Power Transistors

PLANAR POWER

Fairchild has been producing Power Transistors since 1964, and has concentrated on the PLANAR epitaxial technology using discrete emitters and nickel-chromium thin film resistors. This effort has resulted in a line of premium devices that offer the user all the reliability and operating advantages of the PLANAR technology plus the increased power dissipation and safe operating area of discrete emitter devices.

Another benefit in designing with Fairchild's power transistors is the availability of complementary-designed pairs. These NPN-PNP pairs are now available in a variety of packages to a maximum rating of 10 Amperes, 100 Volts and 100 Watts dissipation.

PLANAR POWER ADVANTAGES

Reliability of a transistor depends on many factors. It is a mistake to consider a single factor, such as operating junction temperature, as the overall determinant of the transistor's reliability and life expectancy. There are at least two significant areas, usually neglected by the power transistor buyer, where Planar construction can add materially to the reliability of the device: 1. Long-term drift, and 2. Ambient influences.

LONG-TERM DRIFT AND STABILITY: Planar devices are inherently more stable and are affected less by long-term drift as a function of temperature and time. This is due to the passivated junctions of Planar transistors.

AMBIENT INFLUENCES: Reliability depends on the susceptibility of a given junction to ambient influences within the encapsulation. The passivation techniques used in the Planar process prohibit external influences from contaminating and degrading the junction surface.

Secondary Breakdown

Secondary breakdown frequently shows itself as localized spot heating which melts through the base region and causes a collector-to-emitter short. Take away the localized heating (or the concentration of currents which cause it) and you have removed the major cause of secondary breakdown. Fairchild does this by introducing nickel-chromium thin film resistors in series with the emitters. This prevents concentration of currents in any one spot. Here's how it works:

All power transistors can be represented mechanically as thousands of separate transistors placed in parallel. Theoretically, the same amount of current flows through each. But in reality, because each transistor has slightly different characteristics, one will draw more than its share of current. This causes localized heating, which in turn causes the transistor to "hog" yet more current, which causes more heating. If this unpleasant cycle continues unchecked, the result is secondary breakdown.

The NICR resistors, placed in series with the emitters, prevent this from happening. When a transistor tries to "hog" more than its share of current, the resistor induces a negative feedback which pulls it right back into the safe zone.

Thus, the key to solving secondary breakdown is not wider base areas, and/or lower frequencies. Fairchild power transistors, such as the 2N5002 and 2N5003, have the resistors deposited onto the chip, and assure current sharing over the entire emitter periphery. This technique is highly successful in preventing secondary breakdown, while maintaining high frequency and the superior performance of Planar technology.

PLANAR POWER TRANSISTOR COMPLEMENTARY PAIRS

Collector Current	Maximum Power Dissipation	Pkg.	Complementary Pair NPN — PNP
2 Amperes	6 Watts @ 50° Case	TO - 39	2N5148 — 2N5147
			2N5150 — 2N5149
	30 Watts @ 50° Case	TO - 59	2N4998 — 2N4999
			2N5000 — 2N5001
5 Amperes	10 Watts @ 50° Case	TO - 39	2N5152 — 2N5151
			2N5154 — 2N5153
	50 Watts @ 50° Case	TO - 59	2N5002 — 2N5003
			2N5004 — 2N5005
			2N5284 — 2N5286
			2N5285 — 2N5287
10 Amperes	100 Watts @ 50° Case	TO - 61	2N5006 — 2N5007
			2N5008 — 2N5009
			2N5288 — 2N5290
			2N5289 — 2N5291

PLANAR POWER SELECTION GUIDE

	Max. Power Dissipation @ T_C (W @ °C)	LV_{CEO} (V)	Min. h_{FE} @ I_C/V_{CE}	Package (*) = Isolated Collector	Fairchild Device Number
NPN 1 Amp	5 @ 25°	40	15 @ 1A/1V	TO - 5	2N4237
		60	15 @ 1A/1V	TO - 5	2N4238
		80	15 @ 1A/1V	TO - 5	2N4239
NPN 2 Amp	5 @ 25°	80	25 @ 2A/5V	TO - 5	2N2890
			40 @ 2A/5V	TO - 5	2N2891
	,6 @ 50°	80	15 @ 2A/5V	TO - 39	2N5148
			30 @ 2A/5V	TO - 39	2N5150
	30 @ 25°	80	25 @ 2A/5V	TO - 59	2N2892
				TO - 59*	2N4075
			40 @ 2A/5V	TO - 59	2N2893
				TO - 59*	2N4076
	30 @ 50°	80	15 @ 2A/5V	TO - 59*	2N4998
			30 @ 2A/5V	TO - 59*	2N5000
NPN 5 Amp	4 @ 100°	50	15 @ 5A/6V	TO - 5	2N2657
		60	40 @ 2A/2V	TO - 39	2N4895
			100 @ 2A/2V	TO - 39	2N4896
		70	15 @ 5A/6V	TO - 5	2N2658
		80	40 @ 2A/2V	TO - 39	2N4897
	10 @ 50°	80	20 @ 5A/5V	TO - 39	2N5152
			40 @ 5A/5V	TO - 39	2N5154
	32.5 @ 70° DARLINGTON	60	50 @ 5A/2.5V	TO - 9*	2N5425
			1000 @ 5A/1.5V	TO - 9*	2N5426
	37 @ 100°	80	20 @ 5A/5V	TO - 59*	2N4115
			40 @ 5A/5V	TO - 59*	2N4116
	50 @ 50°	80	20 @ 5A/5V	TO - 59*	2N5002
			40 @ 5A/5V	TO - 59*	2N5004
		100	20 @ 5A/5V	TO - 59*	2N5284
			40 @ 5A/5V	TO - 59*	2N5285
NPN 7 Amp	87 @ 25°	180	30 @ 1A/5V	TO - 3	2N5264
NPN 7.5 Amp	50 @ 100°	80	20 @ 2A/15V	TO - 61	2N1724
				TO - 61*	FT1724
			50 @ 2A/15V	TO - 61	2N1725
				TO - 61*	FT1725
NPN 10 Amp	20 @ 100°	60	40 @ 2A/2V	TO - 59*	2N5083
			100 @ 2A/2V	TO - 59*	2N5084
		80	40 @ 2A/2V	TO - 59*	2N5085
	100 @ 50°	80	20 @ 10A/5V	TO - 61*	2N5006
			45 @ 10A/5V	TO - 61*	2N5008
		100	20 @ 10A/5V	TO - 61*	2N5288
			45 @ 10A/5V	TO - 61*	2N5289
PNP 2 Amp	6 @ 50°	80	15 @ 2A/5V	TO - 39	2N5147
			30 @ 2A/5V	TO - 39	2N5149
	30 @ 50°	80	15 @ 2A/5V	TO - 59*	2N4999
			30 @ 2A/5V	TO - 59*	2N5001
PNP 5 Amp	10 @ 50°	80	20 @ 5A/5V	TO - 39	2N5151
			40 @ 5A/5V	TO - 39	2N5153
	50 @ 50°	80	20 @ 5A/5V	TO - 59*	2N5003
			40 @ 5A/5V	TO - 59*	2N5005
		100	20 @ 5A/5V	TO - 59*	2N5286
			40 @ 5A/5V	TO - 59*	2N5287
PNP 10 Amp	100 @ 50°	80	20 @ 10A/5V	TO - 61*	2N5007
			45 @ 10A/5V	TO - 61*	2N5009
		100	20 @ 10A/5V	TO - 61*	2N5290
			45 @ 10A/5V	TO - 61*	2N5291

FAIRCHILD SUGGESTED EQUIVALENTS

This cross-reference list is intended as a guide only. In some instances there will be package, thermal resistance, and safe area differences. The nearest electrical equivalent was selected on the basis of P_D, V_{CEO}, h_{FE} and $V_{CE(sat)}$.

Please refer to individual device specifications for additional information.

E.I.A. No.	Package	FSC No.
2N389	TO - 53	2N5006
2N389A	TO - 53	2N5006
2N424	TO - 53	2N5006
2N424A	TO - 53	2N5006
2N1047	Note 1	2N5002
2N1047A	Note 1	2N5002
2N1047B	Note 1	2N5002
2N1047C	Note 1	2N5002
2N1048	Note 1	2N5002
2N1048A	Note 1	2N5002
2N1048B	Note 1	2N5002
2N1048C	Note 1	2N5002
2N1049	Note 1	2N5002
2N1049A	Note 1	2N5002
2N1049B	Note 1	2N5002
2N1049C	Note 1	2N5002
2N1050	Note 1	2N5002
2N1050A	Note 1	2N5002
2N1050B	Note 1	2N5002
2N1050C	Note 1	2N5002
2N1079	TO - 53	2N1724
2N1080	TO - 53	2N1724
2N1208	TO - 61	2N5002
2N1209	TO - 61	2N5002
2N1210	TO - 53	2N5002
2N1211	TO - 53	2N5002
2N1212	TO - 61	2N5002
2N1511	TO - 36	2N5006
2N1512	TO - 36	2N5006
2N1513	TO - 36	2N5006
2N1514	TO - 36	2N5006
2N1616	TO - 61	2N5006
2N1616A	TO - 61	2N5006
2N1617	TO - 61	2N5006
2N1617A	TO - 61	2N5006
2N1618	TO - 61	2N5006
2N1618A	TO - 61	2N5006
2N1620	TO - 53	2N5006
2N1647	Note 2	2N5000
2N1648	Note 2	2N5000
2N1649	Note 2	2N5000
2N1650	Note 2	2N5000
2N1690	Note 3	2N5002
2N1691	Note 3	2N5002
2N1703	TO - 36	2N5006
2N1722	TO - 53	2N5006
2N1722A	TO - 53	2N5006
2N1723	TO - 53	2N5008
2N1724	TO - 61	2N1724
2N1724A	TO - 61	2N5006
2N1725	TO - 61	2N1725
2N1768	Note 3	2N5004
2N1769	Note 3	2N5004
2N2032	TO - 53	2N5002
2N2033	TO - 5	2N4238
2N2101	TO - 61	2N5006
2N2102	TO - 5	2N4238
2N2102A	TO - 5	2N4238
2N2150	7/16" Stud	2N5002
2N2151	7/16" Stud	2N5002
2N2339	Note 3	2N5002
2N2383	TO - 36	2N5006
2N2384	TO - 61	2N5006
2N2594	TO - 5	2N4238
2N2632	TO - 62	2N5004
2N2633	TO - 62	2N5004
2N2634	TO - 62	2N5004
2N2657	TO - 5	2N2657
2N2658	TO - 5	2N2658
2N2697	Note 4	2N5002
2N2698	Note 4	2N5004
2N2811	TO - 61	2N5006
2N2812	TO - 61	2N5008
2N2813	TO - 61	2N5006
2N2814	TO - 61	2N5008
2N2828	TO - 59	2N5002
2N2829	TO - 59	2N5004
2N2849-1	TO - 5	2N5154
2N2849-2	7/16" Stud	2N5000
2N2849-3	Note 4	2N5000
2N2850-1	TO - 5	2N5154
2N2850-2	7/16" Stud	2N5000
2N2850-3	Note 4	2N5000
2N2851-1	TO - 5	2N5154
2N2851-2	7/16" Stud	2N5000
2N2851-3	Note 4	2N5000
2N2852-1	TO - 5	2N5154
2N2852-2	7/16" Stud	2N5000
2N2852-3	Note 4	2N5000
2N2853-1	TO - 5	2N5152
2N2854-1	TO - 5	2N5154
2N2854-2	7/16" Stud	2N5000
2N2854-3	Note 4	2N5000
2N2855-1	TO - 5	2N5154
2N2855-2	7/16" Stud	2N5000
2N2855-3	Note 4	2N5000
2N2856-1	TO - 5	2N5152
2N2866	7/16" Stud	2N5002
2N2867	7/16" Stud	2N5004
2N2877	TO - 59	2N5002
2N2878	TO - 59	2N5002
2N2879	TO - 59	2N5002
2N2880	TO - 59	2N5002
2N2887	TO - 61	2N5000
2N2890	TO - 5	2N5150
2N2891	TO - 5	2N5150
2N2892	TO - 59	2N5000
2N2893	TO - 59	2N5000
2N2983	TO - 5	2N4239
2N2984	TO - 5	2N4239
2N2985	TO - 5	2N4239
2N2986	TO - 5	2N4239
2N2987	TO - 5	2N4239
2N2988	TO - 5	2N4239
2N2989	TO - 5	2N4239
2N2990	TO - 5	2N4239
2N2991	Note 4	2N5000
2N2992	Note 4	2N5000
2N2993	Note 4	2N5000
2N2994	Note 4	2N5000
2N2995	Note 4	2N5000
2N3163	TO - 61	2N5007
2N3164	TO - 61	2N5007
2N3165	TO - 61	2N5007
2N3166	TO - 61	2N5007
2N3167	TO - 53	2N5007
2N3168	TO - 53	2N5007
2N3169	TO - 53	2N5007
2N3170	TO - 53	2N5007
2N3175	TO - 61	2N5007
2N3176	TO - 61	2N5007
2N3177	TO - 61	2N5007
2N3178	TO - 61	2N5007
2N3179	TO - 53	2N5007
2N3180	TO - 53	2N5007
2N3181	TO - 53	2N5007
2N3187	TO - 61	2N5007
2N3188	TO - 61	2N5007
2N3189	TO - 61	2N5007
2N3190	TO - 61	2N5007
2N3191	TO - 53	2N5007
2N3192	TO - 53	2N5007
2N3193	TO - 53	2N5007
2N3194	TO - 53	2N5007
2N3199	TO - 59	2N5003
2N3200	TO - 59	2N5003
2N3201	TO - 59	2N5003
2N3205	TO - 59	2N5003
2N3206	TO - 59	2N5003
2N3207	TO - 59	2N5003
2N3220	TO - 59	2N5150
2N3221	TO - 59	2N5150
2N3222	TO - 59	2N5150
2N3223	TO - 59	2N5150
2N3419	TO - 5	2N5148
2N3420	TO - 5	2N5150
2N3421	TO - 5	2N5150
2N3487	TO - 61	2N5006

FAIRCHILD SUGGESTED EQUIVALENTS

E.I.A. No.	Package	FSC No.	E.I.A. No.	Package	FSC No.	E.I.A. No.	Package	FSC No.
2N3488	TO - 61	2N5006	2N3782	TO - 5	2N5147	2N4309	TO - 5	2N4897
2N3489	TO - 61	2N5006	2N3795	TO - 5	2N5147	2N4311	TO - 5	2N4895
2N3490	TO - 61	2N5008	2N3850	TO - 59	2N5000	2N4895	TO - 39	2N4895
2N3491	TO - 61	2N5008	2N3851	TO - 59	2N5000	2N4896	TO - 39	2N4896
2N3492	TO - 61	2N5008	2N3852	TO - 59	2N5000	2N5000	TO - 59	2N5000
2N3551	Flat Pack	2N5008	2N3853	TO - 59	2N5000	2N5001	TO - 59	2N5001
2N3552	Flat Pack	2N5008	2N3945	TO - 5	2N4238	2N5002	TO - 59	2N5002
2N3597	TO - 63	2N5006	2N3996	TO - 59	2N5002	2N5003	TO - 59	2N5003
2N3598	TO - 63	2N5006	2N3997	TO - 59	2N5002	2N5004	TO - 59	2N5004
2N3599	TO - 63	2N5006	2N3998	TO - 59	2N5002	2N5005	TO - 59	2N5005
2N3660	TO - 5	2N4237	2N3999	TO - 59	2N5002	2N5006	TO - 61	2N5006
2N3661	TO - 5	2N4238	2N4036	TO - 5	2N5149	2N5007	TO - 61	2N5007
2N3744	7/16" Stud	2N5002	2N4037	TO - 5	2N5149	2N5008	TO - 61	2N5008
2N3745	7/16" Stud	2N5002	2N4075	TO - 59	2N4075	2N5009	TO - 61	2N5009
2N3746	7/16" Stud	2N5002	2N4076	TO - 59	2N4076	2N5083	TO - 59	2N5083
2N3747	7/16" Stud	2N5004	2N4115	TO - 59	2N4115	2N5084	TO - 59	2N5084
2N3748	7/16" Stud	2N5004	2N4116	TO - 59	2N4116	2N5085	TO - 59	2N5085
2N3749	7/16" Stud	2N5004	2N4150	TO - 5	2N4897	2N5147	TO - 39	2N5147
2N3774	TO - 5	2N5147	2N4210	TO - 63	2N5006	2N5148	TO - 39	2N5148
2N3775	TO - 5	2N5147	2N4211	TO - 63	2N5006	2N5149	TO - 39	2N5149
2N3776	TO - 5	2N5147	2N4237	TO - 5	2N4237	2N5150	TO - 39	2N5150
2N3777	TO - 5	2N5147	2N4238	TO - 5	2N4238	2N5151	TO - 39	2N5151
2N3778	TO - 5	2N5147	2N4239	TO - 5	2N4239	2N5152	TO - 39	2N5152
2N3779	TO - 5	2N5147	2N4301	TO - 61	2N5006	2N5153	TO - 39	2N5153
2N3780	TO - 5	2N5147	2N4305	TO - 5	2N4897	2N5154	TO - 39	2N5154
2N3781	TO - 5	2N5147	2N4307	TO - 5	2N4895			

Note 1. Small offset stud
2. 7/16" hex. stud mount 2 pin
3. Small offset stud
4. 7/16" hex. stud mount flexible leads

POWER TRANSISTORS NUMERICAL INDEX

[redacted]tional Power Transistors

2N1724

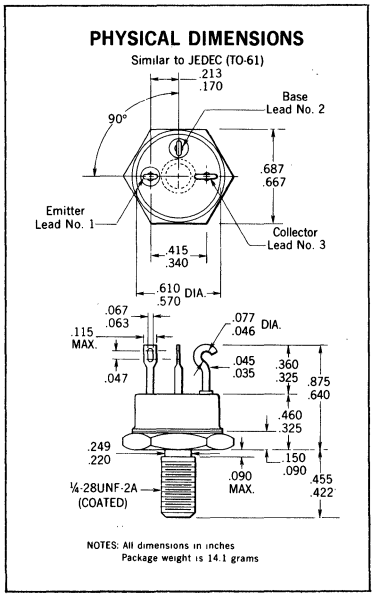
NPN POWER TRANSISTOR

DIFFUSED SILICON PLANAR* TRANSISTOR

FOR IMPROVED PERFORMANCE SEE FAIRCHILD 2N5006•2N5008

GENERAL DESCRIPTION

The Fairchild 2N1724 is a NPN silicon planar* transistor designed primarily for general purpose power applications.



ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−65°C to +200°C
Operating Junction Temperature	+175°C

Maximum Power Dissipation [Notes 2 and 3]

Collector Power Dissipation at 25°C Ambient Temperature	3.0 Watts
at 100°C Case Temperature	50 Watts

Maximum Voltage and Current

V_{CBO}	Collector-Base Voltage	120 Volts
V_{EBO}	Emitter-Base Voltage	10 Volts
V_{CEO}	Collector-Emitter Voltage [Notes 4 and 6]	80 Volts
I_C	Collector Current (continuous)	5.0 Amps
I_E	Emitter Current	5.0 Amps
I_C	Collector Current (peak) [Note 5]	7.5 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain [Note 6]	20	90		$I_C = 2.0$ A	$V_{CE} = 15$ V
h_{FE}	DC Pulse Current Gain [Note 6]	20			$I_C = 100$ mA	$V_{CE} = 15$ V
V_{CE} (sat)	Pulsed Collector Saturation Voltage [Note 6]		1.0	Volt	$I_C = 2.0$ A	$I_B = 200$ mA
V_{BE} (sat)	Pulsed Base-Emitter Voltage [Note 6]		2.0	Volts	$I_C = 2.0$ A	$I_B = 200$ mA
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage [Note 6]	80		Volts	$I_C = 200$ mA	$I_B = 0$
I_{CBO}	Collector Reverse Current		0.5	mA	$I_E = 0$	$V_{CB} = 3.0$ V
I_{CES}	Collector Reverse Current		1.0	mA	$V_{CE} = 60$ V	$V_{BE} = 0$
I_{CES} (150°C)	Collector Reverse Current		2.0	mA	$V_{CE} = 60$ V	$V_{BE} = 0$
I_{CES} (150°C)	Collector Reverse Current		10	mA	$V_{CE} = 120$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current		10	mA	$I_C = 0$	$V_{EB} = 3.0$ V
I_{EBO}	Emitter Cutoff Current		10	mA	$I_C = 0$	$V_{EB} = 10$ V
h_{FE} (−55°C)	DC Pulse Current Gain [Note 6]	12			$I_C = 2.0$ A	$V_{CE} = 15$ V
h_{fe}	Small Signal Current Gain (f = 10 MHz)	1.0			$I_C = 500$ mA	$V_{CE} = 15$ V
V_{EBF}	Emitter Floating Potential Voltage		10	Volts	$V_{CB} = 80$ V	
C_{obo}	Common Base Open Circuit Output Capacitance (f = 1.0 MHz)		550	pF	$I_E = 0$	$V_{CB} = 15$ V

* Planar is a patented Fairchild process.

NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.

(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

(3) These ratings give a maximum junction temperature of 175°C and junction to case thermal resistance of 1.5°C/Watt (derating factor of 667 mW/°C); junction to ambient thermal resistance of 50°C/Watt (derating factor of 20 mW/°C).

(4) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.

(5) Maximum peak collector current may be used if maximum junction temperature is not exceeded.

(6) Pulse Conditions: length = 300 μs; duty cycle = 2%.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

2N2890 • 2N2891 • 2N2892 • 2N2893

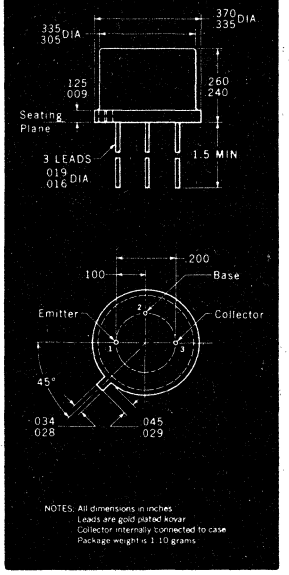
NPN HIGH-POWER, HIGH-VOLTAGE TYPE

DIFFUSED SILICON PLANAR EPITAXIAL TRANSISTORS

GENERAL DESCRIPTION — The 2N2892 and 2N2893 are 30-Watt* NPN silicon Planar epitaxial transistors designed for high-voltage, high-power amplifiers to 20 Mc; 12-, 24-, or 48-Volt DC converters; servo amplifiers; power supplies; and horizontal and vertical CRT output stages. High temperature operation is assured by the characteristic Planar low nanoamps leakage currents at high voltage. They are encased in a 7/16" hex power package.
The 2N2890 and 2N2891 are the same devices in the popular TO-5 package. Electrical characteristics are essentially the same except for lower current and power dissipation ratings.
* See power curves.

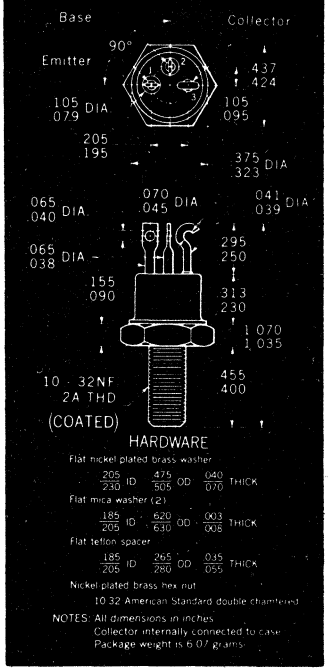
PHYSICAL DIMENSIONS

in accordance with JEDEC (TO-5) outline



2N2890 2N2891

PHYSICAL DIMENSIONS



2N2892 2N2893

ABSOLUTE MAXIMUM RATINGS [Note 1]

	2N2890 2N2891	2N2892 2N2893
Maximum Temperatures		
Storage Temperature	−65°C to +200°C	−65°C to +200°C
Operating Junction Temperature	200°C Maximum	200°C Maximum
Lead Temperature (Soldering, 60 sec. time limit)	300°C Maximum	300°C Maximum
Maximum Power Dissipation		
Total Dissipation at 25°C Case Temperature [Notes 2 and 3]	5.0 Watts	30 Watts
at 100°C Case Temperature [Notes 2 and 3]	2.8 Watts	17 Watts
at 25°C Ambient Temperature [Notes 2 and 3]	0.8 Watt	
Maximum Voltages		
V_{CBO} Collector to Base Voltage	100 Volts	100 Volts
V_{CEO} Collector to Emitter Voltage [Note 4]	80 Volts	80 Volts
V_{EBO} Emitter to Base Voltage	5.0 Volts	5.0 Volts

ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	FACT† SUBGROUP	CHARACTERISTIC	2N2891 2N2893 Min.	Typ.	Max.	2N2890 2N2892 Min.	Typ.	Max.	Units	TEST CONDITIONS
*h_{FE}	1a	DC Pulse Current Gain [Note 5]	50	80	150	30	55	90		I_C = 1.0 A V_{CE} = 2.0 V
h_{FE}	4	DC Pulse Current Gain [Note 5]	40	75		25	50			I_C = 2.0 A V_{CE} = 5.0 V
h_{FE}	4	DC Pulse Current Gain [Note 5]	35	80		20	55			I_C = 100 mA V_{CE} = 2.0 V
*V_{CE} (sat)	4	Collector Saturation Voltage [pulsed, Notes 5 and 6]		0.2	0.5		0.2	0.5	Volts	I_C = 1.0 A I_B = 0.1 A
*V_{CE} (sat)	1a	Collector Saturation Voltage [pulsed, Notes 5 and 6]		0.35	0.75		0.35	0.75	Volts	I_C = 2.0 A I_B = 0.2 A
V_{BE} (sat)	4	Base Saturation Voltage [pulsed, Notes 5 and 6]		1.0	1.2		1.0	1.2	Volts	I_C = 1.0 A I_B = 0.1 A
*V_{BE} (sat)	1a	Base Saturation Voltage [pulsed, Notes 5 and 6]		1.1	1.3		1.1	1.3	Volts	I_C = 2.0 A I_B = 0.2 A
*I_{CEX}	1b	Collector Cutoff Current		2.0	100		2.0	100	nA	V_{CE} = 60 V V_{BE} = −2.0 V
I_{CEX} (150°C)	4	Collector Cutoff Current		7.0	100		7.0	100	μA	V_{CE} = 60 V V_{BE} = −2.0 V
I_{CEO}	1b	Collector Cutoff Current		1.0	50		1.0	50	μA	I_B = 0 V_{CE} = 60 V
h_{fe}	4	Small Signal Current Gain (f = 1 Kc)	50	90		30	65			I_C = 50 mA V_{CE} = 10 V
h_{fe}	4	High Frequency Current Gain (f = 20 Mc)	1.5	2.5		1.5	2.3			I_C = 200 mA V_{CE} = 10 V
C_{obo}	4	Common Base, Open Circuit Output Capacitance		38	70		38	70	pf	I_E = 0 V_{CB} = 10 V

† NOTE: These Numerals Apply to the Fairchild FACT Program.
* NOTE: FACT Program End-Point Measurement Parameter.

Additional Electrical Characteristics on page 2
Notes on page 2

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ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted) (Continued)

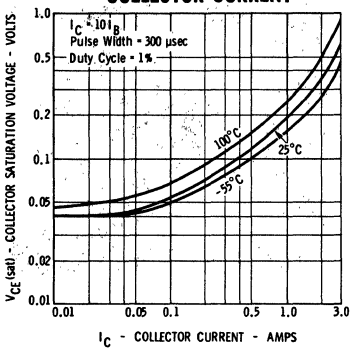
SYMBOL	FACT† SUBGROUP	CHARACTERISTIC	2N2891 2N2893 Min.	Typ.	Max.	2N2890 2N2892 Min.	Typ.	Max.	Units	TEST CONDITIONS
BV_{CBO}	1a	Collector to Base Breakdown Voltage	100			100			Volts	$I_C = 100\,\mu A$ $I_E = 0$
V_{CEO} (sust)	1a	Collector to Emitter Sustaining Voltage [Notes 4 and 5]	80			80			Volts	$I_C = 100$ mA (pulsed) $I_B = 0$
BV_{EBO}	1a	Emitter to Base Breakdown Voltage	5.0			5.0			Volts	$I_C = 0$ $I_E = 10\,\mu A$
t_{on}	4	Turn On Time [Note 7]			0.3			0.3	μsec	$I_C = 1.0$ A $I_{B1} \approx 50$ mA
t_{off}	4	Turn Off Time [Note 7]			1.5			1.5	μsec	$I_C = 1.0$ A, $I_{B1} = I_{B2} \approx 50$ mA

† NOTE: These Numerals Apply to the Fairchild FACT Program.
* NOTE: FACT Program End-Point Measurement Parameter.

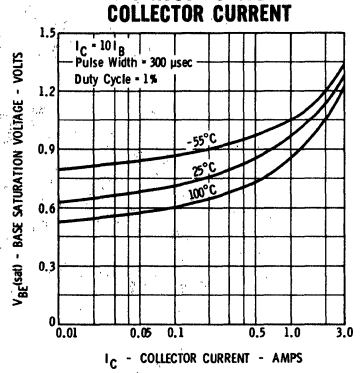
NOTES:
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
(3) These ratings give a maximum junction temperature of 200°C. For the 2N2890 and 2N2891 junction-to-case thermal resistance of 35°C/Watt (derating factor of 28.6 mW/°C); junction-to-ambient thermal resistance of 219°C/Watt (derating factor of 4.56 mW/°C). See power curves for 2N2892 and 2N2893 ratings.
(4) These ratings refer to a high-current point where collector-to-emitter voltage is lowest. For more information send for Fairchild Publication APP-4.
(5) Pulse conditions: length = 300 μsec; duty cycle = 1%.
(6) Saturation voltages for 2N2890 and 2N2891 are measured with ¼" lead length.
(7) See switching circuit for exact I_{B1} and I_{B2} values.

TYPICAL ELECTRICAL CHARACTERISTICS

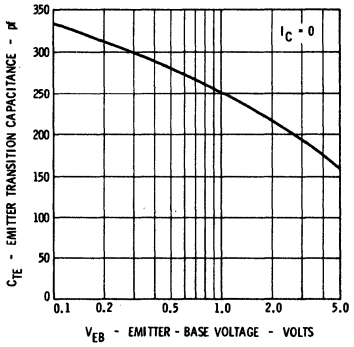
COLLECTOR SATURATION VOLTAGE VERSUS PULSED COLLECTOR CURRENT



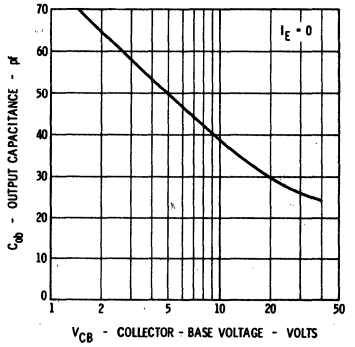
BASE SATURATION VOLTAGE VERSUS PULSED COLLECTOR CURRENT



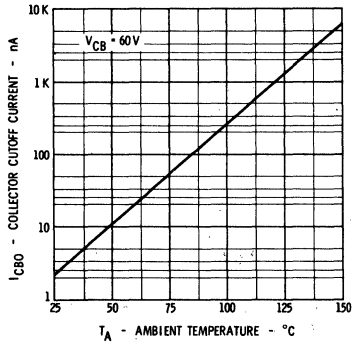
EMITTER TRANSITION CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



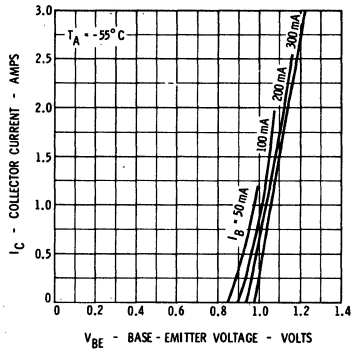
OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



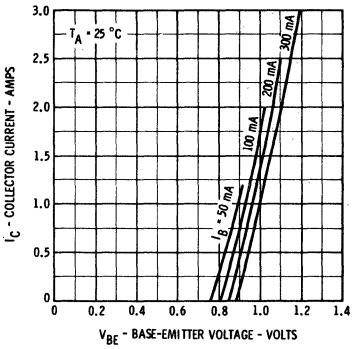
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



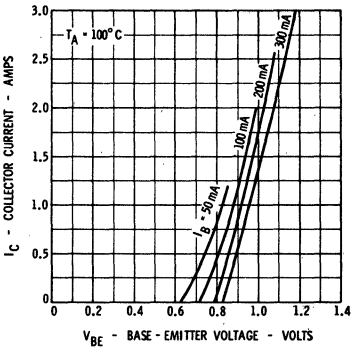
BASE CHARACTERISTICS*



BASE CHARACTERISTICS*



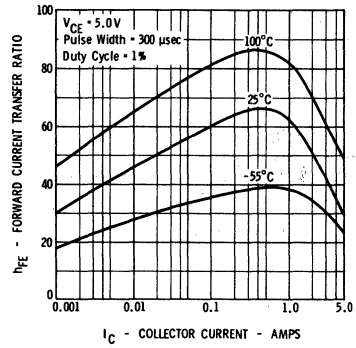
BASE CHARACTERISTICS*



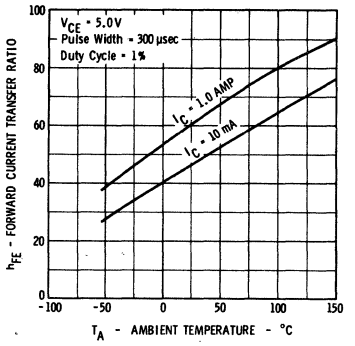
* Single family characteristic on Transistor Curve Tracer.

2N2890 • 2N2892

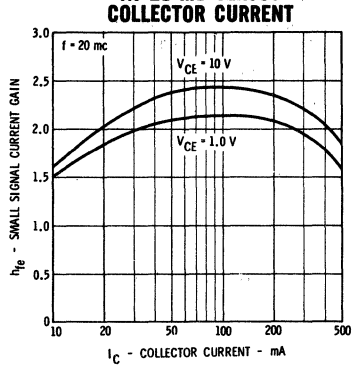
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



PULSED DC CURRENT GAIN VERSUS AMBIENT TEMPERATURE

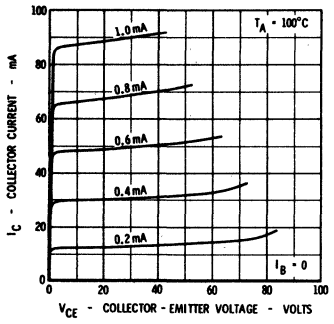


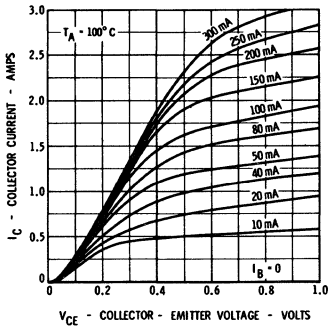
SMALL SIGNAL CURRENT GAIN AT 20 MC VERSUS COLLECTOR CURRENT

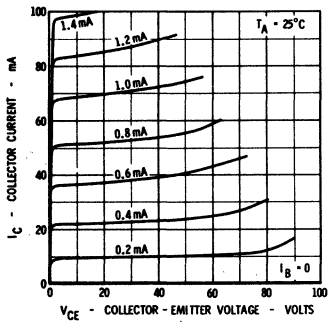


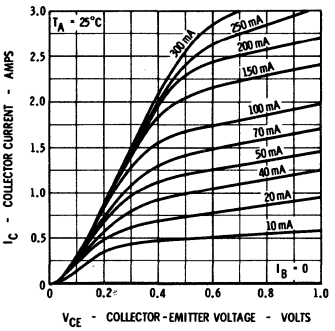
TYPICAL COLLECTOR CHARACTERISTICS*

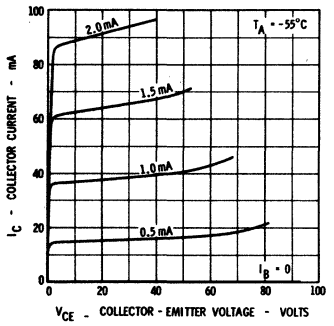
2N2890 • 2N2892

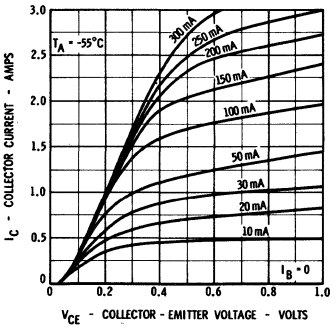




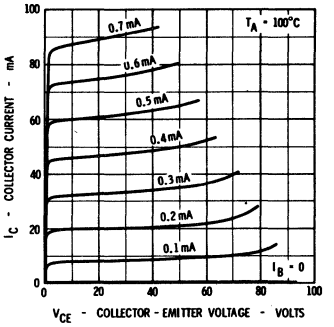


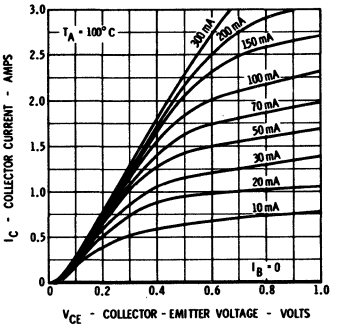


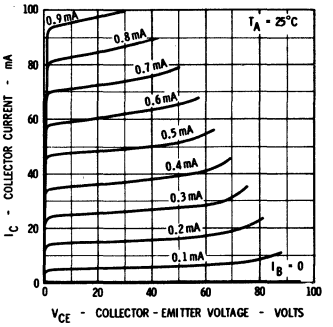


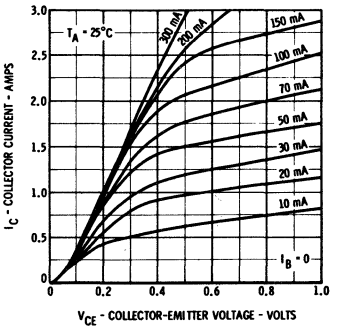


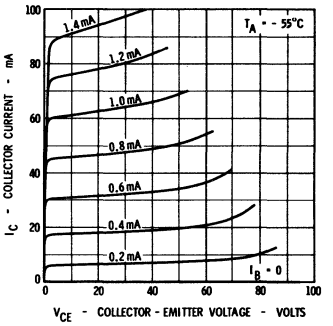
2N2891 • 2N2893

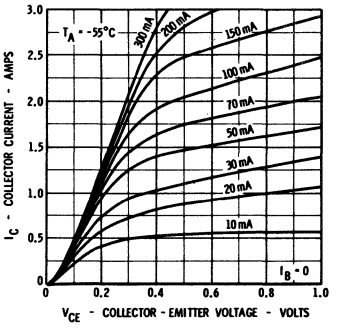








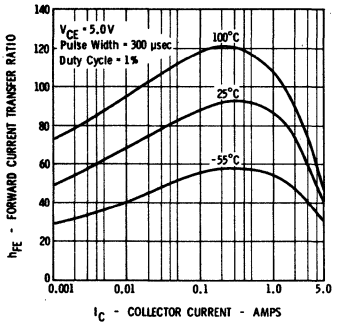




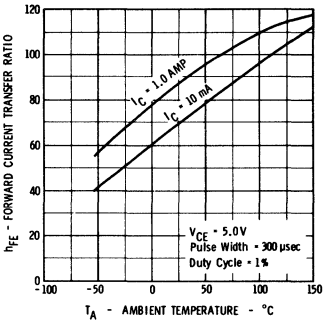
* Single family characteristic on Transistor Curve Tracer.

2N2891 • 2N2893

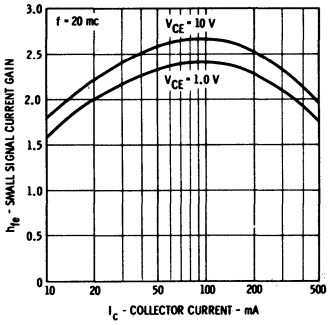
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



PULSED DC CURRENT GAIN VERSUS AMBIENT TEMPERATURE

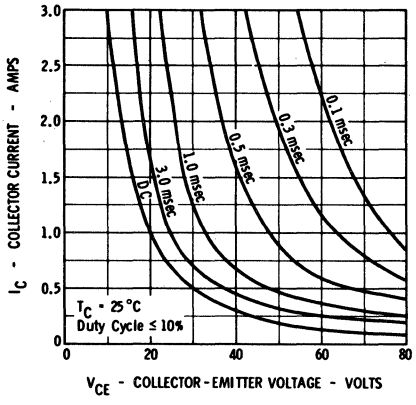


SMALL SIGNAL CURRENT GAIN AT 20 MC VERSUS COLLECTOR CURRENT

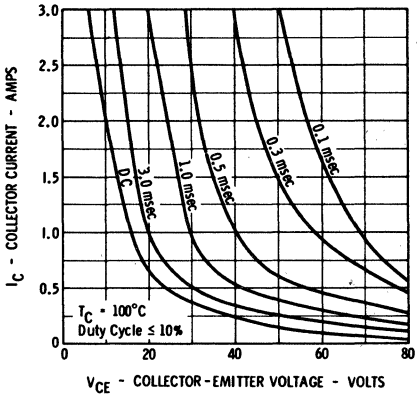


2N2892 • 2N2893

MAXIMUM ALLOWABLE PEAK CURRENT VERSUS COLLECTOR-EMITTER VOLTAGE

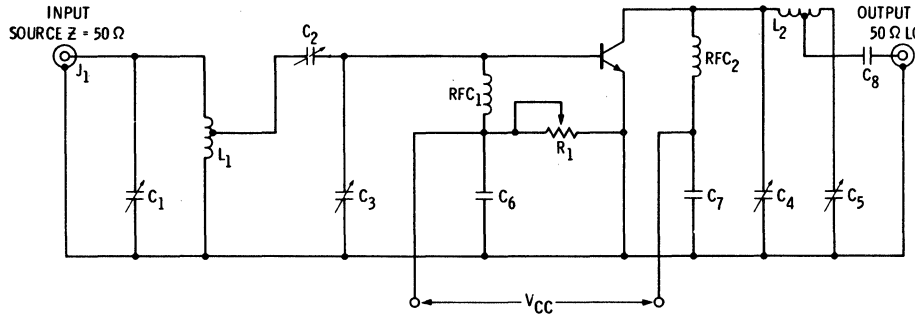


MAXIMUM ALLOWABLE PEAK CURRENT VERSUS COLLECTOR-EMITTER VOLTAGE



20 MC AMPLIFIER

RF Power Output = 12 watts Gain = 7.0 db
Efficiency = 55% V_{CC} = 33 Volts

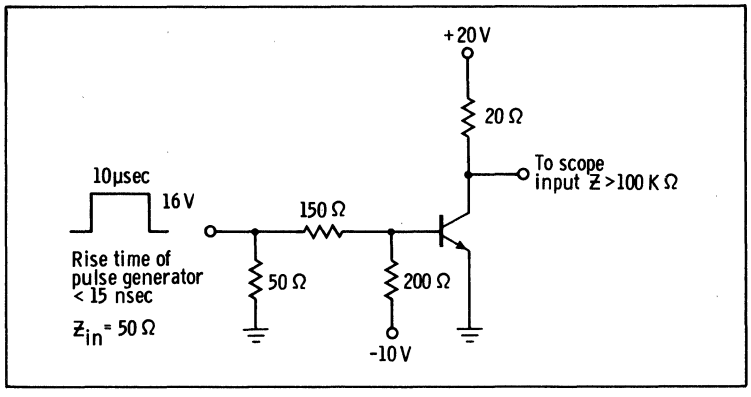


This circuit constructed on 1/16" x 3 7/8" x 5 7/8" copper clad printed circuit board.
Transistor must be used with adequate heat sink.

