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) $T_A = 25°C$ Derate above 25°C	P_D	 225 1.8	 mW mW/°C
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	556	°C/W
Total Device Dissipation Alumina Substrate, (Note 2) $T_A = 25°C$ Derate above 25°C	P_D	 300 2.4	 mW mW/°C
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	417	°C/W
Junction and Storage Temperature	T_J, T_{stg}	−55 to +150	°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.
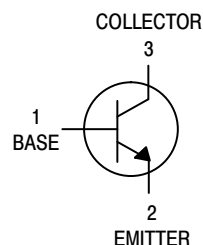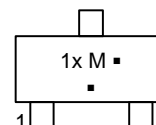2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

ON Semiconductor®
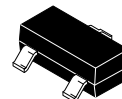
SOT−23 (TO−236)
CASE 318
STYLE 6

COLLECTOR
3

1
BASE

2
EMITTER

MARKING DIAGRAM

1x M ▪

1

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.

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector–Emitter Breakdown Voltage (I_C = 1.0 mAdc, I_B = 0)　　　　　　　　　　MMBT5088L MMBT5089L	$V_{(BR)CEO}$	30 25	– –	Vdc
Collector–Base Breakdown Voltage (I_C = 100 μAdc, I_E = 0)　　　　　　　　　　MMBT5088L MMBT5089L	$V_{(BR)CBO}$	35 30	– –	Vdc
Collector Cutoff Current (V_{CB} = 20 Vdc, I_E = 0)　　　　　　　　　　MMBT5088L (V_{CB} = 15 Vdc, I_E = 0)　　　　　　　　　　MMBT5089L	I_{CBO}	– –	50 50	nAdc
Emitter Cutoff Current ($V_{EB(off)}$ = 3.0 Vdc, I_C = 0)　　　　　　　　MMBT5088L ($V_{EB(off)}$ = 4.5 Vdc, I_C = 0)　　　　　　　　MMBT5089L	I_{EBO}	– –	50 100	nAdc
ON CHARACTERISTICS				
DC Current Gain (I_C = 100 μAdc, V_{CE} = 5.0 Vdc)　　　　　　MMBT5088L MMBT5089L (I_C = 1.0 mAdc, V_{CE} = 5.0 Vdc)　　　　　MMBT5088L MMBT5089L (I_C = 10 mAdc, V_{CE} = 5.0 Vdc)　　　　　MMBT5088L MMBT5089L	h_{FE}	300 400 350 450 300 400	900 1200 – – – –	–
Collector–Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc)	$V_{CE(sat)}$	–	0.5	Vdc
Base–Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc)	$V_{BE(sat)}$	–	0.8	Vdc
SMALL–SIGNAL CHARACTERISTICS				
Current–Gain — Bandwidth Product (I_C = 500 μAdc, 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 mAdc, V_{CE} = 5.0 Vdc, f = 1.0 kHz)　MMBT5088L MMBT5089L	h_{fe}	350 450	1400 1800	–
Noise Figure (I_C = 100 μAdc, 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.
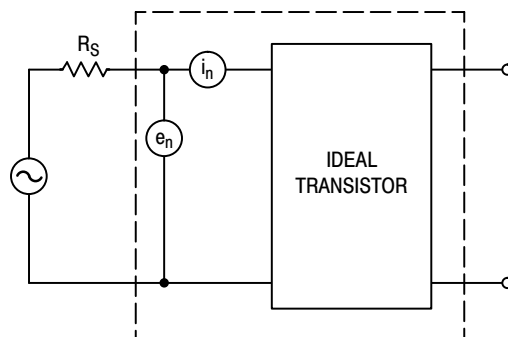

Figure 1. Transistor Noise Model

MMBT5088L, MMBT5089L

NOISE CHARACTERISTICS
(V_{CE} = 5.0 Vdc, T_A = 25°C)
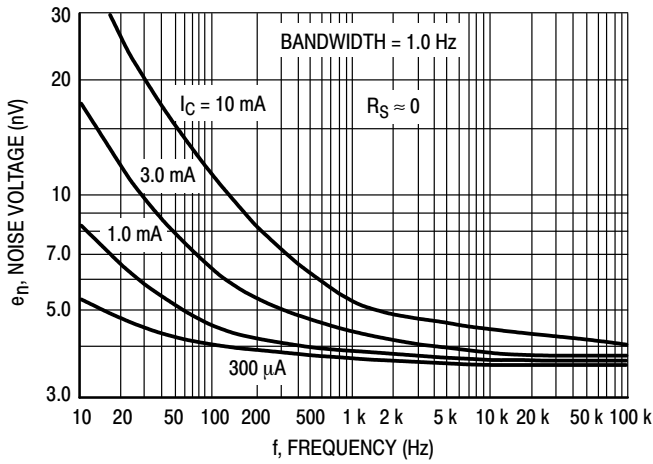
NOISE VOLTAGE

