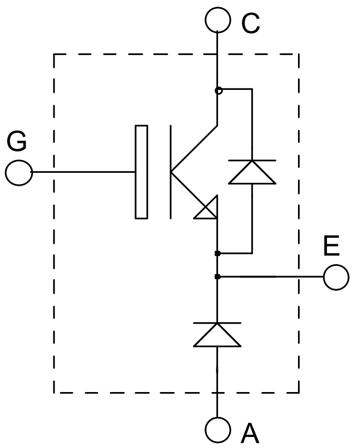
Microsemi POWER PRODUCTS GROUP

APT50GT120JU3

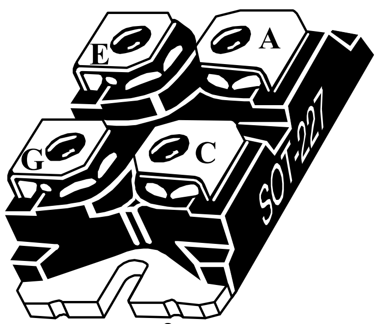
ISOTOP® Buck chopper
Trench + Field Stop IGBT3

V_{CES} = 1200V
I_C = 50A @ Tc = 80°C



Application
- AC and DC motor control
- Switched Mode Power Supplies

Features
- Trench + Field Stop IGBT3 Technology
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 20 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



ISOTOP®

Benefits
- Low conduction losses
- 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			1200	V
I_{C1}	Continuous Collector Current		$T_C = 25°C$	75	A
I_{C2}			$T_C = 80°C$	50	
I_{CM}	Pulsed Collector Current		$T_C = 25°C$	100	
V_{GE}	Gate – Emitter Voltage			±20	V
P_D	Maximum Power Dissipation		$T_C = 25°C$	347	W
IF_{AV}	Maximum Average Forward Current	Duty cycle=0.5	$T_C = 80°C$	27	A
IF_{RMS}	RMS Forward Current (Square wave, 50% duty)			34	

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

All ratings @ T_j = 25°C unless otherwise specified

Electrical Characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{CES}	Zero Gate Voltage Collector Current	V_{GE} = 0V, V_{CE} = 1200V				5	mA
$V_{CE(sat)}$	Collector Emitter saturation Voltage	V_{GE} =15V I_C = 50A	T_j = 25°C	1.4	1.7	2.1	V
			T_j = 125°C		2.0		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE}, I_C = 2mA		5.0		6.5	V
I_{GES}	Gate – Emitter Leakage Current	V_{GE} = ±20V, V_{CE} = 0V				500	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	V_{GE} = 0V V_{CE} = 25V f = 1MHz		3600		pF
C_{oes}	Output Capacitance			188		
C_{res}	Reverse Transfer Capacitance			163		
$T_{d(on)}$	Turn-on Delay Time	Resistive Switching (25°C) V_{GE} = 15V V_{Bus} = 600V I_C = 50A R_G = 18Ω		85		ns
T_r	Rise Time			30		
$T_{d(off)}$	Turn-off Delay Time			420		
T_f	Fall Time			65		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = 15V V_{Bus} = 600V I_C = 50A R_G = 18Ω		90		ns
T_r	Rise Time			45		
$T_{d(off)}$	Turn-off Delay Time			520		
T_f	Fall Time			90		
E_{on}	Turn-on Switching Energy			6.6		mJ
E_{off}	Turn-off Switching Energy			5.8		

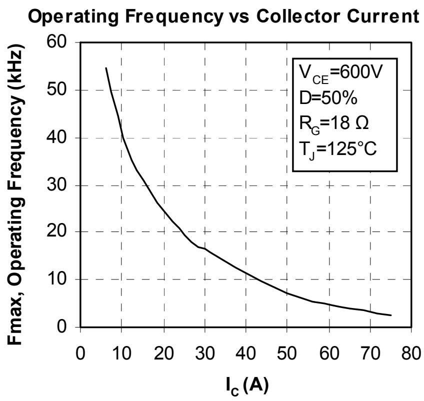
Chopper diode ratings and characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_F	Diode Forward Voltage	I_F = 30A			2.0	2.5	V
		I_F = 60A			2.3		
		I_F = 30A	T_j = 125°C		1.8		
I_{RM}	Maximum Reverse Leakage Current	V_R = 1200V	T_j = 25°C			250	µA
		V_R = 1200V	T_j = 125°C			500	
C_T	Junction Capacitance	V_R = 200V			32		pF
t_{rr}	Reverse Recovery Time	I_F=1A,V_R=30V di/dt =100A/µs	T_j = 25°C		31		ns
	Reverse Recovery Time	I_F = 30A V_R = 800V di/dt =200A/µs	T_j = 25°C		370		
			T_j = 125°C		500		
I_{RRM}	Maximum Reverse Recovery Current		T_j = 25°C		5		A
			T_j = 125°C		12		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		660		nC
			T_j = 125°C		3450		
t_{rr}	Reverse Recovery Time	I_F = 30A V_R = 800V di/dt =1000A/µs	T_j = 125°C		220		ns
Q_{rr}	Reverse Recovery Charge				4650		nC
I_{RRM}	Maximum Reverse Recovery Current				37		A

