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T-23-07

MOTOROLA SEMICONDUCTOR TECHNICAL DATA

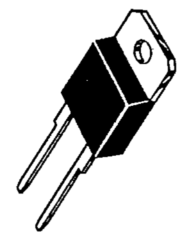
Switchmode™ Power Rectifier

MUR30100E

. . . designed for use in switching power supplies, inverters and as freewheeling diodes, these state-of-the-art devices have the following features:

- Ultrafast 85 ns (Typ) Soft Recovery Time @ I_F = 1.0 Amp, V_R = 30 V, di/dt = 50 A/µs
- 175°C Operating Junction Temperature
- State-of-the-Art Single TO-218 Plastic Package
- High Voltage Capability 1000 Volts
- Low Forward Voltage Drop
- Guaranteed Avalanche Energy Capability: 100 mJoules Min

ULTRAFAST RECTIFIER
30 AMPERES
1000 VOLTS



MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	1000	Volts
Average Rectified Forward Current (Rated V_R) T_C = 70°C	$I_{F(AV)}$	30	Amps
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz) T_C = 150°C	I_{FRM}	30	Amps
Non-Repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	300	Amps
Operating Junction Temperature	T_J	−65 to +175	°C
Storage Temperature	T_{stg}	−65 to +175	°C

THERMAL CHARACTERISTICS

Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.4	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Max	Min	Unit
Instantaneous Forward Voltage (1) @ I_F = 30 Amps, T_C = 25°C @ I_F = 30 Amps, T_C = 100°C	V_F	 1.9 1.8	 — —	Volts
Instantaneous Reverse Current (1) @ Rated DC Voltage, T_C = 25°C @ Rated DC Voltage, T_C = 100°C	I_R	 100 5.0	 — —	 µA mA
Reverse Recovery Time I_F = 1.0 Amp, V_R = 30 V, dI/dt = 50 A/µs	t_{RR}	100	—	ns
Controlled Avalanche Energy	$W_{(aval)}$	—	100	mJ

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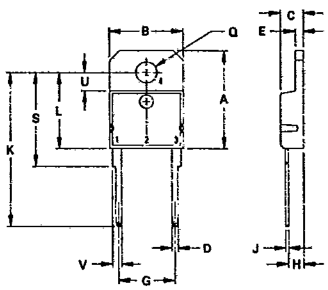
OUTLINE DIMENSIONS



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

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	19.00	19.60	0.749	0.771
B	14.00	14.50	0.551	0.570
C	4.20	5.00	0.165	0.196
D	1.00	1.30	0.040	0.051
E	1.45	1.65	0.058	0.064
G	10.42	11.44	0.411	0.450
H	2.60	3.00	0.103	0.118
J	0.40	0.60	0.016	0.023
K	28.50	32.00	1.123	1.259
L	14.73	15.30	0.579	0.602
Q	4.00	4.25	0.158	0.167
S	17.50	19.50	0.689	0.767
U	3.40	3.80	0.134	0.149
V	1.50	2.00	0.060	0.078

