# Dual General Purpose Transistors

## NPN/PNP Duals (Complementary)

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

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<br>BC847<br>BC848 | $V_{CEO}$ | <br>65<br>45<br>30 | V |
| Collector-Base Voltage<br>BC846<br>BC847<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 |
| Collector Current – Peak | $I_{CM}$ | 200 | mAdc |

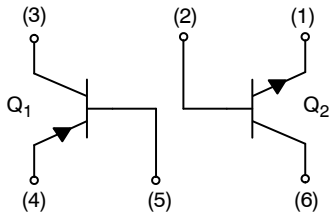
### MAXIMUM RATINGS – PNP

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Emitter Voltage<br>BC846<br>BC847<br>BC848 | $V_{CEO}$ | <br>−65<br>−45<br>−30 | V |
| Collector-Base Voltage<br>BC846<br>BC847<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 |
| Collector Current – Peak | $I_{CM}$ | −200 | mAdc |

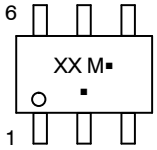
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



**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 |
| SBC846BPDW1T3G | BB | SOT−363<br>(Pb−Free) | 10,000 /<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<br>BC847<br>BC848 | $V_{(BR)CEO}$ | <br><br>65<br>45<br>30 | <br><br>–<br>–<br>– | <br><br>–<br>–<br>– | V |
| Collector−Emitter Breakdown Voltage<br>($I_C$ = 10 μA, $V_{EB}$ = 0)<br>BC846<br>BC847B<br>BC848 | $V_{(BR)CES}$ | <br><br>80<br>50<br>30 | <br><br>–<br>–<br>– | <br><br>–<br>–<br>– | V |
| Collector−Base Breakdown Voltage<br>($I_C$ = 10 μA)<br>BC846<br>BC847<br>BC848 | $V_{(BR)CBO}$ | <br><br>80<br>50<br>30 | <br><br>–<br>–<br>– | <br><br>–<br>–<br>– | V |
| Emitter−Base Breakdown Voltage<br>($I_E$ = 1.0 μA)<br>BC846<br>BC847<br>BC848 | $V_{(BR)EBO}$ | <br><br>6.0<br>6.0<br>6.0 | <br><br>–<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, BC847B<br>BC848C<br>($I_C$ = 2.0 mA, $V_{CE}$ = 5.0 V)<br>BC846B, BC847B<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) All devices except SBC847BPDW1T1G<br>SBC847BPDW1T1G only<br>($I_C$ = 100 mA, $I_B$ = 5.0 mA) All devices<br>($I_C$ = 2 mA, $I_B$ = 0.5 mA) SBC847BPDW1T1G only | $V_{CE(sat)}$ | <br>–<br>–<br>–<br>– | <br>–<br>–<br>–<br>0.024 | <br>0.25<br>0.1<br>0.6<br>– | 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 | | −65 | – | – | |
| BC847 | | −45 | – | – | |
| BC848 | | −30 | – | – | |
| Collector – Emitter Breakdown Voltage ($I_C$ = −10 μA, $V_{EB}$ = 0) | $V_{(BR)CES}$ | | | | V |
| BC846 | | −80 | – | – | |
| BC847 | | −50 | – | – | |
| BC848 | | −30 | – | – | |
| Collector – Base Breakdown Voltage ($I_C$ = −10 μA) | $V_{(BR)CBO}$ | | | | V |
| BC846 | | −80 | – | – | |
| BC847 | | −50 | – | – | |
| BC848 | | −30 | – | – | |
| Emitter – Base Breakdown Voltage ($I_E$ = −1.0 μA) | $V_{(BR)EBO}$ | | | | V |
| BC846 | | −6.0 | – | – | |
| BC847 | | −6.0 | – | – | |
| BC848 | | −6.0 | – | – | |
| 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, BC847B | | – | 150 | – | |
| BC848C | | – | 270 | – | |
| ($I_C$ = −2.0 mA, $V_{CE}$ = −5.0 V) | | | | | |
| BC846B, BC847B | | 200 | 290 | 475 | |
| BC848C | | 420 | 520 | 800 | |
| Collector – Emitter Saturation Voltage | $V_{CE(sat)}$ | | | | V |
| ($I_C$ = −10 mA, $I_B$ = −0.5 mA) All devices except SBC847BPDW1T1G | | – | – | −0.3 | |
| SBC847BPDW1T1G only | | – | – | −0.1 | |
| ($I_C$ = −100 mA, $I_B$ = −5.0 mA) All devices | | – | – | −0.65 | |
| ($I_C$ = −2 mA, $I_B$ = −0.5 mA) SBC847BPDW1T1G only | | – | −0.024 | – | |
| 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

