

MAXIMUM RATINGS

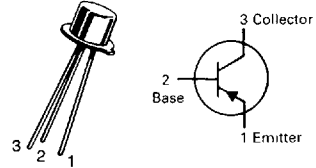
Rating	Symbol	2N3250 2N3251	2N3251A	Unit
Collector-Emitter Voltage	V_{CEO}	-40	-60	Vdc
Collector-Base Voltage	V_{CBO}	-50	-60	Vdc
Emitter-Base Voltage	V_{EBO}	-5.0		Vdc
Collector Current	I_C	-200		mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	0.36	2.06	Watt mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	1.2	6.9	Watts mW/ $^\circ\text{C}$
Operating and Storage Temperature Temperature Range	T_J, T_{stg}	-65 to +200		$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	486	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	146	$^\circ\text{C}/\text{W}$

2N3250 2N3251,A★

CASE 22-03, STYLE 1
TO-18 (TO-206AA)



GENERAL PURPOSE TRANSISTORS

PNP SILICON

★2N3251A is a Motorola
designated preferred device.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage(1) ($I_C = -10$ mAdc)	2N3250, 2N3251 2N3251A	$V_{(BR)CEO}$	-40 -60	—	Vdc
Collector-Base Breakdown Voltage ($I_C = -10$ μAdc)	2N3250, 2N3251 2N3251A	$V_{(BR)CBO}$	-50 -60	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = -10$ μAdc)		$V_{(BR)EBO}$	-5.0	—	Vdc
Collector Cutoff Current ($V_{CE} = -40$ Vdc, $V_{EB} = -3.0$ Vdc)		I_{CEX}	—	-20	nA
Base Cutoff Current ($V_{CE} = -40$ Vdc, $V_{EB} = -3.0$ Vdc)		I_{BL}	—	-50	nAdc

ON CHARACTERISTICS

DC Forward Current Transfer Ratio ($I_C = -0.1$ mAdc, $V_{CE} = -10$ Vdc)	2N3250 2N3251, 2N3251A	h_{FE}	40 80	—	—
($I_C = -1.0$ mAdc, $V_{CE} = -1.0$ Vdc)	2N3250 2N3251, 2N3251A		45 90	—	—
($I_C = -10$ mAdc, $V_{CE} = -1.0$ Vdc)(1)	2N3250 2N3251, 2N3251A		50 100	150 300	
($I_C = -50$ mAdc, $V_{CE} = -1.0$ Vdc)(1)	2N3250 2N3251, 2N3251A		15 30	—	—
Collector-Emitter Saturation Voltage (1) ($I_C = -10$ mAdc, $I_B = -1.0$ mAdc) ($I_C = -50$ mAdc, $I_B = -5.0$ mAdc)		$V_{CE(sat)}$	—	-0.25 -0.5	Vdc
Base-Emitter Saturation Voltage (1) ($I_C = -10$ mAdc, $I_B = -1.0$ mAdc) ($I_C = -50$ mAdc, $I_B = -5.0$ mAdc)		$V_{BE(sat)}$	-0.6 —	-0.9 -1.2	Vdc

SMALL-SIGNAL CHARACTERISTICS

Current-Gain — Bandwidth Product ($I_C = -10$ mAdc, $V_{CE} = -20$ Vdc, $f = 100$ MHz)	2N3250 2N3251, 2N3251A	f_T	250 300	—	MHz
Output Capacitance ($V_{CB} = -10$ Vdc, $I_E = 0$, $f = 1.0$ MHz)		C_{obo}	—	6.0	pF
Input Capacitance ($V_{EB} = -1.0$ Vdc, $I_C = 0$, $f = 1.0$ MHz)		C_{ibo}	—	8.0	pF

2N3250 2N3251,A

ELECTRICAL CHARACTERISTICS (continued) ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
Input Impedance ($I_C = -1.0\text{ mA}$, $V_{CE} = -10\text{ V}$, $f = 1.0\text{ kHz}$)	h_{ie}	1.0 2.0	6.0 12	kohms
Voltage Feedback Ratio ($I_C = -1.0\text{ mA}$, $V_{CE} = -10\text{ V}$, $f = 1.0\text{ kHz}$)	h_{re}	—	10 20	$\times 10^{-4}$
Small-Signal Current Gain ($I_C = -1.0\text{ mA}$, $V_{CE} = -10\text{ V}$, $f = 1.0\text{ kHz}$)	h_{fe}	50 100	200 400	—
Output Admittance ($I_C = -1.0\text{ mA}$, $V_{CE} = -10\text{ V}$, $f = 1.0\text{ kHz}$)	h_{oe}	4.0 10	40 60	μmhos
Collector Base Time Constant ($I_C = -10\text{ mA}$, $V_{CE} = -20\text{ V}$, $f = 31.8\text{ MHz}$)	$rb'CC$	—	250	ps
Noise Figure ($I_C = -100\ \mu\text{A}$, $V_{CE} = -5.0\text{ V}$, $R_S = 1.0\text{ k}\Omega$, $f = 100\text{ Hz}$)	NF	—	6.0	dB

