



# DATA SHEET

SEMICONDUCTOR

BC846BPDW/BC847BPDW

## Dual General Purpose Transistors

### NPN/PNP Duals (Complimentary)

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

- Pb-Free Package is Available

#### 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

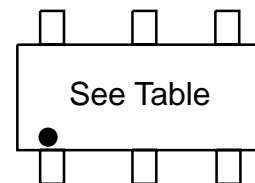
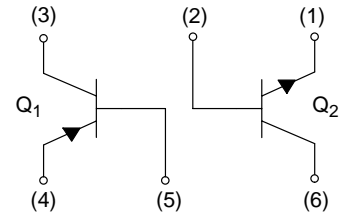
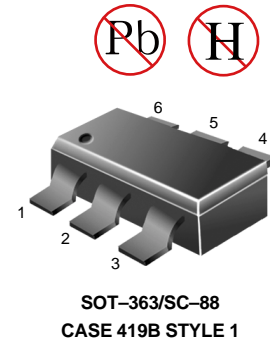
#### MAXIMUM RATINGS – PNP

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

#### 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/°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

## BC846BPDW/BC847BPDW

### 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 BC847C, BC848C $h_{FE}$	– –	150 270	– –	–
( $I_C = 2.0\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ )	BC846B, BC847B BC847C, 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

# ELECTRICAL CHARACTERISTICS

## BC846BPDW/BC847BPDW

### 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 ( $I_C = -10\text{ }\mu\text{A}$ , $V_{EB} = 0$ ) BC846 Series BC847 Series BC848 Series	$V_{(BR)CES}$	-80 -50 -30	-	-	V
Collector–Base Breakdown Voltage ( $I_C = -10\text{ }\mu\text{A}$ ) BC846 Series BC847 Series BC848 Series	$V_{(BR)CBO}$	-80 -50 -30	-	-	V
Emitter–Base Breakdown Voltage ( $I_E = -1.0\text{ }\mu\text{A}$ ) BC846 Series BC847 Series BC848 Series	$V_{(BR)EBO}$	-5.0 -5.0 -5.0	-	-	V
Collector Cutoff Current ( $V_{CB} = -30\text{ V}$ ) ( $V_{CB} = -30\text{ V}$ , $T_A = 150^\circ\text{C}$ )	$I_{CBO}$	-	-	-15 -4.0	nA $\mu\text{A}$
<b>ON CHARACTERISTICS</b>					
DC Current Gain ( $I_C = -10\text{ }\mu\text{A}$ , $V_{CE} = -5.0\text{ V}$ ) BC846B, BC847B BC847C, BC848C  ( $I_C = -2.0\text{ mA}$ , $V_{CE} = -5.0\text{ V}$ ) BC846B, BC847B BC847C, BC848C	$h_{FE}$	- -	150 270	- -	-
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	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

