

MMBT5088LT1G, SMMBT5088LT1G, MMBT5089LT1G, SMMBT5089LT1G

Low Noise Transistors

NPN Silicon

Features

- AEC-Q101 Qualified and PPAP Capable
- S Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant*

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector – Emitter Voltage MMBT5088, SMMBT5088 MMBT5089, SMMBT5089	V_{CEO}	30 25	Vdc
Collector – Base Voltage MMBT5088, SMMBT5088 MMBT5089, SMMBT5089	V_{CBO}	35 30	Vdc
Emitter – Base Voltage	V_{EBO}	4.5	Vdc
Collector Current – Continuous	I_C	50	mAdc

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board, (Note 1) $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	225 1.8	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	556	$^\circ\text{C}/\text{W}$
Total Device Dissipation Alumina Substrate, (Note 2) $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	300 2.4	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$

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. FR-5 = 1.0 x 0.75 x 0.062 in.

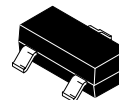
2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

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

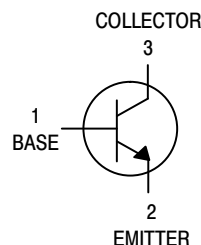


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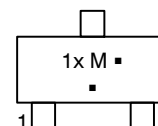
<http://onsemi.com>



SOT-23 (TO-236)
CASE 318
STYLE 6



MARKING DIAGRAM



1x = Device Code

x = Q for MMBT5088L
SMMBT5088L
x = R for MMBT5089L
SMMBT5089L

M = Date Code*

▪ = Pb-Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or overbar may vary depending upon manufacturing location.

ORDERING INFORMATION

Device	Package	Shipping†
MMBT5088LT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
SMMBT5088LT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
MMBT5089LT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
SMMBT5089LT1G	SOT-23 (Pb-Free)	3,000 / 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.

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector – Emitter Breakdown Voltage ($I_C = 1.0\text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	30 25	– –	Vdc
Collector – Base Breakdown Voltage ($I_C = 100\text{ }\mu\text{A}$, $I_E = 0$)	$V_{(BR)CBO}$	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
ON CHARACTERISTICS				
DC Current Gain ($I_C = 100\text{ }\mu\text{A}$, $V_{CE} = 5.0\text{ Vdc}$)	h_{FE}	300 400	900 1200	–
($I_C = 1.0\text{ mA}$, $V_{CE} = 5.0\text{ Vdc}$)		350 450	– –	–
($I_C = 10\text{ mA}$, $V_{CE} = 5.0\text{ Vdc}$)		300 400	– –	–
Collector – Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$)	$V_{CE(sat)}$	–	0.5	Vdc
Base – Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$)	$V_{BE(sat)}$	–	0.8	Vdc
SMALL – SIGNAL CHARACTERISTICS				
Current – Gain — Bandwidth Product ($I_C = 500\text{ }\mu\text{A}$, $V_{CE} = 5.0\text{ Vdc}$, $f = 20\text{ MHz}$)	f_T	50	–	MHz
Collector – Base Capacitance ($V_{CB} = 5.0\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$ emitter guarded)	C_{cb}	–	4.0	pF
Emitter – Base Capacitance ($V_{EB} = 0.5\text{ Vdc}$, $I_C = 0$, $f = 1.0\text{ MHz}$ collector guarded)	C_{eb}	–	10	pF
Small Signal Current Gain ($I_C = 1.0\text{ mA}$, $V_{CE} = 5.0\text{ Vdc}$, $f = 1.0\text{ kHz}$)	h_{fe}	350 450	1400 1800	–
Noise Figure ($I_C = 100\text{ }\mu\text{A}$, $V_{CE} = 5.0\text{ Vdc}$, $R_S = 10\text{ k}\Omega$, $f = 1.0\text{ kHz}$)	NF	– –	3.0 2.0	dB

