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MUR490E, MUR4100E

MUR4100E is a Preferred Device

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 and Mounting Surface Temperature for Soldering Purposes: 220°C Max for 10 Seconds, 1/16″ from Case
- Polarity: Cathode Indicated by Polarity Band

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ULTRAFAST RECTIFIERS
4.0 AMPS, 900 – 1000 VOLTS

AXIAL LEAD
CASE 267−05
STYLE 1

MARKING DIAGRAM

A	= Assembly Location
MUR4xxxE	= Device Code
	xxx = 90 or 100
YY	= Year
WW	= Work Week
▪	= Pb−Free Package

(Note: Microdot may be in either location)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage　　　　MUR490E 　　　　　　　　　　　　　　MUR4100E	V_{RRM} V_{RWM} V_R	 900 1000	V
Average Rectified Forward Current (Sq. Wave) (Mounting Method #3 Per Note 1)	$I_{F(AV)}$	4.0 @ $T_A = 35°C$	A
Nonrepetitive Peak Surge Current (Surge Applied at Rated Load Conditions, Halfwave, Single Phase, 60 Hz)	I_{FSM}	70	A
Operating Junction Storage Temperature	T_J, T_{stg}	–65 to +175	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	See Note 1	°C/W

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.
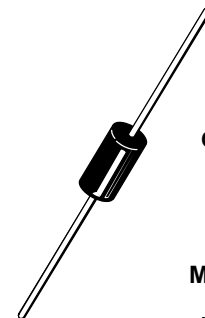
*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.
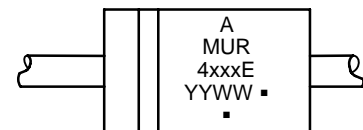
ORDERING INFORMATION

Device	Package	Shipping†
MUR490E	Axial Lead*	500 Units / Bulk
MUR4100E	Axial Lead*	500 Units / Bulk
MUR4100EG	Axial Lead*	500 Units / Bulk
MUR4100ERL	Axial Lead*	1,500/Tape & Reel
MUR4100ERLG	Axial Lead*	1,500/Tape & Reel

†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.

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

ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 1) (i_F = 3.0 Amps, T_J = 150°C) (i_F = 3.0 Amps, T_J = 25°C) (i_F = 4.0 Amps, T_J = 25°C)	v_F	1.53 1.75 1.85	V
Maximum Instantaneous Reverse Current (1) (Rated dc Voltage, T_J = 100°C) (Rated dc Voltage, T_J = 25°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_{AVAL}	20	mJ

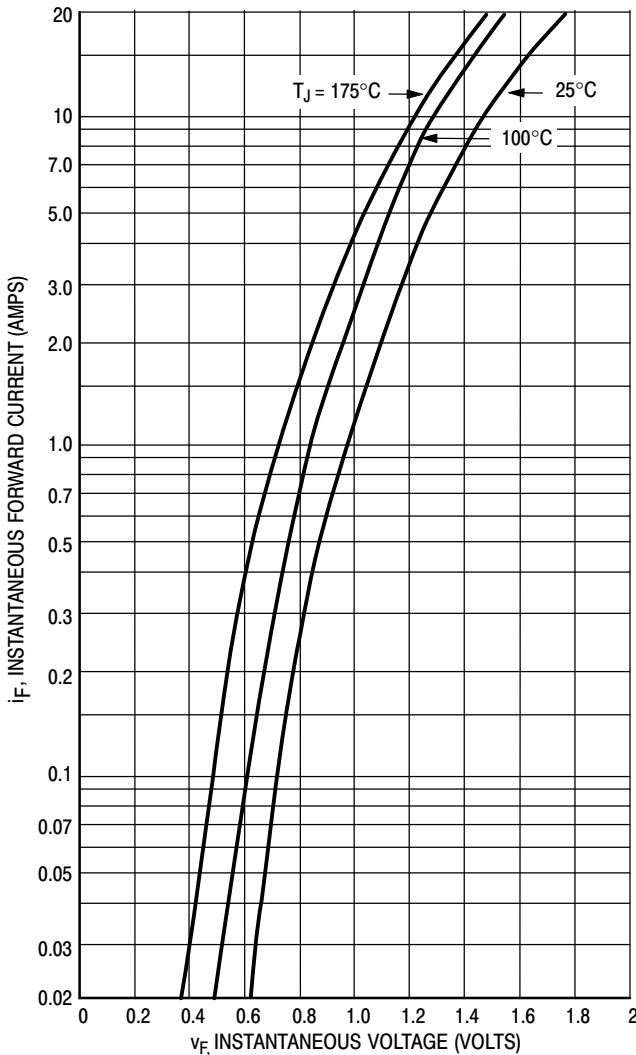1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.
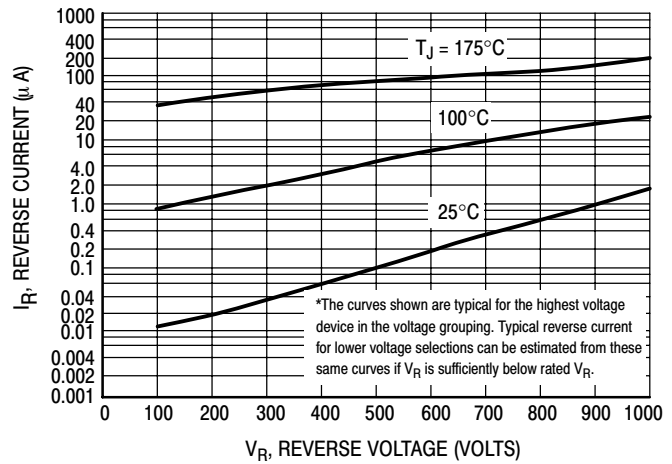