# DEVICE CHARACTERISTICS

## BC846BPDW/BC847BPDW

### TYPICAL NPN CHARACTERISTICS – BC846

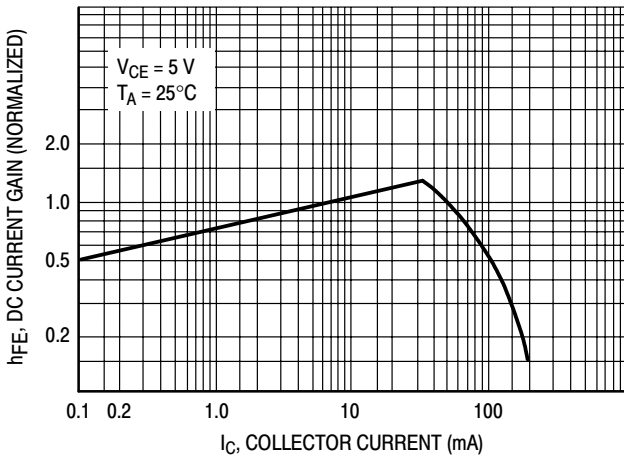


Figure 1. DC Current Gain

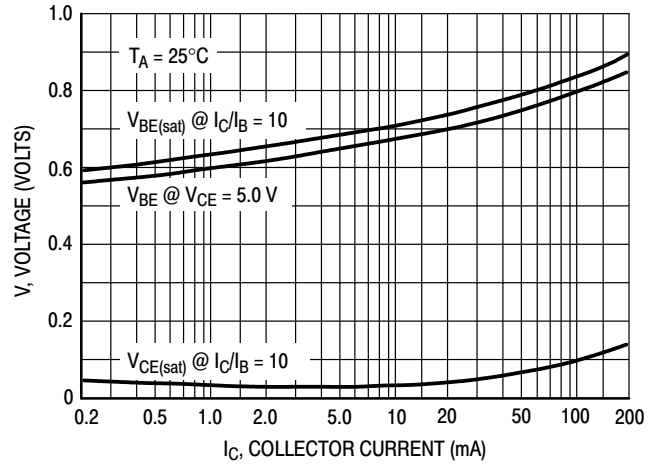


Figure 2. "On" Voltage

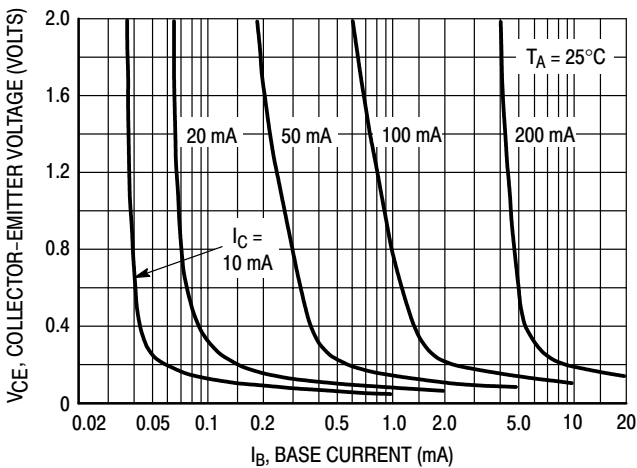


Figure 3. Collector Saturation Region

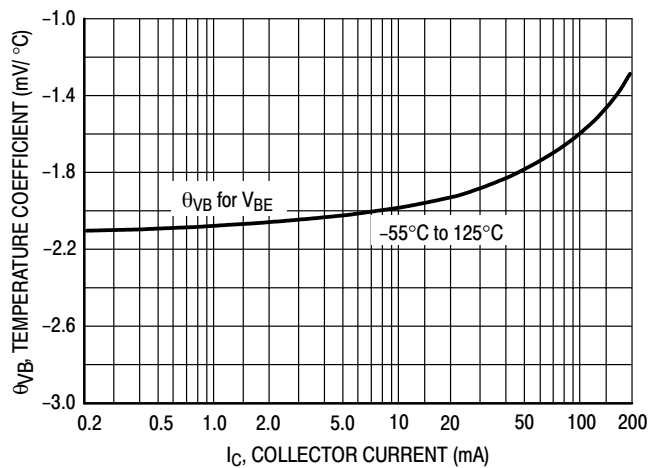


Figure 4. Base-Emitter Temperature Coefficient

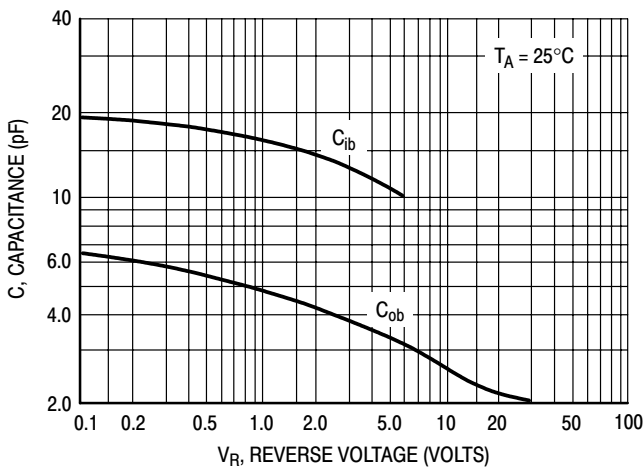


Figure 5. Capacitance

