

# MMBT4403WT1G

## Switching Transistor

### PNP Silicon

#### Features

- Moisture Sensitivity Level: 1
- ESD Rating: Human Body Model; 4 kV,  
Machine Model; 400 V
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### MAXIMUM RATINGS

| 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 | $I_C$     | –600  | mAdc |

#### THERMAL CHARACTERISTICS

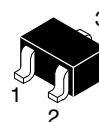
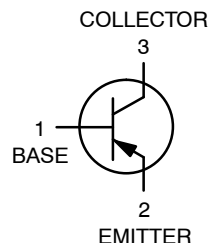
| Characteristic                                                  | Symbol          | Max         | Unit               |
|-----------------------------------------------------------------|-----------------|-------------|--------------------|
| Total Device Dissipation FR–5 Board<br>$T_A = 25^\circ\text{C}$ | $P_D$           | 150         | mW                 |
| Thermal Resistance,<br>Junction–to–Ambient                      | $R_{\theta JA}$ | 833         | $^\circ\text{C/W}$ |
| 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.



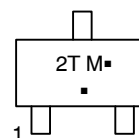
ON Semiconductor®

<http://onsemi.com>



SC-70  
CASE 419  
STYLE 3

#### MARKING DIAGRAM



2T = Specific 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†             |
|--------------|--------------------|-----------------------|
| MMBT4403WT1G | SC-70<br>(Pb-Free) | 3000 /<br>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.

# MMBT4403WT1G

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

| Characteristic                                                                                | Symbol               | Min  | Max  | Unit |
|-----------------------------------------------------------------------------------------------|----------------------|------|------|------|
| <b>OFF CHARACTERISTICS</b>                                                                    |                      |      |      |      |
| Collector–Emitter Breakdown Voltage (Note 1) (I <sub>C</sub> = –1.0 mAdc, I <sub>B</sub> = 0) | V <sub>(BR)CEO</sub> | –40  | –    | Vdc  |
| Collector–Base Breakdown Voltage (I <sub>C</sub> = –0.1 mAdc, I <sub>E</sub> = 0)             | V <sub>(BR)CBO</sub> | –40  | –    | Vdc  |
| Emitter–Base Breakdown Voltage (I <sub>E</sub> = –0.1 mAdc, I <sub>C</sub> = 0)               | V <sub>(BR)EBO</sub> | –5.0 | –    | Vdc  |
| Base Cutoff Current (V <sub>CE</sub> = –35 Vdc, V <sub>EB</sub> = –0.4 Vdc)                   | I <sub>BEV</sub>     | –    | –0.1 | μAdc |
| Collector Cutoff Current (V <sub>CE</sub> = –35 Vdc, V <sub>EB</sub> = –0.4 Vdc)              | I <sub>CEX</sub>     | –    | –0.1 | μAdc |

## ON CHARACTERISTICS

|                                                                                                                                                                                                                                                                                                                                              |                      |                              |                         |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------------|-------------------------|-----|
| DC Current Gain<br>(I <sub>C</sub> = –0.1 mAdc, V <sub>CE</sub> = –1.0 Vdc)<br>(I <sub>C</sub> = –1.0 mAdc, V <sub>CE</sub> = –1.0 Vdc)<br>(I <sub>C</sub> = –10 mAdc, V <sub>CE</sub> = –1.0 Vdc)<br>(I <sub>C</sub> = –150 mAdc, V <sub>CE</sub> = –2.0 Vdc) (Note 1)<br>(I <sub>C</sub> = –500 mAdc, V <sub>CE</sub> = –2.0 Vdc) (Note 1) | h <sub>FE</sub>      | 30<br>60<br>100<br>100<br>20 | –<br>–<br>–<br>300<br>– | –   |
| Collector–Emitter Saturation Voltage (Note 1)<br>(I <sub>C</sub> = –150 mAdc, I <sub>B</sub> = –15 mAdc)<br>(I <sub>C</sub> = –500 mAdc, I <sub>B</sub> = –50 mAdc)                                                                                                                                                                          | V <sub>CE(sat)</sub> | –<br>–                       | –0.4<br>–0.75           | Vdc |
| Base–Emitter Saturation Voltage (Note 1)<br>(I <sub>C</sub> = –150 mAdc, I <sub>B</sub> = –15 mAdc)<br>(I <sub>C</sub> = –500 mAdc, I <sub>B</sub> = –50 mAdc)                                                                                                                                                                               | V <sub>BE(sat)</sub> | –0.75<br>–                   | –0.95<br>–1.3           | Vdc |

