

# ON Semiconductor

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# BC846, BC847, BC848

## General Purpose Transistors

### NPN Silicon

These transistors are designed for general purpose amplifier applications. They are housed in the SC-70/SOT-323 which is designed for low power surface mount applications.

#### Features

- S and 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<br>BC846<br>BC847<br>BC848 | $V_{CEO}$ | 65<br>45<br>30    | V    |
| Collector-Base Voltage<br>BC846<br>BC847<br>BC848    | $V_{CBO}$ | 80<br>50<br>30    | V    |
| Emitter-Base Voltage<br>BC846<br>BC847<br>BC848      | $V_{EBO}$ | 6.0<br>6.0<br>5.0 | V    |
| Collector Current – Continuous                       | $I_C$     | 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

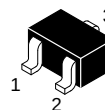
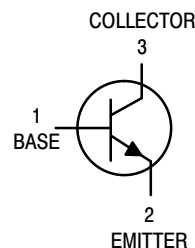
| Characteristic                                                            | Symbol          | Max         | Unit               |
|---------------------------------------------------------------------------|-----------------|-------------|--------------------|
| Total Device Dissipation FR-5 Board,<br>(Note 1) $T_A = 25^\circ\text{C}$ | $P_D$           | 200         | mW                 |
| Thermal Resistance,<br>Junction-to-Ambient                                | $R_{\theta JA}$ | 620         | $^\circ\text{C/W}$ |
| Junction and Storage Temperature                                          | $T_J, T_{stg}$  | -55 to +150 | $^\circ\text{C}$   |

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



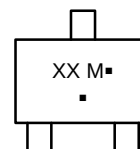
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SC-70/SOT-323  
CASE 419  
STYLE 3

#### MARKING DIAGRAM



XX = Specific Device Code  
M = Month Code  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 12 of this data sheet.

# BC846, BC847, BC848

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

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

### OFF CHARACTERISTICS

|                                                                                                               |                                              |               |                   |             |             |                     |
|---------------------------------------------------------------------------------------------------------------|----------------------------------------------|---------------|-------------------|-------------|-------------|---------------------|
| Collector–Emitter Breakdown Voltage<br>( $I_C = 10\text{ mA}$ )                                               | BC846 Series<br>BC847 Series<br>BC848 Series | $V_{(BR)CEO}$ | 65<br>45<br>30    | –<br>–<br>– | –<br>–<br>– | V                   |
| Collector–Emitter Breakdown Voltage<br>( $I_C = 10\text{ }\mu\text{A}$ , $V_{EB} = 0$ )                       | BC846 Series<br>BC847 Series<br>BC848 Series | $V_{(BR)CES}$ | 80<br>50<br>30    | –<br>–<br>– | –<br>–<br>– | V                   |
| Collector–Base Breakdown Voltage<br>( $I_C = 10\text{ }\mu\text{A}$ )                                         | BC846 Series<br>BC847 Series<br>BC848 Series | $V_{(BR)CBO}$ | 80<br>50<br>30    | –<br>–<br>– | –<br>–<br>– | V                   |
| Emitter–Base Breakdown Voltage<br>( $I_E = 1.0\text{ }\mu\text{A}$ )                                          | BC846 Series<br>BC847 Series<br>BC848 Series | $V_{(BR)EBO}$ | 6.0<br>6.0<br>5.0 | –<br>–<br>– | –<br>–<br>– | V                   |
| Collector Cutoff Current ( $V_{CB} = 30\text{ V}$ )<br>( $V_{CB} = 30\text{ V}$ , $T_A = 150^\circ\text{C}$ ) |                                              | $I_{CBO}$     | –<br>–            | –<br>–      | 15<br>5.0   | nA<br>$\mu\text{A}$ |

### ON CHARACTERISTICS

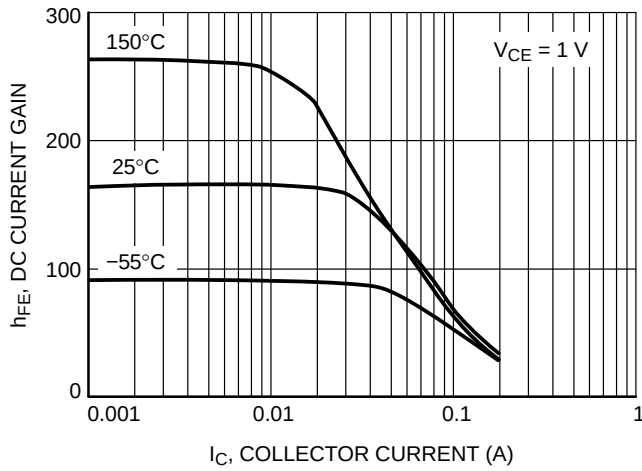
|                                                                                                                                            |                                                                                                                                              |               |                                      |                                           |                                      |    |
|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|-------------------------------------------|--------------------------------------|----|
| DC Current Gain<br>( $I_C = 10\text{ }\mu\text{A}$ , $V_{CE} = 5.0\text{ V}$ )<br><br>( $I_C = 2.0\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ )  | BC846A, BC847A, BC848A<br>BC846B, BC847B, BC848B<br>BC847C, BC848C<br><br>BC846A, BC847A, BC848A<br>BC846B, BC847B, BC848B<br>BC847C, BC848C | $h_{FE}$      | –<br>–<br>–<br><br>110<br>200<br>420 | 90<br>150<br>270<br><br>180<br>290<br>520 | –<br>–<br>–<br><br>220<br>450<br>800 | –  |
| Collector–Emitter Saturation Voltage ( $I_C = 10\text{ mA}$ , $I_B = 0.5\text{ mA}$ )<br>( $I_C = 100\text{ mA}$ , $I_B = 5.0\text{ mA}$ ) |                                                                                                                                              | $V_{CE(sat)}$ | –<br>–                               | –<br>–                                    | 0.25<br>0.6                          | V  |
| Base–Emitter Saturation Voltage ( $I_C = 10\text{ mA}$ , $I_B = 0.5\text{ mA}$ )<br>( $I_C = 100\text{ mA}$ , $I_B = 5.0\text{ mA}$ )      |                                                                                                                                              | $V_{BE(sat)}$ | –<br>–                               | 0.7<br>0.9                                | –<br>–                               | V  |
| Base–Emitter Voltage ( $I_C = 2.0\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ )<br>( $I_C = 10\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ )             |                                                                                                                                              | $V_{BE(on)}$  | 580<br>–                             | 660<br>–                                  | 700<br>770                           | mV |

