

# MMBT2907AL, SMMBT2907AL

## General Purpose Transistors

### PNP Silicon

#### Features

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

#### 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<br>(Note 1) @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$         | $P_D$           | 225<br>1.8  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient   | $R_{\theta JA}$ | 556         | $^\circ\text{C}/\text{W}$  |
| Total Device Dissipation Alumina<br>Substrate, (Note 2) @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 300<br>2.4  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient   | $R_{\theta JA}$ | 417         | $^\circ\text{C}/\text{W}$  |
| Junction and Storage Temperature  | $T_J, T_{stg}$  | -55 to +150 | $^\circ\text{C}$           |

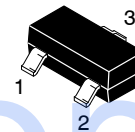
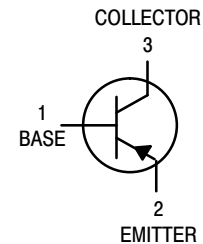
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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.



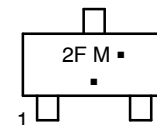
ON Semiconductor®

<http://onsemi.com>



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<br>SMMBT2907ALT1G | SOT-23<br>(Pb-Free) | 3000 / Tape &<br>Reel   |
| MMBT2907ALT3G<br>SMMBT2907ALT3G | SOT-23<br>(Pb-Free) | 10,000 / Tape &<br>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.

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## 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 4)<br>( $I_C = -1.0\text{ mAdc}$ , $I_B = 0$ )<br>( $I_C = -10\text{ mAdc}$ , $I_B = 0$ )            | $V_{(BR)CEO}$ | -60<br>-60 | -             | Vdc             |
| Collector-Base Breakdown Voltage ( $I_C = -10\text{ }\mu\text{Adc}$ , $I_E = 0$ )  | $V_{(BR)CBO}$ | -60        | -             | Vdc             |
| Emitter-Base Breakdown Voltage ( $I_E = -10\text{ }\mu\text{Adc}$ , $I_C = 0$ )  | $V_{(BR)EBO}$ | -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<br>( $V_{CB} = -50\text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = -50\text{ Vdc}$ , $I_E = 0$ , $T_A = 125^\circ\text{C}$ ) | $I_{CBO}$     | -<br>-     | -0.010<br>-10 | $\mu\text{Adc}$ |
| Base Cutoff Current ( $V_{CE} = -30\text{ Vdc}$ , $V_{EB(off)} = -0.5\text{ Vdc}$ )  | $I_{BL}$      | -          | -50           | nAdc            |

## ON CHARACTERISTICS

|   |               |                               |                         |     |
|---|---------------|-------------------------------|-------------------------|-----|
| DC Current Gain<br>( $I_C = -0.1\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ )<br>( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ )<br>( $I_C = -10\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ )<br>( $I_C = -150\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ )<br>( $I_C = -500\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ ) (Note 4) | $h_{FE}$      | 75<br>100<br>100<br>100<br>50 | -<br>-<br>-<br>300<br>- | -   |
| Collector-Emitter Saturation Voltage (Note 4)<br>( $I_C = -150\text{ mAdc}$ , $I_B = -15\text{ mAdc}$ ) (Note 4)<br>( $I_C = -500\text{ mAdc}$ , $I_B = -50\text{ mAdc}$ )  | $V_{CE(sat)}$ | -<br>-                        | -0.4<br>-1.6            | Vdc |
| Base-Emitter Saturation Voltage (Note 4)<br>( $I_C = -150\text{ mAdc}$ , $I_B = -15\text{ mAdc}$ )<br>( $I_C = -500\text{ mAdc}$ , $I_B = -50\text{ mAdc}$ )  | $V_{BE(sat)}$ | -<br>-                        | -1.3<br>-2.6            | Vdc |

