Microsemi
POWER PRODUCTS GROUP

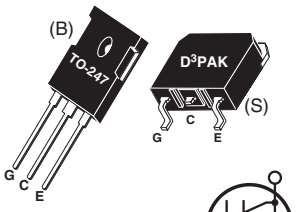
Power MOS 8 Cooler!

APT27GA90BD15
APT27GA90SD15

900V

High Speed PT IGBT

POWER MOS 8® is a high speed Punch-Through switch-mode IGBT. Low E_{off} is achieved through leading technology silicon design and lifetime control processes. A reduced E_{off} - $V_{CE(ON)}$ tradeoff results in superior efficiency compared to other IGBT technologies. Low gate charge and a greatly reduced ratio of C_{res}/C_{ies} provide excellent noise immunity, short delay times and simple gate drive. The intrinsic chip gate resistance and capacitance of the poly-silicone gate structure help control di/dt during switching, resulting in low EMI, even when switching at high frequency.





Combi (IGBT and Diode)

FEATURES

- **Fast switching with low EMI**
- **Very Low E_{off} for maximum efficiency**
- **Ultra low C_{res} for improved noise immunity**
- **Low conduction loss**
- **Low gate charge**
- **Increased intrinsic gate resistance for low EMI**
- **RoHS compliant**

TYPICAL APPLICATIONS

- **ZVS phase shifted and other full bridge**
- **Half bridge**
- **High power PFC boost**
- **Welding**
- **UPS, solar, and other inverters**
- **High frequency, high efficiency industrial**

Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit
V_{ces}	Collector Emitter Voltage	900	V
I_{C1}	Continuous Collector Current @ T_C = 25°C	48	A
I_{C2}	Continuous Collector Current @ T_C = 100°C	27	
I_{CM}	Pulsed Collector Current [1]	79	
V_{GE}	Gate-Emitter Voltage [2]	±30	V
P_D	Total Power Dissipation @ T_C = 25°C	223	W
SSOA	Switching Safe Operating Area @ T_J = 150°C	79A @ 900V	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	°C
T_L	Lead Temperature for Soldering: 0.063" from Case for 10 Seconds	300	

Static Characteristics

T_J = 25°C unless otherwise specified

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
$V_{BR(CES)}$	Collector-Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 1.0mA		900			V
$V_{CE(on)}$	Collector-Emitter On Voltage	V_{GE} = 15V, I_C = 14A	T_J = 25°C		2.5	3.1	
			T_J = 125°C		2.2		
$V_{GE(th)}$	Gate Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 1mA		3	4.5	6	
I_{CES}	Zero Gate Voltage Collector Current	V_{CE} = 900V, V_{GE} = 0V	T_J = 25°C			350	µA
			T_J = 125°C			1500	
I_{GES}	Gate-Emitter Leakage Current	V_{GS} = ±30V				±100	nA

052-6343 Rev D 7 - 2009

Dynamic Characteristic T_J **= 25°C unless otherwise specified** **APT27GA90BD_SD15**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	Capacitance		1390		pF
C_{oes}	Output Capacitance	V_{GE} = 0V, V_{CE} = 25V		145		
C_{res}	Reverse Transfer Capacitance	f = 1MHz		30		
Q_g [3]	Total Gate Charge	Gate Charge		62		nC
Q_{ge}	Gate-Emitter Charge	V_{GE} = 15V		8		
Q_{gc}	Gate- Collector Charge	V_{CE}= 450V I_C = 14A		24		
SSOA	Switching Safe Operating Area	T_J = 150°C, R_G = 10Ω[4], V_{GE} = 15V, L= 100uH, V_{CE} = 900V	79			A
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (25°C)		9		ns
t_r	Current Rise Time	V_{CC} = 600V		8		
$t_{d(off)}$	Turn-Off Delay Time	V_{GE} = 15V		98		
t_f	Current Fall Time	I_C = 14A		84		
E_{on2}	Turn-On Switching Energy	R_G = 10Ω[4]		413		µJ
E_{off} [6]	Turn-Off Switching Energy	T_J = +25°C		287		
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (125°C)		8		ns
t_r	Current Rise Time	V_{CC} = 600V		10		
$t_{d(off)}$	Turn-Off Delay Time	V_{GE} = 15V		137		
t_f	Current Fall Time	I_C = 14A		144		
E_{on2}	Turn-On Switching Energy	R_G = 10Ω[4]		760		µJ
E_{off} [6]	Turn-Off Switching Energy	T_J = +125°C		647		

Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance (IGBT)	-	-	.56	°C/W
$R_{\theta JC}$	Junction to Case Thermal Resistance (Diode)			1.18	
W_T	Package Weight	-	5.9	-	g
Torque	Mounting Torque (TO-247 Package), 4-40 or M3 screw			10	in·lbf

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

2 Pulse test: Pulse Width < 380μs, duty cycle < 2%.

3 See Mil-Std-750 Method 3471.

4 R_G is external gate resistance, not including internal gate resistance or gate driver impedance. (MIC4452)

5 E_{on2} is the clamped inductive turn on energy that includes a commutating diode reverse recovery current in the IGBT turn on energy loss. A combi device is used for the clamping diode.

