

Amplifier Transistors

NPN Silicon

2N5088

2N5089

MAXIMUM RATINGS

Rating	Symbol	2N5088	2N5089	Unit
Collector–Emitter Voltage	V_{CEO}	30	25	Vdc
Collector–Base Voltage	V_{CBO}	35	30	Vdc
Emitter–Base Voltage	V_{EBO}	3.0		Vdc
Collector Current — Continuous	I_C	50		mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	625 5.0		mW mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	1.5 12		Watts mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–55 to +150		$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}^{(1)}$	200	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	$^\circ\text{C/W}$

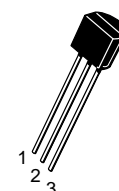
ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
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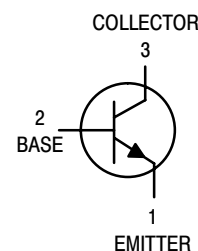
OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage ⁽²⁾ ($I_C = 1.0 \text{ mAdc}$, $I_B = 0$)	$V_{(BR)CEO}$	30 25	— —	Vdc
Collector–Base Breakdown Voltage ($I_C = 100 \mu\text{Adc}$, $I_E = 0$)	$V_{(BR)CBO}$	35 30	— —	Vdc
Collector Cutoff Current ($V_{CB} = 20 \text{ Vdc}$, $I_E = 0$) ($V_{CB} = 15 \text{ Vdc}$, $I_E = 0$)	I_{CBO}	— —	50 50	nAdc
Emitter Cutoff Current ($V_{EB(off)} = 3.0 \text{ Vdc}$, $I_C = 0$) ($V_{EB(off)} = 4.5 \text{ Vdc}$, $I_C = 0$)	I_{EBO}	— —	50 100	nAdc

- $R_{\theta JA}$ is measured with the device soldered into a typical printed circuit board.
- Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2.0\%$.



CASE 29–11, STYLE 1
TO–92 (TO–226AA)



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

Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS				
DC Current Gain ($I_C = 100\ \mu\text{Adc}$, $V_{CE} = 5.0\ \text{Vdc}$)	h_{FE}	300	900	—
		400	1200	
($I_C = 1.0\ \text{mAdc}$, $V_{CE} = 5.0\ \text{Vdc}$)		350	—	
		450	—	
($I_C = 10\ \text{mAdc}$, $V_{CE} = 5.0\ \text{Vdc}$)(2)		300	—	
		400	—	
Collector–Emitter Saturation Voltage ($I_C = 10\ \text{mAdc}$, $I_B = 1.0\ \text{mAdc}$)	$V_{CE(sat)}$	—	0.5	Vdc
Base–Emitter On Voltage ($I_C = 10\ \text{mAdc}$, $V_{CE} = 5.0\ \text{Vdc}$)(2)	$V_{BE(on)}$	—	0.8	Vdc

SMALL–SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product ($I_C = 500\ \mu\text{Adc}$, $V_{CE} = 5.0\ \text{Vdc}$, $f = 20\ \text{MHz}$)	f_T	50	—	MHz
Collector–Base Capacitance ($V_{CB} = 5.0\ \text{Vdc}$, $I_E = 0$, $f = 1.0\ \text{MHz}$)	C_{cb}	—	4.0	pF
Emitter–Base Capacitance ($V_{EB} = 0.5\ \text{Vdc}$, $I_C = 0$, $f = 1.0\ \text{MHz}$)	C_{eb}	—	10	pF
Small–Signal Current Gain ($I_C = 1.0\ \text{mAdc}$, $V_{CE} = 5.0\ \text{Vdc}$, $f = 1.0\ \text{kHz}$)	h_{fe}	350	1400	—
		450	1800	
Noise Figure ($I_C = 100\ \mu\text{Adc}$, $V_{CE} = 5.0\ \text{Vdc}$, $R_S = 1.0\ \text{k}\Omega$, $f = 1.0\ \text{kHz}$)	NF	—	3.0	dB
		—	2.0	

2. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$.