## SMALL-SIGNAL CHARACTERISTICS

|  |           |     |     |     |
|--|-----------|-----|-----|-----|
| Current-Gain - Bandwidth Product (Notes 4, 5),<br>( $I_C = -50\text{ mAdc}$ , $V_{CE} = -20\text{ Vdc}$ , $f = 100\text{ MHz}$ ) | $f_T$     | 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  | $(V_{CC} = -30\text{ Vdc}$ , $I_C = -150\text{ mAdc}$ ,<br>$I_{B1} = -15\text{ mAdc}$ )           | $t_{on}$  | - | 45  | ns |
| Delay Time    |   | $t_d$     | - | 10  |    |
| Rise Time     |   | $t_r$     | - | 40  |    |
| Turn-Off Time | $(V_{CC} = -6.0\text{ Vdc}$ , $I_C = -150\text{ mAdc}$ ,<br>$I_{B1} = I_{B2} = -15\text{ mAdc}$ ) | $t_{off}$ | - | 100 |    |
| Storage Time  |   | $t_s$     | - | 80  |    |
| Fall Time     |   | $t_f$     | - | 30  |    |

- Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .
- $f_T$  is defined as the frequency at which  $|h_{fe}|$  extrapolates to unity.

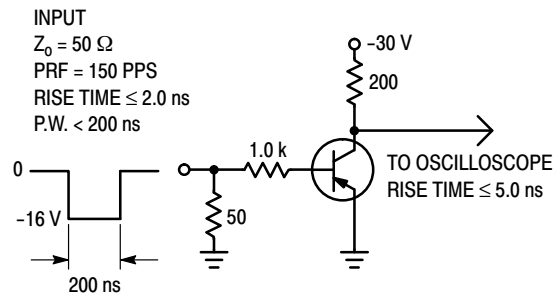


Figure 1. Delay and Rise Time Test Circuit

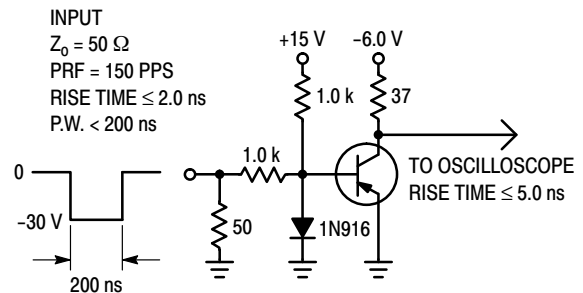


Figure 2. Storage and Fall Time Test Circuit

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## TYPICAL CHARACTERISTICS

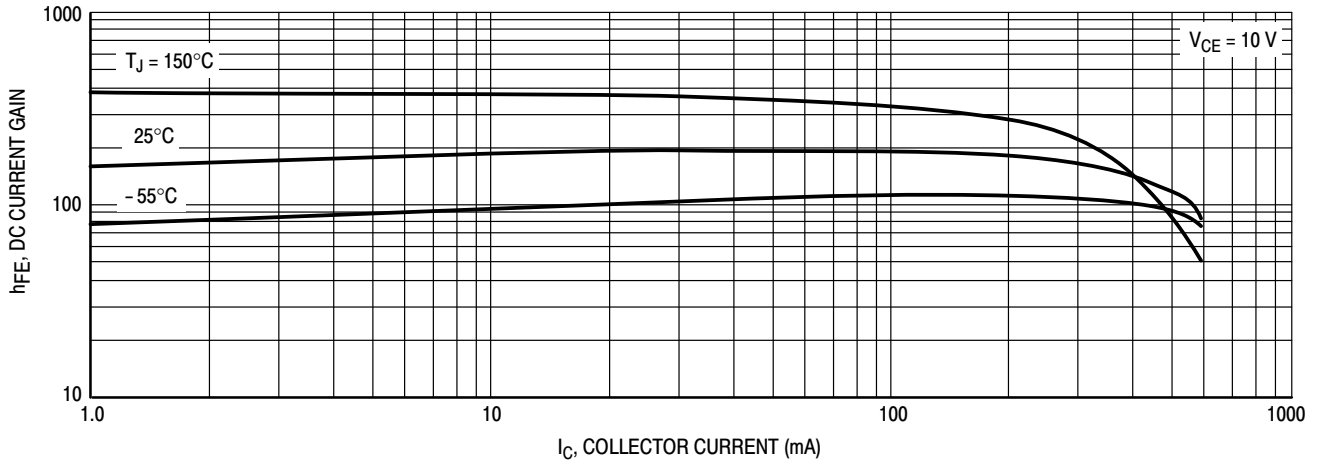


Figure 3. DC Current Gain

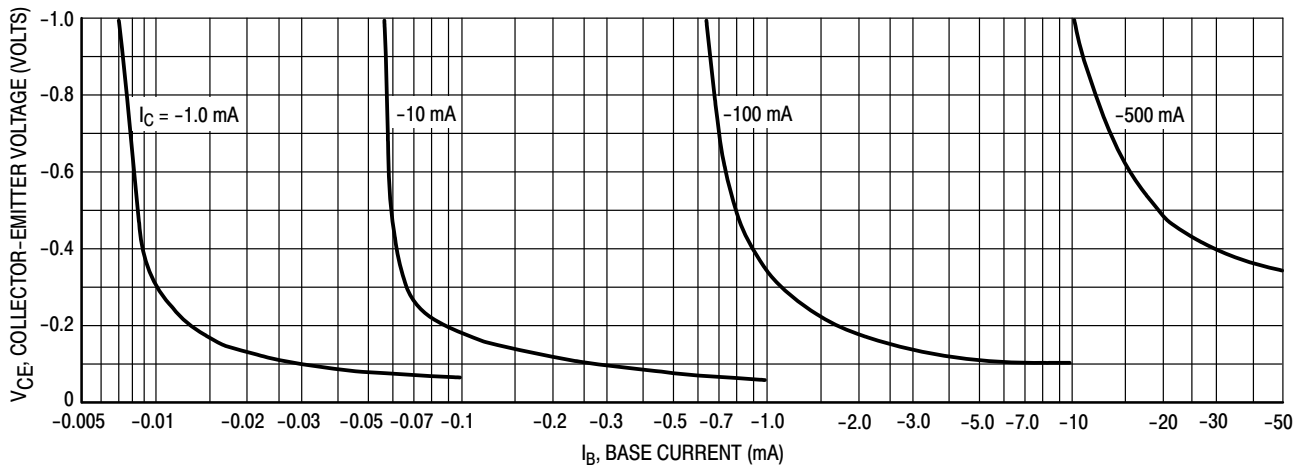


Figure 4. Collector Saturation Region

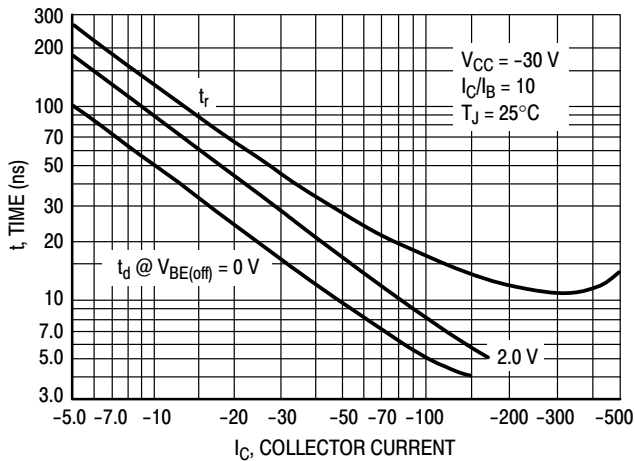


Figure 5. Turn-On Time

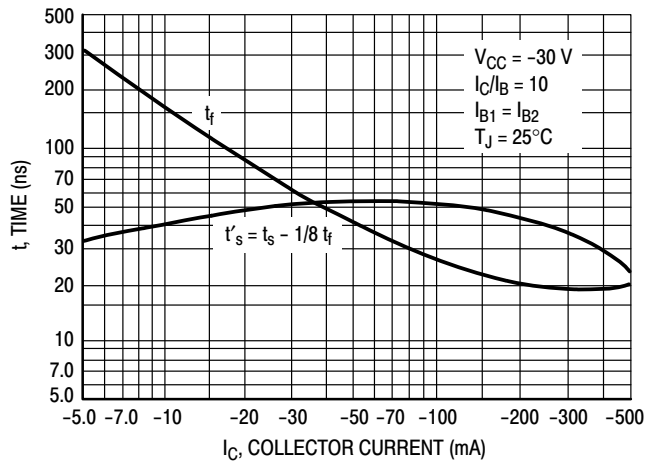


Figure 6. Turn-Off Time

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## TYPICAL SMALL-SIGNAL Characteristics NOISE FIGURE

