

# General Purpose Transistors

## NPN Silicon

### BC846ALT1G Series

#### Features

- Moisture Sensitivity Level: 1
- ESD Rating – Human Body Model: > 4000 V  
– Machine Model: > 400 V
- S and NSV 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

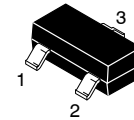
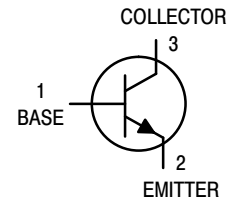
Rating	Symbol	Value	Unit	
Collector-Emitter Voltage	$V_{CEO}$	BC846	65	Vdc
		BC847, BC850	45	
		BC848, BC849	30	
Collector-Base Voltage	$V_{CBO}$	BC846	80	Vdc
		BC847, BC850	50	
		BC848, BC849	30	
Emitter-Base Voltage	$V_{EBO}$	BC846	6.0	Vdc
		BC847, BC850	6.0	
		BC848, BC849	5.0	
Collector Current – Continuous	$I_C$	100	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.

#### THERMAL CHARACTERISTICS

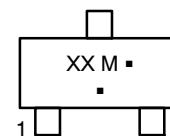
Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board, (Note 1) $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	225	mW
		1.8	mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 1)	$R_{\theta JA}$	556	$^\circ\text{C}/\text{W}$
Total Device Dissipation Alumina Substrate (Note 2) $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	300	mW
		2.4	mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

- FR-5 =  $1.0 \times 0.75 \times 0.062$  in.
- Alumina =  $0.4 \times 0.3 \times 0.024$  in 99.5% alumina.



SOT-23  
CASE 318  
STYLE 6

#### MARKING DIAGRAM



XX = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

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

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 12 of this data sheet.

## BC846ALT1G Series

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

Characteristic	Symbol	Min	Typ	Max	Unit	
<b>OFF CHARACTERISTICS</b>						
Collector – Emitter Breakdown Voltage ( $I_C = 10\text{ mA}$ )	BC846A, B, C BC847A, B, C, BC850B, C BC848A, B, C, BC849B, C	$V_{(BR)CEO}$	65 45 30	– – –	– – –	V
Collector – Emitter Breakdown Voltage ( $I_C = 10\ \mu\text{A}$ , $V_{EB} = 0$ )	BC846A, B, C BC847A, B, C, BC850B, C BC848A, B, C, BC849B, C	$V_{(BR)CES}$	80 50 30	– – –	– – –	V
Collector – Base Breakdown Voltage ( $I_C = 10\ \mu\text{A}$ )	BC846A, B, C BC847A, B, C, BC850B, C BC848A, B, C, BC849B, C	$V_{(BR)CBO}$	80 50 30	– – –	– – –	V
Emitter – Base Breakdown Voltage ( $I_E = 1.0\ \mu\text{A}$ )	BC846A, B, C BC847A, B, C, BC850B, C BC848A, B, C, BC849B, C	$V_{(BR)EBO}$	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 ( $I_C = 10\ \mu\text{A}$ , $V_{CE} = 5.0\text{ V}$ )	BC846A, BC847A, BC848A BC846B, BC847B, BC848B BC846C, BC847C, BC848C	$h_{FE}$	– – –	90 150 270	– – –	–
( $I_C = 2.0\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ )	BC846A, BC847A, BC848A BC846B, BC847B, BC848B, BC849B, BC850B BC846C, BC847C, BC848C, BC849C, BC850C		110 200 420	180 290 520	220 450 800	
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 ( $I_C = 0.2\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ , $R_S = 2.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ , $BW = 200\text{ Hz}$ )	BC846A,B,C, BC847A,B,C, BC848A,B,C BC849B,C, BC850B,C	NF	– –	– –	10 4.0	dB

