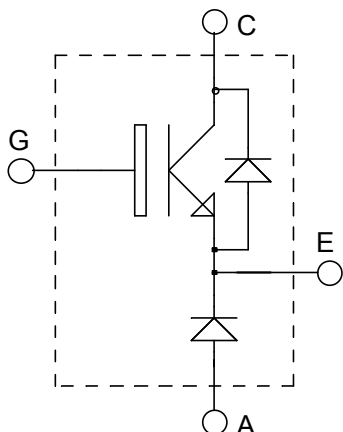


ISOTOP[®] Buck chopper NPT IGBT

$V_{CES} = 600V$
 $I_C = 30A @ T_c = 100^\circ C$



Application

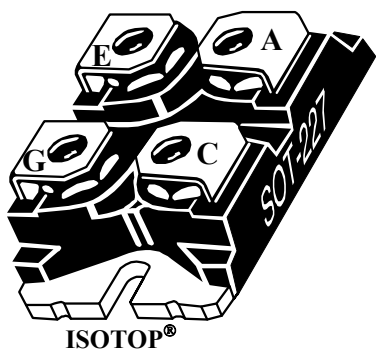
- AC and DC motor control
- Switched Mode Power Supplies

Features

- Non Punch Through (NPT) THUNDERBOLT IGBT
 - Low voltage drop
 - Low tail current
 - Switching frequency up to 100 kHz
 - Soft recovery parallel diodes
 - Low diode VF
 - Low leakage current
 - RBSOA and SCSOA 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 T_c of V_{CEsat}
- RoHS Compliant



Absolute maximum ratings

Symbol	Parameter			Max ratings	Unit
V _{CES}	Collector - Emitter Breakdown Voltage			600	V
I _{C1}	Continuous Collector Current		T _C = 25°C	58	A
I _{C2}			T _C = 100°C	30	
I _{CM}	Pulsed Collector Current		T _C = 25°C	110	
V _{GE}	Gate – Emitter Voltage			±20	V
P _D	Maximum Power Dissipation		T _C = 25°C	192	W
I _{LM}	RBSOA clamped Inductive load Current R _G =11Ω		T _C = 25°C	60	A
I _{FAV}	Maximum Average Forward Current	Duty cycle=0.5	T _C = 80°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
I_{CES}	Zero Gate Voltage Collector Current	$V_{GE} = 0\text{V}$ $V_{CE} = 600\text{V}$	$T_j = 25^\circ\text{C}$ $T_j = 125^\circ\text{C}$		40 1000	μA
$V_{CE(sat)}$	Collector Emitter saturation Voltage	$V_{GE} = 15\text{V}$ $I_C = 30\text{A}$	$T_j = 25^\circ\text{C}$ $T_j = 125^\circ\text{C}$	2.0 2.2	2.5 2.8	V
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE3}$, $I_C = 700\mu\text{A}$	3	4	5	V
I_{GES}	Gate – Emitter Leakage Current	$V_{GE} = \pm 20\text{V}$, $V_{CE} = 0\text{V}$			± 100	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	$V_{GE} = 0\text{V}$		1600	1850	pF
C_{oes}	Output Capacitance	$V_{CE} = 25\text{V}$		150	220	
C_{res}	Reverse Transfer Capacitance	$f = 1\text{MHz}$		90	150	
Q_g	Total gate Charge	$V_{GS} = 15\text{V}$		140	210	nC
Q_{ge}	Gate – Emitter Charge	$V_{Bus} = 300\text{V}$		10	15	
Q_{gc}	Gate – Collector Charge	$I_C = 30\text{A}$		60	90	
$T_{d(on)}$	Turn-on Delay Time	Resistive Switching (25°C)		13	26	ns
T_r	Rise Time	$V_{GE} = 15\text{V}$		41	80	
$T_{d(off)}$	Turn-off Delay Time	$V_{Bus} = 300\text{V}$		147	220	
T_f	Fall Time	$I_C = 30\text{A}$ $R_G = 10\Omega$		200	400	
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C)		17	30	ns
T_r	Rise Time	$V_{GE} = 15\text{V}$		28	60	
$T_{d(off)}$	Turn-off Delay Time	$V_{Bus} = 400\text{V}$		242	360	
T_f	Fall Time	$I_C = 30\text{A}$ $R_G = 10\Omega$		34	70	
E_{ts}	Total switching Losses			1.2	2	mJ
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (150°C)		15	30	ns
T_r	Rise Time	$V_{GE} = 15\text{V}$		27	50	
$T_{d(off)}$	Turn-off Delay Time	$V_{Bus} = 400\text{V}$		265	400	
T_f	Fall Time	$I_C = 30\text{A}$ $R_G = 10\Omega$		41	80	
E_{on}	Turn-on Switching Energy			0.5	1	mJ
E_{off}	Turn-off Switching Energy			1	2	
E_{ts}	Total switching Losses			1.5	3	