6 E_{off} is the clamped inductive turn-off energy measured in accordance with JEDEC standard JESD24-1.

Microsemi reserves the right to change, without notice, the specifications and information contained herein.

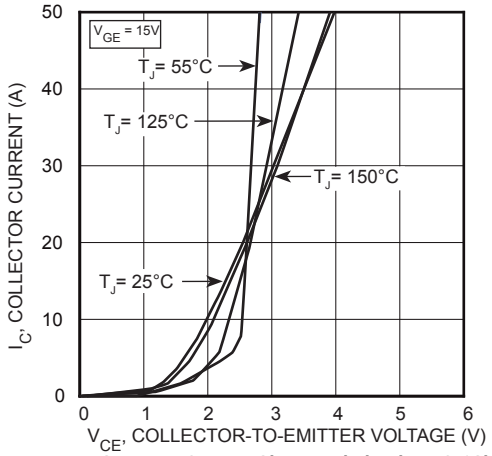


FIGURE 1, Output Characteristics (T_J = 25°C)

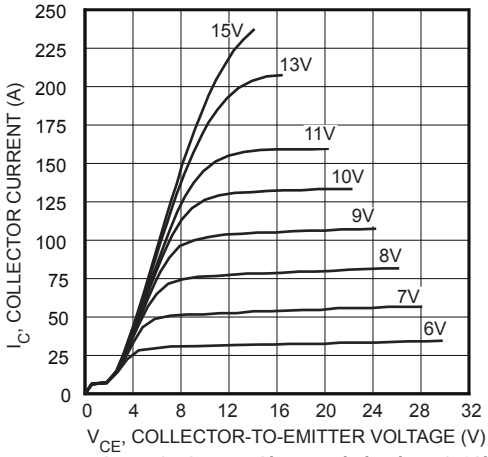


FIGURE 2, Output Characteristics (T_J = 25°C)

