

# MMBT2369LT1, MMBT2369ALT1

MMBT2369ALT1 is a Preferred Device

## Switching Transistors

### NPN Silicon

#### Features

- Pb-Free Packages are Available

#### MAXIMUM RATINGS

| Rating                         | Symbol    | Value | Unit |
|--------------------------------|-----------|-------|------|
| Collector - Emitter Voltage    | $V_{CEO}$ | 15    | Vdc  |
| Collector - Emitter Voltage    | $V_{CES}$ | 40    | Vdc  |
| Collector - Base Voltage       | $V_{CBO}$ | 40    | Vdc  |
| Emitter - Base Voltage         | $V_{EBO}$ | 4.5   | Vdc  |
| Collector Current - Continuous | $I_C$     | 200   | mAdc |

#### THERMAL CHARACTERISTICS

| Characteristic                                                                                                      | Symbol          | Max         | Unit                       |
|---------------------------------------------------------------------------------------------------------------------|-----------------|-------------|----------------------------|
| Total Device Dissipation FR-5 Board<br>(Note 1) $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$         | $P_D$           | 225<br>1.8  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient                                                                             | $R_{\theta JA}$ | 556         | $^\circ\text{C/W}$         |
| Total Device Dissipation Alumina<br>Substrate, (Note 2) $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 300<br>2.4  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient                                                                             | $R_{\theta JA}$ | 417         | $^\circ\text{C/W}$         |
| Junction and Storage Temperature                                                                                    | $T_J, T_{stg}$  | -55 to +150 | $^\circ\text{C}$           |

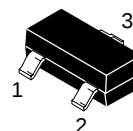
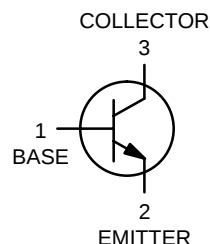
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

- FR-5 =  $1.0 \times 0.75 \times 0.062$  in.
- Alumina =  $0.4 \times 0.3 \times 0.024$  in. 99.5% alumina.



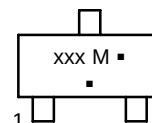
ON Semiconductor®

<http://onsemi.com>



SOT-23  
CASE 318  
STYLE 6

#### MARKING DIAGRAMS



xxx = M1J or 1JA  
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         |
|---------------|---------------------|------------------|
| MMBT2369LT1   | SOT-23              | 3000/Tape & Reel |
| MMBT2369LT1G  | SOT-23<br>(Pb-Free) | 3000/Tape & Reel |
| MMBT2369ALT1  | SOT-23              | 3000/Tape & Reel |
| MMBT2369ALT1G | SOT-23<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.

**Preferred** devices are recommended choices for future use and best overall value.

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

| Characteristic                                                                                                                                       | Symbol               | Min    | Typ    | Max       | Unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------|--------|-----------|------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                           |                      |        |        |           |      |
| Collector–Emitter Breakdown Voltage (Note 3)<br>(I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 0)                                                       | V <sub>(BR)CEO</sub> | 15     | –      | –         | Vdc  |
| Collector–Emitter Breakdown Voltage<br>(I <sub>C</sub> = 10 μAdc, V <sub>BE</sub> = 0)                                                               | V <sub>(BR)CES</sub> | 40     | –      | –         | Vdc  |
| Collector–Base Breakdown Voltage<br>(I <sub>C</sub> = 10 μAdc, I <sub>E</sub> = 0)                                                                   | V <sub>(BR)CBO</sub> | 40     | –      | –         | Vdc  |
| Emitter–Base Breakdown Voltage<br>(I <sub>E</sub> = 10 μAdc, I <sub>C</sub> = 0)                                                                     | V <sub>(BR)EBO</sub> | 4.5    | –      | –         | Vdc  |
| Collector Cutoff Current<br>(V <sub>CB</sub> = 20 Vdc, I <sub>E</sub> = 0)<br>(V <sub>CB</sub> = 20 Vdc, I <sub>E</sub> = 0, T <sub>A</sub> = 150°C) | I <sub>CBO</sub>     | –<br>– | –<br>– | 0.4<br>30 | μAdc |
| Collector Cutoff Current<br>(V <sub>CE</sub> = 20 Vdc, V <sub>BE</sub> = 0)                                                                          | I <sub>CES</sub>     | –      | –      | 0.4       | μAdc |

