Switching, General Purpose, and RF Transistors Epoxy

High Speed Switches
General Purpose Amplifiers
RF-IF Amplifiers and Oscillators

SWITCHING, GENERAL PURPOSE, AND RF TRANSISTORS (EPOXY) NUMERICAL INDEX

Additional General Purpose Amplifiers and Switches

HIGH SPEED SWITCH SELECTION GUIDE

Rated V_{CEO} Volts	Optimum Collector Current mA									
	0.1 — 50		10 — 100		100 — 300		300 — 500		500 — 1000	
	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP
5-6		2N5141		2N5141						
		2N4257		2N4257						
		2N5140		2N5140						
12	2N4274	2N4258	2N4274	2N4258					2N3426	
		2N4389		2N4389						
		2N5055		2N4313						
				2N5055						
15	2N4275		2N3646		2N3646					
			2N4275							
20-25		2N3638		2N3638		2N3638		2N5242*		2N5242
		2N3638A		2N3638A		2N3638A				
		2N5142, 3		2N5142, 3		2N5142, 3				
				2N5242*		2N5242*				
30-45	FT3641*	2N4916	FT3641*	2N5243	FT3641*	2N5243*	FT3641	2N5243*		2N5243
	FT3643*	2N4121	FT3643*	2N4916	FT3643*	FT3644*	FT3643			
	2N4436	FT3644*	2N4436	2N4121	2N4436		2N3724			
	2N4437		2N4437	FT3644*	2N4437		2N4436			
	FT3642*		FT3642*		FT3642*		2N4437			
							FT3642			
46-60		FT3645*	FT3722*	FT3645*	FT3722*	FT3645*	FT3722*		FT3722*	
		2N3645		2N3645		2N3645				

*High dissipation epoxy package devices. FT numbers are the high dissipation versions of the corresponding 2N numbers.

HIGH SPEED SWITCHES (EPOXY) NUMERICAL INDEX

GENERAL PURPOSE AMPLIFIER SELECTION GUIDE

Rated V_{CEO} Volts	Optimum Collector Current mA 0.10 — 50 NPN	 PNP	 10 — 100 NPN	 PNP	 100 — 300 NPN	 PNP	 300 — 500 NPN	 PNP	 500 — 1000 NPN	 PNP
12-20	2N5128, 29 2N5131, 32 2N5136, 37	2N5139	2N5128, 29 2N5136, 37	2N5142	2N5128, 29 2N5136, 37	2N5142	2N5128, 29 2N5136, 37		2N5136, 37	
20-30	2N3565 2N3566 FT3641*, 43* 2N3691-94 SE4022 2N4436, 37 2N5135	2N3638, 38A 2N4916, 17 2N5138 2N4121	2N3566 FT3641*, 43* 2N4436, 37 2N5135 SE8040*	2N3638, 38A 2N5143 FT5040* SE8540*	2N3566 FT3641*, 43* 2N4436, 37 2N5135 SE8040*	2N3638, 38A FT5040* 2N5143 SE8540*	FT3641*, 43* 2N4436, 37 SE8040*	FT5040* SE8540*	SE8040*	FT5040* SE8540*
40-45	FT3567*, 69* FT3642* SE4021 2N4944, 46	2N4248, 50 FT3644*	FT3567*, 69* FT3642* 2N4944, 46	FT3644* FT5041*	FT3567*, 69* FT3642* 2N4944, 46	FT3644* FT5041*	FT3567*, 69* FT3642* 2N4944, 46	FT5041*	FT3567*, 69* 2N4944, 46	FT5041*
60	FT3568* SE4020 2N4945 SE6020, A* SE6022	2N4249 FT3645* FT4354*, 55*	FT3568* 2N4945 SE6020, A* SE6022	FT3645* FT4354* FT4355*	FT3568* 2N4945 SE6020, A* SE6022	FT3645* FT4354* FT4355*	FT3568* 2N4945 SE6020, A* SE6022	FT4354* FT4355*	FT3568* 2N4945	FT4354* FT4355*
80	SE6021, A* SE6023	FT4356*	SE6021, A* SE6023	FT4356*	SE6021, A* SE6023	FT4356*	SE6021, A* SE6023	FT4356*		FT4356*
120	SE7015*									
150	SE7016*	2N4888, 89								
180	SE7017*									

*High dissipation epoxy package devices. FT numbers are the high dissipation versions of the corresponding 2N numbers.

GENERAL PURPOSE AMPLIFIERS & SWITCHES (EPOXY) NUMERICAL INDEX

RF/IF AMPLIFIER SELECTION GUIDE

f MHz	Polarity	Device	Power Gain dB (min)	@ f MHz	NF dB (max)	@ f MHz	C_{cb} pF (max)
27	NPN	SE8012*	10.8	27			9.0
30	NPN	FT3641*	10	30			8.0
	NPN	2N4436	10	30			8.0
45	NPN	2N3688	29	45			1.6
100	PNP	2N4121	25 typ	100	6	100	4.5
	PNP	2N4916	25 typ	100	6	100	4.5
	NPN	SE5006	20	100	5.5 typ	100	1.6
200	NPN	SE3001	12	200	4 typ	60	1.7
	NPN	2N3690	15	200	5.5	200	1.6
	NPN	2N3563	14	200	4 typ	60	1.7
250	NPN	SE1010	6 typ	250	5.5	1.0	3.5
		2N3564	6 typ	250	3.7 typ	1.0	3.5

*FT3641 is a high dissipation epoxy package version of 2N3641; SE8012 is a high dissipation epoxy device.

RF/IF AMPLIFIER SELECTION GUIDE

f MHz	Polarity	Device	OSC P_O mW (min)	@ I_C mA
100	PNP	2N4916	200 typ	10
	PNP	2N4121	200 typ	10
500	PNP	2N4258	10 typ	10
930	NPN	SE3002	3.0	8.0
1000	NPN	SE3005	15	8.0

RF/IF AMPLIFIERS & OSCILLATORS (EPOXY) NUMERICAL INDEX

Additional General Purpose Amplifiers and Switches

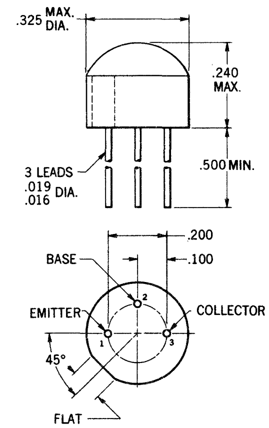
EN697

NPN GENERAL PURPOSE AMPLIFIER

DOUBLE DIFFUSED SILICON PLANAR* TRANSISTOR

- **ELECTRICAL REPLACEMENT FOR 2N697**
- **MEDIUM VOLTAGE - - LV_{CEO} = 30 V (MIN)**
- **MEDIUM GAIN - - h_{FE} = 40-120 AT 150 mA**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures		
Storage Temperature		−65°C to +125°C
Operating Junction Temperature		125°C Maximum
Maximum Power Dissipation		
Total Dissipation at 25°C Case Temperature (Notes 2 & 3)		0.8 Watt
at 25°C Ambient Temperature		0.3 Watt
Maximum Voltages		
V_{CBO}	Collector to Base Voltage	60 Volts
V_{CEO}	**Collector to Emitter Voltage**	**30 Volts**
V_{EBO}	Emitter to Base Voltage	5.0 Volts

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

SYMBOL	CHARACTERISTIC	MIN.	MAX.	UNITS	TEST CONDITIONS	
h_{fe}	DC Pulse Current Gain (Note 5)	40	120		I_C = 150 mA	V_{CE} = 10 V
V_{BE}(sat)	Base Saturation Voltage		1.3	Volts	I_C = 150 mA	I_B = 15 mA
V_{CE}(sat)	Collector Saturation Voltage		1.5	Volts	I_C = 150 mA	I_B = 15 mA
h_{fe}	High Frequency Current Gain (f = 20 MHz)	2.5			I_C = 30 mA	V_{CE} = 10 V
C_{obo}	Output Capacitance		35	pF	I_E = 0	V_{CB} = 10 V
I_{CBO}	Collector Cutoff Current		1.0	μA	I_E = 0	V_{CB} = 30 V
I_{CBO}(100°C)	Collector Cutoff Current		10	μA	I_E = 0	V_{CB} = 30 V
h_{ib}	Input Resistance (f = 1.0 kHz)	24	34	Ω	I_C = 1.0 mA	V_{CB} = 5.0 V
		4.0	8.0	Ω	I_C = 5.0 mA	V_{CB} = 10 V
h_{rb}	Voltage Feedback Ratio (f = 1.0 kHz)		5.0	$x10^{-4}$	I_C = 1.0 mA	V_{CB} = 5.0 V
			5.0	$x10^{-4}$	I_C = 5.0 mA	V_{CB} = 10 V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	25	175		I_C = 1.0 mA	V_{CE} = 5.0 V
		35	200		I_C = 5.0 mA	V_{CE} = 10 V
h_{ob}	Output Conductance (f = 1.0 kHz)	0.1	0.5	μmho	I_C = 1.0 mA	V_{CB} = 5.0 V
		0.1	1.0	μmho	I_C = 5.0 mA	V_{CB} = 10 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 operation.
(3) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 125°C/Watt (derating factor of 8.0 mW/°C); junction to ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C).
(4) 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 = 300μs; duty cycle = 1%.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

EN706 • EN708 • EN914

NPN HIGH SPEED SATURATED SWITCHES

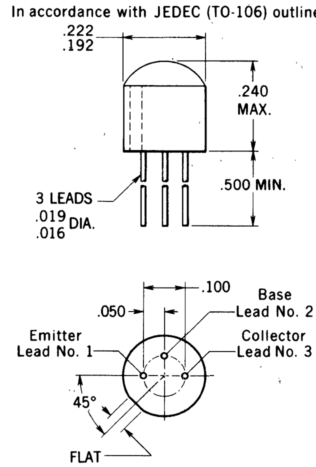
DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

FOR TEST CIRCUITS AND ADDITIONAL DESIGN INFORMATION, SEE FAIRCHILD 2N706, 2N708, AND 2N914 DATA SHEETS

- **ELECTRICAL REPLACEMENTS FOR 2N706, 2N708 AND 2N 914**
- **HIGH SPEED - - $T_S = 20$ ns (max) at 20 mA**
- **HIGH FREQUENCY - - $f_T = 300$ MHz (min) at 20 mA**
- **LOW CAPACITANCE - - $C_{obo} = 6.0$ dB (max) at 5.0 V**

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures				
Storage Temperature				−65°C to +125°C
Operating Junction Temperature				125°C
Lead Temperature (Soldering, 10 Second Time Limit)				260°C
Maximum Power Dissipation				
Total Dissipation at 25°C Case Temperature (Notes 2 and 3)				0.5 Watt
at 25°C Ambient Temperature (Notes 2 and 3)				0.2 Watt
Maximum Voltages		**EN 706**	**EN 708**	**EN 914**
V_{CBO}	Collector to Base Voltage	25 V	40 V	40 V
V_{CEO}	Collector to Emitter Voltage (Note 4)	15 V	15 V	15 V
V_{EBO}	Emitter to Base Voltage	3.0 V	5.0 V	5.0 V

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

SYMBOL	CHARACTERISTICS	EN706 MIN.	EN706 MAX.	EN708 MIN.	EN708 MAX.	EN914 MIN.	EN914 MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain (Note 5)	20		30	120	30	120		$I_C = 10$ mA	$V_{CE} = 1.0$ V
h_{FE}(−55°C)	DC Pulse Current Gain (Note 5)			15		12			$I_C = 10$ mA	$V_{CE} = 1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)			15					$I_C = 0.5$ mA	$V_{CE} = 1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)					10			$I_C = 500$ mA	$V_{CE} = 5.0$ V
V_{CE}(sat)	Collector Saturation Voltage		0.6		0.4			Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{CE}(sat) (−55°C to +125°C)	Collector Saturation Voltage				0.4			Volts	$I_C = 7.0$ mA	$I_B = 0.7$ mA
V_{CE}(sat) (−55°C to +125°C)	Collector Saturation Voltage (Note 6)						0.25	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{CE}(sat)	Collector Saturation Voltage						0.70	Volts	$I_C = 200$ mA	$I_B = 200$ mA
V_{BE}(sat)	Base Saturation Voltage		0.9	0.72	0.85	0.70	0.80	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{BE}(sat) (−55°C)	Base Saturation Voltage				0.95			Volts	$I_C = 7$ mA	$I_B = 0.7$ mA
I_{CBO}	Collector Cutoff Current		0.5					nA	$V_{CB} = 15$ V	$I_E = 0$
I_{CBO}	Collector Cutoff Current				50		100	nA	$V_{CB} = 20$ V	$I_E = 0$
I_{CEX}(+100°C)	Collector Cutoff Current				25		25	μA	$V_{CE} = 20$ V	$V_{BE} = 0.25$ V
I_{CBO}(+100°C)	Collector Cutoff Current		30		25		25	μA	$V_{CB} = 20$ V	$I_E = 0$
r'_b	Base Spreading Resistance (Note 7)				75			Ω	$I_C = 10$ mA	$V_{CE} = 10$ V
BV_{CBO}	Collector to Base Breakdown Voltage	25		40		40		Volts	$I_C = 1.0$ mA	$I_E = 0$

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

FAIRCHILD TRANSISTORS EN706 • EN708 • EN914

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

SYMBOL	CHARACTERISTICS	EN706 MIN.	EN706 MAX.	EN708 MIN.	EN708 MAX.	EN914 MIN.	EN914 MAX.	UNITS	TEST CONDITIONS
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	15		15		15		Volts	$I_C = 30$ mA (pulsed)
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0		5.0		5.0		Volts	$I_C = 0$, $I_E = 100\ \mu A$
$\mathbf{C_{obo}}$	**Output Capacitance**		**6.0**		**6.0**		**6.0**	**pF**	$I_E = 0$, $\mathbf{V_{CB} = 10\ V}$
C_{ibo}	Input Capacitance						9.0	pF	$I_C = 0$, $V_{EB} = 0.5$ V
h_{FE}	High Frequency Current Gain (f = 100 MHz)	2.0							$I_C = 10$ mA, $V_{CE} = 15$ V
h_{FE}	High Frequency Current Gain (f = 100 MHz)			3.0					$I_C = 10$ mA, $V_{CE} = 10$ V
$\mathbf{h_{FE}}$	**High Frequency Current Gain (f = 100 MHz)**					**3.0**			$\mathbf{I_C = 20\ mA}$, $\mathbf{V_{CE} = 10\ V}$
τ_s	Charge Storage Time Constant (Note 8)		60					ns	$I_C \approx 10$ mA, $V_{CC} = 10$ V, $I_{B1} \approx I_{B2} \approx 10$ mA, $R_L = 1\ k\Omega$
τ_s	Charge Storage Time Constant (Note 9)				25			ns	$I_C \approx I_{B1} \approx I_{B2} \approx 10$ mA
τ_s	**Charge Storage Time Constant** (Note 10)						**20**	**ns**	$\mathbf{I_C \approx I_{B1} \approx I_{B2} \approx 20\ mA}$
t_{on}	Turn On Time				40			ns	$I_C \approx 10$ mA, $I_B \approx 3.0$ mA, $V_{BE} = 2.0$ V
t_{on}	Turn On Time						40	ns	$I_C \approx 200$ mA, $I_{B1} \approx 40$ mA
t_{off}	Turn Off Time				75			ns	$I_C \approx 10$ mA, $I_B \approx 3.0$ mA, $I_{B2} \approx 1.0$ mA
t_{off}	Turn Off Time						40	ns	$I_C \approx 200$ mA, $I_{B1} \approx 40$ mA, $I_{B2} \approx 20$ mA

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 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).
(4) 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) $I_C = 1.0$ mA through 20 mA.
(7) $r_b' =$ hie(Real Part) - Measured with GR#1607-A Bridge.
(8) Conditions chosen to make storage time approximately independent of transistor h_{FE}, Measurement with Tektronix R plug-in unit. $\tau_s = K_s \ln 2$.
(9) Measured on sampling scope, PW 400ns.
(10) Measured on sampling scope, PW 200ns.

EN718A · EN956 · EN1613 · EN1711

NPN GENERAL PURPOSE AMPLIFIERS

DOUBLE DIFFUSED SILICON PLANAR* TRANSISTORS

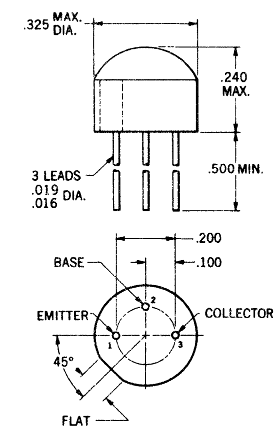
FOR ADDITIONAL DESIGN INFORMATION SEE FAIRCHILD 2N718A DATA SHEET

- **ELECTRICAL REPLACEMENTS FOR 2N718A, 2N956, 2N1613 AND 2N1711**
- **HIGH GAIN - - h_{FE} = 100-300 at 150 mA**
  h_{FE} = 35 (min) at 100 μA
  h_{FE} = 40 (min) at 500 mA
- **HIGH VOLTAGE - - LV_{CEO} = 40 V (min)**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures			
Storage Temperature		−65°C to +125°C	
Operating Junction Temperature		+125°C Maximum	
		EN718A	**EN1613**
Maximum Power Dissipation		**EN956**	**EN1711**
Total Dissipation at 25°C Case Temperature (Notes 2 and 3)		0.6 Watt	0.8 Watt
at 25°C Ambient Temperature (Notes 2 and 3)		0.22 Watt	0.3 Watt
Maximum Voltages			
V_{CBO}	Collector to Base Voltage		75 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)		40 Volts
V_{EBO}	Emitter to Base Voltage		7.0 Volts

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

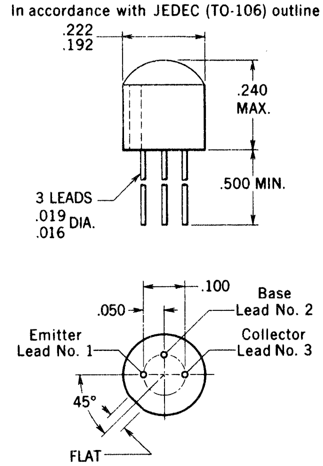
EN1613 · EN1711

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

SYMBOL	CHARACTERISTICS	EN718A EN1613 MIN.	EN718A EN1613 MAX.	EN956 EN1711 MIN.	EN956 EN1711 MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Pulse Current Gain** (Note 5)	40	120	**100**	**300**		**I_C = 150 mA**	V_{CE} = 10 V
h_{FE}	DC Pulse Current Gain (Note 5)	35		75			I_C = 10 mA	V_{CE} = 10 V
h_{FE}	**DC Pulse Current Gain** (Note 5)	20		**40**			**I_C = 500 mA**	V_{CE} = 10 V
h_{FE}(−55°C)	DC Pulse Current Gain (Note 5)	20		30			I_C = 10 mA	V_{CE} = 10 V
h_{FE}	**DC Current Gain**	20		**35**			**I_C = 0.1 mA**	V_{CE} = 10 V
h_{FE}	DC Current Gain			20			I_C = 0.01 mA	V_{CE} = 10 V
V_{BE}(sat)	Base Saturation Voltage (Pulsed, Note 5)		1.3		1.3	Volts	I_C = 150 mA	I_B = 15 mA
V_{CE}(sat)	Collector Saturation Voltage (Pulsed, Note 5)		1.5		1.5	Volts	I_C = 150 mA	I_B = 15 mA
h_{fe}	High Frequency Current Gain (f = 20 MHz)	3.0		3.5			I_C = 30 mA	V_{CE} = 10 V
C_{obo}	Output Capacitance		25		25	pF	I_E = 0	V_{CB} = 10 V
C_{ibo}	Emitter Transition Capacitance		80		80	pF	I_C = 0	V_{EB} = 0.5 V
NF	Noise Figure (Note 6)		12		8.0	dB	I_C = 0.3 mA	V_{CE} = 10 V
I_{CBO}	Collector Cutoff Current		50		50	mμA	I_E = 0	V_{CB} = 60 V
I_{CBO}(100°C)	Collector Cutoff Current		10		10	μA	I_E = 0	V_{CB} = 60 V
BV_{CBO}	Collector to Base Breakdown Voltage	75		75		Volts	I_C = 0.1 mA	I_E = 0

Additional Electrical Characteristics on page 2
Notes on page 2

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

EN718A · EN956

*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	EN718A EN1613 MIN.	EN718A EN1613 MAX.	EN956 EN1711 MIN.	EN956 EN1711 MAX.	UNITS	TEST CONDITIONS	
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	40		40		Volts	$I_C = 10$ mA (pulsed)	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	7.0		7.0		Volts	$I_C = 0$	$I_E = 0.1$ mA
I_{EBO}	Emitter Current		50		50	mμA	$I_C = 0$	$V_{EB} = 5.0$ V
h_{ib}	Input Resistance (f = 1.0 kHz)	24	34	24	34	Ω	$I_C = 1.0$ mA	$V_{CB} = 5.0$ V
		4.0	8.0	4.0	8.0	Ω	$I_C = 5.0$ mA	$V_{CB} = 10$ V
h_{rb}	Voltage Feedback Ratio (f = 1.0 kHz)		5.0		5.0	$x10^{-4}$	$I_C = 1.0$ mA	$V_{CB} = 5.0$ V
			5.0		5.0	$x10^{-4}$	$I_C = 5.0$ mA	$V_{CB} = 10$ V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	25	175	50	400		$I_C = 1.0$ mA	$V_{CE} = 5.0$ V
		35	200	70	400		$I_C = 5.0$ mA	$V_{CE} = 10$ V
h_{ob}	Output Conductance (f = 1.0 kHz)	0.1	0.5	0.1	0.5	μmho	$I_C = 1.0$ mA	$V_{CB} = 5.0$ V
		0.1	1.0	0.1	1.0	μmho	$I_C = 5.0$ mA	$V_{CB} = 10$ 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 operation.
(3) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 125°C/Watt (derating factor of 8.0 mW/°C) for the EN1613 and EN1711; for the EN718A and EN956 167°C/Watt (derating factor of 6.0 mW/°C). Junction to ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C) for the EN1613 and EN1711; for the EN718A and EN956 455°C/Watt (derating factor of 2.2mW/°C).
(4) 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%.
(6) f = 1000 Hz; $R_G = 510Ω$; 1.0 Hz bandwidth.

EN722 • EN1132

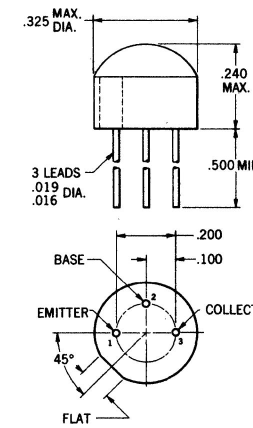
PNP GENERAL PURPOSE AMPLIFIERS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

FOR TEST CIRCUITS AND ADDITIONAL DESIGN INFORMATION SEE FAIRCHILD 2N722 DATA SHEET

- **ELECTRICAL REPLACEMENTS FOR 2N722 and 2N1132**
- **BREAKDOWN VOLTAGE . . . . BV_{CBO} = 50 V (MIN)**
  . . . . LV_{CEO} = 35 V (MIN)
- **BETA . . . . h_{FE} = 30–90 @ 150 mA**
- **FREQUENCY . . . . f_T = 60 MHz (MIN)**
- **CAPACITANCE . . . . C_{ob} = 45 pF (MAX)**

PHYSICAL DIMENSIONS
in accordance with JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

EN1132

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 second time limit)	+260°C Maximum

Maximum Power Dissipation	**EN722**	**EN1132**
Total Dissipation at 25°C Case Temperature [Notes 2 and 3]	0.5 Watt	0.7 Watt
at 25°C Free Air Temperature [Notes 2 and 3]	0.2 Watt	0.3 Watt

Maximum Voltages

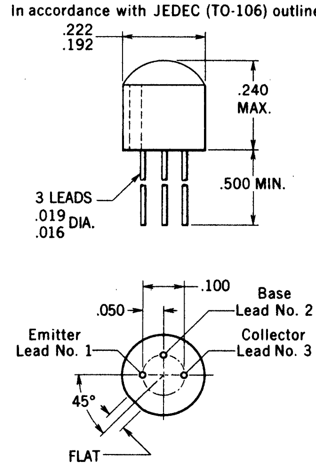
V_{CBO}	Collector to Base Voltage	−50 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	−35 Volts
V_{EBO}	Emitter to Base Voltage	−5.0 Volts

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

SYMBOL	CHARACTERISTIC	MIN.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain [Note 5]	25			I_C = 5.0 mA	V_{CE} = −10 V
h_{FE}	**DC Pulse Current Gain** [Note 5]	**30**	**90**		**I_C = 150 mA**	**V_{CE} = −10 V**
V_{BE} (sat)	Base Saturation Voltage		−1.3	Volts	I_C = 150 mA	I_B = 15 mA
V_{CE} (sat)	Collector Saturation Voltage		−1.5	Volts	I_C = 150 mA	I_B = 15 mA
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	**3.0**			**I_C = 50 mA**	**V_{CE} = −3.0 V**
C_{ob}	**Output Capacitance**		**45**	**pF**	**I_E = 0**	**V_{CB} = −10 V**
C_{TE}	Emitter Transition Capacitance (for EN722 only)		100	pF	I_C = 0	V_{EB} = −0.5 V
C_{TE}	Emitter Transition Capacitance (for EN1132 only)		80	pF	I_C = 0	V_{EB} = −0.5 V
I_{CBO}	Collector Cutoff Current		1.0	μA	I_E = 0	V_{CB} = −30 V
I_{CBO} (100°C)	Collector Cutoff Current		100	μA	I_E = 0	V_{CB} = −30 V
I_{EBO}	Emitter Cutoff Current		100	μA	I_C = 0	V_{EB} = −5.0 V
BV_{CBO}	**Collector to Base Breakdown Voltage**	**−50**		**Volts**	**I_C = 100 μA**	**I_E = 0**

Additional Electrical Characteristics on Page 2.

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

EN722

*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	CHARACTERISTIC	MIN.	MAX.	UNITS	TEST CONDITIONS	
V_{CEO} (sust)	**Collector to Emitter Sustaining Voltage**	**—35**		**Volts**	**I_C = 10 mA (pulsed)**	**I_B = 0**
BV_{EBO}	Emitter to Base Voltage	—5.0		Volts	I_C = 0	I_E = 100 μA
h_{fe}	Current Transfer Ratio	25	100		V_{CE} = —5 V	I_C = 1.0 mA f = 1.0 kHz
h_{fe}	Current Transfer Ratio	30			V_{CE} = —10 V	I_C = 5.0 mA f = 1.0 kHz
h_{ib}	Input Resistance	25	35	Ω	V_{CB} = —5 V	I_C = 1.0 mA f = 1.0 kHz
h_{ib}	Input Resistance		10	Ω	V_{CB} = —10 V	I_C = 5.0 mA f = 1.0 kHz
h_{rb}	Voltage Feedback Ratio		8.0	$\times 10^{-4}$	V_{CB} = —5 V	I_C = 1.0 mA f = 1.0 kHz
h_{rb}	Voltage Feedback Ratio		8.0	$\times 10^{-4}$	V_{CB} = —10 V	I_C = 5.0 mA f = 1.0 kHz
h_{ob}	Output Conductance		1.0	μmho	V_{CB} = —5 V	I_C = 1.0 mA f = 1.0 kHz
h_{ob}	Output Conductance		5.0	μmho	V_{CB} = —10 V	I_C = 5.0 mA, f = 1.0 kHz

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 125°C and junction to case thermal resistance of 143°C/watt (derating factor of 7.0 mW/°C) for the EN1132 and 200°C/watt (derating factor of 5.0 mW/°C) for the EN722; junction to ambient thermal-resistance of 333°C/watt (derating factor of 3.0 mW/°C) for the EN1132 and 500°C/watt (derating factor of 2.0 mW/°C) for the EN722.

(4) 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%.

EN744 • EN2369A • EN3011

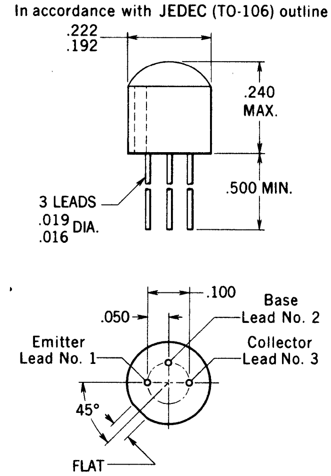
NPN HIGH-SPEED SATURATED SWITCHES

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

FOR TEST CIRCUITS AND ADDITIONAL DESIGN INFORMATION, SEE FAIRCHILD 2N744, 2N2369A AND 2N3011 DATA SHEETS

- **ELECTRICAL REPLACEMENTS FOR 2N744, 2N2369A AND 2N3011**
- **HIGH SPEED - - $\tau_s = 13$ ns (max) at 10 mA**
  - - $t_{on} = 12$ ns (max) at 10 mA
  - - $t_{off} = 18$ ns (max) at 10 mA
- **MEDIUM VOLTAGE - - $LV_{CEO} = 15$ V (min)**
- **MEDIUM GAIN - - $h_{FE} = 40$ (min) at 10 mA, 0.35 V**
- **HIGH FREQUENCY - - $f_T = 500$ MHz (min) at 10 mA**

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures				
Storage Temperature				−65°C to +125°C
Operating Junction Temperature				125°C Maximum
Lead Temperature (Soldering, 10 second time limit)				260°C Maximum
Maximum Power Dissipation				
Total Dissipation at 25°C Case Temperature (Notes 2 and 3)				0.5 Watt
at 25°C Ambient Temperature (Notes 2 and 3)				0.2 Watt
Maximum Voltages		**EN744**	**EN2369A**	**EN3011**
V_{CBO}	Collector to Base Voltage	20 Volts	40 Volts	30 Volts
V_{CES}	Collector to Emitter Voltage		40 Volts	30 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	12 Volts	15 Volts	12 Volts
V_{EBO}	Emitter to Base Voltage	5.0 Volts	4.5 Volts	5.0 Volts
I_C	DC Collector Current	200 mA	200 mA	
I_C	Collector Current (10 μs Pulse)		500 mA	

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

SYMBOL	CHARACTERISTIC	EN744 MIN.	EN744 MAX.	**EN2369A** MIN.	**EN2369A** MAX.	EN3011 MIN.	EN3011 MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Current Gain	20							$I_C = 1.0$ mA	$V_{CE} = 0.25$ V
h_{FE}	**DC Pulse Current Gain** (Note 5)	40	120	**40**		30	120		**$I_C = 10$ mA**	**$V_{CE} = 0.35$ V**
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 5)	20		20					$I_C = 10$ mA	$V_{CE} = 0.35$ V
h_{FE}	DC Pulse Current Gain (Note 5)				120				$I_C = 10$ mA	$V_{CE} = 1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)			30		25			$I_C = 30$ mA	$V_{CE} = 0.4$ V
h_{FE}	DC Pulse Current Gain (Note 5)	20		20		12			$I_C = 100$ mA	$V_{CE} = 1.0$ V
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage** (Notes 4 and 5)	12		**15**		12		**Volts**	**$I_C = 10$ mA**	**$I_B = 0$**
C_{obo}	Output Capacitance		5.0		4.0		4.0	pF	$I_E = 0$	$V_{CB} = 5.0$ V
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**			**5.0**		4.0			**$I_C = 10$ mA**	$V_{CE} = 10$ V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	9.0						dB	$I_C = 10$ mA	$V_{CE} = 10$ V
τ_s	**Charge Storage Time Constant** (Note 6)		18		**13**		13	**ns**	**$I_C \approx I_{B1} \approx -I_{B2} \approx 10$ mA**	
t_{on}	Turn On Time (Note 6)		16		**12**			**ns**	**$I_C \approx 10$ mA, $I_{B1} \approx 3.0$ mA**	
t_{on}	Turn On Time (Note 6)		12					ns	$I_C \approx 100$ mA $I_{B1} \approx 40$ mA	
t_{off}	**Turn Off Time** (Note 6)		24		**18**			**ns**	**$I_C \approx 10$ mA $I_{B1} \approx 3.0$ mA $I_{B2} \approx -1.5$ mA**	
t_{off}	Turn Off Time (Note 6)		45					ns	$I_C \approx 100$ mA $I_{B1} \approx 40$ mA, $I_{B2} \approx -20$ mA	
t_{on}	Turn On Time (Note 6)						15	ns	$I_C \approx 30$ mA, $I_{B1} \approx 3.0$ mA	
t_{off}	Turn Off Time (Note 6)						20	ns	$I_C \approx 30$ mA, $I_{B1} \approx I_{B2} \approx 3.0$ mA	

Additional Electrical Characteristics on page 2

*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 125°C and junction-to-case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/watt (derating factor of 2.0 mW/°C).
(4) 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 $\leq 2\%$.
(6) Measured on Sampling Scope. PW ≥ 200 ns

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

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

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

SYMBOL	CHARACTERISTIC	EN744 MIN.	EN744 MAX.	**EN2369A** MIN.	**EN2369A** MAX.	EN3011 MIN.	EN3011 MAX.	UNITS	TEST CONDITIONS	
V_{CE}(sat)	Collector Saturation Voltage				0.2		0.2	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{CE}(sat) (+100°C)	Collector Saturation Voltage		0.3		0.3			Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{CE}(sat) (+85°C)	Collector Saturation Voltage						0.3	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{CE}(sat)	Collector Saturation Voltage				0.25		0.25	Volts	$I_C = 30$ mA	$I_B = 3.0$ mA
V_{CE}(sat)	Collector Saturation Voltage				0.5		0.5	Volts	$I_C = 100$ mA	$I_B = 10$ mA
V_{CE}(sat) (+100°C)	Collector Saturation Voltage		1.0					Volts	$I_C = 100$ mA	$I_B = 10$ mA
V_{BE}(sat)	Base Saturation Voltage	0.65	0.85	0.7	0.85	0.72	0.87	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{BE}(sat) (−55°C to +100°C)	Base Saturation Voltage			0.59	1.02			Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{BE}(sat) (−55°C)	Base Saturation Voltage		1.1					Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{BE}(sat)	Base Saturation Voltage				1.15		1.15	Volts	$I_C = 30$ mA	$I_B = 3.0$ mA
V_{BE}(sat)	Base Saturation Voltage		1.5		1.6		1.6	Volts	$I_C = 100$ mA	$I_B = 10$ mA
V_{BE}(sat) (−55°C)	Base Saturation Voltage		1.6					Volts	$I_C = 100$ mA	$I_B = 10$ mA
I_{CES}	Collector Cutoff Current		1.0		0.4		0.4	μA	$V_{CE} = 20$ V	$V_{BE} = 0$
I_{CES} (+85°C)	Collector Cutoff Current						20	μA	$V_{CE} = 20$ V	$V_{BE} = 0$
I_{CBO}	Collector Cutoff Current		1.0					μA	$I_E = 0$	$V_{CB} = 20$ V
I_{CBO} (+100°C)	Collector Cutoff Current		25		25			μA	$I_E = 0$	$V_{CB} = 20$ V
I_{CEX} (+100°C)	Collector Cutoff Current		30					μA	$V_{CE} = 10$ V	$V_{BE} = 0.35$ V
I_{EBO}	Emitter Cutoff Current		10					μA	$I_C = 0$	$V_{EB} = 5.0$ V
BV_{EBO}	Emitter to Base Breakdown Voltage			4.5				Volts	$I_E = 10$ μA	$I_C = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0				5.0		Volts	$I_E = 100$ μA	$I_C = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	20		40		30		Volts	$I_C = 10$ μA	$I_E = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage			40		30		Volts	$I_C = 10$ μA	$V_{BE} = 0$

EN870 • EN871

NPN GENERAL PURPOSE AMPLIFIERS

DOUBLE DIFFUSED SILICON PLANAR* TRANSISTORS

FOR TEST CIRCUITS AND ADDITIONAL DESIGN INFORMATION SEE FAIRCHILD 2N870 DATA SHEET

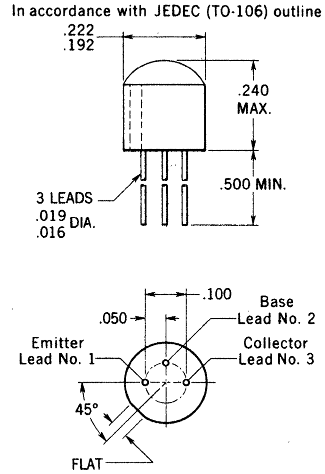
- **ELECTRICAL REPLACEMENTS FOR 2N870 AND 2N871**
- **HIGH VOLTAGE - - $LV_{CEO} = 60$ V (MIN)**
- **HIGH GAIN - - $h_{FE} = 100$-300 AT 150 mA**

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures		
Storage Temperature		−65° to +125°C
Operating Junction Temperature		125°C Maximum
Maximum Power Dissipation		
Total Dissipation at 25°C Case Temperature (Notes 2 and 3)		0.6 Watt
at 25°C Ambient Temperature (Notes 2 and 3)		0.22 Watt
Maximum Voltages		
V_{CBO}	Collector to Base Voltage	100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	60 Volts
V_{EBO}	Emitter to Base Voltage	7.0 Volts

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram Package is electrically non-conductive material

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

SYMBOL	CHARACTERISTIC	EN870 MIN	EN870 MAX.	EN871 MIN.	EN871 MAX.	UNITS	TEST CONDITIONS	
$\mathbf{h_{FE}}$	**DC Pulse Current Gain** (Note 5)	40	120	**100**	**300**		$\mathbf{I_C = 150}$ **mA**	$V_{CE} = 10$ V
h_{FE}	DC Pulse Current Gain (Note 5)	35					$I_C = 10$ mA	$V_{CE} = 10$ V
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 5)	20					$I_C = 10$ mA	$V_{CE} = 10$ V
h_{FE}	DC Current Gain	20					$I_C = 0.1$ mA	$V_{CE} = 10$ V
$V_{BE}(sat)$	Base Saturation Voltage		0.9		0.9	Volts	$I_C = 50$ mA	$I_B = 5.0$ mA
$V_{CE}(sat)$	Collector Saturation Voltage		1.2		1.2	Volts	$I_C = 50$ mA	$I_B = 5.0$ mA
$V_{BE}(sat)$	Base Saturation Voltage		1.3		1.3	Volts	$I_C = 150$ mA	$I_B = 15$ mA
$V_{CE}(sat)$	Collector Saturation Voltage		5.0		5.0	Volts	$I_C = 150$ mA	$I_B = 15$ mA
h_{fe}	High Frequency Current Gain (f = 20 MHz)	2.5		3.0			$I_C = 30$ mA	$V_{CE} = 10$ V
C_{obo}	Output Capacitance		20		20	pF	$I_E = 0$	$V_{CB} = 10$ V
C_{TE}	Emitter Transition Capacitance		85		85	pF	$I_C = 0$	$V_{EB} = 0.5$ V
I_{CBO}	Collector Cutoff Current		100		100	nA	$I_E = 0$	$V_{CB} = 75$ V
$I_{CBO}(100°C)$	Collector Cutoff Current		15		15	μA	$I_E = 0$	$V_{CB} = 75$ V
BV_{CBO}	Collector to Base Breakdown Voltage	100		100		Volts	$I_C = 0$	$I_E = 0.1$ mA
$\mathbf{V_{CEO}(sust)}$	**Collector to Emitter Sustaining Voltage** (Note 4)	**60**		**60**		**Volts**	$\mathbf{I_C = 30}$ **mA** (pulsed)	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	7.0		7.0		Volts	$I_C = 0$	$I_E = 0.1$ mA
I_{EBO}	Emitter Cutoff Current		50		50	nA	$I_C = 0$	$V_{EB} = 5.0$ V
h_{ib}	Input Resistance (f = 1.0 kHz)	20	30	20	30	Ω	$I_C = 1.0$ mA	$V_{CB} = 5.0$ V
h_{ib}	Input Resistance (f = 1.0 kHz)	4.0	8.0	4.0	8.0	Ω	$I_C = 5.0$ mA	$V_{CB} = 10$ V

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 unless otherwise noted)

SYMBOL	CHARACTERISTIC	EN870 MIN.	EN870 MAX.	EN871 MIN.	EN871 MAX.	UNITS	TEST CONDITIONS	
h_{ob}	Output Conductance (f = 1.0 kHz)		0.5		0.5	μmho	$I_C = 1.0$ mA	$V_{CB} = 5.0$ V
h_{ob}	Output Conductance (f = 1.0 kHz)		0.5		0.5	μmho	$I_C = 5.0$ mA	$V_{CB} = 10$ V
h_{rb}	Voltage Feedback Ratio (f= 1.0 kHz)		1.25		5.0	$x10^{-4}$	$I_C = 1.0$ mA	$V_{CB} = 5.0$ V
h_{rb}	Voltage Feedback Ratio (f= 1.0 kHz)		1.50		5.0	$x10^{-4}$	$I_C = 5.0$ mA	$V_{CB} = 10$ V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	30	175	50	400		$I_C = 1.0$ mA	$V_{CE} = 5.0$ V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	45	200	70	400		$I_C = 5.0$ mA	$V_{CE} = 10$ 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 125°C and junction to case thermal resistance of 167°C/Watt (derating factor of 8.0 mW/°C); junction to ambient thermal resistance of 455°C/Watt (derating factor of 2.2 mW/°C).
(4) These ratings refer to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(5) Pulse Conditions: length = 300 μs; duty cycle = 1%.

EN915 · EN916

NPN HIGH FREQUENCY AMPLIFIERS AND OSCILLATORS

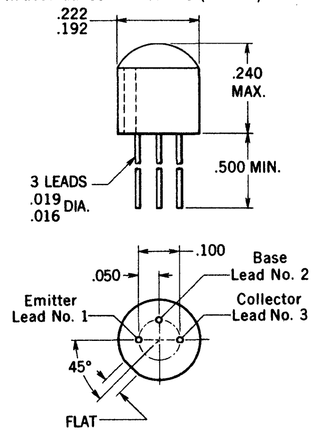
DIFFUSED SILICON PLANAR* TRANSISTORS

FOR TEST CIRCUITS AND ADDITIONAL DESIGN INFORMATION SEE FAIRCHILD 2N915 DATA SHEET

- **ELECTRICAL REPLACEMENTS FOR 2N915 AND 2N916**
- **HIGH VOLTAGE - - LV_{CEO} = 50 V (min.)**
- **HIGH GAIN - - h_{FE} = 50 – 200 AT 10 mA**
- **LOW CAPACITANCE - - C_{obo} = 3.5 pF (max.) AT 10 V**

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−65°C to +125°C
Operating Junction Temperature	125°C Maximum
Lead Temperature (Soldering, 10 Second Time Limit)	260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	0.5 Watts
at 25°C Ambient Temperature (Notes 2 and 3)	0.2 Watts

Maximum Voltages

		EN915	EN916
V_{CBO}	Collector to Base Voltage	70 Volts	45 Volts
V_{CEO}	**Collector to Emitter Voltage** (Note 4)	**50 Volts**	**25 Volts**
V_{EBO}	Emitter to Base Voltage	5.0 Volts	5.0 Volts

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

SYMBOL	CHARACTERISTIC	EN915 MIN.	EN915 MAX.	EN916 MIN.	EN916 MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Pulse Current Gain** (Note 5)	**50**	**200**				I_C = 10 mA	V_{CE} = 5.0 V
h_{FE}	**DC Pulse Current Gain** (Note 5)			**50**	**200**		I_C = 10 mA	V_{CE} = 1.0 V
V_{BE}(sat)	Base Saturation Voltage		0.9		0.9	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{CE}(sat)	Collector Saturation Voltage		1.0		0.5	Volts	I_C = 10 mA	I_B = 1.0 mA
h_{fe}	High Frequency Current Gain (f = 100 MHz)	2.5		3.0			I_C = 10 mA	V_{CE} = 15 V
C_{obo}	**Output Capacitance**		**3.5**			**pF**	I_E = 0	V_{CB} = 10
C_{obo}	Output Capacitance				6.0	pF	I_E = 0	V_{CB} = 5.0 V
C_{ibo}	Input Capacitance		10		10	pF	I_C = 0	V_{EB} = 0.5 V
I_{CBO}	Collector Cutoff Current		50			nA	I_E = 0	V_{CB} = 60 V
I_{CBO}(100°C)	Collector Cutoff Current		3.0			μA	I_E = 0	V_{CB} = 60 V
I_{CBO}	Collector Cutoff Current				50	nA	I_E = 0	V_{CB} = 30 V
I_{CBO}(100°C)	Collector Cutoff Current				10	μA	I_E = 0	V_{CB} = 30 V
BV_{CBO}	Collector to Base Breakdown Voltage	70				Volts	I_C = 100 μA	I_E = 0
BV_{CBO}	Collector to Base Breakdown Voltage					Volts	I_C = 10 μA	I_E = 0
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage**	**50**				**Volts**	I_C = 10 mA	I_B = 0
BV_{EBO}	Base to Emitter Breakdown Voltage	5.0				Volts	I_E = 10 μA	I_C = 0
r'_bC_c	Collector-Base Time Constant (f = 40 MHz)		300		300	ps	I_C = 10 mA	V_{CB} = 10 V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	40	200	40	200		I_C = 1.0 mA	V_{CE} = 5.0 V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	50	250	50	250		I_C = 5.0 mA	V_{CE} = 5.0 V
h_{ie}	Input Resistance (f = 1.0 kHz)		6.0		6.0	kΩ	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{ie}	Input Resistance (f = 1.0 kHz)		2.0		2.0	kΩ	I_C = 5.0 mA	V_{CE} = 5.0 V
h_{oe}	Output Conductance (f = 1.0 kHz)		75		75	μmho	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{oe}	Output Conductance (f = 1.0 kHz)		125		125	μmho	I_C = 5.0 mA	V_{CE} = 5.0 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 operation.
(3) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).
(4) 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%.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

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

EN918

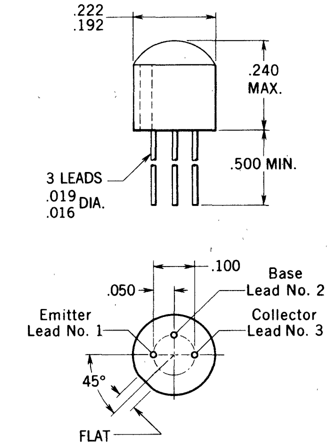
NPN ULTRA-HIGH FREQUENCY OSCILLATOR AND AMPLIFIER

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTOR

FOR POWER GAIN AND POWER OUTPUT TEST CIRCUITS AND ADDITIONAL DESIGN INFORMATION SEE FAIRCHILD 2N918 DATA SHEET

- **ELECTRICAL REPLACEMENT FOR 2N918**
- **HIGH GAIN - - G_{pe} = 15 dB (min.) AT 200 MHz**
  - - P_o = 30 mW (min.) AT 500 MHz
- **LOW CAPACITANCE - - C_{obo} = 1.7 pF (max.) AT 10 V**
- **LOW NOISE - - NF = 6.0 dB (max.) AT 60 MHz**

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−65°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 Second Time Limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	0.5 Watt
at 25°C Ambient Temperature (Notes 2 and 3)	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	30 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	15 Volts
V_{EBO}	Emitter to Base Voltage	3.0 Volts
I_C	Collector Current	50 mA

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

SYMBOL		MIN.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Current Gain	20			I_C = 3.0 mA	V_{CE} = 1.0 V
V_{BE} (sat)	Base Saturation Voltage		1.0	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{CE}(sat)	Collector Saturation Voltage		0.4	Volts	I_C = 10 mA	I_B = 1.0 mA
C_{obo}	**Common-Base, Open-Circuit Output Capacitance**		**1.7**	**pF**	**I_E = 0**	**V_{CB} = 10 V**
C_{obo}	Common-Base, Open-Circuit Output Capacitance		3.0	pF	I_E = 0	V_{CB} = 0
C_{ibo}	Input Capacitance		2.0	pF	I_C = 0	V_{EB} = 0.5 V
I_{CBO}	Collector Cutoff Current		50	nA	I_E = 0	V_{CB} = 15 V
I_{CBO}(100°C)	Collector Cutoff Current		1.0	μA	I_E = 0	V_{CB} = 15 V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	6.0			I_C = 4.0 mA	V_{CE} = 10 V
G_{pe}	**Available Power Gain (neutralized) (f = 200 MHz)**	**14**		**dB**	**I_C = 6.0 mA**	**V_{CB} = 12 V**
P_o	**Power Output f = 500 MHz)**	**30**		**mW**	**I_C = 8.0 mA**	**V_{CB} = 15 V**
η	Collector Efficiency (f = 500 MHz)	25		%	I_C = 8.0 mA	V_{CB} = 15 V
NF	**Noise Figure (f = 60 MHz; R_g = 400 Ω)**		**6.0**	**dB**	**I_C = 1.0 mA**	**V_{CE} = 6.0 V**
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Note 4)	15		Volts	I_C = 3.0 mA	I_B = 0
BV_{CBO}	Collector to Base Breakdown Voltage	30		Volts	I_C = 1.0 μA	I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0		Volts	I_C = 0	I_E = 10 μA

*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 operation.
(3) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 500°C/Watt (derating factor of 5.0 mW/°C) Junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).
(4) Rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

EN930 · EN2484

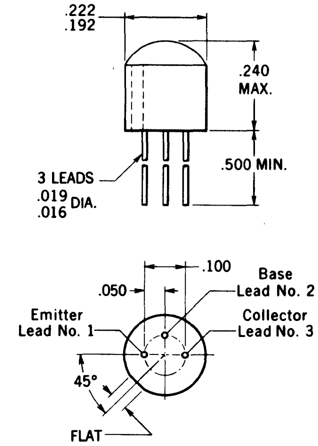
NPN LOW LEVEL, LOW NOISE

DOUBLE DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

FOR TEST CIRCUITS AND ADDITIONAL DESIGN INFORMATION SEE FAIRCHILD 2N2484 DATA SHEET

- **ELECTRICAL REPLACEMENT FOR 2N930 AND 2N2484**
- **HIGH GAIN - - h_{FE} = 250 (MIN) AT 1.0 mA**
  h_{FE} = 800 (MAX) AT 10 mA
  h_{FE} = 100-500 AT 10 μA
- **HIGH BREAKDOWN VOLTAGE - - LV_{CEO} = 60 V (MIN)**
- **LOW NOISE - - NF = 2.0 dB (MAX) AT 10 kHz**
  NF = 10 dB (MAX) AT 100 Hz

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature			−65°C to +125°C
Operating Junction Temperature			125°C Maximum
Lead Temperature (Soldering, 10 second time limit)			260°C Maximum
Maximum Power Dissipation			
Total Dissipation at 25°C Case Temperature (Notes 2 and 3)			0.5 Watt
25°C Ambient Temperature (Notes 2 and 3)			0.2 Watt
Maximum Voltages		**EN930**	**EN2484**
V_{CBO}	Collector to Base Voltage	45 Volts	60 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	45 Volts	60 Volts
V_{EBO}	Emitter to Base Voltage	5.0 Volts	6.0 Volts
I_C	Collector Current	30 mA	50 mA

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

SYMBOL	CHARACTERISTICS	EN930 MIN.	EN930 MAX.	EN2484 MIN.	EN2484 MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Pulse Current Gain** (Note 5)		600		**800**		**I_C = 10 mA**	V_{CE} = 5.0 V
h_{FE}	**DC Current Gain**			**250**			**I_C = 1.0 mA**	V_{CE} = 5.0 V
h_{FE}	DC Current Gain	150		200			I_C = 500 μA	V_{CE} = 5.0 V
h_{FE}	DC Current Gain			175			I_C = 100 μA	V_{CE} = 5.0 V
h_{FE}	**DC Current Gain**	100	300	**100**	**500**		**I_C = 10 μA**	V_{CE} = 5.0 V
h_{FE}	DC Current Gain			30			I_C = 1.0 μA	V_{CE} = 5.0 V
h_{FE}(−55°C)	DC Current Gain	20		20			I_C = 10 μA	V_{CE} = 5.0 V
V_{BE}	Base-Emitter Voltage (Note 5)	0.6	1.0			Volts	I_C = 10 mA	I_B = 0.5 mA
V_{BE}(on)	Base-Emitter On Voltage			0.5	0.7	Volts	I_C = 100 μA	V_{CE} = 5.0 V
V_{CE}(sat)	Collector Saturation Voltage (Note 5)		1.0			Volts	I_C = 10 mA	I_B = 0.5 mA
V_{CE}(sat)	Collector Saturation Voltage				.35	Volts	I_C = 1.0 mA	I_B = 0.1 mA
h_{fe}	High Frequency Current Gain (f = 5.0 MHz)			3.0			I_C = 50 μA	V_{CE} = 5.0 V
h_{fe}	High Frequency Current Gain (f = 30 MHz)	1.0		2.0			I_C = 500 μA	V_{CE} = 5.0 V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	150	600	150	900		I_C = 1.0 mA	V_{CE} = 5.0 V
h_{ib}	Input Resistance (f = 1.0 kHz)	25	32	25	32	Ω	I_C = 1.0 mA	V_{CB} = 5.0 V
h_{ob}	Output Conductance (f = 1.0 kHz)		1.0			μmho	I_C = 1.0 mA	V_{CB} = 5.0 V
h_{rb}	Voltage Feedback Ratio (f = 1.0 kHz)		600			$x10^{-6}$	I_C = 1.0 mA	V_{CB} = 5.0 V
h_{ie}	Input Resistance (f = 1.0 kHz)			3.5	24	kΩ	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{oe}	Output Conductance (f = 1.0 kHz)				40	μmhos	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{re}	Voltage Feedback Ratio				800	$x10^{-6}$	I_C = 1.0 mA	V_{CE} = 5.0 V
I_{CBO}	Collector-Base Cutoff Current		50		50	nA	I_E = 0	V_{CB} = 45 V
I_{CBO}(100°C)	Collector Cutoff Current				10	μA	I_E = 0	V_{CB} = 45 V
I_{CES}	Collector-Emitter Cutoff Current		50			nA	V_{CE} = 45 V	V_{EB} = 0
I_{CES}(100°C)	Collector-Emitter Cutoff Current		10			μA	V_{CE} = 45 V	V_{EB} = 0

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	EN930 MIN.	EN930 MAX.	EN2484 MIN.	EN2484 MAX.	UNITS	TEST CONDITIONS	
I_{EBO}	Emitter-Base Cutoff Current		50		50	nA	$I_C = 0$	$V_{EB} = 5.0$ V
I_{CEO}	Collector-Emitter Cutoff Current		50		50	nA	$I_B = 0$	$V_{CE} = 5.0$ V
C_{obo}	Output Capacitance		8.0		6.0	pF	$I_E = 0$	$V_{CB} = 5.0$ V
C_{TE}	Emitter Transition Capacitance				6.0	pF	$I_C = 0$	$V_{EB} = 0.5$ V
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage** (Notes 4 and 5)	45		**60**		**Volts**	**$I_C = 10$ mA**	**$I_B = 0$**
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0				Volts	$I_C = 0$	$I_E = 10\ \mu A$
BV_{EBO}	Emitter to Base Breakdown Voltage			6.0		Volts	$I_C = 0$	$I_E = 10\ \mu A$
BV_{CBO}	Collector to Base Breakdown Voltage	45		60		Volts	$I_C = 10\ \mu A$	$I_E = 0$
NF	Wide Band Noise Figure (BW = 15.7 kHz; 3dB pts at 10 Hz and 10 kHz)		3.0		3.0	dB	$I_C = 10\ \mu A$, $R_S = 10$ kΩ	$V_{CE} = 5.0$ V
NF	Narrow Band Noise Figure (f = 1.0 kHz)				3.0	dB	$I_C = 10\ \mu A$, $R_S = 10$ k Ω	$V_{CE} = 5.0$ V, Pwr. BW = 200 Hz
NF	**Narrow Band Noise Figure (f = 10 kHz)**				**2.0**	**dB**	**IC = 10 μA, $R_S = 10$ k Ω**	**$V_{CE} = 5.0$ V, Pwr. BW = 2.0 kHz**
NF	**Narrow Band Noise Figure (f = 100 Hz)**				**10**	**dB**	**IC = 10 μA, $R_S = 10$ k Ω**	**$V_{CE} = 5.0$ V, Pwr. BW = 20 Hz**

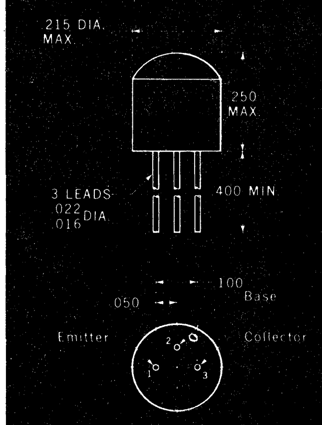
NOTES:

(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 operation.
(3) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).
(4) These ratings refer to a high-current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(5) Pulse conditions: Length = 300 μs; duty cycle = 1%.

SE1001 • SE1002
NPN AM/FM TYPE
DIFFUSED SILICON PLANAR TRANSISTORS

The SE 1001 and SE 1002 are NPN silicon PLANAR transistors designed specifically for A.M.-F.M. receiver applications. They feature high power gain, high beta, and low collector cutoff current in a solid package designed to give maximum mechanical support to the transistor chip.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches.
All leads electrically isolated from case.
Leads are nickel.
Package weight is 0.31 gram.

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures	
Operating Junction Temperature	125°C Maximum
Storage Temperature	−55°C to +125°C
Soldering Temperature (10 sec time limit)	260°C Maximum
Maximum Power Dissipation	
Total Dissipation at 25°C Case Temperature [Note 2]	0.5 Watt
at 65°C Case Temperature [Note 2]	0.3 Watt
at 25°C Ambient Temperature [Note 2]	0.2 Watt
Maximum Voltages	
V_{CBO} Collector to Base Voltage	45 Volts
V_{CEO} Collector to Emitter Voltage [Note 3]	45 Volts
V_{EBO} Emitter to Base Voltage	4.0 Volts

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

SYMBOL	CHARACTERISTIC	SE 1001 Min.	SE 1001 Typ.	SE 1001 Max.	SE 1002 Min.	SE 1002 Typ.	SE 1002 Max.	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain [Note 4]	40		160	100		400		$I_C = 10$ mA $V_{CE} = 10$ V
I_{CBO}	Collector Cutoff Current			0.5			0.5	μA	$I_E = 0$ $V_{CB} = 30$ V
I_{CBO} (65°C)	Collector Cutoff Current			5.0			5.0	μA	$I_E = 0$ $V_{CB} = 30$ V
C_{ob}	Output Capacitance			3.5			3.5	pf	$I_E = 0$ $V_{CB} = 10$ V
NF	Spot Noise Figure [Note 5]		4.0			4.0		db	$I_C = 3.0$ mA $V_{CE} = 10$ V
A_{pg}	Available Power Gain (neutralized) (f = 10.7 mc)		32			32		db	$I_C = 7.0$ mA $V_{CE} = 10$ V
A_{pg}	Available Power Gain (neutralized) (f = 455 kc)		55			55		db	$I_C = 3.0$ mA $V_{CE} = 10$ V
G_C	Conversion Gain (f = 108 mc to 10.7 mc)		20			20		db	$I_C = 7.0$ mA $V_{CE} = 10$ V
BV_{CBO}	Collector to Base Breakdown Voltage	45			45			Volts	$I_C = 0.1$ mA $I_E = 0$
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage [Note 3]	45			45			Volts	$I_C = 10$ mA $I_B = 0$ (pulsed)
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0			4.0			Volts	$I_E = 0.1$ mA $I_C = 0$
h_{fe}	High Frequency Current Gain (f = 100 mc)	2.0	3.5		2.0	3.5			$I_C = 10$ mA $V_{CE} = 15$ V

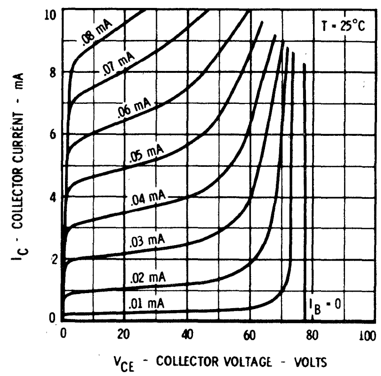
NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high-current point where collector-to-emitter voltage is lowest. For more information send or Fairchild Publication APP-4.
(4) Pulse Conditions: length = 300 μsec; duty cycle = 1%.
(5) f = 1.0 mc; $R_S = 300\Omega$.
(6) Reference: Gertzis, S. and Basselaers, R.— Characterization of R.F. Transistors for AM/FM Radio Applications. IRE, PGBTR, Trans., Nov. 1962.

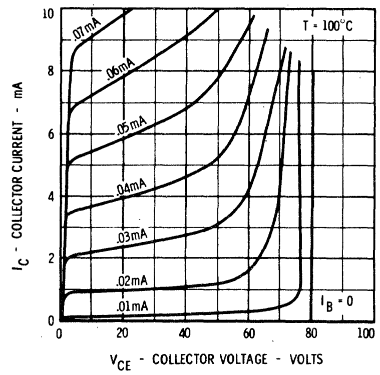
FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

TYPICAL ELECTRICAL CHARACTERISTICS

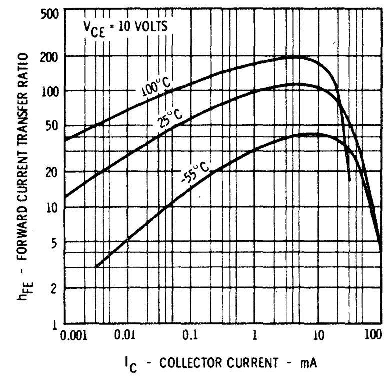
COLLECTOR CHARACTERISTICS



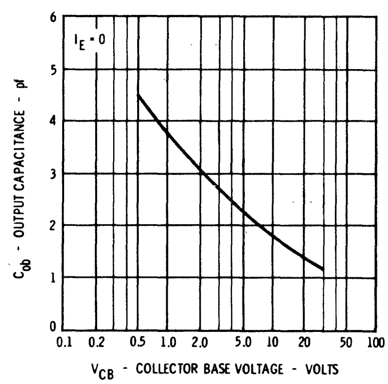
COLLECTOR CHARACTERISTICS



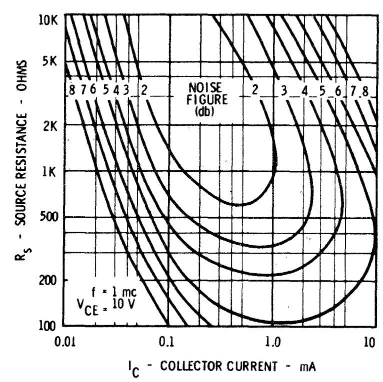
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



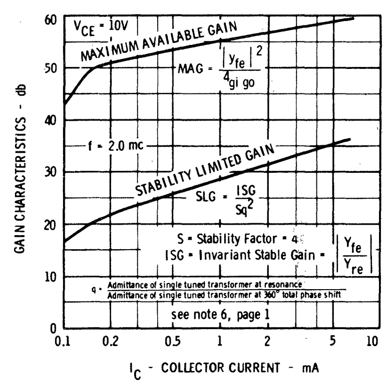
OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



CONTOURS OF SPOT NOISE FIGURE



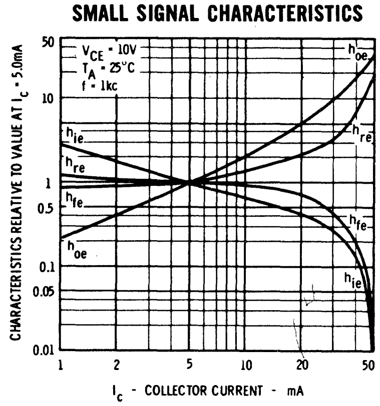
GAIN CHARACTERISTICS VERSUS COLLECTOR CURRENT



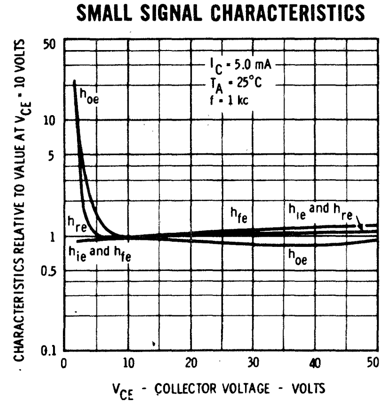
SMALL SIGNAL CHARACTERISTICS (f = 1 KC)

SYMBOL	CHARACTERISTIC	SE 1001 TYP.	SE 1002 TYP.	UNITS	TEST CONDITIONS
h_{ie}	Input Resistance	900	1130	Ohms	$I_C = 5.0$ mA $V_{CE} = 10$ V
h_{oe}	Output Conductance	25	35	μmho	$I_C = 5.0$ mA $V_{CE} = 10$ V
h_{re}	Voltage Feedback Ratio	1.2	1.25	$x10^{-4}$	$I_C = 5.0$ mA $V_{CE} = 10$ V
h_{fe}	Small Signal Current Gain	110	145		$I_C = 5.0$ mA $V_{CE} = 10$ V

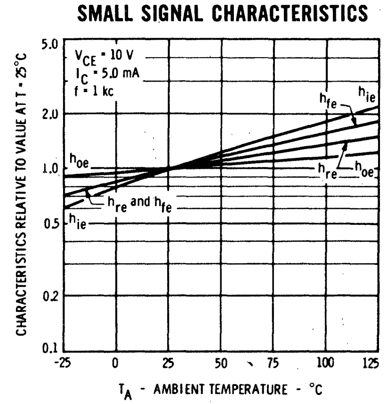
SMALL SIGNAL CHARACTERISTICS



SMALL SIGNAL CHARACTERISTICS

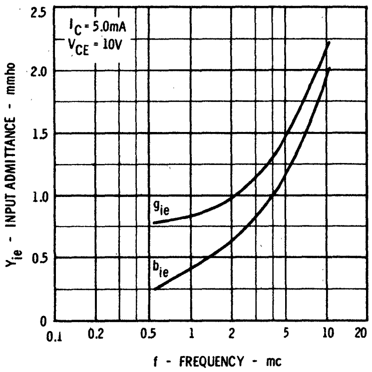


SMALL SIGNAL CHARACTERISTICS

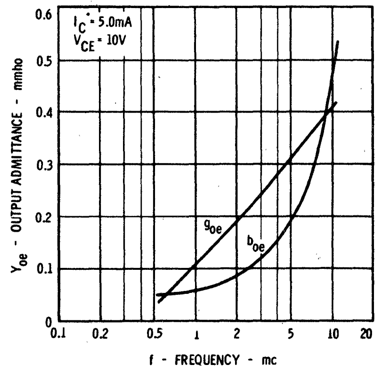


TYPICAL SMALL SIGNAL COMMON EMITTER "Y" PARAMETERS

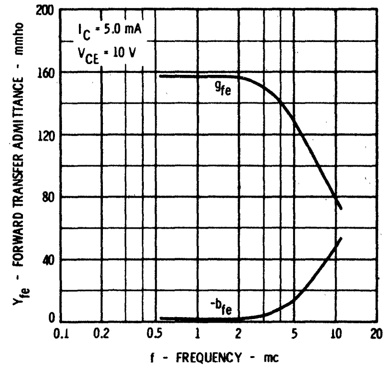
INPUT ADMITTANCE VERSUS FREQUENCY—OUTPUT SHORT CIRCUIT



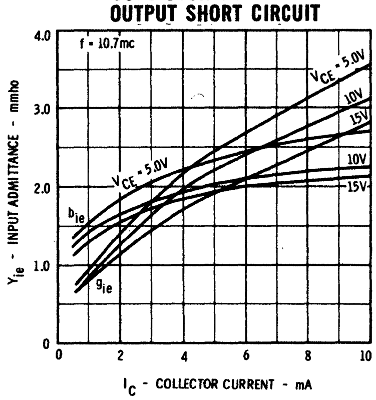
OUTPUT ADMITTANCE VERSUS FREQUENCY—INPUT SHORT CIRCUIT



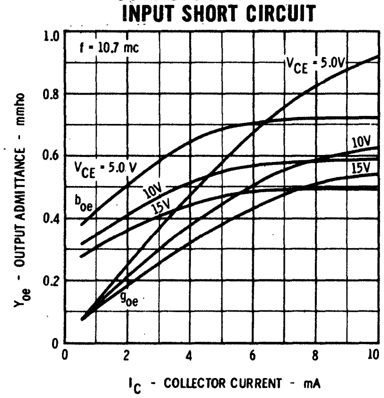
FORWARD TRANSFER ADMITTANCE VERSUS FREQUENCY— OUTPUT SHORT CIRCUIT



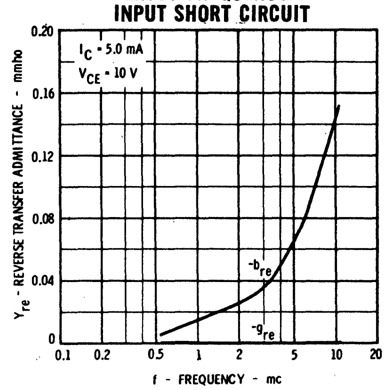
INPUT ADMITTANCE VERSUS COLLECTOR CURRENT— OUTPUT SHORT CIRCUIT



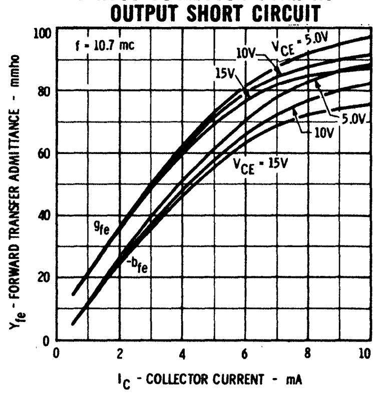
OUTPUT ADMITTANCE VERSUS COLLECTOR CURRENT— INPUT SHORT CIRCUIT



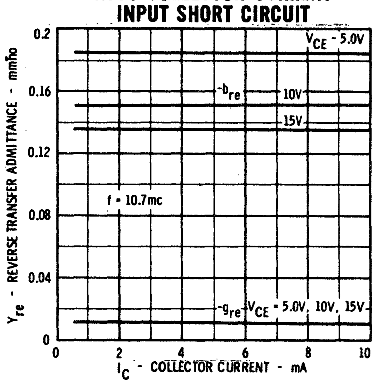
REVERSE TRANSFER ADMITTANCE VERSUS FREQUENCY— INPUT SHORT CIRCUIT



FORWARD TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT— OUTPUT SHORT CIRCUIT

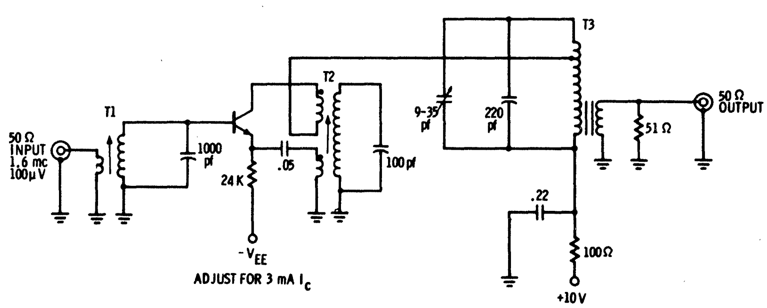


REVERSE TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT— INPUT SHORT CIRCUIT



1.6 MC TO 455 KC AUTODYNE CONVERSION GAIN TEST CIRCUIT

I_C = 2.0-3.0 mA V_{CE} = 10V



TYPICAL GAIN = 42 db

T1 Miller Coil Form
Miller Slug #30-106 Core
Primary . . . 6 T #28 enameled wire
Secondary . . . 28 T #36 enameled wire

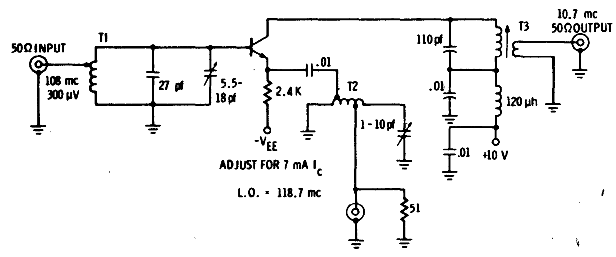
T2 Miller Coil Form
Miller Core #30-106

4 Turns #28 Enameled Wire
1½ Turns #28 Enameled Wire
60 Turns #36 Enameled Wire

T3 Miller #2032 455 KC Transformer
Center Core only

108 MC TO 10.7 MC CONVERSION GAIN TEST CIRCUIT

I_C = 7.0 mA V_{CE} = 10V

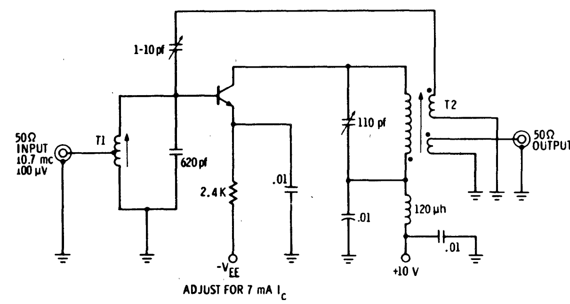


TYPICAL CONVERSION GAIN = 20 db

- **T1** 2.5 turns #16 tinned copper wire tapped 2 turns from Gnd. Coil dia. 3/8" (inside dia.).
- **T2** 4 turns #16 tinned copper wire tapped 3/4 turn from Gnd. and 1¼ turns from Gnd. Coil dia. ¼" (inside dia.).
- **T3** Miller Coil Form
  Miller Core #30-106
  Primary . . . 10 turns #36 enameled wire.
  Secondary . . . 1⅓ turns #28 enameled wire.

10.7 MC NEUTRALIZED POWER GAIN TEST CIRCUIT

I_C = 7.0 mA V_{CE} = 10V

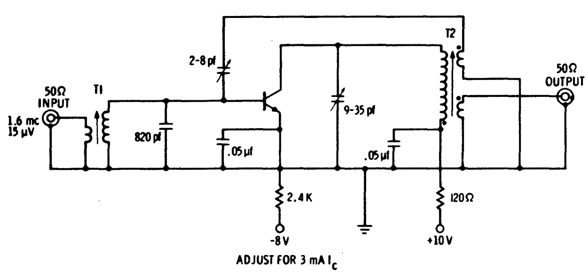


TYPICAL GAIN = 32 db

- **T1** Miller Coil Form
  Miller Core #30-106
  4 turns #28 enameled wire tapped 1.5 turns from Gnd.
- **T2** Miller Coil Form
  Miller Core #30-106
  Primary . . . 10 turns #36 enameled wire.
  Neut. Sec. . . . 5 turns #36 enameled wire (Bifilar).
  Output Sec. . . . 1.33 turns #28 enameled wire (Overwind).

NEUTRALIZED A.M. R.F. AMPLIFIER TEST CIRCUIT

I_C = 3.0 mA V_{CE} = 10V

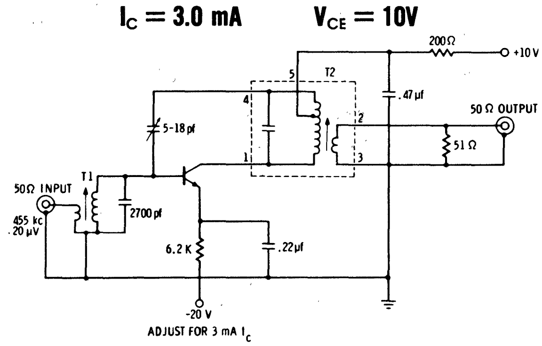


TYPICAL GAIN = 46 db

- **T1** 28 T #36 Nyclad Secondary
  6 T #28 Nyclad Primary
  Miller #80-106 Core
- **T2** 120 T #40 S.S. Enl. Primary
  40 T #40 S.S. Enl. Neut. Sec.
  7 T #28 Nyclad Output Sec., wave wound
  Bifilar with cold end of Primary.

455 KC NEUTRALIZED A.M. I.F. AMPLIFIER TEST CIRCUIT

I_C = 3.0 mA V_{CE} = 10V



TYPICAL GAIN = 55 db

- **T1** 13 T Primary #26 Nyclad; 54 T Secondary #36 Nyclad; .043 mh — Miller #30-106 Core
- **T2** Miller Min. I.F. Transformer #2032.

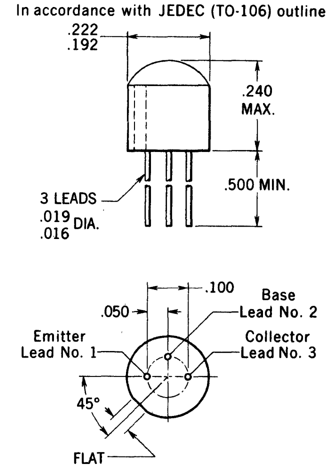
SE 1010

NPN LOW-NOISE RF AMPLIFIER

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTOR

GENERAL DESCRIPTION - The SE1010 is an NPN silicon PLANAR transistor designed specifically for AM receiver applications. It features high power gain, low noise, and low collector cutoff current in a solid package designed to give maximum mechanical support to the transistor chip.

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature		-55°C to +125°C
Operating Junction Temperature		125°C Maximum
Lead Temperature (Soldering, 10 sec time limit)		260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature	(Note 2)	0.5 Watt
at 65°C Case Temperature	(Note 2)	0.3 Watt
at 25°C Ambient Temperature	(Note 2)	0.2 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage		30 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 3)	15 Volts
V_{EBO}	Emitter to Base Voltage		4.0 Volts

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

Symbol	Characteristic	Min	Typ	Max	Units	Test Conditions	
h_{FE}	DC Pulse Current Gain (Note 4)	20	35			I_C = 2.0 mA	V_{CE} = 10 V
V_{CE}(sat)	Collector Saturation Voltage			0.3	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{BE}(sat)	Base Saturation Voltage			0.97	Volts	I_C = 10 mA	I_B = 1.0 mA
I_{CBO}	Collector Cutoff Current			50	nA	V_{CB} = 15 V	I_E = 0
I_{CBO}(65°C)	Collector Cutoff Current			500	nA	V_{CB} = 15 V	I_E = 0
BV_{CBO}	Collector to Base Breakdown Voltage	30			Volts	I_C = 0.1 mA	I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0			Volts	I_E = 0.1 mA	I_C = 0
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 3 and 4)	15			Volts	I_C = 10 mA	I_B = 0
h_{fe}	High Frequency Current Gain (f = 100 MHz)	2.0				I_C = 2.0 mA	V_{CE} = 10 V
C_{ob}	Output Capacitance			3.5	pF	V_{CB} = 10 V	I_E = 0
NF	Noise Figure (Note 5)		3.7	5.5	dB	I_C = 2.0 mA	V_{CE} = 10 V

NOTES:

* Planar is a patented Fairchild process.

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

(2) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/watt (derating factor of 2.0 mW/°C).

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

(4) Pulse Conditions: length = 300 μsec; duty cycle = 1%.

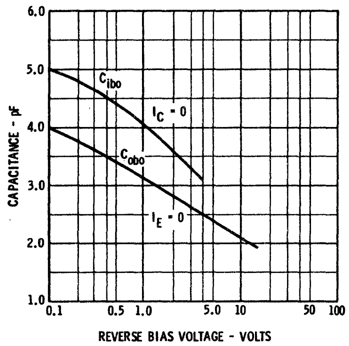
(5) f = 1.0 MHz R_S = 50 Ω.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

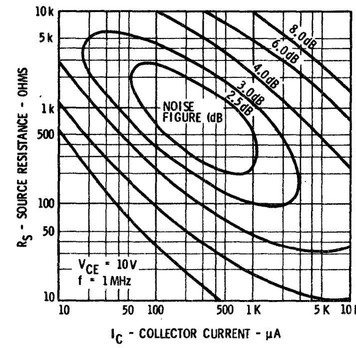
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

TYPICAL ELECTRICAL CHARACTERISTICS

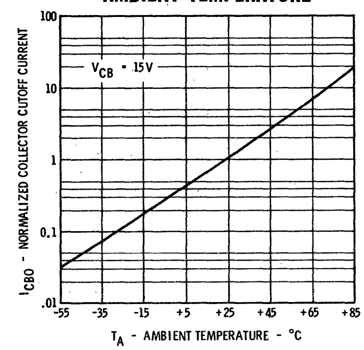
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



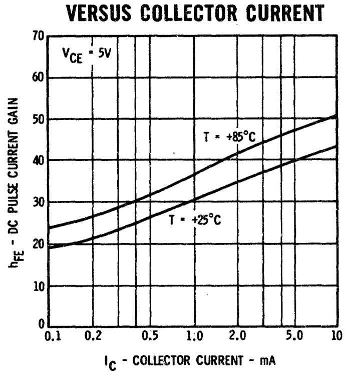
CONTOURS OF SPOT NOISE FIGURE



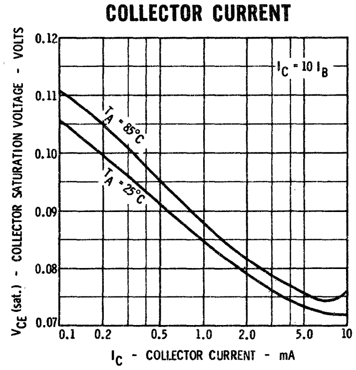
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



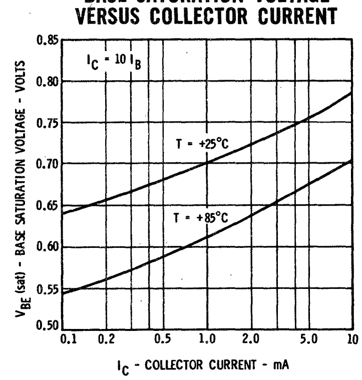
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION VERSUS TEMPERATURE

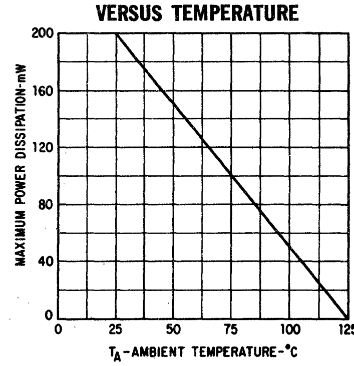
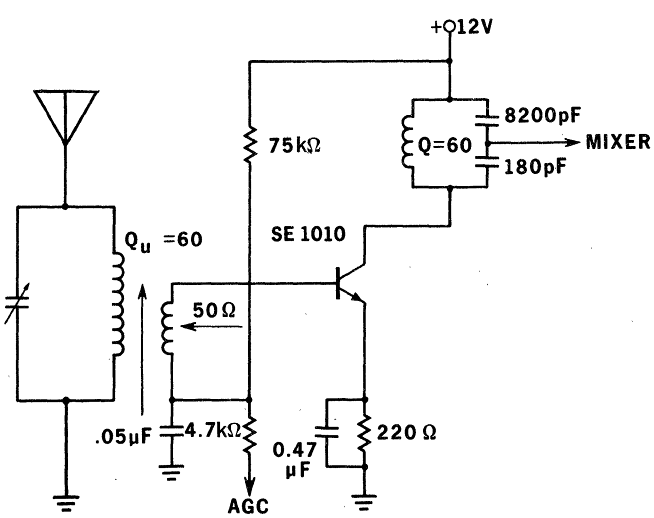


FIG. 1. R-F STAGE FOR MOBILE RADIO

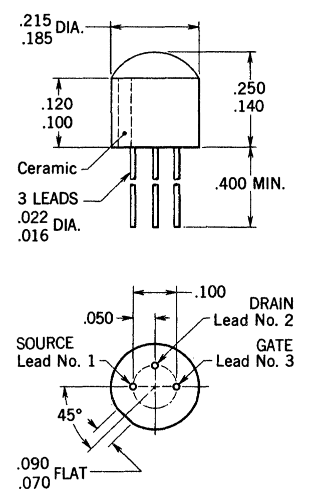


The problem of high SNR with low cross modulation is alleviated with the SE1010 in r-f stages. Noise figure remains satisfactory even when the input inductance is tapped at a very low-impedance point. Cross modulation is reduced because of the very low-level signal applied to the transistor base. The circuit shown in Fig. 1 demonstrated a NF of 5 dB with 3 mA collector current, 31 dB gain, and 1% cross modulation with 100 μV desired input signal at 1 MHz and 23 mV undesired input signal at 1.04 MHz.

SE2001 · SE2002
NPN GENERAL PURPOSES
DIFFUSED SILICON PLANAR*TRANSISTORS

GENERAL DESCRIPTION - The Fairchild SE2001 and SE2002 are NPN silicon PLANAR transistors in a solid package designed to give maximum mechanical support to the transistor chip. They are designed for use in audio and video amplifiers, sync circuits, stereo multiplex, and audio pre-amplifiers.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
Emitter and base leads are gold-plated nickel
Collector lead is gold-plated KOVAR
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures		
Storage Temperature		-55°C to +125°C
Operating Junction Temperature		125°C Maximum
Soldering Temperature (10 sec time limit)		260°C Maximum
Maximum Power Dissipation		
Total Dissipation at 25°C Case Temperature	[Note 2]	0.5 Watt
at 65°C Case Temperature	[Note 2]	0.3 Watt
at 25°C Ambient Temperature	[Note 2]	0.2 Watt
Maximum Voltages		
V_{CBO} Collector to Base Voltage		35 Volts
V_{CEO} Collector to Emitter Voltage [Note 3]		20 Volts
V_{EBO} Emitter to Base Voltage		4.0 Volts

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

Symbol	Characteristic	Min.	Max.	Units	Test Conditions
h_{FE}	DC Pulse Current Gain [Note 4] **SE2001**	40	160		I_C = 10 mA V_{CE} = 1.0 V
h_{FE}	DC Pulse Current Gain [Note 4] **SE2002**	100	400		I_C = 10 mA V_{CE} = 1.0 V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	2.0			I_C = 10 mA V_{CE} = 10 V
V_{CE}(sat)	Collector Saturation Voltage		0.7	Volts	I_C = 10 mA I_B = 1.0 mA
V_{BE}(sat)	Base Saturation Voltage		0.9	Volts	I_C = 10 mA I_B = 1.0 mA
I_{CBO}	Collector Cutoff Current		0.5	μA	I_E = 0 V_{CB} = 15 V
I_{CBO} (65°C)	Collector Cutoff Current		5.0	μA	I_E = 0 V_{CB} = 15 V
C_{obo}	Output Capacitance		6.0	pF	I_E = 0 V_{CB} = 10 V
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage [Notes 3 and 4]	20		Volts	I_C = 10 mA (pulsed) I_B = 0
BV_{CBO}	Collector to Base Breakdown Voltage	35		Volts	I_C = 0.1 mA I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0		Volts	I_C = 0 I_E = 0.1 mA

(See notes on back page)

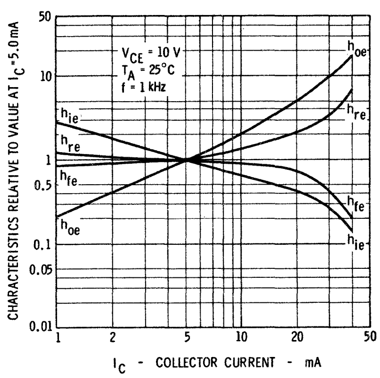
* Planar is a patented Fairchild process.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

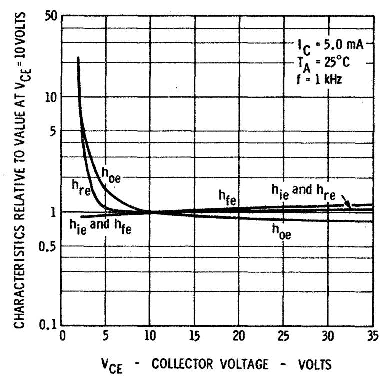
SMALL SIGNAL CHARACTERISTICS f = 1 kHz)

SYMBOL	CHARACTERISTIC	SE 2001 TYP.	SE 2002 TYP.	UNITS	TEST CONDITIONS
h_{ie}	Input Resistance	900	1130	Ohms	$I_C = 5.0$ mA $V_{CE} = 10$ V
h_{oe}	Output Conductance	25	35	μmho	$I_C = 5.0$ mA $V_{CE} = 10$ V
h_{re}	Voltage Feedback Ratio	1.2	1.25	$x10^{-4}$	$I_C = 5.0$ mA $V_{CE} = 10$ V
h_{fe}	Small Signal Current Gain	110	145		$I_C = 5.0$ mA $V_{CE} = 10$ V

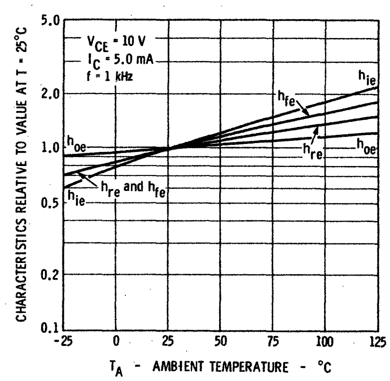
SMALL SIGNAL CHARACTERISTICS



SMALL SIGNAL CHARACTERISTICS



SMALL SIGNAL CHARACTERISTICS



NOTES:

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

(2) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).

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

(4) Pulse Conditions: length = 300 μsec; duty cycle = 1%.

EN2219 · EN2222

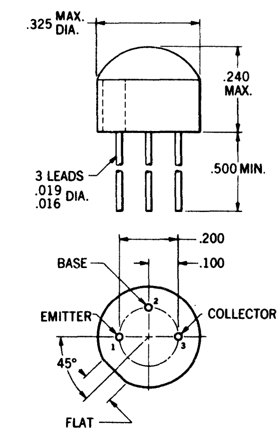
NPN GENERAL PURPOSE AMPLIFIERS AND SWITCHES

DOUBLE DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

FOR TEST CIRCUITS ADDITIONAL DESIGN INFORMATION SEE FAIRCHILD 2N3299 DATA SHEET

- **ELECTRICAL REPLACEMENTS FOR 2N2219 AND 2N2222**
- **HIGH GAIN - - h_{FE} = 100-300 AT 150 mA**
  h_{FE} = 35 (MIN) AT 100 μA
  h_{FE} = 30 (MIN) AT 500 mA
- **MEDIUM VOLTAGE - - LV_{CEO} = 30 V (MIN)**
- **HIGH FREQUENCY - - f_T = 250 MHz (MIN) AT 20 mA**
- **LOW SATURATION VOLTAGE - - V_{CE}(sat) = 0.4 V(MAX) AT 150 mA**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

EN2219

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature			−65°C to +125°C
Operating Junction Temperature			−65°C to +125°C
Lead Temperature (Soldering, 10 second time limit)			260° Maximum
Maximum Power Dissipation		**EN2219**	**EN2222**
Total Dissipation at 25°C Case Temperature	(Notes 2 and 3)	0.7 Watt	0.5 Watt
at 25°C Ambient Temperature	(Notes 2 and 3)	0.35 Watt	0.2 Watt

Maximum Voltages and Current

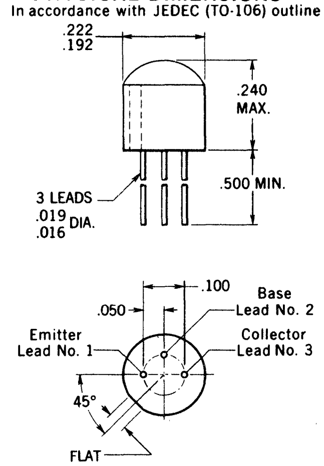
V_{CBO}	Collector to Base Voltage		60 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 4)	30 Volts
V_{EBO}	Emitter to Base Voltage		5.0 Volts
I_C	Collector Current		800 mA

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

SYMBOL	CHARACTERISTICS	MIN.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Pulse Current Gain** (Note 5)	**100**	**300**		**I_C = 150 mA**	V_{CE} = 10 V
h_{FE}	DC Pulse Current Gain (Note 5)	50			I_C = 150 mA	V_{CE} = 1.0 V
h_{FE}	DC Current Gain	75			I_C = 10 mA	V_{CE} = 10 V
h_{FE}	DC Current Gain	50			I_C = 1.0 mA	V_{CE} = 10 V
h_{FE}	**DC Current Gain**	**35**			**I_C = 0.1 mA**	V_{CE} = 10 V
h_{FE}	**DC Pulse Current Gain** (Note 5)	**30**			**I_C = 500 mA**	V_{CE} = 10 V
V_{CE}(sat)	**Collector Saturation Voltage** (pulsed, note 5)		**0.4**	**Volts**	**I_C = 150 mA**	I_B = 15 mA
V_{CE}(sat)	Collector Saturation Voltage (pulsed, note 5)		1.6	Volts	I_C = 500 mA	I_B = 50 mA
V_{BE}(sat)	Base Saturation Voltage (pulsed, note 5)		1.3	Volts	I_C = 150 mA	I_B = 15 mA
V_{BE}(sat)	Base Saturation Voltage (pulsed, note 5)		2.6	Volts	I_C = 500 mA	I_B = 50 mA
h_{fe}	High Frequency Current Gain(f = 100 MHz)	2.5			I_C = 20 mA	V_{CE} = 20 V
f_T	**Gain-Bandwidth Product** (f = 100 MHz)	**250**		**MHz**	**I_C = 20 mA**	V_{CE} = 20 V
I_{CBO}	Collector Cutoff Current		50	nA	I_E = 0	V_{CB} = 50 V
I_{CBO}(100°C)	Collector Cutoff Current		10	μA	I_E = 0	V_{CB} = 50 V
I_{EBO}	Emitter Cutoff Current		50	nA	I_C = 0	V_{EB} = 3.0 V
C_{obo}	Output Capacitance		8.0	pF	I_E = 0	V_{CB} = 10 V

Additional Electrical Characteristics on page 2

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram Package is electrically non-conductive material

EN2222

*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	MIN.	MAX.	UNITS	TEST CONDITIONS	
$R_{e(hie)}$	Real Part of Common-Emitter High-Frequency Input Impedance (f = 300 MHz)		60	Ω	$I_C = 20$ mA	$V_{CE} = 20$ V
BV_{CBO}	Collector to Base Breakdown Voltage	60		Volts	$I_C = 10\ \mu A$	$I_E = 0$
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage** (Notes 4 and 5)	**30**		Volts	**$I_C = 10$ mA**	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		Volts	$I_E = 10\ \mu A$	$I_C = 0$

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 operation.
(3) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 143°C/Watt (derating factor of 7.0 mW/°C); junction to ambient thermal resistance of 286°C/Watt (derating factor of 3.5 mW/°C) for the EN2219. For the EN2222 junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 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%.

EN2894A

PNP HIGH SPEED SATURATED SWITCH

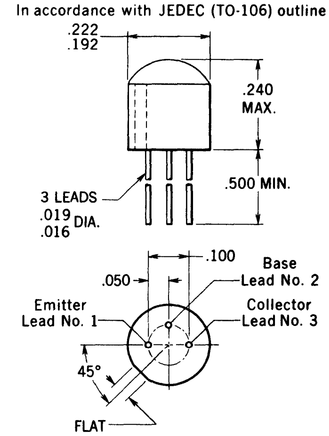
DIFFUSED SILICON PLANAR* II EPITAXIAL TRANSISTOR

For test circuits and additional design information see Fairchild 2N2894A data sheet.

- **ELECTRICAL REPLACEMENT for 2N2894 and 2N2894A**
- **FAST SWITCHING** .... t_{on} = 20 ns **(MAX)** @ 30 mA
  .... t_{off} = 25 ns **(MAX)** @ 30 mA
  .... τ_s = 20 ns **(MAX)** @ 10 mA
- **HIGH FREQUENCY** .... f_T = 800 MHz **(MIN)** @ 30 mA
- **LOW CAPACITANCE** .... C_{obo} = 4.5 pF **(MAX)** @ 5 V
- **LOW SATURATION VOLTAGE** .... $V_{CE(SAT)}$ = 0.13 V **(MAX)** @ I_C = 10 mA

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C
Lead Temperature (Soldering, 10 seconds time limit)	+260°C

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature [Notes 2 and 3]	0.5 Watt
at 25°C Ambient Temperature [Notes 2 and 3]	0.2 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage	−12 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	−12 Volts
V_{EBO}	Emitter to Base Voltage	−4.5 Volts

ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Noted)

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
t_{on}	**Turn On Time**		10	20	ns	$I_C \approx$ 30 mA	$I_{B1} \approx$ 3.0 mA
t_{off}	**Turn Off Time**		15	25	ns	$I_C \approx$ 30 mA $I_{B1} \approx I_{B2} \approx$ 3.0 mA	
t_{on}	Turn On Time		23	60	ns	$I_C \approx$ 30 mA	$I_{B1} \approx$ 1.5 mA
t_{off}	Turn Off Time		13	35	ns	$I_C \approx$ 30 mA $I_{B1} \approx I_{B2} \approx$ 1.5 mA	
τ_s	**Charge Storage Time Constant**		15	20	ns	$I_C \approx I_{B1} \approx I_{B2} \approx$ 10 mA	
V_{CE} (sat)	**Pulsed Collector-Emitter Saturation Voltage** [Note 5]		−0.08	−0.13	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{CE} (sat)	Pulsed Collector-Emitter Saturation Voltage [Note 5]		−0.12	−0.19	Volts	I_C = 30 mA	I_B = 3.0 mA
V_{CE} (sat)	Pulsed Collector-Emitter Saturation Voltage [Note 5]		−0.28	−0.45	Volts	I_C = 100 mA	I_B = 10 mA
V_{BE} (sat)	Pulsed Base-Emitter Saturation Voltage [Note 5]	−0.78	−0.82	−0.92	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{BE} (sat)	Pulsed Base-Emitter Saturation Voltage [Note 5]	−0.85	−0.93	−1.15	Volts	I_C = 30 mA	I_B = 3.0 mA
V_{BE} (sat)	Pulsed Base-Emitter Saturation Voltage [Note 5]	−1.0	−1.14	−1.5	Volts	I_C = 100 mA	I_B = 10 mA
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	8.0	12			I_C = 30 mA	V_{CE} = −10 V
C_{obo}	**Output Capacitance**		3.3	4.5	pF	I_E = 0	V_{CB} = −5.0 V
C_{ibo}	Input Capacitance		4.7	6.0	pF	I_C = 0	V_{EB} = −0.5 V
I_{CES}	Collector Reverse Current		0.2	50	nA	V_{BE} = 0	V_{CE} = −10 V
I_{CBO} (100°C)	Collector Cutoff Current		0.05	10	μA	I_E = 0	V_{CB} = −10 V
V_{CEO} (sust)	**Collector-Emitter Sustaining Voltage** [Notes 4 and 5]	−12			Volts	I_C = 10 mA (pulsed)	I_B = 0
BV_{CBO}	Collector-Base Breakdown Voltage	−12			Volts	I_C = 10 μA	I_E = 0
BV_{CES}	Collector-Emitter Breakdown Voltage	−12			Volts	I_C = 10 μA	V_{BE} = 0
BV_{EBO}	Emitter-Base Breakdown Voltage	−4.5			Volts	I_C = 0	I_E = 100 μA
h_{FE}	DC Pulse Current Gain [Note 5]	20	44			I_C = 1.0 mA	V_{CE} = −0.5 V
h_{FE}	DC Pulse Current Gain [Note 5]	30	53			I_C = 10 mA	V_{CE} = −0.3 V
h_{FE}	DC Pulse Current Gain [Note 5]	40	63	120		I_C = 30 mA	V_{CE} = −0.5 V
h_{FE}	**DC Pulse Current Gain** [Note 5]	30	55			I_C = 100 mA	V_{CE} = −1.0 V
h_{FE} (−55°C)	DC Pulse Current Gain [Note 5]	20	38			I_C = 30 mA	V_{CE} = −0.5 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 125°C and junction to case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/watt (derating factor of 2.0 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%.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

EN2905 • EN2907

PNP HIGH-SPEED SWITCHES AND CORE DRIVERS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

FOR TEST CIRCUITS AND ADDITIONAL DESIGN INFORMATION SEE FAIRCHILD 2N2905 DATA SHEET

- **ELECTRICAL REPLACEMENTS FOR 2N2905 and 2N2907**
- **LOW SATURATION VOLTAGE . . . . $V_{CE(sat)}$ = 0.4 V (MAX) @ 150 mA**
- **FAST SWITCHING . . . . t_{on} = 50 ns (MAX) @ 150 mA**
  . . . . t_{off} = 110 ns (MAX) @ 150 mA
- **HIGH BETA . . . . h_{FE} = 75 (MIN) @ 10 mA**
  . . . . h_{FE} = 100–300 @ 150 mA
- **HIGH BREAKDOWN VOLTAGE . . . . LV_{CEO} = 40 V (MIN) @ 10 mA**

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (soldering, 10 second time limit)	+260°C Maximum

Maximum Power Dissipation [Notes 2 and 3]	**EN2905**	**EN2907**
Total Dissipation at 25°C Case Temperature	0.7 Watt	0.5 Watt
at 25°C Free Air Temperature	0.3 Watt	0.2 Watt

Maximum Voltages and Current

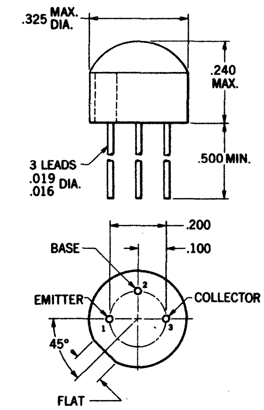
		EN2905	EN2907
V_{CBO}	Collector to Base Voltage	−60 Volts	−60 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	−40 Volts	−40 Volts
V_{EBO}	Emitter to Base Voltage	−5.0 Volts	−5.0 Volts
I_C	Collector Current [Note 2]	600 mA	600 mA

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

SYMBOL	CHARACTERISTIC	MIN.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Current Gain	35			I_C = 0.1 mA	V_{CE} = −10 V
h_{FE}	DC Current Gain	50			I_C = 1.0 mA	V_{CE} = −10 V
h_{FE}	**DC Current Gain**	**75**			**I_C = 10 mA**	**V_{CE} = −10 V**
h_{FE}	**DC Pulse Current Gain** [Note 5]	**100**	**300**		**I_C = 150 mA**	**V_{CE} = −10 V**
h_{FE}	DC Pulse Current Gain [Note 5]	30			I_C = 500 mA	V_{CE} = −10 V
V_{CE} (sat)	**Collector Saturation Voltage** [pulsed, see Note 5]		**−0.4**	**Volts**	**I_C = 150 mA**	**I_B = 15 mA**
V_{CE} (sat)	Collector Saturation Voltage [pulsed, see Note 5]		−1.0	Volts	I_C = 300 mA	I_B = 30 mA
V_{BE} (sat)	Base Saturation Voltage [pulsed, see Note 5]		−1.3	Volts	I_C = 150 mA	I_B = 15 mA
V_{BE} (sat)	Base Saturation Voltage [pulsed, see Note 5]		−2.0	Volts	I_C = 300 mA	I_B = 30 mA
t_d	**Turn-On Delay Time**		**10**	**ns**	**I_{CS} = 150 mA**	**I_{B1} = 15 mA**
t_r	**Rise Time**		**40**	**ns**	**I_{CS} = 150 mA**	**I_{B1} = 15 mA**
t_s	**Storage Time**		**80**	**ns**	**I_{CS} = 150 mA, I_{B1} = I_{B2} = 15 mA**	
t_f	**Fall Time**		**30**	**ns**	**I_{CS} = 150 mA, I_{B1} = I_{B2} = 15 mA**	

Additional Electrical Characteristics on Page 2.

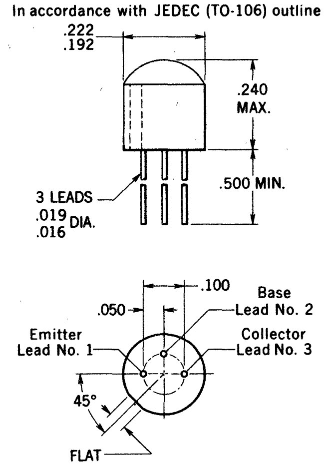
PHYSICAL DIMENSIONS
in accordance with JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

EN2905

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

EN2907

*** 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	CHARACTERISTIC	MIN.	MAX.	UNITS	TEST CONDITIONS	
h_{fe}	High Frequency Current Gain (f = 100 MHz)	1.5			$I_C = 50$ mA	$V_{CE} = -3.0$ V
I_{CBO}	Collector Cutoff Current		50	nA	$I_E = 0$	$V_{CB} = -50$ V
I_{CBO} (100°C)	Collector Cutoff Current		20	μA	$I_E = 0$	$V_{CB} = -50$ V
I_{CEX}	Collector Reverse Current		50	nA	$V_{CE} = -30$ V	$V_{BE} = +0.5$ V
I_B	Base Current		50	nA	$V_{CE} = -30$ V	$V_{BE} = +0.5$ V
C_{ob}	Output Capacitance (f = 100 kHz)		8.0	pF	$I_E = 0$	$V_{CB} = -10$ V
C_{TE}	Emitter Transition Capacitance (f = 100 kHz)		30	pF	$I_C = 0$	$V_{EB} = -2.0$ V
BV_{CBO}	Collector to Base Breakdown Voltage	−60		Volts	$I_C = 10$ μA	$I_B = 0$
V_{CEO} (sust)	**Collector to Emitter Sustaining Voltage** [Notes 4 and 5]	**−40**		**Volts**	**$I_C = 10$ mA (pulsed)**	**$I_B = 0$**
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		Volts	$I_E = 10$ μA	$I_C = 0$

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.

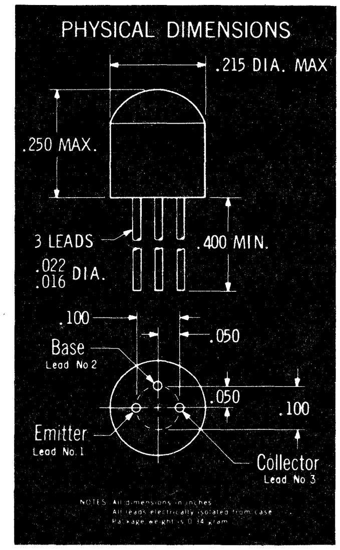
(3) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 143°C/watt (derating factor of 7.0 mW/°C) for the EN2905 and 200°C/watt (derating factor of 5.0 mW/°C) for the EN2907; junction to ambient thermal resistance of 333°C/watt (derating factor of 3.0 mW/°C) for the EN2905 and 500°C/watt (derating factor of 2.0 mW/°C) for the EN2907.

(4) 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%.

SE3001 · SE3002
NPN TV-FM RECEIVER
DIFFUSED SILICON PLANAR TRANSISTORS

The SE3001 and SE3002 are NPN silicon PLANAR transistors designed specifically for TV-FM receiver applications. They feature high power gain, low noise and low leakage in a new solid package designed to give maximum mechanical support to the transistor chip.



ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures	
Operating Junction Temperature	125°C Maximum
Storage Temperature	−55°C to +125°C
Soldering Temperature (10 sec time limit)	260°C Maximum
Maximum Power Dissipation	
Total Dissipation at 25°C Case Temperature [Note 2]	0.5 Watt
at 65°C Case Temperature [Note 2]	0.3 Watt
at 25°C Ambient Temperature [Note 2]	0.2 Watt
Maximum Voltages	
V_{CBO} Collector to Base Voltage	30 Volts
V_{CEO} Collector to Emitter Voltage [Note 3]	12 Volts
V_{EBO} Emitter to Base Voltage	2.0 Volts

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain [Note 4]	20	50			$I_C = 8.0$ mA $V_{CE} = 10$ V
V_{CE} (sat)	Collector Saturation Voltage			0.6	Volt	$I_C = 10$ mA $I_B = 1.0$ mA
C_{ob}	Output Capacitance		1.4	1.7	pf	$I_E = 0$ $V_{CB} = 10$ V
C_{ob}	Output Capacitance		2.7	3.0	pf	$I_E = 0$ $V_{CB} = 0$
I_{CBO}	Collector Cutoff Current			0.5	μA	$I_E = 0$ $V_{CB} = 15$ V
I_{CBO} (65°C)	Collector Cutoff Current			5.0	μA	$I_E = 0$ $V_{CB} = 15$ V
h_{fe}	High Frequency Current Gain (f = 100 mc)	6.0	9.0			$I_C = 8.0$ mA $V_{CE} = 10$ V
A_P	Available Power Gain (neutralized) (f = 200 mc)	12	15		db	$I_C = 6.0$ mA $V_{CB} = 10$ V
P_O	Power Output (f = 500 mc)		40		mW	$I_C = 10$ mA $V_{CB} = 10$ V
P_O	Power Output (f = 930 mc) **SE3001**		2.0		mW	$I_C = 10$ mA $V_{CB} = 10$ V
P_O	Power Output (f = 930 mc) **SE3002**	3.0	8.0		mW	$I_C = 10$ mA $V_{CB} = 10$ V
NF	Noise Figure [Note 5]		4.0		db	$I_C = 1.0$ mA $V_{CE} = 6.0$ V
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage [Note 3 and 4]	12			Volts	$I_C = 3.0$ mA $I_B = 0$ (pulsed)
BV_{CBO}	Collector to Base Breakdown Voltage	30			Volts	$I_C = 100\ \mu$A $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	2.0			Volts	$I_C = 0$ $I_E = 100\ \mu$A

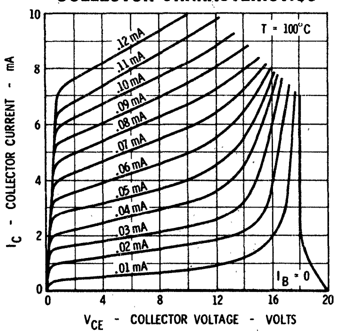
NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high-current point where collector-to-emitter voltage is lowest. For more information send for Fairchild Publication APP-4.
(4) Pulse Conditions: length ≤ 300 μsec; duty cycle ≤ 2%.
(5) f = 60 mc; $R_S = 400\Omega$.

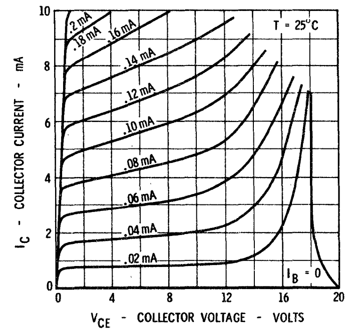
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

TYPICAL ELECTRICAL CHARACTERISTICS

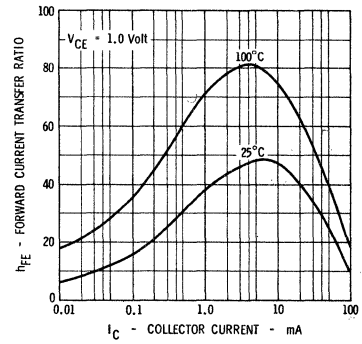
COLLECTOR CHARACTERISTICS



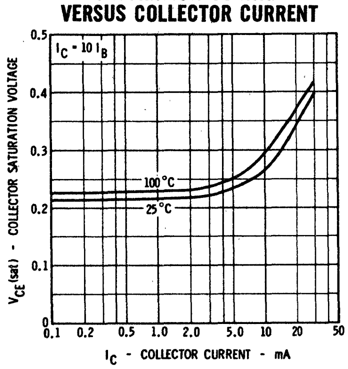
COLLECTOR CHARACTERISTICS



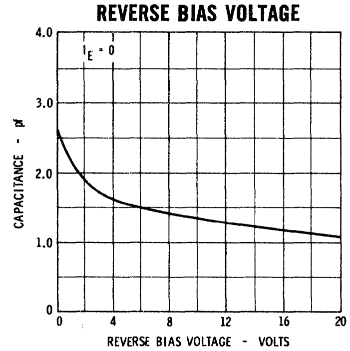
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



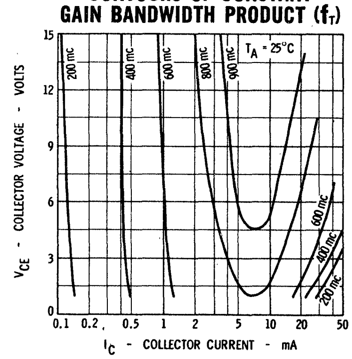
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



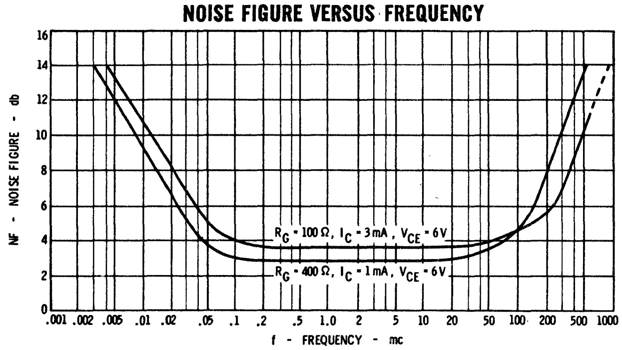
OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



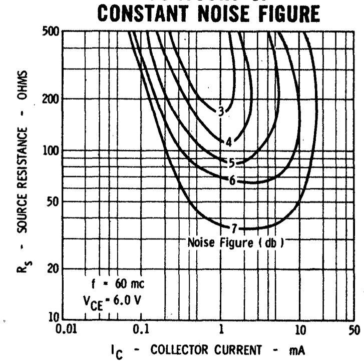
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



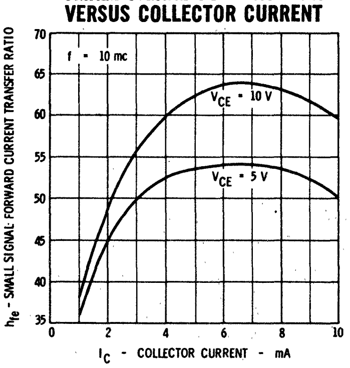
NOISE FIGURE VERSUS FREQUENCY



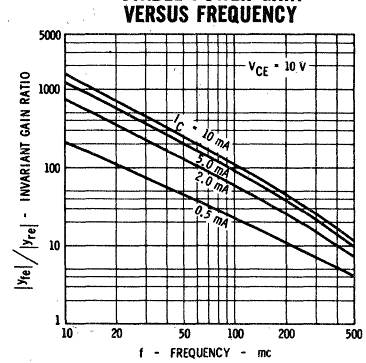
CONTOURS OF CONSTANT NOISE FIGURE



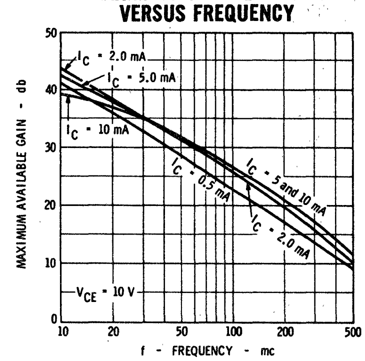
SMALL SIGNAL CURRENT GAIN VERSUS COLLECTOR CURRENT



INVARIANT MAXIMUM STABLE POWER GAIN VERSUS FREQUENCY

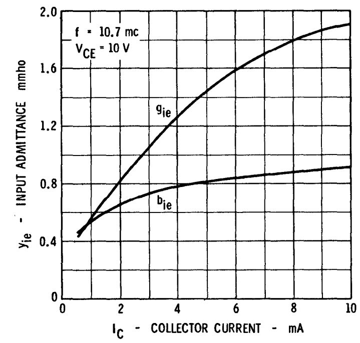


MAXIMUM AVAILABLE GAIN VERSUS FREQUENCY

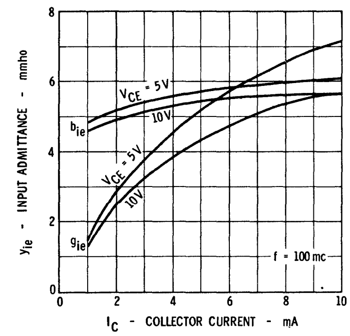


TYPICAL SMALL SIGNAL COMMON EMITTER "Y" PARAMETERS

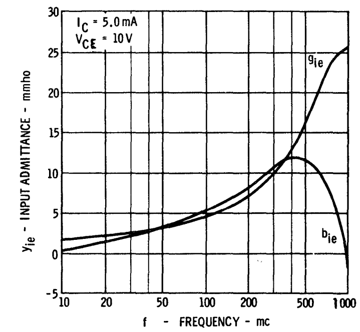
INPUT ADMITTANCE VERSUS COLLECTOR CURRENT — OUTPUT SHORT CIRCUIT



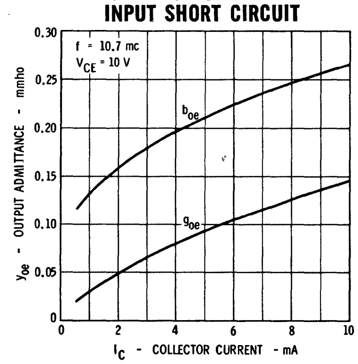
INPUT ADMITTANCE VERSUS COLLECTOR CURRENT — OUTPUT SHORT CIRCUIT



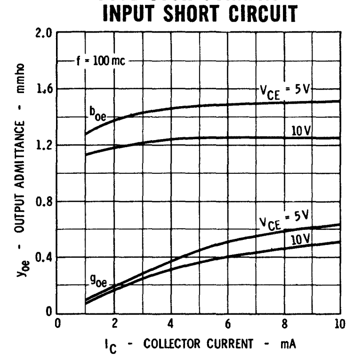
INPUT ADMITTANCE VERSUS FREQUENCY — OUTPUT SHORT CIRCUIT



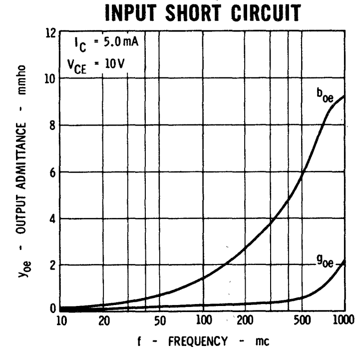
OUTPUT ADMITTANCE VERSUS COLLECTOR CURRENT — INPUT SHORT CIRCUIT



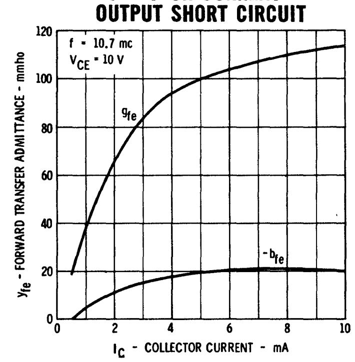
OUTPUT ADMITTANCE VERSUS COLLECTOR CURRENT — INPUT SHORT CIRCUIT



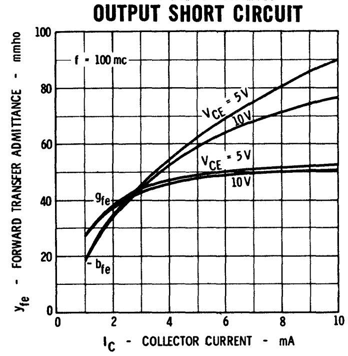
OUTPUT ADMITTANCE VERSUS FREQUENCY — INPUT SHORT CIRCUIT



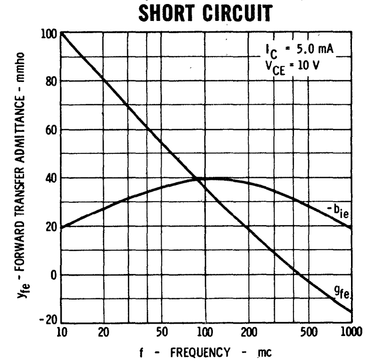
FORWARD TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT — OUTPUT SHORT CIRCUIT



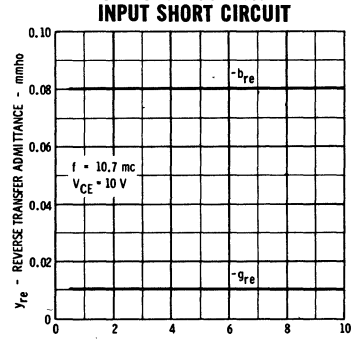
FORWARD TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT — OUTPUT SHORT CIRCUIT



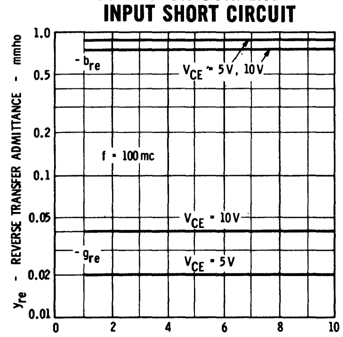
FORWARD TRANSFER ADMITTANCE VERSUS FREQUENCY — OUTPUT SHORT CIRCUIT



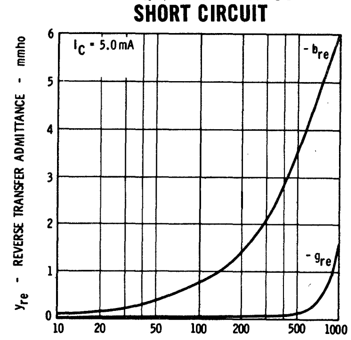
REVERSE TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT — INPUT SHORT CIRCUIT



REVERSE TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT — INPUT SHORT CIRCUIT

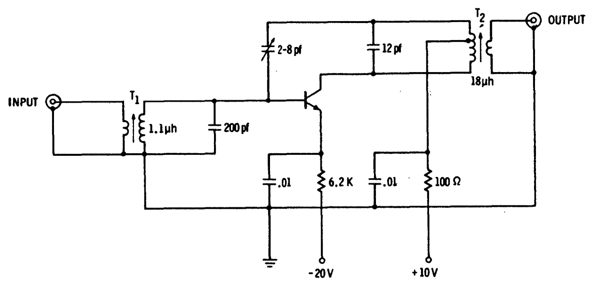


REVERSE TRANSFER ADMITTANCE VERSUS FREQUENCY — INPUT SHORT CIRCUIT



NEUTRALIZED 10.7 MC I.F. TEST CIRCUIT

$I_C = 3.0$ mA $V_{CE} = 10$ V



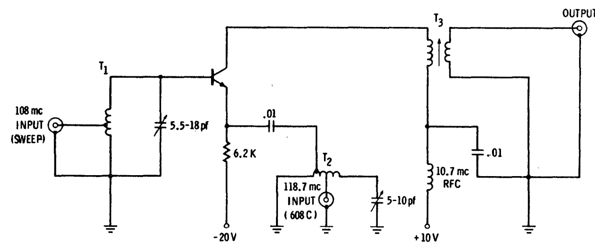
Typical Gain = 37 db

T_1 = 2.6 T Primary #26 Nyclad
10 T Secondary #26 Nyclad

T_2 = 38 T Primary #36 Nyclad tapped at 25 T for Neut.
2.5 Secondary #26 Nyclad

108 MC TO 10.7 MC CONVERSION GAIN TEST CIRCUIT

$I_C = 3.0$ mA $V_{CE} = 10$ V



Typical Gain = 25 db

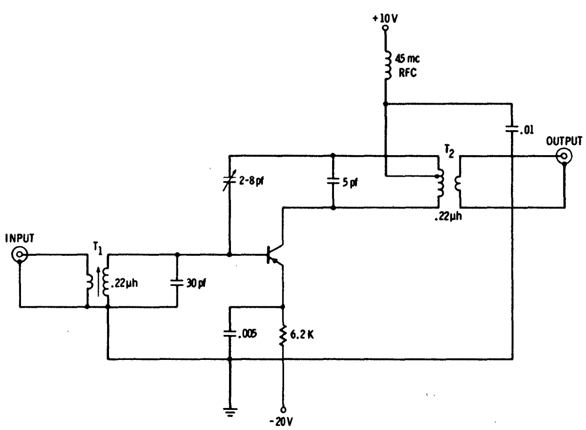
T_1 = 3 T #16 tinned copper wire, tapped at 1 T

T_2 = 2.5 T #16 tinned copper wire, tapped at 0.5 and 1 T

T_3 = 10 T #26 Nyclad Primary
1 T #26 Nyclad Secondary

NEUTRALIZED 45 MC I.F. TEST CIRCUIT

$I_C = 3.0$ mA $V_{CE} = 10$ V



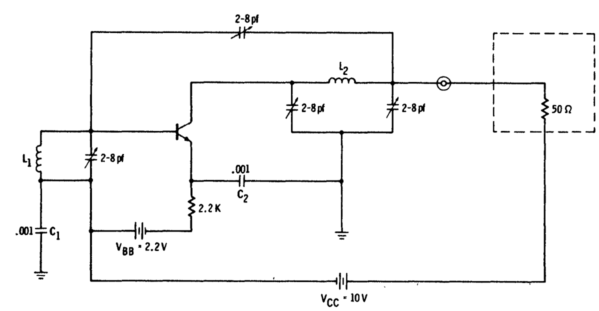
Typical Gain = 28 db

T_1 = 1.2 T Primary #26 Nyclad
4.5 T Secondary #26 Nyclad } Miller #30-106 Core

T_2 = 11 T Primary #26 Nyclad tapped at 4 T for Neut.
1 T Secondary

930 MC OSCILLATOR TEST CIRCUIT

$V_{CC} = 10$ V



Typical Power Out = 7.0 mW

C_1 and C_2 are feed-through capacitors.