### SMALL–SIGNAL CHARACTERISTICS

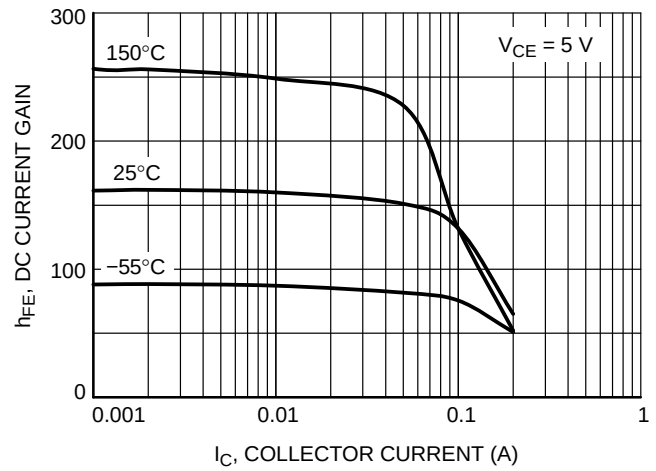
|                                                                                                                                               |           |     |   |     |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|---|-----|-----|
| Current–Gain – Bandwidth Product<br>( $I_C = 10\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f = 100\text{ MHz}$ )                               | $f_T$     | 100 | – | –   | MHz |
| Output Capacitance ( $V_{CB} = 10\text{ V}$ , $f = 1.0\text{ MHz}$ )                                                                          | $C_{obo}$ | –   | – | 4.5 | pF  |
| Noise Figure ( $I_C = 0.2\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ , $R_S = 2.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ , $BW = 200\text{ Hz}$ ) | NF        | –   | – | 10  | dB  |

# BC846, BC847, BC848

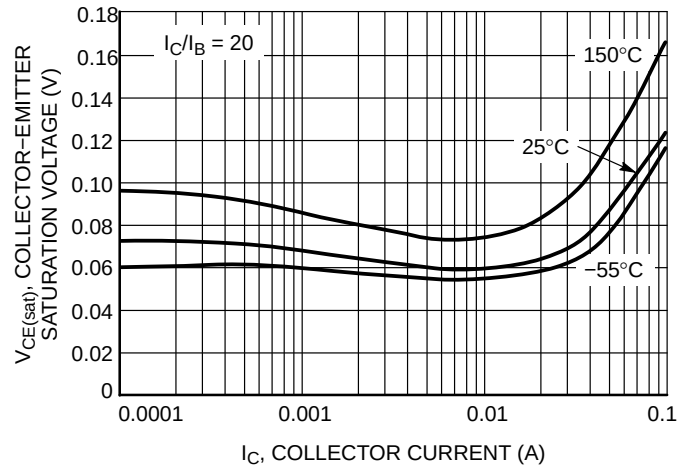
## BC846A, BC847A, BC848A



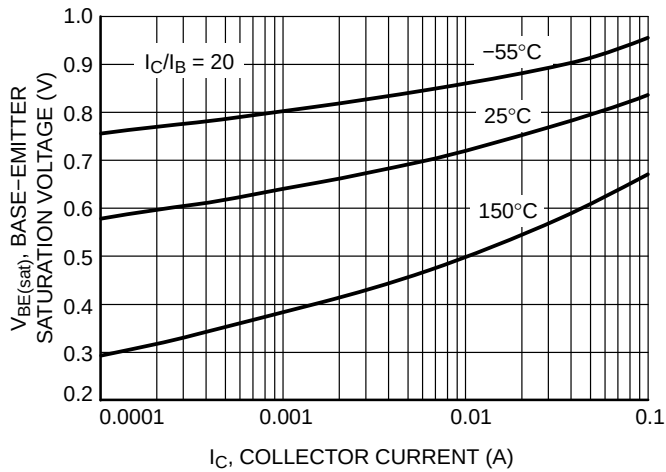
**Figure 1. DC Current Gain vs. Collector Current**



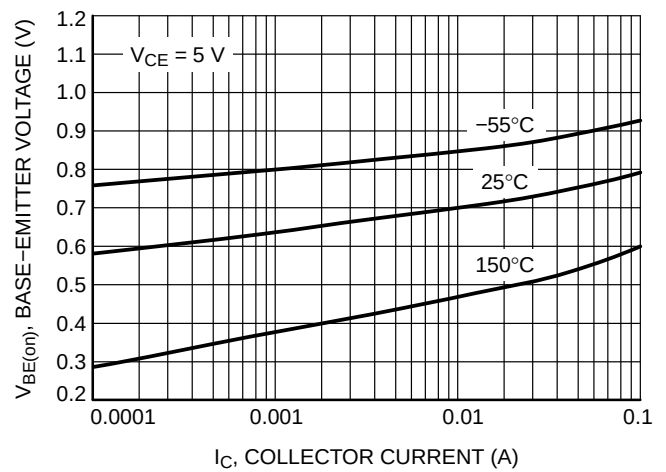
**Figure 2. DC Current Gain vs. Collector Current**



