# MMBT589LT1

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

**ON Semiconductor®**

**http://onsemi.com**

## 30 VOLTS, 2.0 AMPS PNP TRANSISTORS

### Features

- Pb−Free Packages are Available

**MAXIMUM RATINGS** ($T_A$ = 25°C)

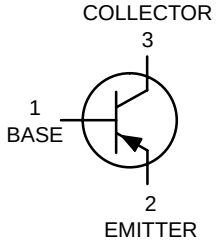
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector−Emitter Voltage | $V_{CEO}$ | −30 | Vdc |
| Collector−Base Voltage | $V_{CBO}$ | −50 | Vdc |
| Emitter−Base Voltage | $V_{EBO}$ | −5.0 | Vdc |
| Collector Current − Continuous | $I_C$ | −1.0 | Adc |
| Collector Current − Peak | $I_{CM}$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

**THERMAL CHARACTERISTICS**

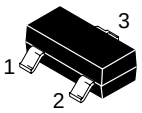
| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Total Device Dissipation FR−5 Board, (Note 1) $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 310<br>2.5 | mW<br>mW/°C |
| Thermal Resistance, Junction−to−Ambient (Note 1) | $R_{\theta JA}$ | 403 | °C/W |
| Total Device Dissipation Alumina Substrate, (Note 2) $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 710<br>5.7 | mW<br>mW/°C |
| Thermal Resistance, Junction−to−Ambient (Note 2) | $R_{\theta JA}$ | 176 | °C/W |
| Total Device Dissipation (Ref. Figure 8) (Single Pulse < 10 sec.) | $P_{Dsingle}$ | 575 | mW |
| Junction and Storage Temperature | $T_J$, $T_{stg}$ | −55 to +150 | °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.

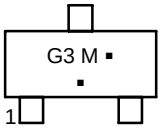
1. FR−4 @ Minimum Pad
2. FR−4 @ 1.0 X 1.0 inch Pad




**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† |
|---|---|---|
| MMBT589LT1 | SOT−23 | 3,000 / Tape & Reel |
| MMBT589LT1G | 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 ($I_C$ = −10 mAdc, $I_B$ = 0) | $V_{(BR)CEO}$ | −30 | − | Vdc |
| Collector−Base Breakdown Voltage ($I_C$ = −0.1 mAdc, $I_E$ = 0) | $V_{(BR)CBO}$ | −50 | − | Vdc |
| Emitter−Base Breakdown Voltage ($I_E$ = −0.1 mAdc, $I_C$ = 0) | $V_{(BR)EBO}$ | −5.0 | − | Vdc |
| Collector Cutoff Current ($V_{CB}$ = −30 Vdc, $I_E$ = 0) | $I_{CBO}$ | − | −0.1 | μAdc |
| Collector−Emitter Cutoff Current ($V_{CES}$ = −30 Vdc) | $I_{CES}$ | − | −0.1 | μAdc |
| Emitter Cutoff Current ($V_{EB}$ = −4.0 Vdc) | $I_{EBO}$ | − | −0.1 | μAdc |
| **ON CHARACTERISTICS** | | | | |
| DC Current Gain (Note 3) (Figure 1)<br>($I_C$ = −1.0 mA, $V_{CE}$ = −2.0 V)<br>($I_C$ = −500 mA, $V_{CE}$ = −2.0 V)<br>($I_C$ = −1.0 A, $V_{CE}$ = −2.0 V)<br>($I_C$ = 2.0 A, $V_{CE}$ = −2.0 V) | $h_{FE}$ | <br>100<br>100<br>80<br>40 | <br>−<br>300<br>−<br>− | − |
| Collector−Emitter Saturation Voltage (Note 3) (Figure 3)<br>($I_C$ = −0.5 A, $I_B$ = −0.05 A)<br>($I_C$ = −1.0 A, $I_B$ = 0.1 A)<br>($I_C$ = −2.0 A, $I_B$ = −0.2 A) | $V_{CE(sat)}$ | <br>−<br>−<br>− | <br>−0.25<br>−0.30<br>−0.65 | V |
| Base−Emitter Saturation Voltage (Note 3) (Figure 2)<br>($I_C$ = −1.0 A, $I_B$ = −0.1 A) | $V_{BE(sat)}$ | − | −1.2 | V |
| Base−Emitter Turn−on Voltage (Note 3)<br>($I_C$ = −1.0 A, $V_{CE}$ = −2.0 V) | $V_{BE(on)}$ | − | −1.1 | V |
| Cutoff Frequency<br>($I_C$ = −100 mA, $V_{CE}$ = −5.0 V, f = 100 MHz) | $f_T$ | 100 | − | MHz |
| Output Capacitance<br>(f = 1.0 MHz) | Cobo | − | 15 | pF |

