

# MBR2045CTG, MBRF2045CTG

## Switch-mode Power Rectifier

### Features and Benefits

- Low Forward Voltage
- Low Power Loss / High Efficiency
- High Surge Capacity
- 175°C Operating Junction Temperature
- 20 A Total (10 A Per Diode Leg)
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- Power Supply – Output Rectification
- Power Management
- Instrumentation

### Mechanical Characteristics

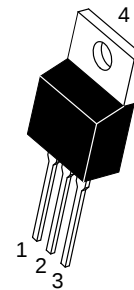
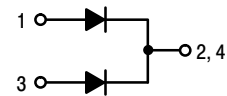
- Case: Epoxy, Molded
- Epoxy Meets UL 94, V-0 @ 0.125 in
- Weight: 1.9 Grams (Approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes:  
260°C Max. for 10 Seconds
- ESD Rating: Human Body Model = 3B  
Machine Model = C



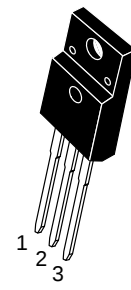
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## SCHOTTKY BARRIER RECTIFIER 20 AMPERES, 45 VOLTS



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



**TO-220  
FULLPAK™  
CASE 221AH**

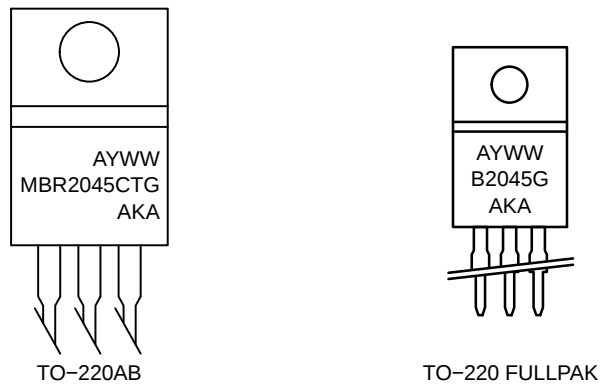
### DEVICE MARKING INFORMATION

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

### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

## MBR2045CTG, MBRF2045CTG



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

Figure 1. Marking Diagrams

### 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>$V_R$ | 45          | V                |
| Average Rectified Forward Current<br>Per Device<br>Per Diode ( $T_C = 165^\circ\text{C}$ )                  | $I_{F(AV)}$                     | 20<br>10    | A                |
| Peak Repetitive Forward Current<br>per Diode Leg (Square Wave, 20 kHz, $T_C = 163^\circ\text{C}$ )          | $I_{FRM}$                       | 20          | A                |
| Non-Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$                       | 150         | A                |
| Peak Repetitive Reverse Surge Current (2.0 $\mu\text{s}$ , 1.0 kHz)<br>See Figure 13                        | $I_{RRM}$                       | 1.0         | A                |
| Storage Temperature Range                                                                                   | $T_{stg}$                       | -65 to +175 | $^\circ\text{C}$ |
| Operating Junction Temperature (Note 1)                                                                     | $T_J$                           | -65 to +175 | $^\circ\text{C}$ |
| Voltage Rate of Change (Rated $V_R$ )                                                                       | $dv/dt$                         | 10,000      | V/ $\mu\text{s}$ |

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>(MBR2045CTG) | $R_{\theta JC}$ | 2.0   | $^\circ\text{C/W}$ |
|                                            | $R_{\theta JA}$ | 60    |                    |
| (MBRF2045CTG)                              | $R_{\theta JC}$ | 4.75  |                    |
|                                            | $R_{\theta JA}$ | 75    |                    |

