

# MMBT589LT1G, NSVMMBT589LT1G

## High Current Surface Mount PNP Silicon Switching Transistor for Load Management in Portable Applications

### Features

- 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 ( $T_A = 25^\circ\text{C}$ )

| Rating                         | Symbol    | Value | Unit |
|--------------------------------|-----------|-------|------|
| Collector-Emitter Voltage      | $V_{CEO}$ | -30   | Vdc  |
| Collector-Base Voltage         | $V_{CBO}$ | -50   | Vdc  |
| Emitter-Base Voltage           | $V_{EBO}$ | -5.0  | Vdc  |
| Collector Current - Continuous | $I_C$     | -1.0  | Adc  |
| Collector Current - Peak       | $I_{CM}$  | -2.0  | A    |

### THERMAL CHARACTERISTICS

| Characteristic  | Symbol                | Max         | Unit                       |
|---|-----------------------|-------------|----------------------------|
| Total Device Dissipation FR-5 Board,<br>(Note 1) $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$        | $P_D$                 | 310<br>2.5  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance<br>Junction-to-Ambient (Note 1)  | $R_{\theta JA}$       | 403         | $^\circ\text{C}/\text{W}$  |
| Total Device Dissipation Alumina<br>Substrate, (Note 2) $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$                 | 710<br>5.7  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance<br>Junction-to-Ambient (Note 2)  | $R_{\theta JA}$       | 176         | $^\circ\text{C}/\text{W}$  |
| Total Device Dissipation (Ref. Figure 8)<br>(Single Pulse < 10 sec.)  | $P_{D\text{single}}$  | 575         | mW                         |
| Junction and Storage Temperature  | $T_J, T_{\text{stg}}$ | -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.

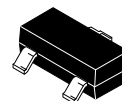
1. FR-4 @ Minimum Pad
2. FR-4 @ 1.0 X 1.0 inch Pad



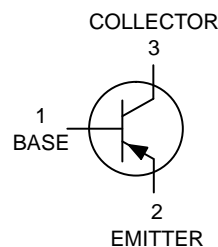
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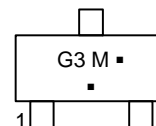
30 VOLTS, 2.0 AMPS  
PNP TRANSISTORS



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



### MARKING DIAGRAM



G3 = Device Code  
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†              |
|----------------|---------------------|------------------------|
| MMBT589LT1G    | SOT-23<br>(Pb-Free) | 3,000 /<br>Tape & Reel |
| NSVMMBT589LT1G | SOT-23<br>(Pb-Free) | 3,000 /<br>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.

