

# BC846BPDW1T1G, BC847BPDW1T1G, BC848CPDW1T1G

## 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

- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### MAXIMUM RATINGS – NPN

Rating	Symbol	Value	Unit
Collector-Emitter Voltage BC846 BC847 BC848	$V_{CEO}$	65 45 30	V
Collector-Base Voltage BC846 BC847 BC848	$V_{CBO}$	80 50 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 BC846 BC847 BC848	$V_{CEO}$	-65 -45 -30	V
Collector-Base Voltage BC846 BC847 BC848	$V_{CBO}$	-80 -50 -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.

#### THERMAL CHARACTERISTICS

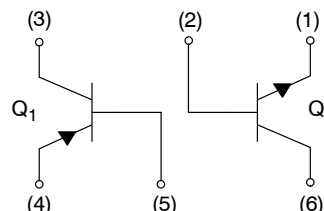
Characteristic	Symbol	Max	Unit
Total Device Dissipation Per Device FR-5 Board (Note 1) $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	380 250 3.0	mW  mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	328	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature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

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



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#### 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	BB	SOT-363 (Pb-Free)	3000 / Tape & Reel
BC847BPDW1T1G	BF	SOT-363 (Pb-Free)	3000 / Tape & Reel
BC847BPDW1T2G	BF	SOT-363 (Pb-Free)	3000 / Tape & Reel
BC848CPDW1T1G	BL	SOT-363 (Pb-Free)	3000 / 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.

# BC846BPDW1T1G, BC847BPDW1T1G, BC848CPDW1T1G

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

Characteristic	Symbol	Min	Typ	Max	Unit	
<b>OFF CHARACTERISTICS</b>						
Collector – Emitter Breakdown Voltage ( $I_C = 10\text{ mA}$ )	BC846 Series BC847 Series BC848 Series	$V_{(BR)CEO}$	65 45 30	– – –	– – –	V
Collector – Emitter Breakdown Voltage ( $I_C = 10\ \mu\text{A}$ , $V_{EB} = 0$ )	BC846 Series BC847B Only BC848 Series	$V_{(BR)CES}$	80 50 30	– – –	– – –	V
Collector – Base Breakdown Voltage ( $I_C = 10\ \mu\text{A}$ )	BC846 Series BC847 Series BC848 Series	$V_{(BR)CBO}$	80 50 30	– – –	– – –	V
Emitter – Base Breakdown Voltage ( $I_E = 1.0\ \mu\text{A}$ )	BC846 Series BC847 Series BC848 Series	$V_{(BR)EBO}$	6.0 6.0 5.0	– – –	– – –	V
Collector Cutoff Current ( $V_{CB} = 30\text{ V}$ ) ( $V_{CB} = 30\text{ V}$ , $T_A = 150^\circ\text{C}$ )		$I_{CBO}$	– –	– –	15 5.0	nA $\mu\text{A}$
<b>ON CHARACTERISTICS</b>						
DC Current Gain ( $I_C = 10\ \mu\text{A}$ , $V_{CE} = 5.0\text{ V}$ )	BC846B, BC847B BC848C	$h_{FE}$	– –	150 270	– –	–
( $I_C = 2.0\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ )	BC846B, BC847B BC848C		200 420	290 520	475 800	
Collector – Emitter Saturation Voltage ( $I_C = 10\text{ mA}$ , $I_B = 0.5\text{ mA}$ ) ( $I_C = 100\text{ mA}$ , $I_B = 5.0\text{ mA}$ )		$V_{CE(sat)}$	– –	– –	0.25 0.6	V
Base – Emitter Saturation Voltage ( $I_C = 10\text{ mA}$ , $I_B = 0.5\text{ mA}$ ) ( $I_C = 100\text{ mA}$ , $I_B = 5.0\text{ mA}$ )		$V_{BE(sat)}$	– –	0.7 0.9	– –	V
Base – Emitter Voltage ( $I_C = 2.0\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ ) ( $I_C = 10\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ )		$V_{BE(on)}$	580 –	660 –	700 770	mV
<b>SMALL-SIGNAL CHARACTERISTICS</b>						
Current – Gain – Bandwidth Product ( $I_C = 10\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f = 100\text{ MHz}$ )		$f_T$	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

# BC846BPDW1T1G, BC847BPDW1T1G, BC848CPDW1T1G

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector – Emitter Breakdown Voltage ( $I_C = -10\text{ mA}$ )	BC846 Series BC847 Series BC848 Series	$V_{(BR)CEO}$	-65 -45 -30	- - -	V
Collector – Emitter Breakdown Voltage ( $I_C = -10\ \mu\text{A}$ , $V_{EB} = 0$ )	BC846 Series BC847 Series BC848 Series	$V_{(BR)CES}$	-80 -50 -30	- - -	V
Collector – Base Breakdown Voltage ( $I_C = -10\ \mu\text{A}$ )	BC846 Series BC847 Series BC848 Series	$V_{(BR)CBO}$	-80 -50 -30	- - -	V
Emitter – Base Breakdown Voltage ( $I_E = -1.0\ \mu\text{A}$ )	BC846 Series BC847 Series BC848 Series	$V_{(BR)EBO}$	-5.0 -5.0 -5.0	- - -	V
Collector Cutoff Current ( $V_{CB} = -30\text{ V}$ ) ( $V_{CB} = -30\text{ V}$ , $T_A = 150^\circ\text{C}$ )		$I_{CBO}$	- -	- -	nA $\mu\text{A}$
<b>ON CHARACTERISTICS</b>					
DC Current Gain ( $I_C = -10\ \mu\text{A}$ , $V_{CE} = -5.0\text{ V}$ )	BC846B, BC847B BC848C	$h_{FE}$	- -	150 270	- -
( $I_C = -2.0\text{ mA}$ , $V_{CE} = -5.0\text{ V}$ )	BC846B, BC847B BC848C		200 420	290 520	475 800
Collector – Emitter Saturation Voltage ( $I_C = -10\text{ mA}$ , $I_B = -0.5\text{ mA}$ ) ( $I_C = -100\text{ mA}$ , $I_B = -5.0\text{ mA}$ )		$V_{CE(sat)}$	- -	- -	-0.3 -0.65
Base – Emitter Saturation Voltage ( $I_C = -10\text{ mA}$ , $I_B = -0.5\text{ mA}$ ) ( $I_C = -100\text{ mA}$ , $I_B = -5.0\text{ mA}$ )		$V_{BE(sat)}$	- -	-0.7 -0.9	- -
Base – Emitter On Voltage ( $I_C = -2.0\text{ mA}$ , $V_{CE} = -5.0\text{ V}$ ) ( $I_C = -10\text{ mA}$ , $V_{CE} = -5.0\text{ V}$ )		$V_{BE(on)}$	-0.6 -	- -	-0.75 -0.82
<b>SMALL-SIGNAL CHARACTERISTICS</b>					
Current – Gain – Bandwidth Product ( $I_C = -10\text{ mA}$ , $V_{CE} = -5.0\text{ Vdc}$ , $f = 100\text{ MHz}$ )		$f_T$	100	-	MHz
Output Capacitance ( $V_{CB} = -10\text{ V}$ , $f = 1.0\text{ MHz}$ )		$C_{ob}$	-	-	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