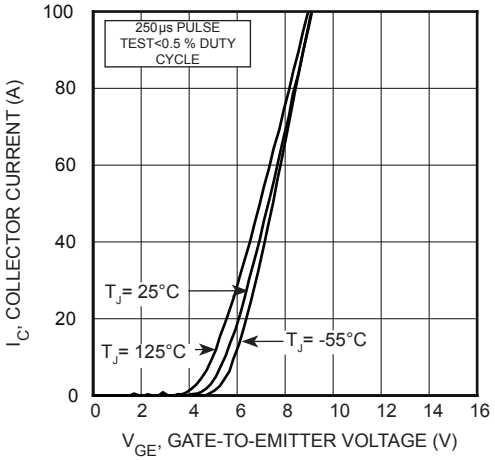


FIGURE 3, Transfer Characteristics

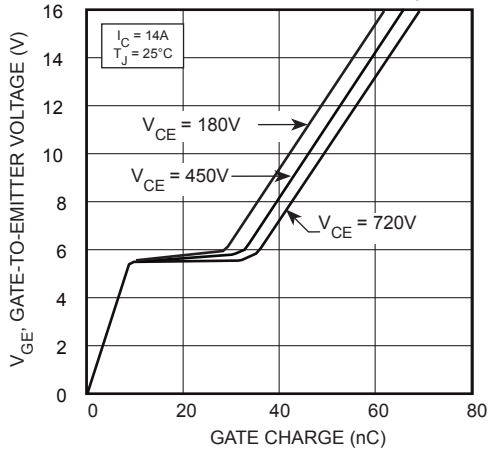


FIGURE 4, Gate charge

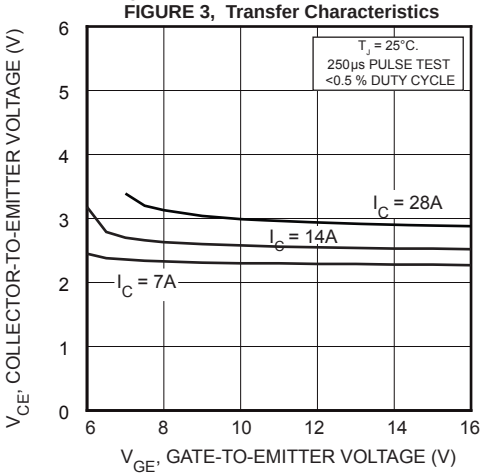


FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage

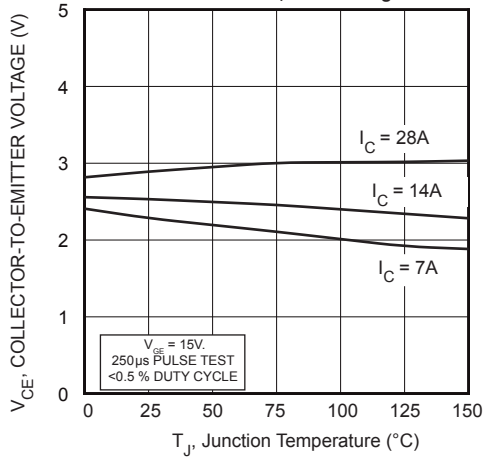


FIGURE 6, On State Voltage vs Junction Temperature

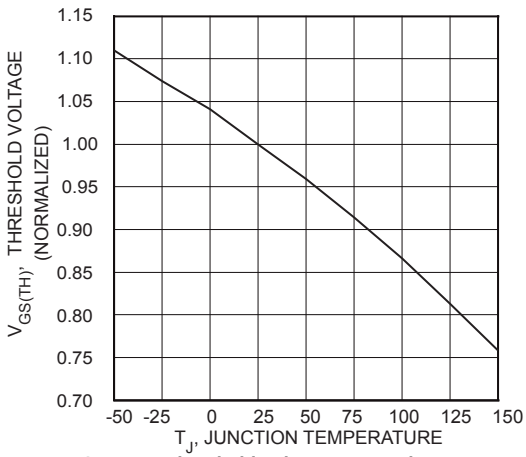


FIGURE 7, Threshold Voltage vs Junction Temperature

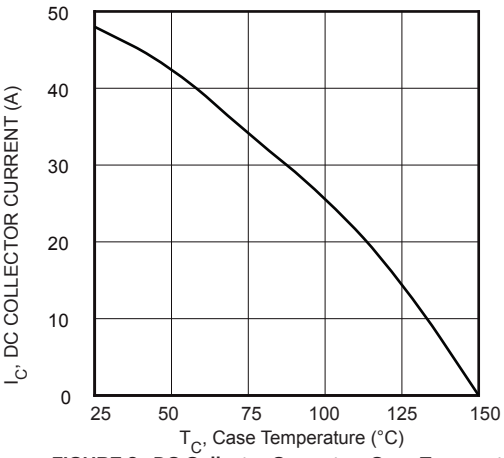


FIGURE 8, DC Collector Current vs Case Temperature

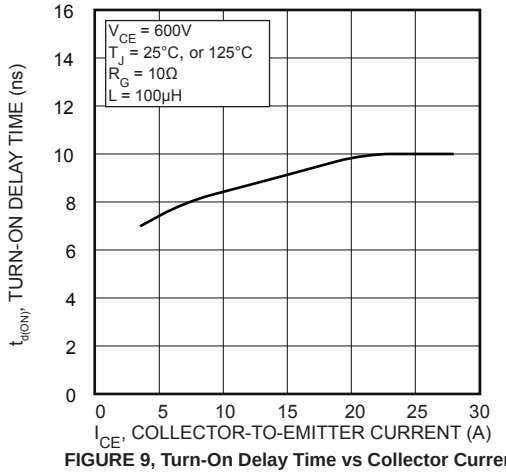


FIGURE 9, Turn-On Delay Time vs Collector Current

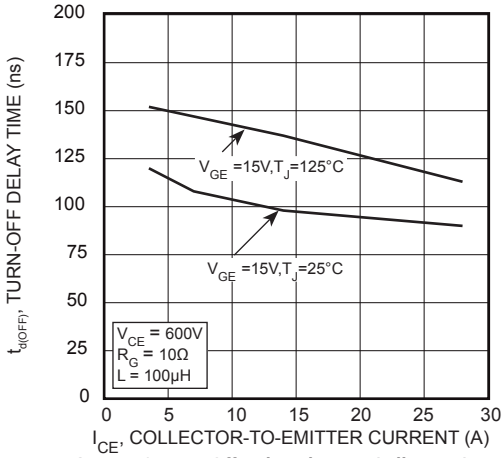


FIGURE 10, Turn-Off Delay Time vs Collector Current

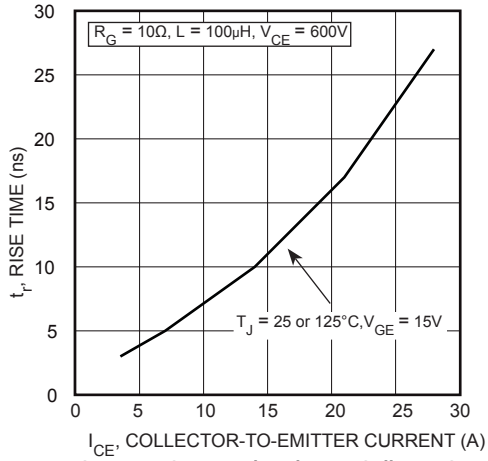


