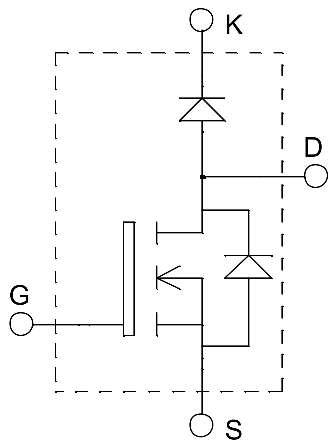
APT5010JLLU2

ISOTOP® Boost chopper MOSFET Power Module

V_{DSS} = 500V
R_{DSon} = 100mΩ max @ Tj = 25°C
I_D = 41A @ Tc = 25°C



Application

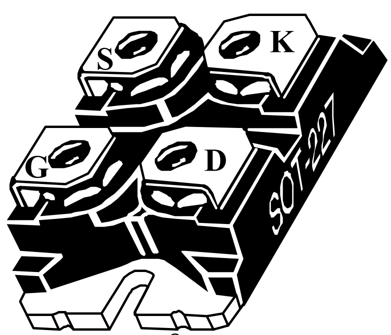
- AC and DC motor control
- Switched Mode Power Supplies
- Power Factor Correction
- Brake switch

Features

- Power MOS 7® MOSFETs
  - Low R_{DSon}
  - Low input and Miller capacitance
  - Low gate charge
  - Fast intrinsic reverse diode
  - Avalanche energy rated
  - Very rugged
- ISOTOP® Package (SOT-227)
- Very low stray inductance
- High level of integration

Benefits

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Very rugged
- Low profile
- RoHS Compliant



ISOTOP®

Absolute maximum ratings

Symbol	*Parameter*			*Max ratings*	*Unit*
V_{DSS}	Drain - Source Breakdown Voltage			500	V
I_D	Continuous Drain Current		$T_c = 25°C$	41	A
			$T_c = 80°C$	30	
I_{DM}	Pulsed Drain current			164	
V_{GS}	Gate - Source Voltage			±30	V
R_{DSon}	Drain - Source ON Resistance			100	mΩ
P_D	Maximum Power Dissipation		$T_c = 25°C$	378	W
I_{AR}	Avalanche current (repetitive and non repetitive)			41	A
E_{AR}	Repetitive Avalanche Energy			50	mJ
E_{AS}	Single Pulse Avalanche Energy			1600	
IF_{AV}	Maximum Average Forward Current	Duty cycle=0.5	Tc = 80°C	30	A
IF_{RMS}	RMS Forward Current (Square wave, 50% duty)			39	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handing Procedures Should Be Followed.

All ratings @ T_j = 25°C unless otherwise specified

Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V, V_{DS} = 500V	T_j = 25°C			100	µA
		V_{GS} = 0V, V_{DS} = 400V	T_j = 125°C			500	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 23A				100	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 2.5mA		3		5	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±20 V, V_{DS} = 0V				±100	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*	*Min*	*Typ*	*Max*	*Unit*
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1MHz		4360		pF
C_{oss}	Output Capacitance			894		
C_{rss}	Reverse Transfer Capacitance			60		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 250V I_D = 41A @ T_J=25°C		96		nC
Q_{gs}	Gate – Source Charge			24		
Q_{gd}	Gate – Drain Charge			49		
$T_{d(on)}$	Turn-on Delay Time	**Resistive switching @ 25°C** V_{GS} = 15V V_{Bus} = 250V I_D = 41A @ T_J=25°C R_G = 0.6Ω		11		ns
T_r	Rise Time			15		
$T_{d(off)}$	Turn-off Delay Time			25		
T_f	Fall Time			3		
E_{on}	Turn-on Switching Energy	**Inductive Switching @ 25°C** V_{bus} = 330V, V_{GS}=15V I_D=46A, R_G=5Ω		543		µJ
E_{off}	Turn-off Switching Energy			509		
E_{on}	Turn-on Switching Energy	**Inductive Switching @ 125°C** V_{bus} = 330V, V_{GS}=15V I_D=46A, R_G=5Ω		843		µJ
E_{off}	Turn-off Switching Energy			593		

