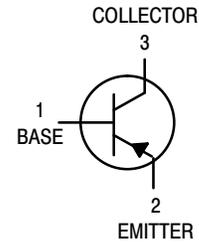# General Purpose Transistors

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°C Derate above 25°C	P_D	225 1.8	mW mW/°C
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	556	°C/W
Total Device Dissipation − Alumina Substrate, (Note 2) @T_A = 25°C Derate above 25°C	P_D	300 2.4	mW mW/°C
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	417	°C/W
Total Device Dissipation − Heat Spreader or equivalent, (Note 4) @T_A = 25°C	P_D	350	mW
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	357	°C/W
Junction and Storage Temperature	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. FR−5 = 1.0 × 0.75 × 0.062 in.
2. Alumina = 0.4 × 0.3 × 0.024 in. 99.5% alumina.
3. Reference SOA curve.
4. Heat Spreader or equivalent = 450 mm^2, 2 oz.

COLLECTOR
3

1
BASE

2
EMITTER
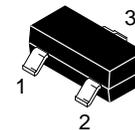
SOT−23 (TO−236AB)
CASE 318
STYLE 6

MARKING DIAGRAM

2F M ▪

1
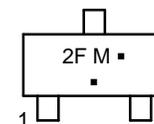
2F = Device Code
M = Date Code*
▪ = Pb−Free Package

(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.

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector–Emitter Breakdown Voltage (Note 5) (I_C = –1.0 mAdc, I_B = 0) (I_C = –10 mAdc, I_B = 0)	$V_{(BR)CEO}$	 –60 –60	 – –	Vdc
Collector–Base Breakdown Voltage (I_C = –10 μAdc, I_E = 0)	$V_{(BR)CBO}$	–60	–	Vdc
Emitter–Base Breakdown Voltage (I_E = –10 μAdc, I_C = 0)	$V_{(BR)EBO}$	–5.0	–	Vdc
Collector Cutoff Current (V_{CE} = –30 Vdc, $V_{EB(off)}$ = –0.5 Vdc)	I_{CEX}	–	–50	nAdc
Collector Cutoff Current (V_{CB} = –50 Vdc, I_E = 0) (V_{CB} = –50 Vdc, I_E = 0, T_A = 125°C)	I_{CBO}	 – –	 –0.010 –10	μAdc
Base Cutoff Current (V_{CE} = –30 Vdc, $V_{EB(off)}$ = –0.5 Vdc)	I_{BL}	–	–50	nAdc
ON CHARACTERISTICS				
DC Current Gain (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) (Note 5)	h_{FE}	 75 100 100 100 50	 – – – 300 –	–
Collector–Emitter Saturation Voltage (Note 5) (I_C = –150 mAdc, I_B = –15 mAdc) (Note 5) (I_C = –500 mAdc, I_B = –50 mAdc)	$V_{CE(sat)}$	 – –	 –0.4 –1.6	Vdc
Base–Emitter Saturation Voltage (Note 5) (I_C = –150 mAdc, I_B = –15 mAdc) (I_C = –500 mAdc, I_B = –50 mAdc)	$V_{BE(sat)}$	 – –	 –1.3 –2.6	Vdc
SMALL–SIGNAL CHARACTERISTICS				
Current–Gain – Bandwidth Product (Notes 5, 6), (I_C = –50 mAdc, V_{CE} = –20 Vdc, f = 100 MHz)	f_T	200	–	MHz
Output Capacitance (V_{CB} = –10 Vdc, I_E = 0, f = 1.0 MHz)	C_{obo}	–	8.0	pF
Input Capacitance (V_{EB} = –2.0 Vdc, I_C = 0, f = 1.0 MHz)	C_{ibo}	–	30	
SWITCHING CHARACTERISTICS				
Turn–On Time	t_{on}	–	45	
Delay Time	t_d	–	10	
Rise Time	t_r	–	40	
Turn–Off Time	t_{off}	–	100	ns
Storage Time	t_s	–	80	
Fall Time	t_f	–	30	

Note for Turn–On / Delay / Rise Time: (V_{CC} = –30 Vdc, I_C = –150 mAdc, I_{B1} = –15 mAdc)

Note for Turn–Off / Storage / Fall Time: (V_{CC} = –6.0 Vdc, I_C = –150 mAdc, I_{B1} = I_{B2} = –15 mAdc)

