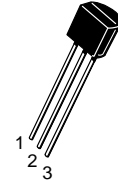
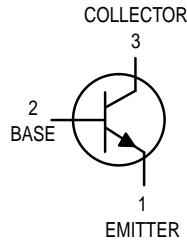


# Amplifier Transistors

## NPN Silicon

**2N5088**  
**2N5089**



CASE 29-04, STYLE 1  
TO-92 (TO-226AA)

### 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/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	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	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	$^\circ\text{C}/\text{W}$

### 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> ( $I_C = 1.0 \text{ mAdc}, I_E = 0$ )	$V_{(BR)CEO}$	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  $\leq 2.0\%$ .

## 2N5088 2N5089

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

Characteristic	Symbol	Min	Max	Unit
<b>ON CHARACTERISTICS</b>				
DC Current Gain ( $I_C = 100\ \mu\text{A}$ dc, $V_{CE} = 5.0\ \text{V}$ dc)	$h_{FE}$	300	900	—
	2N5088	400	1200	
	2N5089			
( $I_C = 1.0\ \text{mA}$ dc, $V_{CE} = 5.0\ \text{V}$ dc)		350	—	
	2N5088	450	—	
	2N5089			
( $I_C = 10\ \text{mA}$ dc, $V_{CE} = 5.0\ \text{V}$ dc)(2)		300	—	
	2N5088	400	—	
	2N5089			
Collector–Emitter Saturation Voltage ( $I_C = 10\ \text{mA}$ dc, $I_B = 1.0\ \text{mA}$ dc)	$V_{CE(\text{sat})}$	—	0.5	Vdc
Base–Emitter On Voltage ( $I_C = 10\ \text{mA}$ dc, $V_{CE} = 5.0\ \text{V}$ dc)(2)	$V_{BE(\text{on})}$	—	0.8	Vdc
<b>SMALL–SIGNAL CHARACTERISTICS</b>				
Current–Gain — Bandwidth Product ( $I_C = 500\ \mu\text{A}$ dc, $V_{CE} = 5.0\ \text{V}$ dc, $f = 20\ \text{MHz}$ )	$f_T$	50	—	MHz
Collector–Base Capacitance ( $V_{CB} = 5.0\ \text{V}$ dc, $I_E = 0$ , $f = 1.0\ \text{MHz}$ )	$C_{cb}$	—	4.0	pF
Emitter–Base Capacitance ( $V_{EB} = 0.5\ \text{V}$ dc, $I_C = 0$ , $f = 1.0\ \text{MHz}$ )	$C_{eb}$	—	10	pF
Small–Signal Current Gain ( $I_C = 1.0\ \text{mA}$ dc, $V_{CE} = 5.0\ \text{V}$ dc, $f = 1.0\ \text{kHz}$ )	$h_{fe}$	350	1400	—
	2N5088	450	1800	
	2N5089			
Noise Figure ( $I_C = 100\ \mu\text{A}$ dc, $V_{CE} = 5.0\ \text{V}$ dc, $R_S = 1.0\ \text{k}\Omega$ , $f = 1.0\ \text{kHz}$ )	NF	—	3.0	dB
	2N5088	—	2.0	
	2N5089			

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

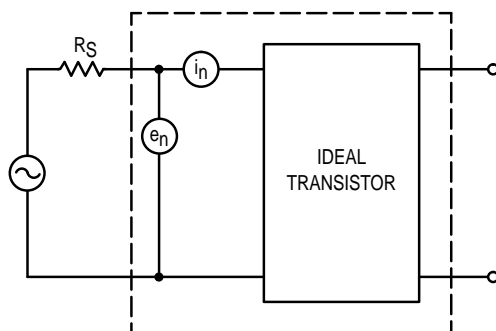
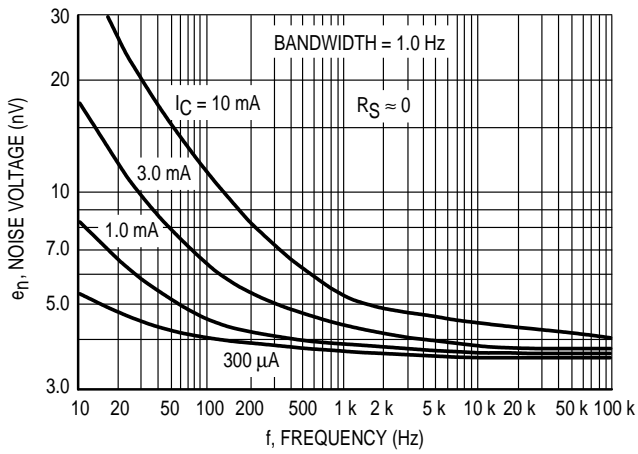