TYPICAL NPN CHARACTERISTICS - BC846

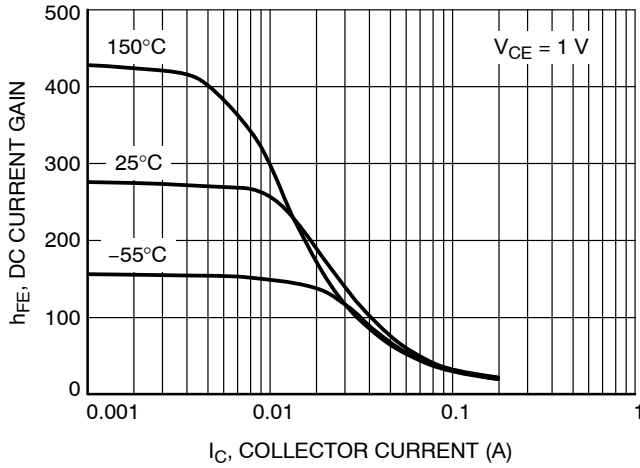


Figure 1. DC Current Gain vs. Collector Current

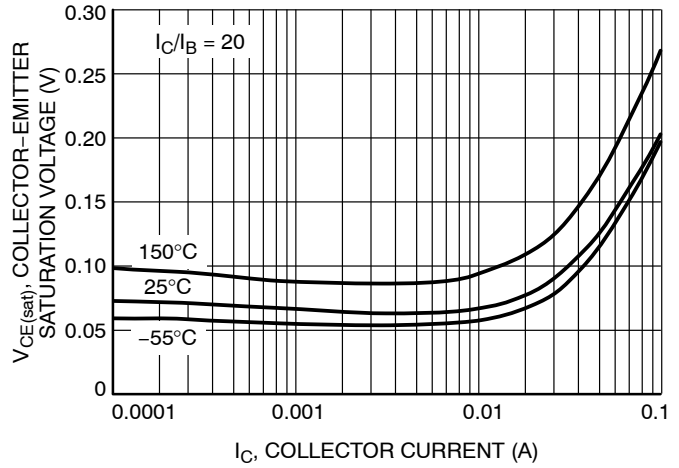


Figure 2. Collector Emitter Saturation Voltage vs. Collector Current

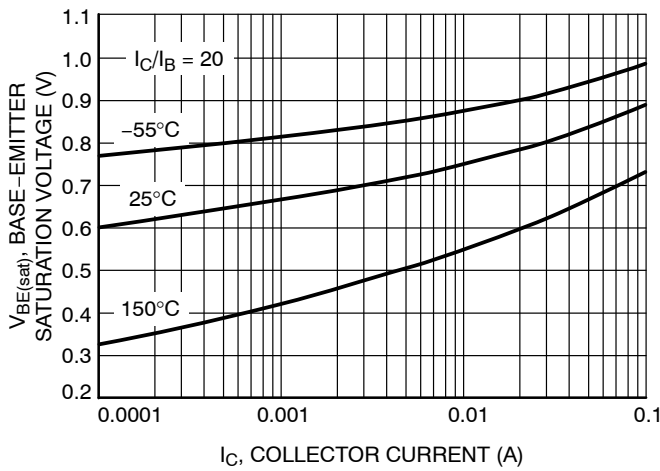


Figure 3. Base Emitter Saturation Voltage vs. Collector Current

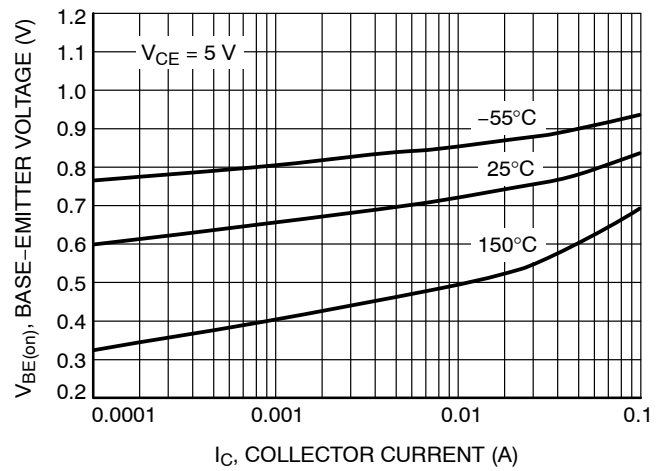


Figure 4. Base Emitter Voltage vs. Collector Current

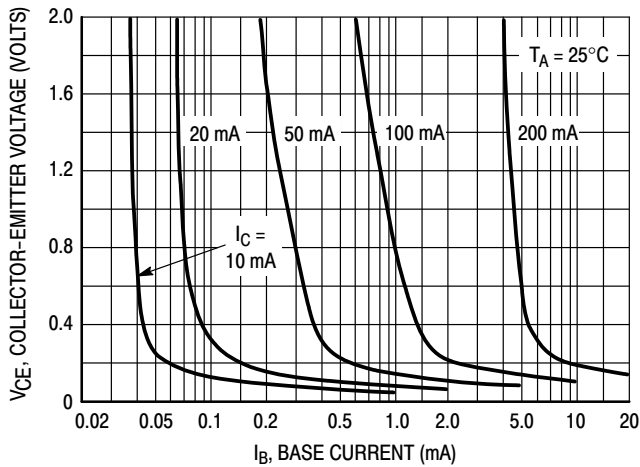


Figure 5. Collector Saturation Region

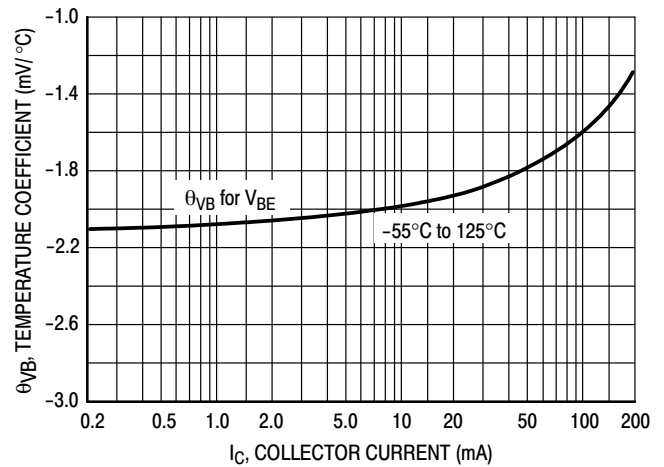


Figure 6. Base-Emitter Temperature Coefficient

TYPICAL NPN CHARACTERISTICS – BC846

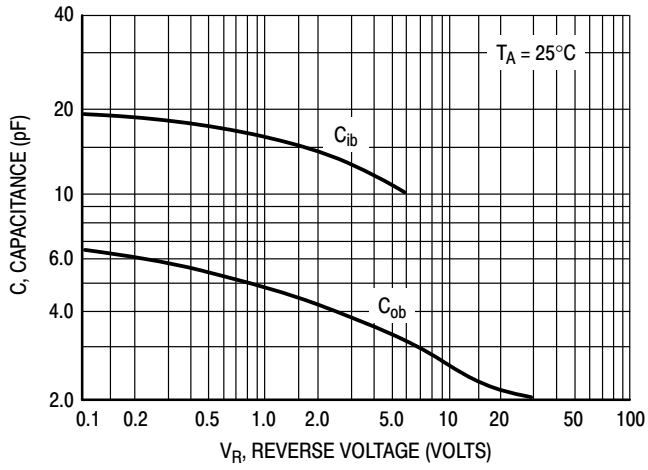


Figure 7. Capacitance

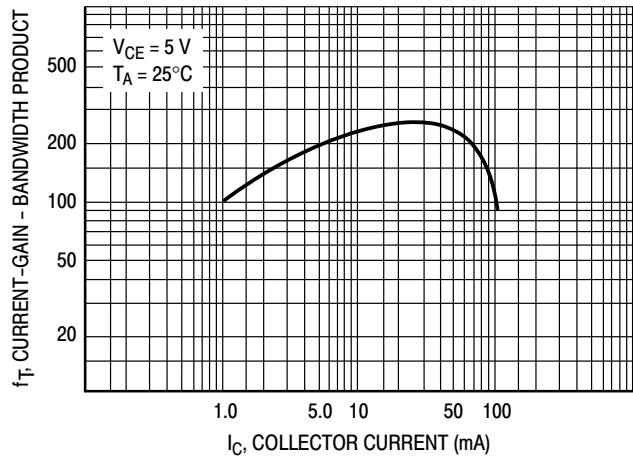


Figure 8. Current-Gain - Bandwidth Product

TYPICAL PNP CHARACTERISTICS — BC846

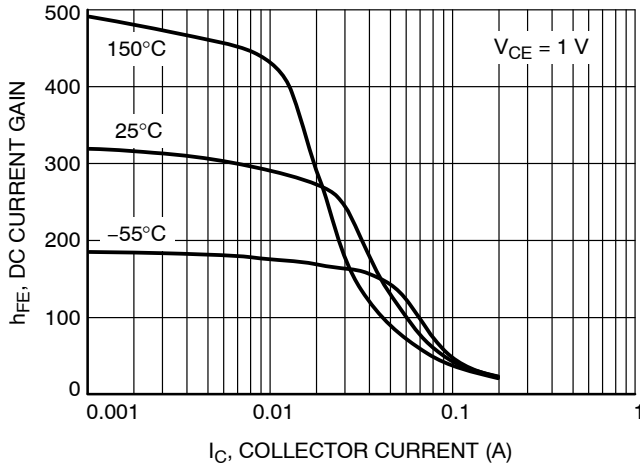


Figure 9. DC Current Gain vs. Collector Current

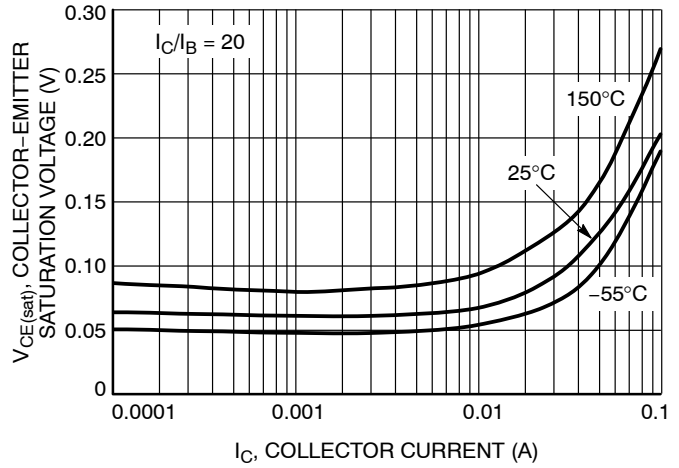


