

MMBT5088L, MMBT5089L

Low Noise Transistors

NPN Silicon

Features

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

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector – Emitter Voltage MMBT5088L MMBT5089L	V_{CEO}	30 25	Vdc
Collector – Base Voltage MMBT5088L MMBT5089L	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	$^\circ\text{C/W}$
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	$^\circ\text{C/W}$
Junction and Storage Temperature	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

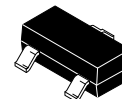
1. FR-5 = 1.0 x 0.75 x 0.062 in.

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

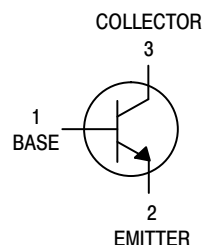


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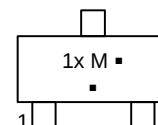
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SOT-23 (TO-236)
CASE 318
STYLE 6



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, SMMBT5088LT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
NSVMMBT5088LT3G	SOT-23 (Pb-Free)	10,000 / Tape & Reel
MMBT5089LT1G, 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.

MMBT5088L, MMBT5089L

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector – Emitter Breakdown Voltage (I _C = 1.0 mA, I _B = 0)	MMBT5088L MMBT5089L	V _{(BR)CEO}	30 25	– –	Vdc
Collector – Base Breakdown Voltage (I _C = 100 µA, I _E = 0)	MMBT5088L MMBT5089L	V _{(BR)CBO}	35 30	– –	Vdc
Collector Cutoff Current (V _{CB} = 20 Vdc, I _E = 0) (V _{CB} = 15 Vdc, I _E = 0)	MMBT5088L MMBT5089L	I _{CBO}	– –	50 50	nAdc
Emitter Cutoff Current (V _{EB(off)} = 3.0 Vdc, I _C = 0) (V _{EB(off)} = 4.5 Vdc, I _C = 0)	MMBT5088L MMBT5089L	I _{EBO}	– –	50 100	nAdc

ON CHARACTERISTICS

DC Current Gain (I _C = 100 µA, V _{CE} = 5.0 Vdc)	MMBT5088L MMBT5089L	h _{FE}	300 400	900 1200	–
(I _C = 1.0 mA, V _{CE} = 5.0 Vdc)	MMBT5088L MMBT5089L		350 450	– –	
(I _C = 10 mA, V _{CE} = 5.0 Vdc)	MMBT5088L MMBT5089L		300 400	– –	
Collector – Emitter Saturation Voltage (I _C = 10 mA, I _B = 1.0 mA)		V _{CE(sat)}	–	0.5	Vdc
Base – Emitter Saturation Voltage (I _C = 10 mA, I _B = 1.0 mA)		V _{BE(sat)}	–	0.8	Vdc

SMALL – SIGNAL CHARACTERISTICS

Current – Gain — Bandwidth Product (I _C = 500 µA, V _{CE} = 5.0 Vdc, f = 20 MHz)		f _T	50	–	MHz
Collector – Base Capacitance (V _{CB} = 5.0 Vdc, I _E = 0, f = 1.0 MHz emitter guarded)		C _{cb}	–	4.0	pF
Emitter – Base Capacitance (V _{EB} = 0.5 Vdc, I _C = 0, f = 1.0 MHz collector guarded)		C _{eb}	–	10	pF
Small Signal Current Gain (I _C = 1.0 mA, V _{CE} = 5.0 Vdc, f = 1.0 kHz)	MMBT5088L MMBT5089L	h _{fe}	350 450	1400 1800	–
Noise Figure (I _C = 100 µA, V _{CE} = 5.0 Vdc, R _S = 10 kΩ, f = 1.0 kHz)	MMBT5088L MMBT5089L	NF	– –	3.0 2.0	dB

