

# MMBT2222ATT1G, NSVMMBT2222ATT1G

## General Purpose Transistor

### NPN Silicon

These transistors are designed for general purpose amplifier applications. They are housed in the SOT-416/SC-75 package which is designed for low power surface mount 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	Max	Unit
Collector-Emitter Voltage	$V_{CEO}$	40	Vdc
Collector-Base Voltage	$V_{CBO}$	75	Vdc
Emitter-Base Voltage	$V_{EBO}$	6.0	Vdc
Collector Current – Continuous	$I_C$	600	mAdc

#### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation (Note 1) $T_A = 25^\circ\text{C}$	$P_D$	150	mW
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	833	$^\circ\text{C/W}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

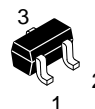
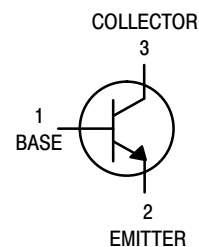
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Device mounted on FR4 glass epoxy printed circuit board using the minimum recommended footprint.



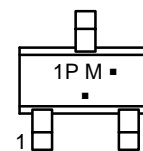
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CASE 463  
SOT-416/SC-75  
STYLE 1

#### MARKING DIAGRAM



1P = Specific Device Code  
M = Date Code  
■ = Pb-Free Package  
(Note: Microdot may be in either location)

#### ORDERING INFORMATION

Device	Package	Shipping†
MMBT2222ATT1G	SOT-416 (Pb-Free)	3000 / Tape & Reel
NSVMMBT2222ATT1G	SOT-416 (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 Specification Brochure, BRD8011/D.

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Breakdown Voltage (Note 1) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	40	–	Vdc
Collector–Base Breakdown Voltage (I <sub>C</sub> = 10 μAdc, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	75	–	Vdc
Emitter–Base Breakdown Voltage (I <sub>E</sub> = 10 μAdc, I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	6.0	–	Vdc
Base Cutoff Current (V <sub>CE</sub> = 60 Vdc, V <sub>EB</sub> = 3.0 Vdc)	I <sub>BL</sub>	–	20	nAdc
Collector Cutoff Current (V <sub>CE</sub> = 60 Vdc, V <sub>EB</sub> = 3.0 Vdc)	I <sub>CEX</sub>	–	10	nAdc

## ON CHARACTERISTICS (Note 2)

DC Current Gain (I <sub>C</sub> = 0.1 mAdc, V <sub>CE</sub> = 10 Vdc) (I <sub>C</sub> = 1.0 mAdc, V <sub>CE</sub> = 10 Vdc) (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 10 Vdc) (I <sub>C</sub> = 150 mAdc, V <sub>CE</sub> = 10 Vdc) (I <sub>C</sub> = 500 mAdc, V <sub>CE</sub> = 10 Vdc)	H <sub>FE</sub>	35 50 75 100 40	– – – – –	–
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 150 mAdc, I <sub>B</sub> = 15 mAdc) (I <sub>C</sub> = 500 mAdc, I <sub>B</sub> = 50 mAdc)	V <sub>CE(sat)</sub>	– –	0.3 1.0	Vdc
Base–Emitter Saturation Voltage (I <sub>C</sub> = 150 mAdc, I <sub>B</sub> = 15 mAdc) (I <sub>C</sub> = 500 mAdc, I <sub>B</sub> = 50 mAdc)	V <sub>BE(sat)</sub>	0.6 –	1.2 2.0	Vdc

## SMALL–SIGNAL CHARACTERISTICS

Current–Gain – Bandwidth Product (I <sub>C</sub> = 20 mAdc, V <sub>CE</sub> = 20 Vdc, f = 100 MHz)	f <sub>T</sub>	300	–	MHz
Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f = 1.0 MHz)	C <sub>obo</sub>	–	8.0	pF
Input Capacitance (V <sub>EB</sub> = 0.5 Vdc, I <sub>C</sub> = 0, f = 1.0 MHz)	C <sub>ibo</sub>	–	30	pF
Input Impedance (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 10 mAdc, f = 1.0 kHz)	h <sub>ie</sub>	0.25	1.25	kΩ
Voltage Feedback Ratio (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 10 mAdc, f = 1.0 kHz)	h <sub>re</sub>	–	4.0	X 10 <sup>-4</sup>
Small–Signal Current Gain (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 10 mAdc, f = 1.0 kHz)	h <sub>fe</sub>	75	375	–
Output Admittance (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 10 mAdc, f = 1.0 kHz)	h <sub>oe</sub>	25	200	μmhos
Noise Figure (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 100 μAdc, R <sub>S</sub> = 1.0 k ohms, f = 1.0 kHz)	NF	–	4.0	dB