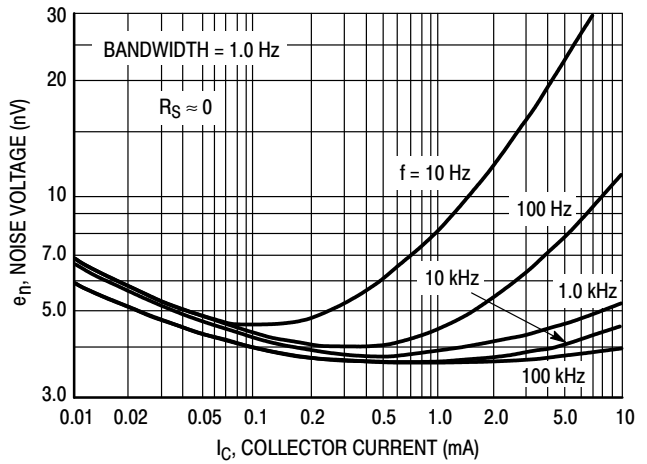Figure 2. Effects of Frequency

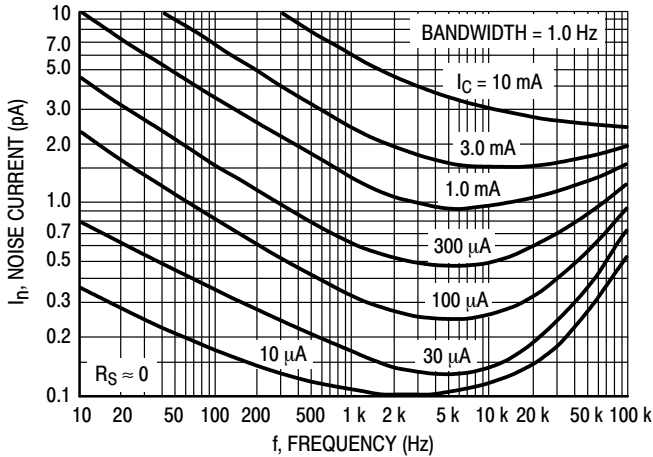Figure 3. Effects of Collector Current
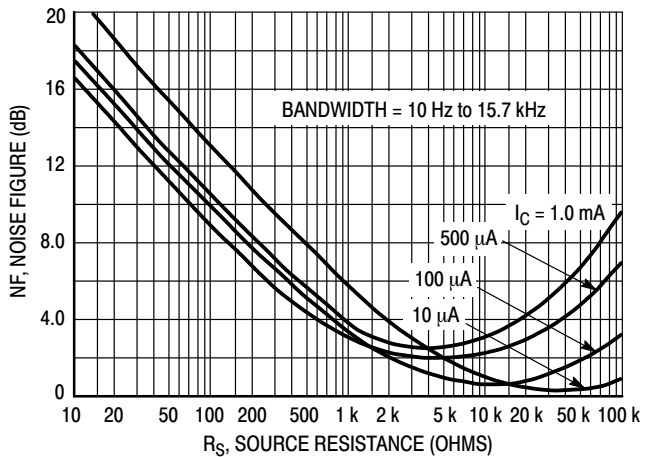

Figure 4. Noise Current

Figure 5. Wideband Noise Figure
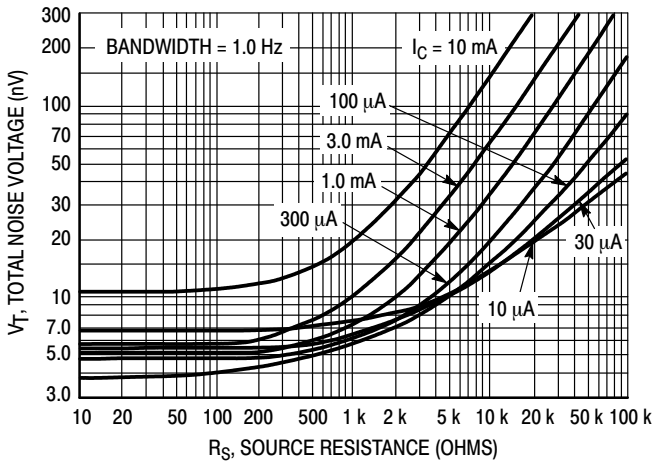
100 Hz NOISE DATA
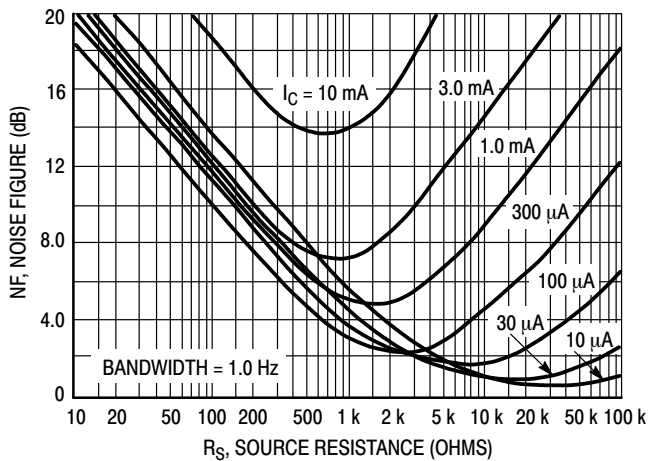

