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

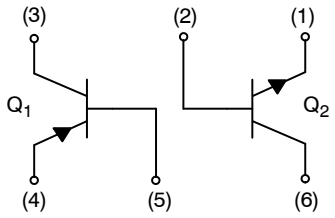
Rating	Symbol	Value	Unit
Collector-Emitter Voltage BC846 BC847 BC848	V_{CEO}	 65 45 30	V
Collector-Base Voltage BC846 BC847 BC848	V_{CBO}	 80 50 30	V
Emitter−Base Voltage	V_{EBO}	6.0	V
Collector Current – Continuous	I_C	100	mAdc
Collector Current – Peak	I_{CM}	200	mAdc

MAXIMUM RATINGS – PNP

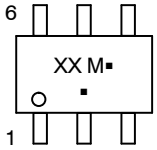
Rating	Symbol	Value	Unit
Collector-Emitter Voltage BC846 BC847 BC848	V_{CEO}	 −65 −45 −30	V
Collector-Base Voltage BC846 BC847 BC848	V_{CBO}	 −80 −50 −30	V
Emitter−Base Voltage	V_{EBO}	−6.0	V
Collector Current – Continuous	I_C	−100	mAdc
Collector Current – Peak	I_{CM}	−200	mAdc

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
SBC846BPDW1T3G	BB	SOT−363 (Pb−Free)	10,000 / 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.

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation Per Device FR−5 Board (Note 1) T_A = 25°C Derate above 25°C	P_D	 380 250 3.0	 mW mW/°C 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 (I_C = 10 mA) BC846 BC847 BC848	$V_{(BR)CEO}$	 65 45 30	 – – –	 – – –	V
Collector−Emitter Breakdown Voltage (I_C = 10 μA, V_{EB} = 0) BC846 BC847B BC848	$V_{(BR)CES}$	 80 50 30	 – – –	 – – –	V
Collector−Base Breakdown Voltage (I_C = 10 μA) BC846 BC847 BC848	$V_{(BR)CBO}$	 80 50 30	 – – –	 – – –	V
Emitter−Base Breakdown Voltage (I_E = 1.0 μA) BC846 BC847 BC848	$V_{(BR)EBO}$	 6.0 6.0 6.0	 – – –	 – – –	V
Collector Cutoff Current (V_{CB} = 30 V) (V_{CB} = 30 V, T_A = 150°C)	I_{CBO}	 – –	 – –	 15 5.0	 nA μA
ON CHARACTERISTICS					
DC Current Gain (I_C = 10 μA, V_{CE} = 5.0 V) BC846B, BC847B BC848C (I_C = 2.0 mA, V_{CE} = 5.0 V) BC846B, BC847B BC848C	h_{FE}	 – – 200 420	 150 270 290 520	 – – 475 800	–
Collector−Emitter Saturation Voltage (I_C = 10 mA, I_B = 0.5 mA) All devices except SBC847BPDW1T1G SBC847BPDW1T1G only (I_C = 100 mA, I_B = 5.0 mA) All devices (I_C = 2 mA, I_B = 0.5 mA) SBC847BPDW1T1G only	$V_{CE(sat)}$	 – – – –	 – – – 0.024	 0.25 0.1 0.6 –	V
Base−Emitter Saturation Voltage (I_C = 10 mA, I_B = 0.5 mA) (I_C = 100 mA, I_B = 5.0 mA)	$V_{BE(sat)}$	 – –	 0.7 0.9	 – –	V
Base−Emitter Voltage (I_C = 2.0 mA, V_{CE} = 5.0 V) (I_C = 10 mA, V_{CE} = 5.0 V)	$V_{BE(on)}$	 580 –	 660 –	 700 770	mV
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_{obo}	–	–	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

