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Designer's™ Data Sheet

SWITCHMODE™ Power Rectifier OR'ing Function Diode D2PAK Surface Mount Power Package

The D²PAK 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
- 100°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8"
- Guaranteed Reverse Avalanche
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to the Industry Standard TO-220 Package

Mechanical Characteristics

- Case: Epoxy, Molded
- 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: B2515L

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	15	Volts
Average Rectified Forward Current (Rated V_R) $T_C = 90^\circ\text{C}$	$I_{F(AV)}$	25	Amps
Peak Repetitive Forward Current (Rated V_R , Square Wave, 20 kHz) $T_C = 100^\circ\text{C}$	I_{FRM}	30	Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	150	Amps
Storage Temperature	T_{stg}	-65 to +150	°C
Operating Junction Temperature	T_J	100	°C
Voltage Rate of Change (Rated V_R)	dv/dt	10000	V/ μs

THERMAL CHARACTERISTICS

Thermal Resistance — Junction to Case — Junction to Ambient (1)	$R_{\theta JC}$ $R_{\theta JA}$	1.0 50	°C/W
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(1) When mounted using minimum recommended pad size on FR-4 board.

Designer's Data for "Worst Case" Conditions — The Designer's Data Sheet permits the design of most circuits entirely from the information presented. SOA Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.

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Thermal Clad is a trademark of the Bergquist Company

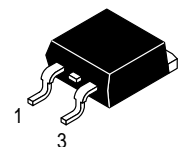
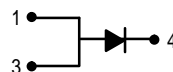
Preferred devices are Motorola recommended choices for future use and best overall value.

Rev 1

MBRB2515L

Motorola Preferred Device

**SCHOTTKY BARRIER
RECTIFIER
25 AMPERES
15 VOLTS**



**CASE 418B-02
D2PAK**

MBRB2515L

ELECTRICAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (2) ($I_F = 19$ Amps, $T_J = 70^\circ\text{C}$) ($I_F = 25$ Amps, $T_J = 70^\circ\text{C}$) ($I_F = 25$ Amps, $T_J = 25^\circ\text{C}$)	V_F	0.28 0.42 0.45	Volts
Maximum Instantaneous Reverse Current (2) (Rated dc Voltage, $T_J = 70^\circ\text{C}$) (Rated dc Voltage, $T_J = 25^\circ\text{C}$)	I_R	200 15	mA