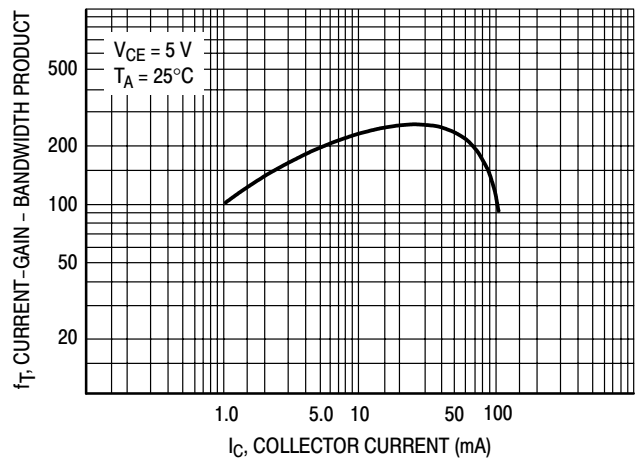


Figure 6. Current-Gain - Bandwidth Product

# DEVICE CHARACTERISTICS

## BC846BPDW/BC847BPDW

### TYPICAL PNP CHARACTERISTICS — BC846

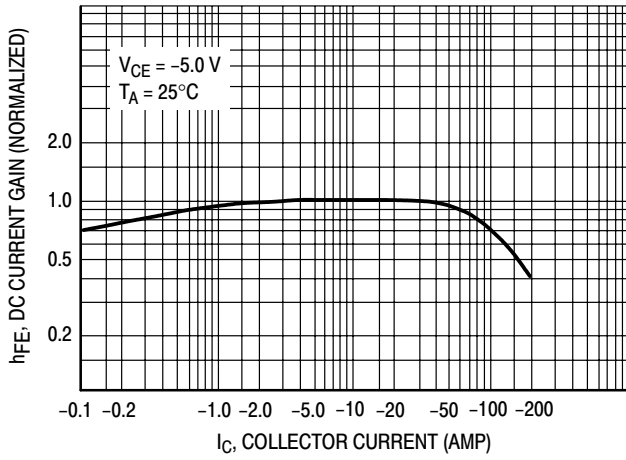


Figure 7. DC Current Gain

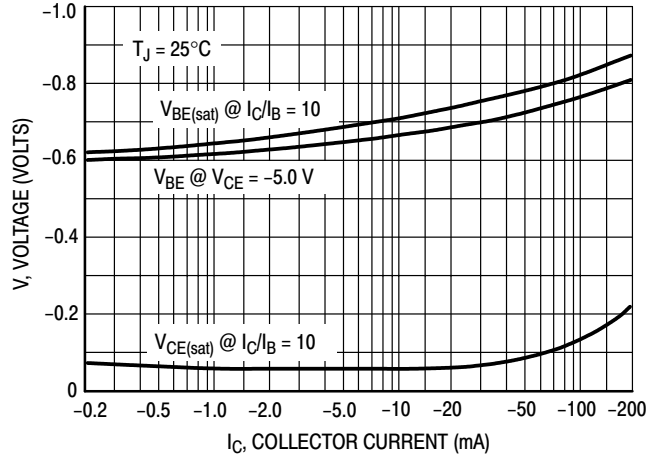


Figure 8. "On" Voltage

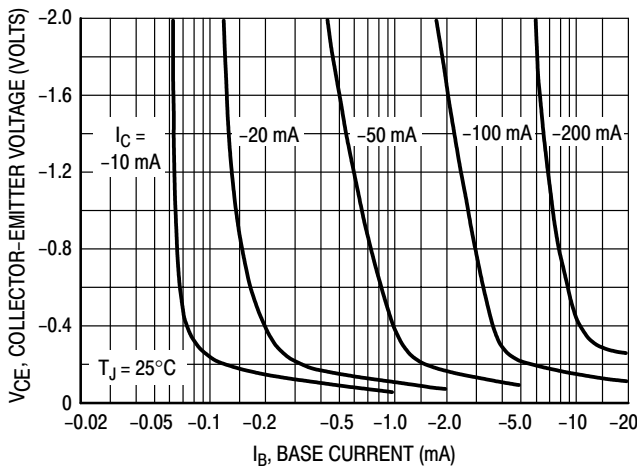


Figure 9. Collector Saturation Region

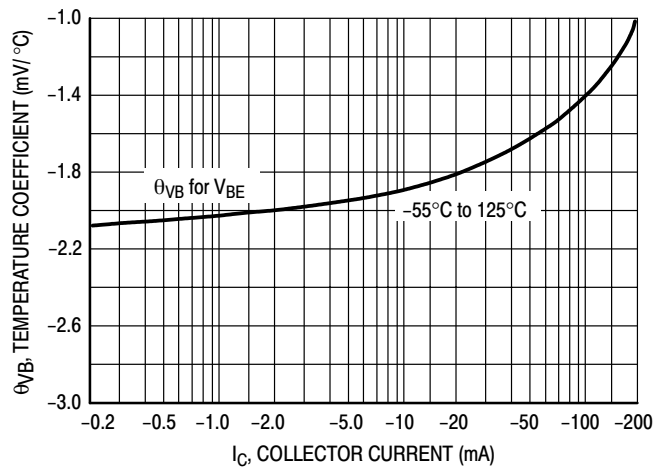


