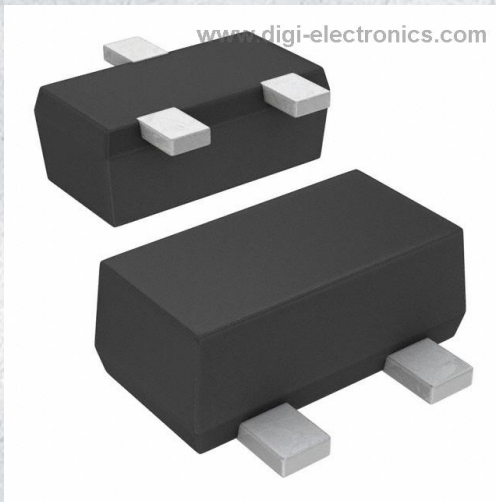


# MMBT2222AT Datasheet



<https://www.DiGi-Electronics.com>

DiGi Electronics Part Number	MMBT2222AT-DG
Manufacturer	<a href="#">onsemi</a>
Manufacturer Product Number	MMBT2222AT
Description	TRANS NPN 40V 0.6A SC89-3
Detailed Description	Bipolar (BJT) Transistor NPN 40 V 600 mA 300MHz 2 50 mW Surface Mount SC-89-3



Tel: +00 852-30501935

RFQ Email: [Info@DiGi-Electronics.com](mailto:Info@DiGi-Electronics.com)

DiGi is a global authorized distributor of electronic components.

## Purchase and inquiry

Manufacturer Product Number:

MMBT2222AT

Series:

-

Transistor Type:

NPN

Voltage - Collector Emitter Breakdown (Max):

40 V

Current - Collector Cutoff (Max):

-

Power - Max:

250 mW

Operating Temperature:

150°C (TJ)

Package / Case:

SC-89, SOT-490

Base Product Number:

MMBT2222

Manufacturer:

onsemi

Product Status:

Obsolete

Current - Collector (Ic) (Max):

600 mA

Vce Saturation (Max) @ Ib, Ic:

1V @ 50mA, 500mA

DC Current Gain (hFE) (Min) @ Ic, Vce:

100 @ 150mA, 1V

Frequency - Transition:

300MHz

Mounting Type:

Surface Mount

Supplier Device Package:

SC-89-3

## Environmental & Export classification

RoHS Status:

ROHS3 Compliant

REACH Status:

REACH Unaffected

HTSUS:

8541.21.0075

Moisture Sensitivity Level (MSL):

1 (Unlimited)

ECCN:

EAR99

# 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

#### MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

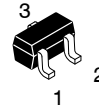
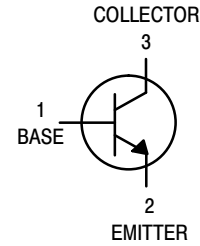
Rating	Symbol	Max	Unit
Collector-Emitter Voltage	$V_{CEO}$	40	Vdc
Collector-Base Voltage	$V_{CBO}$	75	Vdc
Emitter-Base Voltage	$V_{EBO}$	6.0	Vdc
Collector Current - Continuous	$I_C$	600	mAdc

#### 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	$^\circ\text{C}$

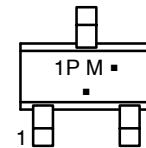
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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



**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 <sup>†</sup>
MMBT2222ATT1G	SOT-416 (Pb-Free)	3000 / Tape & Reel
NSVMMBT2222ATT1G	SOT-416 (Pb-Free)	3000 / Tape & Reel

<sup>†</sup>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.