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# BC846ALT1G Series

BC846A, BC847A, BC848A, SBC846A

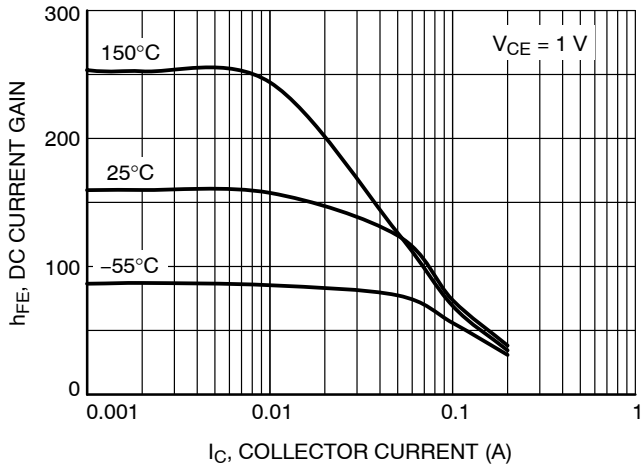


Figure 1. DC Current Gain vs. Collector Current

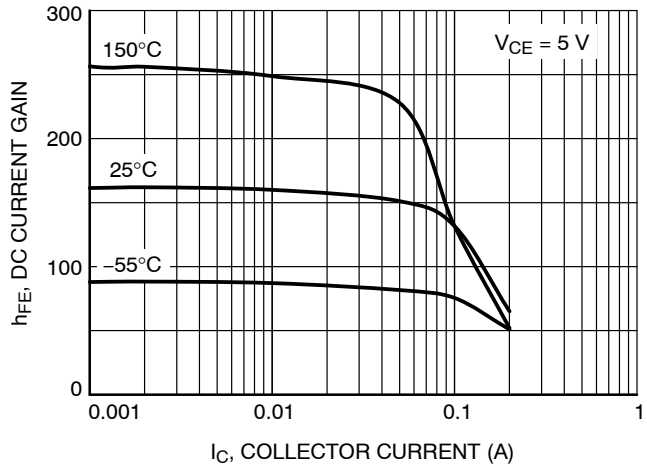


Figure 2. DC Current Gain vs. Collector Current

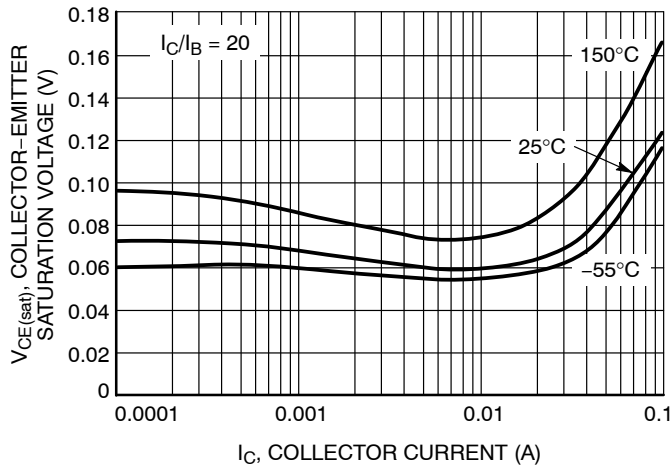


Figure 3. Collector Emitter Saturation Voltage vs. Collector Current

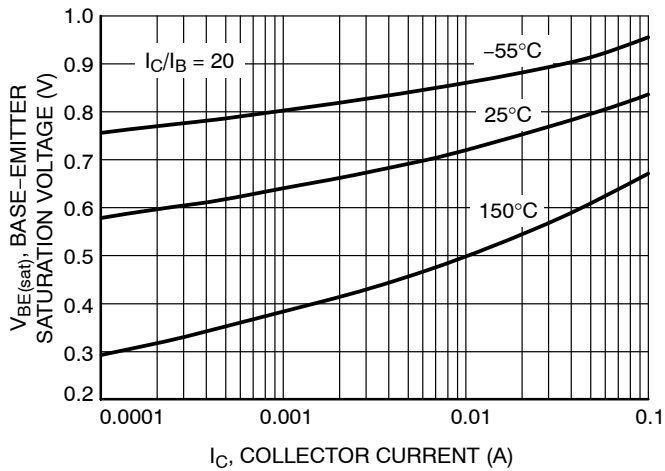


Figure 4. Base Emitter Saturation Voltage vs. Collector Current

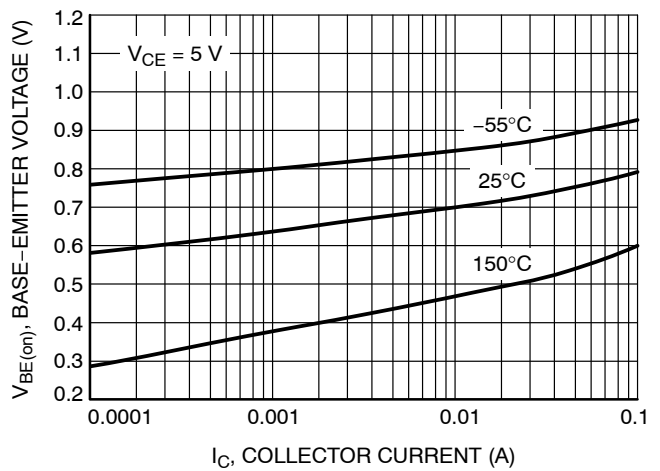


Figure 5. Base Emitter Voltage vs. Collector Current

# BC846ALT1G Series

## BC846A, BC847A, BC848A, SBC846A

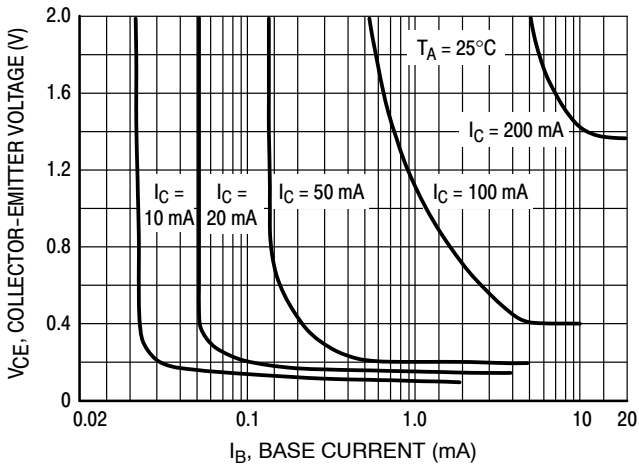