Figure 1. Typical Forward Voltage
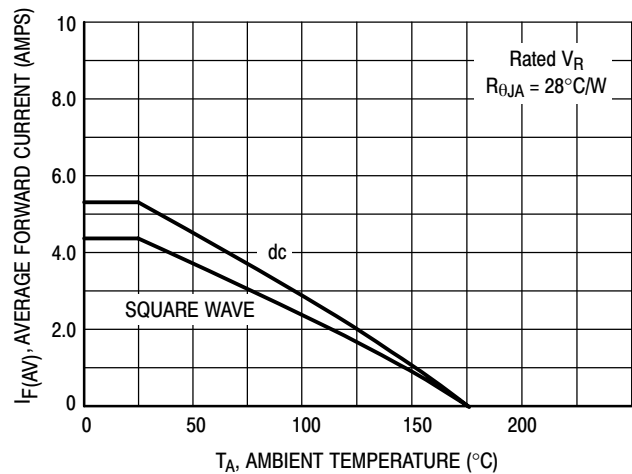

Figure 2. Typical Reverse Current*

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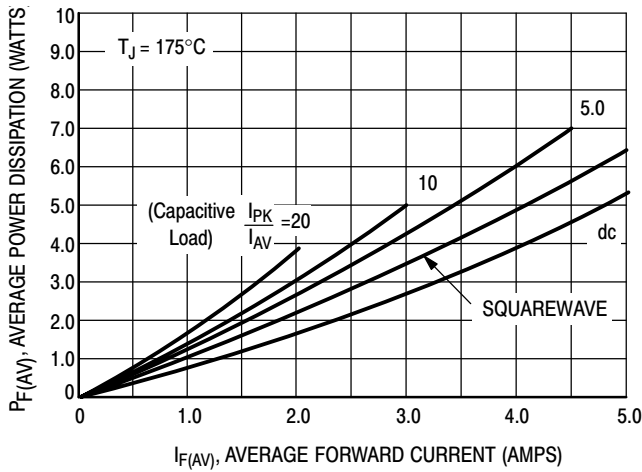**(Mounting Method #3 Per Note 1)**

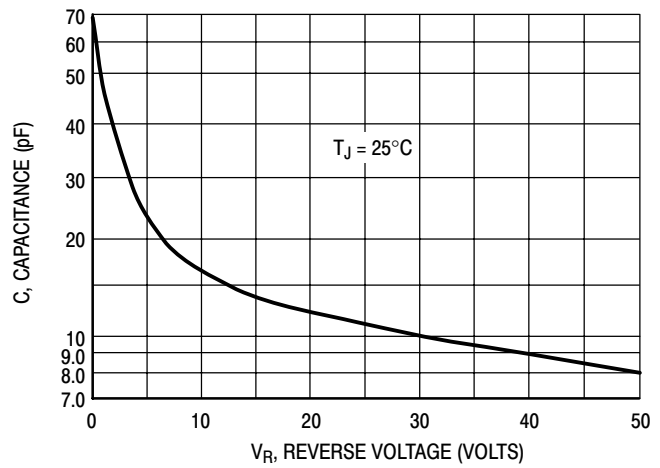**Figure 4. Power Dissipation**
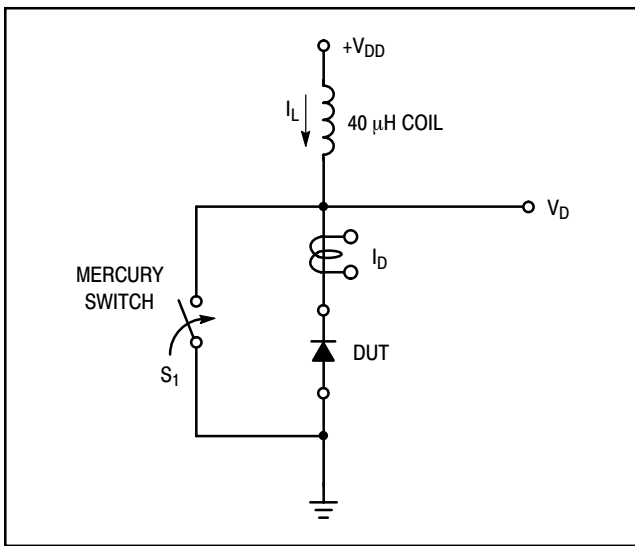

