

# **MBR41H100CTG, MBR41H100CTT4G, MBRB41H100CT-1G, NRVBB41H100CTT4G**

## **SWITCHMODE Power Rectifier 100 V, 40 A**

### **Features and Benefits**

- Low Forward Voltage: 0.67 V @ 125°C
- Low Power Loss/High Efficiency
- High Surge Capacity
- 175°C Operating Junction Temperature
- 40 A Total (20 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
- All Packages are Pb-Free\*

### **Applications**

- Power Supply – Output Rectification
- Power Management
- Instrumentation

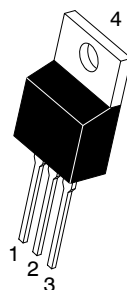
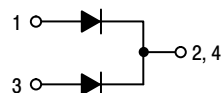
### **Mechanical Characteristics:**

- Case: Epoxy, Molded
- Epoxy Meets UL 94 V-0 @ 0.125 in
- Weight (Approximately): 1.9 Grams (TO-220AB)  
1.7 Grams (D<sup>2</sup>PAK)  
1.5 Grams (TO-262)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds



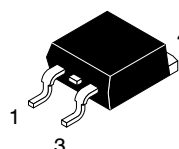
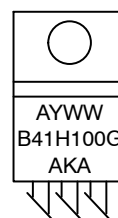
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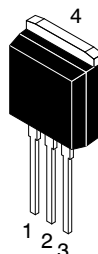


**TO-220AB  
CASE 221A  
PLASTIC  
STYLE 6**

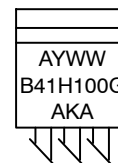
### **MARKING DIAGRAMS**



**D<sup>2</sup>PAK  
CASE 418B  
STYLE 3**



**I<sup>2</sup>PAK (TO-262)  
CASE 418D  
PLASTIC  
STYLE 3**



A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package  
AKA = Polarity Designator

### **ORDERING INFORMATION**

| Device           | Package                      | Shipping†       |
|------------------|------------------------------|-----------------|
| MBR41H100CTG     | TO-220 (Pb-Free)             | 50 Units/Rail   |
| MBRB41H100CT-1G  | TO-262 (Pb-Free)             | 50 Units/Rail   |
| MBRB41H100CTT4G  | D <sup>2</sup> PAK (Pb-Free) | 800/Tape & Reel |
| NRVBB41H100CTT4G | D <sup>2</sup> PAK (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.

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

# MBR41H100CTG, MBR41H100CTT4G, MBRB41H100CT-1G, NRVBB41H100CTT4G

## 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>$V_R$ | 100             | V                |
| Average Rectified Forward Current<br>(Rated $V_R$ ) $T_C = 150^\circ\text{C}$                              | $I_{F(AV)}$                     | 20              | A                |
| Peak Repetitive Forward Current<br>(Rated $V_R$ , Square Wave, 20 kHz) $T_C = 145^\circ\text{C}$           | $I_{FRM}$                       | 40              | A                |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$                       | 350             | A                |
| Operating Junction Temperature (Note 1)                                                                    | $T_J$                           | +175            | $^\circ\text{C}$ |
| Storage Temperature                                                                                        | $T_{stg}$                       | -65 to +175     | $^\circ\text{C}$ |
| Voltage Rate of Change (Rated $V_R$ )                                                                      | $dv/dt$                         | 10,000          | V/ $\mu\text{s}$ |
| Controlled Avalanche Energy (see test conditions in Figures 10 and 11)                                     | $W_{AVAIL}$                     | 400             | mJ               |
| ESD Ratings:<br>Machine Model = C<br>Human Body Model = 3B                                                 |                                 | > 400<br>> 8000 | V                |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

## THERMAL CHARACTERISTICS (Per Diode Leg)

| Characteristic                                                        | Symbol                             | Value     | Unit                      |
|-----------------------------------------------------------------------|------------------------------------|-----------|---------------------------|
| Maximum Thermal Resistance<br>Junction-to-Case<br>Junction-to-Ambient | $R_{\theta JC}$<br>$R_{\theta JA}$ | 2.0<br>70 | $^\circ\text{C}/\text{W}$ |

