

SWITCHMODE™ Power Rectifiers

Ultrafast “E” Series with 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
- Popular TO-220 Package
- Epoxy Meets UL94, V₀ @ 1/8"
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 1000 Volts

Mechanical Characteristics:

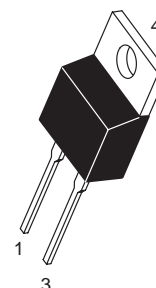
- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U880E, U8100E



MUR8100E
MUR880E

MUR8100E is a
Motorola Preferred Device

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



CASE 221B-03
TO-220AC

MAXIMUM RATINGS

Rating	Symbol	MUR		Unit
		880E	8100E	
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V _{RRM} V _{RWM} V _R	800	1000	Volts
Average Rectified Forward Current Total Device, (Rated V _R), T _C = 150°C	I _{F(AV)}	8.0		Amps
Peak Repetitive Forward Current (Rated V _R , Square Wave, 20 kHz), T _C = 150°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 _{θJC}	2.0	°C/W
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(1) Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

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Preferred devices are Motorola recommended choices for future use and best overall value.

MUR8100E MUR880E**ELECTRICAL CHARACTERISTICS**

Rating	Symbol	MUR		Unit
		880E	8100E	
Maximum Instantaneous Forward Voltage (1) ($i_F = 8.0$ Amps, $T_C = 150^\circ\text{C}$) ($i_F = 8.0$ Amps, $T_C = 25^\circ\text{C}$)	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, $di/dt = 50$ Amps/ 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_{AVAL}		20	mJ

