MUR170E
MUR180E
MUR190E
MUR1100E

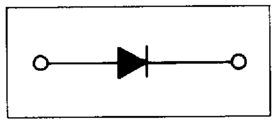
MUR1100E is a Motorola Preferred Device

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 mjoules 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

ULTRAFAST RECTIFIERS
1.0 AMPERE
700–1000 VOLTS



CASE 59-04

MAXIMUM RATINGS

Rating	Symbol	MUR 170	MUR 180	MUR 190	MUR 1100	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	700	800	900	1000	Volts
Average Rectified Forward Current (Square Wave) (Mounting Method #3 Per Note 1)	$I_{F(AV)}$	1.0 @ T_A = 95°C				Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	35				Amps
Operating Junction Temperature and Storage Temperature	T_J, T_{stg}	−65 to +175				°C

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Maximum Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	See Note 1	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (1) (I_F = 1.0 Amps, T_J = 150°C) (I_F = 1.0 Amps, T_J = 25°C)	v_F	 1.50 1.75	Volts
Maximum Instantaneous Reverse Current (1) (Rated dc Voltage, T_J = 100°C) (Rated dc Voltage, T_J = 25°C)	i_R	 600 10	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_{AVAL}	10	mJ

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

3

ELECTRICAL CHARACTERISTICS

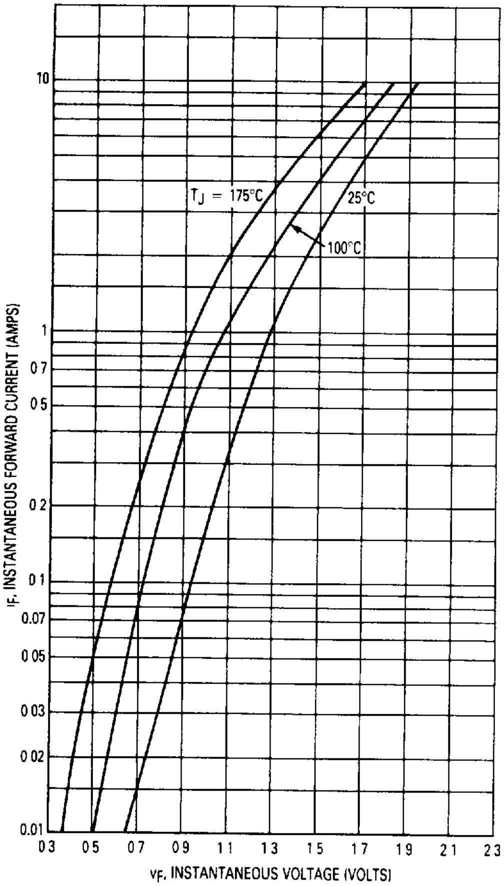


Figure 1. Typical Forward Voltage

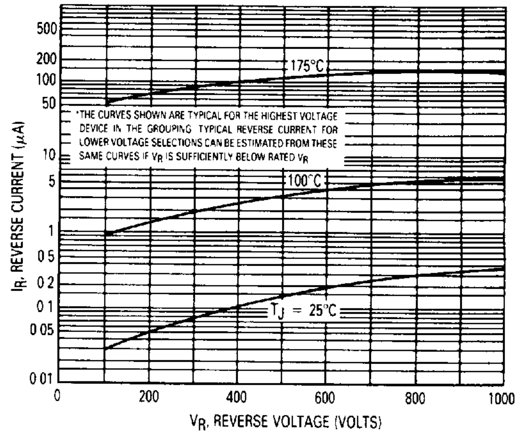


Figure 2. Typical Reverse Current*

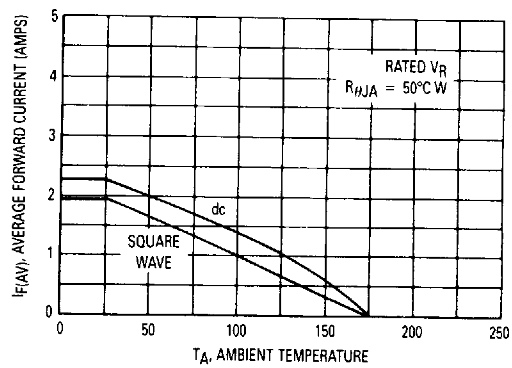


Figure 3. Current Derating
(Mounting Method #3 Per Note 1)

