

**BC846A-Q1 / BC846B-Q1 / BC847A-Q1 / BC847B-Q1
BC847C-Q1 / BC848A-Q1 / BC848B-Q1 / BC848C-Q1****List**

List.....	1
Package outline.....	2
Features.....	2
Mechanical data.....	2
Maximum ratings	2
Electrical characteristics.....	3
Rating and characteristic curves.....	4~12
Pinning information.....	13
Marking.....	13
Suggested solder pad layout.....	13
Packing information.....	14
Reel packing.....	15
Suggested thermal profiles for soldering processes.....	15
High reliability test capabilities.....	16

BC846A-Q1 / BC846B-Q1 / BC847A-Q1 / BC847B-Q1 BC847C-Q1 / BC848A-Q1 / BC848B-Q1 / BC848C-Q1

General Purpose Transistors NPN Silicon

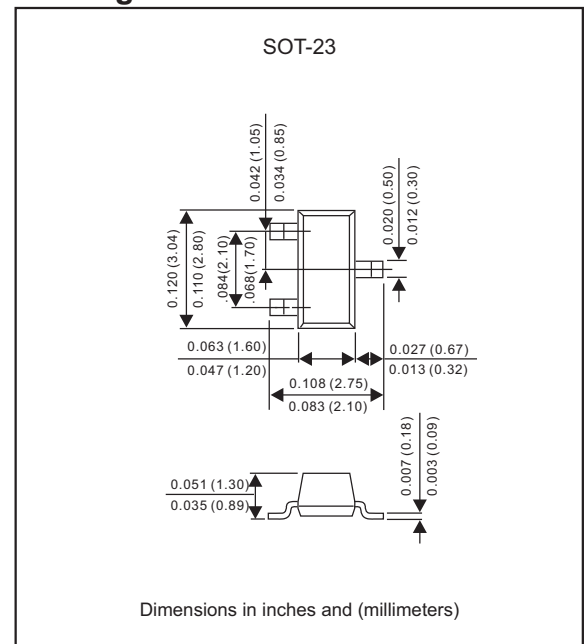
Features

- Epitaxial plana chip construction
- Ideal for medium power application and switching
- Capable of 225mW power dissipation
- Lead-free parts meet RoHS requirements
- Qualified to AEC-Q101 standards for high reliability
- Suffix "-H" indicates Halogen-free part, ex. BC846A-Q1-H

Mechanical data

- Epoxy: UL94-V0 rated flame retardant
- Case : Molded plastic, SOT-23
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Mounting Position : Any
- Weight : Approximated 0.008 gram

Package outline



Maximum ratings (AT $T_A=25^{\circ}\text{C}$ unless otherwise noted)

Parameter		Symbol	Value	Unit
Collector-base voltage	BC846 BC847 BC848	V_{CBO}	80 50 30	Vdc
Collector-emitter voltage	BC846 BC847 BC848	V_{CEO}	65 45 30	Vdc
Emitter-base voltage	BC846 BC847 BC848	V_{EBO}	6.0 6.0 5.0	Vdc
Collector current-continuous		I_C	100	mAdc

Thermal characteristics

Parameter		Symbol	MIN.	TYP.	MAX.	Unit
Total device dissipation FR-5 board (1)	$T_A=25^{\circ}\text{C}$	P_D			225	mW
	Derate above 25°C				1.8	mW/ $^{\circ}\text{C}$
Thermal resistance	Junction to ambient	$R_{\theta JA}$			556	$^{\circ}\text{C}/\text{W}$
Total device dissipation aluminum substrate(2)	$T_A=25^{\circ}\text{C}$	P_D			300	mW
	Derate above 25°C				2.4	mW/ $^{\circ}\text{C}$
Thermal resistance	Junction to ambient	$R_{\theta JA}$			417	$^{\circ}\text{C}/\text{W}$
Operating junction temperature range		T_J	-55		+150	$^{\circ}\text{C}$
Storage temperature range		T_{STG}	-55		+150	$^{\circ}\text{C}$

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

2. Aluminum = 0.4 x 0.3 x 0.024 in., 99.5% aluminum

BC846A-Q1 / BC846B-Q1 / BC847A-Q1 / BC847B-Q1 BC847C-Q1 / BC848A-Q1 / BC848B-Q1 / BC848C-Q1

Electrical characteristics (AT $T_A=25^{\circ}\text{C}$ unless otherwise noted)

Off characteristics

Parameter	Conditions	Symbol	MIN.	TYP.	MAX.	Unit
Collector-base breakdown voltage	$I_C = 10\mu\text{A}$ BC846 BC847 BC848	$V_{(BR)CBO}$	80 50 30			V
Collector-emitter breakdown voltage	$I_C = 10\text{mA}$ BC846 BC847 BC848	$V_{(BR)CEO}$	65 45 30			V
Emitter-base breakdown voltage	$I_E = 1.0\mu\text{A}$ BC846 BC847 BC848	$V_{(BR)EBO}$	6.0 6.0 5.0			V
Collector-emitter breakdown voltage	$I_C = 10\mu\text{A}$, $V_{EB} = 0$ BC846 BC847 BC848	$V_{(BR)CES}$	80 50 30			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 μA

On characteristics

Parameter	Conditions	Symbol	MIN.	TYP.	MAX.	Unit
DC current gain($I_C = 2.0\text{mA}$, $V_{CE} = 5.0\text{V}$)	BC846A, BC847A, BC848A BC846B, BC847B, BC848B BC847C, BC848C	h_{FE}	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 on voltage	$I_C = 2.0\text{mA}$, $V_{CE} = 5.0\text{V}$ $I_C = 10\text{mA}$, $V_{CE} = 5.0\text{V}$	$V_{BE(on)}$	580	660	700 770	mV

Small-signal characteristics

Parameter	Conditions	Symbol	MIN.	TYP.	MAX.	Unit
Current-gain-bandwidth product	$I_C = 10\text{mA}$, $V_{CE} = 5.0\text{V}$, $f = 100\text{MHz}$	f_T	100			MHz
Output capacitance	$V_{CB} = 10\text{V}$, $f = 1.0\text{MHz}$	C_{obo}			4.5	pF
Noise figure	$I_C = 0.2\text{mA}$, $V_{CE} = 5.0\text{V}$, $R_S = 2.0\text{K}\Omega$, $f = 1.0\text{KHz}$, $BW = 200\text{Hz}$ BC846 BC847 BC848	N_F			10	dB

