

# MBRB1045

Preferred Device

## SWITCHMODE™ Power Rectifier

### D<sup>2</sup>PAK Surface Mount Power Package

The D<sup>2</sup>PAK Power Rectifier employs the Schottky Barrier principle in a large metal-to-silicon power diode. State-of-the-art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use in low voltage, high frequency switching power supplies, free wheeling diodes, and polarity protection diodes. These state-of-the-art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8"
- Short Heat Sink Tab Manufactured - Not Sheared!
- Similar in Size to the Industry Standard TO-220 Package

#### Mechanical Characteristics

- Case: Epoxy, Molded, Epoxy Meets UL94, VO
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13" reel by adding a "T4" suffix to the part number
- Marking: MBRB1045
- Device Meets MSL1 Requirements
- ESD Ratings: Machine Model, C (>400 V)  
Human Body Model, 3B (>8000 V)

#### MAXIMUM RATINGS

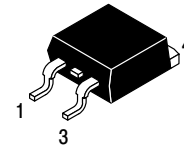
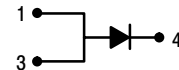
Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	$V_{RRM}$ $V_{RWM}$ $V_R$	45	Volts
Average Rectified Forward Current (Rated $V_R$ ) $T_C = 135^\circ\text{C}$	$I_{F(AV)}$	10	Amps
Peak Repetitive Forward Current (Rated $V_R$ , Square Wave, 20 kHz) $T_C = 135^\circ\text{C}$	$I_{FRM}$	20	Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	$I_{FSM}$	150	Amps
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 65 to +150	°C
Voltage Rate of Change (Rated $V_R$ )	dv/dt	10000	V/ $\mu\text{s}$



ON Semiconductor®

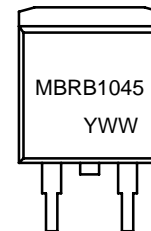
<http://onsemi.com>

### SCHOTTKY BARRIER RECTIFIER 10 AMPERES 45 VOLTS



D<sup>2</sup>PAK  
CASE 418B  
PLASTIC

#### MARKING DIAGRAM



MBRB1045 = Specific Device Code  
Y = Year  
WW = Work Week

#### ORDERING INFORMATION

Device	Package	Shipping
MBRB1045	D <sup>2</sup> PAK	50 Units/Tube
MBRB1045T4	D <sup>2</sup> PAK	800/Tape & Reel

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

# MBRB1045

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance - Junction to Case (Note 1)	$R_{\theta JC}$	1.0	$^{\circ}C/W$
- Junction to Ambient (Note 1)	$R_{\theta JA}$	50	$^{\circ}C/W$

## ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (Note 2) ( $I_F = 10$ Amps, $T_J = 125^{\circ}C$ ) ( $I_F = 20$ Amps, $T_J = 125^{\circ}C$ ) ( $I_F = 20$ Amps, $T_J = 25^{\circ}C$ )	$V_F$	0.57 0.72 0.84	Volts
Maximum Instantaneous Reverse Current (Note 2) (Rated dc Voltage, $T_J = 125^{\circ}C$ ) (Rated dc Voltage, $T_J = 25^{\circ}C$ )	$I_R$	15 0.1	mA

- When mounted using minimum recommended pad size on FR-4 board.
- Pulse Test: Pulse Width = 300  $\mu s$ , Duty Cycle  $\leq 2.0\%$

