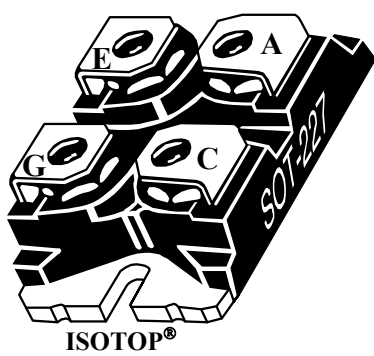
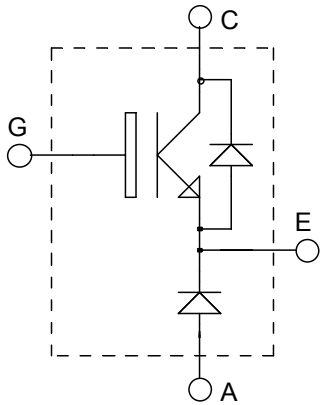


ISOTOP[®] Buck chopper NPT IGBT

V_{CES} = 600V
I_C = 100A @ T_c = 80°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	120	
I _{C2}		T _C = 80°C	100	
I _{CM}	Pulsed Collector Current	T _C = 25°C	320	
V _{GE}	Gate - Emitter Voltage	±20	V	
P _D	Maximum Power Dissipation	T _C = 25°C	416	
IF _{AV}	Maximum Average Forward Current	Duty cycle=0.5	T _C = 80°C	30
IF _{RMS}	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	$V_{GE} = 0\text{V}$ $V_{CE} = 600\text{V}$	$T_j = 25^\circ\text{C}$		100	μA
			$T_j = 125^\circ\text{C}$		1000	
$V_{CE(sat)}$	Collector Emitter saturation Voltage	$V_{GE} = 15\text{V}$ $I_C = 100\text{A}$	$T_j = 25^\circ\text{C}$	2.0	2.5	V
			$T_j = 125^\circ\text{C}$	2.2		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}, I_C = 1\text{mA}$	3		5	V
I_{GES}	Gate – Emitter Leakage Current	$V_{GE} = \pm 20\text{V}, V_{CE} = 0\text{V}$			± 150	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit	
C_{ies}	Input Capacitance	$V_{GE} = 0\text{V}$ $V_{CE} = 25\text{V}$ $f = 1\text{MHz}$		4300		pF	
C_{oes}	Output Capacitance			470			
C_{res}	Reverse Transfer Capacitance			400			
Q_g	Total gate Charge	$V_{GS} = 15\text{V}$ $V_{Bus} = 300\text{V}$ $I_C = 100\text{A}$		330		nC	
Q_{ge}	Gate – Emitter Charge			290			
Q_{gc}	Gate – Collector Charge			200			
$T_{d(on)}$	Turn-on Delay Time	Resistive Switching (25°C) $V_{GE} = 15\text{V}$ $V_{Bus} = 400\text{V}$ $I_C = 100\text{A}$ $R_G = 5\Omega$		26		ns	
T_r	Rise Time			25			
$T_{d(off)}$	Turn-off Delay Time			150			
T_f	Fall Time			30			
E_{on}	Turn-on Switching Energy			3.35			mJ
E_{off}	Turn off Switching Energy			2.85			
$T_{d(on)}$	Turn-on Delay Time		Inductive Switching (125°C) $V_{GE} = 15\text{V}$ $V_{Bus} = 400\text{V}$ $I_C = 100\text{A}$ $R_G = 5\Omega$		26		
T_r	Rise Time			25			
$T_{d(off)}$	Turn-off Delay Time			170			
T_f	Fall Time			40			
E_{on}	Turn-on Switching Energy			4.3		mJ	
E_{off}	Turn-off Switching Energy			3.5			