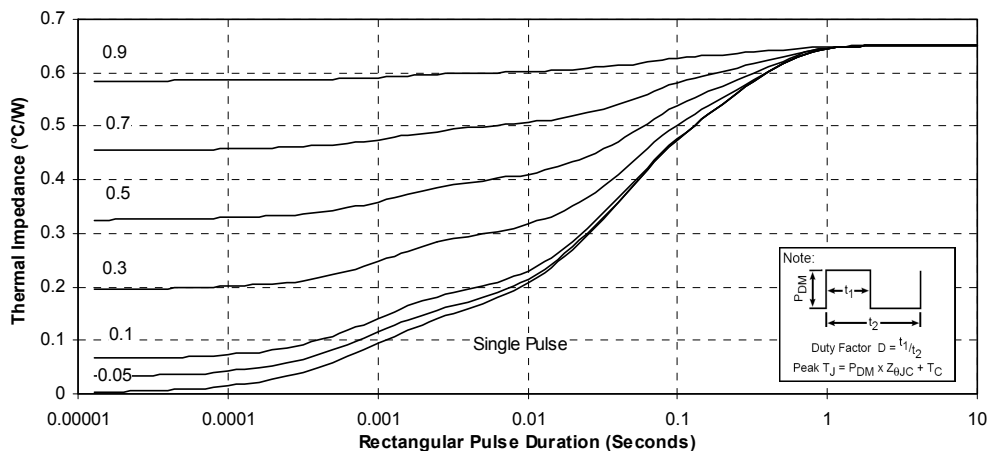
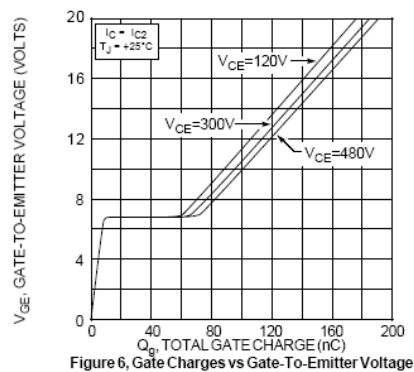
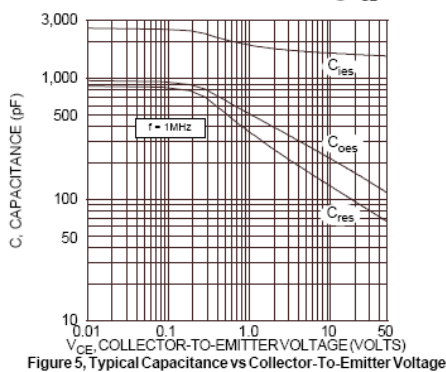
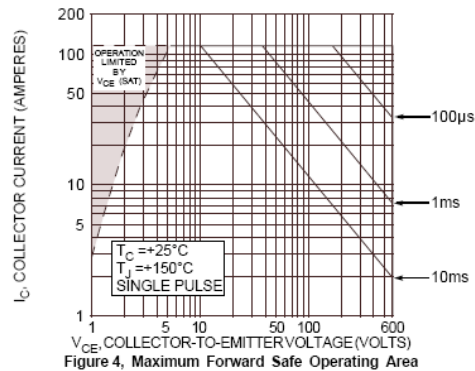
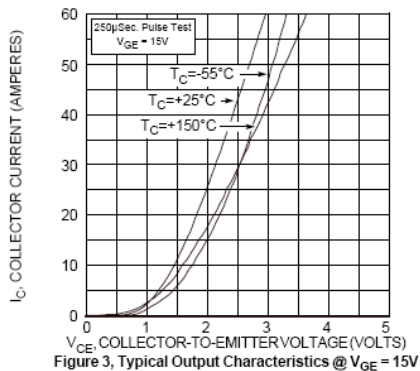
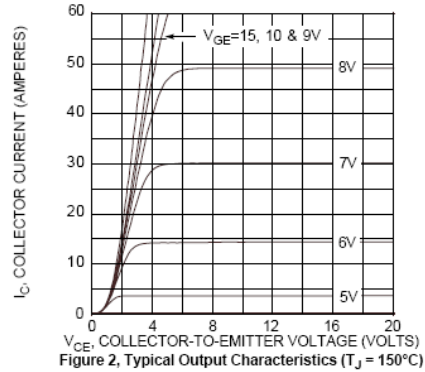
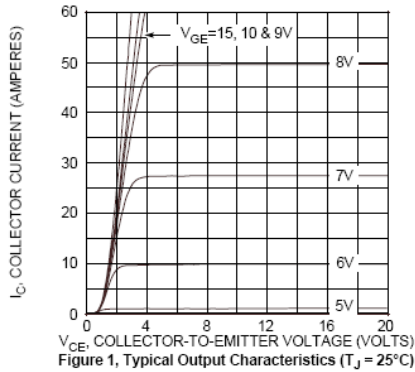
Chopper diode ratings and characteristics