Variable capacitors are Elmenco compression type

C_1, C_2	7 plates	360-1000 pf
C_3	5 plates	170-760 pf
C_4, C_5	4 plates	100-550 pf
C_6, C_7, C_8	.01μfd —50 V Sprague disc type	
R_1	50Ω potentiometer (set at 0.5Ω min.)	
RFC_1	Ohmite Plate Choke Z —28	
RFC_2	100 turns #20 Nyclad Magnet wound on 2KΩ —10W ceramic resistor	
L_1	4 turns 508 Air Dux tapped at 1 7/8 turns from input	
L_2	7 turns 508 Air Dux tapped at 2 1/4 turns from output	
J_1, J_2	BNC connectors	

T_{ON} and T_{OFF} TEST CIRCUIT (For All Transistors)



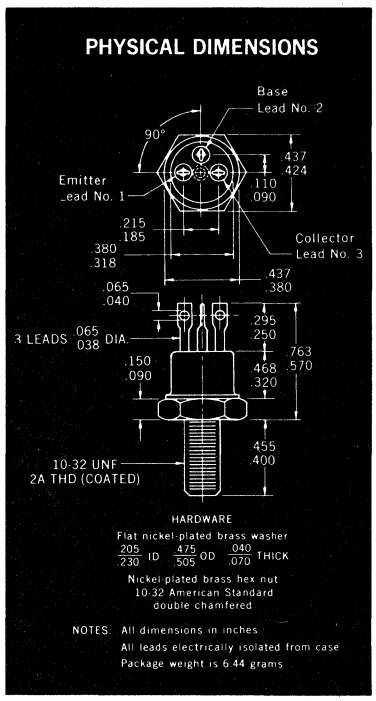
FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

2N4075 • 2N4076

NPN HIGH-POWER, HIGH-VOLTAGE TYPE

DIFFUSED SILICON PLANAR EPITAXIAL TRANSISTORS

- **HIGH BREAKDOWN -- 80 VOLT LV_{CEO}**
- **MAXIMUM COLLECTOR CURRENT -- 3.0 AMPS.**
- **SECONDARY BREAKDOWN RATING -- 17 WATTS @ $T_C = 100°C$**
- **ISOLATED COLLECTOR -- NO INSULATING HARDWARE REQUIRED**
- **HIGH FREQUENCY -- $f_T = 30$ Mc Min.**
- **WIDE BETA SPECIFICATION -- FROM 100 mA TO 2.0 AMPS.**
- **LOW V_{CE} (sat) -- 1.0 V Max. @ 2.0 AMPS.**



ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−65°C to +200°C
Operating Junction Temperature	−65°C to +200°C
Lead Temperature (Soldering, 60 sec time limit)	+300°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature [Notes 2 and 3]	30 Watts
at 100°C Case Temperature [Notes 2 and 3]	**17 Watts**

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	100 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	80 Volts
V_{EBO}	Emitter to Base Voltage	5.0 Volts
I_C	Collector Current	3.0 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	FACT† SUBGROUP	CHARACTERISTIC	2N4076 Min.	2N4076 Typ.	2N4076 Max.	2N4075 Min.	2N4075 Typ.	2N4075 Max.	Units	TEST CONDITIONS
*h_{FE}	1a	DC Pulse Current Gain [Note 5]	50	80	150	30	55	90		$I_C = 1.0$ A $V_{CE} = 2.0$ V
h_{FE}	4	**DC Pulse Current Gain** [Note 5]	**40**	75		**25**	50			**$I_C = 2.0$ A** $V_{CE} = 5.0$ V
h_{FE}	4	**DC Pulse Current Gain** [Note 5]	**35**	80		**20**	55			**$I_C = 100$ mA** $V_{CE} = 2.0$ V
V_{CE} (sat)	4	Collector Saturation Voltage [pulsed, Note 5]		0.2	0.5		0.2	0.5	Volts	$I_C = 1.0$ A $I_B = 0.1$ A
***V_{CE} (sat)**	1a	**Collector Saturation Voltage** [pulsed, Note 5]		0.35	**1.0**		0.35	**1.0**	Volts	**$I_C = 2.0$ A** $I_B = 0.2$ A
V_{BE} (sat)	4	Base Saturation Voltage [pulsed, Note 5]		1.0	1.3		1.0	1.3	Volts	$I_C = 1.0$ A $I_B = 0.1$ A
*V_{BE} (sat)	1a	Base Saturation Voltage [pulsed, Note 5]		1.1	1.8		1.1	1.8	Volts	$I_C = 2.0$ A $I_B = 0.2$ A
V_{CEO} (sust)	1a	**Collector to Emitter Sustaining Voltage** [Notes 4 and 5]	**80**			**80**			Volts	$I_C = 100$ mA (pulsed) $I_B = 0$
*I_{CEX}	1b	Collector Cutoff Current		2.0	100		2.0	100	nA	$V_{CE} = 60$ V $V_{BE} = -2.0$ V
I_{CEX} (150°C)	4	Collector Cutoff Current		7.0	100		7.0	100	μA	$V_{CE} = 60$ V $V_{BE} = -2.0$ V
I_{CEO}	4	Collector Cutoff Current		1.0	50		1.0	50	μA	$V_{CE} = 60$ V $I_B = 0$
h_{fe}	4	Small Signal Current Gain (f = 1.0 kc)	50	90	350	30	65	250		$V_{CE} = 10$ V $I_C = 50$ mA
h_{fe}	4	**High Frequency Current Gain (f = 20 Mc)**	**1.5**	2.5		**1.5**	2.3			$V_{CE} = 10$ V $I_C = 200$ mA

† NOTE: These Numerals Apply to the Fairchild FACT Program.
* NOTE: FACT Program End-Point Measurement Parameter.

Additional Electrical Characteristics on page 2
Notes on page 2

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ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

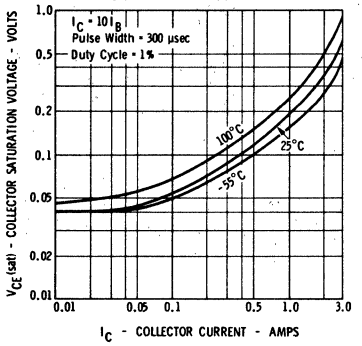
SYMBOL	FACT† SUBGROUP	CHARACTERISTIC	2N4076 Min.	2N4076 Typ.	2N4076 Max.	2N4075 Min.	2N4075 Typ.	2N4075 Max.	Units	TEST CONDITIONS
BV_{CBO}	1a	Collector to Base Breakdown Voltage	100			100			Volts	$I_C = 100\ \mu A$ $I_E = 0$
BV_{EBO}	1a	Emitter to Base Breakdown Voltage	5.0			5.0			Volts	$I_E = 10\ \mu A$ $I_C = 0$
t_{on}	4	Turn On Time [Note 6]			0.3			0.3	μsec	$I_C = 1.0$ A $I_{B1} \approx 50$ mA
t_{off}	4	Turn Off Time [Note 6]			1.5			1.5	μsec	$I_C = 1.0$ A $I_{B1} \approx 50$ mA $I_{B2} \approx -50$ mA
C_{obo}	4	Open Circuit Output Capacitance			70			70	pf	$I_E = 0$ $V_{CB} = 10$ V

† NOTE: These Numerals Apply to the Fairchild FACT Program.
* NOTE: FACT Program End-Point Measurement Parameter.

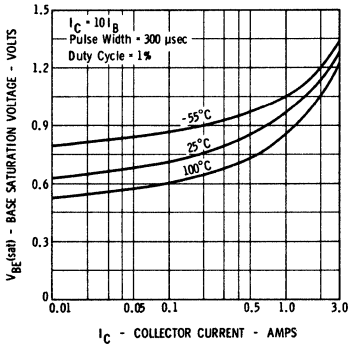
NOTES:
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
(3) These ratings give a maximum junction temperature of 200°C and junction-to-case thermal resistance of 5.83 °C/Watt. See power curves for derating characteristics.
(4) These ratings refer to a high-current point where collector-to-emitter voltage is lowest. For more information send for Fairchild Publication APP-4.
(5) Pulse conditions: length = 300 μsec; duty cycle = 1%.
(6) See switching circuit for exact I_{B1} and I_{B2} values.

TYPICAL ELECTRICAL CHARACTERISTICS FOR 2N4075 AND 2N4076

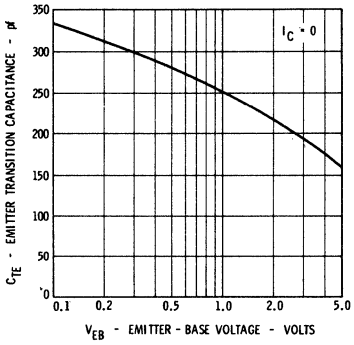
COLLECTOR SATURATION VOLTAGE VERSUS PULSED COLLECTOR CURRENT



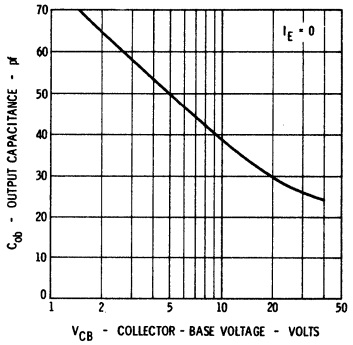
BASE SATURATION VOLTAGE VERSUS PULSED COLLECTOR CURRENT



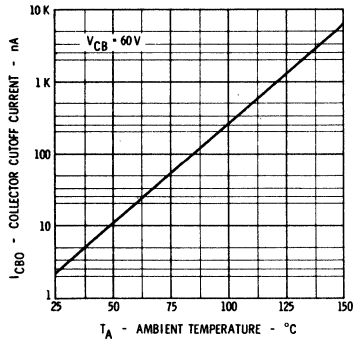
EMITTER TRANSITION CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



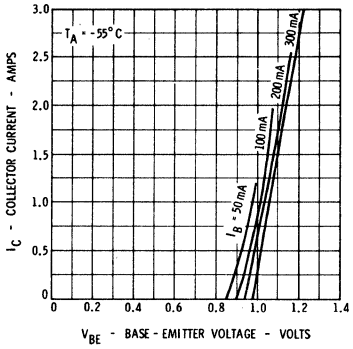
OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



BASE CHARACTERISTICS*



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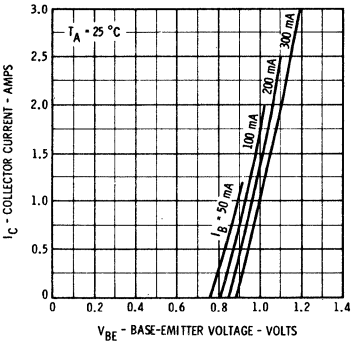

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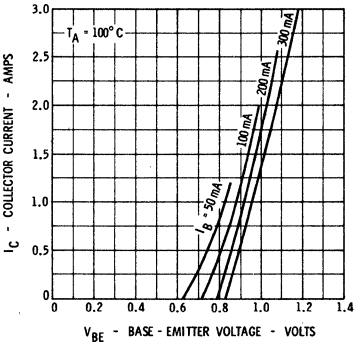
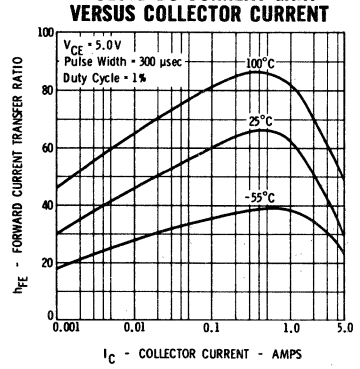


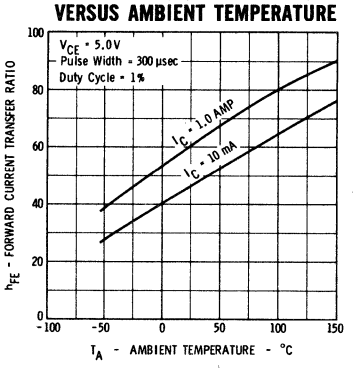
*** Single family characteristic on Transistor Curve Tracer.**

2N4075

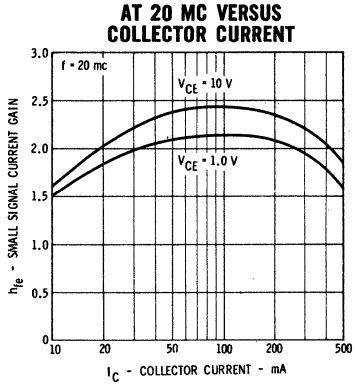
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



PULSED DC CURRENT GAIN VERSUS AMBIENT TEMPERATURE

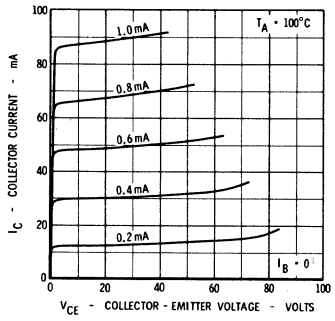


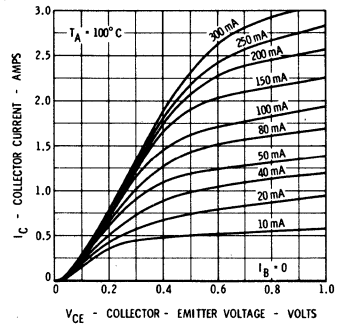
SMALL SIGNAL CURRENT GAIN AT 20 MC VERSUS COLLECTOR CURRENT

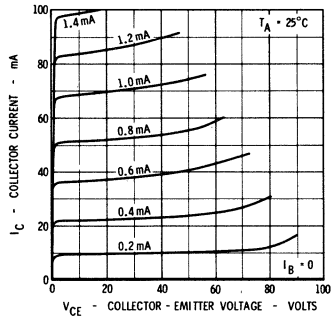


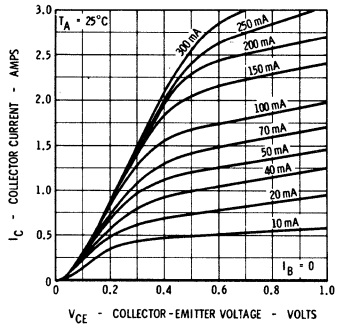
TYPICAL COLLECTOR CHARACTERISTICS*

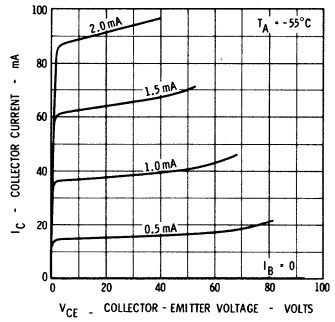
2N4075

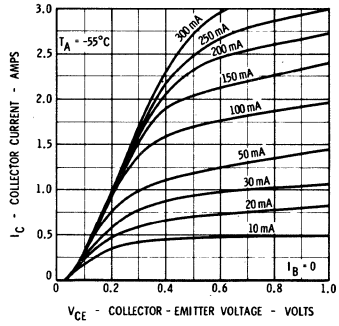




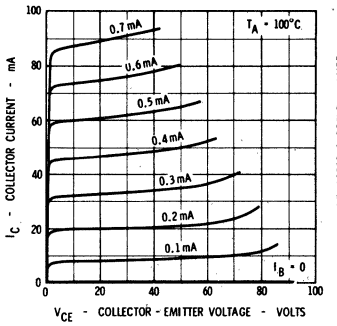


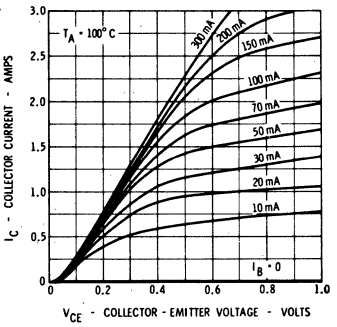


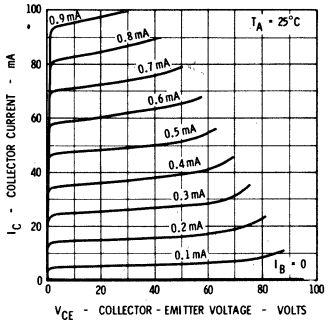


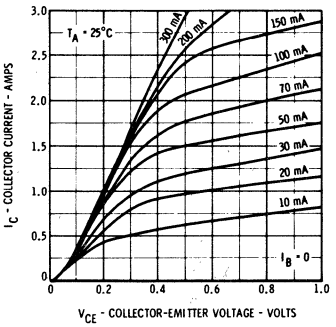


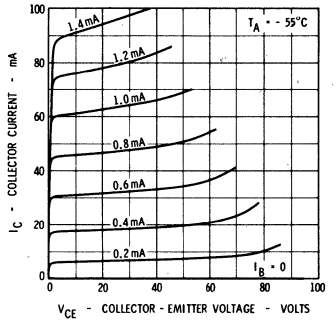
2N4076

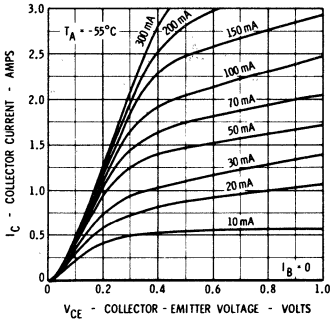








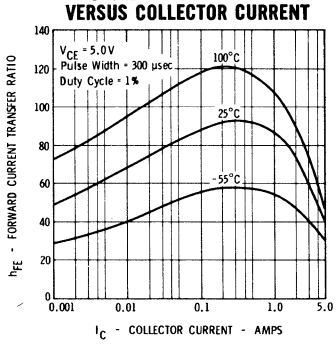




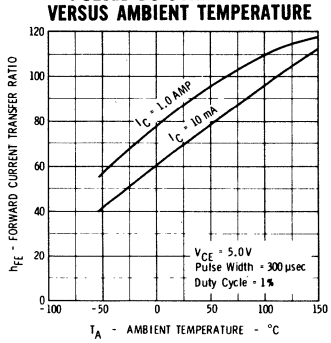
* Single family characteristic on Transistor Curve Tracer.

2N4076

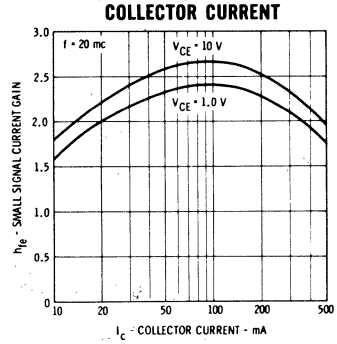
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



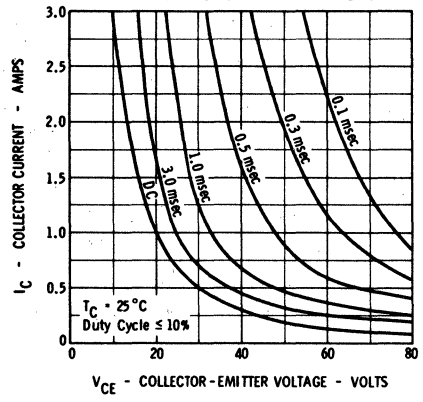
PULSED DC CURRENT GAIN VERSUS AMBIENT TEMPERATURE



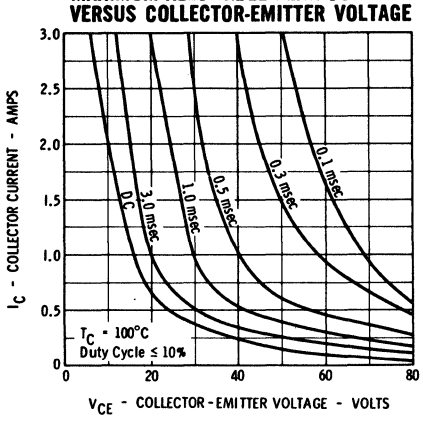
SMALL SIGNAL CURRENT GAIN AT 20 MC VERSUS COLLECTOR CURRENT



MAXIMUM ALLOWABLE PEAK CURRENT VERSUS COLLECTOR-EMITTER VOLTAGE

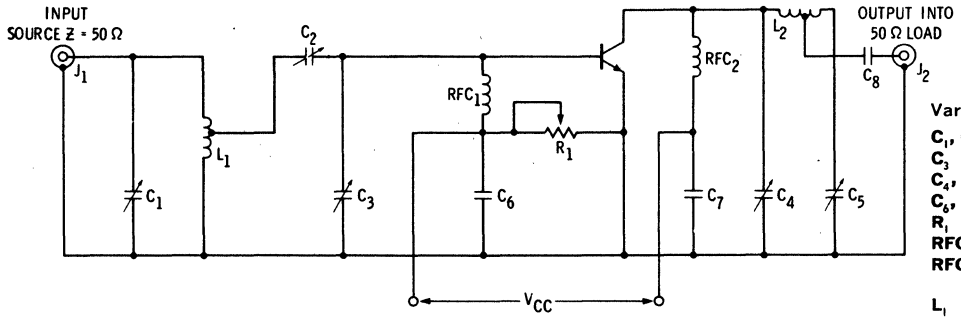


MAXIMUM ALLOWABLE PEAK CURRENT VERSUS COLLECTOR-EMITTER VOLTAGE



20 MC AMPLIFIER

RF Power Output = 12 watts Gain = 7.0 db
Efficiency = 55% V_{CC} = 33 Volts

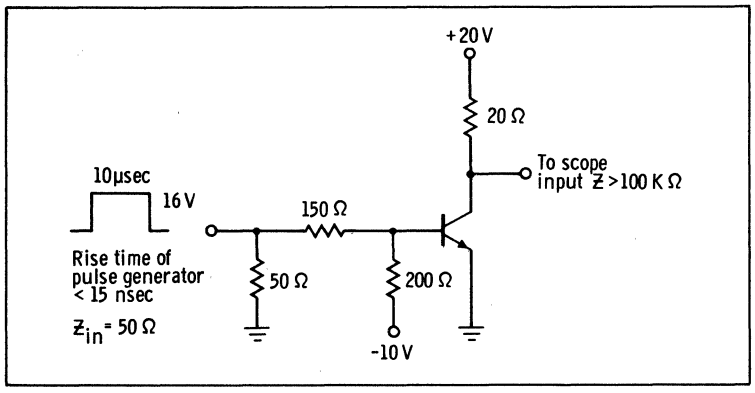


This circuit constructed on 1/16" x 3 7/8" x 5 7/8" copper clad printed circuit board.
Transistor must be used with adequate heat sink.

Variable capacitors are Elmenco compression type

C_1, C_2	7 plates	360-1000 pf
C_3	5 plates	170-760 pf
C_4, C_5	4 plates	100-550 pf
C_6, C_7, C_8	.01μfd —50 V Sprague disc type	
R_1	50Ω potentiometer (set at 0.5Ω min.)	
RFC_1	Ohmite Plate Choke Z —28	
RFC_2	100 turns #20 Nyclad Magnet wound on 2KΩ —10W ceramic resistor	
L_1	4 turns 508 Air Dux tapped at 1 7/8 turns from input	
L_2	7 turns 508 Air Dux tapped at 2 1/4 turns from output	
J_1, J_2	BNC connectors	

T_{ON} and T_{OFF} TEST CIRCUIT



FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

2N4115 • 2N4116

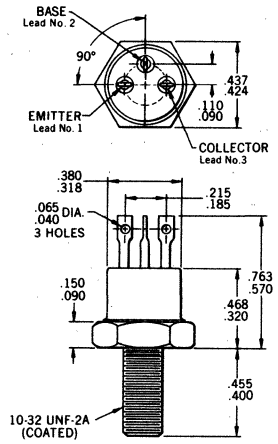
NPN POWER TRANSISTORS

DIFFUSED SILICON PLANAR EPITAXIAL TRANSISTORS

REPLACES FT7207A • FT7207B

- **HIGH POWER — 37 WATTS @ $T_C = 100°C$**
- **HIGH VOLTAGE (LV_{CEO}) — 80 VOLTS MIN.**
- **HIGH CURRENT (V_{CE} sat) — 1.5 VOLTS MAX. @ 5.0 AMPS.**
- **BETA GUARANTEED @ 3 POINTS — 50 mA, 2 AMPS. and 5 AMPS.**
- **HIGH (f_T) — 70 and 80 MHz MIN. @ 0.5 AMP.**
- **ISOLATED COLLECTOR PACKAGE**
- **SAFE AREA EXTENDED BY USE OF NICHROME THIN FILM EMITTER RESISTOR**

PHYSICAL DIMENSIONS
(in accordance with JEDEC TO-59 outline)



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 5.65 grams

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−65°C to +200°C
Operating Junction Temperature	−65°C to +200°C
Lead Temperature (Soldering, 60 sec time limit)	300°C Maximum

Maximum Power Dissipation

Total Dissipation at 100°C Case Temperature (See safe operating area and derating curves)	**37 Watts**
Thermal Resistance	2.7°C/W

Maximum Voltages

V_{CBO}	Collector to Base Voltage	120 Volts
V_{CEO}	Collector to Emitter Voltage [Note 2]	80 Volts
V_{EBO}	Emitter to Base Voltage	**8.0 Volts**

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	† FACT Subgroup	CHARACTERISTIC	2N4115 MIN.	2N4115 TYP.	2N4115 MAX.	2N4116 MIN.	2N4116 TYP.	2N4116 MAX.	UNITS	TEST CONDITIONS
*h_{FE}	1a	DC Pulse Current Gain [Note 3]	**40**	63	**120**	**100**	139	**300**		I_C = **2.0 A** V_{CE} = 5.0 V
h_{FE}	4	DC Pulse Current Gain [Note 3]	**20**	45		**40**	100			I_C = **5.0 A** V_{CE} = 5.0 V
V_{CE} (sat)	4	Pulsed Collector Saturation Voltage [Note 3]		0.5	**1.5**		0.5	**1.5**	Volts	I_C = **5.0 A** I_B = 0.5 A
V_{BE} (sat)	4	Pulsed Base Saturation Voltage [Note 3]		1.3	2.2		1.3	2.2	Volts	I_C = 5.0 A I_B = 0.5 A
*V_{CE} (sat)	1a	Pulsed Collector Saturation Voltage [Note 3]		0.22	0.6		0.22	0.6	Volts	I_C = 2.0 A I_B = 0.2 A
*V_{BE} (sat)	1a	Pulsed Base Saturation Voltage [Note 3]		0.95	1.3		0.95	1.3	Volts	I_C = 2.0 A I_B = 0.2 A
V_{CEO} (sust)	1a	Collector to Emitter Sustaining Voltage [Notes 2 and 3]	**80**			**80**			Volts	I_C = 50 mA (pulsed) I_B = 0
BV_{CES}	1a	Collector to Emitter Breakdown Voltage	120			120			Volts	I_C = 2.0 mA V_{BE} = 0
BV_{EBO}	1a	Emitter to Base Breakdown Voltage	8.0			8.0			Volts	I_C = 0 I_E = 1.0 mA

† NOTE: These Numerals Apply to the Fairchild FACT Program.
* NOTE: FACT Program End-Point Measurement Parameter.

Notes on page 2

Additional Electrical Characteristics on page 2

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

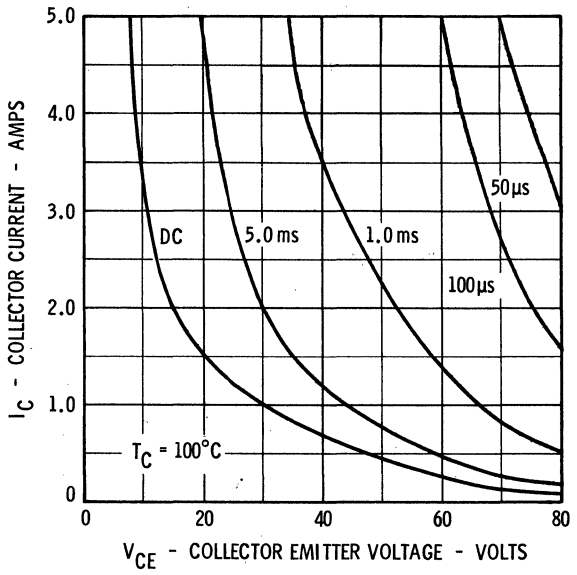
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

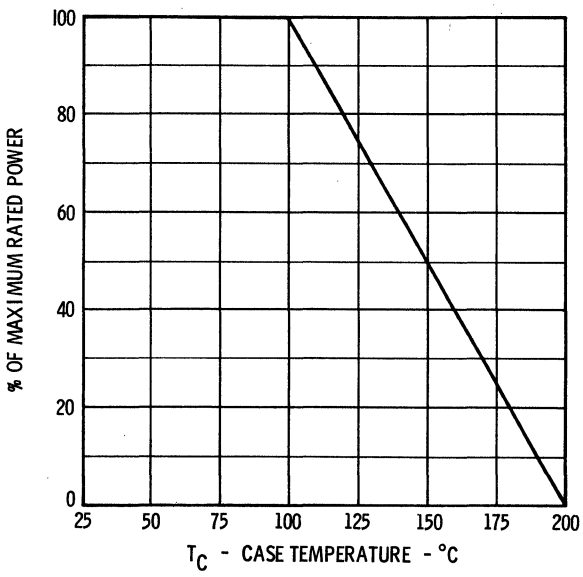
SYMBOL	†FACT Subgroup	CHARACTERISTIC	2N4115 MIN.	2N4115 TYP.	2N4115 MAX.	2N4116 MIN.	2N4116 TYP.	2N4116 MAX.	UNITS	TEST CONDITIONS
*I_{CES}	1b	Collector Reverse Current			10			10	μA	V_{CE} = 60 V V_{BE} = 0
I_{CEO}	4	Collector Cutoff Current			50			50	μA	I_B = 0 V_{CE} = 40 V
I_{CEX} (150°C)	4	Collector Cutoff Current			100			100	μA	V_{CE} = 60 V V_{EB} = 2.0 V
I_{EBO}	4	Emitter Cutoff Current			25			25	μA	I_C = 0 V_{EB} = 6.0 V
h_{FE}	4	DC Pulse Current Gain [Note 3]	**20**	40		**40**	72			I_C = **50 mA** V_{CE} = 5.0 V
h_{FE} (−55°C)	4	DC Pulse Current Gain [Note 3]	15	34		35	82			I_C = 2.0 A V_{CE} = 5.0 V
h_{fe}	4	High Frequency Current Gain (**f = 20 MHz**)	**3.5**	6.75		**4.0**	9.75			I_C = 0.5 A V_{CE} = 5.0 V
C_{obo}	4	Output Capacitance		80	120		80	120	pF	I_E = 0 V_{CE} = 10 V
C_{ibo}	4	Input Capacitance		450	700		450	700	pF	I_C = 0 V_{EB} = 2.0 V
h_{fe}	4	Small Signal Current Gain (f = 1 kHz)	20			40				I_C = 50 mA V_{CE} = 5.0 V
V_{BE} (ON)	4	Pulsed Base Emitter ON Voltage [Note 3]			1.3			1.3	Volts	I_C = 2.0 A V_{CE} = 5.0 V

† NOTE: These Numerals Apply to the Fairchild FACT Program.
* NOTE: FACT Program End-Point Measurement Parameter.

FORWARD BIASED SAFE OPERATING AREA



DERATING CURVE

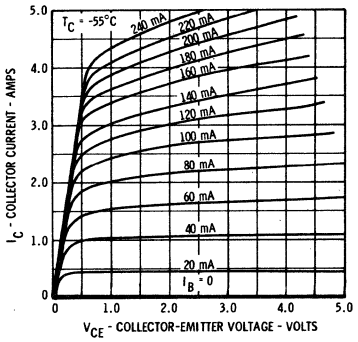


NOTES:
(1) These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.
(2) This rating refers to a high-current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(3) Pulse conditions: length = 300 μs; duty cycle = 1%.

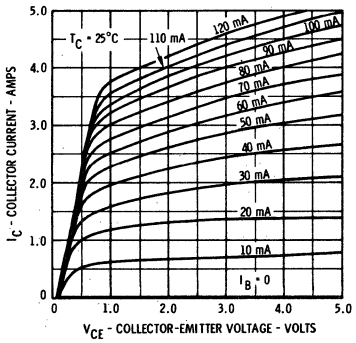
TYPICAL ELECTRICAL CHARACTERISTICS

2N4115

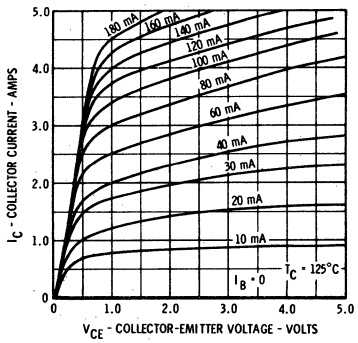
COLLECTOR CHARACTERISTICS*



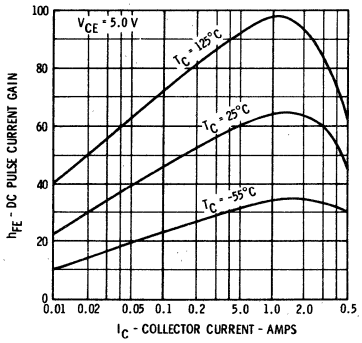
COLLECTOR CHARACTERISTICS*



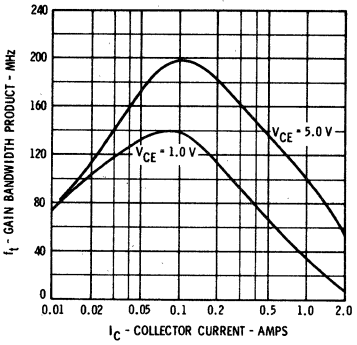
COLLECTOR CHARACTERISTICS*



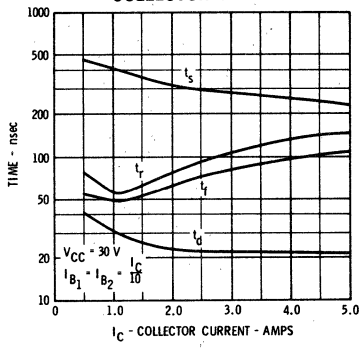
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT

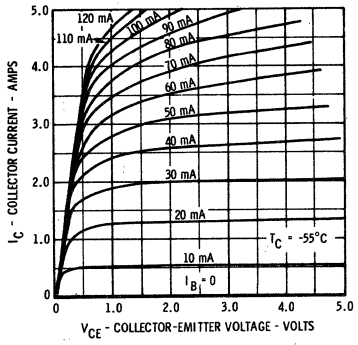


SWITCHING TIMES VERSUS COLLECTOR CURRENT

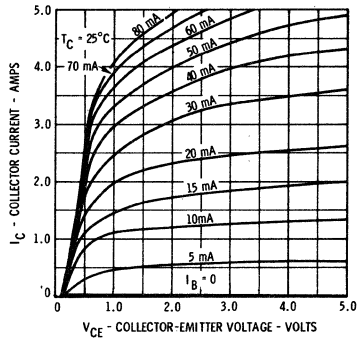


2N4116

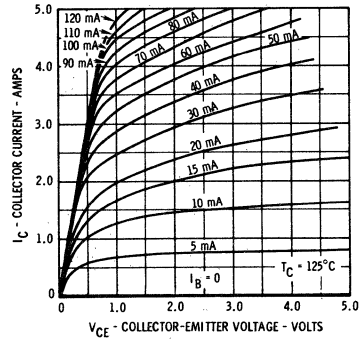
COLLECTOR CHARACTERISTICS*



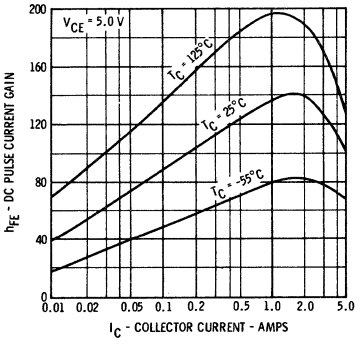
COLLECTOR CHARACTERISTICS*



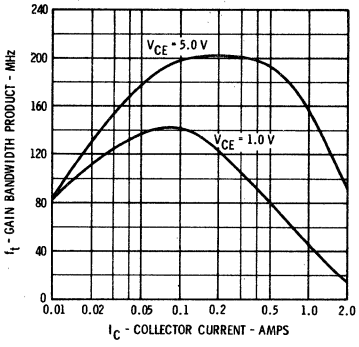
COLLECTOR CHARACTERISTICS*



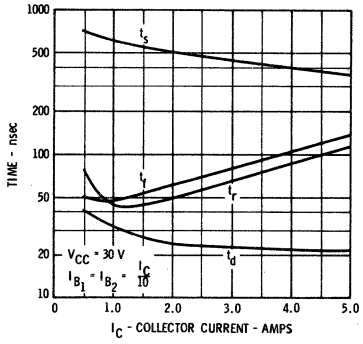
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT



SWITCHING TIMES VERSUS COLLECTOR CURRENT

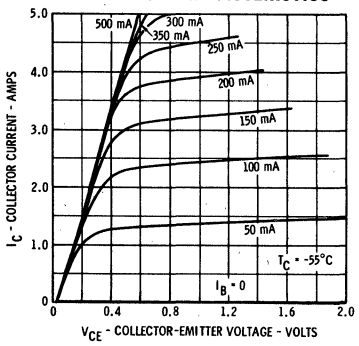


* Single family characteristic on Transistor Curve Tracer.

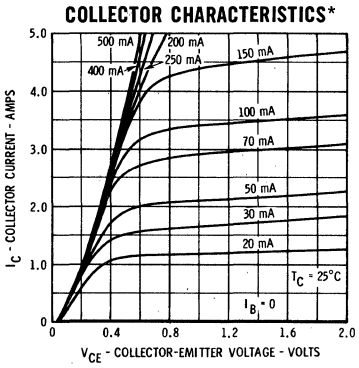
TYPICAL ELECTRICAL CHARACTERISTICS

2N4115•2N4116

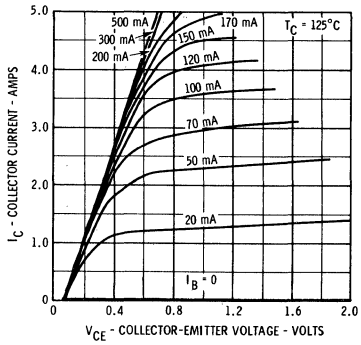
COLLECTOR CHARACTERISTICS*



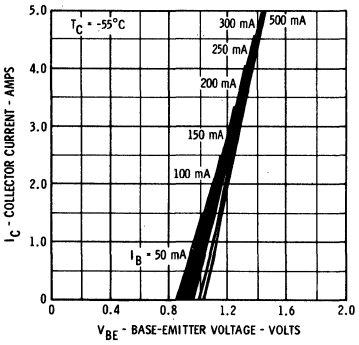
COLLECTOR CHARACTERISTICS*



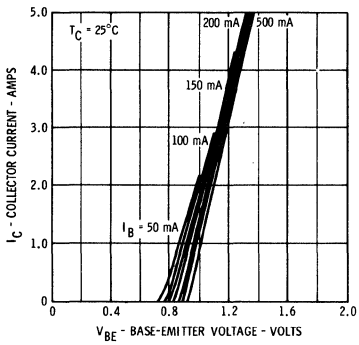
COLLECTOR CHARACTERISTICS*



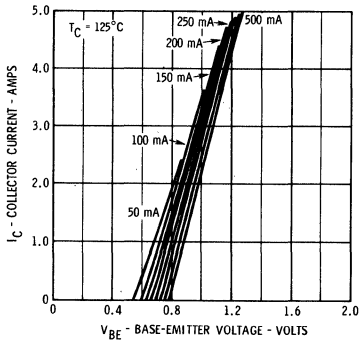
BASE CHARACTERISTICS*



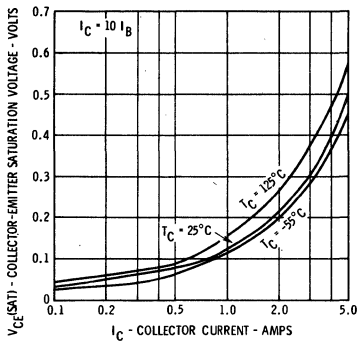
BASE CHARACTERISTICS*



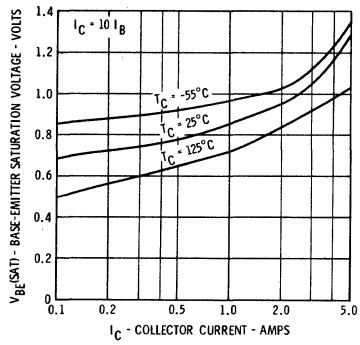
BASE CHARACTERISTICS*



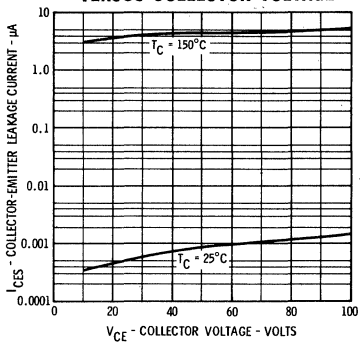
COLLECTOR-EMITTER SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



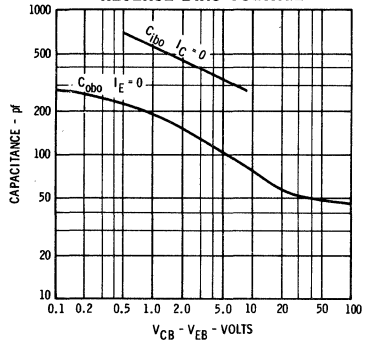
BASE EMITTER SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



COLLECTOR LEAKAGE CURRENT VERSUS COLLECTOR VOLTAGE



INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



* Single family characteristic on Transistor Curve Tracer.

