



**THE DATASHEET OF  
2N5089RLRA**



# 2N5088, 2N5089

## Amplifier Transistors

### NPN Silicon

#### Features

- Pb-Free Packages are Available\*

#### MAXIMUM RATINGS

Rating	Symbol	Value	Unit	
Collector – Emitter Voltage	$V_{CEO}$	2N5088	30	Vdc
		2N5089	25	
Collector – Base Voltage	$V_{CB0}$	2N5088	35	Vdc
		2N5089	30	
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 $25^\circ\text{C}$	$P_D$	2N5088	625	mW
		2N5089	5.0	
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	2N5088	1.5	W
		2N5089	12	
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 (Note 1)	$R_{\theta JA}$	200	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	83.3	$^\circ\text{C/W}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

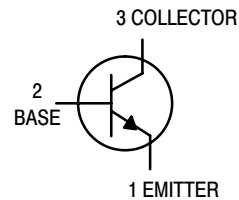
1.  $R_{\theta JA}$  is measured with the device soldered into a typical printed circuit board.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

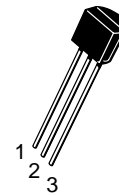


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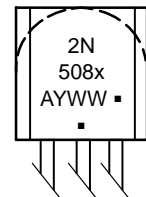
<http://onsemi.com>



#### MARKING DIAGRAM



TO-92  
CASE 29  
STYLE 1



2N508x = Device Code  
x = 8 or 9

A = Assembly Location

Y = Year

WW = Work Week

▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

Device	Package	Shipping†
2N5088	TO-92	5000 Units/Box
2N5088G	TO-92 (Pb-Free)	5000 Units/Box
2N5088RLRA	TO-92	2000/Tape & Reel
2N5088RLRAG	TO-92 (Pb-Free)	2000/Tape & Reel
2N5089	TO-92	5000 Units/Box
2N5089G	TO-92 (Pb-Free)	5000 Units/Box
2N2089RLRA	TO-92	2000/Tape & Reel
2N2089RLRAG	TO-92 (Pb-Free)	2000/Tape & Reel
2N2089RLRE	TO-92	2000/Tape & Reel
2N2089RLREG	TO-92 (Pb-Free)	2000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

## 2N5088, 2N5089

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

Characteristic	Symbol	Min	Max	Unit	
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Breakdown Voltage (Note 2) ( $I_C = 1.0\text{ mAdc}$ , $I_B = 0$ )	2N5088 2N5089	$V_{(BR)CEO}$	30 25	– –	Vdc
Collector–Base Breakdown Voltage ( $I_C = 100\text{ }\mu\text{Adc}$ , $I_E = 0$ )	2N5088 2N5089	$V_{(BR)CBO}$	35 30	– –	Vdc
Collector Cutoff Current ( $V_{CB} = 20\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 15\text{ Vdc}$ , $I_E = 0$ )	2N5088 2N5089	$I_{CBO}$	– –	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
<b>ON CHARACTERISTICS</b>					
DC Current Gain ( $I_C = 100\text{ }\mu\text{Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ )	2N5088 2N5089	$h_{FE}$	300 400	900 1200	–
( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 5.0\text{ Vdc}$ )	2N5088 2N5089		350 450	– –	
( $I_C = 10\text{ mAdc}$ , $V_{CE} = 5.0\text{ Vdc}$ ) (Note 2)	2N5088 2N5089		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 ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 5.0\text{ Vdc}$ ) (Note 2)		$V_{BE(on)}$	–	0.8	Vdc
<b>SMALL–SIGNAL CHARACTERISTICS</b>					
Current–Gain–Bandwidth Product ( $I_C = 500\text{ }\mu\text{Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f = 20\text{ MHz}$ )		$f_T$	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 ( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	2N5088 2N5089	$h_{fe}$	350 450	1400 1800	–
Noise Figure ( $I_C = 100\text{ }\mu\text{Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ , $R_S = 1.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ )	2N5088 2N5089	NF	– –	3.0 2.0	dB