FIGURE 11, Current Rise Time vs Collector Current

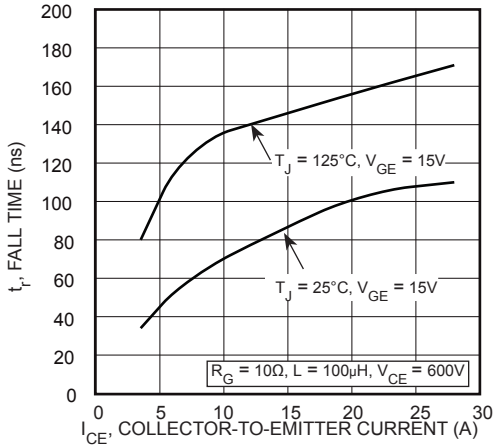


FIGURE 12, Current Fall Time vs Collector Current

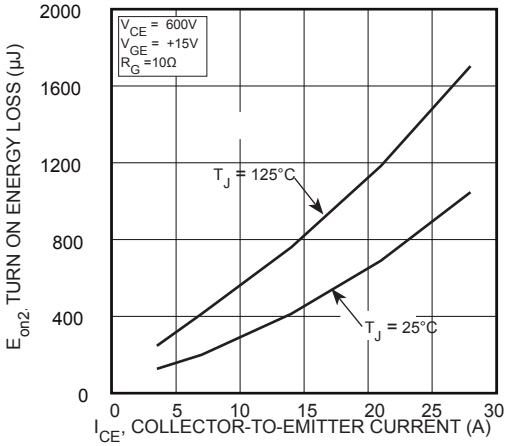


FIGURE 13, Turn-On Energy Loss vs Collector Current

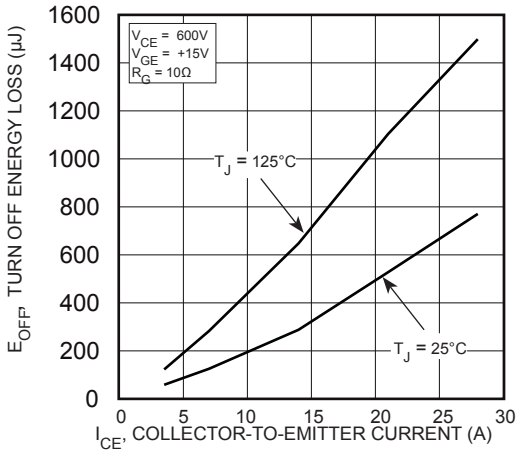


FIGURE 14, Turn-Off Energy Loss vs Collector Current

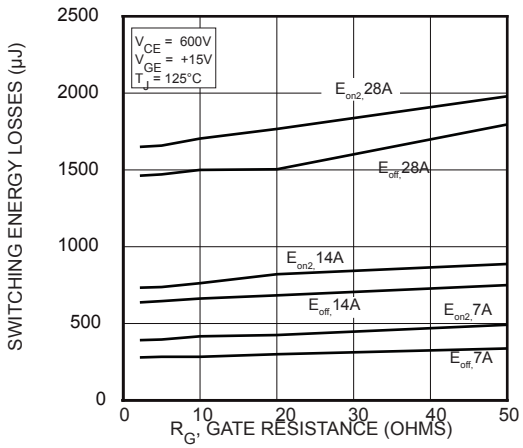


FIGURE 15, Switching Energy Losses vs Gate Resistance

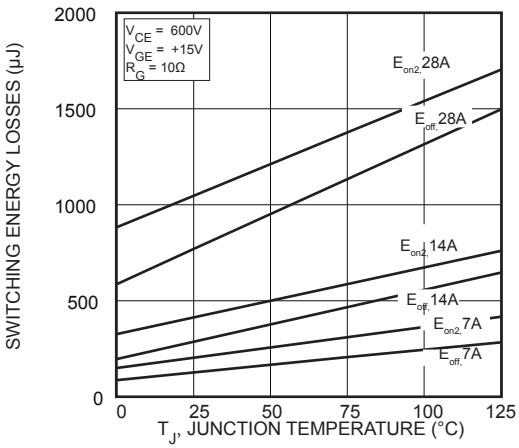


FIGURE 16, Switching Energy Losses vs Junction Temperature

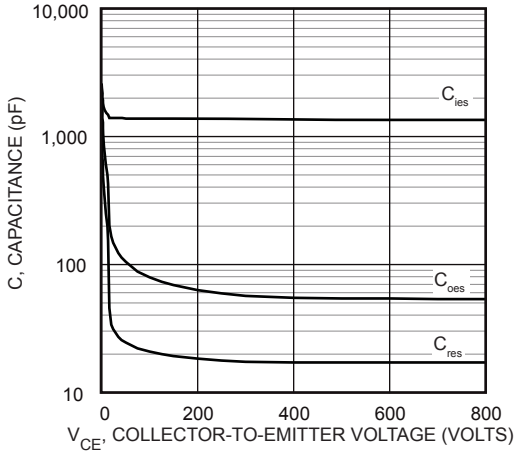


FIGURE 17, Capacitance vs Collector-To-Emitter Voltage

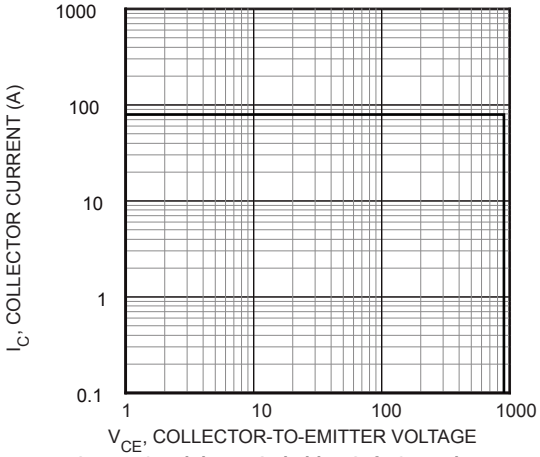


FIGURE 18, Minimum Switching Safe Operating Area

