

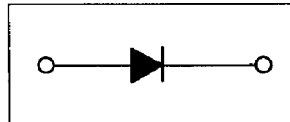
Switchmode Power Rectifiers

Ultrafast "E" Series

w/High Reverse Energy Capability

... designed for use in switching power supplies, inverters and as free wheeling diodes, these state-of-the-art devices have the following 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
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 1000 Volts



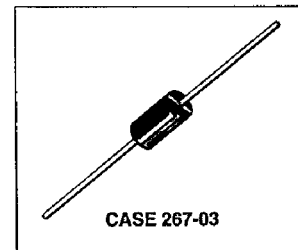
Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16" from case
- Shipped in plastic bags, 5,000 per bag.
- Available Tape and Reeled, 1500 per reel, by adding a "RL" suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: U490E, U4100E

MUR490E
MUR4100E

MUR4100E is a
 Motorola Preferred Device

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



MAXIMUM RATINGS

Rating	Symbol	MUR490E	MUR4100E	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	900	1000	Volts
Average Rectified Forward Current (Square Wave) (Mounting Method #3 Per Note 1)	$I_F(AV)$	4.0 @ $T_A = 35^\circ C$		Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	70		Amps
Operating Junction Temperature and Storage Temperature	T_J, T_{stg}	-65 to +175		$^\circ C$

THERMAL CHARACTERISTICS

Maximum Thermal Resistance, Junction to Case	$R_{\theta JC}$	See Note 1	$^\circ C/W$
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ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (1) ($I_F = 3.0$ Amps, $T_J = 150^\circ C$) ($I_F = 3.0$ Amps, $T_J = 25^\circ C$) ($I_F = 4.0$ Amps, $T_J = 25^\circ C$)	V_F	1.53 1.75 1.85	Volts
Maximum Instantaneous Reverse Current (1) (Rated dc Voltage, $T_J = 100^\circ C$) (Rated dc Voltage, $T_J = 25^\circ C$)	I_R	900 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
Maximum Forward Recovery Time ($I_F = 1.0$ Amp, $di/dt = 100$ Amp/ μs , Recovery to 1.0 V)	t_{fr}	75	ns
Controlled Avalanche Energy (See Test Circuit in Figure 6)	W_{AVAIL}	20	mJ

(1) Pulse Test: Pulse Width = 300 μs , Duty Cycle $\leq 2.0\%$

Rev 2

MUR490E, MUR4100E

ELECTRICAL CHARACTERISTICS

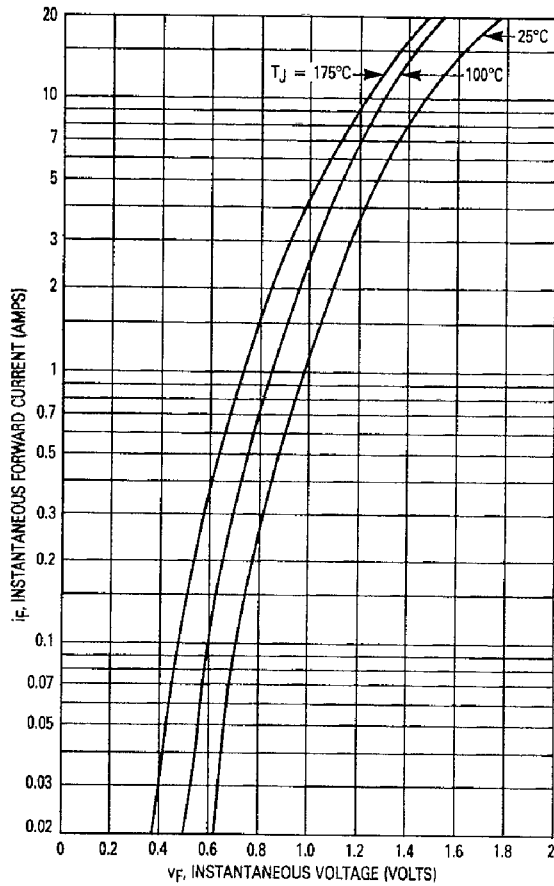


Figure 1. Typical Forward Voltage

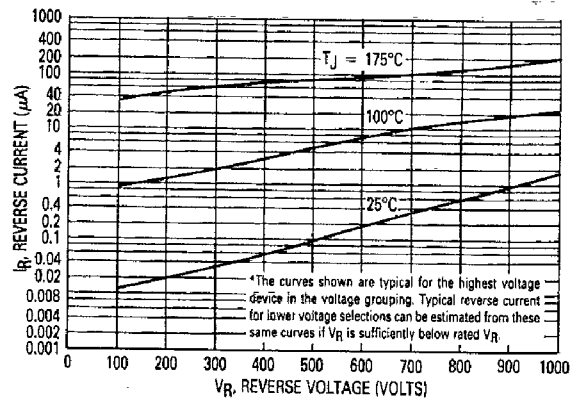


Figure 2. Typical Reverse Current*

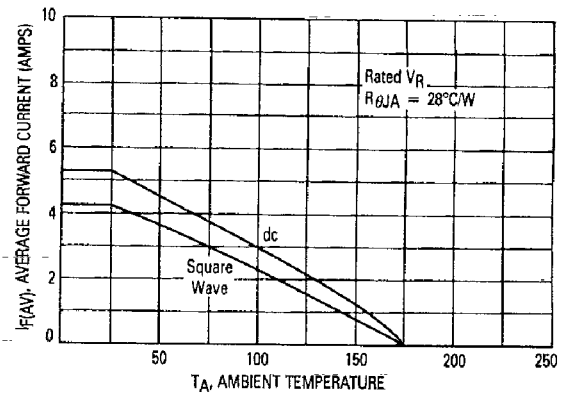


Figure 3. Current Derating
(Mounting Method #3 Per Note 1)