(2) Pulse Test: Pulse Width = 300 μs , Duty Cycle $\leq 2.0\%$

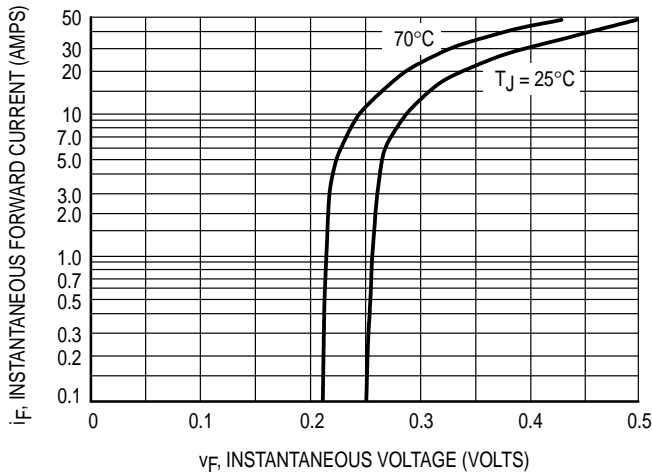


Figure 1. Typical Forward Voltage

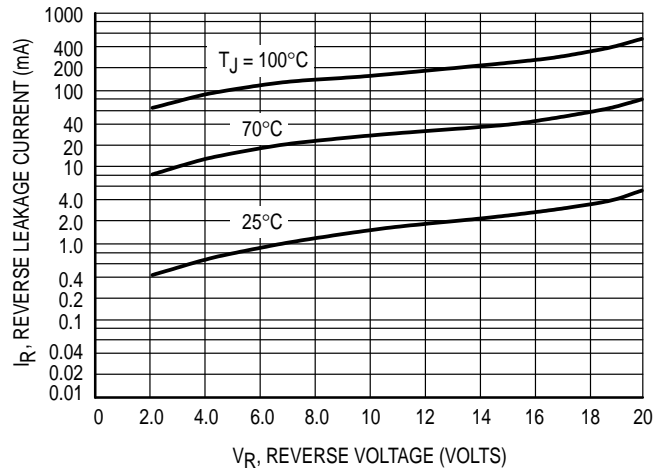


Figure 2. Typical Reverse Leakage Current

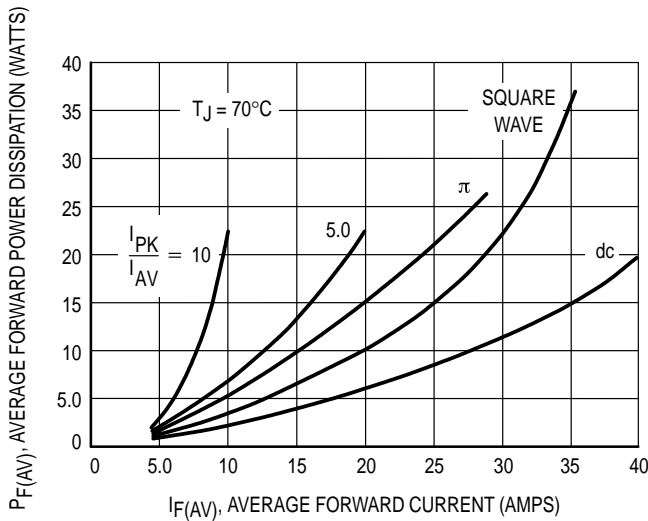


Figure 3. Typical Forward Power Dissipation

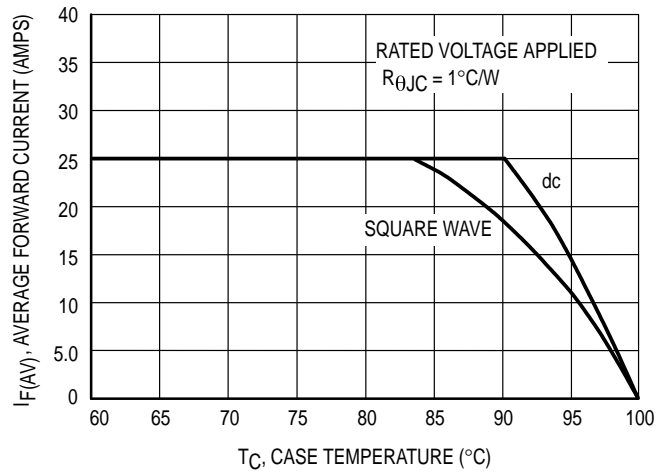


Figure 4. Current Derating, Case

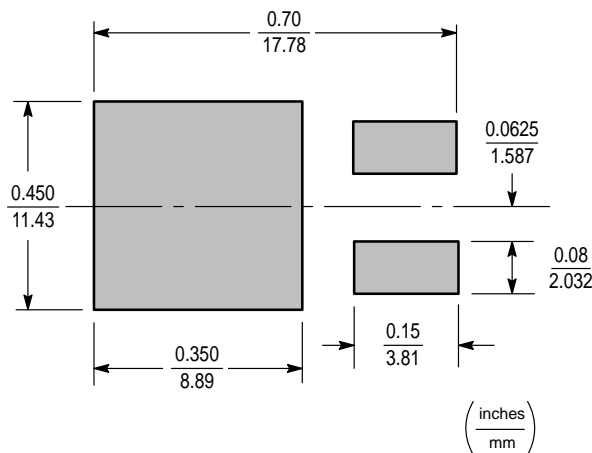
INFORMATION FOR USING THE D²PAK SURFACE MOUNT PACKAGE

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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.



D²PAK POWER DISSIPATION

The power dissipation of the D²PAK 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 D²PAK 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 D²PAK package assumes the recommended drain pad area of 158K mil² 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™. 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 D²PAK is not recommended for wave soldering.

