

# MUR480E, MUR4100E

## SWITCHMODE™ Power Rectifiers

### Ultrafast “E” Series with High Reverse Energy Capability

These state-of-the-art devices are designed for use in switching power supplies, inverters and as free wheeling diodes.

#### 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 V
- These are Pb-Free Devices\*

#### Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.1 Gram (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 in Plastic Bags, 5,000 per Bag
- Available Tape and Reel, 1,500 per Reel, by Adding a “RL” Suffix to the Part Number
- Polarity: Cathode indicated by Polarity Band

#### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage MUR480E MUR4100E	$V_{RRM}$ $V_{RWM}$ $V_R$	800 1000	V
Average Rectified Forward Current (Square Wave; Mounting Method #3 Per Note 2)	$I_{F(AV)}$	4.0 @ $T_A = 35^\circ\text{C}$	A
Non-Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	$I_{FSM}$	70	A
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-65 to +175	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



ON Semiconductor®

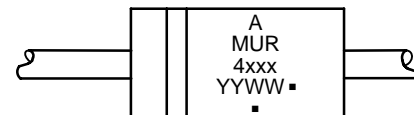
<http://onsemi.com>

### ULTRAFAST RECTIFIER 4.0 AMPERES, 800–1000 VOLTS



AXIAL LEAD  
CASE 267  
STYLE 1

#### MARKING DIAGRAM



A = Assembly Location  
MUR4xxx = Device Number (see page 2)  
YY = Year  
WW = Work Week  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# MUR480E, MUR4100E

## THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Maximum Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	See Note 2	$^{\circ}\text{C}/\text{W}$

## ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Maximum Instantaneous Forward Voltage (Note 1) ( $I_F = 3.0$ Amps, $T_J = 150^{\circ}\text{C}$ ) ( $I_F = 3.0$ Amps, $T_J = 25^{\circ}\text{C}$ ) ( $I_F = 4.0$ Amps, $T_J = 25^{\circ}\text{C}$ )	$V_F$	1.53 1.75 1.85	V
Maximum Instantaneous Reverse Current (Note 1) (Rated dc Voltage, $T_J = 150^{\circ}\text{C}$ ) (Rated dc Voltage, $T_J = 25^{\circ}\text{C}$ )	$i_R$	900 25	$\mu\text{A}$
Maximum Reverse Recovery Time ( $I_F = 1.0$ Amp, $di/dt = 50$ Amp/ $\mu\text{s}$ ) ( $I_F = 0.5$ 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/ $\mu\text{s}$ , 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  $\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

## ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
MUR420E	MUR420E	Axial Lead*	500 Units / Bulk
MUR420EG		Axial Lead*	500 Units / Bulk
MUR420ERL		Axial Lead*	1500 / Tape & Reel
MUR420ERLG		Axial Lead*	1500 / Tape & Reel
MUR420ES	MUR420ES	Axial Lead*	500 Units / Bulk
MUR420ESG		Axial Lead*	500 Units / Bulk
MUR4100E	MUR4100E	Axial Lead*	500 Units / Bulk
MUR4100EG		Axial Lead*	500 Units / Bulk
MUR4100ERL		Axial Lead*	1500 / Tape & Reel
MUR4100ERLG		Axial Lead*	1500 / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*This package is inherently Pb-Free.