SWITCHING CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Delay Time ($V_{CC} = -3.0\text{ Vdc}$, $V_{BE} = +0.5\text{ Vdc}$)	t_d	35	ns
Rise Time ($I_C = -10\text{ mAdc}$, $I_{B1} = -1.0\text{ mA}$)	t_r	35	ns
Storage Time ($I_C = -10\text{ mAdc}$, $I_{B1} = I_{B1} = -1.0\text{ mAdc}$) ($V_{CC} = -3.0\text{ V}$)	t_s	175 200	ns
Fall Time	t_f	50	ns

(1) Pulse Test: $PW = 300\ \mu\text{s}$, Duty Cycle = 2.0%.

SWITCHING TIME CHARACTERISTICS

FIGURE 1 — DELAY AND RISE TIME

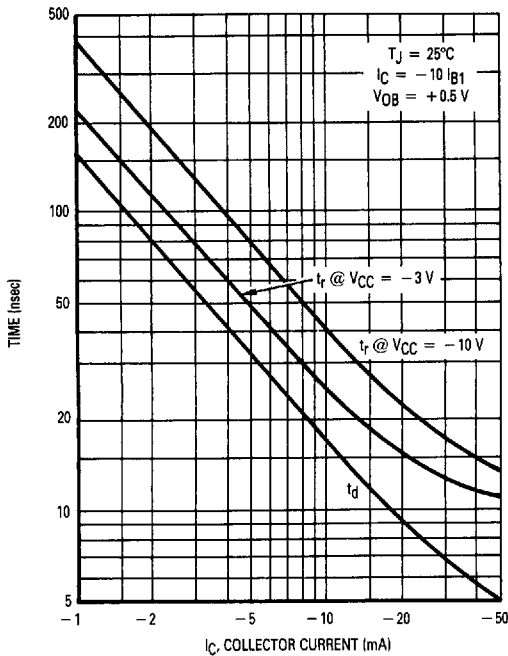
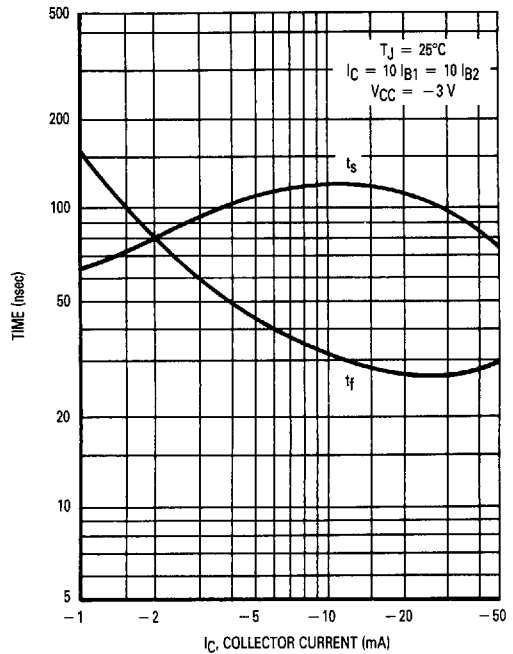


FIGURE 2 — STORAGE AND FALL TIME



AUDIO SMALL-SIGNAL CHARACTERISTICS
NOISE FIGURE VARIATIONS
 (V_{CE} = 6.0 V, T_A = 25°C)