Figure 10. Base-Emitter Temperature Coefficient

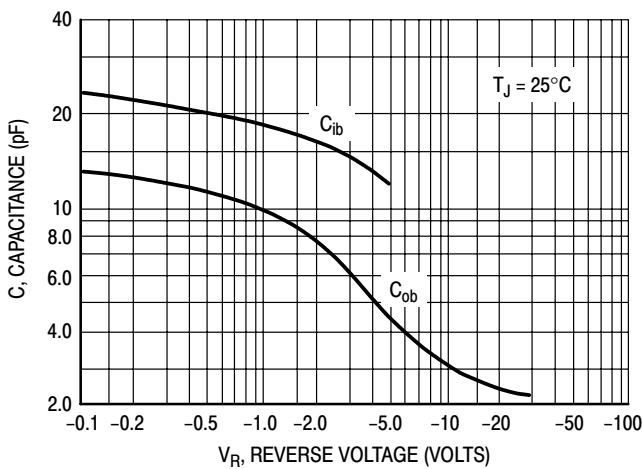


Figure 11. Capacitance

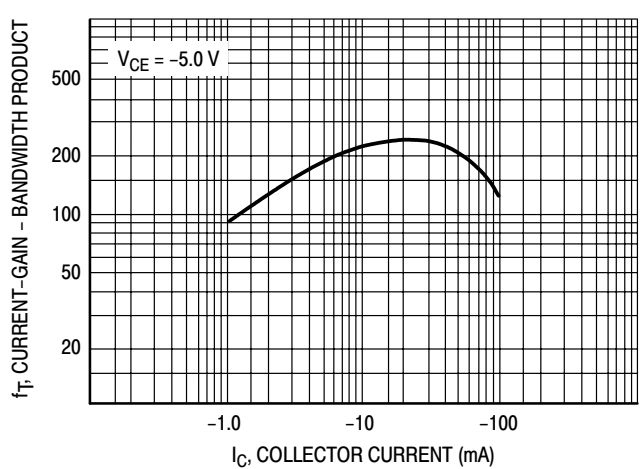


Figure 12. Current-Gain - Bandwidth Product

# DEVICE CHARACTERISTICS

## BC846BPDW/BC847BPDW

### TYPICAL NPN CHARACTERISTICS – BC847 SERIES & BC848 SERIES

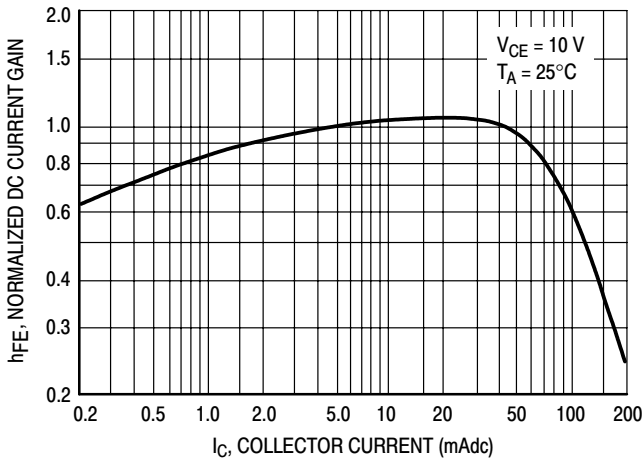


Figure 13. Normalized DC Current Gain

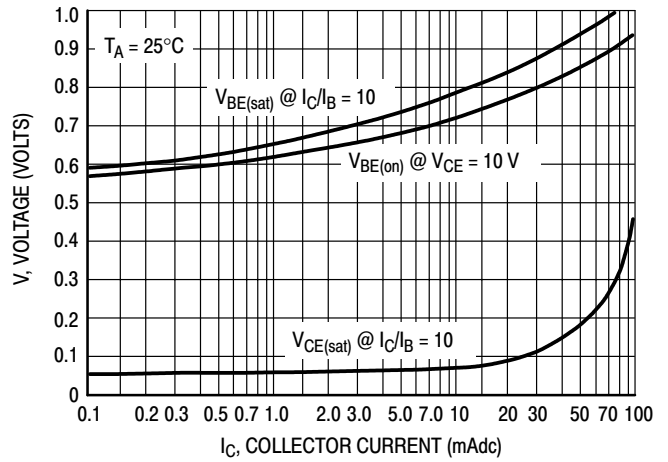


Figure 14. "Saturation" and "On" Voltages