# MBR2045CTG, MBRF2045CTG

## ELECTRICAL CHARACTERISTICS

| Characteristic                                                                                                                                                                                             | Symbol | Min         | Typ                  | Max                  | Unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------|----------------------|----------------------|------|
| Instantaneous Forward Voltage (Note 2)<br>( $i_F = 10\text{ A}$ , $T_J = 125^\circ\text{C}$ )<br>( $i_F = 20\text{ A}$ , $T_J = 125^\circ\text{C}$ )<br>( $i_F = 20\text{ A}$ , $T_J = 25^\circ\text{C}$ ) | $V_F$  | –<br>–<br>– | 0.50<br>0.67<br>0.71 | 0.57<br>0.72<br>0.84 | V    |
| Instantaneous Reverse Current (Note 2)<br>(Rated dc Voltage, $T_J = 125^\circ\text{C}$ )<br>(Rated dc Voltage, $T_J = 25^\circ\text{C}$ )                                                                  | $I_R$  | –<br>–      | 10.4<br>0.02         | 15<br>0.1            | 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 Type          | Shipping <sup>†</sup> |
|---------------------|-----------------------|-----------------------|
| MBR2045CTG          | TO-220<br>(Pb-Free)   | 50 Units / Rail       |
| MBRF2045CTG         | TO-220FP<br>(Pb-Free) | 50 Units / Rail       |

