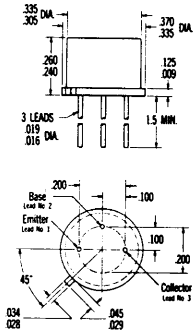
2N2868

NPN HIGH-SPEED, HIGH-CURRENT SWITCH

SILICON PLANAR EPITAXIAL TRANSISTORS

FOR IMPROVED PERFORMANCE SEE FAIRCHILD 2N3108, 2N3110

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



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

GENERAL DESCRIPTION - The Fairchild 2N2868 is an NPN silicon PLANAR epitaxial transistor designed for use in high-speed, high current switching applications.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures
- Storage Temperature: -65°C to +300°C
- Operating Junction Temperature: 200°C Maximum
- Lead Temperature (Soldering, no time limit): 250°C Maximum

Maximum Power Dissipation
- Total Dissipation at 25°C Case Temperature (Notes 2 and 3): 2.8 Watts
- at 100°C Case Temperature (Notes 2 and 3): 1.6 Watts
- at 25°C Ambient Temperature (Notes 2 and 3): 0.8 Watt

Maximum Voltages and Current

V_{CBO}	Collector to Base Voltage		60 Volts
V_{CEO}	Collector to Emitter Voltage	(Note 4)	40 Volts
V_{EBO}	Emitter to Base Voltage		7.0 Volts
I_C	Collector Current		1.0 Amp

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
h_{FE}	DC Pulse Current Gain	(Note 5)	30			I_C = 150 mA	V_{CE} = 1.0 V
h_{FE}	DC Current Gain		30			I_C = 10 mA	V_{CE} = 10 V
h_{FE}	DC Pulse Current Gain	(Note 5)	20			I_C = 500 mA	V_{CE} = 10 V
h_{FE}(-55°C)	DC Current Gain		20			I_C = 10 mA	V_{CE} = 10 V
V_{CE}(sat)	Collector Saturation Voltage			0.25	Volts	I_C = 150 mA	I_B = 15 mA
V_{BE}(sat)	Base Saturation Voltage			1.3	Volts	I_C = 150 mA	I_B = 15 mA
h_{fe}	High Frequency Current Gain (f = 20 mc)		2.5			I_C = 50 mA	V_{CE} = 10 V
I_{CBO}	Collector Cutoff Current			10	nA	V_{CB} = 30 V	I_E = 0
I_{CBO}(150°C)	Collector Cutoff Current			15	μA	V_{CB} = 30 V	I_E = 0
I_{EBO}	Emitter Cutoff Current			50	nA	V_{EB} = 5.0 V	I_C = 0
I_{CEX}	Collector Cutoff Current			100	nA	V_{CE} = 30 V	V_{EB} = 3.0 V
I_{EBX}	Emitter Cutoff Current			100	nA	V_{CE} = 30 V	V_{EB} = 3.0 V
BV_{CBO}	Collector to Base Breakdown Voltage		60		Volts	I_C = 100 μA	I_E = 0
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage	(Notes 4 and 5)	40		Volts	I_C = 25 mA (pulsed)	I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage		7.0		Volts	I_E = 100 μA	I_C = 0
C_{ob}	Output Capacitance (f = 1.0 mc)			20	pf	V_{CB} = 10 V	I_E = 0
τ_b	Base Stored Charge			2.0	μsec	See Figure I	

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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 62.5°C/Watt (derating factor of 16 mW/°C); junction-to-ambient thermal resistance of 218°C/Watt (derating factor of 4.6 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 ≤ 2%.

