

# MMBT3906TT1

## General Purpose Transistors

### PNP Silicon

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<sub>A</sub> = 25°C)

| Rating                         | Symbol           | Value | Unit |
|--------------------------------|------------------|-------|------|
| Collector-Emitter Voltage      | V <sub>CEO</sub> | -40   | Vdc  |
| Collector-Base Voltage         | V <sub>CBO</sub> | -40   | Vdc  |
| Emitter-Base Voltage           | V <sub>EBO</sub> | -5.0  | Vdc  |
| Collector Current - Continuous | I <sub>C</sub>   | -200  | mAdc |

#### THERMAL CHARACTERISTICS

| Characteristic  | Symbol                            | Max         | Unit        |
|---|-----------------------------------|-------------|-------------|
| Total Device Dissipation,<br>FR-4 Board (Note 1) @T <sub>A</sub> = 25°C<br>Derated above 25°C | P <sub>D</sub>                    | 200<br>1.6  | mW<br>mW/°C |
| Thermal Resistance, Junction-to-Ambient<br>(Note 1)   | R <sub>θJA</sub>                  | 600         | °C/W        |
| Total Device Dissipation,<br>FR-4 Board (Note 2) @T <sub>A</sub> = 25°C<br>Derated above 25°C | P <sub>D</sub>                    | 300<br>2.4  | mW<br>mW/°C |
| Thermal Resistance, Junction-to-Ambient<br>(Note 2)   | R <sub>θJA</sub>                  | 400         | °C/W        |
| Junction and Storage Temperature Range  | T <sub>J</sub> , T <sub>stg</sub> | -65 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.

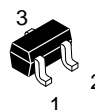
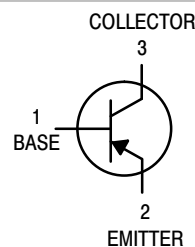
1. FR-4 @ Minimum Pad
2. FR-4 @ 1.0 × 1.0 Inch Pad



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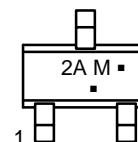
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## GENERAL PURPOSE AMPLIFIER TRANSISTORS SURFACE MOUNT



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 & Reel |
| NSVMMBT3906TT1G | SOT-416<br>(Pb-Free) | 3000 / 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.

# MMBT3906TT1

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

### OFF CHARACTERISTICS

|  |                      |      |     |     |
|--|----------------------|------|-----|-----|
| Collector–Emitter Breakdown Voltage (Note 3)<br>(I <sub>C</sub> = -1.0 mA, I <sub>B</sub> = 0) | V <sub>(BR)CEO</sub> | -40  | -   | Vdc |
| Collector–Base Breakdown Voltage<br>(I <sub>C</sub> = -10 μA, I <sub>E</sub> = 0)              | V <sub>(BR)CBO</sub> | -40  | -   | Vdc |
| Emitter–Base Breakdown Voltage<br>(I <sub>E</sub> = -10 μA, I <sub>C</sub> = 0)                | V <sub>(BR)EBO</sub> | -5.0 | -   | Vdc |
| Base Cutoff Current<br>(V <sub>CE</sub> = -30 Vdc, V <sub>EB</sub> = -3.0 Vdc)                 | I <sub>BL</sub>      | -    | -50 | nA  |
| Collector Cutoff Current<br>(V <sub>CE</sub> = -30 Vdc, V <sub>EB</sub> = -3.0 Vdc)            | I <sub>CEX</sub>     | -    | -50 | nA  |