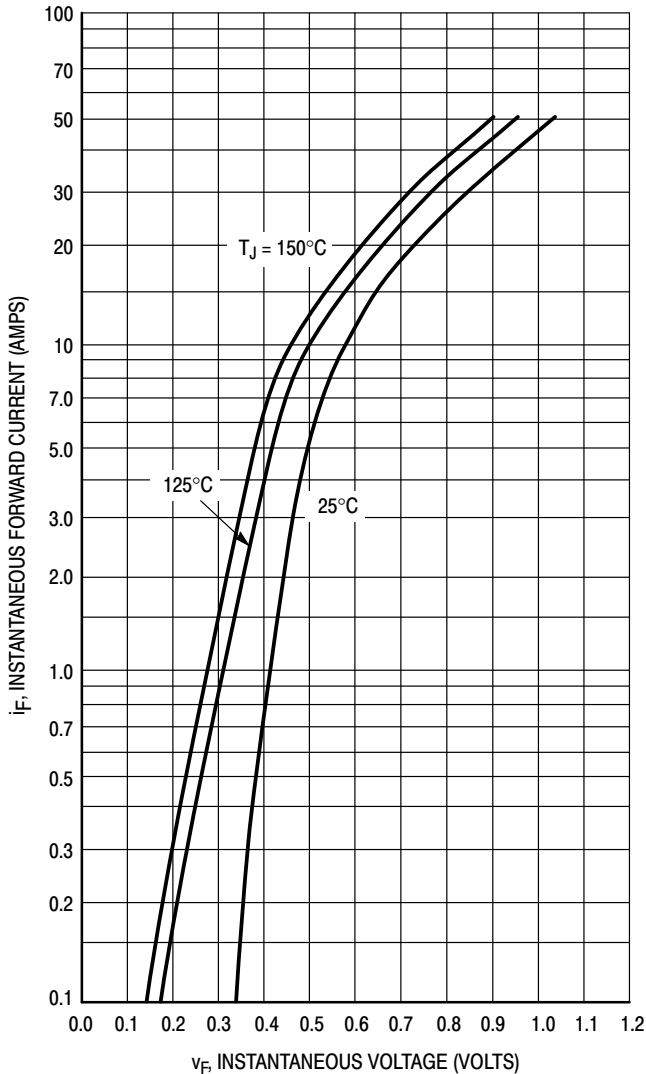


Figure 1. Typical Forward Voltage

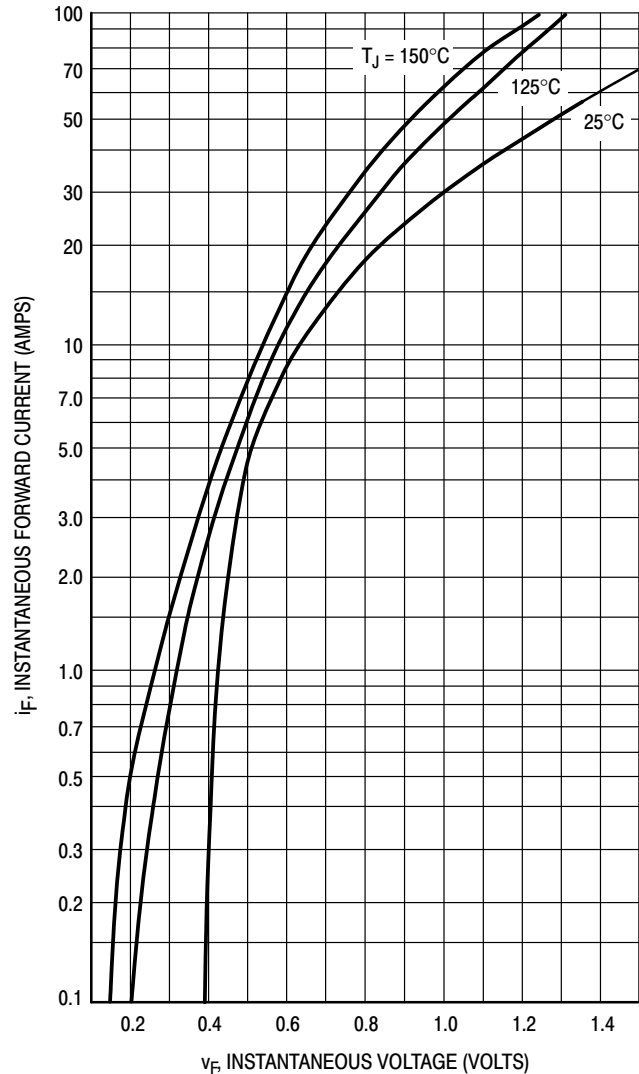


Figure 2. Maximum Forward Voltage

# MBR2045CTG, MBRF2045CTG

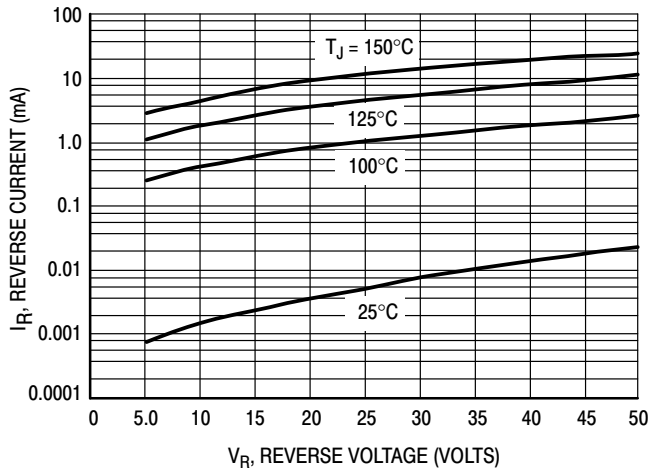


Figure 3. Typical Reverse Current

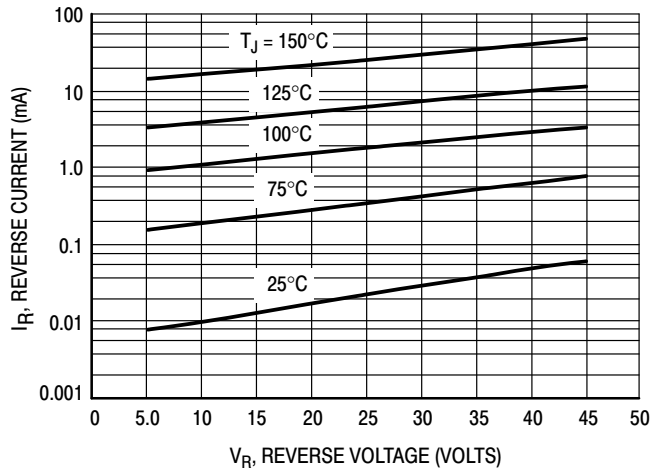