Chopper diode ratings and characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
V_F	Diode Forward Voltage	I_F = 30A			1.6	1.8	V
		I_F = 60A			1.9		
		I_F = 30A	T_j = 125°C		1.4		
I_{RM}	Maximum Reverse Leakage Current	V_R = 600V	T_j = 25°C			250	µA
		V_R = 600V	T_j = 125°C			500	
C_T	Junction Capacitance	V_R = 200V			44		pF
t_{rr}	Reverse Recovery Time	I_F=1A,V_R=30V di/dt =100A/µs	T_j = 25°C		23		ns
	Reverse Recovery Time	I_F = 30A V_R = 400V di/dt =200A/µs	T_j = 25°C		85		
			T_j = 125°C		160		
I_{RRM}	Maximum Reverse Recovery Current		T_j = 25°C		4		A
			T_j = 125°C		8		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		130		nC
			T_j = 125°C		700		
t_{rr}	Reverse Recovery Time	I_F = 30A V_R = 400V di/dt =1000A/µs	T_j = 125°C		70		ns
Q_{rr}	Reverse Recovery Charge				1300		nC
I_{RRM}	Maximum Reverse Recovery Current				30		A

Thermal and package characteristics

Symbol	Characteristic		Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance	MOSFET			0.33	°C/W
		Diode			1.21	
R_{thJA}	Junction to Ambient (IGBT & Diode)				20	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz		2500			V
T_J, T_{STG}	Storage Temperature Range		-55		150	°C
T_L	Max Lead Temp for Soldering:0.063" from case for 10 sec				300	
Torque	Mounting torque (Mounting = 8-32 or 4mm Machine and terminals = 4mm Machine)				1.5	N.m
Wt	Package Weight			29.2		g