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

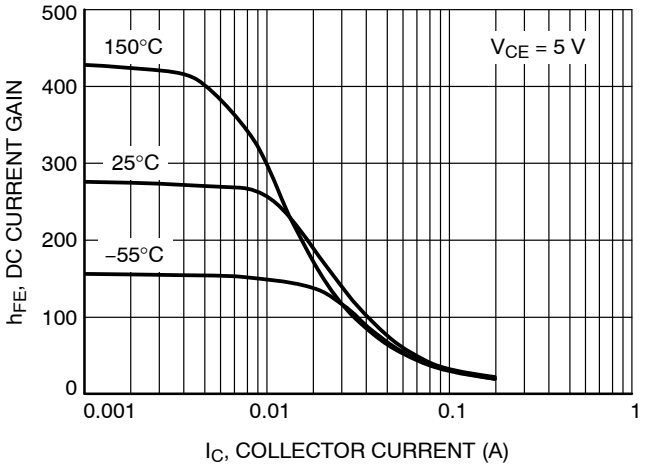


Figure 1. DC Current Gain vs. Collector Current

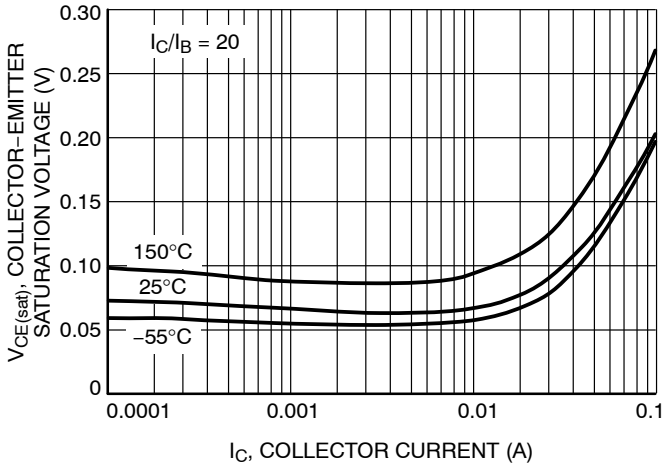


Figure 2. Collector Emitter Saturation Voltage vs. Collector Current

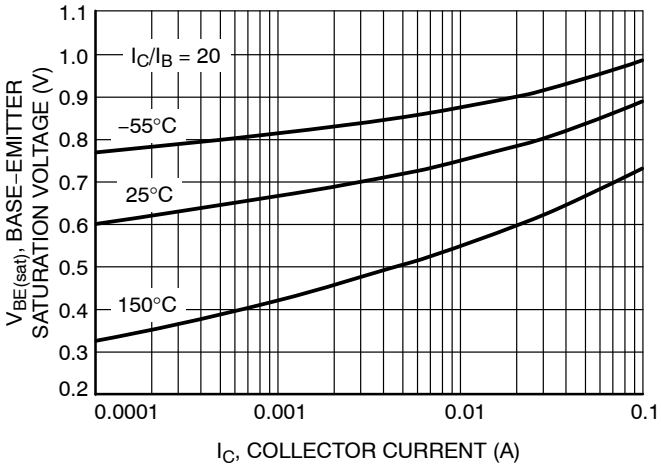


Figure 3. Base Emitter Saturation Voltage vs. Collector Current

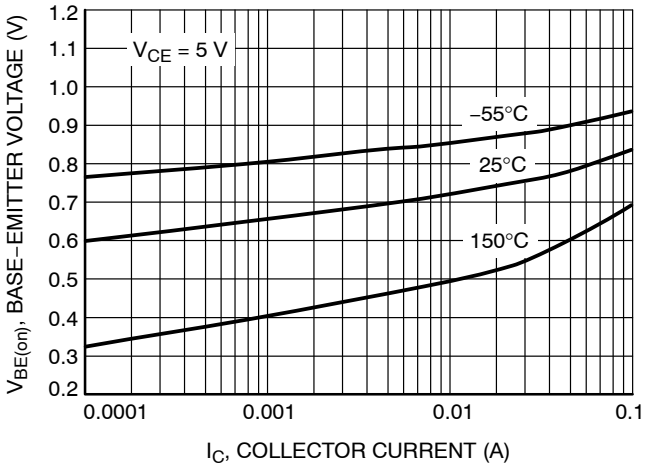


Figure 4. Base Emitter Voltage vs. Collector Current

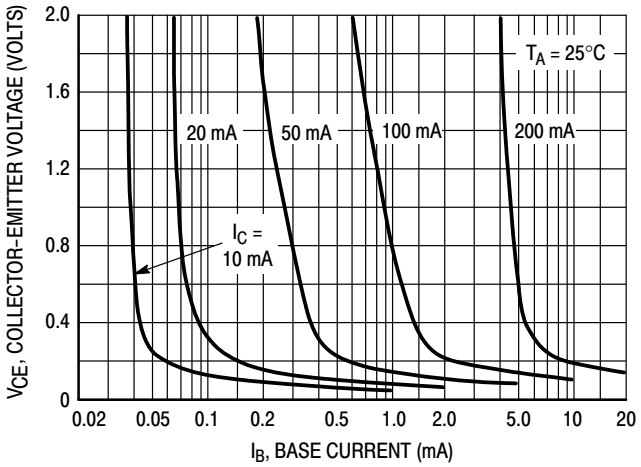


Figure 5. Collector Saturation Region

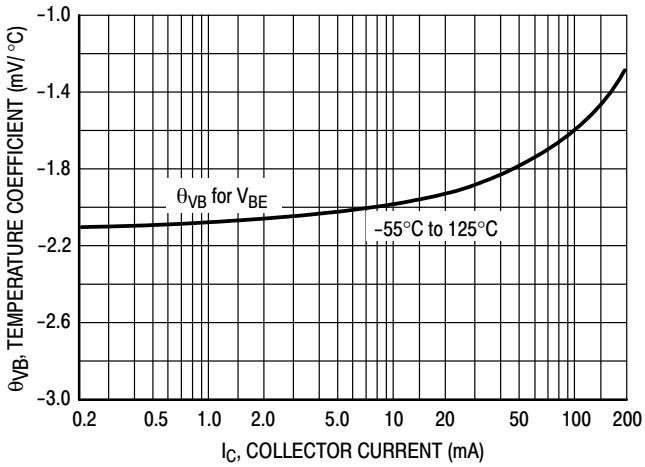


Figure 6. Base−Emitter Temperature Coefficient

TYPICAL NPN CHARACTERISTICS – BC846

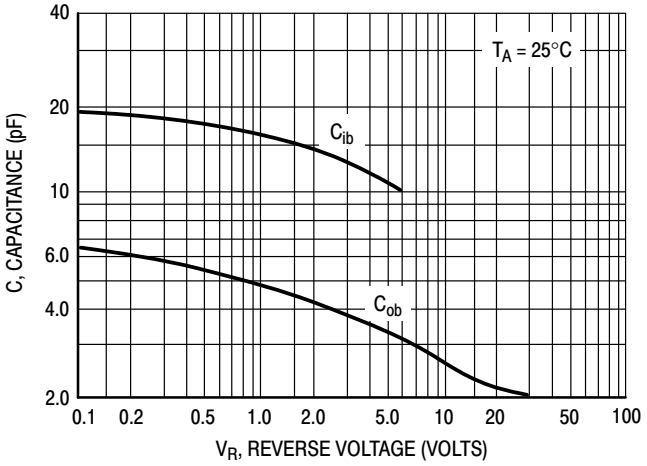


Figure 7. Capacitance

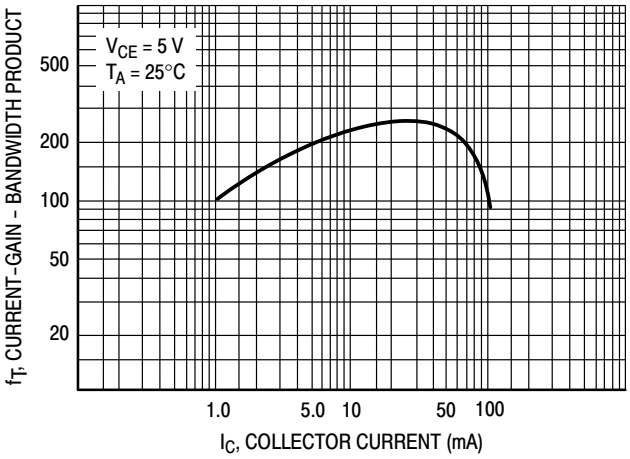


Figure 8. Current–Gain – Bandwidth Product

TYPICAL PNP CHARACTERISTICS — BC846

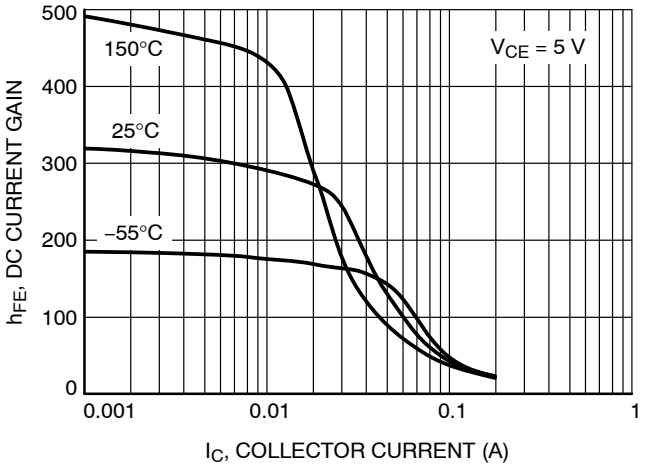


Figure 9. DC Current Gain vs. Collector Current

