

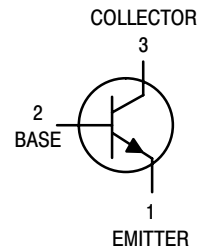
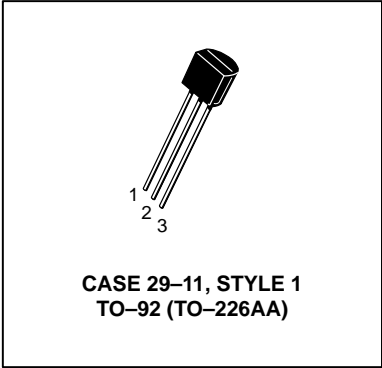
# Amplifier Transistors

## 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 $25^\circ\text{C}$	$P_D$	625	5.0	mW mW/°C
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5	12	Watts mW/°C
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	–55 to +150		°C



### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}^{(1)}$	200	°C/W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	°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 <sup>(2)</sup> ( $I_C = 1.0 \text{ mAdc}, I_B = 0$ )	$V_{(BR)CEO}$	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 ( $V_{EB(\text{off})} = 3.0 \text{ Vdc}, I_C = 0$ ) ( $V_{EB(\text{off})} = 4.5 \text{ Vdc}, I_C = 0$ )	$I_{EBO}$	— —	50 100	nAdc

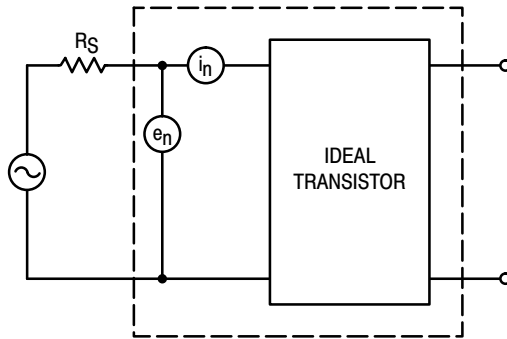
- $R_{\theta JA}$  is measured with the device soldered into a typical printed circuit board.
- Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

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

Characteristic	Symbol	Min	Max	Unit
<b>ON CHARACTERISTICS</b>				
DC Current Gain ( $I_C = 100\ \mu\text{Adc}$ , $V_{CE} = 5.0\ \text{Vdc}$ )	$h_{FE}$	300	900	—
	2N5088	400	1200	
	2N5089			
( $I_C = 1.0\ \text{mAdc}$ , $V_{CE} = 5.0\ \text{Vdc}$ )		350	—	
	2N5088	450	—	
	2N5089			
( $I_C = 10\ \text{mAdc}$ , $V_{CE} = 5.0\ \text{Vdc}$ )(2)		300	—	
	2N5088	400	—	
	2N5089			
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
<b>SMALL–SIGNAL CHARACTERISTICS</b>				
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	—
	2N5088	450	1800	
	2N5089			
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
	2N5088	—	2.0	
	2N5089			

