

# MBR20H100CTG, MBRB20H100CTG, MBRF20H100CTG, NRVBB20H100CTT4G

## Switch-mode Power Rectifier 100 V, 20 A

### Features and Benefits

- Low Forward Voltage: 0.64 V @ 125°C
- Low Power Loss/High Efficiency
- High Surge Capacity
- 175°C Operating Junction Temperature
- 20 A Total (10 A Per Diode Leg)
- Guard-Ring for Stress Protection
- NRVBB Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- Power Supply – Output Rectification
- Power Management
- Instrumentation

### Mechanical Characteristics:

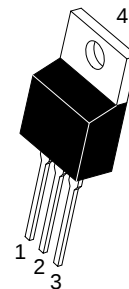
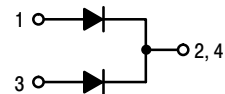
- Case: Epoxy, Molded
- Epoxy Meets UL 94 V-0 @ 0.125 in
- Weight (Approximately):  
1.9 Grams (TO-220)  
1.7 Grams (D<sup>2</sup>PAK)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes:  
260°C Max. for 10 Seconds



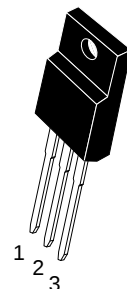
ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

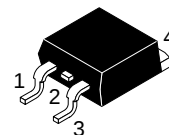
## SCHOTTKY BARRIER RECTIFIER 20 AMPERES, 100 VOLTS



TO-220  
CASE 221A  
STYLE 6



TO-220 FULLPAK™  
CASE 221D  
STYLE 3



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

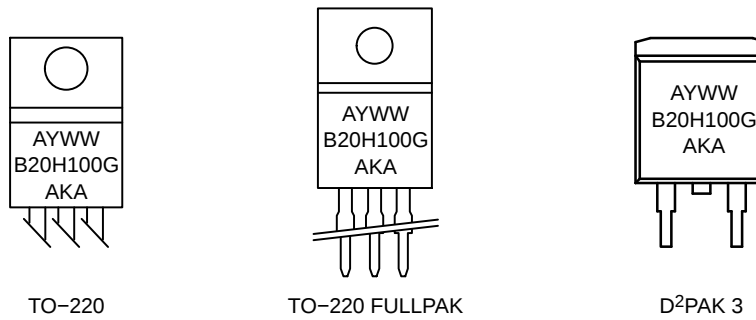
### DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 2 of this data sheet.

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

# MBR20H100CTG, MBRB20H100CTG, MBRF20H100CTG, NRVBB20H100CTT4G



A = Assembly Location  
Y = Year  
WW = Work Week  
B20H100 = Device Code  
G = Pb-Free Device  
AKA = Polarity Designator

Figure 1. Marking Diagrams

## MAXIMUM RATINGS (Per Diode Leg)

| Rating                                                                                                     | Symbol                          | Value           | Unit             |
|------------------------------------------------------------------------------------------------------------|---------------------------------|-----------------|------------------|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage <sup>1</sup>        | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 100             | V                |
| Average Rectified Forward Current<br>(Rated $V_R$ , $T_C = 162^\circ\text{C}$ )                            | $I_{F(AV)}$                     | 10              | A                |
| Peak Repetitive Forward Current<br>(Rated $V_R$ , Square Wave, 20 kHz) $T_C = 160^\circ\text{C}$           | $I_{FRM}$                       | 20              | A                |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$                       | 250             | 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 11 and 12)                                     | $W_{AVAIL}$                     | 200             | 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<br>(MBR20H100CTG, MBRB20H100CTG and NRVBB20H100CTT4G) |                 |       | $^\circ\text{C}/\text{W}$ |
| Junction-to-Case                                                                 | $R_{\theta JC}$ | 2.0   |                           |
| Junction-to-Ambient<br>(MBRF20H100CTG)                                           | $R_{\theta JA}$ | 60    |                           |
| Junction-to-Case                                                                 | $R_{\theta JC}$ | 2.5   |                           |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# MBR20H100CTG, MBRB20H100CTG, MBRF20H100CTG, NRVBB20H100CTT4G

