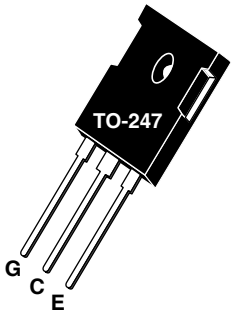
APT30GP60BSC

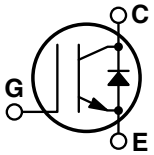
600V

POWER MOS 7® IGBT



A new generation of high voltage power IGBTs. Using punch-through technology and a proprietary metal gate, this IGBT has been optimized for very fast switching, making it ideal for high frequency, high voltage switch-mode power supplies and tail current sensitive applications. In many cases, the POWER MOS 7® IGBT provides a lower cost alternative to a Power MOSFET.

- **Low Conduction Loss**
- **Low Gate Charge**
- **Ultrafast Tail Current shutoff**
- **100 kHz operation @ 400V, 38A**
- **200 kHz operation @ 400V, 27A**
- **SSOA rated**



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

Symbol	Parameter	APT30GP60BSC	UNIT
V_{CES}	Collector-Emitter Voltage	600	Volts
V_{GE}	Gate-Emitter Voltage	±20	
V_{GEM}	Gate-Emitter Voltage Transient	±30	
I_{C1}	Continuous Collector Current @ T_C = 25°C	100	Amps
I_{C2}	Continuous Collector Current @ T_C = 110°C	49	
I_{CM}	Pulsed Collector Current ① @ T_C = 150°C	120	
SSOA	Switching Safe Operating Area @ T_J = 150°C	120A @ 600V	
P_D	Total Power Dissipation	463	Watts
T_J,T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	°C
T_L	Max. Lead Temp. for Soldering: 0.063" from Case for 10 Sec.	300	

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
BV_{CES}	Collector-Emitter Breakdown Voltage (V_{GE} = 0V, I_C = 500µA)	600			Volts
$V_{GE(TH)}$	Gate Threshold Voltage (V_{CE} = V_{GE}, I_C = 1mA, T_j = 25°C)	3	4.5	6	
$V_{CE(ON)}$	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 30A, T_j = 25°C)		2.2	2.7	
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 30A, T_j = 125°C)		2.1		
I_{CES}	Collector Cut-off Current (V_{CE} = 600V, V_{GE} = 0V, T_j = 25°C) ②			500	µA
	Collector Cut-off Current (V_{CE} = 600V, V_{GE} = 0V, T_j = 125°C) ②			3000	
I_{GES}	Gate-Emitter Leakage Current (V_{GE} = ±20V)			±100	nA

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

DYNAMIC CHARACTERISTICS

APT30GP60BSC

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{ies}	Input Capacitance	**Capacitance**		3200		pF
C_{oes}	Output Capacitance	V_{GE} = 0V, V_{CE} = 25V		295		
C_{res}	Reverse Transfer Capacitance	f = 1 MHz		10		
V_{GEP}	Gate-to-Emitter Plateau Voltage	**Gate Charge**		7.5		V
Q_g	Total Gate Charge ③	V_{GE} = 15V		90		nC
Q_{ge}	Gate-Emitter Charge	V_{CE} = 300V		20		
Q_{gc}	Gate-Collector ("Miller") Charge	I_C = 30A		30		
SSOA	Switching SOA	T_J = 150°C, R_G = 5Ω, V_{GE} = 15V, L = 100µH, V_{CE} = 600V	120			A
$t_{d(on)}$	Turn-on Delay Time	**Inductive Switching (25°C)**		14		ns
t_r	Current Rise Time	V_{CC} = 400V		17		
$t_{d(off)}$	Turn-off Delay Time	V_{GE} = 15V		43		
t_f	Current Fall Time	I_C = 30A		55		
E_{on1}	Turn-on Switching Energy ④	R_G = 5Ω		225		µJ
E_{on2}	Turn-on Switching Energy (Diode) ⑤	T_J = +25°C		235		
E_{off}	Turn-off Switching Energy ⑥			275		
$t_{d(on)}$	Turn-on Delay Time	**Inductive Switching (125°C)**		14		ns
t_r	Current Rise Time	V_{CC} = 400V		17		
$t_{d(off)}$	Turn-off Delay Time	V_{GE} = 15V		80		
t_f	Current Fall Time	I_C = 30A		90		
E_{on1}	Turn-on Switching Energy ④	R_G = 5Ω		230		µJ
E_{on2}	Turn-on Switching Energy (Diode) ⑤	T_J = +125°C		245		
E_{off}	Turn-off Switching Energy ⑥			650		

