# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

# Dual General Purpose Transistors

## NPN/PNP Duals (Complementary)

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 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 – NPN**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Emitter Voltage<br>BC846, SBC846<br>BC847, SBC847<br>BC848 | $V_{CEO}$ | <br>65<br>45<br>30 | V |
| Collector-Base Voltage<br>BC846, SBC846<br>BC847, SBC847<br>BC848 | $V_{CBO}$ | <br>80<br>50<br>30 | V |
| Emitter−Base Voltage | $V_{EBO}$ | 6.0 | V |
| Collector Current − Continuous | $I_C$ | 100 | mAdc |

**MAXIMUM RATINGS – PNP**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Emitter Voltage<br>BC846, SBC846<br>BC847, SBC847<br>BC848 | $V_{CEO}$ | <br>−65<br>−45<br>−30 | V |
| Collector-Base Voltage<br>BC846, SBC846<br>BC847, SBC847<br>BC848 | $V_{CBO}$ | <br>−80<br>−50<br>−30 | V |
| Emitter−Base Voltage | $V_{EBO}$ | −5.0 | V |
| Collector Current − Continuous | $I_C$ | −100 | 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.

*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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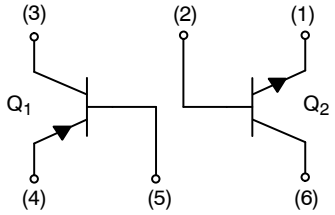
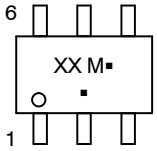
**http://onsemi.com**



**SOT−363**
**CASE 419B**
**STYLE 1**




**MARKING DIAGRAM**




XX = Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

**ORDERING INFORMATION**

| Device | Mark | Package | Shipping† |
|---|---|---|---|
| BC846BPDW1T1G,<br>SBC846BPDW1T1G | BB | SOT−363<br>(Pb−Free) | 3,000 /<br>Tape & Reel |
| SBC846BPDW1T2G | BB | SOT−363<br>(Pb−Free) | 3,000 /<br>Tape & Reel |
| BC847BPDW1T1G | BF | SOT−363<br>(Pb−Free) | 3,000 /<br>Tape & Reel |
| SBC847BPDW1T1G | BF | SOT−363<br>(Pb−Free) | 3,000 /<br>Tape & Reel |
| SBC847BPDW1T3G | BF | SOT−363<br>(Pb−Free) | 10,000 /<br>Tape & Reel |
| BC847BPDW1T2G | BF | SOT−363<br>(Pb−Free) | 3,000 /<br>Tape & Reel |
| BC848CPDW1T1G | BL | SOT−363<br>(Pb−Free) | 3,000 /<br>Tape & Reel |

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

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Total Device Dissipation Per Device<br>FR−5 Board (Note 1)<br>$T_A$ = 25°C<br>Derate above 25°C | $P_D$ | <br>380<br>250<br>3.0 | <br>mW<br>mW/°C<br>mW/°C |
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 328 | °C/W |
| Junction and Storage Temperature | $T_J$, $T_{stg}$ | −55 to +150 | °C |

1. FR−5 = 1.0 x 0.75 x 0.062 in.

## ELECTRICAL CHARACTERISTICS (NPN) ($T_A$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector − Emitter Breakdown Voltage<br>($I_C$ = 10 mA)<br>BC846, SBC846 Series<br>BC847, SBC847 Series<br>BC848 Series | $V_{(BR)CEO}$ | <br>65<br>45<br>30 | <br>−<br>−<br>− | <br>−<br>−<br>− | V |
| Collector − Emitter Breakdown Voltage<br>($I_C$ = 10 μA, $V_{EB}$ = 0)<br>BC846, SBC846 Series<br>BC847B, SBC847B Only<br>BC848 Series | $V_{(BR)CES}$ | <br>80<br>50<br>30 | <br>−<br>−<br>− | <br>−<br>−<br>− | V |
| Collector − Base Breakdown Voltage<br>($I_C$ = 10 μA)<br>BC846, SBC846 Series<br>BC847, SBC847 Series<br>BC848 Series | $V_{(BR)CBO}$ | <br>80<br>50<br>30 | <br>−<br>−<br>− | <br>−<br>−<br>− | V |
| Emitter − Base Breakdown Voltage<br>($I_E$ = 1.0 μA)<br>BC846, SBC846 Series<br>BC847, SBC847 Series<br>BC848 Series | $V_{(BR)EBO}$ | <br>6.0<br>6.0<br>5.0 | <br>−<br>−<br>− | <br>−<br>−<br>− | V |
| Collector Cutoff Current<br>($V_{CB}$ = 30 V)<br>($V_{CB}$ = 30 V, $T_A$ = 150°C) | $I_{CBO}$ | <br>−<br>− | <br>−<br>− | <br>15<br>5.0 | <br>nA<br>μA |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain<br>($I_C$ = 10 μA, $V_{CE}$ = 5.0 V)<br>BC846B, SBC846B, BC847B, SBC847B<br>BC848C<br>($I_C$ = 2.0 mA, $V_{CE}$ = 5.0 V)<br>BC846B, SBC846B, BC847B, SBC84B7<br>BC848C | $h_{FE}$ | <br><br>−<br>−<br><br>200<br>420 | <br><br>150<br>270<br><br>290<br>520 | <br><br>−<br>−<br><br>475<br>800 | − |
| Collector − Emitter Saturation Voltage<br>($I_C$ = 10 mA, $I_B$ = 0.5 mA)<br>($I_C$ = 100 mA, $I_B$ = 5.0 mA) | $V_{CE(sat)}$ | <br>−<br>− | <br>−<br>− | <br>0.25<br>0.6 | V |
| Base − Emitter Saturation Voltage<br>($I_C$ = 10 mA, $I_B$ = 0.5 mA)<br>($I_C$ = 100 mA, $I_B$ = 5.0 mA) | $V_{BE(sat)}$ | <br>−<br>− | <br>0.7<br>0.9 | <br>−<br>− | V |
| Base − Emitter Voltage<br>($I_C$ = 2.0 mA, $V_{CE}$ = 5.0 V)<br>($I_C$ = 10 mA, $V_{CE}$ = 5.0 V) | $V_{BE(on)}$ | <br>580<br>− | <br>660<br>− | <br>700<br>770 | mV |
| **SMALL−SIGNAL CHARACTERISTICS** | | | | | |
| Current − Gain − Bandwidth Product<br>($I_C$ = 10 mA, $V_{CE}$ = 5.0 Vdc, f = 100 MHz) | $f_T$ | <br>100 | <br>− | <br>− | MHz |
| Output Capacitance ($V_{CB}$ = 10 V, f = 1.0 MHz) | $C_{obo}$ | − | − | 4.5 | pF |
| Noise Figure<br>($I_C$ = 0.2 mA, $V_{CE}$ = 5.0 Vdc, $R_S$ = 2.0 kΩ, f = 1.0 kHz, BW = 200 Hz) | NF | <br>− | <br>− | <br>10 | dB |

