

# MMBT6589T1

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

### Features

- Pb-Free Package is Available

### MAXIMUM RATINGS (T<sub>A</sub> = 25°C)

Rating	Symbol	Max	Unit
Collector-Emitter Voltage	V <sub>CEO</sub>	-30	Vdc
Collector-Base Voltage	V <sub>CBO</sub>	-50	Vdc
Emitter-Base Voltage	V <sub>EBO</sub>	-5.0	Vdc
Collector Current – Continuous	I <sub>C</sub>	-1.0	Adc
Collector Current – Peak	I <sub>CM</sub>	-2.0	A
Electrostatic Discharge	ESD	HBM Class 3 MM Class C	

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation T <sub>A</sub> = 25°C Derate above 25°C	P <sub>D</sub> (Note 1)	540 4.4	mW mW/°C
Thermal Resistance, Junction-to-Ambient	R <sub>θJA</sub> (Note 1)	230	°C/W
Total Device Dissipation T <sub>A</sub> = 25°C Derate above 25°C	P <sub>D</sub> (Note 2)	925 7.4	mW mW/°C
Thermal Resistance, Junction-to-Ambient	R <sub>θJA</sub> (Note 2)	135	°C/W
Total Device Dissipation (Single Pulse < 10 s)	P <sub>Dsingle</sub> (Note 2) (Note 3)	1.3	W
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

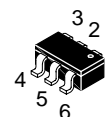
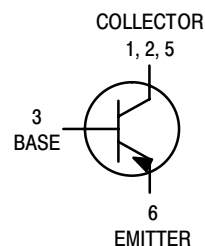
- FR-4 @ Minimum Pad
- FR-4 @ 1.0 X 1.0 inch Pad
- ref: Figure 8



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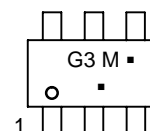
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## 30 VOLTS, 2.0 AMPS PNP TRANSISTOR



TSOP-6  
CASE 318G  
STYLE 7

### MARKING DIAGRAM



G3 = Specific Device Code  
M = Date Code\*  
■ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

### ORDERING INFORMATION

Device	Package	Shipping†
MMBT6589T1	TSOP-6	3000/Tape & Reel
MMBT6589T1G	TSOP-6 (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.

