

# BC846BDW1, BC847BDW1, BC848CDW1

## Dual General Purpose Transistors

### NPN Duals

These transistors are designed for general purpose amplifier applications. They are housed in the SOT-363/SC-88 which is designed for low power surface mount applications.

#### Features

- S and NSV Prefixes 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    | BC846 | BC847 | BC848 | Unit |
|--------------------------------|-----------|-------|-------|-------|------|
| Collector-Emitter Voltage      | $V_{CEO}$ | 65    | 45    | 30    | V    |
| Collector-Base Voltage         | $V_{CBO}$ | 80    | 50    | 30    | V    |
| Emitter-Base Voltage           | $V_{EBO}$ | 6.0   | 6.0   | 5.0   | V    |
| Collector Current - Continuous | $I_C$     | 100   | 100   | 100   | 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 Per Device<br>FR-5 Board (Note 1)<br>$T_A = 25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$ | $P_D$           | 380<br>250<br>3.0 | mW<br>mW/ $^\circ\text{C}$<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance,<br>Junction to Ambient  | $R_{\theta JA}$ | 328               | $^\circ\text{C}/\text{W}$                          |
| Junction and Storage Temperature<br>Range   | $T_J, T_{stg}$  | -55 to +150       | $^\circ\text{C}$                                   |

1. FR-5 = 1.0 x 0.75 x 0.062 in

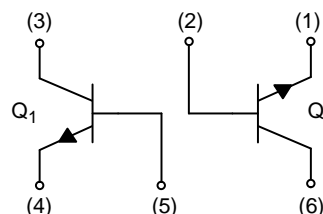


ON Semiconductor®

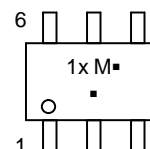
[www.onsemi.com](http://www.onsemi.com)



SOT-363  
CASE 419B  
STYLE 1



#### MARKING DIAGRAM



1x = Specific Device Code  
x = B, F, G, L  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

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

# BC846BDW1, BC847BDW1, BC848CDW1

## 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<br>(I <sub>C</sub> = 10 mA)<br>BC846<br>BC847<br>BC848                      | V <sub>(BR)CEO</sub> | 65<br>45<br>30    | –<br>–<br>– | –<br>–<br>– | V        |
| Collector–Emitter Breakdown Voltage<br>(I <sub>C</sub> = 10 μA, V <sub>EB</sub> = 0)<br>BC846<br>BC847<br>BC848 | V <sub>(BR)CES</sub> | 80<br>50<br>30    | –<br>–<br>– | –<br>–<br>– | V        |
| Collector–Base Breakdown Voltage<br>(I <sub>C</sub> = 10 μA)<br>BC846<br>BC847<br>BC848                         | V <sub>(BR)CBO</sub> | 80<br>50<br>30    | –<br>–<br>– | –<br>–<br>– | V        |
| Emitter–Base Breakdown Voltage<br>(I <sub>E</sub> = 1.0 μA)<br>BC846<br>BC847<br>BC848                          | V <sub>(BR)EBO</sub> | 6.0<br>6.0<br>5.0 | –<br>–<br>– | –<br>–<br>– | V        |
| Collector Cutoff Current<br>(V <sub>CB</sub> = 30 V)<br>(V <sub>CB</sub> = 30 V, T <sub>A</sub> = 150°C)        | I <sub>CB0</sub>     | –<br>–            | –<br>–      | 15<br>5.0   | nA<br>μA |

## ON CHARACTERISTICS

|  |                      |                      |                          |                      |    |
|--|----------------------|----------------------|--------------------------|----------------------|----|
| DC Current Gain<br>(I <sub>C</sub> = 10 μA, V <sub>CE</sub> = 5.0 V)<br>BC846B, BC847B<br>BC847C, BC848C<br>(I <sub>C</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V)<br>BC846B, BC847B<br>BC847C, BC848C | h <sub>FE</sub>      | –<br>–<br>200<br>420 | 150<br>270<br>290<br>520 | –<br>–<br>450<br>800 | –  |
| Collector–Emitter Saturation Voltage<br>(I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.5 mA)<br>(I <sub>C</sub> = 100 mA, I <sub>B</sub> = 5.0 mA)  | V <sub>CE(sat)</sub> | –<br>–               | –<br>–                   | 0.25<br>0.6          | V  |
| Base–Emitter Saturation Voltage<br>(I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.5 mA)<br>(I <sub>C</sub> = 100 mA, I <sub>B</sub> = 5.0 mA)   | V <sub>BE(sat)</sub> | –<br>–               | 0.7<br>0.9               | –<br>–               | V  |
| Base–Emitter Voltage<br>(I <sub>C</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V)<br>(I <sub>C</sub> = 10 mA, V <sub>CE</sub> = 5.0 V)  | V <sub>BE(on)</sub>  | 580<br>–             | 660<br>–                 | 700<br>770           | mV |

## SMALL–SIGNAL CHARACTERISTICS

|   |                  |     |   |     |     |
|---|------------------|-----|---|-----|-----|
| Current–Gain – Bandwidth Product<br>(I <sub>C</sub> = 10 mA, V <sub>CE</sub> = 5.0 Vdc, f = 100 MHz)                    | f <sub>T</sub>   | 100 | – | –   | MHz |
| Output Capacitance<br>(V <sub>CB</sub> = 10 V, f = 1.0 MHz)   | C <sub>obo</sub> | –   | – | 4.5 | pF  |
| Noise Figure<br>(I <sub>C</sub> = 0.2 mA, V <sub>CE</sub> = 5.0 Vdc, R <sub>S</sub> = 2.0 kΩ, f = 1.0 kHz, BW = 200 Hz) | NF               | –   | – | 10  | 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.