Figure 10. Collector Emitter Saturation Voltage vs. Collector Current

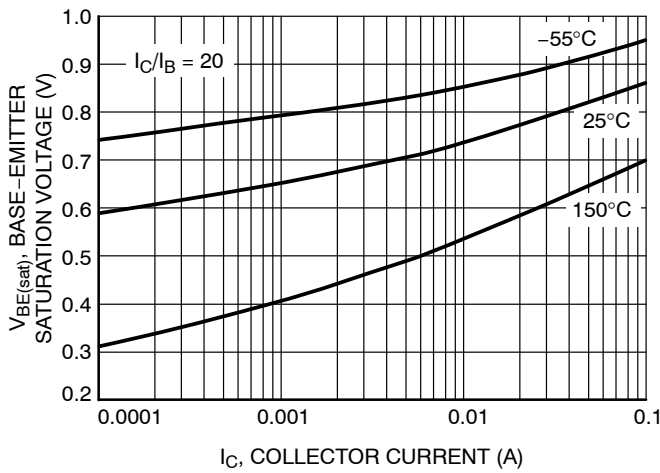


Figure 11. Base Emitter Saturation Voltage vs. Collector Current

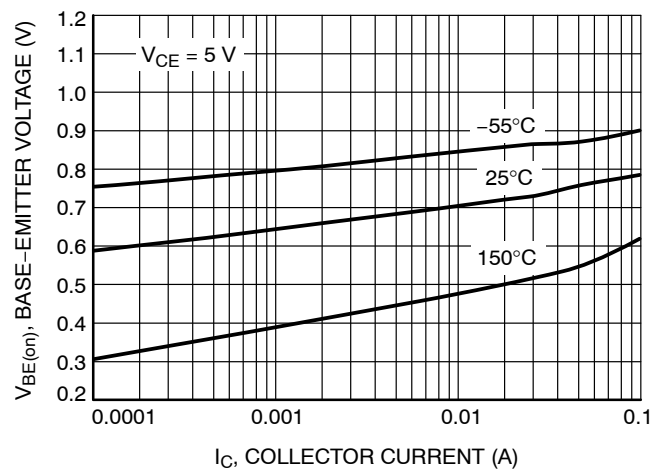


Figure 12. Base Emitter Voltage vs. Collector Current

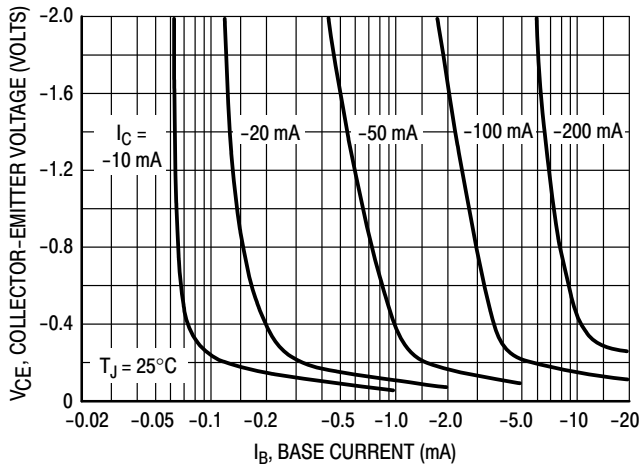


Figure 13. Collector Saturation Region

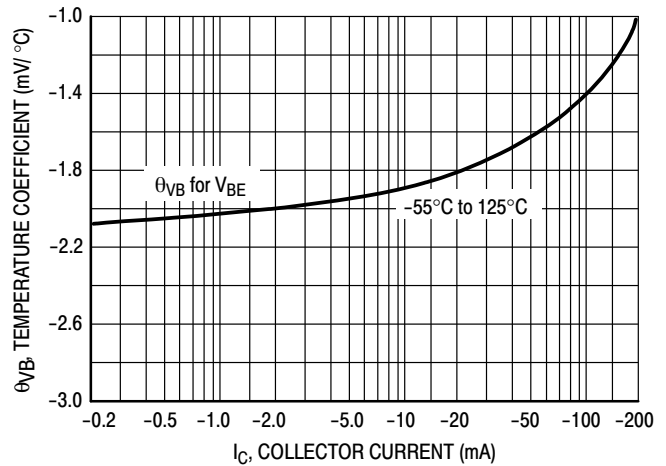


Figure 14. Base-Emitter Temperature Coefficient

# BC846BPDW1T1G, BC847BPDW1T1G, BC848CPDW1T1G

## TYPICAL PNP CHARACTERISTICS — BC846

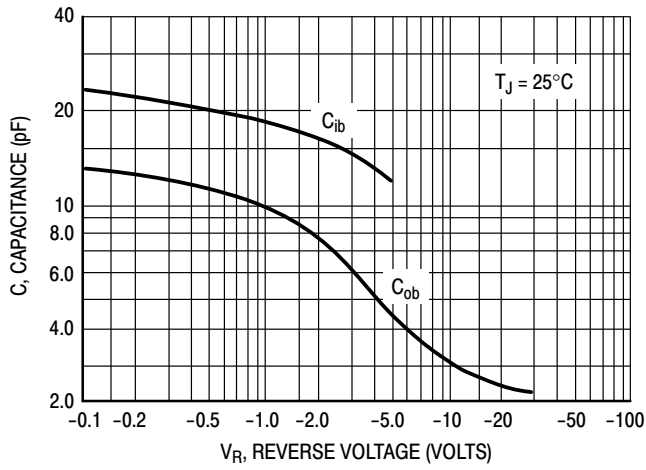


Figure 15. Capacitance

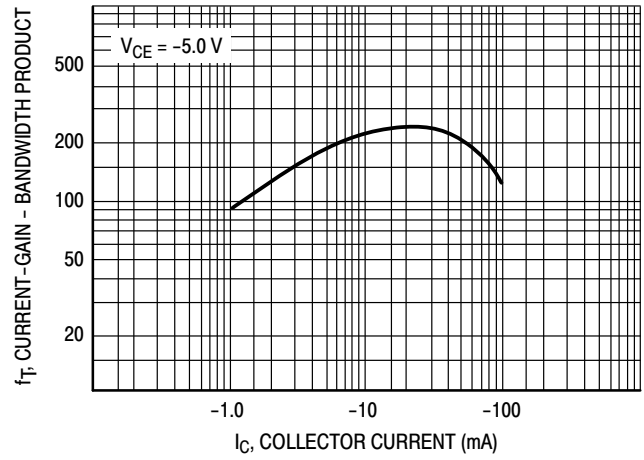


Figure 16. Current-Gain - Bandwidth Product

TYPICAL NPN CHARACTERISTICS - BC847 SERIES

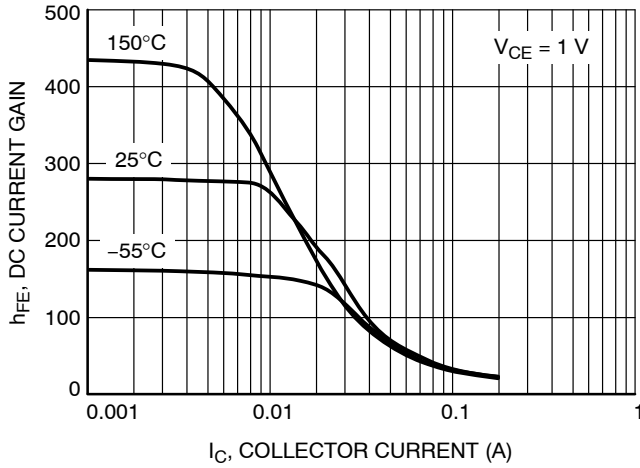


Figure 17. DC Current Gain vs. Collector Current

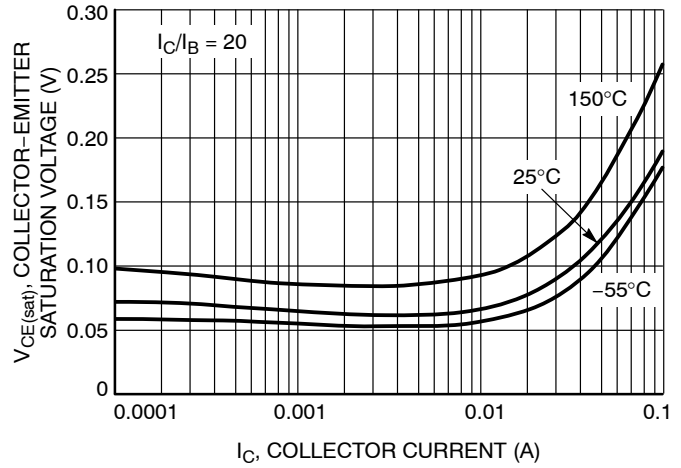


Figure 18. Collector Emitter Saturation Voltage vs. Collector Current

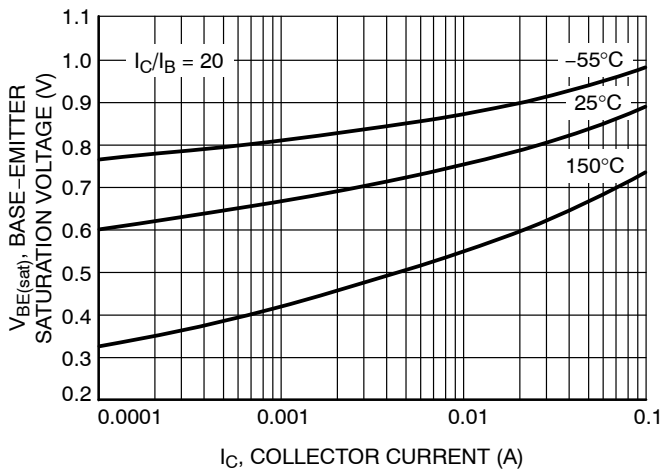