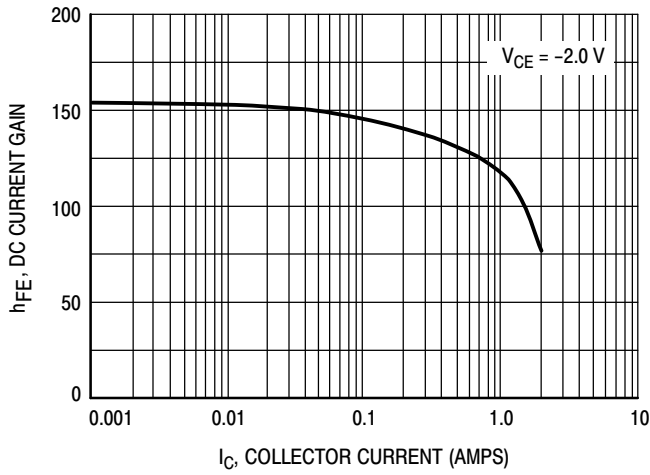
# MMBT6589T1

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

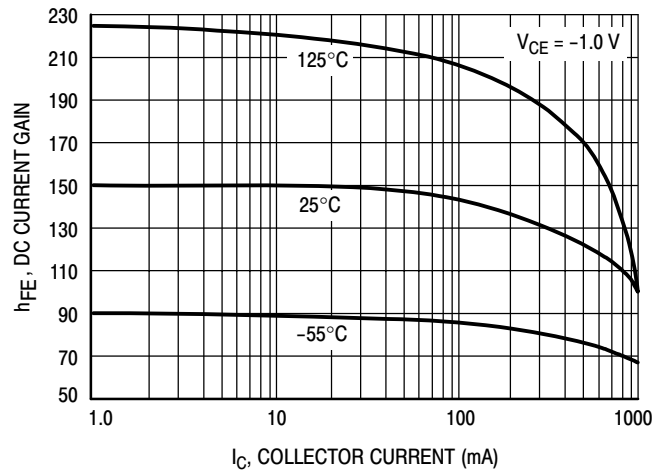
Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Breakdown Voltage ( $I_C = -10\text{ mA}$ , $I_B = 0$ )	$V_{(BR)CEO}$	-30	–	Vdc
Collector–Base Breakdown Voltage ( $I_C = -0.1\text{ mA}$ , $I_E = 0$ )	$V_{(BR)CBO}$	-50	–	Vdc
Emitter–Base Breakdown Voltage ( $I_E = -0.1\text{ mA}$ , $I_C = 0$ )	$V_{(BR)EBO}$	-5.0	–	Vdc
Collector Cutoff Current ( $V_{CB} = -30\text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	–	-0.1	$\mu\text{Adc}$
Collector–Emitter Cutoff Current ( $V_{CES} = -30\text{ Vdc}$ )	$I_{CES}$	–	-0.1	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = -4.0\text{ Vdc}$ )	$I_{EBO}$	–	-0.1	$\mu\text{Adc}$
<b>ON CHARACTERISTICS</b>				
DC Current Gain (Note 4) (Figure 1) ( $I_C = -1.0\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ ) ( $I_C = -500\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ ) ( $I_C = -1.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ ) ( $I_C = 2.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )	$h_{FE}$	100 100 80 40	– 300 – –	
Collector–Emitter Saturation Voltage (Note 4) (Figure 3) ( $I_C = -0.5\text{ A}$ , $I_B = -0.05\text{ A}$ ) ( $I_C = -1.0\text{ A}$ , $I_B = 0.1\text{ A}$ ) ( $I_C = -2.0\text{ A}$ , $I_B = -0.2\text{ A}$ )	$V_{CE(sat)}$	– – –	-0.25 -0.30 -0.65	V
Base–Emitter Saturation Voltage (Note 4) (Figure 2) ( $I_C = -1.0\text{ A}$ , $I_B = -0.1\text{ A}$ )	$V_{BE(sat)}$	–	-1.2	V
Base–Emitter Turn–on Voltage (Note 4) ( $I_C = -1.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )	$V_{BE(on)}$	–	-1.1	V
Cutoff Frequency ( $I_C = -100\text{ mA}$ , $V_{CE} = -5.0\text{ V}$ , $f = 100\text{ MHz}$ )	$f_T$	100	–	MHz
Output Capacitance ( $V_{CB} = -5.0\text{ V}$ , $f = 1.0\text{ MHz}$ )	Cobo	–	20	pF

4. Pulsed Condition: Pulse Width = 300  $\mu\text{sec}$ , Duty Cycle  $\leq 2\%$

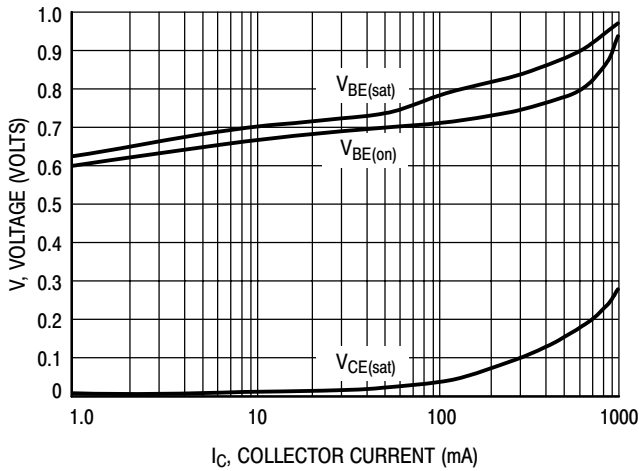
# MMBT6589T1



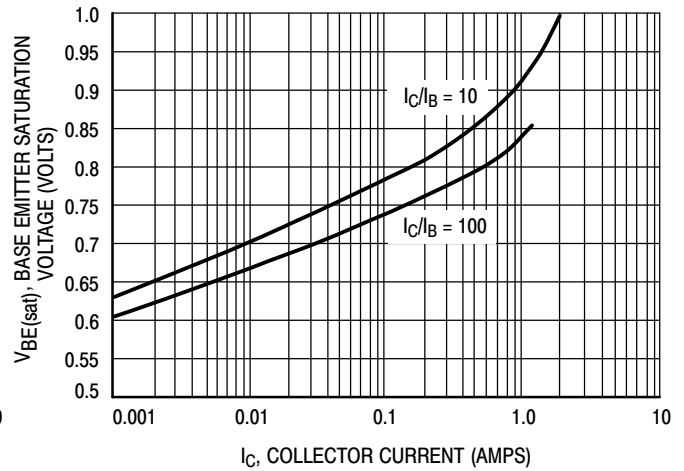
**Figure 1. DC Current Gain versus Collector Current**