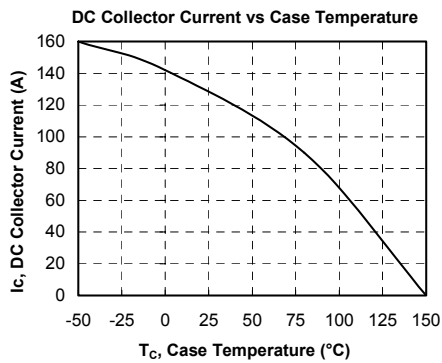
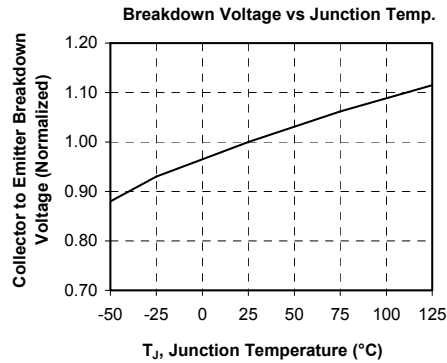
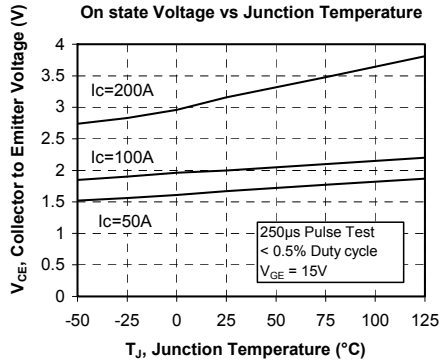
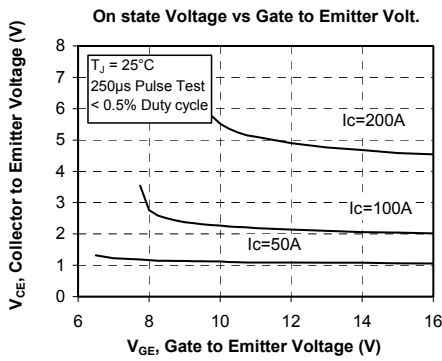
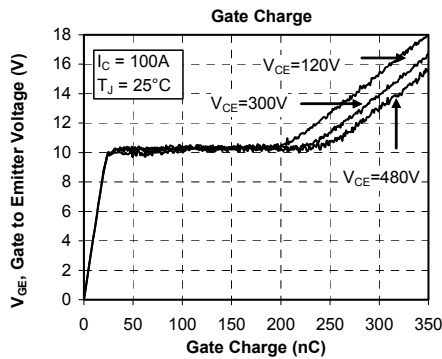
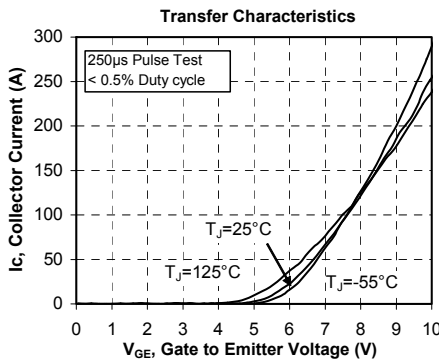
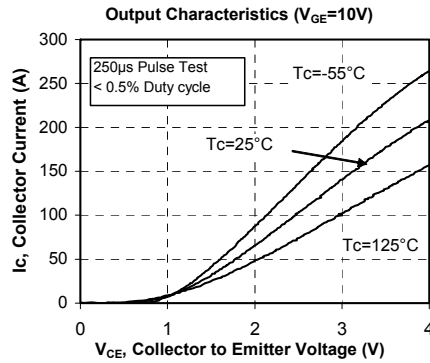
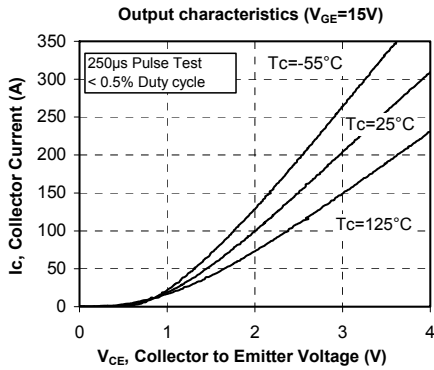
Chopper diode ratings and characteristics

