

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series



ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

## 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 BC846, SBC846 BC847, SBC847 BC848	$V_{CEO}$	65 45 30	V
Collector-Base Voltage BC846, SBC846 BC847, SBC847 BC848	$V_{CBO}$	80 50 30	V
Emitter-Base Voltage	$V_{EBO}$	6.0	V
Collector Current – Continuous	$I_C$	100	mAdc
Collector Current – Peak	$I_{CM}$	200	mAdc

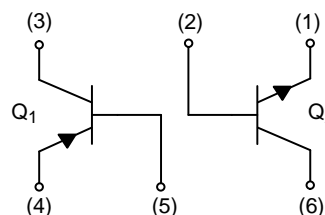
#### MAXIMUM RATINGS – PNP

Rating	Symbol	Value	Unit
Collector-Emitter Voltage BC846, SBC846 BC847, SBC847 BC848	$V_{CEO}$	-65 -45 -30	V
Collector-Base Voltage BC846, SBC846 BC847, SBC847 BC848	$V_{CBO}$	-80 -50 -30	V
Emitter-Base Voltage	$V_{EBO}$	-6.0	V
Collector Current – Continuous	$I_C$	-100	mAdc
Collector Current – Peak	$I_{CM}$	-200	mAdc

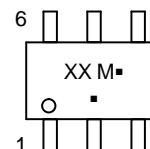
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



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, SBC846BPDW1T1G	BB	SOT-363 (Pb-Free)	3,000 / Tape & Reel
SBC846BPDW1T2G	BB	SOT-363 (Pb-Free)	3,000 / Tape & Reel
BC847BPDW1T1G	BF	SOT-363 (Pb-Free)	3,000 / Tape & Reel
SBC847BPDW1T1G	BF	SOT-363 (Pb-Free)	3,000 / Tape & Reel
SBC847BPDW1T3G	BF	SOT-363 (Pb-Free)	10,000 / Tape & Reel
BC847BPDW1T2G	BF	SOT-363 (Pb-Free)	3,000 / Tape & Reel
BC848CPDW1T1G	BL	SOT-363 (Pb-Free)	3,000 / 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.

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

## 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/ $^\circ\text{C}$ mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	328	$^\circ\text{C/W}$
Junction and Storage Temperature	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

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

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

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage ( $I_C = 10\text{ mA}$ ) BC846, SBC846 Series BC847, SBC847 Series BC848 Series	$V_{(BR)CEO}$	65 45 30	- - -	- - -	V
Collector-Emitter Breakdown Voltage ( $I_C = 10\ \mu\text{A}, V_{EB} = 0$ ) BC846, SBC846 Series BC847B, SBC847B Only BC848 Series	$V_{(BR)CES}$	80 50 30	- - -	- - -	V
Collector-Base Breakdown Voltage ( $I_C = 10\ \mu\text{A}$ ) BC846, SBC846 Series BC847, SBC847 Series BC848 Series	$V_{(BR)CBO}$	80 50 30	- - -	- - -	V
Emitter-Base Breakdown Voltage ( $I_E = 1.0\ \mu\text{A}$ ) BC846, SBC846 Series BC847, SBC847 Series BC848 Series	$V_{(BR)EBO}$	6.0 6.0 6.0	- - -	- - -	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 $\mu\text{A}$

### ON CHARACTERISTICS

DC Current Gain ( $I_C = 10\ \mu\text{A}, V_{CE} = 5.0\text{ V}$ ) BC846B, SBC846B, BC847B, SBC847B BC848C ( $I_C = 2.0\text{ mA}, V_{CE} = 5.0\text{ V}$ ) BC846B, SBC846B, BC847B, SBC847B BC848C	$h_{FE}$	- - 200 420	150 270 290 520	- - 475 800	-
Collector-Emitter Saturation Voltage ( $I_C = 10\text{ mA}, I_B = 0.5\text{ mA}$ ) All devices except SBC847BPDW1T1G SBC847BPDW1T1G only ( $I_C = 100\text{ mA}, I_B = 5.0\text{ mA}$ ) All devices ( $I_C = 2\text{ mA}, I_B = 0.5\text{ mA}$ ) SBC847BPDW1T1G only	$V_{CE(sat)}$	- - - -	- - - 0.024	0.25 0.1 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

### SMALL-SIGNAL CHARACTERISTICS

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

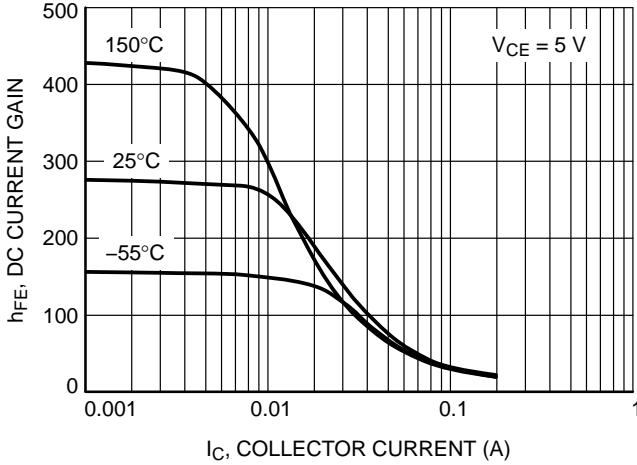
## BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

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

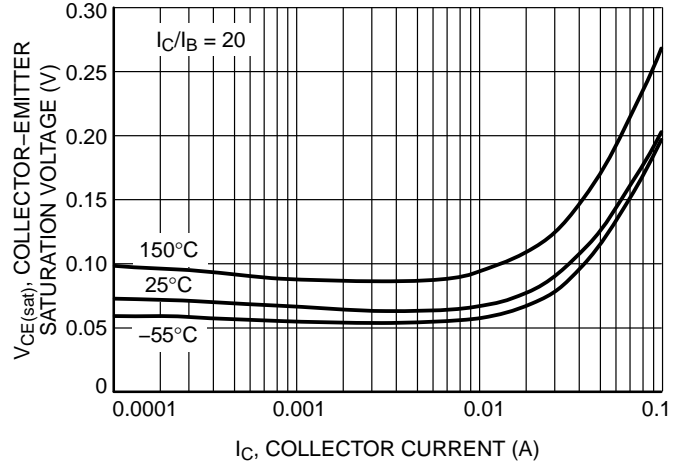
Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Breakdown Voltage ( $I_C = -10\text{ mA}$ ) BC846, SBC846 Series BC847, SBC847 Series BC848 Series	$V_{(BR)CEO}$	-65 -45 -30	-	-	V
Collector–Emitter Breakdown Voltage ( $I_C = -10\ \mu\text{A}$ , $V_{EB} = 0$ ) BC846, SBC846 Series BC847, SBC847 Series BC848 Series	$V_{(BR)CES}$	-80 -50 -30	-	-	V
Collector–Base Breakdown Voltage ( $I_C = -10\ \mu\text{A}$ ) BC846, SBC846 Series BC847, SBC847 Series BC848 Series	$V_{(BR)CBO}$	-80 -50 -30	-	-	V
Emitter–Base Breakdown Voltage ( $I_E = -1.0\ \mu\text{A}$ ) BC846, SBC846 Series BC847, SBC847 Series BC848 Series	$V_{(BR)EBO}$	-6.0 -6.0 -6.0	-	-	V
Collector Cutoff Current ( $V_{CB} = -30\text{ V}$ ) ( $V_{CB} = -30\text{ V}$ , $T_A = 150^\circ\text{C}$ )	$I_{CBO}$	- -	- -	-15 -4.0	nA $\mu\text{A}$
<b>ON CHARACTERISTICS</b>					
DC Current Gain ( $I_C = -10\ \mu\text{A}$ , $V_{CE} = -5.0\text{ V}$ ) BC846B, SBC846B, BC847B, SBC847B BC848C ( $I_C = -2.0\text{ mA}$ , $V_{CE} = -5.0\text{ V}$ ) BC846B, SBC846B, BC847B, SBC847B BC848C	$h_{FE}$	- - 200 420	150 270 290 520	- - 475 800	-
Collector–Emitter Saturation Voltage ( $I_C = -10\text{ mA}$ , $I_B = -0.5\text{ mA}$ ) All devices except SBC847BPDW1T1G SBC847BPDW1T1G only ( $I_C = -100\text{ mA}$ , $I_B = -5.0\text{ mA}$ ) All devices ( $I_C = -2\text{ mA}$ , $I_B = -0.5\text{ mA}$ ) SBC847BPDW1T1G only	$V_{CE(sat)}$	- - - -	- - - -0.024	-0.3 -0.1 -0.65 -	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 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	V
<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

