BC847BPDXV6T1, BC847BPDXV6T5

Dual General Purpose Transistor

NPN/PNP Dual (Complementary)

This transistor is designed for general purpose amplifier applications. It is housed in the SOT−563 which is designed for low power surface mount applications.

- Lead−Free Solder Plating

MAXIMUM RATINGS − NPN

Rating	Symbol	Value	Unit
Collector−Emitter Voltage	V_{CEO}	45	V
Collector−Base Voltage	V_{CBO}	50	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	V_{CEO}	−45	V
Collector−Base Voltage	V_{CBO}	−50	V
Emitter−Base Voltage	V_{EBO}	−5.0	V
Collector Current − Continuous	I_C	−100	mAdc

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

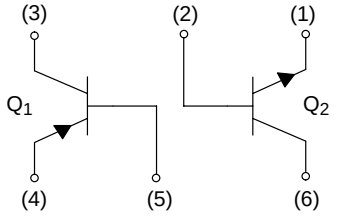
THERMAL CHARACTERISTICS

Characteristic (One Junction Heated)	Symbol	Max	Unit
Total Device Dissipation T_A = 25°C Derate above 25°C	P_D	357 (Note 1) 2.9 (Note 1)	mW mW/°C
Thermal Resistance − Junction-to-Ambient	$R_{\theta JA}$	350 (Note 1)	°C/W
Characteristic (Both Junctions Heated)	**Symbol**	**Max**	**Unit**
Total Device Dissipation T_A = 25°C Derate above 25°C	P_D	500 (Note 1) 4.0 (Note 1)	mW mW/°C
Thermal Resistance − Junction-to-Ambient	$R_{\theta JA}$	250 (Note 1)	°C/W
Junction and Storage Temperature Range	T_J, T_{stg}	−55 to +150	°C

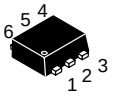
1. FR−4 @ Minimum Pad

ON Semiconductor®

http://onsemi.com

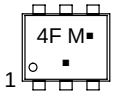


BC847BPDX6T1



SOT−563
CASE 463A
PLASTIC

MARKING DIAGRAM



4F = Specific Device Code
M = Month Code
▪ = Pb−Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
BC847BPDXV6T1	SOT−563	4 mm pitch 4000/Tape & Reel
BC847BPDXV6T1G	SOT−563 (Pb−Free)	2 mm pitch 4000/Tape & Reel
BC847BPDXV6T5	SOT−563	4 mm pitch 8000/Tape & Reel
BC847BPDXV6T5G	SOT−563 (Pb−Free)	2 mm pitch 8000/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.

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)	$V_{(BR)CEO}$	45	−	−	V
Collector−Emitter Breakdown Voltage (I_C = 10 μA, V_{EB} = 0)	$V_{(BR)CES}$	50	−	−	V
Collector−Base Breakdown Voltage (I_C = 10 μA)	$V_{(BR)CBO}$	50	−	−	V
Emitter−Base Breakdown Voltage (I_E = 1.0 μA)	$V_{(BR)EBO}$	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) (I_C = 2.0 mA, V_{CE} = 5.0 V)	h_{FE}	 − 200	 150 290	 − 475	−
Collector−Emitter Saturation Voltage (I_C = 10 mA, I_B = 0.5 mA) (I_C = 100 mA, I_B = 5.0 mA)	$V_{CE(sat)}$	− −	− −	0.25 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)	$V_{(BR)CEO}$	−45	−	−	V
Collector−Emitter Breakdown Voltage (I_C = −10 μA, V_{EB} = 0)	$V_{(BR)CES}$	−50	−	−	V
Collector−Base Breakdown Voltage (I_C = −10 μA)	$V_{(BR)CBO}$	−50	−	−	V
Emitter−Base Breakdown Voltage (I_E = −1.0 μA)	$V_{(BR)EBO}$	−5.0	−	−	V
Collector Cutoff Current (V_{CB} = −30 V) (V_{CB} = −30 V, T_A = 150°C)	I_{CBO}	− −	− −	−15 −4.0	nA μA
ON CHARACTERISTICS					
DC Current Gain (I_C = −10 μA, V_{CE} = −5.0 V) (I_C = −2.0 mA, V_{CE} = −5.0 V)	h_{FE}	− 200	150 290	− 475	−
Collector−Emitter Saturation Voltage (I_C = −10 mA, I_B = −0.5 mA) (I_C = −100 mA, I_B = −5.0 mA)	$V_{CE(sat)}$	− −	− −	−0.3 −0.65	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 On Voltage (I_C = −2.0 mA, V_{CE} = −5.0 V) (I_C = −10 mA, V_{CE} = −5.0 V)	$V_{BE(on)}$	−0.6 −	− −	−0.75 −0.82	V
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