Figure 4. Maximum Reverse Current

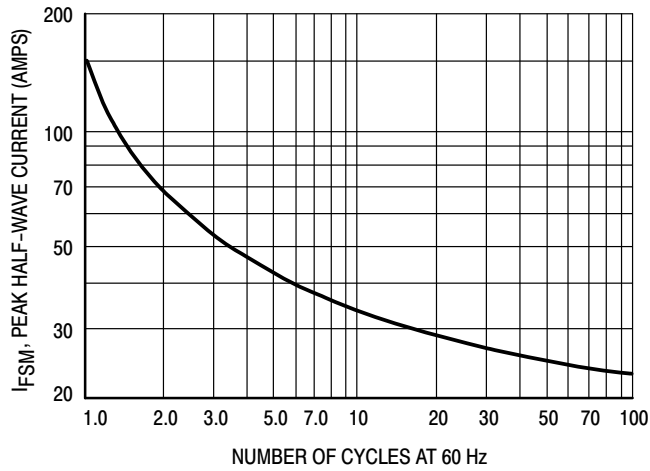


Figure 5. Maximum Surge Capability

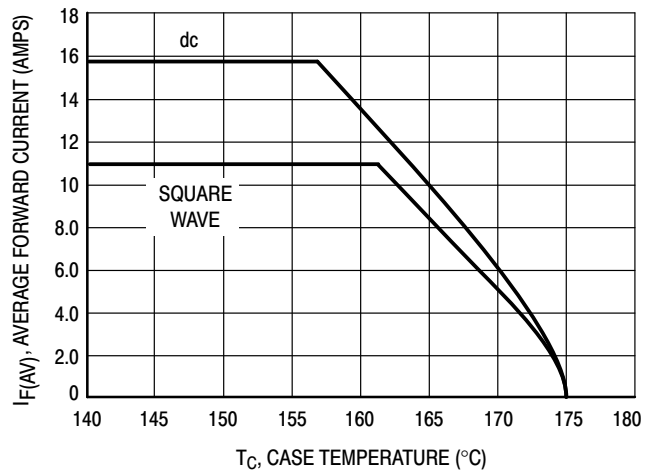


Figure 6. Current Derating, Case, Per Leg

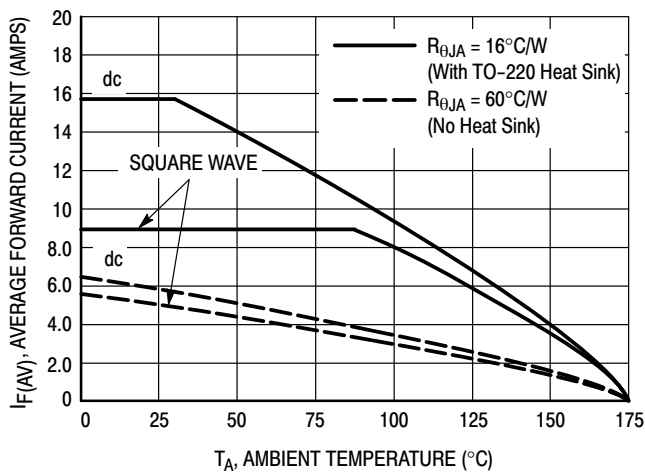


Figure 7. Current Derating, Ambient, Per Leg

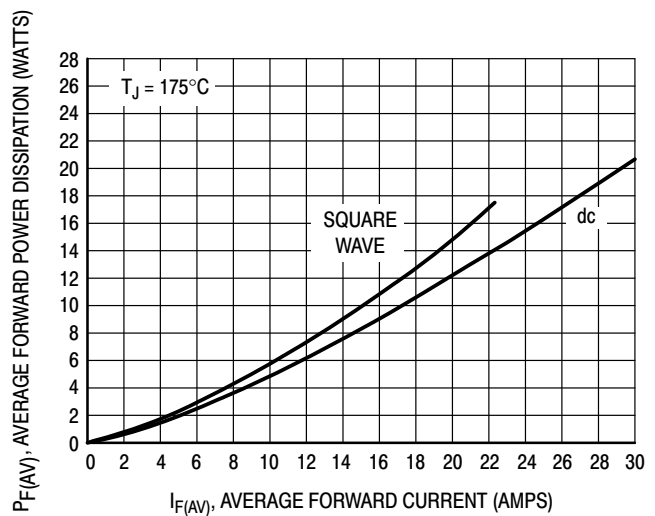