**MMBT2222ATT1G, NSVMMBT2222ATT1G****ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector – Emitter Breakdown Voltage (Note 1) ( $I_C = 10\text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	40	–	Vdc
Collector – Base Breakdown Voltage ( $I_C = 10\ \mu\text{Adc}$ , $I_E = 0$ )	$V_{(BR)CBO}$	75	–	Vdc
Emitter – Base Breakdown Voltage ( $I_E = 10\ \mu\text{Adc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	6.0	–	Vdc
Base Cutoff Current ( $V_{CE} = 60\text{ Vdc}$ , $V_{EB} = 3.0\text{ Vdc}$ )	$I_{BL}$	–	20	nAdc
Collector Cutoff Current ( $V_{CE} = 60\text{ Vdc}$ , $V_{EB} = 3.0\text{ Vdc}$ )	$I_{CEX}$	–	10	nAdc

**ON CHARACTERISTICS** (Note 2)

DC Current Gain ( $I_C = 0.1\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 150\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 500\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )	$H_{FE}$	35 50 75 100 40	– – – – –	–
Collector – Emitter Saturation Voltage ( $I_C = 150\text{ mAdc}$ , $I_B = 15\text{ mAdc}$ ) ( $I_C = 500\text{ mAdc}$ , $I_B = 50\text{ mAdc}$ )	$V_{CE(sat)}$	– –	0.3 1.0	Vdc
Base – Emitter Saturation Voltage ( $I_C = 150\text{ mAdc}$ , $I_B = 15\text{ mAdc}$ ) ( $I_C = 500\text{ mAdc}$ , $I_B = 50\text{ mAdc}$ )	$V_{BE(sat)}$	0.6 –	1.2 2.0	Vdc

**SMALL-SIGNAL CHARACTERISTICS**

Current – Gain – Bandwidth Product ( $I_C = 20\text{ mAdc}$ , $V_{CE} = 20\text{ Vdc}$ , $f = 100\text{ MHz}$ )	$f_T$	300	–	MHz
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{obo}$	–	8.0	pF
Input Capacitance ( $V_{EB} = 0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )	$C_{ibo}$	–	30	pF
Input Impedance ( $V_{CE} = 10\text{ Vdc}$ , $I_C = 10\text{ mAdc}$ , $f = 1.0\text{ kHz}$ )	$h_{ie}$	0.25	1.25	$k\Omega$
Voltage Feedback Ratio ( $V_{CE} = 10\text{ Vdc}$ , $I_C = 10\text{ mAdc}$ , $f = 1.0\text{ kHz}$ )	$h_{re}$	–	4.0	$\times 10^{-4}$
Small – Signal Current Gain ( $V_{CE} = 10\text{ Vdc}$ , $I_C = 10\text{ mAdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	75	375	–
Output Admittance ( $V_{CE} = 10\text{ Vdc}$ , $I_C = 10\text{ mAdc}$ , $f = 1.0\text{ kHz}$ )	$h_{oe}$	25	200	$\mu\text{mos}$
Noise Figure ( $V_{CE} = 10\text{ Vdc}$ , $I_C = 100\ \mu\text{Adc}$ , $R_S = 1.0\text{ k ohms}$ , $f = 1.0\text{ kHz}$ )	NF	–	4.0	dB

**SWITCHING CHARACTERISTICS**

Delay Time	$(V_{CC} = 3.0\text{ Vdc}$ , $V_{BE} = -0.5\text{ Vdc}$ , $I_C = 150\text{ mAdc}$ , $I_{B1} = 15\text{ mAdc}$ )	$t_d$	–	10	ns
Rise Time		$t_r$	–	25	
Storage Time	$(V_{CC} = 30\text{ Vdc}$ , $I_C = 150\text{ mAdc}$ , $I_{B1} = I_{B2} = 15\text{ mAdc}$ )	$t_s$	–	225	ns
Fall Time		$t_f$	–	60	

- Device mounted on FR4 glass epoxy printed circuit board using the minimum recommended footprint.
- Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