Typical MOSFET Performance Curve

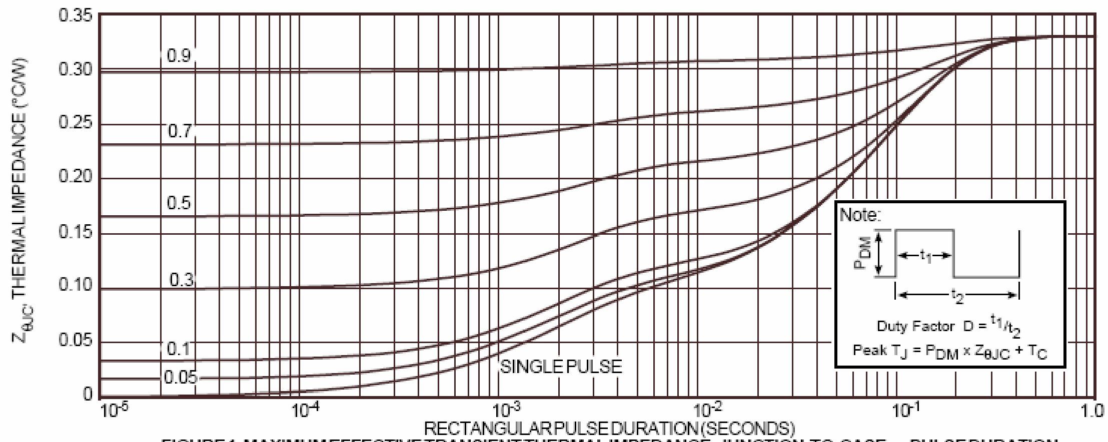


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

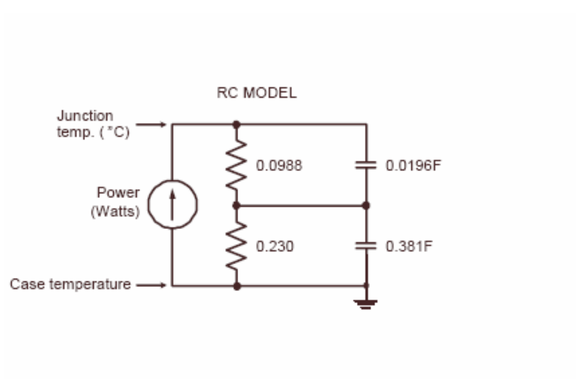


FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL

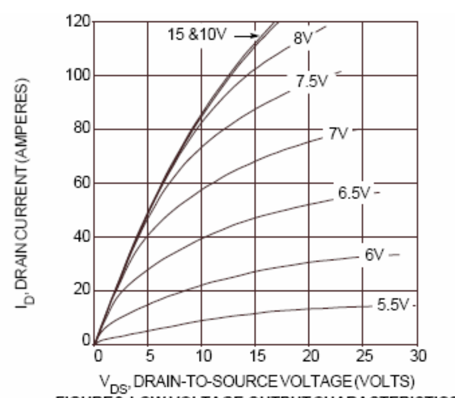


FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

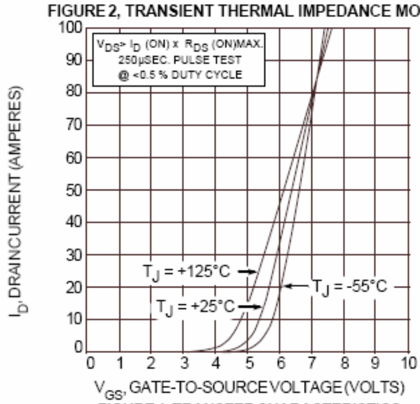


FIGURE 4, TRANSFER CHARACTERISTICS

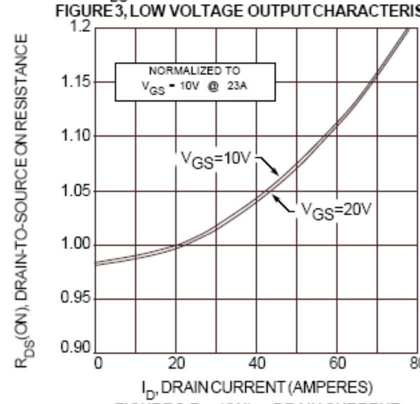


FIGURE 5, R_{DS}(ON) vs DRAIN CURRENT

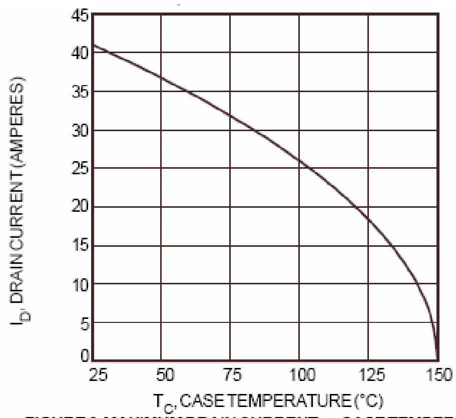


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

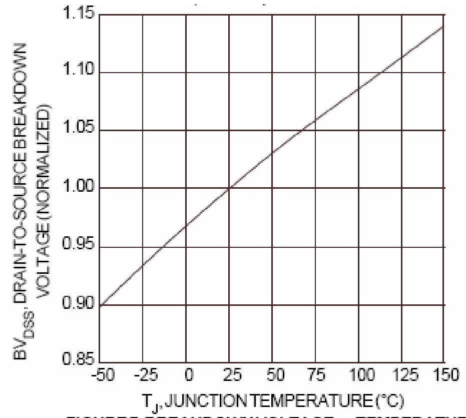


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

