

# 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 $25^\circ\text{C}$	$P_D$	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 $25^\circ\text{C}$	$P_D$	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.

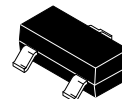
1. FR–5 = 1.0 x 0.75 x 0.062 in.
2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

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

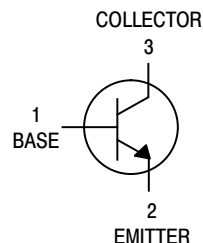


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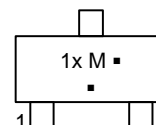
<http://onsemi.com>



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

Characteristic		Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Breakdown Voltage ( $I_C = 1.0\text{ mA}$ , $I_B = 0$ )	MMBT5088L MMBT5089L	$V_{(BR)CEO}$	30 25	– –	Vdc
Collector–Base Breakdown Voltage ( $I_C = 100\text{ }\mu\text{A}$ , $I_E = 0$ )	MMBT5088L MMBT5089L	$V_{(BR)CBO}$	35 30	– –	Vdc
Collector Cutoff Current ( $V_{CB} = 20\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 15\text{ Vdc}$ , $I_E = 0$ )	MMBT5088L MMBT5089L	$I_{CBO}$	– –	50 50	nAdc
Emitter Cutoff Current ( $V_{EB(off)} = 3.0\text{ Vdc}$ , $I_C = 0$ ) ( $V_{EB(off)} = 4.5\text{ Vdc}$ , $I_C = 0$ )	MMBT5088L MMBT5089L	$I_{EBO}$	– –	50 100	nAdc
<b>ON CHARACTERISTICS</b>					
DC Current Gain ( $I_C = 100\text{ }\mu\text{A}$ , $V_{CE} = 5.0\text{ Vdc}$ )	MMBT5088L MMBT5089L	$h_{FE}$	300 400	900 1200	–
( $I_C = 1.0\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ )	MMBT5088L MMBT5089L		350 450	– –	
( $I_C = 10\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ )	MMBT5088L MMBT5089L		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
<b>SMALL–SIGNAL CHARACTERISTICS</b>					
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 ( $I_C = 1.0\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	MMBT5088L MMBT5089L	$h_{fe}$	350 450	1400 1800	–
Noise Figure ( $I_C = 100\text{ }\mu\text{A}$ , $V_{CE} = 5.0\text{ Vdc}$ , $R_S = 10\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ )	MMBT5088L MMBT5089L	NF	– –	3.0 2.0	dB

