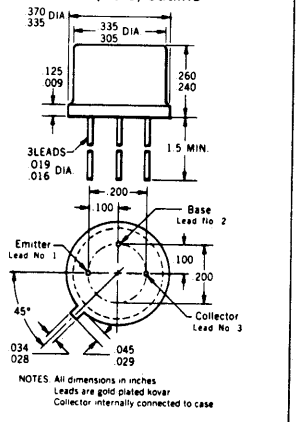
2N3671 · 2N3672 · 2N3673

PNP HIGH-SPEED SWITCHES AND CORE DRIVERS

DIFFUSED SILICON PLANAR EPITAXIAL TRANSISTORS

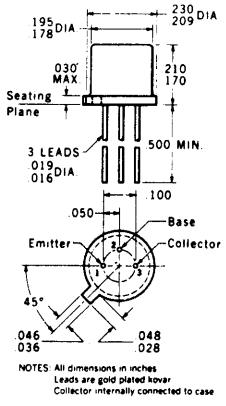
FOR IMPROVED PERFORMANCE SEE FAIRCHILD 2N3502 • 2N3503

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



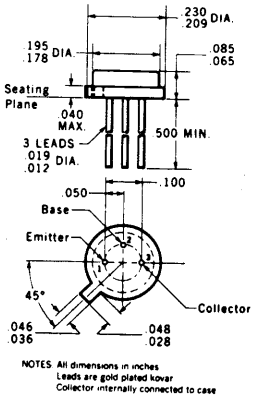
2N3671

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



2N3672

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-46) outline



2N3673

GENERAL DESCRIPTION - The 2N3671, 2N3672 and 2N3673 are PNP silicon Planar epitaxial transistors designed primarily for high-speed saturated switching, line drivers and memory applications.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	-65°C to +200°C
Operating Junction Temperature	200°C Maximum

Maximum Power Dissipation (Notes 2 and 3)

	2N3671	2N3672	2N3673
Total Dissipation at 25°C Case Temperature	3.0 Watts	1.8 Watts	3.0 Watts
at 25°C Ambient Temperature	0.6 Watt	0.4 Watt	0.35 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage		-60 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 4)	-50 Volts
V_{EBO}	Emitter to Base Voltage		-5.0 Volts
I_C	Collector Current	(Note 2)	600 mA

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)	75	225		I_C = 150 mA V_{CE} = -10 V
h_{FE}	DC Current Gain		75			I_C = 1.0 mA V_{CE} = -10 V
h_{FE}	DC Pulse Current Gain	(Note 5)	75			I_C = 10 mA V_{CE} = -10 V
h_{FE}	DC Current Gain		55			I_C = 0.1 mA V_{CE} = -10 V
h_{FE}	DC Pulse Current Gain	(Note 5)	40			I_C = 500 mA V_{CE} = -10 V
h_{FE}	DC Pulse Current Gain	(Note 5)	20			I_C = 150 mA V_{CE} = -0.6 V

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		Min.	Max.	Units	Test Conditions
$V_{CE}(sat)$	Pulsed Collector Saturation Voltage	(Note 5)		-0.4	Volts	I_C = 150 mA I_B = 15 mA
$V_{CE}(sat)$	Pulsed Collector Saturation Voltage	(Note 5)		-1.6	Volts	I_C = 500 mA I_B = 50 mA
$V_{BE}(sat)$	Pulsed Base Saturation Voltage	(Note 5)		-1.3	Volts	I_C = 150 mA I_B = 15 mA
$V_{BE}(sat)$	Pulsed Base Saturation Voltage	(Note 5)		-2.6	Volts	I_C = 500 mA I_B = 50 mA
t_d	Turn-On Delay Time	(See Figure 1)		10	ns	I_{CS} = 150 mA I_{B1} = 15 mA
t_r	Rise Time	(See Figure 1)		40	ns	I_{CS} = 150 mA I_{B1} = 15 mA
t_s	Storage Time	(See Figure 2)		80	ns	I_{CS} = 150 mA, I_{B1} = 15 mA, I_{B2} = -15 mA
t_f	Fall Time	(See Figure 2)		30	ns	I_{CS} = 150 mA, I_{B1} = 15 mA, I_{B2} = -15 mA
t_{on}	Turn On Time	(See Figure 1)		45	ns	I_{CS} = 150 mA I_{B1} = 15 mA
t_{off}	Turn Off Time	(See Figure 2)		100	ns	I_{CS} = 150 mA I_{B1} = 15 mA I_{B2} = -15 mA
h_{fe}	High Frequency Current (f = 100 MHz)		2.0			I_C = 50 mA V_{CE} = -20 V
I_{CBO}	Collector Cutoff Current			10	nA	I_E = 0 V_{CB} = -50 V
$I_{CBO}(150°C)$	Collector Cutoff Current			10	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_{obo}	Output Capacitance			9.0	pF	I_E = 0 V_{CB} = -10 V
C_{ibo}	Input Capacitance			30	pF	I_C = 0 V_{EB} = -2.0 V
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 and 5)		-50		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 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 200°C and junction to case thermal resistance of 58.3°C/watt (derating factor of 17.2 mW/°C); junction to ambient thermal resistance of 292°C/watt (derating factor of 3.43 mW/°C) for the 2N3671. Junction to case thermal resistance of 97.3°C/watt (derating factor of 10.3 mW/°C) junction to ambient thermal resistance of 437°C/watt (derating factor of 2.28 mW/°C for the 2N3672. Junction to case thermal resistance of 58.3°C/watt (derating factor of 17.2 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.

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

FIGURE 1

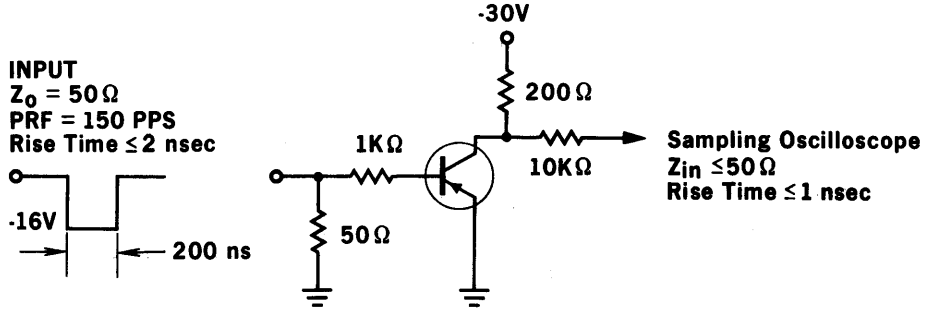
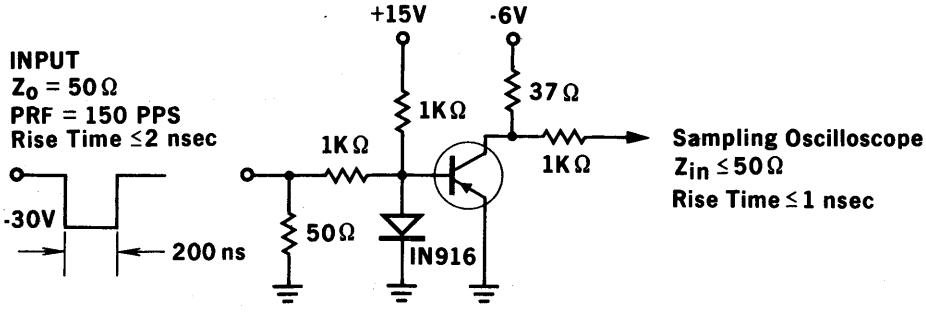


FIGURE 2



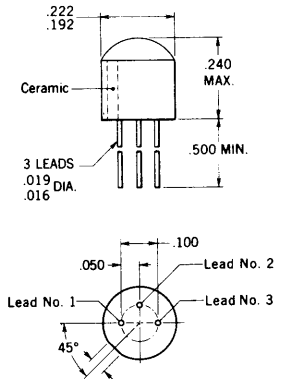
2N3688 • 2N3689 • 2N3690

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.

PHYSICAL DIMENSIONS
Epoxy package
TO-106



NOTES All dimensions in inches
All leads electrically isolated from case

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

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.
(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

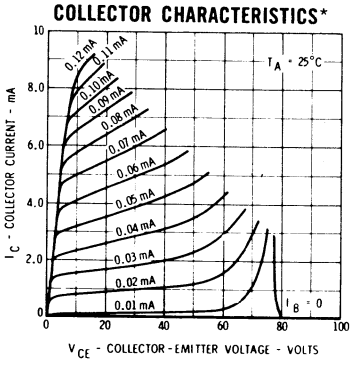
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

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

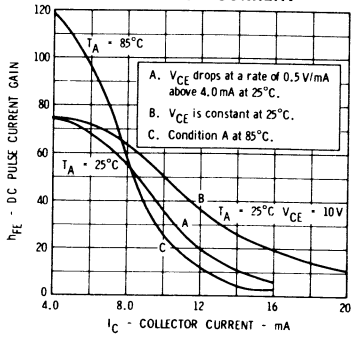
Symbol	Characteristics	2N3688 Min.	2N3688 Typ.	2N3688 Max.	2N3689 Min.	2N3689 Typ.	2N3689 Max.	2N3690 Min.	2N3690 Typ.	2N3690 Max.	Units	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain [Note 4]	30	70		30	70		30	70			$I_C = 4.0$ mA $V_{CE} = 10$ V
I_{CBO}	Collector Cutoff Current			50			50			50	nA	$I_E =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

TYPICAL ELECTRICAL CHARACTERISTICS

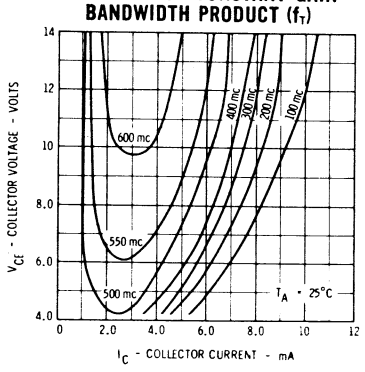
COLLECTOR CHARACTERISTICS*



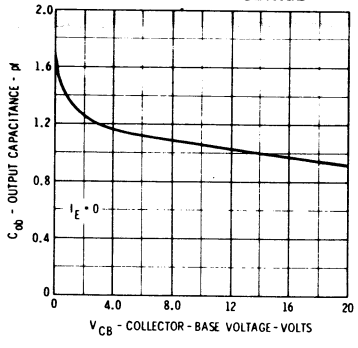
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