**ELECTRICAL CHARACTERISTICS (PNP)** ($T_A$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector – Emitter Breakdown Voltage ($I_C$ = −10 mA) | $V_{(BR)CEO}$ | | | | V |
| BC846, SBC846 Series | | −65 | – | – | |
| BC847, SBC847 Series | | −45 | – | – | |
| BC848 Series | | −30 | – | – | |
| Collector – Emitter Breakdown Voltage ($I_C$ = −10 μA, $V_{EB}$ = 0) | $V_{(BR)CES}$ | | | | V |
| BC846, SBC846 Series | | −80 | – | – | |
| BC847, SBC847 Series | | −50 | – | – | |
| BC848 Series | | −30 | – | – | |
| Collector – Base Breakdown Voltage ($I_C$ = −10 μA) | $V_{(BR)CBO}$ | | | | V |
| BC846, SBC846 Series | | −80 | – | – | |
| BC847, SBC847 Series | | −50 | – | – | |
| BC848 Series | | −30 | – | – | |
| Emitter – Base Breakdown Voltage ($I_E$ = −1.0 μA) | $V_{(BR)EBO}$ | | | | V |
| BC846, SBC846 Series | | −5.0 | – | – | |
| BC847, SBC847 Series | | −5.0 | – | – | |
| BC848 Series | | −5.0 | – | – | |
| Collector Cutoff Current | $I_{CBO}$ | | | | |
| ($V_{CB}$ = −30 V) | | – | – | −15 | nA |
| ($V_{CB}$ = −30 V, $T_A$ = 150°C) | | – | – | −4.0 | μA |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain | $h_{FE}$ | | | | – |
| ($I_C$ = −10 μA, $V_{CE}$ = −5.0 V) | | | | | |
| BC846B, SBC846B, BC847B, SBC847B | | – | 150 | – | |
| BC848C | | – | 270 | – | |
| ($I_C$ = −2.0 mA, $V_{CE}$ = −5.0 V) | | | | | |
| BC846B, SBC846B, BC847B, SBC847B | | 200 | 290 | 475 | |
| BC848C | | 420 | 520 | 800 | |
| Collector – Emitter Saturation Voltage | $V_{CE(sat)}$ | | | | V |
| ($I_C$ = −10 mA, $I_B$ = −0.5 mA) | | – | – | −0.3 | |
| ($I_C$ = −100 mA, $I_B$ = −5.0 mA) | | – | – | −0.65 | |
| Base – Emitter Saturation Voltage | $V_{BE(sat)}$ | | | | V |
| ($I_C$ = −10 mA, $I_B$ = −0.5 mA) | | – | −0.7 | – | |
| ($I_C$ = −100 mA, $I_B$ = −5.0 mA) | | – | −0.9 | – | |
| Base – Emitter On Voltage | $V_{BE(on)}$ | | | | V |
| ($I_C$ = −2.0 mA, $V_{CE}$ = −5.0 V) | | −0.6 | – | −0.75 | |
| ($I_C$ = −10 mA, $V_{CE}$ = −5.0 V) | | – | – | −0.82 | |
| **SMALL– SIGNAL CHARACTERISTICS** | | | | | |
| Current – Gain – Bandwidth Product ($I_C$ = −10 mA, $V_{CE}$ = −5.0 Vdc, f = 100 MHz) | $f_T$ | 100 | – | – | MHz |
| Output Capacitance ($V_{CB}$ = −10 V, f = 1.0 MHz) | $C_{ob}$ | – | – | 4.5 | pF |
| Noise Figure ($I_C$ = −0.2 mA, $V_{CE}$ = −5.0 Vdc, $R_S$ = 2.0 kΩ, f = 1.0 kHz, BW = 200 Hz) | NF | – | – | 10 | dB |