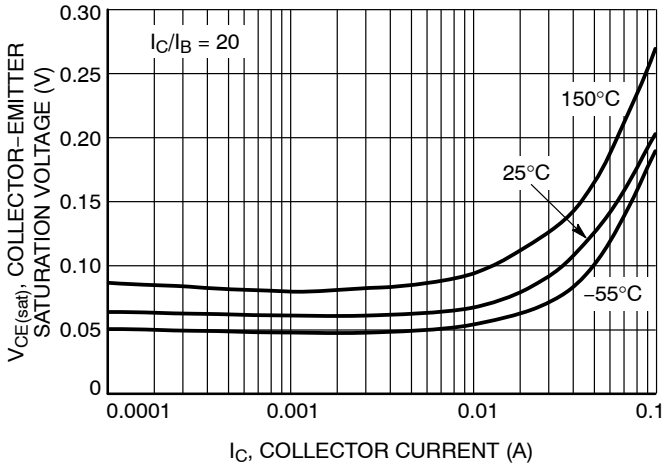


Figure 10. Collector Emitter Saturation Voltage vs. Collector Current

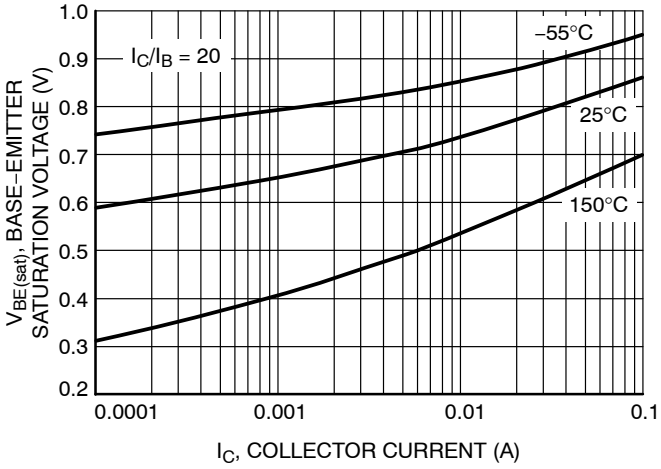


Figure 11. Base Emitter Saturation Voltage vs. Collector Current

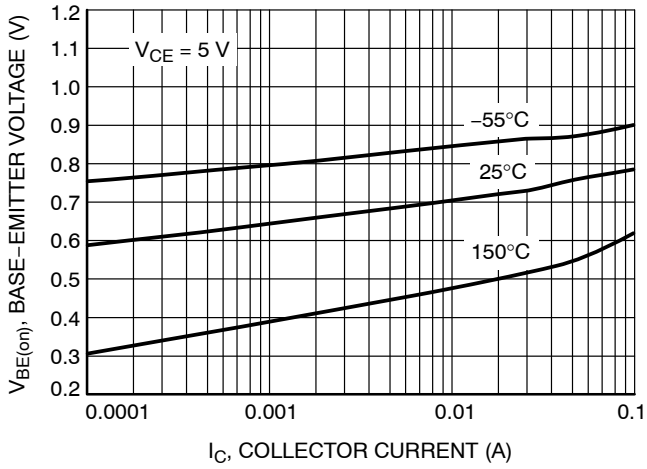


Figure 12. Base Emitter Voltage vs. Collector Current

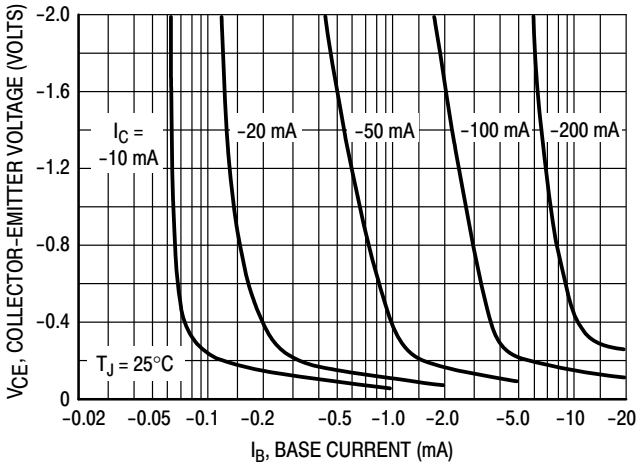


Figure 13. Collector Saturation Region

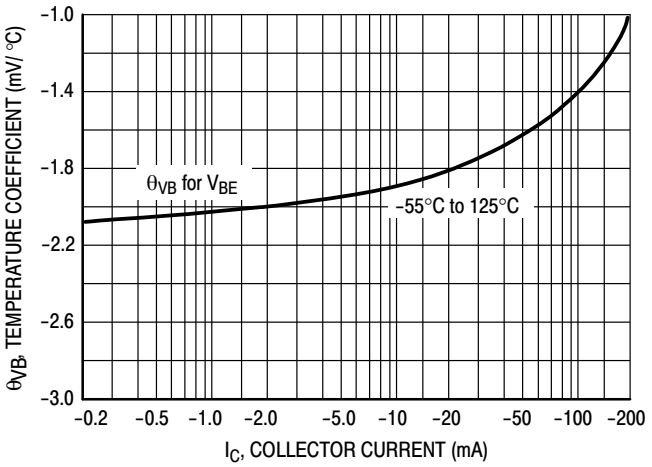


Figure 14. Base−Emitter Temperature Coefficient

TYPICAL PNP CHARACTERISTICS — BC846

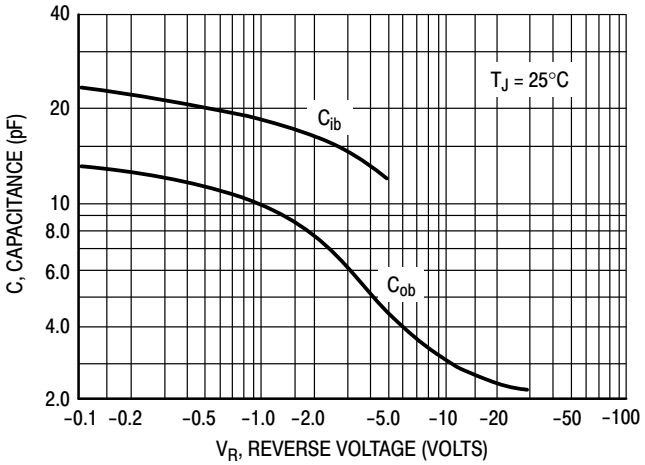


Figure 15. Capacitance

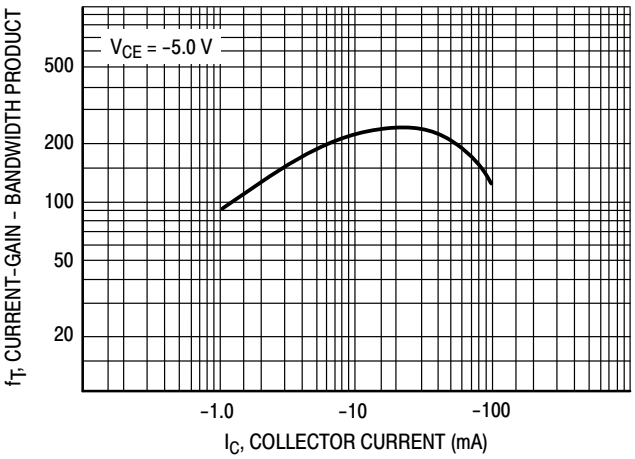


Figure 16. Current−Gain − Bandwidth Product

TYPICAL NPN CHARACTERISTICS – BC847

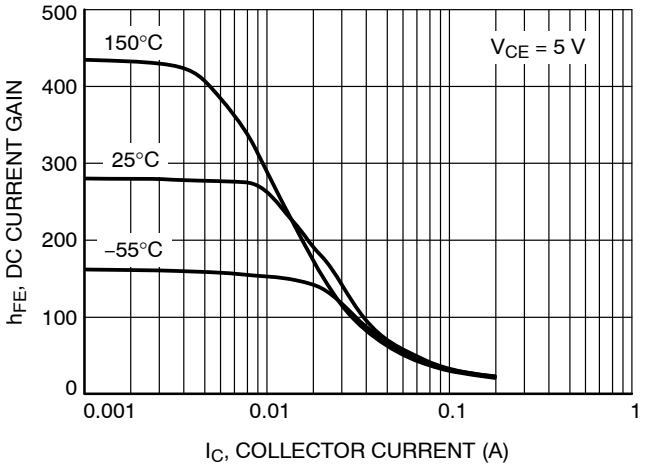


Figure 17. DC Current Gain vs. Collector Current

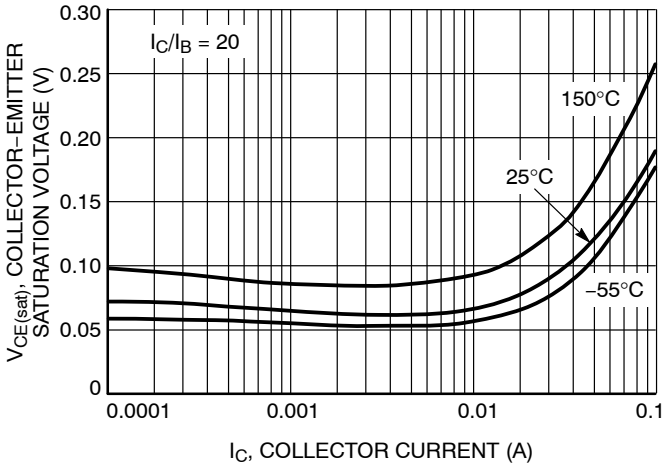


Figure 18. Collector Emitter Saturation Voltage vs. Collector Current