## SWITCHING CHARACTERISTICS

Delay Time	(V <sub>CC</sub> = 3.0 Vdc, V <sub>BE</sub> = –0.5 Vdc, I <sub>C</sub> = 150 mAdc, I <sub>B1</sub> = 15 mAdc)	t <sub>d</sub>	–	10	ns
Rise Time		t <sub>r</sub>	–	25	
Storage Time	(V <sub>CC</sub> = 30 Vdc, I <sub>C</sub> = 150 mAdc, I <sub>B1</sub> = I <sub>B2</sub> = 15 mAdc)	t <sub>s</sub>	–	225	ns
Fall Time		t <sub>f</sub>	–	60	

1. Device mounted on FR4 glass epoxy printed circuit board using the minimum recommended footprint.
2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

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## SWITCHING TIME EQUIVALENT TEST CIRCUITS

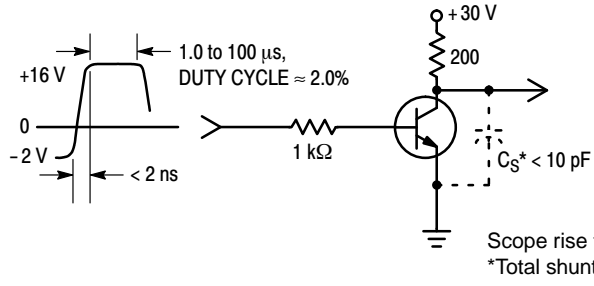


Figure 1. Turn-On Time

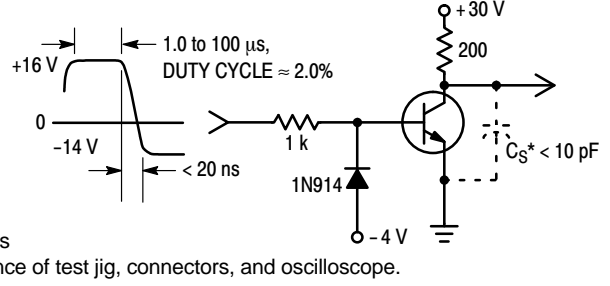


Figure 2. Turn-Off Time

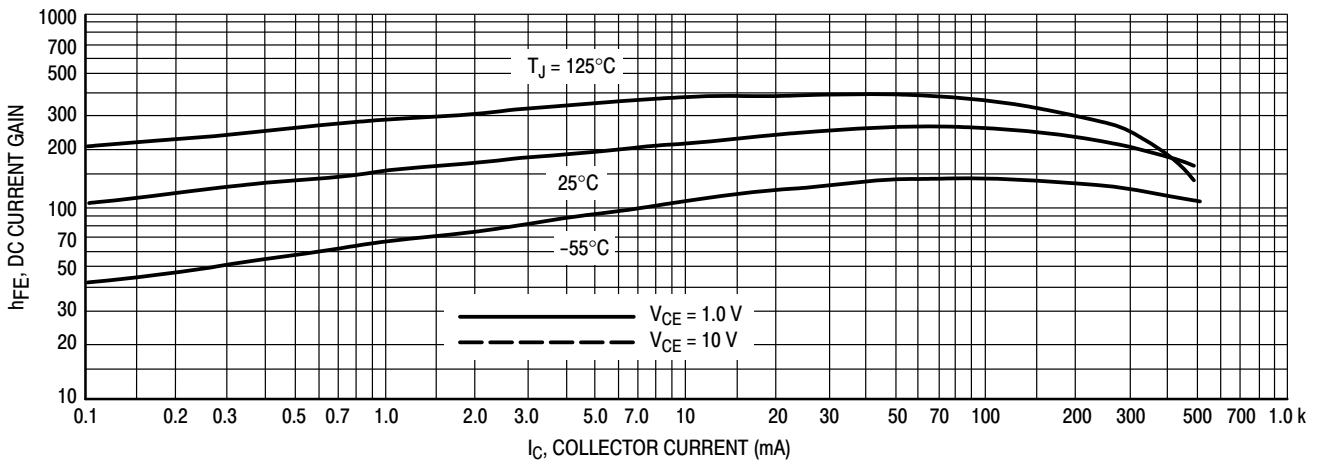


Figure 3. DC Current Gain

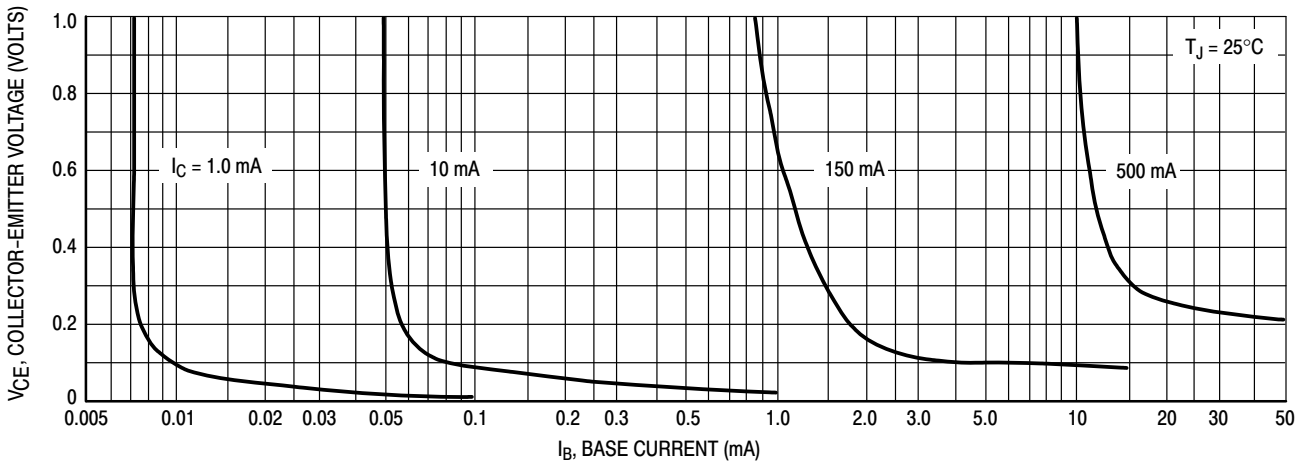


Figure 4. Collector Saturation Region

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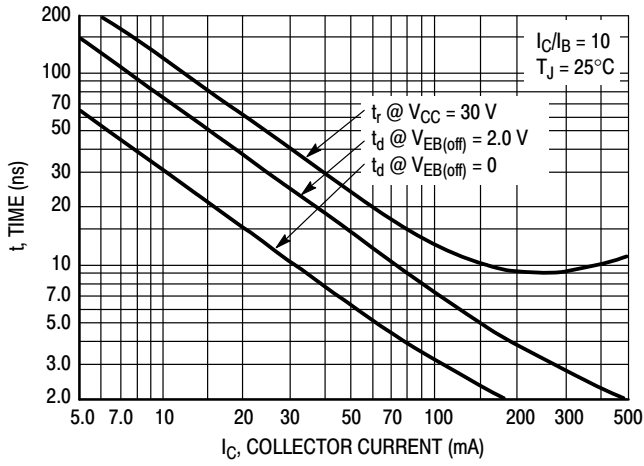