## TYPICAL NPN CHARACTERISTICS – BC846/SBC846

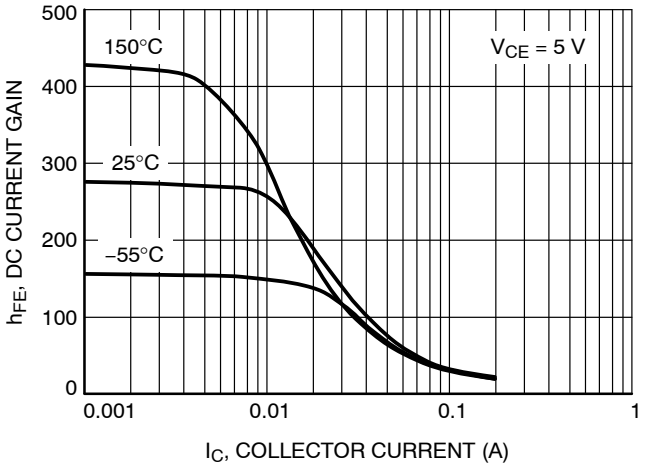



**Figure 1. DC Current Gain vs. Collector Current**

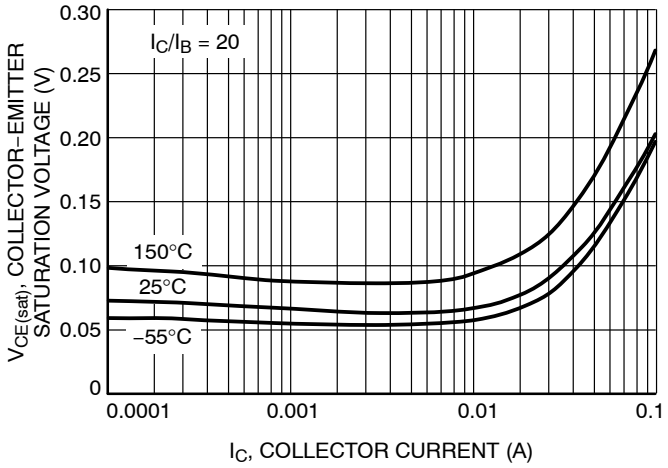



**Figure 2. Collector Emitter Saturation Voltage vs. Collector Current**

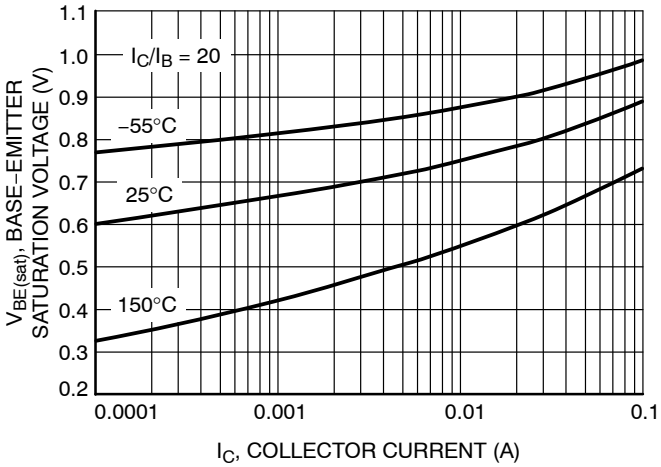



**Figure 3. Base Emitter Saturation Voltage vs. Collector Current**

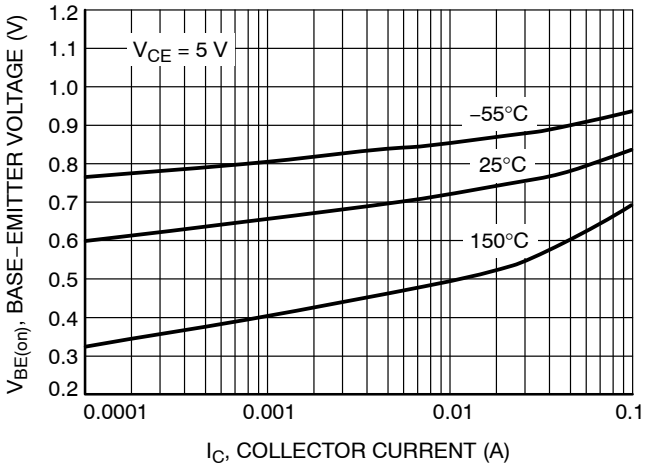



**Figure 4. Base Emitter Voltage vs. Collector Current**

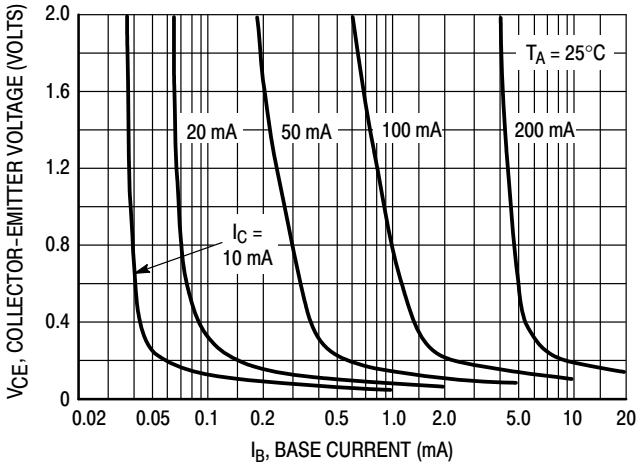



**Figure 5. Collector Saturation Region**

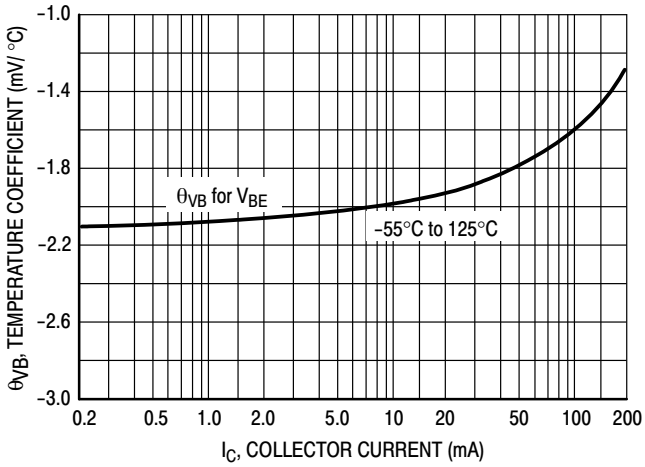



**Figure 6. Base−Emitter Temperature Coefficient**

## TYPICAL NPN CHARACTERISTICS – BC846/SBC846

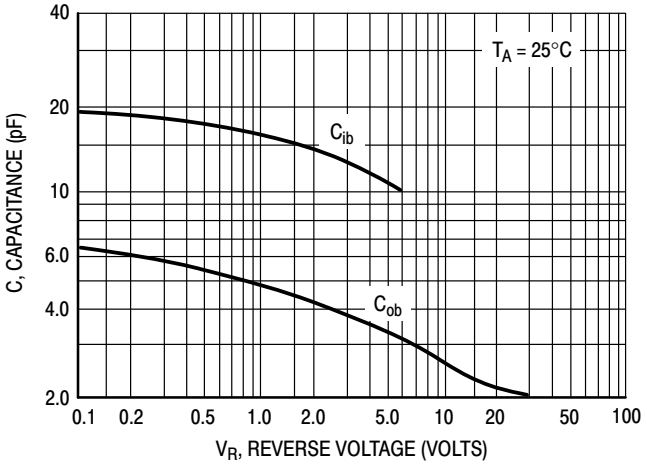



**Figure 7. Capacitance**

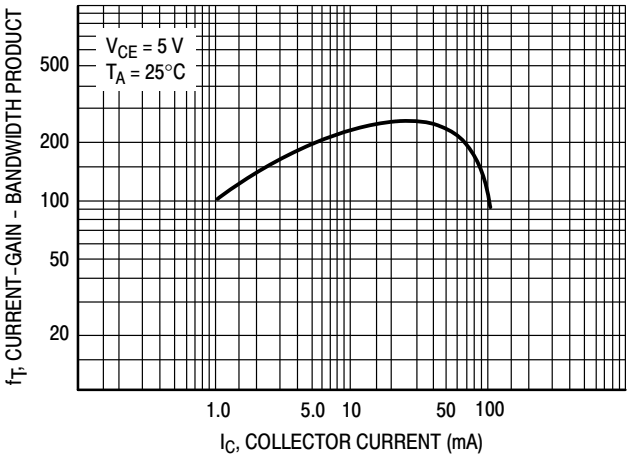



**Figure 8. Current–Gain – Bandwidth Product**

## TYPICAL PNP CHARACTERISTICS — BC846/SBC846

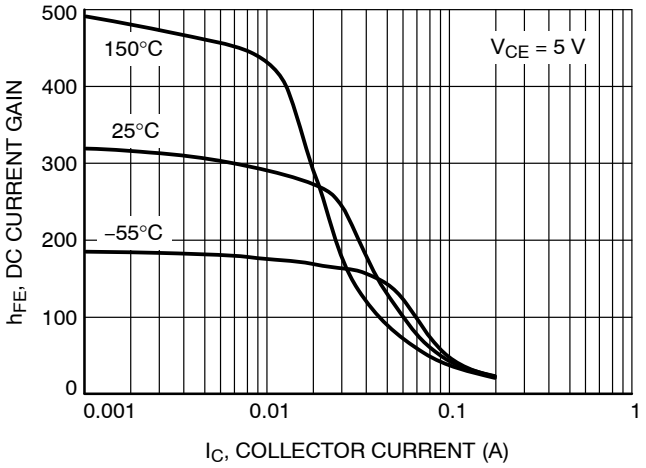



**Figure 9. DC Current Gain vs. Collector Current**

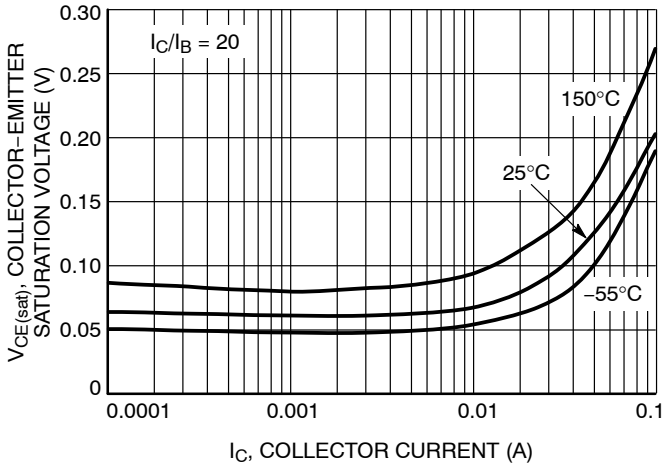