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

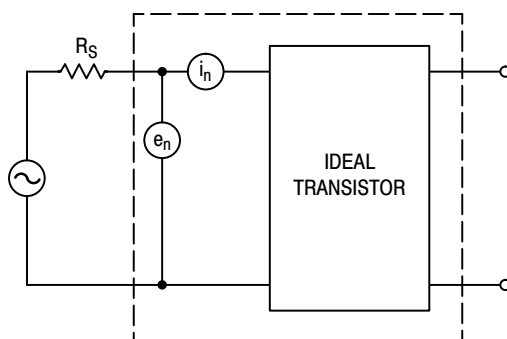


Figure 1. Transistor Noise Model

NOISE CHARACTERISTICS

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

NOISE VOLTAGE

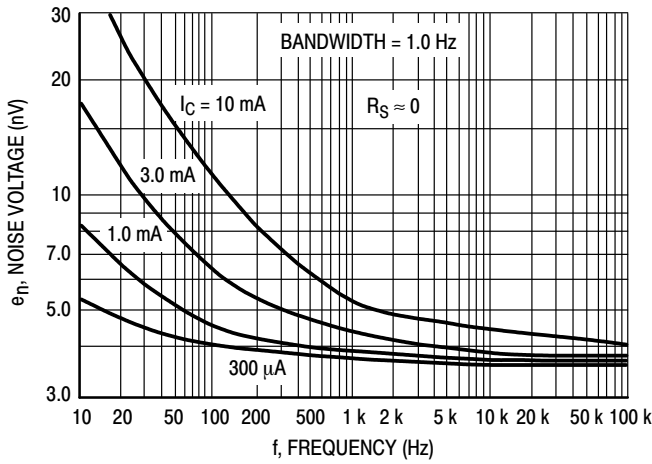


Figure 2. Effects of Frequency

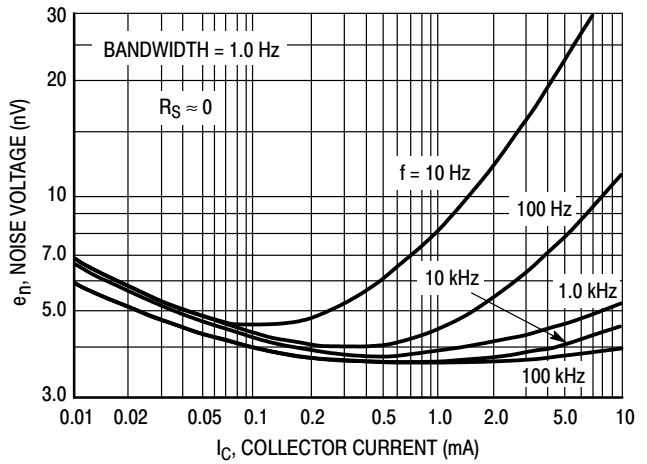


Figure 3. Effects of Collector Current

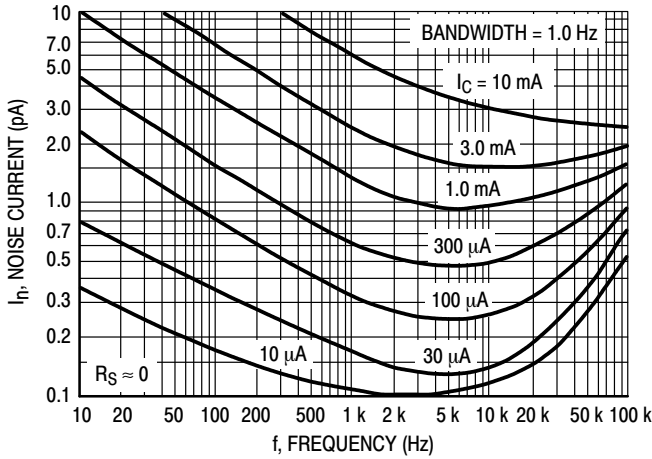


Figure 4. Noise Current