# BC846BDW1, BC847BDW1, BC848CDW1

## TYPICAL CHARACTERISTICS – BC846BDW1

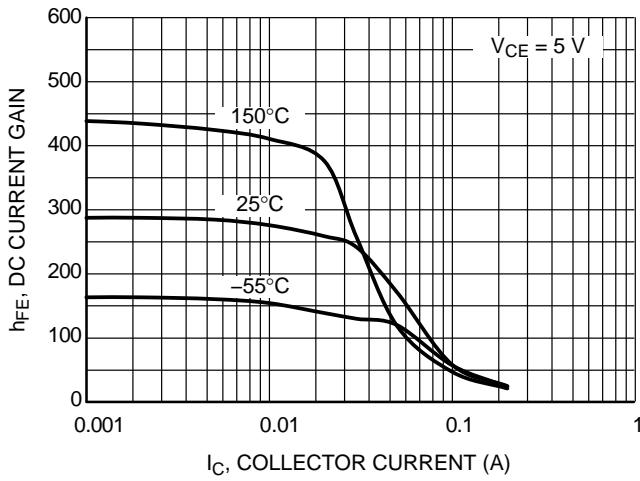


Figure 1. DC Current Gain at  $V_{CE} = 5 V$

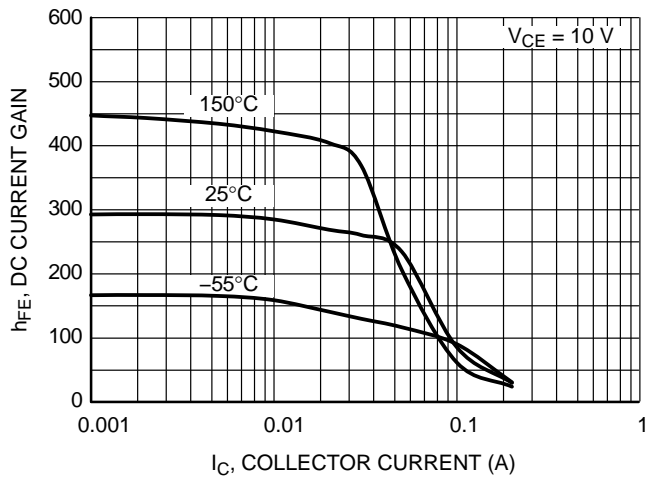


Figure 2. DC Current Gain at  $V_{CE} = 10 V$

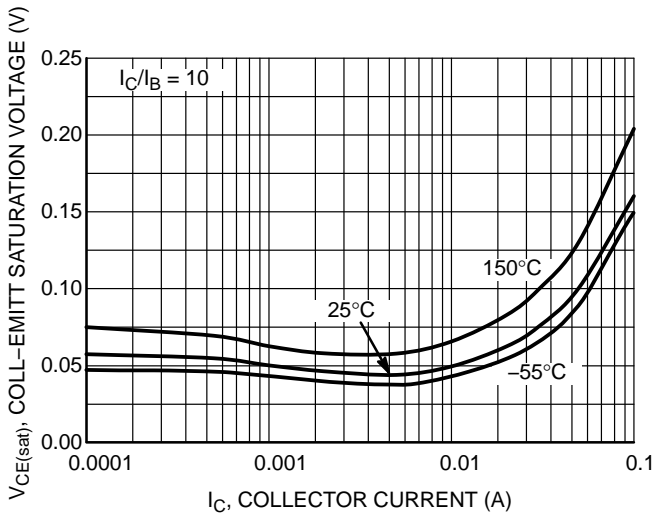


Figure 3.  $V_{CE(sat)}$  at  $I_C/I_B = 10$

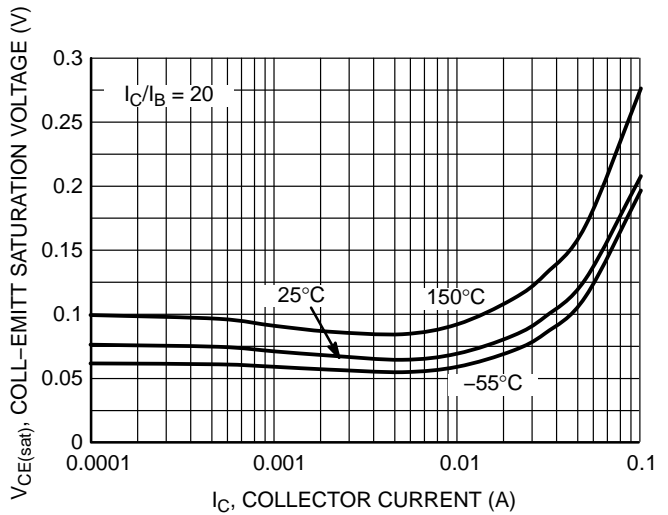


Figure 4.  $V_{CE(sat)}$  at  $I_C/I_B = 20$

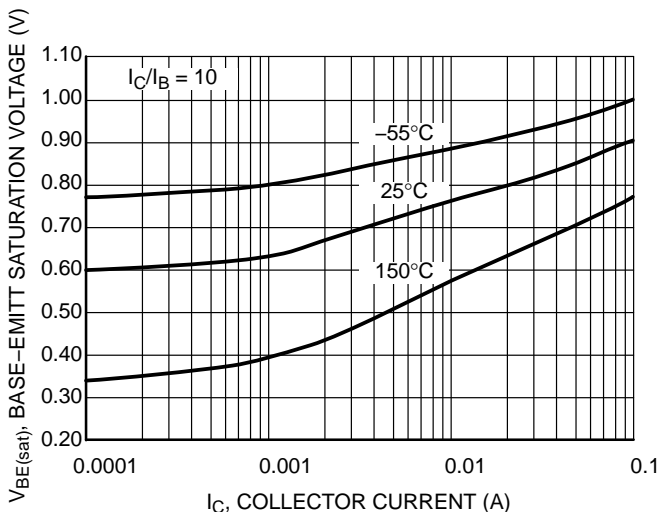


Figure 5.  $V_{BE(sat)}$  at  $I_C/I_B = 10$

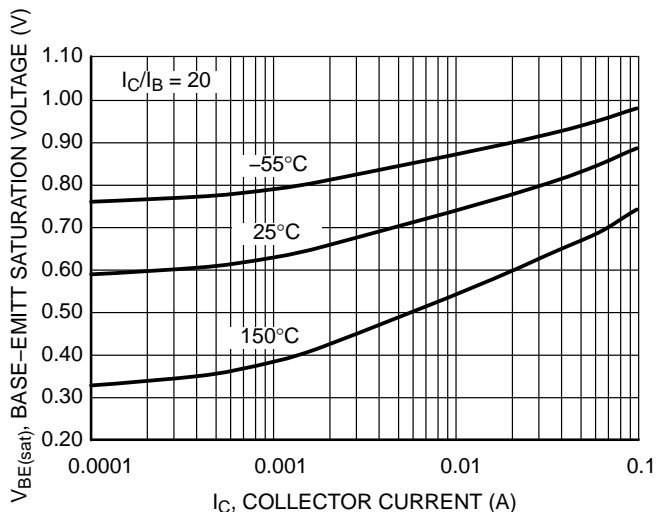


Figure 6.  $V_{BE(sat)}$  at  $I_C/I_B = 20$