## ELECTRICAL CHARACTERISTICS (Per Diode Leg)

| Characteristic                                                                                                                                                                                                                                                           | Symbol | Value                        | Unit |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------------------------|------|
| Maximum Instantaneous Forward Voltage (Note 2)<br>( $I_F = 20\text{ A}$ , $T_C = 25^\circ\text{C}$ )<br>( $I_F = 20\text{ A}$ , $T_C = 125^\circ\text{C}$ )<br>( $I_F = 40\text{ A}$ , $T_C = 25^\circ\text{C}$ )<br>( $I_F = 40\text{ A}$ , $T_C = 125^\circ\text{C}$ ) | $V_F$  | 0.80<br>0.67<br>0.90<br>0.76 | V    |
| Maximum Instantaneous Reverse Current (Note 2)<br>(Rated DC Voltage, $T_C = 125^\circ\text{C}$ )<br>(Rated DC Voltage, $T_C = 25^\circ\text{C}$ )                                                                                                                        | $i_R$  | 10<br>0.01                   | mA   |

- The heat generated must be less than the thermal conductivity from Junction-to-Ambient:  $dP_D/dT_J < 1/R_{\theta JA}$ .
- Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

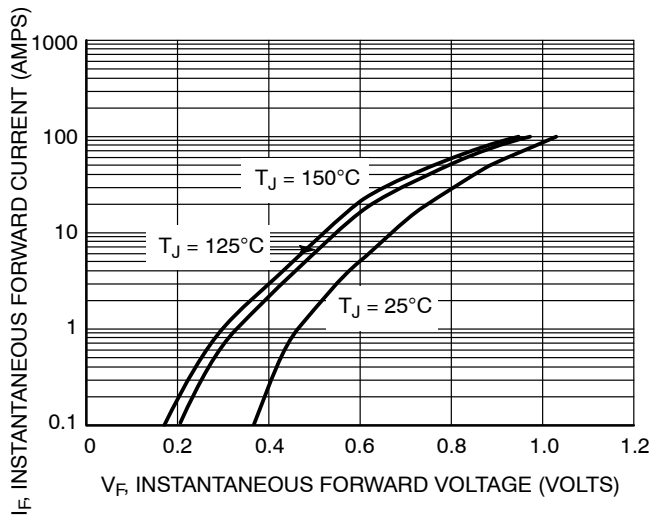


Figure 1. Typical Forward Voltage

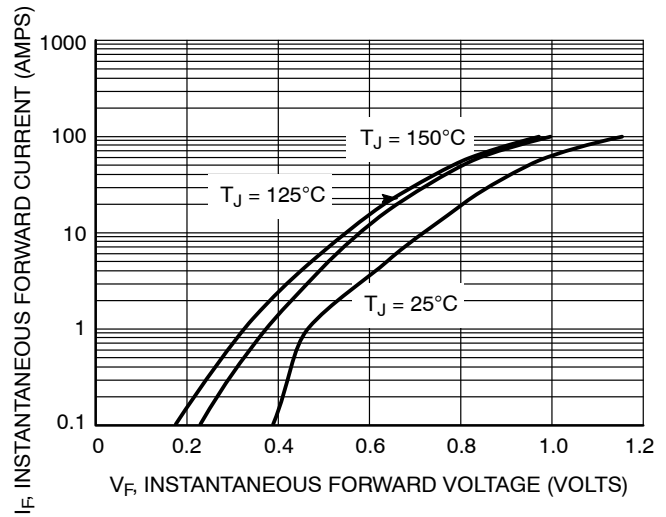


Figure 2. Maximum Forward Voltage

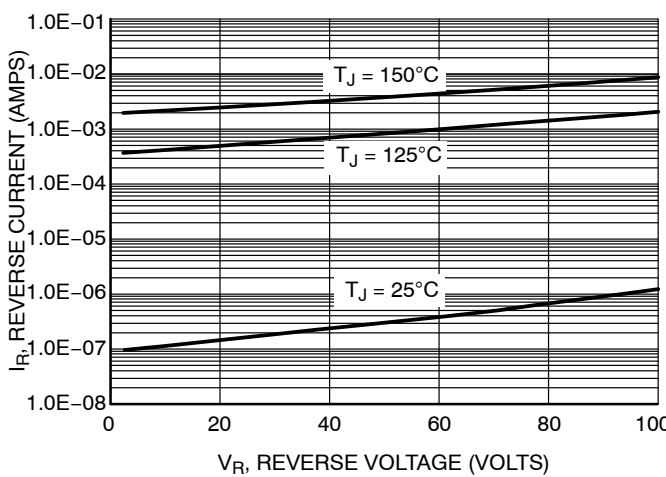


Figure 3. Typical Reverse Current

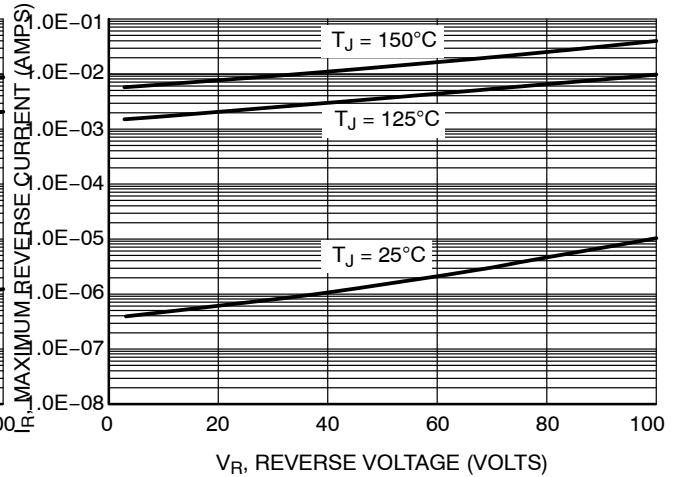


Figure 4. Maximum Reverse Current

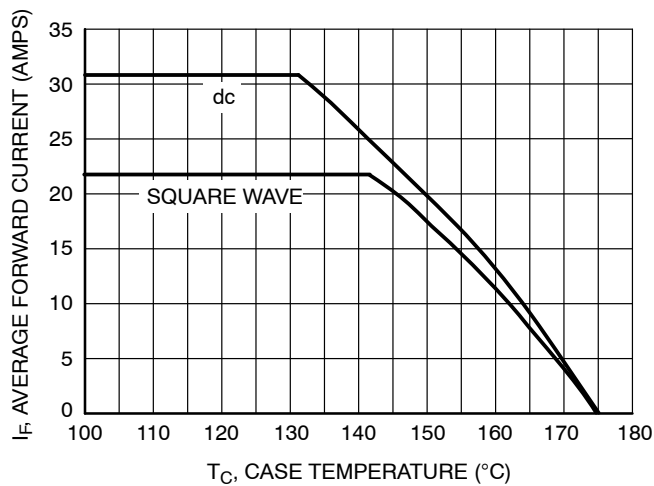


Figure 5. Current Derating

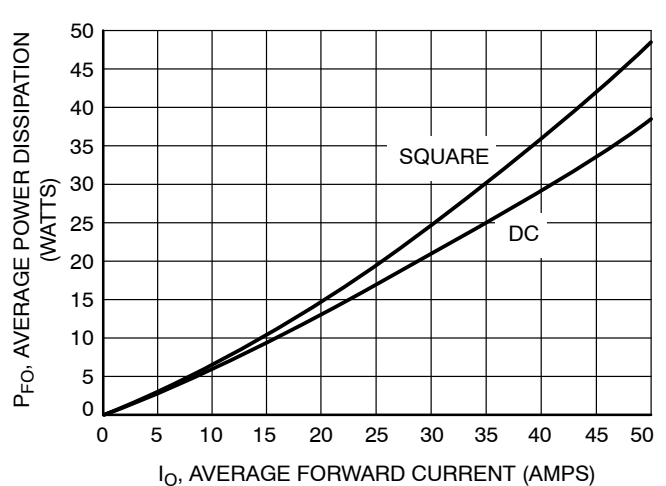


Figure 6. Forward Power Dissipation