## SMALL–SIGNAL CHARACTERISTICS

|                                                                                                      |                 |     |     |                    |
|------------------------------------------------------------------------------------------------------|-----------------|-----|-----|--------------------|
| Current–Gain – Bandwidth Product (I <sub>C</sub> = –20 mAdc, V <sub>CE</sub> = –10 Vdc, f = 100 MHz) | f <sub>T</sub>  | 200 | –   | MHz                |
| Collector–Base Capacitance (V <sub>CB</sub> = –10 Vdc, I <sub>E</sub> = 0, f = 1.0 MHz)              | C <sub>cb</sub> | –   | 8.5 | pF                 |
| Emitter–Base Capacitance (V <sub>BE</sub> = –0.5 Vdc, I <sub>C</sub> = 0, f = 1.0 MHz)               | C <sub>eb</sub> | –   | 30  | pF                 |
| Input Impedance (I <sub>C</sub> = –1.0 mAdc, V <sub>CE</sub> = –10 Vdc, f = 1.0 kHz)                 | h <sub>ie</sub> | 1.5 | 15  | kΩ                 |
| Voltage Feedback Ratio (I <sub>C</sub> = –1.0 mAdc, V <sub>CE</sub> = –10 Vdc, f = 1.0 kHz)          | h <sub>re</sub> | 0.1 | 8.0 | X 10 <sup>–4</sup> |
| Small–Signal Current Gain (I <sub>C</sub> = –1.0 mAdc, V <sub>CE</sub> = –10 Vdc, f = 1.0 kHz)       | h <sub>fe</sub> | 60  | 500 | –                  |
| Output Admittance (I <sub>C</sub> = –1.0 mAdc, V <sub>CE</sub> = –10 Vdc, f = 1.0 kHz)               | h <sub>oe</sub> | 1.0 | 100 | μmhos              |

## SWITCHING CHARACTERISTICS

|              |                                                                                                                    |                |   |     |    |
|--------------|--------------------------------------------------------------------------------------------------------------------|----------------|---|-----|----|
| Delay Time   | (V <sub>CC</sub> = –30 Vdc, V <sub>EB</sub> = –2.0 Vdc,<br>I <sub>C</sub> = –150 mAdc, I <sub>B1</sub> = –15 mAdc) | t <sub>d</sub> | – | 15  | ns |
| Rise Time    |                                                                                                                    | t <sub>r</sub> | – | 20  |    |
| Storage Time | (V <sub>CC</sub> = –30 Vdc, I <sub>C</sub> = –150 mAdc,<br>I <sub>B1</sub> = I <sub>B2</sub> = –15 mAdc)           | t <sub>s</sub> | – | 225 | ns |
| Fall Time    |                                                                                                                    | t <sub>f</sub> | – | 30  |    |