FIGURE 3 — FREQUENCY

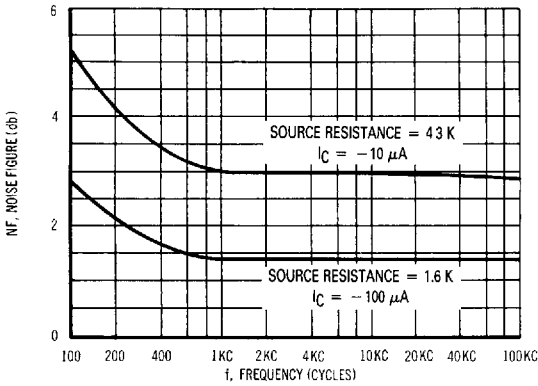
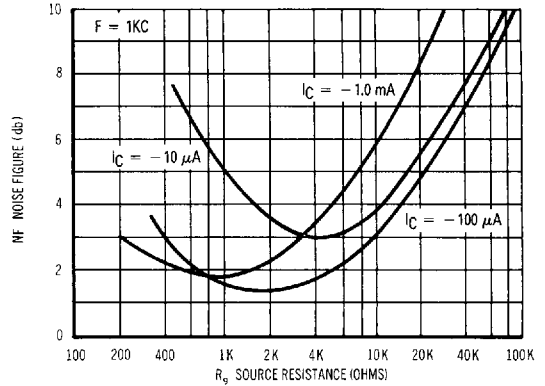