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

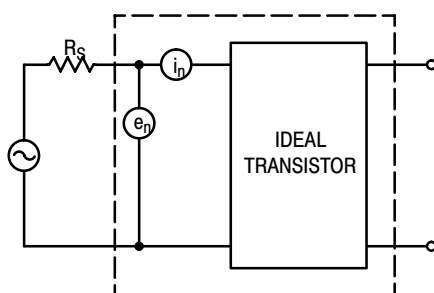


Figure 1. Transistor Noise Model

# 2N5088, 2N5089

## NOISE CHARACTERISTICS

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

### NOISE VOLTAGE

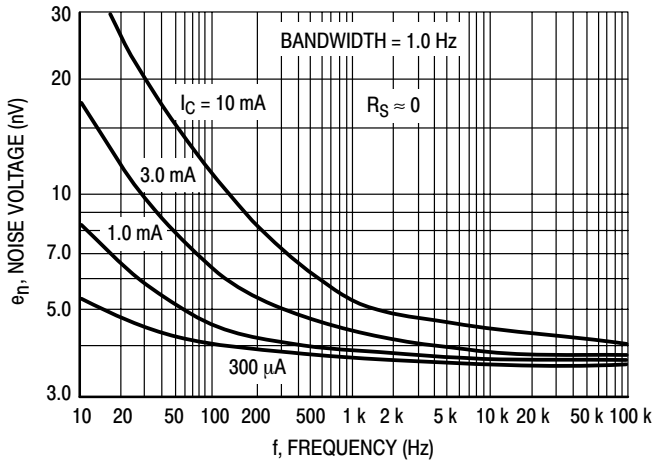


Figure 2. Effects of Frequency

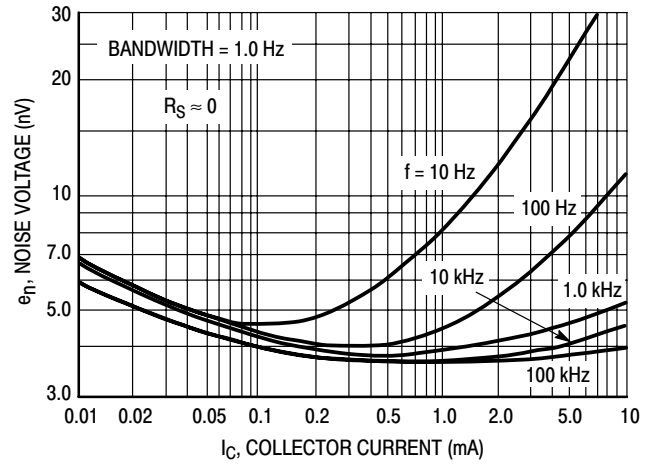


Figure 3. Effects of Collector Current

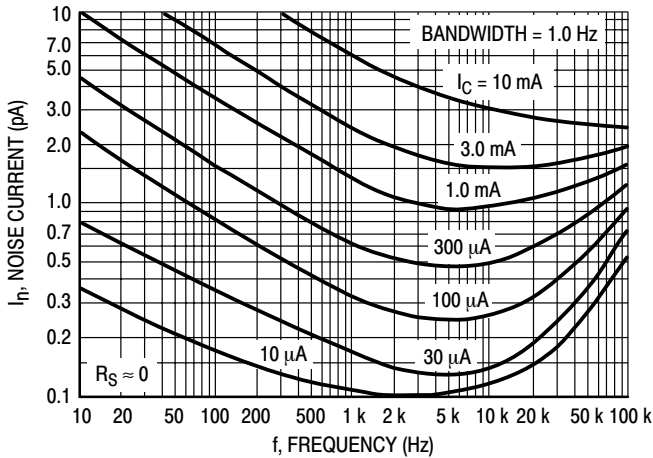


Figure 4. Noise Current

