

# MMBT5401W

## High Voltage Transistor

### PNP Silicon

#### Features

- NSV 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    | $V_{CEO}$ | -150  | Vdc  |
| Collector – Base Voltage       | $V_{CBO}$ | -160  | Vdc  |
| Emitter – Base Voltage         | $V_{EBO}$ | -5.0  | Vdc  |
| Collector Current – Continuous | $I_C$     | -500  | mAdc |

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.

#### THERMAL CHARACTERISTICS

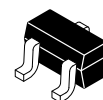
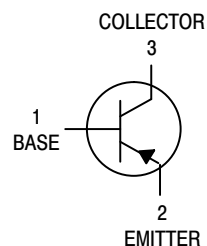
| Characteristic                                                                                                 | Symbol          | Max         | Unit                       |
|----------------------------------------------------------------------------------------------------------------|-----------------|-------------|----------------------------|
| Total Device Dissipation<br>FR-5 Board (Note 2)<br>$T_A = 25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$ | $P_D$           | 400<br>3.2  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance,<br>Junction-to-Ambient                                                                     | $R_{\theta JA}$ | 312         | $^\circ\text{C/W}$         |
| Junction and Storage Temperature                                                                               | $T_J, T_{stg}$  | -55 to +150 | $^\circ\text{C}$           |

1. FR-5 @ 100 mm<sup>2</sup>, 0.5 oz. copper traces, still air.
2. FR-5 = 1.0 × 0.75 × 0.062 in.



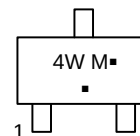
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SC-70 (SOT-323)  
CASE 419  
STYLE 3

#### MARKING DIAGRAM



4W = Specific 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 <sup>†</sup> |
|----------------------------------|--------------------|-----------------------|
| MMBT5401WT1G,<br>NSVMMBT5401WT1G | SC-70<br>(Pb-Free) | 3000 / Tape &<br>Reel |

<sup>†</sup>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.

# MMBT5401W

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

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

### OFF CHARACTERISTICS

|                                                                                                                                                       |               |        |            |                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|------------|-------------------------|
| Collector–Emitter Breakdown Voltage<br>( $I_C = -1.0\text{ mAdc}$ , $I_B = 0$ )                                                                       | $V_{(BR)CEO}$ | -150   | –          | Vdc                     |
| Collector–Base Breakdown Voltage<br>( $I_C = -100\text{ }\mu\text{Adc}$ , $I_E = 0$ )                                                                 | $V_{(BR)CBO}$ | -160   | –          | Vdc                     |
| Emitter–Base Breakdown Voltage<br>( $I_E = -10\text{ }\mu\text{Adc}$ , $I_C = 0$ )                                                                    | $V_{(BR)EBO}$ | -5.0   | –          | Vdc                     |
| Collector–Base Cutoff Current<br>( $V_{CB} = -120\text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = -120\text{ Vdc}$ , $I_E = 0$ , $T_A = 100^\circ\text{C}$ ) | $I_{CBO}$     | –<br>– | -50<br>-50 | nAdc<br>$\mu\text{Adc}$ |

### ON CHARACTERISTICS

|                                                                                                                                                                                                      |               |                |               |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|---------------|-----|
| DC Current Gain<br>( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -5.0\text{ Vdc}$ )<br>( $I_C = -10\text{ mAdc}$ , $V_{CE} = -5.0\text{ Vdc}$ )<br>( $I_C = -50\text{ mAdc}$ , $V_{CE} = -5.0\text{ Vdc}$ ) | $h_{FE}$      | 50<br>60<br>50 | –<br>240<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>–         | -0.2<br>-0.5  | Vdc |
| Base–Emitter Saturation Voltage<br>( $I_C = -10\text{ mAdc}$ , $I_B = -1.0\text{ mAdc}$ )<br>( $I_C = -50\text{ mAdc}$ , $I_B = -5.0\text{ mAdc}$ )                                                  | $V_{BE(sat)}$ | –<br>–         | -1.0<br>-1.0  | Vdc |