FIGURE 4 — SOURCE RESISTANCE



h PARAMETERS
 V_{CE} = 10 V, f = 1.0 kc, T_A = 25°C

FIGURE 5 — CURRENT GAIN

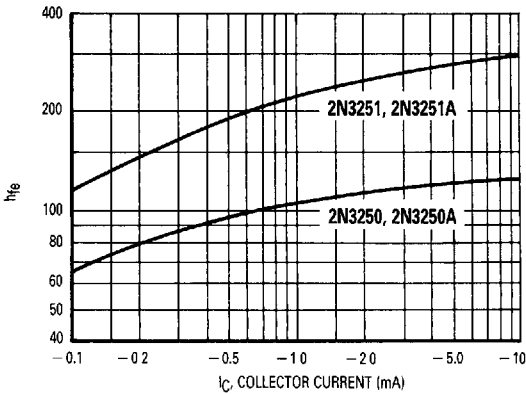


FIGURE 6 — OUTPUT ADMITTANCE

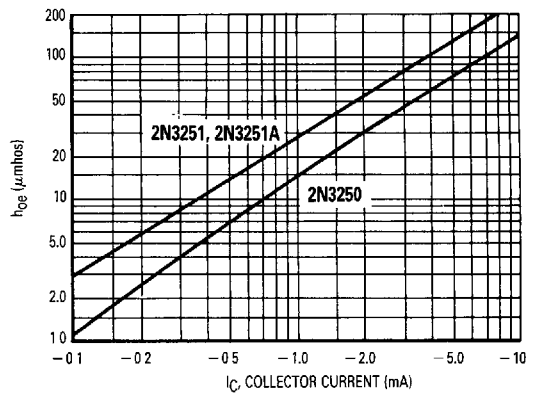


FIGURE 7 — VOLTAGE FEEDBACK RATIO

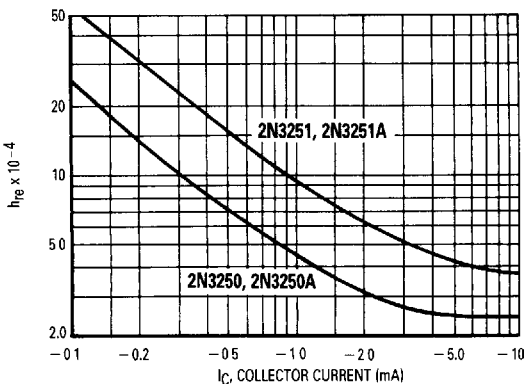


FIGURE 8 — INPUT IMPEDANCE

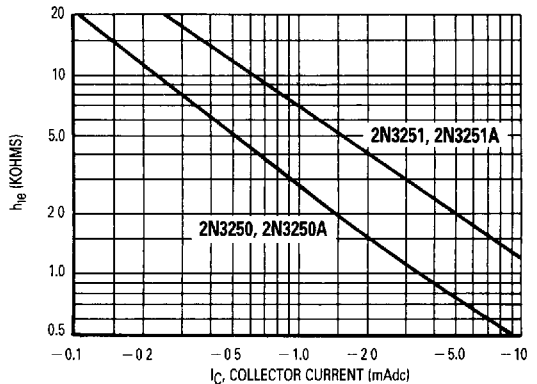


FIGURE 9 — NORMALIZED CURRENT GAIN CHARACTERISTICS

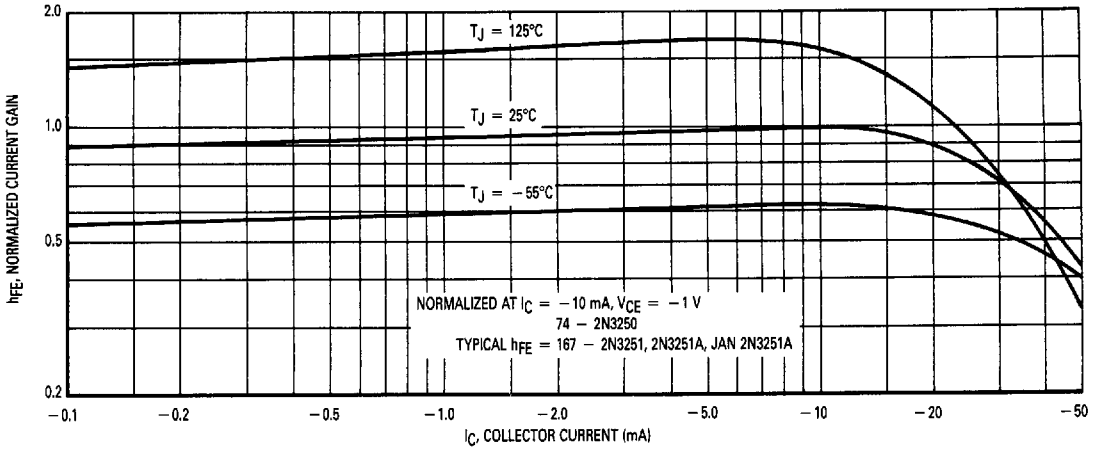
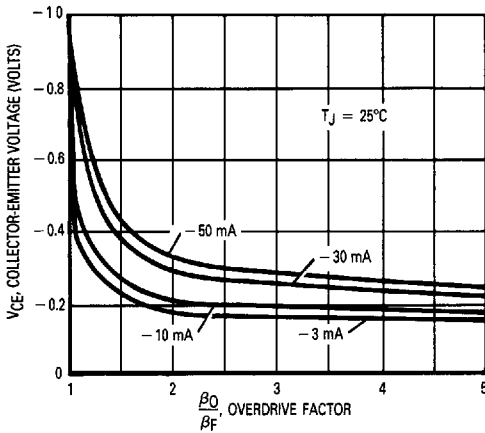


FIGURE 10 — COLLECTOR SATURATION REGION



This graph shows the effect of base current on collector current β_O is the current gain of the transistor at 1 volt, and β_F (forced gain) is the ratio of I_C/I_{BF} in a circuit. EXAMPLE: For type 2N3251, estimate a base current (I_{BF}) to insure saturation at a temperature of 25°C and a collector current of 10 mA.

Observe that at $I_C = 10$ mA an overdrive factor of at least 2.5 is required to drive the transistor well into the saturation region. From Figure 1, it is seen that h_{FE} @ 1 volt is typically 167 (guaranteed limits from the Table of Characteristics can be used for "worst case" design).

$$\frac{\beta_O}{\beta_F} = \frac{h_{FE} @ 1 \text{ Volt}}{I_C / I_{BF}} \quad 2.5 = \frac{167}{10 \text{ mA} / I_{BF}} \quad I_{BF} \approx -6.68 \text{ mA}$$

