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# MMBT2369L, MMBT2369AL

## Switching Transistors

### NPN Silicon

#### Features

- S 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	$V_{CEO}$	15	Vdc
Collector–Emitter Voltage	$V_{CES}$	40	Vdc
Collector–Base Voltage	$V_{CBO}$	40	Vdc
Emitter–Base Voltage	$V_{EBO}$	4.5	Vdc
Collector Current – Continuous	$I_C$	200	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 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.

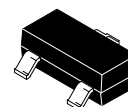
1. FR–5 =  $1.0 \times 0.75 \times 0.062$  in.
2. Alumina =  $0.4 \times 0.3 \times 0.024$  in. 99.5% alumina.

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

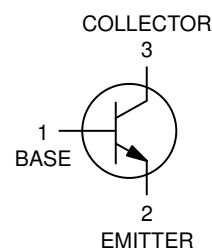


ON Semiconductor®

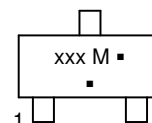
[www.onsemi.com](http://www.onsemi.com)



SOT-23  
CASE 318  
STYLE 6



#### MARKING DIAGRAM



xxx = M1J or 1JA  
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†
MMBT2369LT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
SMMBT2369LT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
MMBT2369ALT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
SMMBT2369ALT1G	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.

# MMBT2369L, MMBT2369AL

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Breakdown Voltage (Note 3) (I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	15	–	–	V <sub>dc</sub>
Collector–Emitter Breakdown Voltage (I <sub>C</sub> = 10 μA <sub>dc</sub> , V <sub>BE</sub> = 0)	V <sub>(BR)CES</sub>	40	–	–	V <sub>dc</sub>
Collector–Base Breakdown Voltage (I <sub>C</sub> = 10 μA <sub>dc</sub> , I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	40	–	–	V <sub>dc</sub>
Emitter–Base Breakdown Voltage (I <sub>E</sub> = 10 μA <sub>dc</sub> , I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	4.5	–	–	V <sub>dc</sub>
Collector Cutoff Current (V <sub>CB</sub> = 20 V <sub>dc</sub> , I <sub>E</sub> = 0) (V <sub>CB</sub> = 20 V <sub>dc</sub> , I <sub>E</sub> = 0, T <sub>A</sub> = 150°C)	I <sub>CBO</sub>	–	–	0.4 30	μA <sub>dc</sub>
Collector Cutoff Current MMBT2369A (V <sub>CE</sub> = 20 V <sub>dc</sub> , V <sub>BE</sub> = 0)	I <sub>CES</sub>	–	–	0.4	μA <sub>dc</sub>

## ON CHARACTERISTICS

DC Current Gain (Note 3) MMBT2369 (I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) MMBT2369A (I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) MMBT2369A (I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 0.35 V <sub>dc</sub> ) MMBT2369A (I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 0.35 V <sub>dc</sub> , T <sub>A</sub> = –55°C) MMBT2369A (I <sub>C</sub> = 30 mA <sub>dc</sub> , V <sub>CE</sub> = 0.4 V <sub>dc</sub> ) MMBT2369 (I <sub>C</sub> = 100 mA <sub>dc</sub> , V <sub>CE</sub> = 2.0 V <sub>dc</sub> ) MMBT2369A (I <sub>C</sub> = 100 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> )	h <sub>FE</sub>	40 – 40 20 30 20 20	– – – – – – –	120 120 – – – – –	–
Collector–Emitter Saturation Voltage (Note 3) MMBT2369 (I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 1.0 mA <sub>dc</sub> ) MMBT2369A (I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 1.0 mA <sub>dc</sub> ) MMBT2369A (I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 1.0 mA <sub>dc</sub> , T <sub>A</sub> = +125°C) MMBT2369A (I <sub>C</sub> = 30 mA <sub>dc</sub> , I <sub>B</sub> = 3.0 mA <sub>dc</sub> ) MMBT2369A (I <sub>C</sub> = 100 mA <sub>dc</sub> , I <sub>B</sub> = 10 mA <sub>dc</sub> )	V <sub>CE(sat)</sub>	– – – – –	– – – – –	0.25 0.20 0.30 0.25 0.50	V <sub>dc</sub>
Base–Emitter Saturation Voltage (Note 3) MMBT2369/A (I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 1.0 mA <sub>dc</sub> ) MMBT2369A (I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 1.0 mA <sub>dc</sub> , T <sub>A</sub> = –55°C) MMBT2369A (I <sub>C</sub> = 30 mA <sub>dc</sub> , I <sub>B</sub> = 3.0 mA <sub>dc</sub> ) MMBT2369A (I <sub>C</sub> = 100 mA <sub>dc</sub> , I <sub>B</sub> = 10 mA <sub>dc</sub> )	V <sub>BE(sat)</sub>	0.7 – – –	– – – –	0.85 1.02 1.15 1.60	V <sub>dc</sub>