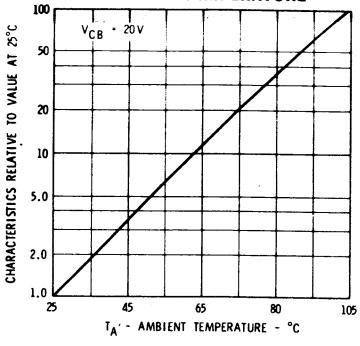
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



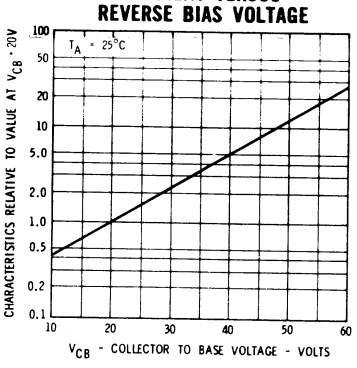
OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



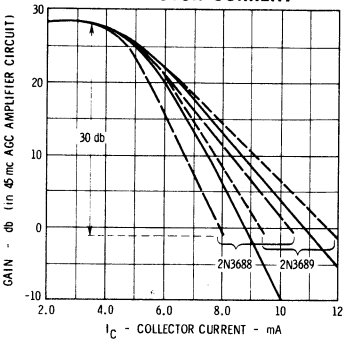
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



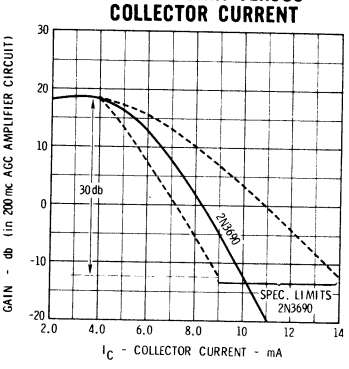
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



TYPICAL GAIN VERSUS COLLECTOR CURRENT

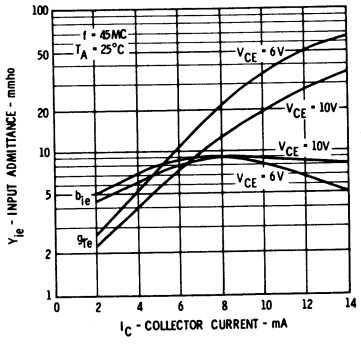
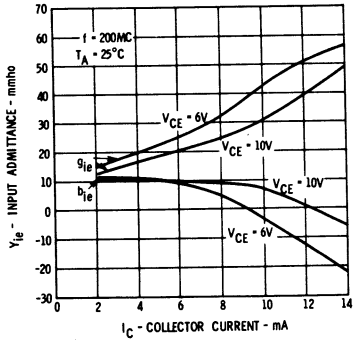
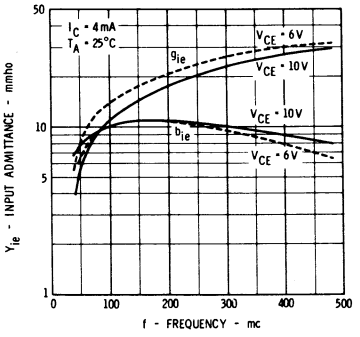
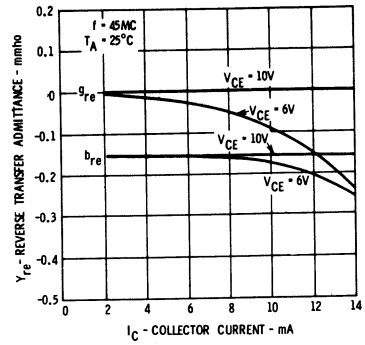
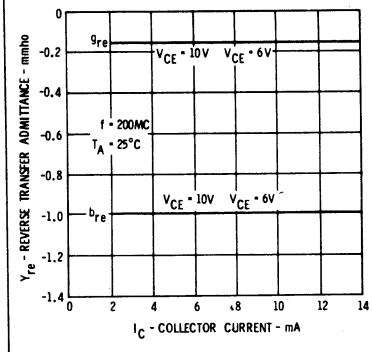
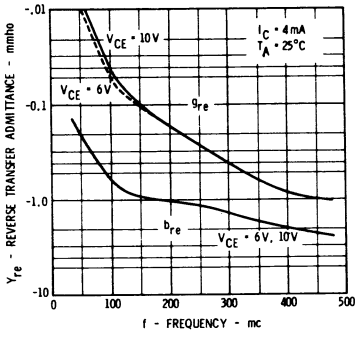
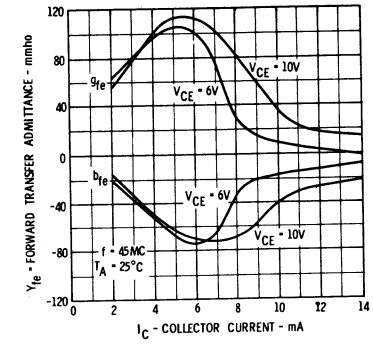
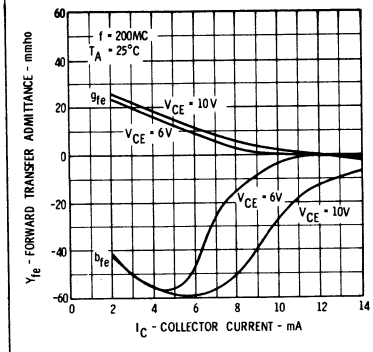
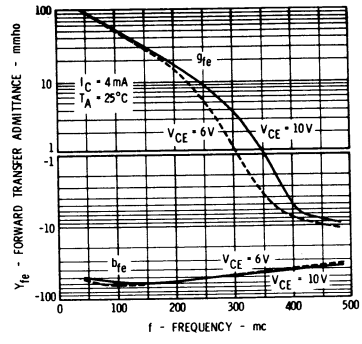
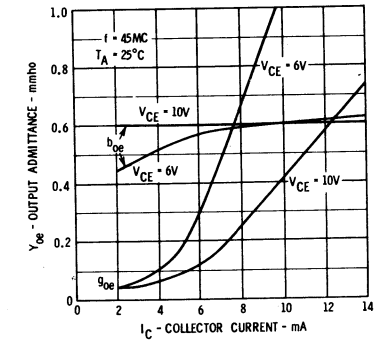
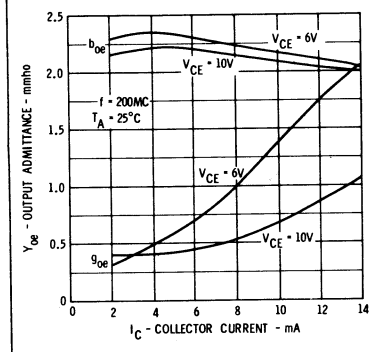
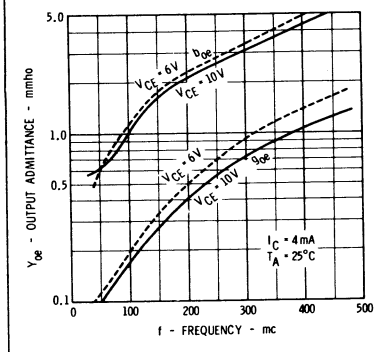


TYPICAL GAIN VERSUS COLLECTOR CURRENT



* 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)			

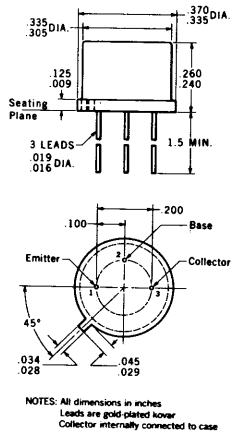
2N3722 • 2N3723

NPN HIGH-VOLTAGE, HIGH-CURRENT SWITCHES

SILICON PLANAR EPITAXIAL TRANSISTORS

- **HIGH BREAKDOWN -- 80 VOLT LV_{CEO}**
- **HIGH FREQUENCY -- f_T = 300 MHz Min.**
- **FAST HIGH CURRENT SWITCHING**
- **LOW V_{CE} (sat) -- 0.75V Max. @ 500 mA**
- **LOW OUTPUT CAPACITANCE -- 9.0 pF**

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



NOTES: All dimensions in inches
Leads are gold-plated kovar
Collector internally connected to case

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

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

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)	0.8 Watt

Maximum Voltages and Current

		2N3722	2N3723
V_{CBO}	Collector to Base Voltage	80 Volts	100 Volts
V_{CES}	Collector to Emitter Voltage	80 Volts	100 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	60 Volts	80 Volts
V_{EBO}	Emitter to Base Voltage	6.0 Volts	6.0 Volts
	Maximum Collector Current (Note 5)	1.0 Amp	1.0 Amp

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

Symbol	Characteristic	2N3722 Min.	2N3722 Typ.	2N3722 Max.	2N3723 Min.	2N3723 Typ.	2N3723 Max.	Units	Test Conditions
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	60			**80**			Volts	I_C = 10 mA (pulsed), I_B = 0
*V_{CE} (sat)	Collector Saturation Voltage (pulsed, see Note 5)		0.35	0.5		**0.45**	**0.75**	Volts	I_C = 500 mA, I_B = 50 mA
V_{CE} (sat)	Collector Saturation Voltage (pulsed, see Note 5)		0.25	0.37		0.30	0.44	Volts	I_C = 300 mA, I_B = 30 mA
t_{on}	Turn-on Time (Note 6)		20	50		**25**	**70**	nsec	$I_C \approx$ 500 mA, $I_{B1} \approx$ 50 mA
t_{off}	Turn-off Time (Note 6)		63	100		**70**	**130**	nsec	$I_C \approx$ 500 mA, $I_{B1} \approx$ 50 mA, $I_{B2} \approx$ −50 mA
h_{fe}	High Frequency Current Gain (f = 100 Mc)	3.0	4.0		**3.0**	**4.0**			I_C = 50 mA, V_{CE} = 10 V
C_{obo}	Common-Base, Open-Circuit Output Capacitance		5.5	10		**5.0**	**9.0**	pf	I_E = 0, V_{CB} = 10 V
C_{ibo}	Common-Base, Open-Circuit Input Capacitance		50	65		50	65	pf	I_C = 0, V_{BE} = −0.5 V

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

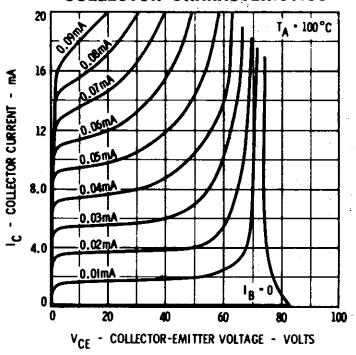
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

