

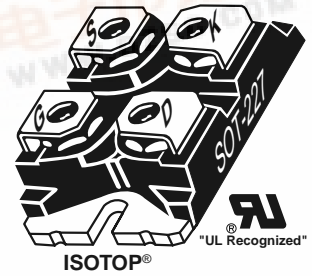


# APT50M75JLLU2

500V 51A 0.075Ω

## POWER MOS 7™

Power MOS 7™ is a new generation of low loss, high voltage, N-Channel enhancement mode power MOSFETS. Both conduction and switching losses are addressed with Power MOS 7™ by significantly lowering  $R_{DS(ON)}$  and  $Q_g$ . Power MOS 7™ combines lower conduction and switching losses along with exceptionally fast switching speeds inherent with APT's patented metal gate structure.



- Lower Input Capacitance
- Lower Miller Capacitance
- Lower Gate Charge,  $Q_g$
- Increased Power Dissipation
- Easier To Drive
- PFC "Boost" Configuration

### MAXIMUM RATINGS

All Ratings:  $T_C = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	APT50M75JLLU2	UNIT
$V_{DSS}$	Drain-Source Voltage	500	Volts
$I_D$	Continuous Drain Current @ $T_C = 25^\circ\text{C}$	51	Amps
$I_{DM}$	Pulsed Drain Current <sup>①</sup>	204	
$V_{GS}$	Gate-Source Voltage Continuous	±30	Volts
$V_{GSM}$	Gate-Source Voltage Transient	±40	
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	465	Watts
	Linear Derating Factor	3.72	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 150	°C
$T_L$	Lead Temperature: 0.063" from Case for 10 Sec.	300	
$I_{AR}$	Avalanche Current <sup>①</sup> (Repetitive and Non-Repetitive)	51	Amps
$E_{AR}$	Repetitive Avalanche Energy <sup>①</sup>	50	mJ
$E_{AS}$	Single Pulse Avalanche Energy <sup>④</sup>	2500	

### STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$BV_{DSS}$	Drain-Source Breakdown Voltage ( $V_{GS} = 0V, I_D = 250\mu A$ )	500			Volts
$I_{D(on)}$	On State Drain Current <sup>②</sup> ( $V_{DS} > I_{D(on)} \times R_{DS(on)}$ Max, $V_{GS} = 10V$ )	51			Amps
$R_{DS(on)}$	Drain-Source On-State Resistance <sup>②</sup> ( $V_{GS} = 10V, 0.5 I_{D(Cont.)}$ )			0.075	Ohms
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{DS} = V_{DSS}, V_{GS} = 0V$ )			100	μA
	Zero Gate Voltage Drain Current ( $V_{DS} = 0.8 V_{DSS}, V_{GS} = 0V, T_C = 125^\circ\text{C}$ )			500	
$I_{GSS}$	Gate-Source Leakage Current ( $V_{GS} = \pm 30V, V_{DS} = 0V$ )			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 2.5mA$ )	3		5	Volts

**CAUTION:** These Devices are Sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

APT Website - <http://www.advancedpower.com>

**DYNAMIC CHARACTERISTICS**

**APT50M75JLLU2**

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
$C_{iss}$	Input Capacitance	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1\text{ MHz}$		5800		pF
$C_{oss}$	Output Capacitance			1200		
$C_{rss}$	Reverse Transfer Capacitance			90		
$Q_g$	Total Gate Charge ③	$V_{GS} = 10V$ $V_{DD} = 0.5 V_{DSS}$ $I_D = I_{D[Cont.]} @ 25^\circ C$		145		nC
$Q_{gs}$	Gate-Source Charge			38		
$Q_{gd}$	Gate-Drain ("Miller") Charge			66		
$t_{d(on)}$	Turn-on Delay Time	$V_{GS} = 15V$ $V_{DD} = 0.5 V_{DSS}$ $I_D = I_{D[Cont.]} @ 25^\circ C$ $R_G = 0.6\Omega$		17		ns
$t_r$	Rise Time			14		
$t_{d(off)}$	Turn-off Delay Time			38		
$t_f$	Fall Time			5		

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$I_S$	Continuous Source Current (Body Diode)			51	Amps
$I_{SM}$	Pulsed Source Current ① (Body Diode)			204	
$V_{SD}$	Diode Forward Voltage ② ( $V_{GS} = 0V, I_S = -I_{D[Cont.]}$ )			1.3	Volts
$t_{rr}$	Reverse Recovery Time ( $I_S = -I_{D[Cont.]}, di_S/dt = 100A/\mu s$ )		620		ns
$Q_{rr}$	Reverse Recovery Charge ( $I_S = -I_{D[Cont.]}, di_S/dt = 100A/\mu s$ )		14.7		$\mu C$
$dv/dt$	Peak Diode Recovery $dv/dt$ ⑤			8	V/ns

**THERMAL CHARACTERISTICS**

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			0.27	$^\circ C/W$
$R_{\theta JA}$	Junction to Ambient			40	

① Repetitive Rating: Pulse width limited by maximum junction temperature.