### ON CHARACTERISTICS (Note 3)

|   |                      |                             |                         |     |
|---|----------------------|-----------------------------|-------------------------|-----|
| DC Current Gain<br>(I <sub>C</sub> = -0.1 mA, V <sub>CE</sub> = -1.0 Vdc)<br>(I <sub>C</sub> = -1.0 mA, V <sub>CE</sub> = -1.0 Vdc)<br>(I <sub>C</sub> = -10 mA, V <sub>CE</sub> = -1.0 Vdc)<br>(I <sub>C</sub> = -50 mA, V <sub>CE</sub> = -1.0 Vdc)<br>(I <sub>C</sub> = -100 mA, V <sub>CE</sub> = -1.0 Vdc) | h <sub>FE</sub>      | 60<br>80<br>100<br>60<br>30 | -<br>-<br>300<br>-<br>- | -   |
| Collector–Emitter Saturation Voltage<br>(I <sub>C</sub> = -10 mA, I <sub>B</sub> = -1.0 mA)<br>(I <sub>C</sub> = -50 mA, I <sub>B</sub> = -5.0 mA)  | V <sub>CE(sat)</sub> | -<br>-                      | -0.25<br>-0.4           | Vdc |
| Base–Emitter Saturation Voltage<br>(I <sub>C</sub> = -10 mA, I <sub>B</sub> = -1.0 mA)<br>(I <sub>C</sub> = -50 mA, I <sub>B</sub> = -5.0 mA)   | V <sub>BE(sat)</sub> | -0.65<br>-                  | -0.85<br>-0.95          | Vdc |

### SMALL-SIGNAL CHARACTERISTICS

|   |                  |     |      |                    |
|---|------------------|-----|------|--------------------|
| Current–Gain – Bandwidth Product<br>(I <sub>C</sub> = -10 mA, V <sub>CE</sub> = -20 Vdc, f = 100 MHz)         | f <sub>T</sub>   | 250 | -    | MHz                |
| Output Capacitance<br>(V <sub>CB</sub> = -5.0 Vdc, I <sub>E</sub> = 0, f = 1.0 MHz)                           | C <sub>obo</sub> | -   | 4.5  | pF                 |
| Input Capacitance <sup>1</sup><br>(V <sub>EB</sub> = -0.5 Vdc, I <sub>C</sub> = 0, f = 1.0 MHz)               | C <sub>ibo</sub> | -   | 10.0 | pF                 |
| Input Impedance<br>(V <sub>CE</sub> = -10 Vdc, I <sub>C</sub> = -1.0 mA, f = 1.0 kHz)                         | h <sub>ie</sub>  | 2.0 | 12   | k Ω                |
| Voltage Feedback Ratio<br>(V <sub>CE</sub> = -10 Vdc, I <sub>C</sub> = -1.0 mA, f = 1.0 kHz)                  | h <sub>re</sub>  | 0.1 | 10   | X 10 <sup>-4</sup> |
| Small–Signal Current Gain<br>(V <sub>CE</sub> = -10 Vdc, I <sub>C</sub> = -1.0 mA, f = 1.0 kHz)               | h <sub>fe</sub>  | 100 | 400  | -                  |
| Output Admittance<br>(V <sub>CE</sub> = -10 Vdc, I <sub>C</sub> = -1.0 mA, f = 1.0 kHz)                       | h <sub>oe</sub>  | 3.0 | 60   | μmhos              |
| Noise Figure<br>(V <sub>CE</sub> = -5.0 Vdc, I <sub>C</sub> = -100 μA, R <sub>S</sub> = 1.0 k Ω, f = 1.0 kHz) | NF               | -   | 4.0  | dB                 |

### SWITCHING CHARACTERISTICS

|              |   |                |   |     |    |
|--------------|---|----------------|---|-----|----|
| Delay Time   | (V <sub>CC</sub> = -3.0 Vdc, V <sub>BE</sub> = 0.5 Vdc) | t <sub>d</sub> | - | 35  | ns |
| Rise Time    | (I <sub>C</sub> = -10 mA, I <sub>B1</sub> = -1.0 mA)    | t <sub>r</sub> | - | 35  |    |
| Storage Time | (V <sub>CC</sub> = -3.0 Vdc, I <sub>C</sub> = -10 mA)   | t <sub>s</sub> | - | 225 | ns |
| Fall Time    | (I <sub>B1</sub> = I <sub>B2</sub> = -1.0 mA)           | t <sub>f</sub> | - | 75  |    |

