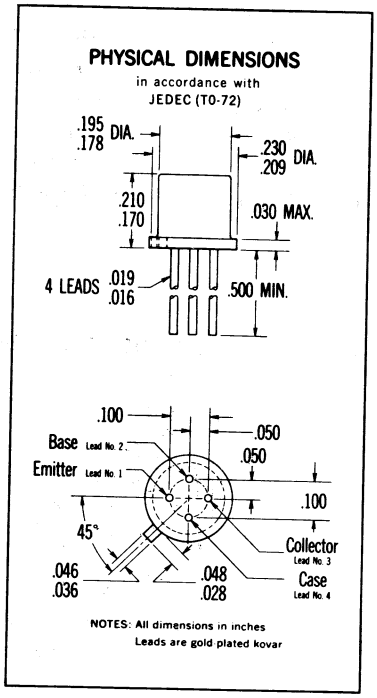
2N3337 · 2N3338 · 2N3339

NPN RF-IF-AGC AMPLIFIERS

DIFFUSED SILICON PLANAR* TRANSISTORS

GENERAL DESCRIPTION — The 2N3337, 2N3338, and 2N3339 are NPN silicon PLANAR transistors designed specifically for RF-IF-AGC applications. They feature high power gain, low noise, and excellent forward AGC characteristics.



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 & 3)	0.5 Watt
at 25°C Ambient Temperature (Notes 2 & 3)	0.3 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	4.0 Volts

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

Symbol	Characteristics		2N3337 2N3338 Min.	2N3337 2N3338 Max.	2N3339 Min.	2N3339 Max.	Units	Test Conditions
G_{Pe_1}	Small-Signal Power Gain (f = 60 MHz)	(Note 7)	24				dB	I_C = 4.0 mA V_{CE} = 10 V
G_{Pe_2}	Small-Signal Power Gain (f = 60 MHz)	(Note 7)	-30				dB	See Note 5
G_{Pe_1}	Small-Signal Power Gain (f = 200 MHz)	(Note 8)			15		dB	I_C = 4.0 mA V_{CE} = 10 V
G_{Pe_2}	Small-Signal Power Gain (f = 200 MHz)	(Note 8)			-30		dB	See Note 6
NF	Noise Figure (f = 60 MHz) 2N3338 only	(Note 7)		5.5			dB	I_C = 4.0 mA V_{CE} = 10 V
NF	Noise Figure (f = 200 MHz)	(Note 8)				5.5	dB	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 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 350°C/Watt (derating factor of 2.86 mW/°C); junction-to-ambient thermal resistance of 583°C/Watt (derating factor of 1.72 mW/°C).

(4) This rating refers to a high-current point where collector-to-emitter voltage is lowest.

(5) G_{Pe_2} is $\leq G_{Pe_1}$ -30 dB when I_C is between 8.0 and 12 mA in the 60 MHz circuit on page 4. $V_{CE} = (12 - \frac{I_C}{2})$.

(6) G_{Pe_2} is $\leq G_{Pe_1}$ - 30 dB when I_C is between 10 and 14 mA in the 200 MHz circuit on page 4. $V_{CE} = (12 - \frac{I_C}{2})$.

(7) Bandwidth = 10 MHz Source resistance (as seen by transistor) = 200Ω.

(8) Bandwidth = 8.0 MHz Source resistance (as seen by transistor) = 100Ω.

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

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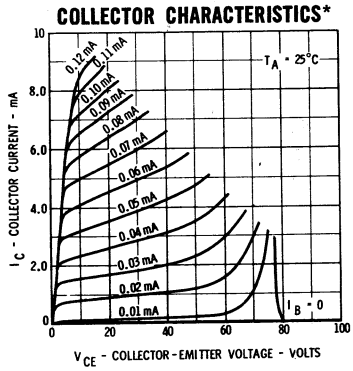
ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature unless otherwise noted)

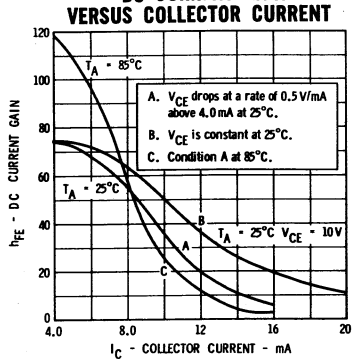
Symbol	Characteristic	Min.	Max.	Units	Test Conditions
h_{FE}	DC Current Gain	30			I_C = 4.0 mA V_{CE} = 10 V
I_{CBO}	Collector Cutoff Current		25	nA	I_E = 0 V_{CB} = 20 V
I_{CBO}(125°C)	Collector Cutoff Current		5.0	μA	I_E = 0 V_{CB} = 20 V
C_{ob}	Output Capacitance		1.6	pf	I_E = 0 V_{CB} = 10 V
h_{fe}	High Frequency Current Gain (f = 100 mc)	4.0			I_C = 4.0 mA V_{CE} = 10 V
BV_{CBO}	Collector to Base Breakdown Voltage	40		Volts	I_C = 100 μA I_E = 0
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 and 9)	40		Volts	I_C = 3.0 mA (pulsed) I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	4.0		Volts	I_E = 100 μA I_C = 0

TYPICAL ELECTRICAL CHARACTERISTICS

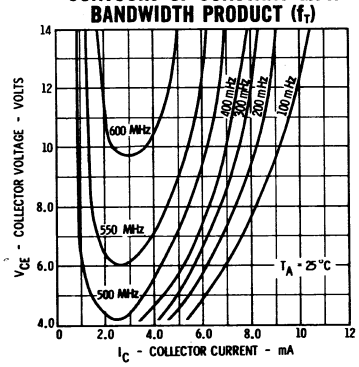
COLLECTOR CHARACTERISTICS*



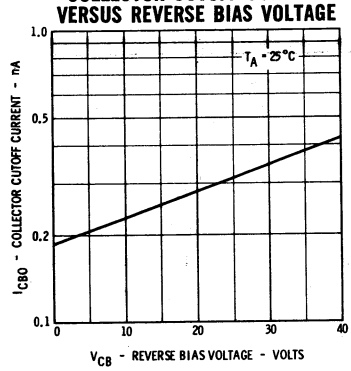
DC CURRENT GAIN VERSUS COLLECTOR CURRENT