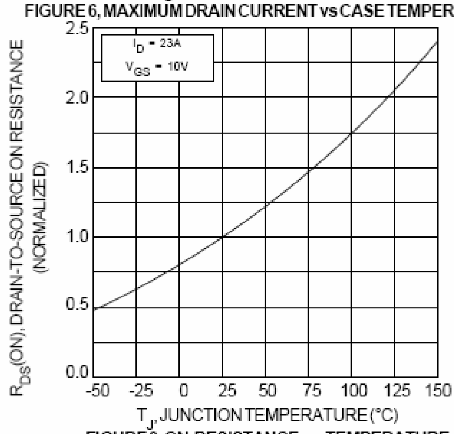


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

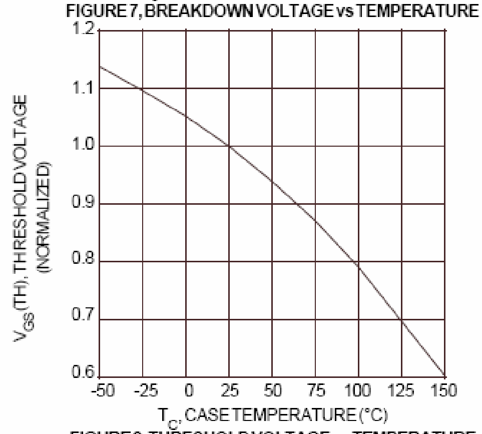


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

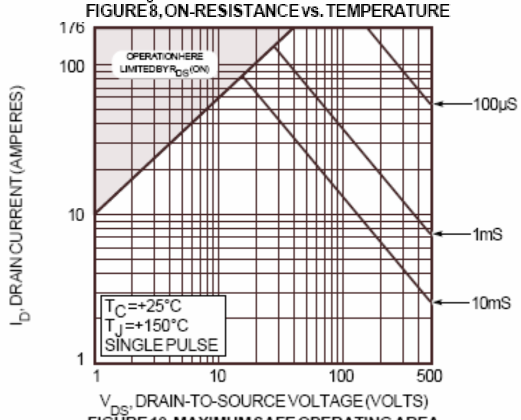


FIGURE 10, MAXIMUM SAFE OPERATING AREA

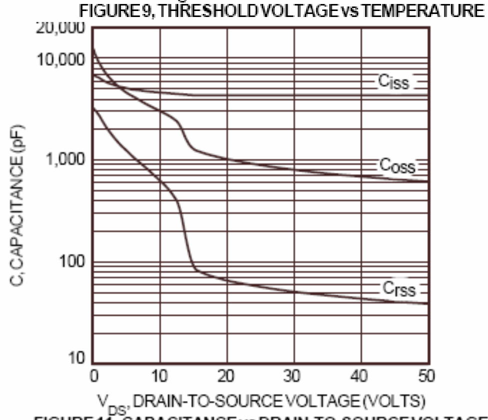


FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

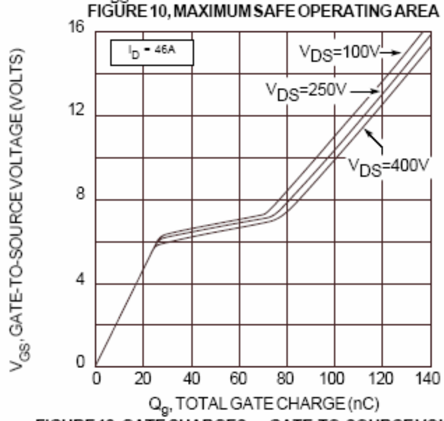


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

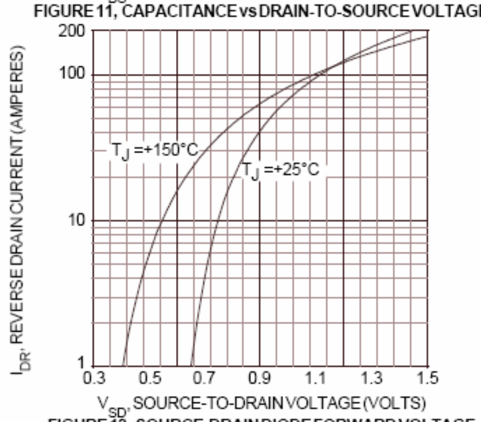


FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE

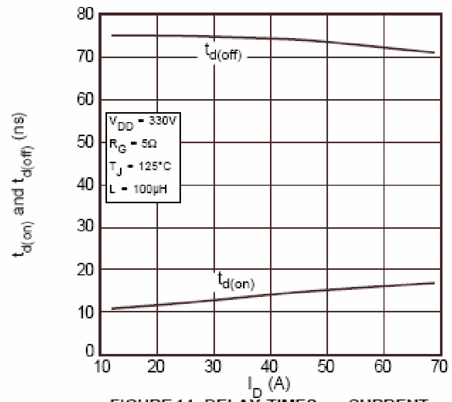