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		
		$I_F = 30A$ $T_j = 125^\circ C$		1.4		
I_{RM}	Maximum Reverse Leakage Current	$V_R = 600V$ $T_j = 25^\circ C$			250	μA
		$V_R = 600V$ $T_j = 125^\circ C$			500	
C_T	Junction Capacitance	$V_R = 200V$		44		pF
t_{rr}	Reverse Recovery Time	$I_F = 1A, V_R = 30V$ $di/dt = 100A/\mu s$ $T_j = 25^\circ C$		23		ns
	Reverse Recovery Time	$T_j = 25^\circ C$		85		
		$T_j = 125^\circ C$		160		
I_{RRM}	Maximum Reverse Recovery Current	$I_F = 30A$ $V_R = 400V$ $di/dt = 200A/\mu s$ $T_j = 25^\circ C$		4		A
		$T_j = 125^\circ C$		8		
Q_{rr}	Reverse Recovery Charge	$T_j = 25^\circ C$		130		nC
		$T_j = 125^\circ C$		700		
t_{rr}	Reverse Recovery Time	$I_F = 30A$		70		ns
Q_{rr}	Reverse Recovery Charge	$V_R = 400V$		1300		nC
I_{RRM}	Maximum Reverse Recovery Current	$di/dt = 1000A/\mu s$		30		A

Thermal and package characteristics

Symbol	Characteristic		Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance	IGBT			0.65	$^\circ C/W$
		Diode			1.21	
R_{thJA}	Junction to Ambient (IGBT & Diode)				20	
V_{ISOL}	RMS Isolation Voltage, any terminal to case $t = 1$ min, 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 IGBT Performance Curve