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

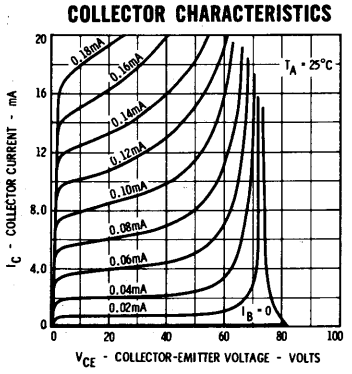
Symbol	Characteristic	2N3722 Min.	2N3722 Typ.	2N3722 Max.	2N3723 Min.	2N3723 Typ.	2N3723 Max.	Units	Test Conditions
*h_{FE}	DC Pulse Current Gain (Note 5)	40	70	150	**40**	**70**	**150**		I_C = 100 mA V_{CE} = 1.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	25	45		25	45			I_C = 10 mA V_{CE} = 1.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	20	35		**15**	**30**			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)				15	30			I_C = 500 mA V_{CE} = 3.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	12	25		12	25			I_C = 800 mA V_{CE} = 5.0 V
h_{FE} (−55°C)	DC Pulse Current Gain (Note 5)	15	30		15	30			I_C = 100 mA V_{CE} = 1.0 V
V_{CE} (sat)	Collector Saturation Voltage (Note 5)		0.15	0.22		0.22	0.28	Volts	I_C = 100 mA I_B = 10 mA
V_{CE} (sat)	Collector Saturation Voltage (Note 5)		0.16	0.25		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		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		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		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	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}	Collector Reverse Current					0.13	0.5	μA	V_{CE} = 50 V V_{EB} = 0
I_{CES} (125°C)	Collector Reverse Current		40	70				μA	V_{CE} = 40 V V_{EB} = 0
I_{CES} (125°C)	Collector Reverse Current					40	70	μA	V_{CE} = 50 V V_{EB} = 0
BV_{CBO}	Collector to Base Breakdown Voltage	80			100			Volts	I_C = 100 μA I_E = 0
B_{CES}	Collector to Emitter Breakdown Voltage	80			100			Volts	I_C = 100 μA V_{EB} = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			6.0			Volts	I_C = 0 I_E = 100 μA
h_{FE} (−55°C)	DC Pulse Current Gain (Note 5)	20			**20**				I_C = 200 mA V_{CE} = 2.0 V

TYPICAL ELECTRICAL CHARACTERISTICS
2N3722

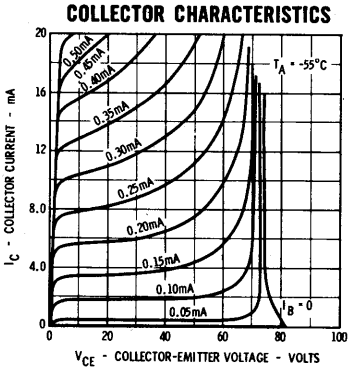
COLLECTOR CHARACTERISTICS



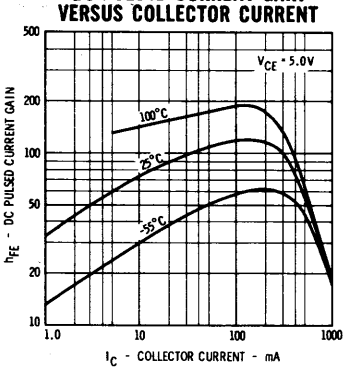
COLLECTOR CHARACTERISTICS



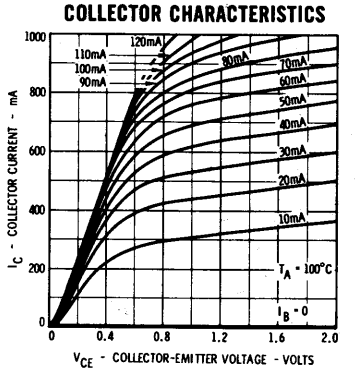
COLLECTOR CHARACTERISTICS



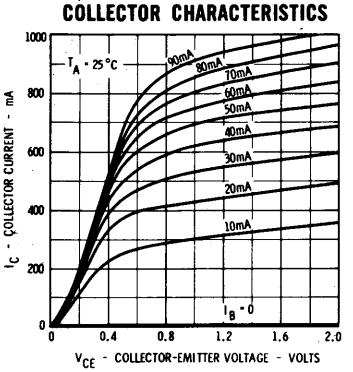
DC PULSED CURRENT GAIN VERSUS COLLECTOR CURRENT



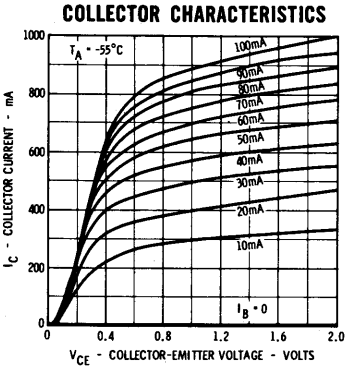
COLLECTOR CHARACTERISTICS



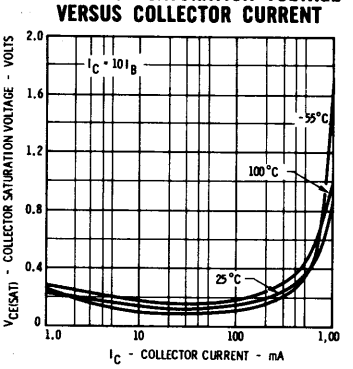
COLLECTOR CHARACTERISTICS



COLLECTOR CHARACTERISTICS



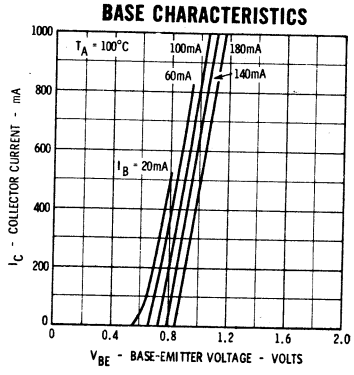
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



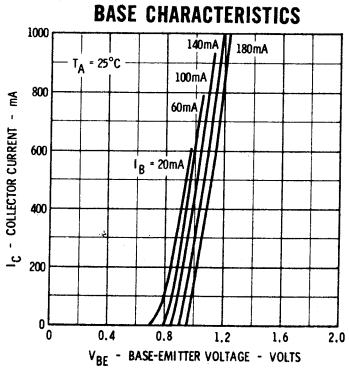
TYPICAL ELECTRICAL CHARACTERISTICS

2N3722 • 2N3723

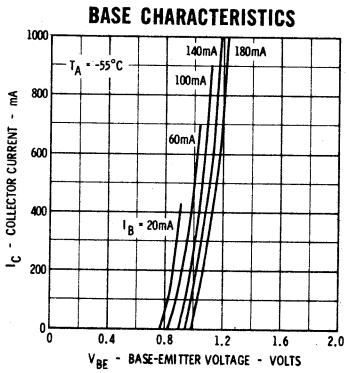
BASE CHARACTERISTICS



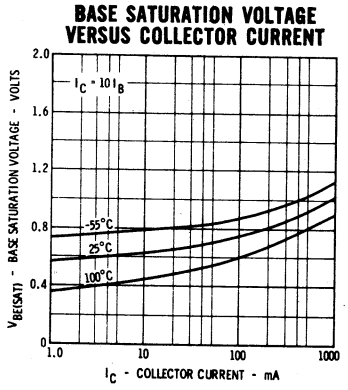
BASE CHARACTERISTICS



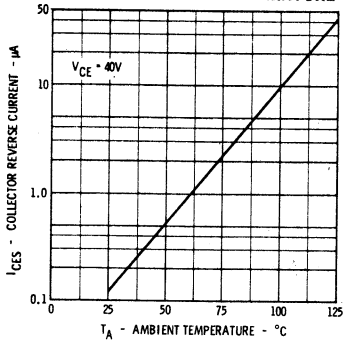
BASE CHARACTERISTICS



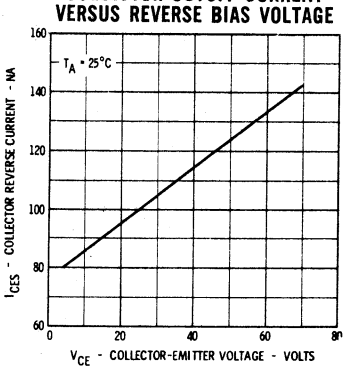
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



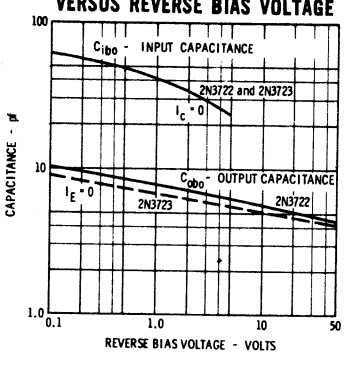
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



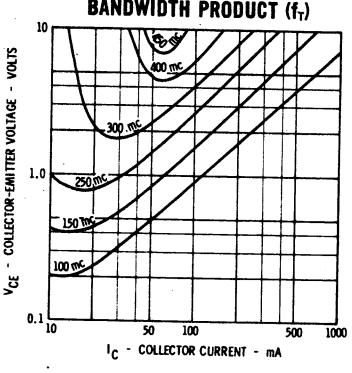
COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE

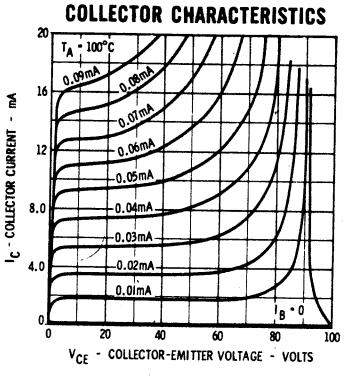


CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)