RECOMMENDED PROFILE FOR REFLOW SOLDERING

On any given PCB 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 5 shows a typical heating profile for use when soldering the D²PAK 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.

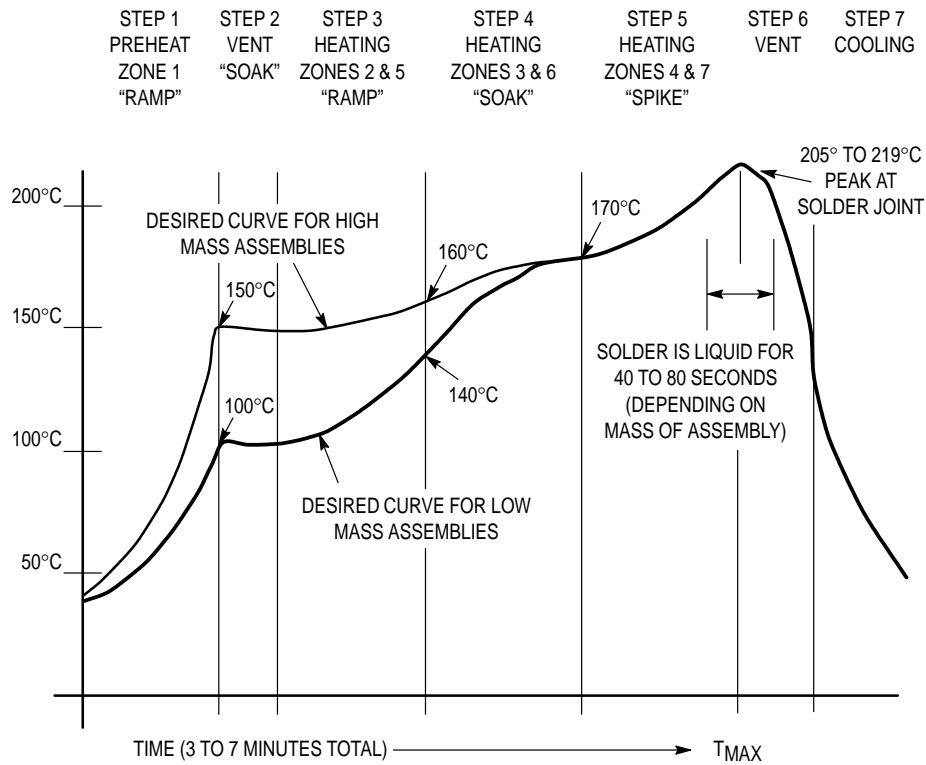
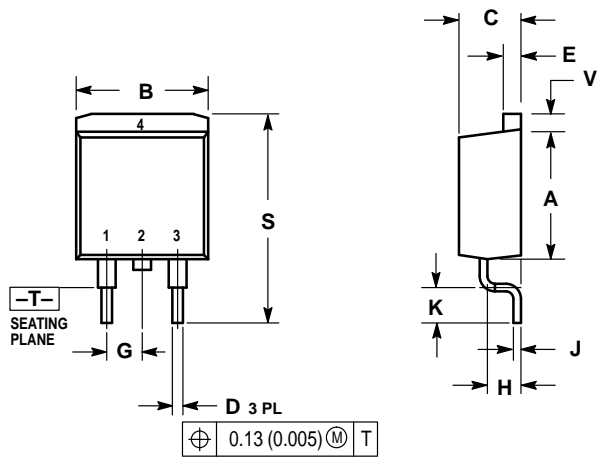


Figure 5. Typical Solder Heating Profile for D²PAK

PACKAGE DIMENSIONS

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CASE 418B-02
ISSUE B

- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

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
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
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40

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

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How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 303-675-2140 or 1-800-441-2447

JAPAN: Nippon Motorola Ltd.: SPD, Strategic Planning Office, 4-32-1,
Nishi-Gotanda, Shinagawa-ku, Tokyo 141, Japan. 81-3-5487-8488

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609
– US & Canada ONLY 1-800-774-1848

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

INTERNET: <http://motorola.com/sps>