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

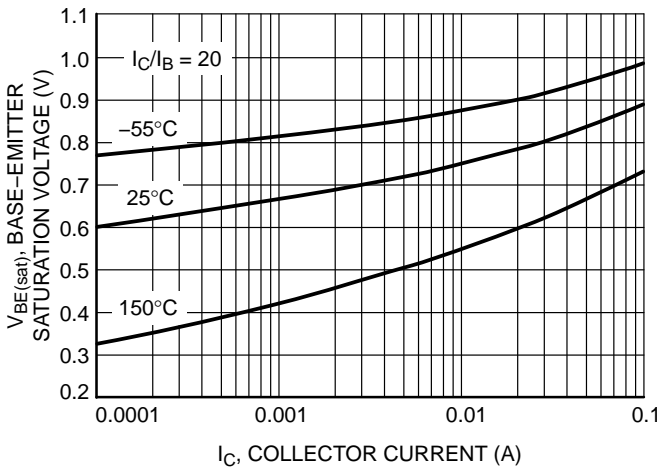
## TYPICAL NPN CHARACTERISTICS – BC846/SBC846



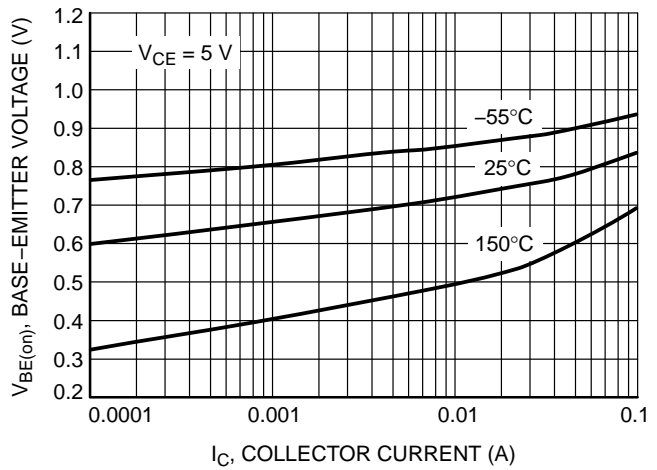
**Figure 1. DC Current Gain vs. Collector Current**



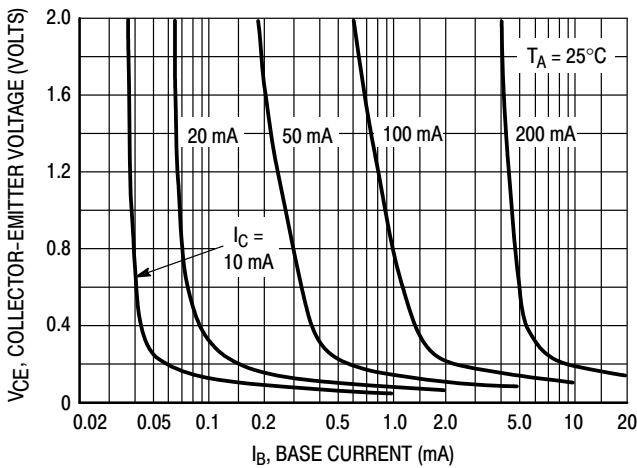
**Figure 2. Collector Emitter Saturation Voltage vs. Collector Current**



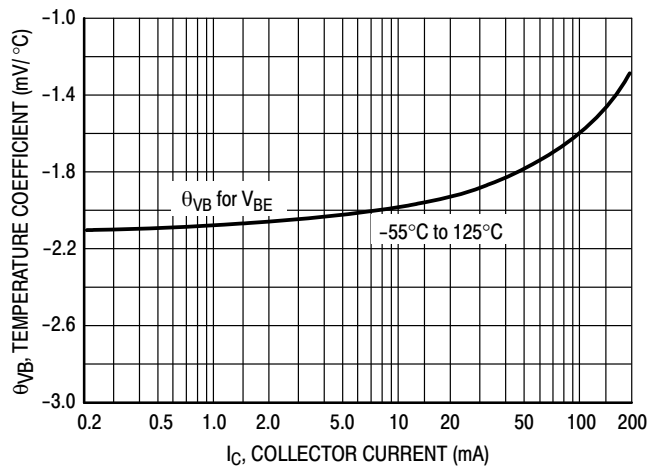
**Figure 3. Base Emitter Saturation Voltage vs. Collector Current**



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



**Figure 5. Collector Saturation Region**



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

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

## TYPICAL NPN CHARACTERISTICS – BC846/SBC846

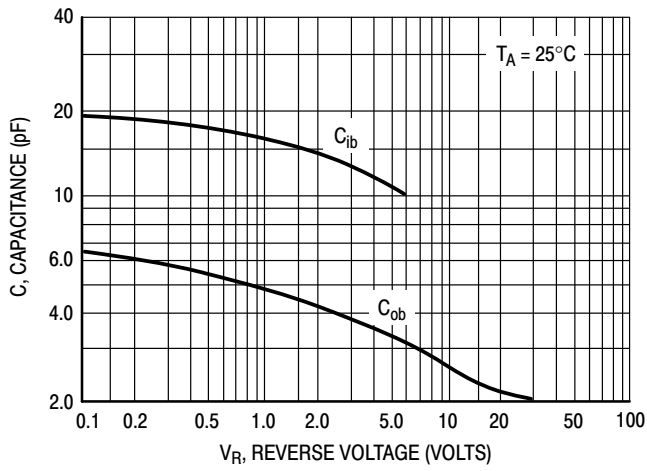


Figure 7. Capacitance

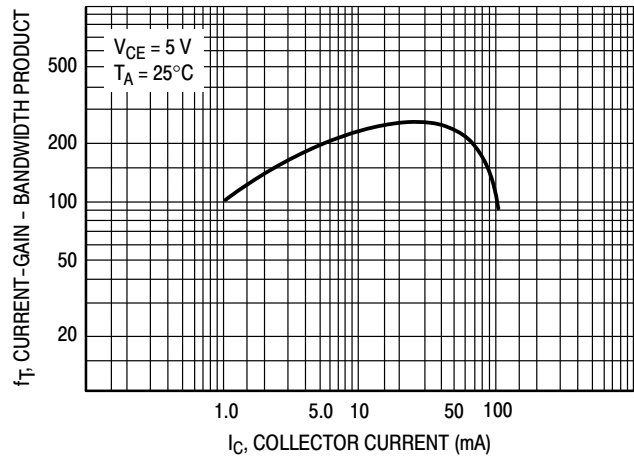
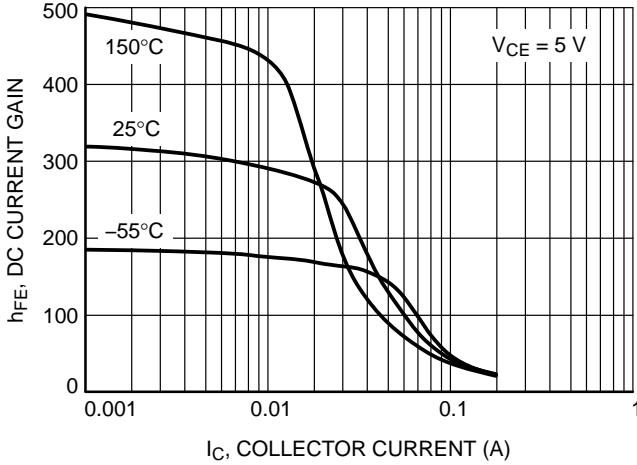