STYLE 1:
PIN 1. CATHODE
3. ANODE
4. CATHODE

CASE 340E-01
TO-218

MOTOROLA

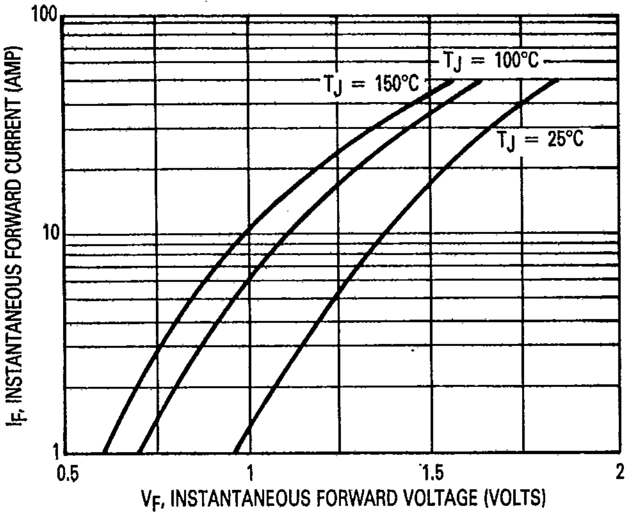


Figure 1. Typical Forward Voltage

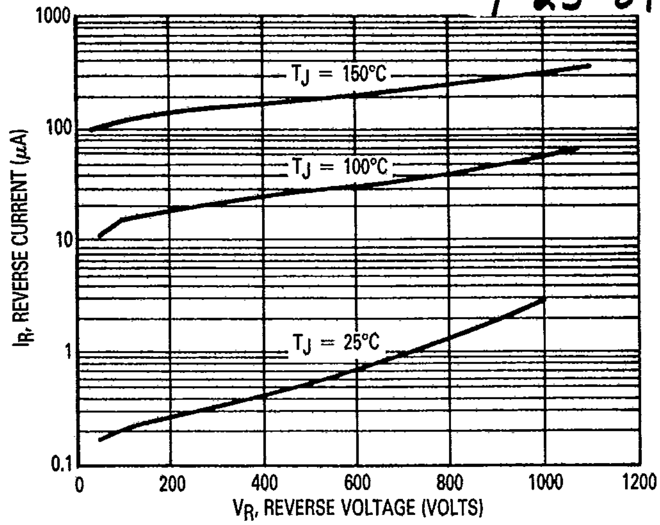


Figure 2. Typical Reverse Current

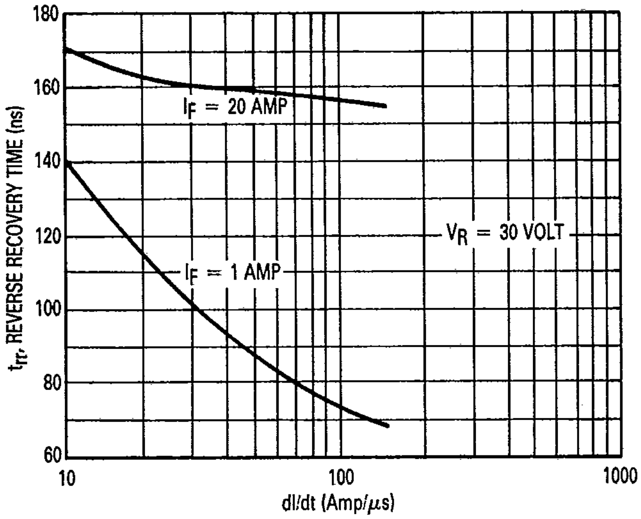


Figure 3. t_{rr} = f (dI/dt) at T_J = 25°C)

