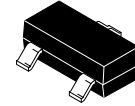


# Switching Transistors

## NPN Silicon

### MMBT2369L, MMBT2369AL



SOT-23  
CASE 318  
STYLE 6

#### 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	mA dc

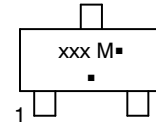
#### THERMAL CHARACTERISTICS

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.

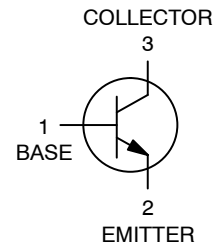
1. FR-5 =  $1.0 \times 0.75 \times 0.062$  in.
2. Alumina =  $0.4 \times 0.3 \times 0.024$  in. 99.5% alumina.

#### 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†
MMBT2369ALT1G	SOT-23 (Pb-Free)	3000 / Tape & Reel
SMMBT2369ALT1G	SOT-23 (Pb-Free)	3000 / Tape & Reel

#### DISCONTINUED (Note 1)

MMBT2369LT1G	SOT-23 (Pb-Free)	3000 / Tape & Reel
MMBT2369LT3G	SOT-23 (Pb-Free)	10,000 / Tape & Reel
SMMBT2369LT1G	SOT-23 (Pb-Free)	3000 / 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](http://BRD8011/D).

1. **DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on [www.onsemi.com](http://www.onsemi.com).

\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/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 mAdc, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	15	–	–	Vdc
Collector – Emitter Breakdown Voltage (I <sub>C</sub> = 10 μAdc, V <sub>BE</sub> = 0)	V <sub>(BR)CES</sub>	40	–	–	Vdc
Collector – Base Breakdown Voltage (I <sub>C</sub> = 10 μAdc, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	40	–	–	Vdc
Emitter – Base Breakdown Voltage (I <sub>E</sub> = 10 μAdc, I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	4.5	–	–	Vdc
Collector Cutoff Current (V <sub>CB</sub> = 20 Vdc, I <sub>E</sub> = 0) (V <sub>CB</sub> = 20 Vdc, I <sub>E</sub> = 0, T <sub>A</sub> = 150°C)	I <sub>CBO</sub>	– –	– –	0.4 30	μAdc
Collector Cutoff Current MMBT2369A (V <sub>CE</sub> = 20 Vdc, V <sub>BE</sub> = 0)	I <sub>CES</sub>	–	–	0.4	μAdc

## ON CHARACTERISTICS

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

## SMALL-SIGNAL CHARACTERISTICS

Output Capacitance (V <sub>CB</sub> = 5.0 Vdc, 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 mAdc, V <sub>CE</sub> = 10 Vdc, 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 mAdc)	t <sub>s</sub>	–	5.0	13	ns
Turn-On Time (V <sub>CC</sub> = 3.0 Vdc, I <sub>C</sub> = 10 mAdc, I <sub>B1</sub> = 3.0 mAdc)	t <sub>on</sub>	–	8.0	12	ns
Turn-Off Time (V <sub>CC</sub> = 3.0 Vdc, I <sub>C</sub> = 10 mAdc, I <sub>B1</sub> = 3.0 mAdc, I <sub>B2</sub> = 1.5 mAdc)	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

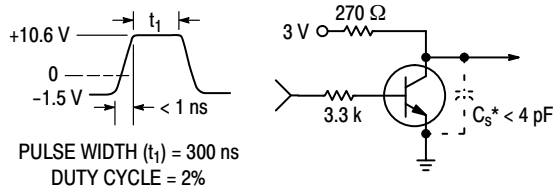


Figure 1.  $t_{on}$  Circuit – 10 mA

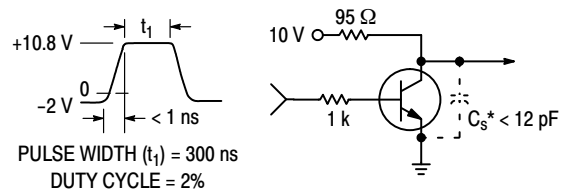


Figure 2.  $t_{on}$  Circuit – 100 mA

\*Total shunt capacitance of test jig and connectors.

