



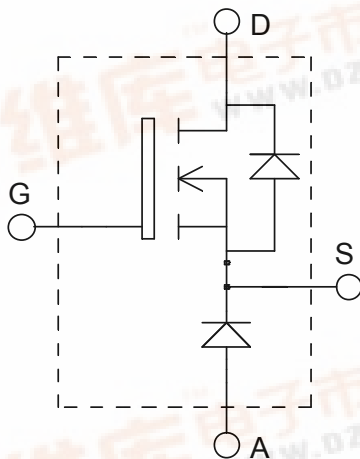
APT40N60JCU3

**ISOTOP[®] Buck chopper
Super Junction
MOSFET Power Module**

$V_{DSS} = 600V$

$R_{DSon} = 70m\Omega \text{ max @ } T_j = 25^{\circ}C$

$I_D = 40A \text{ @ } T_c = 25^{\circ}C$



Application

- AC and DC motor control
- Switched Mode Power Supplies

Features

- **COOLMOS[®]** Power Semiconductors
 - Ultra low R_{DSon}
 - Low Miller capacitance
 - Ultra low gate charge
 - Avalanche energy rated
- ISOTOP[®] Package (SOT-227)
- Very low stray inductance
- High level of integration

Benefits

- Outstanding performance at high frequency operation
- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive TC of V_{CEsat}



Absolute maximum ratings

Symbol	Parameter			Max ratings	Unit
V_{DSS}	Drain - Source Breakdown Voltage			600	V
I_D	Continuous Drain Current		$T_c = 25^{\circ}C$	40	A
			$T_c = 80^{\circ}C$	30	
I_{DM}	Pulsed Drain current			120	
V_{GS}	Gate - Source Voltage			± 20	V
R_{DSon}	Drain - Source ON Resistance			70	$m\Omega$
P_D	Maximum Power Dissipation		$T_c = 25^{\circ}C$	290	W
I_{AR}	Avalanche current (repetitive and non repetitive)			20	A
E_{AR}	Repetitive Avalanche Energy			1	mJ
E_{AS}	Single Pulse Avalanche Energy			1800	
I_{FAV}	Maximum Average Forward Current	Duty cycle=0.5	$T_c = 80^{\circ}C$	30	A
I_{FRMS}	RMS Forward Current (Square wave, 50% duty)			39	

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

All ratings @ $T_j = 25^\circ\text{C}$ unless otherwise specified

Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
BV_{DSS}	Drain - Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	600			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0V, V_{DS} = 600V, T_j = 25^\circ\text{C}$			25	μA
		$V_{GS} = 0V, V_{DS} = 600V, T_j = 125^\circ\text{C}$			250	
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10V, I_D = 20A$			70	$m\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1mA$	2.1	3	3.9	V
I_{GSS}	Gate – Source Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$			± 100	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1MHz$		7015		pF
C_{oss}	Output Capacitance			2565		
C_{rss}	Reverse Transfer Capacitance			212		
Q_g	Total gate Charge	$V_{GS} = 10V$ $V_{Bus} = 300V$ $I_D = 40A$		259		nC
Q_{gs}	Gate – Source Charge			29		
Q_{gd}	Gate – Drain Charge			111		
$T_{d(on)}$	Turn-on Delay Time	Resistive Switching $V_{GS} = 15V$ $V_{Bus} = 380V$ $I_D = 40A$ $R_G = 1.8\Omega$		20		ns
T_r	Rise Time			30		
$T_{d(off)}$	Turn-off Delay Time			115		
T_f	Fall Time			10		
Eon	Turn-on Switching Energy ❶	Inductive switching @ 25°C $V_{GS} = 15V, V_{Bus} = 400V$ $I_D = 40A, R_G = 5\Omega$		670		μJ
Eoff	Turn-off Switching Energy ❷			980		
Eon	Turn-on Switching Energy ❶	Inductive switching @ 125°C $V_{GS} = 15V, V_{Bus} = 400V$ $I_D = 40A, R_G = 5\Omega$		1100		μJ
Eoff	Turn-off Switching Energy ❷			1206		

❶ Eon includes diode reverse recovery

❷ In accordance with JEDEC standard JESD24-1.