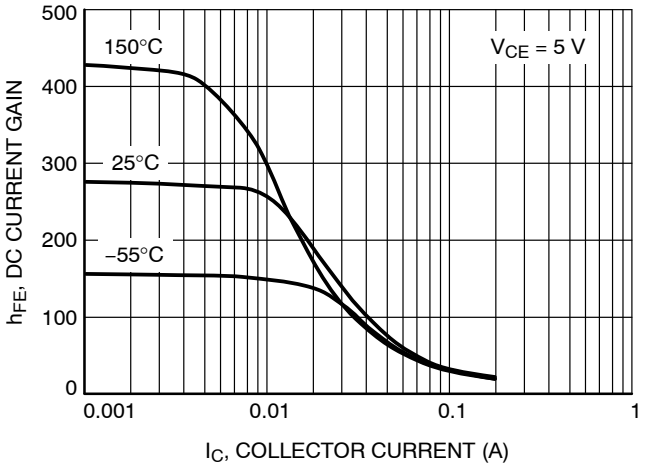


**Figure 1. DC Current Gain vs. Collector Current**

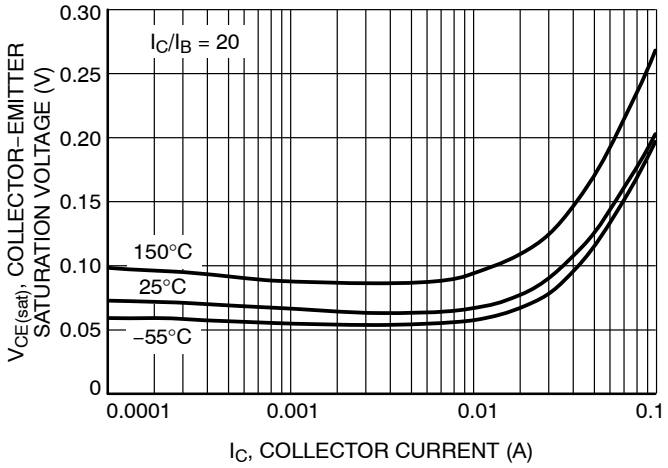


**Figure 2. Collector Emitter Saturation Voltage vs. Collector Current**

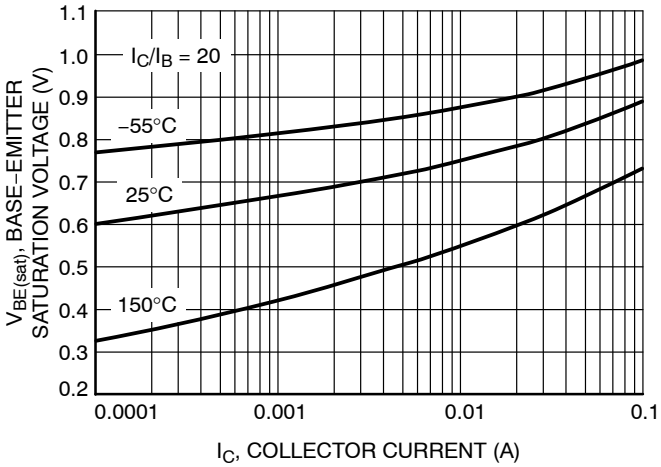


**Figure 3. Base Emitter Saturation Voltage vs. Collector Current**

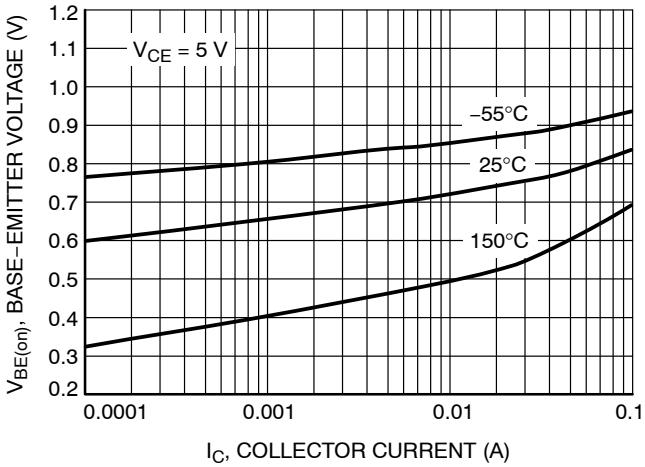


**Figure 4. Base Emitter Voltage vs. Collector Current**

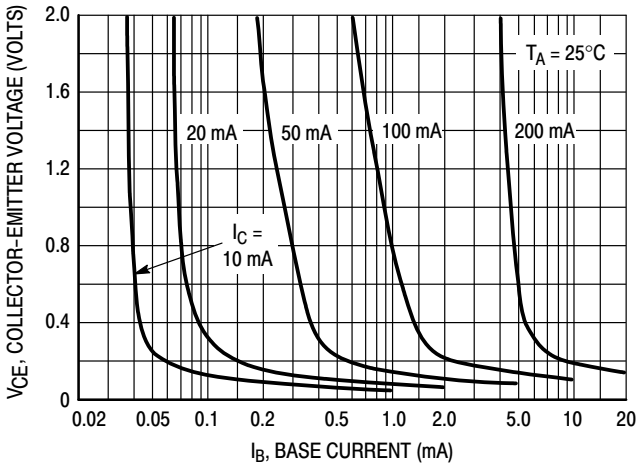


**Figure 5. Collector Saturation Region**

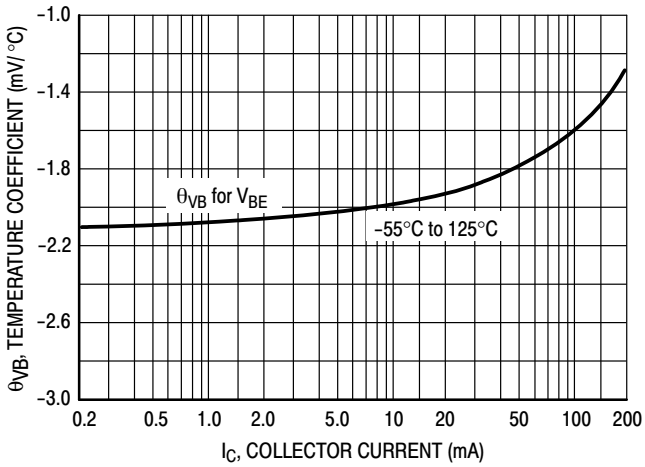


**Figure 6. Base−Emitter Temperature Coefficient**

## TYPICAL NPN CHARACTERISTICS – BC846

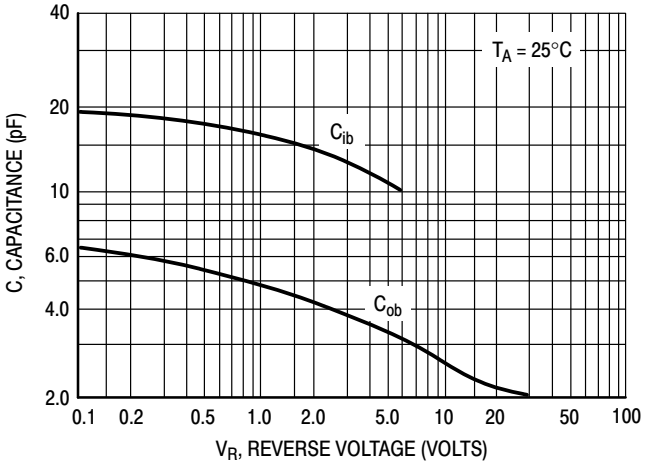


**Figure 7. Capacitance**

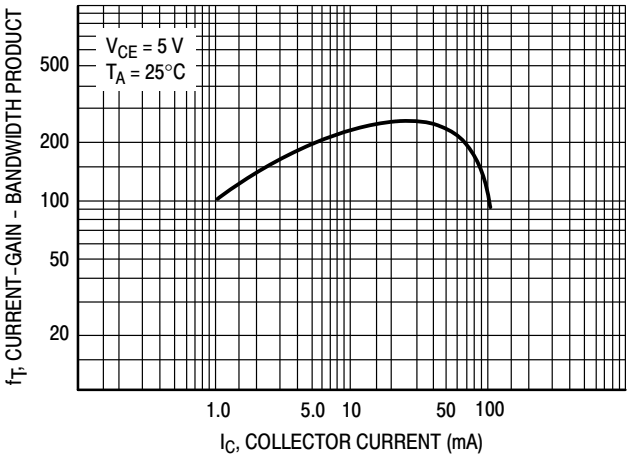


**Figure 8. Current–Gain – Bandwidth Product**

## TYPICAL PNP CHARACTERISTICS — BC846

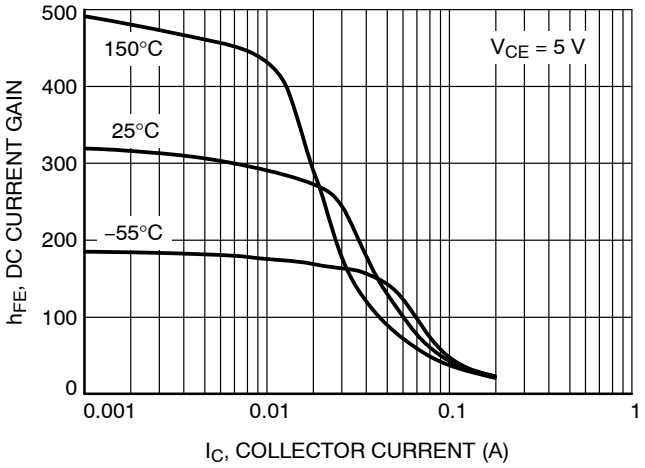