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

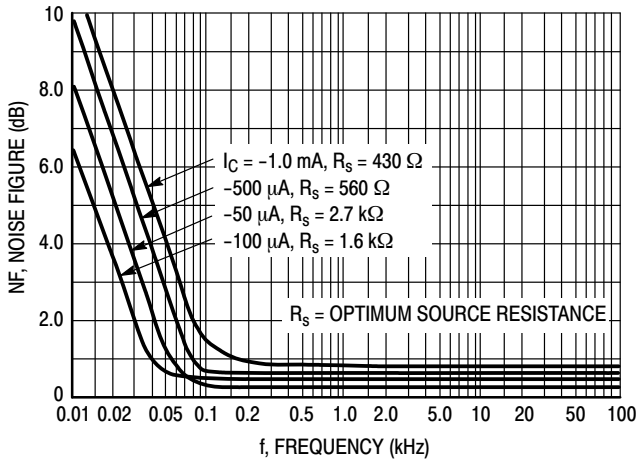


Figure 7. Frequency Effects

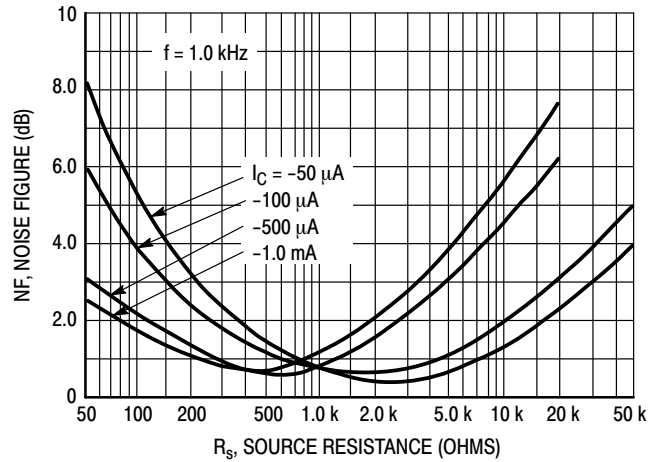


Figure 8. Source Resistance Effects

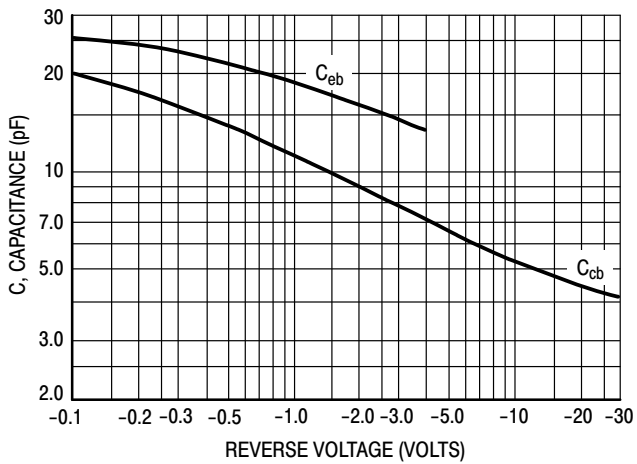


Figure 9. Capacitances

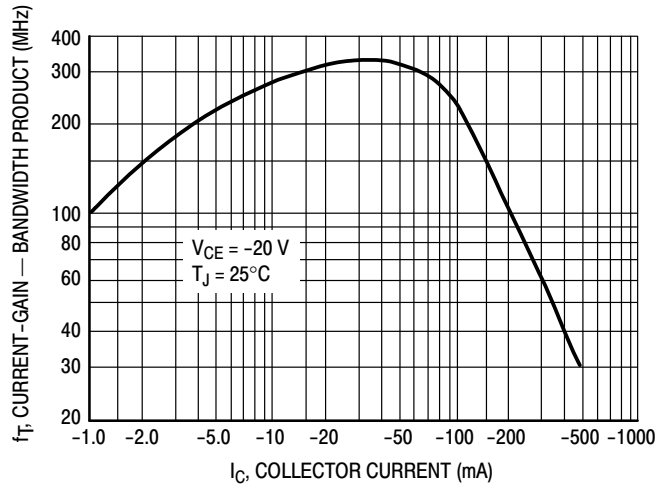


Figure 10. Current-Gain - Bandwidth Product

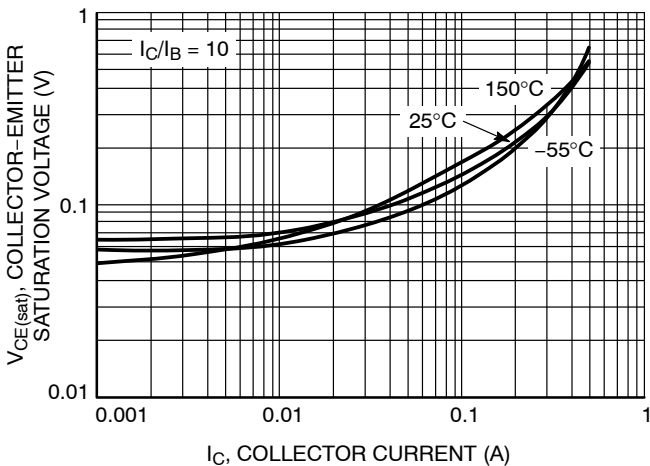