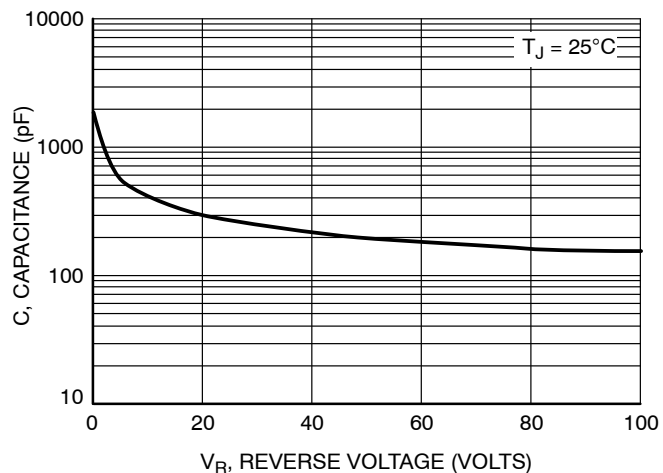


Figure 7. Capacitance

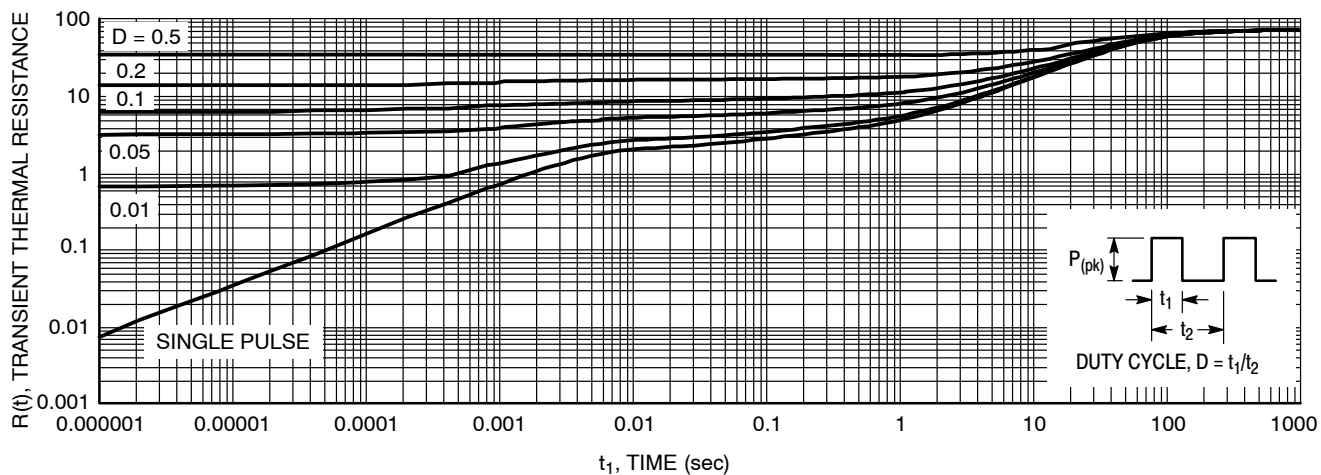


Figure 8. Thermal Response Junction-to-Ambient

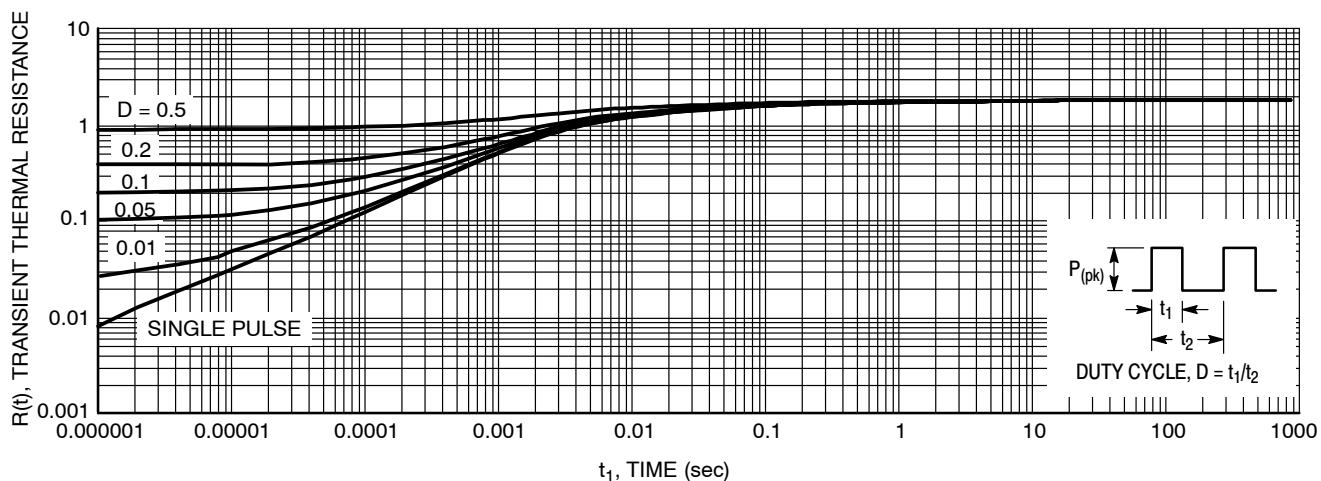


Figure 9. Thermal Response Junction-to-Case

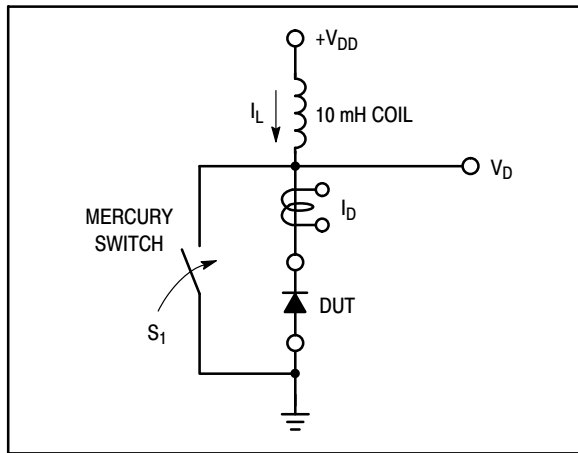


Figure 10. Test Circuit

The unclamped inductive switching circuit shown in Figure 10 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

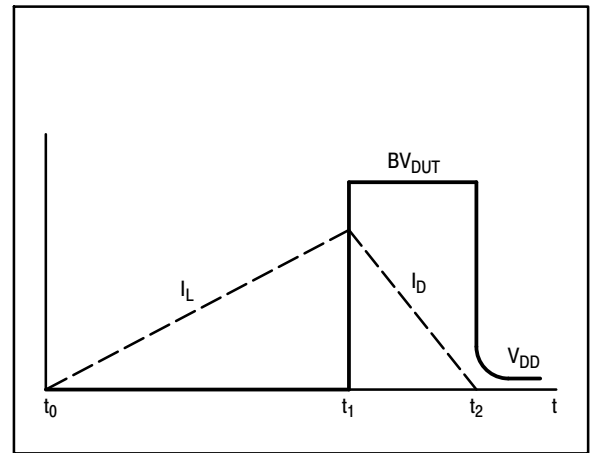


Figure 11. Current-Voltage Waveforms

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):

