

# MMBT5401LT1G

## High Voltage Transistor

### PNP Silicon



ON Semiconductor®

<http://onsemi.com>

#### Features

- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### MAXIMUM RATINGS

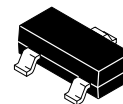
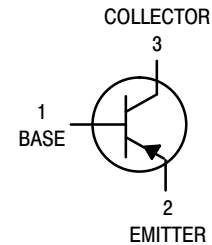
| Rating                         | Symbol    | Value | Unit |
|--------------------------------|-----------|-------|------|
| Collector - Emitter Voltage    | $V_{CEO}$ | -150  | Vdc  |
| Collector - Base Voltage       | $V_{CBO}$ | -160  | Vdc  |
| Emitter - Base Voltage         | $V_{EBO}$ | -5.0  | Vdc  |
| Collector Current - Continuous | $I_C$     | -500  | mAdc |

Stresses exceeding 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.

#### THERMAL CHARACTERISTICS

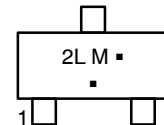
| Characteristic  | Symbol          | Max         | Unit                      |
|---|-----------------|-------------|---------------------------|
| Total Device Dissipation<br>FR-5 Board (Note 1)<br>$T_A = 25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$        | $P_D$           | 225         | mW                        |
| Thermal Resistance,<br>Junction-to-Ambient  | $R_{\theta JA}$ | 556         | $^\circ\text{C}/\text{W}$ |
| Total Device Dissipation<br>Alumina Substrate (Note 2)<br>$T_A = 25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$ | $P_D$           | 300         | mW                        |
| Thermal Resistance,<br>Junction-to-Ambient  | $R_{\theta JA}$ | 417         | $^\circ\text{C}/\text{W}$ |
| Junction and Storage Temperature  | $T_J, T_{stg}$  | -55 to +150 | $^\circ\text{C}$          |

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.



SOT-23 (TO-236)  
CASE 318  
STYLE 6

#### MARKING DIAGRAM



2L = 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†          |
|--------------|---------------------|--------------------|
| MMBT5401LT1G | SOT-23<br>(Pb-Free) | 3000 Tape & Reel   |
| MMBT5401LT3G | SOT-23<br>(Pb-Free) | 10,000 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.

# MMBT5401LT1G

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

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

### OFF CHARACTERISTICS

|  |                      |      |     |                                      |
|--|----------------------|------|-----|--------------------------------------|
| Collector–Emitter Breakdown Voltage<br>(I <sub>C</sub> = –1.0 mA <sub>dc</sub> , I <sub>B</sub> = 0)   | V <sub>(BR)CEO</sub> | –150 | –   | Vdc                                  |
| Collector–Base Breakdown Voltage<br>(I <sub>C</sub> = –100 μA <sub>dc</sub> , I <sub>E</sub> = 0)  | V <sub>(BR)CBO</sub> | –160 | –   | Vdc                                  |
| Emitter–Base Breakdown Voltage<br>(I <sub>E</sub> = –10 μA <sub>dc</sub> , I <sub>C</sub> = 0)   | V <sub>(BR)EBO</sub> | –5.0 | –   | Vdc                                  |
| Collector Cutoff Current<br>(V <sub>CB</sub> = –120 Vdc, I <sub>E</sub> = 0)<br>(V <sub>CB</sub> = –120 Vdc, I <sub>E</sub> = 0, T <sub>A</sub> = 100°C) | I <sub>CES</sub>     | –    | –50 | nA <sub>dc</sub><br>μA <sub>dc</sub> |

