

# General Purpose Transistors

## PNP Silicon

### MMBT3906TT1

This transistor is designed for general purpose amplifier applications. It is housed in the SOT-416/SC-75 package which is designed for low power surface mount applications.

#### Features

- NSVM 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 ( $T_A = 25^\circ\text{C}$ )

| Rating                         | Symbol    | Value | Unit |
|--------------------------------|-----------|-------|------|
| Collector-Emitter Voltage      | $V_{CEO}$ | -40   | Vdc  |
| Collector-Base Voltage         | $V_{CBO}$ | -40   | Vdc  |
| Emitter-Base Voltage           | $V_{EBO}$ | -5.0  | Vdc  |
| Collector Current - Continuous | $I_C$     | -200  | mAdc |

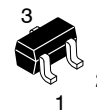
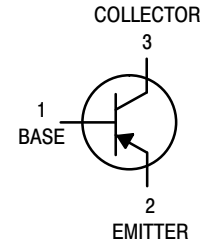
#### THERMAL CHARACTERISTICS

| Characteristic                                                                                                  | Symbol          | Max         | Unit                       |
|-----------------------------------------------------------------------------------------------------------------|-----------------|-------------|----------------------------|
| Total Device Dissipation,<br>FR-4 Board (Note 1) @ $T_A = 25^\circ\text{C}$<br>Derated above $25^\circ\text{C}$ | $P_D$           | 200<br>1.6  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient<br>(Note 1)                                                             | $R_{\theta JA}$ | 600         | $^\circ\text{C/W}$         |
| Total Device Dissipation,<br>FR-4 Board (Note 2) @ $T_A = 25^\circ\text{C}$<br>Derated above $25^\circ\text{C}$ | $P_D$           | 300<br>2.4  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient<br>(Note 2)                                                             | $R_{\theta JA}$ | 400         | $^\circ\text{C/W}$         |
| Junction and Storage Temperature Range                                                                          | $T_J, T_{stg}$  | -65 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.

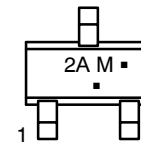
1. FR-4 @ Minimum Pad
2. FR-4 @  $1.0 \times 1.0$  Inch Pad

## GENERAL PURPOSE AMPLIFIER TRANSISTORS SURFACE MOUNT



CASE 463  
SOT-416/SC-75  
STYLE 1

#### MARKING DIAGRAM



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

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

#### ORDERING INFORMATION

| Device          | Package              | Shipping†             |
|-----------------|----------------------|-----------------------|
| MMBT3906TT1G    | SOT-416<br>(Pb-Free) | 3000 / Tape<br>& Reel |
| NSVMMBT3906TT1G | SOT-416<br>(Pb-Free) | 3000 / 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.

# MMBT3906TT1

## 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 3)<br>( $I_C = -1.0\text{ mAdc}$ , $I_E = 0$ ) | $V_{(BR)CEO}$ | -40  | –   | Vdc  |
| Collector – Base Breakdown Voltage<br>( $I_C = -10\text{ }\mu\text{Adc}$ , $I_E = 0$ )     | $V_{(BR)CBO}$ | -40  | –   | Vdc  |
| Emitter – Base Breakdown Voltage<br>( $I_E = -10\text{ }\mu\text{Adc}$ , $I_C = 0$ )       | $V_{(BR)EBO}$ | -5.0 | –   | Vdc  |
| Base Cutoff Current<br>( $V_{CE} = -30\text{ Vdc}$ , $V_{EB} = -3.0\text{ Vdc}$ )          | $I_{BL}$      | –    | -50 | nAdc |
| Collector Cutoff Current<br>( $V_{CE} = -30\text{ Vdc}$ , $V_{EB} = -3.0\text{ Vdc}$ )     | $I_{CEX}$     | –    | -50 | nAdc |