**Figure 10. Collector Emitter Saturation Voltage vs. Collector Current**

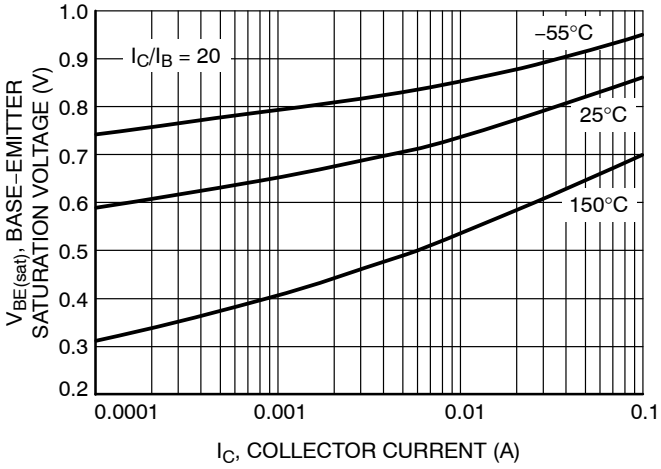



**Figure 11. Base Emitter Saturation Voltage vs. Collector Current**

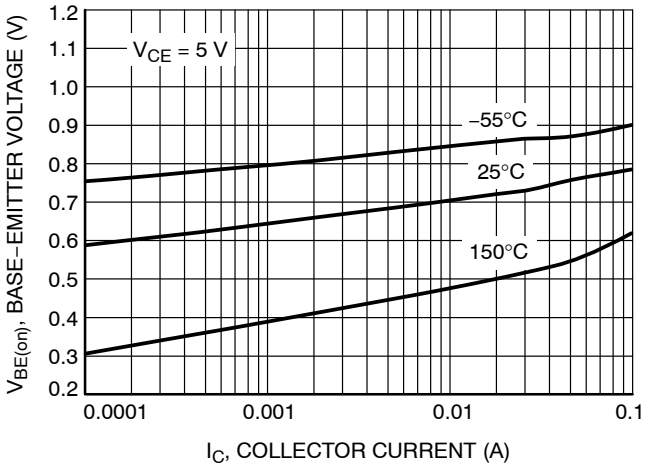



**Figure 12. Base Emitter Voltage vs. Collector Current**

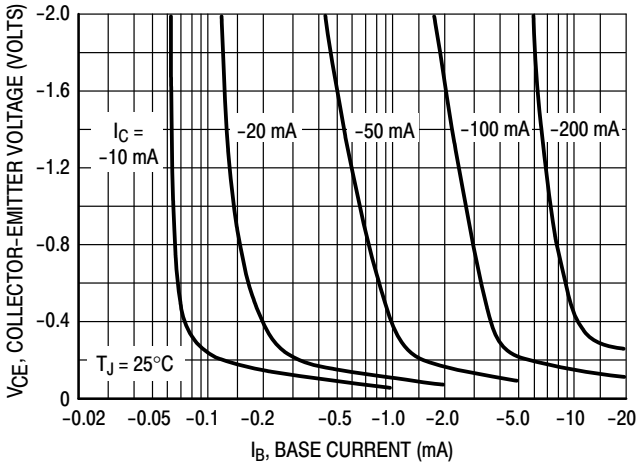



**Figure 13. Collector Saturation Region**

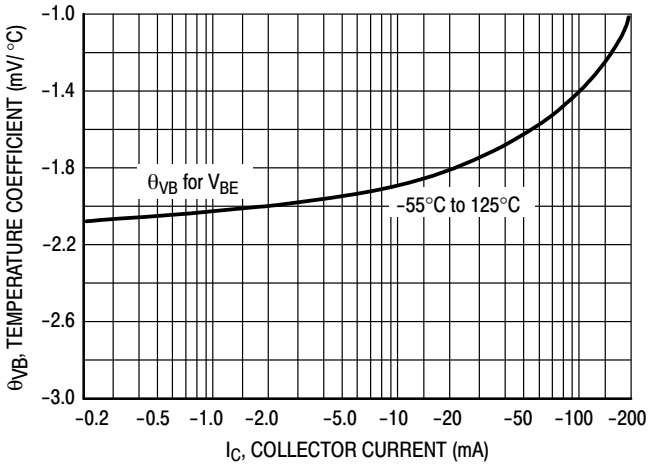



**Figure 14. Base−Emitter Temperature Coefficient**

## TYPICAL PNP CHARACTERISTICS — BC846/SBC846

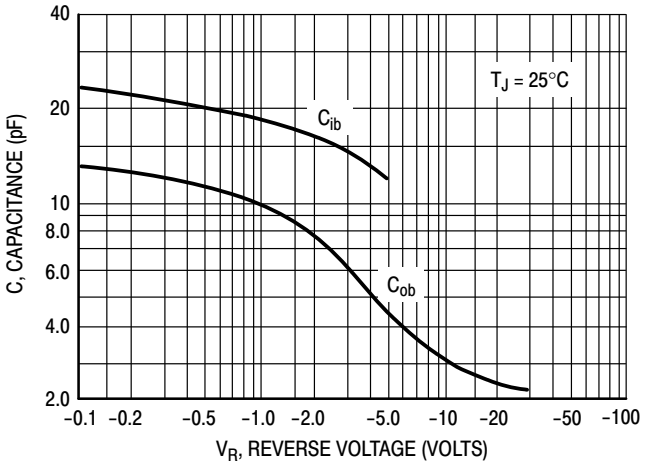



**Figure 15. Capacitance**

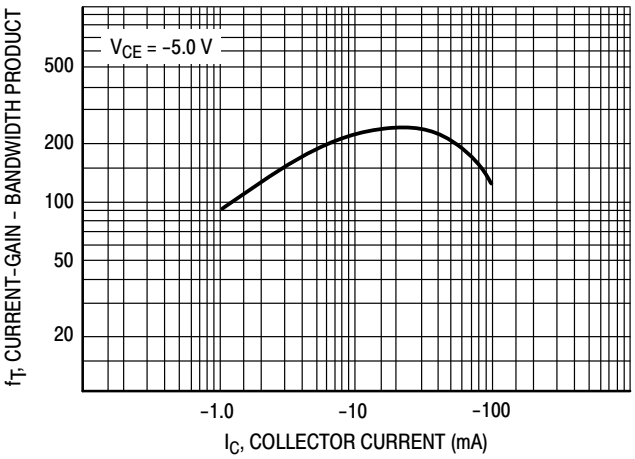



**Figure 16. Current−Gain − Bandwidth Product**

## TYPICAL NPN CHARACTERISTICS – BC847/SBC847 SERIES

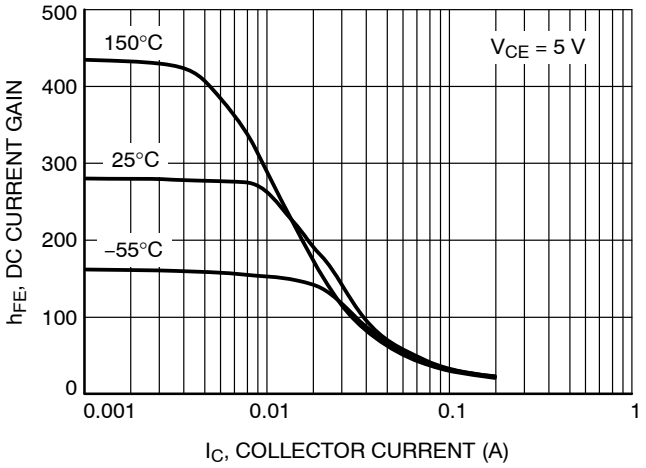



**Figure 17. DC Current Gain vs. Collector Current**

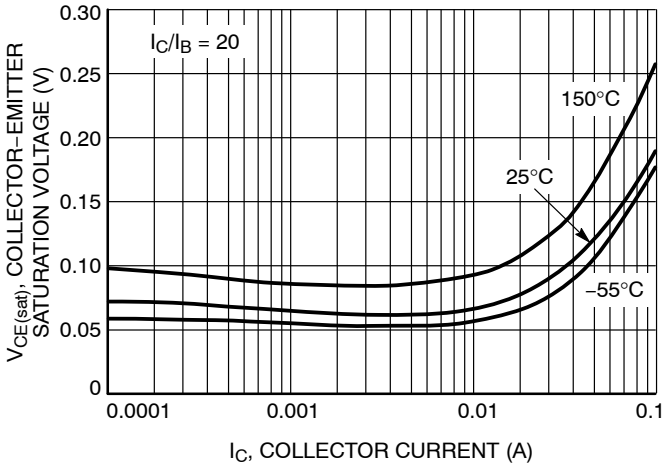



**Figure 18. Collector Emitter Saturation Voltage vs. Collector Current**

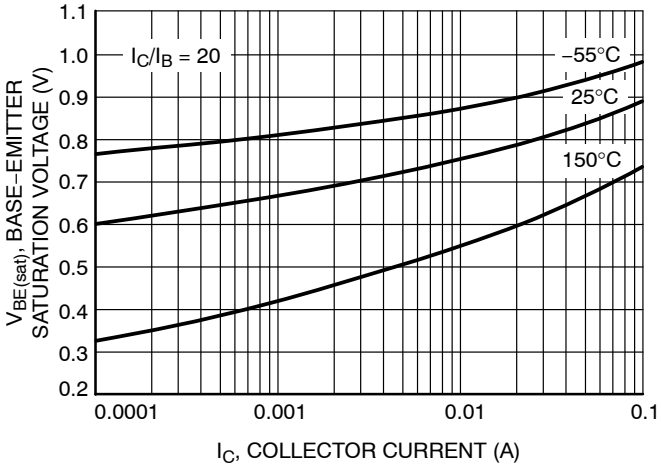



**Figure 19. Base Emitter Saturation Voltage vs. Collector Current**

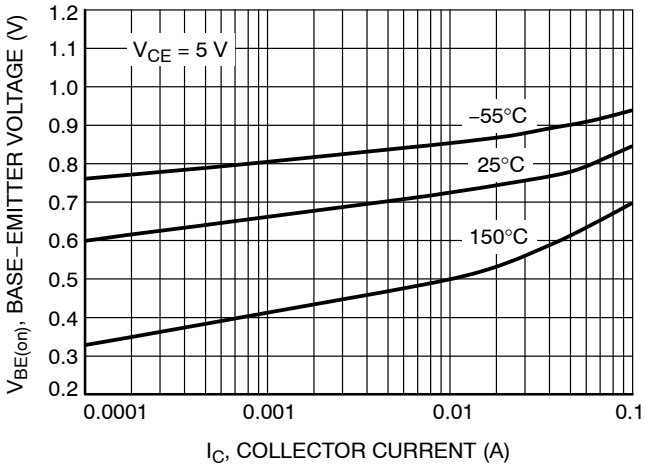