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	T _j = 125°C		70	
Q _{rr}	Reverse Recovery Charge	V _R = 400V			1300		nC
I _{RRM}	Maximum Reverse Recovery Current	di/dt =1000A/μs			30		A

Thermal and package characteristics

Symbol	Characteristic		Min	Typ	Max	Unit
R_{thJC}	Junction to Case	CoolMos			0.43	$^\circ C/W$
		Diode			1.21	
R_{thJA}	Junction to Ambient (IGBT & Diode)				20	$^\circ C/W$
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	$^\circ C$
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 CoolMOS Performance Curve

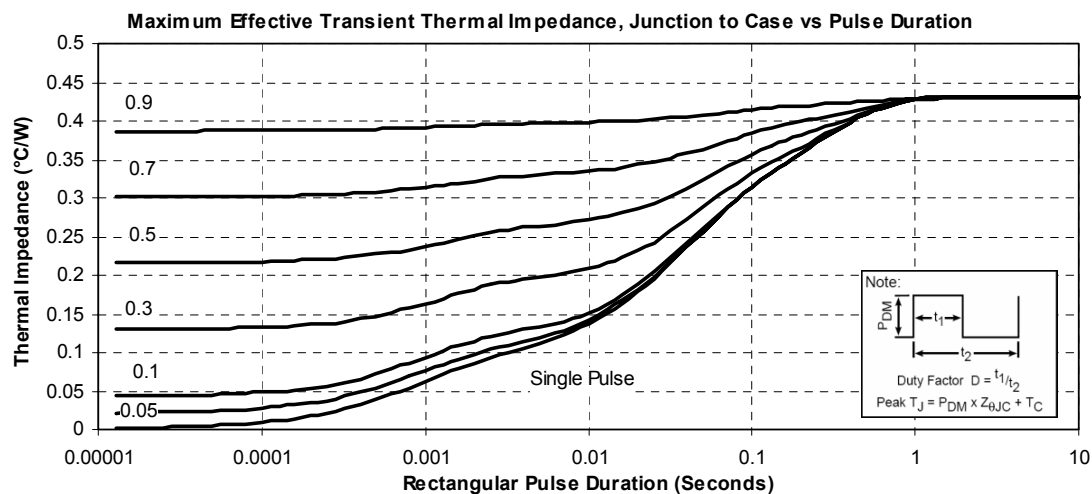


Fig 1, Maximum Effective transient thermal Impedance, Junction to case vs Pulse Duration

