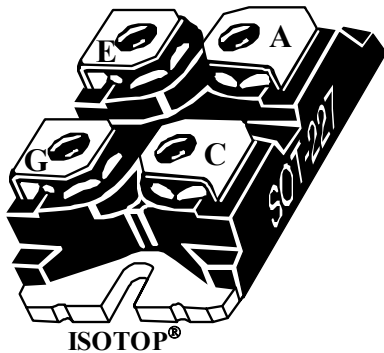
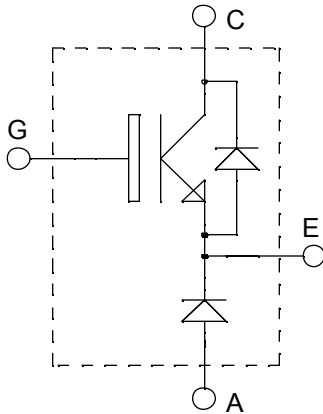


**ISOTOP<sup>®</sup> Buck chopper  
NPT IGBT**
 $V_{CES} = 600V$   
 $I_C = 100A @ T_C = 80^{\circ}C$ 

**Application**

- AC and DC motor control
- Switched Mode Power Supplies

**Features**

- Non Punch Through (NPT) THUNDERBOLT IGBT<sup>®</sup>
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 100 kHz
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - Avalanche energy rated
  - RBSOA and SCSOA rated
- ISOTOP<sup>®</sup> 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	$T_C = 25^{\circ}C$	A
$I_{C2}$		$T_C = 80^{\circ}C$	
$I_{CM}$	Pulsed Collector Current	$T_C = 25^{\circ}C$	320
$V_{GE}$	Gate - Emitter Voltage	$\pm 20$	V
$P_D$	Maximum Power Dissipation	$T_C = 25^{\circ}C$	416
$I_{FAV}$	Maximum Average Forward Current	$T_C = 80^{\circ}C$	A
$I_{FRMS}$	RMS Forward Current (Square wave, 50% duty)		

 **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**

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>	
$I_{CES}$	Zero Gate Voltage Collector Current	$V_{GE} = 0\text{V}$ $V_{CE} = 600\text{V}$	$T_j = 25^\circ\text{C}$			100	$\mu\text{A}$
			$T_j = 125^\circ\text{C}$			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	$V_{GE} = \pm 20\text{V}, V_{CE} = 0\text{V}$			$\pm 150$	nA	

**Dynamic Characteristics**

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>	
$C_{ies}$	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 ( $25^\circ\text{C}$ ) $V_{GE} = 15\text{V}$ $V_{Bus} = 400\text{V}$ $I_C = 100\text{A}$ $R_G = 5\Omega$		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 ( $125^\circ\text{C}$ ) $V_{GE} = 15\text{V}$ $V_{Bus} = 400\text{V}$ $I_C = 100\text{A}$ $R_G = 5\Omega$		26		ns
$T_r$	Rise Time				25		
$T_{d(off)}$	Turn-off Delay Time			170			
$T_f$	Fall Time			40			
$E_{on}$	Turn-on Switching Energy				4.3		mJ
$E_{off}$	Turn-off Switching Energy				3.5		