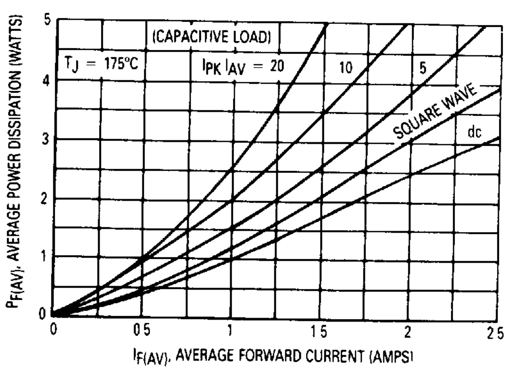


Figure 4. Power Dissipation

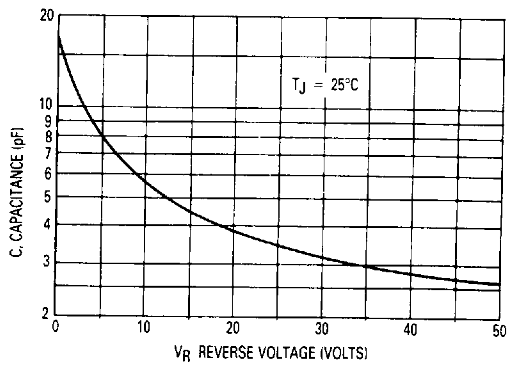


Figure 5. Typical Capacitance

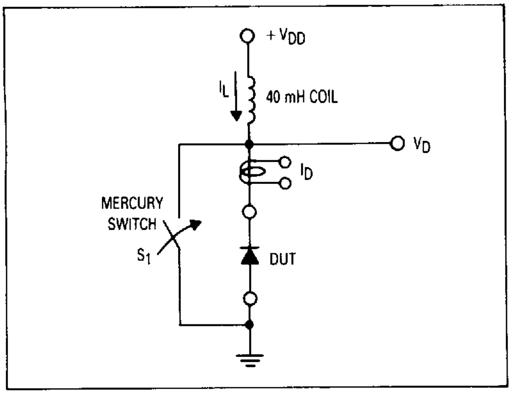


Figure 6. Test Circuit

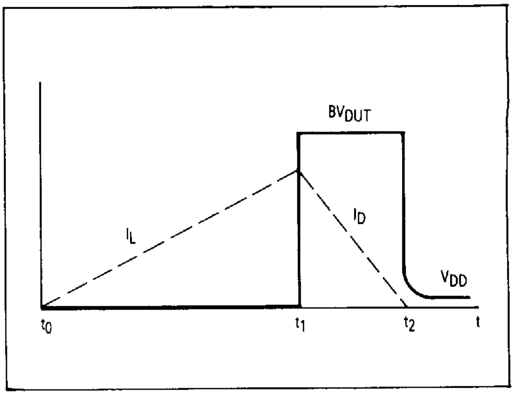


Figure 7. Current-Voltage Waveforms

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 MUR1100E 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):

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

EQUATION (2):

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

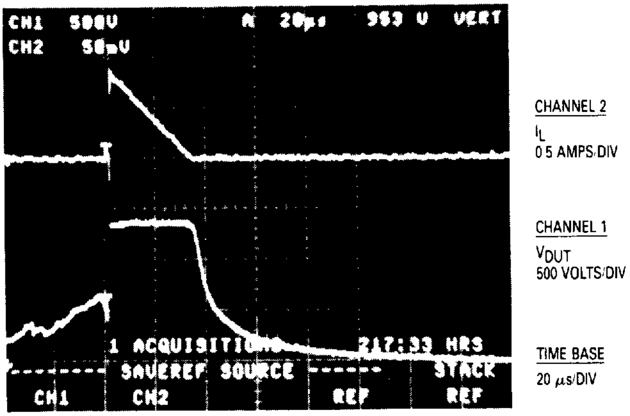


Figure 8. Current-Voltage Waveforms

3

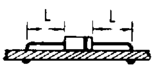
Note 1. Ambient Mounting Data

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

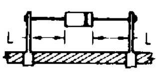
TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

MOUNTING METHOD		LEAD LENGTH, L			UNITS
		1/8	1/4	1/2	
1	$R_{\theta JA}$	52	65	72	°C/W
2	$R_{\theta JA}$	67	80	87	°C/W
3	$R_{\theta JA}$	50			°C/W

MOUNTING METHOD 1

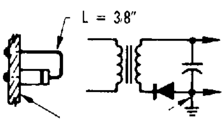


MOUNTING METHOD 2



VECTOR PIN MOUNTING

MOUNTING METHOD 3



BOARD GROUND PLANE

P.C. BOARD WITH
1-1/2" x 1-1/2" COPPER SURFACE

MECHANICAL CHARACTERISTICS

Case: Transfer Molded Plastic
Finish: External Leads are Plated, Leads are readily Solderable
Polarity: Indicated by Cathode Band
Weight: 1.1 Grams (Approximately)
Maximum Lead Temperature for Soldering Purposes:
240°C, 1/8" from case for 10 seconds