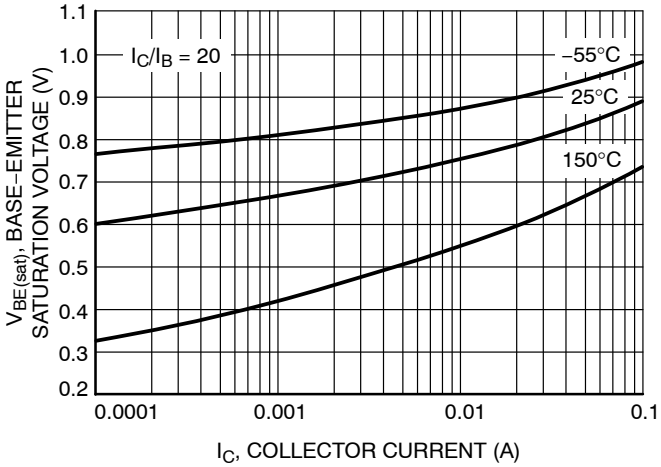


Figure 19. Base Emitter Saturation Voltage vs. Collector Current

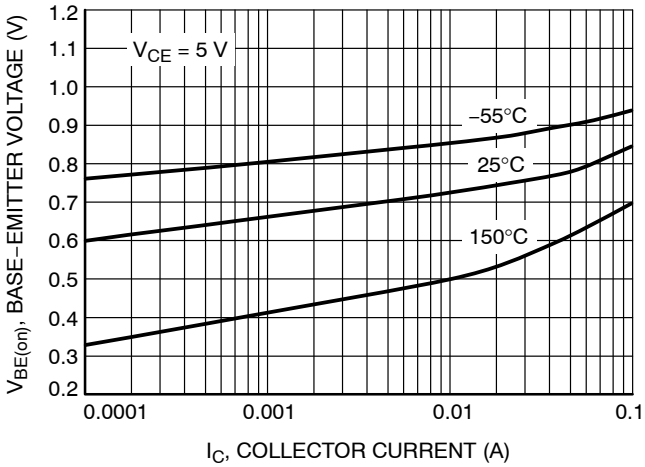


Figure 20. Base Emitter Voltage vs. Collector Current

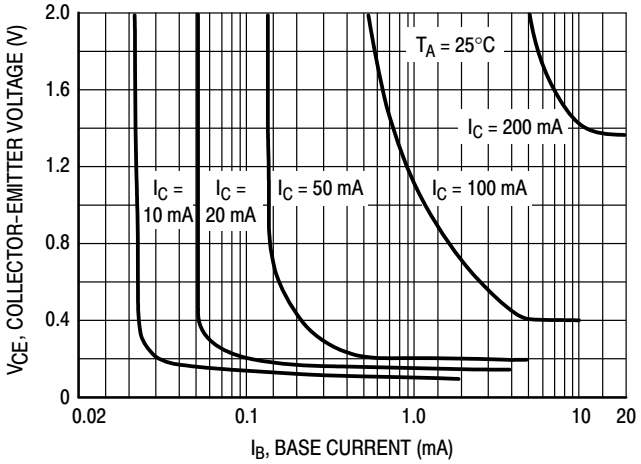


Figure 21. Collector Saturation Region

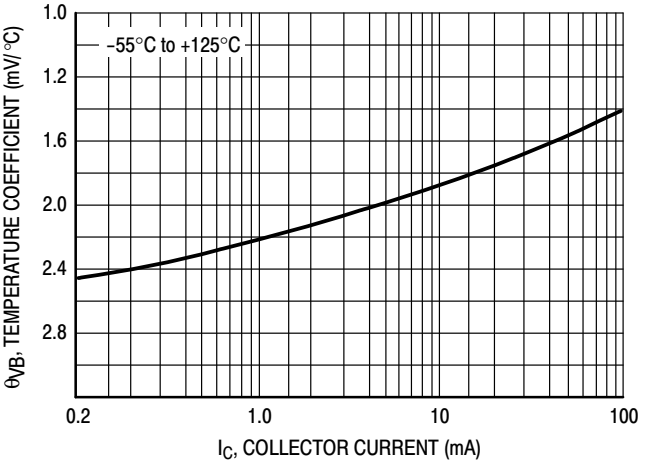


Figure 22. Base−Emitter Temperature Coefficient

TYPICAL NPN CHARACTERISTICS – BC847

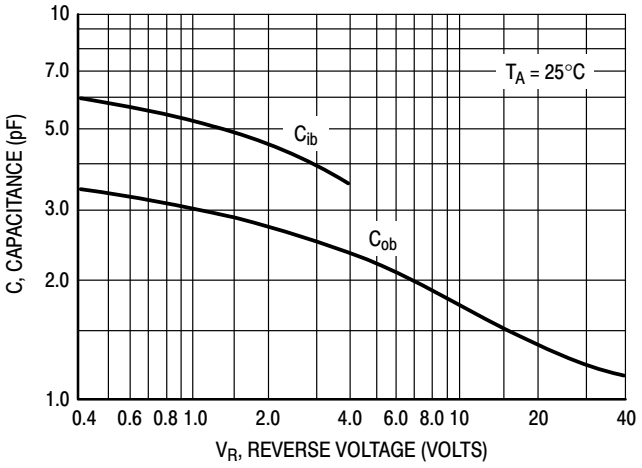


Figure 23. Capacitances

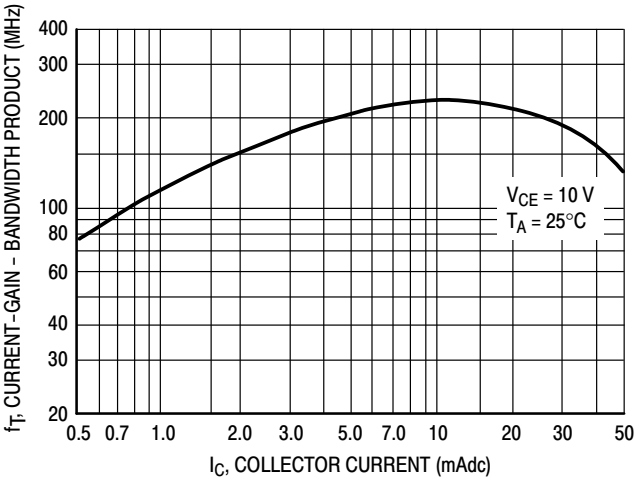


Figure 24. Current–Gain – Bandwidth Product

TYPICAL PNP CHARACTERISTICS – BC847

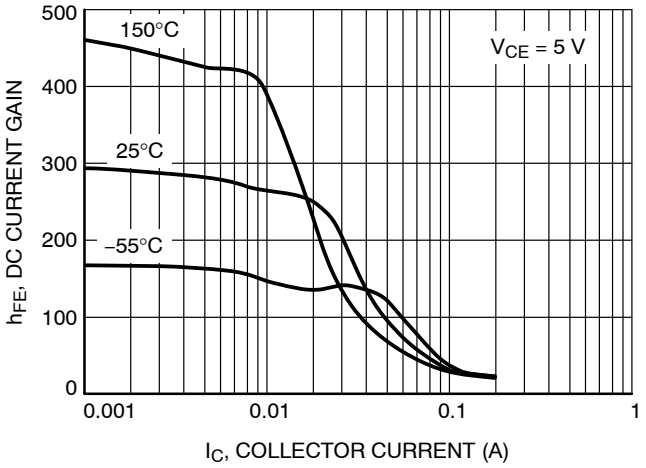


Figure 25. DC Current Gain vs. Collector Current

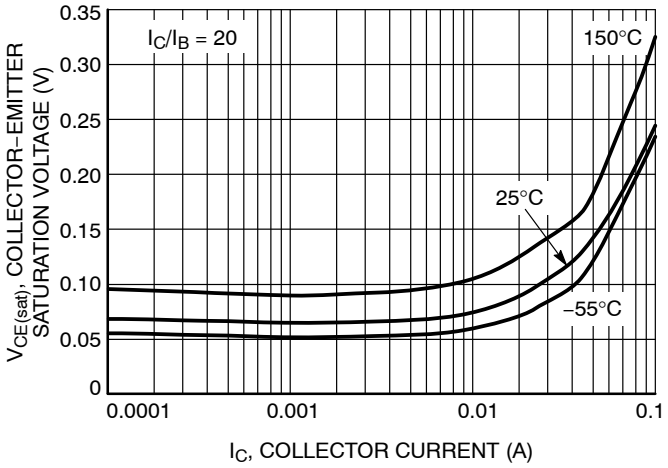


Figure 26. Collector Emitter Saturation Voltage vs. Collector Current

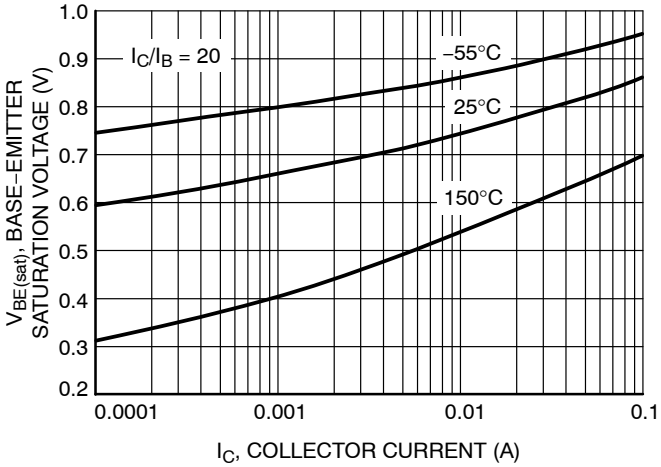


Figure 27. Base Emitter Saturation Voltage vs. Collector Current