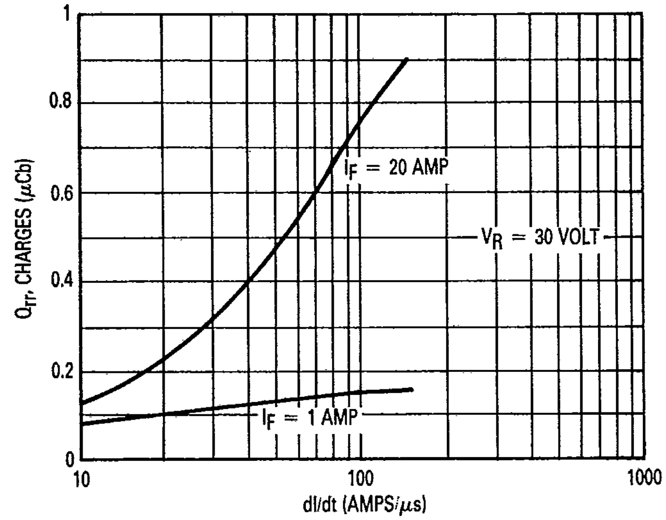


Figure 4. Q_{rr} = f (dI/dt) at T_J = 25°C

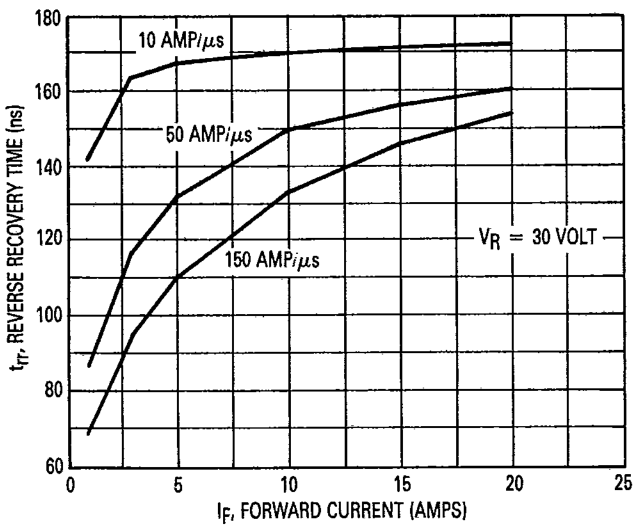


Figure 5. t_{rr} = f (I_F) at T_J = 25°C

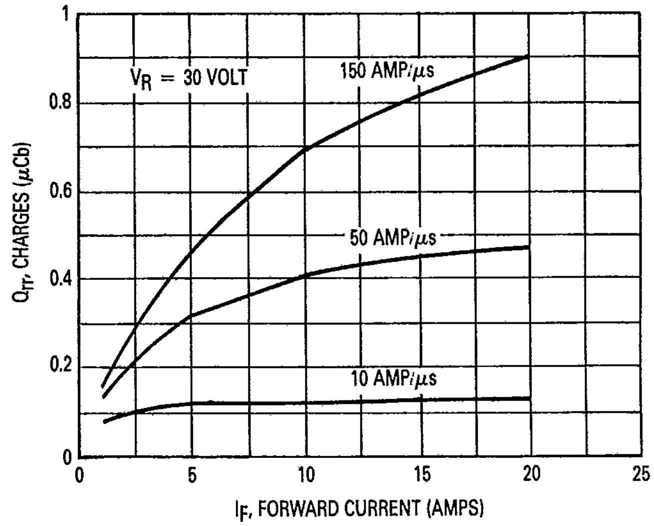


Figure 6. Q_{rr} = f (I_F) at T_J = 25°C

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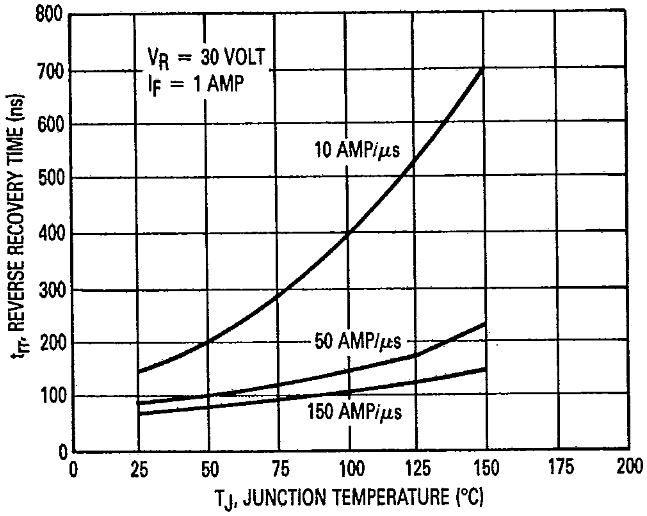


Figure 7. t_{rr} = f (T_J)

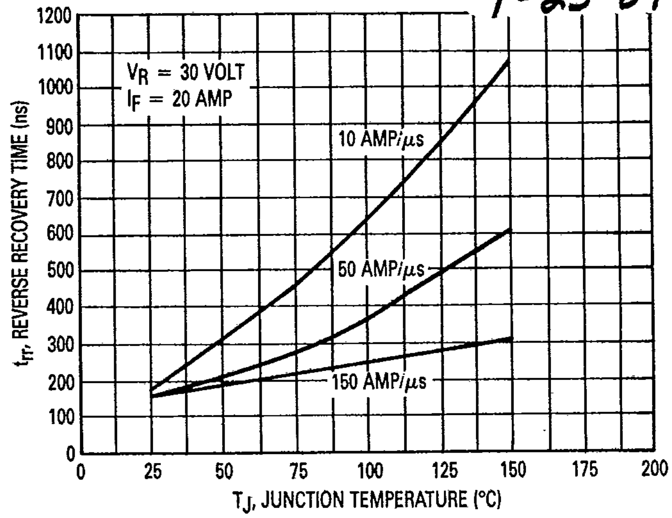


Figure 8. t_{rr} = f (T_J)

