

# Switch-mode Power Rectifiers MUR8100E, MUR880E

## Ultrafast “E” Series with High Reverse Energy Capability

The MUR8100 and MUR880E diodes are designed for use in switching power supplies, inverters and as free wheeling diodes.

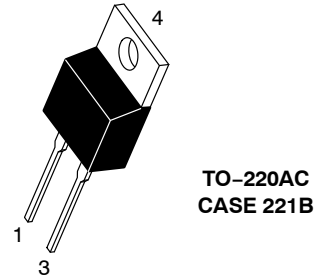
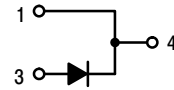
### Features

- 20 mJ Avalanche Energy Guaranteed
- Excellent Protection Against Voltage Transients in Switching Inductive Load Circuits
- Ultrafast 75 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO-220 Package
- Epoxy Meets UL 94 V-0 @ 0.125 in.
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 1000 V
- Pb-Free Packages are Available\*

### Mechanical Characteristics:

- Case: Epoxy, Molded
- 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

## ULTRAFAST RECTIFIERS 8.0 A, 800 V – 1000 V



### MARKING DIAGRAM



A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package  
U8xxxE = Device Code  
xxx = 100 or 80  
KA = Diode Polarity

### ORDERING INFORMATION

| Device    | Package          | Shipping <sup>†</sup> |
|-----------|------------------|-----------------------|
| MUR8100EG | TO-220 (Pb-Free) | 50 Units/Rail         |
| MUR880E   | TO-220 (Pb-Free) | 50 Units/Rail         |

### DISCONTINUED (Note 1)

|          |                  |               |
|----------|------------------|---------------|
| MUR8100E | TO-220 (Pb-Free) | 50 Units/Rail |
| MUR880EG | TO-220 (Pb-Free) | 50 Units/Rail |

<sup>†</sup>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](http://BRD8011/D).

1. **DISCONTINUED:** This device is not recommended for new design. Please contact your onsemi representative for information. The most current information on this device may be available on [www.onsemi.com](http://www.onsemi.com).

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

# MUR8100E, MUR880E

## MAXIMUM RATINGS

| Rating                                                                                                        | Symbol                          | Value       | Unit             |
|---------------------------------------------------------------------------------------------------------------|---------------------------------|-------------|------------------|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage<br>MUR880E<br>MUR8100E | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 800<br>1000 | V                |
| Average Rectified Forward Current<br>(Rated $V_R$ , $T_C = 150^\circ\text{C}$ ) Total Device                  | $I_{F(AV)}$                     | 8.0         | A                |
| Peak Repetitive Forward Current<br>(Rated $V_R$ , Square Wave, 20 kHz, $T_C = 150^\circ\text{C}$ )            | $I_{FM}$                        | 16          | A                |
| Non-Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)   | $I_{FSM}$                       | 100         | A                |
| Operating Junction and Storage Temperature Range                                                              | $T_J, T_{stg}$                  | -65 to +175 | $^\circ\text{C}$ |

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

| Characteristic                               | Symbol          | Value | Unit               |
|----------------------------------------------|-----------------|-------|--------------------|
| Maximum Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 2.0   | $^\circ\text{C/W}$ |

## ELECTRICAL CHARACTERISTICS

| Characteristic                                                                                                                                                               | Symbol     | Value      | Unit          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|---------------|
| Maximum Instantaneous Forward Voltage (Note 1)<br>( $I_F = 8.0\text{ A}$ , $T_C = 150^\circ\text{C}$ )<br>( $I_F = 8.0\text{ A}$ , $T_C = 25^\circ\text{C}$ )                | $V_F$      | 1.5<br>1.8 | V             |
| Maximum Instantaneous Reverse Current (Note 1)<br>(Rated DC Voltage, $T_C = 100^\circ\text{C}$ )<br>(Rated DC Voltage, $T_C = 25^\circ\text{C}$ )                            | $i_R$      | 500<br>25  | $\mu\text{A}$ |
| Maximum Reverse Recovery Time<br>( $I_F = 1.0\text{ A}$ , $di/dt = 50\text{ A}/\mu\text{s}$ )<br>( $I_F = 0.5\text{ A}$ , $i_R = 1.0\text{ A}$ , $I_{REC} = 0.25\text{ A}$ ) | $t_{rr}$   | 100<br>75  | ns            |
| Controlled Avalanche Energy<br>(See Test Circuit in Figure 6)                                                                                                                | $W_{AVAL}$ | 20         | mJ            |