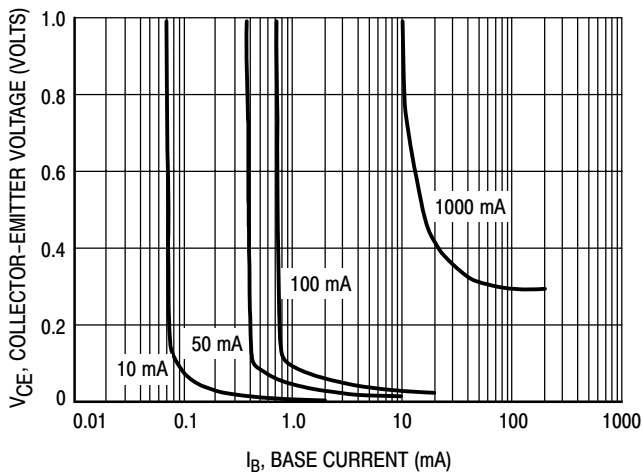
**Figure 2. DC Current Gain versus Collector Current**



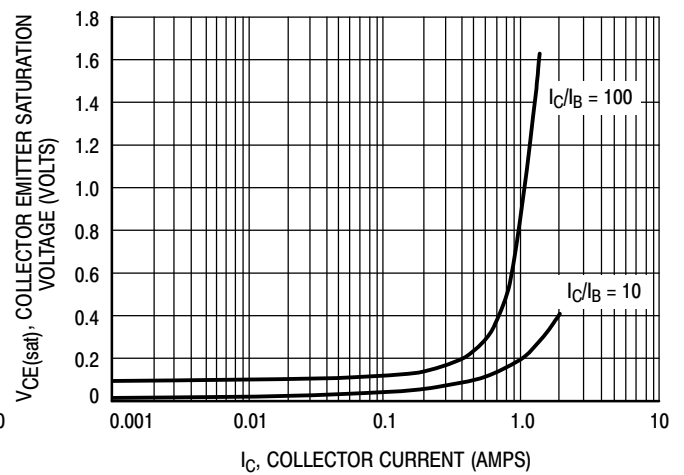
**Figure 3. "On" Voltages**



**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**

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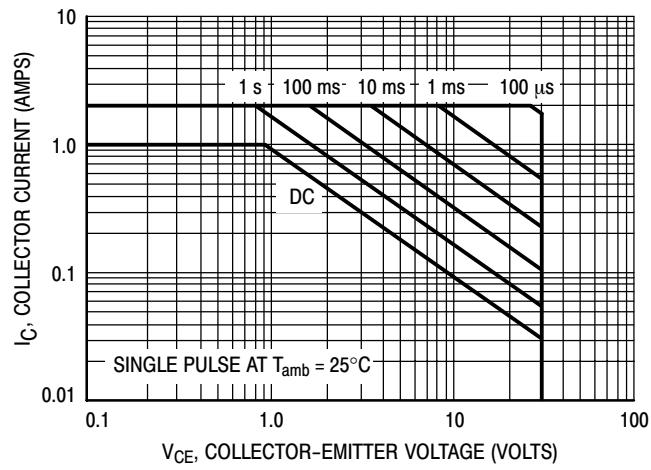