# BC846BDW1, BC847BDW1, BC848CDW1

## TYPICAL CHARACTERISTICS – BC846BDW1

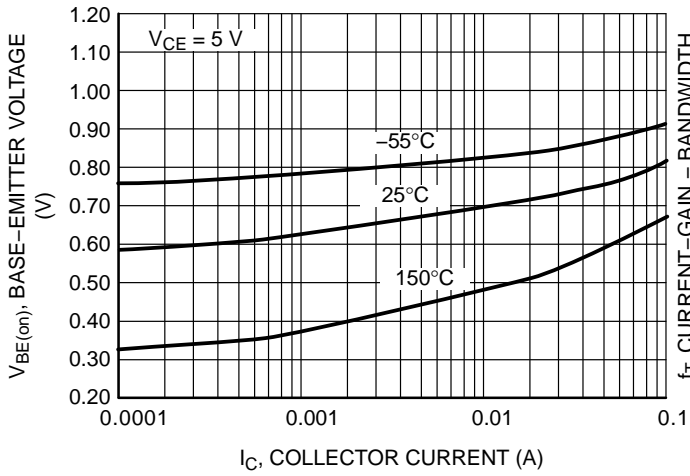


Figure 7.  $V_{BE(on)}$  at  $V_{CE} = 5\text{ V}$

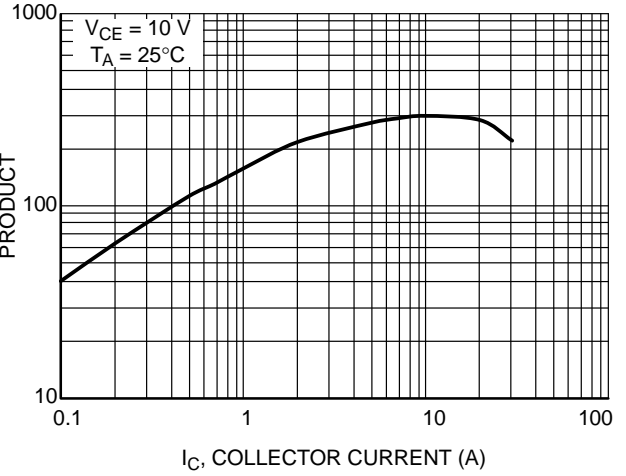


Figure 8. Current - Gain - Bandwidth Product

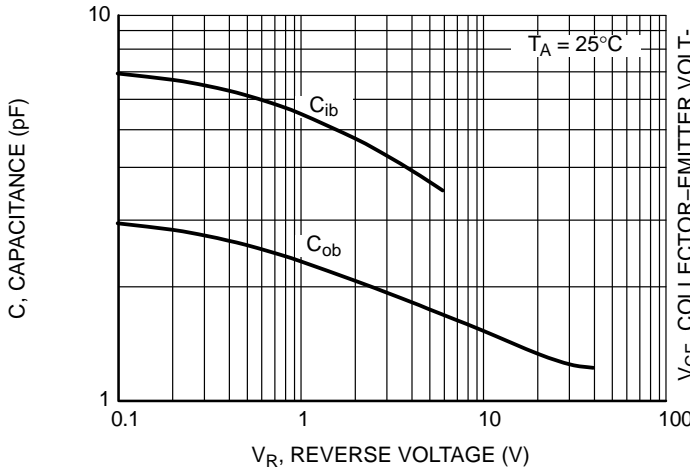


Figure 9. Capacitances

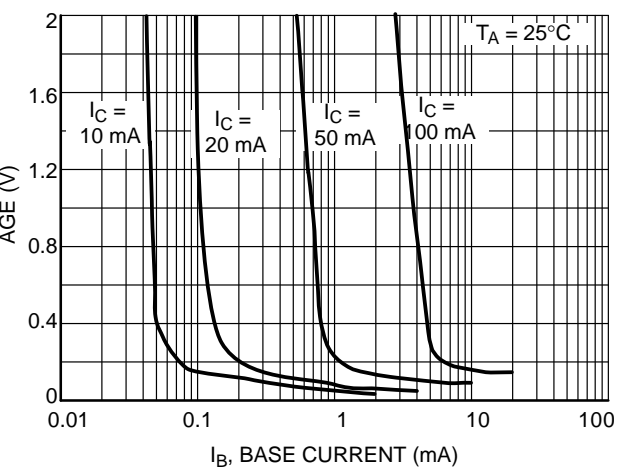


Figure 10. Collector Saturation Region

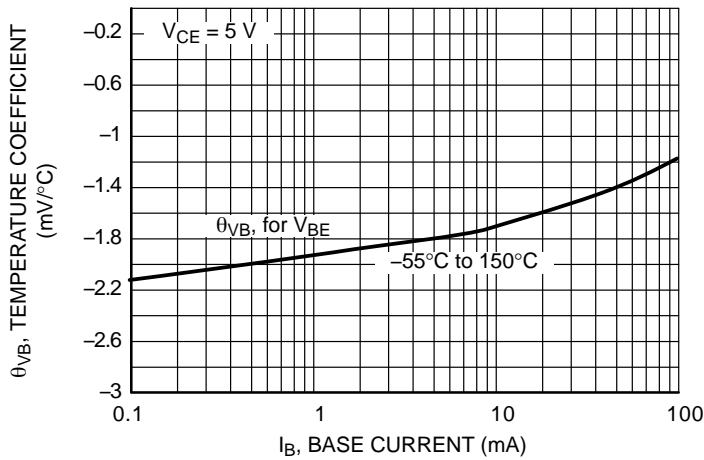


Figure 11. Base-Emitter Temperature Coefficient

# BC846BDW1, BC847BDW1, BC848CDW1

## TYPICAL CHARACTERISTICS – BC847BDW1

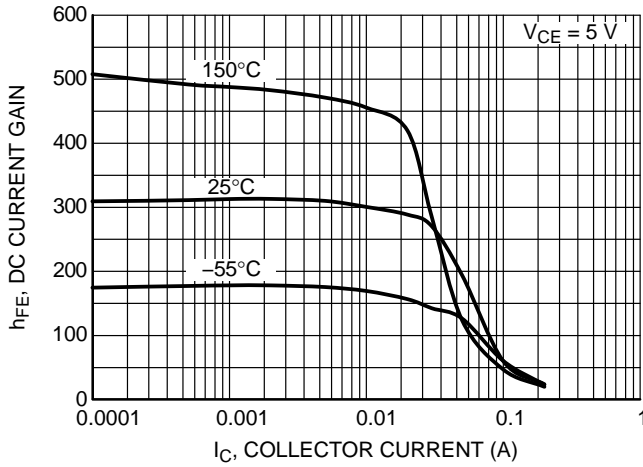