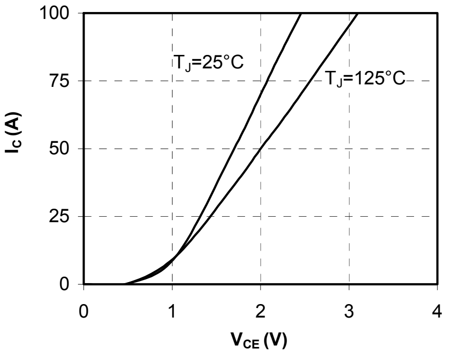
Thermal and package characteristics

Symbol	Characteristic		Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance	IGBT			0.36	°C/W
		Diode			1.1	
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

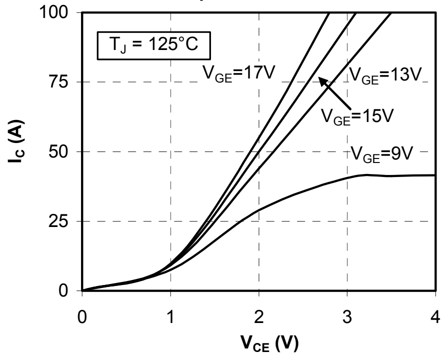
Typical IGBT Performance Curve



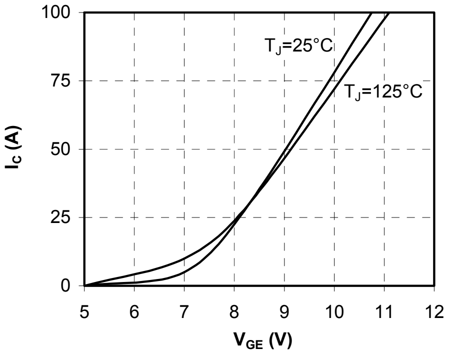
Output Characteristics (V_{GE}=15V)