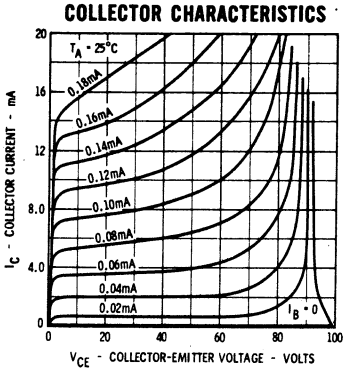


2N3723

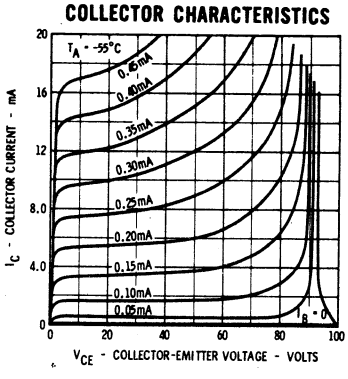
COLLECTOR CHARACTERISTICS



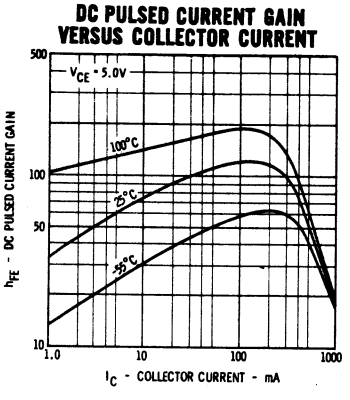
COLLECTOR CHARACTERISTICS



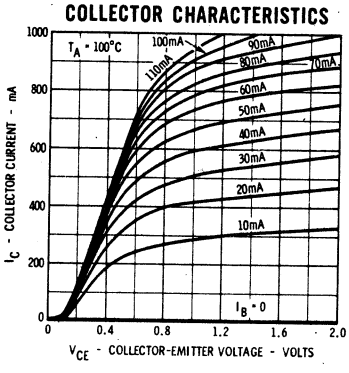
COLLECTOR CHARACTERISTICS



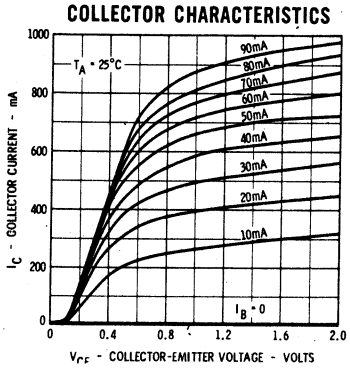
DC PULSED CURRENT GAIN VERSUS COLLECTOR CURRENT



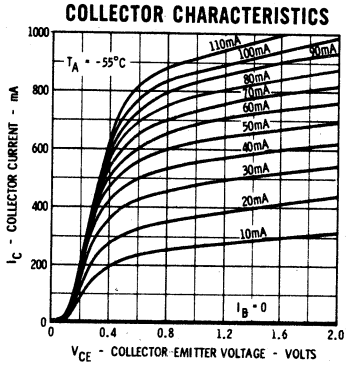
COLLECTOR CHARACTERISTICS



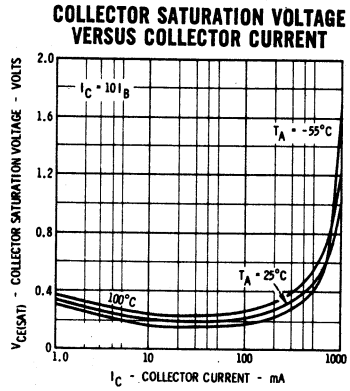
COLLECTOR CHARACTERISTICS



COLLECTOR CHARACTERISTICS



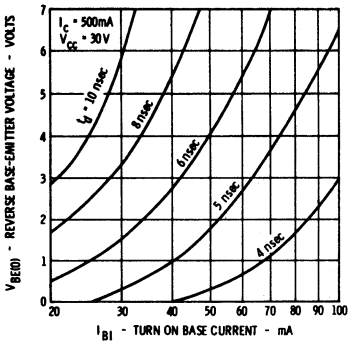
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



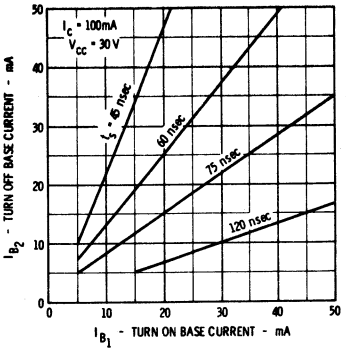
TYPICAL ELECTRICAL CHARACTERISTICS

2N3722 • 2N3723

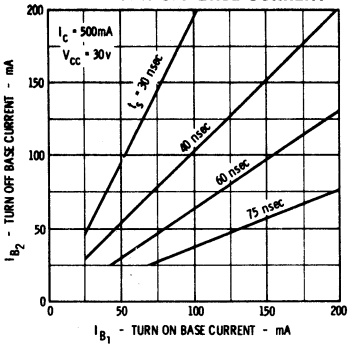
DELAY TIME VERSUS TURN ON BASE CURRENT AND REVERSE BASE EMITTER VOLTAGE



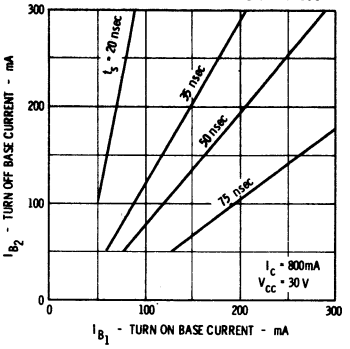
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



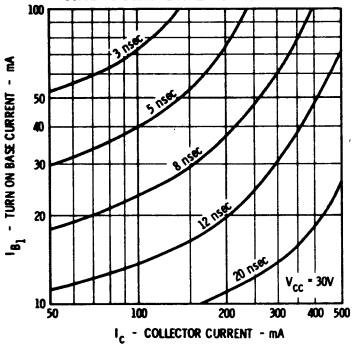
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



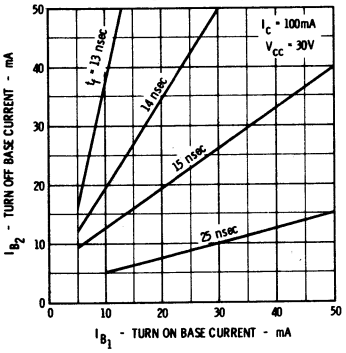
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



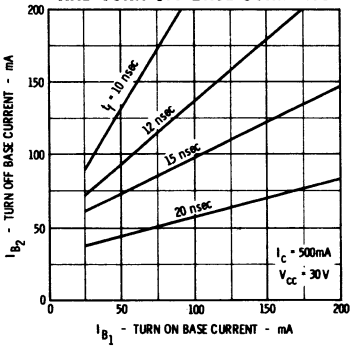
RISE TIME VERSUS COLLECTOR AND TURN ON BASE CURRENT



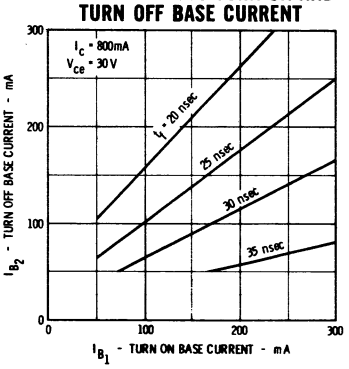
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



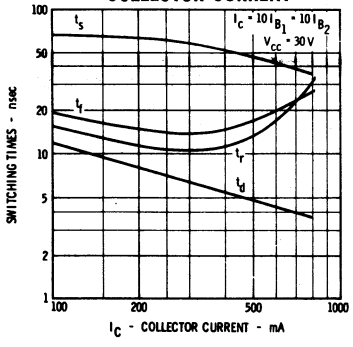
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



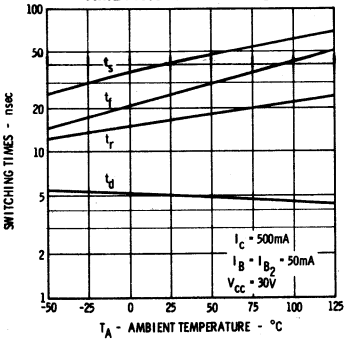
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



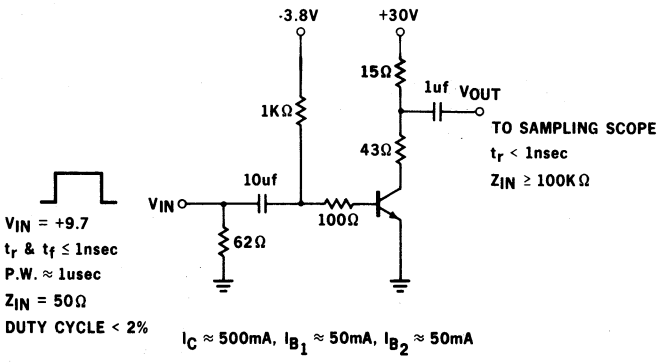
SWITCHING TIMES VERSUS COLLECTOR CURRENT



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 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) Rating refers to a high-current point where collector-to-emitter voltage is lowest.

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

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

2N3728 • 2N3729

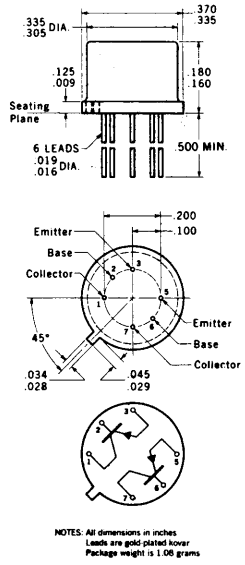
NPN HIGH PERFORMANCE DIFFERENTIAL AMPLIFIERS

DIFFUSED SILICON PLANAR* EPITAXIAL TRANSISTORS

- **BETA RATIO - -** $\frac{h_{FE1}}{h_{FE2}}$ **= 0.9-1.0 FROM 100 μA to 1.0 mA**

  $\frac{h_{FE1}}{h_{FE2}}$ **= 0.8-1.0 FROM 100 μA to 1.0 mA, −55°C to +125°C**
- V_{BE} **MATCHING - -** $|V_{BE1} - V_{BE2}|$ **= 3.0 mV (MAX) FROM 100 μA to 1.0 mA**
- V_{BE} **TRACKING - -** ΔV_{BE} **= 10 μV/°C (MAX) FROM 100 μA to 1.0 mA, −55°C to +125°C**
- **MEDIUM VOLTAGE - -** LV_{CEO} **= 30 V (MIN)**

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
Leads are gold plated kovar
Package weight is 1.06 grams

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures			
Storage Temperature			−65°C to +200°C
Operating Junction Temperature			200°C Maximum
Lead Temperature (Soldering, 60 second time limit)			300°C Maximum
Maximum Power Dissipation		**One Side**	**Both Sides**
Total Dissipation at 25°C Case Temperature (Notes 2 and 3)		1.0 Watt	1.6 Watt
at 100°C Case Temperature (Notes 2 and 3)		0.57 Watt	0.91 Watt
at 25°C Ambient Temperature (Notes 2 and 3)		0.45 Watt	0.55 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		500 mA
$V_{C1\,C2}$	$Collector_1$ to $Collector_2$ Voltage		±200 Volts
	Voltage rating any lead to case		±200 Volts