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

| Characteristic   | Symbol        | Min                    | Max                     | Unit            |
|--|---------------|------------------------|-------------------------|-----------------|
| <b>OFF CHARACTERISTICS</b>   |               |                        |                         |                 |
| Collector–Emitter Breakdown Voltage<br>( $I_C = -10\text{ mAdc}$ , $I_B = 0$ )   | $V_{(BR)CEO}$ | –30                    | –                       | Vdc             |
| Collector–Base Breakdown Voltage<br>( $I_C = -0.1\text{ mAdc}$ , $I_E = 0$ )   | $V_{(BR)CBO}$ | –50                    | –                       | Vdc             |
| Emitter–Base Breakdown Voltage<br>( $I_E = -0.1\text{ mAdc}$ , $I_C = 0$ )   | $V_{(BR)EBO}$ | –5.0                   | –                       | Vdc             |
| Collector Cutoff Current<br>( $V_{CB} = -30\text{ Vdc}$ , $I_E = 0$ )  | $I_{CBO}$     | –                      | –0.1                    | $\mu\text{Adc}$ |
| Collector–Emitter Cutoff Current<br>( $V_{CES} = -30\text{ Vdc}$ )   | $I_{CES}$     | –                      | –0.1                    | $\mu\text{Adc}$ |
| Emitter Cutoff Current<br>( $V_{EB} = -4.0\text{ Vdc}$ )   | $I_{EBO}$     | –                      | –0.1                    | $\mu\text{Adc}$ |
| <b>ON CHARACTERISTICS</b>  |               |                        |                         |                 |
| DC Current Gain (Note 3) (Figure 1)<br>( $I_C = -1.0\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ )<br>( $I_C = -500\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ )<br>( $I_C = -1.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )<br>( $I_C = 2.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ ) | $h_{FE}$      | 100<br>100<br>80<br>40 | –<br>300<br>–<br>–      | –               |
| Collector–Emitter Saturation Voltage (Note 3) (Figure 3)<br>( $I_C = -0.5\text{ A}$ , $I_B = -0.05\text{ A}$ )<br>( $I_C = -1.0\text{ A}$ , $I_B = 0.1\text{ A}$ )<br>( $I_C = -2.0\text{ A}$ , $I_B = -0.2\text{ A}$ )  | $V_{CE(sat)}$ | –<br>–<br>–            | –0.25<br>–0.30<br>–0.65 | V               |
| Base–Emitter Saturation Voltage (Note 3) (Figure 2)<br>( $I_C = -1.0\text{ A}$ , $I_B = -0.1\text{ A}$ )   | $V_{BE(sat)}$ | –                      | –1.2                    | V               |
| Base–Emitter Turn–on Voltage (Note 3)<br>( $I_C = -1.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )  | $V_{BE(on)}$  | –                      | –1.1                    | V               |
| Cutoff Frequency<br>( $I_C = -100\text{ mA}$ , $V_{CE} = -5.0\text{ V}$ , $f = 100\text{ MHz}$ )   | $f_T$         | 100                    | –                       | MHz             |
| Output Capacitance<br>( $f = 1.0\text{ MHz}$ )   | $C_{obo}$     | –                      | 15                      | pF              |

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. Pulsed Condition: Pulse Width = 300 msec, Duty Cycle  $\leq 2\%$

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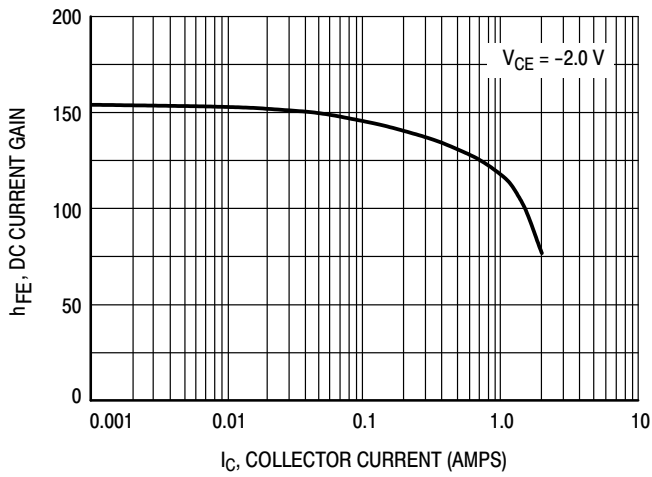