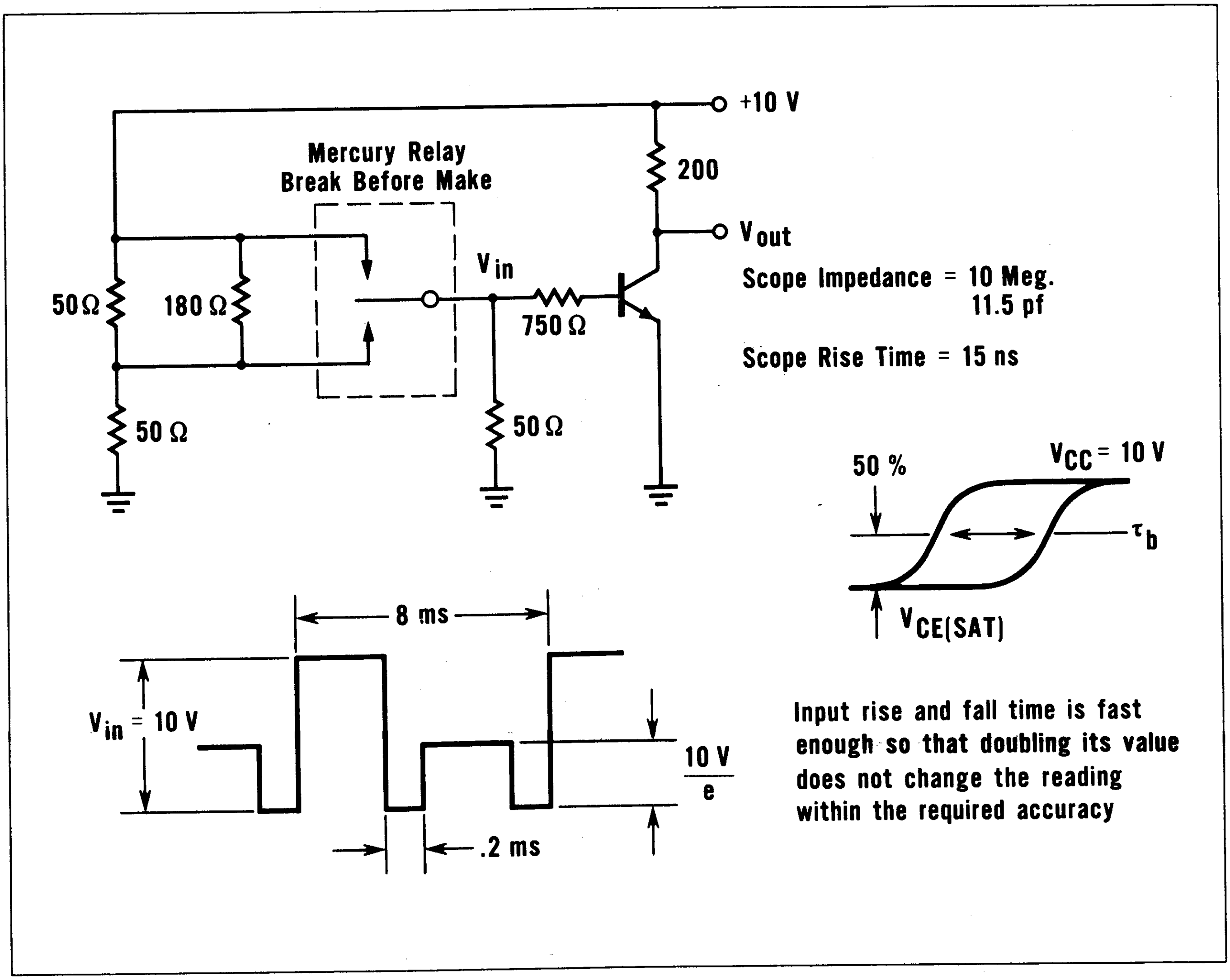


FIGURE 1

2N2890 • 2N2891 • 2N2892 • 2N2893

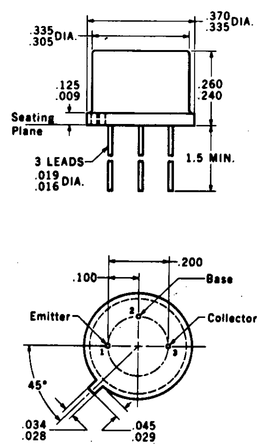
NPN HIGH-POWER, HIGH-VOLTAGE TYPE

DIFFUSED SILICON PLANAR EPITAXIAL TRANSISTORS

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

PHYSICAL DIMENSIONS

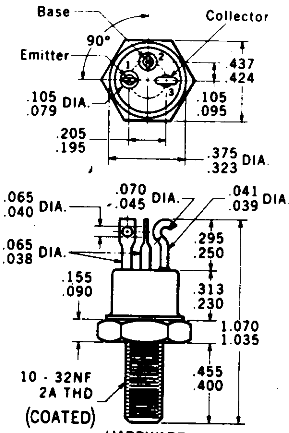
in accordance with JEDEC (TO-5) outline



NOTES: All dimensions in inches
Leads are gold-plated kovar
Collector internally connected to case
Package weight is 1.10 grams

2N2890 2N2891

PHYSICAL DIMENSIONS



HARDWARE
Flat nickel-plated brass washer
.205/.230 ID .475/.505 OD .040/.070 THICK
Flat mica washer (2)
.185/.205 ID .620/.630 OD .003/.008 THICK
Flat teflon spacer
.185/.205 ID .265/.280 OD .035/.055 THICK
Nickel-plated brass hex nut
10-32 American Standard double chamfered
NOTES: All dimensions in inches
Collector internally connected to case
Package weight is 6.07 grams

2N2892 2N2893

ABSOLUTE MAXIMUM RATINGS [Note 1]

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

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

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

Additional Electrical Characteristics on page 2
Notes on page 2

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

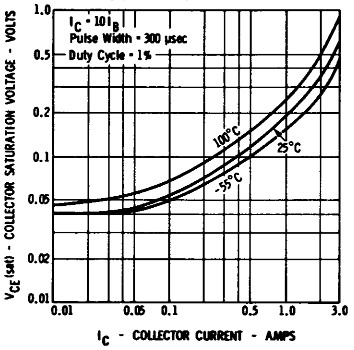
SYMBOL	CHARACTERISTIC	2N2891 2N2893 Min.	Typ.	Max.	2N2890 2N2892 Min.	Typ.	Max.	Units	TEST CONDITIONS
BV_{CBO}	Collector to Base Breakdown Voltage	100			100			Volts	$I_C = 100\,\mu A$ $I_E = 0$
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage [Notes 4 and 5]	80			80			Volts	$I_C = 100$ mA $I_B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

NOTES:

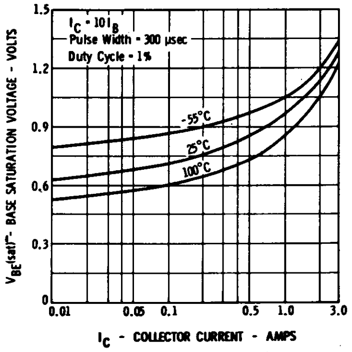
(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
(3) These ratings give a maximum junction temperature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

