

# General Purpose Transistors

## NPN Silicon

### BC846ALT1G Series

#### Features

- Moisture Sensitivity Level: 1
- ESD Rating – Human Body Model: > 4000 V  
– Machine Model: > 400 V
- 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

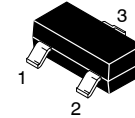
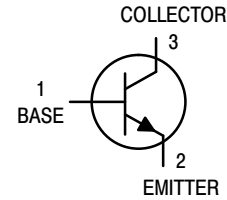
| Rating                                                             | Symbol    | Value             | Unit |
|--------------------------------------------------------------------|-----------|-------------------|------|
| Collector-Emitter Voltage<br>BC846<br>BC847, BC850<br>BC848, BC849 | $V_{CEO}$ | 65<br>45<br>30    | Vdc  |
| Collector-Base Voltage<br>BC846<br>BC847, BC850<br>BC848, BC849    | $V_{CBO}$ | 80<br>50<br>30    | Vdc  |
| Emitter-Base Voltage<br>BC846<br>BC847, BC850<br>BC848, BC849      | $V_{EBO}$ | 6.0<br>6.0<br>5.0 | Vdc  |
| 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

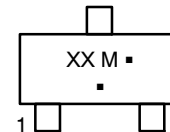
| Characteristic                                                                                                        | Symbol          | Max            | Unit        |
|-----------------------------------------------------------------------------------------------------------------------|-----------------|----------------|-------------|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

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



SOT-23  
CASE 318  
STYLE 6

#### MARKING DIAGRAM



XX = 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

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

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 12.

## BC846ALT1G Series

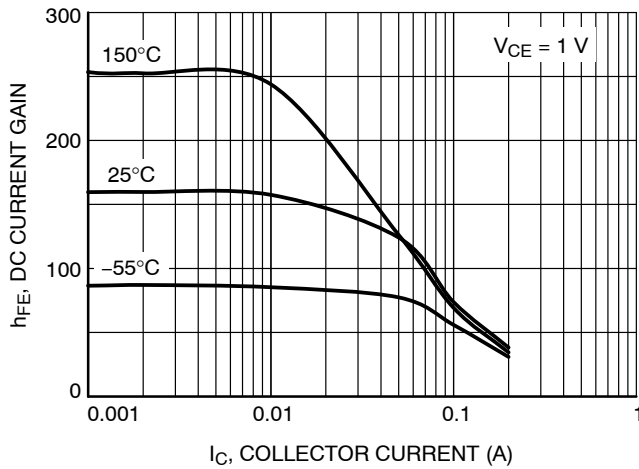
### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic                                                                                                                                      | Symbol        | Min               | Typ               | Max               | Unit                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------|-------------------|-------------------|---------------------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                          |               |                   |                   |                   |                     |
| Collector – Emitter Breakdown Voltage<br>( $I_C = 10\text{ mA}$ )                                                                                   | $V_{(BR)CEO}$ | 65<br>45<br>30    | –<br>–<br>–       | –<br>–<br>–       | V                   |
| Collector – Emitter Breakdown Voltage<br>( $I_C = 10\text{ }\mu\text{A}$ , $V_{EB} = 0$ )                                                           | $V_{(BR)CES}$ | 80<br>50<br>30    | –<br>–<br>–       | –<br>–<br>–       | V                   |
| Collector – Base Breakdown Voltage<br>( $I_C = 10\text{ }\mu\text{A}$ )                                                                             | $V_{(BR)CBO}$ | 80<br>50<br>30    | –<br>–<br>–       | –<br>–<br>–       | V                   |
| Emitter – Base Breakdown Voltage<br>( $I_E = 1.0\text{ }\mu\text{A}$ )                                                                              | $V_{(BR)EBO}$ | 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>$\mu\text{A}$ |
| <b>ON CHARACTERISTICS</b>                                                                                                                           |               |                   |                   |                   |                     |
| DC Current Gain<br>( $I_C = 10\text{ }\mu\text{A}$ , $V_{CE} = 5.0\text{ V}$ )                                                                      | $h_{FE}$      | –<br>–<br>–       | 90<br>150<br>270  | –<br>–<br>–       | –                   |
| ( $I_C = 2.0\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ )                                                                                                 |               | 110<br>200<br>420 | 180<br>290<br>520 | 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                  |
| <b>SMALL – SIGNAL CHARACTERISTICS</b>                                                                                                               |               |                   |                   |                   |                     |
| 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 ( $I_C = 0.2\text{ mA}$ ,<br>$V_{CE} = 5.0\text{ Vdc}$ , $R_S = 2.0\text{ k}\Omega$ ,<br>$f = 1.0\text{ kHz}$ , $BW = 200\text{ Hz}$ ) | NF            | –<br>–            | –<br>–            | 10<br>4.0         | dB                  |

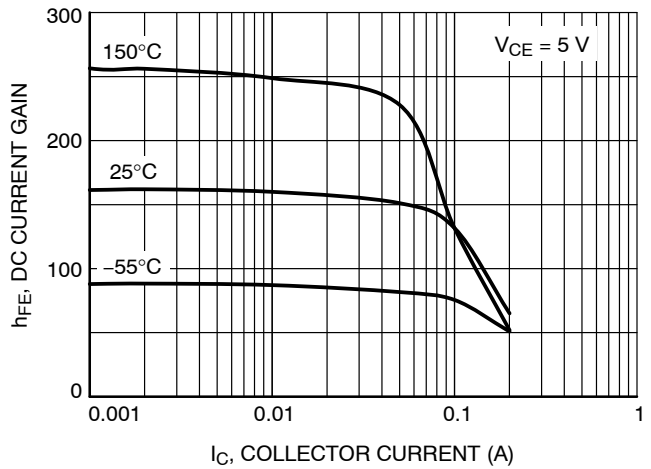
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# BC846ALT1G Series