# MUR480E, MUR4100E

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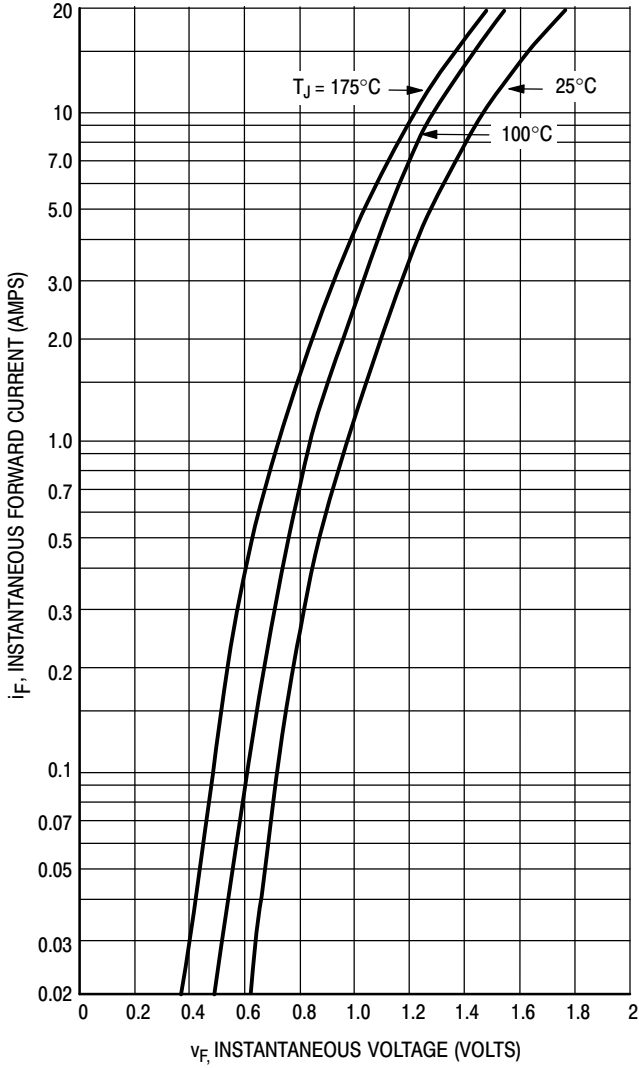


Figure 1. Typical Forward Voltage

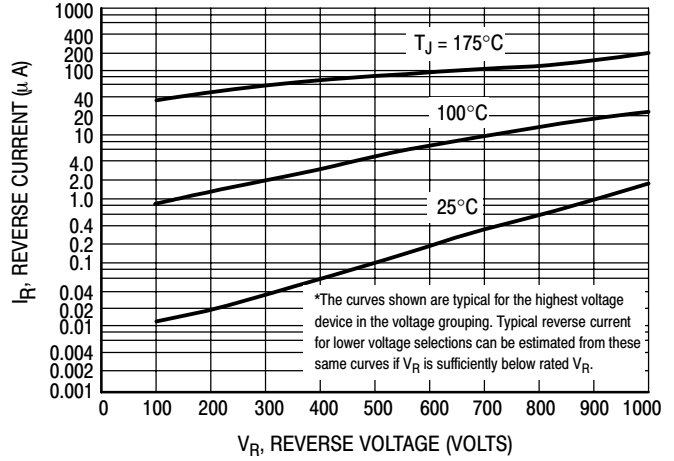


Figure 2. Typical Reverse Current\*

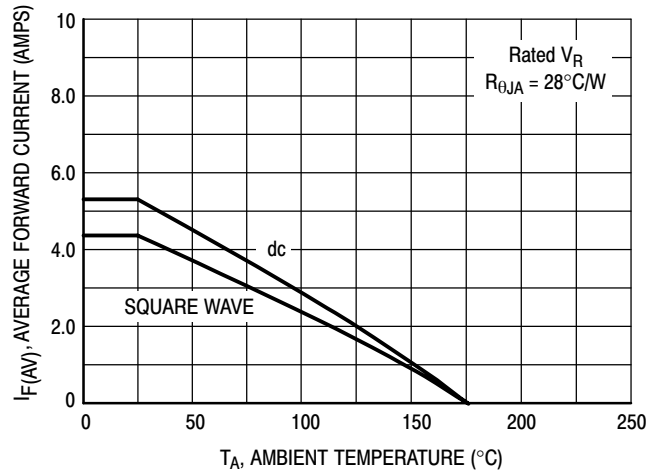


Figure 3. Current Derating (Mounting Method #3 Per Note 2)