### ON CHARACTERISTICS

|  |                      |                |               |     |
|--|----------------------|----------------|---------------|-----|
| DC Current Gain<br>(I <sub>C</sub> = –1.0 mA <sub>dc</sub> , V <sub>CE</sub> = –5.0 Vdc)<br>(I <sub>C</sub> = –10 mA <sub>dc</sub> , V <sub>CE</sub> = –5.0 Vdc)<br>(I <sub>C</sub> = –50 mA <sub>dc</sub> , V <sub>CE</sub> = –5.0 Vdc) | h <sub>FE</sub>      | 50<br>60<br>50 | –<br>240<br>– | –   |
| Collector–Emitter Saturation Voltage<br>(I <sub>C</sub> = –10 mA <sub>dc</sub> , I <sub>B</sub> = –1.0 mA <sub>dc</sub> )<br>(I <sub>C</sub> = –50 mA <sub>dc</sub> , I <sub>B</sub> = –5.0 mA <sub>dc</sub> )                           | V <sub>CE(sat)</sub> | –<br>–         | –0.2<br>–0.5  | Vdc |
| Base–Emitter Saturation Voltage<br>(I <sub>C</sub> = –10 mA <sub>dc</sub> , I <sub>B</sub> = –1.0 mA <sub>dc</sub> )<br>(I <sub>C</sub> = –50 mA <sub>dc</sub> , I <sub>B</sub> = –5.0 mA <sub>dc</sub> )                                | V <sub>BE(sat)</sub> | –<br>–         | –1.0<br>–1.0  | Vdc |

### SMALL–SIGNAL CHARACTERISTICS

|   |                  |     |     |     |
|---|------------------|-----|-----|-----|
| Current–Gain — Bandwidth Product<br>(I <sub>C</sub> = –10 mA <sub>dc</sub> , V <sub>CE</sub> = –10 Vdc, f = 100 MHz)      | f <sub>T</sub>   | 100 | 300 | MHz |
| Output Capacitance<br>(V <sub>CB</sub> = –10 Vdc, I <sub>E</sub> = 0, f = 1.0 MHz)  | C <sub>obo</sub> | –   | 6.0 | pF  |
| Small Signal Current Gain<br>(I <sub>C</sub> = –1.0 mA <sub>dc</sub> , V <sub>CE</sub> = –10 Vdc, f = 1.0 kHz)            | h <sub>fe</sub>  | 40  | 200 | –   |
| Noise Figure<br>(I <sub>C</sub> = –200 μA <sub>dc</sub> , V <sub>CE</sub> = –5.0 Vdc, R <sub>S</sub> = 10 Ω, f = 1.0 kHz) | NF               | –   | 8.0 | dB  |