Rating and characteristic curves

BC846A, BC847A, BC848A

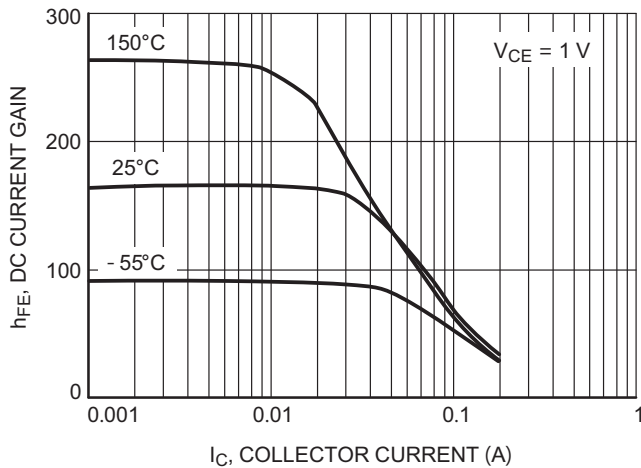


Figure 1. DC Current Gain vs. Collector Current

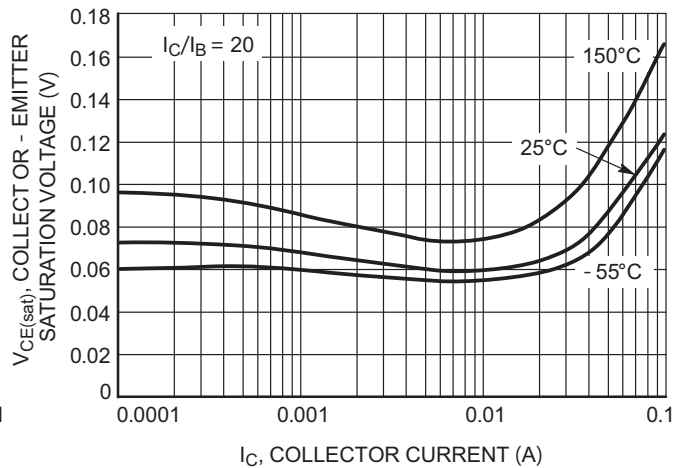


Figure 2. Collector Emitter Saturation Voltage vs. Collector Current

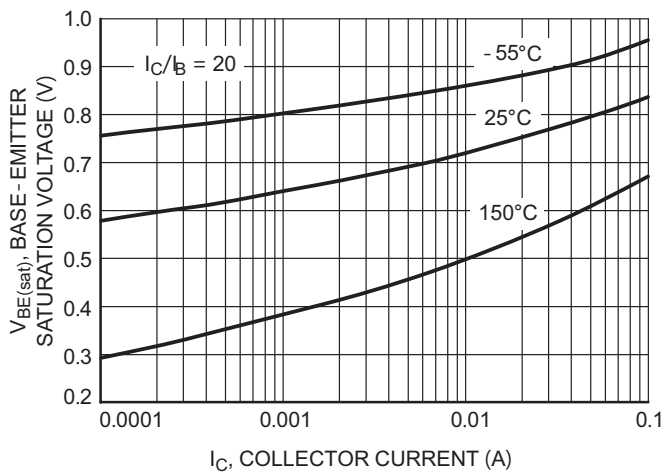


Figure 3. Base Emitter Saturation Voltage vs. Collector Current

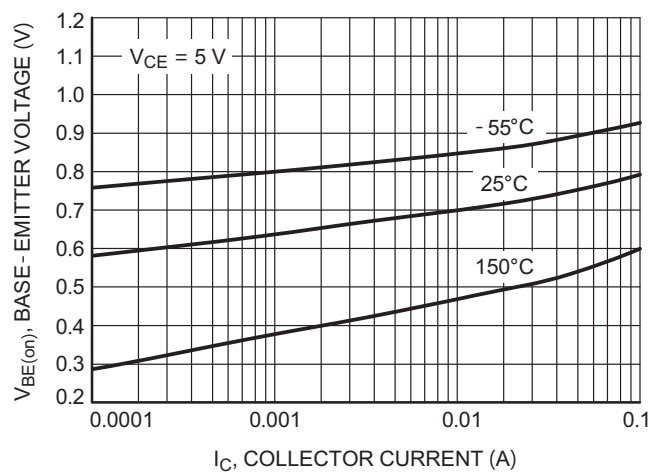


Figure 4. Base Emitter Voltage vs. Collector Current

Rating and characteristic curves

BC846A, BC847A, BC848A

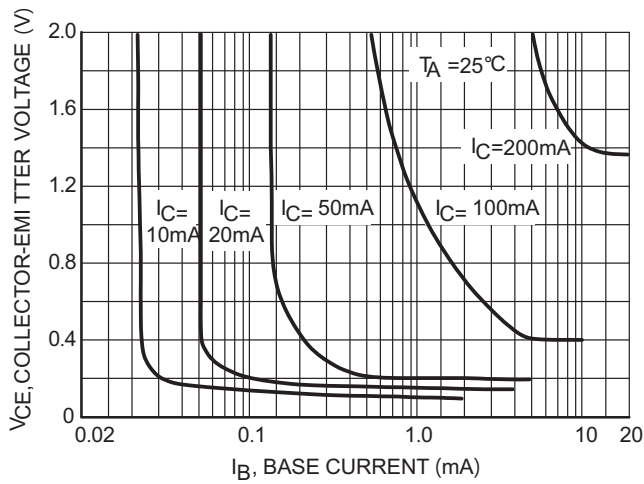


Figure 5. Collector Saturation Region

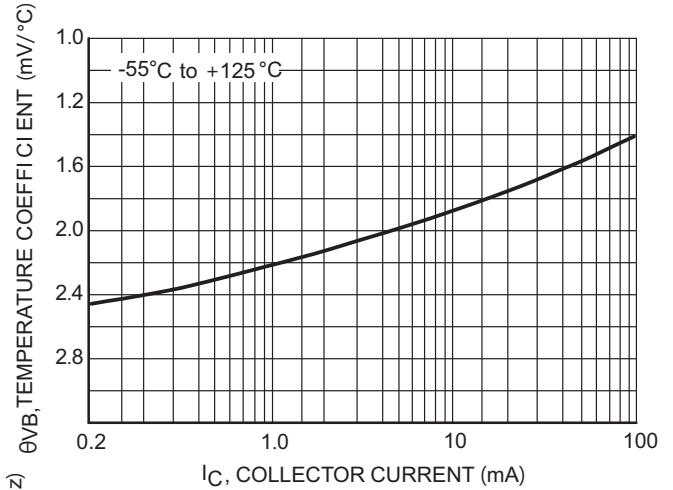


Figure 6. Base-Emitter Temperature Coefficient

