are dried at room temperature.

Directions for Removal of Dice

Pour the Freon TF through a piece of filter paper into a beaker or waste can. Dice will dry rapidly when left at room temperature.

® Freon is Registered Trademark of E. I. DuPont, DeNemours & Co. Inc.

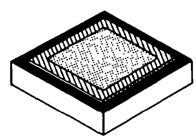
Zener Chips

SILICON ZENER DIODE CHIPS

. . . for use in compact and high performance circuits that are beyond the present state of monolithic production capability.

- Available in 10% (Standard), 5%, 3%, 2% and 1% Tolerance Options (See Note 1)
- Silicon Oxide Passivated Junctions
- Full Voltage Range – 2.4 thru 200 Volts – "A" Series; 1.8 thru 200 Volts – "B" Series
- Limits Guaranteed on Four Electrical Parameters
- Both Anode and Cathode Chip Metalization Compatible with all Wire and Die Bonding Techniques

MZC2.4A10 thru MZC200A10
HIGH LEVEL SERIES
MZC1.8B10 thru MZC200B10
LOW LEVEL SERIES
UNENCAPSULATED SILICON ZENER DIODES

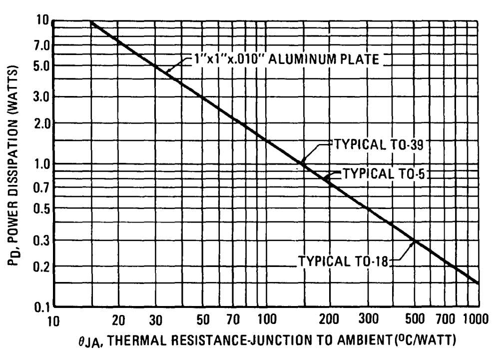


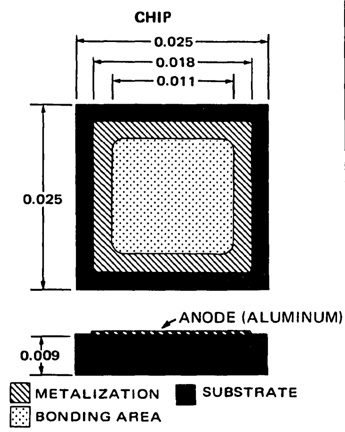
CHIP (MZC)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
DC Power Dissipation @ $T_A = 30^oC$ Derate above $T_A = 30^oC$ using $P_D = (175 - T_A)/\theta_{JA}$	P_D	Figure 1	Watts
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +175	^oC

FIGURE 1 – MAXIMUM POWER DISSIPATION, $T_A = 30^oC$





MZC SERIES – This is a series of gold-backed silicon oxide passivated chips. Chips are compatible with all standard die bonding techniques used in hybrid circuits

DIMENSIONS: NOMINAL

MZC

6

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
V_F = 1.5 V Max @ I_F = 200 mA for all types.

Type Number (Note 1)	Nearest 1N Equivalent (Note 2)	Nominal Zener Voltage V_Z @ I_{ZT} Volts (Note 1)	Test Current I_{ZT} mA (Note 2)	Max Zener Impedance Z_{ZT} @ I_{ZT} Ohms	Max Reverse Leakage Current I_R µA	@ V_R Volts Tolerance 10%	@ V_R Volts Tolerance 5.0%	Max Zener Voltage Temp. Coeff. θ_{VZ} (%/°C) (For Reference Only)
MZC2.4A10	1N5221, 1N4370	2.4	21	53	100	0.95	1.0	-0.085
MZC2.5A10	1N5222	2.5	20	53	100	0.95	1.0	-0.085
MZC2.7A10	1N5223, 1N4371	2.7	19	52	75	0.95	1.0	-0.080
MZC2.8A10	1N5224	2.8	18	51	75	0.95	1.0	-0.080
MZC3.0A10	1N5225, 1N4372	3.0	17	50	50	0.95	1.0	-0.075
MZC3.3A10	1N5226, 1N746	3.3	15	47	25	0.95	1.0	-0.070
MZC3.6A10	1N5227, 1N747	3.6	14	43	15	0.95	1.0	-0.065
MZC3.9A10	1N5228, 1N748	3.9	13	35	10	0.95	1.0	-0.060
MZC4.3A10	1N5229, 1N749	4.3	12	29	5.0	0.95	1.0	±0.055
MZC4.7A10	1N5230, 1N750	4.7	11	24	5.0	1.9	2.0	±0.030
MZC5.1A10	1N5231, 1N751	5.1	9.8	21	5.0	1.9	2.0	±0.030
MZC5.6A10	1N5232, 1N752	5.6	8.9	25	5.0	2.9	3.0	+0.038
MZC6.0A10	1N5233	6.0	8.3	30	5.0	3.3	3.5	+0.038
MZC6.2A10	1N5234, 1N753	6.2	8.1	31	5.0	3.8	4.0	+0.045
MZC6.8A10	1N5235, 1N754	6.8	7.3	38	3.0	4.8	5.0	+0.050
MZC7.5A10	1N5236, 1N755	7.5	6.7	43	3.0	5.7	6.0	+0.058
MZC8.2A10	1N5237, 1N756	8.2	6.1	49	3.0	6.2	6.5	+0.062
MZC8.7A10	1N5238	8.7	5.7	52	3.0	6.2	6.5	+0.065
MZC9.1A10	1N5239, 1N757	9.1	5.5	54	3.0	6.7	7.0	+0.068
MZC10A10	1N5240, 1N758	10	5.0	60	3.0	7.6	8.0	+0.075
MZC11A10	1N5241, 1N962	11	4.5	66	2.0	8.0	8.4	+0.076
MZC12A10	1N5242, 1N759	12	4.2	71	1.0	8.7	9.1	+0.077
MZC13A10	1N5243, 1N964	13	3.8	74	0.5	9.4	9.9	+0.079
MZC14A10	1N5244	14	3.6	33	0.1	9.5	10	+0.082
MZC15A10	1N5245, 1N965	15	3.3	37	0.1	10.5	11	+0.082
MZC16A10	1N5246, 1N966	16	3.1	42	0.1	11.4	12	+0.083
MZC17A10	1N5247	17	2.9	47	0.1	12.4	13	+0.084
MZC18A10	1N5248, 1N967	18	2.8	52	0.1	13.3	14	+0.085
MZC19A10	1N5249	19	2.6	58	0.1	13.3	14	+0.086
MZC20A10	1N5250, 1N968	20	2.5	65	0.1	14.3	15	+0.086
MZC22A10	1N5251, 1N969	22	2.3	70	0.1	16.2	17	+0.087
MZC24A10	1N5252, 1N970	24	2.1	92	0.1	17.1	18	+0.088
MZC25A10	1N5253	25	2.0	100	0.1	18.1	19	+0.089
MZC27A10	1N5254, 1N971	27	1.9	115	0.1	20	21	+0.090
MZC28A10	1N5255	28	1.8	120	0.1	20	21	+0.091
MZC30A10	1N5256, 1N972	30	1.7	140	0.1	22	23	+0.091
MZC33A10	1N5257, 1N973	33	1.5	170	0.1	24	25	+0.092
MZC36A10	1N5258, 1N974	36	1.4	200	0.1	26	27	+0.093
MZC39A10	1N5259, 1N975	39	1.3	230	0.1	29	30	+0.094
MZC43A10	1N5260, 1N976	43	1.2	280	0.1	31	33	+0.095
MZC47A10	1N5261, 1N977	47	1.1	330	0.1	34	36	+0.095
MZC51A10	1N5262, 1N978	51	0.98	390	0.1	37	39	+0.096
MZC56A10	1N5263, 1N979	56	0.89	460	0.1	41	43	+0.096
MZC60A10	1N5264	60	0.83	530	0.1	44	46	+0.097
MZC62A10	1N5265, 1N980	62	0.81	560	0.1	45	47	+0.097
MZC68A10	1N5266, 1N981	68	0.74	680	0.1	49	52	+0.097
MZC75A10	1N5267, 1N982	75	0.67	800	0.1	53	56	+0.098
MZC82A10	1N5268, 1N983	82	0.61	980	0.1	59	62	+0.098
MZC87A10	1N5269	87	0.57	1050	0.1	65	68	+0.099
MZC91A10	1N5270, 1N984	91	0.55	1150	0.1	66	69	+0.099
MZC100A10	1N5271, 1N985	100	0.50	1400	0.1	72	76	+0.110
MZC110A10	1N5272, 1N986	110	0.45	1700	0.1	80	84	+0.110
MZC120A10	1N5273, 1N987	120	0.42	2000	0.1	86	91	+0.110
MZC130A10	1N5274, 1N988	130	0.38	2300	0.1	94	99	+0.110
MZC140A10	1N5275	140	0.36	2700	0.1	101	106	+0.110
MZC150A10	1N5276, 1N989	150	0.33	3000	0.1	108	114	+0.110
MZC160A10	1N5277, 1N990	160	0.31	3400	0.1	116	122	+0.110
MZC170A10	1N5278	170	0.29	3900	0.1	123	129	+0.110
MZC180A10	1N5279, 1N991	180	0.28	4300	0.1	130	137	+0.110
MZC190A10	1N5280	190	0.26	4800	0.1	137	144	+0.110
MZC200A10	1N5281, 1N992	200	0.25	5200	0.1	144	152	+0.110

NOTE 1 – TOLERANCE AND VOLTAGE DESIGNATION

Tolerance Designation – The device type numbers listed have a tolerance of ±10%. For a ±5%, 3%, 2%, or 1%, change the suffix "10" to the desired tolerance.

Voltage Designation – To order devices with Zener voltages other than those listed, the Motorola type number should be modified as shown below.

CHIP DEVICES

M Z C 6.5 A or B 2

- M — MOTOROLA
- Z — ZENER
- C — CHIP
- 6.5 — NOMINAL VOLTAGE
- A or B — SERIES
- 2 — TOLERANCE (±%)

6

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
V_F = 1.5 V Max @ I_F = 200 mA for all types.

Type Number (Note 1)	Nearest 1N Equivalent	Nominal Zener Voltage V_Z @ I_{ZT} = 250 μA Volts (Note 1)	Max Zener Impedance Z_{ZT} @ I_{ZT} = 250 μA Ohms	Max Reverse Leakage Current I_R μA	@ V_R Volts Tolerance 10%	5.0%
MZC1.8B10	1N4614	1.8	1200	7.5	0.9	1.0
MZC2.0B10	1N4615	2.0	1250	5.0	0.9	1.0
MZC2.2B10	1N4616	2.2	1300	4.0	0.9	1.0
MZC2.4B10	1N4617	2.4	1400	2.0	0.9	1.0
MZC2.7B10	1N4618	2.7	1500	1.0	0.9	1.0
MZC3.0B10	1N4619	3.0	1600	0.8	0.9	1.0
MZC3.3B10	1N4620	3.3	1650	7.5	1.0	1.5
MZC3.6B10	1N4621	3.6	1700	7.5	1.5	2.0
MZC3.9B10	1N4622	3.9	1650	5.0	1.5	2.0
MZC4.3B10	1N4623	4.3	1600	4.0	1 5	2.0
MZC4.7B10	1N4624	4.7	1550	10	2.5	3.0
MZC5.1B10	1N4625	5.1	1500	10	2.5	3.Q
MZC5.6B10	1N4626	5.6	1400	10	3.5	4.0
MZC6.2B10	1N4627	6.2	1200	10	4.5	5.0
MZC6.8B10	1N4099	6.8	200	10	4.8	5.2
MZC7.5B10	1N4100	7.5	200	10	5.5	5.7
MZC8.2B10	1N4101	8.2	200	1.0	6.0	6.3
MZC8.7B10	1N4102	8.7	200	1.0	6.2	6.6
MZC9.1B10	1N4103	9.1	300	1.0	6.7	6.9
MZC10B10	1N4104	10	400	1.0	7.0	7.6
MZC11B10	1N4105	11	400	0.05	8.0	8.5
MZC12B10	1N4106	12	300	0.05	8.7	9.1
MZC13B10	1N4107	13	200	0.05	9.4	9.9
MZC14B10	1N4108	14	200	0.05	9.5	10.7
MZC15B10	1N4109	15	200	0.05	10.5	11.4
MZC16B10	1N4110	16	200	0.05	11.4	12.2
MZC17B10	1N4111	17	200	0.05	12.4	12.9
MZC18B10	1N4112	18	200	0.05	13.3	13.7
MZC19B10	1N4113	19	200	0.05	13.3	14.5
MZC20B10	1N4114	20	200	0.01	14.3	15.2
MZC22B10	1N4115	22	200	0.01	16.2	16.7
MZC24B10	1N4116	24	200	0.01	17.1	18.5
MZC25B10	1N4117	25	200	0.01	18.1	19.0
MZC27B10	1N4118	27	200	0.01	20	20.5
MZC28B10	1N4119	28	200	0.01	20	21.3
MZC30B10	1N4120	30	200	0.01	22	22.6
MZC33B10	1N4121	33	200	0.01	24	25.1
MZC36B10	1N4122	36	200	0.01	26	27.4
MZC39B10	1N4123	39	200	0.01	29	29.7
MZC43B10	1N4124	43	250	0.01	31	32.7
MZC47B10	1N4125	47	250	0.01	34	35.8
MZC51B10	1N4126	51	300	0.01	37	38.8
MZC56B10	1N4127	56	300	0.01	41	42.6
MZC60B10	1N4128	60	300	0.01	44	45.6
MZC62B10	1N4129	62	300	0.01	45	47.1
MZC68B10	1N4130	68	400	0.01	49	51.7
MZC75B10	1N4131	75	500	0.01	53	57.0
MZC82B10	1N4132	82	600	0.01	59	62.3
MZC87B10	1N4133	87	700	0.01	65	66.1
MZC91B10	1N4134	91	800	0.01	66	69.2
MZC100B10	1N4135	100	1000	0.01	72	76.0
MZC110B10	–	110	1300	0.01	80	84.0
MZC120B10	–	120	1600	0.01	86	91.0
MZC130B10	–	130	1900	0.01	94	99.0
MZC140B10	–	140	2200	0.01	101	106
MZC150B10	–	150	2600	0.01	108	114
MZC160B10	–	160	3000	0.01	116	122
MZC170B10	–	170	3500	0.01	123	129
MZC180B10	–	180	4000	0.01	130	137
MZC190B10	–	190	4600	0.01	137	144
MZC200B10	–	200	5200	0.01	144	152

Note 2: The MZC2.4A10 Series is tested at a 50 Milliwatt dissipation level and not at the higher test currents of the nearest "1N" equivalents. This procedure is used to minimize correlation problems encountered when probe testing. Zener voltage is guaranteed correlated when the die is mounted on a 1" x 1" x 0.010" aluminum heat sink at T_A = 30°C ±1°C after 90 seconds.

6

FIGURE 2 – TYPICAL CAPACITANCE

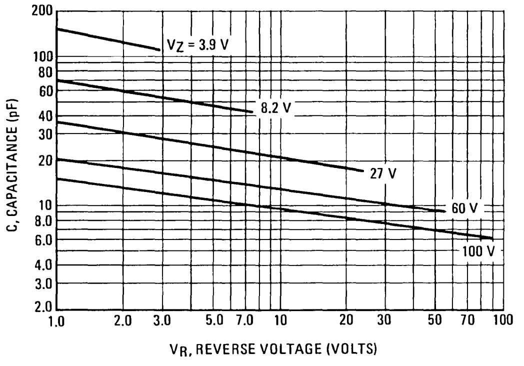


FIGURE 3 – TYPICAL FORWARD CHARACTERISTICS

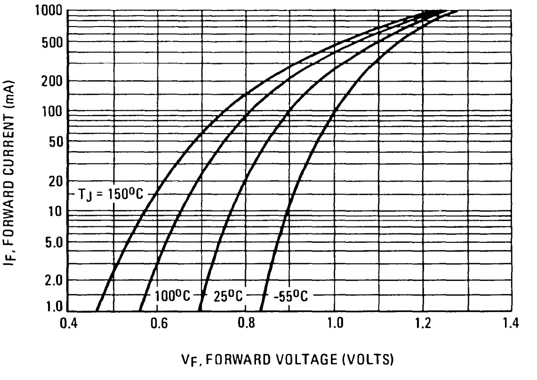


FIGURE 4 – TYPICAL NOISE DENSITY

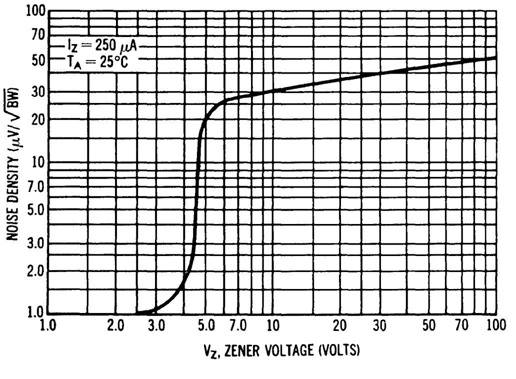
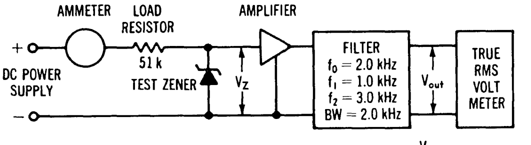


FIGURE 5 – NOISE DENSITY MEASUREMENT METHOD



NOISE DENSITY (VOLTS PER SQUARE ROOT BANDWIDTH) = $\frac{V_{out}}{\text{OVERALL GAIN } \sqrt{BW}}$

WHERE: BW = FILTER BANDWIDTH (Hz)
V_{out} = OUTPUT NOISE (VOLTS RMS)

The input voltage and load resistance are high so that the zener diode is driven from a constant current source. The noise of the amplifier is low so that it is negligible compared to that of the test zener. The filter bandpass is known so that the noise density can be calculated from the formula shown.

6

UNENCAPSULATED THIN-FILM RESISTORS

This data sheet lists a series of multi-tap 10-percent resistor chips designed for the manufacturer of hybrid circuits. These chips are particularly useful for trimming production circuits and for building prototype circuits. These chips have gold-alloy backing that is suitable for eutectic bonding directly to a metalized substrate; or may be bonded to a kovar or ceramic tab and then attached to the substrate using epoxy adhesive or other suitable methods. Electrical connection from the aluminum bonding pads of the resistor chip to other circuit elements is accomplished using conventional wire bonding techniques.

THIN-FILM RESISTORS

MMCR100

RESISTOR CHARACTERISTICS

Characteristic	Value	Unit
Power Rating @ T_A = 25°C Derate to 0 at 200°C	250 max	mW
Temperature Coefficient Resistance See Figure 1	-30 to +300	ppm/°C
Shunt Capacitance to Substrate	1.0 max	pF
Breakdown Voltage to Substrate	400 min	Volts
Resistance to Substrate	10^{15} min	Ohms
Voltage Coefficient	0.001 max	%/Volt
Drift @ 50% rated Power and 125°C	0.05 max 0.01 max	%/first 100 hours %/1000 hours

HANDLING PRECAUTIONS

Although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published specifications, provided three basic requirements are met in the customer's establishment.

1. Such devices are stored in an environment of no more than 30% relative humidity.
2. Devices are die-and-wire bonded in an inert atmosphere not exceeding 400°C.
3. Processing equipment conforms to the minimum standards of equipment normally employed in semiconductor establishments.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

TYPE DESIGNATION

MMCR100-025

- MM — Motorola Microcircuit Component
- R — Resistor
- 100 — Multi-tap Resistor
- 025 — Ohms per Square

TABLE 1 RESISTANCE VALUES

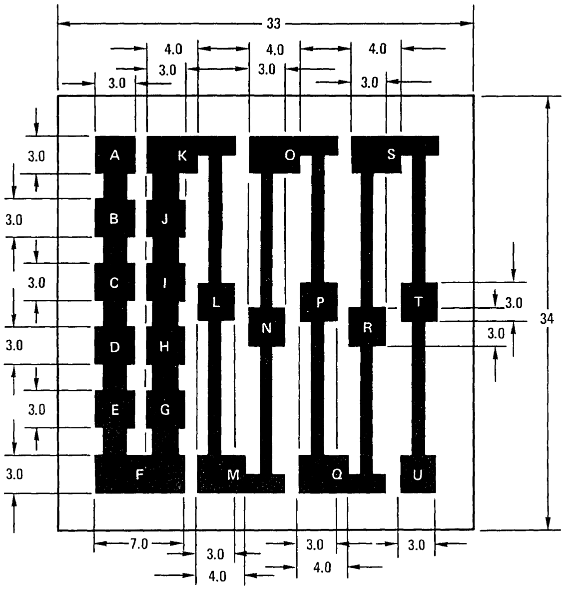
PART NUMBER	OHMS/□	END-TO-END RESISTANCE
MMCR100-025	25	2,750 Ohms
MMCR100-050	50	5,500 Ohms
MMCR100-100	100	11,000 Ohms
MMCR100-200	200	22,000 Ohms
MMCR100-300	300	33,000 Ohms

Each resistor chip is divided into 10 sections of 1 square, and 10 sections of 10 squares.

CONSTRUCTION DETAILS

SUBSTRATE – N-TYPE SILICON – 3 to 8 MILS THICK
ISOLATION LAYER – 10,000 Å SILICON DIOXIDE
CONTACT METALIZATION – ALUMINUM
BACKING – GOLD-ALLOY
RESISTOR ELEMENTS – NICKLE-CHROMIUM ALLOY

All dimensions are in mils



CHIP GEOMETRY

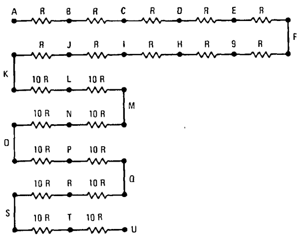


FIGURE 1 – NICHROME TEMPERATURE COEFFICIENT RESISTANCE

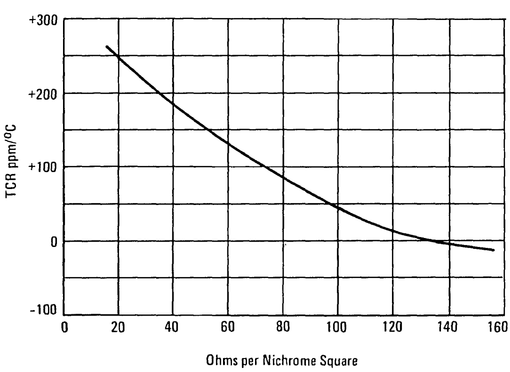
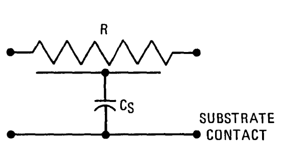


FIGURE 2 – EQUIVALENT CIRCUIT OF THIN-FILM RESISTOR CHIP



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UNENCAPSULATED THIN-FILM RESISTORS

This data sheet lists a series of 5 and 10 percent resistor chips designed for the manufacturer of hybrid microcircuits. These chips may be used in conjunction with screened or deposited resistors or may replace them entirely. The chips have a gold-alloy backing that is suitable for eutectic bonding directly to a substrate; or they may be bonded to a kovar or ceramic tab and then attached to the substrate using epoxy adhesive or other suitable methods. Electrical connection from the aluminum bonding pads of the resistor chip to other circuit elements is accomplished using conventional wire bonding techniques.

THIN-FILM RESISTORS

MMCR105
MMCR110

HANDLING PRECAUTIONS

Although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published specifications, provided three basic requirements are met in the customer's establishment.

1. Such devices are stored in an environment of no more than 30% relative humidity.
2. Devices are die-and-wire bonded in an inert atmosphere not exceeding 400°C.
3. Processing equipment conforms to the minimum standards of equipment normally employed in semiconductor establishments.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

RESISTOR CHARACTERISTICS

Characteristic	Value	Unit
Power Rating @ T_A = 25°C Derates to 0 at 200°C	250 max	mW
Temperature Coefficient Resistance (See Figure 1)	-30 to +300	ppm/°C
Shunt Capacitance to Substrate	1.0 max	pF
Breakdown Voltage to Substrate	400 min	Volts
Resistance to Substrate	10^{15} min	Ohms
Voltage Coefficient	0.001 max	%/Volt
Drift @ 50% rated power and 125°C	0.05 max 0.01 max	%/first 100 hrs. %/1000 hrs.

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TYPE DESIGNATION

MMCR105-301

MOTOROLA MICROCIRCUIT COMPONENT — MM

RESISTOR — CR

RESISTANCE TOLERANCE* — 105

RESISTANCE VALUE IN OHMS. The first two digits represent significant figures; the last digit specifies the number of zeros to follow. (300 OHMS is illustrated) — 301

*RESISTANCE TOLERANCE

SYMBOL	RESISTANCE TOLERANCE PERCENT
101	1
102	2
105	5
110	10
120	20

NOTE: Only 5 and 10 percent tolerance resistors are available as standard products and are listed in this data sheet. 1, 2 and 20 percent resistors are available on special order.

TABLE I – RESISTANCE VALUES

Nominal Resistance In Ohms	Part Number 5% Resistors	Part Number 10% Resistors	Geometry Figure	Pad Terminations (Note 1)
10	MMCR105-100	MMCR110-100	1	A-B
11	MMCR105-110		1	A-B
12	MMCR105-120	MMCR110-120	1	A-B
13	MMCR105-130		1	A-B
15	MMCR105-150	MMCR110-150	1	C-D
16	MMCR105-160		1	C-D
18	MMCR105-180	MMCR110-180	1	C-D
20	MMCR105-200		1	C-D
22	MMCR105-220	MMCR110-220	1	C-D
24	MMCR105-240		1	C-D
27	MMCR105-270	MMCR110-270	1	B-D
30	MMCR105-300		1	A-D
33	MMCR105-330	MMCR110-330	1	A-D
36	MMCR105-360		1	A-D
39	MMCR105-390	MMCR110-390	1	A-D
43	MMCR105-430		1	A-D
47	MMCR105-470	MMCR110-470	1	A-D
51	MMCR105-510		1	A-D
56	MMCR105-560	MMCR110-560	2	C-D
62	MMCR105-620		2	C-D
68	MMCR105-680	MMCR110-680	2	C-D
75	MMCR105-750		2	C-D
82	MMCR105-820	MMCR110-820	2	B-D
91	MMCR105-910		2	B-D
100	MMCR105-101	MMCR110-101	2	B-D
110	MMCR105-111		2	B-D
120	MMCR105-121	MMCR110-121	2	A-D
130	MMCR105-131		2	A-D
150	MMCR105-151	MMCR110-151	2	B-D
160	MMCR105-161		2	A-D
180	MMCR105-181	MMCR110-181	2	A-D
200	MMCR105-201		2	A-D
220	MMCR105-221	MMCR110-221	2	A-D
240	MMCR105-241		2	A-D
270	MMCR105-271	MMCR110-271	2	A-D
300	MMCR105-301		2	A-D
330	MMCR105-331	MMCR110-331	3	A-B
360	MMCR105-361		3	A-B
390	MMCR105-391	MMCR110-391	3	A-B
430	MMCR105-431		3	A-B
470	MMCR105-471	MMCR110-471	3	A-B
510	MMCR105-511		3	A-B
560	MMCR105-561	MMCR110-561	3	A-B
620	MMCR105-621		3	C-D
680	MMCR105-681	MMCR110-681	3	C-D
750	MMCR105-751		3	A-B
820	MMCR105-821	MMCR110-821	3	C-D
910	MMCR105-911		3	C-D
1000	MMCR105-102	MMCR110-102	3	C-D
1100	MMCR105-112		3	C-D
1200	MMCR105-122	MMCR110-122	3	C-D
1300	MMCR105-132		3	C-D
1500	MMCR105-152	MMCR110-152	3	C-D
1600	MMCR105-162		3	A-D
1800	MMCR105-182	MMCR110-182	3	A-D
2000	MMCR105-202		3	A-D
2200	MMCR105-222	MMCR110-222	3	A-D
2400	MMCR105-242		4	A-D
2700	MMCR105-272	MMCR110-272	3	A-D
3000	MMCR105-302		4	A-D
3300	MMCR105-332	MMCR110-332	4	A-C
3600	MMCR105-362		4	A-C
3900	MMCR105-392	MMCR110-392	4	A-C
4300	MMCR105-432		4	A-C
4700	MMCR105-472	MMCR110-472	4	A-C
5100	MMCR105-512		4	A-C
5600	MMCR105-562	MMCR110-562	4	A-C
6200	MMCR105-622		4	A-C
6800	MMCR105-682	MMCR110-682	4	A-C
7500	MMCR105-752		4	A-C
8200	MMCR105-822	MMCR110-822	4	A-C
9100	MMCR105-912		4	A-C

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TABLE I – RESISTANCE VALUES (continued)

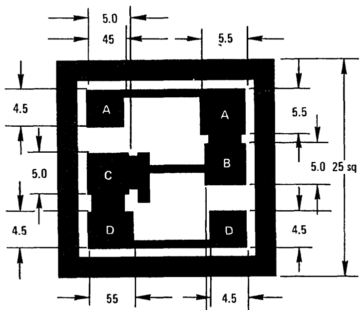
Nominal Resistance In Ohms	Part Number 5% Resistors	Part Number 10% Resistors	Geometry Figure	Pad Terminations (Note 1)
10,000	MMCR105-103	MMCR110-103	5	A-C
11,000	MMCR105-113		5	A-C
12,000	MMCR105-123	MMCR110-123	5	A-C
13,000	MMCR105-133		5	A-C
15,000	MMCR105-153	MMCR110-153	5	A-C
16,000	MMCR105-163		5	A-C
18,000	MMCR105-183	MMCR110-183	5	A-C
20,000	MMCR105-203		5	A-C
22,000	MMCR105-223	MMCR110-223	5	A-C
24,000	MMCR105-243		5	A-C
27,000	MMCR105-273	MMCR110-273	5	A-C
30,000	MMCR105-303		5	A-C
33,000	MMCR105-333	MMCR110-333	6	A-C
36,000	MMCR105-363		6	A-C
39,000	MMCR105-393	MMCR110-393	6	A-C
43,000	MMCR105-433		6	A-C
47,000	MMCR105-473	MMCR110-473	6	A-C
51,000	MMCR105-513		6	A-C
56,000	MMCR105-563	MMCR110-563	7	A-C
62,000	MMCR105-623		7	A-C
68,000	MMCR105-683	MMCR110-683	7	A-C
75,000	MMCR105-753		7	A-C
82,000	MMCR105-823	MMCR110-823	7	A-C
91,000	MMCR105-913		7	A-C
100,000	MMCR105-104	MMCR110-104	7	A-C

Note 1: The nominal resistance is measured between pad terminations as listed. Other resistances are available on the chip, with approximate values as shown in the schematic with the geometry, but these values are not tested or guaranteed.

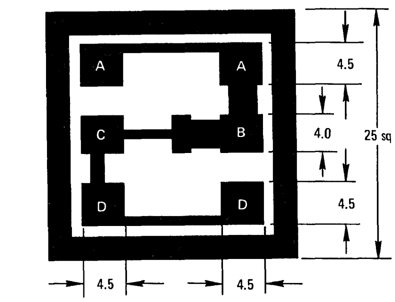
CONSTRUCTION DETAILS

SUBSTRATE – N-TYPE SILICON – 3 to 8 MILS THICK
CONTACT METALIZATION – ALUMINUM
ISOLATION LAYER – 10,000 A SILICON DIOXIDE
BACKING – GOLD-ALLOY
RESISTOR ELEMENT – NICKEL-CHROMIUM ALLOY

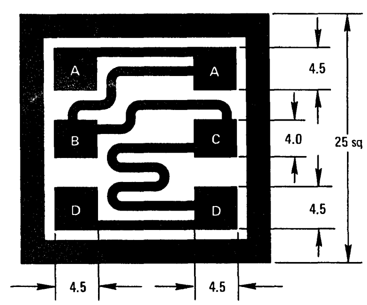
All Dimensions in mils



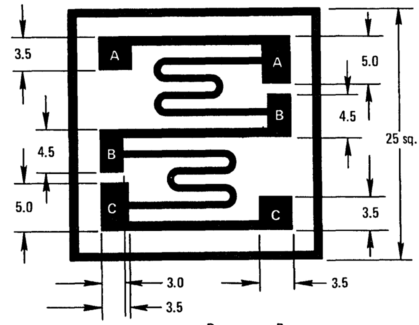
Geometry 1 A R B R C 2R D



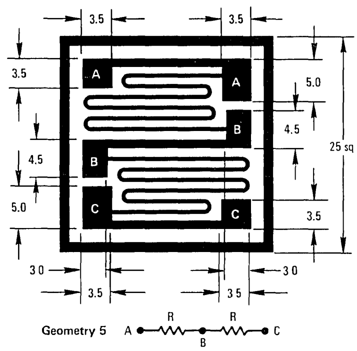
Geometry 2 A R B R C 2R D



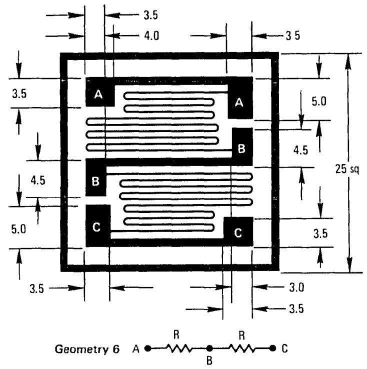
Geometry 3 A R B R C 2R D



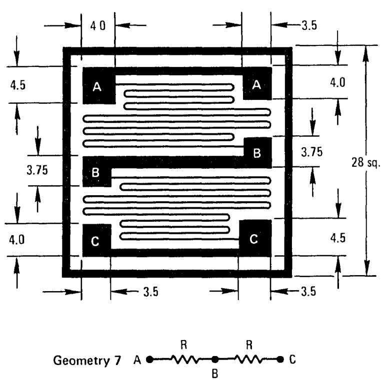
Geometry 4 A R B R C



Geometry 5



Geometry 6



Geometry 7

EQUIVALENT CIRCUIT OF THE THIN-FILM RESISTOR CHIP

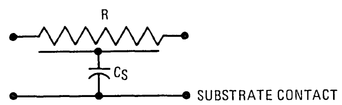
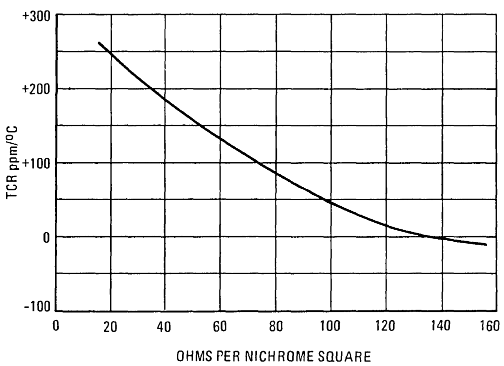


FIGURE 1 – NICHROME TEMPERATURE COEFFICIENT RESISTANCE



GEOMETRY	Number of Nichrome Squares
1	1
2	4
3	60
4	101
5	350
6	1132
7	1588

Microcircuit Components

UNENCAPSULATED THIN-FILM CAPACITORS

This data sheet lists a series of capacitor chips designed for the manufacturer of hybrid circuits. These chips are particularly useful for trimming production circuits and for building prototype circuits. These chips have gold-alloy backing that is suitable for eutectic bonding directly to a metalized substrate; or may be bonded to a kovar or ceramic tab and then attached to the substrate using epoxy adhesive or other suitable methods. Electrical connection from the aluminum bonding pad of the capacitor chip to other circuit elements is accomplished using conventional wire bonding techniques.

UNENCAPSULATED THIN-FILM CAPACITORS

MMCQ100-330
TO
MMCQ100-221
AND
MMCQ100-330-1
TO
MMCQ100-221-1

CAPACITOR CHARACTERISTICS

Characteristic	Value	Unit
Dissipation Factor @ 1.0 kHz	0.02	% Max
Temperature Coefficient of Capacitance	+25 ±10	ppm/°C
Q (Typical) @ 80 MHz	500	–
@ 150 MHz	190	–
@ 200 MHz	75	–
@ 250 MHz	50	–
Drift (after 3000 Hours @ 125°C)	<2.0	%
Operating Temperature Range	-55 to +125	°C
Dielectric Time Constant (Megohm-Microfarad @ +25°C)	10^6	s
Tolerance	10	%

HANDLING PRECAUTIONS

Although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published specifications, provided three basic requirements are met in the customer's establishment.

1. Such devices are stored in an environment of no more than 30% relative humidity.

2. Devices are die-and-wire bonded in an inert atmosphere not exceeding 400°C.

3. Processing equipment conforms to the minimum standards of equipment normally employed in semiconductor establishments.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

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TYPE DESIGNATION

MMCQ100-330

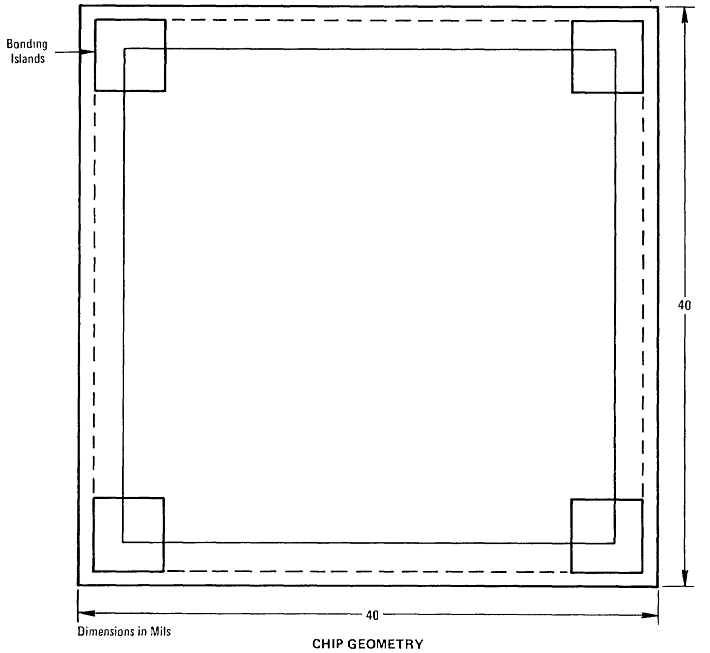
- MM — Motorola Microcircuit Component
- C — Capacitor
- Q — Square Capacitor
- 100-330 — Capacitor Value in pF: 1st two digits = capacity; 3rd digit = # of zeros

AVAILABLE PACKAGES

a "- 1" designates a package of 10 units
no "- 1" designates a package of 400 units

CONSTRUCTION DETAILS

CONTACT METALIZATION – ALUMINUM
BACKING – GOLD-ALLOY



CHIP GEOMETRY

All Dimensions in Millimeters

Device Type	Device Type	Capacity	Breakdown Voltage
MMCQ100-330	MMCQ100-330-1	33 pF	100 Vdc
MMCQ100-390	MMCQ100-390-1	39 pF	100 Vdc
MMCQ100-470	MMCQ100-470-1	47 pF	95 Vdc
MMCQ100-560	MMCQ100-560-1	56 pF	90 Vdc
MMCQ100-680	MMCQ100-680-1	68 pF	85 Vdc
MMCQ100-820	MMCQ100-820-1	82 pF	80 Vdc
MMCQ100-101	MMCQ100-101-1	100 pF	75 Vdc
MMCQ100-121	MMCQ100-121-1	120 pF	65 Vdc
MMCQ100-151	MMCQ100-151-1	150 pF	50 Vdc
MMCQ100-181	MMCQ100-181-1	180 pF	40 Vdc
MMCQ100-221	MMCQ100-221-1	220 pF	20 Vdc

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UNENCAPSULATED THIN-FILM CAPACITORS

This data sheet lists a series of capacitors on one chip designed for the manufacturer of hybrid circuits. These chips are particularly useful for trimming production circuits and for building prototype circuits. The chip has a gold-alloy backing that is suitable for eutectic bonding directly to a metalized substrate; or may be bonded to a kovar or ceramic tab and then attached to the substrate using epoxy adhesive or other suitable methods. Electrical connection from the aluminum bonding pads of the capacitor chip to other circuit elements is accomplished using conventional wire bonding techniques.

UNENCAPSULATED THIN-FILM CAPACITORS

MMCQ101
MMCQ101-1

CAPACITOR CHARACTERISTICS

Characteristic	Value	Unit
Dissipation Factor @ 1.0 kHz	0.02	% Max
Temperature Coefficient of Capacitance	+25 ± 10	ppm/°C
Q (Typical) @ 80 MHz @ 150 MHz @ 200 MHz @ 250 MHz	500 190 75 50	– – – –
Drift (after 3000 Hours @ 125°C)	< 2.0	%
Operating Temperature Range	-55 to +125	°C
Dielectric Time Constant (Megohm-Microfarad @ +25°C)	10^6	s
Maximum DC Working Voltage	100	Vdc
Tolerance	± 10	%

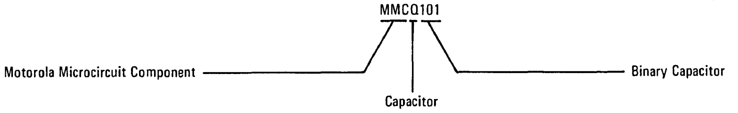
HANDLING PRECAUTIONS

Although the care and handling of unencapsulated semiconductors often require precautions outside the experience of many equipment manufacturers, Motorola warrants that such devices meet or exceed the published specifications, provided three basic requirements are met in the customer's establishment.

1. Such devices are stored in an environment of no more than 30% relative humidity.
2. Devices are die-and-wire bonded in an inert atmosphere not exceeding 400°C.
3. Processing equipment conforms to the minimum standards of equipment normally employed in semiconductor establishments.

Moreover, Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

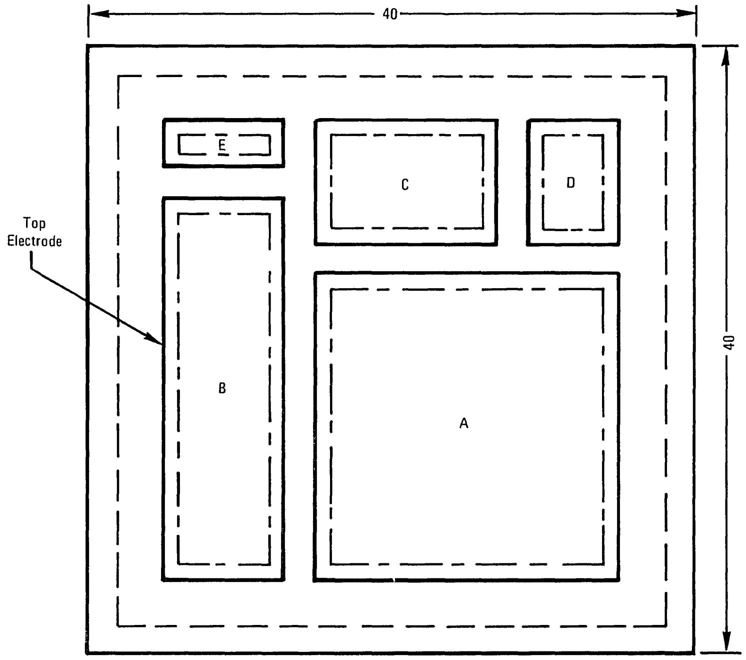
TYPE DESIGNATION



AVAILABLE PACKAGES
a "-1" designates a package of 10 units
no "-1" designates a package of 400 units

CONSTRUCTION DETAILS

CONTACT METALIZATION – ALUMINUM
BACKING – GOLD ALLOY
All dimensions are in mils



CHIP GEOMETRY
A = 16 pF, B = 8.0 pF, C = 4.0 pF, D = 2.0 pF, E = 1.0 pF

BINARY CAPACITOR CONNECTION CODE

Capacity Required	Code	Capacity Required	Code
1 pF	E	17 pF	A + E
2 pF	D	18 pF	A + D
3 pF	E + D	19 pF	A + D + E
4 pF	C	20 pF	A + C
5 pF	C + E	21 pF	A + C + E
6 pF	C + D	22 pF	A + C + D
7 pF	C + D + E	23 pF	A + C + D + E
8 pF	B	24 pF	A + B
9 pF	B + E	25 pF	A + B + E
10 pF	B + D	26 pF	A + B + D
11 pF	B + D + E	27 pF	A + B + D + E
12 pF	B + C	28 pF	A + B + C
13 pF	B + C + E	29 pF	A + B + C + E
14 pF	B + C + D	30 pF	A + B + C + D
15 pF	B + C + D + E	31 pF	A + B + C + D + E
16 pF	A		

BEAM LEAD

MTTL

MCBC5400/MCB5400F SERIES

BEAM LEAD
INTEGRATED CIRCUITS

INDEX

6

DEVICE SPECIFICATIONS

CHANGE NOTICE

BEAM TO PIN CROSS REFERENCE

MCBC5400 (CHIP) versus MCB5400F (FLAT PACK)

In complying with recent EIA agreements, Motorola beam-lead devices now in production conform to the new standard beam numbering system; i.e., the notched beam (beam 1) will be located in the lower left-hand corner when viewing the chip with the geometry face down.

The new beam number arrangement for Motorola devices is shown below.

MCBC5400	BEAM NO.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
MCB5400F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5401	BEAM NO.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
MCB5401F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5402	BEAM NO.	16	1	2	3	4	5	6	8	9	10	11	12	13	14
MCB5402F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5404	BEAM NO.	16	1	2	3	4	5	6	8	9	10	11	12	13	14
MCB5404F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5405	BEAM NO.	16	1	2	3	4	5	6	8	8	10	11	12	13	14
MCB5405F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5410	BEAM NO.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
MCB5410F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5420	BEAM NO.	1	2	–	3	–	4	5	6	7	8	9	10	11	12
MCB5420F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5430	BEAM NO.	12	1	2	3	4	5	6	7	8	9	10	11	–	–
MCB5430F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5440	BEAM NO.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
MCB5440F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5450	BEAM NO.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
MCB5450F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5451	BEAM NO.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
MCB5451F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5453	BEAM NO.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
MCB5453F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5454	BEAM NO.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
MCB5454F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5460	BEAM NO.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
MCB5460F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MCBC5472	BEAM NO.	16	1	2	3	4	5	6	8	9	10	11	12	13	14
MCB5472F	PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14

MTTL

GENERAL INFORMATION

MCBC5400/MCB5400F Series

BEAM LEAD INTEGRATED CIRCUITS

INTRODUCTION

The MTTL MCBC5400/MCB5400F series of transistor-transistor logic is a medium-speed, high noise immunity family of saturating integrated logic circuits designed for digital logic applications requiring clock frequencies to 30 MHz and switching speeds in the 12-15 ns range under moderate capacitive loading.

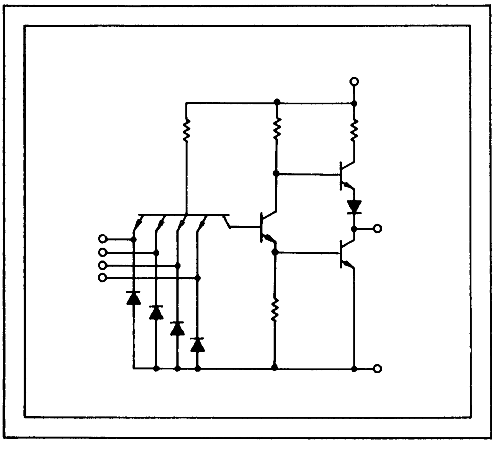
The beam lead sealed-junction technology used in this MTTL family makes the devices useful in military, aerospace, and commercial applications that require a high degree of reliability under environmental conditions of severe temperature extremes, mechanical shock, and high humidity. The beam lead products employ a silicon nitride dielectric that hermetically seals the chip, eliminating the need for a hermetic package. The beam leads are gold cantilevered structures extending from the chip. These beams bond readily to a gold metalized substrate providing one of the most reliable interconnection systems known for semiconductor devices.

The circuits in the MCBC5400/MCB5400F series are identified by a multiple emitter input transistor and an active pullup in the upper output network as shown in Figure 1.

The multiple emitter input configuration offers the maximum amount of logic capability in the minimum physical area and provides improved switching characteristics during turnoff. Clamp diodes are provided at each of the inputs to limit undershoot that occurs in typical applications such as driving long interconnect wiring. The active pullup output configuration provides low impedance in the high output state. The resulting low impedances in both states provide excellent ac noise immunity and allow high-speed operation while driving large capacitive loads.

These beam lead MTTL units have the same electrical characteristics as the conventional flat-pack units and may be used interchangeably with them. This eliminates the need for electrically redesigning equipment for improved reliability after the successful performance of prototype or pre-production units with conventional devices.

FIGURE 1 – TYPICAL MTTL CIRCUIT
MCBC5400/MCB5400F Series



BEAM LEAD TECHNOLOGY

Junction Sealing

In conventional integrated circuits, the P-N junctions are protected by a layer of silicon dioxide. This oxide, while acting as an insulator and providing a degree of protection, is permeable to mobile ions. Ions impinging on the surface of the finished circuit can cause high leakage current and reduction of current gain. Silicon nitride passivation applied over the oxide prevents contaminants that can result in such degradation from reaching the oxide.

Metalization

The metalization on the Motorola beam lead integrated circuits of platinum silicide ohmic contacts topped by layers of titanium and platinum. These in turn are followed by two layers of gold. The first gold layer provides the chip intraconnection and the second, thicker layer forms the cantilevered beams that connect the chip to the outside world (see Figure 2). This metalization method has the ability to withstand conditions of high humidity over extended periods of time without degradation or the formation of undesirable inter-metallics. It is also capable of being bonded to a gold-metalized substrate and provides a highly relaible gold-to-gold bond, which is easily made and readily inspectable. Bonds have also been made to other substrate metal materials without difficulty.

During the bonding process, beam lead devices lift off the substrate surface, which, with the ductility of the gold metal beams and the high quality bond, allows the device to withstand wide variations in temperature without failure due to fatigue.

Separation Etch

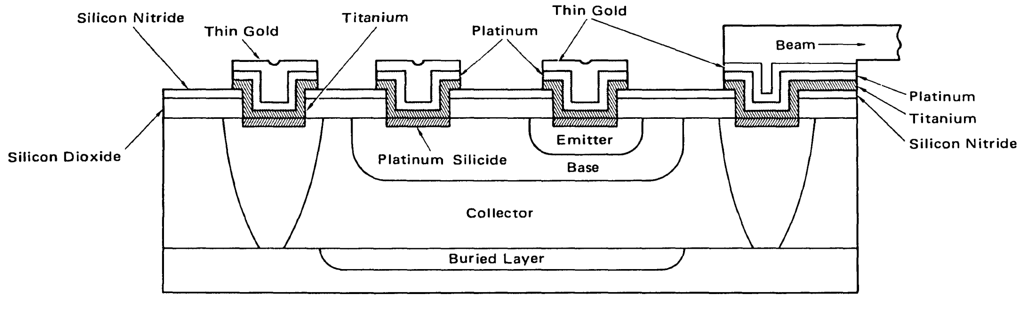
Conventional integrated circuits are separated with a "scribe and break" technique which not only results in a yield loss due to cracking of the die, but can also result in minute cracks, which do not immediately reveal themselves and can cause device failure at a later date. The beam lead sealed-junction devices are separated by chemically etching through the silicon from the back side, thereby avoiding mechanical stresses and/or other latent defects.

TABLE 1
Beam Lead Reliability Assurance Steps

I. Chips
  A. Tests performed after wafer separation etch
    1. Post separation etch visual inspection (backside)
    2. Wafer electrical probe (100% dc test per data sheet at 25°C.
  B. Tests performed on a bonded sample after die transfer and pick
    1. Beam integrity
      a) Bond qualification samples to test header
      b) Push die off header from metallization side
      c) Each beam must withstand 2.00 gm. min.
    2. Junction seal integrity
      a) Electrical test
      b) Apply NaCl over die
      c) Reverse bias input junctions at T_A = 300°C for eight hours in forming gas atmosphere
      d) Electrical test
    3. Electrical qualification
      a) Package sample
      b) DC parameters at all temperatures per data sheet
      c) AC test per data sheet
  C. Inspection after die pick and sort
    1. 100% high power visual inspection
    2. R and QA sample high power inspection

II. Packaged Devices
  A. Inspection after die bond
    1. Sample visual inspection
  B. Testing after encapsulation
    1. Lot stress screening
      a) Temperature cycling: -65°C to 150°C min; 10 cycles
      b) Water immersion: boiling water (≈100°C; 1 hour)
      c) Electrical measurements: dc leakage parameters
      d) Stabilization bake: T_A = 175°C min; 24 hours min
      e) High temperature reverse bias (cost option)
  C. Testing after package cleaning and marking
    1. Electrical tests
      a) Final dc test per data sheet at 25°C (100%)
    2. R and QA final outgoing inspection
      a) Burn in screen (cost option)
      b) Group A — visual/mechanical inspection per MIL-STD-883, method 2009. Group A tests are performed on every lot on a sample basis.
      DC electrical measurements per data sheet (sample)
      AC electrical measurements (sample)
      c) Group B environmental testing per MIL-STD-883 Class A as applicable. These tests are performed periodically during the manufacturing period on a production lot of a representative circuit type. The circuit type selected each period is changed routinely and is representative of all structurally similar devices produced on the same line by the same processes during that period.
      d) Group C — life testing per MIL-STD-883 Class A as applicable. These tests are performed periodically on at least one lot of every circuit family produced during that period.

FIGURE 2 — BEAM LEAD SEALED JUNCTION TRANSISTOR



Reliability Processing

Conventional integrated circuits have established an outstanding reputation for reliability. Beam lead integrated circuits provide even higher reliability by eliminating the major failure modes of conventional circuits. Most failures in conventional integrated circuits are due to contaminants reaching the active chip or to failure in the bonds between the package and the chip. Beam lead technology solves both of these problems. The silicon nitride hermetically seals the chip so that even a leaking package causes no failure. The all-gold beam lead interconnection system eliminates the sources of conventional bond failure. These processes are completely documented by in-process specifications and are carefully monitored for adherance to process requirements and inspection standards by the Motorola Reliability and Quality Assurance Department. In addition, the tests itemized in Table 1 are conducted on all lots from which die are taken for sale either as dice or packaged circuits.

MTTL

GENERAL INFORMATION

MCBC5400/MCB5400F Series
BEAM LEAD INTEGRATED CIRCUITS

Mechanical Properties

The beam leads, which are cantilevered from each die, are tested for beam-strength, hardness, ductility and adhesion to the chip by suitable tests to demonstrate that the die are readily bondable and will be reliable under extreme temperature and mechanical stress conditions.

Packaging and Handling

The MCBC5400/MCB5400F series of beam lead sealed-junction digital integrated circuits is available in the chip form and in a ¼" x ¼" ceramic flat package. The shipping carrier for chips is a 2" square glass plate on which the chips are placed. A thin layer of polymer film covers the plate and retains the chips in place. The chips do not adhere to the film when it is lifted to remove them from the carrier. Care must be exercised when removing the chips from the carrier to ensure that the beams are not bent. This is most easily done by using a vacuum pick-up for this purpose.

TYPICAL CHARACTERISTICS

The following summary presents the typical operating characteristics of the MTTL MCBC5400/MCB5400F series. Unless otherwise indicated, the parameters are defined for V_{CC} = +5.0 volts and T_A = +25°C.

Supply Voltage Operating Range = 4.5 to 5.5 volts

Operating Temperature Range = -55 to +125°C

Output Drive Capability
- Other Gates (Output Loading Factor) = 10
- Capacitance = 600 pF

Output Impedance
- High State = 70 ohms (unsaturated) nominal
- Low State = 10 ohms nominal

Output Voltage Swing = 0.2 to 3.5 volts typical

Input Voltage Limits
- +5.5 volts maximum
- -0.5 volt minimum

Switching Threshold = 1.5 volts nominal

Input Impedance
- High State = 400 k ohms nominal
- Low State = 4.0 k ohms nominal

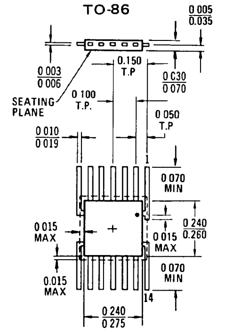
Worst-Case DC Noise Margin
- High State – 0.400 volt minimum
- Low State – 0.400 volt minimum

Power Dissipation (1)
- Basic Gate = 10 mW typ/gate
- Basic Flip-Flop = 40 mW typ/pkg

Switching Speeds (2)
- Average Propagation Delay = 13 ns per gate typical
  30 ns per flip-flop typical
- Rise Time = 2.5 ns typical
- Fall Time = 1.5 ns typical

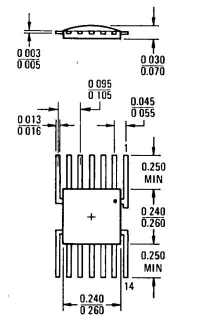
Maximum Flip-Flop Clock Frequency = 20 MHz typical

F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86



Lead 1 identified by color dot or by elbow on lead
All JEDEC dimensions and notes apply

F SUFFIX
CERAMIC PACKAGE
CASE 651



Weight ≈ 0.197 grams

Lead 1 identified by color dot or by elbow on lead.
Top Cover made of silastic material.

Devices formerly using Case 651 are now manufactured in Case 607. Either package may be shipped during the transition.

BREADBOARDING SUGGESTIONS

When breadboarding with any form of high-speed, high-performance TTL, the designer must continually be aware of the fact that he is working with the fastest form of saturating logic available in the industry today. The switching speeds, especially the frequencies associated with the very fast rise and fall times of the circuits, are in the RF range and good high-frequency layout techniques should be used. The following breadboarding suggestions have been included to help the designer in his initial circuit layout. In many cases the breadboarding suggestions will have to be modified to meet the requirements of the designer's specific application.

Power and Ground Distribution

Special care should be taken to insure adequate distribution of power and ground systems. The typical rate of change of currents and voltages for a single MTTL gate is in the range of 10^7 A/s and 10^8 V/s respectively. These figures reflect the necessity for a low-impedance power supply and ground distribution system, if transients are to be minimized and noise margins maintained. The use of AWG No. 20 wire or larger is often required. For printed circuitry, line widths of 100 mils or more are often necessary. A ground plane is desirable when using a large number of units.

Bypassing

To reduce supply transients, the breadboard should be bypassed at the point where power is supplied to the board and at intervals throughout the board. The use of a single bypass capacitor at the output terminal of the power supply is not adequate in a breadboard utilizing the fast rise and fall time MTTL circuits. A comparatively large, low-inductance type capacitor (in the 1.0 μF range) is suggested at the point where power and ground enter the board. In many cases it has been found that distributing 0.01 μF capacitors for every eight packages throughout a breadboard is adequate to suppress normal switching transients. It is also suggested that a bypass capacitor be placed in close proximity to any circuit driving a large capacitive load.

6

Power Dissipation

The standard supply voltage of the MTTL logic circuits is +5.0 Vdc. The typical average dc power dissipation is given for each MTTL circuit.(1) It should be noted that the totem pole output common to all high level MTTL circuits has an associated ac power dissipation factor. This factor results from the timing overlap of the upper and lower output transistors during the normal switching operation and is typically 0.30 mW/MHz/output for a 15 pF load. This ac power dissipation should be added when calculating the total power requirements of the MTTL circuits.

Unused Inputs and Unused Gates

The unused inputs of any MTTL logic circuit should not be left open, and can either be tied to the used inputs or returned to the supply voltage. This will reduce any potential problems resulting from external noise. If the inputs are returned to the supply voltage, care should be taken to insure that the supply voltage does not exceed the maximum rated input voltage of 5.5 volts. If the supply can exceed 5.5 volts, the unused inputs must be returned to a lower voltage. The total number of inputs that can be tied to the output of any driving gate is 50. (This is defined as high state output loading factor.) It should be noted that the low state output loading rules must still be maintained. The minimum logical "1" level, V_{OH} = 2.4 V minimum for the high-state output loading, with V_{tho} = 0.8 V, I_{OH} = -0.4 mA, and V_{CCL}.

The unused inputs of the various flip-flops may be tied back to their associated outputs. To determine which outputs are related to each set of inputs by internal feedback, refer to the circuit schematics.

The inputs of any unused gate in a package should be grounded. This places the gate in its lowest power condition and will help to eliminate unnecessary power drain.

(1)

$$P_D = \frac{I_{PDL} + I_{PDH}}{2} (V_{CC})$$

where I_{PDL} and I_{PDH} are the typical dc current drains at V_{CC} = ±5.0 V.

(2) The switching characteristics of the MTTL family are defined with respect to the associated transistions of the voltage waveforms. The average propagation delay is defined as the average of the turn-on delay and the turn-off delay measured from the 1.5 V point of the input to the 1.5 V point of the associated output transition or:

$$t_{pd} = \frac{t_{on} + t_{off}}{2} \text{ ns.}$$

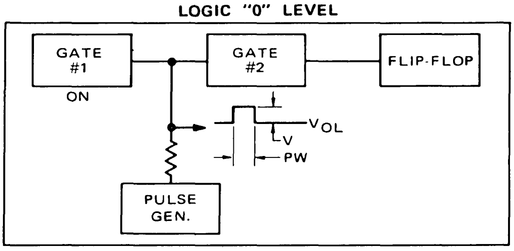
Rise time is defined as the positive going transition of the output from the 10% to the 90% V level. Fall time is defined as the negative transition of the output from the 90% to the 10% V level.

Expanders and Expander Nodes

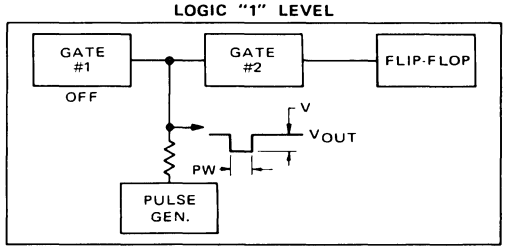
The ORing nodes of all the MTTL AND-OR-INVERT gates are made available for expanding the number of AND gates to 6 (MC5450F) or 8 (MC5453F). Since these are comparatively high-impedance nodes, care should be taken to minimize capacitive loading on the expander terminals if switching speed is to be maintained. When an expander is to be used with an expandable AND-OR-INVERT gate, it should be placed as close as possible to the gate being expanded. The increase in average propagation delay as a function of capacitance added to the expander nodes is typically 1.0 ns/pF.

SIGNAL LINE NOISE IMMUNITY

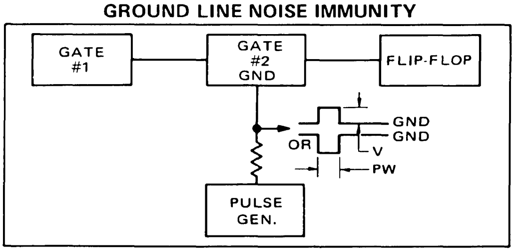
LOGIC "0" LEVEL



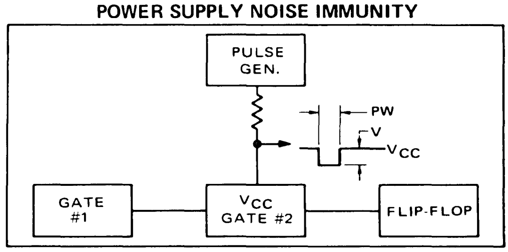
LOGIC "1" LEVEL



GROUND LINE NOISE IMMUNITY

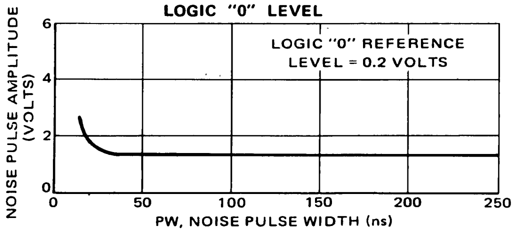


POWER SUPPLY NOISE IMMUNITY

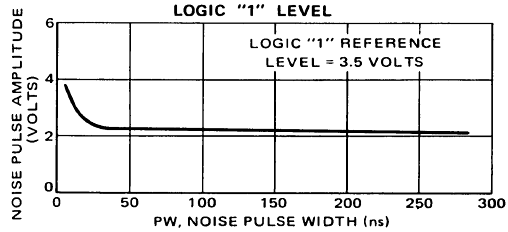


SIGNAL LINE NOISE IMMUNITY

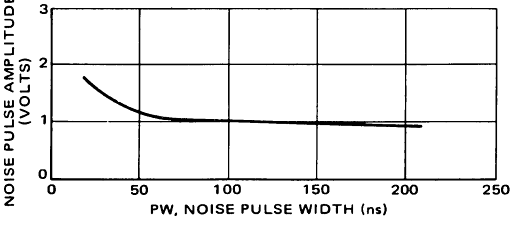
LOGIC "0" LEVEL



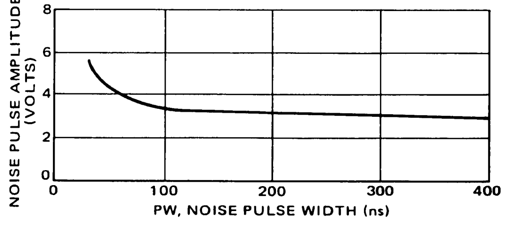
LOGIC "1" LEVEL



GROUND LINE NOISE IMMUNITY



POWER SUPPLY NOISE IMMUNITY



Output OR (AND) Function

Unlike the MDTL family of logic circuits, the outputs of the MTTL logic circuits cannot be tied together to perform the output OR, or more correctly, the output AND function. If the outputs of the MTTL family devices are tied together, it would be possible for the lower output transistor of one circuit and the upper output transistor of another circuit to be "on" simultaneously. This condition provides a low-impedance path from V_{CC} to ground and the current that flows (approximately I_{OS}) exceeds the guaranteed sink current. As a result, the saturated state cannot be maintained and the desired logic function is not satisfied.

6

Operating Characteristics of Flip-Flops

J-K Flip-Flop – MCBC5472/MCB5472F

This master-slave J-K flip-flop triggers on the negative edge of the clock. An AND-input configuration is used, consisting of three J inputs ANDed together and three K inputs ANDed together. A direct $\overline{\text{SET}}$ and $\overline{\text{RESET}}$ are provided to permit presetting data into the flip-flop. The direct $\overline{\text{SET}}$ and $\overline{\text{RESET}}$ control the operation of the flip-flop regardless of the state of the clock.

Information is normally applied to, or changed at the clocked inputs while the clock is in the low state since the master memory is inhibited in this condition. Information may be stored in the master flip-flop section when the clock goes high. Once the input data has been stored in the master flip-flop section it cannot be removed (or changed) by means of the clocked inputs. The direct $\overline{\text{SET}}$ or $\overline{\text{RESET}}$ provide the only means of removing previously stored information. They override the clock input and can be applied any time during the clock cycle.

The state of the master flip-flop is transferred to the slave flip-flop section on the negative transition of the clock, and the outputs respond accordingly. The flip-flop can be set or reset by applying a low state to the direct $\overline{\text{SET}}$ or $\overline{\text{RESET}}$ inputs. A special clamp circuit has been included on the clock line to guarantee that negative transients, such as ringing on the clock line, do not false-trigger the flip-flop. In addition, clamp diodes have been provided on all data inputs to limit any undershoot or negative ringing on the data lines.

Dual J-K Flip-Flop – MCBC5473/MCB5473F

This dual master-slave J-K flip-flop also triggers on the negative edge of the clock. Each of the independent flip-flops has a single J and a single K input. A direct $\overline{\text{RESET}}$ has been provided for preclearing the flip-flop regardless of the state of the clock. The operation of this device is the same as the MCBC5472/MCB5472F. Each of the flip-flops has the special clamp circuit on the clock line as well as clamp diodes on all the data inputs.

Noise Immunity

In a typical system noise begins to pose a problem when it is of such a magnitude that it can change the state of a flip-flop in the system or prevent a flip-flop from changing state at the proper time. Noise can be present on the ground line, the power supply line or the signal line.

In designing a system using MTTL, particular care must be taken due to the extremely high rate of change of voltage and current on the signal lines and current on the power supply and ground lines (see sections on Power and Ground Distribution and Bypassing). These factors increase the possibility of noise generation within the system itself in addition to externally generated noise.

Noise immunity in a digital system is a function of the propagation delays of the gates and flip-flops in the system and the dc threshold levels of these devices. The following block diagrams show typical test set-ups for measuring signal line, ground line and power supply line immunity of a gate in a digital system.

The system is considered disturbed when the flip-flop begins toggling. The curves show the typical noise amplitude a system can accept as a function of noise pulse width. As the pulse widths become narrower the amplitude can increase without disturbing the system. This can begin occurring when the pulse width is less than 20 ns on the signal line or 50 ns on the power supply or ground line. This pulse width-amplitude product is an indication of the minimum noise energy that is required to disturb a system. The low input and output impedances of MTTL gates and flip-flops requires more energy on the signal lines to distrub the system than in DTL or RTL systems. With proper power and ground distribution and bypassing, noise on power supply and ground lines can be maintained below levels which would be detrimental to system operation.