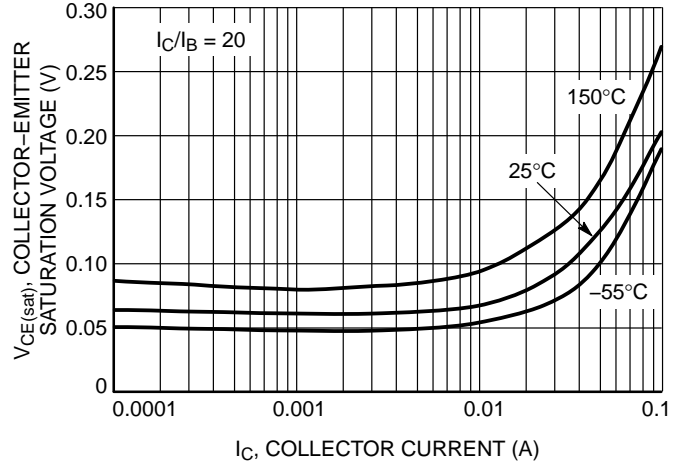
Figure 8. Current-Gain - Bandwidth Product

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

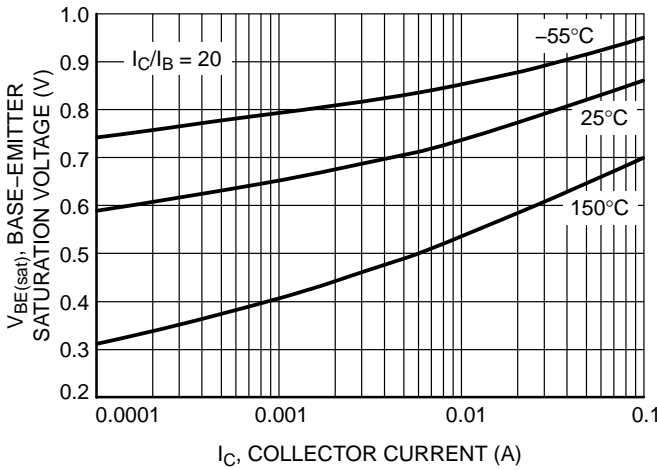
## TYPICAL PNP CHARACTERISTICS — BC846/SBC846



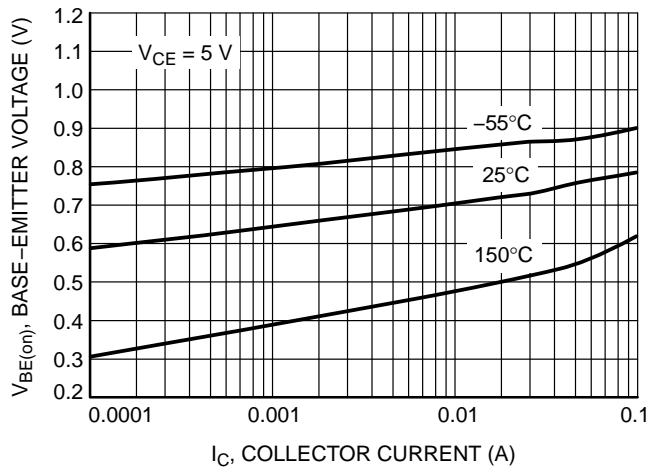
**Figure 9. DC Current Gain vs. Collector Current**



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



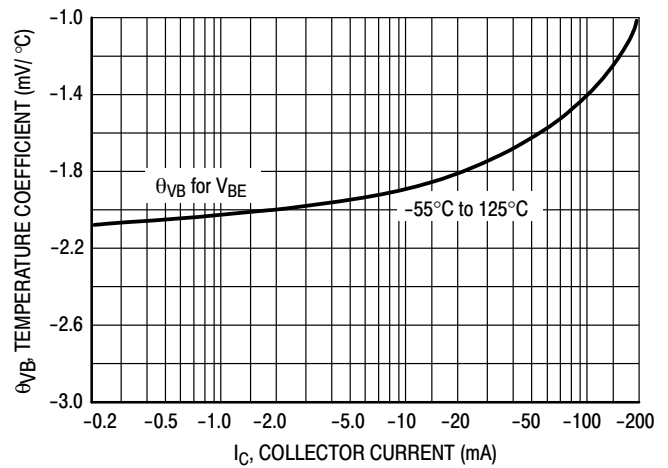
**Figure 11. Base Emitter Saturation Voltage vs. Collector Current**



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



**Figure 13. Collector Saturation Region**



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

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

## TYPICAL PNP CHARACTERISTICS — BC846/SBC846



Figure 15. Capacitance

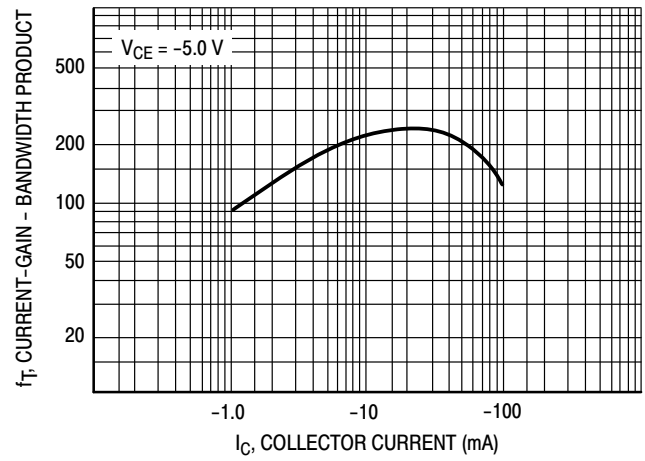
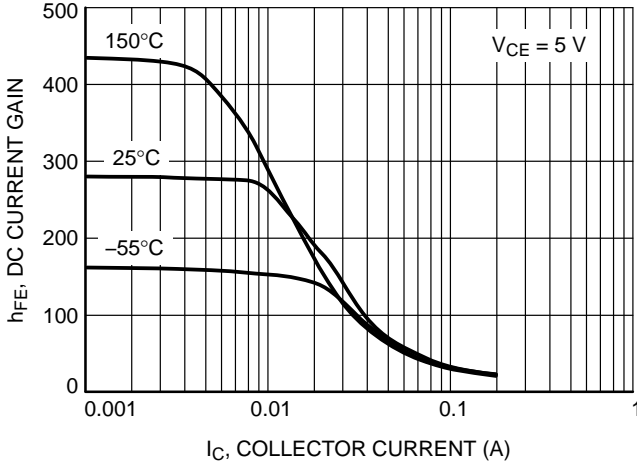