Figure 1. Transistor Noise Model

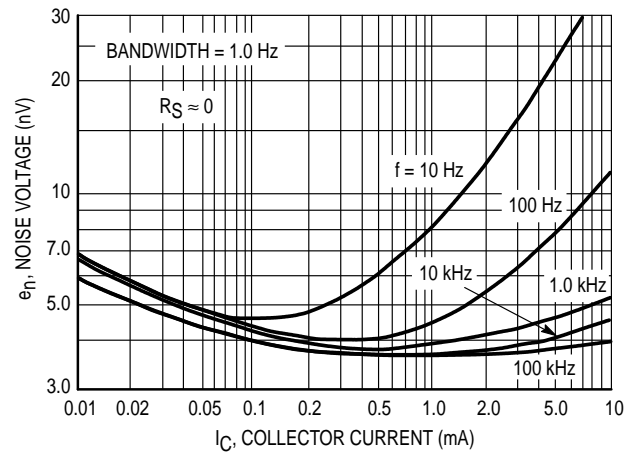
**NOISE CHARACTERISTICS**

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

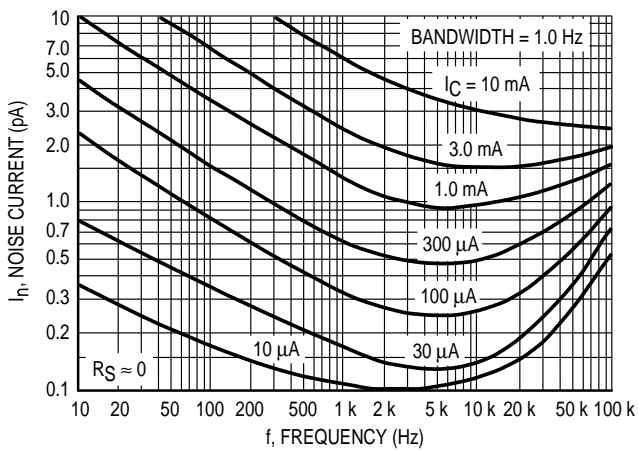
**NOISE VOLTAGE**



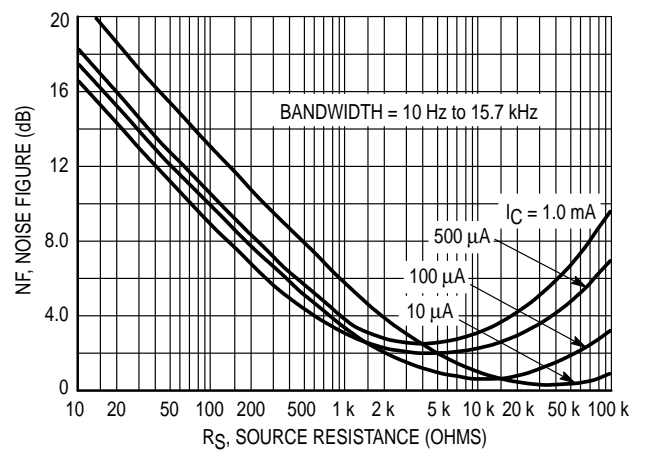
**Figure 2. Effects of Frequency**



**Figure 3. Effects of Collector Current**

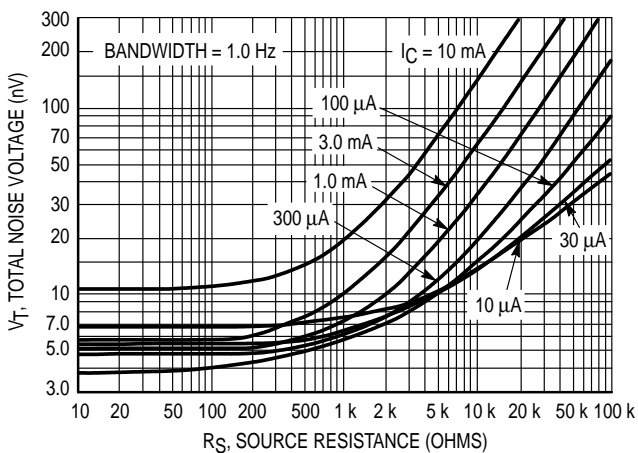


**Figure 4. Noise Current**

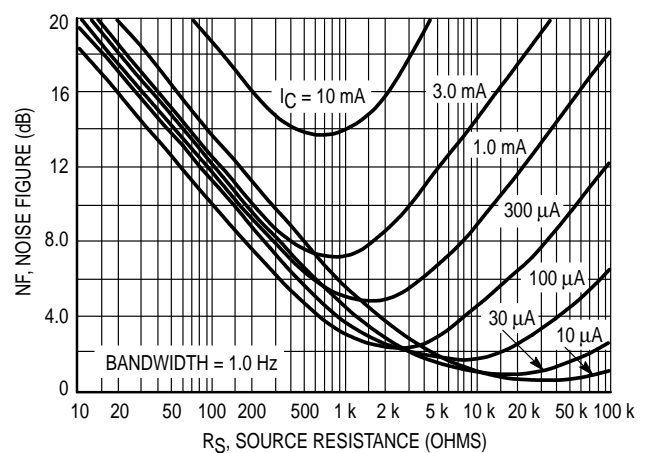


**Figure 5. Wideband Noise Figure**

**100 Hz NOISE DATA**

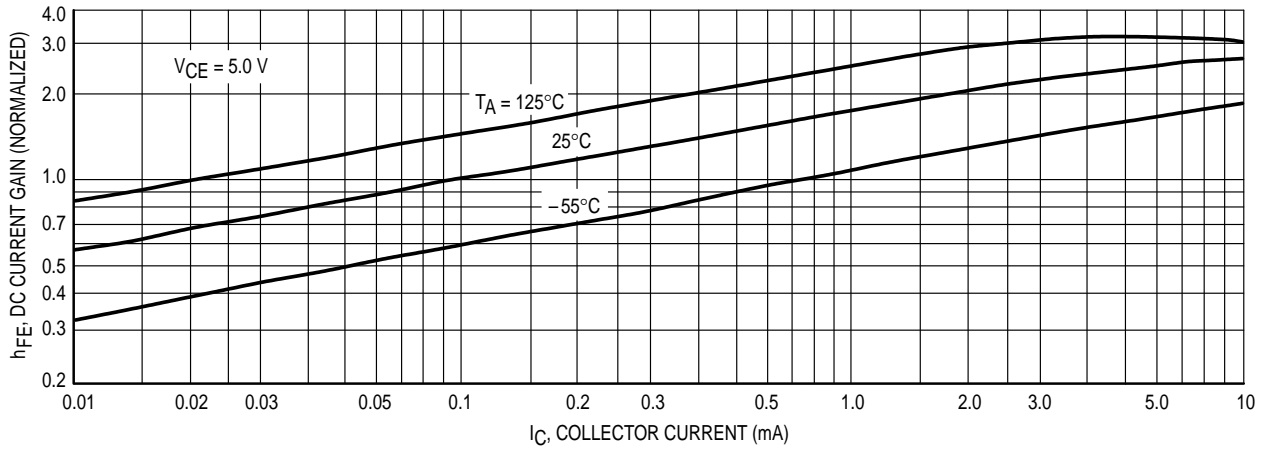