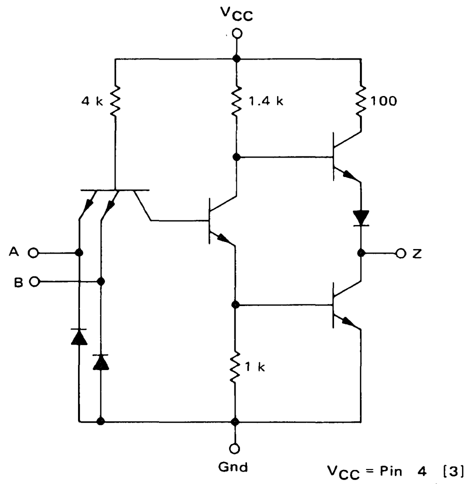
MAXIMUM RATINGS

Rating	Value	Unit
Supply Voltage — Continuous	+7.0	Vdc
Supply Operating Voltage Range	4.5 to 5.5	Vdc
Input Voltage	+5.5	Vdc
Output Voltage	+5.5	Vdc
Operating Temperature Range	-55 to +125	°C
Storage Temperature Range — Ceramic Package	-65 to +150	°C
Maximum Junction Temperature	+175	°C
Thermal Resistance — Junction-to-Case, θ_{JC} Ceramic Package	0.09	°C/mW

MCBC5400*
MCB5400F*

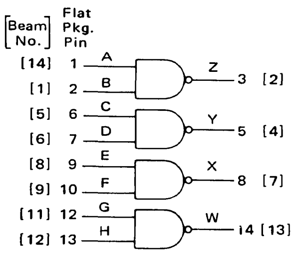
BEAM LEAD

CIRCUIT SCHEMATIC
1/4 OF CIRCUIT SHOWN



V_{CC} = Pin 4 [3]
Gnd = Pin 11 [10]

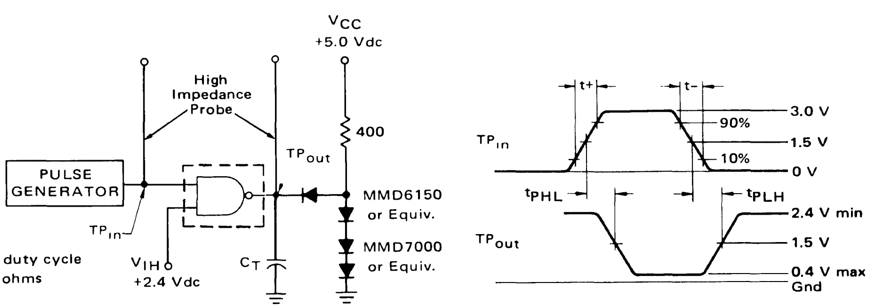
This device consists of four 2-input NAND gates that is produced using beam lead sealed junction technology. These devices are particularly useful in highly reliable systems using hybrid beam lead assembly techniques or standard flat package assembly techniques.



Positive Logic: $Z = \overline{A \bullet B}$
Negative Logic: $Z = \overline{A + B}$

Input Loading Factor = 1
Output Loading Factor = 10
Total Power Dissipation = 40 mW typ/pkg
Propagation Delay Time = 10 ns typ

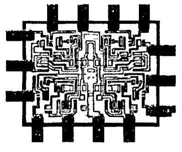
SWITCHING TIME TEST CIRCUIT AND WAVEFORMS



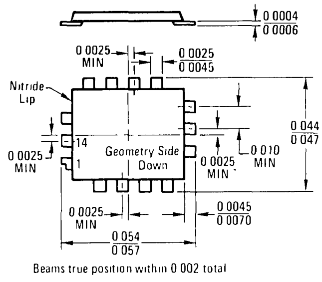
$t+$ = 12 ns
$t-$ = 6.0 ns
PRF = 1.0 MHz, 50% duty cycle
Generator $Z_{out} \approx 50$ ohms

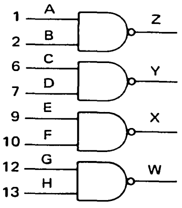
C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

*F suffix = 1/4" x 1/4" ceramic package (Case 607). MCBC-prefixed devices are unencapsulated.
See General Information section for package dimensions.



14-Beam Chip





ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one gate. The other gates are tested in the same manner. Further, test procedures are shown for only one input of the gate under test. To complete testing, sequence through remaining inputs.

FUNCTION	A	B	Z	V_{CC}	Y	C	D	X	E	F	GND	G	H	W
Beam No.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
Flat Pkg. Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14

V = V_{CC} = Pin 4 [3]
Gnd = Pin 11 [10]

						TEST CURRENT/VOLTAGE VALUES (All Temperatures)												
						mA		Volts										
						I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	
						16	-0.4	0.4	2.4	5.5	4.5	5.0	2.0	0.8	5.0	4.5	5.5	Pin 11 [Beam 10] is grounded for all tests in addition to the pins listed below:
		Pin Under Test	Test Limits MCBC5400/MCB5400F −55 to +125°C			TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:												
Characteristic	Symbol		Min	Max	Unit	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
Input Forward Current	I_F	A	-	-1.6	mAdc	-	-	A	-	-	B	-	-	-	-	-	V	*
Leakage Current	I_{R1}	A	-	40	μAdc	-	-	-	A	-	-	-	-	-	-	-	V	B*
	I_{R2}	A	-	1.0	mAdc	-	-	-	-	A	-	-	-	-	-	-	V	B*
Output Output Voltage	V_{OL}	Z	-	0.4	Vdc	Z	-	-	-	-	-	-	A, B	-	-	V	-	*
	V_{OH}	Z	2.4	-	Vdc	-	Z	-	-	-	B	-	-	A	-	V	-	*
Short-Circuit Current	I_{OS}†	Z	-20	-55	mAdc	-	-	-	-	-	-	-	-	-	-	-	V	A, B, Z*
Power Requirements (Total Device) Power Supply Drain	I_{PDH}	V	-	22	mAdc	-	-	-	-	-	-	All Inputs	-	-	-	-	V	-
	I_{PDL}	V	-	8.0	mAdc	-	-	-	-	-	-	-	-	-	-	-	V	A, B*
Switching Parameters						Pulse In	Pulse Out											
Turn-On Delay	t_{PHL}	A, Z	-	15**	ns	A	Z	-	B	-	-	-	-	-	V	-	-	*
Turn-Off Delay	t_{PLH}	A, Z	-	22**	ns	A	Z	-	B	-	-	-	-	-	V	-	-	*

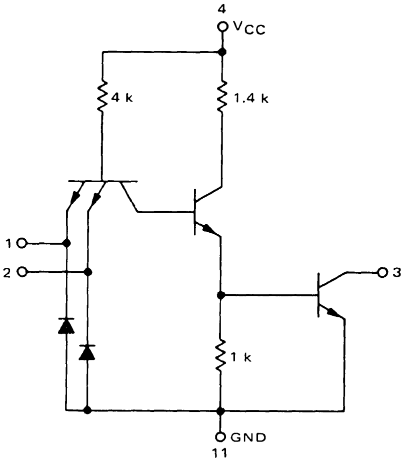
*Ground inputs to gates not under test.
**Tested only at 25°C.
†Only one output should be shorted at a time.

QUAD 2-INPUT "NAND" GATE WITH OPEN COLLECTOR

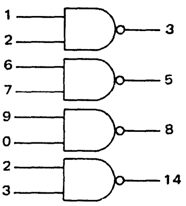
MCBC5401*
MCB5401F*

BEAM LEAD

1/4 OF CIRCUIT SHOWN



This device consists of four 2-input NAND gates with no output pullup network that is produced using beam lead sealed junction technology. These devices are particularly useful in highly reliable systems using hybrid beam lead assembly techniques, or standard flat package assembly techniques.



Positive Logic: $3 = \overline{1 \bullet 2}$

Negative Logic: $3 = \overline{1 + 2}$

Input Loading Factor = 1

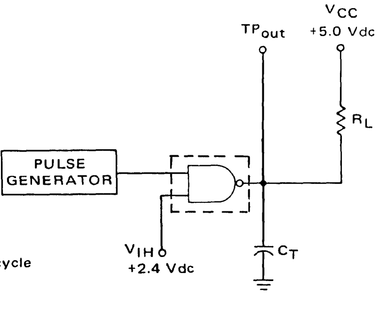
Output Loading Factor = 10

Total Power Dissipation = 40 mW typ/pkg

Propagation Delay Time = 35 ns typ

VOLTAGE WAVEFORMS AND DEFINITIONS

SWITCHING TIME TEST CIRCUIT

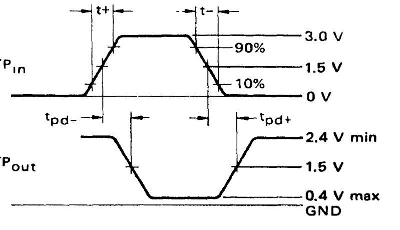


$t+$ = 12 ns

$t-$ = 6.0 ns

PRF = 1.0 MHz, 50% duty cycle

Generator Z_{out} 50 ohms



R_L = 400 ohms for t_{pd-} test.
4.0 k ohms for t_{pd+} test.

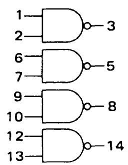
C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

High impedance probes (>1.0 megohm) must be used for tests.

*F suffix = 1/4" x 1/4" ceramic package (Case 651). MCBC-prefixed devices are unencapsulated. Beam numbers are the same as the pin numbers for flat-packaged devices. See General Information section for package and chip details.

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one gate. The other gates are tested in the same manner. Further, test procedures are shown for only one input of the gate under test. To complete testing, sequence through remaining inputs.



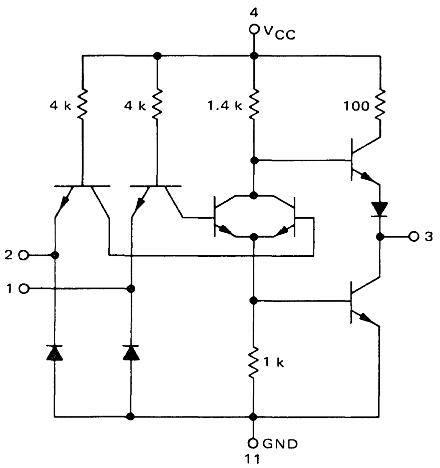
Characteristic	Symbol	Pin Under Test	Test Limits MCBC5401/MCB5401F −55 to +125°C			TEST CURRENT/VOLTAGE VALUES (All Temperatures)												
						mA	Volts											
						I_{OL}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CEX}	V_{CC}	V_{CCL}	V_{CCH}	
						16	0.4	2.4	5.5	4.5	5.0	2.0	0.8	5.5	5.0	4.5	5.5	
						TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:												
			Min	Max	Unit	I_{OL}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CEX}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
Input Forward Current	I_F	1	-	-1.6	mAdc	-	1	-	-	2	-	-	-	-	-	-	4	11*
Leakage Current	I_{R1}	1	-	40	μAdc	-	-	1	-	-	-	-	-	-	-	-	4	2,11*
	I_{R2}	1	-	1.0	mAdc	-	-	-	1	-	-	-	-	-	-	-	4	2,11*
Output Output Voltage	V_{OL}	3	-	0.4	Vdc	3	-	-	-	-	-	1,2	-	-	-	4	-	11*
Output Leakage Current	I_{CEX}	3	-	0.25	mAdc	-	-	-	-	1	-	-	2	3	-	4	-	11*
Power Requirements (Total Device) Power Supply Drain	I_{PDH}	4	-	22	mAdc	-	-	-	-	-	1,2,6,7,9, 10,12,13	-	-	-	-	-	4	11
	I_{PDL}	4	-	8.0	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	1,2,11*
Switching Parameters						Pulse In	Pulse Out											
Turn-On Delay	t_{pd-}	1,3	-	15**	ns	1	3	2	-	-	-	-	-	-	4	-	-	11
Turn-Off Delay	t_{pd+}	1,3	-	45**	ns	1	3	2	-	-	-	-	-	-	4	-	-	11

*Ground inputs to gates not under test.
**Tested only at 25°C.

MCBC5402*
MCB5402F*

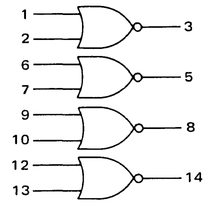
BEAM LEAD

1/4 OF CIRCUIT SHOWN



Pin numbers on drawings are for devices in the flat package.

This device consists of four 2-input NOR gates that is produced using beam lead sealed junction technology. These devices are particularly useful in highly reliable systems using hybrid beam lead assembly techniques or standard flat package assembly techniques.



Positive Logic: $3 = \overline{1 + 2}$

Negative Logic: $3 = \overline{1 \bullet 2}$

Input Loading Factor = 1

Output Loading Factor = 10

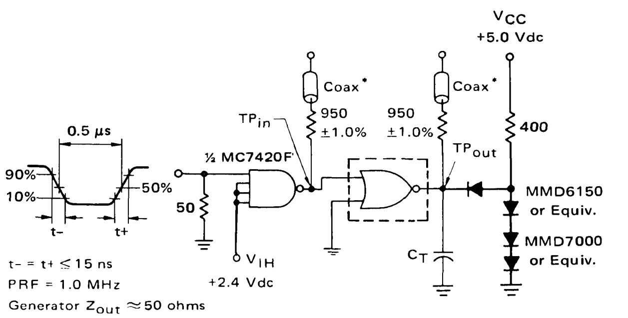
Total Power Dissipation = 48 mW typ/pkg

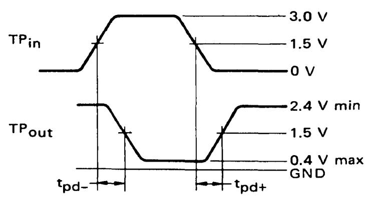
Propagation Delay Time = 10 ns typ

Package No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Beam No.	16	1	2	3	4	5	6	8	9	10	11	12	13	14

VOLTAGE WAVEFORMS AND DEFINITIONS

SWITCHING TIME TEST CIRCUIT





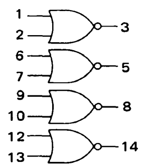
C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

*The coax delays from input to scope and output to scope must be matched. The scope must be terminated in 50-ohm impedance. The 950-ohm resistor and the scope termination impedance constitute a 20:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

*F suffix = 1/4" x 1/4" ceramic package (Case 651) MCBC-prefixed devices are unencapsulated. See General Information section for package and chip details.

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one gate. The other gates are tested in the same manner. Further, test procedures are shown for only one input of the gate under test. To complete testing, sequence through remaining inputs. Pin numbers used are for devices in the flat package.



						TEST CURRENT/VOLTAGE VALUES (All Temperatures)												
						mA		Volts										
						I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	
						16	0.4	0.4	2.4	5.5	4.5	5.0	2.0	0.8	5.0	4.5	5.5	
			Test Limits MCBC5402/MCB5402F −55 to +125°C			TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:												
Characteristic	Symbol	Pin Under Test	Min	Max	Unit	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
Input Forward Current	I_F	1	-	-1.6	mAdc	-	-	1	-	-	2	-	-	-	-	-	4	11*
Leakage Current	I_{R1}	1	-	40	µAdc	-	-	-	1	-	-	-	-	-	-	-	4	2,11*
	I_{R2}	1	-	1.0	mAdc	-	-	-	-	1	-	-	-	-	-	-	4	2,11*
Output Output Voltage	V_{OL}	3	-	0.4	Vdc	3	-	-	-	-	-	-	1	-	-	4	-	2,11*
	V_{OH}	3	2.4	-	Vdc	-	3	-	-	-	-	-	-	2	-	4	-	1,11*
Short-Circuit Current	I_{SC}	3	-20	-55	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	1,2,3,11*
Power Requirements (Total Device) Power Supply Drain	I_{PDH}	4	-	27	mAdc	-	-	-	-	-	-	1,2,6,7,9, 10,12,13	-	-	-	-	4	11
	I_{PDL}	4	-	16	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	1,2,11*
Switching Parameters						Pulse In	Pulse Out											
Turn-On Delay	t_{pd-}	1,3	-	15**	ns	1	3	-	-	-	-	-	-	-	4	-	-	2,11*
Turn-Off Delay	t_{pd+}	1,3	-	22**	ns	1	3	-	-	-	-	-	-	-	4	-	-	2,11*

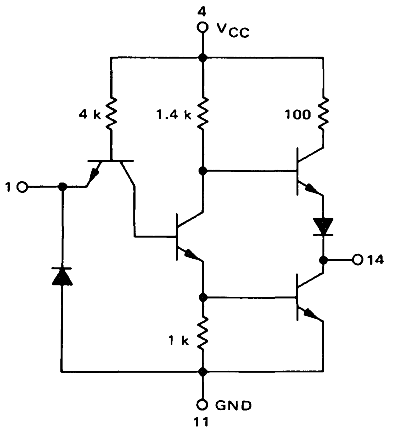
*Ground inputs to gates not under test.
**Tested only at 25°C.

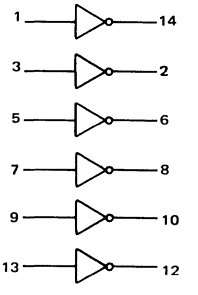
MCBC5404*
MCB5404F*

BEAM LEAD

This device offers six independent inverting gates in a single package. Each gate consists of a single input driving an output inverter.

1/6 OF CIRCUIT SHOWN



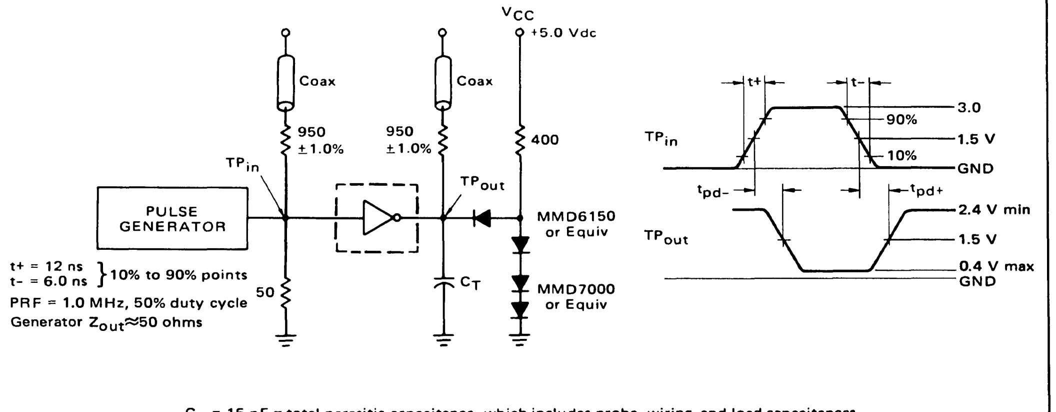


Positive Logic: $14 = \overline{1}$

Input Loading Factor = 1
Output Loading Factor = 10
Total Power Dissipation = 60 mW typ/pkg
Propagation Delay Time = 13 ns typ

6

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS



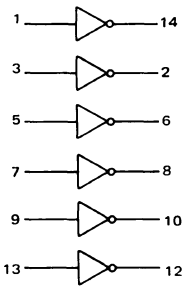
C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

The coax delays from input to scope and output to scope must be matched. The scope must be terminated in 50-ohm impedance. The 950-ohm resistor and the scope termination impedance constitute a 20:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

*F suffix = 1/4" x 1/4" ceramic package (Case 651). MCBC-prefixed devices are unencapsulated. Beam numbers are the same as the pin numbers for flat-packaged devices. See General Information section for package and chip details.

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one inverter. The other inverters are tested in the same manner.



Characteristic	Symbol	Pin Under Test	Test Limits MCBC5404/MCB5404F −55 to +125°C Min	Max	Unit	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
TEST CURRENT/VOLTAGE VALUES (All Temperatures)						mA		Volts										
						16	-0.4	0.4	2.4	5.5	4.5	5.0	2.0	0.8	5.0	4.5	5.5	
TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:																		
Input																		
Forward Current	I_F	1	-	-1.6	mAdc	-	-	1	-	-	-	-	-	-	-	-	4	11*
Leakage Current	I_{R1}	1	-	40	μAdc	-	-	-	1	-	-	-	-	-	-	-	4	11*
	I_{R2}	1	-	1.0	mAdc	-	-	-	-	1	-	-	-	-	-	-	4	11*
Output																		
Output Voltage	V_{OL}	14	-	0.4	Vdc	14	-	-	-	-	-	-	1	-	-	4	-	11*
	V_{OH}	14	2.4	-	Vdc	-	14	-	-	-	-	-	-	1	-	4	-	11*
Short-Circuit Current	I_{SC}	14	-20	-55	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	1,11,14*
Power Requirements (Total Device)																		
Power Supply Drain	I_{PDH}	4	-	33	mAdc	-	-	-	-	-	-	1,3,5,7, 9,13	-	-	-	-	4	11
	I_{PDL}	4	-	12	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	1,3,5,7,9,11,13
Switching Parameters						Pulse In	Pulse Out											
Turn-On Delay	t_{pd-}	14	-	15**	ns	1	14	-	-	-	-	-	-	-	4	-	-	11*
Turn-Off Delay	t_{pd+}	14	-	22**	ns	1	14	-	-	-	-	-	-	-	4	-	-	11*

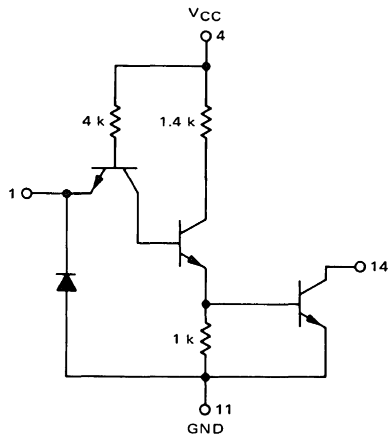
*Ground inputs to inverters not under test.
**Tested only at 25°C.

HEX INVERTER (Open Collector)	MCBC5400/MCB5400F series

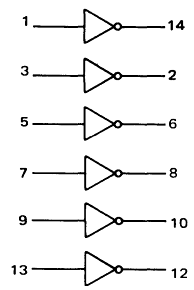
MCBC5405* MCB5405F*

BEAM LEAD

1/4 OF CIRCUIT SHOWN



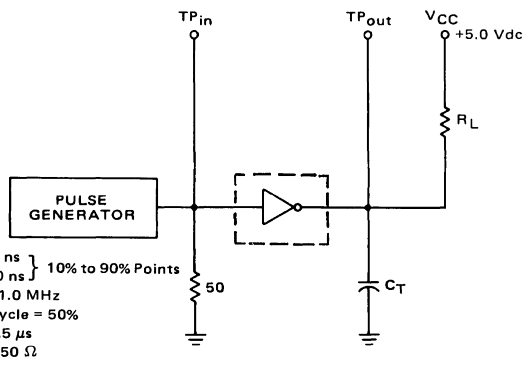
This device consists of six independent inverting gates with no output pullup circuits. It can be used where the Wired-OR function is required, or for driving discrete components.



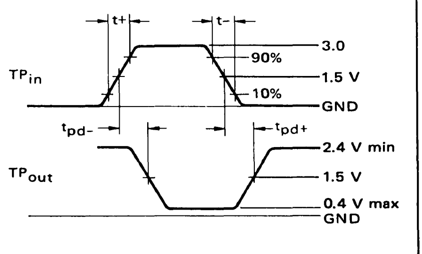
Positive Logic: $14 = \overline{1}$

Input Loading Factor = 1
Output Loading Factor = 10
Total Power Dissipation = 60 mW typ/pkg
Propagation Delay Time = 35 ns typ

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS



$t+ = 12$ ns, $t- = 6.0$ ns } 10% to 90% Points
PRF = 1.0 MHz
Duty Cycle = 50%
PW = 0.5 μs
$Z_{out} \approx 50\ \Omega$



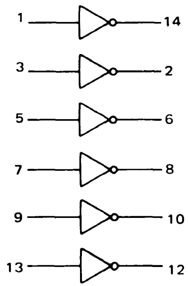
R_L = 400 ohms for t_{pd-} test.
4.0 k ohms for t_{pd+} test.

C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

*F suffix = 1/4" x 1/4" ceramic package (Case 651). MCBC-prefixed devices are unencapsulated. Beam numbers are the same as the pin numbers for flat-packaged devices. See General Information section for package and chip details.

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one inverter. The other inverters are tested in the same manner.

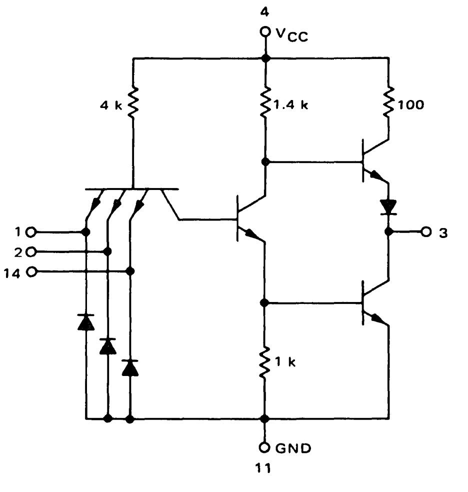


Characteristic	Symbol	Pin Under Test	Test Limits MCBC5405/MCB5405F −55 to +125°C Min	Max	Unit	I_{OL}	V_{CEX}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
TEST CURRENT/VOLTAGE VALUES (All Temperatures)						mA	Volts											
						16	5.5	0.4	2.4	5.5	4.5	5.0	2.0	0.8	5.0	4.50	5.50	
						TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:												
Input Forward Current	I_F	1	-	-1.6	mAdc	-	-	1	-	-	-	-	-	-	-	-	4	11*
Leakage Current	I_{R1}	1	-	40	μAdc	-	-	-	1	-	-	-	-	-	-	-	4	11*
	I_{R2}	1	-	1.0	mAdc	-	-	-	-	1	-	-	-	-	-	-	4	11*
Output Output Voltage	V_{OL}	14	-	0.4	Vdc	14	-	-	-	-	-	-	1	-	-	4	-	11*
Output Leakage Current	I_{CEX}	14	0.25	-	mAdc	-	14	-	-	-	-	-	-	1	-	4	-	11*
Power Requirements (Total Device) Power Supply Drain	I_{PDH}	4	-	33**	mAdc	-	-	-	-	-	-	1,3,5,7, 9,13	-	-	-	-	4	11
	I_{PDL}	4	-	12**	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	1,3,5,7,9,11,13
Switching Parameters						Pulse In	Pulse Out											
Turn-On Delay	t_{pd-}	1, 14	-	15**	ns	1	14	-	-	-	-	-	-	-	4	-	-	11*
Turn-Off Delay	t_{pd+}	1, 14	-	55**	ns	1	14	-	-	-	-	-	-	-	4	-	-	11*

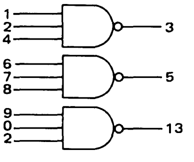
*Ground inputs to inverters not under test.
**Tested only at 25°C.

MCBC5410*
MCB5410F*

BEAM LEAD



The device consists of three 3-input NAND gates. Each gate may be used as an inverter, or two gates may be cross-coupled to form bistable circuits. Beam lead sealed junction technology is used to manufacture these devices. They are particularly useful in highly reliable systems using hybrid beam lead assembly techniques or standard flat package assembly techniques.



Positive Logic: $3 = \overline{1 \cdot 2 \cdot 14}$

Negative Logic: $3 = \overline{1 + 2 + 14}$

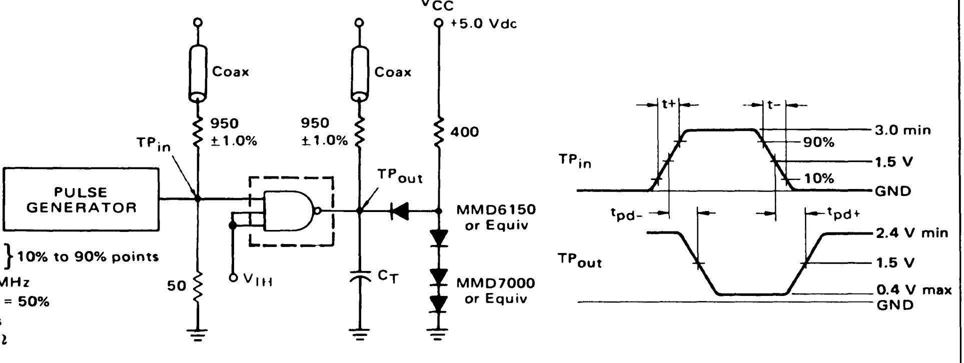
Input Loading Factor = 1

Output Loading Factor = 10

Total Power Dissipation = 30 mW typ/pkg

Propagation Delay Time = 10 ns typ

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS



$t+ = 12$ ns, $t- = 6.0$ ns } 10% to 90% points

PRF = 1.0 MHz

Duty Cycle = 50%

PW = 0.5 μs

$Z_{out} \approx 50\ \Omega$

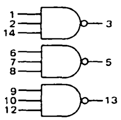
C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

The coax delays from input to scope and output to scope must be matched. The scope must be terminated in 50-ohm impedance. The 950-ohm resistor and the scope termination impedance constitute a 20:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

*F suffix = 1/4" x 1/4" ceramic package (Case 651). MCBC-prefixed devices are unencapsulated. Beam numbers are the same as the pin numbers for flat-packaged devices. See General Information section for package and chip details.

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one gate. The other gates are tested in the same manner. Further, test procedures are shown for only one input of the gate under test. To complete testing, sequence through remaining inputs.



						TEST CURRENT/VOLTAGE VALUES (All Temperatures)												
						mA		Volts										
						I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	
						16	-0.4	0.4	2.4	5.5	4.5	5.0	2.0	0.8	5.0	4.5	5.5	
		Pin Under Test	Test Limits MCBC5410/MCB5410F −55 to +125°C			TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:												
Characteristic	Symbol		Min	Max	Unit	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
Input Forward Current	I_F	1	-	-1.6	mAdc	-	-	1	-	-	2,14	-	-	-	-	-	4	11*
Leakage Current	I_{R1}	1	-	40	μAdc	-	-	-	1	-	-	-	-	-	-	-	4	2,11,14*
	I_{R2}	1	-	1.0	mAdc	-	-	-	-	1	-	-	-	-	-	-	4	2,11,14*
Output Output Voltage	V_{OL}	3	-	0.4	Vdc	3	-	-	-	-	-	-	1,2,14	-	-	4	-	11*
	V_{OH}	3	2.4	-	Vdc	-	3	-	-	-	2,14	-	-	1	-	4	-	11*
Short-Circuit Current	I_{SC}	3	-20	-55	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	1,2,3,8,11*,14
Power Requirements (Total Device) Power Supply Drain	I_{PDH}	4	-	16.5	mAdc	-	-	-	-	-	-	1,2,6,7,8,9, 10,12,14	-	-	-	-	4	11
	I_{PDL}	4	-	6	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	1,2,11,14*
Switching Parameters						Pulse In	Pulse Out											
Turn-On Delay	t_{pd-}	1,3	-	15**	ns	1	3	-	2,14	-	-	-	-	-	4	-	-	11*
Turn-Off Delay	t_{pd+}	1,3	-	22**	ns	1	3	-	2,14	-	-	-	-	-	4	-	-	11*

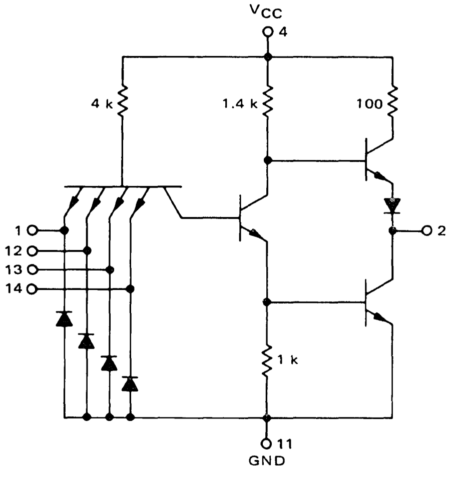
*Ground inputs to gates not under test.
**Tested only at 25°C.

DUAL 4-INPUT "NAND" GATE

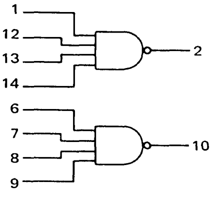
MCBC5420*
MCB5420F*

BEAM LEAD

1/2 OF CIRCUIT SHOWN



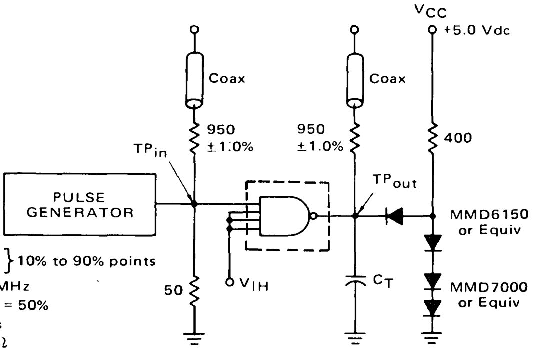
This device consists of two 4-input NAND gates. These gates may be cross-coupled to form a set reset flip-flop.



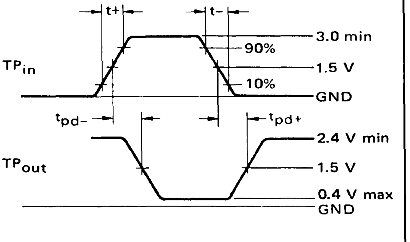
Positive Logic : $2 = \overline{1 \bullet 12 \bullet 13 \bullet 14}$
Negative Logic: $2 = \overline{1 + 12 + 13 + 14}$

Input Loading Factor = 1
Output Loading Factor = 10
Total Power Dissipation = 20 mW typ/pkg
Propagation Delay Time = 10 ns typ

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS



$t+ = 12$ ns, $t- = 6.0$ ns } 10% to 90% points
PRF = 1.0 MHz
Duty Cycle = 50%
PW = 0.5 μs
$Z_{out} \approx 50\ \Omega$



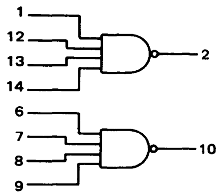
C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

The coax delays from input to scope and output to scope must be matched. The scope must be terminated in 50-ohm impedance. The 950-ohm resistor and the scope termination impedance constitute a 20:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

*F suffix = 1/4" x 1/4" ceramic package (Case 651). MCBC-prefixed devices are unencapsulated. Beam numbers are the same as the pin numbers for flat-packaged devices. See General Information section for package details.

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one gate. The other gates are tested in the same manner. Further, test procedures are shown for only one input of the gate under test. To complete testing, sequence through remaining inputs.

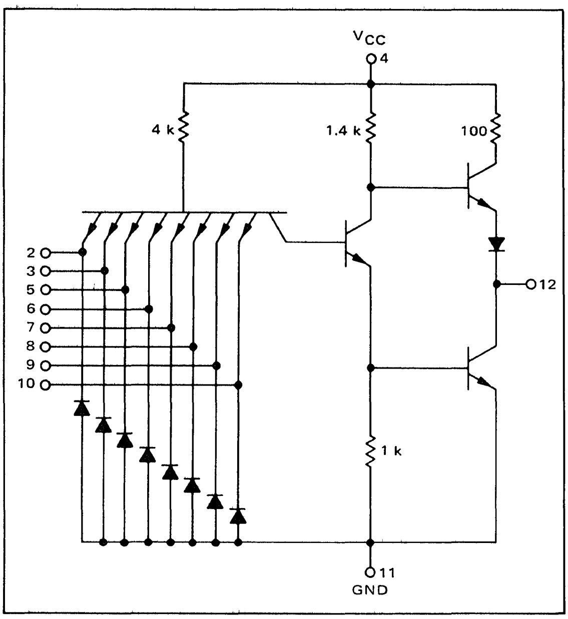


Characteristic	Symbol	Pin Under Test	Test Limits MCBC5420/MCB5420F −55 to +125°C Min	Max	Unit	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
TEST CURRENT/VOLTAGE VALUES (All Temperatures)						mA		Volts										
						16	-0.4	0.4	2.4	5.5	4.5	5.0	2.0	0.8	5.0	4.50	5.50	
TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:																		
Input Forward Current	I_F	1	-	-1.6	mAdc	-	-	1	-	-	12,13,14	-	-	-	-	-	4	11*
Leakage Current	I_{R1}	1	-	40	μAdc	-	-	-	1	-	-	-	-	-	-	-	4	11,12,13,14*
	I_{R2}	1	-	1.0	mAdc	-	-	-	-	1	-	-	-	-	-	-	4	11,12,13,14*
Output Output Voltage	V_{OL}	2	-	0.4	Vdc	2	-	-	-	-	-	-	1,12,13, 14	-	-	4	-	11*
	V_{OH}	2	2.4	-	Vdc	-	2	-	-	-	12,13,14	-	-	1	-	4	-	11*
Short-Circuit Current	I_{SC}†	2	-20	-55	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	1,2,11,12,13,14*
Power Requirements (Total Device) Power Supply Drain	I_{PDH}	4	-	11	mAdc	-	-	-	-	-	-	1,6,7,8,9, 12,13,14	-	-	-	-	4	11
	I_{PDL}	4	-	4	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	1,11,12,13,14*
Switching Parameters						Pulse In	Pulse Out											
Turn-On Delay	t_{pd-}	1.2	-	15**	ns	1	2	-	12,13, 14	-	-	-	-	-	4	-	-	11*
Turn-Off Delay	t_{pd+}	1,2	-	22**	ns	1	2	-	12,13, 14	-	-	-	-	-	4	-	-	11*

*Ground inputs to gate not under test.
**Tested only at 25°C.
†Only one output should be shorted at a time.

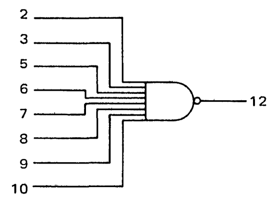
MCBC5430*
MCB5430F*

BEAM LEAD



This device is an 8-input NAND gate. It is useful when processing a large number of variables, such as in encoders and decoders.

Beam lead sealed junction technology is used to manufacture these devices. They are particularly useful in highly reliable systems using hybrid beam lead assembly techniques or standard flat package assembly techniques.

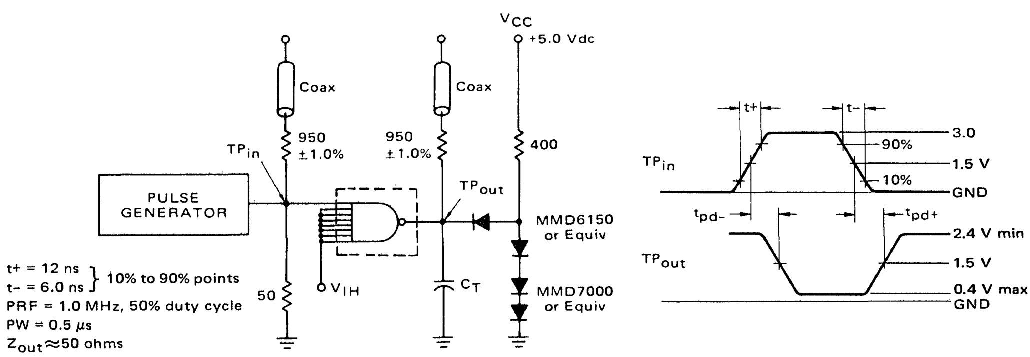


Positive Logic:
$12 = \overline{2 \bullet 3 \bullet 5 \bullet 6 \bullet 7 \bullet 8 \bullet 9 \bullet 10}$

Negative Logic:
$12 = \overline{2 + 3 + 5 + 6 + 7 + 8 + 9 + 10}$

Input Loading Factor = 1
Output Loading Factor = 10
Total Power Dissipation = 10 mW typ/pkg
Propagation Delay Time = 10 ns typ

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS



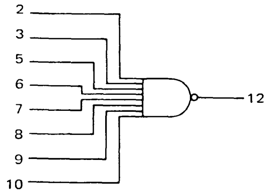
C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

The coax delays from input to scope and output to scope must be matched. The scope must be terminated in 50-ohm impedance. The 950-ohm resistor and the scope termination impedance constitute a 20:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

*F suffix = 1/4" x 1/4" ceramic package (Case 651). MCBC-prefixed devices are unencapsulated. Beam numbers are the same as the pin numbers for flat-packaged devices. See General Information section for package and chip details.

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one input. To complete testing, sequence through remaining inputs in the same manner.



Characteristic	Symbol	Pin Under Test	Test Limits MCBC5430/MCB5430F −55 to +125°C Min	Max	Unit	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
TEST CURRENT/VOLTAGE VALUES (All Temperatures)						mA		Volts										
						16	-0.4	0.4	2.4	5.5	4.5	5.0	2.0	0.8	5.0	4.50	5.50	
						TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:												
Input																		
Forward Current	I_F	2	-	-1.6	mAdc	-	-	2	-	-	3,5,6,7,8, 9,10	-	-	-	-	-	4	11
Leakage Current	I_{R1}	2	-	40	μAdc	-	-	-	2	-	-	-	-	-	-	-	4	3,5,6,7,8,9,10
	I_{R2}	2	-	1.0	mAdc	-	-	-	-	2	-	-	-	-	-	-	4	3,5,6,7,8,9,10
Output																		
Output Voltage	V_{OL}	12	-	0.4	Vdc	12	-	-	-	-	-	-	2,3,5,6,7, 8,9,10	-	-	4	-	11
	V_{OH}	12	2.4	-	Vdc	-	12	-	-	-	3,5,6,7, 8,9,10	-	-	2	-	4	-	11
Short-Circuit Current	I_{SC}	12	-20	-55	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	2,3,5,6,7,8,9,10,11,12
Power Requirements																		
Power Supply Drain	I_{PDH}	4	-	6.0	mAdc	-	-	-	-	-	-	2,3,5,6,7, 8,9,10	-	-	-	-	4	11
	I_{PDL}	4	-	2.0	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	2,3,5,6,7,8,9,10,11
Switching Parameters						Pulse In	Pulse Out											
Turn-On Delay	t_{pd-}	2,12	-	15**	ns	2	12	-	3,5,6,7, 8,9,10	-	-	-	-	-	4	-	-	11
Turn-Off Delay	t_{pd+}	2,12	-	22**	ns	2	12	-	3,5,6,7, 8,9,10	-	-	-	-	-	4	-	-	11

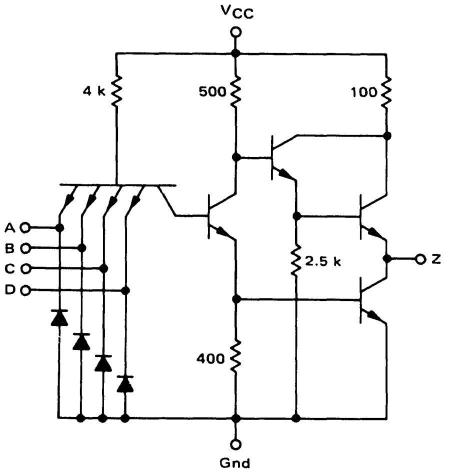
**Tested only at 25°C.

DUAL 4-INPUT "NAND" BUFFER

MCBC5440*
MCB5440F*

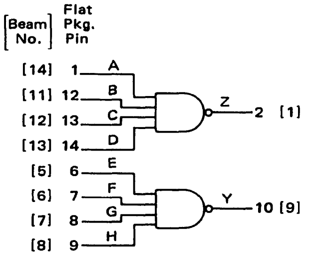
BEAM LEAD

CIRCUIT SCHEMATIC
1/2 OF CIRCUIT SHOWN



V_{CC} = Pin 4 [3]
Gnd = Pin 11 [10]

This device consists of two 4-input NAND power gates that are produced using beam lead sealed junction technology. These devices are particularly useful in highly reliable systems using hybrid beam lead assembly techniques or standard flat package assembly techniques.

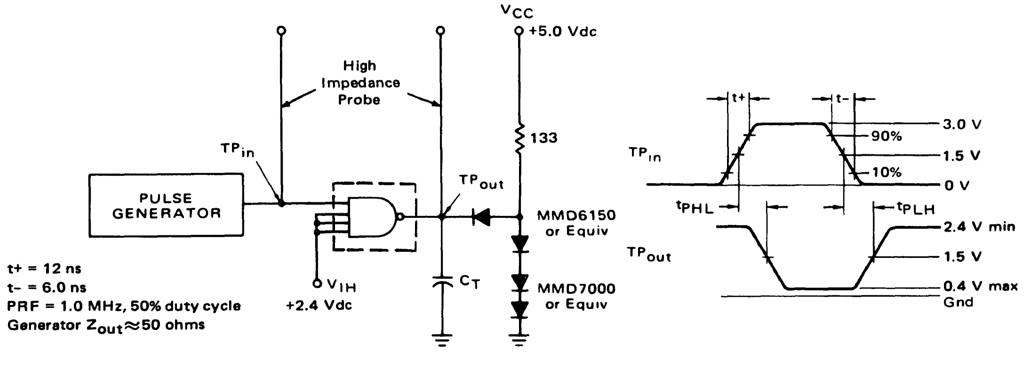


Positive Logic: $Z = \overline{A \bullet B \bullet C \bullet D}$
Negative Logic: $Z = \overline{A + B + C + D}$

Input Loading Factor = 1
Output Loading Factor = 30
Total Power Dissipation = 50 mW typ/pkg
Propagation Delay Time = 13 ns typ

6

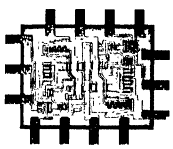
SWITCHING TIME TEST CIRCUIT AND WAVEFORMS



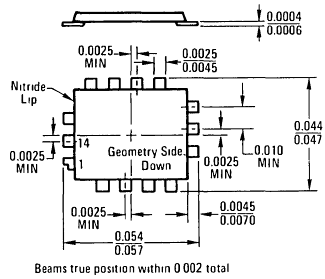
t+ = 12 ns
t- = 6.0 ns
PRF = 1.0 MHz, 50% duty cycle
Generator $Z_{out} \approx 50$ ohms

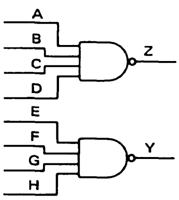
C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

*F suffix = 1/4" x 1/4" ceramic package (Case 607). MCBC-prefixed devices are unencapsulated.
See General Information section for package dimensions.



14-Beam Chip





V = V_{CC} = Pin 4 [3]
Gnd = Pin 11 [10]

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one gate. The other gate is tested in the same manner. Further, test procedures are shown for only one input of the gate under test. To complete testing, sequence through remaining inputs.

FUNCTION	A	Z	–	V_{CC}	–	E	F	G	H	Y	GND	B	C	D
Beam No.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
Flat Pkg. Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14

						TEST CURRENT/VOLTAGE VALUES (All Temperatures)												Pin 11 [Beam 10] is grounded for all tests in addition to the pins listed below.
						mA		Volts										
						I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	
						48	-1.2	0.4	2.4	5.5	4.5	5.0	2.0	0.8	5.0	4.5	5.5	
		Pin Under Test	Test Limits MCBC5440/MCB5440F −55 to +125°C			TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:												
Characteristic	Symbol		Min	Max	Unit	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
Input Forward Current	I_F	A	-	-1.6	mAdc	-	-	A	-	-	B, C, D	-	-	-	-	-	V	*
Leakage Current	I_{R1}	A	-	40	μAdc	-	-	-	A	-	-	-	-	-	-	-	V	B, C, D*
	I_{R2}	A	-	1.0	mAdc	-	-	-	-	A	-	-	-	-	-	-	V	B, C, D*
Output Output Voltage	V_{OL}	Z	-	0.4	Vdc	Z	-	-	-	-	-	-	A, B, C, D	-	-	V	-	*
	V_{OH}	Z	2.4	-	Vdc	-	Z	-	-	-	B, C, D	-	-	A	-	V	-	*
Short-Circuit Current	I_{OS}†	Z	-20	-70	mAdc	-	-	-	-	-	-	-	-	-	-	-	V	A, B, C, D, Z*
Power Requirements (Total Device) Power Supply Drain	I_{PDH}	V	-	27	mAdc	-	-	-	-	-	-	All Inputs	-	-	-	-	V	-
	I_{PDL}	V	-	8.0	mAdc	-	-	-	-	-	-	-	-	-	-	-	V	A, B, C, D*
Switching Parameters						Pulse In	Pulse Out											
Turn-On Delay	t_{PHL}	A, B	-	15**	ns	A	Z	-	B, C, D	-	-	-	-	-	V	-	-	*
Turn-Off Delay	t_{PLH}	A, B	-	22**	ns	A	Z	-	B, C, D	-	-	-	-	-	V	-	-	*

*Ground inputs to gate not under test.
**Tested only at 25°C.
†Only one output should be shorted at a time.

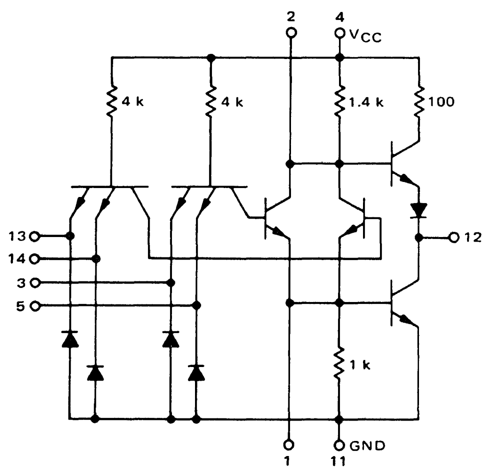
6

EXPANDABLE DUAL
2-WIDE 2-INPUT
"AND-OR-INVERT" GATE

MCBC5450*
MCB5450F*

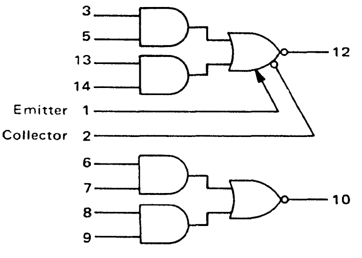
BEAM LEAD

1/2 OF CIRCUIT SHOWN†



†Other half of circuit omits expander inputs.

This device consists of two AND-OR-INVERT gates, one of which is OR expandable. Each gate is made up of two 2-input AND gates ORed together and inverted. Up to four MC5460/7460 expander gates may be ORed with the device at the expander points.

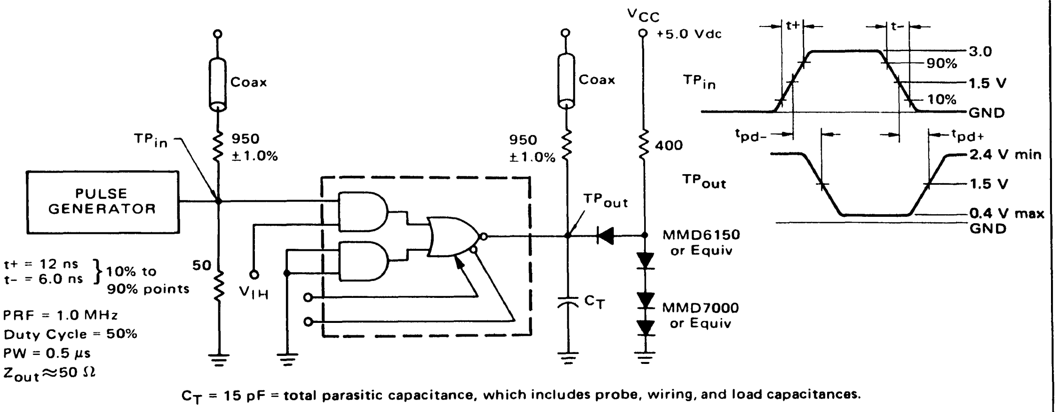


Positive Logic:
$12 = \overline{(3 \cdot 5) + (13 \cdot 14) + (\text{Expanders})}$

Negative Logic:
$12 = \overline{(3+5) \cdot (13+14) \cdot (\text{Expanders})}$

Input Loading Factor = 1
Output Loading Factor = 10
Total Power Dissipation = 28 mW typ/pkg
Propagation Delay Time = 13 ns typ

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS



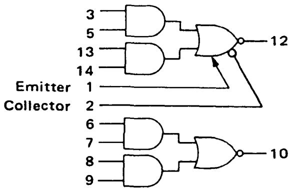
C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

The coax delays from input to scope and output to scope must be matched. The scope must be terminated in 50-ohm impedance. The 950-ohm resistor and the scope termination impedance constitute a 20:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

*F suffix = 1/4" x 1/4" ceramic package (Case 651). MCBC-prefixed devices are unencapsulated. Beam numbers are the same as the pin numbers for flat-packaged devices. See General Information section for package and chip details.

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one gate. The other gate is tested in the same manner. Further, test procedures are shown for only one input of the gate under test. To complete testing, sequence through remaining inputs.



Characteristic	Symbol	Pin Under Test	Test Limits MCBC5450/MCB5450F (All Temperatures) Min	Max	Unit	I_{OL}	I_{OH}	I_{X1}	I_{X2}	I_{X3}	I_{X4}	R_{EX}③	V_{EX}①	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
TEST CURRENT/VOLTAGE VALUES (All Temperatures)						mA						Ohms	Volts											
						16	-0.4	0.41	-0.15	-0.15	0.3	138	0.4	5.5	2.4	5.5	4.5	5.0	2.0	0.8	5.0	4.5	5.5	
TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:																								
Input Forward Current	I_F	14	-	-1.6	mAdc	-	-	-	-	-	-	-	-	14	-	-	13	-	-	-	-	-	4	11*
Leakage Current	I_{R1}	14	-	40	µAdc	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	4	3,5,11,13*
	I_{R2}	14	-	1.0	mAdc	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	4	3,5,11,13*
Expander Input Current	I_{EX}	2 ①	-	-2.9	mAdc	12	-	-	-	-	-	-	1,2	-	-	-	-	-	-	-	-	4	-	3,5,11,13,14*
Base-Emitter Voltage	V_{BE}	1 ②	-	1.0	Vdc	12	-	1,2	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	3,5,11,13,14*
Output Output Voltage	V_{OL}	12	-	0.4	Vdc	12	-	-	-	-	-	-	-	-	-	-	-	-	13,14	-	-	4	-	3,5,11*
		12③	-	0.4	Vdc	12	-	-	-	-	1	2	-	-	-	-	-	-	13,14	-	-	4	-	3,5,11,13,14*
	V_{OH}	12	2.4	-	Vdc	-	12	-	-	-	-	-	-	-	-	-	13	-	-	14	-	4	-	3,5,11*
		12	2.4	-	Vdc	-	12	-	1	2	-	-	-	-	-	-	-	-	-	-	-	4	-	3,5,11,13,14*
Short-Circuit Current	I_{SC} †	12	-20	-55	mAdc	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	3,5,11,13,14*
Power Requirements (Total Device) Power Supply Drain	I_{PDH}	4	-	14	mAdc	-	-	-	-	-	-	-	-	-	-	-	-	1,3,4,5,6, 7,8,9,13	-	-	-	-	4	11
	I_{PDL}	4	-	8	mAdc	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	3,5,11,12,13,14*
Switching Parameters						Pulse In	Pulse Out																	
Turn-On Delay	t_{pd-}	14,12	-	15**	ns	14	12	-	-	-	-	-	-	-	13	-	-	-	-	-	4	-	-	3,5,11*
Turn-Off Delay	t_{pd+}	14,12	-	22**	ns	14	12	-	-	-	-	-	-	-	13	-	-	-	-	-	4	-	-	3,5,11*

*Ground inputs to gate not under test. † Only one output should be shorted at a time. ① See Figure 1. ② See Figure 2. ③ See Figure 3.

** Tested only at 25°C.

FIGURE 1 – I_{EX} TEST CIRCUIT

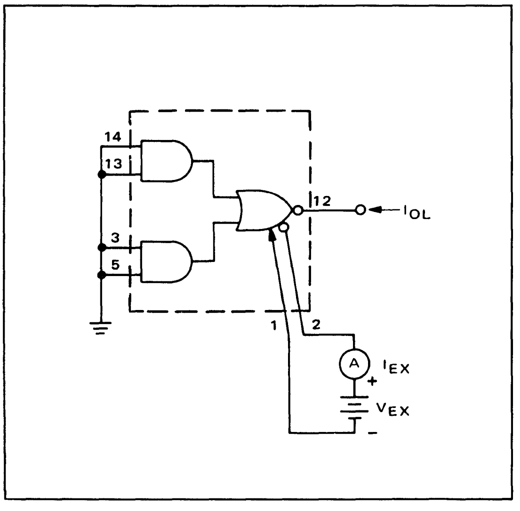


FIGURE 2 – V_{BE} TEST CIRCUIT

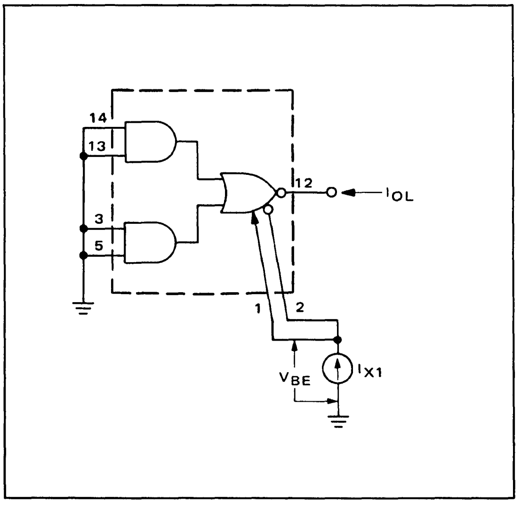
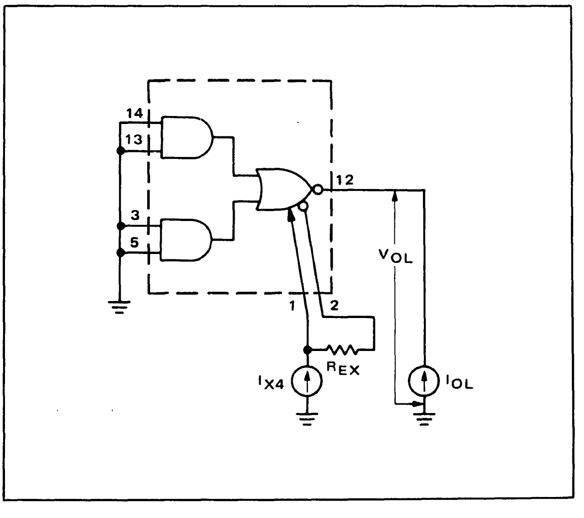


FIGURE 3 – V_{OL} TEST CIRCUIT



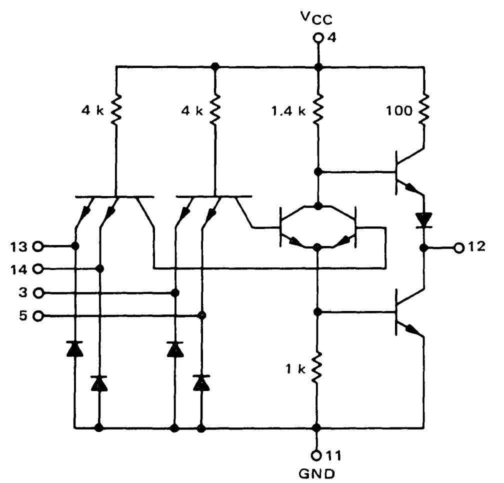
6

DUAL 2-WIDE 2-INPUT
"AND-OR-INVERT" GATE

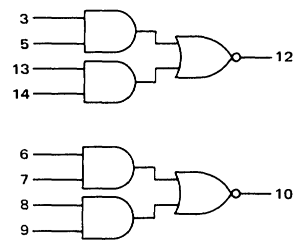
MCBC5451*
MCB5451F*

BEAM LEAD

1/2 OF CIRCUIT SHOWN



This device consists of two AND-OR-INVERT gates. Each gate is made up of two 2-input AND gates ORed together and inverted.

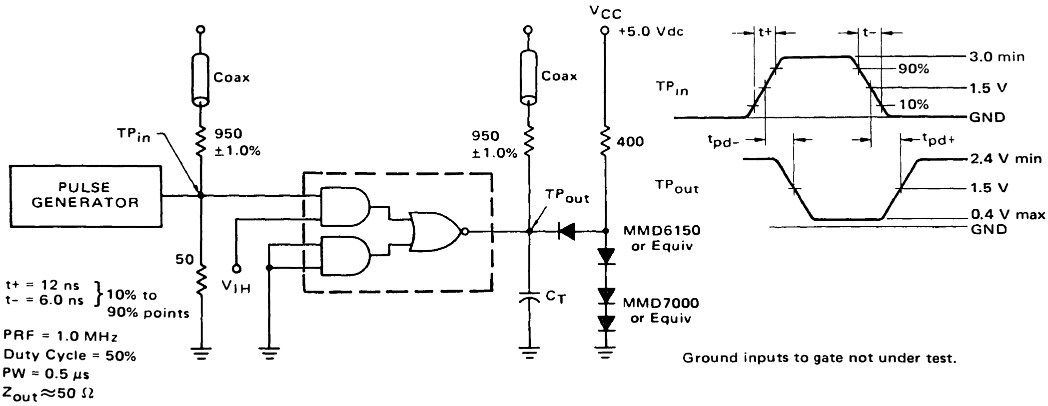


Positive Logic: $12 = \overline{(3 \bullet 5) + (13 \bullet 14)}$

Negative Logic: $12 = \overline{(3 + 5) \bullet (13 + 14)}$

Input Loading Factor = 1
Output Loading Factor = 10
Total Power Dissipation = 28 mW typ/pkg
Propagation Delay Time = 13 ns typ

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS



t+ = 12 ns } 10% to
t- = 6.0 ns } 90% points
PRF = 1.0 MHz
Duty Cycle = 50%
PW = 0.5 µs
$Z_{out} \approx 50\ \Omega$

Ground inputs to gate not under test.

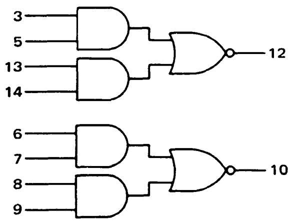
C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

The coax delays from input to scope and output to scope must be matched. The scope must be terminated in 50-ohm impedance. The 950-ohm resistor and the scope termination impedance constitute a 20:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

*F suffix = 1/4" x 1/4" ceramic package (Case 651). MCBC-prefixed devices are unencapsulated. Beam numbers are the same as the pin numbers for flat-packaged devices. See General Information section for package and chip details.

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one gate. The other gates are tested in the same manner. Further, test procedures are shown for only one input of the gate under test. To complete testing, sequence through remaining inputs.



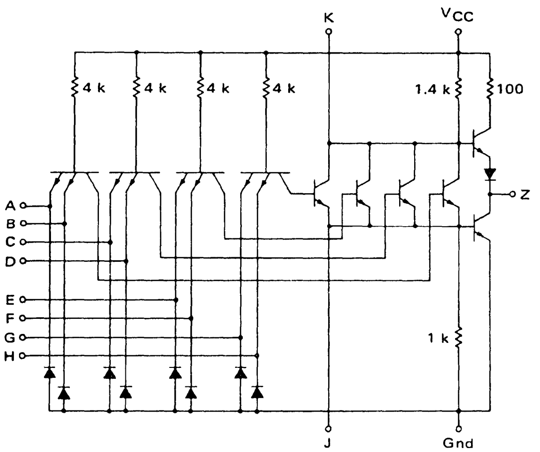
Characteristic	Symbol	Pin Under Test	Test Limits MCBC5451/MCB5451F −55 to +125°C Min	Max	Unit	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
						TEST CURRENT/VOLTAGE VALUES (All Temperatures) mA		Volts										
						16	-0.4	0.4	2.4	5.5	4.5	5.0	2.0	0.8	5.0	4.5	5.5	
						TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:												
Input																		
Forward Current	I_F	14	-	-1.6	mAdc	-	-	14	-	-	13	-	-	-	-	-	4	11*
Leakage Current	I_{R1}	14	-	40	μAdc	-	-	-	14	-	-	-	-	-	-	-	4	3,5,11,13*
	I_{R2}	14	-	1.0	mAdc	-	-	-	-	14	-	-	-	-	-	-	4	3,5,11,13*
Output																		
Output Voltage	V_{OL}	12	-	0.4	Vdc	12	-	-	-	-	-	-	13,14	-	-	4	-	3,5,11*
	V_{OH}	12	2.4	-	Vdc	-	12	-	-	-	13	-	-	14	-	-	4	3,5,11*
Short-Circuit Current	I_{SC}†	12	-20	-55	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	3,5,11,12,13,14*
Power Requirements (Total Device)																		
Power Supply Drain	I_{PDH}	4	-	14	mAdc	-	-	-	-	-	-	3,5,6,7,8, 9,13,14	-	-	-	-	4	11
	I_{PDL}	4	-	8	mAdc	-	-	-	-	-	-	-	-	-	-	-	4	3,5,11,13,14*
Switching Parameters						Pulse In	Pulse Out											
Turn-On Delay	t_{pd-}	14,12	-	15**	ns	14	12	-	13	-	-	-	-	-	4	-	-	3,5,11*
Turn-Off Delay	t_{pd+}	14,12	-	22**	ns	14	12	-	13	-	-	-	-	-	4	-	-	3,5,11*

*Ground inputs to gates not under test.
**Tested only at 25°C.
† Only one output should be shorted at a time.

MCBC5453*
MCB5453F*

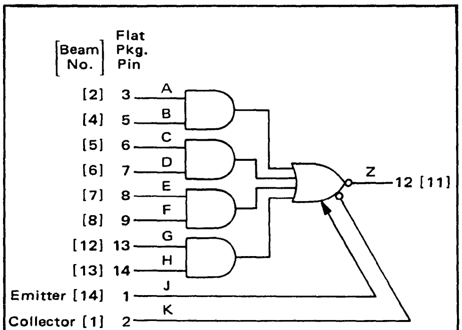
BEAM LEAD

CIRCUIT SCHEMATIC



V_{CC} = Pin 4 [3]
Gnd = Pin 11 [10]

This device consists of four 2-input AND gates ORed together and inverted. Up to four MCB5460 expander gates may be ORed with the device at the expander points. Beam lead sealed junction technology is used to manufacture these devices. They are particularly useful in highly reliable systems using hybrid beam lead assembly techniques or standard flat package assembly techniques.

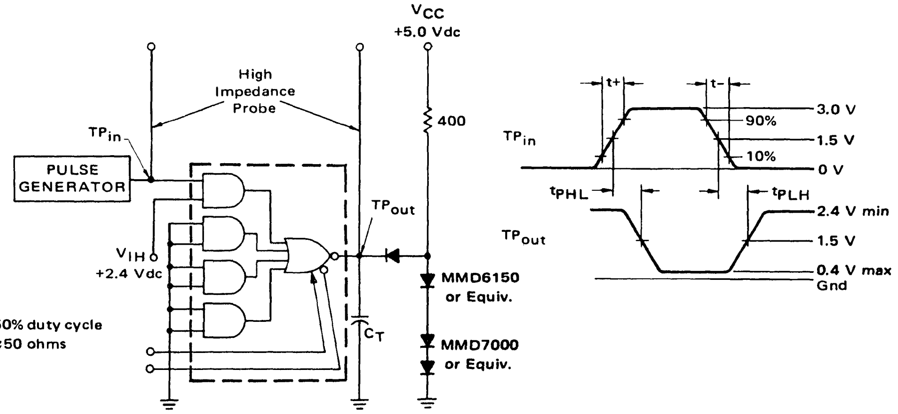


Positive Logic:
$Z = \overline{(A \bullet B) + (C \bullet D) + (E \bullet F) + (G \bullet H) + (\text{Expanders})}$

Negative Logic:
$Z = \overline{(A + B) \bullet (C + D) \bullet (E + F) \bullet (G + H) \bullet (\text{Expanders})}$

Input Loading Factor = 1
Output Loading Factor = 10
Total Power Dissipation = 22 mW typ/pkg
Propagation Delay Time = 13 ns typ

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS

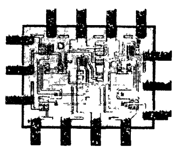


t+ = 12 ns
t- = 6.0 ns
PRF = 1.0 MHz, 50% duty cycle
Generator $Z_{out} \approx 50$ ohms

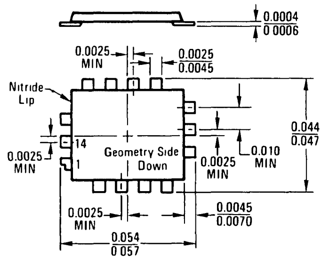
Expander pins should be left open when measuring switching times.

C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

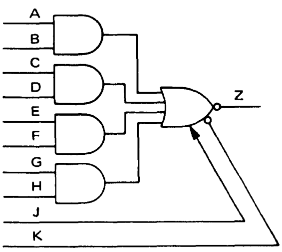
*F suffix = 1/4" x 1/4" ceramic package (Case 607). MCBC-prefixed devices are unencapsulated.
See General Information section for package dimensions.



14-Beam Chip



Beams true position within 0.002 total



V = V_{CC} = Pin 4 [3]
Gnd = Pin 11 [10]

ELECTRICAL CHARACTERISTICS

Test procedures are shown for one input of the device. To complete testing, sequence through remaining inputs in a similar manner.

FUNCTION	J	K	A	V_{CC}	B	C	D	E	F	–	GND	–	G	H
Beam No.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
Flat Pkg. Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14

			Test Limits MCBC5453/MCB5453F −55 to +125°C			TEST CURRENT/VOLTAGE VALUES (All Temperatures): mA						Ohms	Volts											Pin 11 [Beam 10] is grounded for all tests in addition to the pins listed below:
						I_{OL}	I_{OH}	I_{X1}	I_{X2}	I_{X3}	I_{X4}	R_{EX} ③	V_{EX} ①	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	
						16	-0.4	0.41	0.15	-0.15	0.3	138	0.4	0.4	2.4	5.5	4.5	5.0	2.0	0.8	5.0	4.5	5.5	
						TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:																		
Characteristic	Symbol	Pin Under Test	Min	Max	Unit	I_{OL}	I_{OH}	I_{X1}	I_{X2}	I_{X3}	I_{X4}	R_{EX} ③	V_{EX} ①	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
Input																								
Forward Current	I_F	A	-	-1.6	mAdc	-	-	-	-	-	-	-	-	A	-	-	B	-	-	-	-	-	V	-
Leakage Current	I_{R1}	A	-	40	µAdc	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	V	A, C, D, E, F, G, H
	I_{R2}	A	-	1.0	mAdc	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	V	A, C, D, E, F, G, H
Expander Input Current	I_{EX}	K ①	-	-2.9	mAdc	Z	-	-	-	-	-	-	J, K	-	-	-	-	-	-	-	-	V	-	All Inputs
Base-Emitter Voltage	V_{BE}	J ②	-	1.0	Vdc	Z	-	J, K	-	-	-	-	-	-	-	-	-	-	-	-	-	V	-	All Inputs
Output																								
Output Voltage	V_{OL}	Z	-	0.4	Vdc	Z	-	-	-	-	-	-	-	-	-	-	-	-	A, B	-	-	V	-	C, D, E, F, G, H
			-	0.4	Vdc	Z	-	-	-	-	J	K	-	-	-	-	-	-	-	-	-	V	-	All Inputs
	V_{OH}	Z	2.4	-	Vdc	-	Z	-	-	-	-	-	-	-	-	-	A, D, F, H	-	-	B, C, E, G	-	V	-	-
		Z ③	2.4	-	Vdc	-	Z	-	J	K	-	-	-	-	-	-	-	-	-	-	-	V	-	All Inputs
Short-Circuit Current	I_{OS} †	Z	-20	-55	mAdc	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	V	All Inputs, Z
Power Requirements																								
Power Supply Drain	I_{PDH}	V	-	9.5	mAdc	-	-	-	-	-	-	-	-	-	-	-	-	All Inputs	-	-	-	-	V	-
	I_{PDL}	V	-	8.0	mAdc	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	V	All Inputs
Switching Parameters						Pulse In	Pulse Out																	
Turn-On Delay	t_{PHL}	A, Z	-	15*	ns	A	Z	-	-	-	-	-	-	-	B	-	-	-	-	-	V	-	-	C, D, E, F, G, H
Turn-Off Delay	t_{PLH}	A, Z	-	22*	ns	A	Z	-	-	-	-	-	-	-	B	-	-	-	-	-	V	-	-	C, D, E, F, G, H

* Tested only at 25°C. †Only one output should be shorted at a time.
① See Figure 1.
② See Figure 2.
③ See Figure 3.