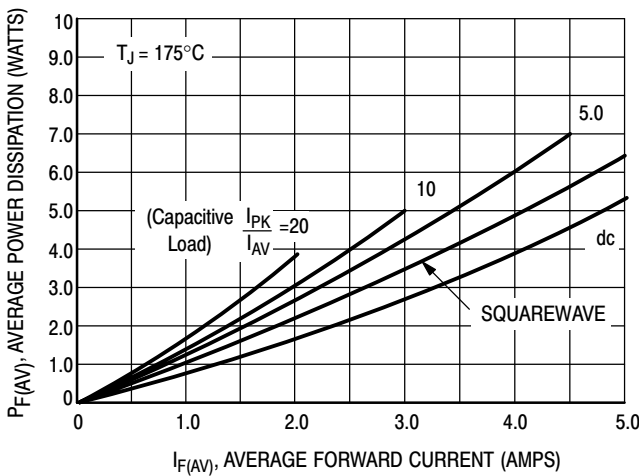


Figure 4. Power Dissipation

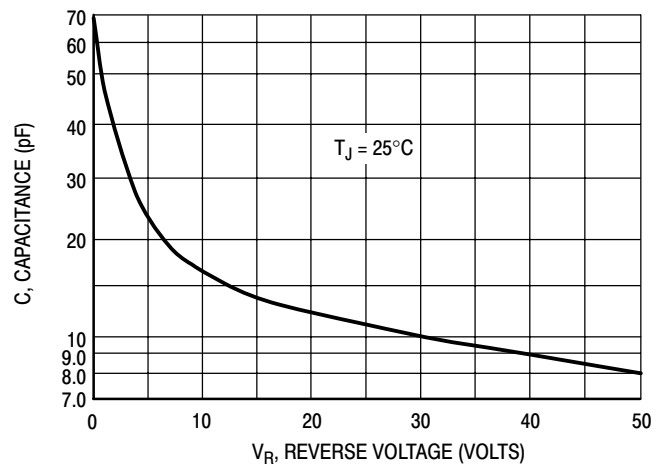


Figure 5. Typical Capacitance

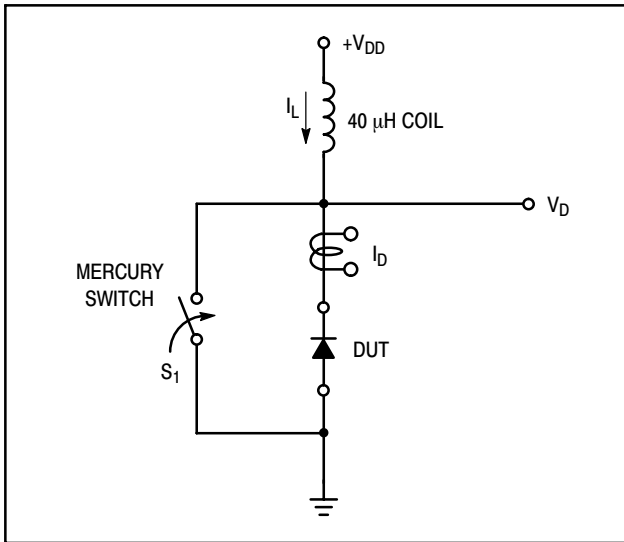


Figure 6. Test Circuit

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

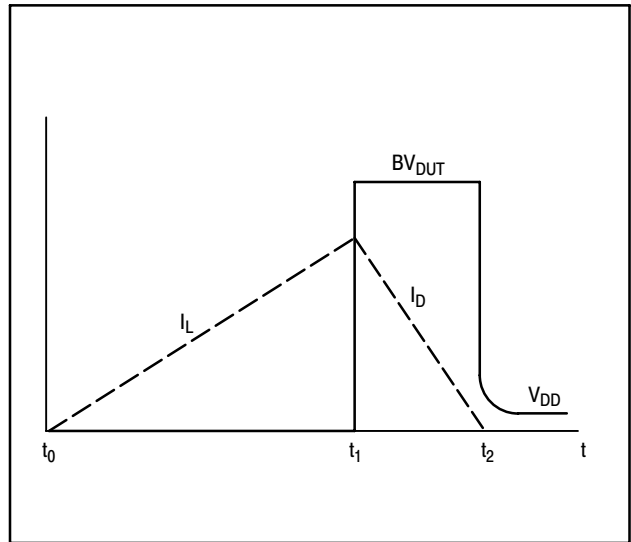


Figure 7. Current–Voltage Waveforms

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

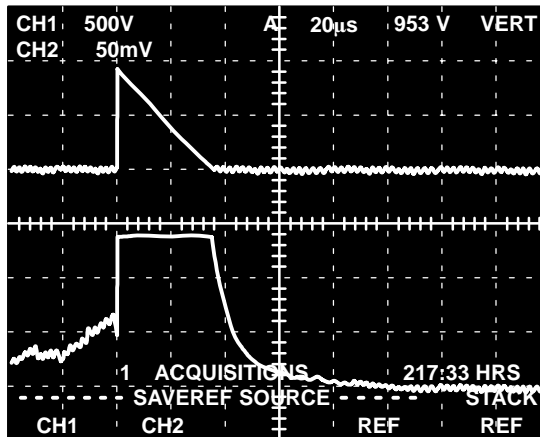
Although it is not recommended to design for this condition, the new “E” series provides added protection against those unforeseen transient viruses that can produce unexplained random failures in unfriendly environments.

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 μs/DIV.

Figure 8. Current–Voltage Waveforms

# MUR480E, MUR4100E

## NOTE 2 – AMBIENT MOUNTING DATA

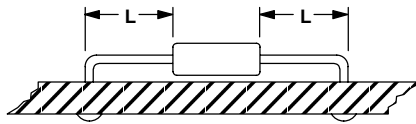
Data shown for thermal resistance junction-to-ambient ( $R_{\theta JA}$ ) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