# MMBT2222ATT1G, NSVMMBT2222ATT1G

## SWITCHING TIME EQUIVALENT TEST CIRCUITS

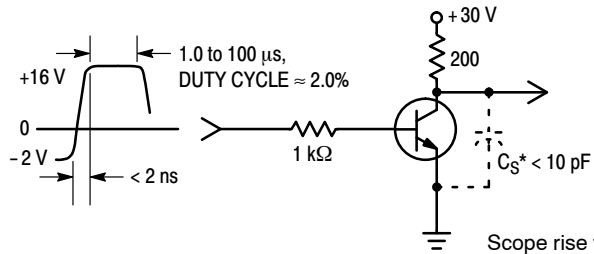


Figure 1. Turn-On Time

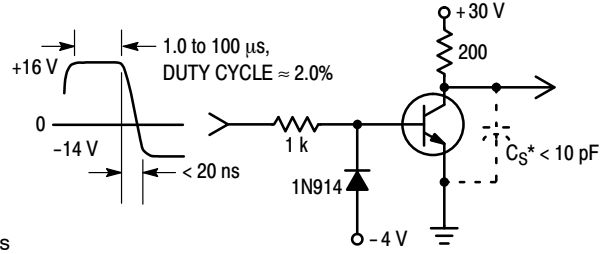


Figure 2. Turn-Off Time

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

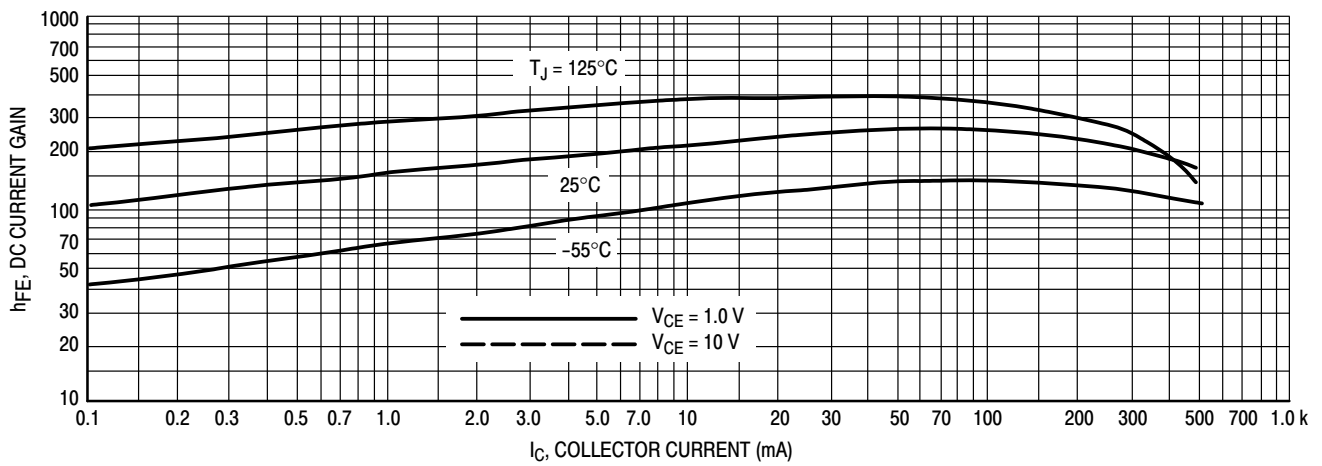