2N4237 • 2N4238 • 2N4239

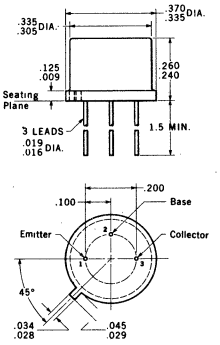
NPN POWER TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

FOR IMPROVED PERFORMANCE SEE FAIRCHILD 2N4895 • 2N4896 • 2N4897

GENERAL DESCRIPTION — The Fairchild 2N4237 • 2N4238 and 2N4239 are NPN, silicon, triode power transistors designed primarily for untuned amplifier applications.

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-5) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Collector internally connected to case
Package weight is 1.1 grams

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−55°C to +200°C
Operating Junction Temperature	−55°C to +200°C
Lead Temperature ¼″ from case for 2 seconds	+230°C

Maximum Power Dissipation

Total Dissipation at or below 25°C Case Temperature [Note 3]	5.0 Watts
(See safe operating area curve)	
at or below 25°C Ambient Temperature [Note 3]	0.8 Watt

Maximum Voltages and Current

		2N4237	2N4238	2N4239
V_{CBO}	Collector to Base Voltage	50 Volts	80 Volts	100 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts	6.0 Volts	6.0 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	40 Volts	60 Volts	80 Volts
I_C	Collector Current [Note 2]	1.0 Amp	1.0 Amp	1.0 Amp
I_B	Base Current [Note 2]	0.5 Amp	0.5 Amp	0.5 Amp

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC		MIN	MAX.	UNITS	TEST CONDITIONS	
I_{CEX}	Collector Cutoff Current	2N4237		0.1	mA	V_{CE} = 50 V	V_{EB} = 1.5 V
		2N4238		0.1	mA	V_{CE} = 80 V	V_{EB} = 1.5 V
		2N4239		0.1	mA	V_{CE} = 100 V	V_{EB} = 1.5 V
I_{CEX} (150°C)	Collector Cutoff Current	2N4237		1.0	mA	V_{CE} = 30 V	V_{EB} = 1.5 V
		2N4238		1.0	mA	V_{CE} = 50 V	V_{EB} = 1.5 V
		2N4239		1.0	mA	V_{CE} = 70 V	V_{EB} = 1.5 V
I_{CBO}	Collector Cutoff Current	2N4237		0.1	mA	V_{CB} = 50 V	I_E = 0
		2N4238		0.1	mA	V_{CB} = 80 V	I_E = 0
		2N4239		0.1	mA	V_{CB} = 100 V	I_E = 0
I_{EBO}	Emitter Cutoff Current			0.5	mA	V_{EB} = 6.0 V	I_C = 0
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage [Notes 4 and 5]	2N4237	40		Volts	I_C = 100 mA	I_B = 0
		2N4238	60		Volts	I_C = 100 mA	I_B = 0
		2N4239	80		Volts	I_C = 100 mA	I_B = 0
I_{CEO}	Collector Cutoff Current	2N4237		1.0	mA	V_{CE} = 30 V	I_B = 0
		2N4238		1.0	mA	V_{CE} = 40 V	I_B = 0
		2N4239		1.0	mA	V_{CE} = 60 V	I_B = 0

Additional Electrical Characteristics on page 2. Notes on page 2.

*Planar is a patented Fairchild process.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	MIN.	MAX.	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain [Note 5]	15			I_C = 1.0 A V_{CE} = 1.0 V
h_{FE}	DC Pulse Current Gain [Note 5]	30			I_C = 500 mA V_{CE} = 4.0 V
h_{FE}	DC Pulse Current Gain [Note 5]	30	150		I_C = 250 mA V_{CE} = 1.0 V
V_{CE} (sat)	Pulsed Collector Saturation Voltage [Note 5]		0.6	Volt	I_C = 1.0 A I_B = 100 mA
V_{CE} (sat)	Pulsed Collector Saturation Voltage [Note 5]		0.3	Volt	I_C = 500 mA I_B = 50 mA
V_{BE} (on)	Pulsed Base to Emitter "ON" Voltage [Note 5]		1.0	Volt	I_C = 250 mA V_{CE} = 1.0 V
V_{BE} (sat)	Pulsed Base Saturation Voltage [Note 5]		1.5	Volts	I_C = 1.0 A I_B = 100 mA
h_{fe}	High Frequency Current Gain (f = 1.0 MHz)	1.0			I_C = 100 mA V_{CE} = 10 V
h_{fe}	Low Frequency Current Gain (f = 1.0 kHz)	30			I_C = 100 mA V_{CE} = 10 V
C_{ob}	Common Base Output Capacitance (f = 0.1 MHz)		100	pF	I_C = 0 V_{CB} = 10 V

NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.

(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

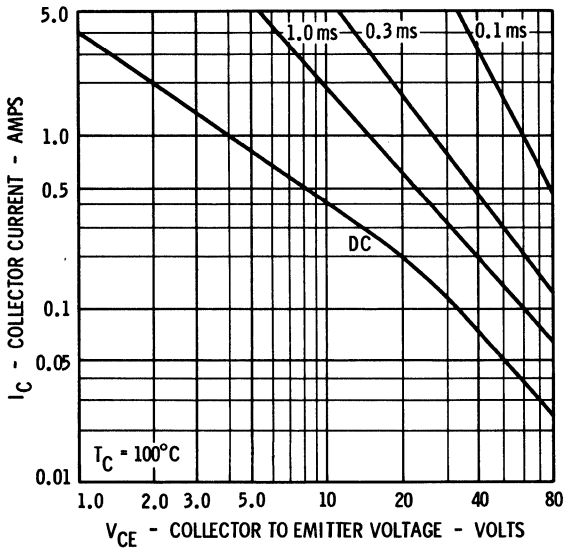
(3) These ratings give a maximum junction temperature of 200°C and junction to case thermal resistance of 35°C/Watt (derating factor of 28.5 mW/°C); junction to ambient thermal resistance of 218.8°C/Watt (derating factor of 4.5 mW/°C).

(4) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.

(5) Pulse Conditions: length = 300 μs; duty cycle = 2%.

MAXIMUM RATING

FORWARD BIASED SAFE OPERATING AREA



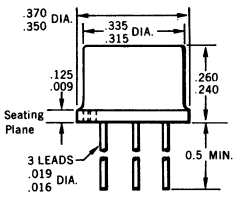
2N4895 • 2N4896 • 2N4897

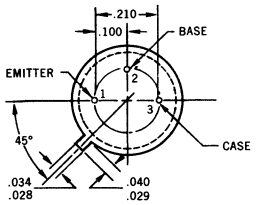
NPN POWER TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **HIGH VOLTAGE - - 150 AND 120 VOLT MIN. BV_{CES}, 80 AND 60 VOLT MIN LV_{CEO}**
- **LOW V_{CE} (sat) - - 1.0 VOLT MAX. @ I_C = 5.0 A, I_B = 0.5 A**
- **HIGH SPEED - - MAX. t_{on} OF 350 ns AND t_{off} OF 650 ns @ I_C = 5.0 A, I_B = 0.5 A**
- **HIGH FREQUENCY - - f_T = 50 AND 80 MHz MINIMUM**
- **LOW LEAKAGE - - MAX. I_{CES} OF 100 μA @ 150°C AS A RESULT OF PLANAR CONSTRUCTION**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-39) outline





NOTES: All dimensions in inches
Leads are gold-plated KOVAR
Lead No. 3 internally connected to case
Package weight is 1.23 grams

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature Range	−65°C to +200°C
Operating Junction Temperature	+200°C
Lead Temperature (Soldering, 60 seconds time limit)	+300°C

Maximum Power Dissipation [Notes 2 and 3]

Total Dissipation at 100°C Case Temperature (See Safe Operating Area and Derating Curves)	4.0 Watts
at 25°C Ambient Temperature	0.8 Watt

Maximum Voltages and Currents

		2N4895 2N4896	2N4897
V_{CBO}	Collector to Base Voltage	120 Volts	150 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	60 Volts	80 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts	6.0 Volts
I_C	Collector Current	5.0 Amps	5.0 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC		MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
V_{CEO} (sust)	**Collector to Emitter Sustaining**	2N4895 2N4896	**60**			**Volts**	I_C = 50 mA	I_B = 0
	Voltage [Notes 4 and 5]	2N4897	**80**			**Volts**	I_C = 50 mA	I_B = 0
BV_{CES}	**Collector to Emitter Voltage**	2N4895 2N4896	**120**			Volts	I_C = 1.0 mA	V_{BE} = 0
		2N4897	**150**			Volts	I_C = 1.0 mA	V_{BE} = 0
BV_{EBO}	Emitter to Base Voltage		6.0			Volts	I_C = 0	I_E = 1.0 mA
I_{CES}	Collector Reverse Current	2N4895 2N4896		0.001	1.0	μA	V_{CE} = 60 V	V_{BE} = 0
		2N4897		0.001	1.0	μA	V_{CE} = 100 V	V_{BE} = 0
I_{EBO}	Emitter Reverse Current			0.002	1.0	μA	I_C = 0	V_{EB} = 4.0 V
h_{FE}	DC Pulse Current Gain [Note 5]	2N4896	100	150	300		I_C = 2.0 A	V_{CE} = 2.0 V
		2N4895 2N4897	40	75	120		I_C = 2.0 A	V_{CE} = 2.0 V
V_{CE} (sat)	**Pulsed Collector Saturation Voltage** [Notes 5 and 6]			0.5	**1.0**	**Volts**	**I_C = 5.0 A**	**I_B = 0.5 A**
V_{BE} (sat)	Pulsed Base Saturation Voltage [Notes 5 and 6]			1.0	1.6	Volts	I_C = 5.0 A	I_B = 0.5 A
C_{obo}	Common-base, Open-circuit Output Capacitance			45	80	pF	I_E = 0	V_{CB} = 10 V
C_{ibo}	Common-base, Open-circuit Input Capacitance			330	500	pF	I_C = 0	V_{EB} = 0.5 V

* Planar is a patented Fairchild process.

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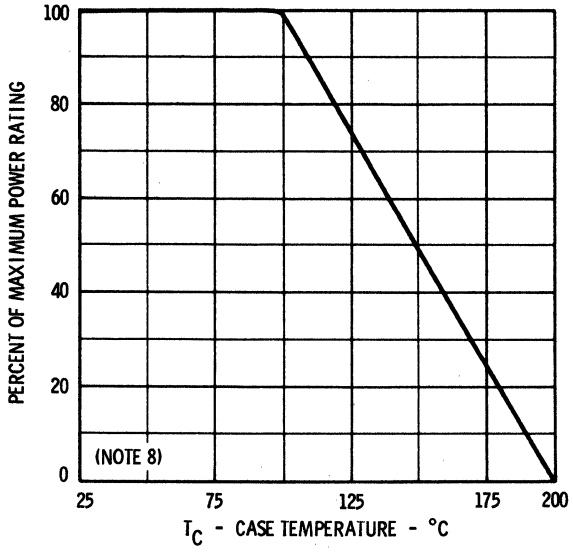
ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

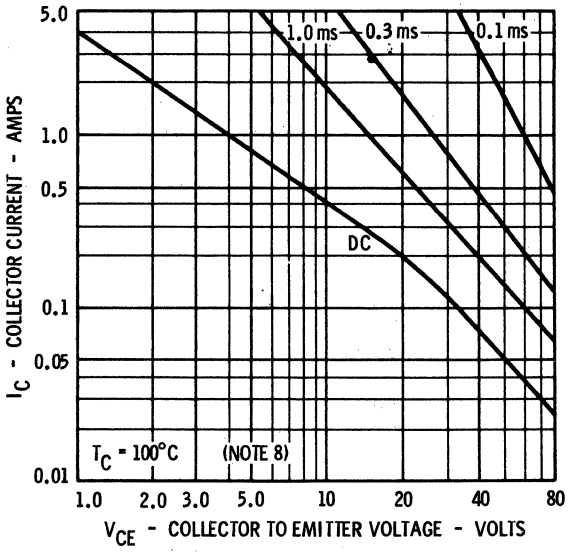
SYMBOL	CHARACTERISTIC		MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
t_d	Delay Time [Note 7]			20	50	ns	$I_C = 5.0$ A	$I_{B1} = 0.5$ A
t_r	Rise Time [Note 7]			160	300	ns	$I_C = 5.0$ A	$I_{B1} = 0.5$ A
t_s	Storage Time [Note 7]			180	350	ns	$I_C = 5.0$ A	$I_{B1} = I_{B2} = 0.5$ A
t_f	Fall Time [Note 7]			120	300	ns	$I_C = 5.0$ A	$I_{B1} = I_{B2} = 0.5$ A
h_{fe}	High Frequency Current Gain	2N4896	4.0	6.0			$I_C = 500$ mA	$V_{CE} = 5.0$ V
	(f = 20 MHz)	2N4895, 2N4897	2.5	6.0			$I_C = 500$ mA	$V_{CE} = 5.0$ V
h_{FE} (−55°C)	DC Pulse Current Gain	2N4896	35	75			$I_C = 2.0$ A	$V_{CE} = 2.0$ V
		2N4895, 2N4897	15	40			$I_C = 2.0$ A	$V_{CE} = 2.0$ V
I_{CES} (150°C)	Collector Reverse Current	2N4895, 2N4896		2.0	100	μA	$V_{CE} = 60$ V	$V_{BE} = 0$
		2N4897		3.0	100	μA	$V_{CE} = 100$ V	$V_{BE} = 0$

MAXIMUM RATINGS

DERATING CURVE



FORWARD BIASED SAFE OPERATING AREA



NOTES:

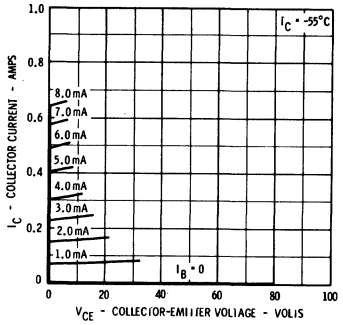
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
(3) These ratings give a maximum junction temperature of 200°C and junction to case thermal resistance of 25°C/Watt (derating factor of 40 mW/°C); junction to ambient thermal resistance of 219°C/Watt (derating factor of 4.56 mW/°C).
(4) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(5) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(6) Point of measurement: ¼" from header.
(7) Test conditions are given in the switching circuit.
(8) The device is thermally limited under ambient conditions. Derate linearly at 4.56 mW/°C for ambient temperatures above 25°C.

FAIRCHILD TRANSISTORS 2N4895 • 2N4896 • 2N4897

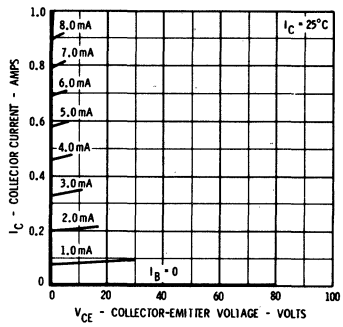
TYPICAL ELECTRICAL CHARACTERISTICS*

2N4895 • 2N4897

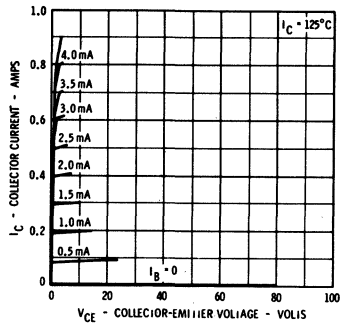
COLLECTOR CHARACTERISTICS ACTIVE REGION



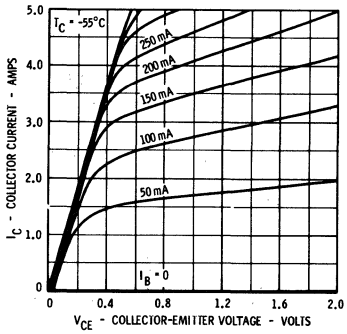
COLLECTOR CHARACTERISTICS ACTIVE REGION



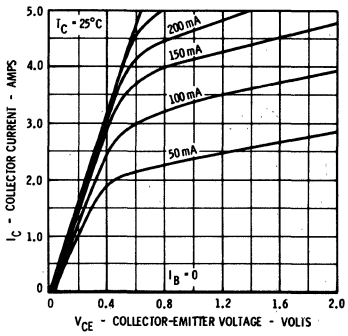
COLLECTOR CHARACTERISTICS ACTIVE REGION



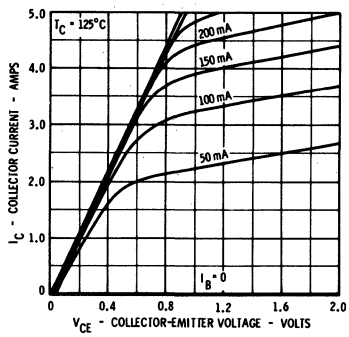
COLLECTOR CHARACTERISTICS SATURATION REGION



COLLECTOR CHARACTERISTICS SATURATION REGION



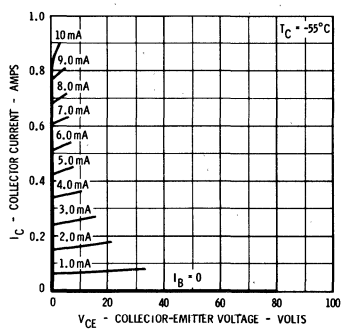
COLLECTOR CHARACTERISTICS SATURATION REGION



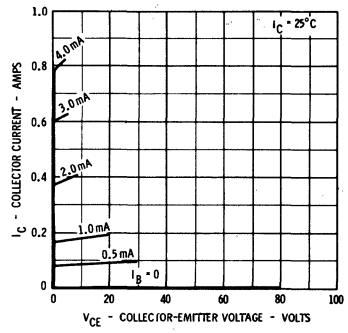
TYPICAL ELECTRICAL CHARACTERISTICS*

2N4896

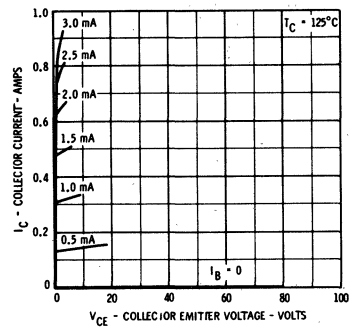
COLLECTOR CHARACTERISTICS ACTIVE REGION



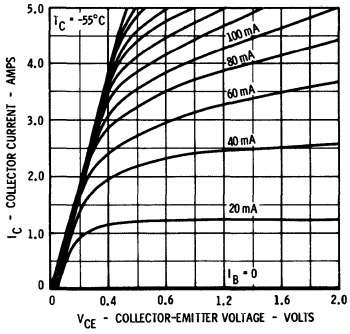
COLLECTOR CHARACTERISTICS ACTIVE REGION



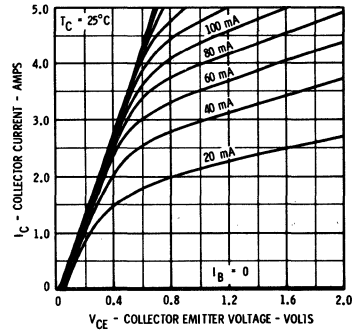
COLLECTOR CHARACTERISTICS ACTIVE REGION



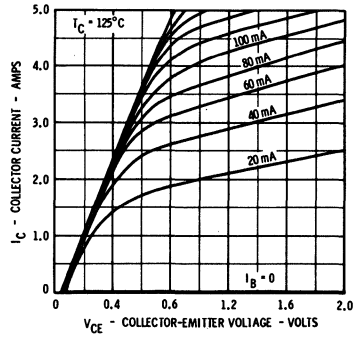
COLLECTOR CHARACTERISTICS SATURATION REGION



COLLECTOR CHARACTERISTICS SATURATION REGION



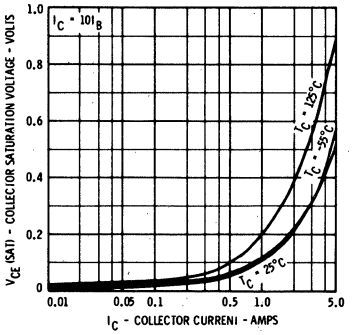
COLLECTOR CHARACTERISTICS SATURATION REGION



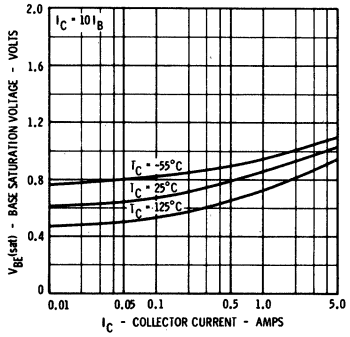
* Single family characteristic on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

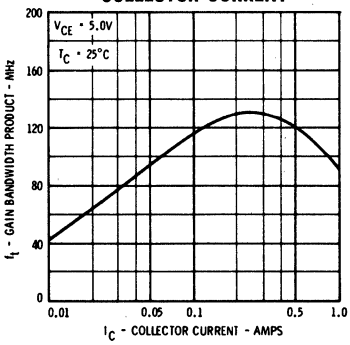
COLLECTOR SATURATION VOLTAGE VERSUS PULSED COLLECTOR CURRENT



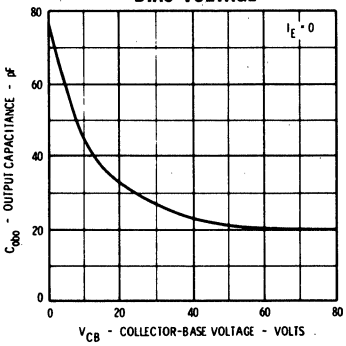
BASE SATURATION VOLTAGE VERSUS PULSED COLLECTOR CURRENT



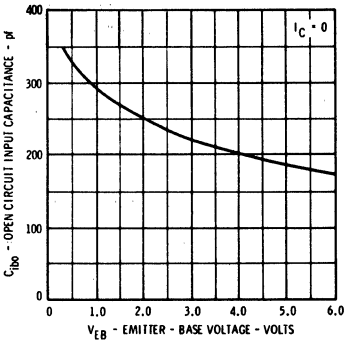
GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT



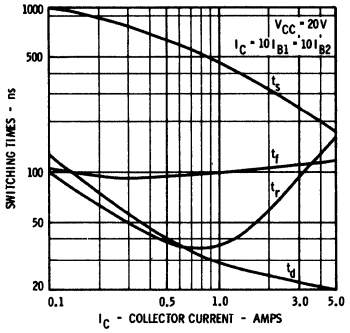
OPEN CIRCUIT OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



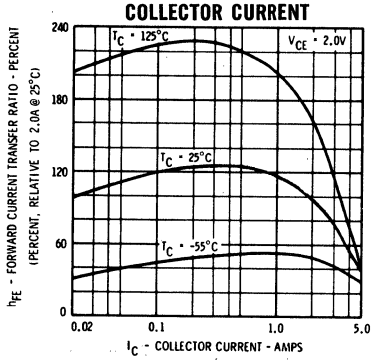
OPEN CIRCUIT INPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



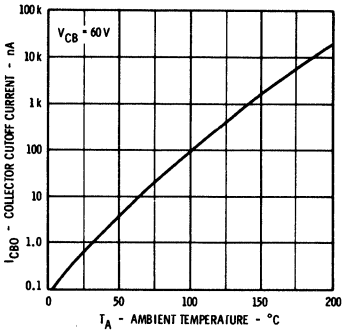
SWITCHING TIMES VERSUS COLLECTOR CURRENT



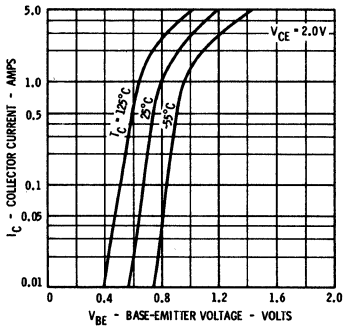
FORWARD CURRENT TRANSFER RATIO VERSUS COLLECTOR CURRENT



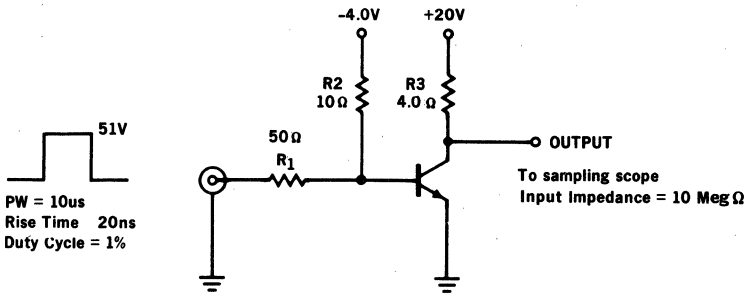
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



COLLECTOR CURRENT VERSUS BASE EMITTER VOLTAGE



SWITCHING TIME TEST CIRCUIT



2N4998 • 2N5000

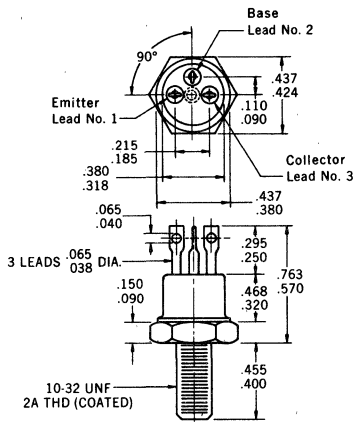
30 WATT NPN POWER TRANSISTORS

DIFFUSED SILICON PLANAR* TRANSISTORS

SEE 2N4999 • 2N5001 FOR PNP COMPLEMENT

- **HIGH POWER - - 30 WATTS @ $T_C = 50°C$, $V_{CE} = 40$ V**
- **HIGH VOLTAGE - - 80 V (MIN) LV_{CEO}**
- **HIGH CURRENT SATURATION VOLTAGE - - 0.85 V (MAX) $V_{CE}(sat)$ @ $I_C = 2.0$ A**
- **HIGH FREQUENCY - - 50 AND 60 MHz (MIN) f_T**
- **BETA GUARANTEED @ 3 POINTS - - 50 mA, 1.0 A AND 2.0 A**
- **ISOLATED COLLECTOR PACKAGE - - NO ISOLATING HARDWARE REQUIRED**
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**

PHYSICAL DIMENSIONS
(in accordance with JEDEC TO-59 outline)



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 6.44 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−65°C to +200°C
Operating Junction Temperature	−65°C to +200°C
Lead Temperature (Soldering, 60 second time limit)	+300°C

Maximum Power Dissipation

Total Dissipation at 50°C Case Temperature, $V_{CE} = 40$ V (See Maximum Permissible Power Curve and Note 4)	30 Watts

Maximum Voltages and Current

V_{CES}	Collector to Emitter Voltage	100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	80 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts
I_C	Collector Current	2.0 Amps

ELECTRICAL CHARACTERISTICS (25° Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N4998 MIN.	2N4998 TYP.	2N4998 MAX.	2N5000 MIN.	2N5000 TYP.	2N5000 MAX.	UNITS	TEST CONDITIONS	
$V_{CEO}(sust)$	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	**80**			**80**			**Volts**	**$I_C = 100$ mA**	**$I_B = 0$**
BV_{CES}	Collector to Emitter Breakdown Voltage	100			100			Volts	$I_C = 1.0$ mA	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			6.0			Volts	$I_C = 0$	$I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**64**		**50**	**120**			**$I_C = 50$ mA**	**$V_{CE} = 5.0$ V**
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**63**	**90**	**70**	**110**	**200**		**$I_C = 1.0$ A**	**$V_{CE} = 5.0$ V**
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	15	45		35	63			$I_C = 1.0$ A	$V_{CE} = 5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**15**	**33**		**30**	**56**			**$I_C = 2.0$ A**	**$V_{CE} = 5.0$ V**
h_{fe}	**High Frequency Current Gain ($f = 20$ MHz)**	**2.5**	**3.8**		**3.0**	**4.3**			**$I_C = 0.2$ A**	**$V_{CE} = 5.0$ V**
$V_{CE}(sat)$	Pulsed Collector Saturation Voltage (Note 3)		0.38	0.46		0.38	0.46	Volts	$I_C = 1.0$ A	$I_B = 0.1$ A
$V_{CE}(sat)$	**Pulsed Collector Saturation Voltage** (Note 3)		**0.75**	**0.85**		**0.75**	**0.85**	**Volts**	**$I_C = 2.0$ A**	**$I_B = 0.2$ A**

Additional Electrical Characteristics on page 2
Notes on page 2

*Planar is a patented Fairchild process.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

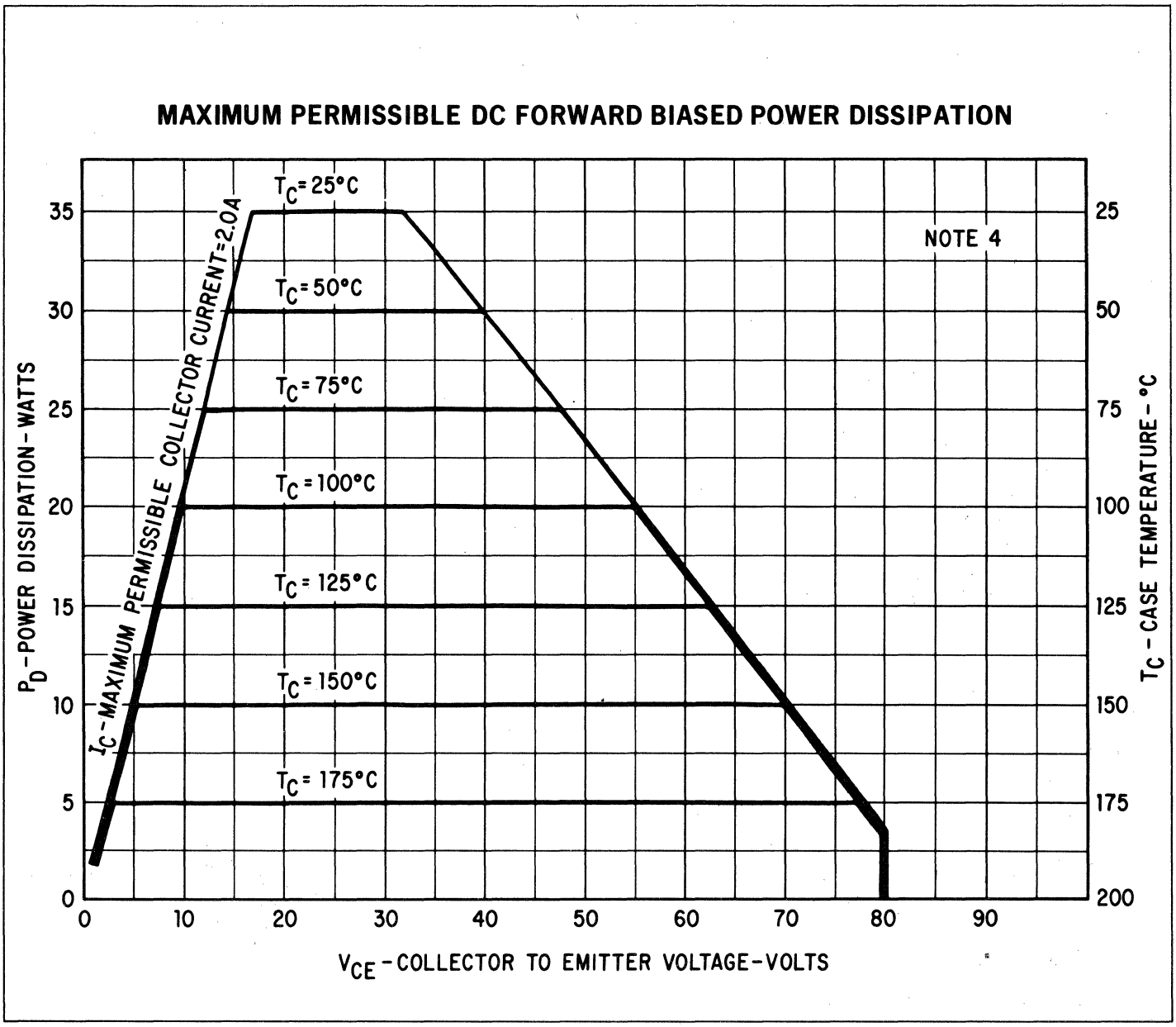
313 FAIRCHILD* DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

ELECTRICAL CHARACTERISTICS (25° Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N4998 MIN.	2N4998 TYP.	2N4998 MAX.	2N5000 MIN.	2N5000 TYP.	2N5000 MAX.	UNITS	TEST CONDITIONS	
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 3)		0.98	1.2		0.98	1.2	Volts	$I_C = 1.0$ A	$I_B = 0.1$ A
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 3)		1.30	1.5		1.30	1.5	Volts	$I_C = 2.0$ A	$I_B = 0.2$ A
V_{BE}(on)	Pulsed Base Emitter "ON" Voltage (Note 3)			1.5			1.5	Volts	$I_C = 2.0$ A	$V_{CE} = 5.0$ V
I_{CES}	Collector Cutoff Current		.002	1.0		.002	1.0	μA	$V_{CE} = 60$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current			1.0			1.0	μA	$I_C = 0$	$V_{EB} = 5.0$ V
I_{CEX}(150°C)	Collector Reverse Current			500			500	μA	$V_{CE} = 60$ V	$V_{EB} = 2.0$ V
C_{cb}	Collector to Base Capacitance		30	70		30	70	pF	$I_E = 0$	$V_{CB} = 10$ V

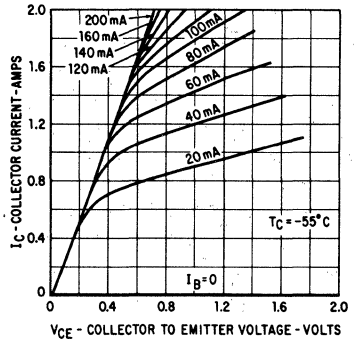
NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(3) Pulse Conditions: length = 300μs; duty cycle = 1%.
(4) Contact factory for maximum permissible power under pulsed or reverse biased operating conditions.

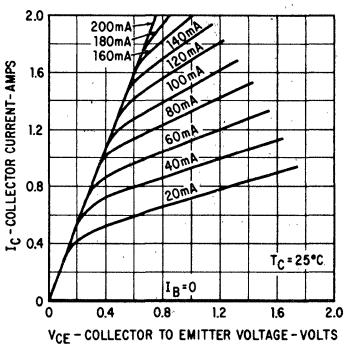


TYPICAL ELECTRICAL CHARACTERISTICS

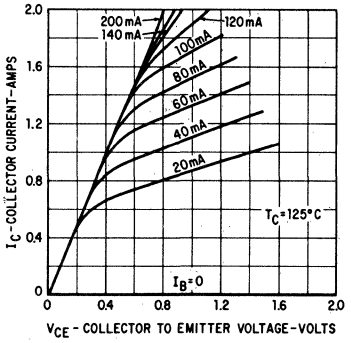
COLLECTOR CHARACTERISTICS* SATURATION REGION



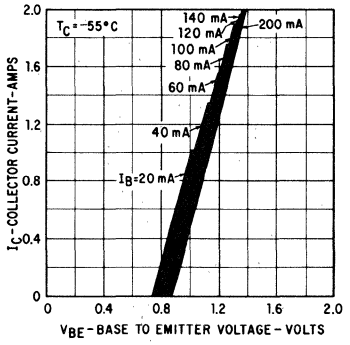
COLLECTOR CHARACTERISTICS* SATURATION REGION



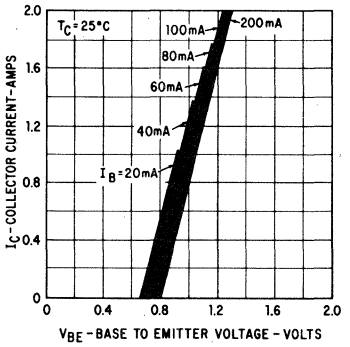
COLLECTOR CHARACTERISTICS* SATURATION REGION



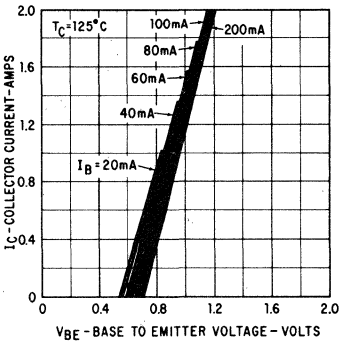
BASE CHARACTERISTICS*



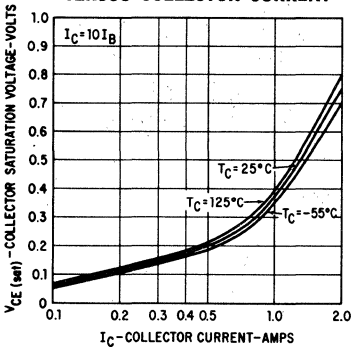
BASE CHARACTERISTICS*



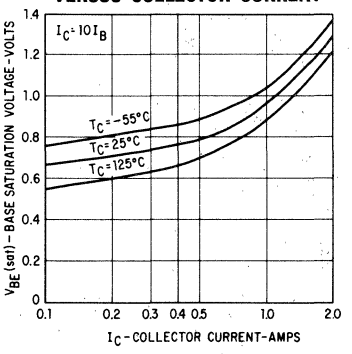
BASE CHARACTERISTICS*



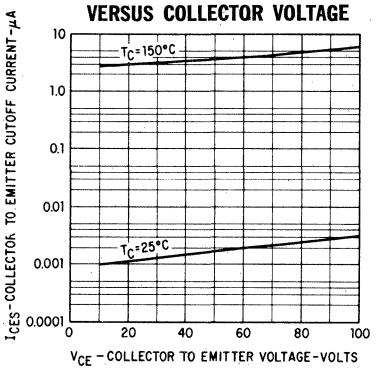
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



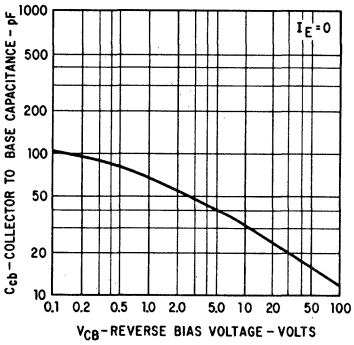
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



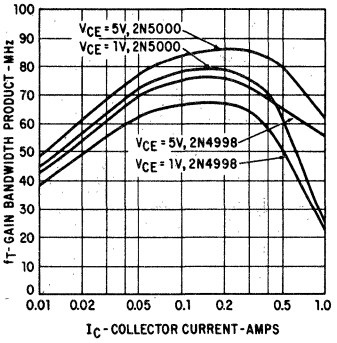
COLLECTOR CUTOFF CURRENT VERSUS COLLECTOR VOLTAGE



COLLECTOR TO BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT

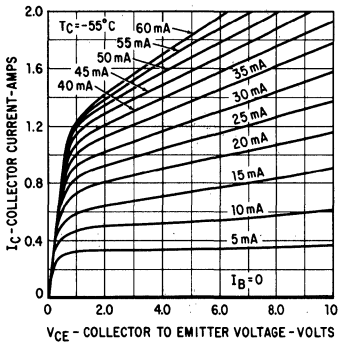


* Single family characteristic on Transistor Curve Tracer.

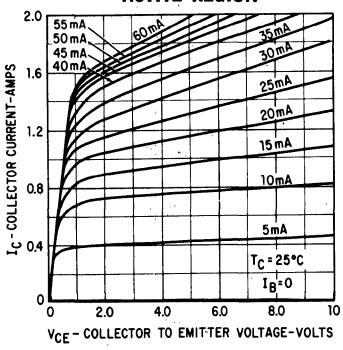
TYPICAL ELECTRICAL CHARACTERISTICS

2N4998

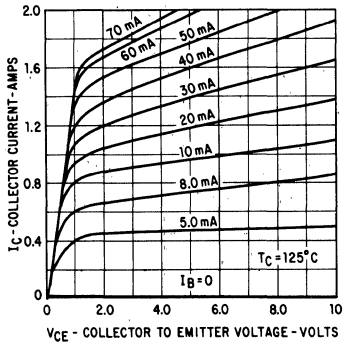
COLLECTOR CHARACTERISTICS* ACTIVE REGION



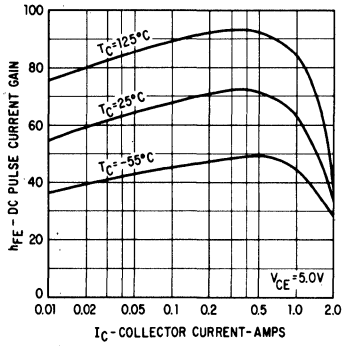
COLLECTOR CHARACTERISTICS* ACTIVE REGION



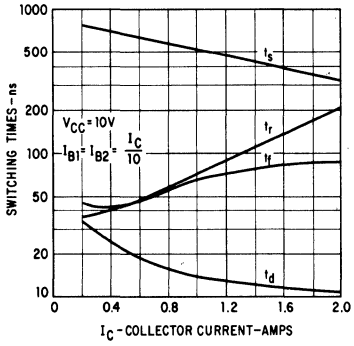
COLLECTOR CHARACTERISTICS* ACTIVE REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

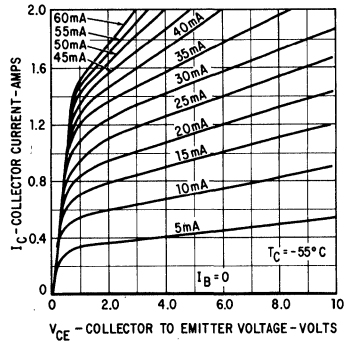


SWITCHING TIMES VERSUS COLLECTOR CURRENT

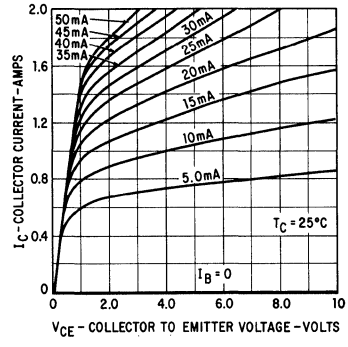


2N5000

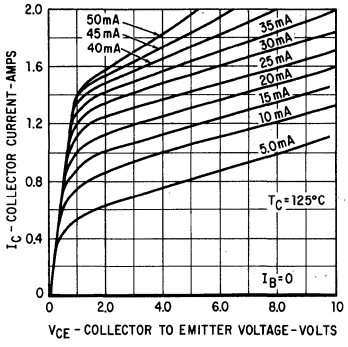
COLLECTOR CHARACTERISTICS* ACTIVE REGION



COLLECTOR CHARACTERISTICS* ACTIVE REGION



COLLECTOR CHARACTERISTICS* ACTIVE REGION



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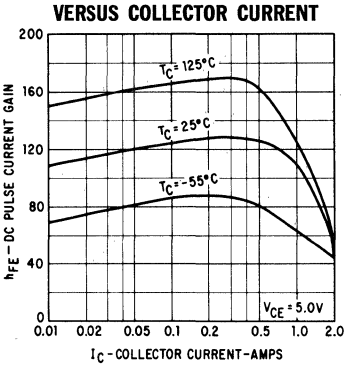

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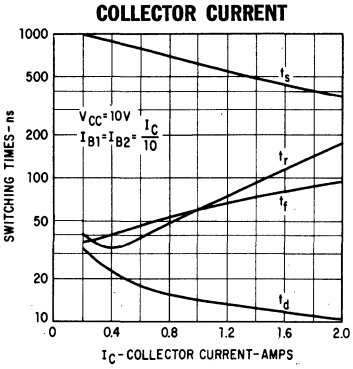

*Single Family Characteristics on Transistor Curve Tracer.