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
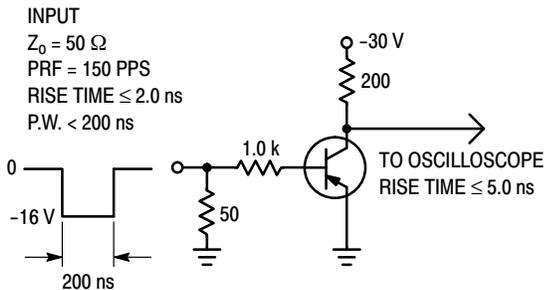6. f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity.

INPUT
Z_0 = 50 Ω
PRF = 150 PPS
RISE TIME ≤ 2.0 ns
P.W. < 200 ns
–30 V
200
1.0 k
50
TO OSCILLOSCOPE
RISE TIME ≤ 5.0 ns
0
–16 V
200 ns

Figure 1. Delay and Rise Time Test Circuit

INPUT
Z_0 = 50 Ω
PRF = 150 PPS
RISE TIME ≤ 2.0 ns
P.W. < 200 ns
+15 V   –6.0 V
1.0 k   37
1.0 k
50   1N916
TO OSCILLOSCOPE
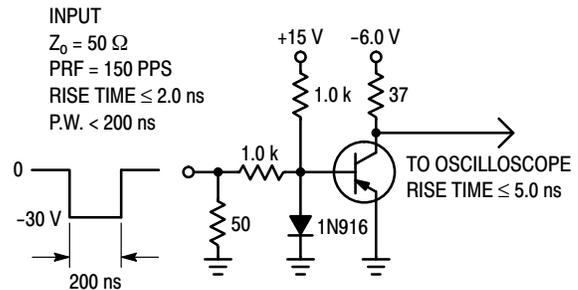RISE TIME ≤ 5.0 ns
0
–30 V
200 ns