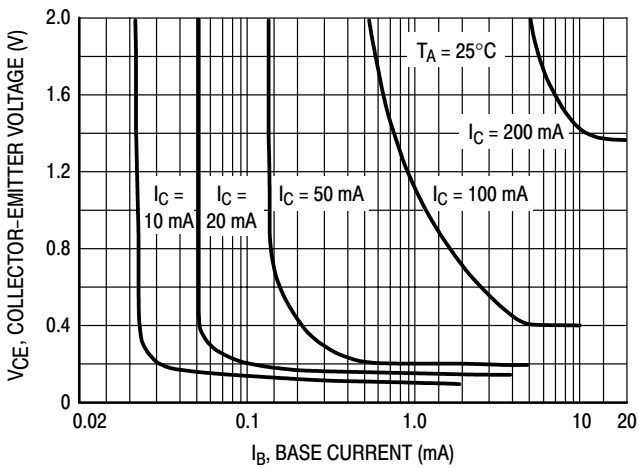


Figure 15. Collector Saturation Region

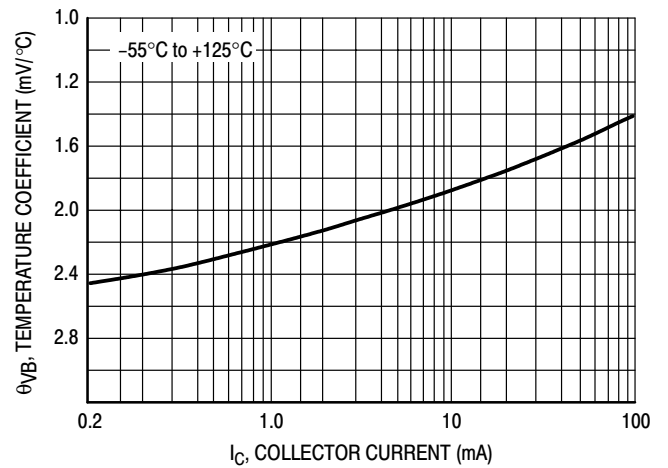


Figure 16. Base-Emitter Temperature Coefficient

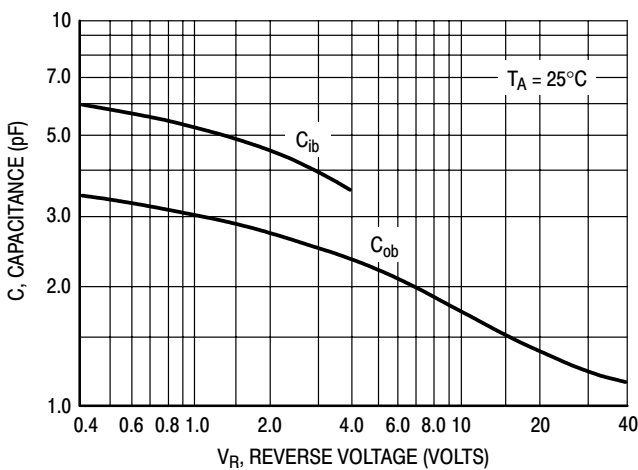


Figure 17. Capacitances

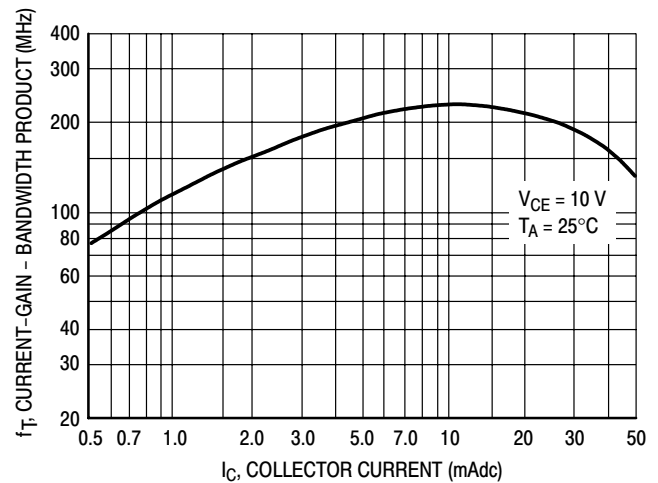


Figure 18. Current-Gain - Bandwidth Product

# DEVICE CHARACTERISTICS

## BC846BPDW/BC847BPDW

### TYPICAL PNP CHARACTERISTICS — BC847 SERIES & BC848 SERIES

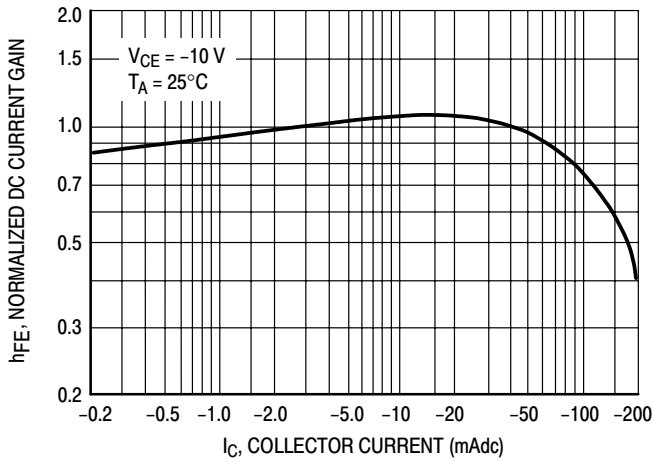