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
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		T _j = 25°C		85	
			T _j = 125°C		160	
I _{RRM}	Maximum Reverse Recovery Current	I _F = 30A V _R = 400V di/dt =200A/μs	T _j = 25°C		4	A
			T _j = 125°C		8	
			T _j = 25°C		130	
Q _{rr}	Reverse Recovery Charge		T _j = 25°C		700	nC
			T _j = 125°C			
t _{rr}	Reverse Recovery Time	I _F = 30A	T _j = 125°C		70	ns
Q _{rr}	Reverse Recovery Charge	V _R = 400V			1300	nC
I _{RRM}	Maximum Reverse Recovery Current	di/dt =1000A/μs			30	A

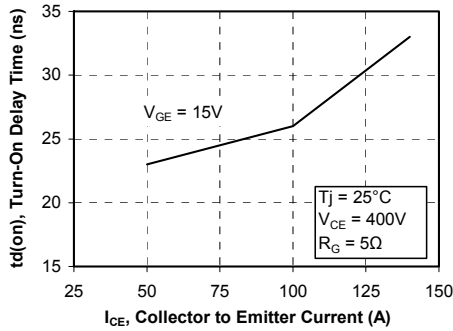
Thermal and package characteristics

<i>Symbol</i>	<i>Characteristic</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
R _{thJC}	Junction to Case Thermal Resistance	IGBT		0.3	°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	°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

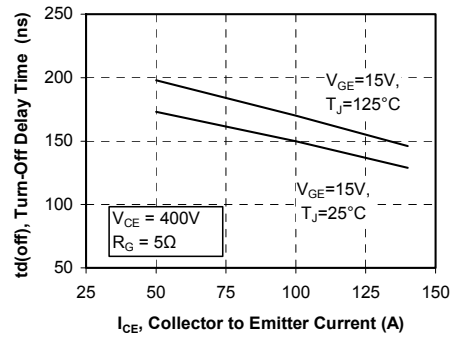
Typical IGBT Performance Curve



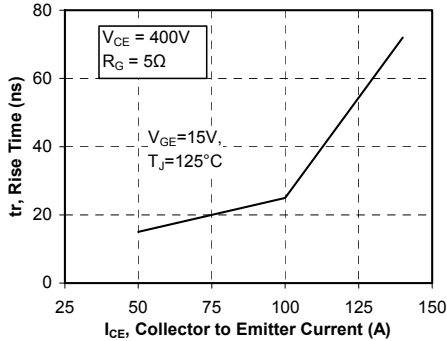
Turn-On Delay Time vs Collector Current



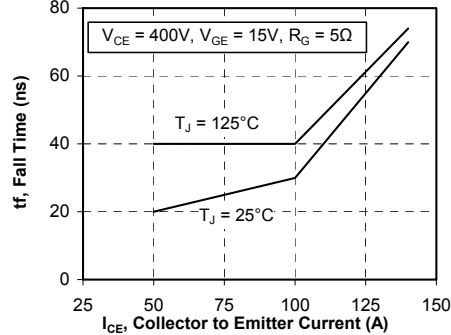
Turn-Off Delay Time vs Collector Current



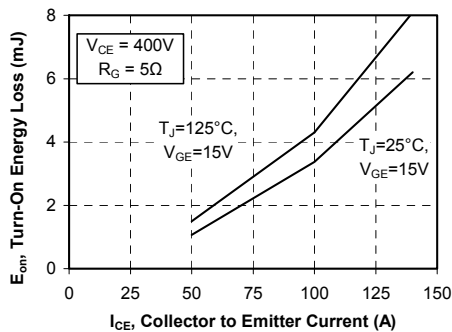
Current Rise Time vs Collector Current



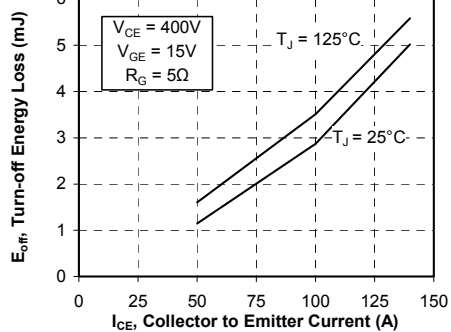
Current Fall Time vs Collector Current



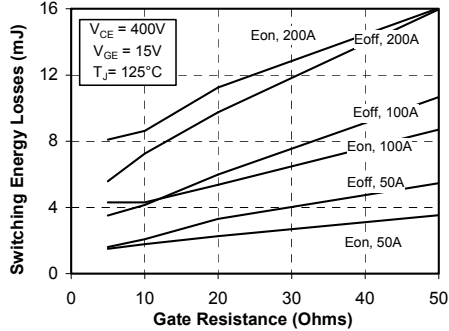
Turn-On Energy Loss vs Collector Current