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

SYMBOL	CHARACTERISTICS	2N3728 MIN.	2N3728 MAX.	2N3729 MIN.	2N3729 MAX.	UNITS	TEST CONDITIONS	
$\frac{h_{FE1}}{h_{FE2}}$	**DC Current Gain Ratio** (Note 5)	0.8	1.0	**0.9**	**1.0**		I_C = 100 μA to 1.0 mA	V_{CE} = 5.0 V
$\frac{h_{FE1}}{h_{FE2}}$	**DC Current Gain Ratio** (Note 5) **(T_A = −55°C to 125°C)**			**0.8**	**1.0**		I_C = 100 μA to 1.0 mA	V_{CE} = 5.0 V
$\lvert V_{BE1} - V_{BE2}\rvert$	**Base-Emitter Voltage Differential**		5.0		**3.0**	**mV**	I_C = 100 μA to 1.0 mA	V_{CE} = 5.0 V
$\lvert\Delta(V_{BE1} - V_{BE2})\rvert$	**Base-Emitter Voltage Differential Change (T_A = −55°C to 25°C)**		1.6 (20 μV/°C)		**0.8 (10 μV/°C)**	**mV**	I_C = 100 μA to 1.0 mA	V_{CE} = 5.0 V
$\lvert\Delta(V_{BE1} - V_{BE2})\rvert$	**Base-Emitter Voltage Differential Change (T_A = 25°C to 125°C)**		2.0 (20 μV/°C)		**1.0 (10 μV/°C)**	**mV**	I_C = 100 μA to 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 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 ambient thermal resistance of 384°C/Watt (derating factor of 2.57 mW/°C) for one side; 318°C/Watt (derating factor of 3.14 mW/°C) for both sides. Junction to case thermal resistance of 175°C/Watt (derating factor of 5.71 mW/°C) for one side; 109°C/Watt (derating factor of 9.15 mW/°C) for both sides.
(4) Rating refers to a high-current point where collector to emitter voltage is lowest.
(5) Lowest of two h_{FE} readings is taken as h_{FE1} for purposes of this ratio.
(6) Pulse Conditions: length = 300 μs; duty cycle = 1%.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

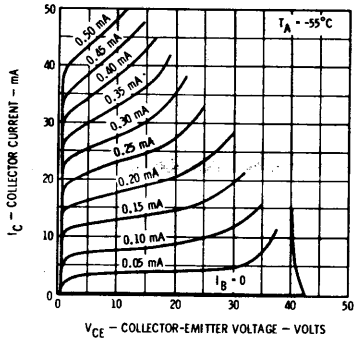
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

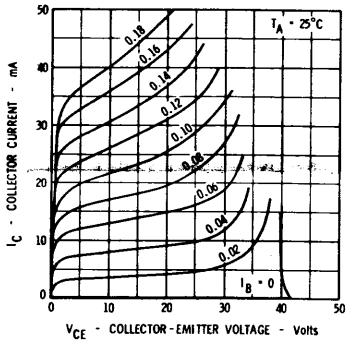
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

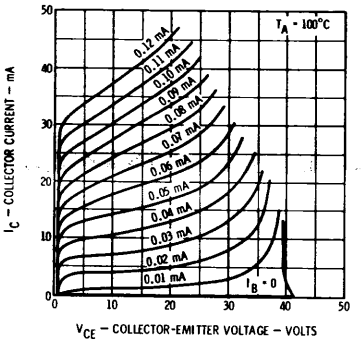
SYMBOL	CHARACTERISTICS	MIN.	MAX.	UNITS	TEST CONDITIONS
h_{FE}	DC Current Gain	30			$I_C = 0.1$ mA $V_{CE} = 5.0$ V
h_{FE}	DC Current Gain	45	180		$I_C = 1.0$ mA $V_{CE} = 5.0$ V
h_{FE}	DC Current Gain (Note 6)	80	280		$I_C = 150$ mA $V_{CE} = 5.0$ V
BV_{CBO}	Collector to Base Breakdown Voltage	60			$I_C = 10\ \mu A$ $I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	5.0			$I_C = 0$ $I_E = 10\ \mu A$
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 and 6)	30			$I_C = 10$ mA $I_B = 0$
V_{CE}(sat)	Collector Saturation Voltage (Note 6)		0.22	Volts	$I_C = 150$ mA $I_B = 15$ mA
V_{BE}(sat)	Base Saturation Voltage (Note 6)		1.1	Volts	$I_C = 150$ mA $I_B = 15$ mA
I_{CBO}	Collector Cutoff Current		10	nA	$I_E = 0$ $V_{CB} = 50$ V
I_{CBO}(150°C)	Collector Cutoff Current		10	μA	$I_E = 0$ $V_{CB} = 50$ V
I_{EBO}	Emitter Cutoff Current		10	nA	$I_C = 0$ $V_{EB} = 3.0$ V
h_{fe}	High Frequency Current Gain	4.0			$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 20 MHz
h_{fe}	High Frequency Current Gain	2.5	6.0		$I_C = 50$ mA, $V_{CE} = 10$ V, f = 100 MHz
C_{obo}	Common-Base, Open-Circuit Output Capacitance		8.0	pF	$I_E = 0$, $V_{CB} = 10$ V, f = 140 kHz
C_{ibo}	Common-Base, Open-Circuit Input Capacitance		20	pF	$I_C = 0$, $V_{EB} = 2.0$ V, f = 140 kHz
h_{ie}	Input Impedance	1.2	4.0	kΩ	$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{re}	Reverse Voltage Feedback Ratio		200	$x10^{-6}$	$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{oe}	Output Conductance		10		$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
h_{fe}	Forward Current Transfer Ratio	50	200		$I_C = 1.0$ mA, $V_{CE} = 10$ V, f = 1.0 kHz
NF	Wideband Noise Figure (f = 15.7 kHz)		7.0	dB	$I_C = 0.1$ mA $V_{CE} = 5.0$ V 3 dB pts @ 25 Hz and 10 kHz $R_S = 1.0$ kΩ

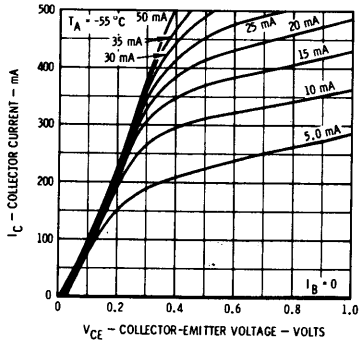
TYPICAL COLLECTOR CHARACTERISTICS*

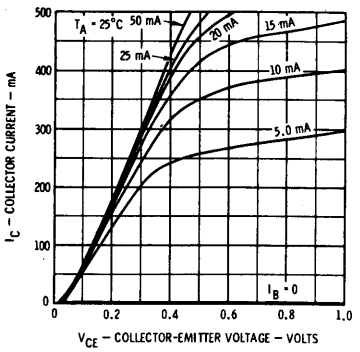
Active Region

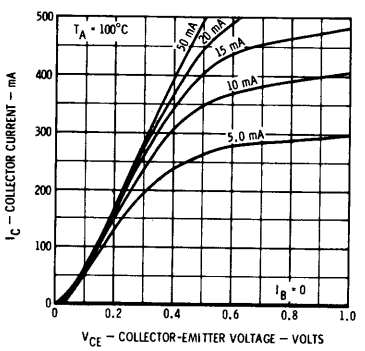








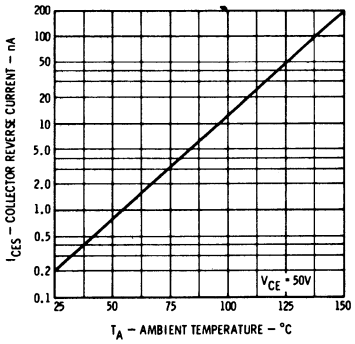




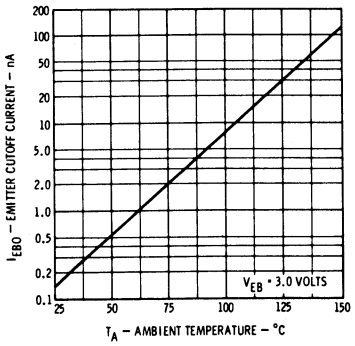
* Single family characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

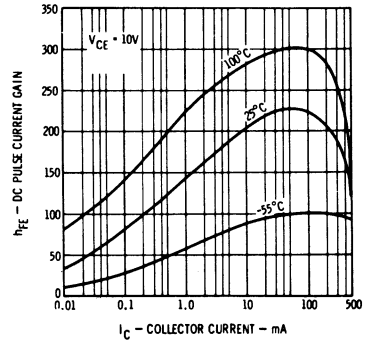
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



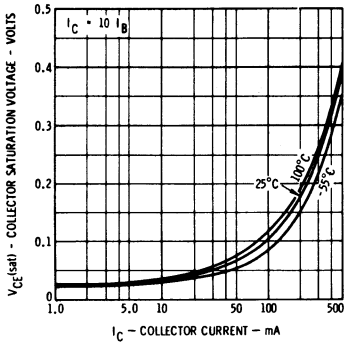
EMITTER CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



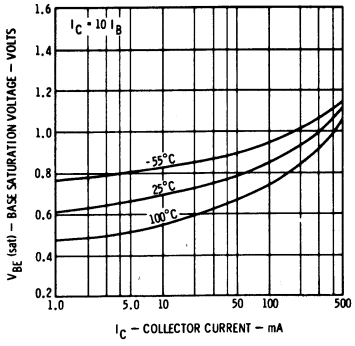
PULSE DC CURRENT GAIN VERSUS COLLECTOR CURRENT



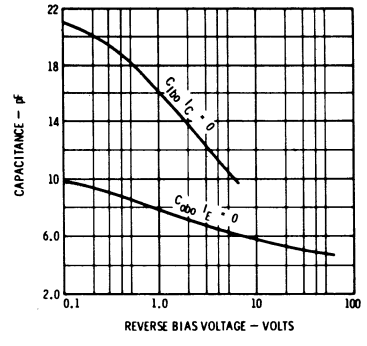
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