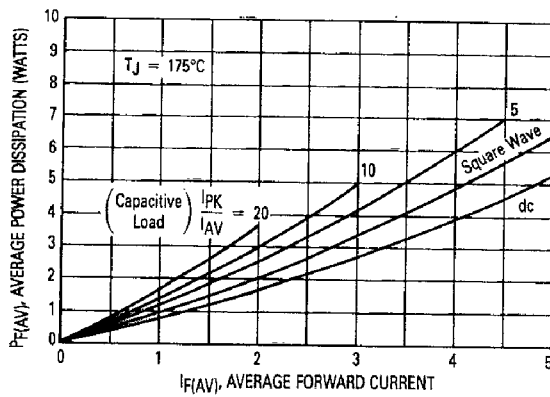


Figure 4. Power Dissipation

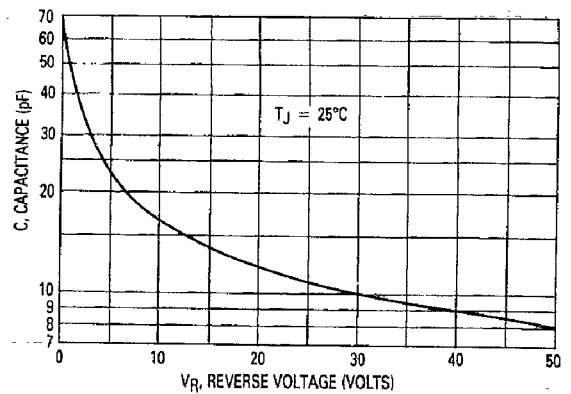


Figure 5. Typical Capacitance

MUR490E, MUR4100E

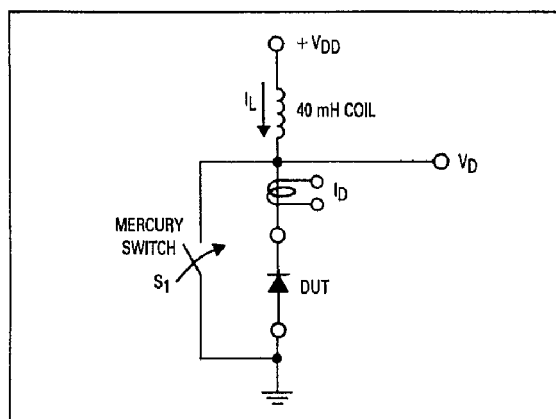


Figure 6. Test Circuit

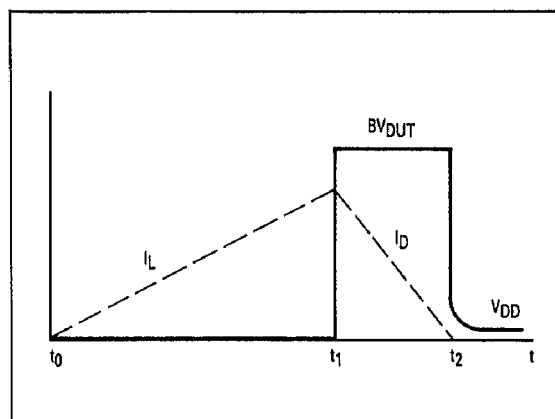


Figure 7. Current-Voltage Waveforms

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 information obtained for the MUR8100E (similar die construction as the MUR4100E Series) 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):

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

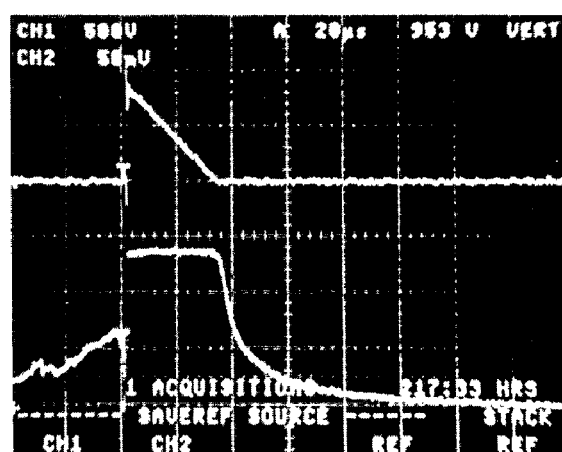


Figure 8. Current-Voltage Waveforms

MUR490E, MUR4100E

Note 1 — Ambient Mounting Data

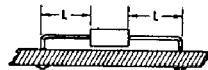
Data shown for thermal resistance junction-to-ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

MOUNTING METHOD		LEAD LENGTH, L (IN)				UNITS
		1/8	1/4	1/2	3/4	
1	$R_{\theta JA}$	50	51	53	55	°C/W
2		58	59	61	63	°C/W
3		28				°C/W

MOUNTING METHOD 1

P.C. Board Where Available Copper Surface area is small.



MOUNTING METHOD 2

Vector Push-In Terminals T-28



MOUNTING METHOD 3

P.C. Board with
1-1/2" x 1-1/2" Copper Surface