L_1 and L_2 are silver tubing with mutual coupling.

This circuit is meant to be used with an attenuator and a filter. The collector supply is fed in through the attenuator.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

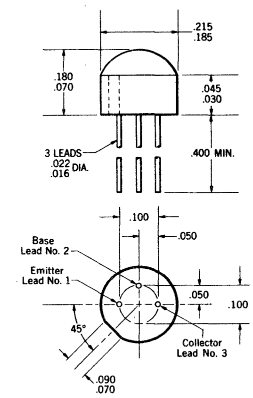
SE3005

NPN UHF OSCILLATOR

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTOR

- **1.0 GHz P_o - - 15 mW MIN.**
- **f_T - - 800 MHzMIN.**
- **f_{max} - - 1.7 GHz MIN.**
- **EXCELLENT VOLTAGE-FREQUENCY STABILITY**

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.2 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Operating Junction Temperature		125°C Maximum
Storage Temperature		−55°C to +125°C
Soldering Temperature (10 second time limit)		
Maximum Power Dissipation		
Total Dissipation at 25°C Case Temperature (Note 2)		0.5 Watt
at 65°C Case Temperature (Note 2)		0.3 Watt
at 25°C Ambient Temperature (Note 2)		0.2 Watt
Maximum Voltages		
V_{CBO}	Collector to Base Voltage	30 Volts
V_{CEO}	Collector to Emitter Voltage (Note 3)	15 Volts
V_{EBO}	Emitter to Base Voltage	4.0 Volts

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

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
P_o	**Power Output (f = 1.0 GHz) (See Fig. 1)**	**15**	**25**		**mW**	**$I_C = 8.0$ mA**	**$V_{CC} = 10$ V**
h_{FE}	DC Pulse Current Gain (Note 4)	45	100	300		$I_C = 5.0$ mA	$V_{CE} = 10$ V
BV_{CBO}	Collector to Base Breakdown Voltage	30			Volts	$I_C = 100\ \mu A$	$I_E = 0$
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Note 3)	15			Volts	$I_C = 1.0$ mA	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			Volts	$I_C = 0$	$I_E = 100\ \mu A$
I_{CBO}	Collector Cutoff Current			10	nA	$I_E = 0$	$V_{CB} = 15$ V
V_{CE}(sat)	Pulsed Collector Saturation Voltage			0.1	Volt	$I_C = 20$ mA	$I_B = 2.0$ mA
C_{ce}	Collector to Emitter Capacitance (f = 1.0 MHz)	0.3	0.6	1.0	pF	$I_E = 0$	$V_{CE} = 10$ V
C_{cb}	Collector to Base Capacitance (f = 1.0 MHz)	0.3	0.6	0.85	pF	$I_E = 0$	$V_{CB} = 10$ V
ΔC_{cb}	**Differential Collector to Base Capacitance (f = 1.0 MHz)**		**0.08**	**0.15**	**pF**	**$I_E = 0$**	**$V_{CB} = 5.0$ V to 10 V**
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**8.0**	**12**			$I_C = 5.0$ mA	$V_{CE} = 10$ V
$r_b'C_c$	Collector to Base Time Constant (f = 80 MHz)		6.0	10	ps	$I_C = 5.0$ mA	$V_{CE} = 10$ V
f_{max}	**Maximum Frequency of Oscillation**	**1.7**	**2.8**		**GHz**	**$I_C = 5.0$ mA**	**$V_{CE} = 10$ V**

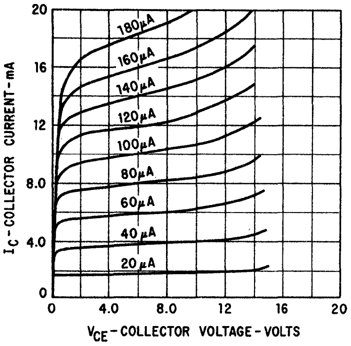
*Planar is a patented Fairchild process.

NOTES:

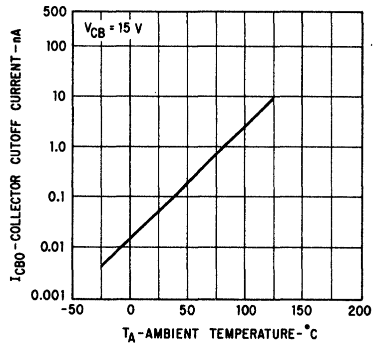
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C) junction-to-ambient thermal resistance of 500°C/watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(4) 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

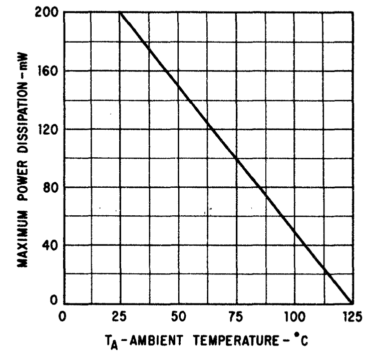
COLLECTOR CHARACTERISTICS



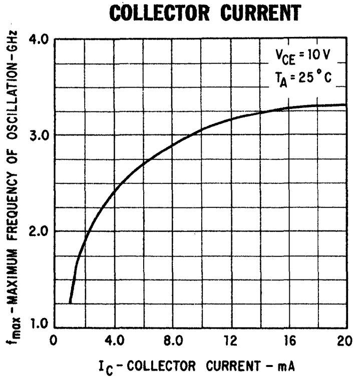
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



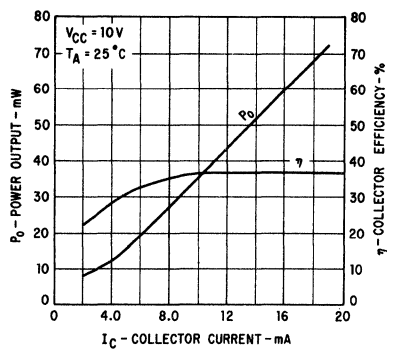
MAXIMUM POWER DISSIPATION VERSUS TEMPERATURE



MAXIMUM FREQUENCY OF OSCILLATION VERSUS COLLECTOR CURRENT



POWER OUTPUT AND COLLECTOR EFFICIENCY VERSUS COLLECTOR CURRENT IN STUB OSCILLATOR CIRCUIT



POWER OUTPUT VERSUS FREQUENCY IN STUB OSCILLATOR CIRCUIT

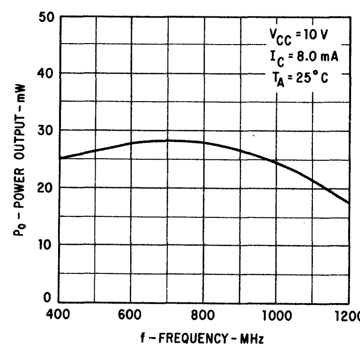
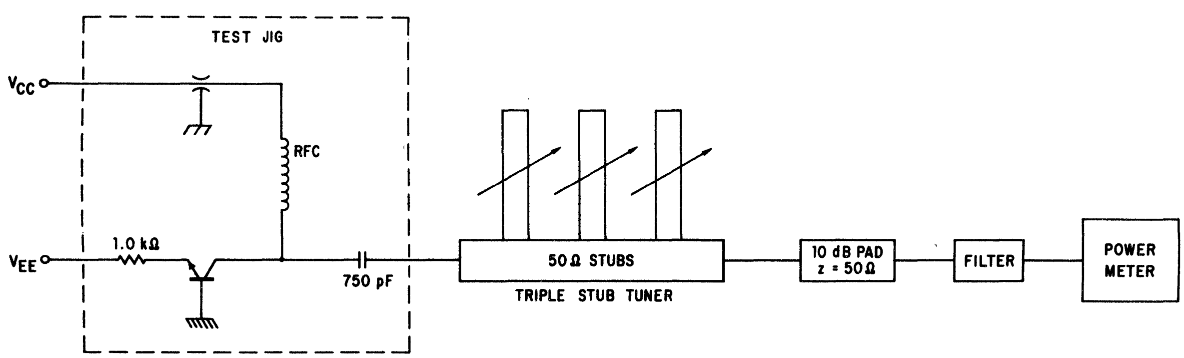


FIGURE 1



EQUIPMENT:

(1) Test Jig
(2) Triple Stub Tuner (Empire Model ST-33 A)
(3) 10 dB Pad (Narda Model 766-10)
(4) Filter (Telonic Model TTF-1000-5-5 EE)
(5) Power Meter (General Microwave Model 454 A)

TEST PROCEDURE:

(1) Apply V_{CC} and V_{EE}
(2) Set Filter to 1.0 GHz
(3) Tune Stubs for Max. Power Out.

EN3009 • EN3013 • EN3014

NPN HIGH SPEED SATURATED SWITCHES

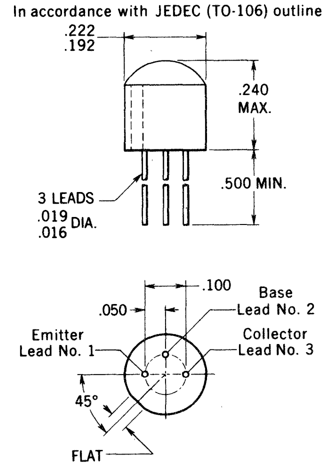
DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

FOR TEST CIRCUITS AND ADDITIONAL DESIGN INFORMATION SEE FAIRCHILD 2N3009, 2N3013 AND 2N3014 DATA SHEETS

- **ELECTRICAL REPLACEMENTS FOR 2N3009, 2N3013 AND 2N3014**
- **HIGH SPEED - - $\tau_s = 18$ns (max.) at 10 mA**
- **LOW SATURATION VOLTAGE - - V_{CE}(sat) = 0.18 V (max.) at 30 mA**
  - - V_{CE}(sat) = 0.25 V (max.) at 30 mA and +100°C
  - - V_{CE}(sat) = 0.5 V (max.) at 300 mA

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−65°C to +125°C
Operating Junction Temperature	125°C Maximum
Lead Temperature (Soldering, 10 Second Time Limit)	260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	0.5 Watt
at 25°C Ambient Temperature (Notes 2 and 3)	0.2 Watt

Maximum Voltages		**EN3009**	**EN3013**	**EN3014**
V_{CBO}	Collector to Base Voltage	40	40	40 Volts
V_{CES}	Collector to Emitter Voltage	40	40	40 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	15	15	20 Volts
V_{EBO}	Emitter to Base Voltage	4.0	5.0	5.0 Volts

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

SYMBOL	CHARACTERISTIC	EN3009 MIN.	EN3009 MAX.	EN3013 MIN.	EN3013 MAX.	EN3014 MIN.	EN3014 MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain (Note 5)					25			$I_C = 10$ mA	$V_{CE} = 0.4$V
h_{FE}	DC Pulse Current Gain (Note 5)	30	120	30	120	30	120		$I_C = 30$ mA	$V_{CE} = 0.4$V
h_{FE} (−55°C)	DC Pulse Current Gain (Note 5)			12		12			$I_C = 30$ mA	$V_{CE} = 0.4$V
h_{FE}	DC Pulse Current Gain (Note 5)	25		25					$I_C = 100$ mA	$V_{CE} = 0.5$V
h_{FE}	DC Pulse Current Gain (Note 5)					25			$I_C = 100$ mA	$V_{CE} = 1.0$V
h_{FE}	DC Pulse Current Gain (Note 5)	15		15					$I_C = 300$ mA	$V_{CE} = 1.0$V
V_{CE}(sat)	Collector Saturation Voltage						0.18	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{CE}(sat)	**Collector Saturation Voltage**		**0.18**		**0.18**		**0.18**	Volts	**$I_C = 30$ mA**	**$I_B = 3.0$ mA**
V_{CE}(sat) (+85°)	Collector Saturation Voltage		0.30					Volts	$I_C = 30$ mA	$I_B = 3.0$ mA
V_{CE}(sat) (+100°C)	**Collector Saturation Voltage**				**0.25**		**0.25**	**Volts**	**$I_C = 30$ mA**	**$I_B = 3.0$ mA**
V_{CE}(sat)	Collector Saturation Voltage		0.28		0.28		0.35	Volts	$I_C = 100$ mA	$I_B = 10$ mA
V_{CE}(sat)	**Collector Saturation Voltage**		**0.50**		**0.50**			**Volts**	**$I_C = 300$ mA**	**$I_B = 30$ mA**
V_{BE}(sat)	Base Saturation Voltage					0.70	0.80	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{BE}(sat)	Base Saturation Voltage	0.75	0.95	0.75	0.95	0.75	0.95	Volts	$I_C = 30$ mA	$I_B = 3.0$ mA
V_{BE}(sat)	Base Saturation Voltage		1.20		1.20		1.20	Volts	$I_C = 100$ mA	$I_B = 10$ mA
V_{BE}(sat)	Base Saturation Voltage		1.70		1.70			Volts	$I_C = 300$ mA	$I_B = 30$ mA
I_{CES}	Collector Cutoff Current		0.50		0.30		0.30	μA	$V_{CE} = 20$ V	$V_{BE} = 0$
I_{CES} (+85°C)	Collector Cutoff Current		15					μA	$V_{CE} = 20$ V	$V_{BE} = 0$

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 Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	EN3009 MIN.	EN3009 MAX.	EN3013 MIN.	EN3013 MAX.	EN3014 MIN.	EN3014 MAX.	UNITS	TEST CONDITIONS	
I_{CES} (+100°C)	Collector Cutoff Current				20		20	μA	$V_{CE} = 20$ V	$V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	40		40		40			$I_C = 100$ μA	$I_E = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	40		40		40			$I_C = 100$ μA	$V_{BE} = 0$
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	15		15		20			$I_C = 10$ mA	$I_B = 0$
BV_{EBO}	Base to Emitter Breakdown Voltage	4.0		5.0		5.0			$I_C = 0$	$I_E = 100$ μA
C_{obo}	Output Capacitance		5.0		5.0		5.0		$I_E = 0$	$V_{CB} = 5.0$ V
C_{ibo}	Input Capacitance		8.0		8.0		8.0		$I_C = 0$	$V_{EB} = 0.5$ V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	3.5		3.5		3.5			$I_C = 30$ mA	$V_{CE} = 10$ V
τ_S	**Charge Storage Time Constant**		**18**		**18**		**18**		**$I_C \approx I_{B1} \approx -I_{B2} \approx 10$ mA**	
t_{on}	Turn On Time		15		15				$I_C \approx 300$ mA	$I_{B1} \approx 30$ mA
t_{on}	Turn On Time						16		$I_C \approx 30$ mA	$I_{B1} \approx 3.0$ mA
t_{off}	Turn Off Time						25		$I_C \approx 30$ mA, $I_{B2} \approx -3.0$ mA	$I_{B1} \approx 3.0$ mA
t_{off}	Turn Off Time		25		25				$I_C \approx 300$ mA, $I_{B2} \approx -30$ mA	$I_{B1} \approx 30$ mA

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 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C). Junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).

(4) 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%.

EN3250

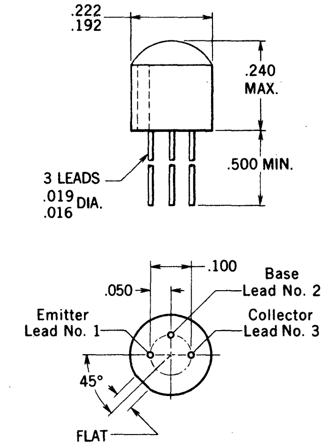
PNP HIGH SPEED SWITCH AND RF AMPLIFIER

DIFFUSED SILICON PLANAR* II EPITAXIAL TRANSISTOR

FOR TEST CIRCUITS AND ADDITIONAL DESIGN INFORMATION SEE FAIRCHILD 2N3250 DATA SHEET

- **ELECTRICAL REPLACEMENT FOR 2N3250**
- **HIGH FREQUENCY - - f_T = 250 MHz (min) at 10mA**
- **LOW NOISE - - NF = 6 dB (max) at 100Hz**
- **HIGH BREAKDOWN - - BV_{CEO} = 40 V (min) at 10mA**
- **LOW CAPACITANCE - - C_{obo} = 6.0 pF (max)**

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package
is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures		
Storage Temperature		−55°C to +125°C
Operating Junction Temperature		+125°C
Soldering Temperature (10 seconds time limit)		+260°C
Maximum Power Dissipation		
Total Dissipation at 25°C Case Temperatures (Notes 2 and 3)		0.5 Watt
at 25°C Free Air Temperature (Notes 2 and 3)		0.2 Watt
Maximum Voltages and Current		
V_{CBO}	Collector to Base Voltage	−40 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	−40 Volts
V_{EBO}	Emitter to Base Voltage	−5.0 Volts
I_C	Collector Current	100 mA

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

SYMBOL	CHARACTERISTICS	MIN.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Current Gain	40			I_C = 100 μA	V_{CE} = −1.0 V
h_{FE}	DC Current Gain	45			I_C = 1.0 mA	V_{CE} = −1.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	50	150		I_C = 10 mA	V_{CE} = −1.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	15			I_C = 50 mA	V_{CE} = −1.0 V
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**2.5**			**I_C = 10 mA**	**V_{CE} = −20 V**
$V_{CE}(sat)$	Collector Saturation Voltage (Note 5)		−0.25	Volt	I_C = 10 mA	I_B = 1.0 mA
$V_{CE}(sat)$	Collector Saturation Voltage (Note 5)		−0.5	Volt	I_C = 50 mA	I_B = 5.0 mA
$V_{BE}(sat)$	Base Saturation Voltage (Note 5)	−0.6	−0.9	Volt	I_C = 10 mA	I_B = 1.0 mA
$V_{BE}(sat)$	Base Saturation Voltage (Note 5)		−1.2	Volt	I_C = 50 mA	I_B = 5.0 mA
BV_{CEO}	**Collector to Emitter Breakdown Voltage** (Notes 4 and 5)	**−40**		**Volts**	**I_C = 10 mA**	**I_B = 0**
BV_{CBO}	Collector to Base Breakdown Voltage	−50		Volts	I_C = 10 μA	I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		Volts	I_C = 0	I_E = 10 μA
C_{obo}	**Output Capacitance**		**6.0**	**pF**	**I_E = 0**	**V_{CB} = −10 V**
C_{TE}	Emitter Transition Capacitance		8.0	pF	I_C = 0	V_{EB} = −1.0 V
t_d	Delay Time		35	ns	I_C = 10 mA	I_{B1} = 1.0 mA
t_r	Rise Time		35	ns	I_C = 10 mA	I_{B1} = 1.0 mA
t_s	Storage Time		175	ns	I_C = 10 mA	I_{B1} = I_{B2} = 1.0 mA
t_f	Fall Time		50	ns	I_C = 10 mA	I_{B1} = I_{B2} = 1.0 mA

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

FAIRCHILD TRANSISTOR EN3250

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

SYMBOL	CHARACTERISTICS	MIN.	MAX.	UNITS	TEST CONDITIONS	
$r_b'C_c$	Collector Base Time Constant (f = 31.8 MHz)		250	ps	$I_C = 10$ mA	$V_{CE} = -20$ V
NF	**Noise Figure (f = 100 Hz)**		**6.0**	**dB**	$I_C = 100\ \mu A$	$V_{CE} = -5.0$ V
I_{CEX}	Collector Current		50	nA	$V_{CE} = -40$ V	$V_{EB} = -3.0$ V
I_{BL}	Base Current		100	nA	$V_{CE} = -40$ V	$V_{EB} = -3.0$ V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	50	200		$I_C = 1.0$ mA	$V_{CE} = -10$ V
h_{re}	Voltage Feedback Ratio (f = 1.0 kHz)		10	$x10^{-4}$	$I_C = 1.0$ mA	$V_{CE} = -10$ V
h_{ie}	Input Impedance (f = 1.0 kHz)	1.0	6.0	kΩ	$I_C = 1.0$ mA	$V_{CE} = -10$ V
h_{oe}	Output Admittance (f = 1.0 kHz)	4.0	40	μmho	$I_C = 1.0$ mA	$V_{CE} = -10$ 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 operation.

(3) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0mW/°C); junction-to-ambient thermal resistance of 500°C/Watt (derating factor of 2.0mW/°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%.

EN3502 · EN3504

PNP HIGH CURRENT SWITCHES

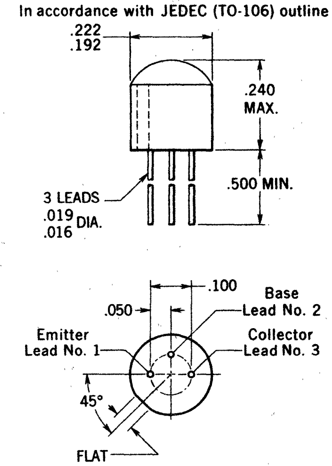
DIFFUSED SILICON PLANAR* II EPITAXIAL TRANSISTORS

FOR TEST CIRCUITS AND ADDITIONAL DESIGN INFORMATION SEE FAIRCHILD 2N3502 DATA SHEET

- **ELECTRICAL REPLACEMENTS FOR 2N3502 AND 2N3504**
- **HIGH BETA - - $h_{FE} = 80$ (MIN) AT 10 μA**
  - - $h_{FE} = 100\text{-}300$ AT 150 mA
  - - $h_{FE} = 30$ (MIN) AT 500 mA
- **LOW SATURATION VOLTAGE - - $V_{CE(sat)} = 0.4$ V (MAX) AT 150 mA**
- **FAST SWITCHING - - $t_{off} = 100$ ns (MAX) AT 300 mA**
- **HIGH BREAKDOWN VOLTAGE - - $LV_{CEO} = 45$ V (MIN)**

ABSOLUTE MAXIMUM RATINGS (Note 1)

		EN3502	EN3504
Maximum Temperatures			
Storage Temperature		−55°C to +125°C	
Operating Junction Temperature		+125°C Maximum	
Lead Temperature (Soldering, 10 sec time limit)		+260°C Maximum	
Maximum Power Dissipation (Notes 2 & 3)		**EN3502**	**EN3504**
Total Dissipation at 25°C Case Temperature		0.7 Watt	0.5 Watt
at 25°C Free Air Temperature		0.3 Watt	0.2 Watt
Maximum Voltages and Current			
V_{CBO}	Collector to Base Voltage	−45 Volts	−45 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	−45 Volts	−45 Volts
V_{EBO}	Emitter to Base Voltage	−5.0 Volts	−5.0 Volts
I_C	Collector Current (Note 2)	600 mA	600 mA

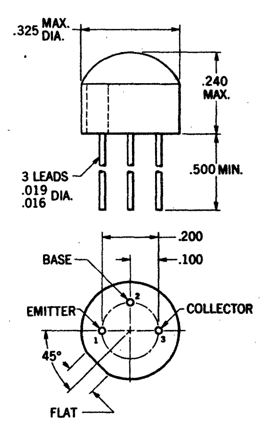


NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

EN3504

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

SYMBOL	CHARACTERISTIC	MIN.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Current Gain**	**80**			**$I_C = 10\ \mu A$**	**$V_{CE} = -10$ V**
h_{FE}	DC Current Gain	120			$I_C = 100\ \mu A$	$V_{CE} = -10$ V
h_{FE}	DC Current Gain	135			$I_C = 1.0$ mA	$V_{CE} = -10$ V
h_{FE}	DC Pulse Current Gain (Note 5)	140			$I_C = 10$ mA	$V_{CE} = -10$ V
h_{FE}	DC Pulse Current Gain (Note 5)	115	300		$I_C = 50$ mA	$V_{CE} = -1.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 5)	**100**	**300**		**$I_C = 150$ mA**	**$V_{CE} = -10$ V**
h_{FE}	**DC Pulse Current Gain** (Note 5)	**30**			**$I_C = 500$ mA**	**$V_{CE} = -10$ V**
h_{FE}(−55°C)	DC Pulse Current Gain (Note 5)	50			$I_C = 50$ mA	$V_{CE} = -10$ V
V_{CE}(sat)	Collector Saturation Voltage (Pulsed, see Note 5)		−0.25	Volts	$I_C = 50$ mA	$I_B = 2.5$ mA
V_{CE}(sat)	**Collector Saturation Voltage** (Pulsed, see Note 5)		**−0.4**	**Volts**	**$I_C = 150$ mA**	**$I_B = 15$ mA**
V_{CE}(sat)	Collector Saturation Voltage (Pulsed, see Note 5)		−1.0	Volts	$I_C = 300$ mA	$I_B = 30$ mA
V_{BE}(sat)	Base Saturation Voltage (Pulsed, see Note 5)		−1.0	Volts	$I_C = 50$ mA	$I_B = 2.5$ mA
V_{BE}(sat)	Base Saturation Voltage (Pulsed, see Note 5)		−1.3	Volts	$I_C = 150$ mA	$I_B = 15$ mA



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

EN3502

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	CHARACTERISTIC	MIN.	MAX.	UNITS	TEST CONDITIONS	
V_{BE}(sat)	Base-Emitter Voltage (Pulsed, see Note 5)		−2.0	Volts	$I_C = 300$ mA	$I_B = 30$ mA
h_{FE}	High Frequency Current Gain (f = 100 MHz)	1.5			$I_C = 50$ mA	$V_{CE} = -3.0$ V
t_{on}	Turn On Time		40	ns	$I_C \approx 300$ mA	$I_{B1} \approx 30$ mA
t_{off}	**Turn Off Time**		**100**	**ns**	**$I_C \approx 300$ mA**	**$I_{B1} \approx 30$ mA, $I_{B2} \approx -30$ mA**
C_{obo}	Output Capacitance		8.0	pF	$I_E = 0$	$V_{CB} = -10$ V
C_{ibo}	Input Capacitance		25	pF	$I_C = 0$	$V_{EB} = -0.5$ V
NF	Noise Figure (f = 1.0 kHz)		4.0	dB	$I_C = 30\ \mu A$	$V_{CE} = 15.0$ V, PB = 200 Hz, $R_S = 10$ kΩ
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage (Notes 4 and 5)**	**−45**		**Volts**	**$I_C = 10$ mA** (pulsed)	**$I_B = 0$**
BV_{CBO}	Collector to Base Breakdown Voltage	−45		Volts	$I_C = 10\ \mu A$	$I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0		Volts	$I_E = 10\ \mu A$	$I_C = 0$
I_{CES}	Collector Reverse Current		10	nA	$V_{CE} = -30$ V	$V_{BE} = 0$
I_{CBO}(+100°C)	Collector Cutoff Current		10	μA	$V_{CB} = -30$ V	$I_E = 0$
h_{ie}	Input Resistance (f = 1.0 kHz)		2300	Ω	$I_C = 10$ mA	$V_{CE} = -10$ V
h_{oe}	Output Conductance (f = 1.0 kHz)		1200	μmhos	$I_C = 10$ mA	$V_{CE} = -10$ V
h_{re}	Voltage Feedback Ratio (f = 1.0 kHz)		1500	$x10^{-6}$	$I_C = 10$ mA	$V_{CE} = -10$ V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	135	420		$I_C = 10$ mA	$V_{CE} = -10$ 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 125°C and junction to case thermal resistance of 143°C/Watt (derating factor of 7.0 mW/°C) for the EN3502 and 200°C/Watt (derating factor of 5.0 mW/°C) for the EN3504. Junction to ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C) for the EN3502 and 500°C/Watt (derating factor of 2.0 mW/°C) for the EN3504.
(4) 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%.

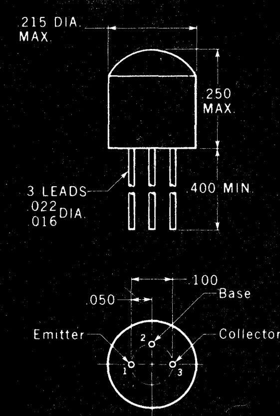
2N3563

NPN LOW LEVEL RF AMPLIFIER

DIFFUSED SILICON PLANAR EPITAXIAL TRANSISTOR

The 2N3563 is an NPN silicon PLANAR epitaxial transistor designed for low-level RF applications. It features high power gain, low noise and low leakage in a new solid package designed to give maximum mechanical support to the transistor chip.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Leads are nickel
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Operating Junction Temperature		+125°C Maximum
Storage Temperature		-55°C to +125°C
Soldering Temperature (10 sec. time limit)		+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature	(Note 2)	0.5 Watt
at 65°C Case Temperature	(Note 2)	0.3 Watt
at 25°C Ambient Temperature	(Note 2)	0.2 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage		30 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 3)	12 Volts
V_{EBO}	Emitter to Base Voltage		2.0 Volts

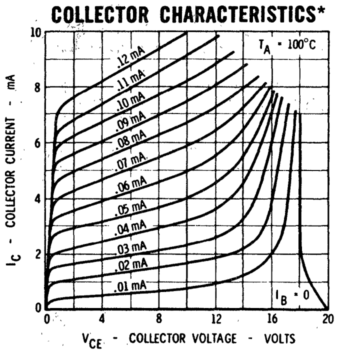
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

Symbol	Characteristics		Min.	Typ.	Max.	Units	Test Conditions	
h_{FE}	DC Pulse Current Gain	(Note 4)	20	50	200		I_C = 8.0 mA	V_{CE} = 10 V
V_{CE}(sat)	Collector Saturation Voltage			0.1		Volts	I_C = 10 mA	I_B = 1.0 mA
C_{obo}	Open Circuit Output Capacitance			1.3	1.7	pf	I_E = 0	V_{CB} = 10 V
C_{cb}	Collector-base Transfer	(Note 7)		0.8		pf	I_E = 0	V_{CB} = 10 V
I_{CBO}	Collector Cutoff Current				50	nA	I_E = 0	V_{CB} = 15 V
I_{CBO}(65°C)	Collector Cutoff Current				5.0	μA	I_E = 0	V_{CB} = 15 V
h_{fe}	High Frequency Current Gain (f = 100 mc)		6.0	9.0			I_C = 8.0 mA	V_{CE} = 10 V
G_{pe}	Available Power Gain (neutralized) (f = 200 mc)	(Note 5)	14	17		db	I_C = 8.0 mA	V_{CE} = 10 V
NF	Noise Figure	(Note 6)		4.0		db	I_C = 1.0 mA	V_{CE} = 6.0 V
$r_b'C_c$	Collector-Base Time Constant (f = 79.8 mc)		8.0	15	25	psec	I_C = 8.0 mA	V_{CB} = 10 V
h_{fe}	Small Signal Current Gain (f = 1.0 Kc)		20		250		I_C = 8.0 mA	V_{CE} = 10 V
BV_{CBO}	Collector to Base Breakdown Voltage		30			Volts	I_E = 0	I_C = 100 μA
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 3 and 4)		12			Volts	I_C = 3.0 mA (pulsed)	I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage		2.0			Volts	I_C = 0	I_E = 10 μA

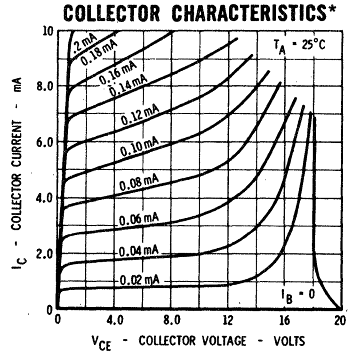
(See notes on back page)

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

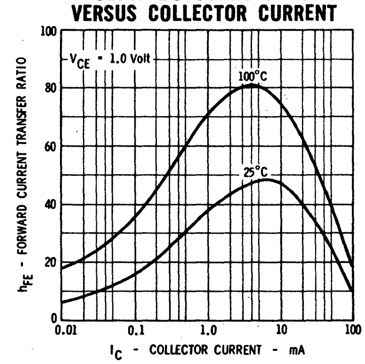
COLLECTOR CHARACTERISTICS*



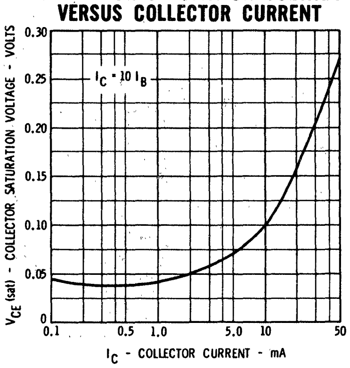
COLLECTOR CHARACTERISTICS*



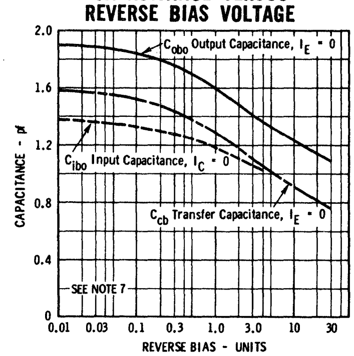
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



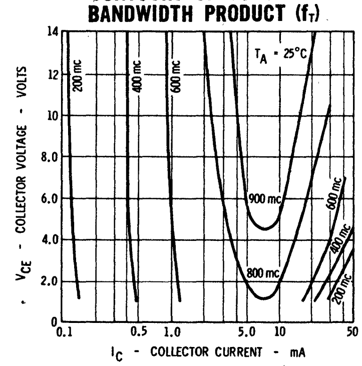
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



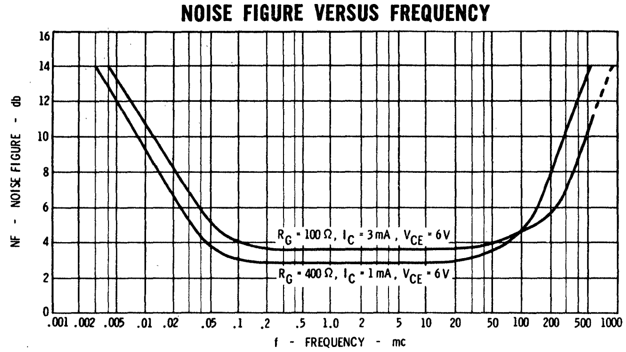
CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



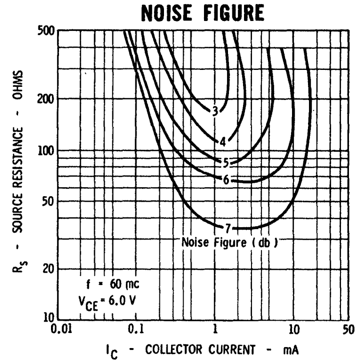
CONTOURS OF CONSTANT BANDWIDTH PRODUCT (f_T)



NOISE FIGURE VERSUS FREQUENCY



CONTOURS OF CONSTANT NOISE FIGURE

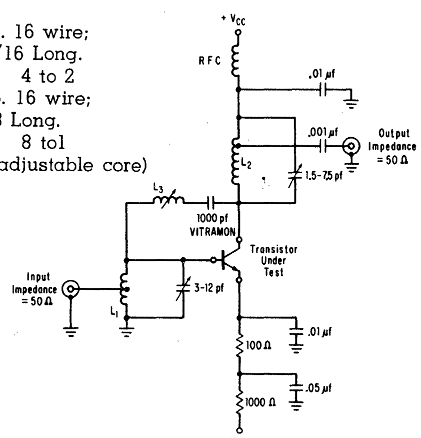


NEUTRALIZED 200 MC POWER GAIN AMPLIFIER TEST CIRCUIT

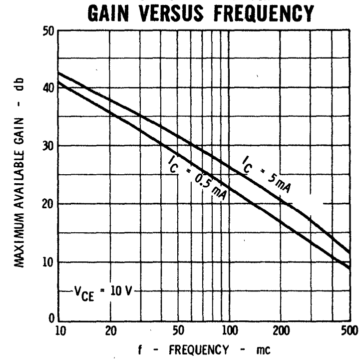
L₁ — 3.5 Turns No. 16 wire;
5/16 Dia; 7/16 Long.
Turns Ratio 4 to 2

L₂ — 8.0 Turns No. 16 wire;
1/8 Dia; 7/8 Long.
Turns Ratio 8 tol

L₃ — 0.4-0.65 μh (adjustable core)



MAXIMUM AVAILABLE GAIN VERSUS FREQUENCY



* Single family characteristics on Transistor Curve Tracer.

NOTES:

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

(2) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).

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

(4) Pulse Conditions: length = 300 μsec; duty cycle ≤ 1%.

(5) Forward gain (db) + reverse gain (db) < (-20 db). See test circuit.

(6) f = 60 mc; R_S = 400 Ω.

(7) C_{cb} is measured using a three-terminal measurement technique with case and emitter guarded. C_{cb} is equivalent to C_{re}.

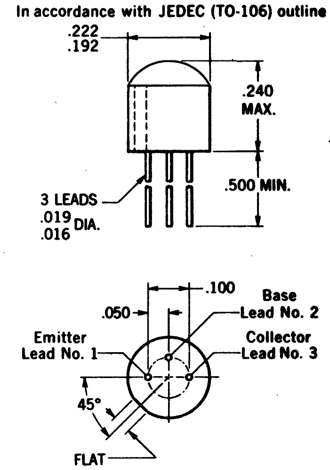
2N3564

NPN RF AMPLIFIER

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTOR

GENERAL DESCRIPTION - The 2N3564 is an NPN silicon PLANAR Epitaxial Transistor. It is designed for high-frequency wide-band amplifiers and is useful in low-power, small-signal tuned RF and IF applications. This device is similar to the SE 1010.

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature		-55°C to +125°C
Operating Junction Temperature		+125°C Maximum
Lead Temperature (Soldering, 10 sec. time limit)		+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature	(Note 2)	0.5 Watt
at 65°C Case Temperature	(Note 2)	0.3 Watt
at 25°C Ambient Temperature	(Note 2)	0.2 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage		30 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 3)	15 Volts
V_{EBO}	Emitter to Base Voltage		4.0 Volts

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

Symbol	Characteristics	Min.	Typ.	Max.	Units	Test Conditions
BV_{CBO}	Collector to Base Breakdown Voltage	30			Volts	I_C = 100 μA I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0			Volts	I_E = 100 μA I_C = 0
$BV_{CEO}(sust)$	Collector to Emitter Sustaining Voltage (Notes 3 & 4)	15			Volts	I_C = 10 mA I_B = 0
$V_{CE}(sat)$	Collector Saturation Voltage			0.3	Volts	I_C = 20 mA I_B = 2.0 mA
$V_{BE}(sat)$	Base Saturation Voltage			0.97	Volts	I_C = 20 mA I_B = 2.0 mA
I_{CBO}	Collector Cutoff Current			50	nA	V_{CB} = 15 V I_E = 0
h_{FE}	DC Pulse Current Gain (Note 4)	20	70			I_C = 15 mA V_{CE} = 10 V
h_{fe}	Low Frequency Current Gain (f = 1 kHz)	20	80			I_C = 15 mA V_{CE} = 10 V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	4.0	7.5			I_C = 15 mA V_{CE} = 10 V
r_b'	Real Part of h_{ie} (f = 350 MHz)		30		ohms	I_C = 15 mA V_{CE} = 10 V
C_{obo}	Open Circuit Output Capacitance		2.5	3.5	pF	V_{CB} = 10 V I_E = 0

Notes on page 2

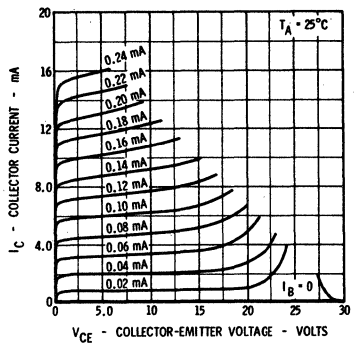
*Planar is a patented Fairchild process.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

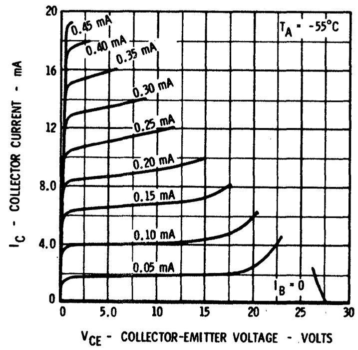
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

TYPICAL ELECTRICAL CHARACTERISTICS

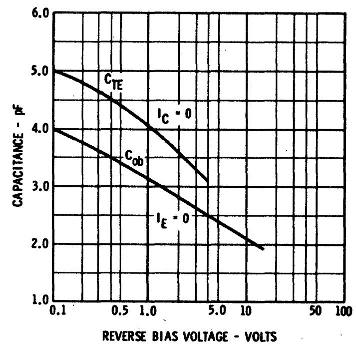
COLLECTOR CHARACTERISTICS*



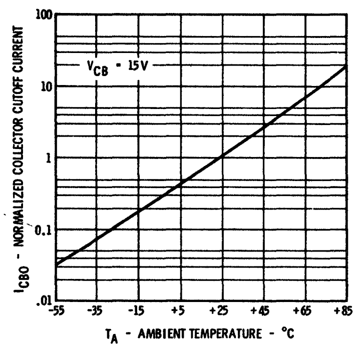
COLLECTOR CHARACTERISTICS*



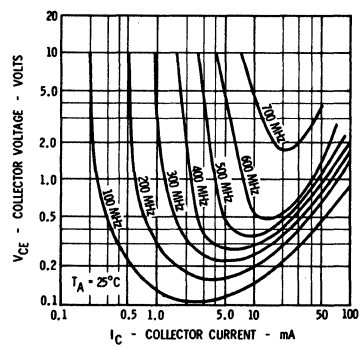
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



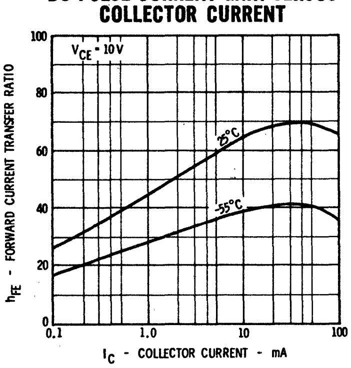
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



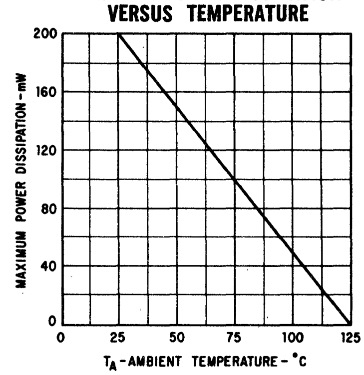
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



MAXIMUM POWER DISSIPATION VERSUS TEMPERATURE



* Single family characteristics on Transistor Curve Tracer

NOTES:

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

(2) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction-to- ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).

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

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

2N3565

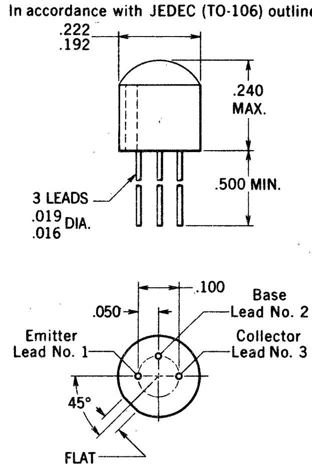
NPN HIGH GAIN

DIFFUSED SILICON PLANAR*TRANSISTOR

The 2N3565 is a very high beta NPN silicon PLANAR* transistor suited for high gain audio preamplifier stages and direct coupled circuits. It also features the solid package designed to give maximum mechanical support to the transistor chip. This is similar to the SE 4002.

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

* Planar is a patented Fairchild process.

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Operating Junction Temperature	+125°C Maximum
Storage Temperature	-55°C to +125°C
Soldering Temperature (10 sec. time limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature	(Note 2)	0.5 Watt
at 65°C Case Temperature	(Note 2)	0.3 Watt
at 25°C Ambient Temperature	(Note 2)	0.2 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage		30 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 3)	25 Volts
V_{EBO}	Emitter to Base Voltage		6.0 Volts

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

Symbol	Characteristic	Min.	Max.	Units	Test Conditions	
h_{FE}	DC Current Gain	150	600		I_C = 1.0 mA	V_{CE} = 10 V
h_{FE}	DC Current Gain	70			I_C = 100 μA	V_{CE} = 10 V
h_{fe}	High Frequency Current Gain (f = 20 MHz)	2.0			I_C = 1.0 mA	V_{CE} = 5.0 V
V_{CE}(sat)	Collector Saturation Voltage		0.35	Volts	I_C = 1.0 mA	I_B = 0.1 mA
I_{CBO}	Collector Cutoff Current		50	nA	I_E = 0	V_{CB} = 25 V
I_{CBO}(65°C)	Collector Cutoff Current		3.0	μA	I_E = 0	V_{CB} = 25 V
C_{obo}	Open Circuit Output Capacitance		4.0	pF	I_E = 0	V_{CB} = 5.0 V
BV_{CBO}	Collector to Base Breakdown Voltage	30		Volts	I_E = 0	I_C = 100 μA
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Note 3)	25		Volts	I_B = 0	I_C = 2.0 mA
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0		Volts	I_C = 0	I_E = 10 μA

NOTES:

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

(2) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).

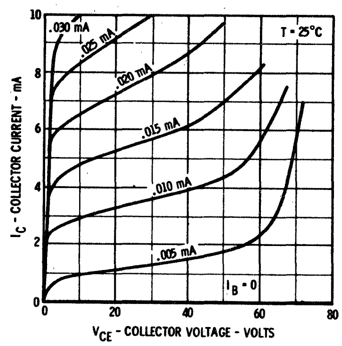
(3) Rating refers to a high-current point where collector-to-emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

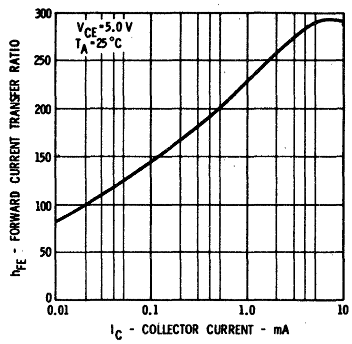
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

TYPICAL ELECTRICAL CHARACTERISTICS

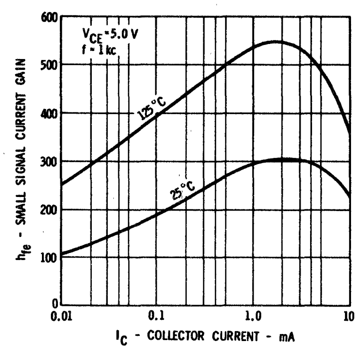
COLLECTOR CHARACTERISTICS*



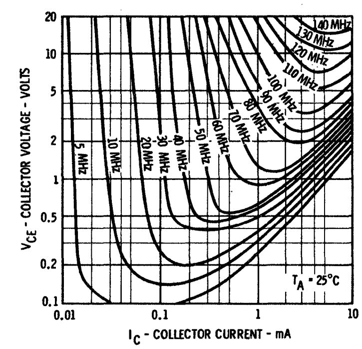
DC PULSED CURRENT GAIN VERSUS COLLECTOR CURRENT



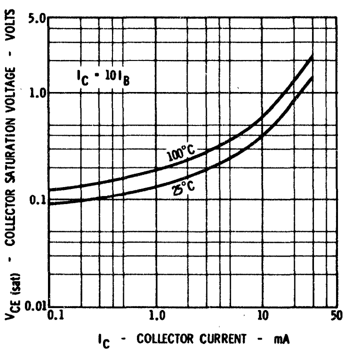
SMALL SIGNAL CURRENT GAIN VERSUS COLLECTOR CURRENT



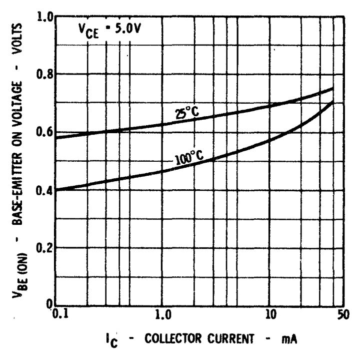
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



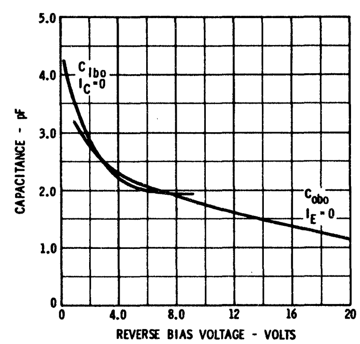
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



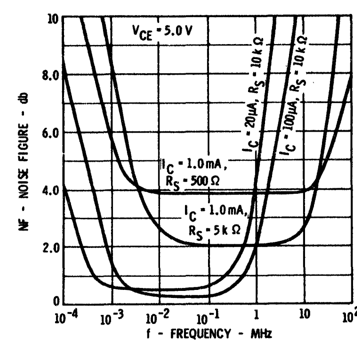
BASE-EMITTER ON VOLTAGE VERSUS COLLECTOR CURRENT



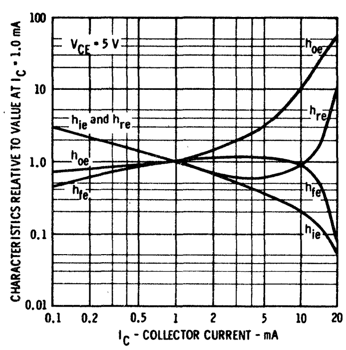
COLLECTOR-BASE AND EMITTER TRANSITION CAPACITANCES VERSUS REVERSE BIAS VOLTAGE

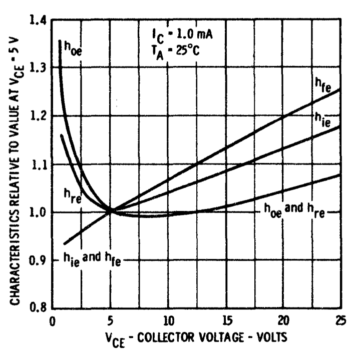


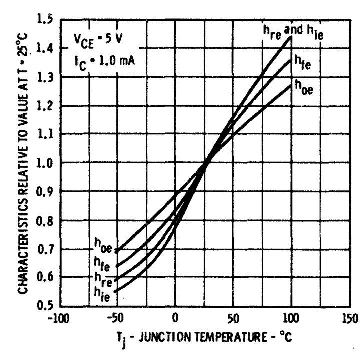
NOISE FIGURE VERSUS FREQUENCY



TYPICAL COMMON EMITTER CHARACTERISTICS (f=1kHz)







* Single family characteristics on Transistor Curve Tracer

SMALL SIGNAL CHARACTERISTICS (f=1kHz, TA=25°C)

Symbol	Characteristic	Min.	Typ.	Max.	Units		
h_{ie}	Input Resistance	2.0	7.5	20	kohms	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{oe}	Output Conductance		11	35	µmhos	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{re}	Voltage Feedback Ratio		300		$x10^{-6}$	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{fe}	Small Signal Current Gain	120	280	750		I_C = 1.0 mA	V_{CE} = 5.0 V
h_{ib}	Input Resistance		27		Ohms	I_C = 1.0 mA	V_{CB} = 5.0 V

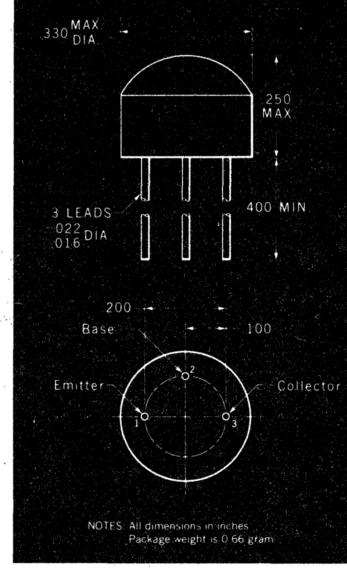
2N3566

NPN HIGH GAIN TYPE

DIFFUSED SILICON PLANAR TRANSISTOR

GENERAL DESCRIPTION - The 2N3566 is an NPN Silicon Planar Transistor designed for use in applications requiring very high gain. It is suitable for medium power output driver and low power output circuits. This device is encased in a solid package designed to give maximum mechanical support to the transistor chip. This device is similar to the SE 6002.

PHYSICAL DIMENSIONS



ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	-55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 sec. time limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature	(Notes 2 and 3)	0.8 Watt
at 75°C Case Temperature	(Notes 2 and 3)	0.4 Watt
at 25°C Ambient Temperature	(Notes 2 and 3)	0.3 Watt

Maximum Voltage

V_{CBO}	Collector to Base Voltage		40 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 4)	30 Volts
V_{EBO}	Emitter to Base Voltage		5.0 Volts

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

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Conditions	
h_{FE}	DC Pulse Current Gain (Note 5)	150	400	600		I_C = 10 mA	V_{CE} = 10 V
h_{FE}	DC Current Gain	80	325			I_C = 2.0 mA	V_{CE} = 10 V
V_{BE}	Base-Emitter Voltage (pulsed, see Note 5)		0.87	0.9	Volts	I_C = 100 mA	V_{CE} = 1.0 V
$V_{CE}(sat)$	Collector Saturation Voltage (pulsed, see Note 5)		0.9	1.0	Volts	I_C = 100 mA	I_B = 10 mA
h_{fe}	High Frequency Current Gain (f = 20 Mc)	2.0				I_C = 30 mA	V_{CE} = 10 V
C_{obo}	Open Circuit Output Capacitance		13	25	pf	I_E = 0	V_{CB} = 10 V
I_{CBO}	Collector Cutoff Current			50	nA	I_E = 0	V_{CB} = 20 V
$I_{CBO}(75°C)$	Collector Cutoff Current			5.0	µA	I_E = 0	V_{CB} = 20 V
BV_{CBO}	Collector to Base Breakdown Voltage	40			Volts	I_E = 0	I_C = 100 µA
$V_{CEO}(sust)$	Collector Emitter Sustaining Voltage (Notes 4 and 5)	30			Volts	I_C = 30 mA (pulsed)	I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			Volts	I_C = 0	I_E = 100 µA

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 125°C and junction-to-case thermal resistance of 125°C/Watt (derating factor of 8.0 mW/°C); junction-to-ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C).

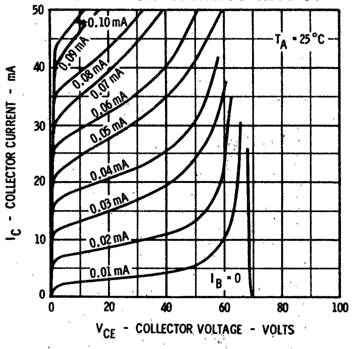
(4) Rating refers to a high-current point where collector-to-emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.

(5) Pulse Conditions: length = 300 µsec; duty cycle $\leq$ 1%.

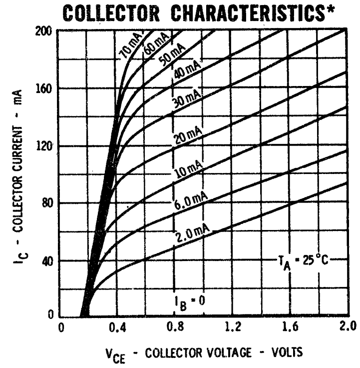
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

TYPICAL ELECTRICAL CHARACTERISTICS

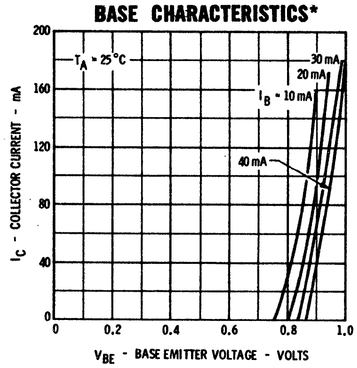
COLLECTOR CHARACTERISTICS*



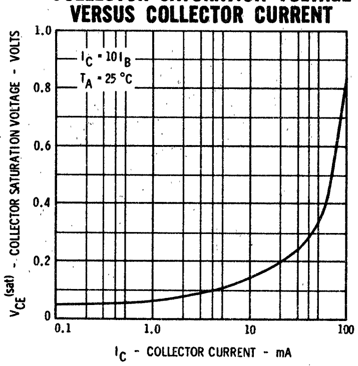
COLLECTOR CHARACTERISTICS*



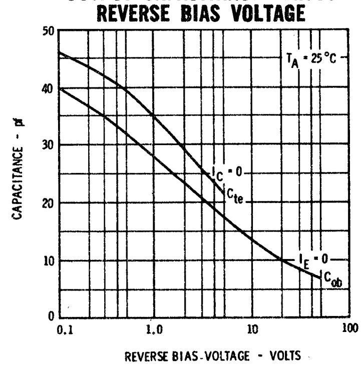
BASE CHARACTERISTICS*



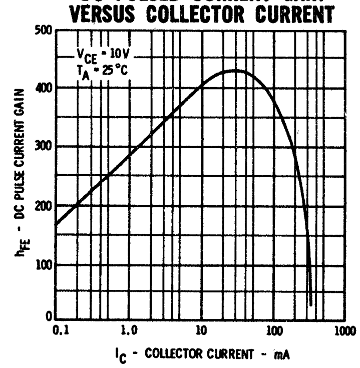
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



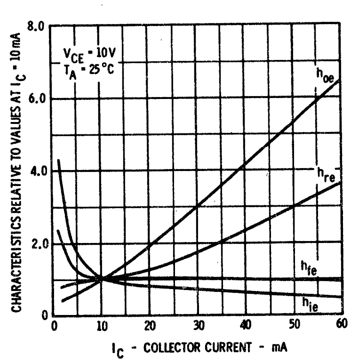
EMITTER TRANSITION AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE

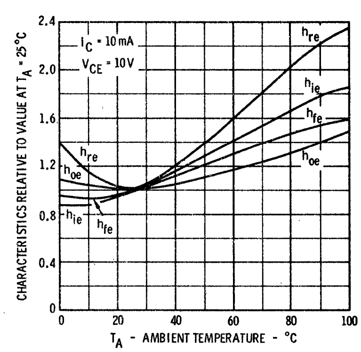


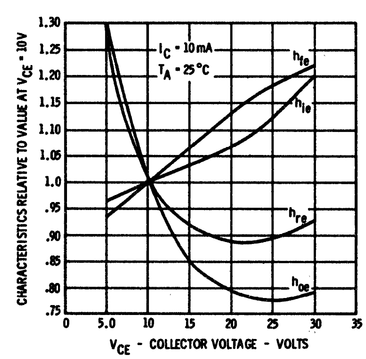
DC PULSED CURRENT GAIN VERSUS COLLECTOR CURRENT



TYPICAL COMMON EMITTER CHARACTERISTICS (f = 1KC)







* Single family characteristics on Transistor Curve Tracer

SMALL SIGNAL CHARACTERISTICS (f = 1KC)

Symbol	Characteristic	Typical	Units	Test Conditions	
h_{ie}	Input Resistance	2.5	Kohms	I_C = 10 mA	V_{CE} = 10 V
h_{oe}	Output Conductance	120	μmhos	I_C = 10 mA	V_{CE} = 10 V
h_{fe}	Small Signal Current Gain	500		I_C = 10 mA	V_{CE} = 10 V
h_{re}	Voltage Feedback Ratio	460	$x10^{-6}$	I_C = 10 mA	V_{CE} = 10 V

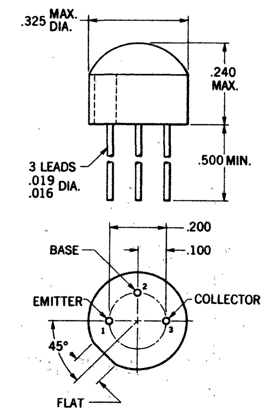
2N3567 • 2N3568

NPN GENERAL PURPOSE TYPES

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

The 2N3567 and 2N3568 are NPN silicon PLANAR*epitaxial transistors designed primarily for amplifier and switching applications over a wide range of voltage and current. These devices feature a useful beta range to 500 mA and low saturation voltage. High collector-to-emitter voltage allows operation to 60 volts for the 2N3568 and 40 volts for the 2N3567.

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package weight is 0.66 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	-55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 sec. time limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature	(Notes 2 & 3)	0.8 Watt
at 25°C Ambient Temperature	(Notes 2 & 3)	0.3 Watt

Maximum Voltages			2N3567	2N3568
V_{CBO}	Collector to Base Voltage		80 Volts	80 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 4)	40 Volts	60 Volts
V_{EBO}	Emitter to Base Voltage		5.0 Volts	5.0 Volts

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

Symbol	Characteristic		2N3567 Min.	2N3567 Typ.	2N3567 Max.	2N3568 Min.	2N3568 Typ.	2N3568 Max.	Units	Test Conditions	
h_{FE}	DC Pulse Current Gain	(Note 5)	40	80	120	40	80	120		I_C = 150 mA	V_{CE} = 1.0 V
h_{FE}	DC Pulse Current Gain	(Note 5)	40			40				I_C = 30 mA	V_{CE} = 1.0 V
$V_{CE}(sat)$	Collector Saturation Voltage (pulsed, see note 5)			0.15	0.25		0.15	0.25	Volts	I_C = 150 mA	I_B = 15 mA
$V_{BE}(sat)$	Base Saturation Voltage (pulsed, see note 5)			0.9	1.1		0.9	1.1	Volts	I_C = 150 mA	I_B = 15 mA
h_{fe}	High Frequency Current Gain (f = 20 MHz)		3.0			3.0				I_C = 50 mA	V_{CE} = 10 V
C_{obo}	Open Circuit Output Capacitance			13	20		13	20	pF	I_E = 0	V_{CB} = 10 V
C_{ibo}	Open Circuit Input Capacitance			63	80		63	80	pF	I_C = 0	V_{EB} = 0.5 V
I_{CBO}	Collector Cutoff Current				50			50	nA	I_E = 0	V_{CB} = 40 V
I_{CBO}(75°C)	Collector Cutoff Current				5.0			5.0	μA	I_E = 0	V_{CB} = 40 V
I_{EBO}	Emitter Cutoff Current				25			25	nA	I_C = 0	V_{EB} = 4.0 V
BV_{CBO}	Collector to Base Breakdown Voltage		80			80			Volts	I_E = 0	I_C = 100 μA
$V_{CEO}(sust)$	Collector to Emitter Sustaining Voltage (Notes 4 and 5)		40			60			Volts	I_C = 30 mA (pulsed)	I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage		5.0			5.0			Volts	I_C = 0	I_E = 10 μA

Notes on page 2

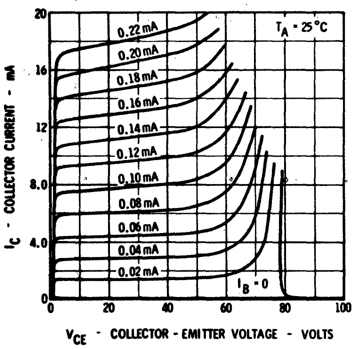
* Planar is a patented Fairchild process.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

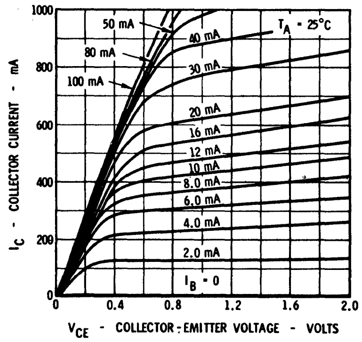
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

TYPICAL ELECTRICAL CHARACTERISTICS

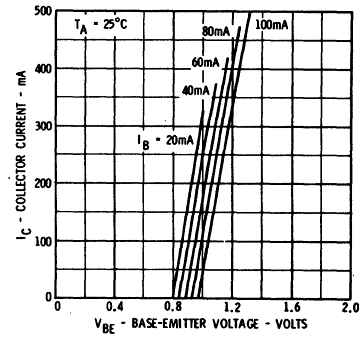
COLLECTOR CHARACTERISTICS*



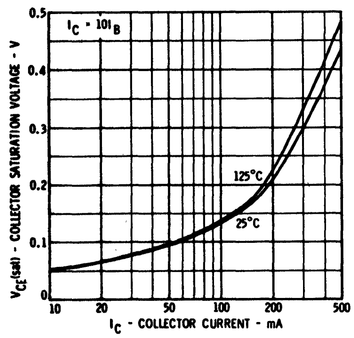
COLLECTOR CHARACTERISTICS*



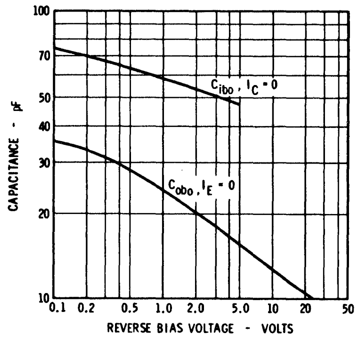
BASE CHARACTERISTICS*



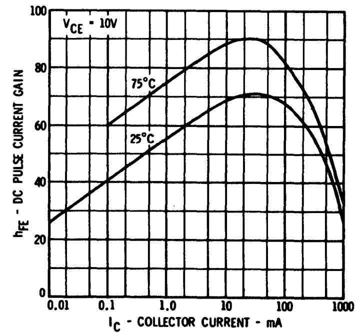
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



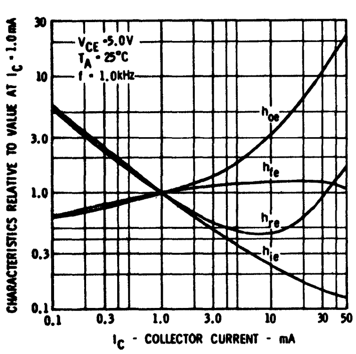
EMITTER TRANSITION AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE

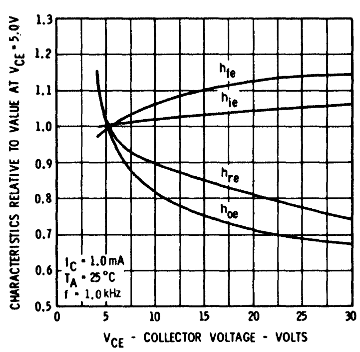


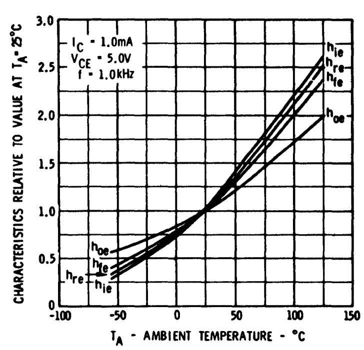
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



TYPICAL COMMON EMITTER CHARACTERISTICS (f=1.0 kHz)







*** Single family characteristics on Curve Tracer.**

SMALL SIGNAL CHARACTERISTICS (f=1.0 kHz)

Symbol	Characteristic	Typical	Units	Test Conditions	
h_{ie}	Input Resistance	1800	Ohms	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{oe}	Output Conductance	8.0	μmhos	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{re}	Voltage Feedback Ratio	2.1	$x10^{-4}$	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{fe}	Small Signal Current Gain	60		I_C = 1.0 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) 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 125°C and junction-to-case thermal resistance of 125°C/Watt (derating factor of 8.0 mW/°C; junction-to-ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C.

(4) 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%.

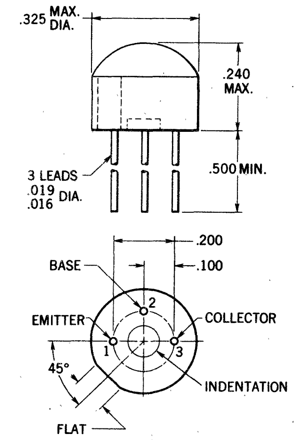
FT3567 • FT3568 • FT3569

NPN GENERAL PURPOSE TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- P_D . . . . . . **4.0 WATTS AT 25°C CASE TEMPERATURE**
- LV_{CEO} . . . . **60 VOLTS MIN.**
- h_{FE} . . . . . **100 MIN. AT 150 mA**
- $V_{CE(sat)}$ . . . **0.25 VOLT MAX. AT 150 mA**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated nickel
Package is electrically Non-conductive material
Package weight is 0.66 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperature

Storage Temperature		−55°C to +125°C
Operating Junction Temperature		+125°C
Lead Temperature (Soldering, 10 second time limit)		+260°C

Maximum Power Dissipation (Notes 2 and 3)

Total Dissipation at 25°C Case Temperature	**4.0 Watts**
at 25°C Ambient Temperature	0.5 Watt

Maximum Voltages

		FT3567 FT3569	FT3568
V_{CBO}	Collector to Base Voltage	80 Volts	80 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	40 Volts	60 Volts
V_{EBO}	Emitter to Base Voltage	5.0 Volts	5.0 Volts

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

SYMBOL	CHARACTERISTICS	FT3567 • FT3568 MIN.	TYP.	MAX.	FT3569 MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
$\mathbf{h_{FE}}$	**DC Pulse Current Gain** (Note 5)	40	80	120	**100**	150	300		**$I_C = 150$ mA**	**$V_{CE} = 1.0$ V**
h_{FE}	DC Pulse Current Gain (Note 5)	40			100				$I_C = 30$ mA	$V_{CE} = 1.0$ V
$\mathbf{V_{CE(sat)}}$	**Pulsed Collector Saturation Voltage** (Note 5)		0.15	**0.25**		0.10	**0.25**	**Volts**	**$I_C = 150$ mA**	**$I_B = 15$ mA**
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 5)		0.85	1.1		0.85	1.1	Volts	$I_C = 150$ mA	$I_B = 15$ mA
h_{fe}	High Frequency Current Gain (f = 20 MHz)	3.0		15	3.0		15		$I_C = 50$ mA	$V_{CE} = 10$ V
C_{cb}	Collector to Base Capacitance (FT3567 only)		16	25		16	25	pF	$I_E = 0$	$V_{CB} = 10$ V
C_{cb}	Collector to Base Capacitance (FT3568 only)		13	20				pF	$I_E = 0$	$V_{CB} = 10$ V
C_{eb}	Emitter to Base Capacitance		63	80		63	80	pF	$I_C = 0$	$V_{EB} = 0.5$ V
I_{CBO}	Collector Cutoff Current			50			50	nA	$I_E = 0$	$V_{CB} = 40$ V
I_{CBO}(75°C)	Collector Cutoff Current			5.0			5.0	μA	$I_E = 0$	$V_{CB} = 40$ V
I_{EBO}	Emitter Cutoff Current			25			25	nA	$I_C = 0$	$V_{EB} = 4.0$ V
BV_{CBO}	Collector to Base Breakdown Voltage	80			80			Volts	$I_C = 100$ μA	$I_E = 0$
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 and 5) [FT3567 only]	40			40			Volts	$I_C = 30$ mA (pulsed)	$I_B = 0$
$\mathbf{V_{CEO(sus)}}$	**Collector to Emitter Sustaining Voltage** (Notes 4 and 5) [FT3568 only]	**60**						**Volts**	**$I_C = 30$ mA**	**$I_B = 0$**
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			5.0			Volts	$I_C = 0$	$I_E = 10$ μA
$V_{BE(on)}$	Base to Emitter "ON" Voltage			1.1			1.1	Volts	$I_C = 150$ mA	$V_{CE} = 1.0$ V

NOTES:

*Planar is a patented Fairchild process.

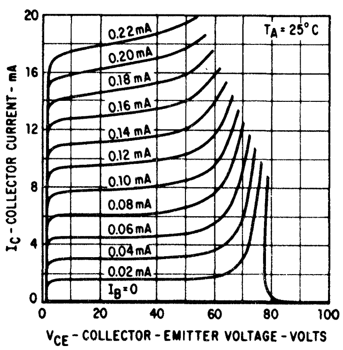
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
(3) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 25°C/Watt (derating factor of 40 mW/°C); junction to ambient thermal resistance of 200°C/Watt (derating factor of 5.0 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%.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

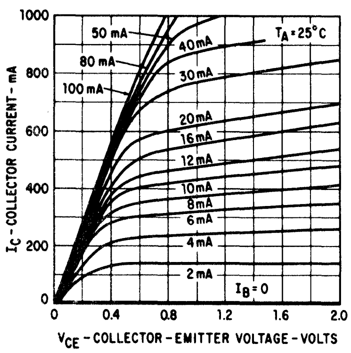
TYPICAL ELECTRICAL CHARACTERISTICS

FT3567 • FT3568

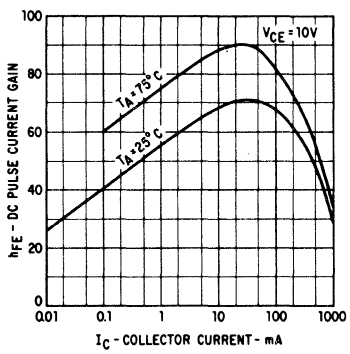
COLLECTOR CHARACTERISTICS*



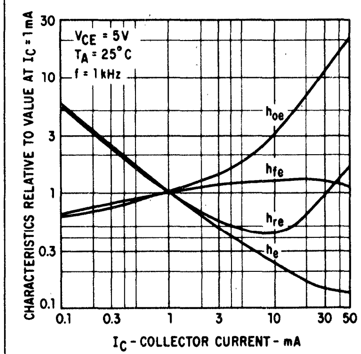
COLLECTOR CHARACTERISTICS*



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

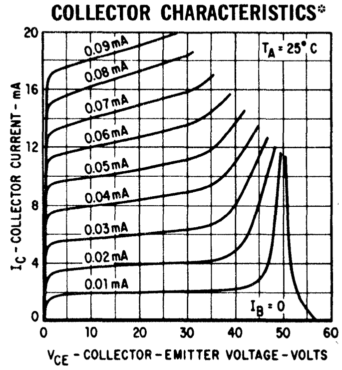


TYPICAL COMMON EMITTER CHARACTERISTICS

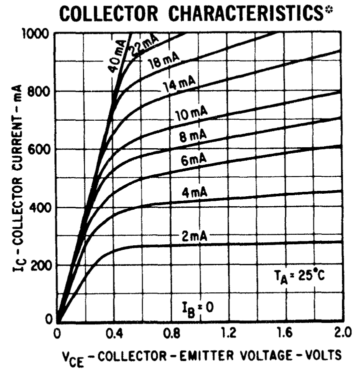


FT3569

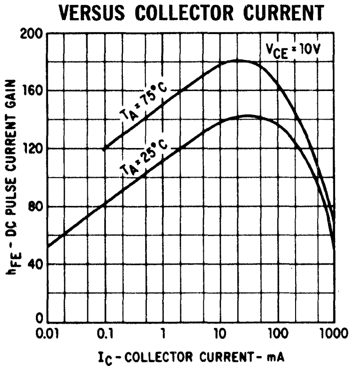
COLLECTOR CHARACTERISTICS*

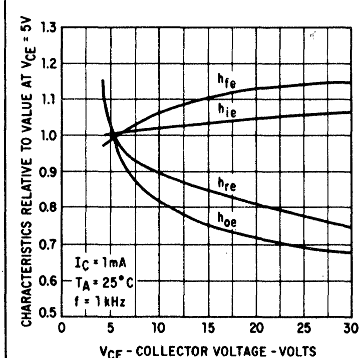


COLLECTOR CHARACTERISTICS*



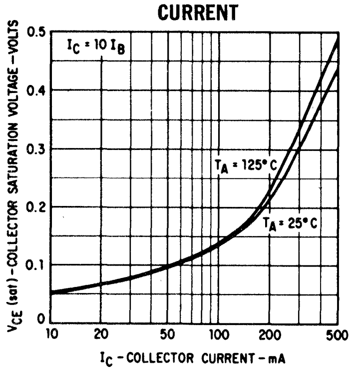
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



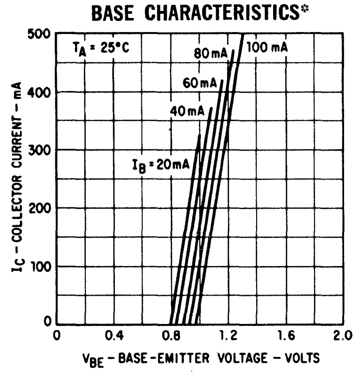


FT3567 • FT3568 • FT3569

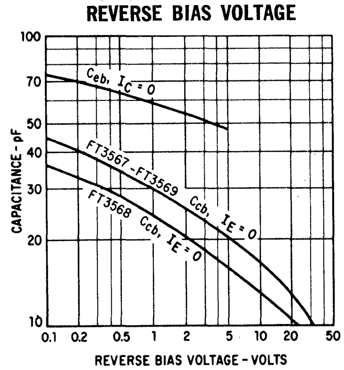
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT

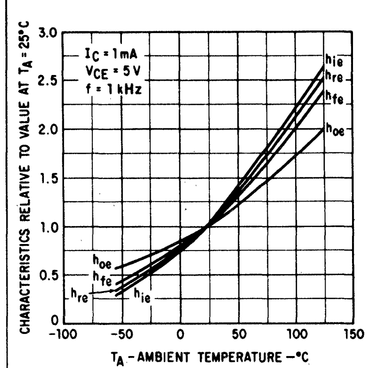


BASE CHARACTERISTICS*



INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE





SMALL SIGNAL CHARACTERISTICS (f = 1.0 kHz)

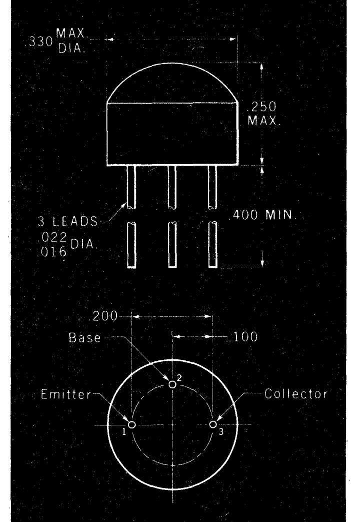
SYMBOL	CHARACTERISTICS	FT3567 • FT3568 TYP.	FT3569 TYP.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance	1800	3800	Ω	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{oe}	Output Conductance	8.0	19.2	μmhos	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{re}	Voltage Feedback Ratio	2.1	5.6	$\times 10^{-4}$	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{fe}	Small Signal Current Gain	60	130		I_C = 1.0 mA	V_{CE} = 5.0 V

2N3569

NPN GENERAL PURPOSE TYPE

DIFFUSED SILICON PLANAR EPITAXIAL TRANSISTOR

The 2N3569 is an NPN silicon PLANAR epitaxial transistor designed primarily for amplifier and switching applications over a wide range of voltage and current. This device features a useful beta range to 500 mA and low saturation voltage. High collector-to-emitter voltage allows operation to 40 volts.



ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	-55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 sec time limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature	(Notes 2 and 3)	0.8 Watt
at 25°C Free Air Temperature	(Notes 2 and 3)	0.3 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage		80 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 4)	40 Volts
V_{EBO}	Emitter to Base Voltage		5.0 Volts

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

Symbol	Characteristic		Min.	Typ.	Max.	Units	Test Conditions	
h_{FE}	DC Pulse Current Gain	(Note 5)	100	150	300		I_C = 150 mA	V_{CE} = 1.0 V
h_{FE}	DC Pulse Current Gain	(Note 5)	100				I_C = 30 mA	V_{CE} = 1.0 V
V_{CE}(sat)	Collector Saturation Voltage (pulsed, see note 5)			0.1	0.25	Volts	I_C = 150 mA	I_B = 15 mA
V_{BE}(sat)	Base Saturation Voltage (pulsed, see note 5)			0.85	1.1	Volts	I_C = 150 mA	I_B = 15 mA
h_{fe}	High Frequency Current Gain (f = 20 Mc)		3.0				I_C = 50 mA	V_{CE} = 10 V
C_{obo}	Common Base Open Circuit Output Capacitance			18	20	pf	I_E = 0	V_{CB} = 10 V
C_{ibo}	Common Base Open Circuit Input Capacitance			44	80	pf	I_C = 0	V_{EB} = 0.5 V
I_{CBO}	Collector Cutoff Current				50	nA	I_E = 0	V_{CB} = 40 V
I_{CBO}(75°C)	Collector Cutoff Current				5.0	μA	I_E = 0	V_{CB} = 40 V
I_{EBO}	Emitter Cutoff Current				25	nA	I_C = 0	V_{EB} = 4.0 V
BV_{CBO}	Collector to Base Breakdown Voltage		80			Volts	I_C = 100 μA	I_E = 0
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 and 5)		40			Volts	I_C = 30 mA (pulsed)	I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage		5.0			Volts	I_E = 10 μA	I_C = 0

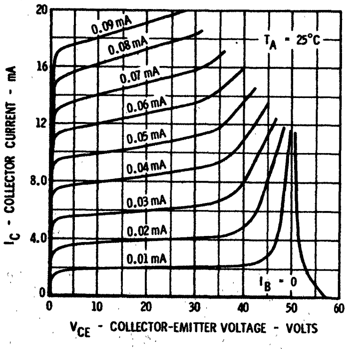
(See notes on back page)

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

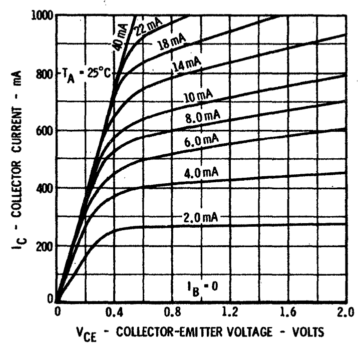
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

TYPICAL ELECTRICAL CHARACTERISTICS

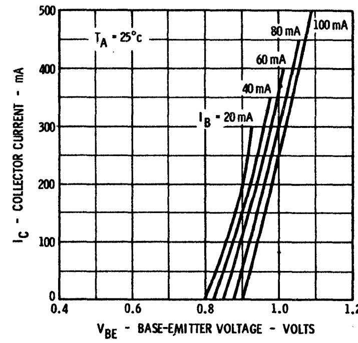
COLLECTOR CHARACTERISTICS*



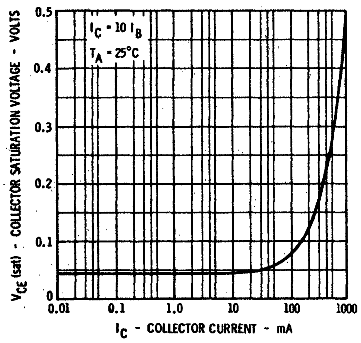
COLLECTOR CHARACTERISTICS*



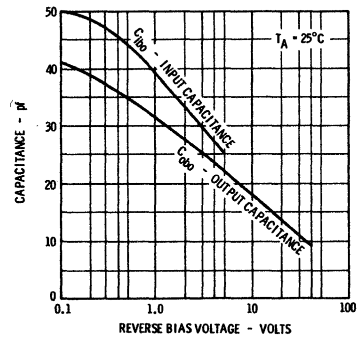
BASE CHARACTERISTICS*



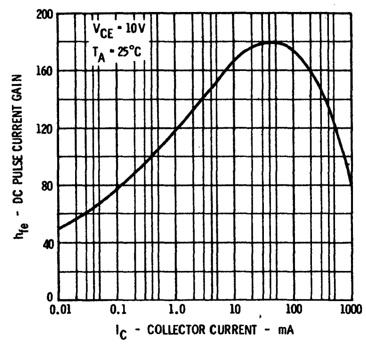
PULSED COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



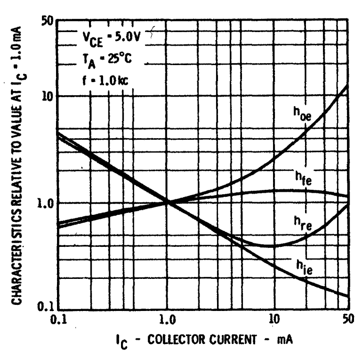
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE

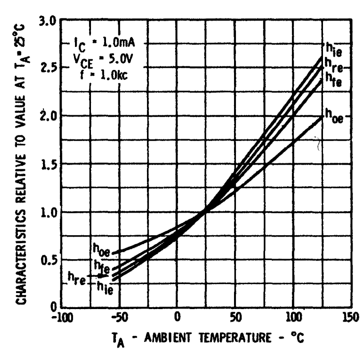


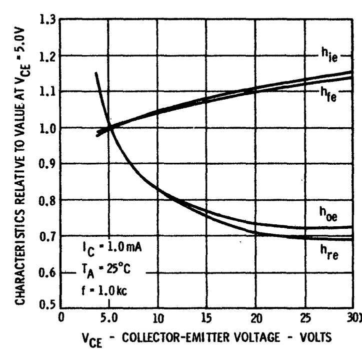
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



TYPICAL COMMON EMITTER CHARACTERISTICS (f=1.0KC)







* **Single family characteristics on Curve Tracer.**

SMALL SIGNAL CHARACTERISTICS (f=1.0KC)

Symbol	Characteristic	Typical	Units	Test Conditions	
h_{ie}	Input Resistance	3800	Ohms	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{oe}	Output Conductance	19.2	µmhos	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{re}	Voltage Feedback Ratio	5.6	$x10^{-4}$	I_C = 1.0 mA	V_{CE} = 5.0 V
h_{fe}	Small Signal Current Gain	130		I_C = 1.0 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) 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 125°C and junction-to-case thermal resistance of 125°C/Watt (derating factor of 8.0 mW/°C; junction-to-ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C.

(4) Rating refers 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%.

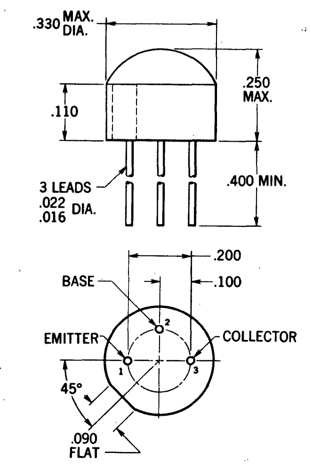
2N3638 · 2N3638A

PNP HIGH CURRENT SWITCHES

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **FAST SWITCHING - - $t_{on} = 75$ ns (max.) @ 300 mA**
  - - $t_{off} = 170$ ns (max.) @ 300 mA
- **HIGH BETA - - h_{FE} 100 (min.) @ $I_C = 50$ mA**
- **HIGH CURRENT - - Up to 500 mA**
- **LOW V_{CE}(sat) - - 1.0 Volt (max.) @ 300 mA**
- **LOW COST IN ALL QUANTITIES**

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package weight is 0.68 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 sec time limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature	(Notes 2 and 3)	0.7 Watt
at 25°C Free Air Temperature	(Notes 2 and 3)	0.3 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage		−25 Volts
V_{CES}	Collector to Emitter Voltage		−25 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 4)	−25 Volts
V_{EBO}	Emitter to Base Voltage		−4.0 Volts
I_C	Collector Current	(Note 2)	500 mA

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

SYMBOL	CHARACTERISTIC	2N3638 MIN.	2N3638 TYP.	2N3638 MAX.	2N3638A MIN.	2N3638A TYP.	2N3638A MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain (Note 5)				80	140			$I_C = 1.0$ mA	$V_{CE} = -10$V
h_{FE}	DC Pulse Current Gain (Note 5)	20	70		100	160			$I_C = 10$ mA	$V_{CE} = -10$V
h_{FE}	**DC Pulse Current Gain** (Note 5)	30	67		**100**	**130**			$I_C = 50$ mA	$V_{CE} = -1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	20	40		20	50			$I_C = 300$ mA	$V_{CE} = -2.0$ V
V_{CE}(sat)	Pulsed Collector Saturation Voltage (Note 5)		−0.08	−0.25		−0.08	−0.25	Volt	$I_C = 50$ mA	$I_B = 2.5$ mA
V_{CE}(sat)	**Pulsed Collector Saturation Voltage** (Note 5)		−0.38	−1.0		**−0.38**	**−1.0**	Volt	$I_C = 300$ mA	$I_B = 30$ mA
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	−25			−25			Volts	$I_C = 10$ mA (pulsed)	$I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−25			−25			Volts	$I_C = 100\ \mu A$	$I_E = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	−25			−25			Volts	$I_C = 100\ \mu A$	$V_{EB} = 0$
t_{on}	**Turn On Time** (Note 6)		28	75		**28**	**75**	ns	$I_C \approx 300$ mA	$I_{B1} \approx 30$ mA
t_{off}	**Turn Off Time** (Note 6)		110	170		**110**	**170**	ns	$I_C \approx 300$ mA	$I_{B1} \approx 30$ mA, $I_{B2} \approx -30$ mA
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	1.0	1.9		**1.5**	**1.9**			$I_C = 50$ mA	$V_{CE} = -3.0$ V
C_{obo}	Common-Base, Open-Circuit Output Capacitance		6.0	20		**6.0**	**10**	pF	$I_E = 0$	$V_{CB} = -10$ V
C_{ibo}	Common-Base, Open-Circuit Input Capacitance		18	65		18	25	pF	$I_C = 0$	$V_{EB} = -0.5$ V

*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

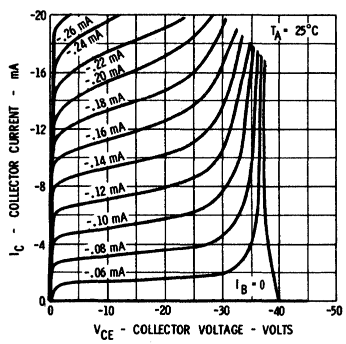
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
$V_{BE}(sat)$	Base-Emitter Saturation Voltage (pulsed, Note 5)		−0.9	−1.1	Volts	$I_C = 50$ mA	$I_B = 2.5$ mA
$V_{BE}(sat)$	Base-Emitter Saturation Voltage (pulsed, Note 5)	−0.8	−1.25	−2.0	Volts	$I_C = 300$ mA	$I_B = 30$ mA
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.0			Volts	$I_E = 100\ \mu A$	$I_C = 0$
I_{CES}	Collector Reverse Current		0.1	35	nA	$V_{CE} = -15$ V	$V_{EB} = 0$
$I_{CES}(65°C)$	Collector Reverse Current		0.002	2.0	μA	$V_{CE} = -15$ V	$V_{EB} = 0$

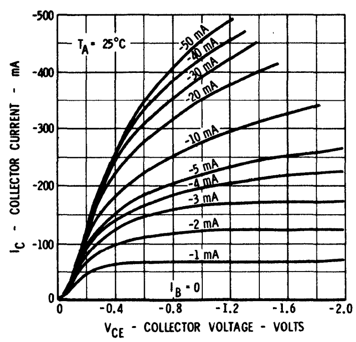
TYPICAL ELECTRICAL CHARACTERISTICS

2N3638

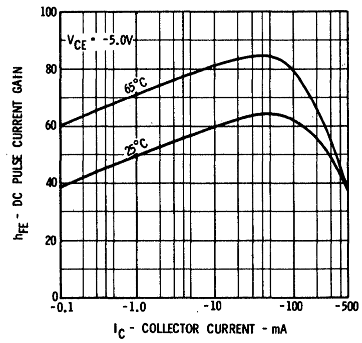
COLLECTOR CHARACTERISTICS*



COLLECTOR CHARACTERISTICS*

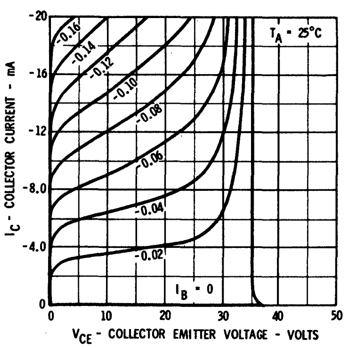


DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

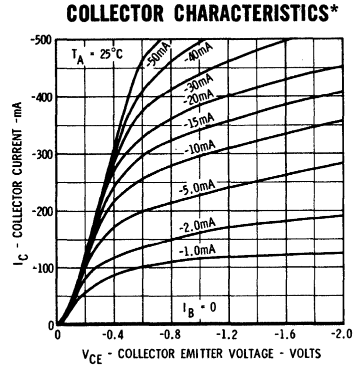


2N3638A

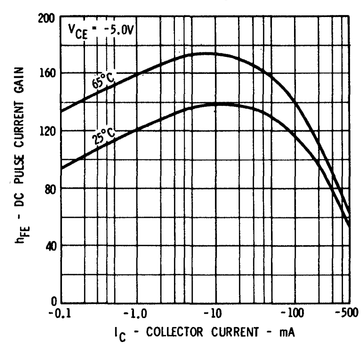
COLLECTOR CHARACTERISTICS*



COLLECTOR CHARACTERISTICS*

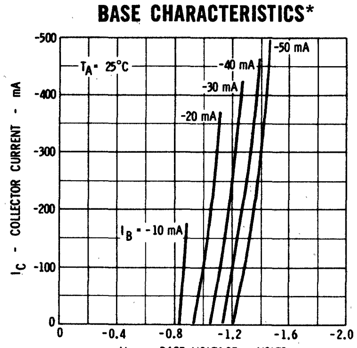


DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

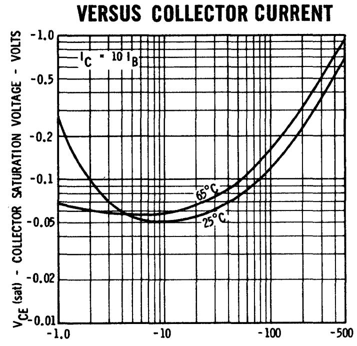


2N3638 • 2N3638A

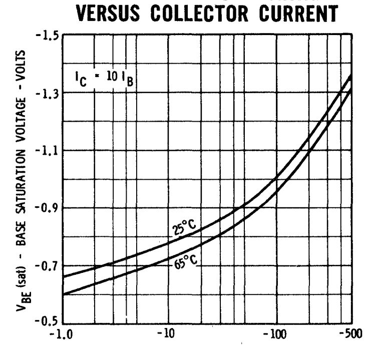
BASE CHARACTERISTICS*



COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



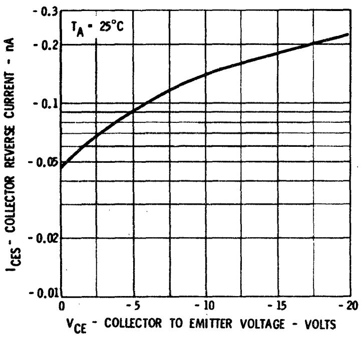
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



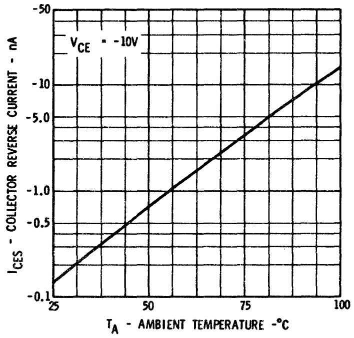
* Single family characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

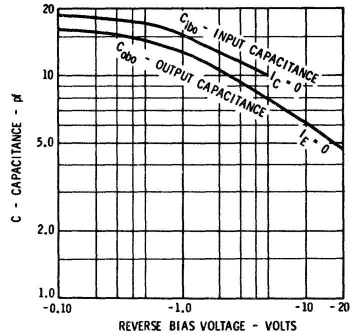
COLLECTOR REVERSE CURRENT VERSUS REVERSE BIAS VOLTAGE



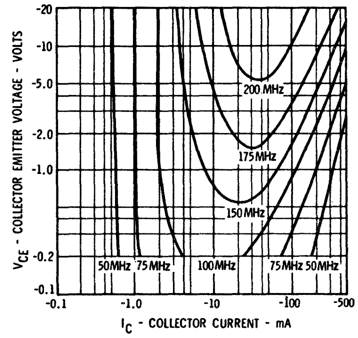
COLLECTOR-BASE DIODE REVERSE CURRENT VERSUS TEMPERATURE



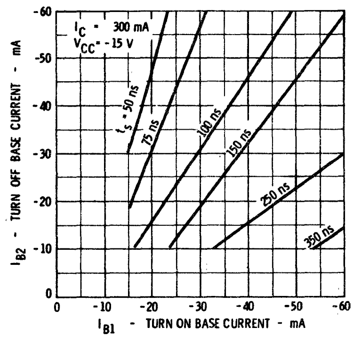
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



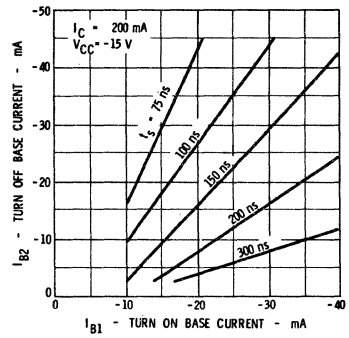
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



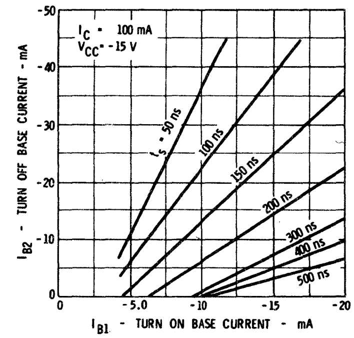
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



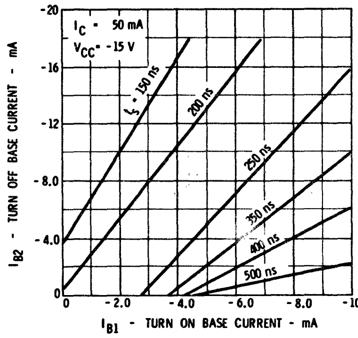
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



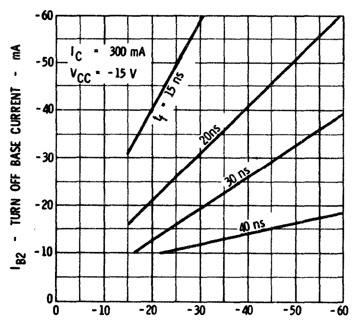
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



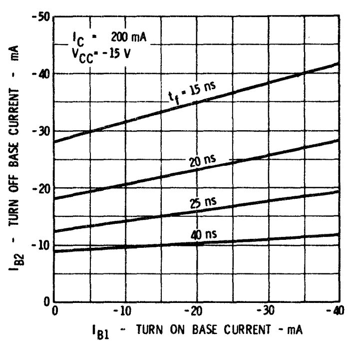
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



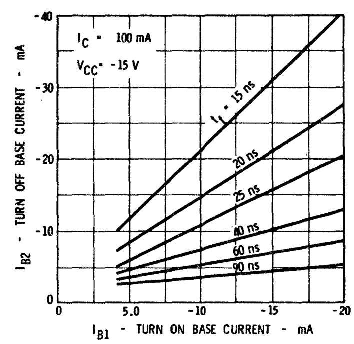
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



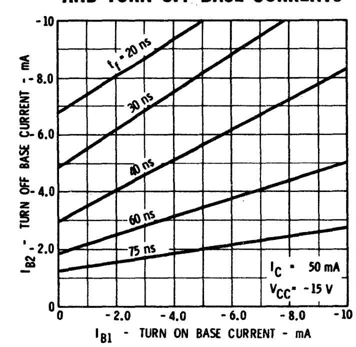
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



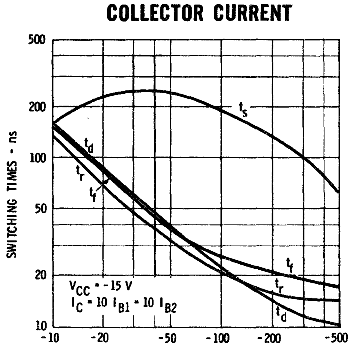
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



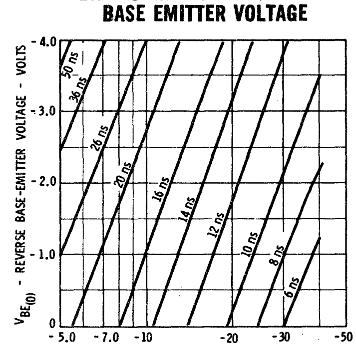
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



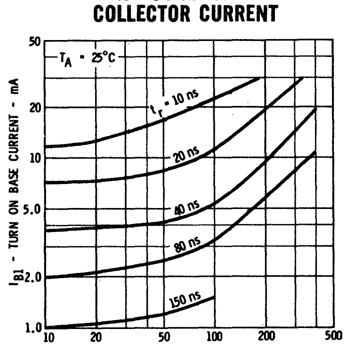
SWITCHING TIMES VERSUS COLLECTOR CURRENT



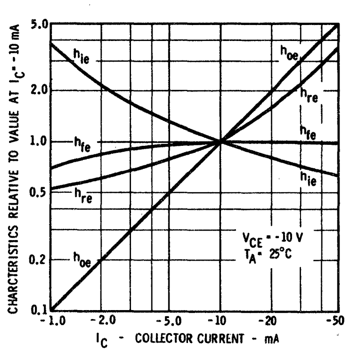
DELAY TIME VERSUS TURN ON BASE CURRENT AND REVERSE BASE EMITTER VOLTAGE

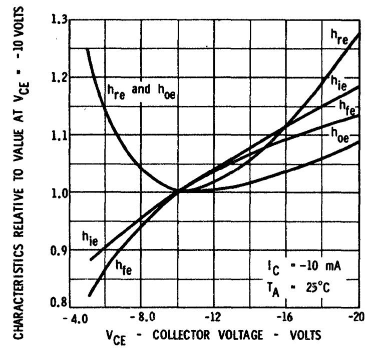


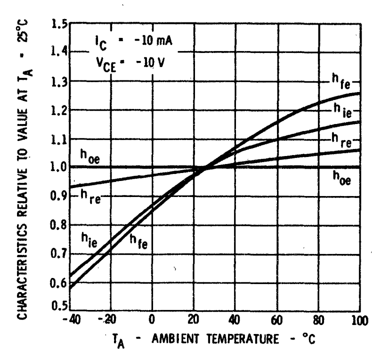
RISE TIME VERSUS TURN ON BASE CURRENT AND COLLECTOR CURRENT



SMALL SIGNAL CHARACTERISTICS







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 125°C and junction to case thermal resistance of 14 °C/Watt (derating factor of 7.0mW/°C); junction to ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C).

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

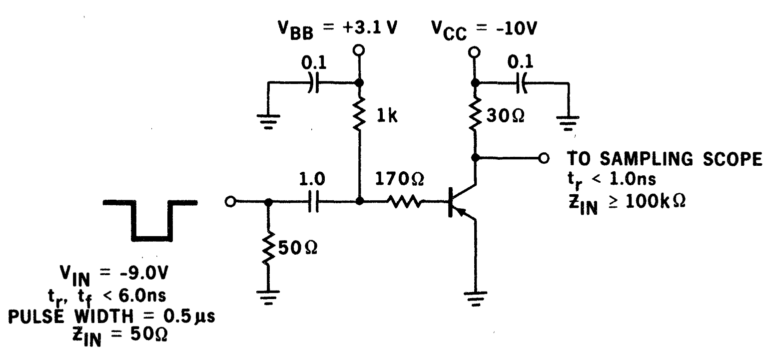
(5) Pulse conditions: length = 300 μs; duty cycle = 1%.

(6) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

h PARAMETERS (f = 1.0 kHz)

		2N3638			2N3638A					
SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance		200	2000		480	2000	ohms	I_C = 10 mA	$V_{CE} = -10$ V
h_{oe}	Output Conductance		80	1200		80	1200	μmhos	I_C = 10 mA	$V_{CE} = -10$ V
h_{re}	Voltage Feedback Ratio		162	2600		162	1500	$x10^{-6}$	I_C = 10 mA	$V_{CE} = -10$ V
h_{fe}	Small Signal Current Gain	25	74		100	180			I_C = 10 mA	$V_{CE} = -10$ V

T_{ON} and T_{OFF} TEST CIRCUIT



FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

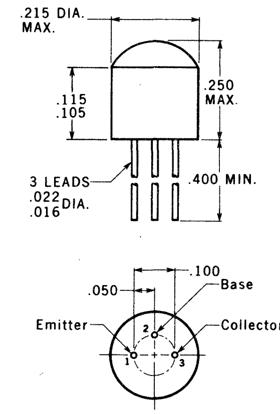
2N3639 • 2N3640

PNP HIGH-SPEED LOGIC SWITCHES

SILICON PLANAR* EPITAXIAL TRANSISTORS

The 2N3639 and 2N3640 are very high speed silicon PNP logic transistors. They are epitaxial PLANAR* units and feature 500 MHz f_T and τ_s of 30 and 50 ns respectively.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Leads are nickel
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	-55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 sec time limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperatures (Notes 2 & 3)	0.5 Watt
at 25°C Free Air Temperature (Notes 2 & 3)	0.2 Watt

Maximum Voltages

		2N3639	2N3640
V_{CBO}	Collector to Base Voltage	-6.0 Volts	-12 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	-6.0 Volts	-12 Volts
V_{EBO}	Emitter to Base Voltage	-4.0 Volts	-4.0 Volts

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

Symbol	Characteristic	2N3639 Min.	2N3639 Typ.	2N3639 Max.	2N3640 Min.	2N3640 Typ.	2N3640 Max.	Units	Test Conditions
τ_s	Charge Storage time (Note 5) Cond. C			30			50	ns	$I_C \approx 10$ mA, $I_{B1} \approx 10$ mA, $I_{B2} \approx -10$ mA
t_{on}	Turn On Time (Note 5) Cond. B			25			25	ns	$I_C \approx 50$ mA $I_{B1} \approx 5.0$ mA
t_{on}	Turn On Time (Note 5) Cond. A		26	60		26	60	ns	$I_C \approx 10$ mA $I_{B1} \approx 0.5$ mA
t_{off}	Turn Off Time (Note 5) Cond. B			25			35	ns	$I_C \approx 50$ mA, $I_{B1} \approx 5.0$ mA, $I_{B2} \approx -5.0$ mA
t_{off}	Turn Off Time (Note 5) Cond. A		38	60		38	75	ns	$I_C \approx 10$ mA, $I_{B1} \approx 0.5$ mA, $I_{B2} \approx -0.5$ mA
h_{fe}	High Frequency Current Gain (f = 100 MHz)	5.0	7.5		5.0	7.5			$I_C = 10$ mA $V_{CE} = -5.0$ V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	3.0	6.0		3.0	6.0			$I_C = 10$ mA $V_{CB} = 0$
h_{FE}	DC Pulse Current Gain (Note 6)	30	63	120	30	63	120		$I_C = 10$ mA $V_{CE} = -0.3$ V
h_{FE}	DC Pulse Current Gain (Note 6)	20	50		20	50			$I_C = 50$ mA $V_{CE} = -1.0$ V
V_{CE}(sat)	Collector Saturation Voltage		-0.07	-0.16		-0.14	-0.2	Volts	$I_C = 10$ mA $I_B = 1.0$ mA
V_{CE}(sat)	Collector Saturation Voltage (pulsed, see note 6)		-0.19	-0.5		-0.37	-0.6	Volts	$I_C = 50$ mA $I_B = 5.0$ mA
V_{CE}(sat)	Collector Saturation Voltage		-0.1	-0.25		-0.18	-0.3	Volts	$I_C = 10$ mA $I_B = 0.5$ mA
V_{CE}(sat)	Collector Saturation Voltage ($T_A = +65°C$)		-0.08	-0.23		-0.15	-0.25	Volts	$I_C = 10$ mA $I_B = 1.0$ mA
V_{BE}(sat)	Base Saturation Voltage	-0.75	-0.9	-0.95	-0.75	-0.9	-0.95	Volts	$I_C = 10$ mA $I_B = 0.5$ mA
V_{BE}(sat)	Base Saturation Voltage	-0.8	-0.9	-1.0	-0.8	-0.9	-1.0	Volts	$I_C = 10$ mA $I_B = 1.0$ mA
V_{BE}(sat)	Base Saturation Voltage (pulsed, see note 6)		-1.1	-1.5		-1.1	-1.5	Volts	$I_C = 50$ mA $I_B = 5.0$ mA

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	Characteristic	2N3639 Min.	2N3639 Typ.	2N3639 Max.	2N3640 Min.	2N3640 Typ.	2N3640 Max.	Units	Test Conditions	
I_{CES}	Collector Reverse Current		0.02	10				nA	V_{CE} = -3.0 V	V_{EB} = 0
I_{CES}	Collector Reverse Current					0.05	10	nA	V_{CE} = -6.0 V	V_{EB} = 0
I_{CES}	Collector Reverse Current (T_A = +65°C)		0.02	1.0				μA	V_{CE} = -3.0 V	V_{EB} = 0
I_{CES}	Collector Reverse Current (T_A = +65°C)					0.05	1.0	μA	V_{CE} = -6.0	V_{EB} = 0
C_{obo}	Common Base Open Circuit Output Capacitance		1.85	3.5		1.85	3.5	pF	I_E = 0	V_{CB} = -5.0 V
C_{obo}	Common Base Open Circuit Output Capacitance		2.5	5.5		2.5	5.5	pF	I_E = 0	V_{CB} = 0
C_{ibo}	Common Base Open Circuit Input Capacitance		1.8	3.5		1.8	3.5	pF	I_C = 0	V_{EB} = -0.5 V
BV_{CBO}	Collector to Base Breakdown Voltage	-6.0			-12			Volts	I_C = 100 μA	I_E = 0
BV_{CES}	Collector to Emitter Breakdown Voltage	-6.0			-12			Volts	I_C = 100 μA	V_{EB} = 0
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 and 6)	-6.0			-12			Volts	I_C = 10 mA (pulsed)	I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	-4.0			-4.0			Volts	I_E = 100 μA	I_C = 0

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 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/Watt (derating factor of 2.0 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.

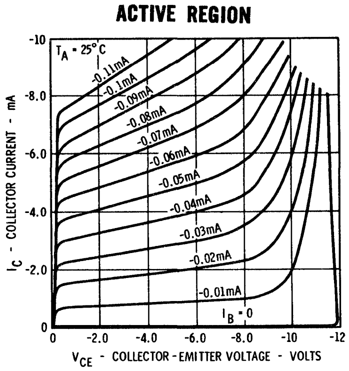
(5) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

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

TYPICAL COLLECTOR CHARACTERISTICS*

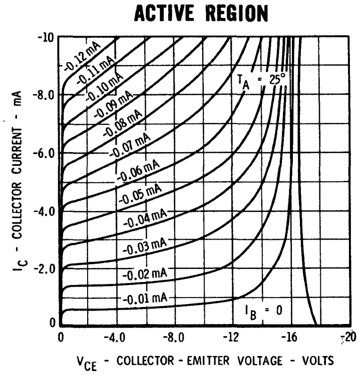
2N3639

ACTIVE REGION



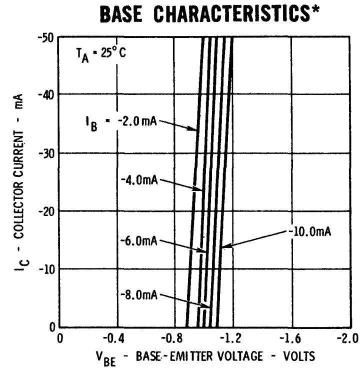
2N3640

ACTIVE REGION

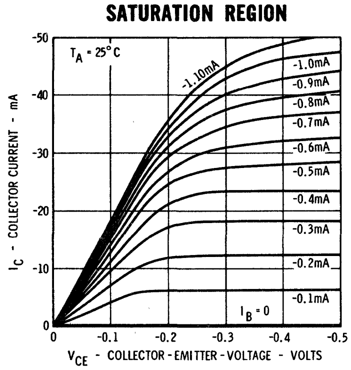


2N3639 2N3640

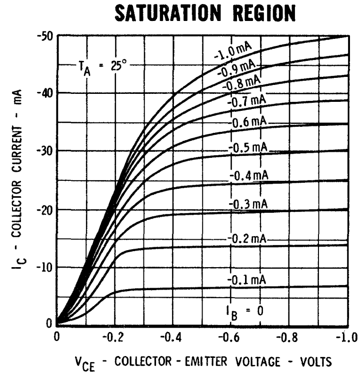
BASE CHARACTERISTICS*



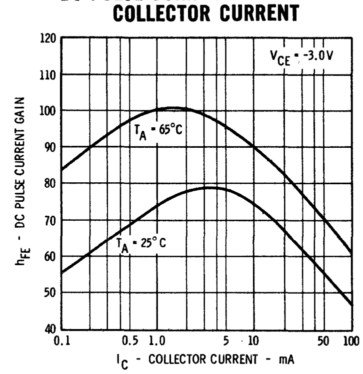
SATURATION REGION



SATURATION REGION



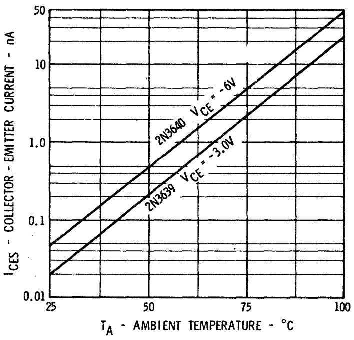
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



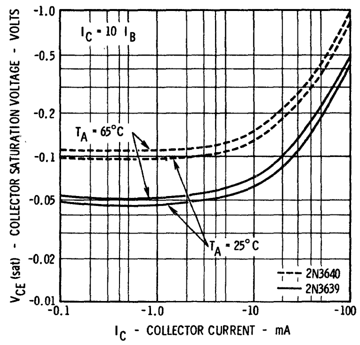
* Single family characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

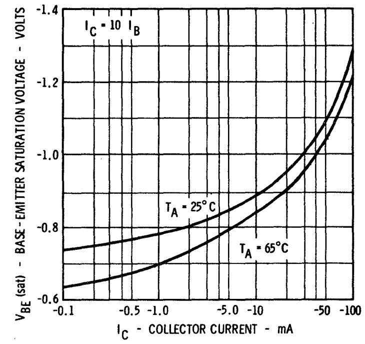
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



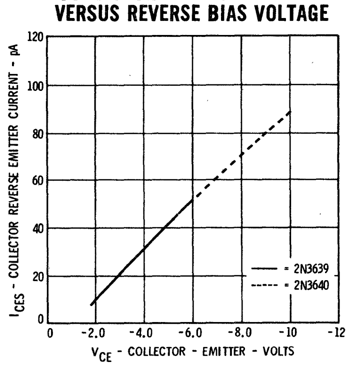
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



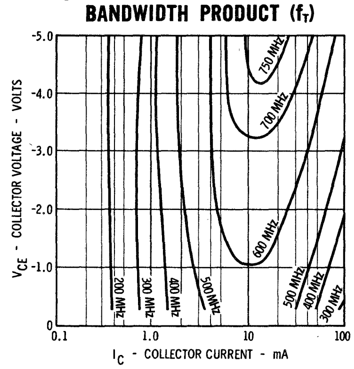
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



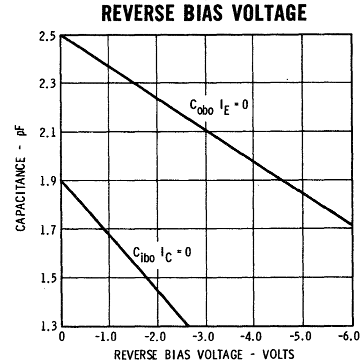
COLLECTOR REVERSE CURRENT VERSUS REVERSE BIAS VOLTAGE



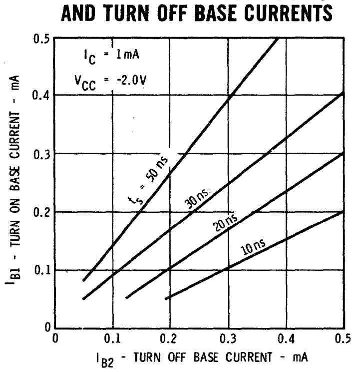
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



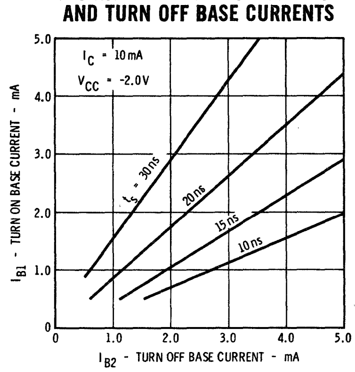
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



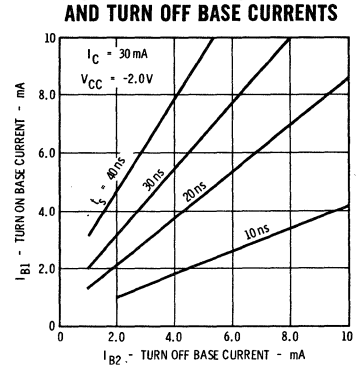
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



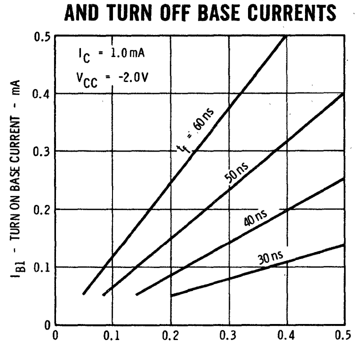
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



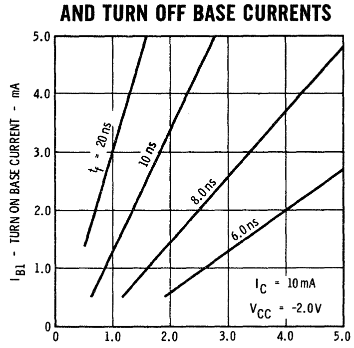
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



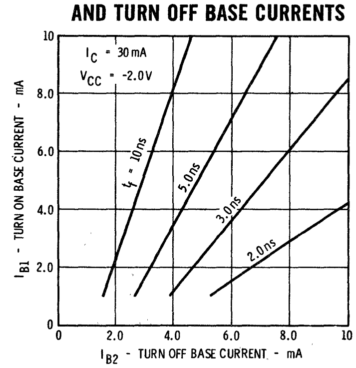
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



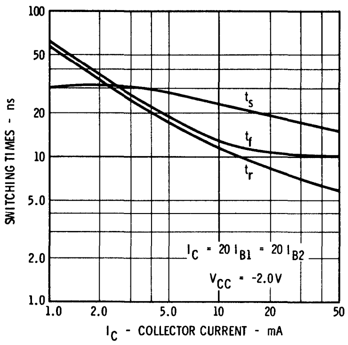
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



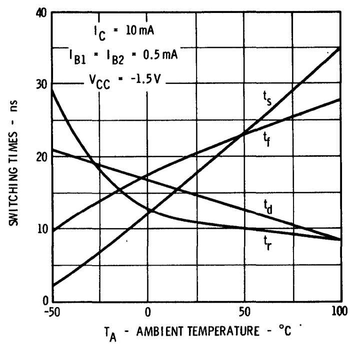
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



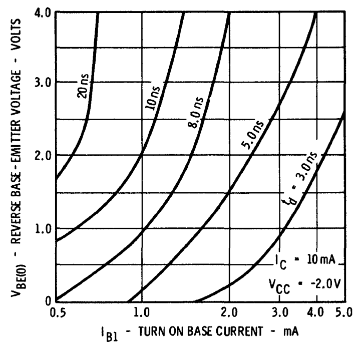
SWITCHING TIMES VERSUS COLLECTOR CURRENT



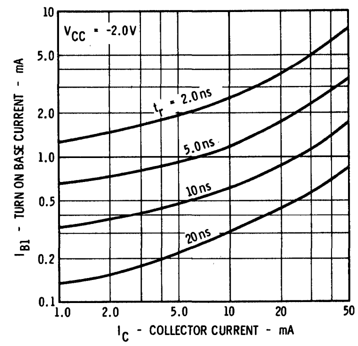
SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



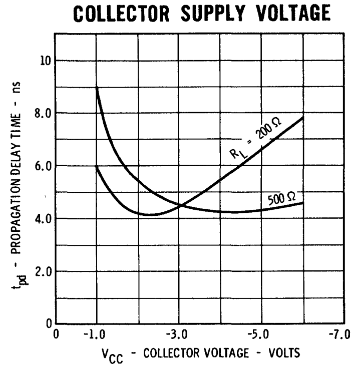
DELAY TIME VERSUS TURN ON BASE CURRENT AND REVERSE BASE EMITTER VOLTAGE



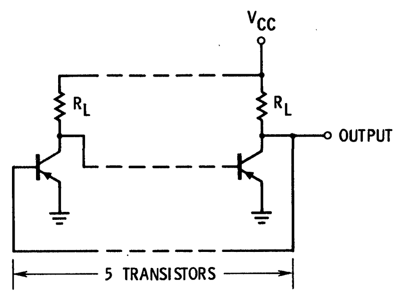
RISE TIME VERSUS COLLECTOR AND TURN ON BASE CURRENTS



PROPAGATION DELAY TIME VERSUS COLLECTOR SUPPLY VOLTAGE

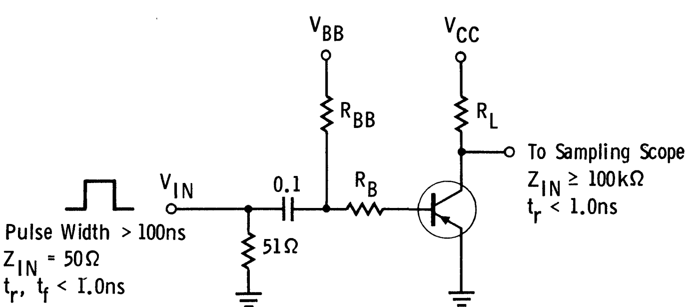


FIVE STAGE RING OSCILLATOR FOR MEASUREMENT OF PROPAGATION DELAY



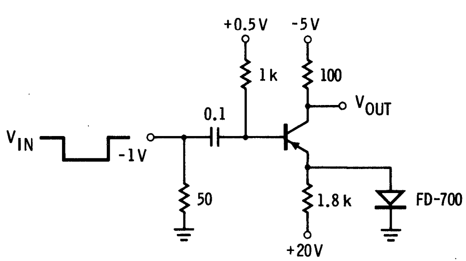
$$t_{pd} = \frac{1}{10 f_{osc}}$$

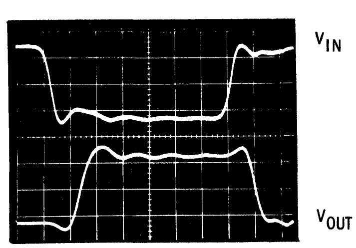
TURN ON AND TURN OFF TEST CIRCUIT



	V_{CC}	V_{BB}	V_{IN}	R_L	R_B	R_{BB}	I_C
Cond. A	-1.5V	-6.0V	+5.0V	130Ω	5kΩ	5kΩ	≈ 10mA
Cond. B	-4.5V	+2.5V	-7.0V	82Ω	680Ω	1kΩ	≈ 50mA
Cond. C	-3.0V	-10V	+9.0V	270Ω	390Ω	510Ω	≈ 10mA

NON-SATURATED SWITCHING PERFORMANCE





2 ns / division

FAIRCHILD SEMICONDUCTOR

A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

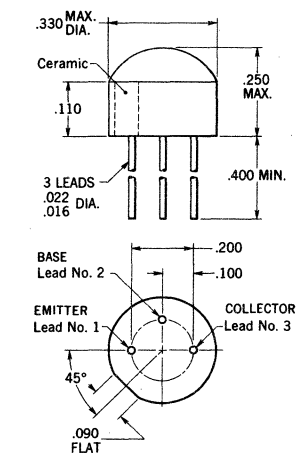
2N3641 • 2N3642 • 2N3643

NPN CLASS-C RF AMPLIFIERS AND HIGH CURRENT SWITCHES

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

The 2N3641, 2N3642, and 2N3643 are NPN silicon PLANAR epitaxial transistors designed for service as Class-C RF amplifiers and high current switches. They feature outstanding RF performance with 700 mW power output at 30 MHz typical. Total switching times are 94 nsec typical at 300 mA.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package weight is 0.68 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	-55°C to +125°C
Operating Junction Temperature	125°C Maximum
Lead Temperature (Soldering 1/16" ±1/32", 10 sec time limit)	260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 & 3)	0.7 Watt
at 25°C Ambient Temperature (Notes 2 & 3)	.35 Watt

Maximum Voltages and Current

		2N3641 2N3643	2N3642
V_{CBO}	Collector to Base Voltage	60 Volts	60 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	30 Volts	45 Volts
V_{EBO}	Emitter to Base Voltage	5.0 Volts	5.0 Volts

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

Symbol	Characteristic		Min.	Typ.	Max.	Units	Test Conditions
G_{PE}	Amplifier Power-Gain (f = 30 MHz)	(Note 7)	10	12		dB	I_C = 0 (Zero Signal) V_{CE} = 15 V
η	Collector Efficiency (f = 30 MHz)	(Note 7)	60	75		%	I_C = 0 (Zero Signal) V_{CE} = 15 V
h_{fe}	High Frequency Current Gain (f = 100 MHz)		2.5				I_C = 50 mA V_{CE} = 5.0 V
h_{FE}	DC Pulse Current Gain 2N3641 (Note 5)	2N3642	40	75	120		I_C = 150 mA V_{CE} = 10 V
		2N3643	100	220	300		I_C = 150 mA V_{CE} = 10 V
h_{FE}	DC Pulse Current Gain 2N3641 (Note 5)	2N3642	15	62			I_C = 500 mA V_{CE} = 10 V
		2N3643	25	125			I_C = 500 mA V_{CE} = 10 V
t_{on}	Turn On Time	(Note 6)		14		nsec	I_C ≈ 300 mA I_{B1} ≈ 30 mA
t_{off}	Turn Off Time	(Note 6)		80		nsec	I_C ≈ 300 mA, I_{B1} ≈ 30 mA I_{B2} ≈ -30 mA

Additional Electrical Characteristics on page 2

* 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 125°C and junction-to-case thermal resistance of 143°C/Watt (derating factor of 7.0 mW/°C); junction-to-ambient thermal resistance of 286°C/Watt (derating factor of 3.5 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.