## ELECTRICAL CHARACTERISTICS (Per Diode Leg)

| Characteristic                                                                                                                                                                                                                                                           | Symbol | Value                        | Unit |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------------------------|------|
| Maximum Instantaneous Forward Voltage (Note 2)<br>( $I_F = 10\text{ A}$ , $T_C = 25^\circ\text{C}$ )<br>( $I_F = 10\text{ A}$ , $T_C = 125^\circ\text{C}$ )<br>( $I_F = 20\text{ A}$ , $T_C = 25^\circ\text{C}$ )<br>( $I_F = 20\text{ A}$ , $T_C = 125^\circ\text{C}$ ) | $V_F$  | 0.77<br>0.64<br>0.88<br>0.73 | V    |
| Maximum Instantaneous Reverse Current (Note 2)<br>(Rated DC Voltage, $T_C = 125^\circ\text{C}$ )<br>(Rated DC Voltage, $T_C = 25^\circ\text{C}$ )                                                                                                                        | $i_R$  | 6.0<br>0.0045                | mA   |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

## ORDERING INFORMATION

| Device Order Number | Package                           | Shipping <sup>†</sup> |
|---------------------|-----------------------------------|-----------------------|
| MBR20H100CTG        | TO-220<br>(Pb-Free)               | 50 Units / Rail       |
| MBRF20H100CTG       | TO-220FP<br>(Pb-Free)             | 50 Units / Rail       |
| MBRB20H100CTT4G     | D <sup>2</sup> PAK 3<br>(Pb-Free) | 800 / Tape & Reel     |
| NRVBB20H100CTT4G*   | D <sup>2</sup> PAK 3<br>(Pb-Free) | 800 / Tape & Reel     |