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\Theta JC}$	Junction to Case (IGBT)			.27	°C/W
$R_{\Theta JC}$	Junction to Case (DIODE)			1.1	
W_T	Package Weight			5.90	gm

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

② For Combi devices, I_{ces} includes both IGBT and Silicon Carbide Schottky 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 the IGBT turn-on loss. (See Figure 24.)

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.)

050-7450 Rev A 3-2004

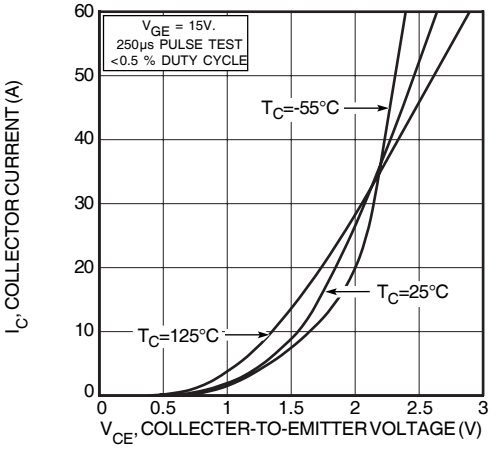


FIGURE 1, Output Characteristics(V_{GE} = 15V)

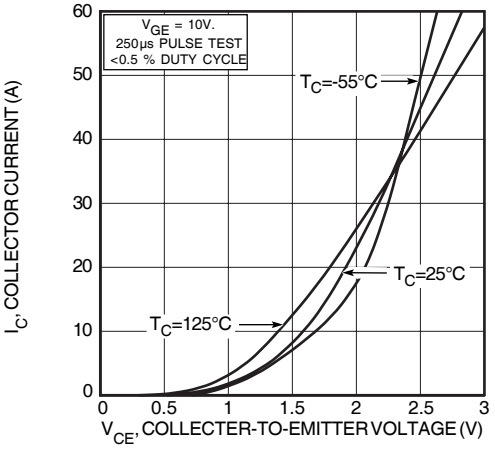


FIGURE 2, Output Characteristics (V_{GE} = 10V)