2N4999 • 2N5001

30 WATT PNP POWER TRANSISTORS

DIFFUSED SILICON PLANAR* TRANSISTORS

SEE 2N4998 • 2N5000 FOR NPN COMPLEMENT

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- **HIGH CURRENT SATURATION VOLTAGE** . . . −0.85 V (MAX) $V_{CE(sat)}$ AT $I_C = 2.0$ A
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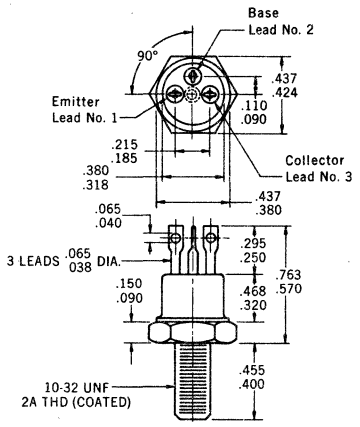

NOTES:
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ABSOLUTE MAXIMUM RATINGS (Note 1)

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Lead Temperature (Soldering, 60 second time limit)	+300°C

Maximum Power Dissipation

Total Dissipation at 50°C Case Temperature, $V_{CE} = -40$ V (See Maximum Permissible Power Curve and Note 4)	30 Watts

Maximum Voltages and Current

V_{CES}	Collector to Emitter Voltage	−100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	−80 Volts
V_{EBO}	Emitter to Base Voltage	−5.5 Volts
I_C	Collector Current	2.0 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	2N4999 MIN.	2N4999 TYP.	2N4999 MAX.	2N5001 MIN.	2N5001 TYP.	2N5001 MAX.	UNITS	TEST CONDITIONS	
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	**−80**			**−80**			**Volts**	**$I_C = 100$ mA**	**$I_B = 0$**
BV_{CES}	Collector to Emitter Breakdown Voltage	−100			−100			Volts	$I_C = 1.0$ mA	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.5			−5.5			Volts	$I_C = 0$	$I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**39**		**50**	**85**			**$I_C = 50$ mA**	**$V_{CE} = -5.0$ V**
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**40**	**90**	**70**	**88**	**200**		**$I_C = 1.0$ A**	**$V_{CE} = -5.0$ V**
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	15	24		35	52			$I_C = 1.0$ A	$V_{CE} = -5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**15**	**28**		**30**	**50**			**$I_C = 2.0$ A**	**$V_{CE} = -5.0$ V**
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	**2.5**	**4.8**		**3.0**	**6.1**			**$I_C = 0.2$ A**	**$V_{CE} = -5.0$ V**
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 3)		−0.38	−0.46		−0.38	−0.46	Volts	$I_C = 1.0$ A	$I_B = 0.1$ A
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 3)		**−0.73**	**−0.85**		**−0.73**	**−0.85**	**Volts**	**$I_C = 2.0$ A**	**$I_B = 0.2$ A**

Additional Electrical Characteristics on page 2
Notes on page 2

*Planar is a patented Fairchild process.

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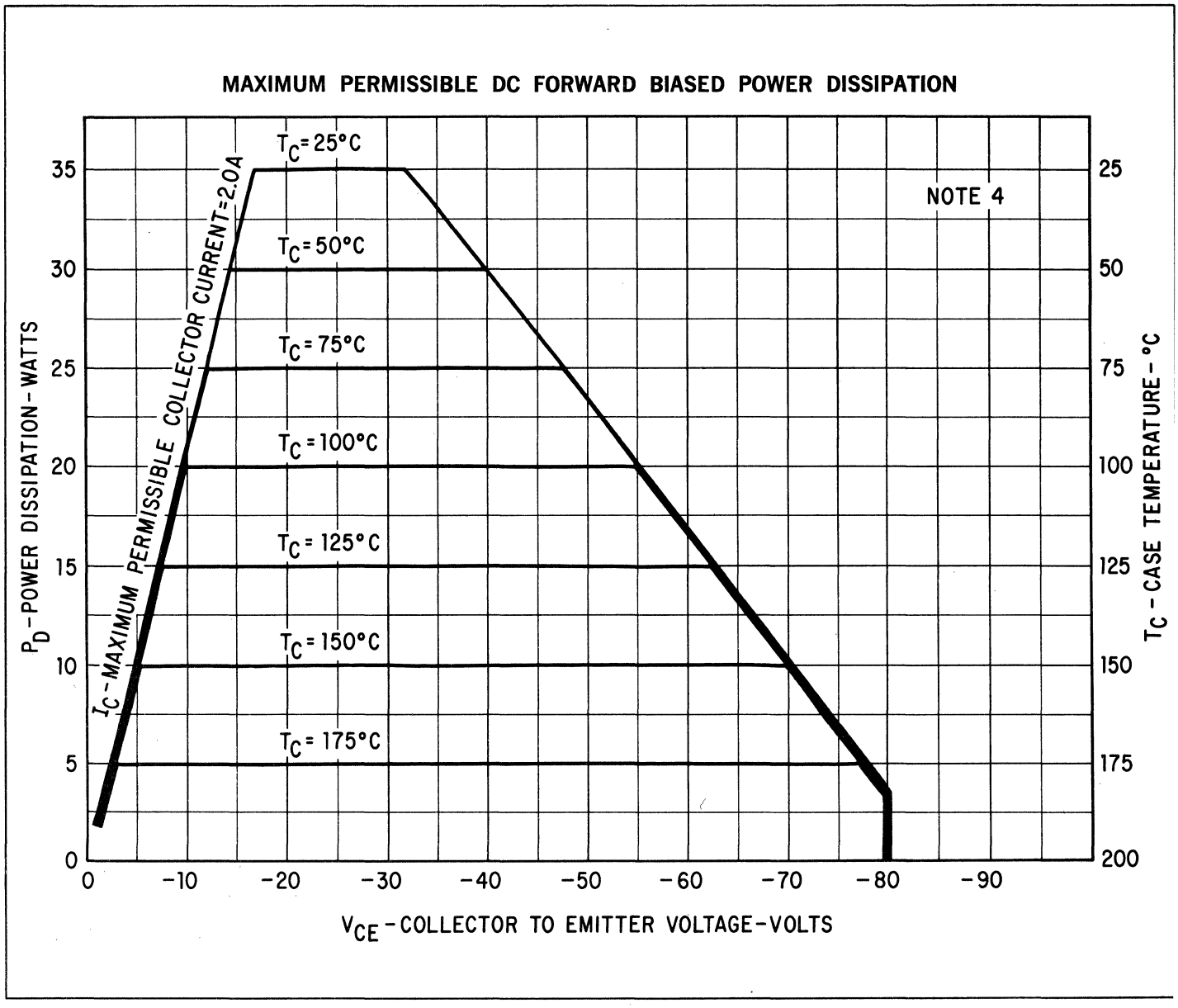
ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	2N4999 MIN.	2N4999 TYP.	2N4999 MAX.	2N5001 MIN.	2N5001 TYP.	2N5001 MAX.	UNITS	TEST CONDITIONS	
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		−0.96	−1.2		−0.96	−1.2	Volts	$I_C = 1.0$ A	$I_B = 0.1$ A
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		−1.28	−1.5		−1.28	−1.5	Volts	$I_C = 2.0$ A	$I_B = 0.2$ A
$V_{BE}(on)$	Pulsed Base Emitter "ON" Voltage (Note 3)			−1.5			−1.5	Volts	$I_C = 2.0$ A	$V_{CE} = -5.0$ V
I_{CES}	Collector Cutoff Current		.002	1.0		.002	1.0	μA	$V_{CE} = -60$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current			1.0			1.0	μA	$I_C = 0$	$V_{EB} = -4.0$ V
$I_{CEX}(150°C)$	Collector Reverse Current			500			500	μA	$V_{CE} = -60$ V	$V_{EB} = -2.0$ V
C_{cb}	Collector to Base Capacitance		46	120		46	120	pF	$I_E = 0$	$V_{CB} = -10$ V

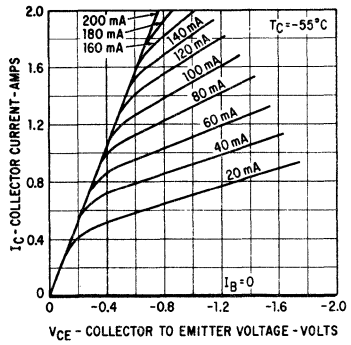
NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(3) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(4) Contact factory for maximum permissible power under pulsed or reverse biased operating conditions.

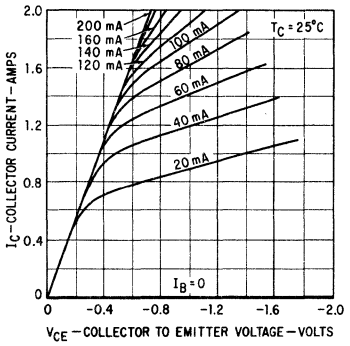


TYPICAL ELECTRICAL CHARACTERISTICS

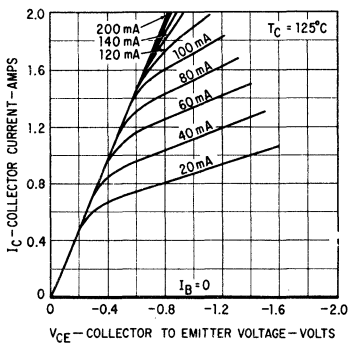
COLLECTOR CHARACTERISTICS* SATURATION REGION



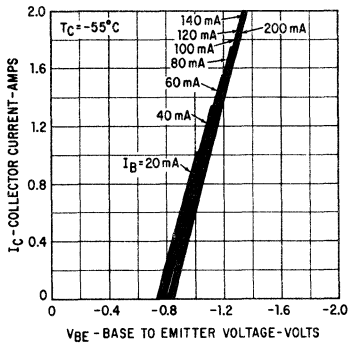
COLLECTOR CHARACTERISTICS* SATURATION REGION



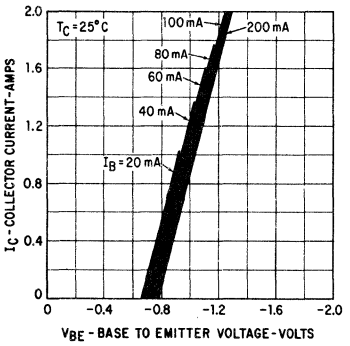
COLLECTOR CHARACTERISTICS* SATURATION REGION



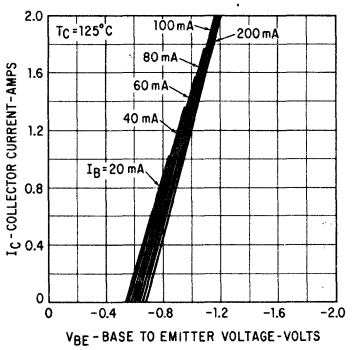
BASE CHARACTERISTICS*



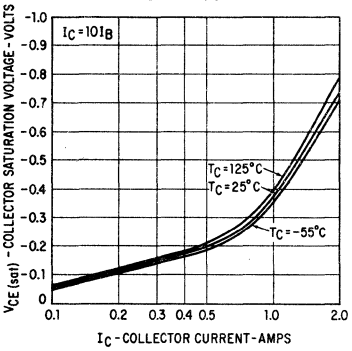
BASE CHARACTERISTICS*



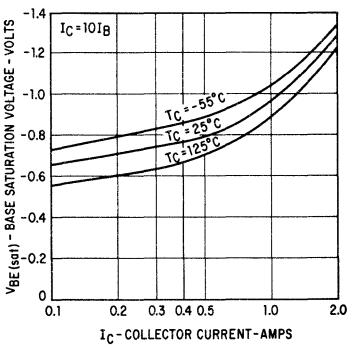
BASE CHARACTERISTICS*



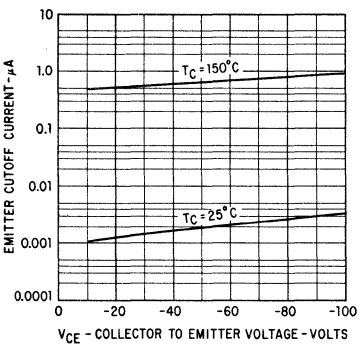
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



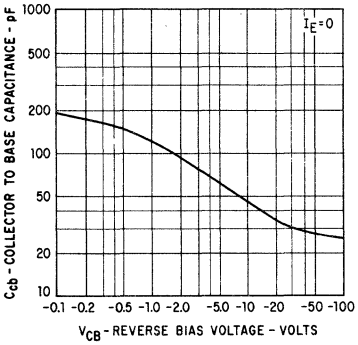
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



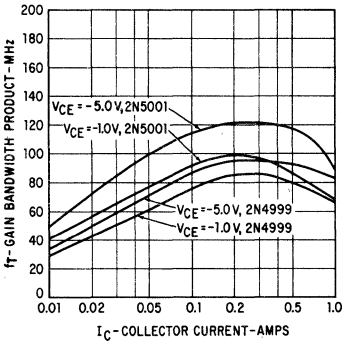
COLLECTOR CUTOFF CURRENT VERSUS COLLECTOR VOLTAGE



COLLECTOR TO BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT

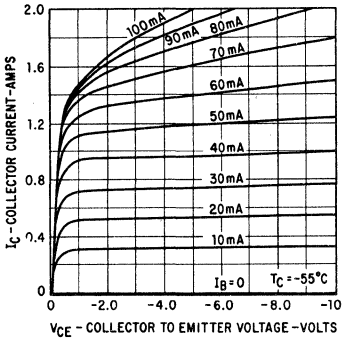


* Single family characteristic on Transistor Curve Tracer.

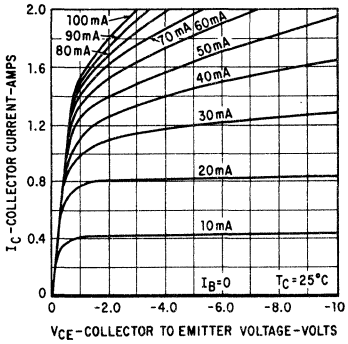
TYPICAL ELECTRICAL CHARACTERISTICS

2N4999

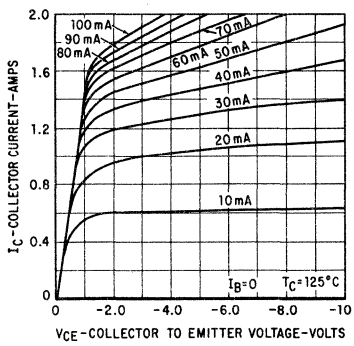
COLLECTOR CHARACTERISTICS* ACTIVE REGION



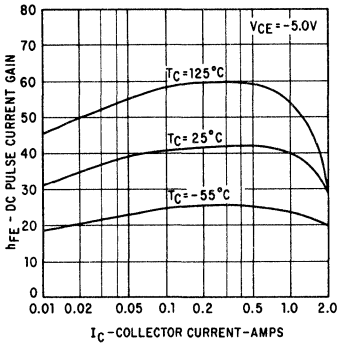
COLLECTOR CHARACTERISTICS* ACTIVE REGION



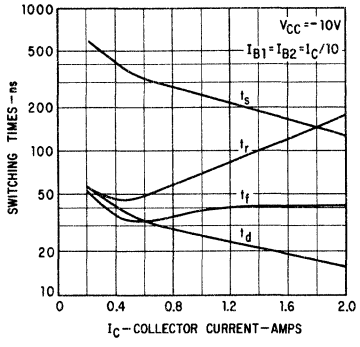
COLLECTOR CHARACTERISTICS* ACTIVE REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

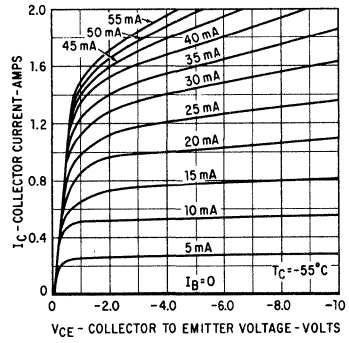


SWITCHING TIMES VERSUS COLLECTOR CURRENT

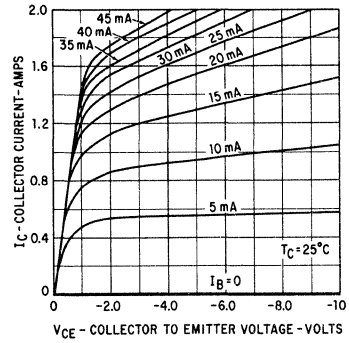


2N5001

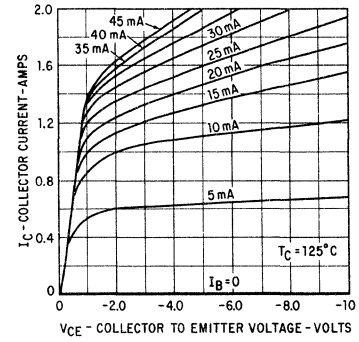
COLLECTOR CHARACTERISTICS* ACTIVE REGION



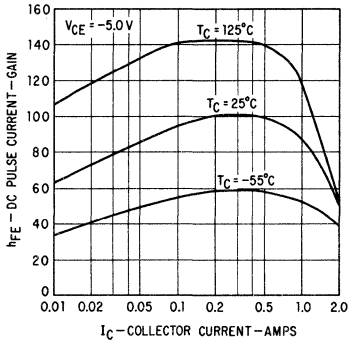
COLLECTOR CHARACTERISTICS* ACTIVE REGION



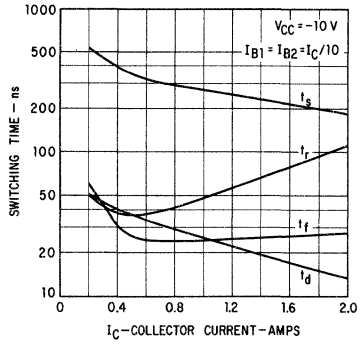
COLLECTOR CHARACTERISTICS* ACTIVE REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



SWITCHING TIMES VERSUS COLLECTOR CURRENT



* Single family characteristic on Transistor Curve Tracer.

2N5002 • 2N5004

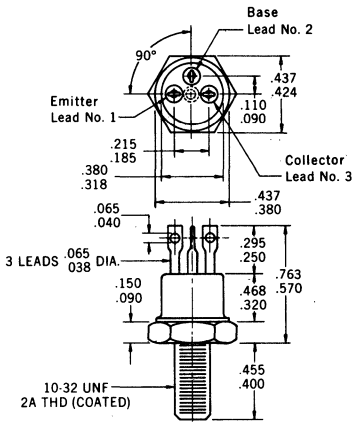
50 WATT NPN POWER TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SEE 2N5003 • 2N5005 FOR PNP COMPLEMENT

- **HIGH POWER** . . . . . **50 WATTS @ $T_C = 50°C$, $V_{CE} = 40$ V**
- **HIGH VOLTAGE** . . . . . **80 V (MIN) LV_{CEO}**
- **HIGH CURRENT SATURATION VOLTAGE** . . . . **1.5 V (MAX) V_{CE}(sat) @ 5.0 A**
- **HIGH FREQUENCY** . . . . . **60 AND 70 MHz (MIN) f_T**
- **BETA GUARANTEED @ 3 POINTS** . . . . . **50 mA, 2.5 A AND 5.0 A**
- **ISOLATED COLLECTOR PACKAGE** . . . . . **NO ISOLATING HARDWARE REQUIRED**
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**

PHYSICAL DIMENSIONS
(in accordance with JEDEC TO-59 outline)



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 6.44 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−65°C to +200°C
Operating Junction Temperature	−65°C to +200°C
Lead Temperature (Soldering, 60 second time limit)	+300°C

Maximum Power Dissipation

Total Dissipation at 50°C Case Temperature, $V_{CE} = 40$ V (See Maximum Permissible Power Curve and Note 4)	50 Watts

Maximum Voltages and Current

V_{CES}	Collector to Emitter Voltage	100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	80 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts
I_C	Collector Current	5.0 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5002 MIN.	2N5002 TYP.	2N5002 MAX.	2N5004 MIN.	2N5004 TYP.	2N5004 MAX.	UNITS	TEST CONDITIONS	
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	**80**			**80**			**Volts**	**$I_C = 100$ mA**	**$I_B = 0$**
BV_{CES}	Collector to Emitter Breakdown Voltage	100			100			Volts	$I_C = 1.0$ mA	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			6.0			Volts	$I_C = 0$	$I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**46**		**50**	**100**			**$I_C = 50$ mA**	**$V_{CE} = 5.0$ V**
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**64**	**90**	**70**	**114**	**200**		**$I_C = 2.5$ A**	**$V_{CE} = 5.0$ V**
h_{FE}(−55°C)	DC Pulse Current Gain (Note 3)	15	26		35	50			$I_C = 2.5$ A	$V_{CE} = 5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**53**		**40**	**65**			**$I_C = 5.0$ A**	**$V_{CE} = 5.0$ V**
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	**3.0**	**3.4**		**3.5**	**4.4**			**$I_C = 0.5$ A**	**$V_{CE} = 5.0$ V**
V_{CE}(sat)	Pulsed Collector Saturation Voltage (Note 3)		0.43	0.75		0.43	0.75	Volts	$I_C = 2.5$ A	$I_B = 0.25$ A
V_{CE}(sat)	**Pulsed Collector Saturation Voltage** (Note 3)		**0.85**	**1.5**		**0.85**	**1.5**	**Volts**	**$I_C = 5.0$ A**	**$I_B = 0.5$ A**

Additional Electrical Characteristics on page 2
Notes on page 2

*Planar is a patented Fairchild process.

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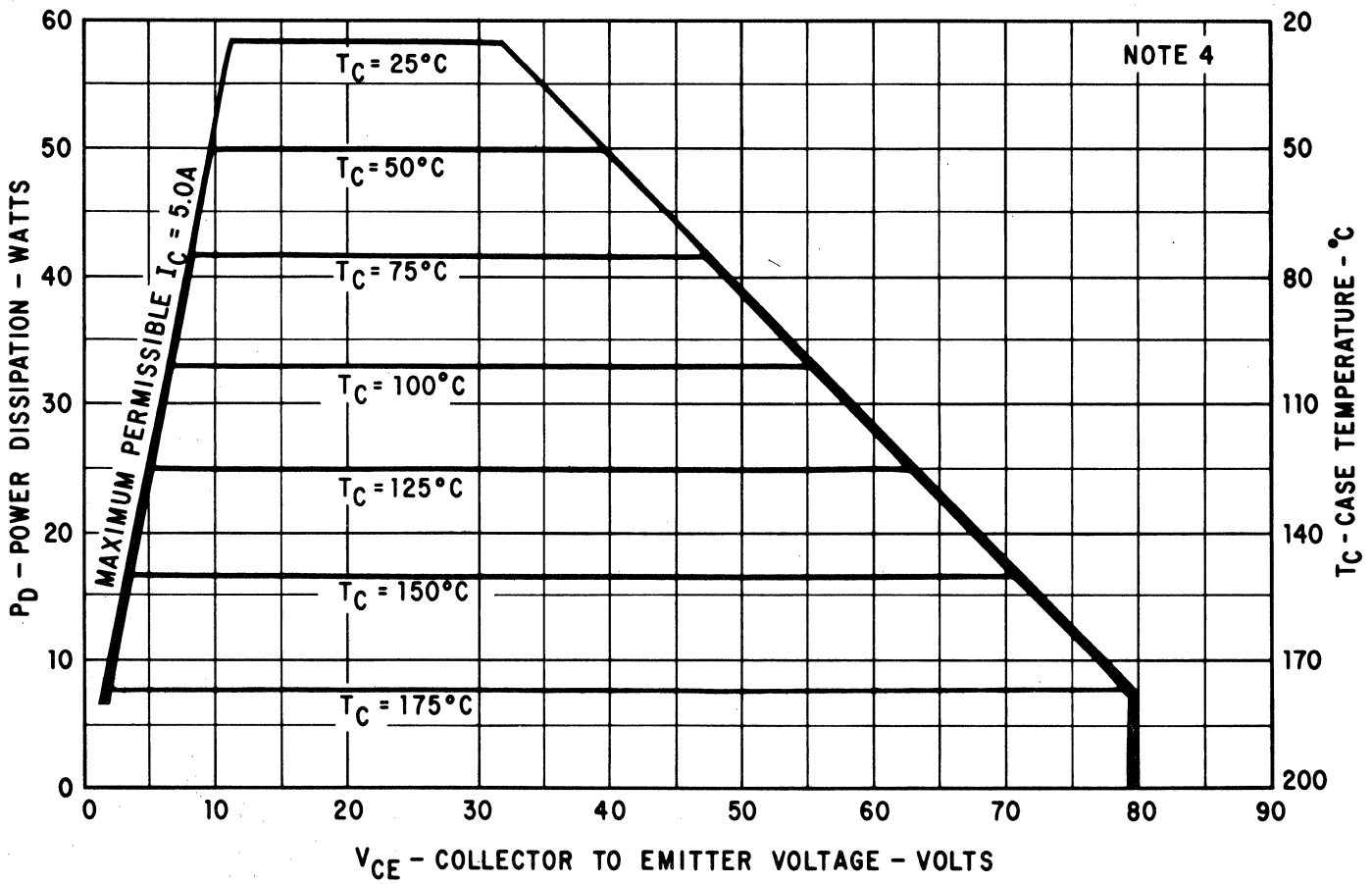
ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5002 MIN.	2N5002 TYP.	2N5002 MAX.	2N5004 MIN.	2N5004 TYP.	2N5004 MAX.	UNITS	TEST CONDITIONS	
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 3)		1.16	1.45		1.16	1.45	Volts	$I_C = 2.5$ A	$I_B = 0.25$ A
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 3)		1.50	2.2		1.50	2.2	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
V_{BE}(on)	Pulsed Base Emitter "ON" Voltage (Note 3)			1.45			1.45	Volts	$I_C = 2.5$ A	$V_{CE} = 5.0$ V
I_{CES}	Collector Cutoff Current		0.007	1.0		0.007	1.0	μA	$V_{CE} = 60$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current			1.0			1.0	μA	$I_C = 0$	$V_{EB} = 5.0$ V
I_{CEX}(150°C)	Collector Reverse Current			500			500	μA	$V_{CE} = 60$ V	$V_{EB} = 2.0$ V
C_{cb}	Collector to Base Capacitance		90	250		90	250	pF	$I_E = 0$	$V_{CB} = 10$ V

NOTES:

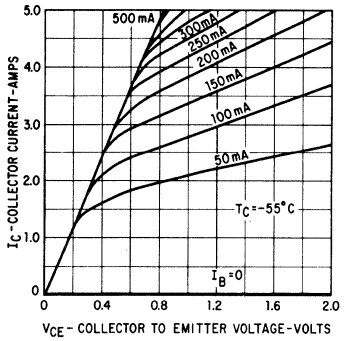
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(3) Pulse Conditions: length = 300μs; duty cycle = 1%.
(4) Contact factory for maximum permissible power under pulsed or reverse biased operating conditions.

MAXIMUM PERMISSIBLE DC FORWARD BIASED POWER DISSIPATION

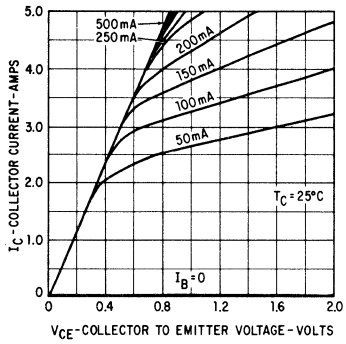


TYPICAL ELECTRICAL CHARACTERISTICS

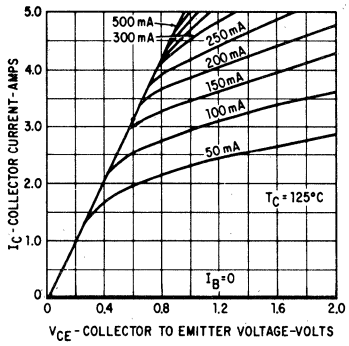
COLLECTOR CHARACTERISTICS* SATURATION REGION



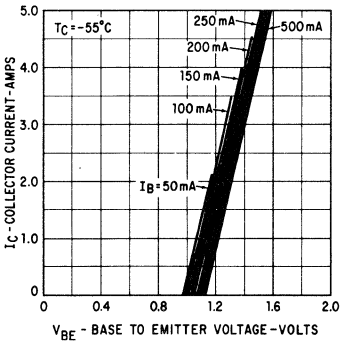
COLLECTOR CHARACTERISTICS* SATURATION REGION



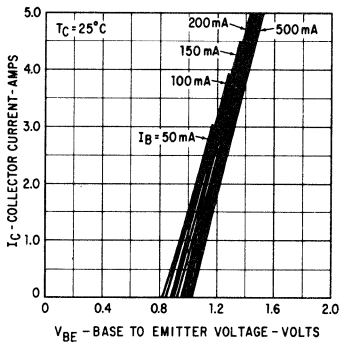
COLLECTOR CHARACTERISTICS* SATURATION REGION



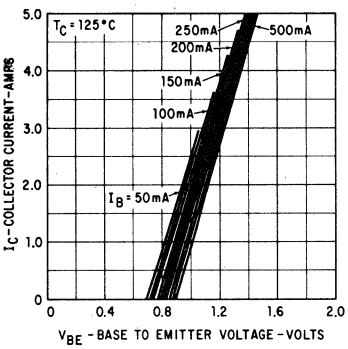
BASE CHARACTERISTICS*



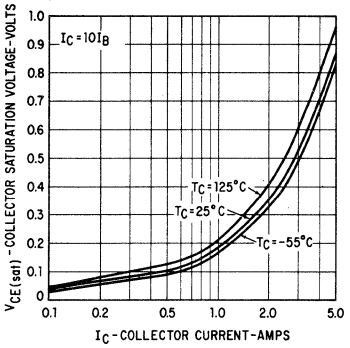
BASE CHARACTERISTICS*



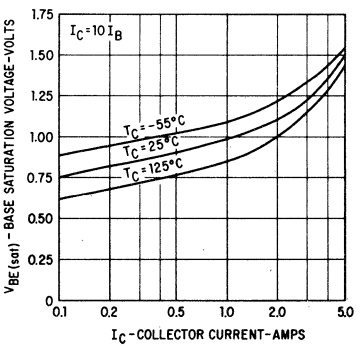
BASE CHARACTERISTICS*



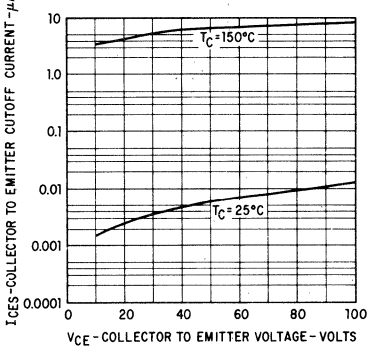
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



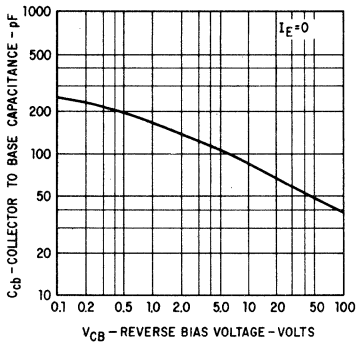
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



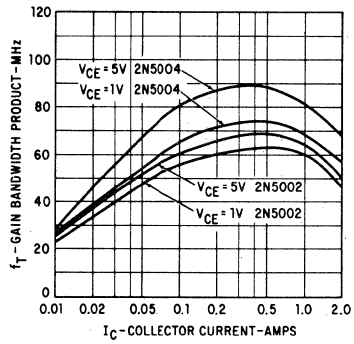
COLLECTOR CUTOFF CURRENT VERSUS COLLECTOR VOLTAGE



COLLECTOR TO BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT

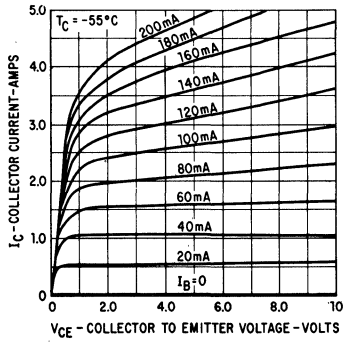


*Single Family Characteristics on Transistor Curve Tracer.

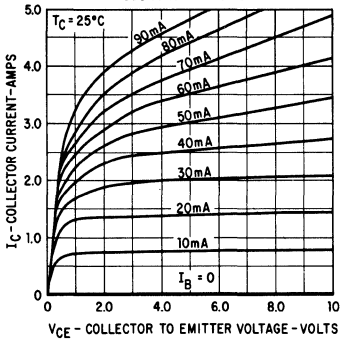
TYPICAL ELECTRICAL CHARACTERISTICS

2N5002

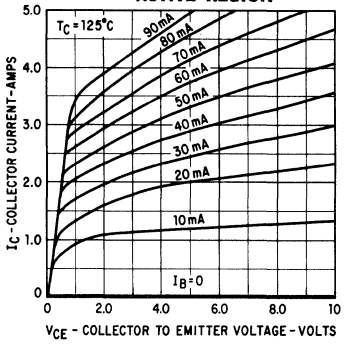
COLLECTOR CHARACTERISTICS* ACTIVE REGION



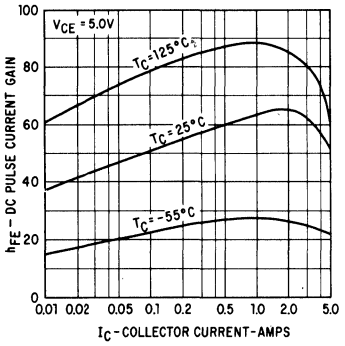
COLLECTOR CHARACTERISTICS* ACTIVE REGION



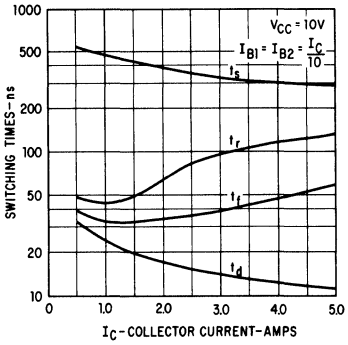
COLLECTOR CHARACTERISTICS* ACTIVE REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

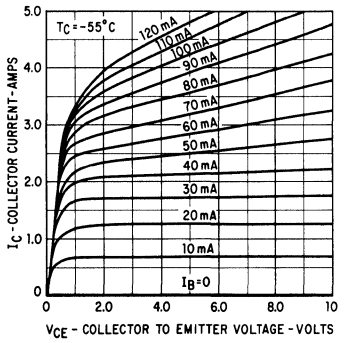


SWITCHING TIMES VERSUS COLLECTOR CURRENT

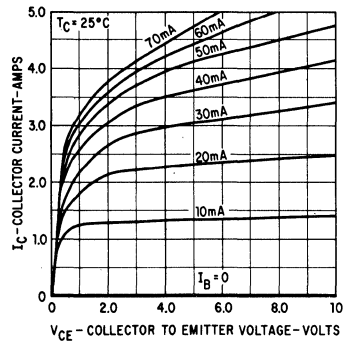


2N5004

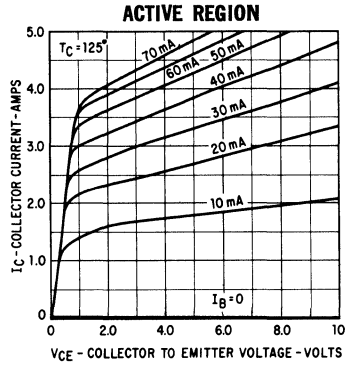
COLLECTOR CHARACTERISTICS* ACTIVE REGION



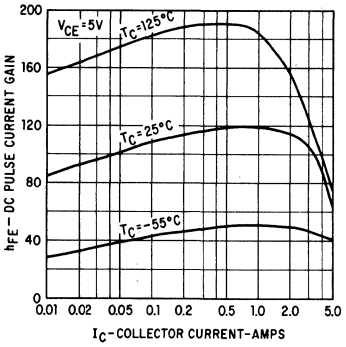
COLLECTOR CHARACTERISTICS* ACTIVE REGION



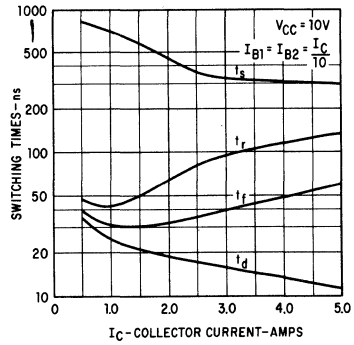
COLLECTOR CHARACTERISTICS* ACTIVE REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



SWITCHING TIMES VERSUS COLLECTOR CURRENT



*Single Family Characteristics on Transistor Curve Tracer.

2N5003 · 2N5005

50 WATT PNP POWER TRANSISTORS

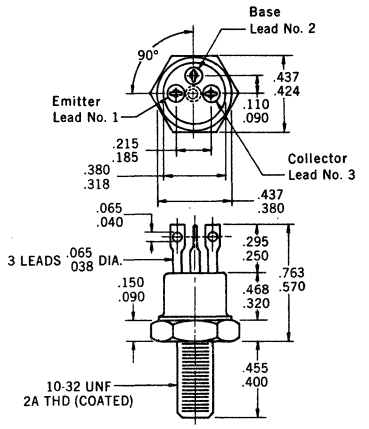
DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SEE 2N5002 • 2N5004 FOR NPN COMPLEMENT

FEATURES

- **HIGH POWER - - 50 WATTS @ $T_C = 50°C$, $V_{CE} = -40$ V**
- **HIGH VOLTAGE - - −80 V (MIN) LV_{CEO}**
- **HIGH CURRENT SAT. VOLTAGE - - −1.5 V (MAX) $V_{CE}(sat)$ @ 5.0 A**
- **HIGH FREQUENCY - - 60 AND 70 MHz (MIN) f_T**
- **BETA GUARANTEED @ 3 POINTS - - 50 mA, 2.5 A AND 5.0 A**
- **ISOLATED COLLECTOR PACKAGE - - NO ISOLATING HARDWARE REQUIRED**
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**

PHYSICAL DIMENSIONS
(in accordance with JEDEC TO-59 outline)



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 6.44 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures		
Storage Temperature		−65°C to +200°C
Operating Junction Temperature		−65°C to +200°C
Lead Temperature (Soldering, 60 seconds time limit)		+300°C
Maximum Power Dissipation		
Total Dissipation at 50°C Case Temperature, $V_{CE} = -40$ V (See Maximum Permissible Power Curve and Note 4)		50 Watts
Maximum Voltages and Current		
V_{CES}	Collector to Emitter Voltage	−100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	− 80 Volts
V_{EBO}	Emitter to Base Voltage	− 5.5 Volts
I_C	Collector Current	5.0 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5003 MIN.	2N5003 TYP.	2N5003 MAX.	2N5005 MIN.	2N5005 TYP.	2N5005 MAX.	UNITS	TEST CONDITIONS	
$V_{CEO}(sust)$	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	**−80**			**−80**			**Volts**	**$I_C = 100$ mA**	**$I_B = 0$**
BV_{CES}	Collector to Emitter Breakdown Voltage	−100			−100			Volts	$I_C = 1.0$ mA	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.5			−5.5			Volts	$I_C = 0$	$I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**52**		**50**	**133**			**$I_C = 50$ mA**	**$V_{CE} = -5.0$ V**
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**50**	**90**	**70**	**114**	**200**		**$I_C = 2.5$A**	**$V_{CE} = -5.0$ V**
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	15	32		35	90			$I_C = 2.5$ A	$V_{CE} = -5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**38**		**40**	**77**			**$I_C = 5.0$ A**	**$V_{CE} = -5.0$ V**
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	**3.0**	**4.05**		**3.5**	**4.85**			**$I_C = 0.5$ A**	**$V_{CE} = -5.0$ V**
$V_{CE}(sat)$	Pulsed Collector Saturation Voltage (Note 3)		−0.45	−0.75		−0.45	−0.75	Volts	$I_C = 2.5$ A	$I_B = 0.25$ A
$V_{CE}(sat)$	**Pulsed Collector Saturation Voltage** (Note 3)		**−0.9**	**−1.5**		**−0.9**	**−1.5**	**Volts**	**$I_C = 5.0$ A**	**$I_B = 0.5$ A**

Additional Electrical Characteristics on page 2

*Planar is a patented Fairchild process.