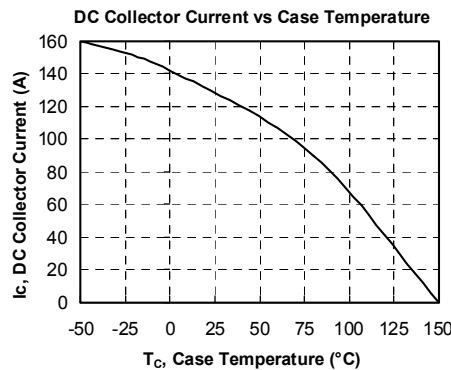
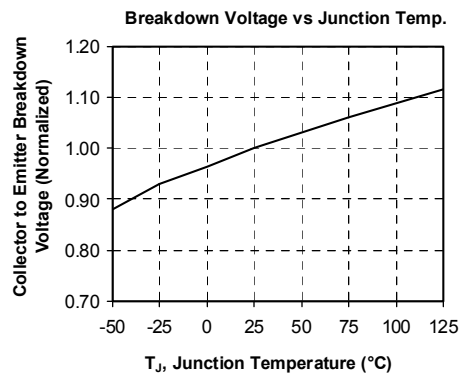
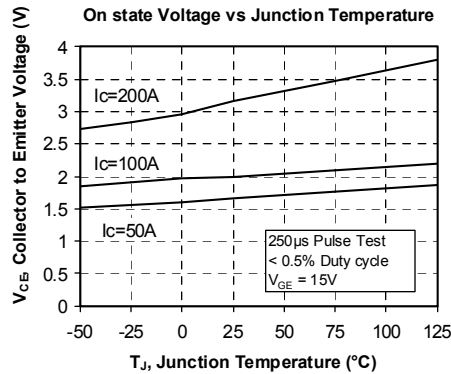
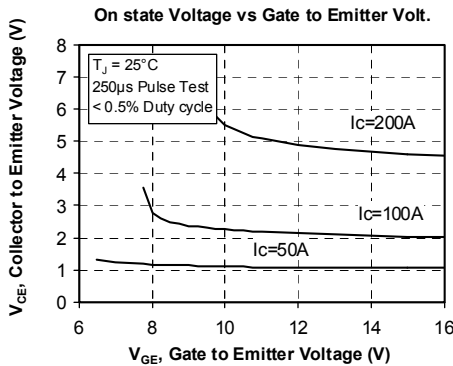
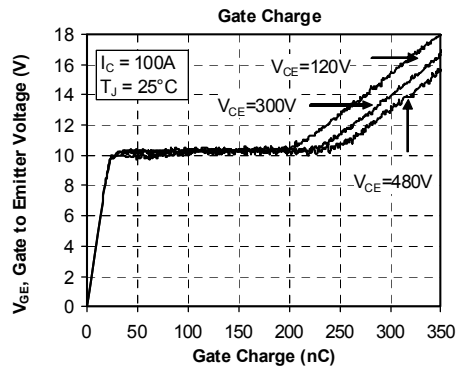
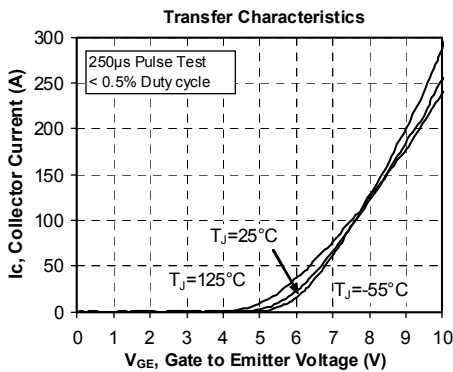
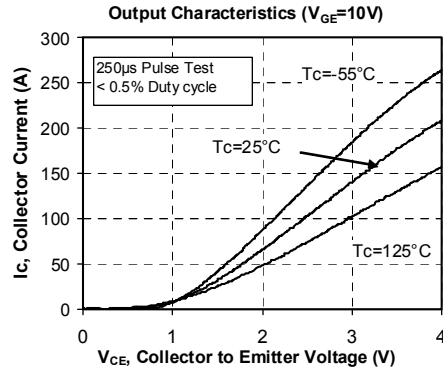
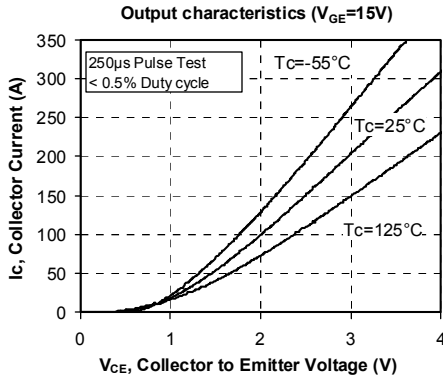
**Chopper diode ratings and characteristics**