## SMALL–SIGNAL CHARACTERISTICS

Output Capacitance (V <sub>CB</sub> = 5.0 V <sub>dc</sub> , I <sub>E</sub> = 0, f = 1.0 MHz)	C <sub>obo</sub>	–	–	4.0	pF
Small Signal Current Gain (I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 100 MHz)	h <sub>fe</sub>	5.0	–	–	–

## SWITCHING CHARACTERISTICS

Storage Time (I <sub>B1</sub> = I <sub>B2</sub> = I <sub>C</sub> = 10 mA <sub>dc</sub> )	t <sub>s</sub>	–	5.0	13	ns
Turn–On Time (V <sub>CC</sub> = 3.0 V <sub>dc</sub> , I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B1</sub> = 3.0 mA <sub>dc</sub> )	t <sub>on</sub>	–	8.0	12	ns
Turn–Off Time (V <sub>CC</sub> = 3.0 V <sub>dc</sub> , I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B1</sub> = 3.0 mA <sub>dc</sub> , I <sub>B2</sub> = 1.5 mA <sub>dc</sub> )	t <sub>off</sub>	–	10	18	ns

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.

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.



# MMBT2369L, MMBT2369AL

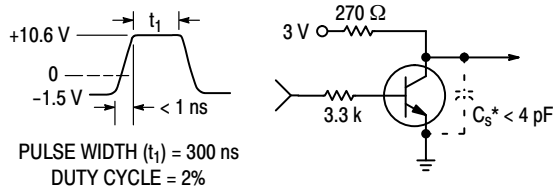


Figure 1.  $t_{on}$  Circuit – 10 mA

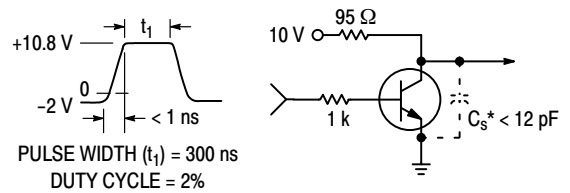


Figure 2.  $t_{on}$  Circuit – 100 mA

\*Total shunt capacitance of test jig and connectors.

