BC846ALT1 Series

BC846, BC847 and BC848 are Preferred Devices

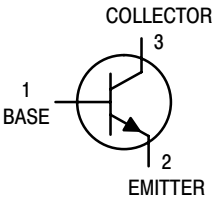
General Purpose Transistors

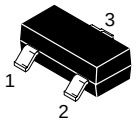
NPN Silicon

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

ON Semiconductor™

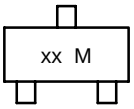
http://onsemi.com





SOT–23
CASE 318
STYLE 6

MARKING DIAGRAM



xx = Device Code (See Table)
M = Date Code

MAXIMUM RATINGS

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

THERMAL CHARACTERISTICS

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

DEVICE MARKING

BC846ALT1 = 1A; BC846BLT1 = 1B; BC847ALT1 = 1E; BC847BLT1 = 1F; BC847CLT1 = 1G; BC848ALT1 = 1J; BC848BLT1 = 1K; BC848CLT1 = 1L; BC849BLT1 = 2B; BC849CLT1 = 2C; BC850BLT1 = 2F; BC850CLT1 = 2G

1. FR–5 = 1.0 × 0.75 × 0.062 in.
2. Alumina = 0.4 × 0.3 × 0.024 in. 99.5% alumina.

ORDERING INFORMATION

Device	Package	Shipping
BC846ALT1	SOT–23	3000/Tape & Reel
BC846ALT3	SOT–23	10,000/Tape & Reel
BC846BLT1	SOT–23	3000/Tape & Reel
BC846BLT3	SOT–23	10,000/Tape & Reel
BC847ALT1	SOT–23	3000/Tape & Reel
BC847BLT1	SOT–23	3000/Tape & Reel
BC847CLT1	SOT–23	3000/Tape & Reel
BC847CLT3	SOT–23	10,000/Tape & Reel
BC848ALT1	SOT–23	3000/Tape & Reel
BC848BLT1	SOT–23	3000/Tape & Reel
BC848BLT3	SOT–23	10,000/Tape & Reel
BC848CLT1	SOT–23	3000/Tape & Reel
BC849BLT1	SOT–23	3000/Tape & Reel
BC849CLT1	SOT–23	3000/Tape & Reel
BC850BLT1	SOT–23	3000/Tape & Reel
BC850CLT1	SOT–23	3000/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector–Emitter Breakdown Voltage (I_C = 10 mA)	BC846A,B	$V_{(BR)CEO}$	65	–	–	V
	BC847A,B,C, BC850B,C		45	–	–	
	BC848A,B,C, BC849B,C		30	–	–	
Collector–Emitter Breakdown Voltage (I_C = 10 μA, V_{EB} = 0)	BC846A,B	$V_{(BR)CES}$	80	–	–	V
	BC847A,B,C BC850B,C		50	–	–	
	BC848A,B,C, BC849B,C		30	–	–	
Collector–Base Breakdown Voltage (I_C = 10 μA)	BC846A,B	$V_{(BR)CBO}$	80	–	–	V
	BC847A,B,C, BC850B,C		50	–	–	
	BC848A,B,C, BC849B,C		30	–	–	
Emitter–Base Breakdown Voltage (I_E = 1.0 μA)	BC846A,B	$V_{(BR)EBO}$	6.0	–	–	V
	BC847A,B,C, BC850B,C		6.0	–	–	
	BC848A,B,C, BC849B,C		5.0	–	–	
Collector Cutoff Current (V_{CB} = 30 V)		I_{CBO}	–	–	15	nA
	(V_{CB} = 30 V, T_A = 150°C)		–	–	5.0	μA
ON CHARACTERISTICS						
DC Current Gain (I_C = 10 μA, V_{CE} = 5.0 V)	BC846A, BC847A, BC848A	h_{FE}	–	90	–	–
	BC846B, BC847B, BC848B		–	150	–	
	BC847C, BC848C		–	270	–	
(I_C = 2.0 mA, V_{CE} = 5.0 V)	BC846A, BC847A, BC848A		110	180	220	
	BC846B, BC847B, BC848B, BC849B, BC850B		200	290	450	
	BC847C, BC848C, BC849C, BC850C		420	520	800	
Collector–Emitter Saturation Voltage (I_C = 10 mA, I_B = 0.5 mA)		$V_{CE(sat)}$	–	–	0.25	V
(I_C = 100 mA, I_B = 5.0 mA)			–	–	0.6	
Base–Emitter Saturation Voltage (I_C = 10 mA, I_B = 0.5 mA)		$V_{BE(sat)}$	–	0.7	–	V
(I_C = 100 mA, I_B = 5.0 mA)			–	0.9	–	
Base–Emitter Voltage (I_C = 2.0 mA, V_{CE} = 5.0 V)		$V_{BE(on)}$	580	660	700	mV
(I_C = 10 mA, V_{CE} = 5.0 V)			–	–	770	
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,		NF				dB
V_{CE} = 5.0 Vdc, R_S = 2.0 kΩ,	BC846A,B, BC847A,B,C, BC848A,B,C		–	–	10	
f = 1.0 kHz, BW = 200 Hz)	BC849B,C, BC850B,C		–	–	4.0	

