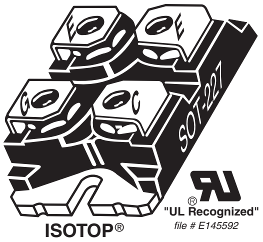
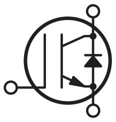
APT100GN120JDQ4

1200V, 100A, $V_{CE(ON)}$ = 1.7V Typical

Utilizing the latest Field Stop and Trench Gate technologies, these IGBT's have ultra low $V_{CE(ON)}$ and are ideal for low frequency applications that require absolute minimum conduction loss. Easy paralleling is a result of very tight parameter distribution and a slightly positive $V_{CE(ON)}$ temperature coefficient. A built-in gate resistor ensures extremely reliable operation, even in the event of a short cuircuit fault. Low gate charge simplifies gate drive design and minimizes losses.



- **1200V Field Stop**
- **Trench Gate: Low $V_{CE(ON)}$**
- **Easy Paralleling**
- **Integrated Gate Resistor: Low EMI, High Reliability**
- **RoHS Compliant**



Applications: Welding, Inductive Heating, Solar Inverters, SMPS, Motor drives, UPS

Maximum Ratings

All Ratings: T_C = 25°C unless otherwise specified.

Symbol	Parameter	Ratings	Unit
V_{CES}	Collector-Emitter Voltage	1200	Volts
V_{GE}	Gate-Emitter Voltage	±30	
I_{C1}	Continuous Collector Current @ T_C = 25°C	153	Amps
I_{C2}	Continuous Collector Current @ T_C = 100°C	70	
I_{CM}	Pulsed Collector Current ①	300	
SSOA	Switching Safe Operating Area @ T_J = 150°C	300A @ 1200V	
P_D	Total Power Dissipation	446	Watts
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	°C

Static Electrical Characteristics

Symbol	Characteristic / Test Conditions	Min	Typ	Max	Unit
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage (V_{GE} = 0V, I_C = 6mA)	1200	-	-	Volts
$V_{GE(TH)}$	Gate Threshold Voltage (V_{CE} = V_{GE}, I_C = 6mA, T_j = 25°C)	5.0	5.8	6.5	
$V_{CE(ON)}$	Collector Emitter On Voltage (V_{GE} = 15V, I_C = 100A, T_j = 25°C)	1.4	1.7	2.1	
	Collector Emitter On Voltage (V_{GE} = 15V, I_C = 100A, T_j = 125°C)	-	2.0	-	
I_{CES}	Collector Cut-off Current (V_{CE} = 1200V, V_{GE} = 0V, T_j = 25°C) ②	-	-	200	μA
	Collector Cut-off Current (V_{CE} = 1200V, V_{GE} = 0V, T_j = 125°C) ②	-	-	1500	
I_{GES}	Gate-Emitter Leakage Current (V_{GE} = ±20V)	-	-	600	nA
$R_{G(int)}$	Integrated Gate Resistor	-	7.5	-	Ω

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

Dynamic Characteristic

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	V_{GE} = 0V, V_{CE} = 25V f = 1MHz	-	6500	-	pF
C_{oes}	Output Capacitance		-	365	-	
C_{res}	Reverse Transfer Capacitance		-	280	-	
V_{GEP}	Gate-to-Emitter Plateau Voltage	Gate Charge V_{GE} = 15V V_{CE}= 600V I_C = 100A	-	9.5	-	V
Q_g	Total Gate Charge③		-	540	-	nC
Q_{ge}	Gate-Emitter Charge		-	50	-	
Q_{gc}	Gate-Collector Charge		-	295	-	
SSOA	Switching Safe Operating Area	T_J = 150°C, R_G = 4.3Ω⑦, V_{GE} = 15V, L = 100μH, V_{CE}= 1200V	300			A
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (25°C) V_{CC} = 800V V_{GE} = 15V I_C = 100A R_G = 1.0Ω⑦ T_J = +25°C	-	50	-	ns
t_r	Current Rise Time		-	50	-	
$t_{d(off)}$	Turn-Off Delay Time		-	615	-	
t_f	Current Fall Time		-	105	-	
E_{on1}	Turn-On Switching Energy④		-	11	-	μJ
E_{on2}	Turn-On Switching Energy⑤		-	15	-	
E_{off}	Turn-Off Switching Energy⑥		-	9.5	-	
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (125°C) V_{CC} = 800V V_{GE} = 15V I_C = 100A R_G = 1.0Ω⑦ T_J = +125°C	-	50	-	ns
t_r	Current Rise Time		-	50	-	
$t_{d(off)}$	Turn-Off Delay Time		-	725	-	
t_f	Current Fall Time		-	210	-	
E_{on1}	Turn-On Switching Energy④		-	12	-	mJ
E_{on2}	Turn-On Switching Energy⑤		-	22	-	
E_{off}	Turn-Off Switching Energy⑥		-	14	-	

Thermal and Mechanical Characteristics

Symbol	Characteristic / Test Conditions	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case **(IGBT)**	-	-	0.28	°C/W
$R_{\theta JC}$	Junction to Case **(DIODE)**	-	-	0.32	
W_T	Package Weight	-	29.2	-	g
Torque	Terminals and Mounting Screws.	-	-	10	in·lbf
		-	-	1.1	N·m
$V_{Isolation}$	RMS Voltage (50-60Hz Sinusoidal Waveform from Terminals to Mounting Base for 1 Min.)	2500	-	-	Volts

① Repetitive Rating: Pulse width limited by maximum junction temperature.