Figure 2. Storage and Fall Time Test Circuit

MMBT2907AL, SMMBT2907AL

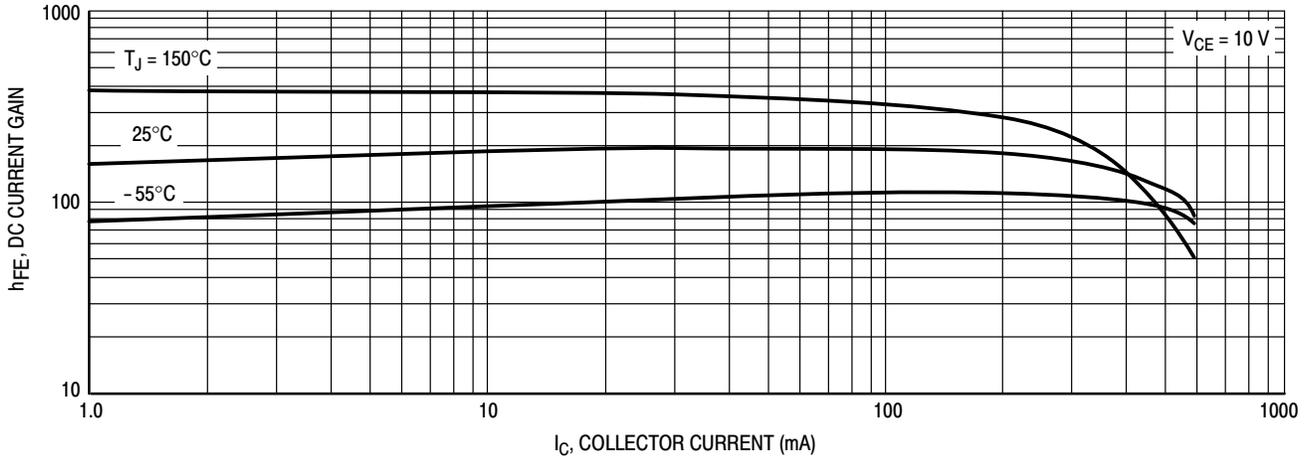## TYPICAL CHARACTERISTICS

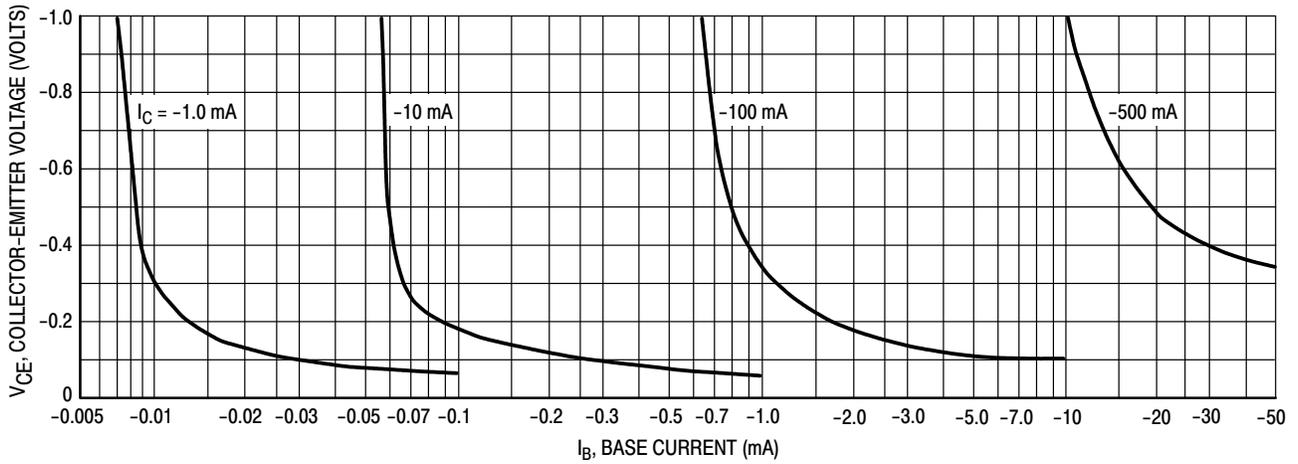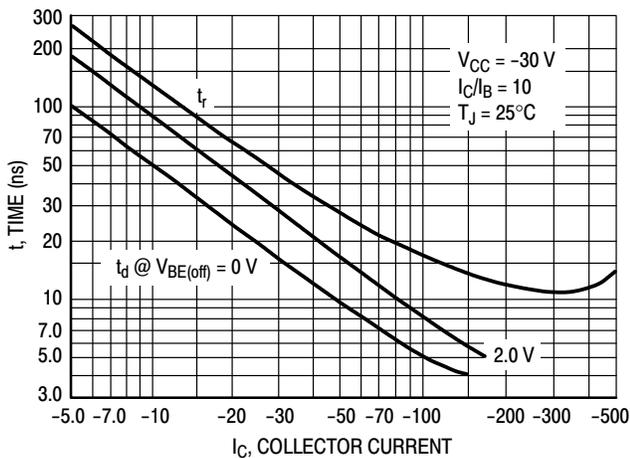**Figure 3. DC Current Gain**

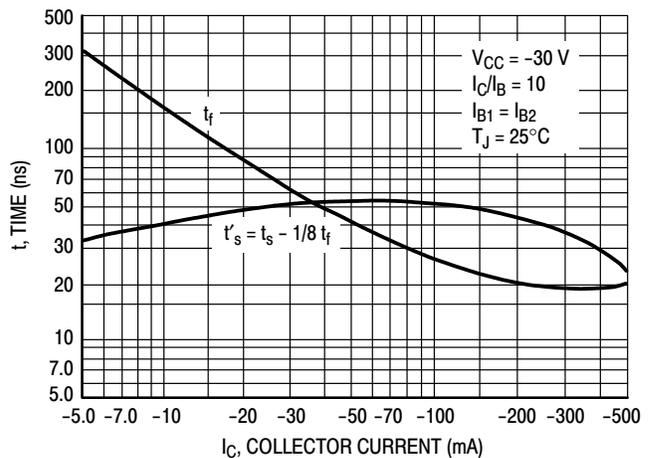**Figure 4. Collector Saturation Region**