**Figure 20. Base Emitter Voltage vs. Collector Current**

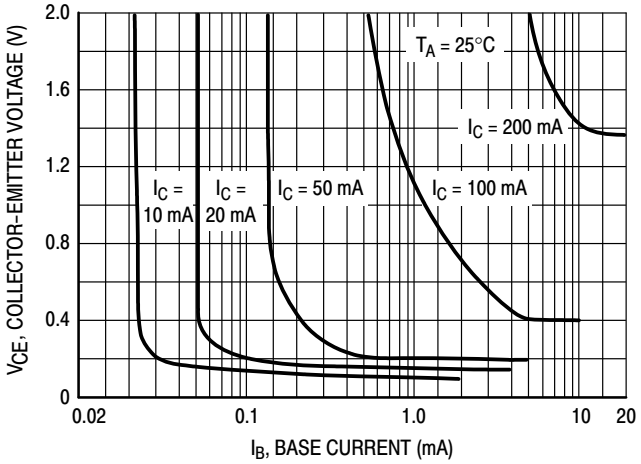



**Figure 21. Collector Saturation Region**

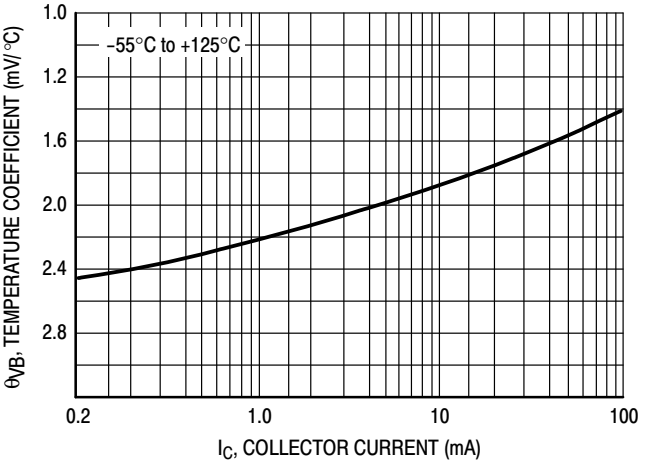



**Figure 22. Base−Emitter Temperature Coefficient**

## TYPICAL NPN CHARACTERISTICS – BC847/SBC847 SERIES

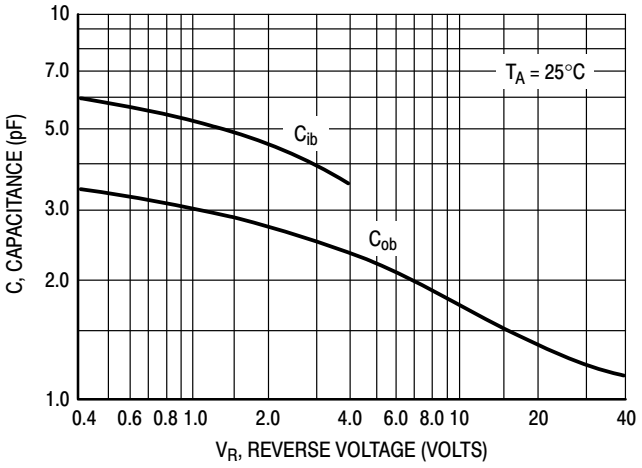



**Figure 23. Capacitances**

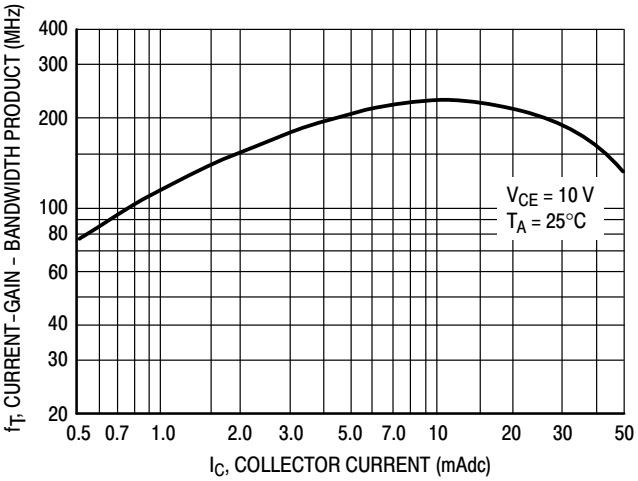



**Figure 24. Current−Gain − Bandwidth Product**

## TYPICAL PNP CHARACTERISTICS – BC847/SBC847 SERIES

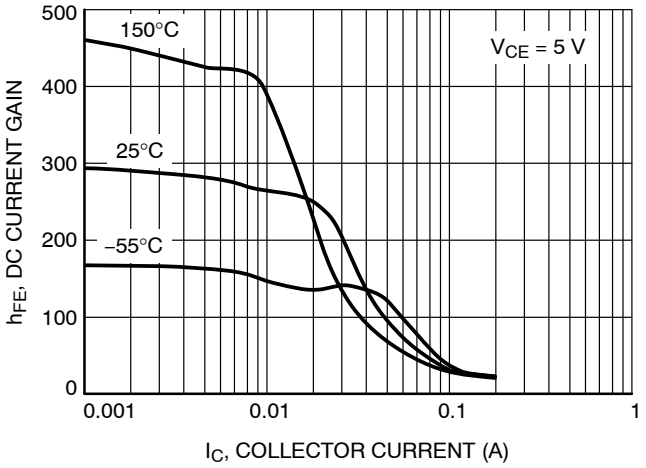



**Figure 25. DC Current Gain vs. Collector Current**

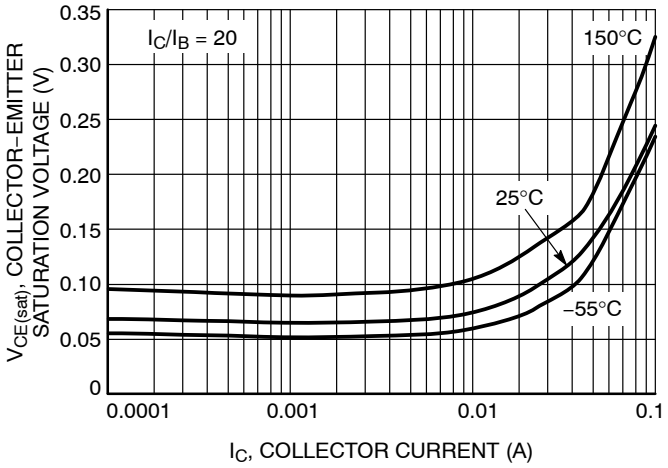



**Figure 26. Collector Emitter Saturation Voltage vs. Collector Current**

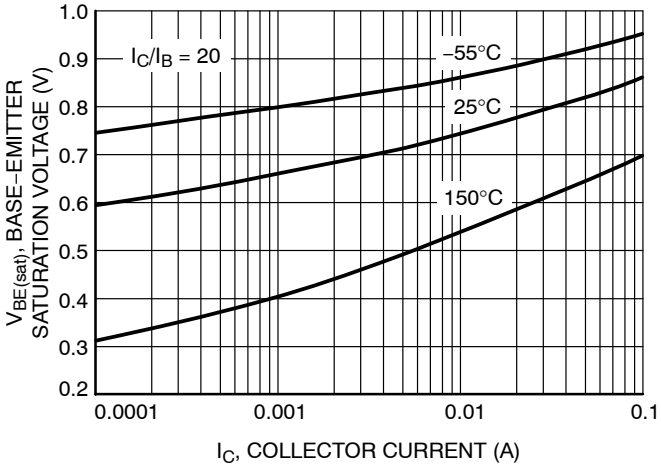



**Figure 27. Base Emitter Saturation Voltage vs. Collector Current**

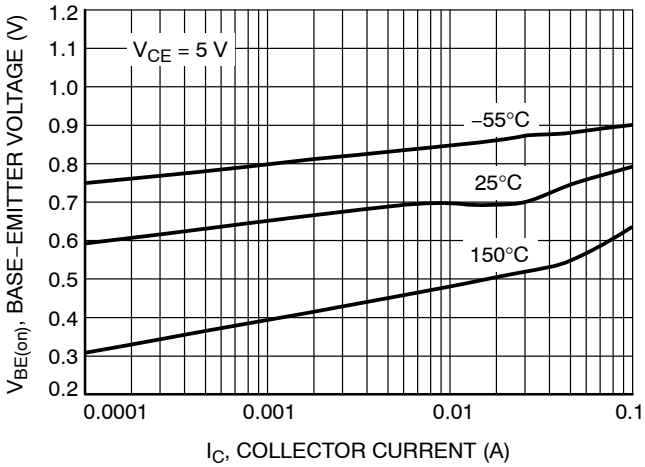



**Figure 28. Base Emitter Voltage vs. Collector Current**

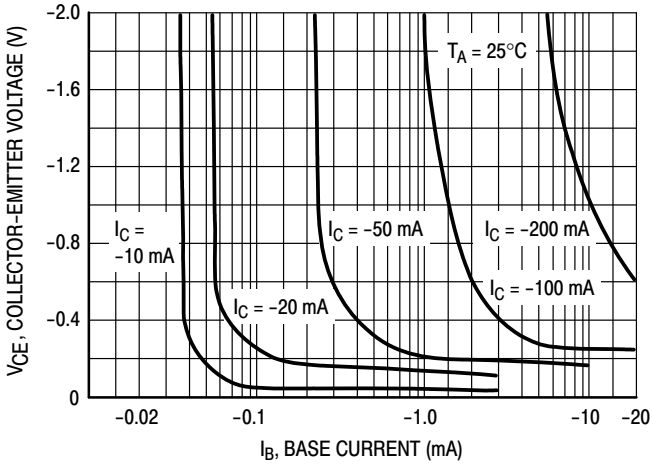



**Figure 29. Collector Saturation Region**

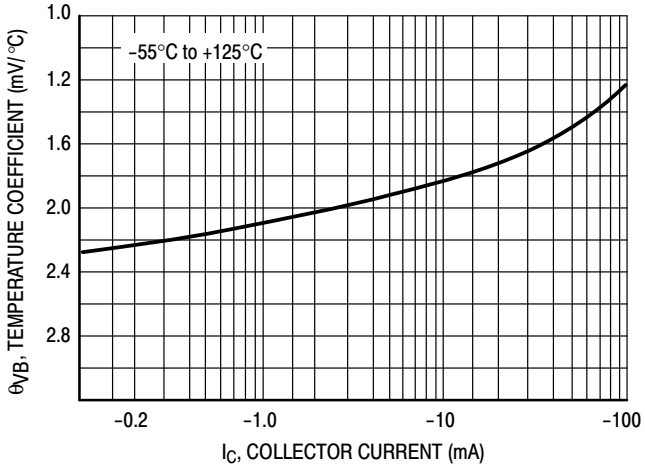