Figure 8. Forward Power Dissipation

# MBR2045CTG, MBRF2045CTG

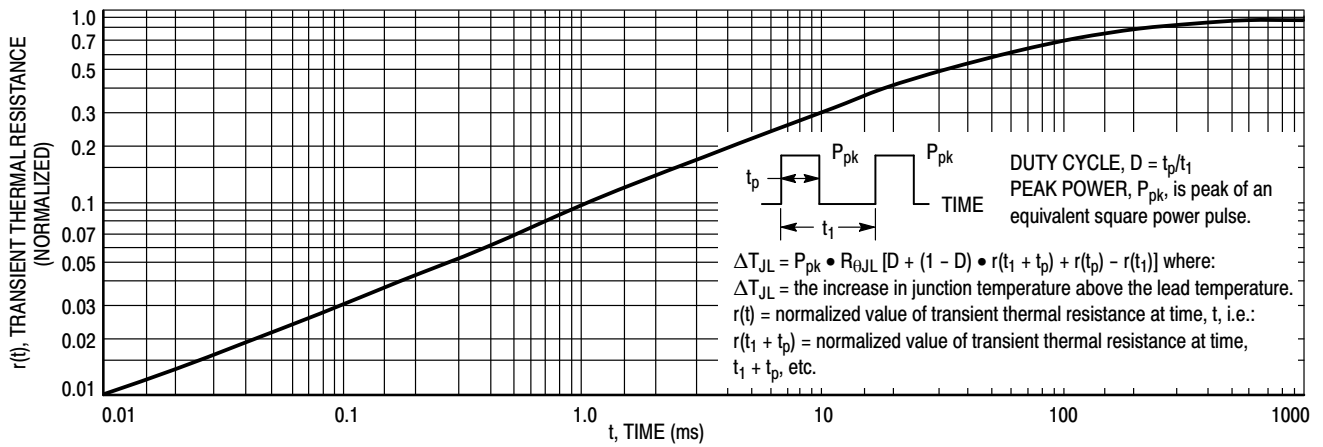


Figure 9. Thermal Response for MBR2045CT

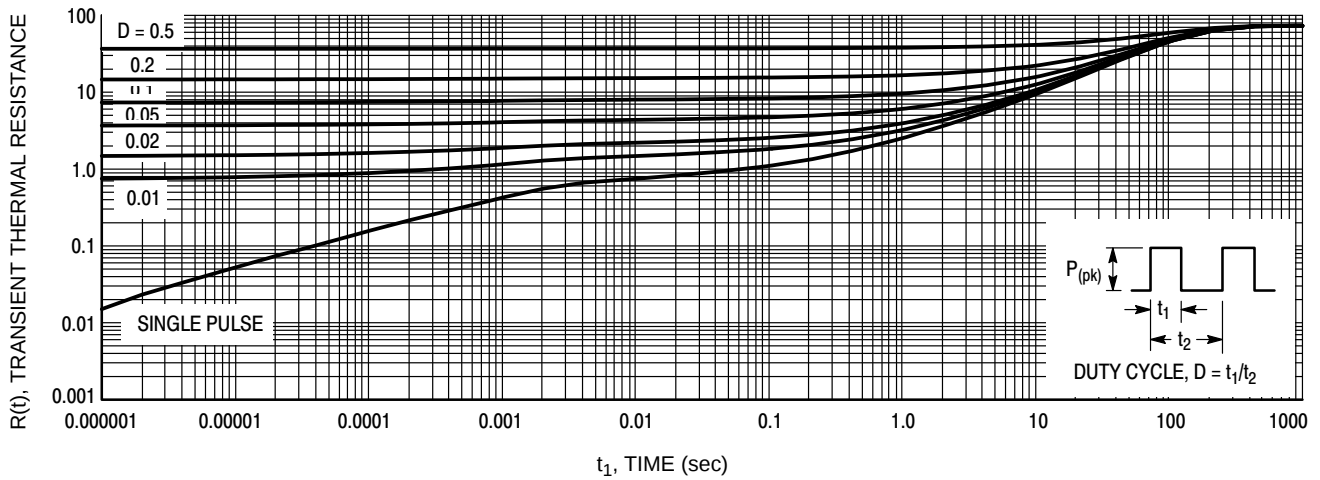


Figure 10. Thermal Response Junction-to-Ambient for MBRF2045CT

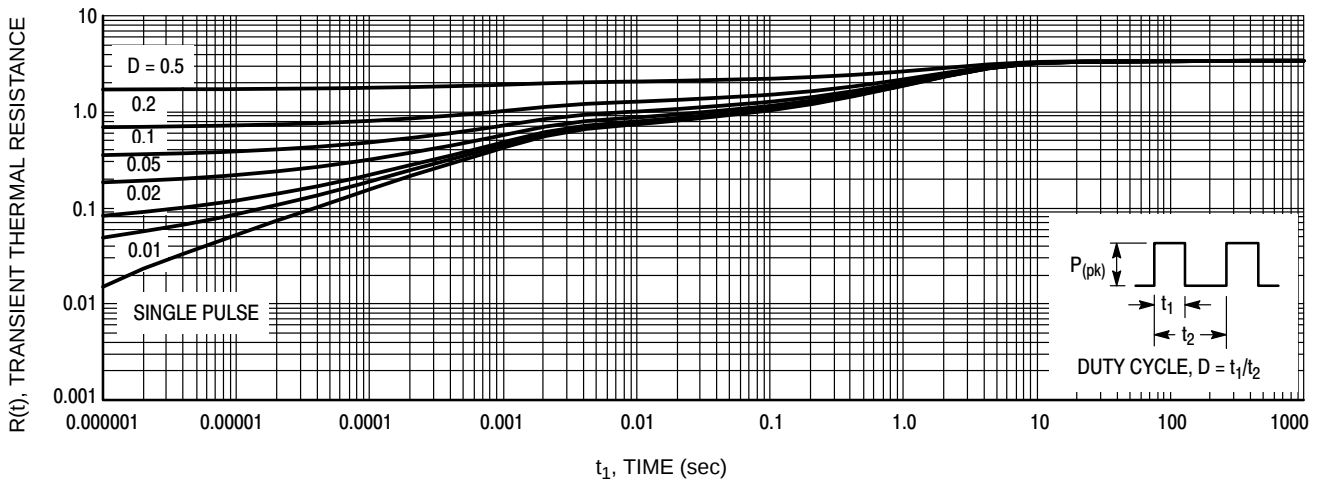


Figure 11. Thermal Response Junction-to-Case for MBRF2045CT

### HIGH FREQUENCY OPERATION

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 12.)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2.0 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss; it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

