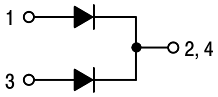
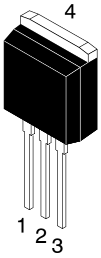
# Switch-mode Power Rectifier

## 60 V, 30 A

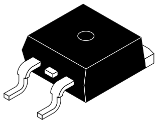
# MBRB30H60CT-1G, MBRB30H60CTT4G, NRVBB30H60CTT4G,

**SCHOTTKY BARRIER RECTIFIERS**
**30 AMPERES, 60 VOLTS**





**I$^2$PAK (TO−262)**
**CASE 418D−01**
**PLASTIC**
**STYLE 3**



**D$^2$PAK 3**
**CASE 418B−04**

### ORDERING AND MARKING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

### Features and Benefits

- Low Forward Voltage
- Low Power Loss/High Efficiency
- High Surge Capacity
- 175°C Operating Junction Temperature
- 30 A Total (15 A Per Diode Leg)
- Guard−Ring for Stress Protection
- AEC−Q101 Qualified and PPAP Capable
- NRVBB Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements
- These are Pb−Free and Halide Free Devices*

### Applications

- Power Supply − Output Rectification
- Power Management
- Instrumentation

### Mechanical Characteristics:

- Case: Epoxy, Molded
- Epoxy Meets UL 94 V−0 @ 0.125 in
- Weight (Approximately): 1.5 Grams (I$^2$PAK)
  1.7 Grams (D$^2$PAK)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds

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

## MAXIMUM RATINGS (Per Diode Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 60 | V |
| Average Rectified Forward Current<br>(Rated $V_R$) $T_C$ = 159°C | $I_{F(AV)}$ | 15 | A |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz) | $I_{FRM}$ | 30 | A |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 260 | A |
| Operating Junction Temperature (Note 1) | $T_J$ | −55 to +175 | °C |
| Storage Temperature | $T_{stg}$ | − 55 to +175 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/µs |
| Controlled Avalanche Energy (see test conditions in Figures 11 and 12) | $W_{AVAL}$ | 350 | mJ |
| ESD Ratings:<br>Machine Model = C<br>Human Body Model = 3B | | > 400<br>> 8000 | V |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. The heat generated must be less than the thermal conductivity from Junction−to−Ambient: $dP_D/dT_J < 1/R_{\theta JA}$.

## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance | | | °C/W |
| (MBRB30H60CT−1G) | | | |
| Junction−to−Case | $R_{\theta JC}$ | 2.0 | |
| Junction−to−Ambient | $R_{\theta JA}$ | 70 | |
| (MBRB30H60CTT4G and NRVBB30H60CTT4G) | | | |
| Junction−to−Case | $R_{\theta JC}$ | 1.6 | |

## ELECTRICAL CHARACTERISTICS (Per Diode Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2) | $v_F$ | | V |
| ($I_F$ = 15 A, $T_C$ = 25°C) | | 0.62 | |
| ($I_F$ = 15 A, $T_C$ = 125°C) | | 0.56 | |
| ($I_F$ = 30 A, $T_C$ = 25°C) | | 0.78 | |
| ($I_F$ = 30 A, $T_C$ = 125°C) | | 0.71 | |
| Maximum Instantaneous Reverse Current (Note 2) | $i_R$ | | mA |
| (Rated DC Voltage, $T_C$ = 25°C) | | 0.3 | |
| (Rated DC Voltage, $T_C$ = 125°C) | | 45 | |

2. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

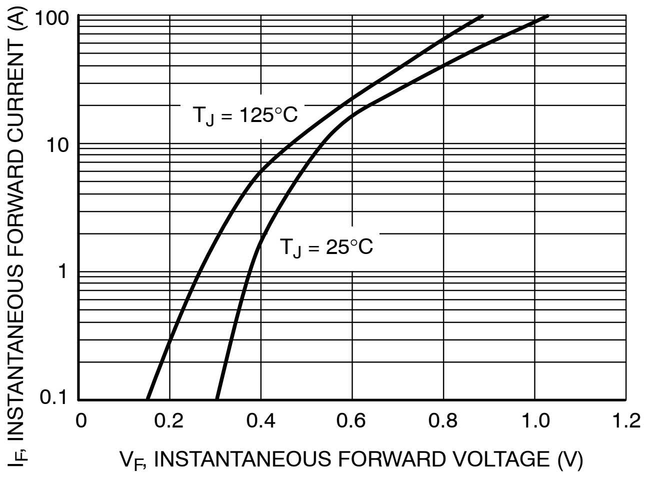


**Figure 1. Typical Forward Voltage**

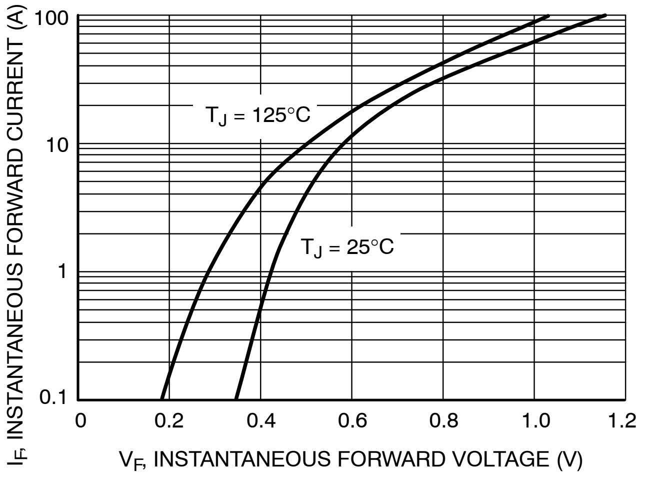


**Figure 2. Maximum Forward Voltage**

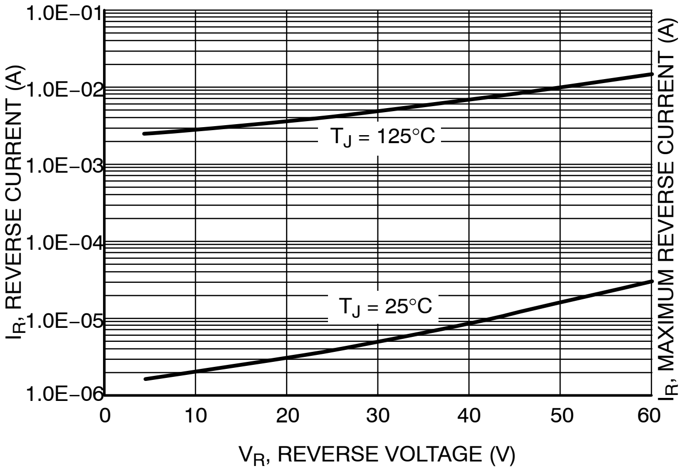


**Figure 3. Typical Reverse Current**

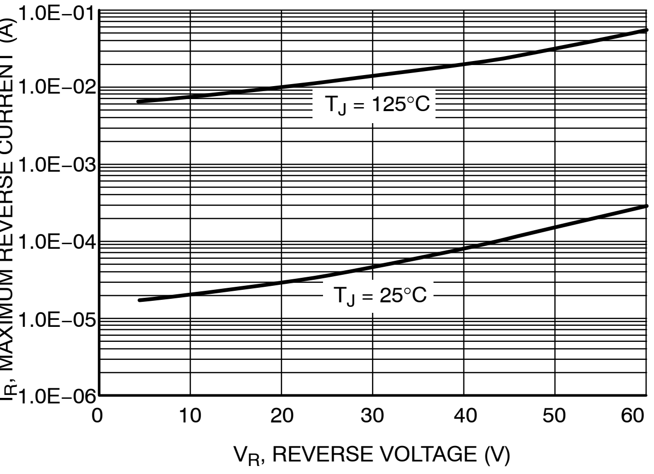


**Figure 4. Maximum Reverse Current**

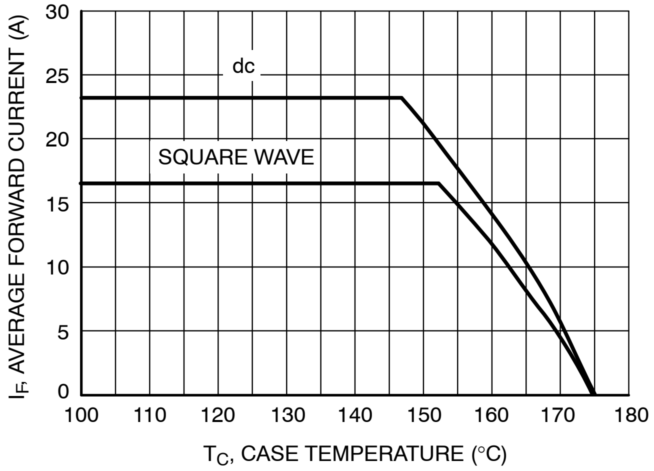