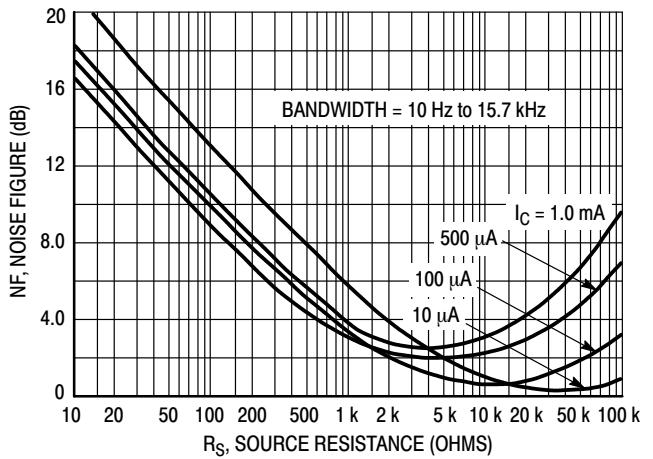


Figure 5. Wideband Noise Figure

100 Hz NOISE DATA

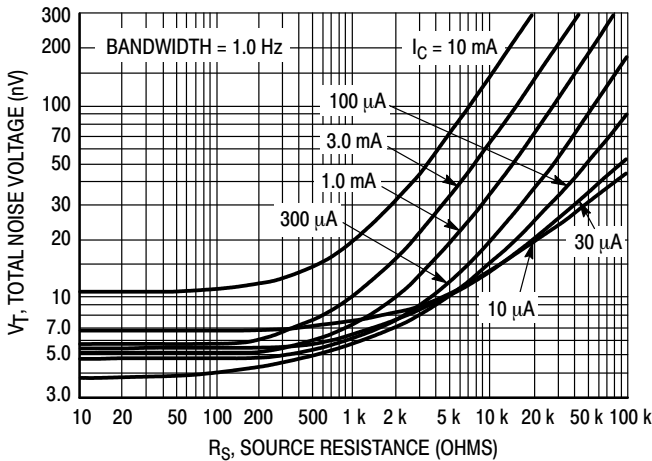


Figure 6. Total Noise Voltage

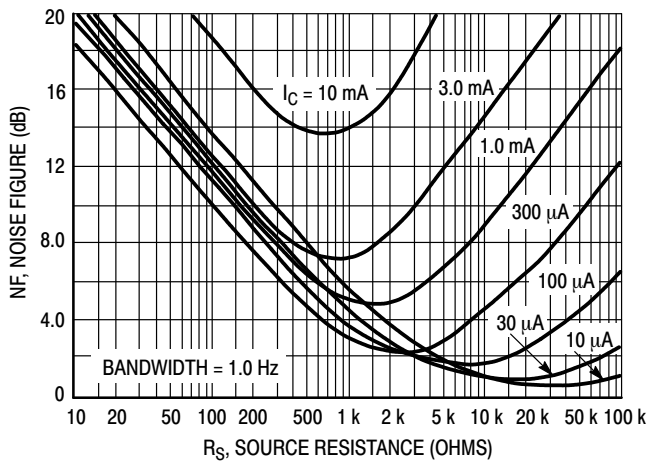


Figure 7. Noise Figure

MMBT5088L, MMBT5089L

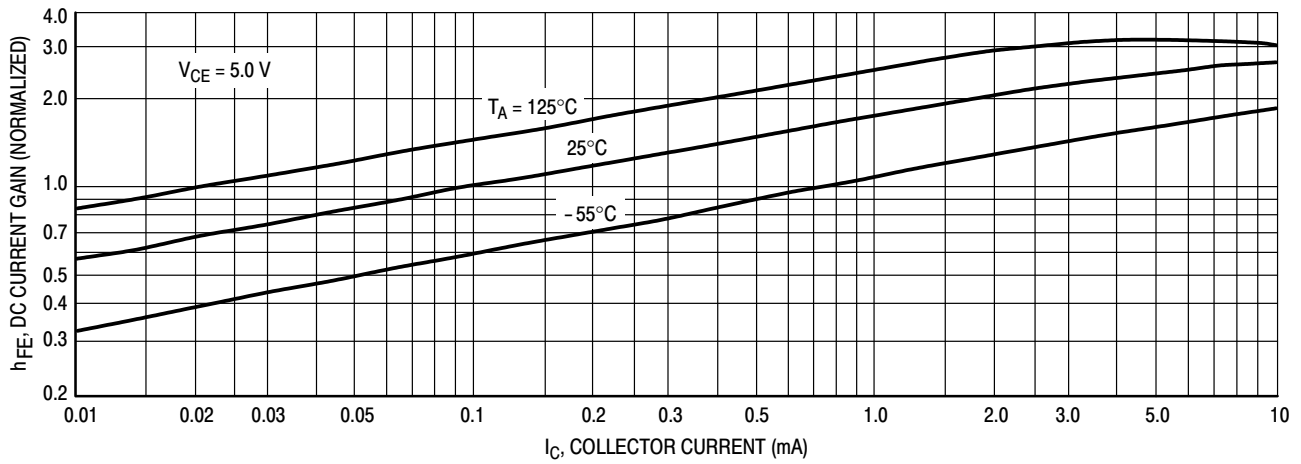


Figure 8. DC Current Gain

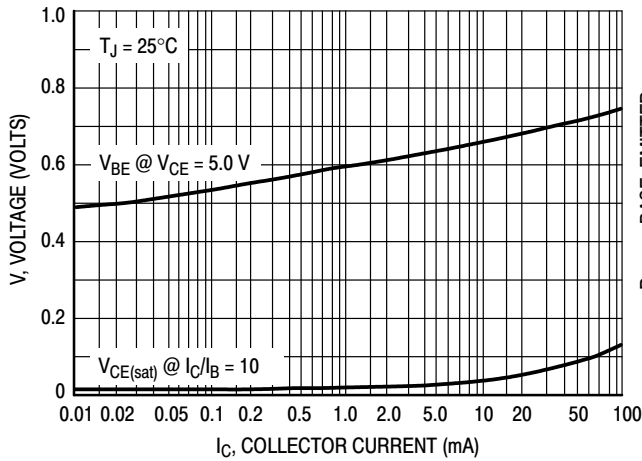


Figure 11. "On" Voltages

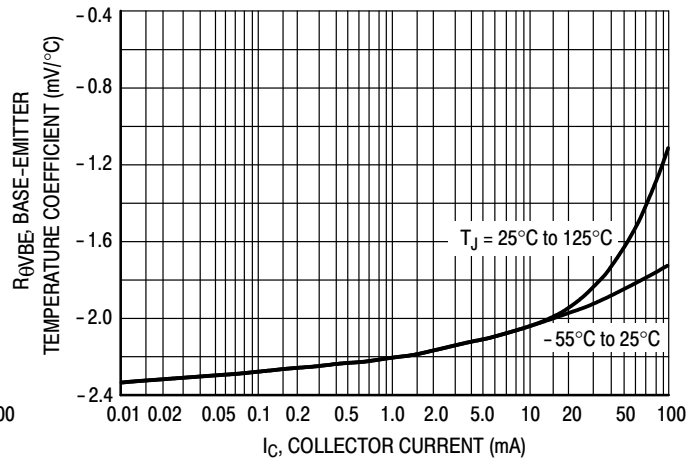


Figure 9. Temperature Coefficients