Figure 7. Safe Operating Area

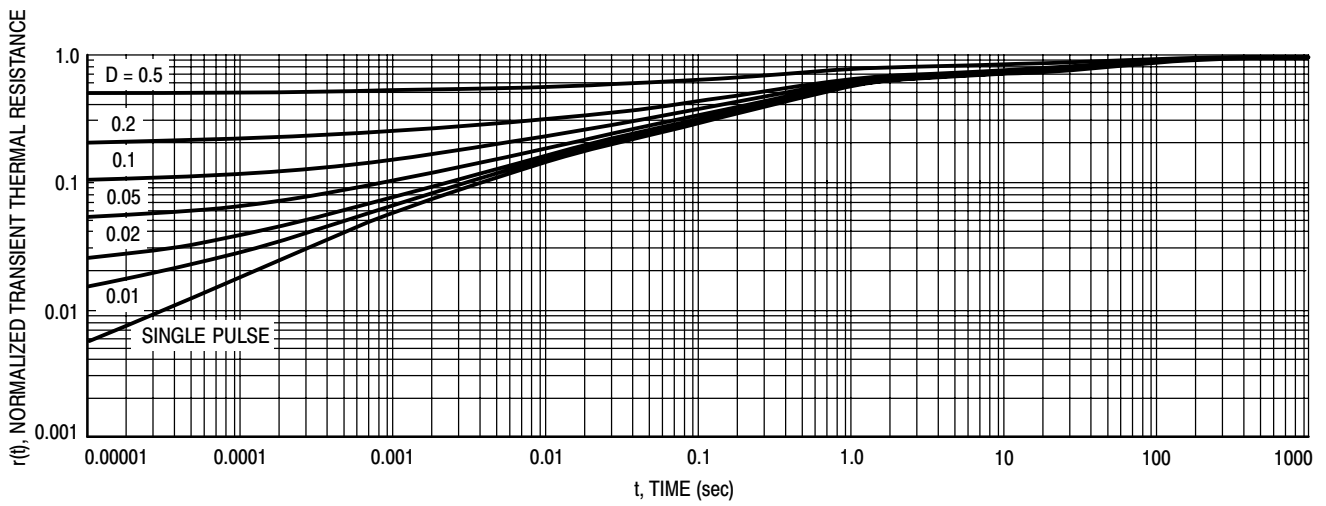
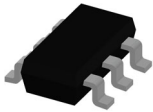
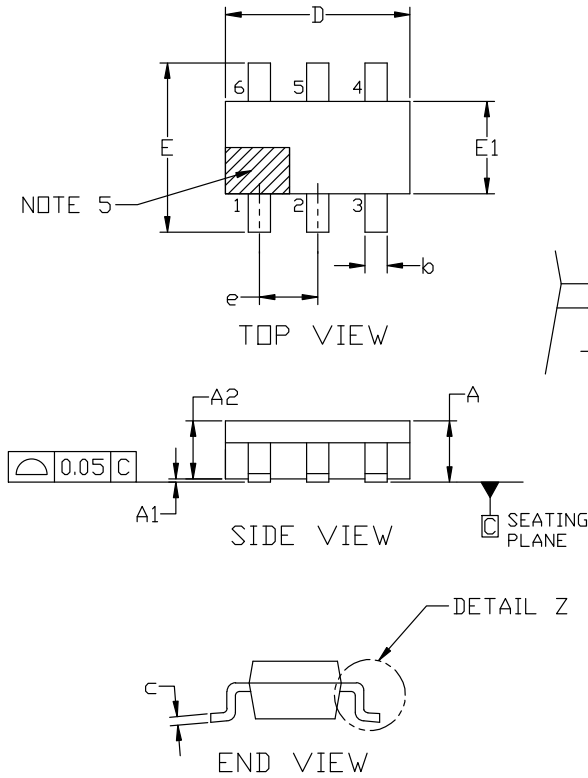


Figure 8. Normalized Thermal Response



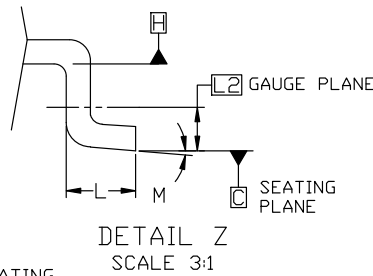
**TSOP-6 3.00x1.50x0.90, 0.95P**  
**CASE 318G**  
**ISSUE W**

DATE 26 FEB 2024



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
5. PIN 1 INDICATOR MUST BE LOCATED IN THE INDICATED ZONE



MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
A2	0.80	0.90	1.00
b	0.25	0.38	0.50
c	0.10	0.18	0.26
D	2.90	3.00	3.10
E	2.50	2.75	3.00
E1	1.30	1.50	1.70
e	0.85	0.95	1.05
L	0.20	0.40	0.60
L2	0.25 BSC		
M	0°	---	10°



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.