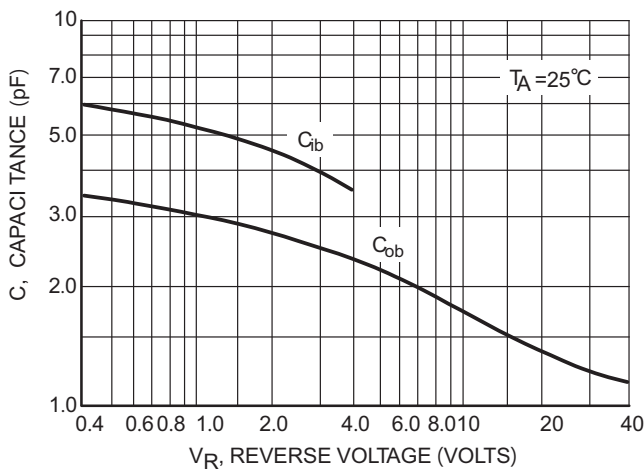


Figure 7. Capacitances

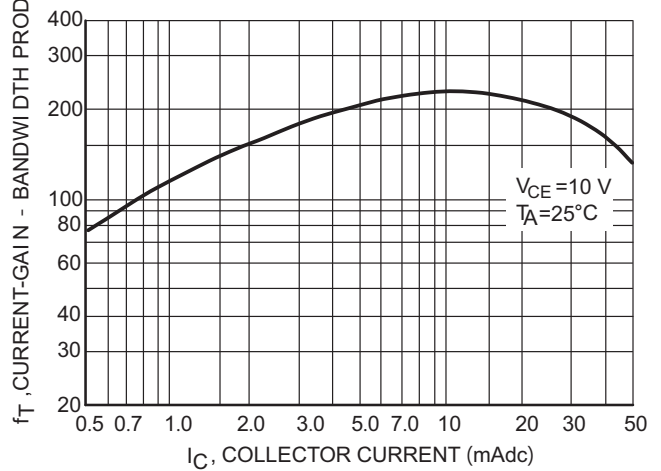


Figure 8. Current-Gain - Bandwidth Product

Rating and characteristic curves

BC846B

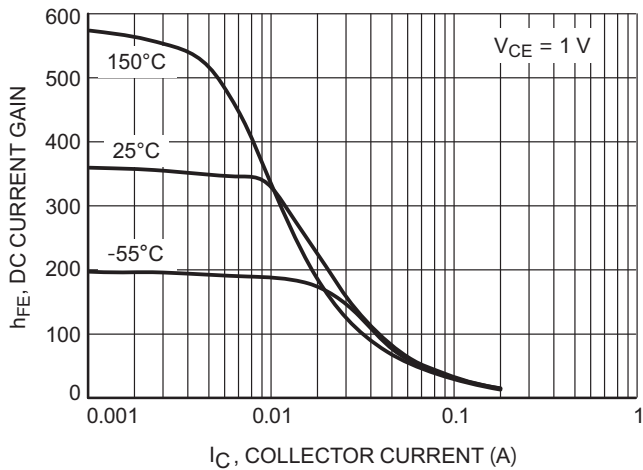


Figure 9. DC Current Gain vs. Collector Current

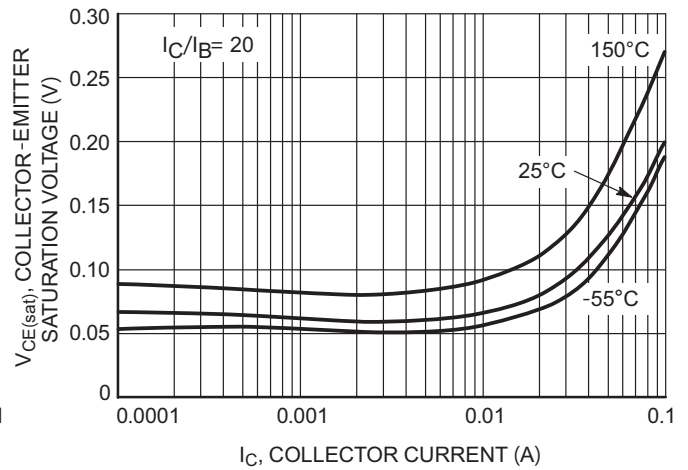


Figure 10. Collector Emitter Saturation Voltage vs. Collector Current

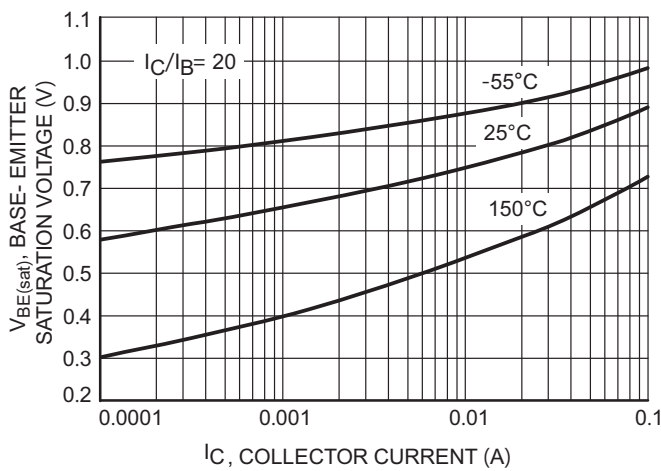


Figure 11. Base Emitter Saturation Voltage vs. Collector Current

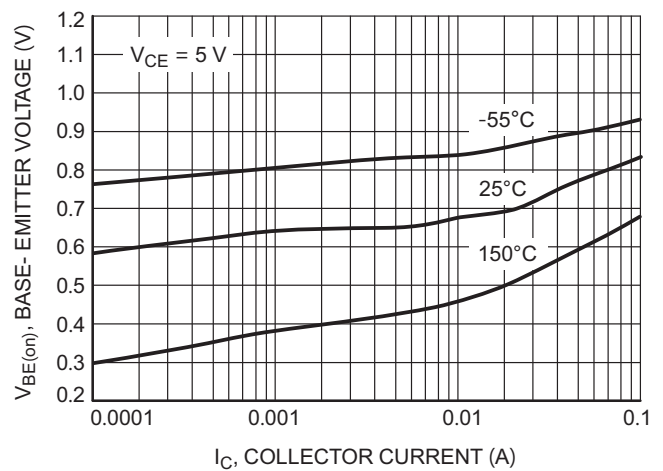


Figure 12. Base Emitter Voltage vs. Collector Current

Rating and characteristic curves

BC846B

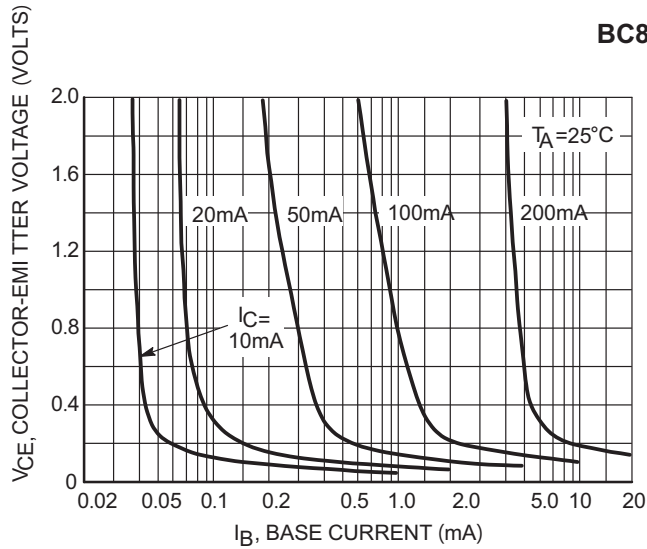


Figure 13. Collector Saturation Region