FAIRCHILD SEMICONDUCTOR
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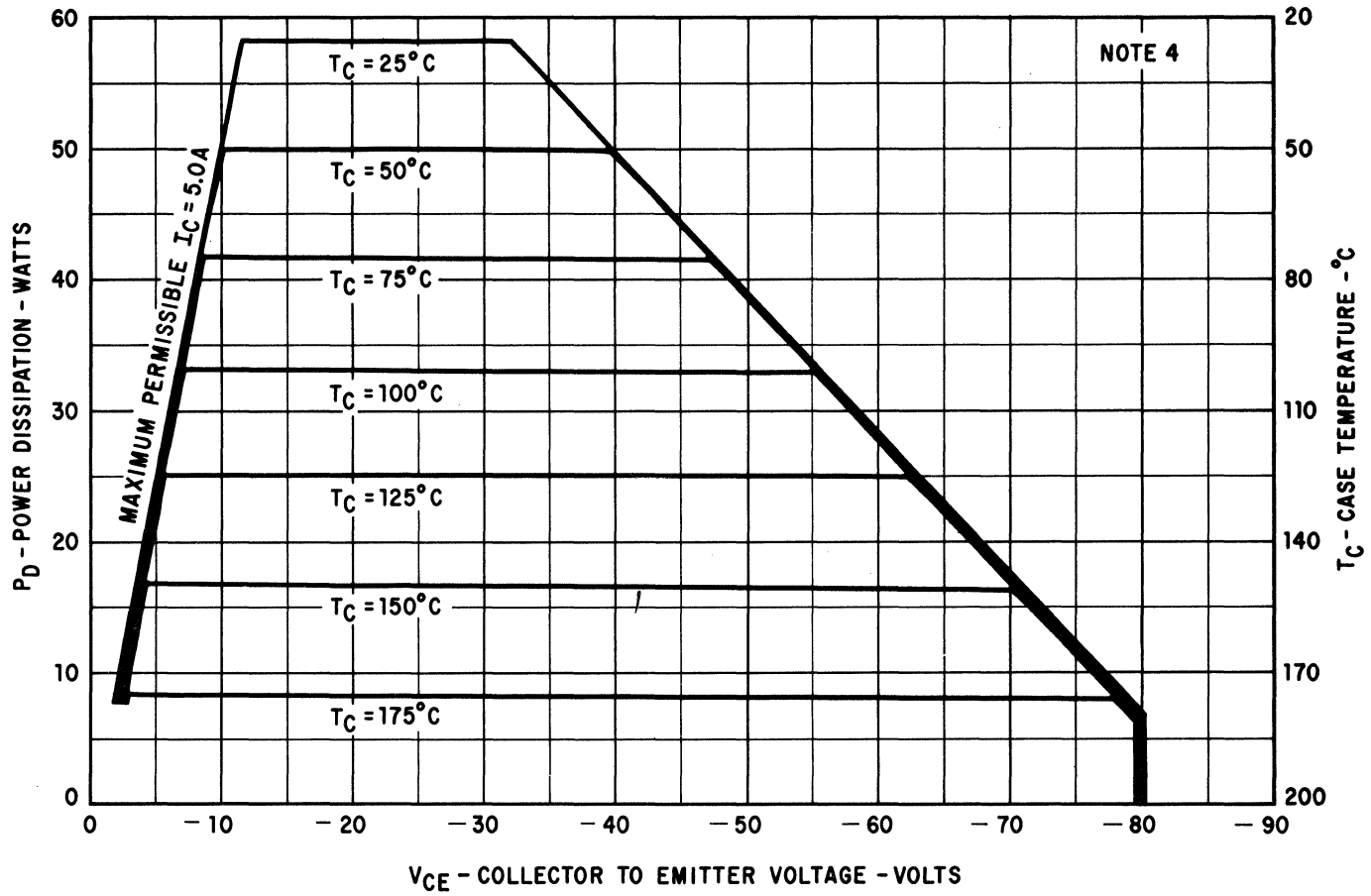
ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5003 MIN.	2N5003 TYP.	2N5003 MAX.	2N5005 MIN.	2N5005 TYP.	2N5005 MAX.	UNITS	TEST CONDITIONS	
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 3)		−1.1	−1.45		−1.1	−1.45	Volts	$I_C = 2.5$ A	$I_B = 0.25$ A
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 3)		−1.55	−2.2		−1.55	−2.2	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
V_{BE}(on)	Pulsed Base Emitter "ON" Voltage (Note 3)			−1.45			−1.45	Volts	$I_C = 2.5$ A	$V_{CE} = -5.0$ V
I_{CES}	Collector Cutoff Current		0.006	1.0		0.006	1.0	μA	$V_{CE} = -60$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current			1.0			1.0	μA	$I_C = 0$	$V_{BE} = 4.0$ V
I_{CEX}(150°C)	Collector Reverse Current			500			500	μA	$V_{CE} = -60$ V	$V_{BE} = 2.0$ V
C_{cb}	Collector to Base Capacitance		170	250		170	250	pF	$I_E = 0$	$V_{CB} = -10$ V

NOTES:

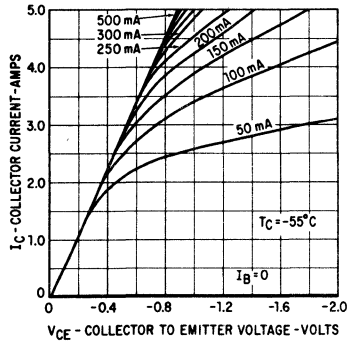
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(3) Pulse Conditions: length = 300μs; duty cycle = 1%.
(4) Contact factory for maximum permissible power under pulsed or reverse biased operating conditions.

MAXIMUM PERMISSIBLE DC FORWARD BIASED POWER DISSIPATION

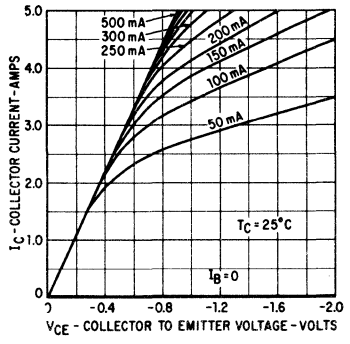


TYPICAL ELECTRICAL CHARACTERISTICS

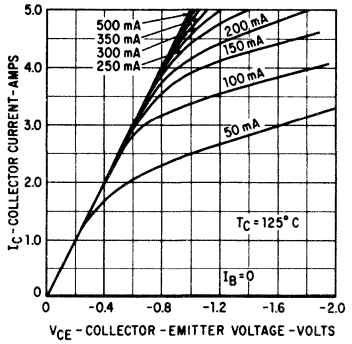
COLLECTOR CHARACTERISTICS SATURATION REGION



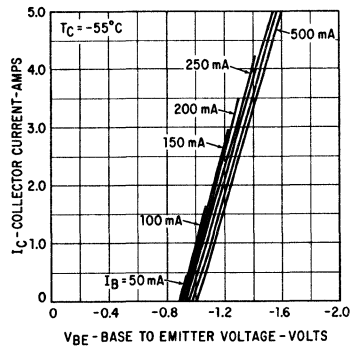
COLLECTOR CHARACTERISTICS SATURATION REGION



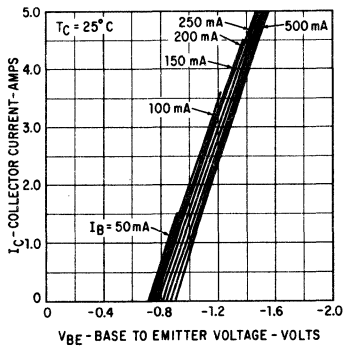
COLLECTOR CHARACTERISTICS SATURATION REGION



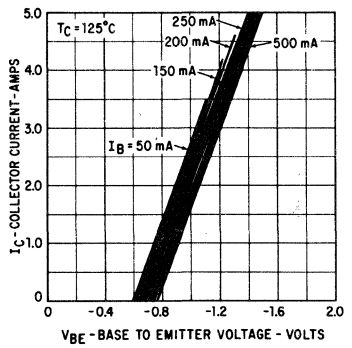
BASE CHARACTERISTICS



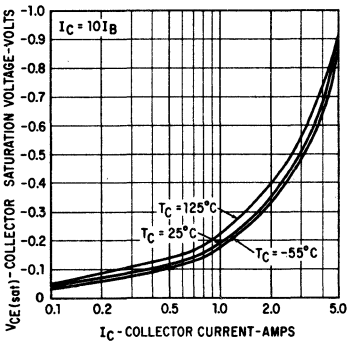
BASE CHARACTERISTICS



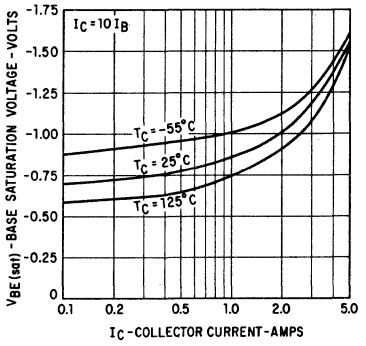
BASE CHARACTERISTICS



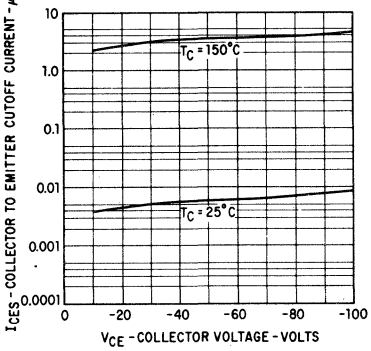
COLLECTOR SATURATION VOLTAGE VS. COLLECTOR CURRENT



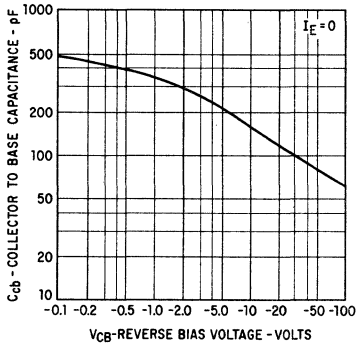
BASE SATURATION VOLTAGE VS. COLLECTOR CURRENT



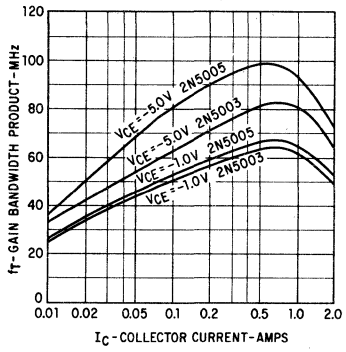
COLLECTOR CUTOFF CURRENT VERSUS COLLECTOR VOLTAGE



COLLECTOR TO BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



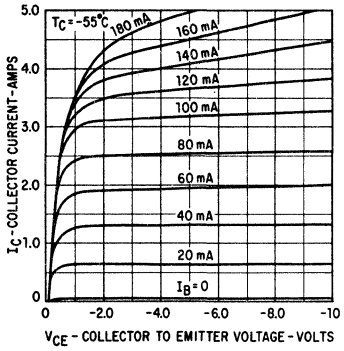
GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT



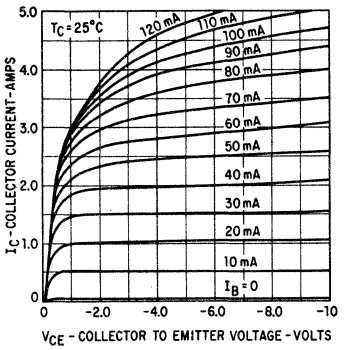
TYPICAL ELECTRICAL CHARACTERISTICS

2N5003

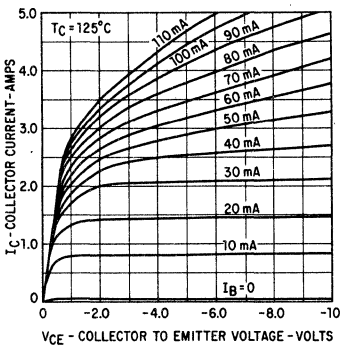
COLLECTOR CHARACTERISTICS



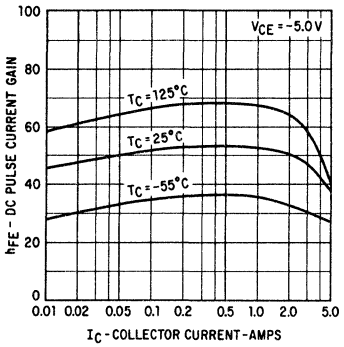
COLLECTOR CHARACTERISTICS



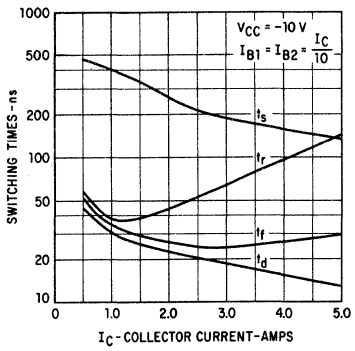
COLLECTOR CHARACTERISTICS



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

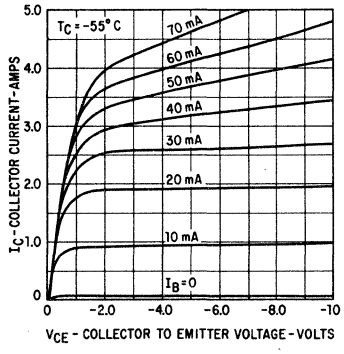


SWITCHING TIMES VERSUS COLLECTOR CURRENT

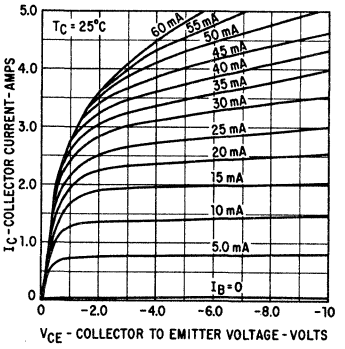


2N5005

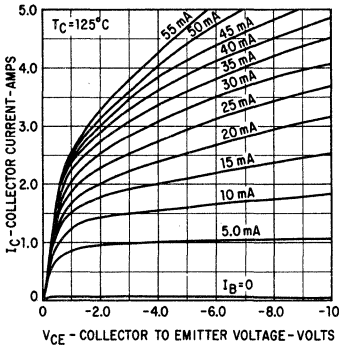
COLLECTOR CHARACTERISTICS



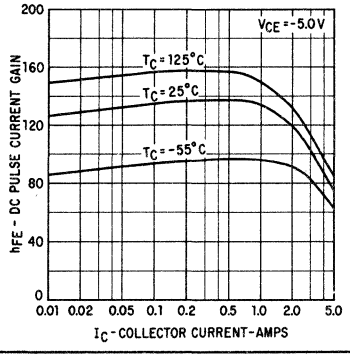
COLLECTOR CHARACTERISTICS



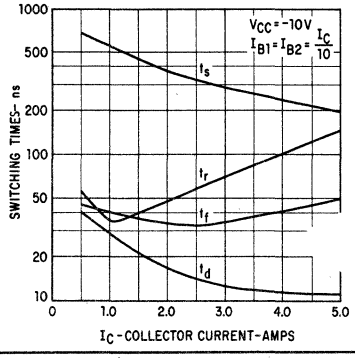
COLLECTOR CHARACTERISTICS



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



SWITCHING TIMES VERSUS COLLECTOR CURRENT



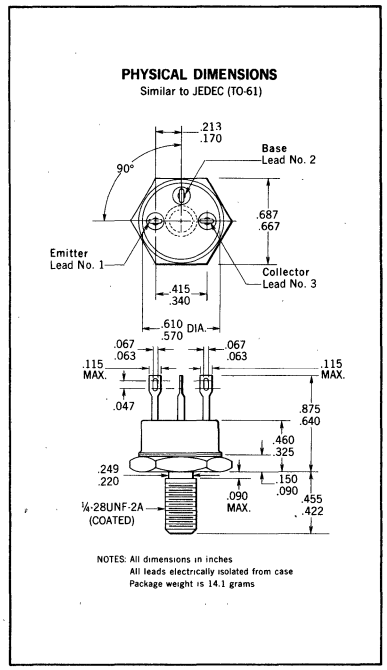
2N5006 · 2N5008

100 WATT NPN POWER TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SEE 2N5007 • 2N5009 FOR PNP COMPLEMENT

- **HIGH POWER - - 100 WATTS @ $T_C = 50°C$, $V_{CE} = 40$ V**
- **HIGH VOLTAGE - - 80 V (MIN) LV_{CEO}**
- **HIGH CURRENT SATURATION VOLTAGE - - 1.5 VOLTS (MAX) $V_{CE}(sat)$ @ 10 A**
- **HIGH FREQUENCY - - 30 AND 40 MHz (MIN) f_T**
- **BETA GUARANTEED AT 3 POINTS - - 100 mA, 5.0 A AND 10 A**
- **ISOLATED COLLECTOR PACKAGE - - NO ISOLATING HARDWARE REQUIRED**
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**



ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−65°C to +200°C
Operating Junction Temperature	−65°C to +200°C
Lead Temperature (Soldering, 60 seconds time limit)	+300°C

Maximum Power Dissipation

Total Dissipation at 50°C Case Temperature, $V_{CE} = 40$V (See Maximum Permissible Power Curve and Note 4)	**100 Watts**

Maximum Voltages and Current

V_{CES}	Collector to Emitter Voltage	100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	80 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts
I_C	Collector Current	10 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5006 MIN.	2N5006 TYP.	2N5006 MAX.	2N5008 MIN.	2N5008 TYP.	2N5008 MAX.	UNITS	TEST CONDITIONS	
$V_{CEO}(sust)$	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	**80**			**80**			**Volts**	**$I_C = 200$ mA**	**$I_B = 0$**
BV_{CES}	Collector to Emitter Breakdown Voltage	100			100			Volts	$I_C = 1.0$ mA	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			6.0			Volts	$I_C = 0$	$I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**35**		**50**	**95**			**$I_C = 100$ mA**	**$V_{CE} = 5.0$ V**
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**42**	**90**	**70**	**108**	**200**		**$I_C = 5.0$ A**	**$V_{CE} = 5.0$ V**
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	12	18		35	51			$I_C = 5.0$ A	$V_{CE} = 5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**33**		**45**	**91**			**$I_C = 10$ A**	**$V_{CE} = 5.0$ V**
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	**1.5**	**2.05**		**2.0**	**2.8**			**$I_C = 2.0$ A**	**$V_{CE} = 5.0$ V**
$V_{CE}(sat)$	Pulsed Collector Saturation Voltage (Note 3)		0.55	0.9		0.55	0.9	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
$V_{CE}(sat)$	**Pulsed Collector Saturation Voltage** (Note 3)		**1.1**	**1.5**		**1.1**	**1.5**	**Volts**	**$I_C = 10$ A**	**$I_B = 1.0$ A**

Additional Electrical Characteristics on page 2

*Planar is a patented Fairchild process.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

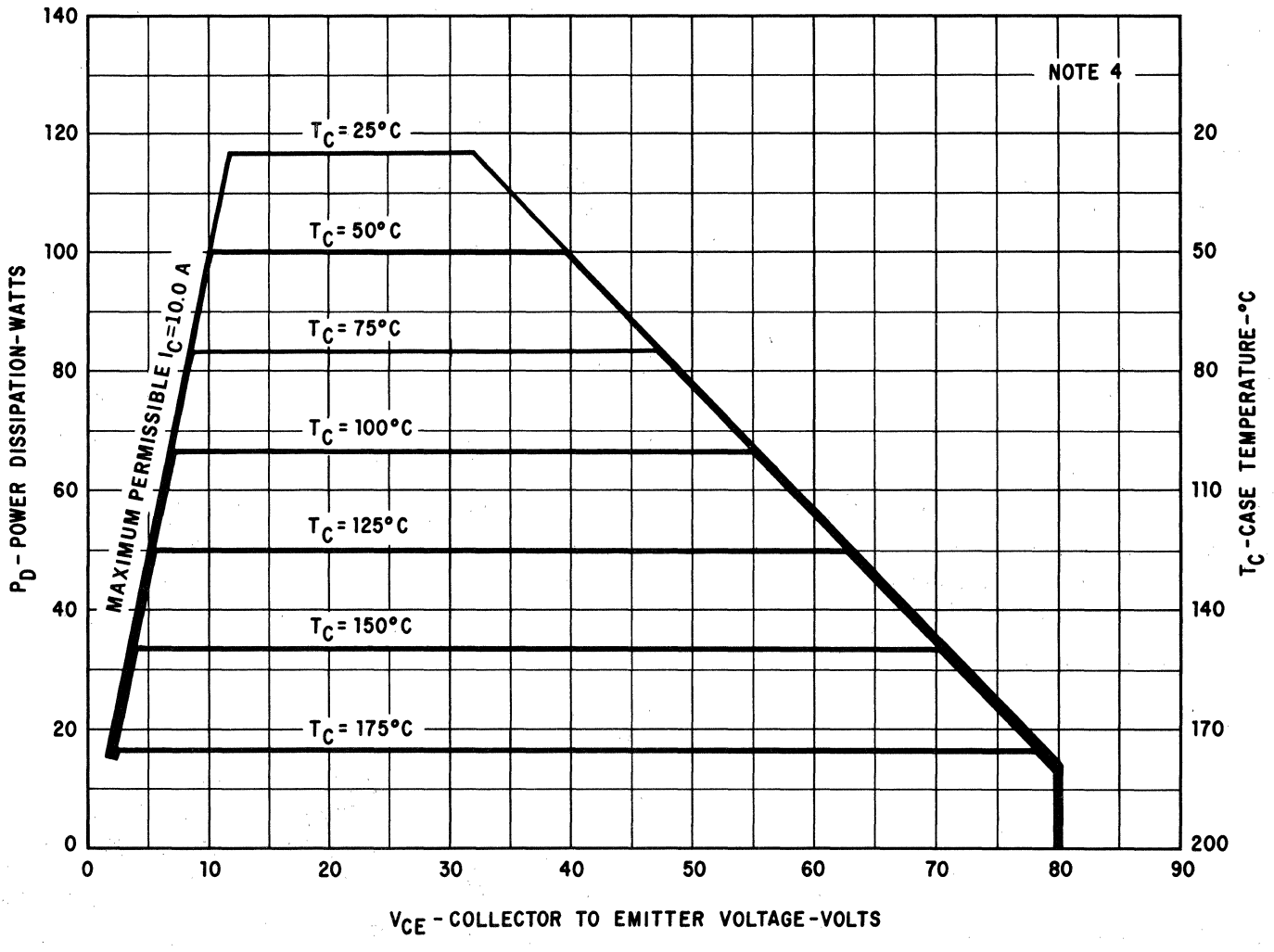
ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5006 MIN.	2N5006 TYP.	2N5006 MAX.	2N5008 MIN.	2N5008 TYP.	2N5008 MAX.	UNITS	TEST CONDITIONS	
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 3)		1.2	1.8		1.2	1.8	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 3)		1.7	2.2		1.7	2.2	Volts	$I_C = 10$ A	$I_B = 1.0$ A
V_{BE}(on)	Pulsed Base Emitter "ON" Voltage (Note 3)			1.8			1.8	Volts	$I_C = 5.0$ A	$V_{CE} = 5.0$ V
I_{CES}	Collector Cutoff Current		0.014	1.0		0.014	1.0	μA	$V_{CE} = 60$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current			1.0			1.0	μA	$I_C = 0$	$V_{EB} = 5.0$ V
I_{CEX}(150°C)	Collector Reverse Current			500			500	μA	$V_{CE} = 60$ V	$V_{EB} = 2.0$ V
C_{cb}	Collector to Base Capacitance (f = 1.0 MHz)		235	275		235	275	pF	$I_E = 0$	$V_{CB} = 10$ V

NOTES:

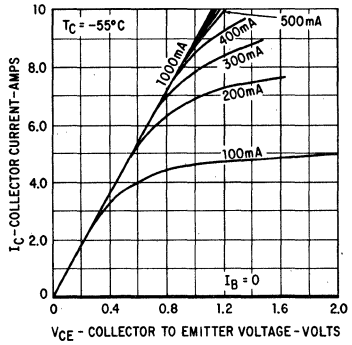
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(3) Pulse Conditions: length = 300μs; duty cycle = 1%.
(4) Contact factory for maximum permissible power under pulsed or reverse biased operating conditions.

MAXIMUM PERMISSIBLE DC FORWARD BIASED POWER DISSIPATION

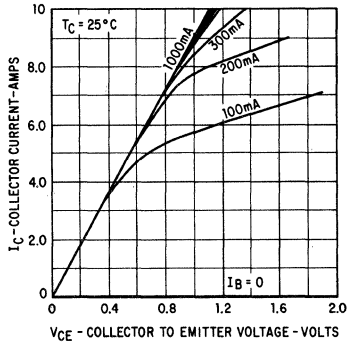


TYPICAL ELECTRICAL CHARACTERISTICS

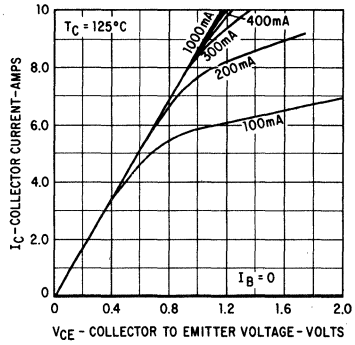
COLLECTOR CHARACTERISTICS* SATURATION REGION



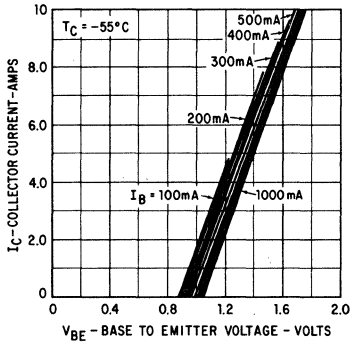
COLLECTOR CHARACTERISTICS* SATURATION REGION



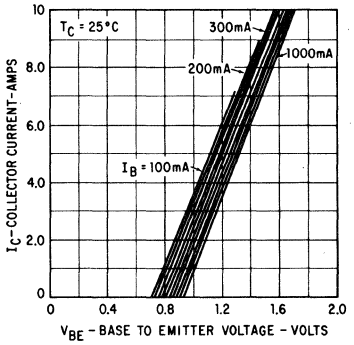
COLLECTOR CHARACTERISTICS* SATURATION REGION



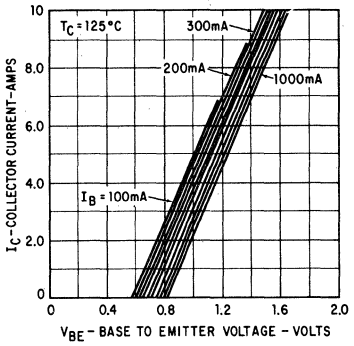
BASE CHARACTERISTICS*



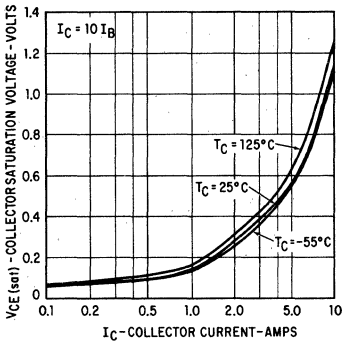
BASE CHARACTERISTICS*



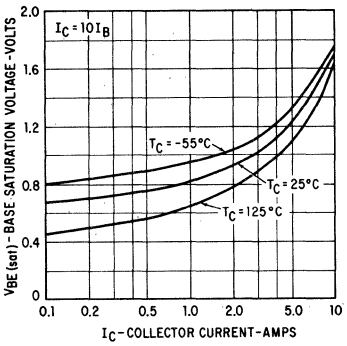
BASE CHARACTERISTICS*



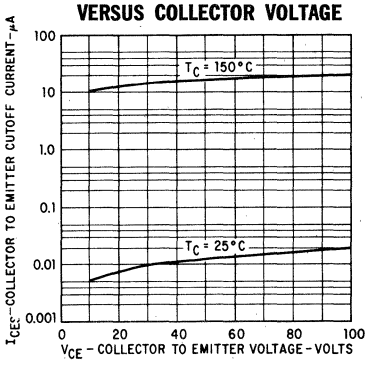
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



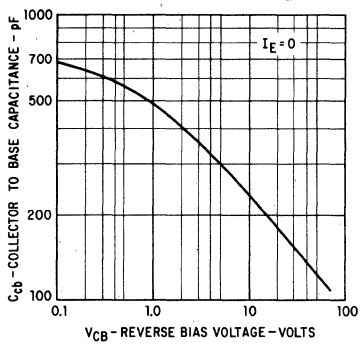
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



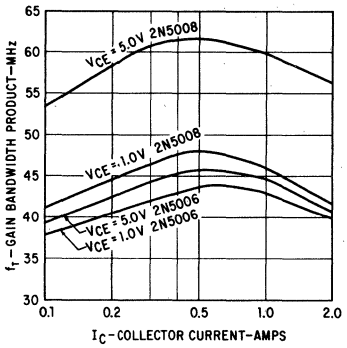
COLLECTOR CUTOFF CURRENT VERSUS COLLECTOR VOLTAGE



COLLECTOR TO BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT

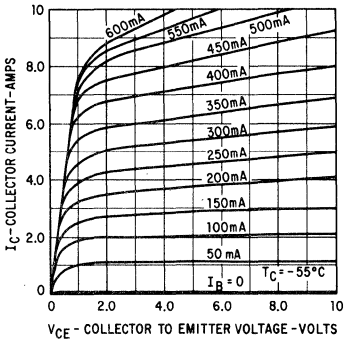


* Single family characteristics on transistor curve tracer.

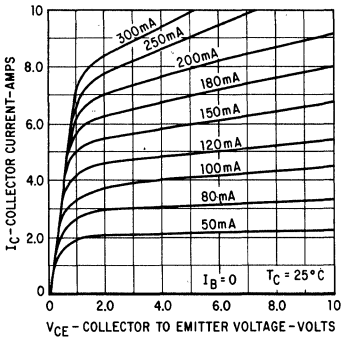
TYPICAL ELECTRICAL CHARACTERISTICS

2N5006

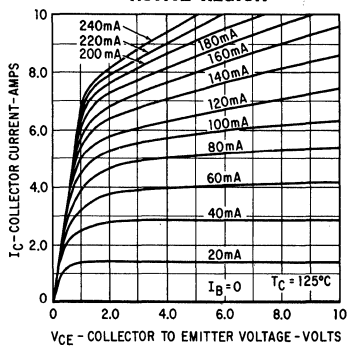
COLLECTOR CHARACTERISTICS* ACTIVE REGION



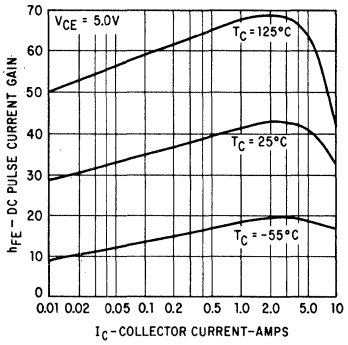
COLLECTOR CHARACTERISTICS* ACTIVE REGION



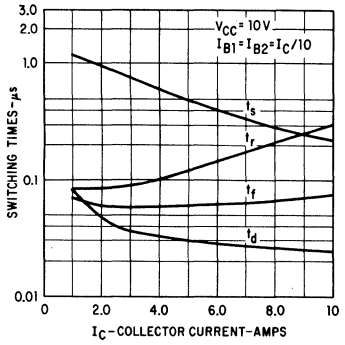
COLLECTOR CHARACTERISTICS* ACTIVE REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

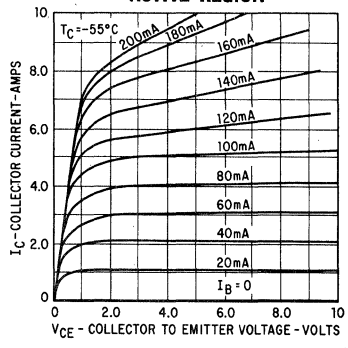


SWITCHING TIMES VERSUS COLLECTOR CURRENT

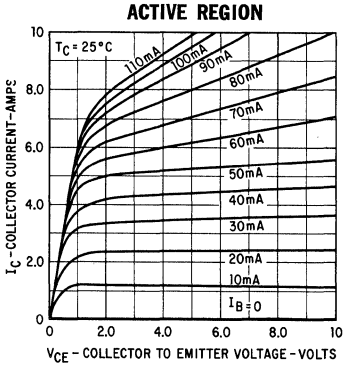


2N5008

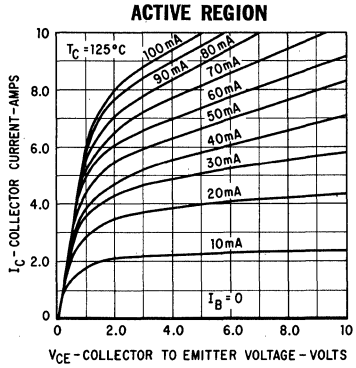
COLLECTOR CHARACTERISTICS* ACTIVE REGION



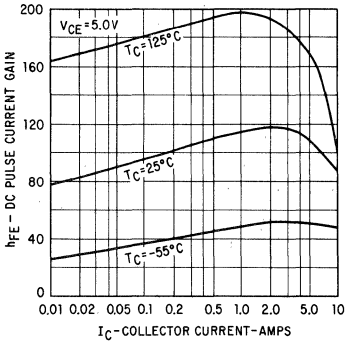
COLLECTOR CHARACTERISTICS* ACTIVE REGION



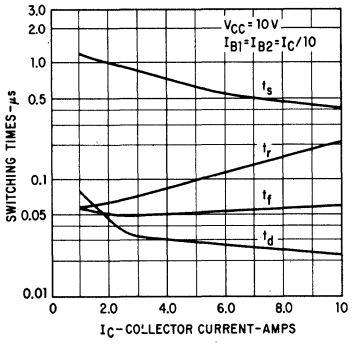
COLLECTOR CHARACTERISTICS* ACTIVE REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



SWITCHING TIMES VERSUS COLLECTOR CURRENT



*Single family characteristic on Transistor Curve Tracer.

2N5007 • 2N5009

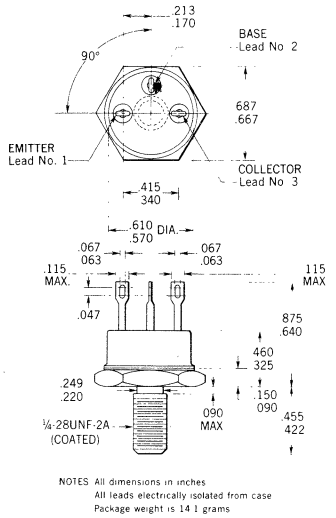
100 WATT PNP POWER TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SEE 2N5006 • 2N5008 FOR NPN COMPLEMENT

- **HIGH POWER . . . . . 100 WATTS AT $T_C = 50°C$, $V_{CE} = -40$ V**
- **HIGH VOLTAGE . . . . . —80 V (MIN) LV_{CEO}**
- **HIGH CURRENT SATURATION VOLTAGE . . . —1.5 V (MAX) $V_{CE(sat)}$ AT 10 A**
- **HIGH FREQUENCY . . . . . 30 AND 40 MHz (MIN) f_T**
- **BETA GUARANTEED AT 3 POINTS . . . . . 100 mA, 5.0 A AND 10 A**
- **ISOLATED COLLECTOR PACKAGE . . . . . NO ISOLATING HARDWARE REQUIRED**
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**

PHYSICAL DIMENSIONS
Similar to JEDEC (TO-61)



NOTES All dimensions in inches
All leads electrically isolated from case
Package weight is 14.1 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	—65°C to +200°C
Operating Junction Temperature	—65°C to +200°C
Lead Temperature (Soldering, 60 seconds time limit)	+300°C

Maximum Power Dissipation

Total Dissipation at 50°C Case Temperature, $V_{CE} = -40$ V (See Maximum Permissible Power Curve and Note 4)	**100 Watts**

Maximum Voltages and Current

V_{CES}	Collector to Emitter Voltage	—100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	—80 Volts
V_{EBO}	Emitter to Base Voltage	—5.5 Volts
I_C	Collector Current	10 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5007 MIN.	2N5007 MAX.	2N5009 MIN.	2N5009 MAX.	UNITS	TEST CONDITIONS	
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	**—80**		**—80**		**Volts**	**$I_C = 200$ mA**	**$I_B = 0$**
BV_{CES}	Collector to Emitter Breakdown Voltage	—100		—100		Volts	$I_C = 1.0$ mA	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	—5.5		—5.5		Volts	$I_C = 0$	$I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**		**50**			**$I_C = 100$ mA**	**$V_{CE} = -5.0$ V**
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**90**	**70**	**200**		**$I_C = 5.0$ A**	**$V_{CE} = -5.0$ V**
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	12		35			$I_C = 5.0$ A	$V_{CE} = -5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**		**45**			**$I_C = 10$ A**	**$V_{CE} = -5.0$ V**
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	**1.5**		**2.0**			**$I_C = 2.0$ A**	**$V_{CE} = -5.0$ V**
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 3)		—0.9		—0.9	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 3)		**—1.5**		**—1.5**	**Volts**	**$I_C = 10$ A**	**$I_B = 1.0$ A**

Additional Electrical Characteristics on page 2

*Planar is a patented Fairchild process.

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313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

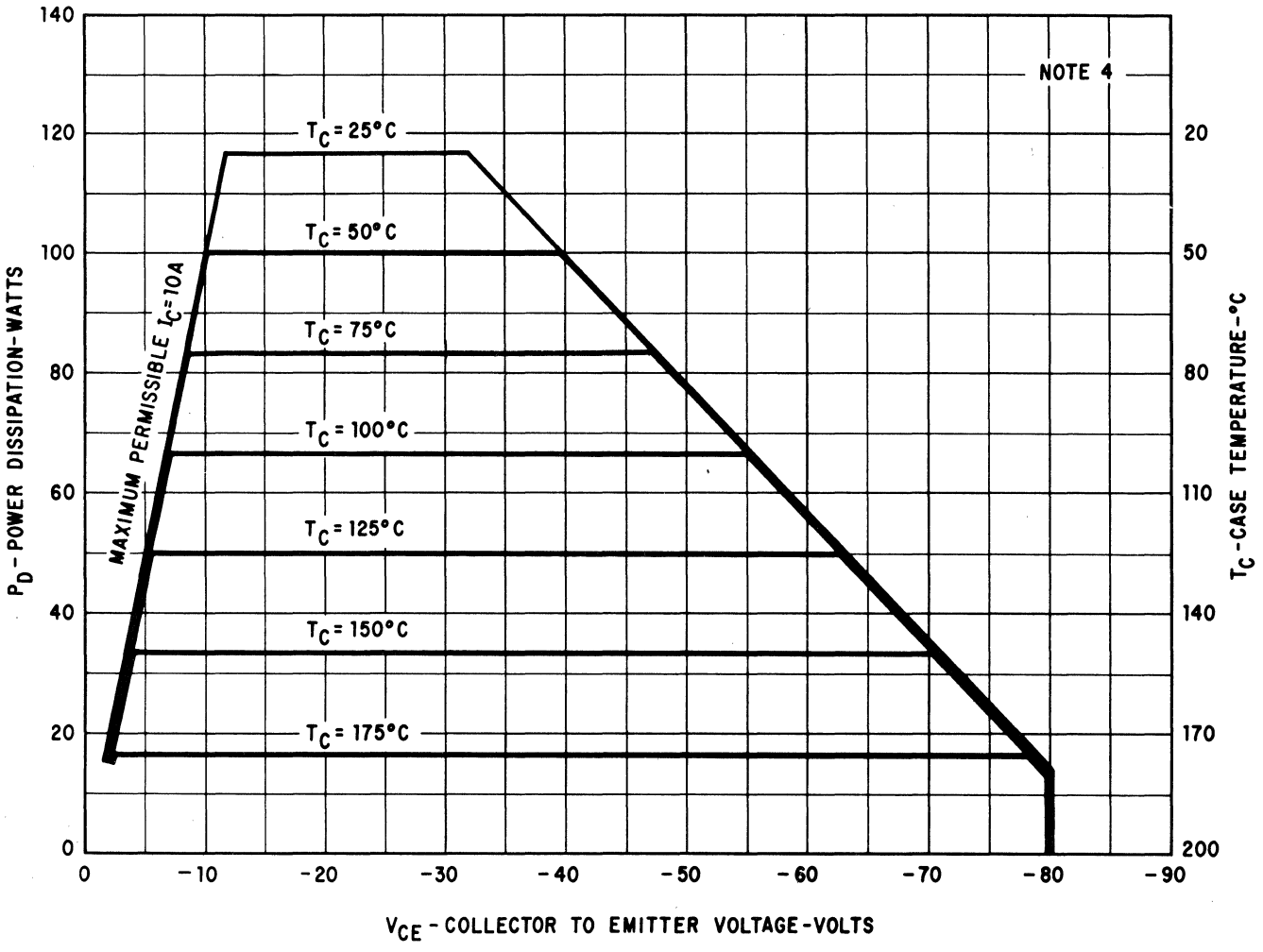
ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5007 MIN.	2N5007 MAX.	2N5009 MIN.	2N5009 MAX.	UNITS	TEST CONDITIONS	
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		−1.8		−1.8	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		−2.2		−2.2	Volts	$I_C = 10$ A	$I_B = 1.0$ A
$V_{BE(on)}$	Pulsed Base Emitter "ON" Voltage (Note 3)		−1.8		−1.8	Volts	$I_C = 5.0$ A	$V_{CE} = -5.0$ V
I_{CES}	Collector Cutoff Current		1.0		1.0	μA	$V_{CE} = -60$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current		1.0		1.0	μA	$I_C = 0$	$V_{EB} = -4.0$ V
I_{CEX}(150°C)	Collector Reverse Current		500		500	μA	$V_{CE} = -60$ V	$V_{EB} = -2.0$ V
C_{cb}	Collector to Base Capacitance (f = 1.0 MHz)		500		500	pF	$I_E = 0$	$V_{CB} = -10$ V

NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest.
(3) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(4) Contact factory for maximum permissible power under pulsed or reverse biased operating conditions.

MAXIMUM PERMISSIBLE DC FORWARD BIASED POWER DISSIPATION



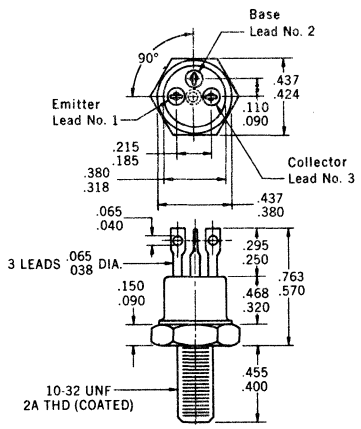
2N5083 • 2N5084 • 2N5085

35 WATT NPN POWER TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **HIGH VOLTAGE . . . . . 150 AND 120 VOLT (MIN) BV_{CES}, 80 AND 60 VOLT (MIN) LV_{CEO}**
- **LOW $V_{CE(sat)}$ . . . . . 1.0 VOLT (MAX) AT $I_C = 10$ A, $I_B = 2.0$ A**
- **HIGH SPEED . . . . . MAX. t_{on} OF 350 ns AND t_{off} OF 650 ns AT $I_C = 5.0$ A, $I_B = 0.5$ A**
- **HIGH FREQUENCY . . . $f_T = 50$ AND 80 MHz (MIN)**
- **LOW LEAKAGE . . . . . MAX. I_{CES} OF 100 μA AT 150°C AS A RESULT OF PLANAR CONSTRUCTION**

PHYSICAL DIMENSIONS
(in accordance with JEDEC TO-59 outline)



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 6.44 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature Range	−65°C to +200°C
Operating Junction Temperature	+200°C
Lead Temperature (Soldering, 60 second time limit)	+300°C

Maximum Power Dissipation (Notes 2 and 3)

Total Dissipation at 25°C Case Temperature	35 Watts

	Maximum Voltages and Currents	**2N5083 2N5084**	**2N5085**
V_{CBO}	Collector to Base Voltage	120 Volts	150 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	60 Volts	80 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts	6.0 Volts
I_C	Collector Current	10 Amps	10 Amps
I_B	Base Current	2.0 Amps	2.0 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS		MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
BV_{CES}	**Collector to Emitter Breakdown Voltage**	**2N5083 2N5084**	**120**			**Volts**	**$I_C = 1.0$ mA**	**$V_{BE} = 0$**
		2N5085	**150**			**Volts**	**$I_C = 1.0$ mA**	**$V_{BE} = 0$**
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	2N5083 2N5084	60			Volts	$I_C = 50$ mA	$I_B = 0$
		2N5085	80			Volts	$I_C = 50$ mA	$I_B = 0$
BV_{EBO}	Emitter to Base Voltage		6.0			Volts	$I_C = 0$	$I_E = 1.0$ mA
I_{CES}	Collector Reverse Current	2N5083 2N5084		0.001	1.0	μA	$V_{CE} = 60$ V	$V_{BE} = 0$
		2N5085		0.001	1.0	μA	$V_{CE} = 100$ V	$V_{BE} = 0$
I_{EBO}	Emitter Reverse Current			0.002	1.0	μA	$I_C = 0$	$V_{EB} = 4.0$ V
h_{FE}	D.C. Pulse Current Gain (Note 5)	2N5084	100	150	300		$I_C = 2.0$ A	$V_{CE} = 2.0$ V
		2N5083 2N5085	40	75	120		$I_C = 2.0$ A	$V_{CE} = 2.0$ V
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 5)			**0.8**	**1.0**	**Volts**	**$I_C = 10$ A**	**$I_B = 2.0$ A**
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 5)			1.15	1.8	Volts	$I_C = 10$ A	$I_B = 2.0$ A
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 5)			0.35	0.5	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 5)			1.0	1.3	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
C_{cb}	Collector to Base Capacitance			45	80	pF	$I_E = 0$	$V_{CB} = 10$ V
C_{eb}	Emitter to Base Capacitance			330	500	pF	$I_C = 0$	$V_{EB} = 0.5$ V

Notes on Page 2 Additional Electrical Characteristics on Page 2

*Planar is a patented Fairchild process.

