

General Purpose Transistors

PNP Silicon

MMBT2907AL, SMMBT2907AL

Features

- S 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

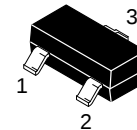
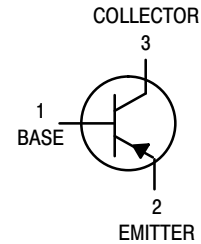
Rating	Symbol	Value	Unit
Collector – Emitter Voltage	V_{CEO}	-60	Vdc
Collector – Base Voltage	V_{CBO}	-60	Vdc
Emitter – Base Voltage	V_{EBO}	-5.0	Vdc
Collector Current – Continuous	I_C	-600	mAdc
Collector Current – Peak (Note 3)	I_{CM}	-1200	mAdc

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation – FR-5 Board (Note 1) @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	225 1.8	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	556	$^\circ\text{C}/\text{W}$
Total Device Dissipation – Alumina Substrate, (Note 2) @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	300 2.4	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Total Device Dissipation – Heat Spreader or equivalent, (Note 4) @ $T_A = 25^\circ\text{C}$	P_D	350	mW
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	357	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$

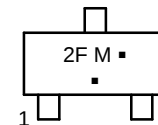
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. FR-5 = $1.0 \times 0.75 \times 0.062$ in.
2. Alumina = $0.4 \times 0.3 \times 0.024$ in. 99.5% alumina.
3. Reference SOA curve.
4. Heat Spreader or equivalent = 450 mm², 2 oz.



SOT-23 (TO-236AB)
CASE 318
STYLE 6

MARKING DIAGRAM



2F = Device Code
M = Date Code*
▪ = Pb-Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or overbar may vary depending upon manufacturing location.

ORDERING INFORMATION

Device	Package	Shipping [†]
MMBT2907ALT1G SMMBT2907ALT1G	SOT-23 (Pb-Free)	3000 / Tape & Reel
MMBT2907ALT3G SMMBT2907ALT3G	SOT-23 (Pb-Free)	10,000 / 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.

MMBT2907AL, SMMBT2907AL

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage (Note 5) ($I_C = -1.0\text{ mA}$, $I_B = 0$) ($I_C = -10\text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	-60 -60	- -	Vdc
Collector-Base Breakdown Voltage ($I_C = -10\text{ }\mu\text{A}$, $I_E = 0$)	$V_{(BR)CBO}$	-60	-	Vdc
Emitter-Base Breakdown Voltage ($I_E = -10\text{ }\mu\text{A}$, $I_C = 0$)	$V_{(BR)EBO}$	-5.0	-	Vdc
Collector Cutoff Current ($V_{CE} = -30\text{ Vdc}$, $V_{EB(off)} = -0.5\text{ Vdc}$)	I_{CEX}	-	-50	nAdc
Collector Cutoff Current ($V_{CB} = -50\text{ Vdc}$, $I_E = 0$) ($V_{CB} = -50\text{ Vdc}$, $I_E = 0$, $T_A = 125^\circ\text{C}$)	I_{CBO}	- -	-0.010 -10	μAdc
Base Cutoff Current ($V_{CE} = -30\text{ Vdc}$, $V_{EB(off)} = -0.5\text{ Vdc}$)	I_{BL}	-	-50	nAdc

ON CHARACTERISTICS

DC Current Gain ($I_C = -0.1\text{ mA}$, $V_{CE} = -10\text{ Vdc}$) ($I_C = -1.0\text{ mA}$, $V_{CE} = -10\text{ Vdc}$) ($I_C = -10\text{ mA}$, $V_{CE} = -10\text{ Vdc}$) ($I_C = -150\text{ mA}$, $V_{CE} = -10\text{ Vdc}$) ($I_C = -500\text{ mA}$, $V_{CE} = -10\text{ Vdc}$) (Note 5)	h_{FE}	75 100 100 100 50	- - - 300 -	-
Collector-Emitter Saturation Voltage (Note 5) ($I_C = -150\text{ mA}$, $I_B = -15\text{ mA}$) (Note 5) ($I_C = -500\text{ mA}$, $I_B = -50\text{ mA}$)	$V_{CE(sat)}$	- -	-0.4 -1.6	Vdc
Base-Emitter Saturation Voltage (Note 5) ($I_C = -150\text{ mA}$, $I_B = -15\text{ mA}$) ($I_C = -500\text{ mA}$, $I_B = -50\text{ mA}$)	$V_{BE(sat)}$	- -	-1.3 -2.6	Vdc