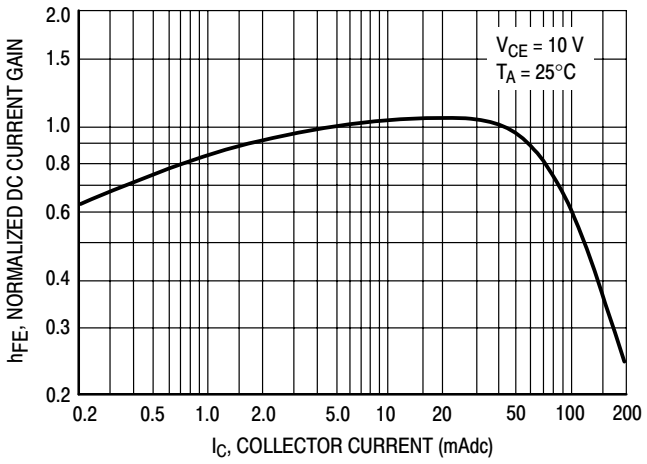


Figure 1. Normalized DC Current Gain

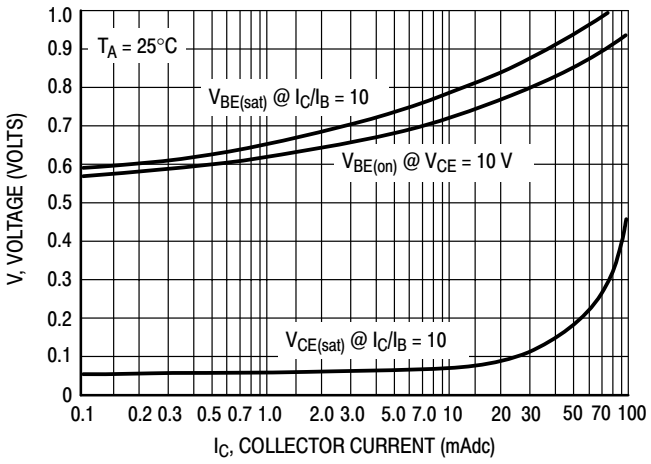


Figure 2. "Saturation" and "On" Voltages

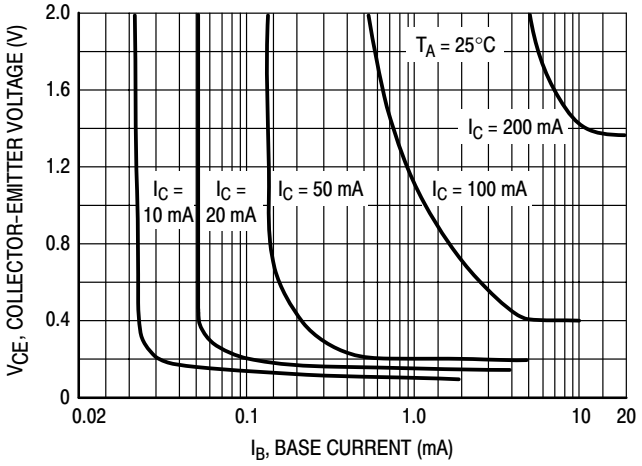


Figure 3. Collector Saturation Region

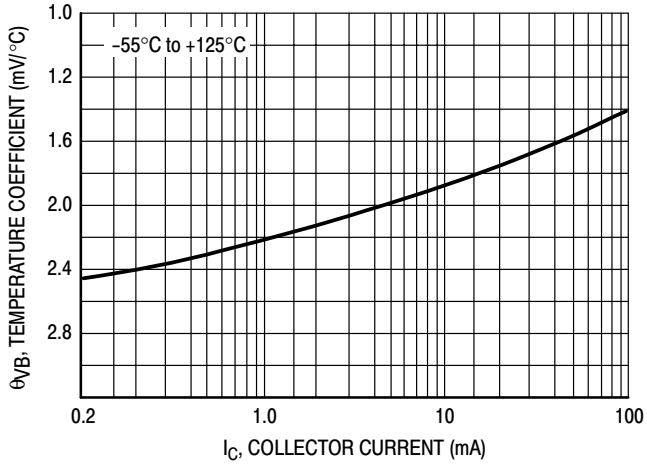


Figure 4. Base−Emitter Temperature Coefficient

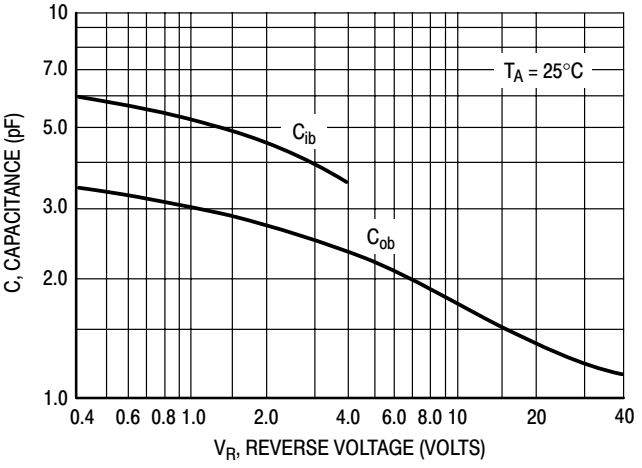


Figure 5. Capacitances