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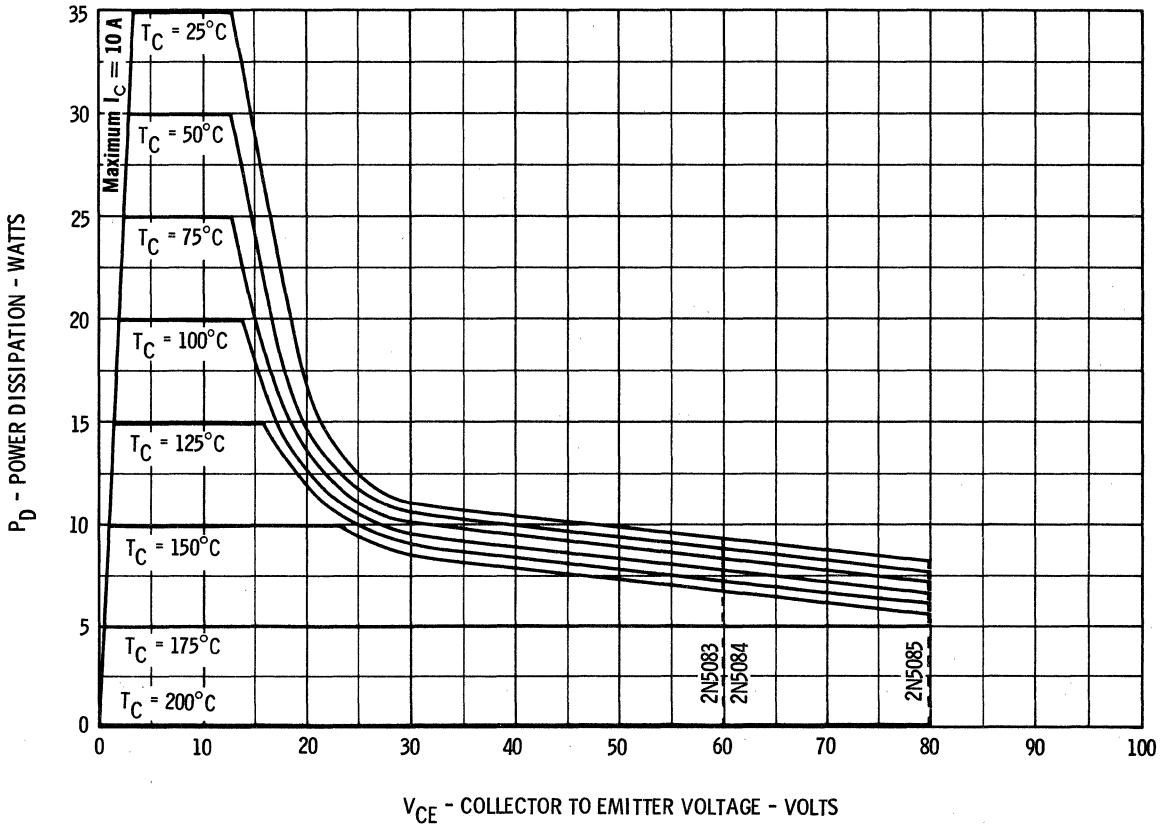
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS		MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
t_d	**Delay Time** (Note 6)			20	50	ns	$I_C = 5.0$ A	$I_{B1} = 0.5$ A
t_r	**Rise Time** (Note 6)			160	300	ns	$I_C = 5.0$ A	$I_{B1} = 0.5$ A
t_s	**Storage Time** (Note 6)			180	350	ns	$I_C = 5.0$ A	$I_{B1} = 0.5$ A $I_{B2} = -0.5$ A
t_f	**Fall Time** (Note 6)			120	300	ns	$I_C = 5.0$ A	$I_{B1} = 0.5$ A $I_{B2} = -0.5$ A
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	2N5084	4.0	6.0			$I_C = 0.5$ A	$V_{CE} = 5.0$ V
		2N5083 2N5085	2.5	6.0			$I_C = 0.5$ A	$V_{CE} = 5.0$ V
$h_{FE}(-55°C)$	D.C. Pulse Current Gain (Note 5)	2N5084	35	75			$I_C = 2.0$ A	$V_{CE} = 2.0$ V
		2N5083 2N5085	15	40			$I_C = 2.0$ A	$V_{CE} = 2.0$ V
$I_{CES}(150°C)$	**Collector Reverse Current**	2N5083 2N5084		2.0	100	μA	$V_{CE} = 60$ V	$V_{BE} = 0$
		2N5085		3.0	100	μA	$V_{CE} = 100$ V	$V_{BE} = 0$

MAXIMUM PERMISSIBLE DC FORWARD BIAS POWER DISSIPATION

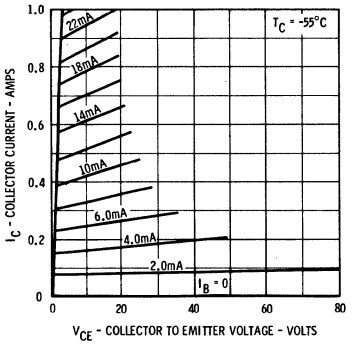


NOTES:
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
(3) See Maximum Permissible D.C. Forward Bias Power Dissipation graph.
(4) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(5) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(6) Test conditions are given in the switching circuit.

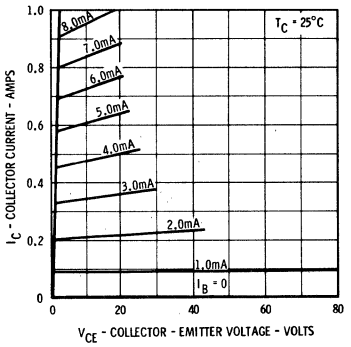
TYPICAL ELECTRICAL CHARACTERISTICS

2N5083 • 2N5085

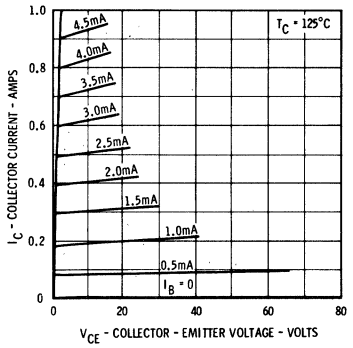
COLLECTOR CHARACTERISTICS* ACTIVE REGION



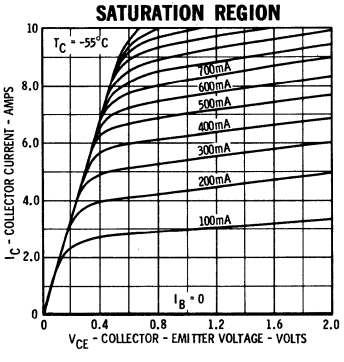
COLLECTOR CHARACTERISTICS* ACTIVE REGION



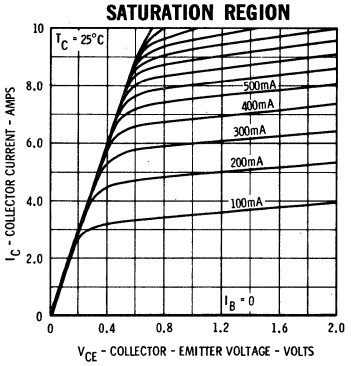
COLLECTOR CHARACTERISTICS* ACTIVE REGION



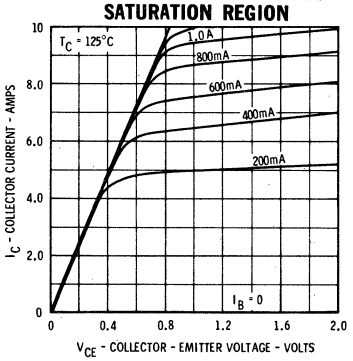
COLLECTOR CHARACTERISTICS* SATURATION REGION



COLLECTOR CHARACTERISTICS* SATURATION REGION



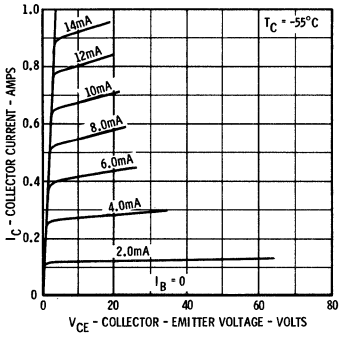
COLLECTOR CHARACTERISTICS* SATURATION REGION



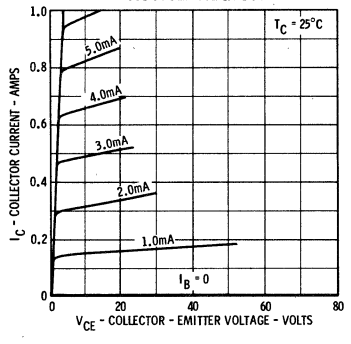
TYPICAL ELECTRICAL CHARACTERISTICS

2N5084

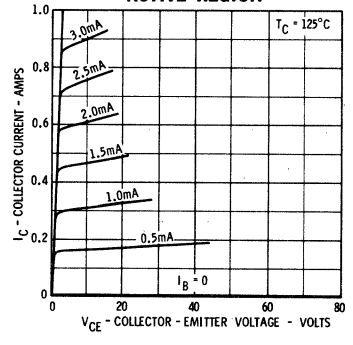
COLLECTOR CHARACTERISTICS* ACTIVE REGION



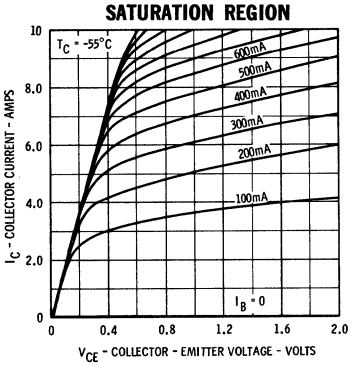
COLLECTOR CHARACTERISTICS* ACTIVE REGION



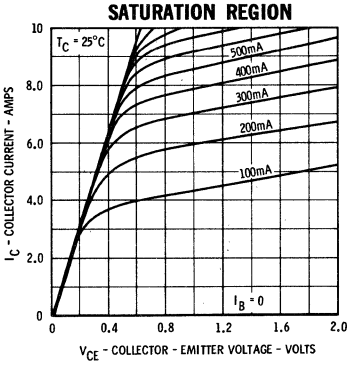
COLLECTOR CHARACTERISTICS* ACTIVE REGION



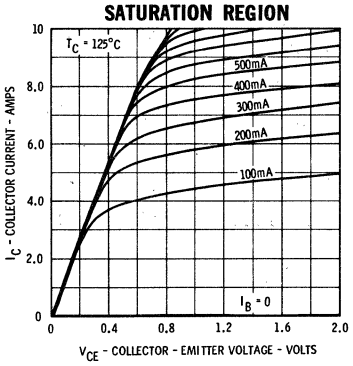
COLLECTOR CHARACTERISTICS* SATURATION REGION



COLLECTOR CHARACTERISTICS* SATURATION REGION



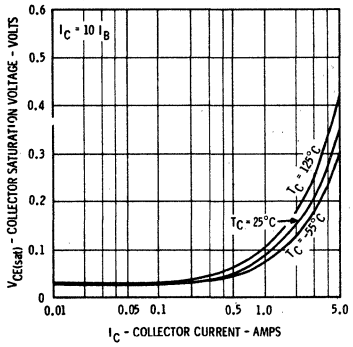
COLLECTOR CHARACTERISTICS* SATURATION REGION



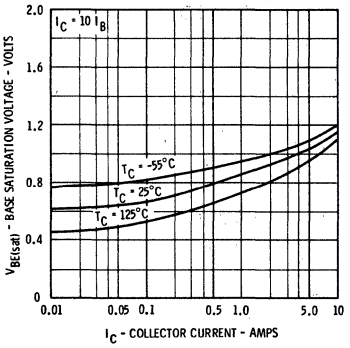
*Single family characteristics on Transistor Curve Tracer

TYPICAL ELECTRICAL CHARACTERISTICS

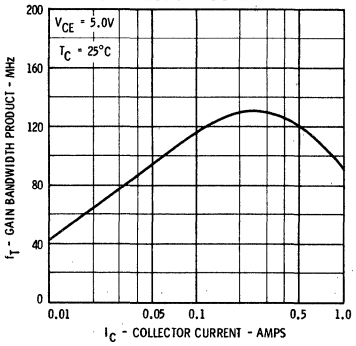
COLLECTOR SATURATION VOLTAGE VERSUS PULSED COLLECTOR CURRENT



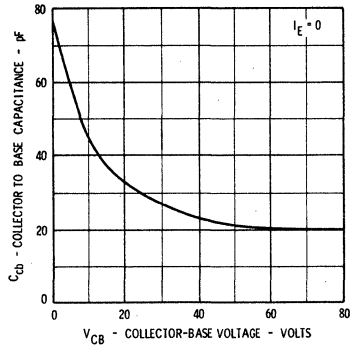
BASE SATURATION VOLTAGE VERSUS PULSED COLLECTOR CURRENT



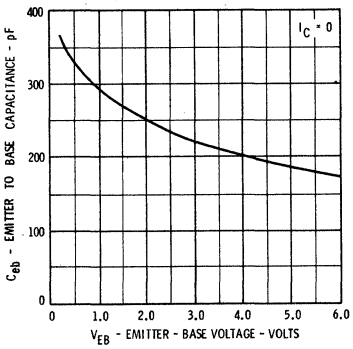
GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT



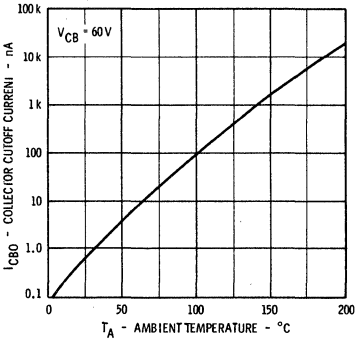
COLLECTOR TO BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



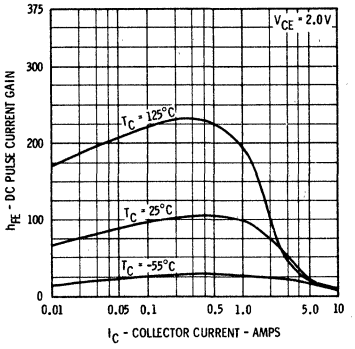
EMITTER TO BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



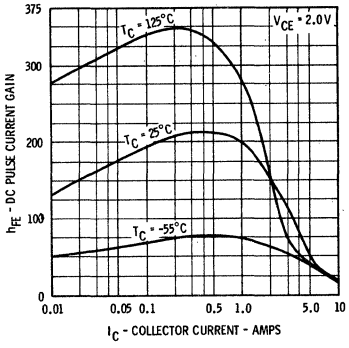
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



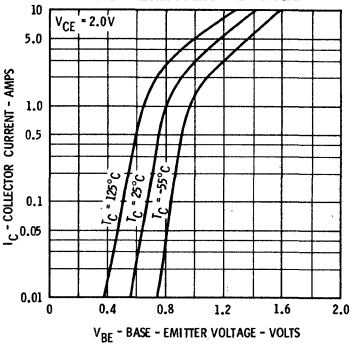
2N5083 • 2N5085 DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



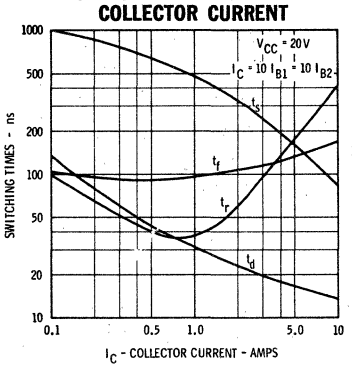
2N5084 DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



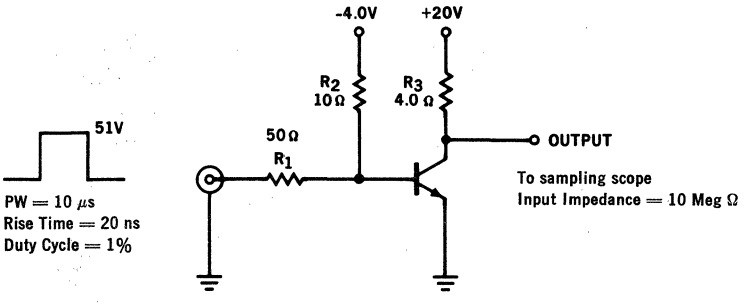
COLLECTOR CURRENT VERSUS BASE EMITTER VOLTAGE



SWITCHING TIMES VERSUS COLLECTOR CURRENT



SWITCHING TIME TEST CIRCUIT



2N5147 • 2N5149

6 WATT PNP POWER TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SEE 2N5148 • 2N5150 FOR NPN COMPLEMENT

- **HIGH POWER . . . . . 6 WATTS AT $T_C = 50°C$, $V_{CE} = -40$ V**
- **HIGH VOLTAGE . . . . . -80 V (MIN) LV_{CEO}**
- **HIGH CURRENT SATURATION VOLTAGE . . . -0.85 V (MAX) $V_{CE(sat)}$ AT $I_C = 2.0$ A**
- **HIGH FREQUENCY . . . . . 50 AND 60 MHz (MIN) f_T**
- **BETA GUARANTEED AT 3 POINTS . . . . . 50 mA, 1.0 A AND 2.0 A**
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	$-65°C$ to $+200°C$
Operating Junction Temperature	$-65°C$ to $+200°C$
Lead Temperature (Soldering, 60 second time limit)	$+300°C$

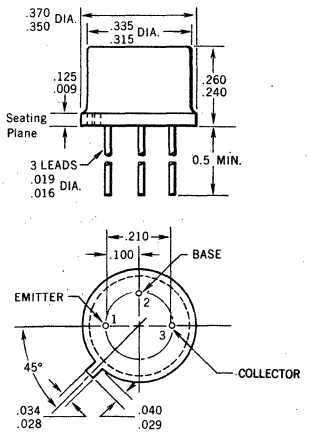
Maximum Power Dissipation

Total Dissipation at 50°C Case Temperature, $V_{CE} = -40$ V	**6.0 Watts**
at 25°C Ambient Temperature	1.0 Watt
(See Maximum Permissible Power Curve and Note 4)	

Maximum Voltages and Current

V_{CES}	Collector to Emitter Voltage	-100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	-80 Volts
V_{EBO}	Emitter to Base Voltage	-5.5 Volts
I_C	Collector Current	2.0 Amps

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-39) outline



NOTES:
All dimensions in inches.
Leads are gold plated Kovar.
Lead No. 3 internally connected to case.
Package weight is 1.23 grams.

ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	2N5147 MIN.	2N5147 TYP.	2N5147 MAX.	2N5149 MIN.	2N5149 TYP.	2N5149 MAX.	UNITS	TEST CONDITIONS	
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 2 & 3)	**-80**			**-80**			**Volts**	**$I_C = 100$ mA**	**$I_B = 0$**
BV_{CES}	Collector to Emitter Breakdown Voltage	-100			-100			Volts	$I_C = 1.0$ mA	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	-5.5			-5.5			Volts	$I_C = 0$	$I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**39**		**50**	**85**			**$I_C = 50$ mA**	**$V_{CE} = -5.0$ V**
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**40**	**90**	**70**	**87**	**200**		**$I_C = 1.0$ A**	**$V_{CE} = -5.0$ V**
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	15	24		35	52			$I_C = 1.0$ A	$V_{CE} = -5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**15**	**28**		**30**	**50**			**$I_C = 2.0$ A**	**$V_{CE} = -5.0$ V**
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	**2.5**	**4.8**		**3.0**	**6.1**			**$I_C = 0.2$ A**	**$V_{CE} = -5.0$ V**
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Notes 3 & 5)		-0.38	-0.46		-0.38	-0.46	Volts	$I_C = 1.0$ A	$I_B = 0.1$ A
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Notes 3 & 5)		**-0.73**	**-0.85**		**-0.73**	**-0.85**	**Volts**	**$I_C = 2.0$ A**	**$I_B = 0.2$ A**

Additional Electrical Characteristics on page 2 Notes on page 2.

*Planar is a patented Fairchild process.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

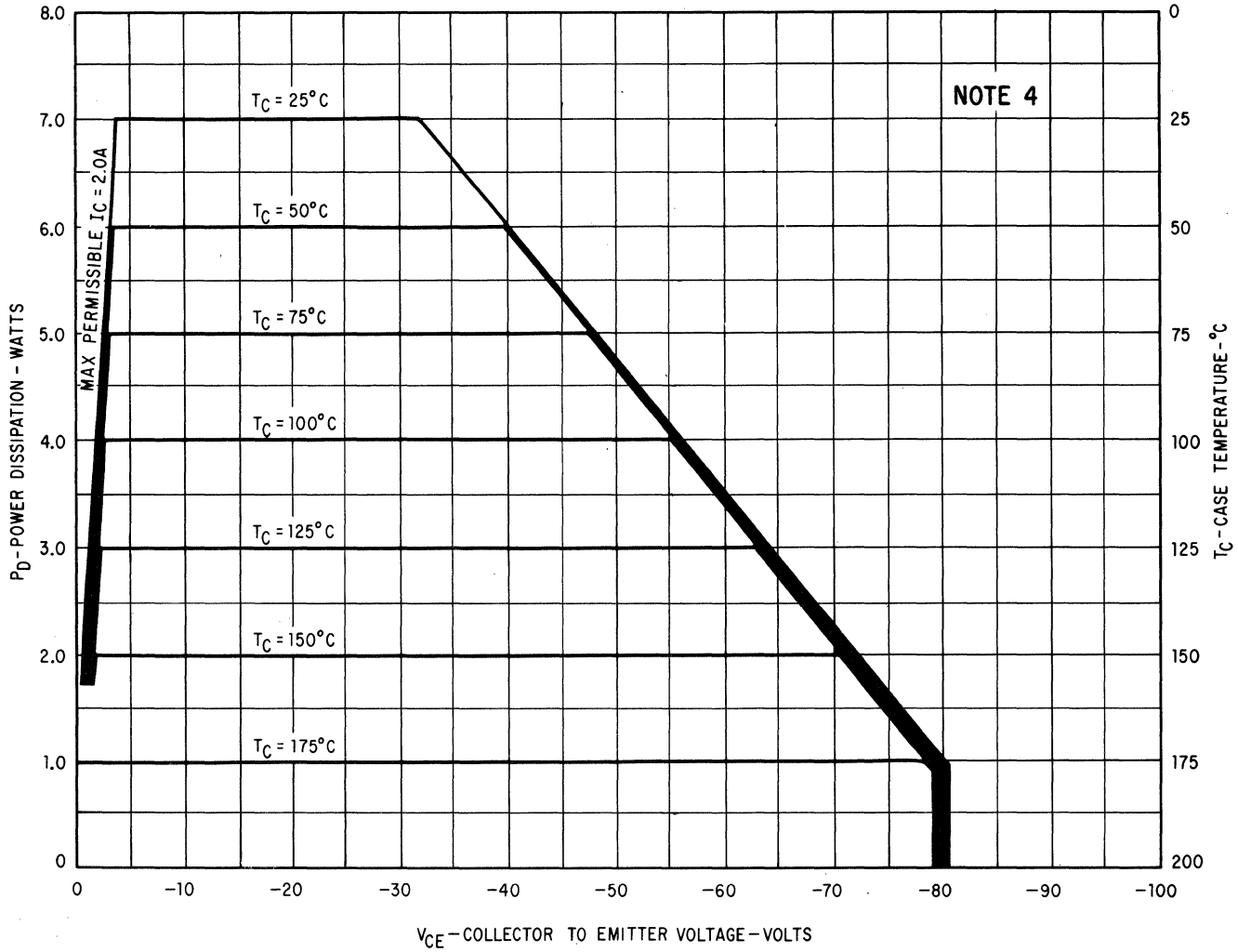
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	2N5147 MIN.	2N5147 TYP.	2N5147 MAX.	2N5149 MIN.	2N5149 TYP.	2N5149 MAX.	UNITS	TEST CONDITIONS	
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Notes 3 and 5)		−0.96	−1.2		−0.96	−1.2	Volts	$I_C = 1.0$ A	$I_B = 0.1$ A
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Notes 3 and 5)		−1.28	−1.5		−1.28	−1.5	Volts	$I_C = 2.0$ A	$I_B = 0.2$ A
$V_{BE(on)}$	Pulsed Base Emitter "ON" Voltage (Notes 3 and 5)			−1.5			−1.5	Volts	$I_C = 2.0$ A	$V_{CE} = -5.0$ V
I_{CES}	Collector Cutoff Current		.002	1.0		.002	1.0	μA	$V_{CE} = -60$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current			1.0			1.0	μA	$I_C = 0$	$V_{EB} = -4.0$ V
I_{CEX}(150°C)	Collector Reverse Current			500			500	μA	$V_{CE} = -60$ V	$V_{EB} = -2.0$ V
C_{cb}	Collector to Base Capacitance		46	120		46	120	pF	$I_E = 0$	$V_{CB} = -10$ V

NOTES:

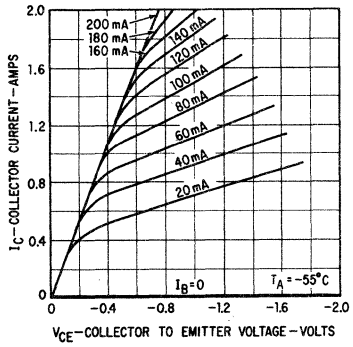
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(3) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(4) Device is thermally limited under free air (ambient) operating conditions. Maximum junction to ambient thermal resistant is 175°C/Watt.
(5) $V_{BE(on)}$ and saturation voltages measured ¼" from header.

MAXIMUM PERMISSIBLE DC FORWARD BIASED POWER DISSIPATION

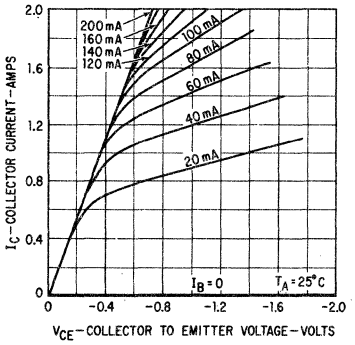


TYPICAL ELECTRICAL CHARACTERISTICS

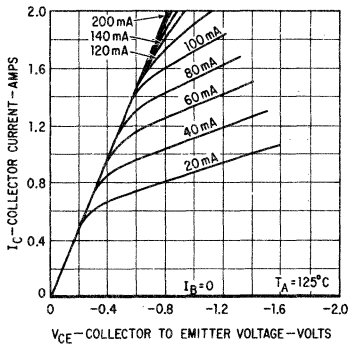
COLLECTOR CHARACTERISTICS* SATURATION REGION



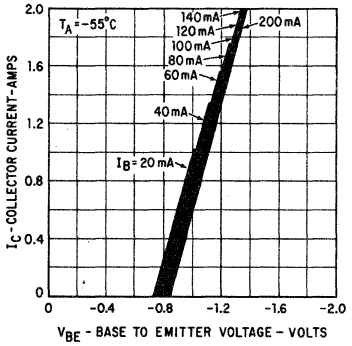
COLLECTOR CHARACTERISTICS* SATURATION REGION



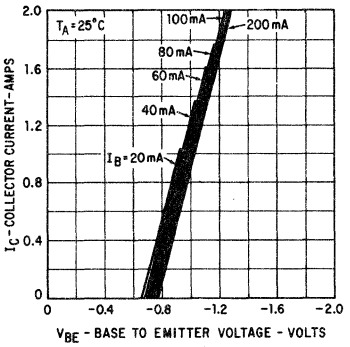
COLLECTOR CHARACTERISTICS* SATURATION REGION



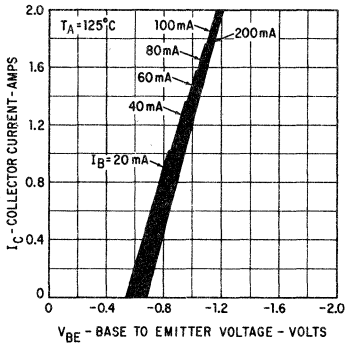
BASE CHARACTERISTICS*



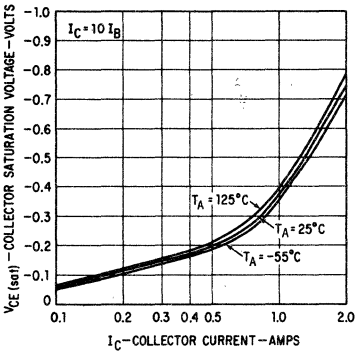
BASE CHARACTERISTICS*



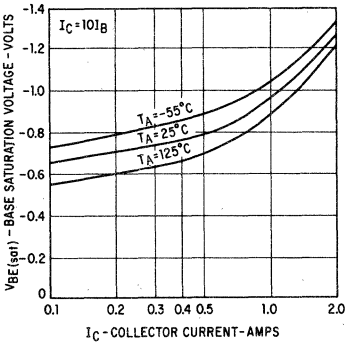
BASE CHARACTERISTICS*



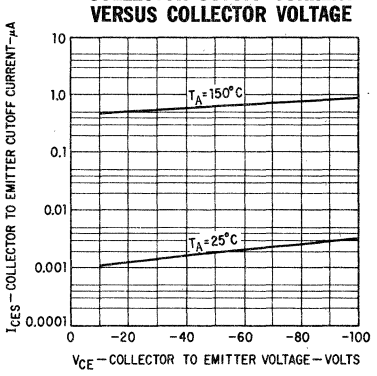
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



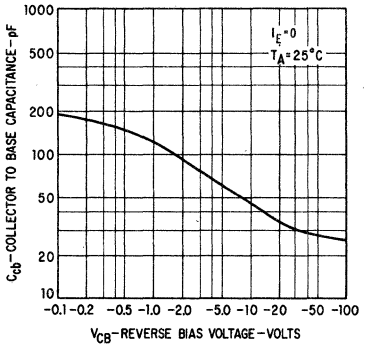
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



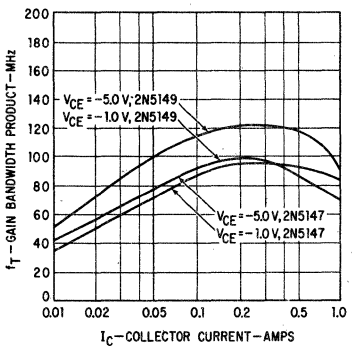
COLLECTOR CUTOFF CURRENT VERSUS COLLECTOR VOLTAGE



COLLECTOR TO BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT

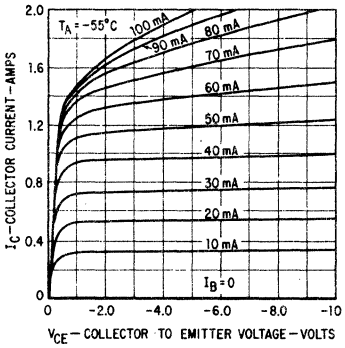


*Single Family Characteristics on Transistor Curve Tracer.

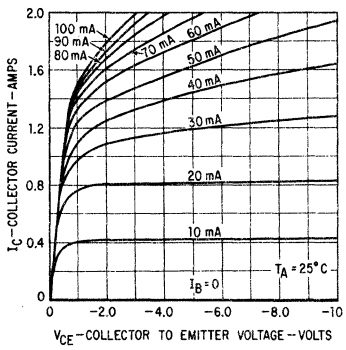
TYPICAL ELECTRICAL CHARACTERISTICS

2N5147

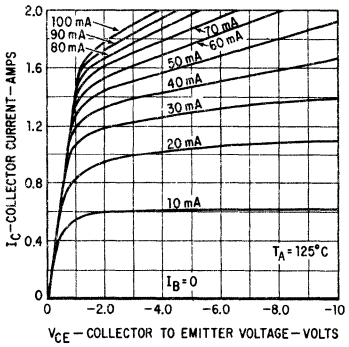
COLLECTOR CHARACTERISTICS* ACTIVE REGION



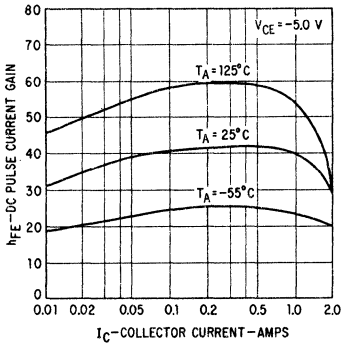
COLLECTOR CHARACTERISTICS* ACTIVE REGION



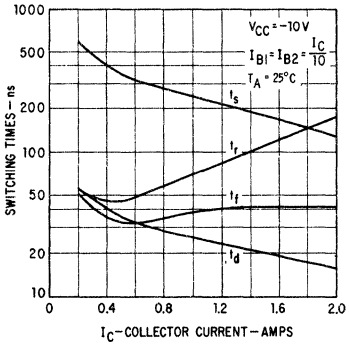
COLLECTOR CHARACTERISTICS* ACTIVE REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

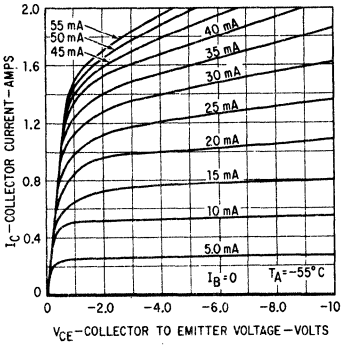


SWITCHING TIMES VERSUS COLLECTOR CURRENT

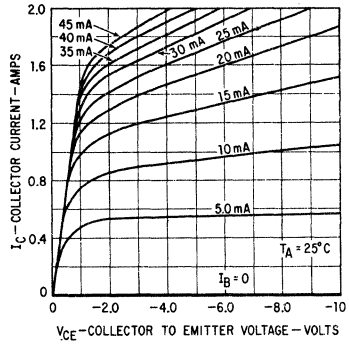


2N5149

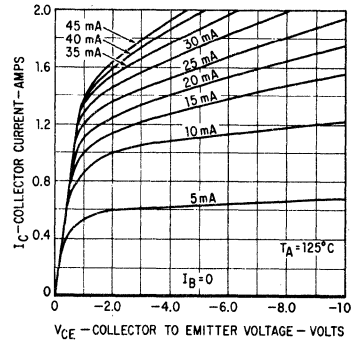
COLLECTOR CHARACTERISTICS* ACTIVE REGION



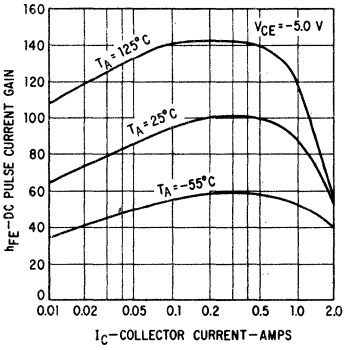
COLLECTOR CHARACTERISTICS* ACTIVE REGION



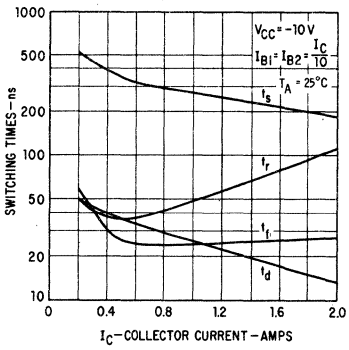
COLLECTOR CHARACTERISTICS* ACTIVE REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



SWITCHING TIMES VERSUS COLLECTOR CURRENT



*Single Family Characteristics on Transistor Curve Tracer.

2N5148 • 2N5150

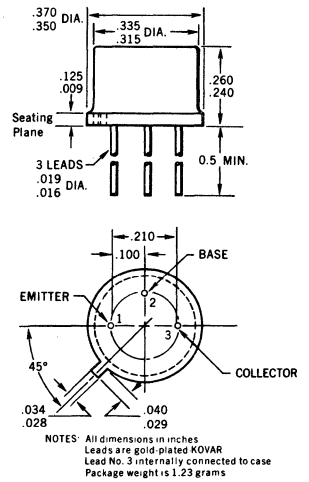
6 WATT NPN POWER TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SEE 2N5147 • 2N5149 FOR PNP COMPLEMENT

- **HIGH POWER** . . . . . 6.0 WATTS AT $T_C = 50°C$, $V_{CE} = 40$ V
- **HIGH VOLTAGE** . . . . . 80 V (MIN) LV_{CEO}
- **HIGH CURRENT SATURATION VOLTAGE** . . . 0.85 V (MAX) $V_{CE(sat)}$ AT 2.0 A
- **HIGH FREQUENCY** . . . . . 50 AND 60 MHz (MIN) f_T
- **BETA GUARANTEED AT 3 POINTS** . . . . . 50 mA, 1.0 A AND 2.0 A
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-39) outline



NOTES: All dimensions in inches
Leads are gold-plated KOVAR
Lead No. 3 internally connected to case
Package weight is 1.23 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−65°C to +200°C
Operating Junction Temperature	−65°C to +200°C
Lead Temperature (Soldering, 60 second time limit)	+300°C

Maximum Power Dissipation (Note 4)

Total Dissipation at 50°C Case Temperature, $V_{CE} = 40$ V	**6.0 Watts**
at 25°C Ambient Temperature	1.0 Watt

Maximum Voltages and Current

V_{CES}	Collector to Emitter Voltage	100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	80 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts
I_C	Collector Current	2.0 Amps

ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

		2N5148			2N5150				
SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	80			80			Volts	$I_C = 100$ mA $I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	100			100			Volts	$I_C = 1.0$ mA $V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			6.0			Volts	$I_C = 0$ $I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	20	64		50	120			$I_C = 50$ mA $V_{CE} = 5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	30	63	90	70	110	200		$I_C = 1.0$ A $V_{CE} = 5.0$ V
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	15	45		35	63			$I_C = 1.0$ A $V_{CE} = 5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	15	33		30	56			$I_C = 2.0$ A $V_{CE} = 5.0$ V
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	2.5	3.8		3.0	4.3			$I_C = 0.2$ A $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Notes 3 and 5)		0.38	0.46		0.38	0.46	Volts	$I_C = 1.0$ A $I_B = 0.1$ A
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Notes 3 and 5)		0.75	0.85		0.75	0.85	Volts	$I_C = 2.0$ A $I_B = 0.2$ A

Additional Electrical Characteristics on page 2
Notes on page 2

*Planar is a patented Fairchild process.

FAIRCHILD
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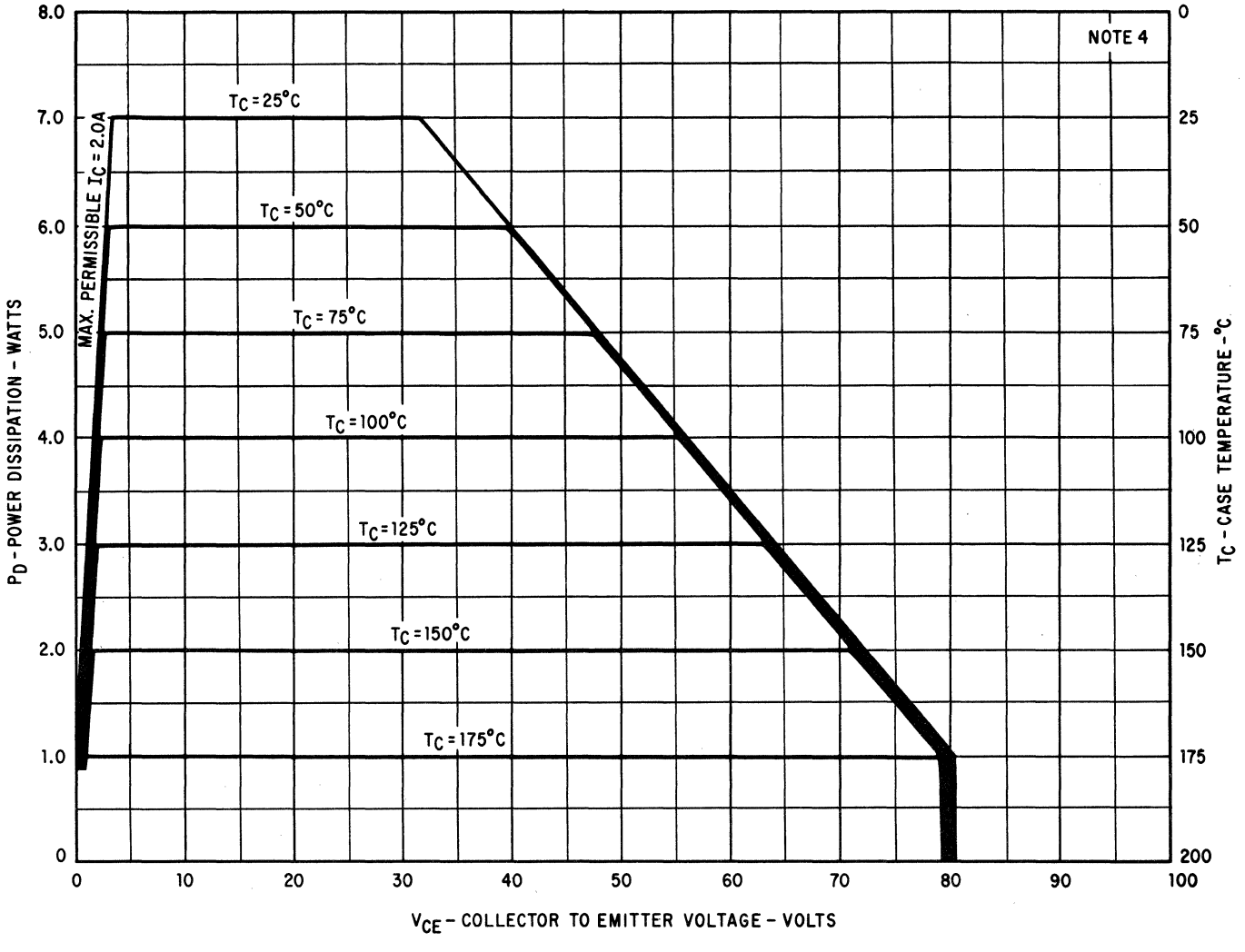
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	2N5148 MIN.	2N5148 TYP.	2N5148 MAX.	2N5150 MIN.	2N5150 TYP.	2N5150 MAX.	UNITS	TEST CONDITIONS	
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Notes 3 and 5)		0.98	1.2		0.98	1.2	Volts	$I_C = 1.0$ A	$I_B = 0.1$ A
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Notes 3 and 5)		1.30	1.5		1.30	1.5	Volts	$I_C = 2.0$ A	$I_B = 0.2$ A
V_{BE}(on)	Pulsed Base Emitter "ON" Voltage (Notes 3 and 5)			1.5			1.5	Volts	$I_C = 2.0$ A	$V_{CE} = 5.0$ V
I_{CES}	Collector Cutoff Current		.002	1.0		.002	1.0	μA	$V_{CE} = 60$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current			1.0			1.0	μA	$I_C = 0$	$V_{EB} = 5.0$ V
I_{CEX}(+150°C)	Collector Reverse Current			500			500	μA	$V_{CE} = 60$ V	$V_{EB} = 2.0$ V
C_{cb}	Collector to Base Capacitance		30	70		30	70	pF	$I_E = 0$	$V_{CB} = 10$ V

NOTES:

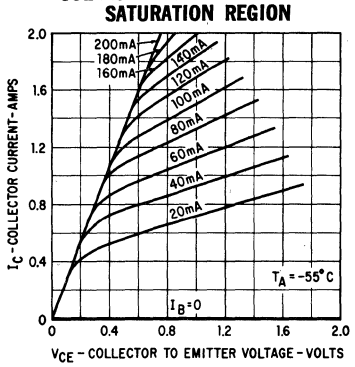
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(3) Pulse Conditions: length = 300μs; duty cycle = 1%.
(4) Device is thermally limited under free air (ambient) operating conditions. Maximum junction-to-ambient thermal resistance is 175°C/Watt. Contact factory for maximum permissible power under pulsed or reversed biased operating conditions.
(5) $V_{BE(on)}$ and saturation voltages measured ¼" from header.