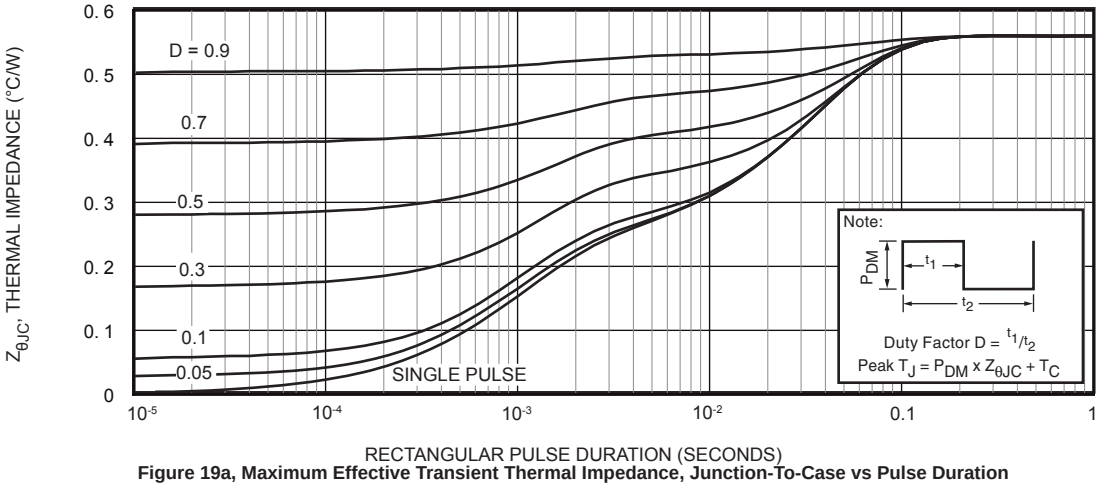


Figure 19a, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

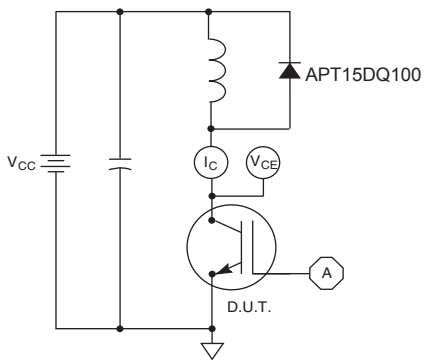


Figure 20, Inductive Switching Test Circuit

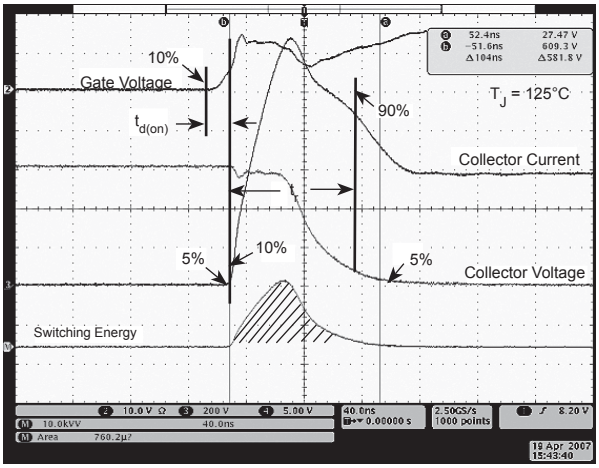


Figure 21, Turn-on Switching Waveforms and Definitions

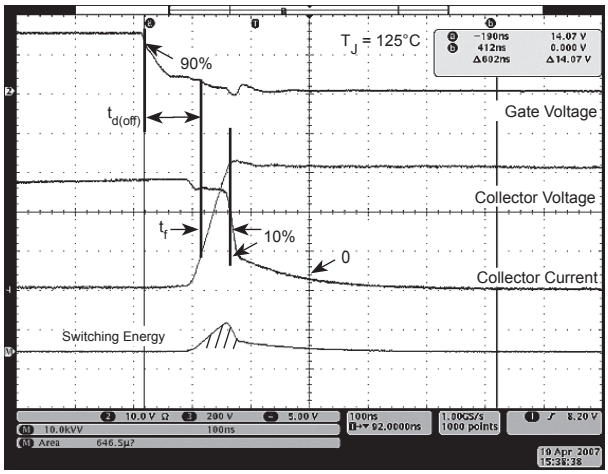


Figure 22, Turn-off Switching Waveforms and Definitions

ULTRAFAST SOFT RECOVERY RECTIFIER DIODE

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

Symbol	Characteristic / Test Conditions	APT27GA90BD_SD15	Unit
$I_{F(AV)}$	Maximum Average Forward Current (T_C = 126°C, Duty Cycle = 0.5)	15	Amps
$I_{F(RMS)}$	RMS Forward Current (Square wave, 50% duty)	29	
I_{FSM}	Non-Repetitive Forward Surge Current (T_J = 45°C, 8.3 ms)	80	