**Figure 3. Collector-Emitter Saturation Voltage vs. Collector Current**



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



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

# BC846, BC847, BC848

## BC846A, BC847A, BC848A

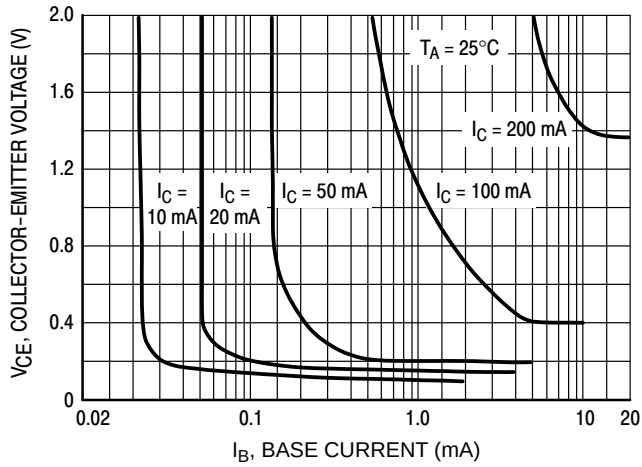


Figure 6. Collector Saturation Region

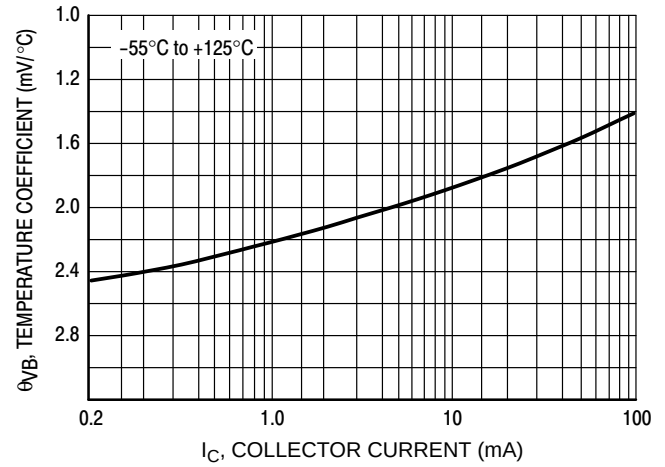


Figure 7. Base-Emitter Temperature Coefficient

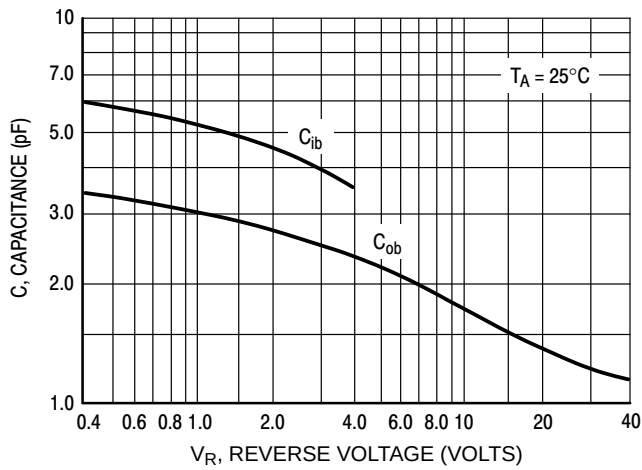


Figure 8. Capacitances

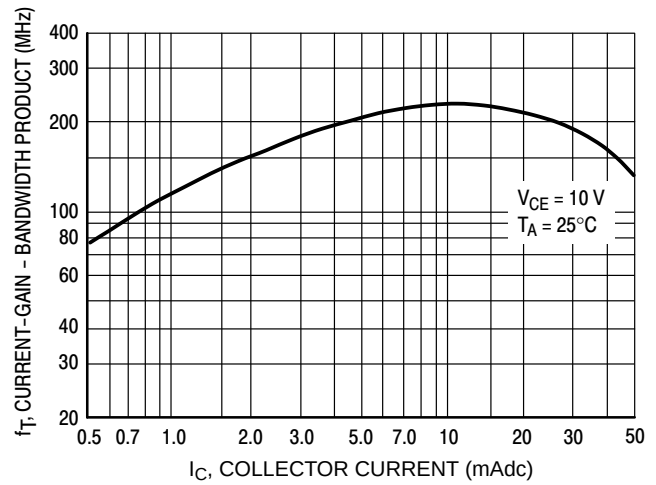
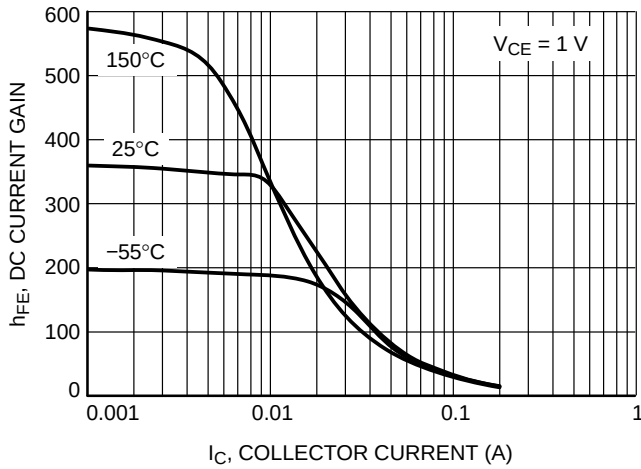


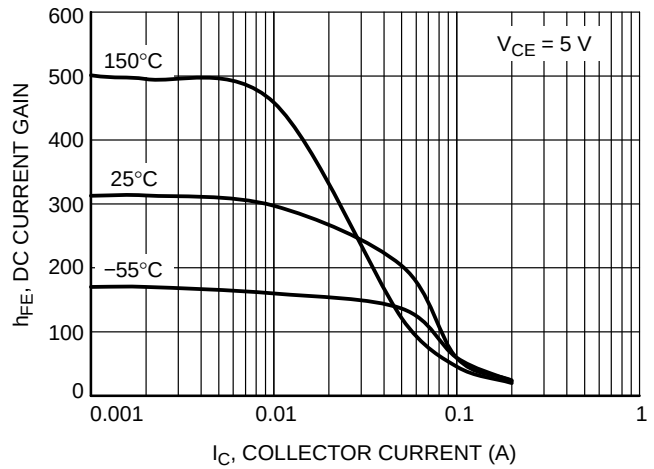
Figure 9. Current-Gain - Bandwidth Product

# BC846, BC847, BC848

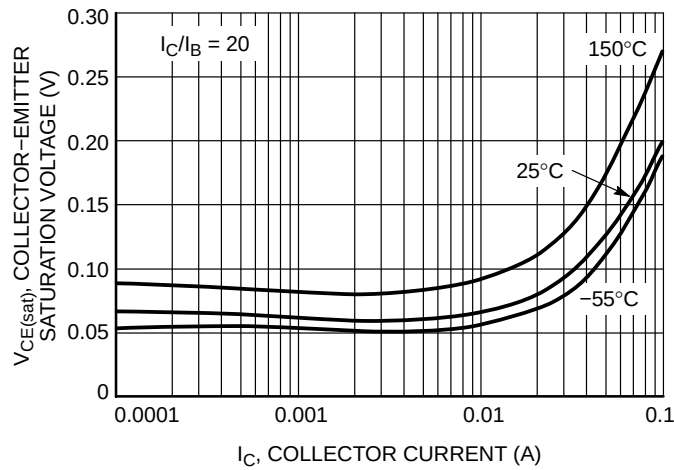
## BC846B



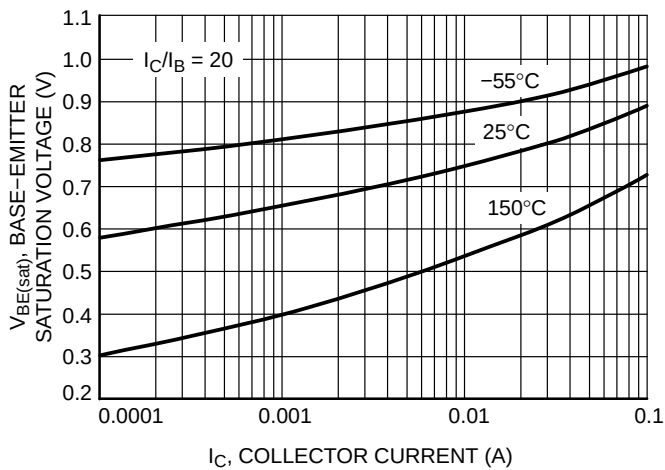
**Figure 10. DC Current Gain vs. Collector Current**