TYPICAL ELECTRICAL CHARACTERISTICS

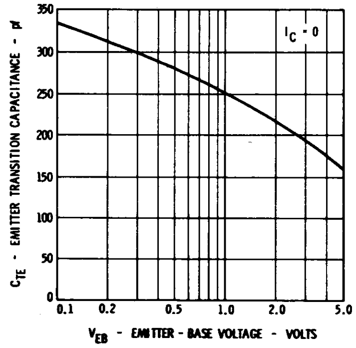
COLLECTOR SATURATION VOLTAGE VERSUS PULSED COLLECTOR CURRENT



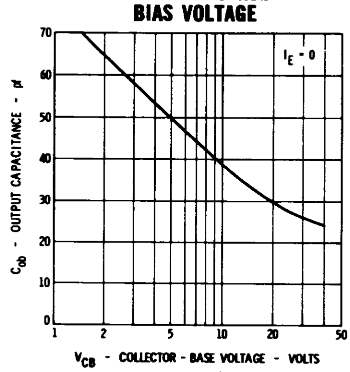
BASE SATURATION VOLTAGE VERSUS PULSED COLLECTOR CURRENT



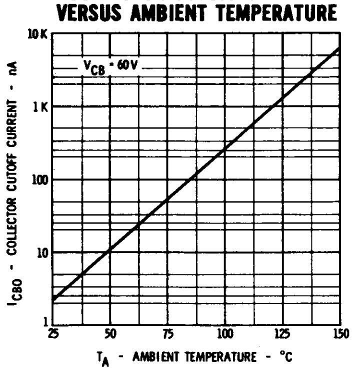
EMITTER TRANSITION CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



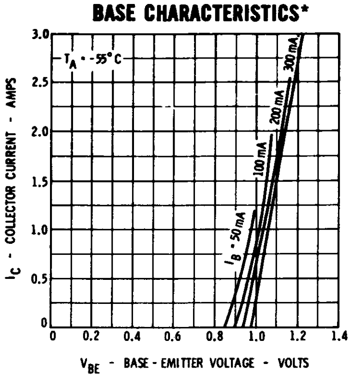
OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



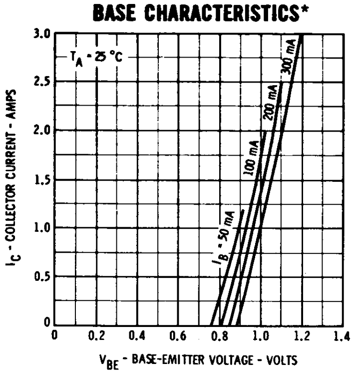
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



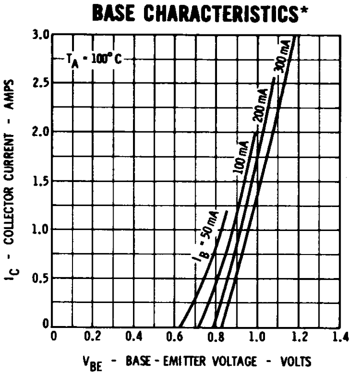
BASE CHARACTERISTICS*



BASE CHARACTERISTICS*



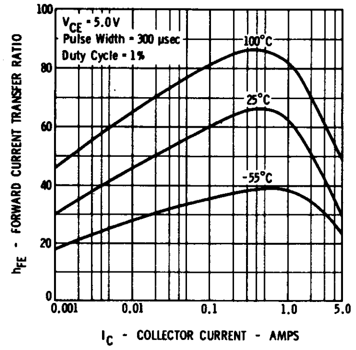
BASE CHARACTERISTICS*



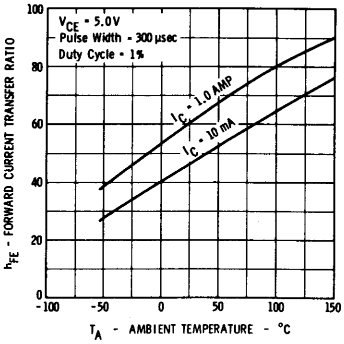
*** Single family characteristic on Transistor Curve Tracer.**

2N2890 • 2N2892

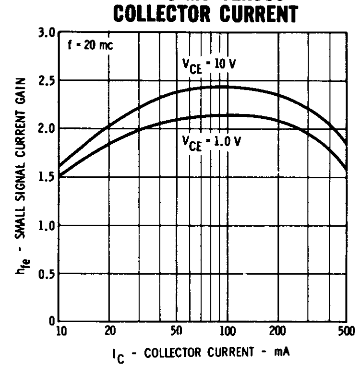
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