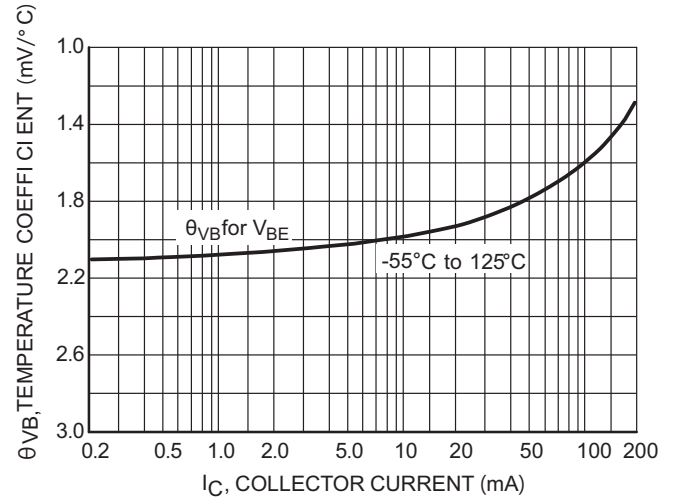


Figure 14. Base-Emitter Temperature Coefficient

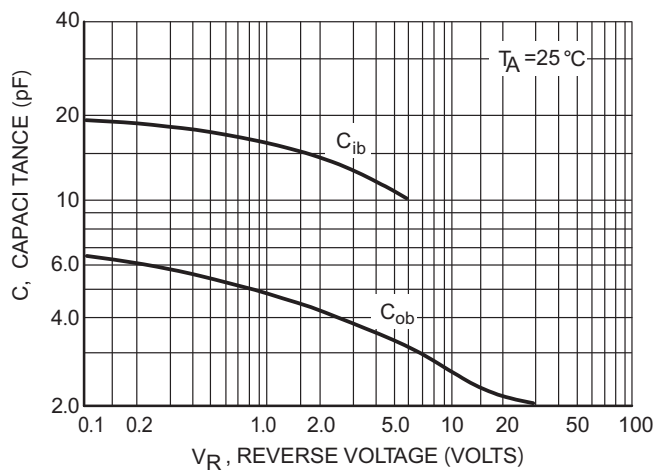


Figure 15. Capacitance

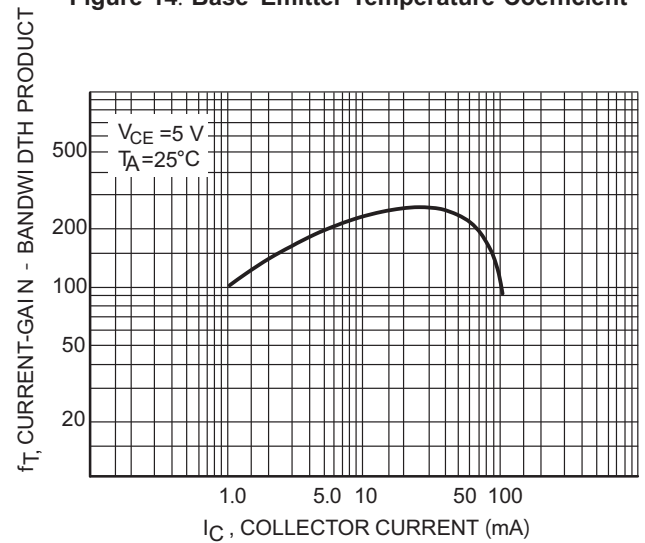


Figure 16. Current-Gain - Bandwidth Product

Rating and characteristic curves

BC847B, BC848B

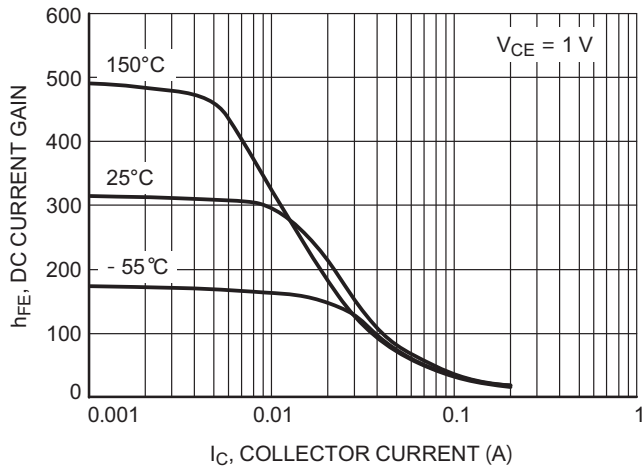


Figure 17. DC Current Gain vs. Collector Current

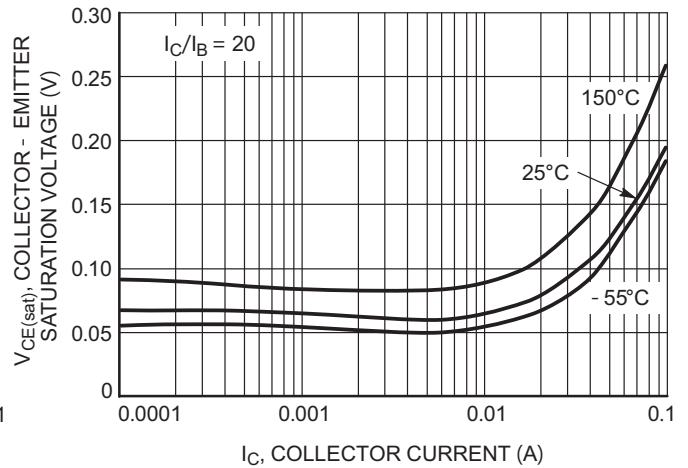


Figure 18. Collector Emitter Saturation Voltage vs. Collector Current

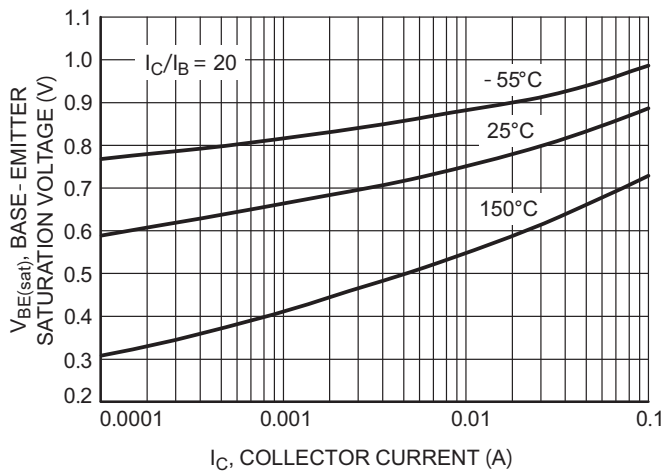


Figure 19. Base Emitter Saturation Voltage vs. Collector Current

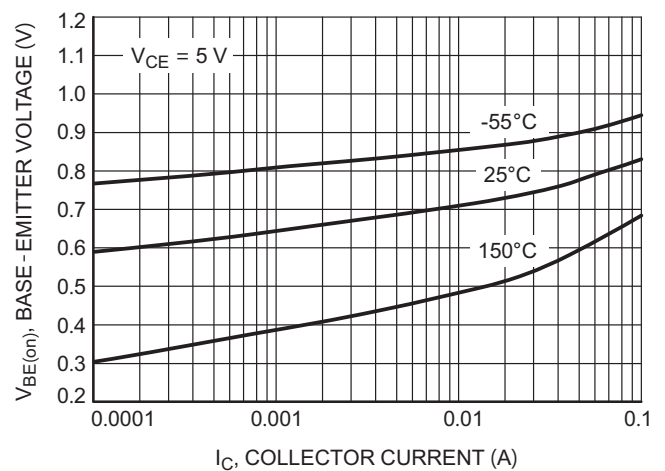


Figure 20. Base Emitter Voltage vs. Collector Current