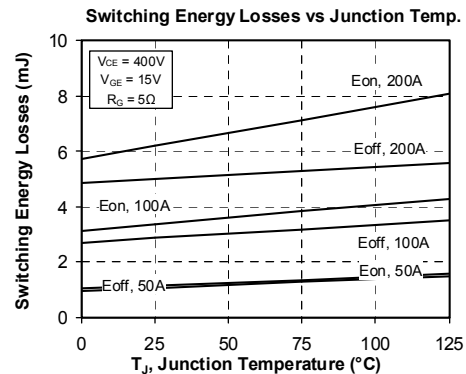
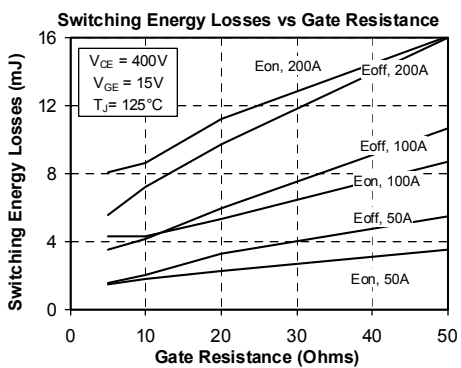
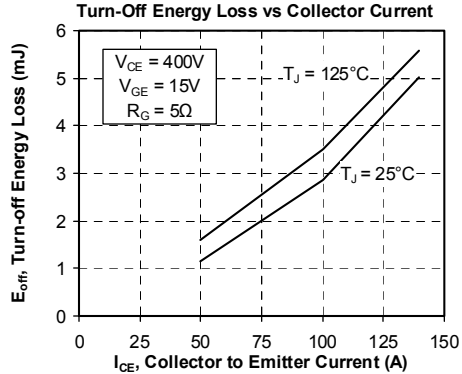
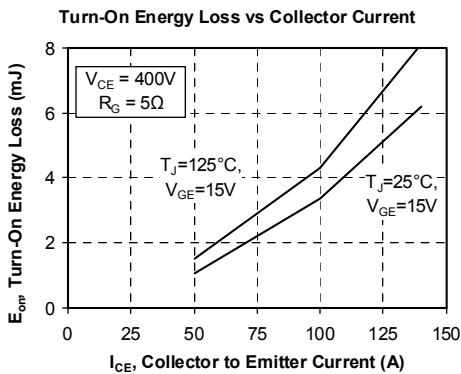
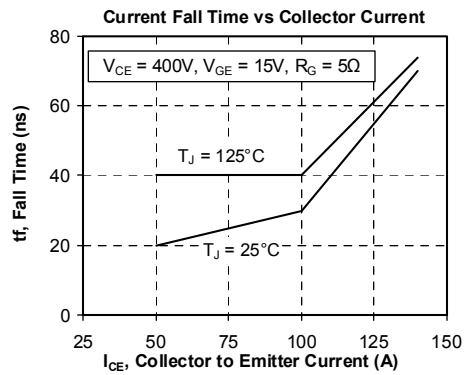
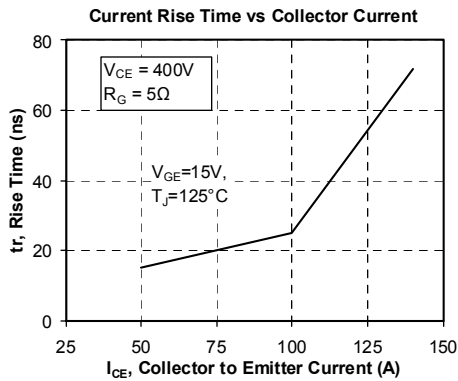
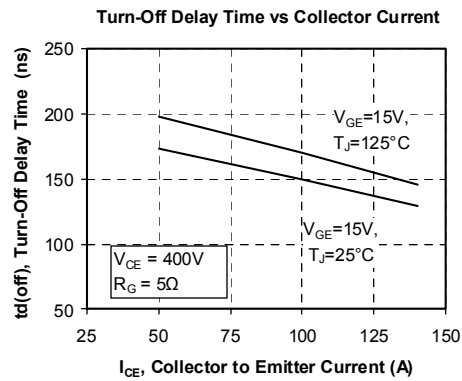
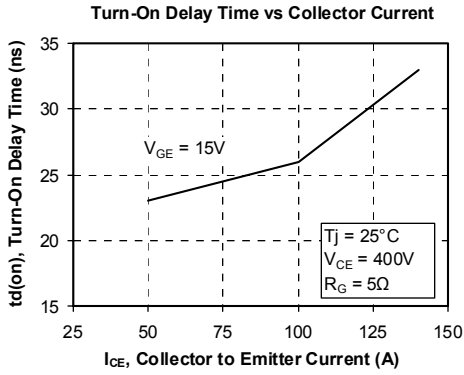
<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>		<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> = 30A			1.6	1.8	V
		I <sub>F</sub> = 60A			1.9		
		I <sub>F</sub> = 30A	T <sub>j</sub> = 125°C		1.4		
I <sub>RM</sub>	Maximum Reverse Leakage Current	V <sub>R</sub> = 600V	T <sub>j</sub> = 25°C			250	μA
		V <sub>R</sub> = 600V	T <sub>j</sub> = 125°C			500	
C <sub>T</sub>	Junction Capacitance	V <sub>R</sub> = 200V			44		pF
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> =1A, V <sub>R</sub> =30V di/dt = 100A/μs	T <sub>j</sub> = 25°C		23		ns
	Reverse Recovery Time		T <sub>j</sub> = 25°C		85		
			T <sub>j</sub> = 125°C		160		
I <sub>RRM</sub>	Maximum Reverse Recovery Current	I <sub>F</sub> = 30A V <sub>R</sub> = 400V di/dt = 200A/μs	T <sub>j</sub> = 25°C		4		A
			T <sub>j</sub> = 125°C		8		
Q <sub>rr</sub>	Reverse Recovery Charge		T <sub>j</sub> = 25°C		130		nC
			T <sub>j</sub> = 125°C		700		
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> = 30A	T <sub>j</sub> = 125°C		70		ns
Q <sub>rr</sub>	Reverse Recovery Charge	V <sub>R</sub> = 400V			1300		nC
I <sub>RRM</sub>	Maximum Reverse Recovery Current	di/dt = 1000A/μs			30		A