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

# MUR8100E, MUR880E

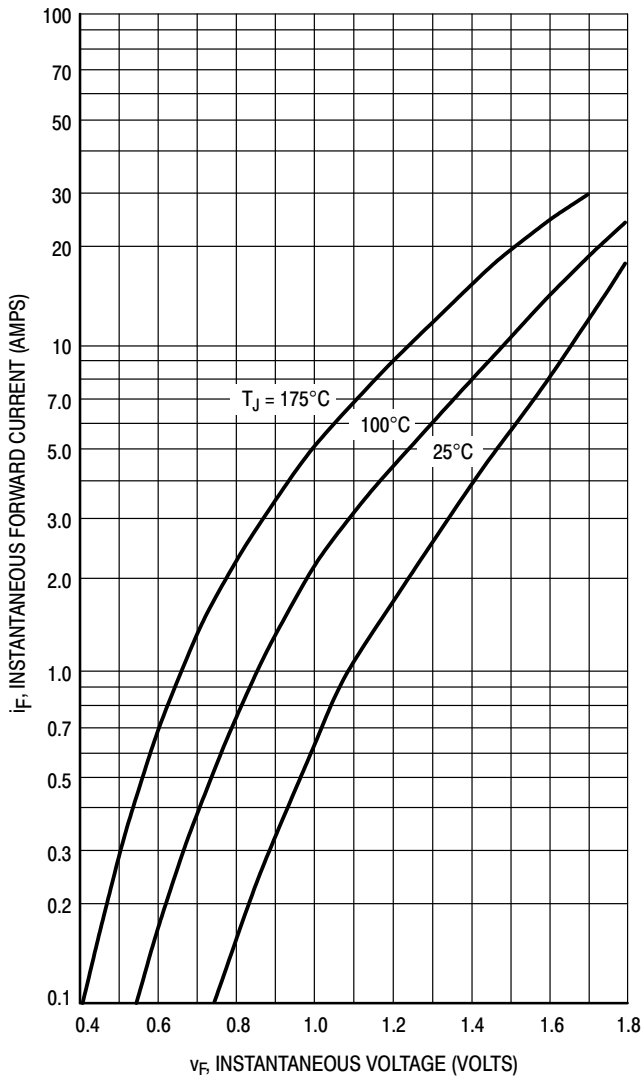


Figure 1. Typical Forward Voltage

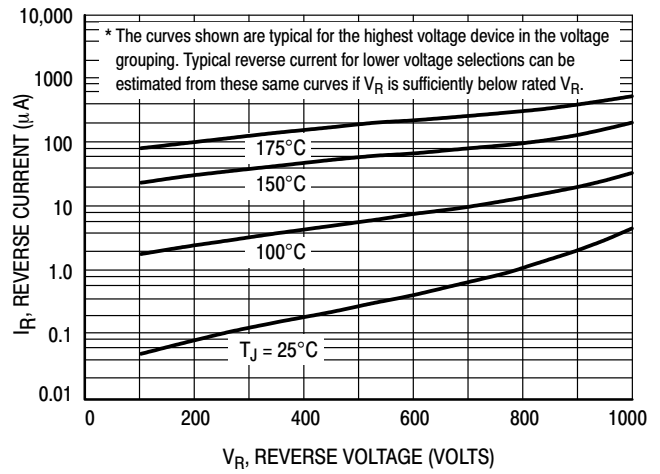


Figure 2. Typical Reverse Current\*

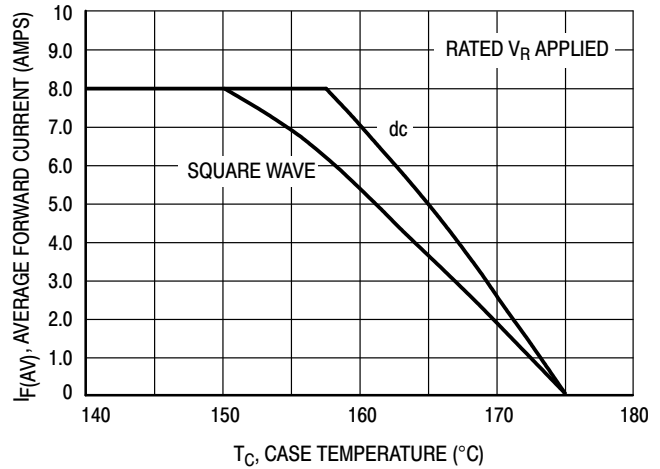


Figure 3. Current Derating, Case

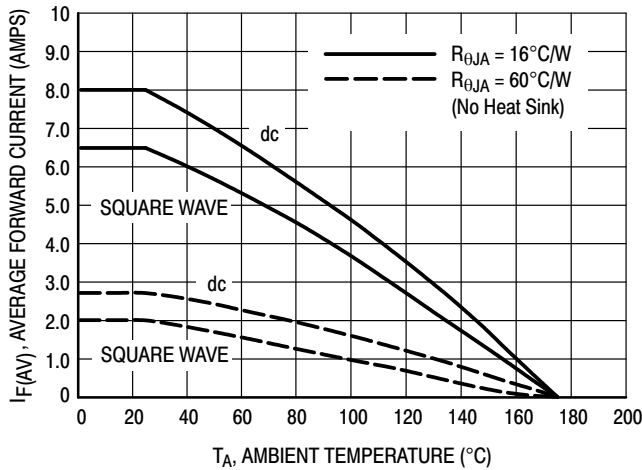


Figure 4. Current Derating, Ambient