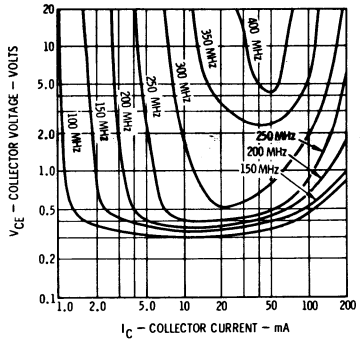
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



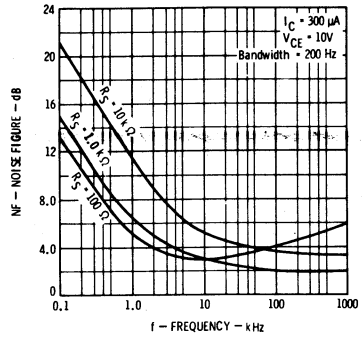
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



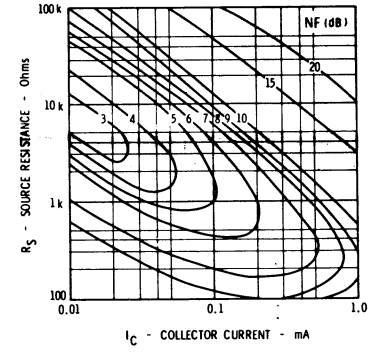
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



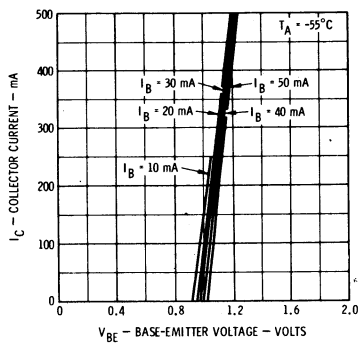
NARROW BAND NOISE FIGURE VERSUS FREQUENCY

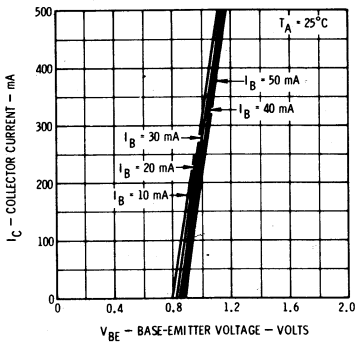


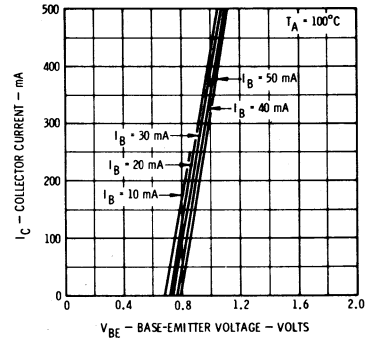
CONTOURS OF CONSTANT WIDE BAND NOISE FIGURE



TYPICAL BASE CHARACTERISTICS







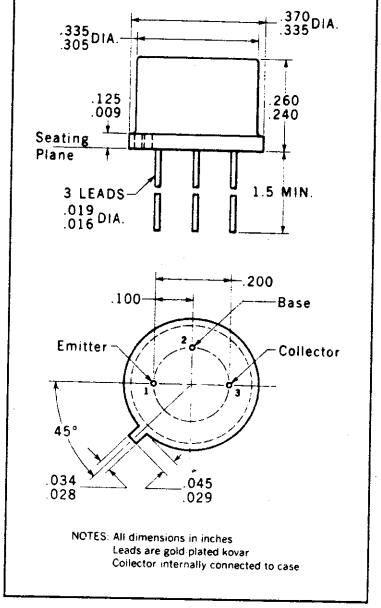
2N3923

NPN HIGH-VOLTAGE AMPLIFIER

DIFFUSED SILICON PLANAR TRANSISTOR

GENERAL DESCRIPTION - The 2N3923 is an NPN silicon PLANAR transistor designed primarily for use as a high-voltage output device where low collector base capacitance is required. The device features a maximum C_{obo} of 3.5 pf together with a minimum LV_{CEO} of 150 volts and a minimum f_T of 40 Mc. The TO-5 package permits operation to 200°C junction temperature and a power rating of 3 watts.

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



NOTES: All dimensions in inches
Leads are gold plated kovar
Collector internally connected to case

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

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

Maximum Power Dissipation

Total Dissipation at 25°C Case Temperature	(Notes 2 and 3)	3.0 Watts
at 25°C Ambient Temperature	(Notes 2 and 3)	0.8 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage		150 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 4)	150 Volts
V_{EBO}	Emitter to Base Voltage		6.0 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 Pulse Current Gain (Note 5)	30	100	120		I_C = 25 mA V_{CE} = 10 V
$h_{FE}(-55°C)$	DC Pulse Current Gain (Note 5)	15	40			I_C = 25 mA V_{CE} = 10 V
h_{FE}	DC Current Gain	15	62			I_C = 100 μA V_{CE} = 10 V
$V_{CEO}(sust)$	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	150			Volts	I_C = 10 mA (pulsed) I_B = 0
BV_{CBO}	Collector to Base Breakdown Voltage	150			Volts	I_C = 100 μA I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	6.0			Volts	I_E = 100 μA I_C = 0
$V_{BE}(sat)$	Base Saturation Voltage		0.77	0.9	Volts	I_C = 25 mA I_B = 2.5 mA
$V_{CE}(sat)$	Collector Saturation Voltage		0.3	1.0	Volts	I_C = 25 mA I_B = 2.5 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 200°C and junction-to-case thermal resistance of 58°C/Watt (derating factor of 17.2 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.

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

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

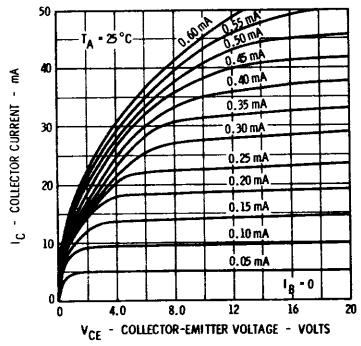
FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

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

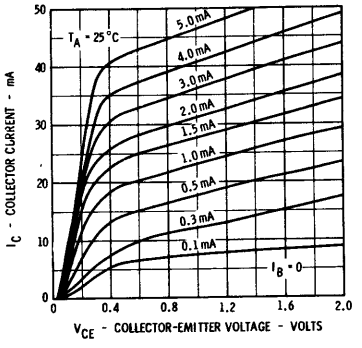
Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Conditions
I_{CBO}	Collector Cutoff Current		0.1	10	nA	$I_E = 0$, $V_{CB} = 100$ V
$I_{CBO}(150°C)$	Collector Cutoff Current		0.5	10	μA	$I_E = 0$, $V_{CB} = 100$ V
I_{EBO}	Emitter Cutoff Current		0.005	50	nA	$I_C = 0$, $V_{EB} = 4.0$ V
h_{fe}	High Frequency Current Gain (f = 20 Mc)	2.0	4.3			$I_C = 10$ mA, $V_{CE} = 10$ V
h_{fe}	Small Signal Current Gain (f = 1.0 Kc)	20				$I_C = 25$ mA, $V_{CE} = 10$ V
C_{obo}	Common Base Open Circuit Output Capacitance		2.6	3.5	pf	$I_E = 0$, $V_{CB} = 20$ V
C_{ibo}	Common Base Open Circuit Input Capacitance		17	25	pf	$I_C = 0$, $V_{EB} = 0.5$ V
$R_e(h_{ie})$	Real Part of Input Impedance (f = 300 Mc)			50	Ohms	$I_C = 10$ mA, $V_{CE} = 10$ V

TYPICAL ELECTRICAL CHARACTERISTICS

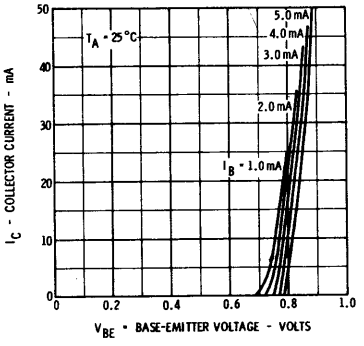
COLLECTOR CHARACTERISTICS *



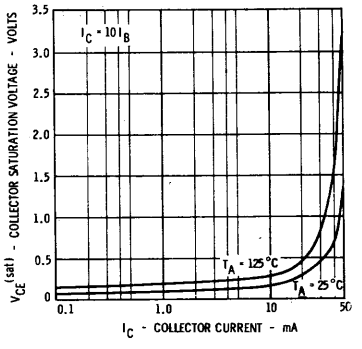
COLLECTOR CHARACTERISTICS *



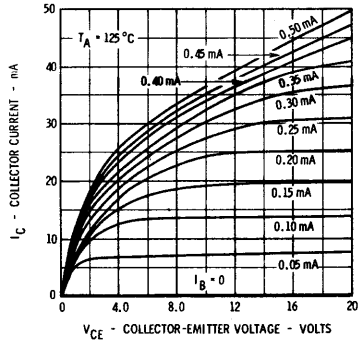
BASE CHARACTERISTICS *



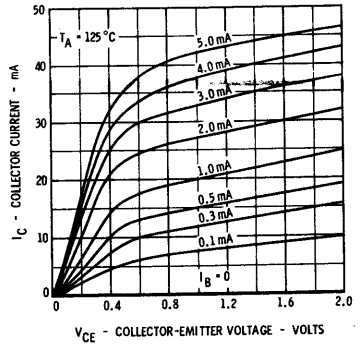
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



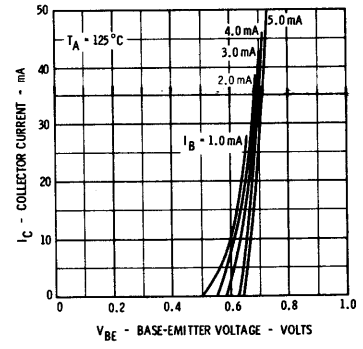
COLLECTOR CHARACTERISTICS *



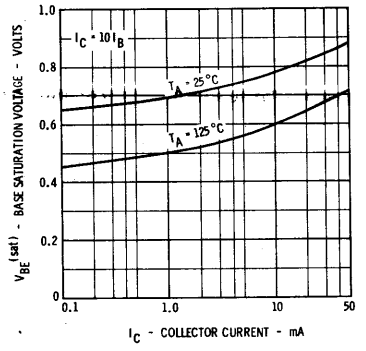
COLLECTOR CHARACTERISTICS *



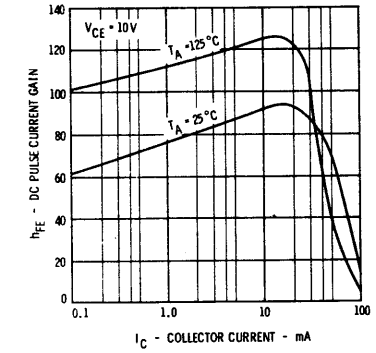
BASE CHARACTERISTICS *



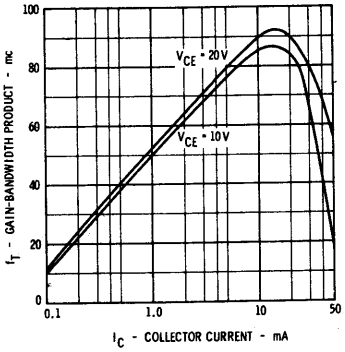
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