6

FIGURE 1 – I_{EX} TEST CIRCUIT

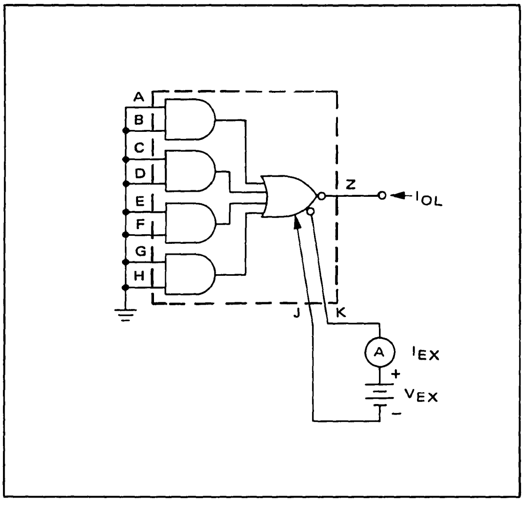


FIGURE 2 – V_{BE} TEST CIRCUIT

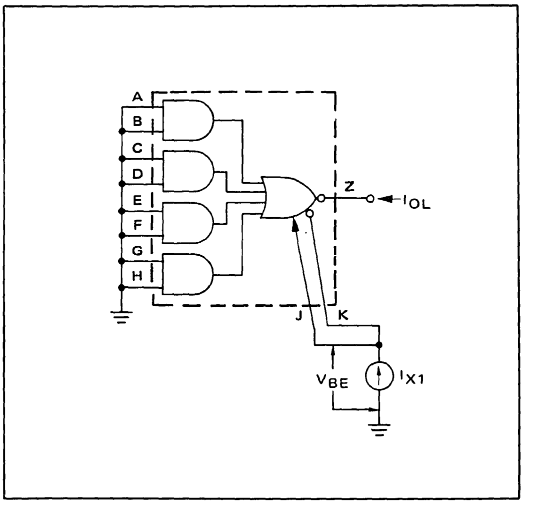
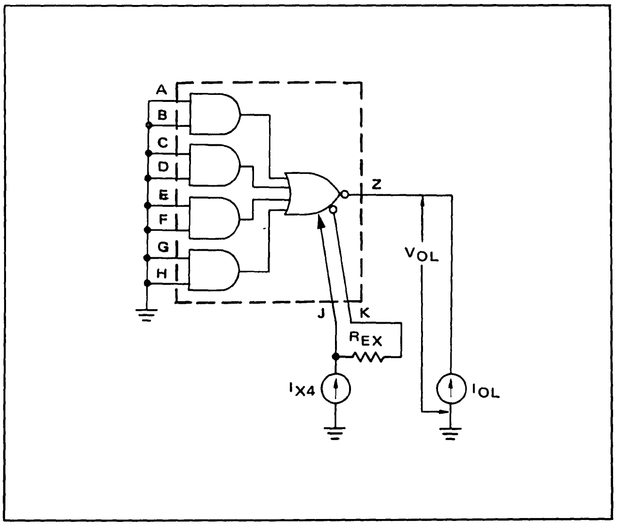


FIGURE 3 – V_{OL} TEST CIRCUIT



6

4-WIDE 2-INPUT
"AND-OR-INVERT" GATE

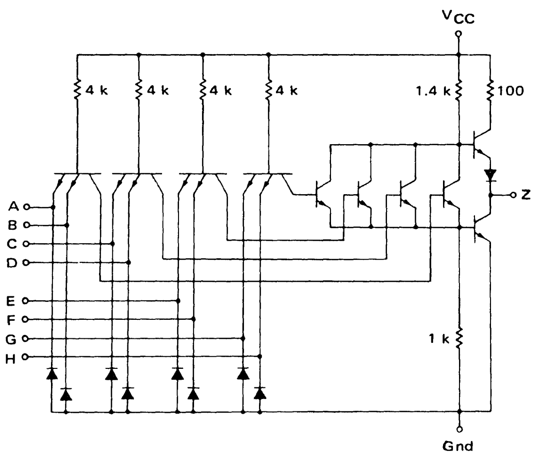
MCBC5454*
MCB5454F*

BEAM LEAD

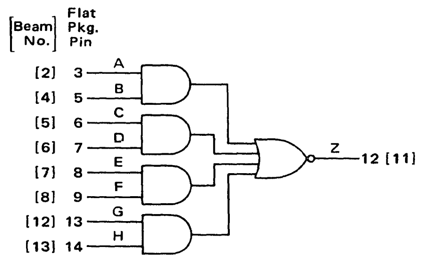
This device consists of four 2-input AND gates ORed together and inverted.

Beam lead sealed junction technology is used to manufacture these devices. They are particularly useful in highly reliable systems using hybrid beam lead assembly techniques or standard flat package assembly techniques.

CIRCUIT SCHEMATIC



V_{CC} = Pin 4 [3]
Gnd = Pin 11 [10]



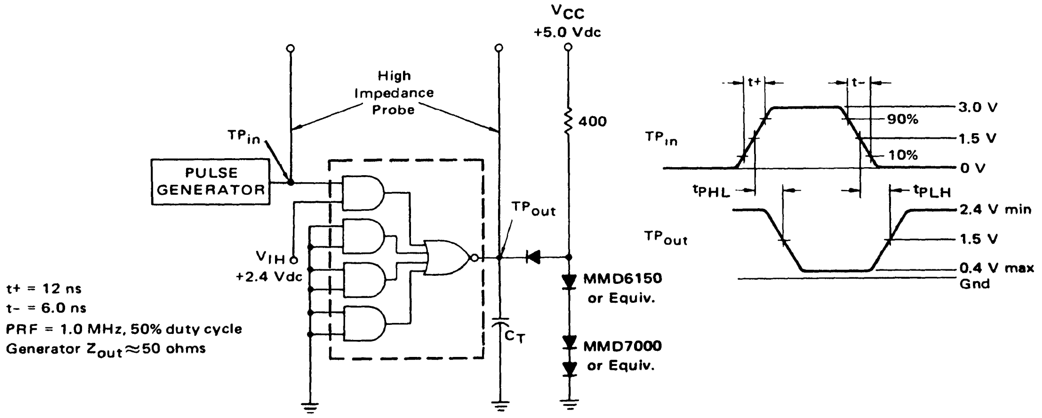
Positive Logic:
$Z = \overline{(A \bullet B) + (C \bullet D) + (E \bullet F) + (G \bullet H)}$

Negative Logic:
$Z = \overline{(A + B) \bullet (C + D) \bullet (E + F) \bullet (G + H)}$

Input Loading Factor = 1
Output Loading Factor = 10
Total Power Dissipation = 22 mW typ/pkg
Propagation Delay Time = 13 ns typ

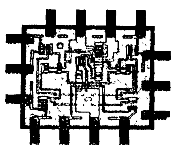
6

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS

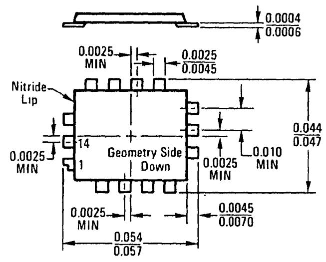


C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

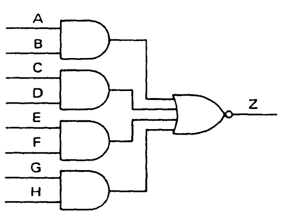
*F suffix = 1/4" x 1/4" ceramic package (Case 607). MCBC-prefixed devices are unencapsulated.
See General Information section for package dimensions.



14-Beam Chip



Beams true position within 0.002 total



ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one input of this device. To complete testing, sequence through remaining inputs in the same manner.

FUNCTION	–	–	A	V_{CC}	B	C	D	E	F	–	Gnd	–	G	H
Beam No.	14	1	2	3	4	5	6	7	8	9	10	11	12	13
Flat Pkg. Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14

V = V_{CC} = Pin 4 [3]
Gnd = Pin 11 [10]

			Test Limits MCBC5454/MCB5454F −55 to +125°C			TEST CURRENT/VOLTAGE VALUES (All Temperatures) mA		Volts										Pin 11 [Beam 10] is grounded for all tests in addition to the pins listed below:
						I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	
						16	-0.4	0.4	2.4	5.5	4.5	5.0	2.0	0.8	5.0	4.5	5.5	
						TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:												
Characteristic	Symbol	Pin Under Test	Min	Max	Unit	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
Input																		
Forward Current	I_F	A	-	-1.6	mAdc	-	-	A	-	-	B	-	-	-	-	-	V	-
Leakage Current	I_{R1}	A	-	40	µAdc	-	-	-	A	-	-	-	-	-	-	-	V	B, C, D, E, F, G, H
	I_{R2}	A	-	1.0	mAdc	-	-	-	-	A	-	-	-	-	-	-	V	B, C, D, E, F, G, H
Output																		
Output Voltage	V_{OL}	Z	-	0.4	Vdc	Z	-	-	-	-	-	-	A, B	-	-	V	-	C, D, E, F, G, H
	V_{OH}	Z	2.4	-	Vdc	-	Z	-	-	-	B, D, F, H	-	-	A, C, E, G	-	V	-	-
Short-Circuit Current	I_{OS}†	Z	-20	-55	mAdc	-	-	-	-	-	-	-	-	-	-	-	V	All Inputs, Z
Power Requirements																		
Power Supply Drain	I_{PDH}	V	-	9.5	mAdc	-	-	-	-	-	-	All Inputs	-	-	-	-	V	-
	I_{PDL}	V	-	8.0	mAdc	-	-	-	-	-	-	-	-	-	-	-	V	All Inputs
Switching Parameters						Pulse In	Pulse Out											
Turn-On Delay	t_{PHL}	A, Z	-	15*	ns	A	Z	-	B	-	-	-	-	-	V	-	-	C, D, E, F, G, H
Turn-Off Delay	t_{PLH}	A, Z	-	22*	ns	A	Z	-	B	-	-	-	-	-	V	-	-	C, D, E, F, G, H

*Tested Only at 25°C.
†Only one output should be shorted at a time.

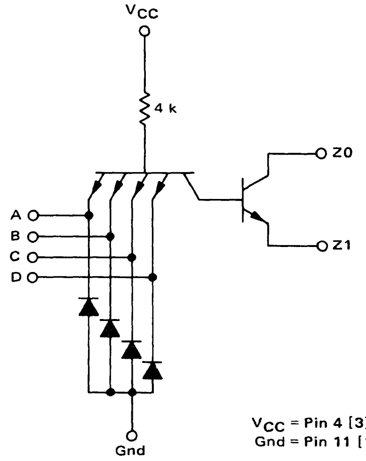
DUAL 4-INPUT EXPANDER
FOR "AND-OR-INVERT" GATES

MCBC5460*
MCB5460F*

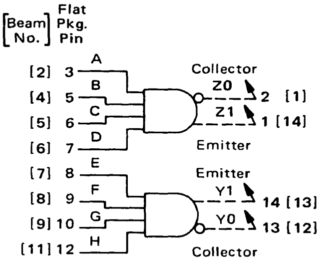
BEAM LEAD

This device consists of two 4-input OR expanders for use with the AND-OR-INVERT gates. A maximum of four expander gates can be added to the MCB5450 or MCB5453 expandable gates without seriously affecting their operation. Beam lead sealed junction technology is used to manufacture these devices. They are particularly useful in highly reliable systems using hybrid beam lead assembly techniques or standard flat package assembly techniques.

CIRCUIT SCHEMATIC
1/2 OF CIRCUIT SHOWN

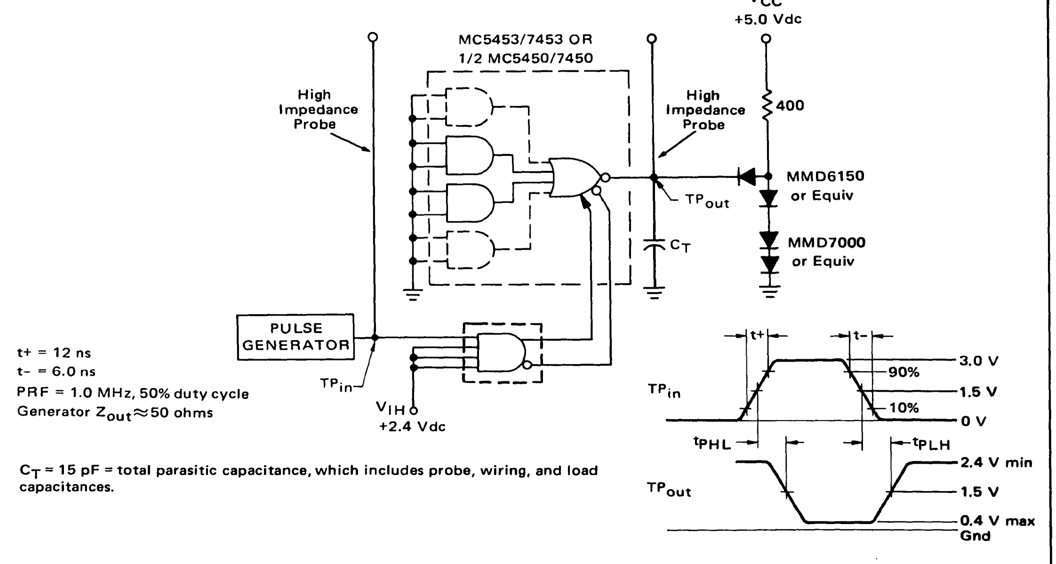


V_{CC} = Pin 4 [3]
Gnd = Pin 11 [10]



Input Loading Factor = 1
Full output loading factor of the expandable gate is maintained.
Total Power Dissipation = 8.0 mW typ/pkg
Propagation Delay Time = 5.0 ns typ

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS

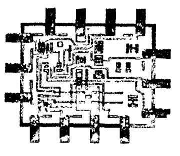


t+ = 12 ns
t- = 6.0 ns
PRF = 1.0 MHz, 50% duty cycle
Generator $Z_{out} \approx 50$ ohms

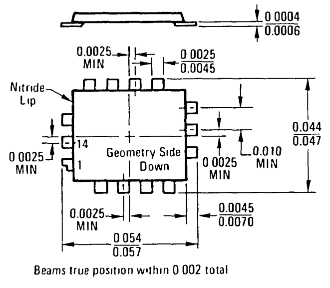
C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

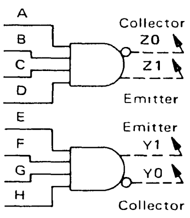
*F suffix = 1/4" x 1/4" ceramic package (Case 607). MCBC-prefixed devices are unencapsulated.
See General Information section for package dimensions.

6



14-Beam Chip





V = V_{CC} = Pin 4 [3]
Gnd = Pin 11 [10]

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one expander. The other expander is tested in the same manner. Further, test procedures are shown for only one input of the expander being tested. To complete testing, sequence through remaining inputs.

FUNCTION	Z1	Z0	A	V_{CC}	B	C	D	E	F	G	GND	H	Y0	Y1
Beam No	14	1	2	3	4	5	6	7	8	9	10	11	12	13
Flat Pkg Pin No	1	2	3	4	5	6	7	8	9	10	11	12	13	14

						TEST VOLTAGE VALUES (All Temperatures)															
						Ohms		Volts													
						R_{EX1}	R_{EX2}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{O1}	V_{O2}	V_{O3}	V_{CC}	V_{CCL}	V_{CCH}	
						1.2 k*	1.1 k‡	0.4	2.4	5.5	4.5	5.0	2.0	0.8	4.5	1.0	0.85	5.0	4.5	5.5	
			Test Limits MCBC5460/MCB5460F −55 to +125°C			TEST VOLTAGE APPLIED TO PINS LISTED BELOW:															Pin 11 [Beam 10] grounded for all tests in addition to the pins listed below:
Characteristic	Symbol	Pin Under Test	Min	Max	Unit	R_{EX1}	R_{EX2}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	V_{R2}	V_{th1}	V_{th0}	V_{O1}	V_{O2}	V_{O3}	V_{CC}	V_{CCL}	V_{CCH}	Gnd
Input																					
Forward Current	I_F	A	-	-1.6	mAdc	-	-	A	-	-	B, C, D	-	-	-	-	-	-	-	-	V	-
Leakage Current	I_{R1}	A	-	40	µAdc	-	-	-	A	-	-	-	-	-	-	-	-	-	-	V	B, C, D
	I_{R2}	A	-	1.0	mAdc	-	-	-	-	A	-	-	-	-	-	-	-	-	-	V	B, C, D
Output																					
Output Voltage	V_{OL}	Z0, Z1†	-	0.4	Vdc	-	Z0	-	-	-	-	-	A, B, C, D	-	-	Z1	-	-	V	-	-
Leakage Current	I_{CEX}	Z0	-	150§	µAdc	Z1	-	-	-	-	B, C, D	-	-	A	Z0	-	-	-	V	-	-
Drive Current	I_{DR}	Z1	-0.3	-	mAdc	-	-	-	-	-	-	-	A, B, C, D	-	-	Z1	-	-	V	-	-
Power Requirements (Total Device)																					
Power Supply Drain	I_{PDL}	V	-	4.0	mAdc	-	-	-	-	-	-	-	-	-	-	-	Z1, Y1	-	-	V	All Inputs
	I_{PDH}	V	-	2.5	mAdc	-	-	-	-	-	-	All Inputs	-	-	-	-	Z1, Y1	-	-	V	-
Switching Parameters						Pulse In															
Turn-On Delay	t_{PHL}	#	-	20**	ns	A	-	-	B, C, D	-	-	-	-	-	-	-	-	V	-	-	-
Turn-Off Delay	t_{PLH}	#	-	30**	ns	A	-	-	B, C, D	-	-	-	-	-	-	-	-	V	-	-	-

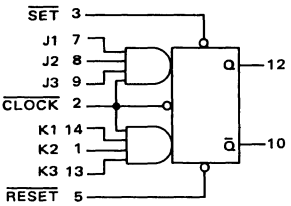
*Resistor to ground.
‡Resistor to V_{CCL}.
#See test circuit.
†V_{OL} measured between pins Z1 and Z0.
§Tested only at low temperature limit; i.e., at -55°C for MCB5460.
**Tested only at 25°C; times include delay of expandable gate.

6

MCBC5472*
MCB5472F*

BEAM LEAD

This negative-edge-clocked J-K flip-flop operates on the master-slave principle. Three K inputs are ANDed together, and three J inputs are ANDed together. $\overline{SET}$ and $\overline{RESET}$ inputs are also available. The device helps minimize package count in J-K flip-flop applications requiring AND gating into the J or K inputs. Beam lead sealed junction technology is used to manufacture these devices. They are particularly useful in highly reliable systems using hybrid beam lead assembly techniques or standard flat package assembly techniques.



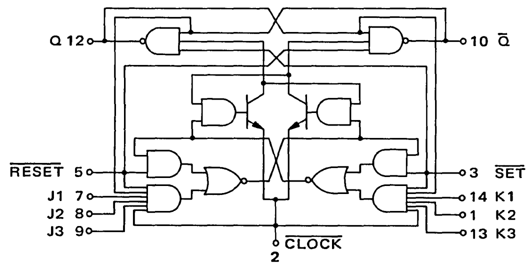
t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\bar{Q}_n$

J = J1 • J2 • J3
K = K1 • K2 • K3

Input Loading Factor:
J, K = 1
$\overline{CLOCK}$, $\overline{SET}$, $\overline{RESET}$ = 2
Output Loading Factor = 10

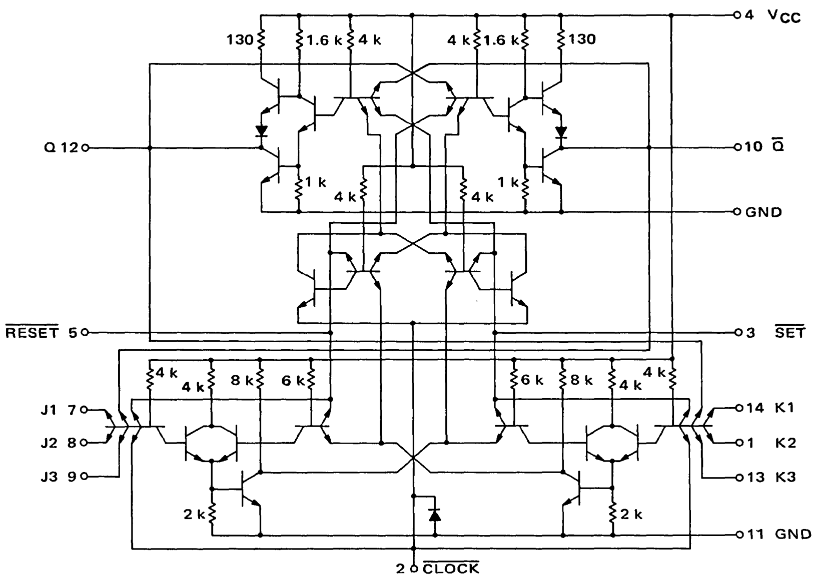
Total Power Dissipation = 40 mW typ/pkg
Propagation Delay Time = 30 ns typ
Max Operating Frequency = 20 MHz typ

LOGIC DIAGRAM



Package No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Beam No.	16	1	2	3	4	5	6	8	9	10	11	12	13	14

6



*F suffix = 1/4" x 1/4" ceramic package (Case 651) MCBC-prefixed devices are unencapsulated. See General Information section for package and chip details.

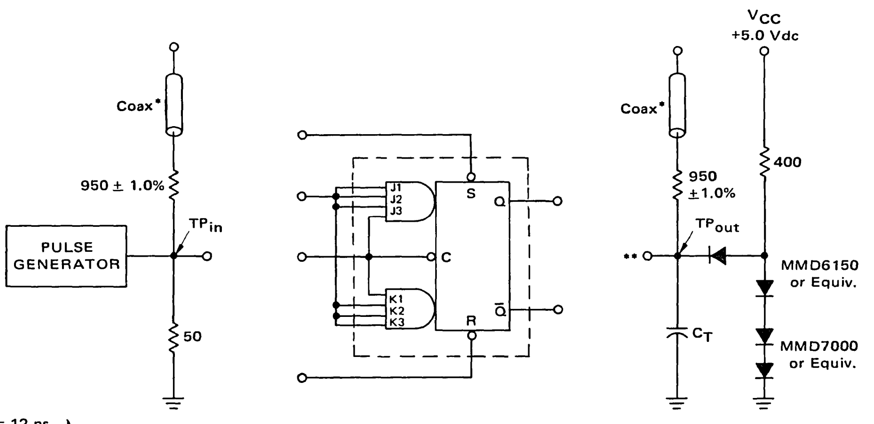
OPERATING CHARACTERISTICS

Data must be applied to the J-K inputs while the clock is low. When the clock input goes to the positive logic "1" state, the data at the J and K inputs is transferred to the master section, where it is stored until the clock changes to the positive logic "0" state. Data at the J and K inputs must not be changed while the clock is high. When the clock returns to the positive logic "0" state, information in the master section is transferred to the slave section.

Application of a logic "0" to the $\overline{SET}$ input will force the Q output to the logic "1" state, and application of a logic "0" to the $\overline{RESET}$ input will force the $\overline{Q}$ output to the logic "1" state. The $\overline{SET}$ and $\overline{RESET}$ inputs override the clock.

Since no charge storage is involved in this flip-flop, rise and fall times are not important to its operation. Clock fall times as long as 1.0 µs will not adversely affect the operation of the flip-flop. The clock pulse need only be wide enough to allow the data to settle in the master section. This time, which is the setup time for a logic "1", is 20 ns minimum.

SWITCHING TIME TEST CIRCUIT



$t+ = 12$ ns, $t- = 6$ ns } 10% to 90% points
f = 10 MHz for waveform A
1.0 MHz for waveforms B, E, and F

Two pulse generators are required and must be slaved together for testing $\overline{SET}$ and $\overline{RESET}$. Only one pulse generator is required for J, K, and $\overline{CLOCK}$ tests.

*The coax delays from input to scope and output to scope must be matched. The scope must be terminated in 50-ohm impedance. The 950-ohm resistor and the scope termination impedance constitute a 20:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

**A load is connected to each output during the test.

C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

6

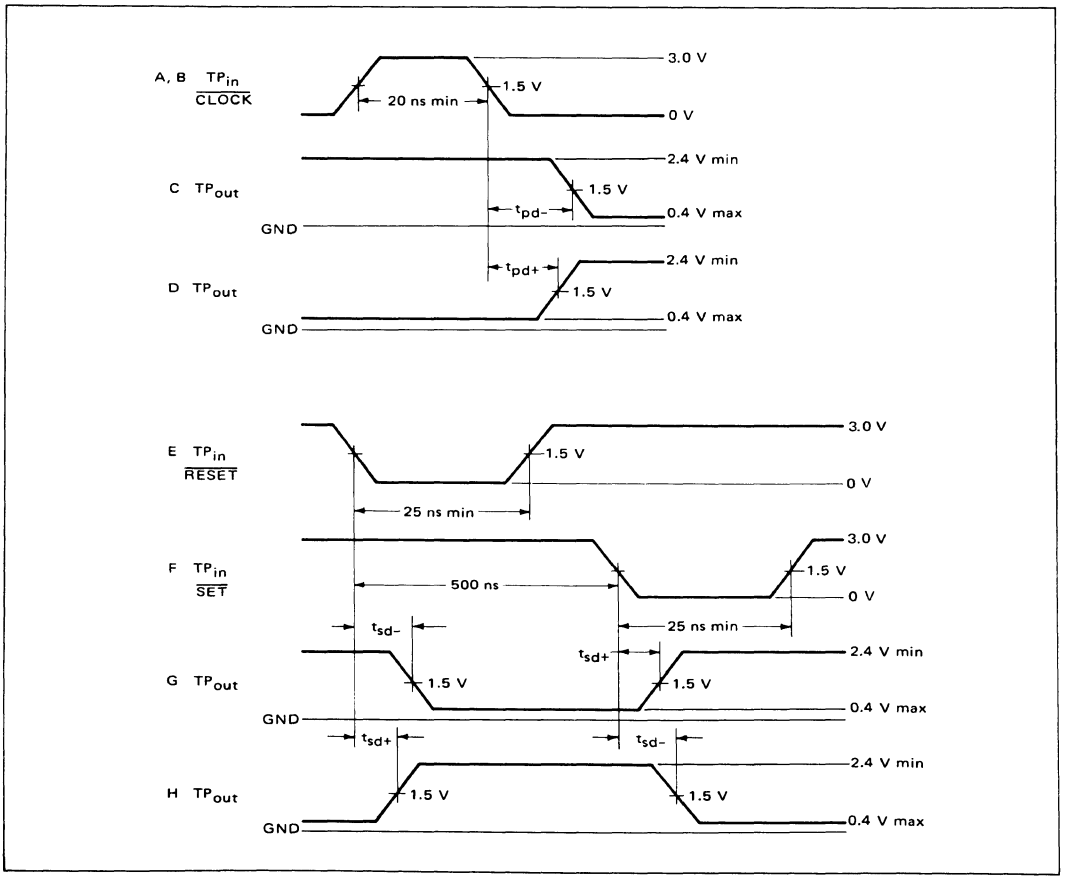
TEST PROCEDURES

(Letters shown in test columns refer to waveforms.)

TEST	SYMBOL	INPUT				Q	$\bar{Q}$	LIMITS		
		$\bar{C}$	J, K	$\bar{R}$	$\bar{S}$			Min	Max	Unit
Toggle Frequency	f_{Tog}	A	A	2.4 V	2.4 V	†	†	15	–	MHz
Turn-On Delay	t_{pd-}	B	B	2.4 V	2.4 V	C	C	10	40	ns
Turn-Off Delay	t_{pd+}	B	B	2.4 V	2.4 V	D	D	10	25	ns
Turn-On Delay	t_{sd-}	2.4 V	2.4 V	E	F	G	H	–	40	ns
Turn-Off Delay	t_{sd+}	2.4 V	2.4 V	E	F	G	H	–	25	ns
Enable Voltage	V_{EN}	B	2.0 V	2.4 V	2.4 V	†	†	†	–	–
Inhibit Voltage	V_{INH}	B	0.8 V	2.4 V	2.4 V	‡	‡	‡	–	–

†Output shall toggle with each input pulse.
‡Output shall NOT toggle.

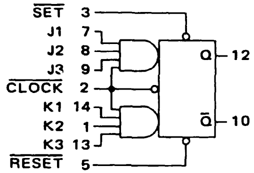
VOLTAGE WAVEFORMS AND DEFINITIONS



6

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one J and one K input, plus the $\overline{\text{SET}}$, $\overline{\text{RESET}}$, and $\overline{\text{CLOCK}}$ inputs. To complete testing, sequence through remaining J and K inputs in the same manner.



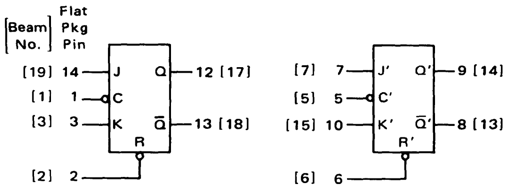
Characteristic		Symbol	Pin Under Test	Test Limits MCBC5472/MCB5472F −55 to +125°C Min	Max	Unit	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_R	V_{th1}	V_{th0}	V_{CCL}	V_{CCH}	Gnd
TEST CURRENT/VOLTAGE VALUES (All Temperatures)							mA		Volts								
							16	-0.4	0.4	2.4	5.5	4.5	2.0	0.8	4.5	5.5	
							TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:										
Input																	
Forward Current	J	I_F	7	-	-1.6	mAdc	-	-	7	-	-	2,5*,8,9	-	-	-	4	11
	K		14	-	-1.6		-	-	14	-	-	1,2,3*,13	-	-	-		
	$\overline{\text{Set}}$		3	-	-3.2		-	-	3	-	-	1,2,7,8,9,13,14	-	-	-		
	$\overline{\text{Reset}}$		5	-			-	-	5	-	-	1,2,7,8,9,13,14	-	-	-		
	$\overline{\text{Clock}}$		2	-			-	-	2	-	-	1,5*,7,8,9,13,14	-	-	-		
			2	-			-	-	2	-	-	1,3*,7,8,9,13,14	-	-	-		
Leakage Current	J	I_{R1}	7	-	40	µAdc	-	-	-	7	-	-	-	-	-	4	2,5,8,9,11
	K		14	-	40		-	-	-	14	-	-	-	-	-		1,2,3,11,13
	$\overline{\text{Set}}$		3	-	80		-	-	-	3	-	-	-	-	-		2,7,8,9,11
	$\overline{\text{Reset}}$		5	-			-	-	-	5	-	-	-	-	-		1,2,11,13,14
	$\overline{\text{Clock}}$		2**	-			-	-	-	2	-	-	-	-	-		1,2,5,7,8,9,11,13,14
	J	I_{R2}	7	-	1.0	mAdc	-	-	-	-	7	-	-	-	-	4	2,5,8,9,11
	K		14	-			-	-	-	-	14	-	-	-	-		1,2,3,11,13
	$\overline{\text{Set}}$		3	-			-	-	-	-	3	-	-	-	-		2,7,8,9,11
	$\overline{\text{Reset}}$		5	-			-	-	-	-	5	-	-	-	-		1,2,11,13,14
	$\overline{\text{Clock}}$		2	-			-	-	-	-	2	-	-	-	-		1,3,5,7,8,9,11,13,14
Output																	
Output Voltage		V_{OL}	10	-	0.4	Vdc	10	-	-	-	-	-	5	3	4	-	11
			12	-	0.4	Vdc	12	-	-	-	-	-	3	5	4	-	11
		V_{OH}	10	2.4	-	Vdc	-	10	-	-	-	-	3	5	4	-	11
			12	2.4	-	Vdc	-	12	-	-	-	-	5	3	4	-	11
Short-Circuit Current		I_{SC}	10	-20	-57	mAdc	-	-	-	-	-	1,7,8,9,13,14	-	-	-	4	2,5,10,11
			12	-20	-57	mAdc	-	-	-	-	-	1,7,8,9,13,14	-	-	-	4	2,3,11,12
Power Requirements																	
Power Supply Drain		I_{PD}	4	-	20	mAdc	-	-	-	-	-	-	-	-	-	4	5,11
			4	-	20	mAdc	-	-	-	-	-	-	-	-	-	4	3,11

*Momentarily ground pin prior to taking measurement.

**Under normal operating conditions this current is negative. This test guarantees that positive leakage current will not exceed the limit shown.

MCBC5473*
MCB5473F*

This negative-edge-clocked dual J-K flip-flop operates on the master-slave principle. The device is quite useful for simple registers and counters where multiple J and K inputs are not required.



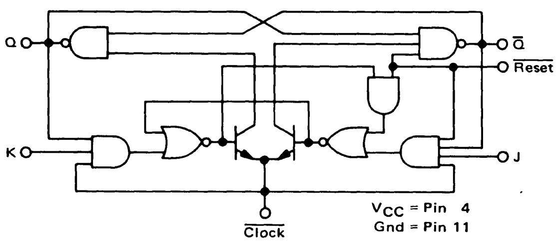
V_{CC} = Pin 4 [4]
Gnd = Pin 11 [16]

t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\bar{Q}_n$

Input Loading Factor:
J, K = 1
$\overline{\text{Reset}}$, $\overline{\text{Clock}}$ = 2

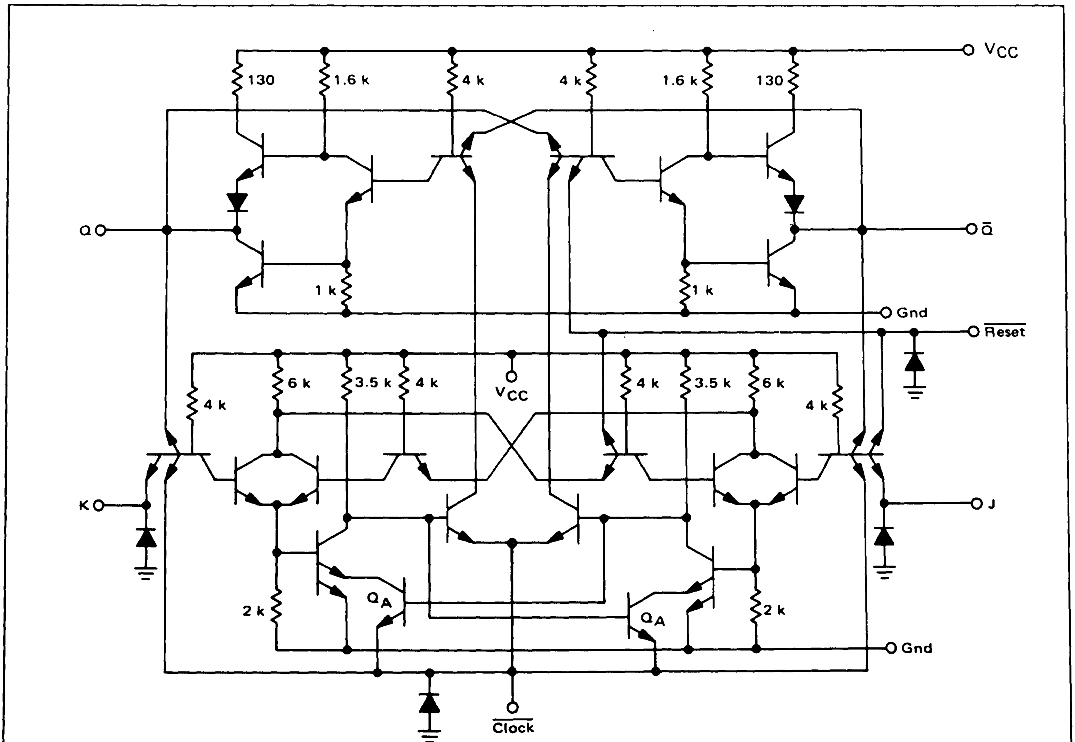
Output Loading Factor = 10
Total Power Dissipation = 80 mW typ/pkg
Propagation Delay Time = 30 ns typ
Operating Frequency = 15 MHz typ

LOGIC DIAGRAM
(1/2 OF DEVICE SHOWN)



V_{CC} = Pin 4
Gnd = Pin 11

CIRCUIT SCHEMATIC
(1/2 OF DEVICE SHOWN)



*F suffix = 1/4" x 1/4" ceramic package (Case 607). MCBC prefixed devices are unencapsulated.
See General Information section for package dimensions.

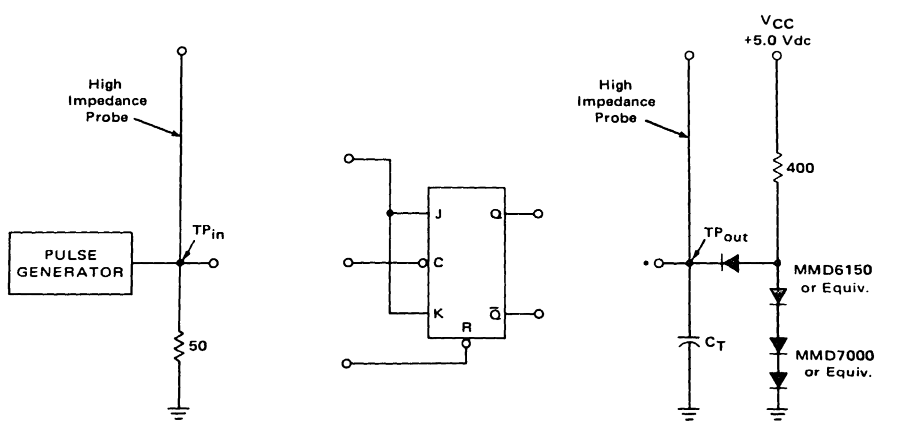
OPERATING CHARACTERISTICS

Data must be applied to the J-K inputs while the clock is low. When the clock input goes to the positive logic "1" state, the data at the J and K inputs is transferred to the master section, where it is stored until the clock changes to the positive logic "0" state. Data at the J and K inputs must not be changed while the clock is high. When the clock returns to the positive logic "0" state, information in the master section is transferred to the slave section.

Application of a logic "0" to the $\overline{\text{Reset}}$ input will force the $\overline{\text{Q}}$ output to the logic "1" state. The $\overline{\text{Reset}}$ input overrides the clock.

Since no charge storage is involved in this flip-flop, rise and fall times are not important to its operation. Clock fall times as long as 1.0 μs will not adversely affect the operation of the flip-flop. The clock pulse need only be wide enough to allow the data to settle in the master section. This time, which is the setup time for a logic "1" is 20 ns minimum.

SWITCHING TIME TEST CIRCUIT



t+ = 12 ns, t− = 6.0 ns } 10% to 90% Points
f = 15 MHz for waveform A
1.0 MHz for waveforms B and C

*A load is connected to each output during the test.

Two pulse generators are required and must be slaved together for t_{sd} tests.

C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

6

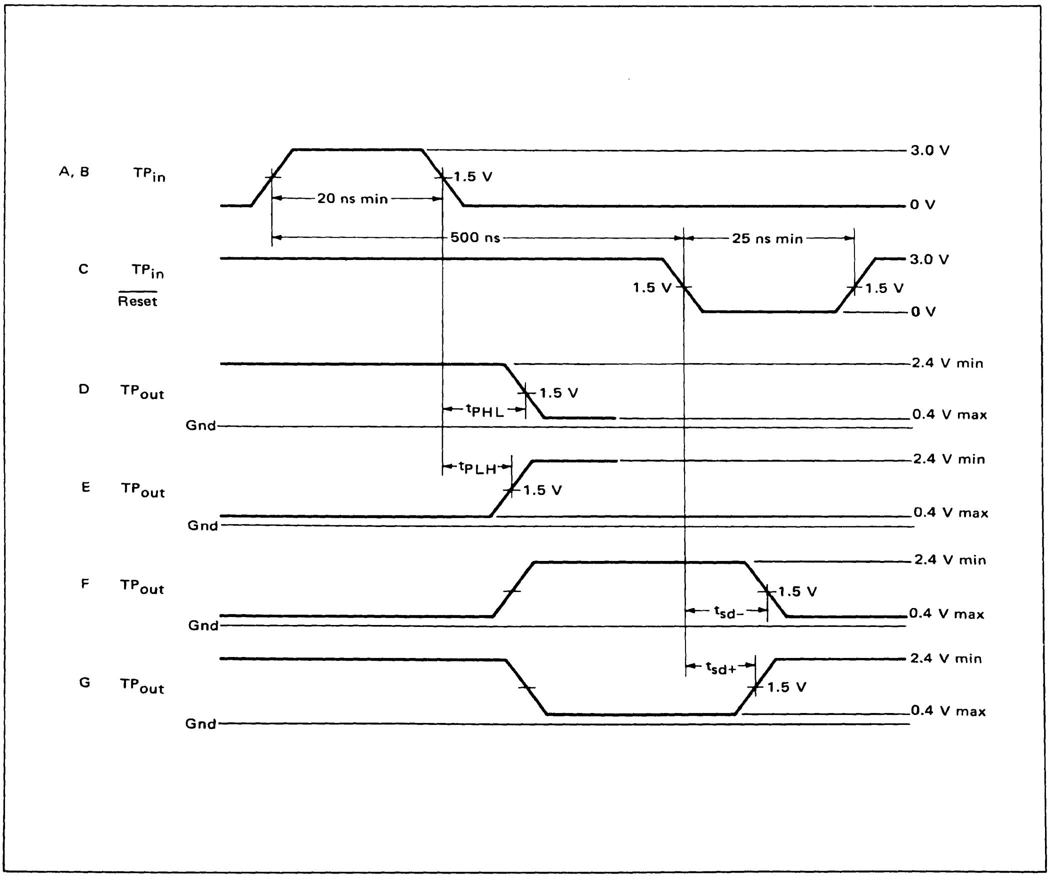
TEST PROCEDURES

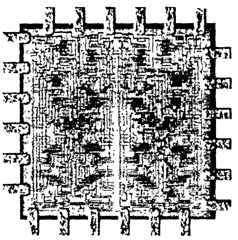
(Letters shown in test columns refer to waveforms.)

TEST	SYMBOL	INPUT			Q	$\bar{Q}$	LIMITS		
		$\bar{C}$	J, K	$\bar{R}$			Min	Max	Unit
Toggle Frequency	f_{Tog}	A	A	2.4 V	†	†	15	–	MHz
Turn-On Delay	t_{PHL}	B	B	2.4 V	D	D	10	40	ns
Turn-Off Delay	t_{PLH}	B	B	2.4 V	E	E	10	25	ns
Turn-On Delay	t_{sd-}	B	B	C	G	–	–	40	ns
Turn-Off Delay	t_{sd+}	B	B	C	–	F	–	25	ns
Enable Voltage	V_{EN}	B	2.0 V	2.4 V	†	†	†	–	–
Inhibit Voltage	V_{INH}	B	0.8 V	2.4 V	‡	‡	‡	–	–

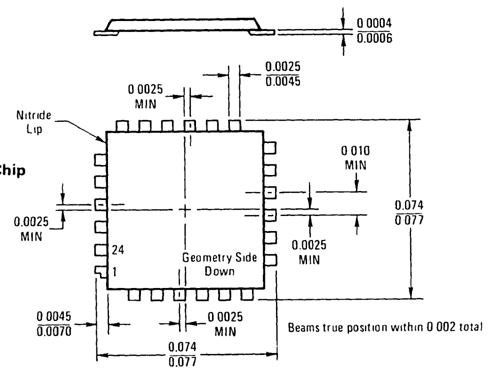
†Output shall toggle with each input pulse.
‡Output shall NOT toggle.

VOLTAGE WAVEFORMS AND DEFINITIONS



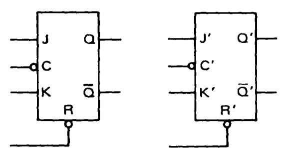


24-Beam Chip



ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one flip-flop. The other flip-flop is tested in the same manner.



FUNCTION	C	R	K	V_{CC}	C'	R'	J'	–	–	–	–	–	Q̄'	Q'	K'	GND	Q	Q̄	J	–	–	–	–	–
Beam No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Flat Pkg. Pin No.	1	2	3	4	5	6	7	–	–	–	–	–	8	9	10	11	12	13	14	–	–	–	–	–

						TEST CURRENT/VOLTAGE VALUES (All Temperatures) mA		Volts										Pin 11 [Beam 16] grounded for all tests in addition to the pins listed below.
						I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_R	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}		
						16	-0.4	0.4	2.4	5.5	4.5	2.0	0.8	5.0	4.50	5.50		
		Pin Under	Test Limits MCBC5473/MCB5473F -55 to +125°C			TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:												
Characteristic	Symbol	Test	Min	Max	Unit	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_R	V_{th1}	V_{th0}	V_{CC}	V_{CCL}	V_{CCH}	**	Gnd
Input																		
Forward Current J	I_F	J	–	-1.6	mAdc	–	–	J	–	–	C,R	–	–	–	–	V	Q	–
K		K	–	-1.6		–	–	K	–	–	C,R	–	–	–	–		Q̄	–
Reset		R	–	-3.2		–	–	R	–	–	C,J	–	–	–	–		–	–
Clock		C	–	-3.2	↓	–	–	C	–	–	J,K,R	–	–	–	–	↓	R	–
Leakage Current J	I_{R1}	J	–	40	µAdc	–	–	–	J	–	–	–	–	–	–	V	–	C,R*
K		K	–	40		–	–	–	K	–	R	–	–	–	–		R	C*
Reset		R	–	80		–	–	–	R	–	–	–	–	–	–		Q̄	C,J*
Clock		C†	–	80	↓	–	–	–	C	–	–	–	–	–	–	↓	–	J*,K,R
J	I_{R2}	J	–	1.0	mAdc	–	–	–	–	J	–	–	–	–	–	V	–	C,R*
K		K	–			–	–	–	–	K	R	–	–	–	–		R	C*
Reset		R	–			–	–	–	–	R	–	–	–	–	–		Q	C,J*
Clock		C	–	↓	↓	–	–	–	–	C	–	–	–	–	–	↓	–	J*,K,R
Output																		
Output Voltage	V_{OL}	Q	–	0.4	Vdc	Q	–	–	–	–	–	–	R	–	V	–	–	C,J*,K
		Q̄	–	0.4	Vdc	Q	–	–	–	–	–	R	–	–	V	–	Q̄	C,J*,K
	V_{OH}	Q	2.4	–	Vdc	–	Q	–	–	–	–	–	–	–	V	–	Q̄	C,J*,K
		Q̄	2.4	–	Vdc	–	Q	–	–	–	–	–	R	–	V	–	–	C,J*,K
Short-Circuit Current	I_{OS}‡	Q	-20	-57	mAdc	–	–	C,J,K	–	–	–	–	–	–	–	V	–	Q,Q*
		Q̄	-20	-57	mAdc	–	–	C,J,K	–	–	–	–	–	–	–	V	–	R,Q*
Power Requirements **(Total Device)**																		
Power Supply Drain	I_{PD}	V	–	40	mAdc	–	–	–	–	–	–	–	–	–	–	V	–	Both R Inputs
		V	–	40	mAdc	–	–	–	–	–	–	–	–	–	–	V	Both Q̄	–

*Ground inputs to flip-flop not under test

**Momentarily ground pin prior to taking measurement to set flip-flop in the desired state (If pin is also in another column, the pin must be returned to that voltage or current for measurement.)

‡Only one output should be shorted at a time

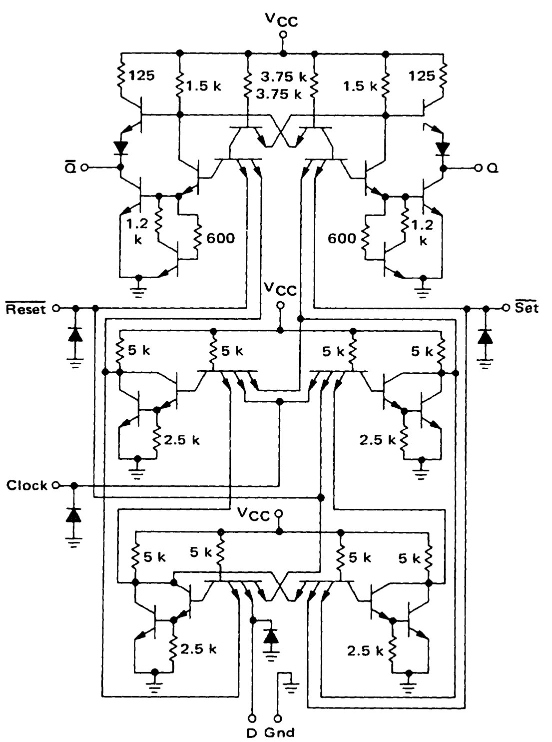
†Under normal operating conditions this current is negative This test guarantees that positive leakage current will not exceed the limit shown.

6

MCBC5479*
MCB5479F*

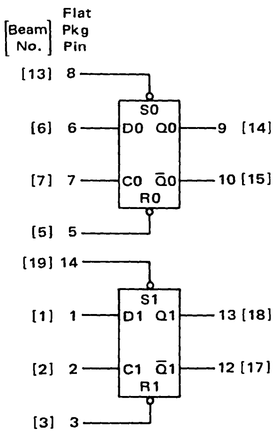
BEAM LEAD

CIRCUIT SCHEMATIC
1/2 OF DEVICE SHOWN



V_{CC} = Pin 4 [4]
Gnd = Pin 11 [16]

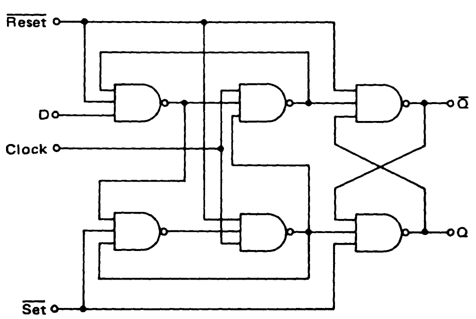
This dual type D flip-flop triggers on the positive edge of the clock input. During the clock transition the state of the D input is transferred to the Q output. The device is useful in shift registers and simple counters.



t_n	t_{n+1}	
D	Q	Q̄
0	0	1
1	1	0

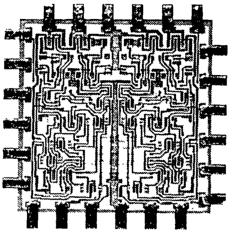
Input Loading Factor:
- D = 1
- $\overline{\text{Set}}$, Clock = 2
- $\overline{\text{Reset}}$ = 3

Output Loading Factor = 10
Total Power Dissipation = 84 mW typ/pkg
Propagation Delay Time = 16 ns typ
Operating Frequency = 30 MHz typ

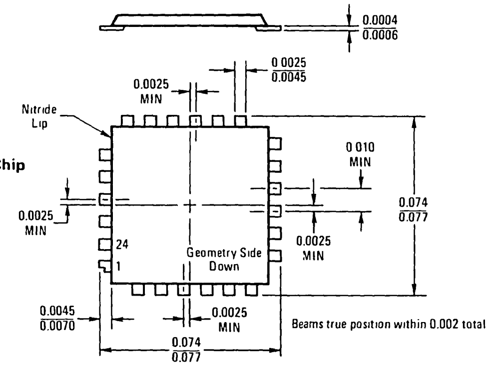


LOGIC DIAGRAM
1/2 OF DEVICE SHOWN

*F suffix = 1/4" x 1/4" ceramic package (Case 607). MCBC prefixed devices are unencapsulated.
See General Information section for package dimensions.

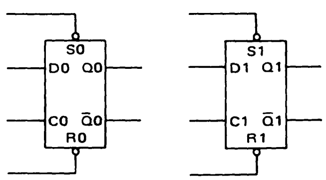


24-Beam Chip



ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one flip-flop. The other flip-flop is tested in the same manner.



FUNCTION	D1	C1	R1	V_{CC}	R0	D0	C0	–	–	–	–	–	S0	Q0	Q0	GND	Q1	Q1	S1	–	–	–	–	–
Beam No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Flat Pkg. Pin No.	1	2	3	4	5	6	7	–	–	–	–	–	8	9	10	11	12	13	14	–	–	–	–	–

						TEST CURRENT/VOLTAGE VALUES (All Temperatures)											Pin 11 (Beam 16) grounded for all tests in addition to the pins listed below
						mA		Volts									
						I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	$V_{th\,1}$	$V_{th\,0}$	V_{CC}	V_{CCL}	V_{CCH}	
						16	-0.4	0.4	2.4	5.5	4.5	2.0	0.8	5.0	4.50	5.50	
			MCBC5479/MCB5479F Test Limits -55 to +125°C			TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:											
Characteristic	Symbol	Pin Under Test	Min	Max	Unit	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_{R1}	$V_{th\,1}$	$V_{th\,0}$	V_{CC}	V_{CCL}	V_{CCH}	Gnd
Input																	
Forward Current D	I_F	D	–	-1.6	mAdc	–	–	D	–	–	R,S	–	–	–	–	V	C0,C1
Set		S	–	-3.2	↓	–	–	S	–	–	R	–	–	–	–	↓	C0,C1,D0
Reset		R	–	-4.8	↓	–	–	R	–	–	D,S	–	–	–	–	↓	C0,C1
Clock		C	–	-3.2	↓	–	–	C	–	–	R	–	–	–	–	↓	C1,D0,S0
Leakage Current D	I_{R1}	D	–	40	µAdc	–	–	–	D	–	C,S	–	–	–	–	V	C1,R0
Set		S	–	80	↓	–	–	–	S	–	C*,D,R	–	–	–	–	↓	C1
Reset		R	–	120	↓	–	–	–	R		C*,S	–	–	–	–	↓	C1,D0
Clock		C	–	80	↓	–	–	–	C	–	S	–	–	–	–	↓	C1,D0,R0
D	I_{R2}	D	–	1.0	mAdc	–	–	–	–	D	C,S	–	–	–	–	V	C1,R0
Set		S	–	↓	↓					S	C*,D,R	–	–	–	–	↓	C1
Reset		R	–	↓	↓	–	–	–	–	R	C*,S	–	–	–	–	↓	C1,D0
Clock		C	–	↓	↓	–	–	–	–	C	S	–	–	–	–	↓	C1,D0,R0
Output																	
Output Voltage	V_{OL}	Q	–	0.4	Vdc	Q	–	–	–	–	–	S	R	–	V	–	C0,C1,D0
		$\bar{Q}$	–	0.4	Vdc	$\bar{Q}$	–	–	–	–	–	R	S	–	V	–	C0,C1,D0
	V_{OH}	Q	2.4	–	Vdc	–	Q	–	–	–	–	R	S	–	V	–	C0,C1,D0
		$\bar{Q}$	2.4	–	Vdc	–	$\bar{Q}$	–	–	–	–	S	R	–	V	–	C0,C1,D0
Short-Circuit Current	I_{OS}†	Q	-20	-57	mAdc	–	–	–	–	–	–	–	–	–	–	V	C0,S0,Q0
		$\bar{Q}$	-20	-57	mAdc	–	–	–	–	–	–	–	–	–	–	V	C1,R0,Q0
Power Requirements (Total Device)																	
Power Supply Drain	I_{PD}	V	–	30	mAdc	–	–	–	–	–	–	–	–	–	–	V	C0,C1,D0,D1,S0,S1
		V	–	30	mAdc	–	–	–	–	–	–	–	–	–	–	V	C0,D0,R0,C1,D1,R1

*Momentarily ground pin prior to taking measurement, then set to state indicated.
†Only one output should be shorted at a time.

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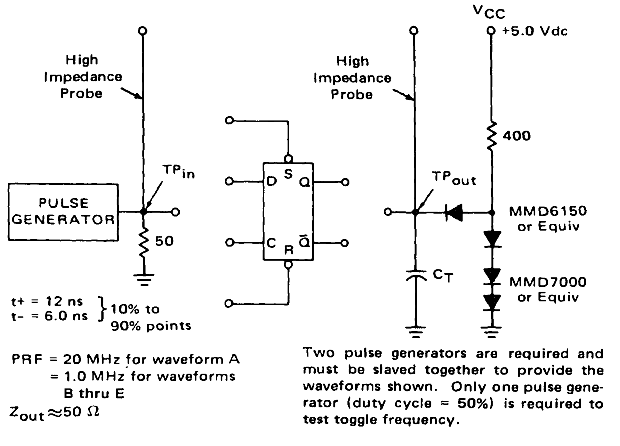
OPERATING CHARACTERISTICS

Data may be applied to the D input any time following 5.0 ns after the leading edge of a clock pulse and 20 ns before the leading edge of the following clock pulse. The state of the D input when the clock changes from the positive logic "0" state to the positive logic "1" state is transferred to the Q output of the flip-flop. The data input cannot be changed between the setup time (20 ns) and the hold time (5.0 ns) without adversely affecting the operation of the flip-flop.

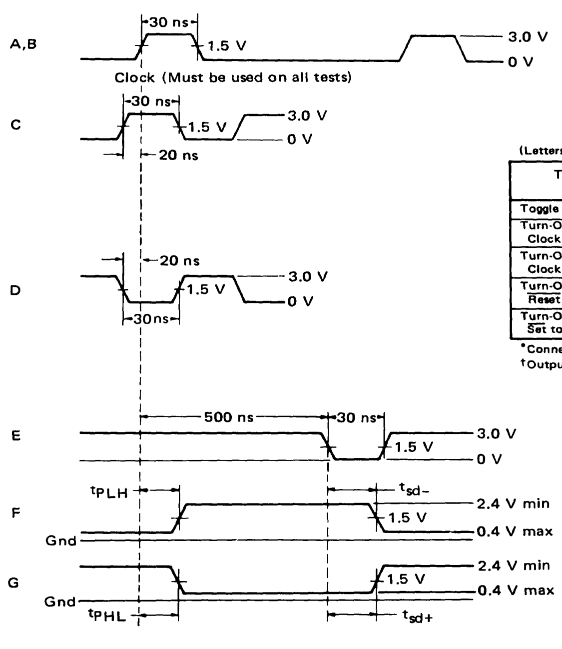
The direct $\overline{Set}$ and $\overline{Reset}$ inputs override the clock, and may be applied any time during the operating cycle.

SWITCHING TIME TEST CIRCUIT



C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

VOLTAGE WAVEFORMS AND DEFINITIONS



TEST PROCEDURES CHART

(Letters shown in test columns refer to waveforms)

TEST	SYMBOL	INPUT				Q	$\overline{Q}$	LIMITS		
		C	D	$\overline{R}$	$\overline{S}$			Min	Max	Unit
Toggle Frequency	f_{Tog}	A	*	2.4 V	2.4 V	†	†	20	–	MHz
Turn-On Delay Clock to Q	t_{PHL}	B	D	2.4 V	2.4 V	G	F	–	30	ns
Turn-Off Delay Clock to Q	t_{PLH}	B	C	2.4 V	2.4 V	F	G	–	30	ns
Turn-On Delay $\overline{Reset}$ to Q	t_{sd-}	B	C	5	2.4 V	G	F	–	25	ns
Turn-Off Delay $\overline{Set}$ to Q	t_{sd+}	B	D	2.4 V	5	F	G	–	25	ns

*Connect to $\overline{Q}$.

†Output shall toggle with each input pulse.

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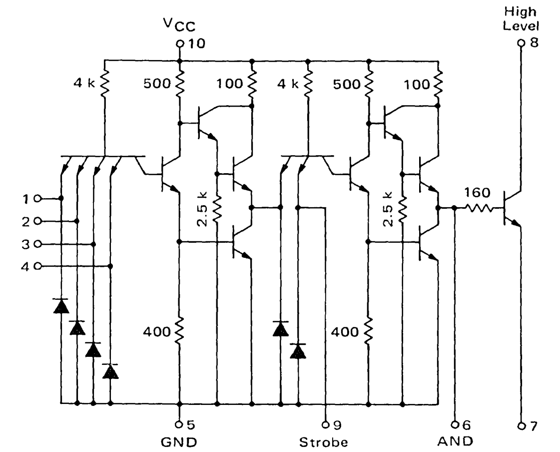
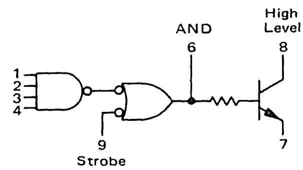
MCB54140F*

BEAM LEAD



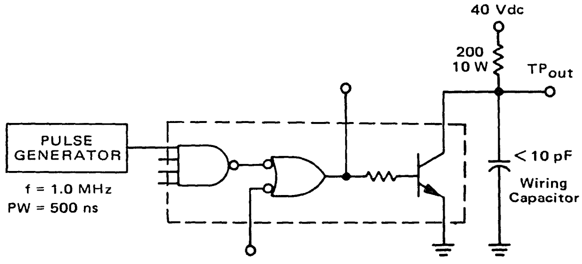
This device is a dual buffer element in a hybrid configuration with a high performance NPN silicon transistor similar to the 2N3253, to allow the output stage to operate to 40 volts with sink current capability of 250 mA. The device may also be used in conjunction with other saturated logic forms.

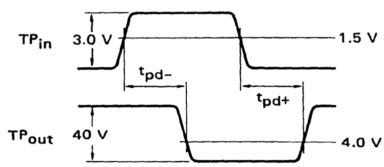


Positive Logic: $\overline{8} = 1 \cdot 2 \cdot 3 \cdot 4 + \overline{9}$
Negative Logic: $\overline{8} = (1 + 2 + 3 + 4)\overline{9}$

Total Power Dissipation = 20 mW typ/pkg
Propagation Delay Time = 70 ns typ

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS

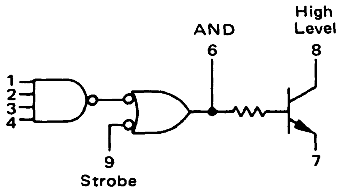




*F suffix = 1/4" x 1/4" ceramic package (Case 651).
See General Information section for package details.

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one input. The other inputs are tested in the same manner.



						TEST CURRENT/VOLTAGE VALUES (All Temperatures)														
						mA				Volts										
						I_{OL}	I_{OLB}	$I_{OLB\,1}$	I_{OHB}	V_{IL}	V_{IH}	V_{CEX}	V_R	$V_{th\,1}$	$V_{th\,0}$	V_{CC}	V_{CCL}	V_{CCH}	V_{max}	
						250	16	48	-0.4	0.4	2.4	40	4.5	2.0	0.80	5.0	4.5	5.5	8.0	
		Pin Under Test	MCB54140F -55 to +125°C			TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:														
Characteristic	Symbol		Min	Max	Unit	I_{OL}	I_{OLB}	$I_{OLB\,1}$	I_{OHB}	V_{IL}	V_{IH}	V_{CEX}	V_R	$V_{th\,1}$	$V_{th\,0}$	V_{CC}	V_{CCL}	V_{CCH}	V_{max}	Gnd
Output Voltage	V_{OL}	8	–	0.50	Vdc	8	–	–	6	–	–	–	–	1,2,3,4,9	–	–	10	–	–	5,7
		8	–	0.50	Vdc	8	–	–	6	–	–	–	–	–	1,2,3,4,9	–	10	–	–	5,7
	V_{OLB}	6	–	0.4	Vdc	–	–	6	–	–	–	–	–	–	1	–	10	–	–	5,7
	V_{OHB}	6	2.1	–	Vdc	–	–	–	6	–	–	–	–	1,2,3,4,9	–	–	10	–	–	5,7
		6	2.1	–	Vdc	–	–	–	6	–	–	–	–	–	1,2,3,4,9	–	10	–	–	5,7
Reverse Current	I_{R1}	1	–	40	μAdc	–	–	–	–	–	1	–	–	–	–	–	–	10	–	2,3,4;5,7
	I_{R2}	1	–	1.0	mAdc	–	–	–	–	–	–	–	–	–	–	–	–	1,10	–	2,3,4,5,7
Output Leakage Current	I_{CEX}	8	–	200	μAdc	–	6	–	–	–	–	8	–	–	1	–	10	–	–	5,7
Forward Current	I_F	1	–	-1.6	mAdc	–	–	–	–	1	–	–	2,3,4	–	–	–	–	10	–	5,7
Power Drain Current	I_{PDH}	10	–	40	mAdc	–	–	–	–	–	–	–	–	–	–	–	–	10	–	–
	I_{max}	10	–	20	mAdc	–	–	–	–	–	–	–	–	–	–	–	–	–	10	1,5,9
Switching Times						Pulse In		Pulse Out												
	t_{pd-}	1,8	–	160*	ns	1		8		–	–	–	–	–	–	10	–	–	–	5,7
	t_{pd+}	1,8	–	220*	ns	1		8		–	–	–	–	–	–	10	–	–	–	5,7

Pins not listed are left open.
*Tested only at 25°C

LINEAR
INTEGRATED CIRCUIT CHIPS

INDEX

6

STANDARD FEATURES for LINEAR INTEGRATED CIRCUIT CHIPS

(See MCC prefix data sheets for device specifications)

All linear integrated circuit chips . . . .

- are 100% electrically tested to sufficient parameter limits (min/max) to permit distinct identification as either premium or industrial versions
- employ phosphorsilicate passivation which protects the entire active surface area including metalization interconnects during shipping and handling
- are 100% visually inspected to the criteria of MIL-STD-883, Method 2010.1, Condition B
- incorporate a minimum of 4000 Å gold backing to insure positive adherence bonding.

FEATURES for BEAM LEAD CHIPS

(See MCBC prefix data sheets for device specifications)

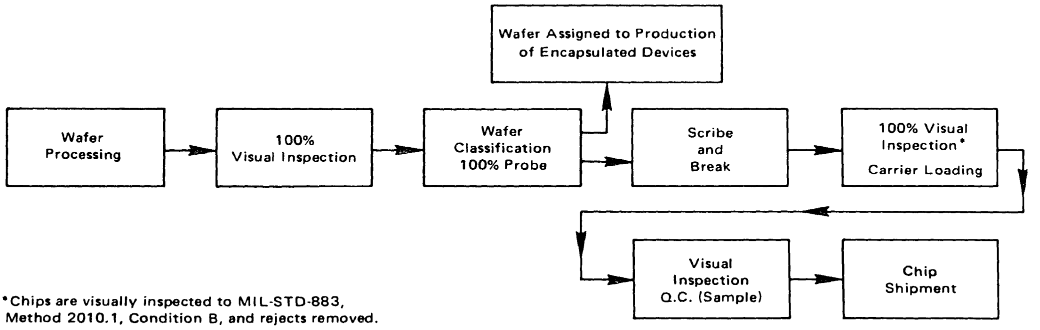
Beam lead linear integrated circuit chips . . . .

- are processed to the same criteria as the digital beam lead integrated circuits to insure the same reliability and performance features.

STANDARD CHIP PROCESSING

The industry-standard linear integrated circuits offered in Motorola's Microcircuit Components line are subjected to the same in-process controls as Motorola's standard encapsulated devices. The chip processing and quality control requirements are designed to insure reliability and performance of the finished product.

The processing and quality control flow chart shows that all wafer processing is completed prior to wafer assignment for subsequent encapsulation or special testing required for unencapsulated devices.



*Chips are visually inspected to MIL-STD-883, Method 2010.1, Condition B, and rejects removed.

NON-STANDARD CHIP PROCESSING

The industry standard unencapsulated integrated circuits are selected to meet a wide variety of application requirements. Nevertheless, there may be occasions when a designer can benefit from a non-standard device for a specific circuit requirement. To satisfy these requirements, almost any device from Motorola's extensive line of linear integrated circuits may be obtained on a specially negotiated basis. Although the electrical specifications of these chips are limited by certain test limitations, the customer may negotiate additional tests. Moreover, various chip technologies such as solder-bump and chrome-silver backing are available on a specially negotiated basis.

HANDLING PRECAUTIONS

Metalization interconnect passivation on all chips provides protection in shipping and handling. However, care should be exercised to prevent damaging the bonding pads. A vacuum pickup is useful for this purpose, tweezers are not recommended.

There are four basic requirements for handling devices in the customer's establishment:

1. Store devices in a covered or sealed container.
2. Store devices in an environment of no more than 30% relative humidity.
3. Process devices in a non-inert atomosphere not exceeding 100°, or in an inert atmosphere not exceeding 400°C.
4. Processing equipment should conform to the minimum standards of equipment normally employed by semiconductor manufacturers.

Motorola's engineering staff is available for consultation in the event of correlation or processing problems encountered in the use of Motorola semiconductor chips. For assistance of this nature, please contact your nearest Motorola sales representative.

STANDARD CARRIER PACKAGES

The non-spill type shipping carrier consists of a compartmentalized tray and fitted transparent cover. Each chip is placed in its compartment, geometry side up, so that incoming visual inspection may be performed prior to breaking the carrier seal. The shipping carrier is designed to:

- provide maximum device protection
- permit the customer to remove only a portion of the devices – the carrier can be resealed
- provide a storage container for the unused devices.

Additional package techniques are under development to facilitate handling, visual inspection and chip storage.

Various packaging and shipping options are available on a negotiated basis. For more information on these options, please contact your Motorola sales representative.

ORDERING INFORMATION

Standard linear chip components are stocked in packages of 10 and 100. When ordering, add –1 to the part number for quantities of 10 per package and a –2 to the part number for quantities of 100 per package.