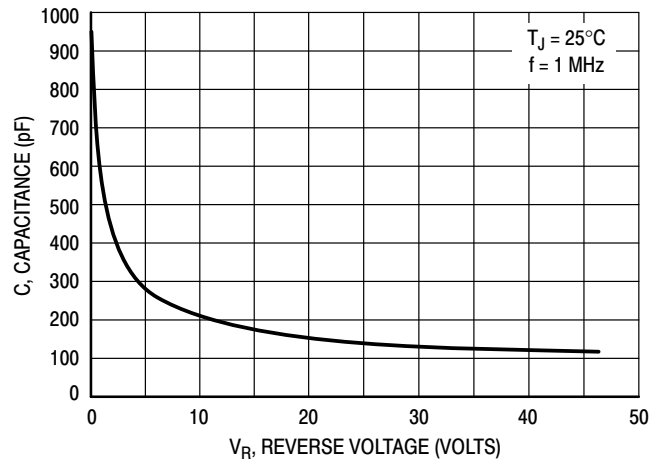


Figure 12. Typical Capacitance

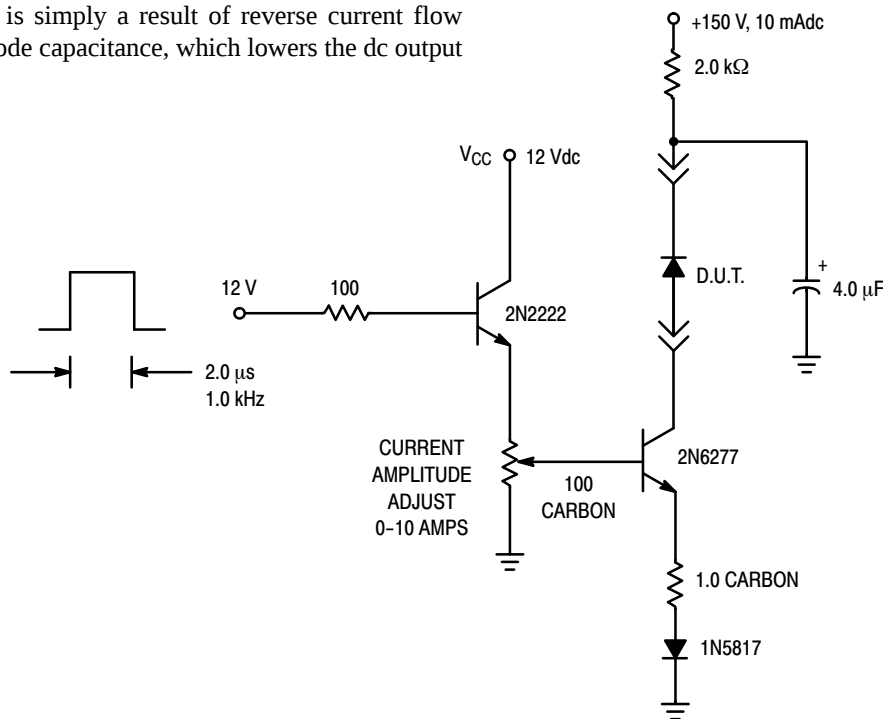
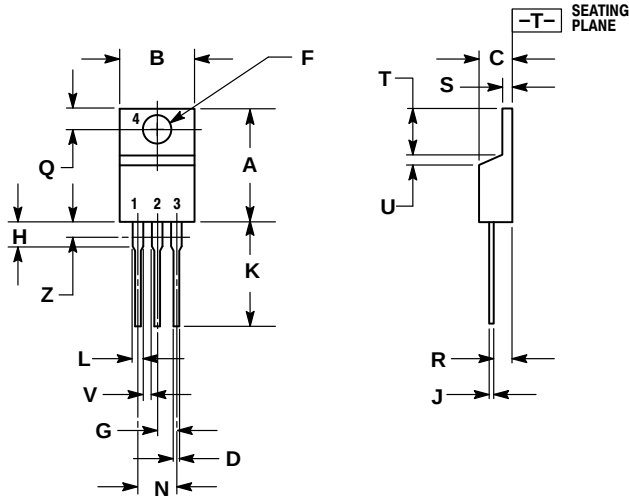