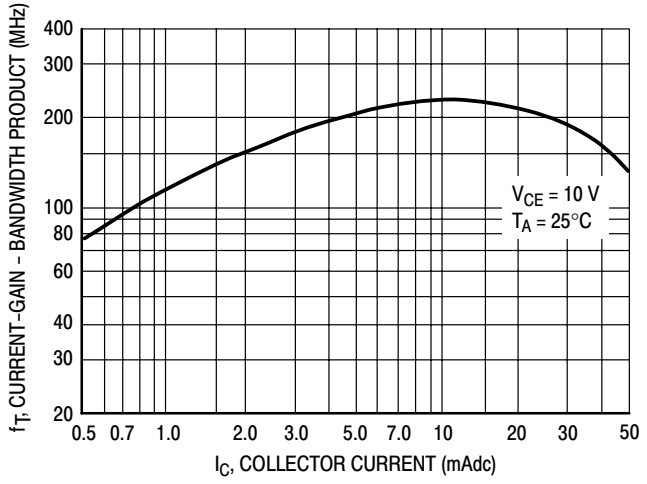


Figure 6. Current−Gain − Bandwidth Product

TYPICAL PNP CHARACTERISTICS

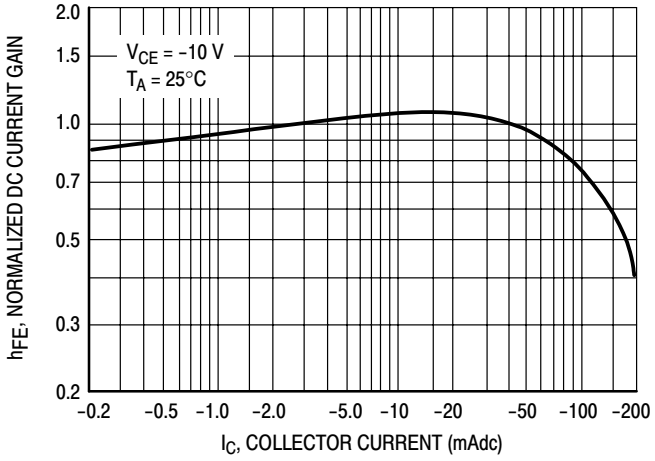


Figure 7. Normalized DC Current Gain

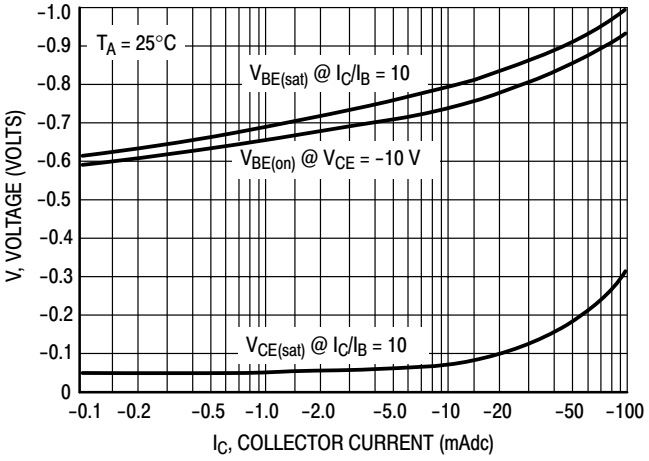


Figure 8. “Saturation” and “On” Voltages

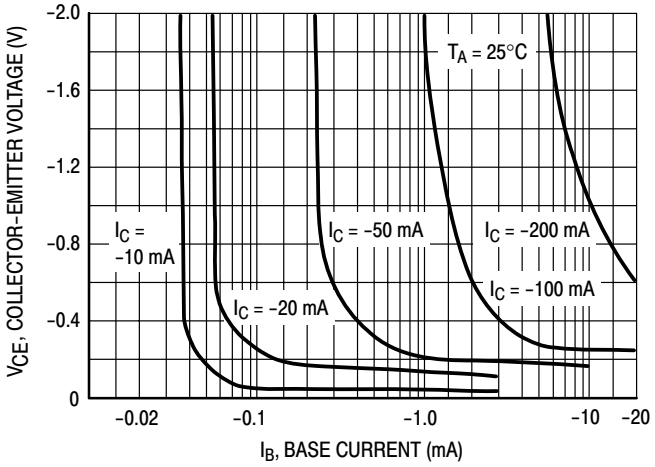


Figure 9. Collector Saturation Region

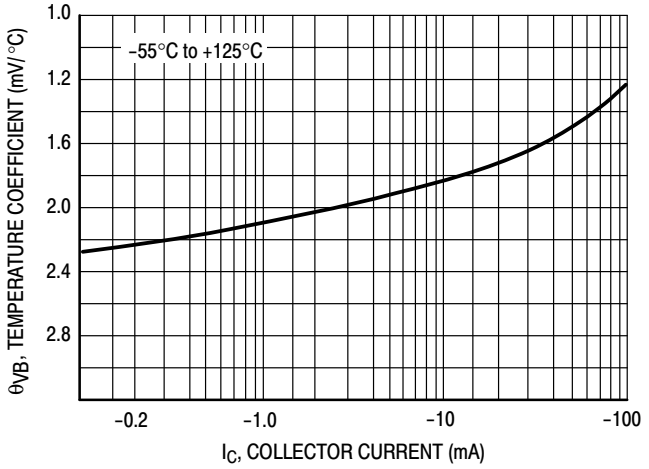


Figure 10. Base−Emitter Temperature Coefficient