### SMALL-SIGNAL CHARACTERISTICS

|                                                                                                                                      |           |     |     |     |
|--------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|-----|-----|
| Current–Gain — Bandwidth Product<br>( $I_C = -10\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 100\text{ MHz}$ )                   | $f_T$     | 100 | 300 | MHz |
| Output Capacitance<br>( $V_{CB} = -10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )                                               | $C_{obo}$ | –   | 6.0 | pF  |
| Small Signal Current Gain<br>( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )                         | $h_{fe}$  | 40  | 200 | –   |
| Noise Figure<br>( $I_C = -200\text{ }\mu\text{Adc}$ , $V_{CE} = -5.0\text{ Vdc}$ , $R_S = 10\text{ }\Omega$ , $f = 1.0\text{ kHz}$ ) | NF        | –   | 8.0 | dB  |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# MMBT5401W

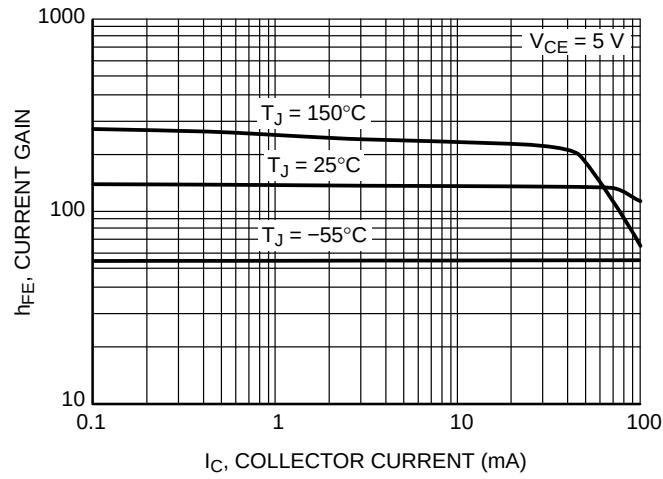


Figure 1. DC Current Gain

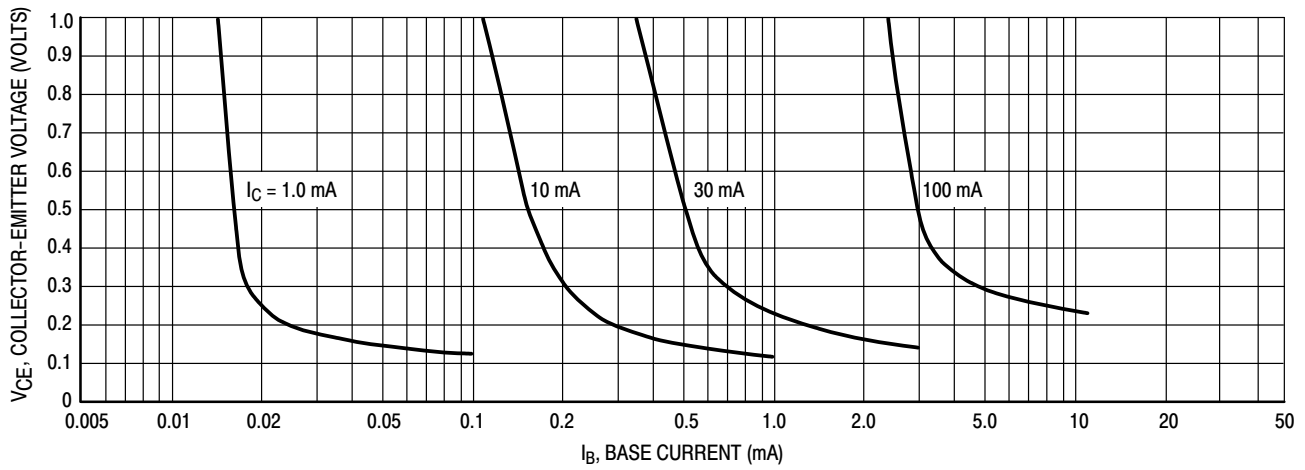


Figure 2. Collector Saturation Region

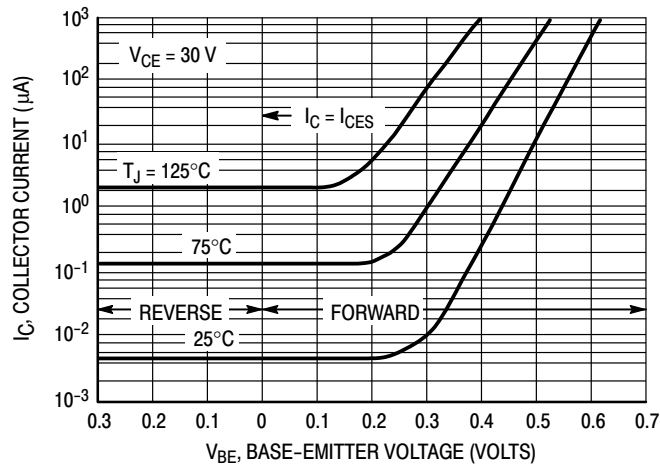
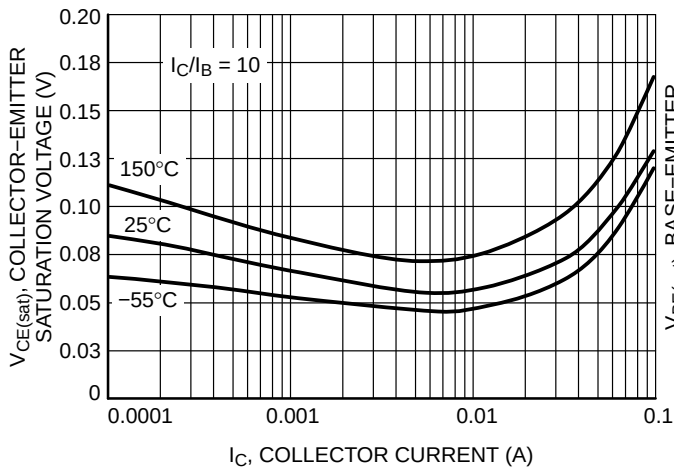
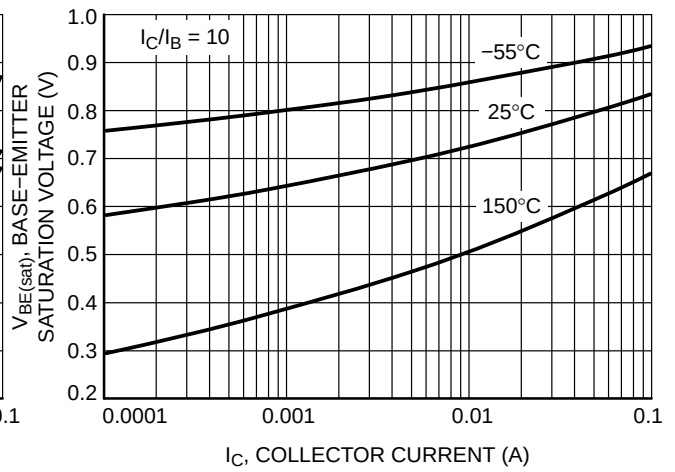