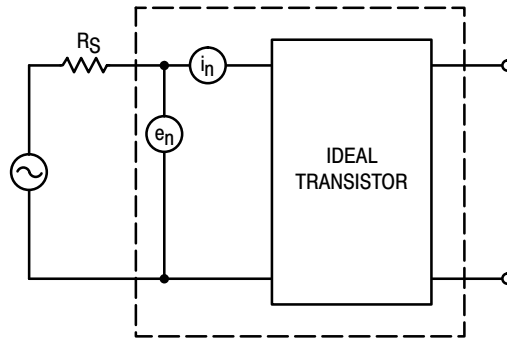


Figure 1. Transistor Noise Model

NOISE CHARACTERISTICS

 $(V_{CE} = 5.0 \text{ Vdc}, T_A = 25^\circ\text{C})$

NOISE VOLTAGE

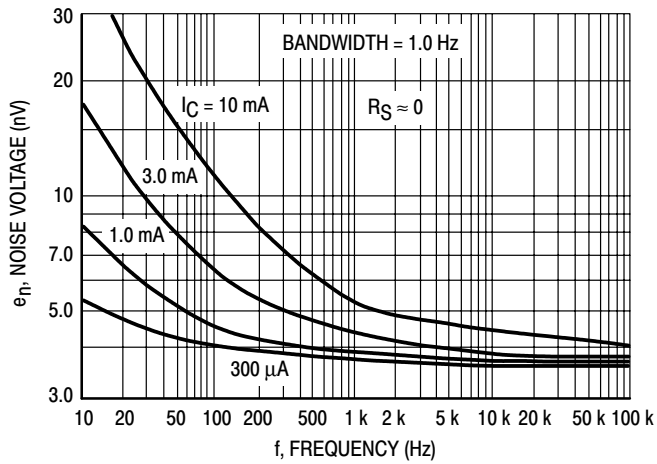


Figure 2. Effects of Frequency

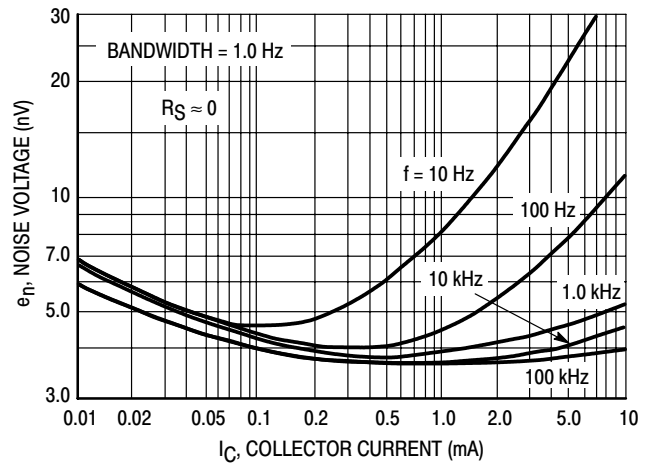


Figure 3. Effects of Collector Current

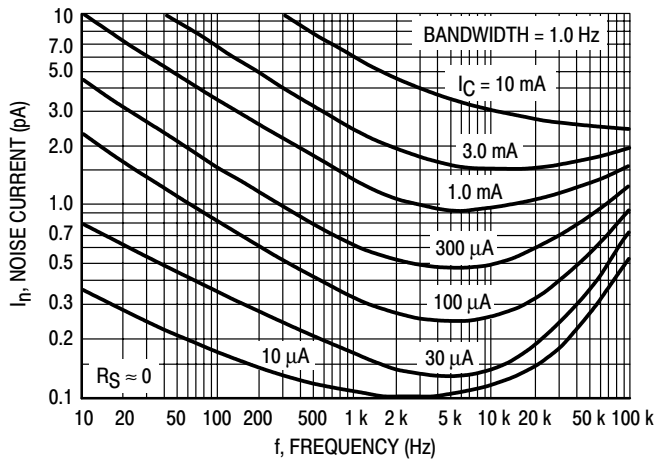