Rating and characteristic curves

BC847B, BC848B

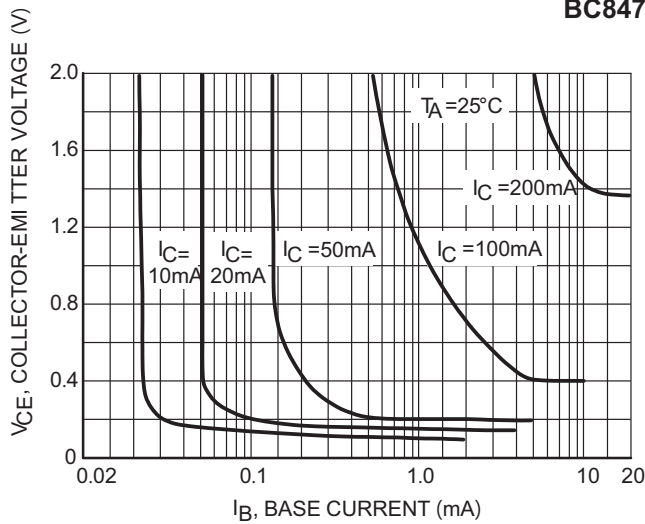


Figure 21. Collector Saturation Region

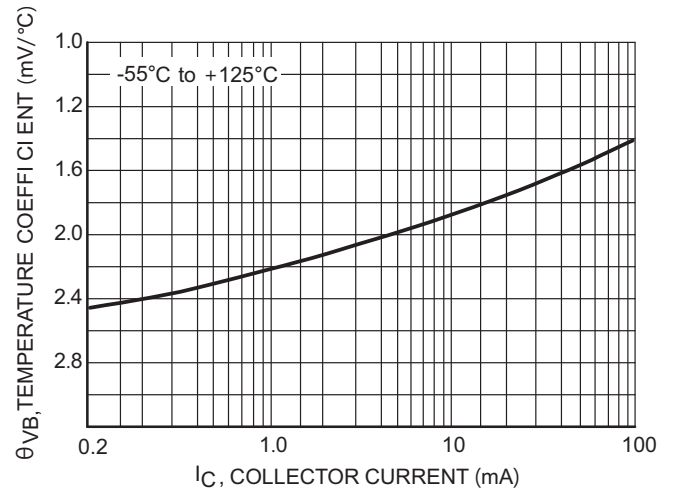


Figure 22. Base-Emitter Temperature Coefficient

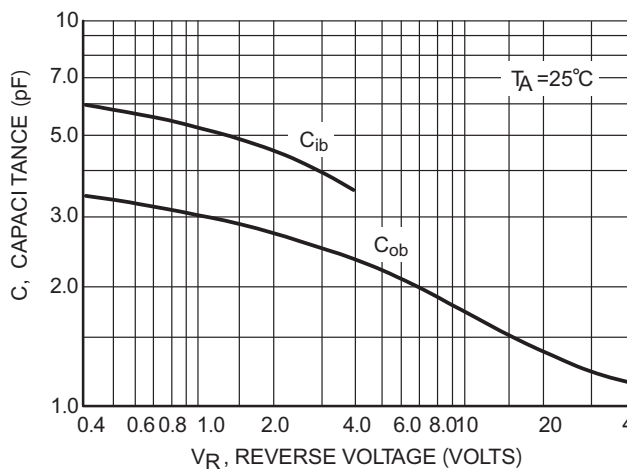


Figure 23. Capacitances

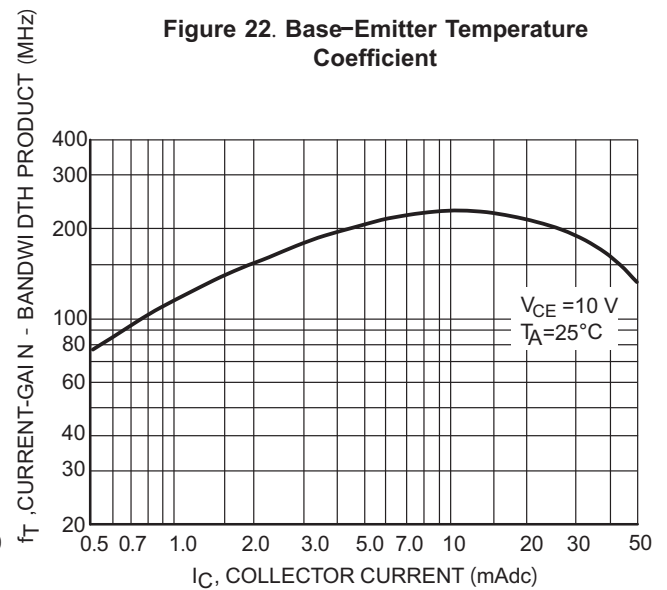


Figure 24. Current-Gain - Bandwidth Product

Rating and characteristic curves

BC847C, BC848C

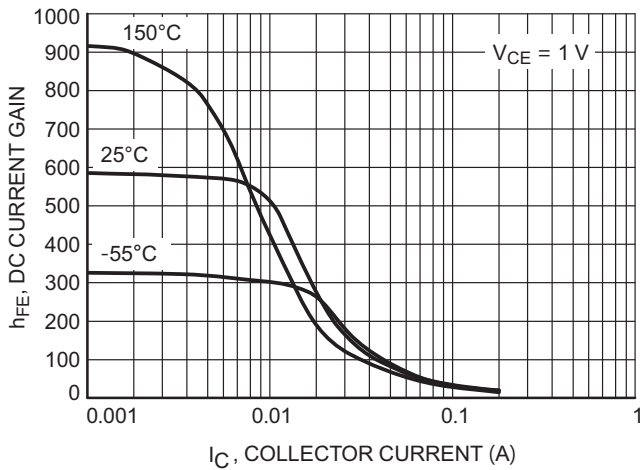


Figure 25. DC Current Gain vs. Collector Current

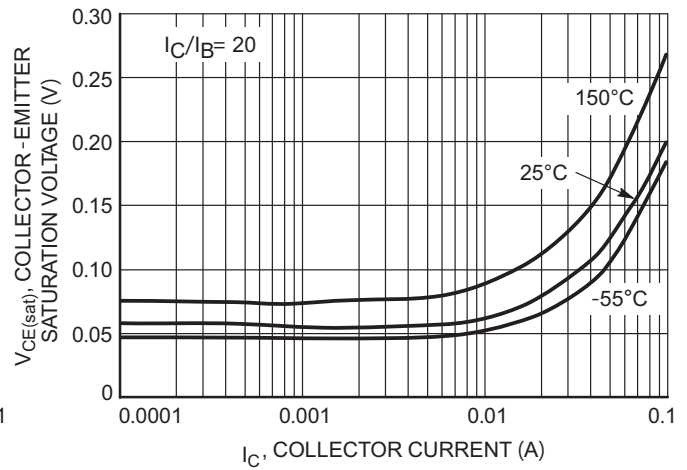


Figure 26. Collector Emitter Saturation Voltage vs. Collector Current

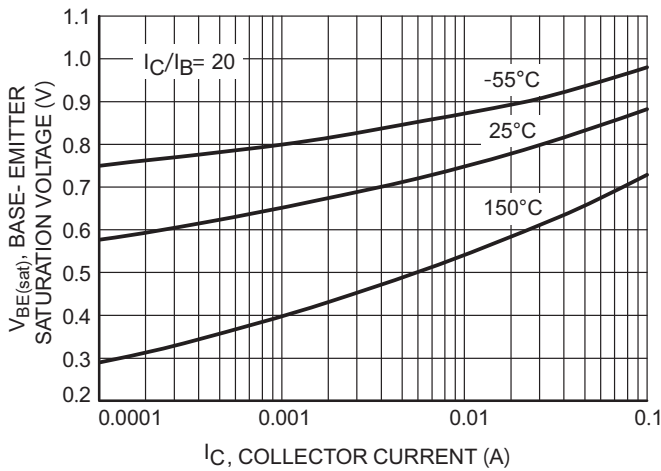