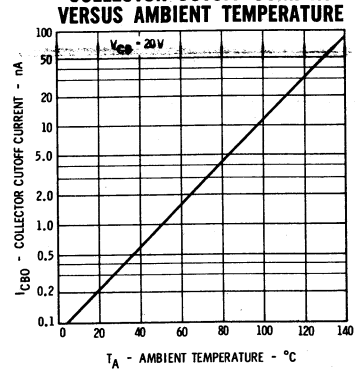
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



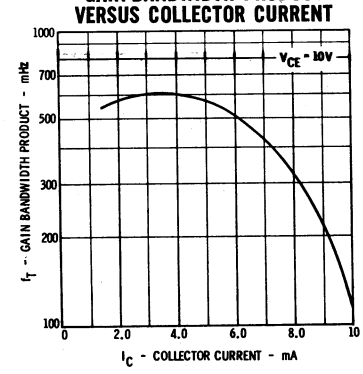
COLLECTOR CUTOFF CURRENT VERSUS REVERSE BIAS VOLTAGE



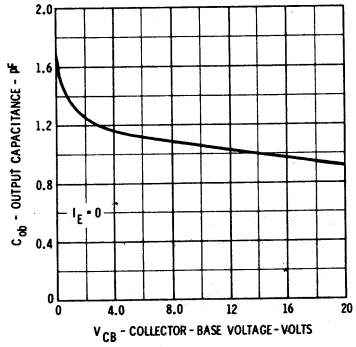
COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



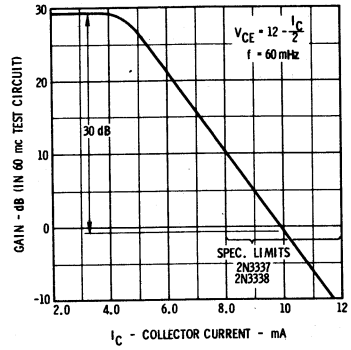
GAIN-BANDWIDTH PRODUCT VERSUS COLLECTOR CURRENT



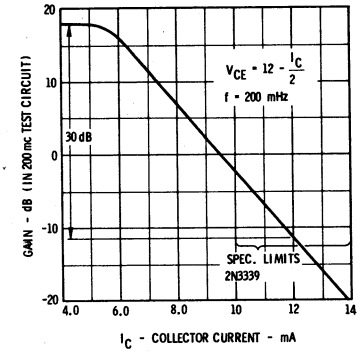
OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



TYPICAL GAIN VERSUS COLLECTOR CURRENT

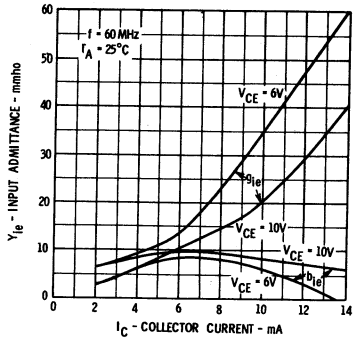
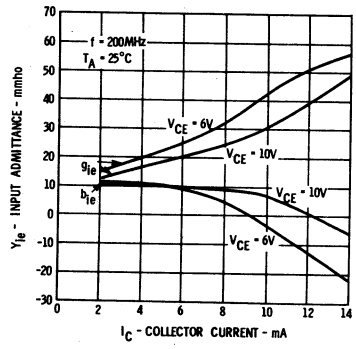
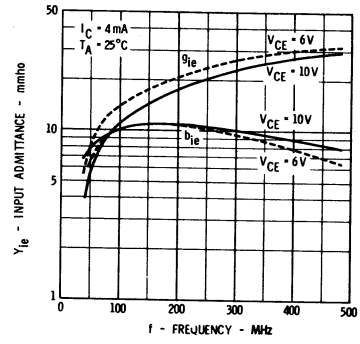
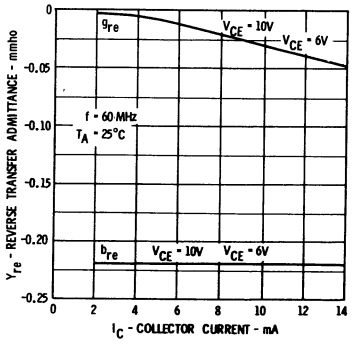
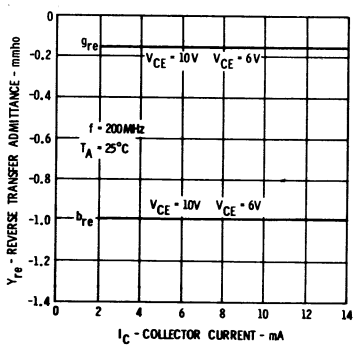
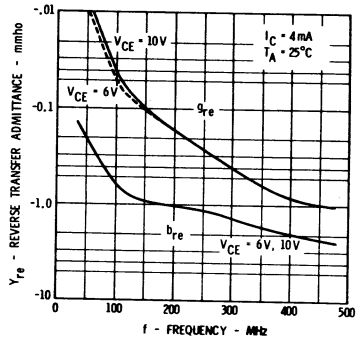
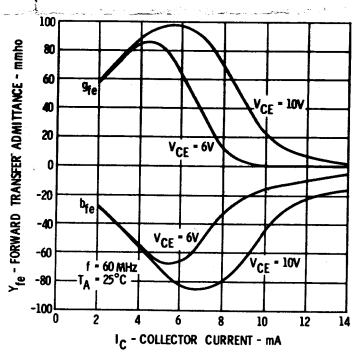
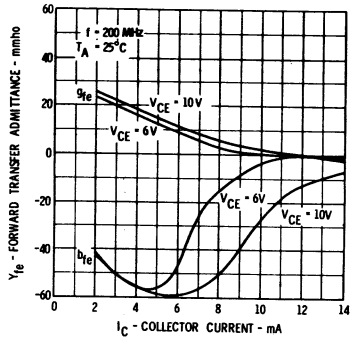
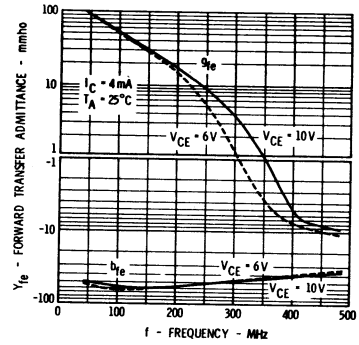
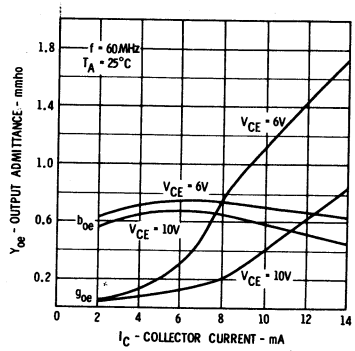
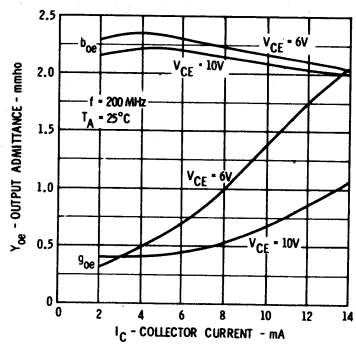
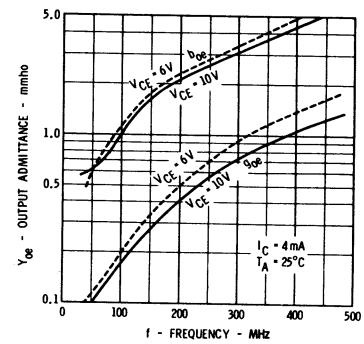