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

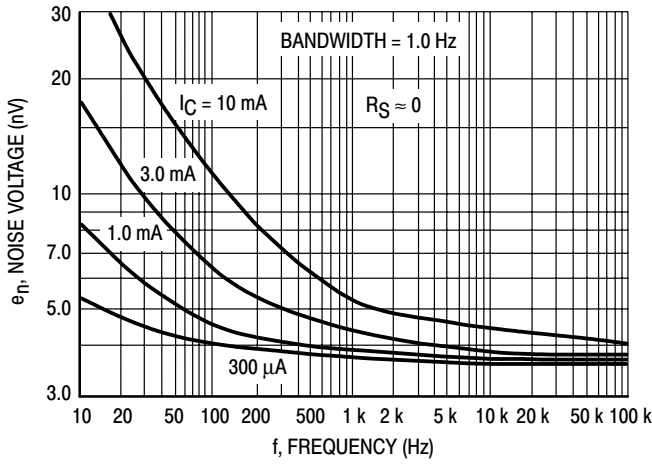


Figure 2. Effects of Frequency

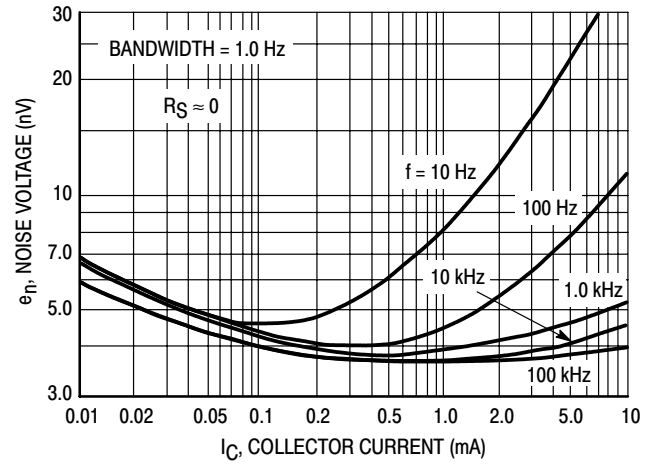


Figure 3. Effects of Collector Current

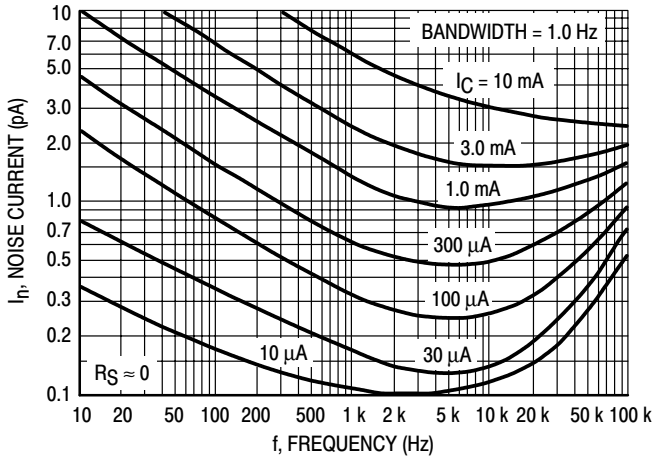


Figure 4. Noise Current

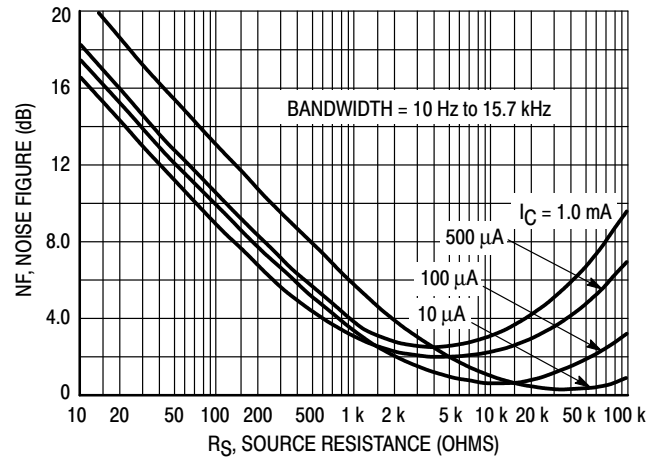


