General Purpose Transistor

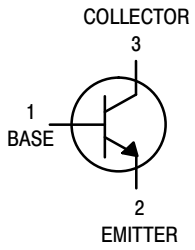
NPN Silicon

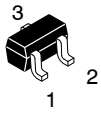
MMBT2222ATT1G, NSVMMBT2222ATT1G

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

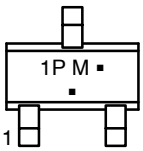
- NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant





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)

MAXIMUM RATINGS (T_A = 25°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°C	P_D	150	mW
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	833	°C/W
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	°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.

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.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector – Emitter Breakdown Voltage (Note 1) (I_C = 10 mAdc, I_B = 0)		$V_{(BR)CEO}$	40	–	Vdc
Collector – Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)		$V_{(BR)CBO}$	75	–	Vdc
Emitter – Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)		$V_{(BR)EBO}$	6.0	–	Vdc
Base Cutoff Current (V_{CE} = 60 Vdc, V_{EB} = 3.0 Vdc)		I_{BL}	–	20	nAdc
Collector Cutoff Current (V_{CE} = 60 Vdc, V_{EB} = 3.0 Vdc)		I_{CEX}	–	10	nAdc
ON CHARACTERISTICS (Note 2)					
DC Current Gain		H_{FE}			–
(I_C = 0.1 mAdc, V_{CE} = 10 Vdc)			35	–	
(I_C = 1.0 mAdc, V_{CE} = 10 Vdc)			50	–	
(I_C = 10 mAdc, V_{CE} = 10 Vdc)			75	–	
(I_C = 150 mAdc, V_{CE} = 10 Vdc)			100	–	
(I_C = 500 mAdc, V_{CE} = 10 Vdc)			40	–	
Collector – Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 150 mAdc, I_B = 15 mAdc)			–	0.3	
(I_C = 500 mAdc, I_B = 50 mAdc)			–	1.0	
Base – Emitter Saturation Voltage		$V_{BE(sat)}$			Vdc
(I_C = 150 mAdc, I_B = 15 mAdc)			0.6	1.2	
(I_C = 500 mAdc, I_B = 50 mAdc)			–	2.0	
SMALL– SIGNAL CHARACTERISTICS					
Current – Gain – Bandwidth Product (I_C = 20 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)		f_T	300	–	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)		C_{obo}	–	8.0	pF
Input Capacitance (V_{EB} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)		C_{ibo}	–	30	pF
Input Impedance (V_{CE} = 10 Vdc, I_C = 10 mAdc, f = 1.0 kHz)		h_{ie}	0.25	1.25	kΩ
Voltage Feedback Ratio (V_{CE} = 10 Vdc, I_C = 10 mAdc, f = 1.0 kHz)		h_{re}	–	4.0	X 10^{-4}
Small – Signal Current Gain (V_{CE} = 10 Vdc, I_C = 10 mAdc, f = 1.0 kHz)		h_{fe}	75	375	–
Output Admittance (V_{CE} = 10 Vdc, I_C = 10 mAdc, f = 1.0 kHz)		h_{oe}	25	200	μmhos
Noise Figure (V_{CE} = 10 Vdc, I_C = 100 μAdc, R_S = 1.0 k ohms, f = 1.0 kHz)		NF	–	4.0	dB
SWITCHING CHARACTERISTICS					
Delay Time	(V_{CC} = 3.0 Vdc, V_{BE} = – 0.5 Vdc, I_C = 150 mAdc, I_{B1} = 15 mAdc)	t_d	–	10	ns
Rise Time		t_r	–	25	
Storage Time	(V_{CC} = 30 Vdc, I_C = 150 mAdc, I_{B1} = I_{B2} = 15 mAdc)	t_s	–	225	ns
Fall Time		t_f	–	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%.