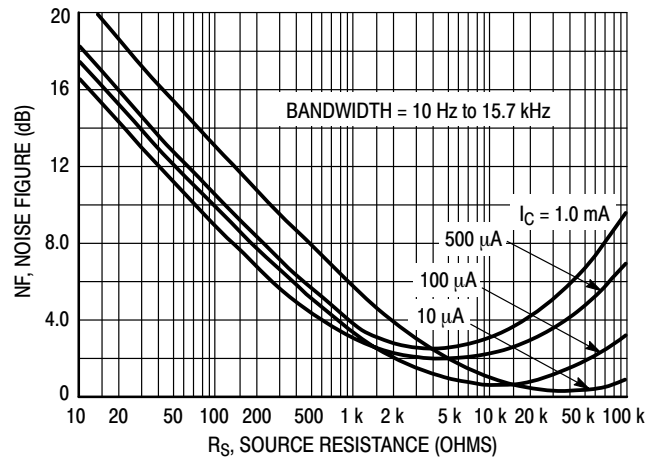


Figure 5. Wideband Noise Figure

### 100 Hz NOISE DATA

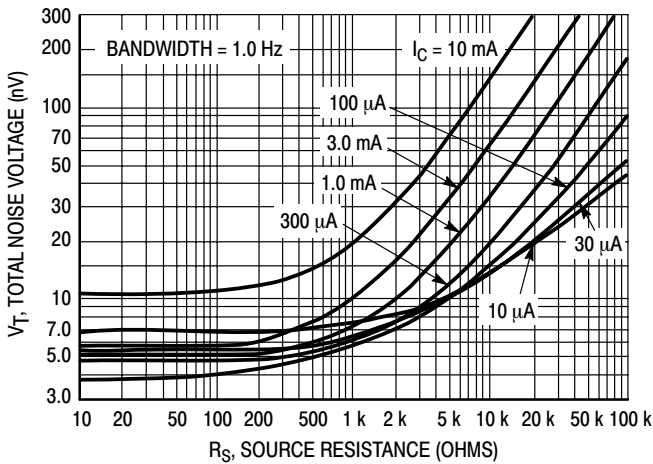


Figure 6. Total Noise Voltage

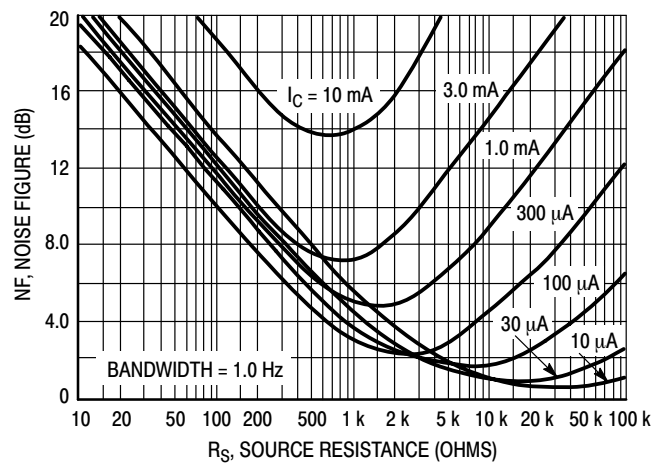


Figure 7. Noise Figure

# 2N5088, 2N5089

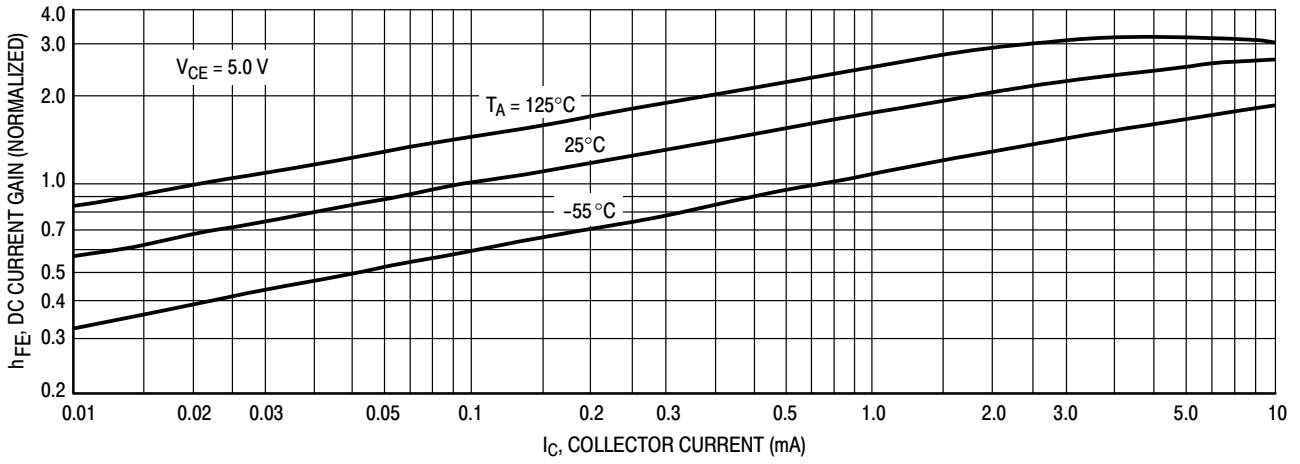


Figure 8. DC Current Gain

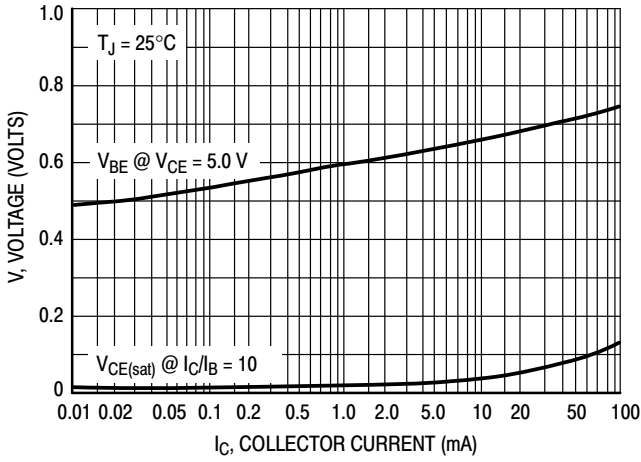


Figure 9. "On" Voltages

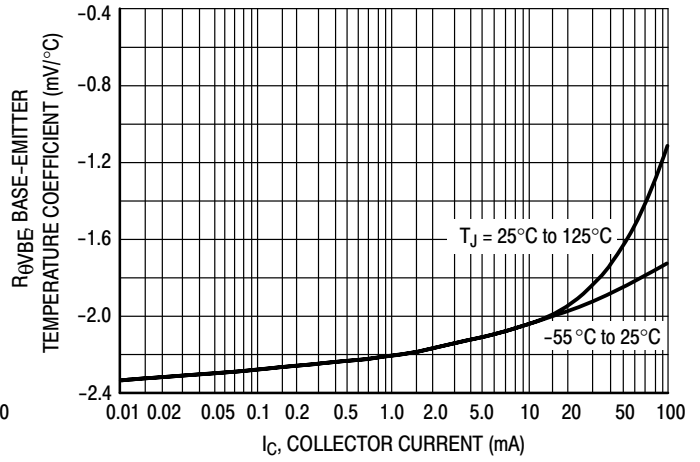


Figure 10. Temperature Coefficients