TYPICAL GAIN VERSUS COLLECTOR CURRENT



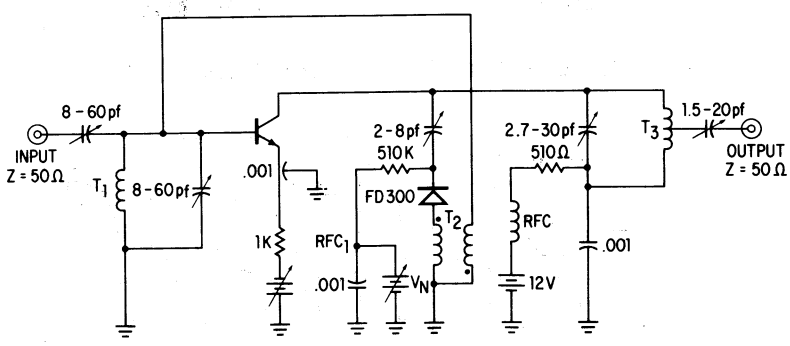
* Single family characteristics on Transistor Curve Tracer

TYPICAL SMALL SIGNAL COMMON EMITTER "Y" PARAMETERS

	60 MHz vs. COLLECTOR CURRENT	200 MHz 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)			

2N3337 - 2N3338

60MHz AGC TEST CIRCUIT



T_1 8 turns #16 tinned copper wire 1/4 inch I.D. x 1/2 inch long.

T_2 7 turns #32 Bifilar wire wound on toroid, I.D. = .120 inch, O.D. = .230 inch, .060 thick.

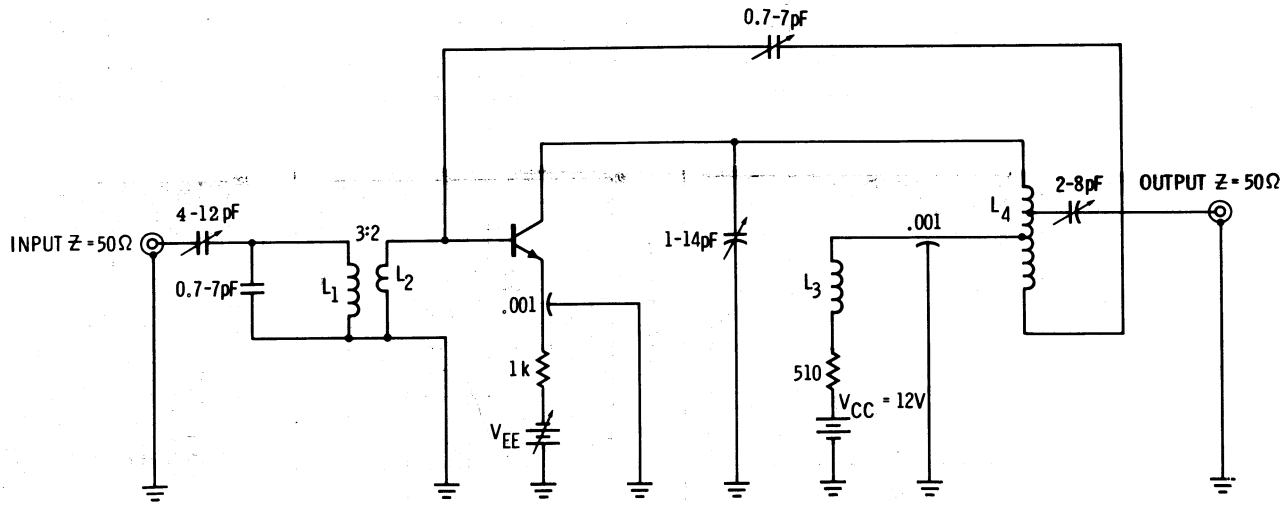
$\frac{1}{\mu_0 Q}$ = .00017 at 50 MHz μ_0 = 40 at 1 MHz

T_3 8 1/2 turns #26 enameled wire, center-tapped, wound on toroid, I.D. = .187 inch, O.D. = .375 inch, .125 thick.

$\frac{1}{\mu_0 Q}$ = .00042 at 150 MHz μ_0 = 16 at 1 MHz

2N3339

200MHz AGC TEST CIRCUIT



L_1 - 3 turns #18 enameled wire on 1/4" ceramic core.

L_2 - 2 turns #18 enameled wire interwound at cold end with L_1.

L_3 - RFC

L_4 - 7 turns 0.076 diameter silver tubing space wound (3/8" I.D., no core), output tap at 2 turns from collector end, ground tap at 4 turns from collector end.