FIGURE 14, DELAY TIMES vs CURRENT

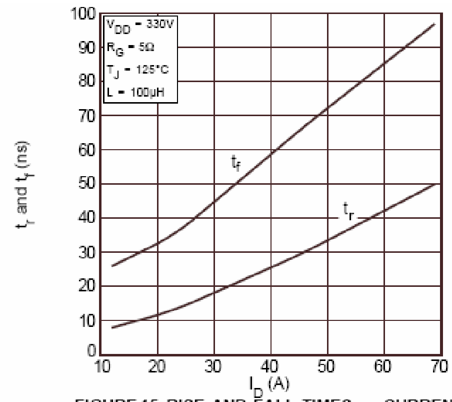


FIGURE 15, RISE AND FALL TIMES vs CURRENT

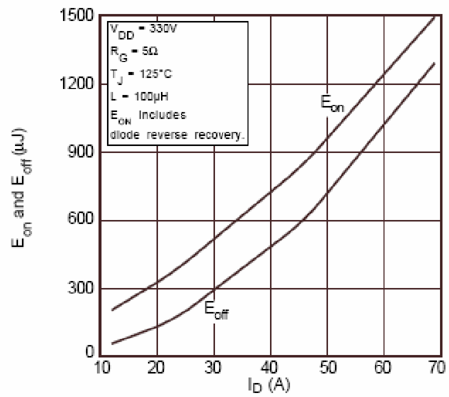


FIGURE 16, SWITCHING ENERGY vs CURRENT

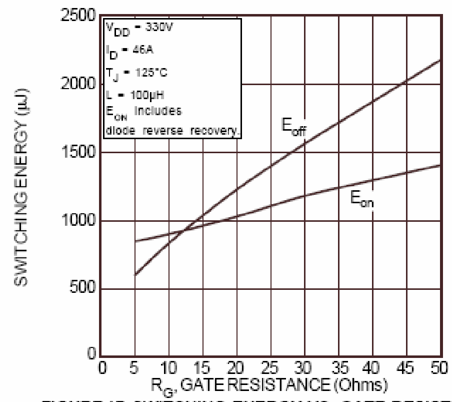


FIGURE 17, SWITCHING ENERGY VS. GATE RESISTANCE

Typical Diode Performance Curve

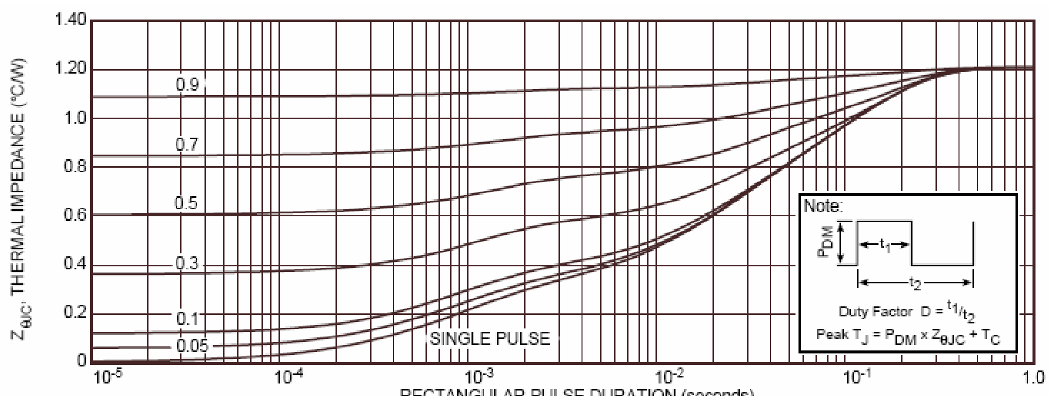


FIGURE 1a. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

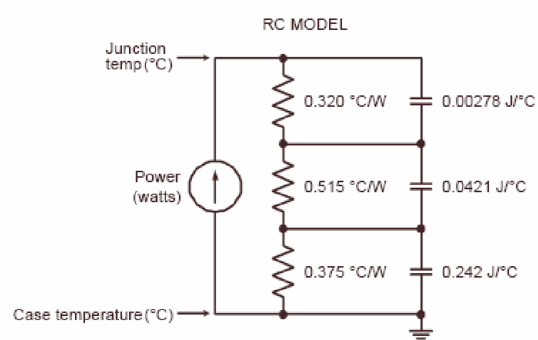


FIGURE 1b, TRANSIENT THERMAL IMPEDANCE MODEL

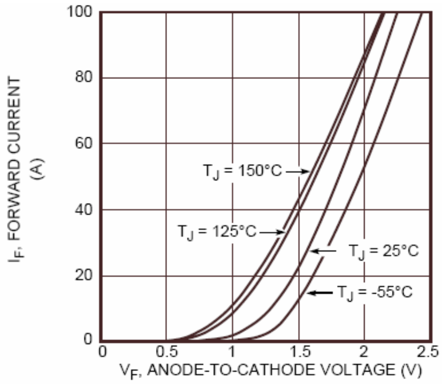


Figure 2. Forward Current *vs.* Forward Voltage

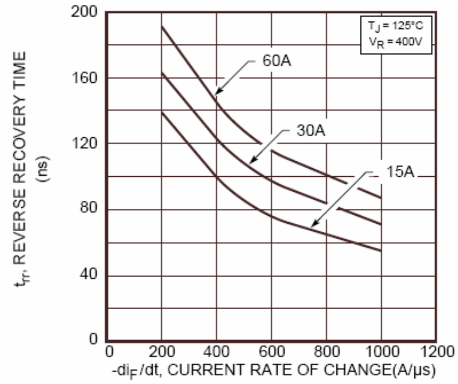