PULSED DC CURRENT GAIN VERSUS AMBIENT TEMPERATURE

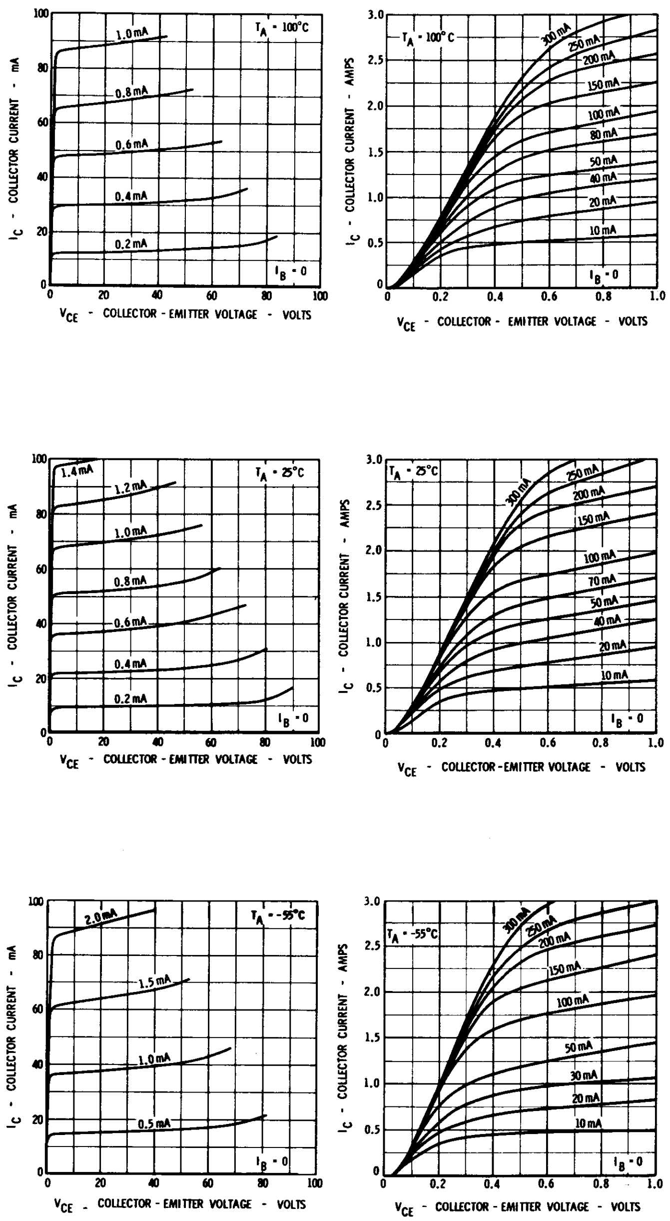


SMALL SIGNAL CURRENT GAIN AT 20 MC VERSUS COLLECTOR CURRENT

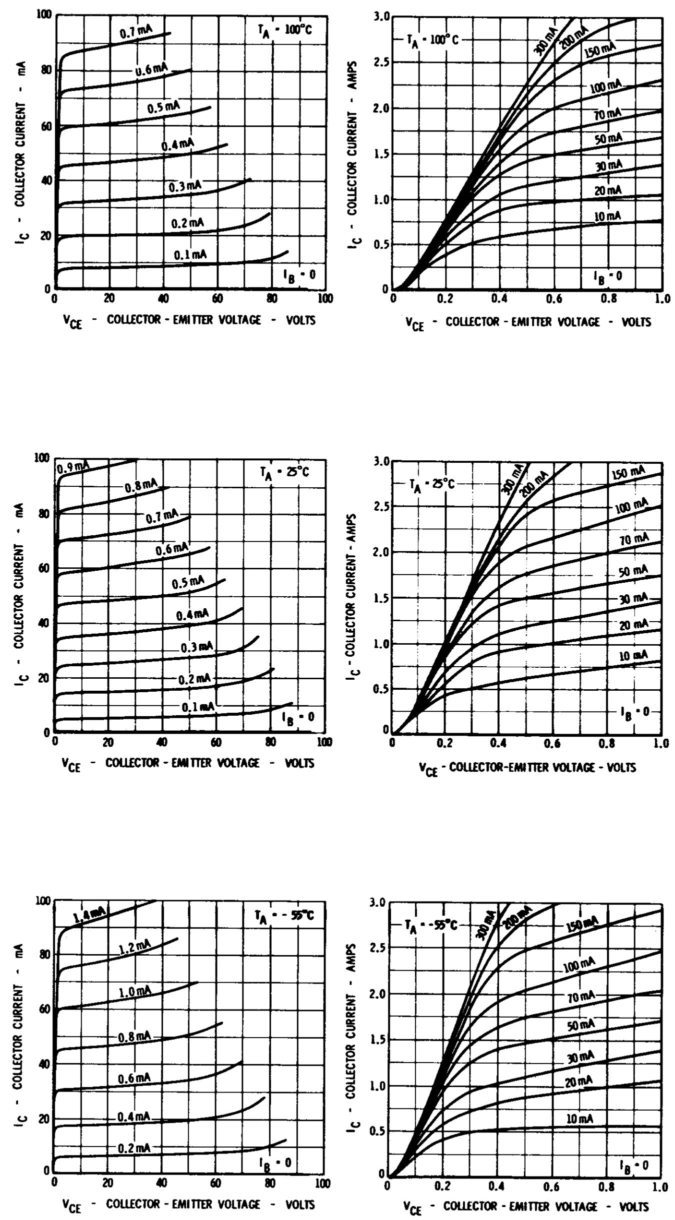


TYPICAL COLLECTOR CHARACTERISTICS*

2N2890 • 2N2892



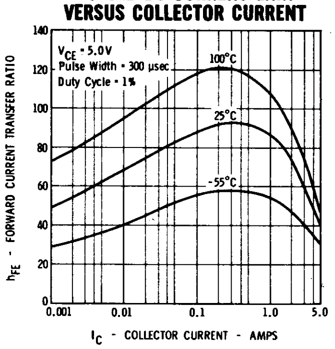
2N2891 • 2N2893



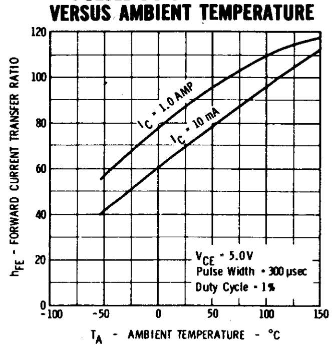
* Single family characteristic on Transistor Curve Tracer.

2N2891 • 2N2893

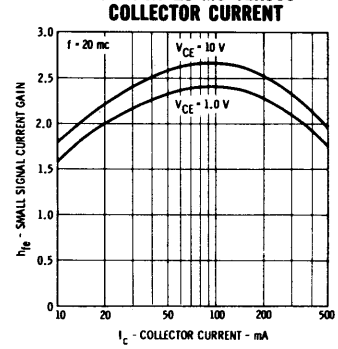
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



PULSED DC CURRENT GAIN VERSUS AMBIENT TEMPERATURE



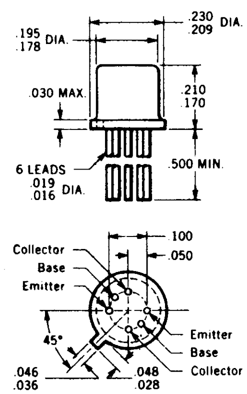
SMALL SIGNAL CURRENT GAIN AT 20 MC VERSUS COLLECTOR CURRENT



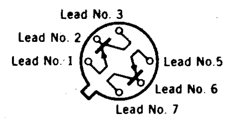
2N2980 • 2N2981 • 2N2982
NPN DIFFERENTIAL AMPLIFIERS
DIFFUSED SILICON PLANAR* TRANSISTORS

These six-terminal devices each contain two isolated high-gain NPN double-diffused silicon PLANAR transistors in one hermetically sealed enclosure. They are designed for use in high-performance differential amplifier circuits.