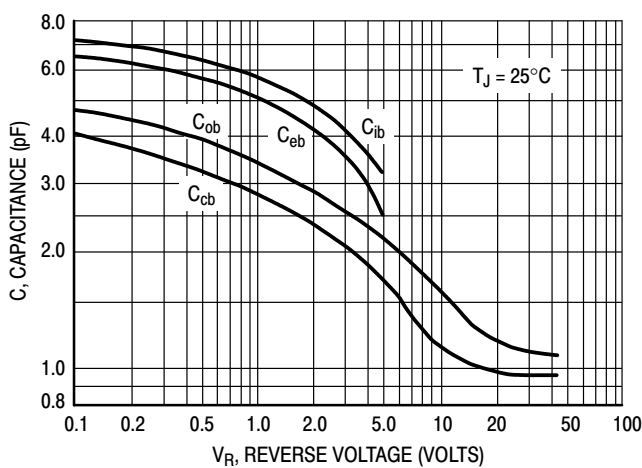


Figure 12. Capacitance

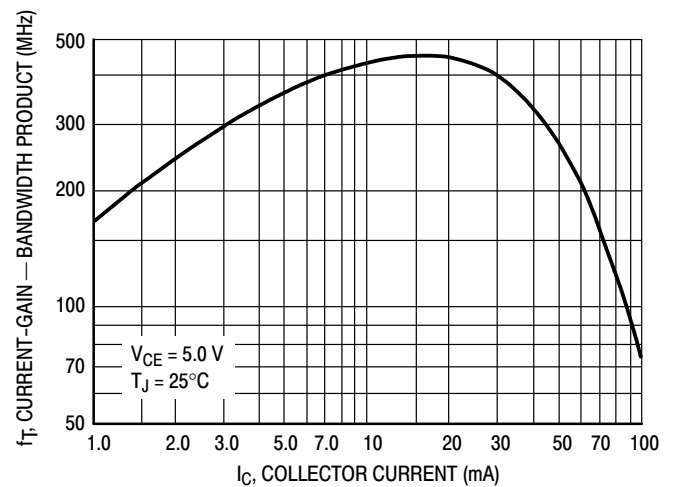


Figure 10. Current-Gain — Bandwidth Product

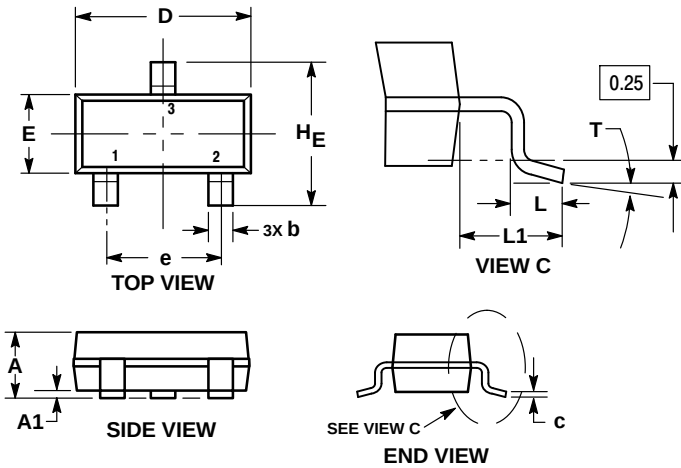
MMBT5088L, MMBT5089L

PACKAGE DIMENSIONS

SOT-23 (TO-236)

CASE 318-08

ISSUE AR



NOTES:

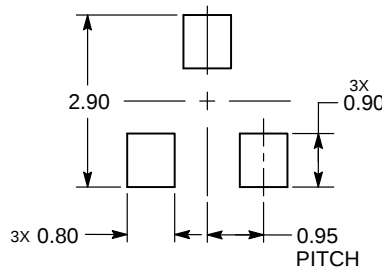
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.039	0.044
A1	0.01	0.06	0.10	0.000	0.002	0.004
b	0.37	0.44	0.50	0.015	0.017	0.020
c	0.08	0.14	0.20	0.003	0.006	0.008
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	0.080
L	0.30	0.43	0.55	0.012	0.017	0.022
L1	0.35	0.54	0.69	0.014	0.021	0.027
HE	2.10	2.40	2.64	0.083	0.094	0.104
T	0°	---	10°	0°	---	10°

STYLE 6:

- PIN 1. BASE
- EMITTER
- COLLECTOR

RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*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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