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

## SWITCHING TIME EQUIVALENT TEST CIRCUIT

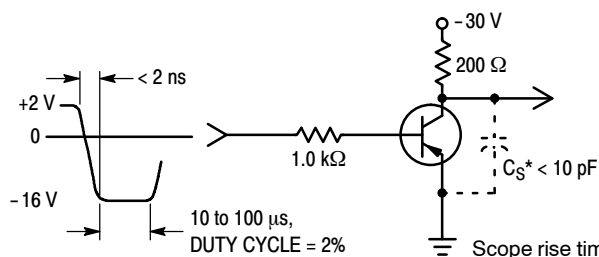


Figure 1. Turn–On Time

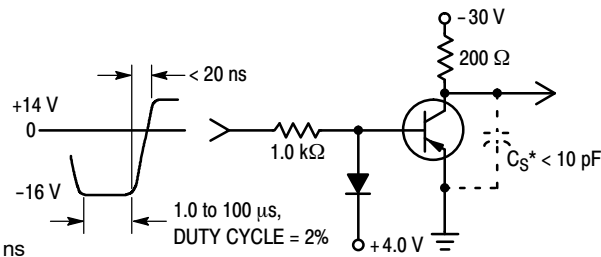


Figure 2. Turn–Off Time

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## TRANSIENT CHARACTERISTICS