## ON CHARACTERISTICS (Note 3)

|                                                                                                                                                                                                                                                                                                                                |               |                             |                         |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------|-------------------------|-----|
| DC Current Gain<br>( $I_C = -0.1\text{ mAdc}$ , $V_{CE} = -1.0\text{ Vdc}$ )<br>( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -1.0\text{ Vdc}$ )<br>( $I_C = -10\text{ mAdc}$ , $V_{CE} = -1.0\text{ Vdc}$ )<br>( $I_C = -50\text{ mAdc}$ , $V_{CE} = -1.0\text{ Vdc}$ )<br>( $I_C = -100\text{ mAdc}$ , $V_{CE} = -1.0\text{ Vdc}$ ) | $h_{FE}$      | 60<br>80<br>100<br>60<br>30 | –<br>–<br>300<br>–<br>– | –   |
| Collector – Emitter Saturation Voltage<br>( $I_C = -10\text{ mAdc}$ , $I_B = -1.0\text{ mAdc}$ )<br>( $I_C = -50\text{ mAdc}$ , $I_B = -5.0\text{ mAdc}$ )                                                                                                                                                                     | $V_{CE(sat)}$ | –<br>–                      | -0.25<br>-0.4           | Vdc |
| Base – Emitter Saturation Voltage<br>( $I_C = -10\text{ mAdc}$ , $I_B = -1.0\text{ mAdc}$ )<br>( $I_C = -50\text{ mAdc}$ , $I_B = -5.0\text{ mAdc}$ )                                                                                                                                                                          | $V_{BE(sat)}$ | -0.65<br>–                  | -0.85<br>-0.95          | Vdc |

## SMALL – SIGNAL CHARACTERISTICS

|                                                                                                                                          |           |     |      |                  |
|------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|------|------------------|
| Current – Gain – Bandwidth Product<br>( $I_C = -10\text{ mAdc}$ , $V_{CE} = -20\text{ Vdc}$ , $f = 100\text{ MHz}$ )                     | $f_T$     | 250 | –    | MHz              |
| Output Capacitance<br>( $V_{CB} = -5.0\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )                                                  | $C_{obo}$ | –   | 4.5  | pF               |
| Input Capacitance <sup>1</sup><br>( $V_{EB} = -0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )                                      | $C_{ibo}$ | –   | 10.0 | pF               |
| Input Impedance<br>( $V_{CE} = -10\text{ Vdc}$ , $I_C = -1.0\text{ mAdc}$ , $f = 1.0\text{ kHz}$ )                                       | $h_{ie}$  | 2.0 | 12   | k $\Omega$       |
| Voltage Feedback Ratio<br>( $V_{CE} = -10\text{ Vdc}$ , $I_C = -1.0\text{ mAdc}$ , $f = 1.0\text{ kHz}$ )                                | $h_{re}$  | 0.1 | 10   | $\times 10^{-4}$ |
| Small – Signal Current Gain<br>( $V_{CE} = -10\text{ Vdc}$ , $I_C = -1.0\text{ mAdc}$ , $f = 1.0\text{ kHz}$ )                           | $h_{fe}$  | 100 | 400  | –                |
| Output Admittance<br>( $V_{CE} = -10\text{ Vdc}$ , $I_C = -1.0\text{ mAdc}$ , $f = 1.0\text{ kHz}$ )                                     | $h_{oe}$  | 3.0 | 60   | $\mu\text{mhos}$ |
| Noise Figure<br>( $V_{CE} = -5.0\text{ Vdc}$ , $I_C = -100\text{ }\mu\text{Adc}$ , $R_S = 1.0\text{ k } \Omega$ , $f = 1.0\text{ kHz}$ ) | NF        | –   | 4.0  | dB               |

## SWITCHING CHARACTERISTICS

|              |                                                            |       |   |     |    |
|--------------|------------------------------------------------------------|-------|---|-----|----|
| Delay Time   | ( $V_{CC} = -3.0\text{ Vdc}$ , $V_{BE} = 0.5\text{ Vdc}$ ) | $t_d$ | – | 35  | ns |
| Rise Time    | ( $I_C = -10\text{ mAdc}$ , $I_{B1} = -1.0\text{ mAdc}$ )  | $t_r$ | – | 35  |    |
| Storage Time | ( $V_{CC} = -3.0\text{ Vdc}$ , $I_C = -10\text{ mAdc}$ )   | $t_s$ | – | 225 | ns |
| Fall Time    | ( $I_{B1} = I_{B2} = -1.0\text{ mAdc}$ )                   | $t_f$ | – | 75  |    |