Figure 19. Base Emitter Saturation Voltage vs. Collector Current

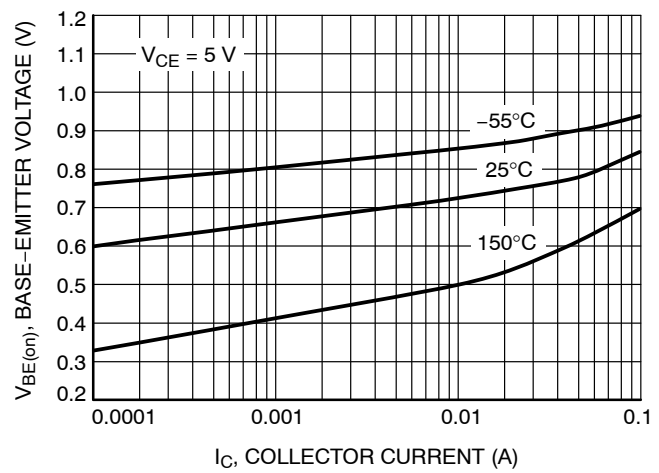


Figure 20. Base Emitter Voltage vs. Collector Current

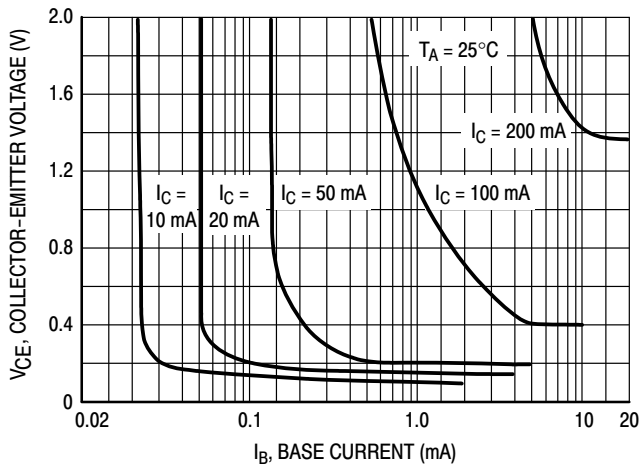


Figure 21. Collector Saturation Region

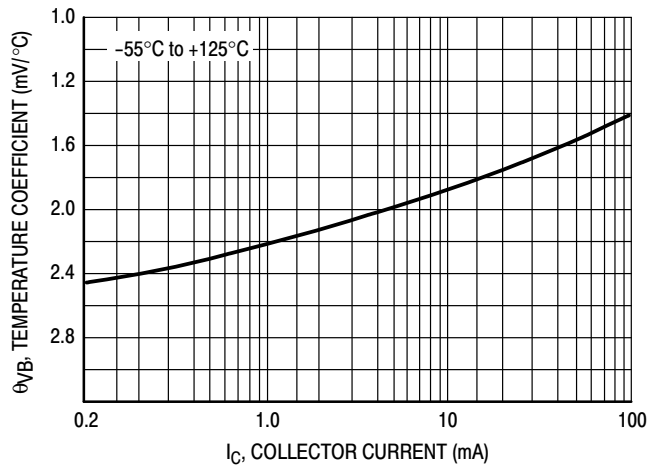


Figure 22. Base-Emitter Temperature Coefficient



BC846BPDW1T1G, BC847BPDW1T1G, BC848CPDW1T1G

TYPICAL NPN CHARACTERISTICS – BC847 SERIES

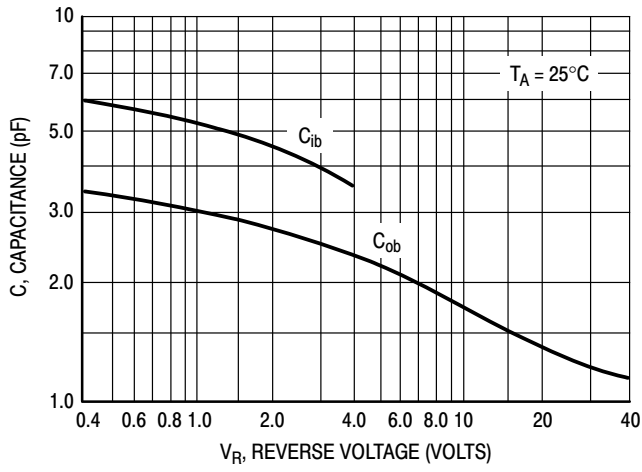


Figure 23. Capacitances

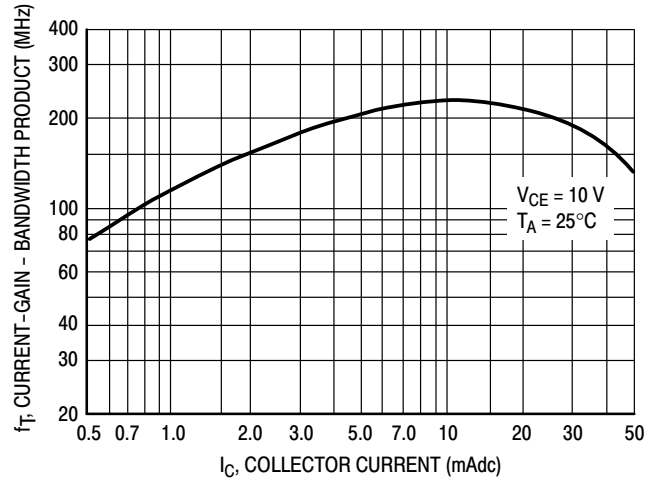


Figure 24. Current-Gain - Bandwidth Product

TYPICAL PNP CHARACTERISTICS – BC847 SERIES

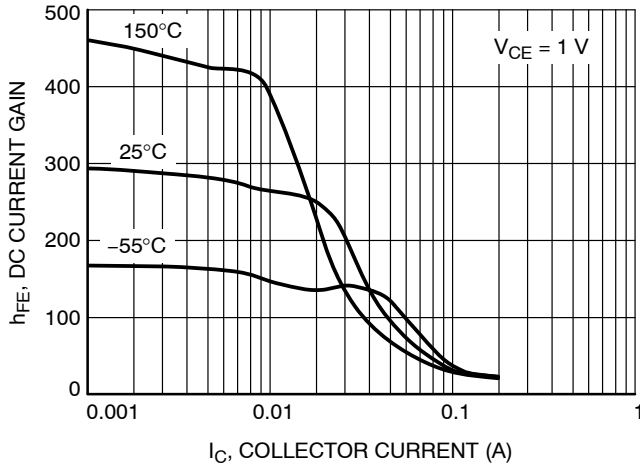


Figure 25. DC Current Gain vs. Collector Current

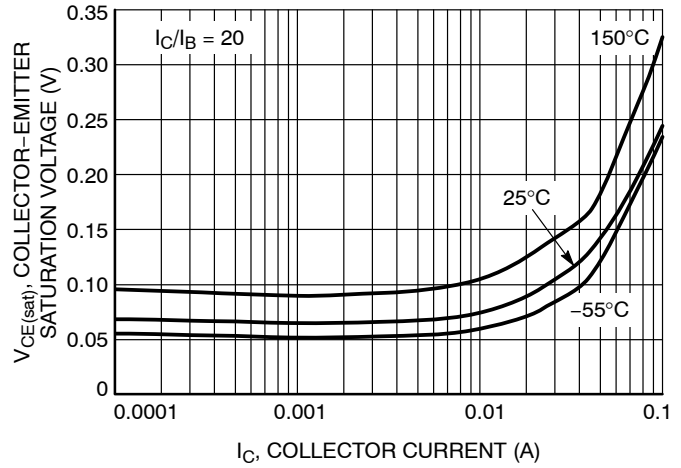


Figure 26. Collector Emitter Saturation Voltage vs. Collector Current

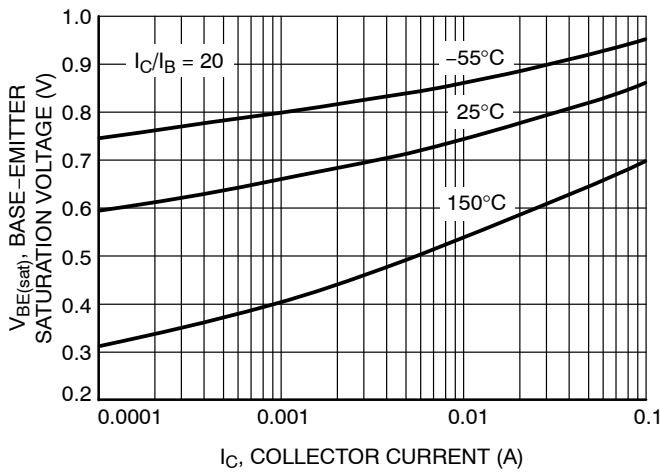


Figure 27. Base Emitter Saturation Voltage vs. Collector Current

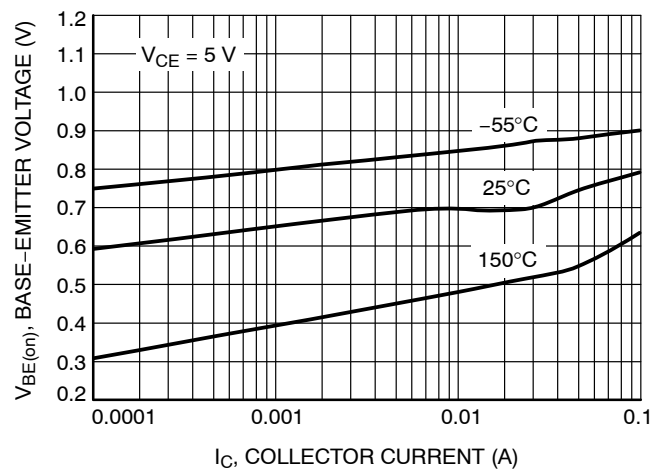