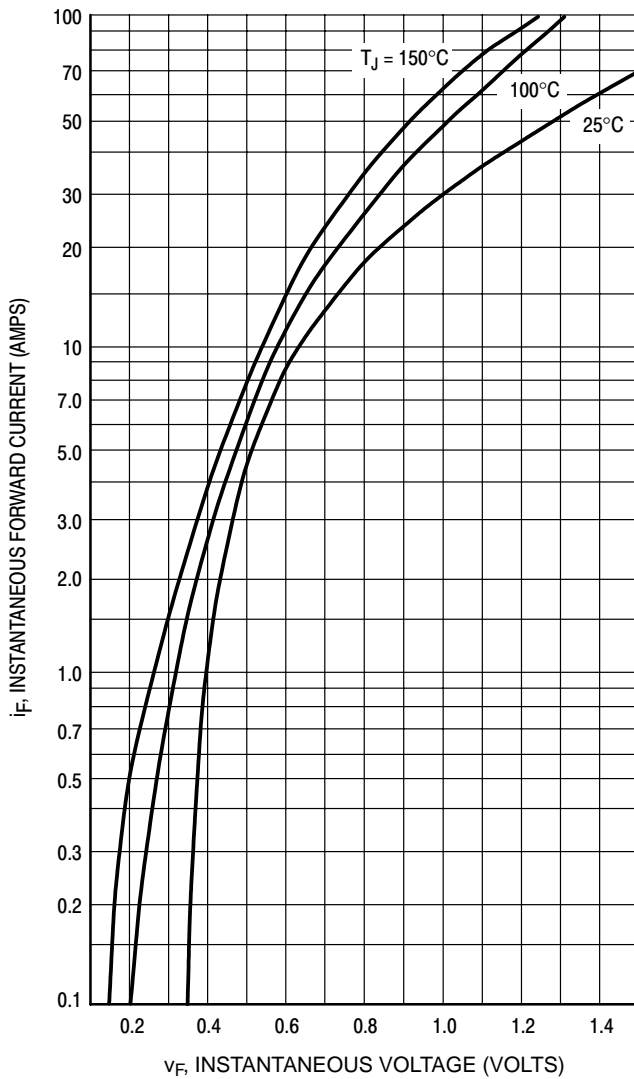


Figure 1. Maximum Forward Voltage

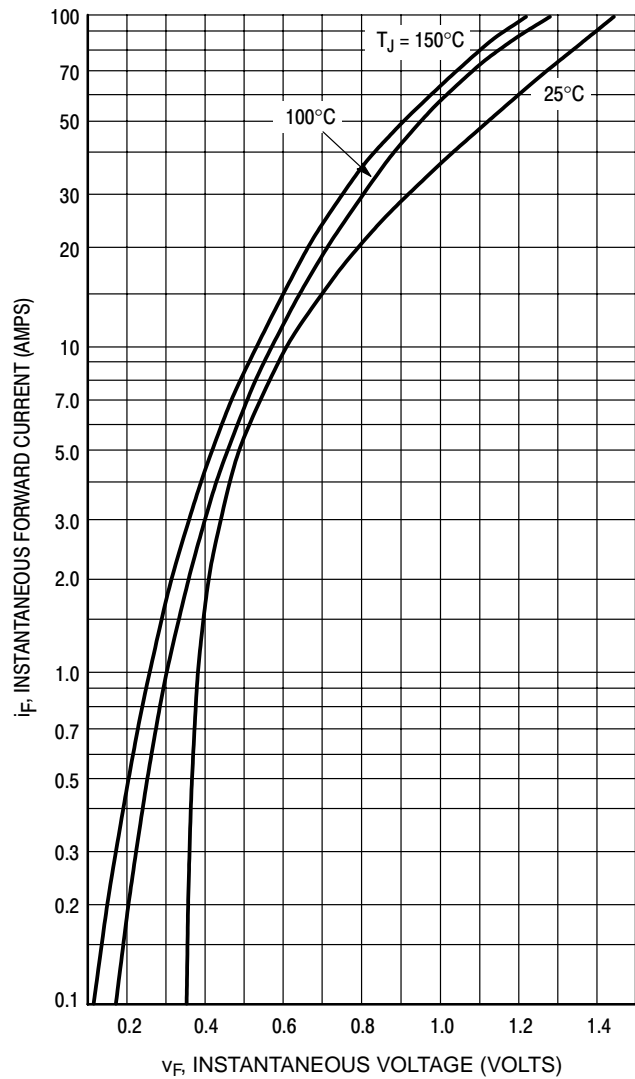


Figure 2. Typical Forward Voltage

# MBRB1045

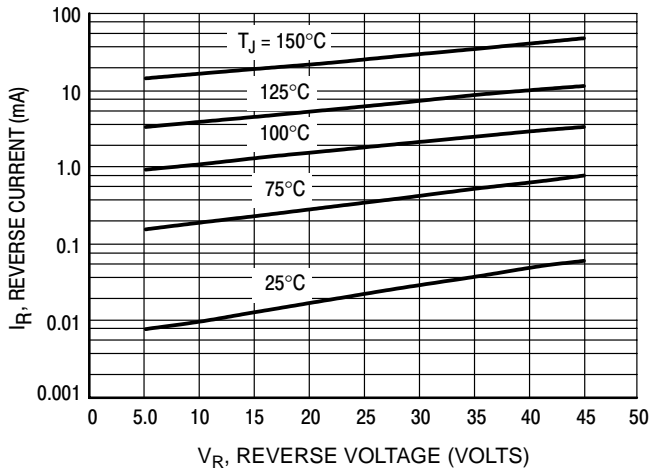


Figure 3. Maximum Reverse Current

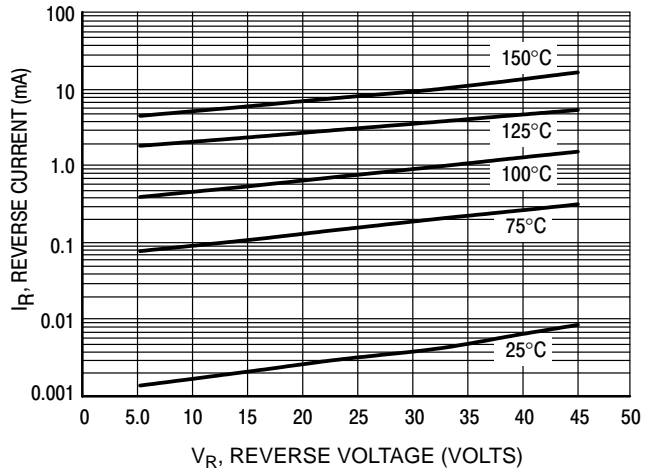


Figure 4. Typical Reverse Current

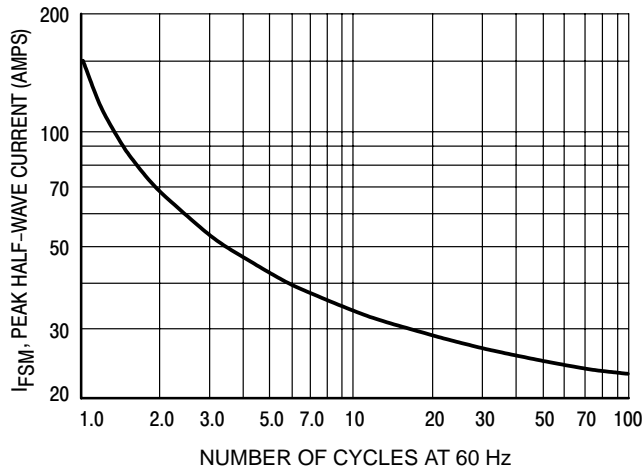