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

\*NRVBB Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

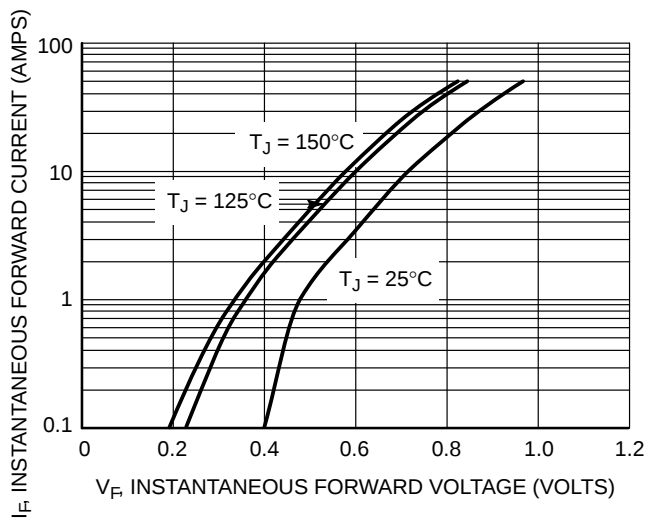


Figure 1. Typical Forward Voltage

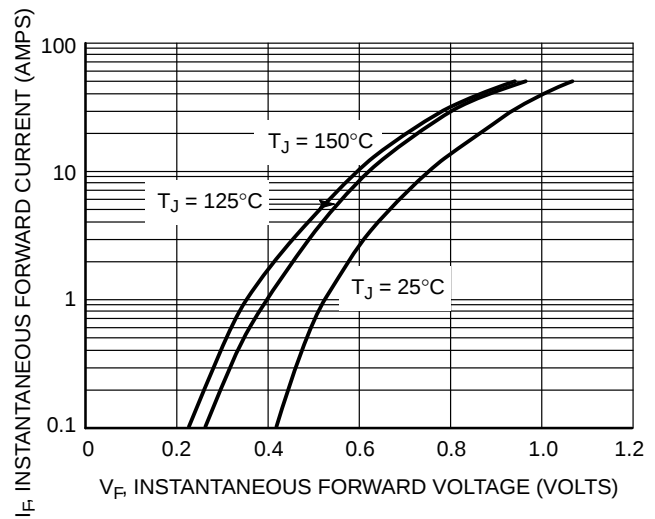


Figure 2. Maximum Forward Voltage

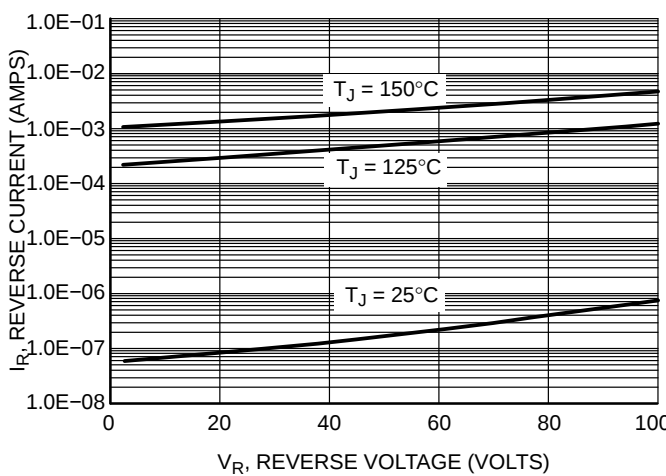


Figure 3. Typical Reverse Current

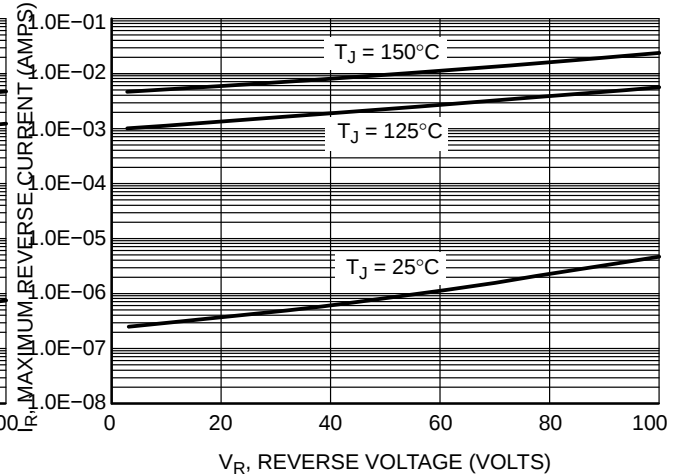