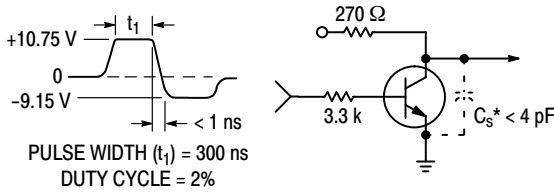


Figure 3.  $t_{off}$  Circuit – 10 mA

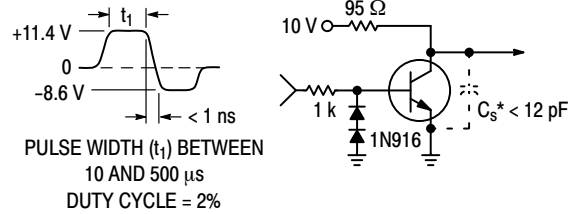
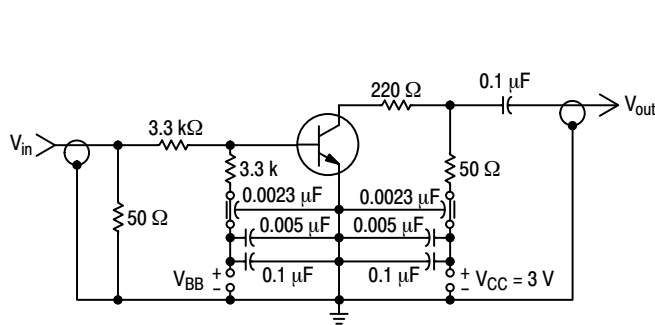
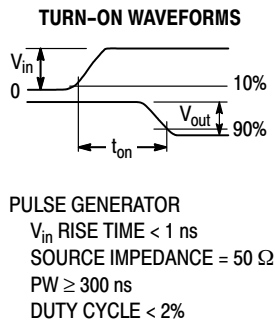


Figure 4.  $t_{off}$  Circuit – 100 mA

\*Total shunt capacitance of test jig and connectors.