Figure 3. DC Current Gain

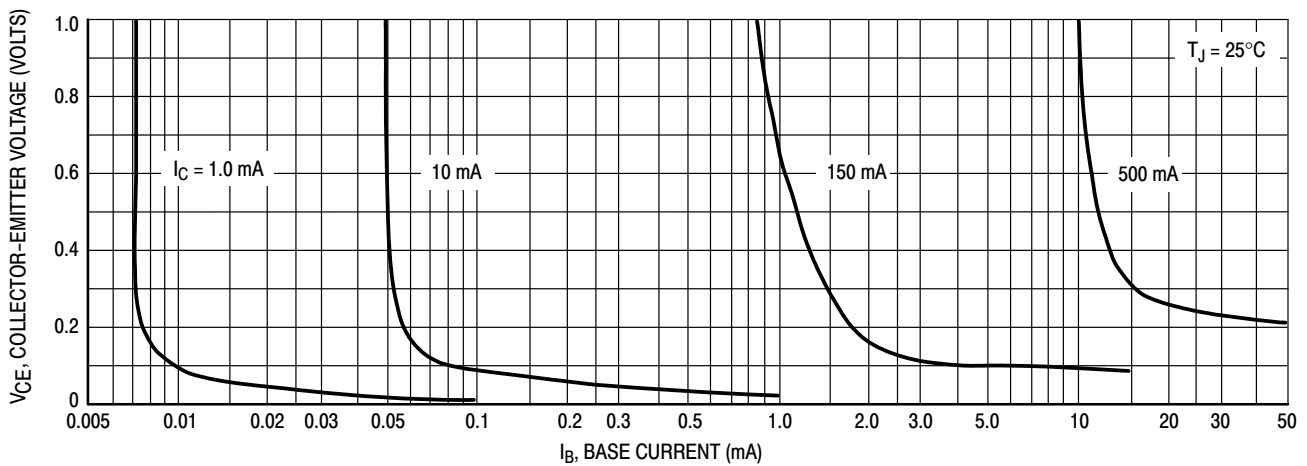


Figure 4. Collector Saturation Region

### MMBT2222ATT1G, NSVMMBT2222ATT1G

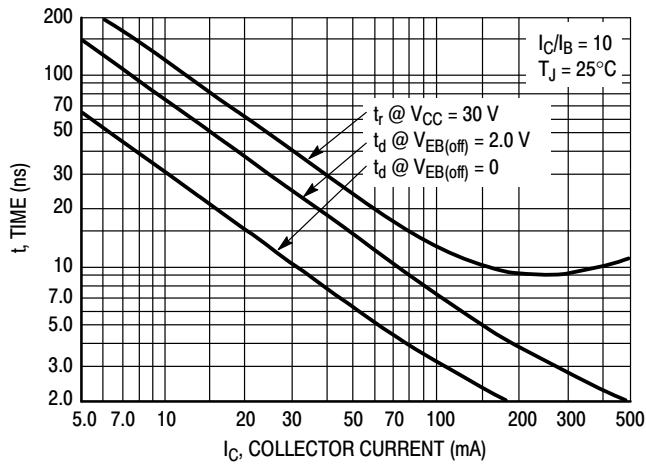


Figure 5. Turn-On Time

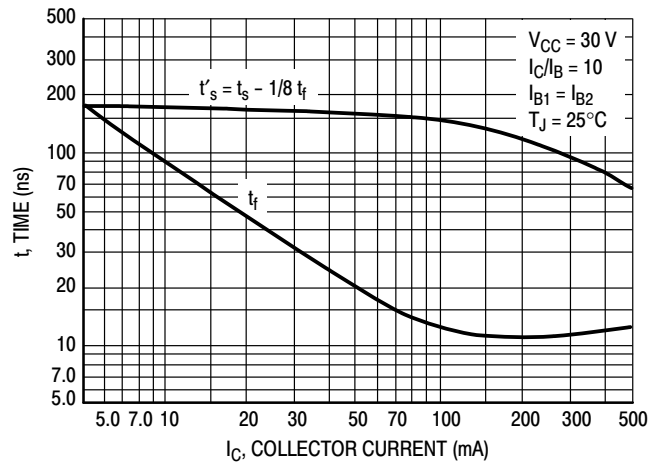


Figure 6. Turn-Off Time

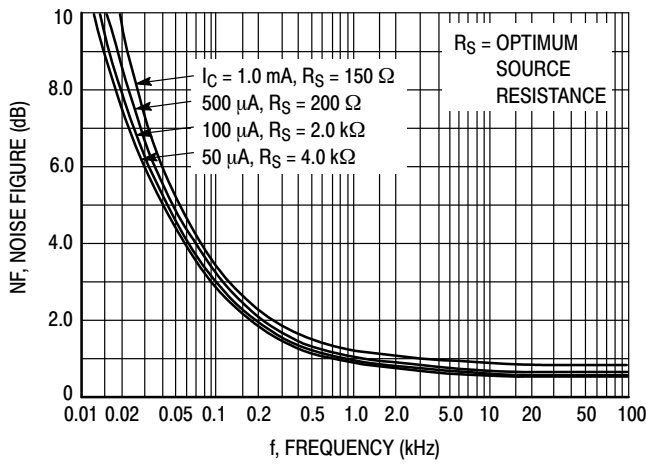