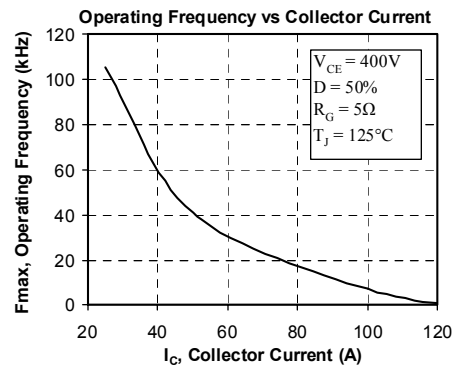
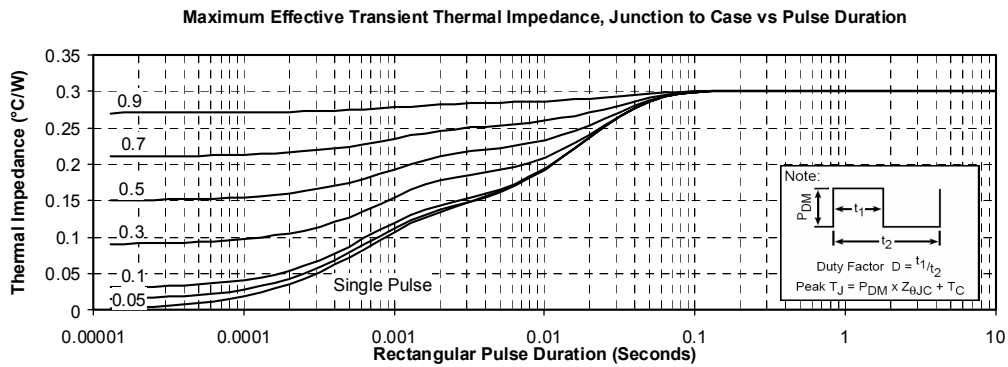
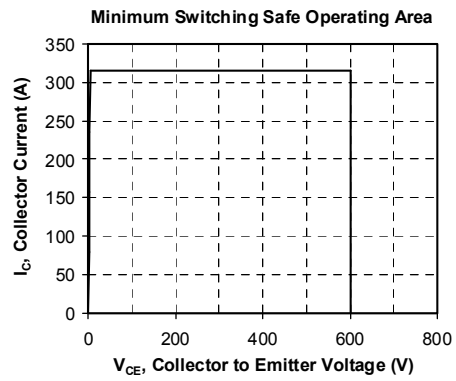
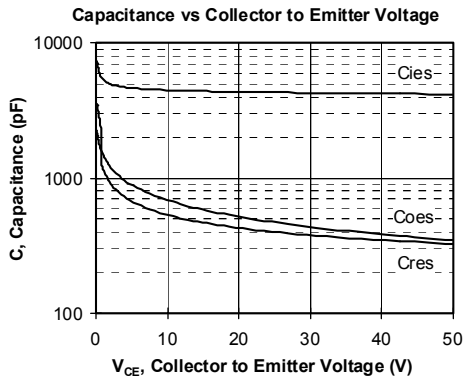
**Thermal and package characteristics**