Figure 13. Test Circuit for  $dv/dt$  and Reverse Surge Current

# MBR2045CTG, MBRF2045CTG

## PACKAGE DIMENSIONS

TO-220  
CASE 221A-09  
ISSUE AH



### 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  | 0.415 | 9.66        | 10.53 |
| C   | 0.160  | 0.190 | 4.07        | 4.83  |
| D   | 0.025  | 0.038 | 0.64        | 0.96  |
| 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  | 0.024 | 0.36        | 0.61  |
| 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  |

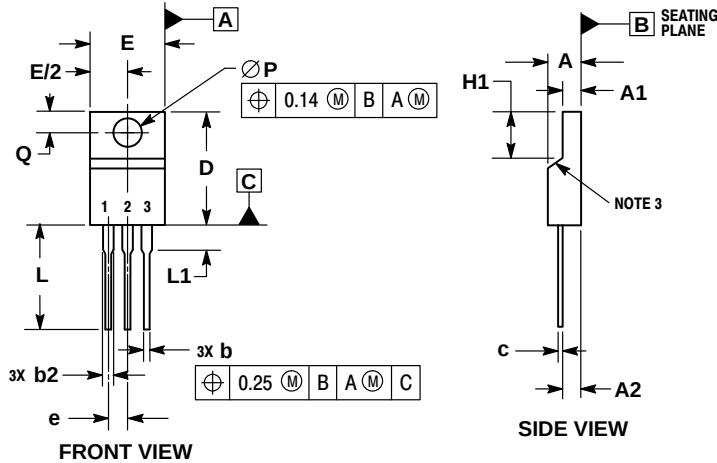
### STYLE 6:

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

# MBR2045CTG, MBRF2045CTG

## PACKAGE DIMENSIONS

### TO-220 FULLPACK, 3-LEAD CASE 221AH ISSUE F

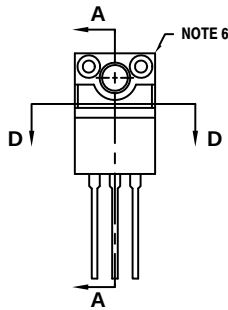


#### NOTES:

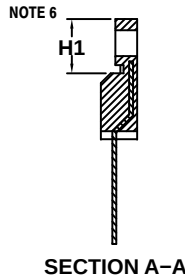
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR UNCONTROLLED IN THIS AREA.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH AND GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.13 PER SIDE. THESE DIMENSIONS ARE TO BE MEASURED AT OUTERMOST EXTREME OF THE PLASTIC BODY.
5. DIMENSION b2 DOES NOT INCLUDE DAMBAR PROTRUSION. LEAD WIDTH INCLUDING PROTRUSION SHALL NOT EXCEED 2.00.
6. CONTOURS AND FEATURES OF THE MOLDED PACKAGE BODY MAY VARY WITHIN THE ENVELOPE DEFINED BY DIMENSIONS A1 AND H1 FOR MANUFACTURING PURPOSES.

| MILLIMETERS |       |       |
|-------------|-------|-------|
| DIM         | MIN   | MAX   |
| A           | 4.30  | 4.70  |
| A1          | 2.50  | 2.90  |
| A2          | 2.50  | 2.90  |
| b           | 0.54  | 0.84  |
| b2          | 1.10  | 1.40  |
| c           | 0.49  | 0.79  |
| D           | 14.70 | 15.30 |
| E           | 9.70  | 10.30 |
| e           | 2.54  | BSC   |
| H1          | 6.60  | 7.10  |
| L           | 12.50 | 14.73 |
| L1          | ---   | 2.80  |
| P           | 3.00  | 3.40  |
| Q           | 2.80  | 3.20  |

#### SECTION D-D



#### ALTERNATE CONSTRUCTION



#### SECTION A-A

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