② For Combi devices, I_{ces} includes both IGBT and FRED leakages.

③ See MIL-STD-750 Method 3471.

④ E_{on1} is the clamped inductive turn-on energy of the IGBT only, without the effect of a commutating diode reverse recovery current adding to z a the IGBT turn-on loss. Tested in inductive switching test circuit shown in figure 21, but with a Silicon Carbide diode.

⑤ E_{on2} is the clamped inductive turn-on energy that includes a commutating diode reverse recovery current in the IGBT turn-on switching loss. (See Figures 21, 22.)

⑥ E_{off} is the clamped inductive turn-off energy measured in accordance with JEDEC standard JESD24-1. (See Figures 21, 23.)

⑦ R_G is external gate resistance not including gate driver impedance.

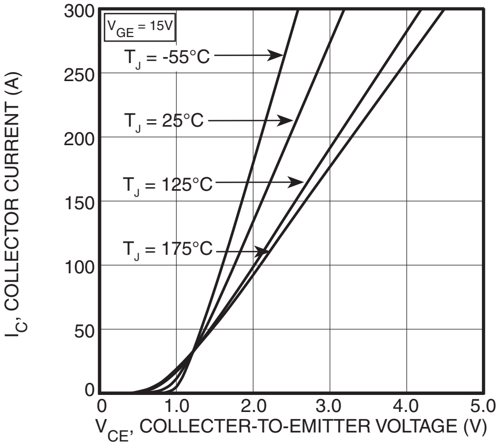


FIGURE 1, Output Characteristics(T_J = 25°C)

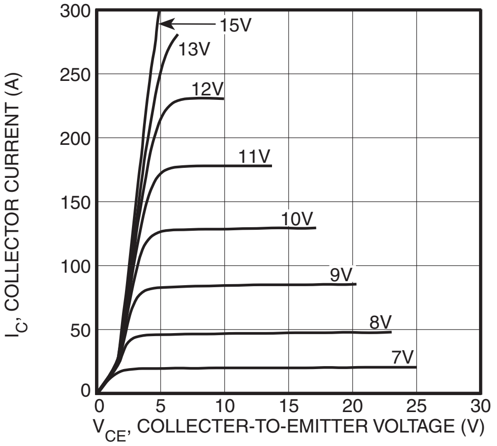


FIGURE 2, Output Characteristics (T_J = 125°C)