Figure 19. Normalized DC Current Gain

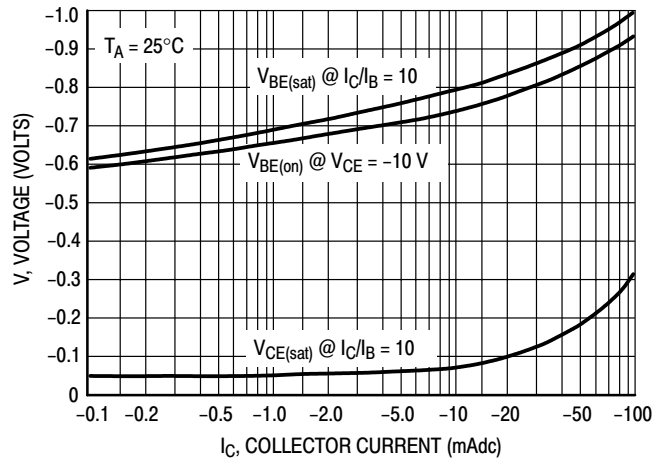


Figure 20. "Saturation" and "On" Voltages

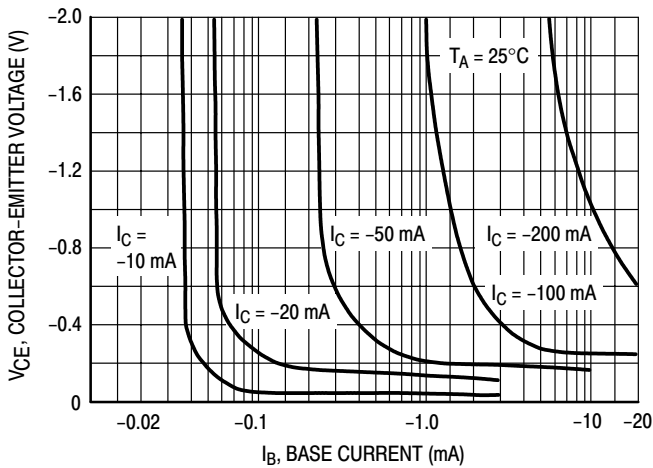


Figure 21. Collector Saturation Region

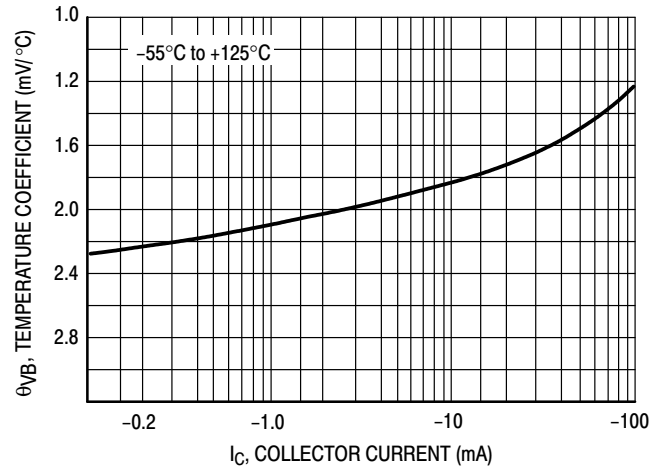


Figure 22. Base-Emitter Temperature Coefficient

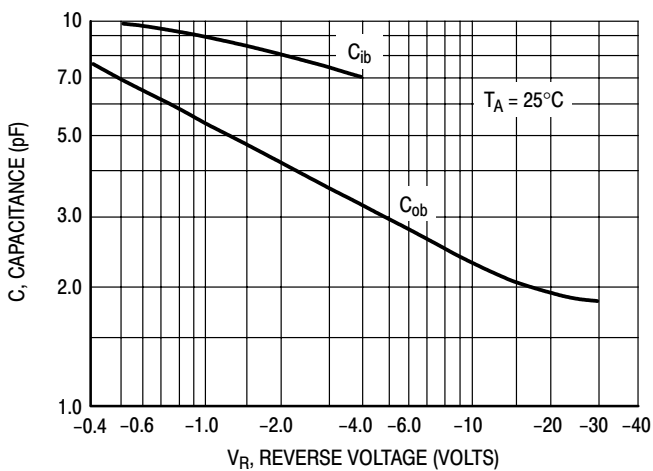


Figure 23. Capacitances

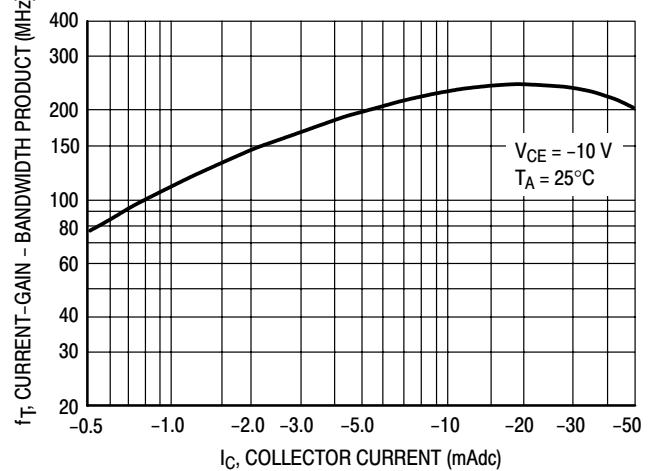