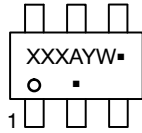
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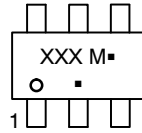
**TSOP-6 3.00x1.50x0.90, 0.95P**  
**CASE 318G**  
**ISSUE W**

DATE 26 FEB 2024

**GENERIC  
MARKING DIAGRAM\***



**IC**



**STANDARD**

XXX = Specific Device Code	XXX = Specific Device Code
A = Assembly Location	M = Date Code
Y = Year	▪ = Pb-Free Package
W = Work Week	
▪ = 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.

- |  |  |   |   |   |  |
|--|--|---|---|---|--|
| <b>STYLE 1:</b><br>PIN 1. DRAIN<br>2. DRAIN<br>3. GATE<br>4. SOURCE<br>5. DRAIN<br>6. DRAIN              | <b>STYLE 2:</b><br>PIN 1. EMITTER 2<br>2. BASE 1<br>3. COLLECTOR 1<br>4. EMITTER 1<br>5. BASE 2<br>6. COLLECTOR 2    | <b>STYLE 3:</b><br>PIN 1. ENABLE<br>2. N/C<br>3. R BOOST<br>4. Vz<br>5. V in<br>6. V out                            | <b>STYLE 4:</b><br>PIN 1. N/C<br>2. V in<br>3. NOT USED<br>4. GROUND<br>5. ENABLE<br>6. LOAD                | <b>STYLE 5:</b><br>PIN 1. EMITTER 2<br>2. BASE 2<br>3. COLLECTOR 1<br>4. EMITTER 1<br>5. BASE 1<br>6. COLLECTOR 2 | <b>STYLE 6:</b><br>PIN 1. COLLECTOR<br>2. COLLECTOR<br>3. BASE<br>4. EMITTER<br>5. COLLECTOR<br>6. COLLECTOR |
| <b>STYLE 7:</b><br>PIN 1. COLLECTOR<br>2. COLLECTOR<br>3. BASE<br>4. N/C<br>5. COLLECTOR<br>6. EMITTER   | <b>STYLE 8:</b><br>PIN 1. Vbus<br>2. D(in)<br>3. D(in)+<br>4. D(out)+<br>5. D(out)<br>6. GND                         | <b>STYLE 9:</b><br>PIN 1. LOW VOLTAGE GATE<br>2. DRAIN<br>3. SOURCE<br>4. DRAIN<br>5. DRAIN<br>6. HIGH VOLTAGE GATE | <b>STYLE 10:</b><br>PIN 1. D(OUT)+<br>2. GND<br>3. D(OUT)-<br>4. D(IN)-<br>5. VBUS<br>6. D(IN)+             | <b>STYLE 11:</b><br>PIN 1. SOURCE 1<br>2. DRAIN 2<br>3. DRAIN 2<br>4. SOURCE 2<br>5. GATE 1<br>6. DRAIN 1/GATE 2  | <b>STYLE 12:</b><br>PIN 1. I/O<br>2. GROUND<br>3. I/O<br>4. I/O<br>5. VCC<br>6. I/O                          |
| <b>STYLE 13:</b><br>PIN 1. GATE 1<br>2. SOURCE 2<br>3. GATE 2<br>4. DRAIN 2<br>5. SOURCE 1<br>6. DRAIN 1 | <b>STYLE 14:</b><br>PIN 1. ANODE<br>2. SOURCE<br>3. GATE<br>4. CATHODE/DRAIN<br>5. CATHODE/DRAIN<br>6. CATHODE/DRAIN | <b>STYLE 15:</b><br>PIN 1. ANODE<br>2. SOURCE<br>3. GATE<br>4. DRAIN<br>5. N/C<br>6. CATHODE                        | <b>STYLE 16:</b><br>PIN 1. ANODE/CATHODE<br>2. BASE<br>3. EMITTER<br>4. COLLECTOR<br>5. ANODE<br>6. CATHODE | <b>STYLE 17:</b><br>PIN 1. EMITTER<br>2. BASE<br>3. ANODE/CATHODE<br>4. ANODE<br>5. CATHODE<br>6. COLLECTOR       |  |

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