# MMBT5401LT1G

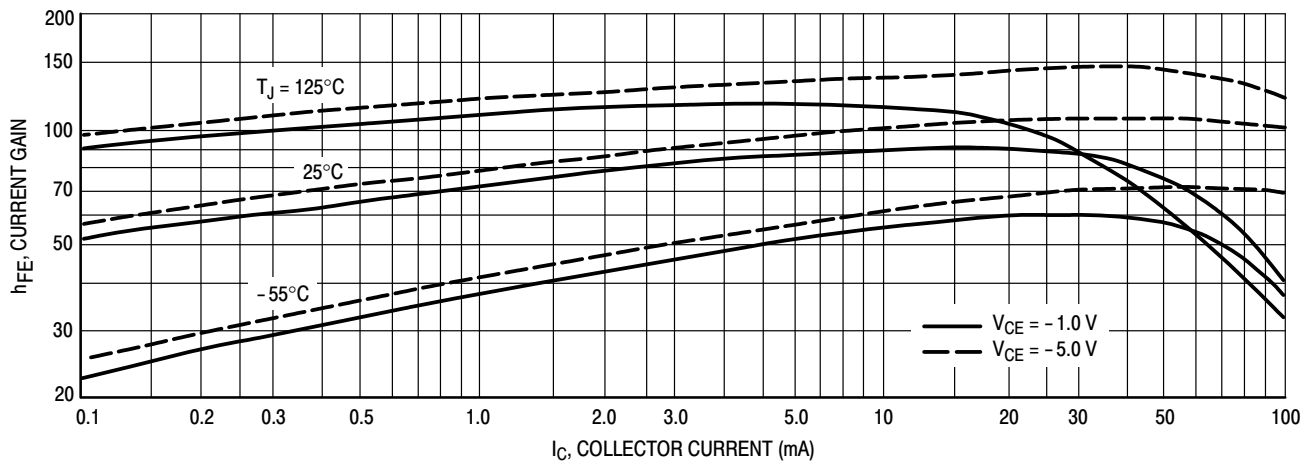


Figure 1. DC Current Gain

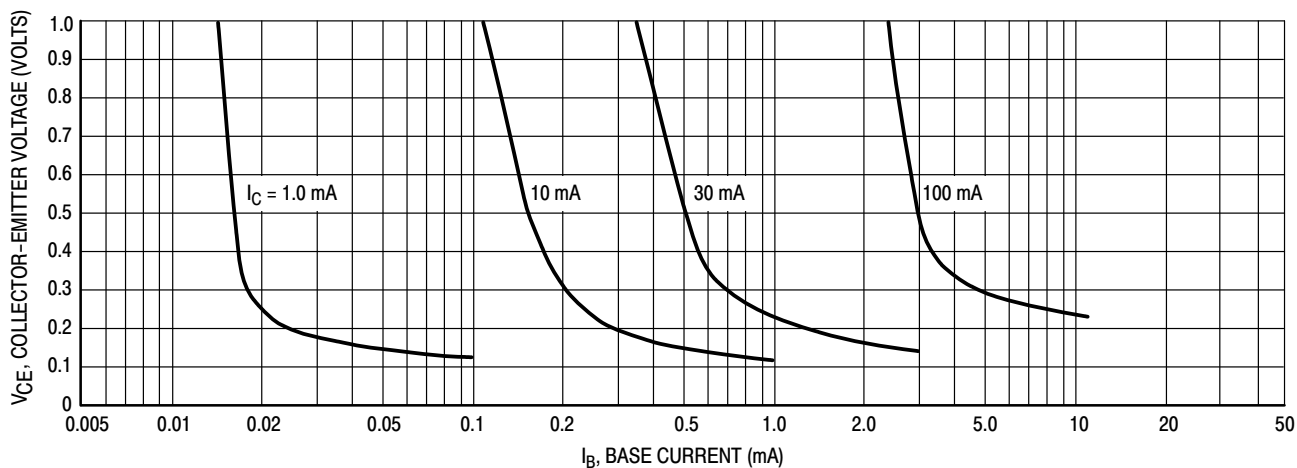


Figure 2. Collector Saturation Region

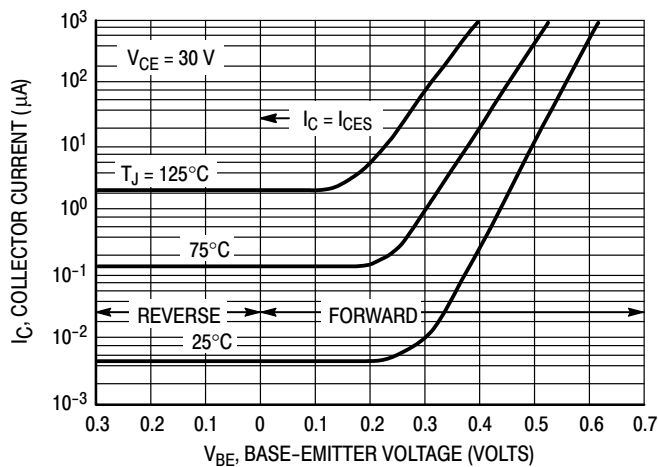
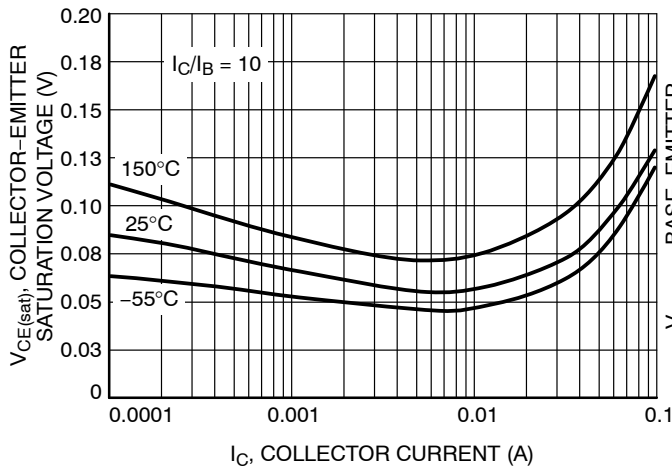
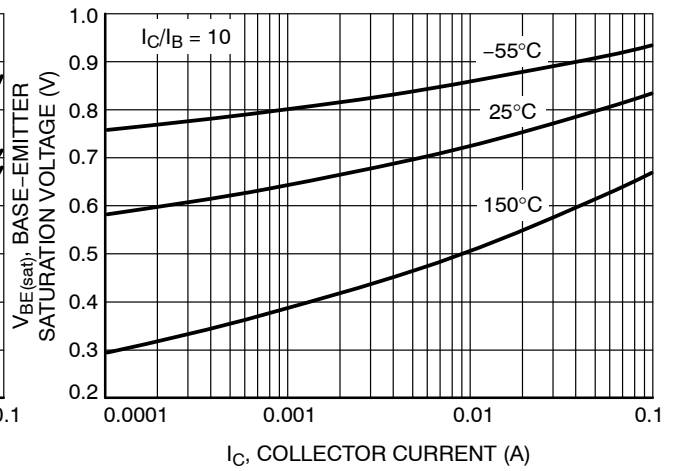