TO OSCILLOSCOPE  
INPUT IMPEDANCE = 50  $\Omega$   
RISE TIME = 1 ns

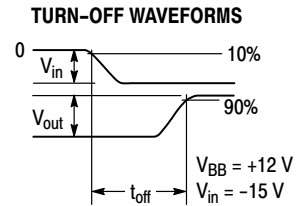


Figure 5. Turn-On and Turn-Off Time Test Circuit

# MMBT2369L, MMBT2369AL

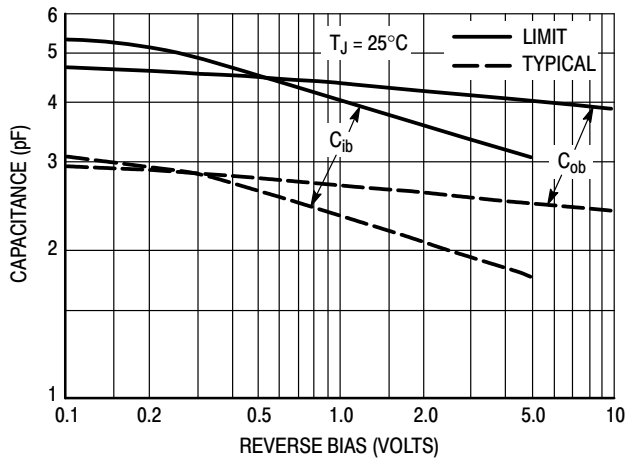


Figure 6. Junction Capacitance Variations

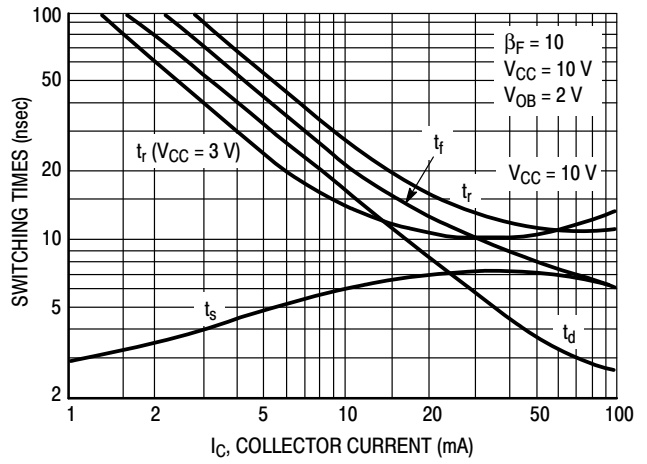


Figure 7. Typical Switching Times

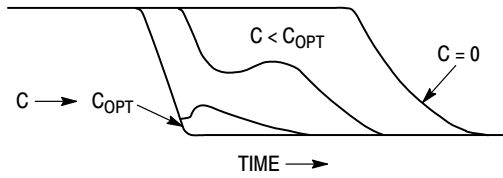


Figure 8. Turn-Off Waveform

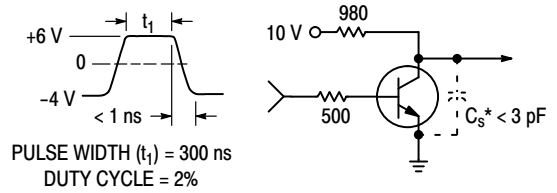


Figure 9. Storage Time Equivalent Test Circuit

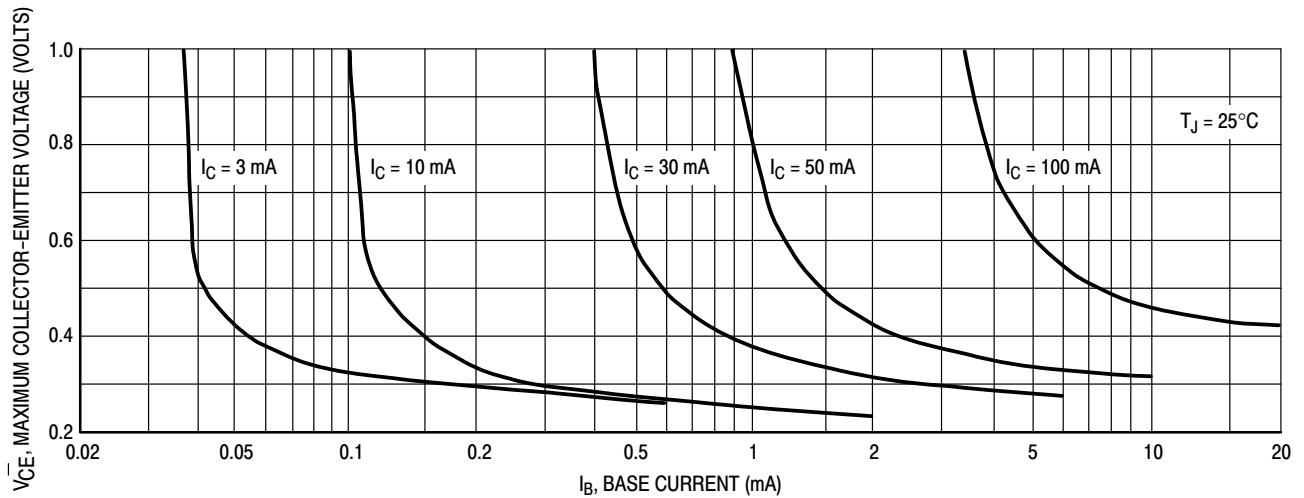


Figure 10. Maximum Collector Saturation Voltage Characteristics

