

# Switchmode Power Rectifiers

## Ultrafast "E" Series

### w/High Reverse Energy Capability

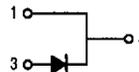
**MUR890E**  
**MUR8100E**

MUR8100E is a  
 Motorola Preferred Device

**ULTRAFAST**  
**RECTIFIERS**  
**8.0 AMPERES**  
**900-1000 VOLTS**

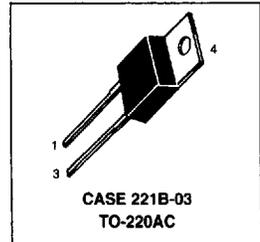
... designed for use in switching power supplies, inverters and as free wheeling diodes, these state-of-the-art devices have the following features:

- 20 mJoules 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 UL94, V<sub>0</sub> @ 1/8"
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 1000 Volts



#### 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
- Shipped 50 units per plastic tube
- Marking: U890E, U8100E



#### MAXIMUM RATINGS

Rating	Symbol	MUR		Unit
		890E	8100E	
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	$V_{RRM}$ $V_{RWM}$ $V_R$	900	1000	Volts
Average Rectified Forward Current Total Device, (Rated $V_R$ ), $T_C = 150^\circ\text{C}$	$I_{F(AV)}$	8.0		Amps
Peak Repetitive Forward Current (Rated $V_R$ , Square Wave, 20 kHz), $T_C = 150^\circ\text{C}$	$I_{FM}$	16		Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	$I_{FSM}$	100		Amps
Operating Junction Temperature and Storage Temperature	$T_J, T_{stg}$	-65 to +175		°C

#### THERMAL CHARACTERISTICS

Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.0	°C/W
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#### ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (1) ( $I_F = 8.0$ Amp, $T_C = 150^\circ\text{C}$ ) ( $I_F = 8.0$ Amp, $T_C = 25^\circ\text{C}$ )	$V_F$	1.5 1.8	Volts
Maximum Instantaneous Reverse Current (1) (Rated dc Voltage, $T_C = 100^\circ\text{C}$ ) (Rated dc Voltage, $T_C = 25^\circ\text{C}$ )	$i_R$	500 25	μA
Maximum Reverse Recovery Time ( $I_F = 1.0$ Amp, $di/dt = 50$ Amp/μs) ( $I_F = 0.5$ Amp, $i_R = 1.0$ Amp, $I_{REC} = 0.25$ Amp)	$t_{rr}$	100 75	ns
Controlled Avalanche Energy (See Test Circuit in Figure 6)	$W_{AVAIL}$	20	mJ