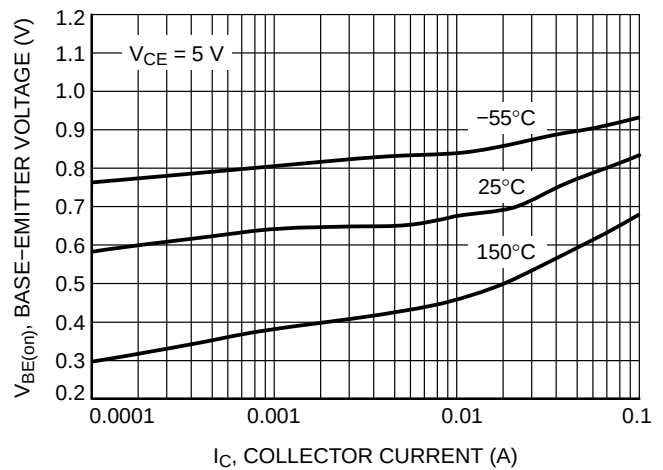
**Figure 11. DC Current Gain vs. Collector Current**



**Figure 12. Collector Emitter Saturation Voltage vs. Collector Current**



**Figure 13. Base Emitter Saturation Voltage vs. Collector Current**



**Figure 14. Base Emitter Voltage vs. Collector Current**

# BC846, BC847, BC848

## BC846B

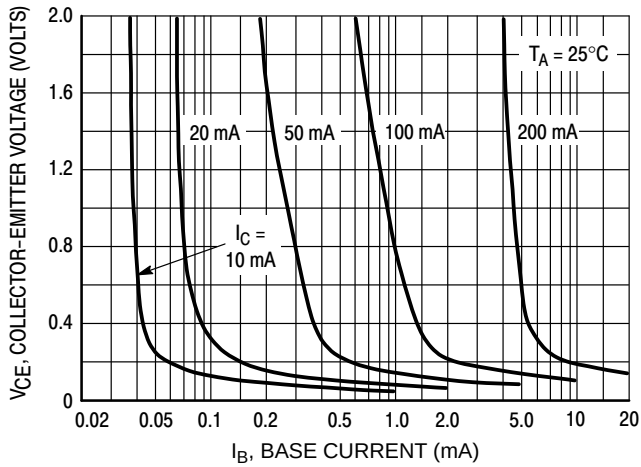


Figure 15. Collector Saturation Region

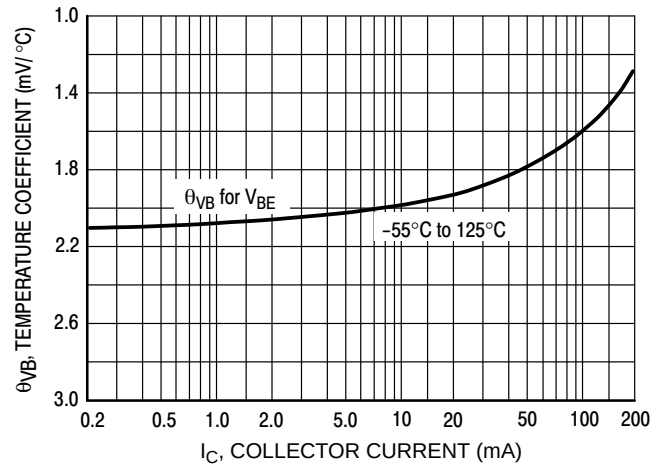


Figure 16. Base-Emitter Temperature Coefficient

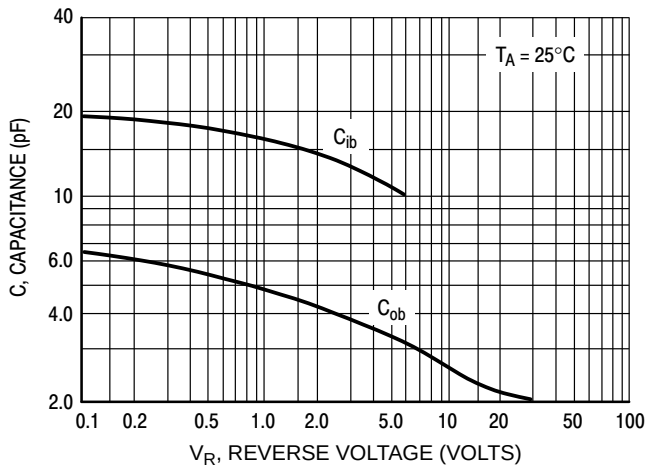


Figure 17. Capacitance

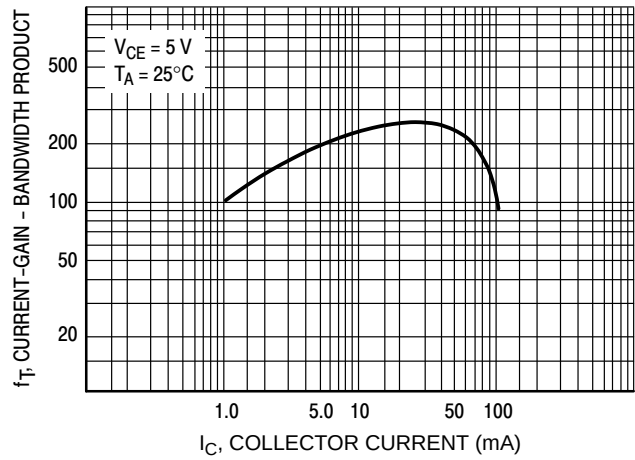
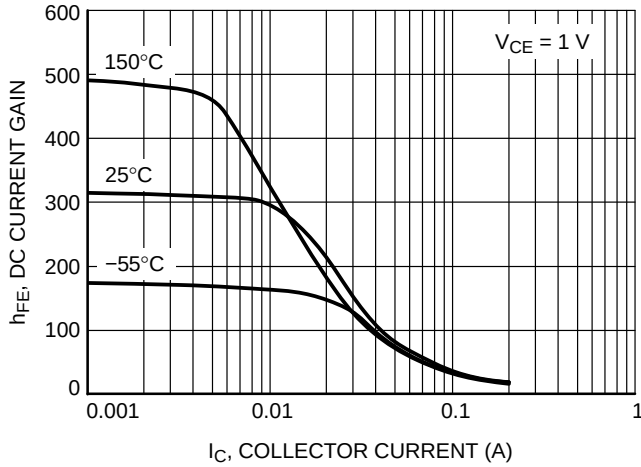