3. Pulsed Condition: Pulse Width = 300 msec, Duty Cycle ≤ 2%

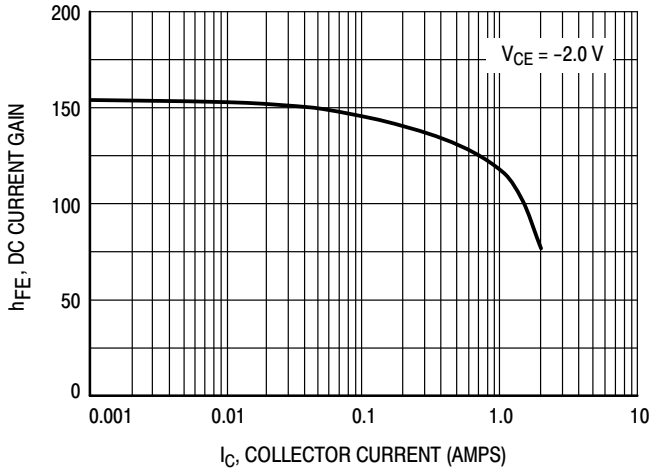



**Figure 1. DC Current Gain versus Collector Current**

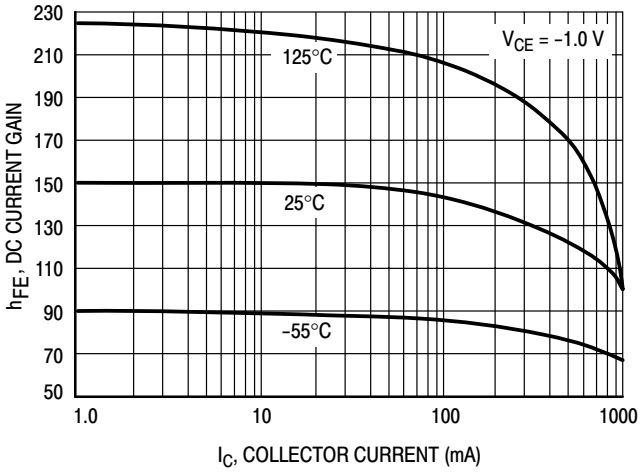



**Figure 2. DC Current Gain versus Collector Current**

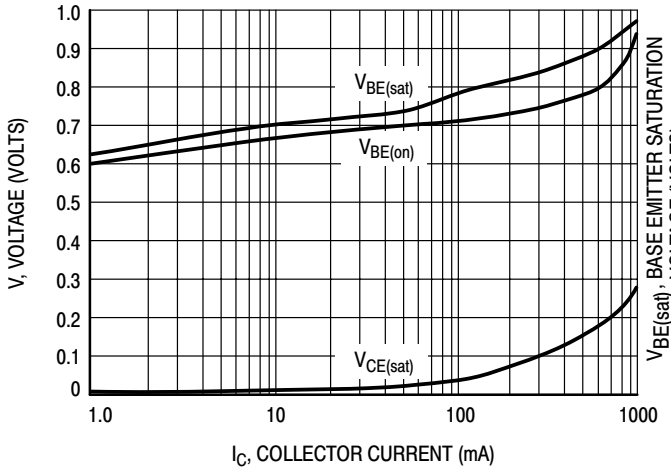



**Figure 3. “On” Voltages**

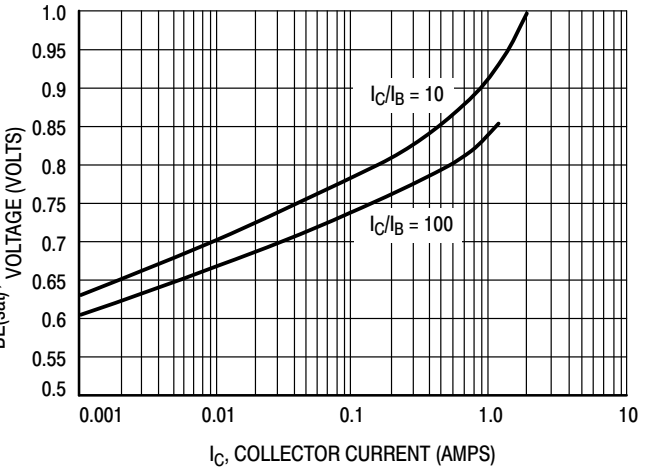



**Figure 4. Base Emitter Saturation Voltage versus Collector Current**

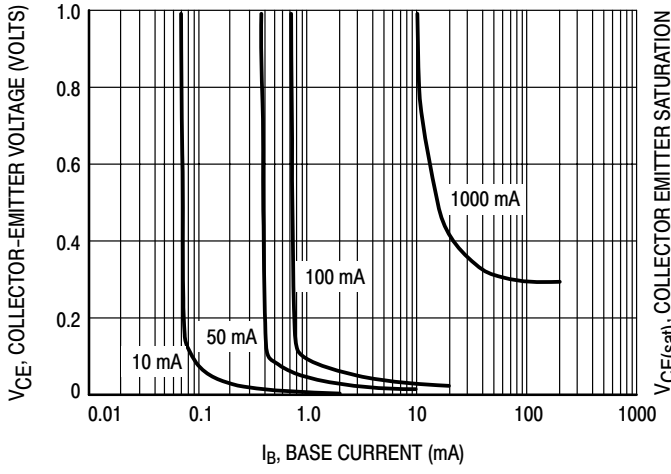