Figure 7. Frequency Effects

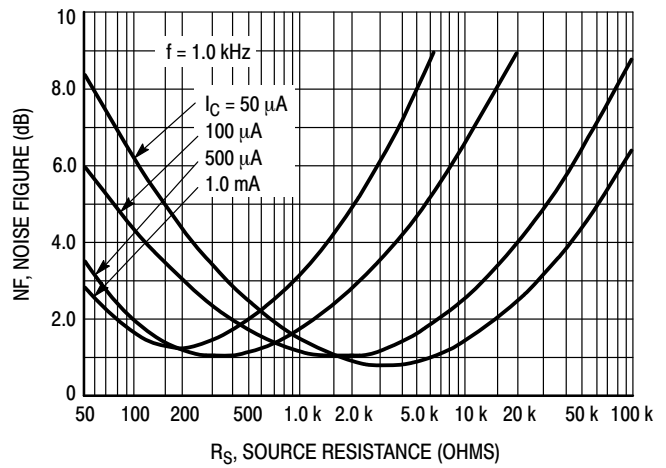


Figure 8. Source Resistance Effects

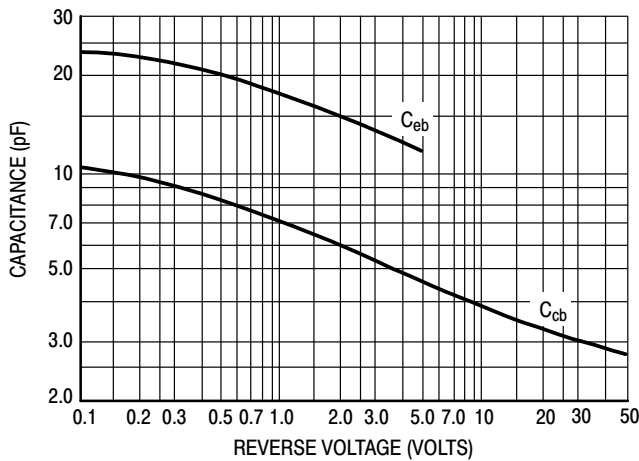


Figure 9. Capacitances

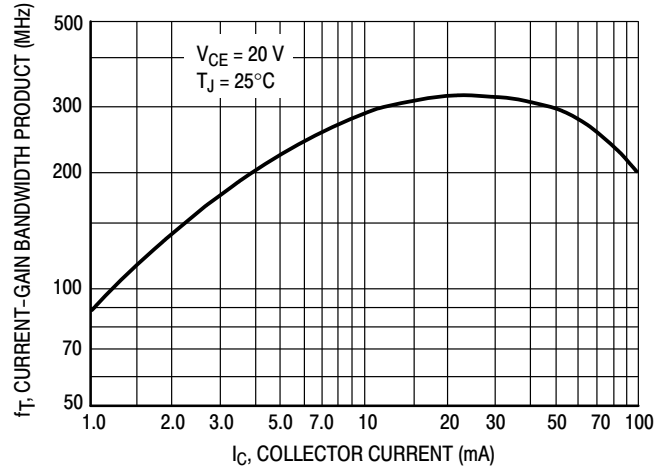
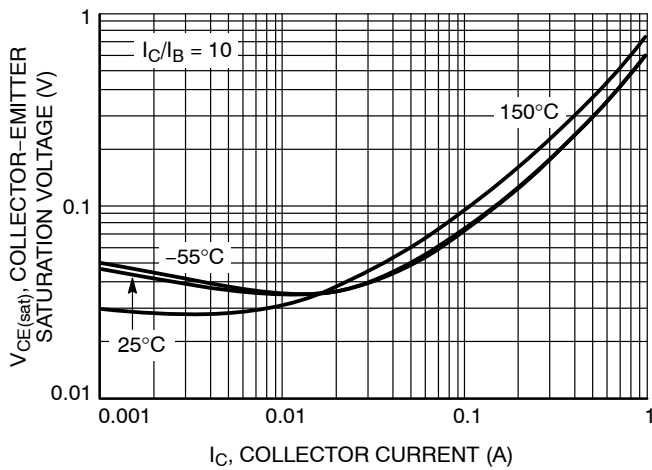
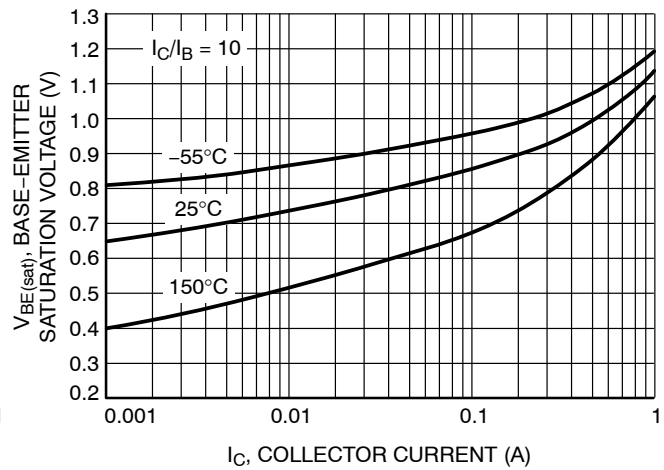