Figure 3. Collector Cut-Off Region

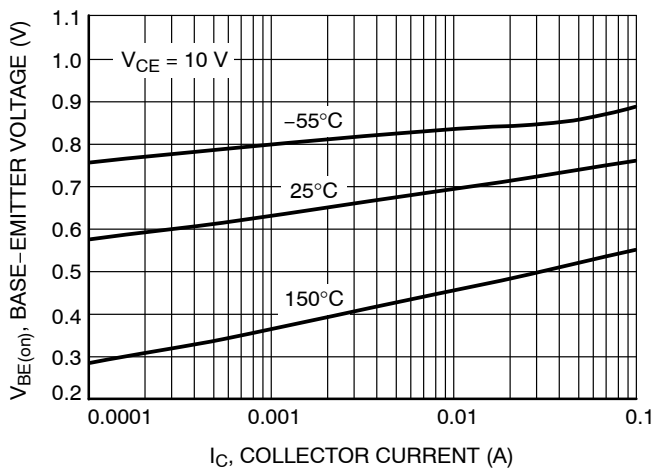
# MMBT5401LT1G



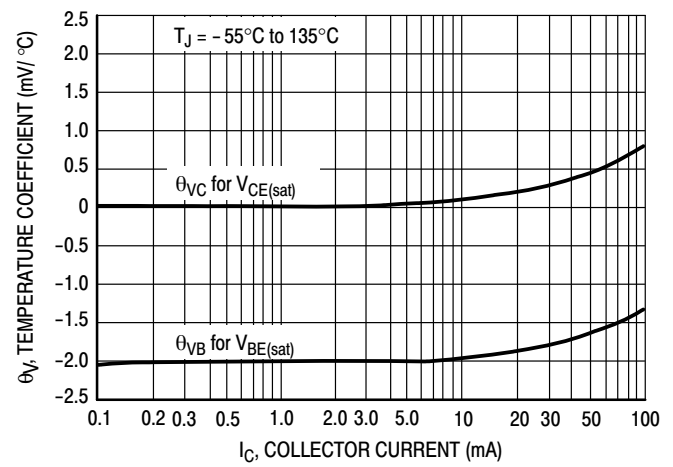
**Figure 4. Collector Emitter Saturation Voltage vs. Collector Current**