**Figure 9. DC Current Gain vs. Collector Current**

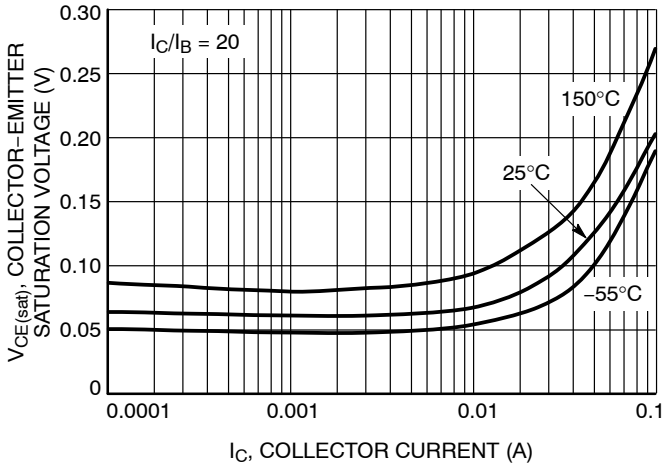


**Figure 10. Collector Emitter Saturation Voltage vs. Collector Current**

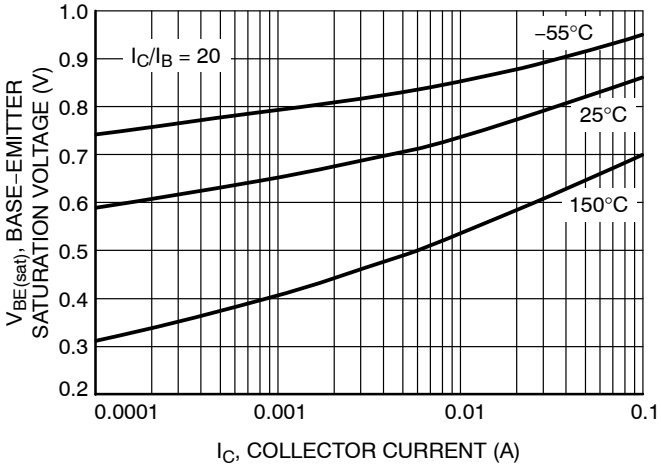


**Figure 11. Base Emitter Saturation Voltage vs. Collector Current**

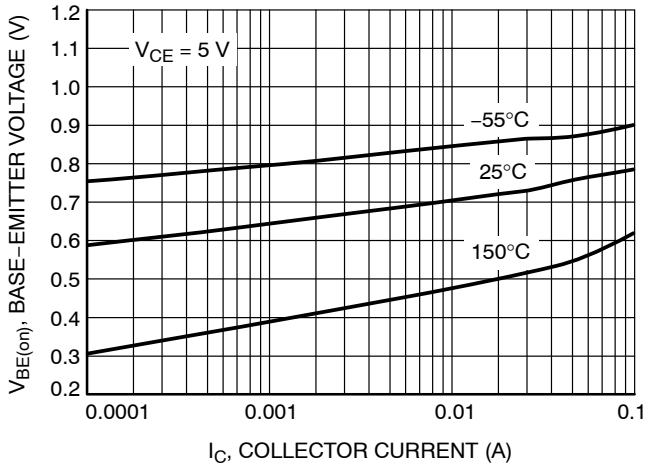


**Figure 12. Base Emitter Voltage vs. Collector Current**

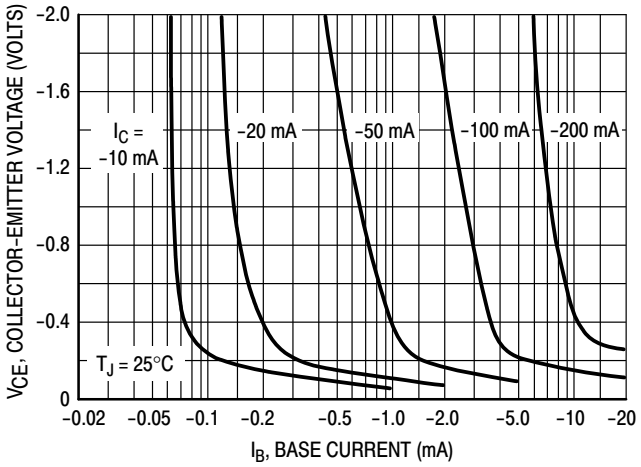


**Figure 13. Collector Saturation Region**

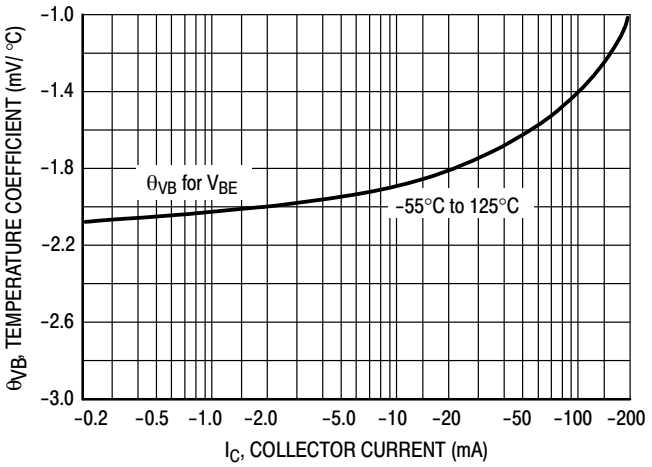


**Figure 14. Base−Emitter Temperature Coefficient**

## TYPICAL PNP CHARACTERISTICS — BC846

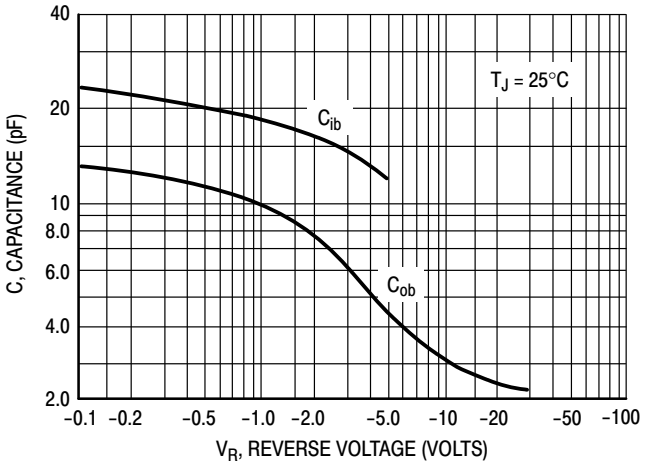


**Figure 15. Capacitance**

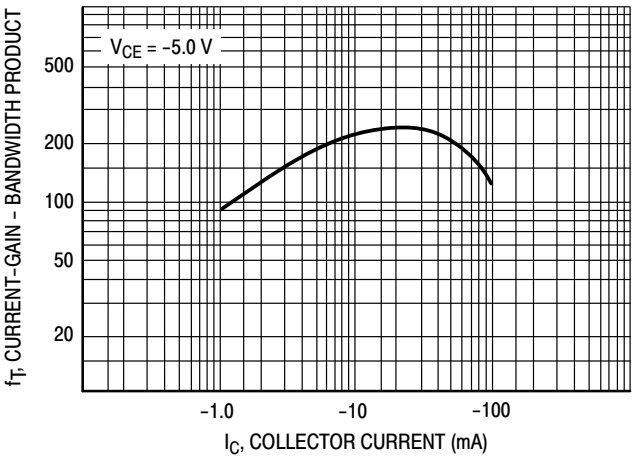


**Figure 16. Current−Gain − Bandwidth Product**

## TYPICAL NPN CHARACTERISTICS – BC847

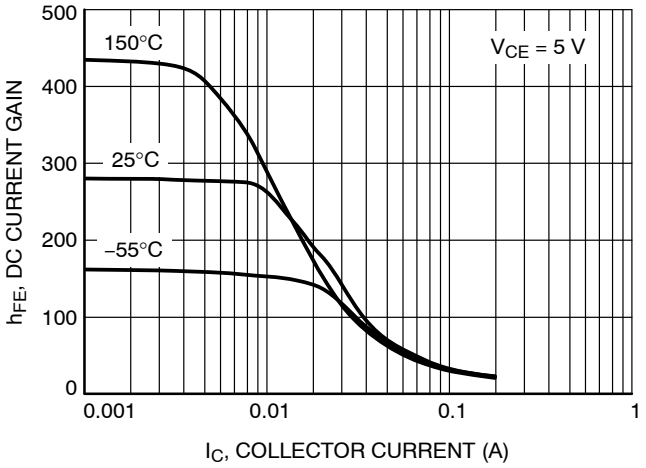