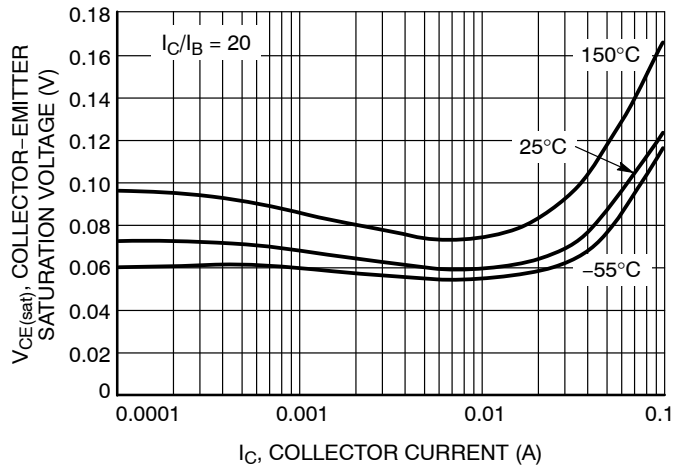
BC846A, BC847A, BC848A, SBC846A



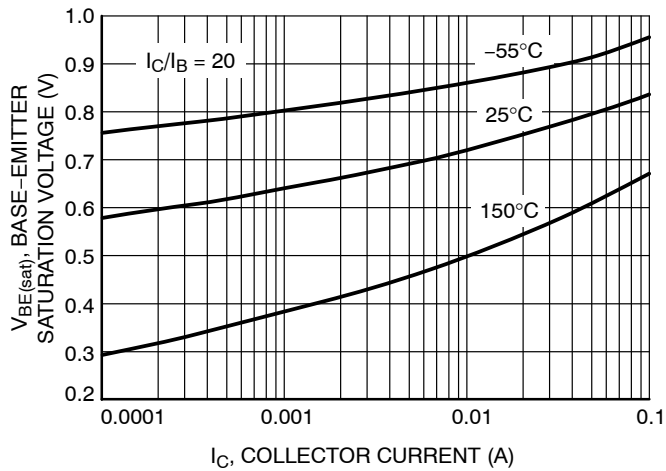
**Figure 1. DC Current Gain vs. Collector Current**



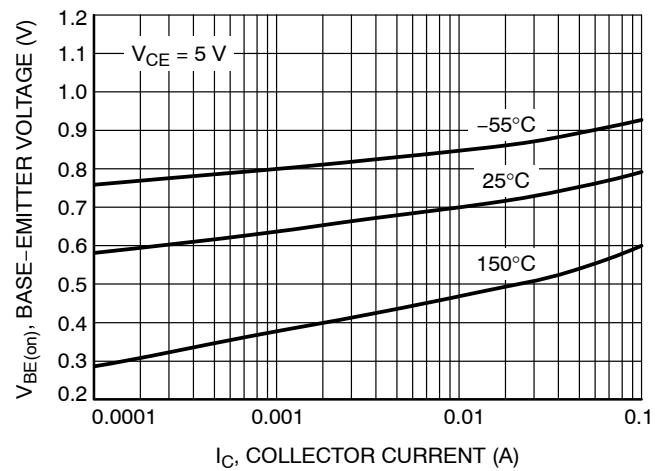
**Figure 2. DC Current Gain vs. Collector Current**



**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**

# BC846ALT1G Series

BC846A, BC847A, BC848A, SBC846A

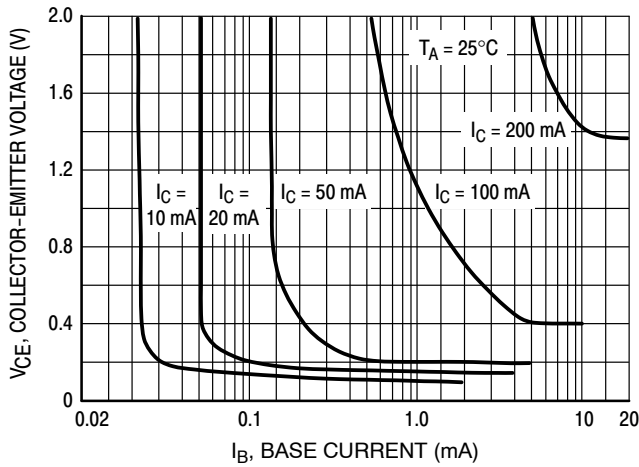


Figure 6. Collector Saturation Region

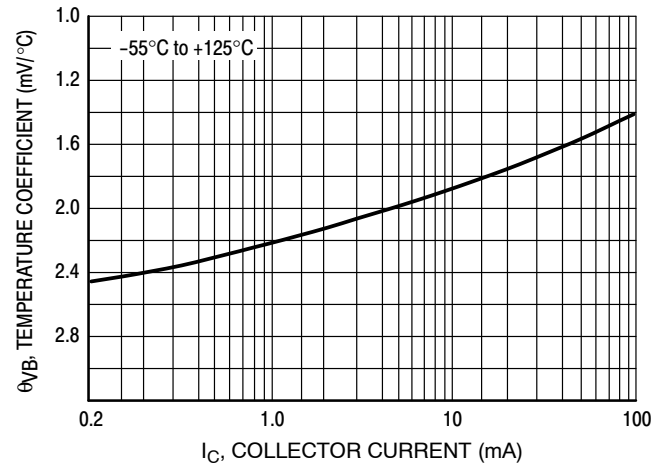


Figure 7. Base-Emitter Temperature Coefficient

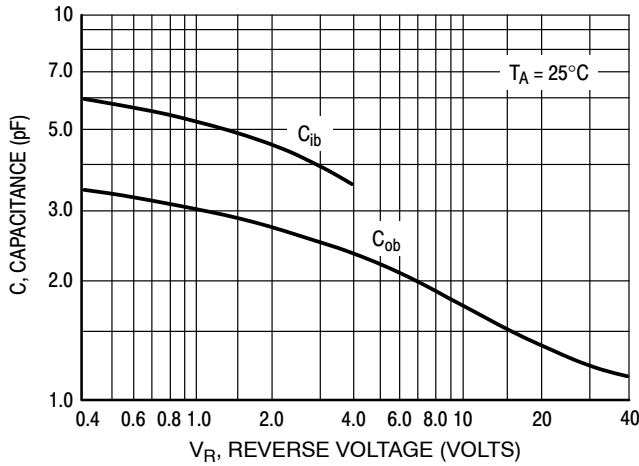


Figure 8. Capacitances

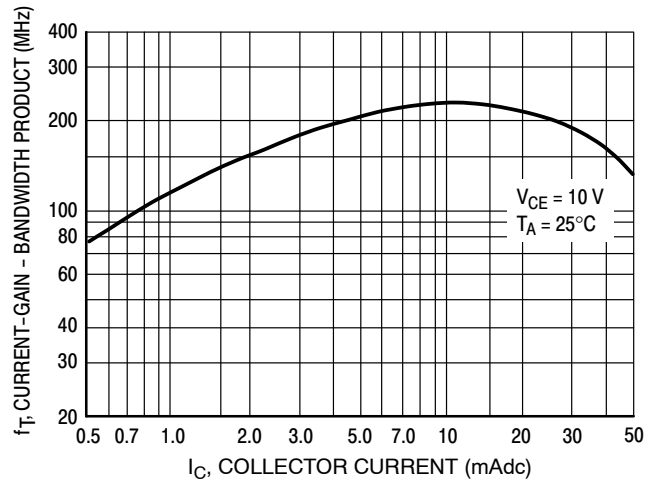
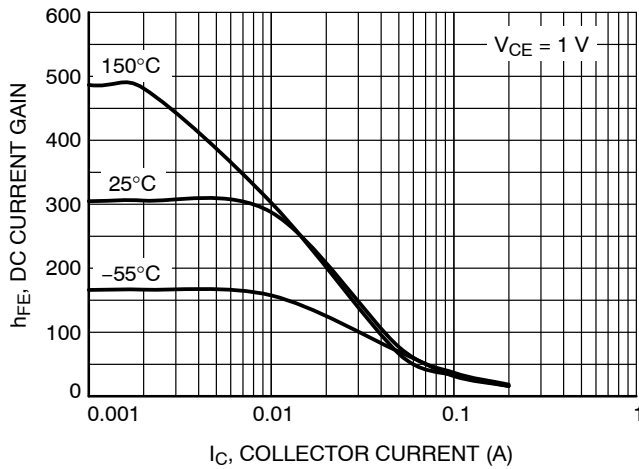