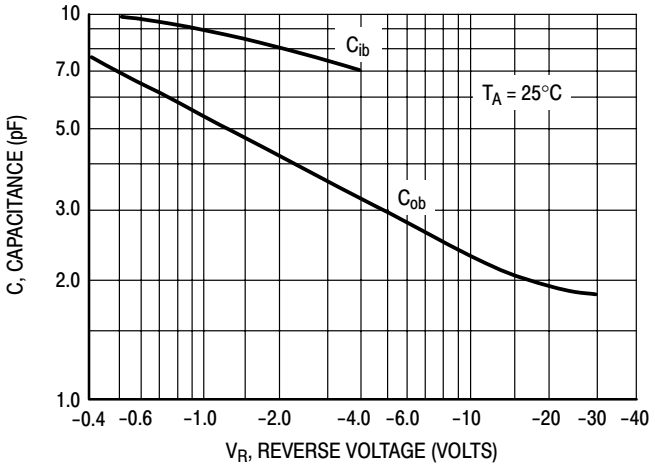


Figure 11. Capacitances

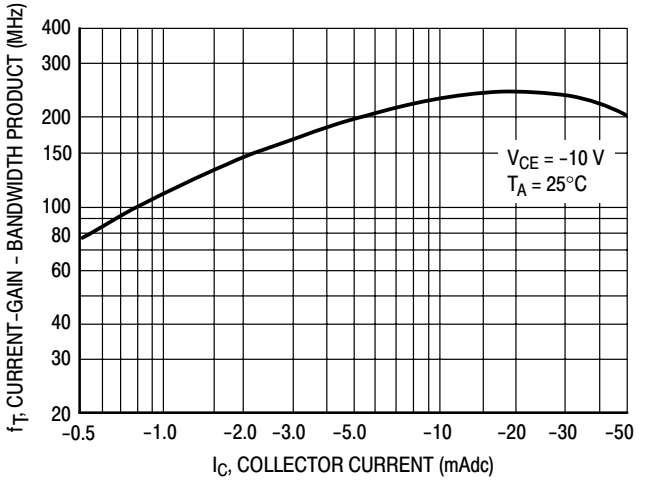
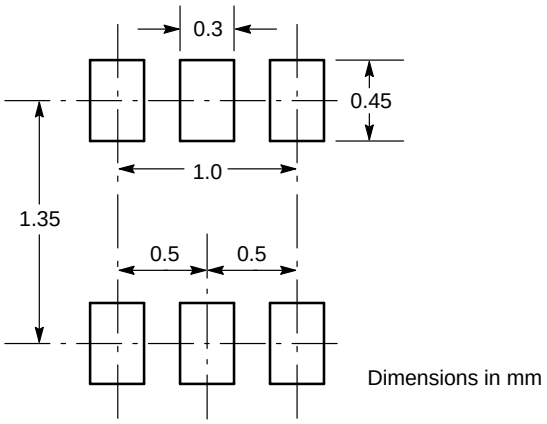


Figure 12. Current−Gain − Bandwidth Product

INFORMATION FOR USING THE SOT−563 SURFACE MOUNT PACKAGE

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to insure proper solder connection interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.