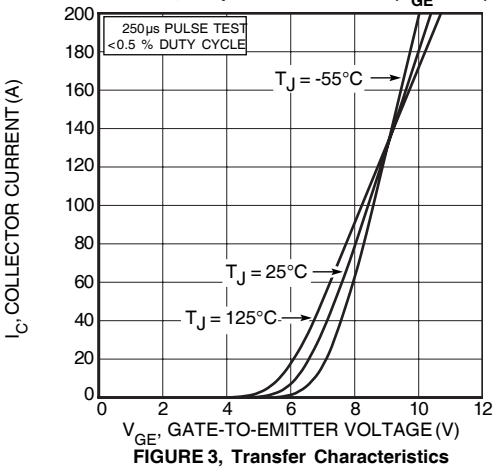


FIGURE 3, Transfer Characteristics

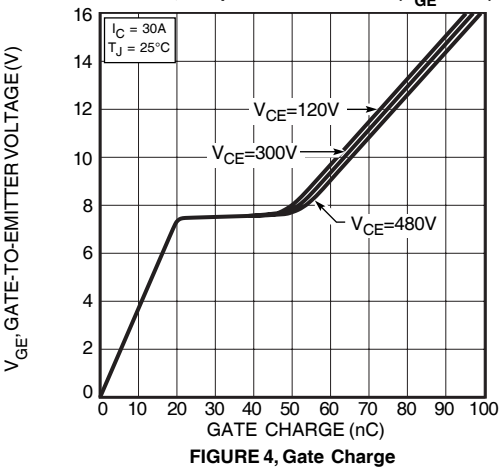


FIGURE 4, Gate Charge

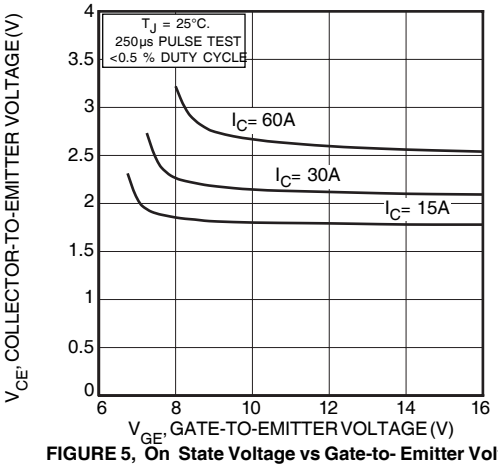


FIGURE 5, On State Voltage vs Gate-to- Emitter Voltage

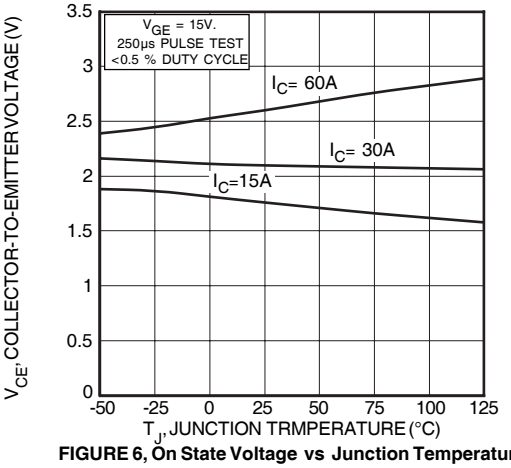


FIGURE 6, On State Voltage vs Junction Temperature

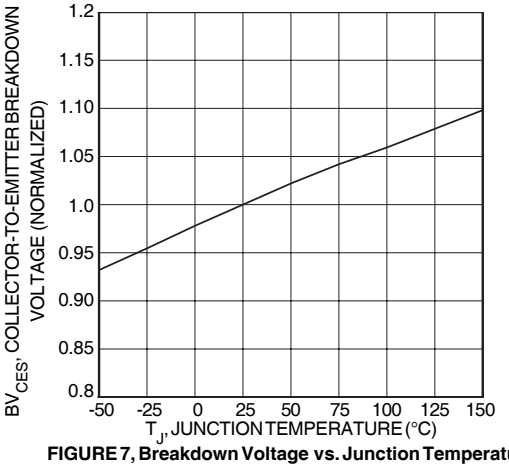


FIGURE 7, Breakdown Voltage vs. Junction Temperature

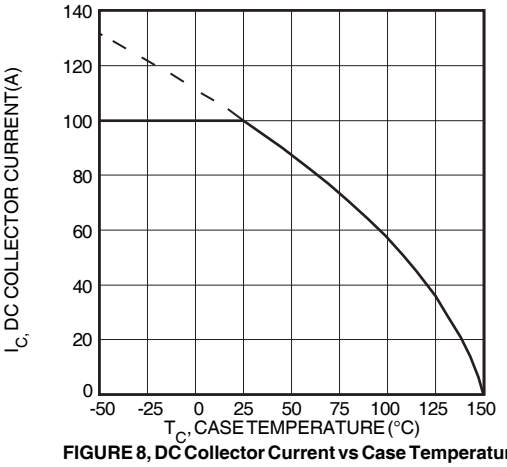


FIGURE 8, DC Collector Current vs Case Temperature

