# MBRB4030

**Preferred Device**

# SWITCHMODE™ Power Rectifier

Using the Schottky Barrier principle with a proprietary barrier metal. These state-of-the-art devices have the following features:

- Guardring for Stress Protection
- Maximum Die Size
- 150°C Operating Junction Temperature
- Short Heat Sink Tab Manufactured - Not Sheared

### Mechanical Characteristics

- Case: Epoxy, Molded, Epoxy Meets UL94, VO
- Weight: 1.7 Grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads Readily Solderable
- 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: B4030
- Device Meets MSL1 Requirements
- ESD Ratings: Machine Model, C (>400 V)
  Human Body Model, 3B (>8000 V)

### MAXIMUM RATINGS

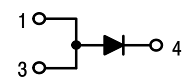
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 30 | V |
| Average Rectified Forward Current (At Rated $V_R$) $T_C$ = +115°C (Note 1.) | $I_{F(AV)}$ | 40 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz) $T_C$ = +112°C | $I_{FRM}$ | 80 | A |
| Non-Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 300 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | -65 to +150 | °C |
| Operating Junction Temperature Range | $T_J$ | -65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |
| Reverse Energy (Unclamped Inductive Surge) ($T_C$ = 25°C, L = 3.0 mH) | W | 600 | mJ |

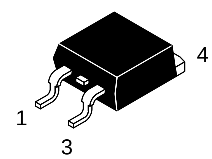
1. Rating applies when pins 1 and 3 are connected.

**ON Semiconductor®**

**http://onsemi.com**

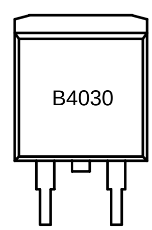
**SCHOTTKY BARRIER RECTIFIER**
**40 AMPERES**
**30 VOLTS**




**$D^2$PAK**
**CASE 418B**
**STYLE 3**

### MARKING DIAGRAM




B4030 = Device Code

### ORDERING INFORMATION

| Device | Package | Shipping |
|---|---|---|
| MBRB4030 | $D^2$PAK | 50/Rail |
| MBRB4030T4 | $D^2$PAK | 800/Tape & Reel |

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

**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance - Junction to Case | $R_{\theta JC}$ | 1.0 | °C/W |
| Thermal Resistance - Junction to Ambient (Note 3.) | $R_{\theta JA}$ | 50 | °C/W |

**ELECTRICAL CHARACTERISTICS**

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Notes 2. and 4.), per Device | $V_F$ | | V |
| ($I_F$ = 20 A, $T_C$ = + 25°C) | | 0.46 | |
| ($I_F$ = 20 A, $T_C$ = +150°C) | | 0.34 | |
| ($I_F$ = 40 A, $T_C$ = + 25°C) | | 0.55 | |
| ($I_F$ = 40 A, $T_C$ = +150°C) | | 0.45 | |
| Maximum Instantaneous Reverse Current (Note 4.), per Device | $I_R$ | | mA |
| (Rated DC Voltage, $T_C$ = + 25°C) | | 0.35 | |
| (Rated DC Voltage, $T_C$ = +125°C) | | 150 | |

2. Rating applies when pins 1 and 3 are connected.
3. Rating applies when surface mounted on the miniumum pad size recommended.
4. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