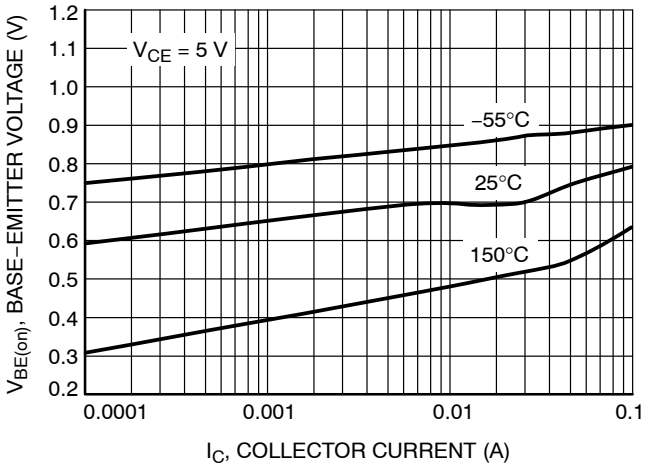


Figure 28. Base Emitter Voltage vs. Collector Current

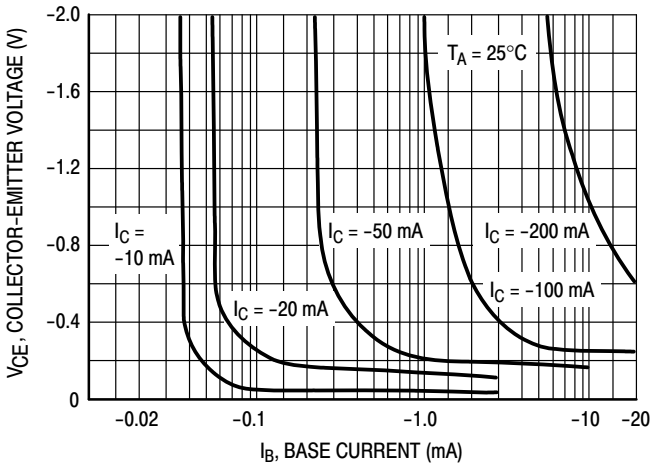


Figure 29. Collector Saturation Region

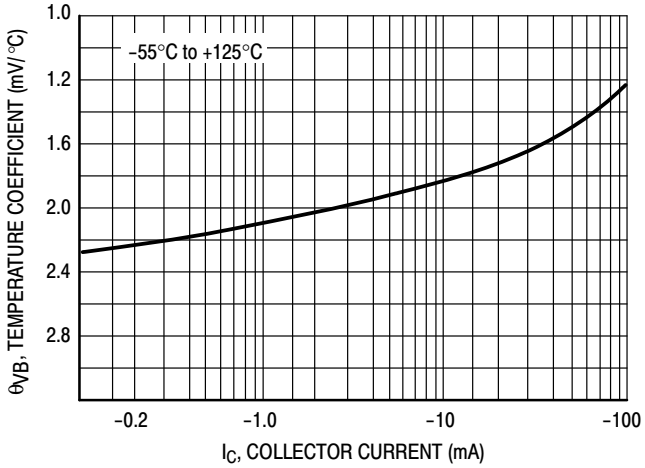


Figure 30. Base−Emitter Temperature Coefficient

TYPICAL PNP CHARACTERISTICS – BC847

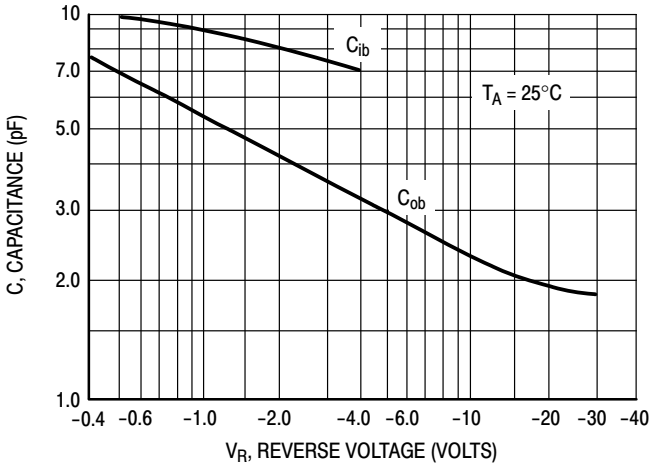


Figure 31. Capacitances

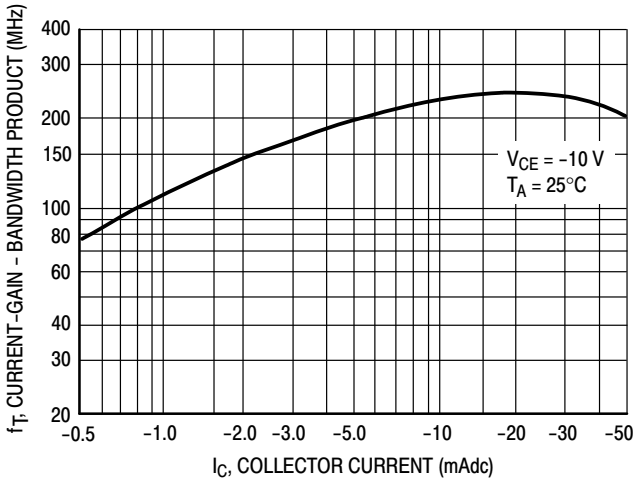


Figure 32. Current−Gain − Bandwidth Product

TYPICAL NPN CHARACTERISTICS – BC848

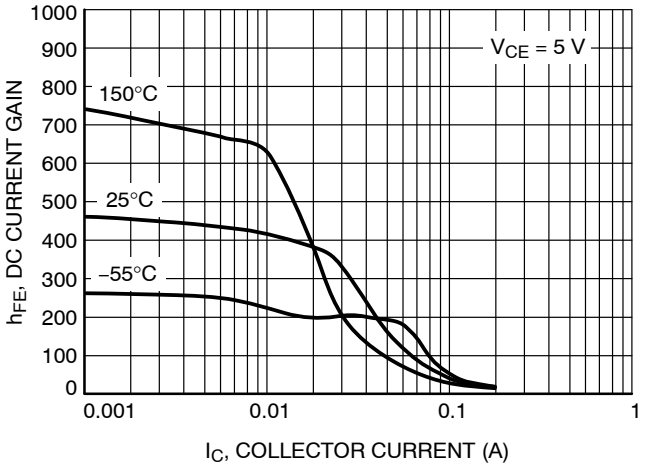


Figure 33. DC Current Gain vs. Collector Current

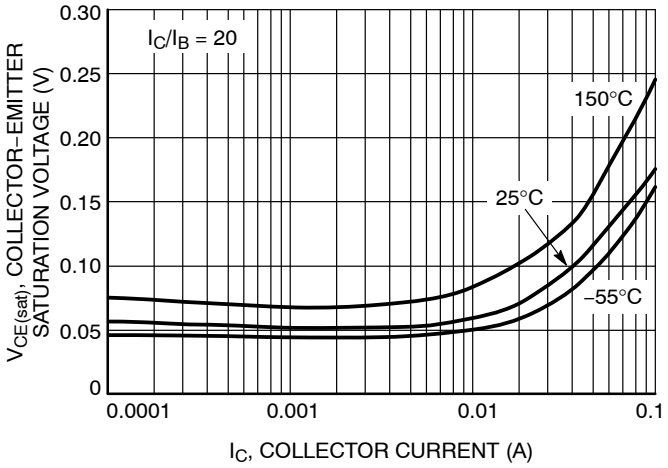


Figure 34. Collector Emitter Saturation Voltage vs. Collector Current

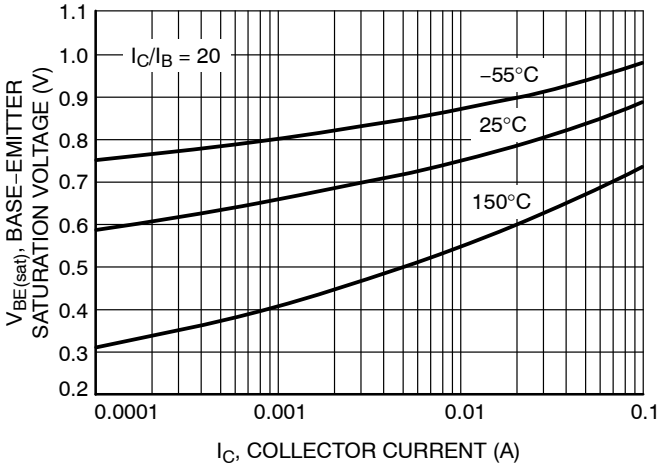


Figure 35. Base Emitter Saturation Voltage vs. Collector Current

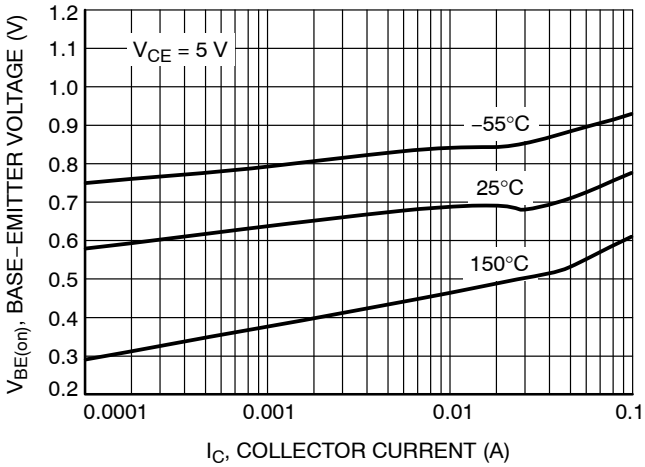


Figure 36. Base Emitter Voltage vs. Collector Current