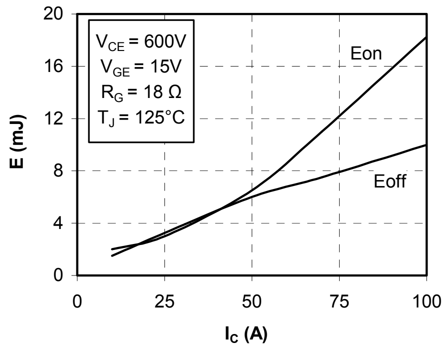
Output Characteristics



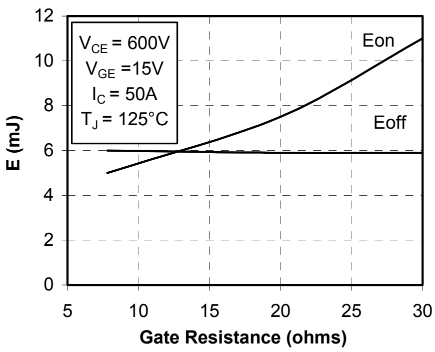
Transfert Characteristics



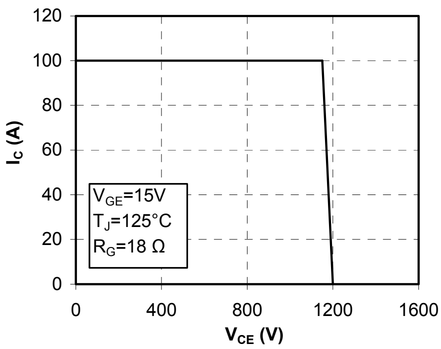
Energy losses vs Collector Current



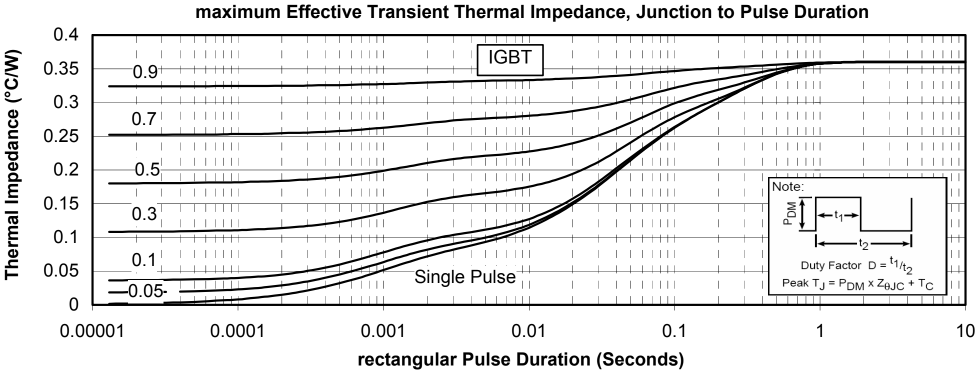
Switching Energy Losses vs Gate Resistance