Figure 10. Current-Gain Bandwidth Product

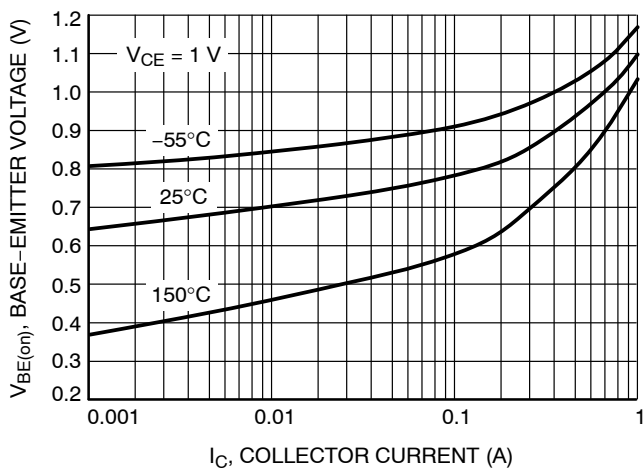
**MMBT2222ATT1G, NSVMMBT2222ATT1G**



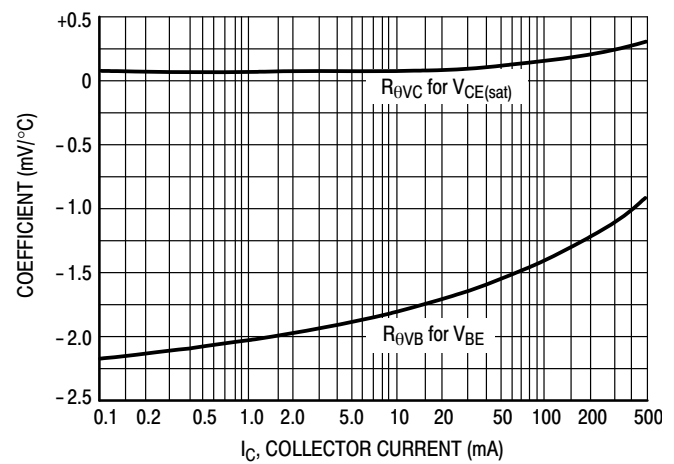
**Figure 11. Collector Emitter Saturation Voltage vs. Collector Current**