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

# MMBT3906TT1

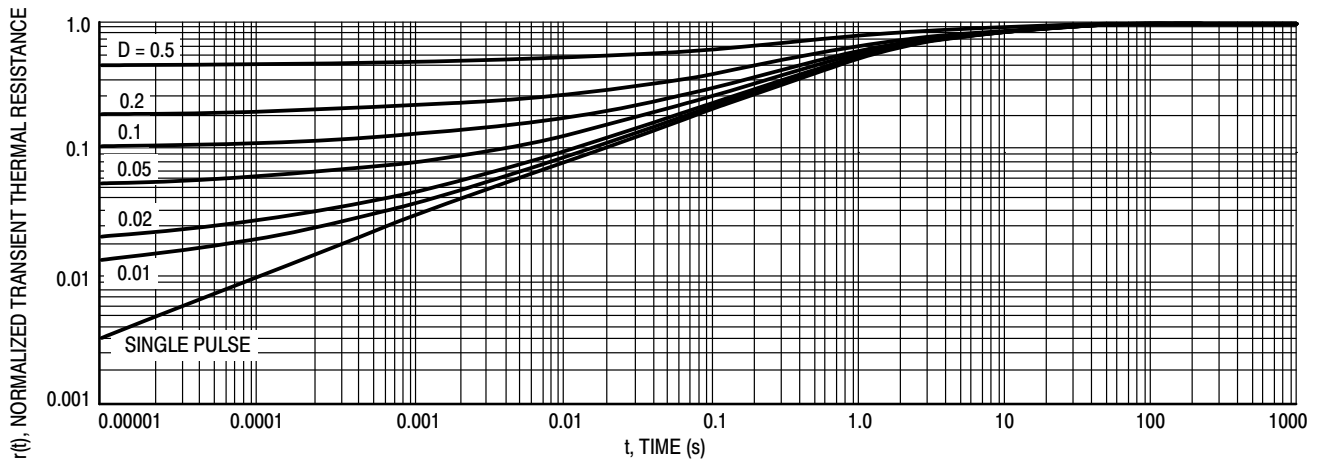


Figure 1. Normalized Thermal Response

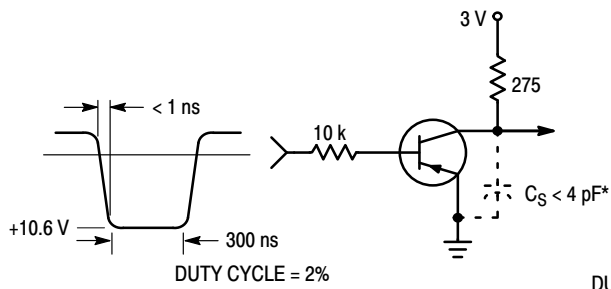


Figure 2. Delay and Rise Time Equivalent Test Circuit

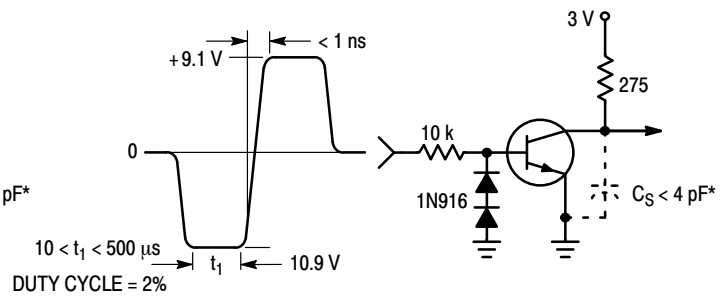


Figure 3. Storage and Fall Time Equivalent Test Circuit