Figure 4. Maximum Reverse Current

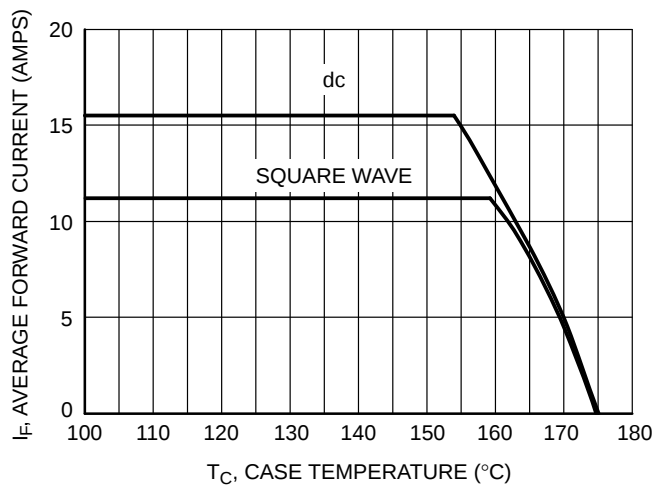


Figure 5. Current Derating

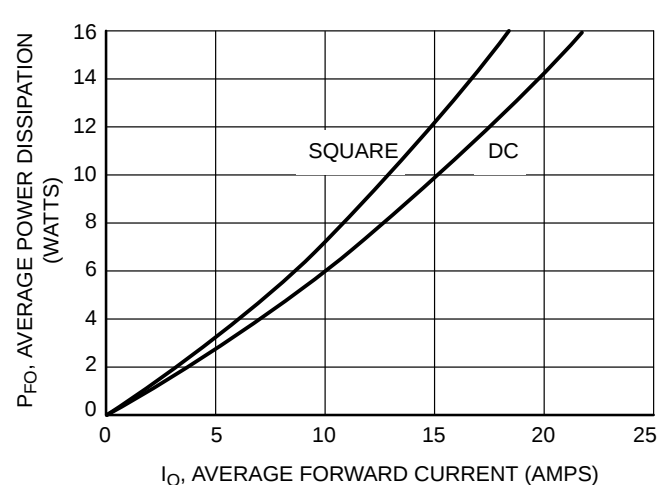


Figure 6. Forward Power Dissipation

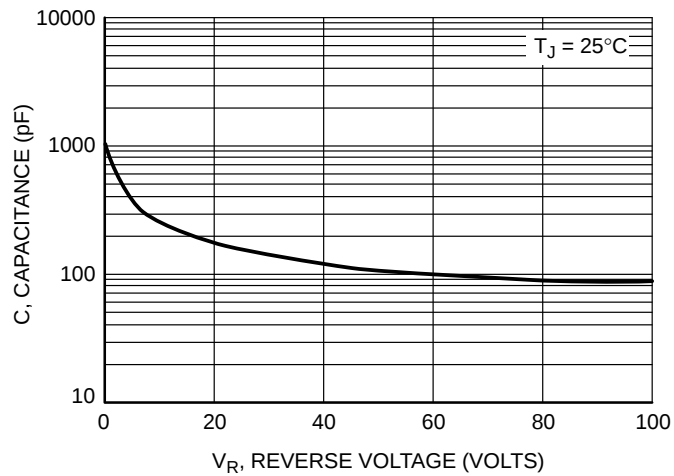


Figure 7. Capacitance

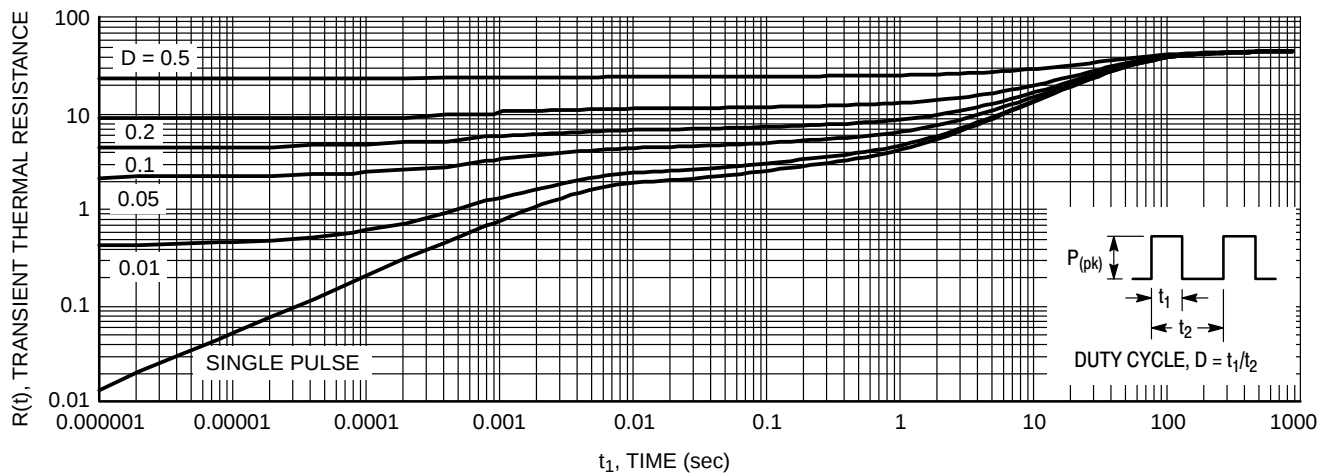


Figure 8. Thermal Response Junction-to-Ambient for MBR20H100CT, MBRB20H100CT and NRVBB20H100CTT4G