**Figure 5. Collector Emitter Saturation Voltage versus Collector Current**

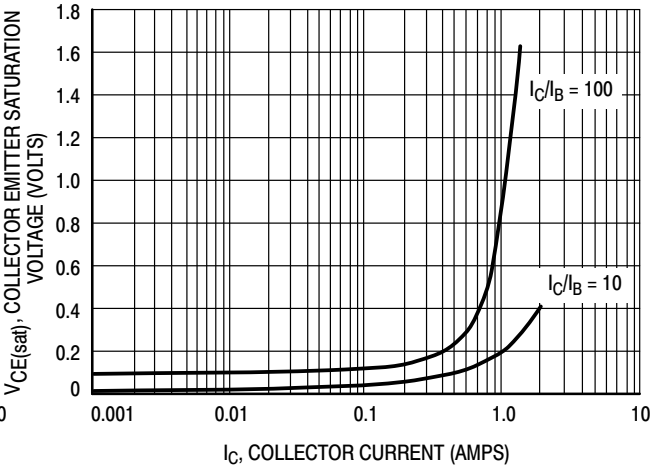



**Figure 6. Collector Emitter Saturation Voltage versus Collector Current**

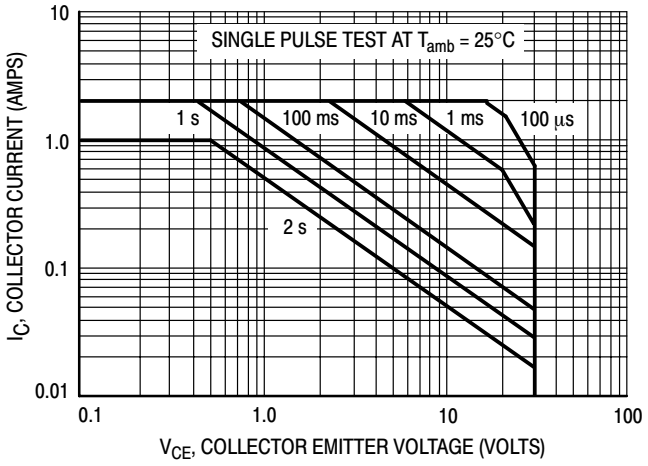



**Figure 7. Safe Operating Area**

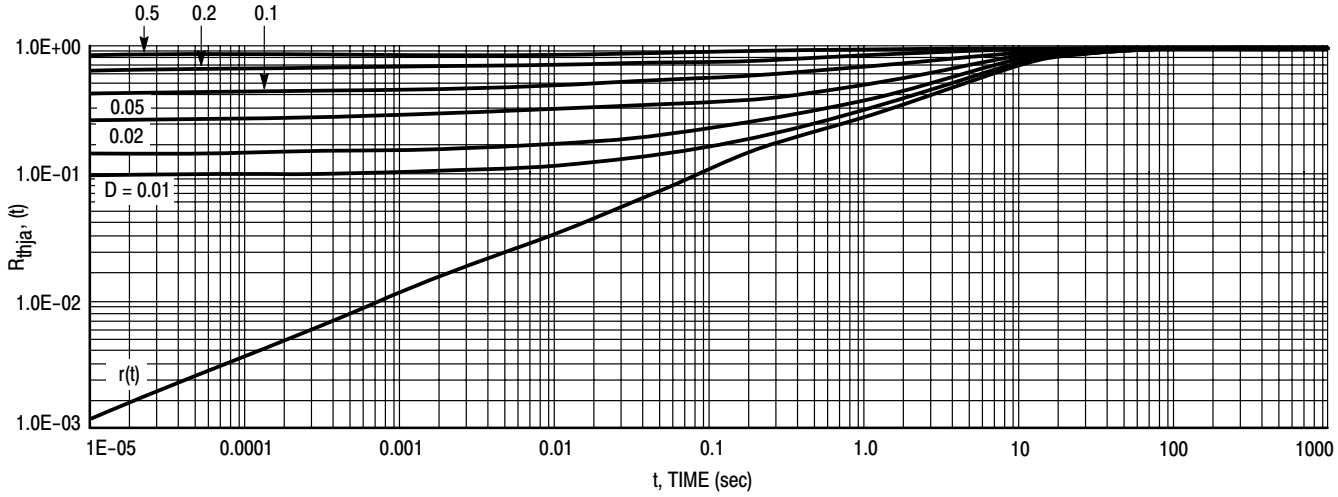
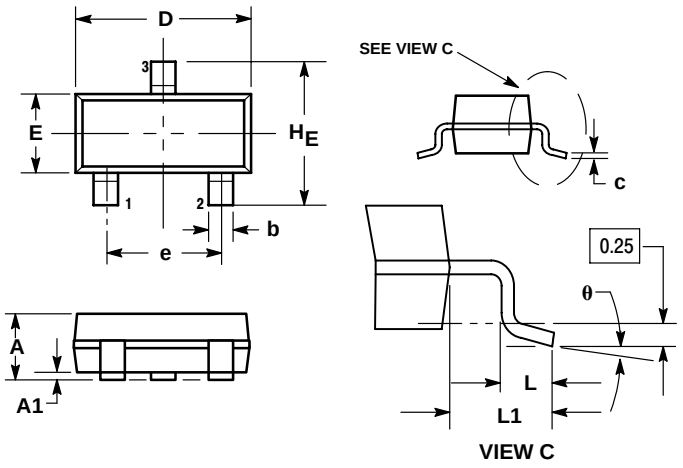



**Figure 8. Normalized Thermal Response**

## PACKAGE DIMENSIONS

**SOT−23 (TO−236)**
CASE 318−08
ISSUE AN

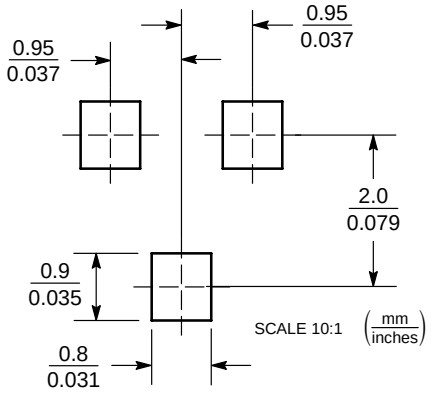



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318−01 THRU −07 AND −09 OBSOLETE, NEW STANDARD 318−08.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | 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 |
| $H_E$ | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |

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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