Figure 27. Base Emitter Saturation Voltage vs. Collector Current

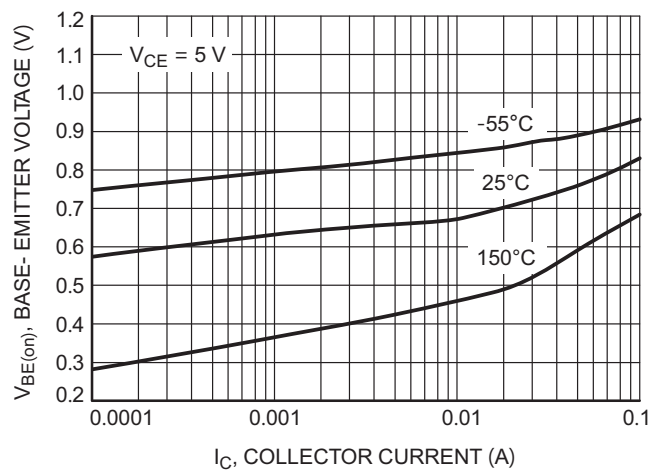


Figure 28. Base Emitter Voltage vs. Collector Current

Rating and characteristic curves

BC847C, BC848C

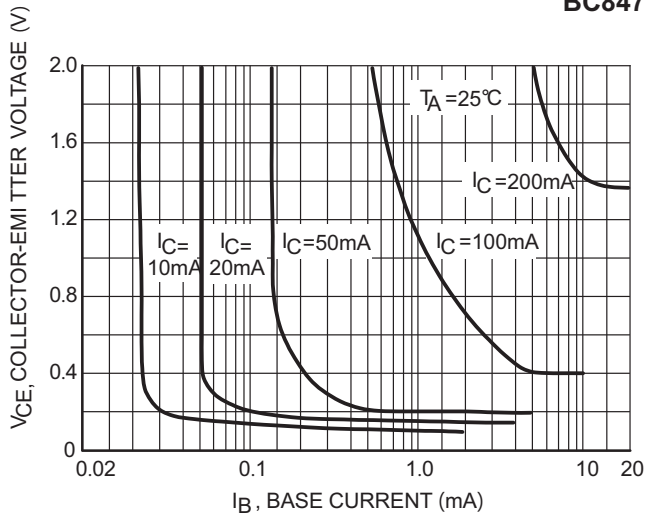


Figure 29. Collector Saturation Region

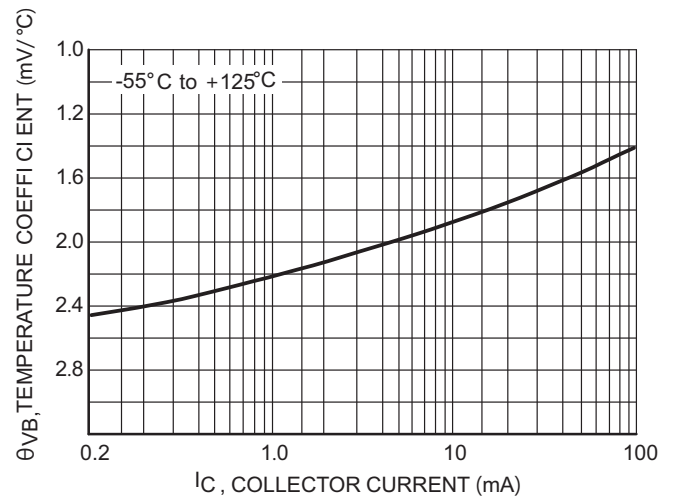


Figure 30. Base-Emitter Temperature Coefficient

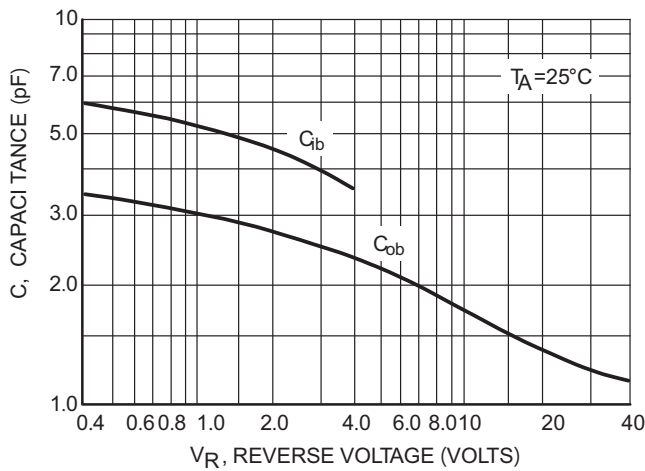


Figure 31. Capacitances

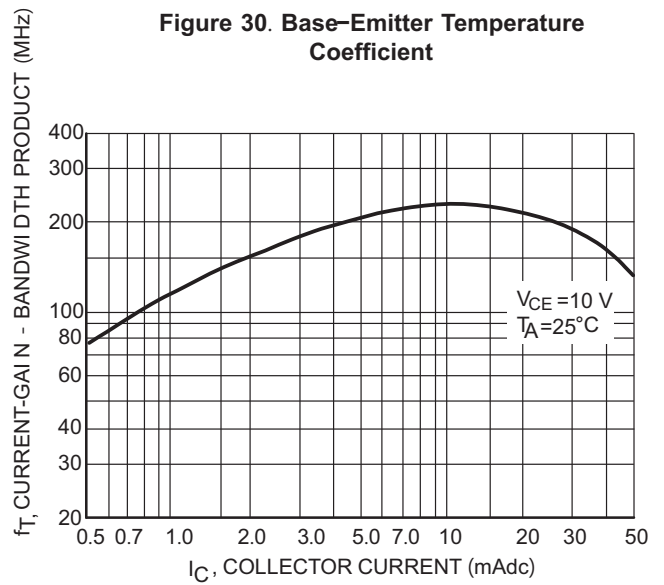


Figure 32. Current-Gain - Bandwidth Product

Rating and characteristic curves

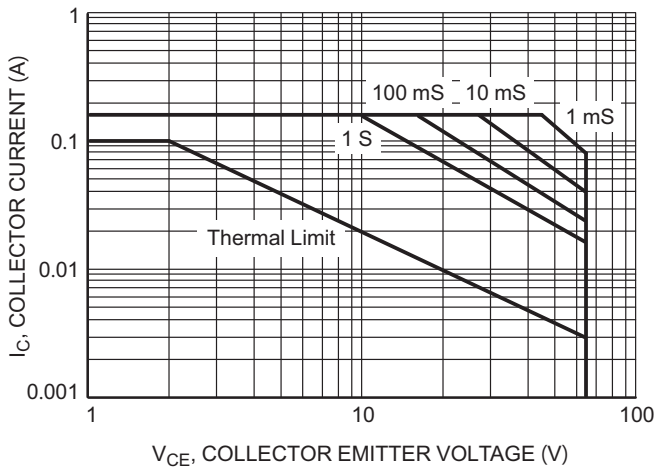


**Figure 33. Safe Operating Area for
BC846A, BC846B**

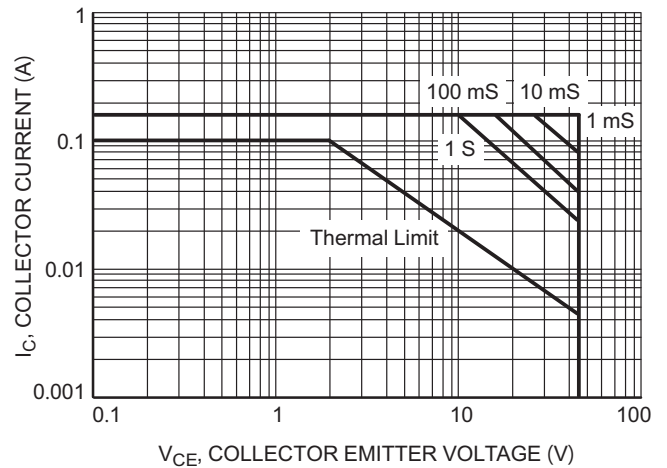