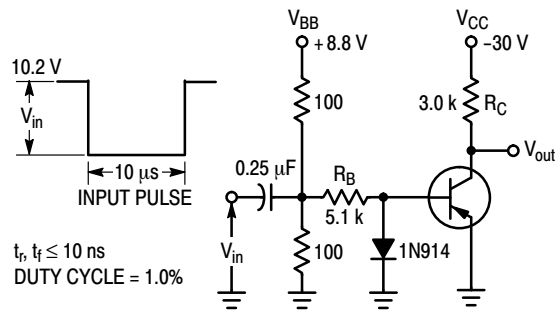
**Figure 5. Base Emitter Saturation Voltage vs. Collector Current**



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

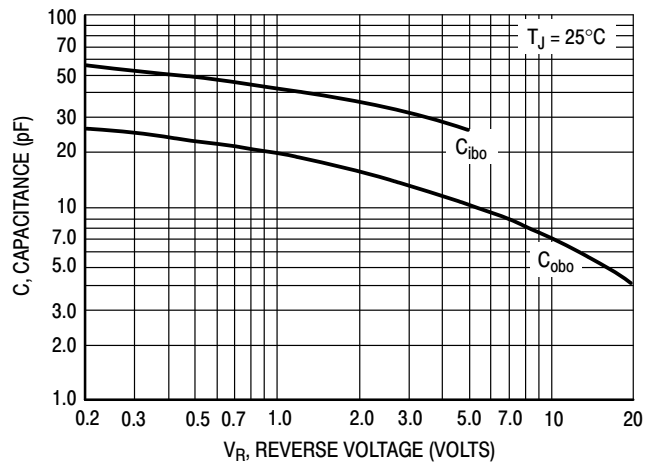


**Figure 7. Temperature Coefficients**



Values Shown are for  $I_C$  @ 10 mA

**Figure 8. Switching Time Test Circuit**



**Figure 9. Capacitances**

# MMBT5401LT1G

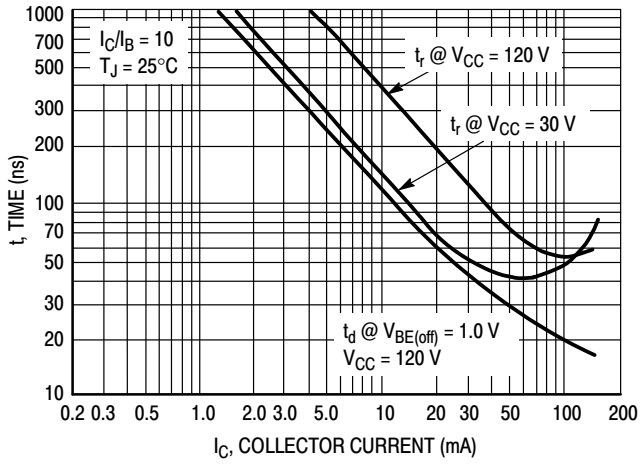


Figure 10. Turn-On Time

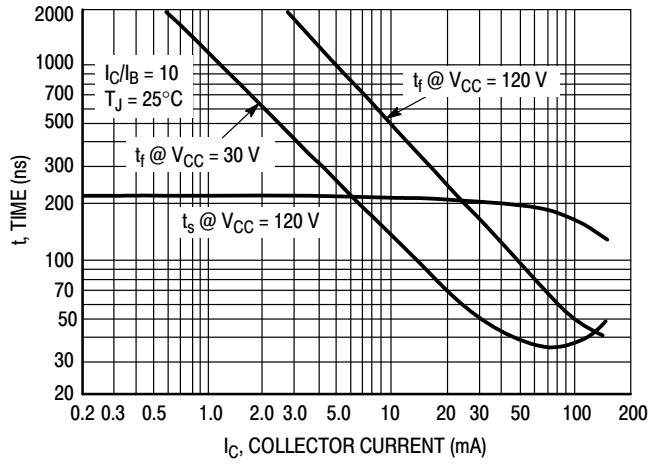


Figure 11. Turn-Off Time

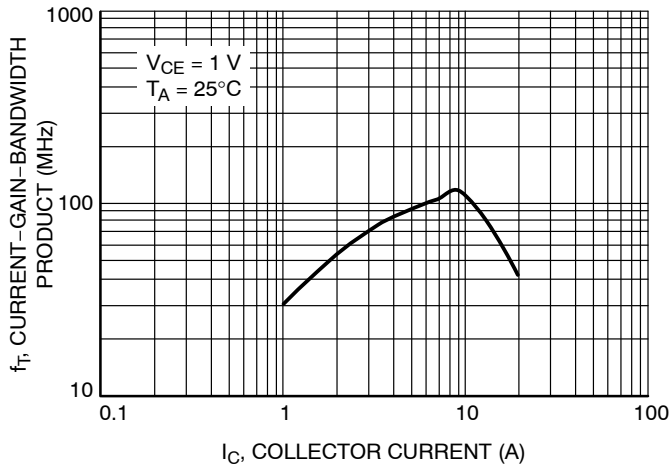