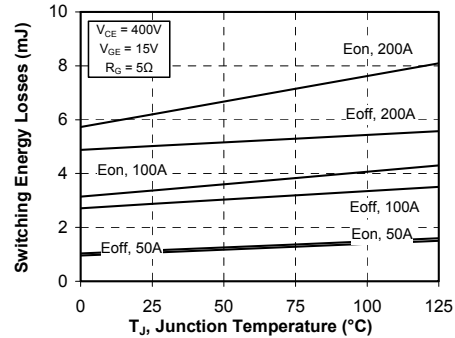
Turn-Off Energy Loss vs Collector Current

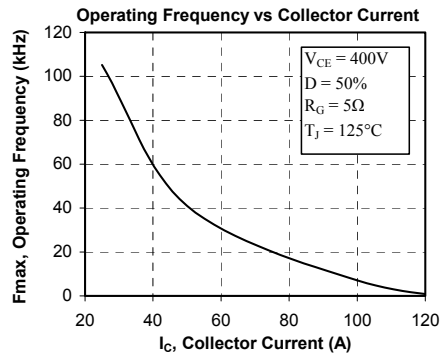
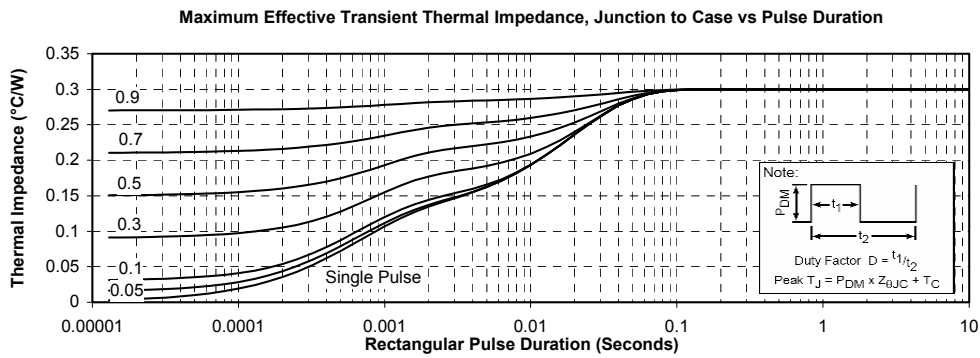
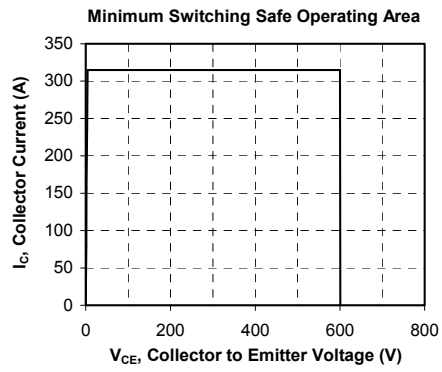
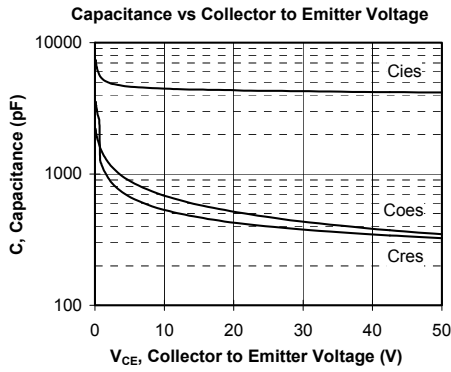


Switching Energy Losses vs Gate Resistance



Switching Energy Losses vs Junction Temp.