\* Total shunt capacitance of test jig and connectors

# MMBT3906TT1

## TYPICAL TRANSIENT CHARACTERISTICS

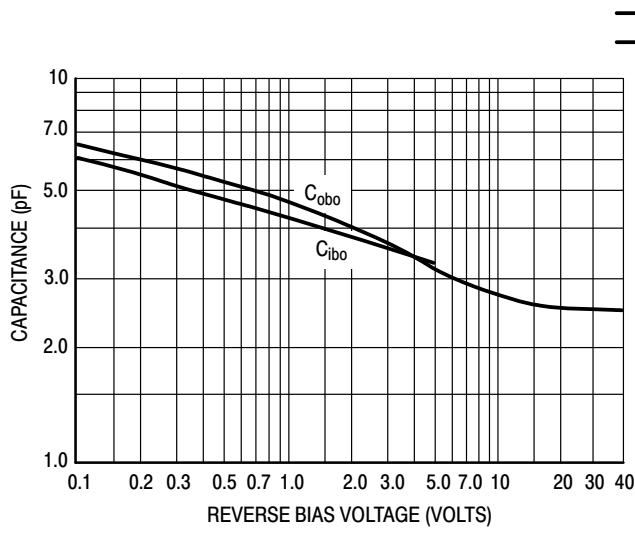


Figure 4. Capacitance

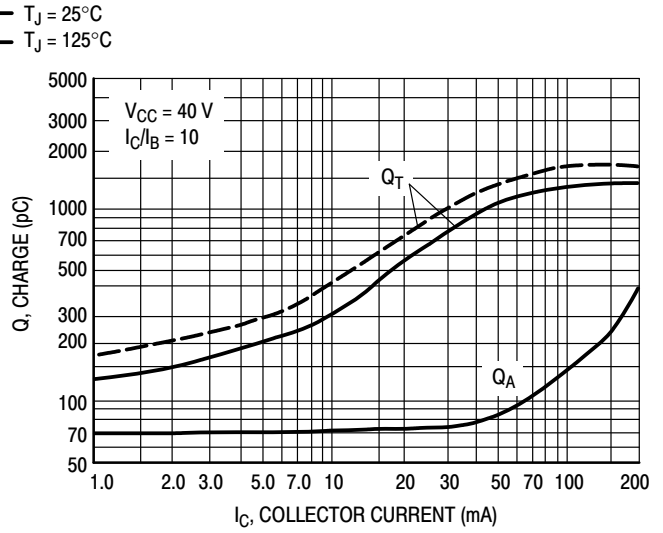


Figure 5. Charge Data

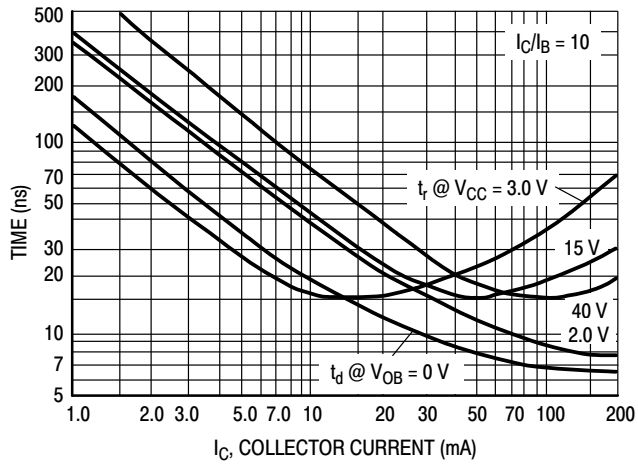


Figure 6. Turn-On Time

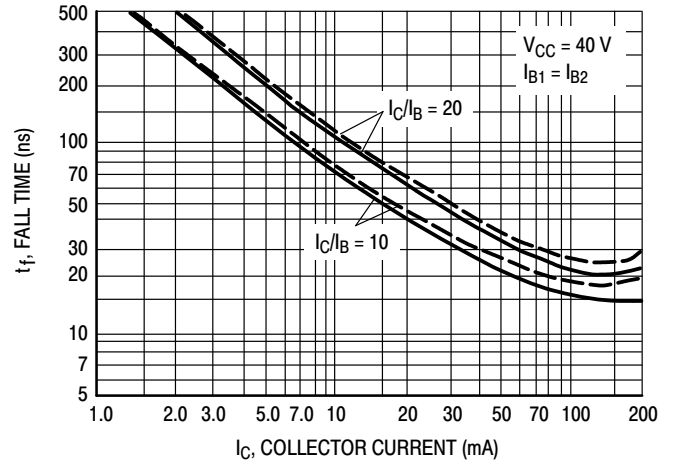


Figure 7. Fall Time