SWITCHING TIME EQUIVALENT TEST CIRCUITS

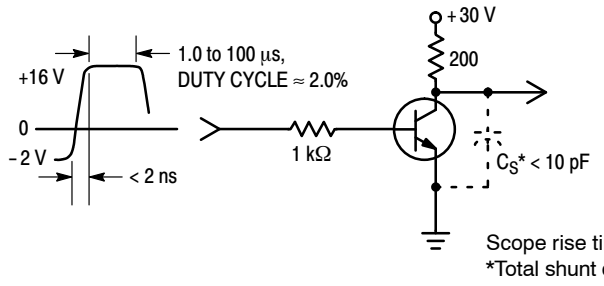


Figure 1. Turn−On Time

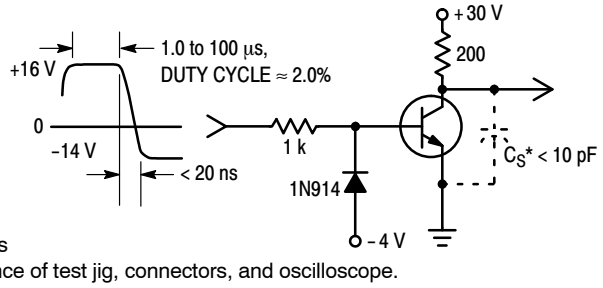


Figure 2. Turn−Off Time

Scope rise time < 4 ns
*Total shunt capacitance of test jig, connectors, and oscilloscope.