## ON CHARACTERISTICS

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                       |                      |                                       |                                 |                                      |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------|---------------------------------------|---------------------------------|--------------------------------------|-----|
| DC Current Gain (Note 3)<br>(I <sub>C</sub> = 10 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> = 10 mAdc, V <sub>CE</sub> = 0.35 Vdc)<br>(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 0.35 Vdc, T <sub>A</sub> = –55°C)<br>(I <sub>C</sub> = 30 mAdc, V <sub>CE</sub> = 0.4 Vdc)<br>(I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 2.0 Vdc)<br>(I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 1.0 Vdc) | MMBT2369<br>MMBT2369A<br>MMBT2369A<br>MMBT2369A<br>MMBT2369A<br>MMBT2369<br>MMBT2369A | h <sub>FE</sub>      | 40<br>–<br>40<br>20<br>30<br>20<br>20 | –<br>–<br>–<br>–<br>–<br>–<br>– | 120<br>120<br>–<br>–<br>–<br>–<br>–  | –   |
| Collector–Emitter Saturation Voltage (Note 3)<br>(I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc)<br>(I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc)<br>(I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc, T <sub>A</sub> = +125°C)<br>(I <sub>C</sub> = 30 mAdc, I <sub>B</sub> = 3.0 mAdc)<br>(I <sub>C</sub> = 100 mAdc, I <sub>B</sub> = 10 mAdc)                                                                                                 | MMBT2369<br>MMBT2369A<br>MMBT2369A<br>MMBT2369A<br>MMBT2369A                          | V <sub>CE(sat)</sub> | –<br>–<br>–<br>–<br>–                 | –<br>–<br>–<br>–<br>–           | 0.25<br>0.20<br>0.30<br>0.25<br>0.50 | Vdc |
| Base–Emitter Saturation Voltage (Note 3)<br>(I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc)<br>(I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc, T <sub>A</sub> = –55°C)<br>(I <sub>C</sub> = 30 mAdc, I <sub>B</sub> = 3.0 mAdc)<br>(I <sub>C</sub> = 100 mAdc, I <sub>B</sub> = 10 mAdc)                                                                                                                                                                | MMBT2369A<br>MMBT2369A<br>MMBT2369A<br>MMBT2369A                                      | V <sub>BE(sat)</sub> | 0.7<br>–<br>–<br>–                    | –<br>–<br>–<br>–                | 0.85<br>1.02<br>1.15<br>1.60         | Vdc |

## SMALL–SIGNAL CHARACTERISTICS

|                                                                                                |                  |     |   |     |    |
|------------------------------------------------------------------------------------------------|------------------|-----|---|-----|----|
| Output Capacitance<br>(V <sub>CB</sub> = 5.0 Vdc, I <sub>E</sub> = 0, f = 1.0 MHz)             | C <sub>obo</sub> | –   | – | 4.0 | pF |
| Small Signal Current Gain<br>(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 10 Vdc, f = 100 MHz) | h <sub>fe</sub>  | 5.0 | – | –   | –  |

## SWITCHING CHARACTERISTICS

|                                                                                                                                |                  |   |     |    |    |
|--------------------------------------------------------------------------------------------------------------------------------|------------------|---|-----|----|----|
| Storage Time<br>(I <sub>B1</sub> = I <sub>B2</sub> = I <sub>C</sub> = 10 mAdc)                                                 | t <sub>s</sub>   | – | 5.0 | 13 | ns |
| Turn–On Time<br>(V <sub>CC</sub> = 3.0 Vdc, I <sub>C</sub> = 10 mAdc, I <sub>B1</sub> = 3.0 mAdc)                              | t <sub>on</sub>  | – | 8.0 | 12 | ns |
| Turn–Off Time<br>(V <sub>CC</sub> = 3.0 Vdc, I <sub>C</sub> = 10 mAdc, I <sub>B1</sub> = 3.0 mAdc, I <sub>B2</sub> = 1.5 mAdc) | t <sub>off</sub> | – | 10  | 18 | ns |