Example: When ordering 250 MCC1709 chips, the most economical approach is to order two MCC1709–2 packages (two packages of 100 chips each) and five MCC1709–1 packages (five packages of 10 chips each). If it is desirable to have all the chips packaged in multiples of 10, then all 250 parts can be ordered as MCC1709–1.

RECOMMENDED INCOMING INSPECTION

Motorola certifies that the devices have been subjected to the visual criteria of MIL-STD-883, Method 2010.1, Condition B.

Should the lot fail the customer's incoming visual inspection, the entire lot, with the package seals intact, shall be returned to Motorola. Incoming visual inspection should be performed prior to breaking the package seals. In no case will Motorola accept a partial return of devices.

MCC1536
MCC1436

OPERATIONAL AMPLIFIERS

Advance Information

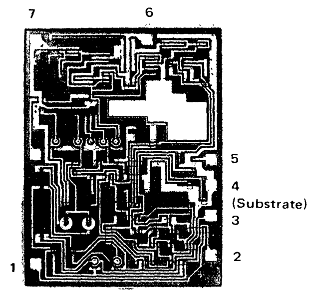
HIGH VOLTAGE, INTERNALLY COMPENSATED MONOLITHIC OPERATIONAL AMPLIFIER CHIP

. . . designed for use as a summing amplifier, integrator, or amplifier with operating characteristics as a function of the external feedback components.

The MCC1536 and MCC1436 employ phosphorsilicate passivation that protects the entire die surface area, including metalization interconnects. All dice have a minimum gold-backed thickness of 4000 Angstroms. The interconnecting metalization and bonding pads are of evaporated aluminum.

- Maximum Supply Voltage – ±40 Vdc
- Output Voltage Swing –
  $\pm 30\ V_{pk(min)}$ (V^+ = +36 V, V^- = -36 V)
  $\pm 22\ V_{pk(min)}$ (V^+ = +28 V, V^- = -28 V)
- Input Bias Current – 20 nA max
- Input Offset Current – 3.0 nA max
- Fast Slew Rate – 2.0 V/μs typ
- Internally Compensated
- Offset Voltage Null Capability
- Input Over-Voltage Protection
- A_{VOL} – 500,000 typ
- Characteristics Independent of Power Supply Voltages – (±5.0 Vdc to ±36 Vdc)

OPERATIONAL AMPLIFIER CHIP
MONOLITHIC SILICON
INTEGRATED CIRCUIT
EPITAXIAL PASSIVATED



MCC1536/MCC1436

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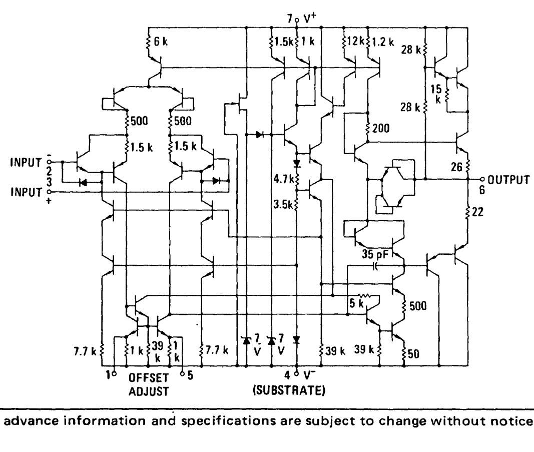
MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

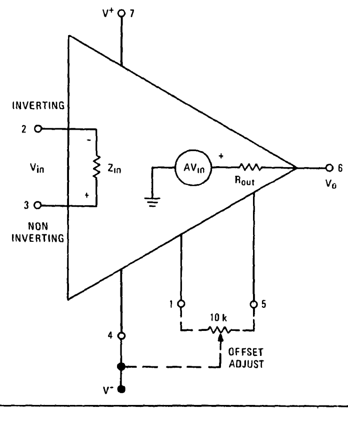
Rating	Symbol	MCC1536	MCC1436	Unit
Power Supply Voltage	V^+	+40	+34	Vdc
	V^-	-40	-34	
Differential Input Signal (1)	V_{in}	$\pm(V^+ + \lvert V^- \rvert - 3)$		Volts
Common-Mode Input Swing	CMV_{in}	$+V^+, -(\lvert V^- \rvert - 3)$		Volts
Output Short Circuit Duration ($V^+ = \lvert V^- \rvert$ = 28 Vdc, V_O = 0)	T_{SC}	5.0		s
Operating Temperature Range	T_A	-55 to +125		°C
Junction Temperature Range	T_{stg}	-65 to +150		°C

(1) The absolute voltage applied to either input terminal must not exceed $+V^+, -(\lvert V^- \rvert - 3)$

CIRCUIT SCHEMATIC



EQUIVALENT CIRCUIT



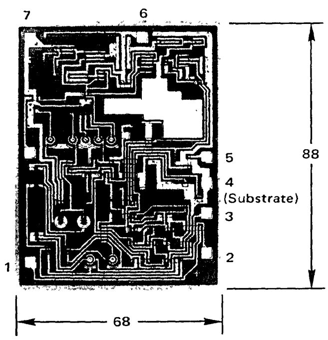
This is advance information and specifications are subject to change without notice.

ELECTRICAL CHARACTERISTICS (V^+ = +28 Vdc, V^- = −28 Vdc, T_A = +25°C unless otherwise noted)

Characteristics	Symbol	MCC1536 Min	MCC1536 Typ	MCC1536 Max	MCC1436 Min	MCC1436 Typ	MCC1436 Max	Unit
Input Bias Current	I_b	–	8.0	20	–	15	40	nAdc
Input Offset Current	I_{io}	–	1.0	3.0	–	5.0	10	nAdc
Input Offset Voltage	V_{io}	–	2.0	5.0	–	5.0	10	mVdc
Differential Input Impedance (Open-Loop, f ≤ 5.0 Hz)								
Parallel Input Resistance	R_p	–	10	–	–	10	–	Meg ohms
Parallel Input Capacitance	C_p	–	2.0	–	–	2.0	–	pF
Common-Mode Input Impedance (f ≤ 5.0 Hz)	$Z_{(in)}$	–	250	–	–	250		Meg ohms
Common-Mode Input Voltage Swing	CMV_{in}	–	±25	–	–	±25	–	V_{pk}
Common-Mode Rejection Ratio (dc)	CM_{rej}	–	110	–	–	110	–	dB
Large Signal dc Open Loop Voltage Gain	A_{VOL}							V/V
(V_o = ± 10 V, R_L = 100 k ohms)		100,000	500,000	–	70,000	500,000	–	
(V_o = ±10 V, R_L = 10 k ohms)		–	200,000	–	–	200,000	–	
Power Bandwidth (Voltage Follower) (A_V = 1, R_L = 5.0 k ohms, THD ≤ 5%, V_o = 40 Vp-p)	P_{BW}	–	23	–	–	23	–	kHz
Unity Gain Crossover Frequency (open-loop)		–	1.0	–	–	1.0	–	MHz
Phase Margin (open-loop, unity gain)		–	50	–	–	50	–	degrees
Gain Margin		–	18	–	–	18	–	dB
Slew Rate (Unity Gain)	dV_{out}/dt	–	2.0	–	–	2.0	–	V/μs
Output Impedance (f ≤ 5.0 Hz)	Z_{out}	–	1.0	–	–	1.0	–	k ohms
Short-Circuit Output Current	I_{SC}	–	±17	–	–	±17	–	mAdc
Output Voltage Swing (R_L = 5.0 k ohms)	V_o							V_{pk}
V^+ = +28 Vdc, V^- = −28 Vdc		±22	±23	–	±20	±22	–	
V^+ = +36 Vdc, V^- = −36 Vdc		±30	±32	–	–	–	–	
Power Supply Sensitivity (dc)								μV/V
V^- = constant, R_s ≤ 10 k ohms	S+	–	15	100	–	35	200	
V^+ = constant, R_s ≤ 10 k ohms	S−	–	15	100	–	35	200	
Power Supply Current	I_D+	–	2.2	4.0	–	2.6	5.0	mAdc
	I_D-	–	2.2	4.0	–	2.6	5.0	
DC Quiescent Power Dissipation (V_o = 0)	P_D	–	124	224	–	146	280	mW

See current MC1536/1436 data sheet for additional information.

MCC1536/MCC1436 BONDING DIAGRAM



All dimensions are nominal and in mils (10^{-3} inches).
Die Dimensions
Thickness = 8.0
Bonding Pads = 4.0 x 4.0

PACKAGING AND HANDLING

The MCC1536/MCC1436 operational amplifier is now available in die (chip) form. The phosphorsilicate passivation protects the metalization and active area of the die but care must be exercized when removing the dice from the shipping carrier to avoid scratching the bonding pads. A vacuum pickup is useful for the handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.

MCC1539
MCC1439

Advance Information

MONOLITHIC OPERATIONAL AMPLIFIER CHIP

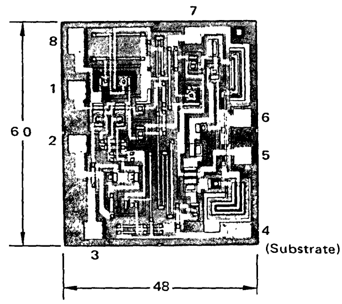
. . . designed for use as a summing amplifier, integrator, or amplifier with operating characteristics as a function of the external feedback components. For detailed information see Motorola Application Note AN-439.

The MCC1539 and MCC1439 employ phosphorsilicate passivation that protects the entire die surface area, including metalization interconnects. All dice have a minimum gold-backed thickness of 4000 Angstroms. The interconnecting metalization and bonding pads are of evaporated aluminum.

- Low Input Offset Voltage – 3.0 mV max
- Low Input Offset Current – 60 nA max
- Large Power-Bandwidth – 20 $V_{p\text{-}p}$ Output Swing at 20 kHz min
- Output Short-Circuit Protection
- Input Over-Voltage Protection
- Class AB Output for Excellent Linearity
- Slew Rate – 34 V/µs typ

OPERATIONAL AMPLIFIER CHIP INTEGRATED CIRCUIT

MONOLITHIC SILICON

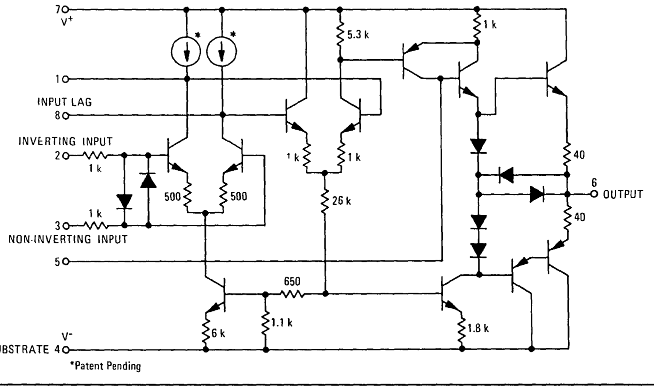


All dimensions are nominal and in mils (10^{-3} inches).
Die Dimensions
Thickness = 8.0
Bonding Pads = 4.0 x 4.0

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

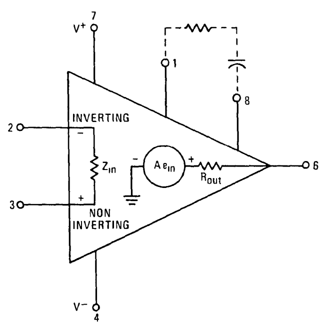
Rating	Symbol	Value	Unit
Power Supply Voltage	V^+ V^-	+18 -18	Vdc Vdc
Differential Input Signal	V_{in}	$\pm[V^+ + \|V^-\|]$	Vdc
Common Mode Input Swing	CMV_{in}	$+V^+, -\|V^-\|$	Vdc
Load Current	I_L	15	mA
Output Short Circuit Duration	t_S	Continuous	
Operating Temperature Range	T_A	-55 to +125	°C
Junction Temperature Range	T_J	-65 to +150	°C

FIGURE 1 – CIRCUIT SCHEMATIC



*Patent Pending

FIGURE 2 – EQUIVALENT CIRCUIT



This is advance information on a new introduction and specifications are subject to change without notice.

ELECTRICAL CHARACTERISTICS (V^+ = +15 Vdc, V^- = -15 Vdc, T_A = +25°C unless otherwise noted)

Characteristic	Symbol	MCC1539 Min	MCC1539 Typ	MCC1539 Max	MCC1439 Min	MCC1439 Typ	MCC1439 Max	Unit
Input Bias Current	I_b	–	0.20	0.50	–	0.20	1.0	µA
Input Offset Current	$\|I_{io}\|$	–	20	60	–	20	100	nA
Input Offset Voltage	$\|V_{io}\|$	–	1.0	3.0	–	2.0	7.5	mV
Average Temperature Coefficient of Input Offset Voltage (R_S = 50 Ω)	$\|TC_{Vio}\|$	–	3.0	–	–	3.0	–	µV/°C
Input Impedance	Z_{in}	–	300	–	–	300	–	kΩ
Input Common-Mode Voltage Swing	CMV_{in}	–	±12	–	–	±12	–	V_{pk}
Common Mode Rejection Ratio (f = 1.0 kHz)	CM_{rej}	–	110	–	–	110	–	dB
Open Loop Voltage Gain (V_o = ±10 V, R_L = 10 kΩ)	A_{VOL}	50,000	120,000	–	15,000	100,000	–	–
Power Bandwidth (A_v = 1, THD ≤ 5%, V_o = 20 Vp-p, R_L = 1.0 kΩ)	PBW	–	50	–	–	50	–	kHz
Step Response								
Gain = 1000, no overshoot,	t_f	–	130	–	–	130	–	ns
	t_{pd}	–	190	–	–	190	–	ns
	dV_{out}/dt	–	6.0	–	–	6.0	–	V/µs
Gain = 1000, 15% overshoot,	t_f	–	80	–	–	80	–	ns
	t_{pd}	–	100	–	–	100	–	ns
	dV_{out}/dt	–	14	–	–	14	–	V/µs
Gain = 100, no overshoot,	t_f	–	60	–	–	60	–	ns
	t_{pd}	–	100	–	–	100	–	ns
	dV_{out}/dt	–	34	–	–	34	–	V/µs
Gain = 10, 15% overshoot,	t_f	–	120	–	–	120	–	ns
	t_{pd}	–	80	–	–	80	–	ns
	dV_{out}/dt	–	6.25	–	–	6.25	–	V/µs
Gain = 1, 15% overshoot,	t_f	–	160	–	–	160	–	ns
	t_{pd}	–	80	–	–	80	–	ns
	dV_{out}/dt	–	4.2	–	–	4.2	–	V/µs
Output Impedance (f = 20 Hz)	Z_{out}	–	4.0	–	–	4.0	–	kΩ
Output Voltage Swing	V_{out}							V_{pk}
(R_L = 2.0 kΩ, f = 1.0 kHz)		–	–	–	±10	±13	–	
(R_L = 1.0 kΩ, f = 1.0 kHz)		±10	±13	–	–	–	–	
Positive Supply Sensitivity (V^- constant)	S^+	–	50	150	–	50	200	µV/V
Negative Supply Sensitivity (V^+ constant)	S^-	–	50	150	–	50	200	µV/V
Power Supply Current (V_o = 0)	I_{D+}	–	3.0	5.0	–	3.0	6.7	mAdc
	I_{D-}	–	3.0	5.0	–	3.0	6.7	
DC Quiescent Power Dissipation (V_o = 0)	P_D	–	90	150	–	90	200	mW

See current MC1539/1439 data sheet for additional information.

PACKAGING AND HANDLING

The MCC1539/MCC1439 operational amplifier is now available as a single monolithic die or encapsulated in the TO-99 and TO-116 hermetic and plastic packages. The phosphorsilicate passivation protects the metalization and active area of the die but care must be exercised when removing the dice from the shipping carrier to avoid scratching the bonding pads. A vacuum pickup is useful for handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.

MCC1558
MCC1458

OPERATIONAL AMPLIFIERS

Advance Information

DUAL MC1741
INTERNALLY COMPENSATED, HIGH PERFORMANCE MONOLITHIC OPERATIONAL AMPLIFIER CHIP

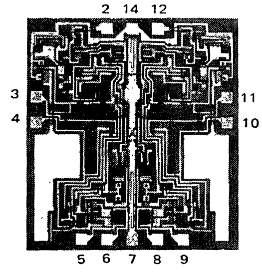
. . . designed for use as a summing amplifier, integrator, or amplifier with operating characteristics as a function of the external feedback components.

The MCC1558 and MCC1458 employ phosphorsilicate passivation that protects the entire die surface area, including metalization interconnects. All dice have a minimum gold-backed thickness of 4000 Angstroms. The interconnecting metalization and bonding pads are of evaporated aluminum.

- No Frequency Compensation Required
- Short-Circuit Protection
- Wide Common-Mode and Differential Voltage Ranges
- Low-Power Consumption
- No Latch Up

(DUAL MC1741)

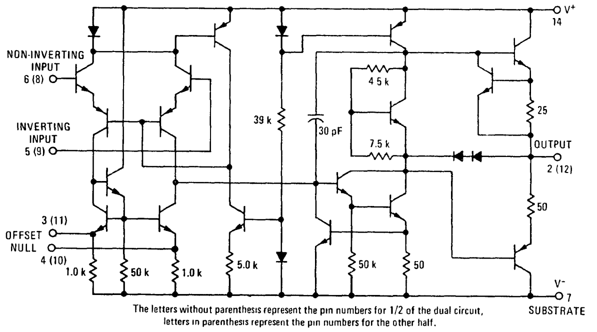
DUAL
OPERATIONAL AMPLIFIER CHIP
INTEGRATED CIRCUIT
MONOLITHIC SILICON



MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

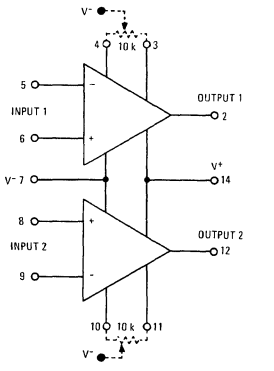
Rating	Symbol	MCC1558	MCC1458	Unit
Power Supply Voltage	V^+ V^-	+22 -22	+18 -18	Vdc
Differential Input Signal	V_{in}	±30		Volts
Common-Mode Input Swing	CMV_{in}	±15		Volts
Output Short Circuit Duration	t_S	Continuous		
Operating Temperature Range	T_A	-55 to +125		°C
Junction Temperature Range	T_J	-65 to +150		°C

FIGURE 1 – CIRCUIT SCHEMATIC



The letters without parenthesis represent the pin numbers for 1/2 of the dual circuit, letters in parenthesis represent the pin numbers for the other half.

FIGURE 2 – OFFSET ADJUST



This is advance information on a new introduction and specifications are subject to change without notice.

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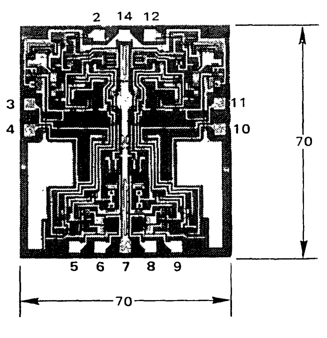
ELECTRICAL CHARACTERISTICS (V^+ = +15 Vdc, V^- = −15 Vdc, T_A = +25°C unless otherwise noted)

Characteristic	Symbol	MCC1558 Min	MCC1558 Typ	MCC1558 Max	MCC1458 Min	MCC1458 Typ	MCC1458 Max	Unit
Input Bias Current	I_b	–	0.2	0.5	–	0.2	0.5	μAdc
Input Offset Current	$\|I_{IO}\|$	–	0.03	0.2	–	0.03	0.2	μAdc
Input Offset Voltage ($R_S \leq$ 10 k ohms)	$\|V_{IO}\|$	–	1.0	5.0	–	2.0	6.0	mVdc
Differential Input Impedance (Open-Loop, f = 20 Hz)								
Parallel Input Resistance	R_p	–	1.0	–	–	1.0	–	Megohm
Parallel Input Capacitance	C_p	–	6.0	–	–	6.0	–	pF
Common-Mode Input Impedance (f = 20 Hz)	$Z_{(in)}$	–	200	–	–	200	–	Megohms
Common-Mode Input Voltage Swing	CMV_{in}	–	±13	–	–	±13	–	V_{pk}
Common-Mode Rejection Ratio (f = 100 Hz)	CM_{rej}	–	90	–	–	90	–	dB
Open-Loop Voltage Gain (V_o = ±10 V, R_L = 2.0 k ohms)	A_{VOL}	50,000	200,000	–	20,000	100,000	–	V/V
Power Bandwidth (A_V = 1, R_L = 2.0 k ohms, THD ≤ 5%, V_o = 20 $V_{p\text{-}p}$)	P_{BW}	–	14	–	–	14	–	kHz
Unity Gain Crossover Frequency (open-loop)		–	1.1	–	–	1.1	–	MHz
Phase Margin (open-loop, unity gain)		–	65	–	–	65	–	degrees
Gain Margin		–	11	–	–	11	–	dB
Slew Rate (Unity Gain)	dV_{out}/dt	–	0.8	–	–	0.8	–	V/μs
Output Impedance (f = 20 Hz)	Z_{out}	–	75	–	–	75	–	ohms
Short-Circuit Output Current	I_{SC}	–	20	–	–	20	–	mAdc
Output Voltage Swing (R_L = 10 k ohms)	V_o	±12	±14	–	±12	±14	–	V_{pk}
Power Supply Sensitivity								μV/V
V^- = constant, $R_s \leq$ 10 k ohms	S^+	–	30	150	–	30	150	
V^+ = constant, $R_s \leq$ 10 k ohms	S^-	–	30	150	–	30	150	
Power Supply Current	I_D^+	–	2.3	5.0	–	2.3	5.6	mAdc
	I_D^-	–	2.3	5.0	–	2.3	5.6	
DC Quiescent Power Dissipation (V_o = 0)	P_D	–	70	150	–	70	170	mW

See current MC1558/MC1458 data sheet for additional information

MCC1558/MCC1458 BONDING DIAGRAM



All dimensions are nominal and in mils (10^{-3} inches).
Die Dimensions
Thickness = 8.0
Bonding Pads = 4.0 x 4.0

PACKAGING AND HANDLING

The MCC1558/MCC1458 dual operational amplifiers are now available as a single monolithic die or encapsulated in a variety of hermetic and plastic packages. The phosphorsilicate passivation protects the metalization and active area of the die but care must be exercised when removing the dice from the shipping carrier to avoid scratching the bonding pads. A vacuum pickup is useful for the handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.

6

MCC1563
MCC1463

Advance Information

MONOLITHIC NEGATIVE VOLTAGE REGULATOR CHIP

The MCC1563/MCC1463 is a "three terminal" negative regulator designed to deliver continuous load current up to 500 mAdc and provide a maximum negative input voltage of -40 Vdc. Output current capability can be increased to greater than 10 Adc through use of one or more external transistors.

The MCC1563 and MCC1463 employ phosphorsilicate passivation that protects the entire die surface area, including metalization interconnects. All dice have a minimum gold-backed thickness of 4000 Angstroms. The interconnecting metalization and bonding pads are of evaporated aluminum.

- Electronic "Shutdown" and Short-Circuit Protection
- Low Output Impedance – 20 Milliohms typ
- Excellent Temperature Stability – $TCV_O = \pm 0.002\%/^{\circ}C$ typ
- High Ripple Rejection – 0.002% typ
- 500 mA Current Capability

NEGATIVE-POWER-SUPPLY VOLTAGE REGULATOR CHIP

MONOLITHIC SILICON INTEGRATED CIRCUIT

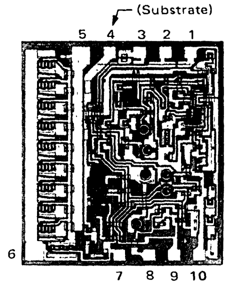


FIGURE 1 – TYPICAL CIRCUIT CONNECTION
$|-3.5| \le V_O \le |-37|$ Vdc, $1 \le I_L \le 500$ mA

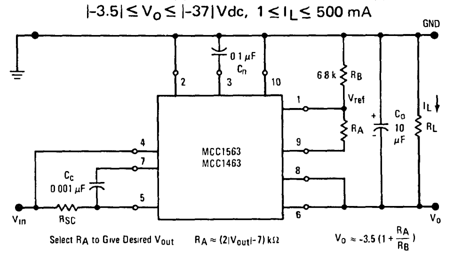


FIGURE 2 – TYPICAL NPN CURRENT BOOST CONNECTION
(V_O = -5.2 Vdc, I_L = 10 Adc [max])

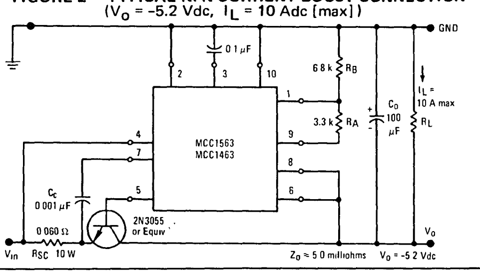
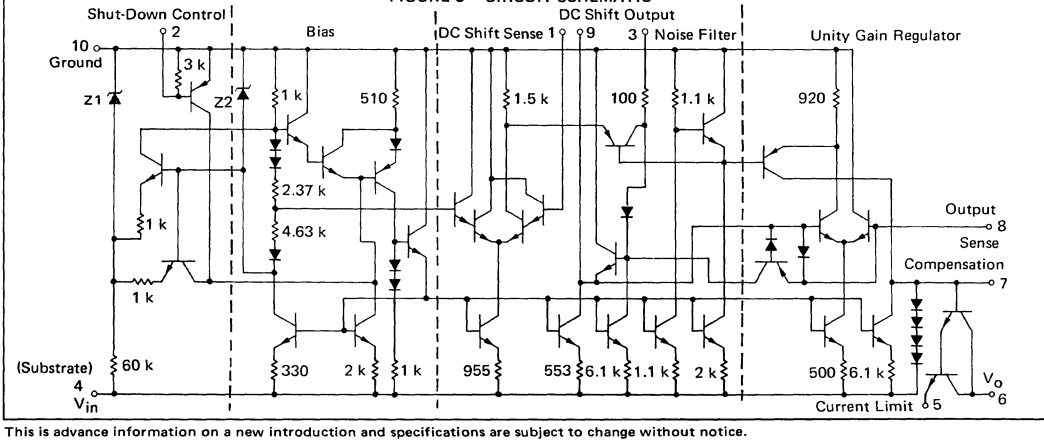


FIGURE 3 – CIRCUIT SCHEMATIC



This is advance information on a new introduction and specifications are subject to change without notice.

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

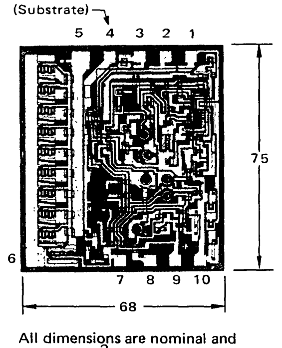
Rating	Symbol	MCC1563	MCC1463	Unit
Input Voltage	V_{in}	-40	-35	Vdc
Peak Load Current	I_L pk	600		mA
Current, Pin 2	$I_{pin\ 2}$	10		mA
Operating Temperature Range	T_A	-55 to +125		°C
Junction Temperature Range	T_J	-65 to +175		°C

ELECTRICAL CHARACTERISTICS (I_L = 100 mAdc, T_A = +25°C unless otherwise noted)

Characteristic	Symbol	MCC1563			MCC1463			Unit
		Min	Typ	Max	Min	Typ	Max	
Input Voltage	V_{in}	–	–	-40	–	–	-35	Vdc
Output Voltage Range	V_O	-3.6	–	-37	-3.8	–	-32	Vdc
Reference Voltage (Pin 1 to Ground)	V_{ref}	-3.4	-3.5	-3.6	-3.2	-3.5	-3.8	Vdc
Minimum Input-Output Voltage Differential (R_{SC} = 0)	$\lvert V_{in} - V_O \rvert$	–	1.5	2.7	–	1.5	3.0	Vdc
Bias Current (I_L = 1.0 mAdc, $I_b = I_{in} - I_L$)	I_b	–	7.0	11	–	7.0	14	mAdc
Output Noise (C_n = 0.1 μF, f = 10 Hz to 5.0 MHz)	v_n	–	120	–	–	120	–	μV(rms)
Temperature Coefficient of Output Voltage	TCV_O	–	±0.002	–	–	±0.002	–	%/°C
Input Regulation	Reg_{in}	–	0.002	–	–	0.003	–	%/V_O
Load Regulation (T_J = Constant [1.0 mA ≤ I_L ≤ 20 mA])	Reg_L	–	0.4	–	–	0.7	–	mV
Output Impedance (f = 1.0 kHz)	Z_O	–	20	–	–	35	–	milliohms
Shutdown Current (V_{in} = -35 Vdc)	I_{sd}	–	7.0	15	–	14	50	μAdc

See current MC1563/1463 data sheet for additional information.

MCC1563/MCC1463 BONDING DIAGRAM



All dimensions are nominal and in mils (10^{-3} inches).
Die Dimensions
Thickness = 8.0
Bonding Pads = 4.0 x 4.0

PACKAGING AND HANDLING

The MCC1563/MCC1463 voltage regulator is now available as a single monolithic die or encapsulated in the Case 602A and Case 614 hermetic packages. The phosphorsilicate passivation protects the metalization and active area of the die but care must be exercised when removing the dice from the shipping carrier to avoid scratching the bonding pads. A vacuum pickup is useful for the handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.

MCC1569
MCC1469

POSITIVE VOLTAGE REGULATORS

Advance Information

MONOLITHIC VOLTAGE REGULATOR CHIP

The MCC1569 and MCC1469 are positive voltage regulators designed to deliver continuous load current up to 500 mAdc. Output voltage is adjustable from 2.5 Vdc to 37 Vdc. Systems requiring both a positive and negative regulated voltage can use the MCC1569 and MCC1563 as complementary regulators with a common input ground.

The MCC1569 and MCC1469 employ phosphorsilicate passivation that protects the entire die surface area, including metalization interconnects. All dice have a minimum gold-backed thickness of 4000 Angstroms. The interconnecting metalization and bonding pads are of evaporated aluminum.

- Electronic "Shut-Down" Control
- Excellent Load Regulation (Low Output Impedance – 20 milliohms typ)
- High Power Capability: Up to 17.5 Watts
- Excellent Temperature Stability: ±0.002%/°C typ
- High Ripple Rejection: 0.002%/V typ

POSITIVE VOLTAGE REGULATOR CHIP INTEGRATED CIRCUIT

MONOLITHIC SILICON EPITAXIAL PASSIVATED

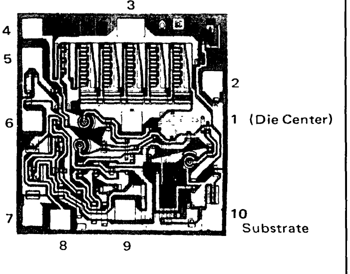
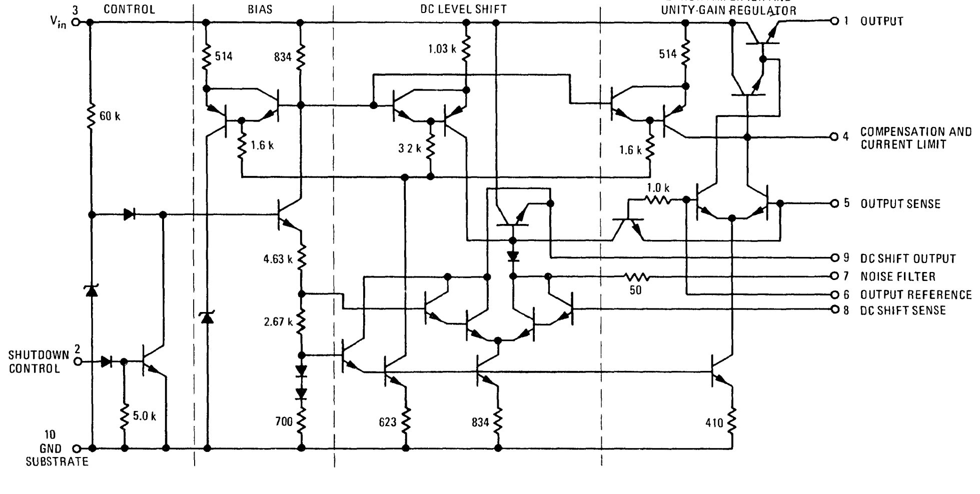


FIGURE 1 – CIRCUIT SCHEMATIC



This is advance information on a new introduction and specifications are subject to change without notice

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

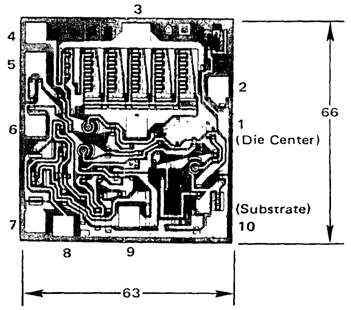
Rating	Symbol	MCC1569	MCC1469	Unit
Input Voltage	V_{in}	40	35	Vdc
Peak Load Current	I_{pk}	600		mA
Current, Pin 2 Current, Pin 9	$I_{pin\ 2}$ $I_{pin\ 9}$	10 5.0		mA
Operating Temperature Range	T_A	-55 to +125		°C
Junction Temperature Range	T_J	-65 to +150		°C

ELECTRICAL CHARACTERISTICS (T_A = +25°C unless otherwise noted)

Characteristic	Symbol	MCC1569			MCC1469			Unit
		Min	Typ	Max	Min	Typ	Max	
Input Voltage	V_{in}	–	–	40	–	–	35	Vdc
Output Voltage Range	V_O	2.5	–	37	2.5	–	32	Vdc
Reference Voltage (Pin 8 to Ground)	V_{ref}	3.4	3.5	3.6	3.2	3.5	3.8	Vdc
Minimum Input-Output Voltage Differential	$V_{in} - V_O$	–	2.1	2.7	–	2.1	3.0	Vdc
Bias Current (I_L = 1.0 mAdc, R_2 = 6.8 k ohms, $I_b = I_{in} - I_L$)	I_b	–	4.0	9.0	–	5.0	12	mAdc
Output Noise (C_n = 0.1 µF, f = 10 Hz to 5.0 MHz)	v_n	–	0.150	–	–	0.150	–	mV(rms)
Temperature Coefficient of Output Voltage	TCV_O	–	±0.002	–	–	±0.002	–	%/°C
Input Regulation	Reg_{in}	–	0.002	–	–	0.003	–	$\%/V_{in}$
Output Impedance (C_c = 0.001 µF, R_{SC} = 1.0 ohm, f = 1.0 kHz, V_{in} = +14 Vdc, V_O = +10 Vdc)	Z_{out}	–	20	–	–	35	–	milliohms
Shutdown Current (V_{in} = +35 Vdc)	I_{sd}	–	70	150	–	140	500	µAdc

See current MC1569/1469 data sheet for additional information.

MCC1569/MCC1469 BONDING DIAGRAM



All dimensions are nominal and in mils (10^{-3} inches).
Die Dimensions
Thickness = 8.0
Bonding Pads = 4.0 x 4.0

PACKAGING AND HANDLING

The MCC1569/MCC1469 voltage regulator is now available as a single monolithic die or encapsulated in the Case 602A and Case 614 hermetic packages. The phosphorsilicate passivation protects the metalization and active area of the die but care must be exercised when removing the dice from the shipping carrier to avoid scratching the bonding pads. A vacuum pickup is useful for the handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.

6

MCC1595
MCC1495

Advance Information

MONOLITHIC FOUR-QUADRANT MULTIPLIER CHIP

. . . designed for uses where the output voltage is a linear product of two input voltages. Typical applications include: multiply, divide*, square root*, mean square*, phase detector, frequency doubler, balanced modulator/demodulator, electronic gain control.

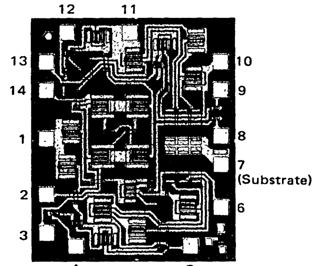
The MCC1595 and MCC1495 employ phosphorsilicate passivation that protects the entire die surface area, including metalization interconnects. All dice have a minimum gold-backed thickness of 4000 Angstroms. The interconnecting metalization and bonding pads are of evaporated aluminum.

*When used with an operational amplifier.

- Excellent Linearity – 0.5% typ Error on X-Input, 1% typ Error on Y-Input – MCC1595
- Excellent Linearity – 1% typ Error on X-Input, 2% typ Error on Y-Input – MCC1495
- Adjustable Scale Factor, K
- Excellent Temperature Stability
- Wide Input Voltage Range – ± 10 Volts

LINEAR FOUR-QUADRANT MULTIPLIER CHIP INTEGRATED CIRCUIT

MONOLITHIC SILICON EPITAXIAL PASSIVATED

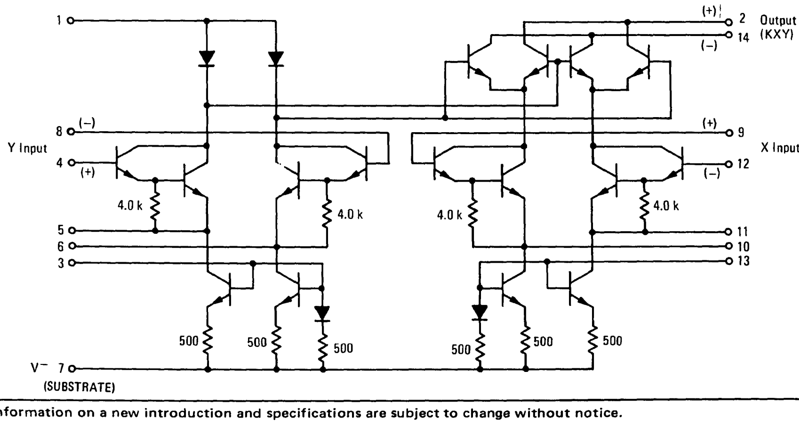


MCC1595/MCC1495 Die

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Applied Voltage (V_2-V_1, $V_{14}-V_1$, V_1-V_9, V_1-V_{12}, V_1-V_4, V_1-V_8, $V_{12}-V_7$, V_9-V_7, V_8-V_7, V_4-V_7)	ΔV	30	Vdc
Differential Input Signal	$V_{12}-V_9$ V_4-V_8	$\pm(6+I_{13}R_X)$ $\pm(6+I_3R_Y)$	Vdc Vdc
Maximum Bias Current	I_3 I_{13}	10 10	mA
Operating Temperature Range	T_A	-55 to +125	°C
Junction Temperature Range	T_J	-65 to +150	°C

CIRCUIT SCHEMATIC



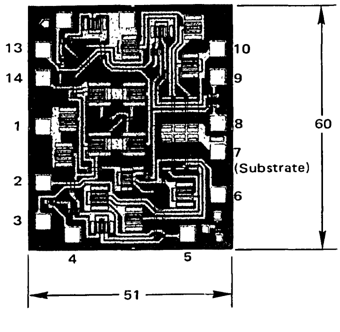
This is advance information on a new introduction and specifications are subject to change without notice.

ELECTRICAL CHARACTERISTICS ($V^+ = +32$ V, $V^- = -15$ V, $T_A = 25^oC$, $I_3 = I_{13} = 1$ mA, $R_X = R_Y = 15$ kΩ, $R_L = 11$ kΩ unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
Linearity: Output Error in Percent of Full Scale: $-10 < V_X < +10$ ($V_Y = \pm10$ V)	MCC1495 MCC1595	E_{RX}	– –	1.0 0.5	– –	%
$-10 < V_Y < +10$ ($V_X = \pm10$ V)	MCC1495 MCC1595	E_{RY}	– –	2.0 1.0	– –	
Squaring Mode Error: Accuracy in Percent of Full Scale After Offset and Scale Factor Adjustment	MCC1495 MCC1595	E_{SQ}	– –	0.75 0.5	– –	%
Scale Factor (Adjustable) $(K = \frac{2R_L}{I_3 R_X R_Y})$		K	–	0.1	–	–
Input Resistance (f = 20 Hz)	MCC1495 MCC1595	R_{INX}	– –	20 35	– –	Megohms
	MCC1495 MCC1595	R_{INY}	– –	20 35	– –	
Differential Output Resistance (f = 20 Hz)		R_o	–	300	–	k Ohms
Input Bias Current $I_{bx} = \frac{(I_9 + I_{12})}{2}$, $I_{by} = \frac{(I_4 + I_8)}{2}$	MCC1495 MCC1595	I_{bx}	– –	2.0 2.0	12 8.0	µA
	MCC1495 MCC1595	I_{by}	– –	2.0 2.0	12 8.0	
Input Offset Current $\lvert I_9 - I_{12}\rvert$	MCC1495 MCC1595	$\lvert I_{iox}\rvert$	– –	0.4 0.2	2.0 1.0	µA
$\lvert I_4 - I_8\rvert$	MCC1495 MCC1595	$\lvert I_{ioy}\rvert$	– –	0.4 0.2	2.0 1.0	
Output Offset Current $\lvert I_{14} - I_2\rvert$	MCC1495 MCC1595	$\lvert I_{oo}\rvert$	– –	20 10	100 50	µA
Frequency Response 3.0 dB Bandwidth 3° Relative Phase Shift Between V_X and V_Y 1% Absolute Error Due to Input-Output Phase Shift		BW_{3dB} f_ϕ f_θ	– – –	3.0 750 30	– – –	MHz kHz kHz
Common Mode Input Swing (Either input)	MCC1495 MCC1595	CMV	– –	±12 ±13	– –	Vdc
Common Mode Quiescent Output Voltage		V_{o1} V_{o2}	– –	21 21	– –	Vdc
Differential Output Voltage Swing Capability		V_{out}	–	±14	–	V_{peak}
Power Supply Sensitivity		S^+ S^-	– –	5.0 10	– –	mV/V
Power Supply Current		I_7	–	6.0	7.0	mA
DC Power Dissipation		P_D	–	135	170	mW

See current MC1595/1495 data sheet for additional information.

MCC1595/MCC1495 BONDING DIAGRAM



PACKAGING AND HANDLING

The MCC1595/MCC1495 is the Four-Quadrant Multiplier now available in die (chip) form. The phosphorsilicate passivation protects the metalization and active area of the die but care must be exercized when removing the dice from the shopping carrier to avoid scratching the bonding pads. A vacuum pickup is useful for the handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.

All dimensions are nominal and in mils (10^{-3} inches).
Die Dimensions
Thickness = 8.0
Bonding Pads = 4.0 x 4.0

6

MCC1709
MCC1709C

OPERATIONAL AMPLIFIERS

Advance Information

MONOLITHIC OPERATIONAL AMPLIFIER CHIP

. . . designed for use as a summing amplifier, integrator, or amplifier with operating characteristics as a function of the external feedback components.

The MCC1709 and MCC1709C employ phosphorsilicate passivation that protects the entire die surface area, including metalization interconnects. All dice have a minimum gold-backed thickness of 4000 Angstroms. The interconnecting metalization and bonding pads are of evaporated aluminum.

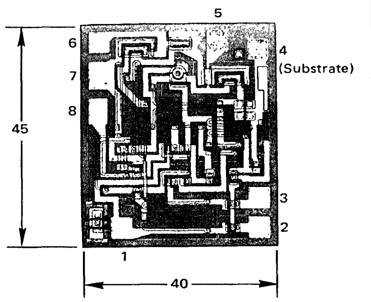
- High-Performance Open Loop Gain Characteristics
  A_{VOL} = 45,000 typical
- Low Temperature Drift – ±3.0 μV/^{o}C
- Large Output Voltage Swing – ±14 V typical @ ±15 V Supply
- Low Output Impedance – Z_{out} = 150 ohms typical

OPERATIONAL AMPLIFIER CHIP
INTEGRATED CIRCUIT
MONOLITHIC SILICON

MAXIMUM RATINGS (T_A = +25^{o}C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+ V^-	+18 -18	Vdc
Differential Input Signal	V_{in}	±5.0	Volts
Common Mode Input Swing	CMV_{in}	$\pm V^+$	Volts
Load Current	I_L	10	mA
Output Short Circuit Duration	t_S	5.0	s
Operating Temperature Range	T_A	-55 to +125	^{o}C
Junction Temperature Range	T_J	-55 to +150	^{o}C

OUTLINE DIMENSIONS and BONDING DIAGRAM



All dimensions are nominal and in mils (10^{-3} inches).
Die Dimensions
Thickness = 8.0
Bonding Pads = 4.0 x 4.0

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FIGURE 1 – CIRCUIT SCHEMATIC

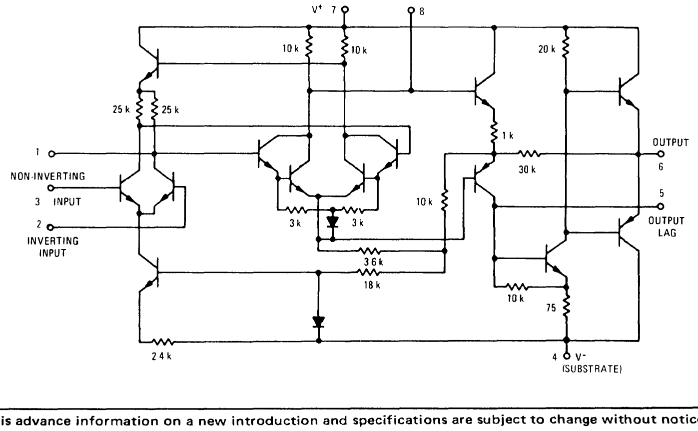
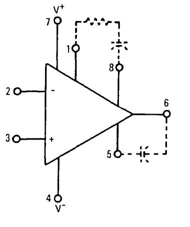


FIGURE 2 – EQUIVALENT CIRCUIT



This is advance information on a new introduction and specifications are subject to change without notice.

ELECTRICAL CHARACTERISTICS (V^+ = +15 Vdc, V^- = -15 Vdc, T_A = +25°C unless otherwise noted)

Characteristic	Symbol	MCC1709 Min	MCC1709 Typ	MCC1709 Max	MCC1709C Min	MCC1709C Typ	MCC1709C Max	Unit
Open Loop Voltage Gain (V_O = ±10 V)	A_{VOL}	25,000	45,000	70,000	15,000	45,000	–	–
Output Impedance (f = 20 Hz)	Z_{out}	–	150	–	–	150	–	Ω
Input Impedance (f = 20 Hz)	Z_{in}	–	400	–	–	250	–	kΩ
Output Voltage Swing (R_L = 10 kΩ)	V_O	±12	±14	–	±12	±14	–	V_{peak}
(R_L = 2.0 kΩ)		±10	±13	–	±10	±13	–	
Input Common-Mode Voltage Swing	CMV_{in}	–	±10	–	–	±10	–	V_{peak}
Common-Mode Rejection Ratio (f = 20 Hz)	CM_{rej}	–	90	–	–	90	–	dB
Input Bias Current	I_b	–	0.2	0.5	–	0.3	1.5	μA
Input Offset Current	$\|I_{io}\|$	–	0.05	0.2	–	0.1	0.5	μA
Input Offset Voltage	$\|V_{io}\|$	–	1.0	5.0	–	2.0	7.5	mV
Step Response								
Gain = 100, 5.0% overshoot	t_f	–	0.8	–	–	0.8	–	μs
	t_{pd}	–	0.38	–	–	0.38	–	μs
	dV_{out}/dt	–	12	–	–	12	–	V/μs
Gain = 10, 10% overshoot	t_f	–	0.6	–	–	0.6	–	μs
	t_{pd}	–	0.34	–	–	0.34	–	μs
	dV_{out}/dt	–	1.7	–	–	1.7	–	V/μs
Gain = 1, 5.0% overshoot	t_f	–	2.2	–	–	2.2	–	μs
	t_{pd}	–	1.3	–	–	1.3	–	μs
	dV_{out}/dt	–	0.25	–	–	0.25	–	V/μs
Power Supply Current	I_D^+	–	2.7	5.5	–	2.7	6.7	mAdc
	I_D^-	–	2.7	5.5	–	2.7	6.7	
DC Quiescent Power Dissipation (Power Supply = ±15 V, V_O = 0)	P_D	–	80	165	–	80	200	mW
Positive Supply Sensitivity (V^- constant)	S^+	–	25	150	–	25	200	μV/V
Negative Supply Sensitivity (V^+ constant)	S^-	–	25	150	–	25	200	μV/V

See current MC1709/1709C data sheet for additional information

PACKAGING AND HANDLING

The MCC1709/MCC1709C operational amplifier is now available as a single monolithic die or encapsulated in a variety of hermetic and plastic packages. The phosphorsilicate passivation protects the metalization and active area of the die but care must be exercised when removing the dice from the shipping carrier to avoid scratching the bonding pads. A vacuum pickup is useful for handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.

6

MCC1710
MCC1710C

DIFFERENTIAL COMPARATORS

Advance Information

MONOLITHIC DIFFERENTIAL VOLTAGE COMPARATOR CHIP

. . . designed for use in level detection, low-level sensing, and memory applications.

The MCC1710 and MCC1710C employ phosphorsilicate passivation that protects the entire die surface area, including metalization interconnects. All dice have a minimum gold-backed thickness of 4000 Angstroms. The interconnecting metalization and bonding pads are of evaporated aluminum.

- Differential Input Characteristics –
  Input Offset Voltage = 1.0 mV
  Offset Voltage Drift = 3.0 μV/°C
- Fast Response Time – 40 ns
- Output Compatible With All Saturating Logic Forms –
  V_{out} = +3.2 V to -0.5 V typical
- Low Output Impedance – 200 ohms

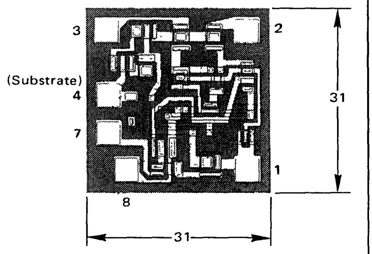
MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+ V^-	+14 -7.0	Vdc
Differential Input Signal	V_{in}	±5.0	Volts
Common Mode Input Swing	CMV_{in}	±7.0	Volts
Peak Load Current	I_L	10	mA
Operating Temperature Range	T_A	-55 to +125	°C
Junction Temperature Range	T_J	-65 to +150	°C

DIFFERENTIAL COMPARATOR CHIP INTEGRATED CIRCUIT

MONOLITHIC SILICON EPITAXIAL PASSIVATED

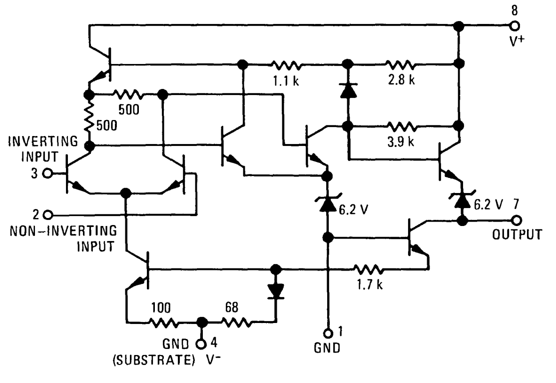
OUTLINE DIMENSIONS and BONDING DIAGRAM



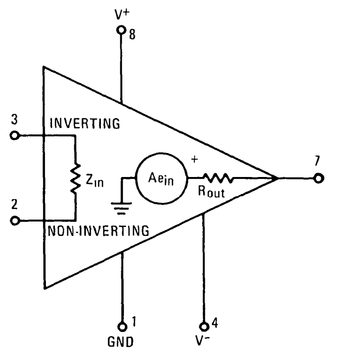
All dimensions are nominal and in mils (10^{-3} inches).
Die Dimensions
Thickness = 8.0
Bonding Pads = 4.0 x 4.0

6

CIRCUIT SCHEMATIC



EQUIVALENT CIRCUIT



This is advance information on a new introduction and specifications are subject to change without notice.

ELECTRICAL CHARACTERISTICS ($V^+ = +12$ Vdc, $V^- = -6.0$ Vdc, $T_A = 25^oC$ unless otherwise noted)

Characteristic	Symbol	MCC1710 Min	MCC1710 Typ	MCC1710 Max	MCC1710C Min	MCC1710C Typ	MCC1710C Max	Unit
Input Offset Voltage (V_O = 1.4 Vdc)	V_{io}	–	1.0	2.0	–	1.5	5.0	mVdc
Input Bias Current (V_O = 1.4 Vdc)	I_b	–	12	20	–	15	25	μAdc
Output Resistance	R_{out}	–	200	–	–	200	–	Ohms
Positive Output Voltage ($V_{in} \geq 5.0$ mV, $0 \leqq I_o \leqq 5.0$ mA)	V_{OH}	2.5	3.2	4.0	2.5	3.2	4.0	Vdc
Negative Output Voltage ($V_{in} \geqq -5.0$ mV)	V_{OL}	-1.0	-0.5	0	-1.0	-0.5	0	Vdc
Output Sink Current ($V_{in} \geqq -5.0$ mV, $V_{out} \geqq 0$)	I_s	2.0	2.5	–	2.0	2.5	–	mAdc
Common Mode Rejection Ratio ($V^- = -7.0$ Vdc, $R_S \leqq 200\ \Omega$)	CM_{rej}	–	100	–	–	100	–	dB
Propagation Delay Time For Positive and Negative Going Input Pulse	t_{pd}	–	40	–	–	40	–	ns
Power Supply Current	I_D^+	–	6.4	9.0	–	6.4	9.0	mAdc
($V_{out} \leqq 0$ Vdc)	I_D^-	–	5.5	7.0	–	5.5	7.0	
DC Quiescent Power Dissipation	P_D	–	115	150	–	110	150	mW

See current MC1710/1710C data sheet for additional information

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PACKAGING AND HANDLING

The MCC1710/MCC1710C differential comparator is now available as a single monolithic die or encapsulated in the TO-91, TO-99, and TO-116 hermetic packages. The phosphorsilicate passivation protects the metalization and active area of the die but care must be exercised when removing the dice from the shipping carrier to avoid scratching the bonding pads. A vacuum pickup is useful for handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.

MCC1711
MCC1711C

DIFFERENTIAL COMPARATORS

Advance Information

MONOLITHIC DUAL DIFFERENTIAL VOLTAGE COMPARATOR CHIP

. . . designed for use in level detection, low-level sensing, and memory applications.

The MCC1711 and MCC1711C employ phosphorsilicate passivation that protects the entire die surface area, including metalization interconnects. All dice have a minimum gold-backed thickness of 4000 Angstroms. The interconnecting metalization and bonding pads are of evaporated aluminum.

- Differential Input –
  Input Offset Voltage = 1.0 mV
  Offset Voltage Drift = 5.0 μV/°C
- Fast Response Time – 40 ns
- Output Compatible with All Saturating Logic Forms –
  V_{out} = +4.5 V to -0.5 V Typical
- Low Output Impedance – 200 Ohms

DUAL DIFFERENTIAL COMPARATOR CHIP INTEGRATED CIRCUIT

MONOLITHIC SILICON EPITAXIAL PASSIVATED

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+	+14	Vdc
	V^-	-7.0	Vdc
Differential Input Signal	V_{in}	±5.0	Volts
Common Mode Input Swing	CMV_{in}	±7.0	Volts
Peak Load Current	I_L	50	mA
Operating Temperature Range	T_A	-55 to +125	°C
Junction Temperature Range	T_J	-65 to +150	°C

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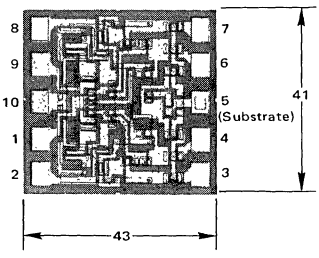
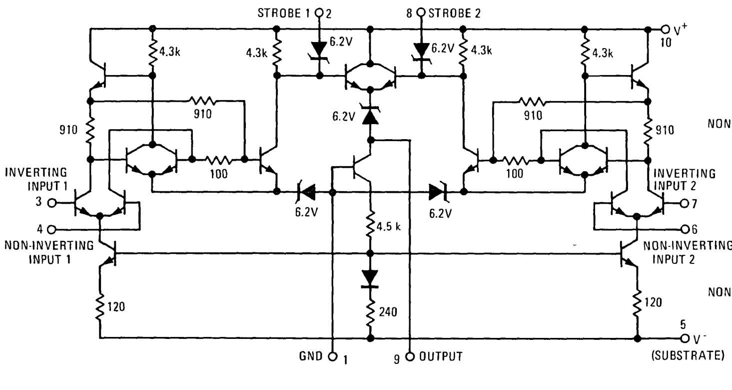
OUTLINE DIMENSIONS and BONDING DIAGRAM

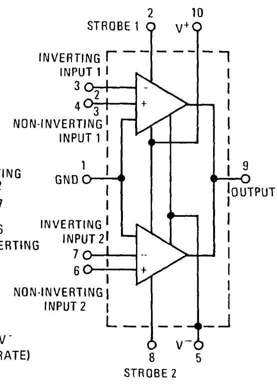


All dimensions are nominal and in mils (10^{-3} inches).
Die Dimensions
Thickness = 8.0
Bonding Pads = 4.0 x 4.0

CIRCUIT SCHEMATIC



EQUIVALENT CIRCUIT



This is advance information on a new introduction and specifications are subject to change without notice.

ELECTRICAL CHARACTERISTICS (each comparator) (V^+ = +12 Vdc, V^- = -6.0 Vdc, T_A = 25°C unless otherwise noted)

Characteristic	Symbol	MCC1711 Min	MCC1711 Typ	MCC1711 Max	MCC1711C Min	MCC1711C Typ	MCC1711C Max	Unit
Input Offset Voltage (V_O = 1.4 Vdc)	V_{io}	–	1.0	3.5	–	1.0	5.0	mVdc
Input Bias Current (V_O = 1.4 Vdc)	I_b	–	25	75	–	25	100	µAdc
Output Resistance	R_{out}	–	200	–	–	200	–	Ohms
Positive Output Voltage ($V_{in} \geqq 10$ mVdc, $0 \leqq I_O \leqq 5.0$ mA)	V_{OH}	2.5	3.2	5.0	2.5	3.2	5.0	Vdc
Negative Output Voltage ($V_{in} \geqq -10$ mVdc)	V_{OL}	-1.0	-0.5	0	-1.0	-0.5	0	Vdc
Strobed Output Level ($V_{strobe} \leqq 0.3$ Vdc)	$V_{OL(st)}$	-1.0	–	0	-1.0	–	0	Vdc
Output Sink Current ($V_{in} \geqq -10$ mV, $V_O \geqq 0$)	I_S	0.5	0.8	–	0.5	0.8	–	mAdc
Strobe Current (V_{strobe} = 100 mVdc)	I_{st}	–	1.2	2.5	–	1.2	2.5	mAdc
Response Time (V_b = 5.0 mV + V_{io})	t_R	–	40	–	–	40	–	ns
Strobe Release Time	t_{SR}	–	12	–	–	12	–	ns
Power Supply Current ($V_O \leqq 0$ Vdc)	I_D^+	–	8.6	–	–	8.6	–	mAdc
	I_D^-	–	3.9	–	–	3.9	–	
Power Consumption		–	130	200	–	130	200	mW

See current MC1711/1711C data sheet for additional information.

6

PACKAGING AND HANDLING

The MCC1711/MCC1711C dual differential comparator is now available as a single monolithic die or encapsulated in the TO-91, TO-100, and TO-116 hermetic packages. The phosphorsilicate passivation protects the metalization and active area of the die but care must be exercised when removing the dice from the shipping carrier to avoid scratching the bonding pads. A vacuum pickup is useful for handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.

MCC1723
MCC1723C

Advance Information

MONOLITHIC VOLTAGE REGULATOR CHIP

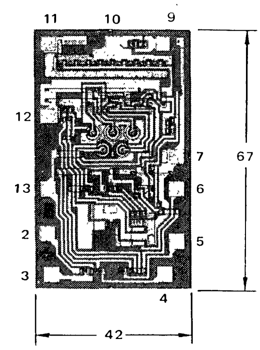
The MCC1723/MCC1723C is a positive or negative voltage regulator designed to deliver load current to 150 mAdc. Output current capability can be increased to several amperes through use of one or more external pass transistors.

The MCC1723 and MCC1723C employ phosphorsilicate passivation that protects the entire die surface area, including metalization interconnects. All dice have a minimum gold-backed thickness of 4000 Angstroms. The interconnecting metalization and bonding pads are of evaporated aluminum.

- Output Voltage Adjustable from 2 Vdc to 37 Vdc
- Output Current to 150 mAdc Without External Pass Transistors
- 0.01% Line Regulation
- Adjustable Short-Circuit Protection

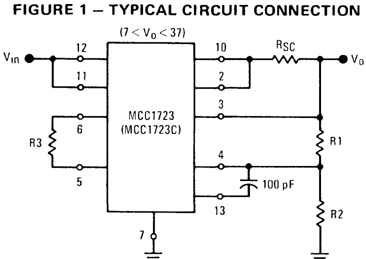
VOLTAGE REGULATOR CHIP

MONOLITHIC SILICON EPITAXIAL PASSIVATED INTEGRATED CIRCUIT



All dimensions are nominal and in mils (10^{-3} inches).
Die Dimensions
Thickness = 8.0
Bonding Pads = 4.0 x 4.0

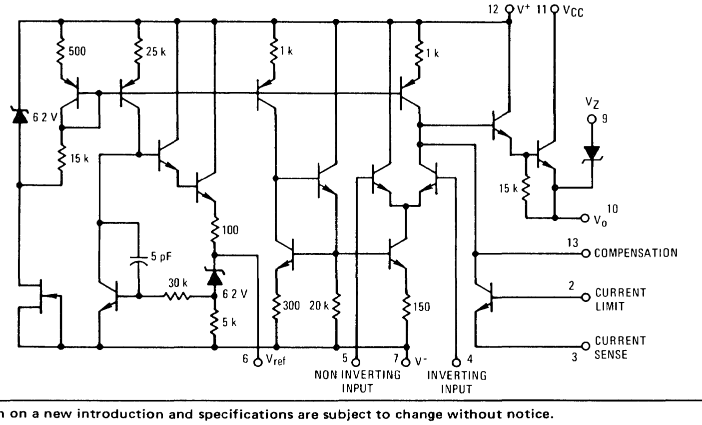
FIGURE 1 – TYPICAL CIRCUIT CONNECTION



$V_o \cong 7\left(\frac{R1+R2}{R2}\right)$ $I_{SC} = \frac{V_{sense}}{R_{SC}} = \frac{0.66}{R_{SC}}$ at $T_J = 25^\circ C$

For best results 10 k < R2 < 100 k
For minimum drift R3 = R1||R2

FIGURE 2 – CIRCUIT SCHEMATIC



This is advance information on a new introduction and specifications are subject to change without notice.

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Pulse Voltage from V^+ to V^- (50 ms) MCC1723	$V_{in(p)}$	50	V_{peak}
Continuous Voltage from V^+ to V^-	V_{in}	40	Vdc
Input-Output Voltage Differential	$V_{in}-V_o$	40	Vdc
Maximum Output Current	I_L	150	mAdc
Current from V_{ref}	I_{ref}	15	mAdc
Operating Temperature Range	T_A	-55 to +125	°C
Junction Temperature Range	T_J	-65 to +150	°C

ELECTRICAL CHARACTERISTICS (Unless otherwise noted: T_A = +25°C, V_{in} = 12 Vdc, V_o = 5 Vdc, I_L = 1 mAdc, R_{SC} = 0, C1 = 100 pF, C_{ref} = 0 and divider impedance as seen by the error amplifier ≤ 10 kΩ connected as shown in Figure 1)

		MCC1723			MCC1723C			
Characteristic	Symbol	Min	Typ	Max	Min	Typ	Max	Unit
Input Voltage Range	V_{in}	9.5	–	40	9.5	–	40	Vdc
Output Voltage Range	V_o	2.0	–	37	2.0	–	37	Vdc
Input-Output Voltage Differential	$V_{in}-V_o$	3.0	–	38	3.0	–	38	Vdc
Reference Voltage	V_{ref}	6.95	7.15	7.35	6.80	7.15	7.50	Vdc
Standby Current Drain (I_L = 0, V_{in} = 30 V)	I_{sb}	–	2.3	3.5	–	2.3	4.0	mAdc
Output Noise Voltage (f = 100 Hz to 10 kHz)	V_n							μV(rms)
C_{ref} = 0		–	20	–	–	20	–	
C_{ref} = 5.0 μF		–	2.5	–	–	2.5	–	
Line Regulation	Reg_{in}							% V_o
(12 V < V_{in} < 15 V)		–	0.01	0.1	–	0.01	0.1	
(12 V < V_{in} < 40 V)		–	0.02	0.2	–	0.1	0.5	
Load Regulation (1.0 mA < I_L < 50 mA)	Reg_{load}		0.03	0.15	–	0.03	0.2	% V_o
Ripple Rejection (f = 50 Hz to 10 kHz)	Rej_R							dB
C_{ref} = 0		–	74	–	–	74	–	
C_{ref} = 5.0 μF		–	86	–	–	86	–	
Short Circuit Current Limit (R_{SC} = 10 Ω, V_o = 0)	I_{SC}	–	65	–	–	65	–	mAdc

See current MC1723/1723C data sheet for additional information.

PACKAGING AND HANDLING

The MCC1723/MCC1723C voltage regulator is now available as a single monolithic die or encapsulated in the Motorola Case 603-03 hermetic package. The phosphorsilicate passivation protects the metalization and active area of the die but care must be exercised when removing the dice from the shipping carrier to avoid scratching the bonding pads. A vacuum pickup is useful for handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.

MCC1741
MCC1741C

OPERATIONAL AMPLIFIERS

Advance Information

INTERNALLY COMPENSATED, HIGH PERFORMANCE MONOLITHIC OPERATIONAL AMPLIFIER CHIP

. . . designed for use as a summing amplifier, integrator, or amplifier with operating characteristics as a function of the external feedback components.

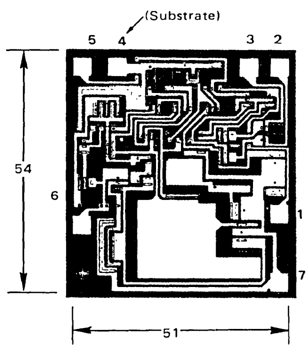
The MCC1741 and MCC1741C employ phosphorsilicate passivation that protects the entire die surface area, including metalization interconnects. All dice have a minimum gold-backed thickness of 4000 Angstroms. The interconnecting metalization and bonding pads are of evaporated aluminum.

- No Frequency Compensation Required
- Short-Circuit Protection
- Offset Voltage Null Capability
- Wide Common-Mode and Differential Voltage Ranges
- Low-Power Consumption
- No Latch Up

OPERATIONAL AMPLIFIER CHIP

MONOLITHIC SILICON INTEGRATED CIRCUIT

OUTLINE DIMENSIONS and BONDING DIAGRAM



All dimensions are nominal and in mils (10^{-3} inches).
Die Dimensions
Thickness = 8.0
Bonding Pads = 4.0 x 4.0

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

Rating	Symbol	Value		Unit
		MCC1741C	MCC1741	
Power Supply Voltage	V^+ V^-	+18 -18	+22 -22	Vdc Vdc
Differential Input Signal	V_{in}	±30		Volts
Common Mode Input Swing (Note 1)	CMV_{in}	±15		Volts
Output Short Circuit Duration (Note 2)	t_S	Continuous		
Operating Temperature Range	T_A	-55 to +125		°C
Junction Temperature Range	T_J	-65 to +150		°C

Note 1. For supply voltages less than ± 15 V, the absolute maximum input voltage is equal to the supply voltage.

Note 2. Supply voltage equal to or less than 15 V.

FIGURE 1 – CIRCUIT SCHEMATIC

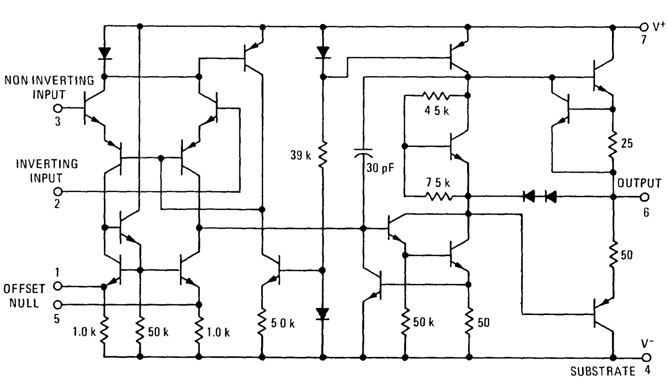
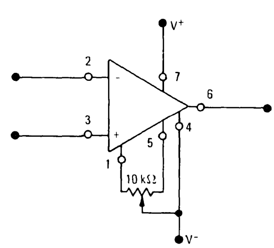


FIGURE 2 – OFFSET ADJUST CIRCUIT



This is advance information on a new introduction and specifications are subject to change without notice.