Figure 5. Turn−On Time

Figure 6. Turn−Off Time

MMBT2907AL, SMMBT2907AL

TYPICAL SMALL−SIGNAL CHARACTERISTICS
NOISE FIGURE
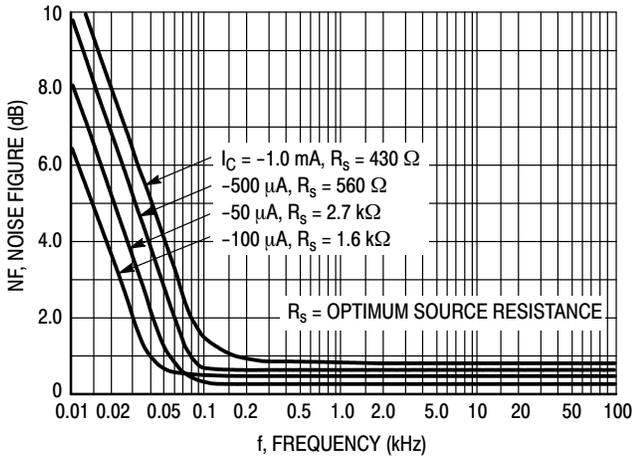V_{CE} = 10 VDC, T_A = 25°C
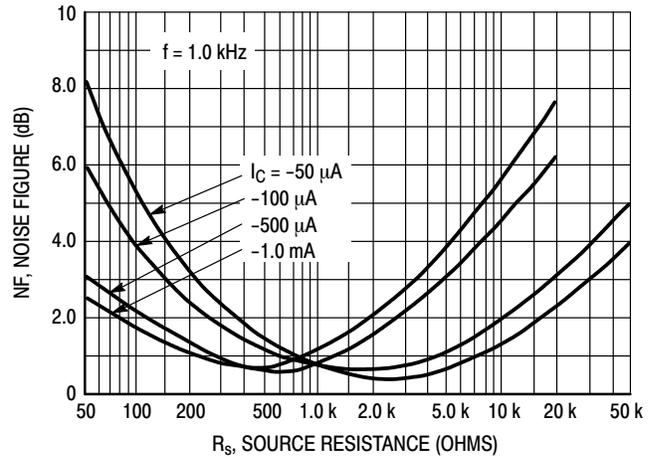

