



**THE DATASHEET OF
2N5088RLRA**



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°C	P_D	2N5088	625	mW
		2N5089	5.0	
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°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	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	83.3	$^\circ\text{C}/\text{W}$

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.

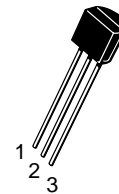
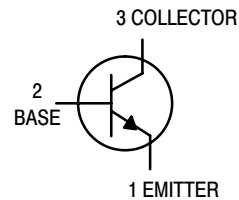
1. $R_{\theta JA}$ is measured with the device soldered into a typical printed circuit board.

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



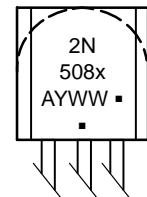
ON Semiconductor®

<http://onsemi.com>



TO-92
CASE 29
STYLE 1

MARKING DIAGRAM



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
OFF CHARACTERISTICS					
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
ON CHARACTERISTICS					
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
SMALL–SIGNAL CHARACTERISTICS					
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 $\leq 2.0\%$.

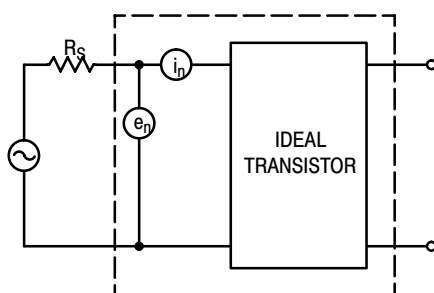


Figure 1. Transistor Noise Model

2N5088, 2N5089

NOISE CHARACTERISTICS

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

NOISE VOLTAGE

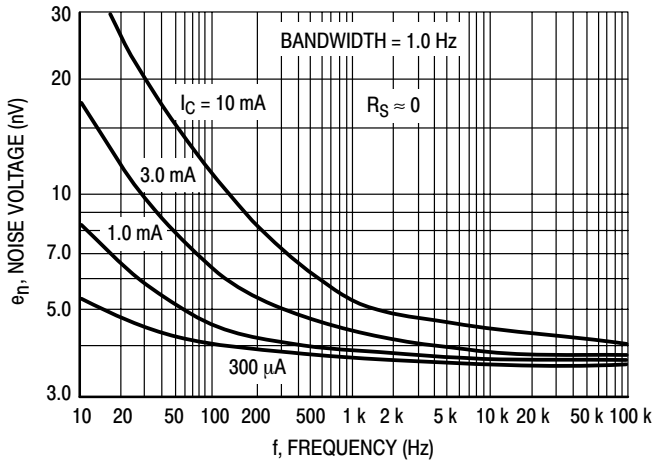


Figure 2. Effects of Frequency

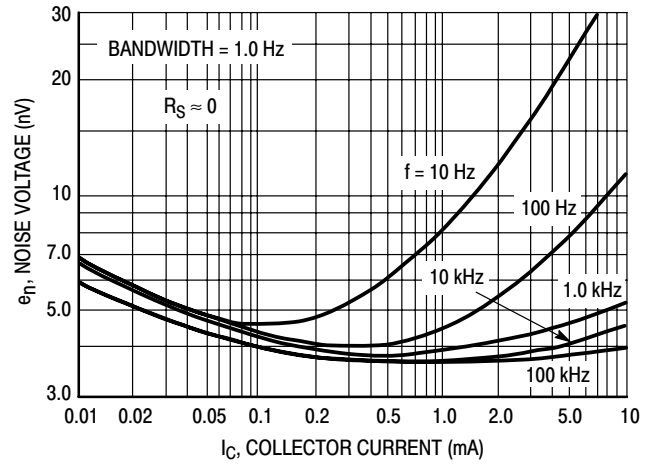


Figure 3. Effects of Collector Current

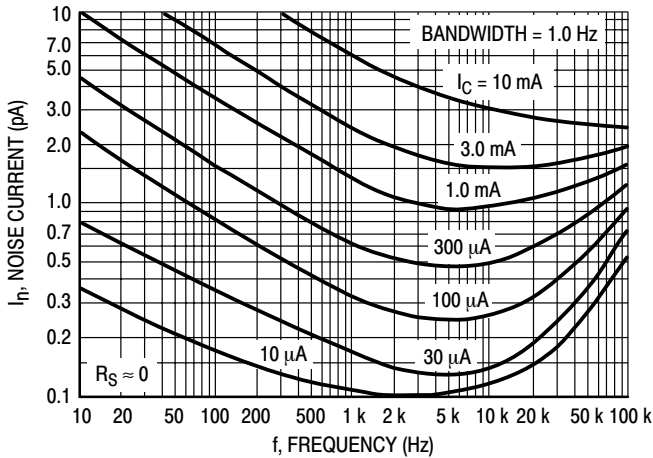


Figure 4. Noise Current

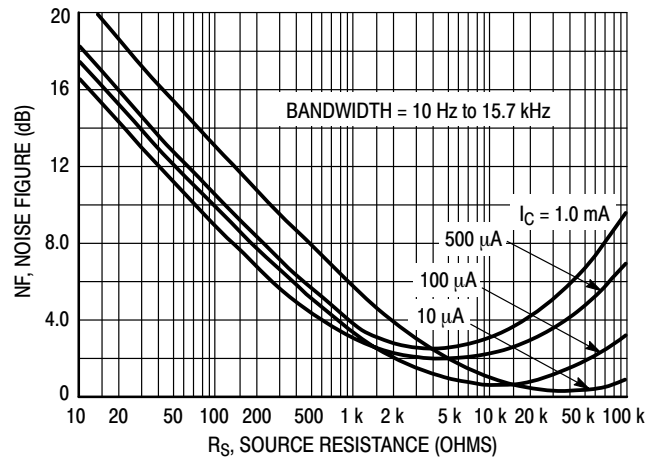


Figure 5. Wideband Noise Figure

100 Hz NOISE DATA

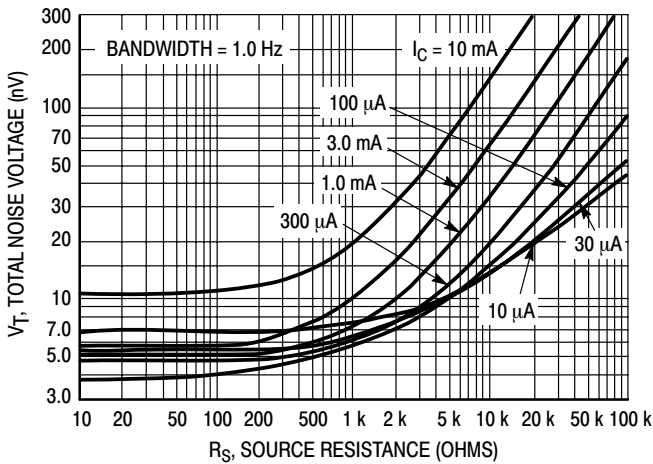


Figure 6. Total Noise Voltage

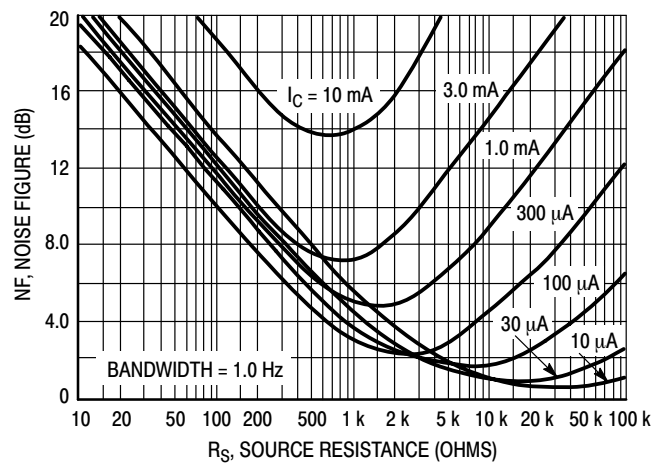


Figure 7. Noise Figure

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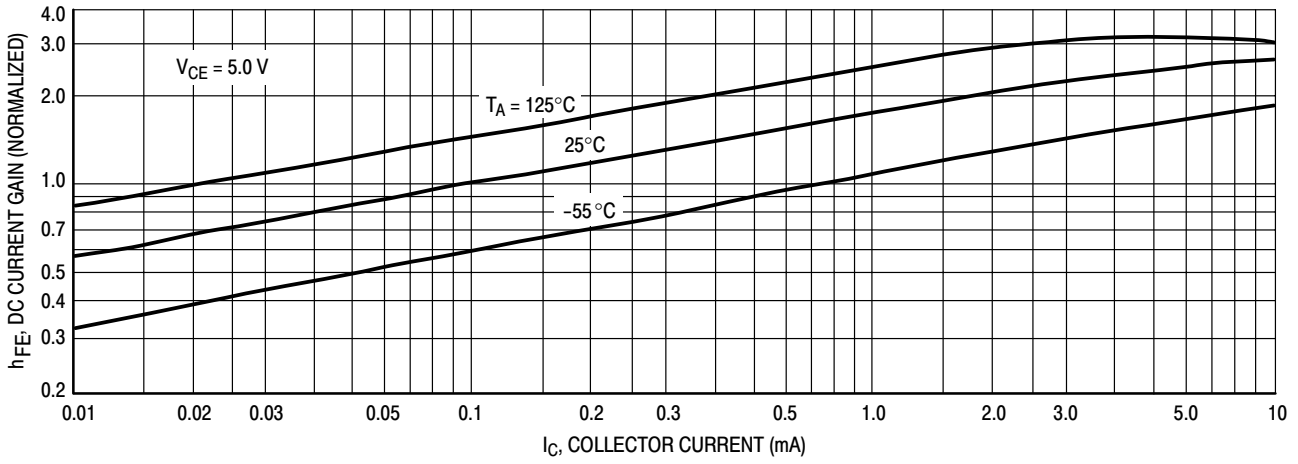