— 25°C — 100°C

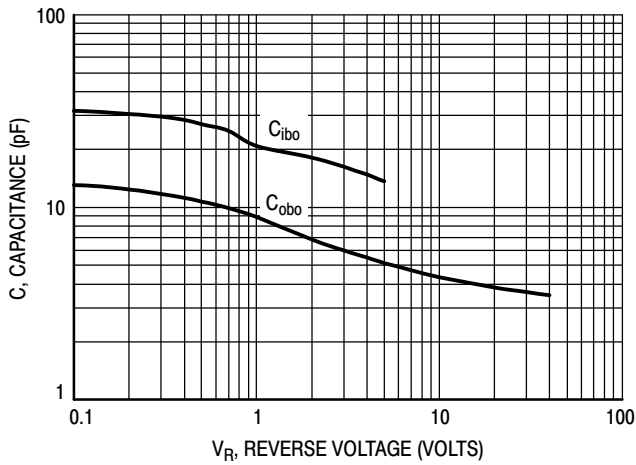


Figure 3. Capacitances

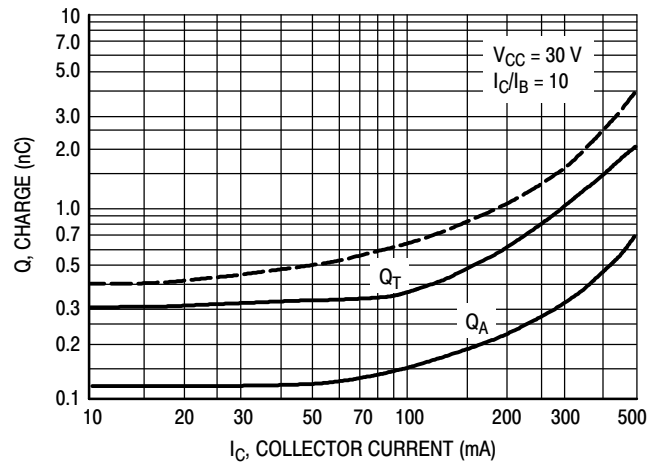


Figure 4. Charge Data

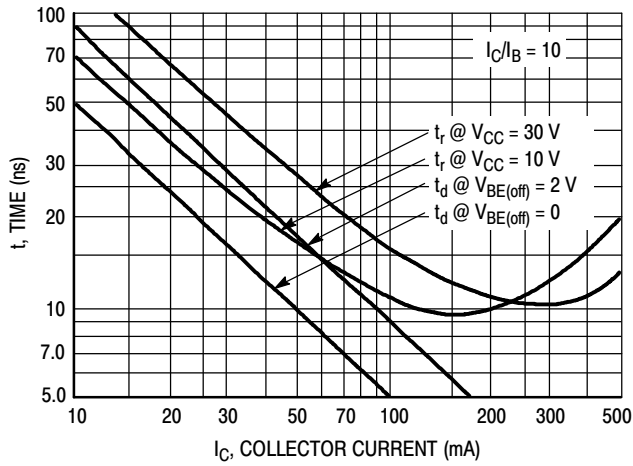


Figure 5. Turn-On Time

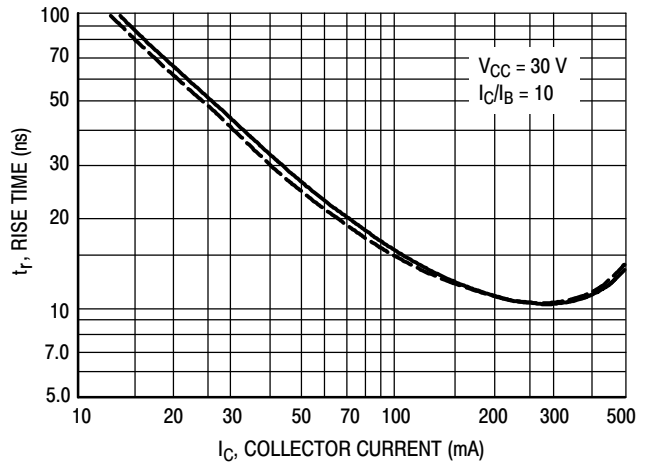


Figure 6. Rise Time

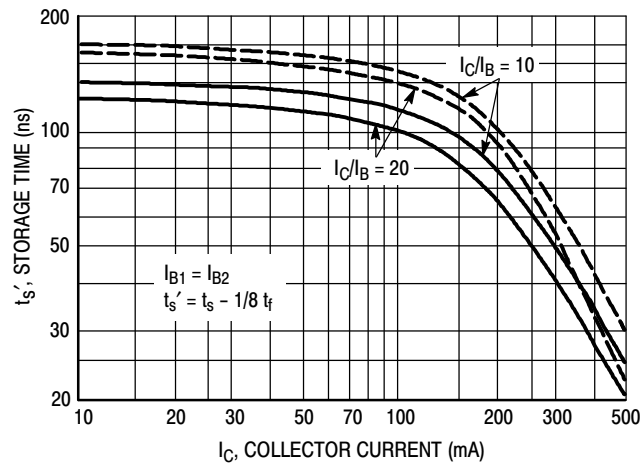


Figure 7. Storage Time

# MMBT4403WT1G

## SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE

$V_{CE} = -10 \text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$ ; Bandwidth = 1.0 Hz