SMALL-SIGNAL CHARACTERISTICS

Current-Gain - Bandwidth Product (Notes 5, 6), ($I_C = -50\text{ mA}$, $V_{CE} = -20\text{ Vdc}$, $f = 100\text{ MHz}$)	f_T	200	-	MHz
Output Capacitance ($V_{CB} = -10\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$)	C_{obo}	-	8.0	pF
Input Capacitance ($V_{EB} = -2.0\text{ Vdc}$, $I_C = 0$, $f = 1.0\text{ MHz}$)	C_{ibo}	-	30	pF

SWITCHING CHARACTERISTICS

Turn-On Time	$(V_{CC} = -30\text{ Vdc}$, $I_C = -150\text{ mA}$, $I_{B1} = -15\text{ mA}$)	t_{on}	-	45	ns
Delay Time		t_d	-	10	
Rise Time		t_r	-	40	
Turn-Off Time	$(V_{CC} = -6.0\text{ Vdc}$, $I_C = -150\text{ mA}$, $I_{B1} = I_{B2} = -15\text{ mA}$)	t_{off}	-	100	
Storage Time		t_s	-	80	
Fall Time		t_f	-	30	

5. Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2.0\%$.

6. f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity.

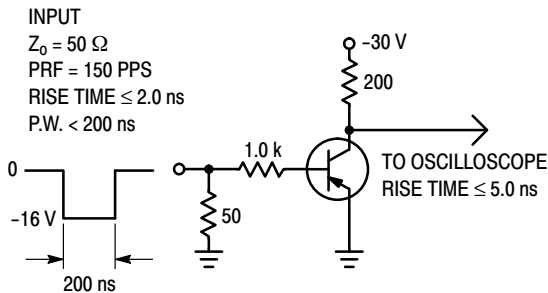