Figure 28. Base Emitter Voltage vs. Collector Current

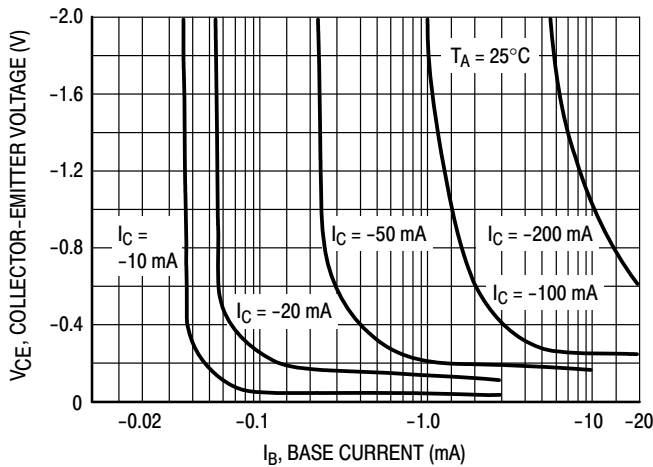


Figure 29. Collector Saturation Region

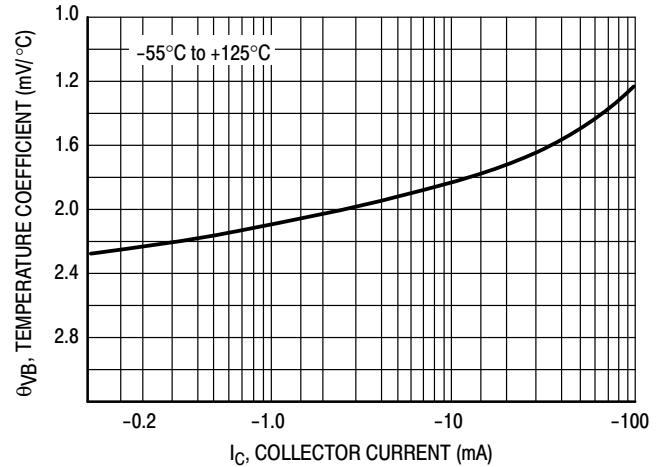


Figure 30. Base-Emitter Temperature Coefficient

BC846BPDW1T1G, BC847BPDW1T1G, BC848CPDW1T1G

TYPICAL PNP CHARACTERISTICS – BC847 SERIES

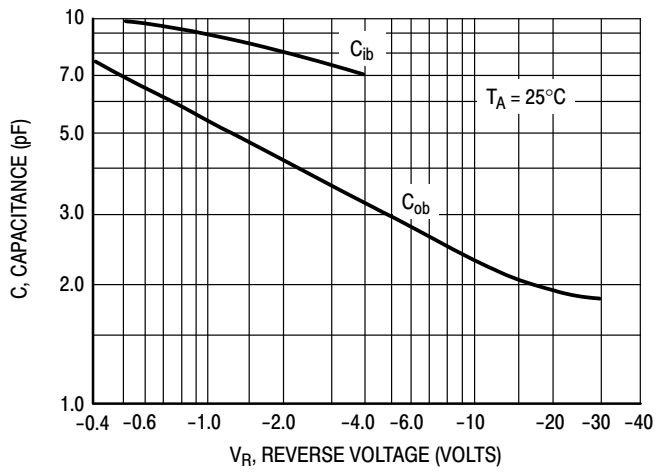


Figure 31. Capacitances

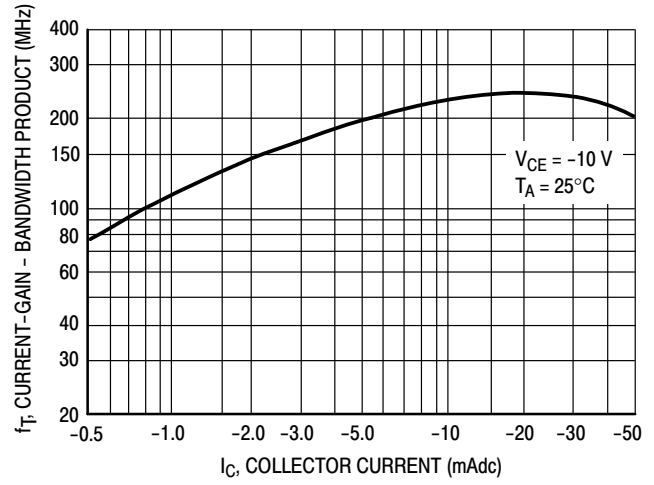


Figure 32. Current-Gain - Bandwidth Product

TYPICAL NPN CHARACTERISTICS – BC848 SERIES

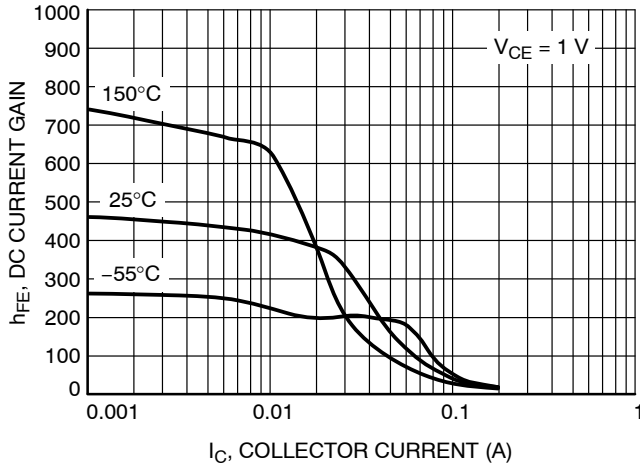


Figure 33. DC Current Gain vs. Collector Current

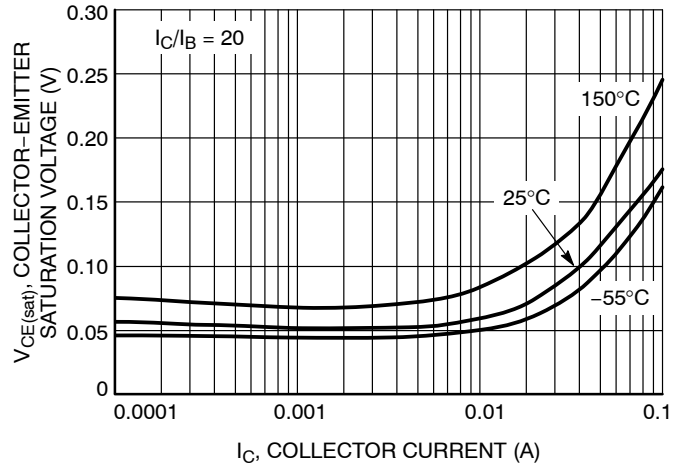


Figure 34. Collector Emitter Saturation Voltage vs. Collector Current

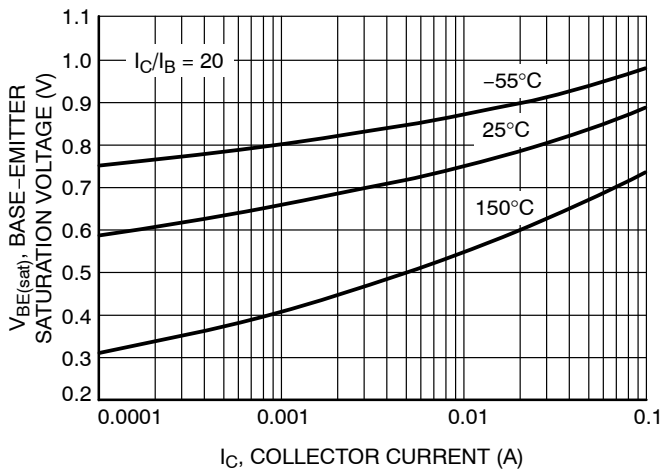


Figure 35. Base Emitter Saturation Voltage vs. Collector Current

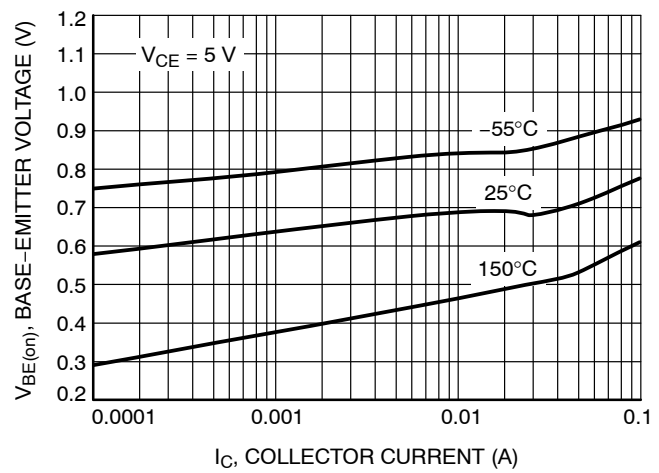


Figure 36. Base Emitter Voltage vs. Collector Current

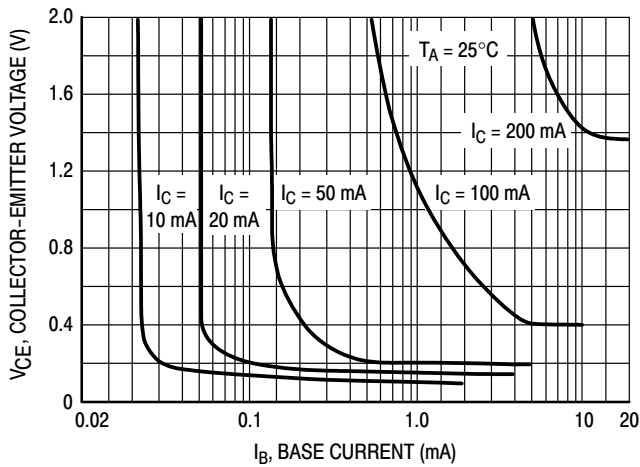