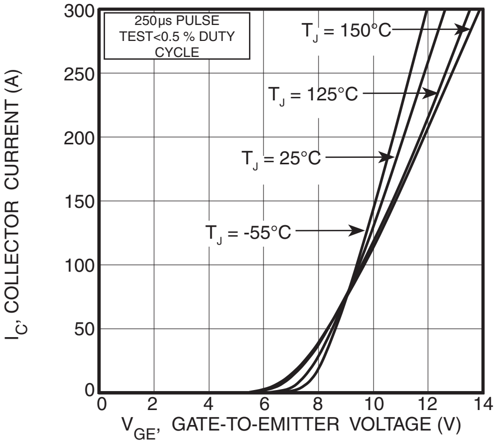


FIGURE 3, Transfer Characteristics

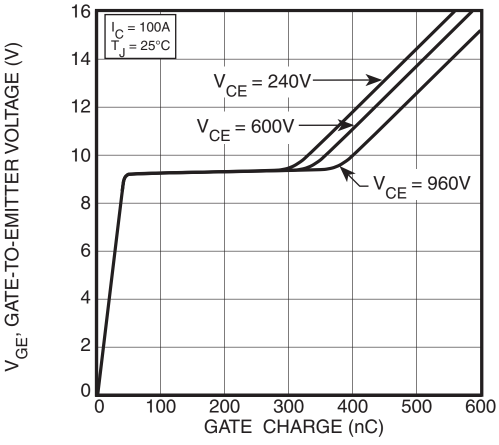


FIGURE 4, Gate Charge

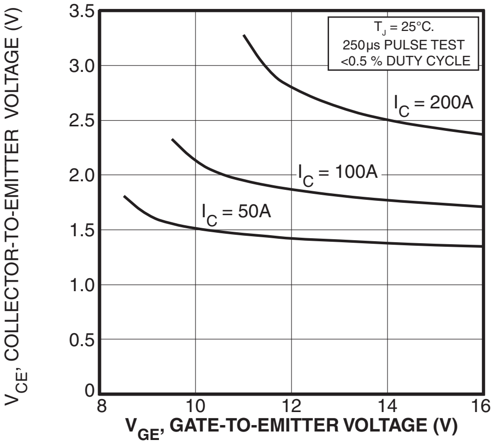


FIGURE 5, On State Voltage vs Gate-to- Emitter Voltage

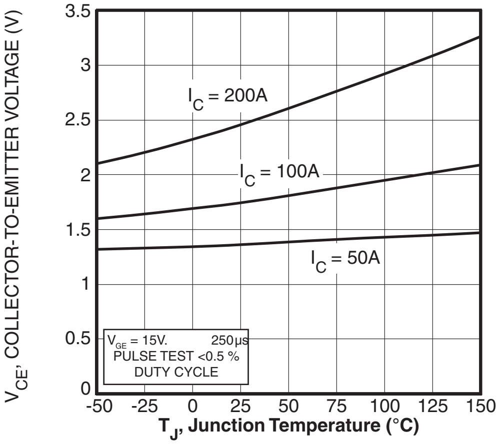


FIGURE 6, On State Voltage vs Junction Temperature

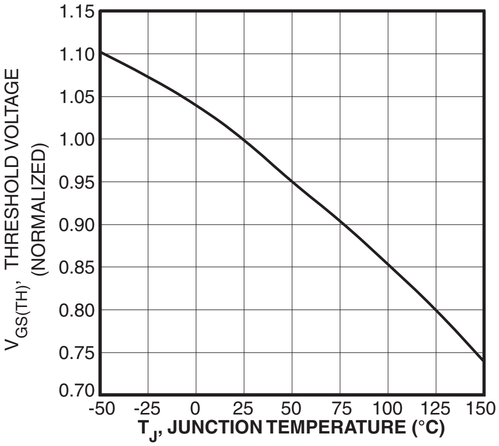


FIGURE 7, Threshold Voltage vs. Junction Temperature

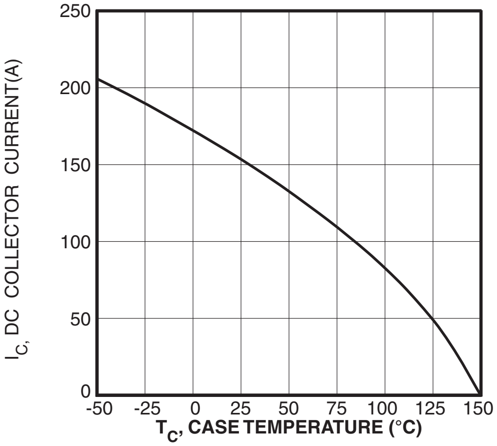


FIGURE 8, DC Collector Current vs Case Temperature

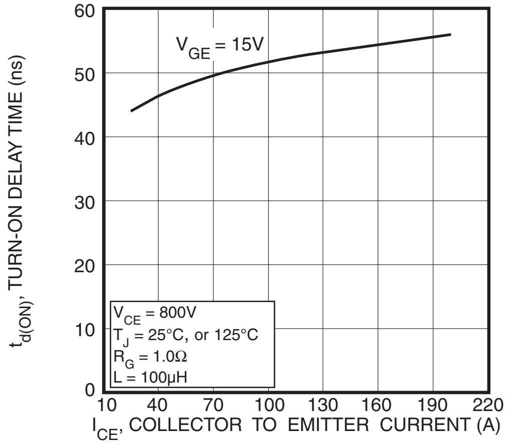


FIGURE 9, Turn-On Delay Time vs Collector Current

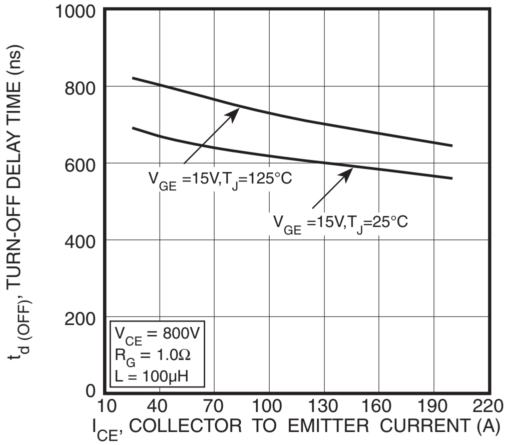


FIGURE 10, Turn-Off Delay Time vs Collector Current

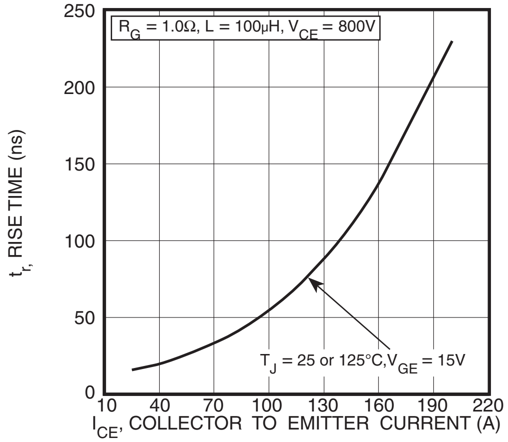


FIGURE 11, Current Rise Time vs Collector Current