**Figure 30. Base−Emitter Temperature Coefficient**

## TYPICAL PNP CHARACTERISTICS – BC847/SBC847 SERIES

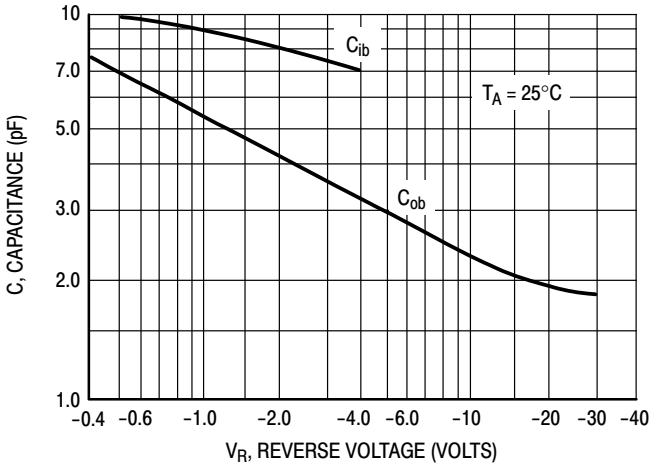



**Figure 31. Capacitances**

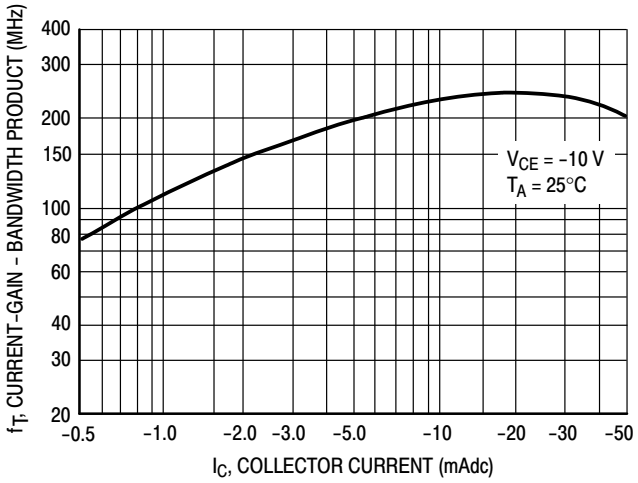



**Figure 32. Current−Gain − Bandwidth Product**

## TYPICAL NPN CHARACTERISTICS – BC848 SERIES

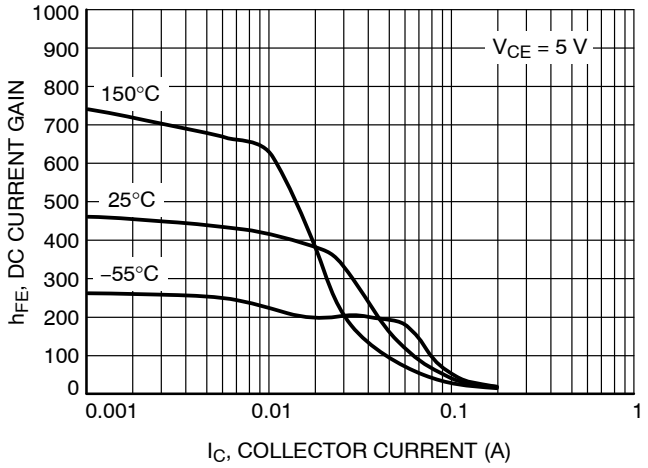



**Figure 33. DC Current Gain vs. Collector Current**

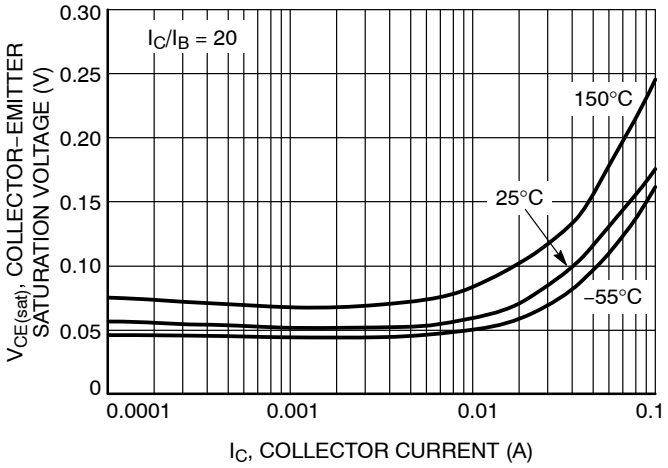



**Figure 34. Collector Emitter Saturation Voltage vs. Collector Current**

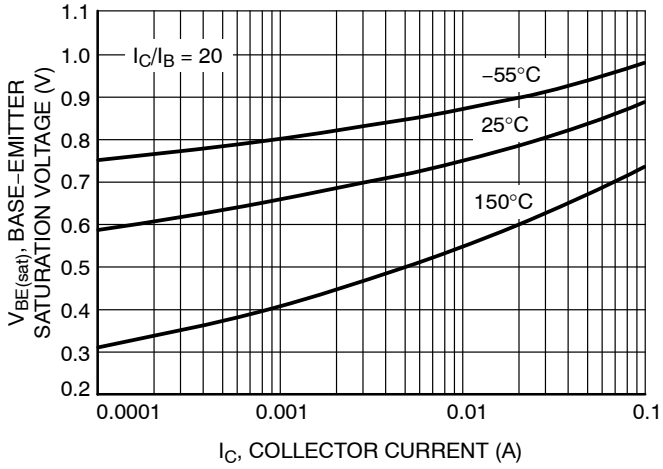



**Figure 35. Base Emitter Saturation Voltage vs. Collector Current**

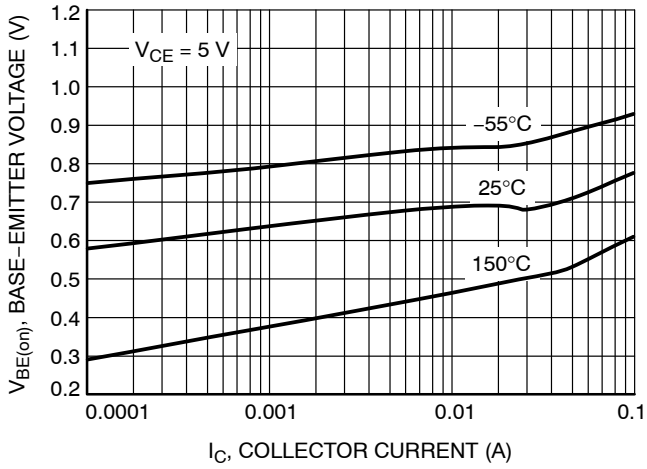



**Figure 36. Base Emitter Voltage vs. Collector Current**

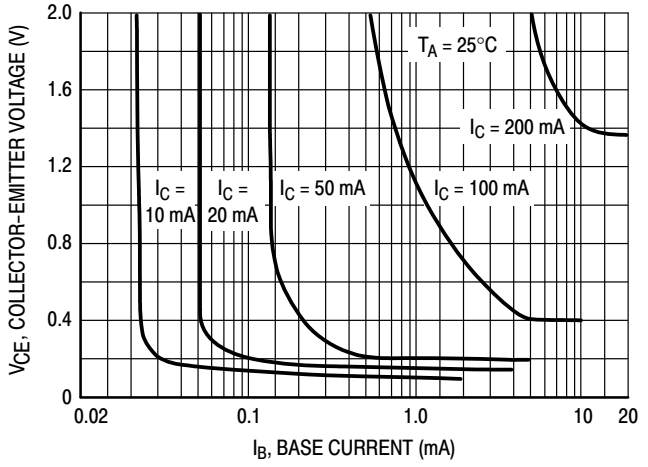



**Figure 37. Collector Saturation Region**

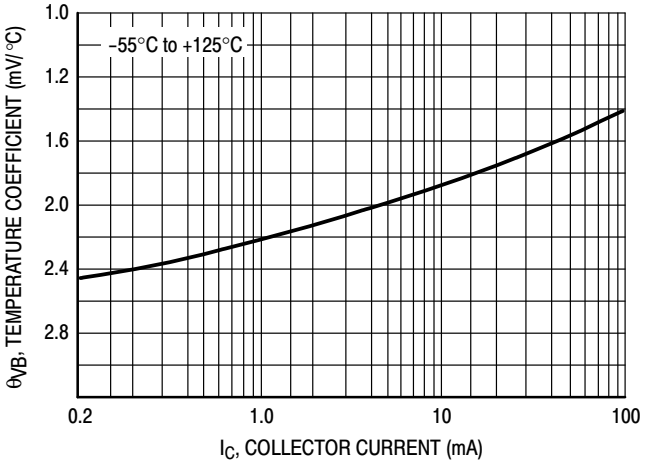



**Figure 38. Base−Emitter Temperature Coefficient**

## TYPICAL NPN CHARACTERISTICS − BC848 SERIES

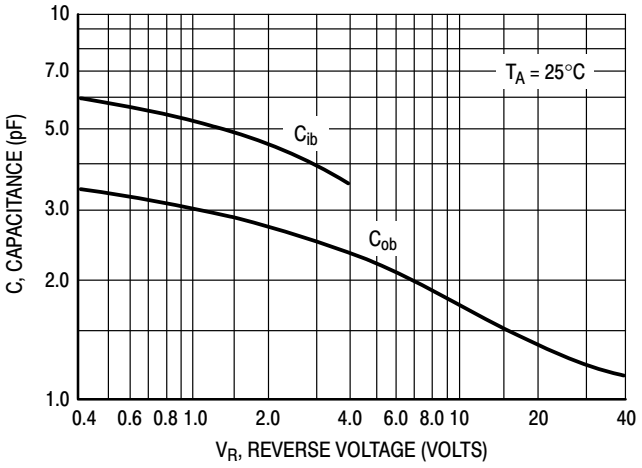



**Figure 39. Capacitances**

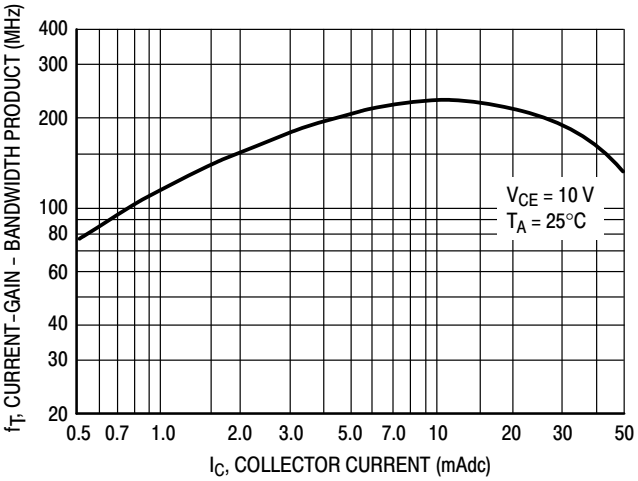