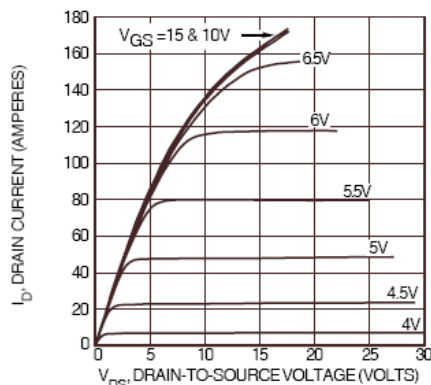


FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

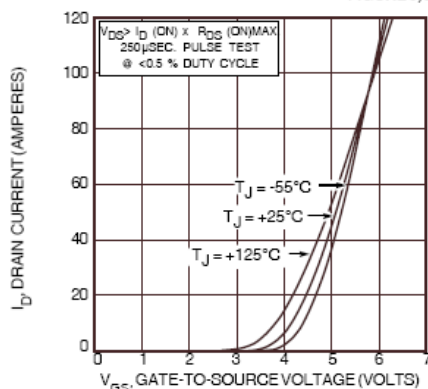


FIGURE 4, TRANSFER CHARACTERISTICS

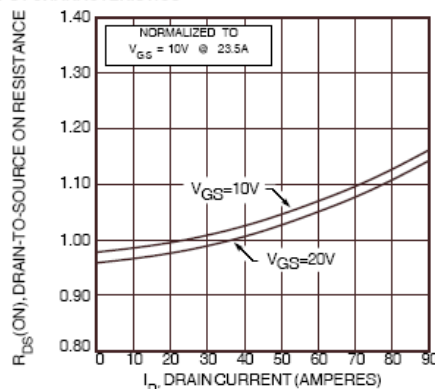


FIGURE 5, $R_{DS(ON)}$ vs DRAIN CURRENT

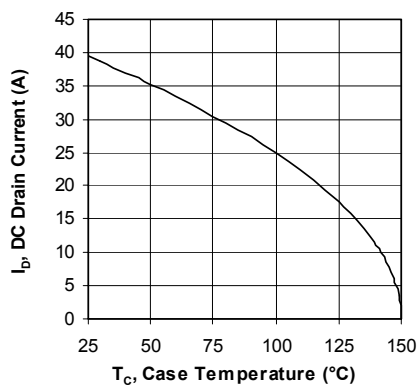


Figure 6, DC Drain Current vs Case Temperature

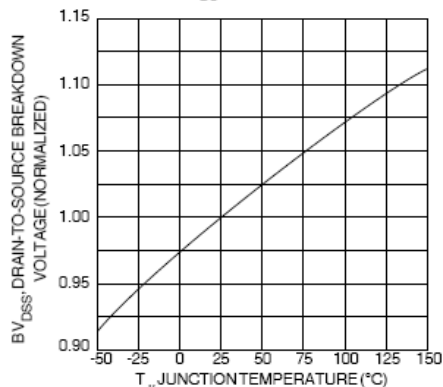


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

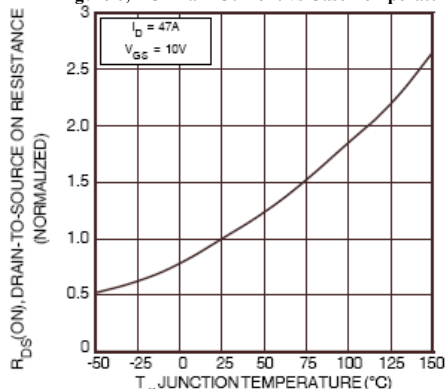


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

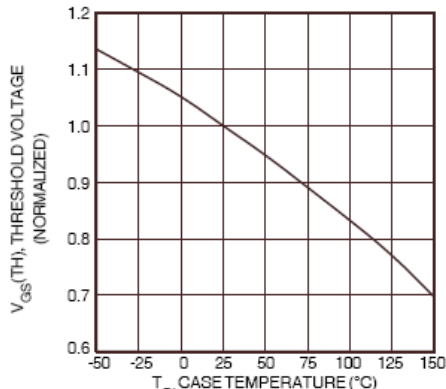


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