Figure 6. Collector Saturation Region

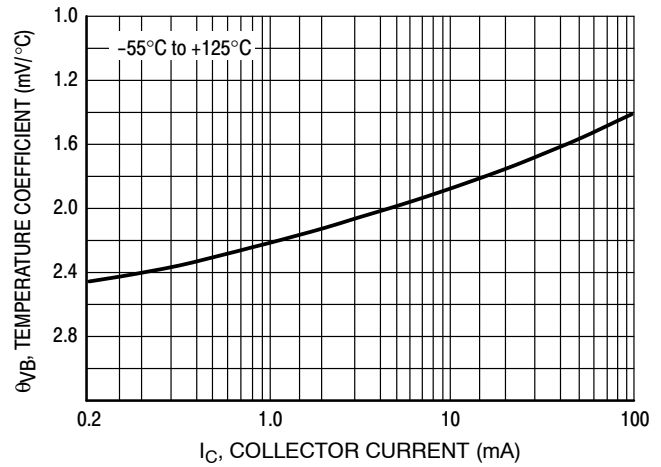


Figure 7. Base-Emitter Temperature Coefficient

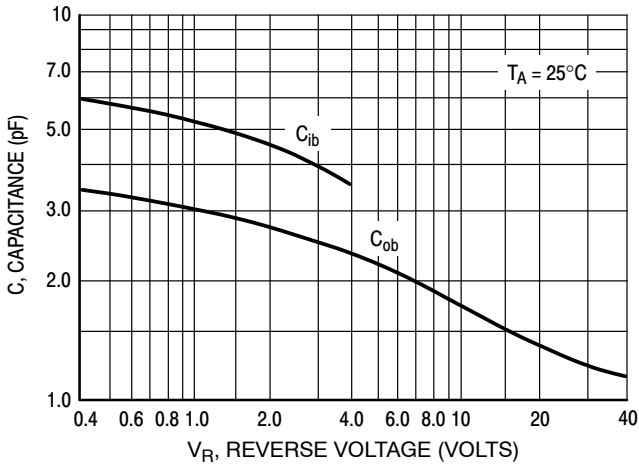


Figure 8. Capacitances

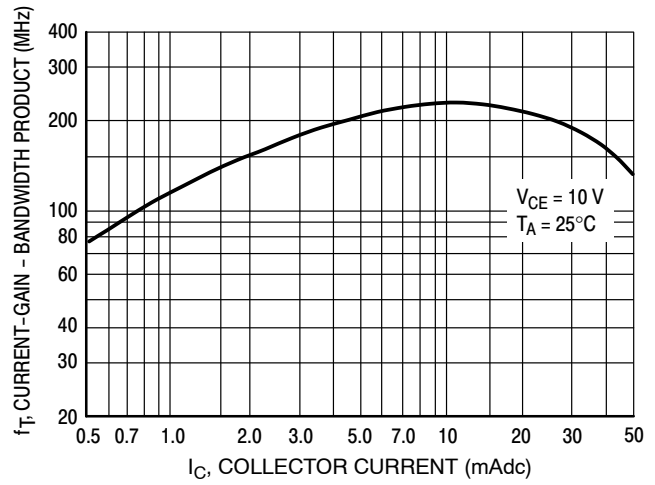
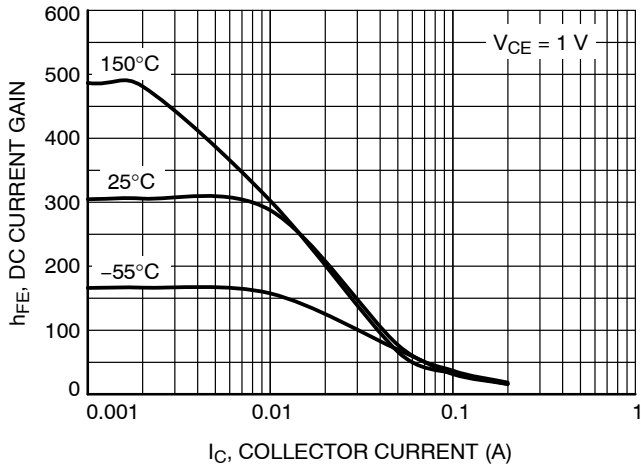


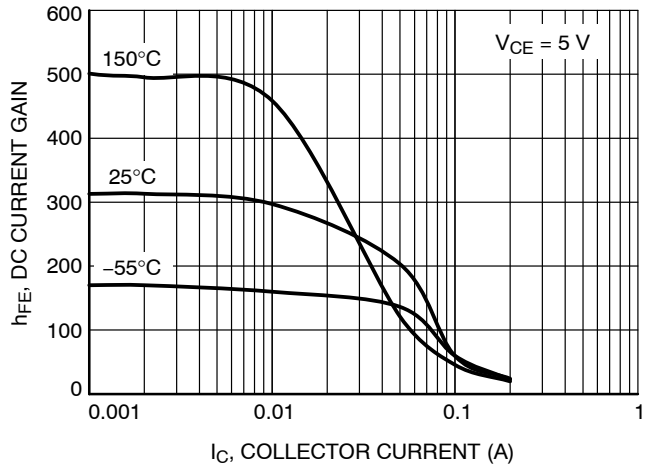
Figure 9. Current-Gain - Bandwidth Product

# BC846ALT1G Series

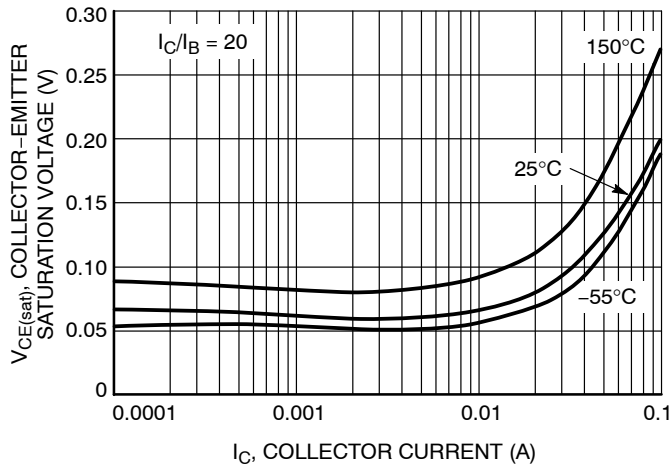
## BC846B, SBC846B



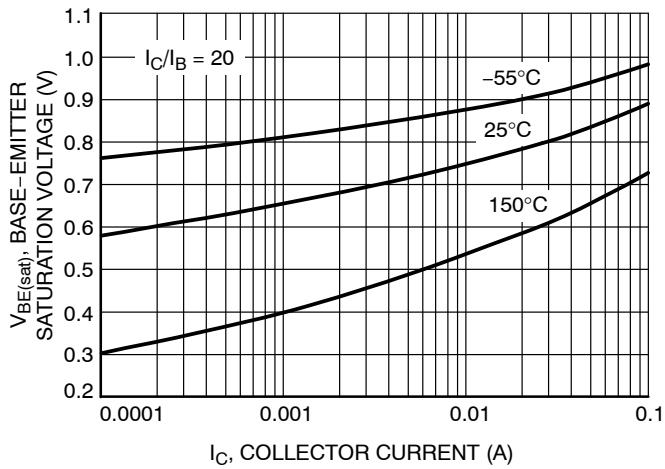
**Figure 10. DC Current Gain vs. Collector Current**



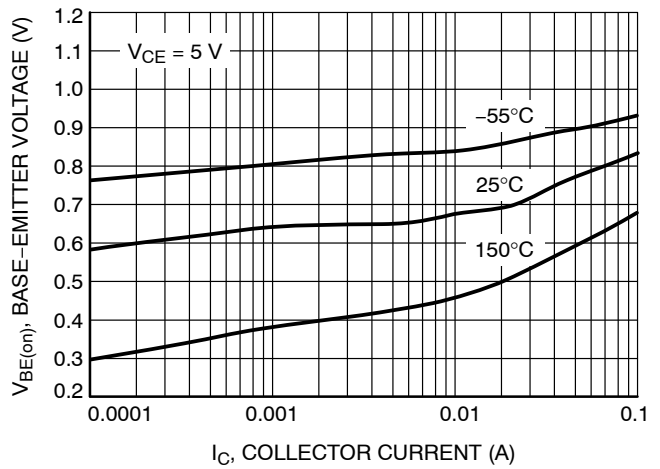
**Figure 11. DC Current Gain vs. Collector Current**