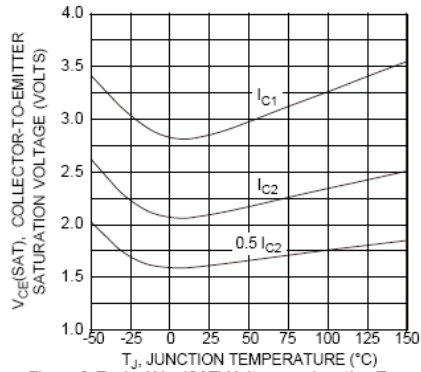


Figure 8, Typical $V_{CE(SAT)}$ Voltage vs Junction Temperature

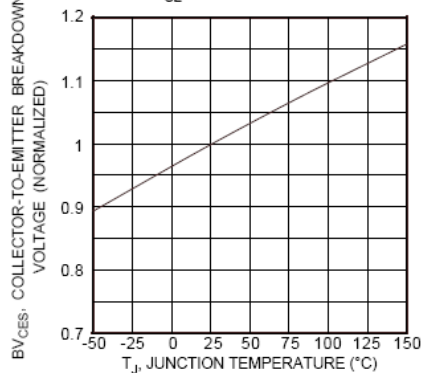


Figure 10, Breakdown Voltage vs Junction Temperature

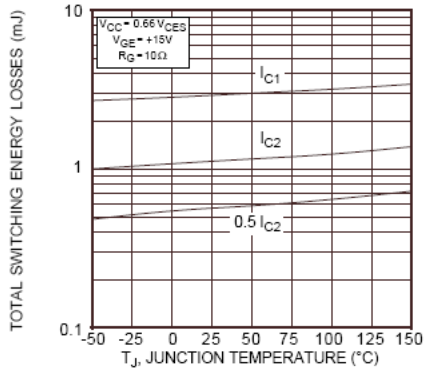


Figure 12, Typical Switching Energy Losses vs. Junction Temperature

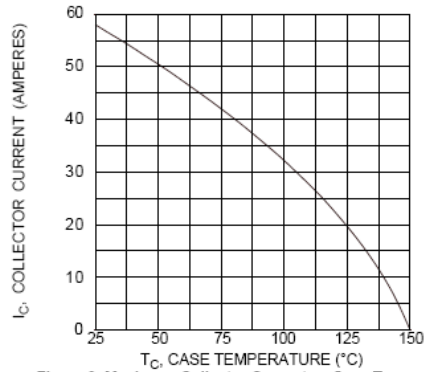


Figure 9, Maximum Collector Current vs Case Temperature

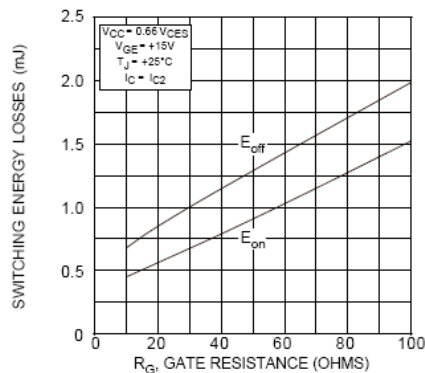


Figure 11, Typical Switching Energy Losses vs Gate Resistance

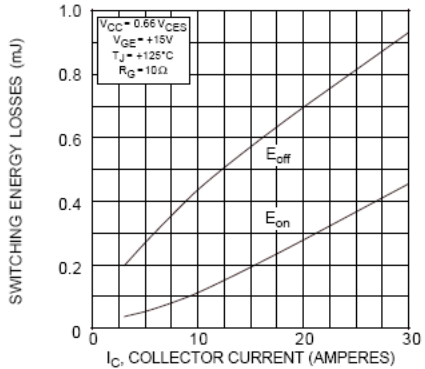