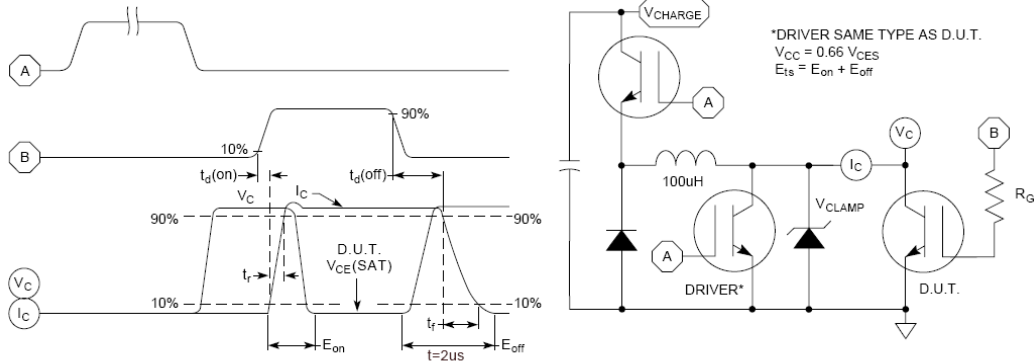


Figure 15, Switching Loss Test Circuit and Waveforms

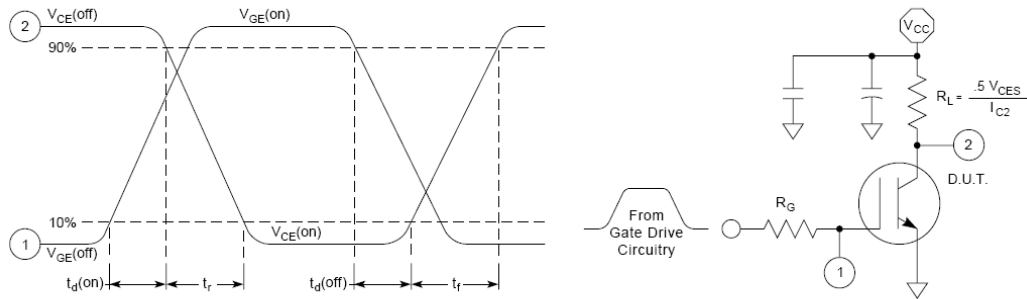


Figure 16, Resistive Switching Time Test Circuit and Waveforms

Typical Diode Performance Curve

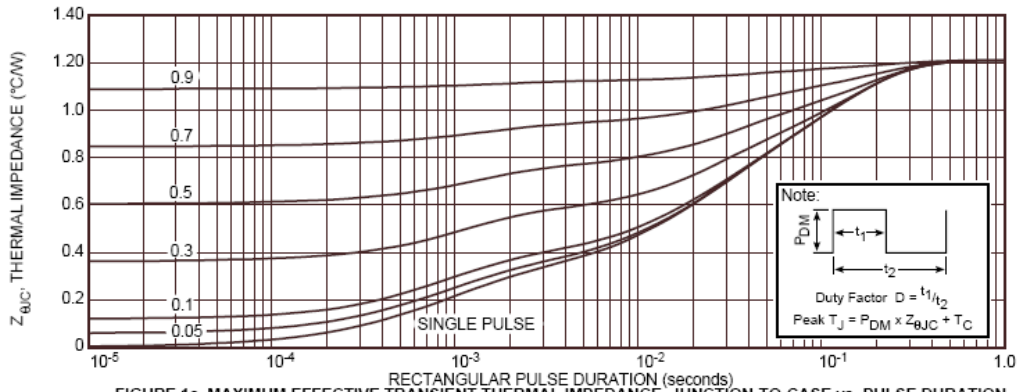


FIGURE 1a. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

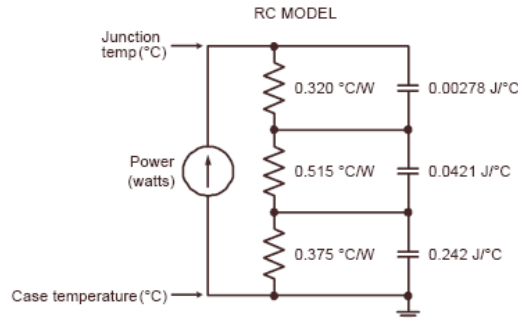


FIGURE 1b, TRANSIENT THERMAL IMPEDANCE MODEL

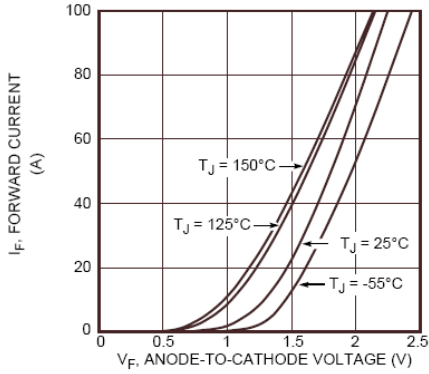


Figure 2. Forward Current vs. Forward Voltage