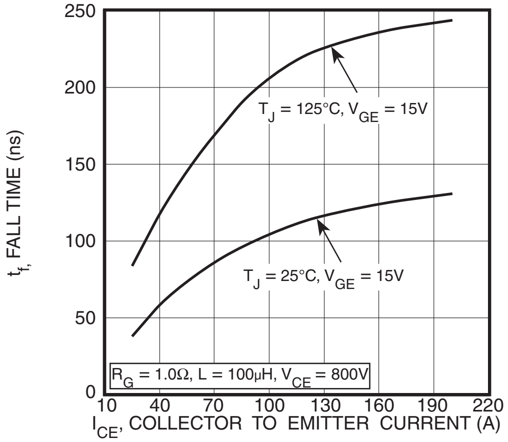


FIGURE 12, Current Fall Time vs Collector Current

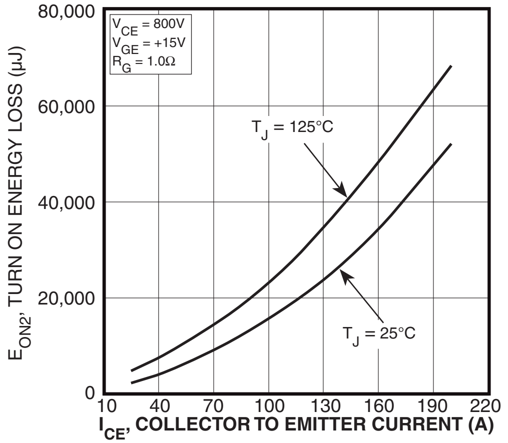


FIGURE 13, Turn-On Energy Loss vs Collector Current

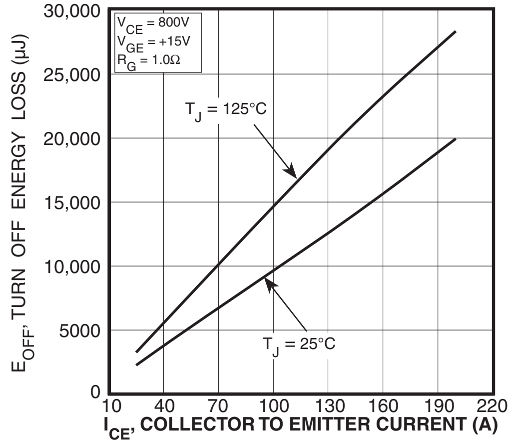


FIGURE 14, Turn Off Energy Loss vs Collector Current

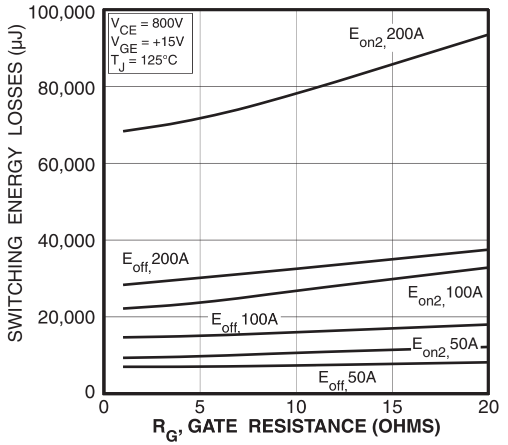


FIGURE 15, Switching Energy Losses vs. Gate Resistance

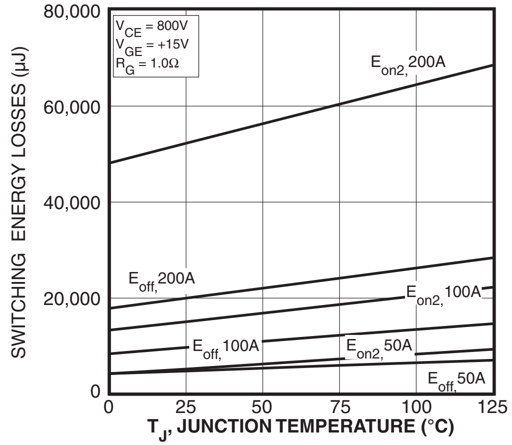


FIGURE 16, Switching Energy Losses vs Junction Temperature

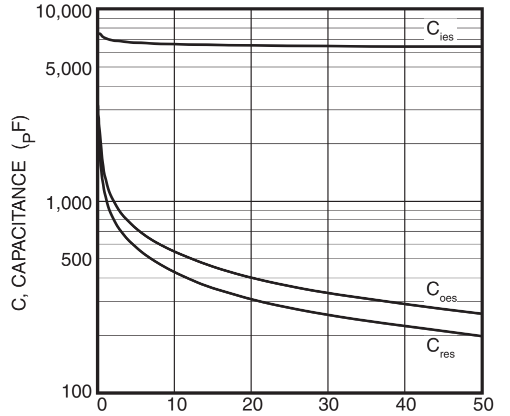


Figure 17, Capacitance vs Collector-To-Emitter Voltage

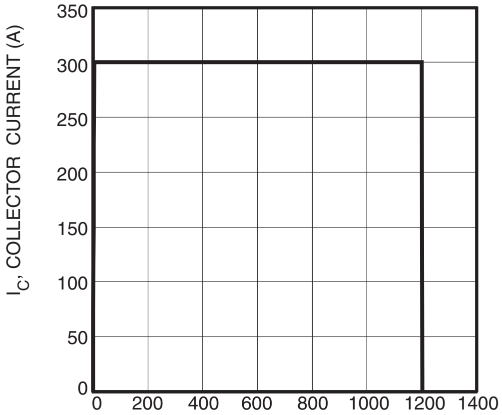


Figure 18,Minimim Switching Safe Operating Area

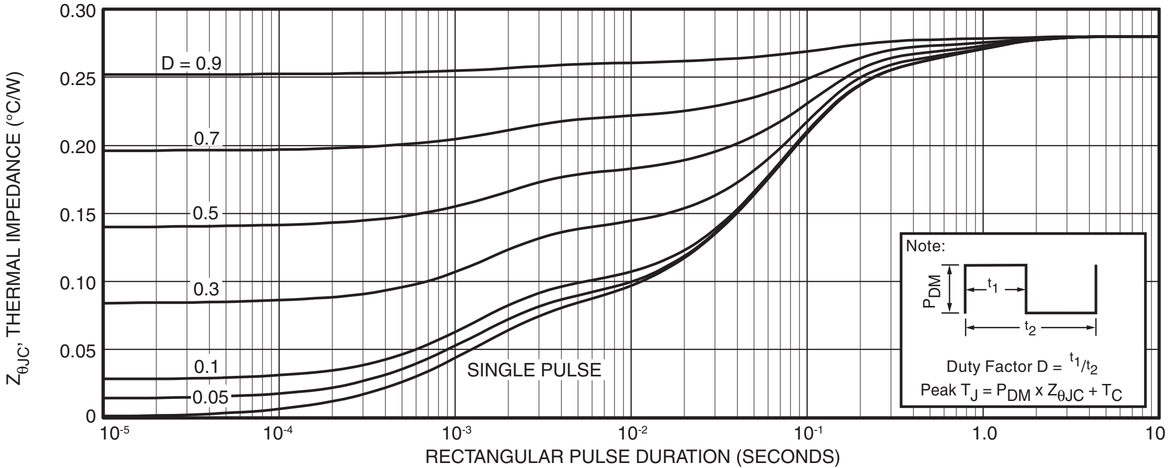


Figure 19a, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