Figure 8. Maximum Surge Capability

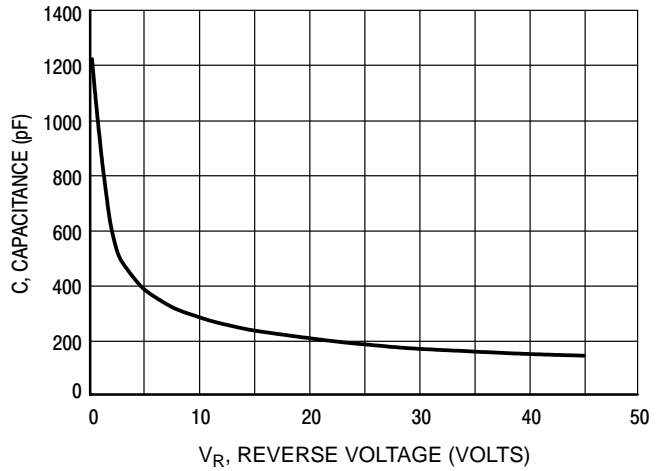


Figure 5. Typical Capacitance

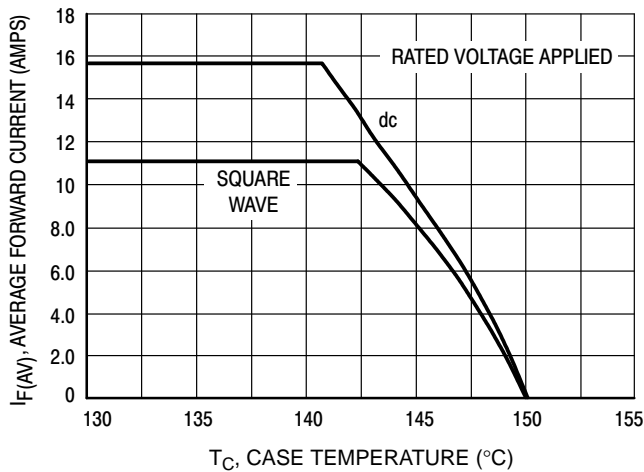


Figure 6. Current Derating, Case,  $R_{\theta JC} = 1.0 \text{ } ^\circ\text{C/W}$

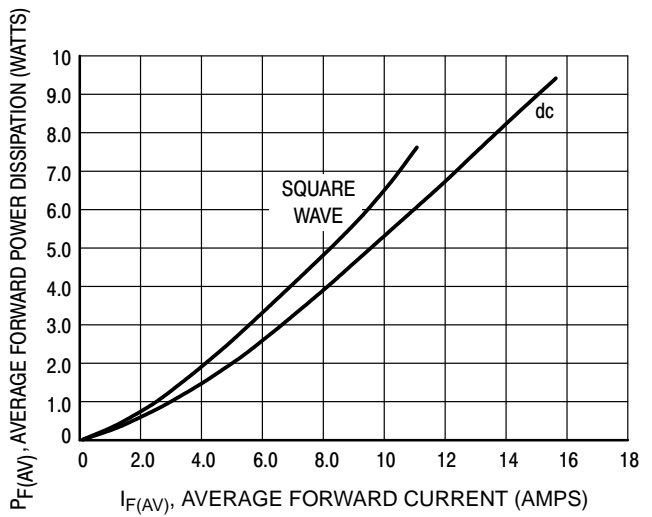


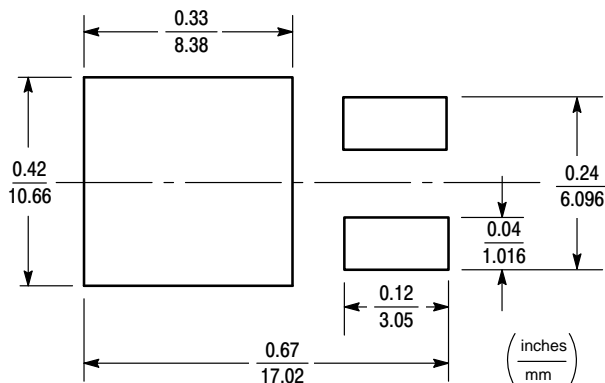
Figure 7. Forward Power Dissipation

## INFORMATION FOR USING THE D<sup>2</sup>PAK SURFACE MOUNT PACKAGE

### MINIMUM RECOMMENDED FOOTPRINTS 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.



### D<sup>2</sup>PAK POWER DISSIPATION

The power dissipation of the D<sup>2</sup>PAK is a function of the drain 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 D<sup>2</sup>PAK 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 2.5 watts.