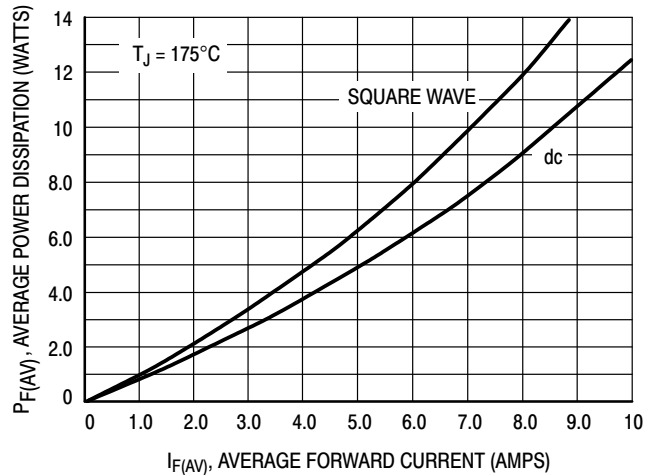


Figure 5. Power Dissipation

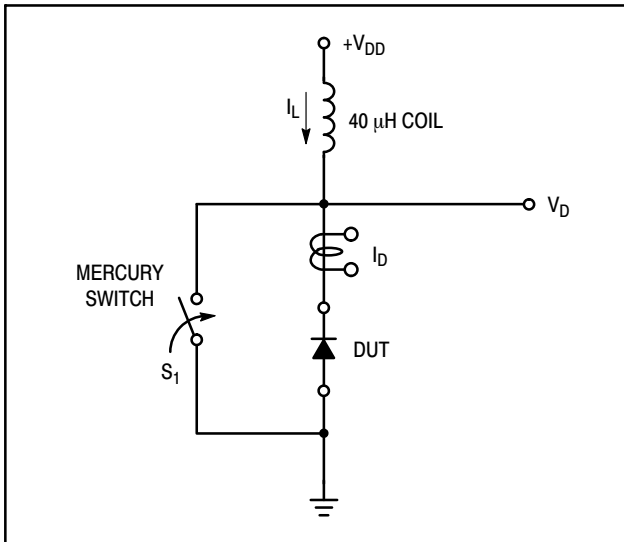


Figure 6. Test Circuit

The unclamped inductive switching circuit shown in Figure 6 was used to demonstrate the controlled avalanche capability of the new “E” series Ultrafast rectifiers. 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