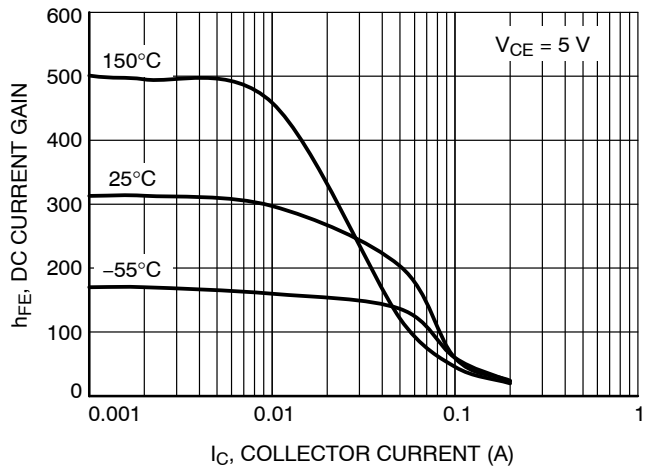
Figure 9. Current-Gain - Bandwidth Product

# BC846ALT1G Series

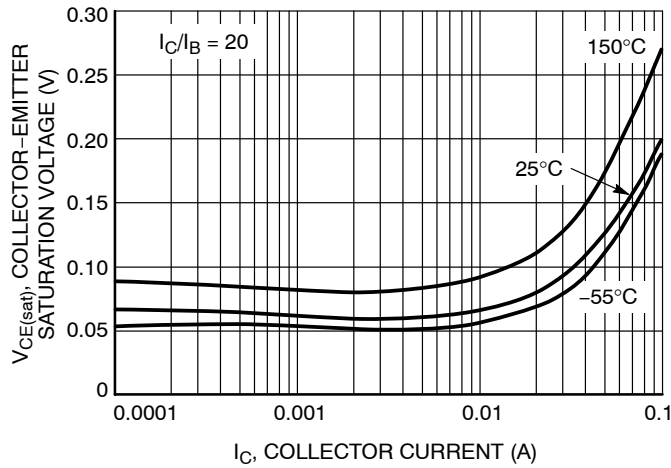
## BC846B, SBC846B



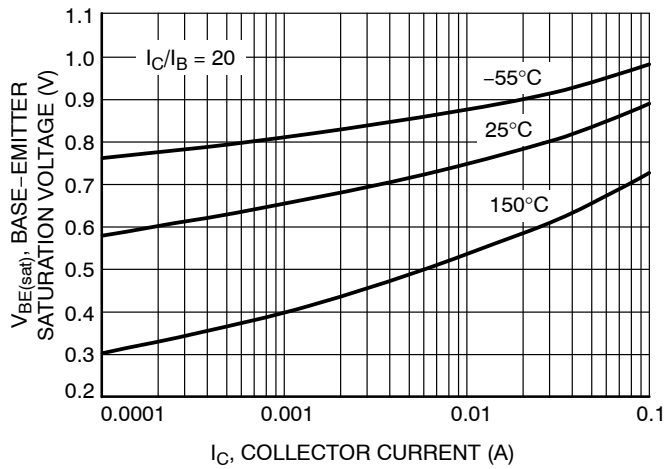
**Figure 10. DC Current Gain vs. Collector Current**



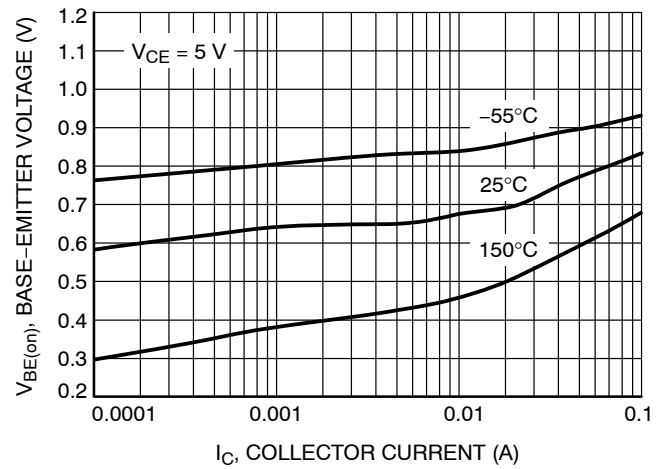
**Figure 11. DC Current Gain vs. Collector Current**