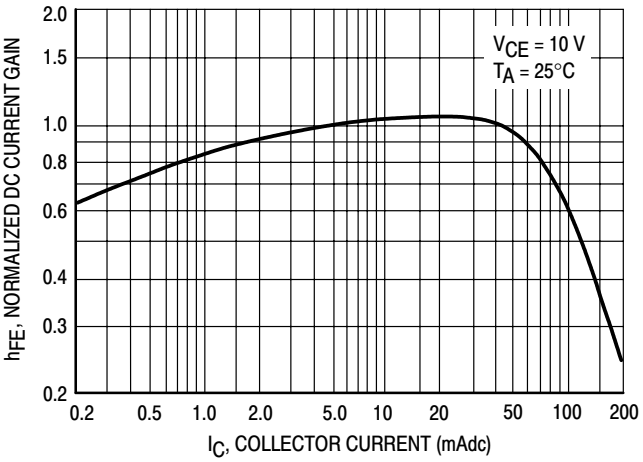


Figure 1. Normalized DC Current Gain

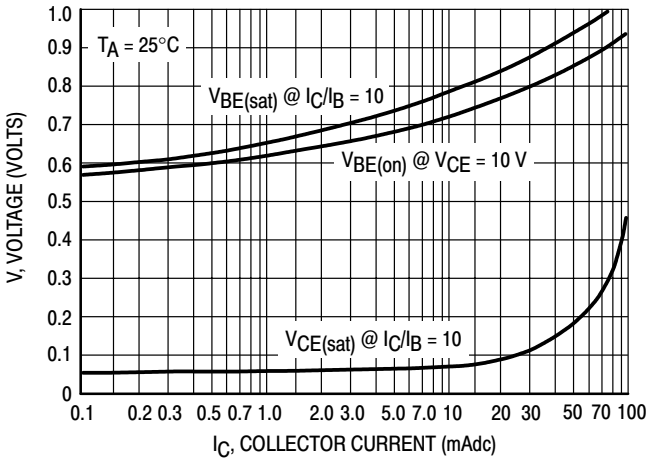


Figure 2. "Saturation" and "On" Voltages

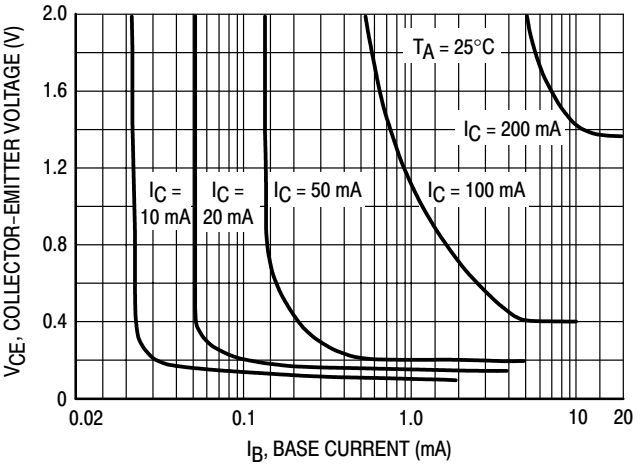


Figure 3. Collector Saturation Region

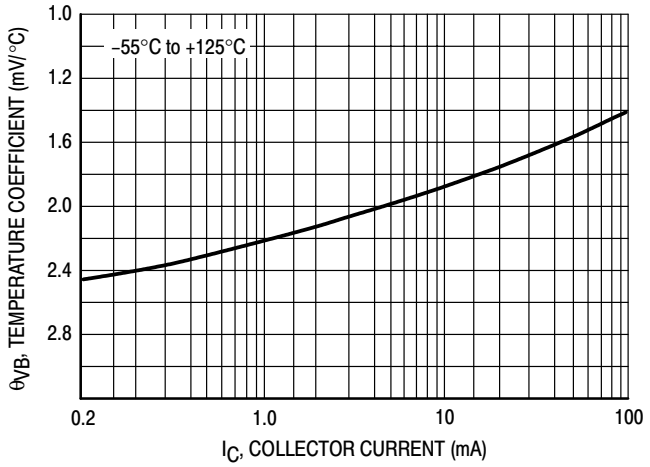


Figure 4. Base−Emitter Temperature Coefficient

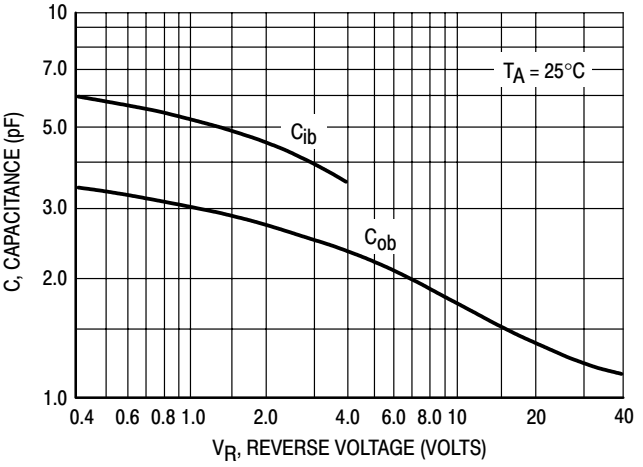


Figure 5. Capacitances

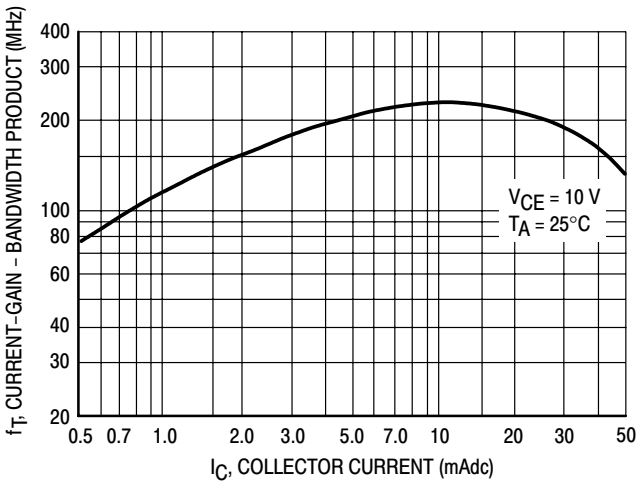


Figure 6. Current−Gain − Bandwidth Product

BC846

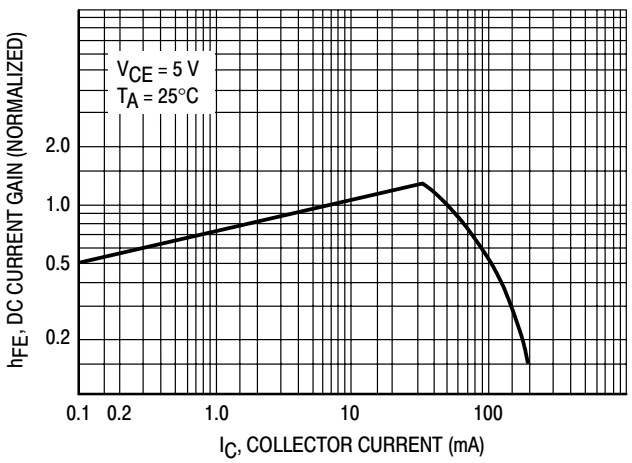


Figure 7. DC Current Gain

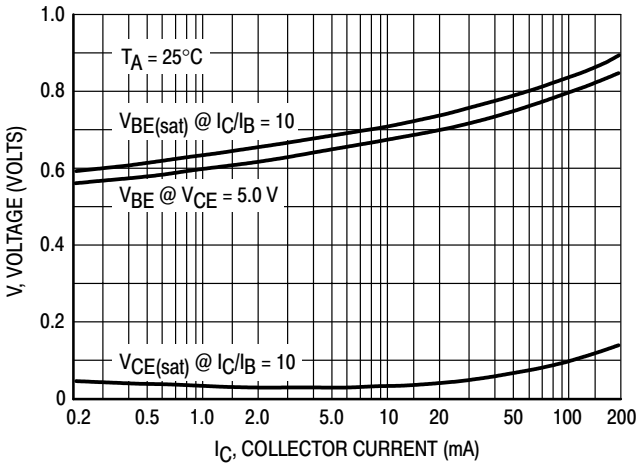


Figure 8. “On” Voltage

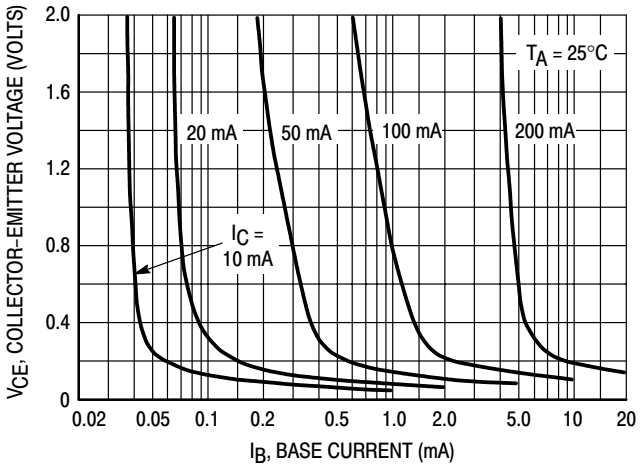