**Figure 40. Current−Gain − Bandwidth Product**

## TYPICAL PNP CHARACTERISTICS – BC848 SERIES

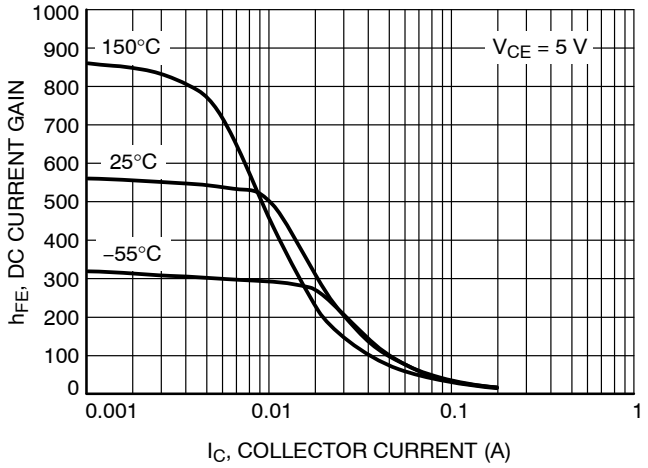



**Figure 41. DC Current Gain vs. Collector Current**

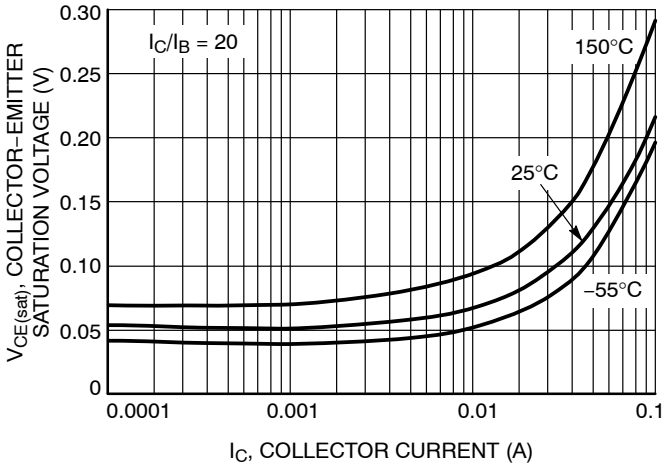



**Figure 42. Collector Emitter Saturation Voltage vs. Collector Current**

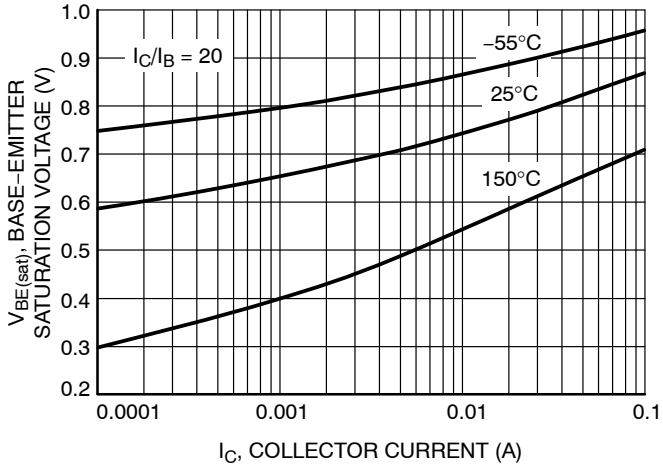



**Figure 43. Base Emitter Saturation Voltage vs. Collector Current**

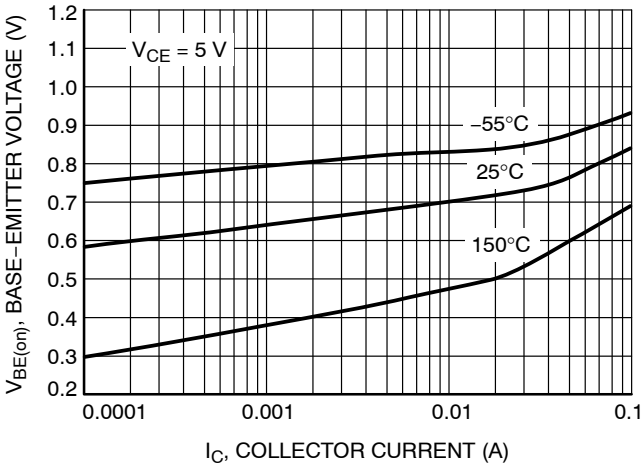



**Figure 44. Base Emitter Voltage vs. Collector Current**

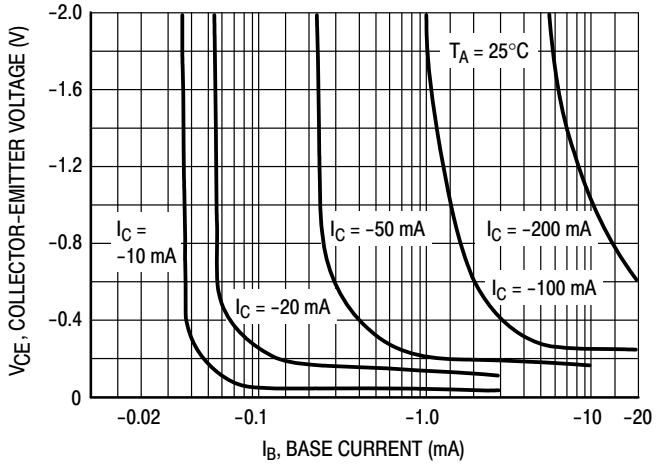



**Figure 45. Collector Saturation Region**

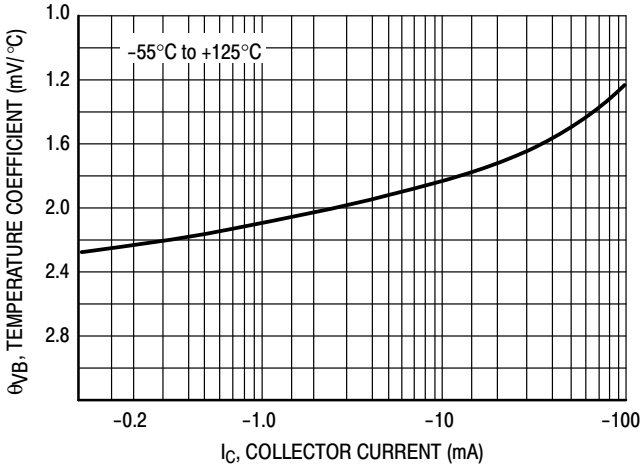



**Figure 46. Base−Emitter Temperature Coefficient**

## TYPICAL PNP CHARACTERISTICS − BC848 SERIES

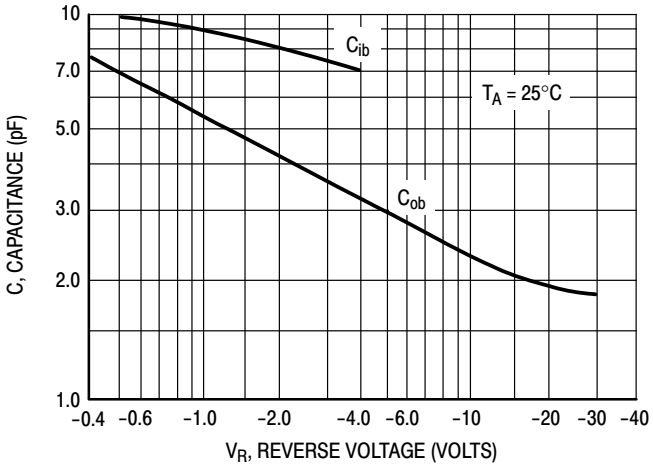



**Figure 47. Capacitances**

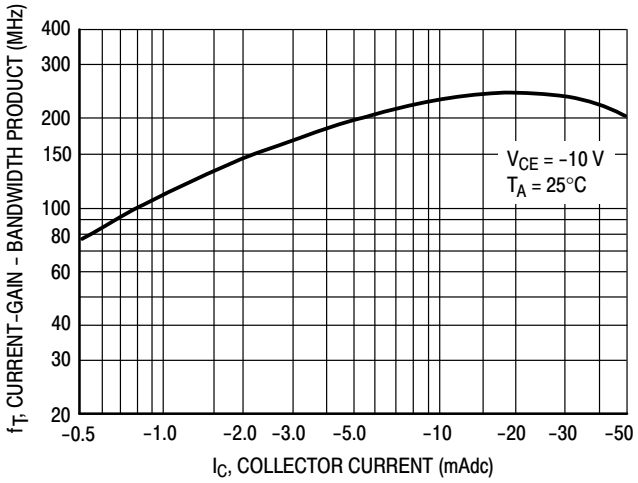



**Figure 48. Current−Gain − Bandwidth Product**

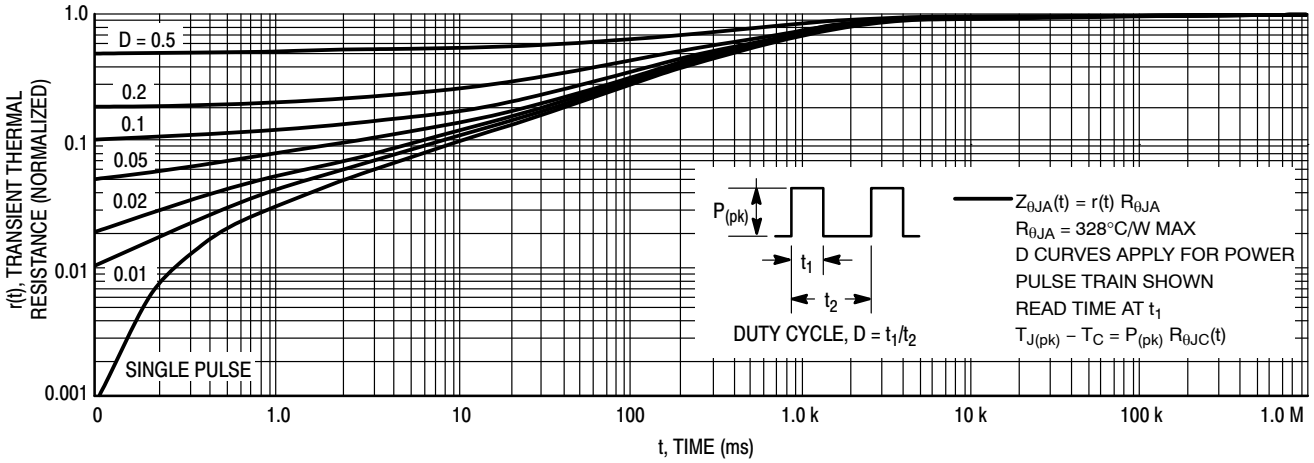



**Figure 49. Thermal Response**

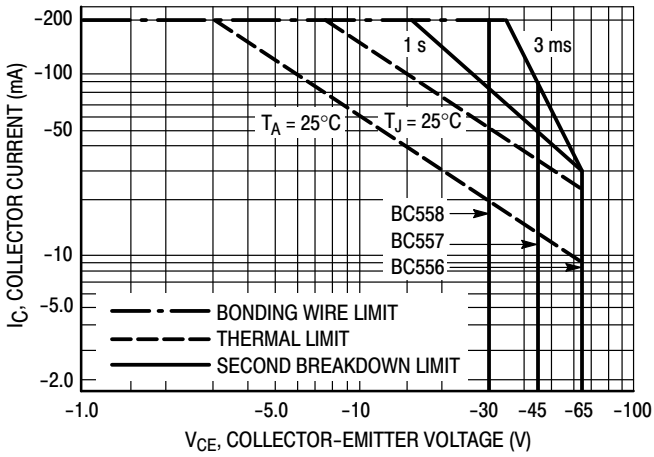


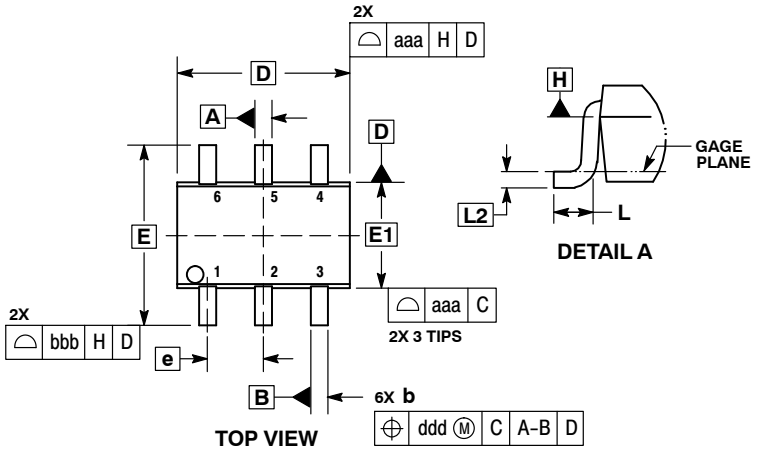