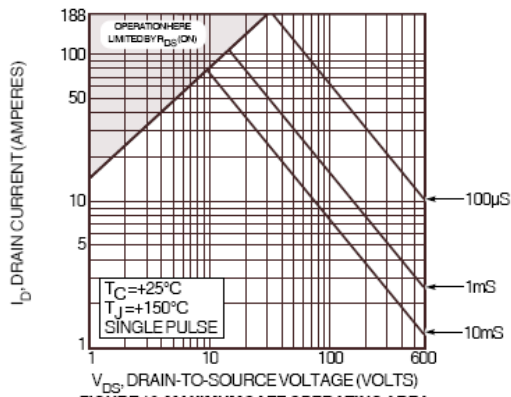


FIGURE 10, MAXIMUM SAFE OPERATING AREA

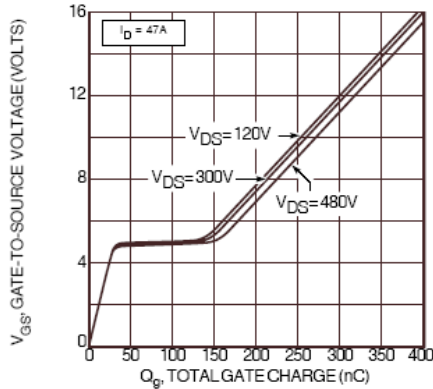


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

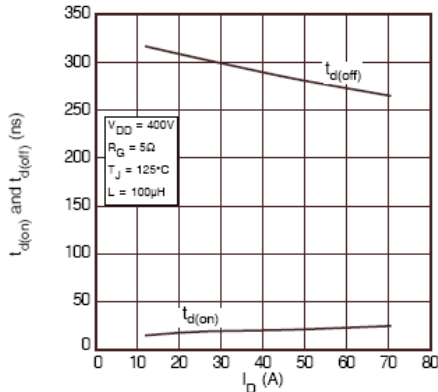


FIGURE 14, DELAY TIMES vs CURRENT

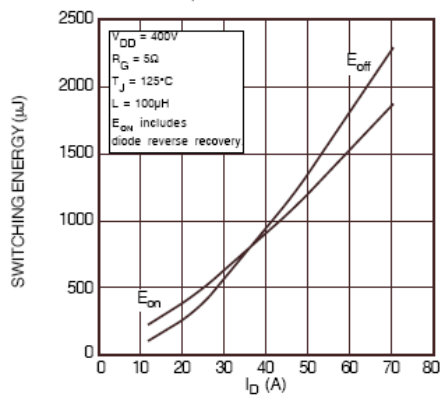


FIGURE 16, SWITCHING ENERGY vs CURRENT

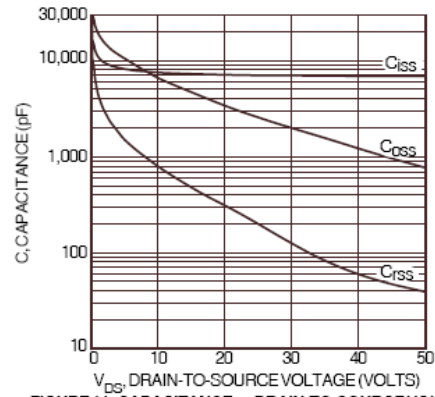


FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

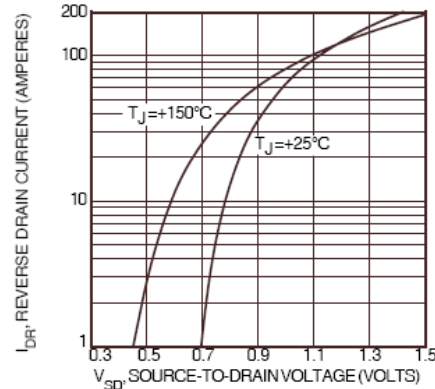


FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE

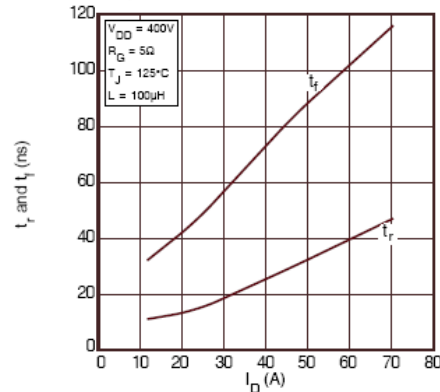


FIGURE 15, RISE AND FALL TIMES vs CURRENT