**Figure 17. DC Current Gain vs. Collector Current**

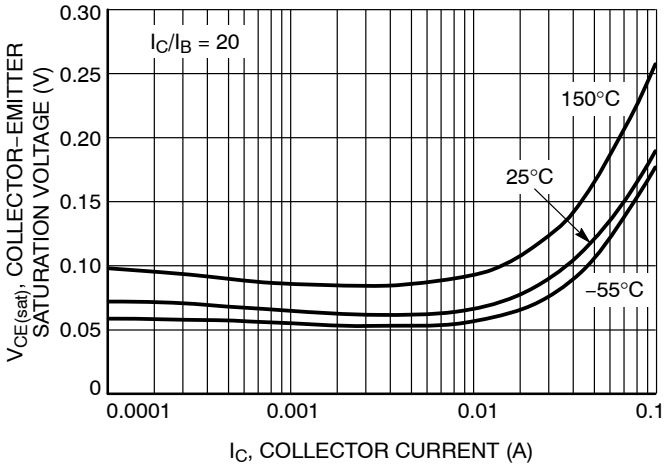


**Figure 18. Collector Emitter Saturation Voltage vs. Collector Current**

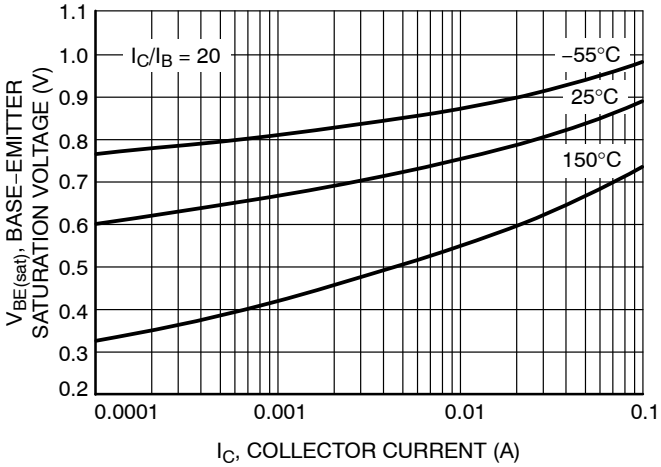


**Figure 19. Base Emitter Saturation Voltage vs. Collector Current**

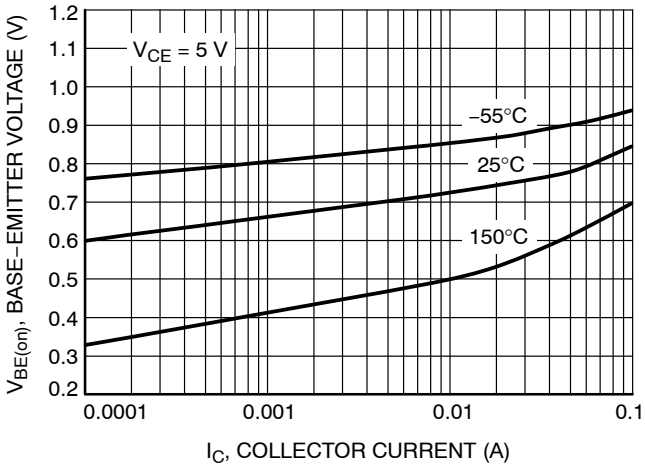


**Figure 20. Base Emitter Voltage vs. Collector Current**

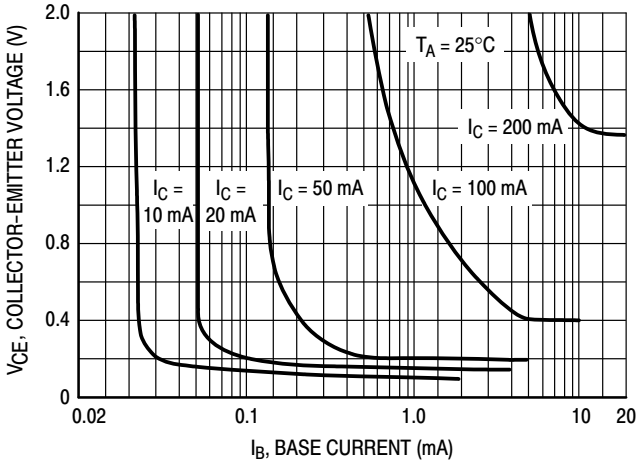


**Figure 21. Collector Saturation Region**

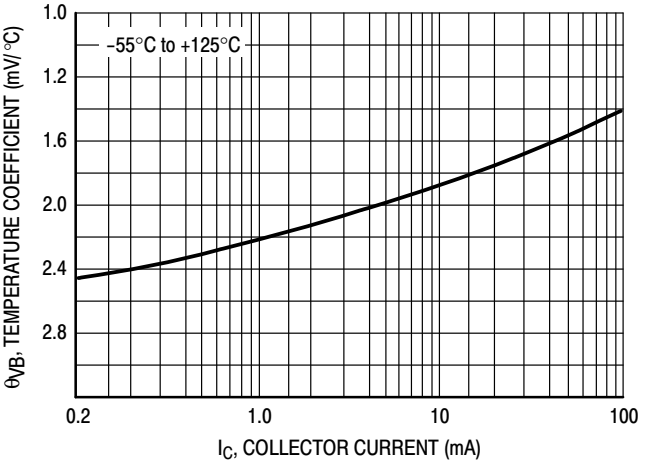


**Figure 22. Base−Emitter Temperature Coefficient**

## TYPICAL NPN CHARACTERISTICS – BC847

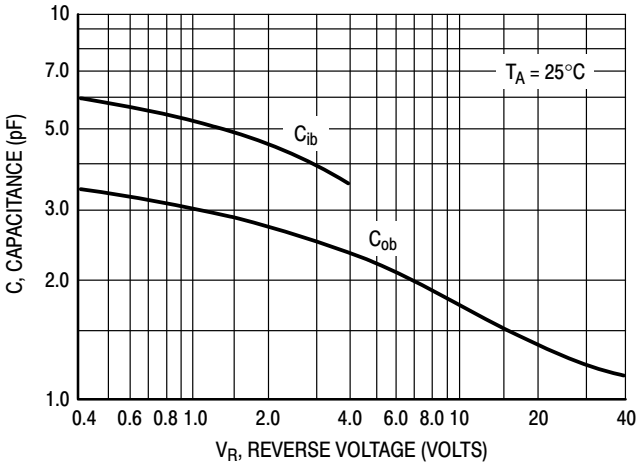


**Figure 23. Capacitances**

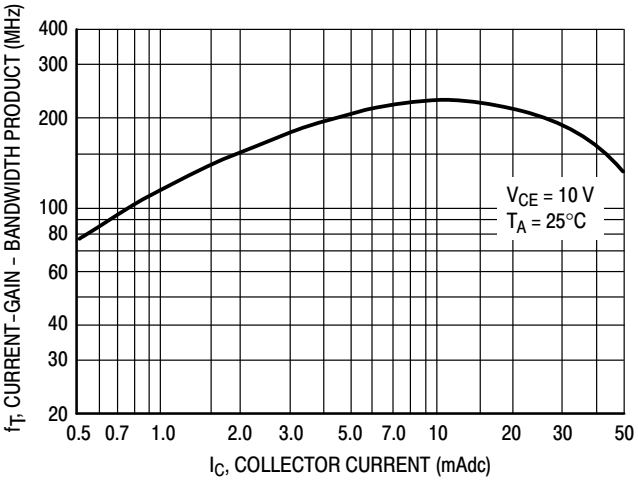


**Figure 24. Current–Gain – Bandwidth Product**

## TYPICAL PNP CHARACTERISTICS – BC847

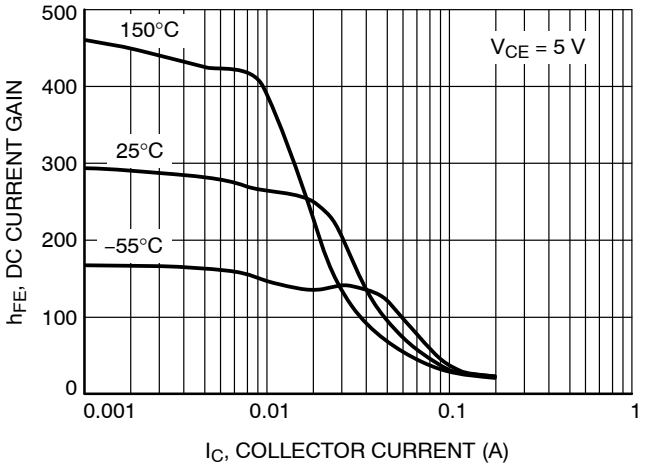


**Figure 25. DC Current Gain vs. Collector Current**

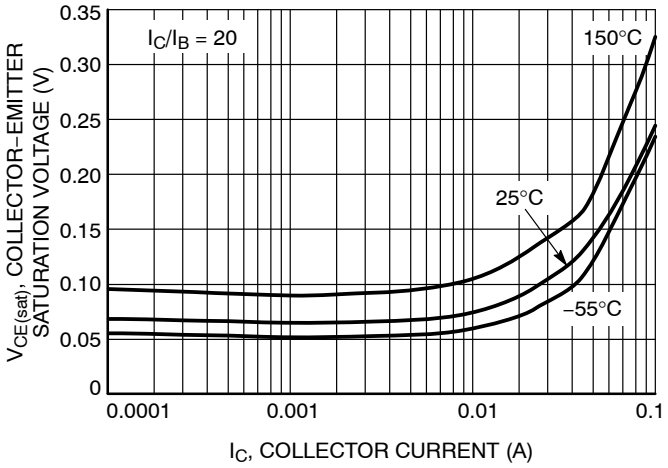