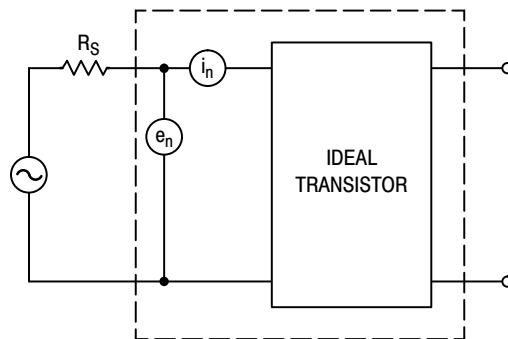


Figure 1. Transistor Noise Model

# MMBT5088L, MMBT5089L

## NOISE CHARACTERISTICS

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

### NOISE VOLTAGE

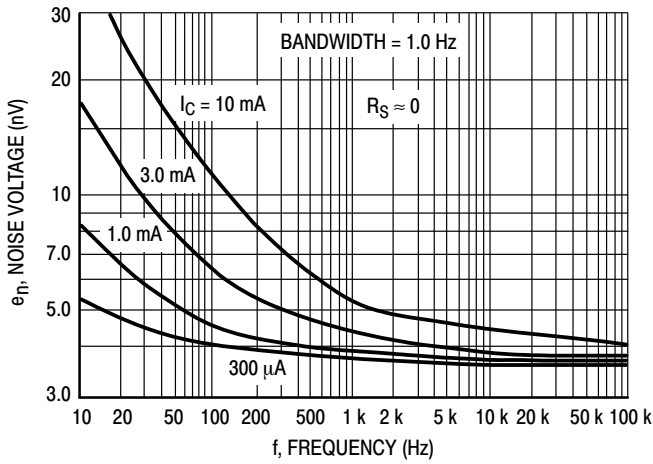


Figure 2. Effects of Frequency

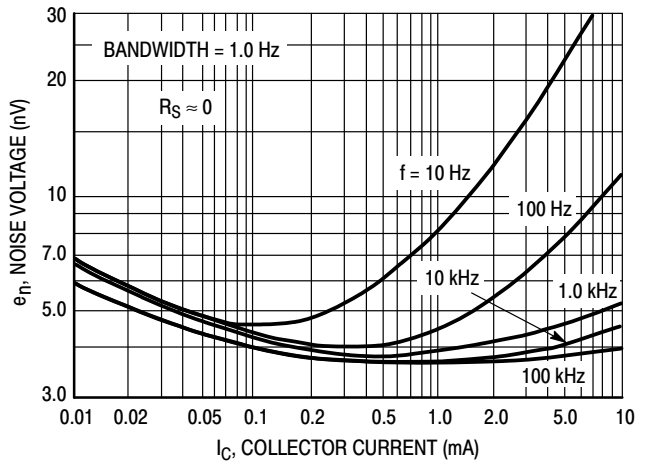


Figure 3. Effects of Collector Current

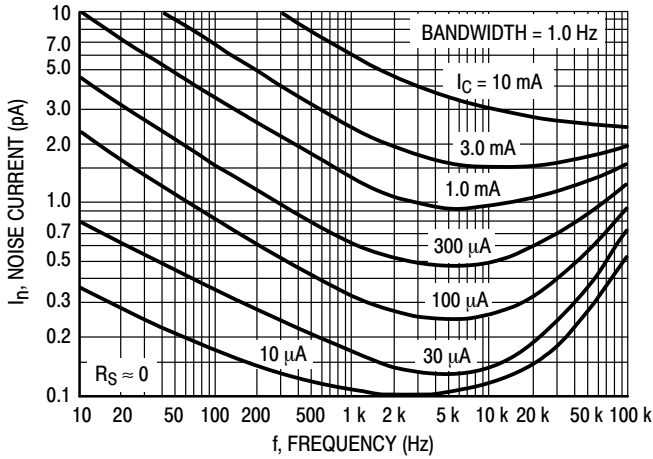


Figure 4. Noise Current

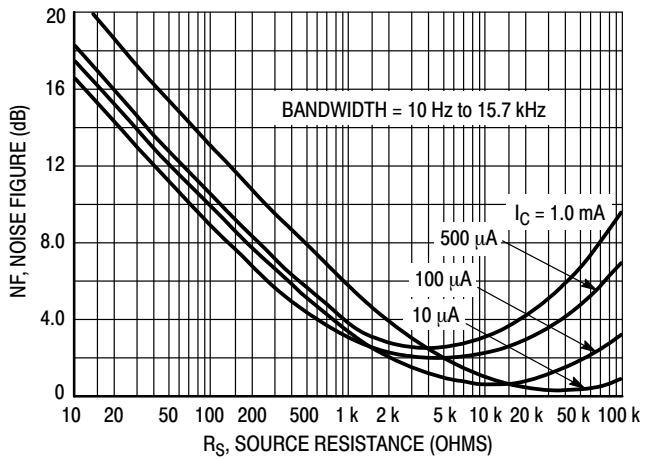


Figure 5. Wideband Noise Figure

### 100 Hz NOISE DATA

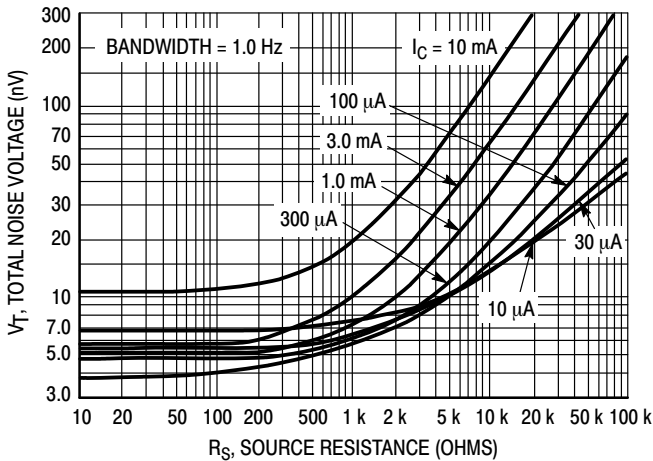