Figure 1. Delay and Rise Time Test Circuit

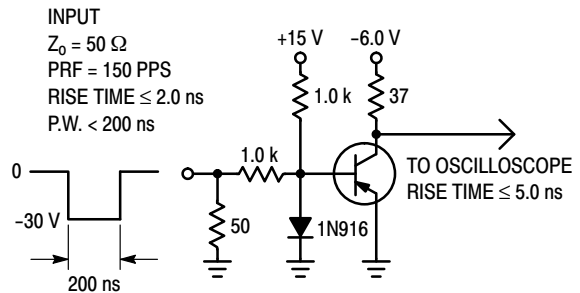


Figure 2. Storage and Fall Time Test Circuit

MMBT2907AL, SMMBT2907AL

TYPICAL CHARACTERISTICS

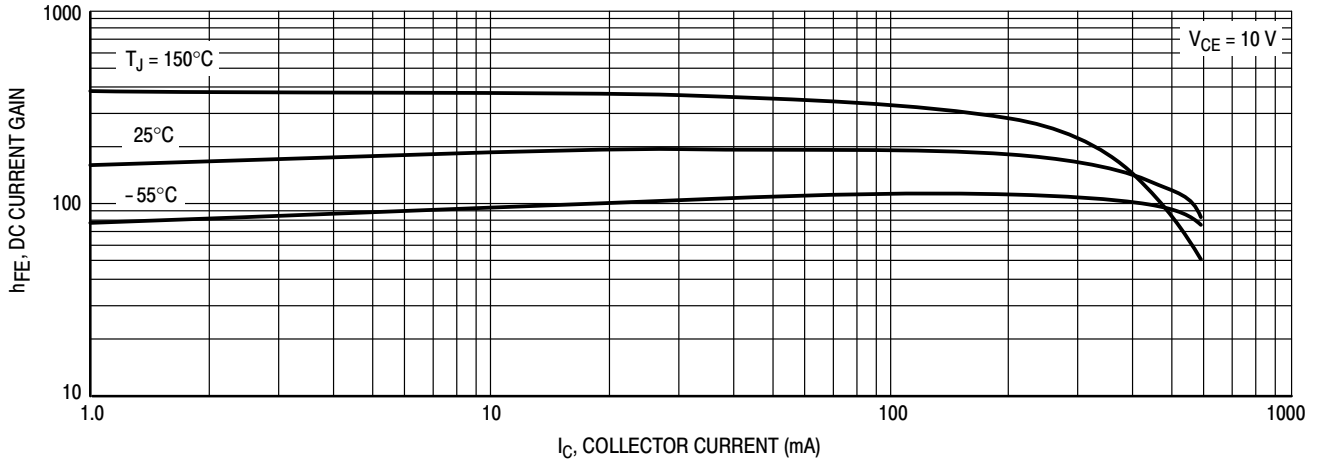


Figure 3. DC Current Gain

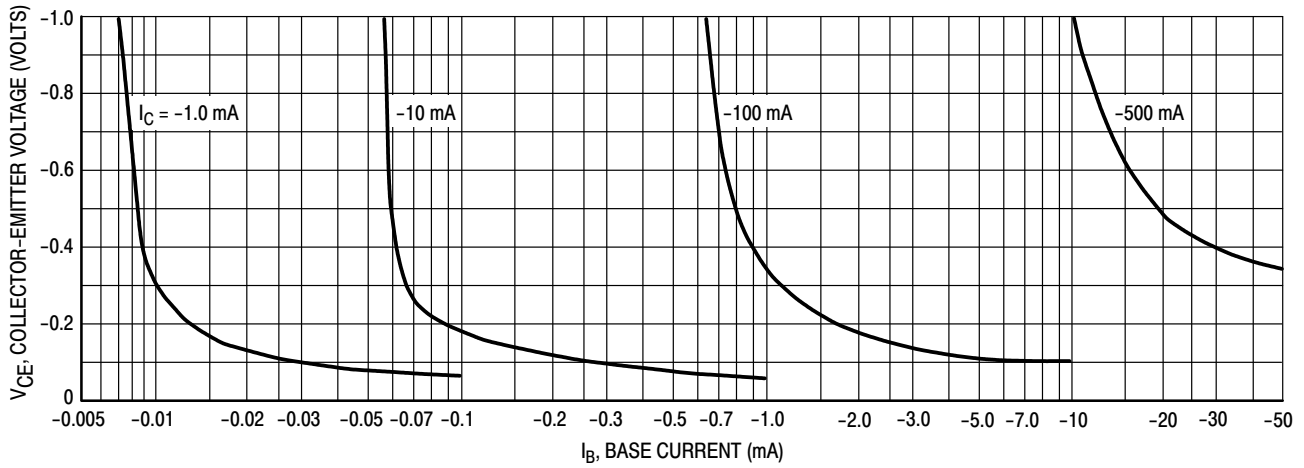


Figure 4. Collector Saturation Region

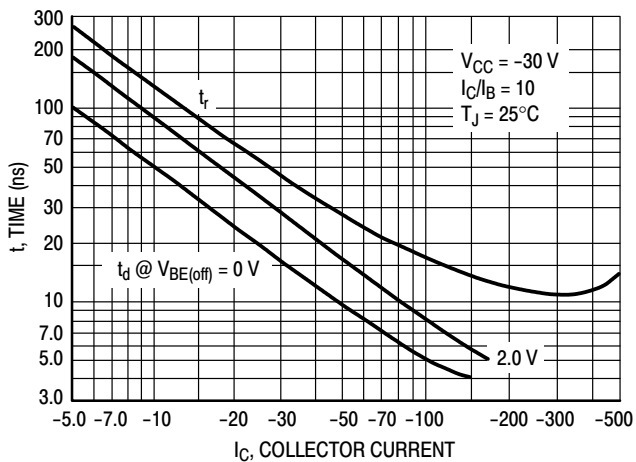


Figure 5. Turn-On Time

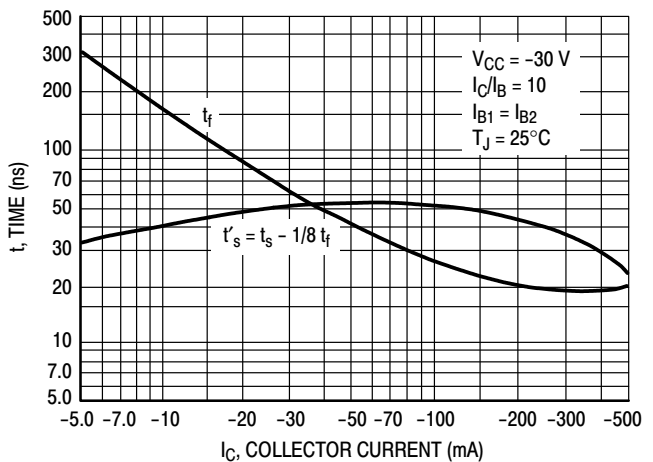


Figure 6. Turn-Off Time

TYPICAL SMALL-SIGNAL CHARACTERISTICS
NOISE FIGURE

$V_{CE} = 10 \text{ VDC}$, $T_A = 25^\circ\text{C}$

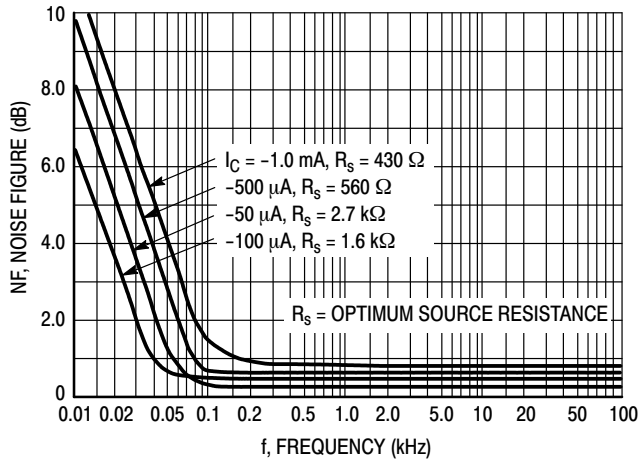


Figure 7. Frequency Effects

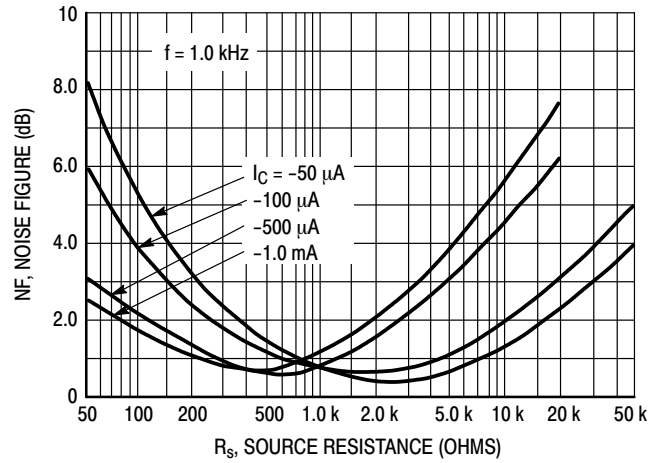


Figure 8. Source Resistance Effects

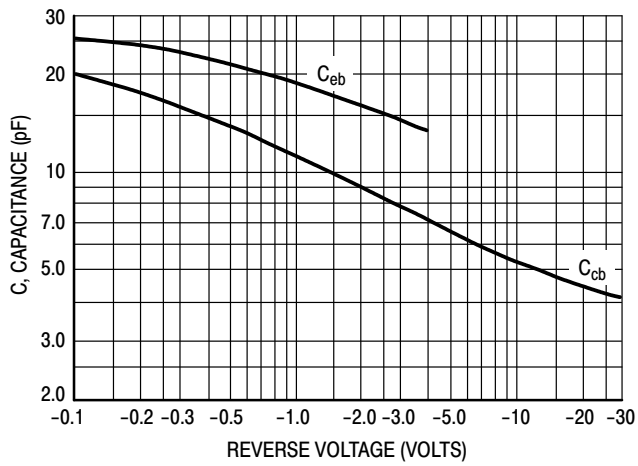


Figure 9. Capacitances

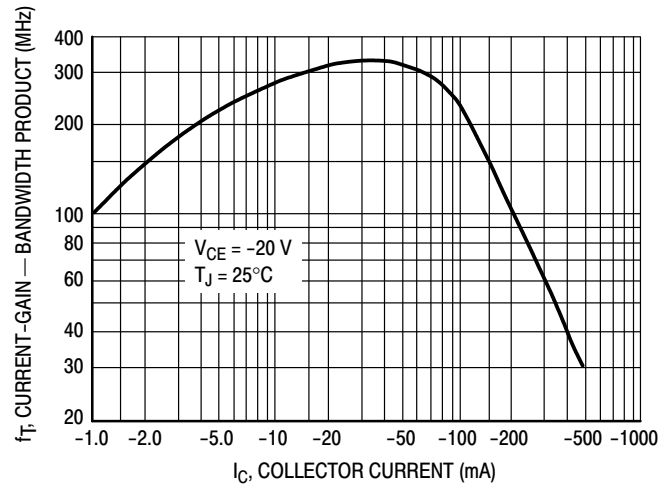


Figure 10. Current-Gain - Bandwidth Product