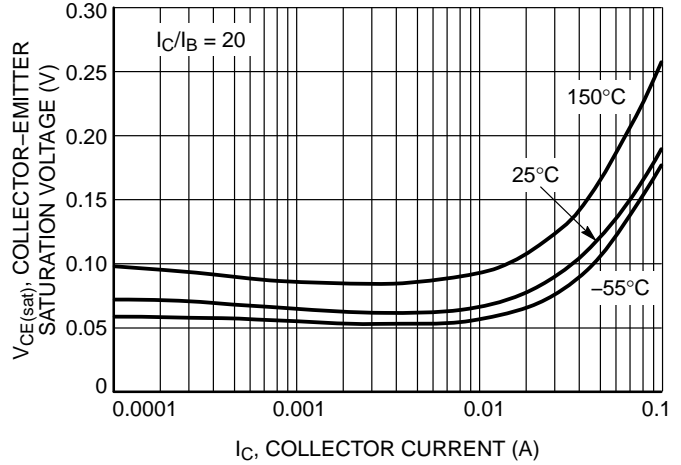
Figure 16. Current-Gain - Bandwidth Product

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

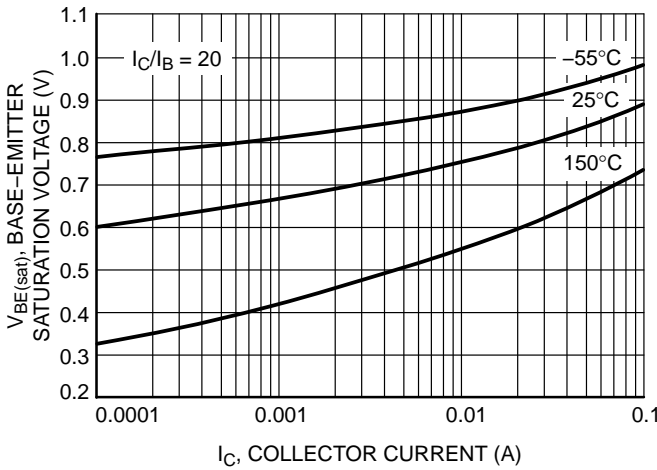
## TYPICAL NPN CHARACTERISTICS – BC847/SBC847 SERIES



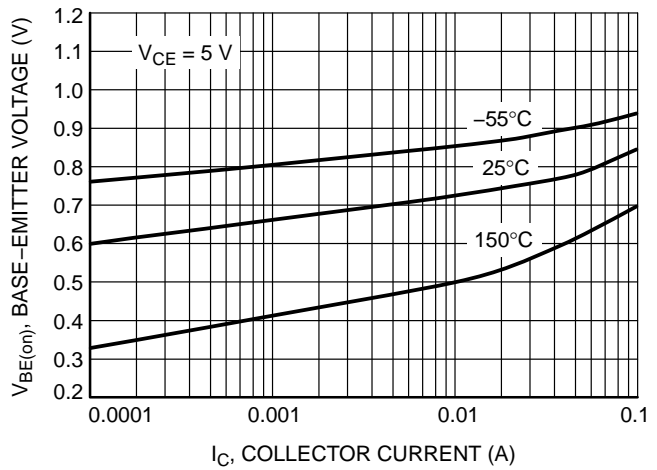
**Figure 17. DC Current Gain vs. Collector Current**



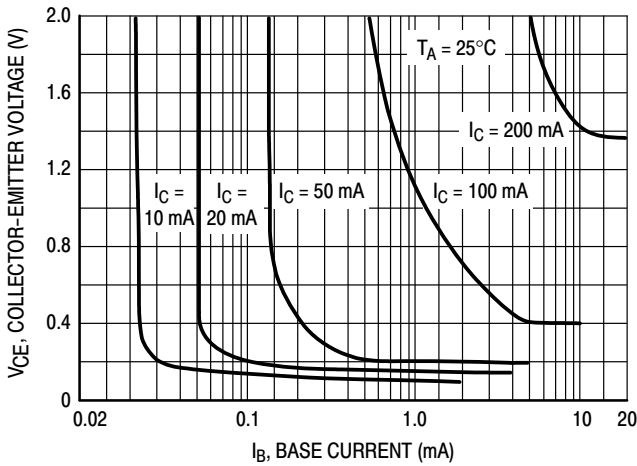
**Figure 18. Collector Emitter Saturation Voltage vs. Collector Current**



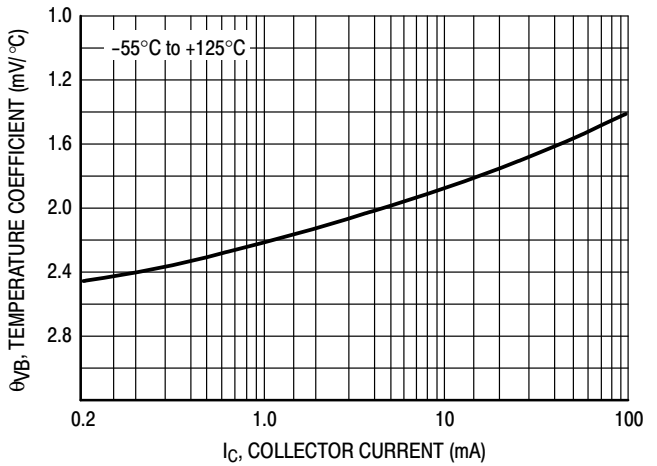
**Figure 19. Base Emitter Saturation Voltage vs. Collector Current**



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



**Figure 21. Collector Saturation Region**



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



# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

## TYPICAL NPN CHARACTERISTICS – BC847/SBC847 SERIES



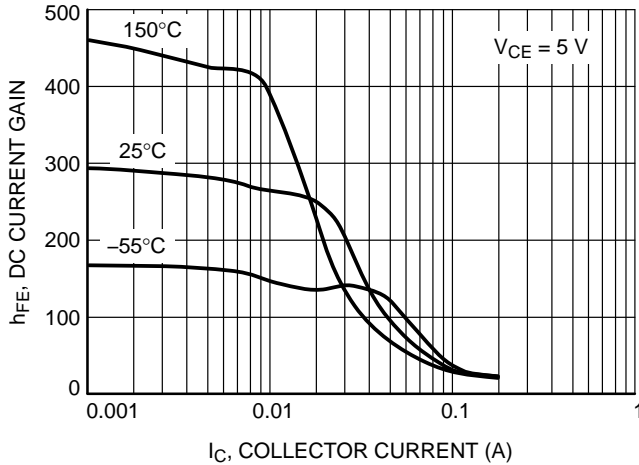
Figure 23. Capacitances



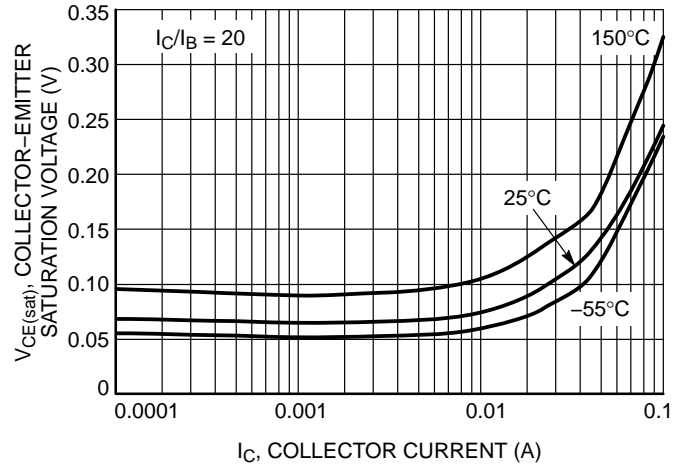
Figure 24. Current-Gain - Bandwidth Product