# MMBT3906TT1

## TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

( $V_{CE} = -5.0$  Vdc,  $T_A = 25^\circ\text{C}$ , Bandwidth = 1.0 Hz)

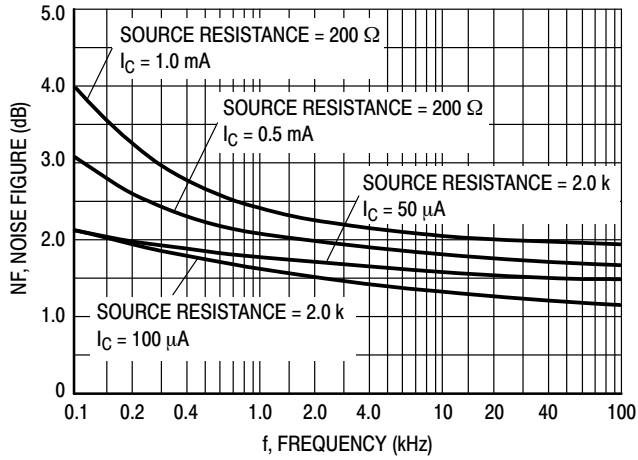


Figure 8.

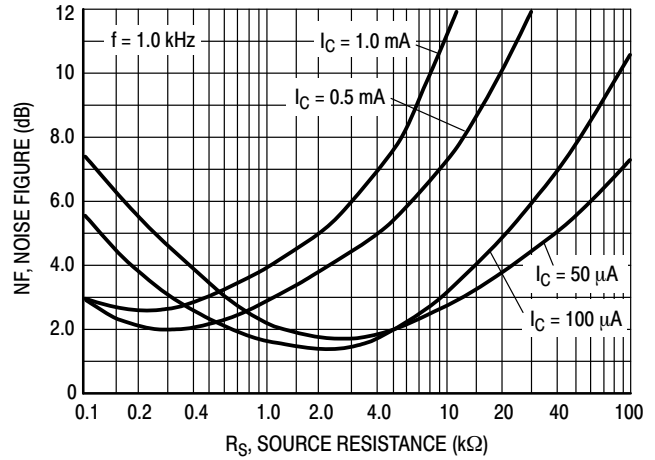


Figure 9.

## h PARAMETERS

( $V_{CE} = -10$  Vdc,  $f = 1.0\ \text{kHz}$ ,  $T_A = 25^\circ\text{C}$ )