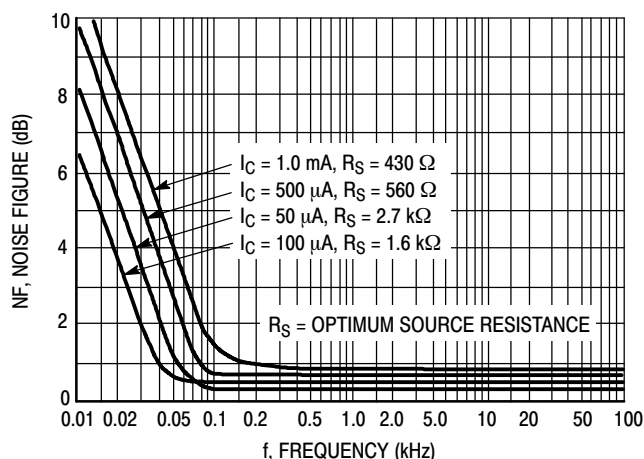


Figure 8. Frequency Effects

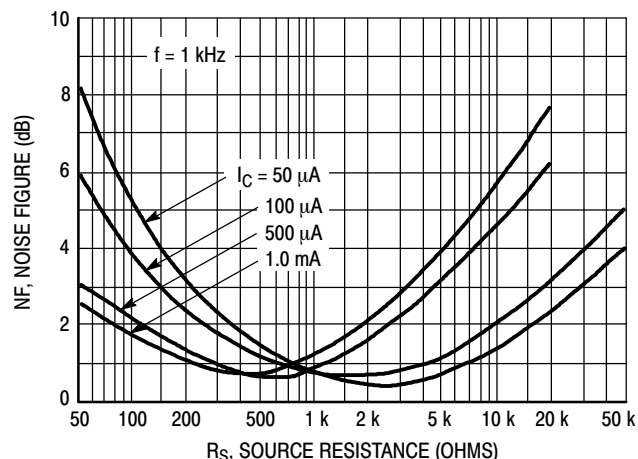


Figure 9. Source Resistance Effects

## h PARAMETERS

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

This group of graphs illustrates the relationship between  $h_{fe}$  and other “h” parameters for this series of transistors. To obtain these curves, a high-gain and a low-gain unit were selected from the MMBT4403WT1 lines, and the same units were used to develop the correspondingly numbered curves on each graph.