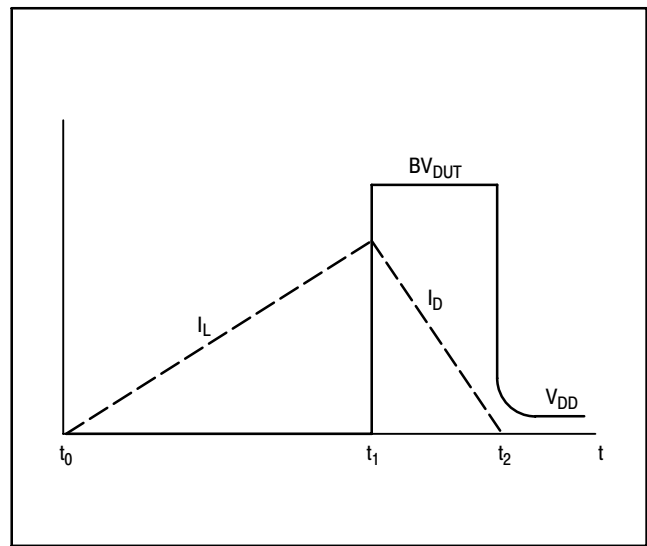**Figure 5. Typical Capacitance**

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 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.
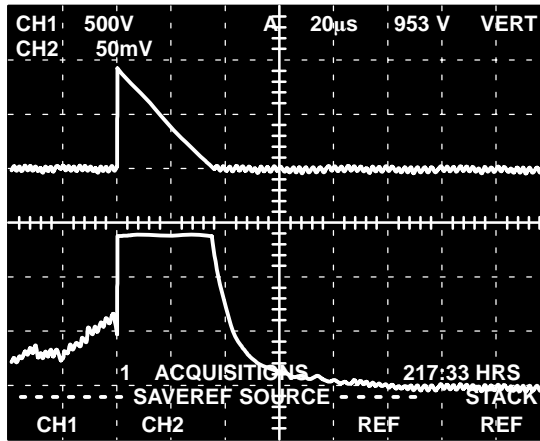
EQUATION (1):

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

EQUATION (2):

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

| CH1 | 500V | | A| 20µs | 953 V | VERT |

CH1 500V / CH2 50mV / A 20µs / 953 V / VERT / 1 ACQUISITIONS / SAVEREF SOURCE / 217:33 HRS / STACK / CH1 CH2 REF REF

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

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.
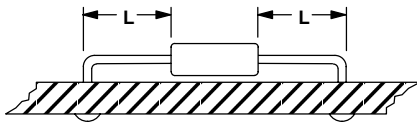
MOUNTING METHOD 2

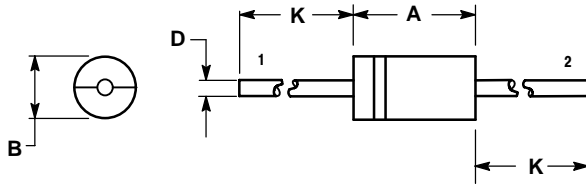**Vector Push–In Terminals T–28**
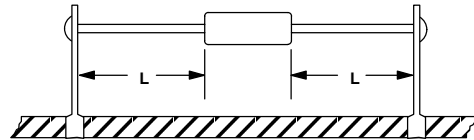
MOUNTING METHOD 3

P.C. Board with 1–1/2″ x 1–1/2″ Copper Surface

L = 1/2″

Board Ground Plane
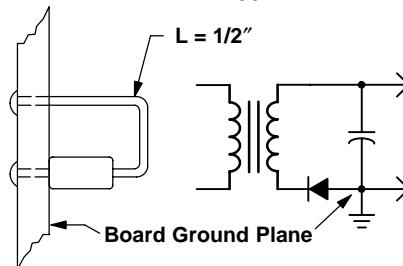
MUR490E, MUR4100E

PACKAGE DIMENSIONS

AXIAL LEAD
CASE 267–05
ISSUE G

NOTES:
1. DIMENSIONS AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 267-04 OBSOLETE, NEW STANDARD 267-05.

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

SWITCHMODE registered trademark of Semiconductor Components Industries, LLC (SCILLC).