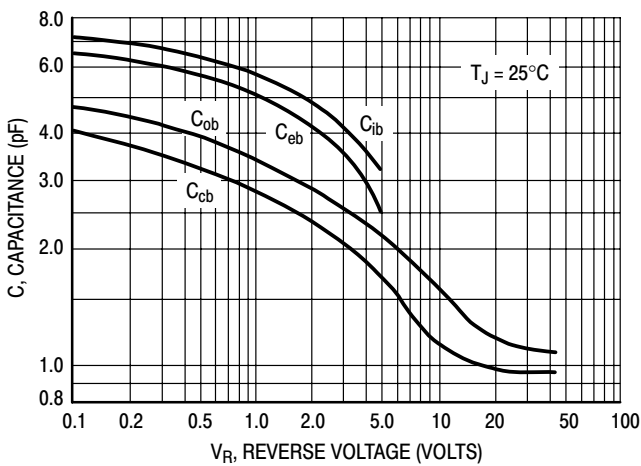


Figure 11. Capacitance

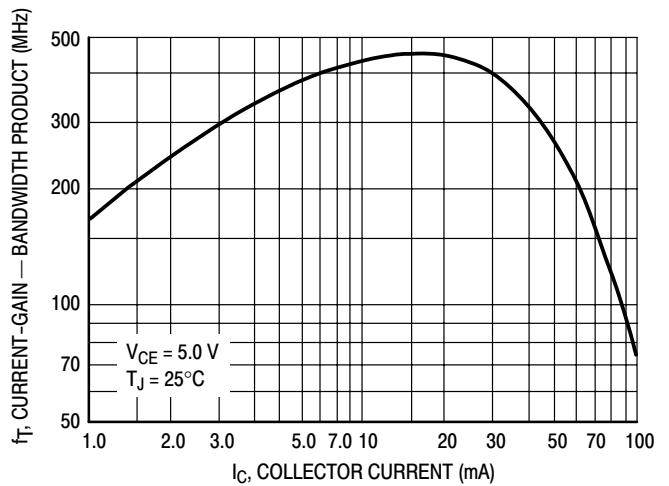
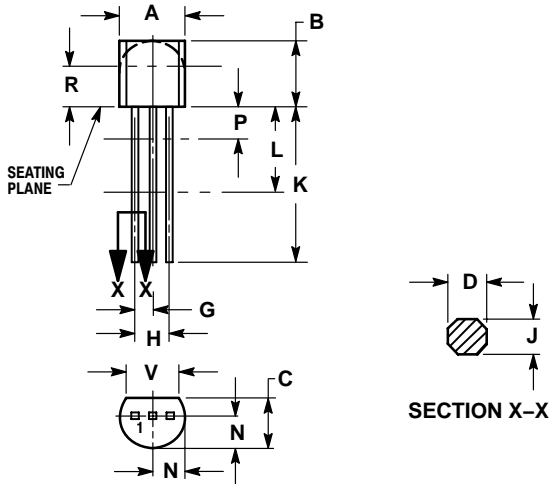


Figure 12. Current-Gain — Bandwidth Product

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## PACKAGE DIMENSIONS

TO-92  
TO-226AA  
CASE 29-11  
ISSUE AL



### 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	---

### STYLE 1:

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

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