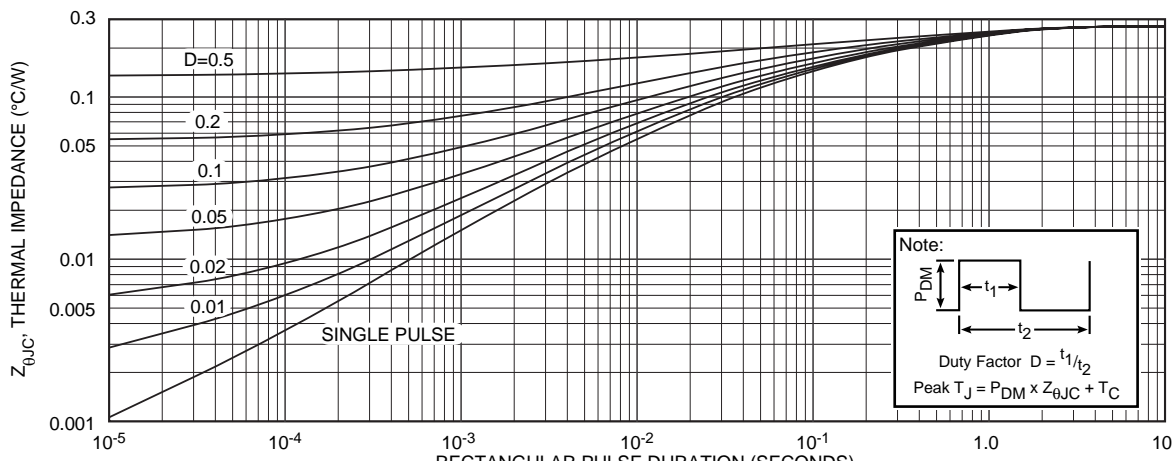
② Pulse Test: Pulse width < 380  $\mu s$ , Duty Cycle < 2%

③ See MIL-STD-750 Method 3471

④ Starting  $T_j = +25^\circ C$ ,  $L = 1.92mH$ ,  $R_G = 25\Omega$ , Peak  $I_L = 51A$

⑤  $dv/dt$  numbers reflect the limitations of the test circuit rather than the device itself.  $I_S \leq -I_{D[Cont.]}$   $di/dt \leq 700A/\mu s$   $v_R \leq V_{DSS}$   $T_J \leq 150^\circ C$

**APT Reserves the right to change, without notice, the specifications and information contained herein.**



APT50M75JLLU2

Diode Specifications Section

**MAXIMUM RATINGS (UltraFast Recovery Diode)**

All Ratings:  $T_C = 25^\circ\text{C}$  unless otherwise specified.

Symbol	Characteristic / Test Conditions	APT50M75JLLU2	UNIT
$V_R$	Maximum D.C. Reverse Voltage	600	Volts
$V_{RRM}$	Maximum Peak Repetitive Reverse Voltage		
$V_{RWM}$	Maximum Working Peak Reverse Voltage		
$I_F(AV)$	Maximum Average Forward Current ( $T_C = 80^\circ\text{C}$ , Duty Cycle = 0.5)	30	Amps
$I_F(RMS)$	RMS Forward Current	60	
$I_{FSM}$	Non-Repetitive Forward Surge Current ( $T_J = 45^\circ\text{C}$ , 8.3mS)	320	
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to 150	$^\circ\text{C}$
$T_L$	Lead Temperature: 0.063" from Case for 10 Sec.	300	