Figure 3. Reverse Recovery Time *vs.* Current Rate of Change

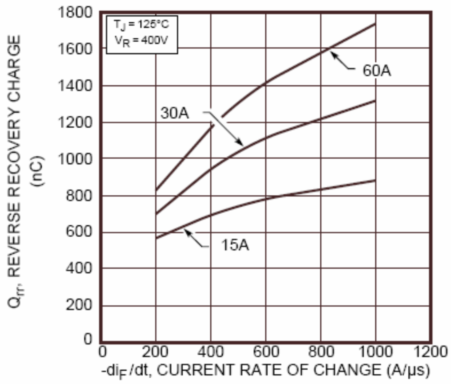


Figure 4. Reverse Recovery Charge *vs.* Current Rate of Change

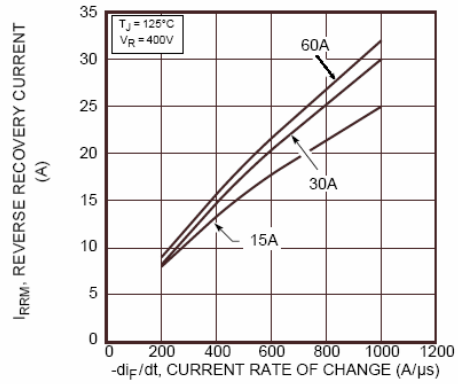


Figure 5. Reverse Recovery Current *vs.* Current Rate of Change

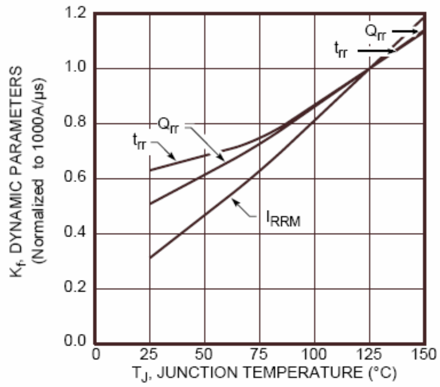


Figure 6. Dynamic Parameters *vs.* Junction Temperature

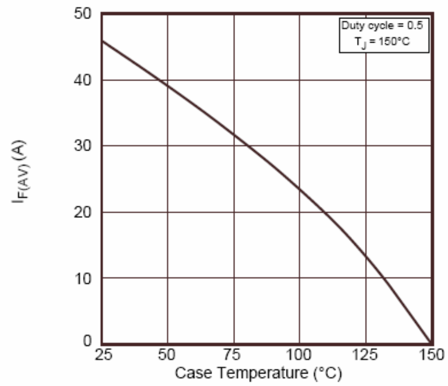


Figure 7. Maximum Average Forward Current *vs.* CaseTemperature

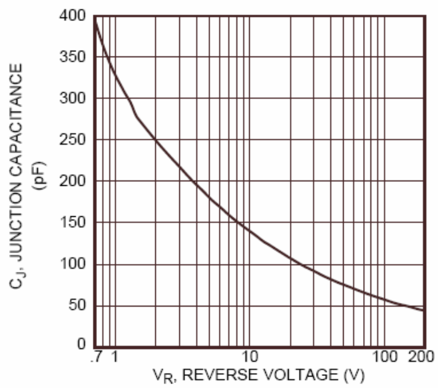


Figure 8. Junction Capacitance *vs.* Reverse Voltage

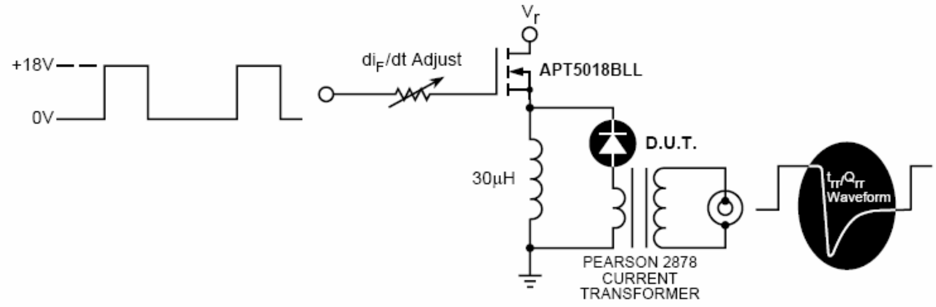


Figure 9. Diode Test Circuit

1. I_F - Forward Conduction Current
