Advance Information

SWITCHMODE™ Ultrafast "E" Series Power Rectifier

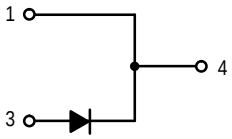
Plastic TO–220 Package

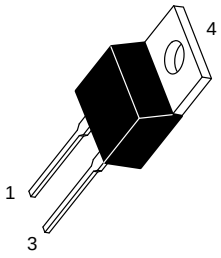
MURH8100E

ULTRAFAST RECTIFIER
8.0 AMPERES
1000 VOLTS

Features mesa epitaxial construction with glass passivation. Ideally suited high frequency switching power supplies; free wheeling diodes; polarity protection diodes; and inverters.

- 20 mjoules Avalanche Energy Guaranteed
- Ultrafast 50 Nanoseconds Recovery Time
- Stable, High Temperature, Glass Passivated Junction
- Monolithic Dual Die Construction.
  May be Paralleled for High Current Output.





CASE 221B–03
TO–220AC

Mechanical Characteristics:

- Case: Molded Epoxy
- Epoxy meets UL94, V_O at 1/8″
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Maximum Temperature of 260°C / 10 Seconds for Soldering
- Shipped in 50 Units per Plastic Tube
- Marking: H8100E

MAXIMUM RATINGS

Rating		Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage		V_{RRM} V_{RWM} V_R	1000	V
Average Rectified Forward Current (At Rated V_R, T_C = 150°C)	Per Leg Per Package	I_O	4.0	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 150°C)	Per Leg	I_{FRM}	8.0	A
Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	Per Package	I_{FSM}	100	A
Storage / Operating Case Temperature		T_{stg}, T_C	–55 to +175	°C
Operating Junction Temperature		T_J	–55 to +175	°C

THERMAL CHARACTERISTICS

Thermal Resistance — Junction–to–Case	Per Leg	$R_{\theta JC}$	2.0	°C/W

ELECTRICAL CHARACTERISTICS

Rating		Symbol	Value		Unit
Maximum Instantaneous Forward Voltage (1), see Figure 2	Per Leg	V_F	**T_J = 25°C**	**T_J = 100°C**	V
(I_F = 4.0 A) (I_F = 8.0 A)			2.2 2.6	1.8 2.1	
Maximum Instantaneous Reverse Current, see Figure 4	Per Leg	I_R	**T_J = 25°C**	**T_J = 100°C**	μA
(V_R = 1000 V) (V_R = 500 V)			10 4.0	100 55	

(1) Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.

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ELECTRICAL CHARACTERISTICS (continued)

Rating	Symbol	Value		Unit
Maximum Reverse Recovery Time (2) Per Leg	t_{rr}	T_J = 25°C	T_J = 125°C	ns
(V_R = 30 V, I_F = 1.0 A, di/dt = 50 A/μs)		50	80	
(V_R = 30 V, I_F = 8.0 A, di/dt = 100 A/μs)		75	100	
Typical t_a @ 8.0 (A)	t_a	38	41	ns
Typical t_b @ 8.0 (A)	t_b	16	23	
Typical Peak Reverse Recovery Current Per Leg	I_{rm}	T_J = 25°C	T_J = 125°C	A
(V_R = 30 V, I_F = 1.0 A, di/dt = 50 A/μs)		1.5	2.2	
(V_R = 30 V, I_F = 8.0 A, di/dt = 100 A/μs)		3.7	5.5	
Controlled Avalanche Energy (See Test Circuit in Figure 9)	Waval	20		mJ

(2) t_{rr} measured projecting from 25% of I_{RM} to ground.