## ELECTRICAL CHARACTERISTICS

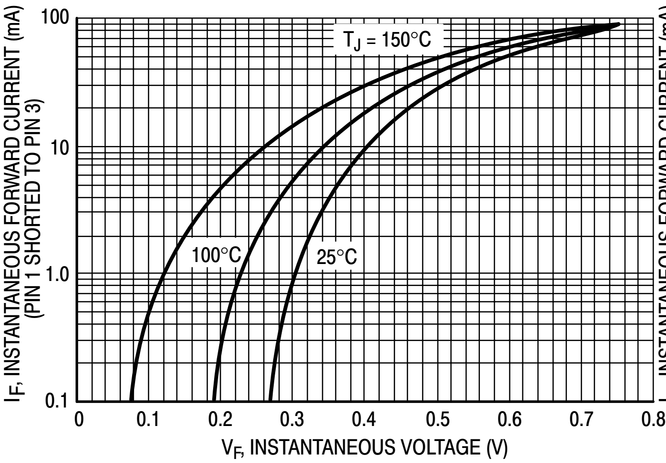



**Figure 1. Maximum Forward Voltage**

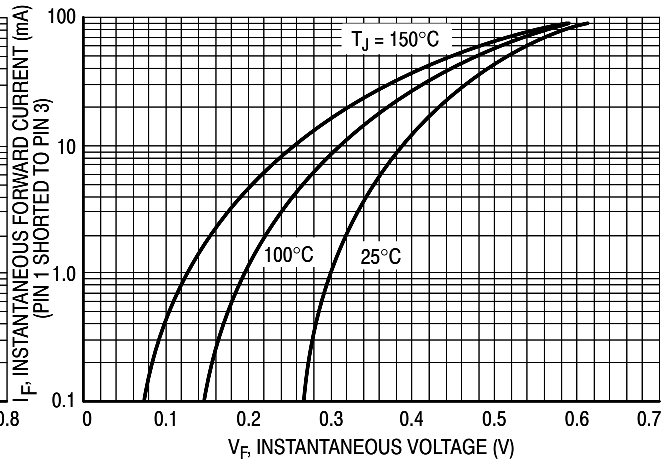



**Figure 2. Typical Forward Voltage**

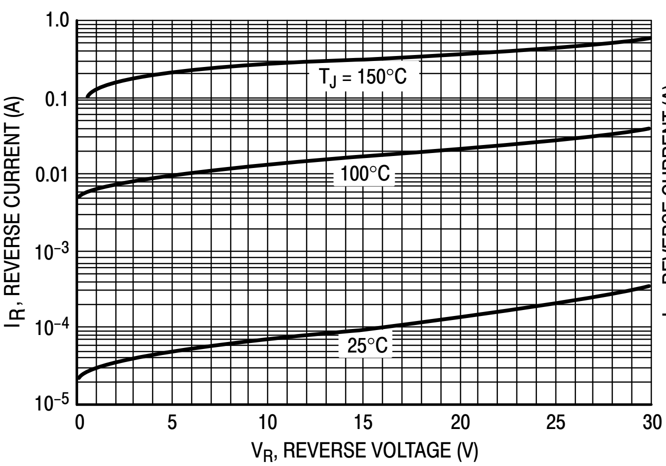



**Figure 3. Maximum Reverse Current**

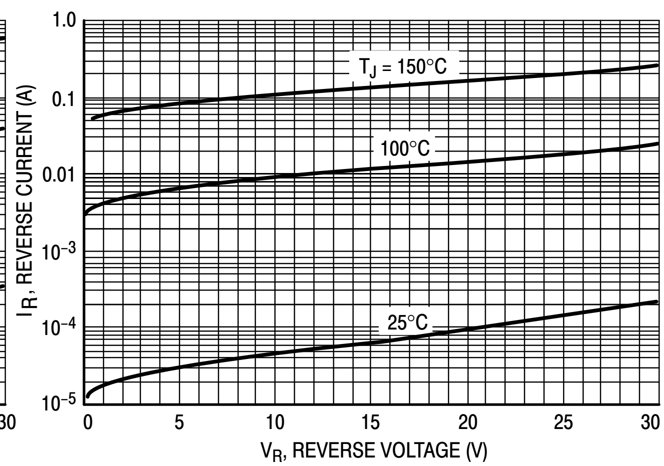



**Figure 4. Typical Reverse Current**

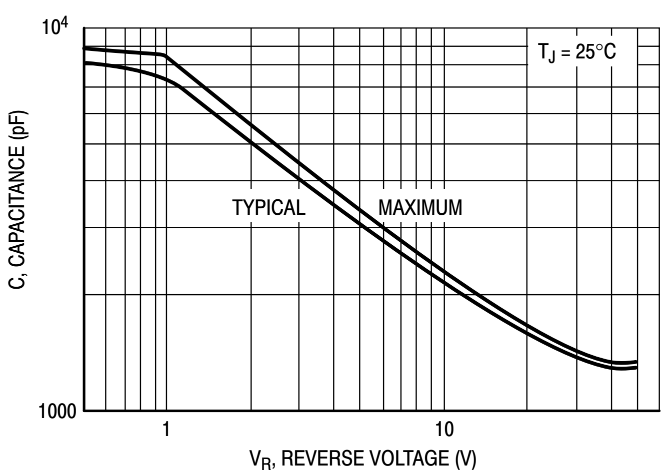



**Figure 5. Maximum and Typical Capacitance**

## ELECTRICAL CHARACTERISTICS

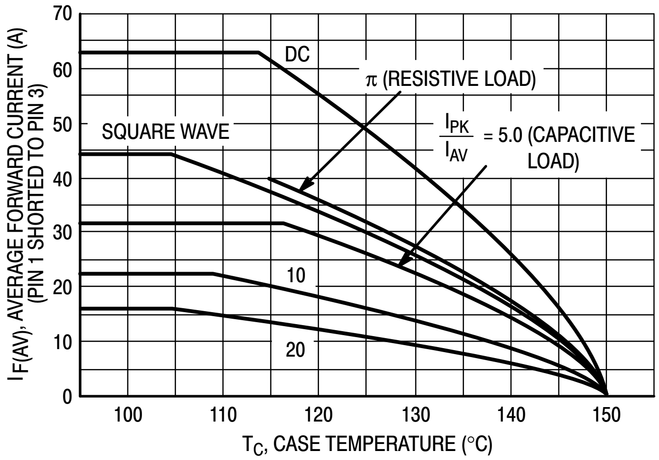