Figure 9. Collector Saturation Region

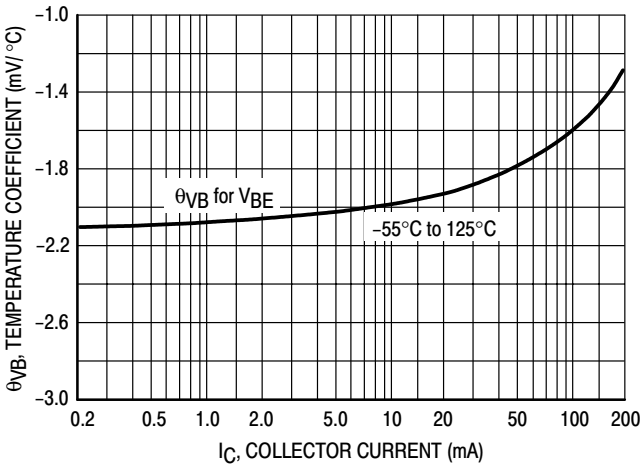


Figure 10. Base–Emitter Temperature Coefficient

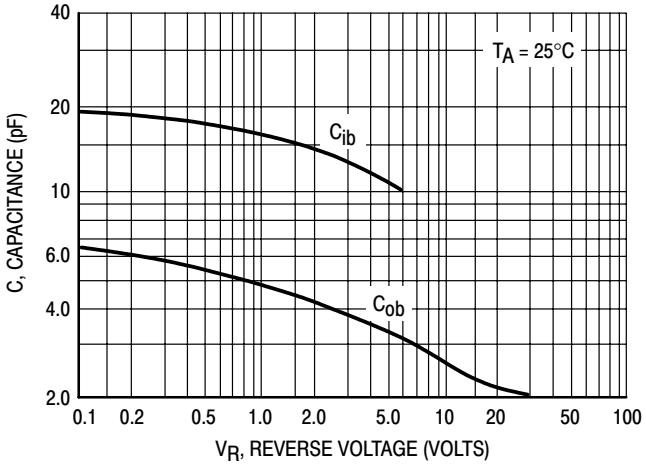


Figure 11. Capacitance

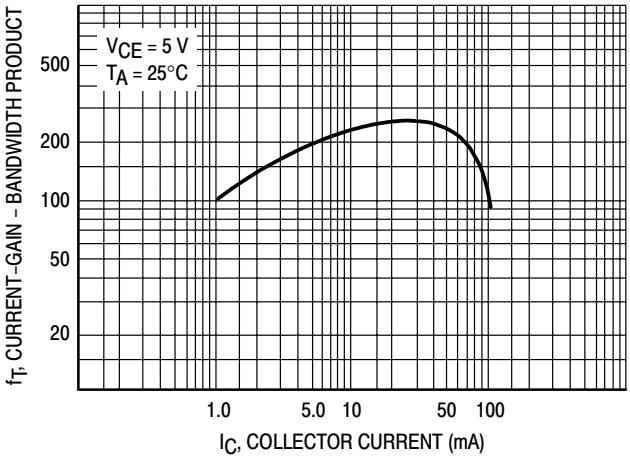
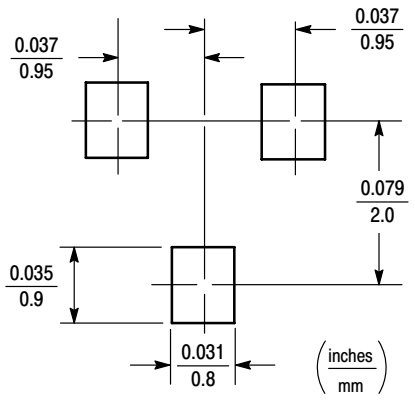


Figure 12. Current–Gain – Bandwidth Product

INFORMATION FOR USING THE SOT–23 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–23

SOT–23 POWER DISSIPATION

The power dissipation of the SOT–23 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–23 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 225 milliwatts.

$$P_D = \frac{150°C - 25°C}{556°C/W} = 225 \text{ milliwatts}$$