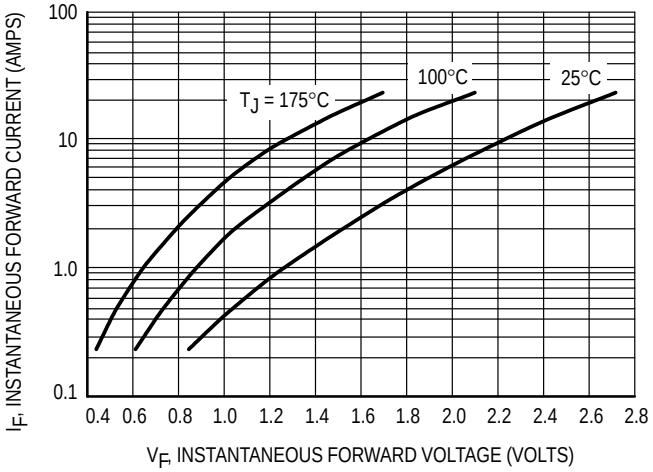


Figure 1. Typical Forward Voltage

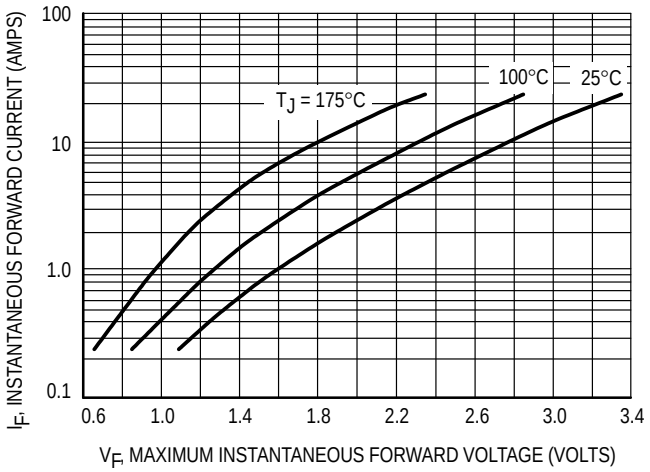


Figure 2. Maximum Forward Voltage

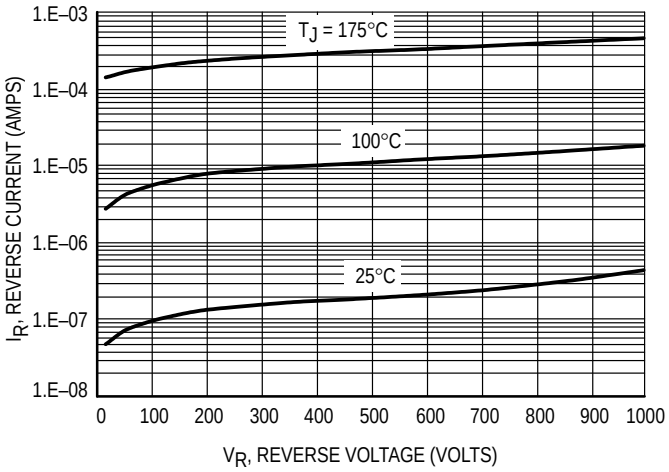


Figure 3. Typical Reverse Current

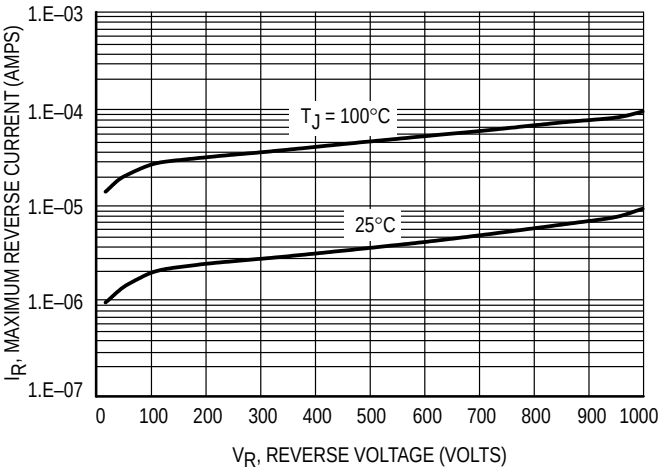


Figure 4. Maximum Reverse Current

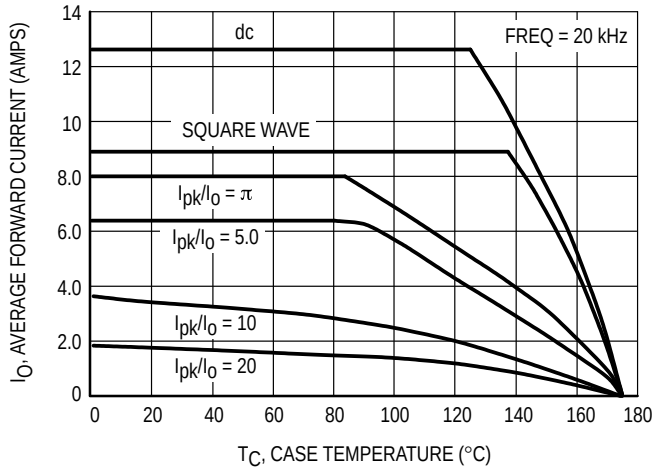


Figure 5. Current Derating, Per Leg

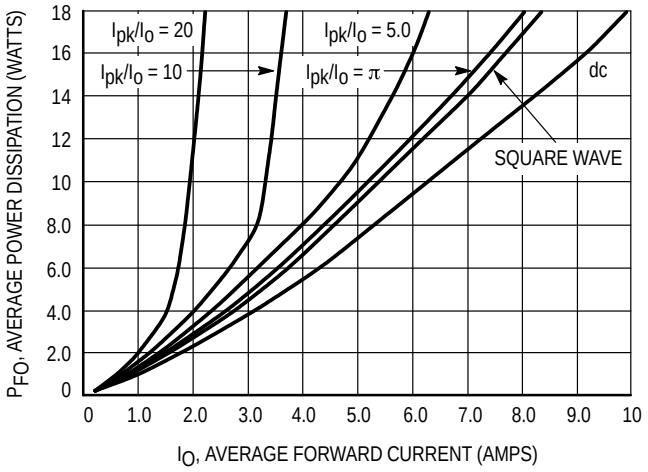


Figure 6. Forward Power Dissipation, Per Leg

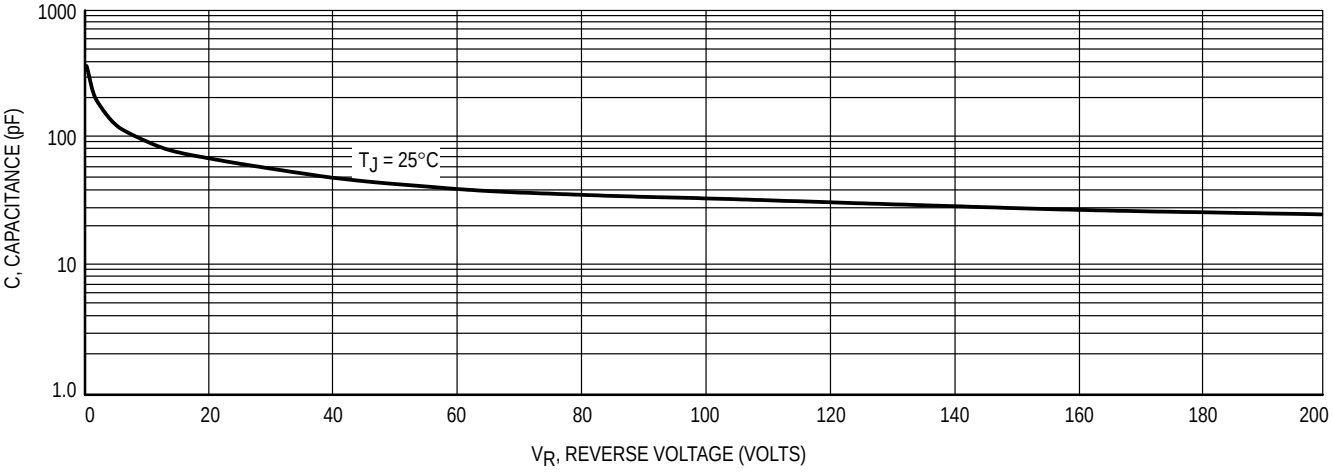