FIGURE 11 — SATURATION VOLTAGES

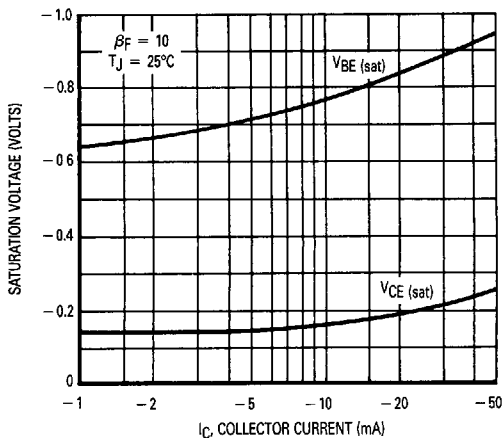


FIGURE 12 — TEMPERATURE COEFFICIENTS

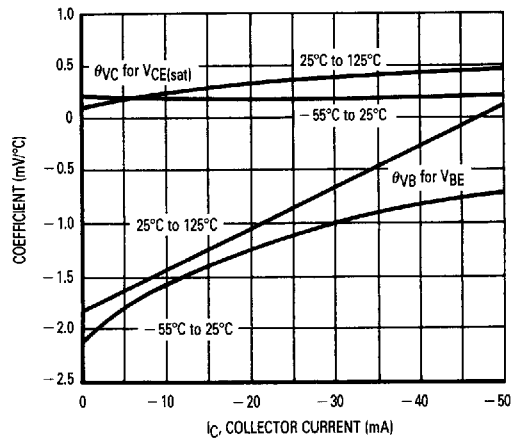


FIGURE 13 — f_T AND $r_b'C_c$ versus I_C

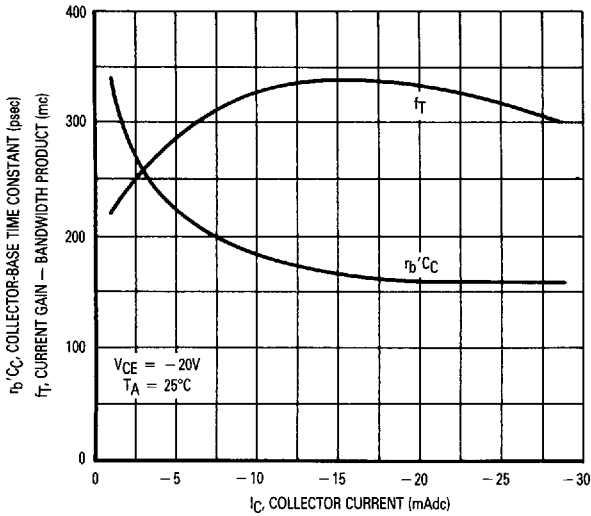


FIGURE 14 — 30 MC EQUIVALENT CIRCUIT

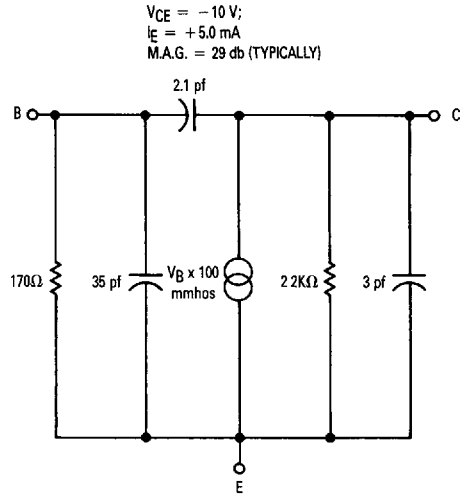


FIGURE 15 — JUNCTION CAPACITANCE

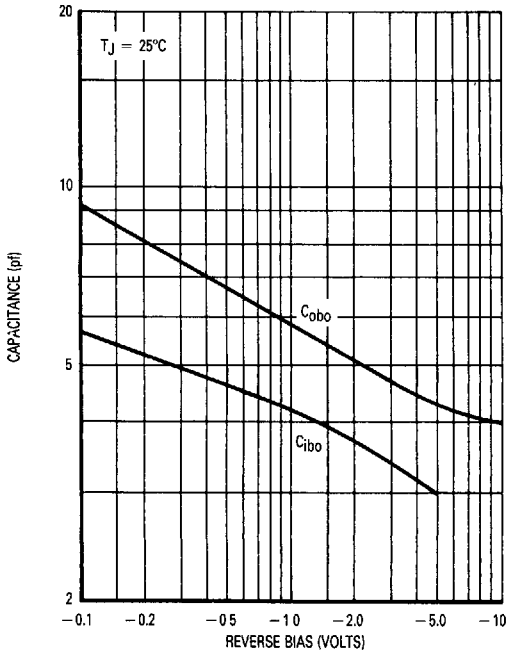
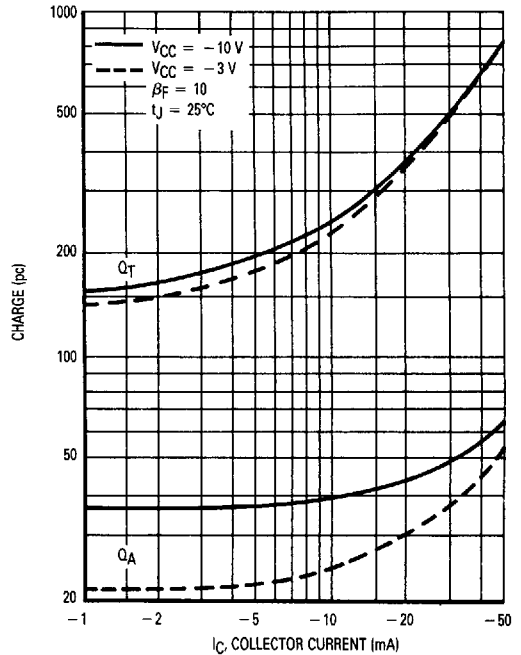


FIGURE 16 — CHARGE DATA



6367254 0103831 637