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



**Figure 13. Base Emitter Saturation Voltage vs. Collector Current**



**Figure 14. Base Emitter Voltage vs. Collector Current**

# BC846ALT1G Series

## BC846B, SBC846B

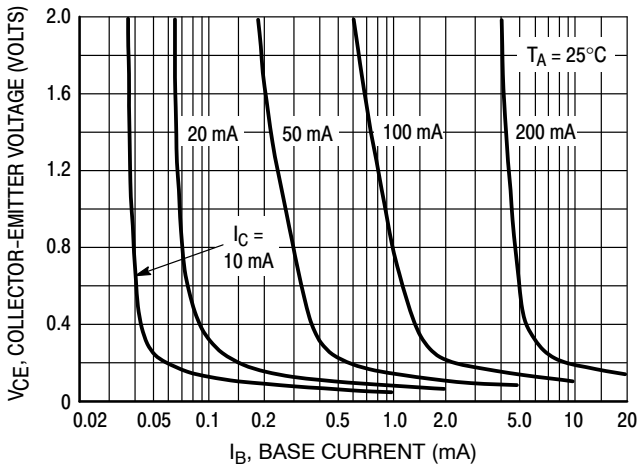


Figure 15. Collector Saturation Region

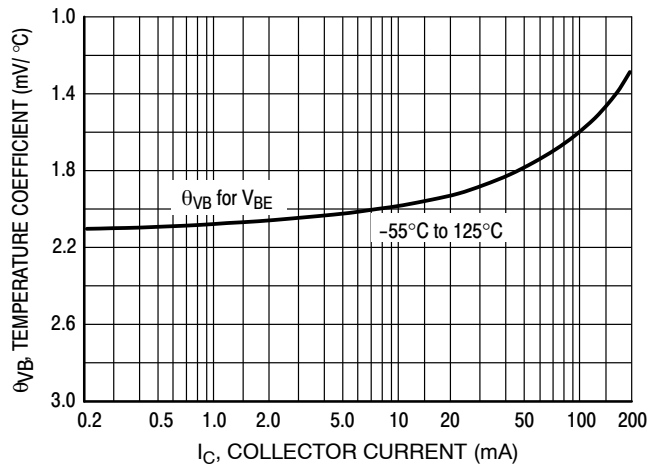


Figure 16. Base-Emitter Temperature Coefficient

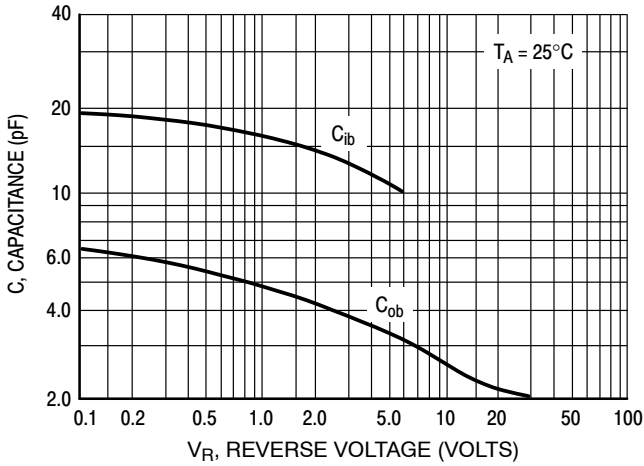


Figure 17. Capacitance

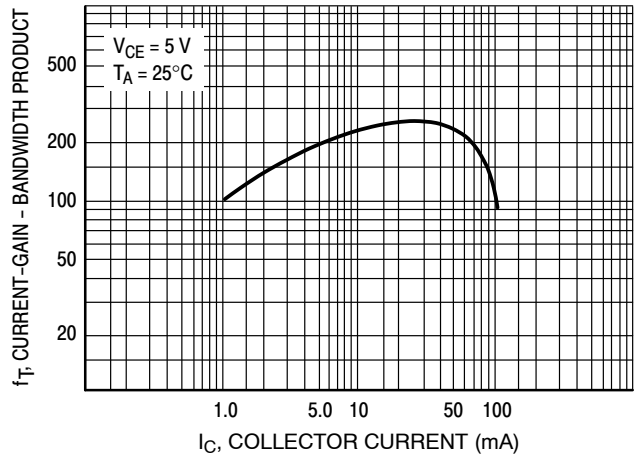


Figure 18. Current-Gain - Bandwidth Product

# BC846ALT1G Series

BC847B, BC848B, BC849B, BC850B, SBC847B, SBC848B

