

General Purpose Transistor

NPN Silicon

MMBT2222AWT1G, SMMBT2222AWT1G

These transistors are designed for general purpose amplifier applications. They are housed in the SOT-323/SC-70 package which is designed for low power surface mount applications.

Features

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

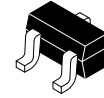
MAXIMUM RATINGS

Rating	Symbol	Value	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

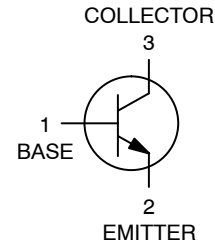
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board $T_A = 25^\circ\text{C}$	P_D	150	mW
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	280	$^\circ\text{C/W}$
Junction and Storage Temperature	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$

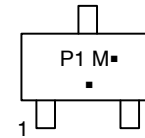
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



SC-70
CASE 419
STYLE 3



MARKING DIAGRAM



P1 = Specific Device Code
M = Date Code
■ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
MMBT2222AWT1G	SC-70 (Pb-Free)	3,000 / Tape & Reel
SMMBT2222AWT1G	SC-70 (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 Specification Brochure, BRD8011/D.

*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

MMBT2222AWT1G, SMMBT2222AWT1G

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 1)

DC Current Gain (Note 1) (I _C = 0.1 mAdc, V _{CE} = 10 Vdc) (I _C = 1.0 mAdc, V _{CE} = 10 Vdc) (I _C = 10 mAdc, V _{CE} = 10 Vdc) (I _C = 150 mAdc, V _{CE} = 10 Vdc) (I _C = 500 mAdc, V _{CE} = 10 Vdc)	H _{FE}	35 50 75 100 40	– – – 300 –	–
Collector – Emitter Saturation Voltage (Note 1) (I _C = 150 mAdc, I _B = 15 mAdc) (I _C = 500 mAdc, I _B = 50 mAdc)	V _{CE(sat)}	– –	0.3 1.0	Vdc
Base – Emitter Saturation Voltage (Note 1) (I _C = 150 mAdc, I _B = 15 mAdc) (I _C = 500 mAdc, I _B = 50 mAdc)	V _{BE(sat)}	0.6 –	1.2 2.0	Vdc

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 kΩ, 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	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