**STATIC ELECTRICAL CHARACTERISTICS**

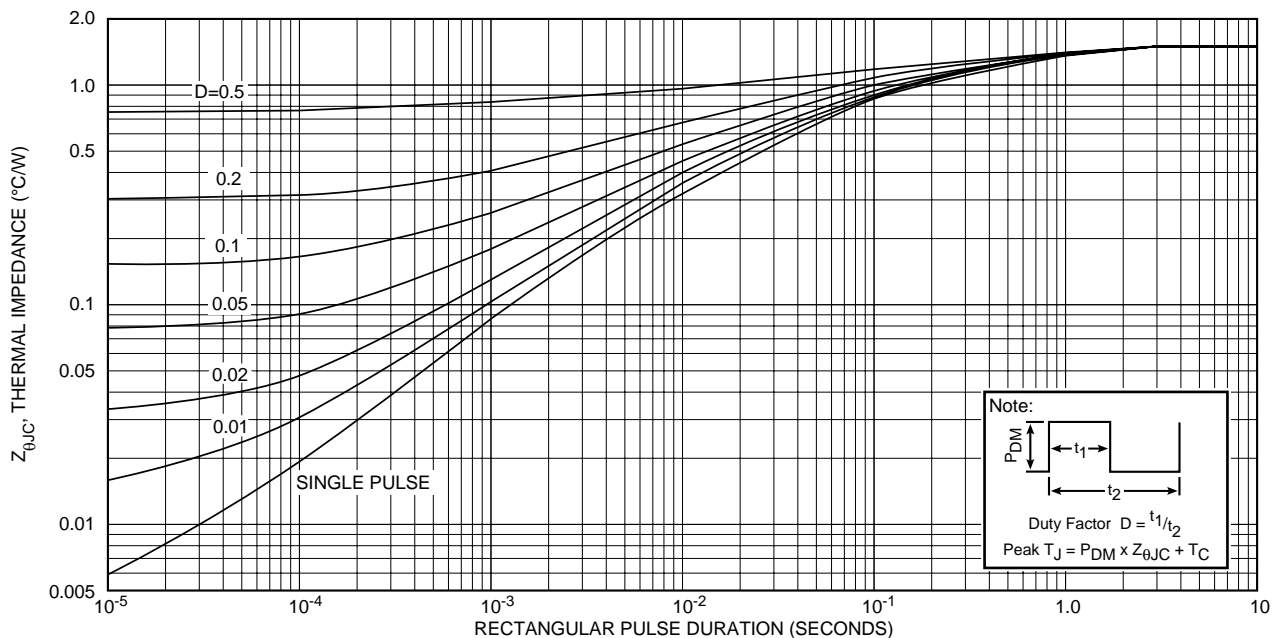
Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$V_F$	Maximum Forward Voltage			1.8	Volts
				$I_F = 30\text{A}$	
				$I_F = 60\text{A}$	
$I_{RM}$	Maximum Reverse Leakage Current			250	$\mu\text{A}$
				$V_R = V_R$ Rated	
				$V_R = V_R$ Rated, $T_J = 125^\circ\text{C}$	
$C_T$	Junction Capacitance, $V_R = 200\text{V}$		40		pF

**DYNAMIC CHARACTERISTICS**

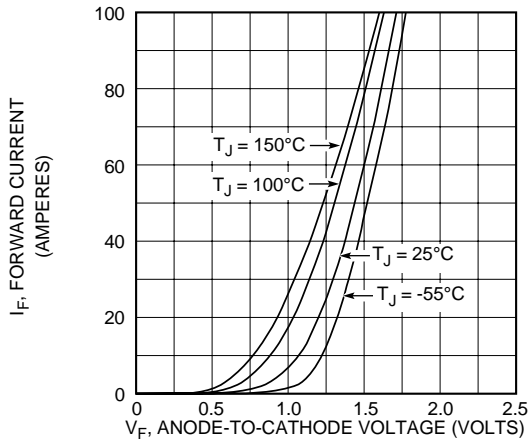
Symbol	Characteristic	MIN	TYP	MAX	UNIT
$t_{rr1}$	Reverse Recovery Time, $I_F = 1.0A$ , $di_F/dt = -15A/\mu S$ , $V_R = 30V$ , $T_J = 25^\circ C$		50	65	nS
$t_{rr2}$	Reverse Recovery Time	$T_J = 25^\circ C$	50		
$t_{rr3}$	$I_F = 30A$ , $di_F/dt = -240A/\mu S$ , $V_R = 350V$	$T_J = 100^\circ C$	80		
$t_{fr1}$	Forward Recovery Time	$T_J = 25^\circ C$	155		
$t_{fr2}$	$I_F = 30A$ , $di_F/dt = 240A/\mu S$ , $V_R = 350V$	$T_J = 100^\circ C$	155		
$I_{RRM1}$	Reverse Recovery Current	$T_J = 25^\circ C$	4	10	Amps
$I_{RRM2}$	$I_F = 30A$ , $di_F/dt = -240A/\mu S$ , $V_R = 350V$	$T_J = 100^\circ C$	7.5	15	
$Q_{rr1}$	Recovery Charge	$T_J = 25^\circ C$	100		nC
$Q_{rr2}$	$I_F = 30A$ , $di_F/dt = -240A/\mu S$ , $V_R = 350V$	$T_J = 100^\circ C$	300		
$V_{fr1}$	Forward Recovery Voltage	$T_J = 25^\circ C$	5		Volts
$V_{fr2}$	$I_F = 30A$ , $di_F/dt = 240A/\mu S$ , $V_R = 350V$	$T_J = 100^\circ C$	5		
$di_M/dt$	Rate of Fall of Recovery Current	$T_J = 25^\circ C$	400		A/ $\mu S$
	$I_F = 30A$ , $di_F/dt = -240A/\mu S$ , $V_R = 350V$ (See Figure 10)	$T_J = 100^\circ C$	200		