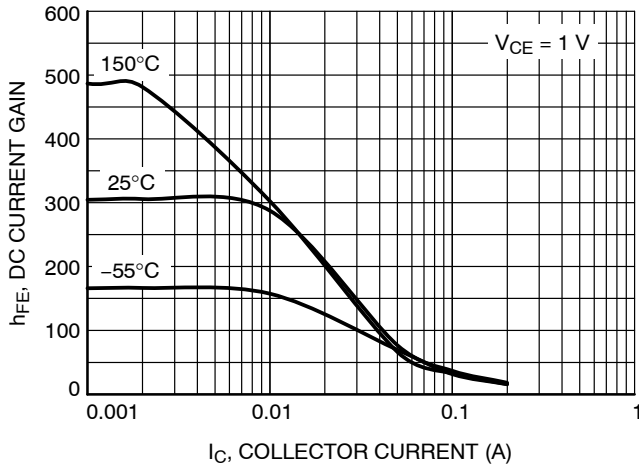


Figure 19. DC Current Gain vs. Collector Current

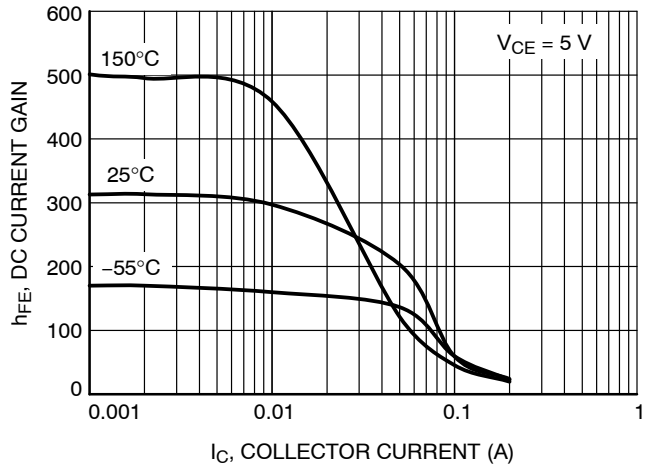


Figure 20. DC Current Gain vs. Collector Current

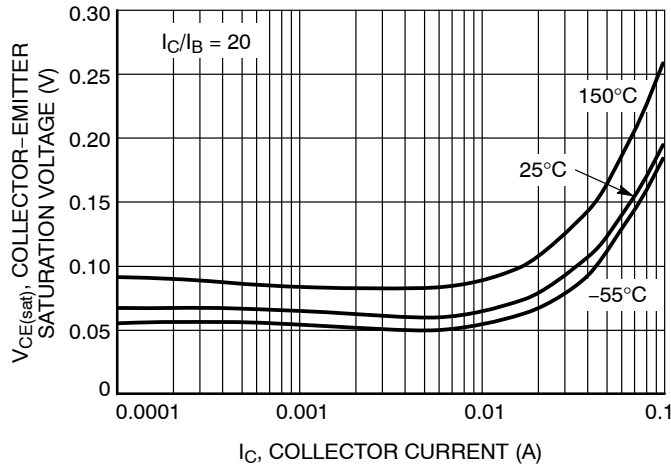


Figure 21. Collector Emitter Saturation Voltage vs. Collector Current

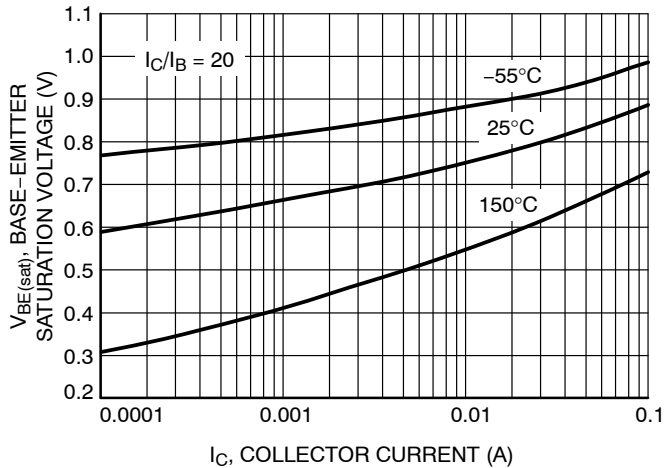


Figure 22. Base Emitter Saturation Voltage vs. Collector Current

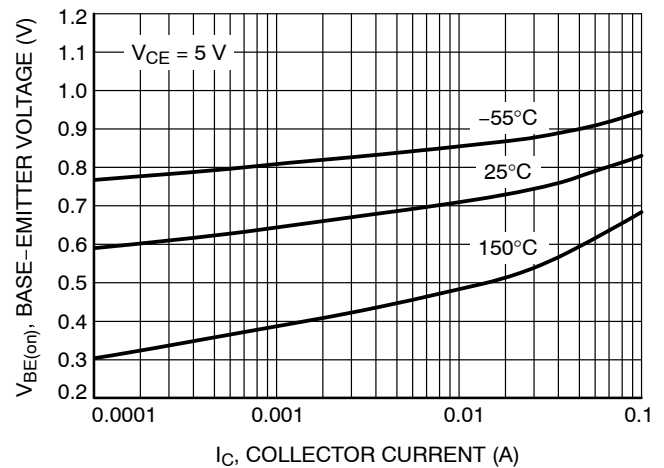


Figure 23. Base Emitter Voltage vs. Collector Current

# BC846ALT1G Series

BC847B, BC848B, BC849B, BC850B, SBC846B, SBC847B, SBC848B

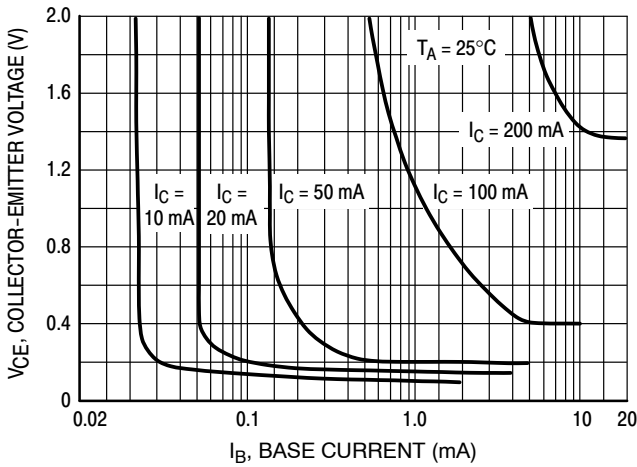


Figure 24. Collector Saturation Region