Figure 11. Collector-Emitter Saturation Voltage vs. Collector Current

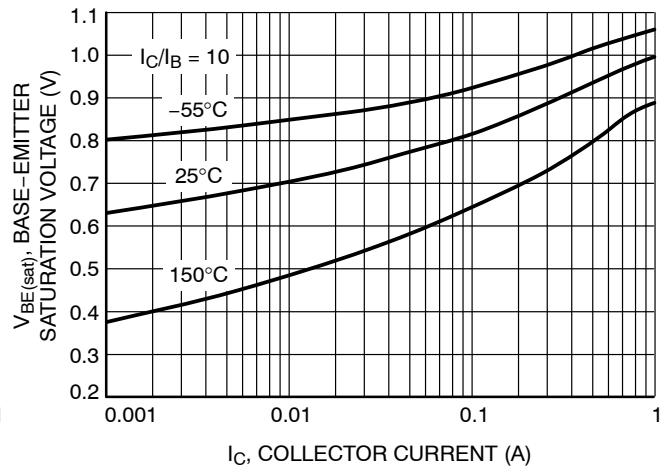
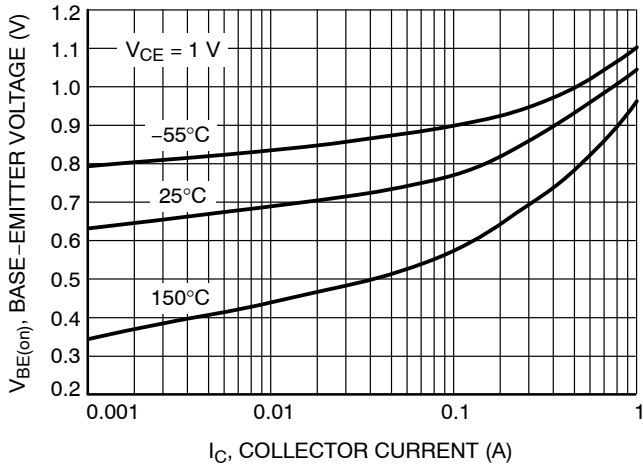


Figure 12. Base-Emitter Saturation Voltage vs. Collector Current

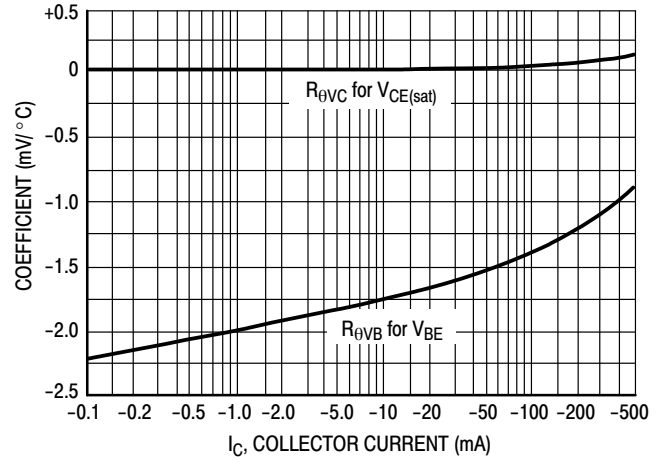
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## TYPICAL SMALL-SIGNAL Characteristics NOISE FIGURE