**Figure 34. Safe Operating Area for
BC847A, BC847B, BC847C**

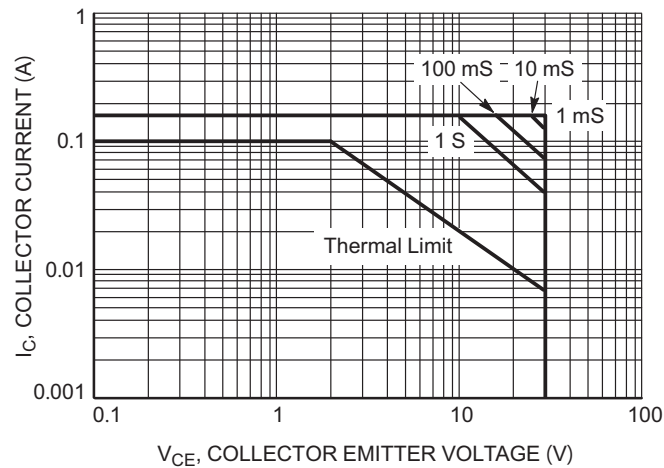
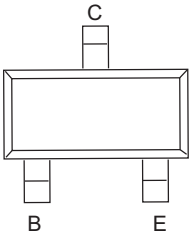
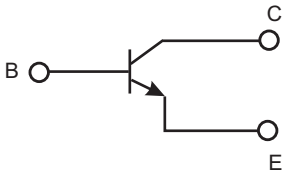


**Figure 35. Safe Operating Area for
BC848A, BC848B, BC848C**

BC846A-Q1 / BC846B-Q1 / BC847A-Q1 / BC847B-Q1 BC847C-Q1 / BC848A-Q1 / BC848B-Q1 / BC848C-Q1

Pinning information

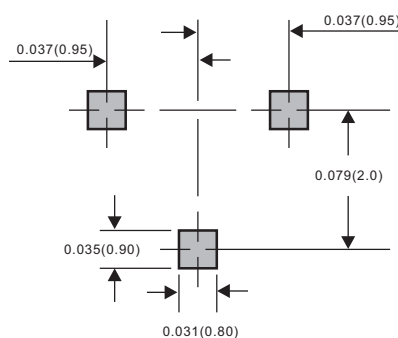
Pin	Simplified outline	Symbol
PinB Base PinC Collector PinE Emitter		

Marking

Type number	Marking code
BC846A-Q1	1A
BC846B-Q1	1B
BC847A-Q1	1E
BC847B-Q1	1F
BC847C-Q1	1G
BC848A-Q1	1J
BC848B-Q1	1K
BC848C-Q1	1L

Suggested solder pad layout

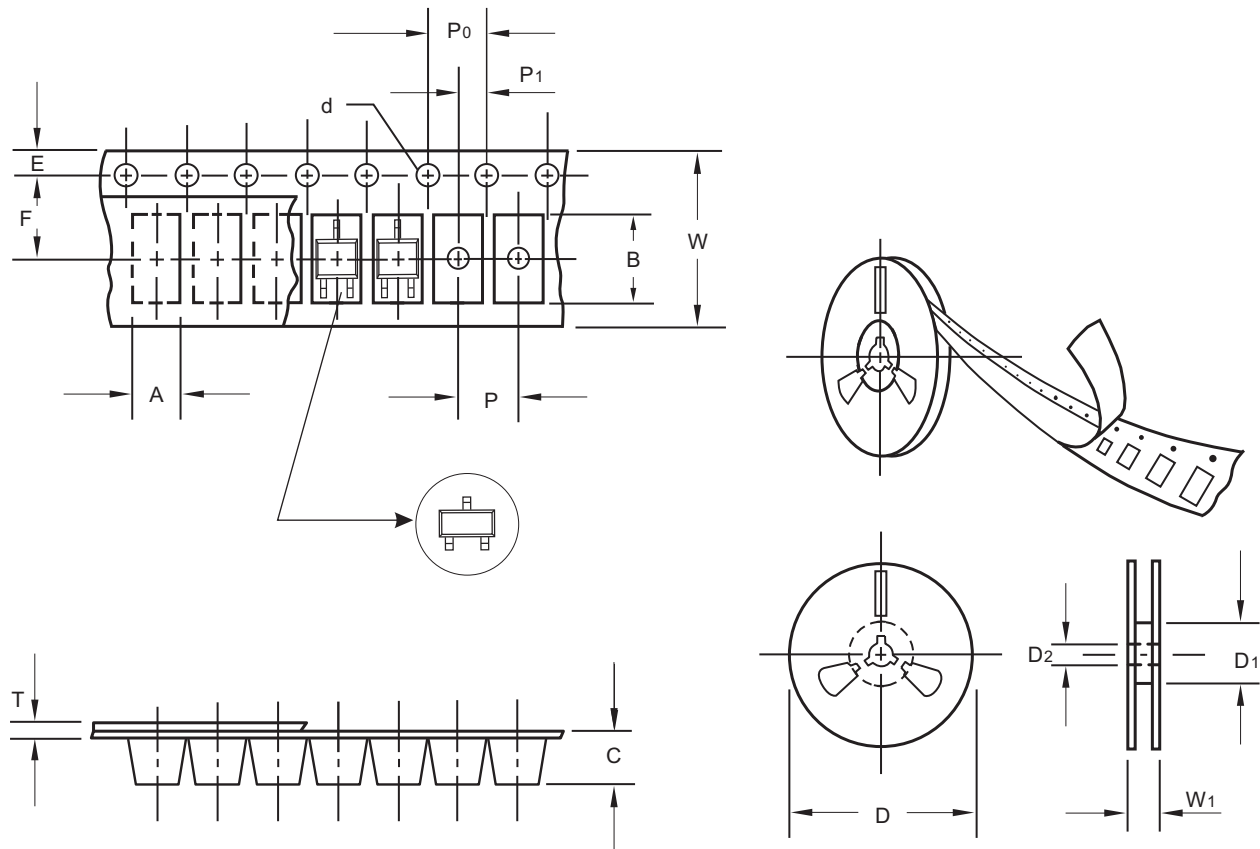
SOT-23



Dimensions in inches and (millimeters)