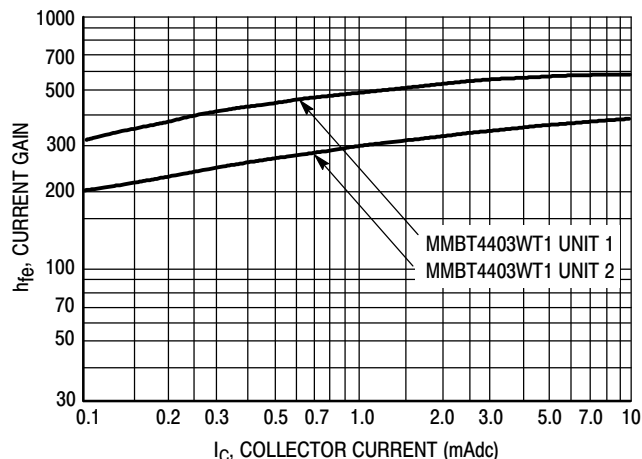


Figure 10. Current Gain

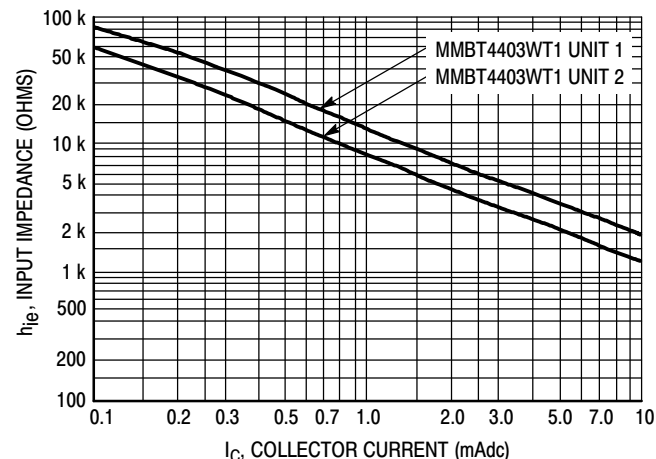


Figure 11. Input Impedance

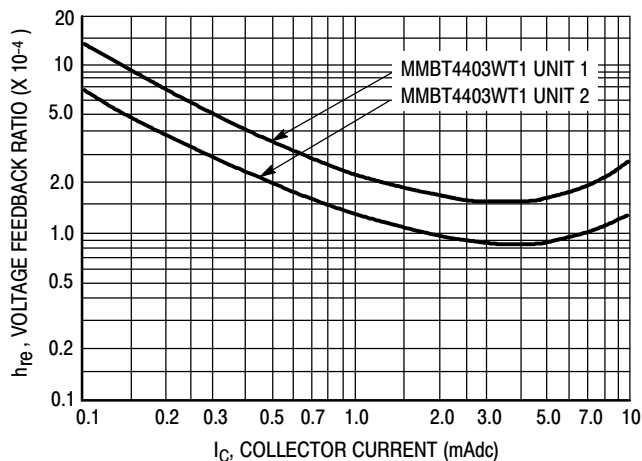


Figure 12. Voltage Feedback Ratio

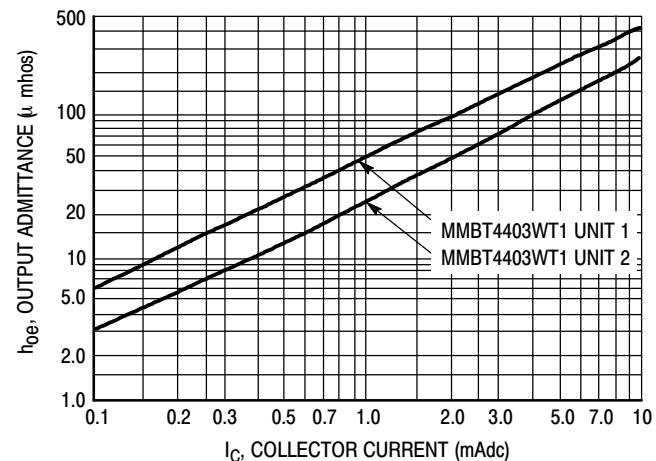


Figure 13. Output Admittance

## STATIC CHARACTERISTICS

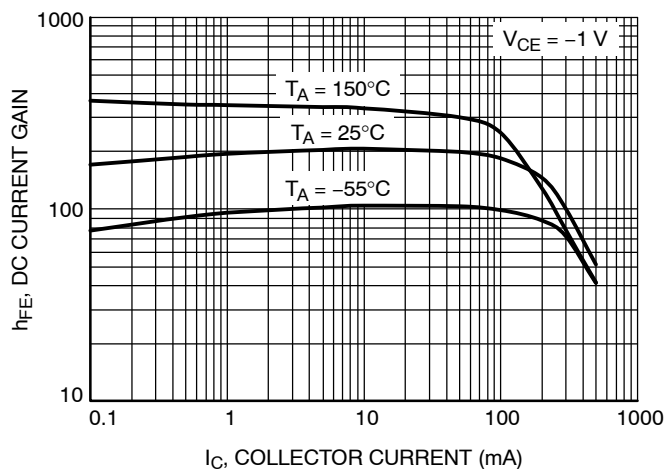


Figure 14. DC Current Gain vs. Collector Current

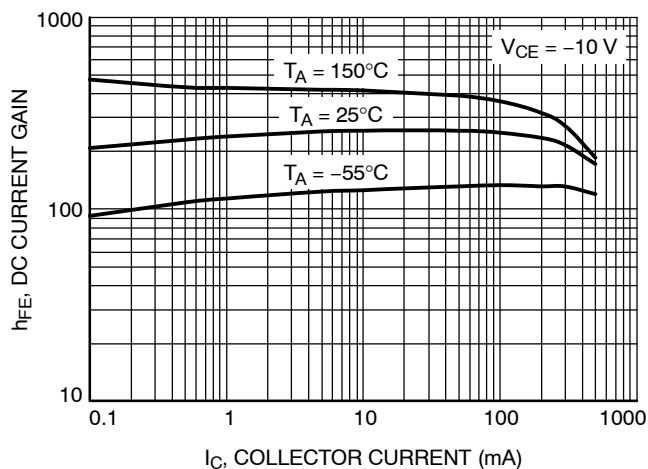


Figure 15. DC Current Gain vs. Collector Current

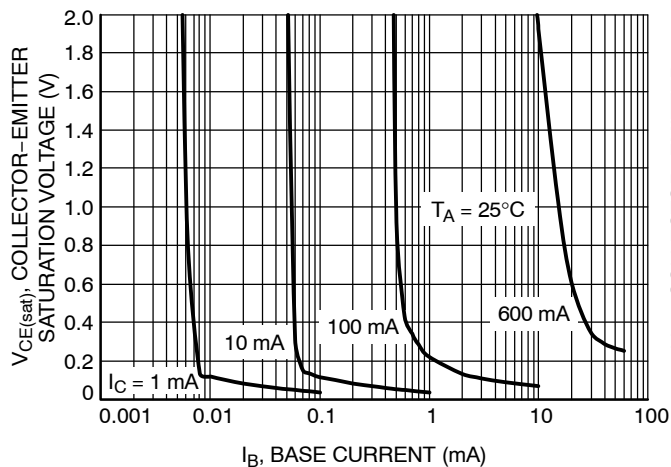


Figure 16. Saturation Region

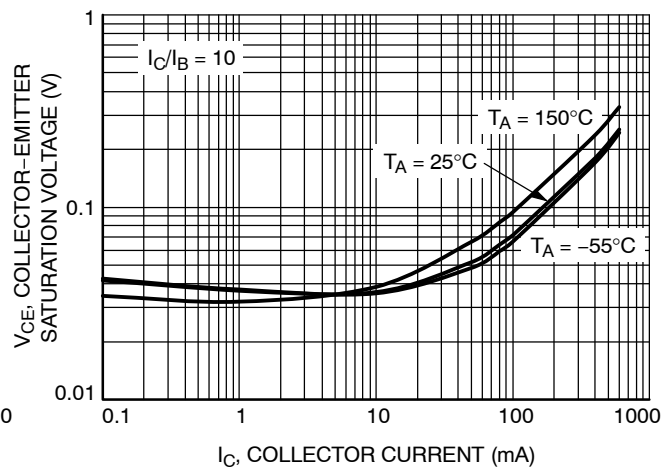