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

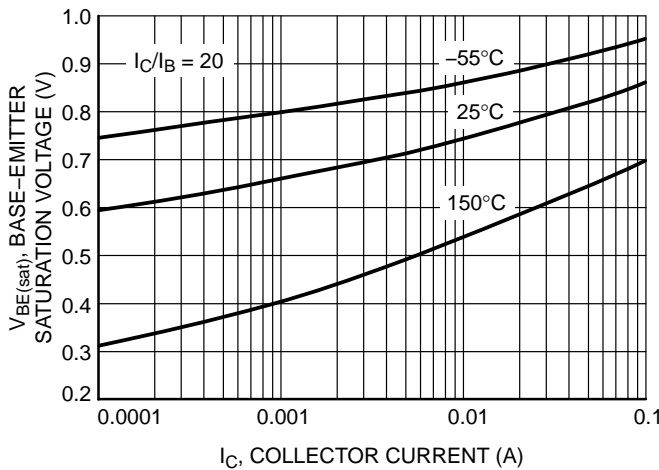
## TYPICAL PNP CHARACTERISTICS – BC847/SBC847 SERIES



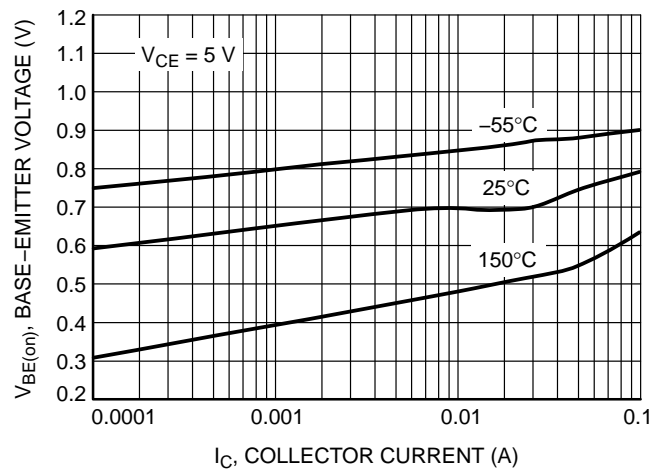
**Figure 25. DC Current Gain vs. Collector Current**



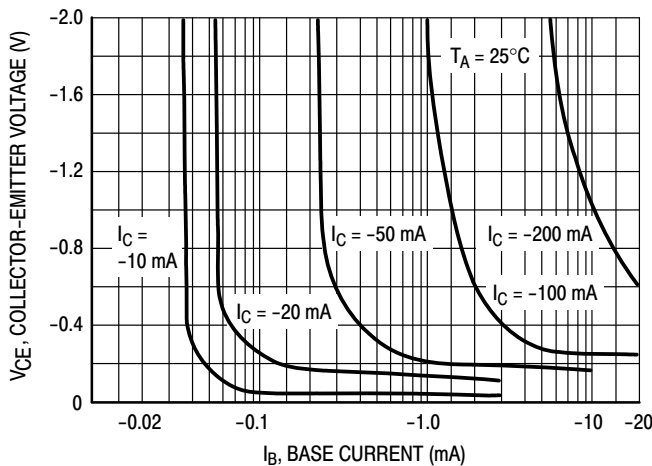
**Figure 26. Collector Emitter Saturation Voltage vs. Collector Current**



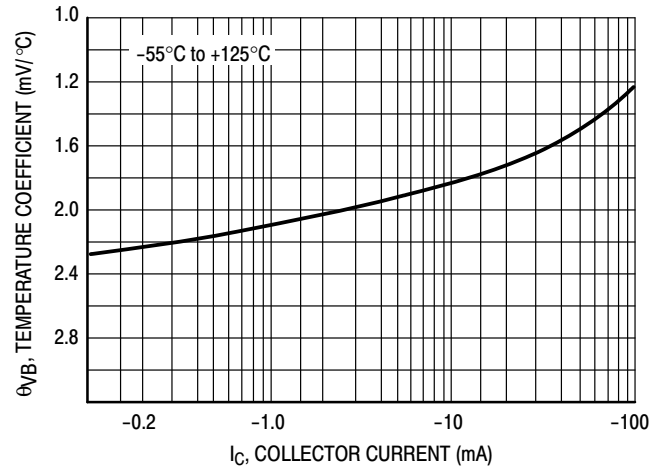
**Figure 27. Base Emitter Saturation Voltage vs. Collector Current**



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



**Figure 29. Collector Saturation Region**



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

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

## TYPICAL PNP CHARACTERISTICS – BC847/SBC847 SERIES

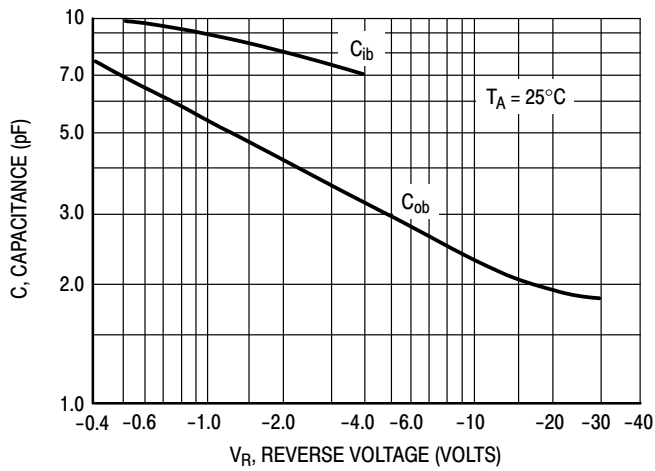


Figure 31. Capacitances

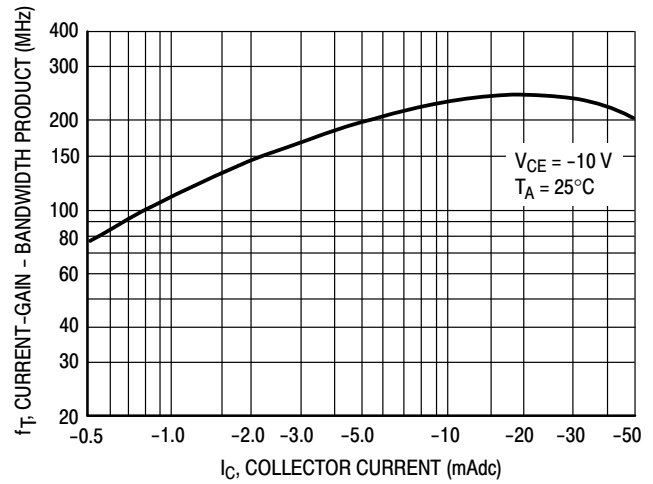
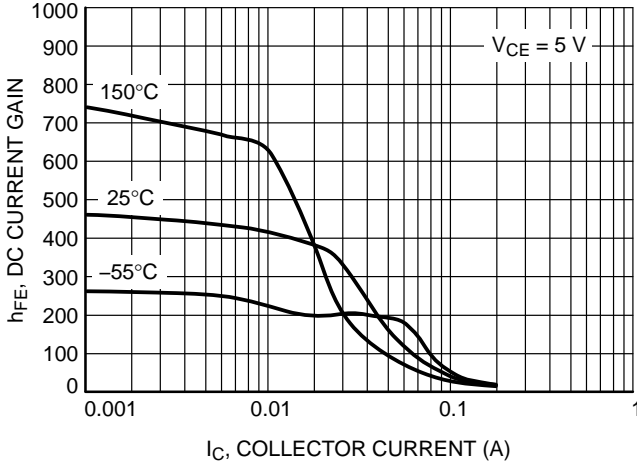