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

(6) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

(7) P_{IN} = 40 mW, R_G = 140 ohms, R_L = 260 ohms, see test circuit.

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)

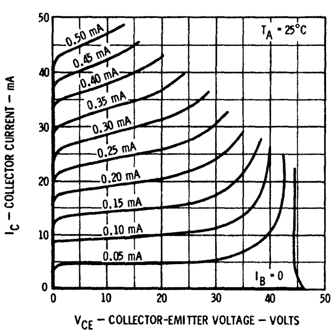
Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Conditions	
BV_{CBO}	Collector to Base Breakdown Voltage	60			Volts	I_C = 10 μA	I_E = 0
$V_{CEO}(sust)$	Collector to Emitter Sustaining Voltage (Notes 4 & 5) 2N3641 2N3643	30			Volts	I_C = 10 mA	I_B = 0
	2N3642	45			Volts	I_C = 10 mA	I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			Volts	I_C = 0	I_E = 10 μA
C_{obo}	Output Capacitance			8.0	pF	I_E = 0	V_{CB} = 10 V
$V_{CE}(sat)$	Collector Saturation Voltage		0.13	0.22	Volts	I_C = 150 mA	I_B = 15 mA
$V_{CE}(sat)$	Collector Saturation Voltage		0.35		Volts	I_E = 500 mA	I_B = 50 mA
I_{CES}	Collector Reverse Current			0.05	μA	V_{CE} = 50 V	V_{EB} = 0
$I_{CES}(65°C)$	Collector Reverse Current			1.0	μA	V_{CE} = 50 V	V_{EB} = 0

TYPICAL ELECTRICAL CHARACTERISTICS

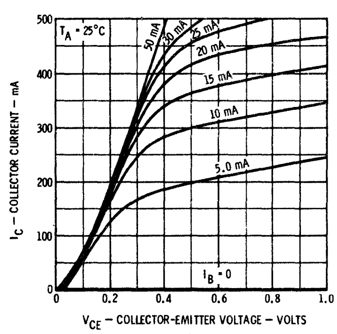
COLLECTOR CHARACTERISTICS*

2N3641 • 2N3642

ACTIVE REGION

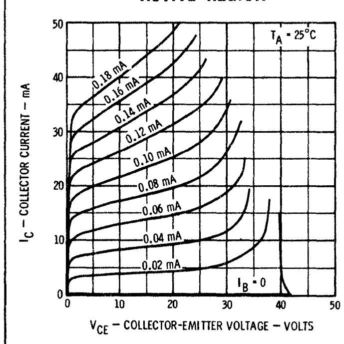


SATURATION REGION

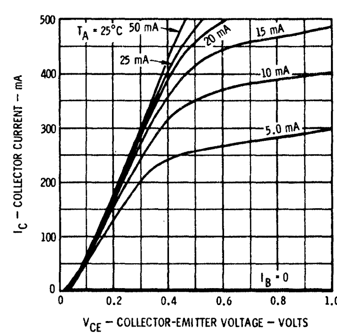


2N3643

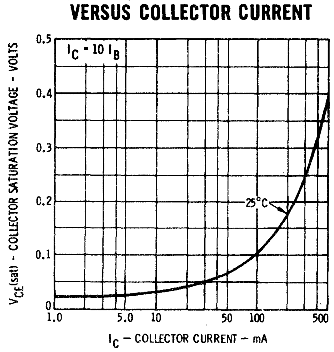
ACTIVE REGION



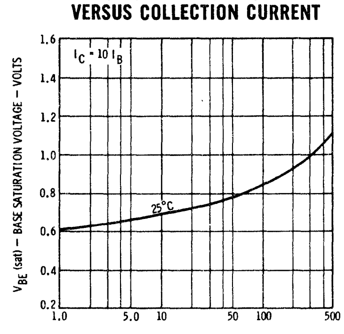
SATURATION REGION



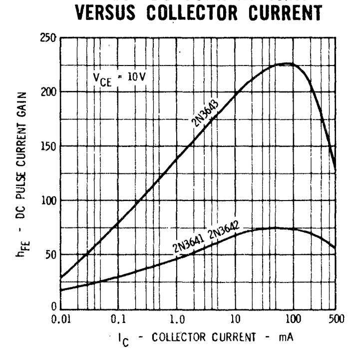
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



BASE SATURATION VOLTAGE VERSUS COLLECTION CURRENT

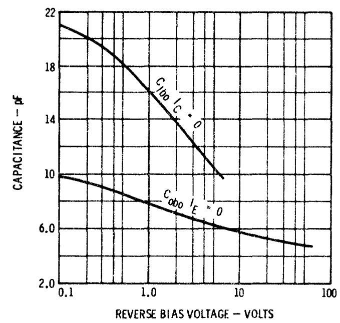


PULSE DC CURRENT GAIN VERSUS COLLECTOR CURRENT

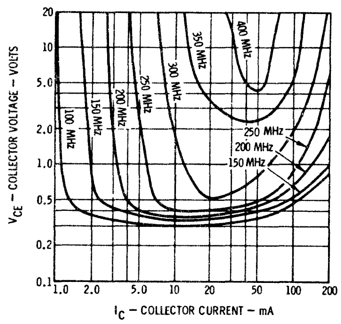


TYPICAL ELECTRICAL CHARACTERISTICS

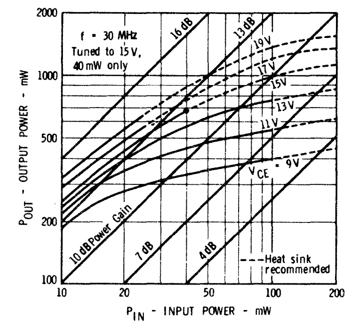
EMITTER TRANSITION AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



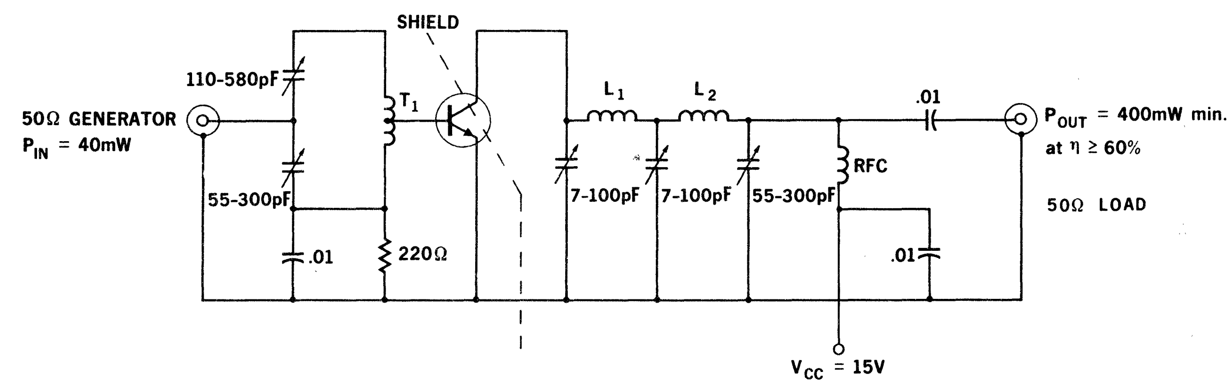
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



TYPICAL POWER IN VERSUS POWER OUT



30 MC AMPLIFIER TEST CIRCUIT

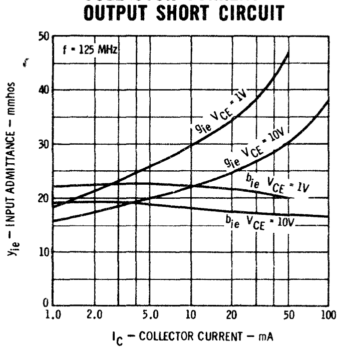


T_1 - 4 Turns no. 20 Wire, ¾" Dia. x ¼" Long, Midtapped.

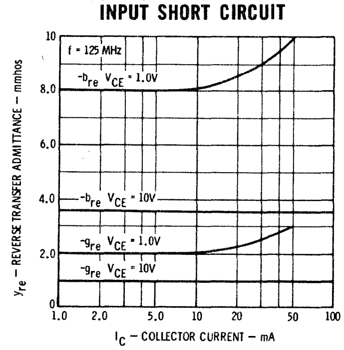
L_1 and L_2 - 4 Turns no. 20 Wire, ½" Dia. x ¼" Long.

Variable Capacitors are Compression Mica.

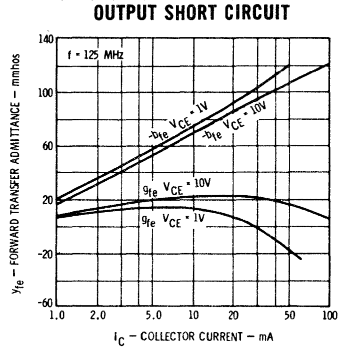
INPUT ADMITTANCE VERSUS COLLECTOR CURRENT — OUTPUT SHORT CIRCUIT



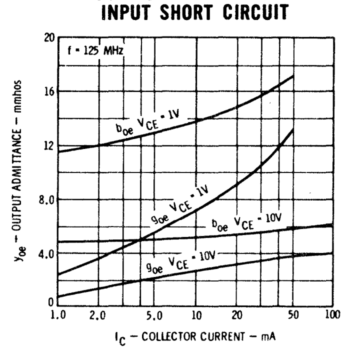
REVERSE TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT — INPUT SHORT CIRCUIT



FORWARD TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT — OUTPUT SHORT CIRCUIT



OUTPUT ADMITTANCE VERSUS COLLECTOR CURRENT — INPUT SHORT CIRCUIT

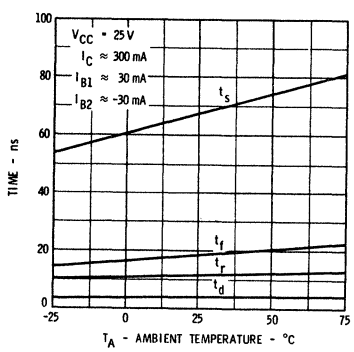


TYPICAL ELECTRICAL CHARACTERISTICS

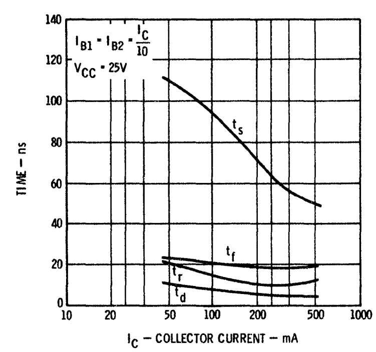
TYPICAL SMALL SIGNAL CHARACTERISTICS
(F = 1 kHz, V_{CE} = 10 VOLTS)

Symbol	Characteristic	2N3641 2N3642 I_C = 10 mA	2N3641 2N3642 50 mA	2N3643 10 mA	2N3643 50 mA	Units
h_{ie}	Input Resistance	460	350	950	880	Ohms
h_{oe}	Output Conductance	55	405	83	660	μmhos
h_{re}	Voltage Feedback Ratio	130	500	205	1500	$x10^{-6}$
h_{fe}	Small Signal Current Gain	90	97	170	220	

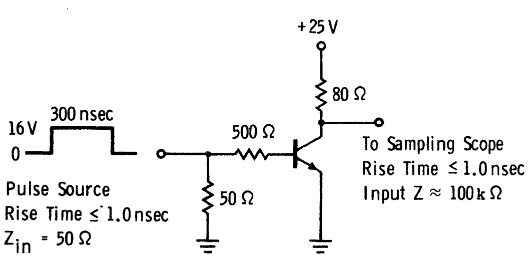
SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



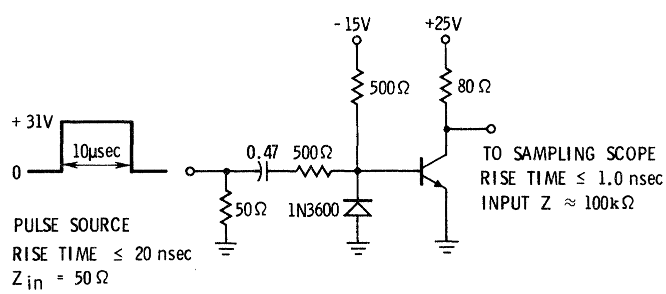
SWITCHING TIMES VERSUS COLLECTOR CURRENT



TURN-ON TEST CIRCUIT



TURN-OFF TEST CIRCUIT



FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

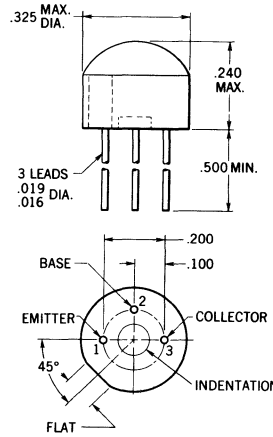
FT3641 • FT3642 • FT3643

NPN CLASS-C RF AMPLIFIERS AND HIGH CURRENT SWITCHES

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **P_d . . . . 3.0 W AT 25°C CASE TEMPERATURE**
  450 mW AT 25°C AMBIENT TEMPERATURE
- **HIGH GAIN . . . . . . 400 mW RF POWER OUT AT 30 MHz**
- **HIGH BETA . . . . . . 100 (MIN) AT 150 mA, 25 (MIN) AT 500 mA**
- **HIGH f_T . . . . 250 MHz (MIN) AT 50 mA**
- **FAST SWITCHING . . . 60 ns (MAX) t_{on} AND 150 ns (MAX) t_{off} AT 300 mA**
- **LOW $V_{CE(sat)}$ . . . . . 0.22 V (MAX) AT 150 mA, 0.35 V (TYP) AT 500 mA**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated nickel
Package is electrically Non-conductive material
Package weight is 0.66 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures			
Storage Temperature			−55°C to +125°C
Operating Junction Temperature			125°C
Lead Temperature (Soldering, 10 second time limit)			260°C
Maximum Power Dissipation			
Total Dissipation at 25°C Case Temperature [Notes 2 and 3]			3.0 Watts
at 25°C Ambient Temperature [Notes 2 and 3]			0.45 Watt
Maximum Voltages		**FT3642**	**FT3641 FT3643**
V_{CBO}	Collector to Base Voltage	60 Volts	60 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	45 Volts	30 Volts
V_{EBO}	Emitter to Base Voltage	5.0 Volts	5.0 Volts

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

		FT3641 • FT3642			FT3643					
SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
G_{PE}	**Amplifier Power Gain (f = 30 MHz)** (Note 7)	**10**	**12**		**10**	**12**		**dB**	$I_C = 0$ (zero signal)	$V_{CE} = 15$ V
η	Collector Efficiency (f = 30 MHz) (Note 7)	60	75		60	75		%	$I_C = 0$ (zero signal)	$V_{CE} = 15$ V
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**2.5**		**8.0**	**2.5**		**8.0**		$I_C = 50$ mA	$V_{CE} = 5.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 5)	**40**	**75**	**120**	**100**	**220**	**300**		$I_C = 150$ mA	$V_{CE} = 10$ V
h_{FE}	**DC Pulse Current Gain** (Note 5)	15	62		**25**	**125**			$I_C = 500$ mA	$V_{CE} = 10$ V
t_{on}	Turn On Time (Note 6)		14	60		14	60	ns	$I_C \approx 300$ mA	$I_{B1} \approx 30$ mA
t_{off}	Turn Off Time (Note 6)		80	150		80	150	ns	$I_C \approx 300$ mA, $I_{B2} \approx -30$ mA	$I_{B1} \approx 30$ mA

NOTES:

* Planar is a patented Fairchild process.

(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 125°C and junction to case thermal resistance of 33.3°C/Watt (derating factor of 30 mW/°C); junction to ambient thermal resistance of 222°C/Watt (derating factor of 22.2 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) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.
(7) P_{IN} = 40 mW. See Test Circuit.

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)

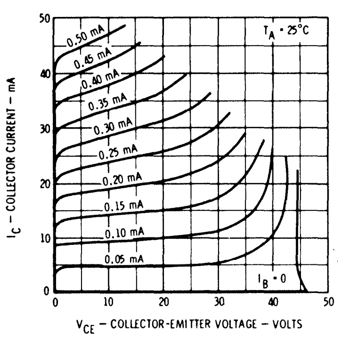
SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
BV_{CBO}	Collector to Base Breakdown Voltage	60			Volts	$I_C = 10\ \mu A$	$I_E = 0$
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 and 5)						
	(FT3641, FT3643)	30			Volts	$I_C = 10$ mA (pulsed)	$I_B = 0$
	(FT3642)	45			Volts	$I_C = 10$ mA (pulsed)	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			Volts	$I_C = 0$	$I_E = 10\ \mu A$
C_{obo}	Output Capacitance (f = 1.0 MHz)			8.0	pF	$I_E = 0$	$V_{CB} = 10$ V
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 5)		**0.13**	**0.22**	**Volts**	**$I_C = 150$ mA**	**$I_B = 15$ mA**
$V_{BE(sat)}$	Pulsed Emitter Saturation Voltage (Note 5)			1.10	Volts	$I_C = 150$ mA	$I_B = 15$ mA
I_{CES}	Collector Reverse Current			0.05	μA	$V_{CE} = 50$ V	$V_{EB} = 0$
$I_{CES}(65°C)$	Collector Reverse Current			1.0	μA	$V_{CE} = 50$ V	$V_{EB} = 0$

TYPICAL ELECTRICAL CHARACTERISTICS

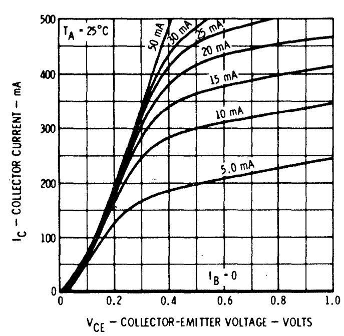
COLLECTOR CHARACTERISTICS*

FT3641 • FT3642

ACTIVE REGION

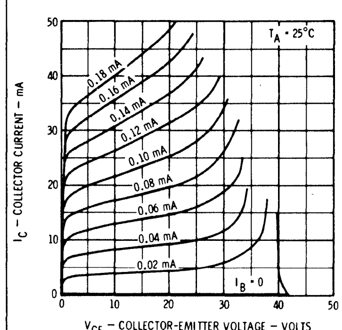


SATURATION REGION

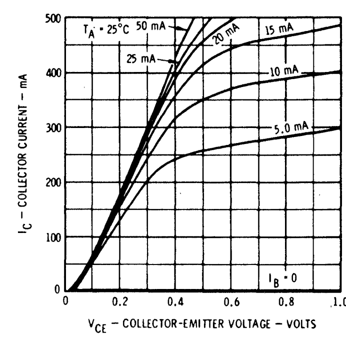


FT3643

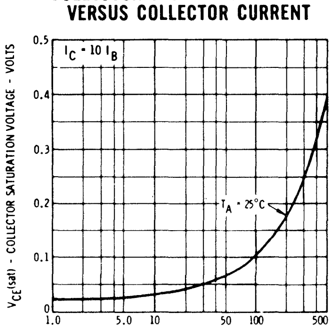
ACTIVE REGION



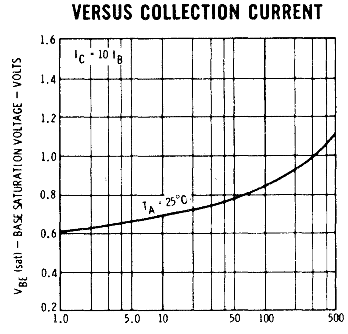
SATURATION REGION



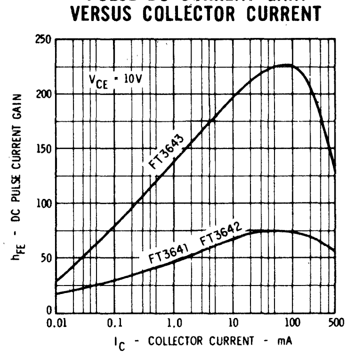
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



BASE SATURATION VOLTAGE VERSUS COLLECTION CURRENT



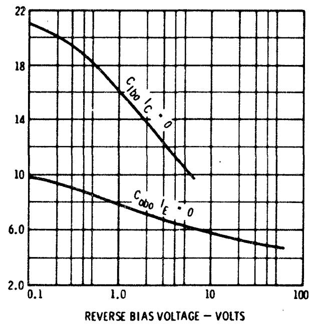
PULSE DC CURRENT GAIN VERSUS COLLECTOR CURRENT



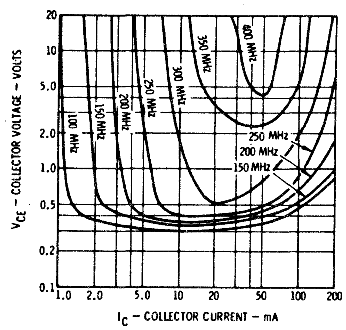
*Single Family Characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

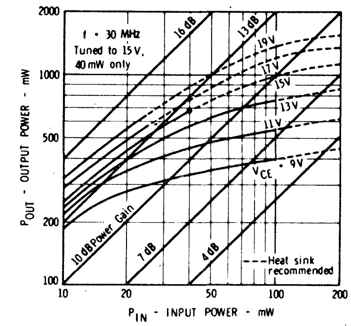
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



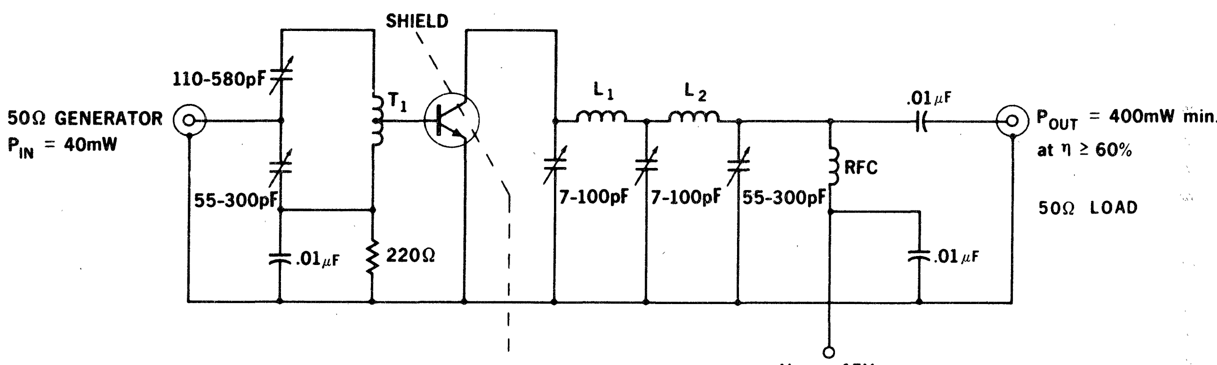
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



TYPICAL POWER IN VERSUS POWER OUT



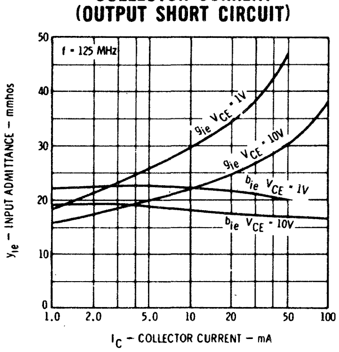
30MHz AMPLIFIER TEST CIRCUIT



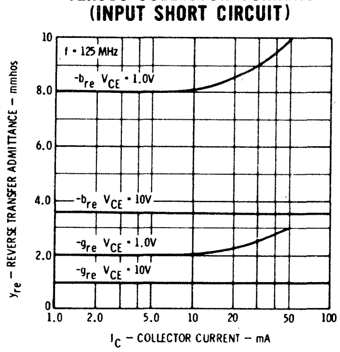
T_1 - 4 Turns no. 20 Wire, ¾" Dia. x ¼" Long, Midtapped.
L_1 and L_2 - 4 Turns no. 20 Wire, ½" Dia. x ¼" Long.
Variable Capacitors are Compression Mica.

R_G = 140Ω, R_L = 260Ω as seen by transistor.

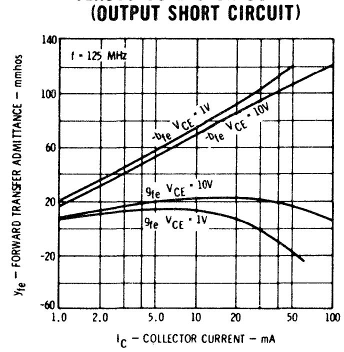
INPUT ADMITTANCE VERSUS COLLECTOR CURRENT (OUTPUT SHORT CIRCUIT)



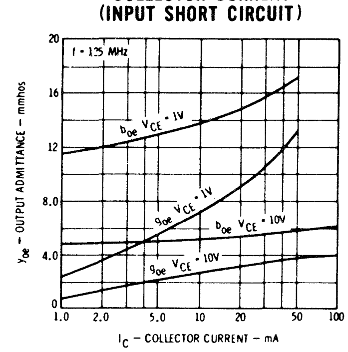
REVERSE TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT (INPUT SHORT CIRCUIT)



FORWARD TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT (OUTPUT SHORT CIRCUIT)



OUTPUT ADMITTANCE VERSUS COLLECTOR CURRENT (INPUT SHORT CIRCUIT)



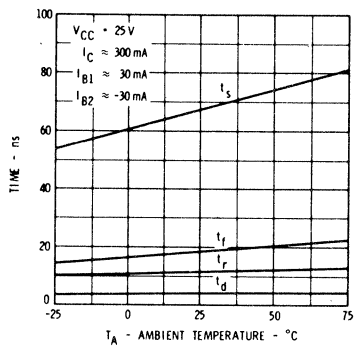
TYPICAL ELECTRICAL CHARACTERISTICS

TYPICAL SMALL SIGNAL CHARACTERISTICS

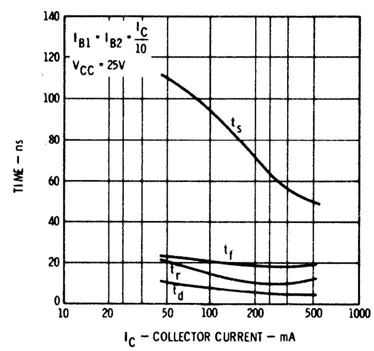
($f = 1$ kHz, $V_{CE} = 10$ V)

		FT3641 • FT3642		FT3643		
Symbol	Characteristic	$I_C = 10$ mA	50 mA	10 mA	50 mA	Units
h_{ie}	Input Resistance	460	350	950	880	Ohms
h_{oe}	Output Conductance	55	405	83	660	μmhos
h_{re}	Voltage Feedback Ratio	130	500	205	1500	$x10^{-6}$
h_{fe}	Small Signal Current Gain	90	97	170	220	

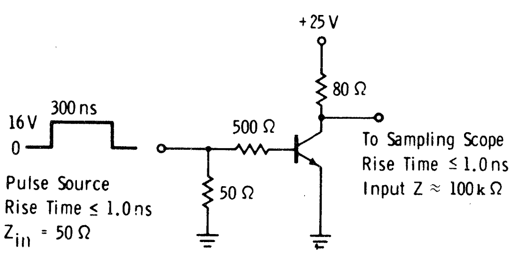
SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



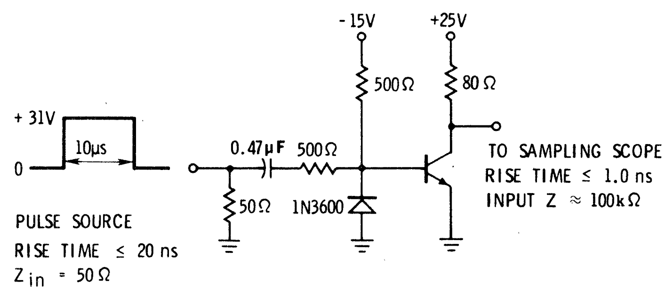
SWITCHING TIMES VERSUS COLLECTOR CURRENT



TURN-ON TEST CIRCUIT



TURN-OFF TEST CIRCUIT



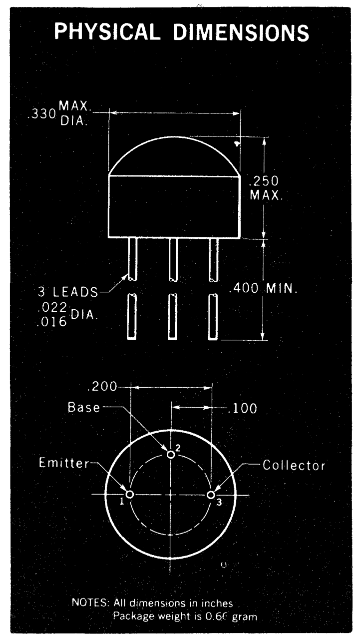
FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

2N3644 · 2N3645

PNP HIGH CURRENT SWITCHES

DIFFUSED SILICON PLANAR EPITAXIAL TRANSISTORS

These PNP silicon PLANAR epitaxial transistors are designed for digital and analog applications at current levels up to 500 milliamperes. Their high beta, high f_T at high current and high LV_{CEO}, make them ideal for use as line drivers and memory applications.



ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	-55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (soldering, 10 sec time limit)	+260°C Maximum

Maximum Power Dissipation	2N3645	2N3644
Total Dissipation at 25°C Case Temperature (Notes 2 & 3)	0.7 Watt	0.7 Watt
at 25°C Free Air Temperature (Notes 2 & 3)	0.3 Watt	0.3 Watt

Maximum Voltages

V_{CBO}	Collector to base Voltage	-60 Volts	-45 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	-60 Volts	-45 Volts
V_{EBO}	Emitter to Base Voltage	-5.0 Volts	-5.0 Volts

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

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain	40	170			I_C = 100 μA V_{CE} = -10 V
h_{FE}	DC Current Gain	80	200			I_C = 1.0 mA V_{CE} = -10 V
h_{FE}	DC Pulse Current Gain (Note 5)	100	270			I_C = 10 mA V_{CE} = -10 V
h_{FE}	DC Pulse Current Gain (Note 5)	115	160	300		I_C = 50 mA V_{CE} = -1.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	100	150	300		I_C = 150 mA V_{CE} = -10 V
h_{FE}	DC Pulse Current Gain (Note 5)	20	50			I_C = 300 mA V_{CE} = -2.0 V
h_{fe}	High Frequency Current Gain (f = 100 Mc)	2.0	2.50			I_C = 20 mA V_{CE} = -20 V
C_{obo}	Common Base Output Capacitance		4.5	8.0	pf	I_E = 0 V_{CB} = -10 V
C_{ibo}	Common Base Input Capacitance		15	25	pf	I_C = 0 V_{EB} = -0.5 V

Additional Electrical Characteristics on page 2

NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor 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 125°C and junction-to-case thermal resistance of 143°C/Watt (derating factor of 7.0 mW/°C); junction-to-ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C).

(4) Rating refers 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 values of I_C, I_{B1}, and I_{B2}.

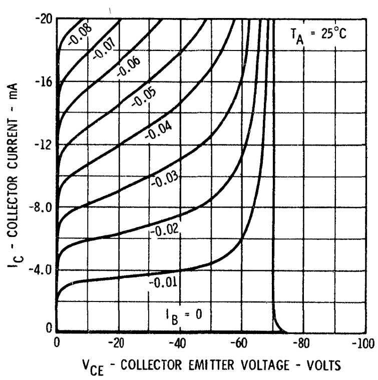
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

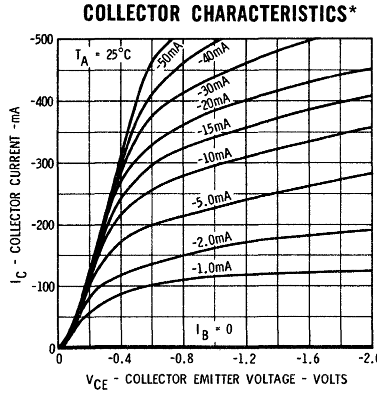
SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
V_{CE}(sat)	Collector Saturation Voltage (Pulsed, see Note 5)		-0.08	-0.25	Volts	I_C = 50 mA I_B = 2.5 mA
V_{CE}(sat)	Collector Saturation Voltage (Pulsed, see Note 5)		-0.18	-0.4	Volts	I_C = 150 mA I_B = 15 mA
V_{CE}(sat)	Collector Saturation Voltage (Pulsed, see Note 5)		-0.5	-1.0	Volts	I_C = 300 mA I_B = 30 mA
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 & 5) 2N3645 2N3644	-60 -45			Volts Volts	I_C = 10 mA I_B = 0 (pulsed)
V_{BE}(sat)	Base Saturation Voltage (Pulsed, see Note 5)		-0.9	-1.0	Volts	I_C = 50 mA I_B = 2.5 mA
V_{BE}(sat)	Base Saturation Voltage (Pulsed, see Note 5)		-1.0	-1.3	Volts	I_C = 150 mA I_B = 15 mA
V_{BE}(sat)	Base Saturation Voltage (Pulsed, see Note 5)	-0.8		-2.0	Volts	I_C = 300 mA I_B = 30 mA
BV_{EBO}	Emitter to Base Breakdown Voltage	-5.0			Volts	I_C = 0 I_E = 10 μA
BV_{CBO}	Collector to Base Breakdown Voltage 2N3645 2N3644	-60 -45			Volts Volts	I_C = 100 μA I_E = 0
t_{on}	Turn On Time (Note 6)		30	40	nsec	$I_C \approx$ 300 mA $I_{B1} \approx$ 30 mA
t_{off}	Turn Off Time (Note 6)		65	100	nsec	$I_C \approx$ 300 mA, $I_{B1} \approx$ 30 mA, $I_{B2} \approx$ -30 mA
I_{CES}	Collector Reverse Current 2N3645			35	nA	V_{CE} = -50 V V_{BE} = 0
	2N3644			35	nA	V_{CE} = -30 V V_{BE} = 0
I_{CES}	Collector Reverse Current (+65°C) 2N3645			2.0	μA	V_{CE} = -50 V V_{BE} = 0
	2N3644			2.0	μA	V_{CE} = -30 V V_{BE} = 0

TYPICAL ELECTRICAL CHARACTERISTICS

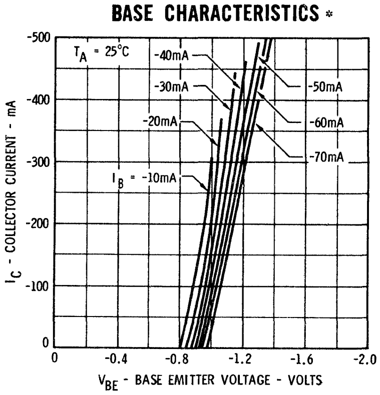
COLLECTOR CHARACTERISTICS*



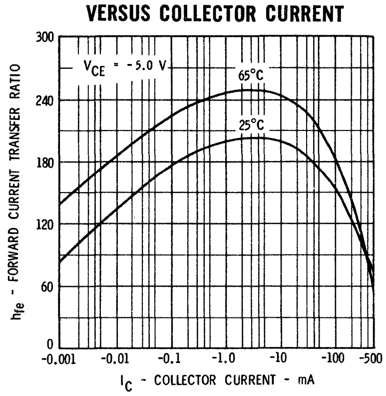
COLLECTOR CHARACTERISTICS*



BASE CHARACTERISTICS*



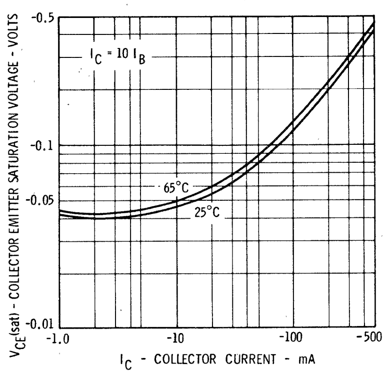
DC PULSED CURRENT GAIN VERSUS COLLECTOR CURRENT



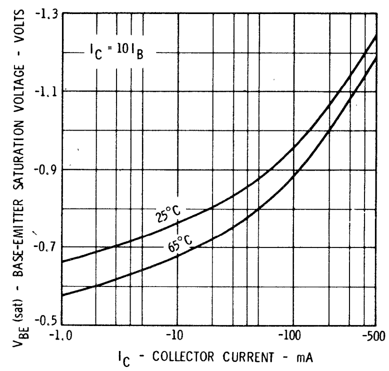
* Single family characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

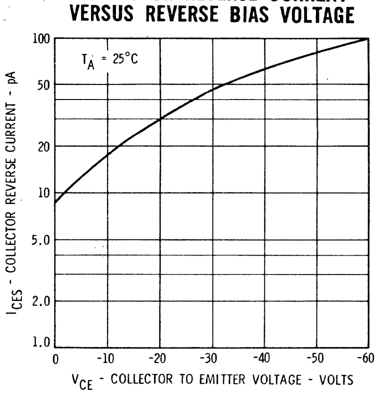
PULSED COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



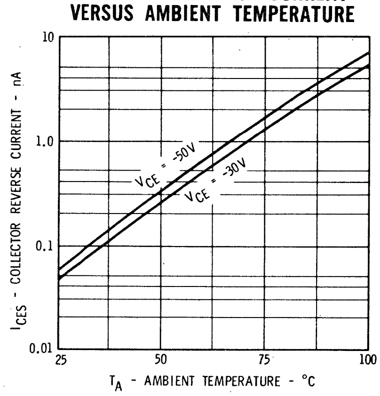
PULSED BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



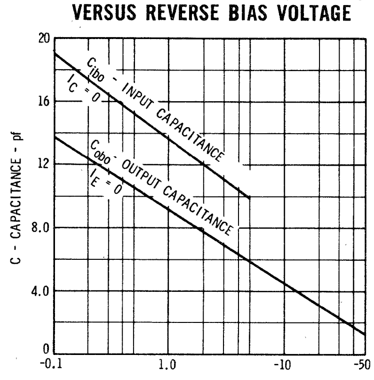
COLLECTOR REVERSE CURRENT VERSUS REVERSE BIAS VOLTAGE



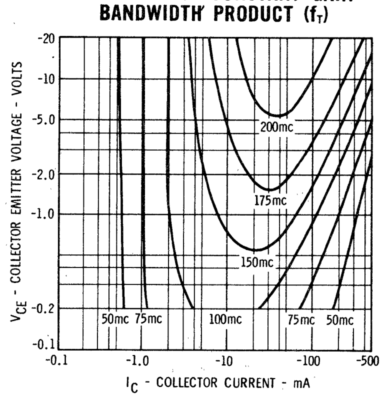
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



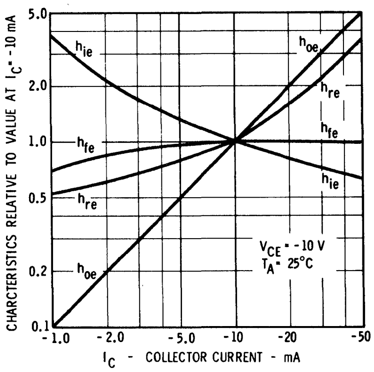
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE

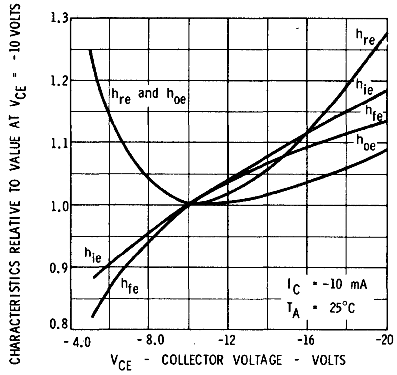


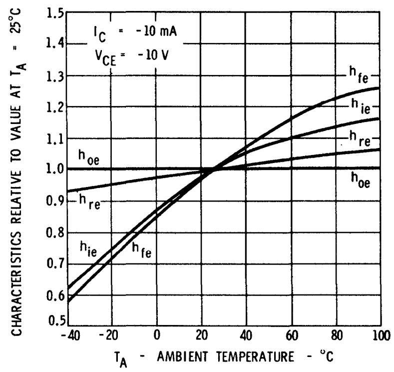
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



SMALL SIGNAL CHARACTERISTICS





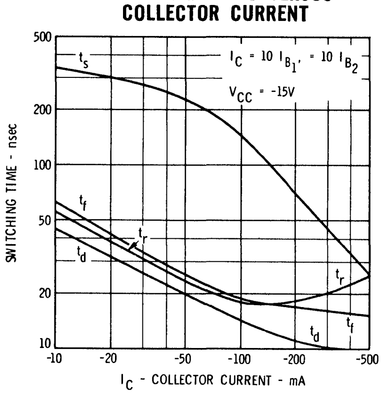


h PARAMETERS (f = 1 kc)

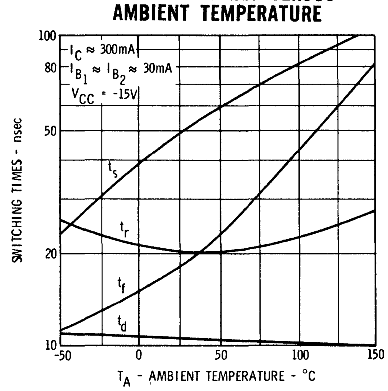
Symbol		Min.	Typ.	Max.	Units	Test Conditions	
h_{ie}	Input Resistance		480	2000	ohms	I_C = 10 mA	V_{CE} = -10 V
h_{oe}	Output Conductance		80	1200	μmhos	I_C = 10 mA	V_{CE} = -10 V
h_{re}	Voltage Feedback Ratio		162	1500	$x10^{-6}$	I_C = 10 mA	V_{CE} = -10 V
h_{fe}	Small Signal Current Gain	100				I_C = 10 mA	V_{CE} = -10 V

TYPICAL ELECTRICAL CHARACTERISTICS

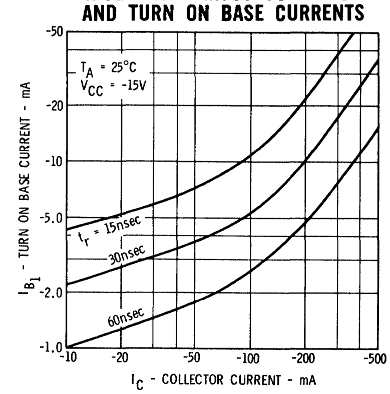
SWITCHING TIMES VERSUS COLLECTOR CURRENT



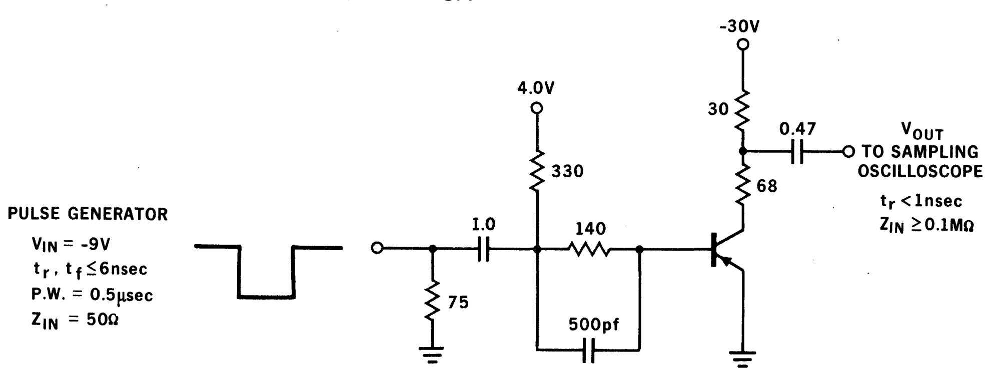
SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



RISE TIME VERSUS COLLECTOR AND TURN ON BASE CURRENTS



T_{ON} AND T_{OFF} TEST CIRCUIT



FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

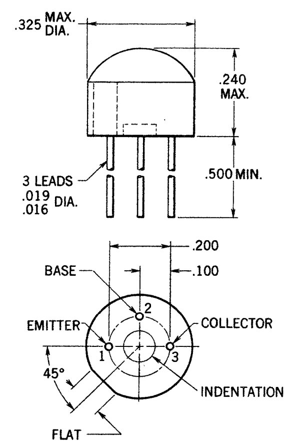
FT3644 • FT3645

PNP HIGH-CURRENT SWITCHES

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **HIGH POWER DISSIPATION . . . . 3.0 WATT AT 25°C CASE TEMPERATURE**
- **HIGH VOLTAGE . . . . 45 V AND 60 V LV_{CEO}**
- **BROAD CURRENT RANGE . . . . 100 μA TO 300 mA**
- **HIGH GAIN BANDWIDTH PRODUCT . . . 250 MHz (TYP) f_T**
- **LOW SATURATION VOLTAGE . . . . 400 mV (MAX) AT I_C = 150 mA**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated nickel
Package is electrically Non-conductive material
Package weight is 0.66 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature		−55°C to +125°C
Operating Junction Temperature		+125°C
Lead Temperature (soldering, 10 second time limit)		+260°C
Maximum Power Dissipation (Notes 2 and 3)		
Total Dissipation at 25°C Case Temperature		**3.0 Watt**
at 25°C Free Air Temperature		0.45 Watt

Maximum Voltages

		FT3645	**FT3644**
V_{CBO}	Collector to Base Voltage	−60 Volts	−45 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	−60 Volts	−45 Volts
V_{EBO}	Emitter to Base Voltage	−5.0 Volts	−5.0 Volts

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Current Gain**	**40**	**170**			I_C = **100 μA**	V_{CE} = **−10 V**
h_{FE}	**DC Current Gain**	**80**	**200**			I_C = **1.0 mA**	V_{CE} = **−10 V**
h_{FE}	**DC Pulse Current Gain** (Note 5)	**100**	**270**			I_C = **10 mA**	V_{CE} = **−10 V**
h_{FE}	**DC Pulse Current Gain** (Note 5)	**115**	**160**	**300**		I_C = **50 mA**	V_{CE} = **−1.0 V**
h_{FE}	**DC Pulse Current Gain** (Note 5)	**100**	**150**	**300**		I_C = **150 mA**	V_{CE} = **−10 V**
h_{FE}	**DC Pulse Current Gain** (Note 5)	**20**	**50**			I_C = **300 mA**	V_{CE} = **−5.0 V**
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**2.0**	**2.5**			I_C = **20 mA**	V_{CE} = **−20 V**
C_{cb}	Collector to Base Capacitance		4.5	8.0	pF	I_E = 0	V_{CB} = −10 V
C_{eb}	Emitter to Base Capacitance		15	25	pF	I_C = 0	V_{EB} = −0.5 V

Additional Electrical Characteristics on page 2

*Planar is a patented Fairchild process.

NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor 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 125°C and junction to case thermal resistance of 33°C/Watt (derating factor of 31 mW/°C); junction to ambient thermal resistance of 222°C/Watt (derating factor of 4.5 mW/°C).
(4) 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) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

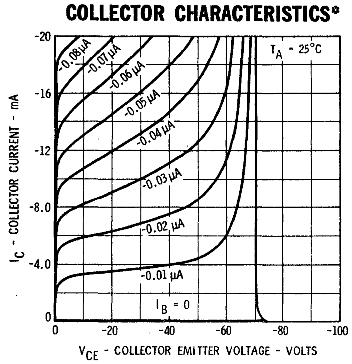
FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

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

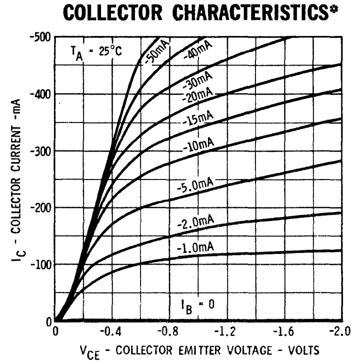
SYMBOL	CHARACTERISTICS		MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
$V_{CE(sat)}$	Collector Saturation Voltage (Pulsed, see Note 5)			−0.08	−0.25	Volts	$I_C = 50$ mA	$I_B = 2.5$ mA
$V_{CE(sat)}$	**Collector Saturation Voltage** (Pulsed, see Note 5)			**−0.18**	**−0.4**	**Volts**	$I_C = 150$ mA	$I_B = 15$ mA
$V_{CE(sat)}$	Collector Saturation Voltage (Pulsed, see Note 5)			−0.5	−1.0	Volts	$I_C = 300$ mA	$I_B = 30$ mA
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage**	**FT3645**	**−60**			**Volts**	$I_C = 10$ mA	$I_B = 0$
	(Notes 4 & 5)	**FT3644**	**−45**			**Volts**	(pulsed)	
$V_{BE(sat)}$	Base Saturation Voltage (Pulsed, see Note 5)			−0.9	−1.0	Volts	$I_C = 50$ mA	$I_B = 2.5$ mA
$V_{BE(sat)}$	Base Saturation Voltage (Pulsed, see Note 5)			−1.0	−1.3	Volts	$I_C = 150$ mA	$I_B = 15$ mA
$V_{BE(sat)}$	Base Saturation Voltage (Pulsed, see Note 5)		−0.8		−2.0	Volts	$I_C = 300$ mA	$I_B = 30$ mA
BV_{EBO}	Emitter to Base Breakdown Voltage		−5.0			Volts	$I_C = 0$	$I_E = 10\ \mu A$
BV_{CBO}	Collector to Base Breakdown Voltage	FT3645	−60			Volts	$I_C = 100\ \mu A$	$I_E = 0$
		FT3644	−45			Volts		
t_{on}	Turn On Time (Note 6)			30	40	ns	$I_C \approx 300$ mA	$I_{B1} \approx 30$ mA
t_{off}	Turn Off Time (Note 6)			65	100	ns	$I_C \approx 300$ mA, $I_{B1} \approx 30$ mA, $I_{B2} \approx -30$ mA	
I_{CES}	Collector Reverse Current	FT3645			35	nA	$V_{CE} = -50$ V	$V_{BE} = 0$
		FT3644			35	nA	$V_{CE} = -30$ V	$V_{BE} = 0$
$I_{CES}(+65°C)$	Collector Reverse Current	FT3645			2.0	μA	$V_{CE} = -50$ V	$V_{BE} = 0$
		FT3644			2.0	μA	$V_{CE} = -30$ V	$V_{BE} = 0$

TYPICAL ELECTRICAL CHARACTERISTICS

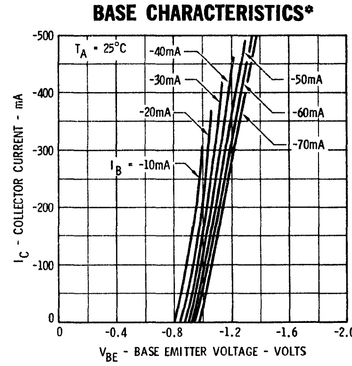
COLLECTOR CHARACTERISTICS*



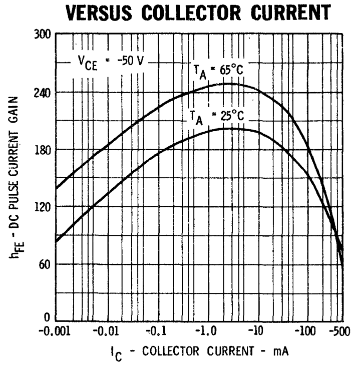
COLLECTOR CHARACTERISTICS*



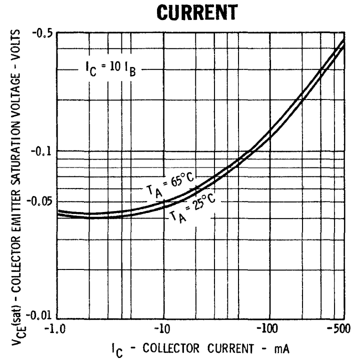
BASE CHARACTERISTICS*



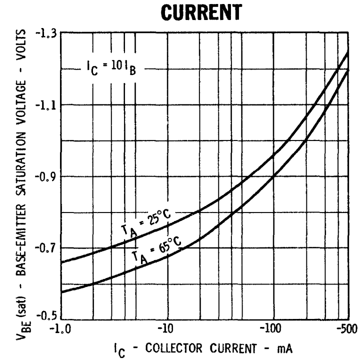
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



PULSED COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



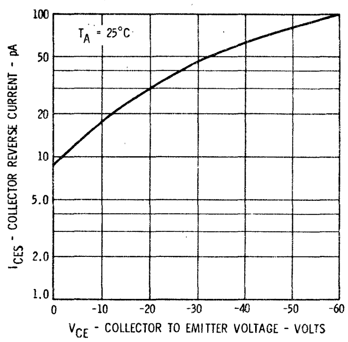
PULSED BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



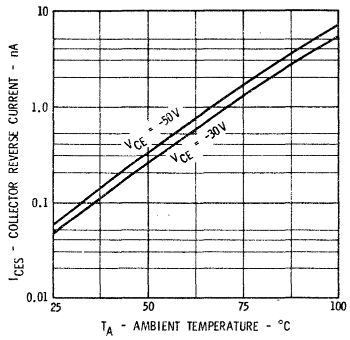
*Single family characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

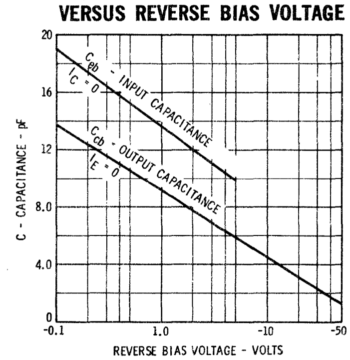
COLLECTOR REVERSE CURRENT VERSUS REVERSE BIAS VOLTAGE



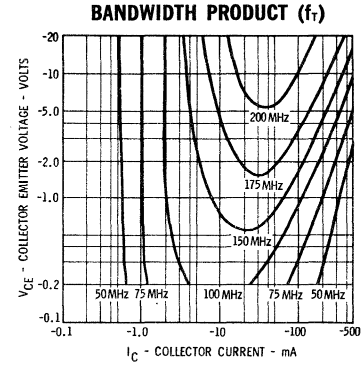
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPEATURE



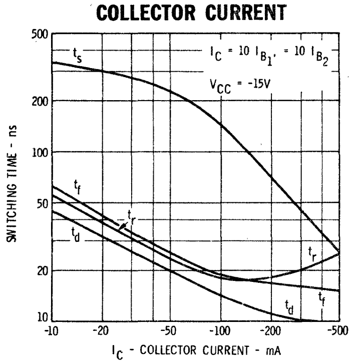
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



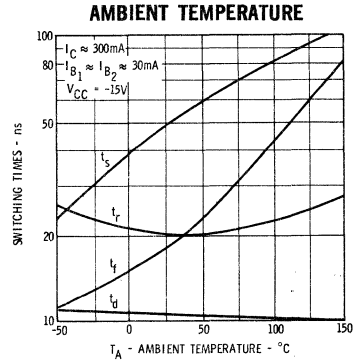
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



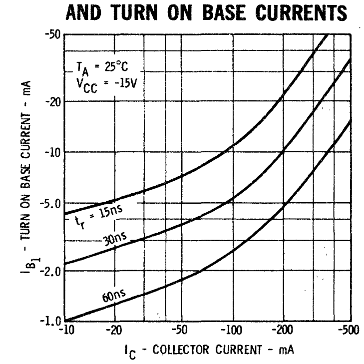
SWITCHING TIMES VERSUS COLLECTOR CURRENT



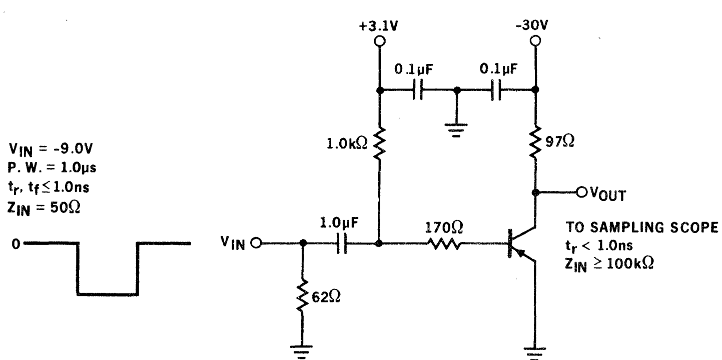
SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



RISE TIME VERSUS COLLECTOR AND TURN ON BASE CURRENTS



t_{on} AND t_{off} TEST CIRCUIT



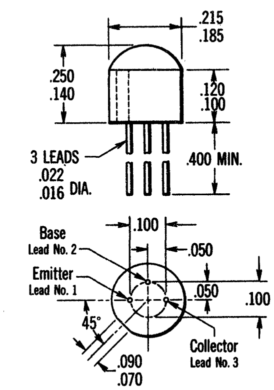
2N3646

FAIRCHILD NPN DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTOR

HIGH SPEED SATURATED SWITCH

The 2N3646 is an NPN silicon PLANAR epitaxial transistor designed for memory applications to 500 milliamperes. It features the unique combination of 350 Hz f_T minimum with a guaranteed 300 milliampere collector saturation voltage of 0.5 volt.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	-55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering 10 sec time limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	0.5 Watt
at 25°C Ambient Temperature (Notes 2 and 3)	0.2 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage	40 Volts
V_{CES}	Collector to Emitter Voltage	40 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	15 Volts
V_{EBO}	Emitter to Base Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Conditions	
$V_{CE}(sat)$	Collector Saturation Voltage (Note 5)		0.16	0.2	Volts	I_C = 30 mA	I_B = 3.0 mA
$V_{CE}(sat)$	Collector Saturation Voltage (Note 5)		0.18	0.28	Volts	I_C = 100 mA	I_B = 10 mA
$V_{CE}(sat)$	Collector Saturation Voltage (Note 5) (T_A = +65°C)		0.18	0.3	Volts	I_C = 30 mA	I_B = 3.0 mA
$V_{CE}(sat)$	Collector Saturation Voltage (Note 5)		0.39	0.5	Volts	I_C = 300 mA	I_B = 30 mA
h_{fe}	High Frequency Current Gain (f = 100 Hz)	3.5	5.5			I_C = 30 mA	V_{CE} = 10 V
τ_s	Charge Storage Time Constant (Note 6)		8.0	18	ns	$I_C = I_{B1} \approx$ 10 mA	$I_{B2} \approx$ -10 mA
t_{on}	Turn On Time (Note 6)		9.0	18	ns	$I_C \approx$ 300 mA	$I_{B1} \approx$ 30 mA
t_{off}	Turn Off Time (Note 6)		15	28	ns	$I_C \approx$ 300 mA, $I_{B1} \approx$ 30 mA, $I_{B2} \approx$ -30 mA	
C_{obo}	Common Base Open Circuit Output Capacitance		3.3	5.0	pF	I_E = 0	V_{CB} = 5.0 V
C_{ibo}	Common Base Open Circuit Input Capacitance		6.6	8.0	pF	I_C = 0	V_{EB} = 0.5 V
h_{FE}	DC Pulse Current Gain (Note 5)	30	60	120		I_C = 30 mA	V_{CE} = 0.4 V
h_{FE}	DC Pulse Current Gain (Note 5)	25	55			I_C = 100 mA	V_{CE} = 0.5 V
h_{FE}	DC Pulse Current Gain (Note 5)	15				I_C = 300 mA	V_{CE} = 1.0 V

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	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
BV_{CBO}	Collector to Base Breakdown Voltage	40			Volts	I_C = 100 μA	I_E = 0
BV_{CES}	Collector to Emitter Breakdown Voltage	40			Volts	I_C = 100 μA	V_{EB} = 0
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	15			Volts	I_C = 10 mA	I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			Volts	I_E = 100 μA	I_C = 0
V_{BE}(sat)	Base Saturation Voltage (Note 5)	0.75	0.82	0.95	Volts	I_C = 30 mA	I_B = 3.0 mA
V_{BE}(sat)	Base Saturation Voltage (Note 5)		0.97	1.2	Volts	I_C = 100 mA	I_B = 10 mA
V_{BE}(sat)	Base Saturation Voltage (Note 5)		1.3	1.7	Volts	I_C = 300 mA	I_B = 30 mA
I_{CES}	Collector Reverse Current		0.04	0.5	μA	V_{CE} = 20 V	V_{EB} = 0
I_{CES}(65°C)	Collector Reverse Current		0.5	3.0	μA	V_{CE} = 20 V	V_{EB} = 0

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 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C). Junction-to-ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).

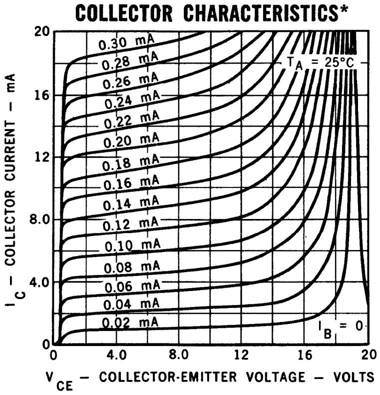
(4) Rating refers to a high-current point where collector-to-emitter voltage is lowest. For more information send for Fairchild Publication APP-4.

(5) Pulse Conditions: length = 300 μsec; duty cycle = 1%.

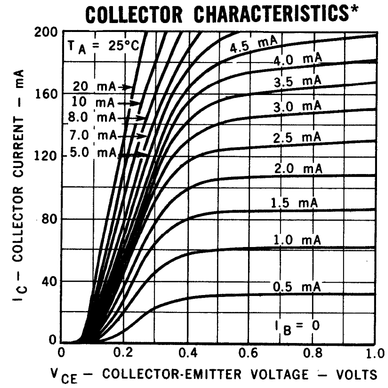
(6) See switching circuits for exact values of I_C, I_{B1}, and I_{B2}.

TYPICAL ELECTRICAL CHARACTERISTICS

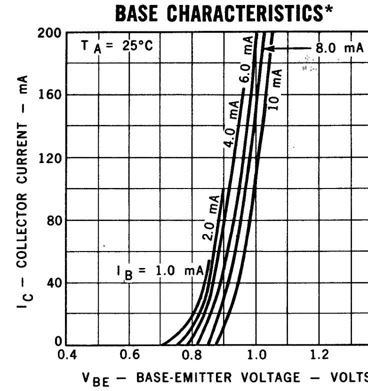
COLLECTOR CHARACTERISTICS*



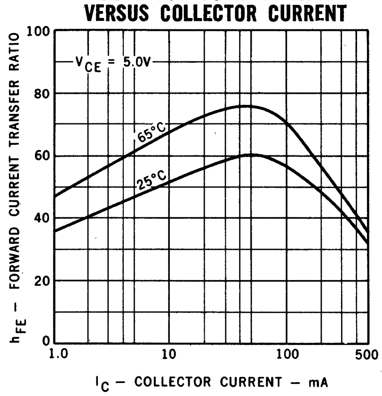
COLLECTOR CHARACTERISTICS*



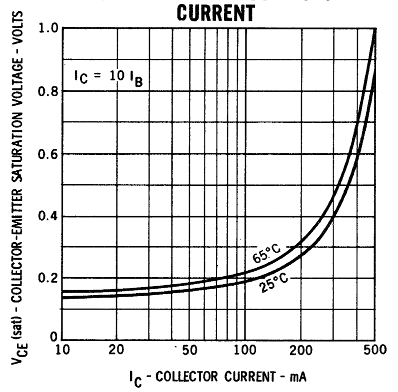
BASE CHARACTERISTICS*



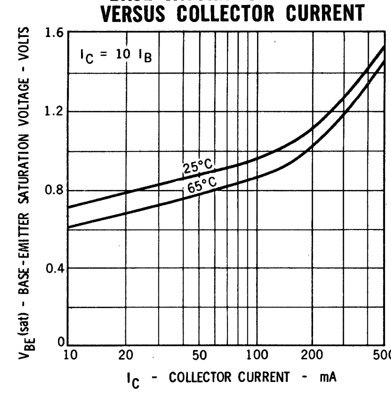
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



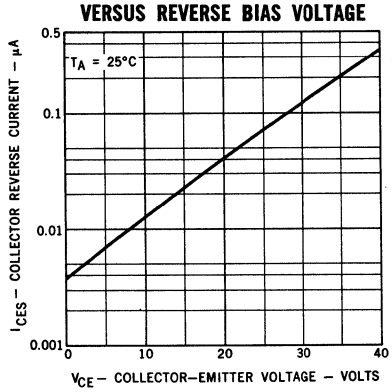
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



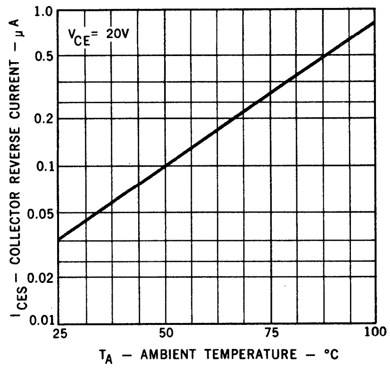
* Single family characteristics on Transistor Curve Tracer

TYPICAL ELECTRICAL CHARACTERISTICS

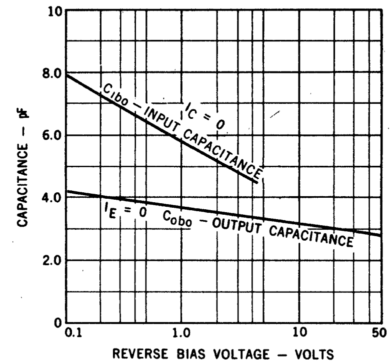
COLLECTOR REVERSE CURRENT VERSUS REVERSE BIAS VOLTAGE



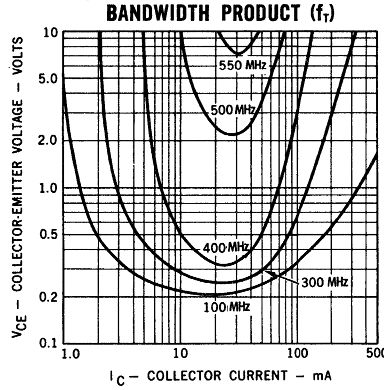
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



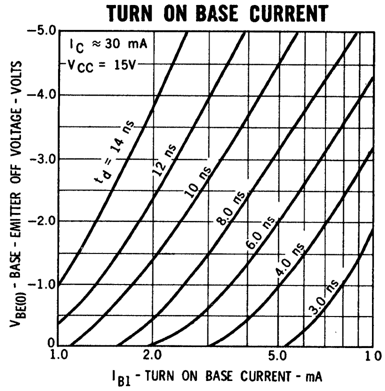
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



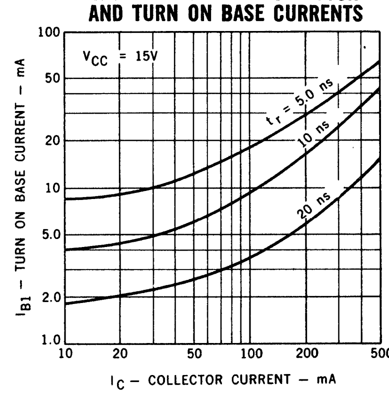
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



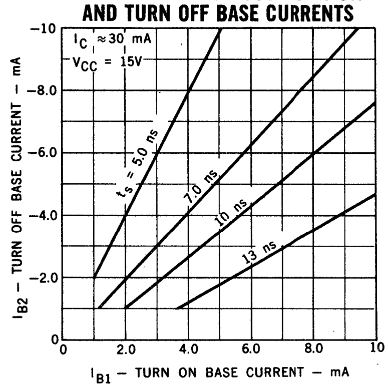
DELAY TIME VERSUS BASE EMITTER OFF VOLTAGE AND TURN ON BASE CURRENT



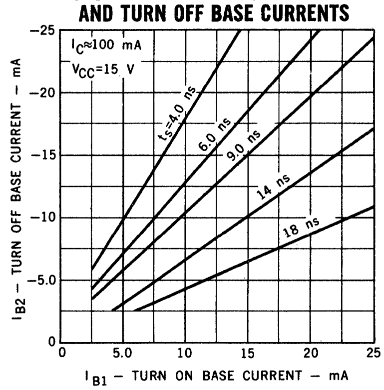
RISE TIME VERSUS COLLECTOR AND TURN ON BASE CURRENTS



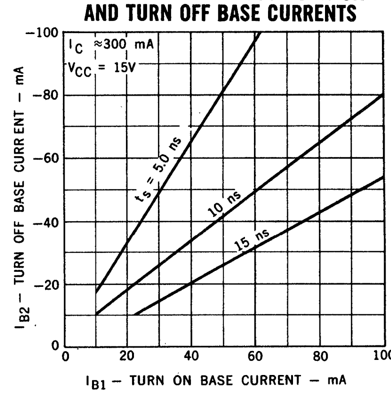
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



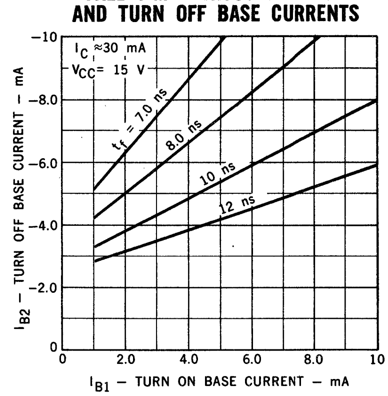
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



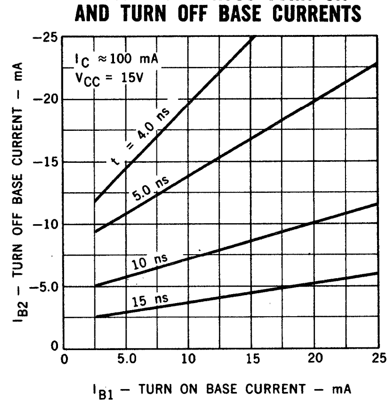
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



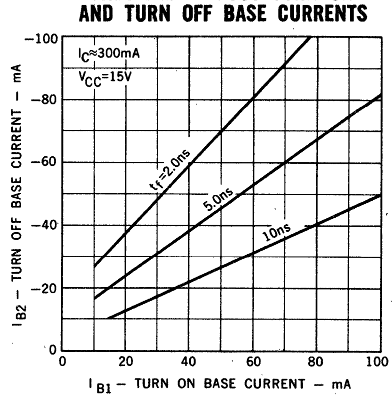
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS

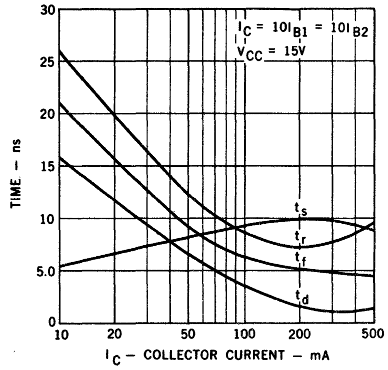


FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS

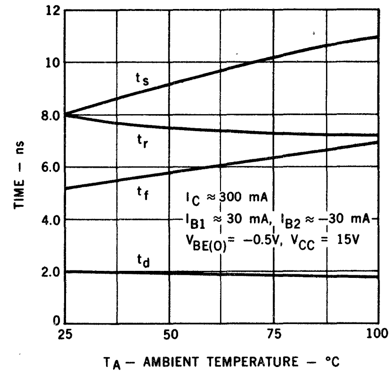


TYPICAL ELECTRICAL CHARACTERISTICS

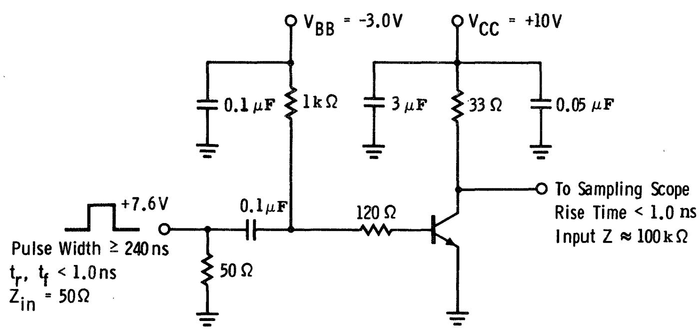
SWITCHING TIMES VERSUS COLLECTOR CURRENT



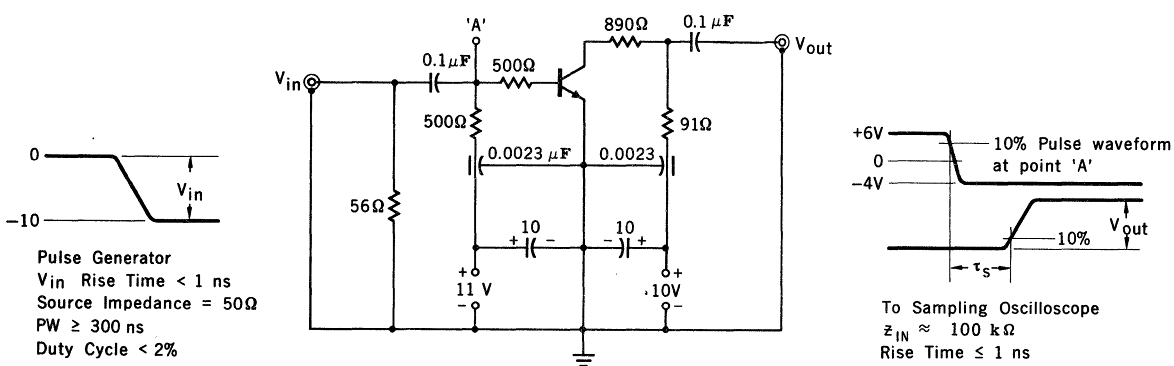
SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



T_{ON} and T_{OFF} TEST CIRCUIT



CHARGE STORAGE TIME MEASUREMENT CIRCUIT



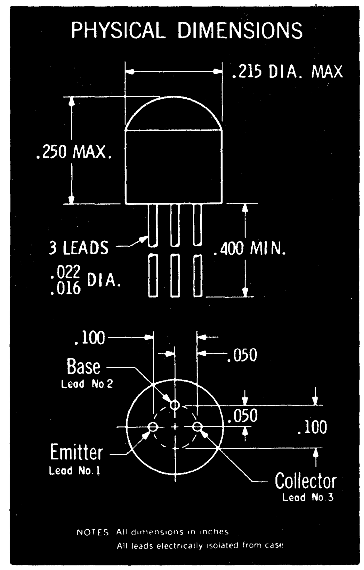
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

2N3688 • 2N3689 • 2N3690

NPN RF-AGC AMPLIFIERS

SILICON PLANAR TRANSISTORS

The 2N3688, 2N3689, and 2N3690 are NPN silicon PLANAR transistors designed specifically for commercial RF-IF-AGC applications. They feature high power gain, low noise, and excellent forward AGC characteristics in a solid package designed to give maximum mechanical support to the transistor chip.



ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Operating Junction Temperature	**125°C** Maximum
Storage Temperature	**−55°C** to **+125°C**
Soldering Temperature	**260°C** Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature [Note 2]	**0.5** Watt
at 65°C Case Temperature [Note 2]	**0.3** Watt
at 25°C Ambient Temperature [Note 2]	**0.2** Watt

Maximum Voltages

V_{CBO} Collector to Base Voltage	**40** Volts
V_{CEO} Collector to Emitter Voltage [Note 3]	**40** Volts
V_{EBO} Emitter to Base Voltage	**4.0** Volts

ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

Symbol	Characteristics	2N3688 Min.	2N3688 Typ.	2N3688 Max.	2N3689 Min.	2N3689 Typ.	2N3689 Max.	2N3690 Min.	2N3690 Typ.	2N3690 Max.	Units	TEST CONDITIONS	
C_{ob}	Output Capacitance		1.1	1.6		1.1	1.6		1.1	1.6	pf	$I_E = 0$	$V_{CB} = 10$ V
C_{cb}	Guarded Output Capacitance		0.8			0.8			0.8		pf	$I_E = 0$	$V_{CB} = 10$ V
NF	Noise Figure [Note 5]								4.0	5.5	db	$I_C = 4.0$ mA	$V_{CE} = 10$ V
h_{fe}	High Frequency Current Gain (f = 100 mc)	4.0	6.0		4.0	6.0		4.0	6.0			$I_C = 4.0$ mA	$V_{CE} = 10$ V
PG_1	Power Gain (f = 45 mc)	29	33		29	33					db	$I_C = 4.0$ mA	$V_{CE} = 10$ V
PG_2	Power Gain (f = 200 mc)							15	18		db	$I_C = 4.0$ mA	$V_{CE} = 10$ V
AGC_1	Automatic Gain Control (f = 45 mc) [Note 6]	8.0		10.5	9.5		12				mA	I_C for which $P_G = P_{G1}$ −30 db in 45 mc test circuit	
AGC_2	Automatic Gain Control (f = 200 mc) [Note 6]							9.0		14	mA	I_C for which $P_G = P_{G2}$ −30 db in 200 mc test circuit	
$r_b'C_c$	Collector-Base Time Constant (f = 80 mc)			15			15			15	psec	$I_C = 4.0$ mA	$V_{CE} = 10$ V

Additional Electrical Characteristics on page 2

NOTES:
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high-current point where collector-to-emitter voltage is lowest. For more information send for Fairchild Publication APP-4.
(4) Pulse Conditions: length = 300 μsec; duty cycle = 1%.
(5) f = 200 mc; $R_S = 100\Omega$; BW = 1.0 mc.
(6) Additional AGC information on page 2.

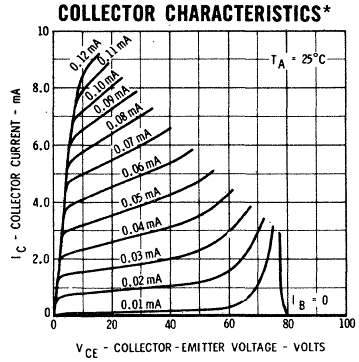
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

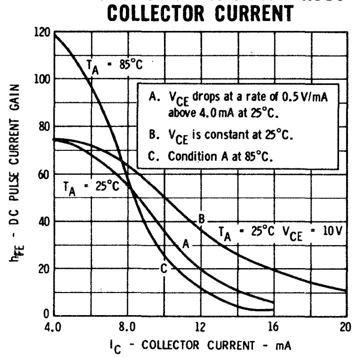
Symbol	Characteristics	2N3688 Min.	2N3688 Typ.	2N3688 Max.	2N3689 Min.	2N3689 Typ.	2N3689 Max.	2N3690 Min.	2N3690 Typ.	2N3690 Max.	Units	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain [Note 4]	**30**	**70**		**30**	**70**		**30**	**70**			$I_C = 4.0$ mA $V_{CE} = 10$ V
I_{CBO}	Collector Cutoff Current			**50**			**50**			**50**	nA	$I_E = 0$ $V_{CB} = 20$ V
I_{CBO} **(65°C)**	Collector Cutoff Current			**5.0**			**5.0**			**5.0**	μA	$I_E = 0$ $V_{CB} = 20$ V
BV_{CBO}	Collector to Base Breakdown Voltage	**40**			**40**			**40**			Volts	$I_C = 100$ μA $I_E = 0$
V_{CEO} **(sust)**	Collector to Emitter Sustaining Voltage [Notes 3 and 4]	**40**			**40**			**40**			Volts	$I_C = 3.0$ mA $I_B = 0$ (Pulsed)
BV_{EBO}	Emitter to Base Breakdown Voltage	**4.0**			**4.0**			**4.0**			Volts	$I_E = 100$ μA $I_C = 0$

TYPICAL ELECTRICAL CHARACTERISTICS

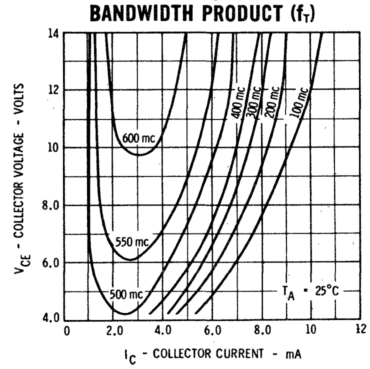
COLLECTOR CHARACTERISTICS*



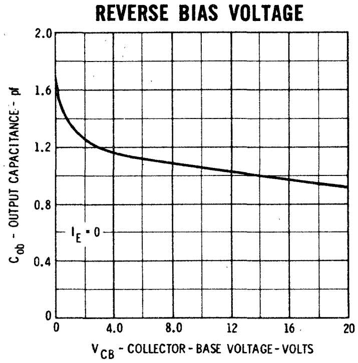
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



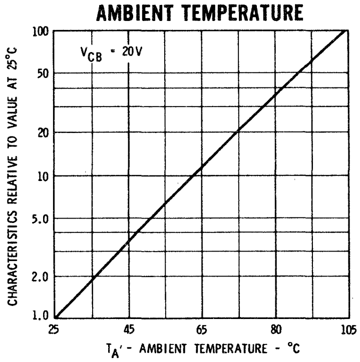
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



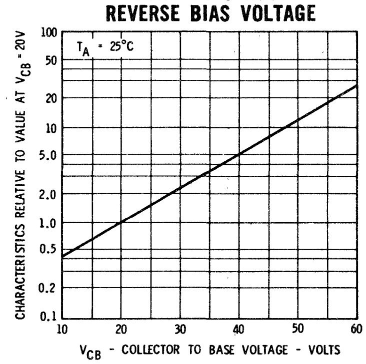
OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



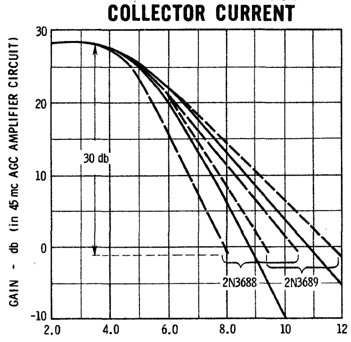
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



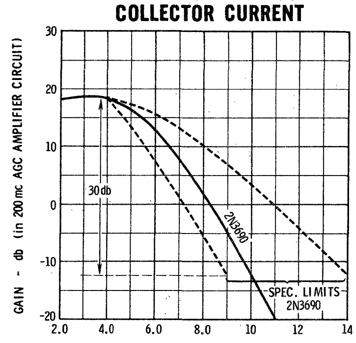
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



TYPICAL GAIN VERSUS COLLECTOR CURRENT



TYPICAL GAIN VERSUS COLLECTOR CURRENT



* Single family characteristics on Transistor Curve Tracer

TYPICAL SMALL SIGNAL COMMON EMITTER "Y" PARAMETERS

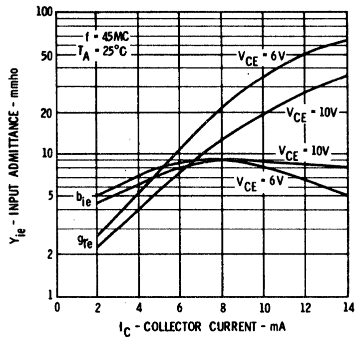
2N3688 • 2N3689 — **45 mc** — vs. COLLECTOR CURRENT

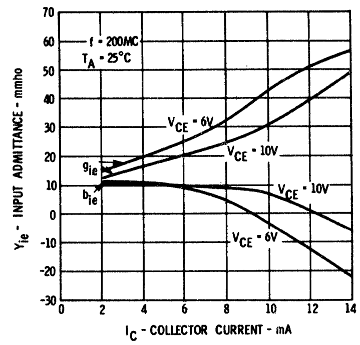
2N3690 — **200 mc** — vs. COLLECTOR CURRENT

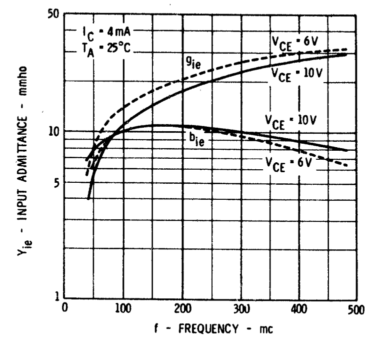
2N3688 • 2N3689 • 2N3690 — **vs. FREQUENCY**

y_{ie}

Input Admittance (output short circuit)

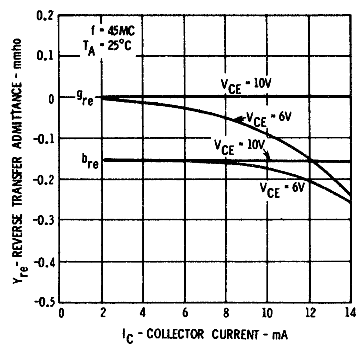


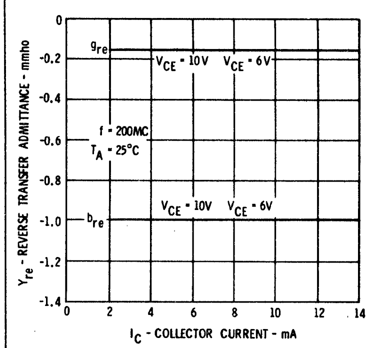


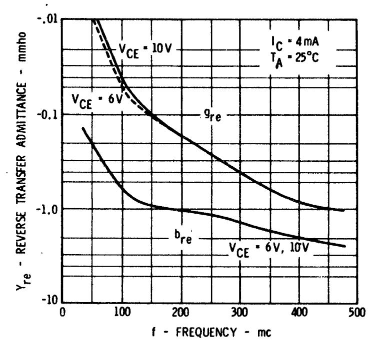


y_{re}

Reverse Transfer Admittance (input short circuit)

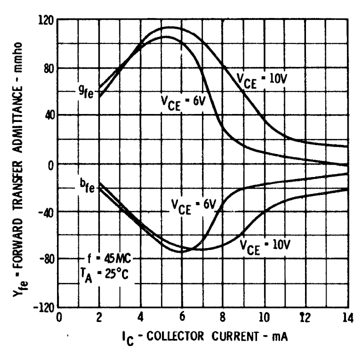


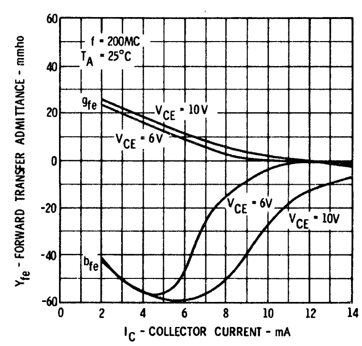


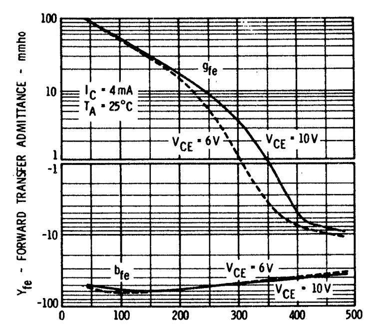


y_{fe}

Forward Transfer Admittance (output short circuit)

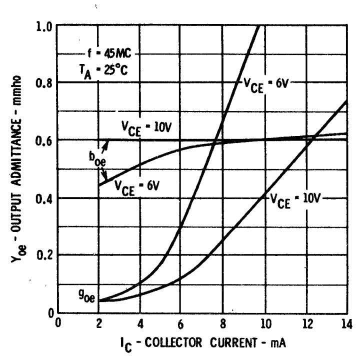


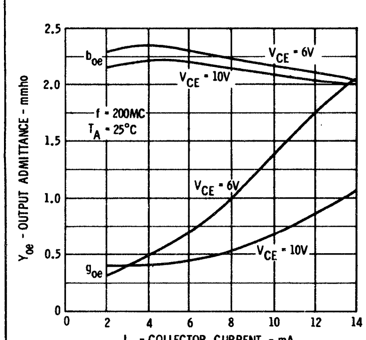


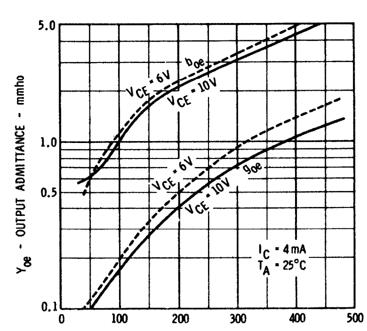


y_{oe}

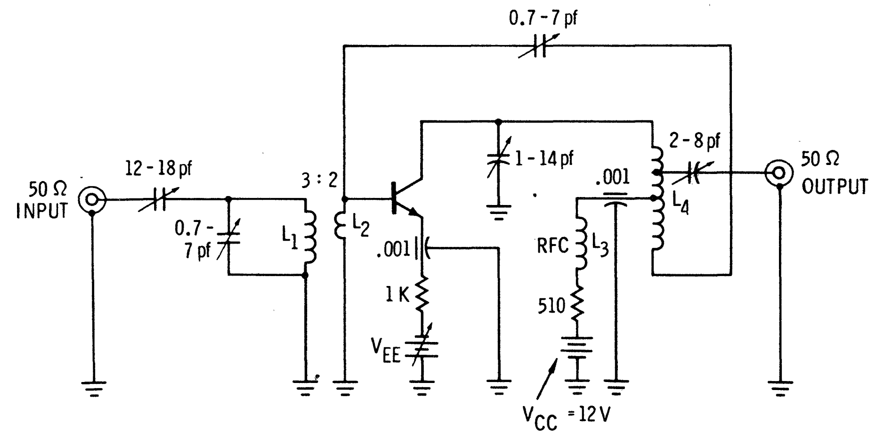
Output Admittance (input short circuit)







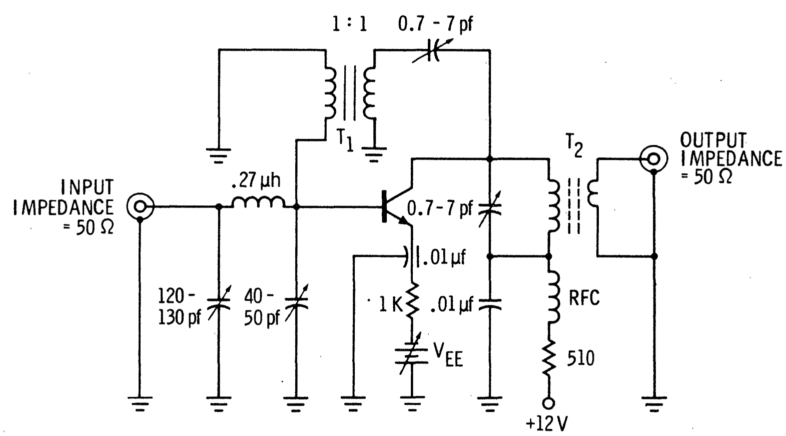
200 MC AGC TEST CIRCUIT



Input impedance referred to transistor is 100 Ω.

L_1 = 3 turns #18 wire on ¼" ceramic core
L_2 = 2 turns #18 wire interwound at cold end with L_1
L_3 = RFC
L_4 = 4 turns .076" diam. silver tubing space wound (⅜" I.D., no core). Output tap at ½ turn from collector end ground tap at 2 turns from collector end

45 MC AGC TEST CIRCUIT



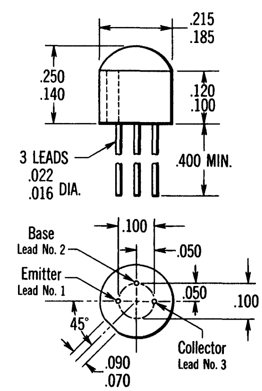
T_1: 12T #32 bifilar wire on Q2 toroid (μ = 115)
T_2: Primary: 10T #36 enameled wire wound on micrometals L-52-6 shielded coil form
Secondary: 2T #36 enameled wire tightly coupled to primary

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

2N3691 · 2N3692
NPN GENERAL PURPOSE
DIFFUSED SILICON PLANAR* TRANSISTORS

GENERAL DESCRIPTION - The 2N3691 and 2N3692 are NPN silicon PLANAR*transistors in a solid package designed to give maximum mechanical support to the transistor chip. They are designed for use in audio and video amplifiers, sync circuits, stereo multiplex, and audio pre-amplifiers. These devices are similar to SE 2001 and SE 2002.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	-55°C to +125°C
Operating Junction Temperature	125°C Maximum
Soldering Temperature (10 sec time limit)	260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature	[Note 2]	0.5 Watt
at 65°C Case Temperature	[Note 2]	0.3 Watt
at 25°C Ambient Temperature	[Note 2]	0.2 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage	35 Volts
V_{CEO}	Collector to Emitter Voltage [Note 3]	25 Volts
V_{EBO}	Emitter to Base Voltage	4.0 Volts

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

Symbol	Characteristic	Min.	Max.	Units	Test Conditions
h_{FE}	DC Pulse Current Gain [Note 4] 2N3691	40	160		I_C = 10 mA V_{CE} = 1.0 V
h_{FE}	DC Pulse Current Gain [Note 4] 2N3692	100	400		I_C = 10 mA V_{CE} = 1.0 V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	2.0			I_C = 10 mA V_{CE} = 15 V
V_{CE}(sat)	Collector Saturation Voltage		0.7	Volts	I_C = 10 mA I_B = 1.0 mA
V_{BE}(sat)	Base Saturation Voltage		0.9	Volts	I_C = 10 mA I_B = 1.0 mA
I_{CBO}	Collector Cutoff Current		50	nA	I_E = 0 V_{CB} = 30 V
I_{CBO} (65°C)	Collector Cutoff Current		5.0	μA	I_E = 0 V_{CB} = 30 V
C_{obo}	Common-Base, Open-Circuit Output Capacitance		6.0	pF	I_E = 0 V_{CB} = 10 V
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage [Notes 3 and 4]	20		Volts	I_C = 10 mA (pulsed) I_B = 0
BV_{CBO}	Collector to Base Breakdown Voltage	35		Volts	I_C = 100 μA I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0		Volts	I_C = 0 I_E = 10 μA

(See notes on back page)

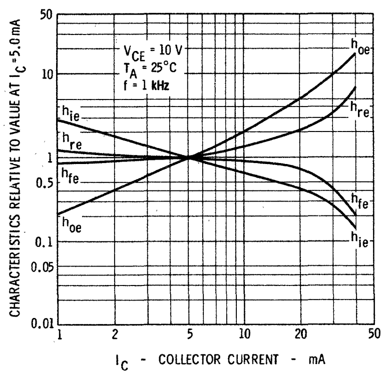
* Planar is a patented Fairchild process.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

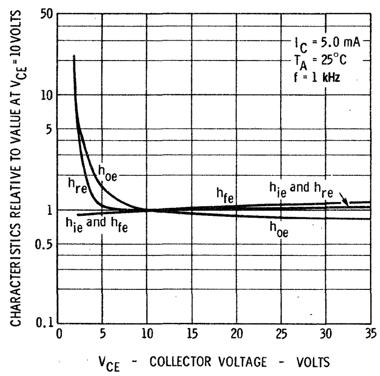
SMALL SIGNAL CHARACTERISTICS (f = 1 kHz)

SYMBOL	CHARACTERISTIC	2N3691 MIN.	2N3691 TYP.	2N3691 MAX.	2N3692 MIN.	2N3692 TYP.	2N3692 MAX.	UNITS	TEST CONDITIONS
h_{ie}	Input Resistance		900			1130		Ohms	I_C = 5.0 mA V_{CE} = 10 V
h_{oe}	Output Conductance		25			35		μmho	I_C = 5.0 mA V_{CE} = 10 V
h_{re}	Voltage Feedback Ratio		1.2			1.25		$x10^{-4}$	I_C = 5.0 mA V_{CE} = 10 V
h_{fe}	Small Signal Current Gain	40	110	200	100	145	560		I_C = 5.0 mA V_{CE} = 10 V

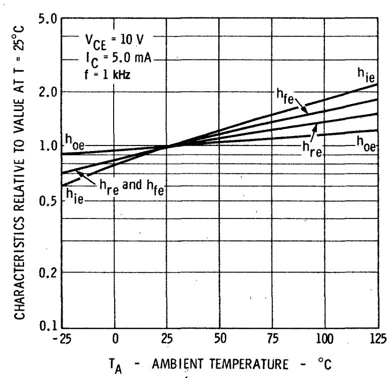
SMALL SIGNAL CHARACTERISTICS



SMALL SIGNAL CHARACTERISTICS



SMALL SIGNAL CHARACTERISTICS



NOTES:

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

(2) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).

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

(4) Pulse Conditions: length = 300 μsec; duty cycle = 1%.

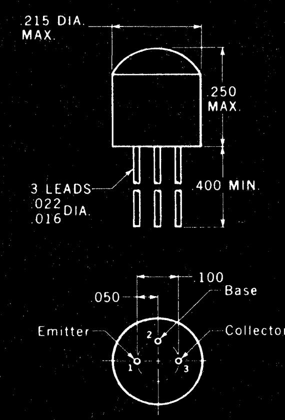
2N3693 • 2N3694

NPN AM/FM TYPE

DIFFUSED SILICON PLANAR TRANSISTORS

GENERAL DESCRIPTION The 2N3693 and 2N3694 are NPN silicon PLANAR transistors designed specifically for A.M.-F.M. receiver applications. They feature high power gain, high beta, and low collector cutoff current in a solid package designed to give maximum mechanical support to the transistor chip. These devices are similar to SE1001 and SE1002.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Leads are nickel
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Operating Junction Temperature	125°C Maximum
Storage Temperature	−55°C to +125°C
Soldering Temperature (10 sec time limit)	260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature [Note 2]	0.5 Watt
at 65°C Case Temperature [Note 2]	0.3 Watt
at 25°C Ambient Temperature [Note 2]	0.2 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage	45 Volts
V_{CEO}	Collector to Emitter Voltage [Note 3]	45 Volts
V_{EBO}	Emitter to Base Voltage	4.0 Volts

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

SYMBOL	CHARACTERISTIC	2N3693 Min.	2N3693 Typ.	2N3693 Max.	2N3694 Min.	2N3694 Typ.	2N3694 Max.	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain [Note 4]	40		160	100		400		$I_C = 10$ mA $V_{CE} = 10$ V
I_{CBO}	Collector Cutoff Current			50			50	nA	$I_E = 0$ $V_{CB} = 35$ V
I_{CBO} (65°C)	Collector Cutoff Current			5.0			5.0	μA	$I_E = 0$ $V_{CB} = 35$ V
C_{obo}	Common Base, Open Circuit, Output Capacitance			3.5			3.5	pf	$I_E = 0$ $V_{CB} = 10$ V
NF	Spot Noise Figure [Note 5]		4.0			4.0		db	$I_C = 3.0$ mA $V_{CE} = 10$ V
A_{pg}	Available Power Gain (neutralized) (f = 10.7 mc)		32			32		db	$I_C = 7.0$ mA $V_{CE} = 10$ V
A_{pg}	Available Power Gain (neutralized) (f = 455 kc)		55			55		db	$I_C = 3.0$ mA $V_{CE} = 10$ V
G_C	Conversion Gain (f = 108 mc to 10.7 mc)		20			20		db	$I_C = 7.0$ mA $V_{CE} = 10$ V
$r_b'C_c$	Collector-Base Time Constant (f = 80 mc)			55			55	psec	$I_C = 10$mA $V_{CE} = 15$ V
BV_{CBO}	Collector to Base Breakdown Voltage	45			45			Volts	$I_C = 0.1$ mA $I_E = 0$
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage [Note 3]	45			45			Volts	$I_C = 10$ mA $I_B = 0$ (pulsed)
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0			4.0			Volts	$I_E = .01$ mA $I_C = 0$
h_{fe}	High Frequency Current Gain (f = 100 mc)	2.0	3.5		2.0	3.5			$I_C = 10$ mA $V_{CE} = 15$ V

NOTES:

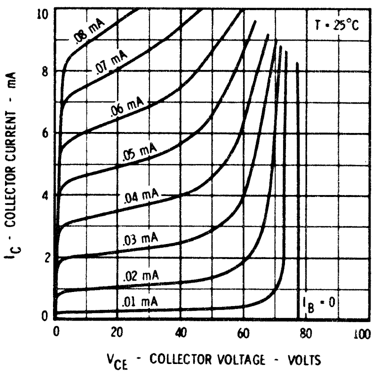
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high-current point where collector-to-emitter voltage is lowest. For more information send or Fairchild Publication APP-4.
(4) Pulse Conditions: length = 300 μsec; duty cycle = 1%.
(5) f = 1.0 mc; $R_S = 300\Omega$.
(6) Reference: Gertzis, S. and Basselaers, R.— Characterization of R.F. Transistors for AM/FM Radio Applications. IRE, PGBTR, Trans., Nov. 1962.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

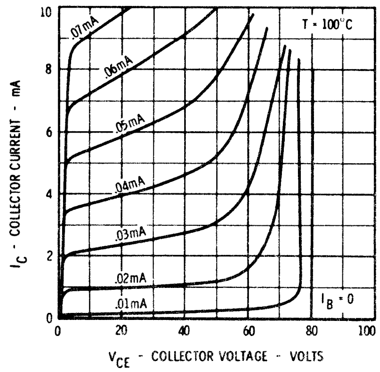
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

TYPICAL ELECTRICAL CHARACTERISTICS

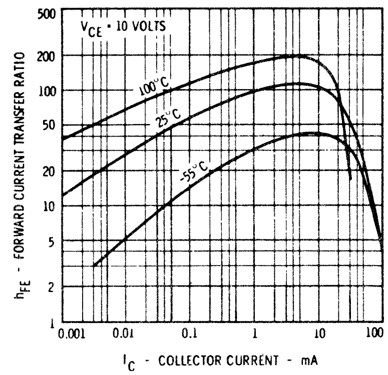
COLLECTOR CHARACTERISTICS



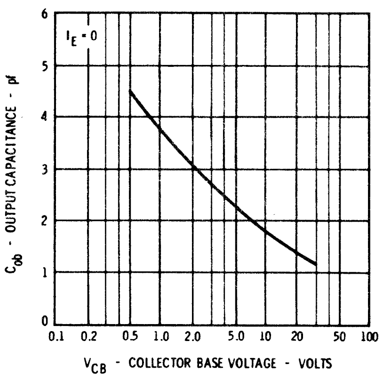
COLLECTOR CHARACTERISTICS



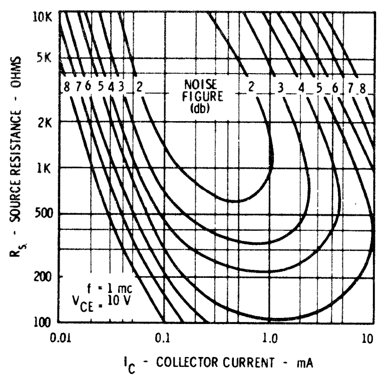
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



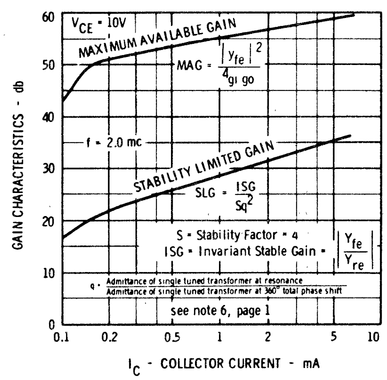
OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



CONTOURS OF SPOT NOISE FIGURE



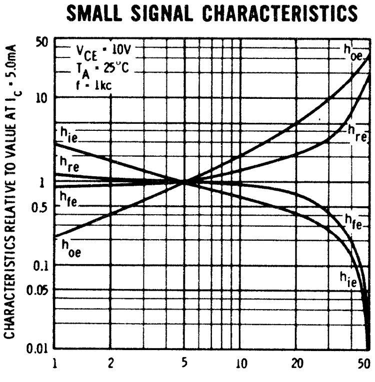
GAIN CHARACTERISTICS VERSUS COLLECTOR CURRENT



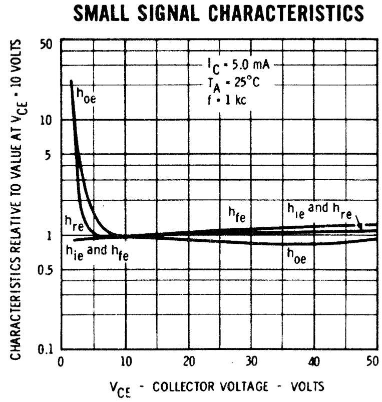
SMALL SIGNAL CHARACTERISTICS (f = 1 KC)

SYMBOL	CHARACTERISTIC	2N3693 TYP.	2N3694 TYP.	UNITS	TEST CONDITIONS
h_{ie}	Input Resistance	900	1130	Ohms	$I_C = 5.0$ mA $V_{CE} = 10$ V
h_{oe}	Output Conductance	25	35	μmho	$I_C = 5.0$ mA $V_{CE} = 10$ V
h_{re}	Voltage Feedback Ratio	1.2	1.25	$x10^{-4}$	$I_C = 5.0$ mA $V_{CE} = 10$ V
h_{fe}	Small Signal Current Gain	110	145		$I_C = 5.0$ mA $V_{CE} = 10$ V

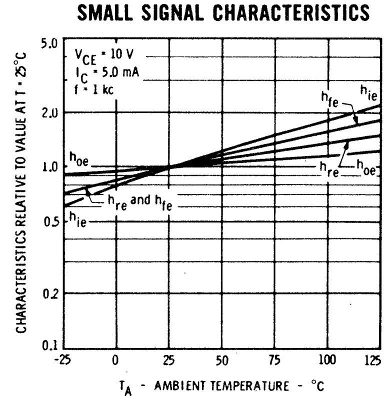
SMALL SIGNAL CHARACTERISTICS



SMALL SIGNAL CHARACTERISTICS

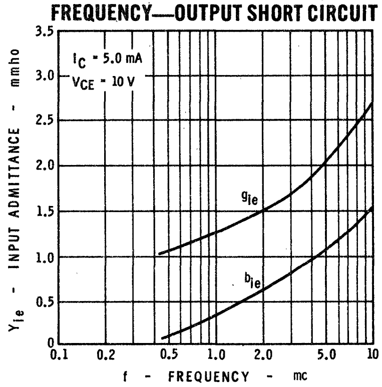


SMALL SIGNAL CHARACTERISTICS

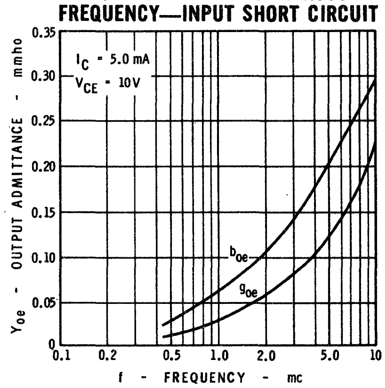


TYPICAL SMALL SIGNAL COMMON EMITTER "Y" PARAMETERS

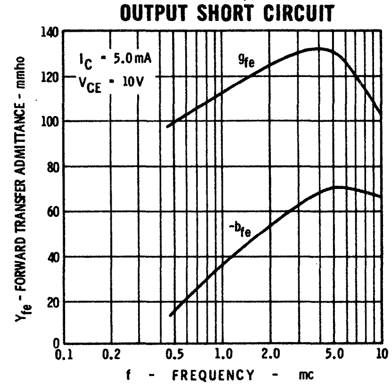
INPUT ADMITTANCE VERSUS FREQUENCY—OUTPUT SHORT CIRCUIT



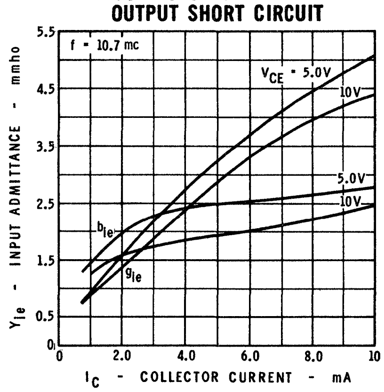
OUTPUT ADMITTANCE VERSUS FREQUENCY—INPUT SHORT CIRCUIT



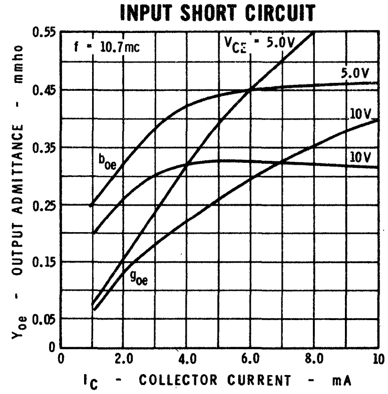
FORWARD TRANSFER ADMITTANCE VERSUS FREQUENCY—OUTPUT SHORT CIRCUIT



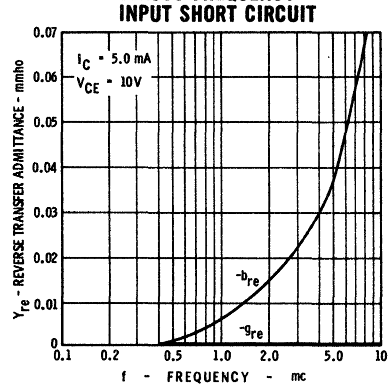
INPUT ADMITTANCE VERSUS COLLECTOR CURRENT—OUTPUT SHORT CIRCUIT



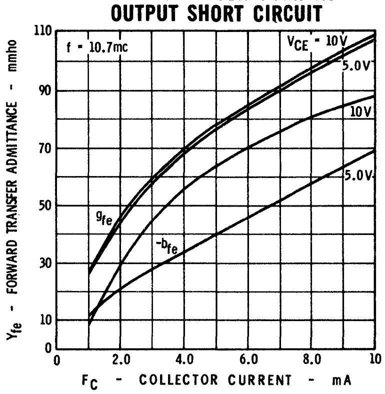
OUTPUT ADMITTANCE VERSUS COLLECTOR CURRENT—INPUT SHORT CIRCUIT



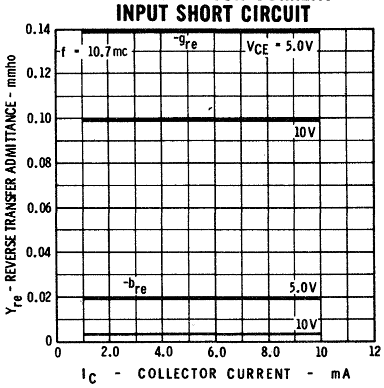
REVERSE TRANSFER ADMITTANCE VERSUS FREQUENCY—INPUT SHORT CIRCUIT



FORWARD TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT—OUTPUT SHORT CIRCUIT

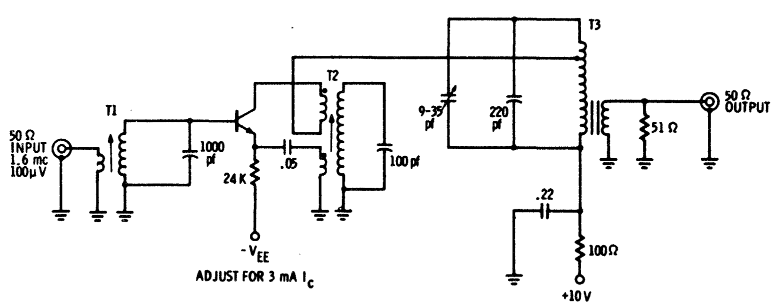


REVERSE TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT—INPUT SHORT CIRCUIT



1.6 MC TO 455 KC AUTODYNE CONVERSION GAIN TEST CIRCUIT

$I_C = 2.0\text{-}3.0$ mA $\quad V_{CE} = 10V$



TYPICAL GAIN = 42 db

T1 Miller Coil Form
Miller Slug #30-106 Core
Primary . . . 6 T #28 enameled wire
Secondary . . . 28 T #36 enameled wire

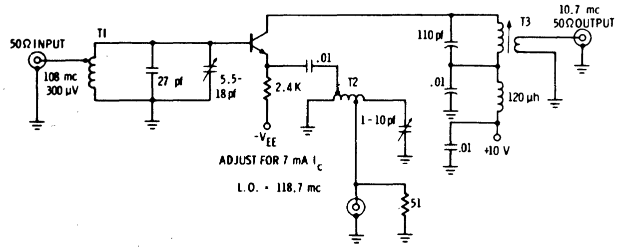
T2 Miller Coil Form
Miller Core #30-106

4 Turns #28 Enameled Wire
60 Turns #36 Enameled Wire
1½ Turns #28 Enameled Wire

T3 Miller #2032 455 KC Transformer
Center Core only

108 MC TO 10.7 MC CONVERSION GAIN TEST CIRCUIT

$I_C = 7.0$ mA $\quad V_{CE} = 10V$



TYPICAL CONVERSION GAIN = 20 db

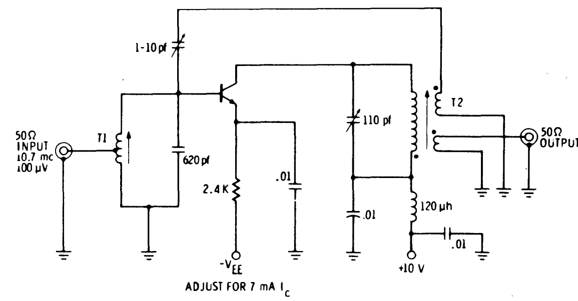
T1 2.5 turns #16 tinned copper wire tapped 2 turns from Gnd. Coil dia. ⅜" (inside dia.).

T2 4 turns #16 tinned copper wire tapped ¾ turn from Gnd. and 1¼ turns from Gnd. Coil dia. ¼" (inside dia.).

T3 Miller Coil Form
Miller Core #30-106
Primary . . . 10 turns #36 enameled wire.
Secondary . . . 1⅓ turns #28 enameled wire.

10.7 MC NEUTRALIZED POWER GAIN TEST CIRCUIT

$I_C = 7.0$ mA $\quad V_{CE} = 10V$



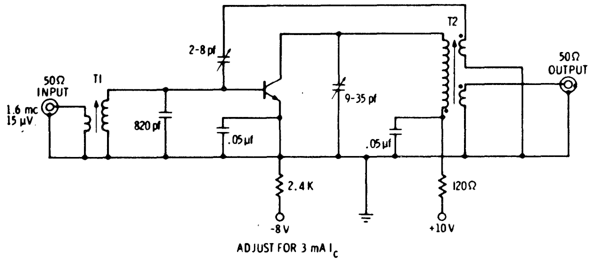
TYPICAL GAIN = 32 db

T1 Miller Coil Form
Miller Core #30-106
4 turns #28 enameled wire tapped 1.5 turns from Gnd.

T2 Miller Coil Form
Miller Core #30-106
Primary . . . 10 turns #36 enameled wire.
Neut. Sec. . . . 5 turns #36 enameled wire (Bifilar).
Output Sec. . . . 1.33 turns #28 enameled wire (Overwind).

NEUTRALIZED A.M. R.F. AMPLIFIER TEST CIRCUIT

$I_C = 3.0$ mA $\quad V_{CE} = 10V$



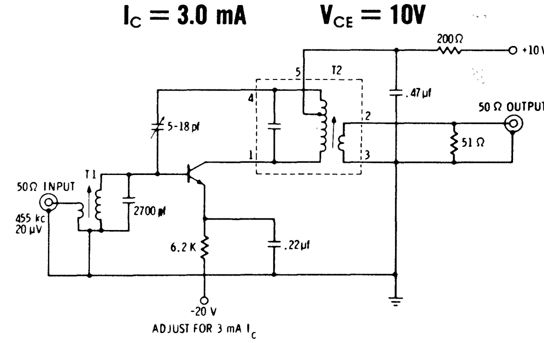
TYPICAL GAIN = 46 db

T1 28 T #36 Nyclad Secondary
6 T #28 Nyclad Primary
Miller #80-106 Core

T2 120 T #40 S.S. Enl. Primary
40 T #40 S.S. Enl. Neut. Sec.
7 T #28 Nyclad Output Sec., wave wound
Bifilar with cold end of Primary.