Figure 37. Collector Saturation Region

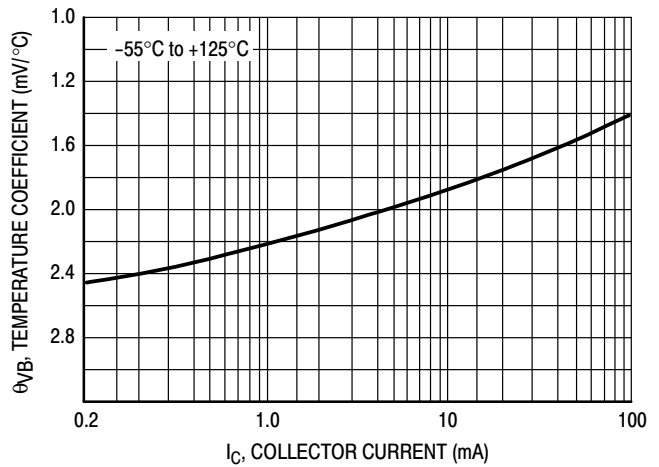


Figure 38. Base-Emitter Temperature Coefficient

# BC846BPDW1T1G, BC847BPDW1T1G, BC848CPDW1T1G

## TYPICAL NPN CHARACTERISTICS – BC848 SERIES

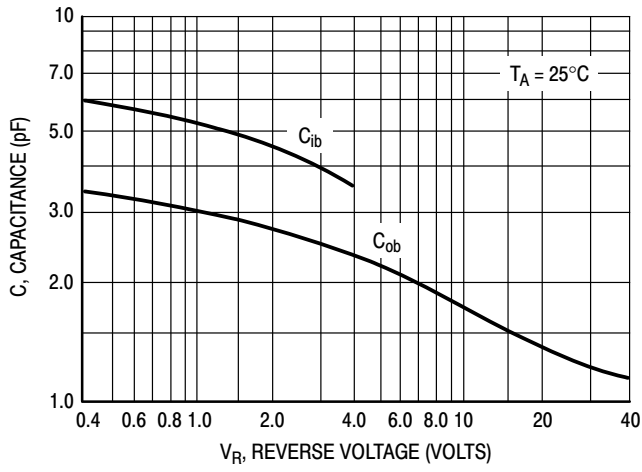


Figure 39. Capacitances

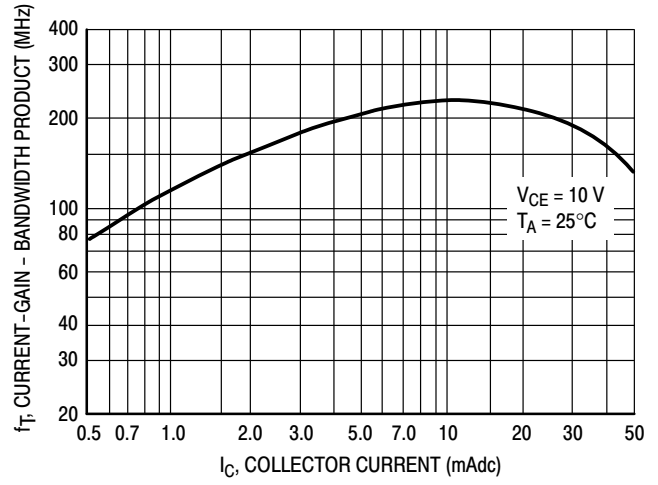


Figure 40. Current-Gain - Bandwidth Product

TYPICAL PNP CHARACTERISTICS – BC848 SERIES

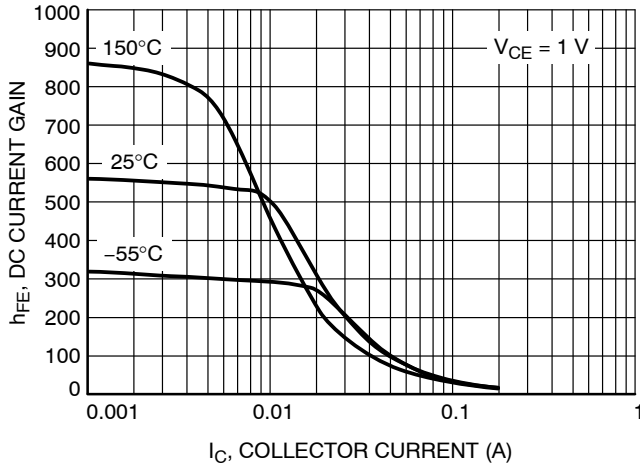


Figure 41. DC Current Gain vs. Collector Current

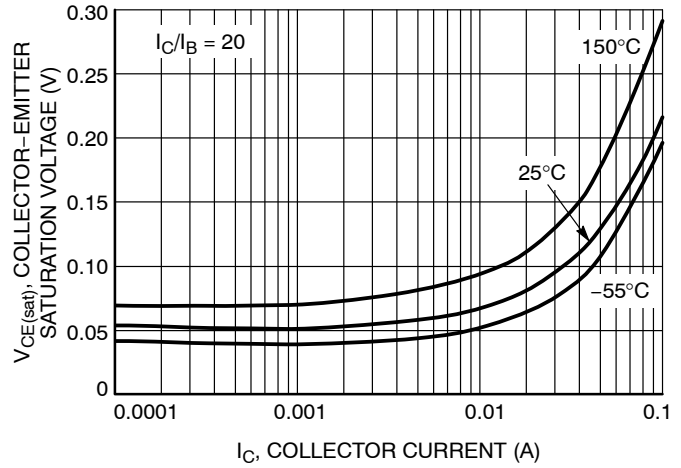


Figure 42. Collector Emitter Saturation Voltage vs. Collector Current

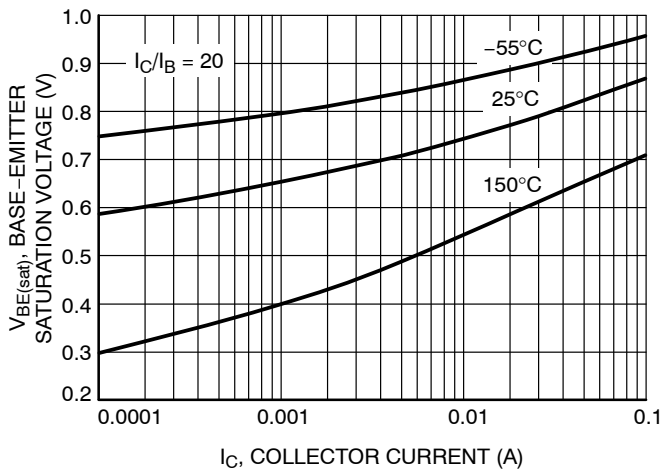


Figure 43. Base Emitter Saturation Voltage vs. Collector Current

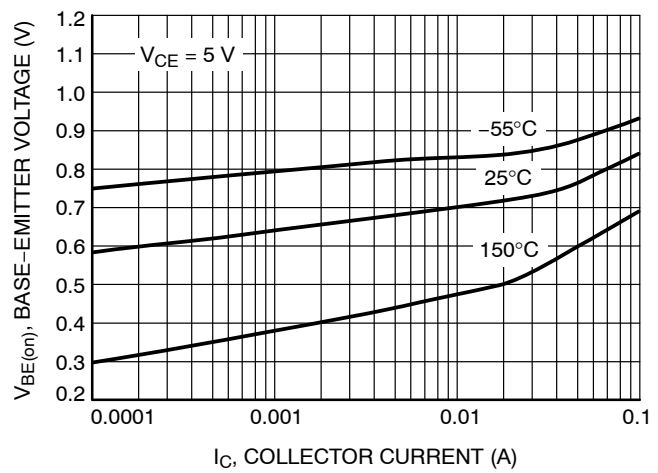


Figure 44. Base Emitter Voltage vs. Collector Current

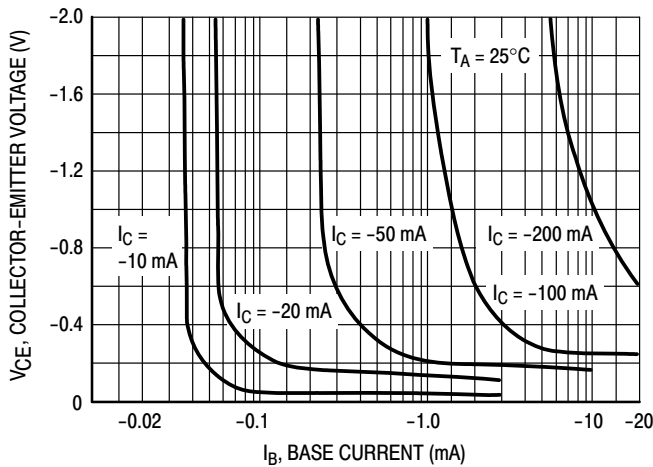


Figure 45. Collector Saturation Region

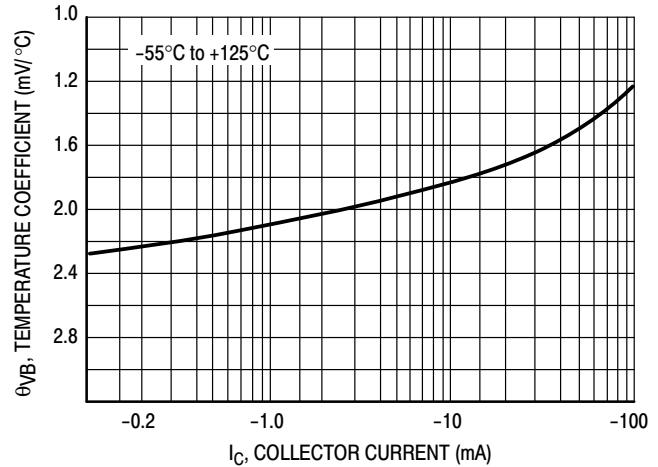


Figure 46. Base-Emitter Temperature Coefficient