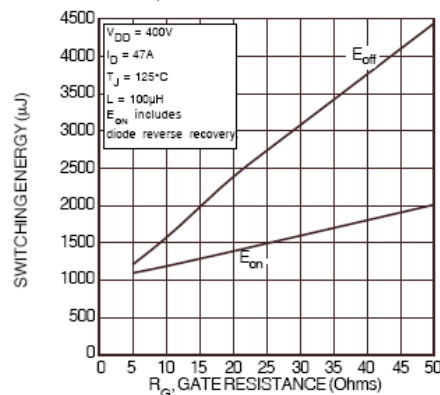


FIGURE 17, SWITCHING ENERGY vs. GATE RESISTANCE

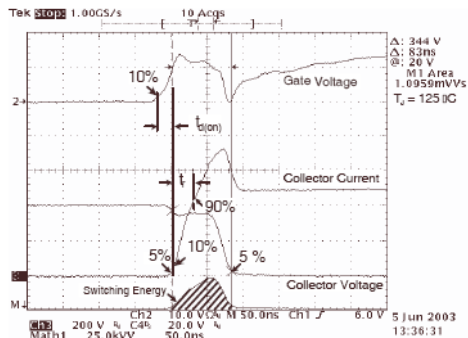


Figure 18, Turn-on Switching Waveforms and Definitions

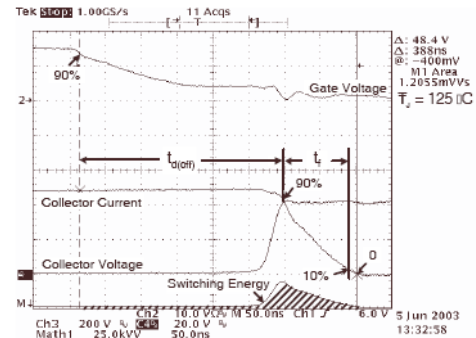


Figure 19, Turn-off Switching Waveforms and Definitions

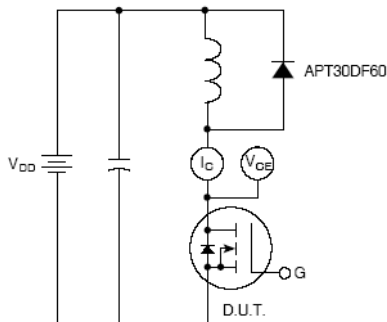


Figure 20, Inductive Switching Test Circuit

Typical Diode Performance Curve

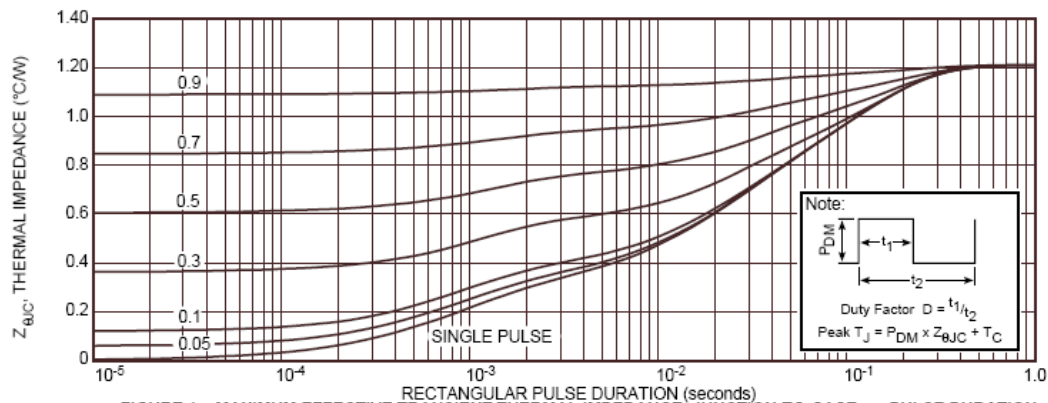


FIGURE 1a. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

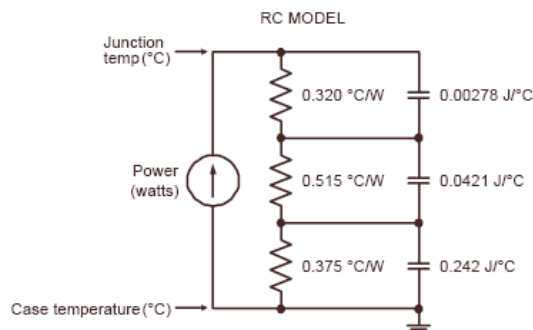


FIGURE 1b, TRANSIENT THERMAL IMPEDANCE MODEL