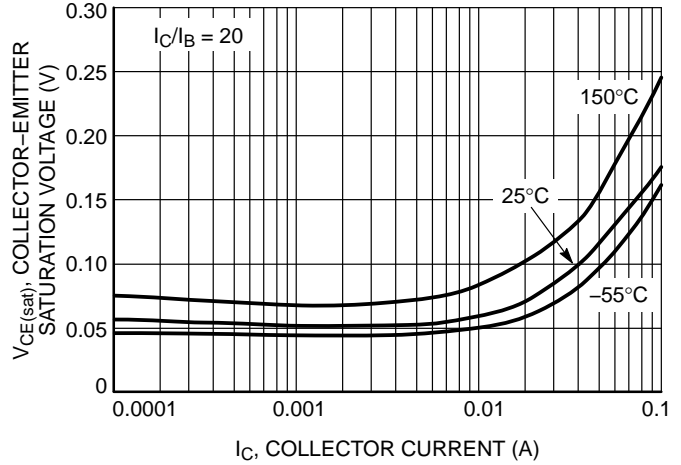
Figure 32. Current-Gain - Bandwidth Product

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

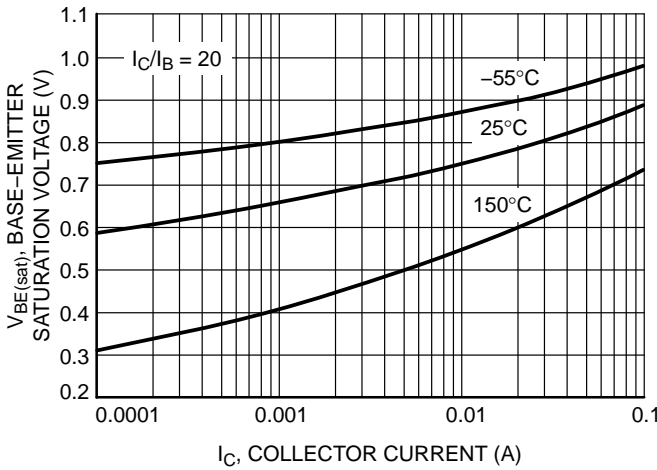
## TYPICAL NPN CHARACTERISTICS – BC848 SERIES



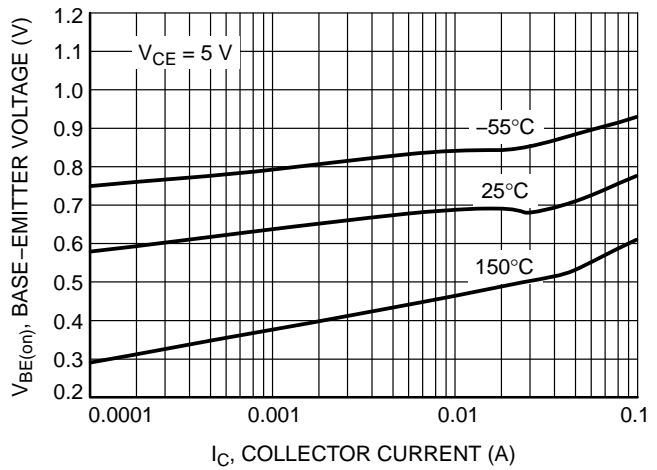
**Figure 33. DC Current Gain vs. Collector Current**



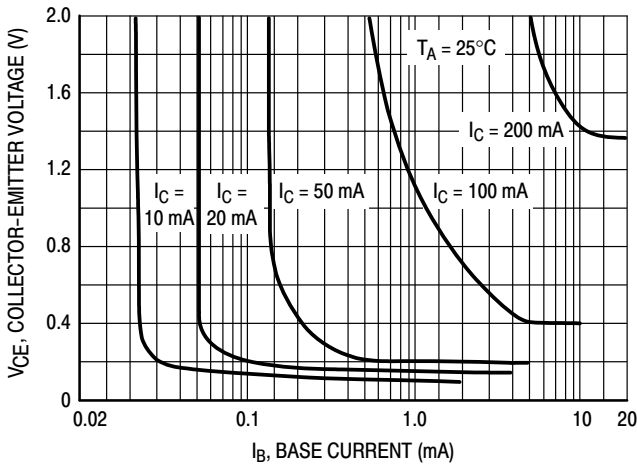
**Figure 34. Collector Emitter Saturation Voltage vs. Collector Current**



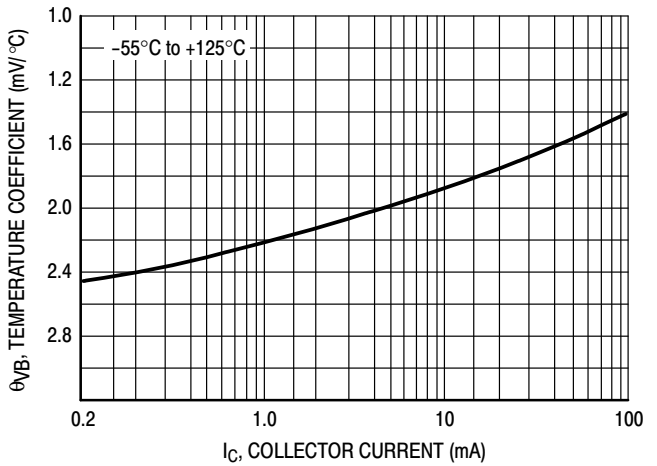
**Figure 35. Base Emitter Saturation Voltage vs. Collector Current**



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



**Figure 37. Collector Saturation Region**



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

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

## TYPICAL NPN CHARACTERISTICS – BC848 SERIES



Figure 39. Capacitances

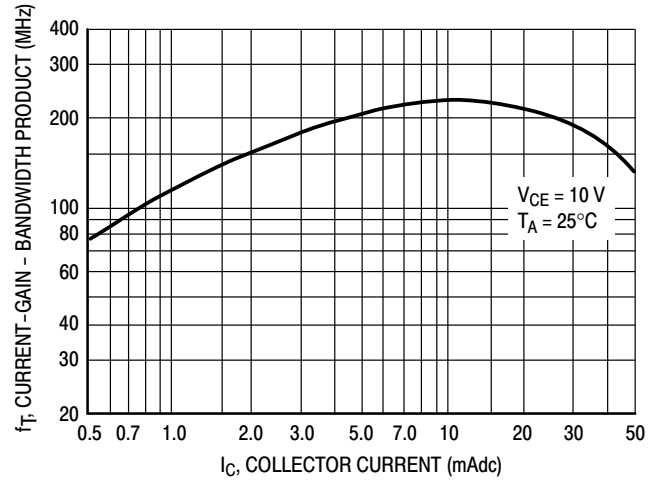
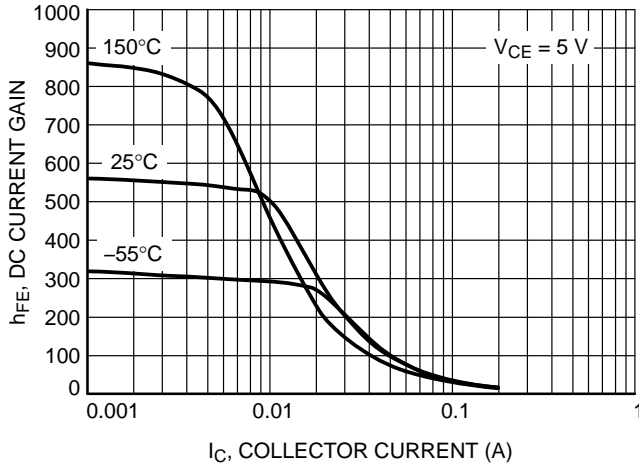