MAXIMUM PERMISSIBLE DC FORWARD BIASED POWER DISSIPATION

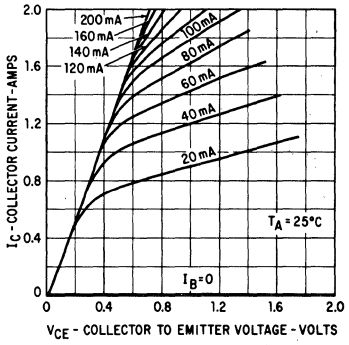


TYPICAL ELECTRICAL CHARACTERISTICS

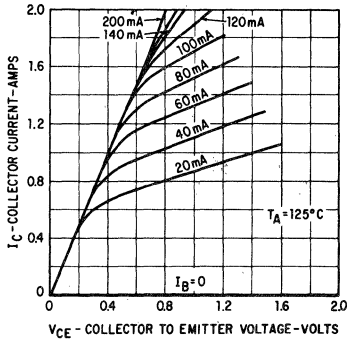
COLLECTOR CHARACTERISTICS* SATURATION REGION



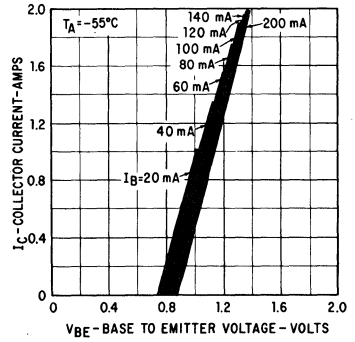
COLLECTOR CHARACTERISTICS* SATURATION REGION



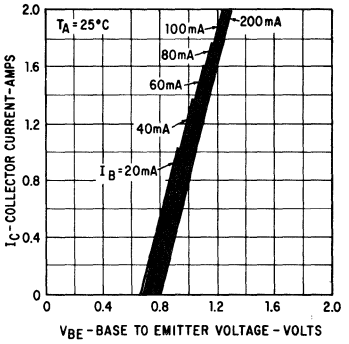
COLLECTOR CHARACTERISTICS* SATURATION REGION



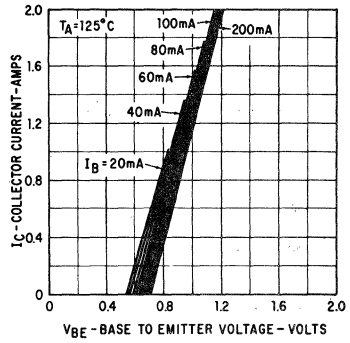
BASE CHARACTERISTICS*



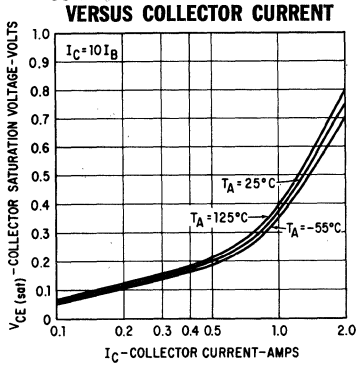
BASE CHARACTERISTICS*



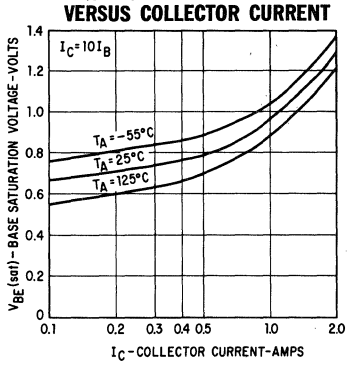
BASE CHARACTERISTICS*



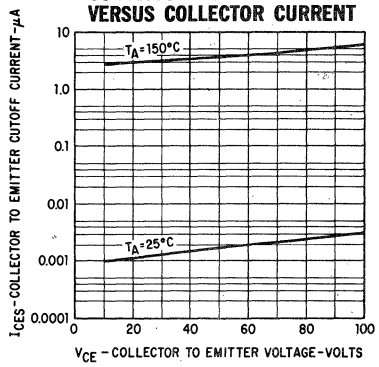
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



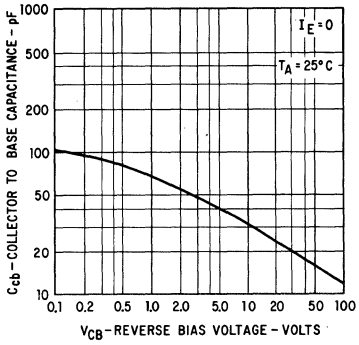
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



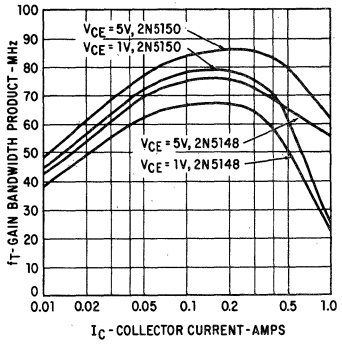
COLLECTOR CUTOFF CURRENT VERSUS COLLECTOR CURRENT



COLLECTOR TO BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT

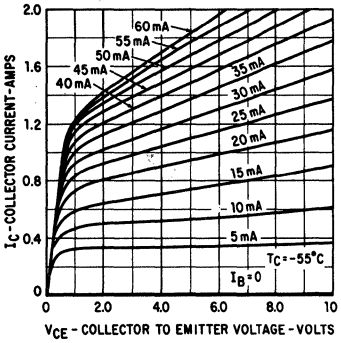


*Single Family Characteristics on Transistor Curve Tracer.

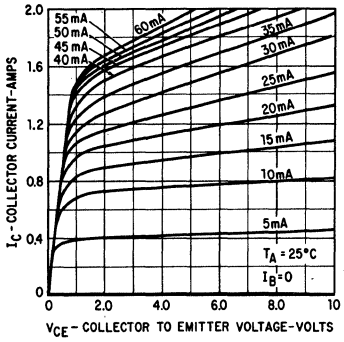
TYPICAL ELECTRICAL CHARACTERISTICS

2N5148

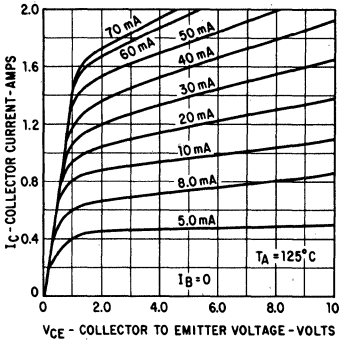
COLLECTOR CHARACTERISTICS* SATURATION REGION



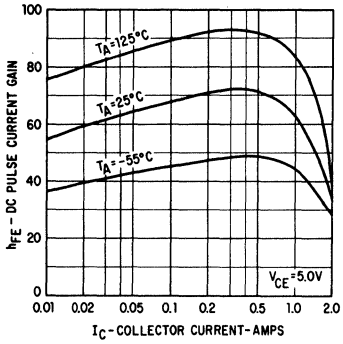
COLLECTOR CHARACTERISTICS* SATURATION REGION



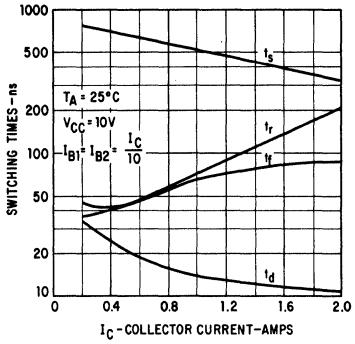
COLLECTOR CHARACTERISTICS* SATURATION REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

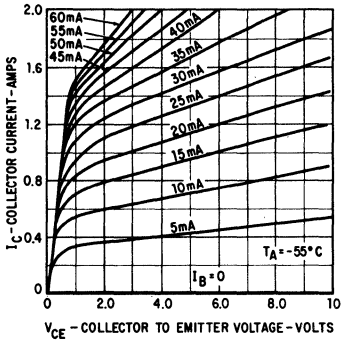


SWITCHING TIMES VERSUS COLLECTOR CURRENT

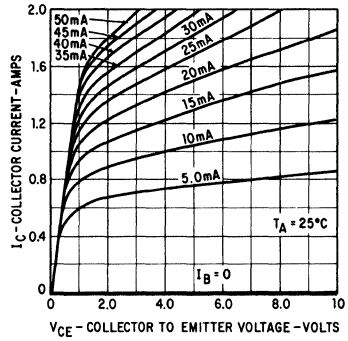


2N5150

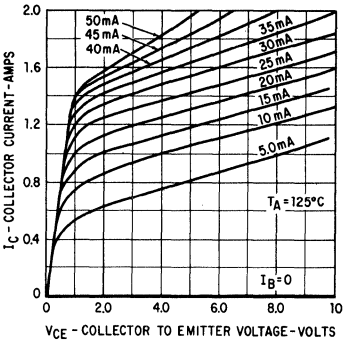
COLLECTOR CHARACTERISTICS* SATURATION REGION



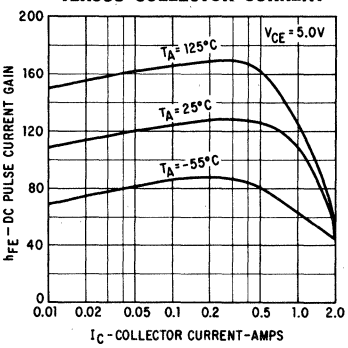
COLLECTOR CHARACTERISTICS* SATURATION REGION



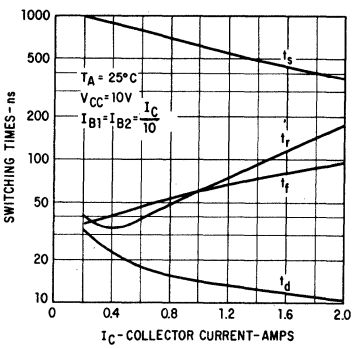
COLLECTOR CHARACTERISTICS* SATURATION REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



SWITCHING TIMES VERSUS COLLECTOR CURRENT



*Single Family Characteristics on Transistor Curve Tracer.

2N5151 • 2N5153

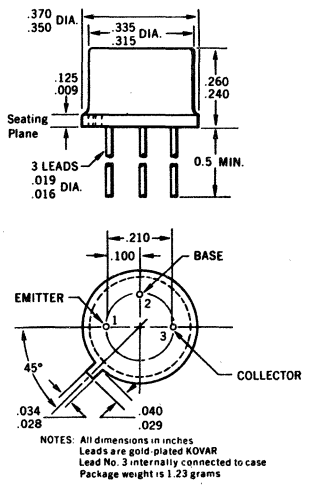
10 WATT PNP POWER TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SEE 2N5152 • 2N5154 FOR NPN COMPLEMENT

- **HIGH POWER . . . . . 10 WATTS AT $T_C = 50°C$, $V_{CE} = -40$ V**
- **HIGH VOLTAGE . . . . . — 80 V (MIN) LV_{CEO}**
- **HIGH CURRENT SATURATION VOLTAGE . . . — 1.5 V (MAX) $V_{CE(sat)}$ AT 5.0 A**
- **HIGH FREQUENCY . . . . . 60 AND 70 MHz (MIN) f_T**
- **BETA GUARANTEED AT 3 POINTS . . . . . 50 mA, 2.5 A AND 5.0 A**
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-39) outline



NOTES: All dimensions in inches
Leads are gold-plated KOVAR
Lead No. 3 internally connected to case
Package weight is 1.23 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−65°C to +200°C
Operating Junction Temperature	−65°C to +200°C
Lead Temperature (Soldering, 60 second time limit)	+300°C

Maximum Power Dissipation (Note 4)

Total Dissipation at 50°C Case Temperature, $V_{CE} = -40$ V (See Maximum Permissible Power Curve)	**10 Watts**
Total Dissipation at 25°C Ambient Temperature	1.0 Watt

Maximum Voltages and Current

V_{CES}	Collector to Emitter Voltage	−100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	−80 Volts
V_{EBO}	Emitter to Base Voltage	−5.5 Volts
I_C	Collector Current	5.0 Amps

ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

		2N5151			2N5153				
SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	**−80**			**−80**			**Volts**	$I_C = 100$ mA $I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Volage	−100			−100			Volts	$I_C = 1.0$ mA $V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.5			−5.5			Volts	$I_C = 0$ $I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**52**		**50**	**133**			$I_C = 50$ mA $V_{CE} = -5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**50**	**90**	**70**	**114**	**200**		$I_C = 2.5$ A $V_{CE} = -5.0$ V
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	15	32		35	90			$I_C = 2.5$ A $V_{CE} = -5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**38**		**40**	**77**			$I_C = 5.0$ A $V_{CE} = -5.0$ V
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	**3.0**	**4.05**		**3.5**	**4.85**			$I_C = 0.5$ A $V_{CE} = -5.0$ V
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Notes 3 and 5)		−0.45	−0.75		−0.45	−0.75	Volts	$I_C = 2.5$ A $I_B = 0.25$ A
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Notes 3 and 5)		**−0.9**	**−1.5**		**−0.9**	**−1.5**	**Volts**	$I_C = 5.0$ A $I_B = 0.5$ A

Additional Electrical Characteristics on page 2

*Planar is a patented Fairchild process.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

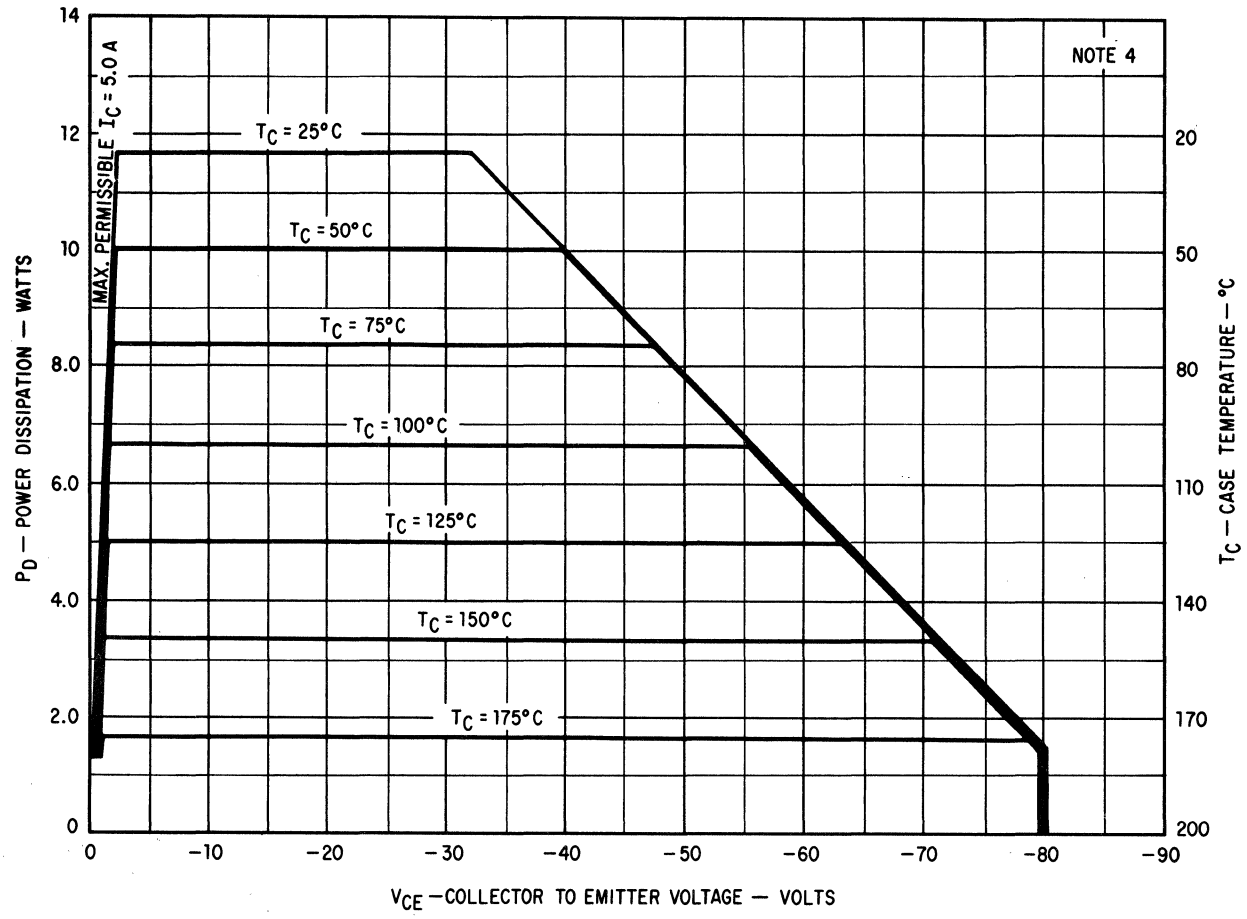
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	2N5151 MIN.	2N5151 TYP.	2N5151 MAX.	2N5153 MIN.	2N5153 TYP.	2N5153 MAX.	UNITS	TEST CONDITIONS	
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Notes 3 and 5)		−1.1	−1.45		−1.1	−1.45	Volts	$I_C = 2.5$ A	$I_B = 0.25$ A
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Notes 3 and 5)		−1.55	−2.2		−1.55	−2.2	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
$V_{BE(on)}$	Pulsed Base Emitter "On" Voltage (Notes 3 and 5)			−1.45			−1.45	Volts	$I_C = 2.5$ A	$V_{CE} = -5.0$ V
I_{CES}	Collector Cutoff Current		0.006	1.0		0.006	1.0	μA	$V_{CE} = -60$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current			1.0			1.0	μA	$I_C = 0$	$V_{BE} = 4.0$ V
I_{CEX}(150°C)	Collector Reverse Current			500			500	μA	$V_{CE} = -60$ V	$V_{BE} = 2.0$ V
C_{cb}	Collector to Base Capacitance		170	250		170	250	pF	$I_E = 0$	$V_{CB} = -10$ V

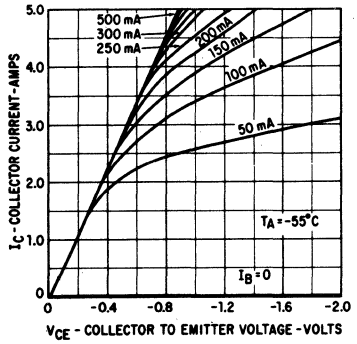
NOTES:
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(3) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(4) Device is thermally limited under free air (ambient) operating conditions. Maximum junction-to-ambient thermal resistance is 175°C/Watt. Contact factory for maximum permissible power under pulsed or reversed biased operating conditions.
(5) $V_{BE(on)}$ and saturation voltages measured ¼" from header.

MAXIMUM PERMISSIBLE DC FORWARD BIASED POWER DISSIPATION

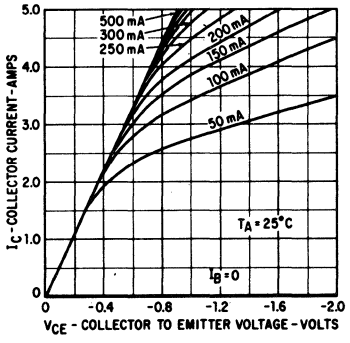


TYPICAL ELECTRICAL CHARACTERISTICS

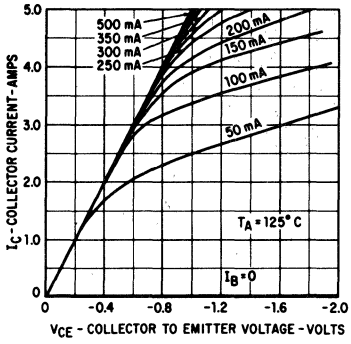
COLLECTOR CHARACTERISTICS* SATURATION REGION



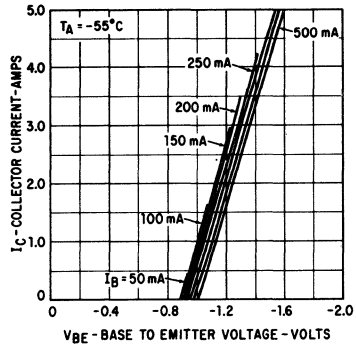
COLLECTOR CHARACTERISTICS* SATURATION REGION



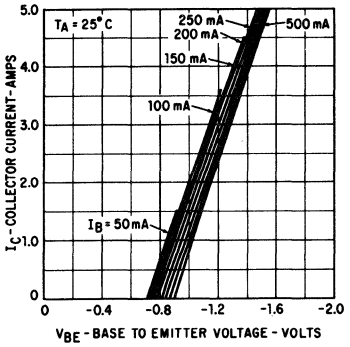
COLLECTOR CHARACTERISTICS* SATURATION REGION



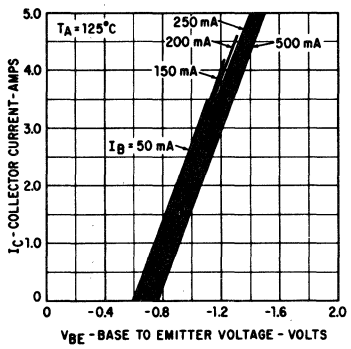
BASE CHARACTERISTICS*



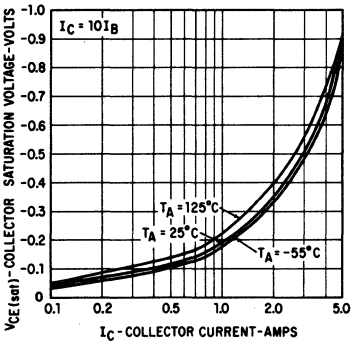
BASE CHARACTERISTICS*



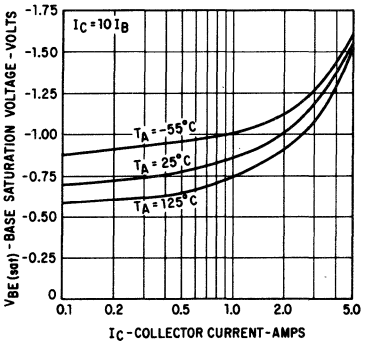
BASE CHARACTERISTICS*



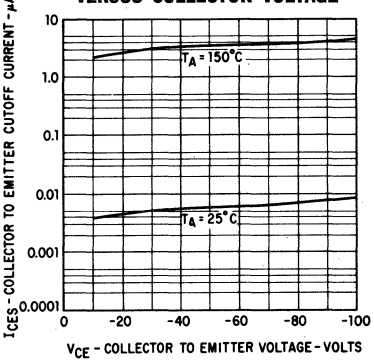
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



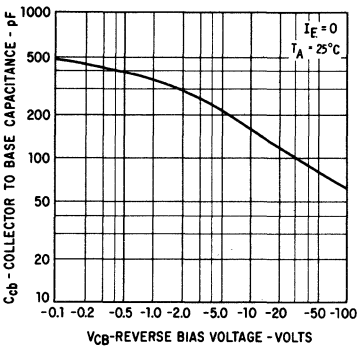
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



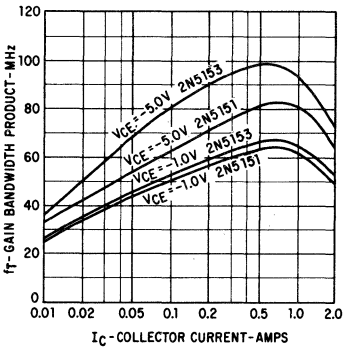
COLLECTOR CUTOFF CURRENT VERSUS COLLECTOR VOLTAGE



COLLECTOR TO BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT

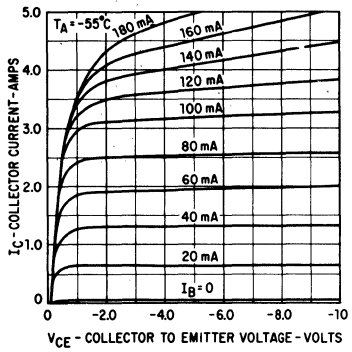


*Single Family Characteristics on Transistor Curve Tracer.

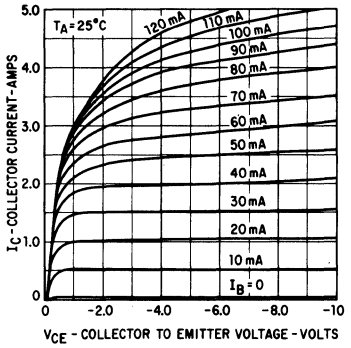
TYPICAL ELECTRICAL CHARACTERISTICS

2N5151

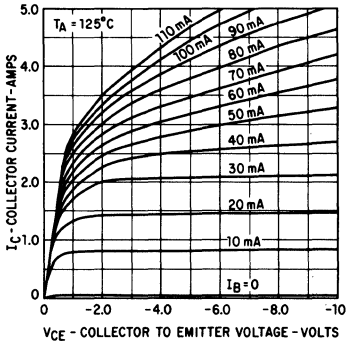
COLLECTOR CHARACTERISTICS* SATURATION REGION



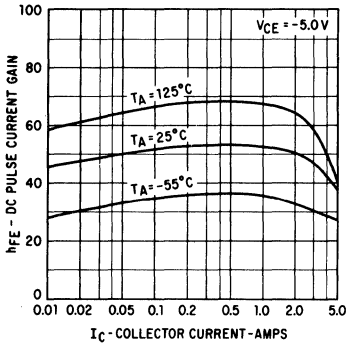
COLLECTOR CHARACTERISTICS* SATURATION REGION



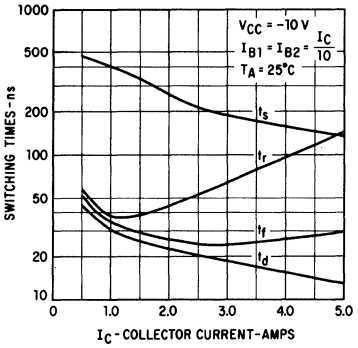
COLLECTOR CHARACTERISTICS* SATURATION REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

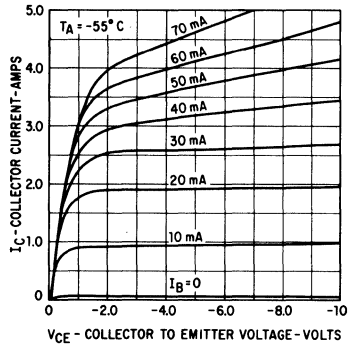


SWITCHING TIMES VERSUS COLLECTOR CURRENT

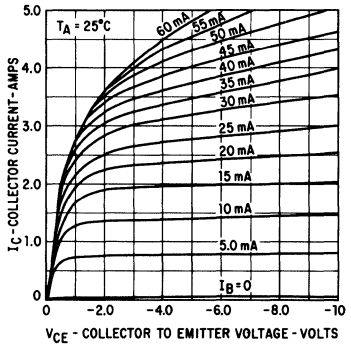


2N5153

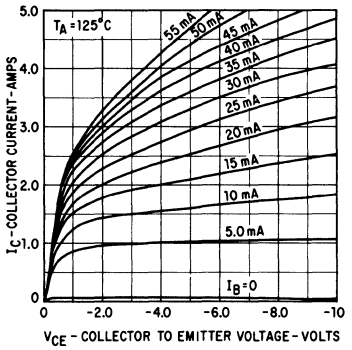
COLLECTOR CHARACTERISTICS* SATURATION REGION



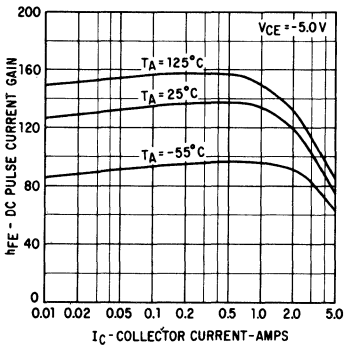
COLLECTOR CHARACTERISTICS* SATURATION REGION



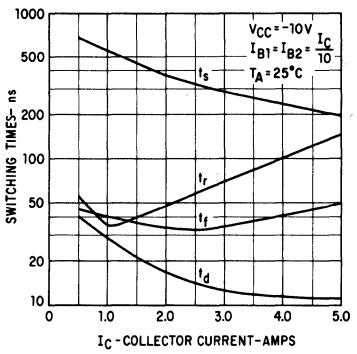
COLLECTOR CHARACTERISTICS* SATURATION REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



SWITCHING TIMES VERSUS COLLECTOR CURRENT



*Single Family Characteristics on Transistor Curve Tracer.

2N5152 • 2N5154

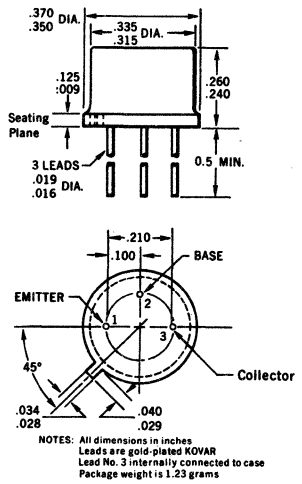
10 WATT NPN POWER TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SEE 2N5151 • 2N5153 FOR PNP COMPLEMENT

- **HIGH POWER** . . . . . 10 WATTS AT $T_C = 50°C$, $V_{CE} = 40$ V
- **HIGH VOLTAGE** . . . . . 80 V (MIN) LV_{CEO}
- **HIGH CURRENT SATURATION VOLTAGE** . . . 1.5 V (MAX) $V_{CE(sat)}$ AT 5.0 A
- **HIGH FREQUENCY** . . . . . 60 AND 70 MHz (MIN) f_T
- **BETA GUARANTEED AT 3 POINTS** . . . . . 50 mA, 2.5 A AND 5.0 A
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-39) outline



NOTES: All dimensions in inches
Leads are gold-plated KOVAR
Lead No. 3 internally connected to case
Package weight is 1.23 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−65°C to +200°C
Operating Junction Temperature	−65°C to +200°C
Lead Temperature (Soldering, 60 second time limit)	+300°C

Maximum Power Dissipation (Note 4)

Total Dissipation at 50°C Case Temperature, $V_{CE} = 40$ V (See Maximum Permissible Power Curve)	**10 Watts**
Total Dissipation at 25°C Ambient Temperature	1.0 Watt

Maximum Voltages and Current

V_{CES}	Collector to Emitter Voltage	100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	80 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts
I_C	Collector Current	5.0 Amps

ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	2N5152 MIN.	2N5152 TYP.	2N5152 MAX.	2N5154 MIN.	2N5154 TYP.	2N5154 MAX.	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	**80**			**80**			**Volts**	$I_C = 100$ mA $I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	100			100			Volts	$I_C = 1.0$ mA $V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			6.0			Volts	$I_C = 0$ $I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**46**		**50**	**100**			$I_C = 50$ mA $V_{CE} = 5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**64**	**90**	**70**	**114**	**200**		$I_C = 2.5$ A $V_{CE} = 5.0$ V
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	15	26		35	50			$I_C = 2.5$ A $V_{CE} = 5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**53**		**40**	**65**			$I_C = 5.0$ A $V_{CE} = 5.0$ V
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	**3.0**	**3.4**		**3.5**	**4.4**			$I_C = 0.5$ A $V_{CE} = 5.0$ V
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Notes 3 and 5)		0.43	0.75		0.43	0.75	Volts	$I_C = 2.5$ A $I_B = 0.25$ A
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Notes 3 and 5)		**0.85**	**1.5**		**0.85**	**1.5**	**Volts**	$I_C = 5.0$ A $I_B = 0.5$ A

Additional Electrical Characteristics on page 2
Notes on page 2

*Planar is a patented Fairchild process.

FAIRCHILD
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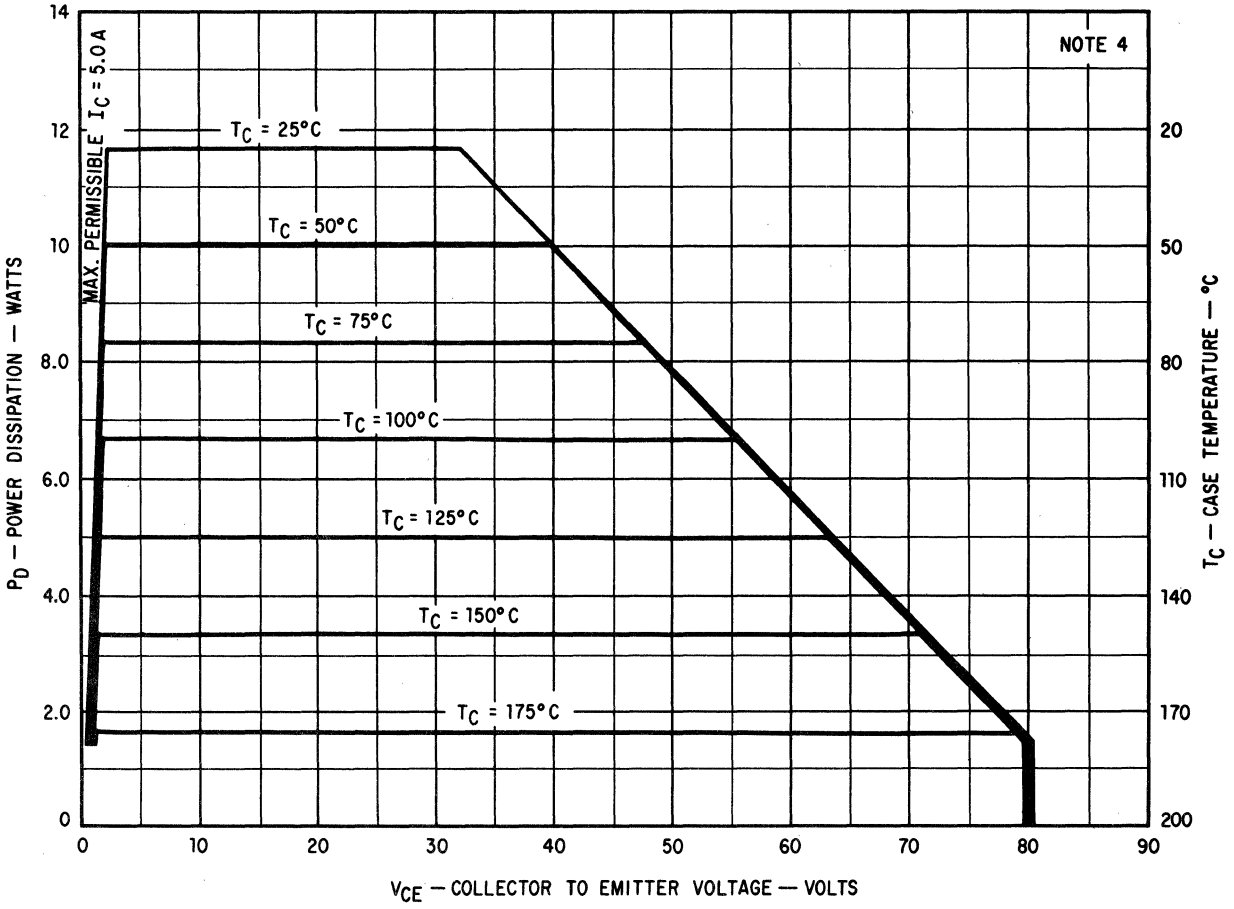
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	2N5152 MIN.	2N5152 TYP.	2N5152 MAX.	2N5154 MIN.	2N5154 TYP.	2N5154 MAX.	UNITS	TEST CONDITIONS	
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Notes 3 and 5)		1.16	1.45		1.16	1.45	Volts	$I_C = 2.5$ A	$I_B = 0.25$ A
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Notes 3 and 5)		1.52	2.2		1.52	2.2	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
V_{BE}(on)	Pulsed Base Emitter "ON" Voltage (Notes 3 and 5)			1.45			1.45	Volts	$I_C = 2.5$ A	$V_{CE} = 5.0$ V
I_{CES}	Collector Cutoff Current		0.007	1.0		0.007	1.0	μA	$V_{CE} = 60$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current			1.0			1.0	μA	$I_C = 0$	$V_{EB} = 5.0$ V
I_{CEX}(+150°C)	Collector Reverse Current			500			500	μA	$V_{CE} = 60$ V	$V_{EB} = 2.0$ V
C_{cb}	Collector to Base Capacitance		80	250		80	250	pF	$I_E = 0$	$V_{CB} = 10$ V

NOTES:

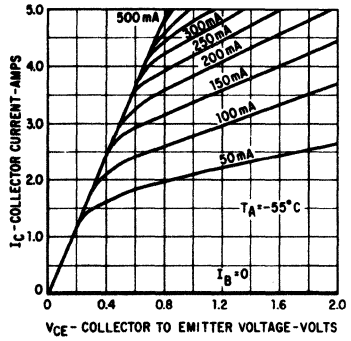
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(3) Pulse Conditions: length = 300μs; duty cycle = 1%.
(4) Device is thermally limited under free air (ambient) operating conditions. Maximum junction-to-ambient thermal resistance is 175°C/Watt. Contact factory for maximum permissible power under pulsed or reversed biased operating conditions.
(5) $V_{BE(on)}$ and saturation voltages measured ¼" from header.