Figure 3. Collector Cut-Off Region

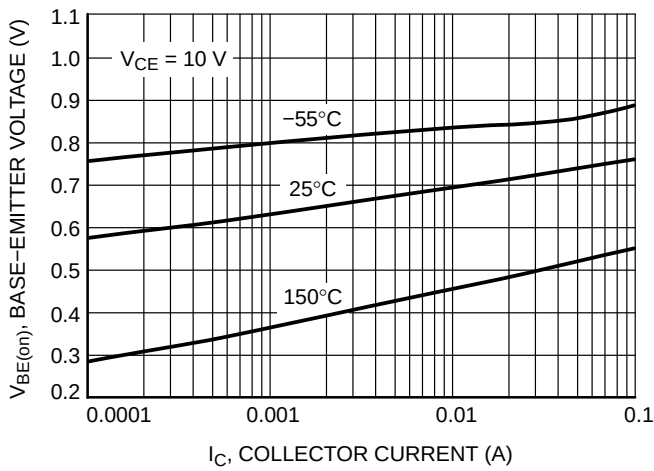
# MMBT5401W



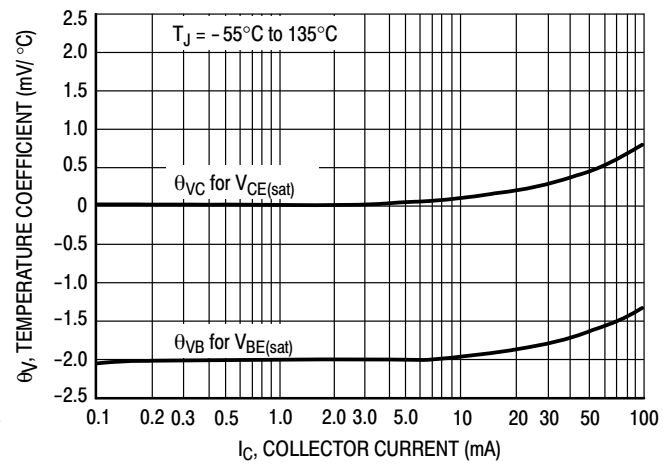
**Figure 4. Collector-Emitter Saturation Voltage vs. Collector Current**



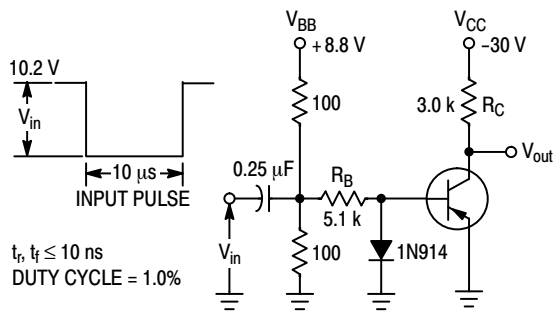
**Figure 5. Base-Emitter Saturation Voltage vs. Collector Current**