PHYSICAL DIMENSIONS



CONNECTION DIAGRAM



BOTTOM VIEW

NOTES All dimensions in inches
Leads are gold plated kovar
Package weight is 0.62 gram

ABSOLUTE MAXIMUM RATINGS [Note 1]

Maximum Temperatures

Storage Temperature	**−65°C** to **300°C**
Operating Junction Temperature	**+200°C** Maximum
Lead Temperature (Soldering, No Time Limit)	**+300°C** Maximum

Maximum Power Dissipation

	One Side	Both Sides
Total Dissipation at 25°C Case Temperature [Notes 2 and 3]	**0.5** Watt	**0.75** Watt
at 100°C Case Temperature [Notes 2 and 3]	**0.29** Watt	**0.43** Watt
at 25°C Ambient Temperature [Notes 2 and 3]	**0.25** Watt	**0.30** Watt

Maximum Voltages and Current for Each Transistor

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
I_C	Collector Current	**500** mA

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

SYMBOL	CHARACTERISTIC	2N2980 MIN.	2N2980 MAX.	2N2981 MIN.	2N2981 MAX.	2N2982 MIN.	2N2982 MAX.	UNITS	TEST CONDITIONS
$\frac{h_{FE1}}{h_{FE2}}$	DC Current Gain Ratio [Note 5]	**0.9**	**1.0**	**0.8**	**1.0**	**0.9**	**1.0**		$I_C = 100\ \mu A$ $V_{CE} = 5.0$ V
$\frac{h_{FE1}}{h_{FE2}}$	DC Current Gain Ratio [Note 5]	**0.9**	**1.0**						$I_C = 1.0$ mA $V_{CE} = 5.0$ V
$\lvert V_{BE1}-V_{BE2}\rvert$	Base-Emitter Voltage Differential		**3.0**		**15**		**5.0**	mV	$I_C = 100\ \mu A$ $V_{CE} = 5.0$ V
$\lvert V_{BE1}-V_{BE2}\rvert$	Base-Emitter Voltage Differential		**5.0**					mV	$I_C = 1.0$ mA $V_{CE} = 5.0$ V
$\Delta(V_{BE1}-V_{BE2})$	Base-Emitter Voltage Differential Change ($T_A = -55°C$ to $+25°C$ or $+25°C$ to $+125°C$)		**10**		**25**		**15**	$\mu V/°C$	$I_C = 100\ \mu A$ $V_{CE} = 5.0$ V
NF	Narrow Band Noise Figure (f = 1.0 kHz)	**8.0**						dB	$I_C = 0.3$ mA $V_{CE} = 10$ V B.W. = 200 Hz $R_g = 510\ \Omega$
NF	Broad Band Noise Figure (f = 25 Hz to 10 kHz)	**8.0**						dB	$I_C = 0.3$ mA $V_{CE} = 10$ V B.W. = 15.7 kHz $R_g = 1.0\ k\Omega$

* Planar is a patented Fairchild process.

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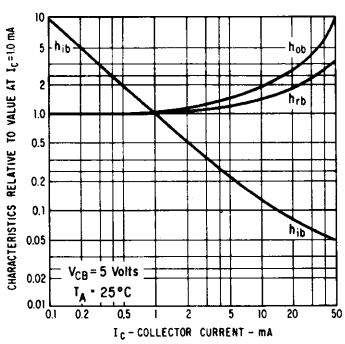
ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise specified)

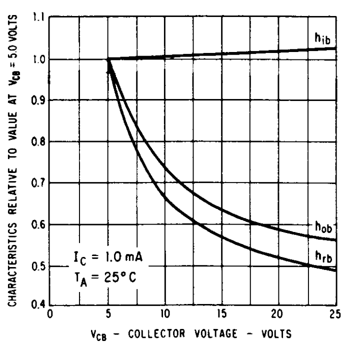
SYMBOL	CHARACTERISTIC	2N2980 MIN.	2N2980 TYP.	2N2980 MAX.	2N2981 2N2982 MIN.	2N2981 2N2982 TYP.	2N2981 2N2982 MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Pulse Current Gain [Note 6]	50	100	150	50	125	200		$I_C = 10$ mA	$V_{CE} = 5.0$ V
h_{FE}	DC Current Gain	40	80	120					$I_C = 1.0$ mA	$V_{CE} = 5.0$ V
h_{FE}	DC Current Gain	30	60	90	25	60	150		$I_C = 100\mu A$	$V_{CE} = 5.0$ V
h_{FE}	DC Current Gain	25	50	75	15	50			$I_C = 10\mu A$	$V_{CE} = 5.0$ V
V_{BE} (sat)	Base Saturation Voltage		0.7	0.9		0.7	0.9	Volts	$I_C = 50$ mA	$I_B = 5.0$ mA
V_{CE} (sat)	Collector Saturation Voltage		0.35	1.2		0.35	1.2	Volts	$I_C = 50$ mA	$I_B = 5.0$ mA
I_{CBO}	Collector Cutoff Current		0.4	2.0		0.4	10	nA	$I_E = 0$	$V_{CB} = 80$ V
I_{CBO} (150°C)	Collector Cutoff Current		1.3	10		1.3	15	μA	$I_E = 0$	$V_{CB} = 80$ V
BV_{CBO}	Collector to Base Breakdown Voltage	100			100			Volts	$I_C = 100\mu A$	$I_E = 0$
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage [Notes 4 and 6]	60			60			Volts	$I_C = 30$ mA (pulsed)	$I_B = 0$
BV_{EBO}	Emitter Breakdown Voltage	7.0			7.0			Volts	$I_C = 0$	$I_E = 100\ \mu A$
I_{EBO}	Emitter Cutoff Current		0.1	2.0		0.1	10	nA	$I_C = 0$	$V_{EB} = 5.0$ V
h_{fe}	High Frequency Current Gain (f = 20 MHz)	3.0	5.0		2.5	5.0			$I_C = 50$mA	$V_{CE} = 10$ V
C_{obo}	Output Capacitance	8.0	12	15	8.0	12	15	pF	$I_E = 0$	$V_{CB} = 10$ V
C_{TE}	Emitter Transition Capacitance	30	60	85	30	60	85	pF	$I_C = 0$	$V_{EB} = 0.5$ V