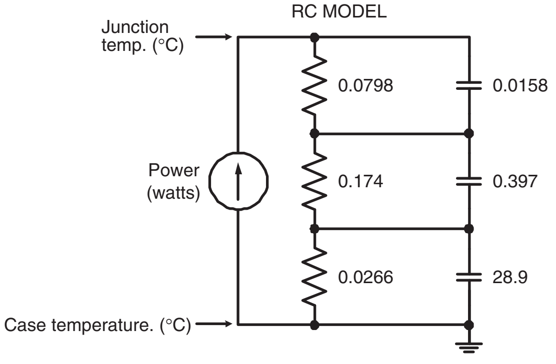
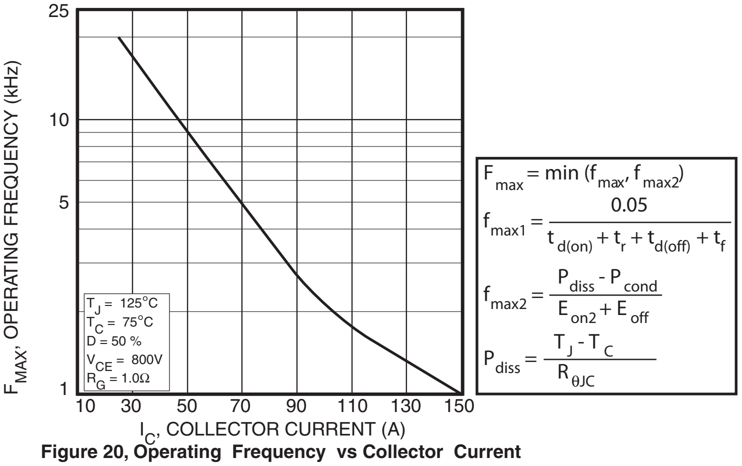


FIGURE 19b, TRANSIENT THERMAL IMPEDANCE MODEL



$$F_{max} = \min(f_{max}, f_{max2})$$

$$f_{max1} = \frac{0.05}{t_{d(on)} + t_r + t_{d(off)} + t_f}$$

$$f_{max2} = \frac{P_{diss} - P_{cond}}{E_{on2} + E_{off}}$$

$$P_{diss} = \frac{T_J - T_C}{R_{\theta JC}}$$

Figure 20, Operating Frequency vs Collector Current

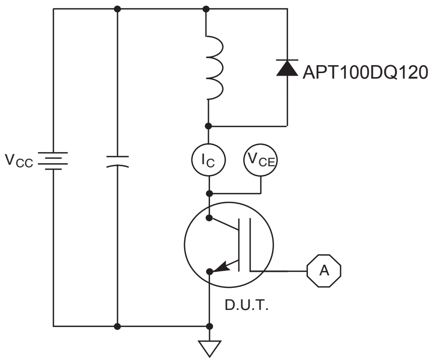


Figure 1, Inductive Switching Test Circuit

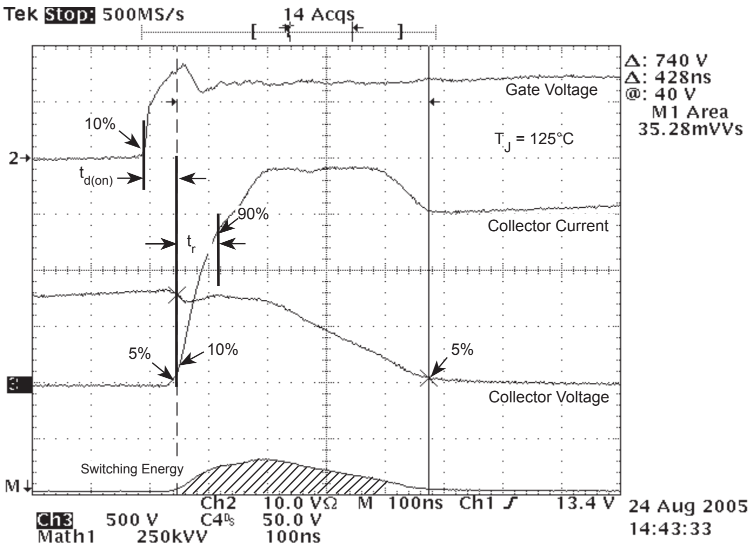


Figure 2, Turn-on Switching Waveforms and Definitions

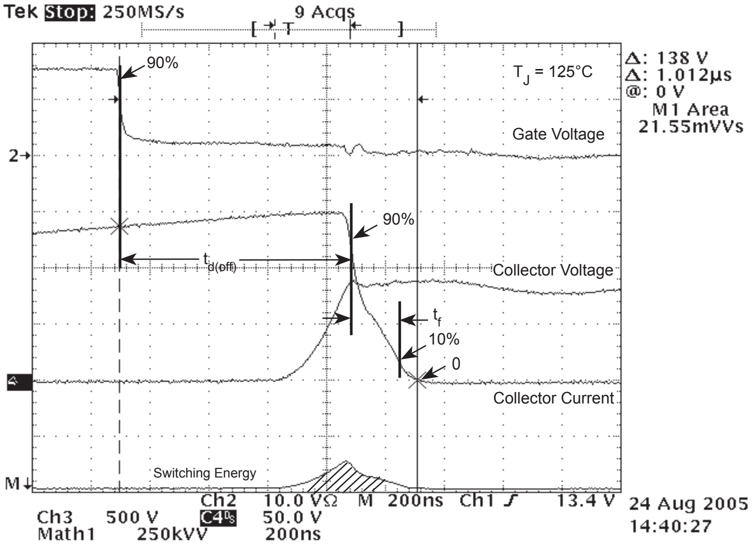


Figure 3, Turn-off Switching Waveforms and Definitions

ULTRAFAST SOFT RECOVERY ANTI-PARALLEL DIODE

MAXIMUM RATINGS

All Ratings: T_C = 25°C unless otherwise specified.