Figure 12. DC Current Gain at  $V_{CE} = 5\text{ V}$

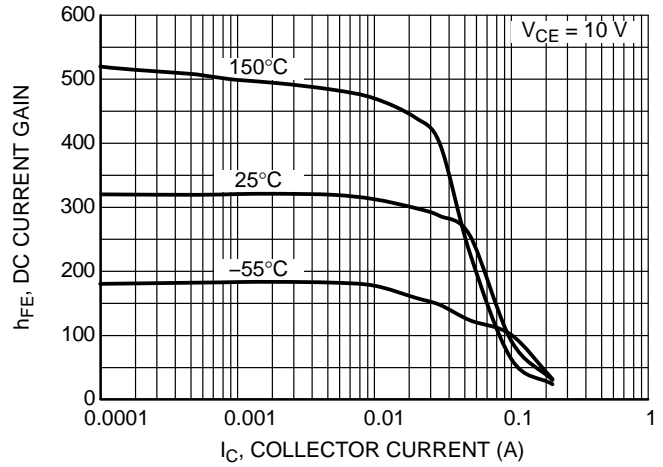


Figure 13. DC Current Gain at  $V_{CE} = 10\text{ V}$

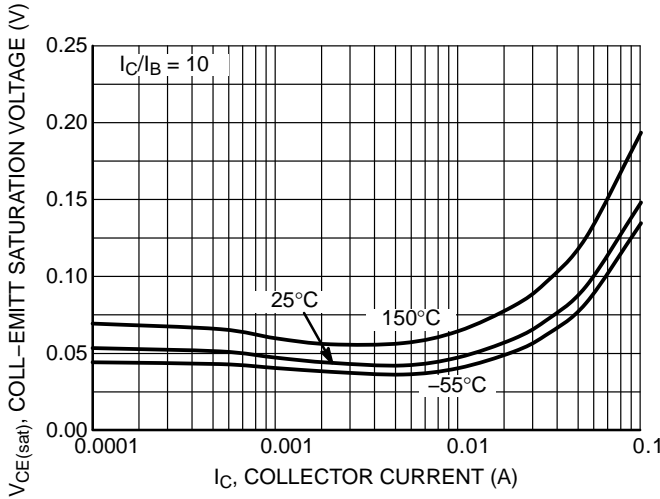


Figure 14.  $V_{CE}$  at  $I_C/I_B = 10$

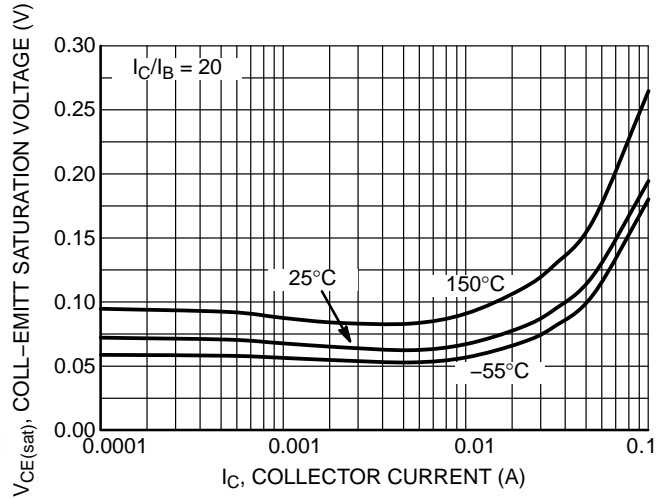


Figure 15.  $V_{CE}$  at  $I_C/I_B = 20$

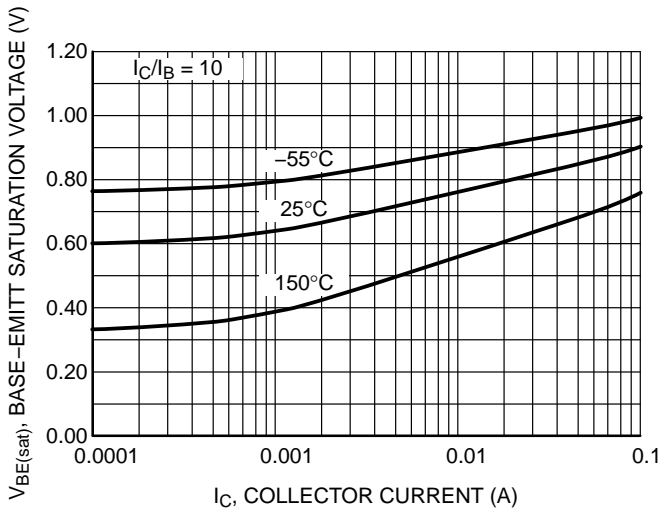


Figure 16.  $V_{BE(sat)}$  at  $I_C/I_B = 10$

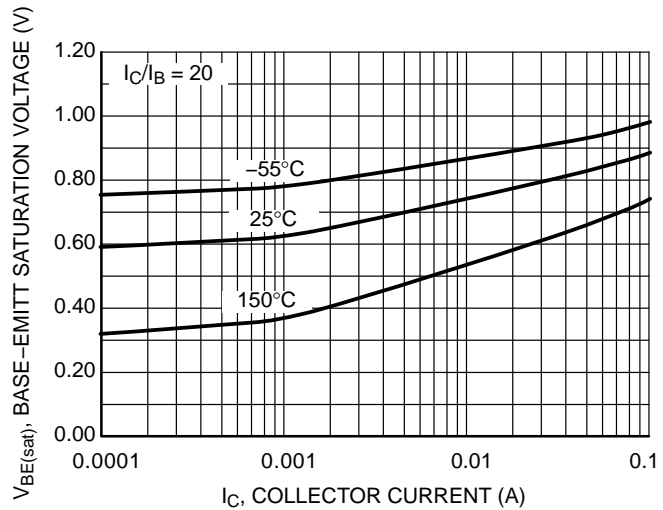


Figure 17.  $V_{BE(sat)}$  at  $I_C/I_B = 20$

# BC846BDW1, BC847BDW1, BC848CDW1

## TYPICAL CHARACTERISTICS – BC847BDW1

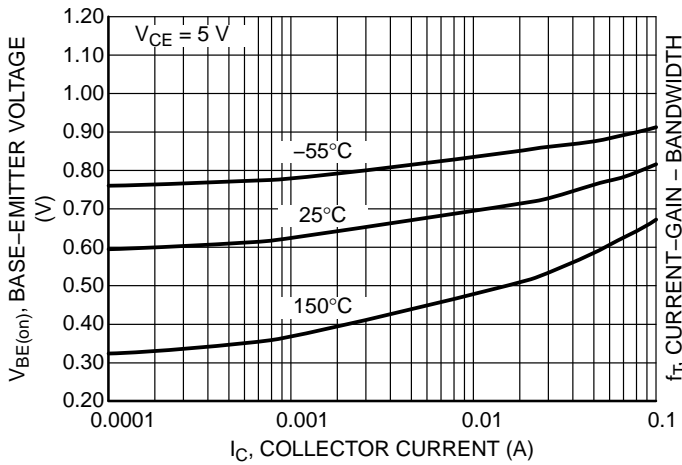