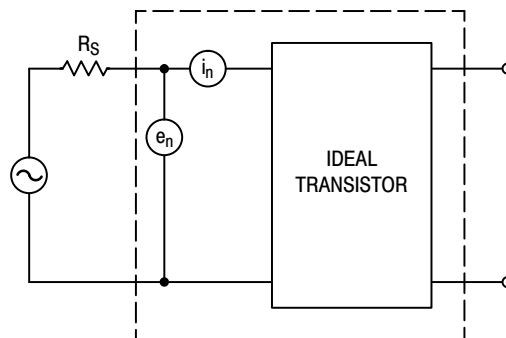


Figure 1. Transistor Noise Model

NOISE CHARACTERISTICS

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

NOISE VOLTAGE

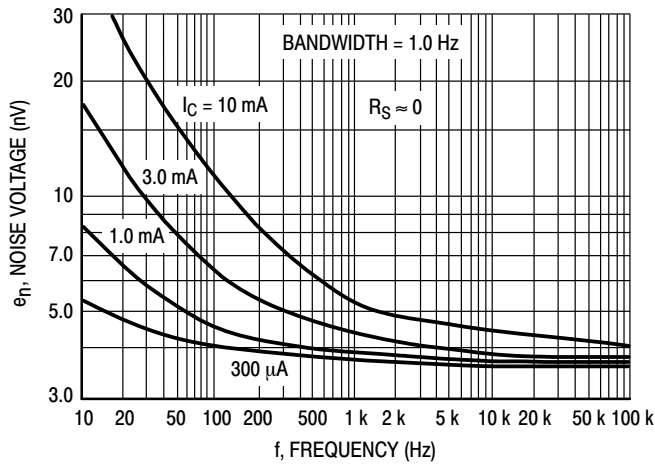


Figure 2. Effects of Frequency

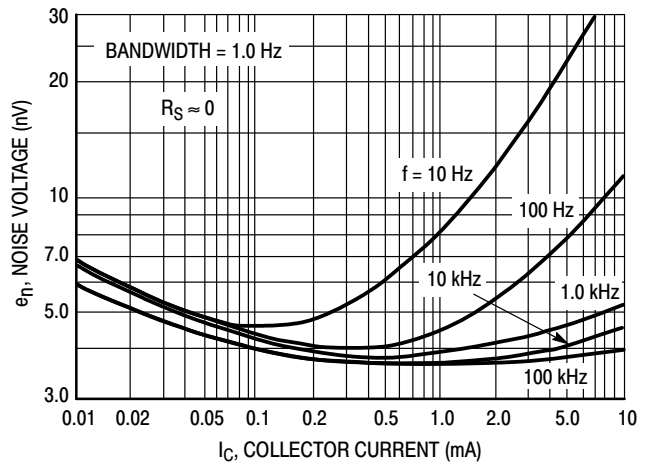


Figure 3. Effects of Collector Current

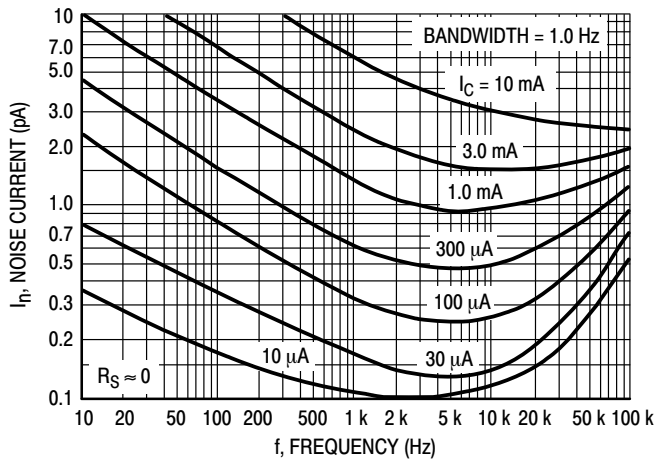


Figure 4. Noise Current

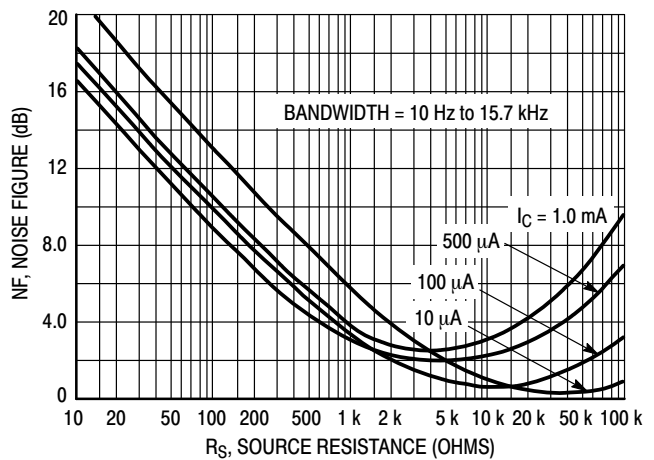


Figure 5. Wideband Noise Figure