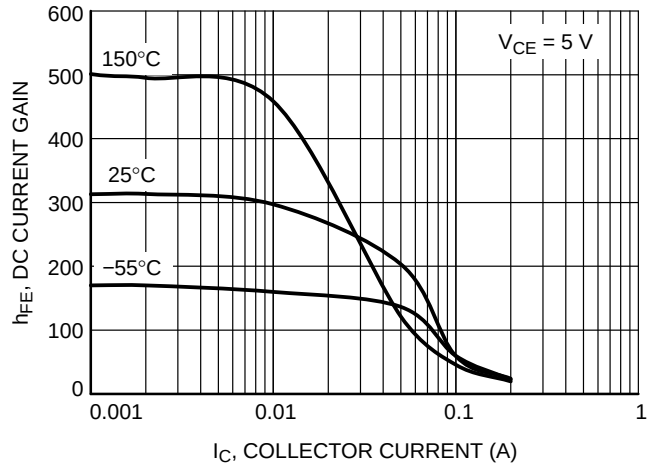
Figure 18. Current-Gain - Bandwidth Product

# BC846, BC847, BC848

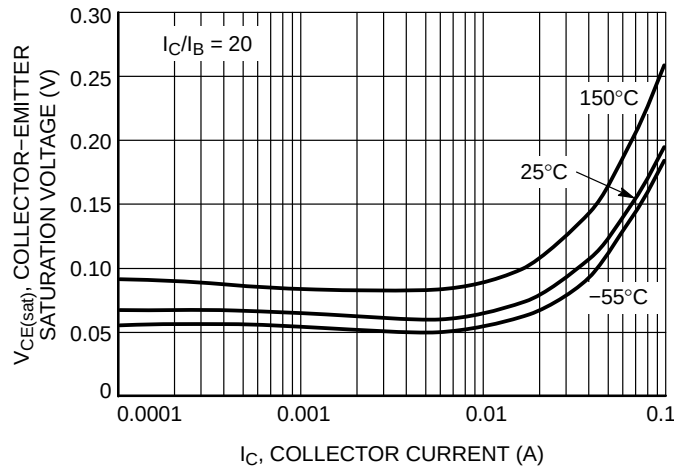
## BC847B, BC848B



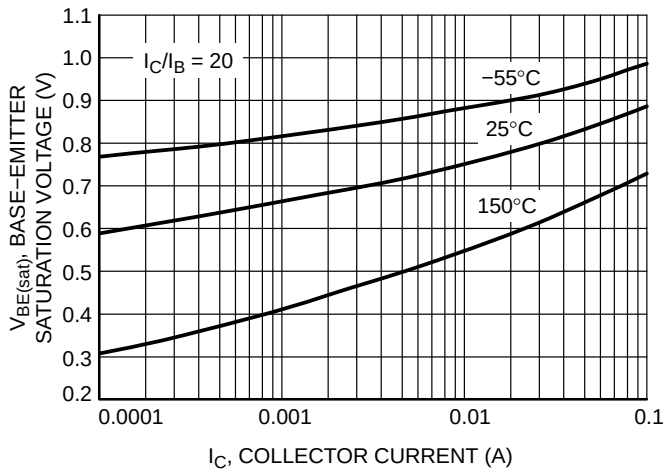
**Figure 19. DC Current Gain vs. Collector Current**



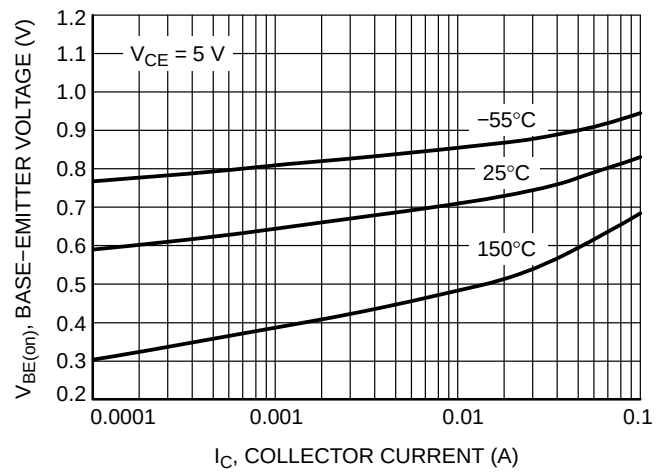
**Figure 20. DC Current Gain vs. Collector Current**