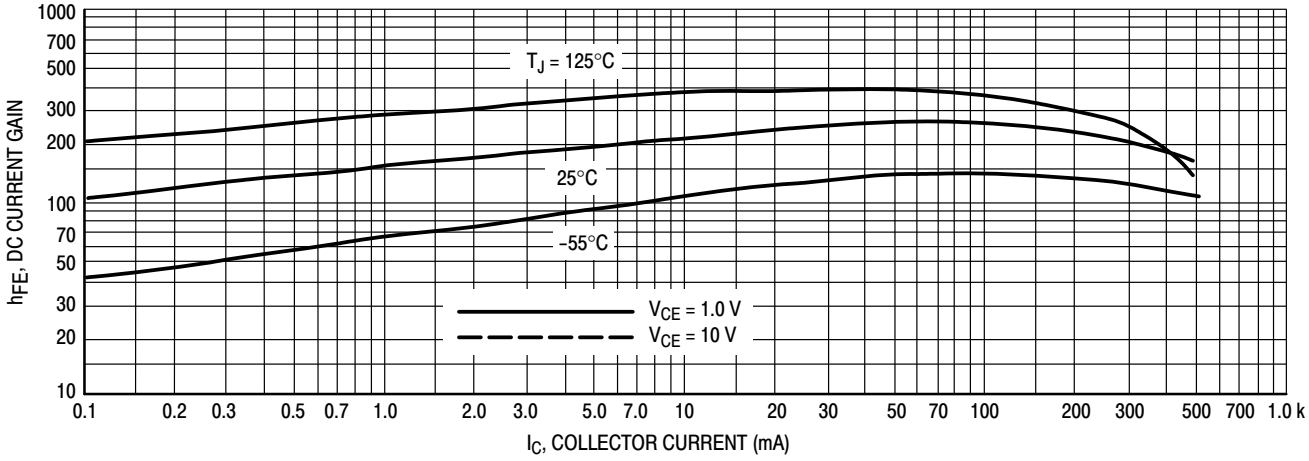


Figure 3. DC Current Gain

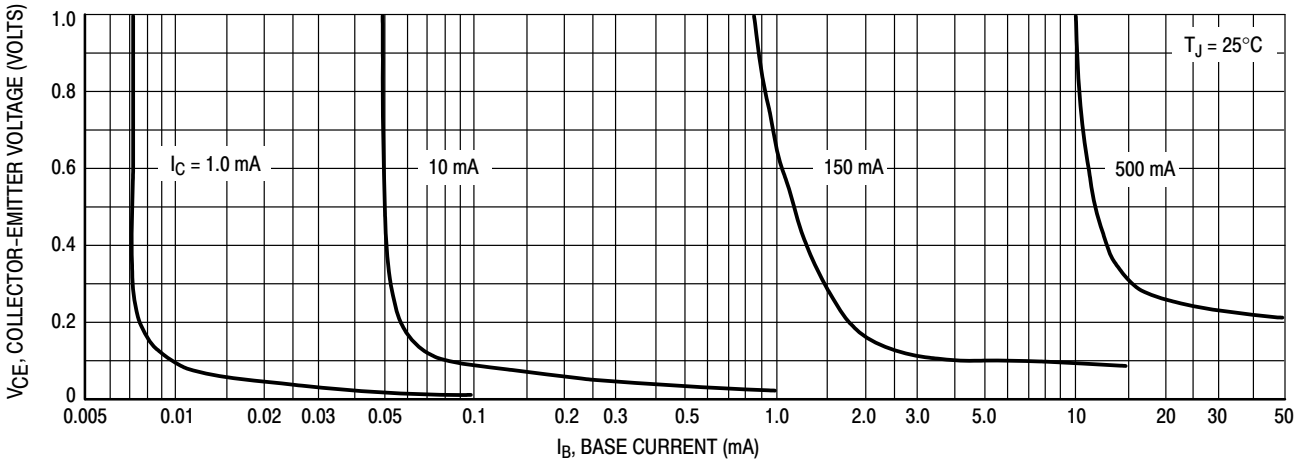


Figure 4. Collector Saturation Region

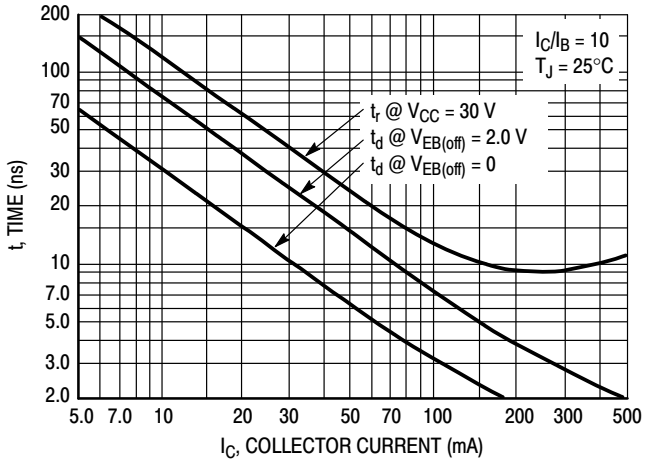


Figure 5. Turn−On Time

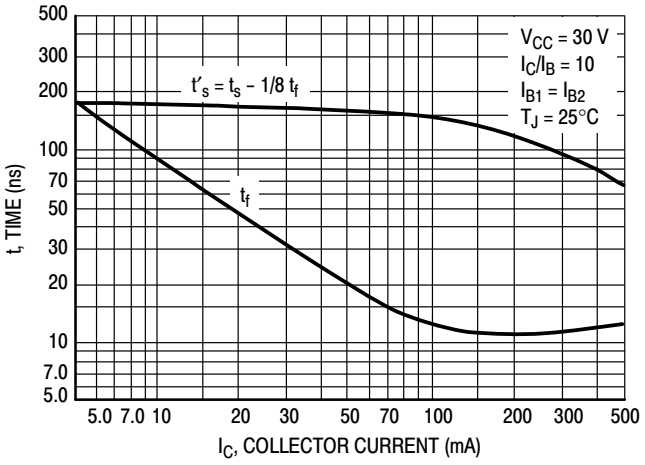


Figure 6. Turn−Off Time

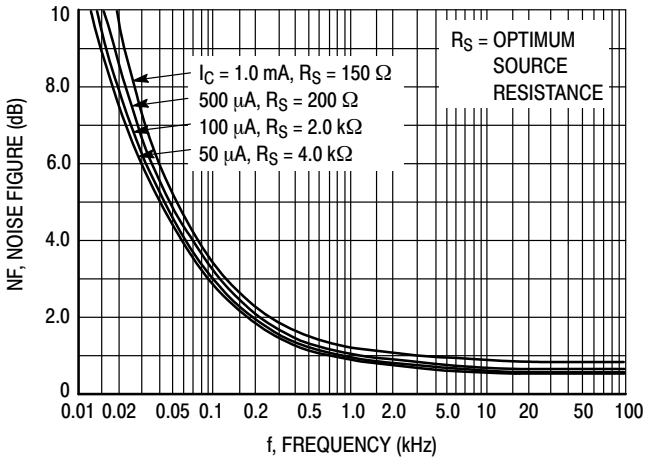


Figure 7. Frequency Effects

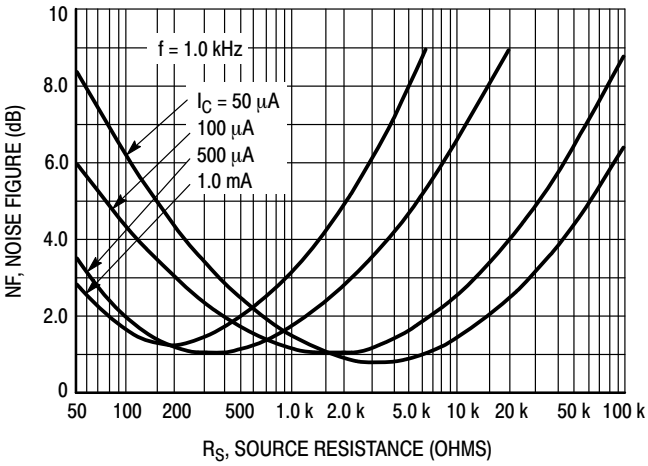


Figure 8. Source Resistance Effects

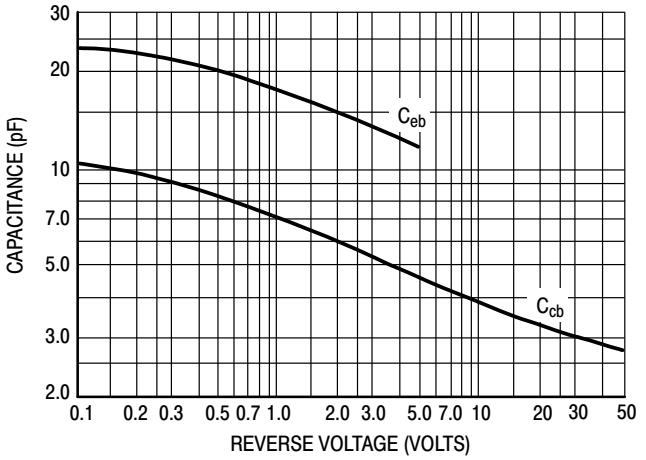


Figure 9. Capacitances

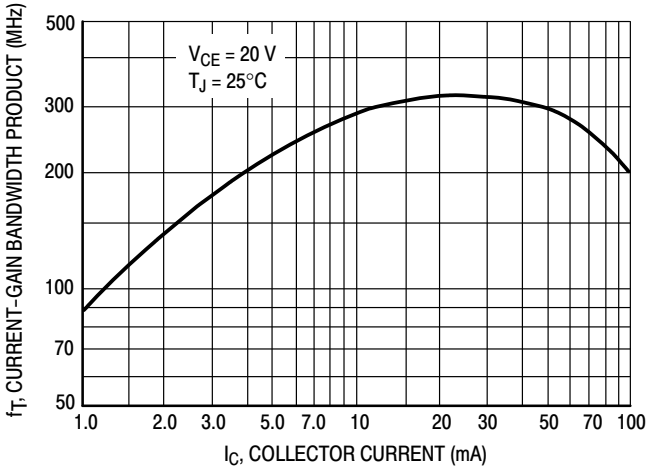


Figure 10. Current−Gain Bandwidth Product