ELECTRICAL CHARACTERISTICS (V^+ = +15 Vdc, V^- = 15 Vdc, T_A = +25°C unless otherwise noted)

Characteristic	Symbol	MCC1741 Min	MCC1741 Typ	MCC1741 Max	MCC1741C Min	MCC1741C Typ	MCC1741C Max	Unit
Open Loop Voltage Gain (R_L = 2.0 kΩ) (V_o = ± 10 V)	A_{VOL}	50,000	200,000	—	20,000	100,000	—	—
Output Impedance (f = 20 Hz)	Z_o	—	75	—	—	75	—	Ω
Input Impedance (f = 20 Hz)	Z_{in}	—	1.0	—	—	1.0	—	Meg Ω
Output Voltage Swing	V_o							V_{peak}
(R_L = 10 kΩ)		±12	±14	—	±12	±14	—	
(R_L = 2 0 kΩ)		±10	±13	—	±10	±13	—	
Input Common-Mode Voltage Swing	CMV_{in}	—	±13	—	—	±13	—	V_{peak}
Common-Mode Rejection Ratio (f = 20 Hz)	CM_{rej}	—	90	—	—	90	—	dB
Input Bias Current	I_b	—	0.2	0.5	—	0.2	0.5	μA
Input Offset Current	$\|I_{io}\|$	—	0 03	0.2	—	0.03	0.2	μA
Input Offset Voltage (R_S = ≦ 10 kΩ)	$\|V_{io}\|$	—	1.0	5.0	—	2.0	6.0	mV
Step Response Gain = 100	t_f	—	29	—	—	29	—	μs
	t_{pd}	—	8.5	—	—	8 5	—	μs
	dV_{out}/dt ①	—	1.0	—	—	1.0	—	V/μs
Gain = 10	t_f	—	3.0	—	—	3.0	—	μs
	t_{pd}	—	1.0	—	—	1.0	—	μs
	dV_{out}/dt ①	—	1 0	—	—	1.0	—	V/μs
Gain = 1	t_f	—	0.6	—	—	0.6	—	μs
	t_{pd}	—	0.38	—	—	0.38	—	μs
	dV_{out}/dt ①	—	0.8	—	—	0.8	—	V/μs
Power Supply Current	I_D^+	—	1.67	2.83	—	1 67	2.83	mA
	I_D^-	—	1.67	2.83	—	1.67	2.83	
DC Quiescent Power Dissipation (Power Supply = ± 15 V, V_o = 0)	P_D	—	50	85	—	50	85	mW
Positive Supply Sensitivity (V^- constant)	S^+	—	30	150	—	30	150	μV/V
Negative Supply Sensitivity (V^+ constant)	S^-	—	30	150	—	30	150	μV/V

① dV_{out}/dt = Slew Rate See current MC1741/1741C data sheet for additional information

PACKAGING AND HANDLING

The MCC1741/MCC1741C operational amplifier is now available as a single monolithic die or encapsulated in a variety of hermetic and plastic packages. The phosphorsilicate passivation protects the metalization and active area of the die but care must be exercised when removing the dice from the shipping carrier to avoid scratching the bonding pads. A vacuum pickup is useful for handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.

MCC1748
MCC1748C

OPERATIONAL AMPLIFIERS

Advance Information

HIGH PERFORMANCE MONOLITHIC OPERATIONAL AMPLIFIER CHIP

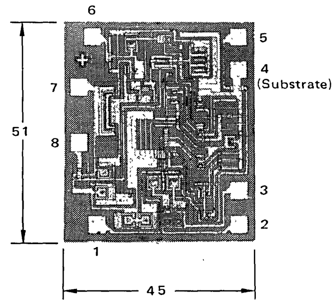
. . . designed for use as a summing amplifier, integrator, or amplifier with operating characteristics as a function of the external feedback components.

The MCC1748 and MCC1748C employ phosphorsilicate passivation that protects the entire die surface area, including metalization interconnects. All dice have a minimum gold-backed thickness of 4000 Angstroms. The interconnecting metalization and bonding pads are of evaporated aluminum.

- Noncompensated MC1741G
- Single 30 pF Capacitor Compensation Required For Unity Gain
- Short-Circuit Protection
- Offset Voltage Null Capability
- Wide Common-Mode and Differential Voltage Ranges
- Low-Power Consumption
- No Latch Up

OPERATIONAL AMPLIFIER CHIP INTEGRATED CIRCUIT

MONOLITHIC SILICON EPITAXIAL PASSIVATED



All dimensions are nominal and in mils (10^{-3} inches).
Die Dimensions
Thickness = 8.0
Bonding Pads = 4.0 x 4.0

6

FIGURE 1 — CIRCUIT SCHEMATIC

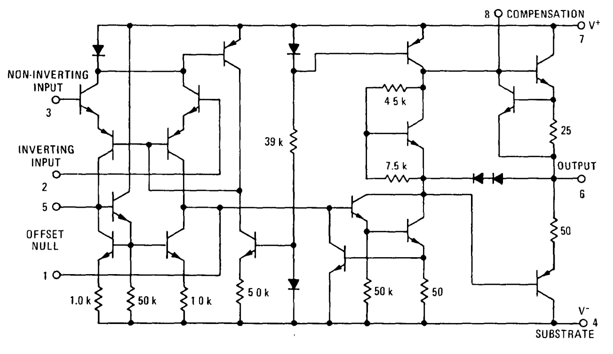
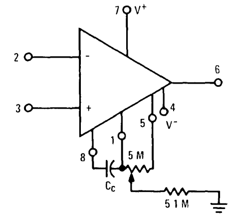


FIGURE 2 — OFFSET ADJUST AND FREQUENCY COMPENSATION



This is advance information on a new introduction and specifications are subject to change without notice.

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

Rating	Symbol	MCC1748	MCC1748C	Unit
Power Supply Voltage	V^+ V^-	+22 -22	+18 -18	Vdc
Differential Input Signal	V_{in}	±30		Volts
Common-Mode Input Swing ①	CMV_{in}	±15		Volts
Output Short Circuit Duration	t_S	Continuous		
Operating Temperature Range	T_A	-55 to +125		°C
Junction Temperature Range	T_J	-65 to +150		°C

ELECTRICAL CHARACTERISTICS (V^+ = +15 Vdc, V^- = -15 Vdc, T_A = +25°C unless otherwise noted)

Characteristics	Symbol	MCC1748 Min	MCC1748 Typ	MCC1748 Max	MCC1748C Min	MCC1748C Typ	MCC1748C Max	Unit
Input Bias Current	I_b	–	0.08	0.5	–	0.08	0.5	µAdc
Input Offset Current	$\|I_{io}\|$	–	0.02	0.2	–	0.02	0.2	µAdc
Input Offset Voltage ($R_S \le 10$ k Ω)	$\|V_{io}\|$	–	1.0	5.0	–	1.0	6.0	mVdc
Differential Input Impedance (Open-Loop, f = 20 Hz)								
Parallel Input Resistance	R_p	–	2.0	–	–	2.0	–	Megohm
Parallel Input Capacitance	C_p	–	1.4	–	–	1.4	–	pF
Common-Mode Input Impedance (f = 20 Hz)	$Z_{(in)}$	–	200	–	–	200		Megohms
Common-Mode Input Voltage Swing	CMV_{in}	–	±13	–	–	±13	–	V_{pk}
Common-Mode Rejection Ratio (f = 100 Hz)	CM_{rej}	–	90	–	–	90	–	dB
Open-Loop Voltage Gain, (V_o = ±10 V, R_L = 2.0 k ohms)	A_{VOL}	50,000	200,000	–	20,000	200,000	–	V/V
Step Response (V_{in} = 20 mV, C_c = 30 pF, R_L = 2 kΩ, C_L = 100 pF)								
Rise Time	t_r	–	0.3	–	–	0.3	–	µs
Overshoot Percentage		–	5.0	–	–	5.0	–	%
Slew Rate	dV_{out}/dt	–	0.8	–	–	0.8	–	V/µs
Output Impedance (f = 20 Hz)	Z_{out}	–	75	–	–	75	–	ohms
Short-Circuit Output Current	I_{SC}	–	25	–	–	25	–	mAdc
Output Voltage Swing (R_L = 10 k ohms)	V_o	±12	±14	–	±12	±14	–	Vpk
R_L = 2 k ohms (T_A = T_{low} to t_{high})		±10	±13	–	±10	±13	–	
Power Supply Sensitivity								µV/V
V^- = constant, $R_s \le 10$ k ohms	S+	–	30	150	–	30	150	
V^+ = constant, $R_s \le 10$ k ohms	S-	–	30	150	–	30	150	
Power Supply Current	I_D^+	–	1.67	2.83	–	1.67	2.83	mAdc
	I_D^-	–	1.67	2.83	–	1.67	2.83	
DC Quiescent Power Dissipation (V_o = 0)	P_D	–	50	85	–	50	85	mW

① For supply voltages less than ±15 V, the Maximum Input Voltage is equal to the Supply Voltage.
See current MC1748/1748C data sheet for additional information.

PACKAGING AND HANDLING

The MCC1748/MCC1748C operational amplifier is now available as a single monolithic die or encapsulated in the TO-99 hermetic package. The phosphorsilicate passivation protects the metalization and active area of the die but care must be exercised when removing the dice from the shipping carrier to avoid scratching the bonding pads. A vacuum pickup is useful for handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.

MCBC1709
MCB1709F

Advance Information

MONOLITHIC OPERATIONAL AMPLIFIER

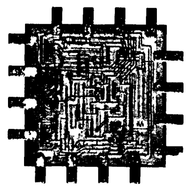
Beam-lead sealed-junction technology and fabrication make the MCBC1709 and MCB1709F devices excellent choices for military, aerospace, and commercial applications; usages requiring a high degree of reliability under environmental conditions of severe temperature extremes, mechanical shock, and high humidity. Beam-lead products employ a silicon-nitride dielectric that hermetically seals the chip, eliminating the need for a hermetic package. The beam leads are gold cantilevered structures extending from the chip. These beams bond readily to a gold metalized substrate providing one of the most reliable interconnection systems known for semiconductor devices.

- High-Performance Open Loop Gain Characteristics
  A_{VOL} = 45,000 typical
- Low Temperature Drift – ±3.0 μV/°C
- Large Output Voltage Swing – ±14 V typical @ ±15 V Supply
- Low Output Impedance – Z_{out} = 150 ohms typical

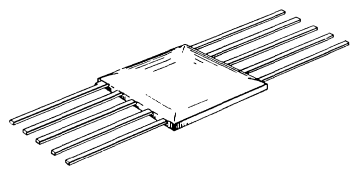
OPERATIONAL AMPLIFIER INTEGRATED CIRCUIT

MONOLITHIC SILICON

BEAM LEAD



BEAM-LEAD CHIP

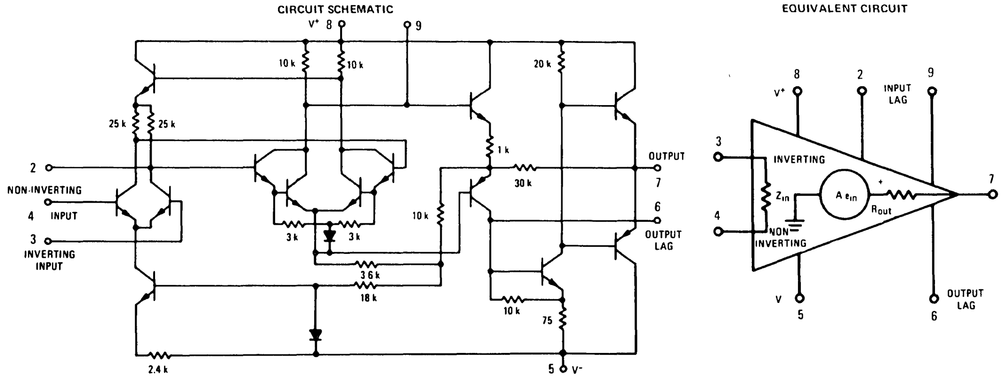


CASE 665
CERAMIC PACKAGE

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+ V^-	+18 -18	Vdc
Differential Input Signal	V_{in}	±5.0	Volts
Common Mode Input Swing	CMV_{in}	$\pm V^+$	Volts
Load Current	I_L	10	mA
Output Short Circuit Duration	t_S	5.0	s
Power Dissipation Derate above T_A = +25°C	P_D	500 3.3	mW mW/°C
Operating Temperature Range	T_A	-55 to +125	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

FIGURE 1



Pin numbers shown are for Case 665, refer to Figure 10 for chip bonding diagram.

This is advance information on a new introduction and specifications are subject to change without notice.

ELECTRICAL CHARACTERISTICS (V^+ = +15 Vdc, V^- = -15 Vdc, T_A = +25°C unless otherwise noted)

Characteristic	Symbol	MCBC1709 and MCB1709F Min	Typ	Max	Unit
Open Loop Voltage Gain (V_O = ±10 V, T_A = -55°C to +125°C)	A_{VOL}	25,000	45,000	70,000	–
Output Impedance (f = 20 Hz)	Z_{out}	–	150	–	Ω
Input Impedance (f = 20 Hz)	Z_{in}	150	400	–	kΩ
Output Voltage Swing (R_L = 10 kΩ)	V_O	±12	±14	–	V_{peak}
(R_L = 2.0 kΩ)		±10	±13	–	
Input Common-Mode Voltage Swing	CMV_{in}	±8.0	±10	–	V_{peak}
Common-Mode Rejection Ratio (f = 20 Hz)	CM_{rej}	70	90	–	dB
Input Bias Current (T_A = +25°C)	I_b	–	0.2	0.5	µA
(T_A = -55°C)		–	0.5	1.5	
Input Offset Current (T_A = +25°C)	$\|I_{io}\|$	–	0.05	0.2	µA
(T_A = -55°C)		–	–	0.5	
(T_A = +125°C)		–	–	0.2	
Input Offset Voltage (T_A = +25°C)	$\|V_{io}\|$	–	1.0	5.0	mV
(T_A = -55°C to +125°C)		–	–	6.0	
Step Response: Gain = 100, 5.0% overshoot, R_1 = 1.0 kΩ, R_2 = 100 kΩ, R_3 = 1.5 kΩ, C_1 = 100 pF, C_2 = 3.0 pF	t_f	–	0.8	–	µs
	t_{pd}	–	0.38	–	µs
	dV_{out}/dt ①	–	12	–	V/µs
Gain = 10, 10% overshoot, R_1 = 1.0 kΩ, R_2 = 10 kΩ, R_3 = 1.5 kΩ, C_1 = 500 pF, C_2 = 20 pF	t_f	–	0.6	–	µs
	t_{pd}	–	0.34	–	µs
	dV_{out}/dt ①	–	1.7	–	V/µs
Gain = 1, 5.0% overshoot, R_1 = 10 kΩ, R_2 = 10 kΩ, R_3 = 1.5 kΩ, C_1 = 5000 pF, C_2 = 200 pF	t_f	–	2.2	–	µs
	t_{pd}	–	1.3	–	µs
	dV_{out}/dt ①	–	0.25	–	V/µs
Average Temperature Coefficient of Input Offset Voltage (R_S = 50 Ω, T_A = -55°C to +125°C)	$\|TC_{Vio}\|$	–	3.0	–	µV/°C
(R_S ≤ 10 kΩ, T_A = -55°C to +125°C)		–	6.0	–	
DC Power Dissipation (Power Supply = ±15 V, V_O = 0)	P_D	–	80	165	mW
Positive Supply Sensitivity (V^- constant)	S^+	–	25	150	µV/V
Negative Supply Sensitivity (V^+ constant)	S^-	–	25	150	µV/V

① dV_{out}/dt = Slew Rate

TYPICAL CHARACTERISTICS

FIGURE 2 – TEST CIRCUIT
V^+ = +15 Vdc, V^- = -15 Vdc, T_A = +25°C

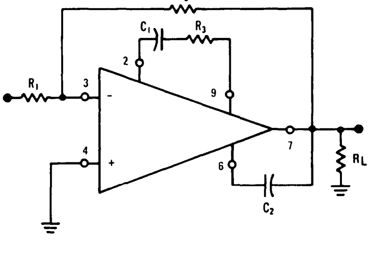


Fig. No.	Curve No.	Test Conditions R_1 (Ω)	R_2 (Ω)	R_3 (Ω)	C_1 (pF)	C_2 (pF)
3	1	10 k	10 k	1.5 k	5.0 k	200
	2	10 k	100 k	1.5 k	500	20
	3	10 k	1.0 M	1.5 k	100	3.0
	4	1.0 k	1.0 M	0	10	3.0
4	1	1.0 k	1.0 M	0	10	3.0
	2	10 k	1.0 M	1.5 k	100	3.0
	3	10 k	100 k	1.5 k	500	20
	4	10 k	10 k	1.5 k	5.0 k	200
5	1	0	∞	1.5 k	5.0 k	200
	2	0	∞	1.5 k	500	20
	3	0	∞	1.5 k	100	3.0
	4	0	∞	0	10	3.0

6

TYPICAL CHARACTERISTICS (continued)

(V^+ = +15 Vdc, V^- = -15 Vdc, T_A = +25°C unless otherwise noted.)

FIGURE 3 – LARGE SIGNAL SWING versus FREQUENCY

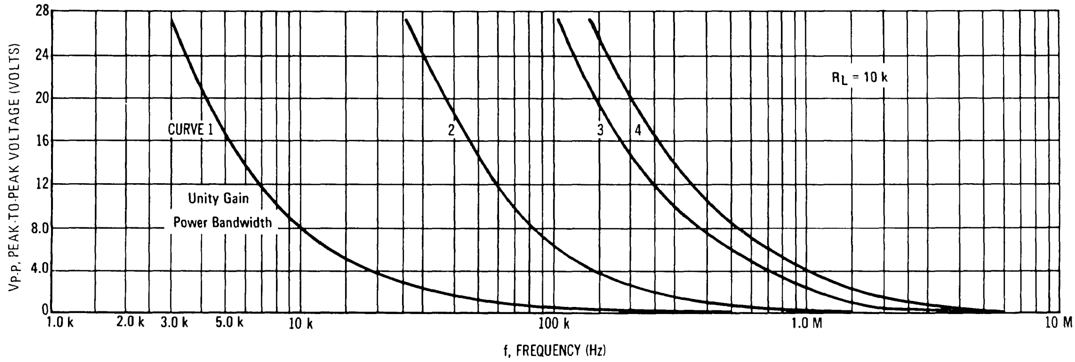


FIGURE 4 – VOLTAGE GAIN versus FREQUENCY

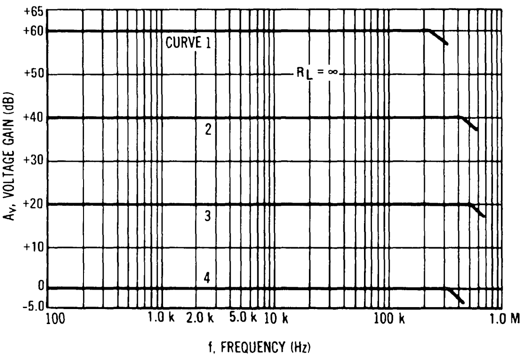


FIGURE 5 – OPEN LOOP VOLTAGE GAIN versus FREQUENCY

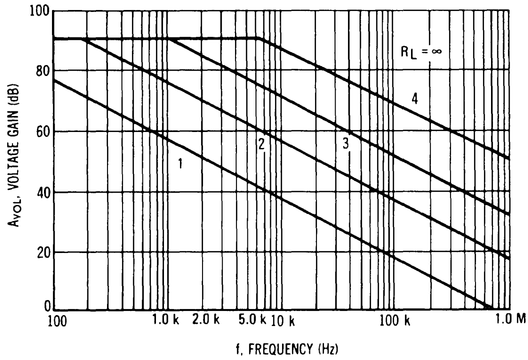


FIGURE 6 – VOLTAGE GAIN versus POWER SUPPLY VOLTAGE

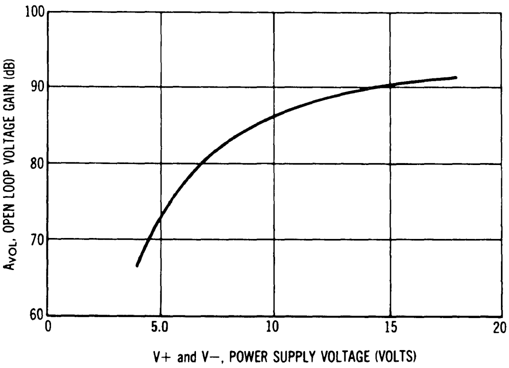
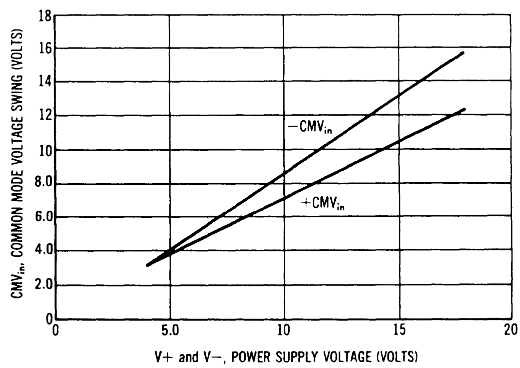


FIGURE 7 – COMMON SWING versus POWER SUPPLY VOLTAGE



TYPICAL CHARACTERISTICS (continued)

(V^+ = +15 Vdc, V^- = −15 Vdc, T_A = +25°C unless otherwise noted.)

FIGURE 8 — POWER DISSIPATION versus POWER SUPPLY VOLTAGE

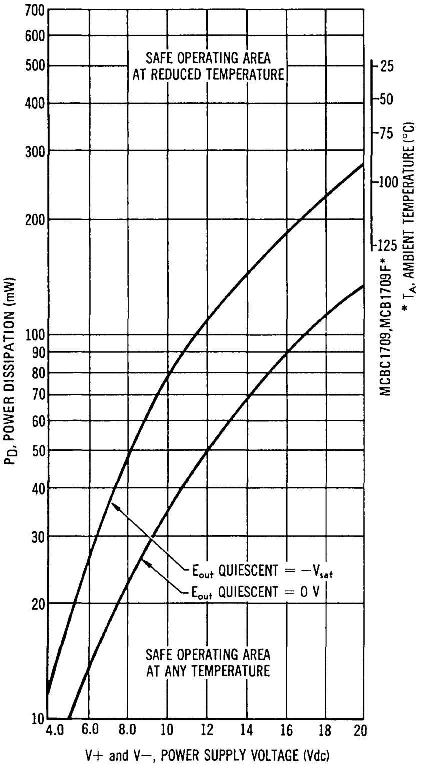


FIGURE 9 — INPUT NOISE VOLTAGE versus SOURCE RESISTANCE

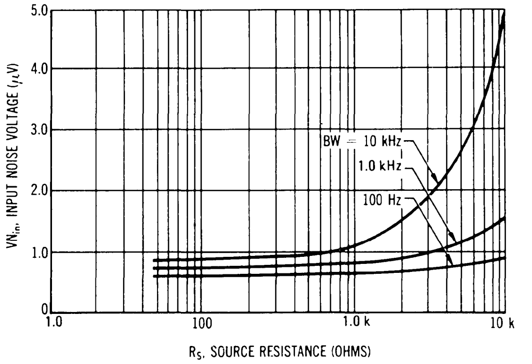
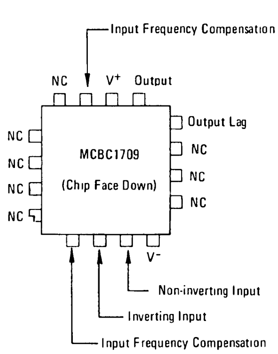
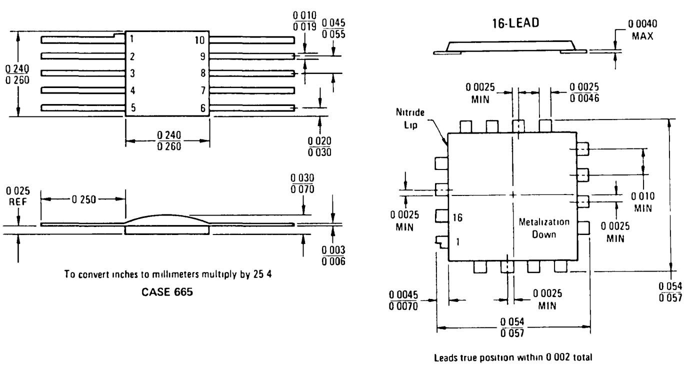


FIGURE 10 — BONDING DIAGRAM



Silicon Thickness = 2.0 mils nominal

OUTLINE DIMENSIONS



PACKAGING AND HANDLING

The MCBC1709 beam-lead sealed-junction linear integrated circuit is available in chip form (non-encapsulated) as shown in the outline dimensional drawing. The shipping carrier for chips is a 2" square glass plate on which the chips are placed. A thin layer of polymer film covers the plate and retains the chips in place. The chips do not adhere to the film when it is lifted to remove them from the carrier. Care must be exercised when removing the chips from the carrier to ensure that the beams are not bent. A vacuum pickup is useful for this purpose.

MCBC1741
MCB1741F

Advance Information

MONOLITHIC OPERATIONAL AMPLIFIER

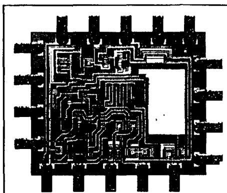
Beam-lead sealed-junction technology and fabrication make the MCBC1741 and MCB1741F devices excellent choices for military, aerospace, and commercial applications; usages requiring a high degree of reliability under environmental conditions of severe temperature extremes, mechanical shock, and high humidity. Beam-lead products employ a silicon-nitride dielectric that hermetically seals the chip, eliminating the need for a hermetic package. The beam leads are gold cantilevered structures extending from the chip. These beams bond readily to a gold metalized substrate providing one of the most reliable interconnection systems known for semiconductor devices.

- No Frequency Compensation Required
- Short-Circuit Protection
- Offset Voltage Null Capability
- Wide Common-Mode and Differential Voltage Ranges
- Low-Power Consumption
- No Latch Up

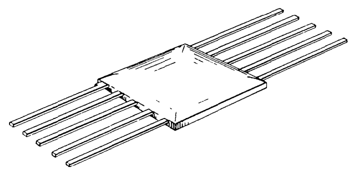
OPERATIONAL AMPLIFIER INTEGRATED CIRCUIT

MONOLITHIC SILICON

BEAM LEAD



BEAM-LEAD CHIP
MCBC1741



MCB1741F
CASE 665
CERAMIC PACKAGE

SCHEMATIC PIN CONNECTIONS

Chip	A	B	C	D	E	F	G
"F" Package	2	3	4	5	6	7	8

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+ V^-	+22 -22	Vdc
Differential Input Signal	V_{in}	±30	Volts
Common Mode Input Swing (Note 1)	CMV_{in}	±15	Volts
Output Short Circuit Duration (Note 2)	t_S	Continuous	
Power Dissipation Derate above T_A = +25°C (Flat Package)	P_D	500 3.3	mW mW/°C
Operating Temperature Range	T_A	-55 to +125	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

Note 1. For supply voltages less than ± 15 V, the absolute maximum input voltage is equal to the supply voltage.

Note 2. Supply voltage equal to or less than 15 V.

FIGURE 1 — CIRCUIT SCHEMATIC

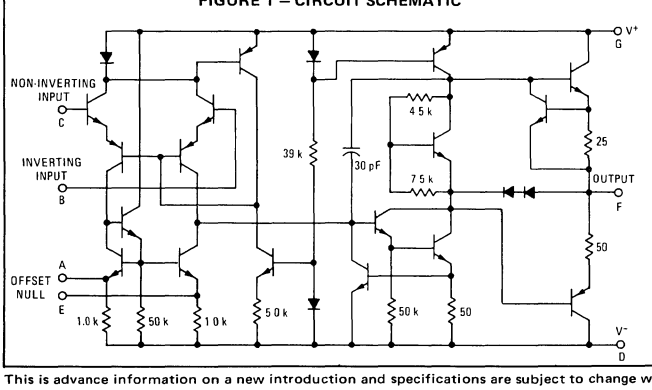
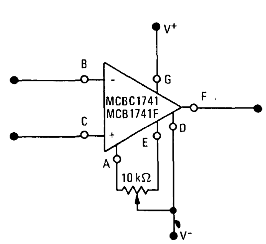


FIGURE 2 — OFFSET ADJUST CIRCUIT



This is advance information on a new introduction and specifications are subject to change without notice.
See Packaging Information Section for outline dimensions.

ELECTRICAL CHARACTERISTICS (V^+ = +15 Vdc, V^- = -15 Vdc, T_A = +25°C unless otherwise noted)

Characteristic	Symbol	MCBC1741, MCB1741F Min	Typ	Max	Unit
Open Loop Voltage Gain (R_L = 2.0 kΩ) (V_O = ±10 V, T_A = +25°C) (V_O = ± 10 V, T_A = -55 to +125°C)	A_{VOL}	 50,000 25,000	 200,000 –	 – –	–
Output Impedance (f = 20 Hz)	Z_o	–	75	–	Ω
Input Impedance (f = 20 Hz)	Z_{in}	0.3	1.0	–	MegΩ
Output Voltage Swing (R_L = 10 kΩ) (R_L = 2.0 kΩ) (R_L = 2.0 kΩ, T_A = -55 to +125°C)	V_O	 ±12 ±10 ±10	 ±14 ±13 –	 – – –	V_{peak}
Input Common-Mode Voltage Swing	CMV_{in}	±12	±13	–	V_{peak}
Common-Mode Rejection Ratio (f = 20 Hz)	CM_{rej}	70	90	–	dB
Input Bias Current (T_A = +25°C) (T_A = -55°C)	I_b	 – –	 0.2 0.5	 0.5 1.5	μA
Input Offset Current (T_A = +25°C) (T_A = -55 to +125°C)	$\|I_{io}\|$	 – –	 0.03 –	 0.2 0.5	μA
Input Offset Voltage (T_A = +25°C) (T_A = -55°C to +125°C)	$\|V_{io}\|$	 – –	 1.0 –	 5.0 6.0	mV
Step Response Gain = 100, R_1 = 1.0 kΩ, R_2 = 100 kΩ, R_3 = 1.0 kΩ	 t_f t_{pd} dV_{out}/dt ①	 – – –	 29 8.5 1.0	 – – –	 μs μs V/μs
Gain = 10, R_1 = 1.0 kΩ, R_2 = 10 kΩ, R_3 = 1.0 kΩ	t_f t_{pd} dV_{out}/dt ①	– – –	3.0 1.0 1.0	– – –	μs μs V/μs
Gain = 1, R_1 = 10 kΩ, R_2 = 10 kΩ, R_3 = 5.0 kΩ	t_f t_{pd} dV_{out}/dt ①	– – –	0.6 0.38 0.8	– – –	μs μs V/μs
Average Temperature Coefficient of Input Offset Voltage (R_S = 50 Ω, T_A = -55°C to +125°C) (R_S = 10 kΩ, T_A = -55°C to +125°C)	$\|TC_{Vio}\|$	 – –	 3.0 6.0	 – –	μV/°C
Average Temperature Coefficient of Input Offset Current (T_A = -55 to +125°C)	$\|TC_{Vio}\|$	–	50	–	pA/°C
DC Power Dissipation (Power Supply = ±15 V, V_O = 0)	P_D	–	50	85	mW
Positive Supply Sensitivity (V^- constant)	S^+	–	30	150	μV/V
Negative Supply Sensitivity (V^+ constant)	S^-	–	30	150	μV/V
Power Bandwidth (A_V = 1, R_L = 2.0 kΩ, THD = 5%, V_O = 20 V_{p-p})	PBW	–	10	–	kHz

① dV_{out}/dt = Slew Rate

6

TYPICAL CHARACTERISTICS (continued)

(V^+ = +15 Vdc, V^- = -15 Vdc, T_A = +25°C unless otherwise noted.)

FIGURE 3 – POWER BANDWIDTH (LARGE SIGNAL SWING versus FREQUENCY)

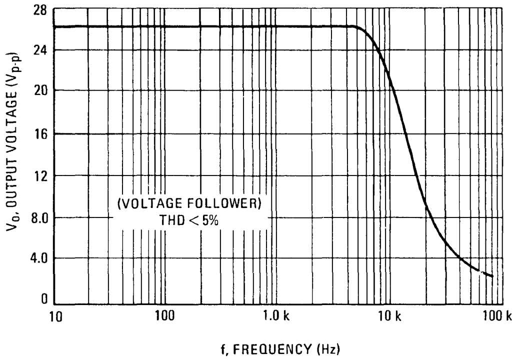


FIGURE 4 – OPEN LOOP FREQUENCY RESPONSE

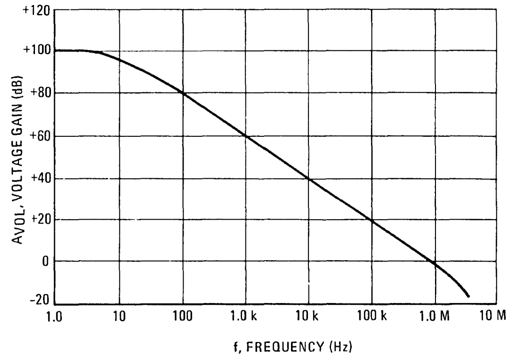


FIGURE 5 – OUTPUT VOLTAGE SWING versus LOAD RESISTANCE

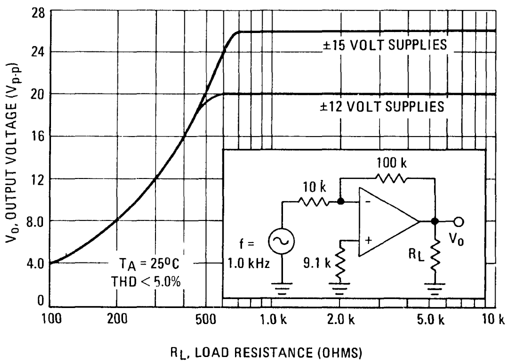


FIGURE 6 – COMMON-MODE REJECTION RATIO versus FREQUENCY

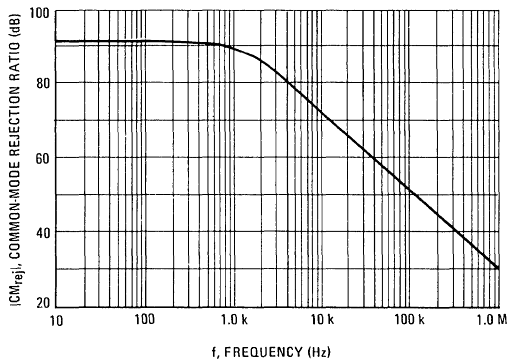


FIGURE 7 – INPUT OFFSET CURRENT versus TEMPERATURE

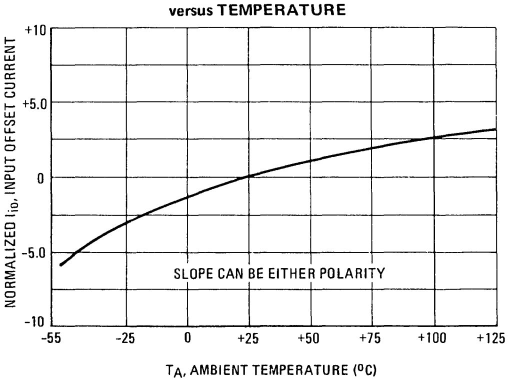
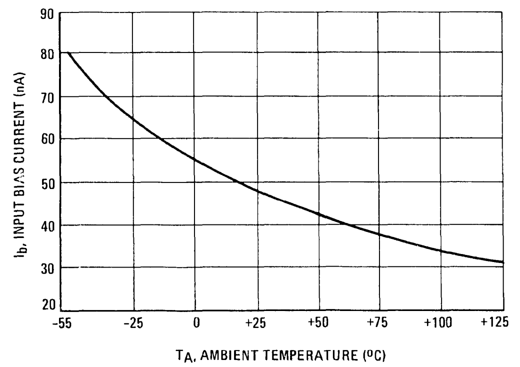


FIGURE 8 – INPUT BIAS CURRENT versus TEMPERATURE



6

TYPICAL CHARACTERISTICS (continued)

(V^+ = +15 Vdc, V^- = -15 Vdc, T_A = +25°C unless otherwise noted.)

FIGURE 9 — POWER DISSIPATION versus POWER SUPPLY VOLTAGE

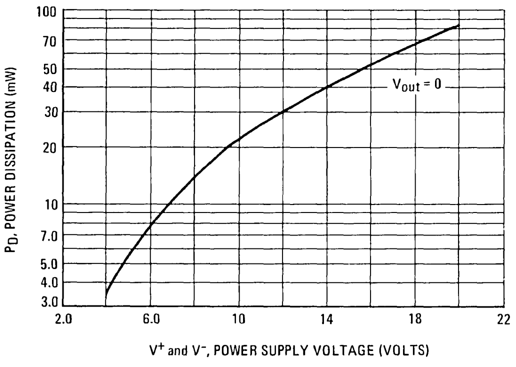


FIGURE 10 — OUTPUT NOISE versus SOURCE RESISTANCE

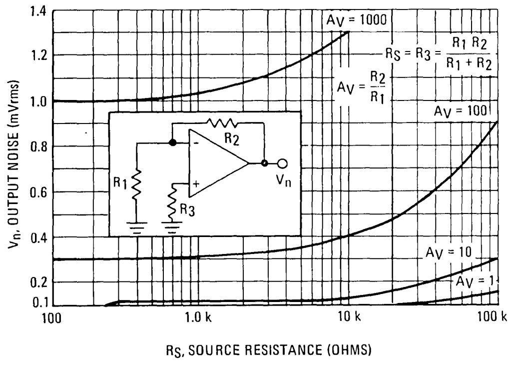
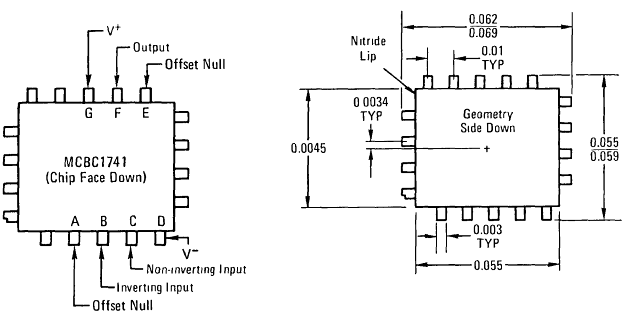


FIGURE 11 — BONDING DIAGRAM



Silicon Thickness = 2.0 mils nominal

PACKAGING AND HANDLING

The MCBC1741 beam-lead sealed-junction linear integrated circuit is available in chip form (non-encapsulated) as shown in the outline dimensional drawing. The shipping carrier for chips is a 2" square glass plate on which the chips are placed. A thin layer of polymer film covers the plate and retains the chips in place. The chips do not adhere to the film when it is lifted to remove them from the carrier. Care must be exercised when removing the chips from the carrier to ensure that the beams are not bent. A vacuum pickup is useful for this purpose.

MCBC1748
MCB1748F

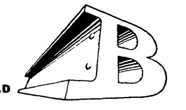
Advance Information

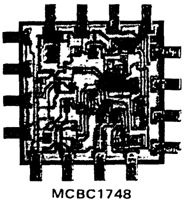
HIGH PERFORMANCE MONOLITHIC OPERATIONAL AMPLIFIER

Beam-lead sealed-junction technology and fabrication make the MCBC1748 and MCB1748F devices excellent choices for use as a summing amplifier, integrator, or amplifier with operating characteristics as a function of the external feedback components. Beam-lead products employ a silicon-nitride dielectric that hermetically seals the chip, eliminating the need for a hermetic package. The beam leads are gold cantilevered structures extending from the chip. These beams bond readily to a gold metalized substrate providing one of the most reliable interconnection systems known for semiconductor devices.

- Noncompensated MCBC1741
- Single 30 pF Capacitor Compensation Required For Unity Gain
- Short-Circuit Protection
- Offset Voltage Null Capability
- Wide Common-Mode and Differential Voltage Ranges
- Low-Power Consumption
- No Latch Up

OPERATIONAL AMPLIFIER INTEGRATED CIRCUIT

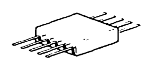




BEAM-LEAD CHIP

MCBC1748

F SUFFIX
CERAMIC PACKAGE
CASE 606
(TO-91)



MCB1748F

SCHEMATIC PIN CONNECTIONS

Chip	A	B	C	D	E	F	G	H
"F" Package	2	3	4	5	6	7	8	9

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+ V^-	+18 -18	Vdc
Differential Input Signal	V_{in}	±5.0	Volts
Common Mode Input Swing ①	CMV_{in}	$\pm V^+$	Volts
Load Current	I_L	10	mA
Output Short Circuit Duration	t_S	5.0	s
Power Dissipation Derate above T_A = +25°C (Flat Package)	P_D	500 3.3	mW mW/°C
Operating Temperature Range	T_A	-55 to +125	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

① For supply voltages less than ±15 V, the Maximum Input Voltage is equal to the Supply Voltage.

FIGURE 1 – CIRCUIT SCHEMATIC

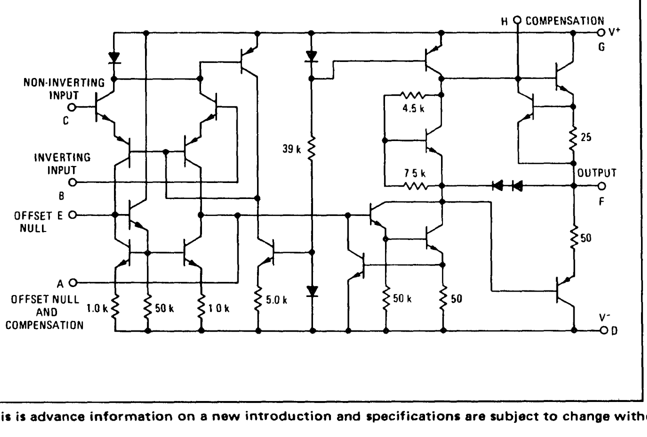
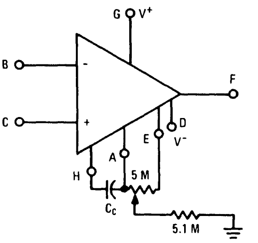


FIGURE 2 – OFFSET ADJUST AND FREQUENCY COMPENSATION



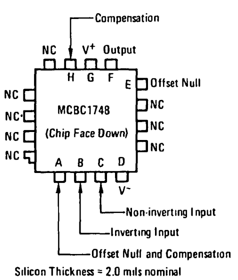
This is advance information on a new introduction and specifications are subject to change without notice.

6

ELECTRICAL CHARACTERISTICS (V^+ = +15 Vdc, V^- = -15 Vdc, T_A = +25°C unless otherwise noted)

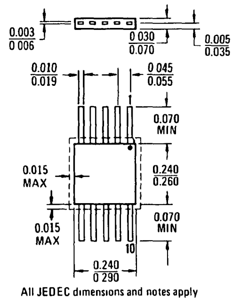
Characteristics	Symbol	Min	Typ	Max	Unit
Open-Loop Voltage Gain, (V_O = +10 V, R_L = 2.0 k ohms)	A_{VOL}	50,000	200,000	–	–
Output Impedance (f = 20 Hz)	Z_o	–	75	–	ohms
Common Mode Input Impedance (f = 20 Hz)	Z_{in}	–	200	–	Megohms
Output Voltage Swing (R_L = 10 k ohms) R_L = 2 k ohms (T_A = -55 to +125°C)	V_o	±12 ±10	±14 ±13	– –	Vpk
Common-Mode Input Voltage Swing	CMV_{in}	–	±13	–	Vpk
Common-Mode Rejection Ratio (f = 100 Hz)	CM_{rej}	–	90	–	dB
Input Bias Current	I_b	–	0.08	0.5	μAdc
Input Offset Current	I_{io}	–	0.02	0.2	μAdc
Input Offset Voltage (R_S ≤ 10 kΩ)	V_{io}	–	1.0	5.0	mVdc
Step Response (V_{in} = 20 mV, C_c = 30 pF, R_L = 2 kΩ, C_L = 100 pF) Rise Time Overshoot Percentage Slew Rate	 t_r dV_{out}/dt	 – – –	 0.3 5.0 0.8	 – – –	 μs % V/μs
Short-Circuit Output Current	I_{SC}	–	25	–	mAdc
Differential Input Impedance (Open-Loop, f = 20 Hz) Parallel Input Resistance Parallel Input Capacitance	 Rp Cp	 – –	 2.0 1.4	 – –	 Megohms pF
Power Supply Sensitivity V^- = constant, R_S ≤ 10 k ohms V^+ = constant, R_S ≤ 10 k ohms	 S+ S-	 – –	 30 30	 150 150	μV/V
Power Supply Current	I_D+ I_D-	– –	1.67 1.67	2.83 2.83	mAdc
DC Quiescent Power Dissipation (V_O = 0)	P_D	–	50	85	mW

BONDING DIAGRAM



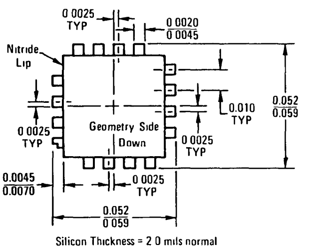
Silicon Thickness = 2.0 mils nominal

OUTLINE DIMENSIONS
F SUFFIX
CERAMIC PACKAGE
CASE 606
(TO-91)



All JEDEC dimensions and notes apply

16-BEAM CHIP



Silicon Thickness = 2.0 mils normal

PACKAGING AND HANDLING

The MCBC1748 beam-lead sealed-junction linear integrated circuit is available in chip form (non-encapsulated) as shown in the outline dimensional drawing. The shipping carrier for chips is a 2" square glass plate on which the chips are placed. A thin layer of polymer film covers the plate and retains the chips in place. The chips do not adhere to the film when it is lifted to remove them from the carrier. Care must be exercised when removing the chips from the carrier to ensure that the beams are not bent. A vacuum pickup is useful for this purpose.

6

6

PACKAGING and HARDWARE

PACKAGING

HARDWARE

7

LEAD TAPE PACKAGING STANDARDS FOR AXIAL-LEAD COMPONENTS

1.0 SCOPE

This document covers packaging requirements for the following axial-lead components for use in automatic testing and assembly equipment: Motorola Case 51 (DO-7), Case 52 (DO-13), Case 59 (DO-41), and Case 17. Packaging, as covered in this document, shall consist of axial-lead components mounted by their leads on pressure-sensitive tape, either wound onto a reel or folded in an oriented manner in a container (ammunition pack).

2.0 PURPOSE

This document establishes Motorola standard practices for lead-tape packaging of axial-lead components and meets the requirements of EIA Standard RS-296-B, "Reel Packaging of Components with Axial Leads."

3.0 REQUIREMENTS

3.1 Component Leads

3.1.1 Component leads shall not be bent beyond 0.047 inch from their nominal position. See Figure 2.

3.1.2 The "C" dimension shall be governed by the overall length of the reel packaged component. The distance between flanges shall be 0.125 inch to 0.250 inch greater than the overall component length. See Figures 2 and 3.

3.2 Orientation

All polarized components must be oriented in one direction. The cathode lead tape shall be blue, and the anode tape shall be white. See Figure 1.

3.3 Reeling

3.3.1 Components on any reel shall not represent more than two date codes whrn date code identification is required.

3.3.2 Component leads shall be positioned perpendicularly between pairs of 0.250 inch tape. See Figure 2.

3.3.3 A minimum 12 inch leader of tape shall be provided before the first and last component on the reel.

3.3.4 50 lb. Kraft paper must be wound between layers of components as far as necessary for component protection. Width of paper is 0.062 inch to 0.750 inch less than "C" dimension of reel. See Figure 3.

3.3.5 A row of components must be centered between the tapes ± 0.047 inch. In addition, individual components may deviate from center of component row ± 0.031 inch. See Figure 2.

3.3.6 Staples shall not be used for splicing. No more than 4 layers of tape shall be used in any splice area and no tape shall be offset from another by more than 0.031 inch noncumulative. Tape splices shall overlap at least 6 inches for butt joints and at least 3 inches for lap joints, and shall not be weaker than unspliced tape.

3.3.7 Quantity per reel shall be as indicated in Table 1. When reeling quantity is less than the established minimum of a suitable sized reel, an ammunition pack will be used. Quantities less than the ammunition pack minimum will not be lead-taped.

3.3.8 A maximum of 10 components may be missing from any 10 foot section. A maximum of 2 consecutive components may be missing, provided this gap is followed by 6 consecutive components.

3.3.9 The single face roll pad shall be placed around the finished reel and taped securely. Each reel shall then be placed in an appropriate container.

3.4 Marking

Minimum reel and carton marking shall consist of the following: See Figure 3.

Customer Part Number
Purchase Order Number
Quantity
Date of Reeling (when applicable)
Manufacturer's Name
Electrical Value (when applicable)
Date Codes (when applicable; see Note 3.3.1)
Tape (when applicable)

4.0 EXCEPTIONS

Requirements differing from this Motorola standard shall be negotiated with the factory.

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LEAD TAPE PACKAGING STANDARDS FOR AXIAL-LEAD COMPONENTS (continued)

TABLE 1 – PACKAGING

Component Type (Case)	Quantity Per Reel Min/Max	Ammunition Pack Qty. Min	Component Spacing A	Tape Spacing B	Reel Dimensions C	D
Case 51 (DO-7) Case 59 (DO-41)	1000/3000	500	0.200 ± 0.015	2.00 ± 0.010	3.00	10.50
Case 17	1000/2000	500	0.200 ± 0.015	2.00 ± 0.010	3.00	10.50
Case 52 (DO-13)	500/1500	250	0.375 ± 0.015	2.375 ± 0.020	3.81	14.00

FIGURE 1 – REEL PACKING

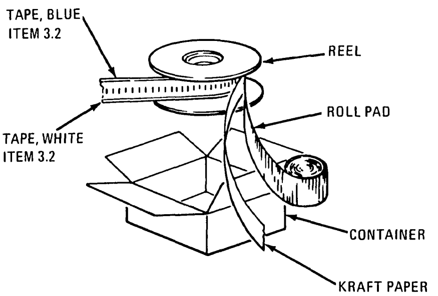


FIGURE 2 – COMPONENT SPACING

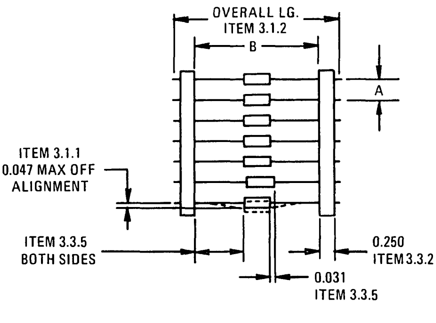


FIGURE 3 – REEL DIMENSIONS

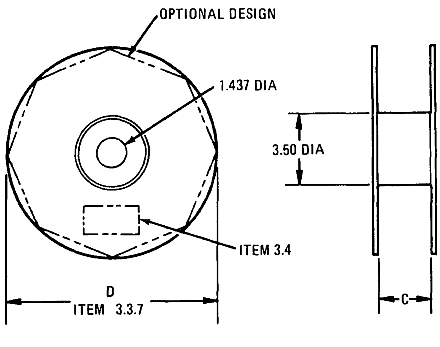
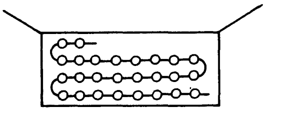


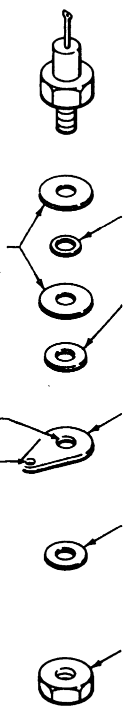
FIGURE 4 – AMMUNITION PACK



MH745
MH746

MOUNTING HARDWARE for MOTOROLA STUD PACKAGES

7/16" RECTIFIER and 10 WATT ZENER DIODE
11/16" RECTIFIER and 50 WATT ZENER DIODE



MICA WASHERS
$\frac{.560}{.570} \times \frac{.195}{.200} \times \frac{.002}{.003}$

NYLON BUSHING
$\frac{.276}{.286} \times \frac{.190}{.195} \times \frac{.041}{.051}$

FLAT WASHER
Steel, Zinc plated
$\frac{.490}{.510} \times \frac{.215}{.225} \times \frac{.030}{.050}$

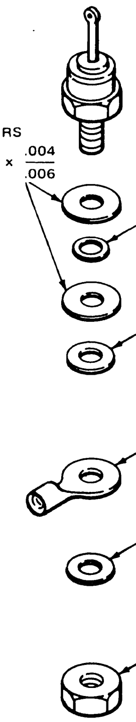
ID $\frac{.195}{.200}$
ID $\frac{.065}{.095}$

SOLDER TERMINAL
Copper, Electro-deposited tin plate
$\frac{.885}{.915} \times \frac{.425}{.455} \times \frac{.020}{.023}$

LOCK WASHER
Steel, Zinc plated,
Internal tooth
$\frac{.365}{.381} \times \frac{.195}{.204} \times \frac{.020}{.025}$

NUT
1018 Steel, Zinc plated,
10-32NF-2B
$\frac{.362}{.375}$ Nom. across flats
$\times \frac{.172}{.192}$ Thick $\frac{.413}{.433}$ across points

7/16 STUD (MH 745)



MICA WASHERS
$\frac{.997}{1.003} \times \frac{.255}{.265} \times \frac{.004}{.006}$

NYLON BUSHING
$\frac{.362}{.372} \times \frac{.264}{.274} \times \frac{.060}{.070}$

FLAT WASHER
Steel, Zinc plated
$\frac{.727}{.749} \times \frac{.276}{.296} \times \frac{.055}{.071}$

SOLDER TERMINAL
Copper, electro-tinned
(AMP #34124)

LOCK WASHER
Steel, spring, Zinc plated,
Internal tooth
$\frac{.460}{.480} \times \frac{.250}{.270} \times \frac{.017}{.027}$

NUT
1018 Steel, Zinc plated
1/4-28NF-2B
$\frac{.425}{.437}$ across flats $\times \frac{.178}{.193}$ Thick
$\frac{.485}{.505}$ across points

11/16 STUD (MH 746)

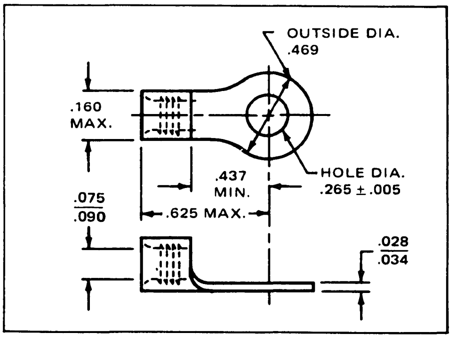
7

Finish meets all environmental requirements of MIL-STD-19500.

Mounting hardware is supplied with the units. For additional hardware, order by kit number:

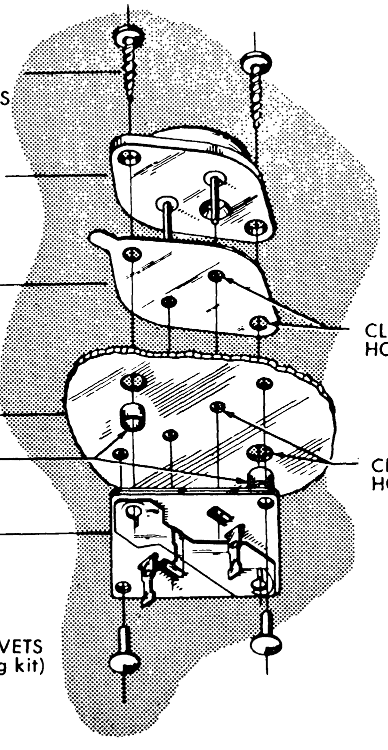
MH745 — 7/16"
STUD MOUNTING HARDWARE

MH746 — 11/16"
STUD MOUNTING HARDWARE



POWER TRANSISTOR MOUNTING KITS

MK-10 – teflon
MK-15 – mica
MK-20 – anodized aluminum
MK-25 – mica



Typical thermal characteristics for teflon, mica, and anodized aluminum insulators used in mounting kits are given in the table below. (Figures may vary with mounting torque applied. Do not over stress.)

KIT TYPE	INSULATING WASHER	TYPICAL THERMAL RESISTANCE (°C/Watt)	
		Dry	With DC4*
—	No Insulator	.20	.10
MK-10	Teflon	1.45	.80
MK-15	Mica	.80	.40
MK-20	Anodized Aluminum	.40	.35
MK-25	Mica	.80	.40

*DC4 is Dow Corning No. 4 Silicone Lubricant.

7

Mounting kits, types MK-10, MK-15, MK-20, and MK-25 provide the necessary hardware for correctly mounting all TO-3 and TO-66 industry standard power transistor types to a chassis. With these kits, power transistors can be electrically insulated from the heat sink chassis, while maintaining complete heat transfer characteristics.

Included in these highly useful kits are a transistor mounting socket, front and back mounting templates for hole drilling guides, two #6 mounting screws, two insulating bushings, an insulating washer and complete mounting instructions.

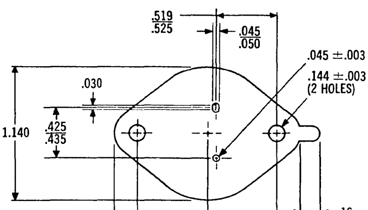
MK-10, MK-15, MK-20, MK-25 (continued)

The teflon-coated glass cloth insulating washer, included in kit MK-10, will find use in installations requiring an insulator of excellent durability. The mica insulator, in kit MK-15 and MK-25, is characterized by very high thermal conductivity. In applications where both good thermal conduction and durability are necessary, the anodized aluminum insulator supplied in kit MK-20, is recommended.

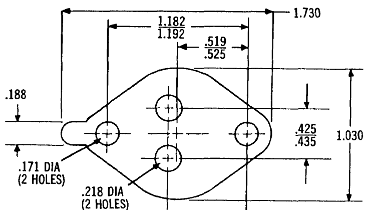
The transistor socket included in all mounting kits, is made of rugged laminated phenolic, with contacts of phosphor bronze.

Three cadmium plated solder lugs, having a 15-amp maximum current capacity, are provided for base, emitter and collector connections.

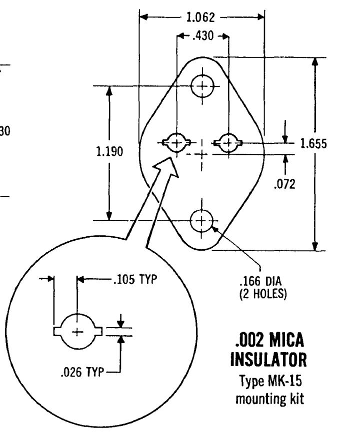
TO-3



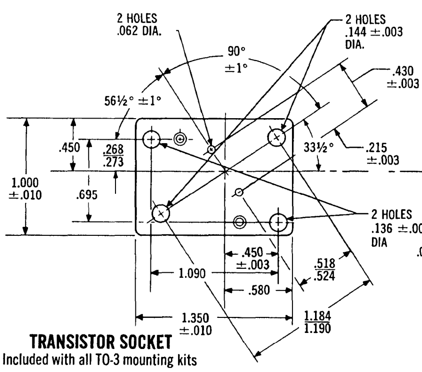
.003 TEFLON INSULATOR
Type MK-10 mounting kit



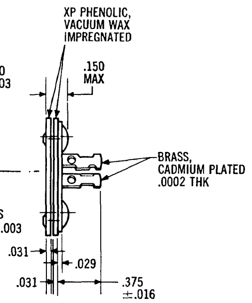
.020 ALUMINUM INSULATOR
Type MK-20 mounting kit

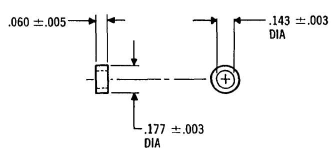


.002 MICA INSULATOR
Type MK-15 mounting kit



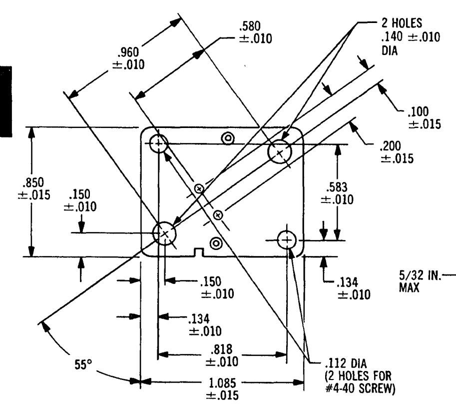
TRANSISTOR SOCKET
Included with all TO-3 mounting kits



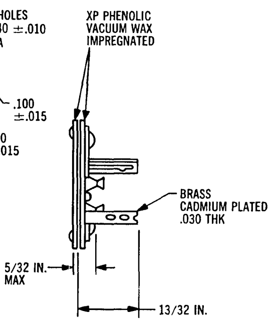


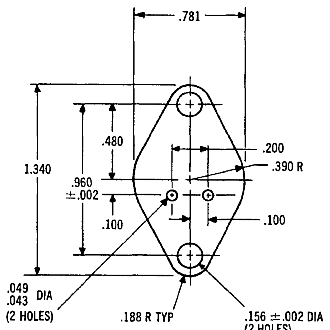
TEFLON INSULATING BUSHING
Included with all mounting kits

TO-66



TRANSISTOR SOCKET
Included with all TO-66 mounting kits





.002 MICA INSULATOR
Type MK-25 mounting kit

TEFLON INSULATING BUSHING
Included with all mounting kits
(Same as for TO-3)

7

MK-30
MK-35

POWER TRANSISTOR MOUNTING KITS

Mounting kits, types MK-30 and MK-35, provide the necessary hardware to properly mount the TO-36 case (standard industry-type power transistors) to the chassis. With these kits, power transistors can be electrically insulated from the heat sink chassis, while maintaining complete heat transfer characteristics

MK-30 Designed for use in applications requiring 30 Amps or less with solder connection to the transistor leads.

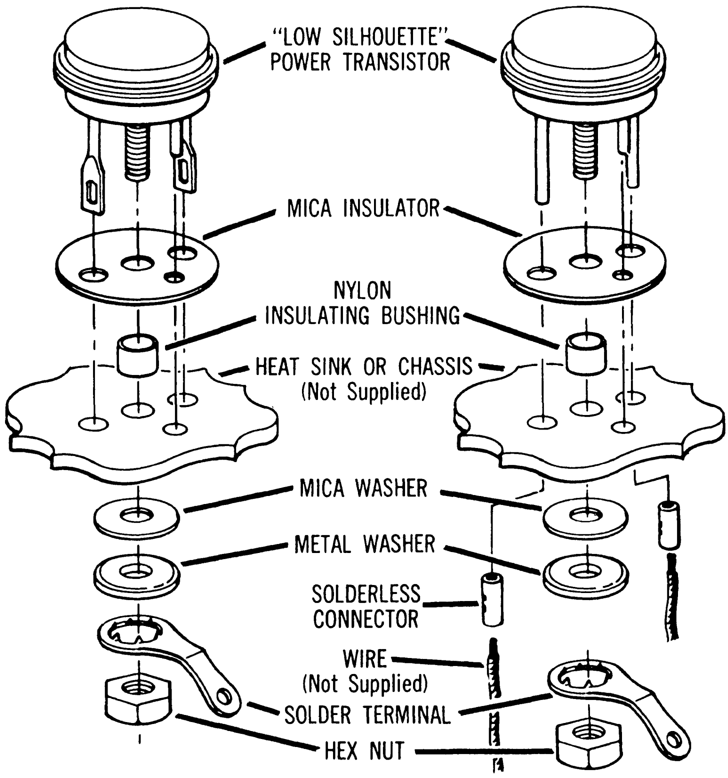
MK-35 Designed for use in applications requiring greater than 30 Amps with solderless connection to the transistor leads.

To obtain maximum contact area between case and heat sink for better heat transfer, it is recommended that the transistor first be mounted on the heat sink or chassis. Then, for maximum wire-to transistor lead strength and high-current capacity, the solderless connectors provided are crimped to the transistor leads and heavy wire. The wires may be soldered directly to the leads if strength and high currents (approximately 50 Amps) are not the primary considerations. (Solderless connector tools are available from the Thomas and Betts Co., Elizabeth, N. J. Possible wire types: AWG #12 regular strand (65 x 30) or #10 solid-tinned copper wire.)

These new mounting kits are individually packaged in a convenient polyethylene container.

MK-30
15 AND 30
AMP UNITS

MK-35
60 AMP UNITS



NOTE: The surface to which the transistor is mounted must be smooth, flat and free of burrs or irregularities which may damage insulation or prevent intimate contact with the transistor mounting base.

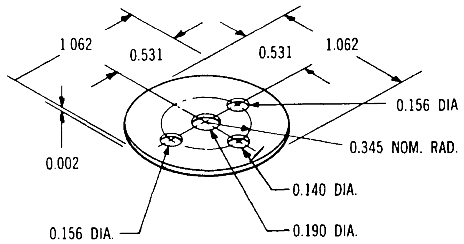
Typical thermal characteristics for mica insulators are given in the table below. (Figures may vary with mounting torque applied. Do not over stress.)

KIT TYPE	INSULATING WASHER	MAXIMUM THERMAL RESISTANCE (°C/Watt)	
		Dry	With DC4*
—	No Insulator	.20	.10
MK-30	Mica	.80	.40
MK-35	Mica	.80	.40

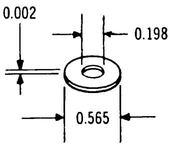
*DC4 is Dow Corning No. 4 Silicone Lubricant.

OUTLINE DIMENSIONS

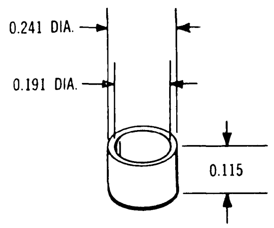
MK-30 / MK-35



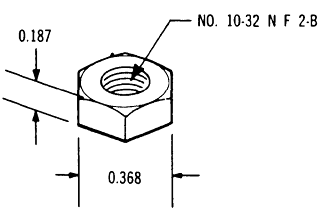
MICA INSULATOR
14B52600F06



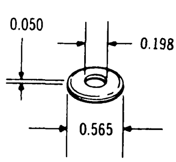
MICA WASHER
14B52600F01



NYLON INSULATING BUSHING
43B51547F01



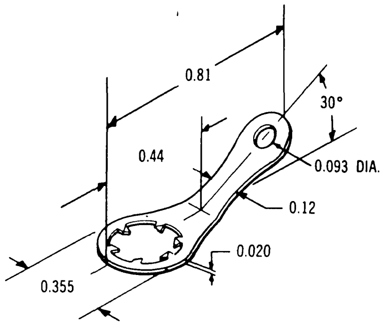
HEX NUT
(Cadmium Plated)
02B51568F13



METAL WASHER
(Cadmium Plated)
04B51567F17

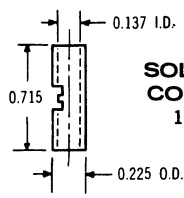
NOTE: All Dimensions Nominal

MK-30 ONLY

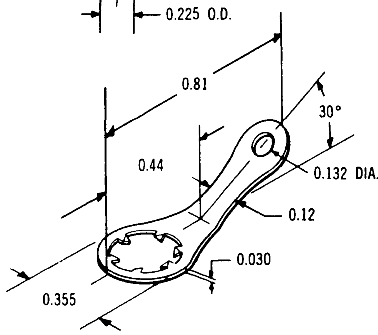


SOLDER TERMINAL
(Tin Dipped)
29B52595F13

MK-35 ONLY



SOLDERLESS CONNECTOR
10M52014A



SOLDER TERMINAL
(Cadmium Plated)
29B52595F09

7

MS-10 POWER TRANSISTOR HEAT SINK

Designed specifically for use with the industry standard type TO-3 (diamond) power transistor, this heat sink will reduce transistor junction temperatures and permit safe operation at higher power levels or under high ambient temperatures.

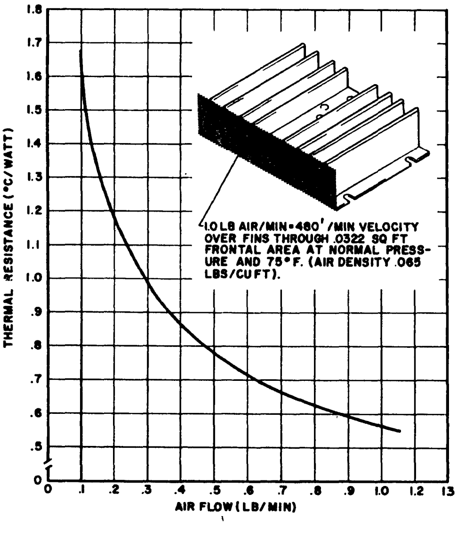
Cooling is accomplished with the MS-10 by conduction, convection and radiation. Although measuring only 4-1/2" by 3-1/16", the MS-10 makes possible thermal dissipation effectively equal to that of a flat sheet of aluminum 10" by 8" by 1/8". This greatly reduces the chassis area necessary for heat dissipation at higher power levels.

The transistor with use of silicon grease should be mounted directly to the MS-10 heat sink with the insulating washers placed at each of the (4) mounting points located on the heat sink flange. This is accomplished by placing (1) shoulder washer on the bottom and (1) flat washer on top of each mounting point of the heat sink. A mica washer is supplied to isolate the transistor from the heat sink if desired.

The MS-10 has a hole pattern arrangement which will accommodate the mounting of one TO-3 power transistor and/or two 10/32" stud mounting diodes. Provided with each MS-10 package is an MK-15 power transistor mounting kit which contains a power transistor socket, mounting screws, complete mounting instructions and a mica insulating washer for use in mounting transistors to the heat sink.

This heat sink is easy to install and does not interfere with the operation of the transistor. For optimum efficiency, the MS-10 should be mounted with the fins vertical.