**Figure 21. Collector-Emitter Saturation Voltage vs. Collector Current**



**Figure 22. Base-Emitter Saturation Voltage vs. Collector Current**



**Figure 23. Base-Emitter Voltage vs. Collector Current**



# BC846, BC847, BC848

## BC847B, BC848B

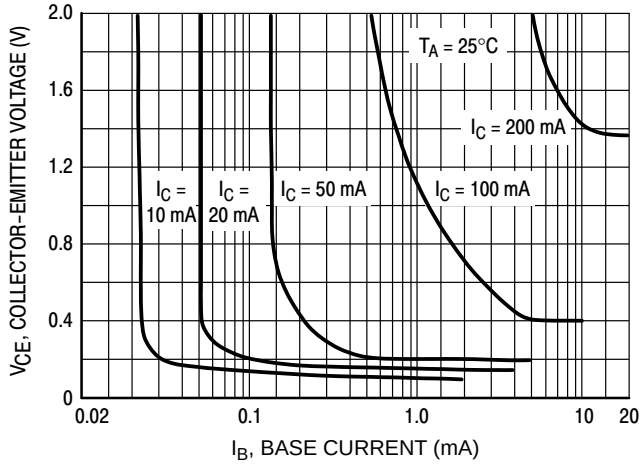


Figure 24. Collector Saturation Region

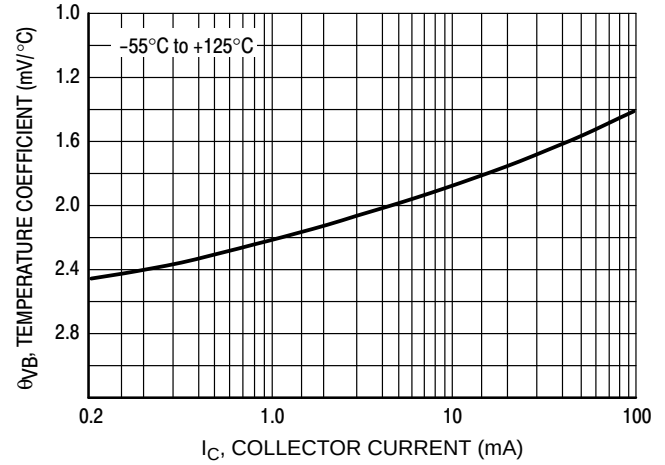


Figure 25. Base-Emitter Temperature Coefficient

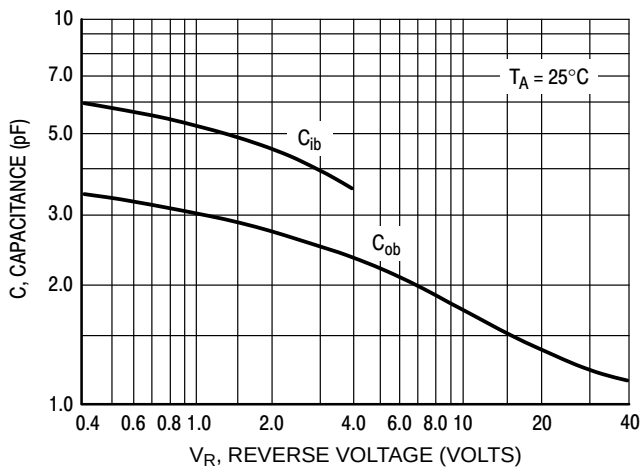


Figure 26. Capacitances

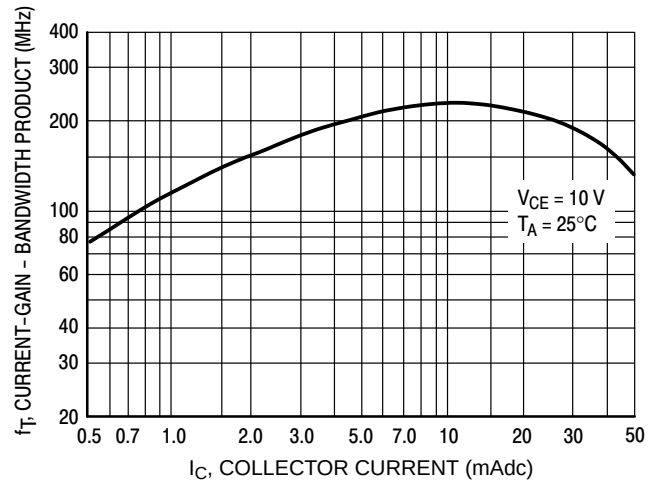
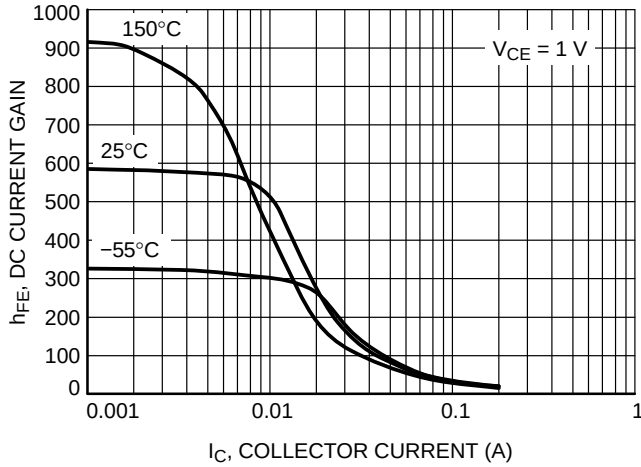


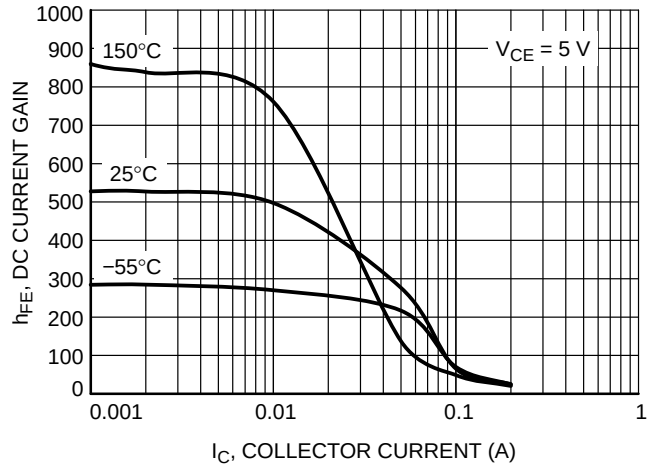
Figure 27. Current-Gain - Bandwidth Product

# BC846, BC847, BC848

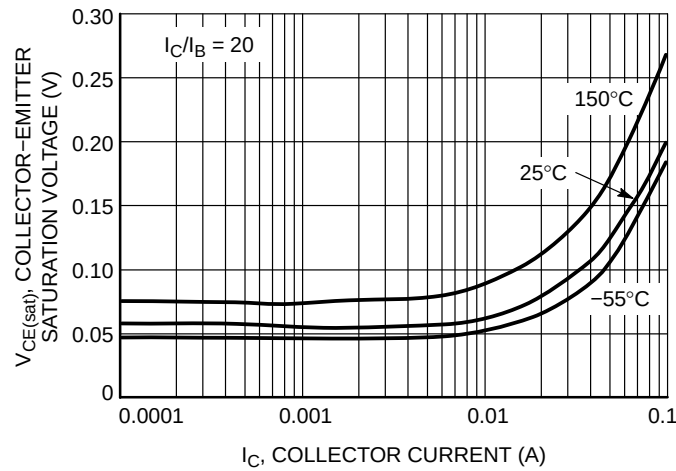
## BC847C, BC848C



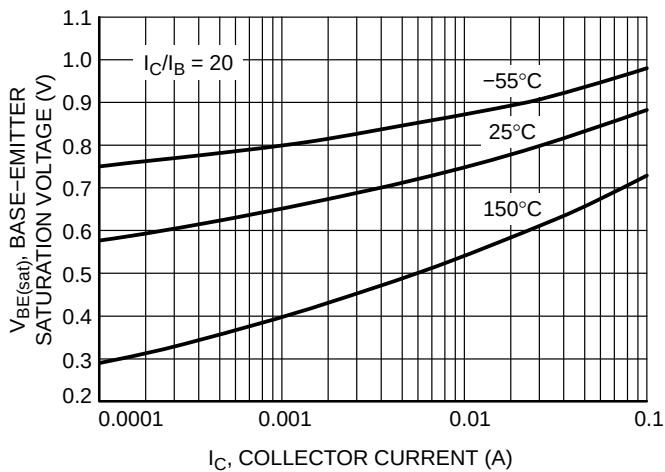
**Figure 28. DC Current Gain vs. Collector Current**