# BC846BPDW1T1G, BC847BPDW1T1G, BC848CPDW1T1G

## TYPICAL PNP CHARACTERISTICS – BC848 SERIES

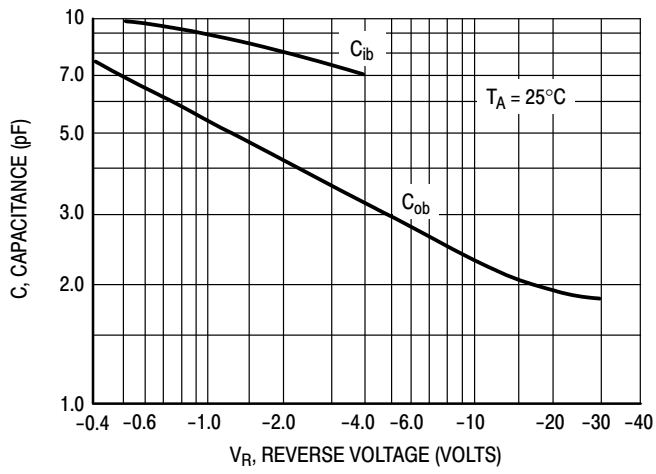


Figure 47. Capacitances

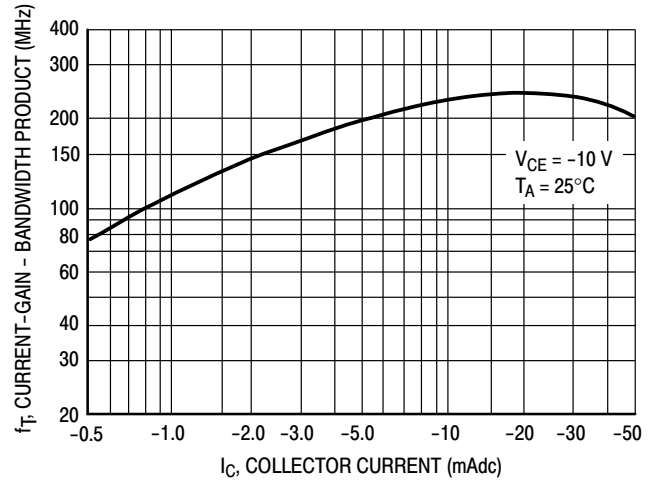


Figure 48. Current-Gain - Bandwidth Product

BC846BPDW1T1G, BC847BPDW1T1G, BC848CPDW1T1G

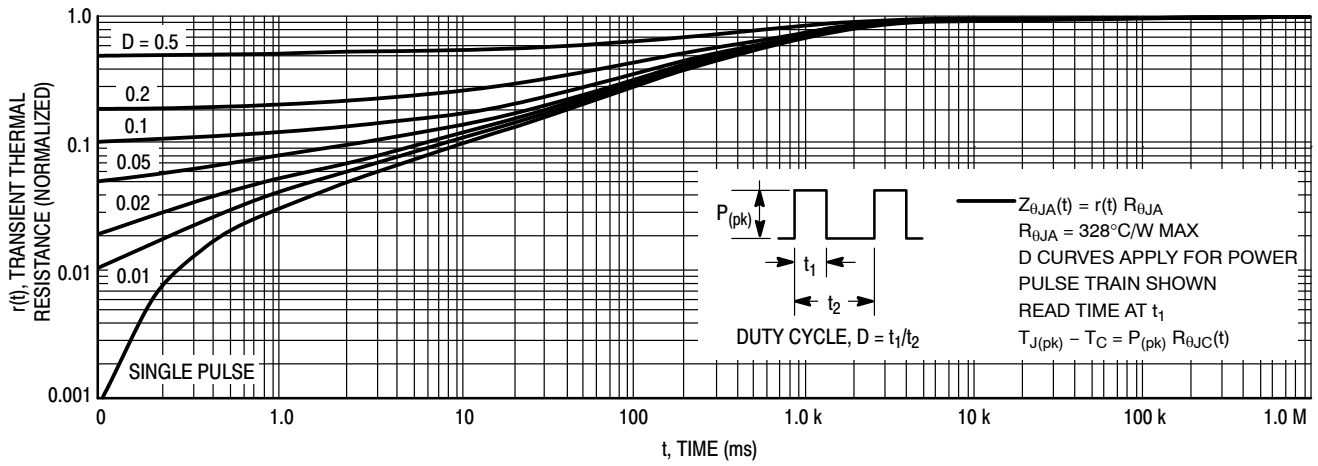


Figure 49. Thermal Response

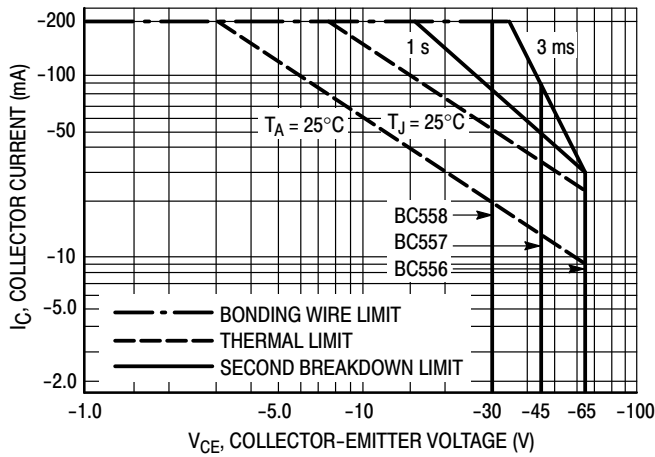


Figure 50. Active Region Safe Operating Area

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.

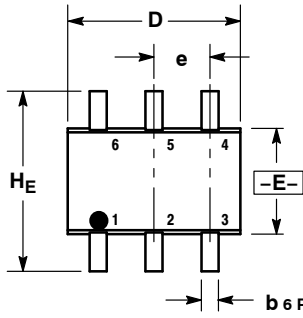
The data of Figure 50 is based upon  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  or  $T_A$  is variable depending upon conditions. Pulse curves are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 49. At high case or ambient temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by the secondary breakdown.



# BC846BPDW1T1G, BC847BPDW1T1G, BC848CPDW1T1G

## PACKAGE DIMENSIONS

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