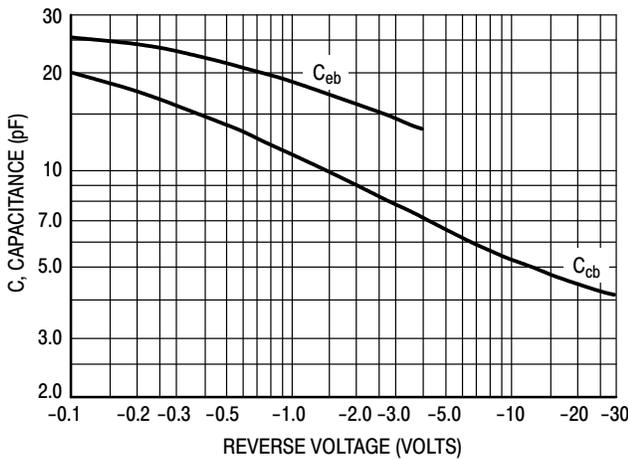**Figure 7. Frequency Effects**

Figure 8. Source Resistance Effects

Figure 9. Capacitances
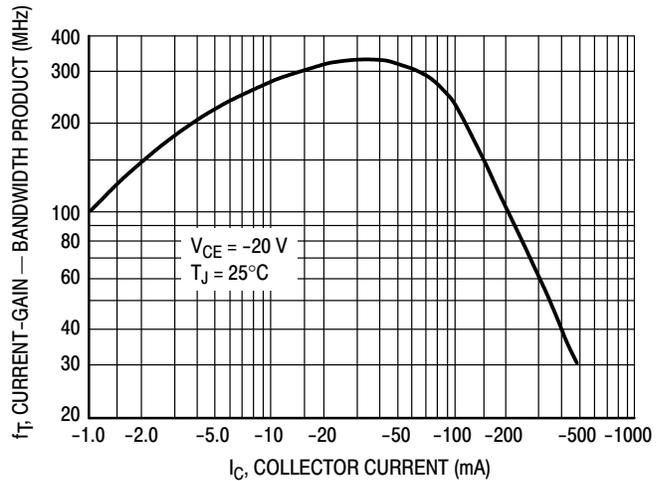
Figure 10. Current−Gain − Bandwidth Product
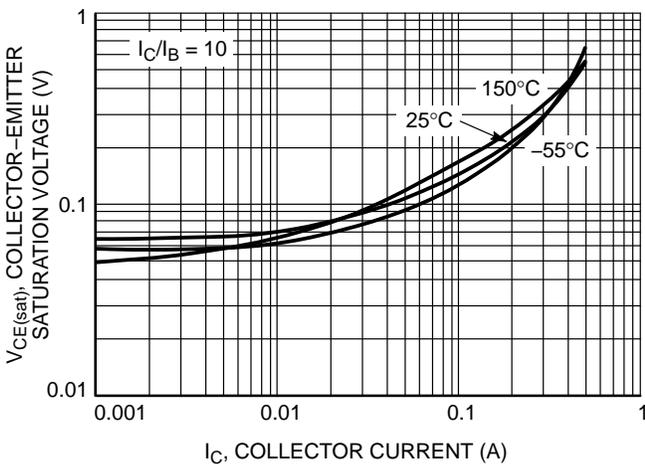
**Figure 11. Collector Emitter Saturation Voltage
vs. Collector Current**
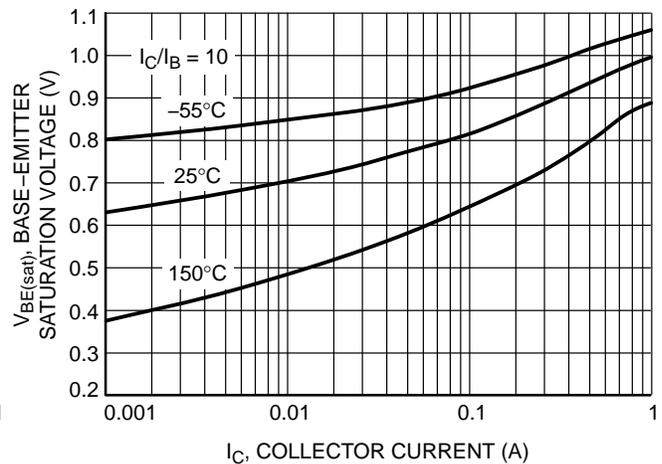
**Figure 12. Base Emitter Saturation Voltage vs.
Collector Current**

MMBT2907AL, SMMBT2907AL

TYPICAL SMALL−SIGNAL CHARACTERISTICS
NOISE FIGURE
V_{CE} = 10 VDC, T_A = 25°C
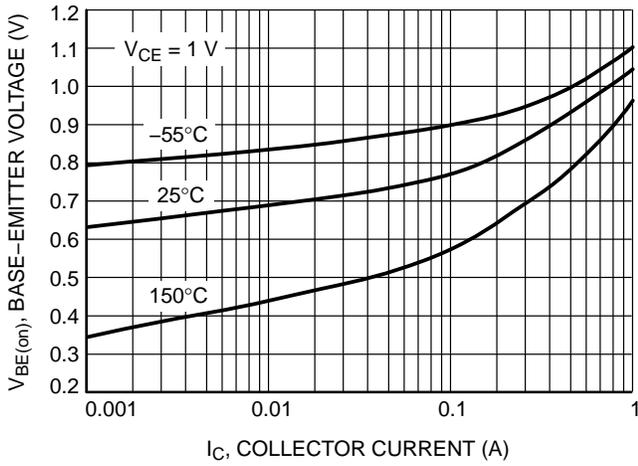
Figure 13. Base Emitter Voltage vs. Collector Current
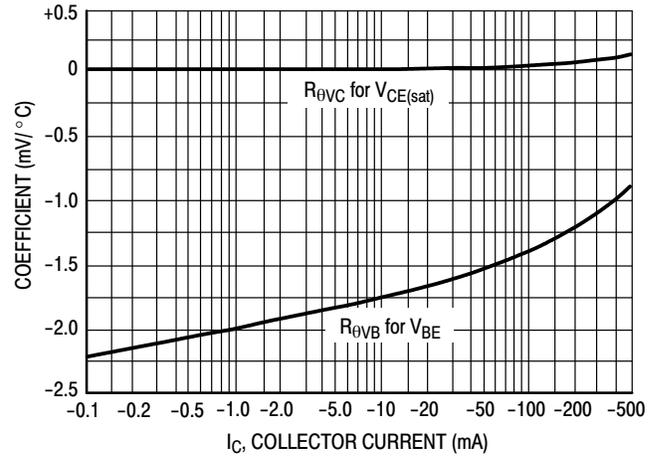
Figure 14. Temperature Coefficients
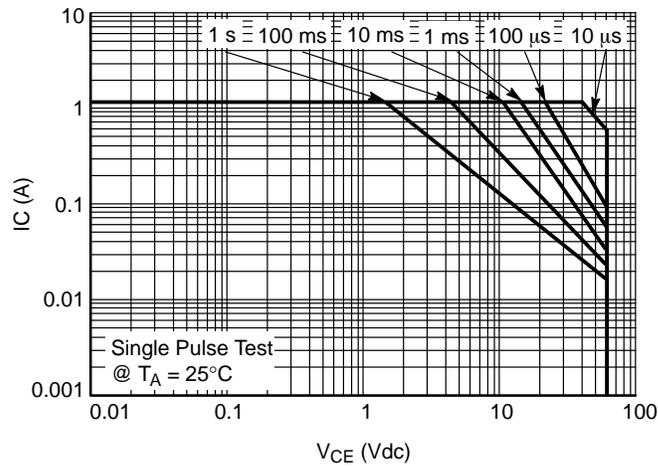
Figure 15. Safe Operating Area
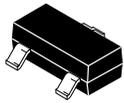
SOT−23 (TO−236) 2.90x1.30x1.00 1.90P
CASE 318
ISSUE AU