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

## MMBT2369LT1, MMBT2369ALT1

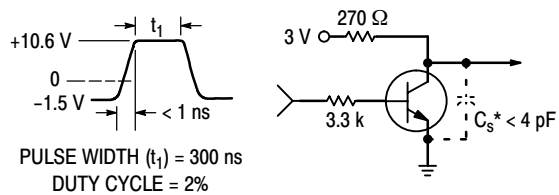


Figure 1.  $t_{on}$  Circuit – 10 mA

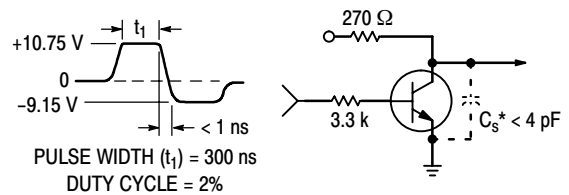


Figure 2.  $t_{off}$  Circuit – 10 mA

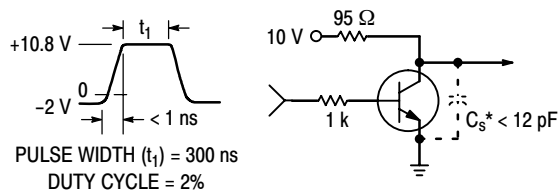


Figure 3.  $t_{on}$  Circuit – 100 mA

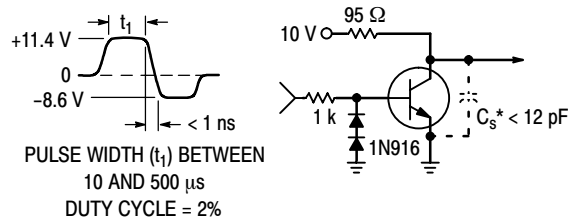
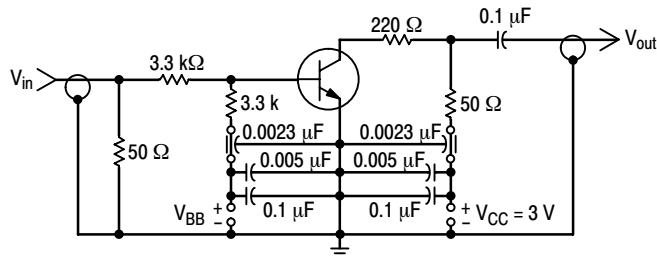
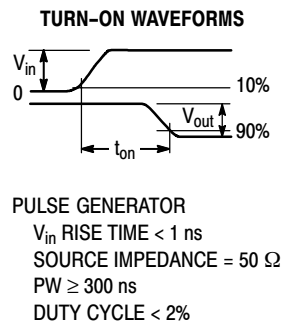