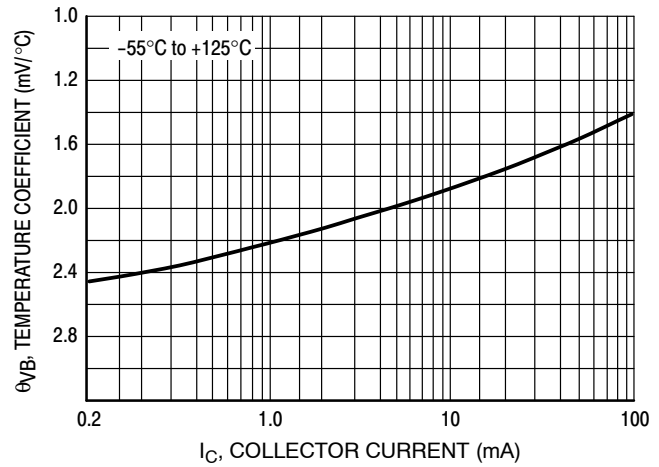


Figure 25. Base-Emitter Temperature Coefficient

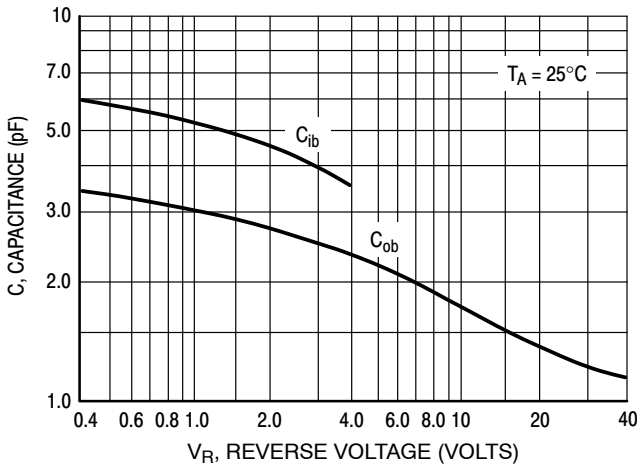


Figure 26. Capacitances

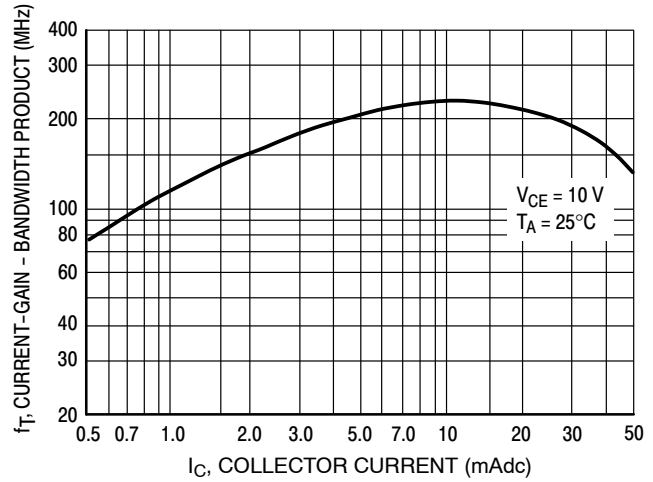
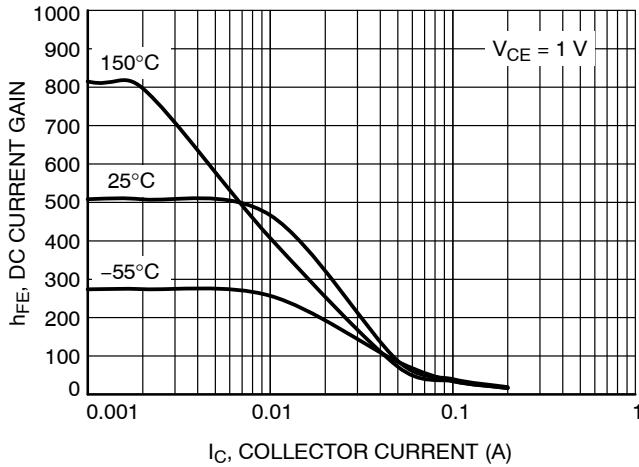


Figure 27. Current-Gain - Bandwidth Product

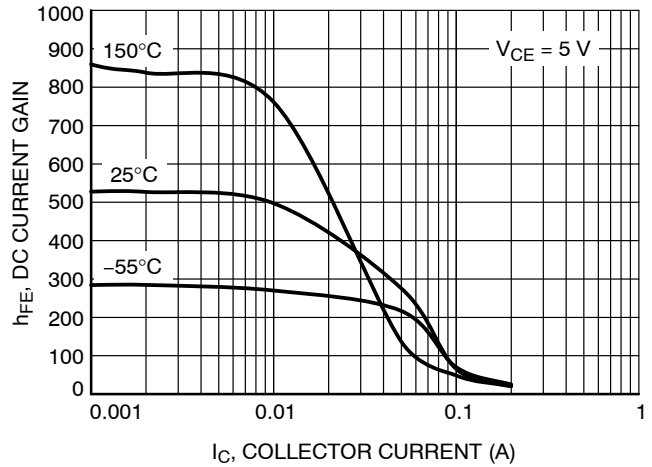


# BC846ALT1G Series

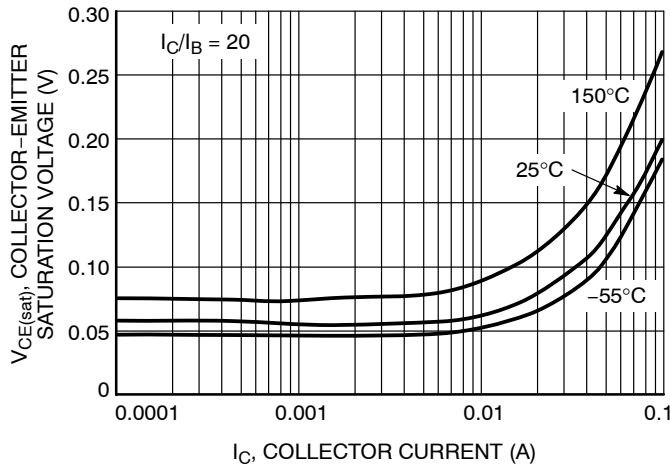
BC846C, BC847C, BC848C, BC849C, BC850C, SBC847C



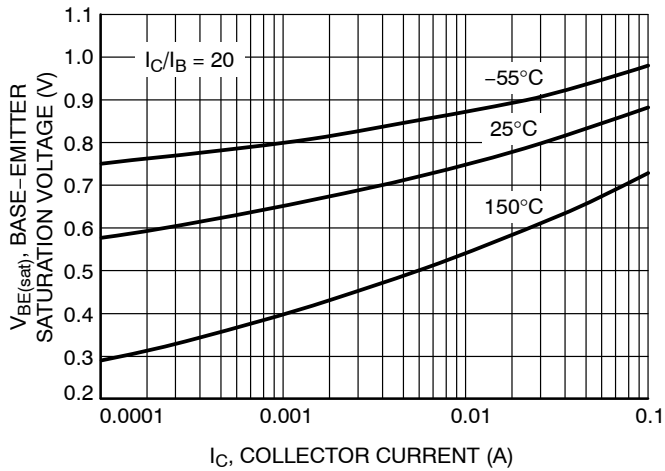
**Figure 28. DC Current Gain vs. Collector Current**



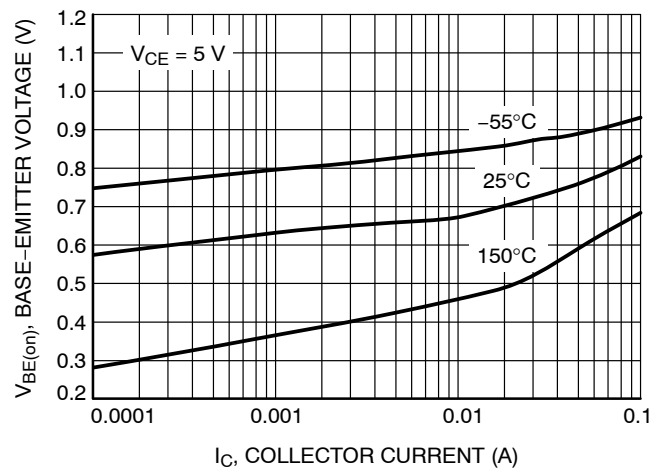
**Figure 29. DC Current Gain vs. Collector Current**