Figure 4. Noise Current

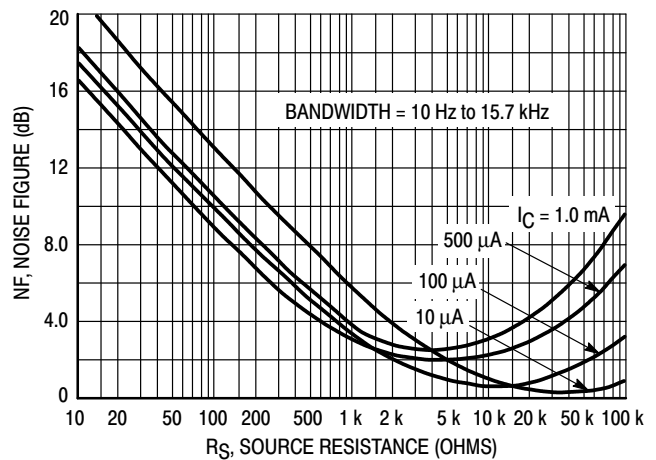


Figure 5. Wideband Noise Figure

100 Hz NOISE DATA

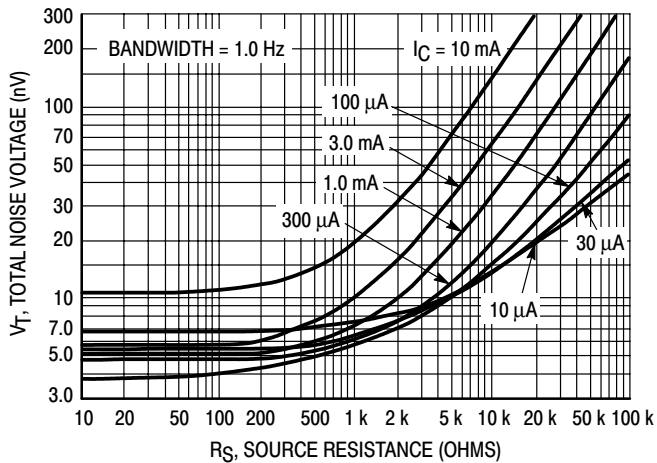


Figure 6. Total Noise Voltage

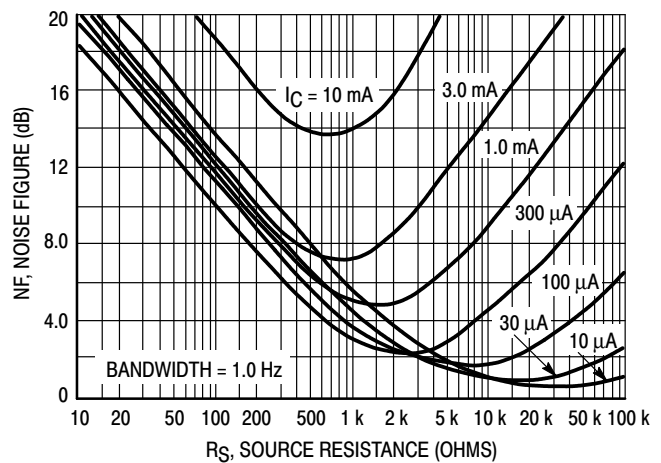


Figure 7. Noise Figure

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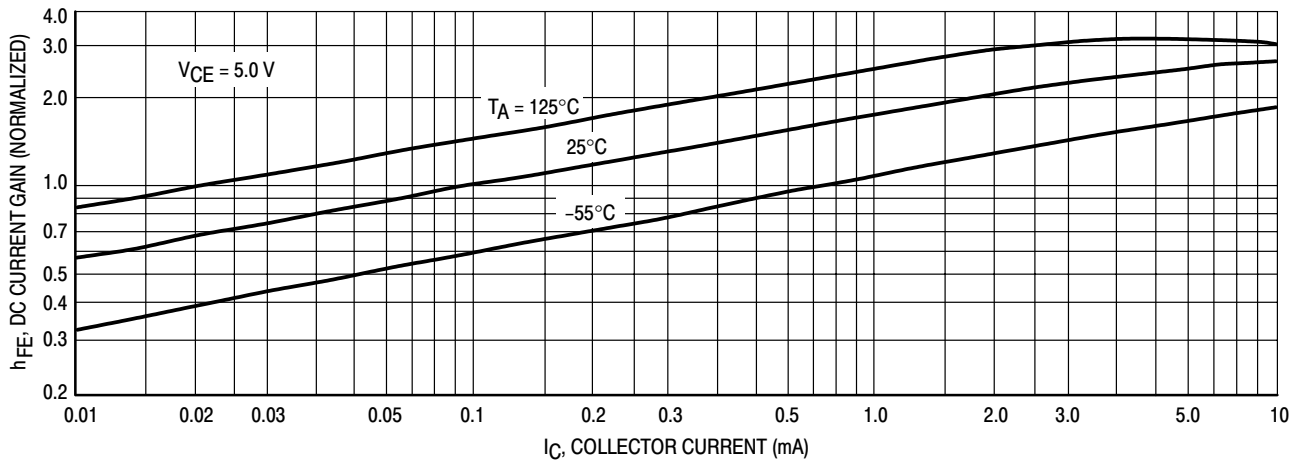