**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**

# BC846ALT1G Series

## BC846B, SBC846B

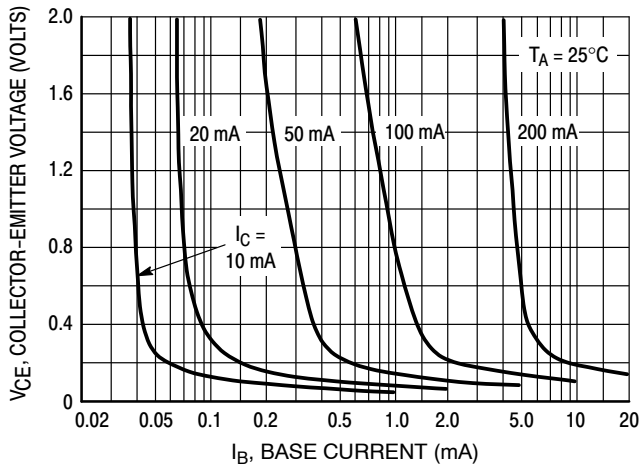


Figure 15. Collector Saturation Region

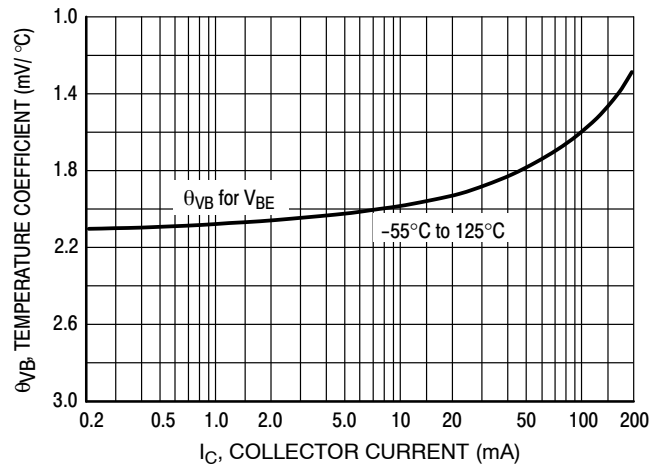


Figure 16. Base-Emitter Temperature Coefficient

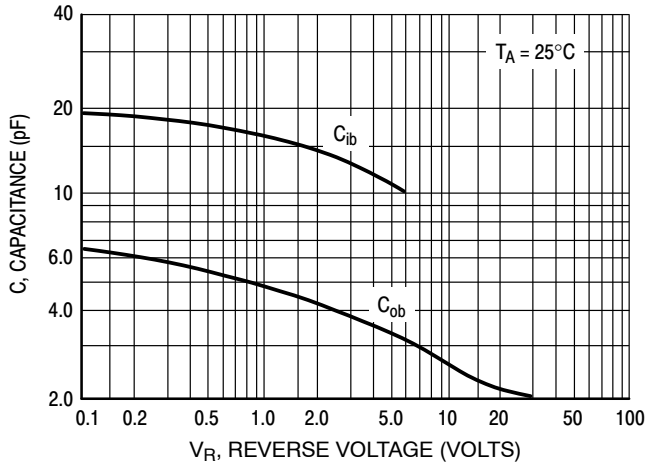


Figure 17. Capacitance

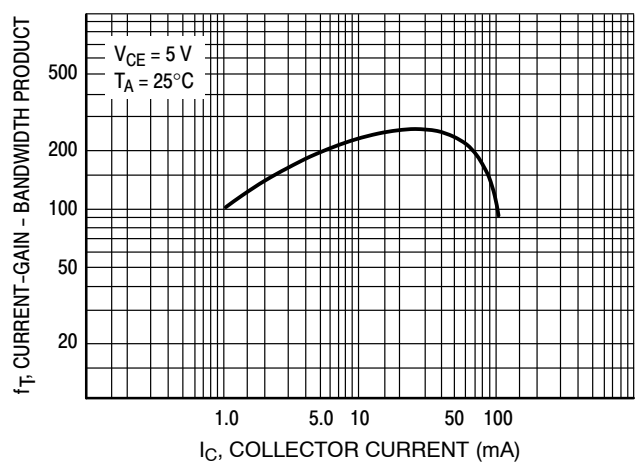


Figure 18. Current-Gain - Bandwidth Product

# BC846ALT1G Series

BC847B, BC848B, BC849B, BC850B, SBC847B, SBC848B

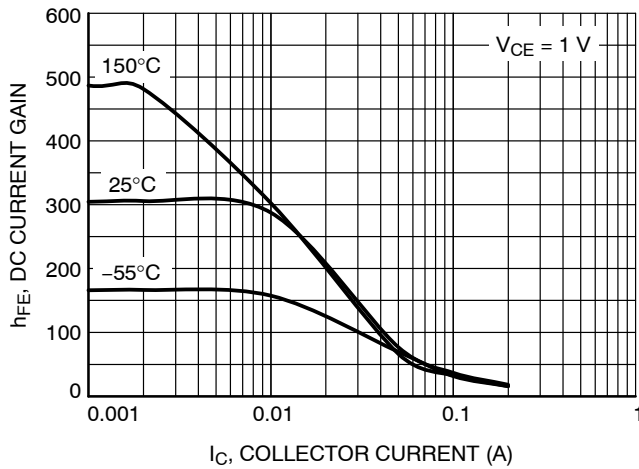


Figure 19. DC Current Gain vs. Collector Current

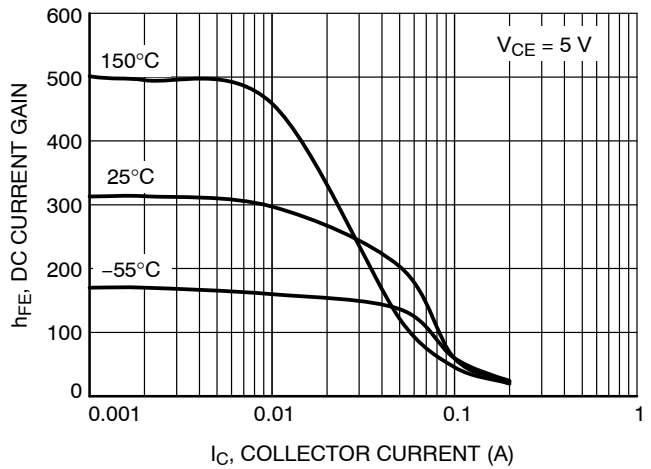


Figure 20. DC Current Gain vs. Collector Current