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

# MMBT3906TT1

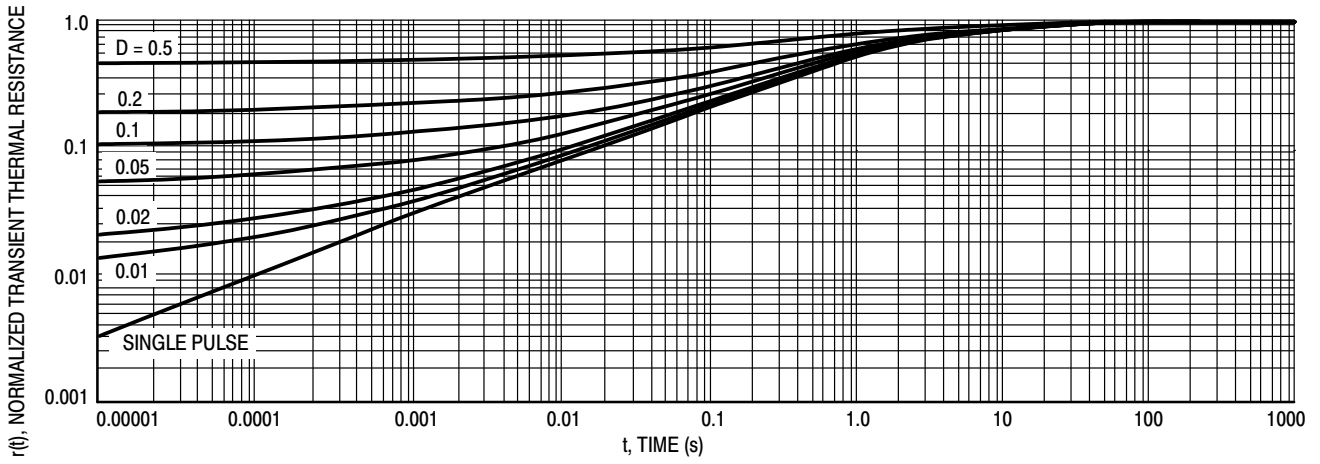


Figure 1. Normalized Thermal Response

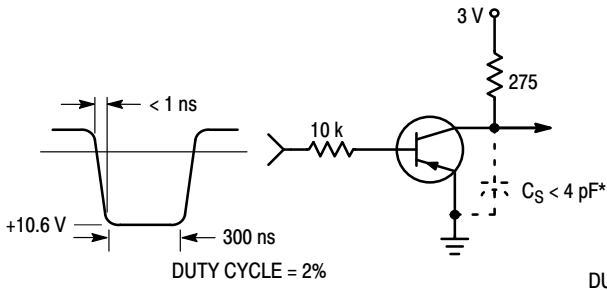


Figure 2. Delay and Rise Time Equivalent Test Circuit

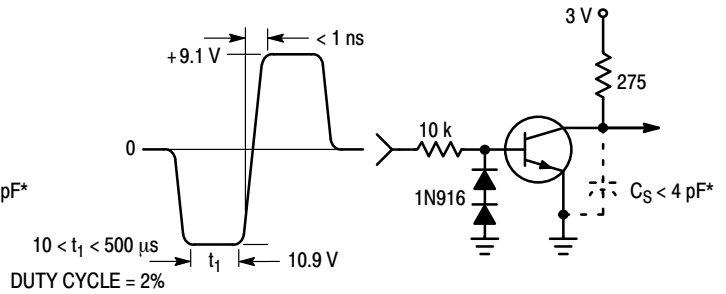