Figure 4.  $t_{off}$  Circuit – 100 mA



TO OSCILLOSCOPE  
INPUT IMPEDANCE = 50  $\Omega$   
RISE TIME = 1 ns

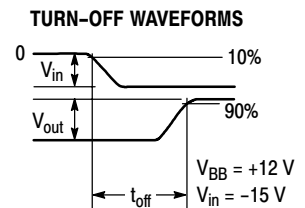


Figure 5. Turn-On and Turn-Off Time Test Circuit

# MMBT2369LT1, MMBT2369ALT1

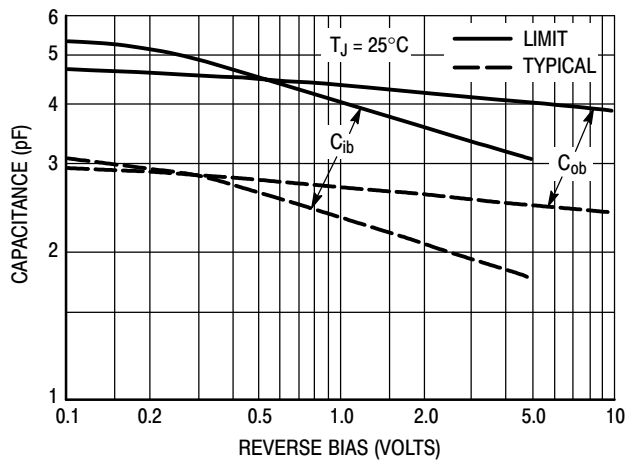


Figure 6. Junction Capacitance Variations

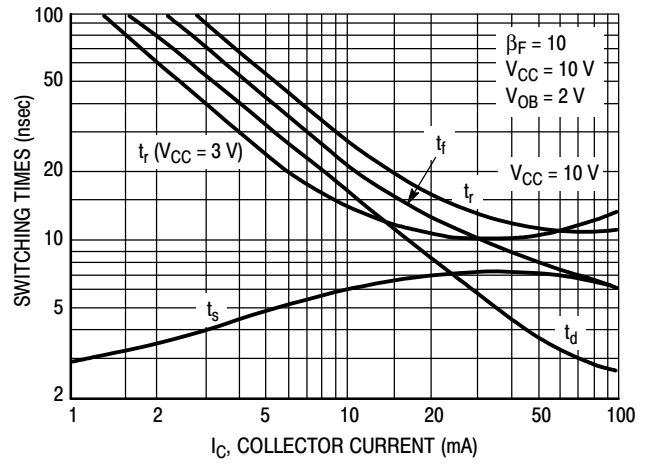


Figure 7. Typical Switching Times

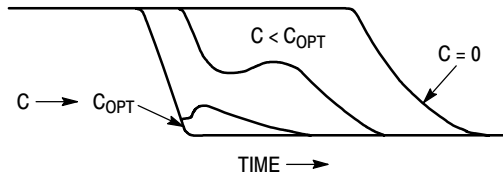


Figure 8. Turn-Off Waveform

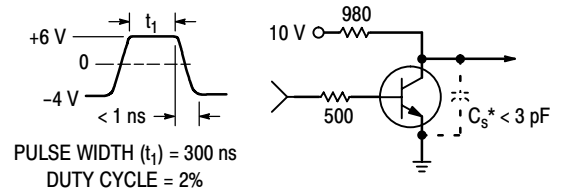


Figure 9. Storage Time Equivalent Test Circuit

# MMBT2369LT1, MMBT2369ALT1

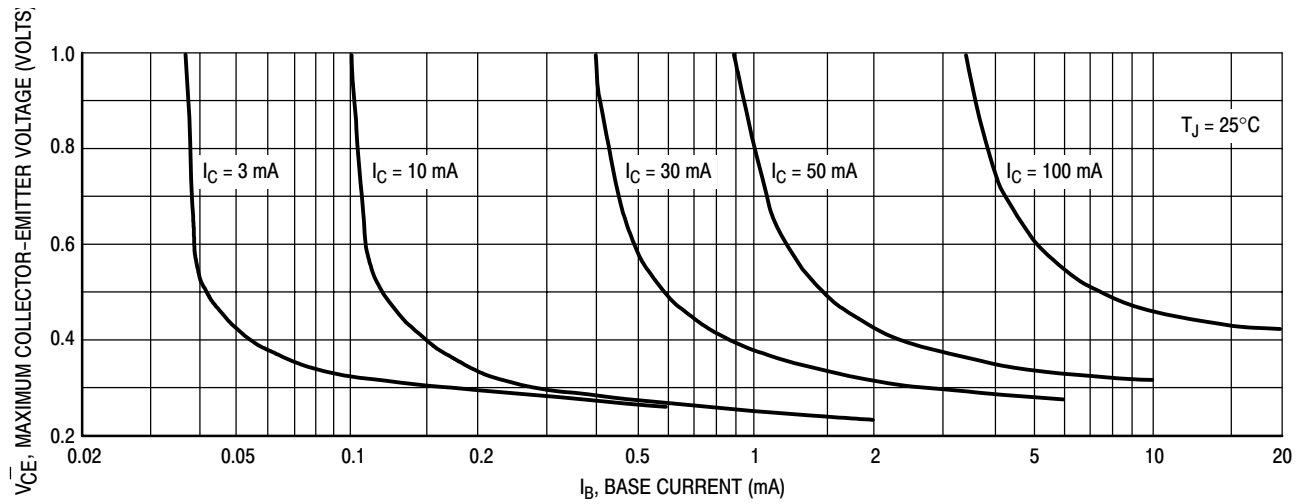


Figure 10. Maximum Collector Saturation Voltage Characteristics

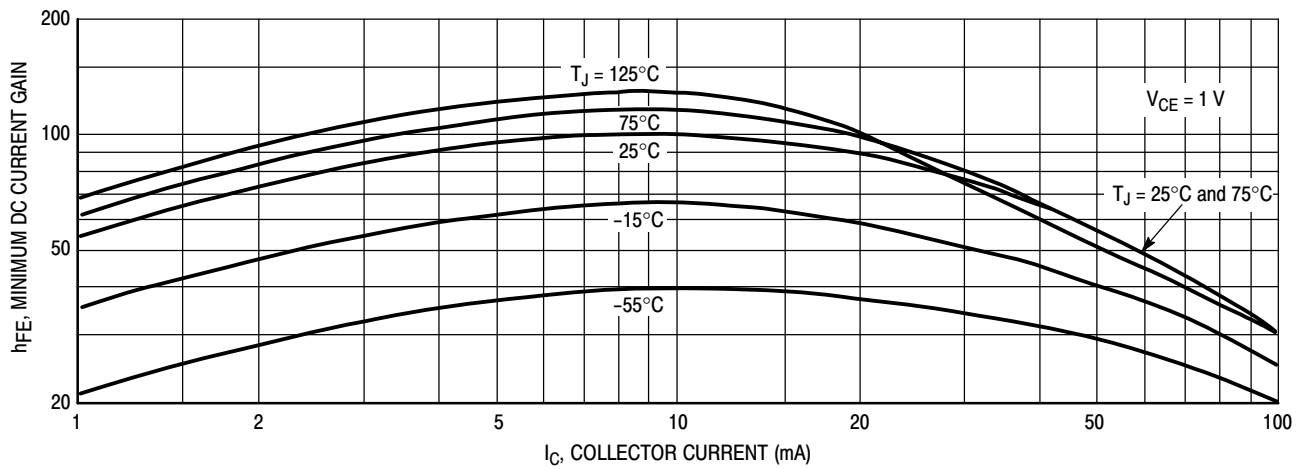