455 KC NEUTRALIZED A.M. I.F. AMPLIFIER TEST CIRCUIT

$I_C = 3.0$ mA $\quad V_{CE} = 10V$



TYPICAL GAIN = 55 db

T1 13 T Primary #26 Nyclad
54 T Secondary #36 Nyclad
.043 mh
} Miller #30-106 Core

T2 Miller Min. I.F. Transformer #2032.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

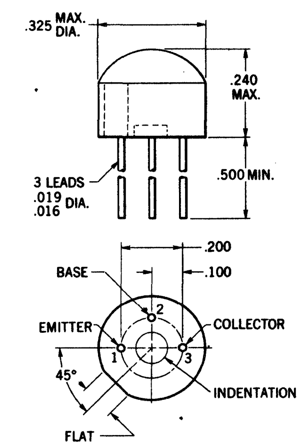
FT3722

NPN HIGH-VOLTAGE, HIGH-CURRENT SWITCH

SILICON PLANAR* EPITAXIAL TRANSISTOR

- **HIGH BREAKDOWN . . . . LV_{CEO} = 60 V (MIN)**
- **HIGH FREQUENCY . . . . f_T = 300 MHz (MIN)**
- **FAST HIGH CURRENT SWITCHING . . . t_{on} = 50 ns (MAX); t_{off} = 100 ns (MAX) AT 500 mA**
- **LOW $V_{CE(sat)}$ . . . . $V_{CE(sat)}$ = 0.5 V (MAX) AT 500 mA**
- **LOW OUTPUT CAPACITANCE . . . . . . C_{cb} = 10 pF (MAX)**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated nickel
Package is electrically Non-conductive material
Package weight is 0.66 gram

*Planar is a patented Fairchild process.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−65°C to +125°C
Operating Junction Temperature	125°C

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	4.0 Watts
at 25°C Ambient Temperature (Notes 2 and 3)	0.5 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	80 Volts
V_{CES}	Collector to Emitter Voltage	80 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	60 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts
	Maximum Collector Current (Note 5)	1.0 Amp

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 4 and 5)	**60**			**Volts**	I_C = 10 mA (pulsed)	I_B = 0
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 5)		**0.35**	**0.5**	**Volts**	I_C = 500 mA	I_B = 50 mA
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 5)		0.25	0.37	Volts	I_C = 300 mA	I_B = 30 mA
t_{on}	**Turn-on Time** (Note 6)		**20**	**50**	**ns**	$I_C \approx$ 500 mA	$I_{B1} \approx$ 50 mA
t_{off}	**Turn-off Time** (Note 6)		**63**	**100**	**ns**	$I_C \approx$ 500 mA,	$I_{B1} \approx$ 50 mA, $I_{B2} \approx$ −50 mA
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**3.0**	**4.0**			I_C = 50 mA	V_{CE} = 10 V
C_{cb}	**Collector-Base Capacitance**		**5.5**	**10**	**pF**	I_E = 0	V_{CB} = 10 V
C_{eb}	Emitter Base Capacitance		50	65	pF	I_C = 0	V_{BE} = −0.5 V

Additional Electrical Characteristics on page 2
Notes on page 4

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

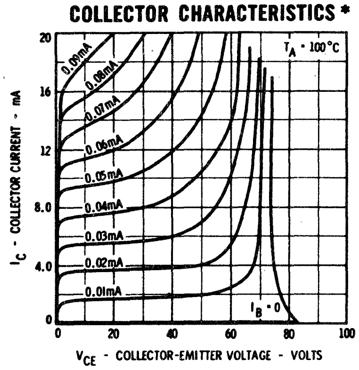
FAIRCHILD TRANSISTOR FT3722

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

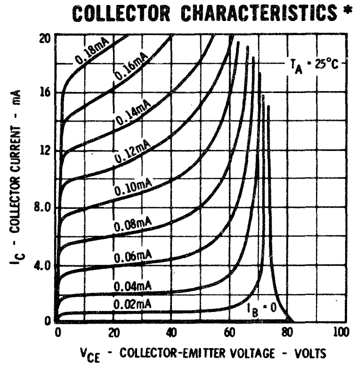
SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain (Note 5)	40	70	150		$I_C = 100$ mA	$V_{CE} = 1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	25	45			$I_C = 10$ mA	$V_{CE} = 1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	20	35			$I_C = 300$ mA	$V_{CE} = 2.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	15	30			$I_C = 500$ mA	$V_{CE} = 2.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	12	25			$I_C = 800$ mA	$V_{CE} = 5.0$ V
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 5)	15	30			$I_C = 100$ mA	$V_{CE} = 1.0$ V
$V_{CE(sat)}$	Collector Saturation Voltage (Note 5)		0.15	0.22	Volts	$I_C = 100$ mA	$I_B = 10$ mA
$V_{CE(sat)}$	Collector Saturation Voltage (Note 5)		0.16	0.25	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
$V_{CE(sat)}$	Collector Saturation Voltage (Note 5)		0.6	2.0	Volts	$I_C = 800$ mA	$I_B = 80$ mA
$V_{BE(sat)}$	Base Saturation Voltage (Note 5)		0.62	0.75	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
$V_{BE(sat)}$	Base Saturation Voltage (Note 5)		0.73	0.85	Volts	$I_C = 100$ mA	$I_B = 10$ mA
$V_{BE(sat)}$	Base Saturation Voltage (Note 5)		0.89	1.1	Volts	$I_C = 300$ mA	$I_B = 30$ mA
$V_{BE(sat)}$	Base Saturation Voltage (Note 5)	0.86	0.91	1.2	Volts	$I_C = 500$ mA	$I_B = 50$ mA
$V_{BE(sat)}$	Base Saturation Voltage (Note 5)		1.0	1.5	Volts	$I_C = 800$ mA	$I_B = 80$ mA
I_{CES}	Collector Reverse Current		0.1	0.5	μA	$V_{CE} = 40$ V	$V_{EB} = 0$
$I_{CES}(65°C)$	Collector Reverse Current		2.0	10	μA	$V_{CE} = 40$ V	$V_{EB} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	80			Volts	$I_C = 100\ \mu$A	$I_E = 0$
B_{CES}	Collector to Emitter Breakdown Voltage	80			Volts	$I_C = 100\ \mu$A	$V_{EB} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			Volts	$I_C = 0$	$I_E = 100\ \mu$A
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 5)	20				$I_C = 200$ mA	$V_{CE} = 2.0$ V

TYPICAL ELECTRICAL CHARACTERISTICS

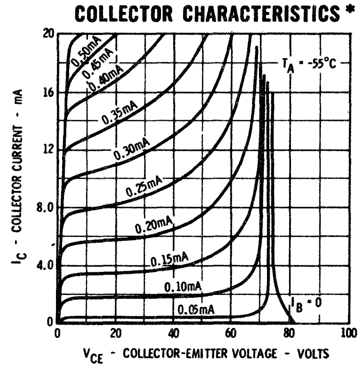
COLLECTOR CHARACTERISTICS *



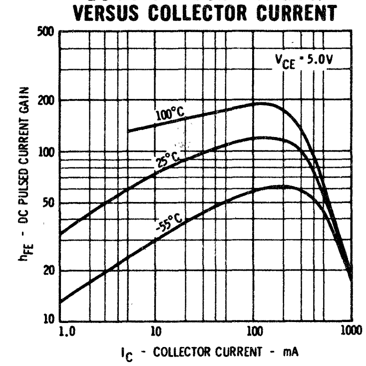
COLLECTOR CHARACTERISTICS *



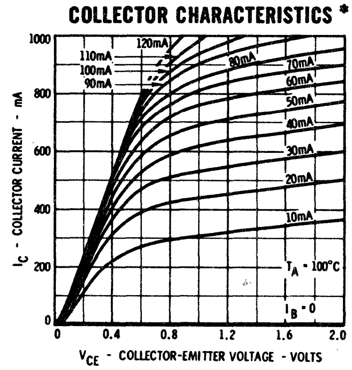
COLLECTOR CHARACTERISTICS *



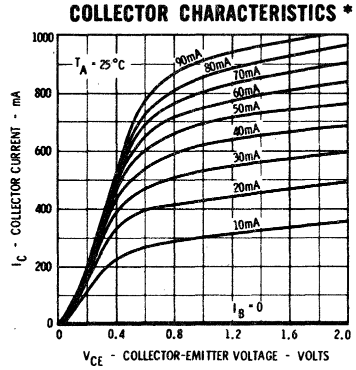
DC PULSED CURRENT GAIN VERSUS COLLECTOR CURRENT



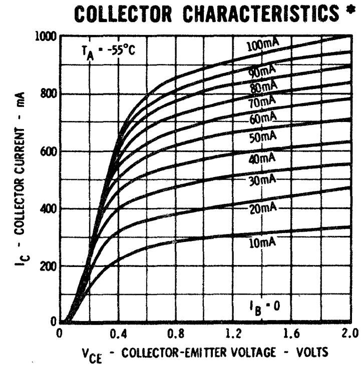
COLLECTOR CHARACTERISTICS *



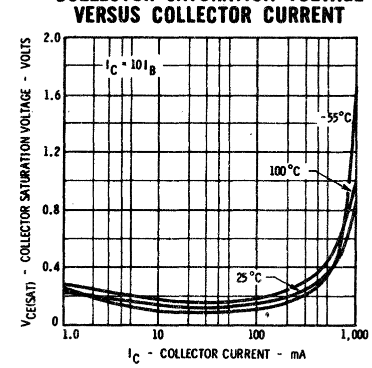
COLLECTOR CHARACTERISTICS *



COLLECTOR CHARACTERISTICS *



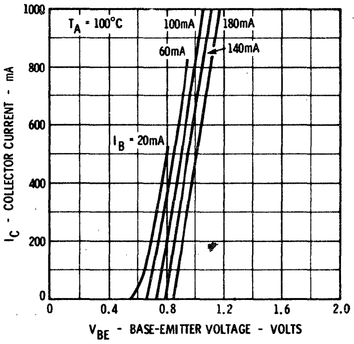
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



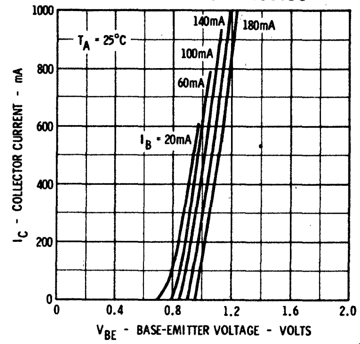
* Single Family Characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

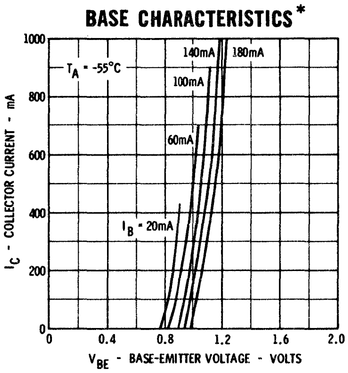
BASE CHARACTERISTICS *



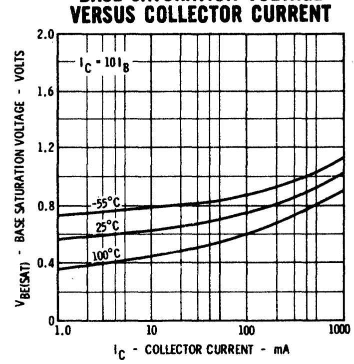
BASE CHARACTERISTICS *



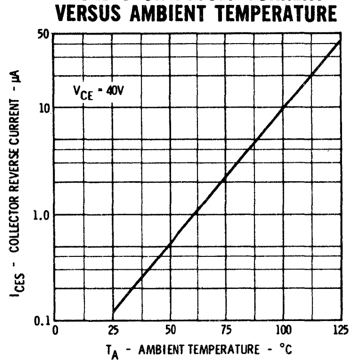
BASE CHARACTERISTICS *



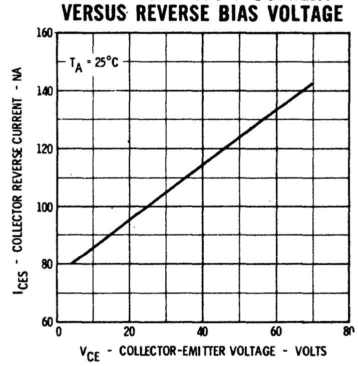
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



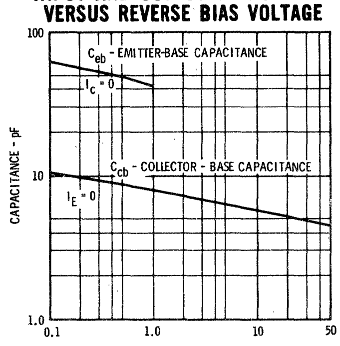
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



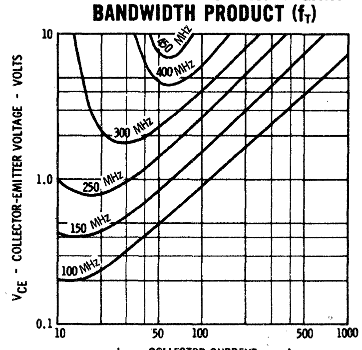
COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



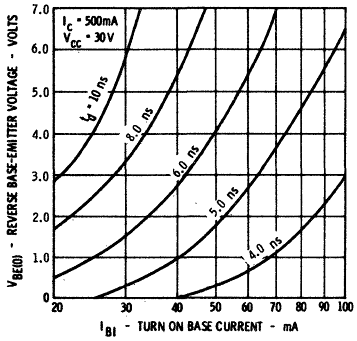
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



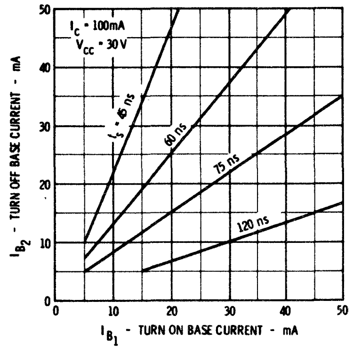
* Single Family Characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

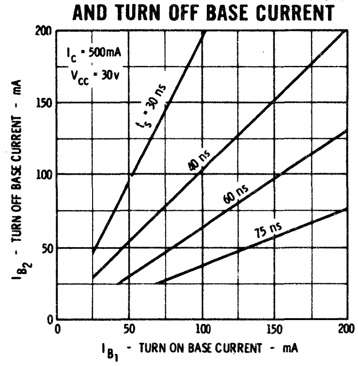
DELAY TIME VERSUS TURN ON BASE CURRENT AND REVERSE BASE EMITTER VOLTAGE



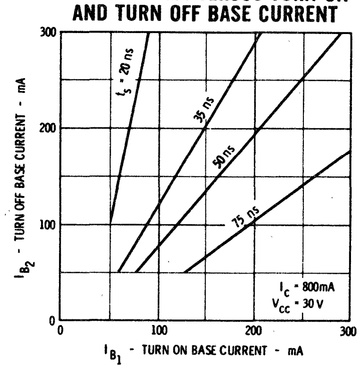
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



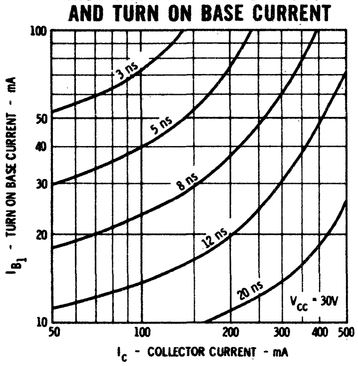
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



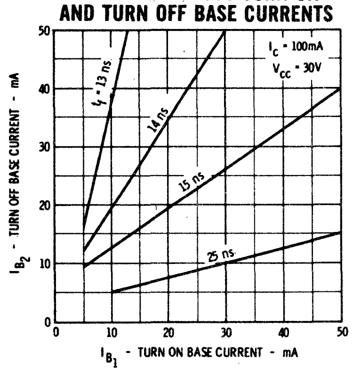
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



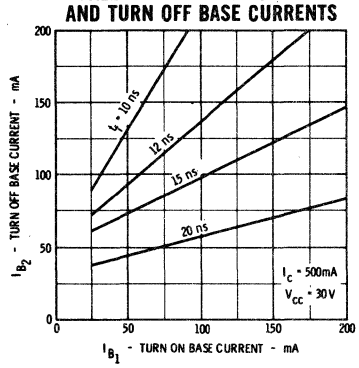
RISE TIME VERSUS COLLECTOR AND TURN ON BASE CURRENT



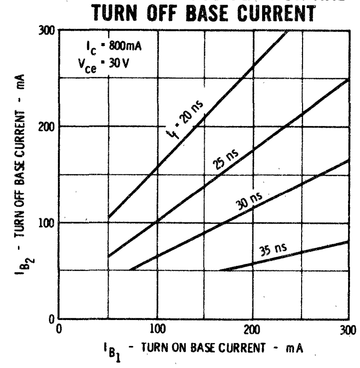
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



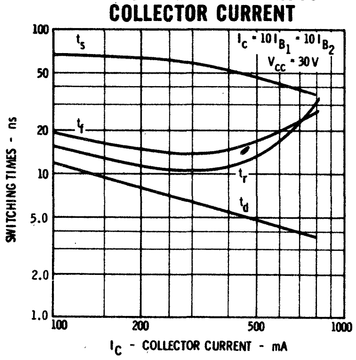
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



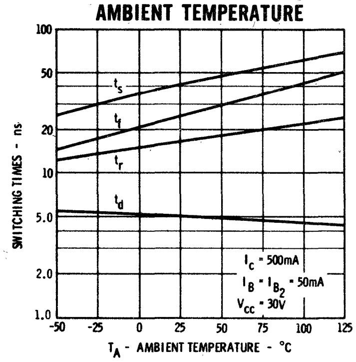
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



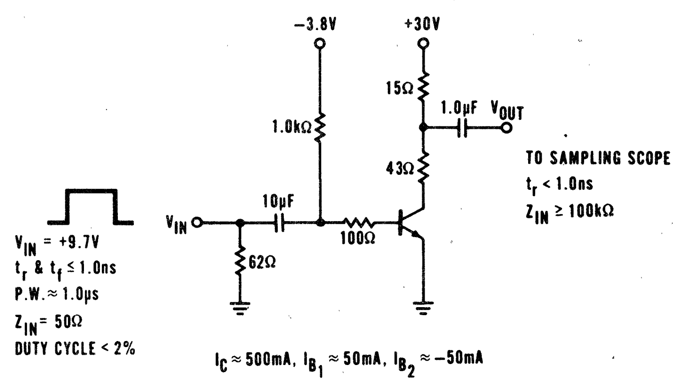
SWITCHING TIMES VERSUS COLLECTOR CURRENT



SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



SWITCHING TIME TEST CIRCUIT



NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor 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 125°C and junction to case thermal resistance of 25°C/Watt (derating factor of 40 mW/°C). Junction to ambient thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C).
(4) Rating refers to a high-current point where collector-to-emitter voltage is lowest.
(5) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(6) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

EN3962

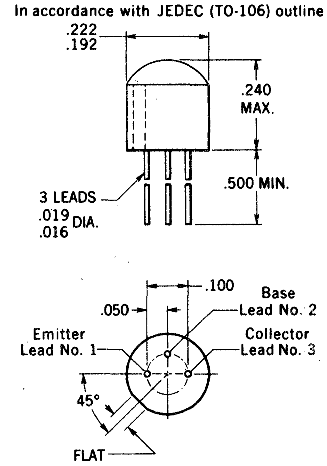
PNP LOW LEVEL, LOW NOISE AMPLIFIER

DIFFUSED SILICON PLANAR* II EPITAXIAL TRANSISTOR

FOR TEST CIRCUITS AND ADDITIONAL DESIGN INFORMATION SEE FAIRCHILD 2N3962 DATA SHEET

- **ELECTRICAL REPLACEMENT FOR 2N3962**
- **LOW NOISE - - NF = 10 dB (max) at 100Hz**
  - - NF = 3 dB (max) at 1kHz
- **HIGH GAIN - - h_{FE} = 60 (min) at 1μA**
  - - h_{FE} = 100-300 at 10μA
- **HIGH BREAKDOWN VOLTAGE - - LV_{CEO} = 60 Volts (min)**
- **EXCELLENT BETA LINEARITY FROM 1μA to 50 mA**

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperatures	−55°C to +125°C
Operating Junction Temperatures	125°C
Lead Temperature (Soldering, 10 second time limit)	260°C

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	0.5 Watt
25°C Ambient Temperature (Notes 2 and 3)	0.2 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage	−60 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	−60 Volts
V_{EBO}	Emitter to Base Voltage	−6.0 Volts

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

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
NF	**Narrow band Noise Figure (f = 100 Hz)**		**3.0**	**10**	**dB**	**I_C = 20 μA** **R_S = 10 kΩ**	**V_{CE} = −0.5 V** **PBW = 15 Hz**
NF	**Narrow band Noise Figure (f = 1.0 kHz)**		**0.8**	**3.0**	**dB**	**I_C = 20 μA** R_S = 10 kΩ	**V_{CE} = −5.0 V** PBW = 150 Hz
NF	Narrow band Noise Figure (f = 10 kHz)		0.8	3.0	dB	I_C = 20 μA R_S = 10 kΩ	V_{CE} = −5.0 V PBW = 1.5 kHz
NF	Wide band Noise Figure		1.0	3.0	dB	I_C = 20 μA R_S = 10 kΩ	V_{CE} = −5.0 V PBW = 15.7 kHz
h_{FE}	**DC Current Gain**	**60**	**175**			**I_C = 1.0 μA**	V_{CE} = −5.0 V
h_{FE}	**DC Current Gain**	**100**	**210**	**300**		**I_C = 10 μA**	V_{CE} = −5.0 V
h_{FE}	**DC Current Gain**	**100**	**240**			**I_C = 100 μA**	V_{CE} = −5.0 V
h_{FE}	**DC Current Gain**	**100**	**260**	**450**		**I_C = 1.0 mA**	V_{CE} = −5.0 V
h_{FE}	**DC Pulse Current Gain** (Note 5)	**100**	**280**			**I_C = 10 mA**	V_{CE} = −5.0 V
h_{FE}	**DC Pulse Current Gain** (Note 5)	**90**	**260**			**I_C = 50 mA**	V_{CE} = −5.0 V
h_{FE}(−55°C)	DC Current Gain	40	90			I_C = 10 μA	V_{CE} = −5.0 V
h_{FE}(−55°C)	DC Pulse Current Gain (Note 5)	45	150			I_C = 50 mA	V_{CE} = −5.0 V
h_{FE}(100°C)	DC Current Gain		375	600		I_C = 1.0 mA	V_{CE} = −5.0 V

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	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
BV_{CBO}	Collector to Base Breakdown Voltage	−60			Volts	$I_C = 10\ \mu A$	$I_E = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	−60			Volts	$I_C = 10\ \mu A$	$I_B = 0$
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage** (Notes 4 and 5)	**−60**			Volts	$I_C = 5.0$ mA(pulsed)	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−6.0			Volts	$I_C = 0$	$I_E = 10\ \mu A$
I_{CES}	Collector Reverse Current		0.5	50	nA	$V_{CE} = -50$ V	$V_{EB} = 0$
I_{CES}(100°C)	Collector Reverse Current		2.0	10	μA	$V_{CE} = -50$ V	$V_{EB} = 0$
I_{EBO}	Emitter Cutoff Current			10	nA	$I_C = 0$	$V_{EB} = -4.0$ V
V_{CE}(sat)	Collector Saturation Voltage		−0.1	−0.25	Volts	$I_C = 10$ mA	$I_B = 0.5$ mA
V_{CE}(sat)	Collector Saturation Voltage (Note 5)		−0.16	−0.4	Volts	$I_C = 50$ mA	$I_B = 5.0$ mA
V_{BE}(sat)	Base Saturation Voltage		−0.72	−0.9	Volts	$I_C = 10$ mA	$I_B = 0.5$ mA
V_{BE}(sat)	Base Saturation Voltage (Note 5)		−0.81	−0.95	Volts	$I_C = 50$ mA	$I_B = 5.0$ mA
h_{ie}	Input Resistance (f = 1.0 kHz)	2.5	8.0	17	kΩ	$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{oe}	Output Conductance (f = 1.0 kHz)	5.0	19	40	μmho	$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{re}	Voltage Feedback Ratio (f = 1.0 kHz)			10	$x10^{-4}$	$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{fe}	Small Signal Current Gain (f =1.0 kHz)	100	300	550		$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{fe}	High Frequency Current Gain (f = 20MHz)	2.0		8.0		$I_C = 0.5$ mA	$V_{CE} = -5.0$ V
C_{obo}	Open Circuit Output Capacitance			6.0	pF	$I_E = 0$	$V_{CB} = -5.0$ V
C_{ibo}	Open Circuit Input Capacitance			16	pF	$I_C = 0$	$V_{EB} = -0.5$ 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 application involving pulsed or low-duty cycle operations.
(3) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C; junction-to-ambient thermal resistance of 500°C/Watt (derating factor of 2.0 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%.

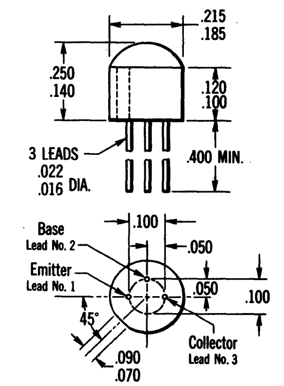
SE4001 • SE4002 • SE4010

NPN HIGH-GAIN, LOW NOISE TYPE

DIFFUSED SILICON PLANAR* TRANSISTORS

The Fairchild SE4001, SE4002, and SE4010 are very high beta NPN silicon PLANAR transistors suitable for high gain audio pre-amplifier stages and direct coupled circuits. The SE4010 is selected for low noise applications. They also feature the solid package designed to give maximum mechanical support to the transistor chip.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures	
Operating Junction Temperature	125°C Maximum
Storage Temperature	−55°C to +125°C
Soldering Temperature (10 sec. time limit)	260°C Maximum
Maximum Power Dissipation	
Total Dissipation at 25°C Case Temperature [Note 2]	0.5 Watt
at 65°C Case Temperature [Note 2]	0.3 Watt
at 25°C Ambient Temperature [Note 2]	0.2 Watt
Maximum Voltages	
V_{CBO} Collector to Base Voltage	30 Volts
V_{CEO} Collector to Emitter Voltage [Note 3]	25 Volts
V_{EBO} Emitter to Base Voltage	6.0 Volts

ELECTRICAL CHARACTERISTICS

(25°C free air temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	SE4001 Min.	SE4001 Typ.	SE4001 Max.	SE4002 Min.	SE4002 Typ.	SE4002 Max.	SE4010 Min.	SE4010 Typ.	SE4010 Max.	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain	60	220	300	200	350	1000	200	350	1000		$I_C = 1.0$ mA $V_{CE} = 10$ V
h_{FE}	DC Current Gain		50			100			100			$I_C = 50\ \mu A$ $V_{CE} = 10$ V
h_{fe}	High Frequency Current Gain (f = 20 MHz)							1.0	1.3			$I_C = 50\ \mu A$ $V_{CE} = 5.0$ V
h_{fe}	High Frequency Current Gain (f = 20 MHz)	2.0			3.0			3.0				$I_C = 1.0$ mA $V_{CE} = 5.0$ V
NF	Narrow Band Noise Figure [Note 5]								1.5	3.0	dB	$I_C = 30\ \mu A$ $V_{CE} = 5.0$ V
V_{CE} (sat)	Collector Saturation Voltage			0.35			0.35			0.35	Volts	$I_C = 1.0$ mA $I_B = 0.1$ mA
I_{CBO}	Collector Cutoff Current			200			200			200	nA	$I_E = 0$ $V_{CB} = 5.0$ V
I_{CBO} (65°C)	Collector Cutoff Current			3.0			3.0			3.0	μA	$I_E = 0$ $V_{CB} = 5.0$ V
C_{obo}	Output Capacitance			4.0			4.0			4.0	pF	$I_E = 0$ $V_{CB} = 5.0$ V
BV_{CBO}	Collector to Base Breakdown Voltage	30			30			30			Volts	$I_C = 100\ \mu A$ $I_E = 0$
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage [Notes 3 and 4]	25			25			25			Volts	$I_C = 10$ mA $I_B = 0$ (pulsed)
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			6.0			6.0			Volts	$I_E = 100\ \mu A$ $I_C = 0$

NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high-current point where collector-to-emitter voltage is lowest. For more information send for Fairchild Publication APP-4.
(4) Pulse Conditions: length = 300 μsec; duty cycle = 1%.
(5) R_S = 10 kΩ; f = 1 kHz; Power Bandwidth of 200 Hz.

* Planar is a patented Fairchild process.

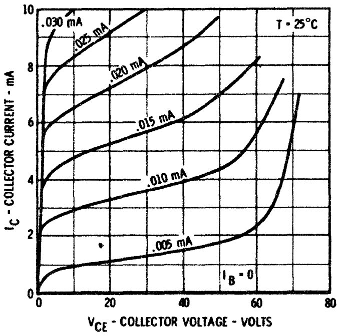
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

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

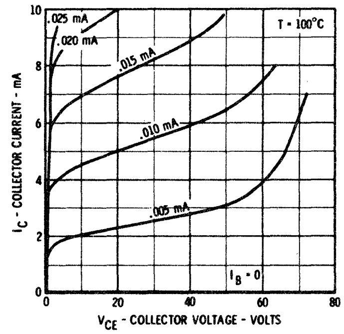
TYPICAL ELECTRICAL CHARACTERISTICS

SE4001

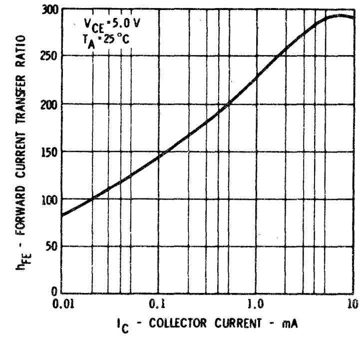
COLLECTOR CHARACTERISTICS*



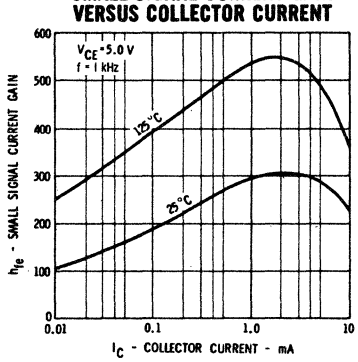
COLLECTOR CHARACTERISTICS*



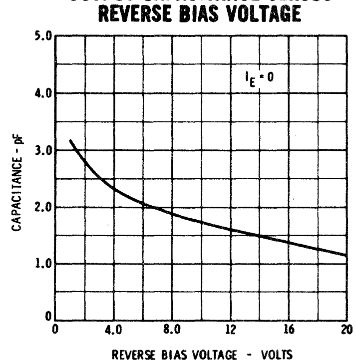
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



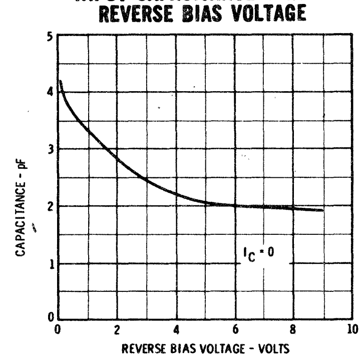
SMALL SIGNAL CURRENT GAIN VERSUS COLLECTOR CURRENT



OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE

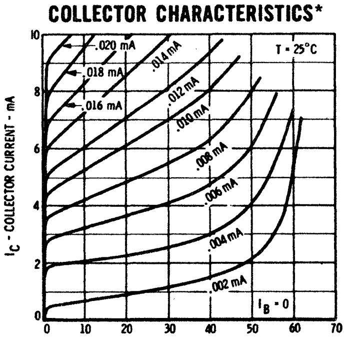


INPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE

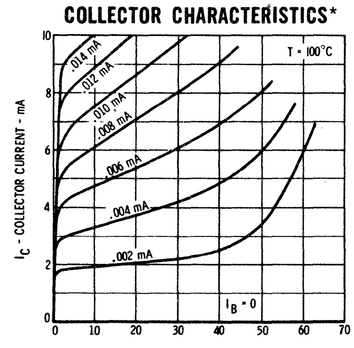


SE4002 • SE4010

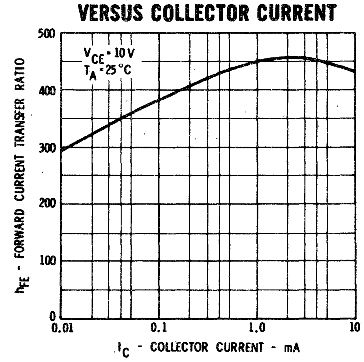
COLLECTOR CHARACTERISTICS*



COLLECTOR CHARACTERISTICS*



PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT

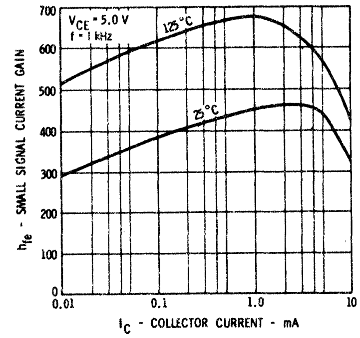


* Single family characteristic on Transistor Curve Tracer.

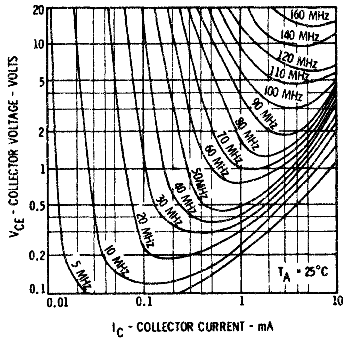
TYPICAL ELECTRICAL CHARACTERISTICS

SE4002 • SE4010

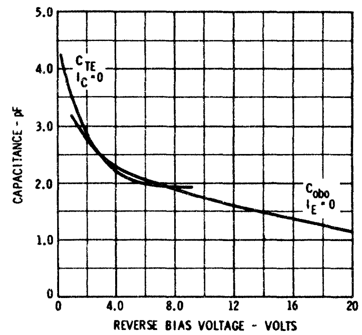
SMALL SIGNAL CURRENT GAIN VERSUS COLLECTOR CURRENT



CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)

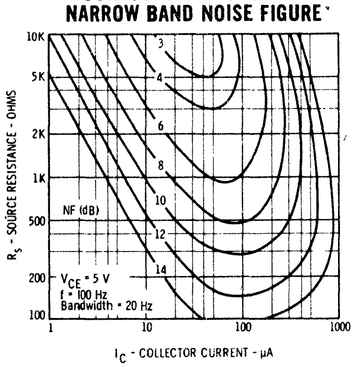


INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE

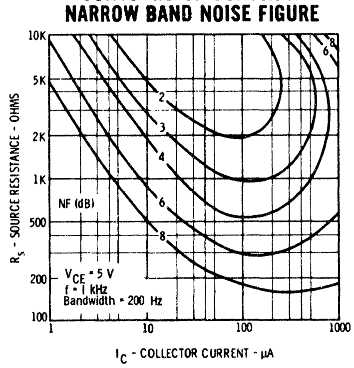


SE4010

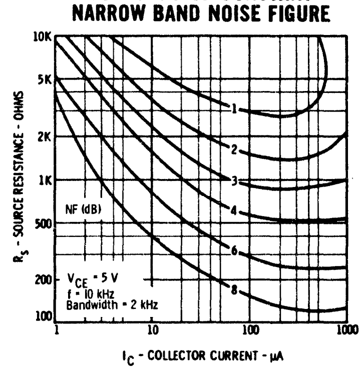
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



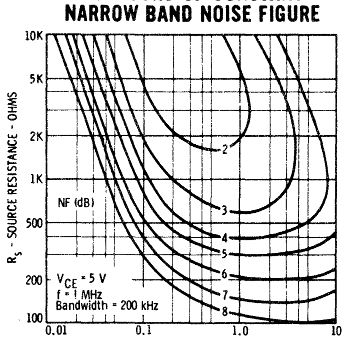
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



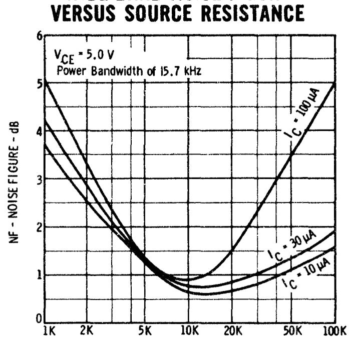
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



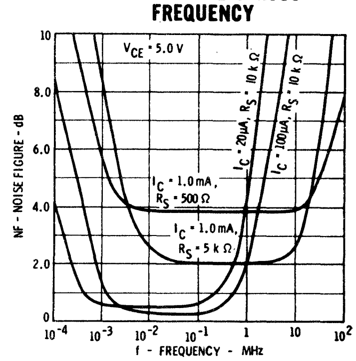
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



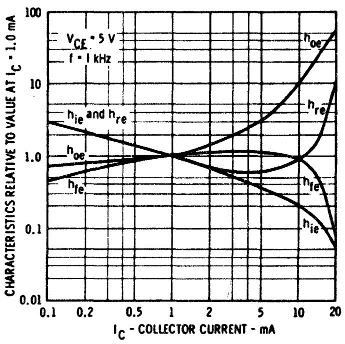
WIDE BAND NOISE FIGURE VERSUS SOURCE RESISTANCE

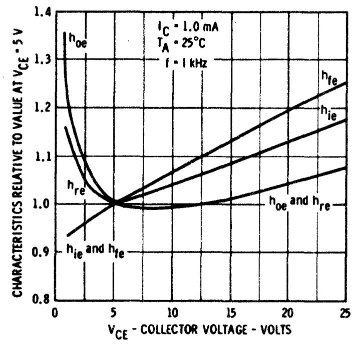


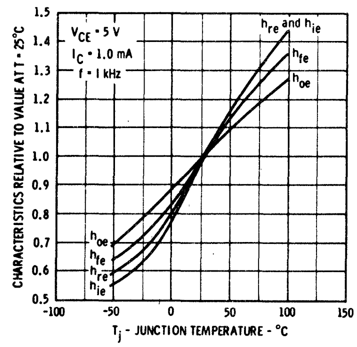
NOISE FIGURE VERSUS FREQUENCY



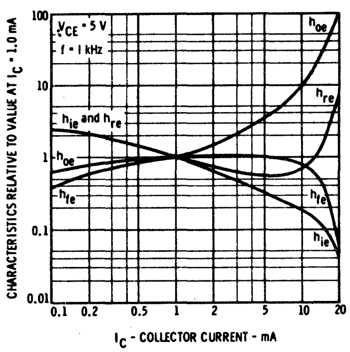
COMMON EMITTER CHARACTERISTICS

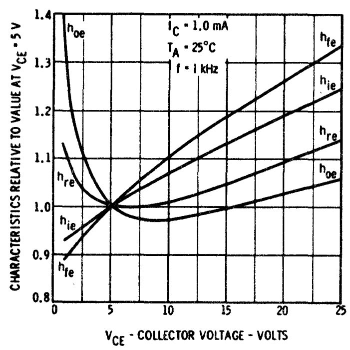


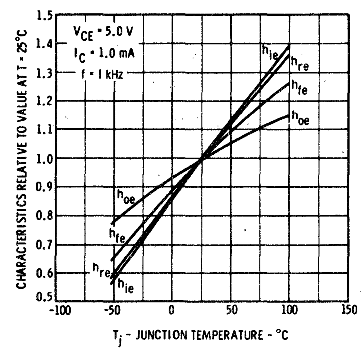




SE4002 • SE4010
COMMON EMITTER CHARACTERISTICS





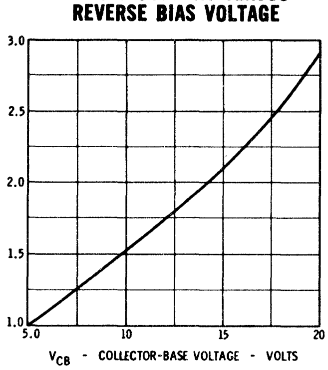


SMALL SIGNAL CHARACTERISTICS (f = 1 kHz)

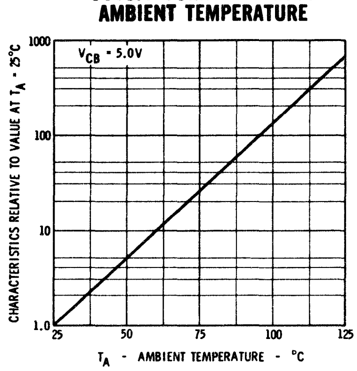
SYMBOL	CHARACTERISTIC	SE4001 TYP.	SE4002 • SE4010 TYP.	UNITS	TEST CONDITIONS
h_{ie}	Input Resistance	7.5	15	kohms	I_C = 1.0 mA V_{CE} = 5.0 V
h_{oe}	Output Conductance	11	15	µmho	I_C = 1.0 mA V_{CE} = 5.0 V
h_{re}	Voltage Feedback Ratio	300	425	$x10^{-6}$	I_C = 1.0 mA V_{CE} = 5.0 V
h_{fe}	Small Signal Current Gain	280	400		I_C = 1.0 mA V_{CE} = 5.0 V
h_{ib}	Input Resistance	27	27	ohms	I_C = 1.0 mA V_{CB} = 5.0 V

SE4001 • SE4002 • SE4010

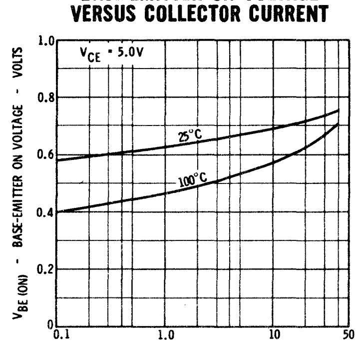
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



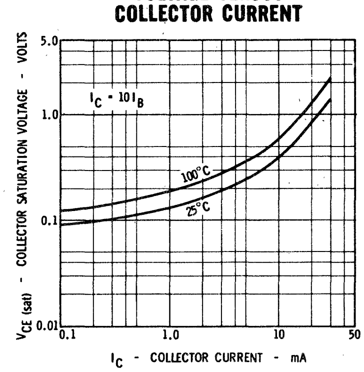
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



BASE-EMITTER ON VOLTAGE VERSUS COLLECTOR CURRENT



COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



FAIRCHILD SEMICONDUCTOR

A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

FT107C • SE4020

NPN LOW LEVEL, LOW NOISE AMPLIFIERS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **LOW 1/f NOISE . . . . NF = 2.5 dB (TYP) AT 100 Hz; 1.0 kΩ**
- **HIGH GAIN . . . . h_{FE} = 100 (MIN) AT 10 μA**
  h_{FE} = 150 (MIN) AT 10 mA
- **LOW SATURATION VOLTAGE . . . $V_{CE(sat)}$ = 0.2 V (MAX) AT 10 mA/0.5 mA**
- **LOW LEAKAGE . . . . I_{CBO} = 2.0 nA (MAX) AT V_{CB} = 45 V**
  I_{CBO} = 50 nA (MAX) AT V_{CB} = 45 V, T_A = 65°C (SE4020)
  I_{CBO} = 1.0 μA (MAX) AT V_{CB} = 45 V, T_A = 125°C (FT107C)

ABSOLUTE MAXIMUM RATINGS (Note 1)

		FT107C	SE4020
Maximum Temperatures			
Storage Temperatures		−65°C to +150°C	−65°C to +125°C
Operating Junction Temperatures		+150°C	+125°C
Lead Temperature (Soldering, 10 seconds time limit)		+300°C	+260°C
Maximum Power Dissipation (Notes 2 and 3)			
Total Dissipation at 25°C Case Temperature		0.86 Watt	0.5 Watt
25°C Ambient Temperature		0.26 Watt	0.2 Watt
Maximum Voltages			
V_{CBO}	Collector to Base Voltage	60 Volts	60 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	60 Volts	60 Volts
V_{EBO}	Emitter to Base Voltage	8.0 Volts	8.0 Volts
I_C	Continuous Collector Current	50 mA	50 mA

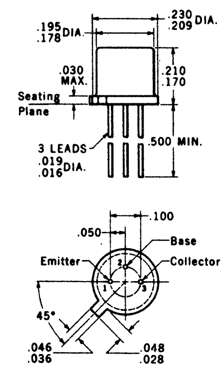
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
NF	Narrow-Band Noise Figure (f = 1.0 kHz)		2.5	6.0	dB	I_C = 100 μA V_{CE} = 5.0 V R_S = 1.0 kΩ BW = 400 Hz
NF	Narrow-Band Noise Figure (f = 1.0 kHz)		1.5	3.0	dB	I_C = 10 μA V_{CE} = 5.0 V R_S = 10 kΩ BW = 400 Hz
NF	**Narrow-Band Noise Figure (f = 100 Hz)**		**2.5**		**dB**	**I_C = 100 μA V_{CE} = 5.0 V R_S = 1.0 kΩ BW = 8.0 Hz**
NF	Wide-Band Noise Figure (f = 10 Hz to 10 kHz)		1.5	3.0	dB	I_C = 10 μA V_{CE} = 5.0 V R_S = 10 kΩ BW = 15.7 kHz
h_{FE}	**DC Current Gain**	**100**	**205**			**I_C = 10 μA V_{CE} = 5.0 V**
h_{FE}	DC Current Gain	120	245			I_C = 100 μA V_{CE} = 5.0 V
h_{FE}	DC Current Gain	135	290			I_C = 1.0 mA V_{CE} = 5.0 V
h_{FE}	**DC Pulse Current Gain** (Note 5)	**150**	**310**	**950**		**I_C = 10 mA V_{CE} = 5.0 V**
h_{FE}(−55°C)	DC Current Gain	25				I_C = 10 μA V_{CE} = 5.0 V
h_{FE}(100°C)	DC Pulse Current Gain (FT107C) (Note 5)		400	1450		I_C = 10 mA V_{CE} = 5.0 V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	1.0	2.0			I_C = 10 mA V_{CE} = 5.0 V

Additional Electrical Characteristics on Page 2

Notes on Page 4

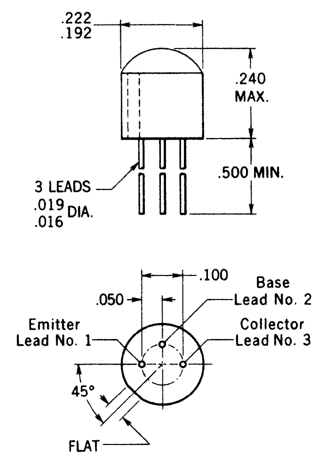
PHYSICAL DIMENSIONS
in accordance with JEDEC (TO-18) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Collector internally connected to case
Package weight is 0.43 gram

FT107C

PHYSICAL DIMENSIONS
in accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram Package is electrically non-conductive material

SE4020

*Planar is a patented Fairchild process.

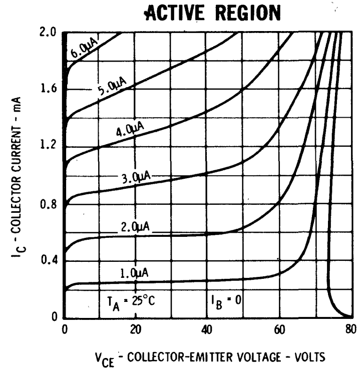
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

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

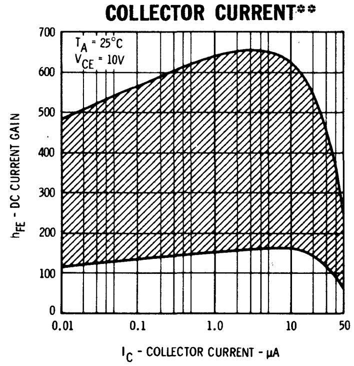
SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
I_{CBO}	**Collector Cutoff Current**		**0.2**	**2.0**	**nA**	$I_E = 0$	$V_{CB} = 45$ V
$I_{CBO}(65°C)$	**Collector Cutoff Current** (SE4020)		**3.0**	**50**	**nA**	$I_E = 0$	$V_{CB} = 45$ V
$I_{CBO}(125°C)$	**Collector Cutoff Current** (FT107C)		**0.1**	**1.0**	**μA**	$I_E = 0$	$V_{CB} = 45$ V
I_{EBO}	Emitter Cutoff Current		0.007	1.0	nA	$I_C = 0$	$V_{EB} = 5.0$ V
C_{cb}	Collector to Base Capacitance		2.5	4.0	pF	$I_E = 0$	$V_{CB} = 5.0$ V
C_{eb}	Emitter to Base Capacitance		4.0	6.0	pF	$I_C = 0$	$V_{EB} = 0.5$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	60			Volts	$I_C = 5.0$ mA	$I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	60			Volts	$I_C = 10\ \mu A$	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	8.0			Volts	$I_C = 0$	$I_E = 10\ \mu A$
$V_{CE(sat)}$	**Pulsed Collector to Emitter Saturation Voltage** (Note 5)		**0.12**	**0.2**	**Volt**	$I_C = 10$ mA	$I_B = 0.5$ mA
$V_{CE(sat)}$	Pulsed Collector to Emitter Saturation Voltage (Note 5)		0.17	0.3	Volt	$I_C = 50$ mA	$I_B = 5.0$ mA
$V_{BE(on)}$	Base to Emitter On Voltage		0.64	0.7	Volt	$I_C = 1.0$ mA	$V_{CE} = 5.0$ V

TYPICAL ELECTRICAL CHARACTERISTICS

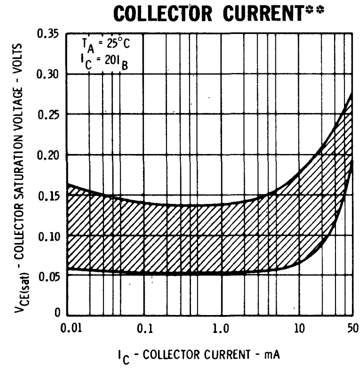
COLLECTOR CHARACTERISTICS* ACTIVE REGION



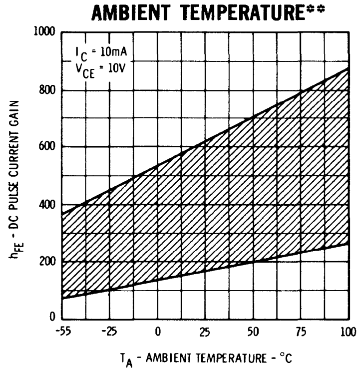
DC CURRENT GAIN VERSUS COLLECTOR CURRENT**



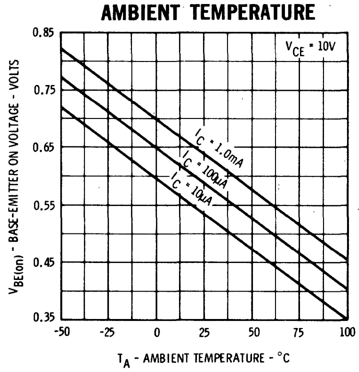
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT**



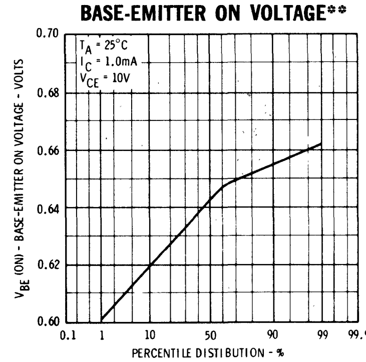
DC PULSE CURRENT GAIN VERSUS AMBIENT TEMPERATURE**



BASE-EMITTER ON VOLTAGE VERSUS AMBIENT TEMPERATURE



DISTRIBUTION OF BASE-EMITTER ON VOLTAGE**

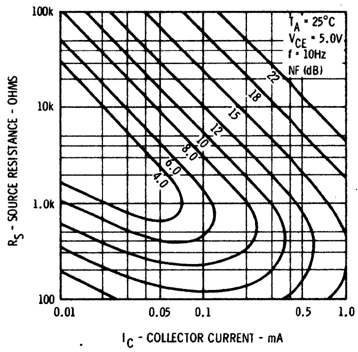


* Single family characteristic on Transistor Curve Tracer.

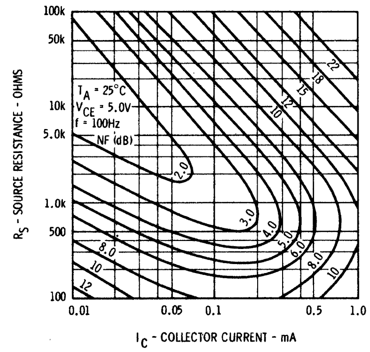
** In recognition of the needs of computer aided design, correlation and distribution information is shown for key parameters. These curves are not guaranteed but represent with a high degree of confidence the distributions and correlations to be expected.

TYPICAL ELECTRICAL CHARACTERISTICS

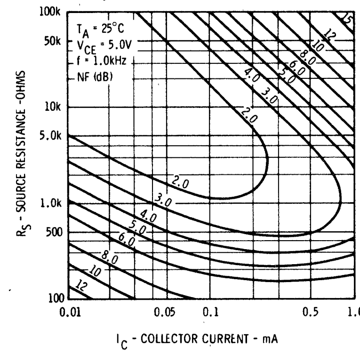
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



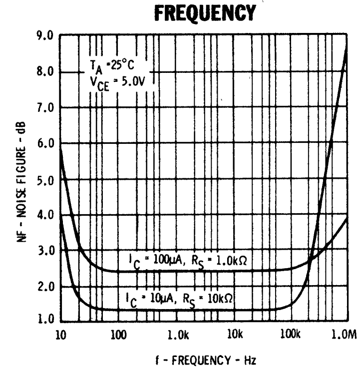
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



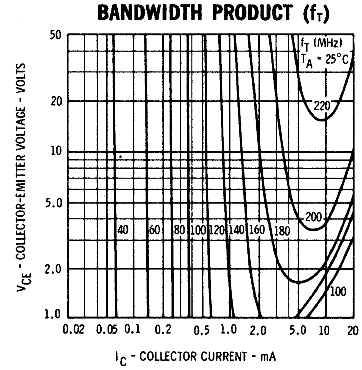
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



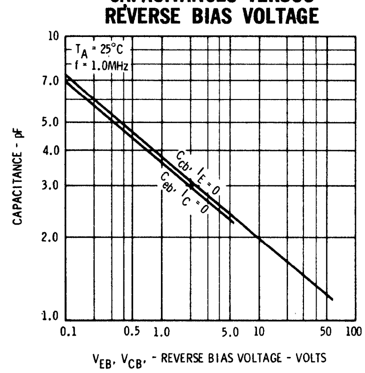
NOISE FIGURE VERSUS FREQUENCY



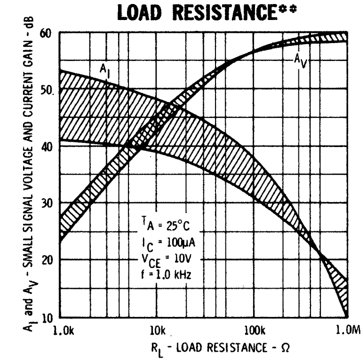
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



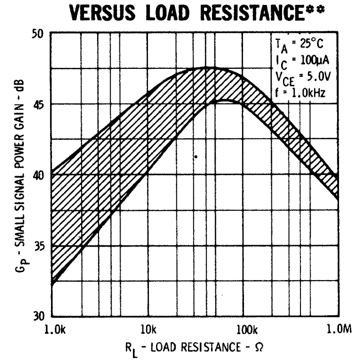
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



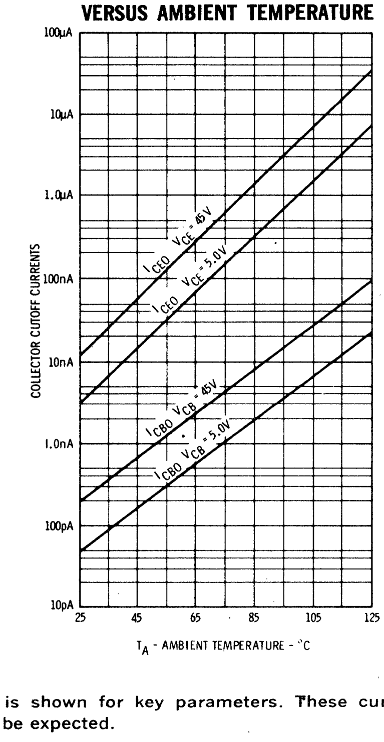
SMALL SIGNAL VOLTAGE AND CURRENT GAIN VERSUS LOAD RESISTANCE**



SMALL SIGNAL POWER GAIN VERSUS LOAD RESISTANCE**



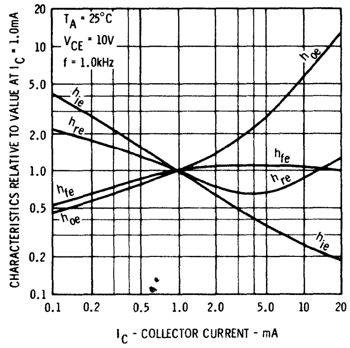
COLLECTOR CUTOFF CURRENTS VERSUS AMBIENT TEMPERATURE



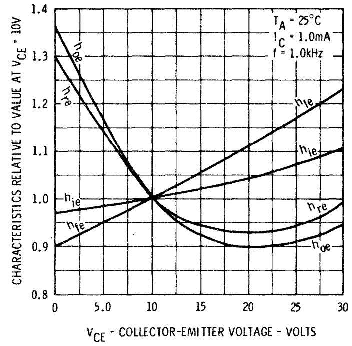
** In recognition of the needs of computer aided design, correlation and distribution information is shown for key parameters. These curves are not guaranteed but represent with a high degree of confidence the distributions and correlations to be expected.

TYPICAL ELECTRICAL CHARACTERISTICS

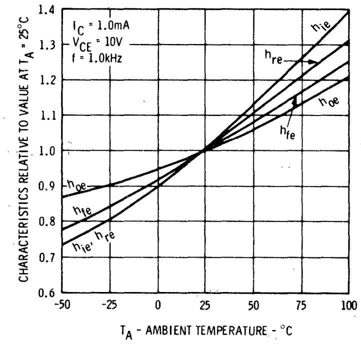
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR CURRENT



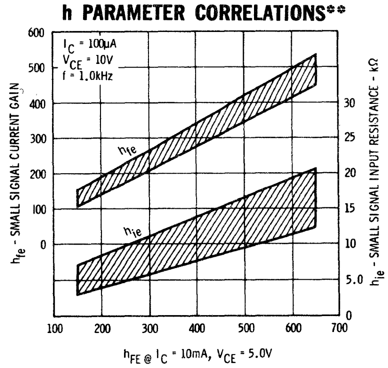
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR-EMITTER VOLTAGE



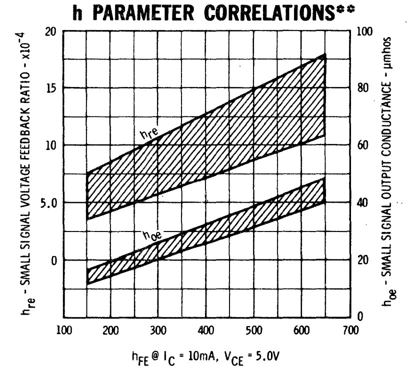
COMMON EMITTER CHARACTERISTICS VERSUS AMBIENT TEMPERATURE



h PARAMETER CORRELATIONS**



h PARAMETER CORRELATIONS**



** In recognition of the needs of computer aided design, correlation and distribution information is shown for key parameters. These curves are not guaranteed but represent with a high degree of confidence the distributions and correlations to be expected.

SMALL SIGNAL CHARACTERISTICS (f = 1.0 kHz)

SYMBOL	CHARACTERISTICS	TYP.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance	8.5	kohms	$I_C = 1.0$ mA	$V_{CE} = 10$ V
h_{oe}	Output Conductance	24	µmhos	$I_C = 1.0$ mA	$V_{CE} = 10$ V
h_{re}	Voltage Feedback Ratio	7.0	$x10^{-4}$	$I_C = 1.0$ mA	$V_{CE} = 10$ V
h_{fe}	Small Signal Current Gain	335		$I_C = 1.0$ mA	$V_{CE} = 10$ 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 150°C and junction to case thermal resistance of 146°C/Watt (derating factor of 6.9 mW/°C); junction to ambient thermal resistance of 480°C/Watt (derating factor of 2.1 mW/°C) for FT107C. A maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C) for SE4020.
(4) This rating refers to a high current point where collector to emitter voltage is lowest.
(5) Pulse Conditions: length = 300 µs; duty cycle = 1%.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

FT107B • SE4021

NPN LOW LEVEL, LOW NOISE AMPLIFIERS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **LOW 1/f NOISE . . . . NF = 6.0 dB (TYP) AT 10 Hz, 1.0 kΩ**
- **HIGH GAIN . . . . h_{FE} = 450 (MIN) AT 10 μA**
  h_{FE} = 600 (MIN) AT 10 mA
- **LOW SATURATION VOLTAGE . . . $V_{CE(sat)}$ = 0.2 V (MAX) AT 10 mA/0.5 mA**
- **LOW LEAKAGE . . . . I_{CBO} = 2.0 nA (MAX) AT V_{CB} = 30 V**
  I_{CBO} = 50 nA (MAX) AT V_{CB} = 30 V, T_A = 65°C (SE4021)
  I_{CBO} = 1.0 μA (MAX) AT V_{CB} = 30 V, T_A = 125°C (FT107B)

ABSOLUTE MAXIMUM RATINGS (Note 1)

		FT107B	SE4021
Maximum Temperatures			
Storage Temperatures		−65°C to +150°C	−65°C to +125°C
Operating Junction Temperatures		+150°C	+125°C
Lead Temperature (Soldering, 10 seconds time limit)		+300°C	+260°C
Maximum Power Dissipation (Notes 2 and 3)			
Total Dissipation at 25°C Case Temperature		0.86 Watt	0.5 Watt
25°C Ambient Temperature		0.26 Watt	0.2 Watt
Maximum Voltages			
V_{CBO}	Collector to Base Voltage	45 Volts	45 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	45 Volts	45 Volts
V_{EBO}	Emitter to Base Voltage	8.0 Volts	8.0 Volts
I_C	Continuous Collector Current	50 mA	50 mA

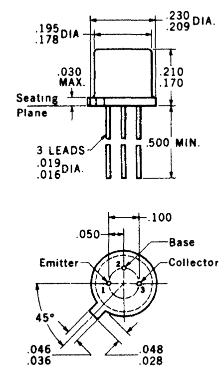
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
NF	Narrow-Band Noise Figure (f = 1.0 kHz)		3.5	6.0	dB	I_C = 100 μA V_{CE} = 5.0 V R_S = 1.0 kΩ BW = 400 Hz
NF	Narrow-Band Noise Figure (f = 1.0 kHz)		1.5	4.0	dB	I_C = 100 μA V_{CE} = 5.0 V R_S = 10 kΩ BW = 400 Hz
NF	Narrow-Band Noise Figure (f = 1.0 kHz)		2.5	8.0	dB	I_C = 100 μA V_{CE} = 5.0 V R_S = 100 kΩ BW = 400 Hz
NF	Narrow-Band Noise Figure (f = 100 Hz)		3.5			I_C = 100 μA V_{CE} = 5.0 V R_S = 1.0 kΩ BW = 8.0 Hz
NF	**Narrow-Band Noise Figure (f = 10 Hz)**		**6.0**	(Note 6)	**dB**	**I_C = 100 μA V_{CE} = 5.0 V R_S = 1.0 kΩ BW = 10 Hz**
NF	Narrow-Band Noise Figure (f = 1.0 kHz)		1.5	3.0	dB	I_C = 10 μA V_{CE} = 5.0 V R_S = 10 kΩ BW = 400 Hz
NF	Wide-Band Noise Figure (f = 10 Hz to 10 kHz)		1.5	3.0	dB	I_C = 10 μA V_{CE} = 5.0 V R_S = 10 kΩ BW = 15.7 kHz
h_{FE}	**DC Current Gain**	**450**	735			**I_C = 10 μA V_{CE} = 5.0 V**
h_{FE}	DC Current Gain	500	840			I_C = 100 μA V_{CE} = 5.0 V
h_{FE}	DC Current Gain	550	960			I_C = 1.0 mA V_{CE} = 5.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	**600**	**950**	**1550**		**I_C = 10 mA V_{CE} = 5.0 V**
h_{FE}(−55°C)	DC Current Gain	130				I_C = 10 μA V_{CE} = 5.0 V
h_{FE}(100°C)	DC Pulse Current Gain (FT107B) (Note 5)		1200	2300		I_C = 10 mA V_{CE} = 5.0 V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	1.5	2.6			I_C = 10 mA V_{CE} = 5.0 V

Additional Characteristics on Page 2

Notes on Page 4

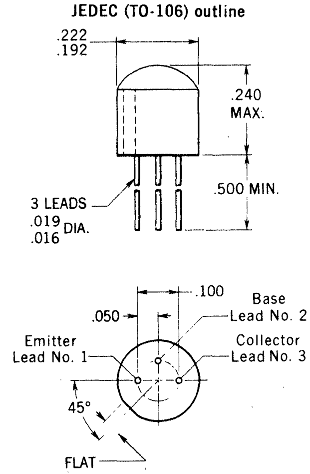
PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-18) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Collector internally connected to case
Package weight is 0.43 gram

FT107B

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram Package is electrically non-conductive material

SE4021

*Planar is a patented Fairchild process.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

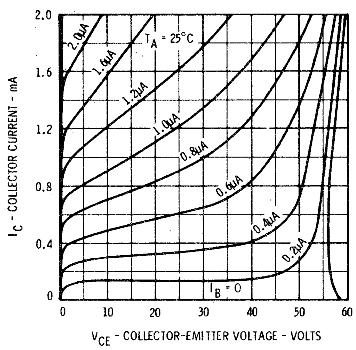
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

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

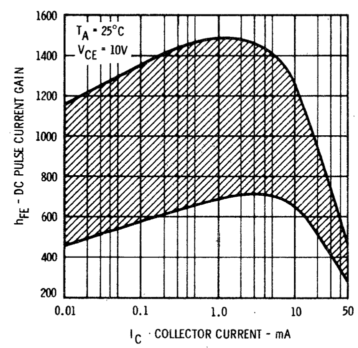
SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
I_{CBO}	**Collector Cutoff Current**		**0.1**	**2.0**	**nA**	**$I_E = 0$**	**$V_{CB} = 30$ V**
I_{CBO}(65°C)	**Collector Cutoff Current (SE4021)**		**1.0**	**50**	**nA**	**$I_E = 0$**	**$V_{CB} = 30$ V**
I_{CBO}(125°C)	**Collector Cutoff Current (FT107B)**		**0.07**	**1.0**	**μA**	**$I_E = 0$**	**$V_{CB} = 30$ V**
I_{EBO}	Emitter Cutoff Current		0.005	1.0	nA	$I_C = 0$	$V_{EB} = 5.0$ V
C_{cb}	Collector to Base Capacitance		2.5	4.0	pF	$I_E = 0$	$V_{CB} = 5.0$ V
C_{eb}	Emitter to Base Capacitance		3.5	6.0	pF	$I_C = 0$	$V_{EB} = 0.5$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	45			Volts	$I_C = 5.0$ mA	$I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	45			Volts	$I_C = 10\ \mu$A	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	8.0			Volts	$I_C = 0$	$I_E = 10\ \mu$A
$V_{CE(sat)}$	**Collector to Emitter Saturation Voltage** (Note 5)		**0.12**	**0.2**	**Volt**	**$I_C = 10$ mA**	**$I_B = 0.5$ mA**
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage (Note 5)		0.18	0.3	Volt	$I_C = 50$ mA	$I_B = 5.0$ mA
$V_{BE(on)}$	Base to Emitter On Voltage		0.62	0.7	Volt	$I_C = 1.0$ mA	$V_{CE} = 5.0$ V

TYPICAL ELECTRICAL CHARACTERISTICS

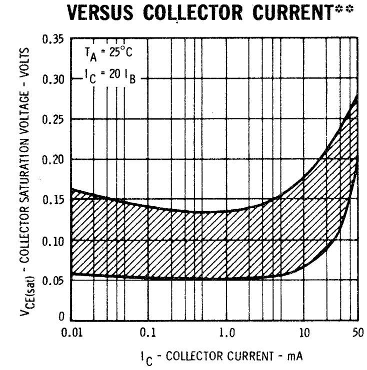
COLLECTOR CHARACTERISTICS* ACTIVE REGION



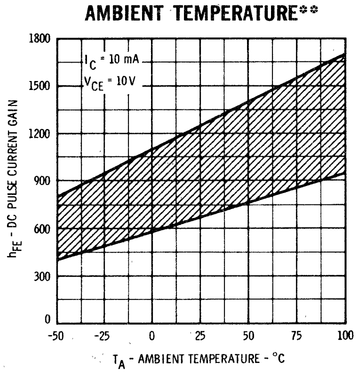
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT**



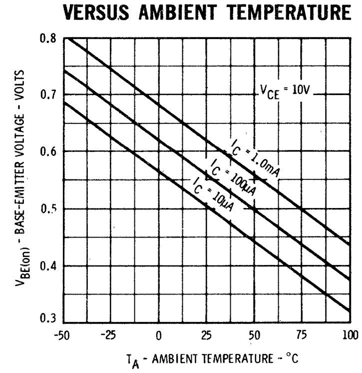
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT**



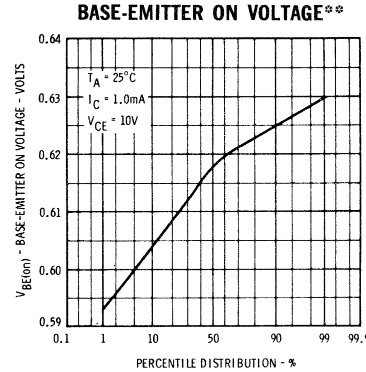
DC PULSE CURRENT GAIN VERSUS AMBIENT TEMPERATURE**



BASE-EMITTER ON VOLTAGE VERSUS AMBIENT TEMPERATURE



DISTRIBUTION OF BASE-EMITTER ON VOLTAGE**

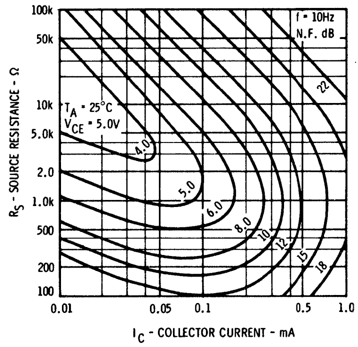


* Single family characteristics on Curve Tracer.

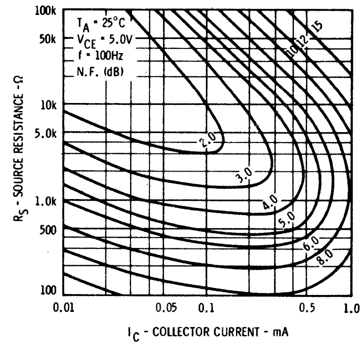
** In recognition of the needs of computer aided design, correlation and distribution information is shown for key parameters. These curves are not guaranteed but represent with a high degree of confidence the distributions and correlations to be expected.

TYPICAL ELECTRICAL CHARACTERISTICS

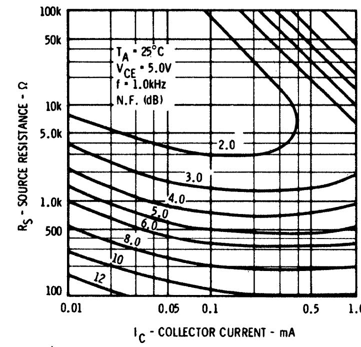
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



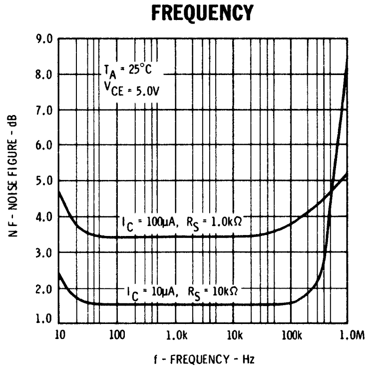
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



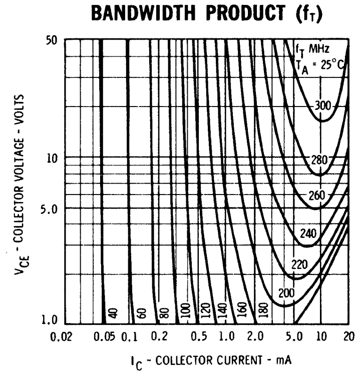
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



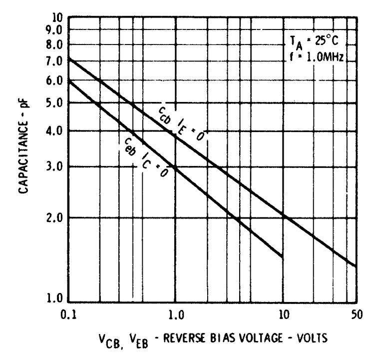
NOISE FIGURE VERSUS FREQUENCY



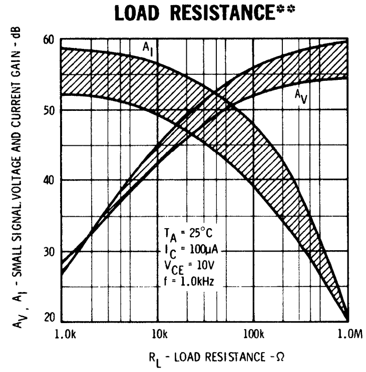
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



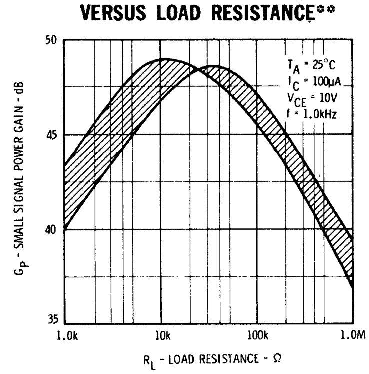
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



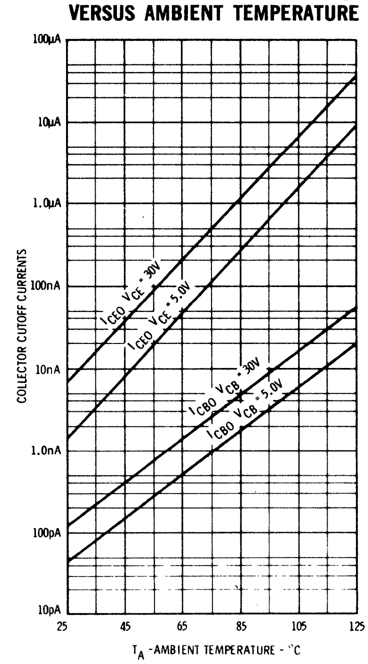
SMALL SIGNAL VOLTAGE AND CURRENT GAIN VERSUS LOAD RESISTANCE**



SMALL SIGNAL POWER GAIN VERSUS LOAD RESISTANCE**



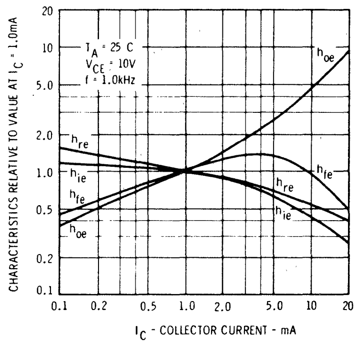
COLLECTOR CUTOFF CURRENTS VERSUS AMBIENT TEMPERATURE



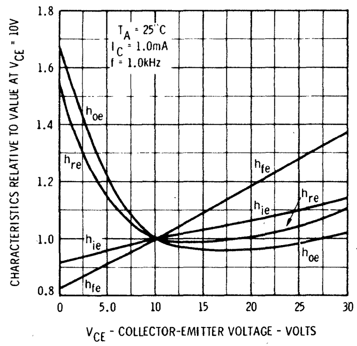
** In recognition of the needs of computer aided design, correlation and distribution information is shown for key parameters. These curves are not guaranteed but represent with a high degree of confidence the distributions and correlations to be expected.

TYPICAL ELECTRICAL CHARACTERISTICS

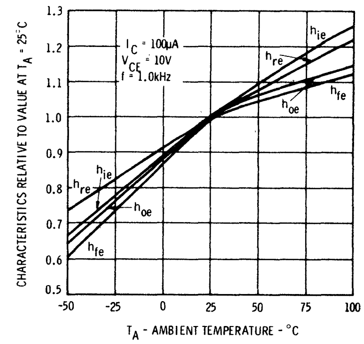
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR CURRENT



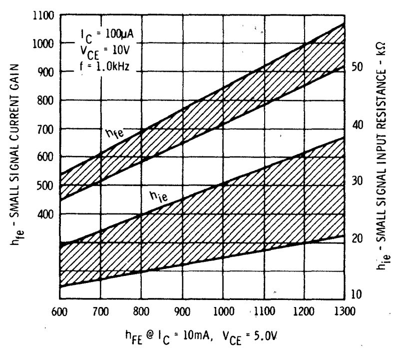
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR-EMITTER VOLTAGE



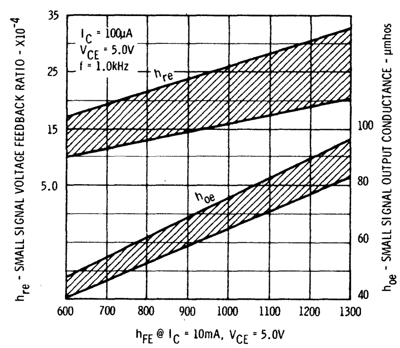
COMMON EMITTER CHARACTERISTICS VERSUS AMBIENT TEMPERATURE



h PARAMETER CORRELATIONS**



h PARAMETER CORRELATIONS**



** In recognition of the needs of computer aided design, correlation and distribution information is shown for key parameters. These curves are not guaranteed but represent with a high degree of confidence the distributions and correlations to be expected.

SMALL SIGNAL CHARACTERISTICS (f = 1.0 kHz)

SYMBOL	CHARACTERISTICS	TYP.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance	28	kΩ	I_C = 1.0 mA	V_{CE} = 10 V
h_{oe}	Output Conductance	74	µmhos	I_C = 1.0 mA	V_{CE} = 10 V
h_{re}	Voltage Feedback Ratio	23	$x10^{-4}$	I_C = 1.0 mA	V_{CE} = 10 V
h_{fe}	Small Signal Current Gain	1050		I_C = 1.0 mA	V_{CE} = 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 150°C and junction to case thermal resistance of 146°C/Watt (derating factor of 6.9 mW/°C); junction to ambient thermal resistance of 480°C/Watt (derating factor of 2.1 mW/°C) for FT107B. A maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C) for SE4021.
(4) This rating refers to a high current point where collector to emitter voltage is lowest.
(5) Pulse Conditions: length = 300 µs; duty cycle = 1%.
(6) Normally >90% of the units will have NF less than 11 dB.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

FT107A • SE4022

NPN LOW LEVEL, LOW NOISE AMPLIFIERS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **LOW 1/f NOISE . . . . NF = 8.0 dB (MAX) AT 10 Hz, 1.0 kΩ**
- **HIGH GAIN . . . . h_{FE} = 900 (MIN) AT 10 μA**
  h_{FE} = 1200 (MIN) AT 10 mA
- **LOW SATURATION VOLTAGE . . . $V_{CE(sat)}$ = 0.2 V (MAX) AT 10 mA/0.5 mA**
- **LOW LEAKAGE . . . . I_{CBO} = 2.0 nA (MAX) AT V_{CB} = 20 V**
  I_{CBO} = 50 nA (MAX) AT V_{CB} = 20 V, T_A = 65°C (SE4022)
  I_{CBO} = 1.0 μA (MAX) AT V_{CB} = 20 V, T_A = 125°C (FT107A)

ABSOLUTE MAXIMUM RATINGS (Note 1)

		FT107A	SE4022
Maximum Temperatures			
Storage Temperatures		−65°C to +150°C	−65°C to +125°C
Operating Junction Temperatures		+150°C	+125°C
Lead Temperature (Soldering, 10 seconds time limit)		+300°C	+260°C
Maximum Power Dissipation (Notes 2 and 3)			
Total Dissipation at 25°C Case Temperature		0.86 Watt	0.5 Watt
25°C Ambient Temperature		0.26 Watt	0.2 Watt
Maximum Voltages			
V_{CBO}	Collector to Base Voltage	30 Volts	30 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	30 Volts	30 Volts
V_{EBO}	Emitter to Base Voltage	8.0 Volts	8.0 Volts
I_C	Continuous Collector Current	50 mA	50 mA

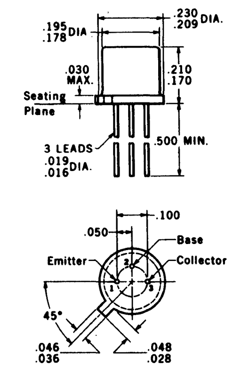
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
NF	Narrow Band Noise Figure (f = 1.0 kHz)		4.0	6.0	dB	I_C = 100 μA, R_S = 1.0 kΩ	V_{CE} = 5.0 V, BW = 400 Hz
NF	Narrow Band Noise Figure (f = 1.0 kHz)		1.0	3.0	dB	I_C = 100 μA, R_S = 10 kΩ	V_{CE} = 5.0 V, BW = 400 Hz
NF	Narrow Band Noise Figure (f = 1.0 kHz)		2.0	6.0	dB	I_C = 100 μA, R_S = 100 kΩ	V_{CE} = 5.0 V, BW = 400 Hz
NF	**Narrow Band Noise Figure (f = 10 Hz)**		**5.0**	**8.0**	**dB**	**I_C = 100 μA, R_S = 1.0 kΩ**	**V_{CE} = 5.0 V, BW = 10 Hz**
h_{FE}	**DC Current Gain**	**900**	**1100**			**I_C = 10 μA**	**V_{CE} = 5.0 V**
h_{FE}	DC Current Gain	1000	1580			I_C = 100 μA	V_{CE} = 5.0 V
h_{FE}	DC Current Gain	1200	1735			I_C = 1.0 mA	V_{CE} = 5.0 V
h_{FE}	**DC Pulse Current Gain (Note 5)**	**1200**	**1540**	**2200**		**I_C = 10 mA**	**V_{CE} = 5.0 V**
h_{FE}(−55°C)	DC Current Gain	300				I_C = 10 μA	V_{CE} = 5.0 V
h_{FE}(100°C)	DC Pulse Current Gain (Note 5) (FT107A)		2140	3300		I_C = 10 mA	V_{CE} = 5.0 V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	2.0	2.8			I_C = 10 mA	V_{CE} = 5.0 V

Additional Electrical Characteristics on Page 2

Notes on Page 4

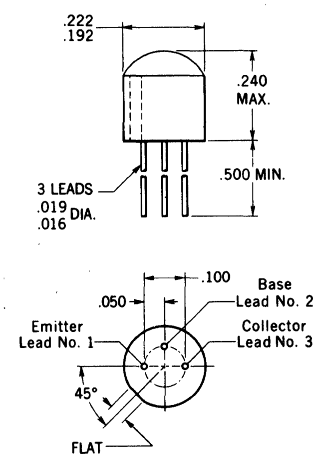
PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-18) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Collector internally connected to case
Package weight is 0.43 gram

FT107A

PHYSICAL DIMENSIONS
in accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram Package
is electrically non-conductive material

SE4022

*Planar is a patented Fairchild process.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

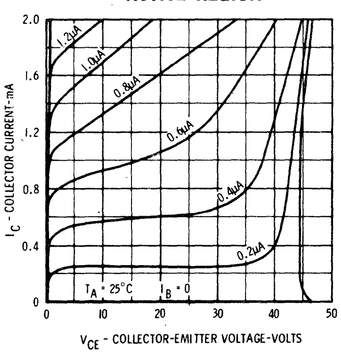
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

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

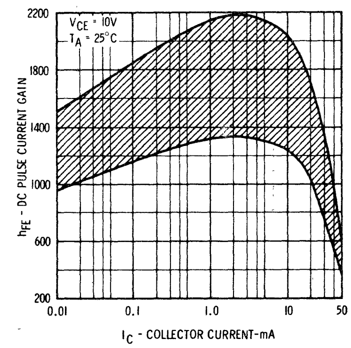
SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
$\mathbf{I_{CBO}}$	**Collector Cutoff Current**		**0.02**	**2.0**	**nA**	$\mathbf{I_E = 0}$	$\mathbf{V_{CB} = 20\ V}$
$\mathbf{I_{CBO}(65°C)}$	**Collector Cutoff Current (SE4022)**		**0.3**	**50**	**nA**	$\mathbf{I_E = 0}$	$\mathbf{V_{CB} = 20\ V}$
$\mathbf{I_{CBO}(125°C)}$	**Collector Cutoff Current (FT107A)**		**0.02**	**1.0**	**μA**	$\mathbf{I_E = 0}$	$\mathbf{V_{CB} = 20\ V}$
I_{EBO}	Emitter Cutoff Current		0.03	1.0	nA	$I_C = 0$	$V_{EB} = 5.0\ V$
C_{cb}	Collector Base Capacitance		2.5	4.0	pF	$I_E = 0$	$V_{CB} = 5.0\ V$
C_{eb}	Emitter Base Capacitance		2.9	6.0	pF	$I_C = 0$	$V_{EB} = 0.5\ V$
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	30			Volts	$I_C = 5.0\ mA$	$I_B = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	30			Volts	$I_C = 10\ \mu A$	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	8.0			Volts	$I_C = 0$	$I_E = 10\ \mu A$
$\mathbf{V_{CE(sat)}}$	**Pulsed Collector to Emitter Saturation Voltage** (Note 5)		**0.085**	**0.2**	**Volt**	$\mathbf{I_C = 10\ mA}$	$\mathbf{I_B = 0.5\ mA}$
$V_{CE(sat)}$	Pulsed Collector to Emitter Saturation Voltage (Note 5)		0.14	0.3	Volt	$I_C = 50\ mA$	$I_B = 5.0\ mA$
$V_{BE(on)}$	Base to Emitter On Voltage		0.6	0.7	Volt	$I_C = 1.0\ mA$	$V_{CE} = 5.0\ V$

TYPICAL ELECTRICAL CHARACTERISTICS

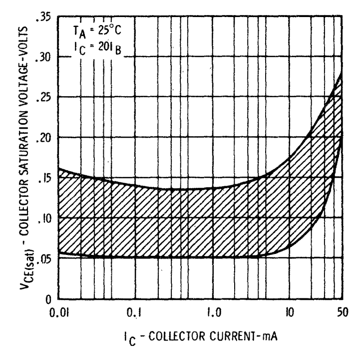
COLLECTOR CHARACTERISTICS* ACTIVE REGION



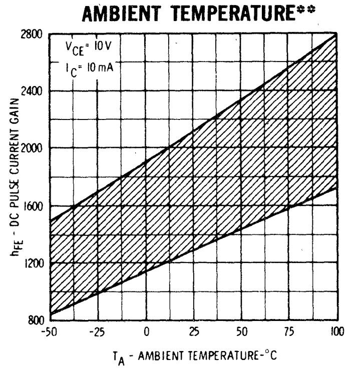
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT**



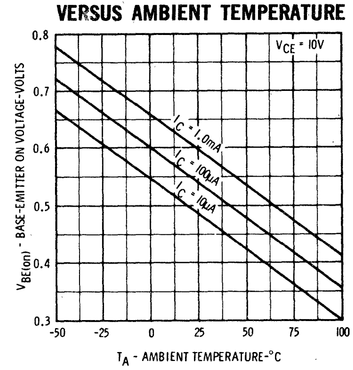
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT**



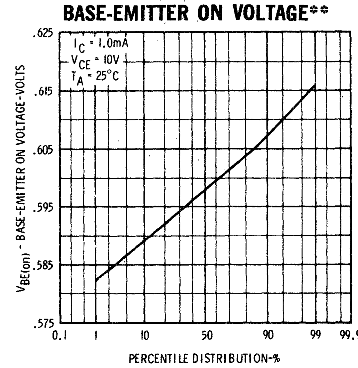
DC PULSE CURRENT GAIN VERSUS AMBIENT TEMPERATURE**



BASE-EMITTER ON VOLTAGE VERSUS AMBIENT TEMPERATURE



DISTRIBUTION OF BASE-EMITTER ON VOLTAGE**

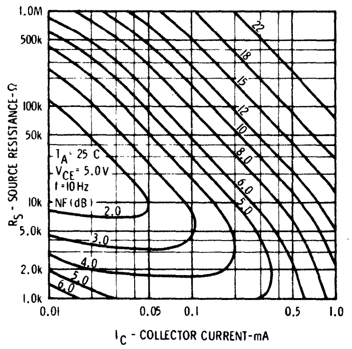


* Single family characteristics on Transistor Curve Tracer.

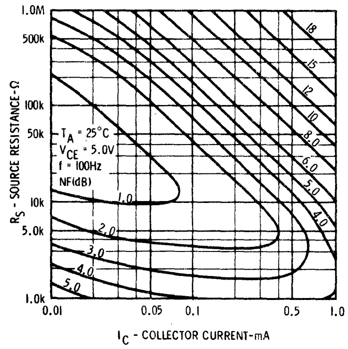
** In recognition of the needs of computer aided design, correlation and distribution information is shown for key parameters. These curves are not guaranteed but represent with a high degree of confidence the distributions and correlations to be expected.

TYPICAL ELECTRICAL CHARACTERISTICS

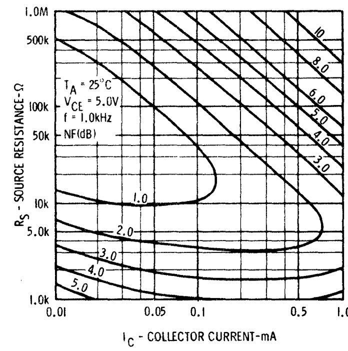
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



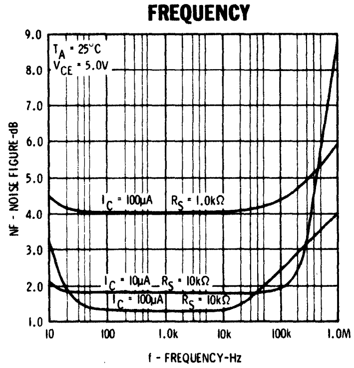
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



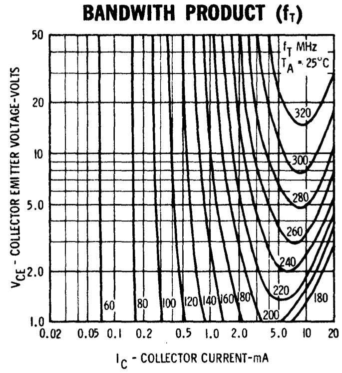
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



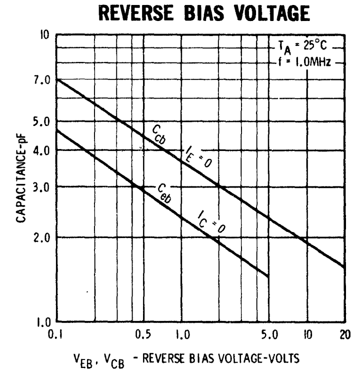
NOISE FIGURE VERSUS FREQUENCY



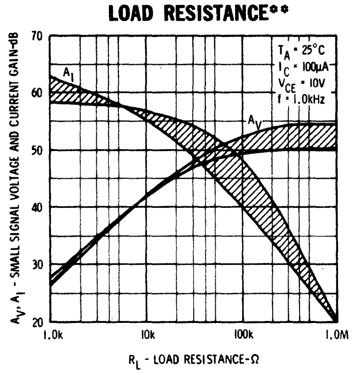
CONTOURS OF CONSTANT GAIN BANDWITH PRODUCT (f_T)



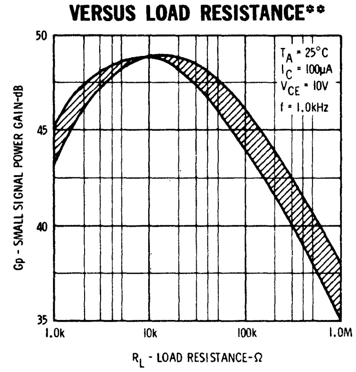
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



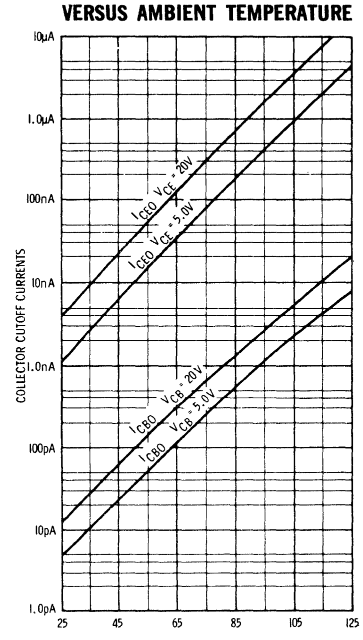
SMALL SIGNAL VOLTAGE AND CURRENT GAIN VERSUS LOAD RESISTANCE**



SMALL SIGNAL POWER GAIN VERSUS LOAD RESISTANCE**



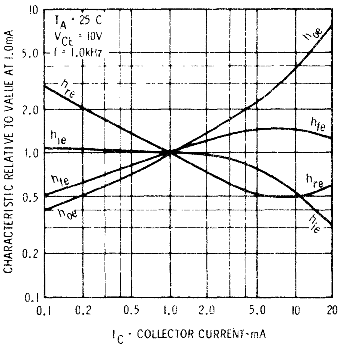
COLLECTOR CUTOFF CURRENTS VERSUS AMBIENT TEMPERATURE



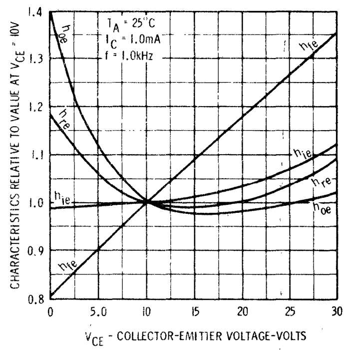
** In recognition of the needs of computer aided design, correlation and distribution information is shown for key parameters. These curves are not guaranteed but represent with a high degree of confidence the distributions and correlations to be expected.

TYPICAL ELECTRICAL CHARACTERISTICS

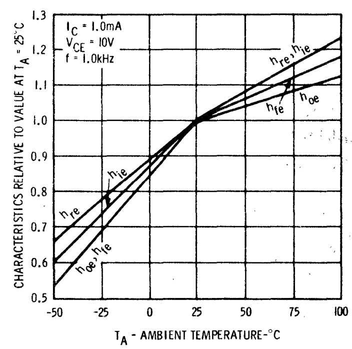
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR CURRENT



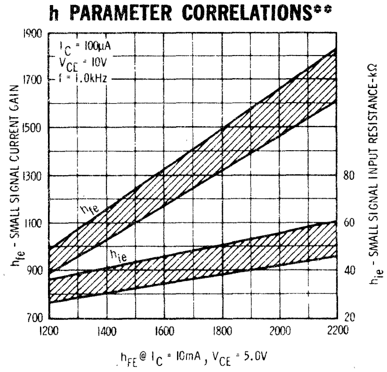
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR-EMITTER VOLTAGE



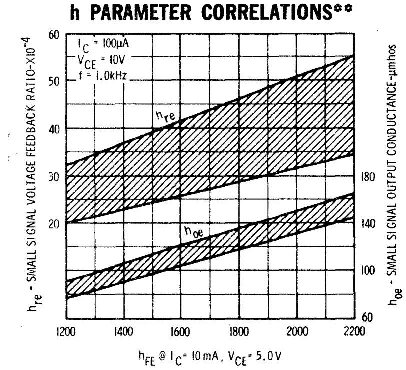
COMMON EMITTER CHARACTERISTICS VERSUS AMBIENT TEMPERATURE



h PARAMETER CORRELATIONS**



h PARAMETER CORRELATIONS**



** In recognition of the needs of computer aided design, correlation and distribution information is shown for key parameters. These curves are not guaranteed but represent with a high degree of confidence the distributions and correlations to be expected.

SMALL SIGNAL CHARACTERISTICS (f = 1.0 kHz)

SYMBOL	CHARACTERISTICS	TYP.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance	39	kohms	$I_C = 1.0$ mA	$V_{CE} = 10$ V
h_{oe}	Output Conductance	120	µmhos	$I_C = 1.0$ mA	$V_{CE} = 10$ V
h_{re}	Voltage Feedback Ratio	33	$\times10^{-4}$	$I_C = 1.0$ mA	$V_{CE} = 10$ V
h_{fe}	Small Signal Current Gain	1630		$I_C = 1.0$ mA	$V_{CE} = 10$ 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 150°C and junction to case thermal resistance of 146°C/Watt (derating factor of 6.9 mW/°C); junction to ambient thermal resistance of 480°C/Watt (derating factor of 2.1 mW/°C) for FT107A. A maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 5.0 mW/°C) for SE4022.
(4) This rating refers to a high current point where collector to emitter voltage is lowest.
(5) Pulse Conditions: length = 300 µs; duty cycle = 1%.

2N4121

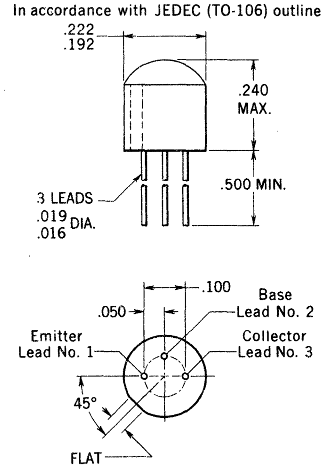
PNP HIGH-SPEED SWITCH AND RF AMPLIFIER

DIFFUSED SILICON PLANAR* II EPITAXIAL TRANSISTOR

- **HIGH BETA (h_{FE}) . . . . 70 TO 200 AT 10 mA**
- **HIGH FREQUENCY (f_T) . . . . 400 MHz MIN. AT 10 mA**
- **EXCELLENT R.F. PERFORMANCE ($r_b'C_c$) . . . 50 ps MAX.**
- **LOW CAPACITANCE (C_{obo}) . . . . 4.5 pF MAX.**
- **LOW NOISE (100 MHz N.F.) . . . . 6.0 dB MAX.**
- **HIGH VOLTAGE (LV_{CEO}) . . . . 40 VOLTS MIN.**

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C
Lead Temperature (Soldering, 10 second time limit)	+260°C

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature [Notes 2 and 3]	0.5 Watt
at 25°C Ambient Temperature [Notes 2 and 3]	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	−40 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	−40 Volts
V_{EBO}	Emitter to Base Voltage	−5.0 Volts
I_C	Collector Current	100 mA

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

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
h_{FE}	**DC Current Gain**	40	70			**$I_C = 100\,\mu A$** $V_{CE} = -1.0$ V
h_{FE}	DC Current Gain	60	100			$I_C = 1.0$ mA $V_{CE} = -1.0$ V
h_{FE}	**DC Pulse Current Gain** [Note 5]	**70**	**150**	**200**		**$I_C = 10$ mA** $V_{CE} = -1.0$ V
h_{FE}	DC Pulse Current Gain [Note 5]	15	30			$I_C = 50$ mA $V_{CE} = -1.0$ V
V_{CE} (sat)	Collector Saturation Voltage		−0.07	−0.13	Volts	$I_C = 1.0$ mA $I_B = 0.1$ mA
V_{CE} (sat)	Pulsed Collector Saturation Voltage [Note 5]		−0.1	−0.14	Volts	$I_C = 10$ mA $I_B = 1.0$ mA
V_{CE} (sat)	**Pulsed Collector Saturation Voltage** [Note 5]		−0.2	−0.3	**Volts**	**$I_C = 50$ mA** $I_B = 5.0$ mA
V_{BE} (sat)	Base Saturation Voltage		−0.65	−0.75	Volts	$I_C = 1.0$ mA $I_B = 0.1$ mA
V_{BE} (sat)	Pulsed Base Saturation Voltage [Note 5]	−0.7	−0.77	−0.9	Volts	$I_C = 10$ mA $I_B = 1.0$ mA
V_{BE} (sat)	Pulsed Base Saturation Voltage [Note 5]		−0.88	−1.1	Volts	$I_C = 50$ mA $I_B = 5.0$ mA
t_{on}	**Turn On Time** [Note 6]		20	40	**ns**	**$I_C \approx 50$ mA** $I_{B1} \approx 5.0$ mA
t_{off}	**Turn Off Time** [Note 6]		95	150	**ns**	**$I_C \approx 50$ mA** $I_{B1} \approx 5.0$ mA $I_{B2} \approx -5.0$ mA
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**4.0**	**5.5**			**$I_C = 10$ mA** $V_{CE} = -20$ V

Additional Electrical Characteristics on page 2

*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 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 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) See switching circuit for exact values of I_C, I_{B1} and I_{B2}.
(7) Power Bandwidth of 15.7 kHz with 3 dB points at 10 Hz and 10 kHz.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

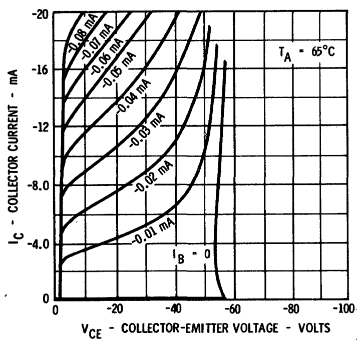
FAIRCHILD TRANSISTOR 2N4121

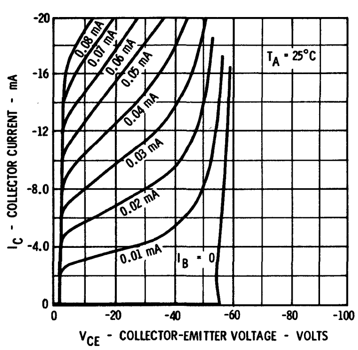
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
V_{CEO} (sust)	**Collector to Emitter Sustaining Voltage** [Notes 4 and 5]	−40			**Volts**	**$I_C = 10$ mA** (pulsed)	$I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−40			Volts	$I_C = 10\ \mu A$	$I_E = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	−40			Volts	$I_C = 10\ \mu A$	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0			Volts	$I_C = 0$	$I_E = 10\ \mu A$
I_{CES}	Collector Reverse Current			25	nA	$V_{CE} = -30$ V	$V_{BE} = 0$
I_{CES} (65°C)	Collector Reverse Current			25	μA	$V_{CE} = -30$ V	$V_{BE} = 0$
C_{obo}	**Open Circuit Output Capacitance**		2.2	4.5	**pF**	$I_E = 0$	**$V_{CB} = -10$V**
C_{ibo}	Open Circuit Input Capacitance		4.0	8.0	pF	$I_C = 0$	$V_{EB} = -0.5$ V
$r_b' C_c$	**Collector-Base Time Constant (f = 80 MHz)**			50	**ps**	**$I_C = 10$ mA**	$V_{CE} = -20$ V
NF	**Noise Figure (f = 100 MHz)**		3.5	6.0	**dB**	**$I_C = 1.0$ mA** **$R_S = 100\Omega$**	$V_{CE} = -5.0$ V BW = 15 MHz
NF	Noise Figure [Note 7]		2.5	4.0	dB	$I_C = 100\ \mu A$ $R_S = 1.0$ kΩ	$V_{CE} = -5.0$ V

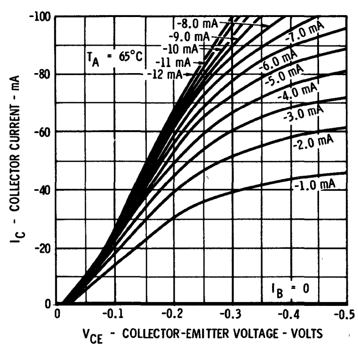
TYPICAL COLLECTOR AND BASE CHARACTERISTICS

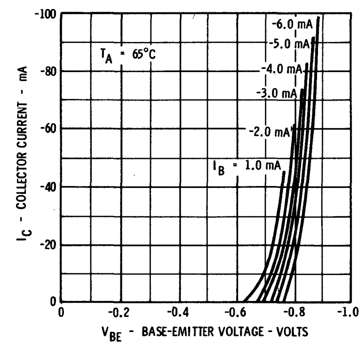
ACTIVE REGION

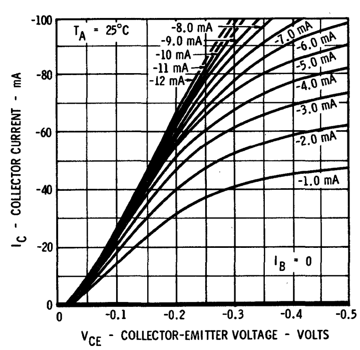


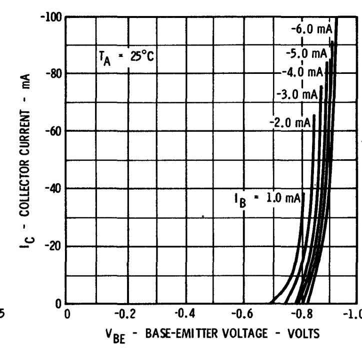


SATURATION REGION

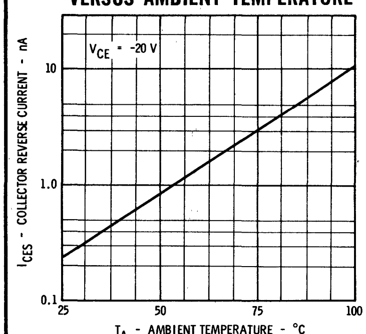




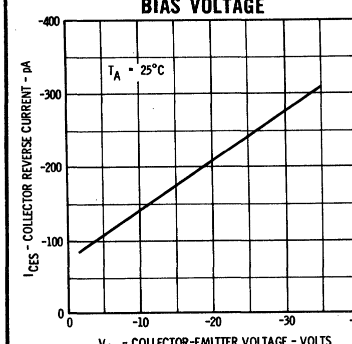




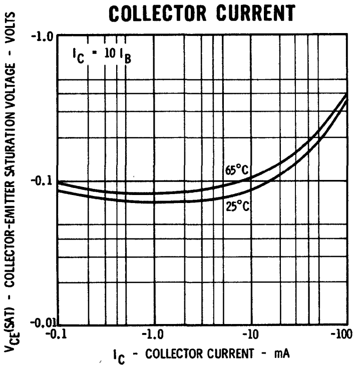
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



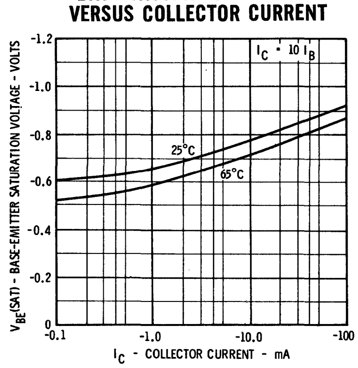
COLLECTOR-BASE REVERSE CURRENT VERSUS REVERSE BIAS VOLTAGE



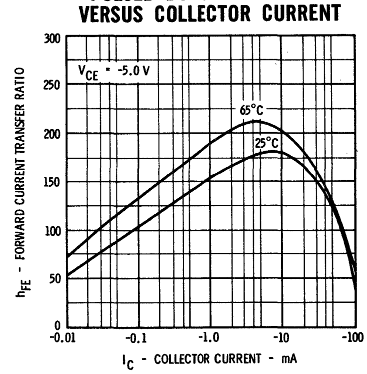
COLLECTOR-EMITTER SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



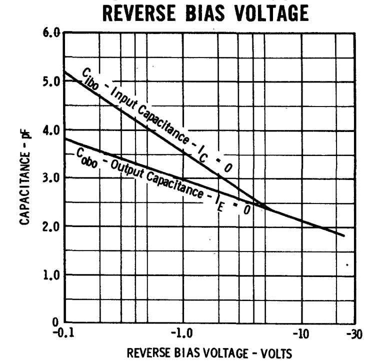
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT

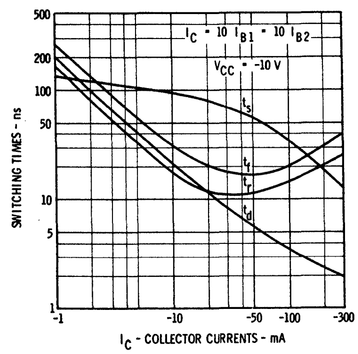


INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE

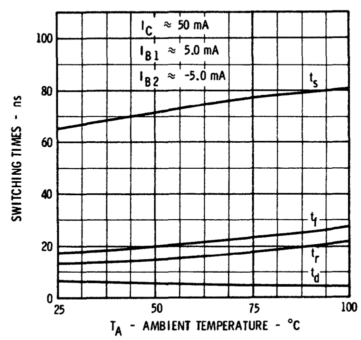


TYPICAL SWITCHING CHARACTERISTICS

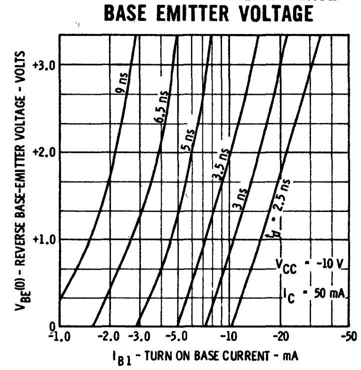
SWITCHING TIMES VERSUS COLLECTOR CURRENT



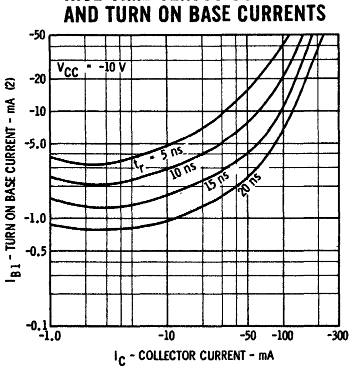
SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



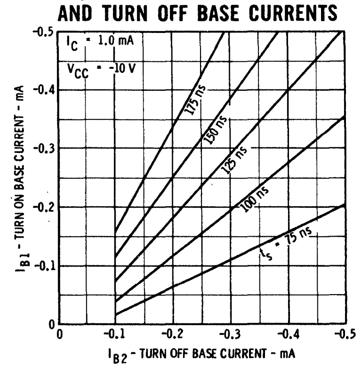
DELAY TIME VERSUS TURN ON BASE CURRENT AND REVERSE BASE EMITTER VOLTAGE



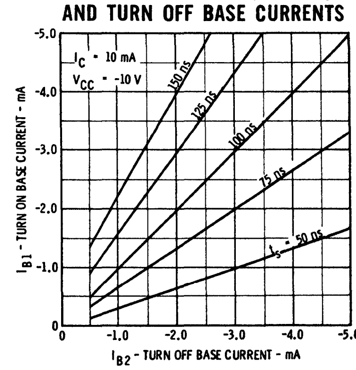
RISE TIME VERSUS COLLECTOR AND TURN ON BASE CURRENTS



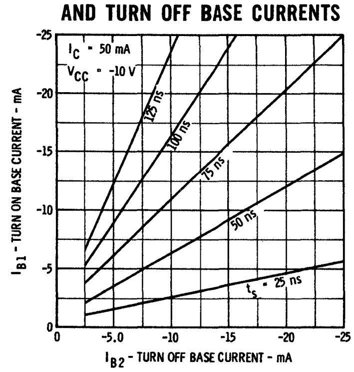
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



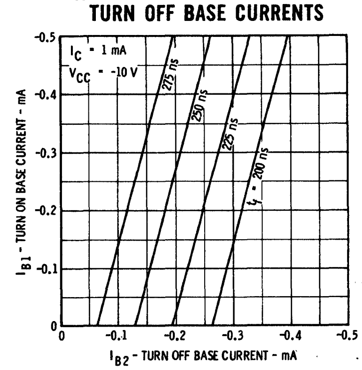
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



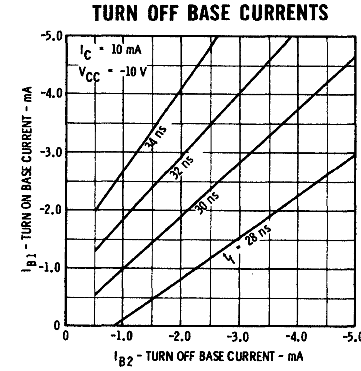
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



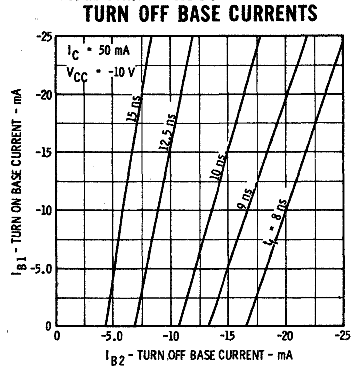
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



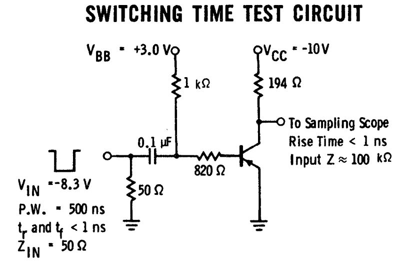
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS

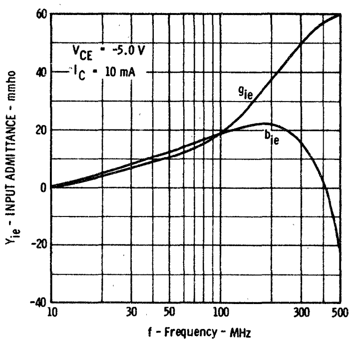


SWITCHING TIME TEST CIRCUIT

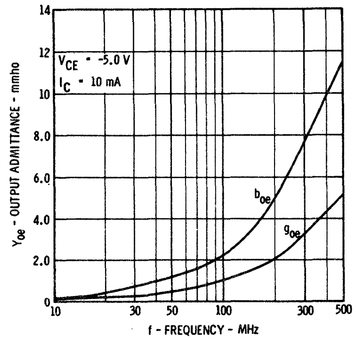


TYPICAL COMMON EMITTER "Y" PARAMETERS

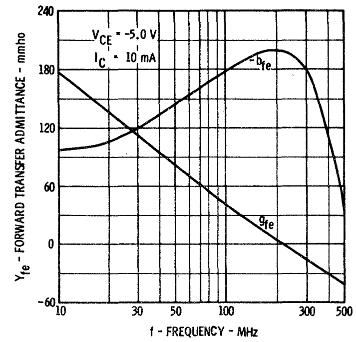
INPUT ADMITTANCE VERSUS FREQUENCY-OUTPUT SHORT CIRCUIT



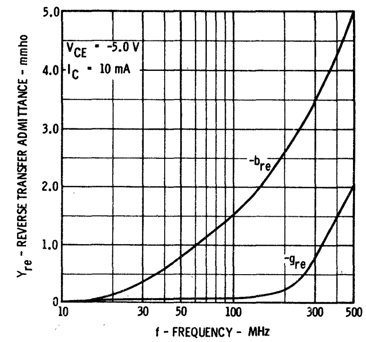
OUTPUT ADMITTANCE VERSUS FREQUENCY-INPUT SHORT CIRCUIT



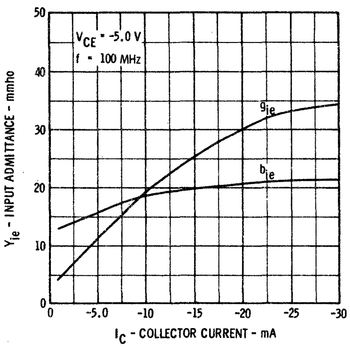
FORWARD TRANSFER ADMITTANCE VERSUS FREQUENCY-OUTPUT SHORT CIRCUIT



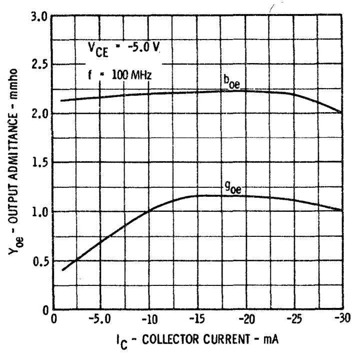
REVERSE TRANSFER ADMITTANCE VERSUS FREQUENCY-INPUT SHORT CIRCUIT



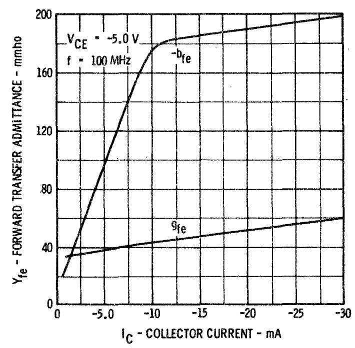
INPUT ADMITTANCE VERSUS COLLECTOR CURRENT OUTPUT SHORT CIRCUIT



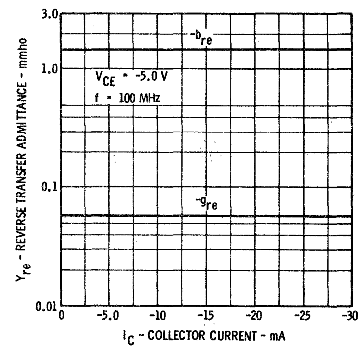
OUTPUT ADMITTANCE VERSUS COLLECTOR CURRENT-INPUT SHORT CIRCUIT



FORWARD TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT-OUTPUT SHORT CIRCUIT



REVERSE TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT-INPUT SHORT CIRCUIT

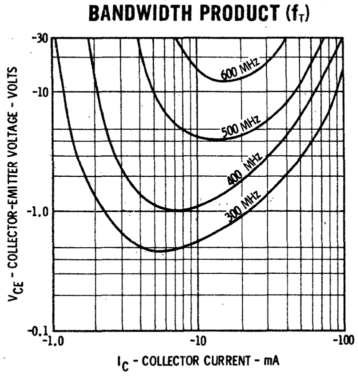


SMALL SIGNAL CHARACTERISTICS (f = 1 kHz)

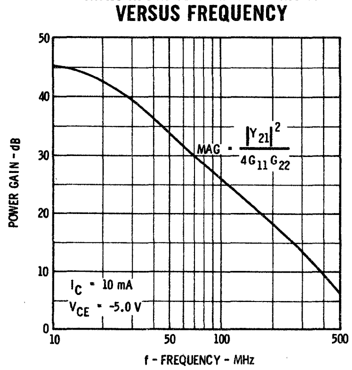
SYMBOL	CHARACTERISTICS	MIN.	MAX.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance	1.0	8.0	kΩ	$I_C = 1.0$ mA	$V_{CE} = -10$ V
h_{oe}	Output Conductance	2.0	24	μmho	$I_C = 1.0$ mA	$V_{CE} = -10$ V
h_{re}	Voltage Feedback Ratio		3.0	$\times10^{-4}$	$I_C = 1.0$ mA	$V_{CE} = -10$ V
h_{fe}	Forward Current Transfer Ratio	50	300		$I_C = 1.0$ mA	$V_{CE} = -10$ V

TYPICAL ELECTRICAL CHARACTERISTICS

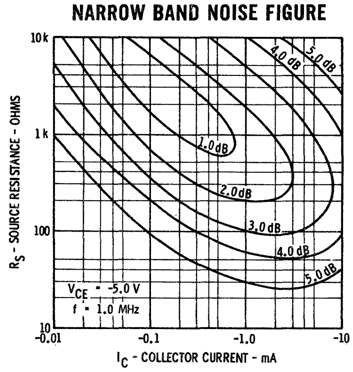
CONTOUR OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



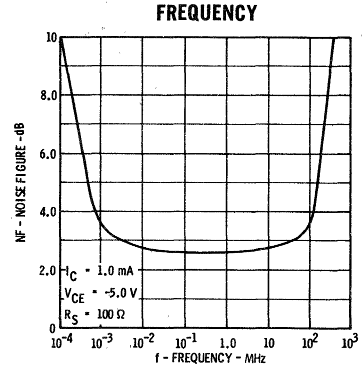
MAXIMUM AVAILABLE GAIN VERSUS FREQUENCY



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



NOISE FIGURE VERSUS FREQUENCY



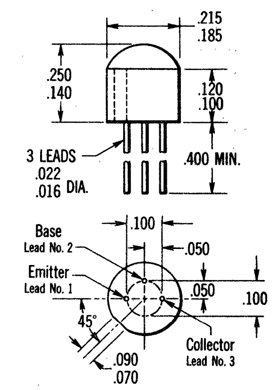
2N4248 • 2N4249 • 2N4250

PNP LOW LEVEL, LOW NOISE AMPLIFIER

DIFFUSED SILICON PLANAR* II TRANSISTORS

- **LOW NOISE FIGURE -- 2.0 dB (MAX) at 1.0 kHz**
- **HIGH CURRENT GAIN -- 250-700 at 100 µA**
- **HIGH BREAKDOWN -- 40 and 60 VOLTS (MIN) LV_{CEO}**
- **EXCELLENT BETA LINEARITY FROM 1 µA to 50 mA**

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

MAXIMUM TEMPERATURES

Storage Temperatures	−55°C to 125°C
Operating Junction Temperatures	125°C
Lead Temperature (Soldering, 10 seconds time limit)	260°C

MAXIMUM POWER DISSIPATION

Total Dissipation at 25°C Case Temperature [Notes 2 and 3]	0.5 Watt
25°C Ambient Temperature [Notes 2 and 3]	0.2 Watt

MAXIMUM VOLTAGES		2N4248 2N4250	2N4249
V_{CBO}	Collector to Base Voltage	−40 Volts	−60 Volts
V_{CEO}	Collector to Emitter Voltage	−40 Volts	−60 Volts
V_{EBO}	Emitter to Base Voltage	−5.0 Volts	−5.0 Volts

ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Noted)

SYMBOL	CHARACTERISTIC	2N4248 MIN.	2N4248 TYP.	2N4248 MAX.	2N4249 MIN.	2N4249 TYP.	2N4249 MAX.	2N4250 MIN.	2N4250 TYP.	2N4250 MAX.	UNITS	TEST CONDITIONS
NF	**Narrow Band Noise Figure (f = 1.0 kHz)** [Note 6]		0.7			0.7	3.0		**0.5**	**2.0**	**dB**	**I_C = 20 µA V_{CE} = −5.0 V**
NF	**Wide Band Noise Figure** [Note 7]		1.0			1.0	3.0		**0.7**	**2.0**	**dB**	**I_C = 20 µA V_{CE} = −5.0 V**
NF	Narrow Band Noise Figure (f = 1.0 kHz) [Note 8]		0.8			0.8	3.0		0.7	2.0	dB	I_C = 250 µA V_{CE} = −5.0 V
h_{FE}	**DC Current Gain**		90			190			**300**			**I_C = 10 µA V_{CE} = −5.0 V**
h_{FE}	**DC Current Gain**	50	100		100	240	300	**250**	**350**	**700**		**I_C = 100 µA V_{CE} = −5.0 V**
h_{FE}	DC Current Gain	50	110		100	250		250	350			I_C = 1.0 mA V_{CE} = −5.0 V
h_{FE}	**DC Pulse Current Gain** [Note 5]	50	120		100	280		**250**	**350**			**I_C = 10 mA V_{CE} = −5.0 V**
BV_{CBO}	Collector to Base Breakdown Voltage	−40			−60			−40			Volts	I_C = 10 µA I_E = 0
BV_{CES}	Collector to Emitter Breakdown Voltage	−40			−60			−40			Volts	I_C = 10 µA
V_{CEO} (sust)	**Collector to Emitter Sustaining Voltage** [Notes 4 and 5]	−40			−60			**−40**			**Volts**	**I_C = 5.0 mA I_B = 0** (pulsed)
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0			−5.0			−5.0			Volts	I_C = 0 I_E = 10 µA
I_{CBO}	**Collector Cutoff Current**			10			10			**10**	**nA**	**I_E = 0 V_{CB} = −40 V**
I_{CBO} (65°C)	Collector Cutoff Current			3.0			3.0			3.0	µA	I_E = 0 V_{CB} = −40 V
I_{EBO}	Emitter Cutoff Current			20			20			20	nA	I_C = 0 V_{BE} = 3.0 V
V_{CE} (sat)	Pulsed Collector Saturation Voltage [Note 5]			−0.25			−0.25			−0.25	Volts	I_C = 10 mA I_B = 0.5 mA
V_{BE} (sat)	Pulsed Base Saturation Voltage [Note 5]			−0.9			−0.9			−0.9	Volts	I_C = 10 mA I_B = 0.5 mA
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	50			100	250	550	250	350	800		I_C = 1.0 mA V_{CE} = −5.0 V
h_{fe}	High Frequency Current Gain (f = 20 MHz)	2.0			2.0			2.5				I_C = 0.5 mA V_{CE} = −5.0 V
C_{obo}	Open Circuit Output Capacitance			6.0			6.0			6.0	pF	I_E = 0 V_{CB} = −5.0 V
C_{ibo}	Open Circuit Input Capacitance			16			16			16	pF	I_C = 0 V_{BE} = 0.5 V

(See notes on back page)

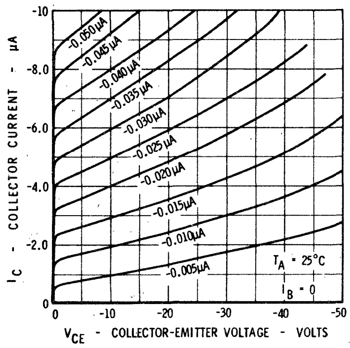
* Planar is a patented Fairchild process.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

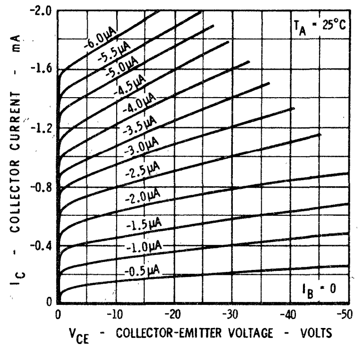
TYPICAL ELECTRICAL CHARACTERISTICS

2N4248 • 2N4249

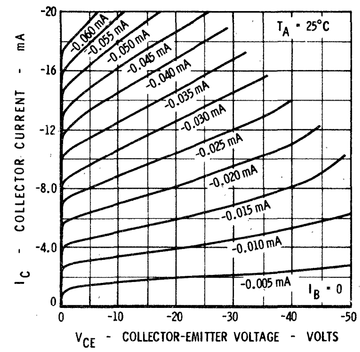
COLLECTOR CHARACTERISTICS



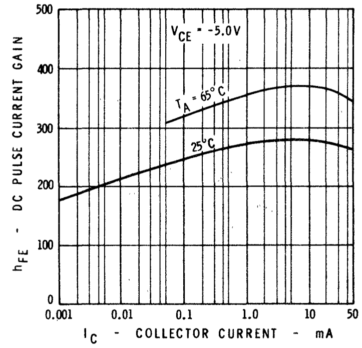
COLLECTOR CHARACTERISTICS



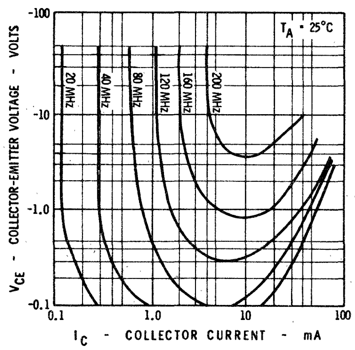
COLLECTOR CHARACTERISTICS



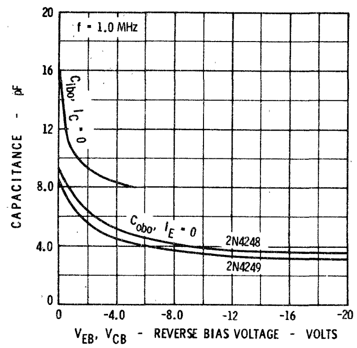
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



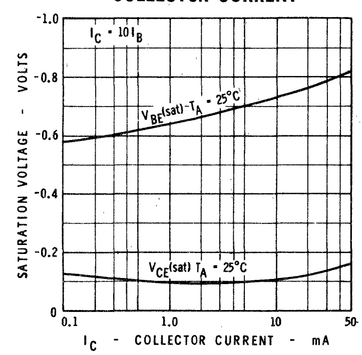
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



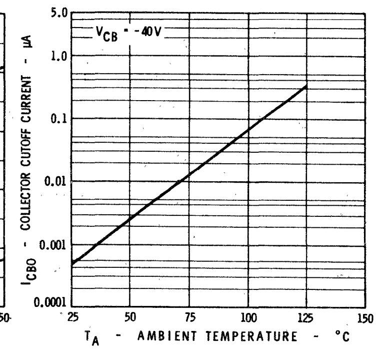
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



COLLECTOR AND BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



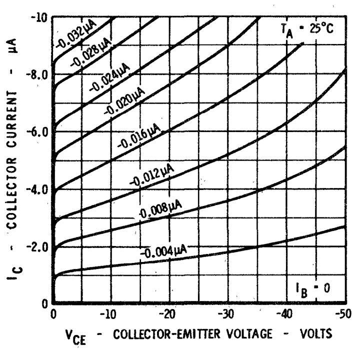
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



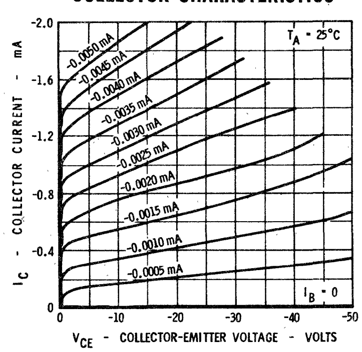
TYPICAL ELECTRICAL CHARACTERISTICS

2N4250

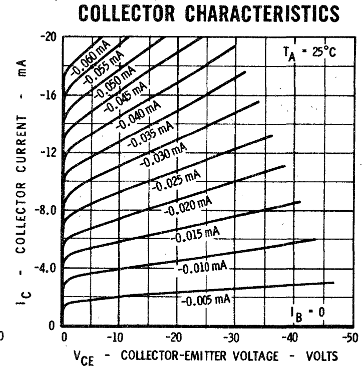
COLLECTOR CHARACTERISTICS



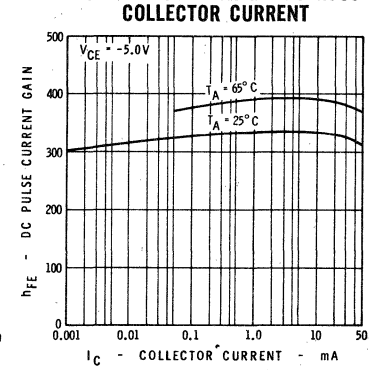
COLLECTOR CHARACTERISTICS



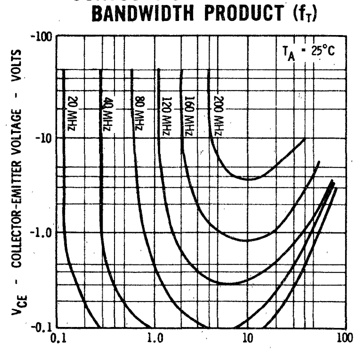
COLLECTOR CHARACTERISTICS



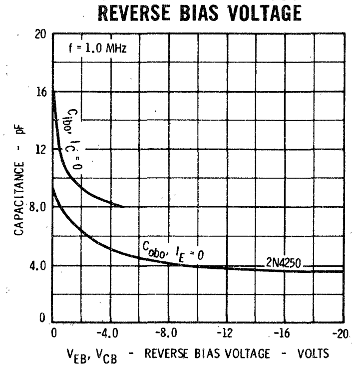
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