Figure 8. DC Current Gain

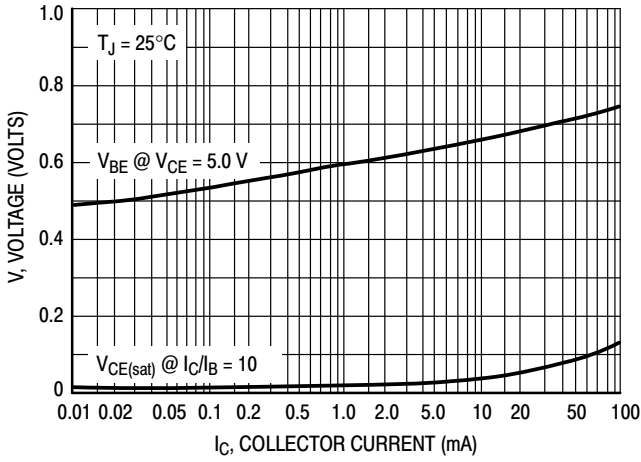


Figure 9. "On" Voltages

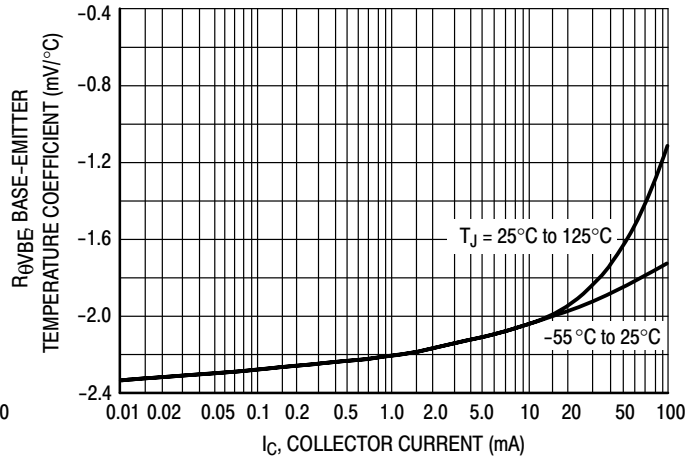


Figure 10. Temperature Coefficients

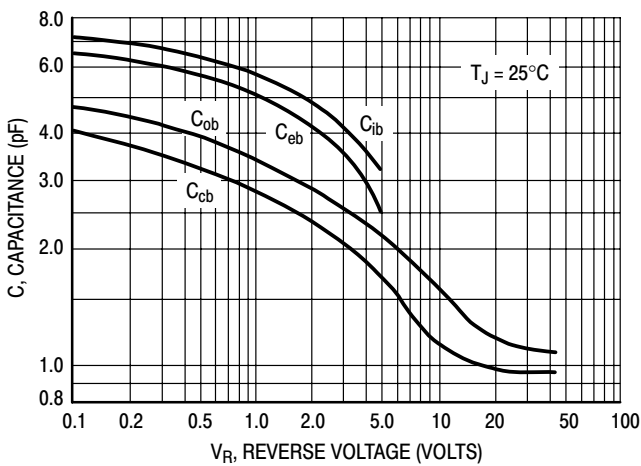


Figure 11. Capacitance

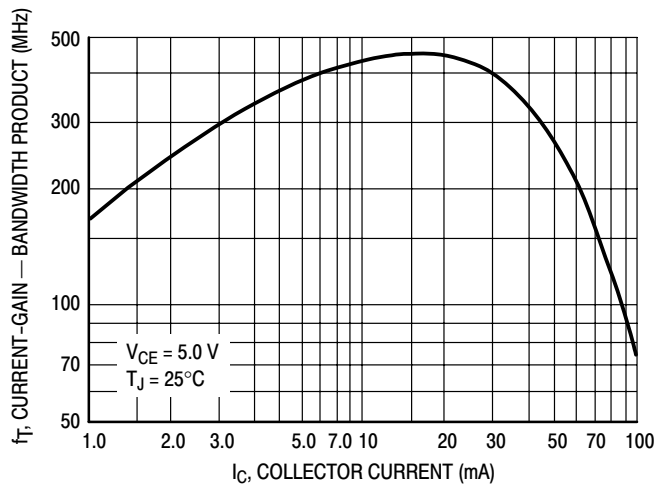
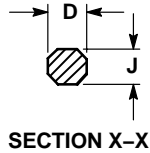
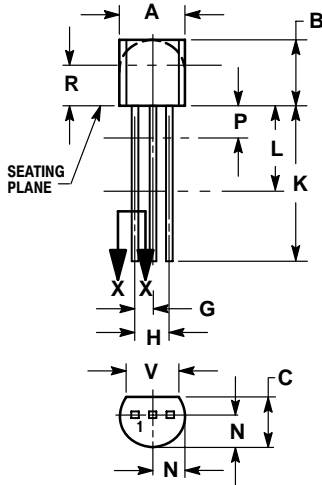


Figure 12. Current-Gain — Bandwidth Product

2N5088, 2N5089

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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