Reverse Safe Operating Area



maximum Effective Transient Thermal Impedance, Junction to Pulse Duration



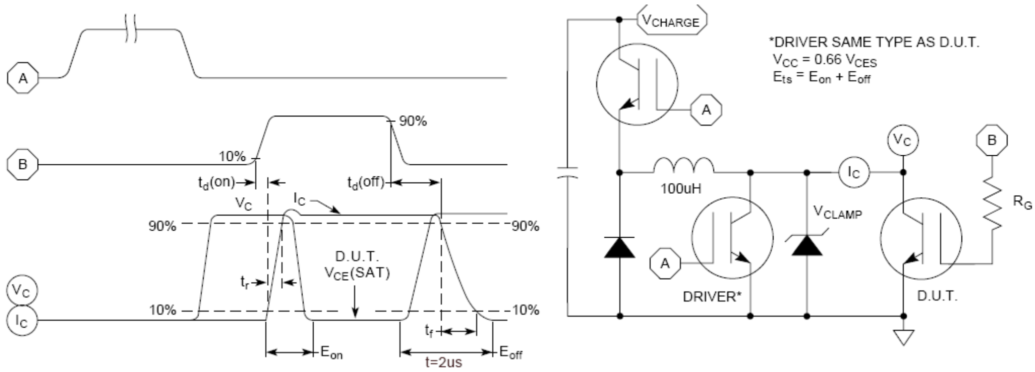


Figure 15, Switching Loss Test Circuit and Waveforms

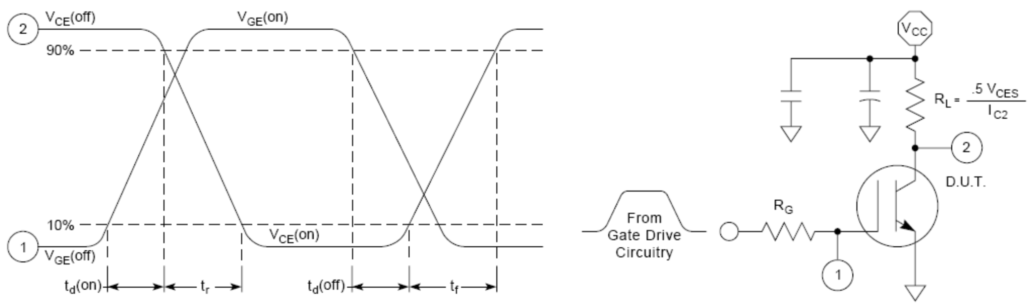


Figure 16, Resistive Switching Time Test Circuit and Waveforms

Typical Diode Performance Curve

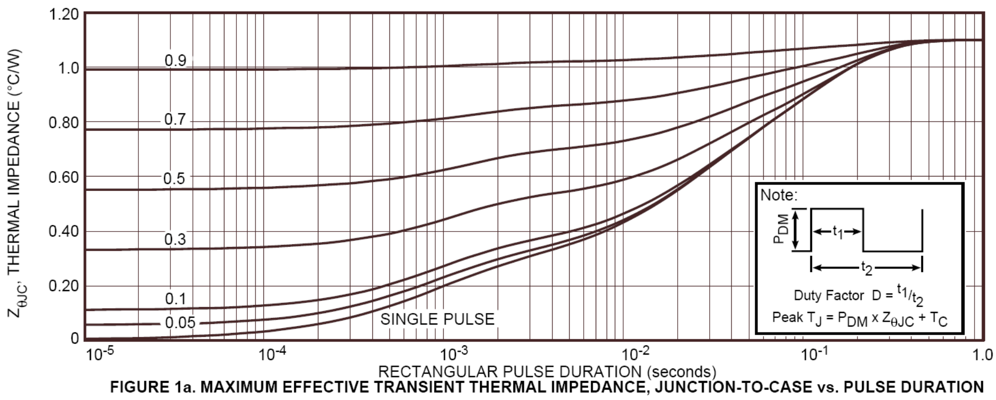


FIGURE 1a. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

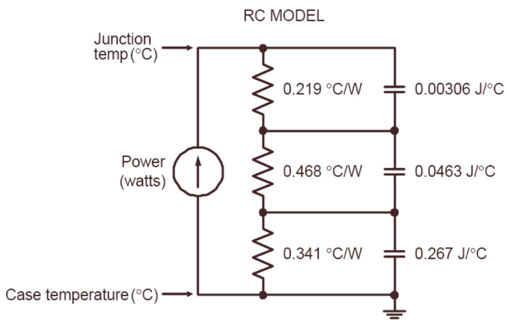


FIGURE 1b, TRANSIENT THERMAL IMPEDANCE MODEL

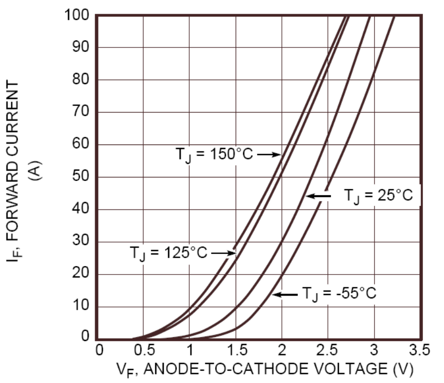


Figure 2. Forward Current *vs.* Forward Voltage

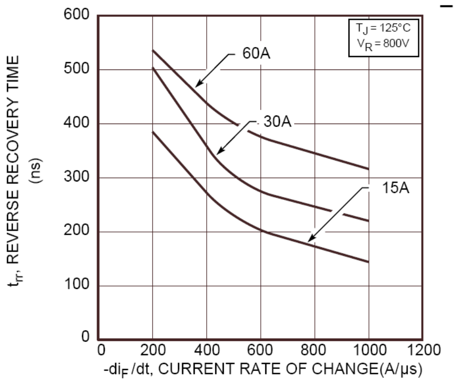


Figure 3. Reverse Recovery Time *vs.* Current Rate of Change

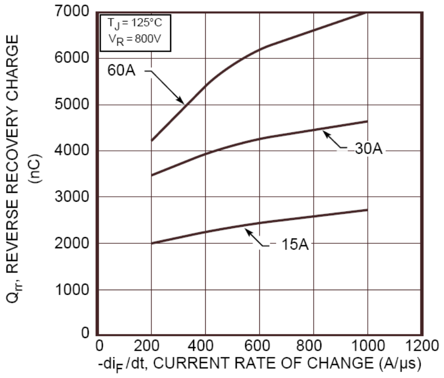


Figure 4. Reverse Recovery Charge *vs.* Current Rate of Change