Figure 6. Total Noise Voltage
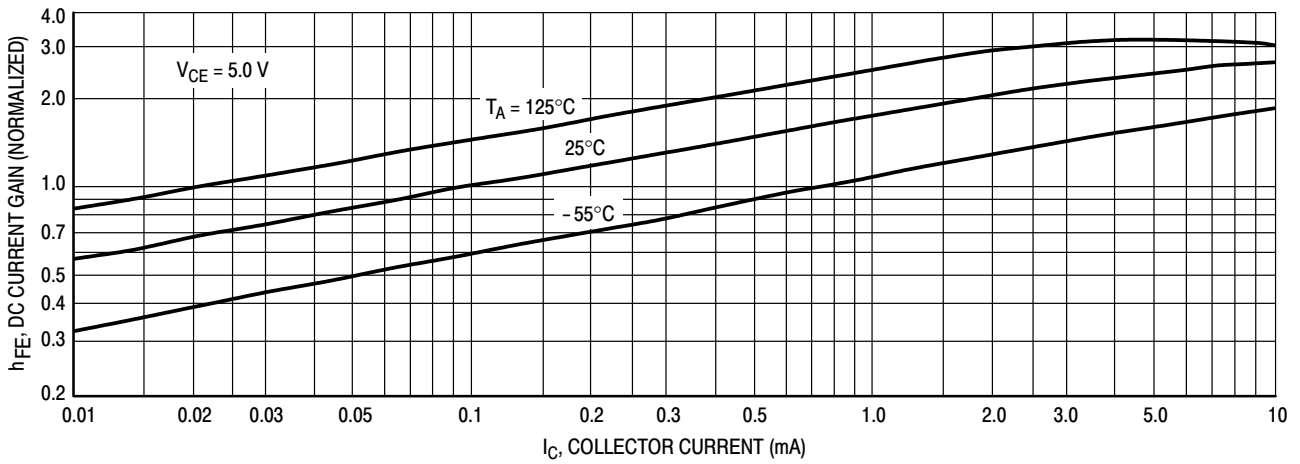

Figure 7. Noise Figure
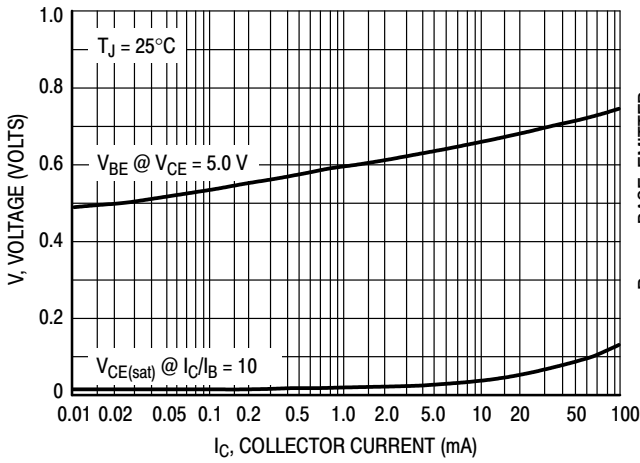
MMBT5088L, MMBT5089L