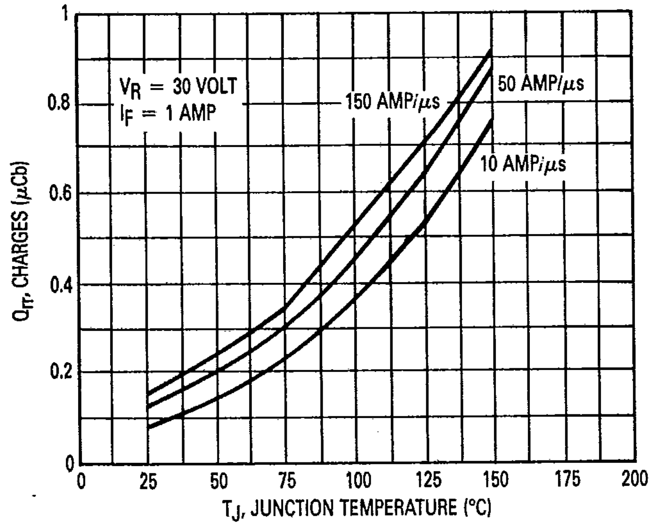


Figure 9. Q_{rr} = f (T_J)

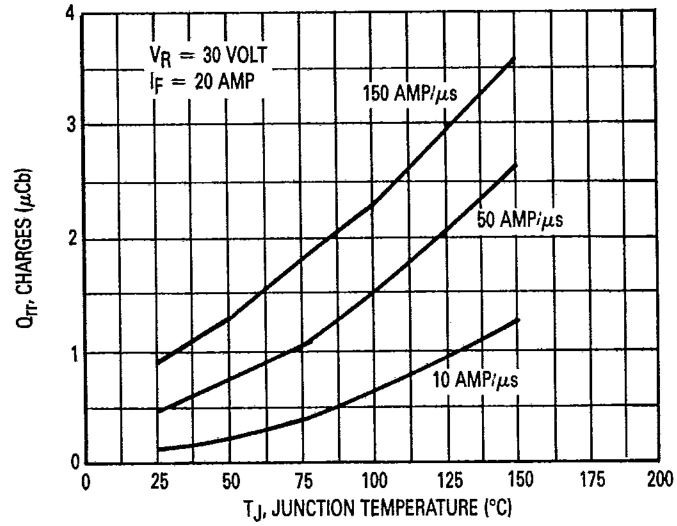


Figure 10. Q_{rr} = f (T_J)

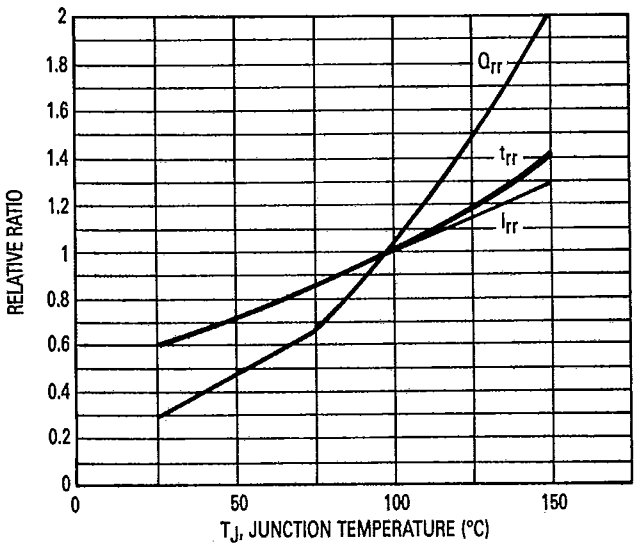
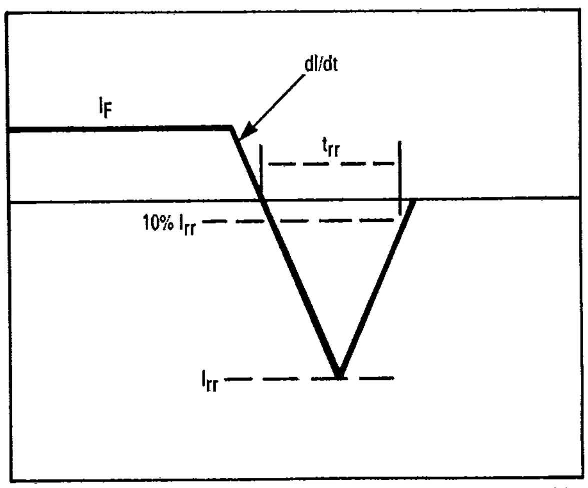