Figure 5. Turn-On Time

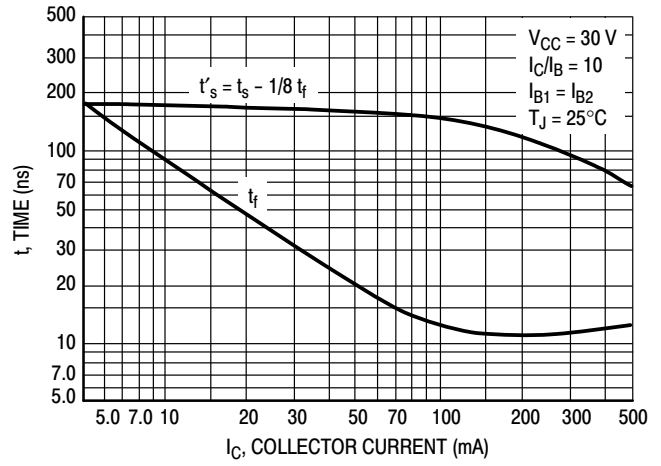


Figure 6. Turn-Off Time

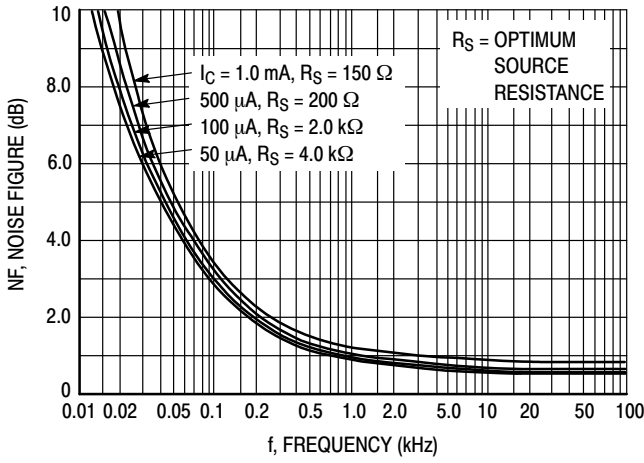


Figure 7. Frequency Effects

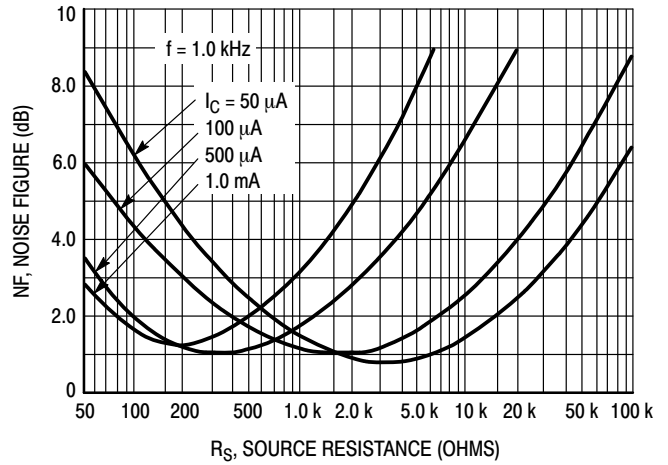


Figure 8. Source Resistance Effects

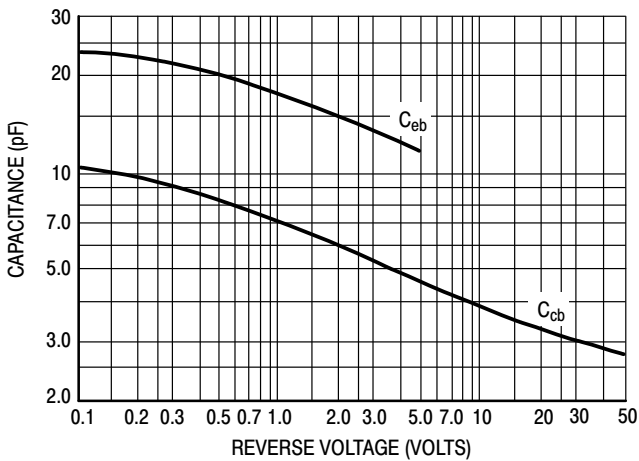


Figure 9. Capacitances

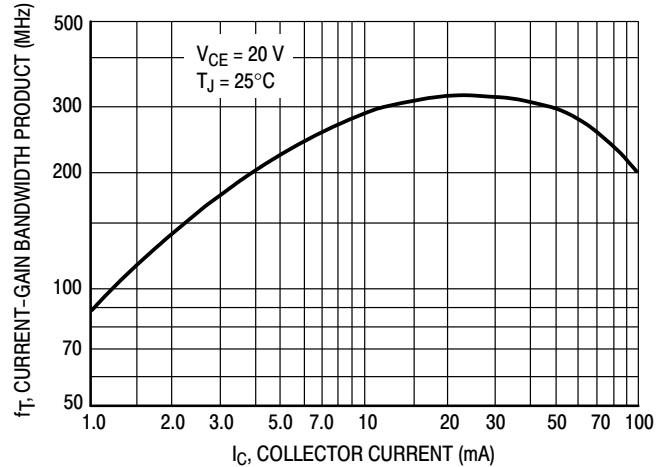