Figure 6. Total Noise Voltage

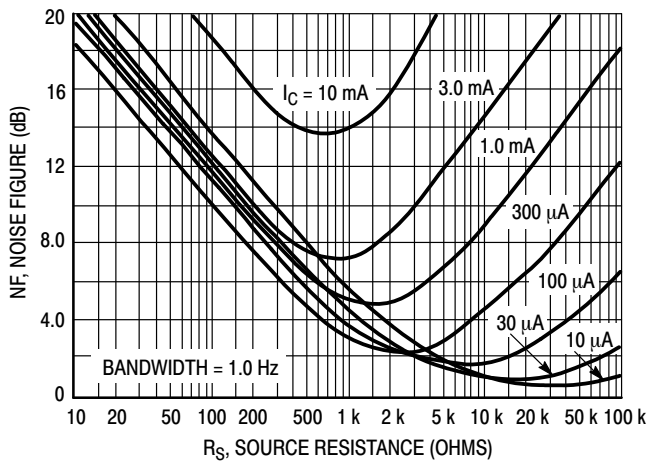


Figure 7. Noise Figure

# MMBT5088L, MMBT5089L

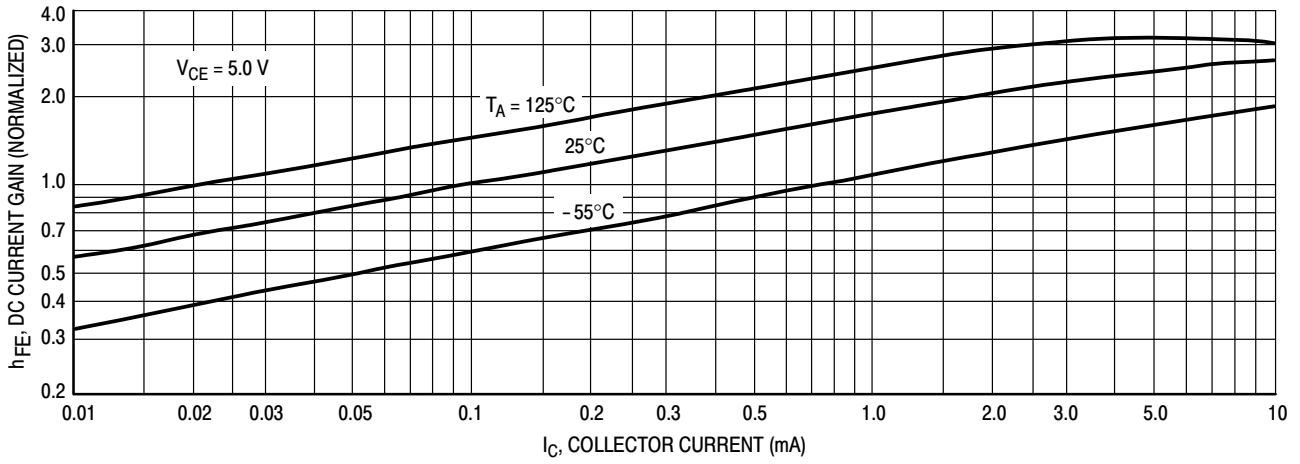


Figure 8. DC Current Gain

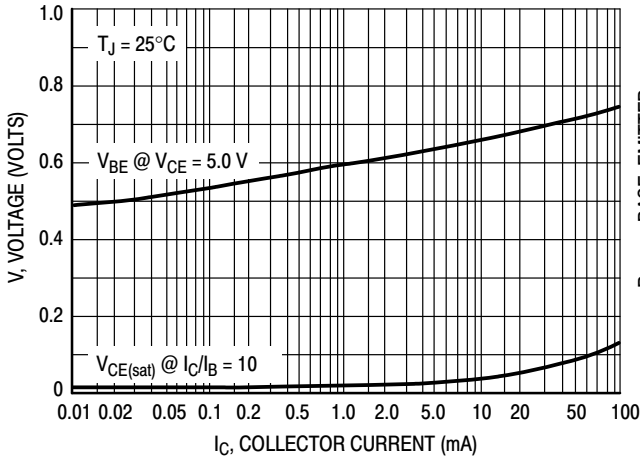


Figure 11. "On" Voltages

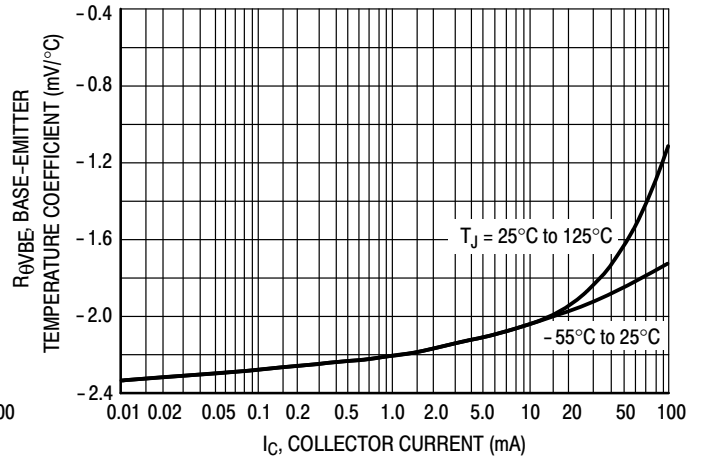


Figure 9. Temperature Coefficients

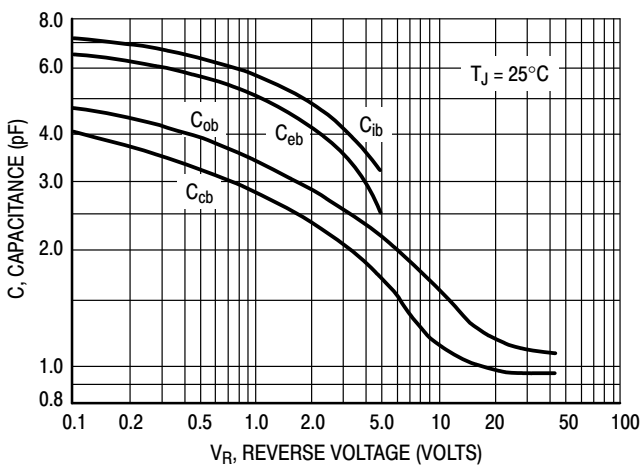


Figure 12. Capacitance

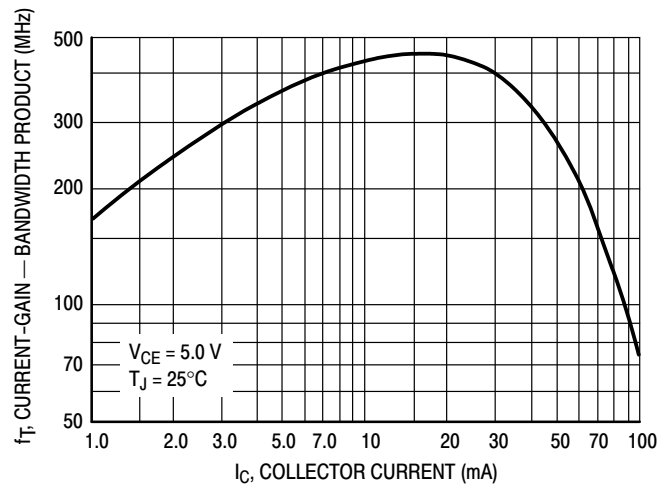
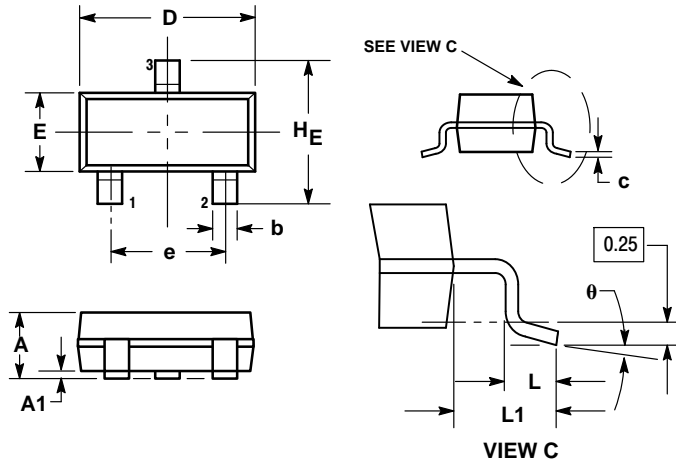


Figure 10. Current-Gain — Bandwidth Product

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## PACKAGE DIMENSIONS

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

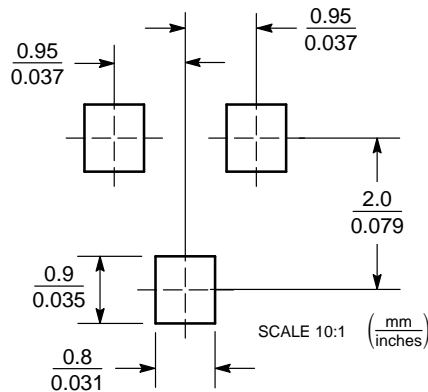


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
  4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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:  
PIN 1. BASE  
2. EMITTER  
3. COLLECTOR

### SOLDERING FOOTPRINT\*



\*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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