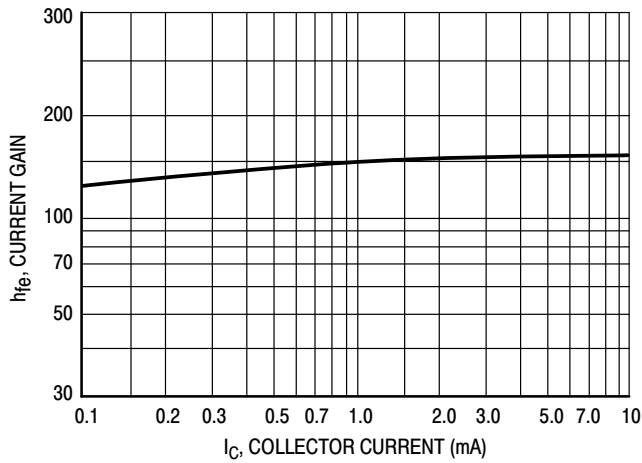


Figure 10. Current Gain

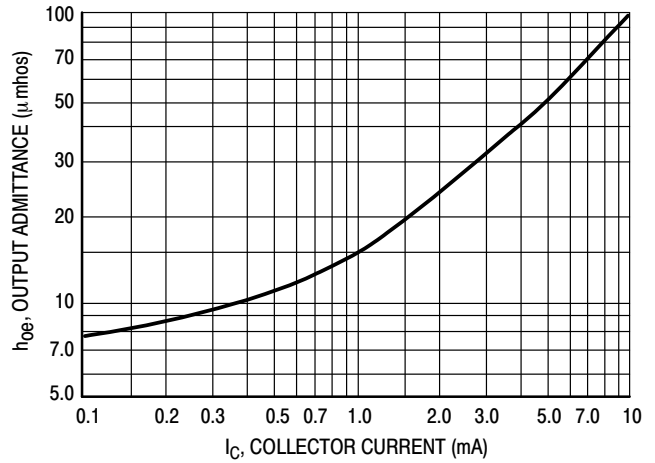


Figure 11. Output Admittance

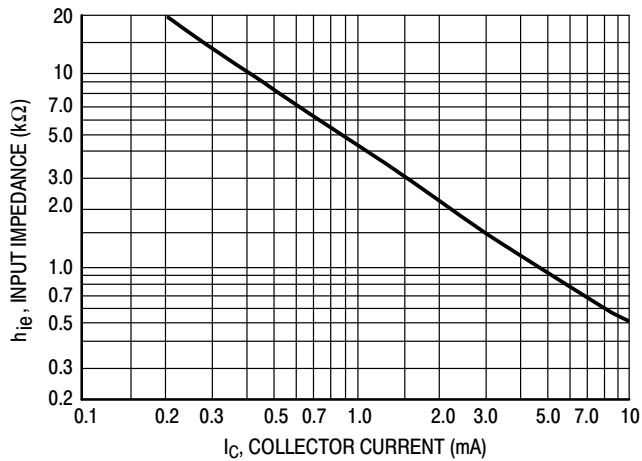


Figure 12. Input Impedance

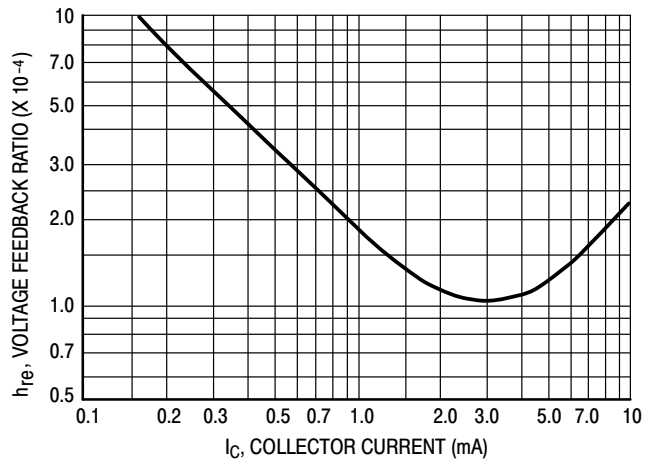


Figure 13. Voltage Feedback Ratio

# MMBT3906TT1

## STATIC CHARACTERISTICS

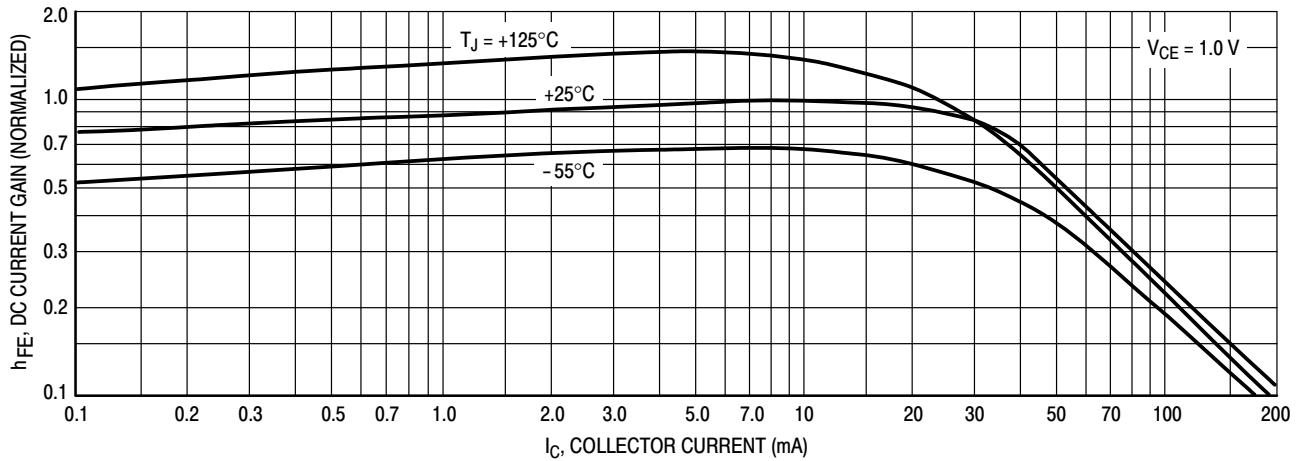


Figure 14. DC Current Gain

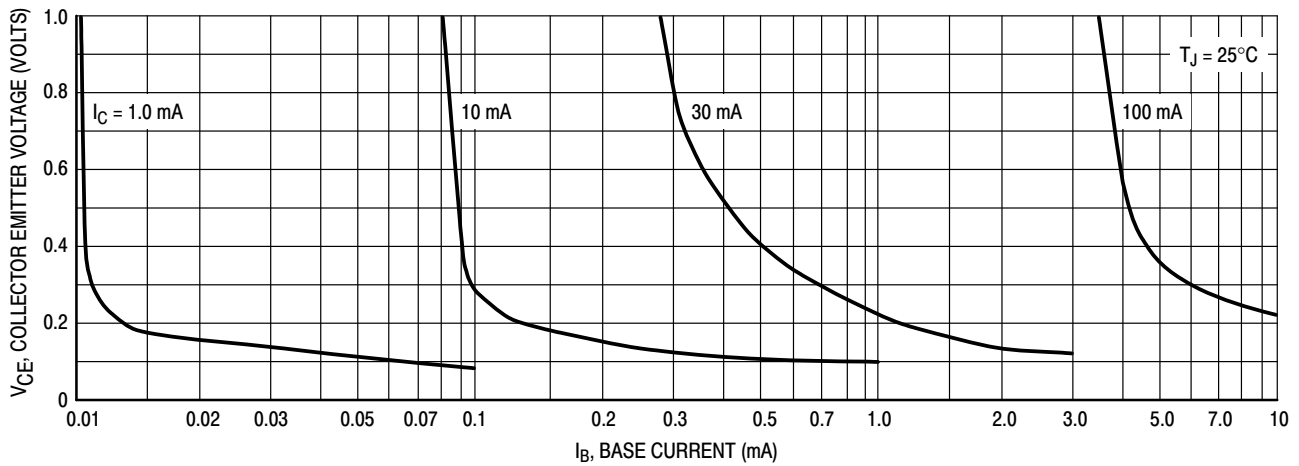