Figure 3. Storage and Fall Time Equivalent Test Circuit

\* Total shunt capacitance of test jig and connectors

# MMBT3906TT1

## TYPICAL TRANSIENT CHARACTERISTICS

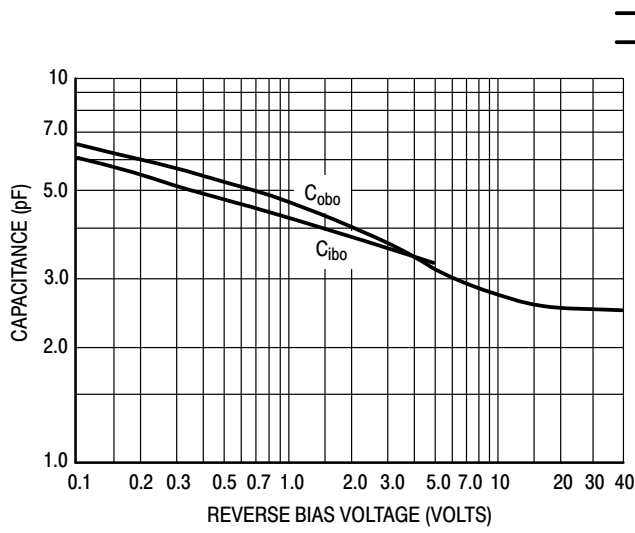


Figure 4. Capacitance

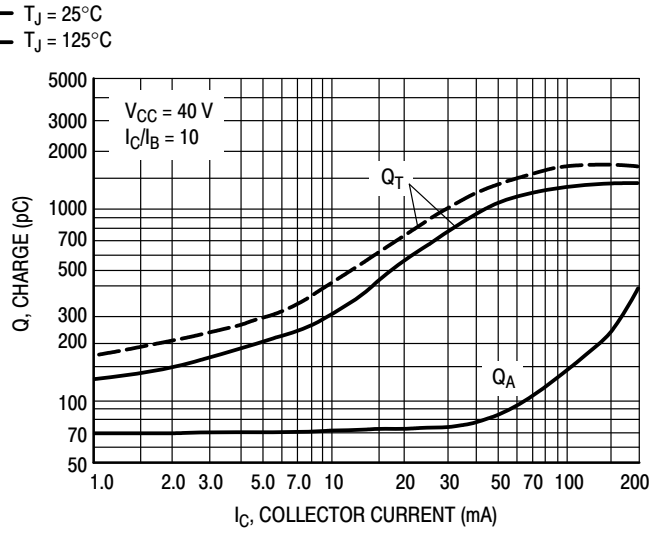


Figure 5. Charge Data

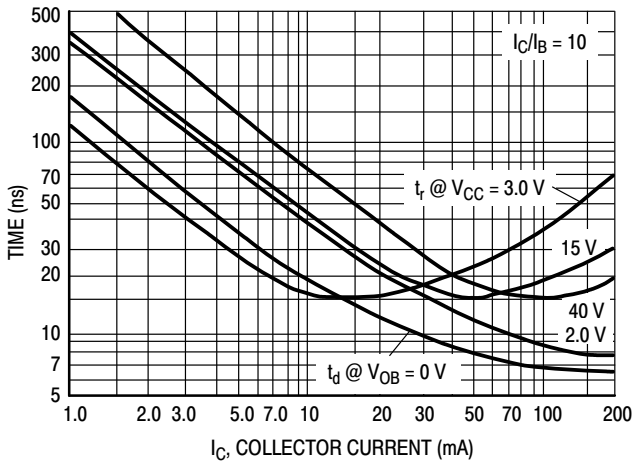