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions		Min	Type	Max	Unit
V_F	Forward Voltage	I_F = 15A		2.5		Volts
		I_F = 30A		3.06		
		I_F = 15A, T_J = 125°C		1.92		

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	-	20	-	ns
t_{rr}	Reverse Recovery Time	I_F = 15A, di_F/dt = -200A/µs V_R = 667V, T_C = 25°C	-	235	-	
Q_{rr}	Reverse Recovery Charge		-	185	-	nC
I_{RRM}	Maximum Reverse Recovery Current		-	3	-	Amps
t_{rr}	Reverse Recovery Time	I_F = 15A, di_F/dt = -200A/µs V_R = 667V, T_C = 125°C	-	300	-	ns
Q_{rr}	Reverse Recovery Charge		-	810	-	nC
I_{RRM}	Maximum Reverse Recovery Current		-	6	-	Amps
t_{rr}	Reverse Recovery Time	I_F = 15A, di_F/dt = -1000A/µs V_R = 667V, T_C = 125°C	-	125	-	ns
Q_{rr}	Reverse Recovery Charge		-	1150	-	nC
I_{RRM}	Maximum Reverse Recovery Current		-	19	-	Amps

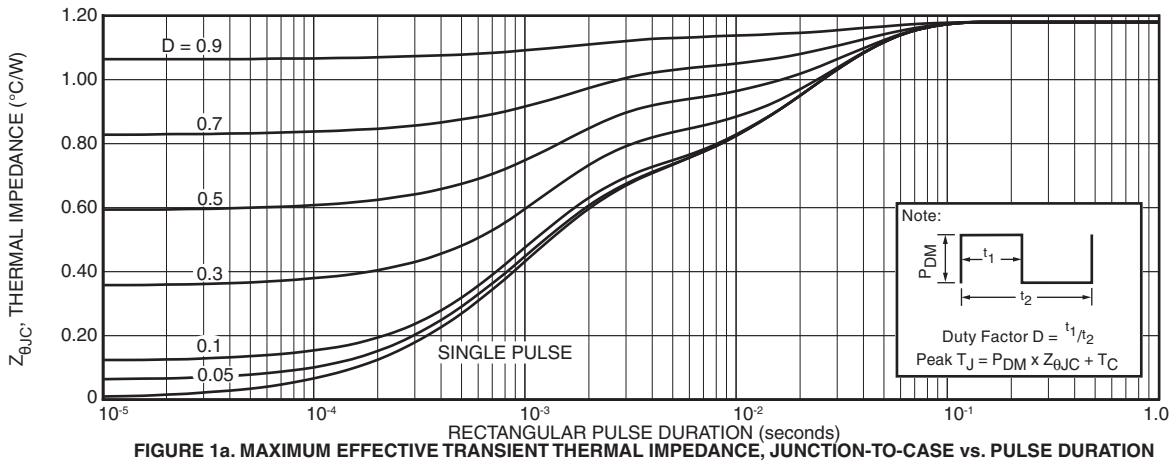