<i>Symbol</i>	<i>Characteristic</i>		<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
R <sub>thJC</sub>	Junction to Case Thermal Resistance	IGBT			0.3	°C/W
		Diode			1.21	
R <sub>thJA</sub>	Junction to Ambient (IGBT & Diode)				20	
V <sub>ISOL</sub>	RMS Isolation Voltage, any terminal to case t = 1 min, I <sub>isol</sub> < 1mA, 50/60Hz		2500			V
T <sub>J</sub> , T <sub>STG</sub>	Storage Temperature Range		-55		150	°C
T <sub>L</sub>	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







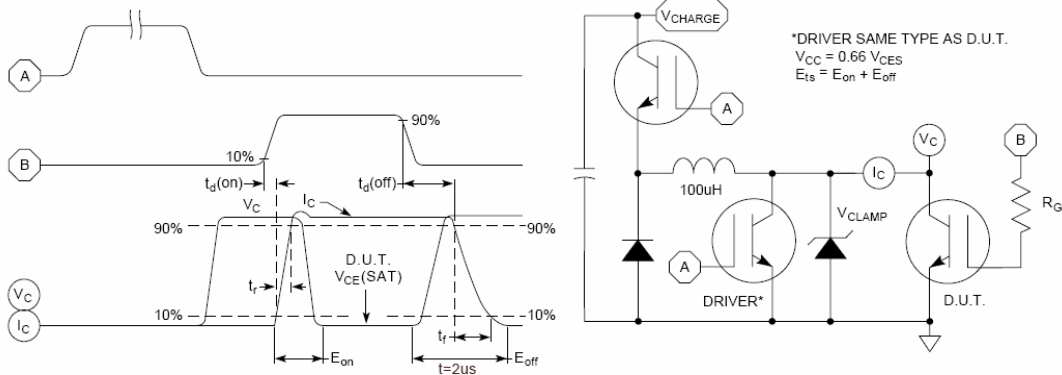


Figure 15, Switching Loss Test Circuit and Waveforms

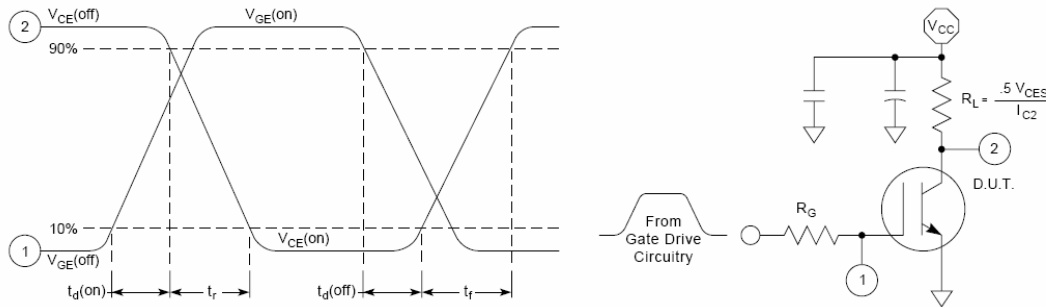


Figure 16, Resistive Switching Time Test Circuit and Waveforms