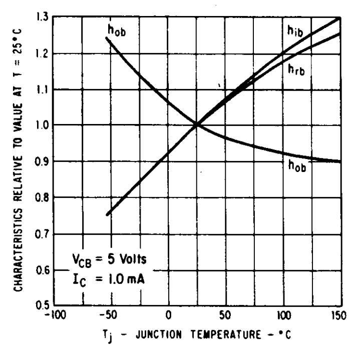
SMALL SIGNAL CHARACTERISTICS (f = 1 kHz)

SYMBOL	CHARACTERISTIC	2N2980 MIN.	2N2980 TYP.	2N2980 MAX.	2N2981 2N2982 MIN.	2N2981 2N2982 TYP.	2N2981 2N2982 MAX.	UNITS	TEST CONDITIONS	
h_{fe}	Small Signal Current Gain	50	80	150	40	125	200		$I_C = 1.0$ mA	$V_{CE} = 5.0$ V
h_{ie}	Input Resistance	1.25	2.3	5.0	1.0		6.0	kohms	$I_C = 1.0$ mA	$V_{CE} = 5.0$ V
h_{oe}	Output Conductance	5.0	9.0	20			30	μmhos	$I_C = 1.0$ mA	$V_{CE} = 5.0$ V
h_{ib}	Input Resistance	20	27	30	20	27	30	Ohms	$I_C = 1.0$ mA	$V_{CB} = 5.0$ V
h_{ob}	Output Conductance	0.1		0.5	0.1	0.2	0.5	μmhos	$I_C = 1.0$ mA	$V_{CB} = 5.0$ V
h_{rb}	Voltage Feedback Ratio			3.0		0.9	3.0	$\times 10^{-4}$	$I_C = 1.0$ mA	$V_{CB} = 5.0$ V