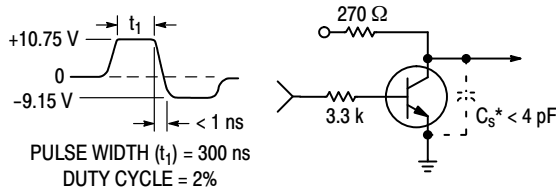


Figure 3.  $t_{off}$  Circuit – 10 mA

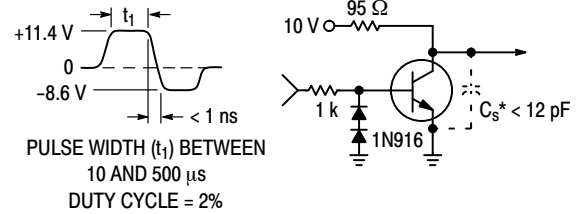
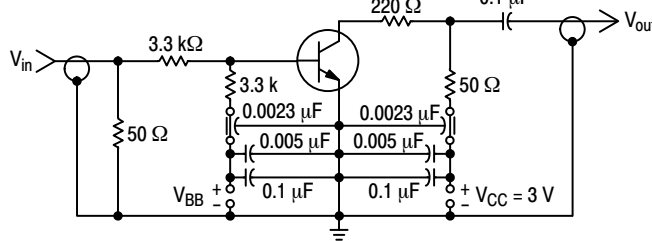
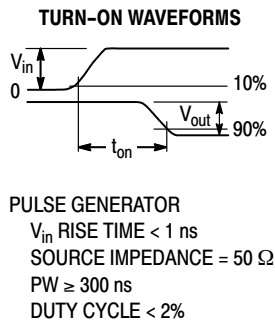


Figure 4.  $t_{off}$  Circuit – 100 mA

\*Total shunt capacitance of test jig and connectors.