Figure 6. Turn-On Time

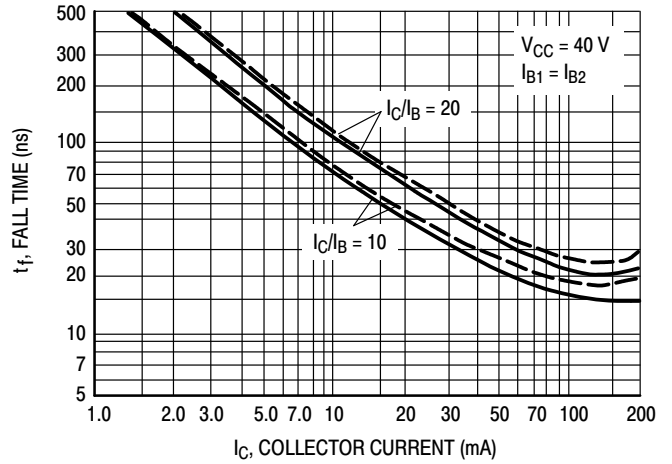


Figure 7. Fall Time

# MMBT3906TT1

## TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

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

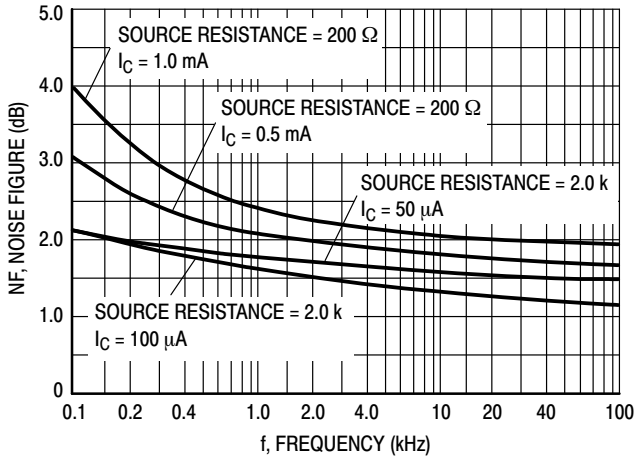


Figure 8.

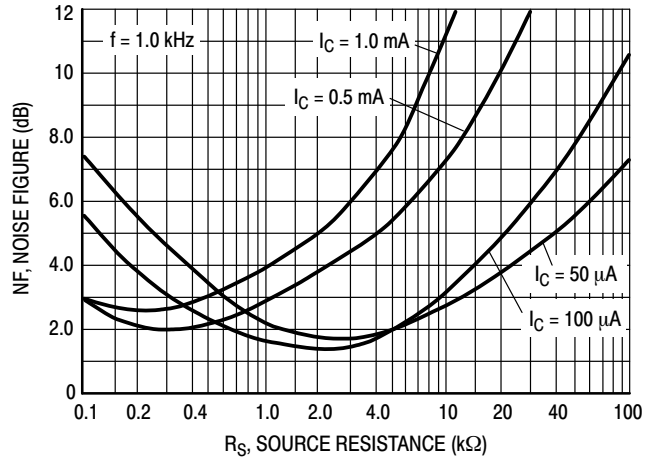


Figure 9.