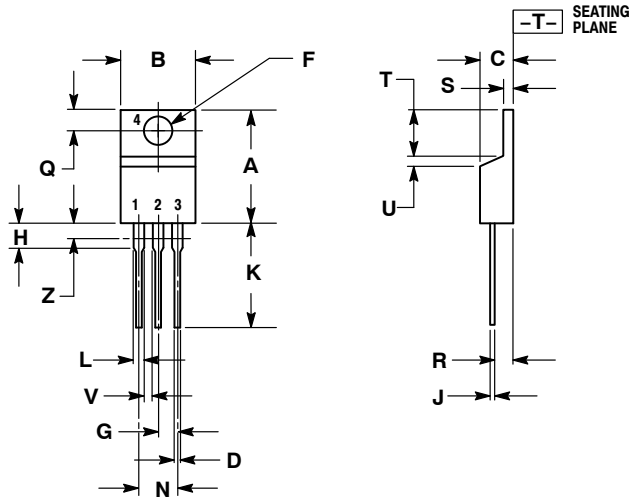
$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^2 \left( \frac{BV_{DUT}}{BV_{DUT} - V_{DD}} \right)$$

EQUATION (2):

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

PACKAGE DIMENSIONS

TO-220  
CASE 221A-09  
ISSUE AG



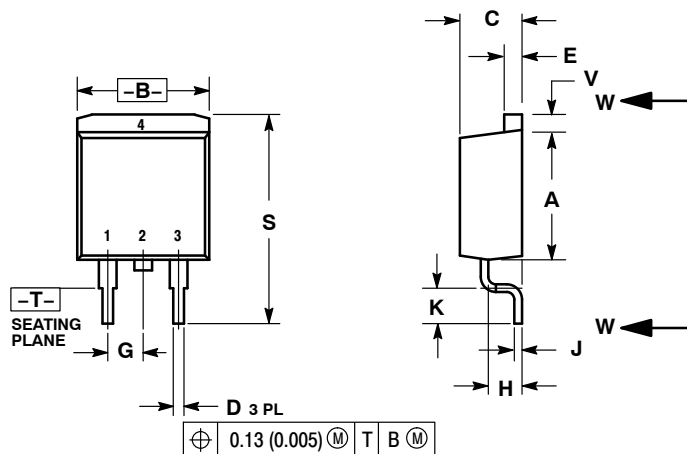
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.570  | 0.620 | 14.48       | 15.75 |
| B   | 0.380  | 0.405 | 9.66        | 10.28 |
| C   | 0.160  | 0.190 | 4.07        | 4.82  |
| D   | 0.025  | 0.036 | 0.64        | 0.91  |
| F   | 0.142  | 0.161 | 3.61        | 4.09  |
| G   | 0.095  | 0.105 | 2.42        | 2.66  |
| H   | 0.110  | 0.161 | 2.80        | 4.10  |
| J   | 0.014  | 0.025 | 0.36        | 0.64  |
| K   | 0.500  | 0.562 | 12.70       | 14.27 |
| L   | 0.045  | 0.060 | 1.15        | 1.52  |
| N   | 0.190  | 0.210 | 4.83        | 5.33  |
| Q   | 0.100  | 0.120 | 2.54        | 3.04  |
| R   | 0.080  | 0.110 | 2.04        | 2.79  |
| S   | 0.045  | 0.055 | 1.15        | 1.39  |
| T   | 0.235  | 0.255 | 5.97        | 6.47  |
| U   | 0.000  | 0.050 | 0.00        | 1.27  |
| V   | 0.045  | ---   | 1.15        | ---   |
| Z   | ---    | 0.080 | ---         | 2.04  |