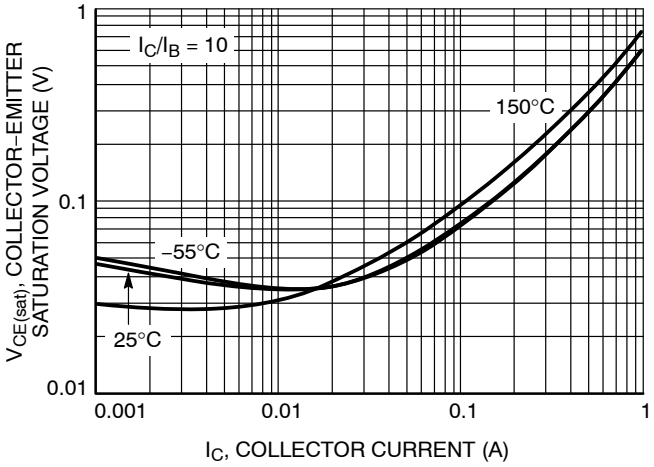


Figure 11. Collector Emitter Saturation Voltage vs. Collector Current

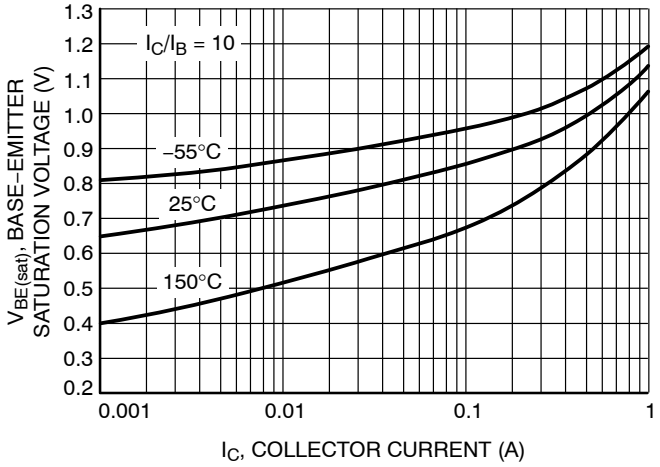


Figure 12. Base Emitter Saturation Voltage vs. Collector Current

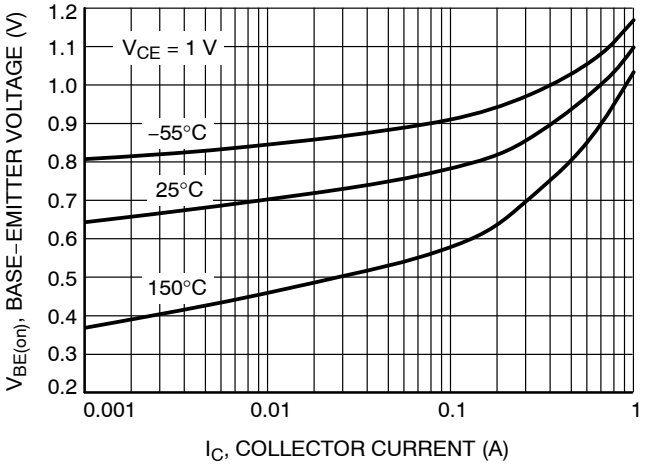


Figure 13. Base Emitter Voltage vs. Collector Current

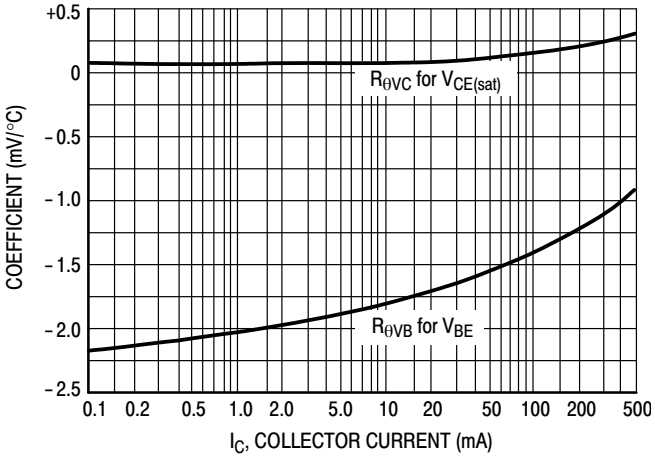


Figure 14. Temperature Coefficients

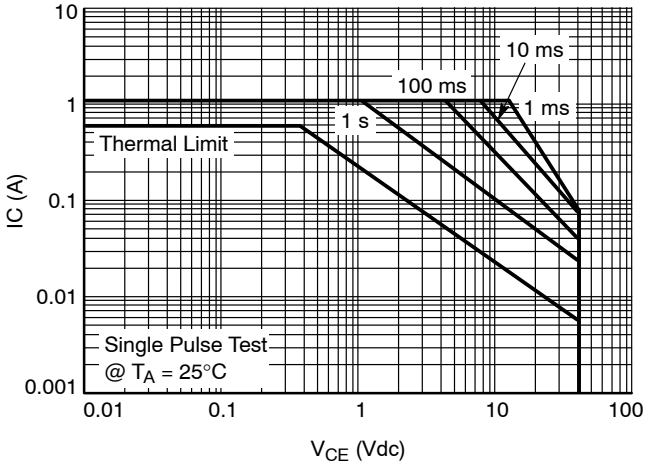
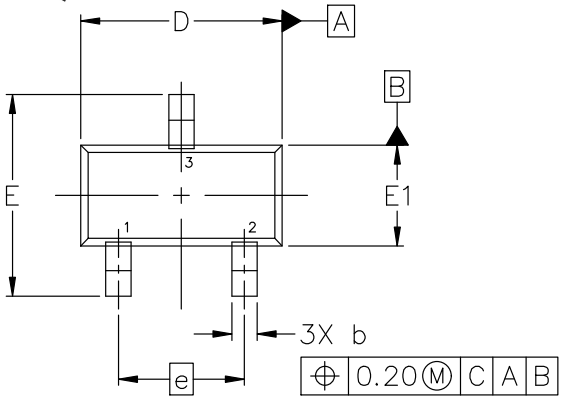


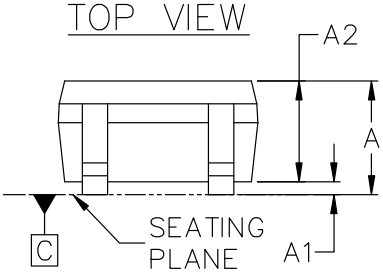
Figure 15. Safe Operating Area