**Figure 5. Current Derating for MBRB30H60CT−1G, MBR30H60CTG, MBRB30H60CTT4G and NRVBB30H60CTT4G**

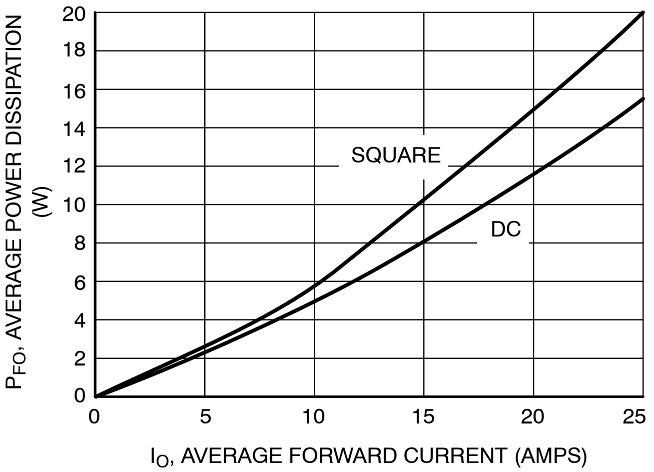


**Figure 6. Forward Power Dissipation**

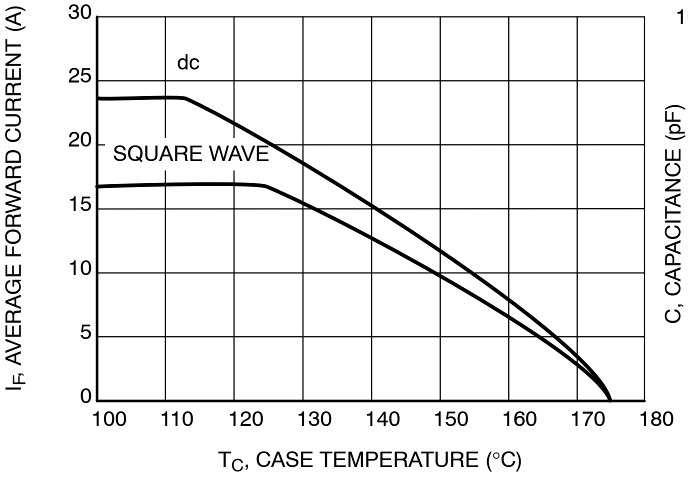


**Figure 8. Current Derating for MBRF30H60CTG and MBRJ30H60CTG**

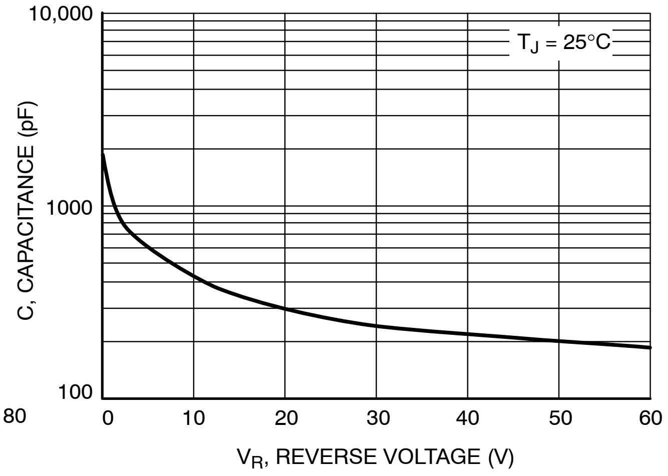


**Figure 7. Capacitance**

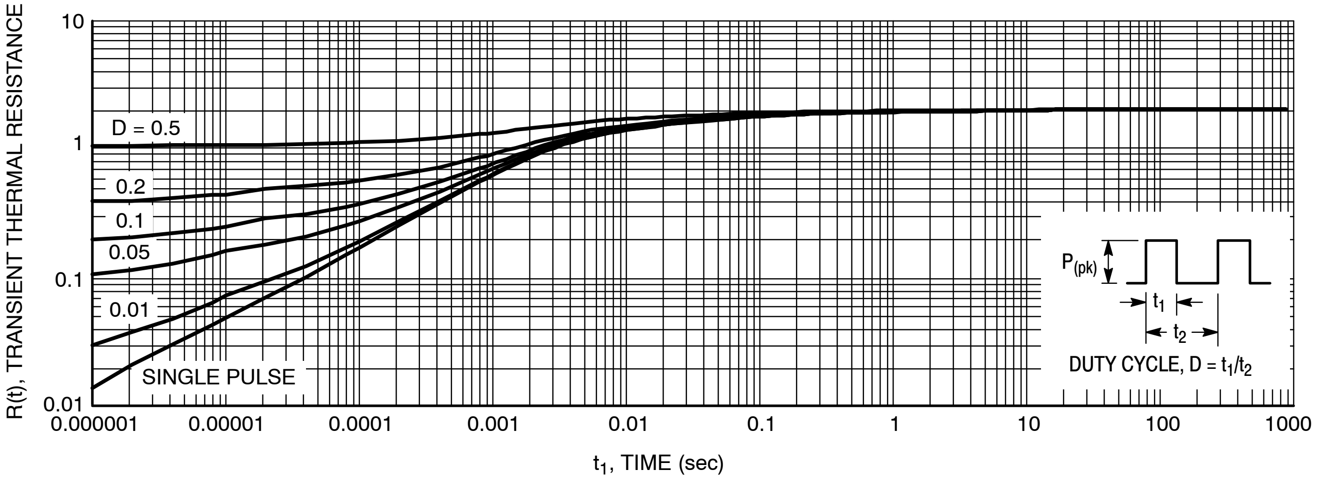


**Figure 9. Thermal Response Junction−to−Case for MBRB30H60CT−1G, MBR30H60CTG, MBRB30H60CTT4G and NVRBB30H60CTT4G**

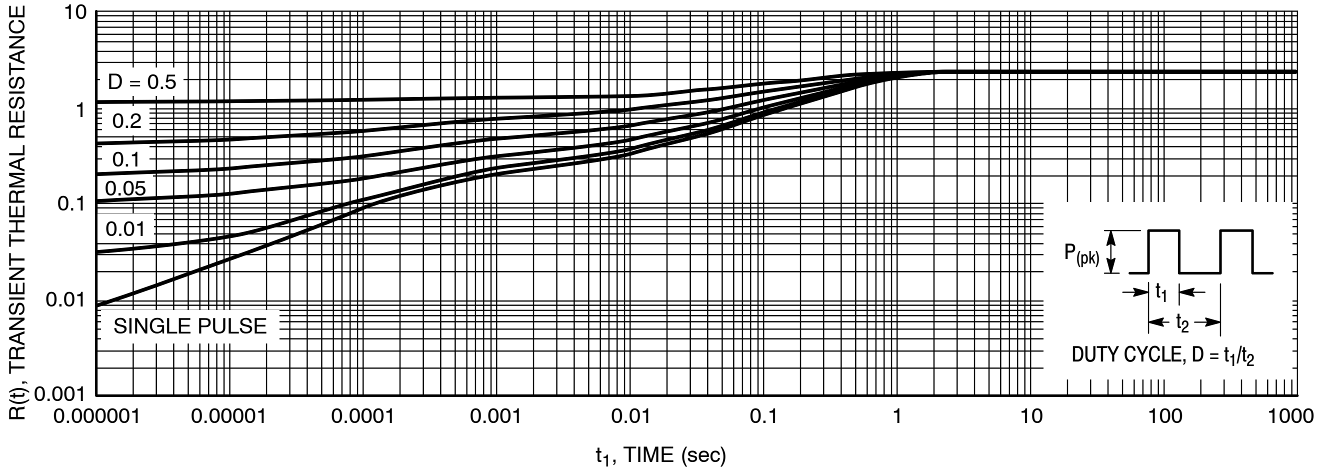