Figure 8. DC Current Gain

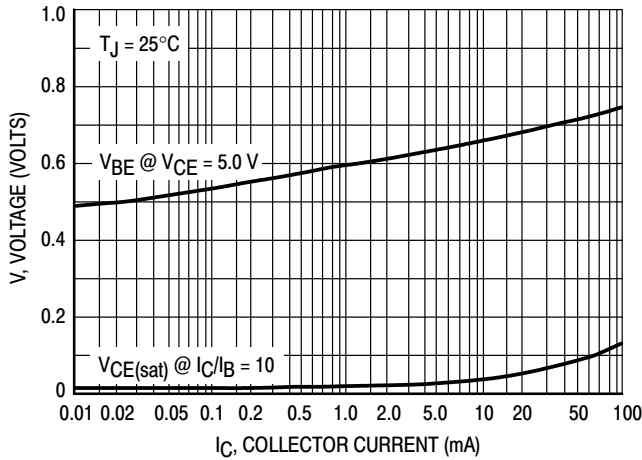


Figure 9. "On" Voltages

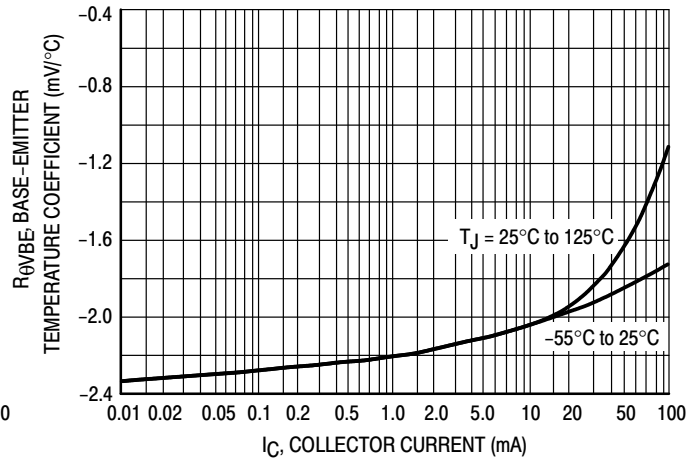


Figure 10. Temperature Coefficients

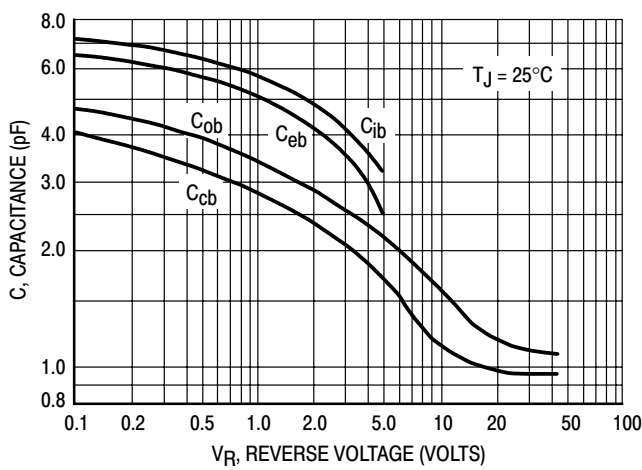


Figure 11. Capacitance

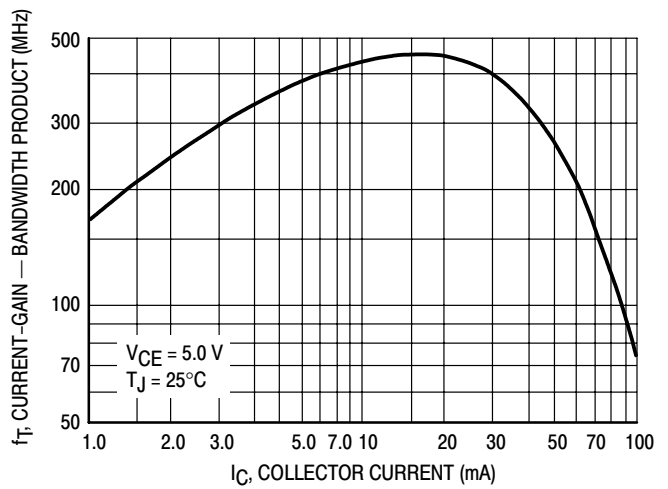
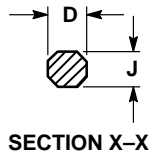
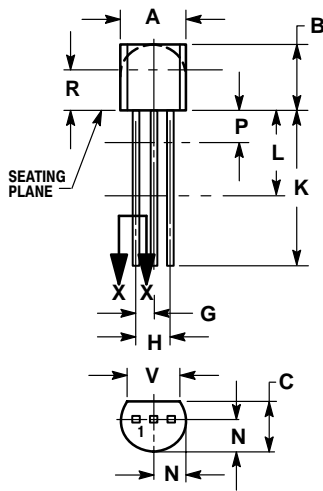


Figure 12. Current-Gain — Bandwidth Product

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PACKAGE DIMENSIONS

TO-92 (TO-226) CASE 29-11 ISSUE AL



STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.021	0.407	0.533
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.080	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.115	---	2.93	---
V	0.135	---	3.43	---

Notes

Notes

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