Symbol	Characteristic / Test Conditions	APT100GN120JRDQ4	Unit
$I_{F(AV)}$	Maximum Average Forward Current (T_C = 88°C, Duty Cycle = 0.5)	100	Amps
$I_{F(RMS)}$	RMS Forward Current (Square wave, 50% duty)	127	
I_{FSM}	Non-Repetitive Forward Surge Current (T_J = 45°C, 8.3 ms)	1000	

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions		Min	Type	Max	Unit
V_F	Forward Voltage	I_F = 100A		2.4	3.0	Volts
		I_F = 150A		2.65		
		I_F = 100A, T_J = 125°C		1.8		

DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
t_{rr}	Reverse Recovery Time	I_F = 1A, di_F/dt = -100A/µs, V_R = 30V, T_J = 25°C	-	45	-	ns
t_{rr}	Reverse Recovery Time	I_F = 100A, di_F/dt = -200A/µs V_R = 800V, T_C = 25°C	-	385	-	
Q_{rr}	Reverse Recovery Charge		-	1055	-	nC
I_{RRM}	Maximum Reverse Recovery Current		-	6	-	Amps
t_{rr}	Reverse Recovery Time	I_F = 100A, di_F/dt = -200A/µs V_R = 800V, T_C = 125°C	-	480	-	ns
Q_{rr}	Reverse Recovery Charge		-	5240	-	nC
I_{RRM}	Maximum Reverse Recovery Current		-	19	-	Amps
t_{rr}	Reverse Recovery Time	I_F = 60A, di_F/dt = -1000A/µs V_R = 800V, T_C = 125°C	-	210	-	ns
Q_{rr}	Reverse Recovery Charge		-	9345	-	nC
I_{RRM}	Maximum Reverse Recovery Current		-	70	-	Amps

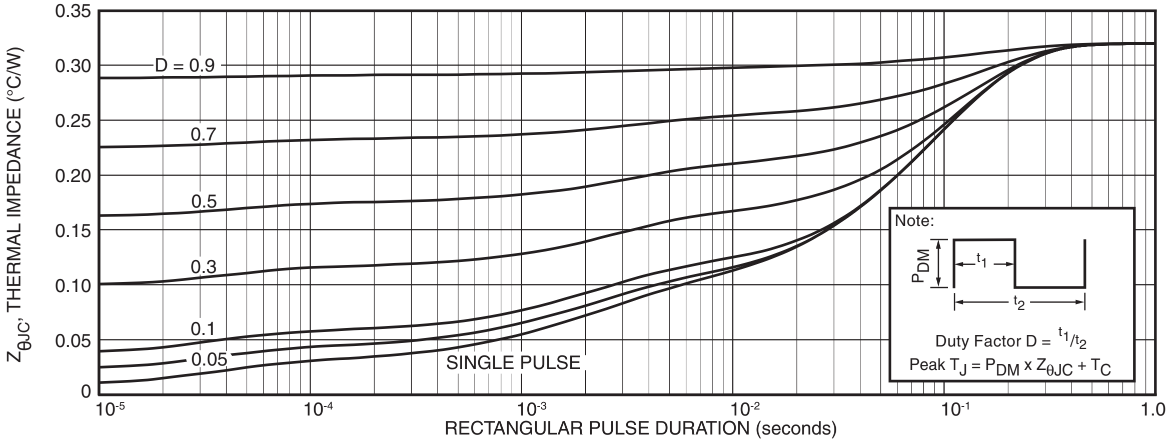
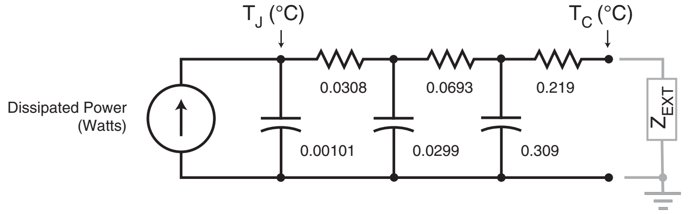


FIGURE 4a. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION



Z_{EXT} are the external thermal impedances: Case to sink, sink to ambient, etc. Set to zero when modeling only the case to junction.