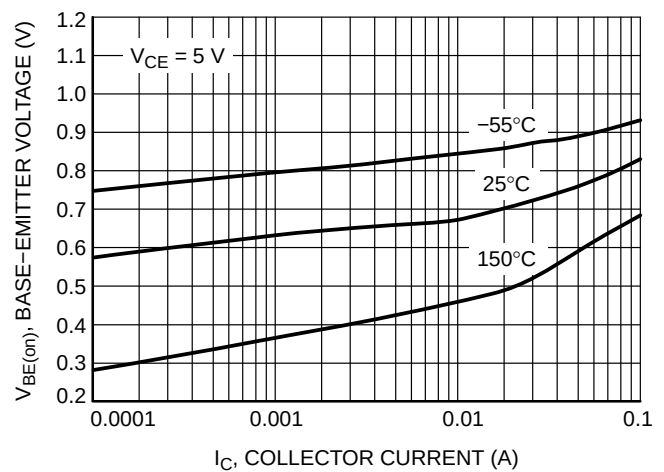
**Figure 29. DC Current Gain vs. Collector Current**



**Figure 30. Collector Emitter Saturation Voltage vs. Collector Current**



**Figure 31. Base Emitter Saturation Voltage vs. Collector Current**



**Figure 32. Base Emitter Voltage vs. Collector Current**

# BC846, BC847, BC848

## BC847C, BC848C

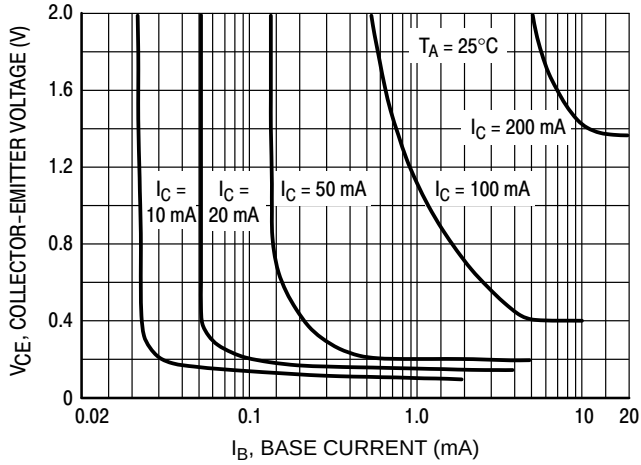


Figure 33. Collector Saturation Region

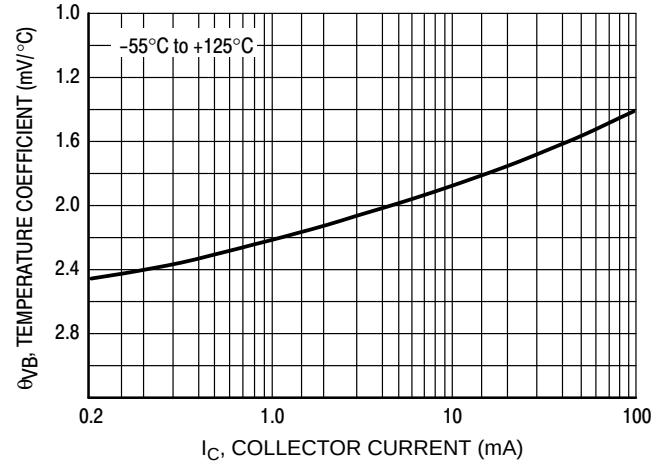


Figure 34. Base-Emitter Temperature Coefficient

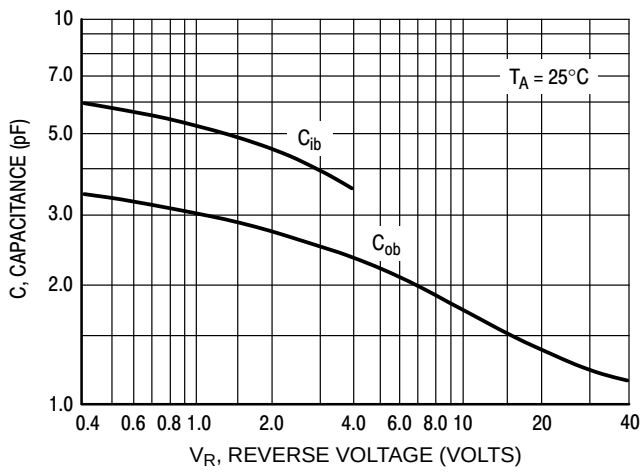


Figure 35. Capacitances

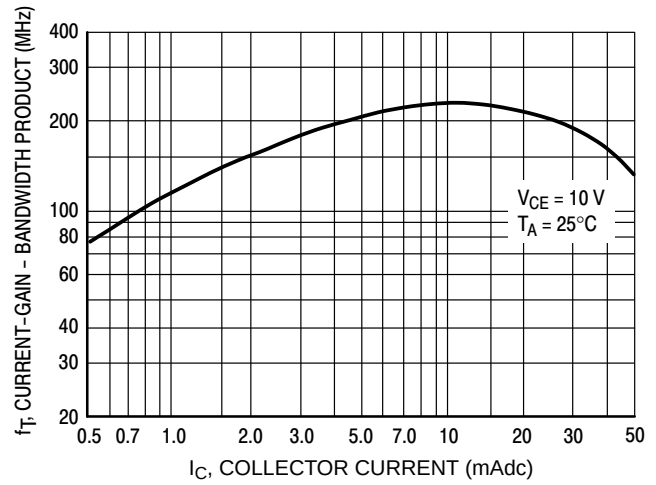
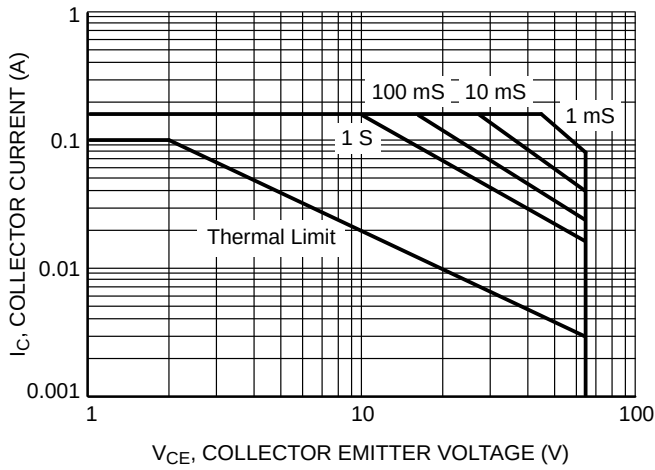
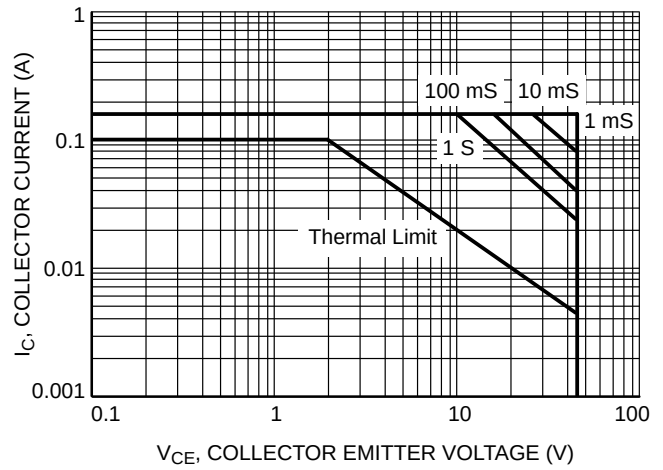


Figure 36. Current-Gain - Bandwidth Product

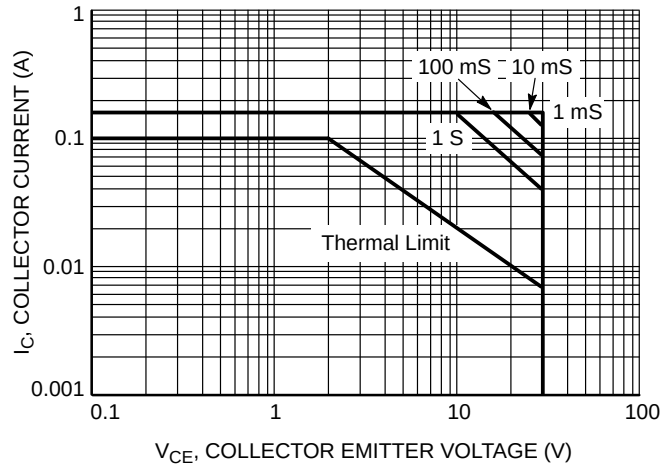
## BC846, BC847, BC848



**Figure 37. Safe Operating Area for  
BC846A, BC846B**



**Figure 38. Safe Operating Area for  
BC847A, BC847B, BC847C**



**Figure 39. Safe Operating Area for  
BC848A, BC848B, BC848C**

## BC846, BC847, BC848

### DEVICE ORDERING AND SPECIFIC MARKING INFORMATION

| Device         | Specific Marking Code | Package                      | Shipping <sup>†</sup> |
|----------------|-----------------------|------------------------------|-----------------------|
| BC846BWT1G     | 1B                    | SC-70 (SOT-323)<br>(Pb-Free) | 3,000 / Tape & Reel   |
| SBC846BWT1G*   |                       |                              |                       |
| BC847AWT1G     | 1E                    |                              | 3,000 / Tape & Reel   |
| SBC847AWT1G*   |                       |                              |                       |
| BC847BWT1G     | 1F                    |                              | 3,000 / Tape & Reel   |