MMBT2222AWT1G, SMMBT2222AWT1G

SWITCHING TIME EQUIVALENT TEST CIRCUITS

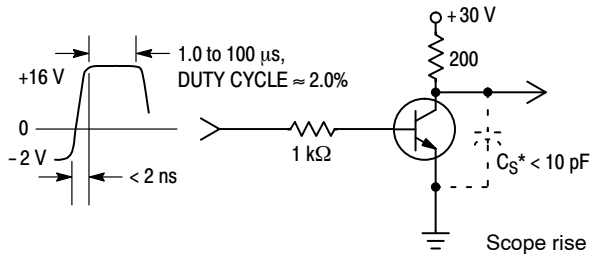


Figure 1. Turn-On Time

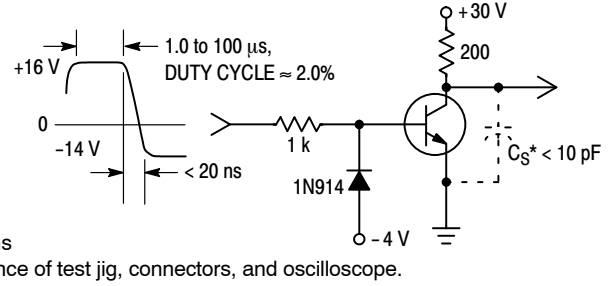


Figure 2. Turn-Off Time

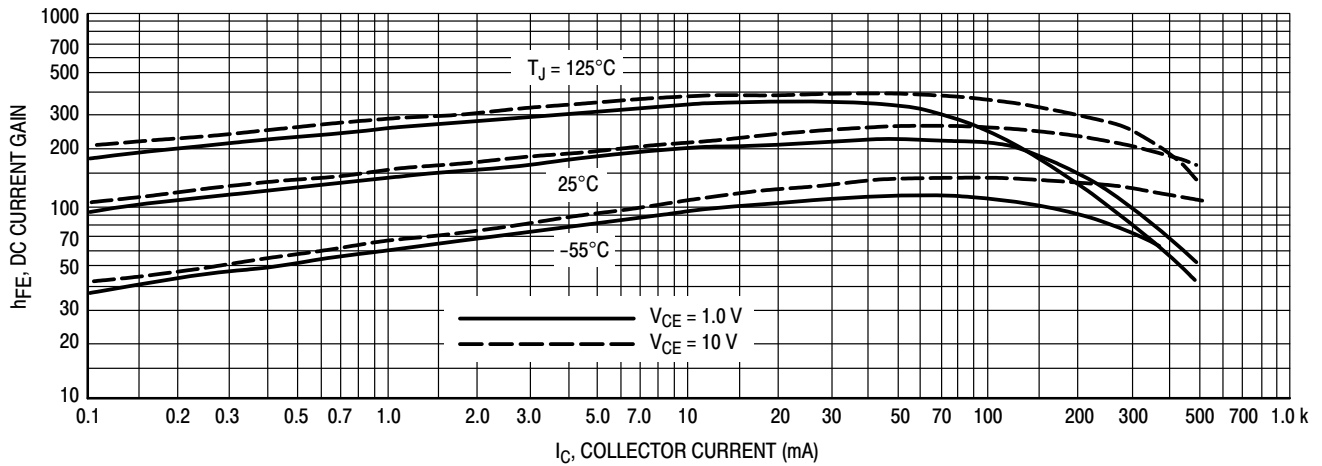


Figure 3. DC Current Gain

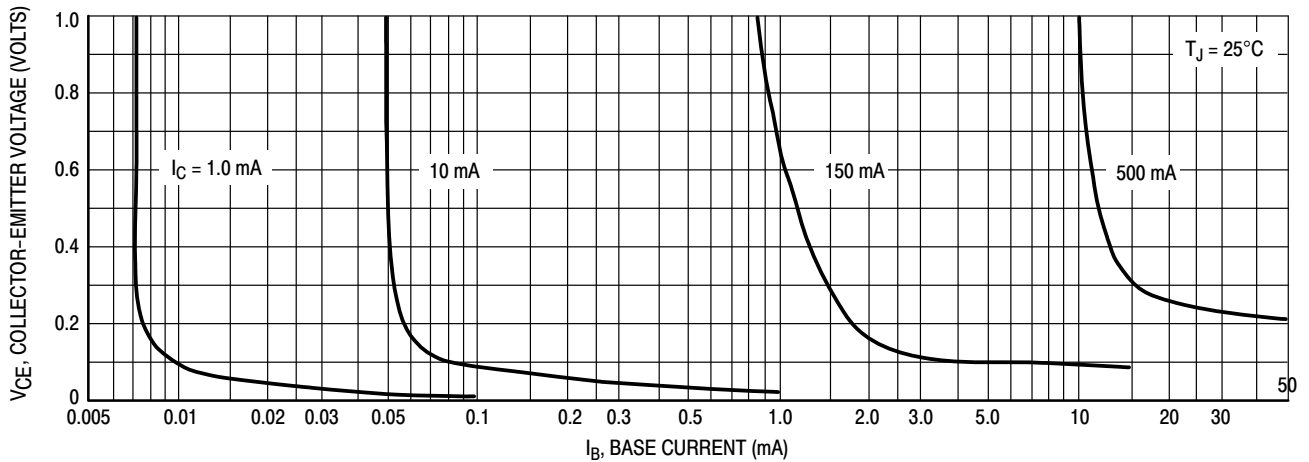


Figure 4. Collector Saturation Region

MMBT2222AWT1G, SMMBT2222AWT1G

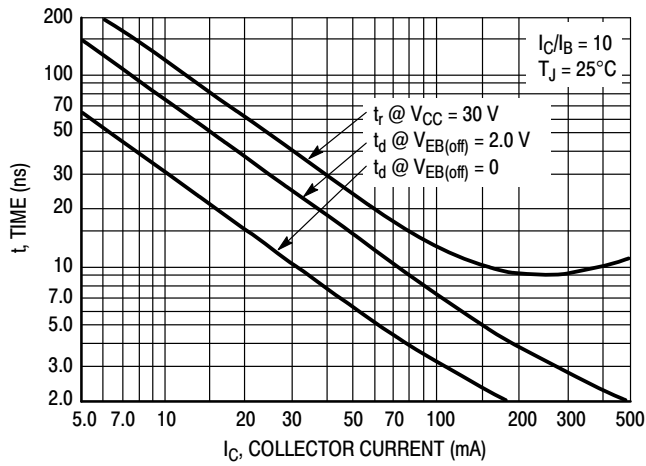


Figure 5. Turn-On Time

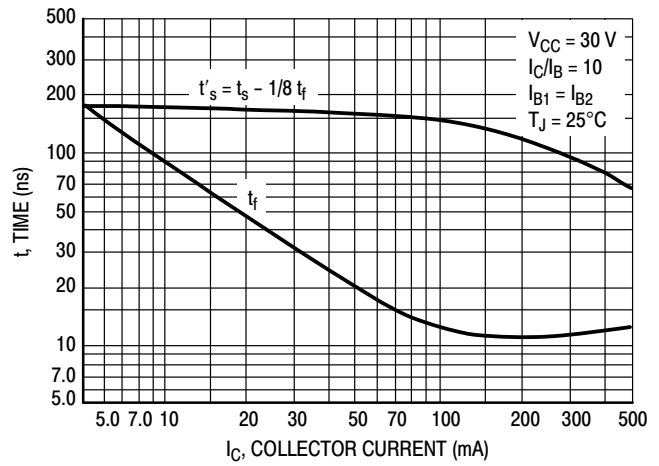


Figure 6. Turn-Off Time

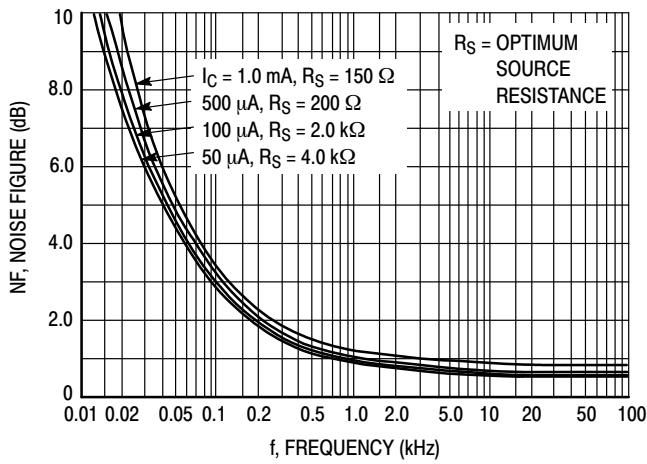


Figure 7. Frequency Effects

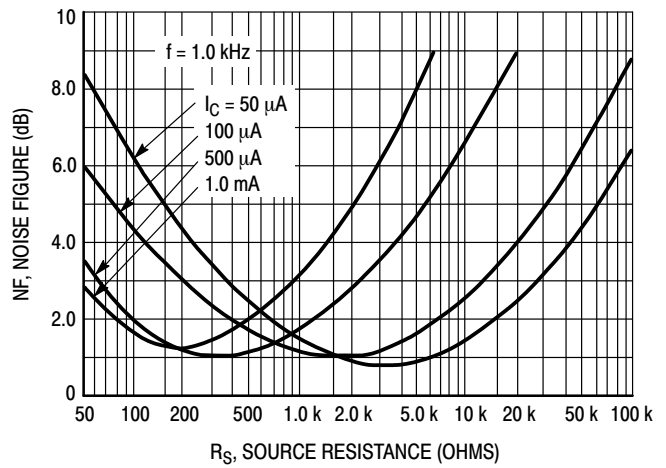


Figure 8. Source Resistance Effects

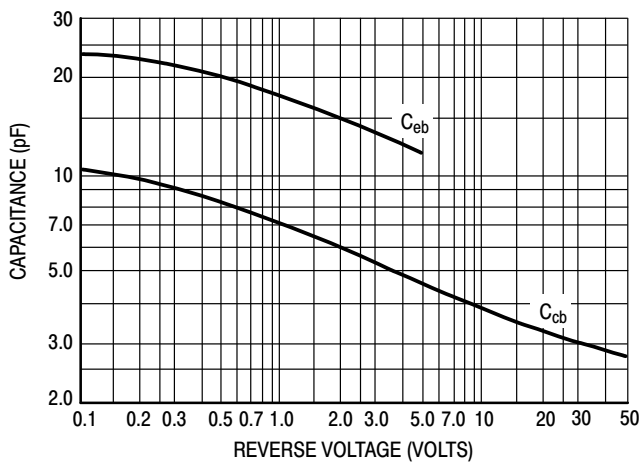


Figure 9. Capacitances