**Figure 10. Thermal Response Junction−to−Case for MBRF30H60CTG and MBRJ30H60CTG**

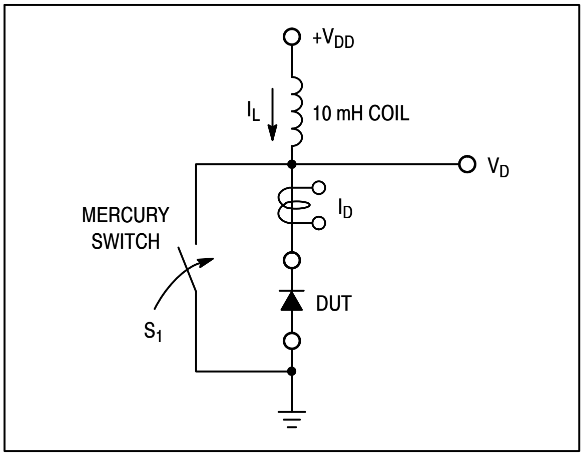


**Figure 11. Test Circuit**

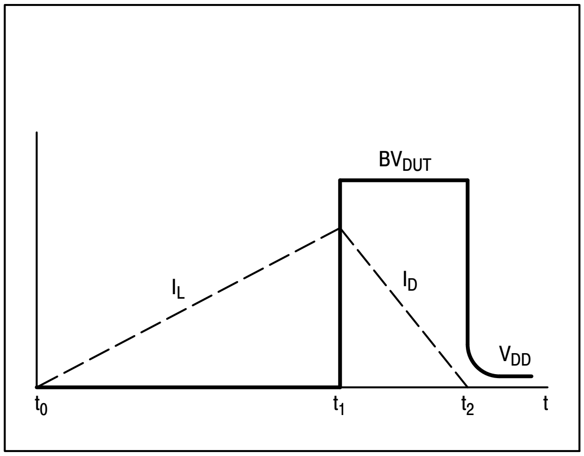


**Figure 12. Current−Voltage Waveforms**

The unclamped inductive switching circuit shown in Figure 11 was used to demonstrate the controlled avalanche capability of this device. A mercury switch was used instead of an electronic switch to simulate a noisy environment when the switch was being opened.

When $S_1$ is closed at $t_0$ the current in the inductor $I_L$ ramps up linearly; and energy is stored in the coil. At $t_1$ the switch is opened and the voltage across the diode under test begins to rise rapidly, due to di/dt effects, when this induced voltage reaches the breakdown voltage of the diode, it is clamped at $BV_{DUT}$ and the diode begins to conduct the full load current which now starts to decay linearly through the diode, and goes to zero at $t_2$.