**Figure 50. Active Region Safe Operating Area**

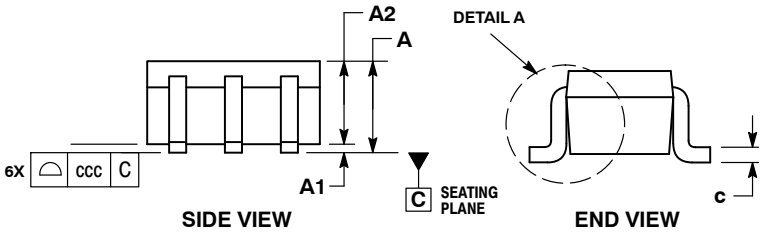
The safe operating area curves indicate $I_C$–$V_{CE}$ limits of the transistor that must be observed for reliable operation. Collector load lines for specific circuits must fall below the limits indicated by the applicable curve.

The data of Figure 50 is based upon $T_{J(pk)}$ = 150°C; $T_C$ or $T_A$ is variable depending upon conditions. Pulse curves are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150°C$. $T_{J(pk)}$ may be calculated from the data in Figure 49. 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.

## PACKAGE DIMENSIONS

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



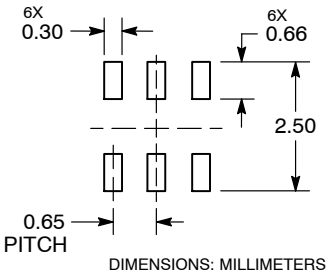




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF 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.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | 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*




DIMENSIONS: MILLIMETERS

*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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