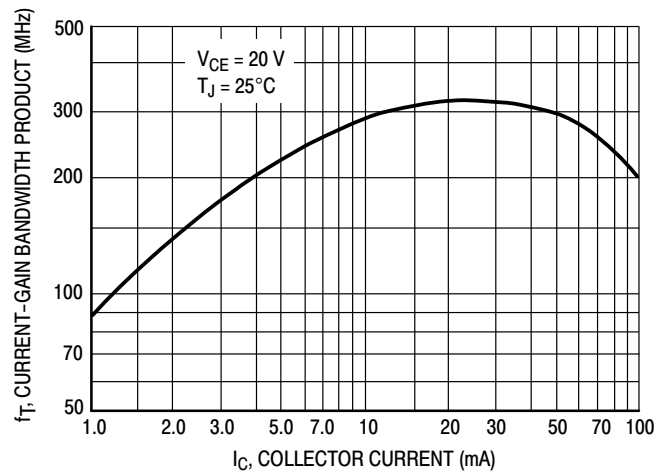


Figure 10. Current-Gain Bandwidth Product

MMBT2222AWT1G, SMMBT2222AWT1G

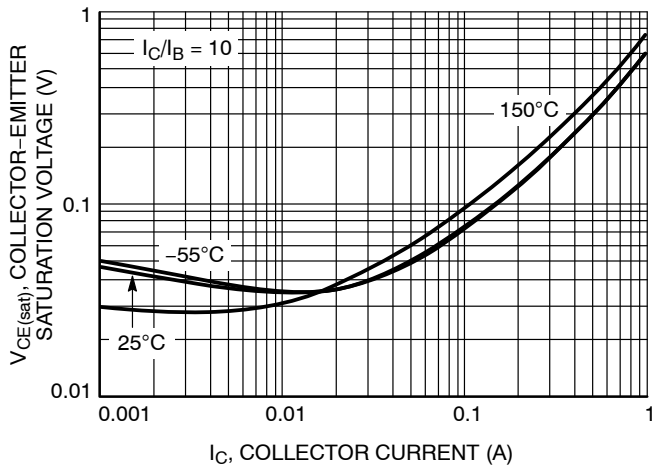


Figure 11. Collector Emitter Saturation Voltage vs. Collector Current

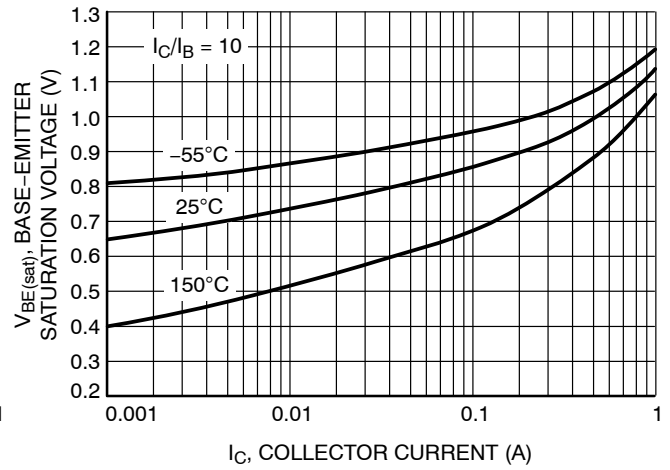


Figure 12. Base Emitter Saturation Voltage vs. Collector Current

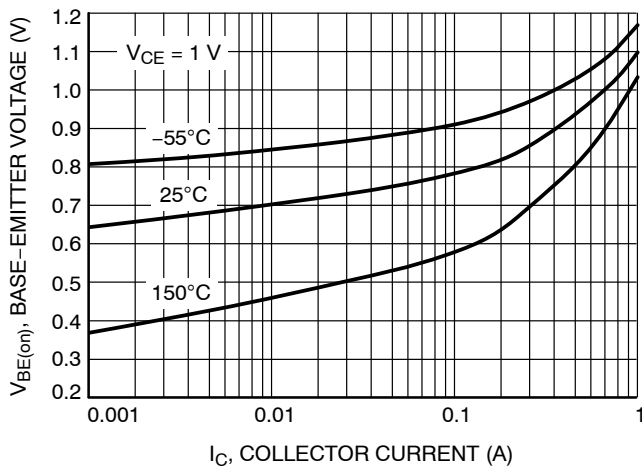


Figure 13. Base Emitter Voltage vs. Collector Current

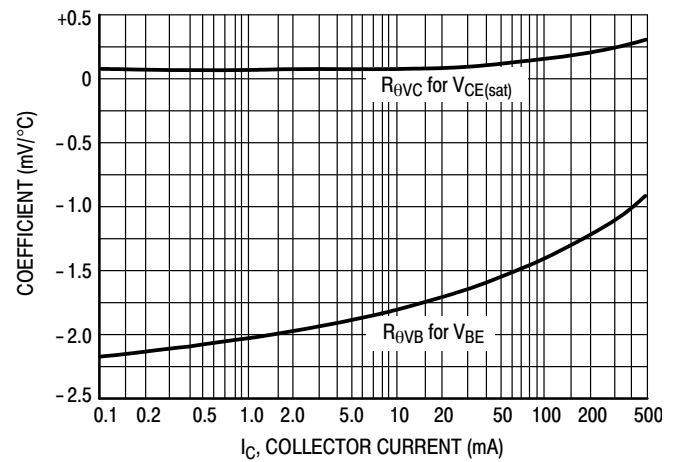


Figure 14. Temperature Coefficients

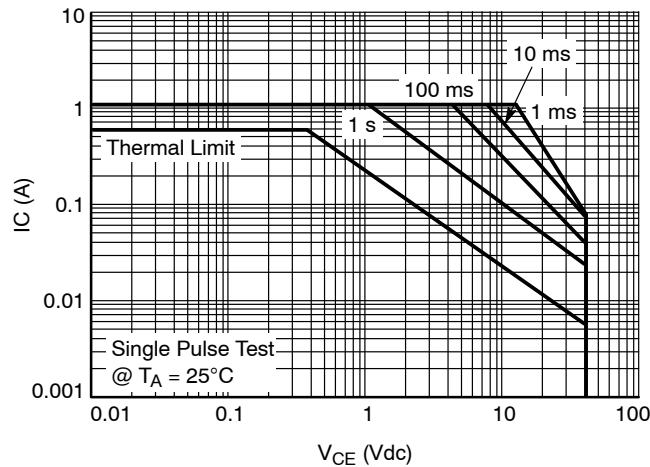
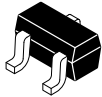


Figure 15. Safe Operating Area



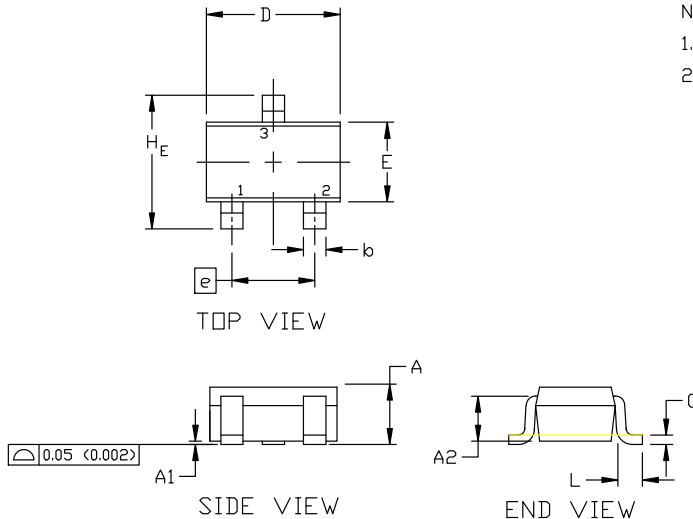
SCALE 4:1

SC-70 (SOT-323)
CASE 419
ISSUE R