**THERMAL AND MECHANICAL CHARACTERISTICS**

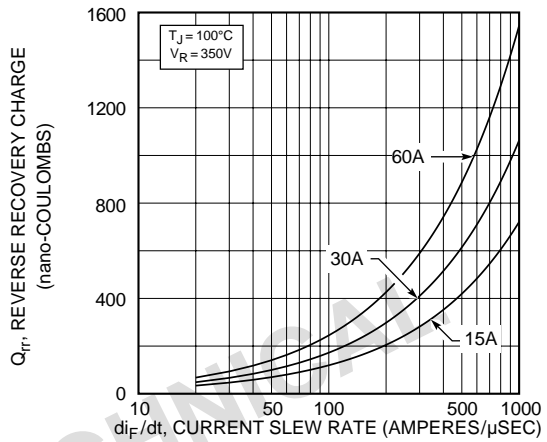
Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction-to-Case Thermal Resistance			0.90	$^\circ C/W$
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance			20	
$W_T$	Package Weight		1.06		oz.
			30		gm.



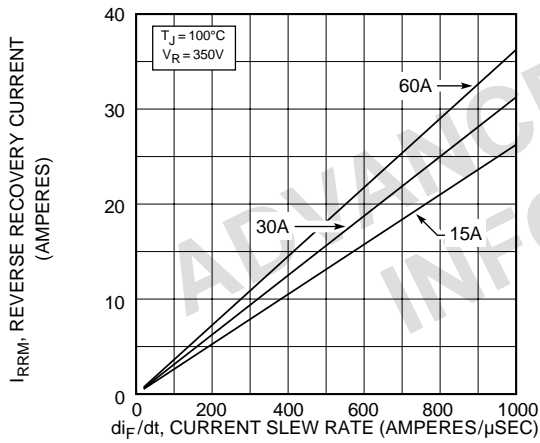
**APT50M75JLLU2**



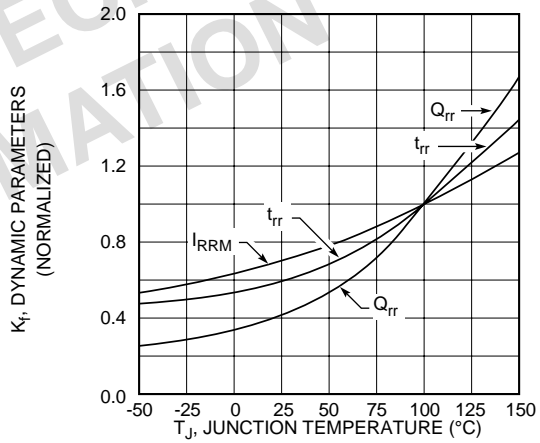
**Figure 15, Forward Voltage Drop vs Forward Current**



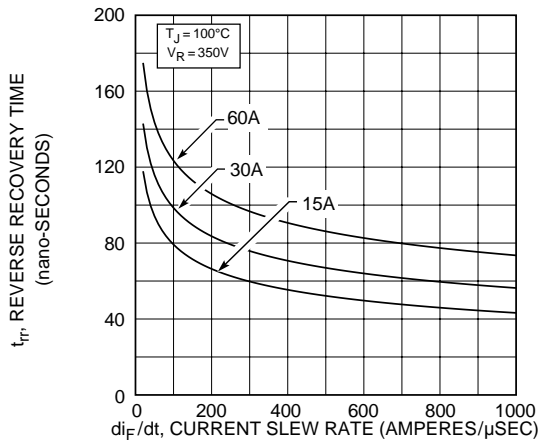
**Figure 16, Reverse Recovery Charge vs Current Slew Rate**