Figure 7. Capacitance

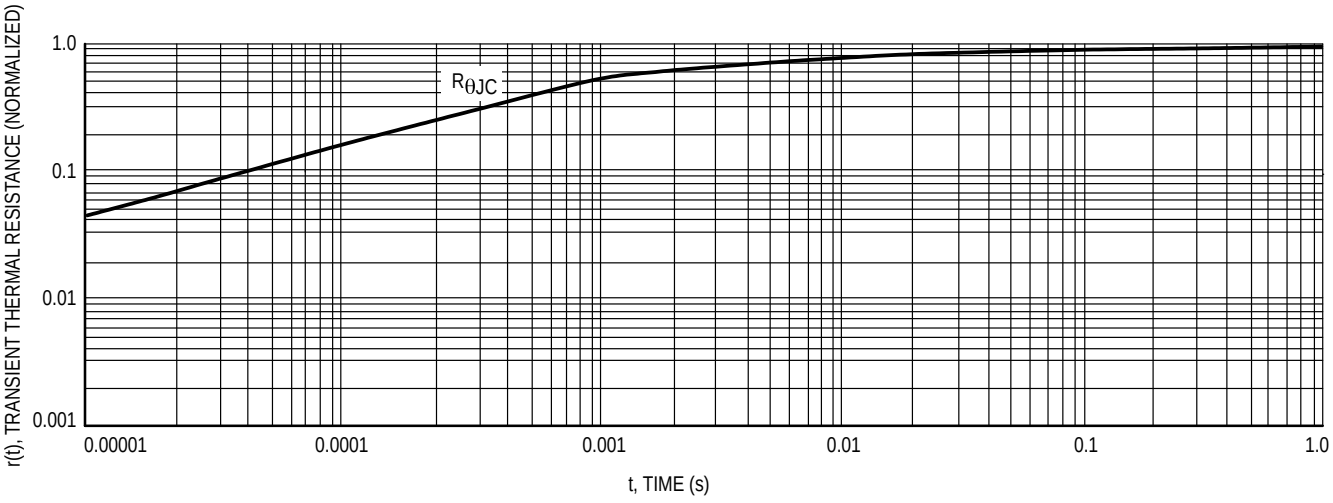


Figure 8. Thermal Response

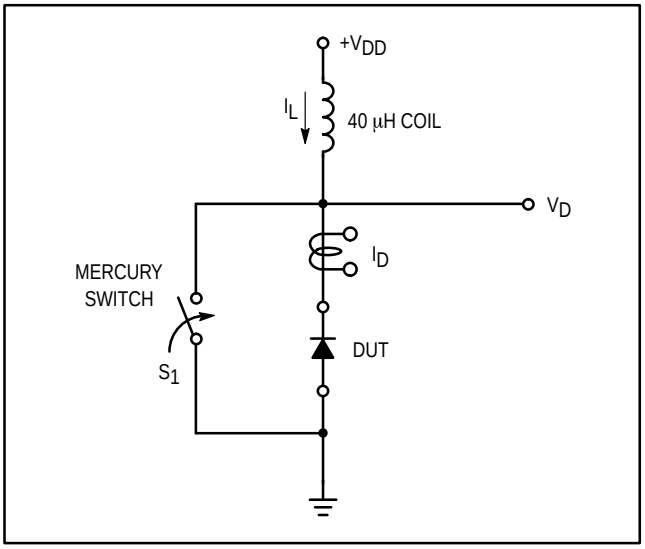


Figure 9. Test Circuit

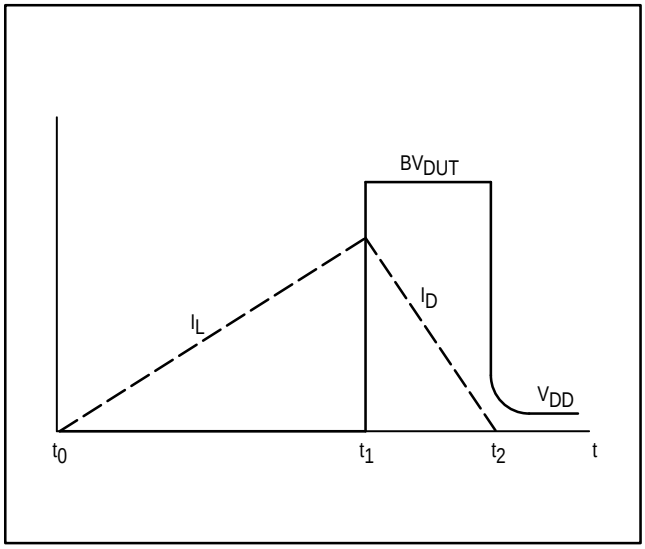


Figure 10. Current–Voltage Waveforms

The unclamped inductive switching circuit shown in Figure 9 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 11, shows the test circuit conducting a peak current of one ampere at a breakdown voltage of 1300 volts, and using Equation (2) the energy absorbed is approximately 20 mjoules.