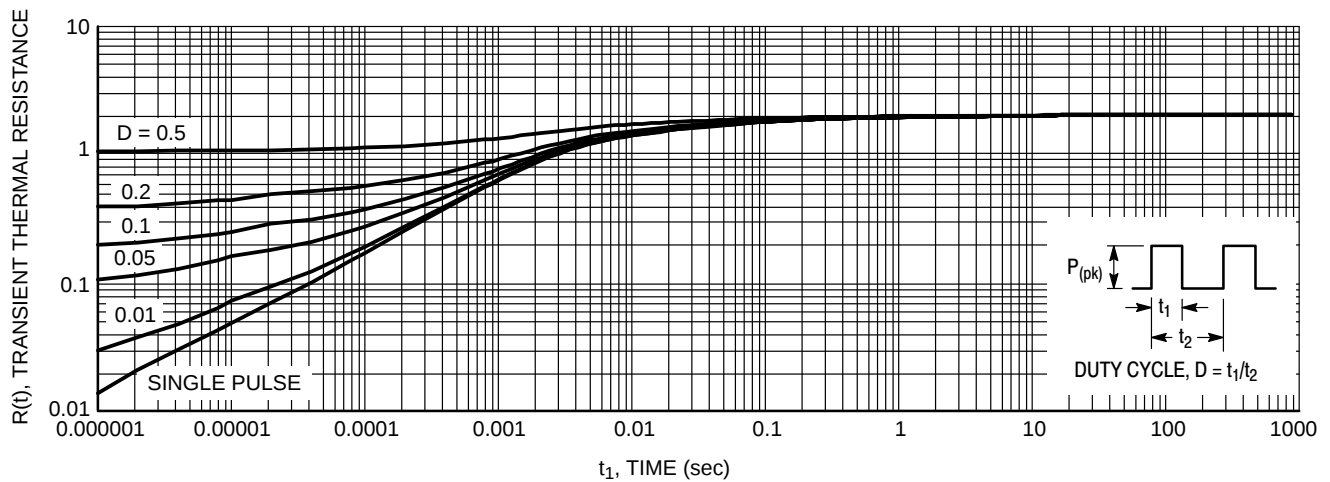


Figure 9. Thermal Response Junction-to-Case for MBR20H100CT, MBRB20H100CT and NRVBB20H100CTT4G