**Figure 6. Total Noise Voltage**

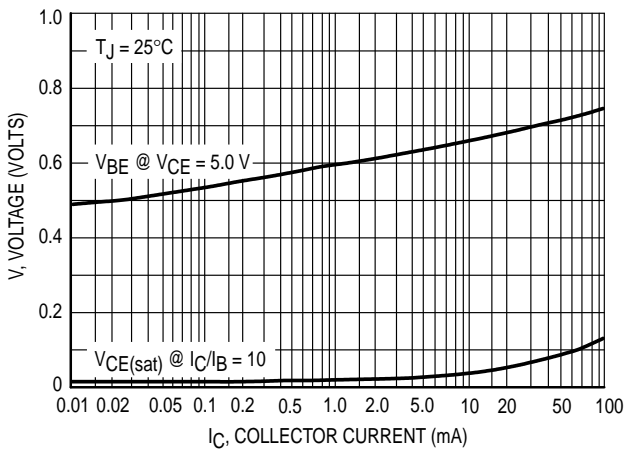


**Figure 7. Noise Figure**

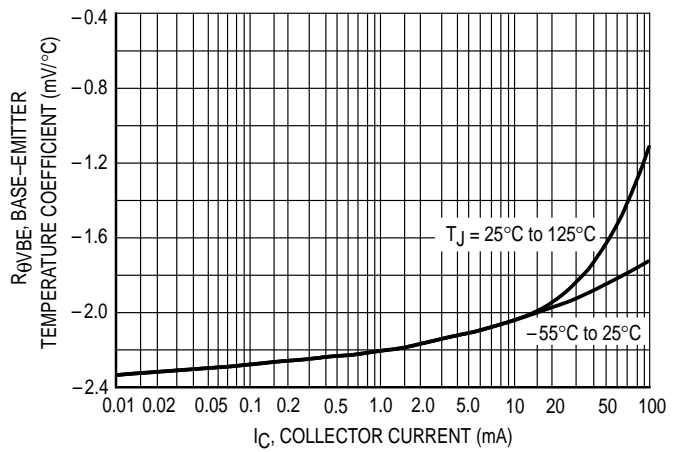
**2N5088 2N5089**



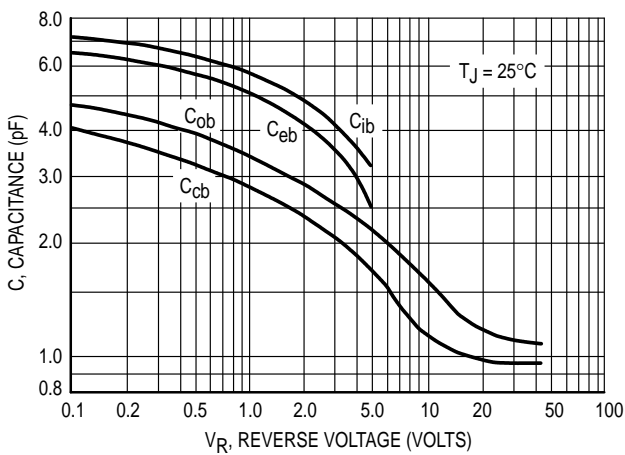
**Figure 8. DC Current Gain**



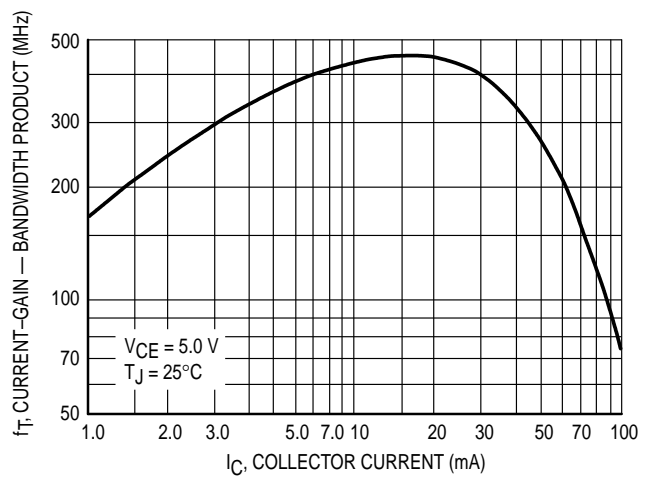
**Figure 9. "On" Voltages**



**Figure 10. Temperature Coefficients**

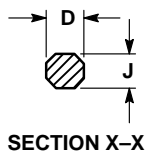
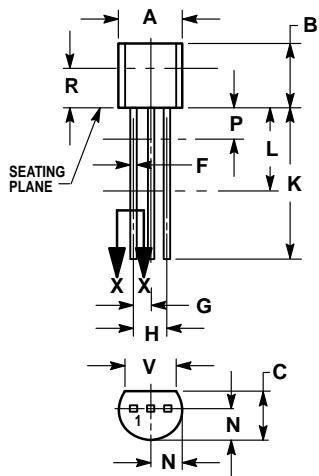


**Figure 11. Capacitance**



**Figure 12. Current-Gain — Bandwidth Product**

PACKAGE DIMENSIONS




**CASE 029-04  
(TO-226AA)  
ISSUE AD**

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
  4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSION D AND J APPLY BETWEEN L AND K MINIMUM. 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	0.022	0.41	0.55
F	0.016	0.019	0.41	0.48
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	—

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

## 2N5088 2N5089

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