SOT−563

SOT−563 POWER DISSIPATION

The power dissipation of the SOT−563 is a function of the pad size. This can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by $T_{J(max)}$, the maximum rated junction temperature of the die, $R_{\theta JA}$, the thermal resistance from the device junction to ambient, and the operating temperature, T_A. Using the values provided on the data sheet for the SOT−563 package, P_D can be calculated as follows:

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

The values for the equation are found in the maximum ratings table on the data sheet. Substituting these values into the equation for an ambient temperature T_A of 25°C, one can calculate the power dissipation of the device which in this case is 150 milliwatts.

$$P_D = \frac{150°C - 25°C}{833°C/W} = 150 \text{ milliwatts}$$

The 833°C/W for the SOT−563 package assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 150 milliwatts. There are other alternatives to achieving higher power dissipation from the SOT−563 package. Another alternative would be to use a ceramic substrate or an aluminum core board such as Thermal Clad®. Using a board material such as Thermal Clad, an aluminum core board, the power dissipation can be doubled using the same footprint.

SOLDERING PRECAUTIONS

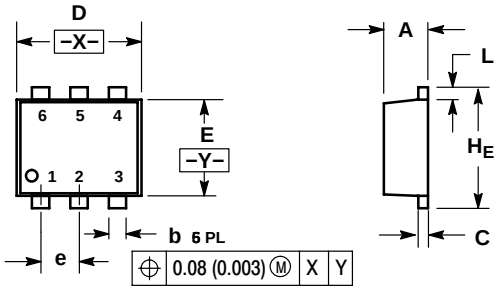
The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize the thermal stress to which the devices are subjected.

- Always preheat the device.
- The delta temperature between the preheat and soldering should be 100°C or less.*
- When preheating and soldering, the temperature of the leads and the case must not exceed the maximum temperature ratings as shown on the data sheet. When using infrared heating with the reflow soldering method, the difference shall be a maximum of 10°C.
- The soldering temperature and time shall not exceed 260°C for more than 10 seconds.
- When shifting from preheating to soldering, the maximum temperature gradient shall be 5°C or less.
- After soldering has been completed, the device should be allowed to cool naturally for at least three minutes. Gradual cooling should be used as the use of forced cooling will increase the temperature gradient and result in latent failure due to mechanical stress.
- Mechanical stress or shock should not be applied during cooling.

* Soldering a device without preheating can cause excessive thermal shock and stress which can result in damage to the device.

PACKAGE DIMENSIONS

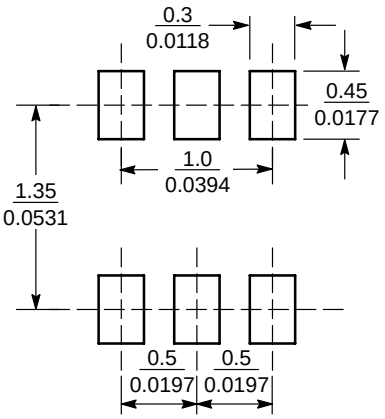
SOT−563, 6 LEAD
CASE 463A−01
ISSUE F



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0.50	0.55	0.60	0.020	0.021	0.023
b	0.17	0.22	0.27	0.007	0.009	0.011
C	0.08	0.12	0.18	0.003	0.005	0.007
D	1.50	1.60	1.70	0.059	0.062	0.066
E	1.10	1.20	1.30	0.043	0.047	0.051
e	0.5 BSC			0.02 BSC		
L	0.10	0.20	0.30	0.004	0.008	0.012
H_E	1.50	1.60	1.70	0.059	0.062	0.066

SOLDERING FOOTPRINT*



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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082−1312 USA
Phone: 480−829−7710 or 800−344−3860 Toll Free USA/Canada
Fax: 480−829−7709 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2−9−1 Kamimeguro, Meguro−ku, Tokyo, Japan 153−0051
Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

Order Literature: http://www.onsemi.com/litorder

For additional information, please contact your local Sales Representative.

BC847CBPDXV6T1/D