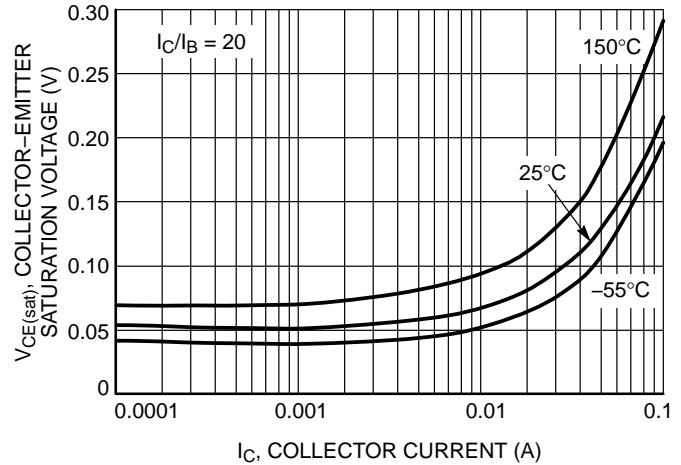
Figure 40. Current-Gain - Bandwidth Product

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

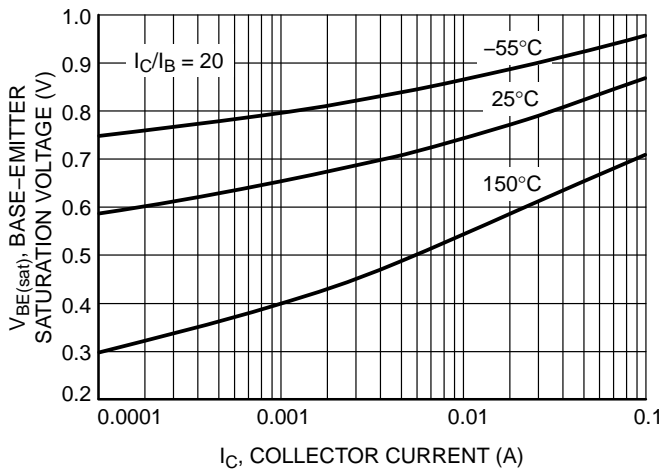
## TYPICAL PNP CHARACTERISTICS – BC848 SERIES



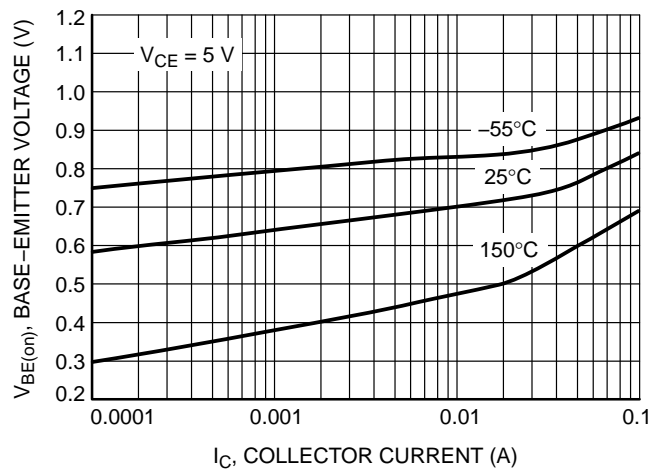
**Figure 41. DC Current Gain vs. Collector Current**



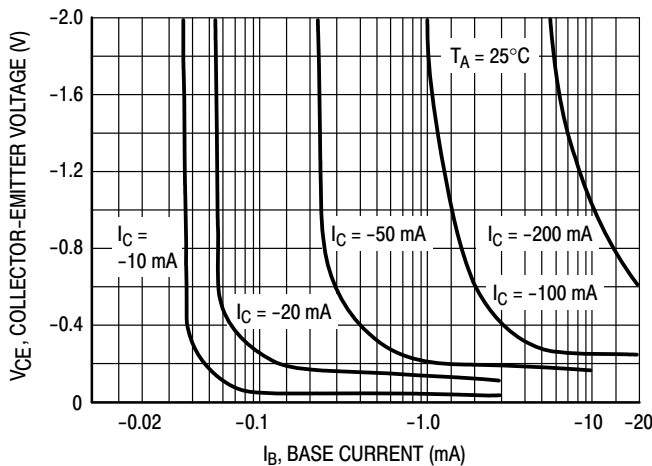
**Figure 42. Collector Emitter Saturation Voltage vs. Collector Current**



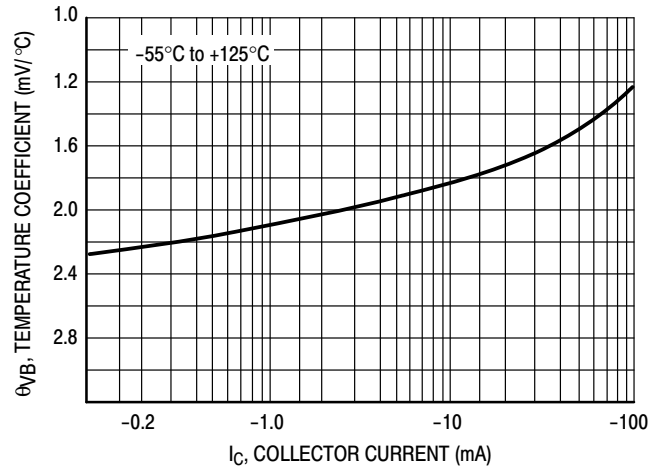
**Figure 43. Base Emitter Saturation Voltage vs. Collector Current**