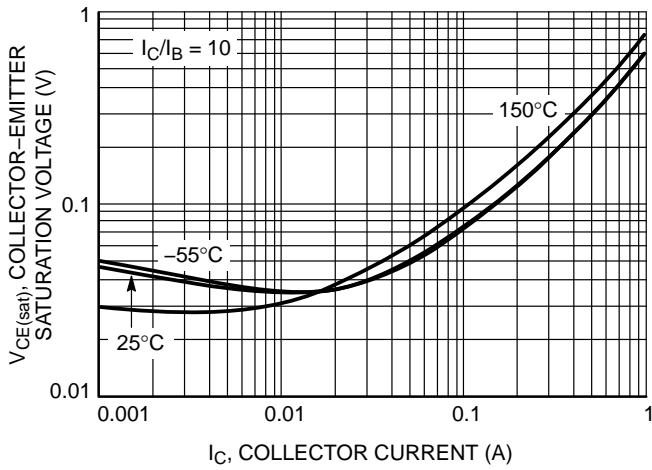
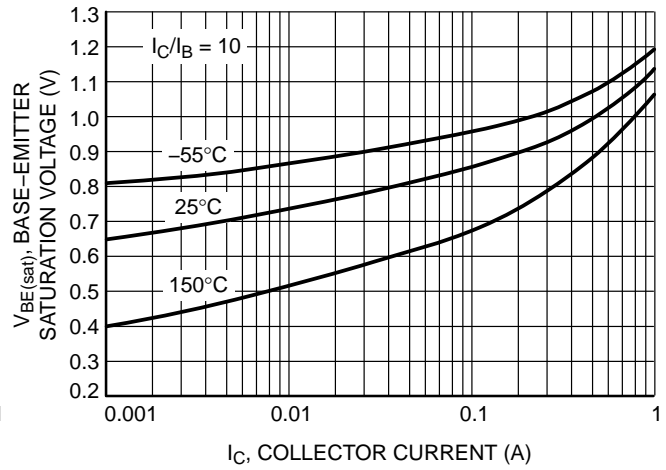


Figure 10. Current-Gain Bandwidth Product

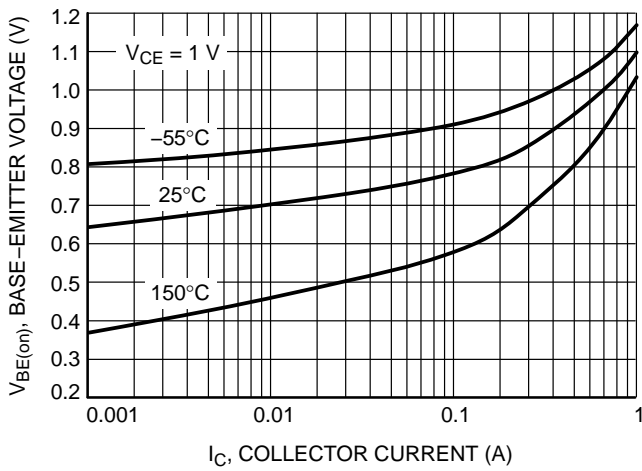
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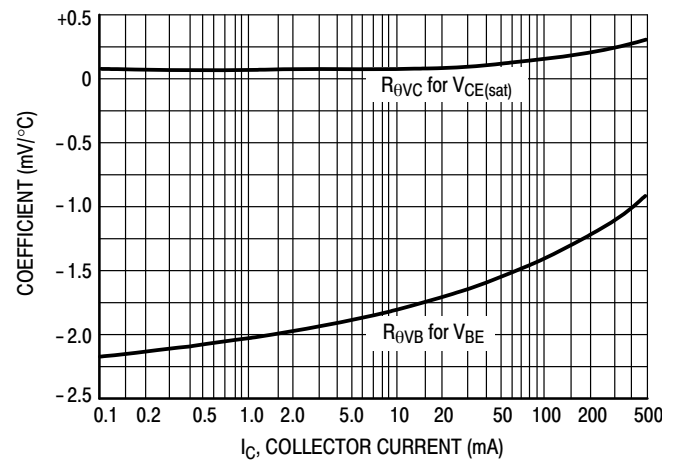
**Figure 11. Collector Emitter Saturation Voltage vs. Collector Current**