**Figure 6. Base-Emitter Voltage vs. Collector Current**

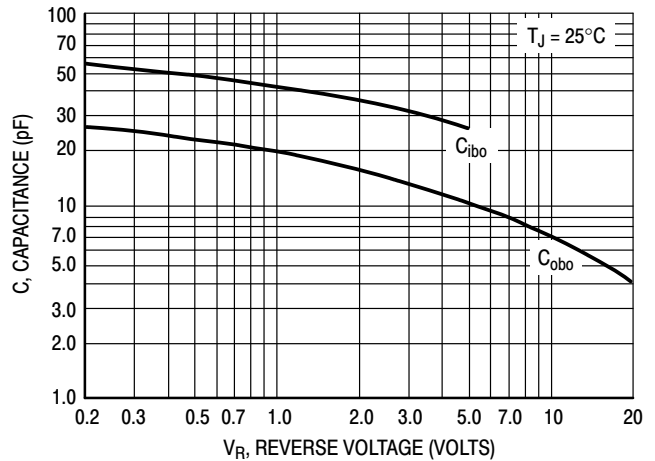


**Figure 7. Temperature Coefficients**



Values Shown are for  $I_C$  @ 10 mA

**Figure 8. Switching Time Test Circuit**



**Figure 9. Capacitances**

# MMBT5401W

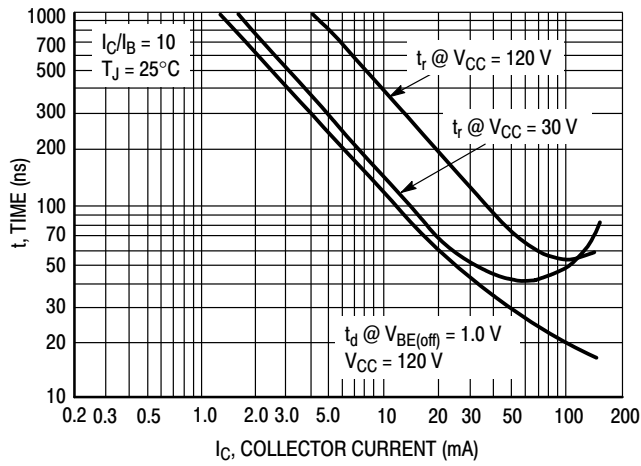


Figure 10. Turn-On Time

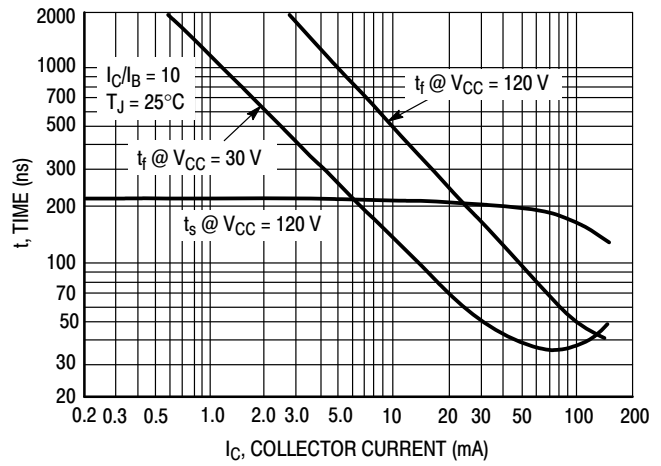


Figure 11. Turn-Off Time

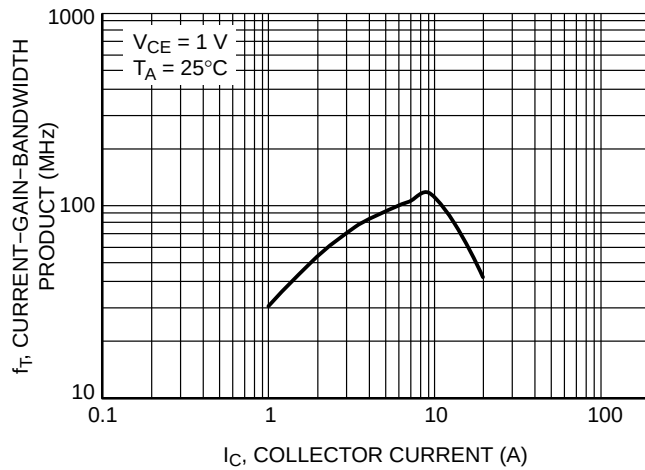


Figure 12. Current Gain Bandwidth Product

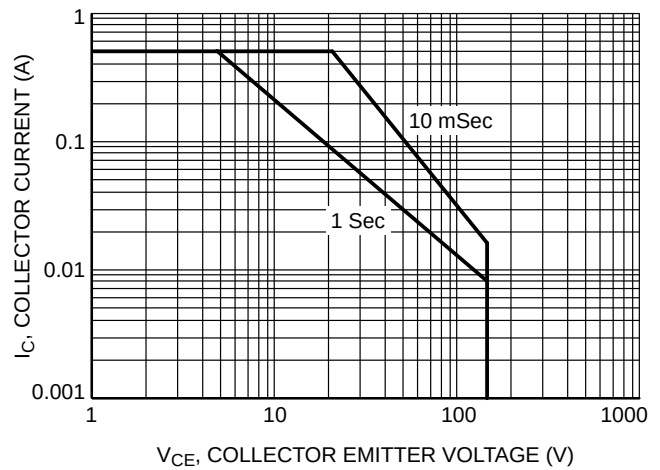
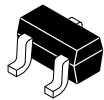