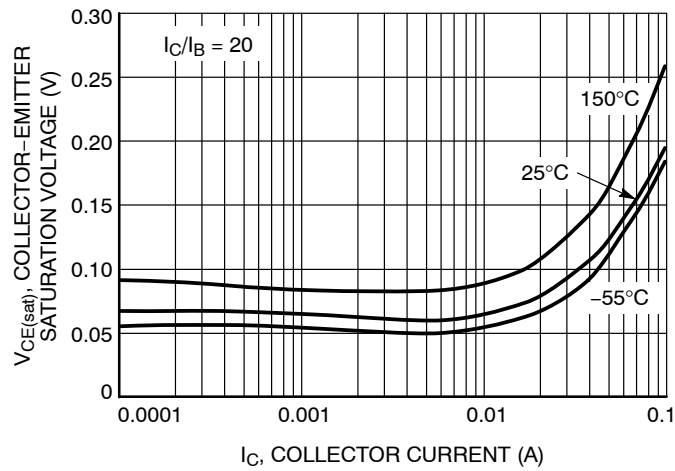


Figure 21. Collector Emitter Saturation Voltage vs. Collector Current

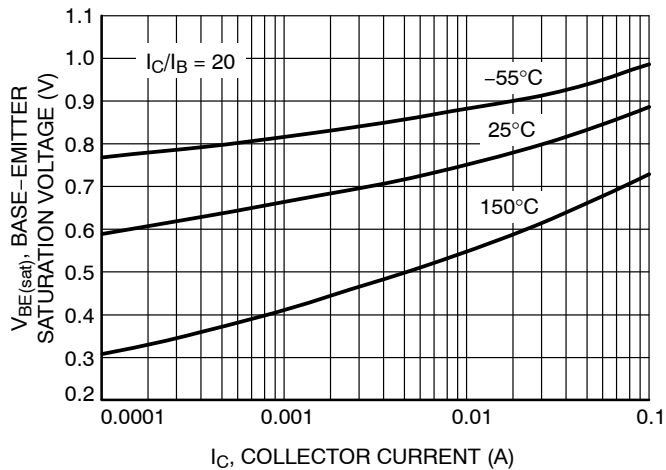


Figure 22. Base Emitter Saturation Voltage vs. Collector Current

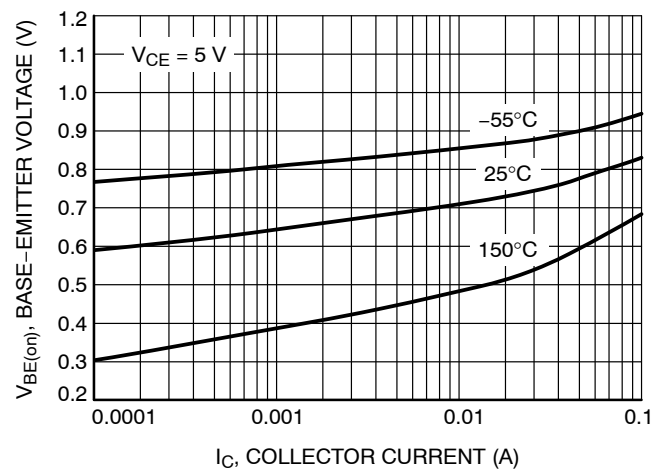


Figure 23. Base Emitter Voltage vs. Collector Current

## BC846ALT1G Series

BC847B, BC848B, BC849B, BC850B, SBC846B, SBC847B, SBC848B

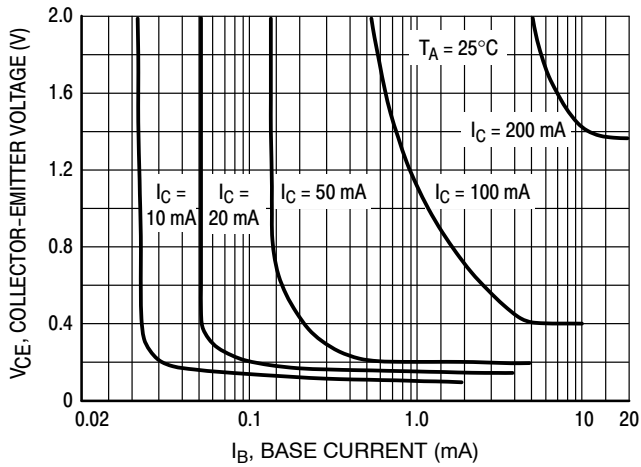


Figure 24. Collector Saturation Region

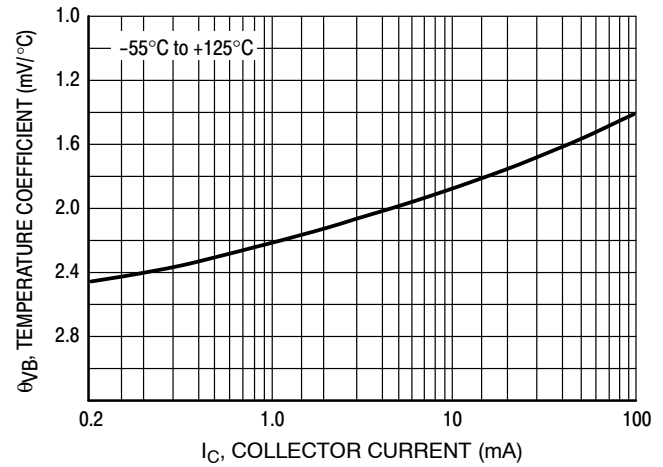


Figure 25. Base-Emitter Temperature Coefficient

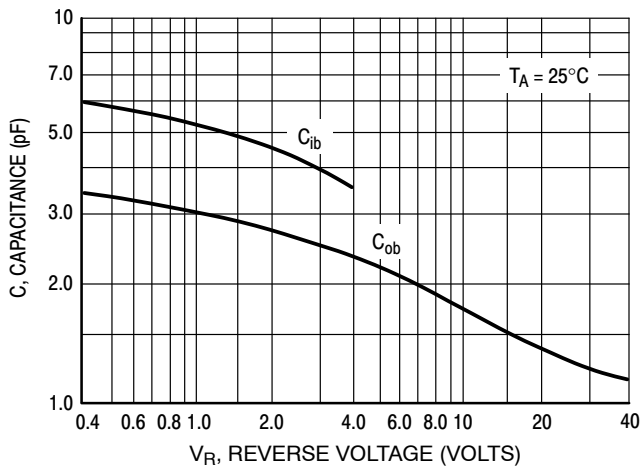


Figure 26. Capacitances

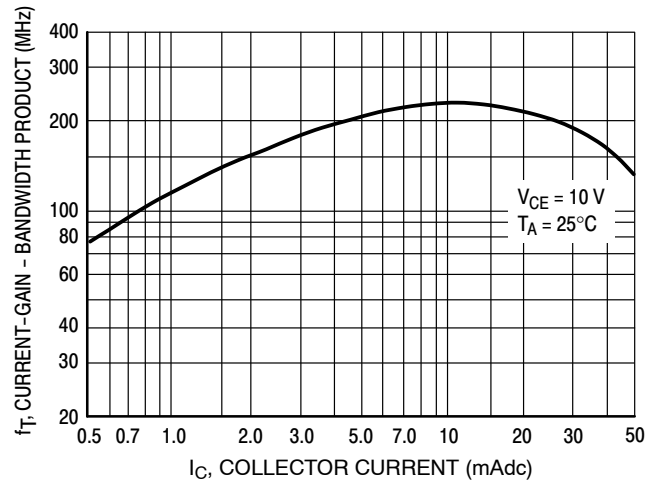
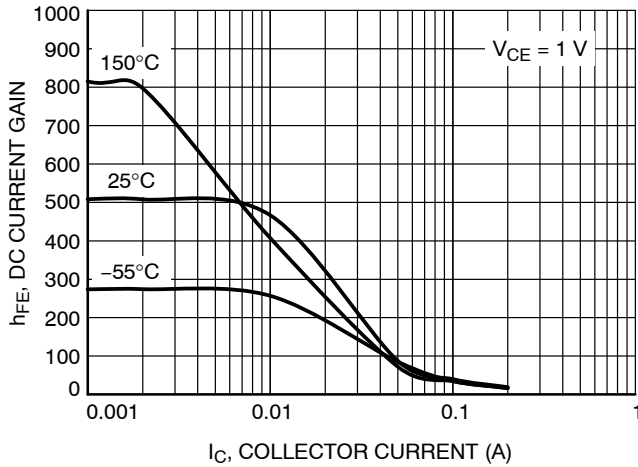