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



**Figure 45. Collector Saturation Region**



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

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

## TYPICAL PNP CHARACTERISTICS – BC848 SERIES

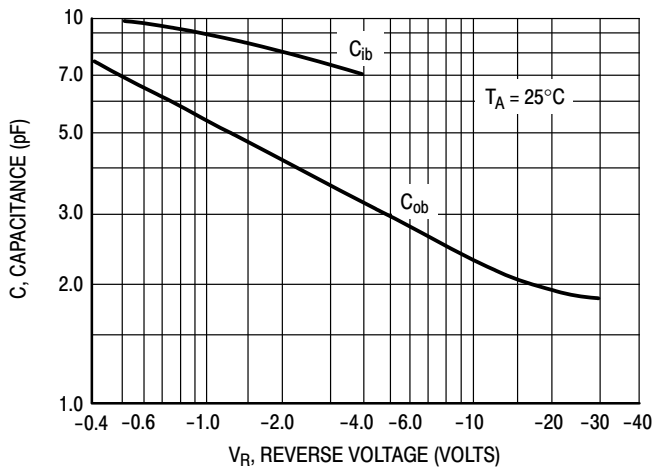


Figure 47. Capacitances

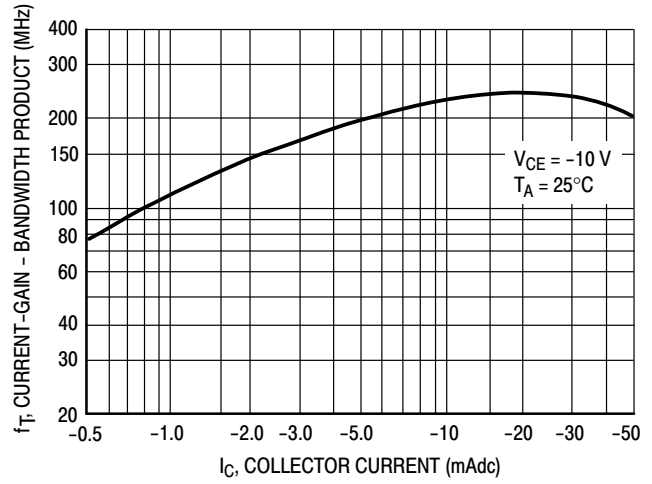


Figure 48. Current-Gain - Bandwidth Product

# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

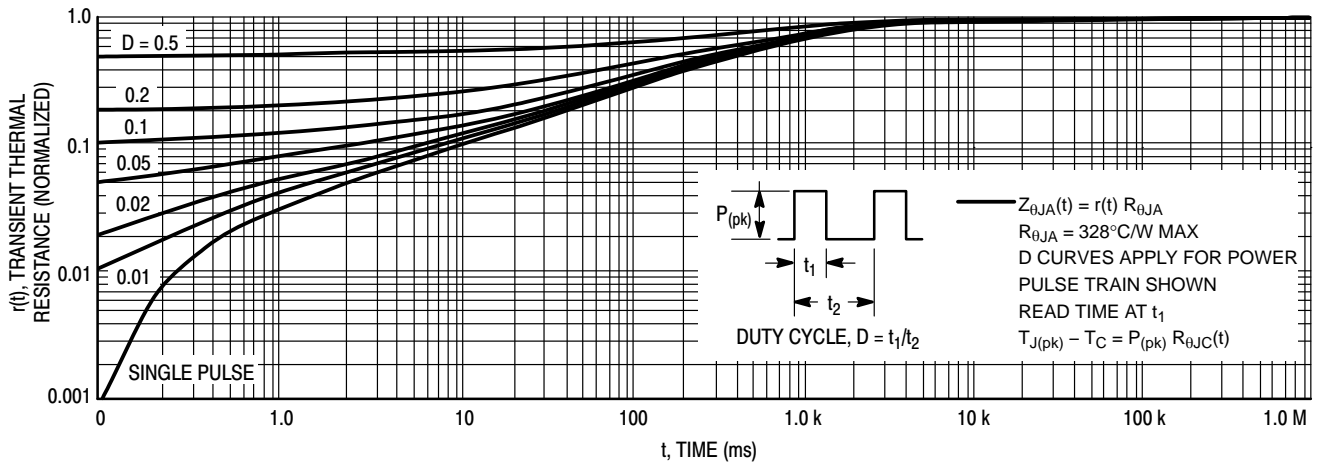


Figure 49. Thermal Response

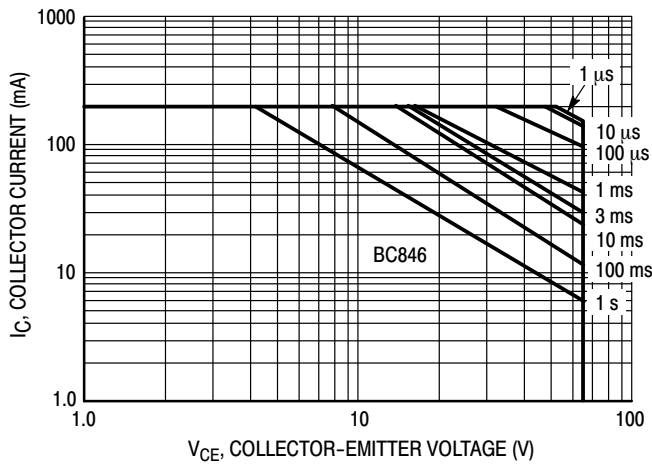


Figure 50. Safe Operating Area – BC846

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  $T_{J(pk)} = 150^{\circ}\text{C}$ ;  $T_C$  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.

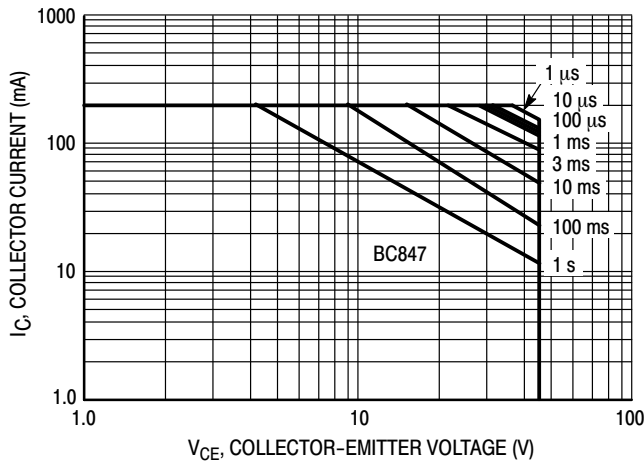


Figure 51. Safe Operating Area – BC847

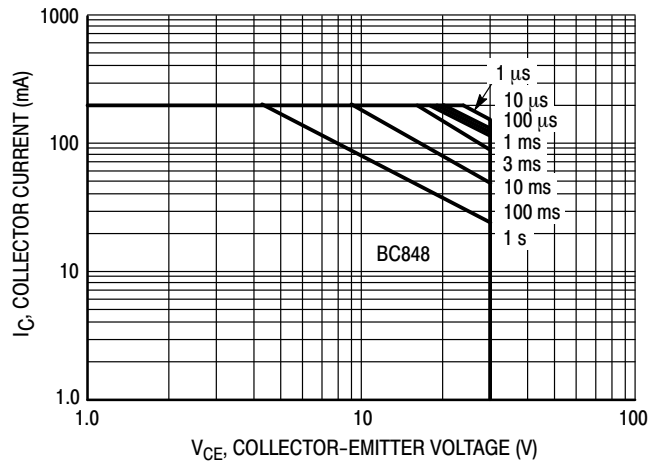


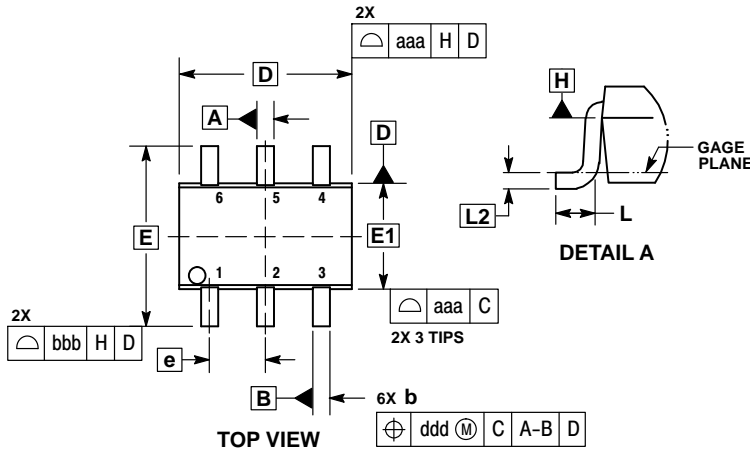
Figure 52. Safe Operating Area – BC848



# BC846BPDW1, BC847BPDW1, BC848CPDW1 Series

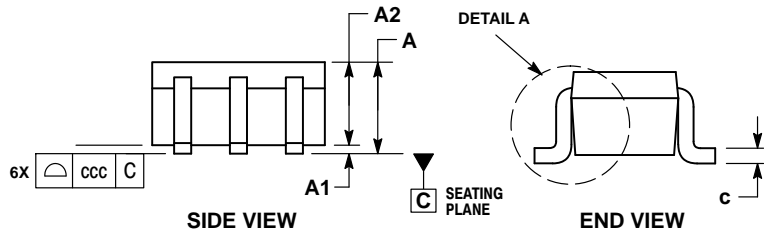
## PACKAGE DIMENSIONS

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

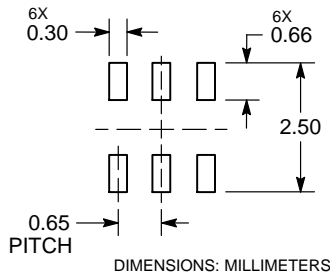


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
  4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES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

DIM	MILLIMETERS			INCHES		
	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		



### RECOMMENDED SOLDERING FOOTPRINT\*



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

\*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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