SC75−3 1.60x0.80x0.80, 1.00P
CASE 463
ISSUE H

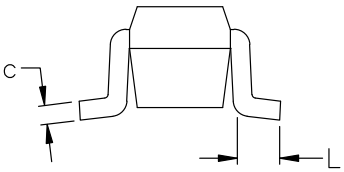
DATE 01 FEB 2024



TOP VIEW



SIDE VIEW



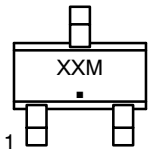
END VIEW

NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5−2018.
2. ALL DIMENSION ARE IN MILLIMETERS.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.70	0.80	0.90
A1	0.00	0.05	0.10
A2		0.80 REF.	
b	0.15	0.20	0.30
c	0.10	0.15	0.25
D	1.55	1.60	1.65
E	1.50	1.60	1.70
E1	0.70	0.80	0.90
e		1.00 BSC	
L	0.10	0.15	0.20

GENERIC
MARKING DIAGRAM*



XX = 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.

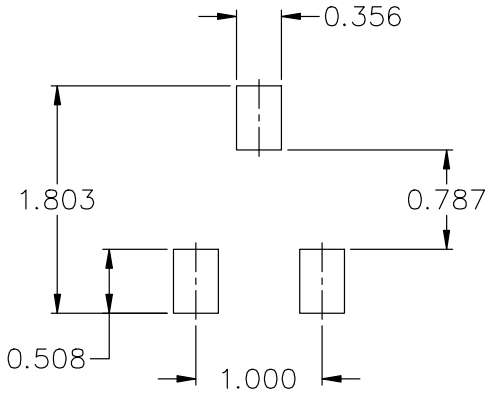
STYLE 1:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 2:
PIN 1. ANODE
2. N/C
3. CATHODE

STYLE 3:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 4:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 5:
PIN 1. GATE
2. SOURCE
3. DRAIN



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.

DOCUMENT NUMBER:	**98ASB15184C**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.	
DESCRIPTION:	**SC75−3 1.60x0.80x0.80, 1.00P**		**PAGE 1 OF 1**

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