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

Mounting Method	$R_{\theta JA}$	Lead Length, L (IN)				Units
		1/8	1/4	1/2	3/4	
1		50	51	53	55	$^{\circ}\text{C}/\text{W}$
2		58	59	61	63	$^{\circ}\text{C}/\text{W}$
3		28				$^{\circ}\text{C}/\text{W}$

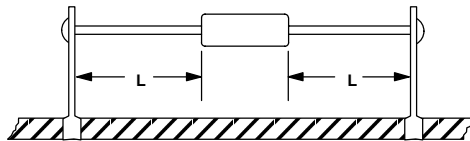
#### MOUNTING METHOD 1

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



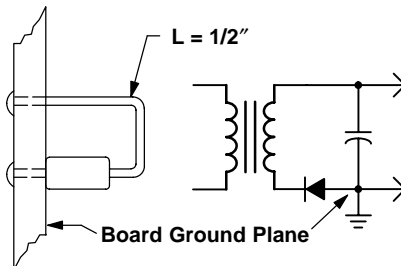
#### MOUNTING METHOD 2

Vector Push-In Terminals T-28



#### MOUNTING METHOD 3

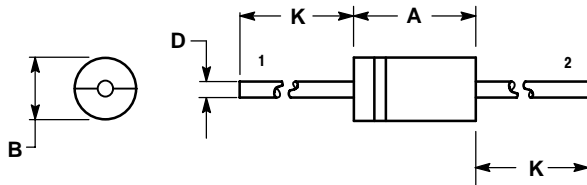
P.C. Board with 1-1/2" x 1-1/2" Copper Surface



# MUR480E, MUR4100E

## PACKAGE DIMENSIONS

AXIAL LEAD  
CASE 267-05  
(DO-201AD)  
ISSUE G



### NOTES:


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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.287	0.374	7.30	9.50
B	0.189	0.209	4.80	5.30
D	0.047	0.051	1.20	1.30
K	1.000	---	25.40	---

### STYLE 1:

- PIN 1. CATHODE (POLARITY BAND)  
2. ANODE

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