2. di_F/dt - Rate of Diode Current Change Through Zero Crossing.
3. I_{RRM} - Maximum Reverse Recovery Current.
4. t_{rr} - Reverse Recovery Time, measured from zero crossing where diode current goes from positive to negative, to the point at which the straight line through I_{RRM} and $0.25 \bullet I_{RRM}$ passes through zero.
5. Q_{rr} - Area Under the Curve Defined by I_{RRM} and t_{rr}.

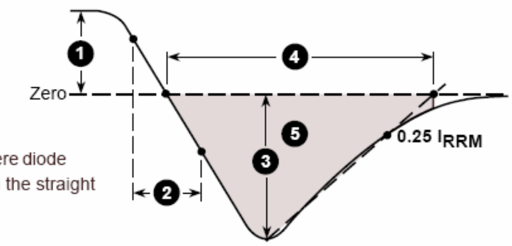
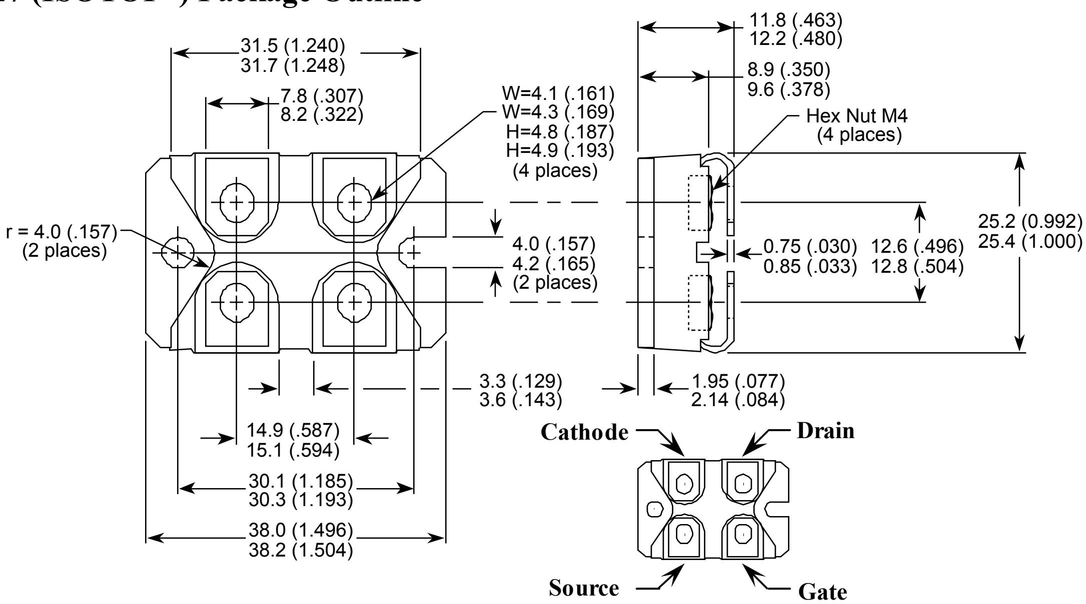


Figure 10, Diode Reverse Recovery Waveform and Definitions

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)

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