2N3426

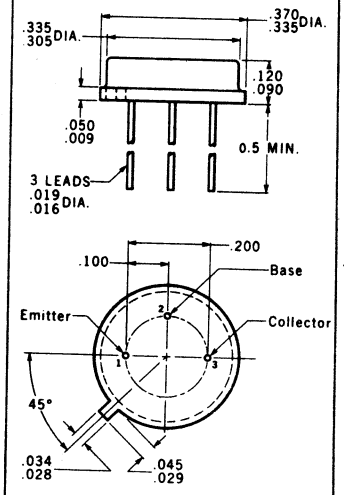
NPN HIGH-SPEED, HIGH CURRENT, SWITCH

SILICON PLANAR* EPITAXIAL TRANSISTOR

GENERAL DESCRIPTION

The 2N3426 is a silicon PLANAR epitaxial transistor with very high speed switching capability at high currents. A maximum V_{CE}(sat) of 0.7 V at one ampere and minimum f_T of 450 MHz qualify it especially for use as a thin film memory driver.

PHYSICAL DIMENSIONS



NOTES: All dimensions in inches
Collector internally connected to case
Leads are gold-plated kovar
Package weight is 0.98 gram

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)		3.0 Watts
at 25°C Ambient Temperature (Notes 2 and 3)		0.6 Watt
Maximum Voltages and Current		
V_{CBO}	Collector to Base Voltage	25 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	12 Volts
V_{EBO}	Emitter to Base Voltage	4.0 Volts
I_C	Collector Current	1.0 Amp

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

Symbol	Characteristic		Min.	Typ.	Max.	Units	Test Conditions
t_{on}	Turn On Time	(Note 6)		10	15	ns	$I_C \approx 1000$ mA $I_{B1} \approx 100$ mA
t_{off}	Turn Off Time	(Note 6)		15	25	ns	$I_C \approx 1000$ mA, $I_{B1} \approx 100$ mA, $I_{B2} \approx -100$ mA
τ_s	Charge Storage Time	(Note 6)			15	ns	$I_C \approx 100$ mA, $I_{B1} \approx 100$ mA, $I_{B2} \approx -100$ mA
h_{fe}	High Frequency Current Gain	(f = 100MHz)	4.5	6.5			I_C = 100 mA V_{CE} = 5.0 V
V_{CE}(sat)	Collector Saturation Voltage	(Note 5)		0.18	0.23	Volts	I_C = 100 mA I_B = 10 mA
V_{CE}(sat)	Collector Saturation Voltage	(Note 5)		0.24	0.33	Volts	I_C = 300 mA I_B = 30 mA
V_{CE}(sat)	Collector Saturation Voltage	(Notes 5 & 7)		0.51	0.7	Volts	I_C = 1000 mA I_B = 100 mA
h_{FE}	DC Pulse Current Gain	(Note 5)	30	60	120		I_C = 300 mA V_{CE} = 0.5 V
C_{obo}	Output Capacitance				25	pF	V_{CB} = 0 I_E = 0
h_{fe}	High Frequency Current Gain	(f = 100MHz)	2.0				I_C = 500 mA V_{CB} = 0

*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-case thermal resistance of 58.3°C/Watt (derating factor of 17.2 mW/°C); junction-to-ambient thermal resistance of 291.6°C/Watt (derating factor of 3.43 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%.

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

(7) This limit applies for a measurement made 1/4" from the bottom of the case.

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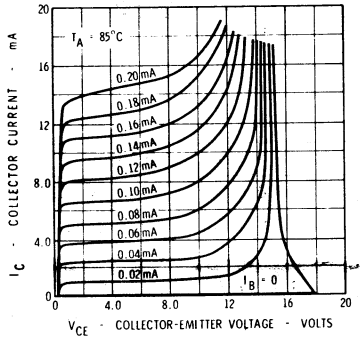
FAIRCHILD TRANSISTOR 2N3426

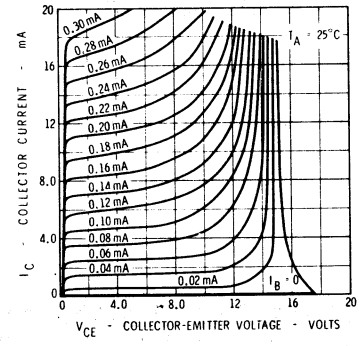
ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

Symbol	Characteristic		Min.	Typ.	Max.	Units	Test Conditions
$V_{CE}(sat)$	Collector Saturation Voltage			0.17	0.25	Volts	I_C = 10 mA, I_B = 1.0 mA
$V_{CE}(sat)$ (85°C)	Collector Saturation Voltage	(Note 5)		0.25	0.5	Volts	I_C = 300 mA, I_B = 30 mA
$V_{BE}(sat)$	Base Saturation Voltage			0.68	0.78	Volts	I_C = 10 mA, I_B = 1.0 mA
$V_{BE}(sat)$	Base Saturation Voltage	(Note 5)		0.84	1.1	Volts	I_C = 100 mA, I_B = 10 mA
$V_{BE}(sat)$	Base Saturation Voltage	(Note 5)		1.0	1.3	Volts	I_C = 300 mA, I_B = 30 mA
$V_{BE}(sat)$	Base Saturation Voltage	(Note 5)	0.9	1.36	2.1	Volts	I_C = 1000 mA, I_B = 100 mA
I_{CES}	Collector Reverse Current			1.5	100	μA	V_{CE} = 15 V, V_{EB} = 0
C_{obo}	Output Capacitance			6.2	15	pF	I_E = 0, V_{CB} = 5.0 V
C_{ibo}	Input Capacitance			14.8	25	pF	I_C = 0, V_{EB} = 0.5 V
BV_{CBO}	Collector to Base Breakdown Voltage		25			Volts	I_C = 500 μA, I_E = 0
$V_{CEO}(sust)$	Collector to Emitter Sustaining Voltage (Notes 4 and 5)		12			Volts	I_C = 30 mA, I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage		4.0			Volts	I_E = 100 μA, I_C = 0
h_{FE}	DC Pulse Current Gain	(Note 5)	30	50			I_C = 100 mA, V_{CE} = 0.5 V
h_{FE}	DC Pulse Current Gain	(Note 5)	20	45			I_C = 10 mA, V_{CE} = 0.5 V