Figure 24. Current-Gain - Bandwidth Product

# DEVICE CHARACTERISTICS

## BC846BPDW/BC847BPDW

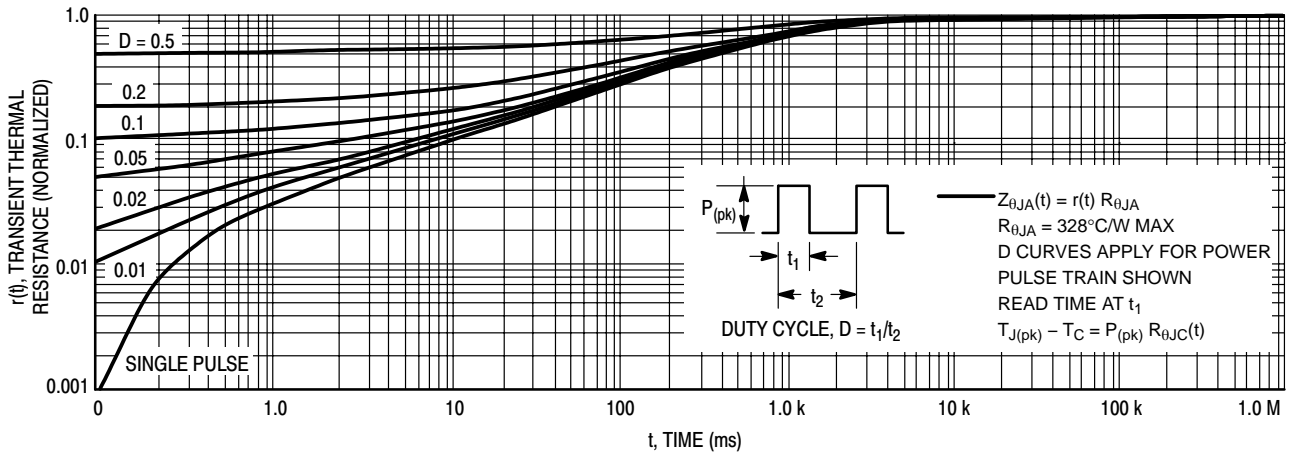


Figure 25. Thermal Response

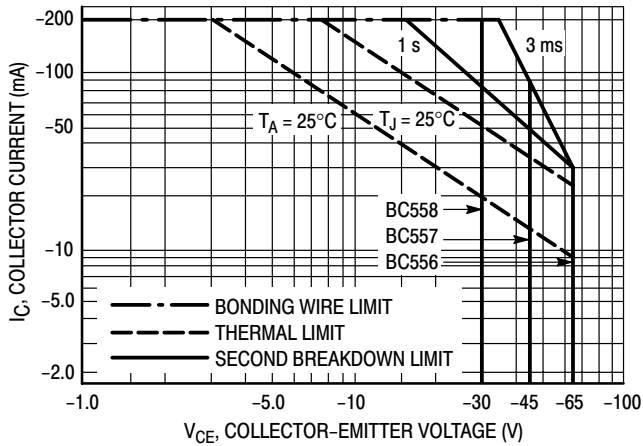


Figure 26. Active Region Safe Operating Area

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.

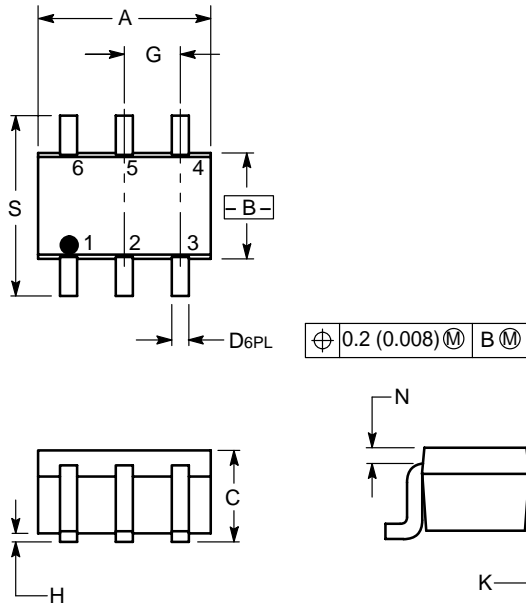
The data of Figure 26 is based upon  $T_{J(pk)} = 150^{\circ}\text{C}$ ;  $T_C$  or  $T_A$  is variable depending upon conditions. Pulse curves are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 150^{\circ}\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 25. At high case or ambient temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by the secondary breakdown.



# PACKAGE OUTLINE & DIMENSIONS

## BC846BPDW/BC847BPDW

SC-88/SOT-363



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20

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