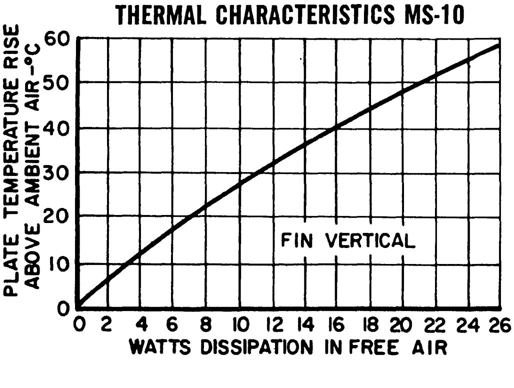
PERFORMANCE UNDER FORCED AIR FLOW OF MS-10 NATURAL CONVECTION TRANSISTOR HEAT SINK

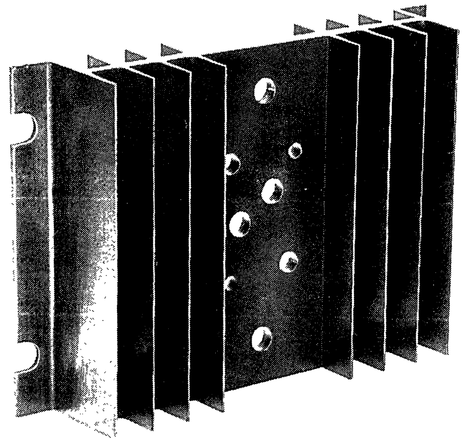


SPECIFICATIONS

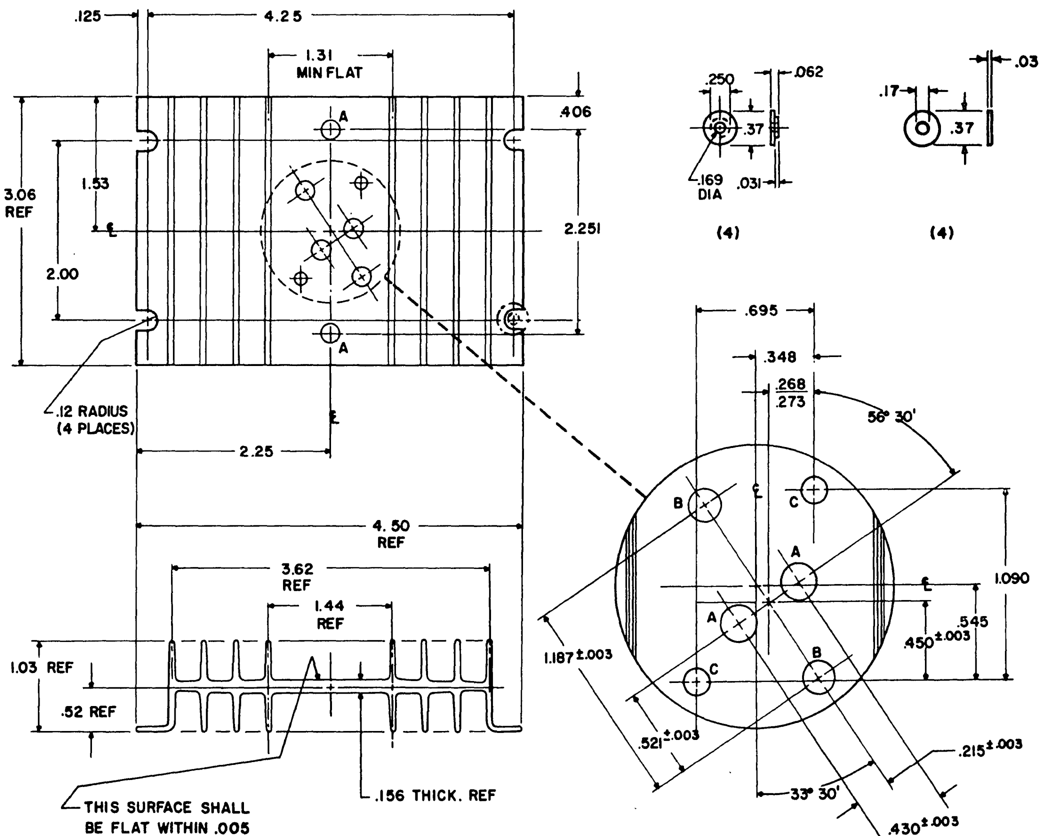
Material	Aluminum Alloy
Finish	Black
Total Surface Area	65 Sq. In. (approx.)
Thermal Resistance	3°C/watt

THERMAL CHARACTERISTICS MS-10





Providing cooling by conduction, convection and radiation, the MS-10 Heat Sink, measuring only 4-1/2" by 3-1/16", has thermal dissipation equal to that of a flat sheet of aluminum 10" x 8" x 1/8".



NATURAL CONVECTION COOLER
IS ALUMINUM. FINISH IS BLACK.

HOLE LIST	
HOLE	SIZE
A	.218 DIA
B	.188 DIA
C	.140 DIA

7

MS-15 POWER TRANSISTOR HEAT SINK

Designed specifically for use with the industry standard type TO-36 ("door-knob") power transistor, this heat sink will reduce transistor junction temperatures and permit safe operation at higher power levels or under high ambient temperatures.

Cooling is accomplished with the MS-15 by conduction, convection and radiation. Although measuring only 4-1/2" by 3-1/16", the MS-15 makes possible thermal dissipation effectively equal to that of a flat sheet of aluminum 10" by 8" by 1/8". This greatly reduces the chassis area necessary for heat dissipation at higher power levels.

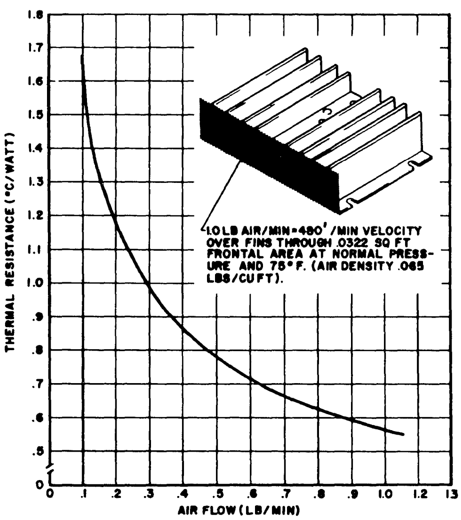
The MS-15 has a hole pattern arrangement which will accommodate the mounting of one TO-36 power transistor. Provided with each MS-15 package is assorted mounting hardware such as: insulating bushing, mica washer, nut, flat washer, solder terminal and insulating washers used in mounting the heat sink to the chassis.

The transistor with use of silicon grease should be mounted directly to the MS-15 heat sink with the insulating washers placed at each of the (4) mounting points located on the heat sink flange. This is accomplished by placing (1) shoulder washer on the bottom and (1) flat washer on top of each mounting point of the heat sink. A mica washer is supplied to isolate the transistor from the heat sink if desired.

> NOTE: When mounting the transistor to the heat sink a torque of 20 in. lbs. max should be applied to the stud.

This heat sink is easy to install and does not interfere with the operation of the transistor. For optimum efficiency, the MS-15 should be mounted with the fins vertical.

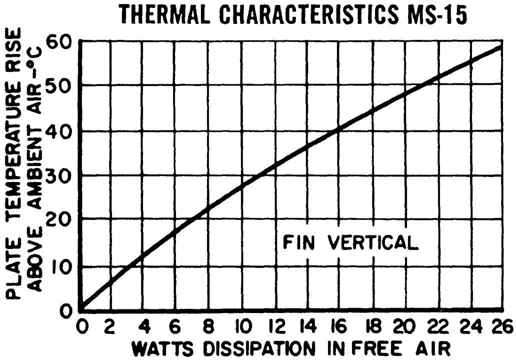
PERFORMANCE UNDER FORCED AIR FLOW OF MS-15 NATURAL CONVECTION TRANSISTOR HEAT SINK



SPECIFICATIONS

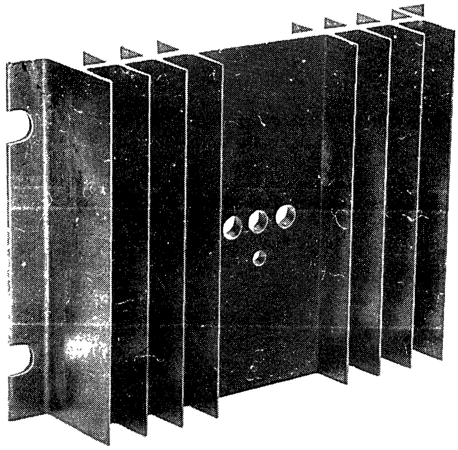
Material	Aluminum Alloy
Finish	Black
Total Surface Area	65 Sq. In. (approx.)
Thermal Resistance	3°C/watt

THERMAL CHARACTERISTICS MS-15

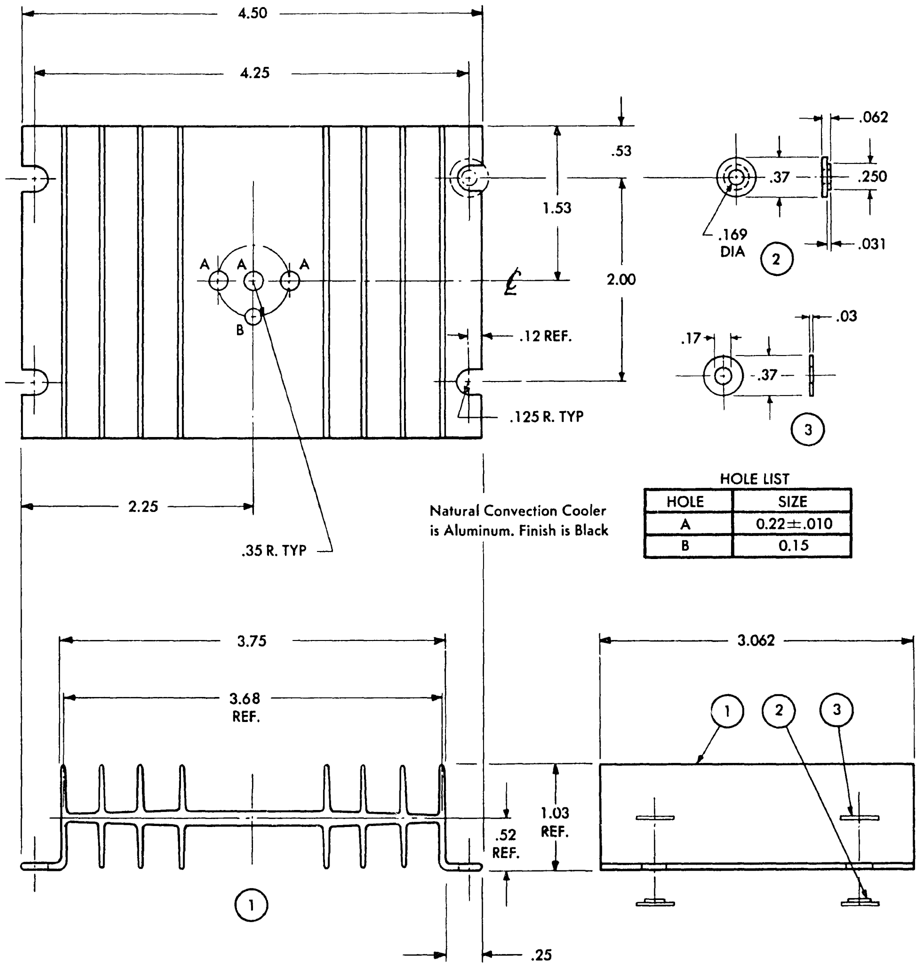


7

MS-15 (continued)



Providing cooling by conduction, convection and radiation, the MS-15 Heat Sink, measuring only 4-1/2" by 3-1/16", has thermal dissipation equal to that of a flat sheet of aluminum 10" x 8" x 1/8".



HOLE LIST

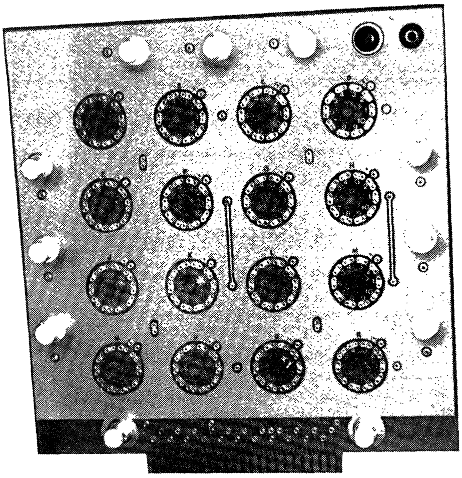
HOLE	SIZE
A	0.22±.010
B	0.15

7

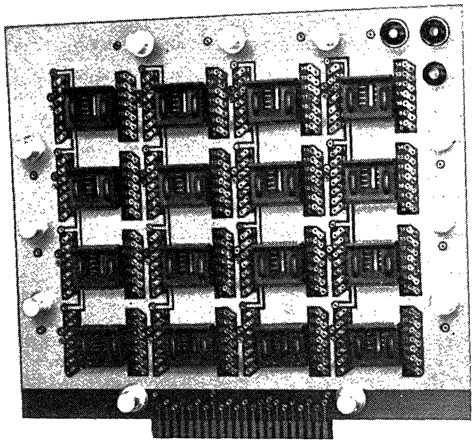
XC63
XC72
XC73

INTEGRATED CIRCUIT INTERCONNECTION BREADBOARDS

Integrated Circuit Interconnection Breadboards, designed to allow rapid interconnection and evaluation of individual integrated circuits or complete logic designs. Little or no soldering is required as a result of the extensive use of sockets and connectors.



XC63



XC72

BREADBOARD SPECIFICATIONS

Specification	XC63	XC72, XC73
Number of Sockets	16	16
Type of Socket	10-pin	14-pin
Number of Pin Jacks per Socket Pin	2	2
Input/Output	22-pin PC edge connector or 11 BNC coaxial connectors	22-pin PC edge connector or 11 BNC coaxial connectors
Power Connection	banana plugs or edge connector pins	banana plugs or edge connector pins
Power Distribution	3 voltage distribution points next to each socket	3 voltage distribution points next to each socket
Temperature Range	$-65^{o}C$ to $+150^{o}C$	$-65^{o}C$ to $+150^{o}C$
Printed Circuit	1/16" glass epoxy with 2 oz gold plated runs	1/16" glass epoxy with 2 oz gold plated runs
Frequency Range	DC to 50 MHz	DC to 50 MHz
Edge Connector*	22 pins	22 pins

*Fits into Amphenol 143-022-01 connector, which is not included with breadboard

7

HOW TO USE INTERCONNECTION PATCHBOARDS

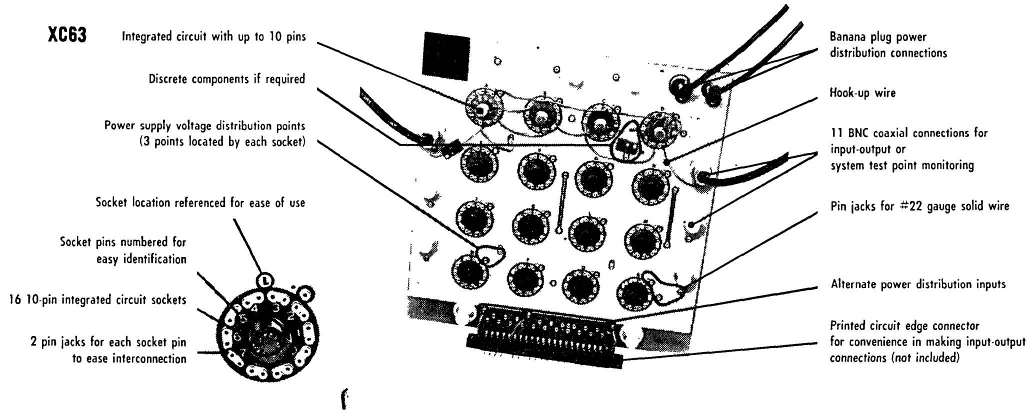
The Integrated Circuit Interconnection Patchboards are, in effect, "universal chassis" designed to simplify testing of individual devices and breadboarding of complete integrated circuit subsystems. Patchboard XC63 is designed for TO-5 integrated circuit packages with up to 10 leads, and Patchboard XC72 is designed for flat packs with up to 14 leads.

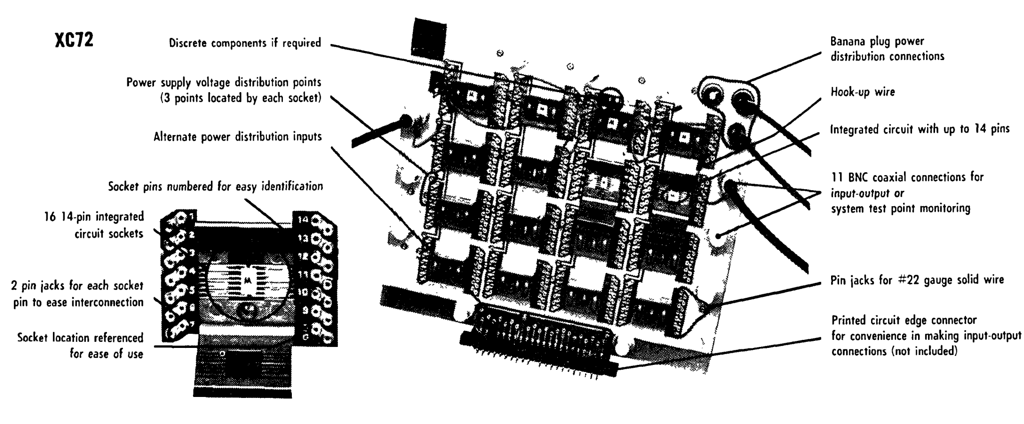
The boards contain 16 sockets for direct plug-in of integrated circuit packages. Associated with each socket are a number of spring-loaded pin jacks which are connected, through printed wiring, to the device pins. There are two pin jacks connected to each socket pin for greater interconnection flexibility. Interconnections between circuits are made simply by inserting 22 gauge (0.025 inch) solid hook-up wire into the appropriate pin jacks, which are designed for high retention capability even after numerous insertions.

A series of eleven BNC coaxial connectors, located around the periphery of the board provide convenient access points for applying input signals and sampling the outputs. Additional communication to and from the board can be made through 22 pin jacks, located on one edge of the board, which are wired to accommodate an edge-mounted, printed circuit strip connector (not supplied).

Three voltage-distribution planes are provided on each board. Two of these, in the form of a copper lamination on each side of the board, are accessible to power supply inputs through banana jacks mounted on the board. Two pin jacks near each socket location are in contact with the copper (one with each plane) and provide a ready means for applying the power supply voltages to the various jacks. A third voltage may be distributed from the edge-mounted strip connector pin jacks which have printed wiring runs to a number of additional pin jacks mounted at convenient locations throughout the board.

Each of the 16 integrated circuit sockets is lettered to aid in correlating logic block diagrams with the patchboard. The pins of each socket are numbered as a further aid. The use of these boards permits the same integrated circuits to be used repeatedly for the evaluation of many commonly used logic configurations with a minimum of effort. More complex designs may be studied by interconnecting several breadboards. Thus, all designs may be evaluated and finalized before the integrated circuits are permanently interconnected in the system.





7

OUTLINE DIMENSIONS

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MOTOROLA CASE NUMBER CROSS REFERENCE

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Case 4-04	TO-41
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Case 6	–
Case 7	TO-68
Case 8	–
Case 9	TO-61
Case 11	TO-3
Case 11A	TO-3*
Case 12	TO-3*
Case 17	–
Case 19	–
Case 20	TO-72
Case 21	TO-17
Case 22	TO-18
Case 22A	TO-18*
Case 23	TO-107
Case 24	TO-102
Case 25	–
Case 26	TO-46
Case 27	TO-52
Case 28	–
Case 29-01,-02	TO-92
Case 29A	–
Case 31	TO-5
Case 34	–
Case 34A	TO-12
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Case 39	TO-37
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Case 43	DO-21
Case 44	DO-4
Case 45	–
Case 46	–
Case 47	–
Case 47A	–
Case 48	–
Case 51	DO-7
Case 52	DO-13
Case 53	–
Case 54	TO-3*
Case 55	–
Case 56	DO-4
Case 56A	DO-4
Case 56B	–
Case 57	–
Case 58	–
Case 59	DO-41
Case 60	–
Case 61	TO-41
Case 62	–
Case 63	–
Case 64	TO-48
Case 70	–
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Case 77-03	–
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Case 80-02	TO-66
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Case 85L	–
Case 86	–
Case 86L	–
Case 87	–
Case 87L	–
Case 88	–
Case 88L	–
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Case 91	–
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Case 144C-02	–
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Case 145A-02	–
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Case 146	DO-14
Case 149-02	TO-1
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Case 154	–
Case 154A	–
Case 155	–
Case 155A	–
Case 156	–
Case 156A	–
Case 157	–
Case 157A	–
Case 158	–
Case 159	–
Case 160	TO-59
Case 160A	TO-59
Case 161	TO-41
Case 166	–
Case 167	–

*Modified

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MOTOROLA CASE NUMBER CROSS REFERENCE (continued)

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Case 169	–	Case 250	–	Case 651	–
Case 171	–	Case 253	–	Case 654-04	TO-78
Case 172	–	Case 257	DO-5	Case 654-07	TO-78
Case 173	–	Case 262	–	Case 655	TO-71
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Case 209	–	Case 623	–	Case 695	TO-71
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Case 211-02	–	Case 627	–		
Case 212	–	Case 628	TO-91		
Case 215	–	Case 631	–		
Case 216	–	Case 632	TO-116		
Case 219	TO-94	Case 635	–		
Case 222	–	Case 637	–		
Case 226	–	Case 638	–		
Case 229	–	Case 639	–		
Case 230	–	Case 641	–		
Case 231	–	Case 642	TO-76		
Case 232	–	Case 643A	–		
Case 234-01	–	Case 644A	–		
Case 234-02	–	Case 645	–		
Case 235	–	Case 646	TO-116		
Case 244	–	Case 647	–		
Case 246	TO-83	Case 648	–		
Case 247	–	Case 649	–		

REGISTERED CASE NUMBER CROSS REFERENCE

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	Case 56A
	Case 56B
DO-5	Case 42
	Case 257
DO-7	Case 42A
	Case 51
DO-13	Case 52
DO-14	Case 146
DO-21	Case 43
DO-41	Case 59
	Case 61
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TO-3	Case 1
	Case 11
TO-3*	Case 3
	Case 3A
	Case 11A
	Case 12
	Case 54
TO-5	Case 31
TO-9	Case 143
TO-12	Case 34A
TO-17	Case 21
TO-18	Case 22
TO-18*	Case 22A
TO-36	Case 5
TO-37	Case 39
TO-39	Case 79
TO-41	Case 4
	Case 4-04
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TO-100	Case 603-03
TO-102	Case 24
TO-107	Case 23
TO-114	Case 177
TO-116	Case 632
	Case 646

*Modified

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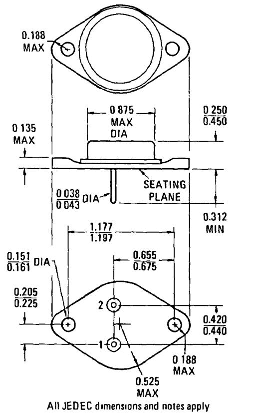
CASE OUTLINE DIMENSIONS

DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

CASE 1 (TO-3)

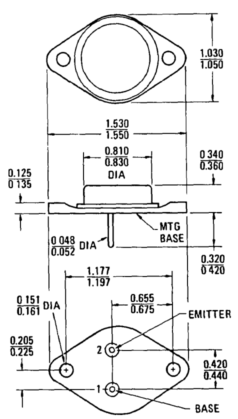


All JEDEC dimensions and notes apply

STYLE 1
PIN 1. BASE
2. EMITTER
Collector connected to case

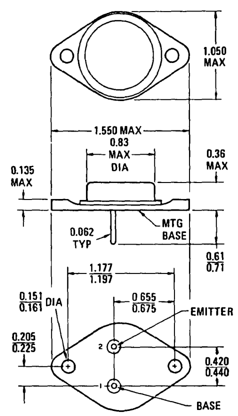
STYLE 2.
PIN 1. BASE
2. COLLECTOR
Emitter connected to case

CASE 3 (TO-3)



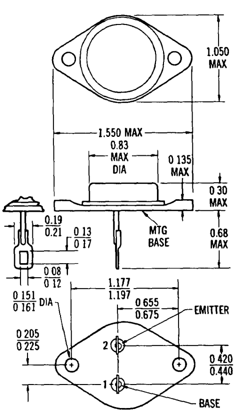
Collector connected to case

CASE 3A (TO-3)



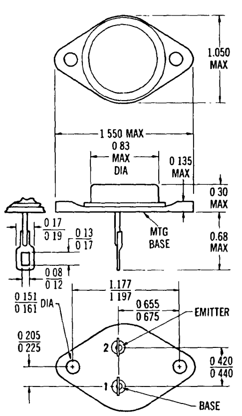
Collector connected to case

CASE 4 (TO-41)



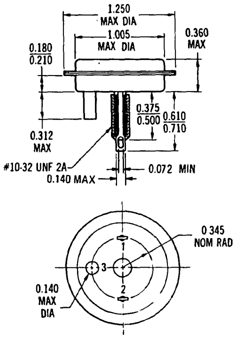
All JEDEC dimensions and notes apply
Collector connected to case

CASE 4-04 (TO-41)



All JEDEC dimensions and notes apply
Collector connected to case

CASE 5 (TO-36)

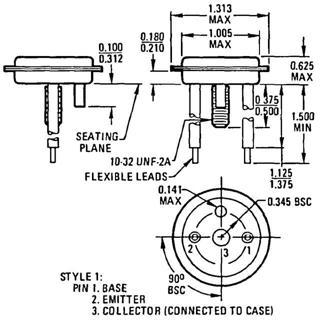


PIN 1. Base
2. Emitter
3. Locator Pin
(Insulated)

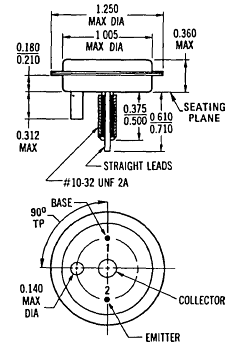
All JEDEC dimensions and notes apply
Collector connected to case

8

CASE6

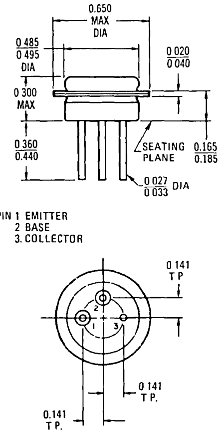


CASE 7 (TO-68)

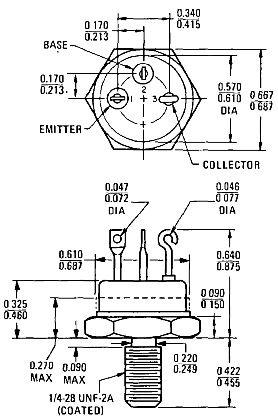


Collector connected to case

CASE 8



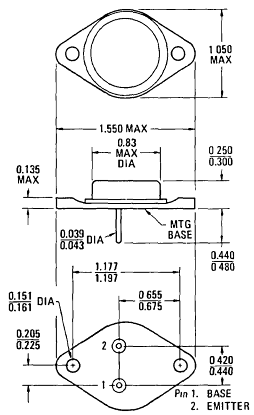
CASE 9 (TO-61)



All JEDEC dimensions and notes apply

Collector connected to case

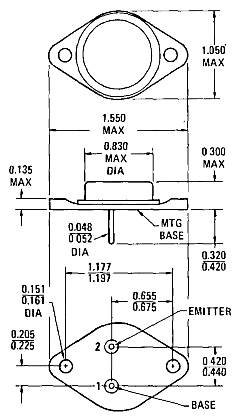
CASE 11 (TO-3)



All JEDEC dimensions and notes apply

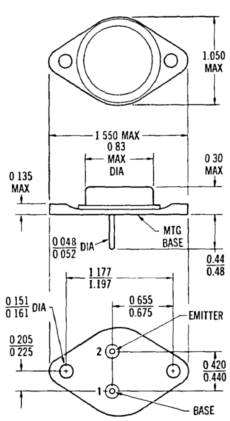
Collector connected to case

CASE 11A (TO-3)



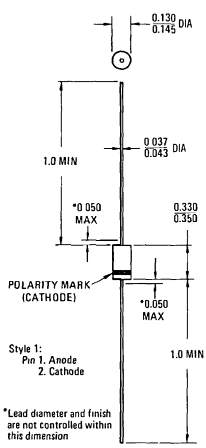
Collector connected to case

CASE 12 (TO-3)

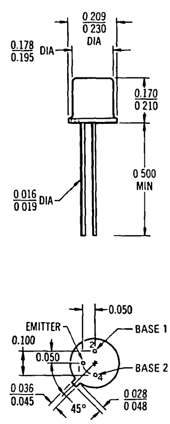


Collector connected to case

CASE 17

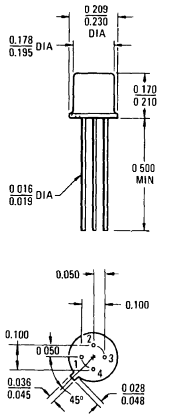


CASE 19



8

CASE 20 (TO-72)



All JEDEC dimensions and notes apply

CASE 20 STYLES

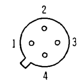
STYLE 1
PIN 1 SOURCE
2 DRAIN
3 GATE
4 CASE LEAD

STYLE 2
PIN 1. SOURCE
2. GATE
3 DRAIN
4 SUBSTRATE AND CASE LEAD

STYLE 3
PIN 1 DRAIN
2 SOURCE
3 GATE
4 CASE LEAD

STYLE 4
PIN 1. SOURCE
2. GATE
3 DRAIN
4 GATE 2 – SUBSTRATE AND CASE

STYLE 5
PIN 1 SOURCE
2. GATE 1
3 DRAIN
4. CASE



STYLE 6
PIN 1 DRAIN
2 SOURCE AND SUBSTRATE
3 GATE
4. SOURCE AND SUBSTRATE

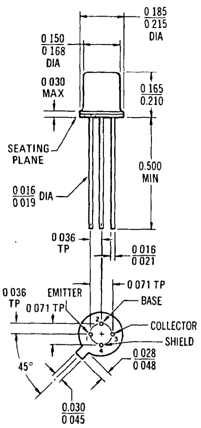
STYLE 7
PIN 1 DRAIN
2 SOURCE
3 GATE
4. CASE AND SUBSTRATE

STYLE 8
PIN 1 EMITTER 2
2. BASE 1
3 COLLECTOR
4 EMITTER 1 BASE 2

STYLE 9
PIN 1 DRAIN
2 GATE 2
3 GATE 1
4 SOURCE, SUBSTRATE AND CASE

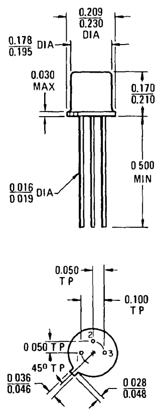
STYLE 10
PIN 1. EMITTER
2 BASE
3 COLLECTOR
4 CASE

CASE 21 (TO-17)



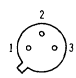
All JEDEC dimensions and notes apply

CASE 22 (TO-18)



All JEDEC dimensions and notes apply

CASE 22 STYLES



STYLE 1.
PIN 1. EMITTER
2 BASE
3. COLLECTOR

STYLE 2
PIN 1 SOURCE, SUBSTRATE, AND CASE
2 GATE
3 DRAIN

STYLE 3.
PIN 1 SOURCE
2. DRAIN
3. GATE

STYLE 4.
PIN 1. SOURCE
2 DRAIN
3. GATE AND CASE

STYLE 5:
PIN 1. EMITTER
2. BASE 1
3. BASE 2

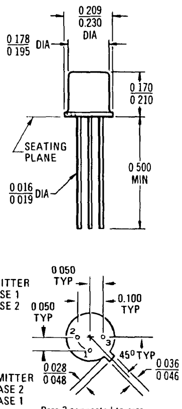
STYLE 6
PIN 1 CATHODE
2. GATE
3 ANODE

STYLE 7.
PIN 1. ANODE
2. BASE
3 CATHODE

STYLE 8:
PIN 1. GATE
2. ANODE 1
3. ANODE 2

STYLE 9:
PIN 1. ANODE 2
2. ANODE 1
3. GATE (CONNECTED TO CASE)

CASE 22A (TO-18)

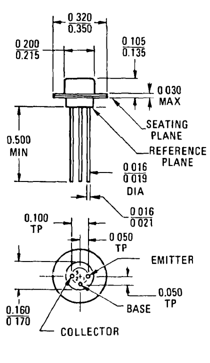


STYLE 1
PIN 1. EMITTER
2 BASE 1
3 BASE 2

STYLE 2
PIN 1 EMITTER
2. BASE 2
3. BASE 1

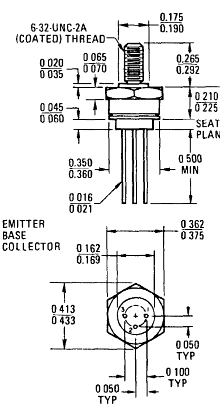
Base 2 connected to case

CASE 23 (TO-107)



All JEDEC dimensions and notes apply

CASE 24 (TO-102)

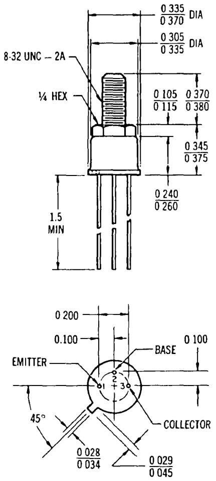


PIN 1. EMITTER
2. BASE
3 COLLECTOR

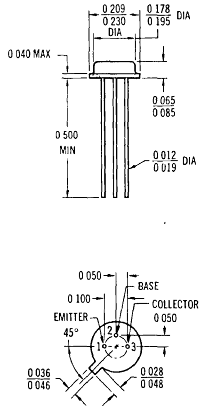
All JEDEC dimensions and notes apply
Collector connected to case, stud isolated from case

8

CASE 25

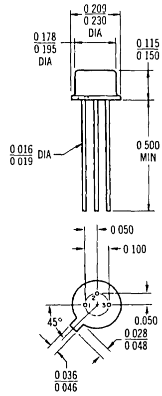


CASE 26 (TO-46)



All JEDEC dimensions and notes apply

CASE 27 (TO-52)

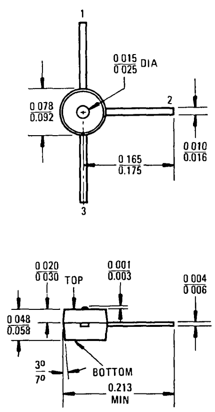


STYLE 1
PIN 1. EMITTER
2 BASE
3 COLLECTOR

STYLE 2
PIN. 1 DRAIN
2. SOURCE
3 CATE & CASE

All JEDEC dimensions and notes apply

CASE 28



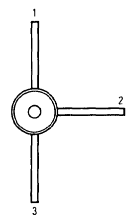
CASE 28 STYLES

STYLE 1
PIN 1 BASE
2 EMITTER
3 COLLECTOR

STYLE 2
PIN 1 ANODE 2
2 ANODE 1
3 CATHODE

STYLE 3
PIN 1 CATHODE 2
2 CATHODE 1
3 ANODE

STYLE 4
PIN 1. CATHODE
2 ANODE
3 COMMON
CATHODE
ANODE



STYLE 5
PIN 1 DRAIN
2 SOURCE
3 GATE

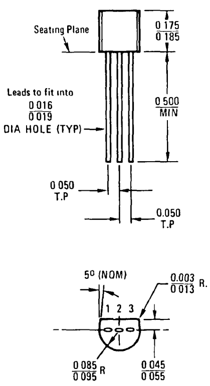
STYLE 6
PIN 1. EMITTER
2 COLLECTOR
3 BASE

STYLE 7
PIN 1 BASE 1
2 EMITTER
3 BASE 2

STYLE 8
PIN 1 CATHODE
2 GATE
3 ANODE

STYLE 9
PIN 1 SOURCE
2 GATE
3 DRAIN

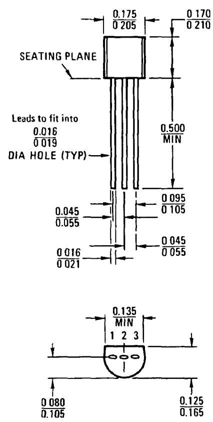
CASE 29-01



All JEDEC dimensions and notes apply

CASE 29-02

(TO-92)



All JEDEC dimensions and notes apply

Dimensions are in inches unless otherwise noted.

8

CASE 29 STYLES

STYLE 1.
PIN 1. EMITTER
2. BASE
3. COLLECTOR .

STYLE 2:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 3:
PIN 1. ANODE
2. ANODE
3. CATHODE

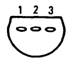
STYLE 4·
PIN 1. CATHODE
2. CATHODE
3 ANODE

STYLE 5:
PIN 1. DRAIN
2. SOURCE
3. GATE

STYLE 6:
PIN 1. GATE
2. SOURCE&SUBSTRATE
3. DRAIN

STYLE 7:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 8:
PIN 1. DRAIN
2. GATE
3. SOURCE & SUBSTRATE



STYLE 9:
PIN 1. BASE 1
2. EMITTER
3. BASE 2

STYLE 10:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 11:
PIN 1. ANODE
2. CATHODE & ANODE
3. CATHODE

STYLE 12:
PIN 1. ANODE 1
2. GATE
3. ANODE 2

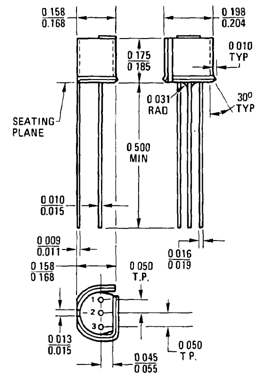
STYLE 13:
PIN 1. ANODE 1
2. GATE
3. CATHODE 2

STYLE 14:
PIN 1. EMITTER
2. COLLECTOR
3. BASE

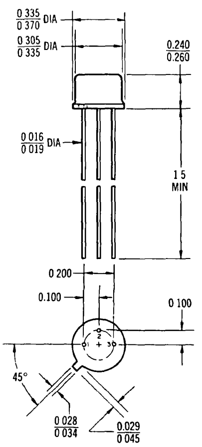
STYLE 15:
PIN 1. ANODE 1
2. CATHODE
3. · ANODE 2

STYLE 16:
PIN 1. ANODE
2. GATE
3. CATHODE

CASE 29A

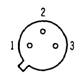


CASE 31 (TO-5)



All JEDEC dimensions and notes apply

CASE 31 STYLES

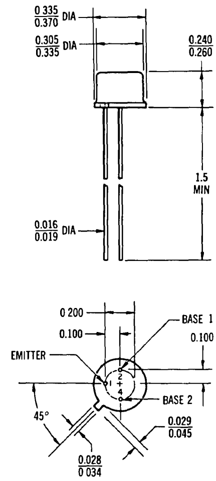


STYLE 1
PIN 1. EMITTER
2. BASE
3. COLLECTOR

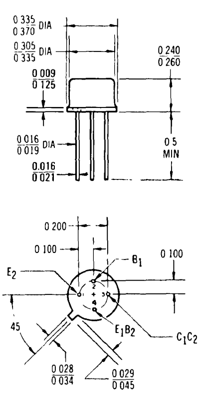
STYLE 2
PIN 1. CATHODE
2 GATE
3. ANODE

STYLE 3
PIN 1. GATE
2 CATHODE
3 ANODE

CASE 34

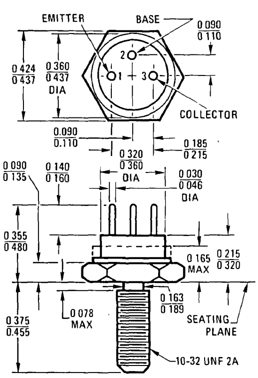


CASE 34A (TO-12)



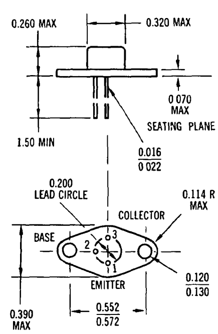
All JEDEC dimensions and notes apply
Collector connected to case

CASE 36 (TO-60)



All JEDEC dimensions and notes apply
STYLE 1 All leads isolated from case
STYLE 2 Emitter connected to case

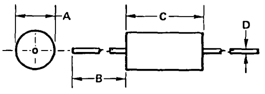
CASE 39 (TO-37)



All JEDEC dimensions and notes apply
Collector connected to case

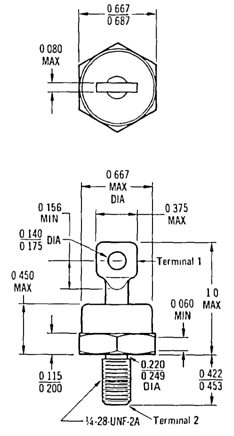
8

CASE 41



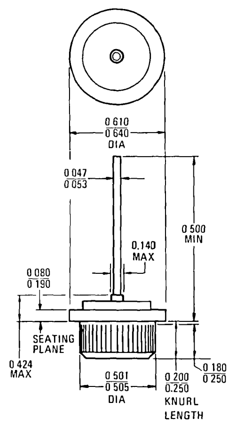
PKG.	OUTLINE DIMENSIONS (INCHES) A MAX	B MIN	C MAX	D MIN/MAX
41-01	0.500	1.25	1.000	0.030/0.034
41-02	0.375	1.25	0.500	0.030/0 034
41-03	0.378	1.25	1.030	0.030/0.034
41-04	0.641	1.75	1.220	0.030/0.034
41-05	0.641	1.25	0.655	0.030/0.034
41-06	0.275	1.25	0.520	0.018/0.022
41-07	0.375	1.25	1.000	0 030/0.034
	MIN/MAX			
41-08	0.240/0.260	1.00	0.520	0.028/0.032
41-09	0.240/0.260	1 00	0.780	0.023/0.032
41-10	0.303/0.323	1.00	1.155	0 028/0.032

CASE 42 (DO-5)



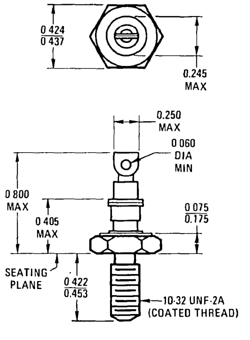
All JEDEC dimensions and notes apply

CASE 43 (DO-21)



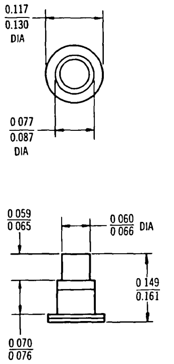
All JEDEC dimensions and notes apply

CASE 44 (DO-4)

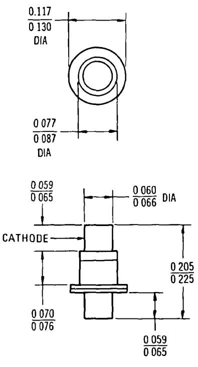


All JEDEC dimensions and notes apply

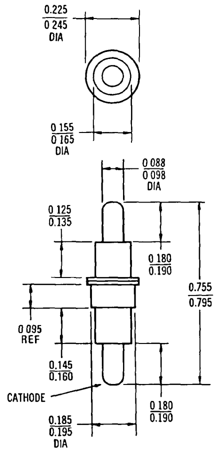
CASE 45



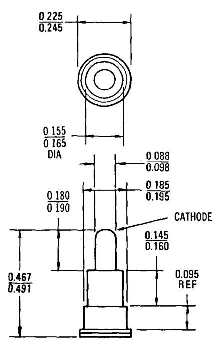
CASE 46



CASE 47



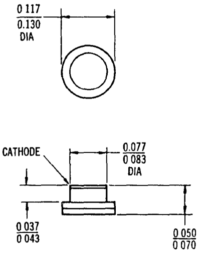
CASE 47A



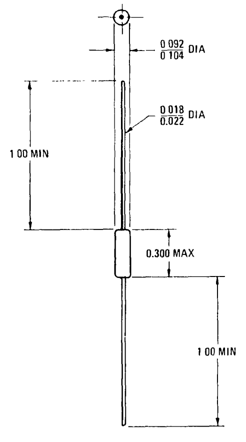
Dimensions are in inches unless otherwise noted.

8

CASE 48

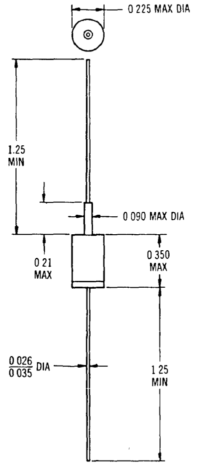


CASE 51 (DO-7)



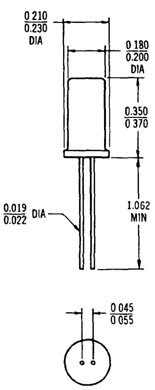
All JEDEC dimensions and notes apply

CASE 52 (DO-13)

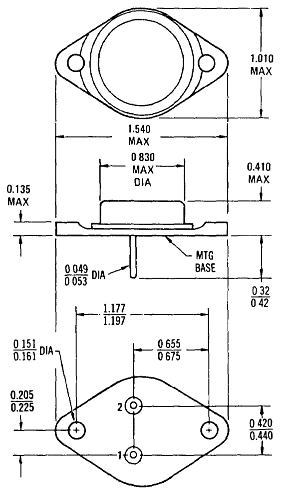


All JEDEC dimensions and notes apply

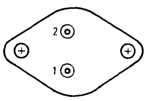
CASE 53



CASE 54 (TO-3)



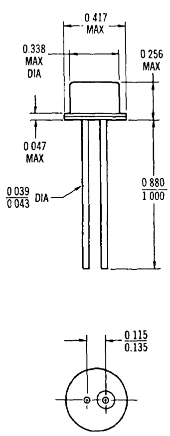
CASE 54 STYLES



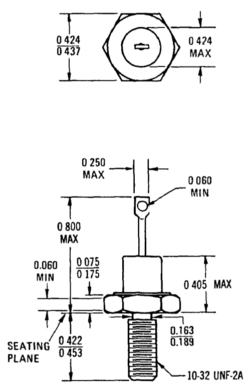
STYLE 1
PIN 1. ANODE
2. GATE
CASE CATHODE

STYLE 2
PIN 1. GATE
2. CATHODE
CASE ANODE

CASE 55

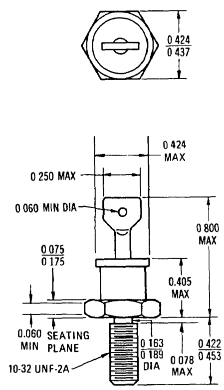


CASE 56 (DO-4)



All JEDEC dimensions and notes apply

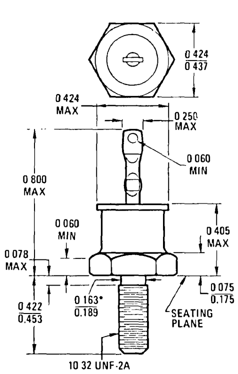
CASE 56A (DO-4)



All JEDEC dimensions and notes apply

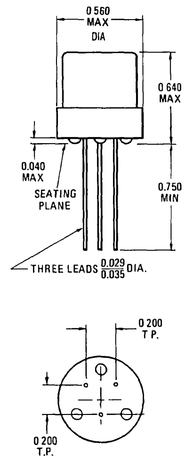
8

CASE 56B

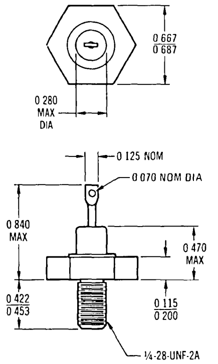


*Dimension is a diameter
All JEDEC dimensions and notes apply

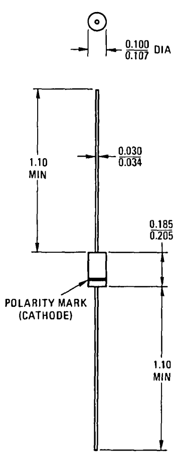
CASE 57



CASE 58

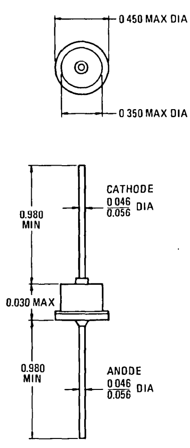


CASE 59 (DO-41)

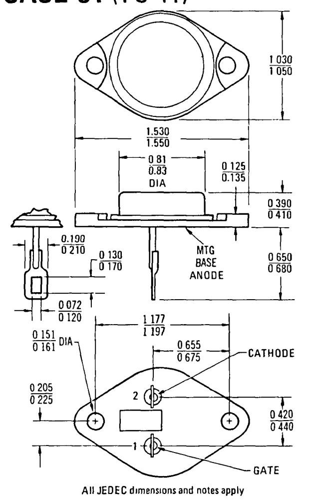


All JEDEC dimensions and notes apply

CASE 60

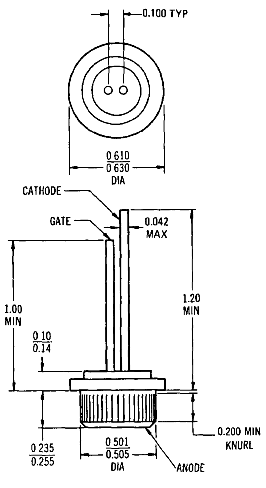


CASE 61 (TO-41)

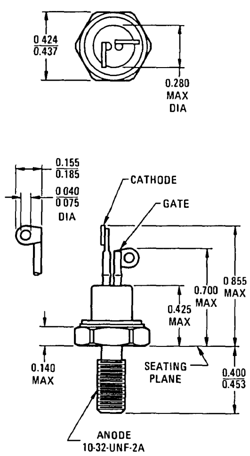


All JEDEC dimensions and notes apply

CASE 62



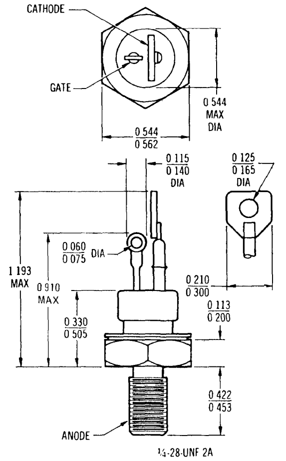
CASE 63



Dimensions are in inches unless otherwise noted.

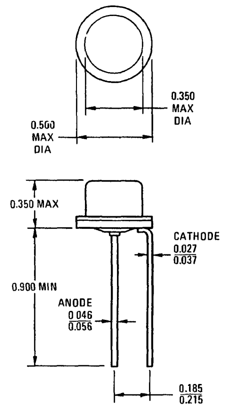
8

CASE 64 (TO-48)

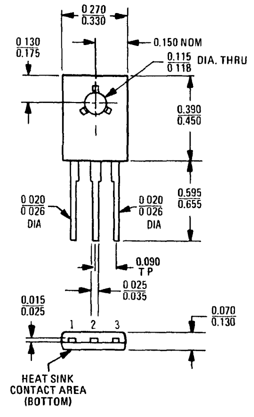


All JEDEC dimensions and notes apply

CASE 70

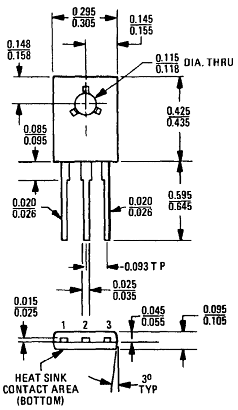


CASE 77-02



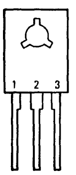
(See page 8-41 for lead form availability)

CASE 77-03



(See page 8-41 for lead form availability)

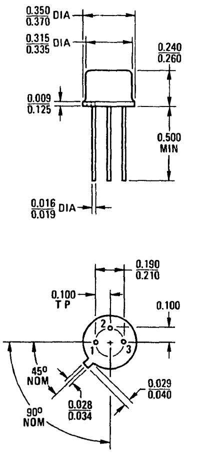
CASE 77 STYLES



STYLE 1
PIN 1. EMITTER
2. COLLECTOR
3. BASE
STYLE 2
PIN 1. CATHODE
2. ANODE
3. GATE
STYLE 3
PIN 1. BASE
2. COLLECTOR
3. EMITTER
STYLE 4
PIN 1. ANODE 1
2. ANODE 2
3. GATE
STYLE 5
PIN 1. MT1
2. MT2
3. GATE

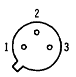
NOTE:
1. MT = MAIN TERMINAL

CASE 79 (TO-39)



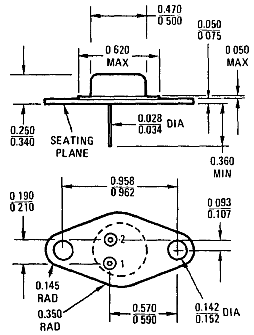
All JEDEC dimensions and notes apply

CASE 79 STYLES



STYLE 1
PIN 1. EMITTER
2. BASE
3. COLLECTOR
STYLE 2
PIN 1. DRAIN
2. SOURCE
3. GATE
STYLE 3
PIN 1. CATHODE
2. GATE
3. ANODE

CASE 80-02 (TO-66)

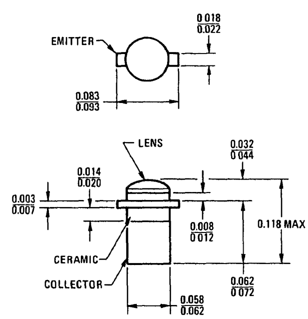


STYLE 1
PIN 1. BASE
2. EMITTER

STYLE 2
PIN 1. EMITTER
2. BASE

All JEDEC dimensions and notes apply
Collector connected to case

CASE 81 (DO-31)



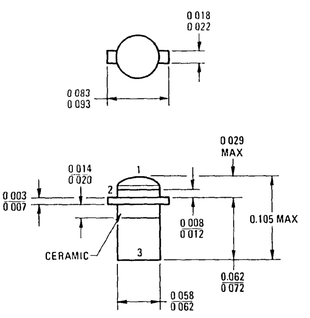
STYLE 1
PIN 1. LENS
2. EMITTER
3. COLLECTOR

STYLE 2
PIN 1. LENS
2. ANODE
3. CATHODE

All JEDEC dimensions and notes apply

8

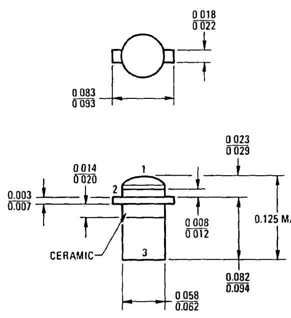
CASE 81A-01



STYLE 1
PIN 1. LENS
2. EMITTER
3. COLLECTOR

STYLE 2
PIN 1. LENS
2. ANODE
3. CATHODE

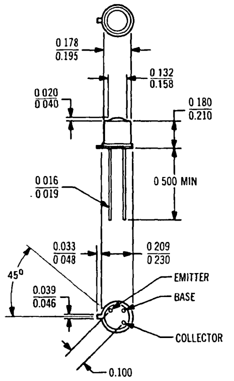
CASE 81A-02



STYLE 1
PIN 1. LENS
2. EMITTER
3. COLLECTOR

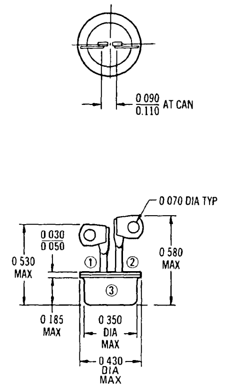
STYLE 2
PIN 1. LENS
2. ANODE
3. CATHODE

CASE 82



NOTES. Leads are gold-plated kovar
Collector internally connected to case
Package weight ≈ 0.45 grams

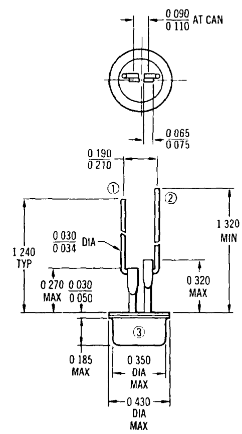
CASE 85



STYLE 1:
PIN 1. GATE
2. CATHODE
CAN-ANODE

STYLE 2:
PIN 1. GATE
2. MAIN TERMINAL 1
3. MAIN TERMINAL 2

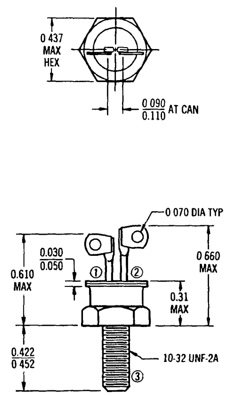
CASE 85L



STYLE 1.
PIN 1. GATE
2. CATHODE
CAN-ANODE

STYLE 2
PIN 1. GATE
2. MAIN TERMINAL 1
3. MAIN TERMINAL 2

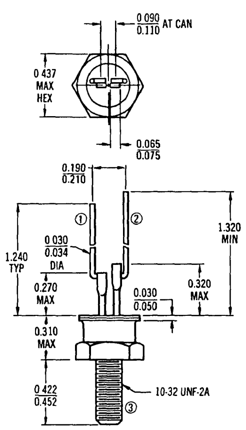
CASE 86



STYLE 1:
PIN 1. GATE
2. CATHODE
STUD-ANODE

STYLE 2:
PIN 1. GATE
2. MAIN TERMINAL 1
3. MAIN TERMINAL 2

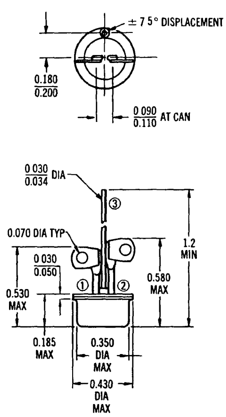
CASE 86L



STYLE 1:
PIN 1. GATE
2. CATHODE
STUD-ANODE

STYLE 2:
PIN 1. GATE
2. MAIN TERMINAL 1
3. MAIN TERMINAL 2

CASE 87



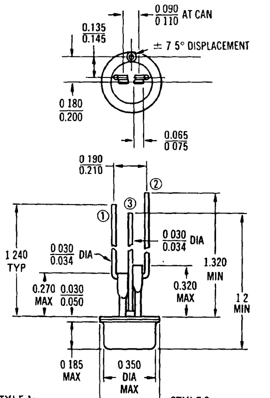
STYLE 1·
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 2
PIN 1. GATE
2. MAIN TERMINAL 1
3. MAIN TERMINAL 2

Dimensions are in inches unless otherwise noted.

8

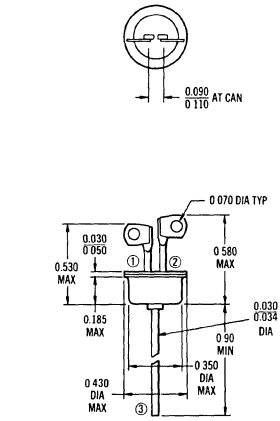
CASE 87L



STYLE 1:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 2:
PIN 1. GATE
2. MAIN TERMINAL 1
3. MAIN TERMINAL 2

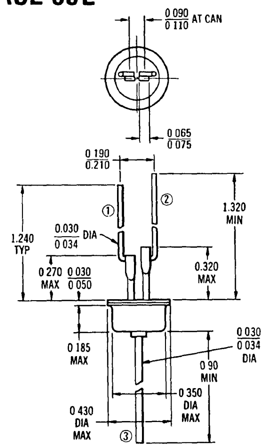
CASE 88



STYLE 1:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 2:
PIN 1. GATE
2. MAIN TERMINAL 1
3. MAIN TERMINAL 2

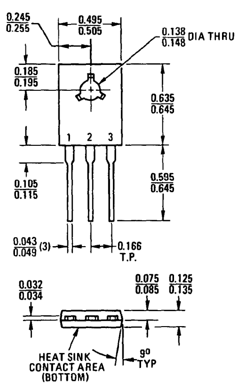
CASE 88L



STYLE 1:
PIN 1. GATE
2. CATHODE
3. ANODE

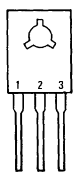
STYLE 2:
PIN 1. GATE
2. MAIN TERMINAL 1
3. MAIN TERMINAL 2

CASE 90-05



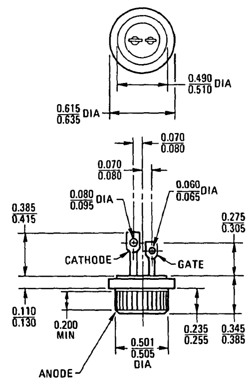
(See page 8-42 for lead form availability)

CASE 90 STYLES

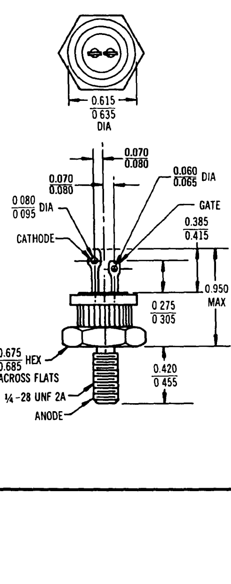


STYLE 1
PIN 1. CATHODE
2. ANODE
3. GATE
STYLE 2
PIN 1 EMITTER
2 COLLECTOR
3. BASE
STYLE 3
PIN 1. CATHODE
2. GATE
3. ANODE
STYLE 4
PIN 1. MT 1
2. MT 2
3. GATE

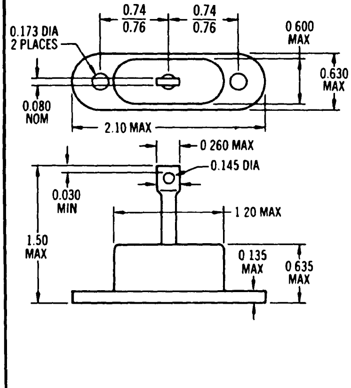
CASE 91



CASE 92



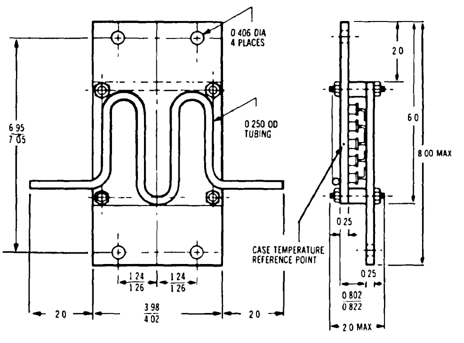
CASE 100



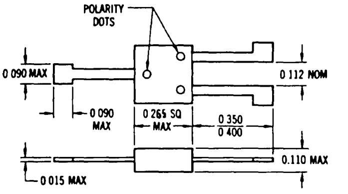
Dimensions are in inches unless otherwise noted.

8

CASE 105

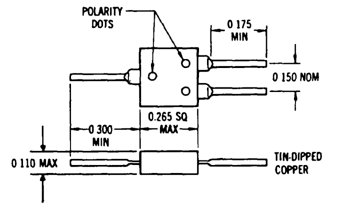


CASE 106



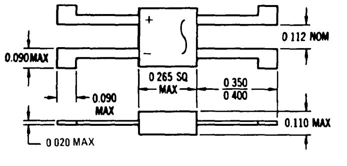
COLOR-CODED POLARITY DOTS:
Y = AC INPUT
R = +DC OUTPUT
(NO MARK) = -DC OUTPUT

CASE 107

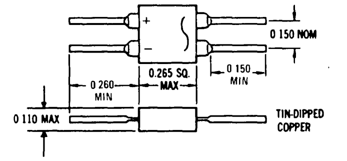


Leads formed to fit into
a hole 0.037 min.

CASE 108

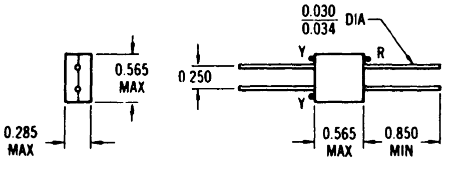


CASE 109

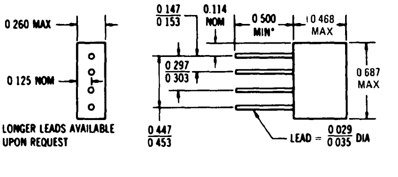


Leads formed to fit into
a hole 0.037 min.

CASE 110

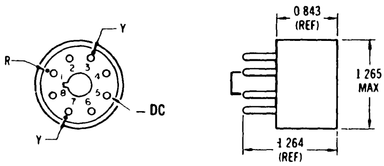


CASE 111

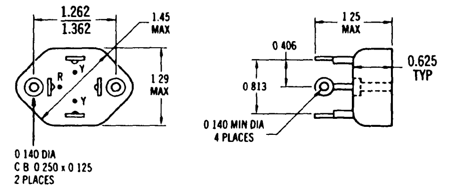


8

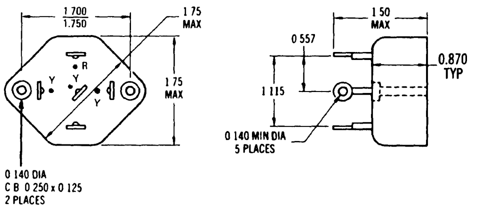
CASE 112



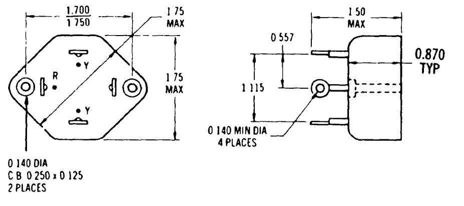
CASE 113



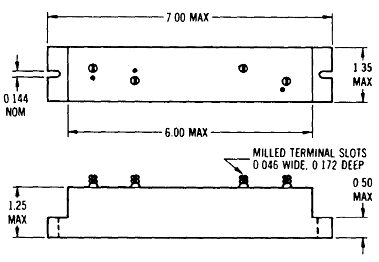
CASE 114



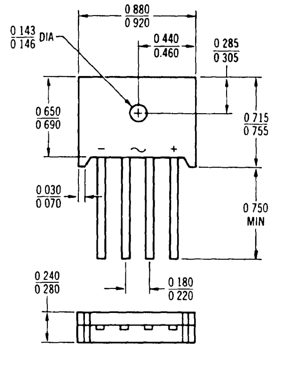
CASE 115



CASE 116

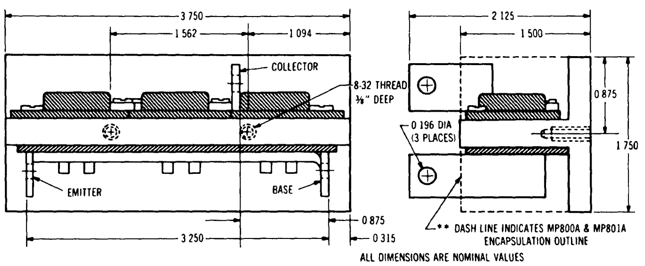


CASE 117



LEAD PATTERN CENTERED
LEADS MUST FIT INTO
0 055 MIN DIA HOLE

CASE 118

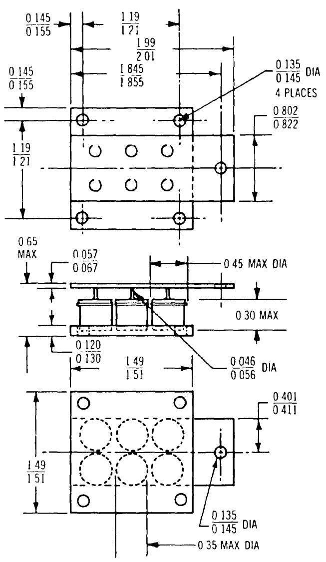


ALL DIMENSIONS ARE NOMINAL VALUES
COLLECTOR IS ELECTRICALLY ISOLATED FROM HEAT SINK CHASSIS

Dimensions are in inches unless otherwise noted.

8

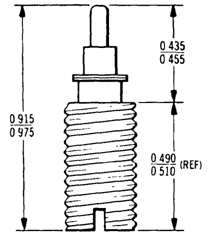
CASE 119



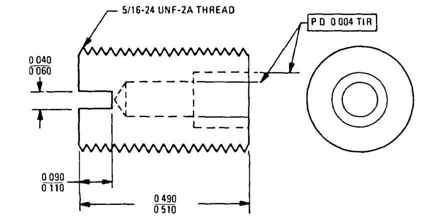
HEAT SINK MAT'L AL ALLOY 3003
WITH NICKEL PLATING

WEIGHT 30 GRAMS (APPROX)

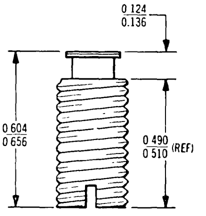
CASE 120



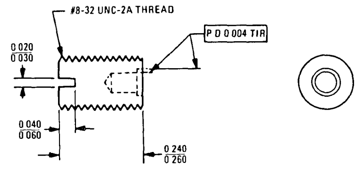
CASE 120, 121 (Adapter Detail)



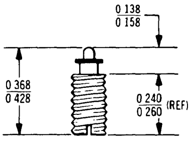
CASE 121



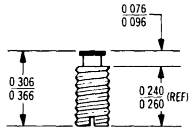
CASE 122, 123, 124 (Adapter Detail)



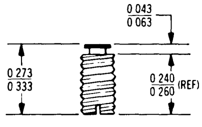
CASE 122



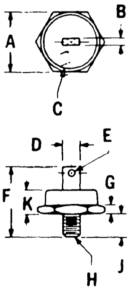
CASE 123



CASE 124

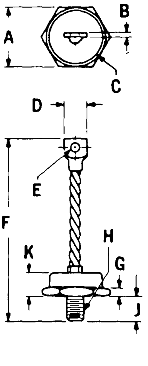


CASE 125
CASE 126
CASE 127
CASE 128



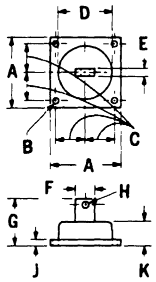
DIMENSION	CASE 125	CASE 126	CASE 127	CASE 128
A (hex)	1.250	1.75	2.00	2.250
B (max)	0.135	0.260	0.260	0.320
C (max dia)	1.20	1.72	1.94	2.20
D (max)	0.525	0.760	1.10	1.10
E (dia)	0.250	0.375	0.562	0.562
F (max)	2.25	3.0	3.50	3.72
G (typ)	0.125	0.375	0.375	0.375
H (thread)	10-32	¾-16 UNF	¾-16 UNF	¾-16 UNF
J (max)	0.500	1.00	1.00	1.00
K (max)	0.570	1.10	1.10	1.10

CASE 129
CASE 130
CASE 131
CASE 132



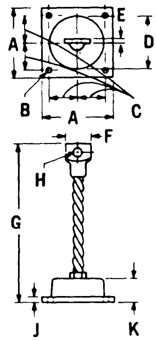
DIMENSION	CASE 129	CASE 130	CASE 131	CASE 132
A (hex)	1.250	1.75	2.00	2.250
B (max)	0.113	0.155	0.200	0.260
C (max dia)	1.20	1.72	1.94	2.20
D (max)	0.590	0.64	1.00	1.155
E (dia)	0.281	0.343	0.531	0.562
F (max)	6.25	8.10	8.10	8.10
G (typ)	0.125	0.375	0.375	0.375
H (thread)	10-32	¾-16 UNF	¾-16 UNF	¾-16 UNF
J (max)	0.500	1.00	1.00	1.00
K (max)	0.570	1.10	1.10	1.10

CASE 133
CASE 134
CASE 135
CASE 136



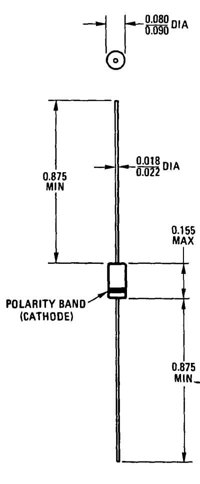
DIMENSION	CASE 133	CASE 134	CASE 135	CASE 136
A (typ)	2.25	3.00	3.00	3.25
B (dia)	0.203	0.281	0.281	0.281
C (max)	0.880	1.255	1.255	1.380
D (max dia)	1.720	2.100	2.200	2.885
E (max)	0.260	0.260	0.320	0.500
F (max)	0.760	1.100	1.100	1.30
G (max)	1.9	2.50	2.70	2.50
H (dia)	0.375	0.562	0.562	0.562
J (max)	0.260	0.260	0.260	0.260
K (max)	1.00	1.00	1.00	1.00

CASE 137
CASE 138
CASE 139

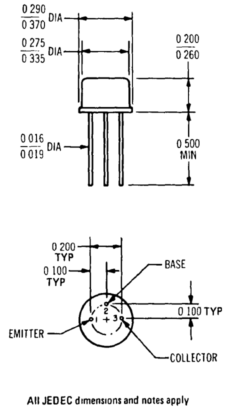


DIMENSION	CASE 137	CASE 138	CASE 139
A (typ)	2.25	3.00	3.00
B (dia)	0.203	0.281	0.281
C (max)	0.880	1.255	1.255
D (max dia)	1.720	2.100	2.20
E (max)	0.155	0.200	0.260
F (max)	0.64	1.00	1.155
G (max)	7.10	6.90	6.90
H (dia)	0.343	0.531	0.562
J (max)	0.260	0.260	0.260
K (max)	1.00	1.00	1.00

CASE 142



CASE 143 (TO-9)

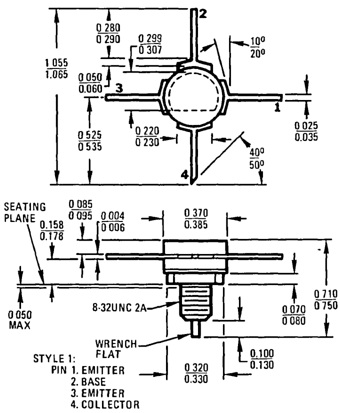


All JEDEC dimensions and notes apply

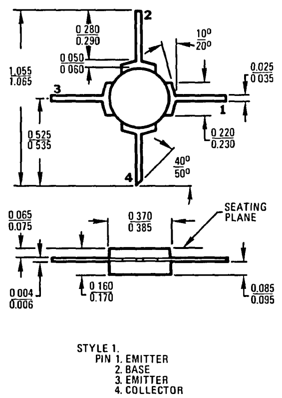
Dimensions are in inches unless otherwise noted.