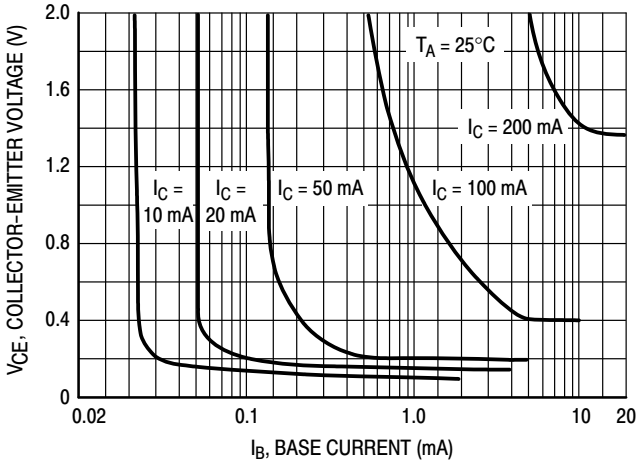


Figure 37. Collector Saturation Region

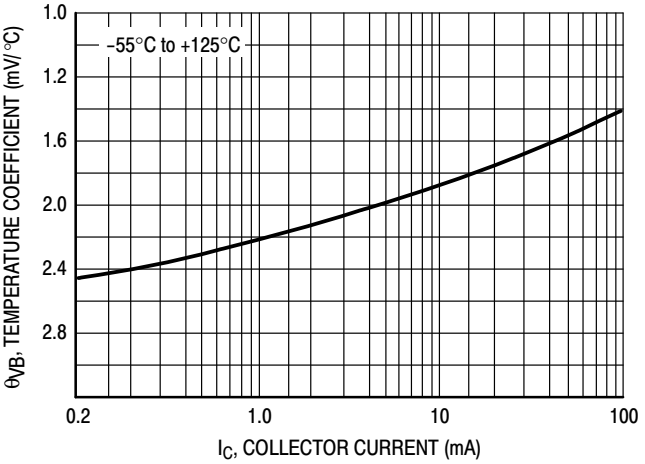


Figure 38. Base−Emitter Temperature Coefficient

TYPICAL NPN CHARACTERISTICS – BC848

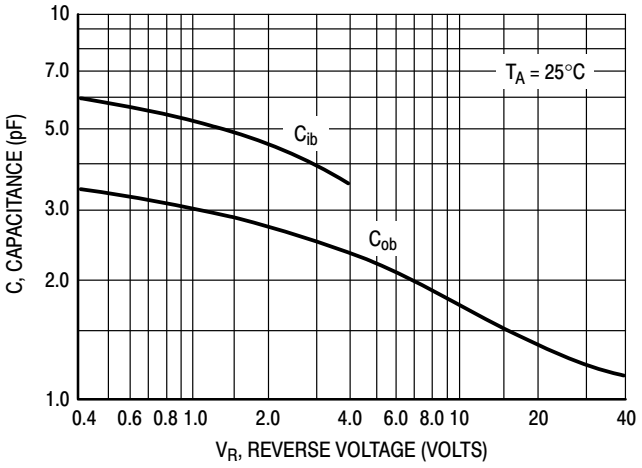


Figure 39. Capacitances

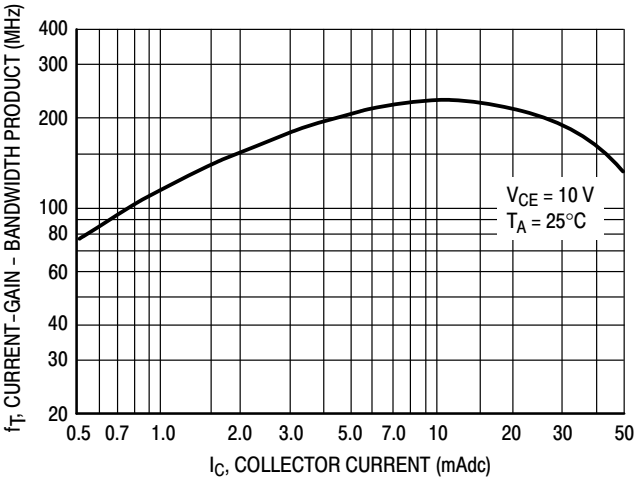


Figure 40. Current−Gain − Bandwidth Product

TYPICAL PNP CHARACTERISTICS – BC848

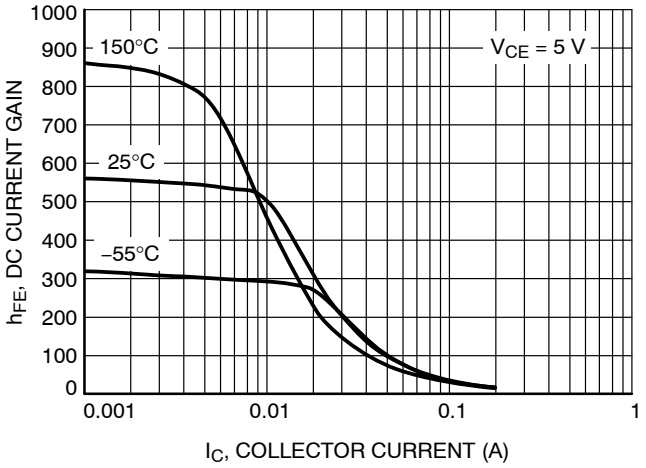


Figure 41. DC Current Gain vs. Collector Current

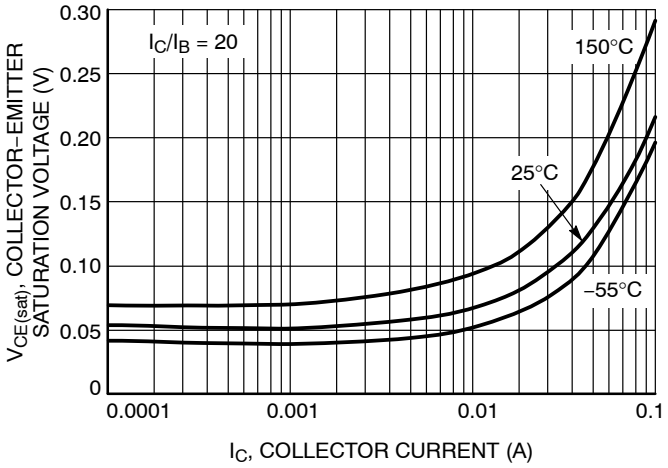


Figure 42. Collector Emitter Saturation Voltage vs. Collector Current

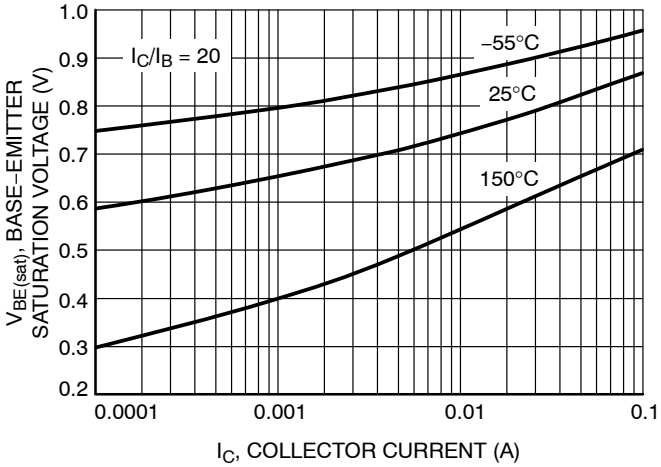


Figure 43. Base Emitter Saturation Voltage vs. Collector Current

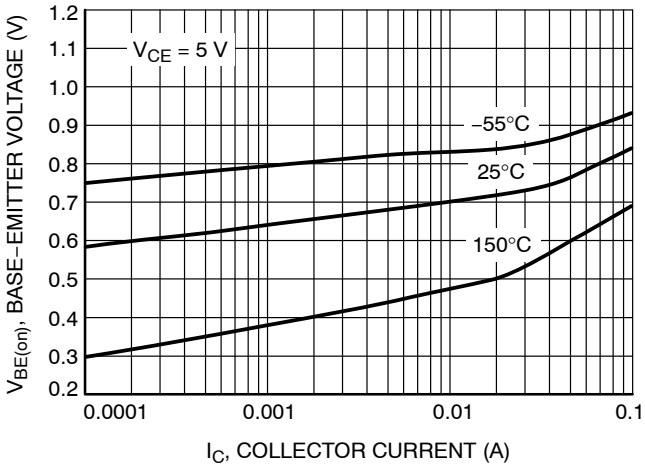


Figure 44. Base Emitter Voltage vs. Collector Current

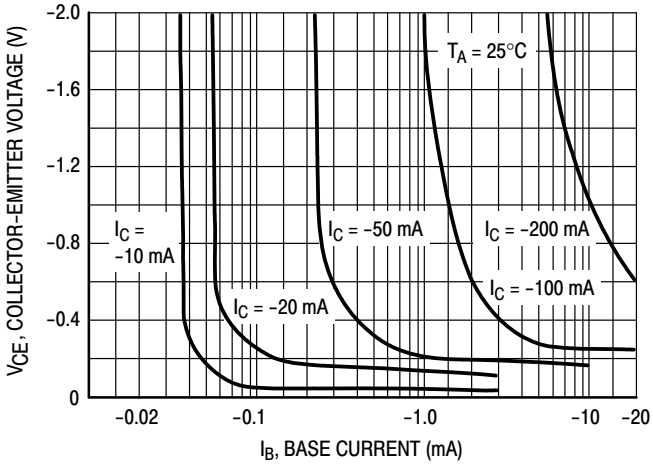


Figure 45. Collector Saturation Region

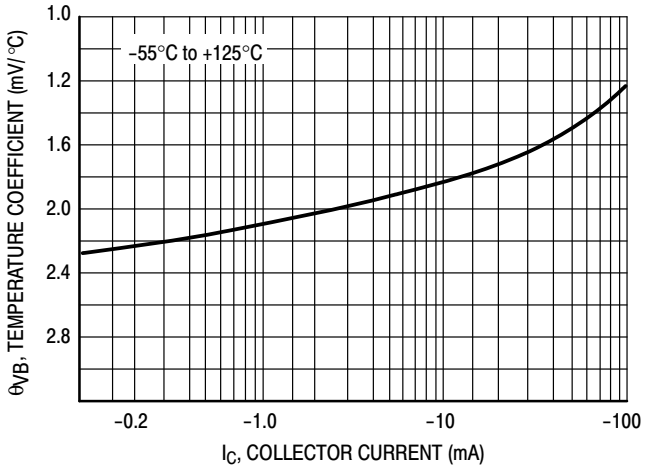