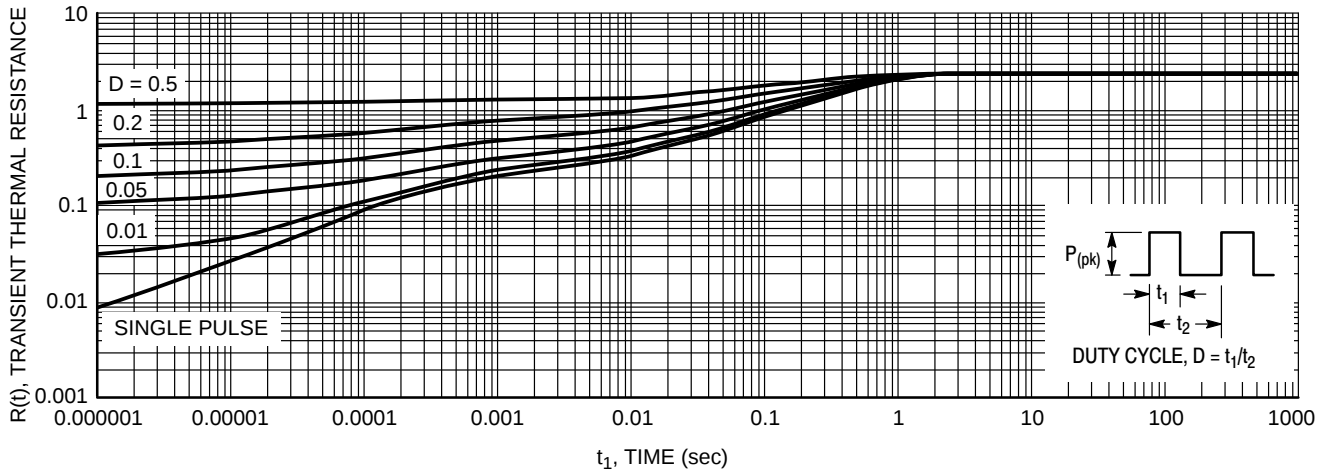


Figure 10. Thermal Response Junction-to-Case for MBRF20H100CT

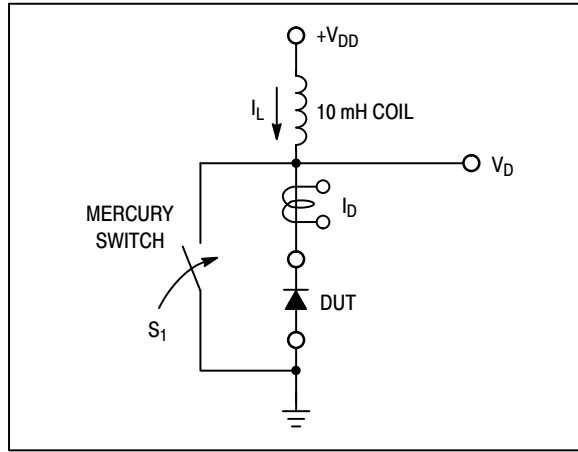


Figure 11. Test Circuit

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

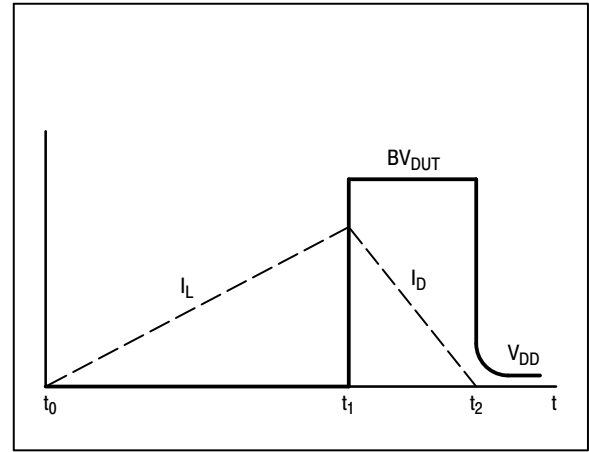


Figure 12. Current-Voltage Waveforms

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):

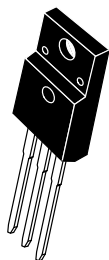
$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^2 \left( \frac{BV_{DUT}}{BV_{DUT} + V_{DD}} \right)$$

EQUATION (2):

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

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

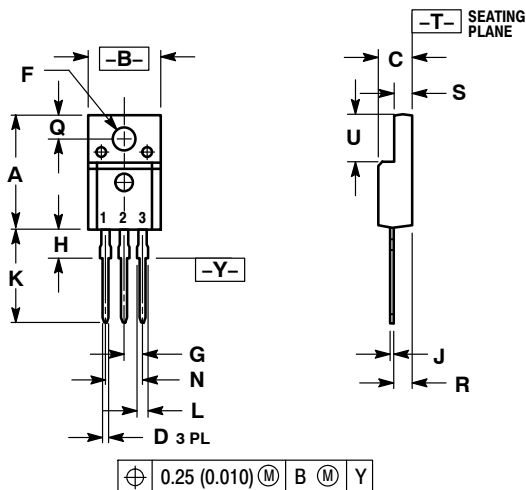
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SCALE 1:1

## TO-220 FULLPAK CASE 221D-03 ISSUE K

DATE 27 FEB 2009



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH
  3. 221D-01 THRU 221D-02 OBSOLETE, NEW STANDARD 221D-03.

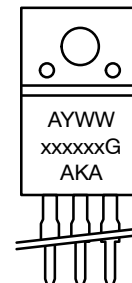
| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.617     | 0.635 | 15.67       | 16.12 |
| B   | 0.392     | 0.419 | 9.96        | 10.63 |
| C   | 0.177     | 0.193 | 4.50        | 4.90  |
| D   | 0.024     | 0.039 | 0.60        | 1.00  |
| F   | 0.116     | 0.129 | 2.95        | 3.28  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.118     | 0.135 | 3.00        | 3.43  |
| J   | 0.018     | 0.025 | 0.45        | 0.63  |
| K   | 0.503     | 0.541 | 12.78       | 13.73 |
| L   | 0.048     | 0.058 | 1.23        | 1.47  |
| N   | 0.200 BSC |       | 5.08 BSC    |       |
| Q   | 0.122     | 0.138 | 3.10        | 3.50  |
| R   | 0.099     | 0.117 | 2.51        | 2.96  |
| S   | 0.092     | 0.113 | 2.34        | 2.87  |
| U   | 0.239     | 0.271 | 6.06        | 6.88  |

## MARKING DIAGRAMS

- STYLE 1:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE
- STYLE 2:  
PIN 1. BASE  
2. COLLECTOR  
3. EMITTER
- STYLE 3:  
PIN 1. ANODE  
2. CATHODE  
3. ANODE
- STYLE 4:  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE
- STYLE 5:  
PIN 1. CATHODE  
2. ANODE  
3. GATE
- STYLE 6:  
PIN 1. MT 1  
2. MT 2  
3. GATE