Figure 13, Typical Switching Energy Losses vs Collector Current

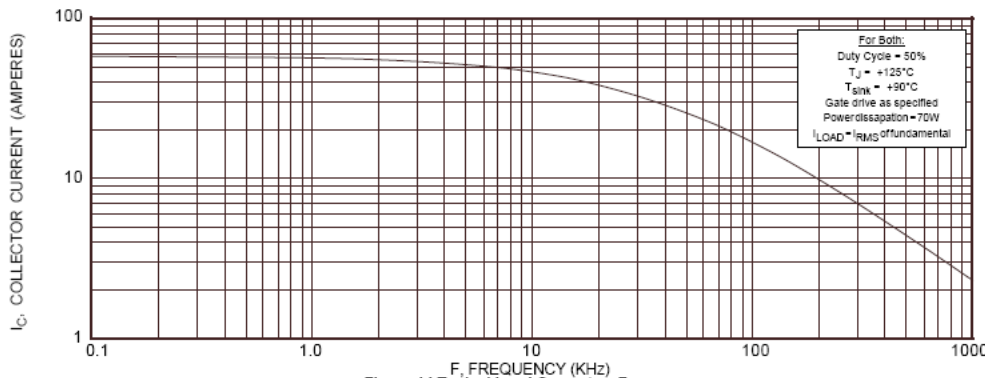


Figure 14, Typical Load Current vs Frequency

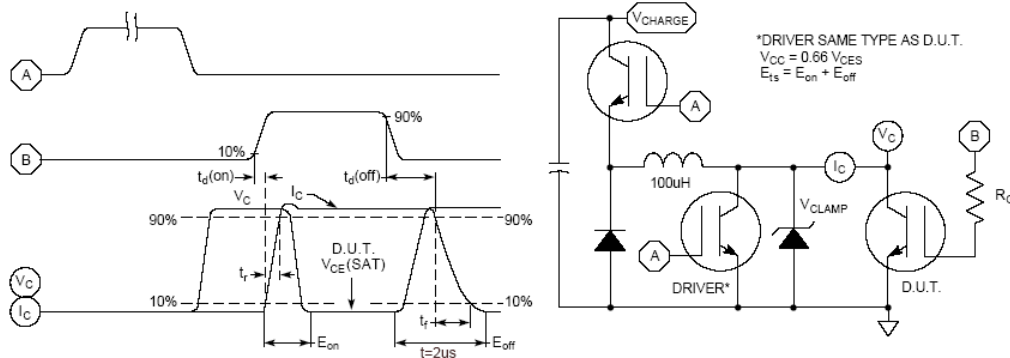


Figure 15, Switching Loss Test Circuit and Waveforms

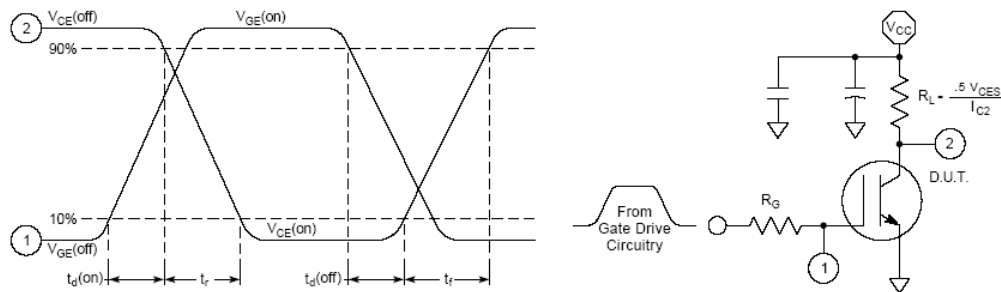


Figure 16, Resistive Switching Time Test Circuit and Waveforms

Typical Diode Performance Curve

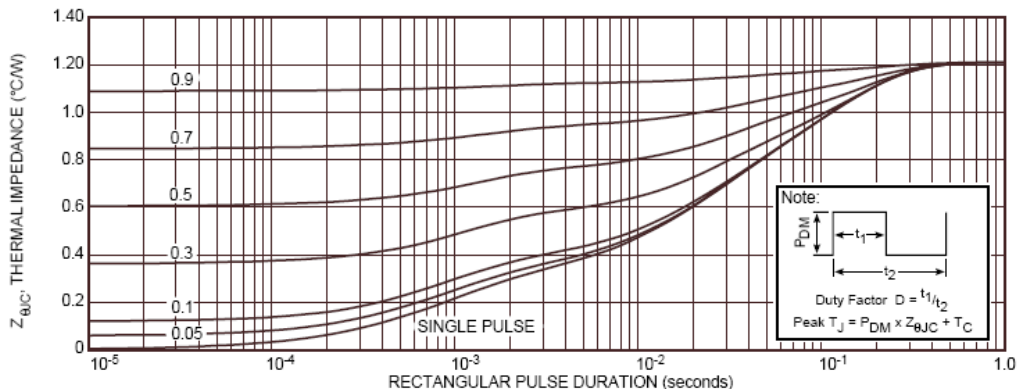


FIGURE 1a. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

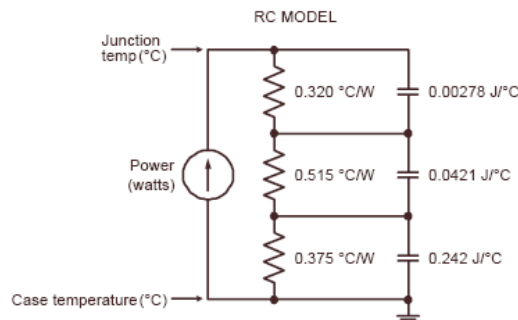


FIGURE 1b, TRANSIENT THERMAL IMPEDANCE MODEL