# MMBT2369L, MMBT2369AL

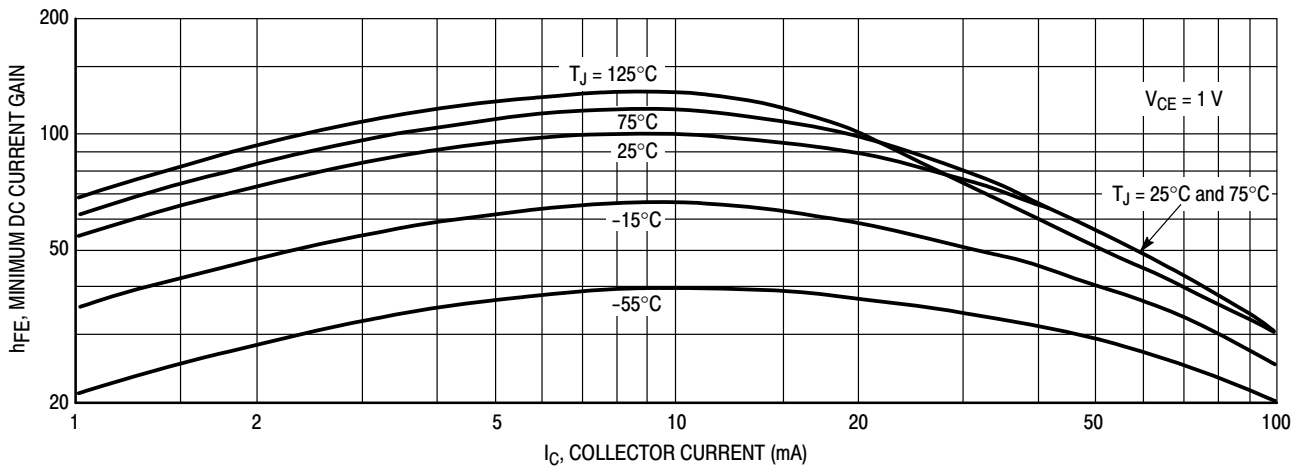


Figure 11. Minimum Current Gain Characteristics

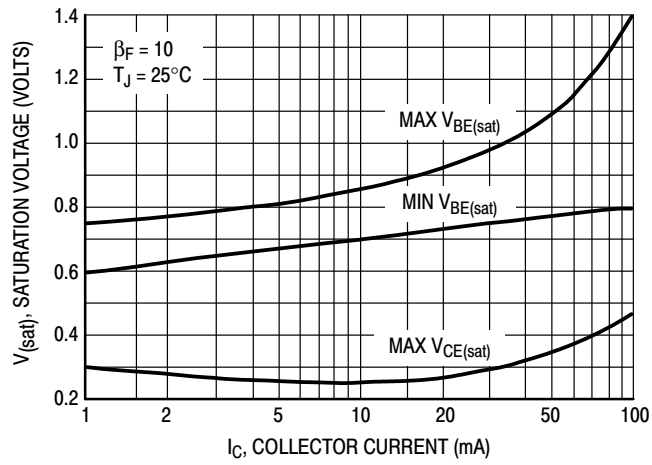
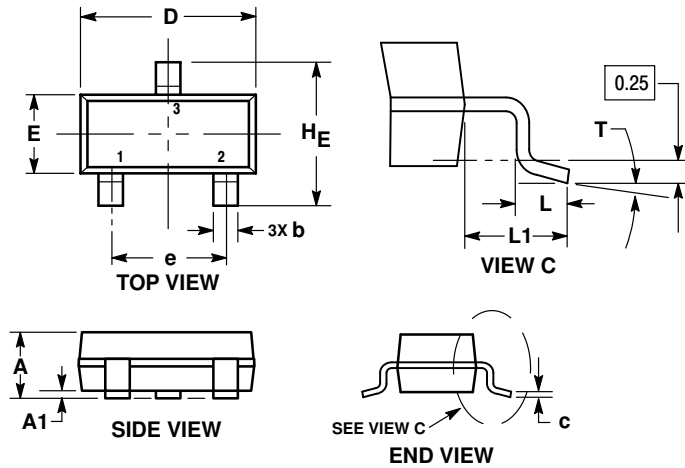


Figure 12. Saturation Voltage Limits

# MMBT2369L, MMBT2369AL

## PACKAGE DIMENSIONS

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

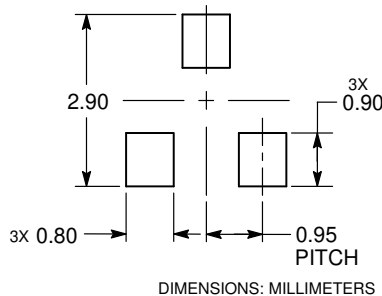


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
  4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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  
2. EMITTER  
3. COLLECTOR

### RECOMMENDED SOLDERING FOOTPRINT



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