**Figure 26. Collector Emitter Saturation Voltage vs. Collector Current**

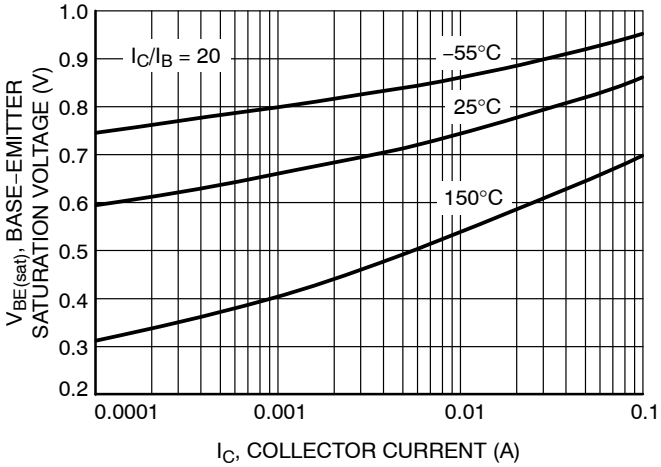


**Figure 27. Base Emitter Saturation Voltage vs. Collector Current**

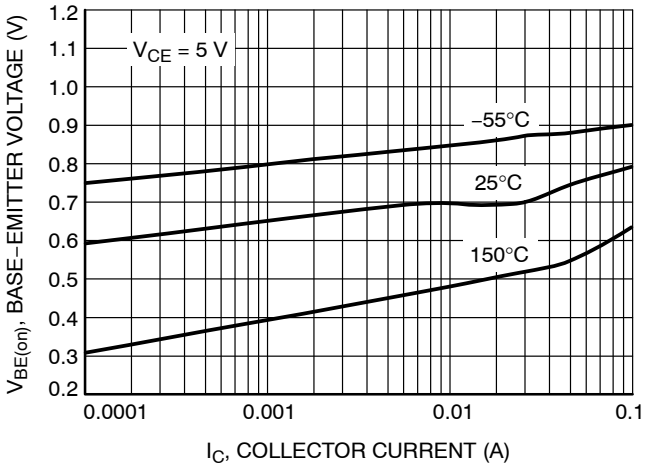


**Figure 28. Base Emitter Voltage vs. Collector Current**

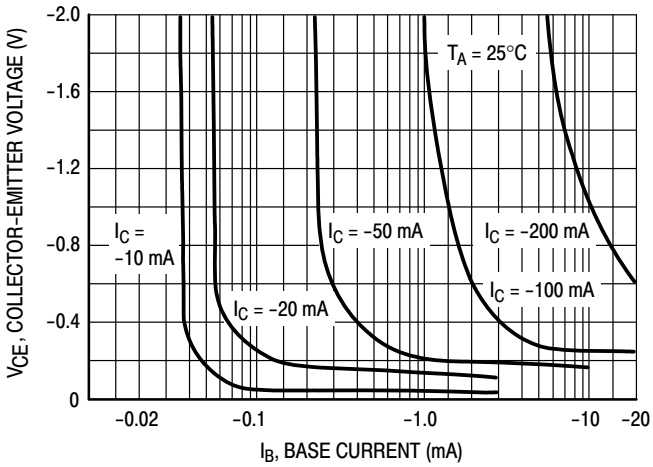


**Figure 29. Collector Saturation Region**

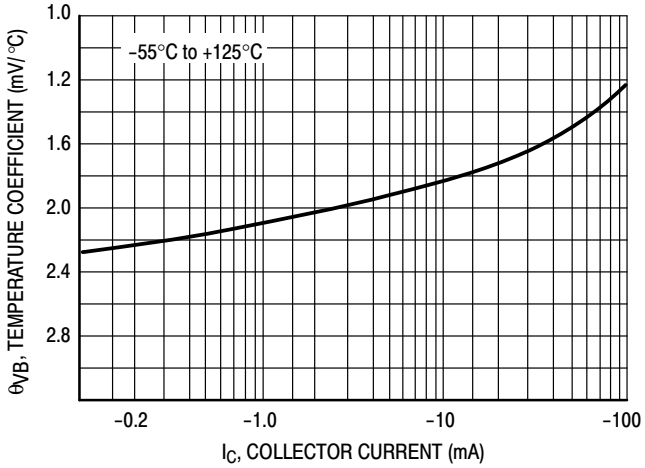


**Figure 30. Base−Emitter Temperature Coefficient**

## TYPICAL PNP CHARACTERISTICS – BC847

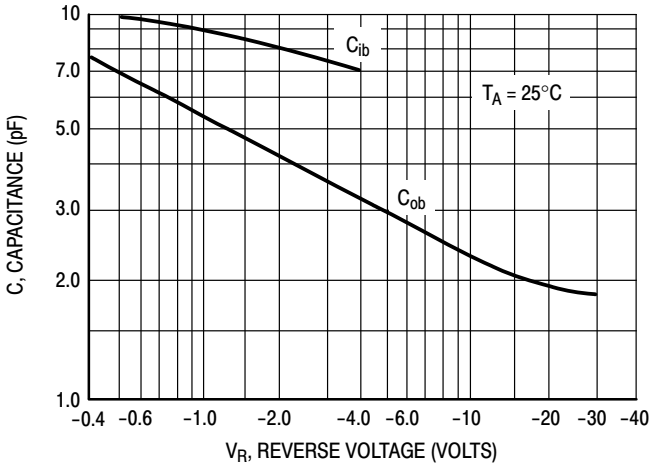


**Figure 31. Capacitances**

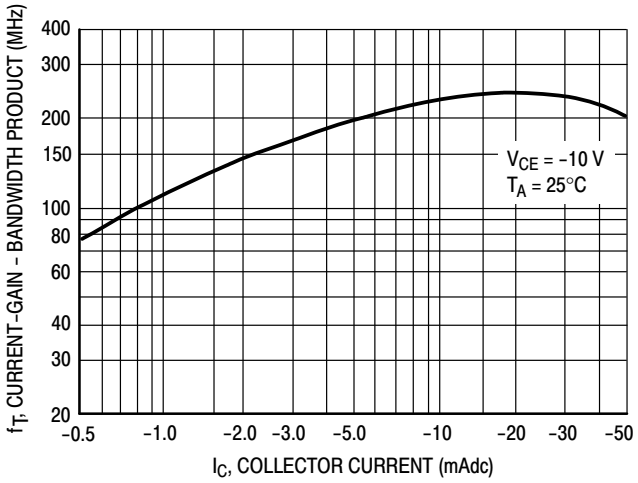


**Figure 32. Current−Gain − Bandwidth Product**

## TYPICAL NPN CHARACTERISTICS – BC848

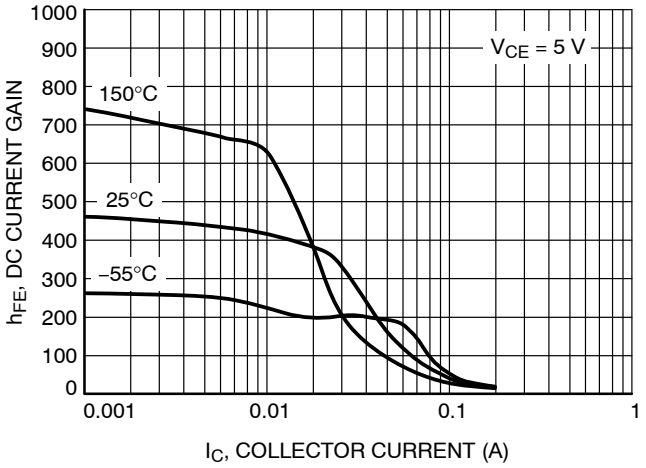


**Figure 33. DC Current Gain vs. Collector Current**

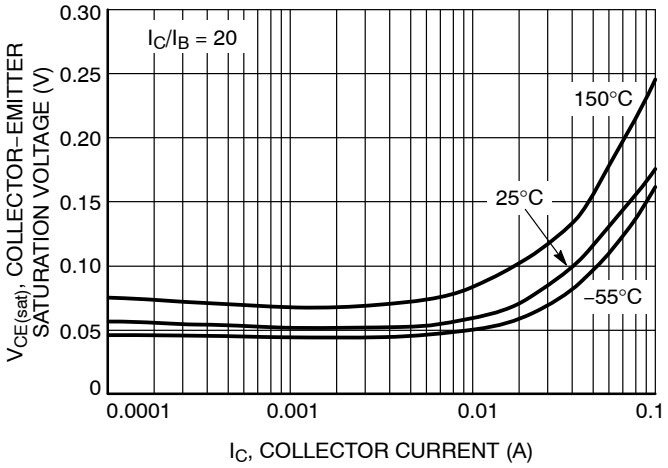