By solving the loop equation at the point in time when $S_1$ is opened; and calculating the energy that is transferred to the diode it can be shown that the total energy transferred is equal to the energy stored in the inductor plus a finite amount of energy from the $V_{DD}$ power supply while the diode is in breakdown (from $t_1$ to $t_2$) minus any losses due to finite component resistances. Assuming the component resistive elements are small Equation (1) approximates the total energy transferred to the diode. It can be seen from this equation that if the $V_{DD}$ voltage is low compared to the breakdown voltage of the device, the amount of energy contributed by the supply during breakdown is small and the total energy can be assumed to be nearly equal to the energy stored in the coil during the time when $S_1$ was closed, Equation (2).

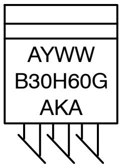
**EQUATION (1):**

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^{2} \left( \frac{BV_{DUT}}{BV_{DUT} V_{DD}} \right)$$

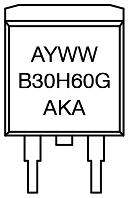
**EQUATION (2):**

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^{2}$$

## MARKING DIAGRAMS



I$^2$PAK (TO−262)



D$^2$PAK

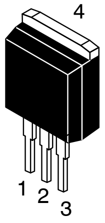
B30H60 = Device Code
A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package
AKA = Polarity Designator

## ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| MBRB30H60CT−1G | TO−262<br>(Pb−Free) | 50 Units / Tube |
| MBRB30H60CTT4G | D$^2$PAK<br>(Pb−Free) | 800 / Tape & Reel |
| NRVBB30H60CTT4G | D$^2$PAK<br>(Pb−Free) | 800 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

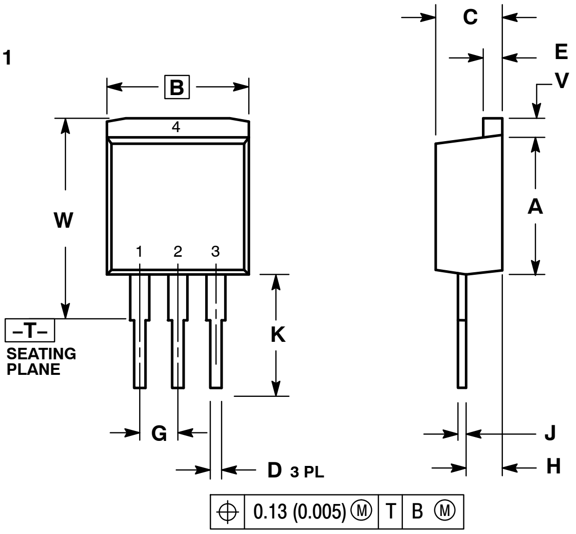
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS



**SCALE 1:1**

### D2PAK, 3−LEAD, STRAIGHT
CASE 418
ISSUE J

DATE 08 OCT 2003



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 418−01 THRU −04 OBSOLETE, NEW STANDARD 418−05.

| | 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 |
| **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** | 0.285 | 0.305 | 7.493 | 7.747 |
| **V** | 0.045 | 0.055 | 1.14 | 1.40 |
| **W** | 0.525 | 0.545 | 13.335 | 13.843 |

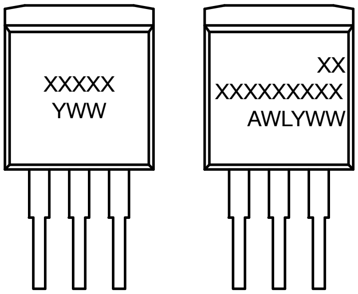
STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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