Figure 6. Current Derating, Infinite Heatsink

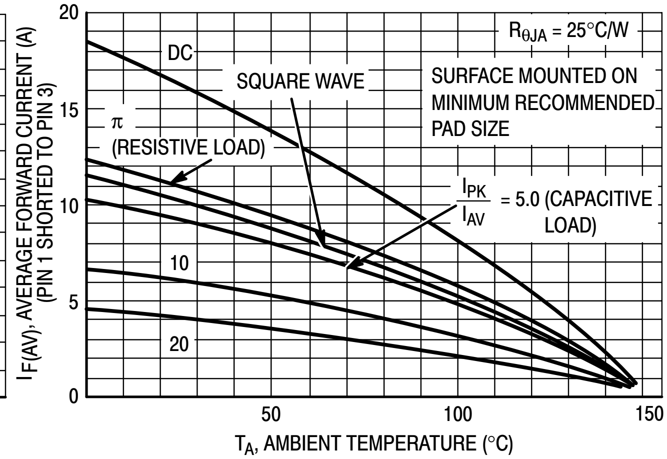



Figure 7. Current Derating

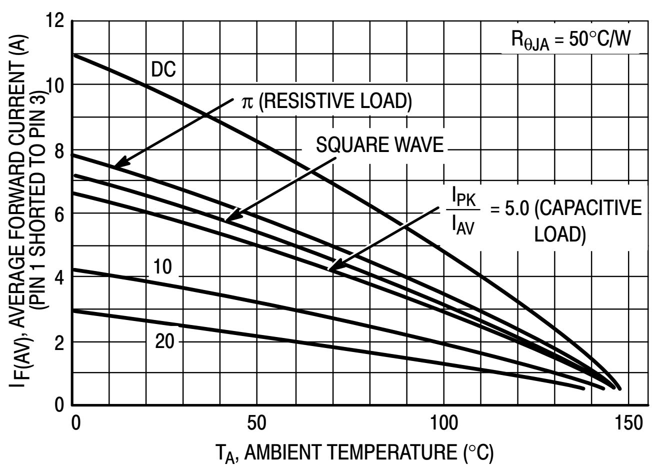



Figure 8. Current Derating, Free Air

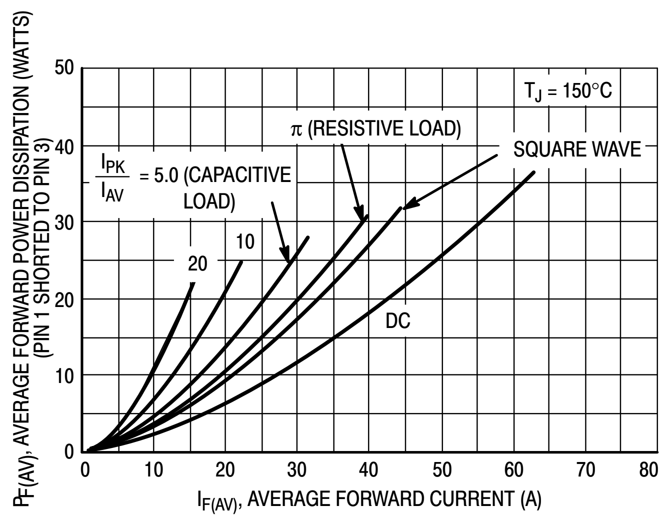



Figure 9. Forward Power Dissipation

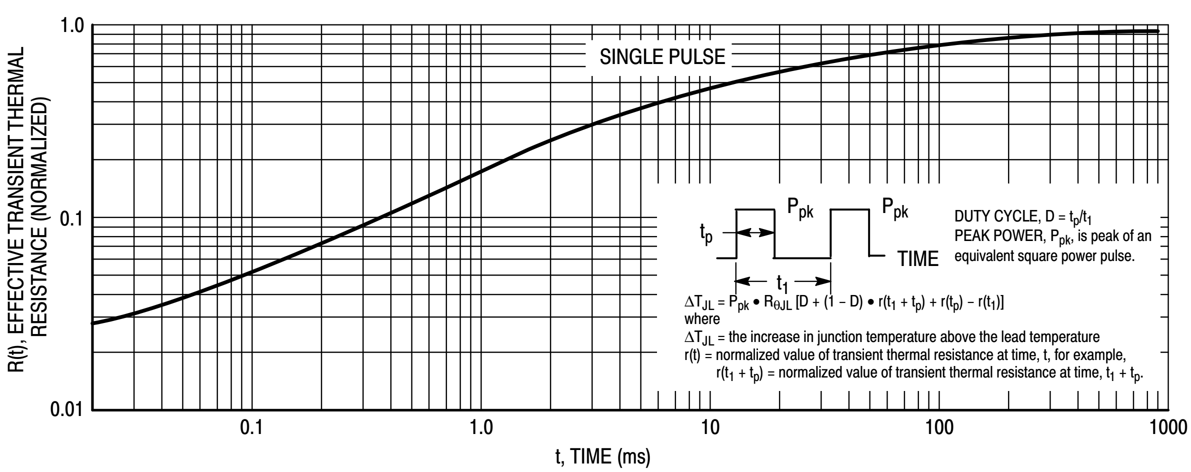
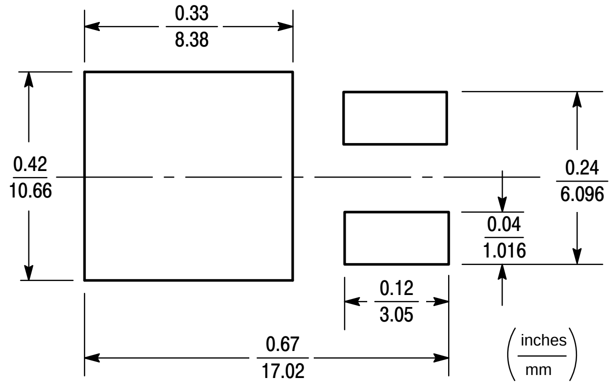



Figure 10. Thermal Response

# INFORMATION FOR USING THE D$^2$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$^2$PAK POWER DISSIPATION

The power dissipation of the D$^2$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$^2$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.

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

The 50°C/W for the D$^2$PAK package assumes the recommended drain pad area of 158K mil$^2$ 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 D$^2$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 11 shows a typical heating profile for use when soldering the D$^2$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.