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

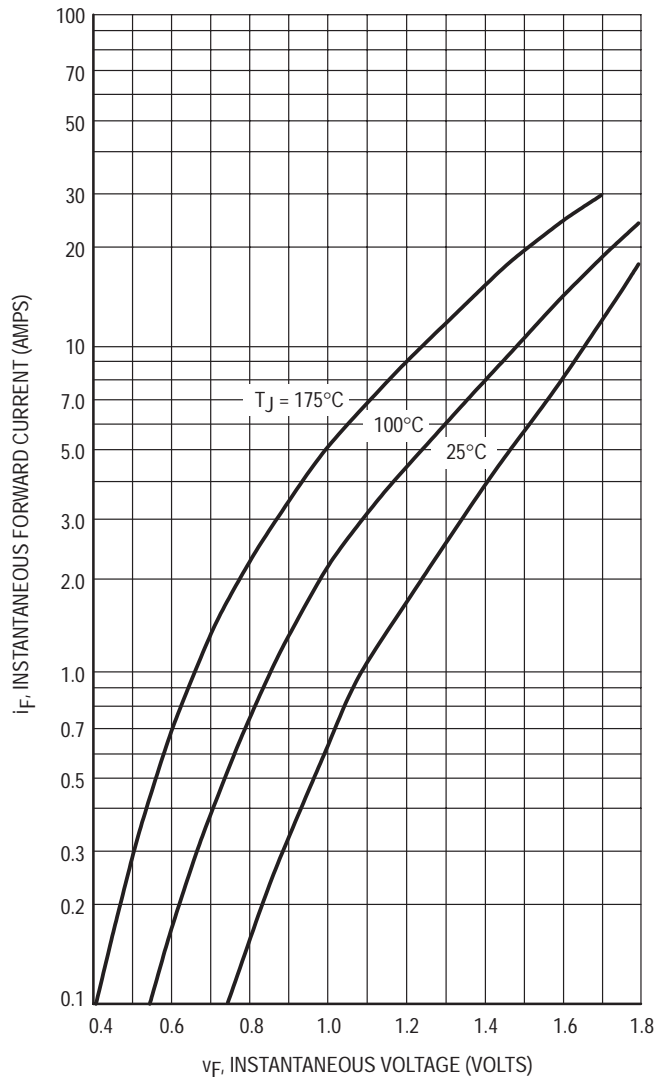


Figure 1. Typical Forward Voltage

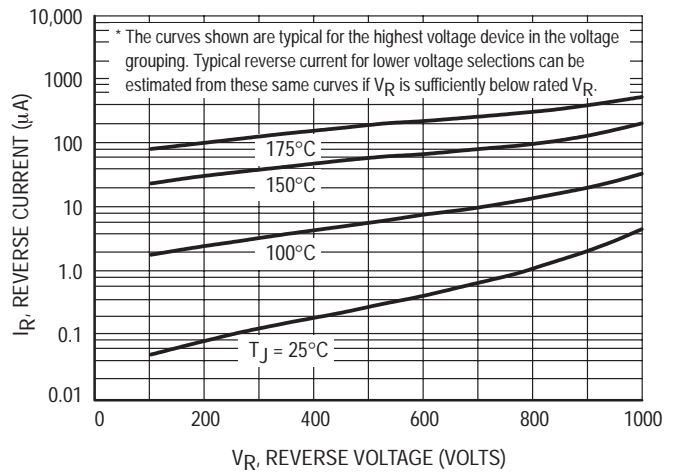


Figure 2. Typical Reverse Current*

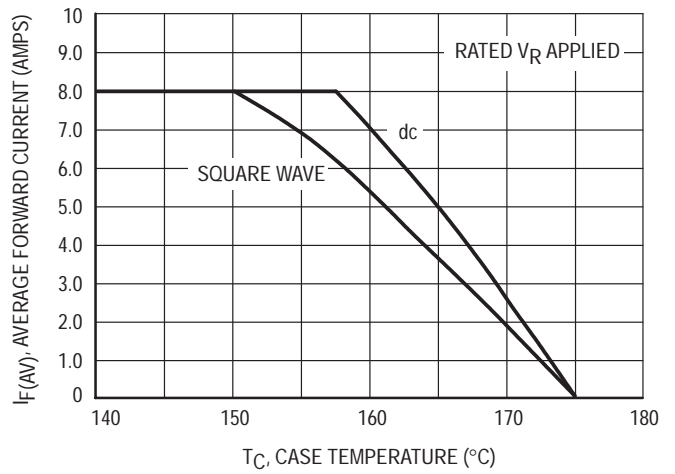


Figure 3. Current Derating, Case

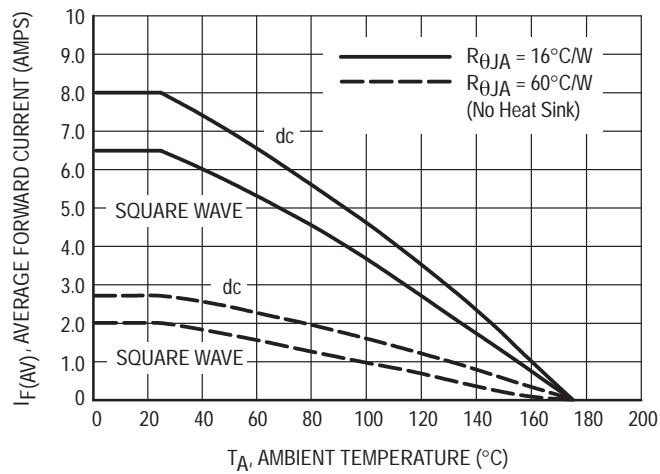


Figure 4. Current Derating, Ambient

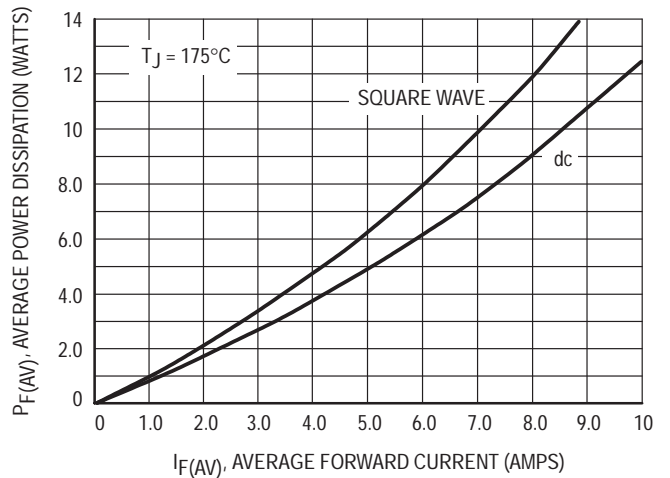


Figure 5. Power Dissipation

MUR8100E MUR8800E

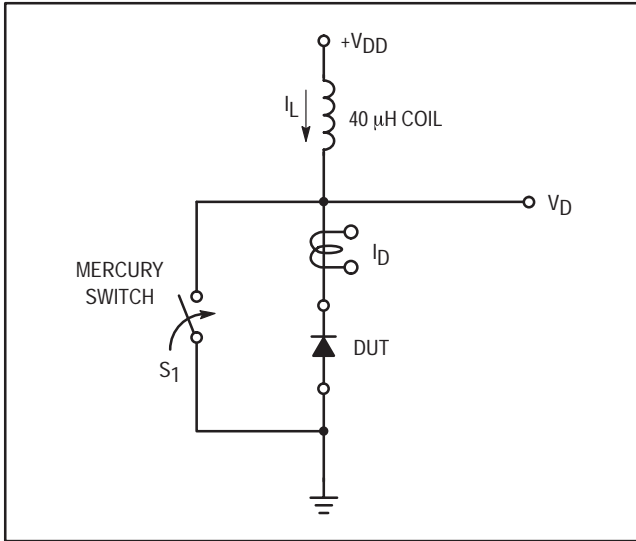


Figure 6. Test Circuit

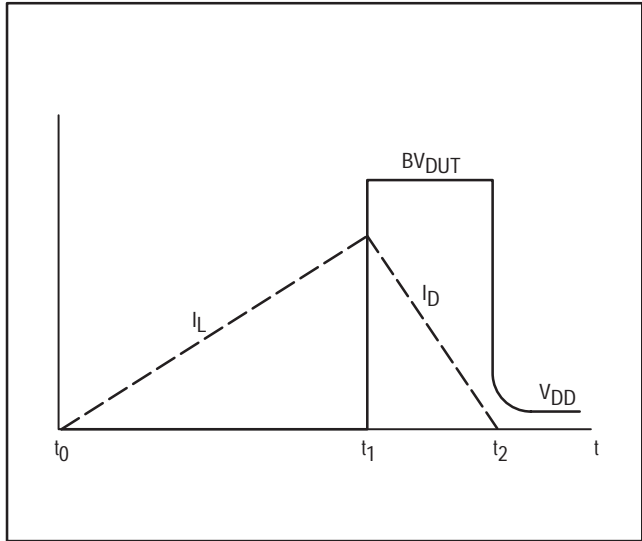


Figure 7. Current–Voltage Waveforms

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 S₁ is closed at t₀ the current in the inductor I_L ramps up linearly; and energy is stored in the coil. At t₁ 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 t₂.

By solving the loop equation at the point in time when S₁ 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 t₁ to t₂) 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 S₁ 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.

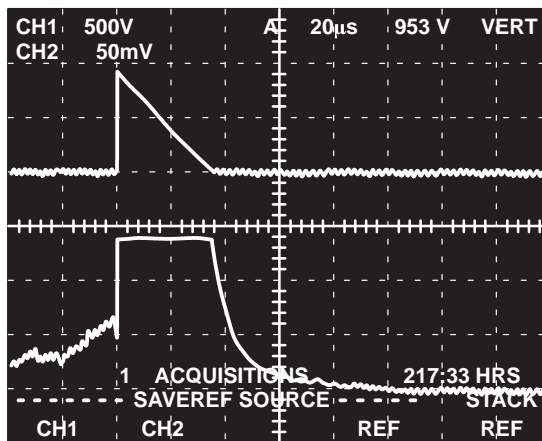
Although it is not recommended to design for this condition, the new “E” series provides added protection against those unforeseen transient viruses that can produce unexplained random failures in unfriendly environments.