Figure 18.  $V_{BE(on)}$  at  $V_{CE} = 5\text{ V}$

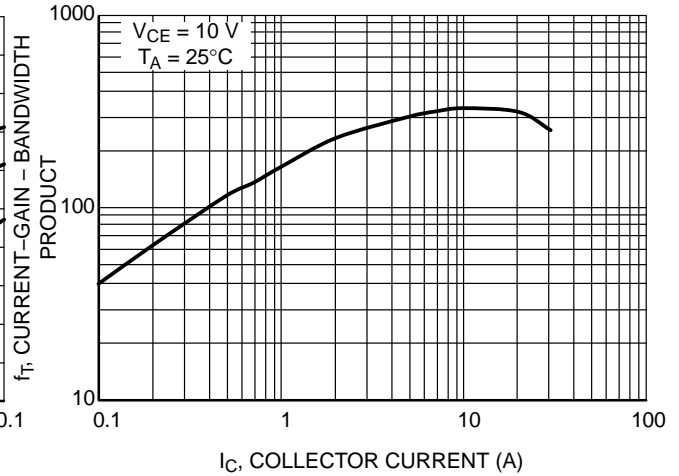


Figure 19. Current - Gain - Bandwidth Product

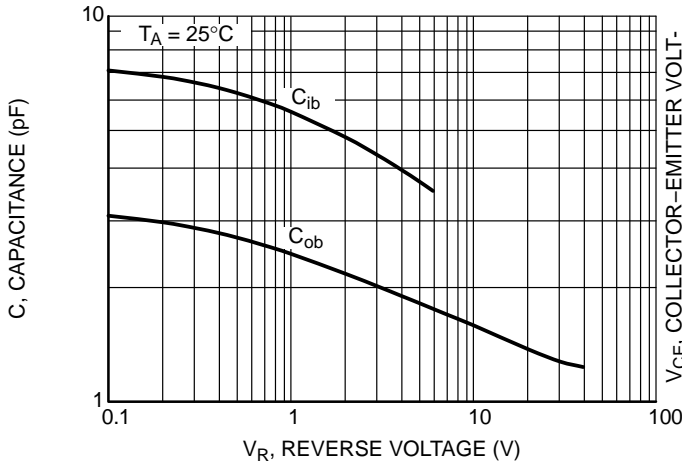


Figure 20. Capacitances

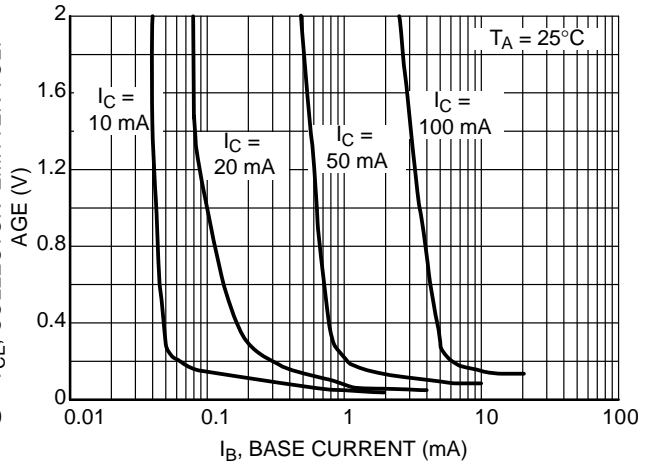


Figure 21. Collector Saturation Region

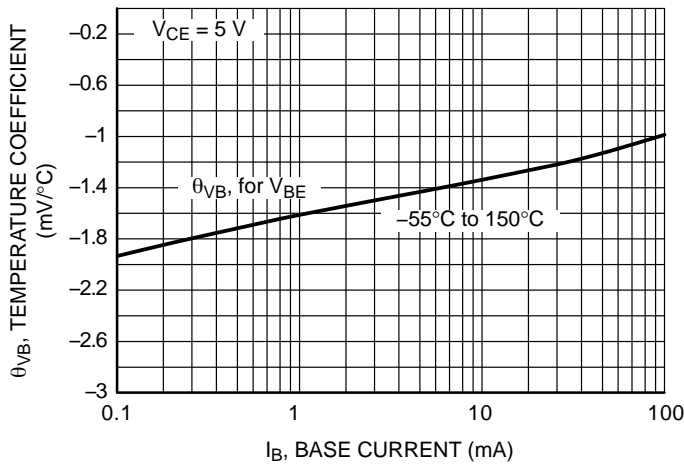


Figure 22. Base-Emitter Temperature Coefficient

# BC846BDW1, BC847BDW1, BC848CDW1

## TYPICAL CHARACTERISTICS – BC848CDW1



Figure 23. DC Current Gain at  $V_{CE} = 5\text{ V}$



Figure 24. DC Current Gain at  $V_{CE} = 10\text{ V}$