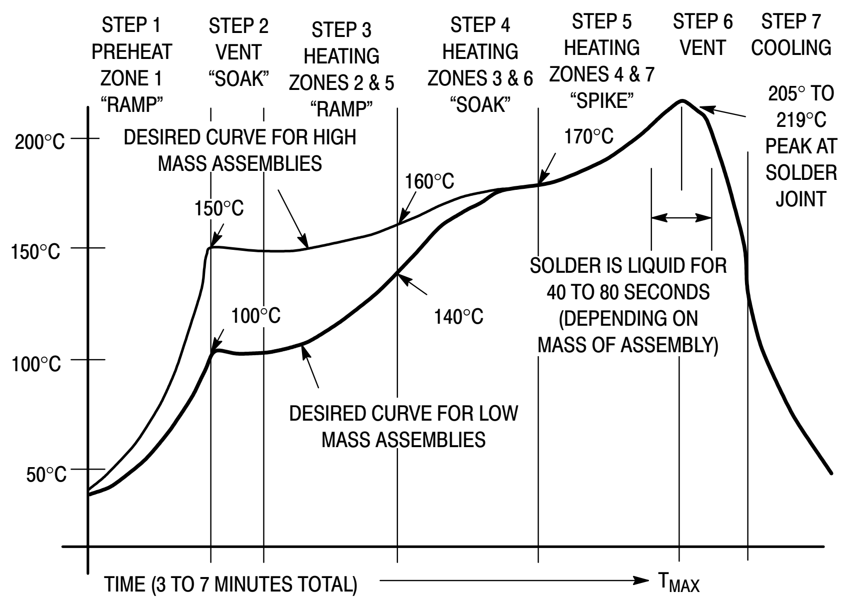
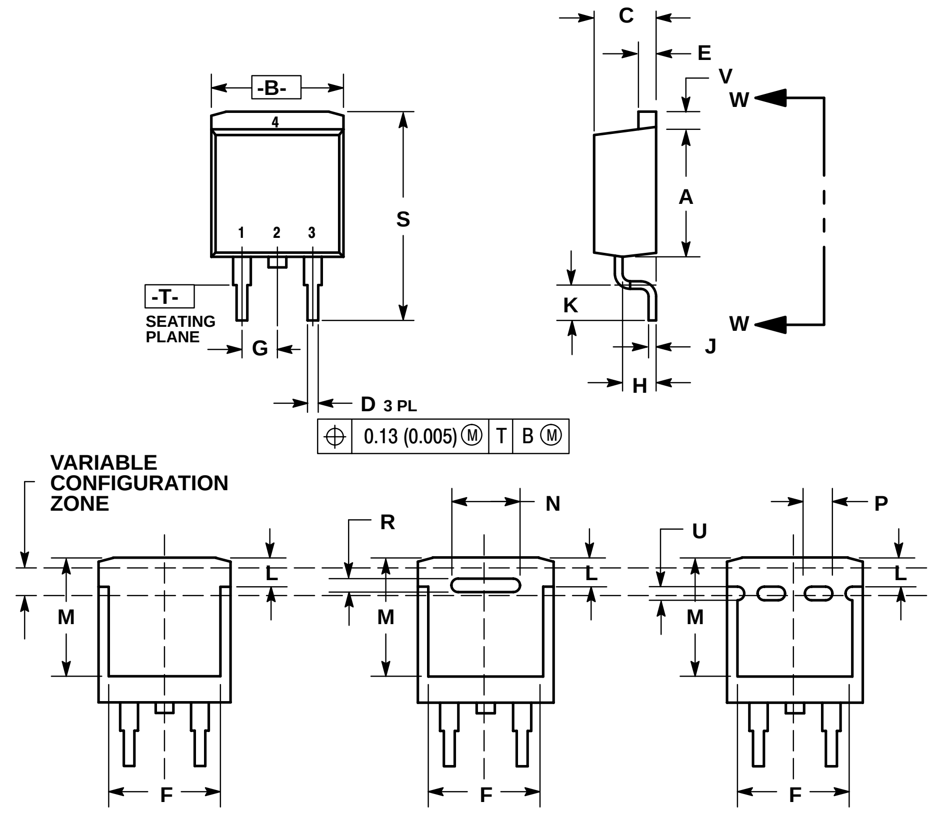



**Figure 11. Typical Solder Heating Profile**

## PACKAGE DIMENSIONS

### D$^2$PAK
CASE 418B-04
ISSUE H




VIEW W-W 1    VIEW W-W 2    VIEW W-W 3

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.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

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Thermal Clad is a trademark of the Bergquist Company.



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