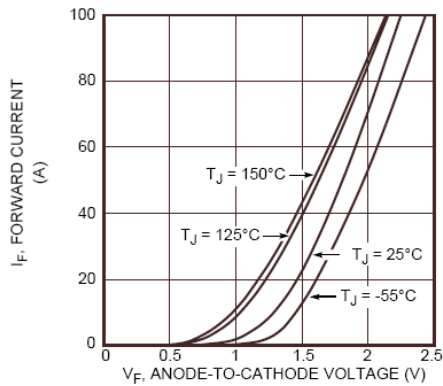


Figure 2. Forward Current vs. Forward Voltage

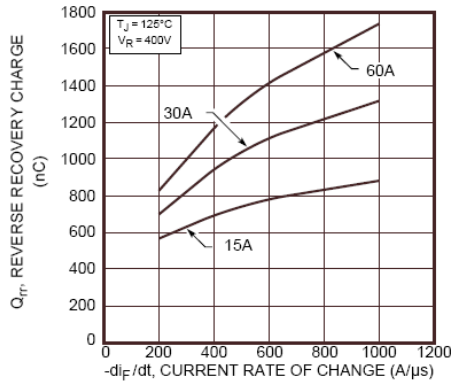


Figure 4. Reverse Recovery Charge vs. Current Rate of Change

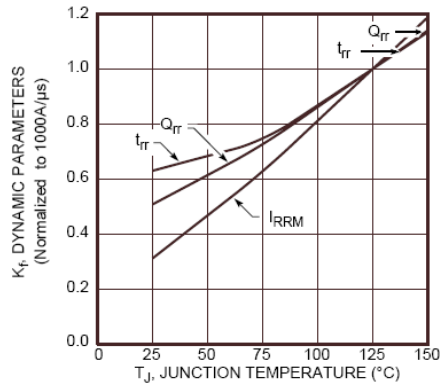


Figure 6. Dynamic Parameters vs. Junction Temperature

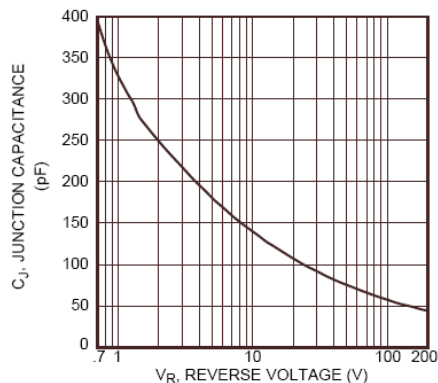


Figure 8. Junction Capacitance vs. Reverse Voltage

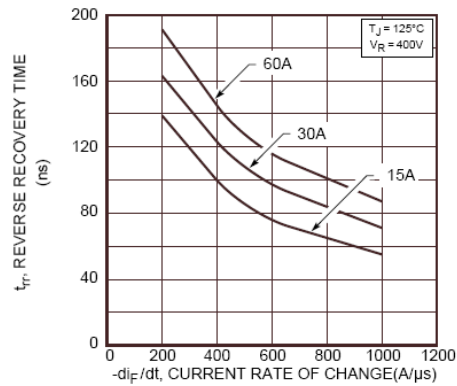


Figure 3. Reverse Recovery Time vs. Current Rate of Change

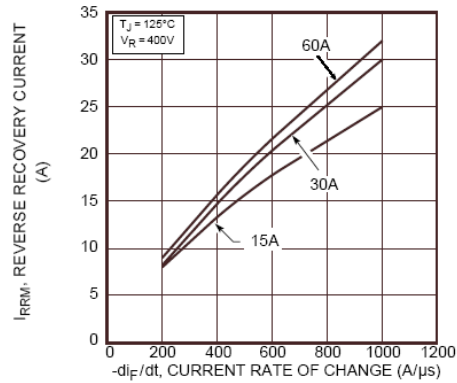


Figure 5. Reverse Recovery Current vs. Current Rate of Change

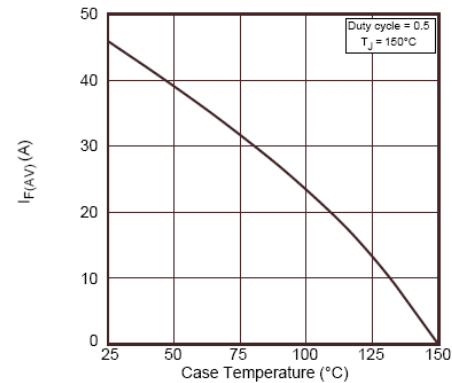