Figure 1. DC Current Gain versus Collector Current

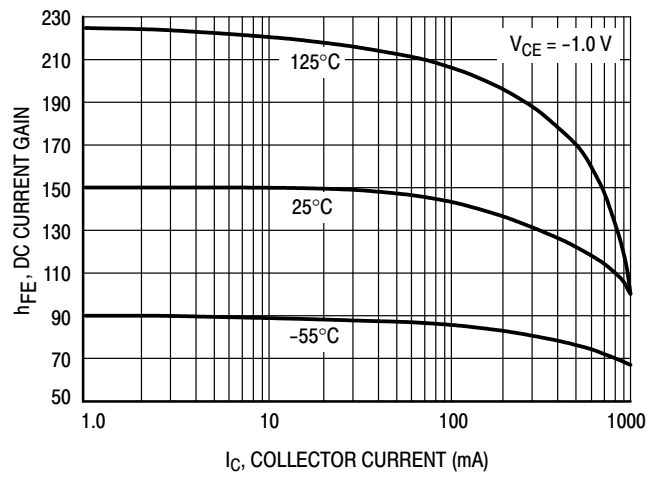


Figure 2. DC Current Gain versus Collector Current

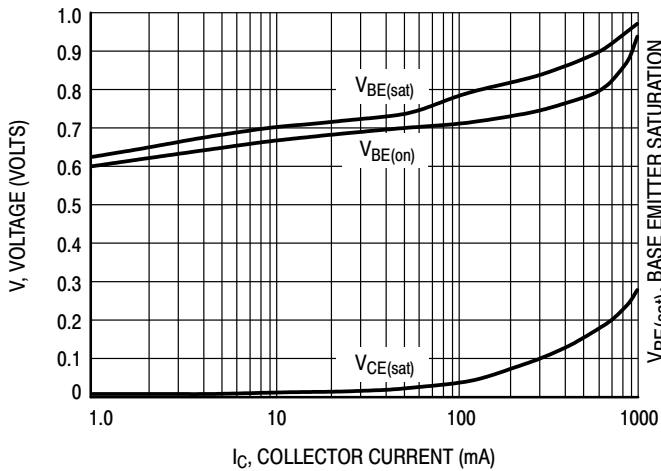


Figure 3. "On" Voltages

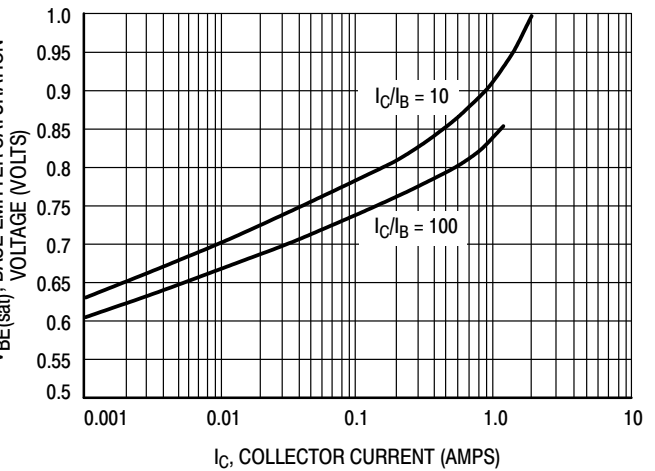


Figure 4. Base Emitter Saturation Voltage versus Collector Current

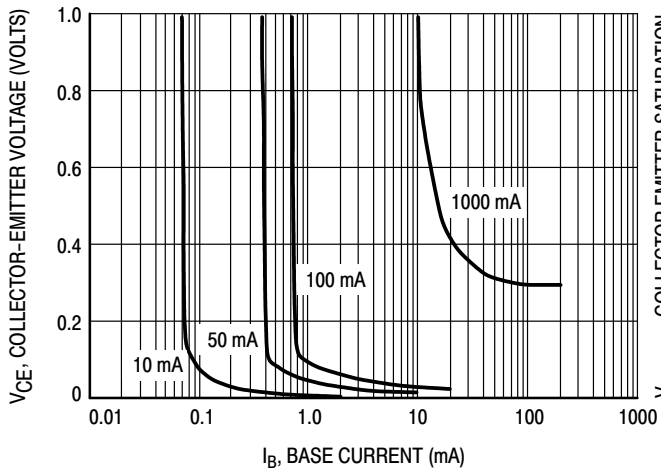


Figure 5. Collector Emitter Saturation Voltage versus Collector Current

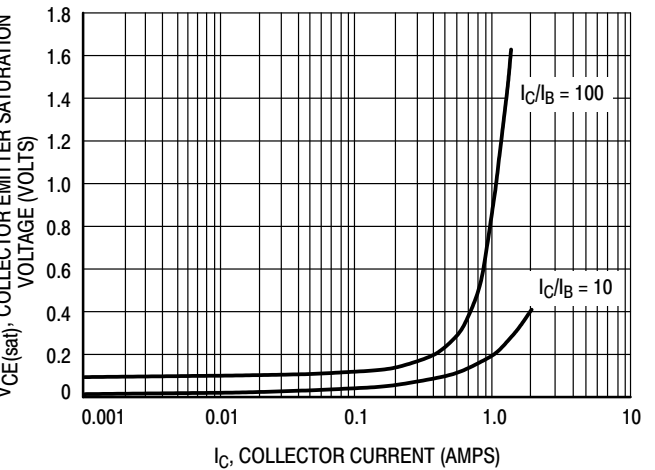


Figure 6. Collector Emitter Saturation Voltage versus Collector Current