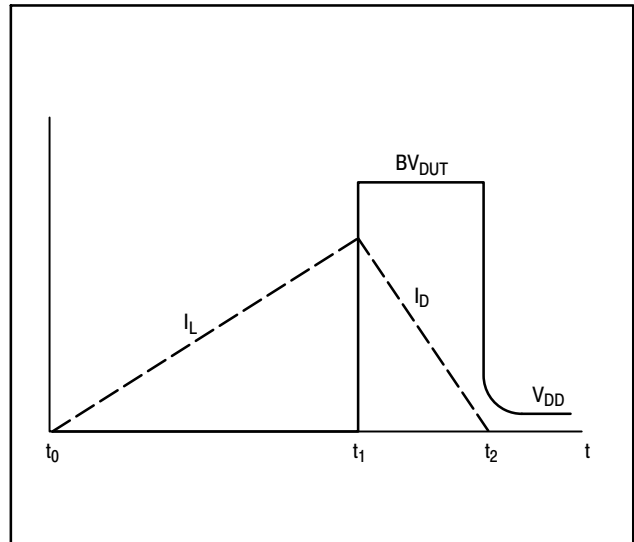


Figure 7. Current-Voltage Waveforms

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).

The oscilloscope picture in Figure 8, shows the MUR8100E in this test circuit conducting a peak current of one ampere at a breakdown voltage of 1300 V, and using Equation (2) the energy absorbed by the MUR8100E is approximately 20 mjoules.

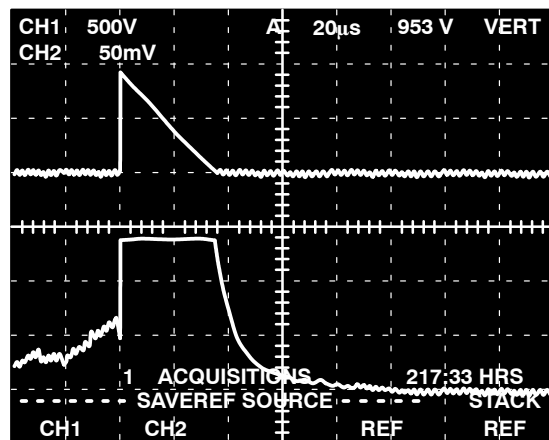
Although it is not recommended to design for this condition, the new “E” series provides added protection against those unforeseen transient viruses that can produce unexplained random failures in unfriendly environments.

EQUATION (1):

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

EQUATION (2):

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



CHANNEL 2:

$I_L$   
0.5 AMPS/DIV.

CHANNEL 1:

$V_{DUT}$   
500 VOLTS/DIV.

TIME BASE:

20 μs/DIV.