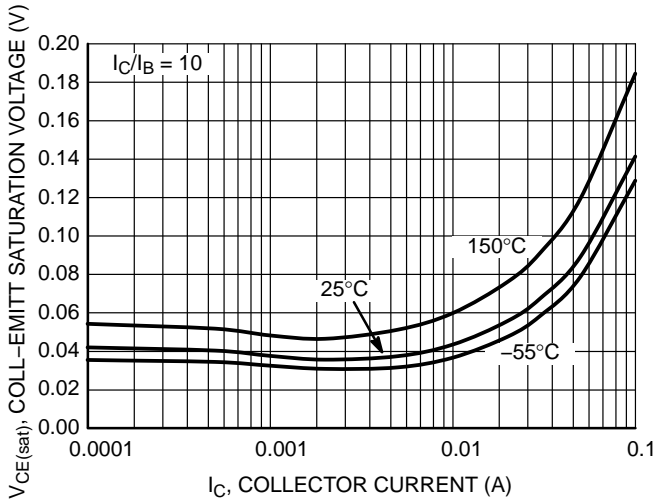


Figure 25.  $V_{CE}$  at  $I_C/I_B = 10$



Figure 26.  $V_{CE}$  at  $I_C/I_B = 20$

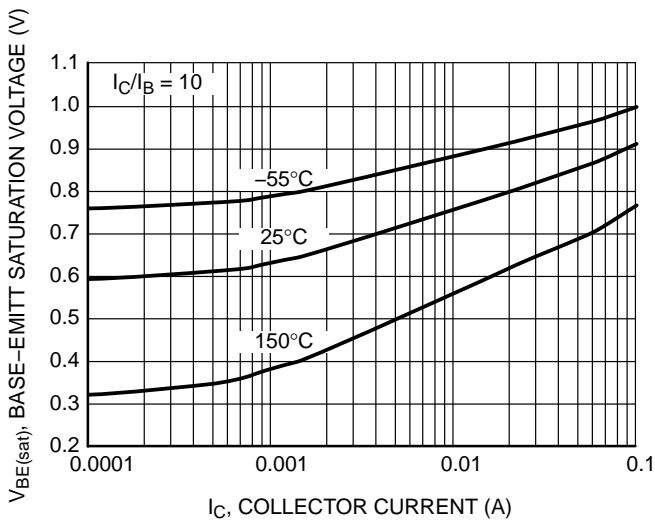


Figure 27.  $V_{BE}(\text{sat})$  at  $I_C/I_B = 10$



Figure 28.  $V_{BE}(\text{sat})$  at  $I_C/I_B = 20$

# BC846BDW1, BC847BDW1, BC848CDW1

## TYPICAL CHARACTERISTICS – BC848CDW1

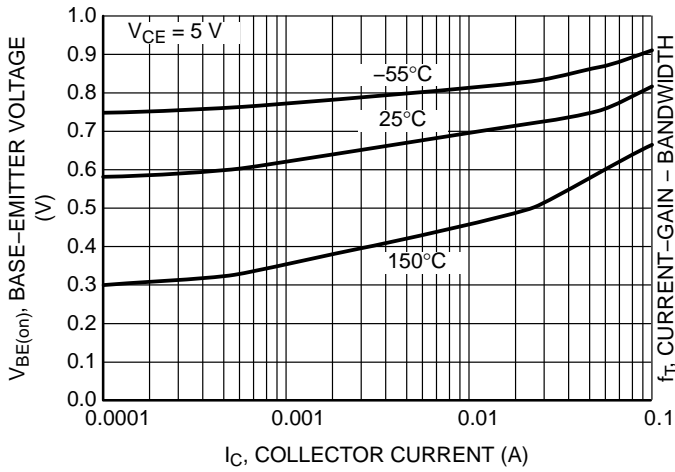


Figure 29.  $V_{BE(on)}$  at  $V_{CE} = 5\text{ V}$

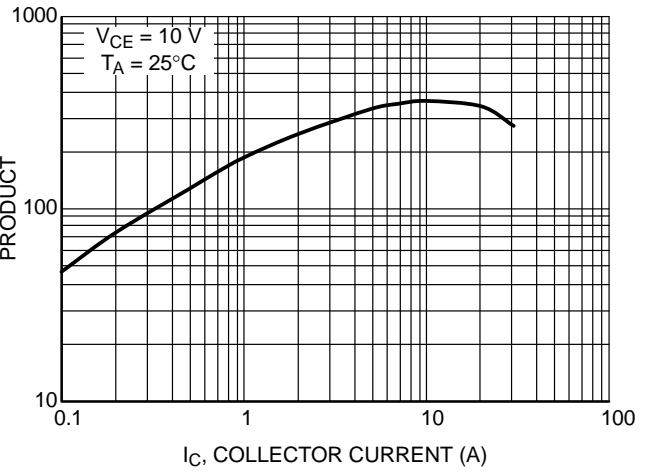


Figure 30. Current – Gain – Bandwidth Product

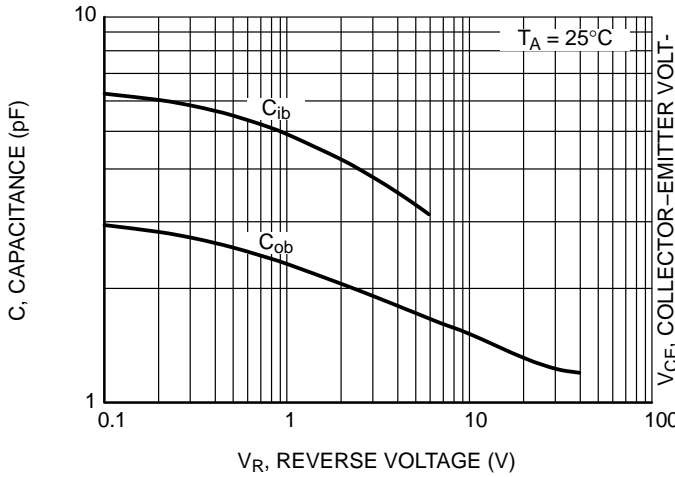


Figure 31. Capacitances