FIGURE 1a. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

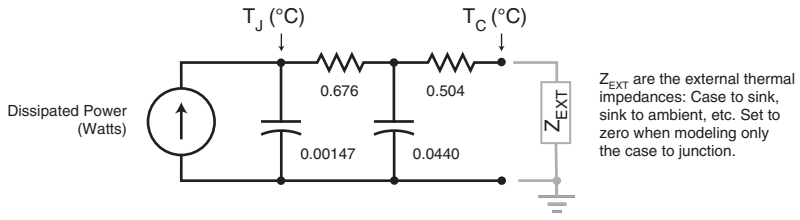


FIGURE 1b, TRANSIENT THERMAL IMPEDANCE MODEL

052-6343 Rev D 7 - 2009

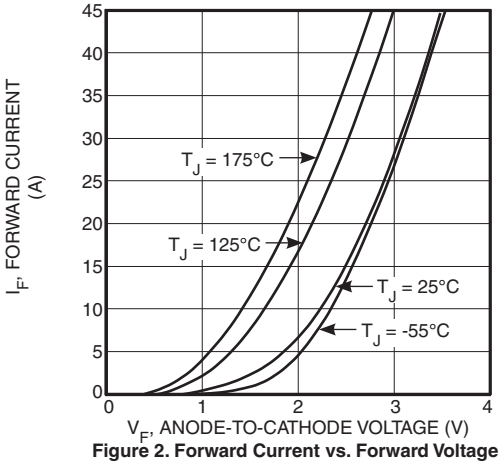


Figure 2. Forward Current vs. Forward Voltage

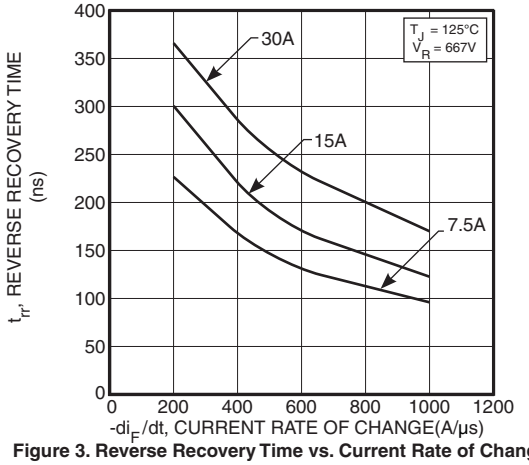


Figure 3. Reverse Recovery Time vs. Current Rate of Change

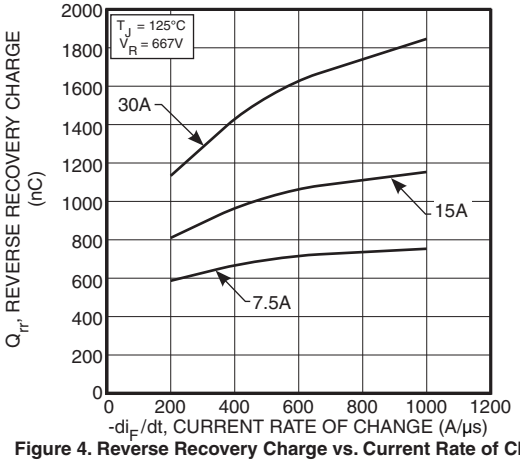


Figure 4. Reverse Recovery Charge vs. Current Rate of Change

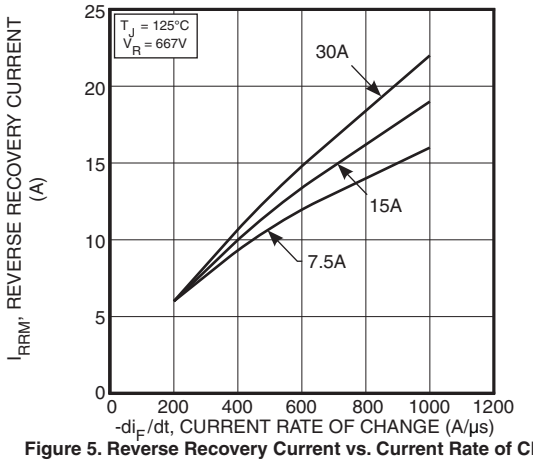


Figure 5. Reverse Recovery Current vs. Current Rate of Change

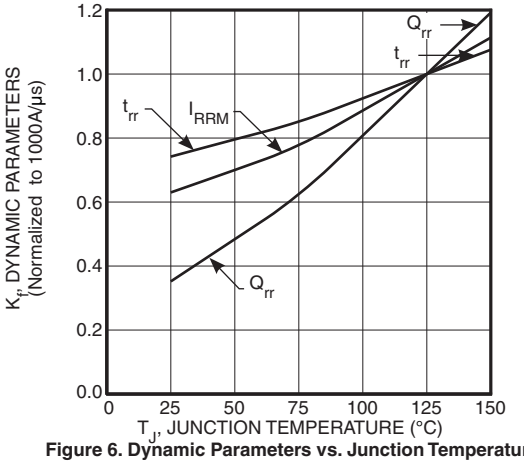


Figure 6. Dynamic Parameters vs. Junction Temperature

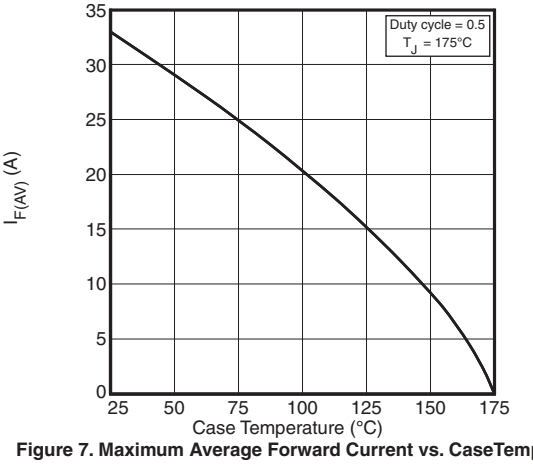


Figure 7. Maximum Average Forward Current vs. CaseTemperature

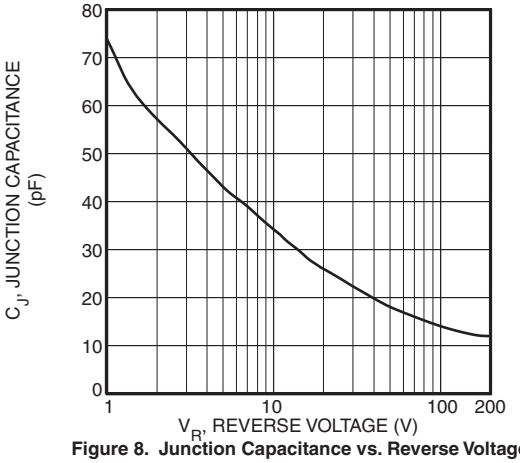


Figure 8. Junction Capacitance vs. Reverse Voltage