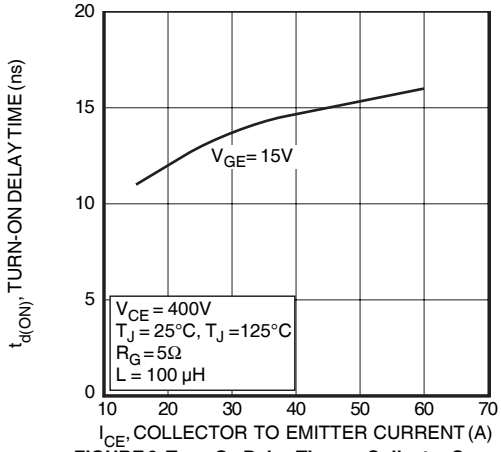


FIGURE 9, Turn-On Delay Time vs Collector Current

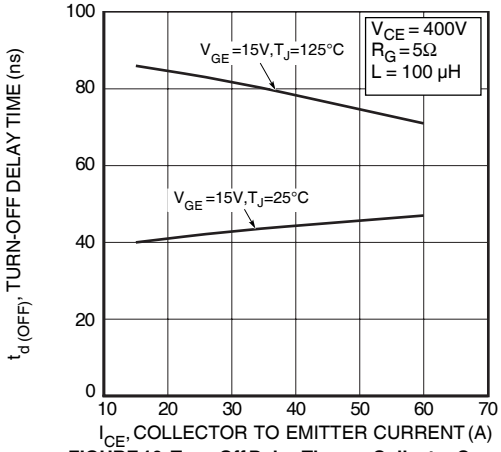


FIGURE 10, Turn-Off Delay Time vs Collector Current

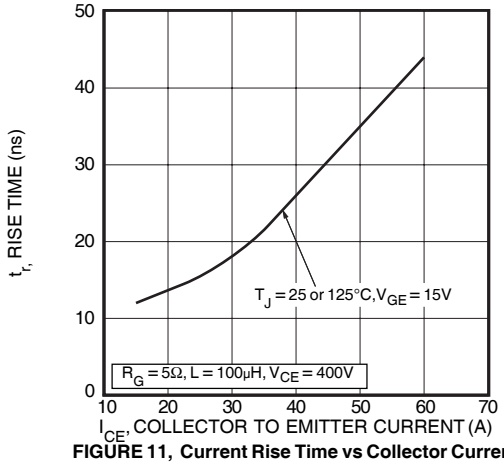


FIGURE 11, Current Rise Time vs Collector Current

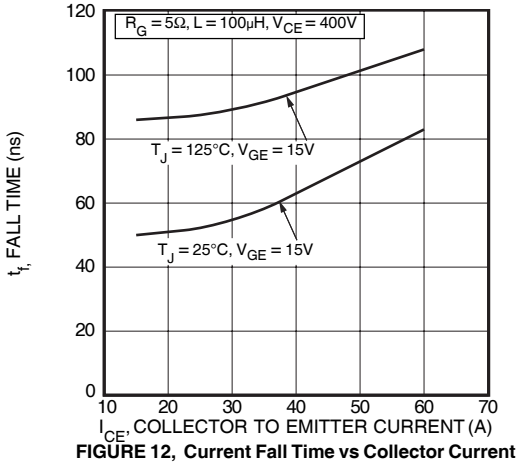


FIGURE 12, Current Fall Time vs Collector Current

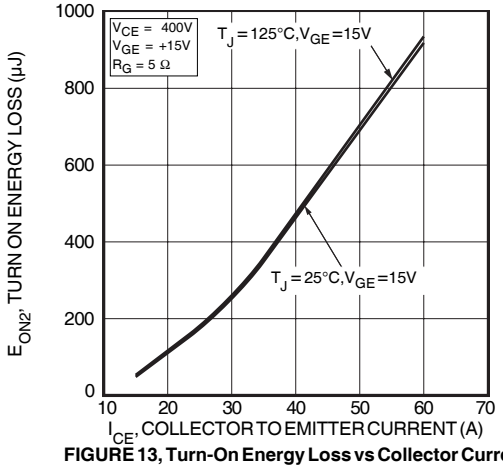


FIGURE 13, Turn-On Energy Loss vs Collector Current

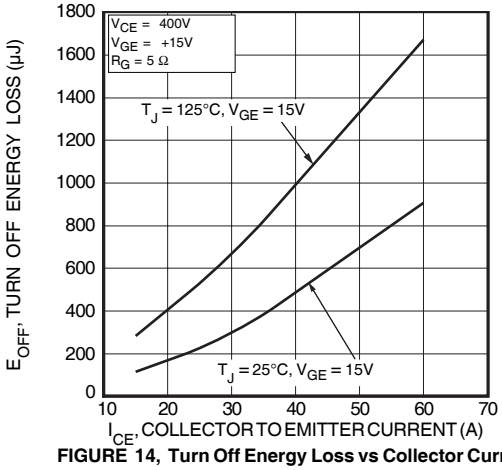