Figure 15. Collector Saturation Region

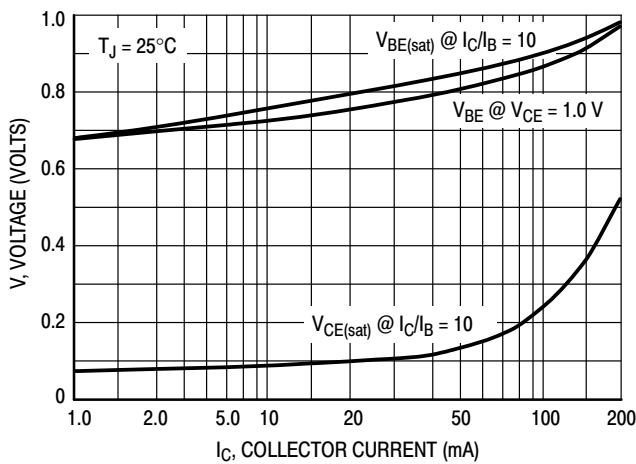


Figure 16. "ON" Voltages

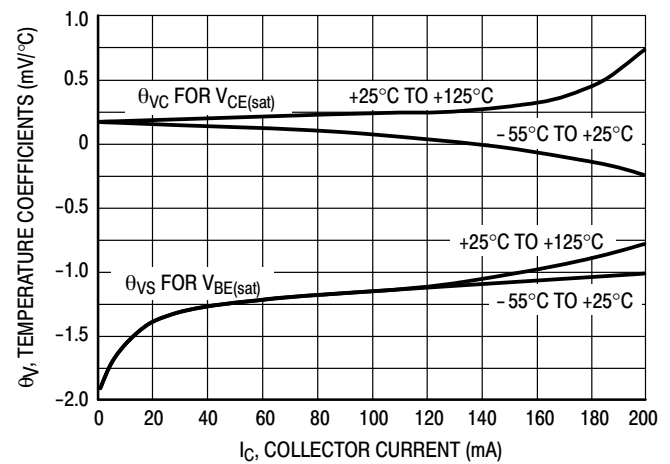
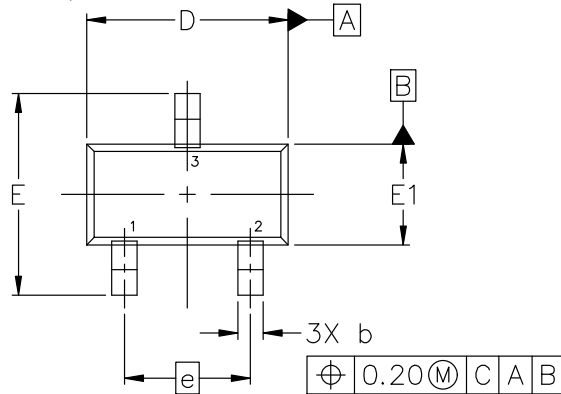


Figure 17. Temperature Coefficients

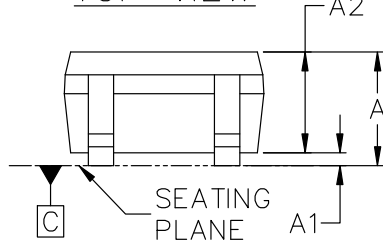
**SC75-3 1.60x0.80x0.80, 1.00P**

CASE 463  
ISSUE H

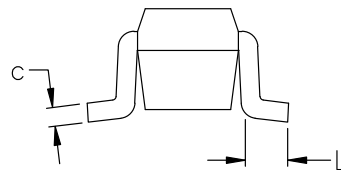
DATE 01 FEB 2024



TOP VIEW

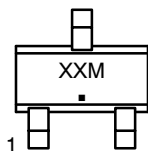


SIDE VIEW



END VIEW

**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

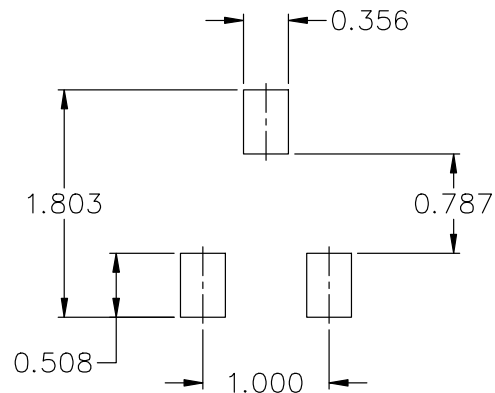
STYLE 2:  
PIN 1. ANODE  
2. N/C  
3. CATHODE

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

| 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 |



**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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