Figure 8. Current-Voltage Waveforms

MUR8100E, MUR880E

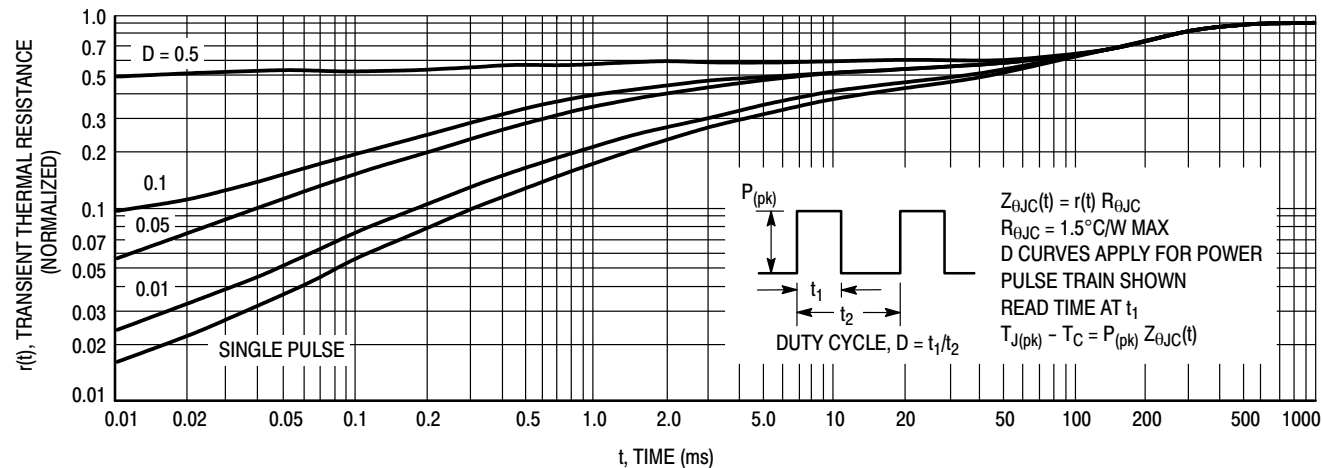


Figure 9. Thermal Response

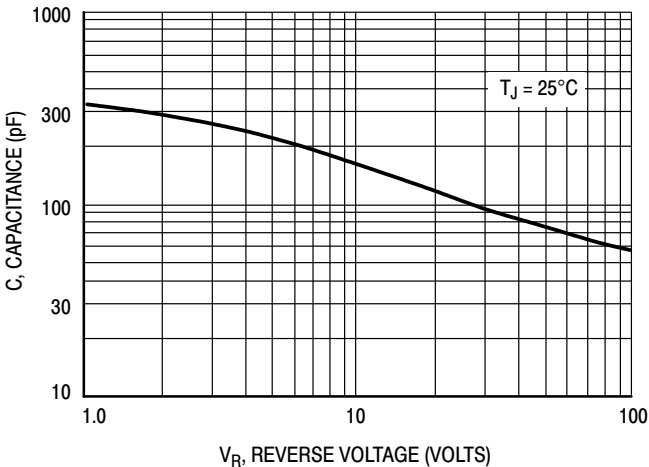
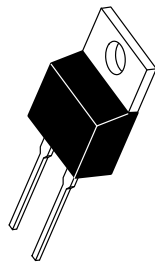
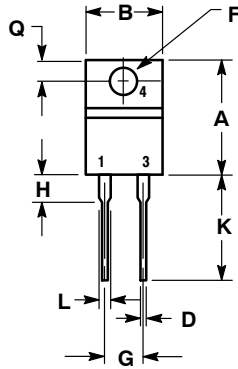


Figure 10. Typical Capacitance



SCALE 1:1



TO-220, 2-LEAD  
CASE 221B-04  
ISSUE F

DATE 12 APR 2013

NOTES:

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

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.595  | 0.620 | 15.11       | 15.75 |
| B   | 0.380  | 0.405 | 9.65        | 10.29 |
| C   | 0.160  | 0.190 | 4.06        | 4.82  |
| D   | 0.025  | 0.039 | 0.64        | 1.00  |
| F   | 0.142  | 0.161 | 3.61        | 4.09  |
| G   | 0.190  | 0.210 | 4.83        | 5.33  |
| H   | 0.110  | 0.130 | 2.79        | 3.30  |
| J   | 0.014  | 0.025 | 0.36        | 0.64  |
| K   | 0.500  | 0.562 | 12.70       | 14.27 |
| L   | 0.045  | 0.060 | 1.14        | 1.52  |
| Q   | 0.100  | 0.120 | 2.54        | 3.04  |
| R   | 0.080  | 0.110 | 2.04        | 2.79  |
| S   | 0.045  | 0.055 | 1.14        | 1.39  |
| T   | 0.235  | 0.255 | 5.97        | 6.48  |
| U   | 0.000  | 0.050 | 0.000       | 1.27  |

STYLE 1:  
PIN 1. CATHODE  
2. N/A  
3. ANODE  
4. CATHODE

STYLE 2:  
PIN 1. ANODE  
2. N/A  
3. CATHODE  
4. ANODE

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DESCRIPTION: TO-220, 2-LEAD

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