## h PARAMETERS

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

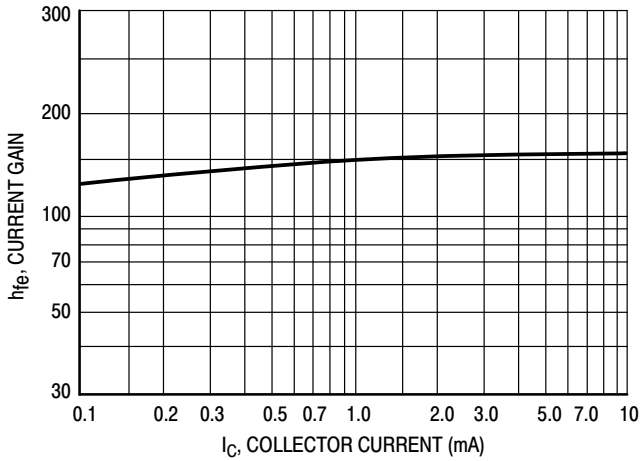


Figure 10. Current Gain

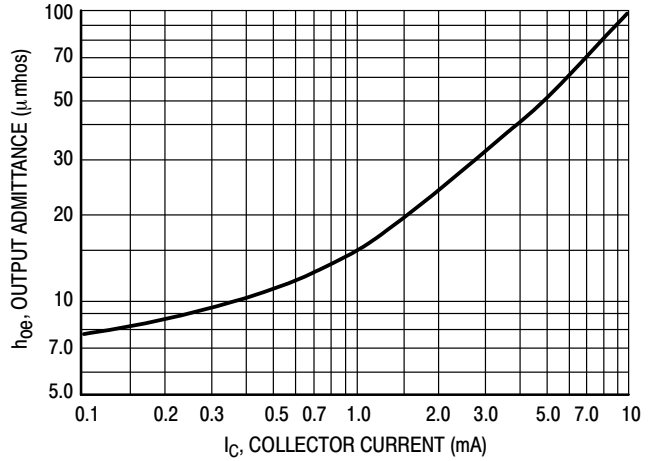


Figure 11. Output Admittance

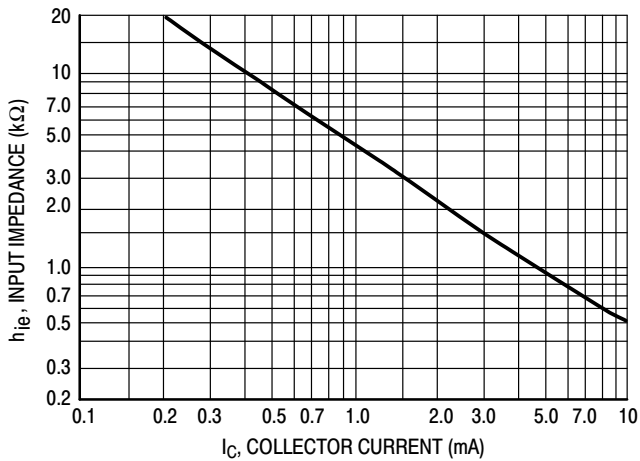


Figure 12. Input Impedance

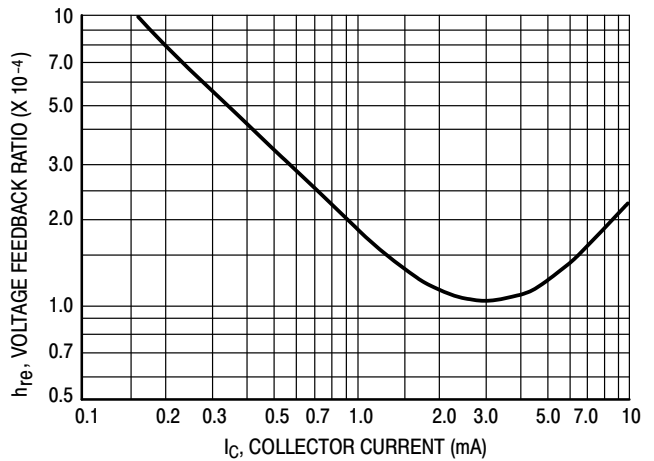


Figure 13. Voltage Feedback Ratio

# MMBT3906TT1

## STATIC CHARACTERISTICS

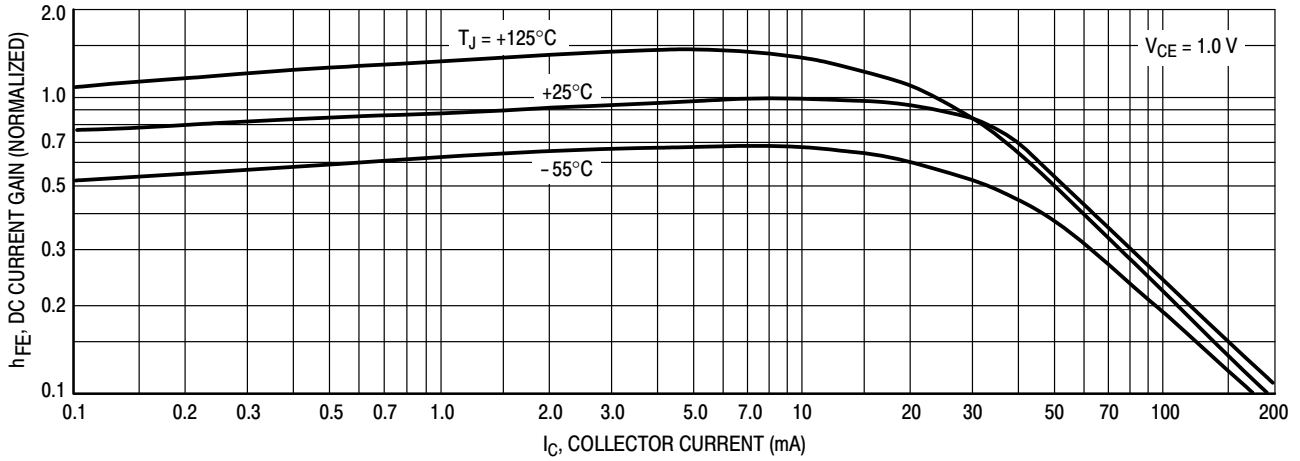


Figure 14. DC Current Gain

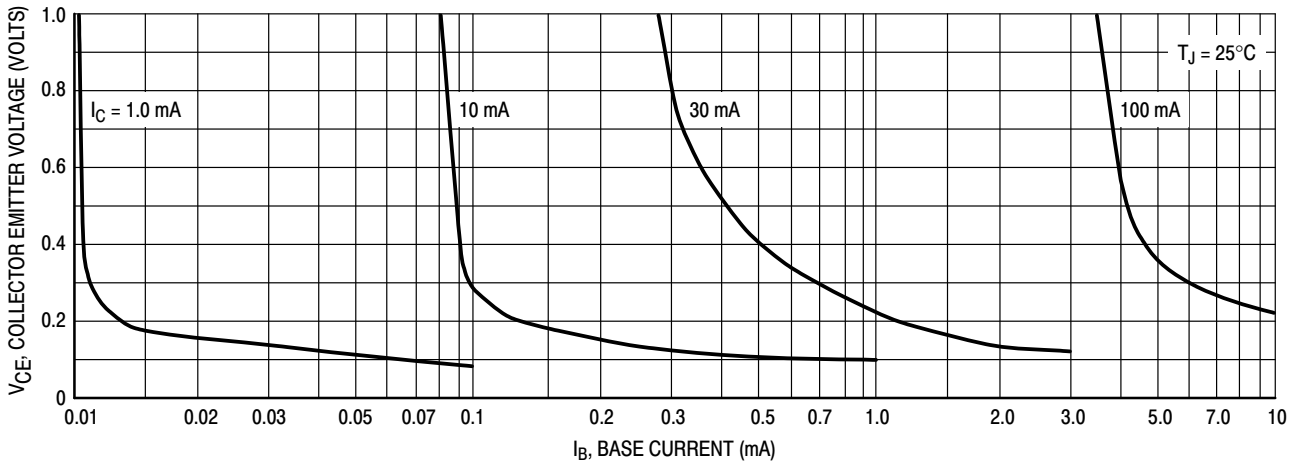


Figure 15. Collector Saturation Region

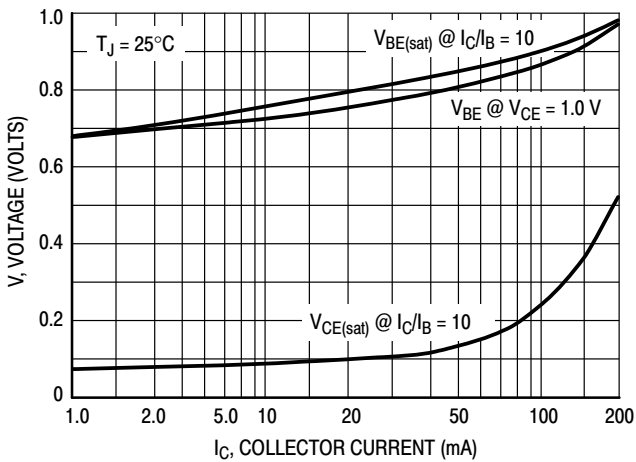


Figure 16. "ON" Voltages

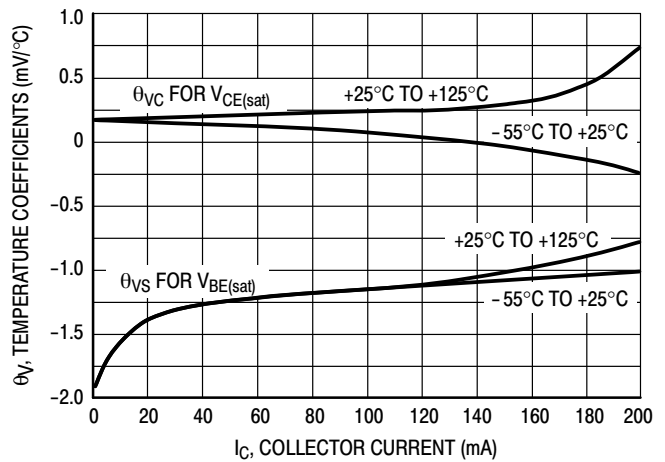


Figure 17. Temperature Coefficients

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