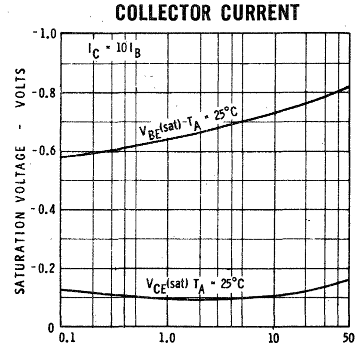
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



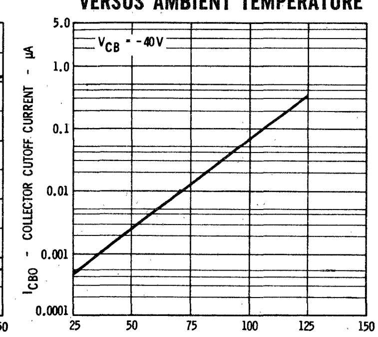
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



COLLECTOR AND BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



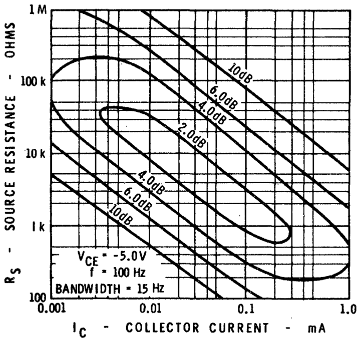
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



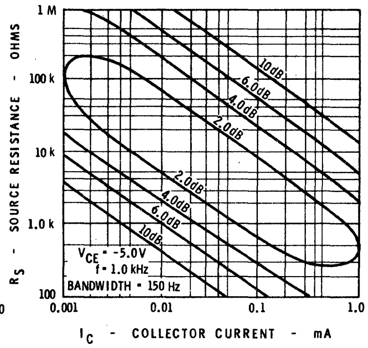
TYPICAL ELECTRICAL CHARACTERISTICS

2N4250

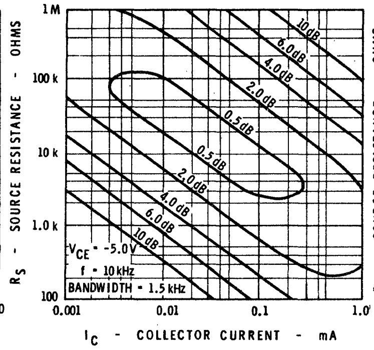
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



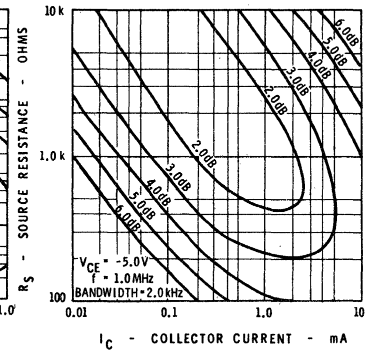
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



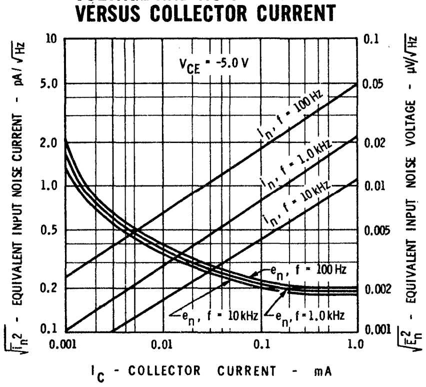
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



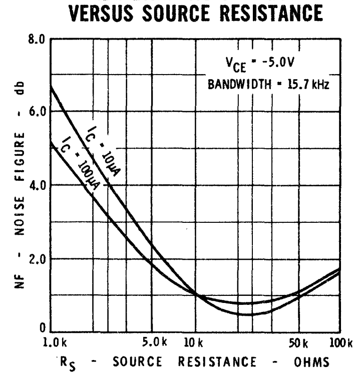
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



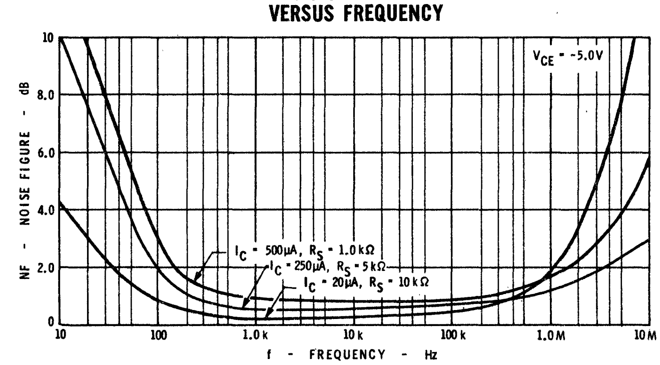
EQUIVALENT INPUT NOISE VOLTAGE AND NOISE CURRENT VERSUS COLLECTOR CURRENT



WIDE BAND NOISE FIGURE VERSUS SOURCE RESISTANCE



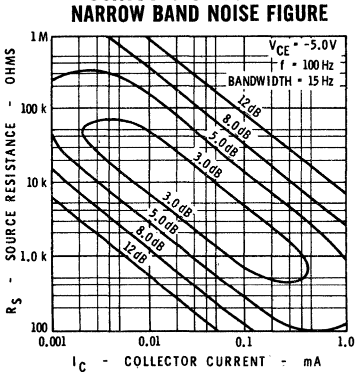
NOISE FIGURE VERSUS FREQUENCY



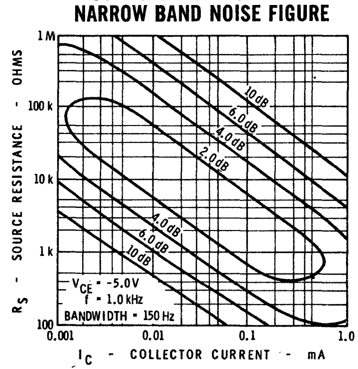
TYPICAL ELECTRICAL CHARACTERISTICS

2N4249

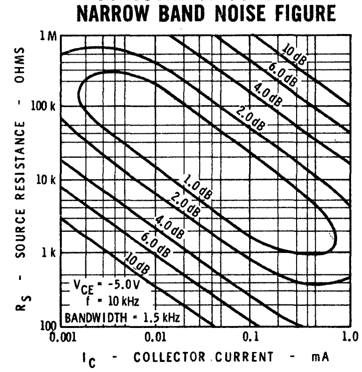
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



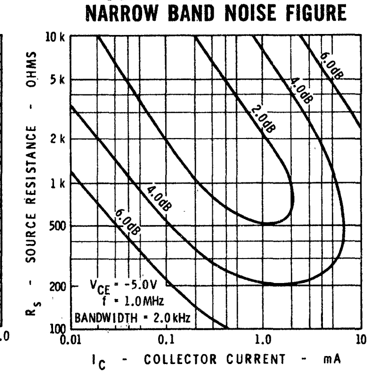
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



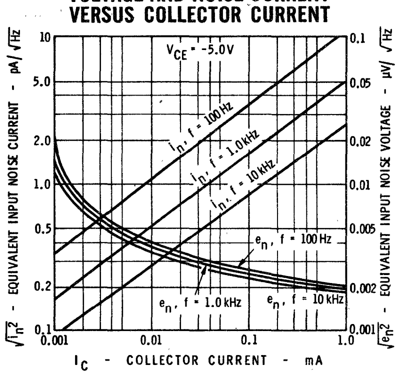
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



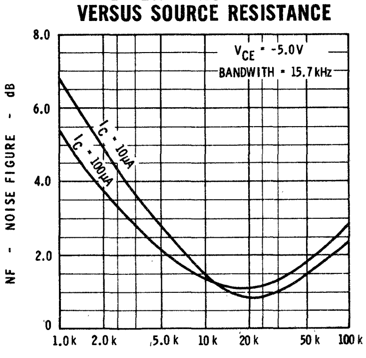
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



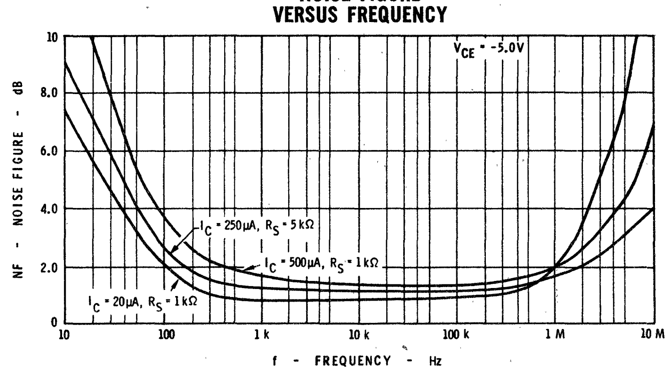
EQUIVALENT INPUT NOISE VOLTAGE AND NOISE CURRENT VERSUS COLLECTOR CURRENT



WIDE BAND NOISE FIGURE VERSUS SOURCE RESISTANCE



NOISE FIGURE VERSUS FREQUENCY



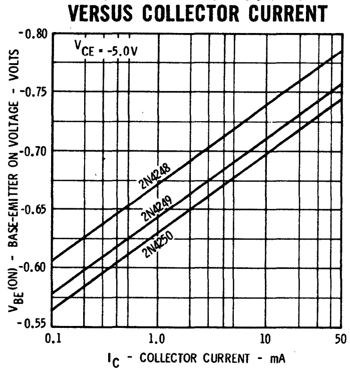
SMALL SIGNAL CHARACTERISTICS (f = 1 kHz)

SYMBOL	CHARACTERISTIC	2N4249 MIN.	2N4249 TYP.	2N4249 MAX.	2N4250 MIN.	2N4250 TYP.	2N4250 MAX.	UNITS	TEST CONDITIONS
h_{ie}	Input Resistance	2.5	8.0	17	6.0	10	20	kΩ	$I_C = 1.0$ mA $V_{CE} = -5.0$ V
h_{oe}	Output Conductance	5.0	19	40	5.0	25	50	μmho	$I_C = 1.0$ mA $V_{CE} = -5.0$ V
h_{re}	Voltage Feedback Ratio			10			10	$x10^{-4}$	$I_C = 1.0$ mA $V_{CE} = -5.0$ V
h_{fe}	Small Signal Current Gain	100	250	550	250	350	800		$I_C = 1.0$ mA $V_{CE} = -5.0$ V

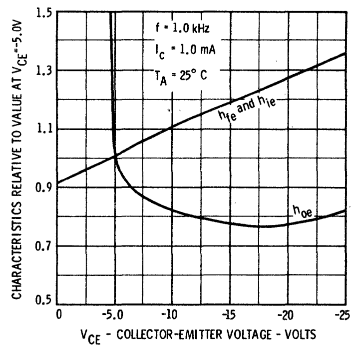
TYPICAL ELECTRICAL CHARACTERISTICS

2N4248 • 2N4249 • 2N4250

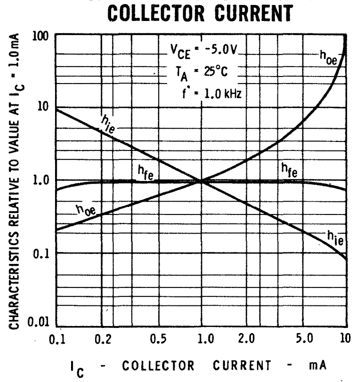
BASE-EMITTER ON VOLTAGE VERSUS COLLECTOR CURRENT



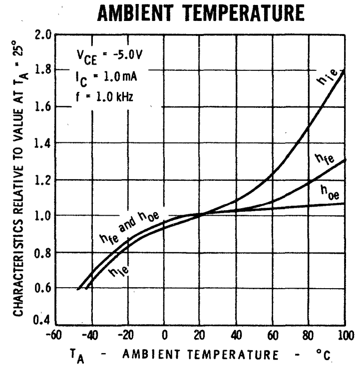
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR-EMITTER VOLTAGE



COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR CURRENT



COMMON EMITTER CHARACTERISTICS VERSUS AMBIENT TEMPERATURE



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 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500 °C/Watt (derating factor of 2.0 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) R_S = 10 kΩ, Power Bandwidth of 150 Hz.
(7) R_S = 10 kΩ, Power Bandwidth of 15.7 kHz with 3.0 dB points at 10 Hz and 10 kHz.
(8) R_S = 1.0 kΩ, Power Bandwidth of 150 Hz.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

2N4257 · 2N4258

PNP ULTRA HIGH-SPEED LOGIC SWITCHES

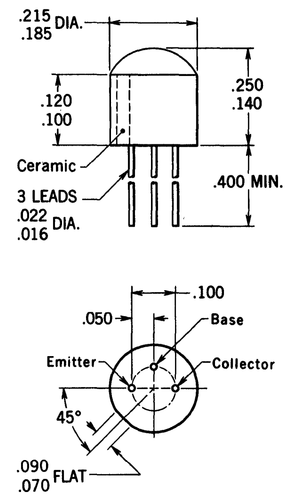
SILICON PLANAR*II EPITAXIAL TRANSISTORS

FEATURES

- **LOW STORAGE TIME — τ_s = 20 ns (Max).**
- **LOW CAPACITANCE — C_{obo} = 3.0 pF (Max), C_{ibo} = 3.5 pF (Max).**
- **HIGH FREQUENCY — f_T = 700 MHz (Min).**
- **LOW SATURATION VOLTAGE — V_{CE} (sat) = −0.15 V (Max) @ I_C = 10 mA**

* Planar is a patented Fairchild process.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 seconds time limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperatures [Notes 2 and 3]	0.5 Watt
at 25°C Free Air Temperature [Notes 2 and 3]	0.2 Watt

Maximum Voltages		2N4257	**2N4258**
V_{CBO}	Collector to Base Voltage	−6.0 Volts	−12 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	−6.0 Volts	−12 Volts
V_{EBO}	Emitter to Base Voltage	−4.5 Volts	−4.5 Volts

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

SYMBOL	CHARACTERISTIC	2N4257 MIN.	2N4257 TYP.	2N4257 MAX.	2N4258 MIN.	2N4258 TYP.	2N4258 MAX.	UNITS	TEST CONDITIONS
τ_s	**Charge Storage Time** [Note 6]		11	15		**13**	**20**	**ns**	**$I_C \approx$ 10 mA $I_{B1} \approx$ 10 mA $I_{B2} \approx$ −10 mA**
t_{on}	**Turn On Time** [Note 6]		9.0	15		**9.0**	**15**	**ns**	**$I_C \approx$ 10 mA $I_{B1} \approx$ 1.0 mA**
t_{off}	**Turn Off Time** [Note 6]		12	15		**14**	**20**	**ns**	**$I_C \approx$ 10 mA $I_{B1} \approx$ 1.0 mA $I_{B2} \approx$ −1.0 mA**
h_{fe}	High Frequency Current Gain (f = 100 MHz)	5.0	11						I_C = 10 mA V_{CE} = −5.0 V
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**				**7.0**	**13**			**I_C = 10 mA V_{CE} = −10 V**
C_{obo}	**Common Base, Open Circuit Output Capacitance**		2.0	3.0		**2.0**	**3.0**	**pF**	**V_{CB} = −5.0 V I_E = 0**
C_{ibo}	**Common Base, Open Circuit Input Capacitance**		2.4	3.5		**2.4**	**3.5**	**pF**	**I_C = 0 V_{EB} = −0.5 V**
h_{FE}	DC Pulse Current Gain [Note 5]	15	40		15	40			I_C = 1.0 mA V_{CE} = −0.5 V
h_{FE}	**DC Pulse Current Gain** [Note 5]	30	67	120	**30**	**67**	**120**		**I_C = 10 mA V_{CE} = −0.3 V**
h_{FE}	DC Pulse Current Gain [Note 5]	30	80		30	80			I_C = 50 mA V_{CE} = −1.0 V
V_{CE} (sat)	**Pulsed Collector Saturation Voltage** [Note 5]		−0.08	−0.15		**−0.08**	**−0.15**	Volts	**I_C = 10 mA I_B = 1.0 mA**
V_{CE} (sat)	Pulsed Collector Saturation Voltage [Note 5]		−0.2	−0.5		−0.2	−0.5	Volts	I_C = 50 mA I_B = 5.0 mA

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

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

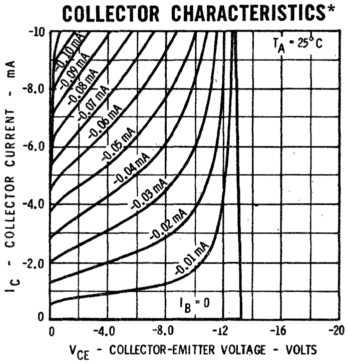
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N4257 MIN.	2N4257 TYP.	2N4257 MAX.	2N4258 MIN.	2N4258 TYP.	2N4258 MAX.	UNITS	TEST CONDITIONS
V_{BE} (sat)	Pulsed Base Saturation Voltage [Note 5]	−0.8	−0.88	−0.95	−0.8	−0.88	−0.95	Volts	$I_C = 10$ mA $I_B = 1.0$ mA
V_{BE} (sat)	Pulsed Base Saturation Voltage [Note 5]		−1.16	−1.5		−1.16	−1.5	Volts	$I_C = 50$ mA $I_B = 5.0$ mA
I_{CES}	Collector Reverse Current		0.02	10				nA	$V_{CE} = -3.0$ V $V_{BE} = 0$
I_{CES}	Collector Reverse Current					0.02	10	nA	$V_{CE} = -6.0$ V $V_{BE} = 0$
I_{CES} (+65°C)	Collector Reverse Current		0.3	5.0				μA	$V_{CE} = -3.0$ V $V_{BE} = 0$
I_{CES} (+65°C)	Collector Reverse Current					0.5	5.0	μA	$V_{CE} = -6.0$ V $V_{BE} = 0$
V_{CEO} (sust)	**Collector to Emitter Sustaining Voltage** [Notes 4 and 5]	−6.0			**−12**			**Volts**	**$I_C = 3.0$ mA** $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.5			−4.5			Volts	$I_C = 0$ $I_E = 100\ \mu$A
BV_{CES}	Collector to Emitter Breakdown Voltage	−6.0			−12			Volts	$I_C = 100\ \mu$A $V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−6.0			−12			Volts	$I_C = 100\ \mu$A $I_E = 0$

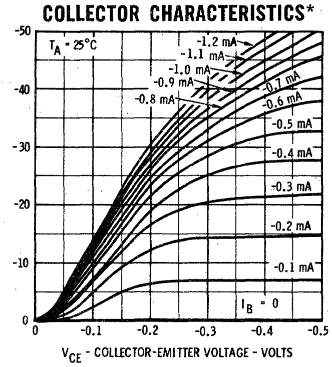
TYPICAL ELECTRICAL CHARACTERISTICS

2N4257

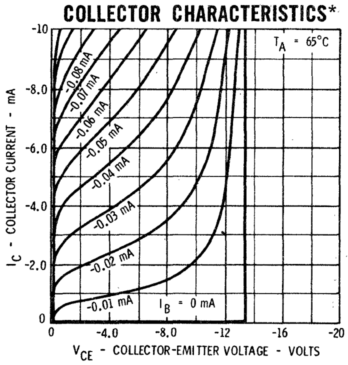
COLLECTOR CHARACTERISTICS*



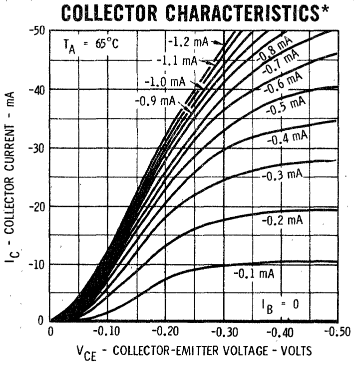
COLLECTOR CHARACTERISTICS*



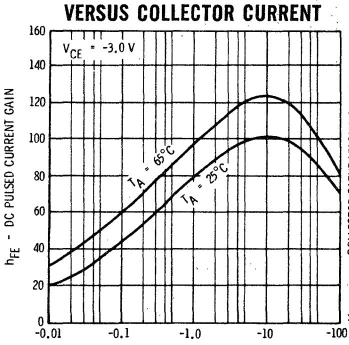
COLLECTOR CHARACTERISTICS*



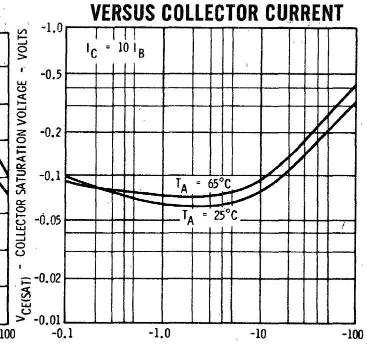
COLLECTOR CHARACTERISTICS*



DC PULSED CURRENT GAIN VERSUS COLLECTOR CURRENT

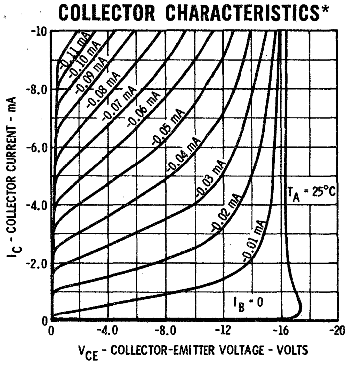


COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT

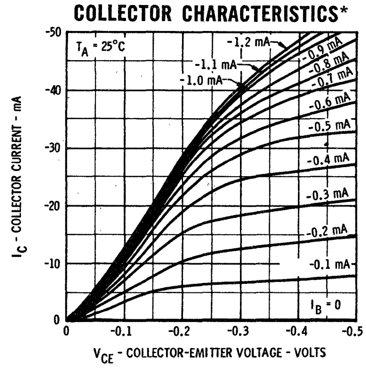


2N4258

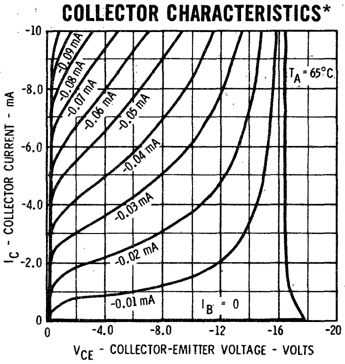
COLLECTOR CHARACTERISTICS*



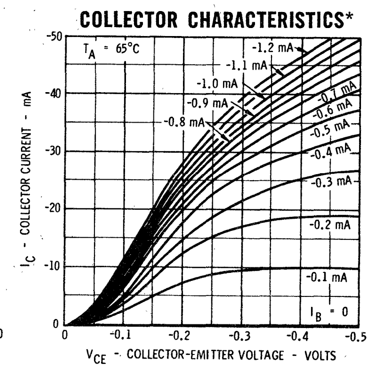
COLLECTOR CHARACTERISTICS*



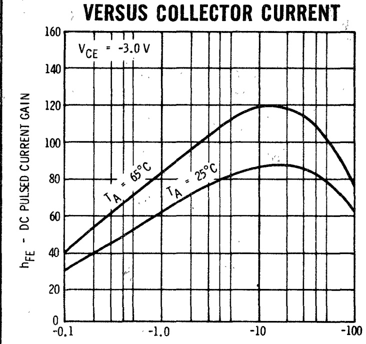
COLLECTOR CHARACTERISTICS*



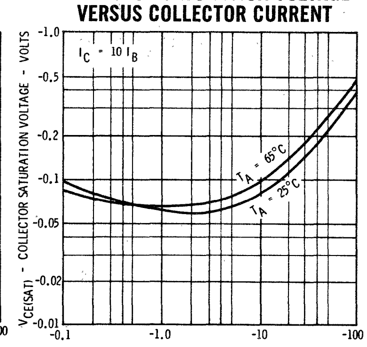
COLLECTOR CHARACTERISTICS*



DC PULSED CURRENT GAIN VERSUS COLLECTOR CURRENT



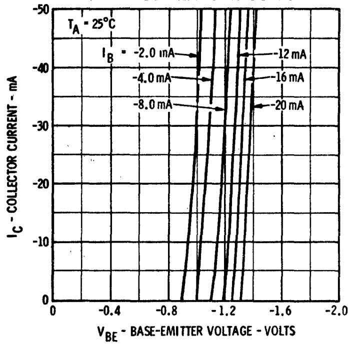
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



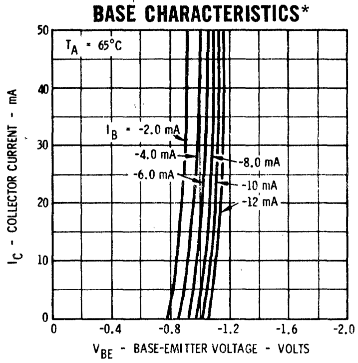
* Single family characteristic on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

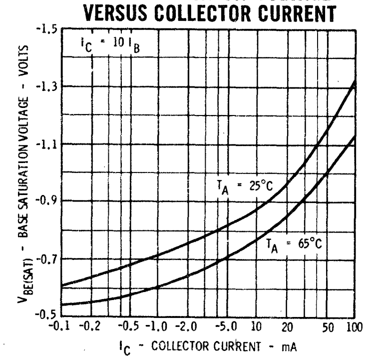
BASE CHARACTERISTICS*



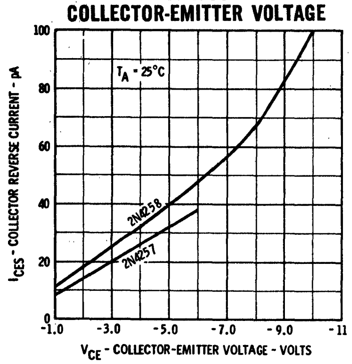
BASE CHARACTERISTICS*



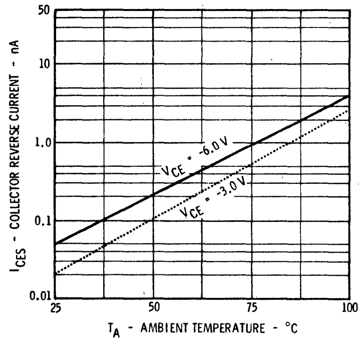
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



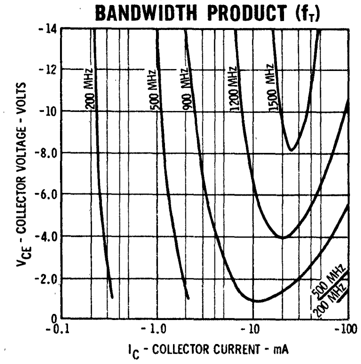
COLLECTOR REVERSE CURRENT VERSUS COLLECTOR-EMITTER VOLTAGE



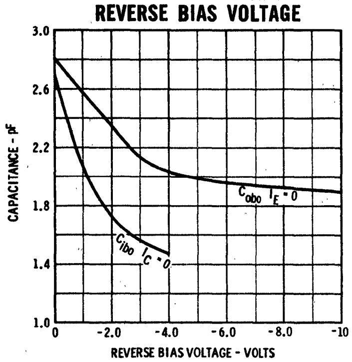
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



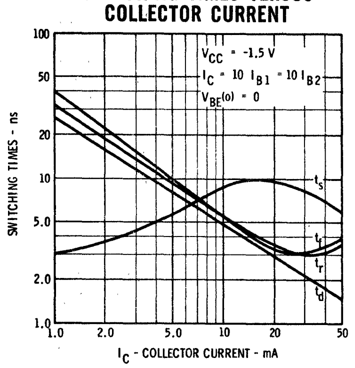
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



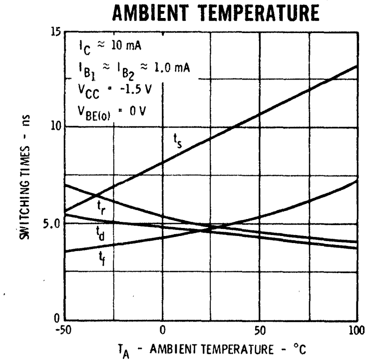
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



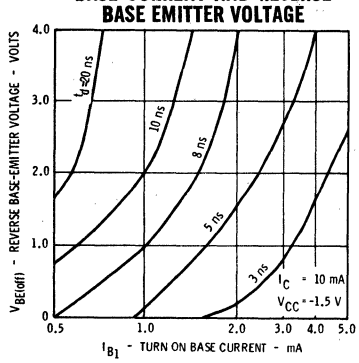
SWITCHING TIMES VERSUS COLLECTOR CURRENT



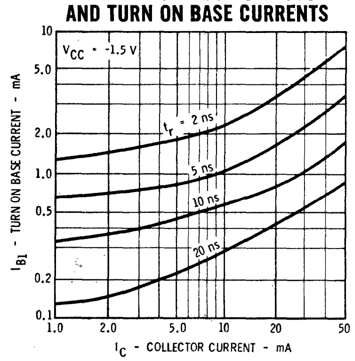
SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



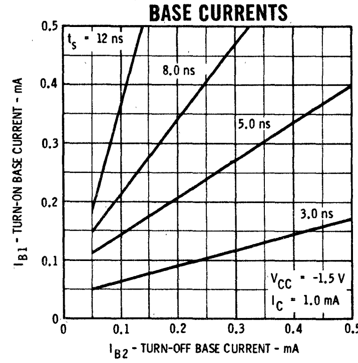
DELAY TIME VERSUS TURN ON BASE CURRENT AND REVERSE BASE EMITTER VOLTAGE



RISE TIME VERSUS COLLECTOR AND TURN ON BASE CURRENTS



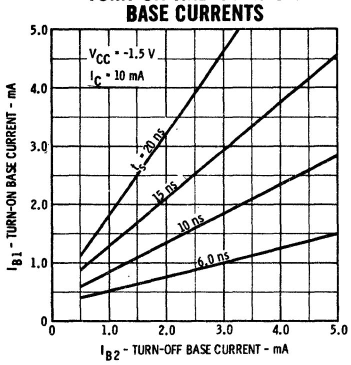
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



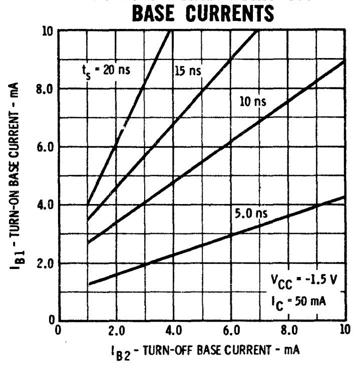
* Single family characteristic on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

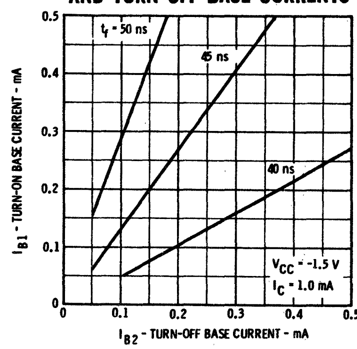
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



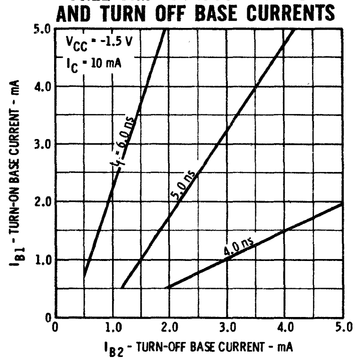
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



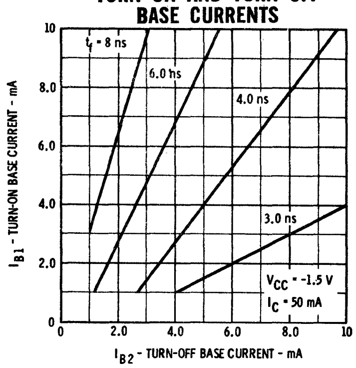
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



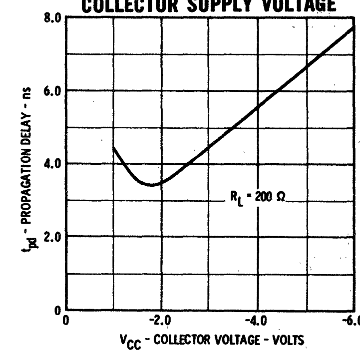
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



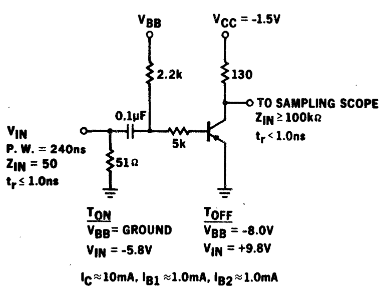
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



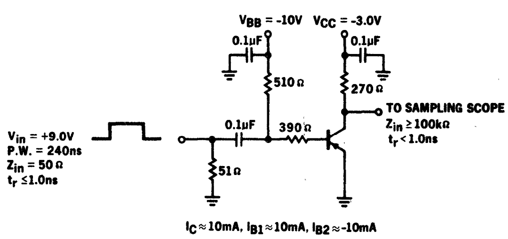
PROPAGATION DELAY TIME VERSUS COLLECTOR SUPPLY VOLTAGE



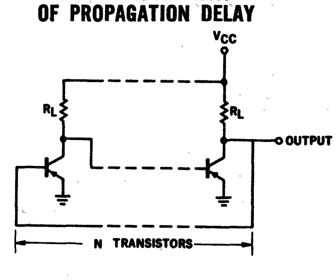
TURN ON AND TURN OFF TEST CIRCUIT



CHARGE STORAGE TIME TEST CIRCUIT



FIVE STAGE RING OSCILLATOR FOR MEASUREMENT OF PROPAGATION DELAY



$$t_{pd} = \frac{1}{2Nf_{osc}}$$

NOTES:

(1) These ratings are limiting values above which the serviceability of any 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 125°C and junction to case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/watt (derating factor of 2.0 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 µsec; duty cycle = 1%.
(6) See switching circuit for exact values of I_C, I_{B1} and I_{B2}.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

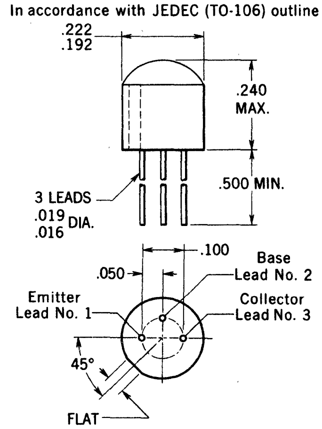
2N4274 • 2N4275

NPN HIGH-SPEED SATURATED SWITCH

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **HIGH FREQUENCY CURRENT GAIN -- f_T = 400 MHz MIN.**
- **LOW CAPACITANCE -- C_{obo} = 4 pF MAX.**
- **LOW CHARGE STORAGE TIME -- τ_s = 13 ns MAX.**
- **LOW V_{CE}(sat) -- 0.2 VOLT MAX. @ 10 mA**

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	125°C Maximum
Lead Temperature (Soldering: 10 sec Time Limit)	260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	0.5 Watt
at 25°C Ambient Temperature	0.2 Watt

Maximum Voltages and Current		2N4274	2N4275
V_{CBO}	Collector to Base Voltage	30 Volts	40 Volts
V_{CES}	Collector to Emitter Voltage	30 Volts	40 Volts
V_{CEO}	Collector to Emitter Voltage	12 Volts	15 Volts
V_{EBO}	Emitter to Base Voltage	4.5 Volts	4.5 Volts
I_C	Collector Current (10 μs Pulse)	500 mA	500 mA
I_C	DC Collector Current	100 mA	100 mA

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

SYMBOL	CHARACTERISTIC	2N4274 MIN.	2N4274 TYP.	2N4274 MAX.	2N4275 MIN.	2N4275 TYP.	2N4275 MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain (Note 5)	35	66	120	35	66	120		I_C = 10 mA	V_{CE} = 1.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	30	71		30	71			I_C = 30 mA	V_{CE} = 0.4 V
h_{FE}	DC Pulse Current Gain (Note 5)	18	45		18	45			I_C = 100 mA	V_{CE} = 1.0 V
V_{BE} (sat)	Base Saturation Voltage (Note 5)	0.72	0.80	0.85	0.72	0.80	0.85	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{BE} (sat)	Base Saturation Voltage (Note 5)	0.74	0.85	1.00	0.74	0.85	1.00	Volts	I_C = 10 mA	I_B = 3.3 mA
V_{BE} (sat)	Base Saturation Voltage (Note 5)		0.90	1.15		0.90	1.15	Volts	I_C = 30 mA	I_B = 3.0 mA
V_{BE} (sat)	Base Saturation Voltage (Note 5)		1.10	1.60		1.10	1.60	Volts	I_C = 100 mA	I_B = 10 mA
V_{CE} (sat)	**Collector Saturation Voltage** (Note 5)		**0.14**	**0.20**		**0.14**	**0.20**	**Volts**	**I_C = 10 mA**	**I_B = 1.0 mA**
V_{CE} (sat)	Collector Saturation Voltage (Note 5)		0.12	0.18		0.12	0.18	Volts	I_C = 10 mA	I_B = 3.3 mA
V_{CE} (sat)	Collector Saturation Voltage (Note 5)		0.17	0.25		0.17	0.25	Volts	I_C = 30 mA	I_B = 3.0 mA
V_{CE} (sat) (65°C)	Collector Saturation Voltage (Note 5)		0.19	0.30		0.19	0.30	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{CE} (sat)	Collector Saturation Voltage (Note 5)		0.28	0.50		0.28	0.50	Volts	I_C = 100 mA	I_B = 10 mA

Notes and 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	CHARACTERISTIC	2N4274 MIN.	2N4274 TYP.	2N4274 MAX.	2N4275 MIN.	2N4275 TYP.	2N4275 MAX.	UNITS	TEST CONDITIONS	
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**4.0**	**6.75**		**4.0**	**6.75**			**$I_C = 10$ mA**	**$V_{CE} = 10$ V**
C_{obo}	**Output Capacitance**		**2.3**	**4.0**		**2.3**	**4.0**	**pF**	$I_E = 0$	**$V_{CB} = 5.0$ V**
I_{CES}	Collector Reverse Current		0.05	0.40		0.05	0.40	μA	$V_{CE} = 20$ V	$V_{BE} = 0$
I_{CBO} (65°C)	Collector Cutoff Current		1.0	10		1.0	10	μA	$I_E = 0$	$V_{CB} = 20$ V
BV_{CES}	Collector to Emitter Breakdown Voltage	30			40			Volts	$I_C = 10$ μA	$V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	30			40			Volts	$I_C = 10$ μA	$I_E = 0$
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	12			15			Volts	$I_C = 10$ mA (pulsed)	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.5			4.5			Volts	$I_C = 0$	$I_E = 10$ μA
τ_s	**Charge Storage Time Constant** (Note 6)		**7.0**	**13**		**7.0**	**13**	**ns**	**$I_C = I_{B1} \approx 10$ mA, $I_{B2} \approx -10$ mA**	
t_{on}	Turn On Time (Note 6)		8.0	12		8.0	12	ns	$I_C \approx 10$ mA, $I_{B1} \approx 3.3$ mA	
t_{off}	Turn Off Time (Note 6)		7.0	12		7.0	12	ns	$I_C \approx 10$ mA, $I_{B1} \approx 3.3$ mA, $I_{B2} \approx -3.3$ mA	

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 125°C and junction to case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C). Junction to ambient thermal resistance of 500°C/watt (derating factor of 2.0 mW/°C.

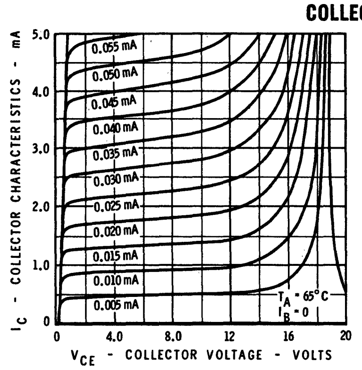
(4) Rating refers to a high-current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.

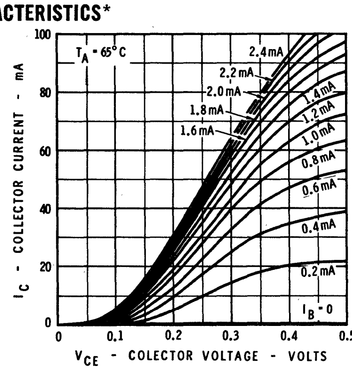
(5) Pulse Conditions: length = 300 μs; duty cycle = 1%.

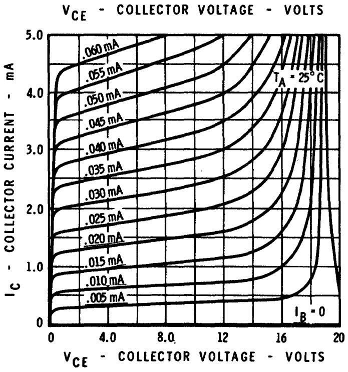
(6) See switching circuits for exact value of I_C, I_{B1}, and I_{B2}.

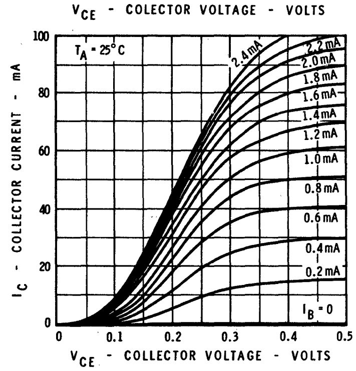
TYPICAL ELECTRICAL CHARACTERISTICS

COLLECTOR CHARACTERISTICS*

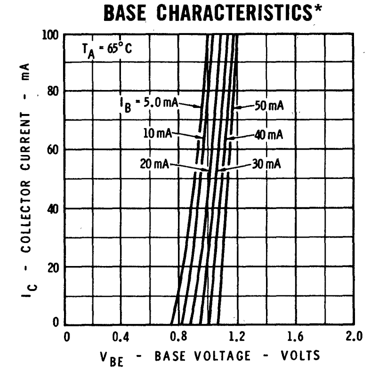


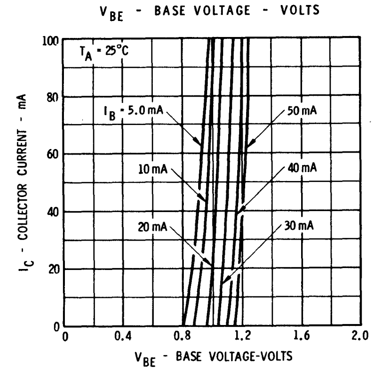




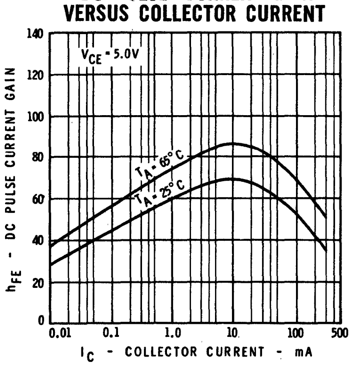


BASE CHARACTERISTICS*

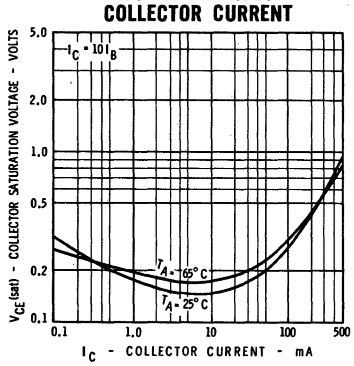




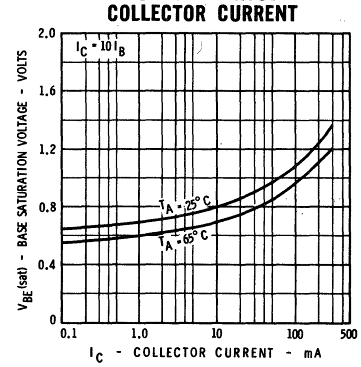
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT

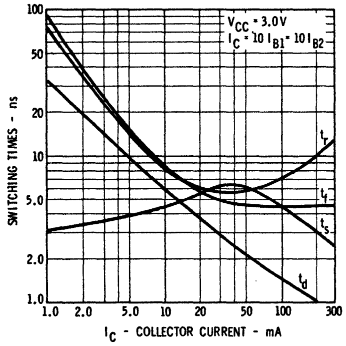


BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT

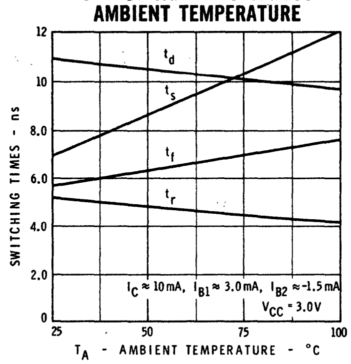


TYPICAL ELECTRICAL CHARACTERISTICS

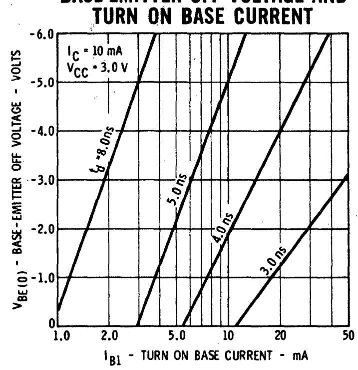
SWITCHING TIMES VERSUS COLLECTOR CURRENT



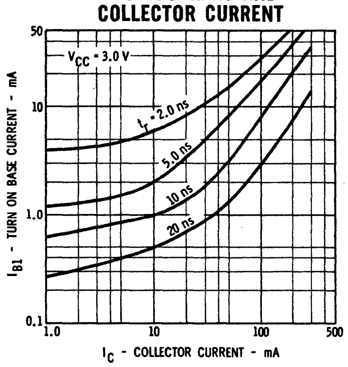
SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



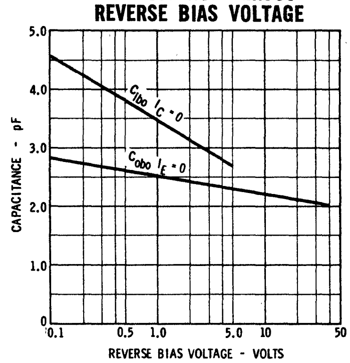
DELAY TIME VERSUS BASE-EMITTER OFF VOLTAGE AND TURN ON BASE CURRENT



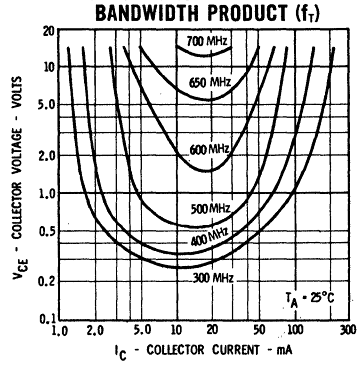
RISE TIME VERSUS TURN ON BASE CURRENT AND COLLECTOR CURRENT



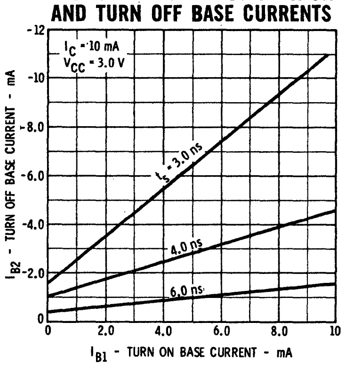
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



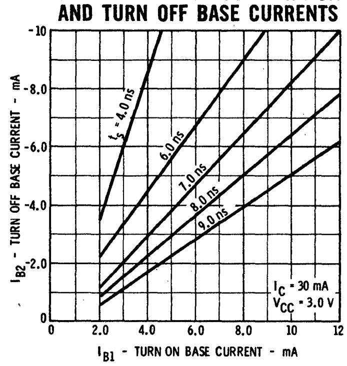
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (fT)



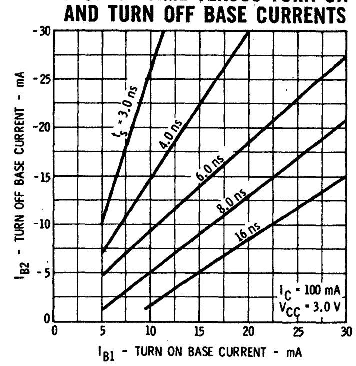
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



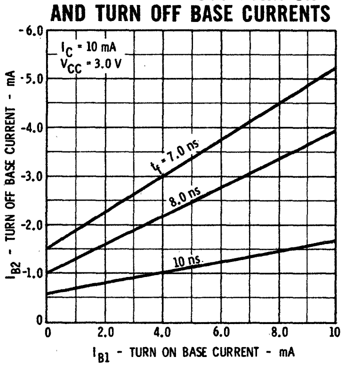
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



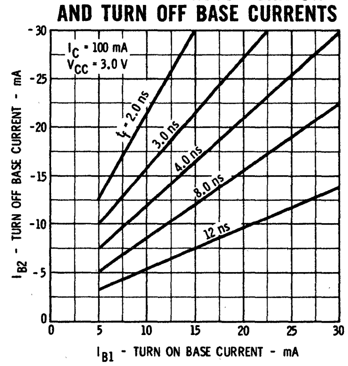
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



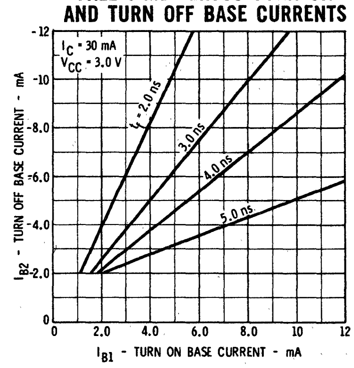
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS

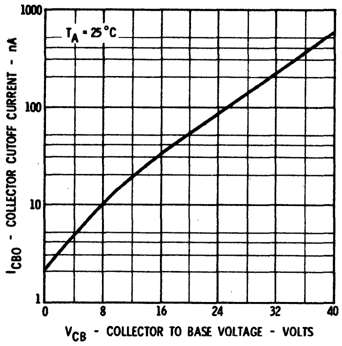


FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS

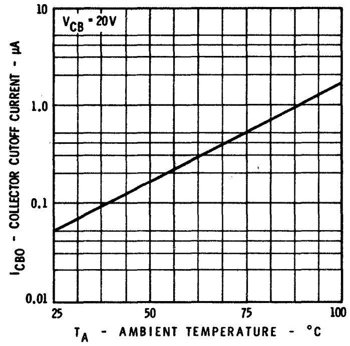


TYPICAL ELECTRICAL CHARACTERISTICS

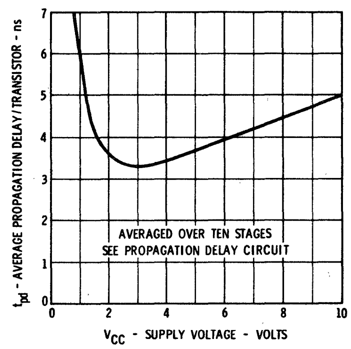
COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



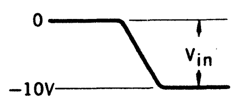
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



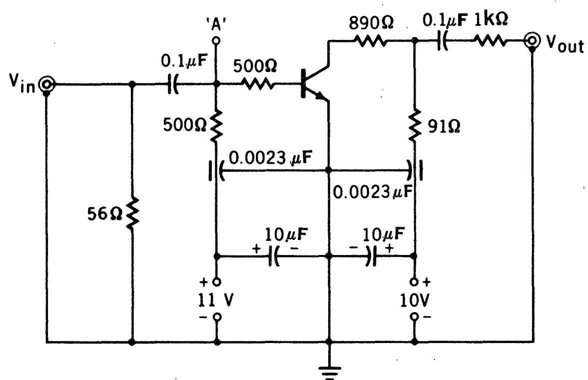
AVERAGE PROPAGATION DELAY PER TRANSISTOR VERSUS COLLECTOR VOLTAGE

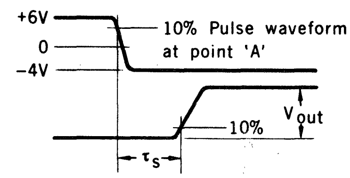


CHARGE STORAGE TIME MEASUREMENT CIRCUIT



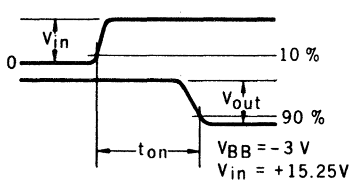
Pulse Generator
V_{in} Rise Time < 1 ns
Source Impedance = 50Ω
PW ≥ 300 ns
Duty Cycle < 2 %



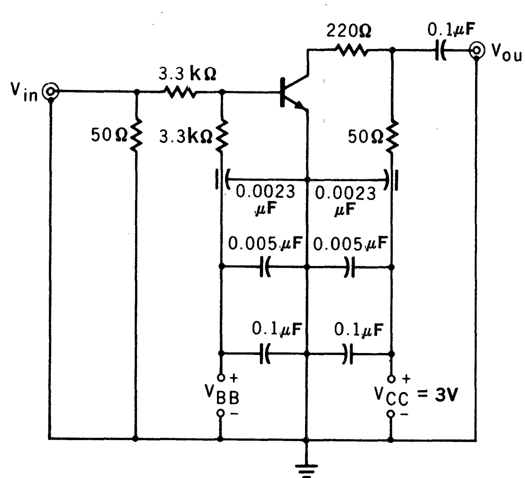


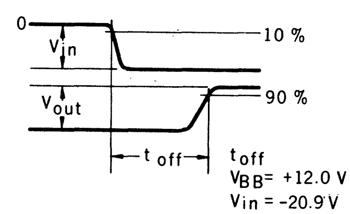
To Sampling Oscilloscope
Input Impedance = 50Ω
Rise Time ≤ 1 ns

t_{ON} — t_{OFF} MEASUREMENT CIRCUIT



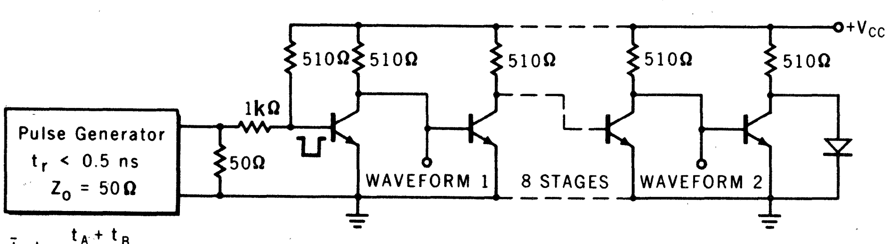
Pulse Generator
V_{in} Rise Time < 1 ns
Source Impedance = 50Ω
PW ≥ 300 ns
Duty Cycle < 2 %

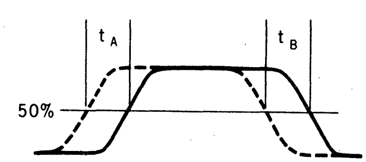




To Sampling Oscilloscope
Input Impedance = 50Ω
Rise Time ≤ 1 ns

CIRCUIT FOR MEASUREMENT OF PROPAGATION DELAY





Waveforms 1 and 2 Superimposed

$$\bar{t}pd = \frac{t_A + t_B}{20}$$

$\bar{t}pd$ = Average Propagation per Transistor

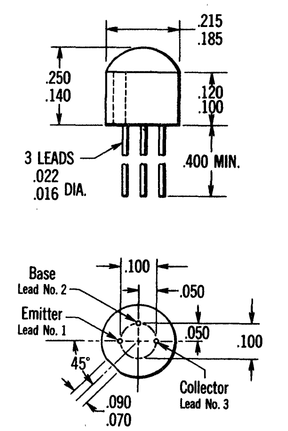
2N4313

PNP HIGH-SPEED SWITCH

DIFFUSED SILICON PLANAR*II EPITAXIAL TRANSISTOR

- **LOW STORAGE TIME -- τ_s = 20 ns (MAX)**
- **LOW TURN ON TIME -- t_{on} = 20 ns (MAX)**
- **LOW TURN OFF TIME -- t_{off} = 25 ns (MAX)**
- **HIGH FREQUENCY -- f_T = 700 MHz (MIN)**
- **LOW CAPACITANCE -- C_{obo} = 4.5 pF (MAX)**
- **LOW SATURATION VOLTAGE -- $V_{CE\,(sat)}$ = 0.13 V (MAX) @ I_C = 10 mA**

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
Emitter and base leads are gold-plated nickel
Collector lead is gold-plated KOVAR
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C
Lead Temperature (Soldering, 10 seconds time limit)	+260°C

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature [Notes 2 and 3]	0.5 Watt
at 25°C Ambient Temperature [Notes 2 and 3]	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	−12 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	−12 Volts
V_{EBO}	Emitter to Base Voltage	−4.5 Volts
V_{CES}	Collector to Emitter Voltage	−12 Volts
I_C	Collector Current [Note 2]	100 mA

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

SYMBOL	CHARACTERISTICS	MIN.	Typ.	MAX.	UNITS	TEST CONDITIONS	
V_{CE} (sat)	**Pulsed Collector-Emitter Saturation Voltage [Note 5]**		**−0.07**	**−0.13**	**Volts**	**I_C = 10 mA**	**I_B = 1.0 mA**
V_{CE} (sat)	Pulsed Collector-Emitter Saturation Voltage [Note 5]		−0.10	−0.19	Volts	I_C = 30 mA	I_B = 3.0 mA
V_{CE} (sat)	**Pulsed Collector-Emitter Saturation Voltage [Note 5]**		**−0.25**	**−0.45**	**Volts**	**I_C = 100 mA**	**I_B = 10 mA**
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**7.0**	**12**			**I_C = 30 mA**	**V_{CE} = −10 V**
C_{obo}	**Common Base, Open Circuit Output Capacitance**		**3.3**	**4.5**	**pF**	**I_E = 0**	**V_{CB} = −5.0 V**
C_{ibo}	Common Base, Open Circuit Input Capacitance		3.8	6.0	pF	I_C = 0	V_{EB} = −0.5 V
I_{CES}	Collector Reverse Current		0.05	50	nA	V_{CE} = −10 V	V_{EB} = 0
I_{CES} (65°C)	Collector Reverse Current		0.002	10	μA	V_{CE} = −10 V	V_{EB} = 0
τ_s	**Charge Storage Time** [Note 6, Figure 1]		**15**	**20**	**ns**	**$I_C \approx$ 10 mA**	**$I_{B1} \approx I_{B2} \approx$ 10 mA**
t_{on}	**Turn On Time** [Note 6, Figure 2]		**10**	**20**	**ns**	**$I_C \approx$ 30 mA**	**$I_{B1} \approx$ 3.0 mA**
t_{off}	**Turn Off Time** [Note 6, Figure 2]		**15**	**25**	**ns**	**$I_C \approx$ 30 mA**	**$I_{B1} \approx I_{B2} \approx$ 3.0 mA**
t_d	Delay Time [Note 6, Figure 2]		4	10	ns	$I_C \approx$ 30 mA	$I_{B1} \approx$ 3.0 mA
t_r	Rise Time [Note 6, Figure 2]		6	15	ns	$I_C \approx$ 30 mA	$I_{B1} \approx$ 3.0 mA
t_s	Storage Time [Note 6, Figure 2]		12	20	ns	$I_C \approx$ 30 mA	$I_{B1} \approx I_{B2} \approx$ 3.0 mA
t_f	Fall Time [Note 6, Figure 2]		3	15	ns	$I_C \approx$ 30 mA	$I_{B1} \approx I_{B2} \approx$ 3.0 mA

Additional Electrical Characteristics on page 2

* 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 125°C and junction to case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/watt (derating factor of 2.0 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) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

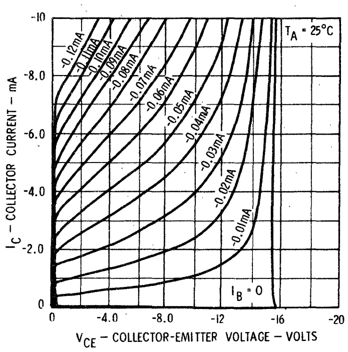
FAIRCHILD TRANSISTOR 2N4313

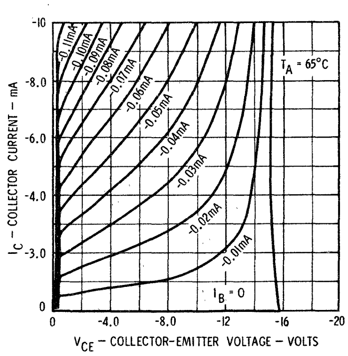
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Noted)

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
V_{BE} (sat)	Pulsed Base-Emitter Saturation Voltage		−0.88	−0.92	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{BE} (sat)	Pulsed Base-Emitter Saturation Voltage	−0.8	−0.93	−1.15	Volts	I_C = 30 mA	I_B = 3.0 mA
V_{BE} (sat)	Pulsed Base-Emitter Saturation Voltage	−0.95	−1.14	−1.5	Volts	I_C = 100 mA	I_B = 10 mA
$V_{CEO\,(sus)}$	**Collector-Emitter Sustaining Voltage** [Notes 4 and 5]	**−12**			**Volts**	**I_C = 10 mA** (pulsed)	**I_B = 0**
BV_{CBO}	Collector-Base Breakdown Voltage	−12			Volts	I_C = 100 μA	I_E = 0
BV_{EBO}	Emitter-Base Breakdown Voltage	−4.5			Volts	I_E = 100 μA	I_C = 0
h_{FE}	DC Pulse Current Gain	18	44			I_C = 1.0 mA	V_{CE} = −0.5 V
h_{FE}	DC Pulse Current Gain [Note 5]	30	55			I_C = 10 mA	V_{CE} = −1.0 V
h_{FE}	DC Pulse Current Gain [Note 5]	30	63	120		I_C = 30 mA	V_{CE} = −0.5 V
h_{FE}	**DC Pulse Current Gain** [Note 5]	**25**	**55**			**I_C = 100 mA**	**V_{CE} = −1.0 V**

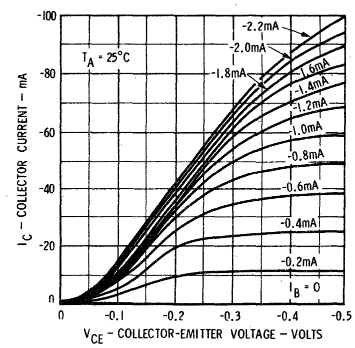
TYPICAL ELECTRICAL CHARACTERISTICS

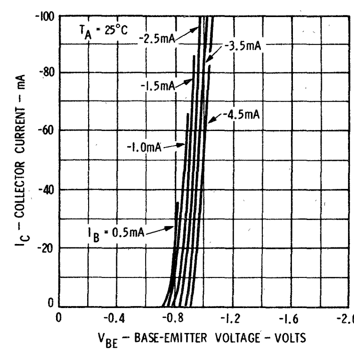
ACTIVE REGION*

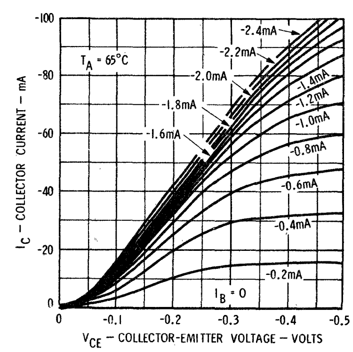


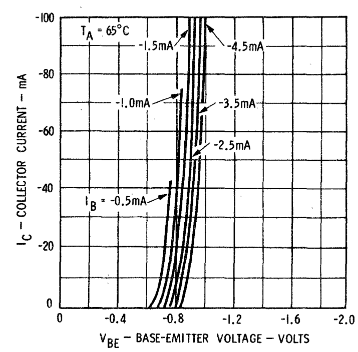


SATURATION REGION*



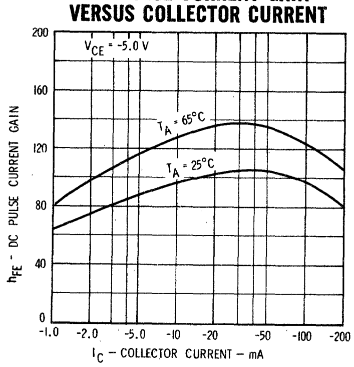




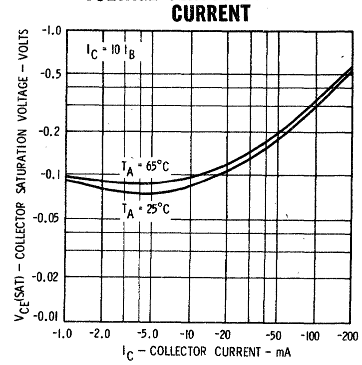


* Single family characteristic on Transistor Curve Tracer.

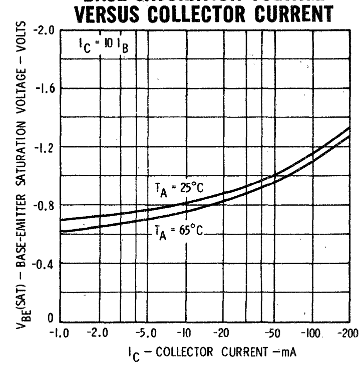
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT

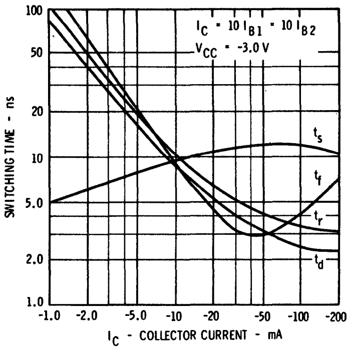


BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT

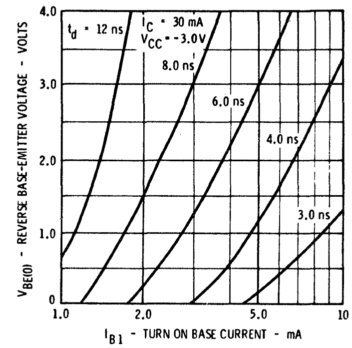


TYPICAL ELECTRICAL CHARACTERISTICS

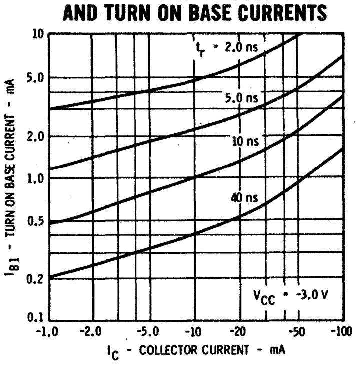
SWITCHING TIME VERSUS COLLECTOR CURRENT



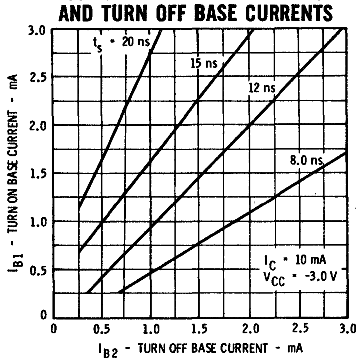
DELAY TIME VERSUS TURN ON BASE CURRENT AND REVERSE BASE EMITTER VOLTAGE



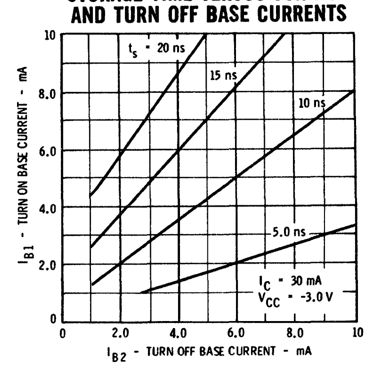
RISE TIME VERSUS COLLECTOR AND TURN ON BASE CURRENTS



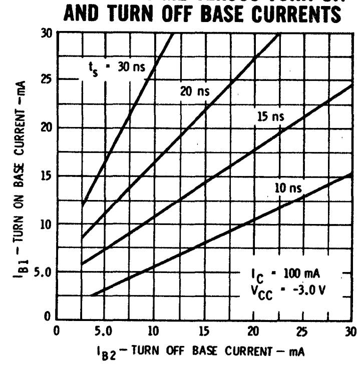
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



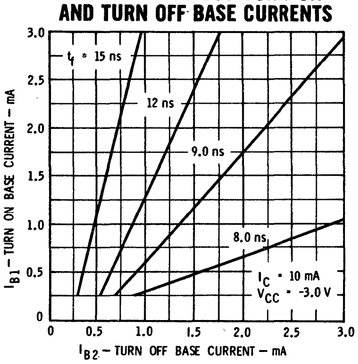
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



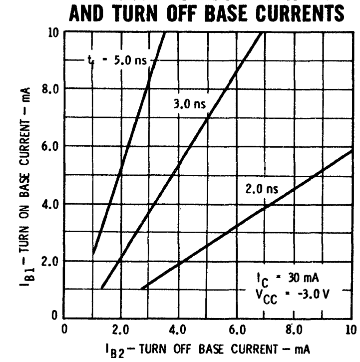
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



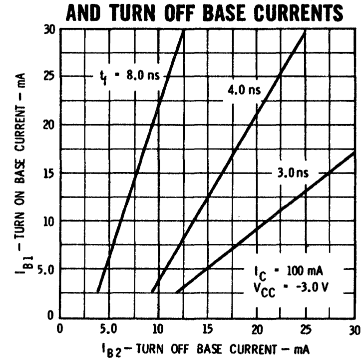
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



SWITCHING TIME VERSUS AMBIENT TEMPERATURE

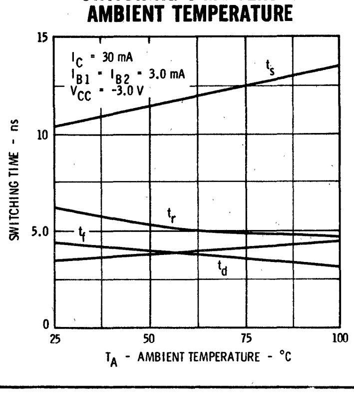


FIG. 1 CHARGE STORAGE TIME TEST CIRCUIT

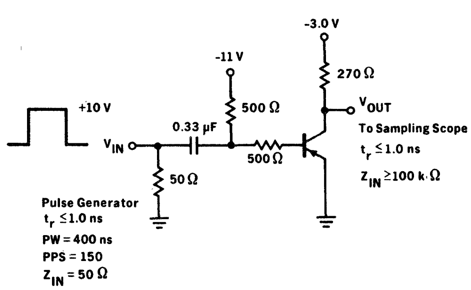
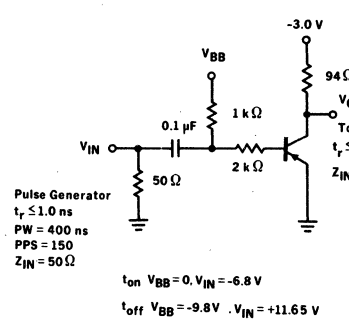
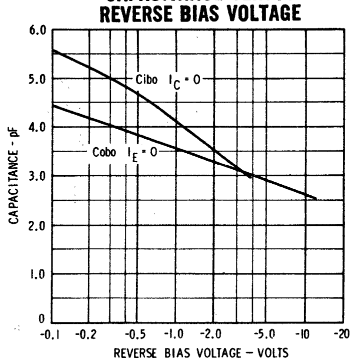


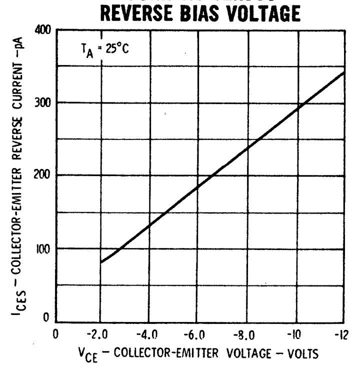
FIG. 2 SWITCHING TIME TEST CIRCUIT



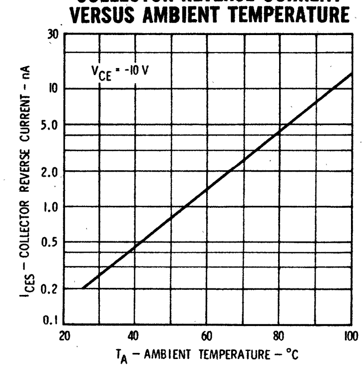
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



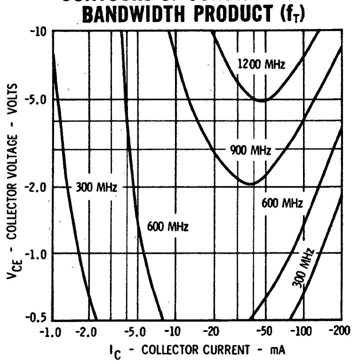
COLLECTOR-EMITTER REVERSE CURRENT VERSUS REVERSE BIAS VOLTAGE



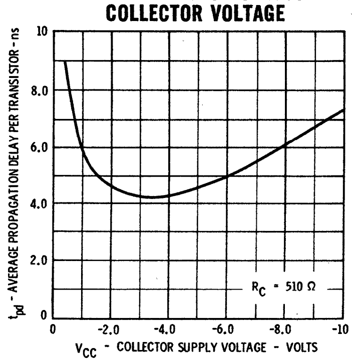
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



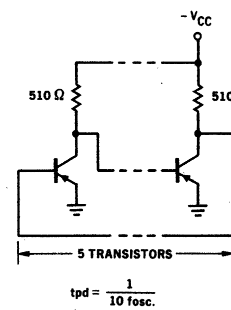
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



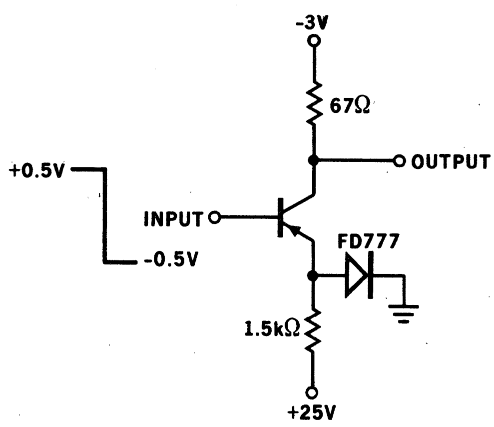
AVERAGE PROPAGATION DELAY PER TRANSISTOR VERSUS COLLECTOR VOLTAGE



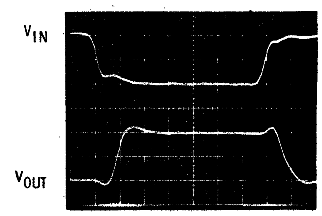
FIVE STAGE RING OSCILLATOR FOR MEASUREMENT OF PROPAGATION DELAY



NON-SATURATED SWITCHING PERFORMANCE



t_{on} = 2 ns Typ.
t_{off} = 2 ns Typ.



2ns/DIV.

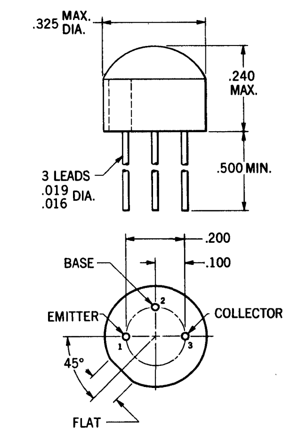
2N4354 • 2N4355 • 2N4356

PNP LOW LEVEL, LOW NOISE AMPLIFIERS AND HIGH CURRENT SWITCHES

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **HIGH BREAKDOWN . . . . —60 AND —80 VOLT (MIN) LV_{CEO}**
- **EXCELLENT BETA LINEARITY . . . FROM 100 µA TO 500 mA**
- **LOW NOISE FIGURE . . . . 3 dB (MAX) AT 1.0 kHz**
- **LOW $V_{CE(sat)}$ . . . . 1.0 VOLT (MAX) AT I_C = 1.0 A**
- **COMPLEMENTARY WITH 2N3567, 2N3568, 2N3569**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature		−55°C to +125°C
Operating Junction Temperature		125°C
Lead Temperature (Soldering, 10 second time limit)		260°C
Maximum Power Dissipation (Notes 2 and 3)		
Total Dissipation at 25°C Case Temperature		**0.8 Watt**
at 25°C Ambient Temperature		0.35 Watt
Maximum Voltages	**2N4354 2N4355**	**2N4356**
V_{CBO} Collector to Base Voltage	−60 Volts	−80 Volts
V_{CEO} Collector to Emitter Voltage (Note 4)	−60 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	CHARACTERISTIC	2N4354 MIN.	TYP.	MAX.	2N4355 MIN.	TYP.	MAX.	2N4356 MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
h_{FE}	**DC Pulse Current Gain** (Note 5)	25	110		**60**	**180**		**25**	**160**			**I_C = 100 µA V_{CE} = −10 V**
h_{FE}	**DC Pulse Current Gain** (Note 5)	40	120		75	200		40	180			I_C = 1 mA V_{CE} = −10 V
h_{FE}	**DC Pulse Current Gain** (Note 5)	50	120	500	**100**	**200**	**400**	**50**	**180**	**250**		**I_C = 10 mA V_{CE} = −10 V**
h_{FE}	DC Pulse Current Gain (Note 5)	40	115		75	190		40	170			I_C = 100 mA V_{CE} = −10 V
h_{FE}	**DC Pulse Current Gain** (Note 5)	30	110		**75**	**170**		**30**	**160**			**I_C = 500 mA V_{CE} = −10 V**
h_{fe}	High Frequency Current Gain (f = 100 MHz)	1.0	2.0	5.0	1.0	2.0	5.0	1.0	2.0	5.0		I_C = 50 mA V_{CE} = −10 V
BV_{CBO}	Collector to Base Breakdown Voltage	−60			−60			−80			Volts	I_C = 10 µA I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0			−5.0			−5.0			Volts	I_C = 0 I_E = 10 µA
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 4 and 5)	−60			**−60**			**−80**			**Volts**	**I_C = 10 mA I_B = 0 (pulsed)**
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 5)					**−0.5**	**−1.0**				**Volts**	**I_C = 1.0 A I_B = 100 mA**
$V_{BE(sat)}$	**Pulsed Base Saturation Voltage** (Note 5)						**−1.2**				**Volts**	**I_C = 1.0 A I_B = 100 mA**
$V_{BE(ON)}$	Pulsed Base Emitter "ON" Voltage (Note 5)					−1.05	−1.20				Volts	I_C = 1.0 A V_{CE} = −1.0 V

Additional Electrical Characteristics on Page 2

*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 125°C and junction to case thermal resistance of 125°C/Watt (derating factor of 8.0 mW/°C); junction to ambient thermal resistance of 286°C/Watt (derating factor of 3.5 mW/°C).
(4) Rating refers to a high current point where collector to emitter voltage is lowest.
(5) Pulse Conditions: length = 300 µs; duty cycle = 1%.
(6) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

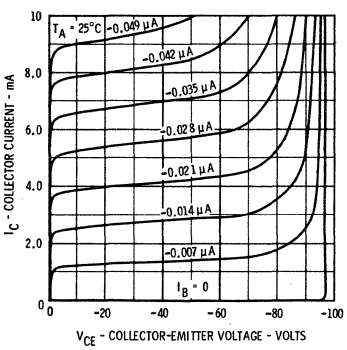
FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

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

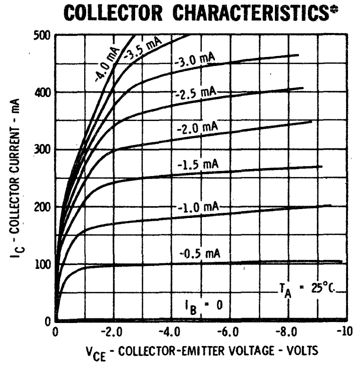
SYMBOL	CHARACTERISTIC	TYP.	MAX.	UNITS	TEST CONDITIONS	
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 5)	−0.10	−0.15	Volts	$I_C = 150$ mA	$I_B = 15$ mA
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 5)	**−0.25**	**−0.5**	**Volts**	**$I_C = 500$ mA**	**$I_B = 50$ mA**
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 5)	−0.8	−0.9	Volts	$I_C = 150$ mA	$I_B = 15$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 5)		−1.1	Volts	$I_C = 500$ mA	$I_B = 50$ mA
$V_{BE(ON)}$	Pulsed Base Emitter "ON" Voltage (Note 5)	−0.95	−1.1	Volts	$I_C = 500$ mA	$V_{CE} = -0.5$ V
I_{CBO}	Collector Cutoff Current	0.2	50	nA	$I_E = 0$	$V_{CB} = -50$ V
$I_{CBO}(+75°C)$	Collector Cutoff Current	0.02	5.0	μA	$I_E = 0$	$V_{CB} = -50$ V
I_{EBO}	Emitter to Base Current	1.0	100	nA	$I_C = 0$	$V_{EB} = -4.0$ V
C_{cb}	Collector to Base Capacitance (f = 1.0 MHz)	15	30	pF	$I_C = 0$	$V_{CB} = -10$ V
C_{eb}	Emitter to Base Capacitance (f = 1.0 MHz)	75	110	pF	$I_C = 0$	$V_{EB} = -0.5$ V
t_{on}	Turn-on Time (Note 6)	23	100	ns	$I_C \simeq 500$ mA	$I_{B1} \simeq 50$ mA
t_{off}	Turn-off Time (Note 6)	200	400	ns	$I_C \simeq 500$ mA $I_{B2} \simeq -50$ mA	$I_{B1} \simeq 50$ mA
NF	**Noise Figure (f = 1.0 kHz)**	**1.0**	**3.0**	**dB**	**$I_C = 100$ μA** **$R_S = 1.0$ kΩ**	**$V_{CE} = -10$ V**

TYPICAL ELECTRICAL CHARACTERISTICS

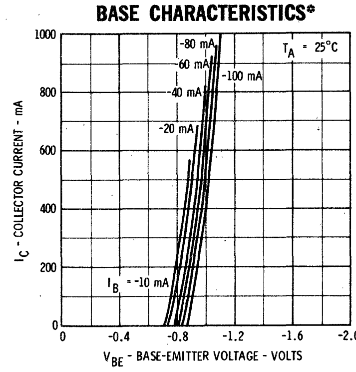
COLLECTOR CHARACTERISTICS*



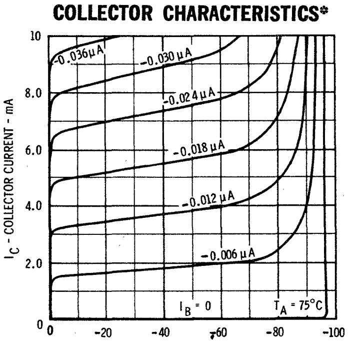
COLLECTOR CHARACTERISTICS*



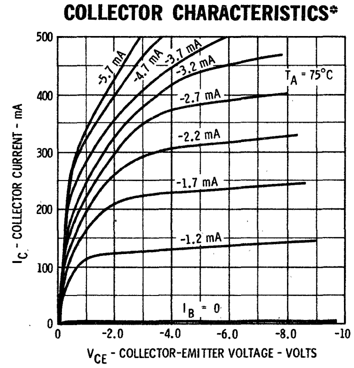
BASE CHARACTERISTICS*



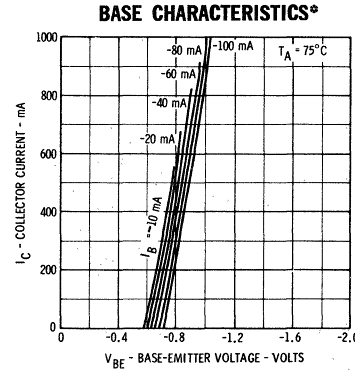
COLLECTOR CHARACTERISTICS*



COLLECTOR CHARACTERISTICS*

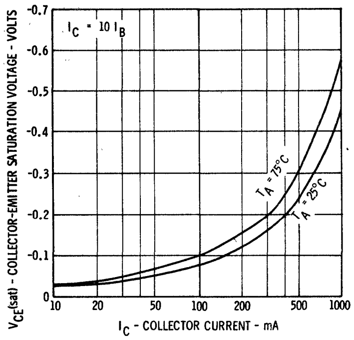


BASE CHARACTERISTICS*

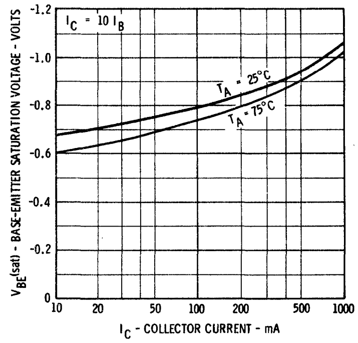


*Single family characteristic on Transistor Curve Tracer.

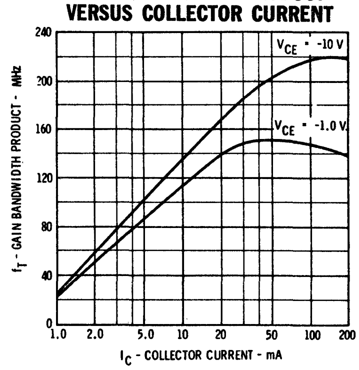
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



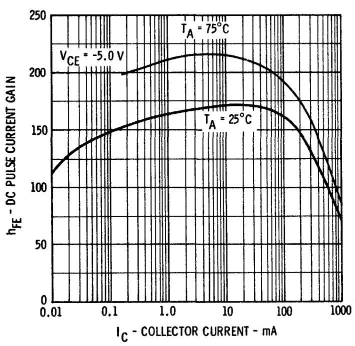
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



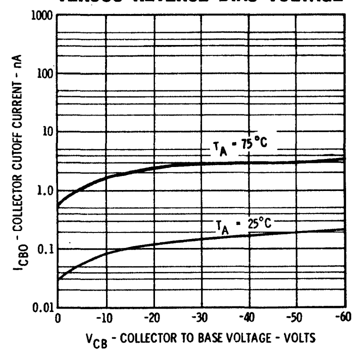
GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT



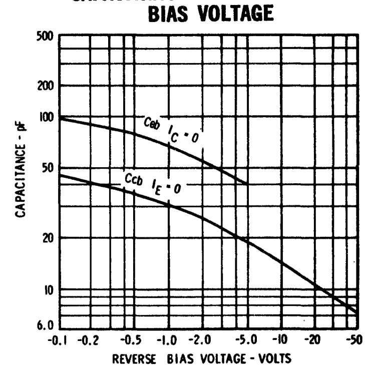
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



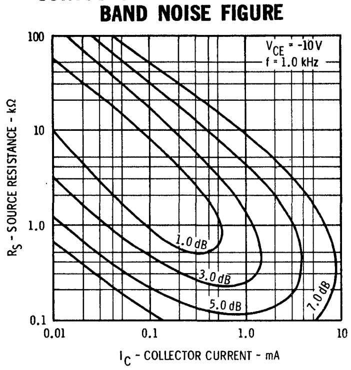
COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



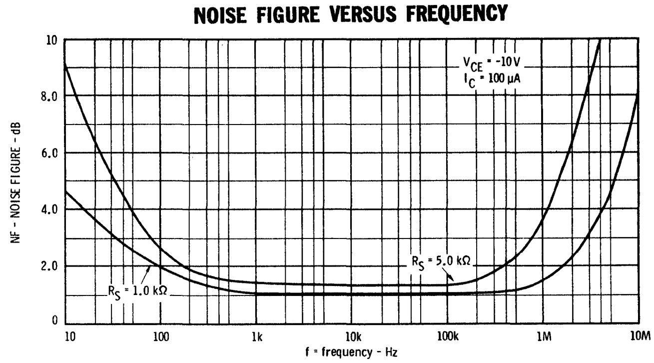
COMMON BASE OPEN CIRCUIT INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



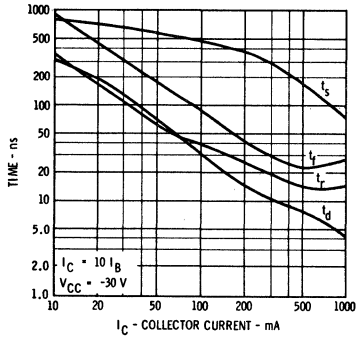
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



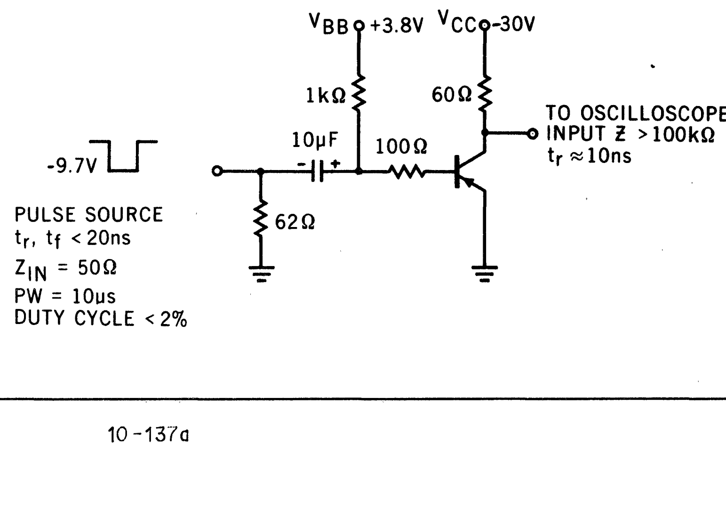
NOISE FIGURE VERSUS FREQUENCY



SWITCHING TIMES VERSUS COLLECTOR CURRENT



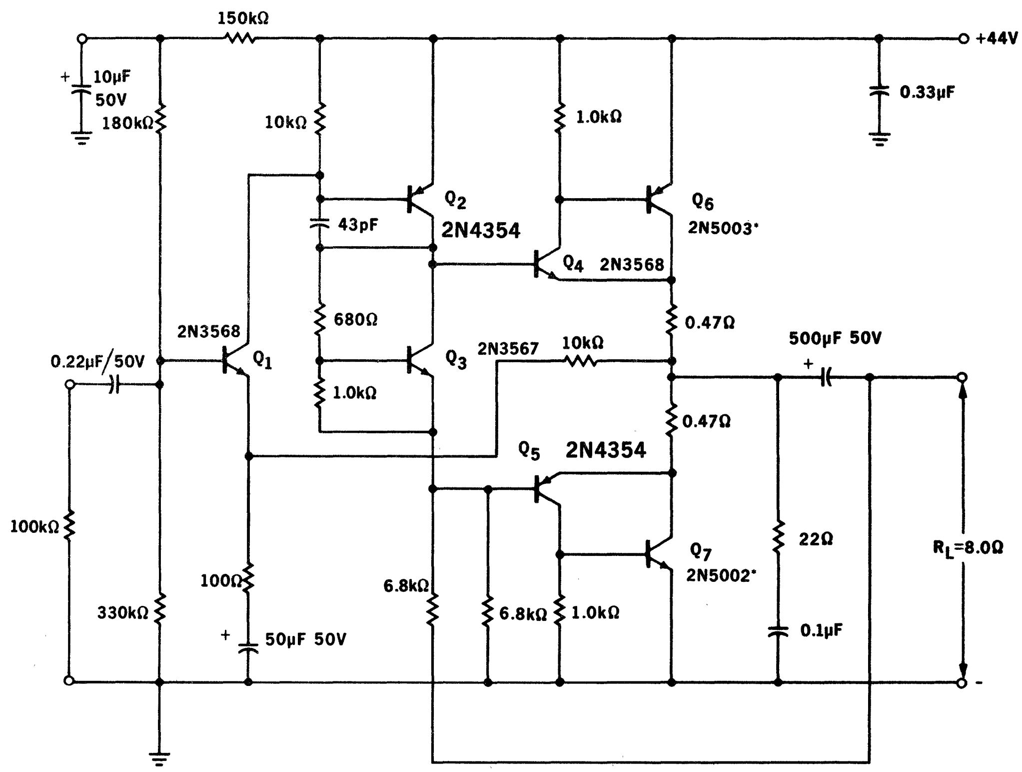
t_{on} AND t_{off} TEST CIRCUIT



TYPICAL SMALL SIGNAL CHARACTERISTICS (f = 1 kHz)

SYMBOL	CHARACTERISTICS	TYP.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance	800	Ω	$I_C = 10$ mA	$V_{CE} = -10$ V
h_{oe}	Output Conductance	75	μmho	$I_C = 10$ mA	$V_{CE} = -10$ V
h_{re}	Voltage Feedback Ratio	180	$X10^{-6}$	$I_C = 10$ mA	$V_{CE} = -10$ V
h_{fe}	Small Signal Current Gain	140		$I_C = 10$ mA	$V_{CE} = -10$ V

TYPICAL 25 WATT POWER AMPLIFIER
USING THE 2N4354 IN THE DRIVER STAGES



*OR EQUIVALENT SILICON OUTPUT TRANSISTOR

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

FT4354 • FT4355 • FT4356

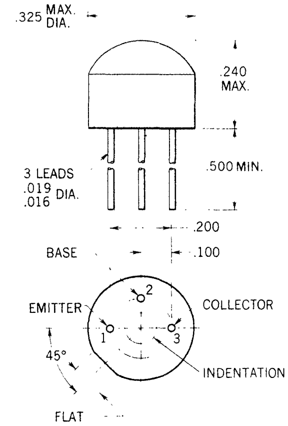
PNP LOW LEVEL, LOW NOISE AMPLIFIERS AND HIGH CURRENT SWITCHES

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

SIMILAR TO 2N4354 • 2N4355 • 2N4356 EXCEPT FOR INCREASED POWER DISSIPATION

- **HIGH POWER DISSIPATION . . . 4.0 WATTS AT 25°C CASE TEMPERATURE**
- **HIGH BREAKDOWN . . . . —60 AND —80 VOLT (MIN) LV_{CEO}**
- **EXCELLENT BETA LINEARITY . . . FROM 100 μA TO 500 mA**
- **LOW NOISE FIGURE . . . . 3 dB (MAX) AT 1.0 kHz**
- **LOW $V_{CE(sat)}$ . . . . 1.0 VOLT (MAX) AT $I_C = 1.0$ A**
- **COMPLEMENTARY WITH FT3567, FT3568, FT3569**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold plated nickel
Package is electrically Non conductive material
Package weight is 0.66 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures			
Storage Temperature			−55°C to +125°C
Operating Junction Temperature			125°C
Lead Temperature (Soldering, 10 second time limit)			260°C
Maximum Power Dissipation (Notes 2 and 3)			
Total Dissipation at 25°C Case Temperature			**4.0 Watts**
at 25°C Ambient Temperature			0.5 Watt
Maximum Voltages		**FT4354 FT4355**	**FT4356**
V_{CBO}	Collector to Base Voltage	−60 Volts	−80 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	−60 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)

		FT4354			FT4355			FT4356				
SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
h_{FE}	**DC Pulse Current Gain** (Note 5)	25	110		60	180		25	160			$I_C = 100\ \mu A$ $V_{CE} = -10$ V
h_{FE}	**DC Pulse Current Gain** (Note 5)	40	120		75	200		40	180			$I_C = 1.0$ mA $V_{CE} = -10$ V
h_{FE}	**DC Pulse Current Gain** (Note 5)	50	120	500	100	200	400	50	180	250		$I_C = 10$ mA $V_{CE} = -10$ V
h_{FE}	DC Pulse Current Gain (Note 5)	40	115		75	190		40	170			$I_C = 100$ mA $V_{CE} = -10$ V
h_{FE}	**DC Pulse Current Gain** (Note 5)	30	110		75	170		30	160			$I_C = 500$ mA $V_{CE} = -10$ V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	1.0	2.0	5.0	1.0	2.0	5.0	1.0	2.0	5.0		$I_C = 50$ mA $V_{CE} = -10$ V
BV_{CBO}	Collector to Base Breakdown Voltage	−60			−60			−80			Volts	$I_C = 10\ \mu A$ $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0			−5.0			−5.0			Volts	$I_C = 0$ $I_E = 10\ \mu A$
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Notes 4 and 5)	−60			−60			−80			Volts	$I_C = 10$ mA $I_B = 0$ (pulsed)
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 5)					−0.5	−1.0				Volts	$I_C = 1.0$ A $I_B = 100$ mA
$V_{BE(sat)}$	**Pulsed Base Saturation Voltage** (Note 5)						−1.2				Volts	$I_C = 1.0$ A $I_B = 100$ mA
$V_{BE(ON)}$	Pulsed Base Emitter "ON" Voltage (Note 5)					−1.05	−1.20				Volts	$I_C = 1.0$ A $V_{CE} = -1.0$ V

Additional Electrical Characteristics on Page 2

*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 125°C and junction to case thermal resistance of 25°C/Watt (derating factor of 40 mW/°C); junction to ambient thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C).
(4) Rating refers to a high current point where collector to emitter voltage is lowest.
(5) Pulse Conditions: length 300 μs; duty cycle 1%.
(6) See switching circuit for exact values of [illegible], [illegible], and [illegible].

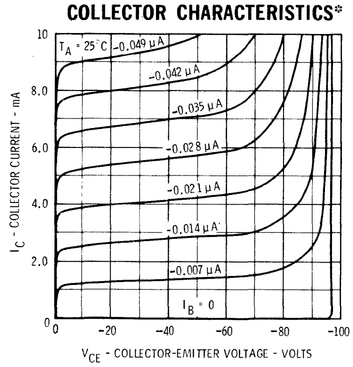
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

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

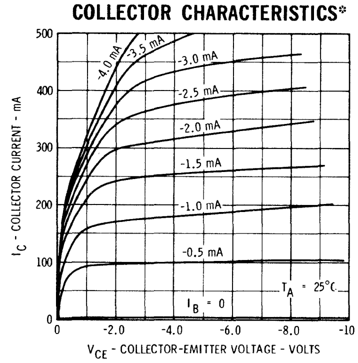
SYMBOL	CHARACTERISTIC	TYP.	MAX.	UNITS	TEST CONDITIONS	
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 5)	−0.10	−0.15	Volts	$I_C = 150$ mA	$I_B = 15$ mA
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 5)	**−0.25**	**−0.5**	**Volts**	**$I_C = 500$ mA**	**$I_B = 50$ mA**
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 5)	−0.8	−0.9	Volts	$I_C = 150$ mA	$I_B = 15$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 5)		−1.1	Volts	$I_C = 500$ mA	$I_B = 50$ mA
$V_{BE(ON)}$	Pulsed Base Emitter "ON" Voltage (Note 5)	−0.95	−1.1	Volts	$I_C = 500$ mA	$V_{CE} = -0.5$ V
I_{CBO}	Collector Cutoff Current	0.2	50	nA	$I_E = 0$	$V_{CB} = -50$ V
$I_{CBO}(+75°C)$	Collector Cutoff Current	0.02	5.0	μA	$I_E = 0$	$V_{CB} = -50$ V
I_{EBO}	Emitter to Base Current	1.0	100	nA	$I_C = 0$	$V_{EB} = -4.0$ V
C_{cb}	Collector to Base Capacitance (f = 1.0 MHz)	15	30	pF	$I_C = 0$	$V_{CB} = -10$ V
C_{eb}	Emitter to Base Capacitance (f = 1.0 MHz)	75	110	pF	$I_C = 0$	$V_{EB} = -0.5$ V
t_{on}	Turn-on Time (Note 6)	23	100	ns	$I_C \simeq 500$ mA	$I_{B1} \simeq 50$ mA
t_{off}	Turn-off Time (Note 6)	200	400	ns	$I_C \sim 500$ mA $I_{B2} \simeq -50$ mA	$I_{B1} \sim 50$ mA
NF	**Noise Figure (f = 1.0 kHz)**	**1.0**	**3.0**	**dB**	**$I_C = 100$ μA** **$R_S = 1.0$ kΩ**	**$V_{CE} = -10$ V**

TYPICAL ELECTRICAL CHARACTERISTICS

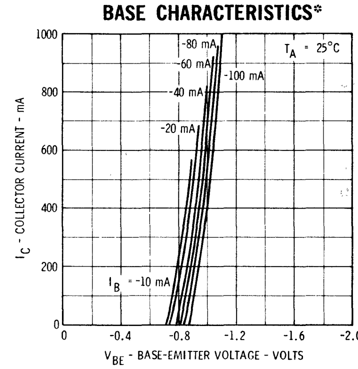
COLLECTOR CHARACTERISTICS*



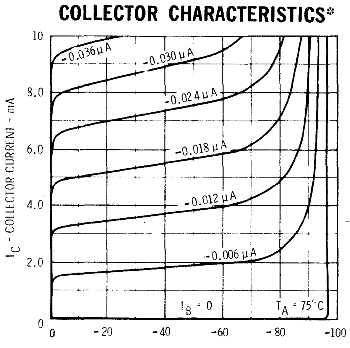
COLLECTOR CHARACTERISTICS*



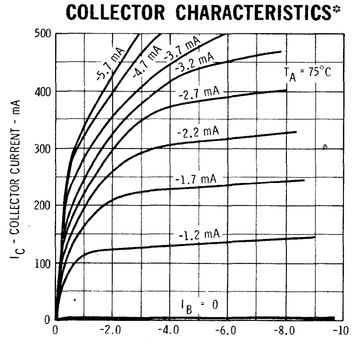
BASE CHARACTERISTICS*



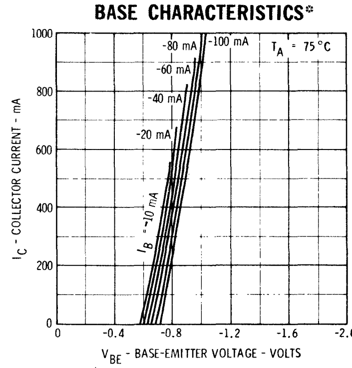
COLLECTOR CHARACTERISTICS*



COLLECTOR CHARACTERISTICS*

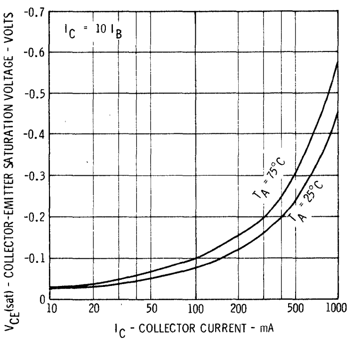


BASE CHARACTERISTICS*

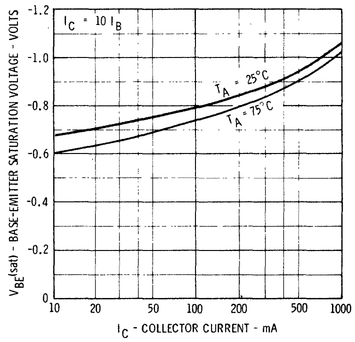


*Single family characteristic on Transistor Curve Tracer.

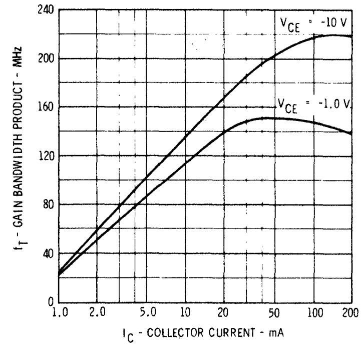
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



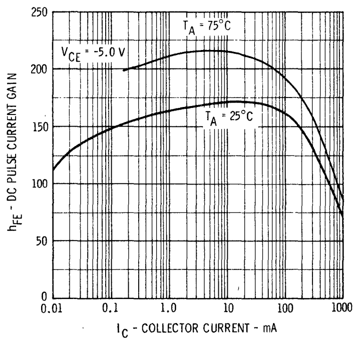
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



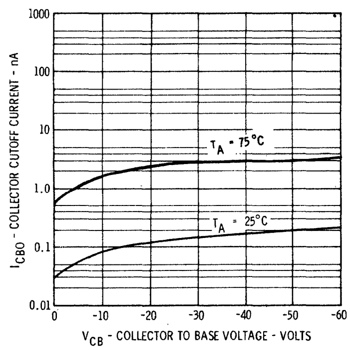
GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT



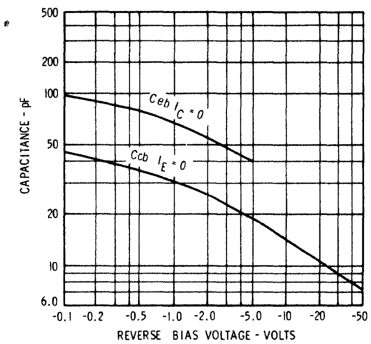
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



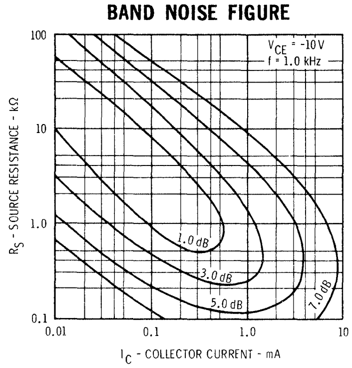
COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



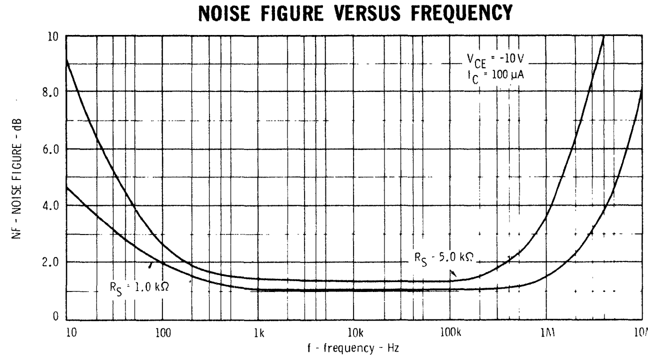
COMMON BASE OPEN CIRCUIT INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



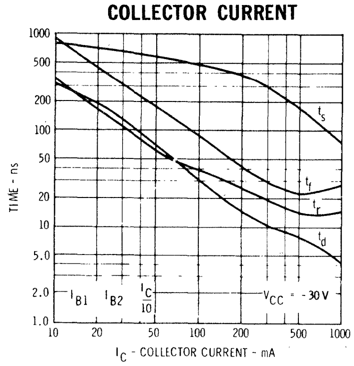
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



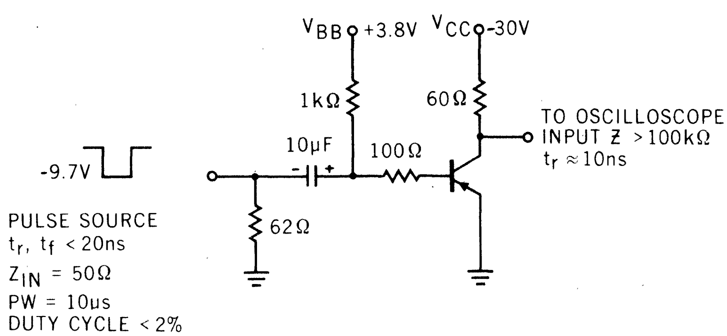
NOISE FIGURE VERSUS FREQUENCY



SWITCHING TIMES VERSUS COLLECTOR CURRENT



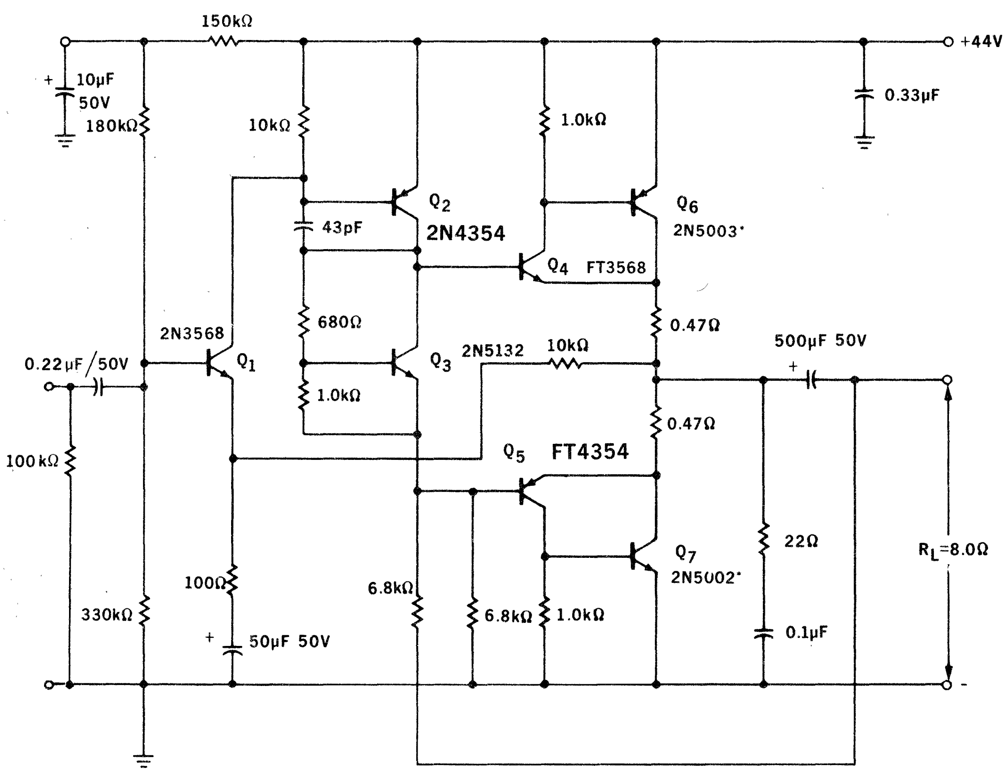
t_{ON} AND t_{OFF} TEST CIRCUIT



TYPICAL SMALL SIGNAL CHARACTERISTICS (f = 1 kHz)

SYMBOL	CHARACTERISTICS	TYP.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance	800	Ω	$I_C = 10$ mA	$V_{CE} = -10$ V
h_{oe}	Output Conductance	75	μmho	$I_C = 10$ mA	$V_{CE} = -10$ V
h_{re}	Voltage Feedback Ratio	180	X10	$I_C = 10$ mA	$V_{CE} = -10$ V
h_{fe}	Small Signal Current Gain	140		$I_C = 10$ mA	$V_{CE} = -10$ V

TYPICAL 25 WATT POWER AMPLIFIER
USING THE FT4354 IN THE DRIVER STAGES



*OR EQUIVALENT SILICON OUTPUT TRANSISTOR

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

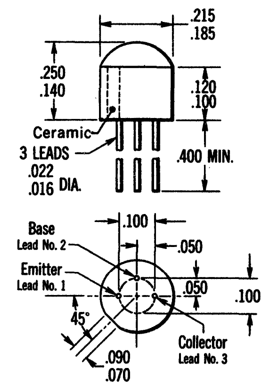
2N4436 • 2N4437

NPN CLASS-C RF AMPLIFIERS AND HIGH CURRENT SWITCHES

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **HIGH GAIN -- 400 mW RF POWER OUT @ 30 MHz**
- **HIGH BETA -- 100 MIN @ 150 mA, 25 MIN @ 500 mA**
- **HIGH f_T -- 250 MHz MIN @ 50 mA**
- **FAST SWITCHING -- 60 ns MAX t_{on} AND 150 ns MAX t_{off} @ 300 mA**
- **LOW $V_{CE(sat)}$ -- 0.22 V MAX @ 150 mA, 0.35 V TYP. @ 500 mA**

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	125°C
Lead Temperature (Soldering, 10 second time limit)	260°C

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature [Notes 2 and 3]	0.5 Watt
at 25°C Ambient Temperature [Notes 2 and 3]	0.2 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage	60 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	30 Volts
V_{EBO}	Emitter to Base Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Noted)

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
G_{PE}	**Amplifier Power Gain (f = 30 MHz)** [Note 7]	**10**	**12**		**dB**	**$I_C = 0$ $V_{CE} = 15$ V** (zero signal)
η	Collector Efficiency (f = 30 MHz) [Note 7]	60	75		%	$I_C = 0$ $V_{CE} = 15$ V (zero signal)
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**2.5**		**8.0**		**$I_C = 50$ mA $V_{CE} = 5.0$ V**
h_{FE}	**DC Pulse Current Gain** [Note 5] **2N4436**	**40**	**75**	**120**		$I_C = 150$ mA $V_{CE} = 10$ V
	2N4437	**100**	**220**	**300**		$I_C = 150$ mA $V_{CE} = 10$ V
h_{FE}	DC Pulse Current Gain [Note 5] 2N4436	15	62			$I_C = 500$ mA $V_{CE} = 10$ V
	2N4437	25	125			$I_C = 500$ mA $V_{CE} = 10$ V
t_{on}	Turn On Time [Note 6]		14	60	ns	$I_C \approx 300$ mA $I_{B1} \approx 30$ mA
t_{off}	Turn Off Time [Note 6]		80	150	ns	$I_C \approx 300$ mA $I_{B1} \approx 30$ mA $I_{B2} \approx 30$ mA

* 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 125°C and junction to case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/watt (derating factor of 2.0 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 = 300μs; duty cycle = 1%.
(6) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.
(7) P_{IN} = 40 mW. See Test Circuit.

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)

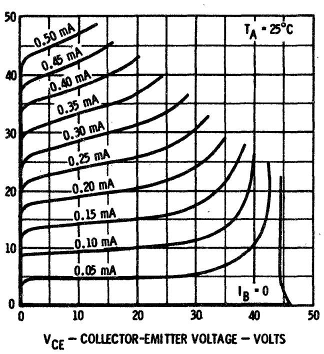
SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	60			Volts	$I_C = 10\ \mu A$ $I_E = 0$
$V_{CEO\ (sust)}$	Collector to Emitter Sustaining Voltage [Notes 4 and 5]	30			Volts	$I_C = 10$ mA $I_B = 0$ (pulsed)
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			Volts	$I_C = 0$ $I_E = 10\ \mu A$
C_{obo}	Output Capacitance (f = 1.0 MHz)			8.0	pF	$I_E = 0$ $V_{CB} = 10$ V
$V_{CE\ (sat)}$	**Pulsed Collector Saturation Voltage** [Note 5]		**0.13**	**0.22**	**Volts**	**$I_C = 150$ mA $I_B = 15$ mA**
$V_{BE\ (sat)}$	Pulsed Emitter Saturation Voltage [Note 5]			1.10	Volts	$I_C = 150$ mA $I_B = 15$ mA
I_{CES}	Collector Reverse Current			0.05	μA	$V_{CE} = 50$ V $V_{EB} = 0$
I_{CES} (65°C)	Collector Reverse Current			1.0	μA	$V_{CE} = 50$ V $V_{EB} = 0$

TYPICAL ELECTRICAL CHARACTERISTICS

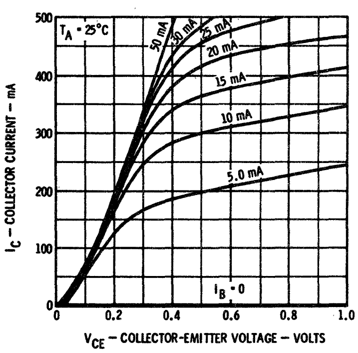
COLLECTOR CHARACTERISTICS*

2N4436

ACTIVE REGION

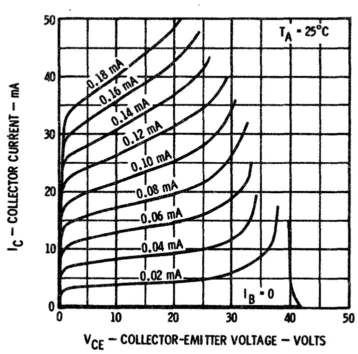


SATURATION REGION

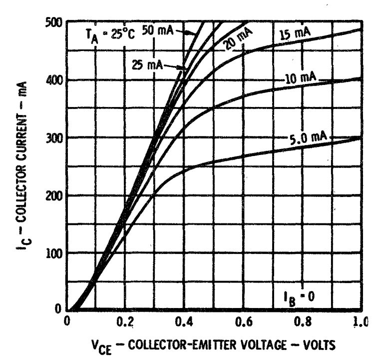


2N4437

ACTIVE REGION

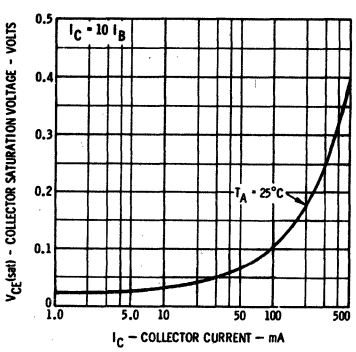


SATURATION REGION

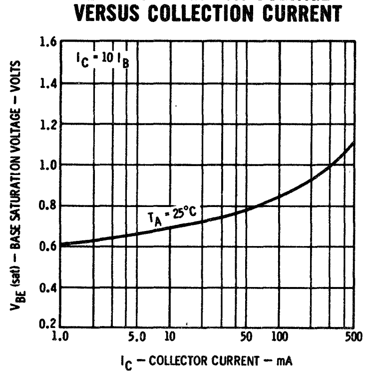


* Single family characteristic on Transistor Curve Tracer.

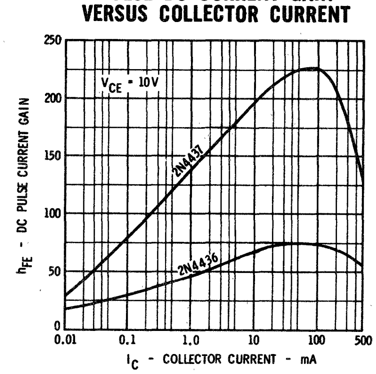
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



BASE SATURATION VOLTAGE VERSUS COLLECTION CURRENT

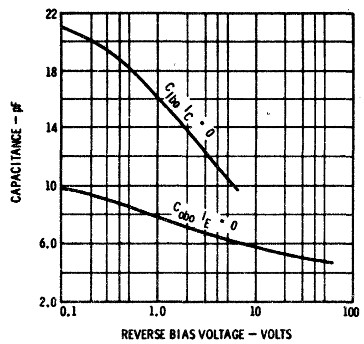


PULSE DC CURRENT GAIN VERSUS COLLECTOR CURRENT

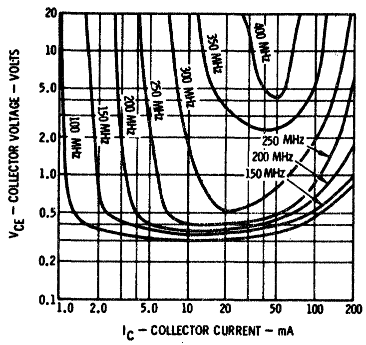


TYPICAL ELECTRICAL CHARACTERISTICS

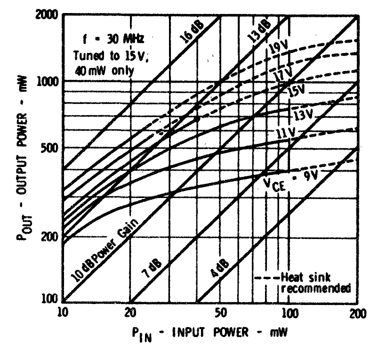
EMITTER TRANSITION AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



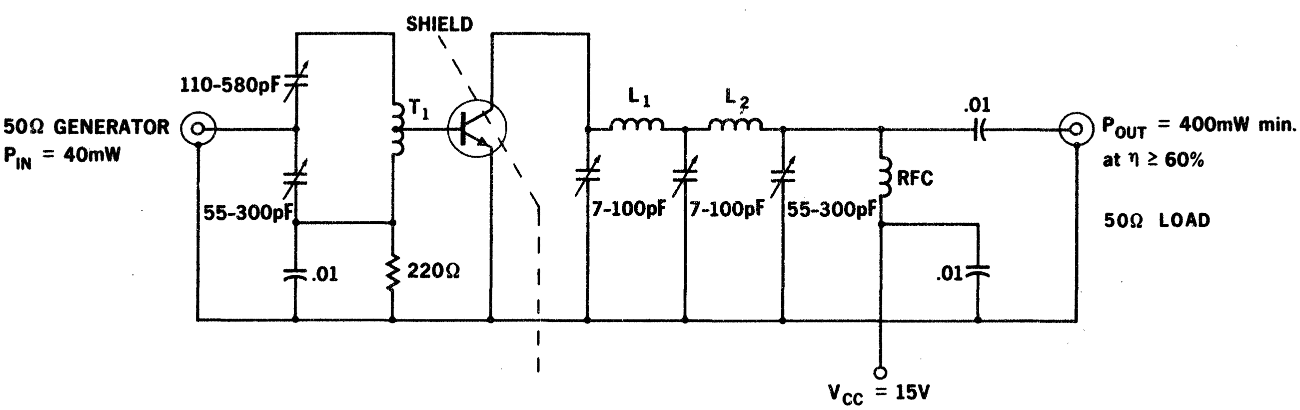
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



TYPICAL POWER IN VERSUS POWER OUT



30MHz AMPLIFIER TEST CIRCUIT



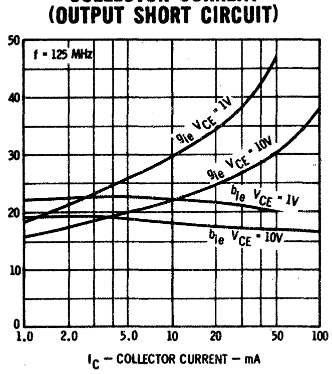
T_1 - 4 Turns no. 20 Wire, ¾" Dia. x ¼" Long, Midtapped.

L_1 and L_2 - 4 Turns no. 20 Wire, ½" Dia. x ¼" Long.

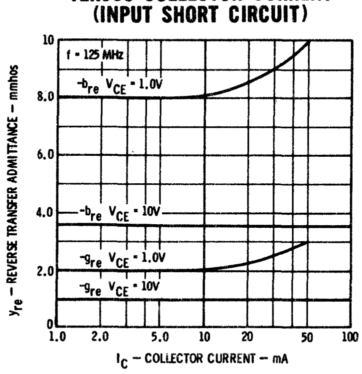
Variable Capacitors are Compression Mica.

$R_G = 140\Omega$, $R_L = 260\Omega$ as seen by transistor.