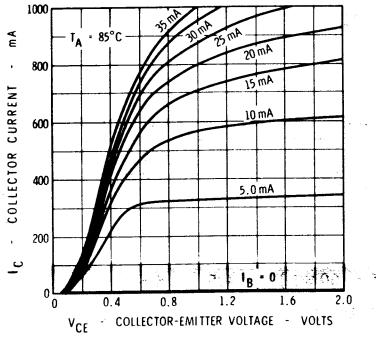
TYPICAL COLLECTOR AND BASE CHARACTERISTICS *

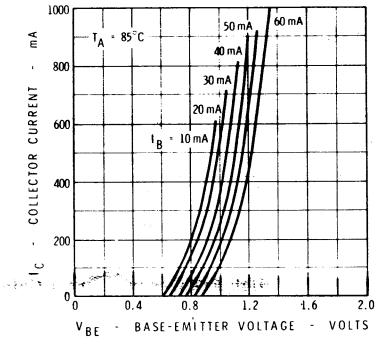
ACTIVE REGION

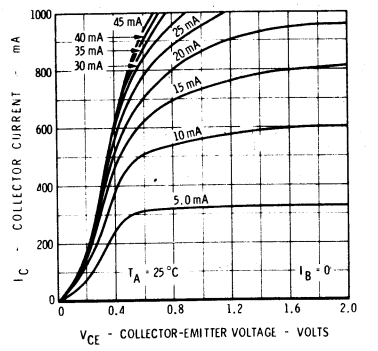


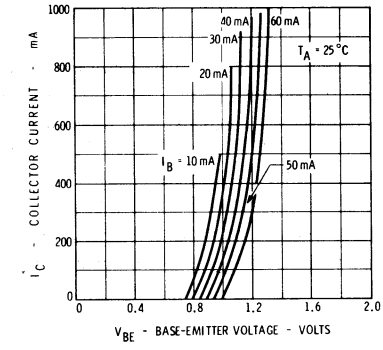


SATURATION REGION





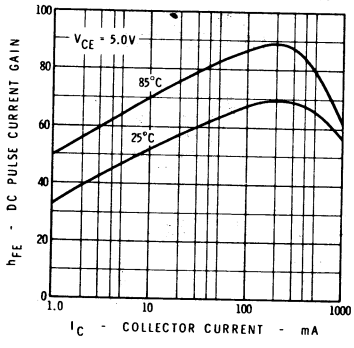




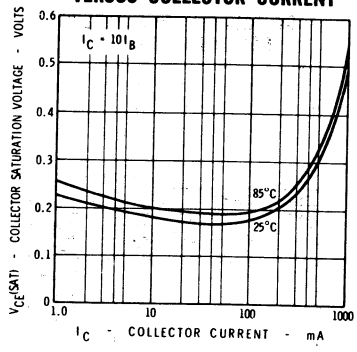
* Single family characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

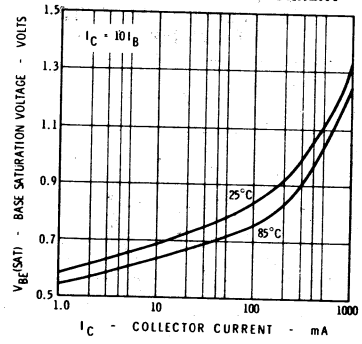
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



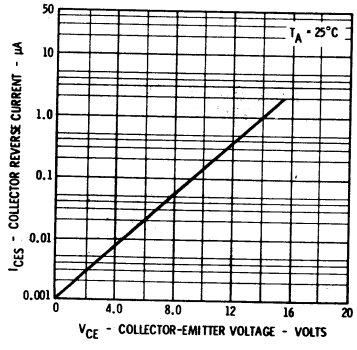
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



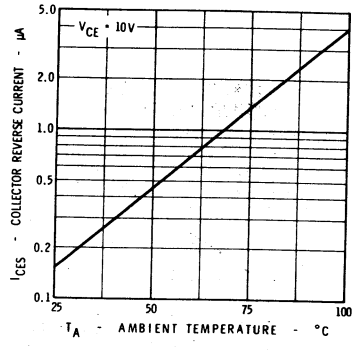
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



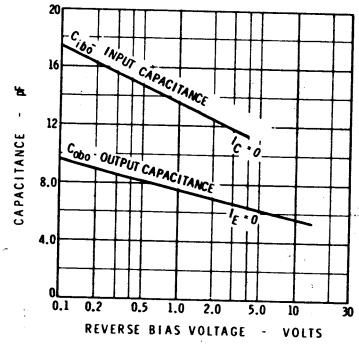
COLLECTOR REVERSE CURRENT VERSUS REVERSE BIAS VOLTAGE



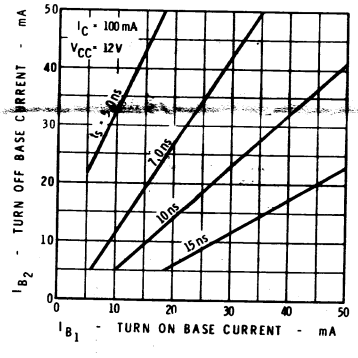
COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



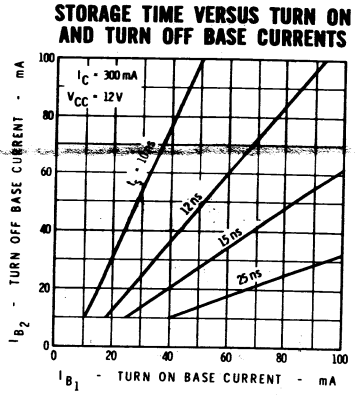
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



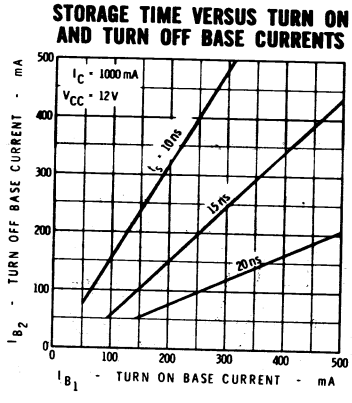
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



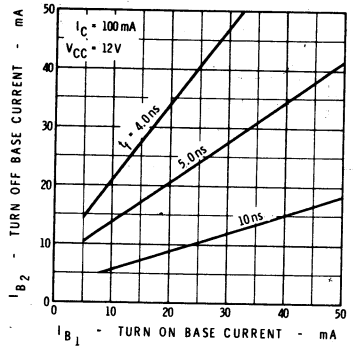
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



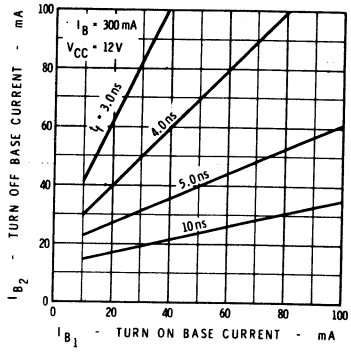
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



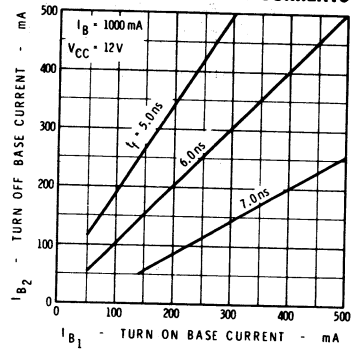
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS

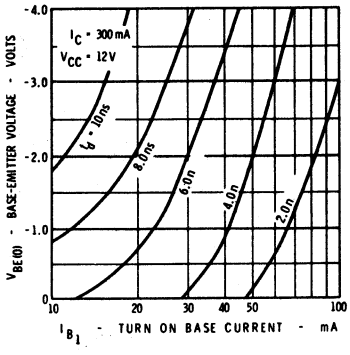


FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS

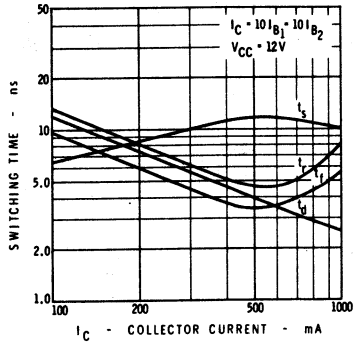


TYPICAL ELECTRICAL CHARACTERISTICS

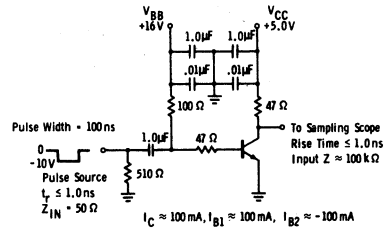
DELAY TIME VERSUS TURN ON BASE CURRENT AND REVERSE BASE EMITTER VOLTAGE



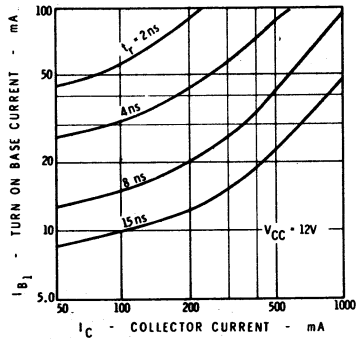
SWITCHING TIMES VERSUS COLLECTOR CURRENT



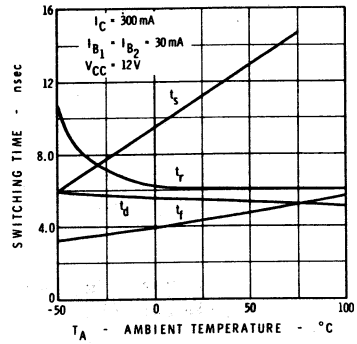
CHARGE STORAGE TIME TEST CIRCUIT



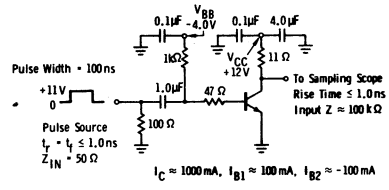
RISE TIME VERSUS COLLECTOR AND TURN ON BASE CURRENTS



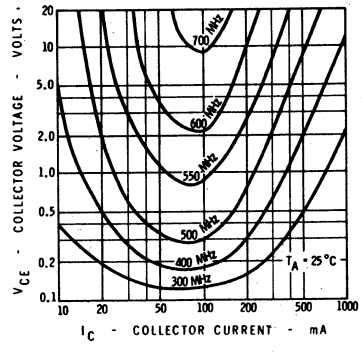
SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



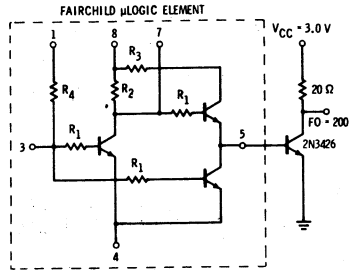
TURN ON AND TURN OFF TEST CIRCUIT



CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)

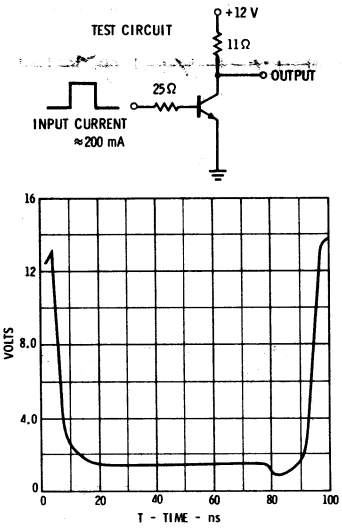


IMPROVING FAN-OUT CAPABILITY



2N3426 used to convert buffer element (Part #900) FAN-OUT from 25 to 200.

HIGH SPEED 1 AMPERE PULSE SOURCE



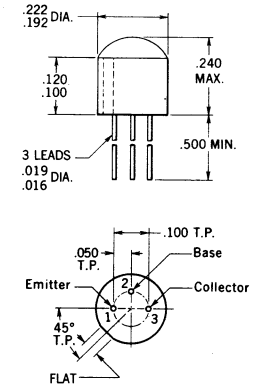
2N3563

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
Epoxy package
TO-106



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
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

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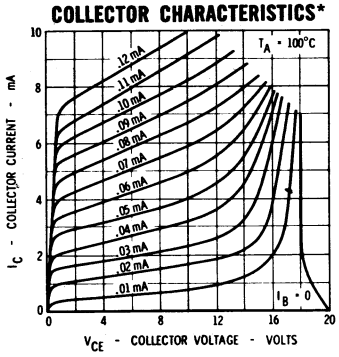
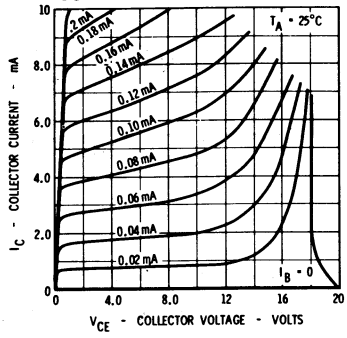
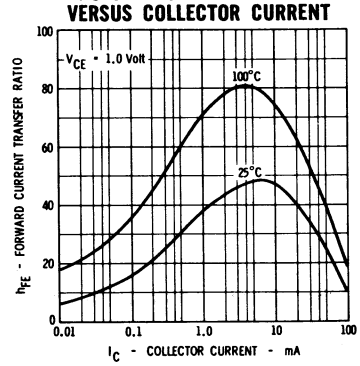
COLLECTOR CHARACTERISTICS*



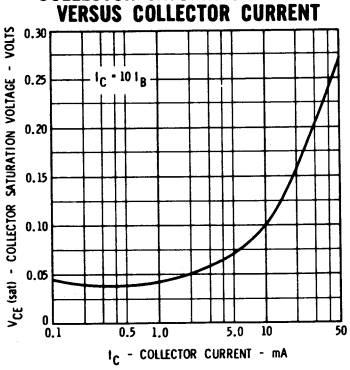
COLLECTOR CHARACTERISTICS*



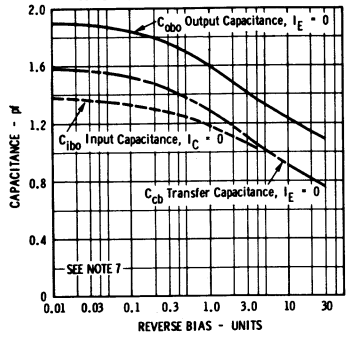
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



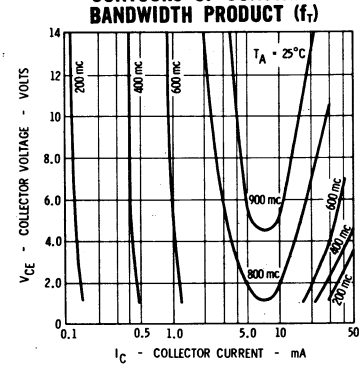
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



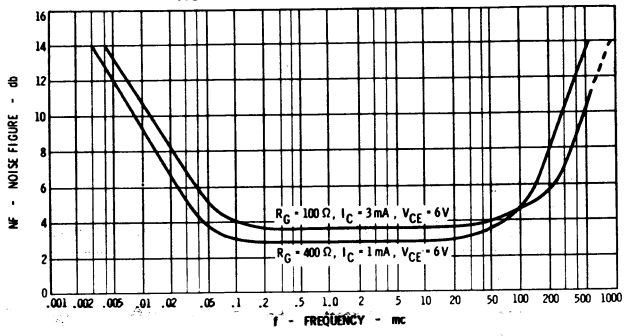
CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



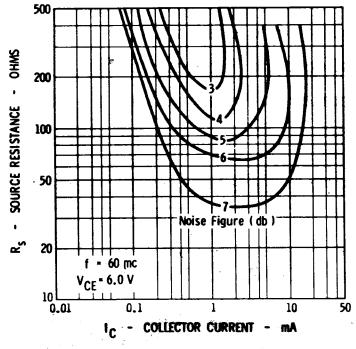
CONTOURS OF CONSTANT BANDWIDTH PRODUCT (f_T)



NOISE FIGURE VERSUS FREQUENCY



CONTOURS OF CONSTANT NOISE FIGURE

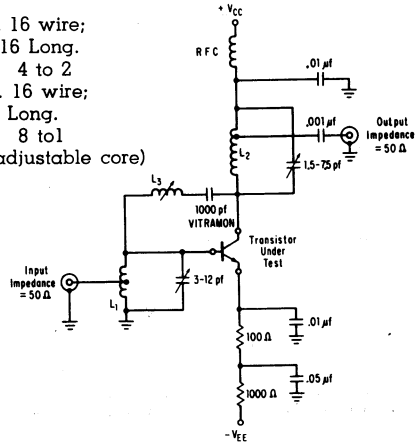


NEUTRALIZED 200 MC POWER GAIN AMPLIFIER TEST CIRCUIT

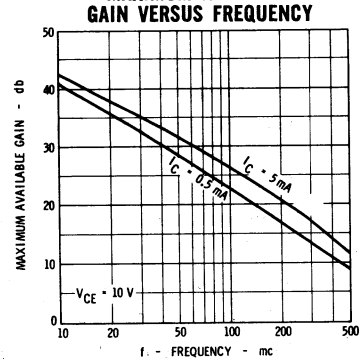
L_1 — 3.5 Turns No. 16 wire; 5/16 Dia; 7/16 Long. Turns Ratio 4 to 2

L_2 — 8.0 Turns No. 16 wire; 1/8 Dia; 7/8 Long. Turns Ratio 8 tol

L_3 — 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.

(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}.

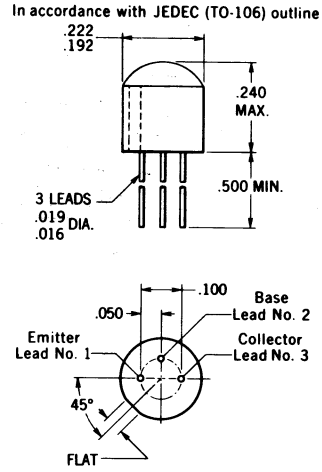
2N3564

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

*Planar is a patented Fairchild process.