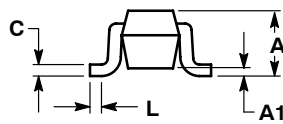
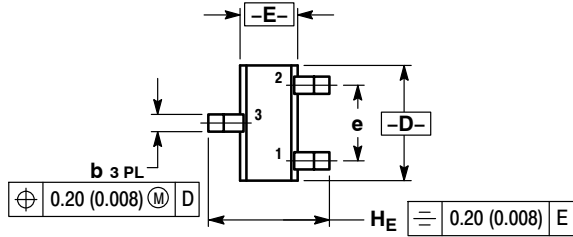
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SC-75/SOT-416  
CASE 463-01  
ISSUE G

DATE 07 AUG 2015

SCALE 4:1



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

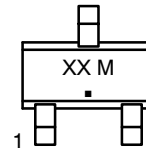
STYLE 5:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| DIM | MILLIMETERS |      |      | INCHES   |       |       |
|-----|-------------|------|------|----------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN      | NOM   | MAX   |
| A   | 0.70        | 0.80 | 0.90 | 0.027    | 0.031 | 0.035 |
| A1  | 0.00        | 0.05 | 0.10 | 0.000    | 0.002 | 0.004 |
| b   | 0.15        | 0.20 | 0.30 | 0.006    | 0.008 | 0.012 |
| C   | 0.10        | 0.15 | 0.25 | 0.004    | 0.006 | 0.010 |
| D   | 1.55        | 1.60 | 1.65 | 0.061    | 0.063 | 0.065 |
| E   | 0.70        | 0.80 | 0.90 | 0.027    | 0.031 | 0.035 |
| e   | 1.00 BSC    |      |      | 0.04 BSC |       |       |
| L   | 0.10        | 0.15 | 0.20 | 0.004    | 0.006 | 0.008 |
| HE  | 1.50        | 1.60 | 1.70 | 0.060    | 0.063 | 0.067 |

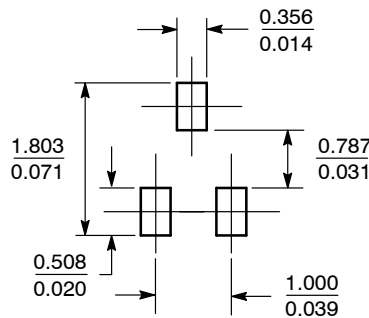
GENERIC MARKING DIAGRAM\*



- 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.

SOLDERING FOOTPRINT\*



SCALE 10:1 (mm/inches)

\*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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| DESCRIPTION:     | SC-75/SOT-416 | PAGE 1 OF 1  |

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