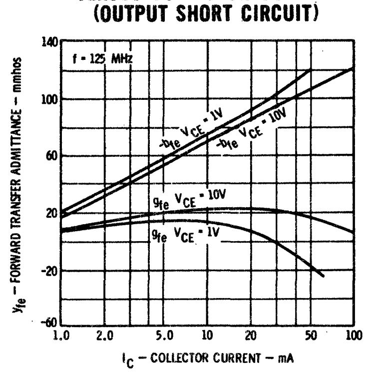
INPUT ADMITTANCE VERSUS COLLECTOR CURRENT (OUTPUT SHORT CIRCUIT)



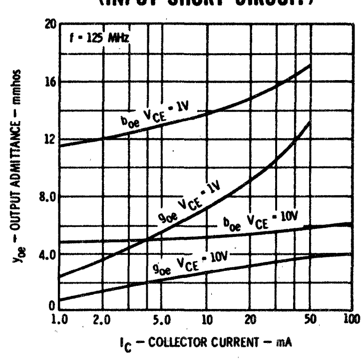
REVERSE TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT (INPUT SHORT CIRCUIT)



FORWARD TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT (OUTPUT SHORT CIRCUIT)



OUTPUT ADMITTANCE VERSUS COLLECTOR CURRENT (INPUT SHORT CIRCUIT)

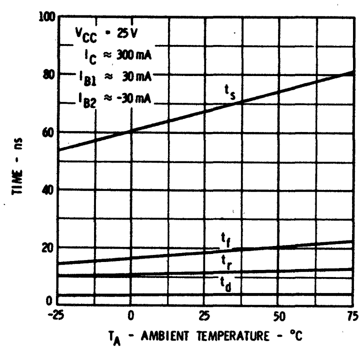


TYPICAL ELECTRICAL CHARACTERISTICS

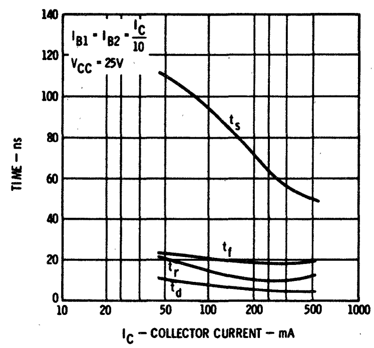
TYPICAL SMALL SIGNAL CHARACTERISTICS
($f = 1$ kHz, $V_{CE} = 10$ V)

Symbol	Characteristic	2N4436 $I_C = 10$ mA	2N4436 50 mA	2N4437 10 mA	2N4437 50 mA	Units
h_{ie}	Input Resistance	460	350	950	880	Ohms
h_{oe}	Output Conductance	55	405	83	660	μmhos
h_{re}	Voltage Feedback Ratio	130	500	205	1500	x10^{-6}
h_{fe}	Small Signal Current Gain	90	97	170	220	

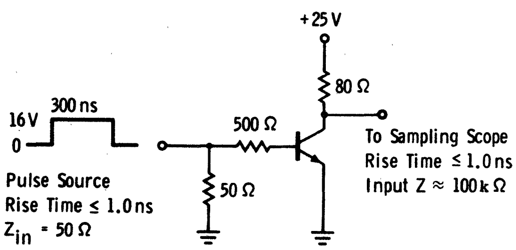
SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



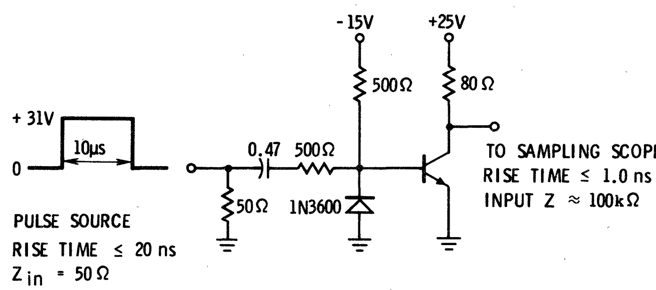
SWITCHING TIMES VERSUS COLLECTOR CURRENT



TURN-ON TEST CIRCUIT



TURN-OFF TEST CIRCUIT



FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

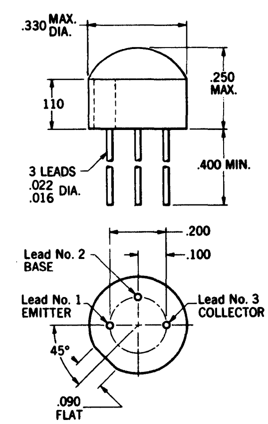
2N4888 • 2N4889

PNP LOW NOISE HIGH VOLTAGE AMPLIFIER

DIFFUSED SILICON PLANAR* II TRANSISTORS

- **VERY HIGH VOLTAGE (LV_{CEO}) -- 150 VOLTS (Min.)**
- **LOW NOISE FIGURE -- 3.0 dB (Max.) @ 1.0 kHz**
- **LOW OUTPUT CAPACITANCE (C_{obo}) -- 4.0 pF (Max.)**
- **HIGH BETA (h_{FE}) -- 80–300 @ 10 mA**
- **EXCELLENT BETA LINEARITY FROM 10 μA to 50 mA**

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package weight is 0.68 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C
Soldering Temperature (10 second time limit)	+260°C

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature [Note 2]	**0.8 Watt**
at 75°C Case Temperature [Note 2]	**0.4 Watt**
at 25°C Ambient Temperature [Note 2]	**0.3 Watt**

Maximum Voltages

V_{CBO}	Collector to Base Voltage	−150 Volts
V_{CEO}	Collector to Emitter Voltage [Note 3]	−150 Volts
V_{EBO}	Emitter to Base Voltage	−6.0 Volts

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

SYMBOL	CHARACTERISTIC	2N4888 MIN.	2N4888 TYP.	2N4888 MAX.	**2N4889** MIN.	**2N4889** TYP.	**2N4889** MAX.	UNITS	TEST CONDITIONS
V_{CEO}	**Collector to Emitter Sustaining Voltage**	−150			**−150**			**Volts**	**I_C = 2.0 mA I_B = 0**
BV_{CBO}	Collector to Base Breakdown Voltage	−150			−150			Volts	I_C = 100 μA I_E = 0
NF	Narrow Band Noise Figure (f = 100 Hz)					3.0	10	dB	I_C = 250 μA V_{CE} = −5.0 V R_S = 1.0 kΩ B.W. = 15 Hz
NF	**Narrow Band Noise Figure (f = 1.0 kHz)**					**0.8**	**3.0**	**dB**	**I_C = 30 μA V_{CE} = −5.0 V R_S = 10 kΩ B.W. = 150 Hz**
NF	Narrow Band Noise Figure (f = 10 kHz)					1.5	3.0	dB	I_C = 250 μA V_{CE} = −5.0 V R_S = 1.0 kΩ B.W. = 1.5 kHz
NF	Wide Band Noise Figure (f = 10 Hz to 10 kHz)					2.0	4.0	dB	I_C = 250 μA V_{CE} = −5.0 V R_S = 1.0 kΩ B.W. = 15.7 kHz
NF	Narrow Band Noise Figure (f = 1.0 MHz)					2.0	4.0	dB	I_C = 1.0 mA V_{CE} = −10 V R_S = 1.0 kΩ B.W. = 2.0 kHz
h_{FE}	**DC Pulse Current Gain** [Note 4]		30		**60**	**135**			**I_C = 100 μA V_{CE} = −10 V**
h_{FE}	**DC Pulse Current Gain** [Note 4]	30	40		**70**	**150**			**I_C = 1.0 mA V_{CE} = −10 V**
h_{FE}	**DC Pulse Current Gain** [Note 4]	40	45	400	**80**	**150**	**300**		**I_C = 10 mA V_{CE} = −10 V**
C_{obo}	**Common-Base, Open Circuit Output Capacitance (f = 1.0 MHz)**		2.5	4.0		**2.5**	**4.0**	**pF**	**V_{CB} = −20 V I_E = 0**

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

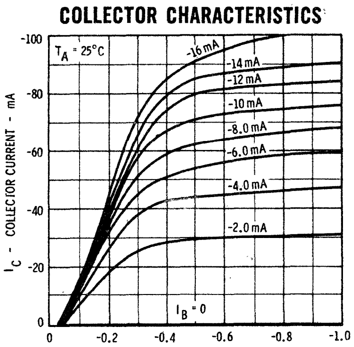
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	2N4888 MIN.	2N4888 TYP.	2N4888 MAX.	**2N4889** MIN.	**2N4889** TYP.	**2N4889** MAX.	UNITS	TEST CONDITIONS
I_{CBO}	Collector Cutoff Current		0.7	50		0.7	10	nA	$V_{CB} = -100\,V$ $I_E = 0$
I_{CBO} (65°C)	Collector Cutoff Current		0.01	2.5		0.01	0.5	μA	$V_{CB} = -100\,V$ $I_E = 0$
V_{CE} (sat)	Pulsed Collector Saturation Voltage [Note 4]		−0.1	−0.5		−0.1	−0.5	Volts	$I_C = 10\,mA$ $I_B = 1.0\,mA$
BV_{EBO}	Emitter to Base Breakdown Voltage	−6.0			−6.0			Volts	$I_E = 10\,\mu A$ $I_C = 0$
I_{EBO}	Emitter Cutoff Current		0.4	50		0.4	10	nA	$V_{EB} = -4.0\,V$ $I_C = 0$
V_{BE} (on)	Pulsed Base Emitter On Voltage [Note 4]		−0.66	−0.8		−0.59	−0.7	Volts	$I_C = 1.0\,mA$ $V_{CE} = -10\,V$
V_{BE} (sat)	Pulsed Base Saturation Voltage [Note 4]		−0.74	−0.9		−0.74	−0.9	Volts	$I_C = 10\,mA$ $I_B = 1.0\,mA$
C_{ibo}	Common-Base, Open-Circuit Input Capacitance		11	30		11	25	pF	$V_{EB} = -0.5\,V$ $I_C = 0$
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	1.5	1.8	8.0	**2.0**	**3.3**	**8.0**		**$I_C = 1.0\,mA$ $V_{CE} = -10\,V$**

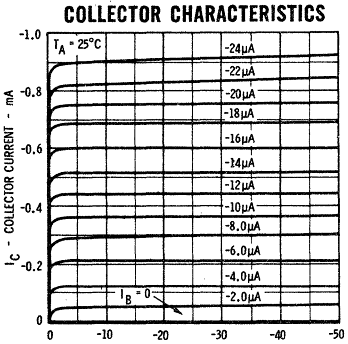
NOTES:
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 125°C/Watt (derating factor of 8.0 mW/°C); junction to ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C).
(3) 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.
(4) Pulse Conditions: length = 300 μs; duty cycle = 1%.

2N4888
TYPICAL ELECTRICAL CHARACTERISTICS

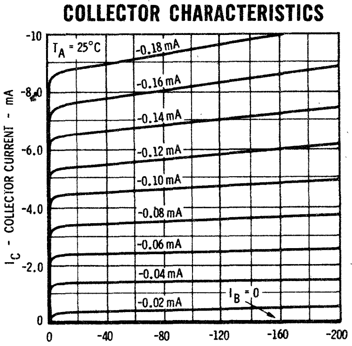
COLLECTOR CHARACTERISTICS



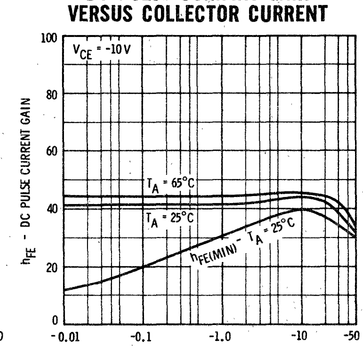
COLLECTOR CHARACTERISTICS



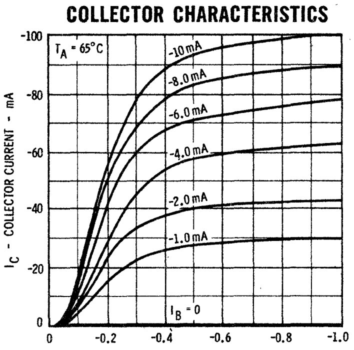
COLLECTOR CHARACTERISTICS



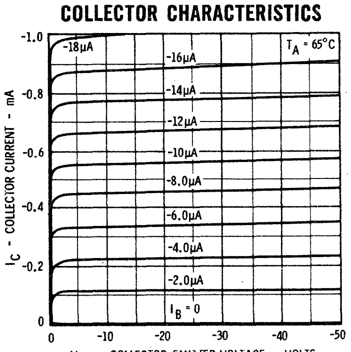
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



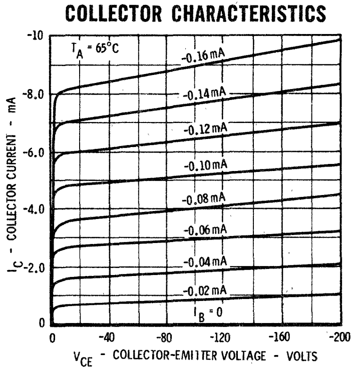
COLLECTOR CHARACTERISTICS



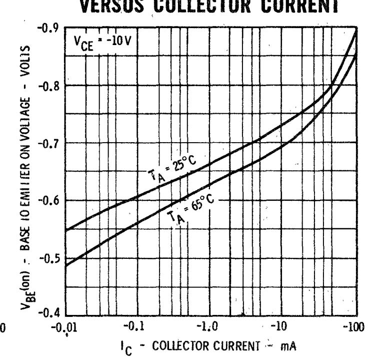
COLLECTOR CHARACTERISTICS



COLLECTOR CHARACTERISTICS

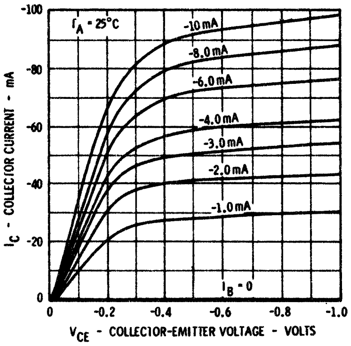


BASE-EMITTER ON VOLTAGE VERSUS COLLECTOR CURRENT

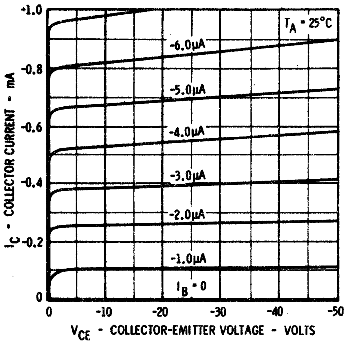


2N4889
TYPICAL ELECTRICAL CHARACTERISTICS

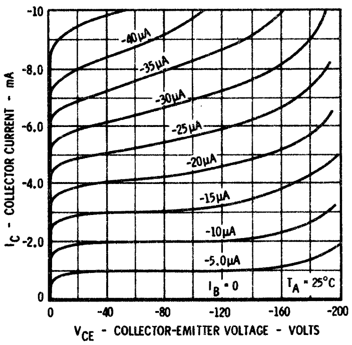
COLLECTOR CHARACTERISTICS



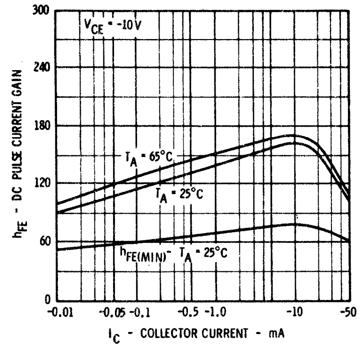
COLLECTOR CHARACTERISTICS



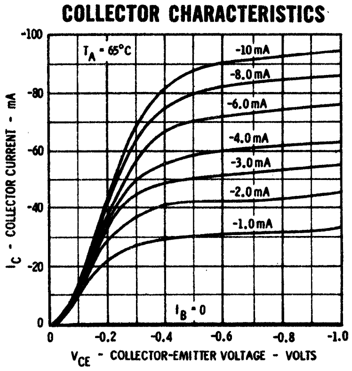
COLLECTOR CHARACTERISTICS



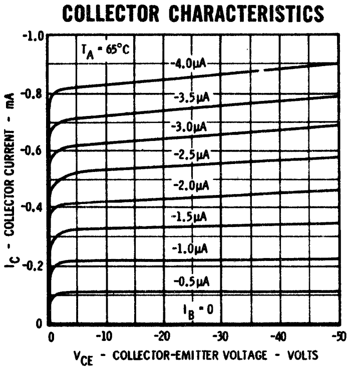
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



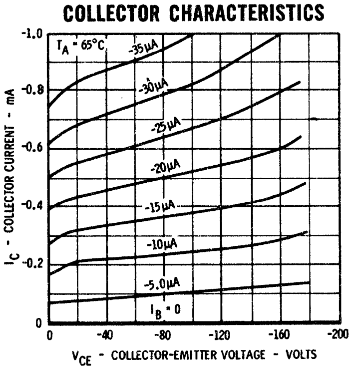
COLLECTOR CHARACTERISTICS



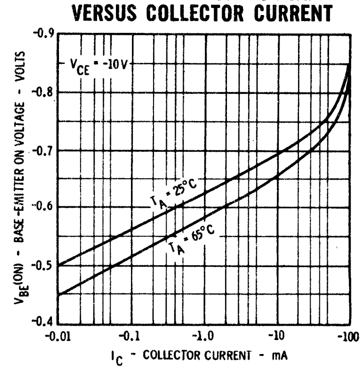
COLLECTOR CHARACTERISTICS



COLLECTOR CHARACTERISTICS

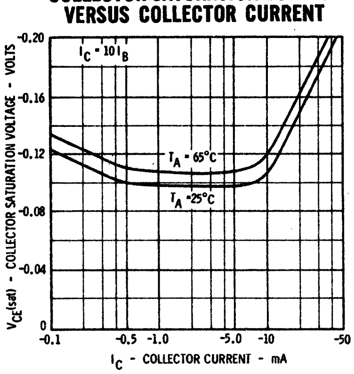


BASE-EMITTER ON VOLTAGE VERSUS COLLECTOR CURRENT

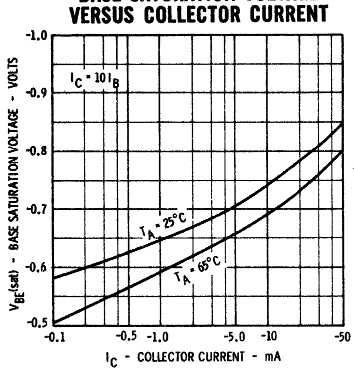


2N4888 • 2N4889

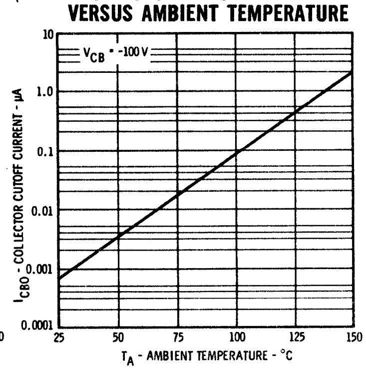
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



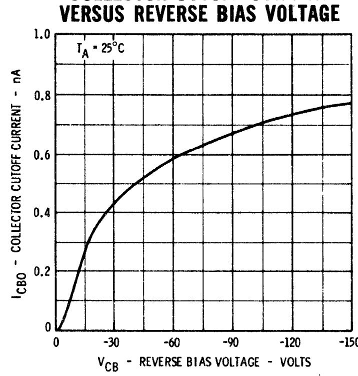
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



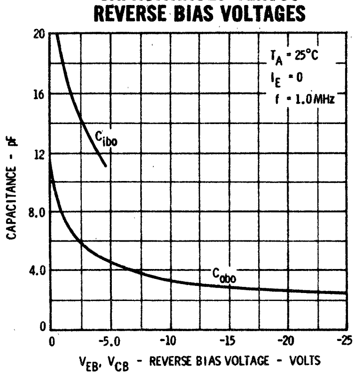
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



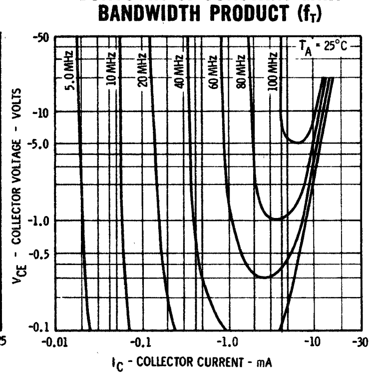
COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGES

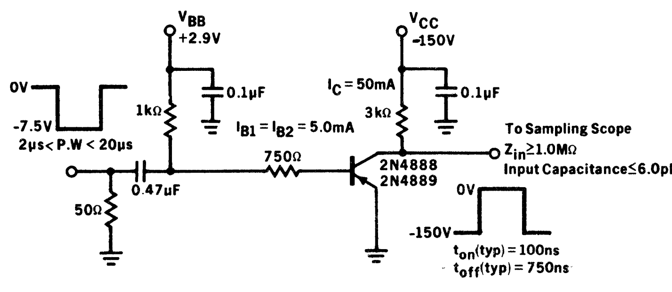


CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



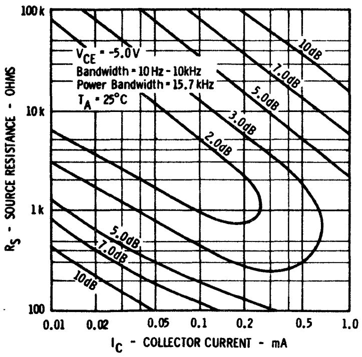
T_{on} — T_{off}

SWITCHING CIRCUIT

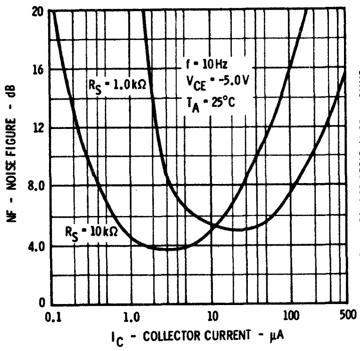


2N4889
TYPICAL ELECTRICAL CHARACTERISTICS

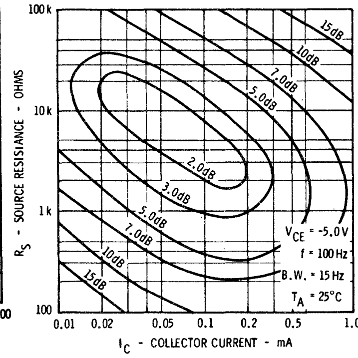
CONTOURS OF CONSTANT WIDE BAND NOISE FIGURE



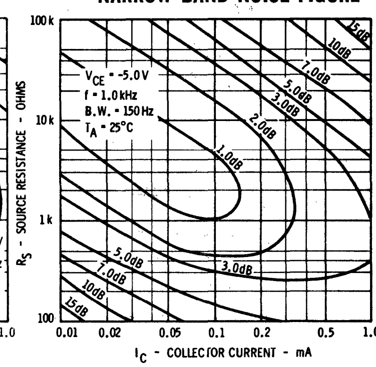
NOISE FIGURE VERSUS COLLECTOR CURRENT



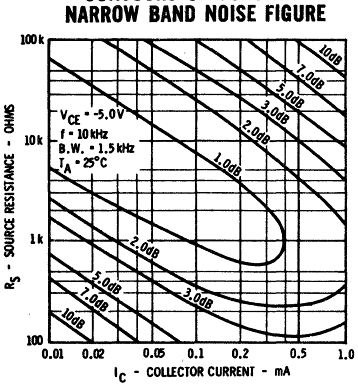
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



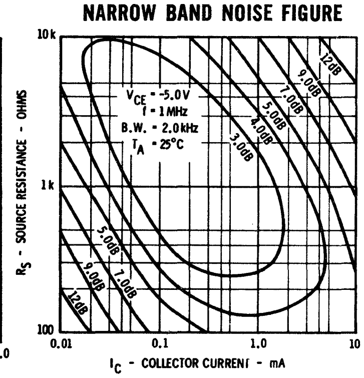
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



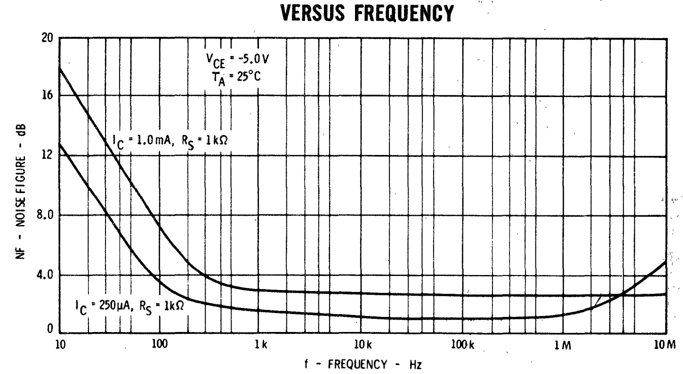
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



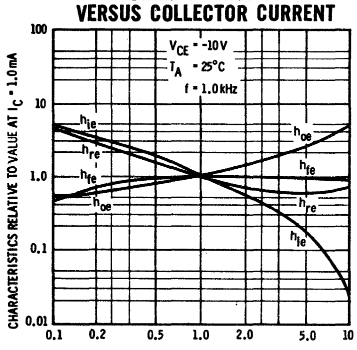
SPOT NOISE FIGURE VERSUS FREQUENCY



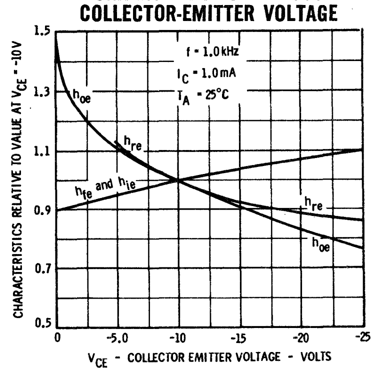
SMALL SIGNAL CHARACTERISTICS (f = 1.0 kHz)

SYMBOL	CHARACTERISTIC	2N4888 MIN.	TYP.	MAX.	2N4889 MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
h_{fe}	Small Signal Current Gain	30	40	500	65	150	400		$I_C = 1.0$ mA $V_{CE} = -10$ V
h_{ie}	Input Resistance	0.75	1.2	20	1.7	5.0	12	kΩ	$I_C = 1.0$ mA $V_{CE} = -10$ V
h_{oe}	Output Conductance	1.4	2.5	40	3.0	10	25	μmhos	$I_C = 1.0$ mA $V_{CE} = -10$ V
h_{re}	Voltage Feedback Ratio		1.0			2.5	5.0	$\times 10^{-4}$	$I_C = 1.0$ mA $V_{CE} = -10$ V

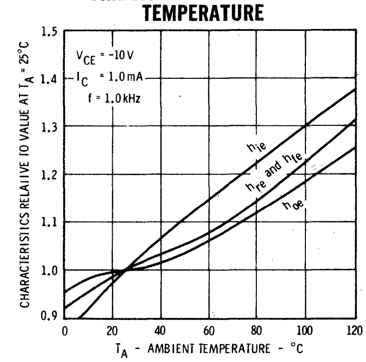
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR CURRENT



COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR-EMITTER VOLTAGE



COMMON EMITTER CHARACTERISTICS VERSUS TEMPERATURE



FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

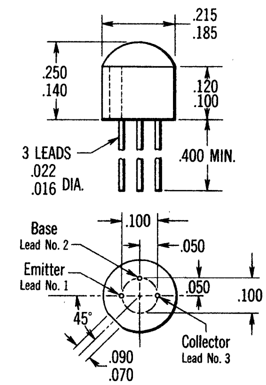
2N4916 • 2N4917

PNP HIGH-SPEED SWITCH AND RF AMPLIFIER

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **HIGH BETA (h_{FE}) -- 150 to 300 @ 10 mA**
- **HIGH FREQUENCY (f_T) -- 450 MHz Min. @ 10 mA**
- **EXCELLENT R.F. PERFORMANCE ($r_b'C_c$) -- 50 ps Max.**
- **LOW CAPACITANCE (C_{obo}) -- 4.5 pF Max.**
- **LOW NOISE (100 MHz N.F.) -- 6.0 dB Max.**

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 sec time limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature [Notes 2 and 3]	0.5 Watt
at 25°C Ambient Temperature [Notes 2 and 3]	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	−30 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	−30 Volts
V_{EBO}	Emitter to Base Voltage	−5.0 Volts
I_C	Collector Current	100 mA

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

SYMBOL	CHARACTERISTIC	2N4916 MIN.	2N4916 TYP.	2N4916 MAX.	2N4917 MIN.	2N4917 TYP.	2N4917 MAX.	UNITS	TEST CONDITIONS
h_{FE}	**DC Current Gain**	40	70		**100**	**150**			**I_C = 100 μA** V_{CE} = −1.0 V
h_{FE}	DC Current Gain	60	100		150	200			I_C = 1.0 mA V_{CE} = −1.0 V
h_{FE}	**DC Pulse Current Gain** [Note 5]	70	150	200	**150**	**200**	**300**		**I_C = 10 mA** V_{CE} = −1.0 V
h_{FE}	DC Pulse Current Gain [Note 5]	15	30		30	60			I_C = 50 mA V_{CE} = −1.0 V
V_{CE} (sat)	Collector Saturation Voltage		−0.07	−0.13		−0.07	−0.13	Volts	I_C = 1.0 mA I_B = 0.1 mA
V_{CE} (sat)	Pulsed Collector Saturation Voltage [Note 5]		−0.1	−0.14		−0.1	−0.14	Volts	I_C = 10 mA I_B = 1.0 mA
V_{CE} (sat)	**Pulsed Collector Saturation Voltage** [Note 5]		−0.2	−0.3		**−0.2**	**−0.3**	**Volts**	**I_C = 50 mA** I_B = 5.0 mA
V_{BE} (sat)	Base Saturation Voltage		−0.65	−0.75		−0.65	−0.75	Volts	I_C = 1.0 mA I_B = 0.1 mA
V_{BE} (sat)	Pulsed Base Saturation Voltage [Note 5]	−0.7	−0.77	−0.9	−0.7	−0.77	−0.9	Volts	I_C = 10 mA I_B = 1.0 mA
V_{BE} (sat)	Pulsed Base Saturation Voltage [Note 5]	−0.75	−0.88	−1.1	−0.75	−0.88	−1.1	Volts	I_C = 50 mA I_B = 5.0 mA
t_{on}	**Turn On Time** [Note 6]		20	40		**20**	**40**	**ns**	**I_C ≈ 50 mA** I_{B1} ≈ 5.0 mA
t_{off}	**Turn Off Time** [Note 6]		95	150		**95**	**150**	**ns**	**I_C ≈ 50 mA** I_{B1} ≈ 5.0 mA I_{B2} ≈ −5.0 mA
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	4.0	5.5		**4.5**	**6.0**			**I_C = 10 mA** V_{CE} = −20 V

Additional Electrical Characteristics on page 2

* 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 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 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) See switching circuit for exact values of I_C, I_{B1} and I_{B2}.
(7) Power Bandwidth of 15.7 kHz with 3 dB points at 10 Hz and 10 kHz.

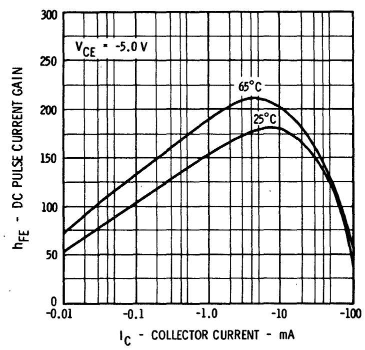
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

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

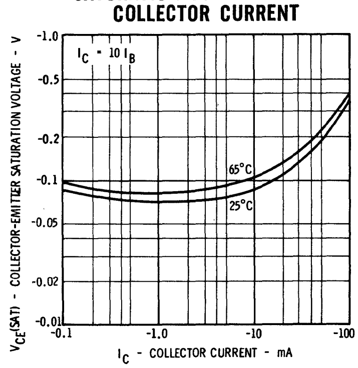
SYMBOL	CHARACTERISTIC	2N4916 MIN.	2N4916 TYP.	2N4916 MAX.	2N4917 MIN.	2N4917 TYP.	2N4917 MAX.	UNITS	TEST CONDITIONS
V_{CEO} (sust)	**Collector to Emitter Sustaining Voltage** [Notes 4 and 5]	−30			**−30**			**Volts**	**I_C = 10 mA** I_B = 0 (pulsed)
BV_{CBO}	Collector to Base Breakdown Voltage	−30			−30			Volts	I_C = 10 μA I_E = 0
BV_{CES}	Collector to Emitter Breakdown Voltage	−30			−30			Volts	I_C = 10 μA V_{BE} = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0			−5.0			Volts	I_C = 0 I_E = 10 μA
I_{CES}	Collector Reverse Current			25			25	nA	V_{CE} = −15 V V_{BE} = 0
I_{CES} (65°C)	Collector Reverse Current			25			25	μA	V_{CE} = −15 V V_{BE} = 0
C_{obo}	**Open Circuit Output Capacitance**		2.2	4.5		**2.2**	**4.5**	**pF**	I_E = 0 **V_{CB} = −10V**
C_{ibo}	Open Circuit Input Capacitance		4.0	8.0		4.0	8.0	pF	I_C = 0 V_{EB} = −0.5 V
$r_b' C_c$	**Collector-Base Time Constant (f = 80 MHz)**			50			**50**	**ps**	**I_C = 10 mA** V_{CE} = −20 V
NF	**Noise Figure (f = 100 MHz)**		3.5	6.0		**3.5**	**6.0**	**dB**	**I_C = 1.0 mA** V_{CE} = −5.0 V **R_S = 100Ω** BW = 15 MHz
NF	Noise Figure [Note 7]		2.5	4.0		2.5	4.0	dB	I_C = 100 μA V_{CE} = −5.0 V R_S = 1.0 kΩ

TYPICAL ELECTRICAL CHARACTERISTICS

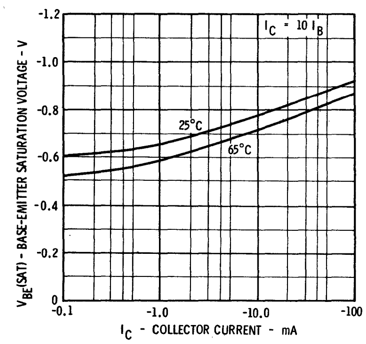
DC PULSED CURRENT GAIN VERSUS COLLECTOR CURRENT



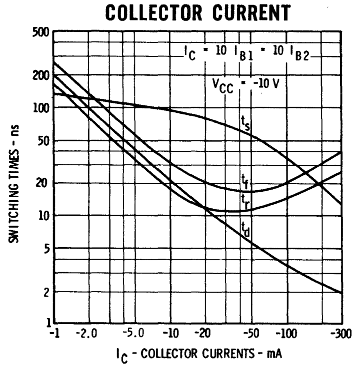
COLLECTOR-EMITTER SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



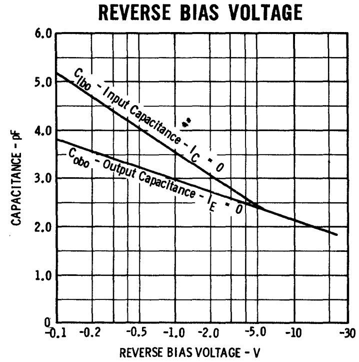
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



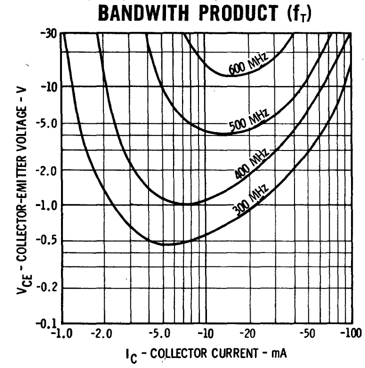
SWITCHING TIMES VERSUS COLLECTOR CURRENT



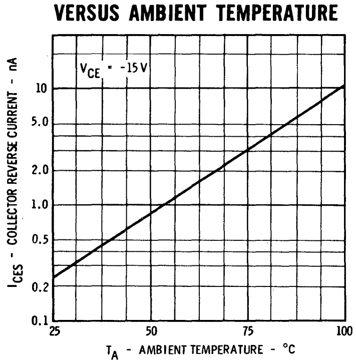
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



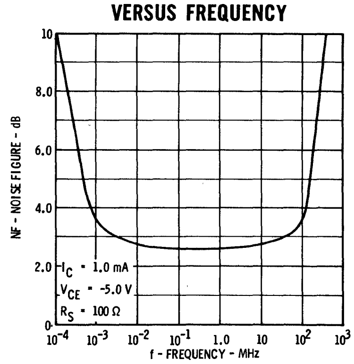
CONTOURS OF CONSTANT GAIN BANDWITH PRODUCT (f_T)



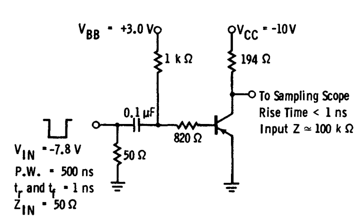
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



NOISE FIGURE VERSUS FREQUENCY



SWITCHING TIME TEST CIRCUIT



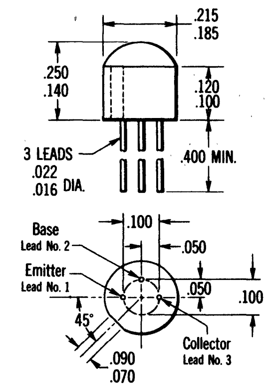
2N4944 • 2N4945 • 2N4946

NPN GENERAL PURPOSE TRANSISTORS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **LV_{CEO} — 60 Volts Min.**
- **h_{FE} — 100 Min. at 150 mA**
- **V_{CE} (sat) — 0.25 Volt Max. at 150 mA**

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperature

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C
Lead Temperature (Soldering, 10 second time limit)	+260°C

Maximum Power Dissipation [Notes 2 and 3]

Total Dissipation at 25°C Case Temperature	0.6 Watt
at 25°C Ambient Temperature	0.22 Watt

Maximum Voltages		2N4944 2N4946	2N4945
V_{CBO}	Collector to Base Voltage	80 Volts	80 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	40 Volts	60 Volts
V_{EBO}	Emitter to Base Voltage	5.0 Volts	5.0 Volts

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

		2N4944 • 2N4945			2N4946					
SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Pulse Current Gain** [Note 5]	40	80	120	**100**	150	300		**$I_C = 150$ mA**	**$V_{CE} = 1.0$ V**
h_{FE}	DC Pulse Current Gain [Note 5]	40			100				$I_C = 30$ mA	$V_{CE} = 1.0$ V
V_{CE}(sat)	**Pulsed Collector Saturation Voltage** [Note 5]		0.15	**0.25**		0.10	**0.25**	**Volts**	**$I_C = 150$ mA**	**$I_B = 15$ mA**
V_{BE} (sat)	Pulsed Base Saturation Voltage [Note 5]		0.85	1.1		0.85	1.1	Volts	$I_C = 150$ mA	$I_B = 15$ mA
h_{fe}	High Frequency Current Gain (f = 20 MHz)	3.0		15	3.0		15		$I_C = 50$ mA	$V_{CE} = 10$ V
C_{obo}	Common Base, Open Circuit Output Capacitance (2N4944 only)		16	25		16	25	pF	$I_E = 0$	$V_{CB} = 10$ V
C_{obo}	Common Base, Open Circuit Output Capacitance (2N4945 only)		13	20				pF	$I_E = 0$	$V_{CB} = 10$ V
C_{ibo}	Common Base, Open Circuit Input Capacitance		63	80		63	80	pF	$I_C = 0$	$V_{EB} = 0.5$ V
I_{CBO}	Collector Cutoff Current			50			50	nA	$I_E = 0$	$V_{CB} = 40$ V
I_{CBO} (75°C)	Collector Cutoff Current			5.0			5.0	μA	$I_E = 0$	$V_{CB} = 40$ V
I_{EBO}	Emitter Cutoff Current			25			25	nA	$I_C = 0$	$V_{EB} = 4.0$ V
BV_{CBO}	Collector to Base Breakdown Voltage	80			80			Volts	$I_C = 100$ μA	$I_E = 0$
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage [Notes 4 and 5] (2N4944 only)	40			40			Volts	$I_C = 30$ mA (pulsed)	$I_B = 0$
V_{CEO} (sust)	**Collector to Emitter Sustaining Voltage** [Notes 4 and 5] (2N4945 only)	**60**						**Volts**	**$I_C = 30$ mA**	**$I_B = 0$**
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			5.0			Volts	$I_C = 0$	$I_E = 10$ μA

* Planar is a patented Fairchild process.

NOTES:

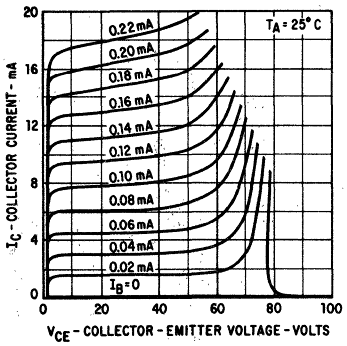
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
(3) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 167°C/Watt (derating factor of 6.0 mW/°C); junction to ambient thermal resistance of 455°C/Watt (derating factor of 2.2 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%.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

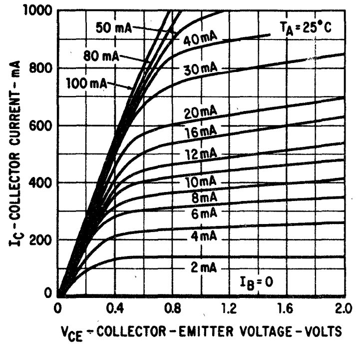
TYPICAL ELECTRICAL CHARACTERISTICS

2N4944 2N4945

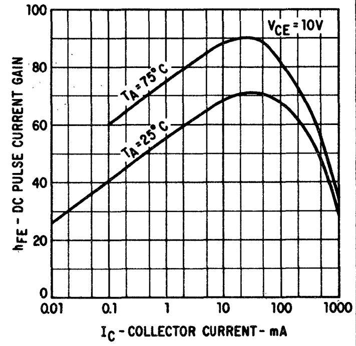
COLLECTOR CHARACTERISTICS*



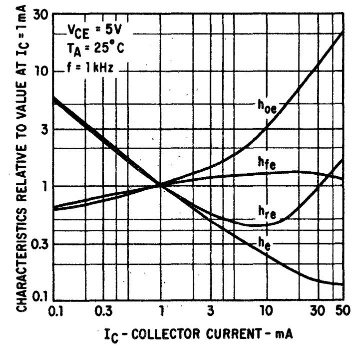
COLLECTOR CHARACTERISTICS*



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

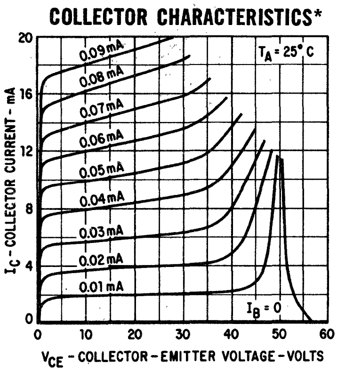


TYPICAL COMMON EMITTER CHARACTERISTICS

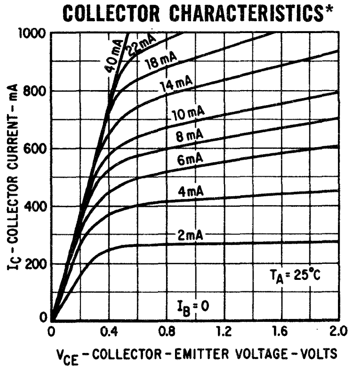


2N4946

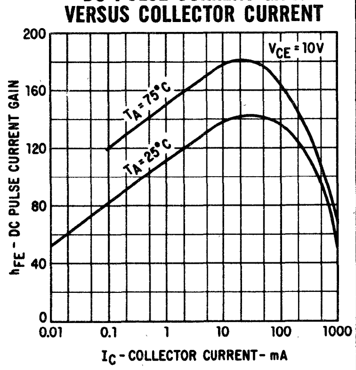
COLLECTOR CHARACTERISTICS*

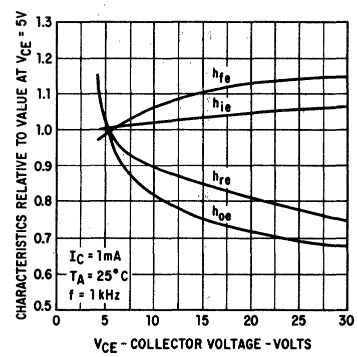


COLLECTOR CHARACTERISTICS*



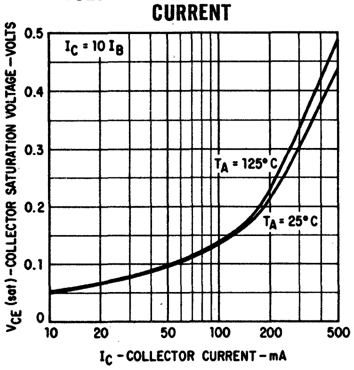
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



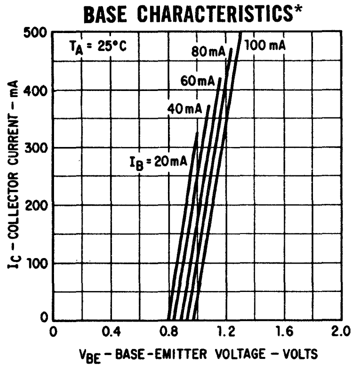


2N4944 2N4945 2N4946

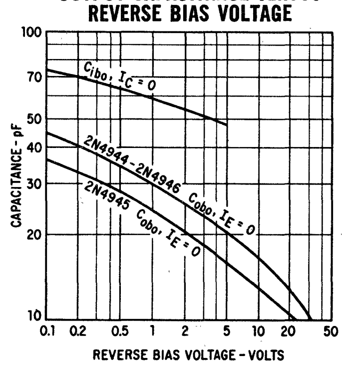
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT

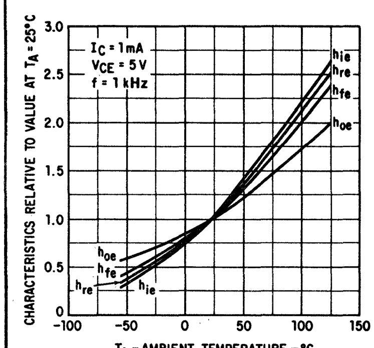


BASE CHARACTERISTICS*



EMITTER TRANSITION AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE





SMALL SIGNAL CHARACTERISTICS (f = 1.0 kHz)

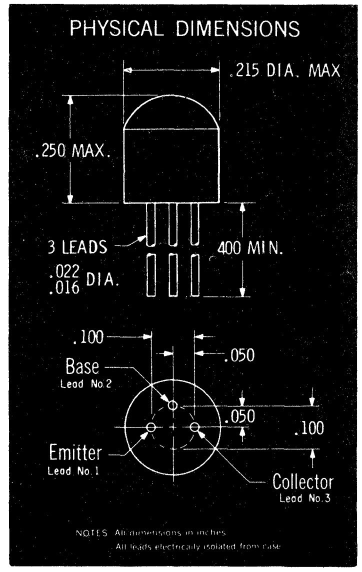
SYMBOL	CHARACTERISTIC	TYP.	TYP.	UNITS	TEST CONDITIONS
h_{ie}	Input Resistance	1800	3800	ohms	$I_C = 1.0$ mA $V_{CE} = 5.0$ V
h_{oe}	Output Conductance	8.0	19.2	μmhos	$I_C = 1.0$ mA $V_{CE} = 5.0$ V
h_{re}	Voltage Feedback Ratio	2.1	5.6	$\times 10^{-4}$	$I_C = 1.0$ mA $V_{CE} = 5.0$ V
h_{fe}	Small Signal Current Gain	60	130		$I_C = 1.0$ mA $V_{CE} = 5.0$ V

SE5001 · SE5002 · SE5003

NPN RF-AGC AMPLIFIERS

SILICON PLANAR TRANSISTORS

The SE5001, SE5002, and SE5003 are NPN silicon PLANAR transistors designed specifically for commercial RF-IF-AGC applications. They feature high power gain, low noise, and excellent forward AGC characteristics in a solid package designed to give maximum mechanical support to the transistor chip.



ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Operating Junction Temperature	**125°C** Maximum
Storage Temperature	**−55°C** to **+125°C**
Soldering Temperature	**260°C** Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature [Note 2]	**0.5** Watt
at 65°C Case Temperature [Note 2]	**0.3** Watt
at 25°C Ambient Temperature [Note 2]	**0.2** Watt

Maximum Voltages

V_{CBO} Collector to Base Voltage	**40** Volts
V_{CEO} Collector to Emitter Voltage [Note 3]	**40** Volts
V_{EBO} Emitter to Base Voltage	**4.0** Volts

ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

Symbol	Characteristics	SE5001 Min.	SE5001 Typ.	SE5001 Max.	SE5002 Min.	SE5002 Typ.	SE5002 Max.	SE5003 Min.	SE5003 Typ.	SE5003 Max.	Units	TEST CONDITIONS	
C_{ob}	Output Capacitance		1.1	1.6		1.1	1.6		1.1	1.6	pf	$I_E = 0$	$V_{CB} = 10$ V
NF	Noise Figure [Note 5]								4.0	5.5	db	$I_C = 4.0$ mA	$V_{CE} = 10$ V
h_{fe}	High Frequency Current Gain (f = 100 mc)	4.0	6.0		4.0	6.0		4.0	6.0			$I_C = 4.0$ mA	$V_{CE} = 10$ V
PG_1	Power Gain (f = 45 mc)	22	28		22	28					db	$I_C = 4.0$ mA	$V_{CE} = 10$ V
PG_2	Power Gain (f = 200 mc)							15	18		db	$I_C = 4.0$ mA	$V_{CE} = 10$ V
AGC_1	Automatic Gain Control (f = 45 mc) [Note 6]	8.0		10.5	9.5		12				mA	I_C for which $P_G = P_{G1}$ −30 db in 45 mc test circuit	
AGC_2	Automatic Gain Control (f = 200 mc) [Note 6]							9.0		14	mA	I_C for which $P_G = P_{G2}$ −30 db in 200 mc test circuit	

Additional Electrical Characteristics on page 2

NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high-current point where collector-to-emitter voltage is lowest. For more information send for Fairchild Publication APP-4.
(4) Pulse Conditions: length = 300 μsec; duty cycle = 1%.
(5) f = 200 mc; $R_S = 100\Omega$.
(6) Additional AGC information on page 2.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

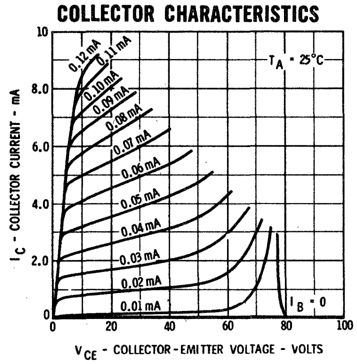
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

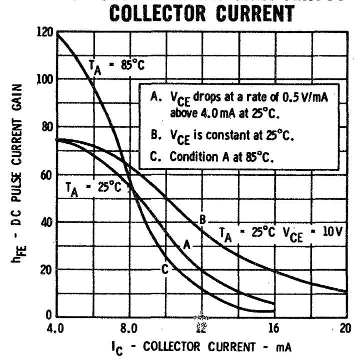
Symbol	Characteristics	SE5001 Min.	SE5001 Typ.	SE5001 Max.	SE5002 Min.	SE5002 Typ.	SE5002 Max.	SE5003 Min.	SE5003 Typ.	SE5003 Max.	Units	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain [Note 4]	30	70		30	70		30	70			$I_C = 4.0$ mA $V_{CE} = 10$ V
I_{CBO}	Collector Cutoff Current			500			500			500	nA	$I_E = 0$ $V_{CB} = 20$ V
I_{CBO} (65°C)	Collector Cutoff Current			5.0			5.0			5.0	μA	$I_E = 0$ $V_{CB} = 20$ V
BV_{CBO}	Collector to Base Breakdown Voltage	40			40			40			Volts	$I_C = 100$ μA $I_E = 0$
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage [Notes 3 and 4]	40			40			40			Volts	$I_C = 3.0$ mA $I_B = 0$ (Pulsed)
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0			4.0			4.0			Volts	$I_E = 100$ μA $I_C = 0$

TYPICAL ELECTRICAL CHARACTERISTICS

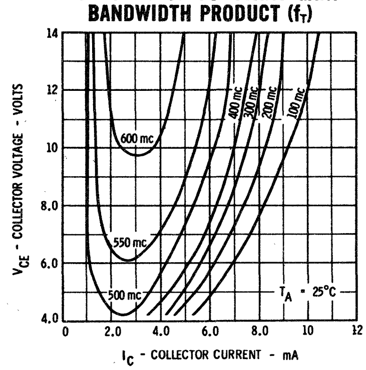
COLLECTOR CHARACTERISTICS



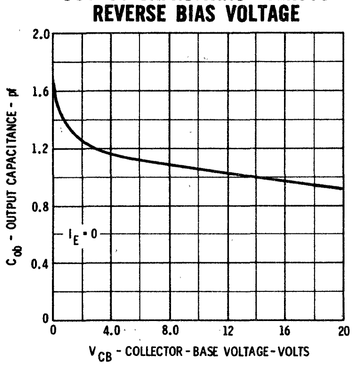
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



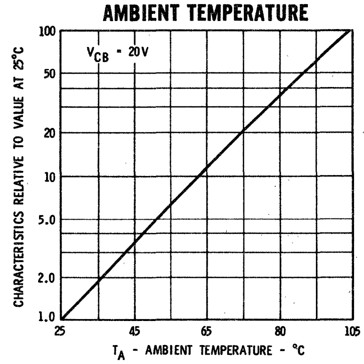
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



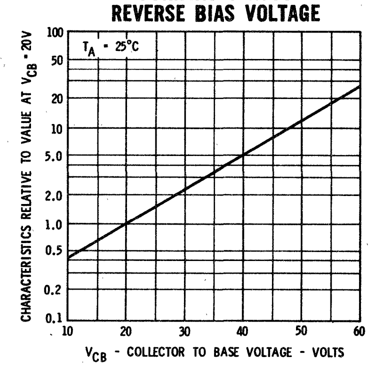
OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



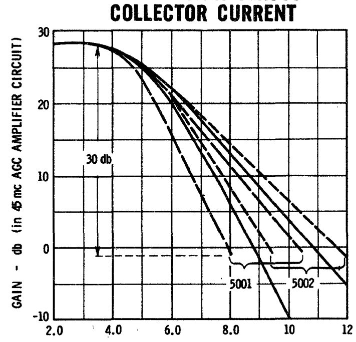
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



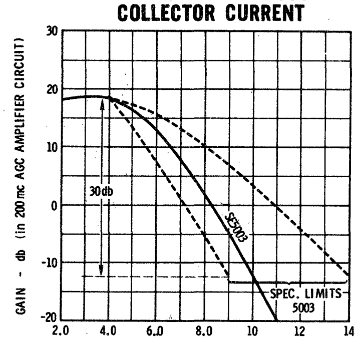
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



TYPICAL GAIN VERSUS COLLECTOR CURRENT



TYPICAL GAIN VERSUS COLLECTOR CURRENT

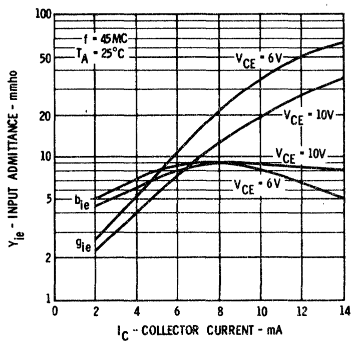


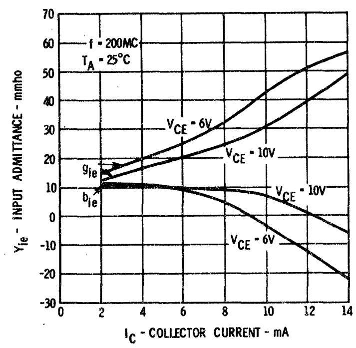
TYPICAL SMALL SIGNAL COMMON EMITTER "Y" PARAMETERS

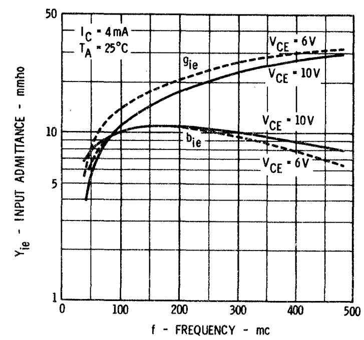
SE5001 • SE5002	SE5003	SE5001 • SE5002 • SE5003
45 mc vs. COLLECTOR CURRENT	**200 mc** vs. COLLECTOR CURRENT	**vs. FREQUENCY**

y_{ie}

Input Admittance
(output short circuit)

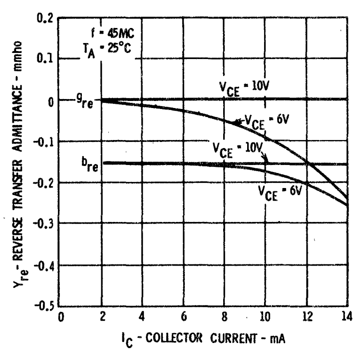


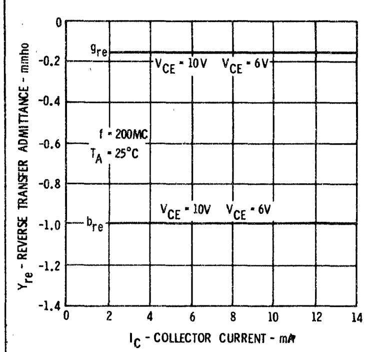


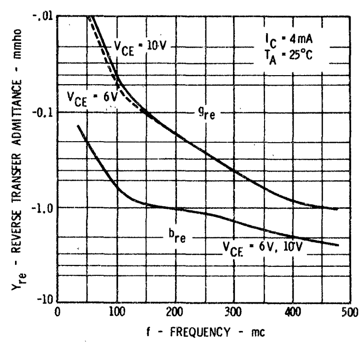


y_{re}

Reverse
Transfer Admittance
(input short circuit)

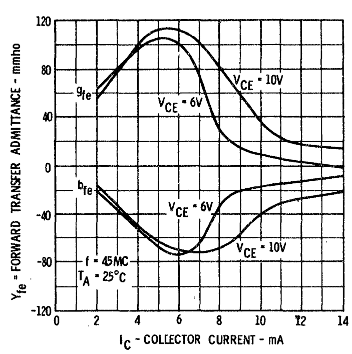


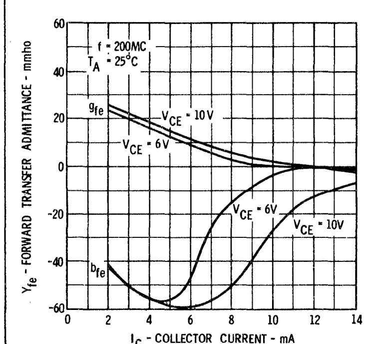


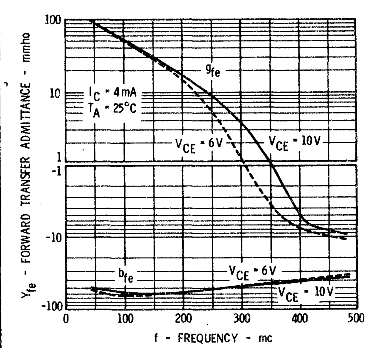


y_{fe}

Forward
Transfer Admittance
(output short circuit)

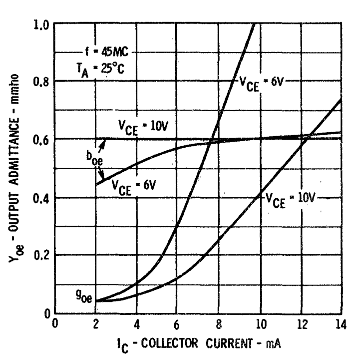


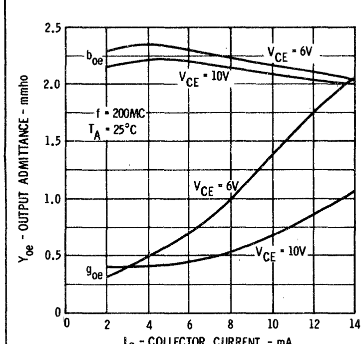


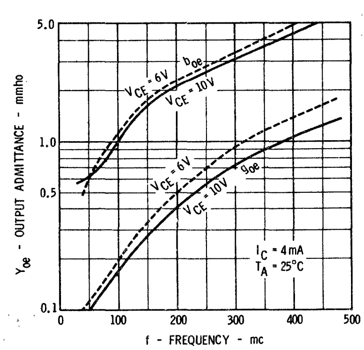


y_{oe}

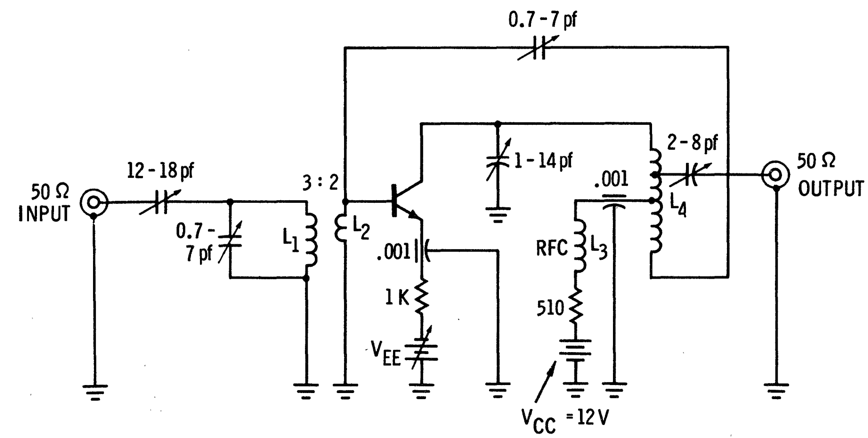
Output Admittance
(input short circuit)







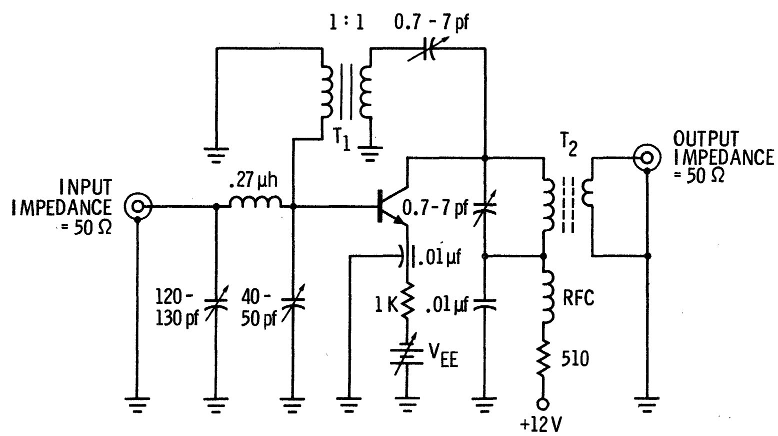
200 MC AGC TEST CIRCUIT



Input impedance referred to transistor is 100 Ω.

L_1 = 3 turns #18 wire on ¼″ ceramic core
L_2 = 2 turns #18 wire interwound at cold end with L_1
L_3 = RFC
L_4 = 4 turns .076″ diam. silver tubing space wound (⅜″ I.D., no core). Output tap at ½ turn from collector end ground tap at 2 turns from collector end

45 MC AGC TEST CIRCUIT



T_1: 12T #32 bifilar wire on Q2 toroid ($\mu = 115$)
T_2: Primary: 10T #36 enameled wire wound on micrometals L-52-6 shielded coil form
Secondary: 2T #36 enameled wire tightly coupled to primary

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

SE5006

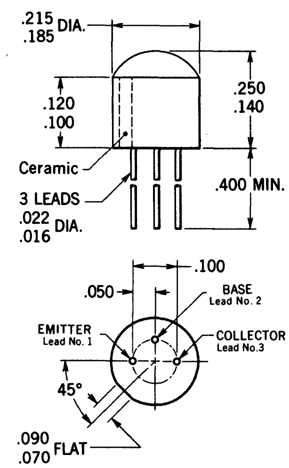
NPN RF AMPLIFIER

SILICON PLANAR* TRANSISTOR

- **LOW FEEDBACK CAPACITANCE -- C_{obo} = 1.6 pF Max.**
- **HIGH POWER GAIN -- PG @ 100 MHz = 20 dB Min.**
- **HIGH BREAKDOWN VOLTAGE -- LV_{CEO} = 40 V Min.**
- **LOW NOISE FIGURE -- NF @ 100 MHz = 5.5 dB Typ.**
- **FORWARD AGC CHARACTERISTIC**

* Planar is a patented Fairchild process.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram

ABSOLUTE MAXIMUM RATINGS [Notes 1 and 2]

Maximum Temperatures	
Operating Junction Temperature	125°C
Storage Temperature	−55°C to +125°C
Soldering Temperature	260°C
Maximum Power Dissipation	
Total Dissipation at 25°C Case Temperature [Note 2]	0.5 Watt
at 65°C Case Temperature [Note 2]	0.3 Watt
at 25°C Ambient Temperature [Note 2]	0.2 Watt
Maximum Voltages	
V_{CBO} Collector to Base Voltage	40 Volts
V_{CEO} Collector to Emitter Voltage [Note 3]	40 Volts
V_{EBO} Emitter to Base Voltage	4.0 Volts

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

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
C_{obo}	**Output Capacitance**		**1.1**	**1.6**	**pF**	**$I_E = 0$ $V_{CB} = 10$ V**
NF	**Noise Figure** [Note 5]		**5.5**		**dB**	**$I_C = 4.0$ mA $V_{CC} = 15$ V** f = 100 MHz $R_S = 100\,\Omega$
h_{fe}	High Frequency Current Gain (f = 100 MHz)	4.0	6.0			$I_C = 4.0$ mA $V_{CE} = 10$ V
PG	**Power Gain** (f = 455 kHz) [Note 5]	**35**			**dB**	**$I_C = 4.0$ mA $V_{CC} = 12$ V**
PG	**Power Gain** (f = 10.7 MHz) [Note 5]	**28**			**dB**	**$I_C = 4.0$ mA $V_{CC} = 12$ V**
PG	**Power Gain** (f = 100 MHz) [Note 5]	**20**	**26**		**dB**	**$I_C = 4.0$ mA $V_{CC} = 15$ V**
AGC	**Automatic Gain Control (f = 100 MHz)** [Note 5]	**6.0**	**9**	**10.5**	**mA**	**I_C for which PG_{AGC} = PG − 30 dB**
V_{CE} (sat)	Collector Saturation Voltage			2.0	Volts	$I_C = 10$ mA $I_B = 5.0$ mA
V_{BE} (sat)	Pulsed Base Saturation Voltage [Note 4]			0.98	Volt	$I_C = 10$ mA $I_B = 5.0$ mA
h_{FE}	DC Pulse Current Gain [Note 4]	30	70			$I_C = 4.0$ mA $V_{CE} = 10$ V
I_{CBO}	Collector Cutoff Current		1.0	50	nA	$I_E = 0$ $V_{CB} = 20$ V
I_{CBO} (65°C)	Collector Cutoff Current			5.0	μA	$I_E = 0$ $V_{CB} = 20$ V
V_{CEO} (sust)	**Collector to Emitter Sustaining Voltage** [Notes 3 and 4]	**40**			**Volts**	**$I_C = 3.0$ mA $I_B = 0$** (pulsed)
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0			Volts	$I_C = 0$ $I_E = 100\,\mu$A

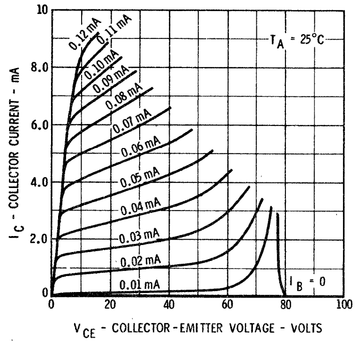
NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high-current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(4) Pulse Conditions: length = 300 μsec; duty cycle = 1%.
(5) See Test Circuit.

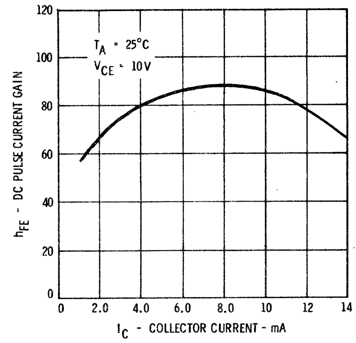
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

TYPICAL ELECTRICAL CHARACTERISTICS

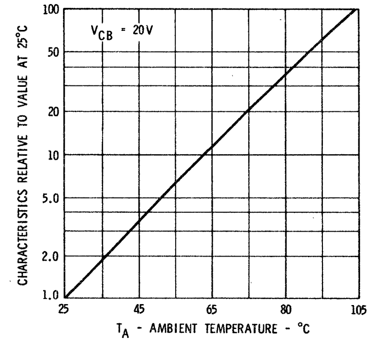
COLLECTOR CHARACTERISTICS



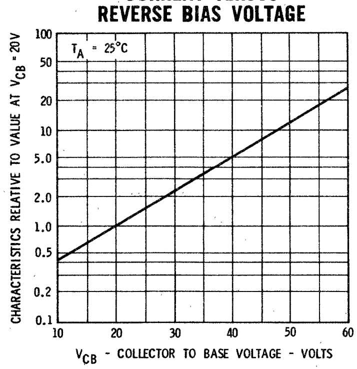
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



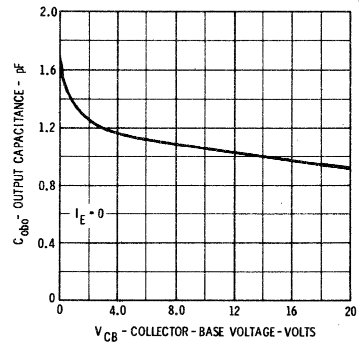
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



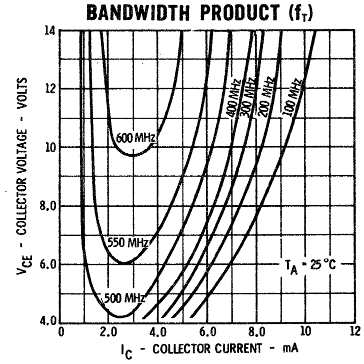
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



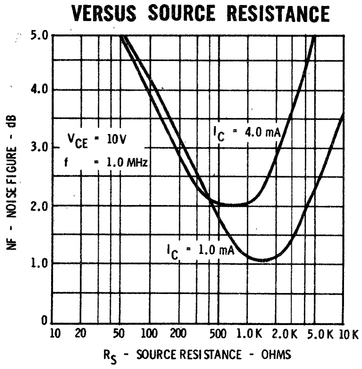
OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



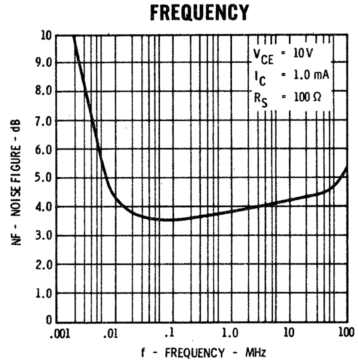
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



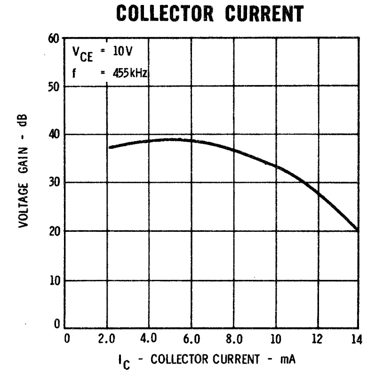
NARROW BAND NOISE FIGURE VERSUS SOURCE RESISTANCE



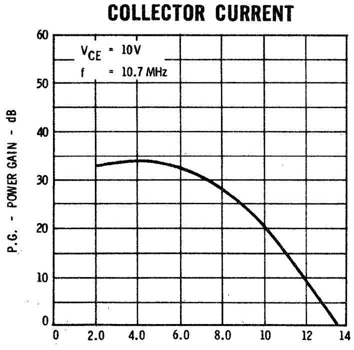
NOISE FIGURE VERSUS FREQUENCY



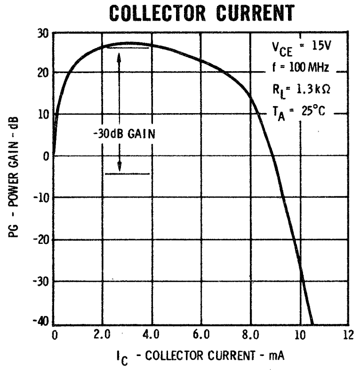
VOLTAGE GAIN VERSUS COLLECTOR CURRENT



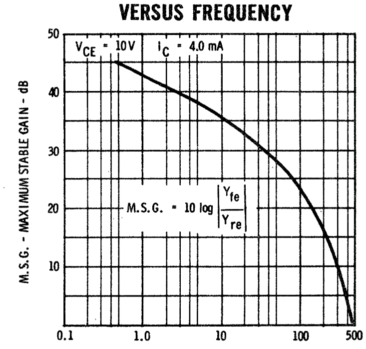
POWER GAIN VERSUS COLLECTOR CURRENT



POWER GAIN VERSUS COLLECTOR CURRENT



MAXIMUM STABLE GAIN VERSUS FREQUENCY



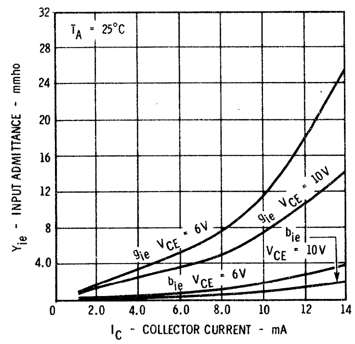
FAIRCHILD TRANSISTOR SE5006

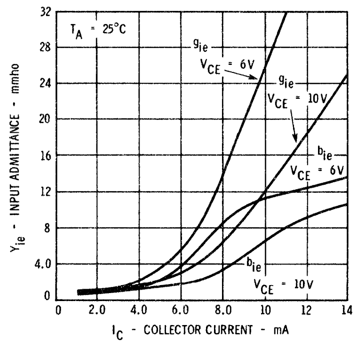
TYPICAL SMALL SIGNAL COMMON EMITTER "Y" PARAMETERS

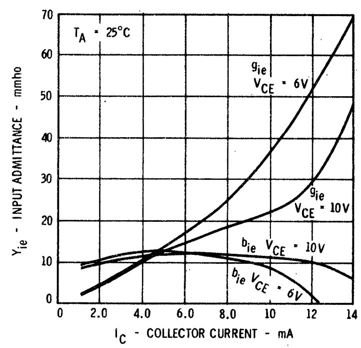
455 kHz	10.7 MHz	100 MHz
vs. COLLECTOR CURRENT	vs. COLLECTOR CURRENT	vs. COLLECTOR CURRENT

y_{ie}

Input Admittance
(output short circuit)

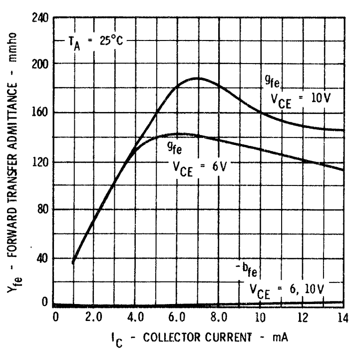


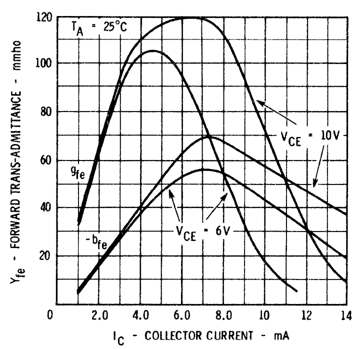


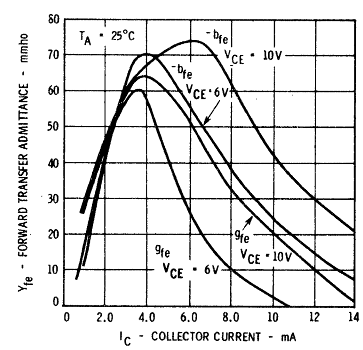


y_{fe}

Forward
Transfer Admittance
(output short circuit)

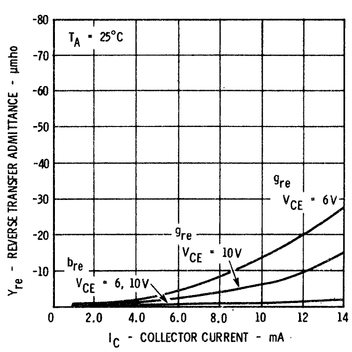


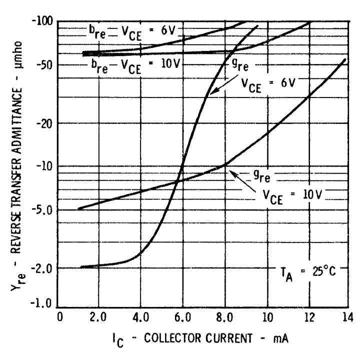


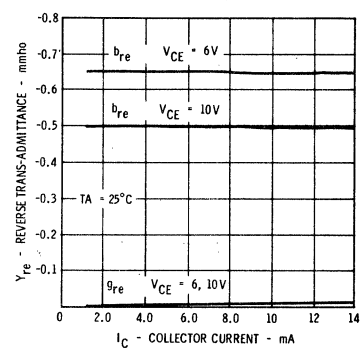


y_{re}

Reverse
Transfer Admittance
(input short circuit)

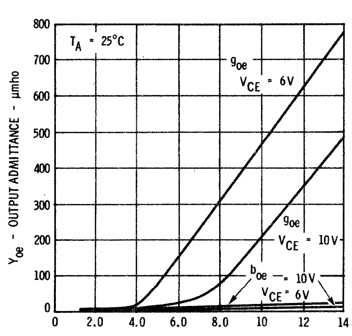


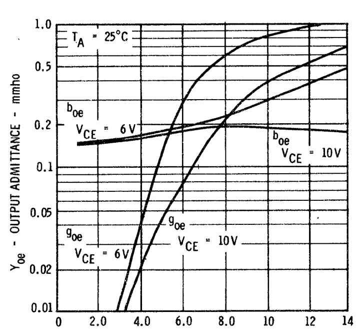


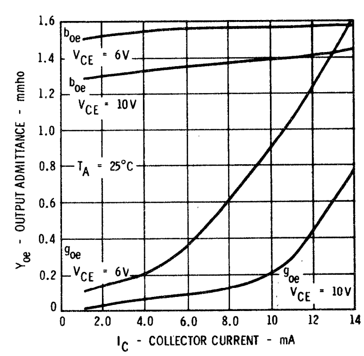


y_{oe}

Output Admittance
(input short circuit)

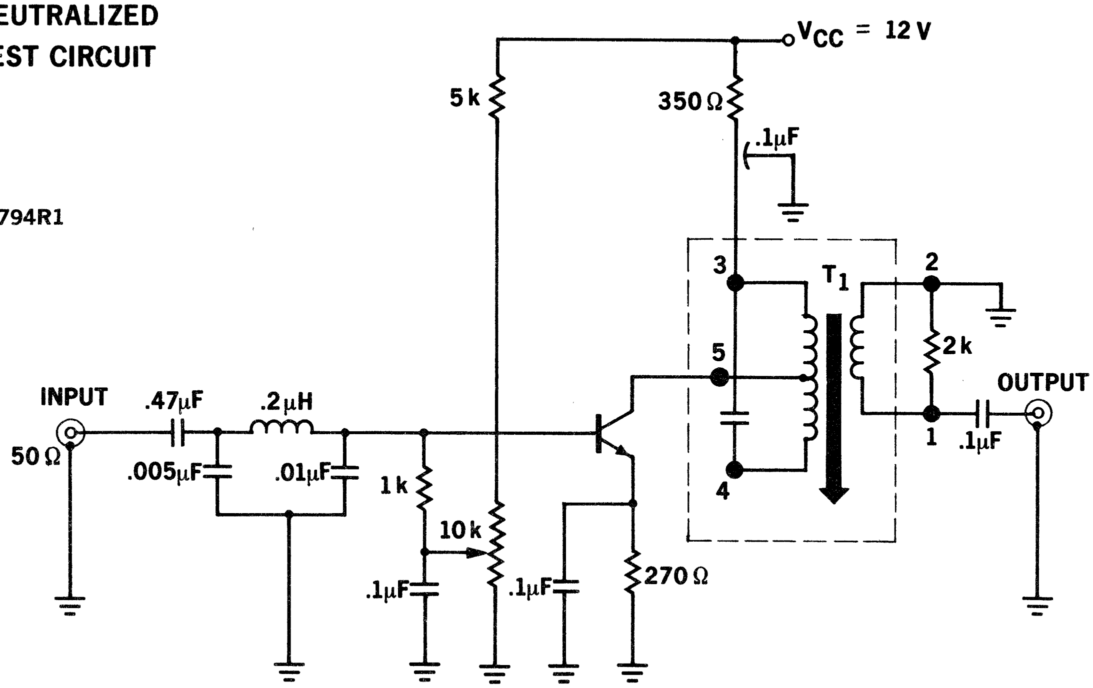




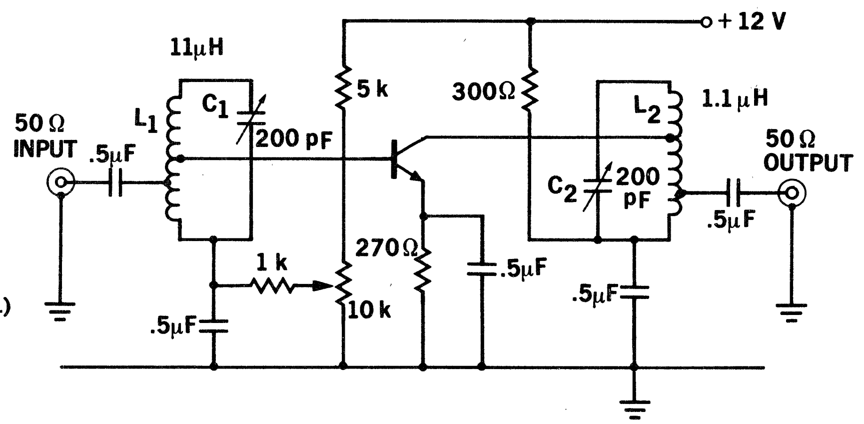


455 kHz UNNEUTRALIZED AMPLIFIER TEST CIRCUIT

T_1 = T.R.W. #17794R1



10.7 MHz UNNEUTRALIZED AMPLIFIER TEST CIRCUIT



C_1 and C_2 ARCO #465

L_1 = 11 μH (0.9 inch of #632 AIRDUX COIL)
Input Tap at 2.9T from cold side
Output Tap at 3.66T from cold side

L_2 = 1.1 μH (1.5 inches of #608 AIRDUX COIL)
Input Tap at 2.3T from cold side
Output Tap at 0.5T from cold side

All resistors are ½ watt.

Typical gain at I_C = 4 mA is 34 dB.

100 MHz AGC AND NF TEST CIRCUIT

L_1 = #14 Buss Wire — 3T — 3/8" I.D. — 5/12" long
Tap at 1½T from cold end

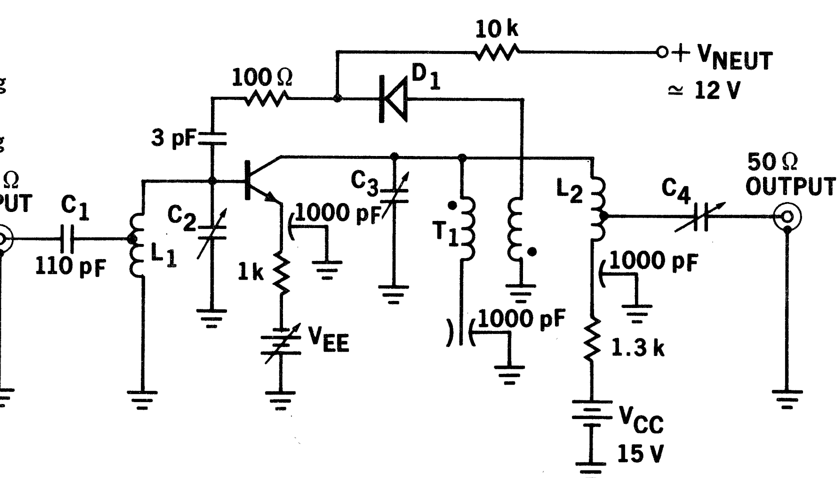
L_2 = #18 enameled — 5T — 3/8" I.D. — 5/16" long
Tap at 1½T from cold end

T_1 = #36 Bifilar — 1T in balum core Q_3

C_2 = 1 to 35 pF Johanson #803 (or equivalent)

C_3,C_4 = 1 to 35 pF Johanson #803 (or equivalent)

D_1 — FD 300



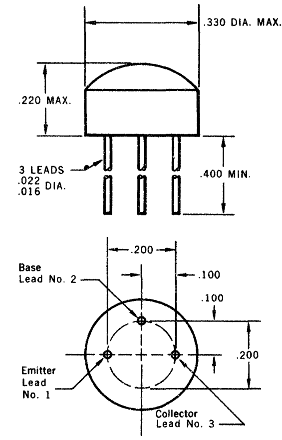
SE5025

NPN IF AMPLIFIER

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- OPTIMIZED FOR FINAL VIDEO IF AMPLIFIER
- LOW C_{re} = 1.0pF MAX.
- LOW g_{oe} = 200 μmho MAX.
- HIGH 45MHz POWER GAIN = 25 dB MIN.
- HIGH LV_{CEO} = 30V MIN.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.5 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	-55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 sec time limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature	(Notes 2 and 3)	0.5 Watt
at 25°C Free Air Temperature	(Notes 2 and 3)	0.25 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage	30 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	30 Volts
V_{EBO}	Emitter to Base Voltage	3.0 Volts

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

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Conditions	
G_{pe}	**Power Gain, Fixed Neutralization (f = 45MHz)**	25	28		dB	I_C = 10 mA	V_{CE} = 10 V
C_{re}	**Reverse Transfer Capacitance**	0.6	0.85	1.0	pF	I_E = 0	V_{CB} = 10 V
g_{oe}	**Output Admittance, Input Short Circuit (f = 45 MHz)**	30	90	200	μmho	I_C = 10 mA	V_{CE} = 10 V
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	30			Volts	I_C = 1.0 mA (pulsed)	I_B = 0
BV_{CBO}	Collector to Base Breakdown Voltage	30			Volts	I_C = 100 μA	I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0			Volts	I_E = 10 μA	I_C = 0
h_{FE}	DC Pulse Current Gain (Note 5)	20	35	100		I_C = 10 mA	V_{CE} = 10 V
h_{fe}	High Frequency Current (f = 100MHz)	3.0	4.5	7.0		I_C = 10 mA	V_{CE} = 10 V
V_{CE}(sat)	**Collector Saturation Voltage (Note 5)**			0.6	Volts	I_C = 20 mA (pulsed)	I_B = 1.0 mA
I_{CEO}	Collector Cutoff Current			1.0	μA	I_B = 0	V_{CE} = 30 V
I_{CBO}	Collector Cutoff Current			50	nA	I_E = 0	V_{CB} = 30 V

(See notes on back page)

* 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

NOTES:

(1) These ratings are limiting values above which the serviceability of any 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.

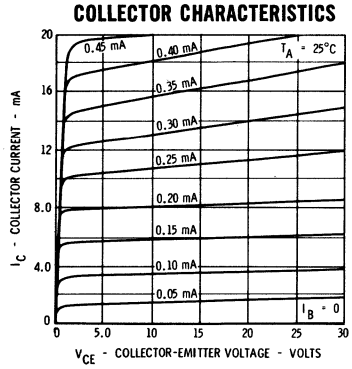
(3) These ratings give a maximum junction temperature of 125°C and junction-to-case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction-to-ambient thermal resistance of 400°C/Watt (derating factor of 2.5 mW/°C).

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

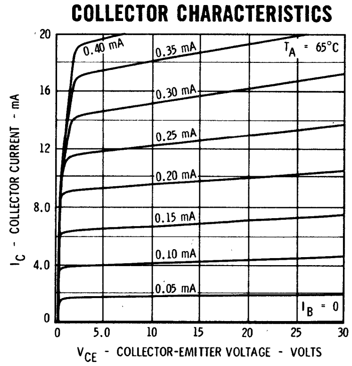
(5) Pulse Conditions: length = 300 μs; duty cycle = 1%.

TYPICAL ELECTRICAL CHARACTERISTICS

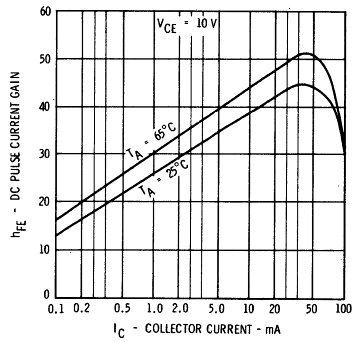
COLLECTOR CHARACTERISTICS



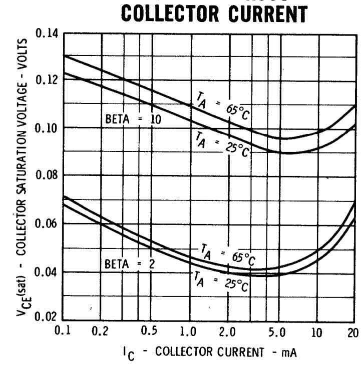
COLLECTOR CHARACTERISTICS



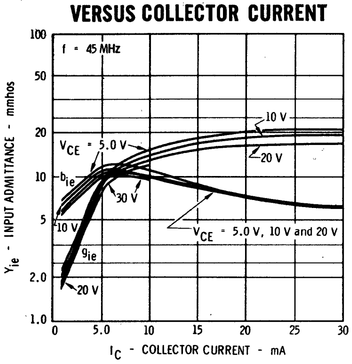
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



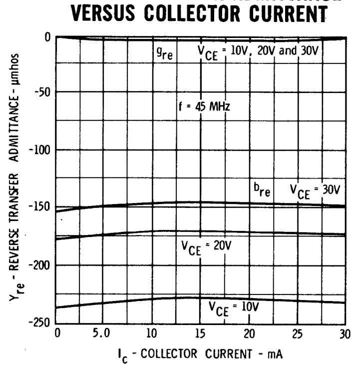
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



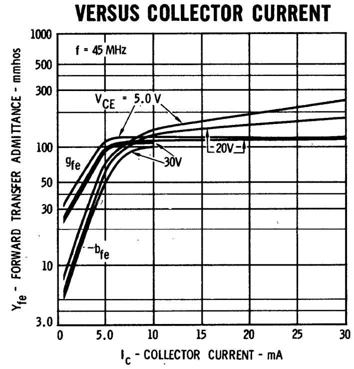
INPUT ADMITTANCE VERSUS COLLECTOR CURRENT



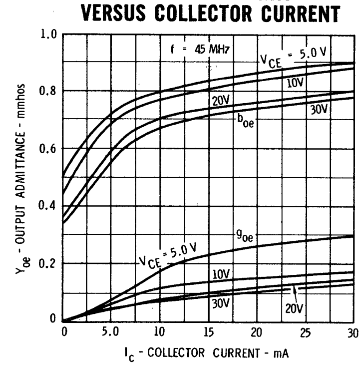
REVERSE TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT



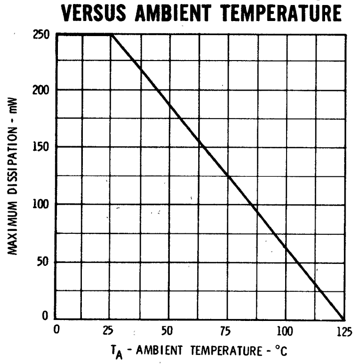
FORWARD TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT



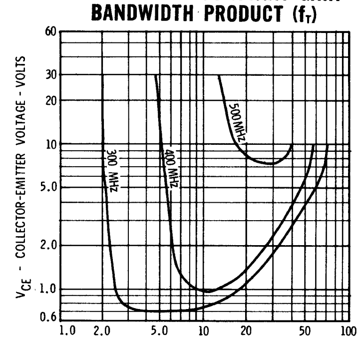
OUTPUT ADMITTANCE VERSUS COLLECTOR CURRENT



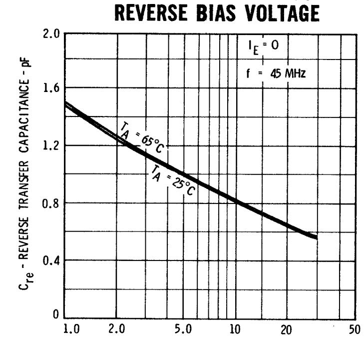
MAXIMUM POWER DISSIPATION VERSUS AMBIENT TEMPERATURE



CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



REVERSE TRANSFER CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



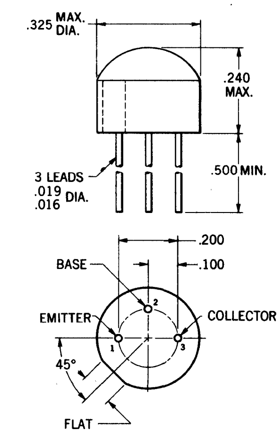
2N5040 · 2N5041

PNP HIGH CURRENT AMPLIFIERS

DIFFUSED SILICON PLANAR* II EPITAXIAL TRANSISTORS

- **EXCELLENT BETA LINEARITY** . . . . $\frac{h_{FE} \text{ @ } 500\text{ mA}}{h_{FE} \text{ @ } 150\text{ mA}} = 0.75$ **(Min.)**
- **LOW SATURATION VOLTAGE** . . . . **V_{CE}(sat) = 0.45 V (typ.) @ I_C = 1.0A, I_B = 33 mA**
  . . . . **V_{CE}(sat) = 0.20 V (typ.) @ I_C = 500 mA, I_B = 50 mA**
- **HIGH BREAKDOWN VOLTAGE** . . . . **LV_{CEO} = 40 V (min.) @ I_C = 30 mA**
- **COMPLEMENTARY WITH NPN 2N3567**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C
Lead Temperature (Soldering, 10 second time limit)	+260°C

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	0.8 Watt
at 25°C Free Air Temperature (Notes 2 and 3)	0.3 Watt

Maximum Voltages		**2N5040**	**2N5041**
V_{CBO}	Collector to Base Voltage	25 Volts	40 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	25 Volts	40 Volts
V_{EBO}	Emitter to Base Voltage	4.0 Volts	5.0 Volts

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

SYMBOL	CHARACTERISTIC	2N5040 MIN.	2N5040 TYP.	2N5040 MAX.	2N5041 MIN.	2N5041 TYP.	2N5041 MAX.	UNITS	TEST CONDITIONS	
$\frac{h_{FE2}}{h_{FE1}}$	**DC Pulse Current Gain Ratio** (Note 5)		0.5		**0.75**	**0.85**			**h_{FE1}@I_C=150 mA** **h_{FE2}@I_C=500 mA**	**V_{CE} = −1.0 V** **V_{CE} = −1.0 V**
h_{FE1}	**DC Pulse Current Gain** (Note 5)	30	170		**40**	**75**	**150**		**I_C=150 mA**	**V_{CE} = −1.0 V**
h_{FE2}	**DC Pulse Current Gain** (Note 5)	20	75		**30**	**65**			**I_C=500 mA**	**V_{CE} = −1.0 V**
h_{FE}	DC Pulse Current Gain (Note 5)	20	200		30	85	225		I_C=10 mA	V_{CE} = −1.0 V
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage** (Note 4)	−25			**−40**			**Volts**	**I_C=30 mA (pulsed)**	**I_B=0**
BV_{CBO}	Collector to Base Breakdown Voltage	−25			−40			Volts	I_C=100 μA	I_E=0
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.0			−5.0			Volts	I_C=0	I_E=10 μA
V_{CE}(sat)	Pulsed Collector Saturation Voltage (Note 5)		−0.09	−0.25		−0.09	−0.25	Volt	I_C=150 mA	I_B=15 mA
V_{CE}(sat)	**Pulsed Collector Saturation Voltage** (Note 5)		−0.4	−1.0		**−0.2**	**−0.5**	**Volt**	**I_C=500 mA**	**I_B=50 mA**
V_{CE}(sat)	**Pulsed Collector Saturation Voltage** (Note 5)					**−0.45**	**−1.3**	**Volts**	**I_C=1.0 A**	**I_B=33 mA**
V_{BE}(on)	Pulsed Base Emitter on Voltage (Note 5)		−0.69	−0.85		−0.69	−0.75	Volt	I_C=20 mA	V_{CE} = −5.0 V
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 5)		−0.82	−1.1		−0.82	−1.1	Volts	I_C=150 mA	I_B=15 mA
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 5)		−0.9	−1.2		−0.85	−1.1	Volts	I_C=500 mA	I_B=50 mA
V_{BE}(sat)	Pulsed Base Saturation Voltage					−0.95	−1.2	Volts	I_C=1.0 A	I_B=33 mA

*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) Thse 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 125°C and junction to case thermal resistance of 125°C/Watt (derating factor of 8.0 mW/°C); junction to ambient thermal resistance of 333°C/Watt (derating factor of 3.0 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) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

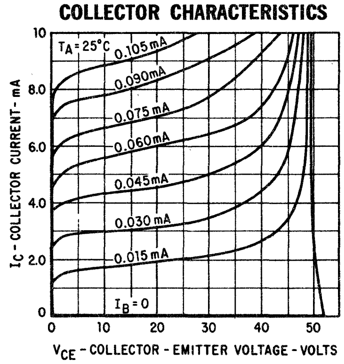
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

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

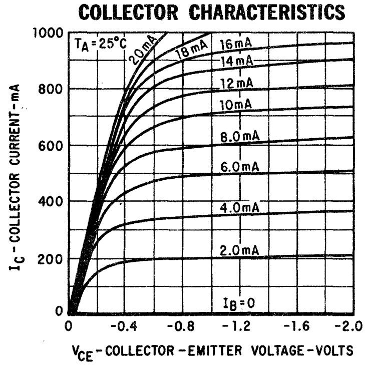
SYMBOL	CHARACTERISTIC	2N5040 MIN.	2N5040 TYP.	2N5040 MAX.	2N5041 MIN.	2N5041 TYP.	2N5041 MAX.	UNITS	TEST CONDITIONS	
I_{CBO}	Collector Cutoff Current		0.1	50				nA	$I_C = 0$	$V_{CB} = -15$ V
I_{CBO}	Collector Cutoff Current					0.1	50	nA	$I_C = 0$	$V_{CB} = -30$ V
I_{CBO}(65°C)	Collector Cutoff Current		0.01	1.0				μA	$I_C = 0$	$V_{CB} = -15$ V
I_{CBO}(65°C)	Collector Cutoff Current					0.01	1.0	μA	$I_C = 0$	$V_{CB} = -30$ V
I_{EBO}	Emitter Cutoff Current					0.01	50	nA	$I_C = 0$	$V_{EB} = -4.0$ V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	0.8	2.0		1.0	2.0			$I_C = 50$ mA	$V_{CE} = -10$ V
c_{cb}	Collector to Base Capacitance (f = 1.0 MHz)		15	35		15	35	pF	$I_E = 0$	$V_{CB} = -10$ V
C_{eb}	Emitter to Base Capacitance (f = 1.0 MHz)		75	120		75	120	pF	$I_C = 0$	$V_{EB} = -0.5$ V
t_{on}	Turn On Time (Note 6)		23			30		ns	$I_C \approx 500$ mA	$I_{B1} \approx 50$ mA
t_{off}	Turn Off Time (Note 6)		200			250		ns	$I_C \approx 500$ mA	$I_{B1} = I_{B2} \approx 50$ mA
NF	Narrow Band Noise Figure (f = 1.0 kHz)		1.0			1.0		dB	$I_C = 200\ \mu$A	$V_{CE} = -5.0$ V, $R_S = 1.0$ kΩ

TYPICAL ELECTRICAL CHARACTERISTICS (2N5041 only)

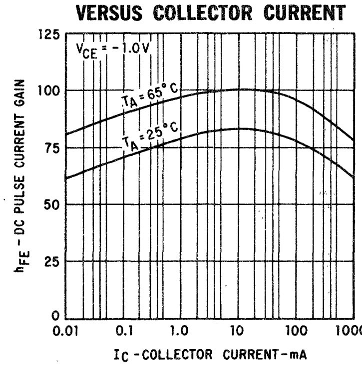
ACTIVE REGION COLLECTOR CHARACTERISTICS



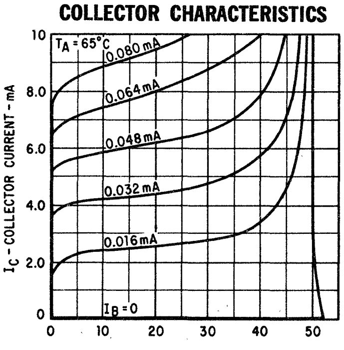
SATURATION REGION COLLECTOR CHARACTERISTICS



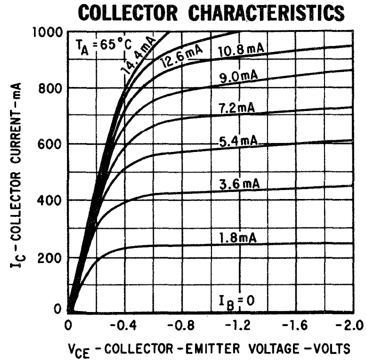
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



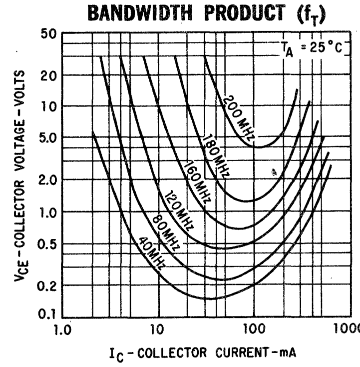
ACTIVE REGION COLLECTOR CHARACTERISTICS



SATURATION REGION COLLECTOR CHARACTERISTICS

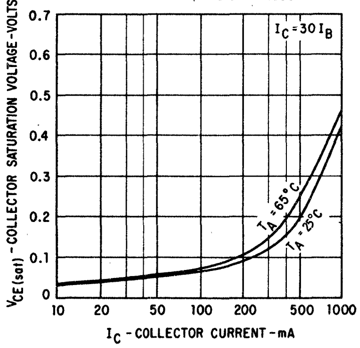


CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)

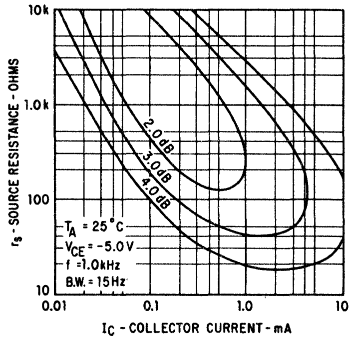


TYPICAL ELECTRICAL CHARACTERISTICS
(2N5041 only)

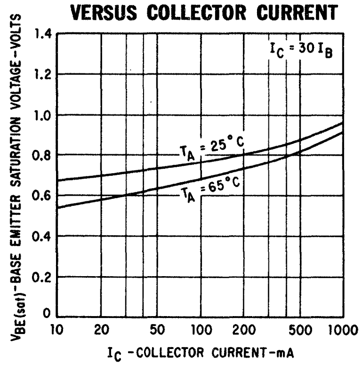
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



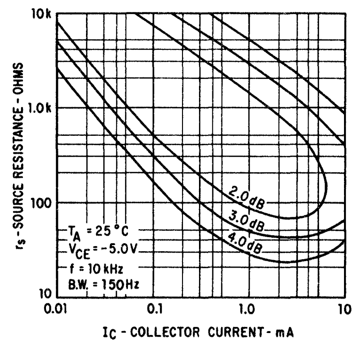
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



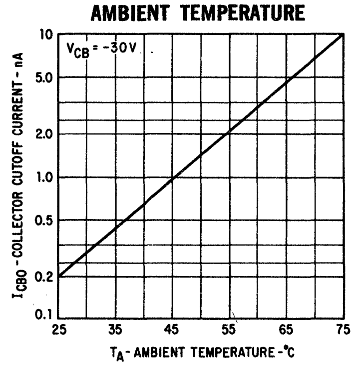
PULSED BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



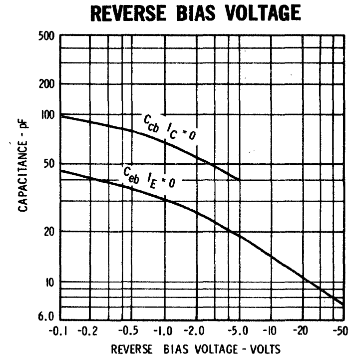
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE

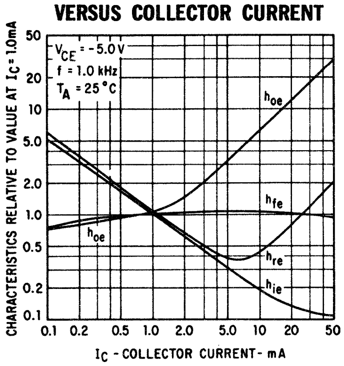


INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE

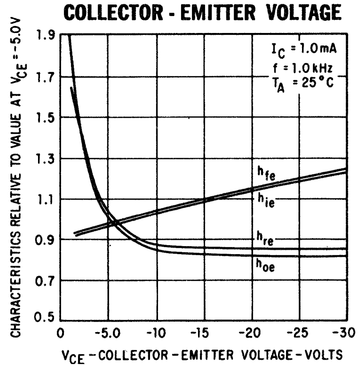


TYPICAL ELECTRICAL CHARACTERISTICS
(2N5041 only)

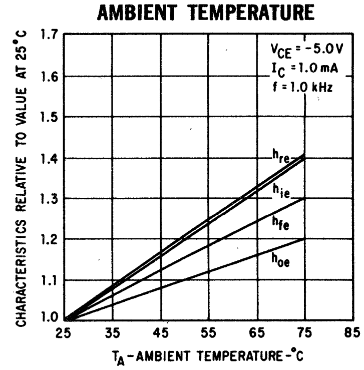
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR CURRENT



COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR - EMITTER VOLTAGE



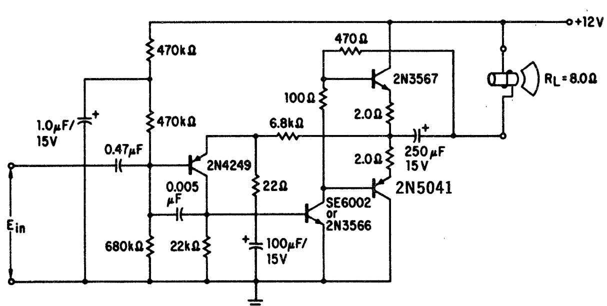
COMMON EMITTER CHARACTERISTICS VERSUS AMBIENT TEMPERATURE



SMALL SIGNAL CHARACTERISTICS (f = 1.0 kHz)

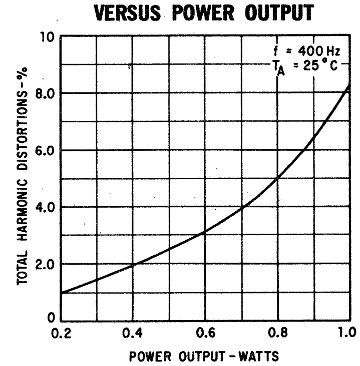
SYMBOL	CHARACTERISTIC	TYP.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance	2.3	kΩ	$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{oe}	Output Conductance	17	μmho	$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{re}	Voltage Feedback Ratio	4.5	$x10^{-4}$	$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{fe}	Small Signal Current Gain	78		$I_C = 1.0$ mA	$V_{CE} = -5.0$ V

1.0 WATT AUDIO AMPLIFIER



SENSITIVITY—14 mV (rms) FOR 1.0 WATT OUTPUT (R_L = 8.0Ω; f = 400 Hz)
S+N/N — 62dB BELOW 1.0 WATT

TOTAL HARMONIC DISTORTION VERSUS POWER OUTPUT



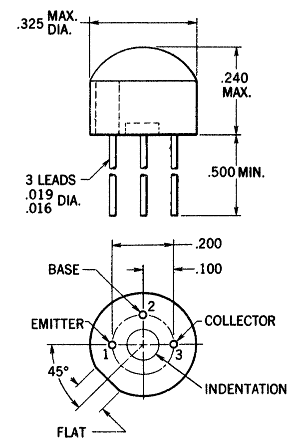
FT5040 · FT5041

PNP HIGH CURRENT AMPLIFIERS

DIFFUSED SILICON PLANAR* II EPITAXIAL TRANSISTORS

- **HIGH POWER DISSIPATION . . . . 4.0 WATT @ $T_C = 25°C$**
- **EXCELLENT BETA LINEARITY . . . . $\frac{h_{FE} @ 500 mA}{h_{FE} @ 150 mA} = 0.75$ (Min.)**
- **LOW SATURATION VOLTAGE . . . . $V_{CE}(sat) = -0.45$ V (typ.) @ $I_C = 1.0A$, $I_B = 33$ mA**
  . . . . $V_{CE}(sat) = -0.20$ V (typ.) @ $I_C = 500$ mA, $I_B = 50$ mA
- **HIGH BREAKDOWN VOLTAGE . . . . $LV_{CEO} = -40$ V (min.) @ $I_C = 30$ mA**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated nickel
Package is electrically Non-conductive material
Package weight is 0.66 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C
Lead Temperature (Soldering, 10 second time limit)	+260°C

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	**4.0 Watt**
at 25°C Free Air Temperature (Notes 2 and 3)	0.5 Watt

Maximum Voltages

		FT5040	**FT5041**
V_{CBO}	Collector to Base Voltage	−25 Volts	−40 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	−25 Volts	−40 Volts
V_{EBO}	Emitter to Base Voltage	−4.0 Volts	−5.0 Volts

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

SYMBOL	CHARACTERISTIC	FT5040 MIN.	FT5040 TYP.	FT5040 MAX.	**FT5041** MIN.	**FT5041** TYP.	**FT5041** MAX.	UNITS	TEST CONDITIONS	
h_{FE2}/h_{FE1}	**DC Pulse Current Gain Ratio** (Note 5)		0.5		**0.75**	**0.85**			**h_{FE1}@I_C=150 mA** **h_{FE2}@I_C=500 mA**	**$V_{CE} = -1.0$ V** **$V_{CE} = -1.0$ V**
h_{FE1}	**DC Pulse Current Gain** (Note 5)	30	170		**40**	**75**	**150**		**I_C=150 mA**	**$V_{CE} = -1.0$ V**
h_{FE2}	**DC Pulse Current Gain** (Note 5)	20	75		**30**	**65**			**I_C=500 mA**	**$V_{CE} = -1.0$ V**
h_{FE}	DC Pulse Current Gain (Note 5)	20	200		30	85	225		I_C=10 mA	$V_{CE} = -1.0$ V
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage (Note 4 & 5)**	−25			**−40**			**Volts**	**I_C=30 mA (pulsed)**	**I_B=0**
BV_{CBO}	Collector to Base Breakdown Voltage	−25			−40			Volts	I_C=100 μA	I_E=0
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.0			−5.0			Volts	I_C=0	I_E=10 μA
V_{CE}(sat)	Pulsed Collector Saturation Voltage (Note 5)		−0.09	−0.25		−0.09	−0.25	Volt	I_C=150 mA	I_B=15 mA
V_{CE}(sat)	**Pulsed Collector Saturation Voltage** (Note 5)		−0.4	−1.0		**−0.2**	**−0.5**	**Volt**	**I_C=500 mA**	**I_B=50 mA**
V_{CE}(sat)	**Pulsed Collector Saturation Voltage** (Note 5)					**−0.45**	**−1.3**	**Volts**	**I_C=1.0 A**	**I_B=33 mA**
V_{BE}(on)	Pulsed Base Emitter on Voltage (Note 5)		−0.69	−0.85		−0.69	−0.75	Volt	I_C=20 mA	$V_{CE} = -5.0$ V
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 5)		−0.82	−1.1		−0.82	−1.1	Volts	I_C=150 mA	I_B=15 mA
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 5)		−0.9	−1.2		−0.85	−1.1	Volts	I_C=500 mA	I_B=50 mA
V_{BE}(sat)	Pulsed Base Saturation Voltage					−0.95	−1.2	Volts	I_C=1.0 A	I_B=33 mA

NOTES:

*Planar is a patented Fairchild process.

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) Thse 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 125°C and junction to case thermal resistance of 125°C/Watt (derating factor of 40 mW/°C); junction to ambient thermal resistance of 200°C/Watt (derating factor of 5.0 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) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

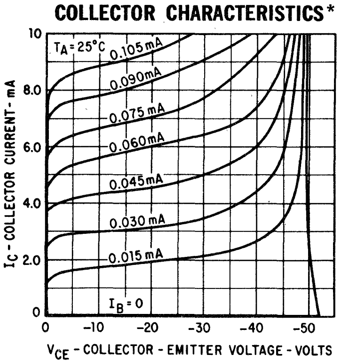
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

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

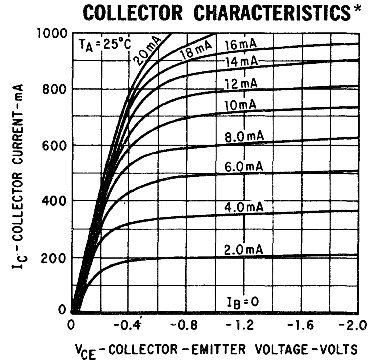
SYMBOL	CHARACTERISTIC	FT5040 MIN.	FT5040 TYP.	FT5040 MAX.	FT5041 MIN.	FT5041 TYP.	FT5041 MAX.	UNITS	TEST CONDITIONS	
I_{CBO}	Collector Cutoff Current		0.1	50				nA	$I_C = 0$	$V_{CB} = -15$ V
I_{CBO}	Collector Cutoff Current					0.1	50	nA	$I_C = 0$	$V_{CB} = -30$ V
I_{CBO}(65°C)	Collector Cutoff Current		0.01	1.0				μA	$I_C = 0$	$V_{CB} = -15$ V
I_{CBO}(65°C)	Collector Cutoff Current					0.01	1.0	μA	$I_C = 0$	$V_{CB} = -30$ V
I_{EBO}	Emitter Cutoff Current					0.01	50	nA	$I_C = 0$	$V_{EB} = -4.0$ V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	0.8	2.0		1.0	2.0			$I_C = 50$ mA	$V_{CE} = -10$ V
C_{cb}	Collector to Base Capacitance (f = 1.0 MHz)		15	35		15	35	pF	$I_E = 0$	$V_{CB} = -10$ V
C_{eb}	Emitter to Base Capacitance (f = 1.0 MHz)		75	120		75	120	pF	$I_C = 0$	$V_{EB} = -0.5$ V
t_{on}	Turn On Time (Note 6)		23			30		ns	$I_C \approx 500$ mA	$I_{B1} \approx 50$ mA
t_{off}	Turn Off Time (Note 6)		200			250		ns	$I_C \approx 500$ mA	$I_{B1} = I_{B2} \approx 50$ mA
NF	Narrow Band Noise Figure (f = 1.0 kHz)		1.0			1.0		dB	$I_C = 200$ μA	$V_{CE} = -5.0$ V, $R_S = 1.0$ kΩ

TYPICAL ELECTRICAL CHARACTERISTICS (FT5041 only)

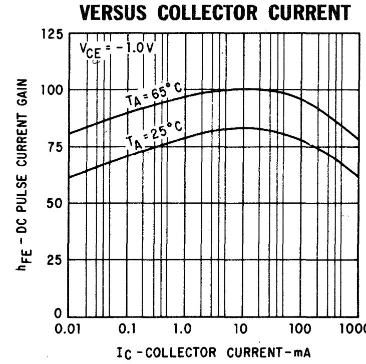
ACTIVE REGION COLLECTOR CHARACTERISTICS*



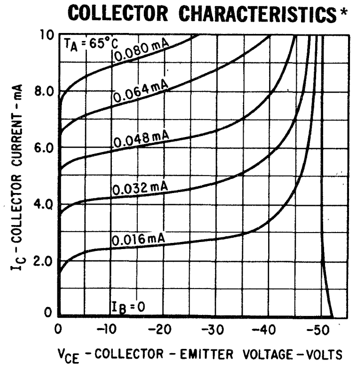
SATURATION REGION COLLECTOR CHARACTERISTICS*



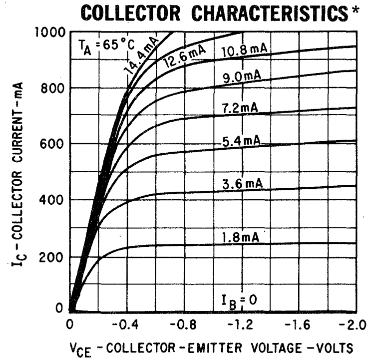
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



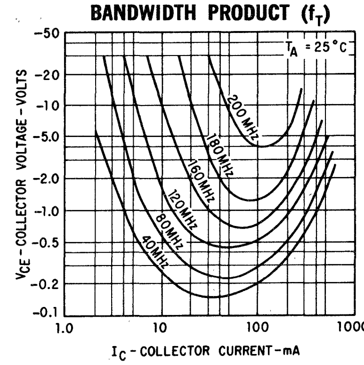
ACTIVE REGION COLLECTOR CHARACTERISTICS*



SATURATION REGION COLLECTOR CHARACTERISTICS*



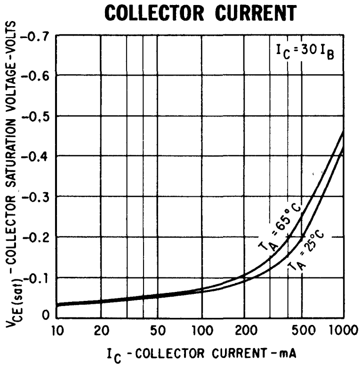
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



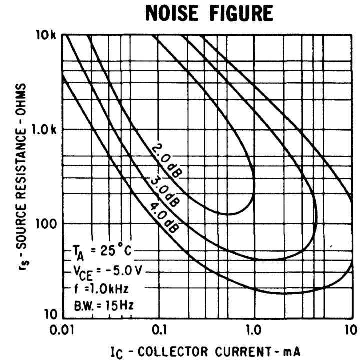
* Single family characteristic on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS
(FT5041 only)

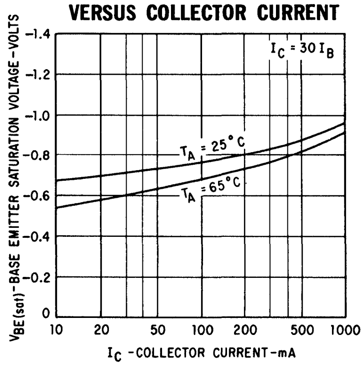
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



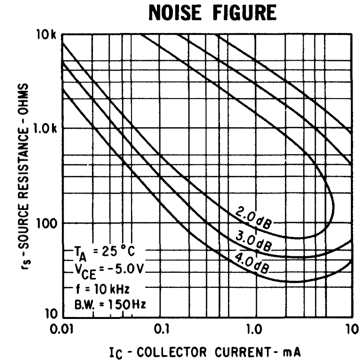
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



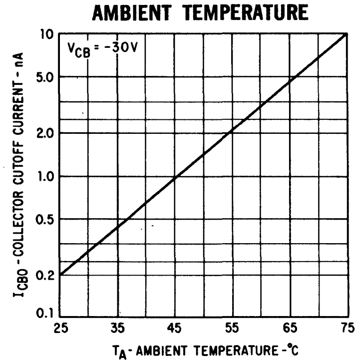
PULSED BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



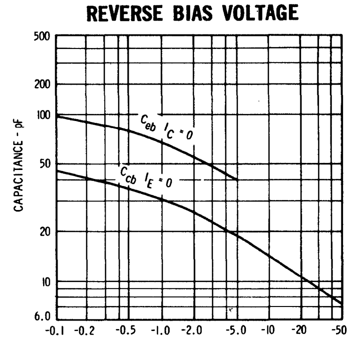
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE

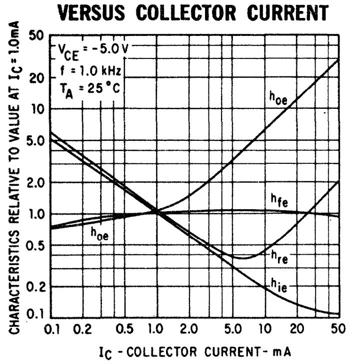


INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE

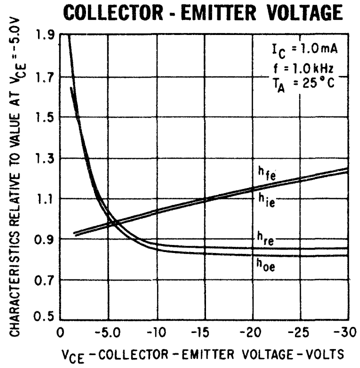


TYPICAL ELECTRICAL CHARACTERISTICS (FT5041 only)

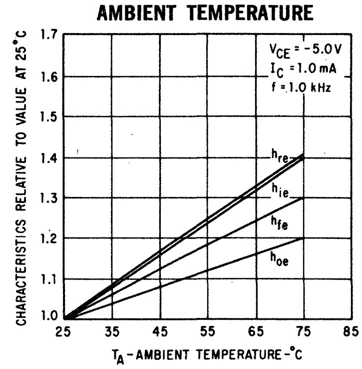
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR CURRENT



COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR - EMITTER VOLTAGE



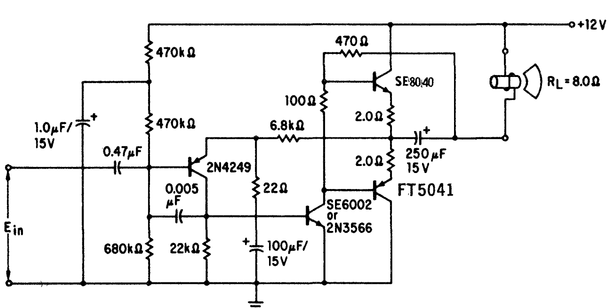
COMMON EMITTER CHARACTERISTICS VERSUS AMBIENT TEMPERATURE



SMALL SIGNAL CHARACTERISTICS (f = 1.0 kHz)

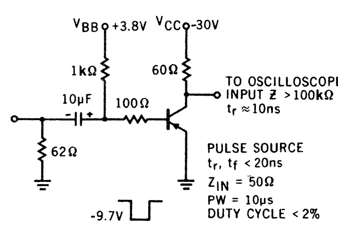
SYMBOL	CHARACTERISTIC	TYP.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance	2.3	kΩ	$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{oe}	Output Conductance	17	μmho	$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{re}	Voltage Feedback Ratio	4.5	$\times 10^{-4}$	$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{fe}	Small Signal Current Gain	78		$I_C = 1.0$ mA	$V_{CE} = -5.0$ V

1.0 WATT AUDIO AMPLIFIER

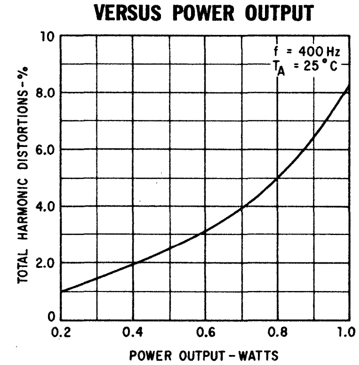


SENSITIVITY—14 mV (rms) FOR 1.0 WATT OUTPUT (R_L = 8.0Ω; f = 400 Hz)
S+N/N — 62 dB BELOW 1.0 WATT

t_{on} AND t_{off} TEST CIRCUIT



TOTAL HARMONIC DISTORTION VERSUS POWER OUTPUT



FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

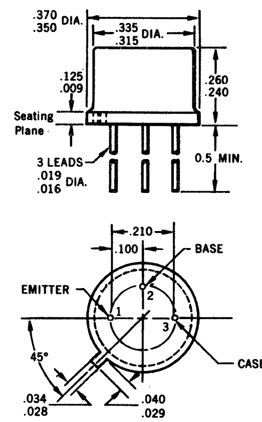
2N5042

PNP HIGH CURRENT AMPLIFIER

DIFFUSED SILICON PLANAR* II EPITAXIAL TRANSISTOR

- **EXCELLENT BETA LINEARITY - -** $\frac{h_{FE} @ 500\ mA}{h_{FE} @ 150\ mA} = 0.75$ **(min.)**
- **LOW SATURATION VOLTAGE - -** $V_{CE}(sat) = 0.45$ **(typ.) @** $I_C = 1.0\ A$, $I_B = 33\ mA$
- **HIGH BREAKDOWN VOLTAGE - -** $LV_{CEO} = 40\ V$ **(min.) @** $I_C = 30\ mA$
- **LOW DISTORTION - - 0.5% (typ.) @ 5.0 WATTS**
- **COMPLEMENTARY WITH NPN SE8002 AND 2N3110**

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	+200°C
Lead Temperature (Soldering, 60 second time limit)	+300°C
Maximum Power Dissipation	
Total Dissipation	
at 25°C Case Temperature (Notes 2 & 3)	4.0 Watts
at 25°C Ambient Temperature (Notes 2 & 3)	0.8 Watt
Maximum Voltages	
V_{CBO} Collector to Base Voltage	−40 Volts
V_{CEO} Collector to Emitter Voltage (Note 4)	−40 Volts
V_{EBO} Emitter to Base Voltage	−5.0 Volts

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

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE2}/h_{FE1}	**DC Pulse Current Gain Ratio** (Note 5)	**0.75**	**0.85**			h_{FE1} @ $I_C = 150$ mA h_{FE2} @ $I_C = 500$ mA	$V_{CE} = -1.0$ V $V_{CE} = -1.0$ V
h_{FE1}	**DC Pulse Current Gain** (Note 5)	**40**	**75**	**150**		$I_C = 150$ mA	$V_{CE} = -1.0$ V
h_{FE2}	**DC Pulse Current Gain** (Note 5)	**30**	**65**			$I_C = 500$ mA	$V_{CE} = -1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	30	85	225		$I_C = 10$ mA	$V_{CE} = -1.0$ V
$V_{CEO}(sust)$	**Collector to Emitter Sustaining Voltage** (Notes 4 & 5)	**−40**			**Volts**	$I_C = 30$ mA (pulsed)	$I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−40			Volts	$I_C = 100\ \mu A$	$I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0			Volts	$I_C = 0$	$I_E = 10\ \mu A$
$V_{CE}(sat)$	Pulsed Collector Saturation Voltage (Note 5)		−0.09	−0.25	Volt	$I_C = 150$ mA	$I_B = 15$ mA
$V_{CE}(sat)$	Pulsed Collector Saturation Voltage (Note 5)		−0.20	−0.50	Volt	$I_C = 500$ mA	$I_B = 50$ mA
$V_{CE}(sat)$	**Pulsed Collector Saturation Voltage** (Note 5)		**−0.45**	**−1.3**	**Volts**	$I_C = 1.0$ A	$I_B = 33$ mA
$V_{BE}(on)$	Pulsed Base Emitter On Voltage (Note 5)		−0.69	−0.75	Volt	$I_C = 20$ mA	$V_{CE} = -5.0$V
$V_{BE}(sat)$	Pulsed Base Saturation Voltage (Note 5)		−0.82	−1.1	Volts	$I_C = 150$ mA	$I_B = 15$ mA
$V_{BE}(sat)$	Pulsed Base Saturation Voltage (Note 5)		−0.85	−1.1	Volts	$I_C = 500$ mA	$I_B = 50$ mA
$V_{BE}(sat)$	Pulsed Base Saturation Voltage (Note 5)		−0.95	−1.2	Volts	$I_C = 1.0$ A	$I_B = 33$ mA
I_{CBO}	Collector Cutoff Current		0.2	50	nA	$I_E = 0$	$V_{CB} = -30$ V
$I_{CBO}(150°C)$	Collector Cutoff Current		1.0	20	μA	$I_E = 0$	$V_{CB} = -30$ V
I_{EBO}	Emitter Cutoff Current		0.1	50	nA	$I_C = 0$	$V_{EB} = -4.0$ V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	1.0	2.0	5.0		$I_C = 50$ mA	$V_{CE} = -10$ V
C_{cb}	Collector to Base Capacitance (f = 1.0 MHz)		15	35	pF	$I_E = 0$	$V_{CB} = -10$ V
C_{eb}	Emitter to Base Capacitance (f = 1.0 MHz)		75	120	pF	$I_C = 0$	$V_{EB} = -0.5$ V
t_{on}	Turn On Time (Note 6)		23		ns	$I_C \approx 500$ mA	$I_{B1} \approx 50$ mA
t_{off}	Turn Off Time (Note 6)		200		ns	$I_C \approx 500$ mA	$I_{B1} = I_{B2} \approx 50$ mA
NF	Narrow Band Noise Figure (f = 1.0 kHz)		1.0		dB	$I_C = 200\ \mu A$	$V_{CE} = 5.0$ V $R_S = 1.0\ k\Omega$

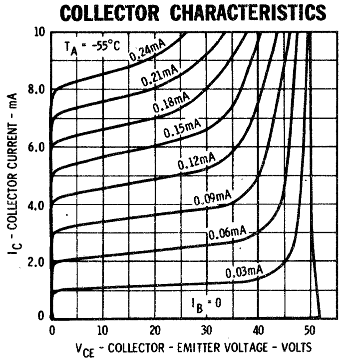
Additional Electrical Characteristics and Notes on Page 3

*Planar is a patented Fairchild process.