- STYLE 6:
- PIN 1. ANODE  
2. CATHODE  
3. ANODE  
4. CATHODE

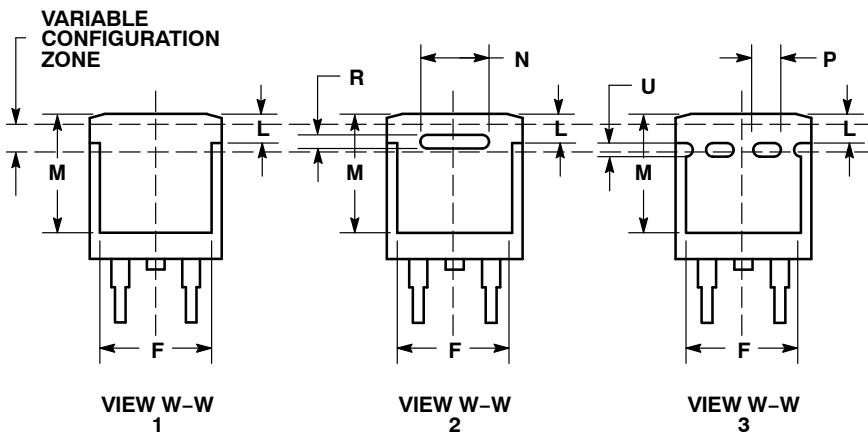
PACKAGE DIMENSIONS

D<sup>2</sup>PAK 3  
CASE 418B-04  
ISSUE K



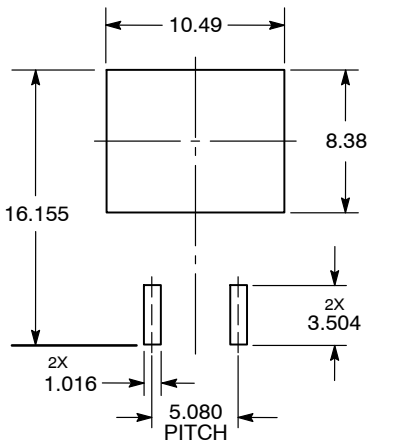
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. 418B-01 THRU 418B-03 OBSOLETE, NEW STANDARD 418B-04.

| 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 3:
- PIN 1. ANODE
  - CATHODE
  - ANODE
  - CATHODE

SOLDERING FOOTPRINT\*

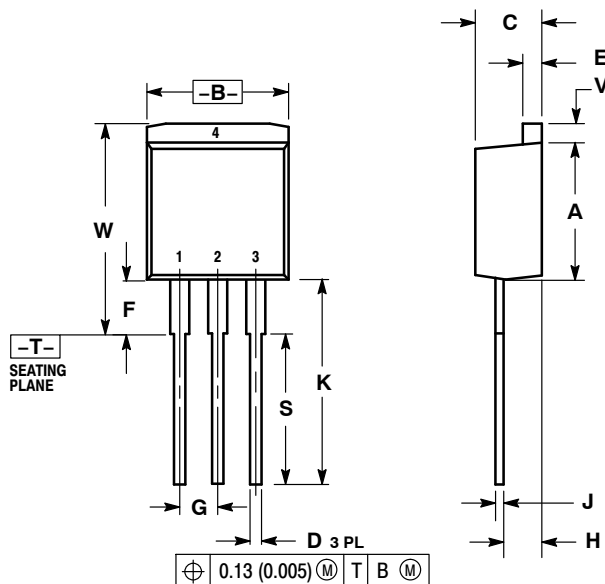


DIMENSIONS: MILLIMETERS

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

PACKAGE DIMENSIONS

I<sup>2</sup>PAK (TO-262)  
CASE 418D-01  
ISSUE D



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

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.335     | 0.380 | 8.51        | 9.65  |
| B   | 0.380     | 0.406 | 9.65        | 10.31 |
| C   | 0.160     | 0.185 | 4.06        | 4.70  |
| D   | 0.026     | 0.035 | 0.66        | 0.89  |
| E   | 0.045     | 0.055 | 1.14        | 1.40  |
| F   | 0.122 REF |       | 3.10 REF    |       |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.094     | 0.110 | 2.39        | 2.79  |
| J   | 0.013     | 0.025 | 0.33        | 0.64  |
| K   | 0.500     | 0.562 | 12.70       | 14.27 |
| S   | 0.390 REF |       | 9.90 REF    |       |
| V   | 0.045     | 0.070 | 1.14        | 1.78  |
| W   | 0.522     | 0.551 | 13.25       | 14.00 |

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

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