Bipolar



Rectifier

xxxxxx = Specific Device Code  
G = Pb-Free Package  
A = Assembly Location  
Y = Year  
WW = Work Week

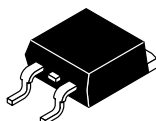
A = Assembly Location  
Y = Year  
WW = Work Week  
xxxxxx = Device Code  
G = Pb-Free Package  
AKA = Polarity Designator

|                  |                |                                                                                                                                                                                     |
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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

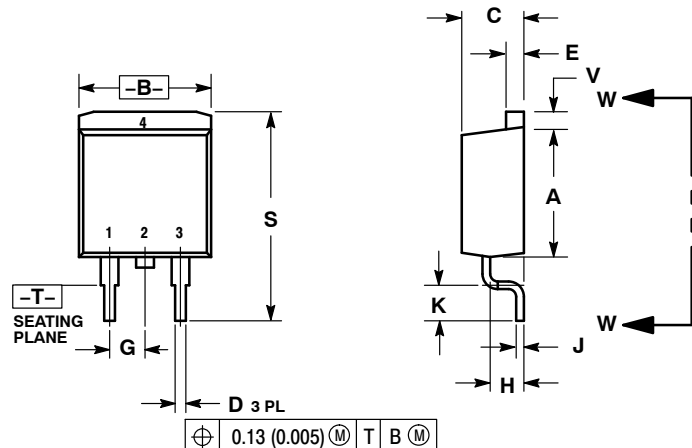
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**D<sup>2</sup>PAK 3**  
CASE 418B-04  
ISSUE L

DATE 17 FEB 2015

SCALE 1:1

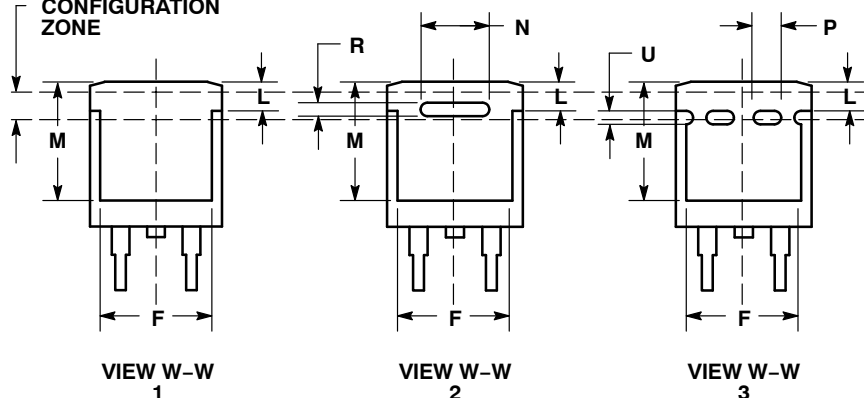


## NOTES:

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

| 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  |

## VARIABLE CONFIGURATION ZONE



### 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

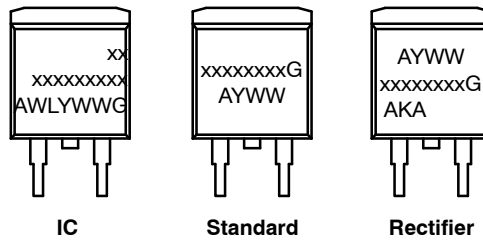
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**D<sup>2</sup>PAK 3**  
CASE 418B-04  
ISSUE L

DATE 17 FEB 2015

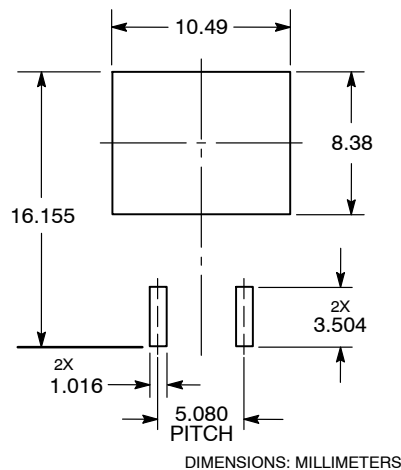
**GENERIC  
MARKING DIAGRAM\***



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.

**SOLDERING FOOTPRINT\***



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

|                         |                           |                                                                                                                                                                                     |
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