MAXIMUM PERMISSIBLE DC FORWARD BIASED POWER DISSIPATION

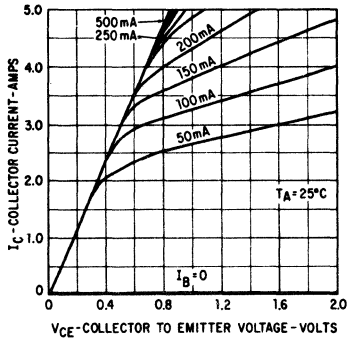


TYPICAL ELECTRICAL CHARACTERISTICS

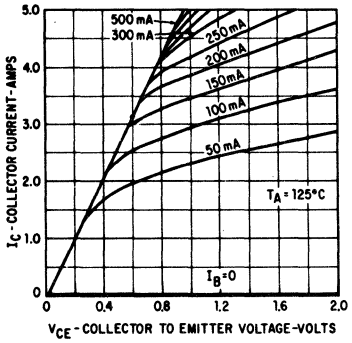
COLLECTOR CHARACTERISTICS* SATURATION REGION



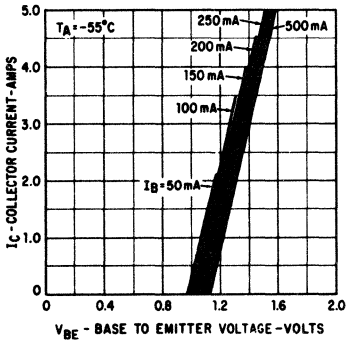
COLLECTOR CHARACTERISTICS* SATURATION REGION



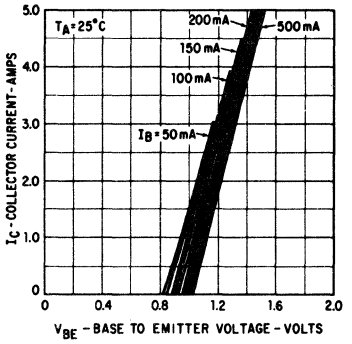
COLLECTOR CHARACTERISTICS* SATURATION REGION



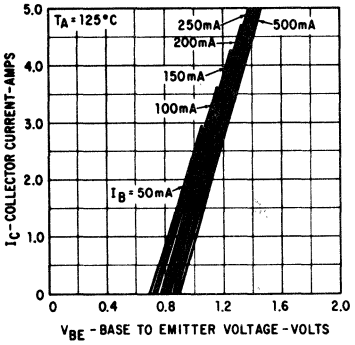
BASE CHARACTERISTICS*



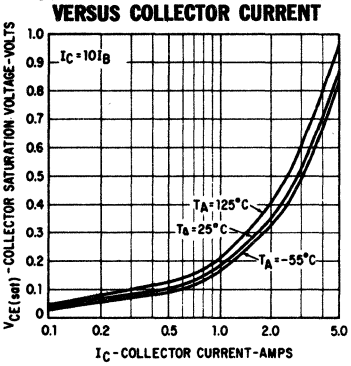
BASE CHARACTERISTICS*



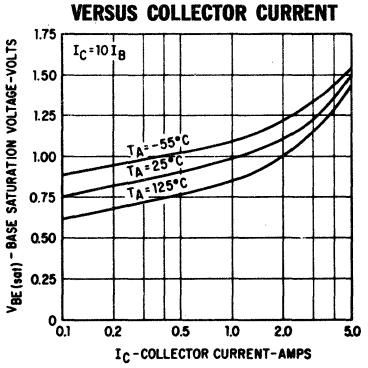
BASE CHARACTERISTICS*



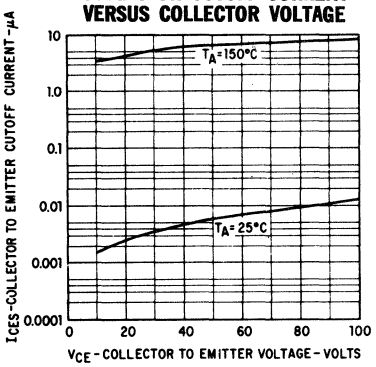
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



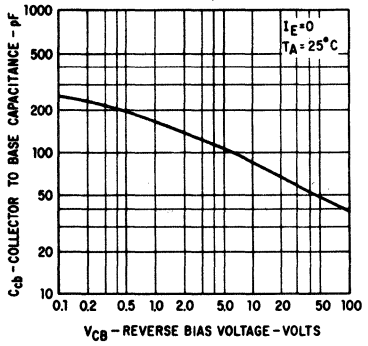
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



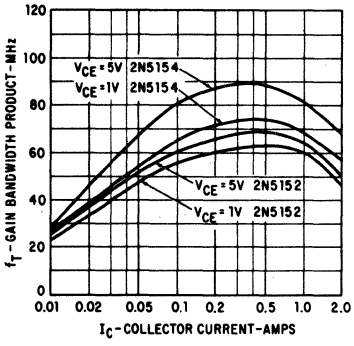
COLLECTOR CUTOFF CURRENT VERSUS COLLECTOR VOLTAGE



COLLECTOR TO BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



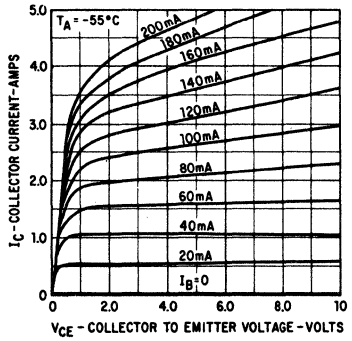
GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT



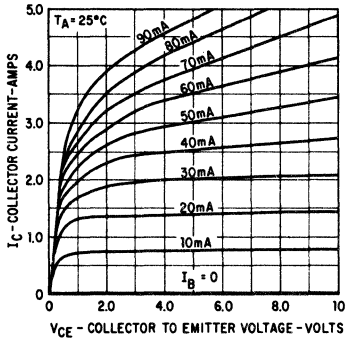
*Single Family Characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS
2N5152

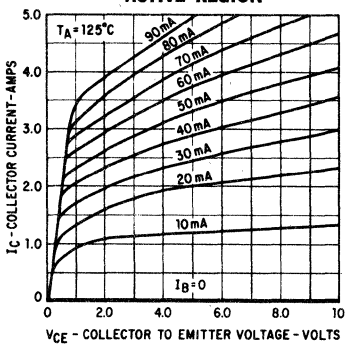
COLLECTOR CHARACTERISTICS* ACTIVE REGION



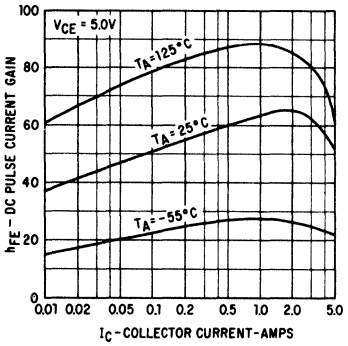
COLLECTOR CHARACTERISTICS* ACTIVE REGION



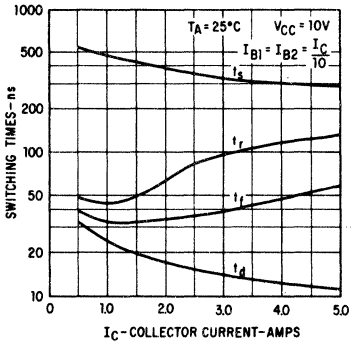
COLLECTOR CHARACTERISTICS* ACTIVE REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

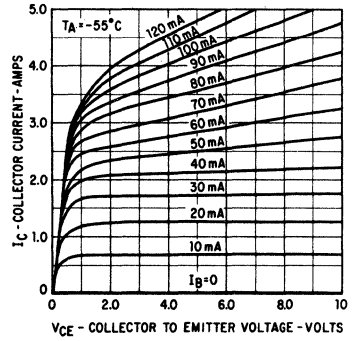


SWITCHING TIMES VERSUS COLLECTOR CURRENT

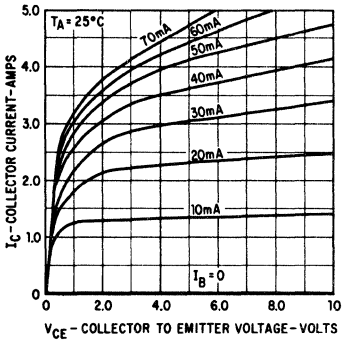


2N5154

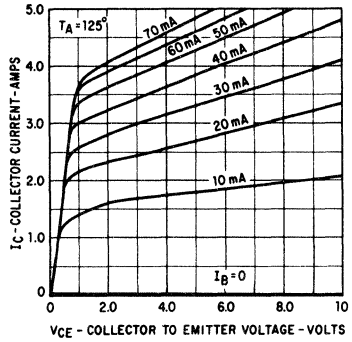
COLLECTOR CHARACTERISTICS* ACTIVE REGION



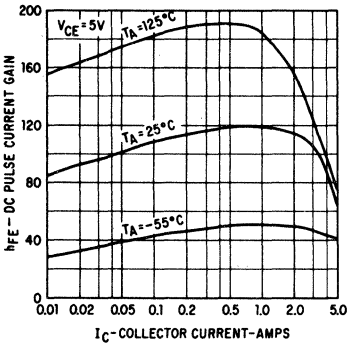
COLLECTOR CHARACTERISTICS* ACTIVE REGION



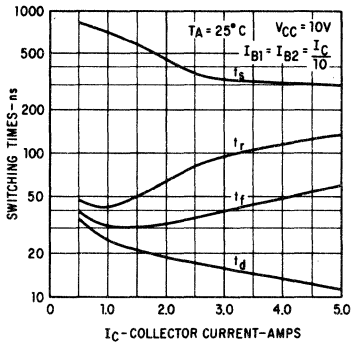
COLLECTOR CHARACTERISTICS* ACTIVE REGION



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



SWITCHING TIMES VERSUS COLLECTOR CURRENT



*Single Family Characteristics on Transistor Curve Tracer.

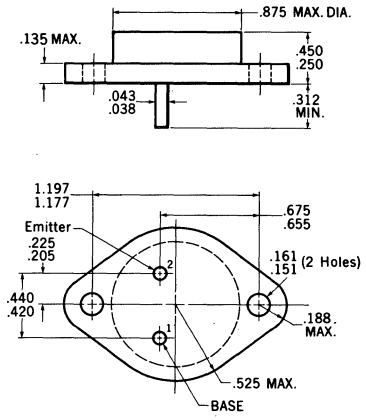
2N5264

NPN HIGH VOLTAGE-HIGH CURRENT TRANSISTOR

DIFFUSED SILICON PLANAR* EPITAXIAL DEVICE

- **HIGH VOLTAGE . . . . 300 V BV_{CES}, 180 V LV_{CEO}**
- **HIGH CURRENT . . . MAX. $V_{CE(sat)}$ OF 1.25 V AT $I_C = 7.0$ A, $I_B = 0.7$ A**
- **HIGH SPEED . . . . . MAX. t_f OF 1.0 μs AT $I_C = 7.0$ A, $I_B = \pm 0.7$ A**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-3) outline



NOTES: All dimensions in inches
Leads 1 and 2 electrically isolated from case
Case is third electrical connection (Collector)
Leads are nickel alloy
Package weight 8.71 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures		
Storage Temperature		−65°C to +200°C
Operating Junction Temperature		+200°C
Maximum Power Dissipation (Note 2)		
Total Dissipation at 25°C Case Temperature (See Safe Operating Area)		**87 Watts**
Junction to Case Thermal Resistance		2.0°C/W
Maximum Voltages and Currents		
V_{CBO}	Collector to Base Voltage	300 Volts
V_{CEO}	Collector to Emitter Voltage	180 Volts
V_{EBO}	Emitter to Base Voltage	5.0 Volts
I_C	Collector Current	10.0 Amps
I_B	Base Current	2.0 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
BV_{CES}	**Collector to Emitter Breakdown Voltage**	**300**			**Volts**	**$I_C = 1.0$ mA**	**$R_{BE} = 0\ \Omega$**
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 3)		**0.60**	**1.25**	**Volts**	**$I_C = 7.0$ A**	**$I_B = 0.7$ A**
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		1.20	1.60	Volts	$I_C = 7.0$ A	$I_B = 0.7$ A
I_{CES}	Collector Cutoff Current		0.05	10	μA	$V_{CE} = 200$ V	$R_{BE} = 0\ \Omega$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			Volts	$I_C = 0$	$I_E = 1.0$ mA
I_{EBO}	Emitter Cutoff Current		0.01	10	μA	$I_C = 0$	$V_{EB} = 4.0$ V
h_{FE}	DC Pulse Current Gain (Note 3)	30	125	300		$I_C = 1.0$ A	$V_{CE} = 2.5$ V
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage**	**180**			**Volts**	**$I_C = 20$ mA**	**$R_{BE} = \infty$**
I_{CES}(150°C)	Collector Cutoff Current		0.005	1.0	mA	$V_{CE} = 200$ V	$R_{BE} = 0\ \Omega$
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 3)		0.35	0.65	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		1.10	1.40	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
C_{cb}	Collector to Base Capacitance		55	80	pF	$I_E = 0$	$V_{CB} = 50$ V
h_{fe}	High Frequency Current Gain (f = 20 MHz)	2.5	3.5			$I_C = 100$ mA	$V_{CE} = 10$ V
t_{on}	Turn On Time		0.40	1.0	μs	$I_C = 7.0$ A, $I_{B1} = I_{B2} = 0.7$ A	
t_{stg}	Storage Time		0.50	1.5	μs	$I_C = 7.0$ A, $I_{B1} = I_{B2} = 0.7$ A	
t_f	**Fall Time**		**0.40**	**1.0**	**μs**	**$I_C = 7.0$ A, $I_{B1} = I_{B2} = \pm 0.7$ A**	
t_{on}	Turn On Time			1.5	μs	$I_C = 1.0$ A, $I_{B1} = I_{B2} = 0.1$ A	
t_{stg}	Storage Time			2.5	μs	$I_C = 1.0$ A, $I_{B1} = I_{B2} = 0.1$ A	
t_f	Fall Time			1.5	μs	$I_C = 1.0$ A, $I_{B1} = I_{B2} = 0.1$ A	

NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.

(2) The maximum power dissipation rating is the greatest allowable DC power. Maximum allowable power dissipation at any operating voltage is determined from the "Forward Biased Safe Operating Area" curve.

(3) Pulse Conditions: length = 300 μs; duty cycle = 1%.

*Planar is a patented Fairchild process.

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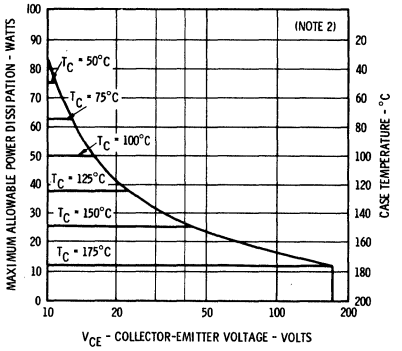
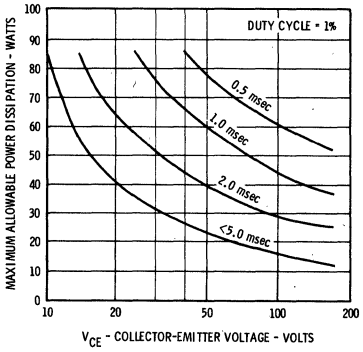
DC FORWARD BIASED SAFE OPERATING AREA

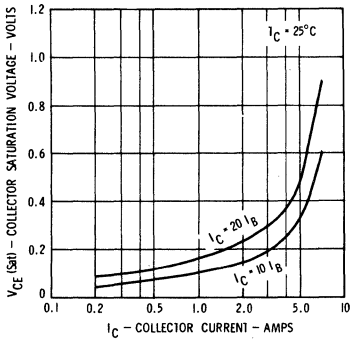


PULSED FORWARD BIASED SAFE OPERATING AREA

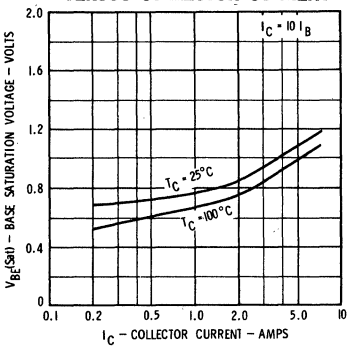


TYPICAL ELECTRICAL CHARACTERISTICS

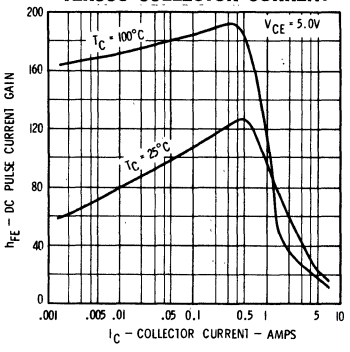
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



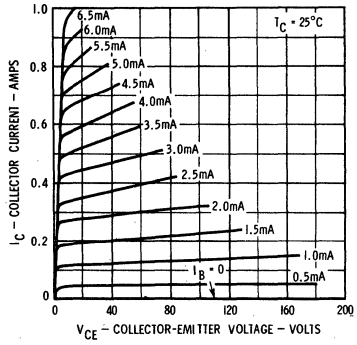
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



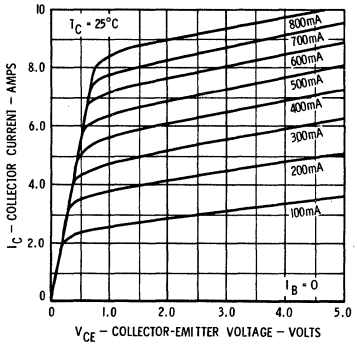
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



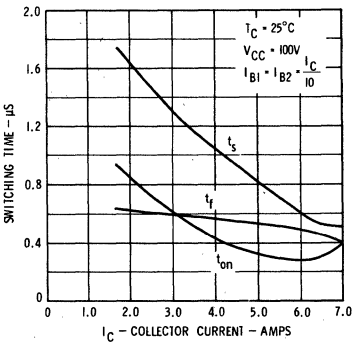
COLLECTOR CHARACTERISTICS ACTIVE REGION*



COLLECTOR CHARACTERISTICS SATURATION REGION*



SWITCHING TIME VERSUS COLLECTOR CURRENT



*Single family characteristics on Transistor Curve Tracer.

2N5284 • 2N5285

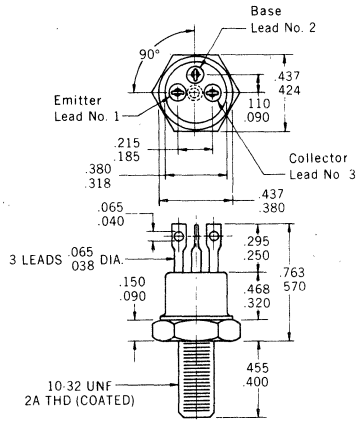
50 WATT NPN POWER TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SEE 2N5286 • 2N5287 FOR PNP COMPLEMENT

- **HIGH POWER . . . . . 50 WATTS AT $T_C = 50°C$, $V_{CE} = 40$ V**
- **HIGH VOLTAGE . . . . . 100 V (MIN) LV_{CEO}**
- **HIGH CURRENT SATURATION VOLTAGE . . . 1.5 V (MAX) $V_{CE(sat)}$ AT 5.0 A**
- **HIGH FREQUENCY . . . . . 60 AND 70 MHz (MIN) f_T**
- **BETA GUARANTEED AT 3 POINTS . . . . . 50 mA, 2.5 A AND 5.0 A**
- **ISOLATED COLLECTOR PACKAGE . . . . . NO ISOLATING HARDWARE REQUIRED**
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**

PHYSICAL DIMENSIONS
(in accordance with JEDEC TO-59 outline)



NOTES All dimensions in inches
All leads electrically isolated from case
Package weight is 6.44 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−65°C to +200°C
Operating Junction Temperature	−65°C to +200°C
Lead Temperature (Soldering, 60 seconds time limit)	+300°C

Maximum Power Dissipation

Total Dissipation at 50°C Case Temperature, $V_{CE} = 40$ V (See Maximum Permissible Power Curve and Note 4)	50 Watts

Maximum Voltages and Current

V_{CES}	Collector to Emitter Voltage	120 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	100 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts
I_C	Collector Current	5.0 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5284 MIN.	2N5284 TYP.	2N5284 MAX.	2N5285 MIN.	2N5285 TYP.	2N5285 MAX.	UNITS	TEST CONDITIONS	
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	**100**			**100**			**Volts**	**$I_C = 100$ mA**	**$I_B = 0$**
BV_{CES}	Collector to Emitter Breakdown Voltage	120			120			Volts	$I_C = 1.0$ mA	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			6.0			Volts	$I_C = 0$	$I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**46**		**50**	**100**			**$I_C = 50$ mA**	**$V_{CE} = 5.0$ V**
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**64**	**90**	**70**	**114**	**200**		**$I_C = 2.5$ A**	**$V_{CE} = 5.0$ V**
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	15	26		35	50			$I_C = 2.5$ A	$V_{CE} = 5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**53**		**40**	**65**			**$I_C = 5.0$ A**	**$V_{CE} = 5.0$ V**
h_{fe}	**High Frequency Current Gain** ($f = 20$ MHz)	**3.0**	**3.4**		**3.5**	**4.4**			**$I_C = 0.5$ A**	**$V_{CE} = 5.0$ V**
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 3)		0.43	0.75		0.43	0.75	Volts	$I_C = 2.5$ A	$I_B = 0.25$ A
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 3)		**0.85**	**1.5**		**0.85**	**1.5**	**Volts**	**$I_C = 5.0$ A**	**$I_B = 0.5$ A**

Additional Electrical Characteristics on page 2
Notes on page 2

*Planar is a patented Fairchild process.

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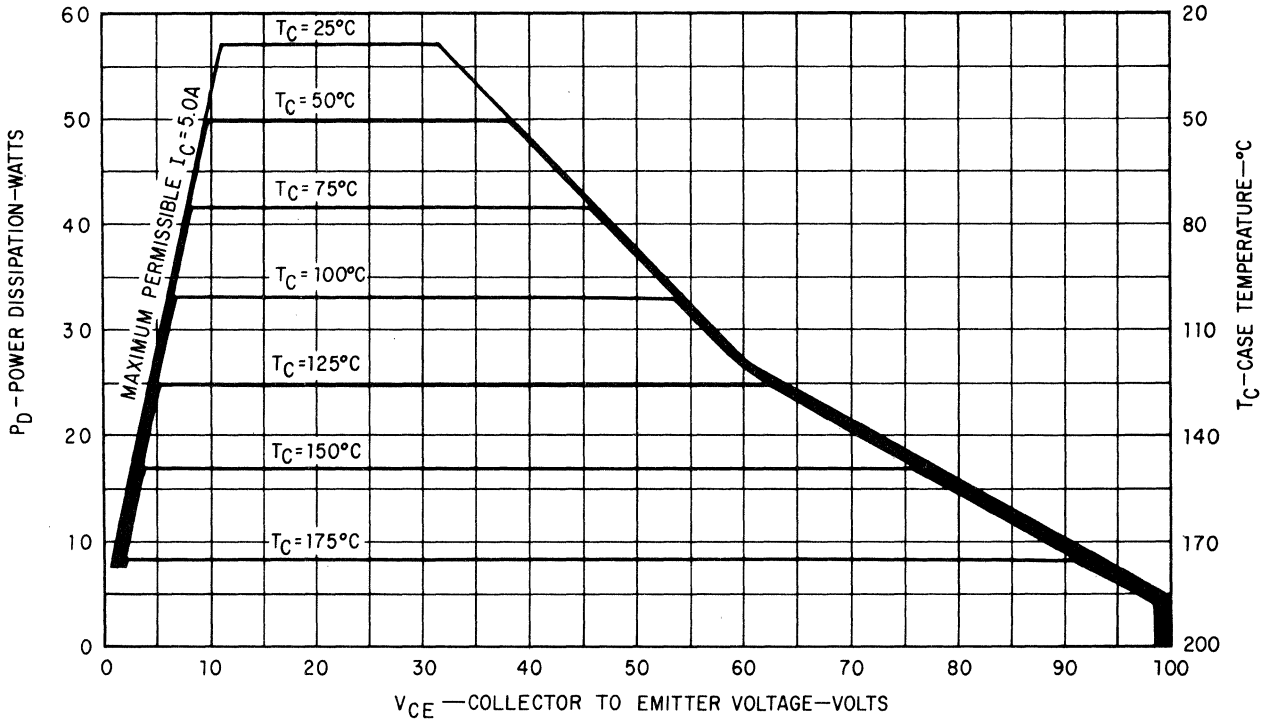
ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

		2N5284			2N5285					
SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		1.16	1.45		1.16	1.45	Volts	$I_C = 2.5$ A	$I_B = 0.25$ A
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		1.50	2.2		1.50	2.2	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
$V_{BE(on)}$	Pulsed Base Emitter "ON" Voltage (Note 3)			1.45			1.45	Volts	$I_C = 2.5$ A	$V_{CE} = 5.0$ V
I_{CES}	Collector Cutoff Current		0.007	1.0		0.007	1.0	μA	$V_{CE} = 80$ V	$V_{BE} = 0$
I_{CEO}	Collector Cutoff Current			50			50	μA	$I_B = 0$	$V_{CE} = 60$ V
I_{EBO}	Emitter Cutoff Current			1.0			1.0	μA	$I_C = 0$	$V_{EB} = 5.0$ V
I_{CEX}(150°C)	Collector Reverse Current			500			500	μA	$V_{CE} = 80$ V	$V_{EB} = 2.0$ V
C_{cb}	Collector to Base Capacitance		90	250		90	250	pF	$I_E = 0$	$V_{CB} = 10$ V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	20			20				$I_C = 100$ mA	$V_{CE} = 5.0$ V

NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest.
(3) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(4) Contact factory for maximum permissible power under pulsed or reverse biased operating conditions.

MAXIMUM PERMISSIBLE DC FORWARD BIASED POWER DISSIPATION



2N5286 • 2N5287

50 WATT PNP POWER TRANSISTORS

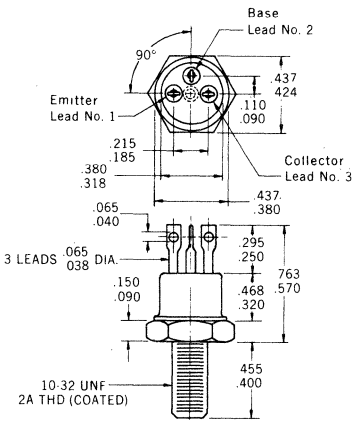
DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SEE 2N5284 • 2N5285 FOR NPN COMPLEMENT

FEATURES

- **HIGH POWER . . . . . 50 WATTS AT $T_C = 50°C$, $V_{CE} = -40$ V**
- **HIGH VOLTAGE . . . . . —100 V (MIN) LV_{CEO}**
- **HIGH CURRENT SATURATION VOLTAGE . . . —1.5 V (MAX) $V_{CE(sat)}$ AT 5.0 A**
- **HIGH FREQUENCY . . . . . 60 AND 70 MHz (MIN) f_T**
- **BETA GUARANTEED AT 3 POINTS . . . . . 50 mA, 2.5 A AND 5.0 A**
- **ISOLATED COLLECTOR PACKAGE . . . . . NO ISOLATING HARDWARE REQUIRED**
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**

PHYSICAL DIMENSIONS
(in accordance with JEDEC TO-59 outline)



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 6.44 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	—65°C to +200°C
Operating Junction Temperature	—65°C to +200°C
Lead Temperature (Soldering, 60 seconds time limit)	+300°C

Maximum Power Dissipation

Total Dissipation at 50°C Case Temperature, $V_{CE} = -40$ V (See Maximum Permissible Power Curve and Note 4)	50 Watts

Maximum Voltages and Current

V_{CES}	Collector to Emitter Voltage	—100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	—100 Volts
V_{EBO}	Emitter to Base Voltage	—5.5 Volts
I_C	Collector Current	5.0 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5286 MIN.	2N5286 TYP.	2N5286 MAX.	2N5287 MIN.	2N5287 TYP.	2N5287 MAX.	UNITS	TEST CONDITIONS	
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	**—100**			**—100**			**Volts**	**$I_C = 100$ mA**	**$I_B = 0$**
BV_{CES}	Collector to Emitter Breakdown Voltage	—100			—100			Volts	$I_C = 1.0$ mA	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	—5.5			—5.5			Volts	$I_C = 0$	$I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**52**		**50**	**130**			**$I_C = 50$ mA**	**$V_{CE} = -5.0$ V**
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**50**	**90**	**70**	**114**	**200**		**$I_C = 2.5$ A**	**$V_{CE} = -5.0$ V**
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	15	32		35	90			$I_C = 2.5$ A	$V_{CE} = -5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**	**38**		**40**	**77**			**$I_C = 5.0$ A**	**$V_{CE} = -5.0$ V**
h_{fe}	**High Frequency Current Gain** (f = 20 MHz)	**3.0**	**4.05**		**3.5**	**4.85**			**$I_C = 0.5$ A**	**$V_{CE} = -5.0$ V**
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 3)		—0.45	—0.75		—0.45	—0.75	Volts	$I_C = 2.5$ A	$I_B = 0.25$ A
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 3)		**—0.9**	**—1.5**		**—0.9**	**—1.5**	**Volts**	**$I_C = 5.0$ A**	**$I_B = 0.5$ A**

Additional Electrical Characteristics on Page 2
Notes on Page 2

*Planar is a patented Fairchild process.

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313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

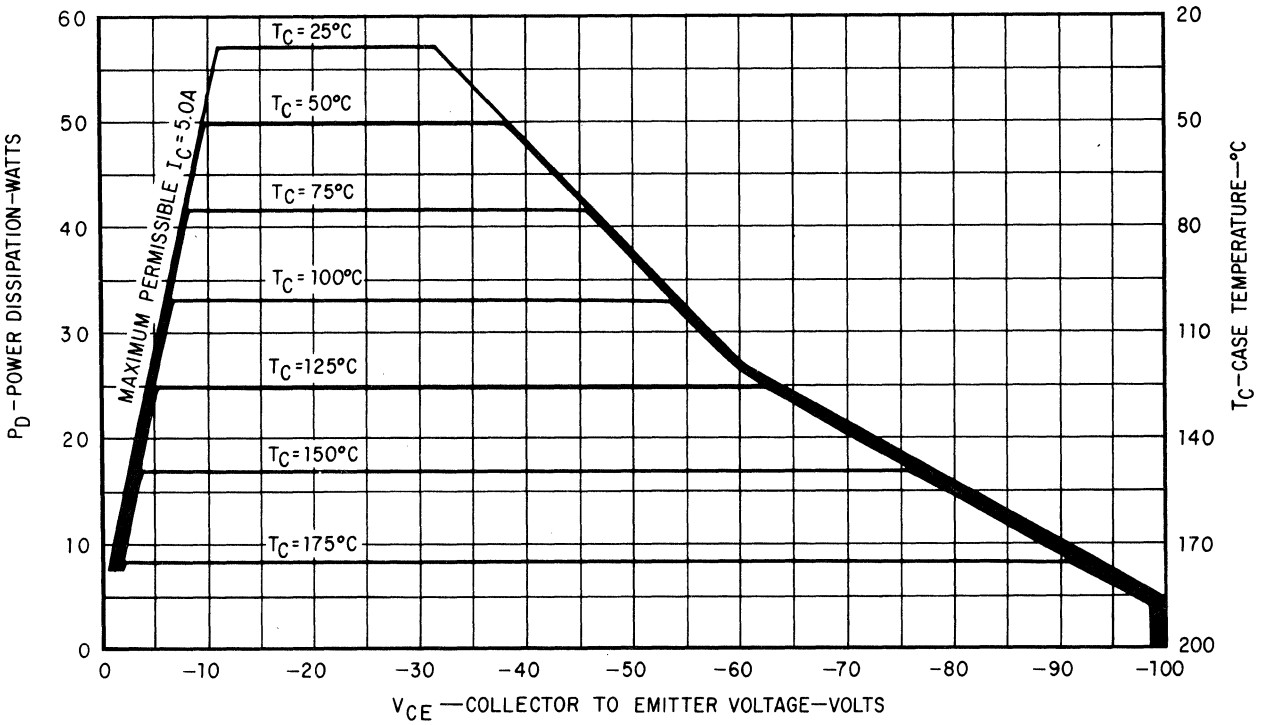
ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5286 MIN.	2N5286 TYP.	2N5286 MAX.	2N5287 MIN.	2N5287 TYP.	2N5287 MAX.	UNITS	TEST CONDITIONS	
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		−1.1	−1.45		−1.1	−1.45	Volts	$I_C = 2.5$ A	$I_B = 0.25$ A
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		−1.55	−2.2		−1.55	−2.2	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
$V_{BE(on)}$	Pulsed Base Emitter "ON" Voltage (Note 3)			−1.45			−1.45	Volts	$I_C = 2.5$ A	$V_{CE} = -5.0$ V
I_{CES}	Collector Cutoff Current		0.006	1.0		0.006	1.0	μA	$V_{CE} = -80$ V	$V_{BE} = 0$
I_{CEO}	Collector Cutoff Current			50			50	μA	$I_B = 0$	$V_{CE} = -60$ V
I_{EBO}	Emitter Cutoff Current			1.0			1.0	μA	$I_C = 0$	$V_{BE} = 4.0$ V
I_{CEX}(150°C)	Collector Reverse Current			500			500	μA	$V_{CE} = -80$ V	$V_{BE} = 2.0$ V
C_{cb}	Collector to Base Capacitance		170	250		170	250	pF	$I_E = 0$	$V_{CB} = -10$ V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	20			20				$I_C = 100$ mA	$V_{CE} = -5.0$ V

NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest.
(3) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(4) Contact factory for maximum permissible power under pulsed or reverse biased operating conditions.

MAXIMUM PERMISSIBLE DC FORWARD BIASED POWER DISSIPATION



2N5288 • 2N5289

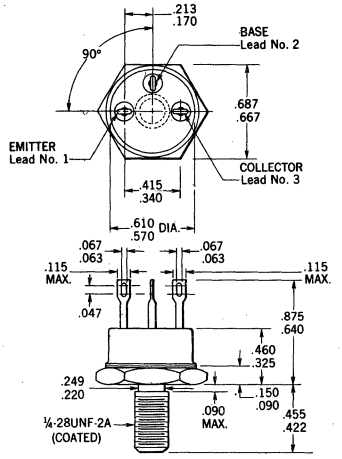
100 WATT NPN POWER TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SEE 2N5290 • 2N5291 FOR PNP COMPLEMENT

- **HIGH POWER . . . . . 100 WATTS AT $T_C = 50°C$, $V_{CE} = 40$ V**
- **HIGH VOLTAGE . . . . . 100 V (MIN) LV_{CEO}**
- **HIGH CURRENT SATURATION VOLTAGE . . . 1.5 V (MAX) $V_{CE(sat)}$ AT 10 A**
- **HIGH FREQUENCY . . . . . 30 AND 40 MHz (MIN) f_T**
- **BETA GUARANTEED AT 3 POINTS . . . . . 100 mA, 5.0 A AND 10 A**
- **ISOLATED COLLECTOR PACKAGE . . . . . NO ISOLATING HARDWARE REQUIRED**
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**

PHYSICAL DIMENSIONS
Similar to JEDEC (TO-61)



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 14.1 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−65°C to +200°C
Operating Junction Temperature	−65°C to +200°C
Lead Temperature (Soldering, 60 seconds time limit)	+300°C

Maximum Power Dissipation

Total Dissipation at 50°C Case Temperature, $V_{CE} = 40$ V (See Maximum Permissible Power Curve and Note 4)	**100 Watts**

Maximum Voltages and Current

V_{CES}	Collector to Emitter Voltage	120 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	100 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts
I_C	Collector Current	10 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5288 MIN.	2N5288 MAX.	2N5289 MIN.	2N5289 MAX.	UNITS	TEST CONDITIONS	
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	**100**		**100**		**Volts**	**$I_C = 200$ mA**	**$I_B = 0$**
BV_{CES}	Collector to Emitter Breakdown Voltage	120		120		Volts	$I_C = 1.0$ mA	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		6.0		Volts	$I_C = 0$	$I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**		**50**			**$I_C = 100$ mA**	**$V_{CE} = 5.0$ V**
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**90**	**70**	**200**		**$I_C = 5.0$ A**	**$V_{CE} = 5.0$ V**
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	12		35			$I_C = 5.0$ A	$V_{CE} = 5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**		**45**			**$I_C = 10$ A**	**$V_{CE} = 5.0$ V**
h_{fe}	**High Frequency Current Gain ($f = 20$ MHz)**	**1.5**		**2.0**			**$I_C = 2.0$ A**	**$V_{CE} = 5.0$ V**
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 3)		0.9		0.9	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 3)		**1.5**		**1.5**	**Volts**	**$I_C = 10$ A**	**$I_B = 1.0$ A**

Additional Electrical Characteristics on page 2

*Planar is a patented Fairchild process.

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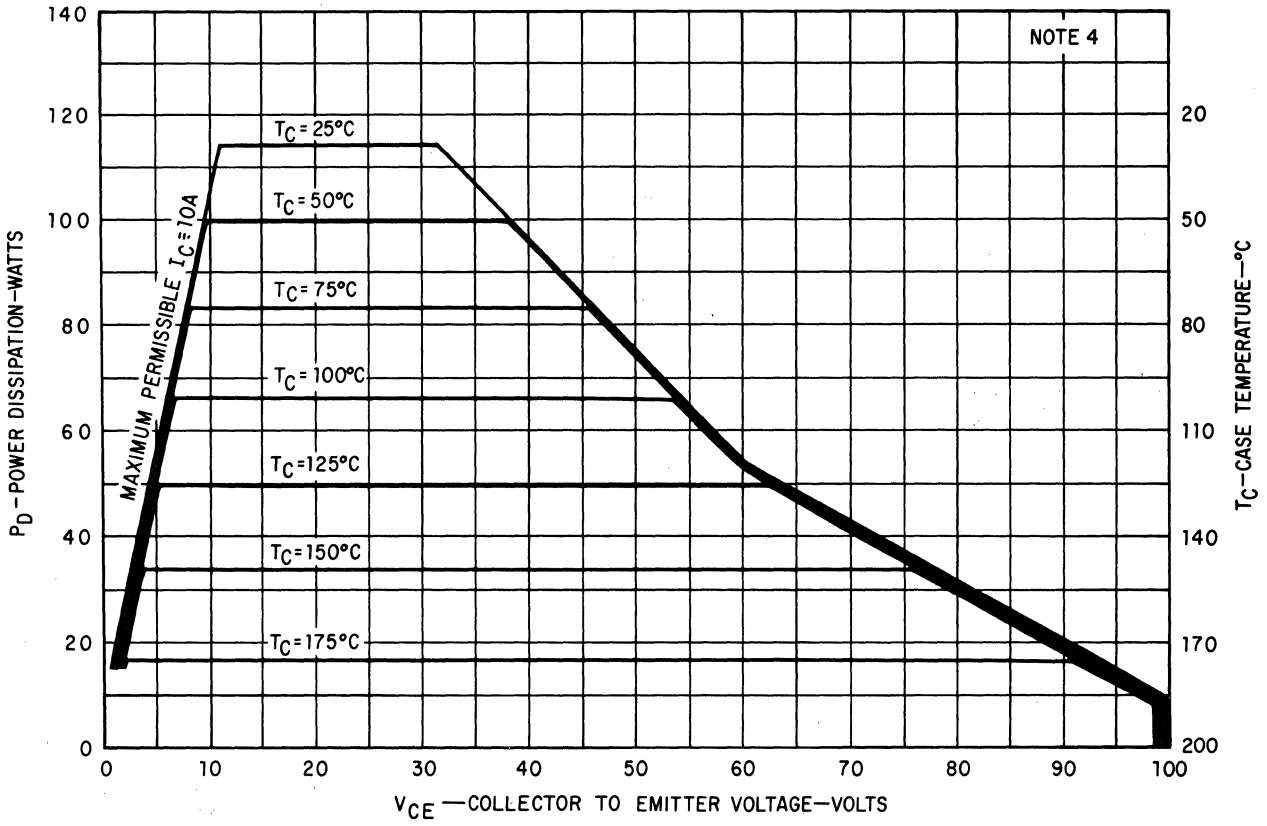
ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5288 MIN.	2N5288 MAX.	2N5289 MIN.	2N5289 MAX.	UNITS	TEST CONDITIONS	
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		1.8		1.8	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		2.2		2.2	Volts	$I_C = 10$ A	$I_B = 1.0$ A
$V_{BE(on)}$	Pulsed Base Emitter "ON" Voltage (Note 3)		1.8		1.8	Volts	$I_C = 5.0$ A	$V_{CE} = 5.0$ V
I_{CES}	Collector Cutoff Current		1.0		1.0	μA	$V_{CE} = 80$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current		1.0		1.0	μA	$I_C = 0$	$V_{EB} = 5.0$ V
I_{CEX}(150°C)	Collector Reverse Current		500		500	μA	$V_{CE} = 80$ V	$V_{EB} = 2.0$ V
C_{cb}	Collector to Base Capacitance		275		275	pF	$I_E = 0$	$V_{CB} = 10$ V
I_{CES}	Collector Cutoff Current		1.0		1.0	mA	$V_{CE} = 120$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current		1.0		1.0	mA	$I_C = 0$	$V_{EB} = 6.0$ V
I_{CEO}	Collector Cutoff Current		50		50	μA	$I_B = 0$	$V_{CE} = 60$ V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	20		50			$I_C = 200$ mA	$V_{CE} = 5.0$ V

NOTES:
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest.
(3) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(4) Contact factory for maximum permissible power under pulsed or reverse biased operating conditions.

MAXIMUM PERMISSIBLE DC FORWARD BIASED POWER DISSIPATION



2N5290 • 2N5291

100 WATT PNP POWER TRANSISTORS

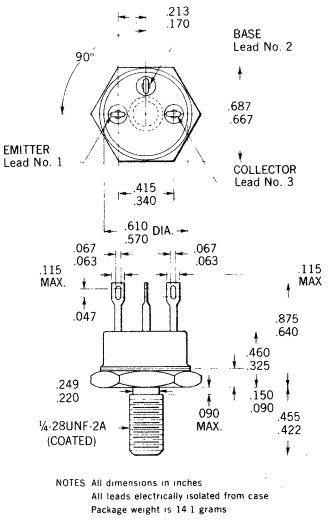
DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SEE 2N5288 • 2N5289 FOR NPN COMPLEMENT

- **HIGH POWER** . . . . . **100 WATTS AT $T_C = 50°C$, $V_{CE} = -40$ V**
- **HIGH VOLTAGE** . . . . . **-100 V (MIN) LV_{CEO}**
- **HIGH CURRENT SATURATION VOLTAGE** . . . **1.5 V (MAX) $V_{CE(sat)}$ AT 10 A**
- **HIGH FREQUENCY** . . . . . **30 AND 40 MHz (MIN) f_T**
- **BETA GUARANTEED AT 3 POINTS** . . . . . **100 mA, 5.0 A AND 10 A**
- **ISOLATED COLLECTOR PACKAGE** . . . . . **NO ISOLATING HARDWARE REQUIRED**
- **DISCRETE EMITTER GEOMETRY WITH INTEGRATED FEEDBACK RESISTORS**

PHYSICAL DIMENSIONS

Similar to JEDEC (TO-61)



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 14.1 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures		
Storage Temperature		$-65°C$ to $+200°C$
Operating Junction Temperature		$-65°C$ to $+200°C$
Lead Temperature (Soldering, 60 seconds time limit)		$+300°C$
Maximum Power Dissipation		
Total Dissipation at 50°C Case Temperature, $V_{CE} = -40$ V (See Maximum Permissible Power Curve and Note 4)		**100 Watts**
Maximum Voltages and Current		
V_{CES}	Collector to Emitter Voltage	-100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 2)	-100 Volts
V_{EBO}	Emitter to Base Voltage	-5.5 Volts
I_C	Collector Current	10 Amps

ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

		2N5290		2N5291			
SYMBOL	CHARACTERISTIC	MIN.	MAX.	MIN.	MAX.	UNITS	TEST CONDITIONS
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 2 and 3)	**-100**		**-100**		**Volts**	**$I_C = 200$ mA $I_B = 0$**
BV_{CES}	Collector to Emitter Breakdown Voltage	-100		-100		Volts	$I_C = 1.0$ mA $V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	-5.5		-5.5		Volts	$I_C = 0$ $I_E = 1.0$ mA
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**		**50**			**$I_C = 100$ mA $V_{CE} = -5.0$ V**
h_{FE}	**DC Pulse Current Gain** (Note 3)	**30**	**90**	**70**	**200**		**$I_C = 5.0$ A $V_{CE} = -5.0$ V**
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 3)	12		35			$I_C = 5.0$ A $V_{CE} = -5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 3)	**20**		**45**			**$I_C = 10$ A $V_{CE} = -5.0$ V**
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	**1.5**		**2.0**			**$I_C = 2.0$ A $V_{CE} = -5.0$ V**
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 3)		-0.9		-0.9	Volts	$I_C = 5.0$ A $I_B = 0.5$ A
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 3)		**-1.5**		**-1.5**	**Volts**	**$I_C = 10$ A $I_B = 1.0$ A**

Additional Electrical Characteristics on page 2

*Planar is a patented Fairchild process.

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ELECTRICAL CHARACTERISTICS (25°C Case Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N5290 MIN.	2N5290 MAX.	2N5291 MIN.	2N5291 MAX.	UNITS	TEST CONDITIONS	
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		−1.8		−1.8	Volts	$I_C = 5.0$ A	$I_B = 0.5$ A
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 3)		−2.2		−2.2	Volts	$I_C = 10$ A	$I_B = 1.0$ A
$V_{BE(on)}$	Pulsed Base Emitter "ON" Voltage (Note 3)		−1.8		−1.8	Volts	$I_C = 5.0$ A	$V_{CE} = -5.0$ V
I_{CES}	Collector Cutoff Current		1.0		1.0	μA	$V_{CE} = -80$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current		1.0		1.0	μA	$I_C = 0$	$V_{EB} = -4.0$ V
I_{CEX}(150°C)	Collector Reverse Current		500		500	μA	$V_{CE} = -80$ V	$V_{EB} = -2.0$ V
C_{cb}	Collector to Base Capacitance		500		500	pF	$I_E = 0$	$V_{CB} = -10$ V
I_{CES}	Collector Cutoff Current		1.0		1.0	mA	$V_{CE} = -100$ V	$V_{BE} = 0$
I_{EBO}	Emitter Cutoff Current		1.0		1.0	mA	$I_C = 0$	$V_{EB} = -5.5$ V
I_{CEO}	Collector Cutoff Current		50		50	μA	$I_B = 0$	$V_{CE} = -60$ V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	20		50			$I_C = 200$ mA	$V_{CE} = -5.0$ V

NOTES:
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) This rating refers to a high current point where collector to emitter voltage is lowest.
(3) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(4) Contact factory for maximum permissible power under pulsed or reverse biased operating conditions.

MAXIMUM PERMISSIBLE DC FORWARD BIASED POWER DISSIPATION