Figure 27. Current-Gain - Bandwidth Product

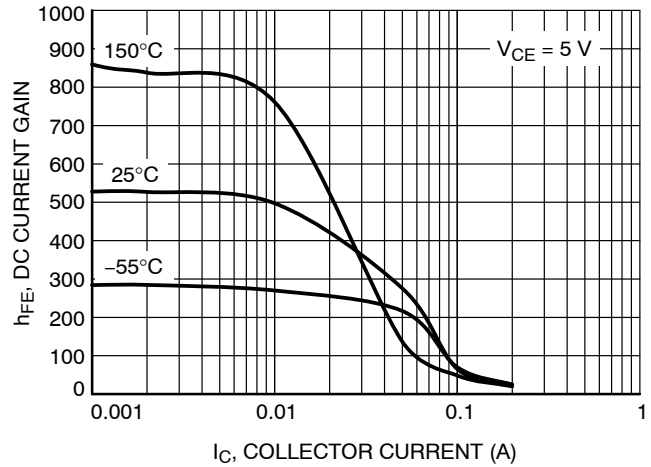


# BC846ALT1G Series

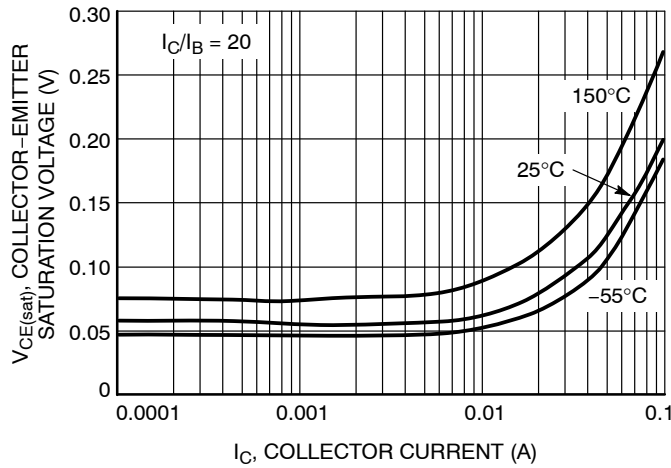
BC846C, BC847C, BC848C, BC849C, BC850C, SBC847C



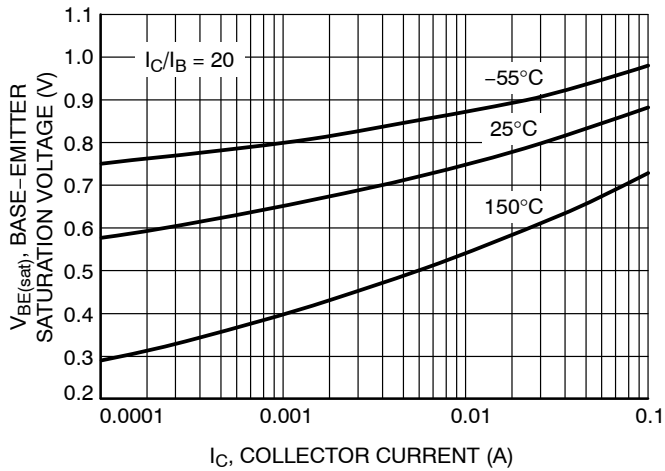
**Figure 28. DC Current Gain vs. Collector Current**



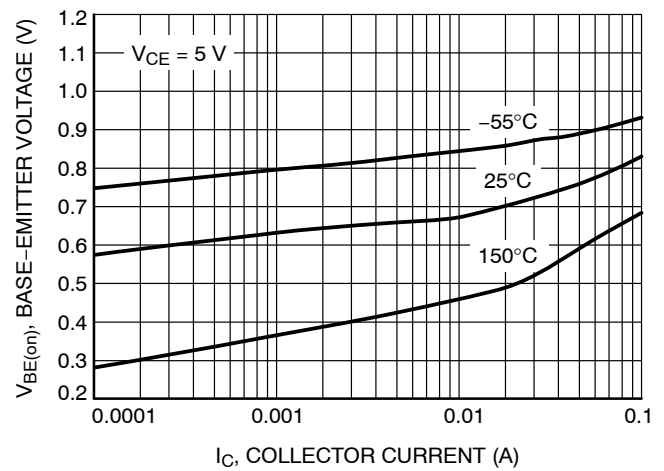
**Figure 29. DC Current Gain vs. Collector Current**