**Figure 34. Collector Emitter Saturation Voltage vs. Collector Current**

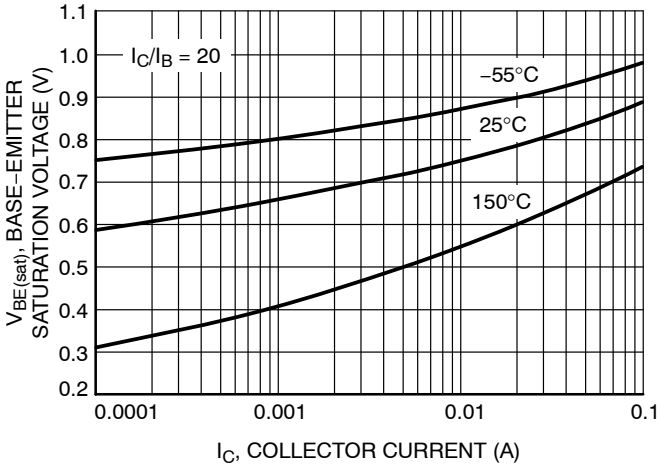


**Figure 35. Base Emitter Saturation Voltage vs. Collector Current**

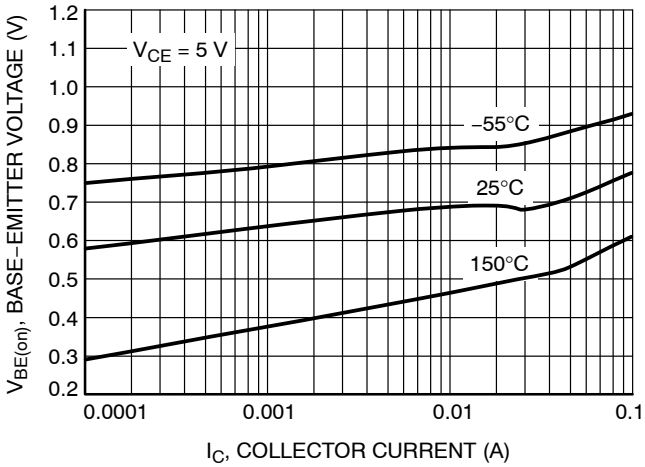


**Figure 36. Base Emitter Voltage vs. Collector Current**

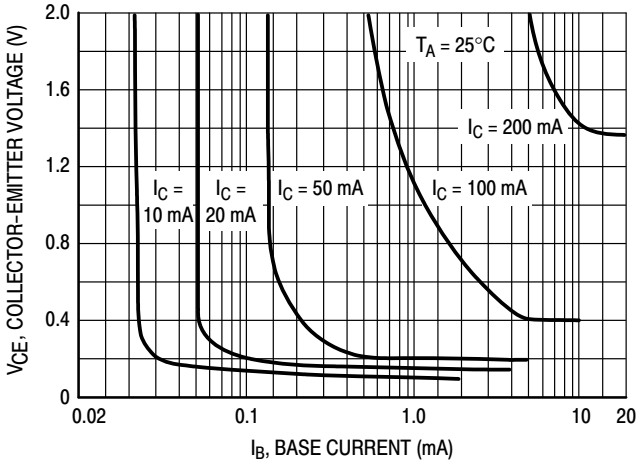


**Figure 37. Collector Saturation Region**

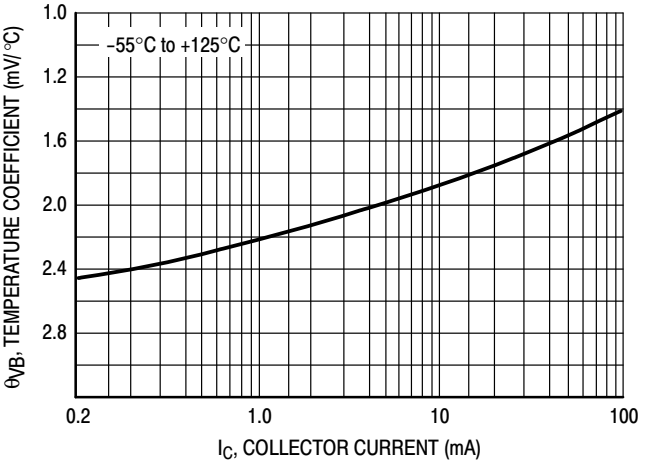


**Figure 38. Base−Emitter Temperature Coefficient**

## TYPICAL NPN CHARACTERISTICS – BC848

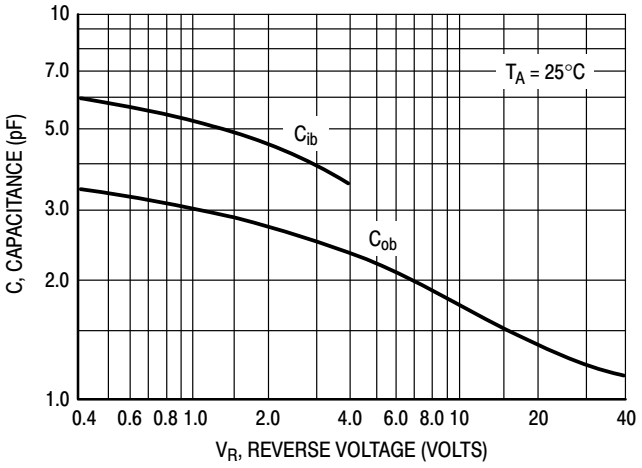


**Figure 39. Capacitances**

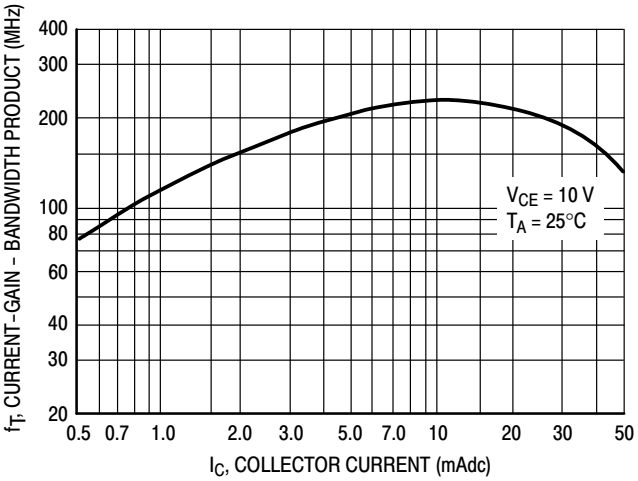


**Figure 40. Current−Gain − Bandwidth Product**

## TYPICAL PNP CHARACTERISTICS – BC848

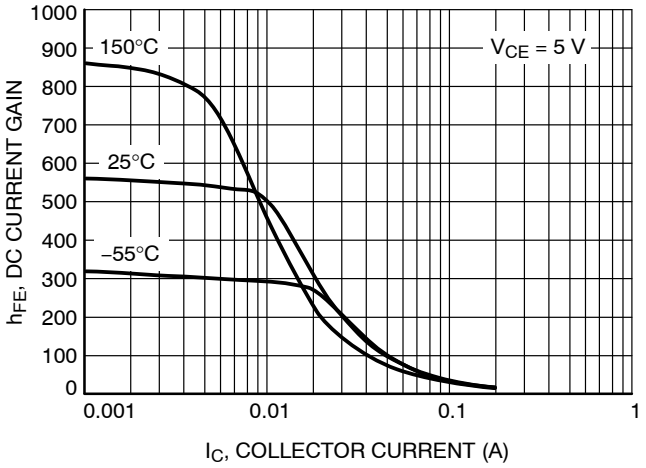


**Figure 41. DC Current Gain vs. Collector Current**

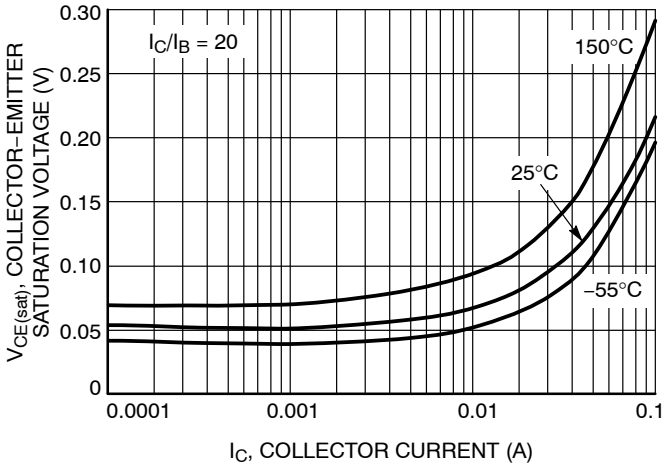