**Figure 30. Collector Emitter Saturation Voltage vs. Collector Current**



**Figure 31. Base Emitter Saturation Voltage vs. Collector Current**



**Figure 32. Base Emitter Voltage vs. Collector Current**

# BC846ALT1G Series

BC846C, BC847C, BC848C, BC849C, BC850C, SBC847C

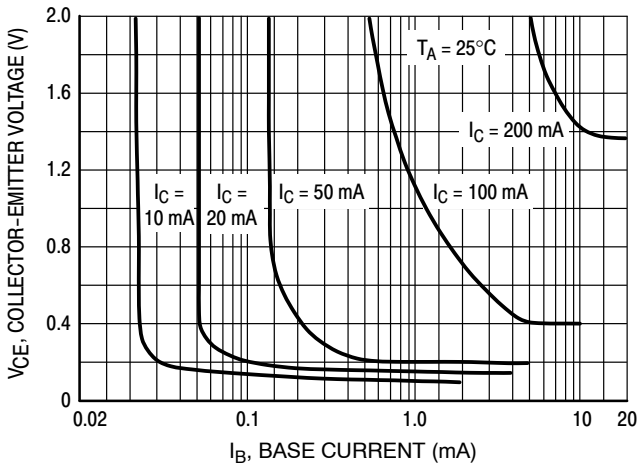


Figure 33. Collector Saturation Region

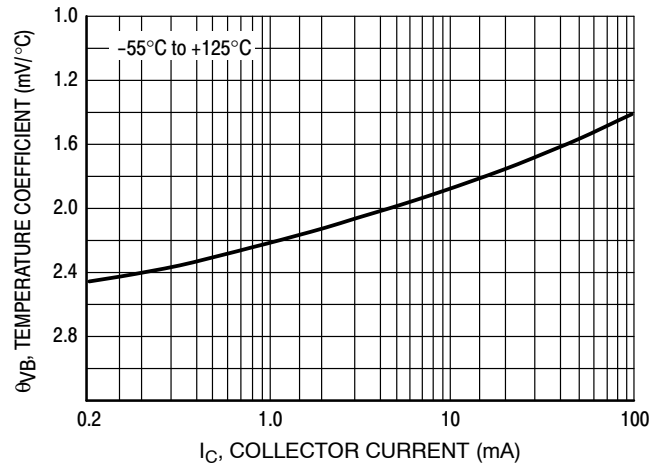


Figure 34. Base-Emitter Temperature Coefficient

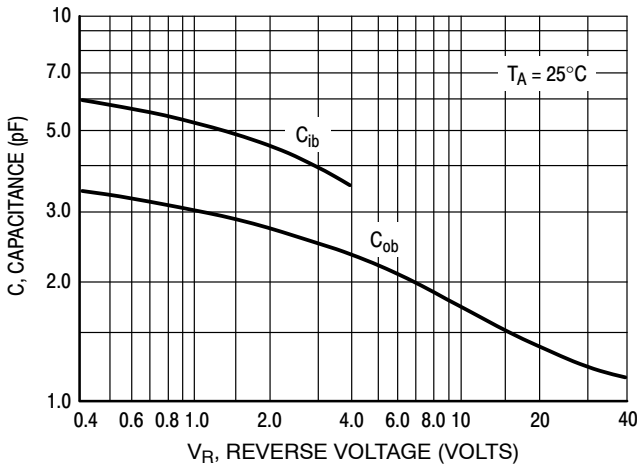


Figure 35. Capacitances

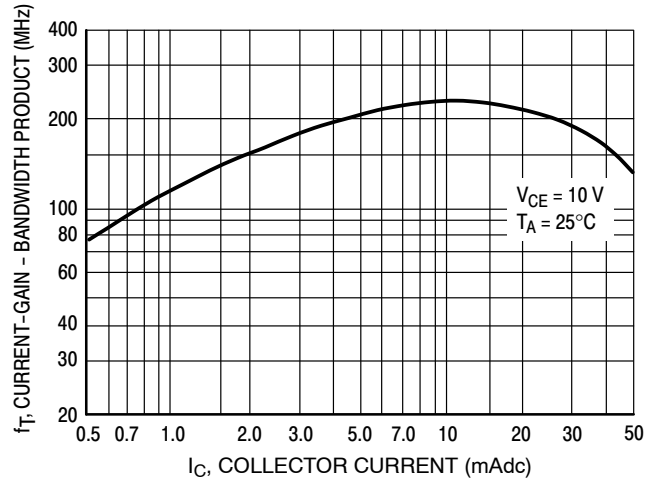
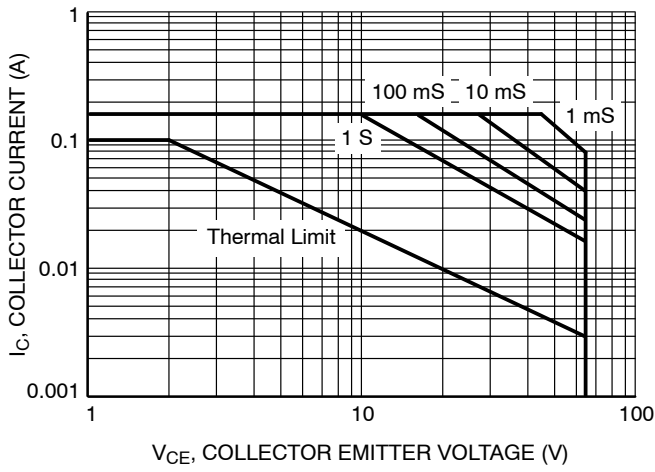
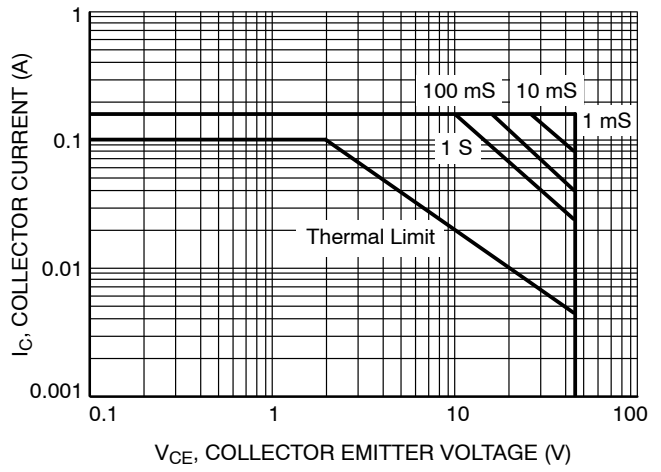