Figure 5. Wideband Noise Figure

100 Hz NOISE DATA

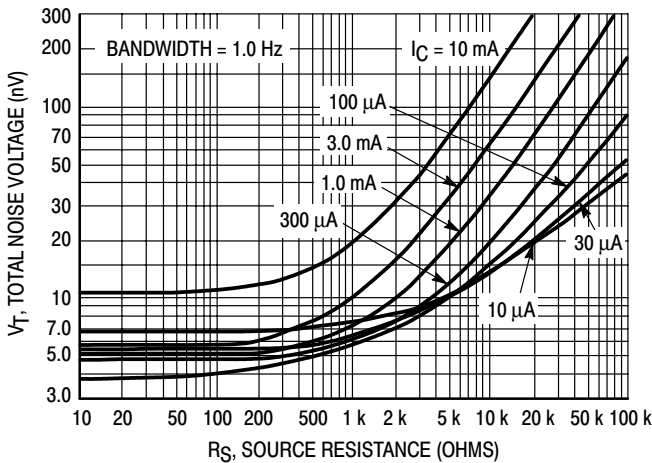


Figure 6. Total Noise Voltage

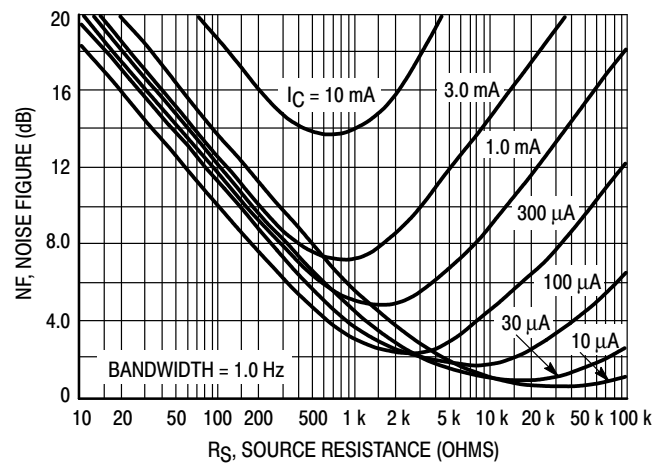


Figure 7. Noise Figure

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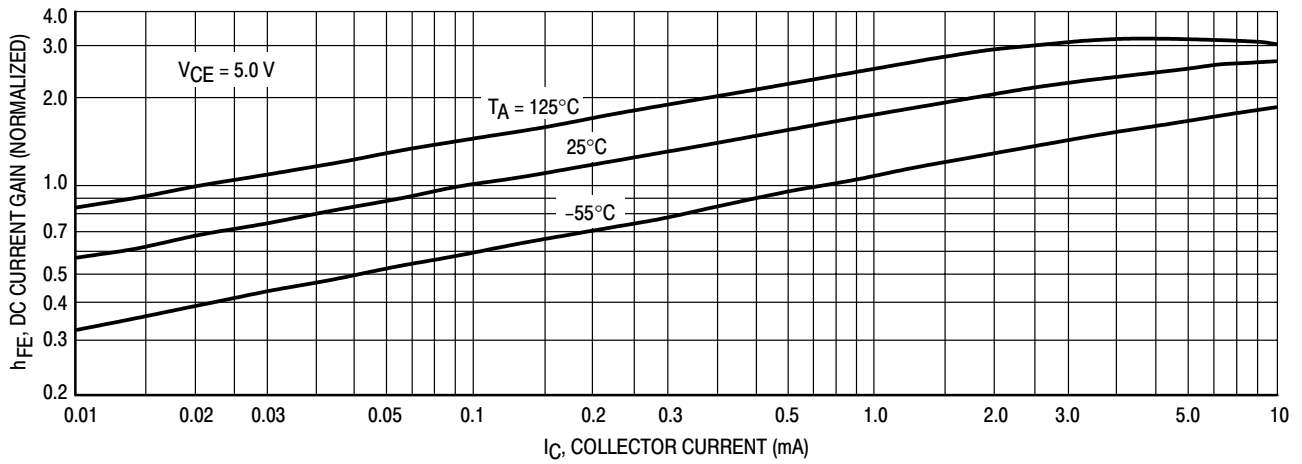