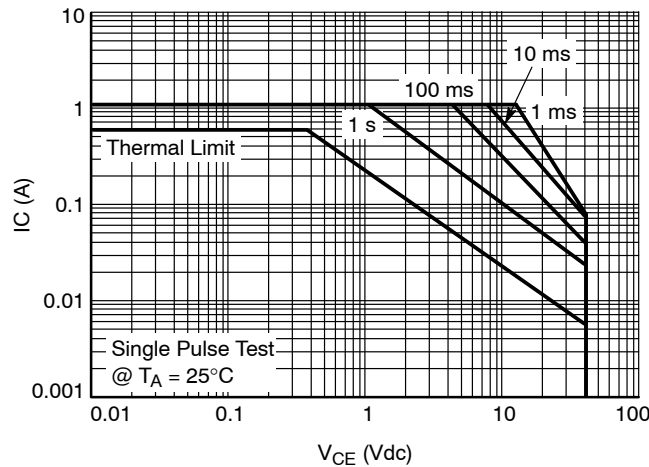
**Figure 12. Base Emitter Saturation Voltage vs. Collector Current**



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



**Figure 14. Temperature Coefficients**



**Figure 15. Safe Operating Area**



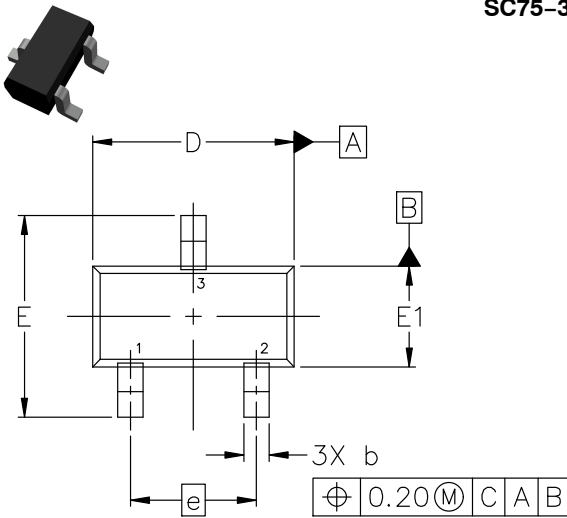
**MECHANICAL CASE OUTLINE  
PACKAGE DIMENSIONS**

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

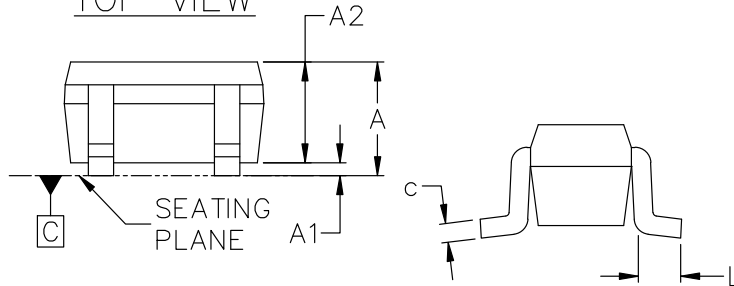
DATE 01 FEB 2024

NOTES:

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



TOP VIEW

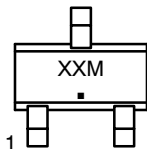


SIDE VIEW

END VIEW

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

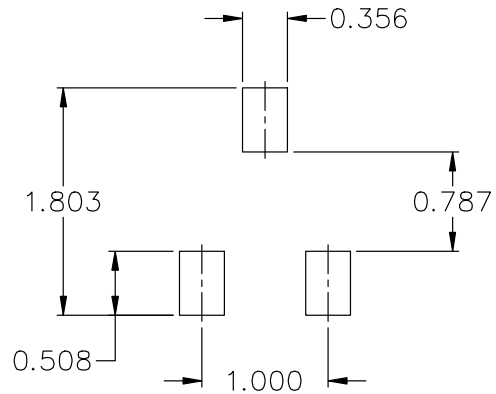
**GENERIC MARKING DIAGRAM\***



- 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.

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<b>DESCRIPTION:</b>	<b>SC75-3 1.60x0.80x0.80, 1.00P</b>	<b>PAGE 1 OF 1</b>

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