BC846A-Q1 / BC846B-Q1 / BC847A-Q1 / BC847B-Q1 BC847C-Q1 / BC848A-Q1 / BC848B-Q1 / BC848C-Q1

Packing information



unit:mm

Item	Symbol	Tolerance	SOT-23
Carrier width	A	0.1	3.15
Carrier length	B	0.1	2.77
Carrier depth	C	0.1	1.22
Sprocket hole	d	0.1	1.50
13" Reel outside diameter	D	2.0	-
13" Reel inner diameter	D1	min	-
7" Reel outside diameter	D	2.0	178.00
7" Reel inner diameter	D1	min	55.00
Feed hole diameter	D2	0.5	13.00
Sprocket hole position	E	0.1	1.75
Punch hole position	F	0.1	3.50
Punch hole pitch	P	0.1	4.00
Sprocket hole pitch	P0	0.1	4.00
Embossment center	P1	0.1	2.00
Overall tape thickness	T	0.1	0.23
Tape width	W	0.3	8.00
Reel width	W1	1.0	12.0

Note: Devices are packed in accordance with EIA standard RS-481-A and specifications listed above.

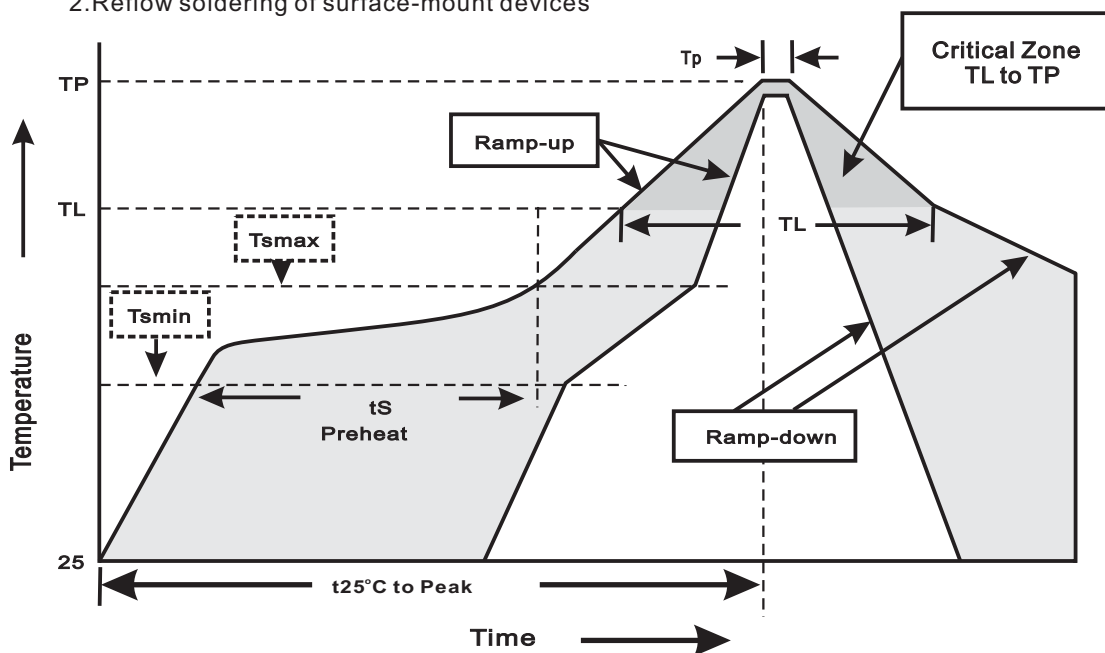
BC846A-Q1 / BC846B-Q1 / BC847A-Q1 / BC847B-Q1 BC847C-Q1 / BC848A-Q1 / BC848B-Q1 / BC848C-Q1

Reel packing

PACKAGE	REEL SIZE	REEL (pcs)	COMPONENT SPACING (m/m)	BOX (pcs)	INNER BOX (m/m)	REEL DIA, (m/m)	CARTON SIZE (m/m)	CARTON (pcs)	APPROX. GROSS WEIGHT (kg)
SOT-23	7"	3,000	4.0	30,000	183*123*183	178	382*257*387	240,000	11.6

Suggested thermal profiles for soldering processes

- 1.Storage environment: Temperature=5°C~40°C Humidity=55%±25%
- 2.Reflow soldering of surface-mount devices



3.Reflow soldering

Profile Feature	Soldering Condition
Average ramp-up rate(T _L to T _P)	<3°C/sec
Preheat -Temperature Min(T _{min}) -Temperature Max(T _{max}) -Time(min to max)(t _s)	150°C 200°C 60~120sec
T _{max} to T _L -Ramp-upRate	<3°C/sec
Time maintained above: -Temperature(T _L) -Time(t _L)	217°C 60~260sec
Peak Temperature(T _P)	255°C-0/+5°C
Time within 5°C of actual Peak Temperature(t _r)	10~30sec
Ramp-down Rate	<6°C/sec
Time 25°C to Peak Temperature	<6minutes

BC846A-Q1 / BC846B-Q1 / BC847A-Q1 / BC847B-Q1 BC847C-Q1 / BC848A-Q1 / BC848B-Q1 / BC848C-Q1

High reliability test capabilities

Item Test	Conditions	Reference
1. MSL Preconditioning	24hr bake@125°C+168hrs@85°C /85%RH+3xIR@260°C+1flux immersion+alcohol+DI H2O rinse	JESD22-A113
2. Intermittent Operating Life	Ta=25°C, ΔTj≥100°C On/Off=2min Test Duration:1000hrs	MIL-STD-750E METHOD 1037
3. High Temperature Reverse Bias	VCE=80%BVCEO (Tjmax=150°C)Test Duration:1000hrs	JESD22-A108
4. High Temperature Storage Life	Ta=125°C Test Duration:1000hrs	JESD22 A-103
5. Temperature Cycle	-55°C(15min) to 150°C(15min)Test Cycles:1000cycles	JESD22 A-104
6. Autoclave	P=2atm Ta=121°C RH=100% Test Duration:96hrs	JESD22 A-102
7. Solderability	245±5°C for 5sec	J-STD-002
8. Moisture Resistance	Ta=85°C/85% Relative humidity Test Duration:1000hrs	MIL-STD-750E METHOD 1021.2
9. Resistance To Solder Heat	260±5°C for 10sec	JESD22 B-106
10. High Temperature High Humidity Reverse Bias	Ta=85°C, 85%RH, VCE=80%BVCEO Test Duration:1000hrs	JESD22-A101