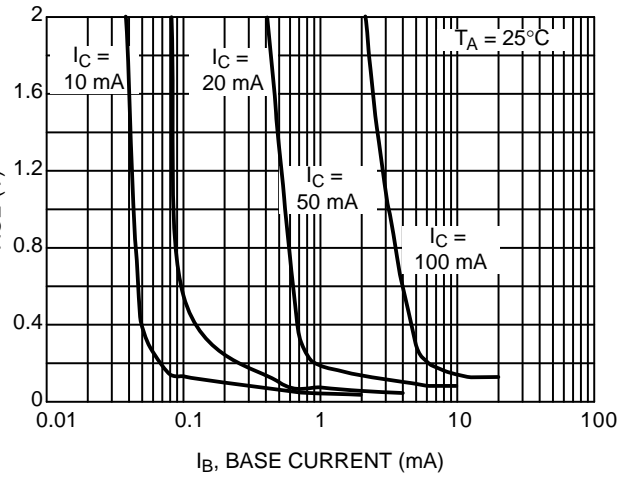


Figure 32. Collector Saturation Region

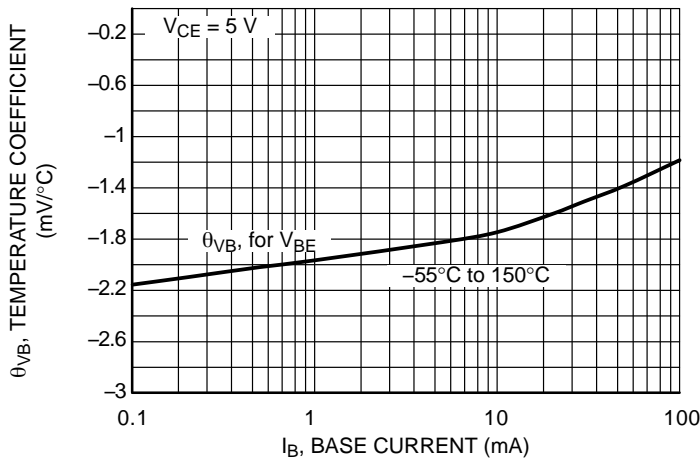


Figure 33. Base–Emitter Temperature Coefficient



# BC846BDW1, BC847BDW1, BC848CDW1

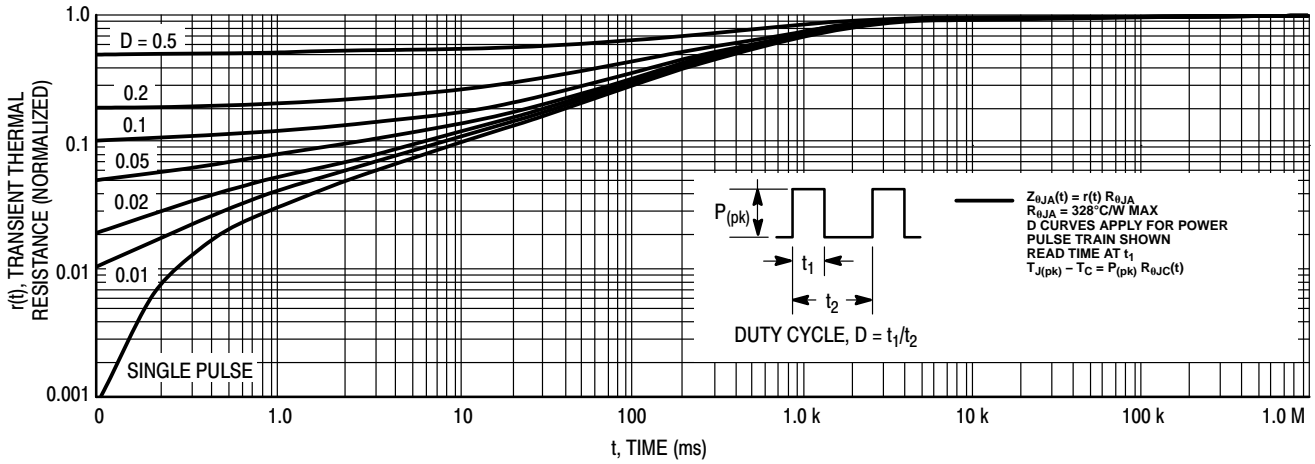


Figure 34. Thermal Response

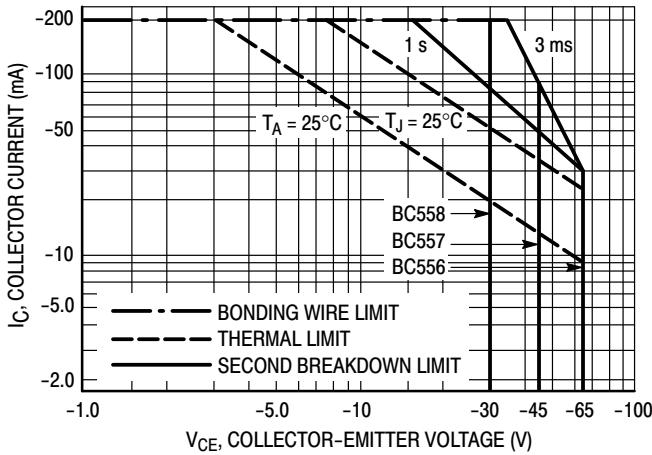


Figure 35. Active Region Safe Operating Area

The safe operating area curves indicate  $I_C$ - $V_{CE}$  limits of the transistor that must be observed for reliable operation. Collector load lines for specific circuits must fall below the limits indicated by the applicable curve.