### GENERIC MARKING DIAGRAMS*



**Discrete** **IC**

XXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

| | | |
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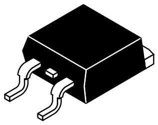
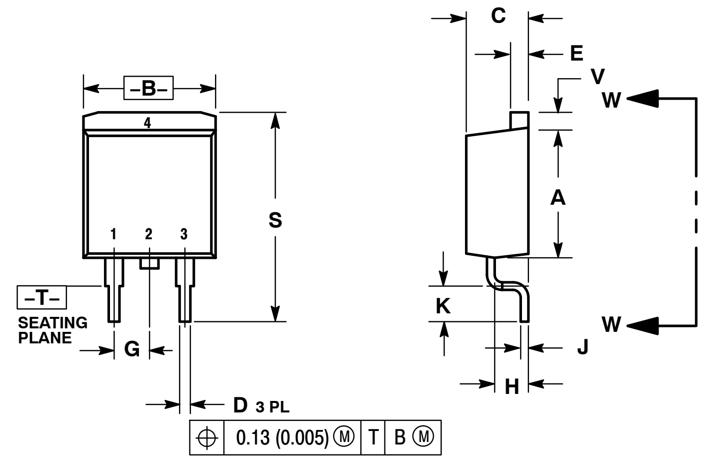


# D$^2$PAK 3
CASE 418B−04
ISSUE L

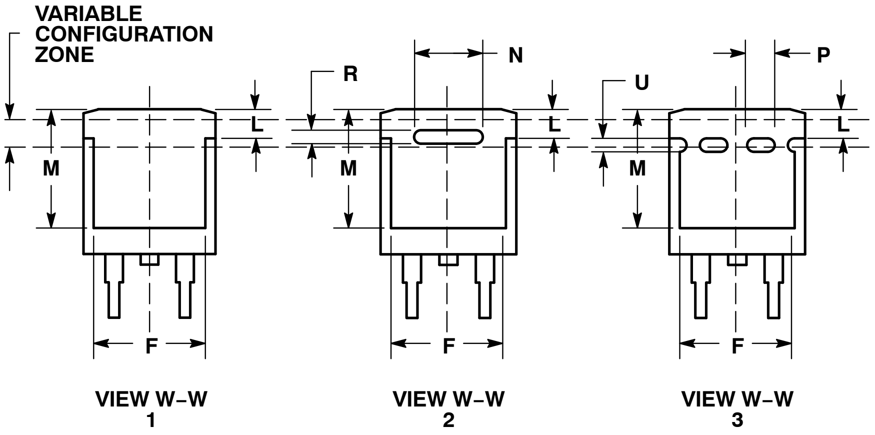
DATE 17 FEB 2015

**SCALE 1:1**



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 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

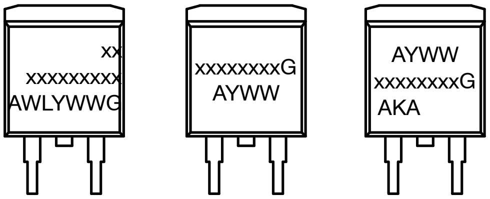
STYLE 6:
PIN 1. NO CONNECT
2. CATHODE
3. ANODE
4. CATHODE

## MARKING INFORMATION AND FOOTPRINT ON PAGE 2

# $D^2$PAK 3
CASE 418B−04
ISSUE L

DATE 17 FEB 2015

## GENERIC MARKING DIAGRAM*

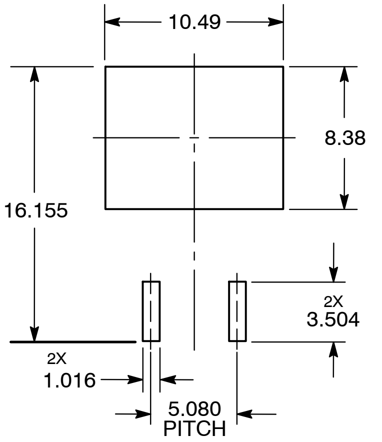


**IC** **Standard** **Rectifier**

xx = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
G = Pb−Free Package
AKA = Polarity Indicator

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

## SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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

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