**Typical Diode Performance Curve**

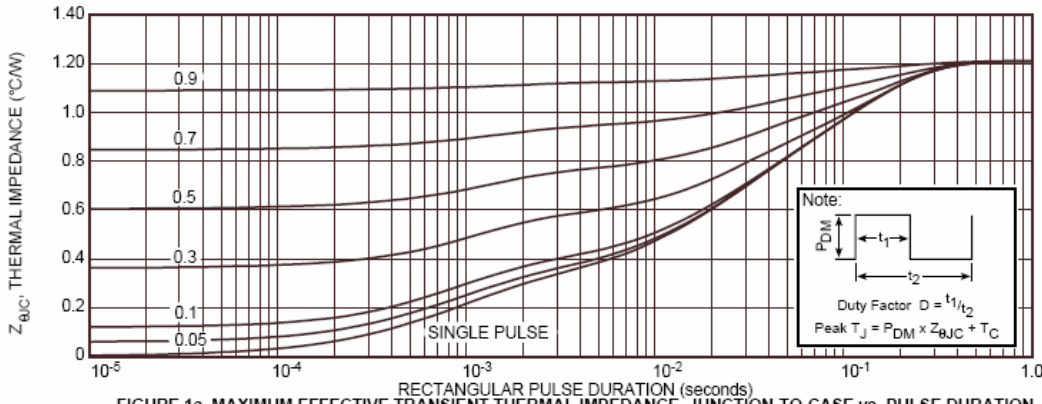


FIGURE 1a. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

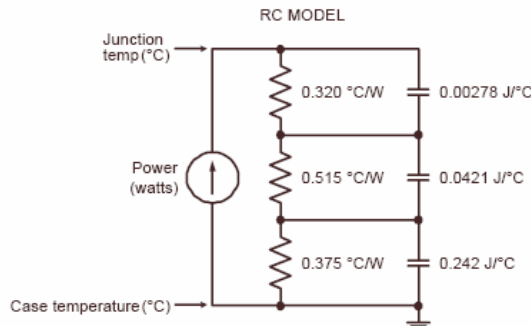


FIGURE 1b, TRANSIENT THERMAL IMPEDANCE MODEL

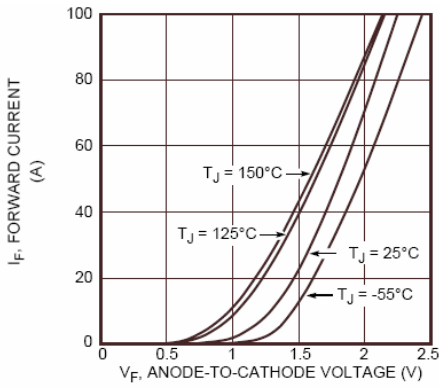


Figure 2. Forward Current vs. Forward Voltage

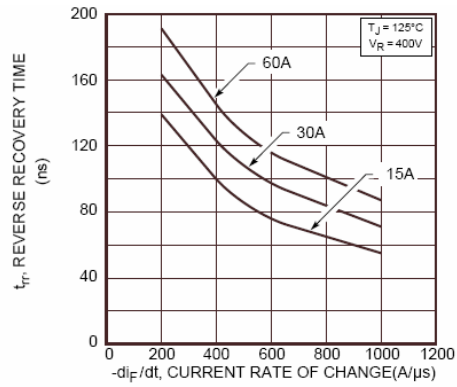


Figure 3. Reverse Recovery Time vs. Current Rate of Change

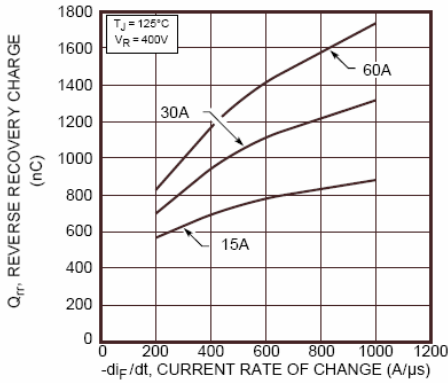


Figure 4. Reverse Recovery Charge vs. Current Rate of Change

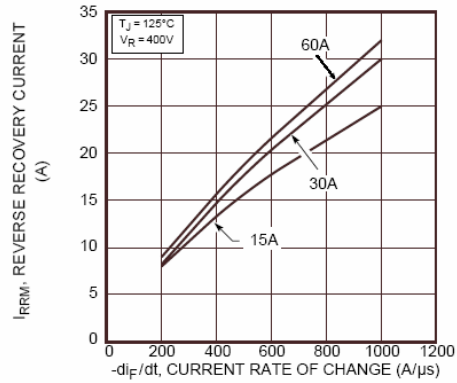


Figure 5. Reverse Recovery Current vs. Current Rate of Change

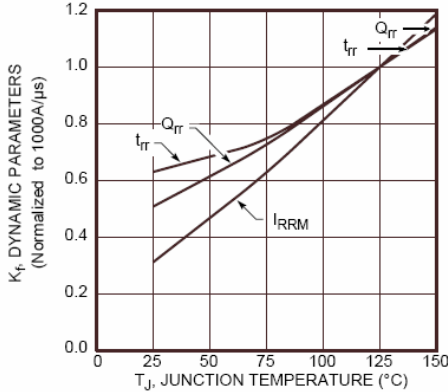


Figure 6. Dynamic Parameters vs. Junction Temperature

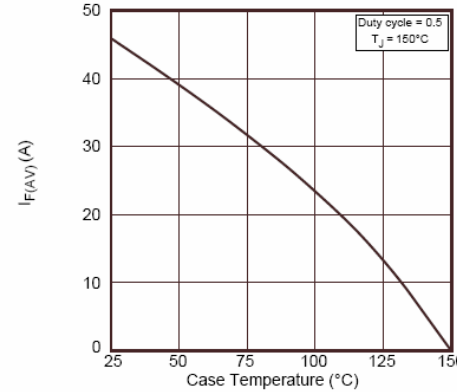