Figure 36. Current-Gain - Bandwidth Product

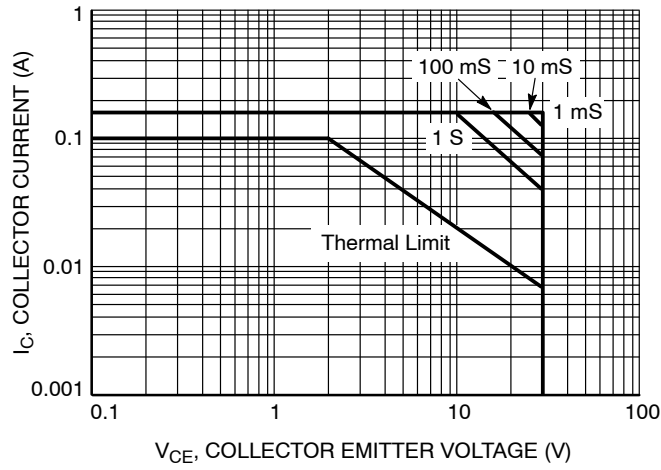
# BC846ALT1G Series



**Figure 37. Safe Operating Area for BC846A, BC846B, BC846C**



**Figure 38. Safe Operating Area for BC847A, BC847B, BC847C, BC850B, BC850C**



**Figure 39. Safe Operating Area for BC848A, BC848B, BC848C, BC849B, BC849C**

## BC846ALT1G Series

### ORDERING INFORMATION

Device	Marking	Package	Shipping†
BC846ALT1G	1A	SOT-23 (Pb-Free)	3,000 / Tape & Reel
SBC846ALT1G*			
BC846ALT3G			10,000 / Tape & Reel
BC846BLT1G	1B		3,000 / Tape & Reel
SBC846BLT1G*			
BC846BLT3G			10,000 / Tape & Reel
SBC846BLT3G*			
BC846CLT1G	3C		3,000 / Tape & Reel
BC847ALT1G	1E		3,000 / Tape & Reel
BC847ALT3G			10,000 / Tape & Reel
BC847BLT1G	1F		3,000 / Tape & Reel
SBC847BLT1G*			
BC847BLT3G			10,000 / Tape & Reel
NSVBC847BLT3G*			
BC847CLT1G	1G		3,000 / Tape & Reel
SBC847CLT1G*			
BC847CLT3G			10,000 / Tape & Reel
BC848ALT1G	1J		3,000 / Tape & Reel
BC848BLT1G	1K		3,000 / Tape & Reel
SBC848BLT1G*			
BC848BLT3G			10,000 / Tape & Reel
BC848CLT1G	1L		3,000 / Tape & Reel
NSVBC848CLT1G*			
BC848CLT3G			10,000 / Tape & Reel
BC849BLT1G	2B		3,000 / Tape & Reel
NSVBC849BLT1G*			
BC849BLT3G			10,000 / Tape & Reel
BC849CLT1G	2C		3,000 / Tape & Reel
BC849CLT3G			10,000 / Tape & Reel
BC850BLT1G	2F		3,000 / Tape & Reel
NSVBC850BLT1G*			
BC850CLT1G	2G		
NSVBC850CLT1G*			

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*S and NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



**SOT-23 (TO-236)**  
CASE 318-08  
ISSUE AS

DATE 30 JAN 2018

SCALE 4:1



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.039	0.044
A1	0.01	0.06	0.10	0.000	0.002	0.004
b	0.37	0.44	0.50	0.015	0.017	0.020
c	0.08	0.14	0.20	0.003	0.006	0.008
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.080
L	0.30	0.43	0.55	0.012	0.017	0.022
L1	0.35	0.54	0.69	0.014	0.021	0.027
HE	2.10	2.40	2.64	0.083	0.094	0.104
T	0°	---	10°	0°	---	10°

**RECOMMENDED SOLDERING FOOTPRINT**



**GENERIC MARKING DIAGRAM\***



XXX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

STYLE 1 THRU 5:  
CANCELLED

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

STYLE 7:  
PIN 1. EMITTER  
2. BASE  
3. COLLECTOR

STYLE 8:  
PIN 1. ANODE  
2. NO CONNECTION  
3. CATHODE

STYLE 9:  
PIN 1. ANODE  
2. ANODE  
3. CATHODE

STYLE 10:  
PIN 1. DRAIN  
2. SOURCE  
3. GATE

STYLE 11:  
PIN 1. ANODE  
2. CATHODE  
3. CATHODE-ANODE

STYLE 12:  
PIN 1. CATHODE  
2. CATHODE  
3. ANODE

STYLE 13:  
PIN 1. SOURCE  
2. DRAIN  
3. GATE

STYLE 14:  
PIN 1. CATHODE  
2. GATE  
3. ANODE

STYLE 15:  
PIN 1. GATE  
2. CATHODE  
3. ANODE

STYLE 16:  
PIN 1. ANODE  
2. CATHODE  
3. CATHODE

STYLE 17:  
PIN 1. NO CONNECTION  
2. ANODE  
3. CATHODE

STYLE 18:  
PIN 1. NO CONNECTION  
2. CATHODE  
3. ANODE

STYLE 19:  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE-ANODE

STYLE 20:  
PIN 1. CATHODE  
2. ANODE  
3. GATE

STYLE 21:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN

STYLE 22:  
PIN 1. RETURN  
2. OUTPUT  
3. INPUT

STYLE 23:  
PIN 1. ANODE  
2. ANODE  
3. CATHODE

STYLE 24:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE

STYLE 25:  
PIN 1. ANODE  
2. CATHODE  
3. GATE

STYLE 26:  
PIN 1. CATHODE  
2. ANODE  
3. NO CONNECTION

STYLE 27:  
PIN 1. CATHODE  
2. CATHODE  
3. CATHODE

STYLE 28:  
PIN 1. ANODE  
2. ANODE  
3. ANODE

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<b>DESCRIPTION:</b>	<b>SOT-23 (TO-236)</b>	<b>PAGE 1 OF 1</b>

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