**Figure 42. Collector Emitter Saturation Voltage vs. Collector Current**

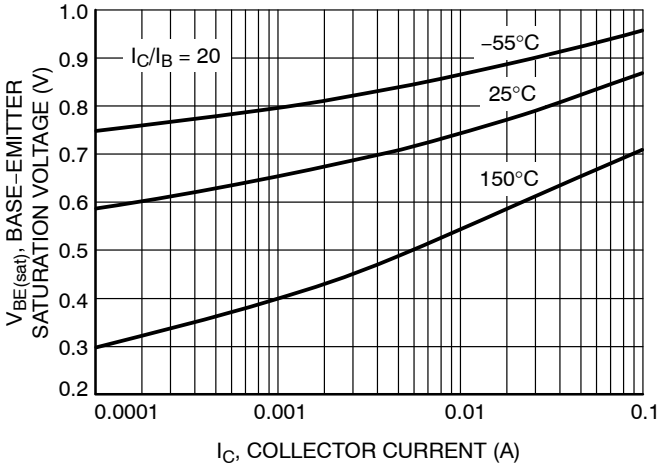


**Figure 43. Base Emitter Saturation Voltage vs. Collector Current**

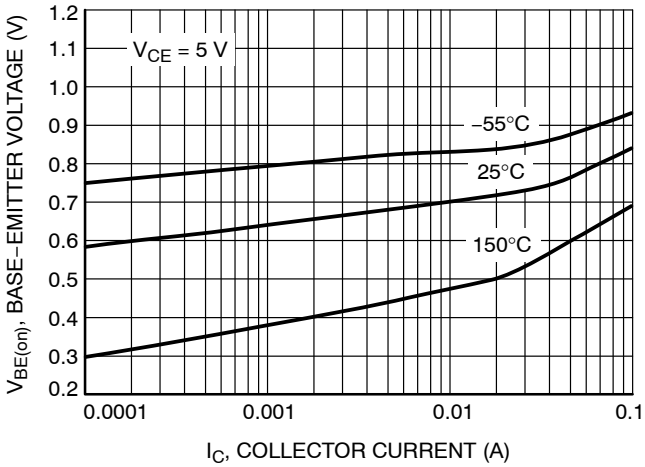


**Figure 44. Base Emitter Voltage vs. Collector Current**

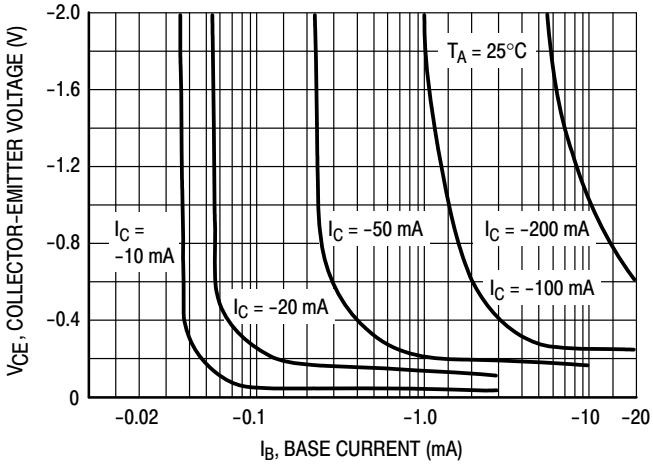


**Figure 45. Collector Saturation Region**

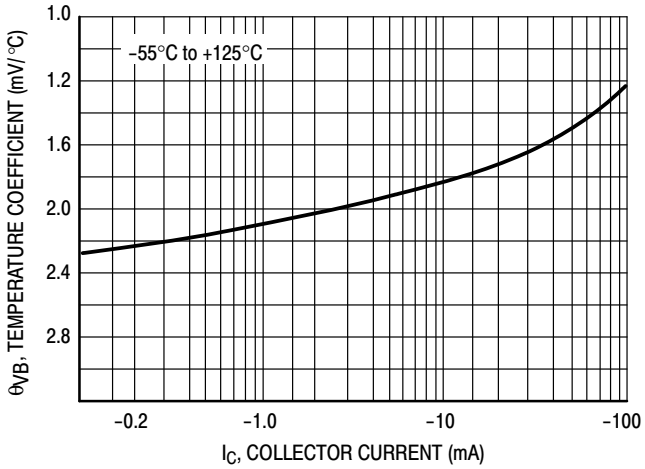


**Figure 46. Base−Emitter Temperature Coefficient**

## TYPICAL PNP CHARACTERISTICS – BC848

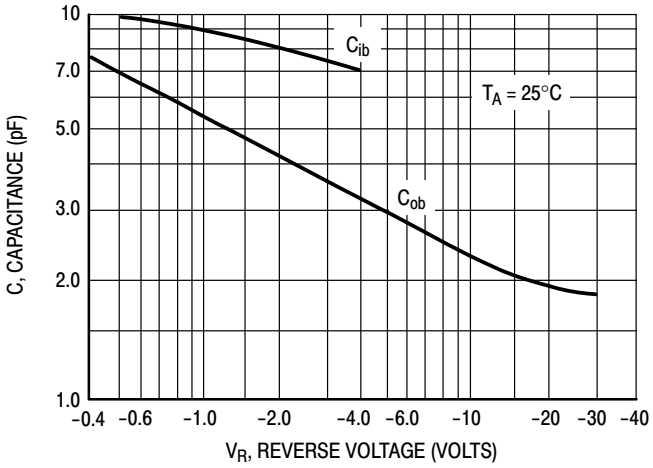


**Figure 47. Capacitances**

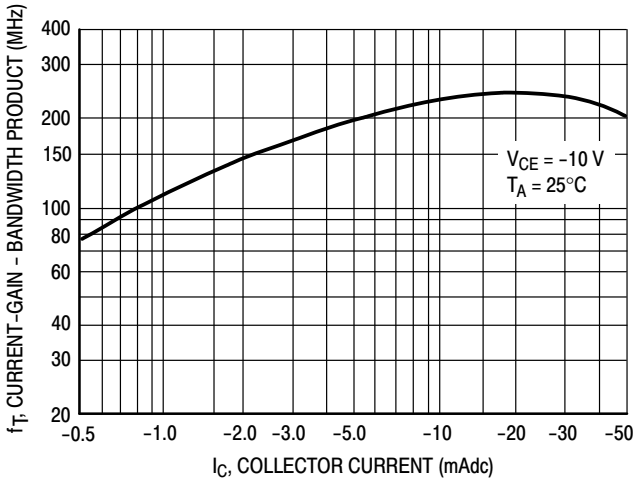


**Figure 48. Current−Gain − Bandwidth Product**

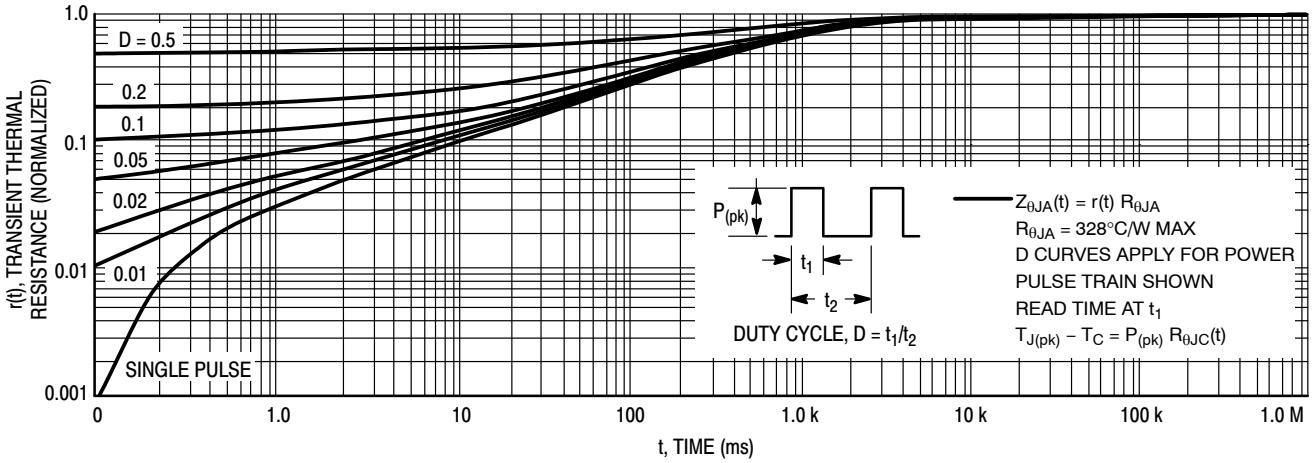


**Figure 49. Thermal Response**

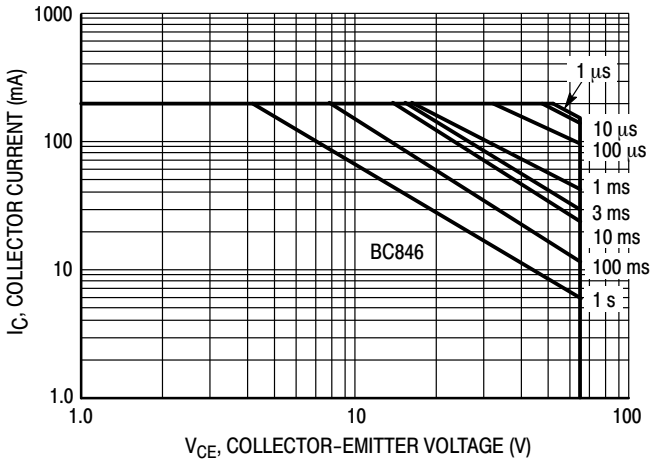


**Figure 50. Safe Operating Area – BC846**

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.