**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**

# BC846ALT1G Series

BC846C, BC847C, BC848C, BC849C, BC850C, SBC847C

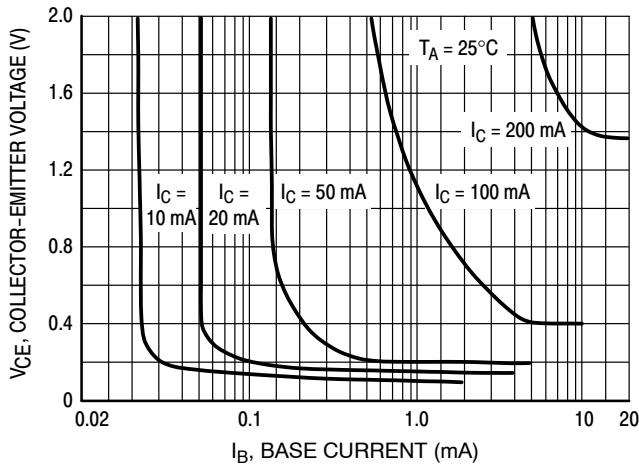


Figure 33. Collector Saturation Region

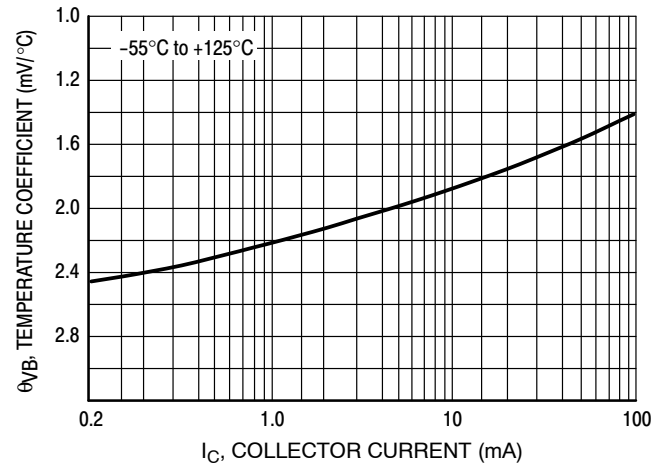


Figure 34. Base-Emitter Temperature Coefficient

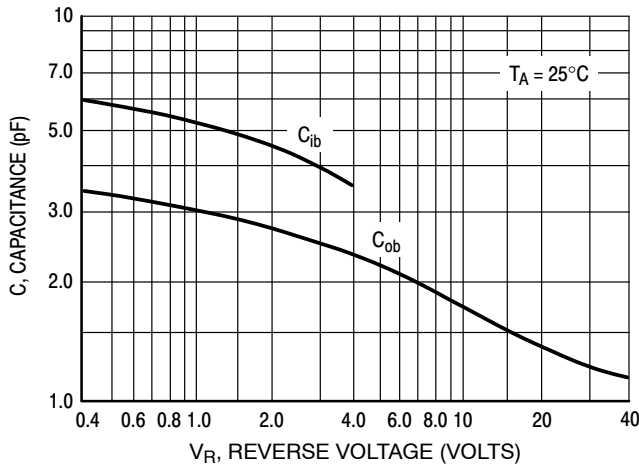


Figure 35. Capacitances

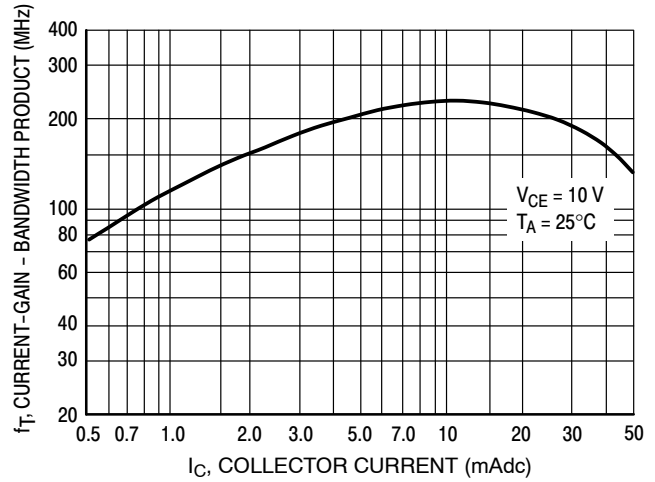
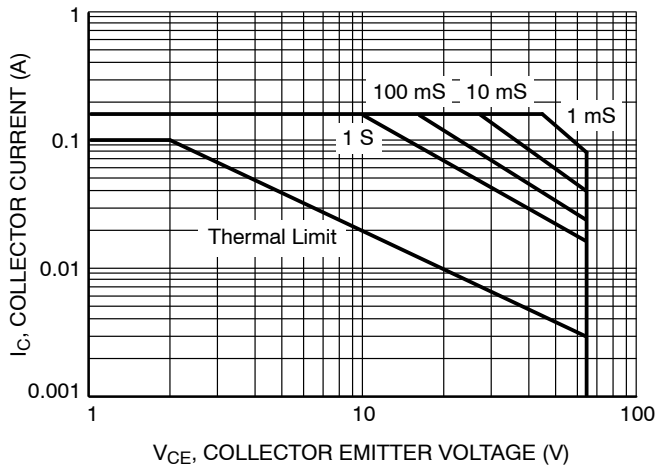
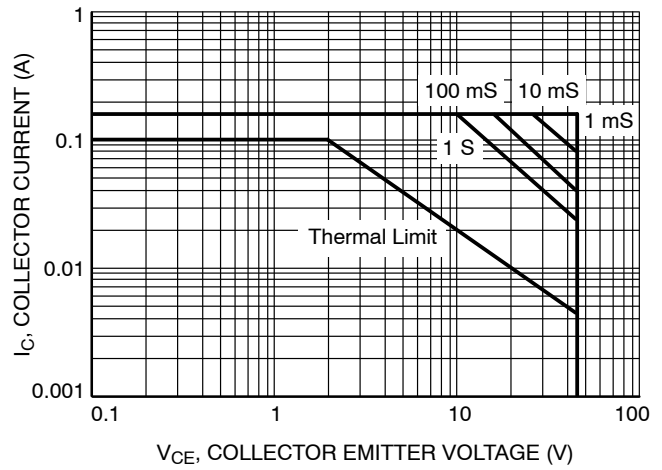


Figure 36. Current-Gain - Bandwidth Product

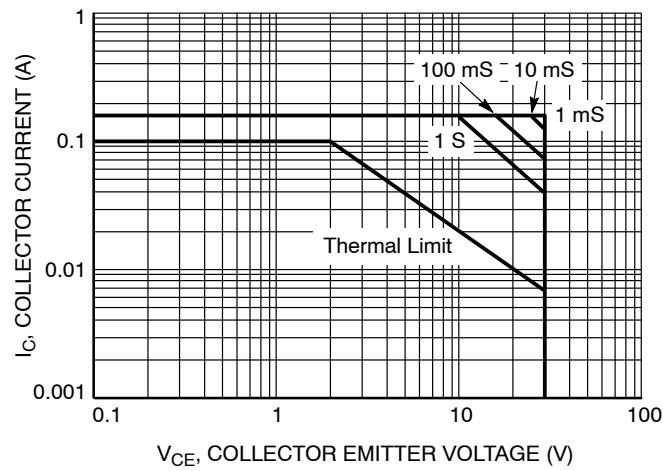
## BC846ALT1G Series



**Figure 37. Safe Operating Area for  
BC846A, BC846B, BC846C**



**Figure 38. Safe Operating Area for  
BC847A, BC847B, BC847C, BC850B, BC850C**



**Figure 39. Safe Operating Area for  
BC848A, BC848B, BC848C, BC849B, BC849C**

## BC846ALT1G Series

### ORDERING INFORMATION

| Device         | Marking | Package             | Shipping <sup>†</sup> |  |
|----------------|---------|---------------------|-----------------------|--|
| BC846ALT1G     | 1A      | SOT-23<br>(Pb-Free) | 3,000 / Tape & Reel   |  |
| SBC846ALT1G*   |         |                     |                       |  |
| BC846ALT3G     |         |                     | 10,000 / Tape & Reel  |  |
| BC846BLT1G     | 1B      |                     | 3,000 / Tape & Reel   |  |
| SBC846BLT1G*   |         |                     |                       |  |
| BC846BLT3G     |         |                     | 10,000 / Tape & Reel  |  |
| SBC846BLT3G*   |         |                     |                       |  |
| BC846CLT1G     | 3C      |                     | 3,000 / Tape & Reel   |  |
| BC847ALT1G     | 1E      |                     | 3,000 / Tape & Reel   |  |
| BC847BLT1G     | 1F      |                     | 3,000 / Tape & Reel   |  |
| SBC847BLT1G*   |         |                     |                       |  |
| BC847BLT3G     |         |                     | 10,000 / Tape & Reel  |  |
| NSVBC847BLT3G* |         |                     |                       |  |
| BC847CLT1G     | 1G      |                     | 3,000 / Tape & Reel   |  |
| SBC847CLT1G*   |         |                     |                       |  |
| BC847CLT3G     |         |                     | 10,000 / Tape & Reel  |  |
| BC848ALT1G     | 1J      |                     | 3,000 / Tape & Reel   |  |
| BC848BLT1G     | 1K      |                     | 3,000 / Tape & Reel   |  |
| SBC848BLT1G*   |         |                     |                       |  |
| BC848BLT3G     |         |                     | 10,000 / Tape & Reel  |  |
| BC848CLT1G     | 1L      |                     | 3,000 / Tape & Reel   |  |
| NSVBC848CLT1G* |         |                     |                       |  |
| BC848CLT3G     |         |                     | 10,000 / Tape & Reel  |  |
| BC849BLT1G     | 2B      |                     | 3,000 / Tape & Reel   |  |
| BC849CLT1G     | 2C      |                     | 3,000 / Tape & Reel   |  |
| BC850BLT1G     | 2F      |                     | 3,000 / Tape & Reel   |  |
| NSVBC850BLT1G* |         |                     |                       |  |
| BC850CLT1G     | 2G      |                     |                       |  |
| NSVBC850CLT1G* |         |                     |                       |  |