# MMBT589LT1G, NSVMMBT589LT1G

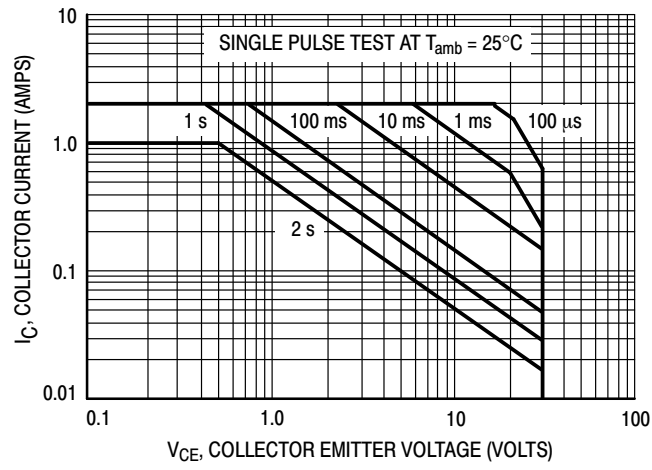


Figure 7. Safe Operating Area

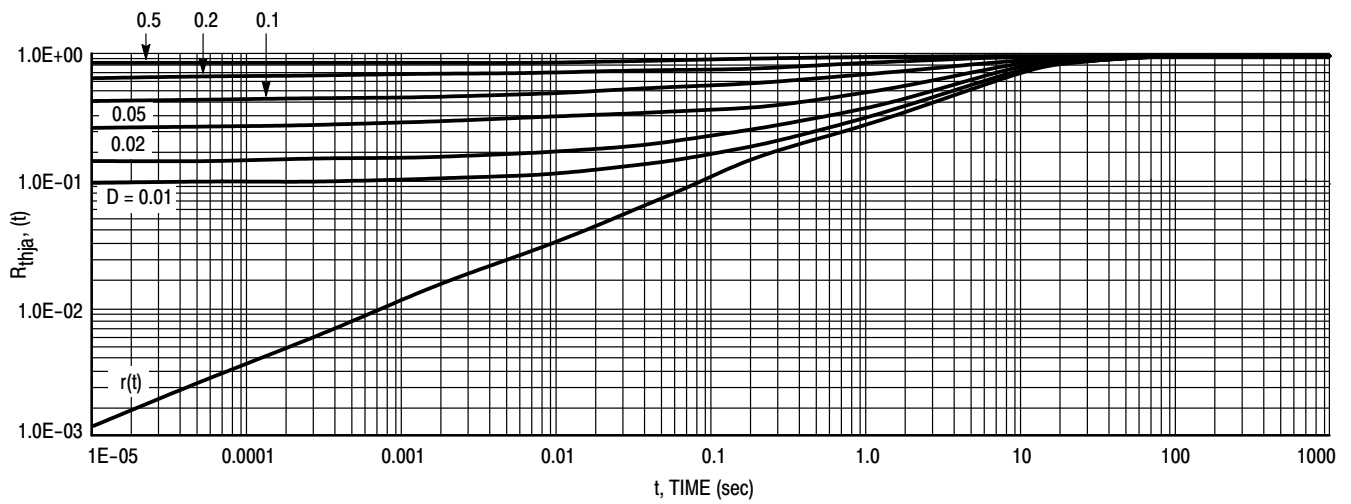


Figure 8. Normalized Thermal Response

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



**SOT-23 (TO-236)**  
CASE 318-08  
ISSUE AS

DATE 30 JAN 2018

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.

| 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°   |

**RECOMMENDED SOLDERING FOOTPRINT**



**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.

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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