DATE 14 AUG 2024

SCALE 4:1

TOP VIEW

DETAIL "A"
Scale 3:1

SIDE VIEW

DETAIL "A"

END VIEW

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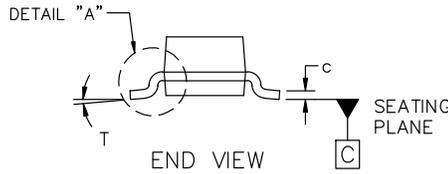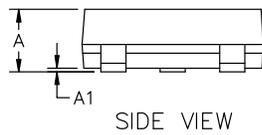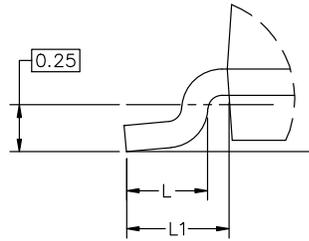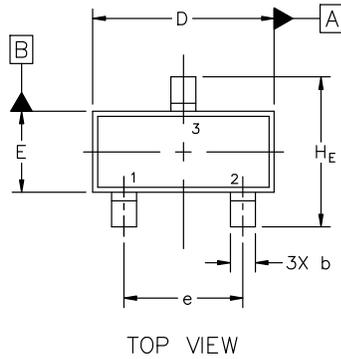
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.89	1.00	1.11
A1	0.01	0.06	0.10
b	0.37	0.44	0.50
c	0.08	0.14	0.20
D	2.80	2.90	3.04
E	1.20	1.30	1.40
e	1.78	1.90	2.04
L	0.30	0.43	0.55
L1	0.35	0.54	0.69
H_E	2.10	2.40	2.64
T	0°	−−−	10°

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*

XXXM▪
▪
1
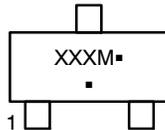
XXX = Specific Device Code
M   = Date Code
▪   = Pb−Free Package

*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.

2.90
3X 0.95
3X 0.56
0.95
PITCH

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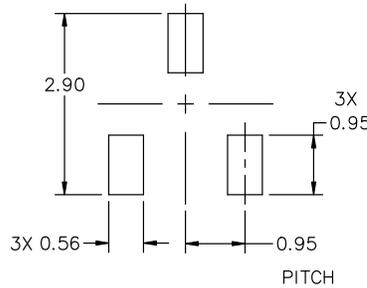
* For additional information on our Pb−Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

DOCUMENT NUMBER:	98ASB42226B		
DESCRIPTION:	SOT−23 (TO−236) 2.90x1.30x1.00 1.90P		PAGE 1 OF 2

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

DOCUMENT NUMBER:	98ASB42226B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	SOT−23 (TO−236) 2.90x1.30x1.00 1.90P		PAGE 2 OF 2

ADDITIONAL INFORMATION

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

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