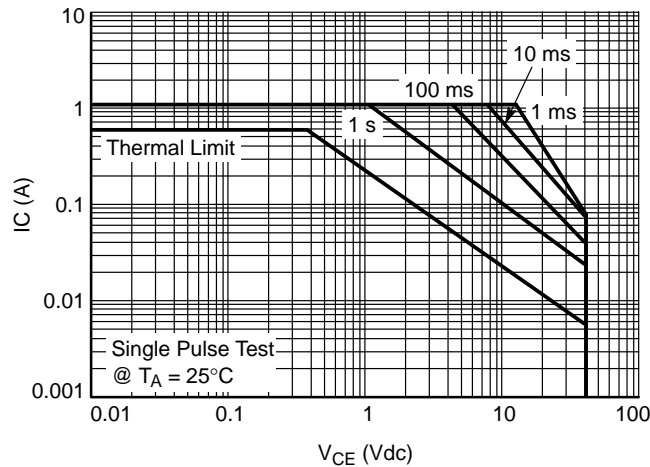
**Figure 12. Base Emitter Saturation Voltage vs. Collector Current**



**Figure 13. Base Emitter Voltage vs. Collector Current**



**Figure 14. Temperature Coefficients**

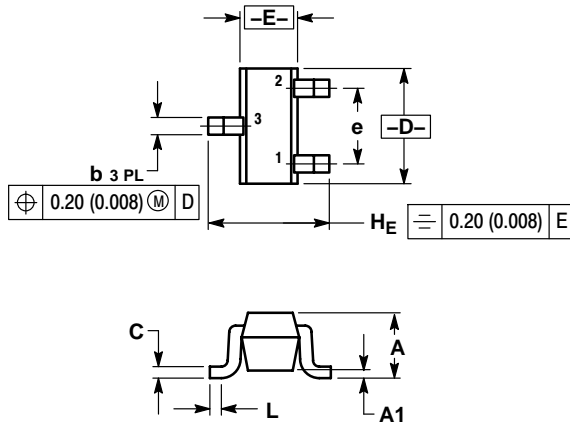


**Figure 15. Safe Operating Area**

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## PACKAGE DIMENSIONS

SC-75/SOT-416  
CASE 463  
ISSUE G



### NOTES:

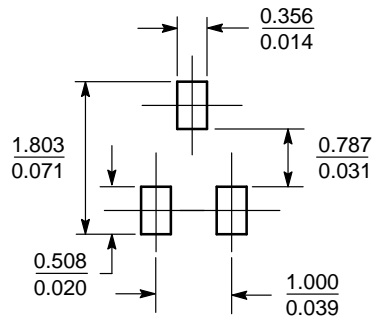
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	0.80	0.90	0.027	0.031	0.035
A1	0.00	0.05	0.10	0.000	0.002	0.004
b	0.15	0.20	0.30	0.006	0.008	0.012
C	0.10	0.15	0.25	0.004	0.006	0.010
D	1.55	1.60	1.65	0.061	0.063	0.065
E	0.70	0.80	0.90	0.027	0.031	0.035
e	1.00 BSC			0.04 BSC		
L	0.10	0.15	0.20	0.004	0.006	0.008
H <sub>E</sub>	1.50	1.60	1.70	0.060	0.063	0.067

### STYLE 1:

1. BASE
2. EMITTER
3. COLLECTOR

### SOLDERING FOOTPRINT\*



SCALE 10:1 ( $\frac{\text{mm}}{\text{inches}}$ )

\*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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