100 Hz NOISE DATA

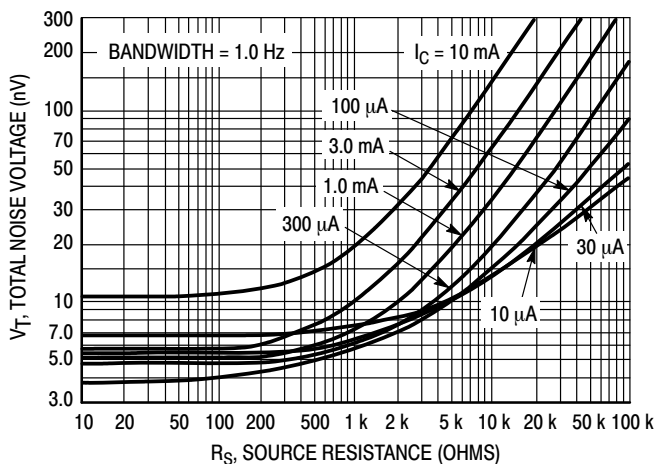


Figure 6. Total Noise Voltage

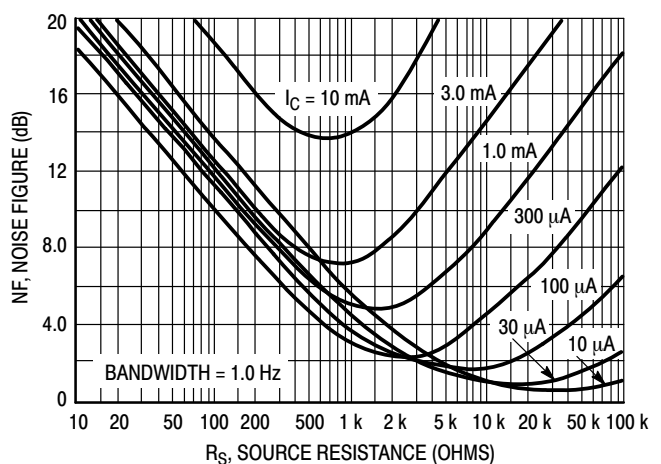


Figure 7. Noise Figure

MMBT5088LT1G, SMMBT5088LT1G, MMBT5089LT1G, SMMBT5089LT1G

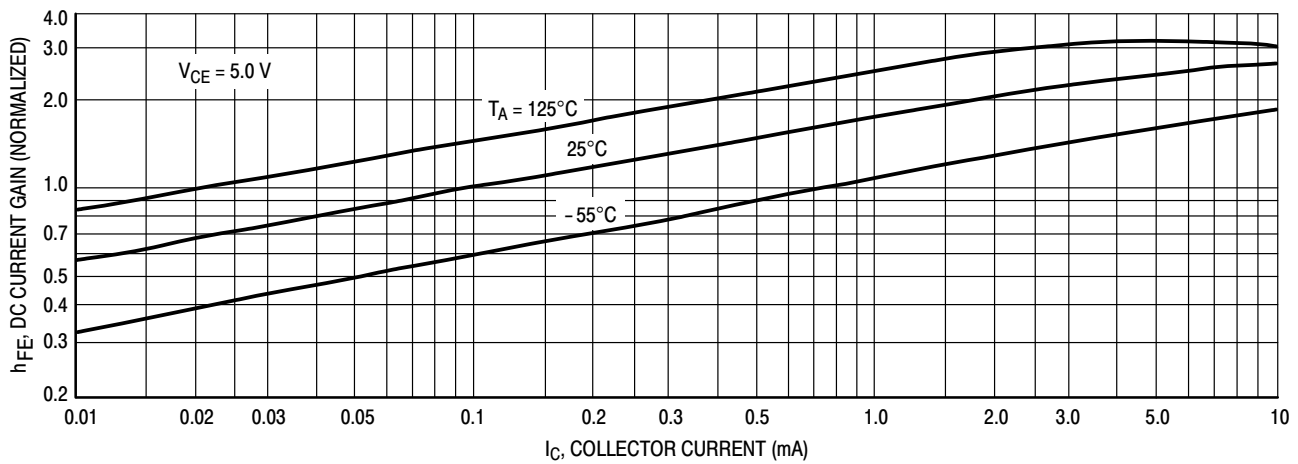


Figure 8. DC Current Gain

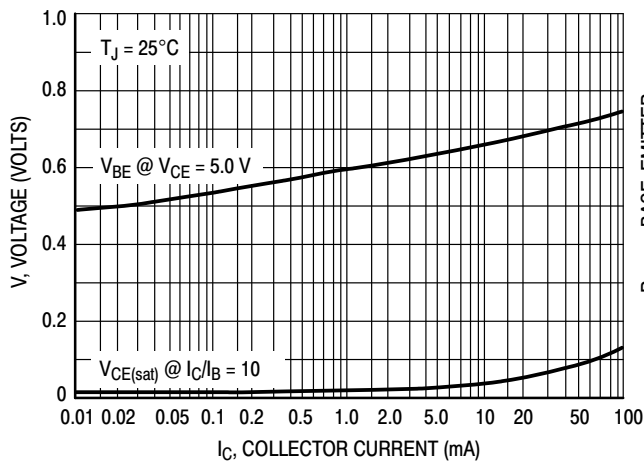


Figure 11. "On" Voltages

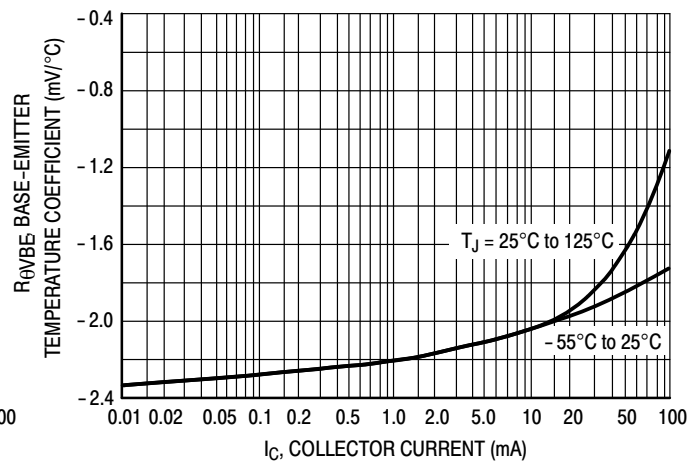


Figure 9. Temperature Coefficients