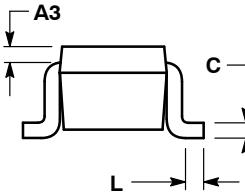
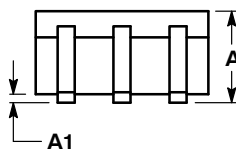


$\text{b } 6 \text{ PL}$   
 $\text{M } 0.2 (0.008) \text{ M } \text{E } \text{M}$

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419B-01 OBSOLETE, NEW STANDARD 419B-02.

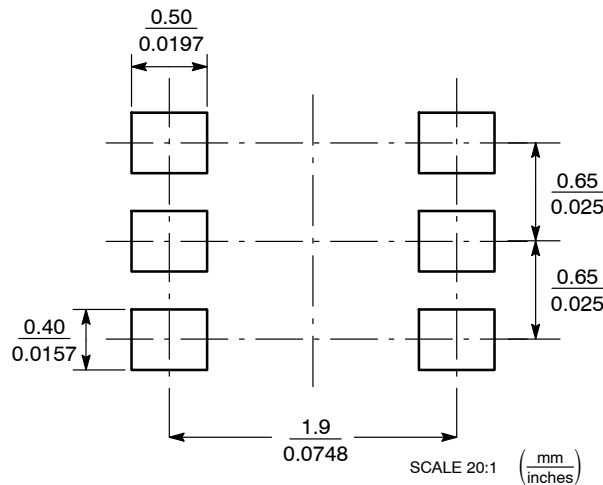
DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.80	0.95	1.10	0.031	0.037	0.043
A1	0.00	0.05	0.10	0.000	0.002	0.004
A3	0.20 REF			0.008 REF		
b	0.10	0.21	0.30	0.004	0.008	0.012
C	0.10	0.14	0.25	0.004	0.005	0.010
D	1.80	2.00	2.20	0.070	0.078	0.086
E	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65 BSC			0.026 BSC		
L	0.10	0.20	0.30	0.004	0.008	0.012
HE	2.00	2.10	2.20	0.078	0.082	0.086



STYLE 1:

- PIN 1. EMITTER 2
- BASE 2
- COLLECTOR 1
- EMITTER 1
- BASE 1
- COLLECTOR 2

### SOLDERING FOOTPRINT\*



### SC-88/SC70-6/SOT-363

\*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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