The data of Figure 35 is based upon  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  or  $T_A$  is variable depending upon conditions. Pulse curves are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 34. At high case or ambient temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by the secondary breakdown.

# BC846BDW1, BC847BDW1, BC848CDW1

## ORDERING INFORMATION

| Device           | Markings | Package              | Shipping <sup>†</sup> |
|------------------|----------|----------------------|-----------------------|
| BC846BDW1T1G     | 1B       | SOT-363<br>(Pb-Free) | 3,000 / Tape & Reel   |
| SBC846BDW1T1G*   | 1B       | SOT-363<br>(Pb-Free) | 3,000 / Tape & Reel   |
| BC847BDW1T1G     | 1F       | SOT-363<br>(Pb-Free) | 3,000 / Tape & Reel   |
| SBC847BDW1T1G*   | 1F       | SOT-363<br>(Pb-Free) | 3,000 / Tape & Reel   |
| BC847BDW1T3G     | 1F       | SOT-363<br>(Pb-Free) | 10,000 / Tape & Reel  |
| SBC847BDW1T3G*   | 1F       | SOT-363<br>(Pb-Free) | 10,000 / Tape & Reel  |
| NSVBC847BDW1T2G* | 1F       | SOT-363<br>(Pb-Free) | 10,000 / Tape & Reel  |
| BC847CDW1T1G     | 1G       | SOT-363<br>(Pb-Free) | 3,000 / Tape & Reel   |
| SBC847CDW1T1G*   | 1G       | SOT-363<br>(Pb-Free) | 3,000 / Tape & Reel   |
| BC848CDW1T1G     | 1L       | SOT-363<br>(Pb-Free) | 3,000 / Tape & Reel   |
| NSVBC848CDW1T1G* | 1L       | SOT-363<br>(Pb-Free) | 3,000 / Tape & Reel   |

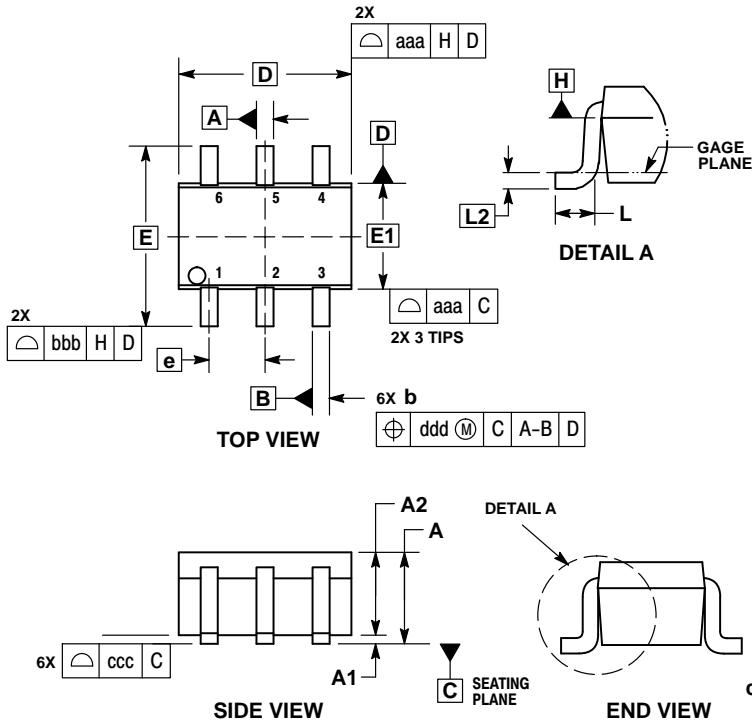
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*S and NSV Prefixes for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

# BC846BDW1, BC847BDW1, BC848CDW1

## PACKAGE DIMENSIONS

SC-88/SC70-6/SOT-363  
CASE 419B-02  
ISSUE Y

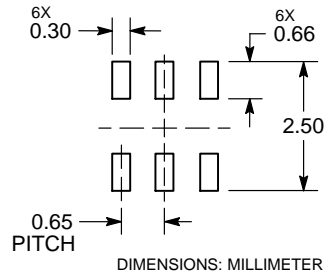


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
  4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
  5. DATUMS A AND B ARE DETERMINED AT DATUM H.
  6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
  7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

| DIM | MILLIMETERS |      |      | INCHES    |       |       |
|-----|-------------|------|------|-----------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN       | NOM   | MAX   |
| A   | ---         | ---  | 1.10 | ---       | ---   | 0.043 |
| A1  | 0.00        | ---  | 0.10 | 0.000     | ---   | 0.004 |
| A2  | 0.70        | 0.90 | 1.00 | 0.027     | 0.035 | 0.039 |
| b   | 0.15        | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| C   | 0.08        | 0.15 | 0.22 | 0.003     | 0.006 | 0.009 |
| D   | 1.80        | 2.00 | 2.20 | 0.070     | 0.078 | 0.086 |
| E   | 2.00        | 2.10 | 2.20 | 0.078     | 0.082 | 0.086 |
| E1  | 1.15        | 1.25 | 1.35 | 0.045     | 0.049 | 0.053 |
| e   | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| L   | 0.26        | 0.36 | 0.46 | 0.010     | 0.014 | 0.018 |
| L2  | 0.15 BSC    |      |      | 0.006 BSC |       |       |
| aaa | 0.15        |      |      | 0.006     |       |       |
| bbb | 0.30        |      |      | 0.012     |       |       |
| ccc | 0.10        |      |      | 0.004     |       |       |
| ddd | 0.10        |      |      | 0.004     |       |       |

- STYLE 1:  
PIN 1. EMITTER 2  
2. BASE 2  
3. COLLECTOR 1  
4. EMITTER 1  
5. BASE 1  
6. COLLECTOR 2

### RECOMMENDED 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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