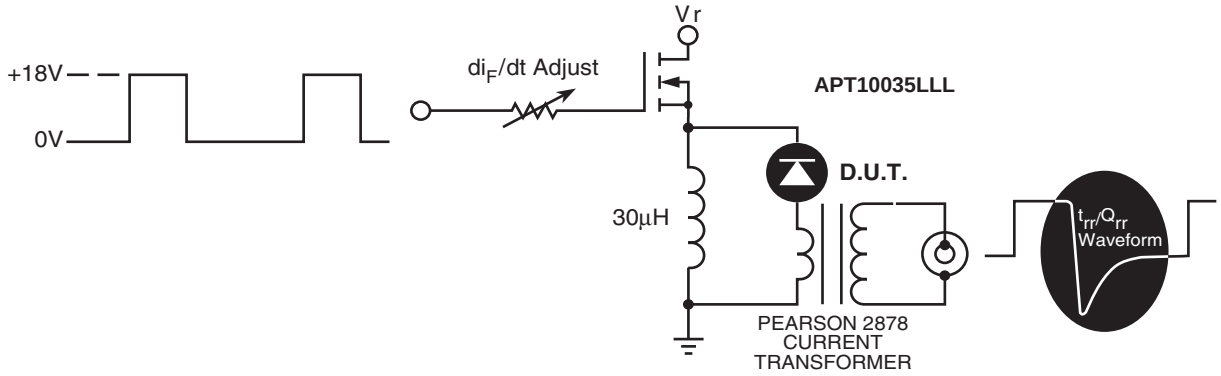
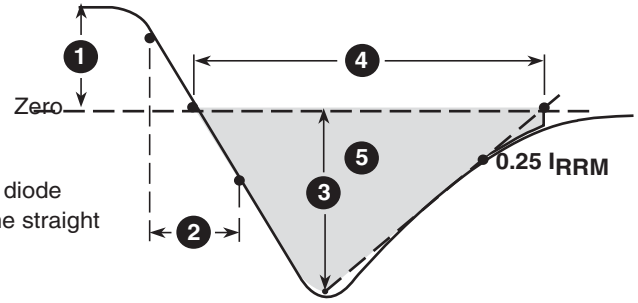


Figure 9. Diode Test Circuit

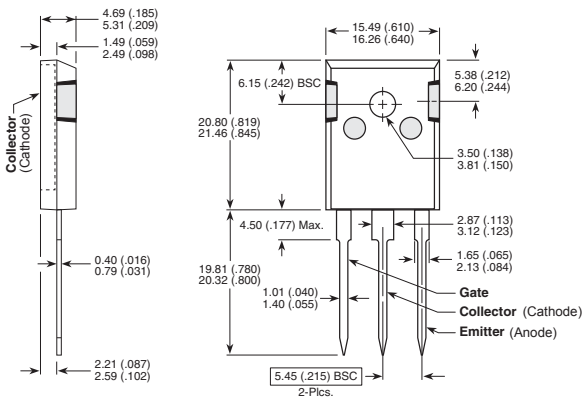


1. I_F - Forward Conduction Current
2. di_F/dt - Rate of Diode Current Change Through Zero Crossing.
3. I_{RRM} - Maximum Reverse Recovery Current.
4. t_{rr} - Reverse Recovery Time, measured from zero crossing where diode current goes from positive to negative, to the point at which the straight line through I_{RRM} and 0.25•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

TO-247 Package Outline

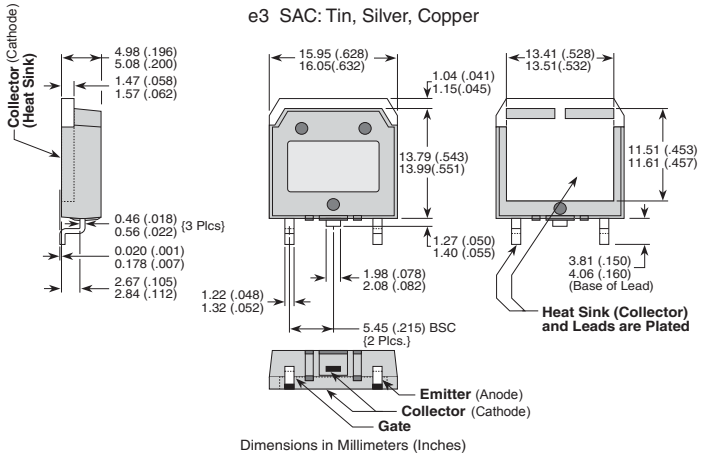
e1 SAC: Tin, Silver, Copper



Dimensions in Millimeters and (Inches)

D^{3}PAK Package Outline

e3 SAC: Tin, Silver, Copper



Dimensions in Millimeters (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.

052-6343 Rev D 7 - 2009