Figure 11. Minimum Current Gain Characteristics

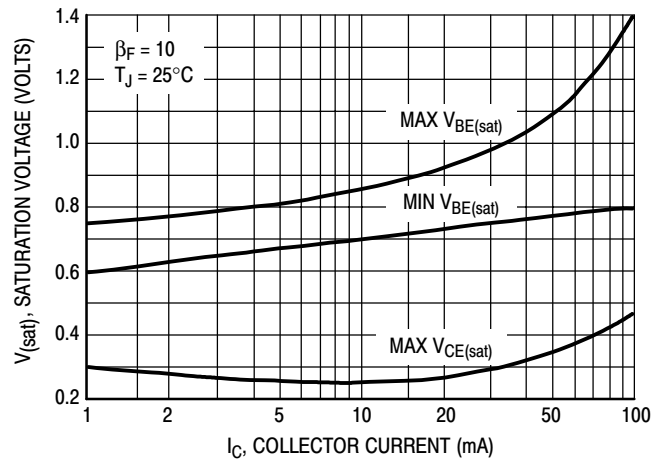
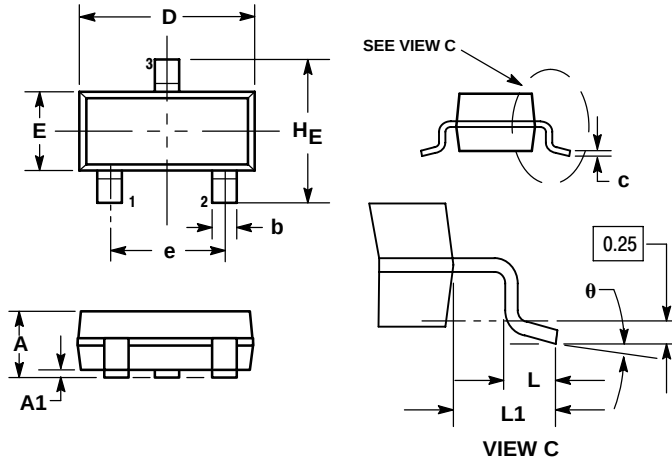


Figure 12. Saturation Voltage Limits

# MMBT2369LT1, MMBT2369ALT1

## PACKAGE DIMENSIONS

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



### NOTES:

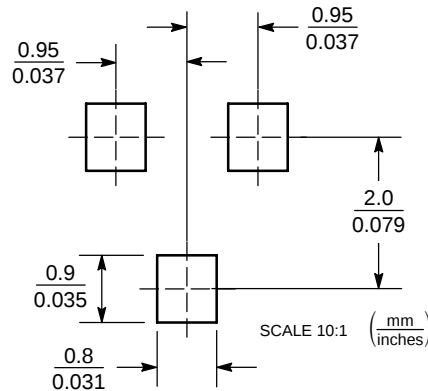
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-01 THRU -07 AND -09 OBSOLETE, NEW STANDARD 318-08.

| 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 |
| H_E | 2.10        | 2.40 | 2.64 | 0.083  | 0.094 | 0.104 |

### STYLE 6:

- PIN 1. BASE
- EMITTER
- 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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