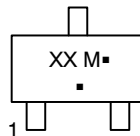
DATE 11 OCT 2022

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH

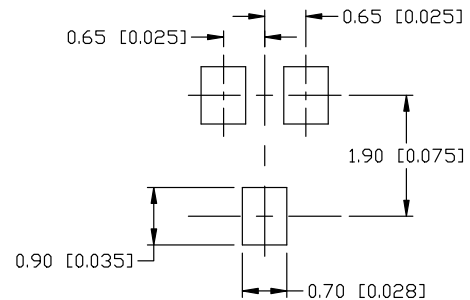


DIM	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.80	0.90	1.00	0.032	0.035	0.040
A1	0.00	0.05	0.10	0.000	0.002	0.004
A2	0.70 REF			0.028 BSC		
b	0.30	0.35	0.40	0.012	0.014	0.016
c	0.10	0.18	0.25	0.004	0.007	0.010
D	1.80	2.00	2.20	0.071	0.080	0.087
E	1.15	1.24	1.35	0.045	0.049	0.053
e	1.20	1.30	1.40	0.047	0.051	0.055
e1	0.65 BSC			0.026 BSC		
L	0.20	0.38	0.56	0.008	0.015	0.022
H _E	2.00	2.10	2.40	0.079	0.083	0.095

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.



* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

SOLDERING FOOTPRINT

STYLE 1:
CANCELLED

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

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

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

STYLE 5:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 6:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 7:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 8:
PIN 1. GATE
2. SOURCE
3. DRAIN

STYLE 9:
PIN 1. ANODE
2. CATHODE
3. CATHODE-ANODE

STYLE 10:
PIN 1. CATHODE
2. ANODE
3. ANODE-CATHODE

STYLE 11:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

DOCUMENT NUMBER:	98ASB42819B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SC-70 (SOT-323)	PAGE 1 OF 1

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at
www.onsemi.com/support/sales