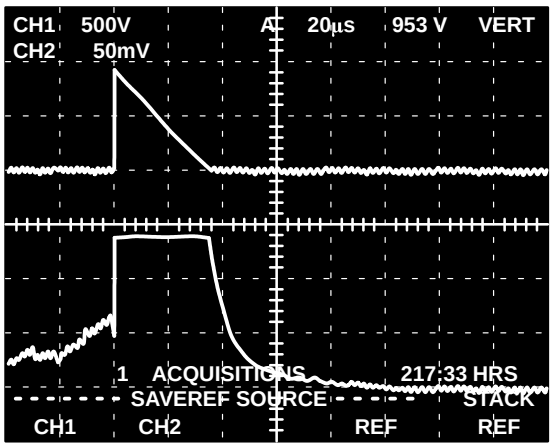
Although it is not recommended to design for this condition, the new "E" series provides added protection against those unforeseen transient viruses that can produce unexplained random failures in unfriendly environments.

EQUATION (1):

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

EQUATION (2):

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



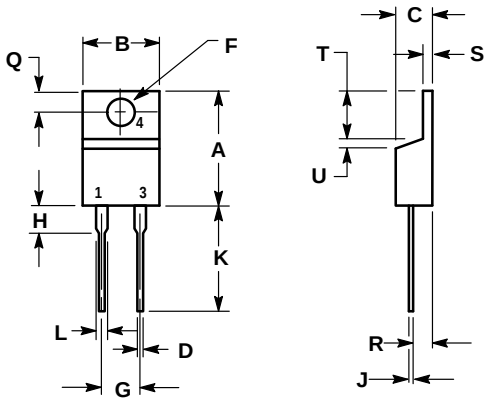
CHANNEL 2:
I_L
0.5 AMPS/DIV.

CHANNEL 1:
V_{DUT}
500 VOLTS/DIV.

TIME BASE:
20 μs/DIV.

Figure 11. Current–Voltage Waveforms

PACKAGE DIMENSIONS



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

	INCHES		MILLIMETERS	
DIM	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	0.035	0.64	0.89
F	0.142	0.147	3.61	3.73
G	0.190	0.210	4.83	5.33
H	0.110	0.130	2.79	3.30
J	0.018	0.025	0.46	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

CASE 221B–04
ISSUE C

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