FIGURE 4b, TRANSIENT THERMAL IMPEDANCE MODEL

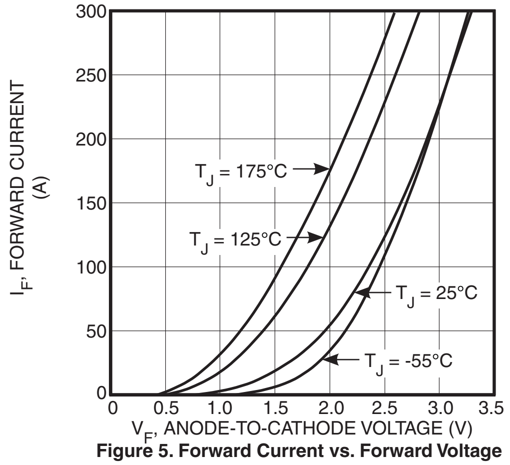


Figure 5. Forward Current vs. Forward Voltage

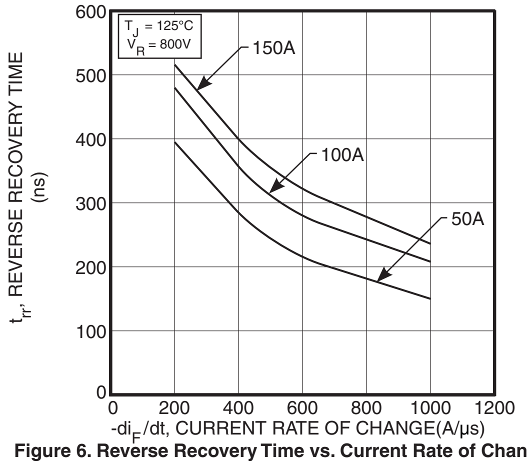


Figure 6. Reverse Recovery Time vs. Current Rate of Change

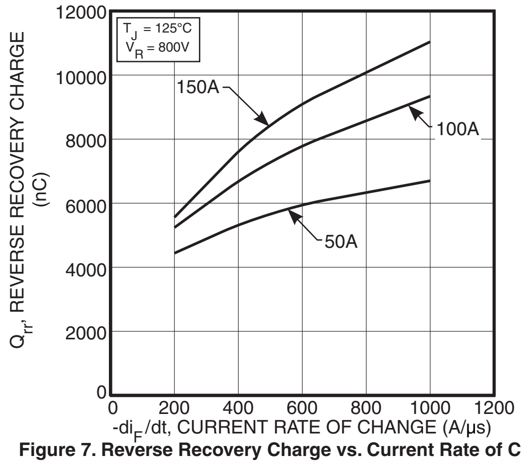


Figure 7. Reverse Recovery Charge vs. Current Rate of Change

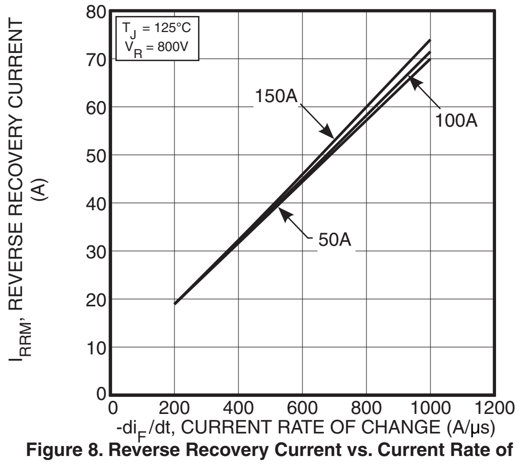


Figure 8. Reverse Recovery Current vs. Current Rate of Change

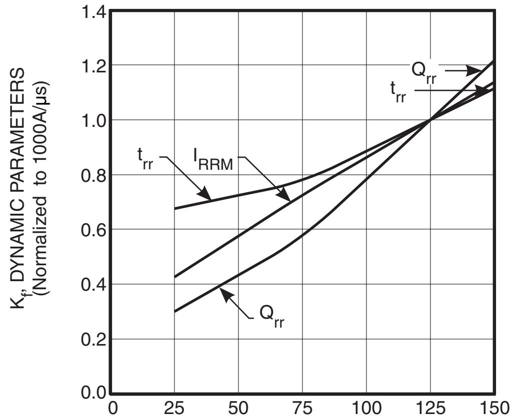


Figure 9. Dynamic Parameters vs. Junction Temperature

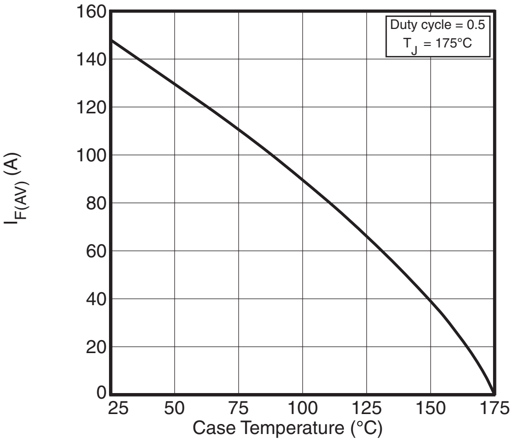


Figure 10. Maximum Average Forward Current vs. CaseTemperature

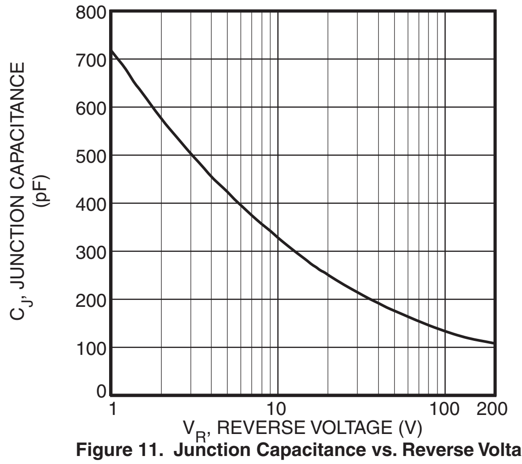


Figure 11. Junction Capacitance vs. Reverse Voltage

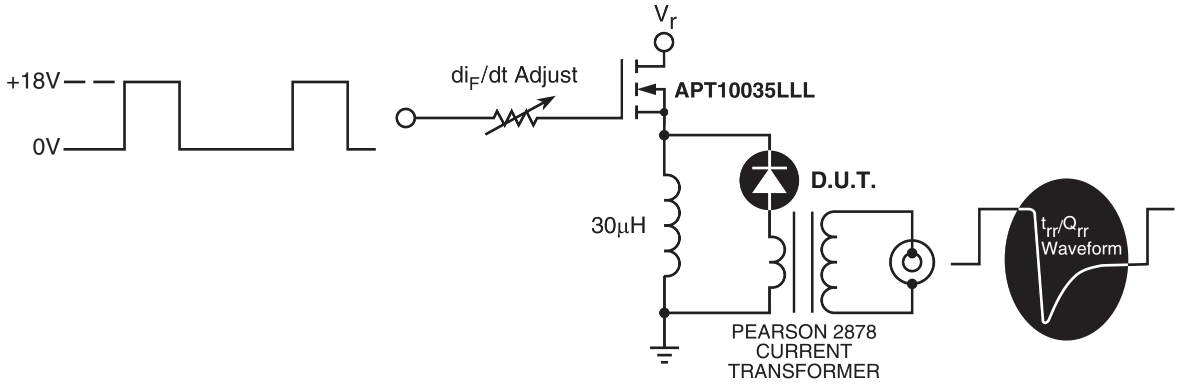