FIGURE 14, Turn Off Energy Loss vs Collector Current

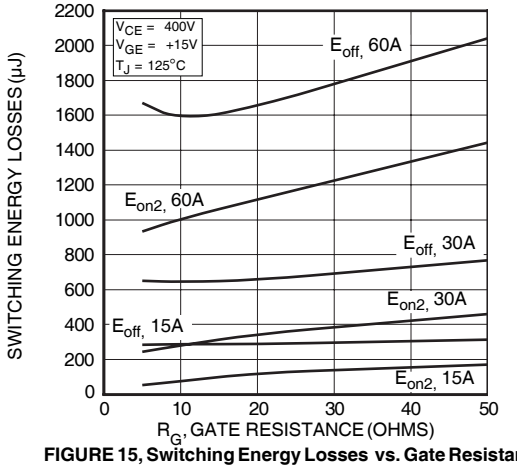


FIGURE 15, Switching Energy Losses vs. Gate Resistance

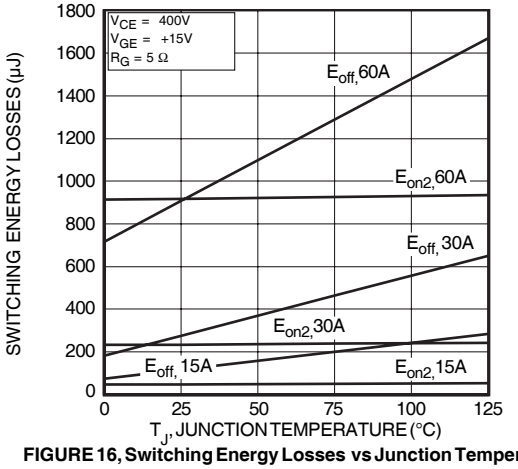


FIGURE 16, Switching Energy Losses vs Junction Temperature

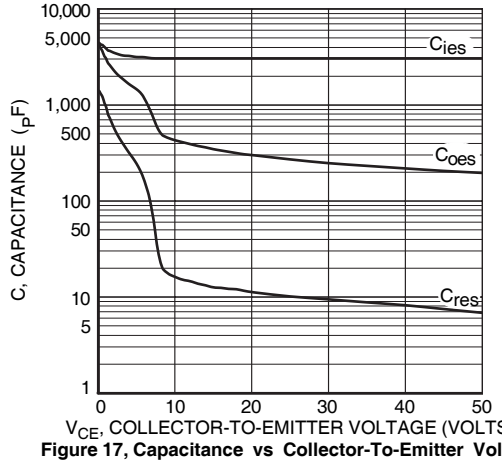


Figure 17, Capacitance vs Collector-To-Emitter Voltage

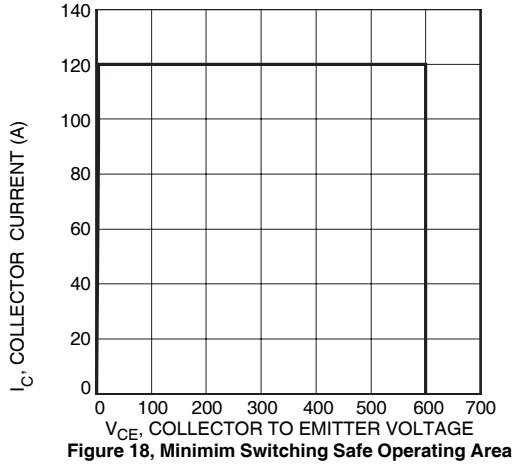


Figure 18, Minimim Switching Safe Operating Area

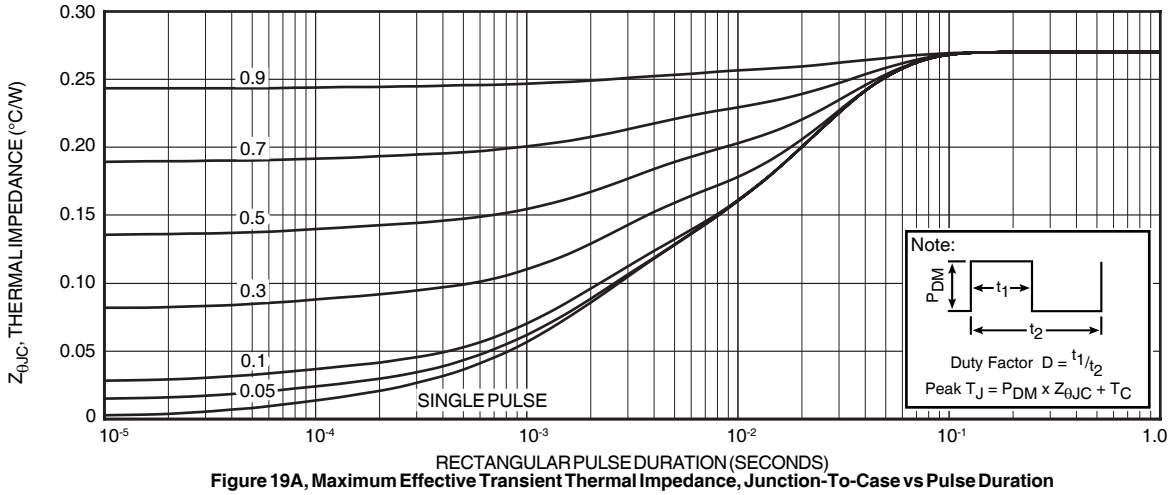