Figure 11. Dynamic Parameters = f (T_J)



t_{rr}: lapse between I_F crossing the 0 axis downward and I_R reaching 10% of I_{rr} upward

Figure 12. t_{rr} Definition

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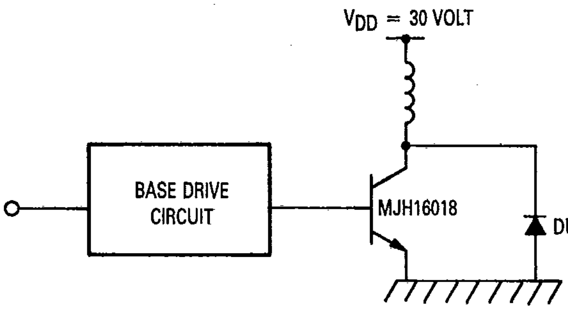

Figure 13. Avalanche Test Circuit

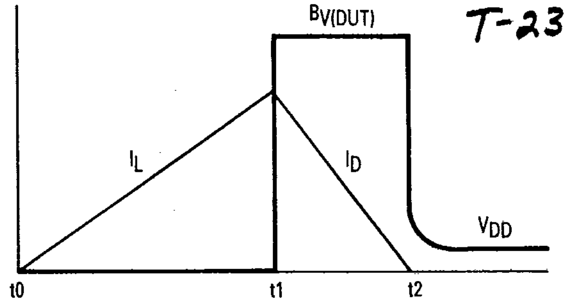

Figure 14. Current-Voltage Waveforms

The unclamped inductive switching circuit shown in Figure 13 was used to demonstrate the controlled avalanche capability of the new "E" series Ultrafast Rectifiers. Figure 14 represents the Current-Voltage waveforms during tests.

When the transistor is turned-on at t0, the current in the inductor I_L ramps up linearly and energy is stored in the coil. At t1 the transistor is turned-off and 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 $B_{V(DUT)}$ 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 the transistors is turned-off, 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 DUT, 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 the transistor was ON, Equation 2.

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:

$W_{aval} \approx 1/2\ LI2(peak)\ (B_{V(DUT)}/(B_{V(DUT)} - V_{DD}))$

EQUATION 2:

$W_{aval} = 1/2\ LI2(peak)$

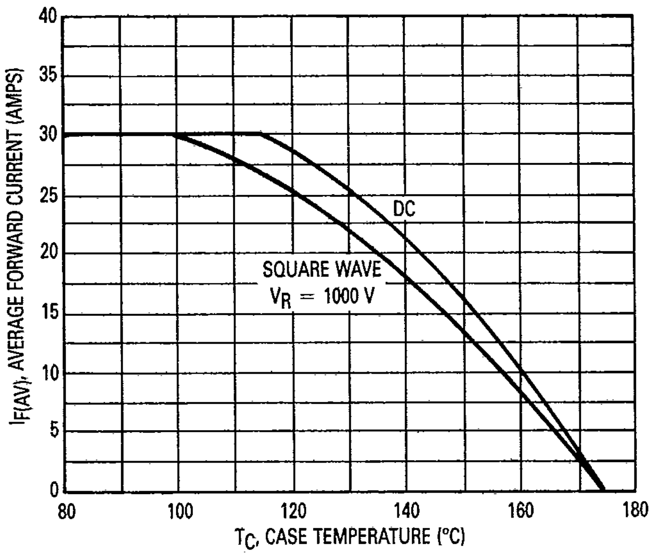

Figure 15. Current Derating, Case

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