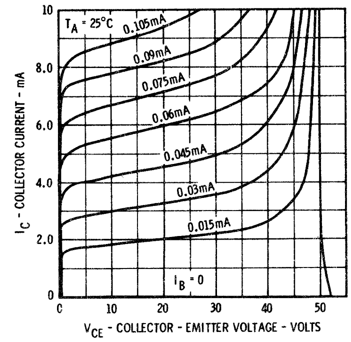
FAIRCHILD
SEMICONDUCTOR
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

TYPICAL ELECTRICAL CHARACTERISTICS

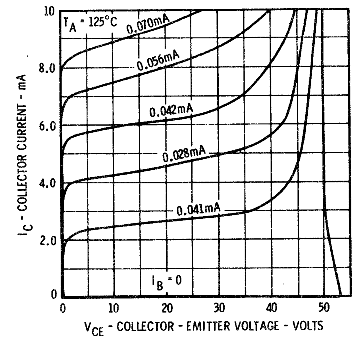
ACTIVE REGION COLLECTOR CHARACTERISTICS



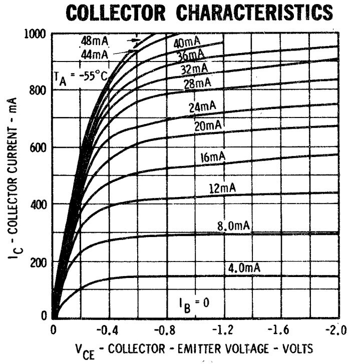
ACTIVE REGION COLLECTOR CHARACTERISTICS



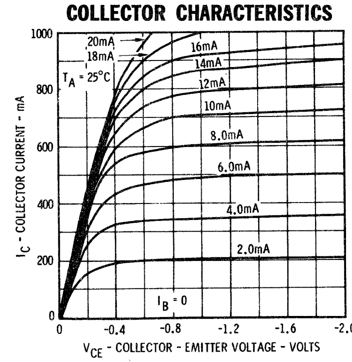
ACTIVE REGION COLLECTOR CHARACTERISTICS



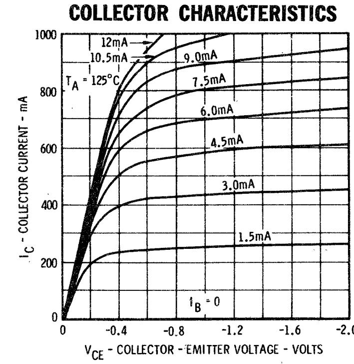
SATURATION REGION COLLECTOR CHARACTERISTICS



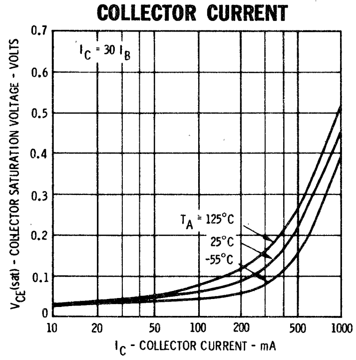
SATURATION REGION COLLECTOR CHARACTERISTICS



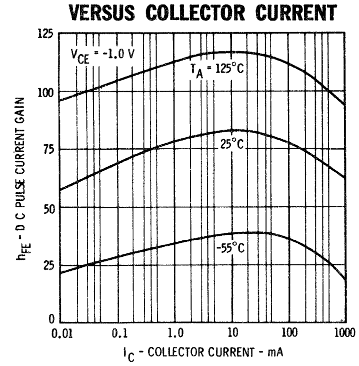
SATURATION REGION COLLECTOR CHARACTERISTICS



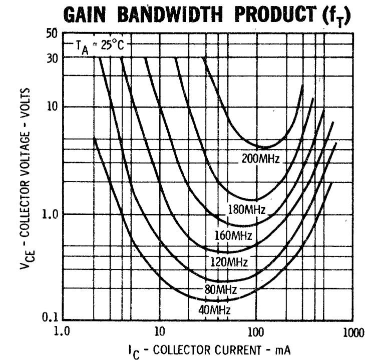
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



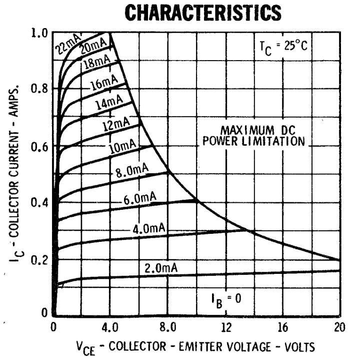
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



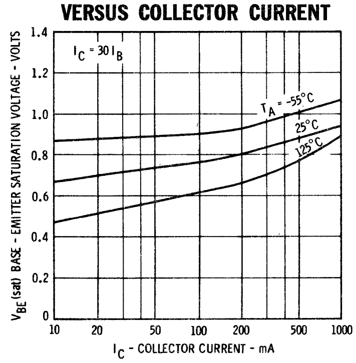
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



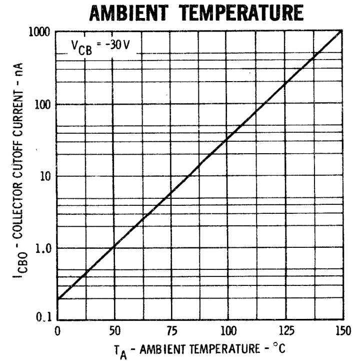
LARGE SIGNAL COLLECTOR CHARACTERISTICS



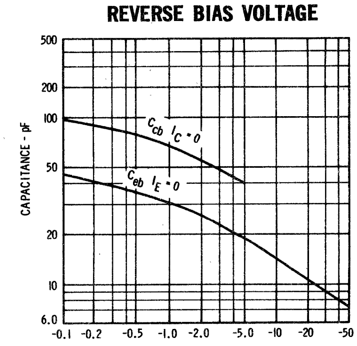
PULSED BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



FAIRCHILD TRANSISTOR 2N5042

SMALL SIGNAL CHARACTERISTICS (f = 1.0 kHz)

SYMBOL	CHARACTERISTIC	TYP.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance	2.3	kΩ	$I_C = 1.0$ mA	$V_{CE} = 5.0$ V
h_{oe}	Output Conductance	17	μmhos	$I_C = 1.0$ mA	$V_{CE} = 5.0$ V
h_{re}	Voltage Feedback Ratio	4.5	$\times 10^{-4}$	$I_C = 1.0$ mA	$V_{CE} = 5.0$ V
h_{fe}	Small Signal Current Gain	78		$I_C = 1.0$ 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) 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 43.8°C/Watt (derating factor of 22.8 mW/°C); junction to ambient thermal resistance of 219°C/Watt (derating factor of 4.56 mW/°C).

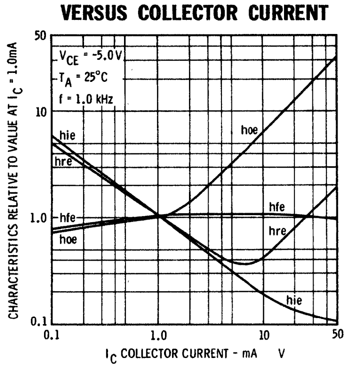
(4) This rating refers to a high current point where collector-to-emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.

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

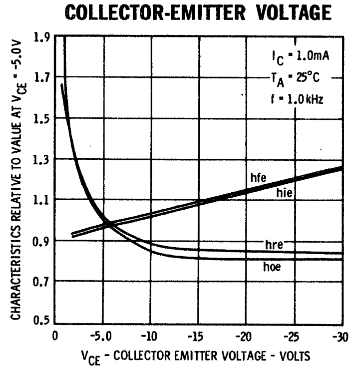
(6) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

TYPICAL ELECTRICAL CHARACTERISTICS

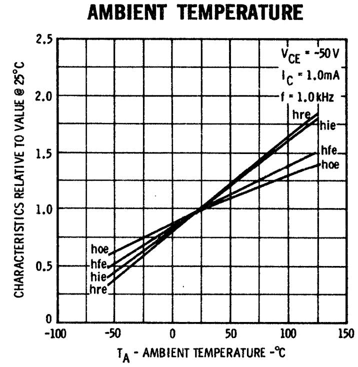
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR CURRENT



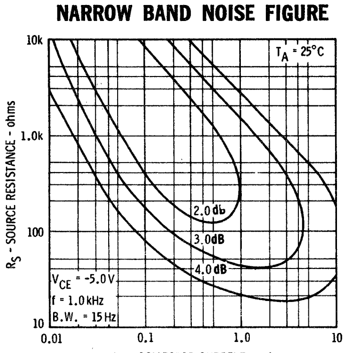
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR-EMITTER VOLTAGE



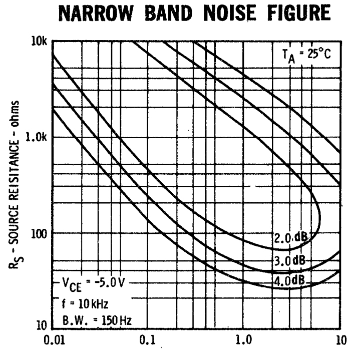
COMMON EMITTER CHARACTERISTICS VERSUS AMBIENT TEMPERATURE



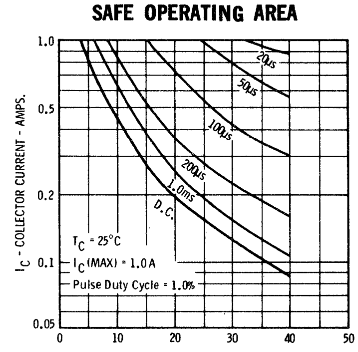
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE

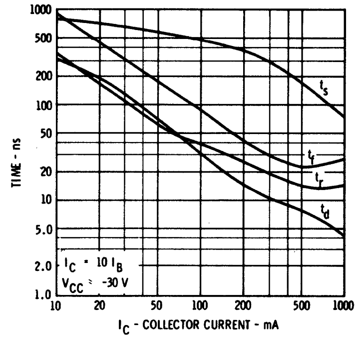


FORWARD BIASED SAFE OPERATING AREA

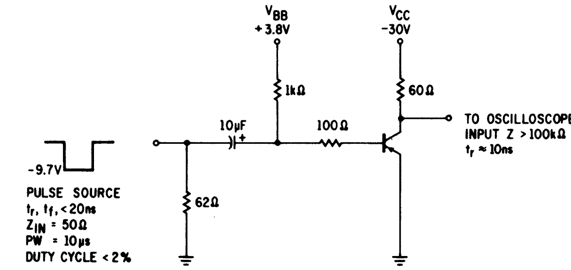


FAIRCHILD TRANSISTOR 2N5042

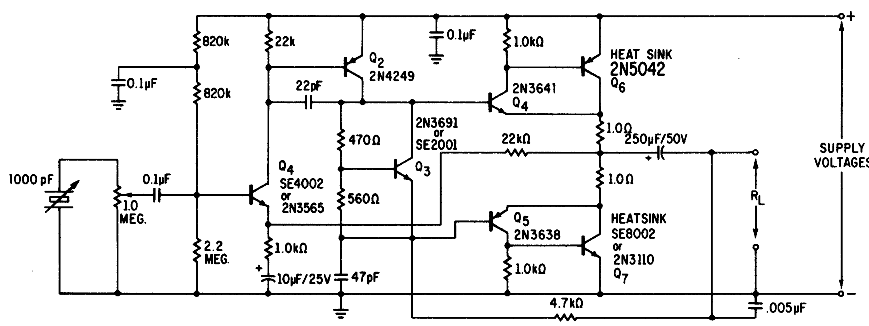
SWITCHING TIMES VERSUS COLLECTOR CURRENT



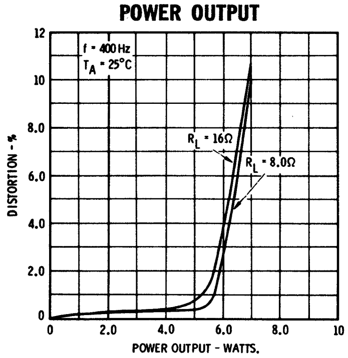
t_{on} AND t_{off} TEST CIRCUIT



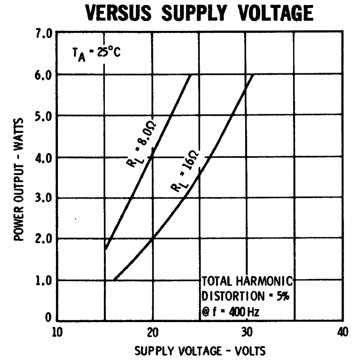
FIVE WATT AUDIO AMPLIFIER



DISTORTION VERSUS POWER OUTPUT

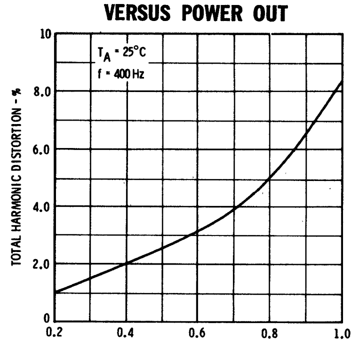


POWER OUTPUT VERSUS SUPPLY VOLTAGE

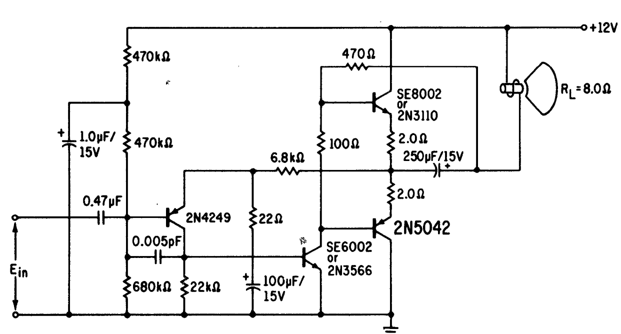


	V_{supply}=30V R_L=16Ω	V_{supply}=24V R_L=8.0 Ω
Total Harmonic Distortion @ f = 400 Hz, P_{out} = 5.0 W	0.7%	0.5%
Sensitivity @ f = 400 Hz, P_{out} = 5.0 W	410 mV(rms)	300 mV(rms)
$\frac{S+N}{N}$ (dB below 5.0 W)	64 dB	75 dB

TOTAL HARMONIC DISTORTION VERSUS POWER OUT



1.0 WATT AUDIO AMPLIFIER



SENSITIVITY - 14 mV(rms) for 1.0 watt output (R_L = 8.0Ω; 400 Hz)

S+N/N - 62 dB below 1.0 watt

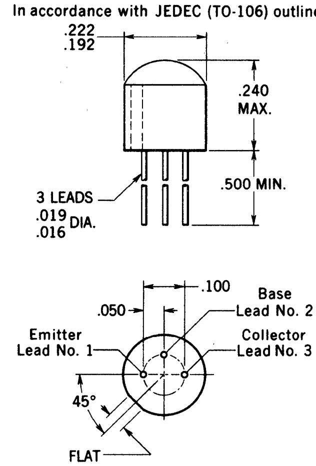
2N5055

PNP HIGH-SPEED SWITCH

DIFFUSED SILICON PLANAR*II EPITAXIAL TRANSISTOR

- **FAST SWITCHING** . . . . t_{on} = 20 ns (MAX) @ 30 mA
  . . . . t_{off} = 25 ns (MAX) @ 30 mA
  . . . . τ_s = 20 ns (MAX) @ 10 mA
- **HIGH FREQUENCY** . . . . f_T = 550 MHz (MIN) @ 20 mA
- **LOW CAPACITANCE** . . . . C_{cb} = 4.5 pF (MAX) @ 5 V
- **LOW SATURATION VOLTAGE** . . . $V_{CE\,(sat)}$ = 0.19 V (MAX) @ 30 mA

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C
Lead Temperature (Soldering, 10 seconds time limit)	+260°C

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature [Notes 2 and 3]	0.5 Watt
at 25°C Ambient Temperature [Notes 2 and 3]	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	−12 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	−12 Volts
V_{EBO}	Emitter to Base Voltage	−4.5 Volts
V_{CES}	Collector to Emitter Voltage	−12 Volts
I_C	Collector Current [Note 2]	100 mA

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

SYMBOL	CHARACTERISTICS	MIN.	Typ.	MAX.	UNITS	TEST CONDITIONS	
V_{CE} (sat)	Pulsed Collector-Emitter Saturation Voltage [Note 5]		−0.07	−0.13	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{CE} (sat)	**Pulsed Collector-Emitter Saturation Voltage [Note 5]**		**−0.10**	**−0.19**	**Volts**	**I_C = 30 mA**	**I_B = 3.0 mA**
V_{CE} (sat)	**Pulsed Collector-Emitter Saturation Voltage [Note 5]**		**−0.25**	**−0.45**	**Volts**	**I_C = 100 mA**	**I_B = 10 mA**
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**5.5**	**9.0**			**I_C = 20 mA**	**V_{CE} = −10 V**
C_{cb}	**Collector to Base Capacitance**		**3.3**	**4.5**	**pF**	**I_E = 0**	**V_{CB} = −5.0 V**
C_{eb}	Emitter to Base Capacitance		3.8	6.0	pF	I_C = 0	V_{EB} = −0.5 V
I_{CES}	Collector Reverse Current		0.05	50	nA	V_{CE} = −10 V	V_{EB} = 0
I_{CES} (65°C)	Collector Reverse Current		0.002	10	μA	V_{CE} = −10 V	V_{EB} = 0
τ_s	**Charge Storage Time** [Note 6, Figure 1]		**15**	**20**	**ns**	**$I_C \approx$ 10 mA**	**$I_{B1} \approx I_{B2} \approx$ 10 mA**
t_{on}	**Turn On Time** [Note 6, Figure 2]		**10**	**20**	**ns**	**$I_C \approx$ 30 mA**	**$I_{B1} \approx$ 3.0 mA**
t_{off}	**Turn Off Time** [Note 6, Figure 2]		**15**	**25**	**ns**	**$I_C \approx$ 30 mA**	**$I_{B1} \approx I_{B2} \approx$ 3.0 mA**
t_d	Delay Time [Note 6, Figure 2]		4	10	ns	$I_C \approx$ 30 mA	$I_{B1} \approx$ 3.0 mA
t_r	Rise Time [Note 6, Figure 2]		6	15	ns	$I_C \approx$ 30 mA	$I_{B1} \approx$ 3.0 mA
t_s	Storage Time [Note 6, Figure 2]		12	20	ns	$I_C \approx$ 30 mA	$I_{B1} \approx I_{B2} \approx$ 3.0 mA
t_f	Fall Time [Note 6, Figure 2]		3	15	ns	$I_C \approx$ 30 mA	$I_{B1} \approx I_{B2} \approx$ 3.0 mA

Additional Electrical Characteristics on page 2

* 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 125°C and junction to case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/watt (derating factor of 2.0 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) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

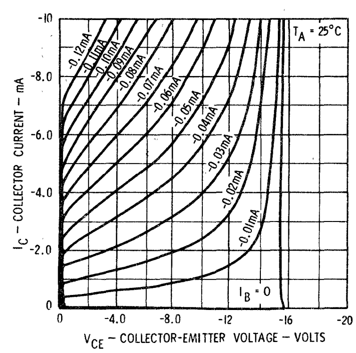
FAIRCHILD TRANSISTOR 2N5055

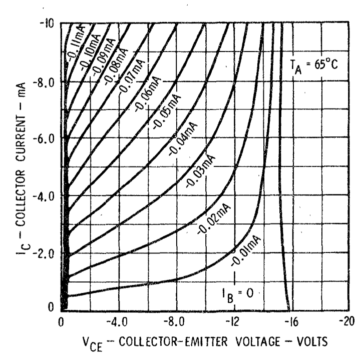
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Noted)

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
V_{BE} (sat)	Pulsed Base-Emitter Saturation Voltage		−0.88	−0.92	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{BE} (sat)	Pulsed Base-Emitter Saturation Voltage	−0.8	−0.93	−1.15	Volts	I_C = 30 mA	I_B = 3.0 mA
V_{BE} (sat)	Pulsed Base-Emitter Saturation Voltage	−0.95	−1.14	−1.5	Volts	I_C = 100 mA	I_B = 10 mA
$V_{CEO\ (sus)}$	**Collector-Emitter Sustaining Voltage** [Notes 4 and 5]	**−12**			**Volts**	**I_C = 10 mA** (pulsed)	**I_B = 0**
BV_{CBO}	Collector-Base Breakdown Voltage	−12			Volts	I_C = 100 μA	I_E = 0
BV_{EBO}	Emitter-Base Breakdown Voltage	−4.5			Volts	I_E = 100 μA	I_C = 0
h_{FE}	DC Current Gain	12	44			I_C = 1.0 mA	V_{CE} = −0.5 V
h_{FE}	DC Pulse Current Gain [Note 5]	20	55			I_C = 10 mA	V_{CE} = −1.0 V
h_{FE}	DC Pulse Current Gain [Note 5]	30	63	100		I_C = 30 mA	V_{CE} = −0.5 V
h_{FE}	**DC Pulse Current Gain** [Note 5]	**20**	**55**			**I_C = 100 mA**	**V_{CE} = −1.0 V**

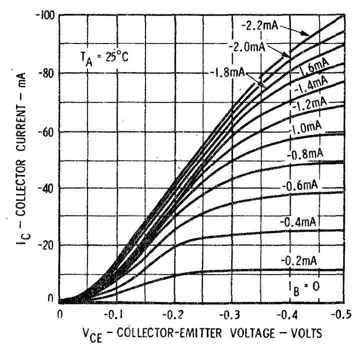
TYPICAL ELECTRICAL CHARACTERISTICS

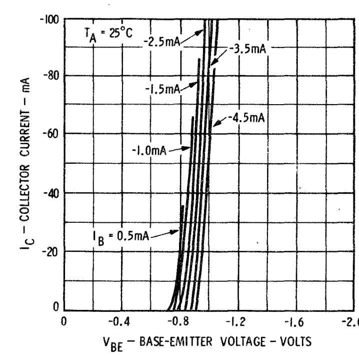
ACTIVE REGION*

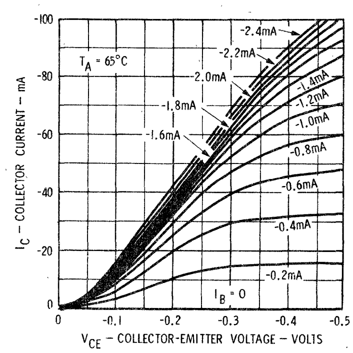


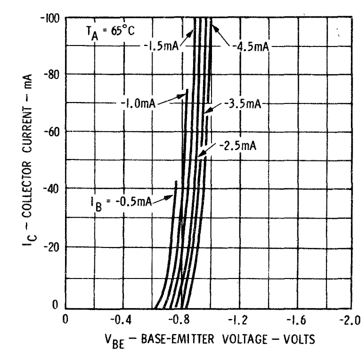


SATURATION REGION*



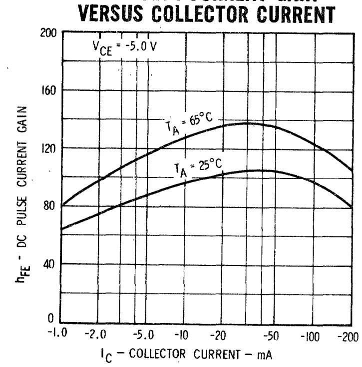




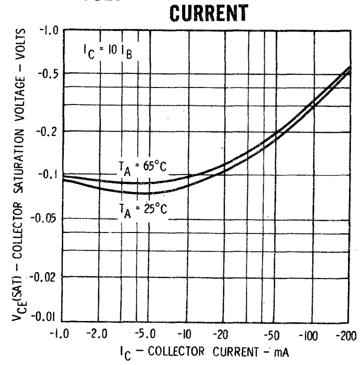


* Single family characteristic on Transistor Curve Tracer.

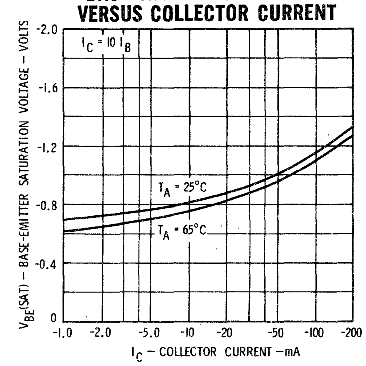
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT

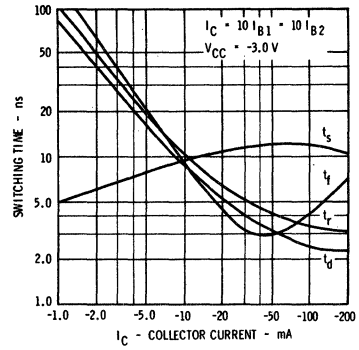


BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT

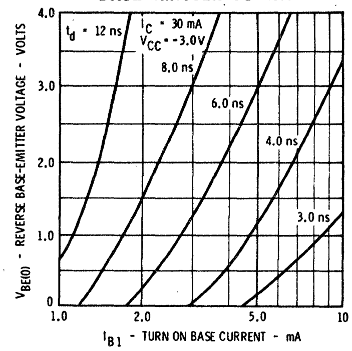


TYPICAL ELECTRICAL CHARACTERISTICS

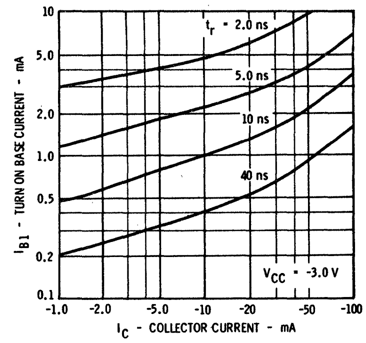
SWITCHING TIME VERSUS COLLECTOR CURRENT



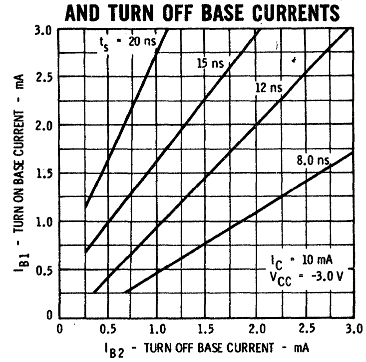
DELAY TIME VERSUS TURN ON BASE CURRENT AND REVERSE BASE EMITTER VOLTAGE



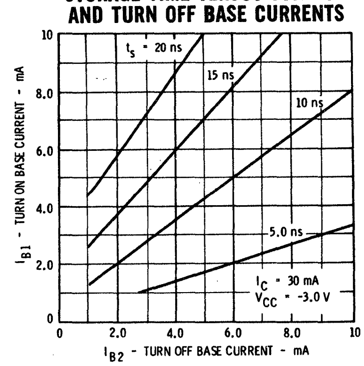
RISE TIME VERSUS COLLECTOR AND TURN ON BASE CURRENTS



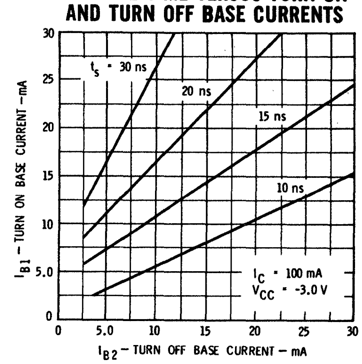
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



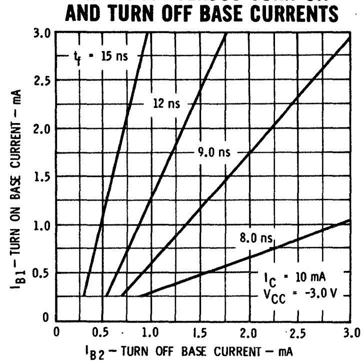
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



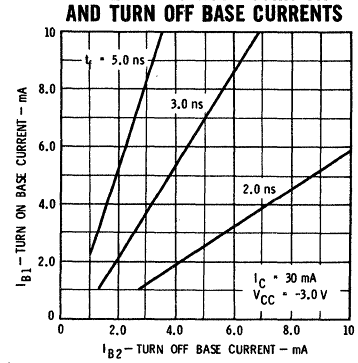
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



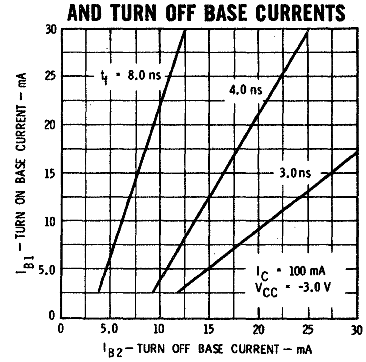
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



SWITCHING TIME VERSUS AMBIENT TEMPERATURE

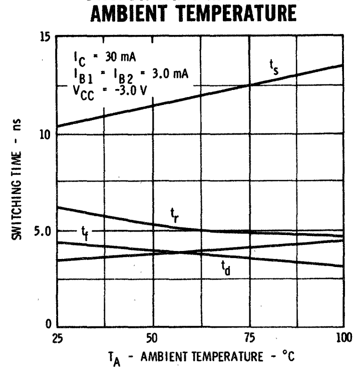


FIG. 1 CHARGE STORAGE TIME TEST CIRCUIT

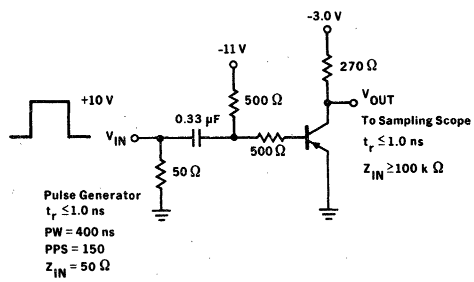
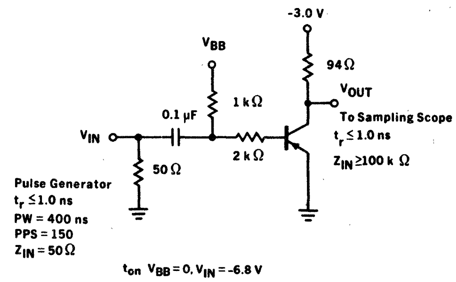


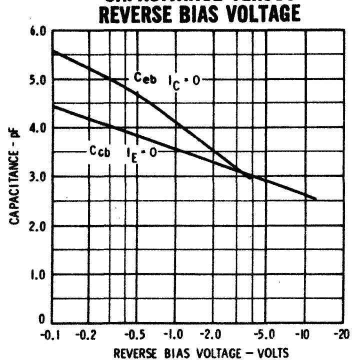
FIG. 2 SWITCHING TIME TEST CIRCUIT



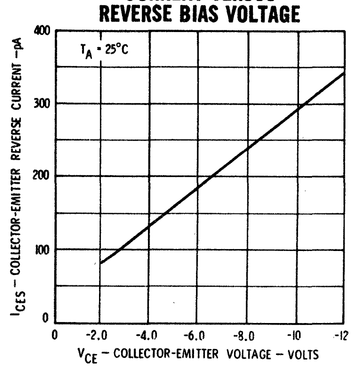
t_{on} $V_{BB} = 0$, $V_{IN} = -6.8$ V

t_{off} $V_{BB} = -9.8$ V, $V_{IN} = +11.65$ V

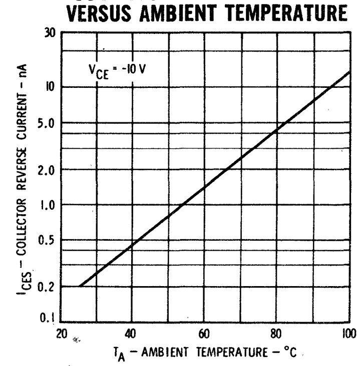
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



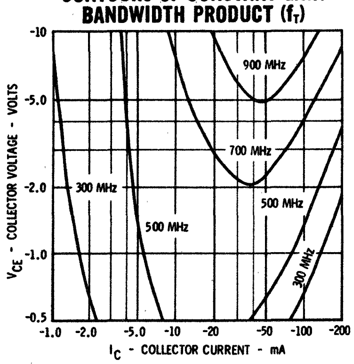
COLLECTOR-EMITTER REVERSE CURRENT VERSUS REVERSE BIAS VOLTAGE



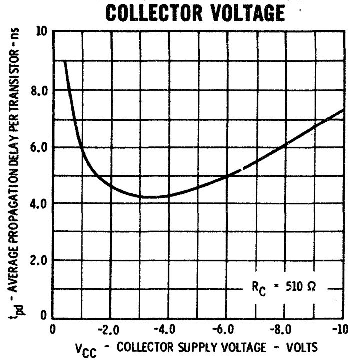
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



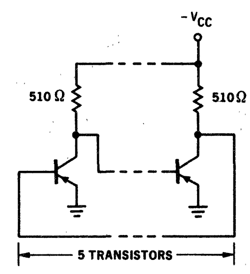
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



AVERAGE PROPAGATION DELAY PER TRANSISTOR VERSUS COLLECTOR VOLTAGE

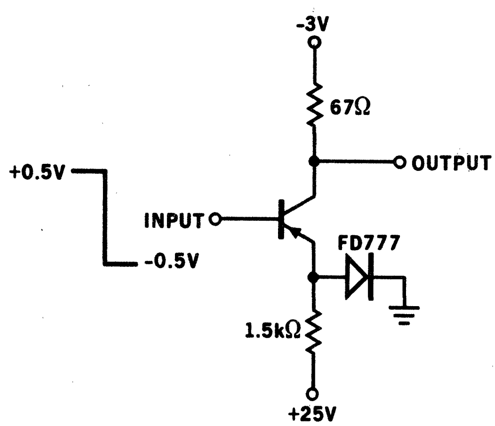


FIVE STAGE RING OSCILLATOR FOR MEASUREMENT OF PROPAGATION DELAY

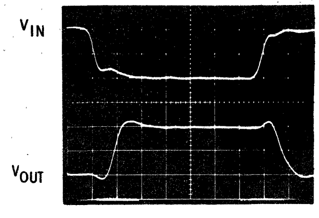


$tpd = \frac{1}{10\ fosc.}$

NON-SATURATED SWITCHING PERFORMANCE



t_{on} = 2 ns Typ.
t_{off} = 2 ns Typ.



2ns/DIV.

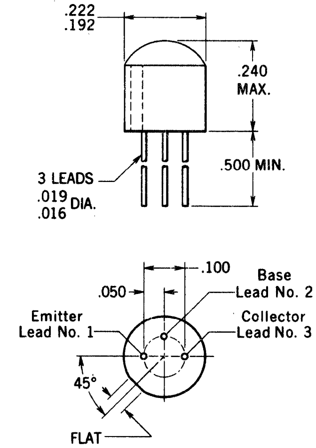
2N5126

NPN RF AMPLIFIER

DIFFUSED SILICON PLANAR* TRANSISTOR

- **LOW FEEDBACK CAPACITANCE . . . C_{cb} = 1.6 pF (MAX)**
- **HIGH POWER GAIN . . . . PG AT 100 MHz = 26 dB (TYP)**
- **BREAKDOWN VOLTAGE . . . . LV_{CEO} = 20 V (MIN)**
- **LOW NOISE FIGURE . . . . NF AT 100 MHz = 5.5 dB (TYP)**
- **FORWARD AGC CHARACTERISTIC**

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Notes 1 and 2)

Maximum Temperatures

Operating Junction Temperature	+125°C
Storage Temperature	−55°C to +125°C
Lead Temperature (Soldering, 10 second time limit)	+260°C

Maximum Power Dissipation (Note 2)

Total Dissipation at 25°C Case Temperature	0.5 Watt
at 25°C Ambient Temperature	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	20 Volts
V_{CEO}	Collector to Emitter Voltage (Note 3)	20 Volts
V_{EBO}	Emitter to Base Voltage	3.0 Volts

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
C_{cb}	**Collector-Base Capacitance**		**1.1**	**1.6**	**pF**	**$I_E = 0$**	**$V_{CB} = 10$ V**
NF	**Noise Figure** (Note 5)		**5.5**		**dB**	**$I_C = 4.0$ mA**	**$V_{CC} = 15$ V**
						f = 100 MHz	$R_S = 100\Omega$
h_{fe}	High Frequency Current Gain (f = 100 MHz)	3.0	6.0			$I_C = 4.0$ mA	$V_{CE} = 10$ V
A_V	**Voltage Gain (f = 455 kHz)** (Note 5)		**37**		**dB**	**$I_C = 4.0$ mA**	**$V_{CC} = 12$ V**
PG	**Power Gain (f = 10.7 MHz)** (Note 5)		**30**		**dB**	**$I_C = 4.0$ mA**	**$V_{CC} = 12$ V**
PG	**Power Gain (f = 100 MHz)** (Note 5)		**26**		**dB**	**$I_C = 4.0$ mA**	**$V_{CC} = 15$ V**
AGC	**Automatic Gain Control (f = 100 MHz)** (Note 5)		**9**		**mA**	**I_C for which PG_{AGC} = PG − 30 dB**	
V_{CE}(sat)	Collector Saturation Voltage			2.0	Volts	$I_C = 10$ mA	$I_B = 5.0$ mA
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 4)			0.98	Volt	$I_C = 10$ mA	$I_B = 5.0$ mA
h_{FE}	DC Pulse Current Gain (Note 4)	20	70	350		$I_C = 4.0$ mA	$V_{CE} = 10$ V
I_{CBO}	Collector Cutoff Current		1.0	50	nA	$I_E = 0$	$V_{CB} = 10$ V
I_{CBO}(65°C)	Collector Cutoff Current			5.0	μA	$I_E = 0$	$V_{CB} = 10$ V
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage** (Notes 3 and 4)	**20**			**Volts**	**$I_C = 3.0$ mA**	**$I_B = 0$**
BV_{CBO}	Collector to Base Breakdown Voltage	20			Volts	$I_C = 100$ μA	$I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0			Volts	$I_C = 0$	$I_E = 100$ μA
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	15		400		$I_C = 4.0$ mA	$V_{CE} = 10$ V
V_{BE}(on)	Base to Emitter On Voltage (Note 5)			0.98	Volts	$I_C = 10$ mA	$V_{CE} = 10$ V

*Planar is a patented Fairchild process.

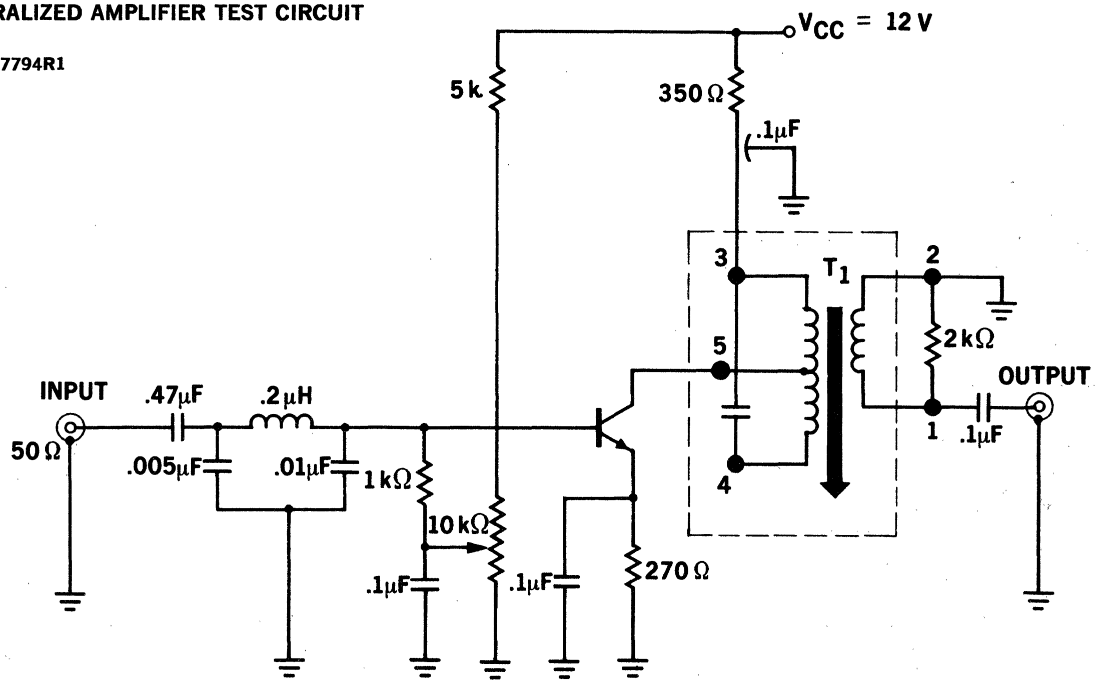
NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high-current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(4) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(5) See Test Circuit.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

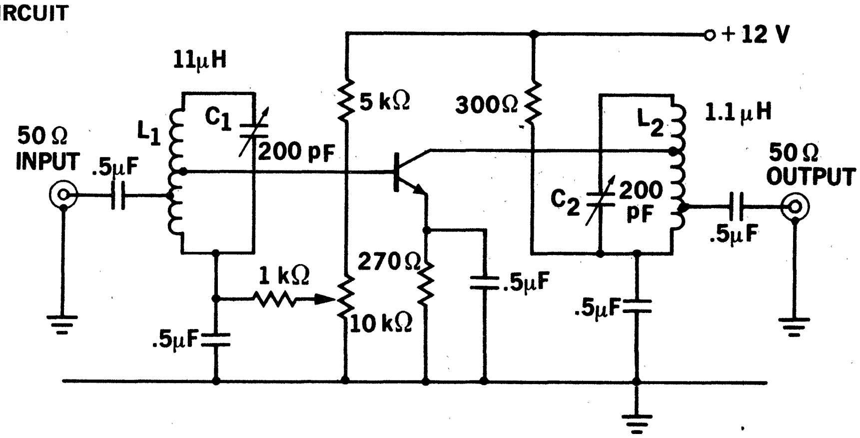
455 kHz UNNEUTRALIZED AMPLIFIER TEST CIRCUIT

T_1 = T.R.W. #17794R1



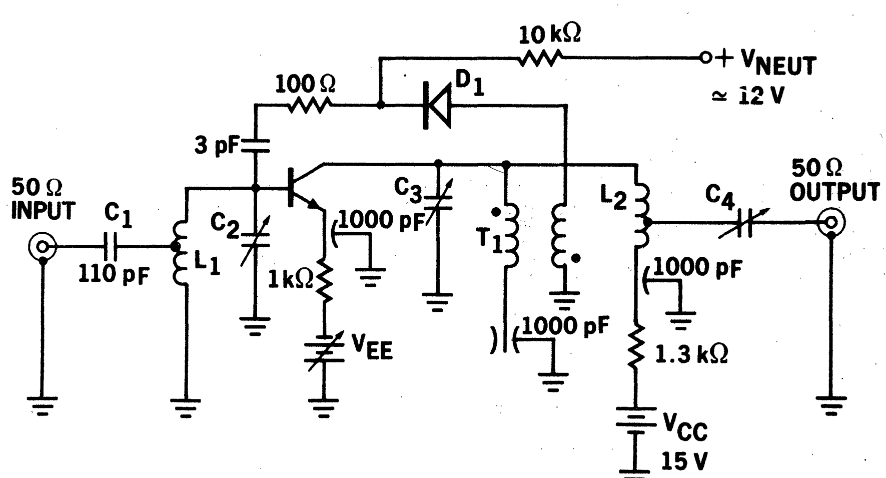
10.7 MHz UNNEUTRALIZED AMPLIFIER TEST CIRCUIT

C_1 and C_2 ARCO #465
L_1 = 11 μH (0.9 inch of #632 AIRDUX COIL)
Input Tap at 2.9T from cold side
Output Tap at 3.66T from cold side
L_2 = 1.1 μH (1.5 inches of #608 AIRDUX COIL)
Input Tap at 2.3T from cold side
Output Tap at 0.5T from cold side
All resistors are ½ watt.
Typical gain at I_C = 4 mA is 34 dB.



100 MHz AGC AND NF TEST CIRCUIT

L_1 = #14 Buss Wire — 3T — ⅜" I.D. — 5/12" long
Tap at 1½T from cold end
L_2 = #18 enameled — 5T — ⅜" I.D. — 5/16" long
Tap at 1½T from cold end
T_1 = #36 Bifilar — 1T in balum core Q_3
C_2 = 1 to 35 pF Johanson #803 (or equivalent)
C_3, C_4 = 1 to 35 pF Johanson #803 (or equivalent)
D_1 – FD 300



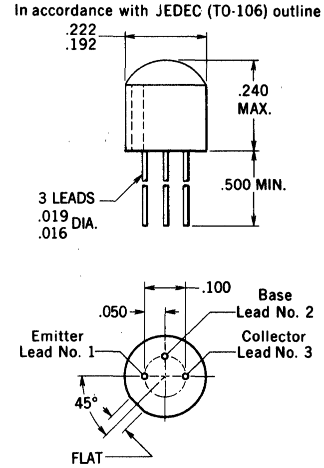
2N5127

NPN RF AMPLIFIER

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTOR

- **HIGH FREQUENCY - - f_T = 750 MHz (TYP) AT 15 mA**
- **LOW CAPACITY - - C_{cb} = 3.5 pF (MAX), 2.5 pF (TYP) AT 10 V**
- **LOW NOISE - - NF = 3.7 dB (TYP) AT 1.0 MHz**

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 second time limit)	+260°C Maximum

Maximum Power Dissipation (Note 2)

Total Dissipation at 25°C Case Temperature	0.5 Watt
at 25°C Ambient Temperature	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	20 Volts
V_{CEO}	Collector to Emitter Voltage (Note 3)	12 Volts
V_{EBO}	Emitter to Base Voltage	3.0 Volts

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
BV_{CBO}	Collector to Base Breakdown Voltage	20			Volts	$I_C = 100\ \mu A$	$I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0			Volts	$I_E = 100\ \mu A$	$I_C = 0$
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 3 and 4)	12			Volts	$I_C = 10$ mA	$I_B = 0$
V_{CE}(sat)	Collector Saturation Voltage			0.3	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{BE}(sat)	Base Saturation Voltage			1.0	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
I_{CBO}	Collector Cutoff Current			50	nA	$V_{CB} = 10$ V	$I_E = 0$
I_{CBO} (65°C)	Collector Cutoff Current			5.0	μA	$V_{CB} = 10$ V	$I_E = 0$
h_{FE}	DC Pulse Current Gain (Note 4)	15	35	300		$I_C = 2.0$ mA	$V_{CE} = 10$ V
h_{FE}	DC Pulse Current Gain (Note 4)		70			$I_C = 15$ mA	$V_{CE} = 10$ V
h_{fe}	Low Frequency Current Gain (f = 1 kHz)	12	80	400		$I_C = 2.0$ mA	$V_{CE} = 10$ V
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**1.5**	3.0			**$I_C = 2.0$ mA**	$V_{CE} = 10$ V
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**		**7.5**			**$I_C = 15$ mA**	$V_{CE} = 10$ V
r_b'	Real Part of h_{ie} (f = 350 MHz)		30		Ω	$I_C = 15$ mA	$V_{CE} = 10$ V
C_{cb}	**Collector-Base Capacitance**		**2.5**	**3.5**	**pF**	**$V_{CB} = 10$ V**	$I_E = 0$
NF	**Noise Figure (f = 1.0 MHz)**		**3.7**		**dB**	**$I_C = 2.0$ mA, $R_S = 50\Omega$**	**$V_{CE} = 10$ V**
V_{BE}(on)	Base to Emitter On Voltage (Note 4)			1.0	Volts	$I_C = 10$ mA	$V_{CE} = 10$ 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 ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(4) Pulse Conditions: length = 300 μs; duty cycle = 1%.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

2N5128 • 2N5129

NPN CLASS-C RF AMPLIFIERS AND HIGH CURRENT SWITCHES

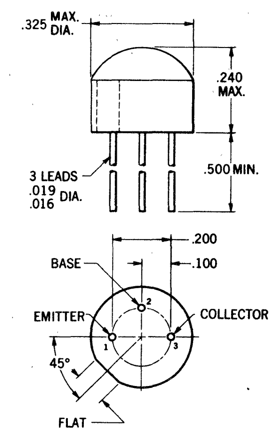
DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **HIGH GAIN - - 400 mW RF POWER OUT AT 30 MHz (TYP)**
- **BETA - - 35 (MIN) AT 50 mA, 20 (MIN) AT 10 mA**
- **HIGH f_T - - 200 MHz (MIN) AT 50 mA**
- **FAST SWITCHING - - 14 ns (TYP) t_{on} AND 80 ns (TYP) t_{off} AT 300 mA**
- **LOW V_{CE}(sat) - - 0.25 V (MAX) AT 150 mA, 0.35 V (TYP) AT 500 mA**

ABSOLUTE MAXIMUM RATINGS (Note 1)

		2N5128	2N5129
Maximum Temperature			
Storage Temperature		−55°C to +125°C	
Operating Junction Temperature			+125°C
Lead Temperature (Soldering, 10 second time limit)			+260°C
Maximum Power Dissipation (Notes 2 and 3)		**2N5128**	**2N5129**
Total Dissipation at 25°C Case Temperature		0.7 Watt	0.5 Watt
at 25°C Ambient Temperature		0.3 Watt	0.2 Watt
Maximum Voltages and Current		**2N5128**	**2N5129**
V_{CBO}	Collector to Base Voltage	15 Volts	15 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	12 Volts	12 Volts
V_{EBO}	Emitter to Base Voltage	3.0 Volts	3.0 Volts

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

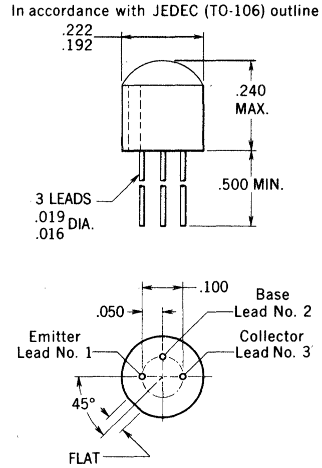
2N5128

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
G_{PE}	**Amplifier Power Gain (f = 30 MHz)** (Note 7)		**12**		**dB**	**I_C = 0 (zero signal)**	**V_{CE} = 15 V**
η	Collector Efficiency (f = 30 MHz) (Note 7)		75		%	I_C = 0 (zero signal)	V_{CE} = 15 V
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**2.0**		**8.0**		**I_C = 50 mA**	**V_{CE} = 5.0 V**
h_{FE}	DC Pulse Current Gain (Note 5)	20	85			I_C = 10 mA	V_{CE} = 10 V
h_{FE}	**DC Pulse Current Gain** (Note 5)	**35**	**75**	**350**		**I_C = 50 mA**	V_{CE} = 10 V
h_{FE}	DC Pulse Current Gain (Note 5)		62			I_C = 500 mA	V_{CE} = 10 V
t_{on}	**Turn On Time** (Note 6)		**14**		**ns**	**$I_C \approx$ 300 mA**	**$I_{B1} \approx$ 30 mA**
t_{off}	**Turn Off Time** (Note 6)		**80**		**ns**	**$I_C \approx$ 300 mA, $I_{B2} \approx$ 30 mA**	**$I_{B1} \approx$ 30 mA**

Additional Electrical Characteristics on page 2

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

2N5129

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 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C) for 2N5129 and junction to case thermal resistance of 143°C/Watt (derating factor of 7.0 mW/°C) and a junction to ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C) for 2N5128.
(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) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.
(7) P_{IN} = 40 mW. See Test Circuit.

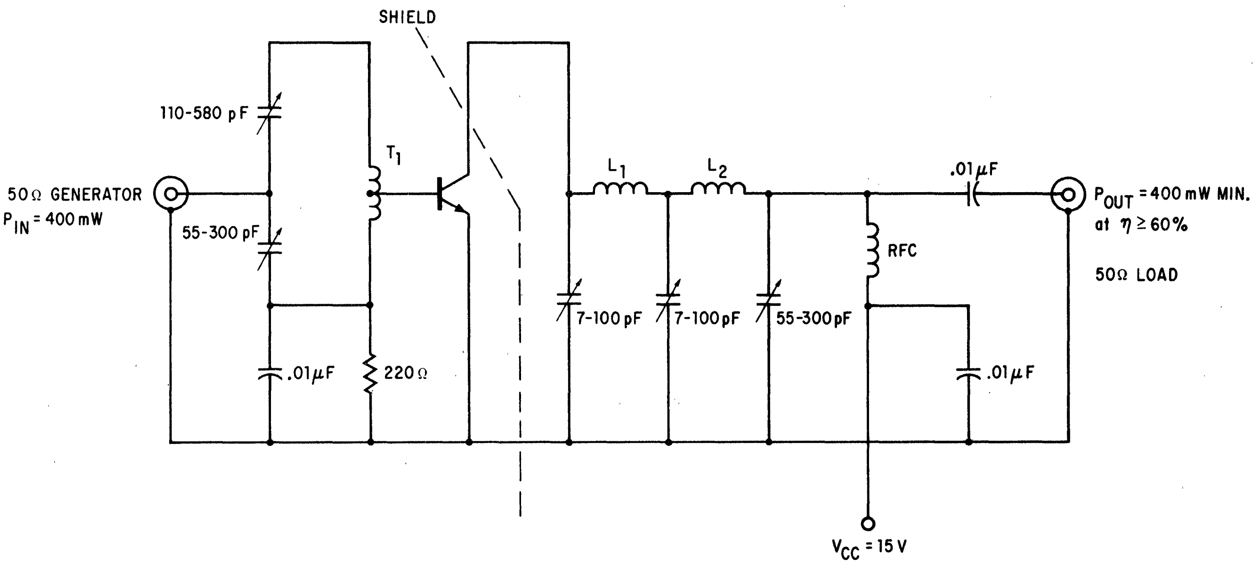
*Planar is a patented Fairchild process.

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	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
BV_{CES}	Collector to Emitter Breakdown Voltage	15			Volts	$I_C = 10\ \mu A$	$I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	15			Volts	$I_C = 10\ \mu A$	$I_E = 0$
$V_{CEO}(sust)$	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	12			Volts	$I_C = 10$ mA (pulsed)	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0			Volts	$I_C = 0$	$I_E = 10\ \mu A$
C_{cb}	Collector-Base Capacitance (f = 1.0 MHz)			10	pF	$I_E = 0$	$V_{CB} = 10$ V
$V_{CE}(sat)$	**Pulsed Collector Saturation Voltage** (Note 5)		**0.13**	**0.25**	**Volts**	**$I_C = 150$ mA**	**$I_B = 15$ mA**
$V_{CE}(sat)$	**Pulsed Collector Saturation Voltage** (Note 5)		**0.35**		**Volts**	**$I_C = 500$ mA**	**$I_B = 50$ mA**
$V_{BE}(sat)$	Pulsed Emitter Saturation Voltage (Note 5)			1.10	Volts	$I_C = 150$ mA	$I_B = 15$ mA
I_{CBO}	Collector Cutoff Current			0.05	μA	$V_{CE} = 10$ V	$V_{EB} = 0$
$I_{CBO}(65°C)$	Collector Cutoff Current			1.0	μA	$V_{CE} = 10$ V	$V_{EB} = 0$
$V_{BE}(on)$	Base to Emitter On Voltage (Note 5)			1.1	Volts	$I_C = 150$ mA	$V_{CE} = 5.0$ V

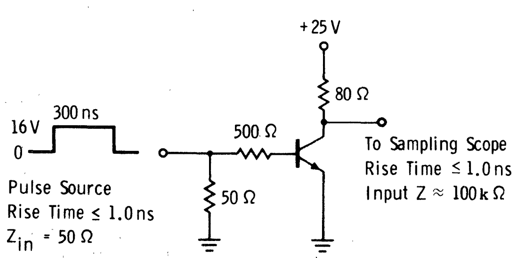
30 MHz AMPLIFIER TEST CIRCUIT



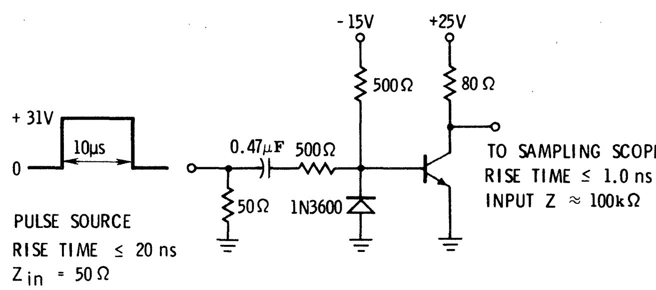
T_1 - 4 Turns No. 20 Wire, ¾" Dia. x ¼" Long, Midtapped.
L_1 and L_2 - 4 Turns No. 20 Wire, ½" Dia. x ¼" Long.

Variable Capacitors are Compression Mica.
R_G = 140 Ω, R_L = 260 Ω as seen by transistor.

TURN-ON TEST CIRCUIT



TURN-OFF TEST CIRCUIT



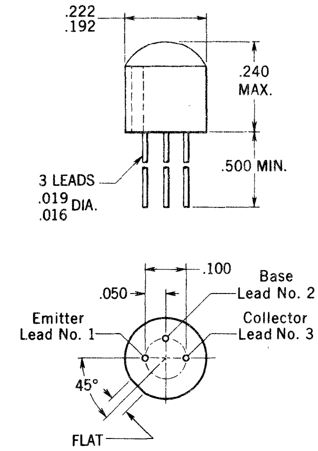
2N5130

NPN LOW LEVEL RF AMPLIFIER

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTOR

- **HIGH GAIN . . . . G_{pe} = 15 dB (TYP) AT 200 MHz**
- **HIGH POWER OUTPUT . . . P_o = 40 mW (TYP) AT 500 MHz**
  P_o = 7.0 mW (TYP) AT 930 MHz
- **LOW NOISE . . . . NF = 4.0 dB (TYP) AT 60 MHz**
- **BREAKDOWN VOLTAGE . . . LV_{CEO} = 12 V (MIN)**

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package
is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature		−55°C to +125°C
Operating Junction Temperature		+125°C Maximum
Soldering Temperature (10 second time limit)		+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature	(Note 2)	0.5 Watt
at 65°C Case Temperature	(Note 2)	0.3 Watt
at 25°C Ambient Temperature	(Note 2)	0.2 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage		30 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 3)	12 Volts
V_{EBO}	Emitter to Base Voltage		1.0 Volts

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain (Note 4)	15	50	250		I_C = 8.0 mA	V_{CE} = 10 V
V_{CE}(sat)	Collector Saturation Voltage		0.1	0.6	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{BE}(sat)	Base Saturation Voltage			1.0	Volts	I_C = 10 mA	I_B = 1.0 mA
C_{cb}	Collector-Base Capacitance		1.3	1.7	pF	I_E = 0	V_{CB} = 10 V
C_{cb}	Collector-Base Capacitance		2.7		pF	I_E = 0	V_{CB} = 0 V
I_{CBO}	Collector Cutoff Current			50	nA	I_E = 0	V_{CB} = 10 V
I_{CBO}(65°C)	Collector Cutoff Current			5.0	μA	I_E = 0	V_{CB} = 10 V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	4.5	9.0			I_C = 8.0 mA	V_{CE} = 10 V
G_{pe}	Available Power Gain (neutralized) (Note 5) (f = 200 MHz)		17		dB	I_C = 8.0 mA	V_{CE} = 10 V
NF	Noise Figure (f = 60 MHz)		4.0		dB	I_C = 1.0 mA R_S = 400 Ω	V_{CE} = 6.0 V
$r_b'C_c$	Collector-Base Time Constant (f = 79.8 MHz)		15		ps	I_C = 8.0 mA	V_{CB} = 10 V
V_{BE}(on)	Base to Emitter On Voltage			1.0	Volts	I_C = 10 mA	V_{CE} = 10 V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	12		300		I_C = 8.0 mA	V_{CE} = 10 V
BV_{CBO}	Collector to Base Breakdown Voltage	30			Volts	I_E = 0	I_C = 100 μA
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 3 and 4)	12			Volts	I_C = 3.0 mA (pulsed)	I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	1.0			Volts	I_C = 0	I_E = 10 μA
P_o	Power Output (f = 500 MHz)		40		mW	I_C = 10 mA	V_{CB} = 10 V
P_o	Power Output (f = 930 MHz)		7.0		mW	I_C = 10 mA	V_{CB} = 10 V

Notes on page 2

*Planar is a patented Fairchild process.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

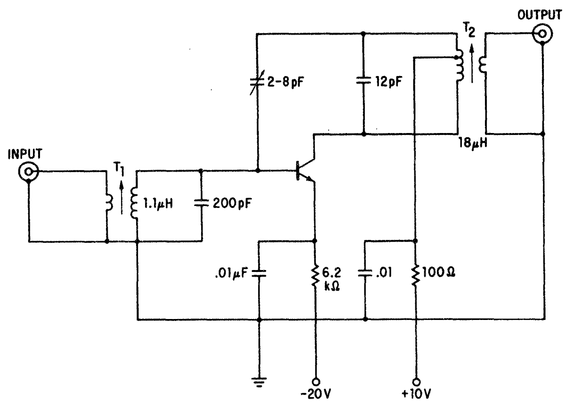
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

FAIRCHILD TRANSISTOR 2N5130

NEUTRALIZED 10.7 MHz I.F. TEST CIRCUIT

$I_C = 3.0$ mA $V_{CE} = 10$ V

Typical Gain = 37 dB



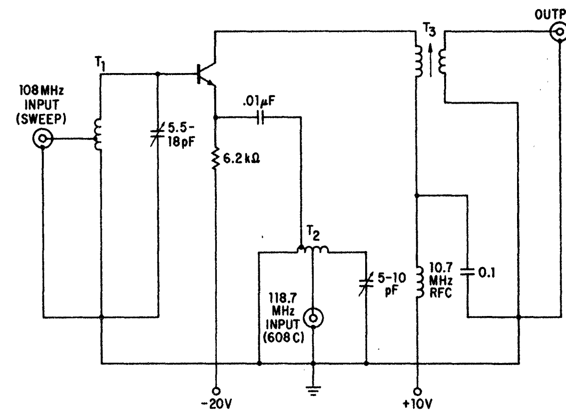
T_1 = 2.6 T Primary #26 Nyclad
10 T Secondary #26 Nyclad

T_2 = 38 T Primary #36 Nyclad tapped at 25 T for Neut.
2.5 Secondary #26 Nyclad

10.8 MHz TO 10.7 MHz CONVERSION GAIN TEST CIRCUIT

$I_C = 3.0$ mA $V_{CE} = 10$ V

Typical Gain = 25 dB



T_1 = 3 T #16 tinned copper wire, tapped at 1 T

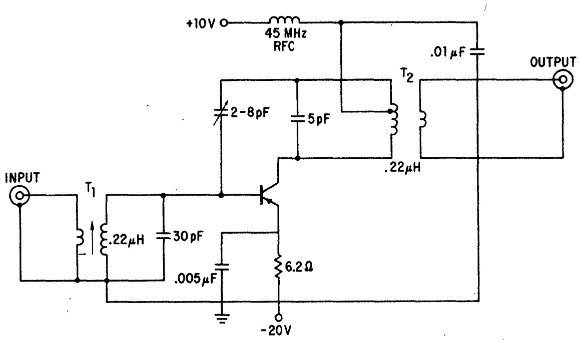
T_2 = 2.5 T #16 tinned copper wire, tapped at 0.5 and 1 T

T_3 = 10 T #26 Nyclad Primary
1 T #26 Nyclad Secondary

NEUTRALIZED 45 MHz I.F. TEST CIRCUIT

$I_C = 3.0$ mA $V_{CE} = 10$ V

Typical Gain = 28 dB



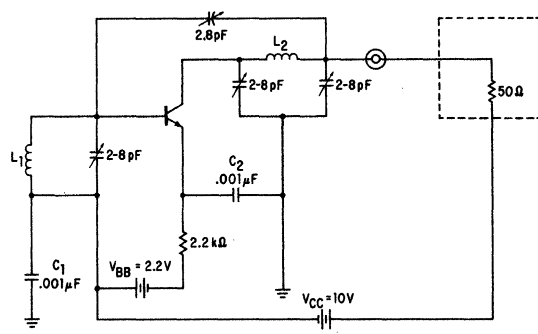
T_1 = 1.2 T Primary #26 Nyclad
4.5 T Secondary #26 Nyclad } Miller #30-106 Core

T_2 = 11 T Primary #26 Nyclad tapped at 4 T for Neut.
1 T Secondary

930 MHz OSCILLATOR TEST CIRCUIT

$V_{CC} = 10$ V

Typical Power Out = 7.0 mW



C_1 and C_2 are feed-through capacitors.

L_1 and L_2 are silver tubing with mutual coupling.

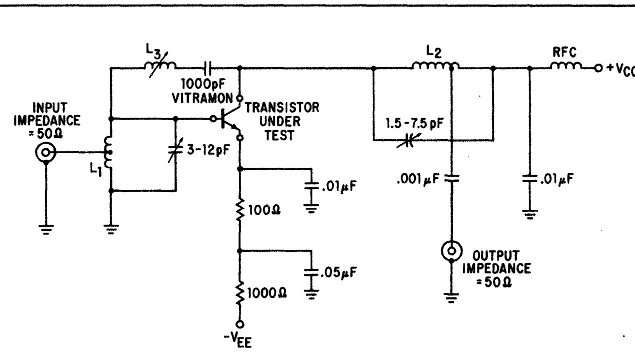
This circuit is meant to be used with an attenuator and a filter. The collector supply is fed in through the attenuator.

NEUTRALIZED 200 MHz POWER GAIN AMPLIFIER TEST CIRCUIT

L_1 — 3.5 Turns No. 16 wire; 5/16 Dia; 7/16 Long. Turns Ratio 4 to 2

L_2 — 8.0 Turns No. 16 wire; 1/8 Dia; 7/8 Long. Turns Ratio 8 to 1

L_3 — 0.4-0.65 μh (adjustable core)



NOTES:

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

(2) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW°/C).

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

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

(5) Forward gain (dB) + reverse gain (dB) < (−20 dB). See test circuit.

2N5131

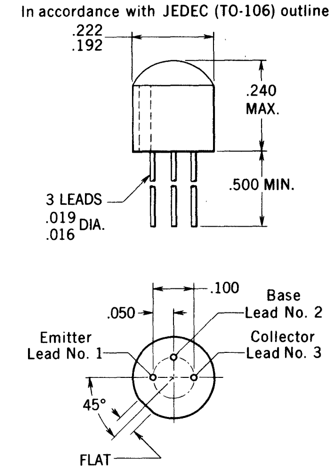
NPN GENERAL PURPOSE AMPLIFIER

DIFFUSED SILICON PLANAR* TRANSISTORS

- **GAIN - - h_{FE} = 30-500 AT 10 mA**
- **BREAKDOWN VOLTAGE - - LV_{CEO} = 15 V (MIN)**
- **FREQUENCY RESPONSE - - f_T = 100 MHz (MIN) AT 10 mA**

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	125°C Maximum
Soldering Temperature (10 second time limit)	260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Note 2)	0.5 Watt
at 25°C Ambient Temperature (Note 2)	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	20 Volts
V_{CEO}	Collector to Emitter Voltage (Note 3)	15 Volts
V_{EBO}	Emitter to Base Voltage	3.0 Volts

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

SYMBOL	CHARACTERISTICS	MIN.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Pulse Current Gain** (Note 4)	**30**	**500**		**I_C = 10 mA**	**V_{CE} = 1.0 V**
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**1.0**			**I_C = 10 mA**	**V_{CE} = 15 V**
V_{CE}(sat)	Collector Saturation Voltage		1.0	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{BE}(sat)	Base Saturation Voltage		1.0	Volts	I_C = 10 mA	I_B = 1.0 mA
I_{CBO}	Collector Cutoff Current		50	nA	I_E = 0	V_{CB} = 10 V
I_{CBO}(65°C)	Collector Cutoff Current		5.0	μA	I_E = 0	V_{CB} = 10 V
C_{cb}	Collector-Base Capacitance (f = 1.0MHz)		6.0	pF	I_E = 0	V_{CB} = 10 V
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage** (Notes 3 and 4)	**15**		**Volts**	**I_C = 3.0 mA**	**I_B = 0**
BV_{CBO}	Collector to Base Breakdown Voltage	20		Volts	I_C = 100 μA	I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0		Volts	I_C = 0	I_E = 10 μA
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	25	600		I_C = 10 mA	V_{CE} = 10 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 ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high-current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(4) Pulse Conditions: length = 300 μs; duty cycle = 1%.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

2N5132

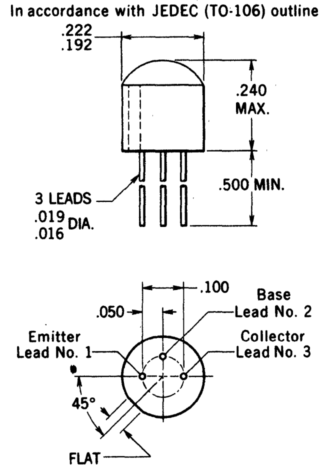
NPN AM/FM AMPLIFIER

DIFFUSED SILICON PLANAR* TRANSISTOR

- **HIGH GAIN - - A_{pg} = 32 dB (TYP) @ 10.7 MHz**
  A_{pg} = 55 dB (TYP) @ 455 kHz
- **HIGH CONVERSION GAIN - - G_C = 20 dB (TYP) 108 MHz to 10.7 MHz**
- **LOW NOISE - - NF = 4.0 dB (TYP) @ 1.0 MHz**
- **LOW CAPACITANCE - - C_{cb} = 3.5 pF (MAX) @ 10 V**

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures		
Operating Junction Temperature		125°C Maximum
Storage Temperature		−55°C to +125°C
Lead Temperature (Soldering, 10 second time limit)		260°C Maximum
Maximum Power Dissipation		
Total Dissipation at 25°C Case Temperature (Note 2)		0.5 Watt
at 25°C Ambient Temperature (Note 2)		0.2 Watt
Maximum Voltages and Current		
V_{CBO}	Collector to Base Voltage	20 Volts
V_{CEO}	Collector to Emitter Voltage (Note 3)	20 Volts
V_{EBO}	Emitter to Base Voltage	3.0 Volts

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain (Note 4)	30		400		$I_C = 10$ mA	$V_{CE} = 10$ V
I_{CBO}	Collector Cutoff Current			50	nA	$I_E = 0$	$V_{CB} = 10$ V
I_{CBO}(65°C)	Collector Cutoff Current			5.0	μA	$I_E = 0$	$V_{CB} = 10$ V
C_{cb}	**Collector-Base Capacitance**			**3.5**	**pF**	**$I_E = 0$**	**$V_{CB} = 10$ V**
NF	**Spot Noise Figure** (Note 5)		**4.0**		**dB**	**$I_C = 3.0$ mA**	**$V_{CE} = 10$ V**
						f = 1.0 MHz	**$R_S = 300\ \Omega$**
A_{pg}	**Available Power Gain** (neutralized) **(f = 10.7 MHz)**		**32**		**dB**	**$I_C = 7.0$ mA**	**$V_{CE} = 10$ V**
A_{pg}	**Available Power Gain** (neutralized) **(f = 455 kHz)**		**55**		**dB**	**$I_C = 3.0$ mA**	**$V_{CE} = 10$ V**
G_C	**Conversion Gain (f = 108 MHz to 10.7 MHz)**		**20**		**dB**	**$I_C = 7.0$ mA**	**$V_{CE} = 10$ V**
$r_b'C_c$	Collector-Base Time Constant (f = 80 MHz)		30		ps	$I_C = 10$ mA	$V_{CE} = 15$ V
BV_{CBO}	Collector to Base Breakdown Voltage	20			Volts	$I_C = .01$ mA	$I_E = 0$
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Note 3)	20			Volts	$I_C = 10$ mA (pulsed)	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0			Volts	$I_E = .01$ mA	$I_C = 0$
h_{fe}	High Frequency Current Gain (f = 100 MHz)	2.0	3.5			$I_C = 10$ mA	$V_{CE} = 15$ V
h_{fe}	Low Frequency Current Gain (f = 1.0 kHz)	20		650		$I_C = 10$ mA	$V_{CE} = 10$ V
V_{BE}(sat)	Base Saturation Voltage (Note 5)			0.90	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{CE}(sat)	Collector Saturation Voltage (Note 5)			2.0	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{BE}(on)	Base to Emitter On Voltage (Note 5)			0.90	Volts	$I_C = 10$ mA	$V_{CE} = 10$ 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 ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°/Watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high-current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(4) Pulse Conditions: length = 300 μs; duty cycle = 1%.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

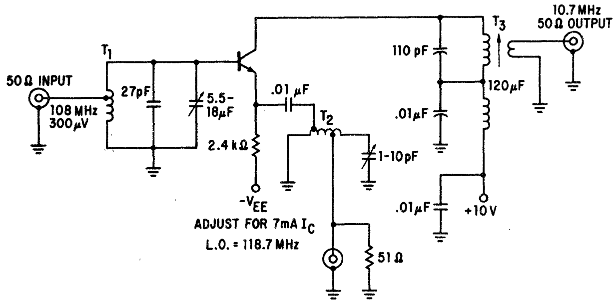
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

FAIRCHILD TRANSISTOR 2N5132

108MHz TO 10.7MHz CONVERSION GAIN TEST CIRCUIT

$I_C = 7.0$ mA $V_{CE} = 10V$

TYPICAL CONVERSION GAIN = 20 dB



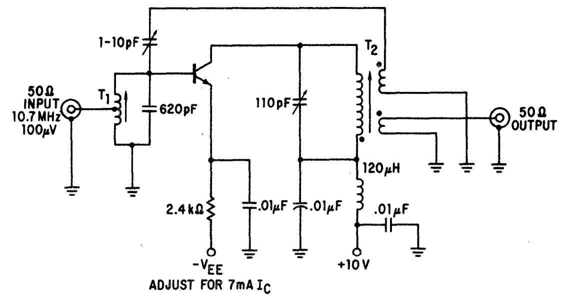
T1 2.5 TURNS No.16 TINNED COPPER WIRE TAPPED 2 TURNS FROM GND. COIL DIA. 3/8" (INSIDE DIA.).
T2 4 TURNS No.16 TINNED COPPER WIRE TAPPED 3/4 TURN FROM GND. AND 1 1/4 TURNS FROM GND. COIL DIA. 1/4" (INSIDE DIA.).

T3 MILLER COIL FORM
MILLER CORE No. 30-106
PRIMARY...10 TURNS No. 36 ENAMELED WIRE.
SECONDARY...1 1/3 TURNS No. 28 ENAMELED WIRE.

10.7MHz NEUTRALIZED POWER GAIN TEST CIRCUIT

$I_C = 7.0$ mA $V_{CE} = 10V$

TYPICAL GAIN = 32 dB



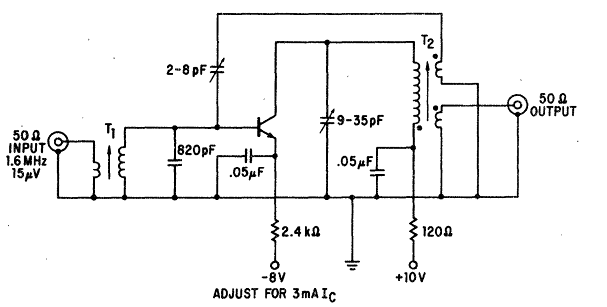
T1 MILLER COIL FORM
MILLER CORE No.30-106
4 TURNS No.28 ENAMELED WIRE TAPPED 1.5 TURNS FROM GND.

T2 MILLER COIL FORM
MILLER CORE No. 30-106
PRIMARY...10 TURNS No. 36 ENAMELED WIRE.
NEUT. SEC....5 TURNS No.36 ENAMELED WIRE (BIFILAR).
OUTPUT SEC....1.33 TURNS No.28 ENAMELED WIRE (OVERWIND).

NEUTRALIZED A.M. R.F. AMPLIFIER TEST CIRCUIT

$I_C = 3.0$ mA $V_{CE} = 10V$

TYPICAL GAIN = 46 dB



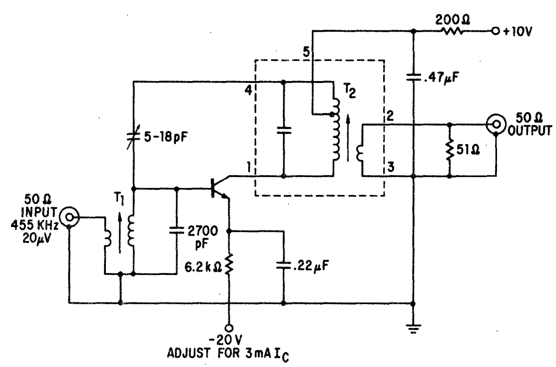
T1 28 T No. 36 NYCLAD SECONDARY
6 T No. 28 NYCLAD PRIMARY
MILLER No. 80-106 CORE

T2 120 T No. 40 S.S. ENL. PRIMARY
40 T No. 40 S.S. ENL. NEUT. SEC.
7 T No.28 NYCLAD OUTPUT SEC., WAVE WOUND BIFILAR WITH COLD END OF PRIMARY.

455kHz NEUTRALIZED A.M. I.F. AMPLIFIER TEST CIRCUIT

$I_C = 3.0$ mA $V_{CE} = 10V$

TYPICAL GAIN = 55 dB



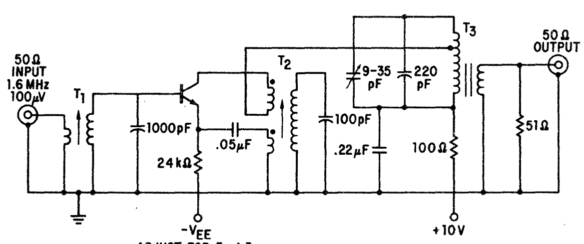
T1 13 T PRIMARY No. 26 NYCLAD
54 T SECONDARY No. 36 NYCLAD
.043 mh
MILLER No.30-106 CORE

T2 MILLER MIN. I.F. TRANSFORMER No. 2032.

1.6MHz TO 455kHz AUTODYNE CONVERSION GAIN TEST CIRCUIT

$I_C = 2.0\text{-}3.0$ mA $V_{CE} = 10V$

TYPICAL GAIN = 42 dB



T1 MILLER COIL FORM
MILLER SLUG No.30-106 CORE
PRIMARY...6 T No. 28 ENAMELED WIRE
SECONDARY...28 T No. 36 ENAMELED WIRE

T2 MILLER COIL FORM
MILLER CORE No.30-106
4 TURNS No.28 ENAMELED WIRE
1 1/2 TURNS No.28 ENAMELED WIRE
60 TURNS No.36 ENAMELED WIRE

T3 MILLER No. 2032 455 kHz TRANSFORMER
CENTER CORE ONLY

2N5133

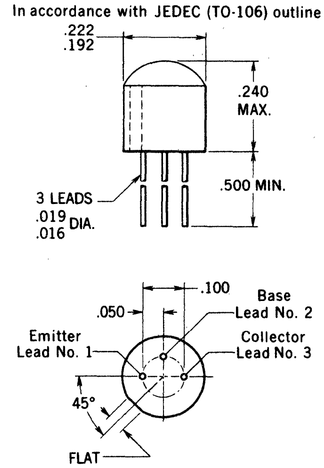
NPN HIGH-GAIN, LOW-NOISE AMPLIFIER

DIFFUSED SILICON PLANAR* TRANSISTOR

- **LOW NOISE - - NF = 1.5 dB (TYP) @ 1.0 kHz**
- **HIGH GAIN - - h_{FE} = 60 (MIN), 220 (TYP) @ 1.0 mA**
  h_{FE} = 50 (TYP) @ 50 μA
- **BREAKDOWN VOLTAGE - - LV_{CEO} = 18 VOLTS (MIN)**

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Operating Junction Temperature	125°C Maximum
Storage Temperature	−55°C to +125°C
Lead Temperature (Soldering, 10 second time limit)	260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Note 2)	0.5 Watt
at 25°C Ambient Temperature (Note 2)	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	20 Volts
V_{CEO}	Collector to Emitter Voltage (Note 3)	18 Volts
V_{EBO}	Emitter to Base Voltage	3.0 Volts

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Current Gain**	**60**	**220**	**1000**		**I_C = 1.0 mA**	V_{CE} = 5.0 V
h_{FE}	**DC Current Gain**		**50**			**I_C = 50 μA**	V_{CE} = 10 V
h_{fe}	High Frequency Current Gain (f = 20 MHz)		1.3			I_C = 50 μA	V_{CE} = 5.0 V
h_{fe}	High Frequency Current Gain (f = 20 MHz)	2.0		20		I_C = 1.0 mA	V_{CE} = 5.0 V
NF	**Narrow Band Noise Figure (f = 1.0 kHz)**		1.5		dB	**I_C = 30 μA**	**V_{CE} = 5.0 V**
						PWR BW = 200 Hz	**R_S = 10 kΩ**
V_{CE}(sat)	Collector Saturation Voltage			0.4	Volts	I_C = 1.0 mA	I_B = 0.1 mA
I_{CBO}	Collector Cutoff Current			50	nA	I_E = 0	V_{CB} = 15 V
I_{CBO}(65°C)	Collector Cutoff Current			5.0	μA	I_E = 0	V_{CB} = 15 V
C_{cb}	Collector-Base Capacitance			5.0	pF	I_E = 0	V_{CB} = 5.0 V
BV_{CBO}	Collector to Base Breakdown Voltage	20			Volts	I_C = 100 μA	I_E = 0
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage** (Notes 3 and 4)	**18**			**Volts**	**I_C = 3.0 mA**	I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0			Volts	I_E = 10 μA	I_C = 0
V_{BE}(on)	Base to Emitter On Voltage			0.75	Volts	I_C = 100 μA	V_{CE} = 5.0 V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	50		1100		I_C = 1.0 mA	V_{CE} = 5.0 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 ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).
(3) Rating refers to a high-current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(4) Pulse Conditions: length = 300 μs; duty cycle = 1%.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

2N5134

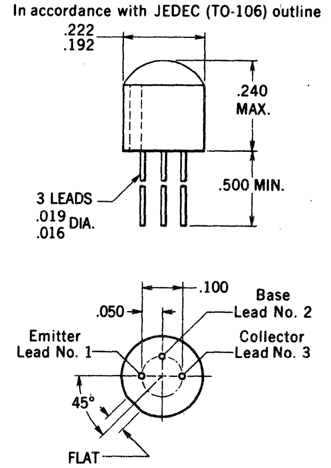
NPN HIGH-SPEED SATURATED SWITCH

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTOR

- **HIGH FREQUENCY CURRENT GAIN . . . $f_T = 400$ MHz (MIN)**
- **LOW CAPACITANCE . . . . $C_{cb} = 4$ pF (MAX)**
- **LOW CHARGE STORAGE TIME . . . . . . $\tau_S = 18$ ns (MAX)**
- **LOW V_{CE}(sat) . . . . 0.2 VOLT (MAX) AT 10 mA**

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	125°C Maximum
Lead Temperature (Soldering, 10 second time limit)	260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	0.5 Watt
at 25°C Ambient Temperature	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	20 Volts
V_{CES}	Collector to Emitter Voltage	20 Volts
V_{CEO}	Collector to Emitter Voltage	10 Volts
V_{EBO}	Emitter to Base Voltage	3.5 Volts
I_C	Collector Current (10 μs Pulse)	500 mA
I_C	DC Collector Current	100 mA

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain (Note 5)	20	66	150		$I_C = 10$ mA	$V_{CE} = 1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	15	71			$I_C = 30$ mA	$V_{CE} = 0.4$ V
h_{FE}	DC Pulse Current Gain (Note 5)		40			$I_C = 100$ mA	$V_{CE} = 1.0$ V
V_{BE}(sat)	Base Saturation Voltage	0.70	0.80	0.90	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{BE}(sat)	Base Saturation Voltage	0.72	0.85	1.10	Volts	$I_C = 10$ mA	$I_B = 3.3$ mA
V_{BE}(sat)	Base Saturation Voltage		0.90		Volts	$I_C = 30$ mA	$I_B = 3.0$ mA
V_{BE}(sat)	Base Saturation Voltage		1.10		Volts	$I_C = 100$ mA	$I_B = 10$ mA
V_{CE}(sat)	**Collector Saturation Voltage**		**0.14**	**0.25**	**Volts**	**$I_C = 10$ mA**	**$I_B = 1.0$ mA**
V_{CE}(sat)	Collector Saturation Voltage		0.12	0.20	Volts	$I_C = 10$ mA	$I_B = 3.3$ mA
V_{CE}(sat)	Collector Saturation Voltage		0.17		Volts	$I_C = 30$ mA	$I_B = 3.0$ mA
V_{CE}(sat) (+65°C)	Collector Saturation Voltage		0.19		Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{CE}(sat)	Collector Saturation Voltage		0.28		Volts	$I_C = 100$ mA	$I_B = 10$ mA
h_{fe}	**High Frequency Current Gain (f= 100 MHz)**	**2.5**	**5.75**			**$I_C = 10$ mA**	**$V_{CE} = 10$ V**
C_{cb}	**Collector-Base Capacitance**		**2.3**	**4.0**	**pF**	**$I_E = 0$**	**$V_{CB} = 5.0$ V**
I_{CES}	Collector Reverse Current		0.05	0.40	μA	$V_{CE} = 15$ V	$V_{BE} = 0$
I_{CBO}(65°C)	Collector Cutoff Current		1.0	10	μA	$I_E = 0$	$V_{CB} = 15$ V
BV_{CES}	Collector to Emitter Breakdown Voltage	20			Volts	$I_C = 10$ μA	$V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	20			Volts	$I_C = 10$ μA	$I_E = 0$
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	10			Volts	$I_C = 10$ mA (pulsed)	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	3.5			Volts	$I_C = 0$	$I_E = 10$ μA
τ_s	**Charge Storage Time Constant** (Note 6)		**7.0**	**18**	**ns**	**$I_C = I_{B1} \approx 10$ mA, $I_{B2} \approx -10$ mA**	
t_{on}	Turn On Time (Note 6)		8.0	18	ns	$I_C \approx 10$ mA, $I_{B1} \approx 3.3$ mA	
t_{off}	Turn Off Time (Note 6)		7.0	18	ns	$I_C \approx 10$ mA, $I_{B1} \approx 3.3$ mA, $I_{B2} \approx -3.3$ mA	

(See notes on back page)

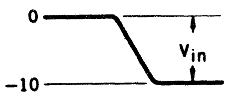
***Planar is a patented Fairchild process.**

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

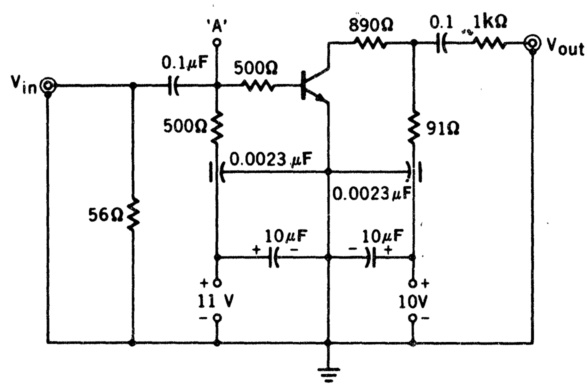
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

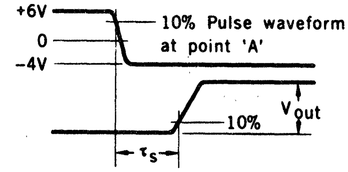
FAIRCHILD TRANSISTOR 2N5134

CHARGE STORAGE TIME MEASUREMENT CIRCUIT



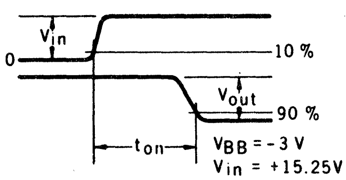
Pulse Generator
V_{in} Rise Time < 1 ns
Source Impedance = 50Ω
PW ≥ 300 ns
Duty Cycle < 2 %



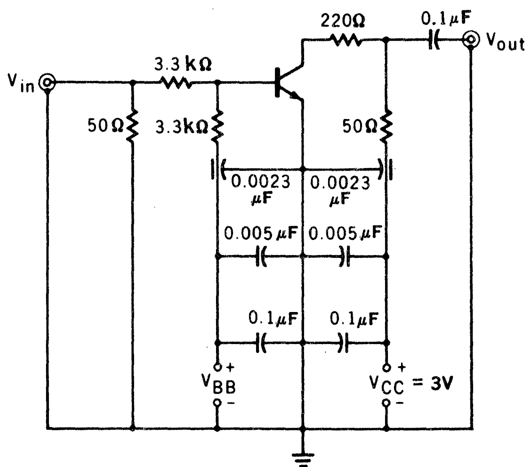


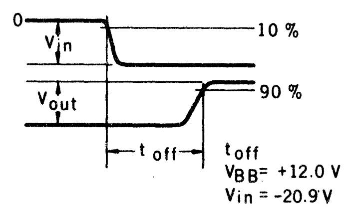
To Sampling Oscilloscope
Input Impedance = 50Ω
Rise Time ≤ 1 ns

t_{ON} — t_{OFF} MEASUREMENT CIRCUIT



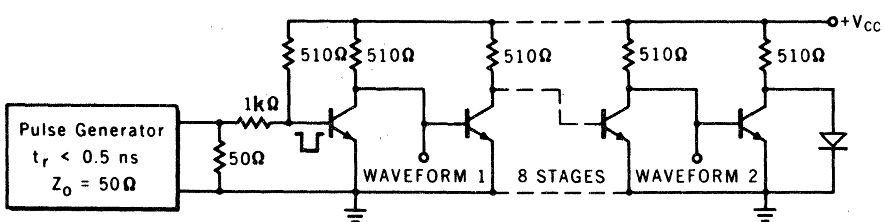
Pulse Generator
V_{in} Rise Time < 1 ns
Source Impedance = 50Ω
PW ≥ 300 ns
Duty Cycle < 2 %

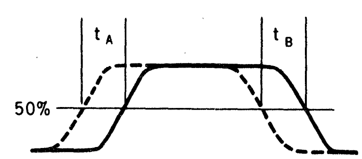




To Sampling Oscilloscope
Input Impedance = 50Ω
Rise Time ≤ 1 ns

CIRCUIT FOR MEASUREMENT OF PROPAGATION DELAY





Waveforms 1 and 2 Superimposed

$$\bar{t}pd = \frac{t_A + t_B}{20}$$

$\bar{t}pd$ = Average Propagation per Transistor

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 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C). Junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).
(4) 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) See switching circuits for exact value of I_C, I_{B1}, and I_{B2}.

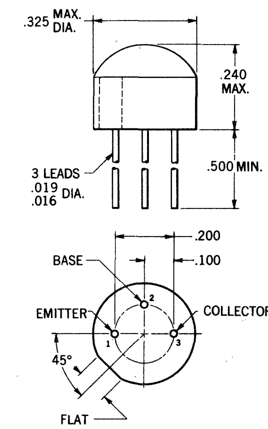
2N5135

NPN HIGH GAIN AMPLIFIER

DIFFUSED SILICON PLANAR* TRANSISTOR

- **HIGH GAIN - - $h_{FE} = 400$ (TYP) @ 10 mA**
- **BREAKDOWN VOLTAGE - - $LV_{CEO} = 25$ VOLTS (MIN)**
- **FREQUENCY RESPONSE - - $f_T = 40$ MHz (MIN) @ 30 mA**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 second time limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	0.8 Watt
at 25°C Ambient Temperature (Notes 2 and 3)	0.3 Watt

Maximum Voltage and Current

V_{CES}	Collector to Emitter Voltage	30 Volts
V_{CBO}	Collector to Base Voltage	30 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	25 Volts
V_{EBO}	Emitter to Base Voltage	4.0 Volts

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Pulse Current Gain** (Note 5)	**50**	**400**	**600**		**$I_C = 10$ mA**	$V_{CE} = 10$ V
h_{FE}	DC Current Gain	15	325			$I_C = 2.0$ mA	$V_{CE} = 10$ V
V_{BE}	Base-Emitter Voltage (Note 5)		0.87	1.0	Volts	$I_C = 100$ mA	$V_{CE} = 1.0$ V
$V_{CE}(sat)$	Collector Saturation Voltage (Note 5)		0.9	1.0	Volts	$I_C = 100$ mA	$I_B = 10$ mA
$V_{BE}(sat)$	Base Saturation Voltage (Note 5)			1.0	Volts	$I_C = 100$ mA	$I_B = 10$ mA
h_{fe}	**High Frequency Current Gain (f = 20 MHz)**	**2.0**		**15**		**$I_C = 30$ mA**	$V_{CE} = 10$ V
C_{cb}	Collector-Base Capacitance		13	25	pF	$I_E = 0$	$V_{CB} = 10$ V
I_{CBO}	Collector Cutoff Current			300	nA	$I_E = 0$	$V_{CB} = 15$ V
$I_{CBO}(+65°C)$	Collector Cutoff Current			10	μA	$I_E = 0$	$V_{CB} = 15$ V
BV_{CES}	Collector to Emitter Breakdown Voltage	30			Volts	$I_C = 100\ \mu$A	$V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	30			Volts	$I_E = 0$	$I_C = 100\ \mu$A
V_{CEO}(sust)	**Collector Emitter Sustaining Voltage** (Notes 4 and 5)	**25**			**Volts**	**$I_C = 10$ mA (pulsed)**	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0			Volts	$I_C = 0$	$I_E = 10\ \mu$A
V_{BE}	Base to Emitter Voltage (Note 5)			1.0	Volts	$I_C = 100$ mA	$V_{CE} = 1.0$ 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 temperature of 125°C and junction to case thermal resistance of 125°C/Watt (derating factor of 8.0 mW/°C); junction to ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C).
(4) 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 $\leq$ 1%.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

2N5136 • 2N5137

NPN GENERAL PURPOSE AMPLIFIERS

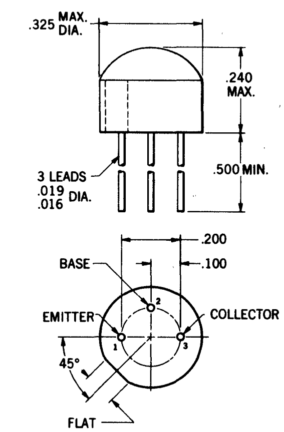
DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- LV_{CEO} - - 20 VOLTS (MIN)
- h_{FE} - - 20-400 AT 150 mA
- $V_{CE}(sat)$ - - 0.25 VOLT (MAX) AT 150 mA

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperature		
Storage Temperature		−55°C to +125°C
Operating Junction Temperature		+125°C
Lead Temperature (Soldering, 10 second time limit)		+260°C
Maximum Power Dissipation (Notes 2 and 3)	**2N5136**	**2N5137**
Total Dissipation at 25°C Case Temperature	0.8 Watt	0.6 Watt
at 25°C Ambient Temperature	0.3 Watt	0.22 Watt
Maximum Voltages and Current	**2N5136**	**2N5137**
V_{CBO} Collector to Base Voltage	30 Volts	30 Volts
V_{CEO} Collector to Emitter Voltage (Note 4)	20 Volts	20 Volts
V_{EBO} Emitter to Base Voltage	3.0 Volts	3.0 Volts

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



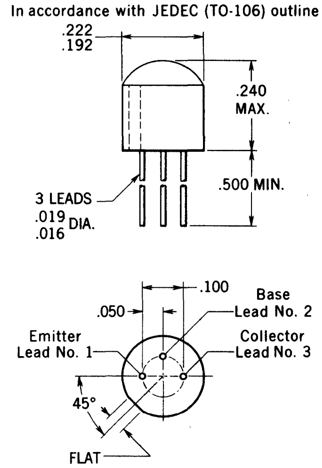
NOTES: All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

2N5136

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Pulse Current Gain (Note 5)**	**20**	**100**	**400**		**$I_C = 150$ mA**	**$V_{CE} = 1.0$ V**
h_{FE}	DC Pulse Current Gain (Note 5)	20				$I_C = 30$ mA	$V_{CE} = 1.0$ V
$V_{CE}(sat)$	**Pulsed Collector Saturation Voltage (Note 5)**		0.10	**0.25**	**Volts**	**$I_C = 150$ mA**	**$I_B = 15$ mA**
$V_{BE}(sat)$	Pulsed Base Saturation Voltage (Note 5)		0.85	1.1	Volts	$I_C = 150$ mA	$I_B = 15$ mA
h_{fe}	High Frequency Current Gain (f = 20 MHz)	2.0		20		$I_C = 50$ mA	$V_{CE} = 5.0$ V
C_{cb}	Collector-Base Capacitance		16	35	pF	$I_E = 0$	$V_{CB} = 10$ V
C_{eb}	Emitter Base Capacitance		63	85	pF	$I_C = 0$	$V_{EB} = 0.5$ V
I_{CBO}	Collector Cutoff Current			100	nA	$I_E = 0$	$V_{CB} = 20$ V
$I_{CBO}(65°C)$	Collector Cutoff Current			10	μA	$I_E = 0$	$V_{CB} = 20$ V
I_{EBO}	Emitter Cutoff Current			100	nA	$I_C = 0$	$V_{EB} = 2.0$ V
BV_{CBO}	Collector to Base Breakdown Voltage	30			Volts	$I_C = 100\mu A$	$I_E = 0$
$V_{CEO}(sust)$	**Collector to Emitter Sustaining Voltage** (Notes 4 and 5)	**20**			**Volts**	**$I_C = 10$ mA** (pulsed)	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	3.0			Volts	$I_C = 0$	$I_E = 10\ \mu A$
$V_{BE}(on)$	Base to Emitter On Voltage (Note 5)			1.1	Volts	$I_C = 150$ mA	$V_{CE} = 1.0$ V

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

2N5137

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 125°C and junction to case thermal resistance of 167°C/Watt (derating factor of 6.0 mW/°C); junction to ambient thermal resistance of 455°C/Watt (derating factor of 2.2 mW/°C) for 2N5137 and a junction to case thermal resistance of 125°C/Watt (derating factor of 8.0 mW/°C); junction to ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C) for 2N5136.
(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%.

*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

2N5138

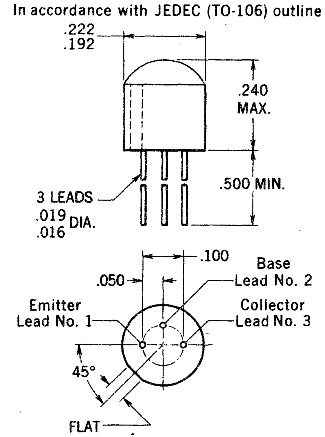
PNP LOW-LEVEL AMPLIFIER

DIFFUSED SILICON PLANAR* II TRANSISTOR

- **LOW NOISE FIGURE . . . . 0.7 dB (TYP) AT f = 1 kHz**
- **HIGH CURRENT GAIN . . . h_{FE} = 100 (TYP) AT I_C = 100 μA**
- **HIGH BREAKDOWN . . . . . LV_{CEO} = 30 V (MIN)**
- **EXCELLENT BETA LINEARITY FROM 1 μA TO 50 mA**

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures		
Storage Temperatures		−55° to +125°C
Operating Junction Temperatures		+125°C
Lead Temperature (Soldering, 10 second time limit)		+260°C
Maximum Power Dissipation (Notes 2 and 3)		
Total Dissipation at 25°C Case Temperature		0.5 Watt
at 25°C Ambient Temperature		0.2 Watt
Maximum Voltages and Current		
V_{CBO}	Collector to Base Voltage	−30 Volts
V_{CEO}	Collector to Emitter Voltage	−30 Volts
V_{EBO}	Emitter to Base Voltage	−5.0 Volts

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

SYMBOL	CHARACTERISTICS	2N5138 MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
NF	**Narrow Band Noise Figure (f = 1.0 kHz)** (Note 6)		0.7		**dB**	**I_C = 20 μA**	V_{CE} = −5.0 V
NF	**Wide Band Noise Figure** (Note 7)		1.0		**dB**	**I_C = 20 μA**	V_{CE} = −5.0 V
NF	Narrow Band Noise Figure (f = 1.0 kHz) (Note 8)		0.8		dB	I_C = 250 μA	V_{CE} = −5.0 V
h_{FE}	**DC Current Gain**	50	100	800		**I_C = 100 μA**	V_{CE} = −10 V
h_{FE}	DC Current Gain	50	110			I_C = 1.0 mA	V_{CE} = −10 V
h_{FE}	**DC Pulse Current Gain** (Note 5)	50	120			**I_C = 10 mA**	V_{CE} = −10 V
BV_{CBO}	Collector to Base Breakdown Voltage	−30			Volts	I_C = 100 μA	I_E = 0
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage** (Notes 4 and 5)	−30			**Volts**	**I_C = 10 mA** (pulsed)	I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0			Volts	I_C = 0	I_E = 100 μA
I_{CBO}	**Collector Cutoff Current**			10	**nA**	**I_E = 0**	**V_{CB} = −20 V**
I_{CBO}(65°C)	Collector Cutoff Current			3.0	μA	I_E = 0	V_{CB} = −20 V
V_{CE}(sat)	Pulsed Collector Saturation Voltage (Note 5)			−0.3	Volts	I_C = 10 mA	I_B = 0.5 mA
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 5)			−1.0	Volts	I_C = 10 mA	I_B = 0.5 mA
V_{BE}(on)	Pulsed Base to Emitter "On" Voltage (Note 5)		−0.74	−1.0	Volts	I_C = 10 mA	V_{CE} = −10 V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	40		1000		I_C = 1.0 mA	V_{CE} = −10 V
h_{fe}	High Frequency Current Gain (f = 20 MHz)	1.5				I_C = 0.5 mA	V_{CE} = −5.0 V
C_{cb}	Collector to Base Capacitance			7.0	pF	I_E = 0	V_{CB} = −5.0 V
C_{eb}	Emitter to Base Capacitance			30	pF	I_C = 0	V_{EB} = −0.5 V

*Planar is a patented Fairchild process.

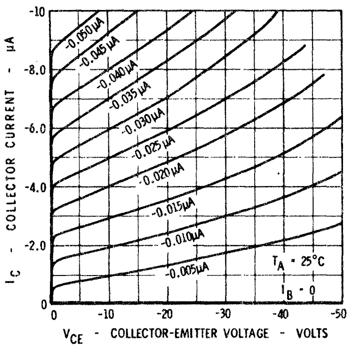
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

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

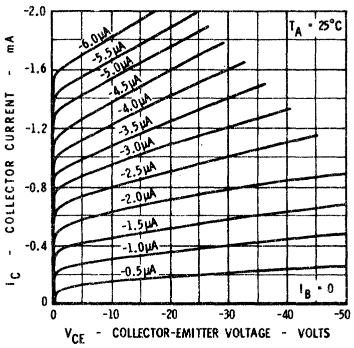
FAIRCHILD TRANSISTOR 2N5138

TYPICAL ELECTRICAL CHARACTERISTICS
2N5138

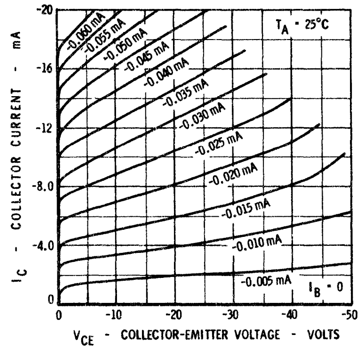
COLLECTOR CHARACTERISTICS*



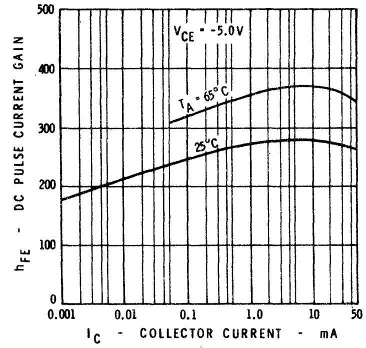
COLLECTOR CHARACTERISTICS*



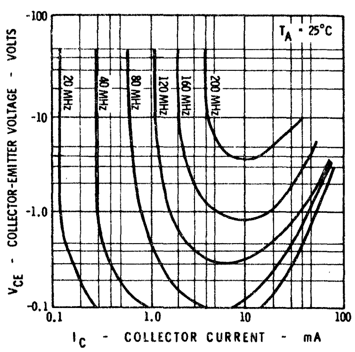
COLLECTOR CHARACTERISTICS*



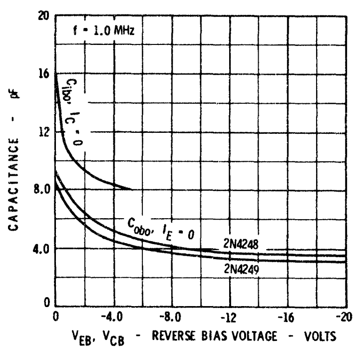
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



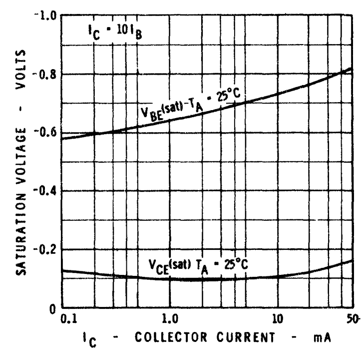
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



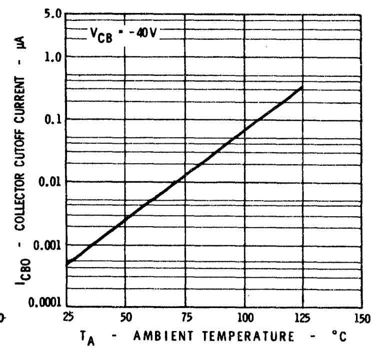
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



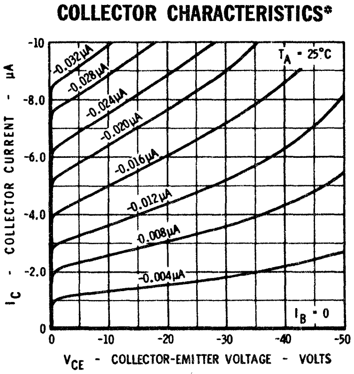
COLLECTOR AND BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



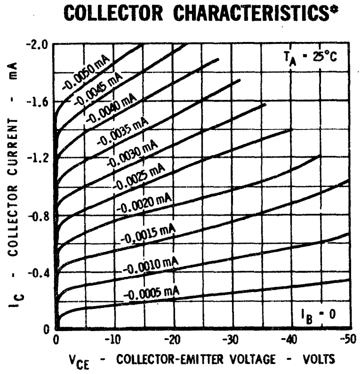
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



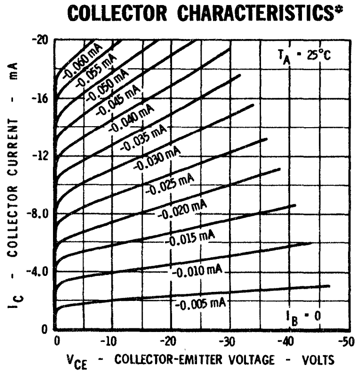
COLLECTOR CHARACTERISTICS*



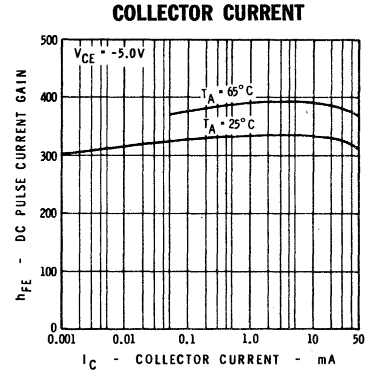
COLLECTOR CHARACTERISTICS*



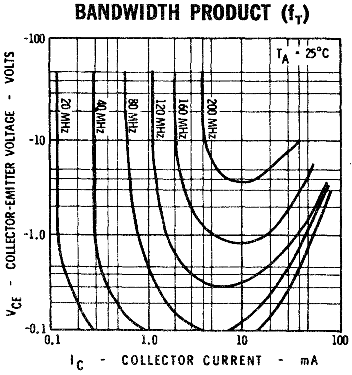
COLLECTOR CHARACTERISTICS*



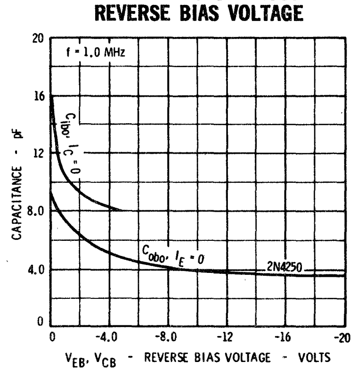
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



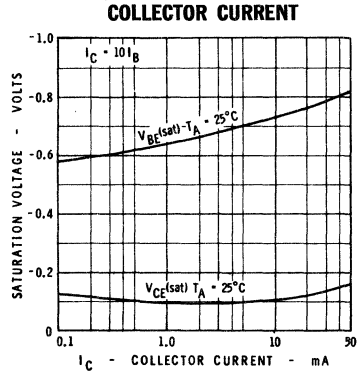
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



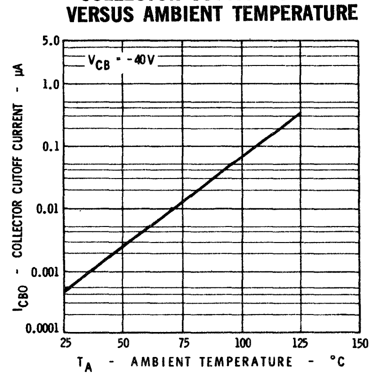
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



COLLECTOR AND BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT

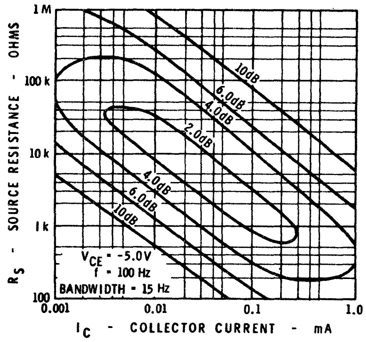


COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE

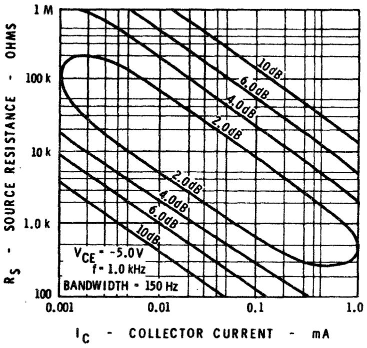


TYPICAL ELECTRICAL CHARACTERISTICS
2N5138

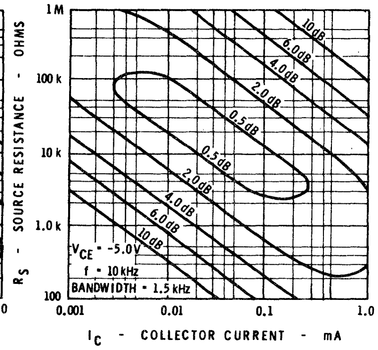
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



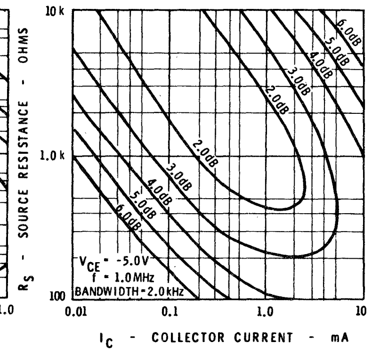
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



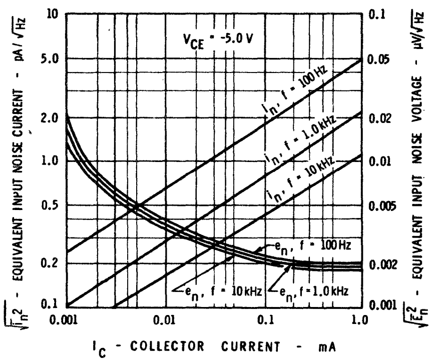
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



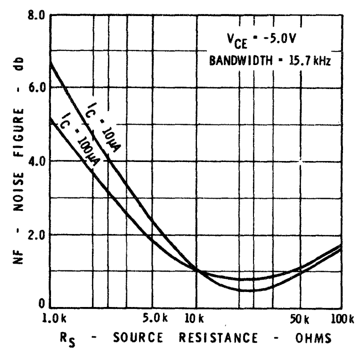
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



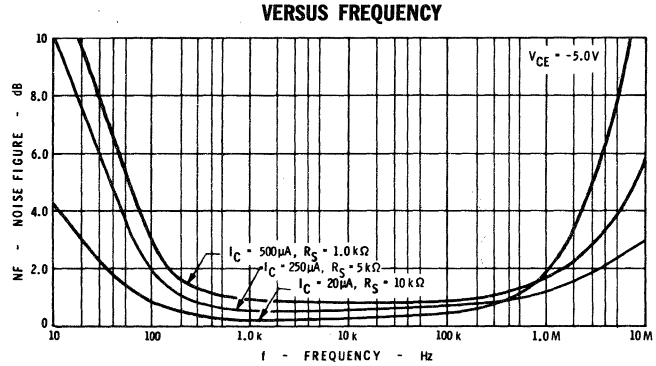
EQUIVALENT INPUT NOISE VOLTAGE AND NOISE CURRENT VERSUS COLLECTOR CURRENT



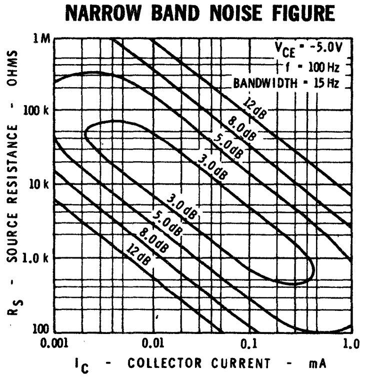
WIDE BAND NOISE FIGURE VERSUS SOURCE RESISTANCE



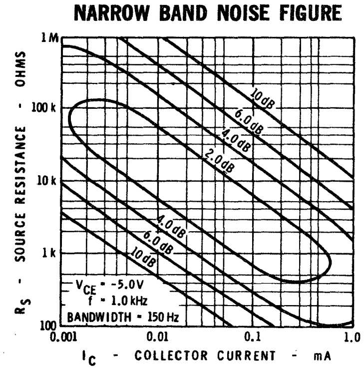
NOISE FIGURE VERSUS FREQUENCY



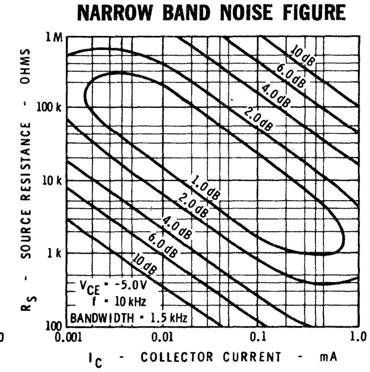
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



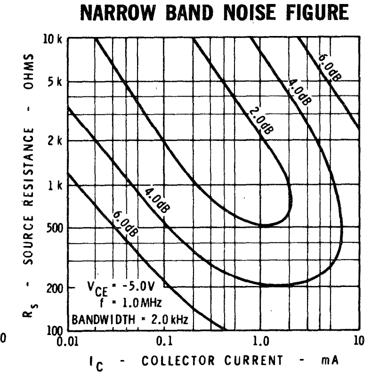
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



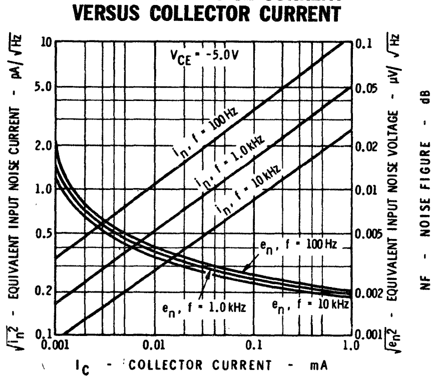
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



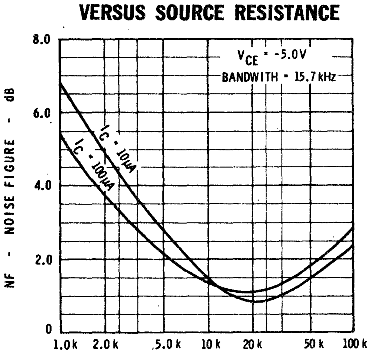
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



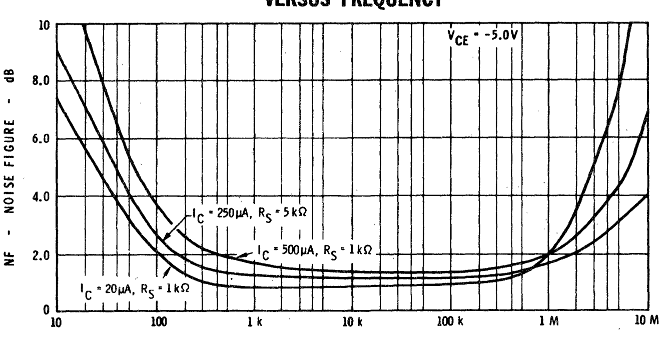
EQUIVALENT INPUT NOISE VOLTAGE AND NOISE CURRENT VERSUS COLLECTOR CURRENT



WIDE BAND NOISE FIGURE VERSUS SOURCE RESISTANCE



NOISE FIGURE VERSUS FREQUENCY



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 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 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) R_S = 10 kΩ, Power Bandwidth of 150 Hz.
(7) R_S = 10 kΩ, Power Bandwidth of 15.7 kHz with 3.0 dB points at 10 Hz and 10 kHz.
(8) R_S = 1.0 kΩ, Power Bandwidth of 150 Hz.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

2N5139

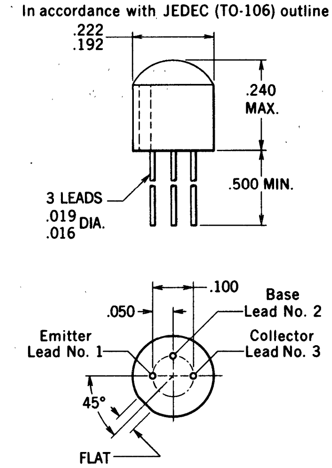
PNP HIGH-SPEED SWITCH AND RF AMPLIFIER

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTOR

- **HIGH BETA . . . . $h_{FE} = 150$ (TYP) AT 10 mA**
- **HIGH FREQUENCY . . . $f_T = 500$ MHz (TYP) AT 10 mA**
- **LOW CAPACITANCE . . . $C_{cb} = 2.2$ pF (TYP)**
- **HIGH VOLTAGE . . . . . $LV_{CEO} = 20$ VOLTS (MIN)**

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures		
Storage Temperature		−55°C to +125°C
Operating Junction Temperature		+125°C Maximum
Lead Temperature (Soldering, 10 second time limit)		+260°C Maximum
Maximum Power Dissipation (Notes 2 and 3)		
Total Dissipation at 25°C Case Temperature		0.5 Watt
at 25°C Ambient Temperature		0.2 Watt
Maximum Voltages and Current		
V_{CBO}	Collector to Base Voltage	−20 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	−20 Volts
V_{EBO}	Emitter to Base Voltage	−5.0 Volts
I_C	Collector Current	100 mA

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Current Gain**	30	70			**$I_C = 100$ μA**	$V_{CE} = -10$ V
h_{FE}	DC Current Gain	40	100			$I_C = 1.0$ mA	$V_{CE} = -10$ V
h_{FE}	**DC Pulse Current Gain** (Note 5)	40	150			**$I_C = 10$ mA**	$V_{CE} = -1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	15	30			$I_C = 50$ mA	$V_{CE} = -10$ V
V_{CE}(sat)	Collector Saturation Voltage			−0.15	Volts	$I_C = 1.0$ mA	$I_B = 0.1$ mA
V_{CE}(sat)	Pulsed Collector Saturation Voltage (Note 5)			−0.20	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{CE}(sat)	**Pulsed Collector Saturation Voltage** (Note 5)		−0.2	−0.5	**Volts**	**$I_C = 50$ mA**	$I_B = 5.0$ mA
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 5)	−0.7	−0.77	−1.0	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 5)		−0.75	−1.25	Volts	$I_C = 50$ mA	$I_B = 5.0$ mA
t_{on}	**Turn On Time** (Note 6)			50	**ns**	**$I_C \approx 50$ mA**	$I_{B1} \approx 5.0$ mA
t_{off}	**Turn Off Time** (Note 6)			200	**ns**	**$I_C \approx 50$ mA**	$I_{B1} \approx 5.0$ mA, $I_{B2} \approx -5.0$ mA
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	3.0	5.0			**$I_C = 10$ mA**	$V_{CE} = -20$ V

Additional Electrical Characteristics on page 2

*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 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 mW/°C).
(4) 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) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

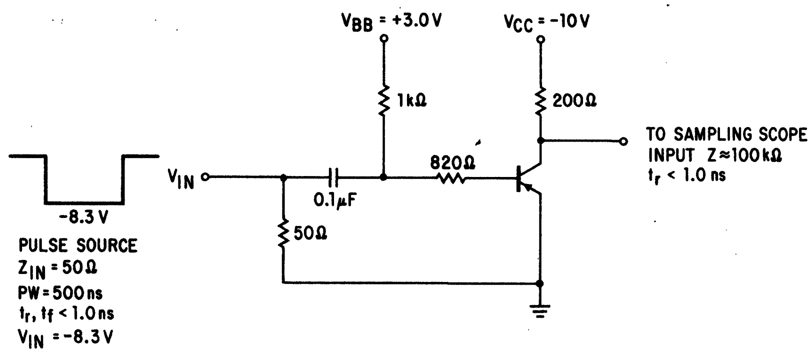
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

FAIRCHILD TRANSISTOR 2N5139

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage** (Notes 4 and 5)	−20			**Volts**	**$I_C = 10$ mA** (pulsed)	$I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−20			Volts	$I_C = 100\ \mu A$	$I_E = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	−20			Volts	$I_C = 100\ \mu A$	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0			Volts	$I_C = 0$	$I_E = 100\ \mu A$
I_{CES}	Collector Reverse Current			50	nA	$V_{CE} = -15$ V	$V_{BE} = 0$
I_{CES}(+65°C)	Collector Reverse Current			25	μA	$V_{CE} = -15$ V	$V_{BE} = 0$
C_{cb}	**Collector to Base Capacitance**	5.0			**pF**	$I_E = 0$	**$V_{CB} = -10$ V**
C_{eb}	Emitter to Base Capacitance	8.0			pF	$I_C = 0$	$V_{EB} = -0.5$ V

SWITCHING TIME TEST CIRCUIT



2N5140

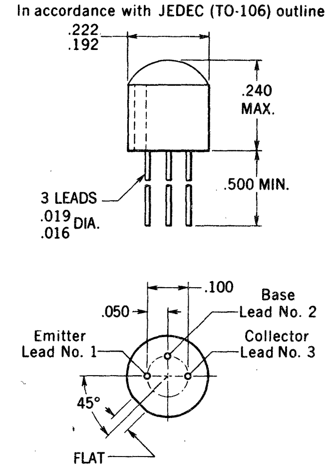
PNP ULTRA HIGH-SPEED SWITCH

SILICON PLANAR* II EPITAXIAL TRANSISTOR

- **ULTRA HIGH SPEED** . . . . t_{on} = 20 ns (MAX) AT $I_C \approx$ 10 mA
  t_{off} = 20 ns (MAX) AT $I_C \approx$ 10 mA
- **LOW SATURATION VOLTAGE** . . . V_{CE}(sat) = −0.2 V (MAX) AT I_C = 10 mA
- **LOW CAPACITANCE** . . . . C_{cb} = 5.0 pF (MAX)
- **LOW LEAKAGE** . . . . I_{CES} = 50 nA (MAX)

PHYSICAL DIMENSIONS

In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C Maximum
Lead Temperature (Soldering, 10 second time limit)	+260°C Maximum

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	0.5 Watt
at 25°C Free Air Temperature (Notes 2 and 3)	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	−5.0 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	−5.0 Volts
V_{EBO}	Emitter to Base Voltage	−4.0 Volts
I_C	Collector Current	50 mA

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
t_{on}	**Turn On Time** (Note 6, Fig. 1)		10	20	ns	$I_C \approx$ 10 mA	$I_{B1} \approx$ 1.0 mA
t_{off}	**Turn Off Time** (Note 6, Fig. 1)		13	20	ns	$I_C \approx$ 10 mA	$I_{B1} \approx$ 1.0 mA $I_{B2} \approx$ −1.0 mA
τ_s	Charge Storage Time (Note 6, Fig. 2)		15		ns	$I_C \approx$ 10 mA	$I_{B1} \approx$ 10 mA $I_{B2} \approx$ −10 mA
h_{FE}	**DC Pulse Current Gain** (Note 5)	20	50	140		I_C = 10 mA	V_{CE} = −1.0 V
h_{FE}	DC Pulse Current Gain (Note 5)		30			I_C = 1.0 mA	V_{CE} = −0.5 V
h_{FE}	DC Pulse Current Gain (Note 5)		70			I_C = 50 mA	V_{CE} = −1.0 V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	4.0	10			I_C = 10 mA	V_{CE} = −5.0 V
C_{cb}	**Collector to Base Capacitance**		2.0	5.0	pF	V_{CB} = −5.0 V	I_E = 0
C_{eb}	**Emitter to Base Capacitance**		2.5	5.0	pF	I_C = 0	V_{EB} = −0.5 V
V_{BE}(sat)	Pulsed Base Saturation Voltage (Note 5)		−0.88	−1.20	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{CE}(sat)	**Pulsed Collector Saturation Voltage** (Note 5)		−0.08	−0.2	Volts	I_C = 10 mA	I_B = 1.0 mA
V_{CE}(sat)	Pulsed Collector Saturation Voltage (Note 5)		−0.20	−0.75	Volts	I_C = 50 mA	I_B = 5.0 mA

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

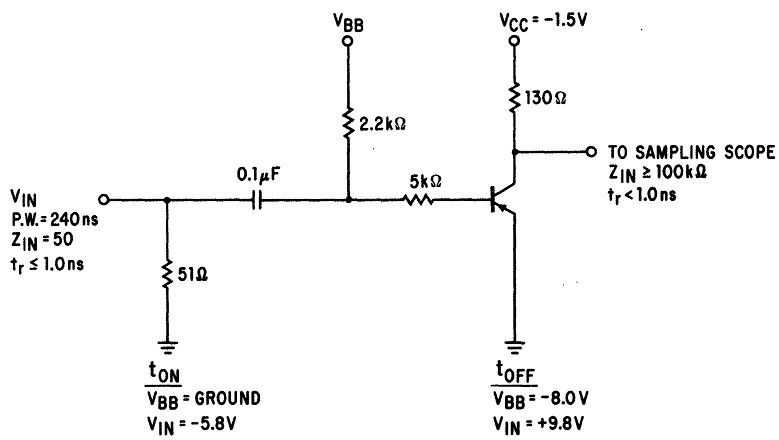
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
I_{CES}	Collector Reverse Current		0.1	50	nA	$V_{CE} = -3.0$ V	$V_{BE} = 0$
$I_{CES}(+65°C)$	Collector Reverse Current		1.0	5.0	μA	$V_{CE} = -3.0$ V	$V_{BE} = 0$
V_{CEO}(sust)	**Collector to Emitter Sustaining Voltage** (Notes 4 and 5)	−5.0			**Volts**	**$I_C = 10$ mA**	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.0			Volts	$I_C = 0$	$I_E = 100$ μA
BV_{CES}	Collector to Emitter Breakdown Voltage	−5.0			Volts	$I_C = 100$ μA	$V_{BE} = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	−5.0			Volts	$I_C = 100$ μA	$I_E = 0$

NOTES:

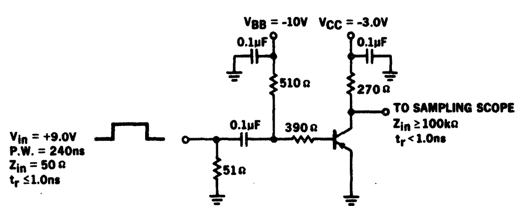
(1) These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.
(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
(3) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/Watt (derating factor of 2.0 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) See switching circuit for exact values of I_C, I_{B1} and I_{B2}.