Figure 17. Collector Emitter Saturation Voltage vs. Collector Current

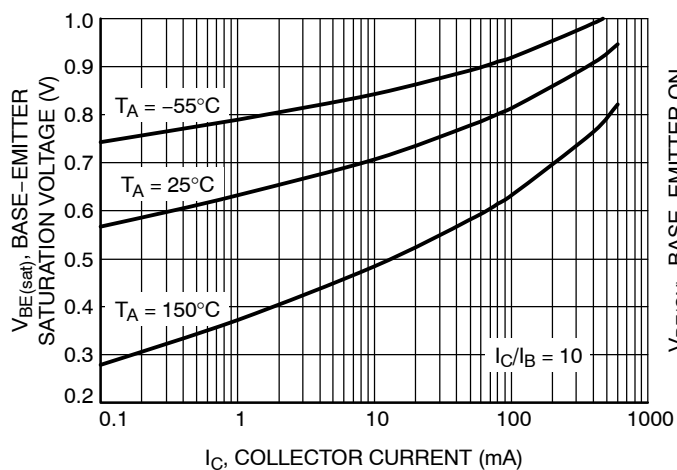


Figure 18. Base Emitter Saturation Voltage vs. Collector Current

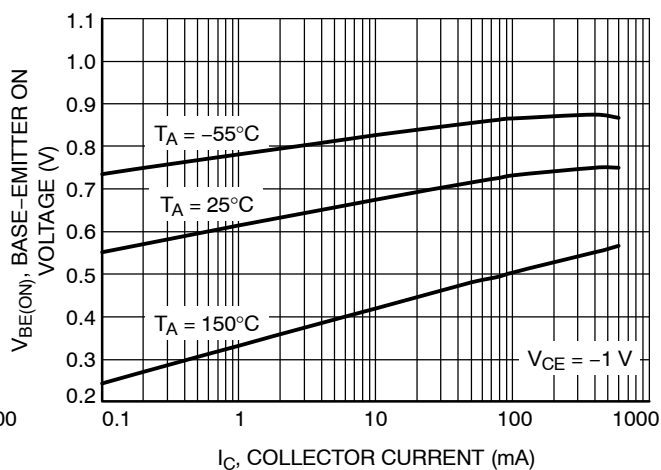


Figure 19. Base-Emitter Turn-On Voltage vs. Collector Current

# MMBT4403WT1G

## STATIC CHARACTERISTICS

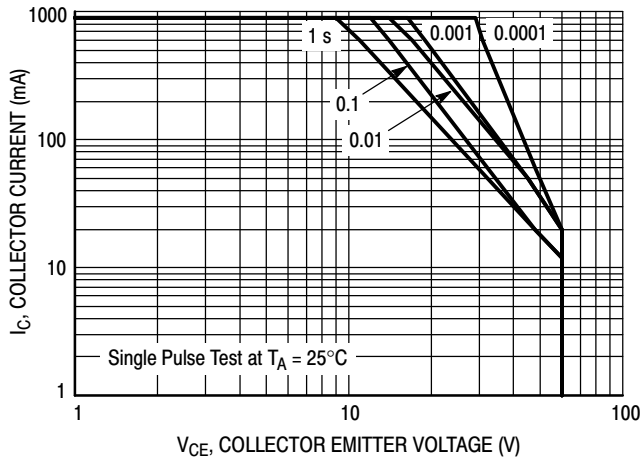


Figure 20. Safe Operating Area

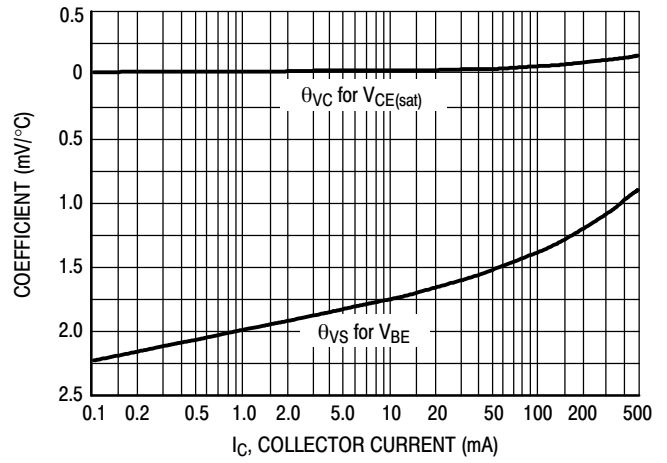
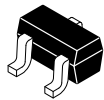


Figure 21. Temperature Coefficients



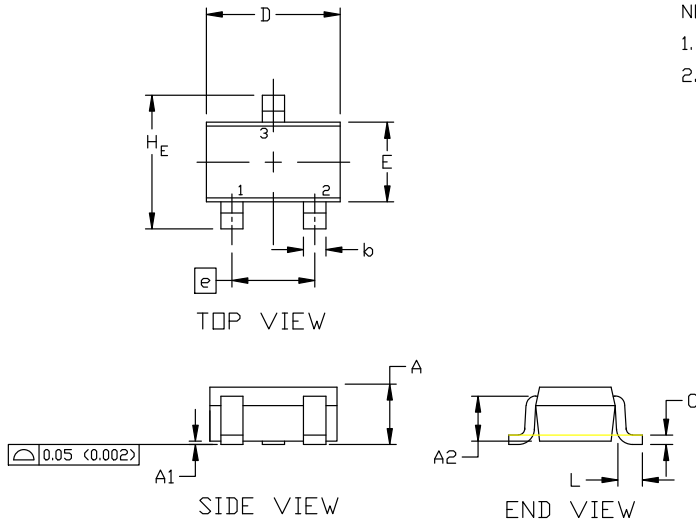
SCALE 4:1

### SC-70 (SOT-323)

#### CASE 419

#### ISSUE R

DATE 11 OCT 2022

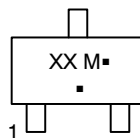


#### NOTES:

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

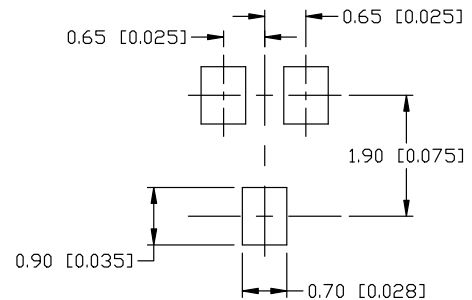
| DIM            | MILLIMETERS |      |      | INCHES    |       |       |
|----------------|-------------|------|------|-----------|-------|-------|
|                | MIN.        | NOM. | MAX. | MIN.      | NOM.  | MAX.  |
| A              | 0.80        | 0.90 | 1.00 | 0.032     | 0.035 | 0.040 |
| 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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