(1) Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

Rev 1

# MUR890E, MUR8100E

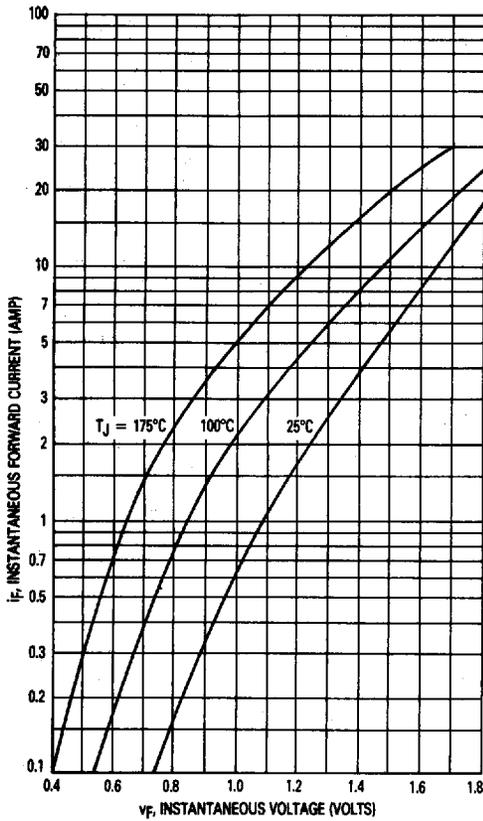


Figure 1. Typical Forward Voltage

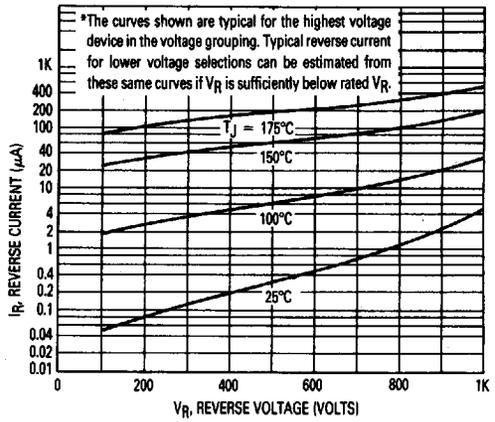


Figure 2. Typical Reverse Current\*

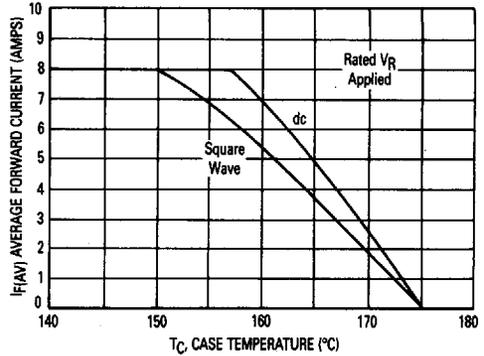


Figure 3. Current Derating, Case

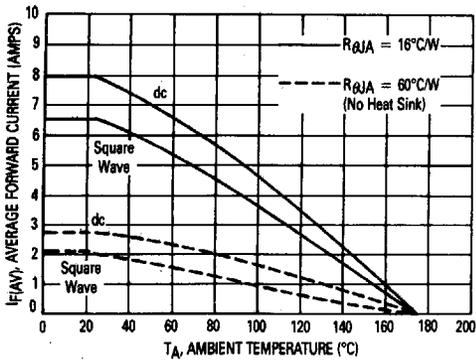


Figure 4. Current Derating, Ambient

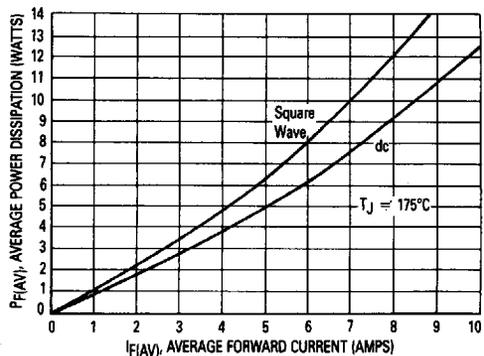


Figure 5. Power Dissipation

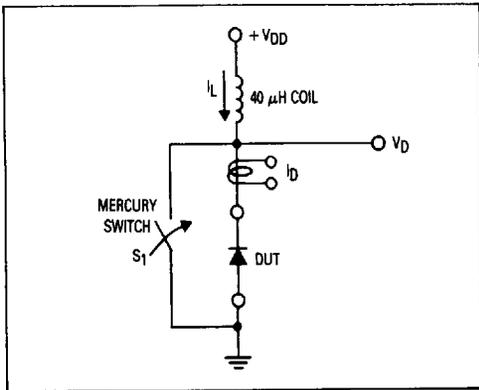


Figure 6. Test Circuit

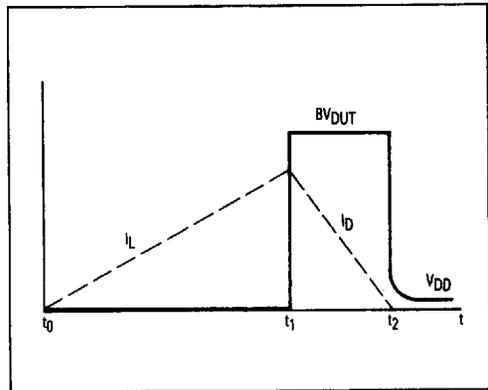


Figure 7. Current-Voltage Waveforms

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 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 volts, and using Equation (2) the energy absorbed by the MUR8100E is approximately 20 mjoules.

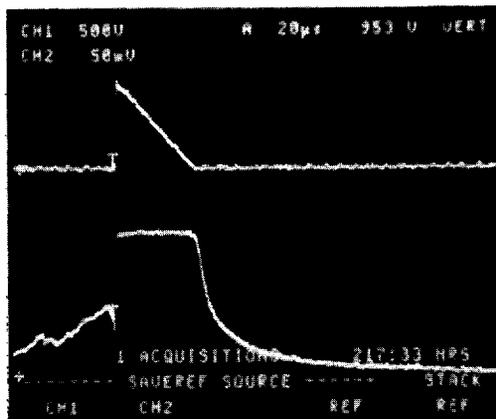
Although it is not recommended to design for this condition, the new "E" series provides added protection against those unforeseen transient viruses that can produce unexplained random failures in unfriendly environments.

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  $\mu$ s/DIV.

Figure 8. Current-Voltage Waveforms

# MUR890E, MUR8100E

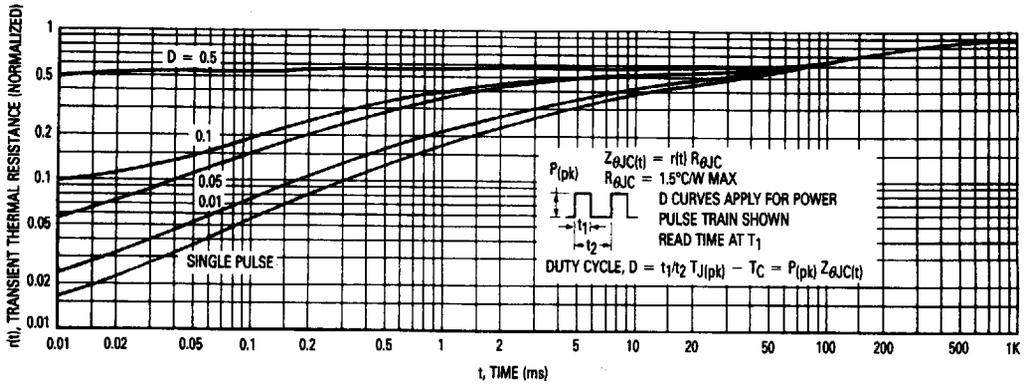


Figure 9. Thermal Response

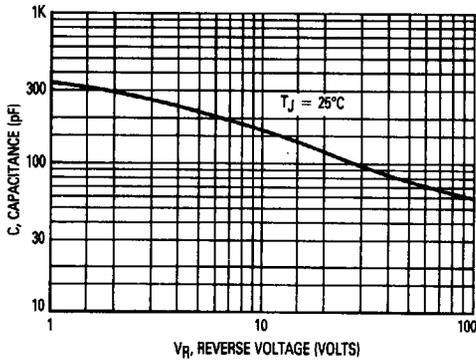


Figure 10. Typical Capacitance

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