Fig. 1
TURN ON AND TURN OFF TEST CIRCUIT



$I_C \approx 10$mA, $I_{B1} \approx 1.0$mA, $I_{B2} \approx -1.0$mA

Fig. 2
CHARGE STORAGE TIME TEST CIRCUIT



$I_C \approx 10$mA, $I_{B1} \approx 10$mA, $I_{B2} \approx -10$mA

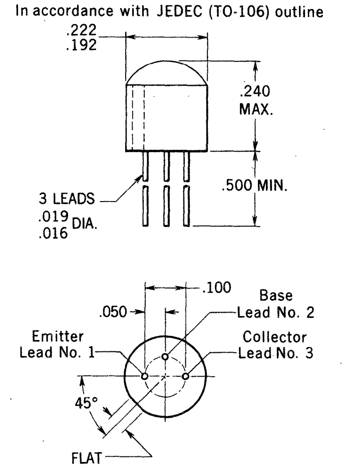
2N5141

PNP HIGH-SPEED SWITCH

DIFFUSED SILICON PLANAR* II EPITAXIAL TRANSISTOR

- **FAST SWITCHING TIME . . . . . t_{on} = 90 ns (MAX)**
  t_{off} = 150 ns (MAX)
- **LOW CAPACITANCE . . . . C_{eb} = 8 pF (MAX)**
  C_{cb} = 7 pF (MAX)
- **HIGH FREQUENCY . . . . f_T = 300 MHz (MIN)**
- **LOW SATURATION VOLTAGE . . . V_{CE}(sat) = 0.2 V (MAX)**

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C
Lead Temperature (Soldering, 10 second time limit)	+260°C

Maximum Power Dissipation (Notes 2 and 3)

Total Dissipation at 25°C Case Temperature	0.5 Watt
at 25°C Ambient Temperature	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	−6.0 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	−6.0 Volts
V_{EBO}	Emitter to Base Voltage	−6.0 Volts
V_{CES}	Collector to Emitter Voltage	−4.0 Volts
I_C	Collector Current	100 mA

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
V_{CE}(sat)	**Pulsed Collector-Emitter Saturation** (Note 5)		**−0.07**	**−0.2**	**Volts**	**I_C = 10 mA**	**I_B = 1.0 mA**
V_{CE}(sat)	Pulsed Collector-Emitter Saturation (Note 5)		**−0.10**	−0.25	Volts	I_C = 30 mA	I_B = 3.0 mA
V_{CE}(sat)	**Pulsed Collector-Emitter Saturation** (Note 5)		**−0.25**	**−0.6**	**Volts**	**I_C = 100 mA**	**I_B = 10 mA**
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**3.0**	**12**			**I_C = 20 mA**	**V_{CE} = −5.0 V**
C_{cb}	**Collector to Base Capacitance**		**3.3**	**7.0**	**pF**	**I_E = 0**	**V_{CB} = −5.0 V**
C_{eb}	Emitter to Base Capacitance		3.8	8.0	pF	I_C = 0	V_{EB} = −0.5 V
I_{CES}	Collector Reverse Current		0.05	100	nA	V_{CE} = −4.0 V	V_{EB} = 0
I_{CES}(65°C)	Collector Reverse Current		0.002	10	μA	V_{CE} = −4.0 V	V_{EB} = 0
t_{on}	**Turn On Time** (Note 6, Figure 1)		**25**	**90**	**ns**	**$I_C \approx$ 30 mA**	**$I_{B1} \approx$ 3.0 mA**
t_{off}	**Turn Off Time** (Note 6, Figure 1)		**40**	**150**	**ns**	**$I_C \approx$ 30 mA**	**$I_{B1} \approx$ 3.0 mA** **$I_{B2} \approx$ −3.0 mA**
t_d	**Delay Time** (Note 6, Figure 1)		**4**	**45**	**ns**	**$I_C \approx$ 30 mA**	**$I_{B1} \approx$ 3.0 mA**
t_r	**Rise Time** (Note 6, Figure 1)		**6**	**70**	**ns**	**$I_C \approx$ 30 mA**	**$I_{B1} \approx$ 3.0 mA**
t_s	**Storage Time** (Note 6, Figure 1)		**12**	**100**	**ns**	**$I_C \approx$ 30 mA**	**$I_{B1} \approx I_{B2} \approx$ 3.0 mA**
t_f	**Fall Time** (Note 6, Figure 1)		**3**	**70**	**ns**	**$I_C \approx$ 30 mA**	**$I_{B1} \approx I_{B2} \approx$ 3.0 mA**

Additional Electrical Characteristics on page 2

*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 125°C and junction to case thermal resistance of 200°C/watt (derating factor of 5.0 mW/°C); junction to ambient thermal resistance of 500°C/watt (derating factor of 2.0 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 = 200 μs; duty cycle = 1%.
6) See switching circuits for exact values of I_C, I_{B1}, and I_{B2}.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

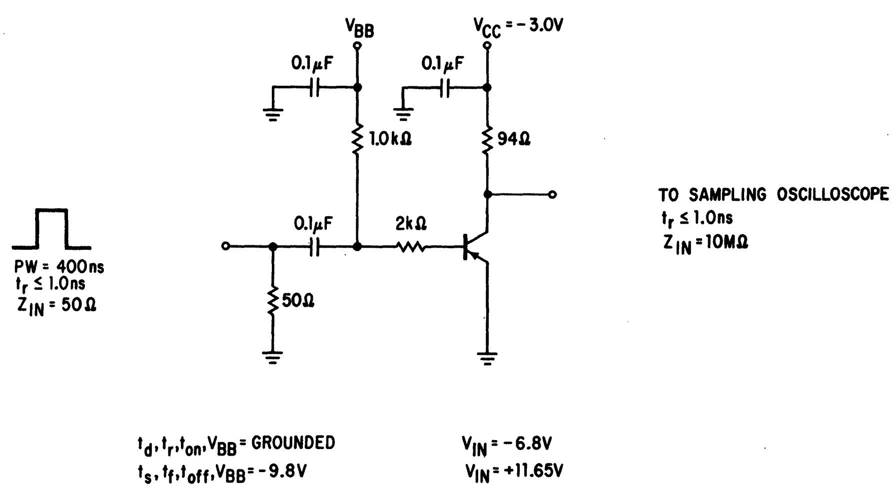
FAIRCHILD TRANSISTOR 2N5141

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
V_{BE}(sat)	Pulsed Base-Emitter Saturation Voltage		−0.88	−1.1	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
V_{BE}(sat)	Pulsed Base-Emitter Saturation Voltage	−0.8	−0.93	−1.25	Volts	$I_C = 30$ mA	$I_B = 3.0$ mA
V_{BE}(sat)	Pulsed Base-Emitter Saturation Voltage		−1.14	−2.0	Volts	$I_C = 100$ mA	$I_B = 10$ mA
V_{CEO}(sust)	**Collector-Emitter Sustaining Voltage** (Notes 4 and 5)	**−6.0**			**Volts**	**$I_C = 10$ mA (pulsed)**	**$I_B = 0$**
BV_{CBO}	Collector-Base Breakdown Voltage	−6.0			Volts	$I_C = 100\ \mu A$	$I_E = 0$
BV_{EBO}	Emitter-Base Breakdown Voltage	−4.0			Volts	$I_E = 100\ \mu A$	$I_C = 0$
h_{FE}	**DC Pulse Current Gain**	**15**	**44**			**$I_C = 1.0$ mA**	$V_{CE} = -2.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	25	55			$I_C = 10$ mA	$V_{CE} = -2.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	30	63			$I_C = 30$ mA	$V_{CE} = -2.0$ V
h_{FE}	**DC Pulse Current Gain** (Note 5)	**15**	**55**			**$I_C = 100$ mA**	**$V_{CE} = -5.0$ V**

SWITCHING TIME TEST CIRCUIT

(Figure 1)



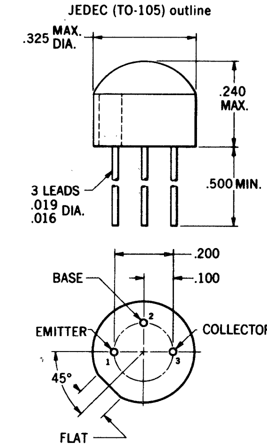
2N5142 • 2N5143

PNP HIGH-CURRENT SWITCHES

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **ULTRA-LOW COST PNP TRANSISTOR**
- **BETA** . . . . $h_{FE} = 30$ (MIN) AT 50 mA
  $h_{FE} = 15$ (MIN) AT 300 mA
- **LOW SATURATION VOLTAGE** . . . $V_{CE}(sat) = -0.08$ V (TYP) AT 50 mA
  $V_{CE}(sat) = -0.50$ V (TYP) AT 300 mA
- **FAST SWITCHING** . . . . $t_{on} = 30$ ns (TYP) AT 300 mA
  $t_{off} = 65$ ns (TYP) AT 300 mA
- **BREAKDOWN VOLTAGE** . . . . . . $LV_{CEO} = -20$ VOLTS (MIN) AT 10 mA

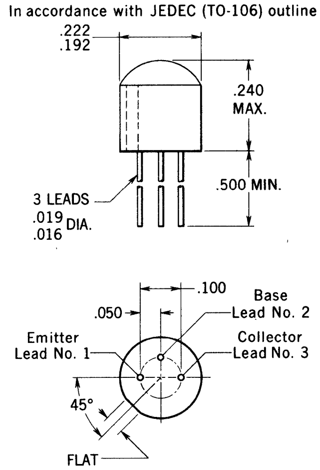
PHYSICAL DIMENSIONS in accordance with JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

2N5142

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

2N5143

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−55°C to +125°C	
Operating Junction Temperature	+125°C Maximum	
Lead Temperature (Soldering, 10 second time limit)	+260°C Maximum	
Maximum Power Dissipation (Notes 2 and 3)	**2N5142**	**2N5143**
Total Dissipation at 25°C Case Temperature	0.7 Watt	0.5 Watt
at 25°C Free Air Temperature	0.3 Watt	0.2 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage	−20 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	−20 Volts
V_{EBO}	Emitter to Base Voltage	−4.0 Volts
I_C	Collector Current	500 mA

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

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain (Note 5)	30	70			$I_C = 50$ mA	$V_{CE} = -1.0$V
h_{FE}	DC Pulse Current Gain (Note 5)	15	50			$I_C = 300$ mA	$V_{CE} = -1.0$ V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	1.0	1.9			$I_C = 50$ mA	$V_{CE} = -3.0$ V
C_{cb}	Collector to Base Capacitance		4.5	10	pF	$I_E = 0$	$V_{CB} = -10$ V
C_{eb}	Emitter to Base Capacitance		15	30	pF	$I_C = 0$	$V_{EB} = -0.5$ V

Additional Electrical Characteristics on page 2

*Planar is a patented Fairchild process.

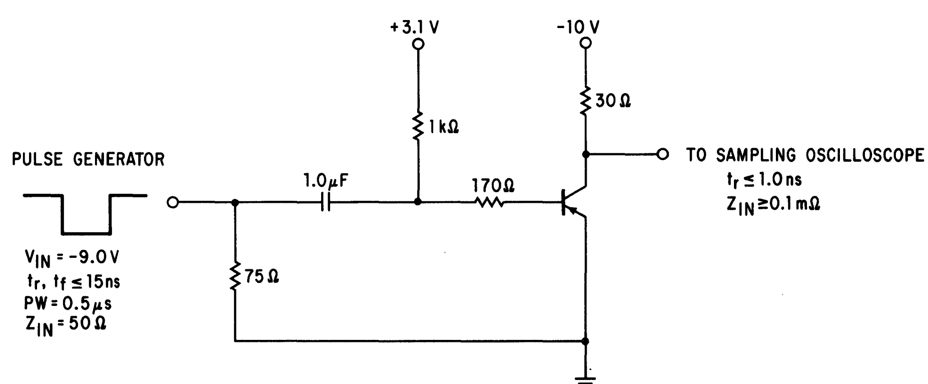
NOTES:
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
(3) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 143°C/Watt (derating factor of 7.0 mW/°C) for the 2N5142; and 200°C/Watt (derating factor of 5.0 mW/°C) for the 2N5143, junction to ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C) for the 2N5142; and 500°C/Watt (derating factor of 5.0 mW/°C) for the 2N5143.
(4) 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) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

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	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
V_{CE}(sat)	Collector Saturation Voltage (Pulsed, Note 5)		−0.08	−0.5	Volts	$I_C = 50$ mA	$I_B = 2.5$ mA
V_{CE}(sat)	Collector Saturation Voltage (Pulsed, Note 5)		−0.5	−2.0	Volts	$I_C = 300$ mA	$I_B = 30$ mA
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	−20			Volts	$I_C = 10$ mA (pulsed)	$I_B = 0$
V_{BE}(sat)	Base Saturation Voltage (Pulsed, Note 5)		−0.9	−1.5	Volts	$I_C = 50$ mA	$I_B = 2.5$ mA
V_{BE}(sat)	Base Saturation Voltage (Pulsed, Note 5)	−0.8		−2.5	Volts	$I_C = 300$ mA	$I_B = 30$ mA
BV_{EBO}	Emitter to Base Breakdown Voltage	−4.0			Volts	$I_C = 0$	$I_E = 100\ \mu A$
BV_{CBO}	Collector to Base Breakdown Voltage	−20			Volts	$I_C = 100\ \mu A$	$I_E = 0$
t_{on}	Turn On Time (Note 6)		30	100	ns	$I_C \approx 300$ mA	$I_{B1} \approx 30$ mA
t_{off}	Turn Off Time (Note 6)		65	200	ns	$I_C \approx 300$ mA, $I_{B1} \approx 30$ mA, $I_{B2} \approx -30$ mA	
I_{CES}	Collector Reverse Current			35	nA	$V_{CE} = -12$ V	$V_{BE} = 0$
I_{CES}	Collector Reverse Current (+65°C)			2.0	μA	$V_{CE} = -12$ V	$V_{BE} = 0$

TURN ON AND TURN OFF TEST CIRCUIT



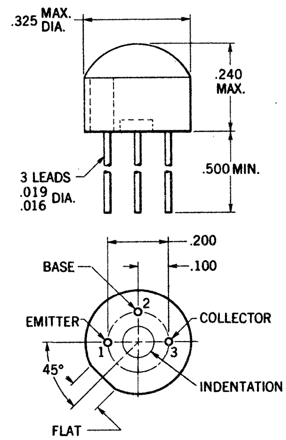
2N5242 • 2N5243

PNP HIGH-CURRENT SWITCHES

DIFFUSED SILICON PLANAR* II EPITAXIAL TRANSISTORS

- **FAST SWITCHING . . . . t_{on} = 25 ns (TYP) AT 500 mA**
  t_{off} = 65 ns (TYP) AT 500 mA
- **LOW SATURATION VOLTAGE . . . $V_{CE(sat)}$ = 0.75 V (MAX) AT 1.0 A**
- **HIGH FREQUENCY . . . . f_T = 250 MHz (TYP) AT 50 mA**
- **HIGH BETA . . . . h_{FE} = 25 - 100 AT 500 mA**
  h_{FE} = 50 (TYP) AT 1.0 A

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated nickel
Package is electrically Non-conductive material
Package weight is 0.66 gram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C
Lead Temperature (soldering, 10 second time limit)	+260°C

Maximum Power Dissipation (Notes 2 and 3)

Total Dissipation at 25°C Case Temperature	4.0 Watts
at 25°C Ambient Temperature	0.5 Watt

Maximum Voltages and Current		**2N5242**	**2N5243**
V_{CBO}	Collector to Base Voltage	−20 Volts	−30 Volts
V_{CES}	Collector to Emitter Voltage	−20 Volts	−30 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	−20 Volts	−30 Volts
V_{EBO}	Emitter to Base Voltage	−5.0 Volts	−5.0 Volts
I_C	Collector Current	1.0 Amp	1.0 Amp

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

		2N5242			2N5243					
SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	−20			−30			Volts	I_C = 10 mA	I_B = 0
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 5)		−0.22	−0.38		−0.24	−0.38	Volts	I_C = 500 mA	I_B = 50 mA
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 5)		**−0.33**	**−0.75**		**−0.33**	**−0.75**	**Volts**	I_C = **1.0 A**	I_B = **100 mA**
h_{FE}	DC Pulse Current Gain (Note 5)	25	50	100	25	45	100		I_C = 500 mA	V_{CE} = −1.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	**25**	**50**		25	45			I_C = **1.0 A**	V_{CE} = **−5.0 V**
t_{on}	**Turn On Time** (Note 6)		**25**	**40**		**25**	**40**	**ns**	$I_C \approx$ **500 mA**	$I_{B1} \approx$ **50 mA**
t_{off}	**Turn Off Time** (Note 6)		**65**	**90**		**65**	**90**	**ns**	$I_C \approx$ **500 mA**	$I_{B1} \approx$ **50 mA**
										$I_{B2} \approx$ **−50 mA**
C_{cb}	Collector to Base Capacitance		20	35		18	35	pF	I_E = 0	V_{CB} = −10 V
h_{fe}	**High Frequency Current Gain (f = 100 MHz)**	**1.7**	**2.5**		1.7	2.3			I_C = **50 mA**	V_{CE} = **−10 V**

Additional Electrical Characteristics on Page 2

*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 125°C and junction to case thermal resistance of 25°C/Watt (derating factor of 40 mW/°C); junction to ambient thermal resistance of 200°C/Watt (derating factor of 5.0 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) See switching circuit for exact values of I_C, I_{B1} and I_{B2}.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

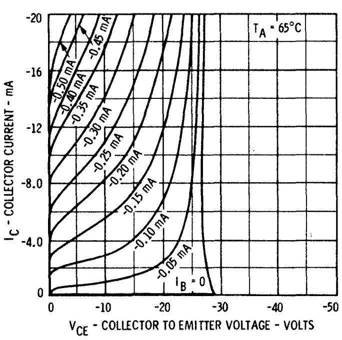
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	2N5242 MIN.	2N5242 TYP.	2N5242 MAX.	2N5243 MIN.	2N5243 TYP.	2N5243 MAX.	UNITS	TEST CONDITIONS	
BV_{CBO}	Collector to Base Breakdown Voltage	−20			−30			Volts	$I_C = 100\ \mu A$	$I_E = 0$
BV_{CES}	Collector to Emitter Breakdown Voltage	−20			−30			Volts	$I_C = 100\ \mu A$	$V_{BE} = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	−5.0			−5.0			Volts	$I_C = 0$	$I_E = 100\ \mu A$
h_{FE}	DC Pulse Current Gain (Note 5)	15	45		15	40			$I_C = 100$ mA	$V_{CE} = -1.0$ V
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 5)		−0.1	−0.2		−0.12	−0.2	Volts	$I_C = 100$ mA	$I_B = 10$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 5)		−0.8	−1.0		−0.8	−1.0	Volts	$I_C = 100$ mA	$I_B = 10$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 5)	−0.9	−1.02	−1.4	−0.9	−1.02	−1.4	Volts	$I_C = 500$ mA	$I_B = 50$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 5)		−1.2	−1.75		−1.2	−1.75	Volts	$I_C = 1.0$ A	$I_B = 100$ mA
I_{CES}	Collector Reverse Current		6.0	100				nA	$V_{CE} = -10$ V	$V_{BE} = 0$
I_{CES}	Collector Reverse Current					8.0	100	nA	$V_{CE} = -20$ V	$V_{BE} = 0$
$I_{CES}(65°C)$	Collector Reverse Current		0.1	1.0				μA	$V_{CE} = -10$ V	$V_{BE} = 0$
$I_{CES}(65°C)$	Collector Reverse Current					0.15	1.0	μA	$V_{CE} = -20$ V	$V_{BE} = 0$
C_{eb}	Emitter to Base Capacitance		80	100		80	100	pF	$I_C = 0$	$V_{BE} = 0.5$ V

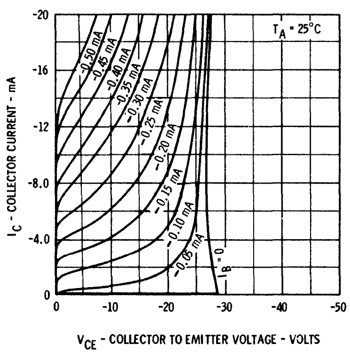
TYPICAL ELECTRICAL CHARACTERISTICS

2N5242

COLLECTOR CHARACTERISTICS*

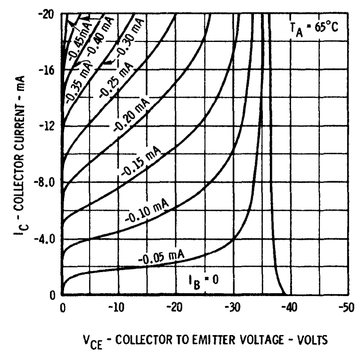


COLLECTOR CHARACTERISTICS*

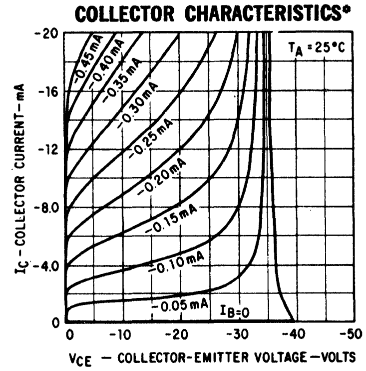


2N5243

COLLECTOR CHARACTERISTICS*

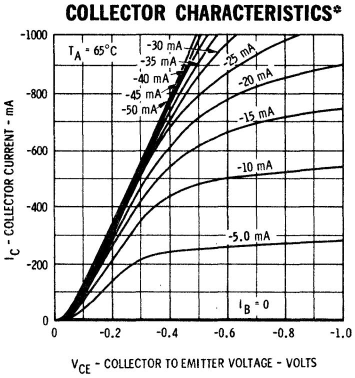


COLLECTOR CHARACTERISTICS*

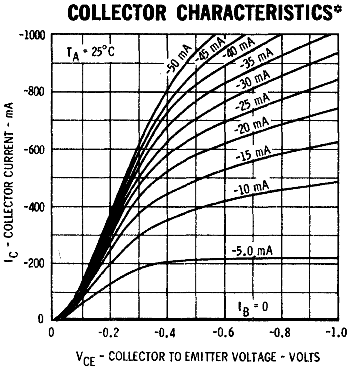


2N5242 • 2N5243

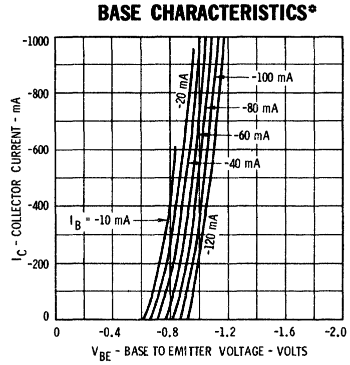
COLLECTOR CHARACTERISTICS*



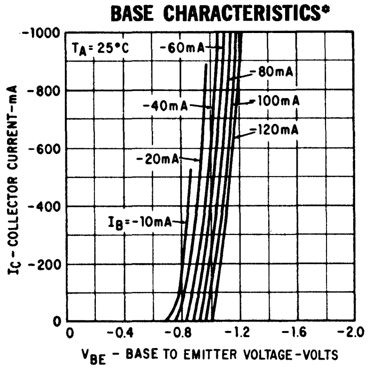
COLLECTOR CHARACTERISTICS*



BASE CHARACTERISTICS*



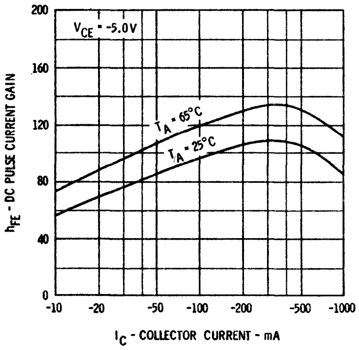
BASE CHARACTERISTICS*



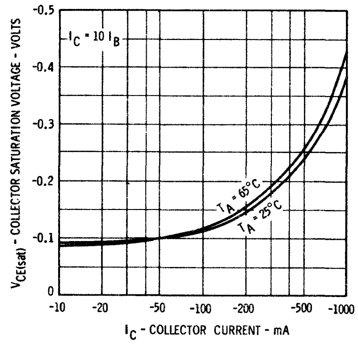
*Single family characteristics on Transistor Curve Tracer

TYPICAL ELECTRICAL CHARACTERISTICS

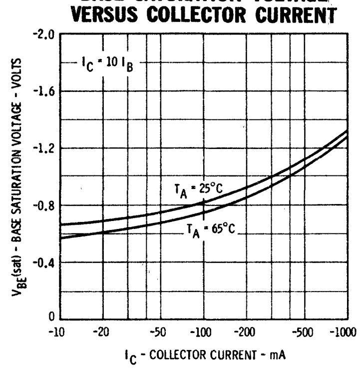
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



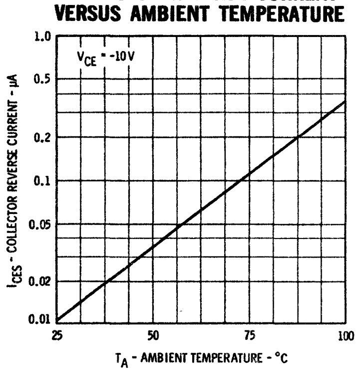
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



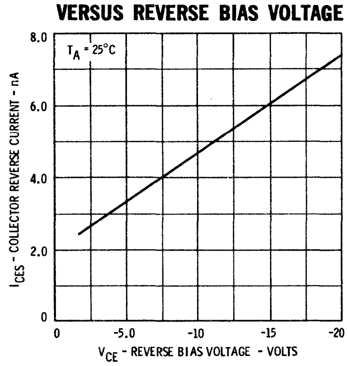
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



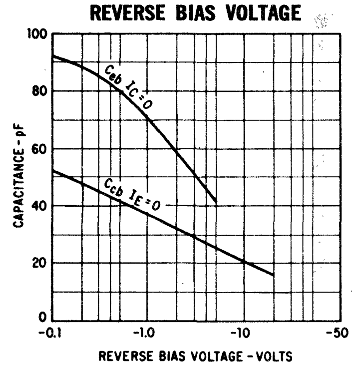
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



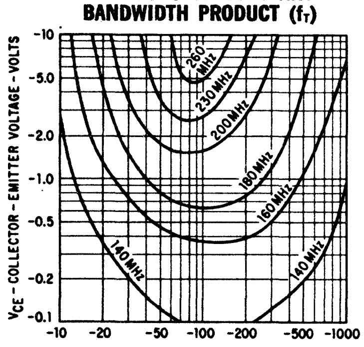
COLLECTOR REVERSE CURRENT VERSUS REVERSE BIAS VOLTAGE



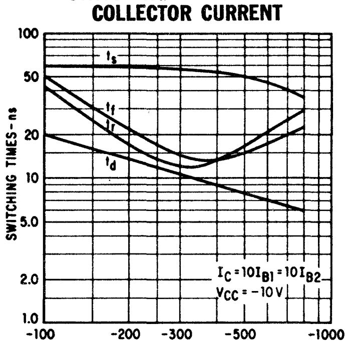
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



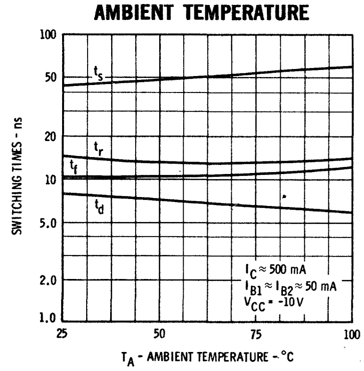
CONTOURS OF CONSTANT BANDWIDTH PRODUCT (f_T)



SWITCHING TIMES VERSUS COLLECTOR CURRENT

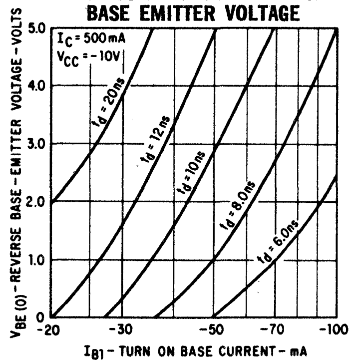


SWITCHING TIMES VERSUS AMBIENT TEMPERATURE

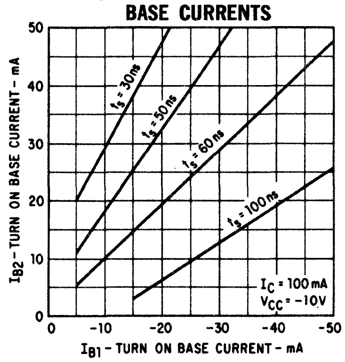


TYPICAL ELECTRICAL CHARACTERISTICS

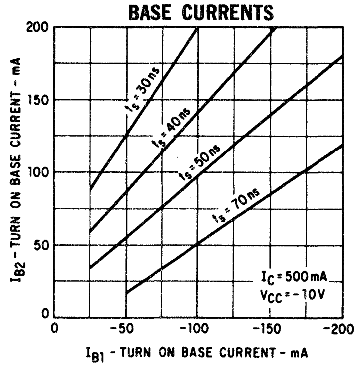
DELAY TIME VERSUS TURN ON BASE CURRENT AND REVERSE BASE EMITTER VOLTAGE



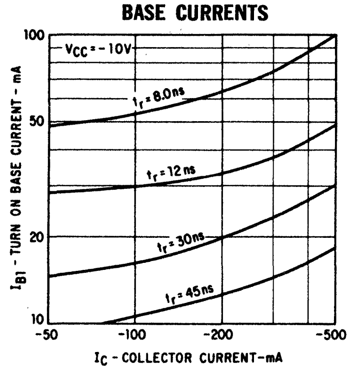
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



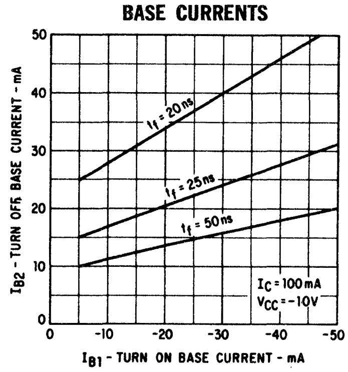
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



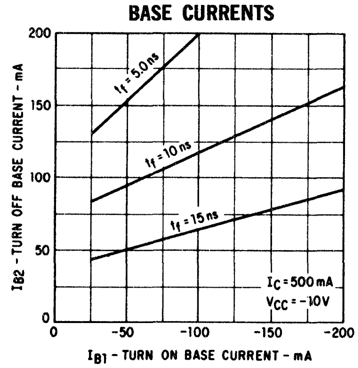
RISE TIME VERSUS COLLECTOR CURRENT AND TURN-ON BASE CURRENTS



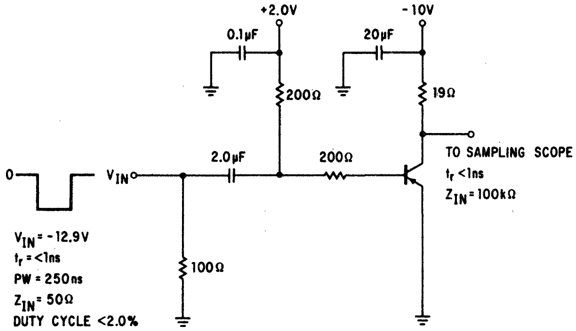
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



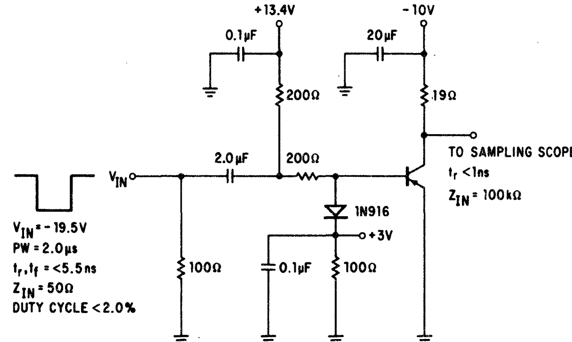
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



TURN-ON CIRCUIT



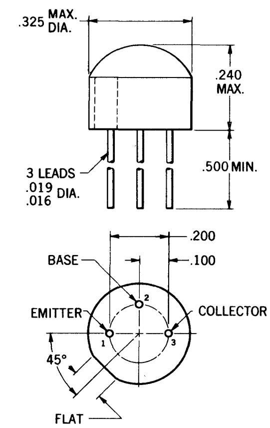
TURN-OFF CIRCUIT



SE6001 • SE6002
NPN HIGH GAIN TYPE
DIFFUSED SILICON PLANAR* TRANSISTORS

GENERAL DESCRIPTION — The Fairchild SE6001 and SE6002 are NPN Silicon Planar Transistors designed for use in applications requiring very high gain. They are suitable for medium power output driver and low power output circuits. These devices are encased in a solid package designed to give maximum mechanical support to the transistor chip.

PHYSICAL DIMENSIONS
(JEDEC TO-105)



NOTES:
All dimensions in inches.
Leads are gold-plated Kovar.
Package weight is 0.68 gram.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Operating Junction Temperature	125°C Maximum
Storage Temperature	−55°C to +125°C
Lead Temperature (Soldering, 10 second time limit)	260°C Maximum

Maximum Power Dissipation (Notes 2 and 3)

Total Dissipation at 25°C Case Temperature	0.8 Watt
at 75°C Case Temperature	0.4 Watt
at 25°C Ambient Temperature	0.3 Watt

Maximum Voltages

V_{CBO}	Collector to Base Voltage	40 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	30 Volts
V_{EBO}	Emitter to Base Voltage	5.0 Volts

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

SYMBOL	CHARACTERISTICS	MIN.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain (Note 5) [SE6001]	50	200		$I_C = 10$ mA	$V_{CE} = 10$ V
h_{FE}	DC Pulse Current Gain (Note 5) [SE6002]	150	600		$I_C = 10$ mA	$V_{CE} = 10$ V
h_{fe}	High Frequency Current Gain (f = 20 MHz)	2.0			$I_C = 30$ mA	$V_{CE} = 10$ V
$V_{CE(sat)}$	Collector Saturation Voltage (Note 5)		1.0	Volt	$I_C = 100$ mA	$I_B = 10$ mA
$V_{BE(on)}$	Base to Emitter "On" Voltage (Note 5)		0.9	Volt	$I_C = 100$ mA	$V_{CE} = 1.0$ V
I_{CBO}	Collector Cutoff Current		500	nA	$I_E = 0$	$V_{CB} = 20$ V
I_{CBO}(75°C)	Collector Cutoff Current		5.0	μA	$I_E = 0$	$V_{CB} = 20$ V
C_{obo}	Output Capacitance		25	pF	$I_E = 0$	$V_{CB} = 10$ V
BV_{CBO}	Collector to Base Breakdown Voltage	40		Volts	$I_C = 100$ μA	$I_E = 0$
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	30		Volts	$I_C = 30$ mA (pulsed)	$I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0		Volts	$I_E = 100$ μA	$I_C = 0$

Notes on page 2.

*Planar is a patented Fairchild process.

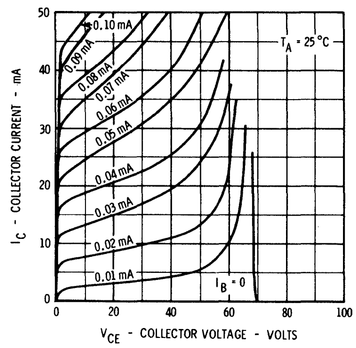
FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

SMALL SIGNAL CHARACTERISTICS (f = 1 kHz)

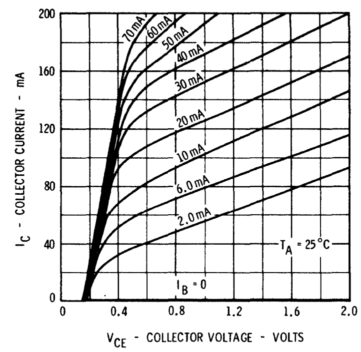
SYMBOL	CHARACTERISTICS	TYP.	UNITS	TEST CONDITIONS	
h_{ie}	Input Resistance	2.5	kΩ	$I_C = 10$ mA	$V_{CE} = 10$ V
h_{oe}	Output Conductance	120	μmhos	$I_C = 10$ mA	$V_{CE} = 10$ V
h_{fe}	Small Signal Current Gain	500		$I_C = 10$ mA	$V_{CE} = 10$ V
h_{re}	Voltage Feedback Ratio	460	$\times 10^{-6}$	$I_C = 10$ mA	$V_{CE} = 10$ V

TYPICAL ELECTRICAL CHARACTERISTICS

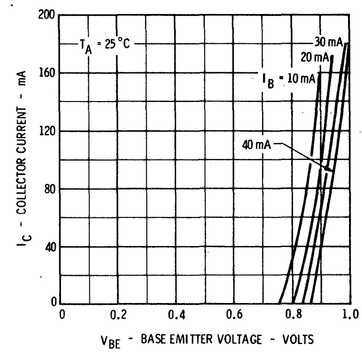
COLLECTOR CHARACTERISTICS*



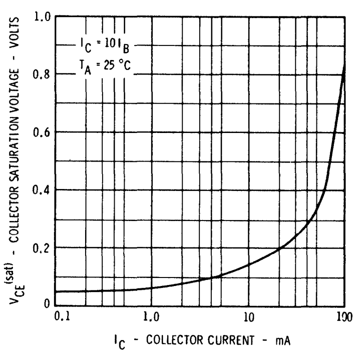
COLLECTOR CHARACTERISTICS*



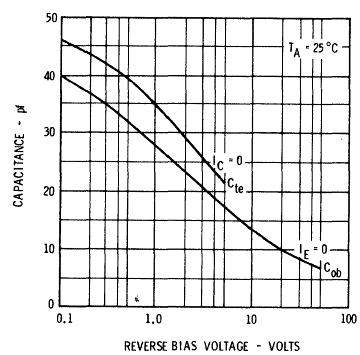
BASE CHARACTERISTICS*



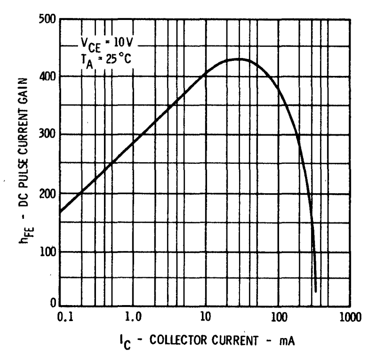
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



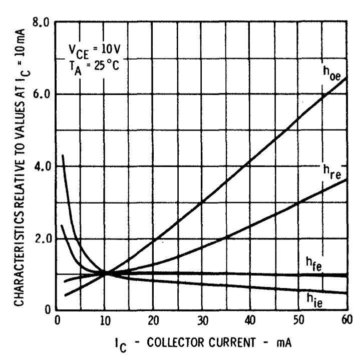
EMITTER TRANSITION AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE

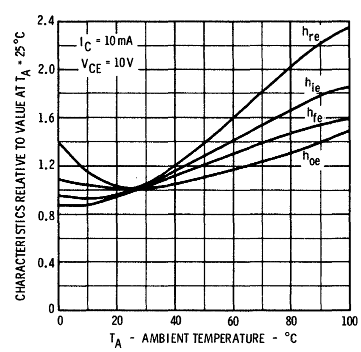


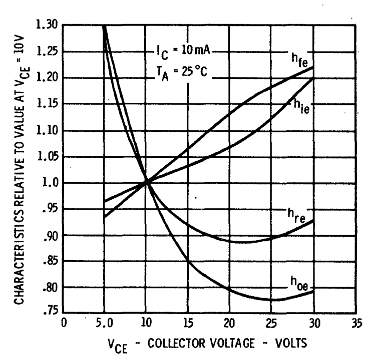
DC PULSED CURRENT GAIN VERSUS COLLECTOR CURRENT



TYPICAL COMMON EMITTER CHARACTERISTICS (f = 1 kHz)







*Single family characteristics on Transistor Curve Tracer

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 125°C and junction to case thermal resistance of 125°C/Watt (derating factor of 8.0 mW/°C); junction to ambient thermal resistance of 333°C/Watt (derating factor of 3.0 mW/°C).
(4) 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%.

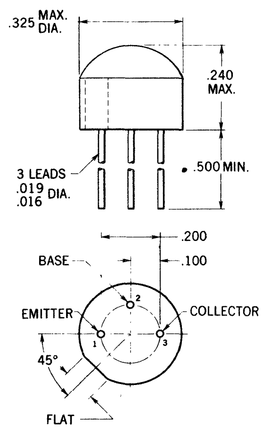
SE6020 · SE6020A · SE6021 · SE6021A · SE6022 · SE6023

NPN GENERAL PURPOSE AMPLIFIERS AND SATURATED SWITCHES

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **P_D . . . . . 4.0 WATTS AT $T_C = 25°C$**
- **LV_{CEO} . . . 80 VOLTS (MIN)**
- **h_{FE} . . . . . 12 SPECIFICATIONS FROM 100 μA TO 500 mA; −55°C TO +65°C**
- **$V_{CE(sat)}$ . . . 0.5 V (MAX) AT 500 mA; 0.18 V (MAX) AT 150 mA**
- **f_T . . . . . . 250 MHz (MIN) AT 50 mA**

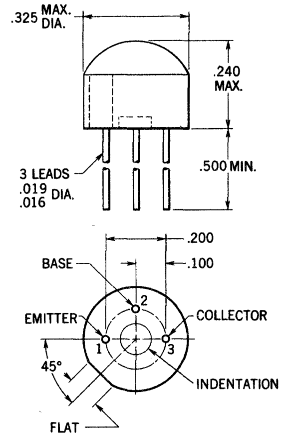
PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES All dimensions in inches
Leads are gold-plated kovar
Package is electrically Non-conductive material
Package weight is 0.66 gram

SE6020 • SE6021

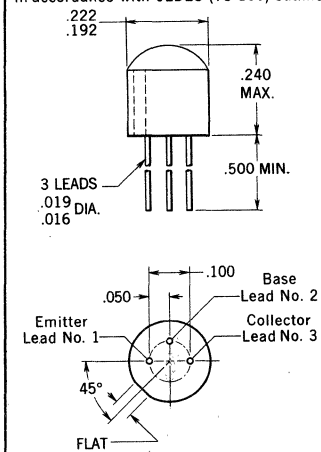
PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated nickel
Package is electrically Non-conductive material
Package weight is 0.66 gram

SE6020A • SE6021A

PHYSICAL DIMENSIONS
In accordance with JEDEC (TO-106) outline



NOTES: All dimensions in inches
All leads electrically isolated from case
Package weight is 0.31 gram. Package is electrically non-conductive material

SE6022 • SE6023

* Planar is a patented Fairchild process.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperature

Storage Temperature	−55°C to +125°C
Operating Junction Temperature	+125°C
Lead Temperature (Soldering, 10 second time limit)	+260°C

Maximum Power Dissipation (Notes 2 and 3)

	SE6020 SE6021	SE6020A SE6021A	SE6022 SE6023
Total Dissipation at 25°C Case Temperature	0.8 Watt	4.0 Watts	0.6 Watt
at 25°C Ambient Temperature	0.3 Watt	0.5 Watt	0.22 Watt

Maximum Voltages and Current

		SE6020 SE6020A SE6022	SE6021 SE6021A SE6023
V_{CBO}	Collector to Base Voltage	60 Volts	80 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	60 Volts	80 Volts
V_{EBO}	Emitter to Base Voltage	6.5 Volts	6.5 Volts
I_C	Collector Current	1.0 Amp	1.0 Amp

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 Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	SE6020 • SE6020 A • SE6022 MIN.	TYP.	MAX.	SE6021 • SE6021 A • SE6023 MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	**DC Pulse Current Gain** (Note 5)	**40**	**100**		**40**	**100**			**$I_C = 150$ mA**	**$V_{CE} = 1.0$ V**
$h_{FE}(-55°C)$	**DC Pulse Current Gain** (Note 5)	**10**	**40**		**10**	**40**			**$I_C = 150$ mA**	**$V_{CE} = 1.0$ V**
$h_{FE}(+65°C)$	DC Pulse Current Gain (Note 5)		120	340		120	340		$I_C = 150$ mA	$V_{CE} = 1.0$ V
h_{FE}	DC Current Gain	30	60		30	70			$I_C = 100\ \mu A$	$V_{CE} = 10$ V
h_{FE}	DC Current Gain	60	100		60	120			$I_C = 1.0$ mA	$V_{CE} = 10$ V
h_{FE}	DC Pulse Current Gain (Note 5)	90	140		90	170			$I_C = 10$ mA	$V_{CE} = 10$ V
h_{FE}	DC Pulse Current Gain (Note 5)	100	150		100	180			$I_C = 50$ mA	$V_{CE} = 10$ V
h_{FE}	**DC Pulse Current Gain** (Note 5)	**100**	**180**	**300**	**100**	**180**	**300**		**$I_C = 150$ mA**	**$V_{CE} = 10$ V**
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 5)	25	60		25	60			$I_C = 150$ mA	$V_{CE} = 10$ V
$h_{FE}(+65°C)$	**DC Pulse Current Gain** (Note 5)		**220**	**380**		**220**	**380**		**$I_C = 150$ mA**	**$V_{CE} = 10$ V**
h_{FE}	DC Pulse Current Gain (Note 5)	70	100		70	120			$I_C = 300$ mA	$V_{CE} = 10$ V
h_{FE}	DC Pulse Current Gain (Note 5)	45	60		45	70			$I_C = 500$ mA	$V_{CE} = 10$ V
h_{fe}	**High Frequency Current Gain ($f = 100$ MHz)**	**2.5**	**4.0**	**6.0**	**2.5**	**4.0**	**6.0**		**$I_C = 50$ mA**	**$V_{CE} = 5.0$ V**
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 5)		0.04	0.07		0.04	0.07	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 5)		**0.15**	**0.18**		**0.15**	**0.18**	**Volts**	**$I_C = 150$ mA**	**$I_B = 15$ mA**
$V_{CE(sat)}(+65°C)$	Pulsed Collector Saturation Voltage (Note 5)		0.14	0.28		0.14	0.28	Volts	$I_C = 150$ mA	$I_B = 15$ mA
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 5)		0.23	0.31		0.27	0.31	Volts	$I_C = 300$ mA	$I_B = 30$ mA
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 5)		0.36	0.5		0.42	0.5	Volts	$I_C = 500$ mA	$I_B = 50$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 5)		0.67	0.72		0.67	0.72	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
$V_{BE(sat)}$	**Pulsed Base Saturation Voltage** (Note 5)	**0.78**	**0.82**	**0.90**	**0.78**	**0.82**	**0.90**	**Volts**	**$I_C = 150$ mA**	**$I_B = 15$ mA**
$V_{BE(sat)}(-55°C)$	**Pulsed Base Saturation Voltage** (Note 5)		**0.92**	**1.10**		**0.92**	**1.10**	**Volts**	**$I_C = 150$ mA**	**$I_B = 15$ mA**
$V_{BE(sat)}(+65°C)$	**Pulsed Base Saturation Voltage** (Note 5)	**0.72**	**0.82**		**0.72**	**0.82**		**Volts**	**$I_C = 150$ mA**	**$I_B = 15$ mA**
$V_{BE(sat)}$	**Pulsed Base Saturation Voltage** (Note 5)		**0.95**	**1.05**		**0.95**	**1.05**	**Volts**	**$I_C = 300$ mA**	**$I_B = 30$ mA**
$V_{BE(sat)}$	**Pulsed Base Saturation Voltage** (Note 5)		**1.1**	**1.3**		**1.1**	**1.3**	**Volts**	**$I_C = 500$ mA**	**$I_B = 50$ mA**
$V_{BE}(on)$	Pulsed Base Emitter On Voltage		0.75	0.88		0.75	0.88	Volts	$I_C = 150$ mA	$V_{CE} = 10$ V
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	60			80			Volts	$I_C = 10$ mA	$I_B = 0$
BV_{CES}	Collector to Base Breakdown Voltage	60			80			Volts	$I_C = 10\ \mu A$	$I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.5			6.5			Volts	$I_C = 0$	$I_E = 10\ \mu A$
I_{CBO}	Collector Cutoff Current		1.0	100		1.0	100	nA	$I_E = 0$	$V_{CB} = 50$ V
$I_{CBO}(+65°C)$	Collector Cutoff Current		1.0	10		1.0	10	μA	$I_E = 0$	$V_{CB} = 50$ V
I_{EBO}	Emitter Cutoff Current		1.0	100		1.0	100	nA	$I_C = 0$	$V_{EB} = 4.0$ V
C_{cb}	Collector to Base Capacitance ($f = 1.0$ MHz)		11	15		11	15	pF	$I_E = 0$	$V_{CB} = 10$ V
C_{eb}	Emitter to Base Capacitance ($f = 1.0$ MHz)		50	75		50	75	pF	$I_C = 0$	$V_{EB} = 0.5$ V
t_{on}	Turn On Time (Fig. 1)		70	150		70	150	ns	$I_C \approx 150$ mA	$I_{B1} \approx 15$ mA
t_{off}	Turn Off Time (Fig. 1)		700	1000		700	1000	ns	$I_C \approx 150$ mA	$I_{B1} \approx 15$ mA
										$I_{B2} \approx -15$ mA
t_{on}	Turn On Time (Fig. 1)		80			80		ns	$I_C \approx 300$ mA	$I_{B1} \approx 30$ mA
t_{off}	Turn Off Time (Fig. 1)		600			600		ns	$I_C \approx 300$ mA	$I_{B1} \approx 30$ mA
										$I_{B2} \approx -30$ mA
t_{on}	Turn On Time (Fig. 1)		100			100		ns	$I_C \approx 500$ mA	$I_{B1} \approx 50$ mA
t_{off}	Turn Off Time (Fig. 1)		500			500		ns	$I_C \approx 500$ mA	$I_{B1} \approx 50$ mA
										$I_{B2} \approx -50$ mA

t_{on}, t_{off} TEST CIRCUIT

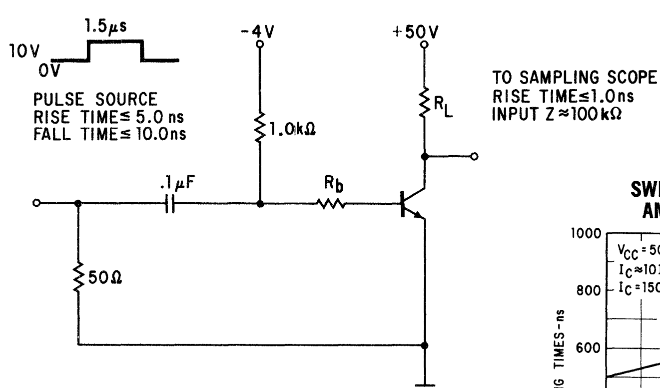
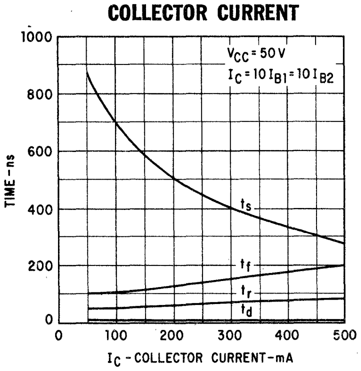


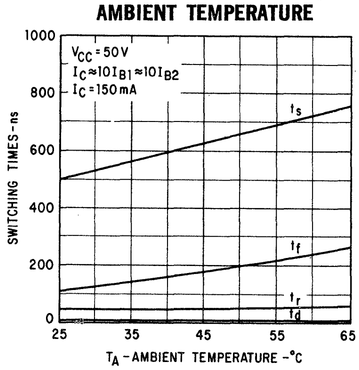
FIG. 1

I_C	R_b	R_L
150 mA	314 Ω	330 Ω
300 mA	157 Ω	167 Ω
500 mA	94 Ω	100 Ω

SWITCHING TIMES VERSUS COLLECTOR CURRENT

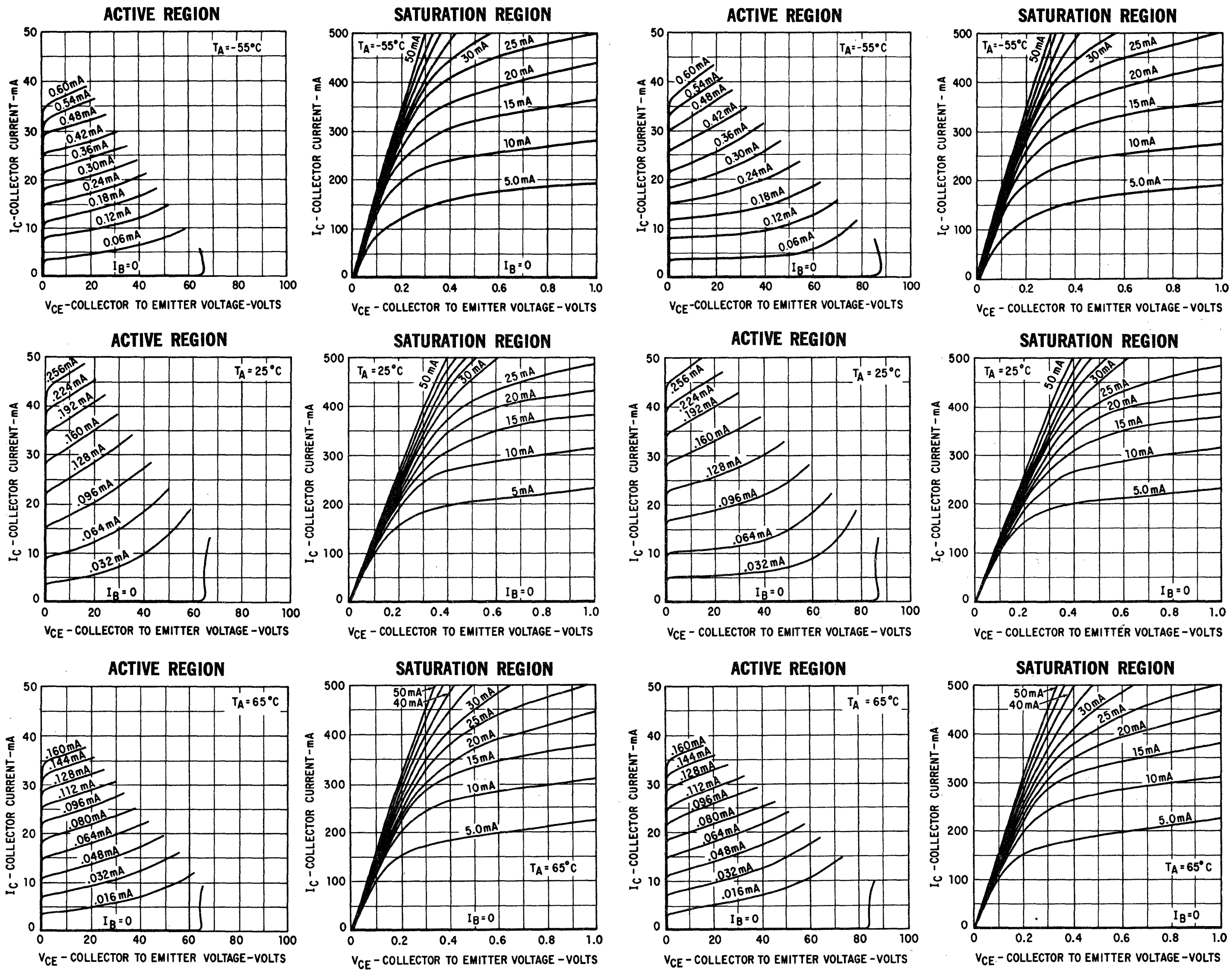


SWITCHING TIMES VERSUS AMBIENT TEMPERATURE

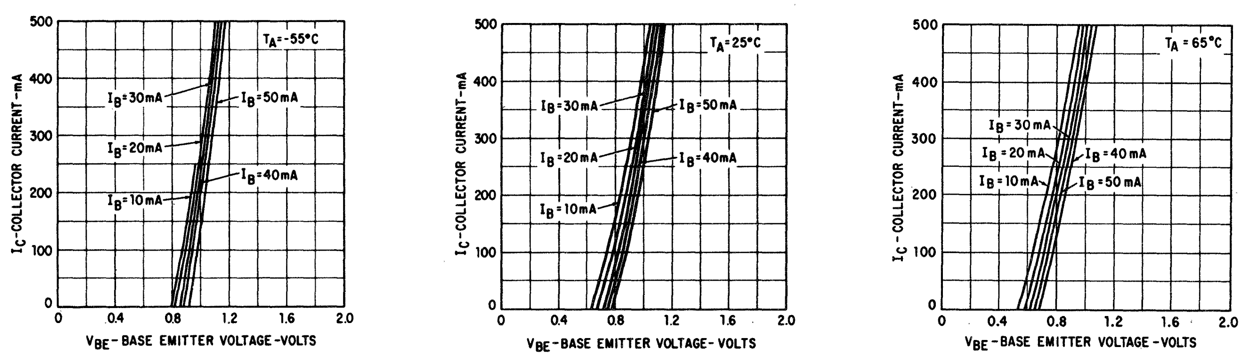


TYPICAL COLLECTOR CHARACTERISTICS*

SE6020 • SE6020A • SE6022 SE6021 • SE6021A • SE6023



TYPICAL BASE CHARACTERISTICS*



* Single family characteristic on Transistor Curve Tracer.

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 125°C and junction to case thermal resistance of 125°C/Watt (derating factor of 8.0 mW/°C) for the SE6020, SE6021 and 333°C/Watt (derating factor of 3.0 mW/°C) for the SE6022 and SE6023. Junction to ambient thermal resistance of 167°C/Watt (derating factor of 6.0 mW/°C) for the SE6020, SE6021 and 455°C/Watt (derating factor of 2.2 mW/°C) for the SE6022 and SE6023. Junction to case thermal resistance of 25°C/Watt (derating factor of 40 mW/°C) and a junction to ambient thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C) for the SE6020A, SE6021A.

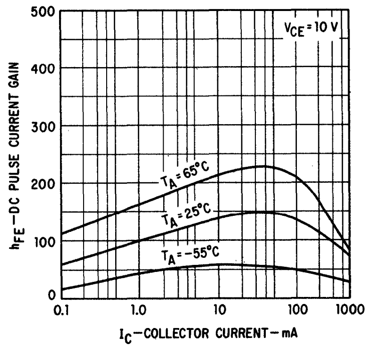
(4) Rating refers to a high-current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.

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

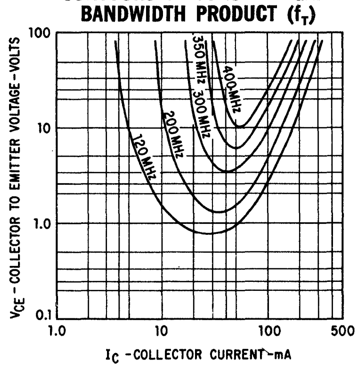
(6) See switching circuit for exact values of I_C, I_{B1}, and I_{B2}.

TYPICAL ELECTRICAL CHARACTERISTICS

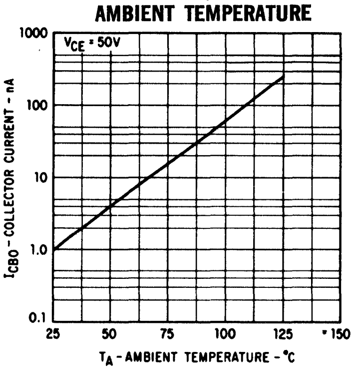
PULSE DC CURRENT GAIN VERSUS COLLECTOR CURRENT



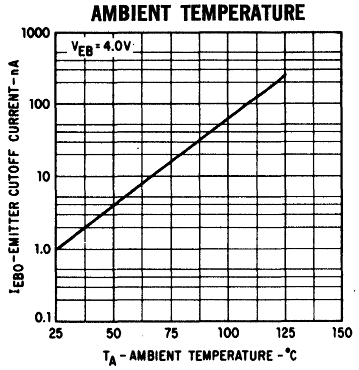
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (fT)



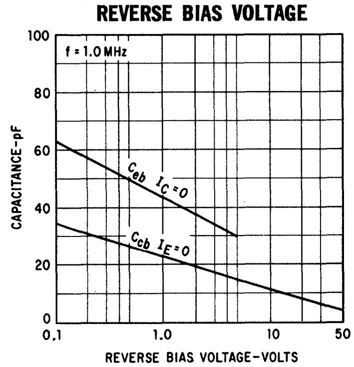
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



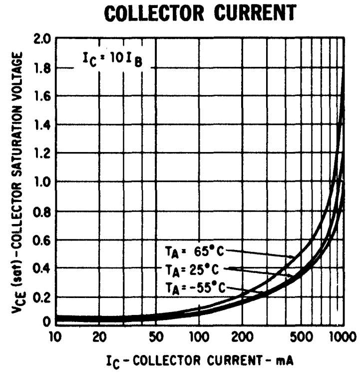
EMITTER CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



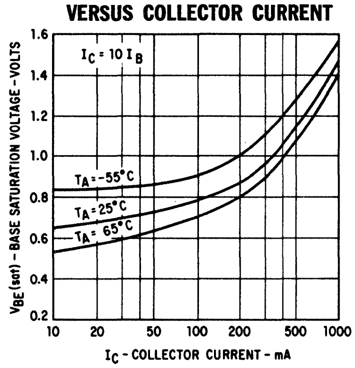
COLLECTOR-BASE AND EMITTER-BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



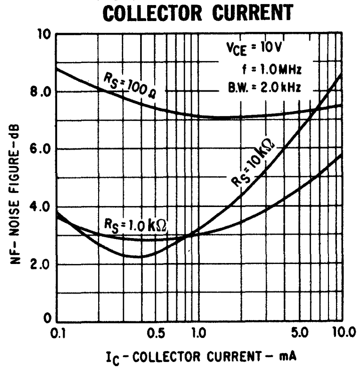
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



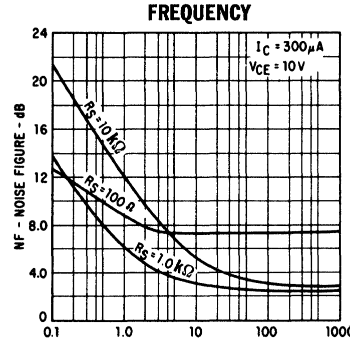
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



NOISE FIGURE VERSUS COLLECTOR CURRENT



NOISE FIGURE VERSUS FREQUENCY



FAIRCHILD

SEMICONDUCTOR

A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

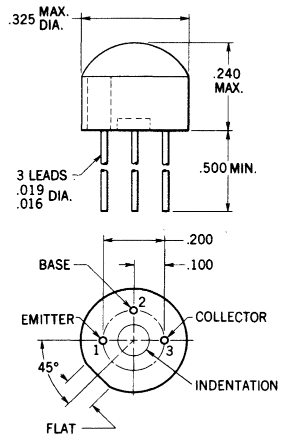
SE7015 • SE7016 • SE7017

NPN HIGH VOLTAGE AMPLIFIERS

DIFFUSED SILICON PLANAR* TRANSISTORS

- **HIGH POWER . . . . . . $P_D = 3.0$ W AT $T_C = 25°C$**
  $P_D = 0.45$ W AT $T_A = 25°C$
- **HIGH VOLTAGE . . . . . LV_{CEO} = (MIN) 100 V (SE7015); 140 V (SE7016); 180 V (SE7017)**
- **LOW CAPACITANCE . . . $C_{cb} = 3.0$ pF (MAX) AT 20 V (SE7017)**
- **HIGH FREQUENCY . . . $f_T = 50$ MHz (MIN) AT 10 mA**

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES: All dimensions in inches
Leads are gold-plated nickel
Package is electrically Non-conductive material
Package weight is 0 66 gram

*Planar is a patented Fairchild process.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperature				
Storage Temperature				−55°C to +125°C
Operating Junction Temperature				+125°C
Lead Temperature (Soldering, 10 second time limit)				+260°C
Maximum Power Dissipation (Notes 2 and 3)				
Total Dissipation at 25°C Case Temperature				**3.0 Watts**
at 25°C Ambient Temperature				**0.45 Watt**
Maximum Voltages		**SE7015**	**SE7016**	**SE7017**
V_{CBO}	Collector to Base Voltage	100 Volts	140 Volts	180 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	100 Volts	140 Volts	180 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts	6.0 Volts	6.0 Volts

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

SYMBOL	CHARACTERISTIC	SE7015 MIN.	SE7015 TYP.	SE7015 MAX.	SE7016 MIN.	SE7016 TYP.	SE7016 MAX.	SE7017 MIN.	SE7017 TYP.	SE7017 MAX.	UNITS	TEST CONDITIONS	
$\mathbf{C_{cb}}$	**Collector to Base Capacitance**		2.8	3.5		2.8	3.5		**2.4**	**3.0**	**pF**	$\mathbf{I_E = 0}$	$\mathbf{V_{CB} = 20\ V}$
$\mathbf{h_{fe}}$	**High Frequency Gain (f = 20 MHz)**	**2.5**	**4.3**		**2.5**	**4.3**		**2.5**	**4.3**			$\mathbf{I_C = 10\ mA}$	$\mathbf{V_{CE} = 10\ V}$
h_{FE}	DC Current Gain	30	75		30	75		30	75			$I_C = 1.0$ mA	$V_{CE} = 10$ V
h_{FE}	DC Pulse Current Gain (Note 5)	50	90	275	50	90	275	50	90	275		$I_C = 25$ mA	$V_{CE} = 10$ V
h_{FE}	DC Pulse Current Gain (Note 5)	30	75		30	75		30	75			$I_C = 50$ mA	$V_{CE} = 10$ V
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 5)	15	25		15	25		15	25			$I_C = 25$ mA	$V_{CE} = 10$ V
$\mathbf{V_{CEO(sus)}}$	**Collector to Emitter Voltage** (Notes 4 & 5)	**100**			**140**			**180**			**Volts**	$\mathbf{I_C = 10\ mA}$	$\mathbf{I_B = 0}$
BV_{CBO}	Collector to Base Breakdown Voltage	100			140			180			Volts	$I_C = 100\ \mu A$	$I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			6.0			6.0			Volts	$I_C = 0$	$I_E = 100\ \mu A$
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage		0.3	2.0		0.3	2.0		0.3	2.0	Volts	$I_C = 25$ mA	$I_B = 2.5$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 5)		0.77	0.9		0.77	0.9		0.77	0.9	Volts	$I_C = 25$ mA	$I_B = 2.5$ mA
I_{CBO}	Collector Cutoff Current		0.1	10							nA	$I_E = 0$	$V_{CB} = 80$ V
I_{CBO}	Collector Cutoff Current					0.1	10				nA	$I_E = 0$	$V_{CB} = 110$ V
I_{CBO}	Collector Cutoff Current								0.1	10	nA	$I_E = 0$	$V_{CB} = 150$ V
$I_{CBO}(65°C)$	Collector Cutoff Current		0.001	1.0							μA	$I_E = 0$	$V_{CB} = 80$ V
$I_{CBO}(65°C)$	Collector Cutoff Current					0.001	1.0				μA	$I_E = 0$	$V_{CB} = 110$ V
$I_{CBO}(65°C)$	Collector Cutoff Current								0.001	1.0	μA	$I_E = 0$	$V_{CB} = 150$ V
I_{EBO}	Emitter Cutoff Current		0.005	10		0.005	10		0.005	10	nA	$I_C = 0$	$V_{EB} = 4.0$ V
C_{eb}	Emitter to Base Capacitance		17	25		17	25		17	25	pF	$I_C = 0$	$V_{EB} = 0.5$ V
$R_e(h_{ie})$	Real Part of Input Impedance (f = 300 MHz)			50			50			50	Ω	$I_C = 10$ mA	$V_{CE} = 10$ V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	40	100		40	100		40	100			$I_C = 25$ mA	$V_{CE} = 10$ V

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

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

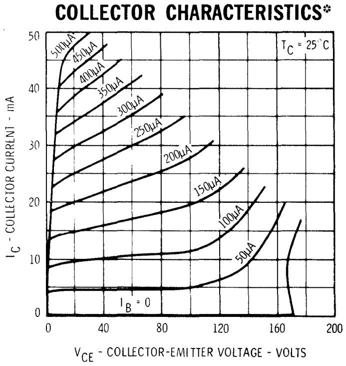
NOTES:

(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 125°C and junction to case thermal resistance of 33.3°C/Watt (derating factor of 30 mW/°C); junction to ambient thermal resistance of 222°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.
(5) Pulse Conditions: length = 300 μs; duty cycle = 1%.

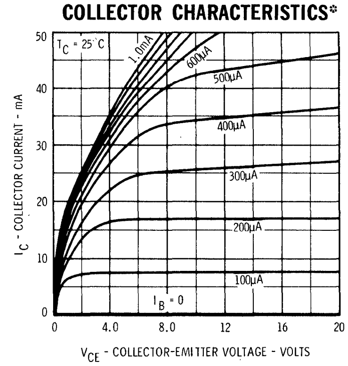
TYPICAL ELECTRICAL CHARACTERISTICS (SE7016 ONLY)

(Except Safe Operating Area, which is a guarantee)

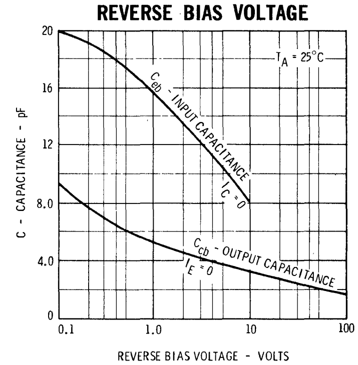
COLLECTOR CHARACTERISTICS*



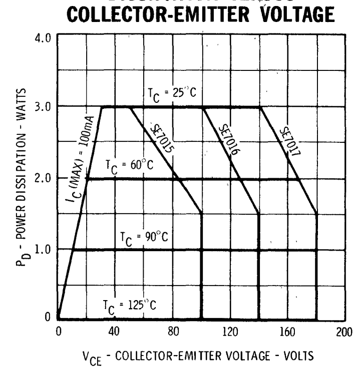
COLLECTOR CHARACTERISTICS*



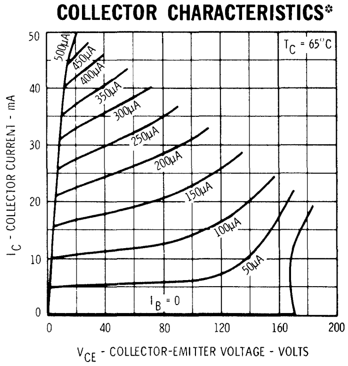
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



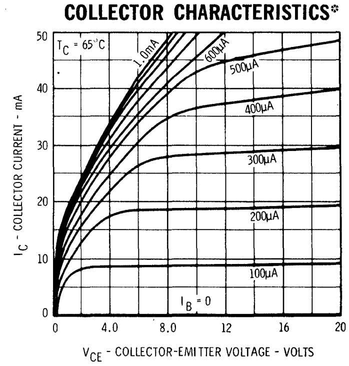
GUARANTEED MAXIMUM FORWARD BIASED POWER DISSIPATION VERSUS COLLECTOR-EMITTER VOLTAGE



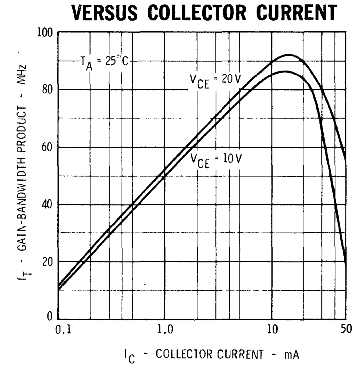
COLLECTOR CHARACTERISTICS*



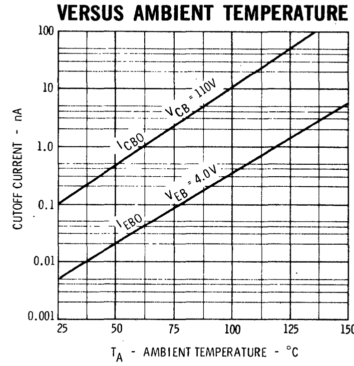
COLLECTOR CHARACTERISTICS*



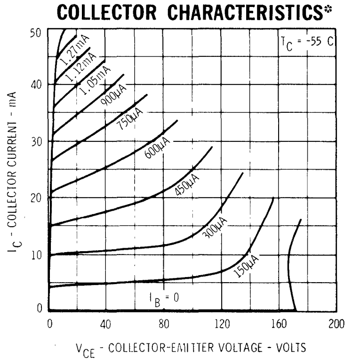
GAIN—BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT



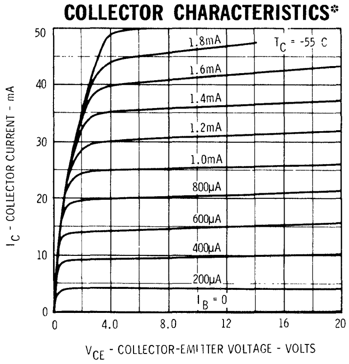
COLLECTOR & EMITTER CUTOFF CURRENTS VERSUS AMBIENT TEMPERATURE



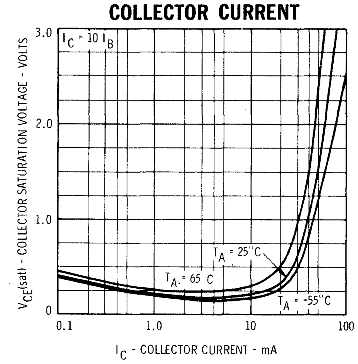
COLLECTOR CHARACTERISTICS*



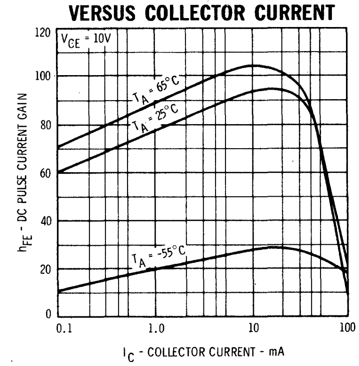
COLLECTOR CHARACTERISTICS*



COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



* Single Family Characteristics on Transistor Curve Tracer.

SE8010 • SE8012

NPN RF AMPLIFIER

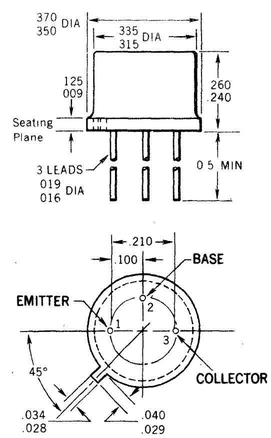
DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **HIGH POWER DISSIPATION . . . $P_D = 800$ mW AT $T_A = 25°C$**
  $P_D = 4.0$ W AT $T_C = 25°C$
- **HIGH POWER GAIN . . . . 600 mW P_O AT 27 MHz**
- **HIGH VOLTAGE . . . . $LV_{CEO} = 60$ V**

ABSOLUTE MAXIMUM RATINGS (Note 1)

	SE8010	SE8012
Maximum Temperatures	**SE8010**	**SE8012**
Storage Temperature	−65°C to +200°C	−65°C to +125°C
Operating Junction Temperature	200°C Maximum	125°C Maximum
Maximum Power Dissipation (Notes 2 and 3)	**SE8010**	**SE8012**
Total Dissipation at 25°C Case Temperature	**4.0 W**	**4.0 W**
at 25°C Free Air Temperature	**800 mW**	**500 mW**
Maximum Voltages and Current	**SE8010**	**SE8012**
V_{CBO} Collector to Base Voltage	100 Volts	100 Volts
V_{CEO} Collector to Emitter Voltage (Note 4)	**60 Volts**	**60 Volts**
V_{EBO} Emitter to Base Voltage	6.0 Volts	6.0 Volts
I_C Collector Current	500 mA	500 mA

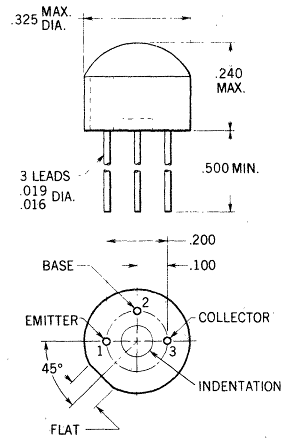
PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-39) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Collector internally connected to case
Package weight is 1.23 gram

SE8010

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES. All dimensions in inches
Leads are gold-plated nickel
Package is electrically Non-conductive material
Package weight is 0.66 gram

SE8012

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

*Planar is a patented Fairchild process.

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
G_{PE}	**Amplifier Power Gain (f = 27 MHz)** (Note 6)	**10.8**	**12**		**dB**	**$V_{CE} = 12$ V**	**$P_{in} = 50$ mW**
h_{FE}	DC Pulse Current Gain (Note 5)	40		150		$I_C = 100$ mA	$V_{CE} = 1.0$ V
h_{FE}	DC Pulse Current Gain (Note 5)	15				$I_C = 500$ mA	$V_{CE} = 3.0$ V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	3.0				$I_C = 50$ mA	$V_{CE} = 10$ V
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 5)			0.75	Volts	$I_C = 500$ mA	$I_B = 50$ mA
$V_{BE(sat)}$	Pulsed Emitter Saturation Voltage (Note 5)			1.20	Volts	$I_C = 500$ mA	$I_B = 50$ mA
I_{CES}	Collector Reverse Current			500	nA	$V_{CE} = 50$ V	$V_{EB} = 0$
C_{cb}	Collector-Base Capacitance			9.0	pF	$V_{CB} = 10$ V	$I_E = 0$
C_{eb}	Emitter-Base Capacitance			65	pF	$V_{EB} = 0.5$ V	$I_C = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	100			Volts	$I_C = 100\ \mu A$	$I_E = 0$
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage** (Note 5)	**60**			**Volts**	**$I_C = 10$ mA**	**$I_B = 0$**
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			Volts	$I_E = 100\mu A$	$I_C = 0$

NOTES:

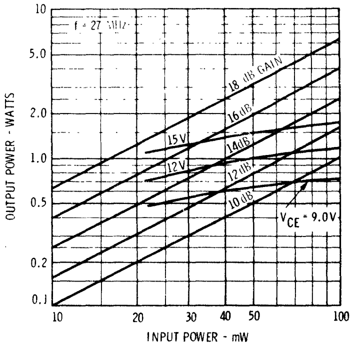
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
(3) These ratings give a maximum junction temperature of 200°C, a junction to case thermal resistance of 43.8°C/Watt (derating factor of 22.8 mW/°C) and a junction to ambient thermal resistance of 219°C/Watt (derating factor of 4.56 mW/°C) for the SE8010. These ratings give a maximum junction temperature of 125°C, a junction to case thermal resistance of 25°C/Watt (derating factor of 40 mW/°C) and a junction to ambient thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C) for the SE8012.
(4) Rating refers to a high-current point where collector to emitter voltage is lowest.
(5) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(6) See Test Circuit.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

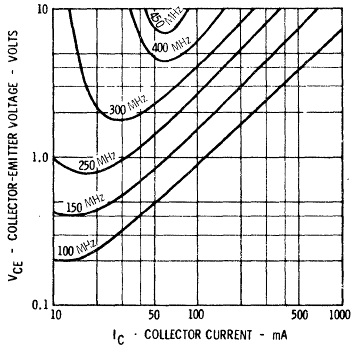
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

TYPICAL ELECTRICAL CHARACTERISTICS

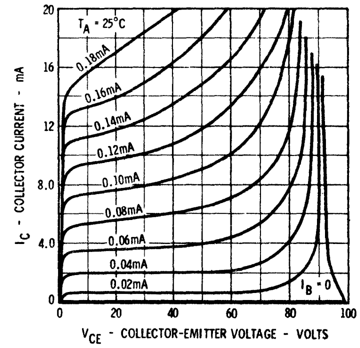
TYPICAL DRIVER AMPLIFIER PERFORMANCE



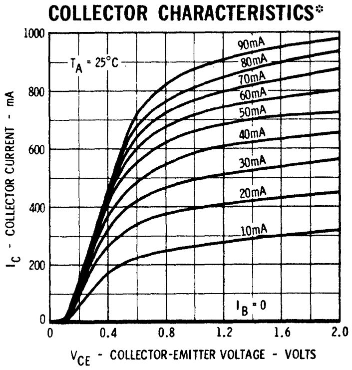
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



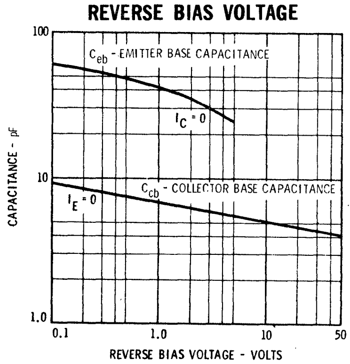
COLLECTOR CHARACTERISTICS*



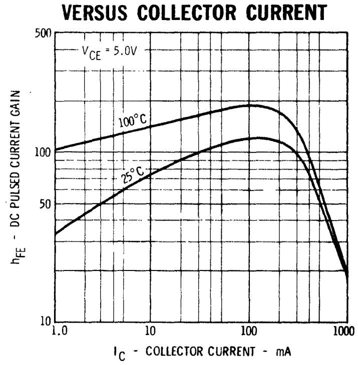
COLLECTOR CHARACTERISTICS*



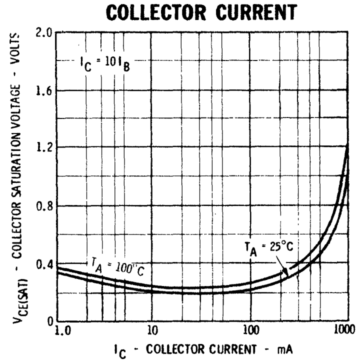
COLLECTOR AND EMITTER CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



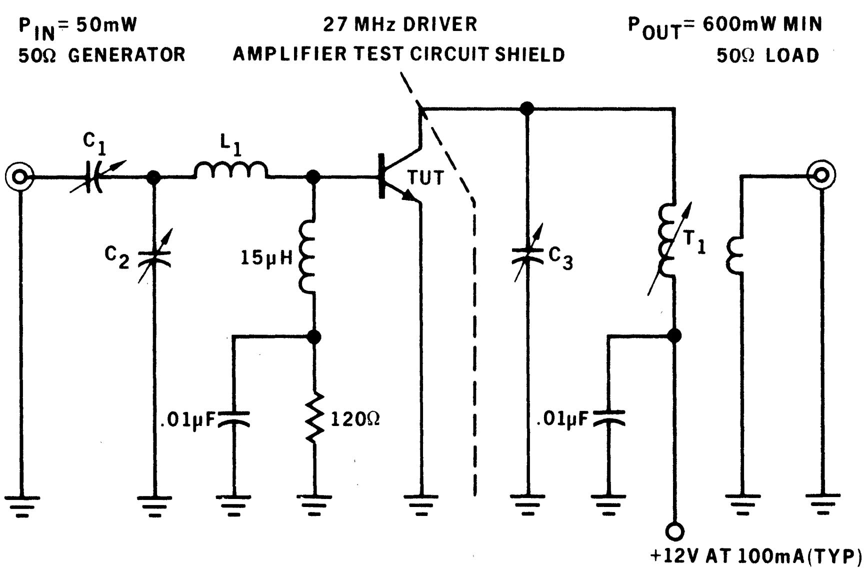
DC PULSED CURRENT GAIN VERSUS COLLECTOR CURRENT



COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



*Single family characteristic on Transistor Curve Tracer.



C_1, C_2 — 7 to 100pF, compression mica trimmer (Arco 423)
C_3 — 43 to 63pF, compression mica trimmer (Arco 402) in parallel with 43pF. Dipped mica.
L_1 — 0.35μH (7 T Air Dux 408)
T_1 — 9 turns primary, 5 turns secondary
No. 18 enamel close wound on ¼ inch slug tuned form
(CTC 1535-2-2, red slug).

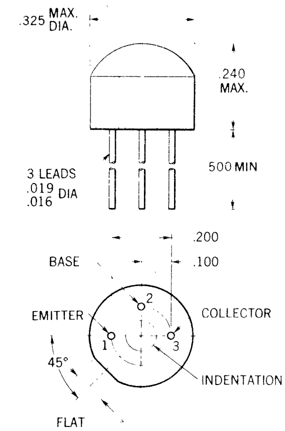
SE8040 • SE8041 • SE8042 • SE8540 • SE8541 • SE8542

NPN-PNP GENERAL PURPOSE COMPLEMENTARY AMPLIFIERS

DIFFUSED SILICON PLANAR* TRANSISTORS

- **MATCHED h_{FE} GROUPINGS AVAILABLE (See Note 7)**
- **HIGH GAIN** . . . . **h_{FE} = 40-540 AT 150 mA, 1.0 V**
  h_{FE} = 30 (MIN) AT 500 mA, 1.0 V
- **NPN AND PNP COMPLEMENTS (Note 7)** . . . **SE8040, SE8041 AND SE8042 ARE NPN**
  SE8540, SE8541 AND SE8542 ARE PNP
- **LOW SATURATION VOLTAGE** . . . . **$V_{CE(sat)}$ = 0.12 V (MAX) AT 150 mA, 0.3 V (MAX) AT 500 mA FOR SE8040, SE8041 AND SE8042**
  $V_{CE(sat)}$ = —0.25 V (MAX) AT 150 mA, —0.7 V (MAX) AT 500 mA FOR SE8540, SE8541 AND SE8542

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-105) outline



NOTES All dimensions in inches
Leads are gold plated nickel
Package is electrically Non conductive material
Package weight is 0.66 gram

SE8040 • SE8540

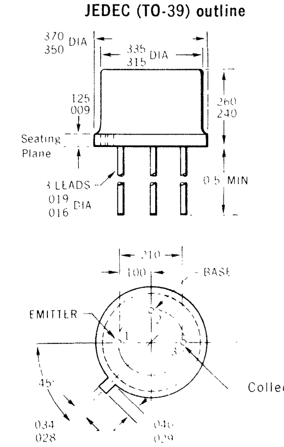
ABSOLUTE MAXIMUM RATINGS (Note 1)	**SE8040**	**SE8041**	**SE8042**
Maximum Temperatures	**SE8540**	**SE8541**	**SE8542**
Storage Temperature	−55°C to +125°C	−65°C to +200°C	−65°C to +200°C
Operating Junction Temperature	+125°C	+200°C	+200°C
Lead Temperature (Soldering, 10 second time limit)	+260°C	+300°C	+300°C
Maximum Power Dissipation (Notes 2, 3 and 4)			
Total Dissipation at or below 100°C Case Temperature			4.0 Watts
Total Dissipation at 25°C Case Temperature	4.0 Watts	4.0 Watts	
at 25°C Free Air Temperature	0.5 Watt	0.8 Watt	1.0 Watt

Maximum Voltages and Current		**SE8040 SE8041 SE8042**	**SE8540 SE8541 SE8542**
V_{CBO}	Collector to Base Voltage	30 Volts	−30 Volts
V_{CEO}	Collector to Emitter Voltage (Note 5)	30 Volts	−30 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts	−5.0 Volts
I_C	Continuous Collector Current (T_C = +75°C)	1.0 Amp	1.0 Amp
I_C	Continuous Collector Current (T_C = +100°C)	0.75 Amp	0.75 Amp

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

SYMBOL	CHARACTERISTICS		MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS (Reverse Voltage Polarity For PNP)	
h_{FE}	**DC Pulse Current Gain** (Note 6)		**40**	**70**	**540**		**I_C = 150 mA**	**V_{CE} = 1.0 V**
h_{FE}	**DC Pulse Current Gain** (Note 6)		**30**	**65**			**I_C = 500 mA**	**V_{CE} = 1.0 V**
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 5 & 6)	SE8040 SE8041, SE8042	30			Volts	I_C = 30 mA	I_B = 0
$V_{CEO(sus)}$	Collector to Emitter Sustaining Voltage (Notes 5 & 6)	SE8540 SE8541, SE8042	−30			Volts	I_C = 30 mA	I_B = 0
BV_{CBO}	Collector to Base Breakdown Voltage	SE8040 SE8041, SE8042	30			Volts	I_C = 10 μA	I_E = 0
BV_{CBO}	Collector to Base Breakdown Voltage	SE8540 SE8541, SE8542	−30			Volts	I_C = 100 μA	I_E = 0
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 6)	SE8040 SE8041, SE8042		0.35	1.0	Volts	I_C = 1.0 A	I_B = 33 mA
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage (Note 6)	SE8540 SE8541, SE8542		−0.5	−1.3	Volts	I_C = 1.0 A	I_B = 33 mA
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 6)	**SE8040 SE8041, SE8042**		**0.2**	**0.3**	**Volts**	**I_C = 500 mA**	**I_B = 25 mA**
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 6)	**SE8540 SE8541, SE8542**		**—0.3**	**—0.7**	**Volts**	**I_C = 500 mA**	**I_B = 25 mA**
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 6)	**SE8040 SE8041, SE8042**		**0.08**	**0.12**	**Volts**	**I_C = 150 mA**	**I_B = 15 mA**
$V_{CE(sat)}$	**Pulsed Collector Saturation Voltage** (Note 6)	**SE8540 SE8541, SE8542**		**—0.15**	**—0.25**	**Volts**	**I_C = 150 mA**	**I_B = 15 mA**

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



NOTES: All dimensions in inches
Leads are gold plated kovar
Collector internally connected to case
Package weight is 1.23 grams

SE8041 • SE8541
SE8042 • SE8542

Additional Electrical Characteristics on Page 2

Notes on Page 6

*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

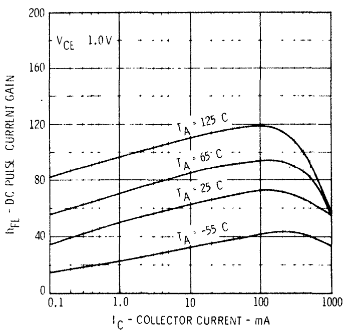
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

SYMBOL	CHARACTERISTICS	SE8040 • SE8041 • SE8042 MIN.	TYP.	MAX.	SE8540 • SE8541 • SE8542 MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS (Reverse Voltage Polarity For SE8540 • SE8541 • SE8542)	
h_{FE}	DC Pulse Current Gain (Note 6)	30	60		30	68			$I_C = 10$ mA	$V_{CE} = 1.0$ V
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 6)		0.95	1.2		−0.96	−1.2	Volts	$I_C = 1.0$ A	$I_B = 33$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 6)		0.93	1.0		−0.92	−1.15	Volts	$I_C = 500$ mA	$I_B = 25$ mA
$V_{BE(sat)}$	Pulsed Base Saturation Voltage (Note 6)		0.82	0.85		−0.79	−1.1	Volts	$I_C = 150$ mA	$I_B = 15$ mA
$V_{BE(on)}$	Pulsed Base Emitter (On) Voltage (Note 6)	0.63	0.68	0.73	−0.65	−0.68	−0.75	Volts	$I_C = 20$ mA	$V_{CE} = 5.0$ V
I_{CBO}	Collector Cutoff Current		0.9	50		0.1	50	nA	$I_E = 0$	$V_{CB} = 25$ V
I_{CBO}(65°C)	Collector Cutoff Current	(SE8040)	.008	5.0	(SE8540)	.002	1.0	μA	$I_E = 0$	$V_{CB} = 25$ V
I_{CBO}(125°C)	Collector Cutoff Current	(SE8041, SE8042)	0.1	20	(SE8541, SE8542)	0.1	20	μA	$I_E = 0$	$V_{CB} = 25$ V
BV_{EBO}	Base to Emitter Breakdown Voltage	6.0			−5.0			Volts	$I_E = 10$ μA	$I_C = 0$
I_{EBO}	Base to Emitter Cutoff Current		2.0	50		2.0	50	nA	$I_C = 0$	$V_{EB} = 4.0$ V
h_{fe}	High Frequency Current Gain (f = 100 MHz)	1.3	2.3	5.0	1.0	2.0	5.0		$I_C = 50$ mA	$V_{CE} = 10$ V
C_{cb}	Collector to Base Capacitance (f = 1.0 MHz)		9.0	12		20	35	pF	$I_E = 0$	$V_{CB} = 10$ V
C_{eb}	Emitter to Base Capacitance (f = 1.0 MHz)		60	65		80	120	pF	$I_C = 0$	$V_{EB} = 0.5$ V

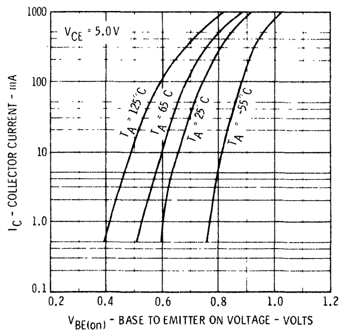
TYPICAL ELECTRICAL CHARACTERISTICS

SE8040 • SE8041 • SE8042

DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

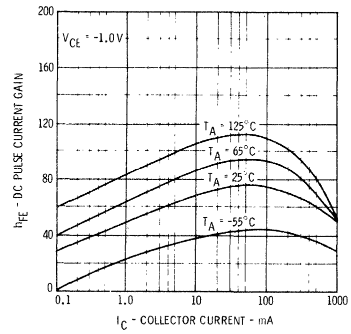


BASE TO EMITTER ON VOLTAGE VERSUS COLLECTOR CURRENT

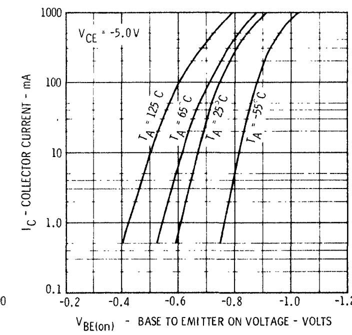


SE8540 • SE8541 • SE8542

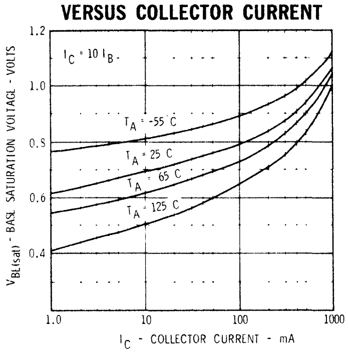
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



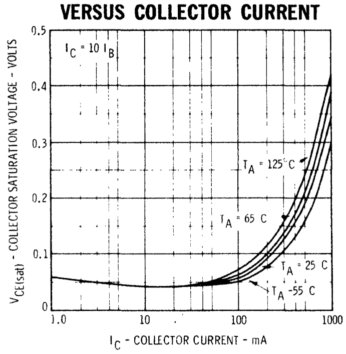
BASE TO EMITTER ON VOLTAGE VERSUS COLLECTOR CURRENT



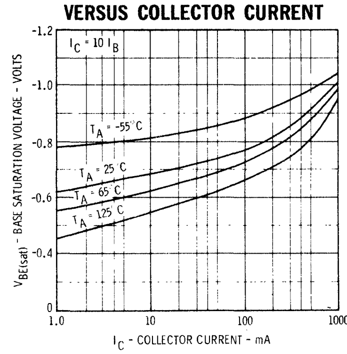
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



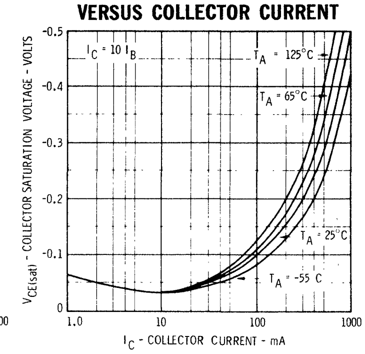
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



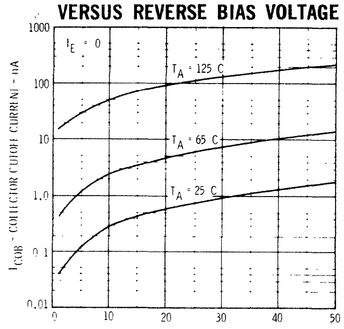
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



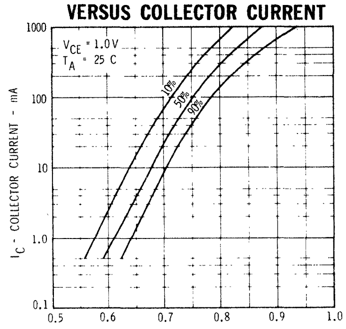
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



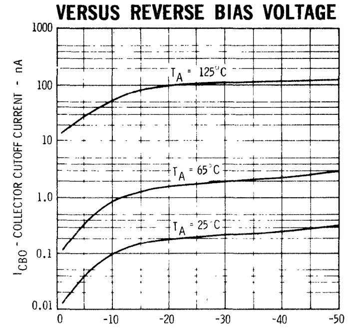
COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



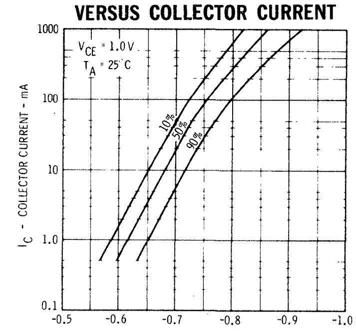
DISTRIBUTION OF BASE EMITTER VOLTAGE VERSUS COLLECTOR CURRENT



COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE

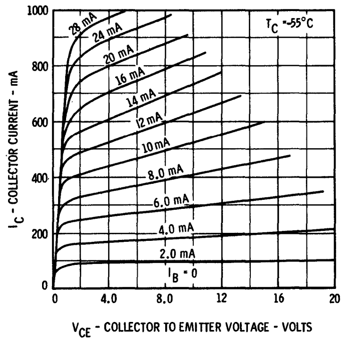


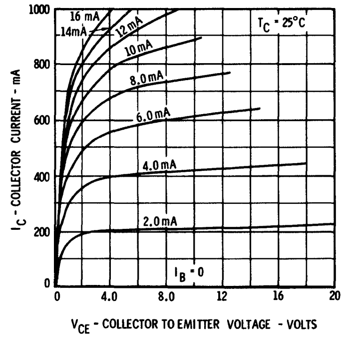
DISTRIBUTION OF BASE EMITTER VOLTAGE VERSUS COLLECTOR CURRENT

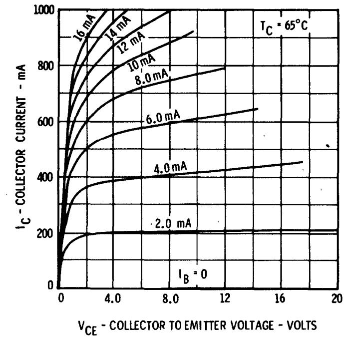


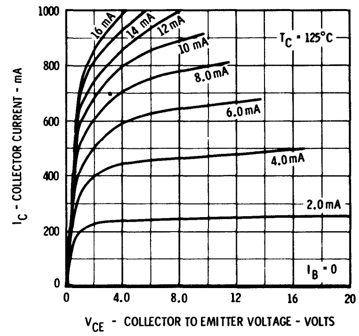
SE8040 • SE8041 • SE8042

TYPICAL LARGE SIGNAL COLLECTOR CHARACTERISTICS

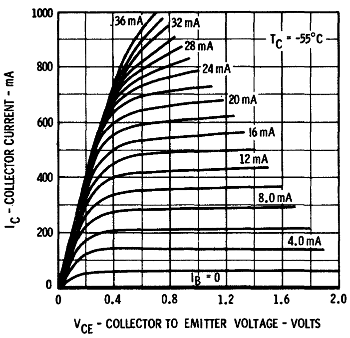


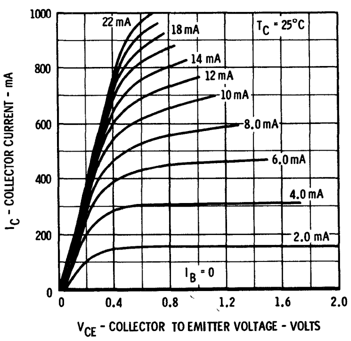


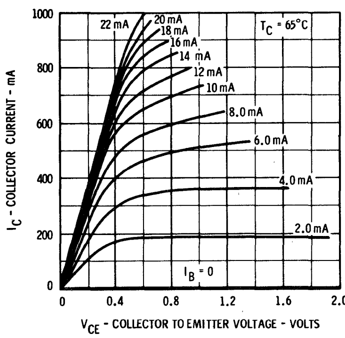


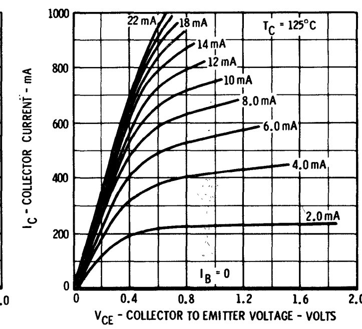


TYPICAL COLLECTOR SATURATION CHARACTERISTICS

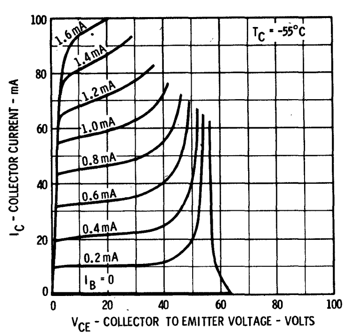


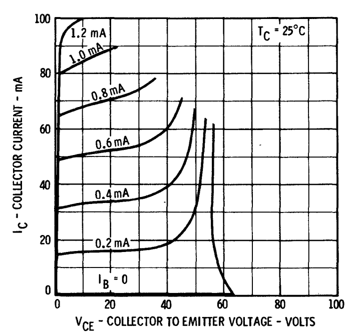


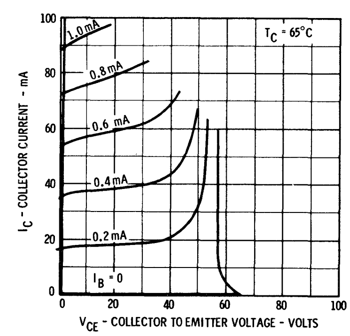


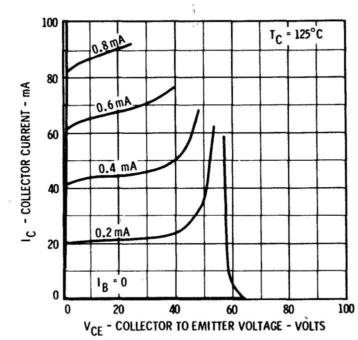


TYPICAL SMALL SIGNAL COLLECTOR CHARACTERISTICS

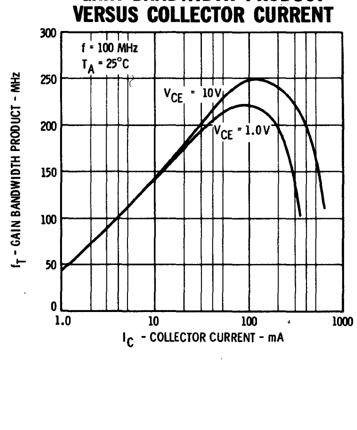




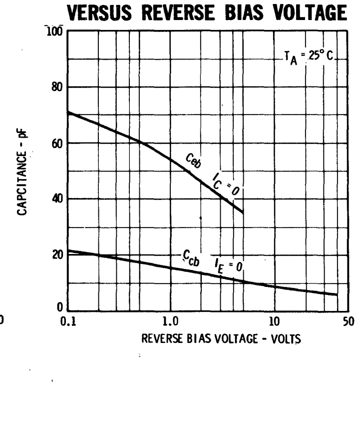




GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT

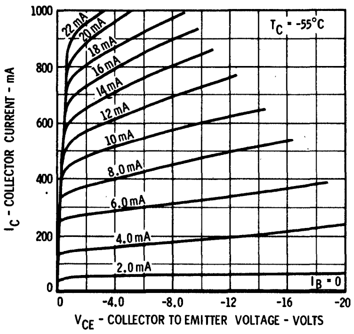


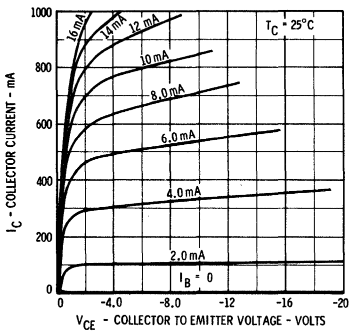
COLLECTOR TO BASE AND EMITTER TO BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE

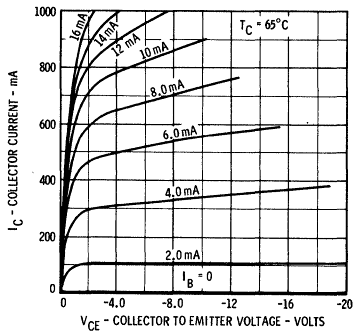


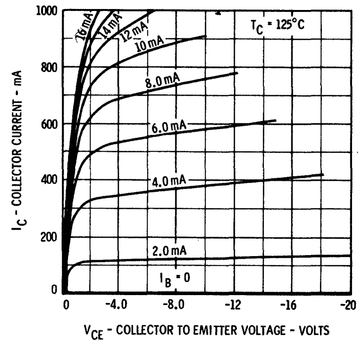
SE8540 • SE8541 • SE8542

TYPICAL LARGE SIGNAL COLLECTOR CHARACTERISTICS

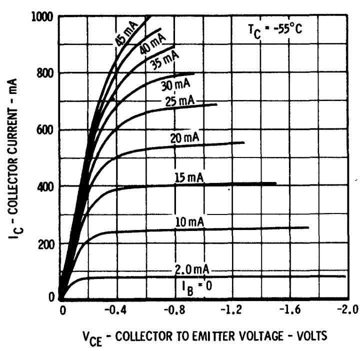


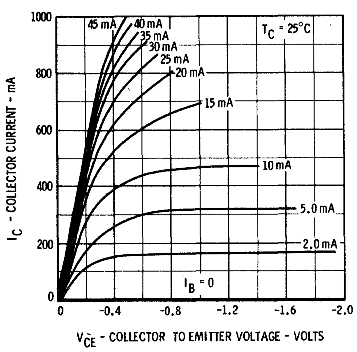


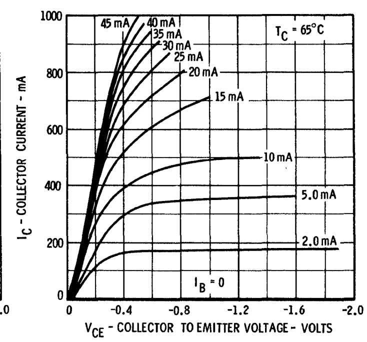


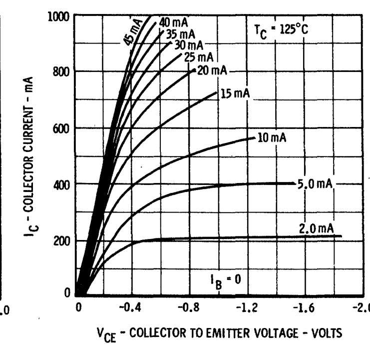


TYPICAL COLLECTOR SATURATION CHARACTERISTICS

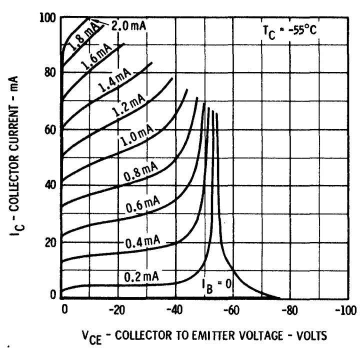


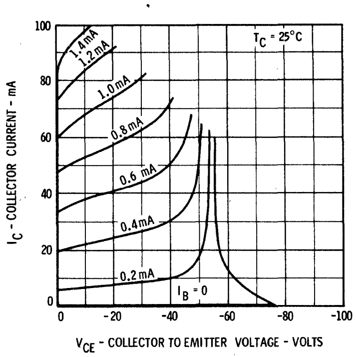


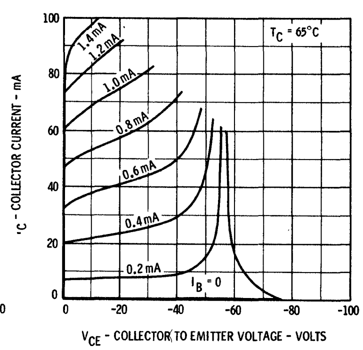


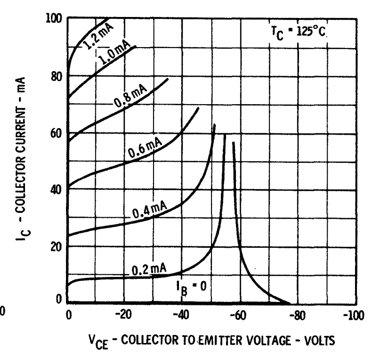


TYPICAL SMALL SIGNAL COLLECTOR CHARACTERISTICS

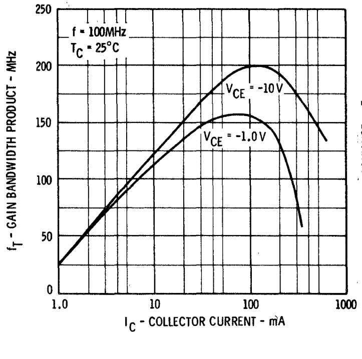








GAIN BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT



COLLECTOR-BASE AND EMITTER BASE CAPACITANCE VERSUS REVERSE BIAS VOLTAGE

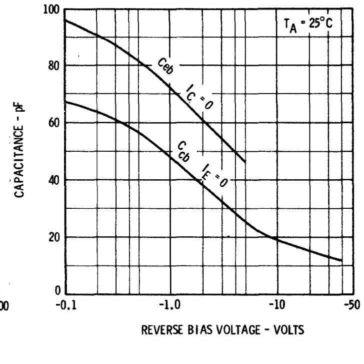


Figure 1—SCHEMATIC DIAGRAM

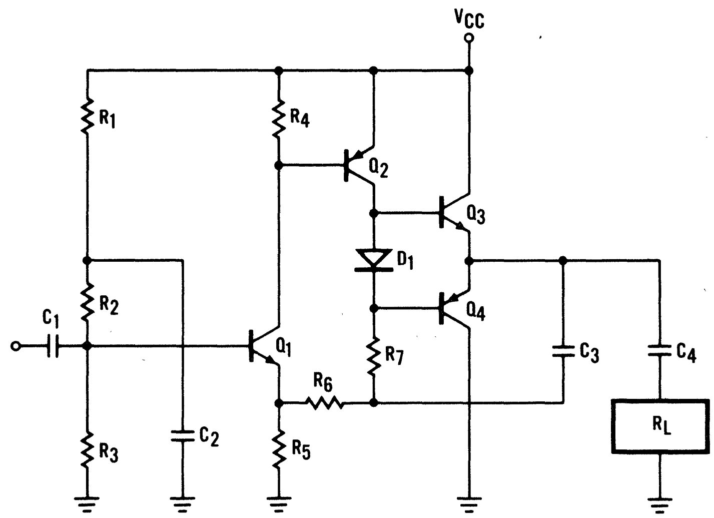
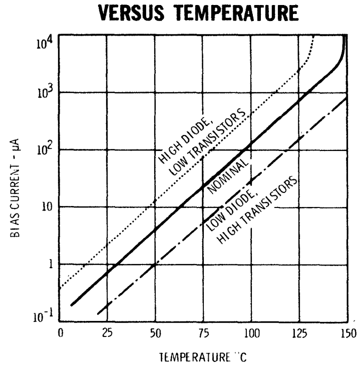


Table 1—SCHEMATIC VALUES

Circuit Voltage Load Resistance	12 V 4 ohm	18 V 8 ohm	28 V 16 ohm
Q_1	SE4021	SE4021	SE4021
Q_2	2N4249	2N3638	2N3638
Q_3	SE8040	SE8040	SE8042
Q_4	SE8540	SE8540	SE8542
D_1	FDH694	FDH694	FDH694
R_1	2.2 MΩ	4.7 MΩ	5.6 MΩ
R_2	2.7 MΩ	4.7 MΩ	10 MΩ
R_3	1.2 MΩ	1.2 MΩ	1 MΩ
R_4	22 kΩ	22 kΩ	22 kΩ
R_5	100 Ω	47 kΩ	56 Ω
R_6	180 Ω	180 Ω	470 Ω
R_7	120 Ω	120 Ω	150 Ω
C_1	0.01 μF	0.01 μF	0.01 μF
C_2	0.01 μF	0.01 μF	0.01 μF
C_3	50 μF, 6 V	25 μF, 6 V	25 μF, 6 V
C_4	500 μF, 10 V	500 μF, 15 V	250 μF, 20 V

BIAS CURRENT VERSUS TEMPERATURE



HARMONIC DISTORTION VERSUS POWER OUTPUT (f = 1 kHz)

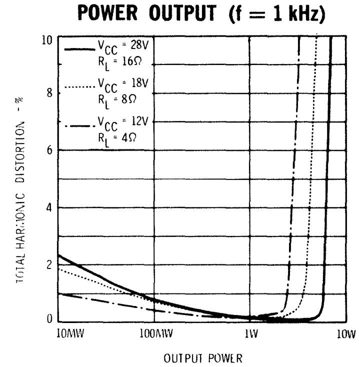
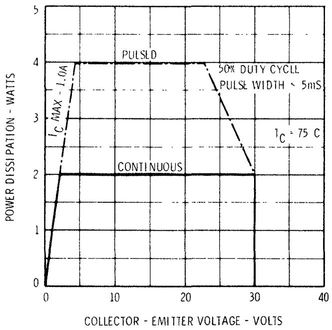


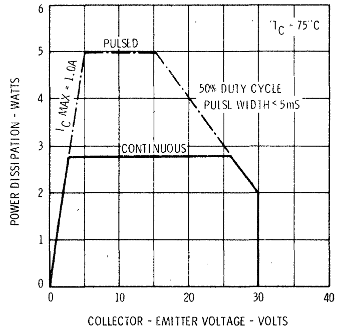
FIGURE 2

For additional information, send for Fairchild Application Brief 58

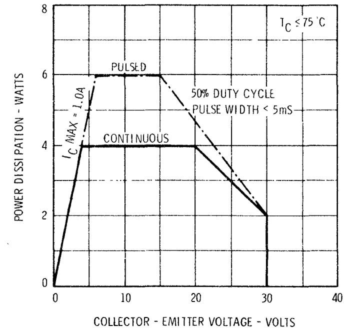
MAXIMUM FORWARD BIASED POWER DISSIPATION VERSUS COLLECTOR-EMITTER VOLTAGE SE8040, SE8540 ONLY



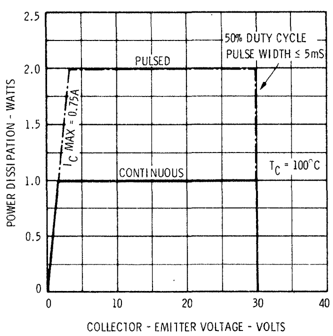
MAXIMUM FORWARD BIASED POWER DISSIPATION VERSUS COLLECTOR-EMITTER VOLTAGE SE8041, SE8541 ONLY



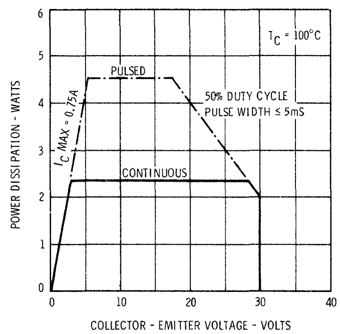
MAXIMUM FORWARD BIASED POWER DISSIPATION VERSUS COLLECTOR-EMITTER VOLTAGE SE8042, SE8542 ONLY



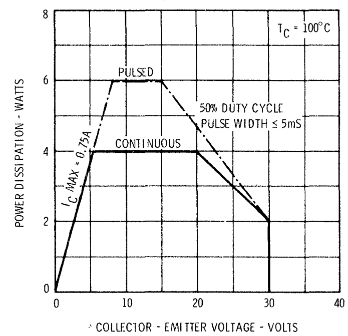
MAXIMUM FORWARD BIASED POWER DISSIPATION VERSUS COLLECTOR-EMITTER VOLTAGE SE8040, SE8540 ONLY



MAXIMUM FORWARD BIASED POWER DISSIPATION VERSUS COLLECTOR-EMITTER VOLTAGE SE8041, SE8541 ONLY



MAXIMUM FORWARD BIASED POWER DISSIPATION VERSUS COLLECTOR-EMITTER VOLTAGE SE8042, SE8542 ONLY



* Reverse Voltage Polarity for SE8540, SE8541 and SE8542

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 if curves shown above will be exceeded.
(3) These ratings give a maximum junction temperature of 125°C and junction to case thermal resistance of 25°C/Watt (derating factor of 40 mW/°C); junction to ambient thermal resistance of 200°C/Watt (derating factor of 5.0 mW/°C) for the SE8040 and SE8540.
(4) These ratings give a maximum junction temperature of 200°C and junction to case thermal resistance of 43.7°C/Watt (derating factor of 22.8 mW/°C); junction to ambient thermal resistance of 219°C/Watt (derating factor of 4.56 mW/°C) for the SE8041 and SE8541; junction to ambient thermal resistance of 175°C/Watt (derating factor of 5.71 mW/°C) for the SE8042 and SE8542.
(5) This rating refers to a high current point where collector to emitter voltage is lowest.
(6) Pulse Conditions: length = 300 μs; duty cycle = 1%.
(7) If h_{FE} matching is required, order SE804——M and SE854——M. Equal numbers of NPN's and PNP's from the following classifications will be shipped and will be marked to indicate matching group(s). There is no guarantee of the quantities of individual groupings. At the manufacturer's option, units marked with h_{FE} group suffixes (M1, etc.) may be shipped as SE8040 etc.

GROUP	M1	M2	M3	M4	M5	M6	M7
h_{FE} RANGE	40-52	48-64	58-77	70-93	83-110	100-130	118-150
I_C = 150 mA	M8	M9	M10	M11	M12	M13	M14
V_{CE} = 1.0 V	135-183	163-220	197-263	235-315	285-380	340-450	410-540

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION