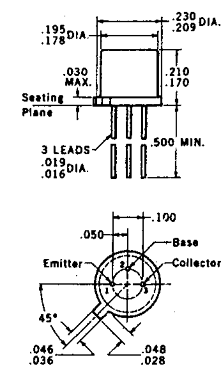
2N3962 • 2N3963 • 2N3964 • 2N3965

PNP LOW-LEVEL, LOW-NOISE TYPE

DIFFUSED SILICON PLANAR* II TRANSISTORS

- **LOW NOISE FIGURE . . . . NF = 2.0 dB (MAX) AT 1.0 kHz**
  NF = 4.0 dB (MAX) AT 100 Hz
- **HIGH CURRENT GAIN . . . . . . h_{FE} = 180 (MIN) AT 1.0 μA**
  h_{FE} = 250 - 500 AT 10 μA
  h_{FE} = 250 - 600 AT 1.0 mA
- **HIGH BREAKDOWN VOLTAGE . . . LV_{CEO} = 45, 60 AND 80 VOLTS**
- **EXCELLENT BETA LINEARITY FROM 1.0 μA TO 50 mA**

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

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)

Total Dissipation at 25°C Case Temperature	1.2 Watts
at 25°C Ambient Temperature	0.36 Watt

Maximum Voltages and Current

		2N3962 2N3965	2N3963	2N3964
V_{CBO}	Collector to Base Voltage	−60 Volts	−80 Volts	−45 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	−60 Volts	−80 Volts	−45 Volts
V_{EBO}	Emitter to Base Voltage	−6.0 Volts	−6.0 Volts	−6.0 Volts

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

SYMBOL	CHARACTERISTICS	2N3962 • 2N3963 MIN.	TYP.	MAX.	2N3964 • 2N3965 MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
h_{FE}	DC Current Gain	60	175		180	300			I_C = 1.0 μA	V_{CE} = −5.0 V
h_{FE}	DC Current Gain	100	210	300	250	320	500		I_C = 10 μA	V_{CE} = −5.0 V
h_{FE}	DC Current Gain	100	240		250	330			I_C = 100 μA	V_{CE} = −5.0 V
h_{FE}	DC Current Gain	100	260	450	250	330	600		I_C = 1.0 mA	V_{CE} = −5.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	100	280		200	330			I_C = 10 mA	V_{CE} = −5.0 V
h_{FE}	DC Pulse Current Gain (Note 5)	90	260		180	315			I_C = 50 mA	V_{CE} = −5.0 V
h_{FE}(−55°C)	DC Current Gain	40	90		100	160			I_C = 10 μA	V_{CE} = −5.0 V
h_{FE}(−55°C)	DC Pulse Current Gain (Note 5)	45	150		90	190			I_C = 50 mA	V_{CE} = −5.0 V
h_{FE}(+100°C)	DC Current Gain		375	600		400	800		I_C = 1.0 mA	V_{CE} = −5.0 V
BV_{CBO}	Collector to Base Breakdown Voltage	−60	2N3962 (only)		−45	2N3964 (only)		Volts	I_C = 10 μA	I_E = 0
BV_{CBO}	Collector to Base Breakdown Voltage	−80	2N3963 (only)		−60	2N3965 (only)		Volts	I_C = 10 μA	I_E = 0
BV_{CES}	Collector to Emitter Breakdown Voltage	−60	2N3962 (only)		−45	2N3964 (only)		Volts	I_C = 10 μA	I_B = 0
BV_{CES}	Collector to Emitter Breakdown Voltage	−80	2N3963 (only)		−60	2N3965 (only)		Volts	I_C = 10 μA	I_B = 0
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	−60	2N3962 (only)		−45	2N3964 (only)		Volts	I_C = 5.0 mA (pulsed)	I_B = 0
V_{CEO}(sust)	Collector to Emitter Sustaining Voltage (Notes 4 & 5)	−80	2N3963 (only)		−60	2N3965 (only)		Volts	I_C = 5.0 mA (pulsed)	I_B = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	−6.0			−6.0			Volts	I_C = 0	I_E = 10 μA
NF	Wideband Noise Figure (f = 10 Hz to 10 kHz)		1.0	3.0		0.7	2.0	dB	I_C = 20 μA, R_S = 10 kΩ	V_{CE} = −5.0 V, BW = 15.7 kHz
NF	Narrowband Noise Figure (f = 10 kHz)		0.8	3.0		0.5	2.0	dB	I_C = 20 μA, R_S = 10 kΩ	V_{CE} = −5.0 V, BW = 1.5 kHz
NF	Narrowband Noise Figure (f = 1.0 kHz)		0.8	3.0		0.5	2.0	dB	I_C = 20 μA, R_S = 10 kΩ	V_{CE} = −5.0 V, BW = 150 Hz
NF	Narrowband Noise Figure (f = 100 Hz)		3.0	10		1.8	4.0	dB	I_C = 20 μA, R_S = 10 kΩ	V_{CE} = −5.0 V, BW = 15 Hz
NF	Narrowband Noise Figure (f = 10 Hz)					3.5	8.0	dB	I_C = 20 μA, R_S = 10 kΩ	V_{CE} = −5.0 V, BW = 2.0 Hz

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

*Planar is a patented Fairchild process.

FAIRCHILD
SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

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

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

SYMBOL	CHARACTERISTICS	2N3962 • 2N3963 MIN.	TYP.	MAX.	2N3964 • 2N3965 MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
I_{CES}	Collector Reverse Current	(2N3962)	0.5	10	(2N3965)	0.5	10	nA	$V_{CE} = -50$ V	$V_{EB} = 0$
I_{CES}	Collector Reverse Current	(2N3963)	0.5	10				nA	$V_{CE} = -70$ V	$V_{EB} = 0$
I_{CES}	Collector Reverse Current				(2N3964)	0.5	10	nA	$V_{CE} = -40$ V	$V_{EB} = 0$
$I_{CES}(+150°C)$	Collector Reverse Current	(2N3962)	2.0	10	(2N3965)	0.5	10	μA	$V_{CE} = -50$ V	$V_{EB} = 0$
$I_{CES}(+150°C)$	Collector Reverse Current	(2N3963)	2.0	10				μA	$V_{CE} = -70$ V	$V_{EB} = 0$
$I_{CES}(+150°C)$	Collector Reverse Current				(2N3964)	2.0	10	μA	$V_{CE} = -40$ V	$V_{EB} = 0$
I_{EBO}	Emitter Cutoff Current			10			10	nA	$I_C = 0$	$V_{EB} = -4.0$ V
$V_{CE}(sat)$	Collector Saturation Voltage		−0.1	−0.25		−0.1	−0.25	Volts	$I_C = 10$ mA	$I_B = 0.5$ mA
$V_{CE}(sat)$	Collector Saturation Voltage (Note 5)		−0.16	−0.4		−0.16	−0.4	Volts	$I_C = 50$ mA	$I_B = 5.0$ mA
$V_{BE}(sat)$	Base Saturation Voltage		−0.72	−0.9		−0.72	−0.9	Volts	$I_C = 10$ mA	$I_B = 0.5$ mA
$V_{BE}(sat)$	Base Saturation Voltage (Note 5)		−0.81	−0.95		−0.81	−0.95	Volts	$I_C = 50$ mA	$I_B = 5.0$ mA
h_{ie}	Input Resistance (f = 1.0 kHz)	2.5	8.0	17	6.0	10	20	kΩ	$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{oe}	Output Conductance (f = 1.0 kHz)	5.0	19	40	5.0	25	50	μmho	$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{re}	Voltage Feedback Ratio (f = 1.0 kHz)			10			10	$x10^{-4}$	$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{fe}	Small Signal Current Gain (f = 1.0 kHz)	100	300	550	250	360	700		$I_C = 1.0$ mA	$V_{CE} = -5.0$ V
h_{fe}	High Frequency Current Gain (f = 20 MHz)	2.0		8.0	2.5		8.0		$I_C = 0.5$ mA	$V_{CE} = -5.0$ V
C_{obo}	Open Circuit Output Capacitance			6.0			6.0	pF	$I_E = 0$	$V_{CB} = -5.0$ V
C_{ibo}	Open Circuit Input Capacitance			15			15	pF	$I_C = 0$	$V_{EB} = -0.5$ V

NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These are steady state limits. The factory should be consulted on 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 146°C/Watt (derating factor of 6.85 mW/°C); junction to ambient thermal resistance of 486°C/Watt (derating factor of 2.06 mW/°C).
(4) This rating refers to a high-current point where collector to emitter voltage is lowest. For more information send for Fairchild Publication APP-4/2.
(5) Pulse Conditions: length = 300 μs; duty cycle = 1%.

TYPICAL ELECTRICAL CHARACTERISTICS
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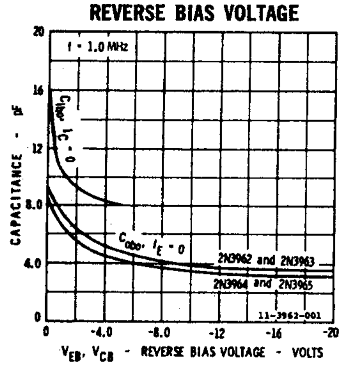
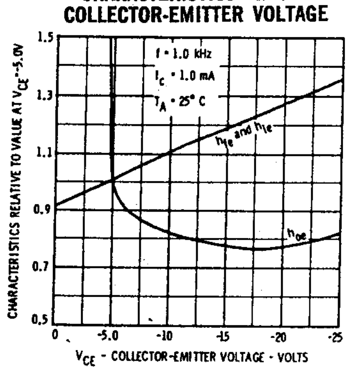
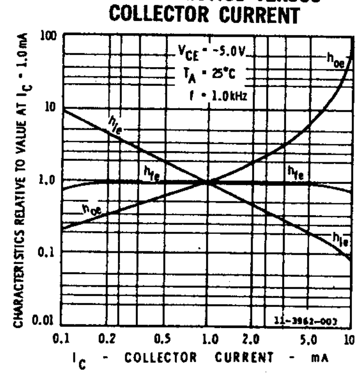
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



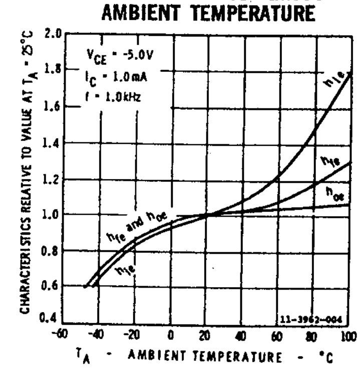
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR-EMITTER VOLTAGE



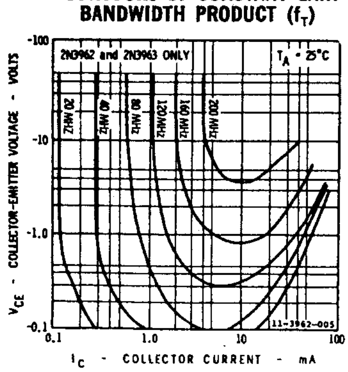
COMMON EMITTER CHARACTERISTICS VERSUS COLLECTOR CURRENT



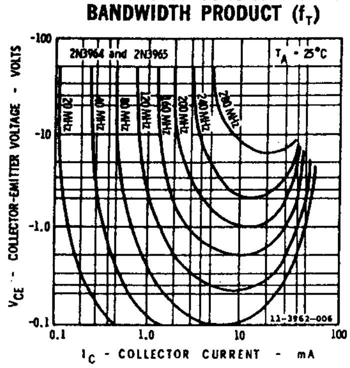
COMMON EMITTER CHARACTERISTICS VERSUS AMBIENT TEMPERATURE



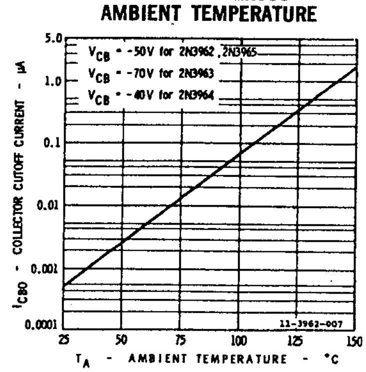
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



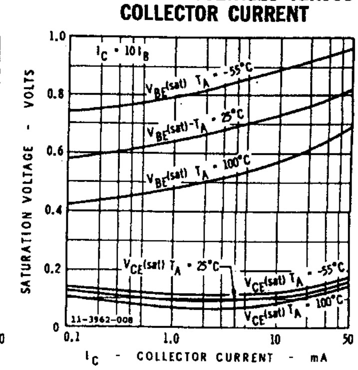
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



COLLECTOR CUTOFF CURRENT VERSUS AMBIENT TEMPERATURE



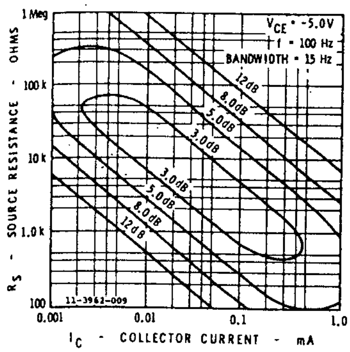
COLLECTOR AND BASE SATURATION VOLTAGES VERSUS COLLECTOR CURRENT



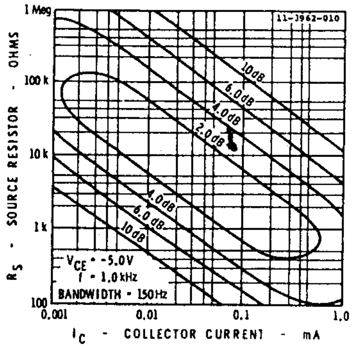
TYPICAL ELECTRICAL CHARACTERISTICS

2N3962 • 2N3963

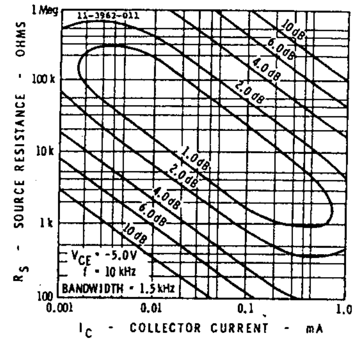
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



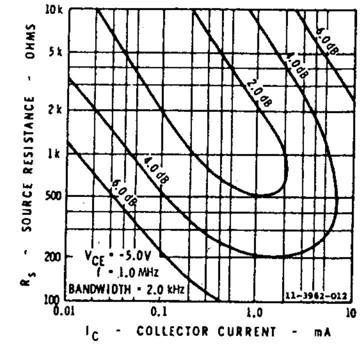
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



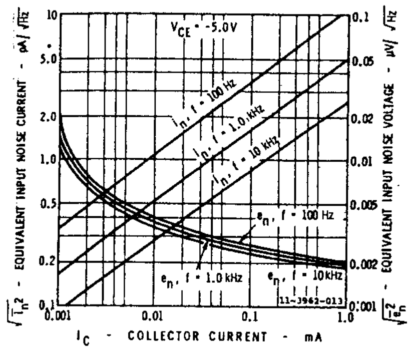
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



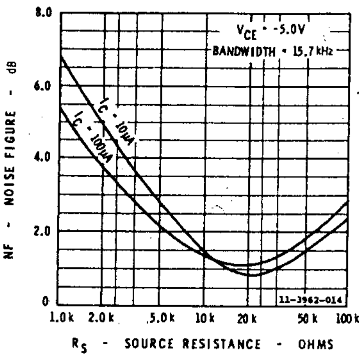
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



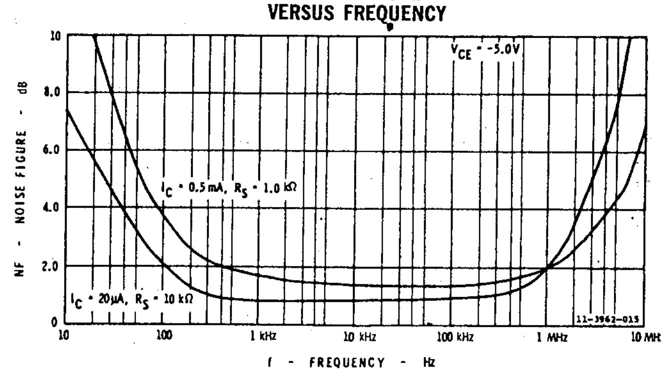
EQUIVALENT INPUT NOISE VOLTAGE AND NOISE CURRENT VERSUS COLLECTOR CURRENT



WIDE BAND NOISE FIGURE VERSUS SOURCE RESISTANCE

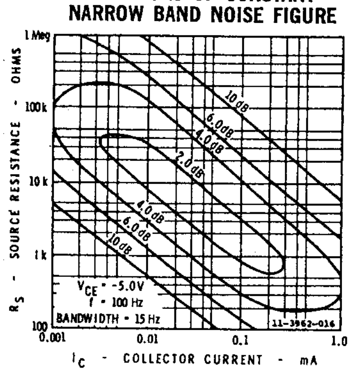


NOISE FIGURE VERSUS FREQUENCY

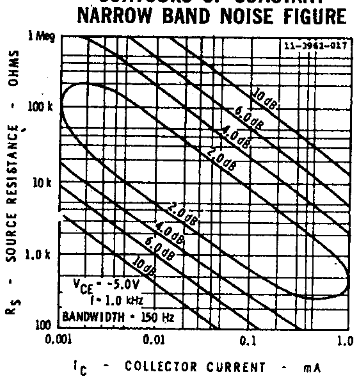


2N3964 • 2N3965

CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



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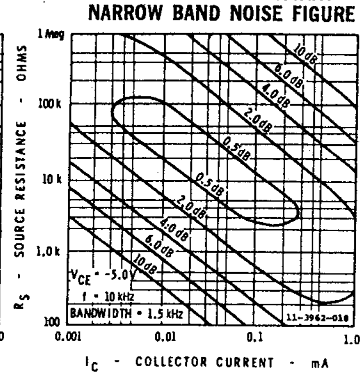
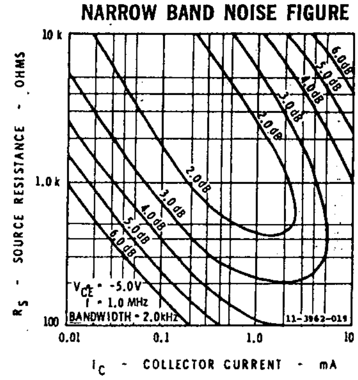
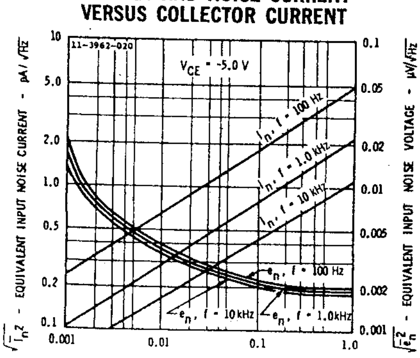


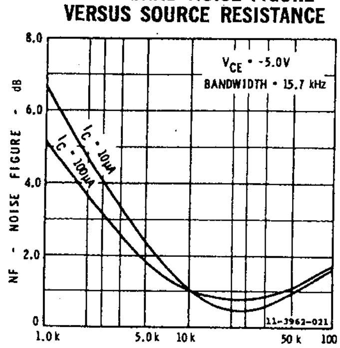
CONTOURS OF CONSTANT NARROW BAND NOISE FIGURE



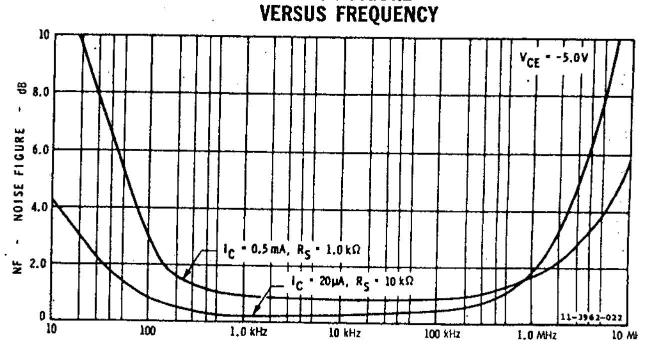
EQUIVALENT INPUT NOISE VOLTAGE AND NOISE CURRENT VERSUS COLLECTOR CURRENT



WIDE BAND NOISE FIGURE VERSUS SOURCE RESISTANCE



NOISE FIGURE VERSUS FREQUENCY

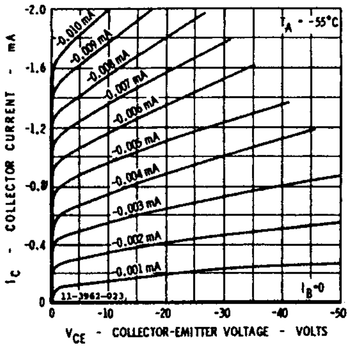


FAIRCHILD TRANSISTORS 2N3962 • 2N3963 • 2N3964 • 2N3965

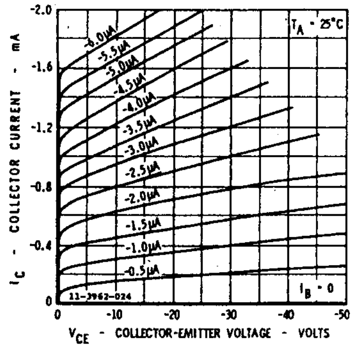
TYPICAL ELECTRICAL CHARACTERISTICS

2N3962 • 2N3963

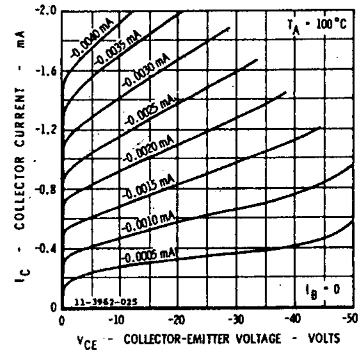
COLLECTOR CHARACTERISTICS*



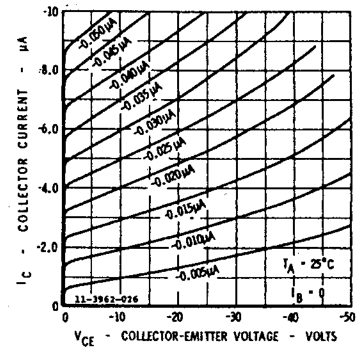
COLLECTOR CHARACTERISTICS*



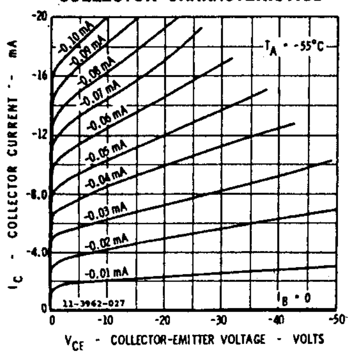
COLLECTOR CHARACTERISTICS*



COLLECTOR CHARACTERISTICS*



COLLECTOR CHARACTERISTICS*



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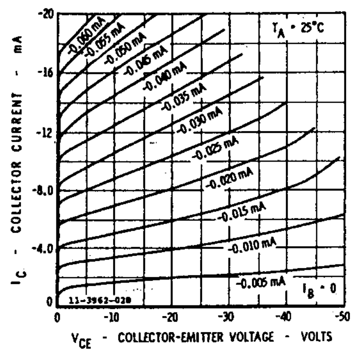
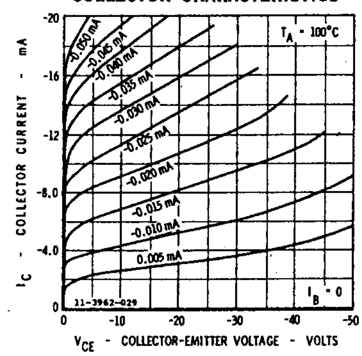
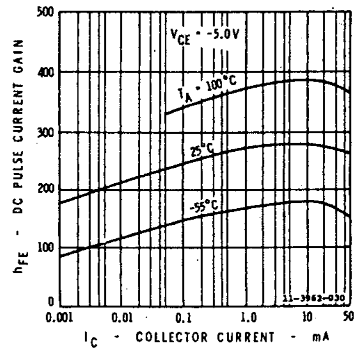


COLLECTOR CHARACTERISTICS*

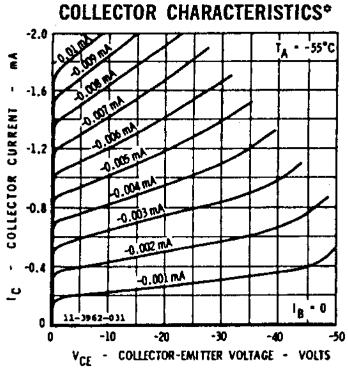


DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT

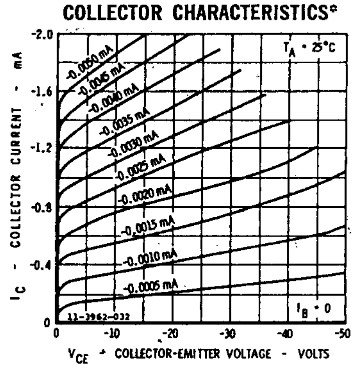


2N3964 • 2N3965

COLLECTOR CHARACTERISTICS*



COLLECTOR CHARACTERISTICS*



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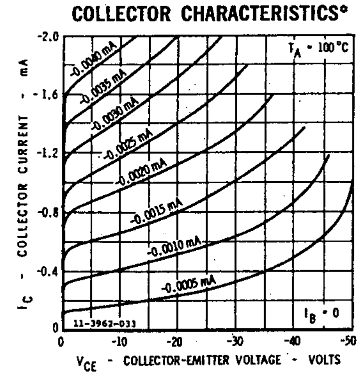

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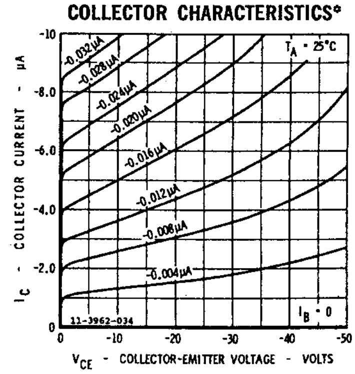
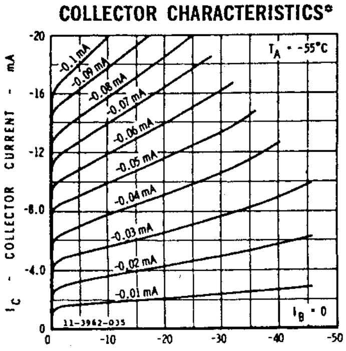
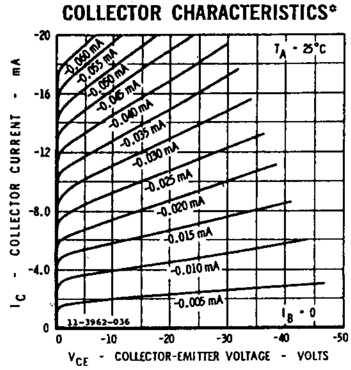


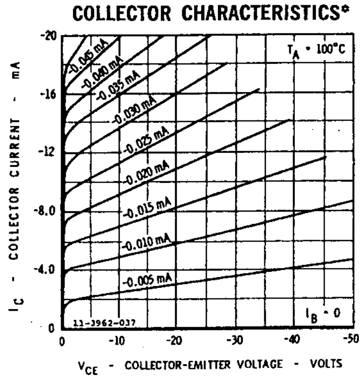
COLLECTOR CHARACTERISTICS*



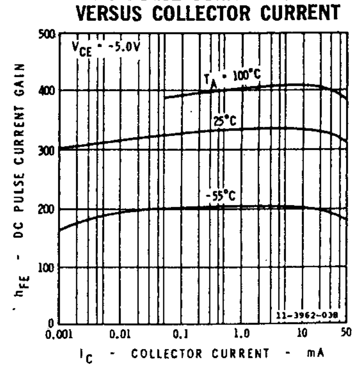
COLLECTOR CHARACTERISTICS*



COLLECTOR CHARACTERISTICS*



DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



*Single family characteristics on Transistor Curve Tracer.