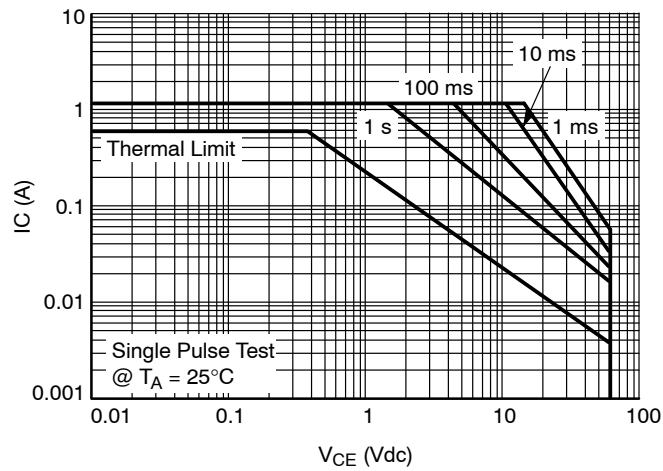
$V_{CE} = 10 \text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$



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



**Figure 14. Temperature Coefficients**

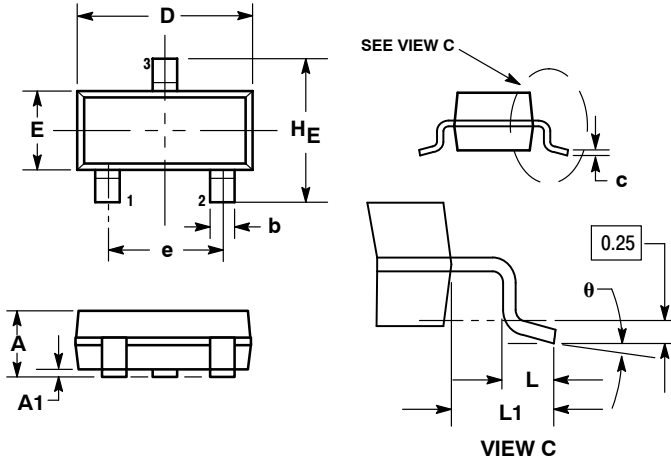


**Figure 15. Safe Operating Area**

# MMBT2907AL, SMMBT2907AL

## PACKAGE DIMENSIONS

SOT-23 (TO-236)  
CASE 318-08  
ISSUE AP



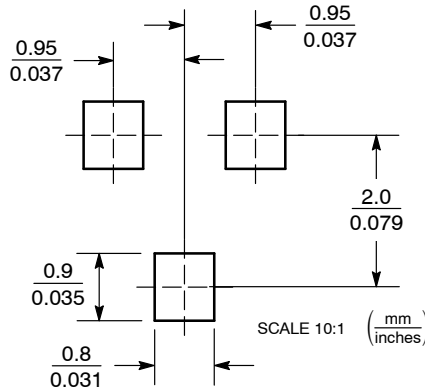
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH.

| DIM | MILLIMETERS |      |      | INCHES |       |       |
|-----|-------------|------|------|--------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN    | NOM   | MAX   |
| A   | 0.89        | 1.00 | 1.11 | 0.035  | 0.040 | 0.044 |
| A1  | 0.01        | 0.06 | 0.10 | 0.001  | 0.002 | 0.004 |
| b   | 0.37        | 0.44 | 0.50 | 0.015  | 0.018 | 0.020 |
| c   | 0.09        | 0.13 | 0.18 | 0.003  | 0.005 | 0.007 |
| D   | 2.80        | 2.90 | 3.04 | 0.110  | 0.114 | 0.120 |
| E   | 1.20        | 1.30 | 1.40 | 0.047  | 0.051 | 0.055 |
| e   | 1.78        | 1.90 | 2.04 | 0.070  | 0.075 | 0.081 |
| L   | 0.10        | 0.20 | 0.30 | 0.004  | 0.008 | 0.012 |
| L1  | 0.35        | 0.54 | 0.69 | 0.014  | 0.021 | 0.029 |
| HE  | 2.10        | 2.40 | 2.64 | 0.083  | 0.094 | 0.104 |
| θ   | 0°          | ---  | 10°  | 0°     | ---   | 10°   |

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

### SOLDERING 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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