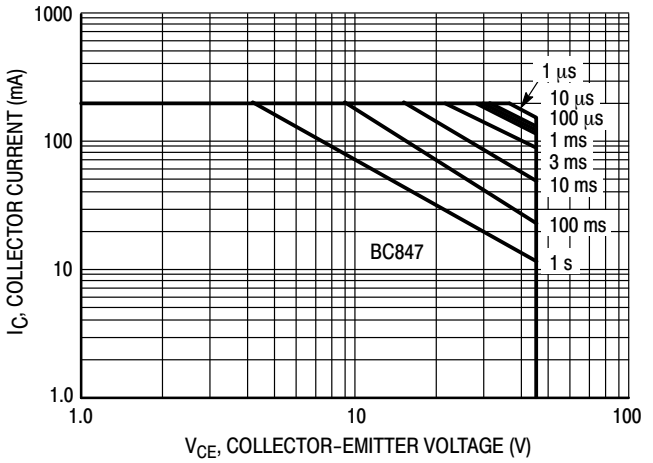


**Figure 51. Safe Operating Area – BC847**

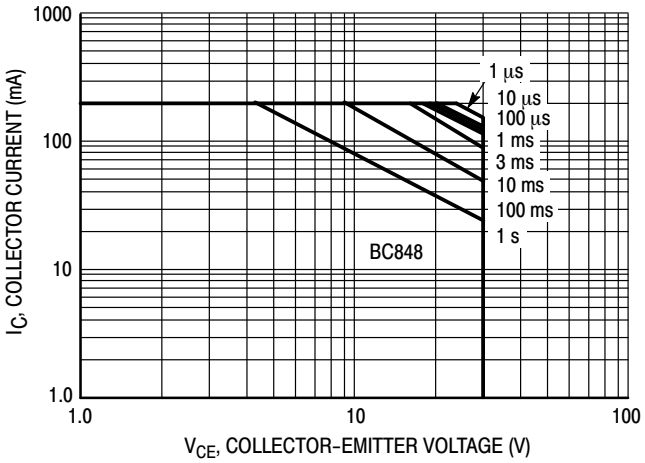


**Figure 52. Safe Operating Area – BC848**



**SC−88 2.00x1.25x0.90, 0.65P**
CASE 419B−02
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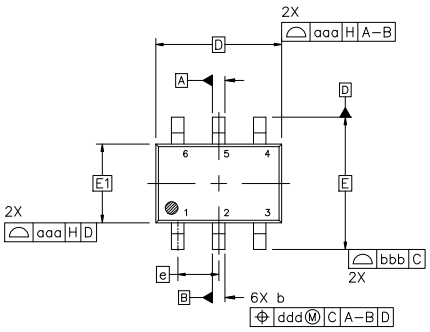
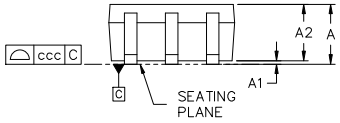
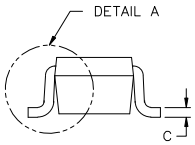
DATE 18 APR 2024



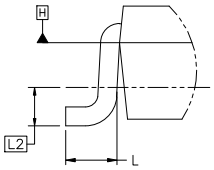

TOP VIEW




SIDE VIEW




END VIEW

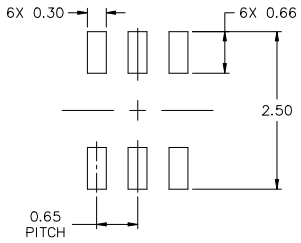



DETAIL A
SCALE 2:1

NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5−2018.
2. ALL DIMENSION ARE IN 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.

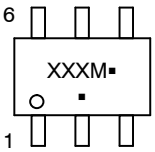
| | MILLIMETERS | | |
|---|---|---|---|
| DIM | MIN. | NOM. | MAX. |
| A | −−− | −−− | 1.10 |
| A1 | 0.00 | −−− | 0.10 |
| A2 | 0.70 | 0.90 | 1.00 |
| b | 0.15 | 0.20 | 0.25 |
| c | 0.08 | 0.15 | 0.22 |
| D | 2.00 BSC | | |
| E | 2.10 BSC | | |
| E1 | 1.25 BSC | | |
| e | 0.65 BSC | | |
| L | 0.26 | 0.36 | 0.46 |
| L2 | 0.15 BSC | | |
| aaa | 0.15 | | |
| bbb | 0.30 | | |
| ccc | 0.10 | | |
| ddd | 0.10 | | |




RECOMMENDED MOUNTING FOOTPRINT*

* FOR ADDITIONAL INFORMATION ON OUR Pb−FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

## GENERIC MARKING DIAGRAM*




XXX = Specific Device Code
M = Date Code*
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or position may vary depending upon manufacturing location.

*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.

**STYLES ON PAGE 2**

| | | | |
|---|---|---|---|
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**SC−88 2.00x1.25x0.90, 0.65P**
CASE 419B−02
ISSUE Z

DATE 18 APR 2024

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

STYLE 2:
CANCELLED

STYLE 3:
CANCELLED

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

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

STYLE 6:
PIN 1. ANODE 2
2. N/C
3. CATHODE 1
4. ANODE 1
5. N/C
6. CATHODE 2

STYLE 7:
PIN 1. SOURCE 2
2. DRAIN 2
3. GATE 1
4. SOURCE 1
5. DRAIN 1
6. GATE 2

STYLE 8:
CANCELLED

STYLE 9:
PIN 1. EMITTER 2
2. EMITTER 1
3. COLLECTOR 1
4. BASE 1
5. BASE 2
6. COLLECTOR 2

STYLE 10:
PIN 1. SOURCE 2
2. SOURCE 1
3. GATE 1
4. DRAIN 1
5. DRAIN 2
6. GATE 2

STYLE 11:
PIN 1. CATHODE 2
2. CATHODE 2
3. ANODE 1
4. CATHODE 1
5. CATHODE 1
6. ANODE 2

STYLE 12:
PIN 1. ANODE 2
2. ANODE 2
3. CATHODE 1
4. ANODE 1
5. ANODE 1
6. CATHODE 2

STYLE 13:
PIN 1. ANODE
2. N/C
3. COLLECTOR
4. EMITTER
5. BASE
6. CATHODE

STYLE 14:
PIN 1. VREF
2. GND
3. GND
4. IOUT
5. VEN
6. VCC

STYLE 15:
PIN 1. ANODE 1
2. ANODE 2
3. ANODE 3
4. CATHODE 3
5. CATHODE 2
6. CATHODE 1

STYLE 16:
PIN 1. BASE 1
2. EMITTER 2
3. COLLECTOR 2
4. BASE 2
5. EMITTER 1
6. COLLECTOR 1

STYLE 17:
PIN 1. BASE 1
2. EMITTER 1
3. COLLECTOR 2
4. BASE 2
5. EMITTER 2
6. COLLECTOR 1

STYLE 18:
PIN 1. VIN1
2. VCC
3. VOUT2
4. VIN2
5. GND
6. VOUT1

STYLE 19:
PIN 1. I OUT
2. GND
3. GND
4. V CC
5. V EN
6. V REF

STYLE 20:
PIN 1. COLLECTOR
2. COLLECTOR
3. BASE
4. EMITTER
5. COLLECTOR
6. COLLECTOR

STYLE 21:
PIN 1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. N/C
6. CATHODE 1

STYLE 22:
PIN 1. D1 (i)
2. GND
3. D2 (i)
4. D2 (c)
5. VBUS
6. D1 (c)

STYLE 23:
PIN 1. Vn
2. CH1
3. Vp
4. N/C
5. CH2
6. N/C

STYLE 24:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE

STYLE 25:
PIN 1. BASE 1
2. CATHODE
3. COLLECTOR 2
4. BASE 2
5. EMITTER
6. COLLECTOR 1

STYLE 26:
PIN 1. SOURCE 1
2. GATE 1
3. DRAIN 2
4. SOURCE 2
5. GATE 2
6. DRAIN 1

STYLE 27:
PIN 1. BASE 2
2. BASE 1
3. COLLECTOR 1
4. EMITTER 1
5. EMITTER 2
6. COLLECTOR 2

STYLE 28:
PIN 1. DRAIN
2. DRAIN
3. GATE
4. SOURCE
5. DRAIN
6. DRAIN

STYLE 29:
PIN 1. ANODE
2. ANODE
3. COLLECTOR
4. EMITTER
5. BASE/ANODE
6. CATHODE

STYLE 30:
PIN 1. SOURCE 1
2. DRAIN 2
3. DRAIN 2
4. SOURCE 2
5. GATE 1
6. DRAIN 1

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

| | | | |
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