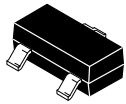
### DISCONTINUED (Note 3)

|                |    |                     |                      |
|----------------|----|---------------------|----------------------|
| BC847ALT3G     | 1E | SOT-23<br>(Pb-Free) | 10,000 / Tape & Reel |
| NSVBC849BLT1G* | 2B |                     | 3,000 / Tape & Reel  |
| BC849BLT3G     |    |                     | 10,000 / Tape & Reel |
| BC849CLT3G     | 2C |                     | 10,000 / 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 Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

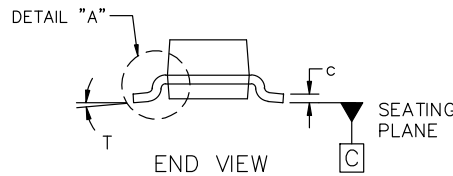
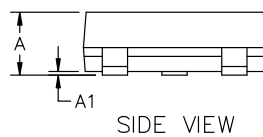
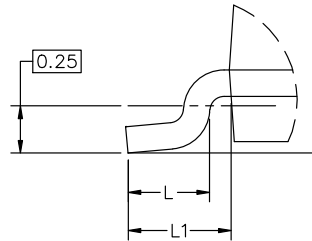
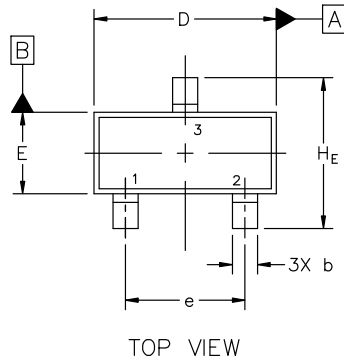
3. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on [www.onsemi.com](http://www.onsemi.com).



SCALE 4:1

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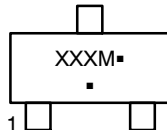


| MILLIMETERS |      |      |      |
|-------------|------|------|------|
| DIM         | MIN  | NOM  | MAX  |
| A           | 0.89 | 1.00 | 1.11 |
| A1          | 0.01 | 0.06 | 0.10 |
| b           | 0.37 | 0.44 | 0.50 |
| c           | 0.08 | 0.14 | 0.20 |
| D           | 2.80 | 2.90 | 3.04 |
| E           | 1.20 | 1.30 | 1.40 |
| e           | 1.78 | 1.90 | 2.04 |
| L           | 0.30 | 0.43 | 0.55 |
| L1          | 0.35 | 0.54 | 0.69 |
| HE          | 2.10 | 2.40 | 2.64 |
| T           | 0°   | ---  | 10°  |

NOTES:

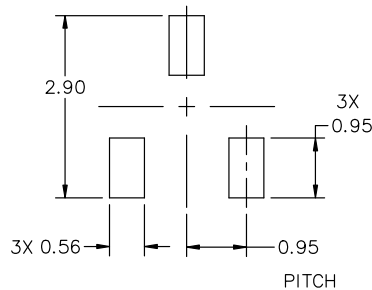
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

GENERIC  
MARKING DIAGRAM\*



XXX = 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.



RECOMMENDED  
MOUNTING FOOTPRINT

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

STYLES ON PAGE 2

|                  |                                      |                                                                                                                                                                                     |
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**ISSUE AU**

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|                                                         |                                                       |                                                             |                                                             |                                                             |                                                             |
|---------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|
| STYLE 1 THRU 5:<br>CANCELLED                            | STYLE 6:<br>PIN 1. BASE<br>2. EMITTER<br>3. COLLECTOR | STYLE 7:<br>PIN 1. EMITTER<br>2. BASE<br>3. COLLECTOR       | STYLE 8:<br>PIN 1. ANODE<br>2. NO CONNECTION<br>3. CATHODE  |                                                             |                                                             |
| STYLE 9:<br>PIN 1. ANODE<br>2. ANODE<br>3. CATHODE      | STYLE 10:<br>PIN 1. DRAIN<br>2. SOURCE<br>3. GATE     | STYLE 11:<br>PIN 1. ANODE<br>2. CATHODE<br>3. CATHODE-ANODE | STYLE 12:<br>PIN 1. CATHODE<br>2. CATHODE<br>3. ANODE       | STYLE 13:<br>PIN 1. SOURCE<br>2. DRAIN<br>3. GATE           | STYLE 14:<br>PIN 1. CATHODE<br>2. GATE<br>3. ANODE          |
| STYLE 15:<br>PIN 1. GATE<br>2. CATHODE<br>3. ANODE      | STYLE 16:<br>PIN 1. ANODE<br>2. CATHODE<br>3. CATHODE | STYLE 17:<br>PIN 1. NO CONNECTION<br>2. ANODE<br>3. CATHODE | STYLE 18:<br>PIN 1. NO CONNECTION<br>2. CATHODE<br>3. ANODE | STYLE 19:<br>PIN 1. CATHODE<br>2. ANODE<br>3. CATHODE-ANODE | STYLE 20:<br>PIN 1. CATHODE<br>2. ANODE<br>3. GATE          |
| STYLE 21:<br>PIN 1. GATE<br>2. SOURCE<br>3. DRAIN       | STYLE 22:<br>PIN 1. RETURN<br>2. OUTPUT<br>3. INPUT   | STYLE 23:<br>PIN 1. ANODE<br>2. ANODE<br>3. CATHODE         | STYLE 24:<br>PIN 1. GATE<br>2. DRAIN<br>3. SOURCE           | STYLE 25:<br>PIN 1. ANODE<br>2. CATHODE<br>3. GATE          | STYLE 26:<br>PIN 1. CATHODE<br>2. ANODE<br>3. NO CONNECTION |
| STYLE 27:<br>PIN 1. CATHODE<br>2. CATHODE<br>3. CATHODE | STYLE 28:<br>PIN 1. ANODE<br>2. ANODE<br>3. ANODE     |                                                             |                                                             |                                                             |                                                             |

|                  |                                      |                                                                                                                                                                                     |
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