Figure 12, Diode Test Circuit

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 $0.25 \bullet I_{RRM}$ passes through zero.

⑤ Q_{rr} - Area Under the Curve Defined by I_{RRM} and t_{rr}.

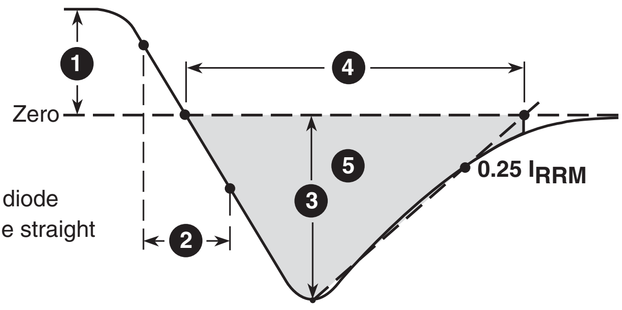
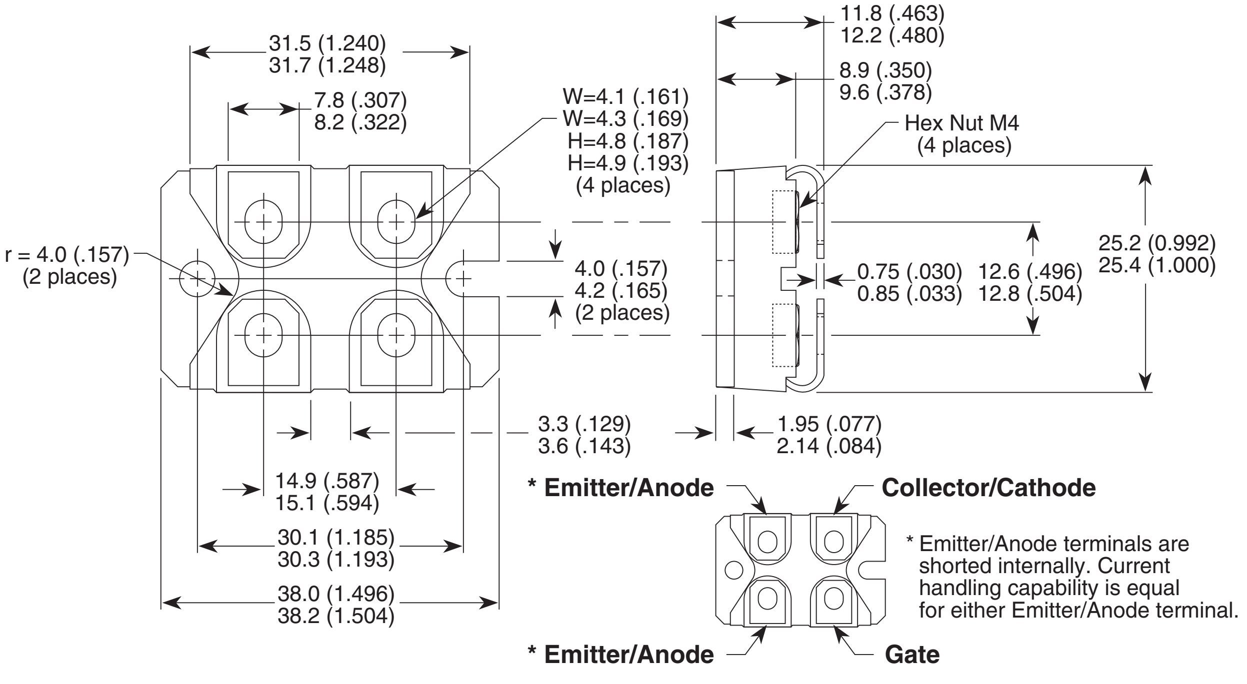


Figure 13, Diode Reverse Recovery Waveform and Definitions

SOT-227 (ISOTOP®) Package Outline



* Emitter/Anode terminals are shorted internally. Current handling capability is equal for either Emitter/Anode terminal.

Dimensions in Millimeters and (Inches)

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 6,939,743, 7,352,045 5,283,201 5,801,417 5,648,283 7,196,634 6,664,594 7,157,886 6,939,743 7,342,262 and foreign patents. US and Foreign patents pending. All Rights Reserved.