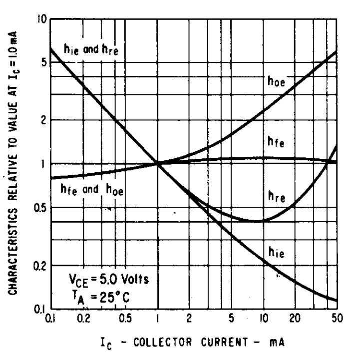
TYPICAL COMMON BASE CHARACTERISTICS

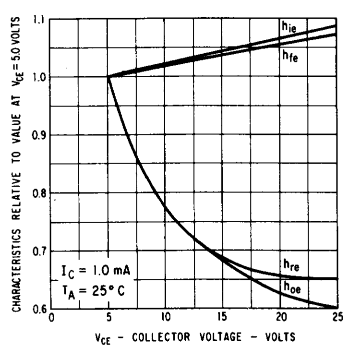


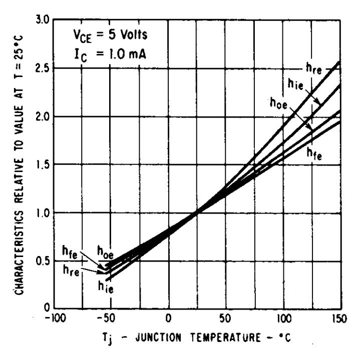




TYPICAL COMMON EMITTER CHARACTERISTICS



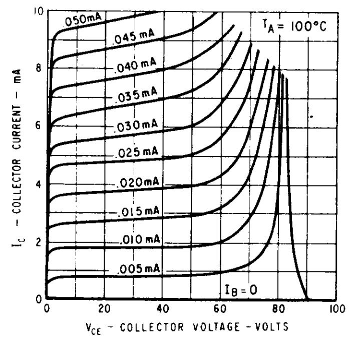


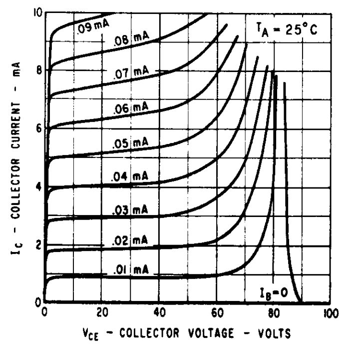


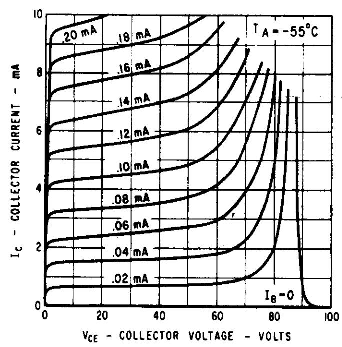
TYPICAL ELECTRICAL CHARACTERISTICS

HIGH VOLTAGE

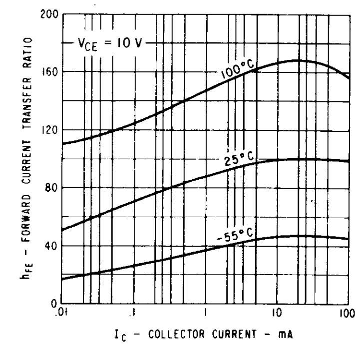
COLLECTOR CHARACTERISTICS*



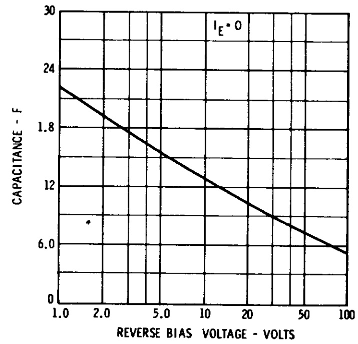




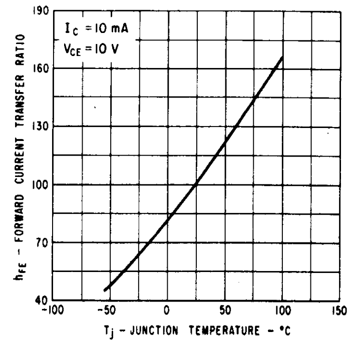
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



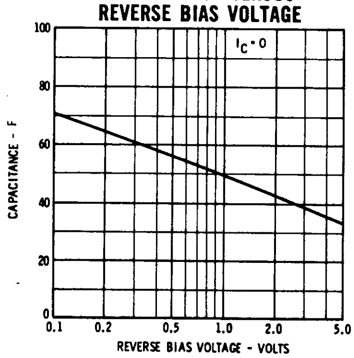
OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



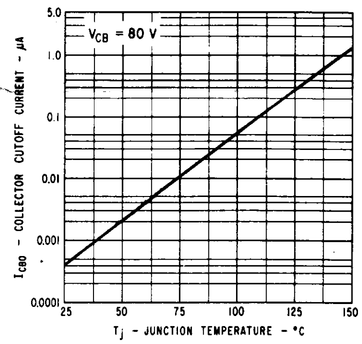
DC PULSE CURRENT GAIN VERSUS TEMPERATURE



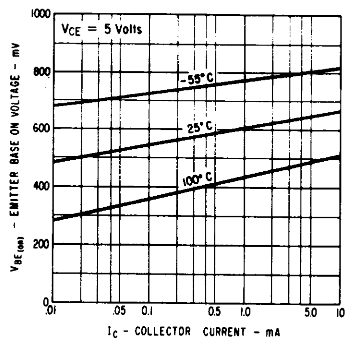
EMITTER TRANSITION CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



COLLECTOR CUTOFF CURRENT VERSUS TEMPERATURE

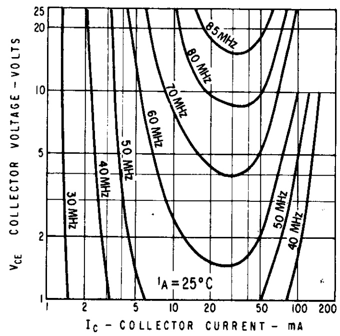


EMITTER-BASE ON VOLTAGE VERSUS COLLECTOR CURRENT

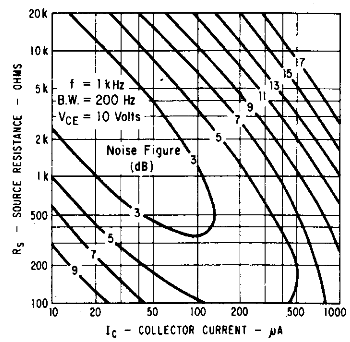


*Single family characteristics on Transistor Curve Tracer.

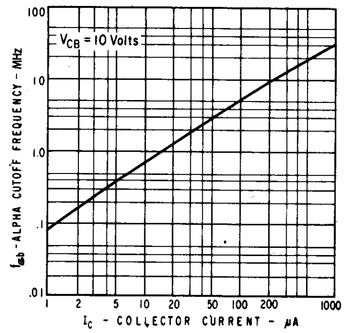
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)