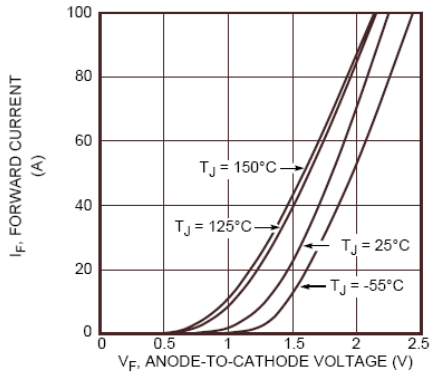


Figure 2. Forward Current vs. Forward Voltage

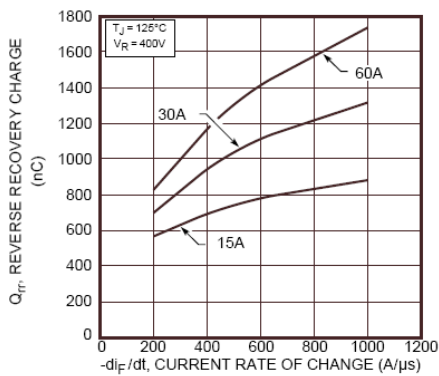


Figure 4. Reverse Recovery Charge vs. Current Rate of Change

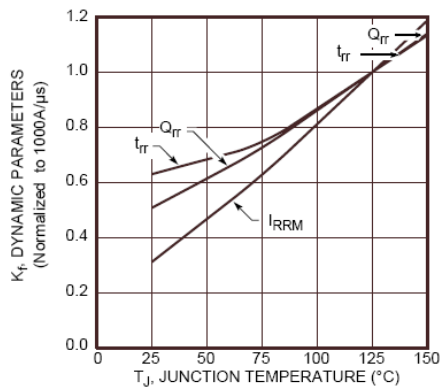


Figure 6. Dynamic Parameters vs. Junction Temperature

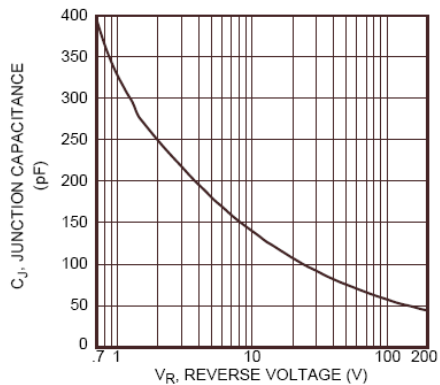


Figure 8. Junction Capacitance vs. Reverse Voltage

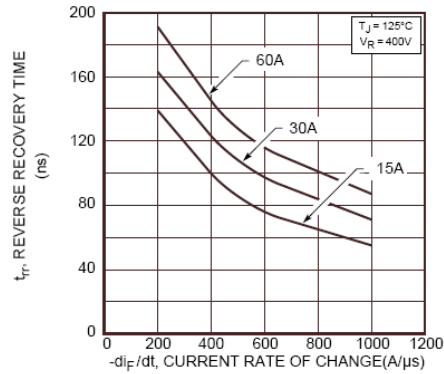


Figure 3. Reverse Recovery Time vs. Current Rate of Change

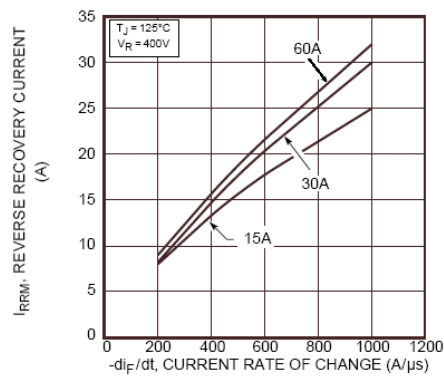


Figure 5. Reverse Recovery Current vs. Current Rate of Change