Figure 7. Maximum Average Forward Current vs. Case Temperature

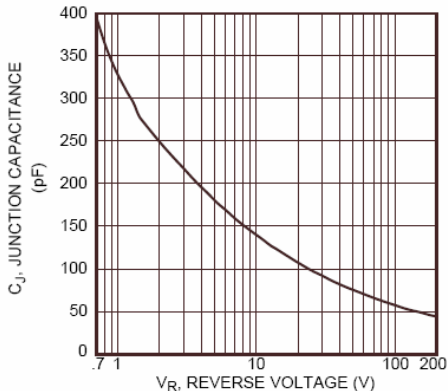


Figure 8. Junction Capacitance vs. Reverse Voltage



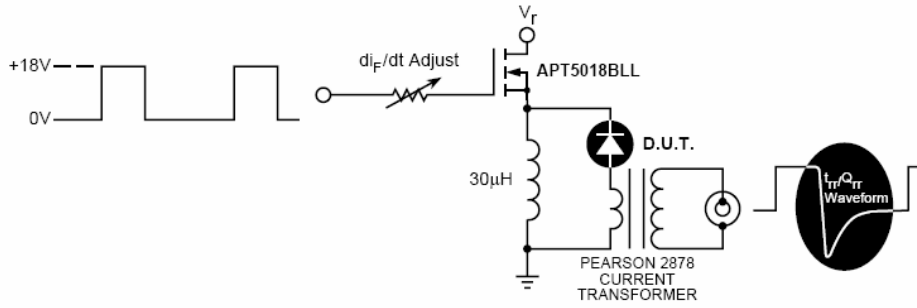


Figure 9. Diode Test Circuit

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

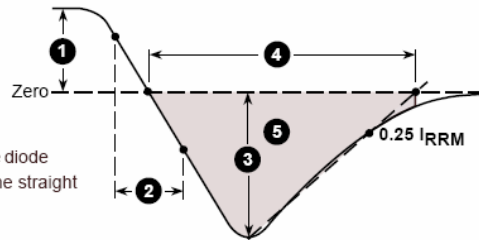
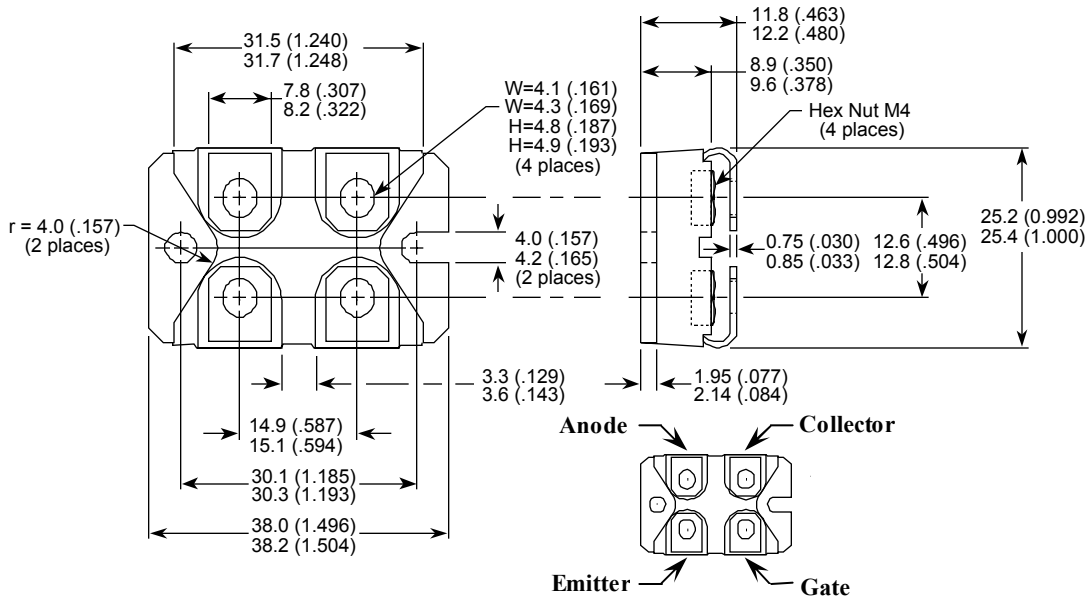


Figure 10. Diode Reverse Recovery Waveform and Definitions

### SOT-227 (ISOTOP<sup>®</sup>) Package Outline



Dimensions in Millimeters and (Inches)

ISOTOP<sup>®</sup> is a registered trademark of ST Microelectronics NV

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Microsemi'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.