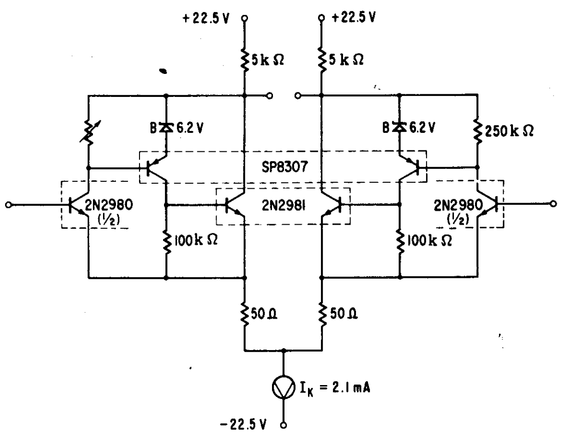


CONTOURS OF NARROW BAND NOISE FIGURE

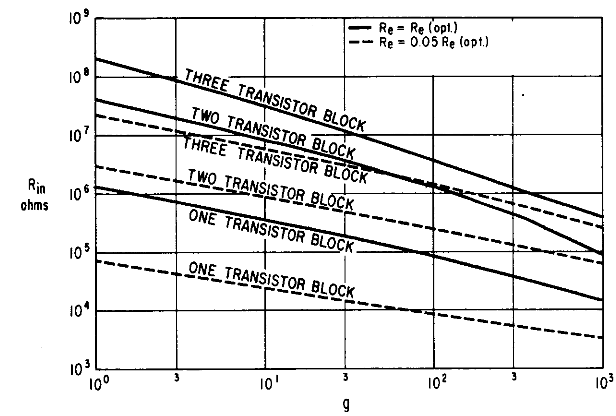


ALPHA CUTOFF FREQUENCY VERSUS COLLECTOR CURRENT

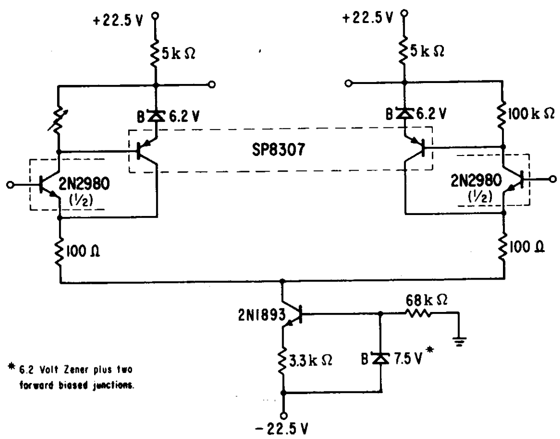




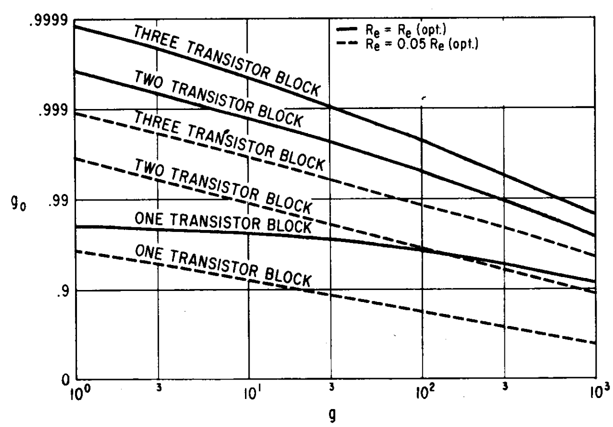
THE IMPROVED DIFFERENTIAL AMPLIFIER USING THE THREE-TRANSISTOR BLOCK.



INPUT RESISTANCE AS A FUNCTION OF g FOR $R_e = R_e$ (OPT.) AND $R_e = .05 R_e$ (OPT.)



THE IMPROVED DIFFERENTIAL AMPLIFIER USING THE TWO-TRANSISTOR BLOCK.



NORMALIZED GAIN, g_o, AS A FUNCTION of g ($g = R_L/R_e$) FOR $R_e = R_e$(OPT.) AND $R_e = .05 R_e$ (OPT.)

For additional information on these and other differential amplifier circuits see Fairchild TP-16, APP-23, APP-45, and APP-60.

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 200°C and junction-to-case thermal resistance of 350°C/watt (derating factor of 2.86 mW/°C) for one side; 233°C/watt (derating factor of 4.3 mW/°C) for both sides. Junction-to-ambient thermal resistance of 700°C/watt (derating factor of 1.43 mW/°C) for one side; 583°C/watt (derating factor of 1.72 mW/°C) for both sides.
(4) Rating refers to a high-current point where collector-to-emitter voltage is lowest.
(5) Lowest of the two h_{FE} readings is taken as h_{FE1} for purposes of this ratio.
(6) Pulse Conditions: length = 300 μsec; duty cycle = 1%.

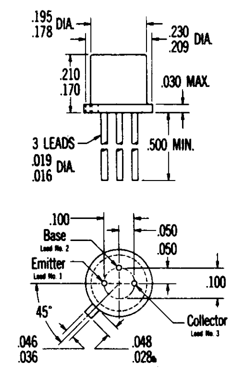
FT1746

FAIRCHILD PNP SILICON PLANAR EPITAXIAL TRANSISTOR

HIGH-VOLTAGE, HIGH-FREQUENCY SWITCH AND RF AMPLIFIER

GENERAL DESCRIPTION - The FT1746 is a double-diffused silicon PNP PLANAR epitaxial transistor packaged in the JEDEC TO-18 outline. It is specifically designed for digital and analog applications requiring high-voltage and high-frequency characteristics in combination. Typical f_T is 150 mc.

PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-18) 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
Soldering Temperature (60 seconds time limit)		300°C Maximum
Maximum Power Dissipation		
Total Dissipation at 25°C Case Temperature	[Note 2 and 3]	1.2 Watts
at 100°C Case Temperature	[Note 2 and 3]	0.68 Watt
at 25°C Ambient Temperature		0.36 Watt
Maximum Voltages		
V_{CBO}	Collector to Base Voltage	-35 Volts
V_{CEO}	Collector to Emitter Voltage	-30 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 5]	20			I_C = 10 mA	V_{CE} = -5.0 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
h_{fe}	High Frequency Current Gain (f = 100 mc)	1.0			I_C = 10 mA	V_{CE} = -10 V
C_{ob}	Output Capacitance		9.0	pf	I_E = 0	V_{CB} = -10 V
C_{TE}	Input Capacitance		11	pf	I_C = 0	V_{EB} = -0.5 V
I_{CBO}	Collector Cutoff Current		5.0	nA	I_E = 0	V_{CB} = -15 V
I_{CBO}(150°C)	Collector Cutoff Current		25	μA	I_E = 0	V_{CB} = -15 V
BV_{CBO}	Collector to Base Breakdown Voltage	-35		Volts	I_C = 10 μA	I_E = 0
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage [Note 4]	-30		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 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 operation.

(3) These ratings give a maximum junction temperature of 200°C and junction-to-case thermal resistance of 146°C/Watt (derating factor of 6.9 mW/°C); junction-to-ambient thermal resistance of 486°C/Watt (derating factor of 2.1 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%.

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