Figure 13. Safe Operating Area



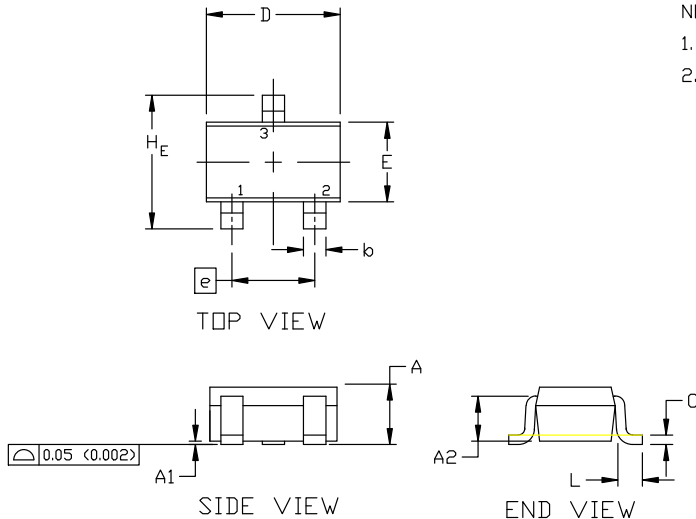
SCALE 4:1

### SC-70 (SOT-323)

#### CASE 419

#### ISSUE R

DATE 11 OCT 2022

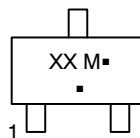


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH

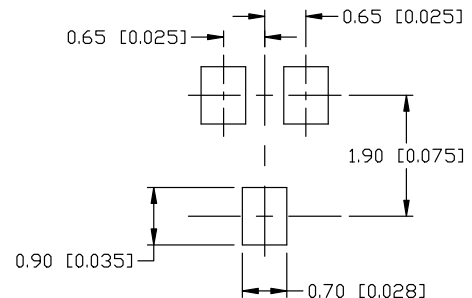
| DIM            | MILLIMETERS |      |      | INCHES    |       |       |
|----------------|-------------|------|------|-----------|-------|-------|
|                | MIN.        | NOM. | MAX. | MIN.      | NOM.  | MAX.  |
| A              | 0.80        | 0.90 | 1.00 | 0.032     | 0.035 | 0.040 |
| A1             | 0.00        | 0.05 | 0.10 | 0.000     | 0.002 | 0.004 |
| A2             | 0.70 REF    |      |      | 0.028 BSC |       |       |
| b              | 0.30        | 0.35 | 0.40 | 0.012     | 0.014 | 0.016 |
| c              | 0.10        | 0.18 | 0.25 | 0.004     | 0.007 | 0.010 |
| D              | 1.80        | 2.00 | 2.20 | 0.071     | 0.080 | 0.087 |
| E              | 1.15        | 1.24 | 1.35 | 0.045     | 0.049 | 0.053 |
| e              | 1.20        | 1.30 | 1.40 | 0.047     | 0.051 | 0.055 |
| e1             | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| L              | 0.20        | 0.38 | 0.56 | 0.008     | 0.015 | 0.022 |
| H <sub>E</sub> | 2.00        | 2.10 | 2.40 | 0.079     | 0.083 | 0.095 |

#### 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.



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

#### SOLDERING FOOTPRINT

STYLE 1:  
CANCELLED

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

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

STYLE 4:  
PIN 1. CATHODE  
2. CATHODE  
3. ANODE

STYLE 5:  
PIN 1. ANODE  
2. ANODE  
3. CATHODE

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

STYLE 7:  
PIN 1. BASE  
2. EMITTER  
3. COLLECTOR

STYLE 8:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN

STYLE 9:  
PIN 1. ANODE  
2. CATHODE  
3. CATHODE-ANODE

STYLE 10:  
PIN 1. CATHODE  
2. ANODE  
3. ANODE-CATHODE

STYLE 11:  
PIN 1. CATHODE  
2. CATHODE  
3. CATHODE

|                  |                 |                                                                                                                                                                                     |
|------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION:     | SC-70 (SOT-323) | PAGE 1 OF 1                                                                                                                                                                         |

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