8

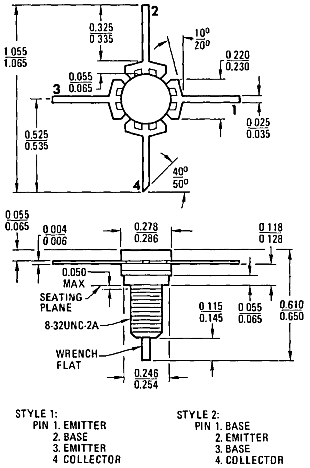
CASE 144B-03



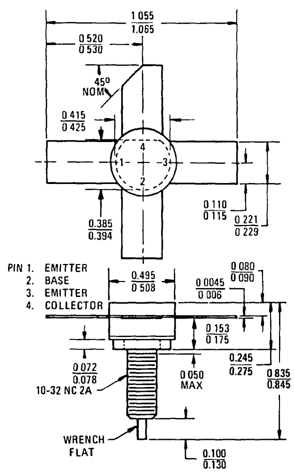
CASE 144C-02



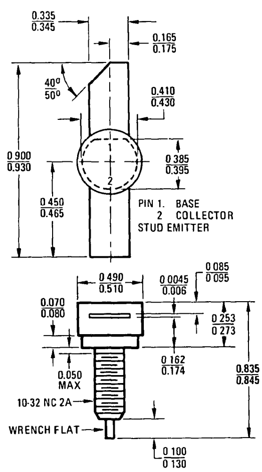
CASE 144D-04



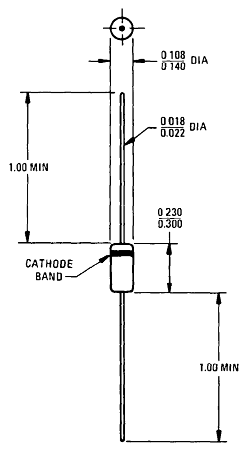
CASE 145A-02



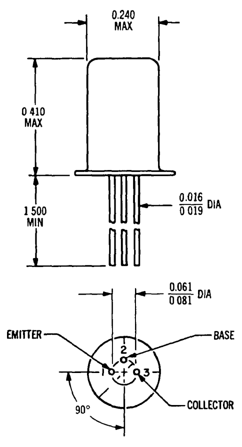
CASE 145C-01



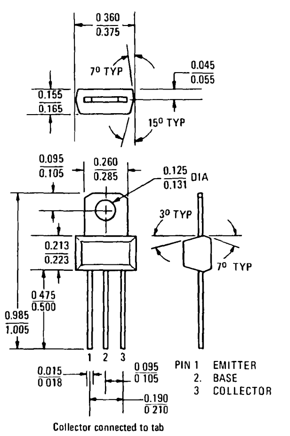
CASE 146 (DO-14)



CASE 149-02 (TO-1)



CASE 152



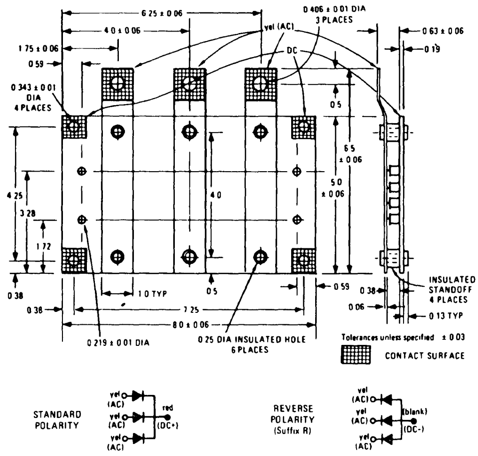
(See page 8-44 for lead form availability)

Dimensions are in inches unless otherwise noted.

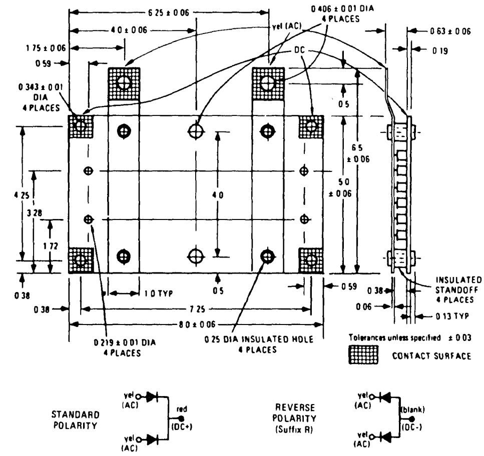
8

8

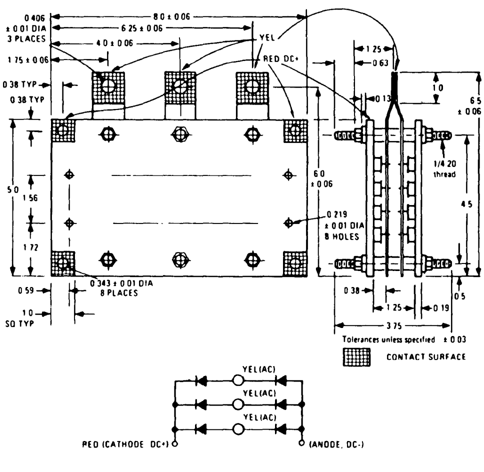
CASE 154



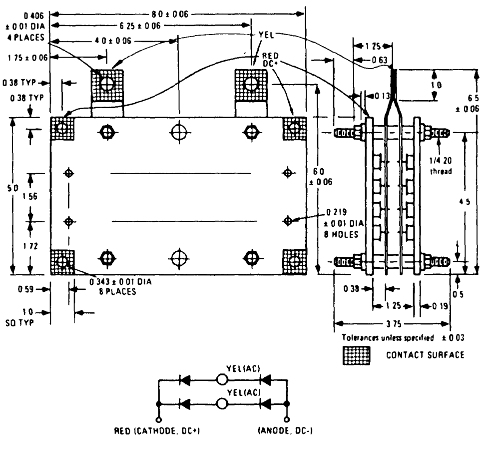
CASE 154A



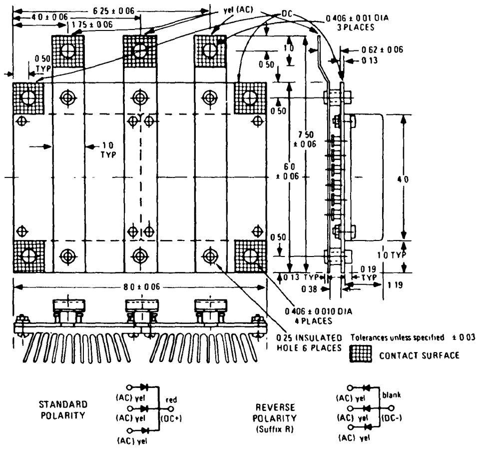
CASE 155



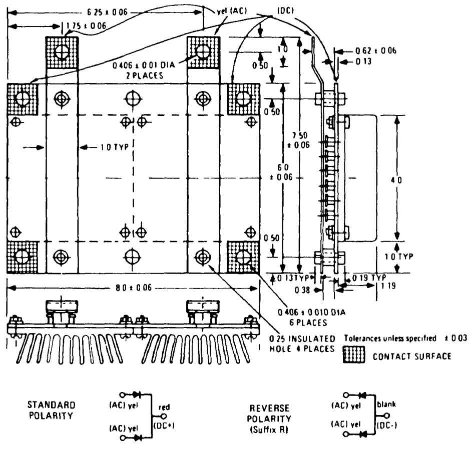
CASE 155A



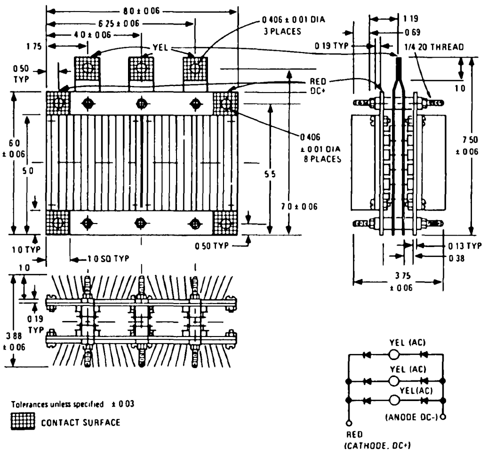
CASE 156



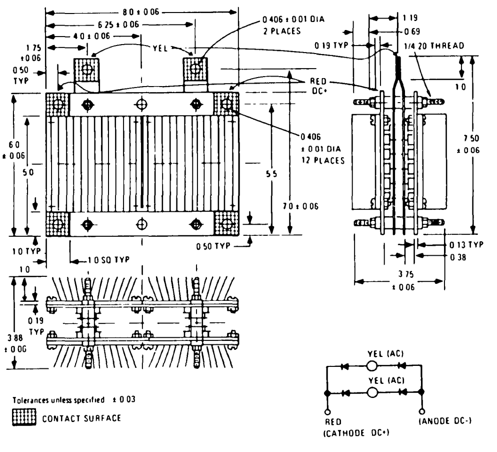
CASE 156A



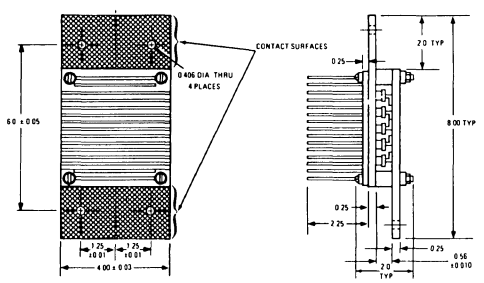
CASE 157



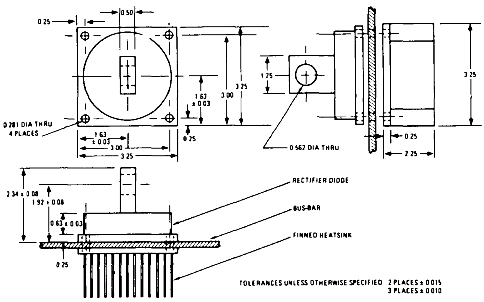
CASE 157A



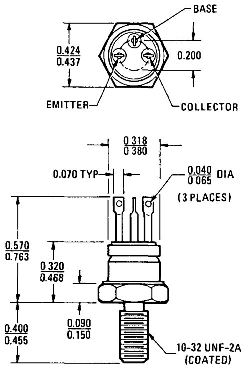
CASE 158



CASE 159

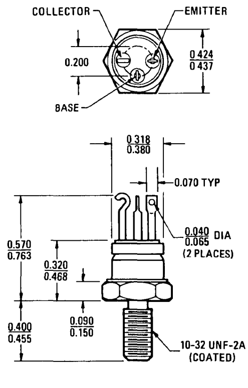


CASE 160 (TO-59)



All leads isolated from case

CASE 160A (TO-59)

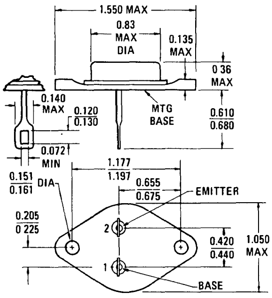


All JEDEC dimensions and notes apply
Collector connected to case

Dimensions are in inches unless otherwise noted.

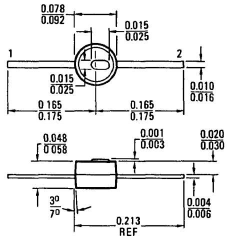
8

CASE 161 (TO-41)



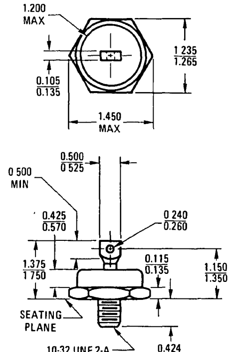
Collector connected to case

CASE 166



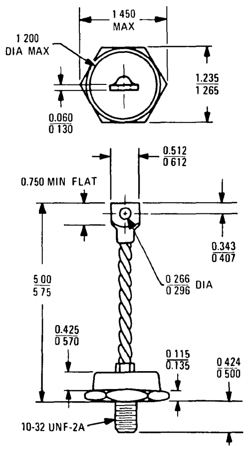
NOTE:
1. RAISED TAB IS CIRCULAR ON 166-01
STYLE 1:
PIN 1. ANODE
2. CATHODE

CASE 167

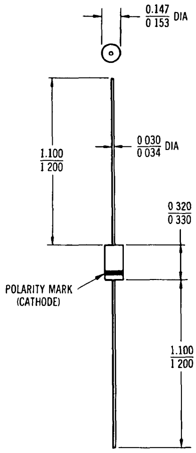


NOTES:
CRIMPED LUG
ANGULAR ORIENTATION
OF LUG UNDEFINED.

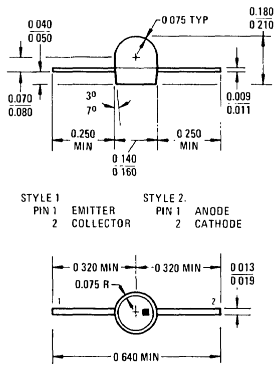
CASE 168



CASE 169



CASE 171

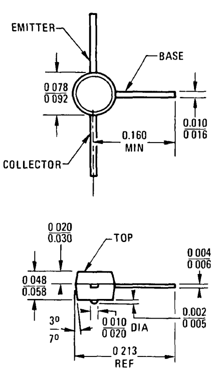


STYLE 1
PIN 1 EMITTER
2 COLLECTOR

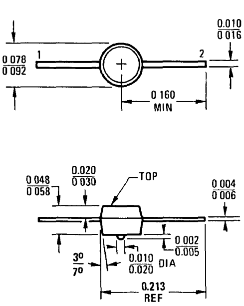
STYLE 2.
PIN 1 ANODE
2 CATHODE

Lead 2 indicated by square bonding pad on bottom of device

CASE 172

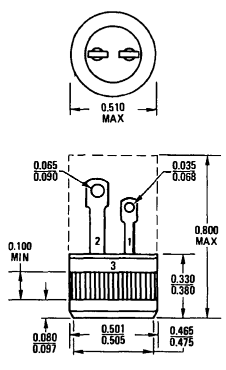


CASE 173



Collector indicated by arrow on bottom of device.

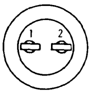
CASE 174



All JEDEC dimensions and notes apply

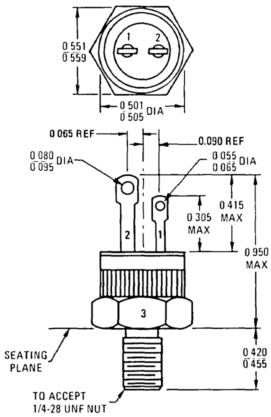
8

CASE 174 STYLES

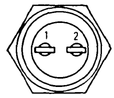


STYLE 1:
PIN 1. GATE
2. CATHODE
CASE ANODE
STYLE 2
PIN 1. GATE
2. ANODE
CASE. CATHODE
STYLE 3:
PIN 1. GATE
2. MAIN TERMINAL 1
CASE. MAIN TERMINAL 2

CASE 175

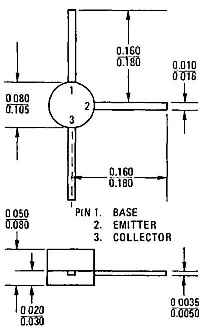


CASE 175 STYLES

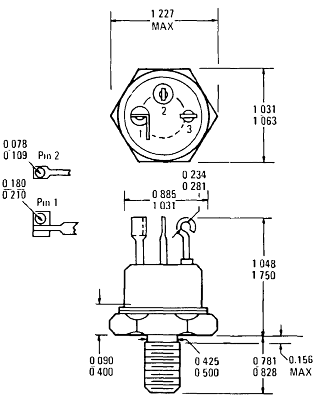


STYLE 1:
PIN 1. GATE
2. CATHODE
STUD. ANODE
STYLE 2:
PIN 1. GATE
2. ANODE
STUD. CATHODE
STYLE 3.
PIN 1. GATE
2. MAIN TERMINAL 1
STUD. MAIN TERMINAL 2

CASE 176

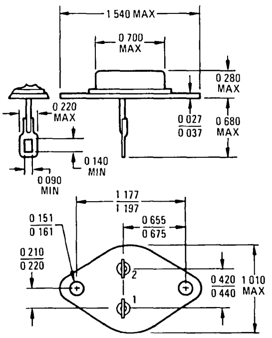


CASE 177 (TO-114)



All JEDEC dimensions and notes apply

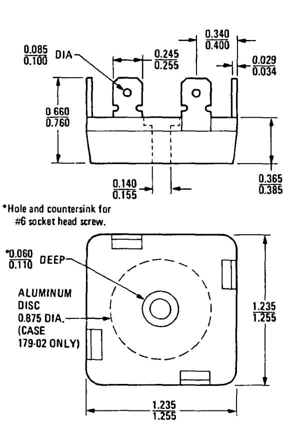
CASE 178



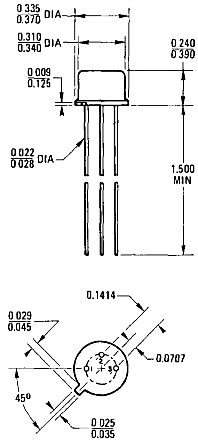
STYLE 1:
PIN 1. GATE
2 CATHODE
CASE. ANODE

STYLE 2:
PIN 1. GATE
2 MAIN TERMINAL 1
CASE MAIN TERMINAL 2

CASE 179



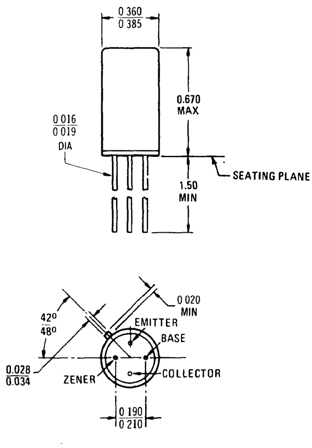
CASE 180



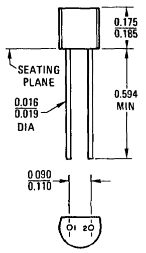
Dimensions are in inches unless otherwise noted.

8

CASE 181

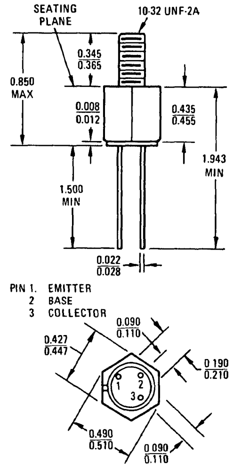


CASE 182-01

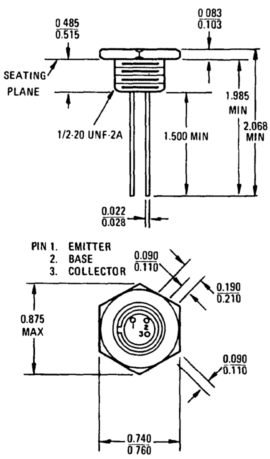


STYLE 1:
PIN 1. ANODE
2. CATHODE
STYLE 2:
PIN 1. CATHODE
2. ANODE
STYLE 3:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2

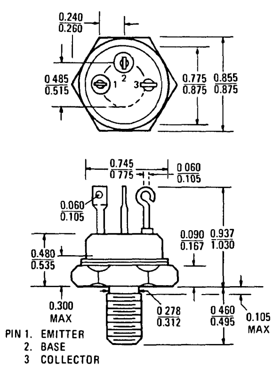
CASE 183



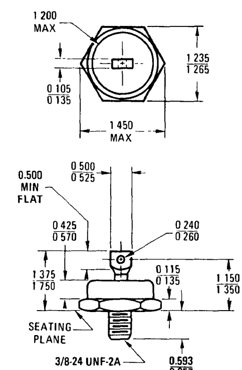
CASE 184



CASE 188

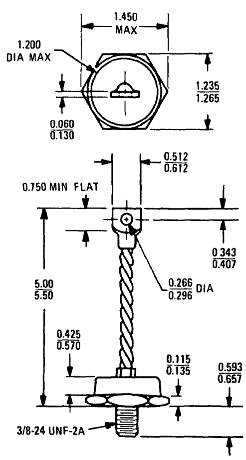


CASE 189

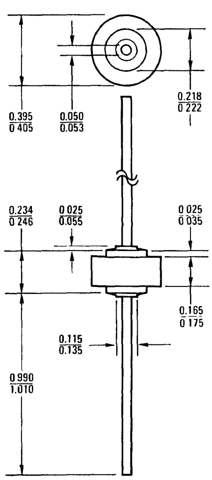


NOTES
CRIMPED LUG
ANGULAR ORIENTATION
OF LUG UNDEFINED.

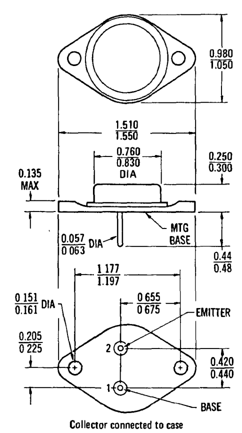
CASE 190



CASE 194



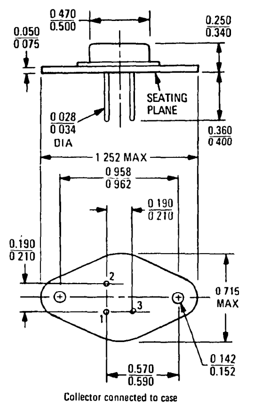
CASE 197



Collector connected to case

8

CASE 198

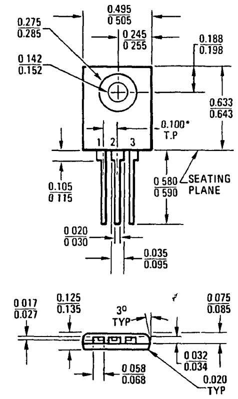


Collector connected to case

STYLE 1:
PIN 1. EMITTER
2. BASE 1
3. BASE 2

STYLE 2:
PIN 1. BASE 1
2. EMITTER
3. BASE 2
CASE - COLLECTOR

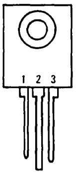
CASE 199-04



*Dimension is to centerline of leads

(See page 8-43 for lead form availability)

CASE 199 STYLES

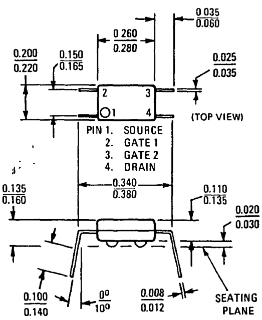


STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER

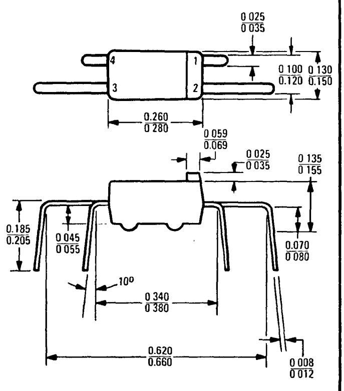
STYLE 2.
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 3:
PIN 1. ANODE 1
2. ANODE 2
3. GATE

CASE 206

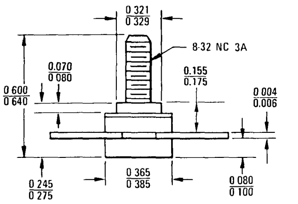


CASE 206A



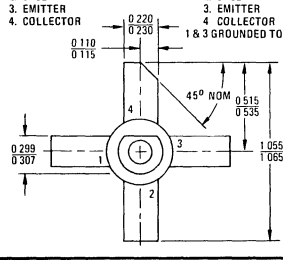
Weight ≈ 0.25 gram

CASE 208

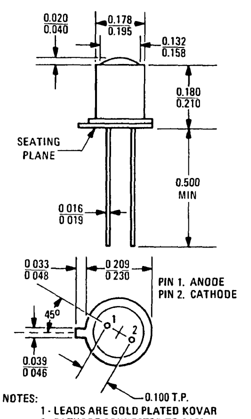


STYLE 1:
PIN 1. EMITTER
2. BASE
3. EMITTER
4. COLLECTOR

STYLE 2.
PIN 1. EMITTER
2. BASE
3. EMITTER
4 COLLECTOR
1 & 3 GROUNDED TO STUD

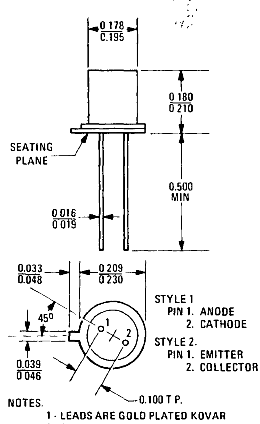


CASE 209



NOTES:
1 - LEADS ARE GOLD PLATED KOVAR
2 - CATHODE CONNECTED TO CASE
3 - PKG. WT. ≈ 0.45 GRAMS.

CASE 210



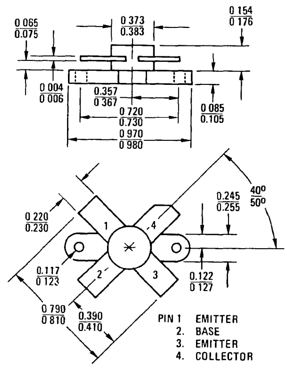
STYLE 1
PIN 1. ANODE
2. CATHODE

STYLE 2.
PIN 1. EMITTER
2. COLLECTOR

NOTES.
1 - LEADS ARE GOLD PLATED KOVAR
2 - CATHODE CONNECTED TO CASE
3 - PKG. WT. ≈ 0.45 GRAMS.

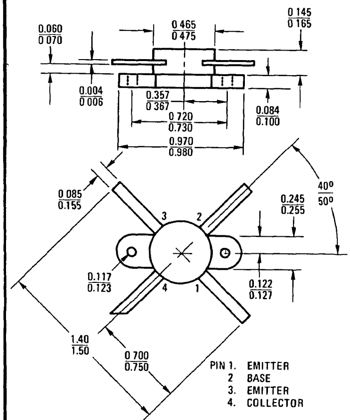
Dimensions are in inches unless otherwise noted.

CASE 211-01



PIN 1. EMITTER
2. BASE
3. EMITTER
4. COLLECTOR

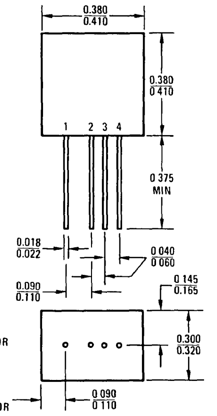
CASE 211-02



PIN 1. EMITTER
2. BASE
3. EMITTER
4. COLLECTOR

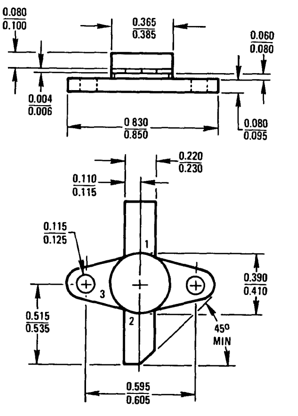
Flange Isolated

CASE 212



STYLE 1.
PIN 1. ZENER
2. EMITTER
3. BASE
4. COLLECTOR
STYLE 2:
PIN 1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR

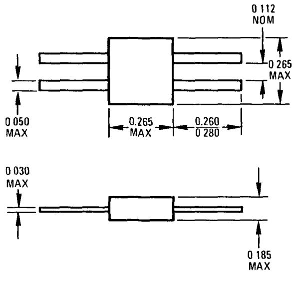
CASE 215



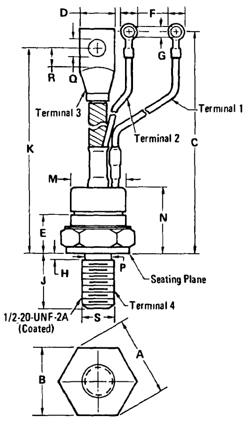
STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER

STYLE 2:
PIN 1. GROUNDED EMITTER
2. OPPOSED BASE
3. COLLECTOR

CASE 216



CASE 219 (TO-94)



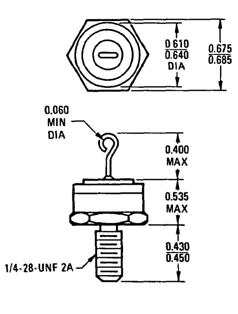
STYLE 1·
TERMINAL 1. GATE
2. CATHODE
3. CATHODE
4. ANODE

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	–	1 227	–	31.160
B	1.031	1.063	26.190	27.000
C	6.850	7.500	174.000	190.500
D	0.437	0.650	11.100	16 500
E	0.170	0.500	4.400	12.700
F	0.215	0.300	5.490	7.620
G	0.140	0.150	3.560	3.810
H	–	0.125	–	3.170
J	0.797	0.827	20.250	21.000
K	5.775	6.265	146.700	159.100
M	–	1.031	–	26.180
N	–	2.500	–	63.500
P	0.425	0.499	10.800	12.670
Q	0.260	0.310	6.610	7.870
R	0.250	–	6.350	–
S	0.4619	0.4675	11.733	11.874

All JEDEC dimensions and notes apply

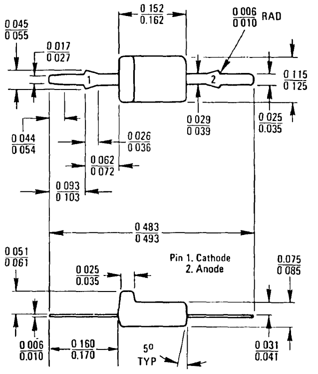
Dimensions are in inches unless otherwise noted.

CASE 222

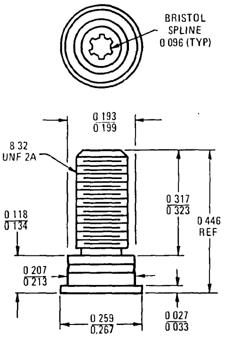


8

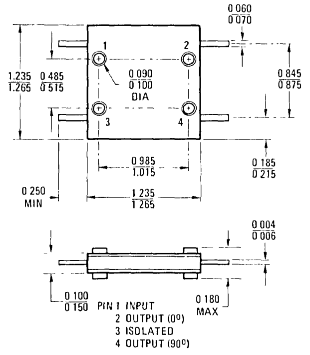
CASE 226



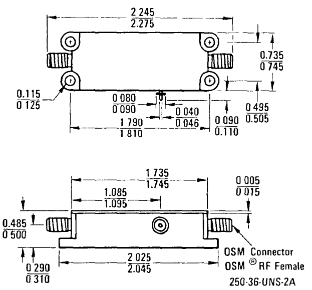
CASE 229



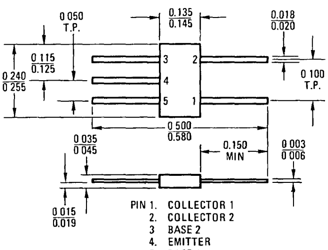
CASE 230



CASE 231

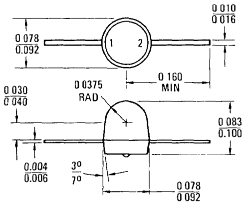


CASE 232



PIN 1. COLLECTOR 1
2. COLLECTOR 2
3 BASE 2
4. EMITTER
5 BASE 1

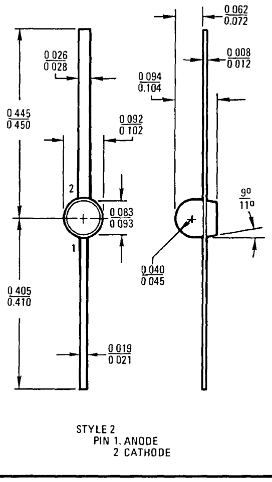
CASE 234-01



STYLE 1
PIN 1. EMITTER
2. COLLECTOR

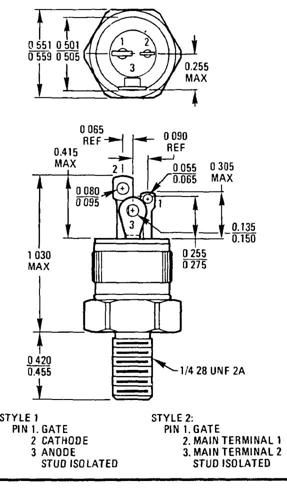
STYLE 2
PIN 1. ANODE
2. CATHODE
Cathode indicated by larger bonding pad on bottom of device

CASE 234-02



STYLE 2
PIN 1. ANODE
2 CATHODE

CASE 235



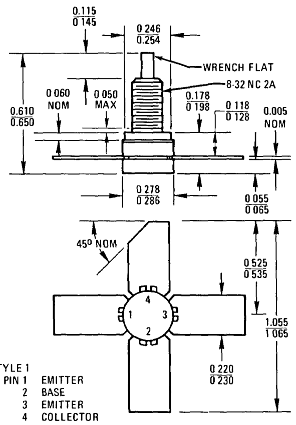
STYLE 1
PIN 1. GATE
2 CATHODE
3 ANODE
STUD ISOLATED

STYLE 2:
PIN 1. GATE
2. MAIN TERMINAL 1
3. MAIN TERMINAL 2
STUD ISOLATED

Dimensions are in inches unless otherwise noted.

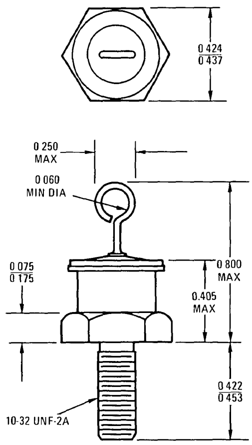
8

CASE 244

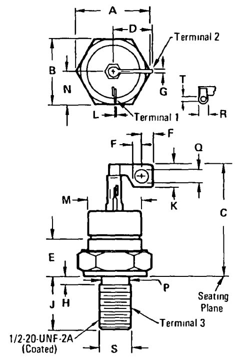


STYLE 1
PIN 1 EMITTER
2 BASE
3 EMITTER
4 COLLECTOR

CASE 245



CASE 246 (TO-83)

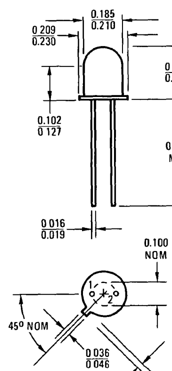


STYLE 1:
TERMINAL 1 GATE
2. CATHODE
3. ANODE

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	–	1 227	–	31 160
B	1.031	1.063	26.190	27.000
C	–	1.810	–	45.970
D	–	0.650	–	16.510
E	0.170	0.500	4 320	12.700
F	0.180	–	4 580	–
G	0.060	0.115	1.530	2.920
H	–	0.125	–	3.170
J	0.797	0.827	20.250	21.000
K	0 360	0.470	9.200	11.900
L	0.012	0.050	0.310	1.270
M	–	1.031	–	26.180
N	–	0.575	–	14.600
P	0.425	0.499	10.800	12 670
Q	0 180	0.260	4.580	6.600
R	0.115	0.160	2.930	4 060
S	0.4619	0 4675	11.733	11.874
T	0.060	0.080	1.530	2.030

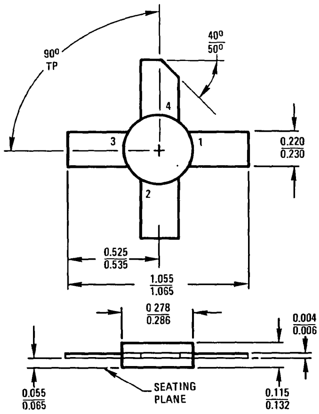
All JEDEC dimensions and notes apply

CASE 247



STYLE 1
PIN 1. ANODE
PIN 2. CATHODE

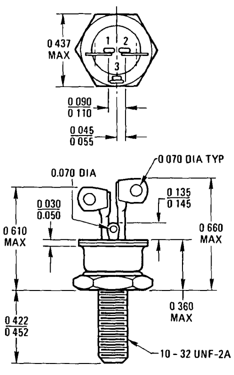
CASE 249



STYLE 1:
PIN 1 EMITTER
2. BASE
3. EMITTER
4. COLLECTOR

Dimensions are in inches unless otherwise noted.

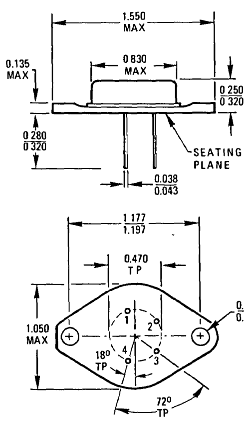
CASE 250



STYLE 1
PIN 1 GATE
2. CATHODE
3 ANODE
STUD-ISOLATED

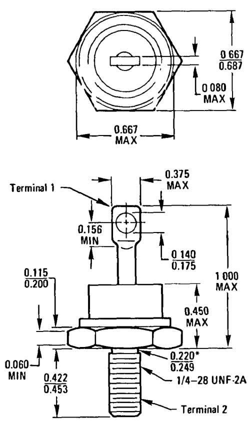
STYLE 2.
PIN 1 GATE
2 ANODE 1
3 ANODE 2
STUD-ISOLATED

CASE 253



PIN 1. EMITTER 2
2. BASE 2
3. BASE 1
4. EMITTER 1

CASE 257 (DO-5)

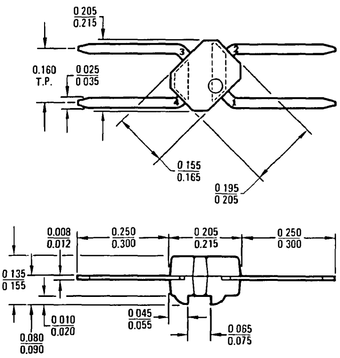


*Dimension is a diameter.

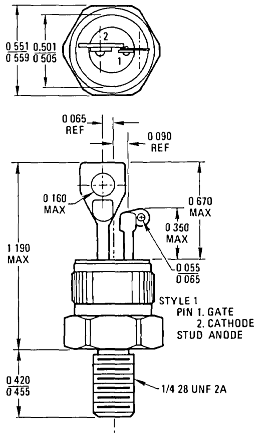
All JEDEC dimensions and notes apply

8

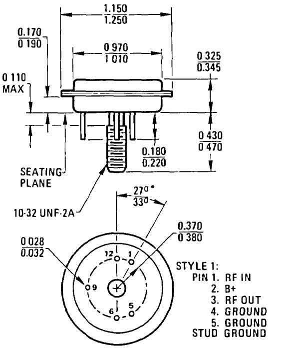
CASE 262



CASE 263

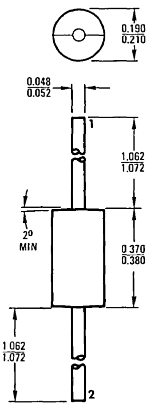


CASE 264

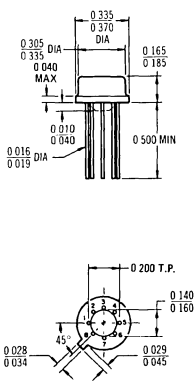


*Applies Between Leads 5 and 6

CASE 267



CASE 601 (TO-99)

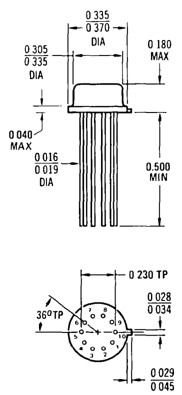


Weight ≈ 0.920 gram

All JEDEC dimensions and notes apply

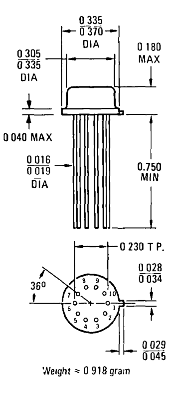
Case connected to pin 4 through substrate

CASE 602A



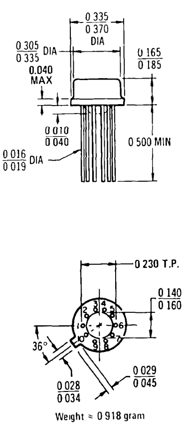
Weight ≈ 0.918 gram

CASE 602B



Weight ≈ 0.918 gram

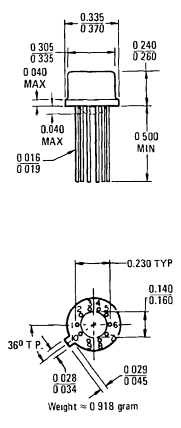
CASE 603-02 (TO-100)



Weight ≈ 0.918 gram

All JEDEC dimensions and notes apply

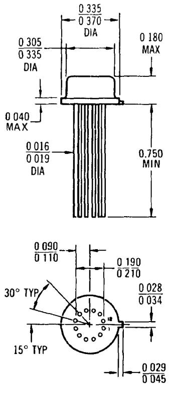
CASE 603-03 (TO-100)



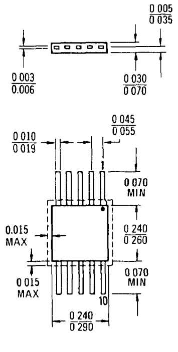
Weight ≈ 0.918 gram

8

CASE 604

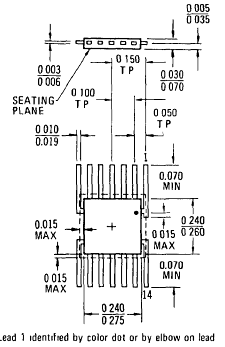


CASE 606 (TO-91)



All JEDEC dimensions and notes apply

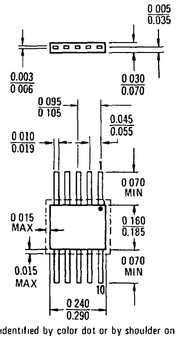
CASE 607 (TO-86) (Formerly CASE 83)



Lead 1 identified by color dot or by elbow on lead

All JEDEC dimensions and notes apply

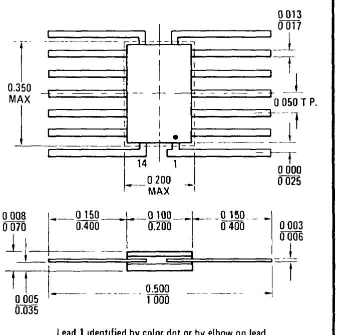
CASE 608 (TO-90)



Lead 1 identified by color dot or by shoulder on lead

All JEDEC dimensions and notes apply

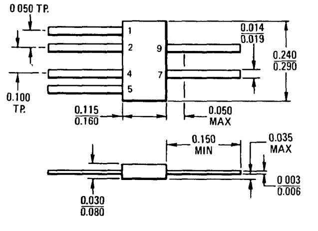
CASE 609 (TO-85)



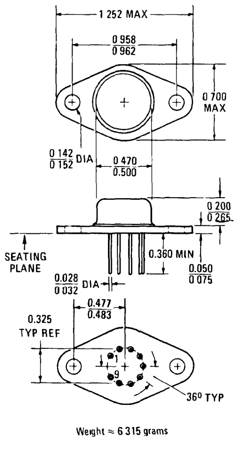
Lead 1 identified by color dot or by elbow on lead

All JEDEC dimensions and notes apply

CASE 610A-03 (TO-89)

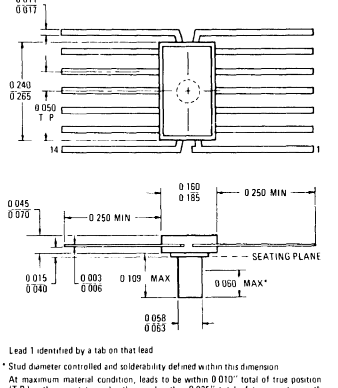


CASE 614



Weight ≈ 6.315 grams

CASE 617

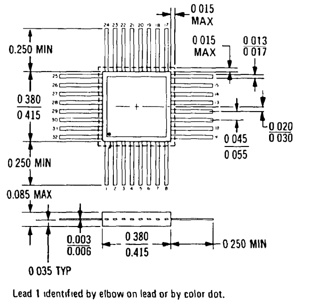


Lead 1 identified by a tab on that lead

* Stud diameter controlled and solderability defined within this dimension

At maximum material condition, leads to be within 0.010" total of true position (T.P.) with respect to each other, and within 0.025" total of true position with respect to stud

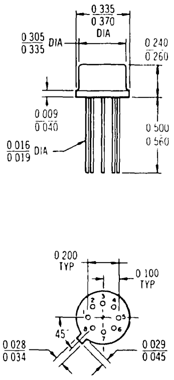
CASE 618



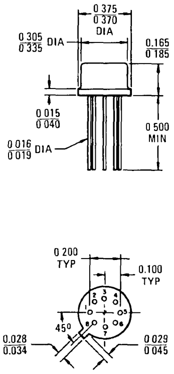
Lead 1 identified by elbow on lead or by color dot.

8

CASE 619-01

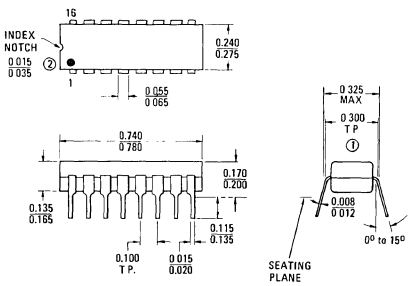


CASE 619-02



Dimensions are in inches unless otherwise noted.

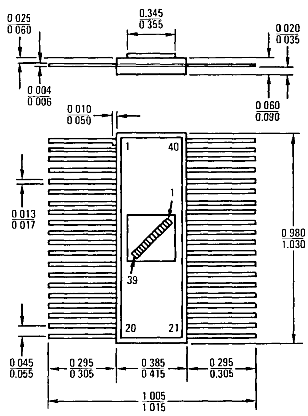
CASE 620



① This dimension is measured from the lead centers at the seating plane with leads vertical.

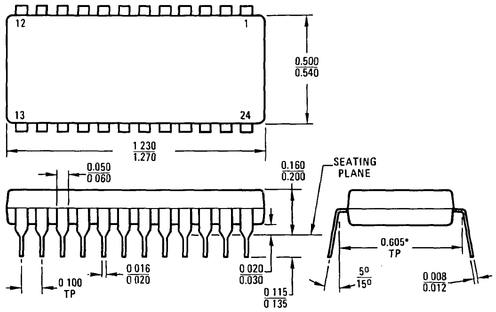
② Lead 1 identified by color dot, notch in lead, or notch in ceramic

CASE 621



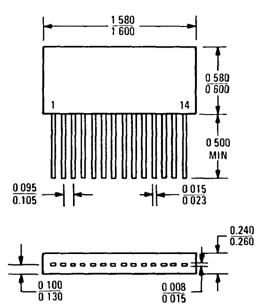
Pin 1 is Common to all Elements and is Indicated by Tab on Lead.

CASE 623



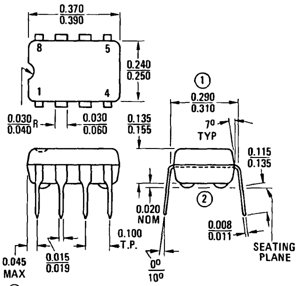
*Dimension is to lead centerline when formed parallel

CASE 625



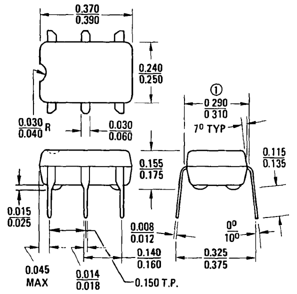
8

CASE 626



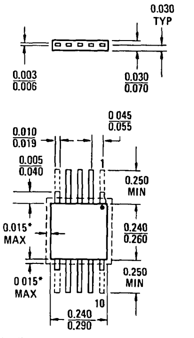
① Measure to center line of leads when parallel.
② Four insulating stand-offs are provided.
Weight ≈ 0.446 gram

CASE 627



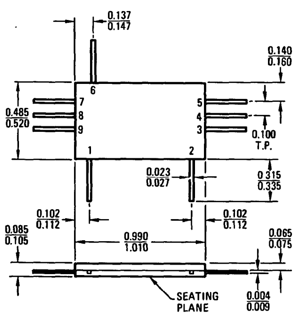
Weight ≈ 0.40 gram
① Measure to center line of leads when parallel.

CASE 628 (TO-91)

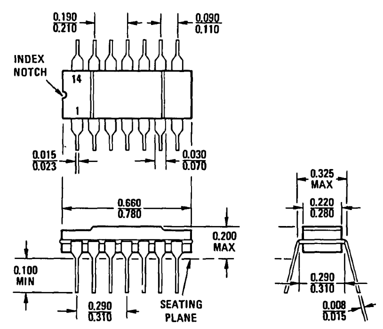


Lead 1 identified by color dot or by shoulder on lead.
Leads 1, 5, 6, 10 are clipped.
*Tolerance for lid skewing, glass meniscus, and glass overrun.

CASE 631



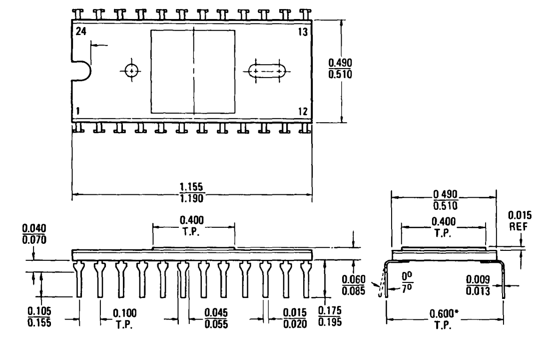
CASE 632 (TO-116)



Weight ≈ 1.954 grams

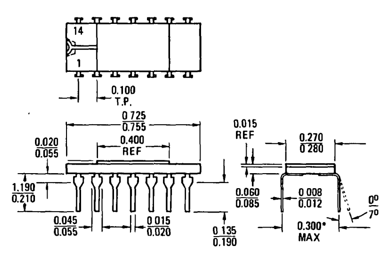
All JEDEC TO-116 dimensions and notes apply.

CASE 635



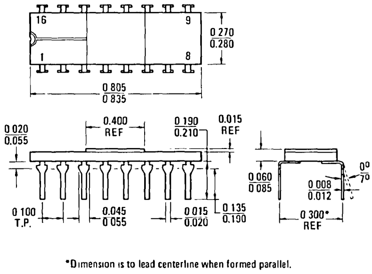
*Dimension is to lead centerline when formed parallel.

CASE 637



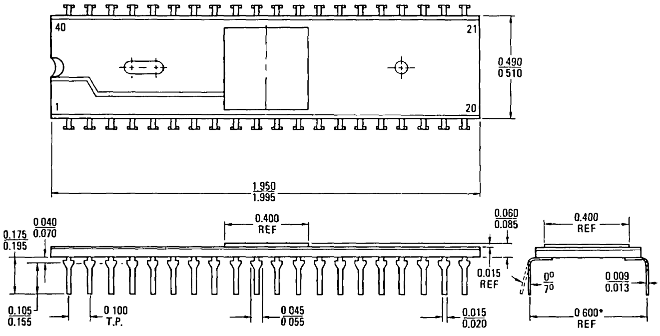
*Dimension is to lead centerline when formed parallel.

CASE 638



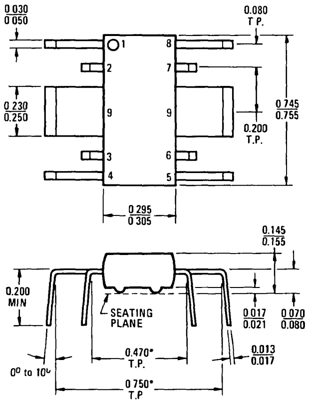
*Dimension is to lead centerline when formed parallel.

CASE 639



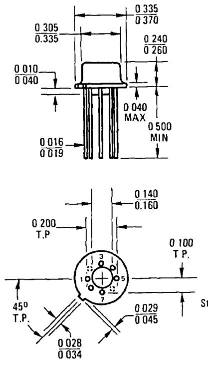
*Dimension is to lead centerline when formed parallel.

CASE 641



*Dimension is to lead centerline when formed parallel

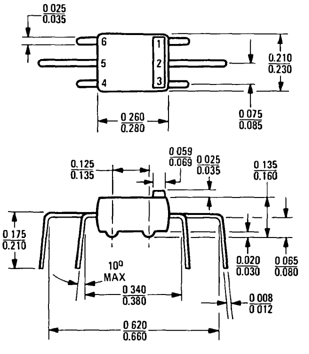
CASE 642 (TO-76)



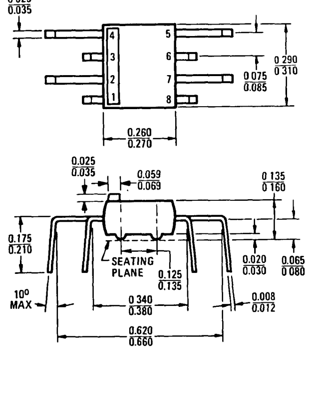
Style 1:
Pin 1 Drain 1
2 Omitted
3. Gate 1
4 Substrate
5. Gate 2
6. Omitted
7 Drain 2
8. Source 1

All JEDEC dimensions and notes apply

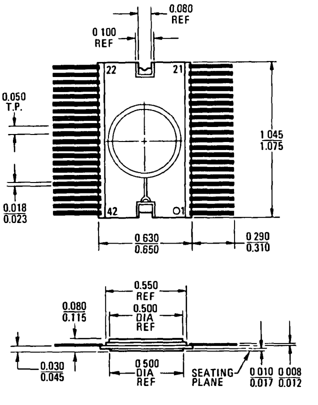
CASE 643A



CASE 644A



CASE 645

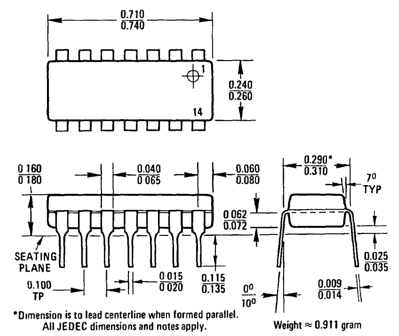


Identification dot on ceramic by pin 1.

Dimensions are in inches unless otherwise noted.

8

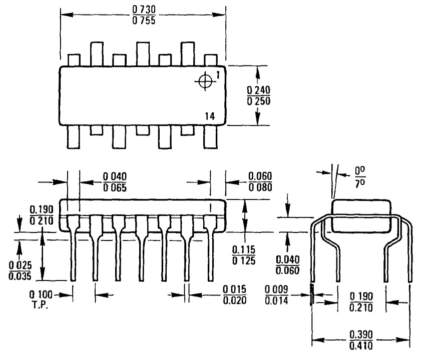
CASE 646 (TO-116)



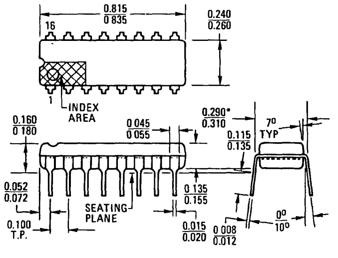
*Dimension is to lead centerline when formed parallel.
All JEDEC dimensions and notes apply.

Weight ≈ 0.911 gram

CASE 647

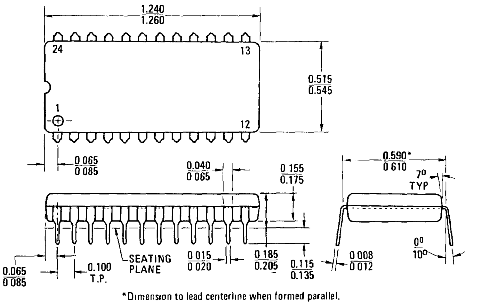


CASE 648



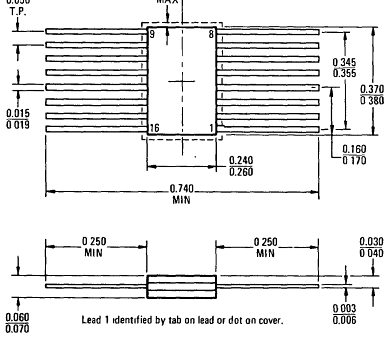
*Dimension is to lead centerline when formed parallel.

CASE 649



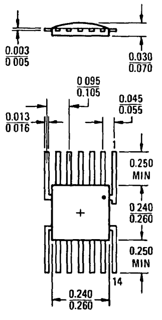
*Dimension to lead centerline when formed parallel.

CASE 650



Lead 1 identified by tab on lead or dot on cover.

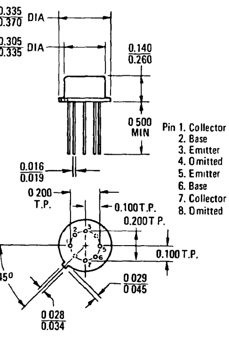
CASE 651



Lead 1 identified by color dot or by elbow on lead.
Top Cover made of silastic material.

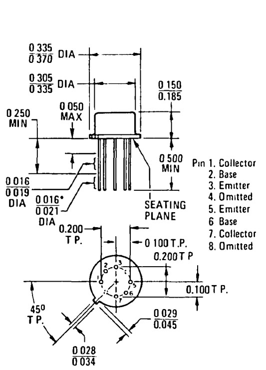
Weight ≈ 0.197 grams

CASE 654-04 (TO-78)



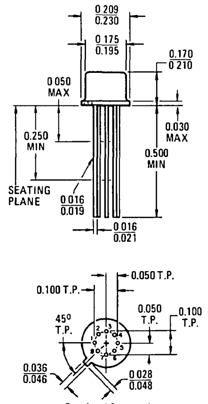
All Leads Electrically Isolated from Case

CASE 654-07 (TO-78)



*Diameter uncontrolled beyond 0.500".
All Leads Electrically Isolated from Case

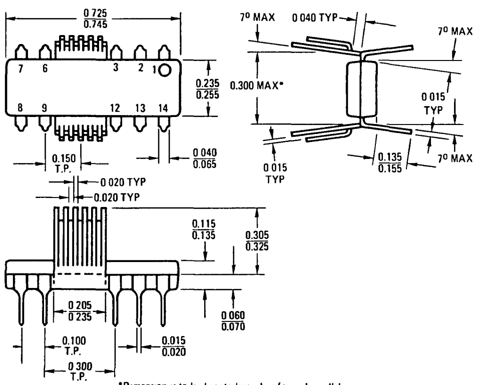
CASE 655 (TO-71)



Pins 4 and 8 omitted
All JEDEC dimensions and notes apply

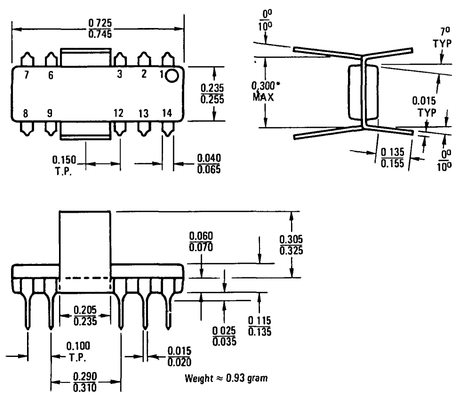
Dimensions are in inches unless otherwise noted.

CASE 656



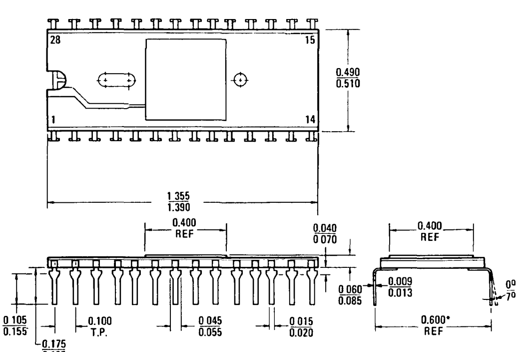
*Dimension is to lead centerline when formed parallel.

CASE 661



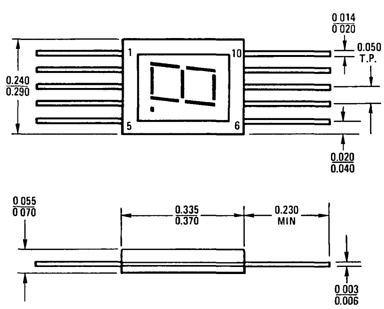
*Dimension is to lead centerline when formed parallel.

CASE 663



*Dimension is to lead centerline when formed parallel.

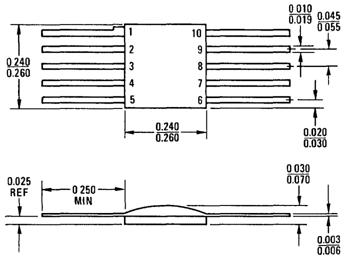
CASE 664-01



8

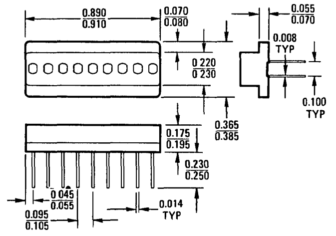
8

CASE 665

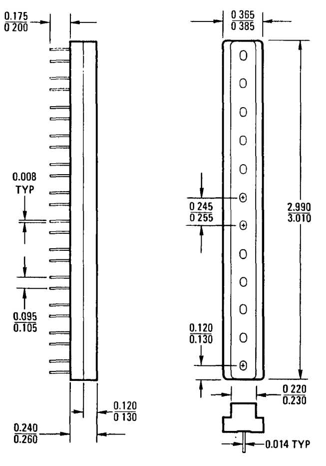


Weight ≈ 0.188 gram

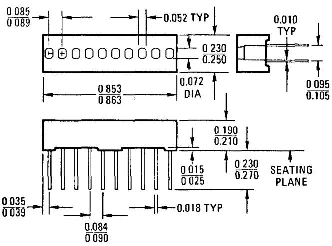
CASE 669



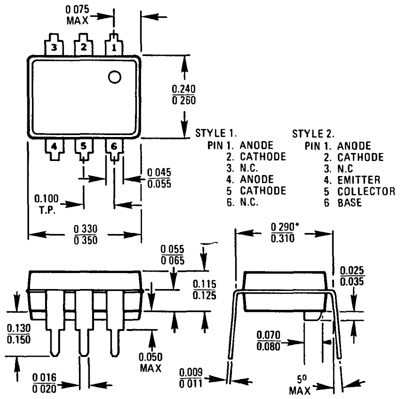
CASE 670



CASE 671

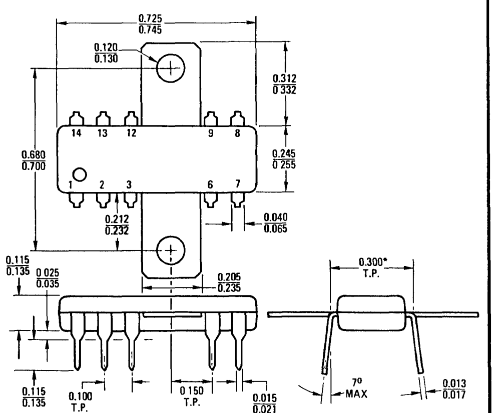


CASE 673



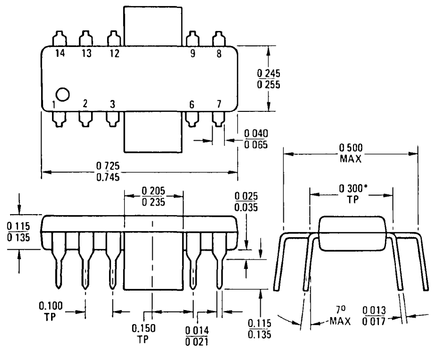
*Dimension is to lead centerline when formed parallel.

CASE 675



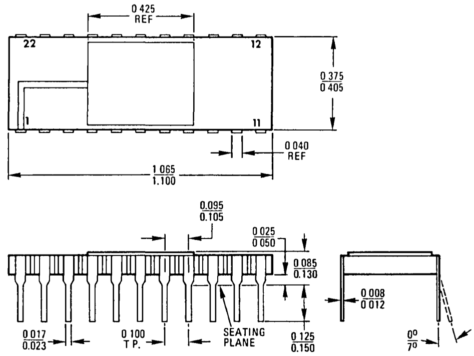
*Dimension is to lead centerline when formed parallel.

CASE 676

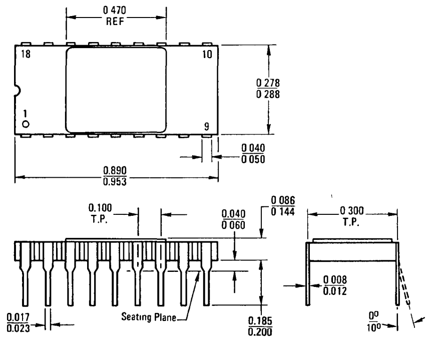


*Dimension is to lead centerline when formed parallel

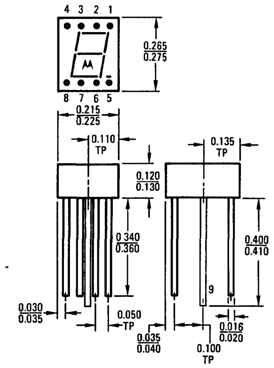
CASE 677



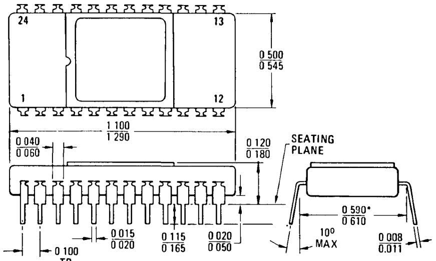
CASE 680



CASE 683

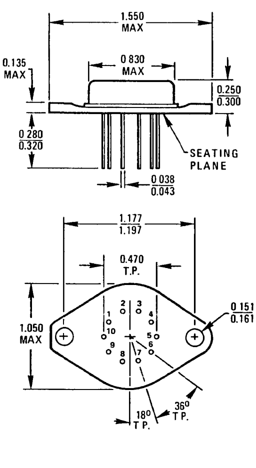


CASE 684



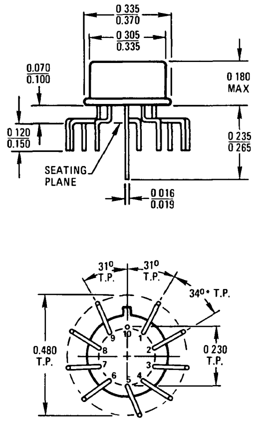
*Dimension is to lead centerline when formed parallel
Lead number one cut for identification or marked on top

CASE 685



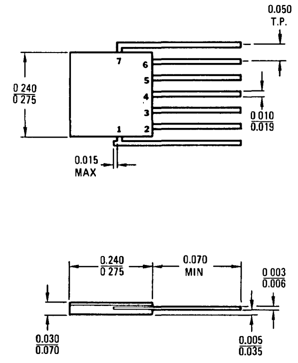
8

CASE 686



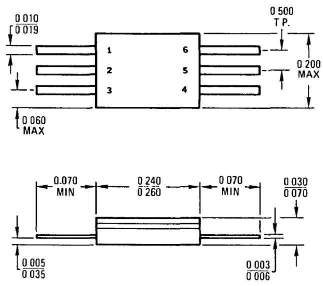
*Seven places; (between all leads except 5 & 6, 9 & 10, 10 & 1)

CASE 687

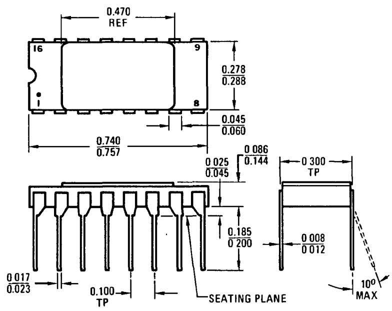


Lead 1 identified by elbow on lead.