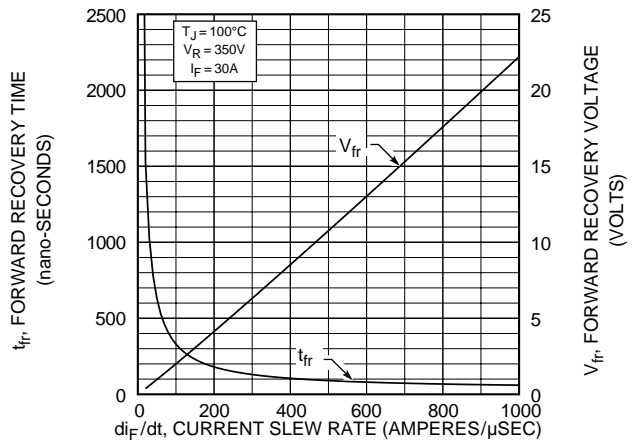
**Figure 17, Reverse Recovery Current vs Current Slew Rate**



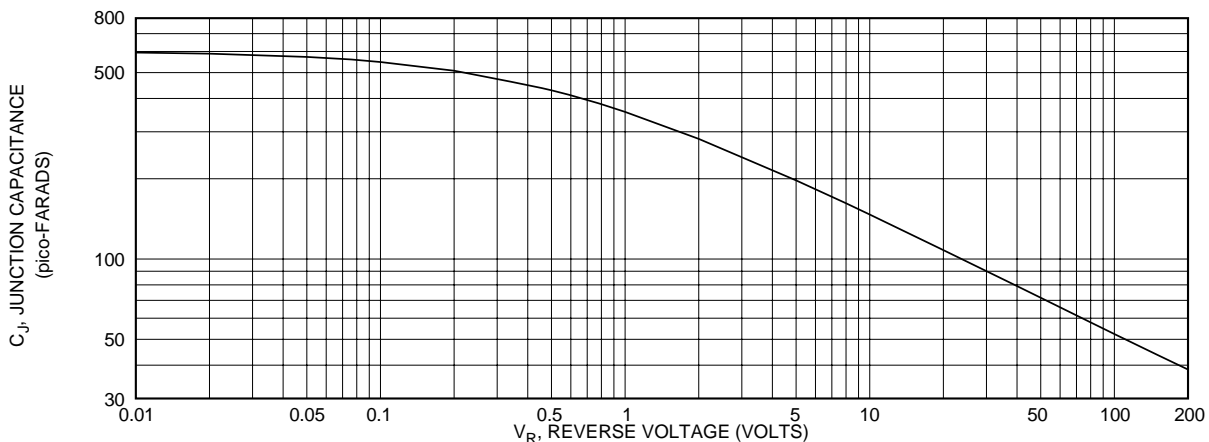
**Figure 18, Dynamic Parameters vs Junction Temperature**