EQUATION (1):

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

EQUATION (2):

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



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

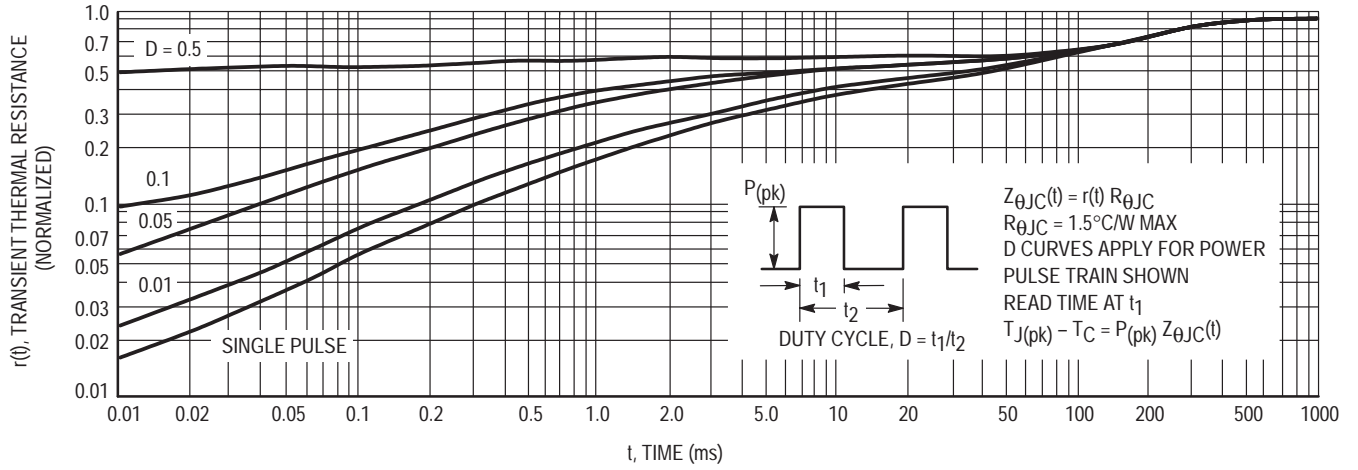


Figure 9. Thermal Response

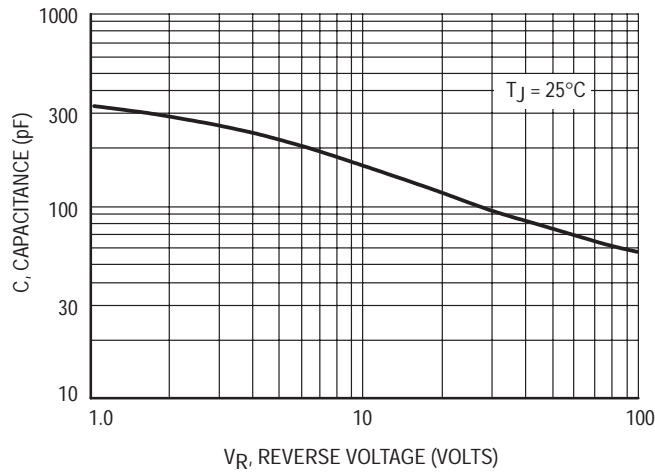
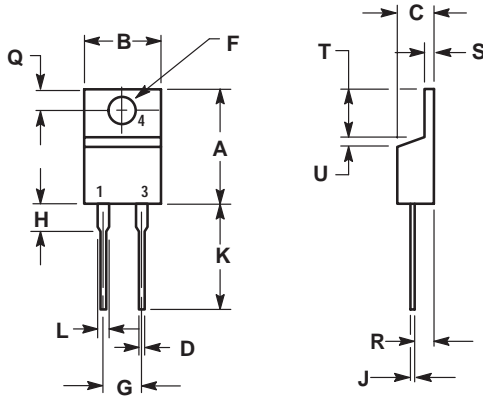


Figure 10. Typical Capacitance


PACKAGE DIMENSIONS



- 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	0.035	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
 (TO-220AC)
 ISSUE C

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How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution;
 P.O. Box 5405, Denver, Colorado 80217. 1-303-675-2140 or 1-800-441-2447

JAPAN: Motorola Japan Ltd.; SPD, Strategic Planning Office, 141,
 4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan. 81-3-5487-8488

Customer Focus Center: 1-800-521-6274

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 1-602-244-6609
 Motorola Fax Back System – US & Canada ONLY 1-800-774-1848
 – http://sps.motorola.com/mfax/

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Centre,
 2, Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong.
 852-26668334

HOME PAGE: <http://motorola.com/sps/>