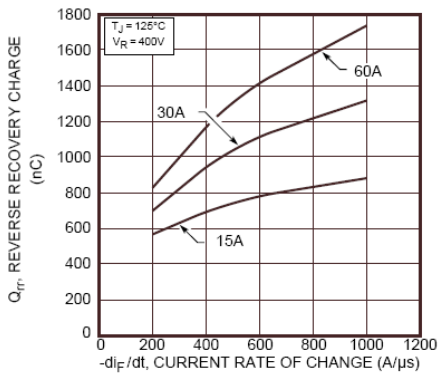


Figure 4. Reverse Recovery Charge vs. Current Rate of Change

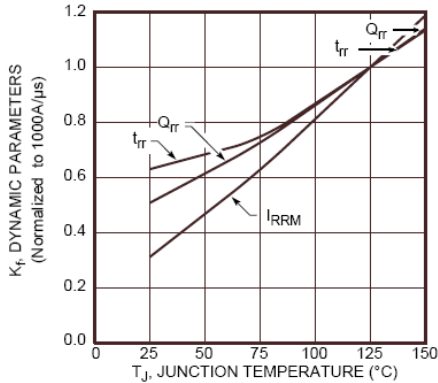


Figure 6. Dynamic Parameters vs. Junction Temperature

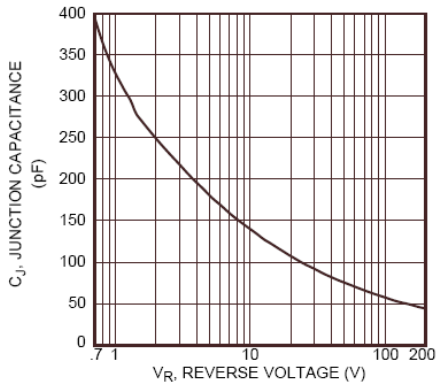


Figure 8. Junction Capacitance vs. Reverse Voltage

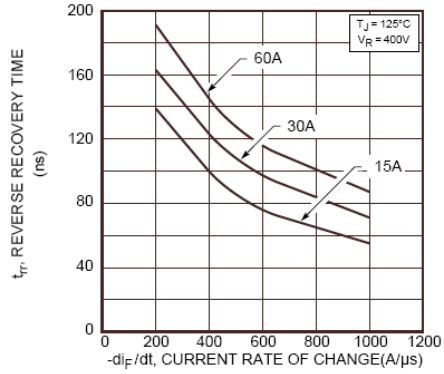


Figure 3. Reverse Recovery Time vs. Current Rate of Change

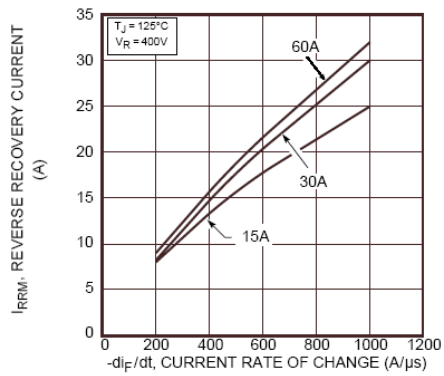


Figure 5. Reverse Recovery Current vs. Current Rate of Change