Figure 12. Current Gain Bandwidth Product

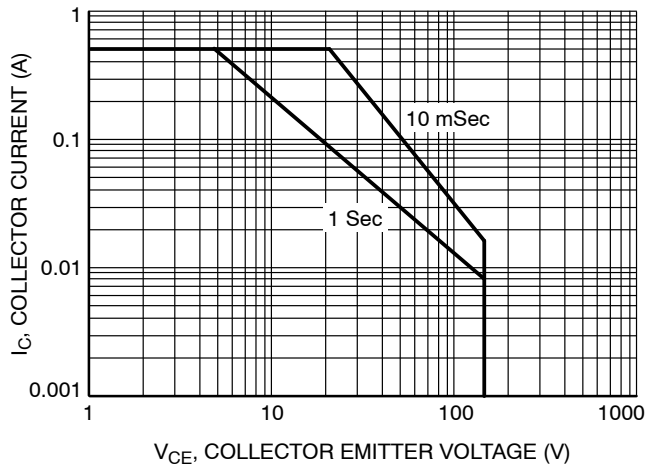
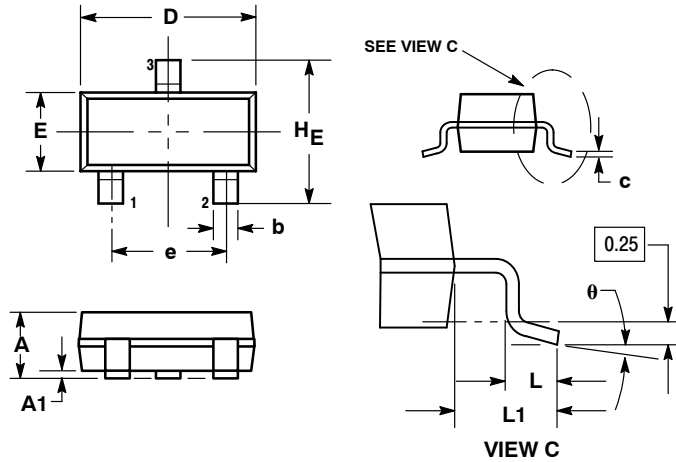


Figure 13. Safe Operating Area

# MMBT5401LT1G

## PACKAGE DIMENSIONS

SOT-23-3 (TO-236)  
CASE 318-08  
ISSUE AN



NOTES:

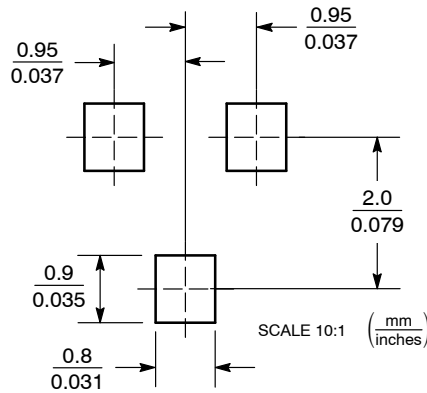
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-01 THRU -07 AND -09 OBSOLETE, NEW STANDARD 318-08.

| 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 |

STYLE 6:

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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