The 556°C/W for the SOT–23 package assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 225 milliwatts. There are other alternatives to achieving higher power dissipation from the SOT–23 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

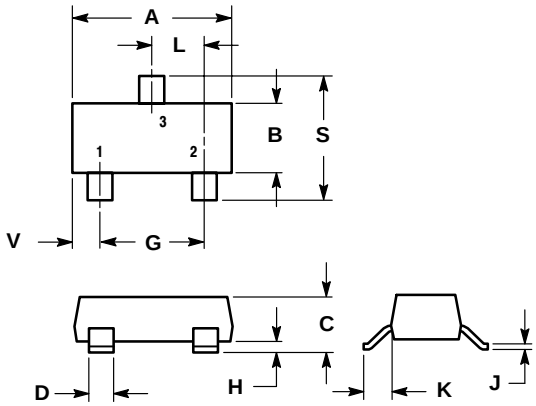
The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize 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–23
TO–236AB
CASE 318–09
ISSUE AF



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

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.1102	0.1197	2.80	3.04
B	0.0472	0.0551	1.20	1.40
C	0.0385	0.0498	0.99	1.26
D	0.0140	0.0200	0.36	0.50
G	0.0670	0.0826	1.70	2.10
H	0.0040	0.0098	0.10	0.25
J	0.0034	0.0070	0.085	0.177
K	0.0180	0.0236	0.45	0.60
L	0.0350	0.0401	0.89	1.02
S	0.0830	0.0984	2.10	2.50
V	0.0177	0.0236	0.45	0.60

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

Notes

Thermal Clad is a trademark of the Bergquist Company.

PUBLICATION ORDERING INFORMATION

Literature Fulfillment:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303–675–2175 or 800–344–3860 Toll Free USA/Canada
Fax: 303–675–2176 or 800–344–3867 Toll Free USA/Canada
Email: ONlit@hibbertco.com

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

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ON Semiconductor Website: http://onsemi.com

For additional information, please contact your local
Sales Representative.