**Figure 19, Reverse Recovery Time vs Current Slew Rate**



**Figure 20, Forward Recovery Voltage/Time vs Current Slew Rate**



**Figure 21, Junction Capacitance vs Reverse Voltage**

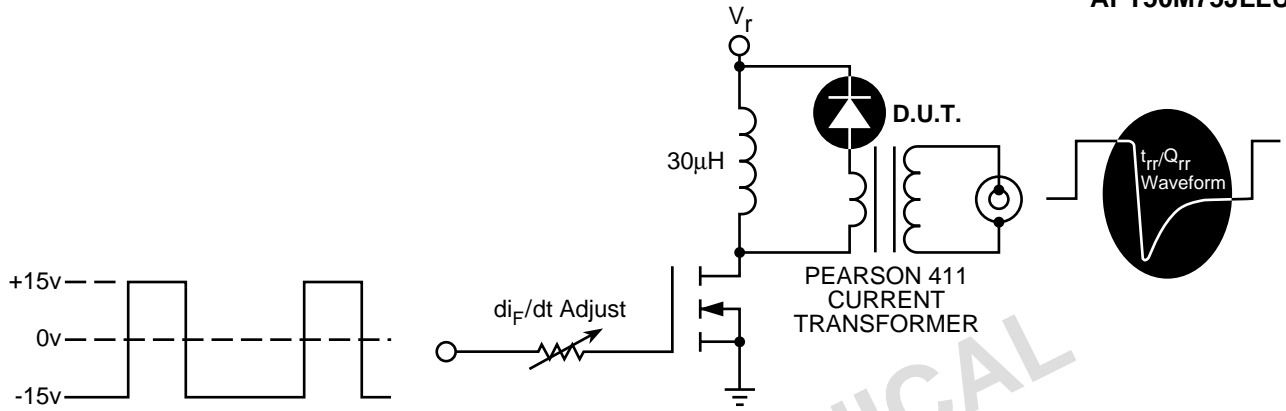


Figure 22, Diode Reverse Recovery Test Circuit and Waveforms

1  $I_F$  - Forward Conduction Current

2  $di_F/dt$  - Current Slew Rate, Rate of Forward Current Change Through Zero Crossing.

3  $I_{RRM}$  - Peak Reverse Recovery Current.

4  $t_{rr}$  - Reverse Recovery Time Measured from Point of  $I_F$  Current Falling Through Zero to a Tangent Line { 6  $di_M/dt$  } Extrapolated Through Zero Defined by 0.75 and 0.50  $I_{RRM}$ .

5  $Q_{rr}$  - Area Under the Curve Defined by  $I_{RRM}$  and  $t_{rr}$ .

6  $di_M/dt$  - Maximum Rate of Current Change During the Trailing Portion of  $t_{rr}$ .

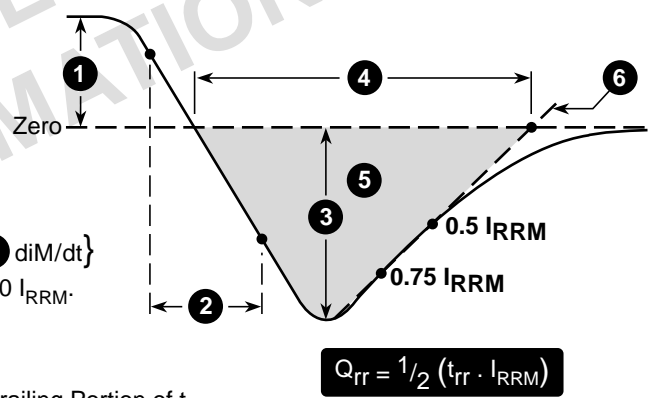
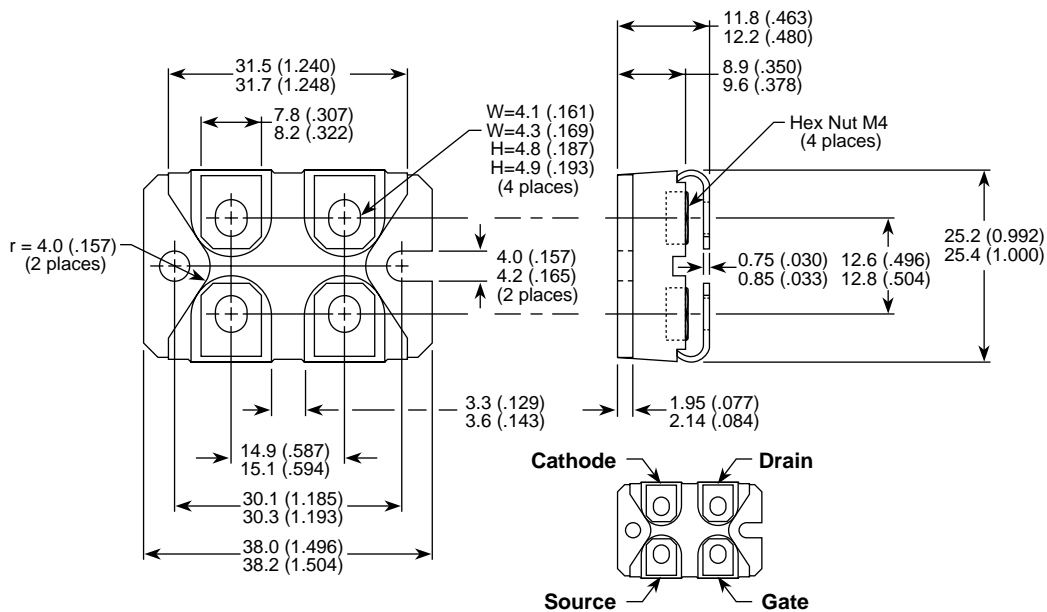


Figure 23, Diode Reverse Recovery Waveform and Definitions

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)