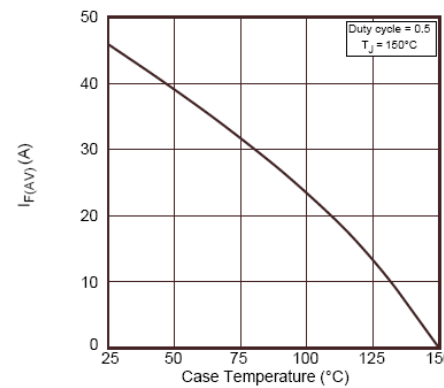


Figure 7. Maximum Average Forward Current vs. Case Temperature

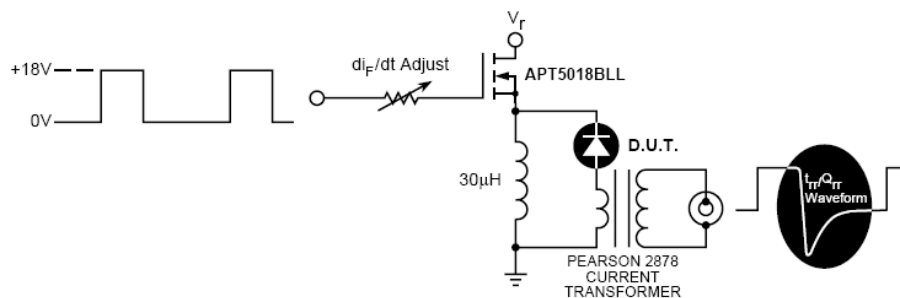


Figure 9. Diode Test Circuit

- 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 $0.25 \cdot I_{RRM}$ passes through zero.
- 5 Q_{rr} - Area Under the Curve Defined by I_{RRM} and t_{rr} .

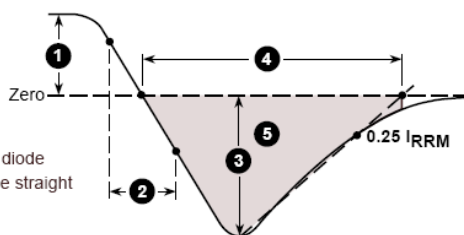
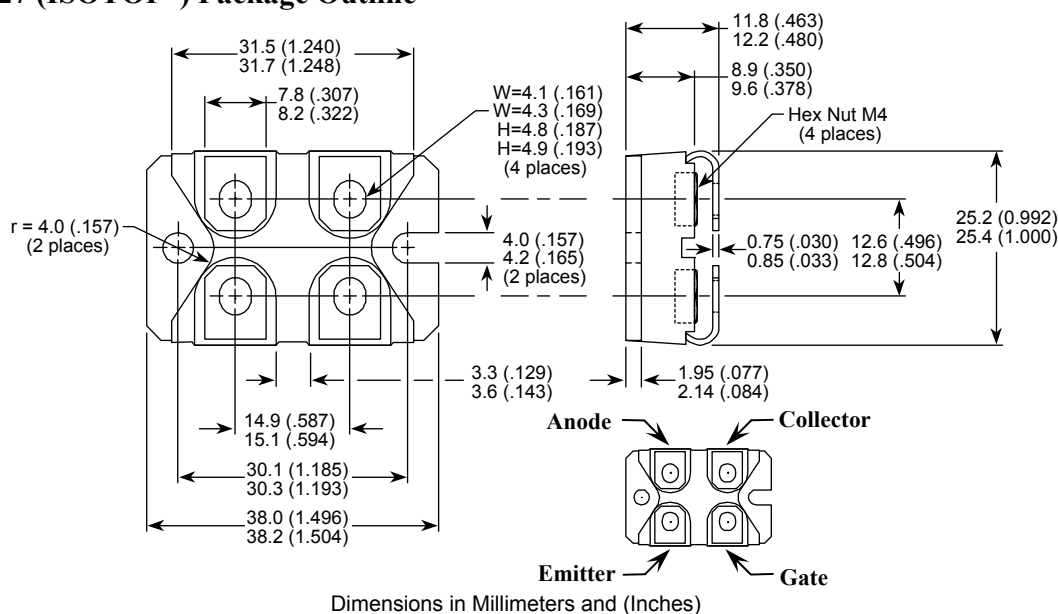


Figure 10, Diode Reverse Recovery Waveform and Definitions

SOT-227 (ISOTOP[®]) Package Outline



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