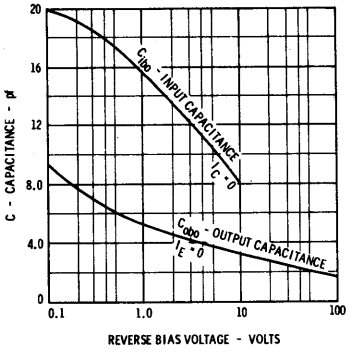
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



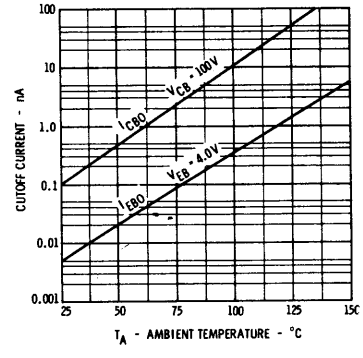
GAIN–BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT



INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



COLLECTOR & EMITTER CUTOFF CURRENTS VERSUS AMBIENT TEMPERATURE



* Single family characteristics on Transistor Curve Tracer

2N3930 • 2N3931 • 2N4357 • 2N4358

PNP HIGH VOLTAGE AMPLIFIER

DIFFUSED SILICON PLANAR* II TRANSISTORS

FEATURES

- **HIGH VOLTAGE -- 240 VOLT LV_{CEO}**
- **HIGH BETA -- 80-300 @ 10 mA**
- **LOW NOISE -- 3 dB @ 1.0 kHz**
- **EXCELLENT BETA LINEARITY from 10 μA to 50 mA**

ABSOLUTE MAXIMUM RATINGS [Note 1]

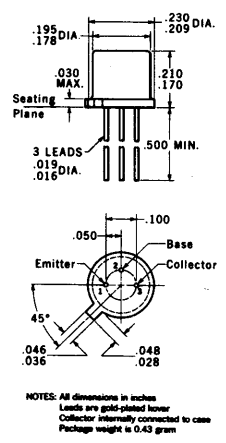
Maximum Temperatures

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

Maximum Power Dissipation [Notes 2 and 3]	2N3930 2N4357	2N3931 **2N4358**
Total Dissipation at 25°C Case Temperature	1.4 Watts	2.5 Watts
at 25°C Ambient Temperature	0.4 Watt	0.7 Watt

Maximum Voltages		2N3930 2N3931	2N4357 **2N4358**
V_{CBO}	Collector to Base Voltage	−180 Volts	−240 Volts
V_{CEO}	Collector to Emitter Voltage [Note 4]	−180 Volts	−240 Volts
V_{EBO}	Emitter to Base Voltage	−6.0 Volts	−6.0 Volts

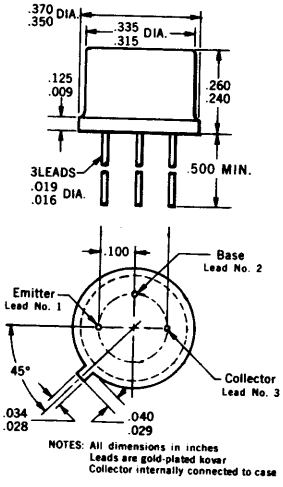
PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-18) outline



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

2N3930 • 2N4357

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



NOTES: All dimensions in inches
Leads are gold-plated kovar
Collector internally connected to case

2N3931 • 2N4358

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	2N3930 2N3931	−180			Volts	$I_C = 10\ \mu A$ $I_E = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	2N4357 2N4358	−240			Volts	$I_C = 10\ \mu A$ $I_E = 0$
$V_{CEO(sust)}$	Collector to Emitter Sustaining Voltage	2N3930 2N3931	−180			Volts	$I_C = 2.0$ mA $I_B = 0$
$V_{CEO(sust)}$	**Collector to Emitter Sustaining Voltage**	**2N4357 2N4358**	**−240**			**Volts**	**$I_C = 2.0$ mA $I_B = 0$**
h_{FE}	**DC Current Gain**		**60**	**110**			**$I_C = 10\ \mu A$ $V_{CE} = -10$ V**
h_{FE}	**DC Current Gain**		**80**	**170**			**$I_C = 1.0$ mA $V_{CE} = -10$ V**
h_{FE}	**DC Pulse Current Gain** [Note 5]		**80**	**200**	**300**		**$I_C = 10$ mA $V_{CE} = -10$ V**
h_{FE} (−55°C)	DC Current Gain		15	50			$I_C = 10\ \mu A$ $V_{CE} = -10$ V
h_{FE} (−55°C)	DC Current Gain		30	105			$I_C = 100\ \mu A$ $V_{CE} = -10$ V
$V_{CE(sat)}$	Collector Saturation Voltage	2N3930 2N3931		−0.1	−0.25	Volts	$I_C = 10$ mA $I_B = 1.0$ mA
$V_{CE(sat)}$	Collector Saturation Voltage	2N4357 2N4358		−0.2	−0.5	Volts	$I_C = 10$ mA $I_B = 1.0$ mA

* Planar is a patented Fairchild process.

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

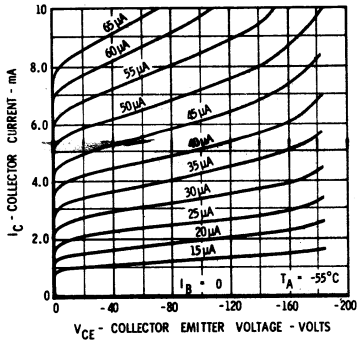
313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

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

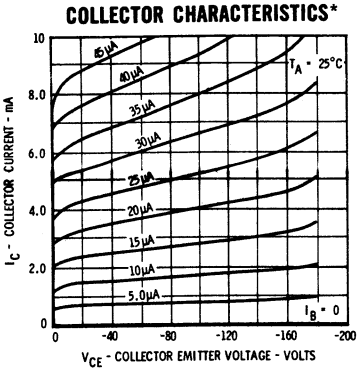
SYMBOL	CHARACTERISTIC		MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
$V_{BE(sat)}$	Base Saturation Voltage			0.74	0.9	Volts	$I_C = 10$ mA	$I_B = 1.0$ mA
BV_{EBO}	Emitter to Base Breakdown Voltage		−6.0			Volts	$I_E = 10\ \mu A$	$I_C = 0$
I_{EBO}	Emitter Cutoff Current			0.2	10	nA	$I_C = 0$	$V_{EB} = -4.0$ V
I_{CBO}	Collector Reverse Current	2N3930 2N3931		0.2	10	nA	$I_E = 0$	$V_{CB} = -100$ V
I_{CBO}	Collector Reverse Current	2N4357 2N4358		0.5	20	nA	$I_E = 0$	$V_{CB} = -200$ V
I_{CBO} (150°C)	Collector Reverse Current	2N3930 2N3931		0.03	10	μA	$I_E = 0$	$V_{CB} = -100$ V
I_{CBO} (150°C)	Collector Reverse Current	2N4357 2N4358		0.07	20	μA	$I_E = 0$	$V_{CB} = -200$ V
C_{obo}	Open Circuit, Output Capacitance (f = 1.0 MHz)			5.0	7.0	pF	$I_E = 0$	$V_{CB} = -5.0$ V
C_{ibo}	Open Circuit, Input Capacitance (f = 1.0 MHz)			20	25	pF	$I_C = 0$	$V_{EB} = -0.5$ V
h_{fe}	High Frequency Current Gain (f = 20 MHz)		2.0	3.0	8.0		$I_C = 1.0$ mA	$V_{CE} = -10$ V
NF	Narrow Band Noise Figure (f = 10 kHz)			1.0	3.0	dB	$I_C = 10\ \mu A$, $R_S = 10$ kΩ	$V_{CE} = -5.0$ V, BW = 1.5 kHz
NF	**Narrow Band Noise Figure (f = 1.0 kHz)**			**1.0**	**3.0**	**dB**	**$I_C = 10\ \mu A$, $R_S = 10$ kΩ**	**$V_{CE} = -5.0$ V, BW = 150 Hz**
NF	Narrow Band Noise Figure (f = 100 Hz)			2.0	10	dB	$I_C = 10\ \mu A$, $R_S = 10$ kΩ	$V_{CE} = -5.0$ V, BW = 15 Hz