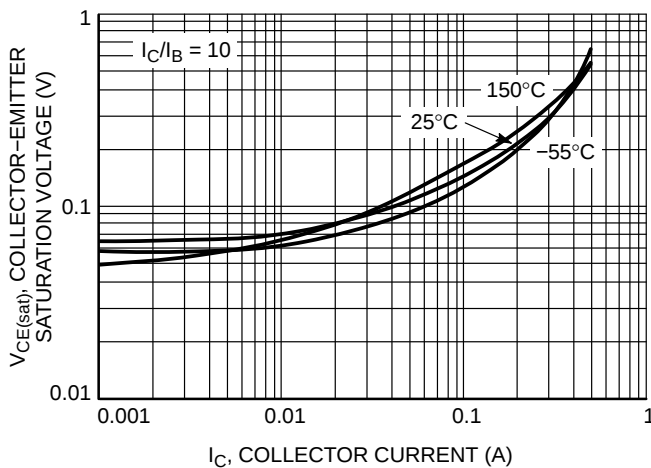


Figure 11. Collector Emitter Saturation Voltage vs. Collector Current

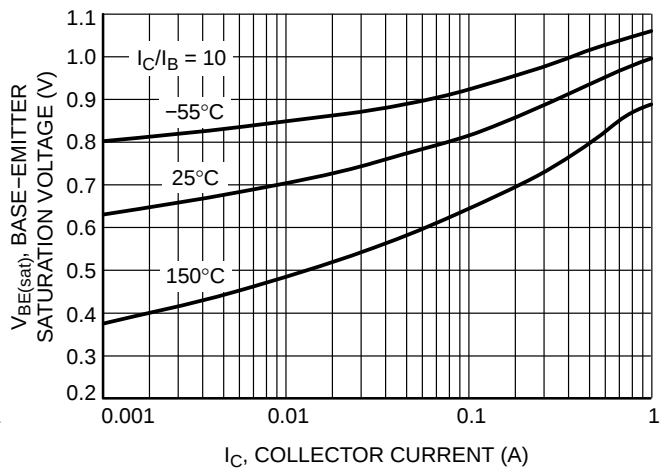


Figure 12. Base Emitter Saturation Voltage vs. Collector Current

MMBT2907AL, SMMBT2907AL

TYPICAL SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE

$V_{CE} = 10 \text{ VDC}$, $T_A = 25^\circ\text{C}$

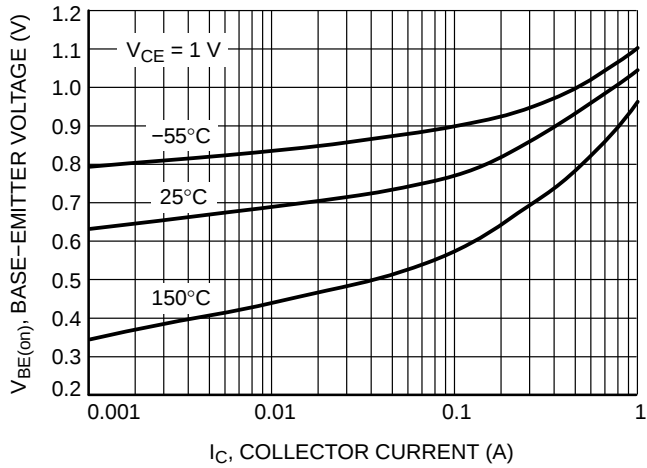


Figure 13. Base Emitter Voltage vs. Collector Current

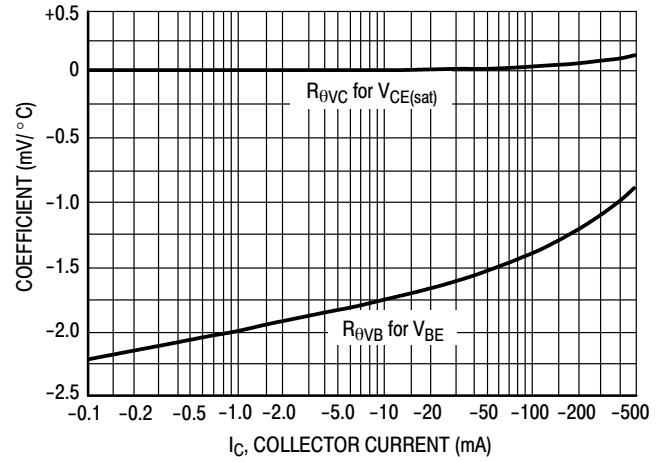


Figure 14. Temperature Coefficients

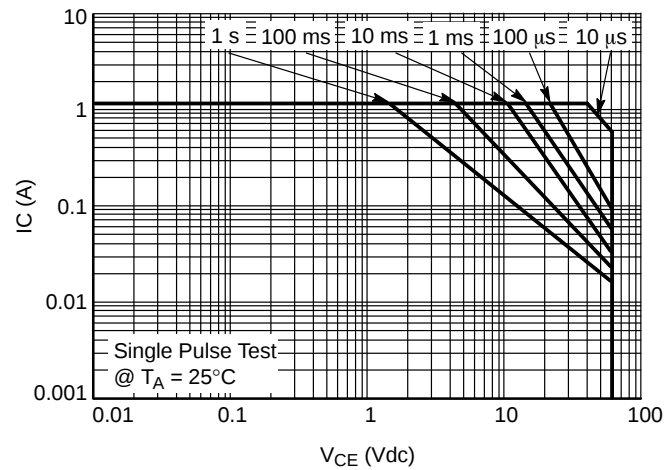


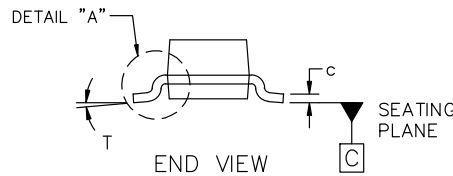
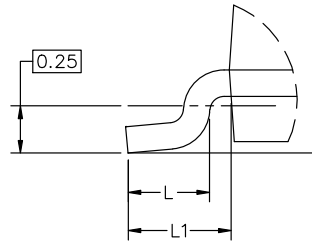
Figure 15. Safe Operating Area



SCALE 4:1

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CASE 318
ISSUE AU

DATE 14 AUG 2024

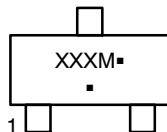


MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.89	1.00	1.11
A1	0.01	0.06	0.10
b	0.37	0.44	0.50
c	0.08	0.14	0.20
D	2.80	2.90	3.04
E	1.20	1.30	1.40
e	1.78	1.90	2.04
L	0.30	0.43	0.55
L1	0.35	0.54	0.69
HE	2.10	2.40	2.64
T	0°	---	10°

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

GENERIC
MARKING DIAGRAM*



XXX = 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.



RECOMMENDED
MOUNTING FOOTPRINT

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

STYLES ON PAGE 2

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CASE 318
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DATE 14 AUG 2024

STYLE 1 THRU 5: CANCELLED	STYLE 6: PIN 1. BASE 2. EMITTER 3. COLLECTOR	STYLE 7: PIN 1. EMITTER 2. BASE 3. COLLECTOR	STYLE 8: PIN 1. ANODE 2. NO CONNECTION 3. CATHODE		
STYLE 9: PIN 1. ANODE 2. ANODE 3. CATHODE	STYLE 10: PIN 1. DRAIN 2. SOURCE 3. GATE	STYLE 11: PIN 1. ANODE 2. CATHODE 3. CATHODE-ANODE	STYLE 12: PIN 1. CATHODE 2. CATHODE 3. ANODE	STYLE 13: PIN 1. SOURCE 2. DRAIN 3. GATE	STYLE 14: PIN 1. CATHODE 2. GATE 3. ANODE
STYLE 15: PIN 1. GATE 2. CATHODE 3. ANODE	STYLE 16: PIN 1. ANODE 2. CATHODE 3. CATHODE	STYLE 17: PIN 1. NO CONNECTION 2. ANODE 3. CATHODE	STYLE 18: PIN 1. NO CONNECTION 2. CATHODE 3. ANODE	STYLE 19: PIN 1. CATHODE 2. ANODE 3. CATHODE-ANODE	STYLE 20: PIN 1. CATHODE 2. ANODE 3. GATE
STYLE 21: PIN 1. GATE 2. SOURCE 3. DRAIN	STYLE 22: PIN 1. RETURN 2. OUTPUT 3. INPUT	STYLE 23: PIN 1. ANODE 2. ANODE 3. CATHODE	STYLE 24: PIN 1. GATE 2. DRAIN 3. SOURCE	STYLE 25: PIN 1. ANODE 2. CATHODE 3. GATE	STYLE 26: PIN 1. CATHODE 2. ANODE 3. NO CONNECTION
STYLE 27: PIN 1. CATHODE 2. CATHODE 3. CATHODE	STYLE 28: PIN 1. ANODE 2. ANODE 3. ANODE				

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