Figure 46. Base−Emitter Temperature Coefficient

TYPICAL PNP CHARACTERISTICS – BC848

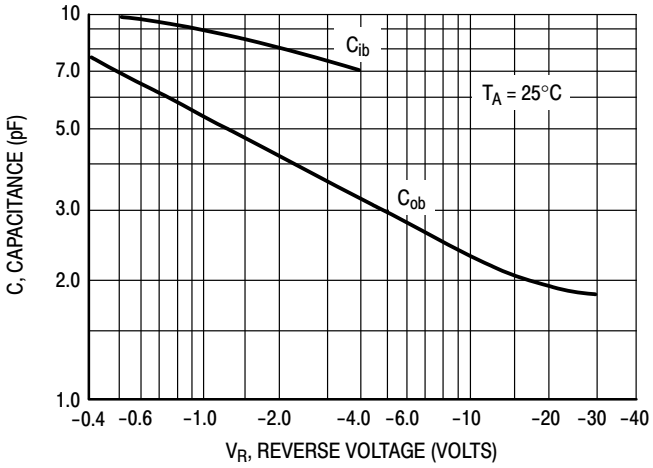


Figure 47. Capacitances

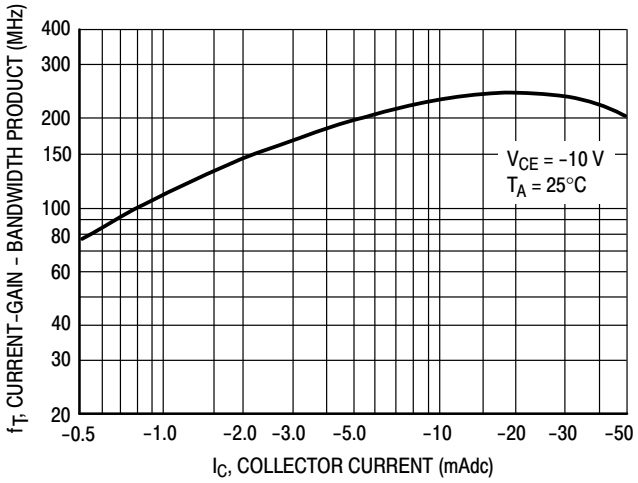


Figure 48. Current−Gain − Bandwidth Product

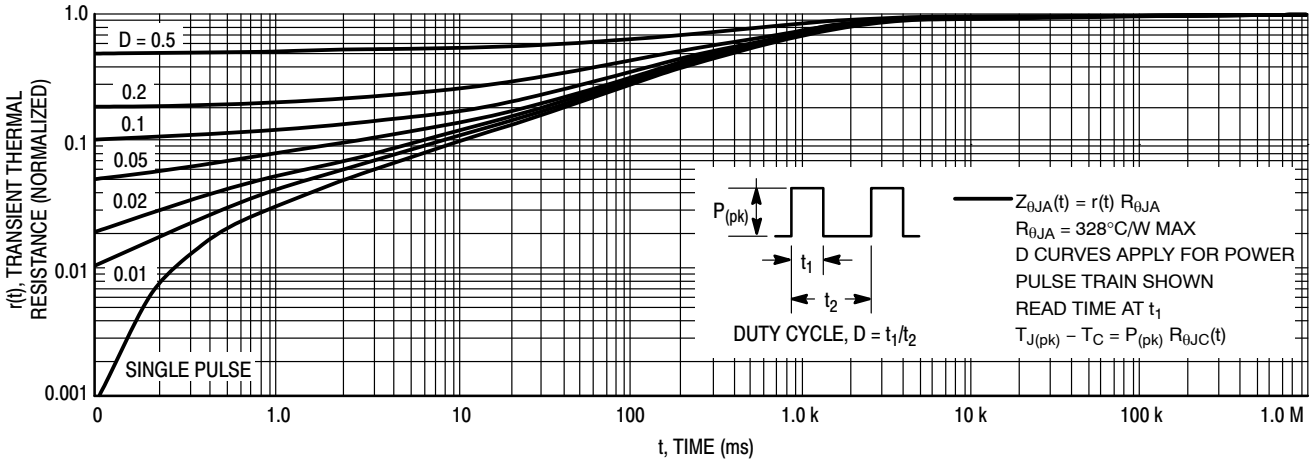


Figure 49. Thermal Response

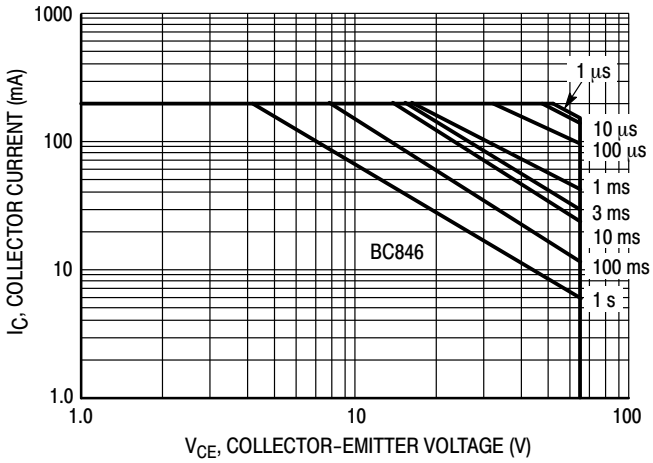


Figure 50. Safe Operating Area – BC846

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.

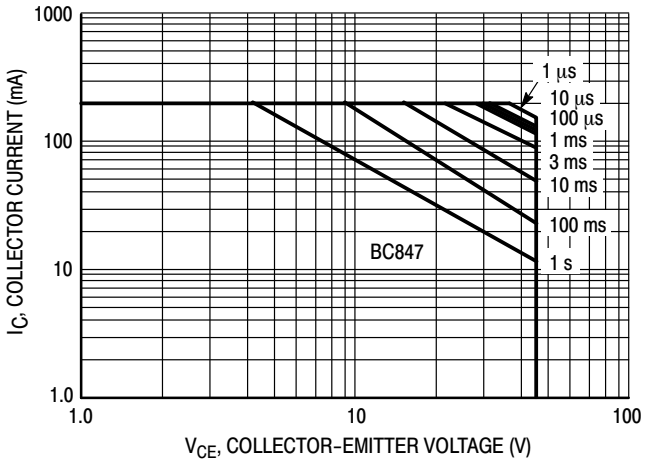


Figure 51. Safe Operating Area – BC847

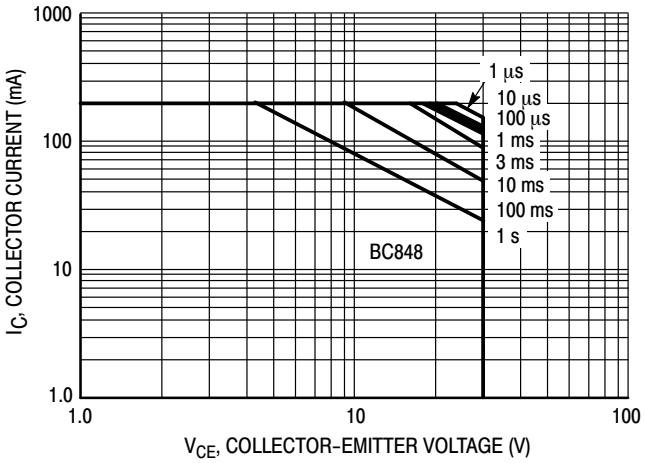
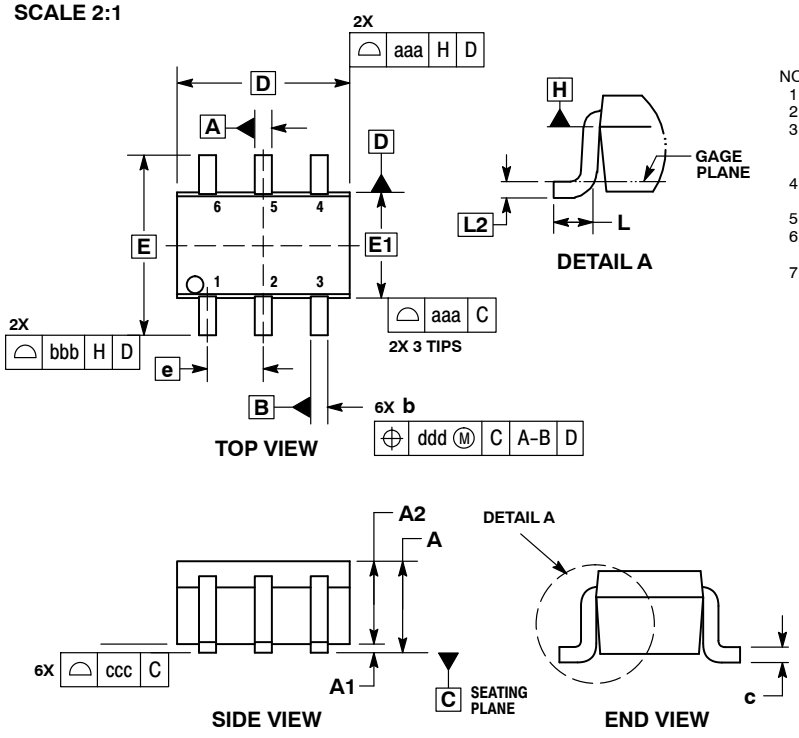


Figure 52. Safe Operating Area – BC848

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

DATE 11 DEC 2012

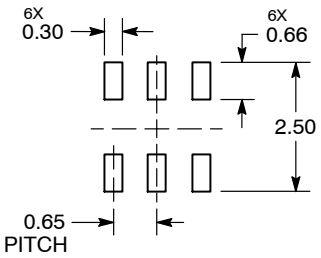
1
SCALE 2:1



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

	MILLIMETERS			INCHES		
DIM	**MIN**	**NOM**	**MAX**	**MIN**	**NOM**	**MAX**
A	−−−	−−−	1.10	−−−	−−−	0.043
A1	0.00	−−−	0.10	0.000	−−−	0.004
A2	0.70	0.90	1.00	0.027	0.035	0.039
b	0.15	0.20	0.25	0.006	0.008	0.010
C	0.08	0.15	0.22	0.003	0.006	0.009
D	1.80	2.00	2.20	0.070	0.078	0.086
E	2.00	2.10	2.20	0.078	0.082	0.086
E1	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65 BSC			0.026 BSC		
L	0.26	0.36	0.46	0.010	0.014	0.018
L2	0.15 BSC			0.006 BSC		
aaa	0.15			0.006		
bbb	0.30			0.012		
ccc	0.10			0.004		
ddd	0.10			0.004		

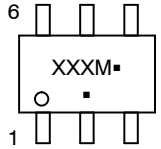
RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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, "▪", may or may not be present. Some products may not follow the Generic Marking.

STYLES ON PAGE 2

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

DATE 11 DEC 2012

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.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support
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