TYPICAL ELECTRICAL CHARACTERISTICS

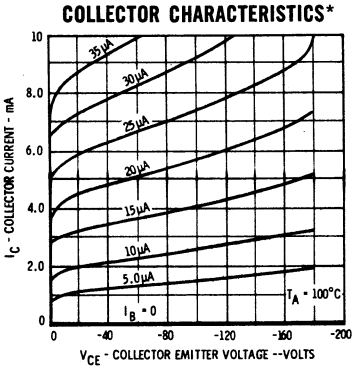
COLLECTOR CHARACTERISTICS*



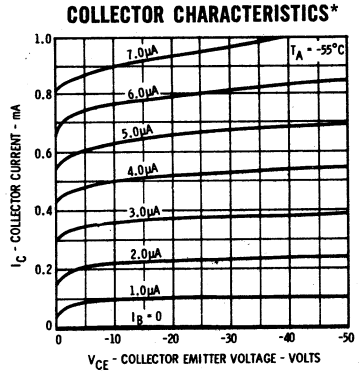
COLLECTOR CHARACTERISTICS*



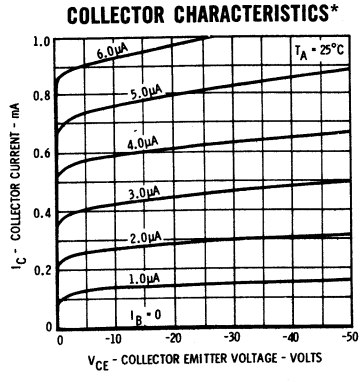
COLLECTOR CHARACTERISTICS*



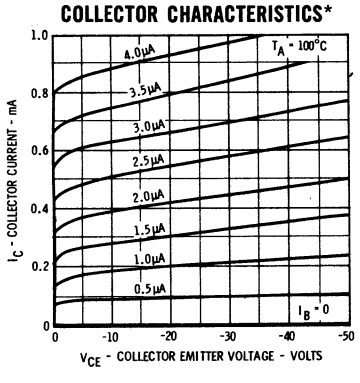
COLLECTOR CHARACTERISTICS*



COLLECTOR CHARACTERISTICS*



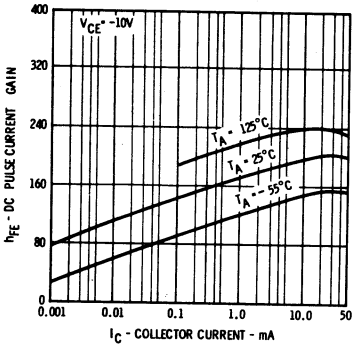
COLLECTOR CHARACTERISTICS*



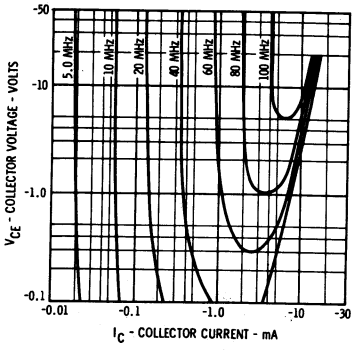
* Single family characteristic on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

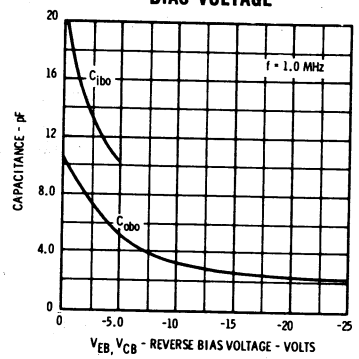
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



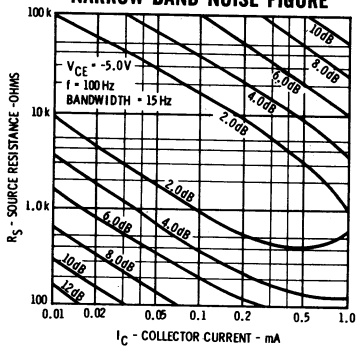
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_t)



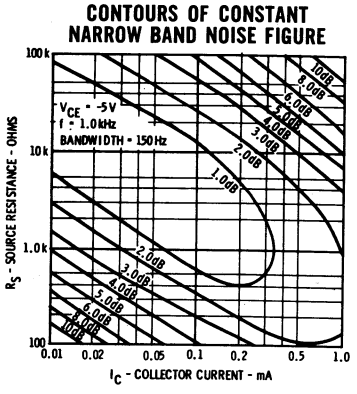
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



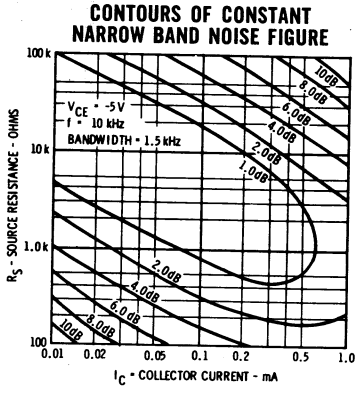
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



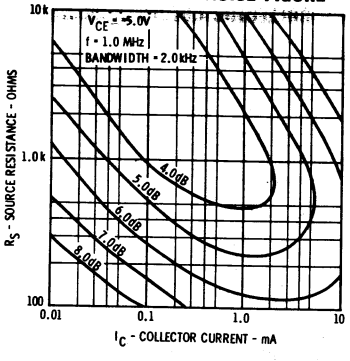
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



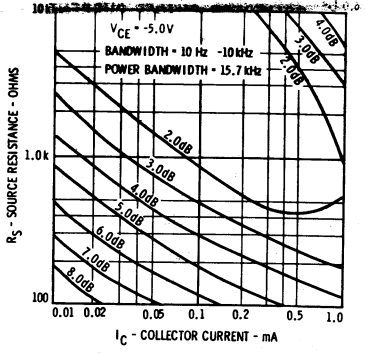
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



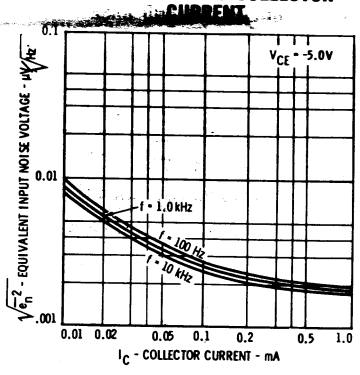
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



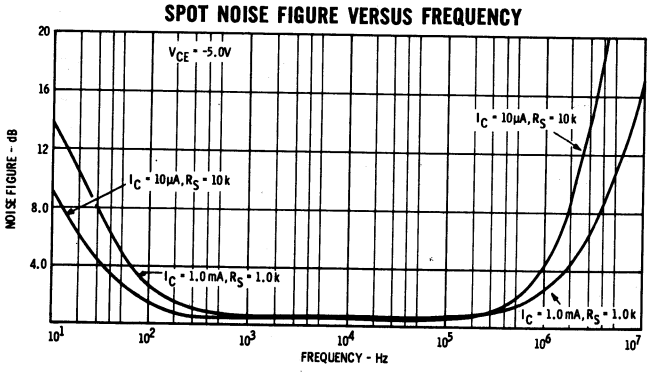
CONTOURS OF CONSTANT WIDE BAND NOISE FIGURE



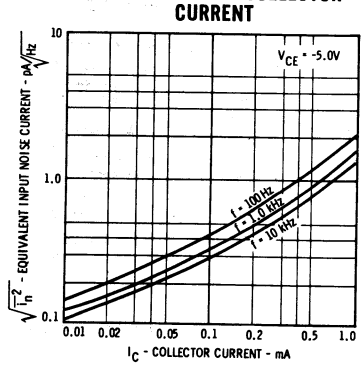
EQUIVALENT INPUT NOISE VOLTAGE VERSUS COLLECTOR CURRENT



SPOT NOISE FIGURE VERSUS FREQUENCY



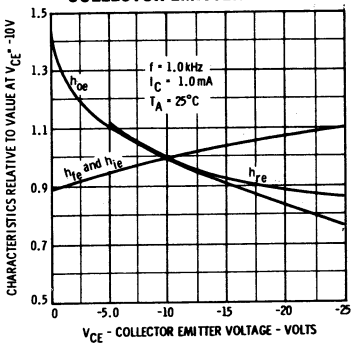
EQUIVALENT INPUT NOISE CURRENT VERSUS COLLECTOR CURRENT



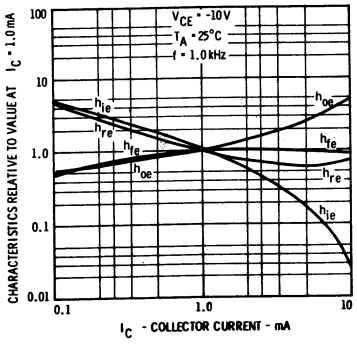
SMALL SIGNAL CHARACTERISTICS ($f = 1.0$ kHz, $T_A = 25°C$)

SYMBOL	CHARACTERISTIC	MIN.	MAX.	UNITS	TEST CONDITIONS
h_{fe}	Small Signal Current Gain	100	400		$I_C = 1.0$ mA $V_{CE} = -10$ V
h_{ie}	Input Resistance	2.5	12	kOhms	$I_C = 1.0$ mA $V_{CE} = -10$ V
h_{oe}	Output Conductance	5.0	25	μmhos	$I_C = 1.0$ mA $V_{CE} = -10$ V

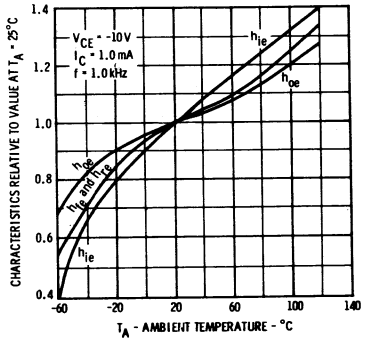
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR-EMITTER VOLTAGE



COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR CURRENT

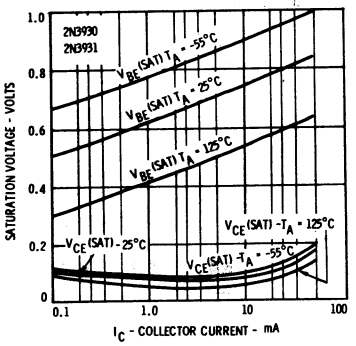


COMMON EMITTER CHARACTERISTICS VERSUS AMBIENT TEMPERATURE

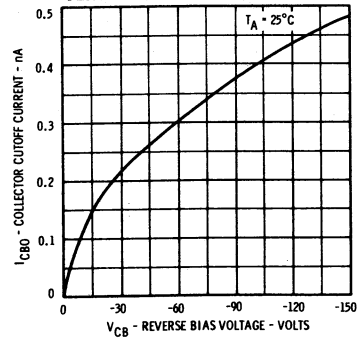


TYPICAL ELECTRICAL CHARACTERISTICS

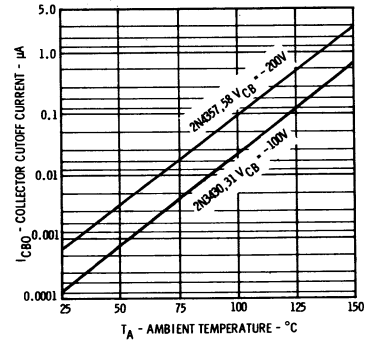
COLLECTOR AND BASE ~~SATURATION VOLTAGES VERSUS~~ COLLECTOR CURRENT



COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



COLLECTOR CUTOFF CURRENT 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 200°C and junction to case thermal resistance of 125°C/watt (derating factor of 8.0 mW/°C); junction to ambient thermal resistance of 438°C/watt (derating factor of 2.28 mW/°C) for the 2N3920 and 2N4357; junction to case thermal resistance of 70°C/watt (derating factor of 14.3 mW/°C); junction to ambient thermal resistance of 250°C/watt (derating factor of 4.0 mW/°C) for the 2N3931 and 2N4358.

(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%.