Figure 8. DC Current Gain

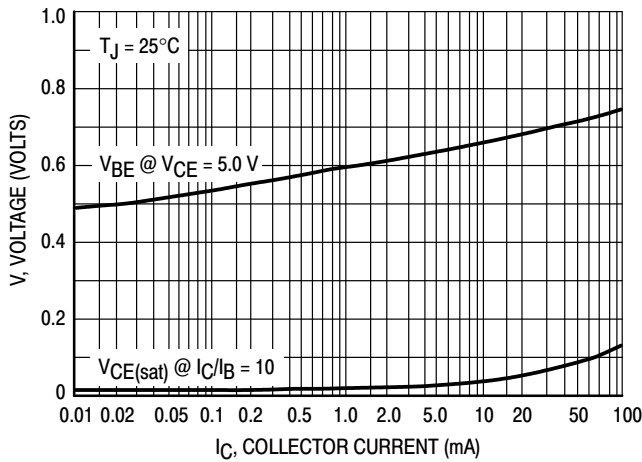


Figure 9. "On" Voltages

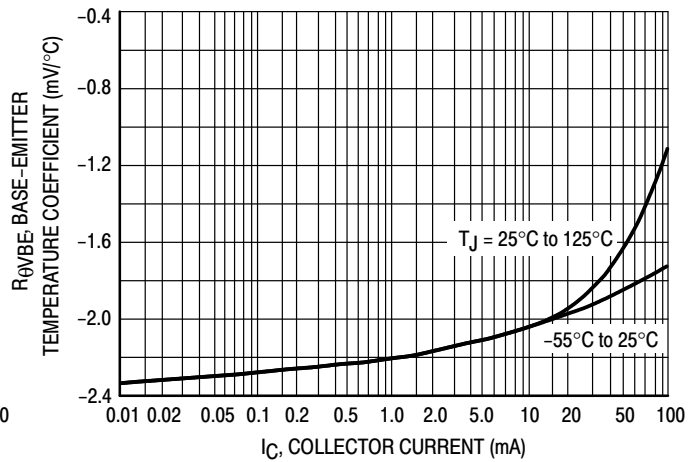


Figure 10. Temperature Coefficients

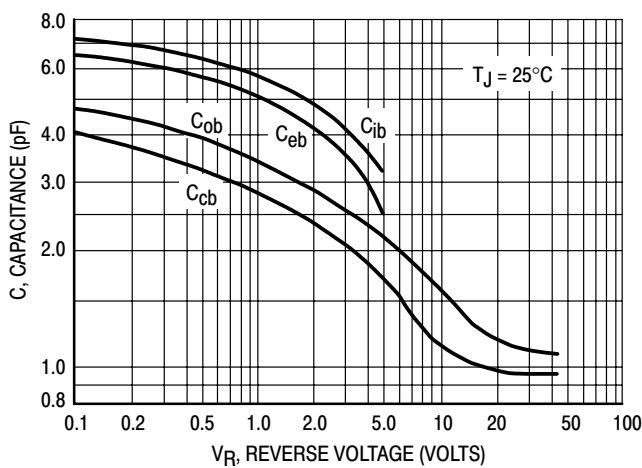


Figure 11. Capacitance

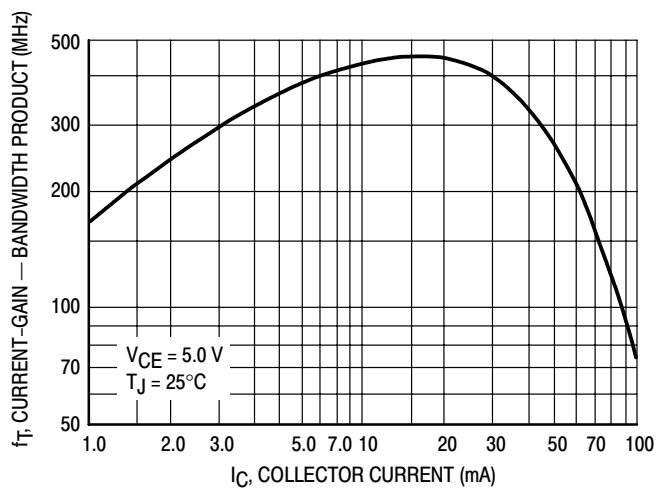
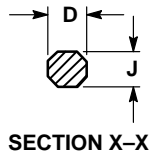
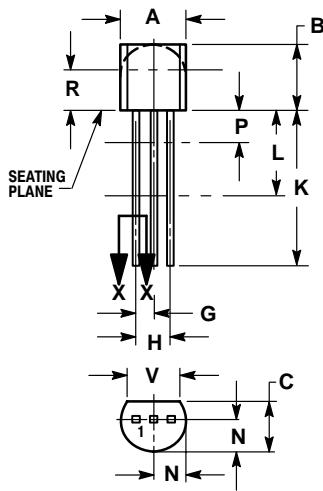


Figure 12. Current-Gain — Bandwidth Product

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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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