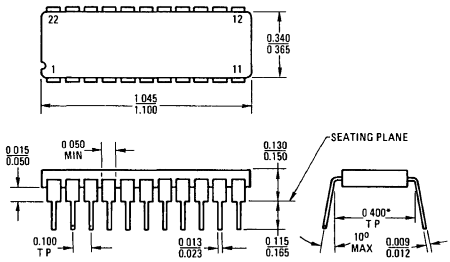
CASE 688



CASE 690

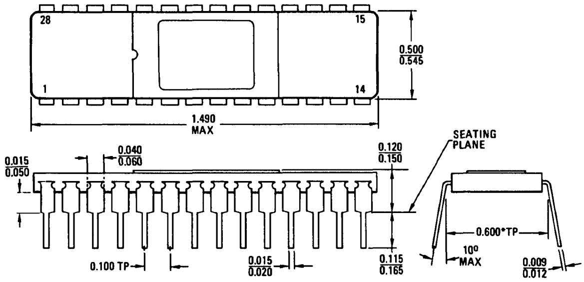


CASE 694



*Dimension is to lead centerline when formed parallel.
Lead number one identified by notch on top.

CASE 695 (TO-71)



*Dimension is to lead centerline when formed parallel
Lead number one cut for identification or marked on top

Dimensions are in inches unless otherwise noted.

8

LEADFORMS

FOR PLASTIC POWER SOCKETS

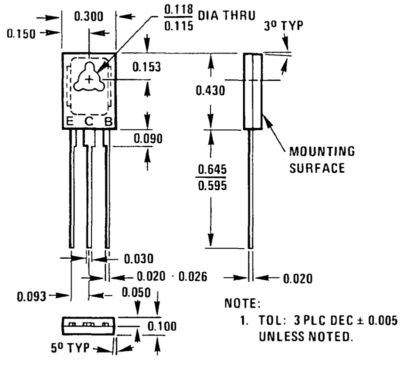
Plastic power transistors can be lead formed to a variety of configurations for insertion into sockets designed for metal-can devices. Leadform flexibility permits direct insertion into TO-66 and TO-5 sockets, or circuit-board mounting, either flat mount or flag mount.

A desired special leadform can be ordered as follows:

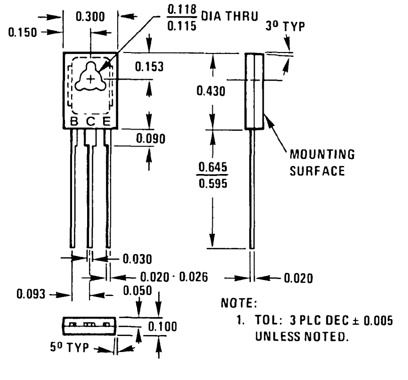
1. Select the desired transistor and case style, i.e., 2N5190 or MJE340.
2. Locate the selected case-style section in the leadform diagrams shown below.
3. Determine the leadform suffix letter (A, B, C, etc.) of the lead form required.
4. Add the lead form suffix letter to the transistor type number when placing your order. Example: 2N5190 lead form B; or MJE340 lead form A.

CASE 77

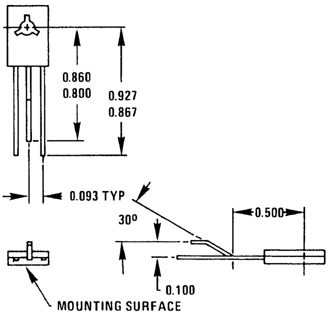
STYLE 1



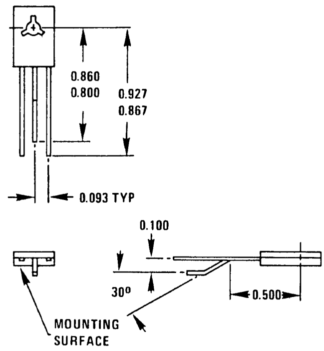
STYLE 3



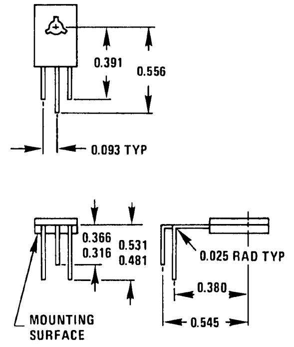
CASE 77
LEAD FORM "A"



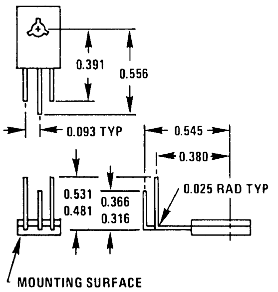
CASE 77
LEAD FORM "B"



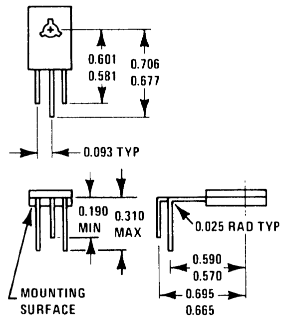
CASE 77
LEAD FORM "C"



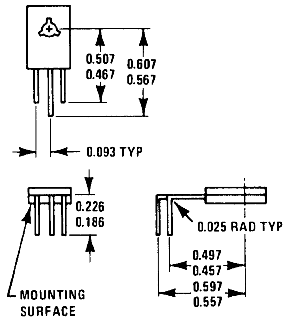
CASE 77
LEAD FORM "D"



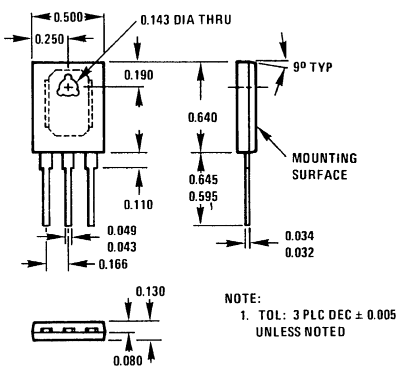
CASE 77
LEAD FORM "E"



CASE 77
LEAD FORM "F"

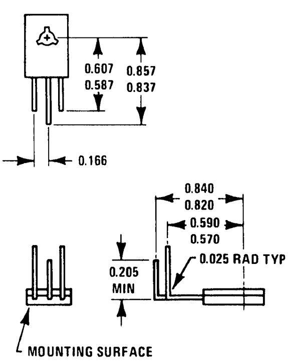


CASE 90



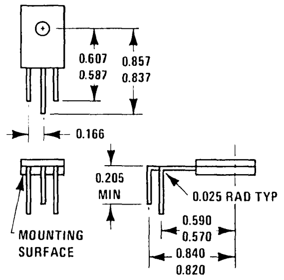
NOTE:
1. TOL: 3 PLC DEC ± 0.005 UNLESS NOTED

CASE 90
LEAD FORM "A"

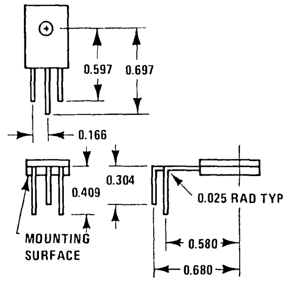


8

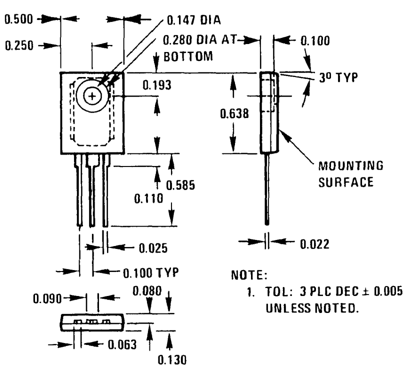
CASE 90
LEAD FORM "B"



CASE 90
LEAD FORM "C"

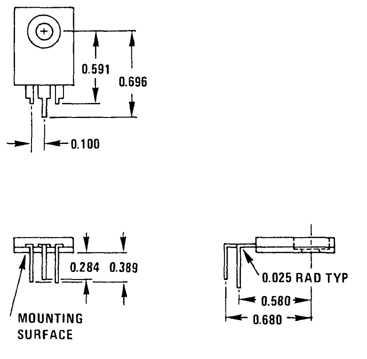


CASE 199

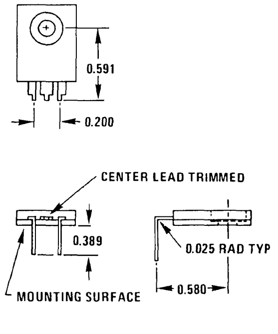


NOTE:
1. TOL: 3 PLC DEC ± 0.005 UNLESS NOTED.

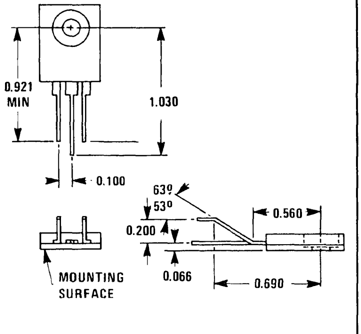
CASE 199
LEAD FORM "A"



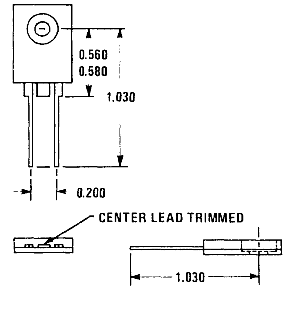
CASE 199
LEAD FORM "B"



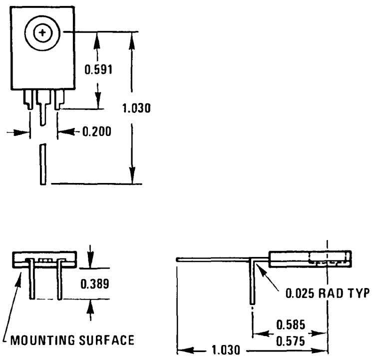
CASE 199
LEAD FORM "C"



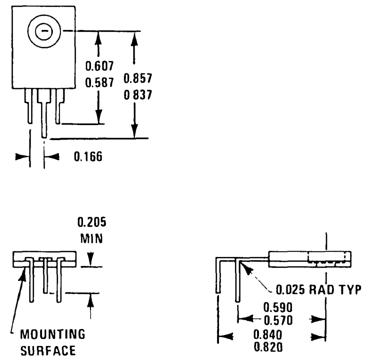
CASE 199
LEAD FORM "D"



CASE 199
LEAD FORM "E"



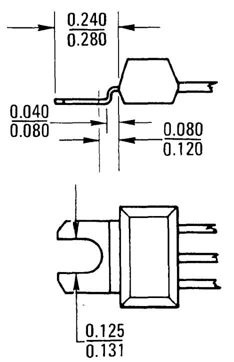
CASE 199
LEAD FORM "F"



Uniwatt Package (Case 152)

This package is designed with the collector mounted on a metal tab that extends out of the plastic. The tab can be attached to a heat sink to conduct heat away from the junction.

CASE 152



Tab formed for flush mounting available on request.

APPLICATION NOTES

9

9

APPLICATION NOTE SELECTION GUIDE

The application Notes described in this section have been prepared to acquaint the circuits and systems engineer with the broad line of Motorola Semiconductor Products and their applications. The Cross Reference Table lists the application categories in alphabetical order. The section entitled Application Note Abstracts gives a brief summary of the application note content.

To obtain copies of these notes, simply list the AN-number or numbers and send your request on your company letterhead to Technical Information Center, Motorola Semiconductor Products Inc., P.O. Box 20919, Phoenix, Arizona 85036.

APPLICATION CATEGORY	APPLICATION NOTE NUMBER
ADDERS	AN-236, AN-286
AMPLIFIERS	
Audio	
Power, 1 W, IC	AN-401
1-2 W, Plastic Transistor	AN-426A
3-35 W, Plastic Transistor	AN-484
40-100 W, Metal Package	AN-485
20, 30 W, Darlington	AN-483
Thermal Considerations	AN-182
Differential	AN-231, AN-407
Operational (See INTEGRATED CIRCUITS)	
Radio Frequency	
Small Signal	AN-166, AN-215, AN-247, AN-259, AN-267, AN-406, AN-419, AN-421, AN-423, AN-513
Power (See TRANSMITTERS)	
Sense (for core memories)	AN-245, AN-474
Servo	AN-225
Video	AN-171, AN-247, AN-287, AN-299, AN-404, AN-475, AN-491
Gated	
ANALOG TO DIGITAL CONVERSION	AN-471
ANTENNA SWITCHING	AN-412
ARC SUPPRESSION	AN-444
ARITHMETIC OPERATIONS	AN-286, AN-487, AN-488
BATTERY CHARGING	AN-294, AN-447
BREADBOARDING	AN-270, AN-504
CHOPPERS	AN-220, AN-470
CODE CONVERSION	AN-446, AN-465, AN-506
COMPARATORS	AN-204, AN-405, AN-439, AN-547
CONTROL CIRCUITS	AN-552
CONVERTERS (Power)	AN-163, AN-169, AN-442
COUNTERS	
Clocked	AN-251
Decade	AN-251, AN-257, AN-262A, AN-451, AN-516
Divide-by	AN-262A, AN-456, AN-505
Frequency	AN-451, AN-516
Gray Code	AN-257
General	AN-251, AN-257
Programmable	AN-456
Ring	AN-221, AN-257
Ripple	AN-194A, AN-251,
CUSTOM INTEGRATED CIRCUITS	AN-446
DATA SHEET, USING	
FET	AN-455
Operational Amplifier, IC	AN-273
UHF Amplifiers	AN-419
Zeners, TC	AN-437
ENVELOPE DETECTOR	AN-411
ERROR DETECTION AND CORRECTION	AN-446, AN-496
DISPLAY SYSTEMS	AN-516
FIELD EFFECT TRANSISTORS	
Amplifiers	AN-231, AN-423, AN-455, AN-511
Current Regulators	AN-462, AN-511
Digital Circuits	AN-219, AN-220, AN-511
General	AN-211A, AN-455, AN-511
FILTERS	
Twin Tee	AN-248
FLASHER	AN-466
FLIP-FLOPS	AN-226, AN-280, AN-414, AN-493
FOUR-LAYER DIODES	AN-221, AN-462
FREQUENCY METER	AN-297
FREQUENCY SHIFT KEYER	AN-475, AN-491
FREQUENCY SYNTHESIZER	AN-553
GENERATORS	
Function	AN-510
Pulse	AN-510
Ramp	AN-221, AN-462
Sawtooth	AN-221, AN-462
Staircase	AN-221, AN-462
HAMMING CODE	AN-446, AN-496
HARMONIC GENERATION (See VARACTORS)	
HEATER CONTROLS	
Feedback	AN-413, AN-466
Non-Feedback	AN-242, AN-453
HEAT SINKS	AN-290A, AN-472

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APPLICATION CATEGORY	APPLICATION NOTE NUMBER
INTEGRATED CIRCUITS	
Digital	
MDTL	AN-263, AN-408, AN-409, AN-487, AN-496
MECL	AN-194A, AN-202, AN-239, AN-257, AN-274, AN-278, AN-280, AN-417, AN-418, AN-456, AN-488, AN-496, AN-504
MHTL	AN-298, AN-414, AN-467
MRTL	AN-251, AN-264, AN-286, AN-296, AN-408, AN-451
MTTL	AN-466, AN-464, AN-465, AN-476, AN-488, AN-492, AN-493, AN-494, AN-496, AN-505, AN-506, AN-516,
Memory Circuits	AN-245A, AN-446, AN-464, AN-474, AN-506, AN-550
General	AN-270, AN-298
Linear	
Operational Amplifiers	AN-204, AN-248, AN-261, AN-273, AN-400, AN-403, AN-405, AN-407, AN-411, AN-439, AN-459, AN-460
Power Amplifiers	AN-401
Linear Multipliers	AN-489, AN-490
Sense Amplifiers	AN-245A, AN-474
Voltage Regulators	AN-458, AN-473, AN-497, AN-498, AN-499, AN-500
Video Amplifiers	AN-299, AN-404, AN-475, AN-491
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APPLICATION NOTE ABSTRACTS

AN-139A Understanding Transistor Response Parameters

This note explains high-frequency transistor response parameters and discusses their interdependence. Useful nomograms are given for determining h_{fe}, f_T, f_{ae}, f_{max}, and many other parameters.

AN-140 Characterization of SCR's as Switches for Line Type Modulators

Although Silicon Controlled Rectifiers are highly desirable as switches in DC pulse circuits, they are usually specified and characterized for AC applications only. This article discusses the SCR characteristics desirable for DC pulse applications, and proposes simple test circuits for evaluating such devices as pulse circuit switches. A device already characterized for such applications is described.

AN-147 High-Power Varactor Diodes: Theory and Application

This article treats varactors in non-rigorous terms, discussing what they are, how they work, and how to use them in practical high-power, high-frequency, output circuits.

AN-150 Getting Transistors Into Single-Sideband Amplifiers

Silicon power transistors coupled with unique circuit design approaches make possible a 30 watt peak-power single-sideband transmitter operating at 30 MHz.

AN-151 Charge Storage Varactors for Extra UHF Power

This report describes a varactor multiplier which may be used to achieve power outputs of more than 50 Watts at 150 MHz, and 20 Watts at 450 MHz. With such high-frequency capabilities, transistor-varactor combinations can replace triodes and klystrons in many UHF and microwave applications.

AN-159 Design Tips for Coaxial-Cavity Varactor Multipliers

Most microwave engineers picture a coaxial cavity as a bulky construction, difficult to design easily. This report demonstrates that varactor multipliers can easily be designed as small as any other. Design principles and operational data for 500 MHz - 1000 MHz doublers are given.

AN-163 Silicon Power Transistors Provide New Solutions to Voltage Control Problems

Three useful circuits - a short circuit proof voltage regulator, an inexpensive switching regulator and a 100 kHz dc-to-dc converter are described.

AN-166 Using Linvill Techniques for RF Amplifiers

A design procedure, derived from theory developed by J. G. Linvill, simplifies the design of single stage small-signal RF amplifiers. A 200 MHz amplifier serves as an example of the technique.

AN-169 A Low Voltage High Current Converter

The output of low-voltage sources, i.e. solar cells, etc., often must be converted to a higher voltage to be useful. Utilizing a high-performance power transistor to efficiently perform this task, this converter can switch currents as high as 50 amperes.

AN-176 Power Varactor Gives 5 Watts Output at 3 GHz

A discussion of the design and performance of the high power MV1808 varactor, including design details of a 1 GHz frequency doubler and a 1 GHz to 3 GHz tripler.

AN-177 Two Stage Varactor Multiplier Provides High Power at 400 MHz

This "times-eight" frequency multiplier can provide a nominal 40 watts of CW power at an output frequency of 400 MHz with a conversion efficiency of 30 percent.

AN-178 Epicap Tuning Diode Theory and Applications

General electronic-tuning considerations are discussed, including important parameters such as Q, tuning range, and temperature stability.

AN-182 A Method of Predicting Thermal Stability

Variations in DC bias current with temperature is an important consideration in the design of reliable transistor audio amplifiers. This note gives a useful method of predicting the thermal stability of biasing circuits.

AN-189 Solid-State Pulse Width Modulation DC Motor Control

Pulse-width modulation, an effective method of dc voltage control, provides motor speed regulation under varying torque conditions - ideal for traction drive vehicles.

AN-191 Varactor Diodes and Circuits for High Power Output and Linear Response

Three new varactors are described, and varactor multiplier circuits - a 50 MHz to 100 MHz push-push doubler, a 500 MHz to 1000 MHz harmonic doubler, and a 200 MHz to 600 MHz harmonic tripler - - are presented in detail.

AN-194 Designing Integrated Serial Counters

MECL monolithic integrated J-K flip-flops serve as building blocks for ultra-high-speed ripple counters. General design techniques for designing counters of any arbitrary count.

AN-199 A Solid-State 15 kHz Power Inverter

Fast-switching power transistors allows the design of a high-frequency power converter featuring minimum size and weight of reactive components.

AN-204A High Performance Integrated Operational Amplifiers

Two new high performance monolithic operational amplifiers feature exceptionally high input impedance and high open loop gain. This note describes the function of each stage in the circuit, methods of frequency compensating and dc biasing. Four applications are discussed: a summing circuit, an integrator, a dc comparator, and transfer function simulation.

AN-210 FM Modulation Capabilities of Epicap VVC's

The author shows by empirical methods that the frequency vs. voltage curve for Epicap voltage variable capacitors is linear for small (sufficient for most FM modulator applications) voltage variations.

A rigorous mathematical explanation of this linear interdependence follows the empirical demonstration.

AN-211 Field Effect Transistors in Theory and Practice

The basic theory, construction, and application information for field effect transistors (junction and MOS types) are given. Also included are some typical test circuits for checking FET parameters.

AN-213 Varactor Multipliers Provide High Output Power Above 6 GHz

The author employs a high performance varactor diode in the design of several multiplier circuits which feature exceptionally high output power versus frequency capabilities. Among the circuits discussed are a 2 to 5 GHz doubler, a 2 to 6 GHz tripler, a 2.83 to 8.5 GHz tripler, and a 500 MHz to 4 GHz one-step multiplier.

A physical and electrical characterization of the 1N5154, 1N5155 varactors, sufficient for design purposes, precedes the actual design discussion.

AN-215 RF Small Signal Design Using Admittance Parameters

The author shows that the power gain and stability of high frequency transistors may be completely described by two-port parameters.

This paper presents a summary of the overall design solution for the small signal RF amplifier using admittance parameters. Design considerations and relationships for both stable and the potentially unstable transistor are presented together with a discussion of the neutralized, unneutralized, matched, and mis-matched amplifiers.

AN-219 The Field Effect Transistor in Digital Applications

Field effect transistors have definite advantages over junction transistors in many digital applications; high fan-out, direct coupled circuitry (lower component count), extremely low power dissipation, and low temperature coefficient circuits are among the most important.

This paper provides the designer with an up-to-date discussion of JFET and IGFET switching characteristics and how they are used in the design of basic digital circuits. The final portion of this paper discusses a family of JFET logic circuits, a family of IGFET, and future prospects.

AN-220 FET's in Chopper and Analog Switching Circuits

The author's discussion begins with elementary chopper and analog switch characteristics - - explores fully the considerations required for conventional and FET chopper and analog switch design - - and finishes with specific FET circuit examples.

AN-221 4-Layer and Current-Limiter Diodes Reduce Circuit Cost and Complexity

The authors present four simple circuits in which 4-layer diodes and current-limiter diodes are used to provide increased circuit performance: A Saw-tooth generator (two variations), a staircase generator and a ring counter.

A brief discussion of the electrical characteristics of 4-layer and field effect diodes precedes the circuit examples.

AN-222 The ABCs of Solid-State DC to AC Inverters

The author provides a comprehensive examination of the entire field of dc to ac inverters. Among the topics discussed are: the proper inverter for a specific application; operation principles of different types of inverters; the problem of proper device selection in the design of inverters; an inverter design example.

AN-223 Cascade Noise Figure for Integrated Circuit Transistors

In vacuum tube circuitry, the combination of the grounded-cathode and the grounded-grid cascade has superior noise properties to all other two-stage amplifiers. In transistor circuitry the noise performance of a single-stage amplifier is well known, but little information has been published about the best performance obtainable from two-stage transistor amplifiers. This paper evaluates the noise performance of all possible two-stage transistor amplifiers. Also, since the noise contribution of stages beyond the second is normally small, this analysis will be valid for amplifiers with any number of stages.

AN-225 High Performance All Solid-State Servo Amplifiers

The design of 7.5 Watt transformer-coupled solid-state servo amplifier and a 10 Watt complementary transistor servo amplifier are fully discussed. The transformer coupled amplifier, requiring only three transistors, provides a stable voltage gain of 100. The complementary amplifier, though more complex, is direct coupled throughout thus eliminating the transformer and its accompanying phase shift problems.

AN-226 Thermal Measurements on Semiconductors

This note describes the techniques used by Motorola to obtain the thermal resistance of transistors, rectifiers, and thyristors.

AN-228 20 Watts at 1 GHz with Step Recovery Varactors

Varactor harmonic multiplier circuit power handling capabilities have now been extended to 20 Watts at 1 GHz and 10 Watts at 2 GHz by two new varactors, the 1N5149 and 1N5150. This note provides a complete discussion of the design and performance of these two varactors. Several high performance multiplier circuits: - a 0.5 GHz to 1 GHz doubler; a 0.4 GHz to 1.2 GHz tripler; and a 0.46 GHz to 1.84 GHz quadrupler are also discussed.

AN-231 FET Differential Amplifier

The field effect transistor is often a better choice than the bipolar transistor in many differential amplifier applications, particularly when high input impedance is required. This report discusses drift compensation of field effect transistors for differential amplifier applications.

AN-232 1.5 GHz 10 Watt Two-Stage Cascade Multiplier

Two high-performance varactors -- the 1N5149 and 1N5150 -- are employed in a cascade multiplier which features over 10 watts power output at 1.5 GHz.

AN-238 Transistor Mixer Design Using Admittance Parameters

Mixer circuit design may be simplified by the use of small-signal admittance parameters. This note describes in detail the effective application of this design technique and the corresponding results. Several design examples are discussed.

AN-239 MECL Integrated Circuit Schmitt Triggers

The Schmitt Trigger, a regenerative circuit which changes state abruptly when the input signal crosses specified dc trigger levels, can be fabricated from MECL integrated logic gates. This note describes the modifications necessary to convert standard MECL logic gates to Schmitt Triggers, and also the performance to be expected from such units. Examples of the MECL Schmitt Trigger used for wave shaping and pulse generator applications are also included.

AN-240 SCR Power Control Fundamentals

Relationships of control angle to peak voltage, average voltage, RMS voltage and power are presented in chart form. Time constant for relaxation oscillators are discussed for both DC and AC supplies. These basics form the heart of SCR control.

AN-243 Transistor-Varactor-Multiplier Versus Transistor-Multiplier

Several watts of power in the upper portion of the L band may be obtained with either the transistor amplifier driving a varactor multiplier (TAVM), or the transistor amplifier-multiplier (TAM). This report presents a careful evaluation of both types of circuits.

AN-245A An Integrated Core Memory Sense Amplifier

This application note discusses core memories and related design considerations for a sense amplifier. Performance and environmental specifications for the amplifier design are carefully established so that the circuit will work with any computer using core memories. The final circuit design is then analyzed and measured performance is discussed. The amplifier features a small uncertainty region (6 mV max), adjustable voltage gain, and fast cycle time (0.5 μs).

AN-247 An Integrated Circuit RF-IF Amplifier

A new, versatile integrated circuit for RF-IF applications is introduced which offers high gain, extremely low internal feedback and wide AGC range. The circuit is a common-emitter, common-base pair (the cascade connection) with an AGC transistor and associated biasing circuitry. The amplifier is built on a very small die and is economically comparable to a single transistor, yet it offers performance advantages unobtainable with a single device. This application note describes the AC and DC operation of the circuit, a discussion of Y-parameters for calculating optimum power and voltage gain, and a variety of applications as an IF single-tuned amplifier, IF stagger-tuned amplifier, oscillator, video-audio amplifier and modulator. A discussion of noise figure is also included.

AN-248 A High Voltage Monolithic Operational Amplifier

This note introduces a high voltage monolithic operational amplifier featuring high open loop gain, large common mode input signal, and low drift. The function of each stage in the circuit is analyzed, and methods for frequency compensating the amplifier are discussed. DC biasing parameters are also examined. Four applications using the amplifier are discussed: a source follower, a twin tee filter and oscillator, a voltage regulator, and a high input impedance voltmeter.

AN-249 Designing Around the Tuning Diode Inductance

The effect of varactor inductance is described, and equations and graphs are presented in order to predict the inductance value and to determine when its effects on performance is significant.

In addition a design example of a varactor-tuned capacity-loaded half-wave cavity from 470 MHz to 890 MHz, and derivations of design equations for varactor tuned quarter wave and half-wave cavities as well as for lumped series tuned circuits are shown.

AN-251A Decade Counters Using MRTL Integrated Circuits

This application note discusses the design and implementation of decade counters using the MRTL family of integrated logic. Ripple counters, shift counters, and parallel clocked counters are developed using BCD, 2'421, and excess 3 digital codes. Up and down counting techniques are discussed. Output decoding, problem areas and circuit limitations are covered for all counter types.

AN-257 Decade Counters Using MECL J-K Flip-Flops

This note discusses the use of MECL integrated circuits in four types of decade counters. The logic and circuit design of an excess three up-down counter, a 2'421 up-down counter, a Gray code counter, and a switch-tail ring counter with ten line output are illustrated.

AN-260 Selecting Varactor Diodes

High output power in the UHF region can be achieved with varactors. A device selection procedure based on experience, theory and common sense is offered.

AN-261A Transistor Logarithmic Conversion Using an Operational Amplifier

The design of a log amplifier using a common base transistor configuration as the feedback element of an integrated circuit operational amplifier circuit is discussed in this application note. Six decades of logarithmic conversion are obtained with less than 1% error of output voltage. The possible causes of error are discussed followed by two applications: direct multiplication of two numbers, and solution of the equation $Z = X^n$.

AN-263A Choosing DTL Integrated Logic Circuits

This article discusses diode-transistor logic, DTL, integrated circuits, and the considerations a user should make in choosing this integrated circuit family. Consideration is given to the advantages and limitations one encounters with this logic form. Three versions of DTL are considered in this report; conventional DTL, modified DTL, and high noise immunity DTL.

AN-264 MRTL Integrated Circuit Shift Registers

This note discusses the design considerations for the implementation of a 16-bit shift register using J-K flip-flops. The shift register described has the capability, upon command, to shift left or shift right and to enter information serially or in parallel. All problems encountered in the implementation and operation of the register are discussed.

AN-267 Matching Network Designs with Computer Solutions

Computer solutions for four networks commonly used in solid-state high frequency amplifiers have been tabulated.

AN-268 Pulse Triggering of Radar Modulator SCR's

Factors involved in dynamic gate triggering are examined and relations of gate triggering characteristics to variations of total current amplifications with gate current are shown.

AN-270 Nanosecond Pulse Handling Techniques

The rapid advancement in the field of high speed digital integrated circuits has brought into focus many problem areas in the methods of pulse measurement techniques and new concepts dealing with these problems. This paper is intended to discuss the more common, yet perhaps not well known, pitfalls of measurement systems, a method of detecting them and possible solutions.

AN-274 MECL Integrated Circuit Shift Registers

A generic shift-right, shift-left register with parallel entry, end-around-shift, and complementation capabilities is discussed. Maximum practical operating speed, delay times and timing considerations of the logic gating signals are determined. The basic register as developed may be used for data handling, for number scaling, or in the arithmetic portion of a digital computer.

AN-278 Using Shift Registers as Pulse Delay Networks

This note discusses high speed clocked shift registers using J-K flip-flops and employed as a digital incremental delay. The register may be clocked with a frequency division counter to accomplish any desired delay with increments as small as 20 ns. The circuit as developed may be used for timing basic computer decisions or as an adjustable delay line for pulse.

AN-280 MECL 85 MHz J-K Flip-Flop

A new high-speed J-K flip-flop is discussed. Capabilities, performance, and applications are explained along with typical and worst case operating data. This flip-flop with four J inputs and four K inputs more than doubles the operating speed of registers and counters as employed in a system.

AN-282 Systemizing RF Power Amplifier Design

The design of high-power, Class C, RF transistor amplifiers can be greatly simplified through the use of large-signal device characterization. This note explains design procedures and furnishes large-signal impedance data for thirteen Motorola RF power transistors.

AN-286 Binary Addition Using MRTL IC's

This note discusses the principles of binary addition with positive numbers and considers the implementation of binary adders with MRTL. The full adder function is illustrated using MRTL half adders, NOR gates arranged to simulate half adders, and with NOR gates in a two level logic scheme.

The full adder and associated logic is developed for a four-bit parallel (asynchronous) adder and for serial (synchronous) adder.

AN-287 Color IF Amplifier and AGC Circuit

A non-neutralized, three-stage IF video amplifier is described. Included is the associated keyed AGC circuitry. The circuits were used in a transistorized color set built in the Applications Laboratory at Motorola.

AN-290A Mounting Procedure, and Thermal Aspects of, Thermopad Plastic Power Devices

Several Motorola power devices are now encapsulated into the plastic Thermopad package.Two package sizes are presently available: One about 0.3 by 0.4 inch (Case 77), and the larger 0.5 by 0.625 inch (Case 90). The mounting methods are similar for both packages. This note describes several methods and considers some thermal aspects.

AN-292 Thermal Response of Semiconductors

This note explains a workable method – using the concept of transient thermal resistance – of predicting junction temperature at any point in time regardless of the power waveform.

AN-293 Theory and Characteristics of the Unijunction Transistor

The unijunction transistor is examined as to theory of operation, design structures, static and transient characteristics.

AN-294 Unijunction Transistor Timers and Oscillators

Twelve different unijunction transistor circuits, complete with parts lists are given. Temperature stabilization of the peak-point voltage is examined and dynamic operation paths are discussed.

AN-295 Suppressing RFI in Thyristor Circuits

Measures taken to suppress RFI are shown. Design considerations and examples are explored as well as some solutions to the RFI problem.

AN-296 Construction of A Master-Slave Flip-Flop from MRTL Gates

Information is provided on the construction of a master-slave flip-flop circuit from standard MRTL gates. Characteristics of the resulting circuit are given and an application of the configuration illustrates the advantage of this type of flip-flop.

AN-297 Integrated Circuits for High Frequency to Voltage Conversion

This application note concerns the technique of using integrated circuits in a linear frequency to voltage converter from 1 MHz to 30 MHz. A theoretical analysis is given as well as a working design.

AN-298 Noise Immunity With High Threshold Logic

A comparison of noise immunity characteristics is made between MHTL devices and standard saturated logic devices.

AN-299 An IC Wideband Video Amplifier With AGC

This application describes the use of the MC1550 as a wideband video amplifier with AGC. The analysis of a single stage amplifier with 28 dB of gain and 22 MHz bandwidth is given with the results extended to a 78 dB video amplifier with 10 MHz bandwidth.

AN-400 An Operational Amplifier Tester

A simple and inexpensive tester for Motorola's line of operational amplifiers is described which will measure the open loop voltage gain, the equivalent input offset voltage, the maximum positive and negative output voltage swing, and a view of the transfer function which shows the linearity of the device.

Included is an elementary discussion of the parameters measured and their relationship to closed loop performance.

AN-401 The MC1554 One-Watt Monolithic Integrated Circuit Power Amplifier

This application note discusses four different applications for the MC1554, along with a circuit description including dc characteristics, frequency response, and distortion. A section of the note is also devoted to package power dissipation calculations including the use of the curves on the power amplifier data sheet.

AN-402 Insulated Gate FET's Used in IC's

The note acquaints the circuit designer with the integrated FET. A brief description of the operation of the Insulated-Gate Field Effect transistor is presented. This discussion is followed by a description of the FET in integrated form and finally, the basic advantages of FET IC's are explored.

AN-403 Single Power Supply Operation of IC Op Amps

A split zener biasing technique that permits use of the MC1530/1531, MC1533, and MC1709 operational amplifiers and their restricted temperature counterparts MC1430/1431, MC1433 and MC1709C from a single power supply voltage is discussed in detail. General circuit considerations as well as specific ac and dc device considerations are outlined to minimize operating and design problems.

AN-404 A Wideband Monolithic Video Amplifier

This note describes the basic principles of ac and dc operation of the MC1552G and MC1553G, characteristics obtained as a function of the device operating modes, and typical circuit applications.

AN-405 DC Comparator Operations Utilizing Monolithic IC Amplifiers

The use of the MC1533 operational amplifier and the MC1710 differential comparator are discussed. The capabilities and performance are given along with typical operating curves for both devices.

AN-406A UHF Broadband Amplifier Design

A design technique is given for a wideband amplifier operating at UHF frequencies. A shunt-shunt feed-back network and Y-parameters at sampled frequencies are used.

AN-407 A General Purpose IC Differential Output Operational Amplifier

This application note discusses four different applications for the MC1520 and a complete description of the device itself. The final sections of the note discuss such topics as operation from single and split power supplies, frequency compensation, and various feedback schemes.

AN-408 Problems and Solutions With MDTL and MRTL

Problems which may be encountered in using MRTL or MDTL integrated circuits in low or medium speed systems are examined in this report. Methods of shaping clock waveforms, restrictions on input and output terminals when interfacing with discrete components, and techniques for extending temperature range are discussed.

AN-409 MDTL Multivibrator Circuits

This note describes methods of using MDTL gates to form astable and monostable multivibrators. The operation of the MC951/MC851 monostable multivibrator is also covered as well as a simple pulse-shaping circuit.

AN-411 The MC1535 Monolithic Dual Op Amp

This note discusses two dual operational amplifier applications and an input compensation scheme for fast slew rate for the MC1535. A complete ac and dc circuit analysis is presented in addition to many of the pertinent electrical characteristics and how they might affect the system performance.

AN-412 Duplexing With Step Recovery Varactors

The switching function in a duplexer circuit can be performed automatically by a step recovery varactor, eliminating the need for an external bias circuit. In this note, two CW duplexers are described: a 133 MHz lumped constant component duplexer and a 450 MHz microstrip transmission line duplexer.

AN-413 Unijunction Trigger Circuits for Gated Thyristors

This note describes the methods of supplying controlled pulse widths in synchronization with the ac power line to gated thyristors. The unijunction transistor provides a simple and convenient means of obtaining such pulses as well as including feedback with very little additional circuitry.

AN-414 Operation and Application of MHTL I/C Flip-Flops

A master-slave R-S and a dual J-K are the initial flip-flop elements available in the Motorola High Threshold Logic (MHTL) family. This note describes operation and characteristics of each unit and illustrates several applications of these devices.

AN-415A Avoiding Second Breakdown

The use of safe-area data, the physical mechanism of second breakdown and applications to various circuits are presented. Also included is a short discussion of test procedures and a typical test circuit used to establish safe area curves.

AN-416 One-Step High Order Frequency Multipliers

The circuits described in this report include the use of lumped constants, coaxial cavities, and waveguides. The design of lumped constant, low order multipliers is discussed in Application Notes AN-147 and AN-151 and coaxial cavity multiplier design is treated in Note AN-159. Therefore, only a brief outline of the X2 and X3 multiplier circuits will be given.

AN-417 IC Crystal Controlled Oscillators

Crystal controlled square wave oscillators can be used as clock drivers, harmonic sources for frequency markers, in frequency synthesizers, frequency comparators, etc. It is difficult to obtain high frequency square waves due to the long propagation delays of the most integrated circuits. The MECL II clock driver with 2 ns propagation delay eliminates this problem. This note describes square wave oscillator circuits with crystal control that are capable of output frequencies, inverted and non-inverted, up to 150 MHz.

AN-418 High Speed Monostable Multivibrator Design with MECL Integrated Circuits

This note describes two configurations of monostable multivibrators using the MC1023 clock driver and a delay element. Operating frequencies in excess of 70 MHz and pulse widths of 4 nanoseconds are possible. Methods of obtaining the predetermined delay are also discussed.

AN-419 UHF Amplifier Design Using Data Sheet Design Curves

This note describes the design of UHF narrowband amplifiers using the device loading admittances taken directly from the device data sheet. A design example is given in the form of a 1 GHz microstrip amplifier. Predicted results are compared to actual measured values. Also included is a short discussion on practical microstrip construction techniques.

AN-421 Semiconductor Noise Figure Considerations

A summary of many of the important noise figure considerations related with the design of low noise amplifiers is presented. The basic fundamentals involving noise, noise figure, and noise figure-frequency characteristics are then discussed with the emphasis on characteristics common to all semiconductors. A brief introduction is made to various methods of data sheet presentation of noise figure and a summary is given for the various methods of measurement. A discussion of low noise circuit design, utilizing many of the previously discussed considerations, is included.

AN-422 Testers for Thyristors and Trigger Diodes

This paper describes inexpensive go-no-go testers for thyristors and trigger diodes. Each is very simple to use and is well adapted to incoming inspection and other applications requiring fast testing of major parameters.

AN-423 Field-Effect Transistor RF Amplifier Design Techniques

Amplifier design theory utilizing the two port network model for an active device has been well developed and used extensively in bipolar transistor high frequency amplifier design.

This paper discusses some of the theoretical and practical considerations for using this popular method to design field effect transistor amplifiers.

AN-426A Low-Power Audio Amplifiers Using Complementary Plastic Transistors

The use of complementary-symmetry output transistors in low-power audio amplifiers enables the circuit designer to achieve maximum circuit performance at minimum component cost. This note describes several audio amplifier circuits suitable for power outputs of up to 2 watts with 8-, 16- and 40-ohm loads. Also described is a line-operated single-ended audio amplifier suitable for table-radio or television applications.

AN-432B A Monolithic Integrated FM Stereo Decoder System

This application note discusses the circuit approach that has been taken in the realization of the first monolithic integrated stereo multiplex decoder built for consumer usage, as well as some of the details concerning its incorporation in an FM stereo receiver.

AN-436 Conventional and Soft-Start Dimming of Incandescent Lights

This note describes two dimmers that provide wide-range control of incandescent light intensity by adjusting the angle of conduction in a series triac. One dimmer features simplicity for small size and low cost, while the other offers soft-start operation to limit inrush current and lengthen lamp life.

AN-437 Design Considerations and Performance of Motorola Temperature-Compensated Zener Reference Diodes

This application note defines Motorola temperature-compensated zener (reference) diodes, explains the device characteristics, describes electrical testing, discusses the advanced concepts of device reliability and quality assurance, and outlines device construction.

AN-439 MC1539 Op Amp and its Applications

This application note discusses the MC1539, a second generation operational amplifier. The general use and operation of the amplifier is discussed with special mention made of improved operation over that of its first generation predecessor—the 709 type amplifier.

In addition to the detailed discussion on the dc and ac operation of the device, considerable emphasis is placed on operational performance. Many applications are offered to demonstrate the device capability, including a high frequency feed-forward scheme, and a source follower application.

AN-440 Theory and Characteristics of Photo Transistors

A brief history of the photo-electric effect is discussed, followed by a comprehensive analysis of the effect in bulk semiconductors, pn junctions and phototransistors. A model is presented for the phototransistor. Static and transient data for the MRD300 provide typical phototransistor characteristics. Appendices provide a discussion of the relationship of irradiation and illumination and define terms specifically related to phototransistors.

AN-441 SCR Slaving Circuits

This circuit makes use of a low-cost transistor to overcome the limitations of a conventional R-C discharge circuit in slave firing of an SCR. It is especially useful where zero-point switching techniques are employed to control large electrical loads.

AN-442 Designing DC-DC Converters for Capacitor Charging with Batteries

This paper outlines design considerations for converters used for charging energy-storage capacitors with low-voltage batteries. The ratio of capacitor voltage to battery voltage is chosen to be greater than 100.

A discussion of converter characteristics is presented here from the standpoint of efficiency, frequency of oscillation, rate of energy transfer from battery to capacitor, and peak battery current drain.

A complete circuit is included that is tolerant of semiconductor parameter variations and is thus suitable for economical mass production.

AN-443 Directional and Speed Control for Series, Universal and Shunt Motors

A simple circuit containing few components allows control of both speed and direction of rotation of dc motors. The use of thyristors provides continuous driver control through the speed range without compromising the torque characteristics of the motors.

AN-444 Triac Prevents High Current Relay Arcing

A triac in shunt with the contacts of a relay that switches large currents drastically reduces the size of contacts required. Since the triac is subjected to current surges for only a short time and at a low duty cycle, it can conduct currents many times its steady-state rated value.

AN-445 Pulse-Width Modulation for DC-Motor Speed Control

Feedback derived from a motor's armature and dependent on its speed can be used to counteract the reduction in speed that accompanies loading. This note describes two speed-control circuits which use different methods to obtain the feedback signal. One method uses voltage sensing, and the other an optical pickup.

AN-446 128-Bit Read Only Memory

Read Only Memories can now be fabricated as integrated circuit arrays and hence will have a great impact upon digital system design. Applications of the Motorola 16-word, 8-bit Read Only Memory (ROM) are discussed. The applications are grouped into two classifications according to the type of memory addressing utilized – (1) Random Accessing (2) Sequential Addressing.

AN-447 Fast Charging Systems for Ni-Cd Batteries

This note discusses the requirements and problems encountered in designing fast charging systems for nickel-cadmium (Ni-Cd) cells, including some cell characteristics affected by high-rate charging.

AN-450 Induction Motor Speed Control

A method of providing speed control above and below design speed for an induction motor is shown in this note. Such speed control increases the versatility of an induction motor and permits it to be used in fulfilling requirements formerly satisfied only by dc motors.

AN-451 A Frequency Counter Using Motorola RTL Integrated Circuits

A frequency-period counter with a total hardware cost under $200.00, based on unit quantity prices, is described. The instrument measures the periods and frequencies of periodic waveforms, ranging in frequency from 10 Hz to 20 MHz, and counts random occurances for selected gate times of one millisecond to 10 seconds. A four digit decimal readout is provided. The low cost is achieved by utilizing plastic MRTL devices in unique versions of a crystal controlled oscillator, a period selector, a one shot multivibrator, a pulse shaper, and a switch contact bounce eliminator circuit.

AN-453 Zero Point Switching Techniques

This note discusses two unique pulse-type thyristor triggering circuits which meet the exact timing requirements of zero-point switching. They dissipate very little power and can be used with either sensitive or "shorted" gate devices.

AN-454 AC Overcurrent Protective Circuit with Automatic Reset

A unique circuit that will protect ac resistive loads from both overvoltage and overcurrent is shown. One feature of this circuit is that the sensing element is not in series with the load when the load is turned on.

AN-455 Using the FET Designers Data Sheet for Worst Case Amplifier Circuit Design

Basic information for the use of field effect transistors is provided, and is an aid to complete understanding of the Designers Data Sheet. This report discusses the advantages, disadvantages, types and modes of operation of FETs and presents a definitive discussion of key parameters with their relationship to circuit design, when applicable.

AN-456 A 50 MHz Programmable Counter Designed with MECL II Integrated Circuits

A high speed programmable counter using the MECL II family of logic is discussed. The counter is designed to accept an input frequency up to 50 MHz and divide it by any number from 2 to 999. This number is programmed into three decades of synchronous down counters. These decades with additional decoding and control logic comprise a complete high speed divide-by-N counter system.

AN-459 A Simple Technique for Extending Op Amp Power Bandwidth

The design of fast response amplifiers is presented without the use of "tricky" compensation procedures or calculations using data sheet information. Circuit analysis for compensation procedure is given.

AN-460 Using Transient Response to Determine Operational Amplifier Stability

This application note describes a technique for evaluating the stability of any particular feedback amplifier configuration by analyzing its response to a step-function input. A theoretical analysis is given along with an example.

AN-461 Transient Suppression with a Power Zener Diode

Voltage transients are a major cause of component failure in semiconductor circuits. A design engineer must consider this problem carefully if he is to insure maximum circuit reliability. This note discusses the sources of transients and their detection, and describes transient suppression using power zener diodes designed for this purpose.

AN-462 FET Current Regulators—Circuits and Diodes

Included are numerous FET current sourcing circuits, along with an extensive treatment of the current regulating diode and its uses as a valuable component in circuit design.

AN-464 MTTL Designer's Note – The MC4004/MC4005, A 16-Bit Random Access Memory

High speed, non-destructive readout (NDRO) memory systems can be constructed with the MTTL 16-bit memory chip. Information concerning the chip that is pertinent to the design of a complete memory system is herein presented. The topics discussed are: (1) operation of the 16-bit memory including typical read and write sequences, (2) typical dc and switching characteristics as a function of temperature, power supply, and output load, and (3) examples of memory system organization utilizing the 16-bit memory as the basic cell.

AN-465 MTTL Designer's Note – The MC4006/MC4007 Decoders

Two MTTL complex functions, the MC4006 Binary to One-of-Eight Decoder and the MC4007 Dual Binary to One-of-Four Decoder are discussed. Their basic modes of operation and expansion capabilities are described. Examples of the use of the decoders in various systems are presented.

AN-466 Circuit Applications for the Triac

This note discusses the basic theory of operation of the triac with control methods and circuit applications. Among the applications included are basic switches, lamp dimmers, motor controls, a heater control, a flasher, a regulator, protective circuits and zero-point switching.

AN-467 Using Motorola High Threshold Logic

This application note explains operation of the Motorola High Threshold Logic (MHTL) family of integrated circuits. It briefly describes the members of the family and provides many of the characteristics of the units. Several examples are provided to aid the reader in the application of this unique logic family.

AN-469 Line Operated 15-kHz Inverter

The circuit shown in this note is a line-operated inverter. It makes use of high-voltage, high-frequency silicon power transistors to provide 120 volts and 200 watts at 15 kilohertz. Because of the high frequency of operation, the components used can be small in size, resulting in a very compact inverter.

AN-470 Bipolar Chopper Transistors and Circuits

Bipolar transistor chopper circuits are used in many applications for low-drift amplification of dc and low-frequency ac signals. This note discusses the characteristics of transistors used as choppers and the circuits in which they can be used.

AN-471 Analog-To-Digital Conversion Techniques

The subject of analog-to-digital conversion and many of the techniques that can be used to accomplish it are discussed. The paper is written in general terms from a system point of view and is intended to assist the reader in determining which conversion technique is best suited for a given application.

AN-472 Mounting and Heat Sinking Uniwatt Plastic Transistors

The Uniwatt plastic package is now being used for several medium-power transistor types. This note describes several methods for mounting such devices, with emphasis on proper heat sinking for best thermal characteristics.

AN-473 A Monolithic High-Power Series Voltage Regulator

This note discusses MC1560/MC1561 voltage regulator in terms of internal operation, development of these circuits, and how they are advantageously used in supply fabrication.

AN-474 The MC1541 – A Gated Dual-Channel Sense Amplifier for Core Memories

The MC1541 sense amplifier can provide many magnetic core memory systems with lower system cycle times and a lower package count than with previous sense amplifiers. Circuit operation, design considerations, interface problems and typical applications are discussed.

AN-475 Using the MC1545 – A Monolithic, Gated-Video Amplifier

Because of the unique design of the MC1545, this amplifier can be used as a gated video amplifier, sense amplifier, amplitude modulator, frequency shift keyer, balanced modulator, pulse amplifier, and many other applications. This note describes the ac and dc operation of the circuit and presents applications of the device as a video switch, amplitude modulator, balanced modulator, pulse amplifier, and others.

AN-476 MTTL Designer's Note – The MC4000 Data Selector and the MC4002 Data Distributor

Two MTTL complex functions, the MC4002 four and two-channel data distributor, and the MC4000 dual four-channel data selector are discussed. Their basic modes of operation and expansion capabilities are described. Examples of the use of the data distributor and the data selector in various systems are presented.

AN-477 A 30-Watt 175 MHz Power Amplifier Using PNP Transistors

This note describes a three-stage power amplifier that delivers 30 watts output at 175 MHz. It utilizes the first commercially available VHF PNP high-power transistors to provide 29 dB gain, 50% overall efficiency, and low spurious output.

AN478A Small Signal RF Design with Dual-Gate MOSFETS

The dual-gate MOSFET offers low noise, high gain, and excellent AGC, cross-modulation and overload characteristics in RF applications. Recent devices also feature silicon nitride passivation for ease of handling and reliability. This note discusses the characteristics of dual-gate MOSFETs, with emphasis on designing circuits, noise figure, AGC, bandwidth and detuning, cross-modulation and mixer operation.

AN-480 Regulators Using Operational Amplifiers

The theory of op amp voltage regulator design is discussed. The problem areas associated with such designs are also detailed. The MC1560 is used as a OTC voltage reference in the op amp regulator designs that are shown. It is shown that regulation from 0.01% to 0.001% is possible.

AN-481 A Broadband 4-Watt Aircraft Transmitter

This report describes a 4-W wideband AM aircraft transmitter intended for light aircraft. The frequency range is 118 to 136 MHz and no tuning is required when changing frequency. The RF circuitry can be operated from 12.5 V, or can be used with a series modulator described in the note from 26 V.

AN-482 Electronic Speed Control of Appliance Motors

This application note discusses the possibilities of controlling several types of induction motors, universal motors, and permanent-magnet motors, and includes circuit designs for each. By matching the motor to its electronic control, the designer can obtain a simple and efficient system.

AN-483A 20 and 30 Watt Power Amplifiers Using Darlington Output Transistors

Use of monolithic power Darlington output transistors can greatly simplify the design of high-fidelity amplifiers. Described herein is a 20-W amplifier which uses only three transistors, and a 30-W amplifier which uses four.

AN-484 Medium-Power Audio Amplifiers Using Complementary Plastic Transistors

This note describes complementary-symmetry power amplifiers of 3- to 35- watt capability designed for 8-ohm loads. The circuits use inexpensive plastic-encapsulated silicon transistors in both low-level and output stages. Information is provided for specifying the transistors, power supplies and heat sinking.

AN-485 High-Power Audio Amplifiers with Short-Circuit Protection

This application note describes a recommended circuit approach for high-performance audio amplifiers in the 35-W to 100-W RMS power range. Circuitry is included which enables the amplifier to operate safely continuously under any load condition including a short.

AN-487 A High-Speed Ripple-Through Arithmetic Processor

A simple, systematic building block approach for designing a high-speed, ripple-through arithmetic processor is described. Using only gates and full adders, ultra-high speed multiplication, division, square root extraction, addition, and subtraction may be performed. Several variations of an arithmetic processor design are detailed and comparisons of speed and package count using the MECL and MDTL logic in 14-pin, 16-pin, 24-pin, 32-pin, and 64-pin packages are given.

AN-488 High-Speed Addition Using Lookahead Carry Techniques

The use of the lookahead carry principle to increase the operating speed of adder systems is described. Several adders of different sizes using variations of lookahead carry are developed and the logical implementation of these using the MTTL III and MECL II and III logic families is given.

AN-489 Analysis and Basic Operation of the MC1595

The MC1595 monolithic linear four-quadrant multiplier is discussed. The equations for the analysis are given along with performance that is characteristic of the device. A few basic applications are given to assist the designer in system design.

AN-490 Using the MC1595 Multiplier in Arithmetic Operations

This application note discusses the use of the MC1595 linear four quadrant multiplier in arithmetic operations. Included is a discussion of the MC1595 used in the multiply, divide, square and square root modes of operation. Actual circuits for these functions are shown with measured data and a discussion of the errors occurring in each mode.

AN-491 Gated Video Amplifier Applications The MC1545

This application note reviews the basic operation of the MC1545 and discusses some of the more popular applications for the MC1545. Included are several modulator types, temperature compensation of the active gate, AGC, gated oscillators, FSK systems, and single supply operation.

AN-492 Operating Characteristics of Motorola MC3000/MC3100 Series Transistor-Transistor Logic Gates

This application note explains the advantages of using the MC3000/MC3100 Series of conventional TTL. Design data is included which should allow determination of the operating characteristics under almost any set of conditions.

AN-493 The MC3000/MC3100 Series Transistor-Transistor Logic Flip-Flops

This application note explains the basic operation of the various flip-flops available in the MC3000/MC3100 series of transistor-transistor logic from Motorola. Typical operating characteristics are included so that operation under different conditions can be determined.

AN-495 A 25-Watt, 175 MHz Transmitter for 12.5-Volt Operation

This note describes the power amplifier stages of a 175-MHz 25-watt transmitter. The transmitter requires a 12.5 volt dc power source and is therefore suitable for operation directly from the electrical system of a 12-volt vehicle.

AN-496 Error Detection and Correction Using Exclusive-OR Gates and Parity Trees

The availability of Exclusive OR gates and parity trees allows digital system designers to use error detection and correction codes to improve their system reliability and maintainability without the major cost penalty that has existed in the past. Use of Exclusive-OR gates and parity trees available in the MRTL, MTTL, MDTL, and MECL families to design simple parity and single error Hamming parity detection and correction circuits is discussed.

AN-497 A Floating Voltage and Current Regulator-The MC1566

This note discusses the MC1566 theory, operation, and application in the context of high-voltage regulation. Several circuits are given to demonstrate the versatility of this regulator.

AN-498 Voltage and Current Boost Techniques Using The MC1560-61

The stability requirements for the current boosted MC1560-61 are discussed. Both internal and external compensation techniques are shown, along with heat-sink design information and typical circuits, including a self-oscillating switching regulator, and a voltage boost circuit.

AN-499 Shutdown Techniques for the MC1560-61/69 Monolithic Voltage Regulators

This note discusses the many ways one can use the shutdown control for the MC1560 Monolithic Voltage Regulator. These include logic control, short circuit detection, over voltage detection, junction temperature control, and thermal feedback. Also discussed, are current foldback and methods of restarting automatically from the shutdown state. The techniques discussed apply equally to the MC1560, MC1561, and MC1569 positive voltage regulators.

AN-500 Development, Analysis, and Basic Operation of the MC1560-61 Monolithic Voltage Regulators

In this note, the analysis and basic operation of the MC1560 and the MC1561 voltage regulators are discussed. The tests and parameters used on the data sheet are considered, and the problems of specifying a monolithic voltage regulator are identified. The basic circuit configurations are shown with some insight for the typical performance one can expect.

AN-502 A 40-W, 50-MHz, Transmitter for 12.5-Volt Operation

This report describes a three stage, three transistor transmitter capable of providing 40 watts continuous power output at 50 MHz in operation from a 12.5 V supply

The synthesis of the matching networks in the transmitter is greatly simplified by the application of a design procedure utilizing large-signal transistor impedance data.

AN-503 A 25-W Broadband Aircraft Transmitter

This report describes a wideband aircraft transmitter with a typical carrier output of 25 watts. The frequency range is 118-136 MHz and no tuning is required. The supply voltage is 13.6 V.

AN-504 The MC1600 Series MECL III Gates

This application note explains the basic operation of the various gates available in the MECL III logic family. Typical operating characteristics are included as an aid to the designer of high-speed logic along with recommended layout, breadboarding, and testing procedures. This note will also provide the designer with some insight into the overall capabilities of this logic line as they apply to this application.

AN-505 The MC4012, AN MTTL 4-Bit Shift Register

The MC4012 is a 4-bit shift register consisting of four D-type flip-flops operated in the synchronous mode and may be used for temporary storage of information. The MC4012 may be operated in either the parallel or serial mode input depending upon the logic state of the mode control. Circuit operation and various applications of the device are the subject of this application note.

AN-506 Code Conversion with Semiconductor Read Only Memories

In digital systems, data is manipulated and transmitted in coded form and frequently must be translated from one code into another. The use of read only memories to perform the various code conversions is discussed in this note. In particular, methods for converting data from the binary code to the binary coded decimal representation, and vice versa, are detailed. Conversion from the Hollerith code to the common 8-bit codes, such as the RS-358, ASC II, and EBCDIC codes, as well as conversions between the 8-bit codes are also treated.

AN-507 A 13-W Broadband AM Aircraft Transmitter

This report describes a wideband AM aircraft transmitter with a typical carrier output level of 13 W. The frequency range is 118 to 136 MHz with no tuning required. The supply voltage for the transmitter is 13.6 V. A transformerless series modulator is also described, and with this system, a 27.2-V supply is required. Lower-power 2.5 and 7-W transmitters are also included

AN508 Apprications of Phototransistors in Electro-Optic Systems

This note reviews phototransistor theory, characteristics and terminology, then discusses the design of electro-optic systems using device information and geometric considerations. It also includes several circuit designs that are suited to dc, low-frequency and high-frequency applications.

AN-509 True RMS Voltage Regulators

This note describes ac voltage regulators that are ideal for use with electronic and electrical equipment such as lamps and heaters that are highly sensitive to supply voltage. These regulators maintain constant rms voltage levels for input or load changes.

AN-510A A Function Generator

This report describes an inexpensive function generator with sine-, square-, and triangular-wave outputs. A combination of discrete and integrated circuits provide lowest cost without sacrificing good performance. Maximum output amplitude of all waveforms is 20 volts peak to peak from a 50-ohm output impedance. Frequency range is 1 Hz to 1 MHz.

AN-511 Low Frequency Applications of Field-Effect Transistors

Field-effect transistors enjoy usage in a wide range of applications at both high and low frequencies. This report discusses the low-frequency applications. with an emphasis on the lesser-known uses. General topics covered are switches and choppers, amplifiers, voltage-variable resistors, current limiters, and microwatt logic.

AN-512 Applications of Fast-Recovery Rectifiers

Many applications that use silicon rectifiers at high frequencies or repetition rates can be improved with fast-recovery diodes. This note discusses the characteristics of these diodes and describes typical applications in which they excel.

AN-513 A High Gain Integrated Circuit RF-IF Amplifier With Wide Range AGC

This note describes the operation and application of the MC1590G, a monolithic RF-IF amplifier. Included are several applications for IF amplifiers, a mixer, video amplifiers, single and two-stage RF amplifiers.

AN-517 Improving the Efficiency of Low Voltage, High-Current Rectification

The efficiency of low-voltage, high-current rectification can be improved by using either barrier rectifier diodes or synchronous rectification. This note discusses both approaches and compares them to the use of conventional silicon rectifiers.

AN-518 Constant-Speed Motor Control Using Tachometer Feedback

A simple tachometer can provide feedback control for shaded-pole motors and better brush life for universal motors. This note describes pickups and circuits suitable for use in such equipment as home appliances and power tools.

AN-519 Using MDTL Logic Blocks

This Application Note discusses typical applications of basic MDTL components such as gates and flip-flops, with emphasis placed on the positive logic AND, OR, NOR, NAND, and Exclusive-OR functions. Methods of interfacing MDTL with other popular logic families are also discussed.

AN-521 Using Balanced Emitter Transistors in RF Applications

Motorola Balanced Emitter Transistors provide excellent performance and resistance to burnout under conditions of mismatching and detuning in high-frequency power amplifiers. This note describes the characteristics and typical applications of these transistors.

AN-522 The MC1556 Operational Amplifier and its Applications

This application note discusses the MC1556, a second generation, internally compensated monolithic operational amplifier. Particular emphasis is placed on its distinct advantages over the early 709-type amplifier and the more recent 741-type amplifier.

Along with a description of its operation this note presents a discussion on various applications of the MC1556, high-lighting its capabilities, and points out its characteristics so the reader may make effective use of the device.

AN-523 MOS Multiplex Switches

The characteristics and parameters of the MC1150 and the MC1151 MOS Multiplex Switches are described and the use of these devices in multiplexers and decoder drivers is discussed. Also included is a discussion of logic level translators for interfacing these MOS devices with other logic lines such as RTL, DTL, and TTL.

AN-524 Converting Relay Control Systems to Digital I/C'S

Basic Boolean Algebra and logic functions are defined and discussed. A method of converting relay diagrams to logic diagrams is then presented. Several examples and a system design illustrate the conversion method using MHTL.

AN-526 Theory, Characteristics and Applications of Silicon Unilateral, and Bilateral Switches

The SUS/SBS are constructed as simple integrated circuits which perform as gated or voltage sensitive switches. Device theory and operation are explained plus circuit applications in the areas of power thyristor triggering and logic. Devices illustrated include the MUS4987-88 and the MBS4991-92.

AN-527 Theory, Characteristics and Applications of the Programmable Unijunction Transistor

This note discusses the characteristics of a programmable unijunction transistor (PUT) and offers comparisons with the annular unijunction. Also included are several circuits showing their versatility of the PUT.

AN-528 Binary-to-BCD-to-Binary Conversion with Complex IC Functions

Complex function integrated circuits reduce the cost of performing conversion from binary to the BCD code or from the BCD code to binary. Four methods of performing each conversion are discussed and compared.

AN-529 Regulated Line Operated Inverter Uses High Voltage Power Transistors and Hot Carrier Rectifiers

This report describes a line operated 225 Watt preregulated power supply which offers considerable reductions in overall size and weight as compared to more conventional techniques of obtaining low voltages at high currents.

AN-530A The MC7491A Eight-Bit Serial Shift Register and the MC7495 Four-Bit Shift Register

Operation of the MC5491/7491A 8-bit shift register and the MC5495/7495 4-bit universal shift register are discussed. Typical applications are covered for each device and use of the two devices in a data transmission system is illustrated.

AN-531 A Monolithic, Balanced Modulator/Demodulator for Communications Applications

The MC1596 monolithic circuit is a highly versatile communications building block. In this note. both theoretical and practical information are given to aid the designer in the use of this part. Applications include modulators for AM, SSB, and suppressed carrier AM; demodulates for the previously mentioned modulation forms and FM are also included.

AN-532A MTTL and MECL Avionics Digital Frequency Synthesizer

This application note discusses several approaches that illustrate applications of complex digital integrated circuits directed toward avionics frequency synthesizers. The techniques presented point out the simplicity with which both MTTL and MECL digital integrated circuits can be used to produce frequency synthesis for avionic communications.

AN-533 Semiconductor for Plated-Wire Memories

An introduction to the operation and electrical characteristics of plated-wire memories is provided in conjunction with the applications of semiconductors that interface with the plated-wire memories.

Devices discussed include drivers, sense amplifiers, and decoders. Memory organization and memory-related semiconductor applications are also mentioned.

AN-534 Commutating Filter Techniques

This note describes the design and construction of commutating (digital) filters using Motorola MECL II, MTTL III and MC7400 digital integrated circuits. A short section on commutating filter theory is included along with examples of filters and their responses.

AN535 Phase-Locked Loop Design Fundamentals

The fundamental design concepts for phase-locked loops implemented with integrated circuits are outlined. The necessary equations required to evaluate the basic loop performance are given in conjunction with a brief design example.

AN-536 Micro-T Package Transistors for High Speed Logic Systems

Integrated circuits have become the first thought of most designers faced with a digital problem; for specialized needs such as extremely high speed, high speed with minimum power dissipation, or unusual logic functions. However discrete transistors in the ultra-small Micro-T package may prove advantageous.

AN-537 The MC4023, AN MTTL 4-Bit Universal Counter

The MC4023 Universal Counter can be connected to count any number from two through twelve except seven and eleven. For all settings, counting is in a binary sequence from count zero to the selected number. Operating characteristics and applications of the device are the subject of this application note.

AN-538 Motorola Complementary MOS I/C'S

This note discusses some of the properties of N-channel and P-channel MOSFETs and describes how they are used to construct complementary MOS integrated circuits. Some MCMOS logic functions are discussed, and the design of a MCMOS programmable binary up-counter is given.

AN-539 Interfacing with MOS I/C'S

This application note discusses the problem of interfacing MOS integrated circuits with the logic levels of MECL, MDTL, MTTL, and MRTL. The emphasis is placed primarily on the use of other integrated circuits to achieve this interfacing.

AN-540 A Synchronously Gated N-Decade Sweep Oscillator

This report describes a unique solid state oscillator system which hypothetically can be swpet over any frequency range. The prototype discussed herein is swept over only five decades. Options are provided to preselect only one, two or five frequency decades between 10 Hz and 10 MHz, whether sequential or not.

AN-541 Medium Scale Integration in the Numerical Control Field

Since medium scale integration means complex functions, the logic design engineer must understand both the product and its end use in order that his design be optimized. Transistor-Transistor Logic has a number of devices such as programmable counter, phase detectors, voltage controlled multivibrators, comparators, etc., which are available today in integrated circuit form. The devices can be applied to the numerical-controls field and are subject to this paper.

AN-543 Integrated Circuit IF Amplifiers For AM/FM and FM Radios

This application note discusses the design and performance of four IF amplifiers using integrated circuits. The IF amplifiers discussed include a high performance circuit, a circuit utilizing a quadrature detector, a composite AM/FM circuit, and an economy model for use with an external discriminator.

AN-544 A Printed Circuit VHF TV Tuner Using Tuning Diodes

A printed circuit VHF varactor tuner was designed and built in the Motorola Applications Laboratory. The design was centered around high capacitance tuning diodes, PIN band switching diodes, the dual-gate MOSFET, and a cascode mixer. This note describes the tuner, the design procedure, and the tuner performance.

AN-545 Television Video IF Amplifier Using Integrated Circuits

This applications note considers the requirements of the video IF amplifier section of a television receiver, and gives working circuit schematics using integrated circuits which have been specifically designed for consumer oriented products. The integrated circuits used are the MC1350, MC1352, MC1353 and the MC1330.

AN-546 Solid-State Linear Power Amplifier Design

Linear amplifier design techniques and new RF power transistors developed specifically for HF (2-30 MHz) linear amplifier service are discussed.

AN-547 A High Speed Dual Differential Comparator, The MC1514

This application note discusses a few of the many uses for the MC1514 dual comparator. Many applications such as sense amplifier, multivibrators, peak level detectors are presented.

AN-548 Microstrip Design Techniques for UHF Amplifiers

The design and construction of a 25 watt UHF power amplifier utilizing microstrip techniques for the 450 to 512 MHz band is discussed. The amplifier utilizes the 2N5945, 2N5946 and 2N6136 RF power transistors.

AN-549 A Vertical Deflection Circuit Using Complementary Transistors

A vertical defection system for television sets is discussed which uses complementary transistors in the output stage to avoid the need for an output transformer. This system consists of two separate circuits – an oscillator and a power amplifier – either of which can be used separately or as part of a different system. The oscillator produces a saw-tooth voltage waveform. The power amplifier converts a saw-tooth voltage waveform into a saw-tooth current waveform to drive the scan coils.

AN-550 Programming the MCM5003/5004 Programmable Read Only Memory

This note describes programming methods for the MCM5003/5004 512 bit (64x8) TTL Programmable Read Only Memory (PROM). These program methods can result in short design cycles for custom ROM circuits. Operation and circuit details of the MCM5003/5004 are given first. Then programming methods and circuitry are discussed. The simplest programmer uses only five ICs, while a more sophisticated programmer, using automatic sequencing, requires a total of 25 ICs.

AN-552 The Control Engineer's Guide to IC Applications

This report is a guide to the use of integrated circuits, and as such provides practical solutions to a number of common problems encountered in circuits used for sensing and control which must operate in an industrial environment. The report is divided into two parts – digital ICs and linear ICs.

AN-553 A New Generation of Integrated Avionic Synthesizers

The need to generate signals of a multitude of different frequencies for avionic systems has resulted in complex solutions in the past. With the introduction of certain standard product integrated circuits, frequency synthesis using digital phase locked loop techniques presents a more practical solution. Several different types of servo phase locked loop systems are discussed and a practical design example is given. Results of design examples are presented along with possible applications.

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