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

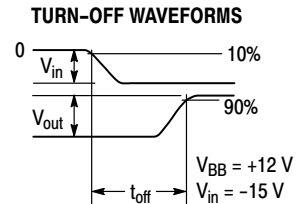


Figure 5. Turn-On and Turn-Off Time Test Circuit

# MMBT2369L, MMBT2369AL

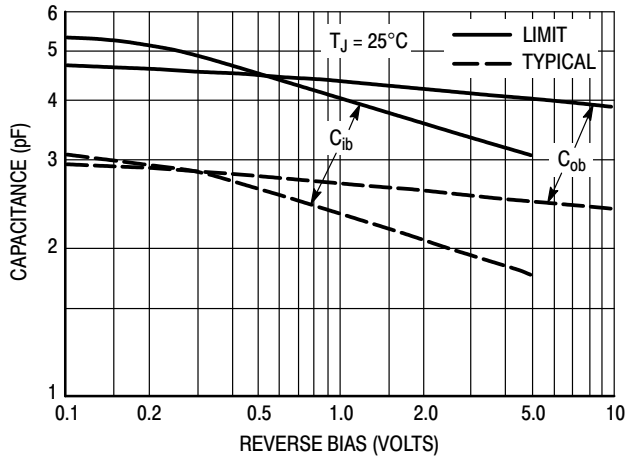


Figure 6. Junction Capacitance Variations

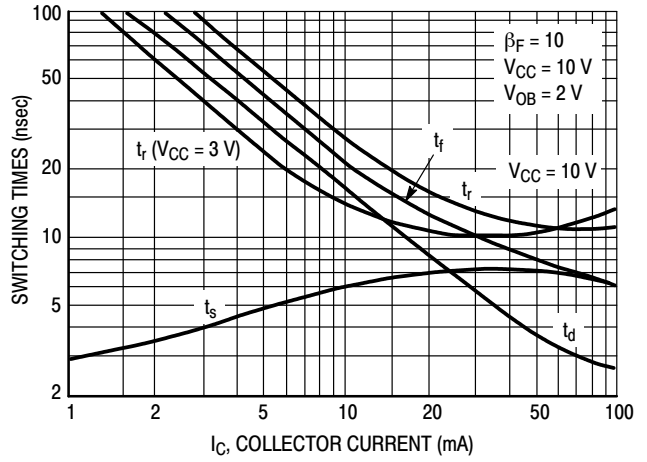


Figure 7. Typical Switching Times

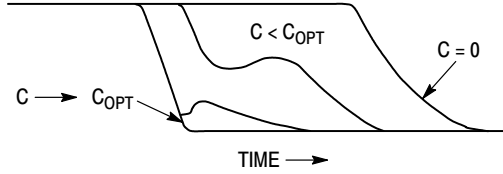


Figure 8. Turn-Off Waveform

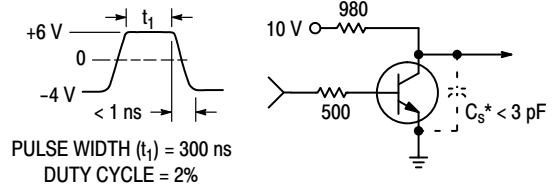


Figure 9. Storage Time Equivalent Test Circuit

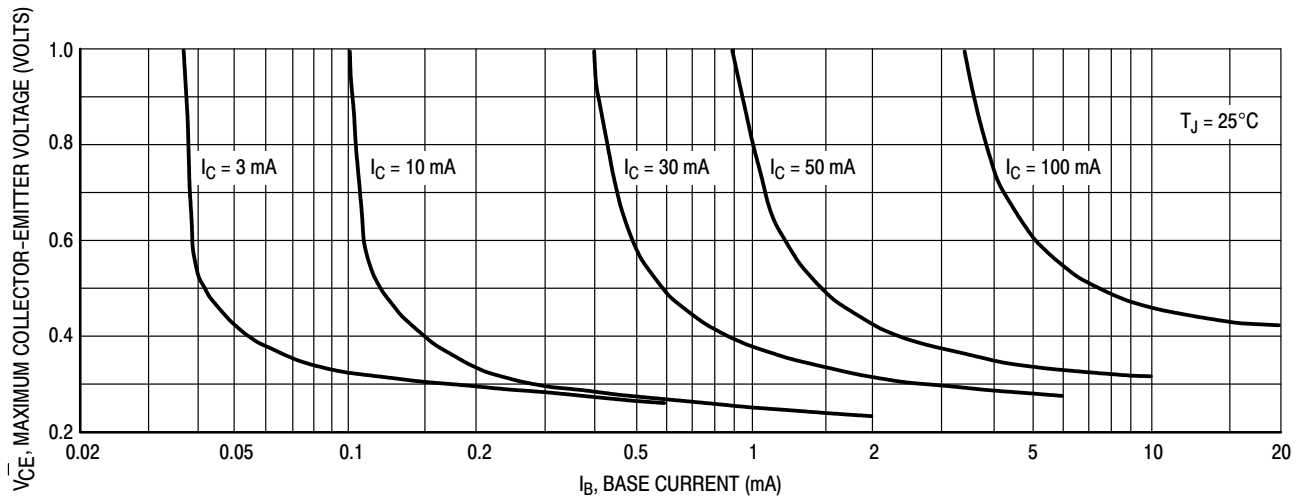


Figure 10. Maximum Collector Saturation Voltage Characteristics

# MMBT2369L, MMBT2369AL

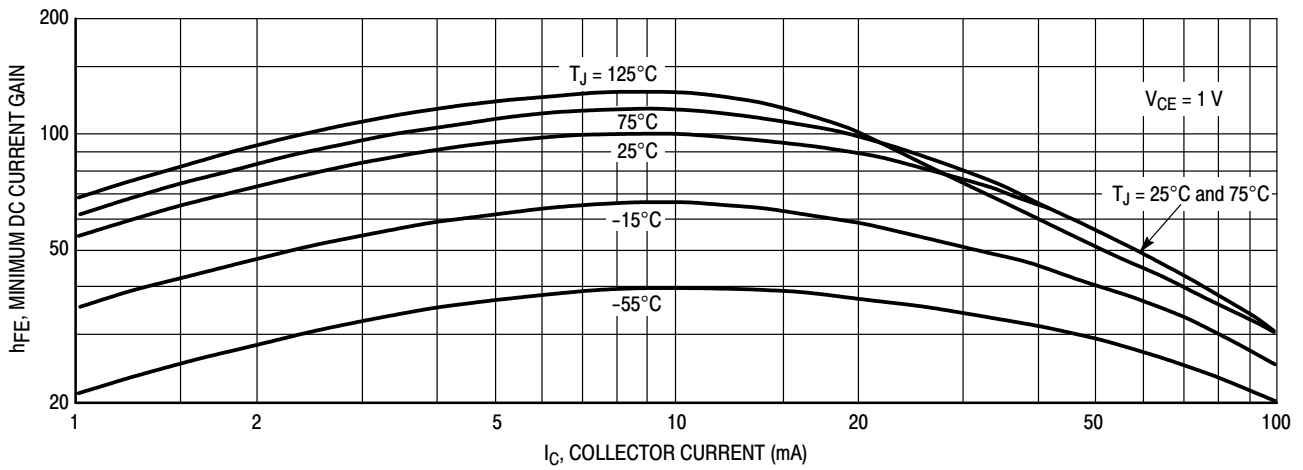


Figure 11. Minimum Current Gain Characteristics

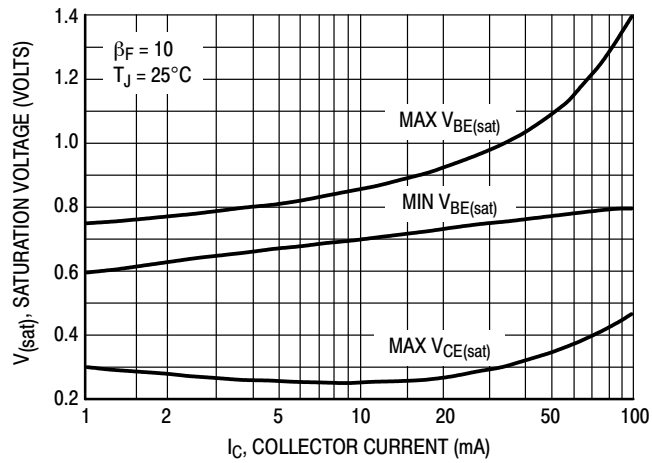


Figure 12. Saturation Voltage Limits



SCALE 4:1

**SOT-23 (TO-236) 2.90x1.30x1.00 1.90P**  
**CASE 318**  
**ISSUE AU**

DATE 14 AUG 2024



MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.89	1.00	1.11
A1	0.01	0.06	0.10
b	0.37	0.44	0.50
c	0.08	0.14	0.20
D	2.80	2.90	3.04
E	1.20	1.30	1.40
e	1.78	1.90	2.04
L	0.30	0.43	0.55
L1	0.35	0.54	0.69
HE	2.10	2.40	2.64
T	0°	---	10°

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: 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.

**GENERIC MARKING DIAGRAM\***



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.



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

**STYLES ON PAGE 2**

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<b>DESCRIPTION:</b>	<b>SOT-23 (TO-236) 2.90x1.30x1.00 1.90P</b>	<b>PAGE 1 OF 2</b>

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**SOT-23 (TO-236) 2.90x1.30x1.00 1.90P**  
**CASE 318**  
**ISSUE AU**

DATE 14 AUG 2024

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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