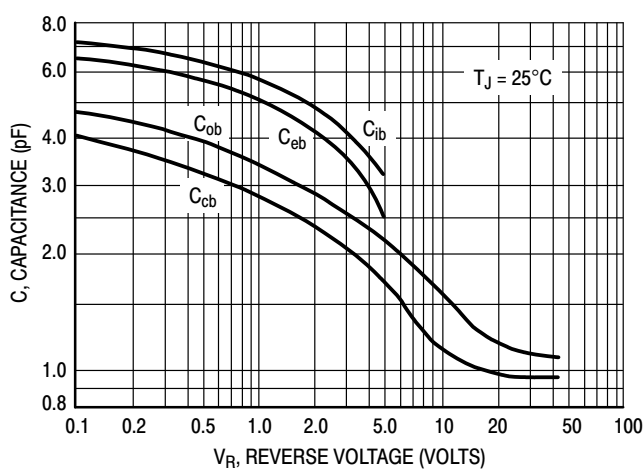


Figure 12. Capacitance

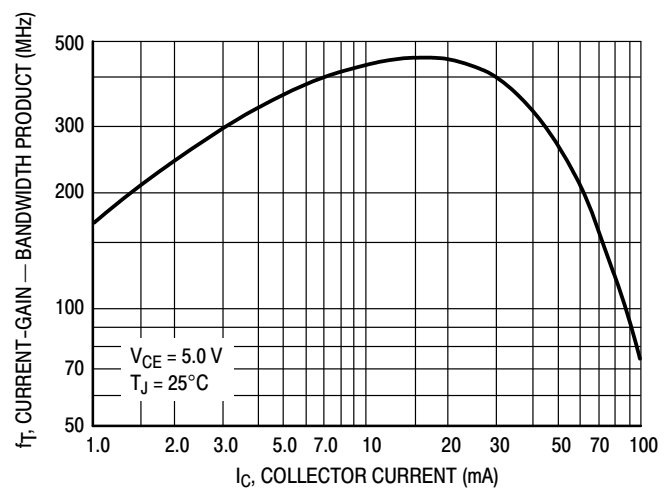
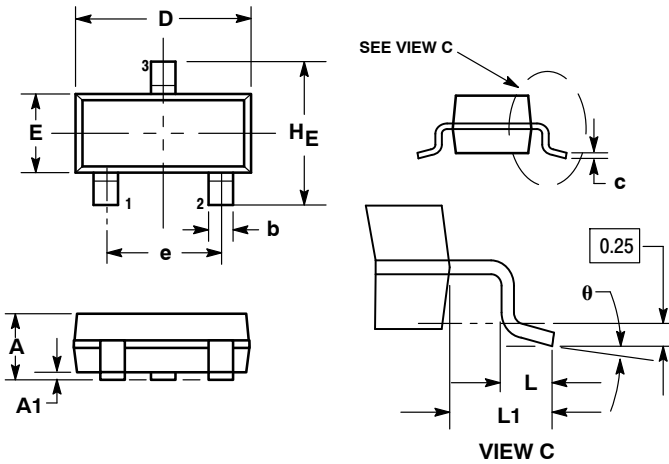


Figure 10. Current-Gain — Bandwidth Product

MMBT5088LT1G, SMMBT5088LT1G, MMBT5089LT1G, SMMBT5089LT1G

PACKAGE DIMENSIONS

SOT-23 (TO-236) CASE 318-08 ISSUE AP



NOTES:

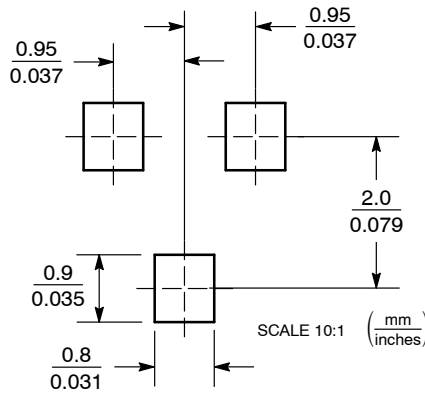
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.040	0.044
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.37	0.44	0.50	0.015	0.018	0.020
c	0.09	0.13	0.18	0.003	0.005	0.007
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.081
L	0.10	0.20	0.30	0.004	0.008	0.012
L1	0.35	0.54	0.69	0.014	0.021	0.029
HE	2.10	2.40	2.64	0.083	0.094	0.104
θ	0°		10°	0°		10°

STYLE 6:

1. BASE
2. EMITTER
3. COLLECTOR

SOLDERING FOOTPRINT



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MMBT5088LT1/D

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