Figure 7. Maximum Average Forward Current vs. Case Temperature

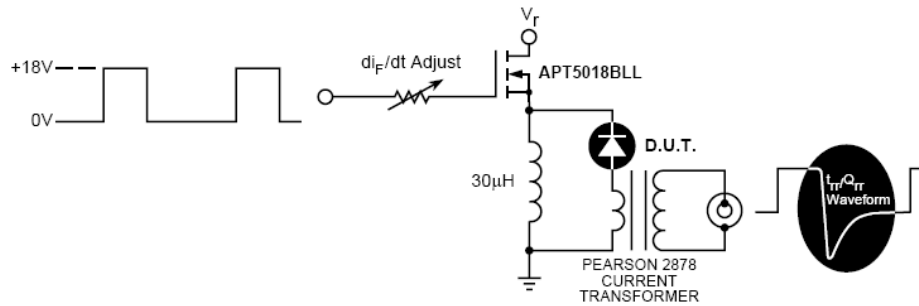


Figure 9. Diode Test Circuit

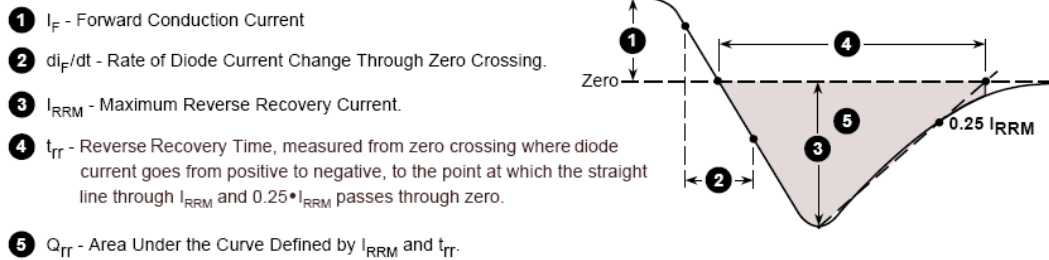
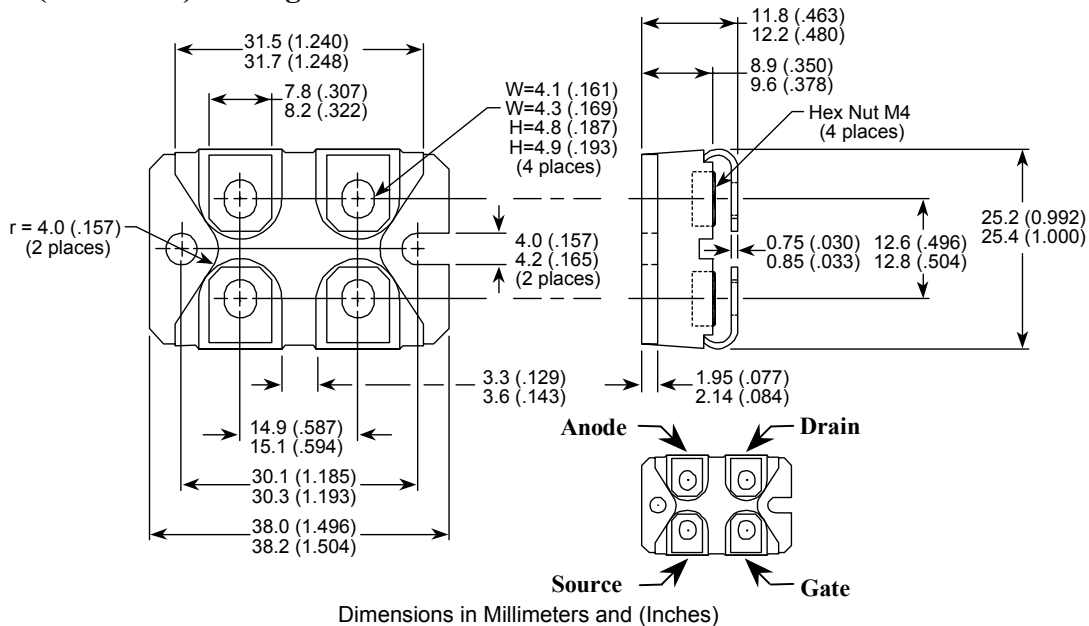


Figure 10. Diode Reverse Recovery Waveform and Definitions

SOT-227 (ISOTOP®) Package Outline



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APT's products are covered by one or more of U.S. patents 4,895,810 5,045,903 5,089,434 5,182,234 5,019,522 5,262,336 6,503,786 5,256,583 4,748,103 5,283,202 5,231,474 5,434,095 5,528,058 and foreign patents. U.S. and Foreign patents pending. All Rights Reserved.