| SBC847BWT1G*   |                       |                              |                       |
| BC847CWT1G     | 1G                    |                              | 3,000 / Tape & Reel   |
| SBC847CWT1G*   |                       |                              |                       |
| BC847CWT3G     | 1G                    |                              | 10,000 / Tape & Reel  |
| SBC847CWT3G*   |                       |                              |                       |
| BC848BWT1G     | 1K                    |                              | 3,000 / Tape & Reel   |
| NSVBC848BWT1G* |                       |                              |                       |
| BC848CWT1G     | 1L                    |                              |                       |

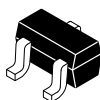
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



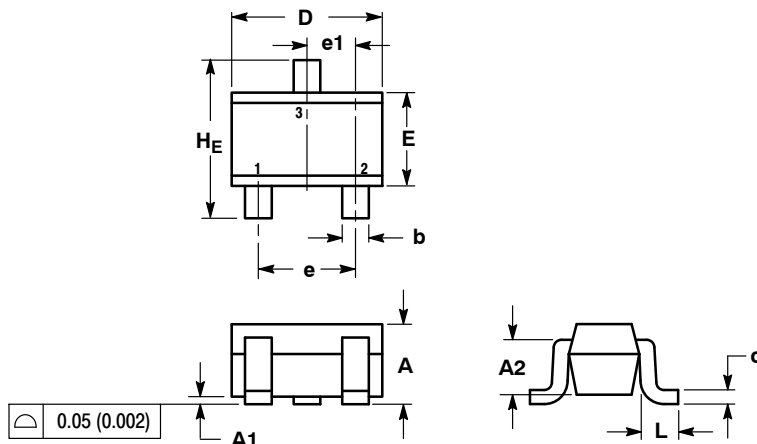
SCALE 4:1

### SC-70 (SOT-323)

#### CASE 419-04

#### ISSUE N

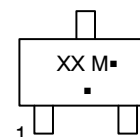
DATE 11 NOV 2008



NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI 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 REF |       |       |
| 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        | 2.10 | 2.20 | 0.071     | 0.083 | 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_E | 2.00        | 2.10 | 2.40 | 0.079     | 0.083 | 0.095 |

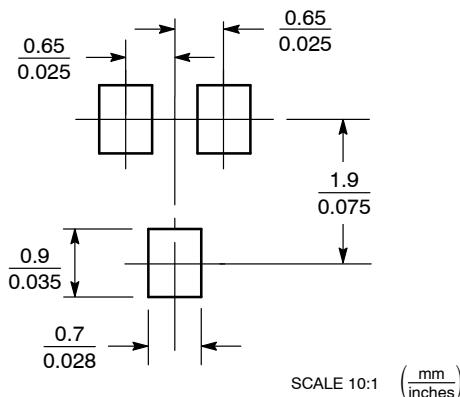
### GENERIC MARKING DIAGRAM



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.

### 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.

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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