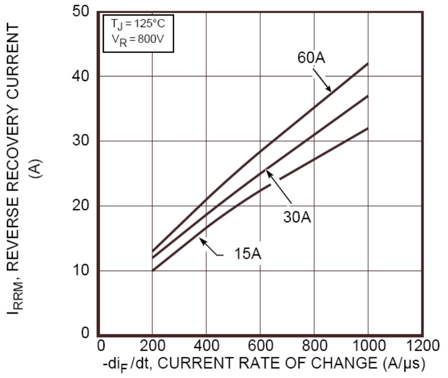


Figure 5. Reverse Recovery Current *vs.* Current Rate of Change

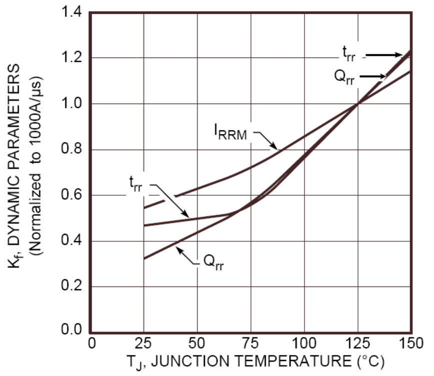


Figure 6. Dynamic Parameters *vs.* Junction Temperature

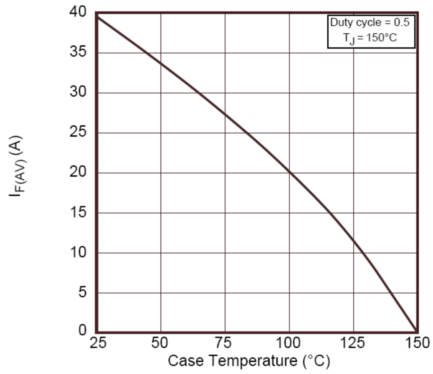


Figure 7. Maximum Average Forward Current *vs.* CaseTemperature

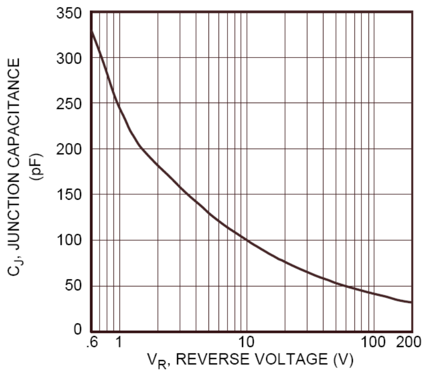


Figure 8. Junction Capacitance *vs.* Reverse Voltage

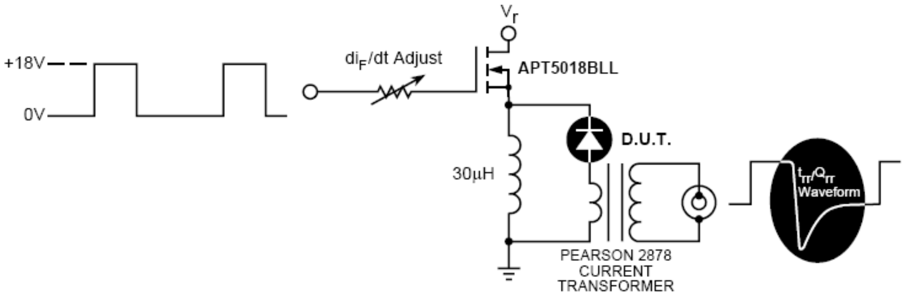


Figure 9. Diode Test Circuit

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

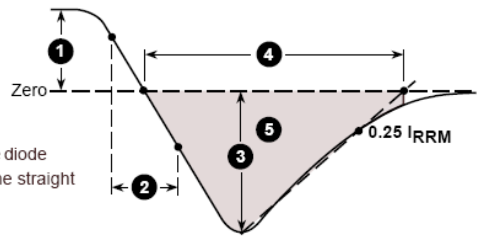
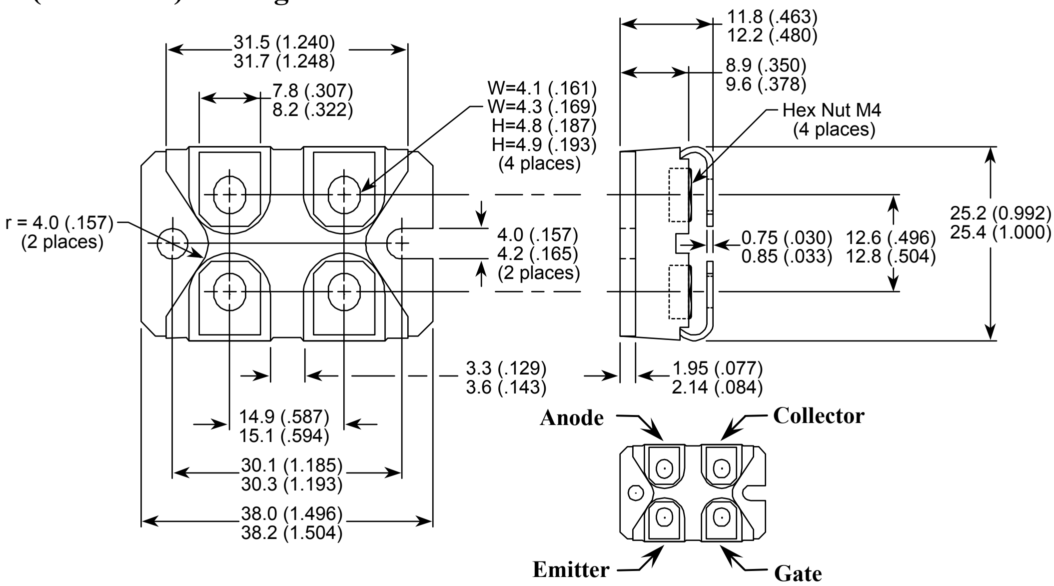


Figure 10, Diode Reverse Recovery Waveform and Definitions

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)

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