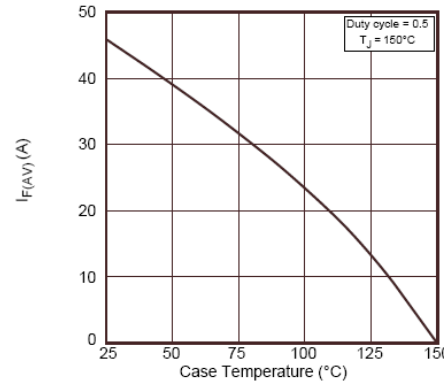


Figure 7. Maximum Average Forward Current vs. Case Temperature

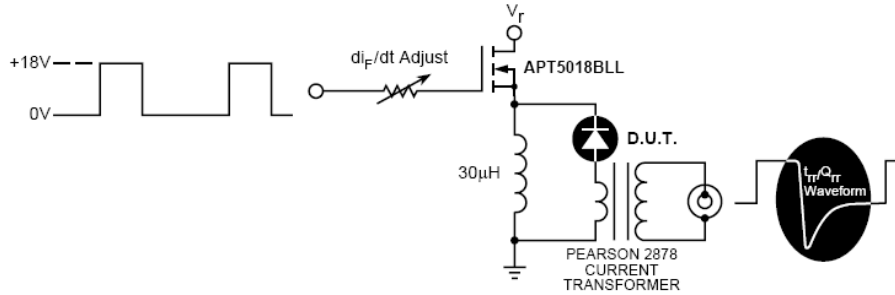


Figure 9. Diode Test Circuit

- 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} .

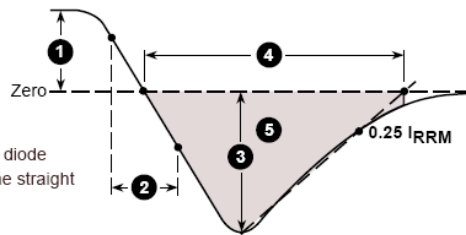
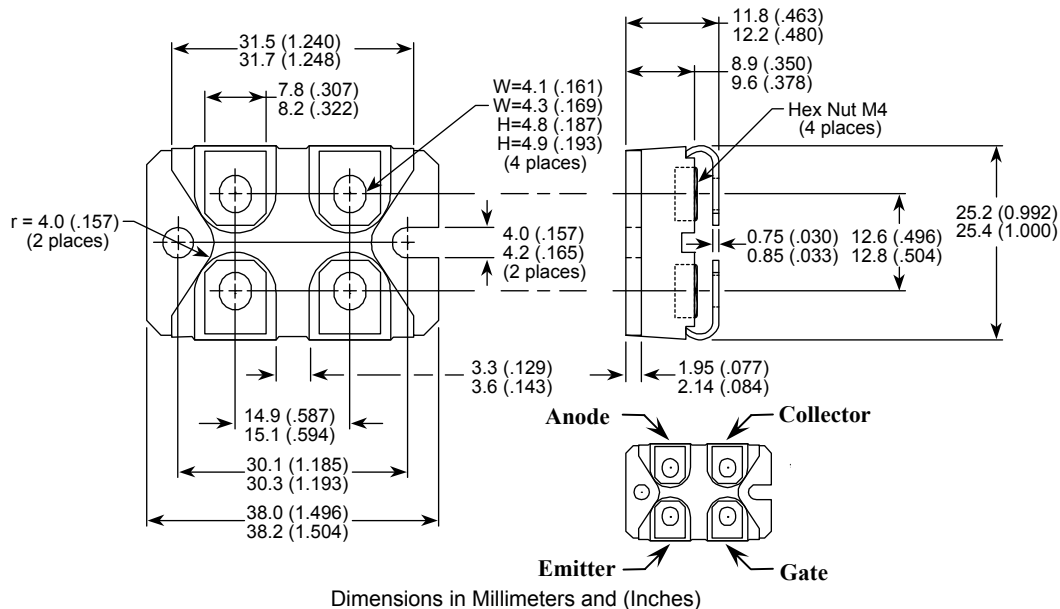


Figure 10, Diode Reverse Recovery Waveform and Definitions

SOT-227 (ISOTOP[®]) Package Outline



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