$$P_D = \frac{150^\circ\text{C} - 25^\circ\text{C}}{50^\circ\text{C/W}} = 2.5 \text{ watts}$$

The 50°C/W for the D<sup>2</sup>PAK package assumes the recommended drain pad area of 158K mil<sup>2</sup> on FR-4 glass epoxy printed circuit board to achieve a power dissipation of 2.5 watts using the footprint shown. Another alternative is to use a ceramic substrate or an aluminum core board such as Thermal Clad<sup>®</sup>. By using an aluminum core board material such as Thermal Clad, the power dissipation can be doubled using the same footprint.

### GENERAL 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 5 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.

\* Due to shadowing and the inability to set the wave height to incorporate other surface mount components, the D<sup>2</sup>PAK is not recommended for wave soldering.

RECOMMENDED PROFILE FOR REFLOW SOLDERING

For any given circuit board, there will be a group of control settings that will give the desired heat pattern. The operator must set temperatures for several heating zones, and a figure for belt speed. Taken together, these control settings make up a heating “profile” for that particular circuit board. On machines controlled by a computer, the computer remembers these profiles from one operating session to the next. Figure 9 shows a typical heating profile for use when soldering the D<sup>2</sup>PAK to a printed circuit board. This profile will vary among soldering systems but it is a good starting point. Factors that can affect the profile include the type of soldering system in use, density and types of components on the board, type of solder used, and the type of board or substrate material being used. This profile shows temperature versus time. The line on the

graph shows the actual temperature that might be experienced on the surface of a test board at or near a central solder joint. The two profiles are based on a high density and a low density board. The Vitronics SMD310 convection/infrared reflow soldering system was used to generate this profile. The type of solder used was 62/36/2 Tin Lead Silver with a melting point between 177-189 °C. When this type of furnace is used for solder reflow work, the circuit boards and solder joints tend to heat first. The components on the board are then heated by conduction. The circuit board, because it has a large surface area, absorbs the thermal energy more efficiently, then distributes this energy to the components. Because of this effect, the main body of a component may be up to 30 degrees cooler than the adjacent solder joints.

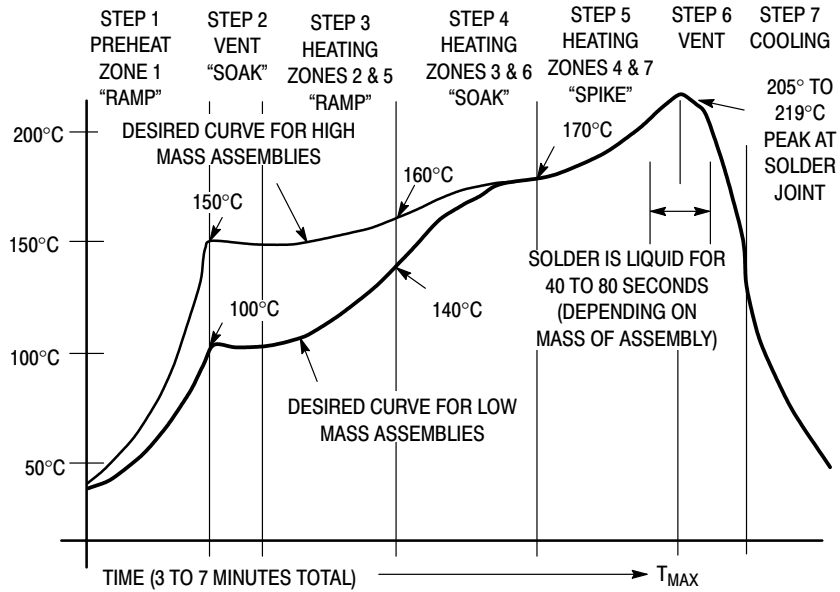
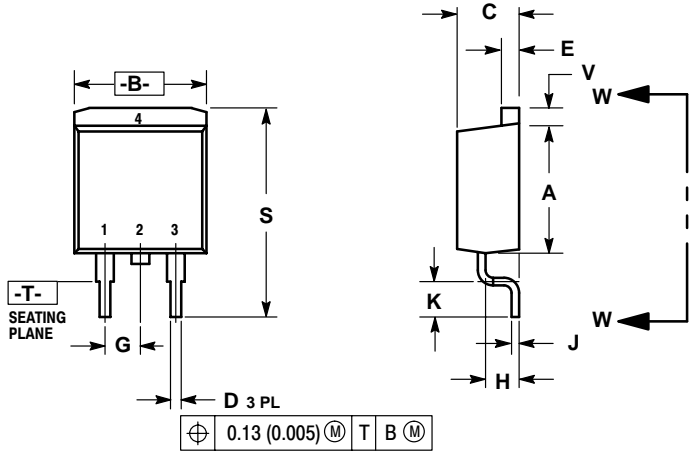