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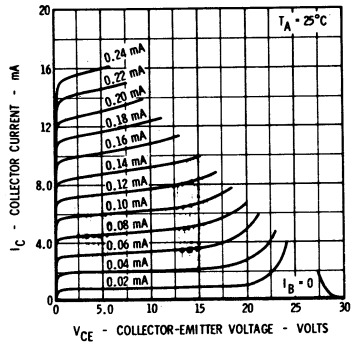
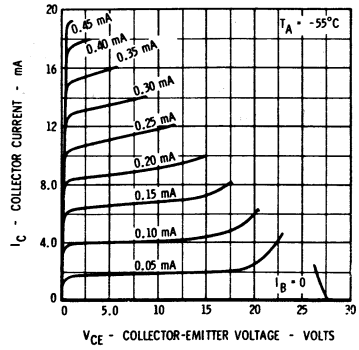
TYPICAL ELECTRICAL CHARACTERISTICS

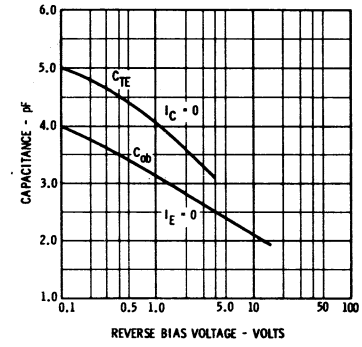
COLLECTOR CHARACTERISTICS*



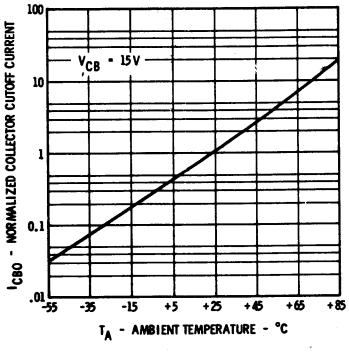
COLLECTOR CHARACTERISTICS*



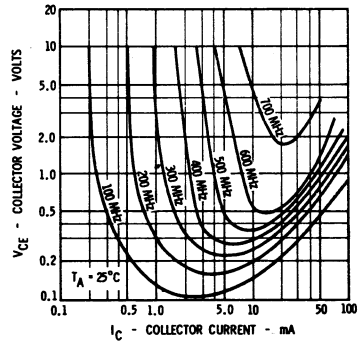
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



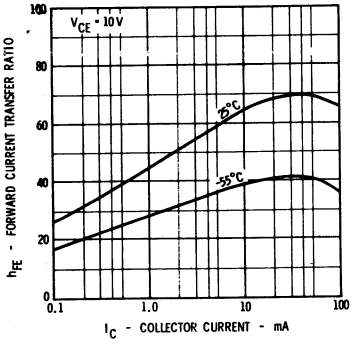
NORMALIZED COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



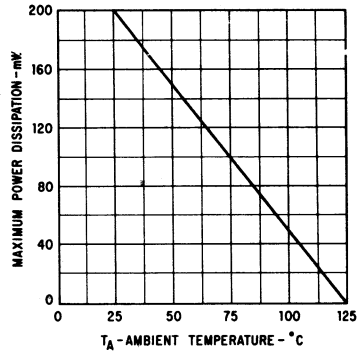
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



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).

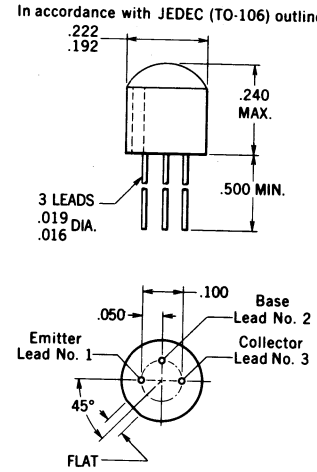
(3) Rating refers to a high-current point where collector-to-emitter voltage is lowest.

(4) Pulse Conditions: length = 300 μs ; duty cycle $\leq$ 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 pre-amplifier 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.

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FAIRCHILD TRANSISTOR 2N3565

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

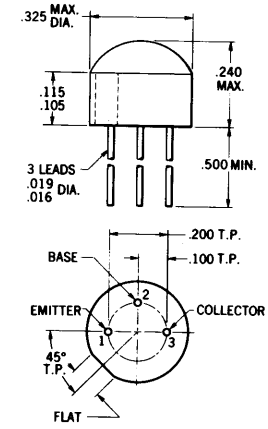
2N3566

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
Epoxy package
TO-105



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 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.

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

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SMALL SIGNAL CHARACTERISTICS (f = 1KC)

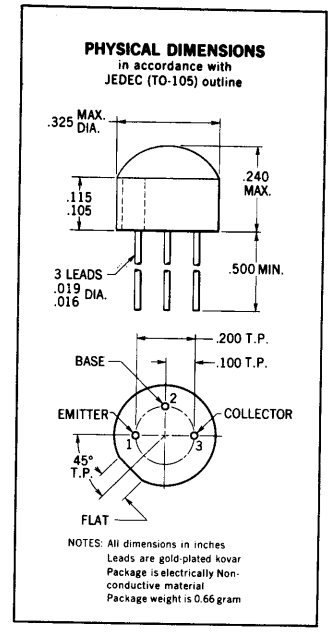
Symbol	Characteristic	Typical	Units	Test Conditions
h_{ie}	Input Resistance	2.5	Kohms	I_C = 10 mA V_{CE} = 10 V
h_{oe}	Output Conductance	120	μmhos	I_C = 10 mA V_{CE} = 10 V
h_{fe}	Small Signal Current Gain	500		I_C = 10 mA V_{CE} = 10 V
h_{re}	Voltage Feedback Ratio	460	$x10^{-6}$	I_C = 10 mA V_{CE}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



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

* Planar is a patented Fairchild process.

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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 $\leq$ 1%.

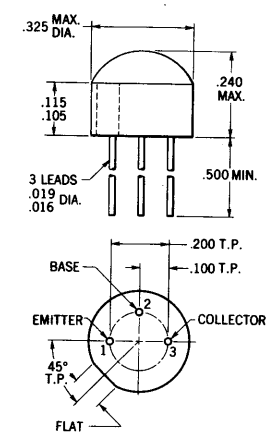
2N3569

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.

PHYSICAL DIMENSIONS
Epoxy package
TO-105



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 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

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FAIRCHILD TRANSISTOR 2N3569

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.

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