Figure 8. DC Current Gain

Figure 11. "On" Voltages
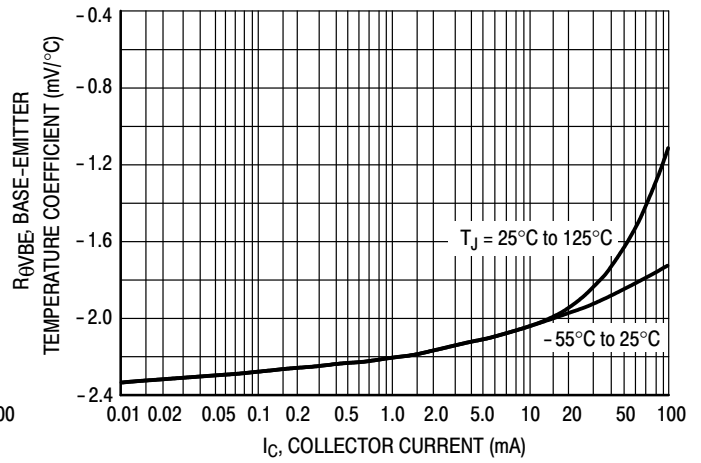
Figure 9. Temperature Coefficients
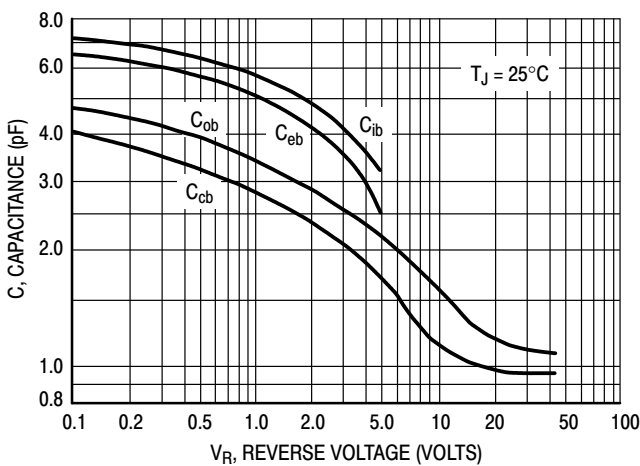
Figure 12. Capacitance
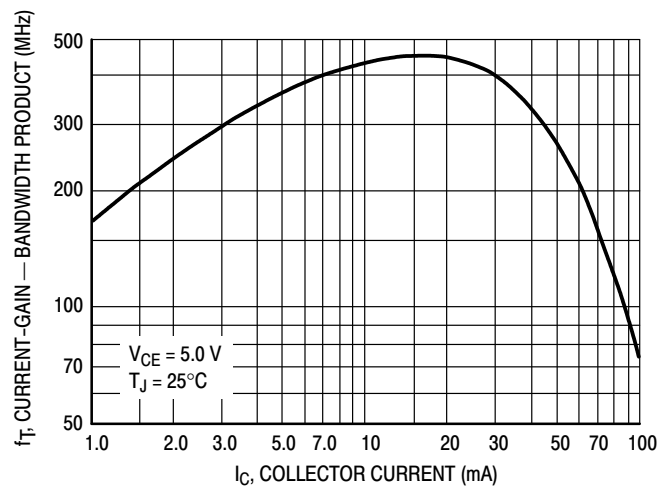
Figure 10. Current–Gain — Bandwidth Product

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SCALE 4:1

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.

TOP VIEW

DETAIL A

SIDE VIEW

DETAIL A

END VIEW

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
H_E	2.10	2.40	2.64	0.083	0.094	0.104
T	0°	---	10°	0°	---	10°

GENERIC MARKING DIAGRAM*

XXXM▪
▪
1

XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

2.90

3X
0.95

3X 0.56

0.95

PITCH

RECOMMENDED
MOUNTING 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.

STYLES ON PAGE 2

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STYLE 1 THRU 5:
CANCELLED

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 7:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

STYLE 9:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

STYLE 11:
PIN 1. ANODE
2. CATHODE
3. CATHODE−ANODE

STYLE 12:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 13:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 14:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 15:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 16:
PIN 1. ANODE
2. CATHODE
3. CATHODE

STYLE 17:
PIN 1. NO CONNECTION
2. ANODE
3. CATHODE

STYLE 18:
PIN 1. NO CONNECTION
2. CATHODE
3. ANODE

STYLE 19:
PIN 1. CATHODE
2. ANODE
3. CATHODE−ANODE

STYLE 20:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 21:
PIN 1. GATE
2. SOURCE
3. DRAIN

STYLE 22:
PIN 1. RETURN
2. OUTPUT
3. INPUT

STYLE 23:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 24:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 25:
PIN 1. ANODE
2. CATHODE
3. GATE

STYLE 26:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION

STYLE 27:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

STYLE 28:
PIN 1. ANODE
2. ANODE
3. ANODE

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DESCRIPTION:	SOT−23 (TO−236)		PAGE 2 OF 2

ADDITIONAL INFORMATION

◊

单击下面可查看定价，库存，交付和生命周期等信息

>>ON Semiconductor(安森美)