Figure 9. Typical Solder Heating Profile for D<sup>2</sup>PAK

# MBRB1045

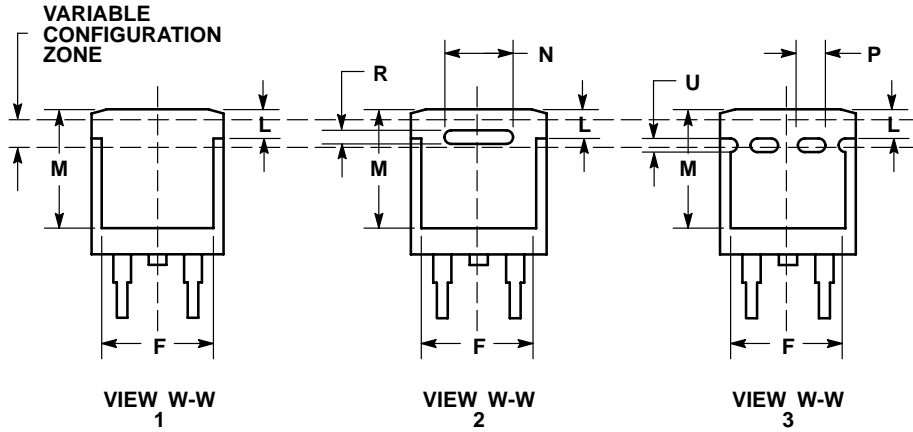
## PACKAGE DIMENSIONS

### D<sup>2</sup>PAK CASE 418B-04 ISSUE H



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. 418B-01 THRU 418B-03 OBSOLETE, NEW STANDARD 418B-04.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
F	0.310	0.350	7.87	8.89
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
L	0.052	0.072	1.32	1.83
M	0.280	0.320	7.11	8.13
N	0.197 REF		5.00 REF	
P	0.079 REF		2.00 REF	
R	0.039 REF		0.99 REF	
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40




- STYLE 1: PIN 1. BASE  
2. COLLECTOR  
3. EMITTER  
4. COLLECTOR
- STYLE 2: PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN

- STYLE 3: PIN 1. ANODE  
2. CATHODE  
3. ANODE  
4. CATHODE
- STYLE 4: PIN 1. GATE  
2. COLLECTOR  
3. EMITTER  
4. COLLECTOR

- STYLE 5: PIN 1. CATHODE  
2. ANODE  
3. CATHODE  
4. ANODE

**Notes**

SWITCHMODE is a trademark of Semiconductor Components Industries, LLC.  
Thermal Clad is a registered trademark of the Bergquist Company.

**ON Semiconductor** and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

## 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

**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>

For additional information, please contact your local  
Sales Representative.