Figure 19A, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

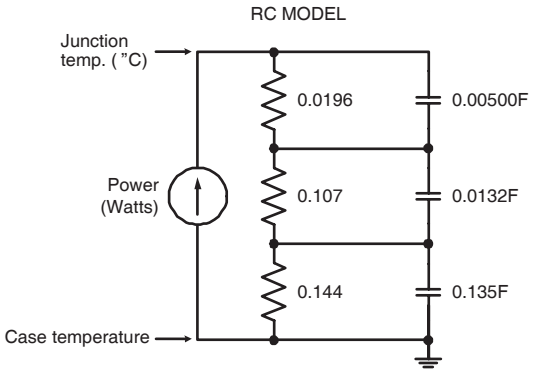
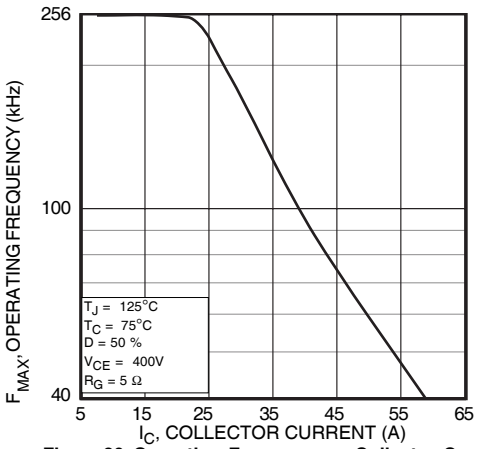


FIGURE 19B, TRANSIENT THERMAL IMPEDANCE MODEL



$$F_{max} = \min(f_{max1}, f_{max2})$$

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

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

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

Figure 20, Operating Frequency vs Collector Current

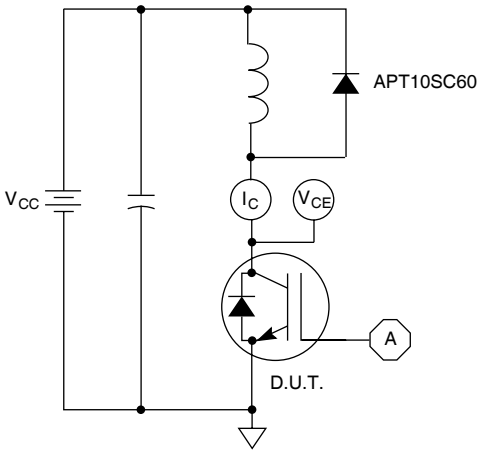


Figure 21, Inductive Switching Test Circuit

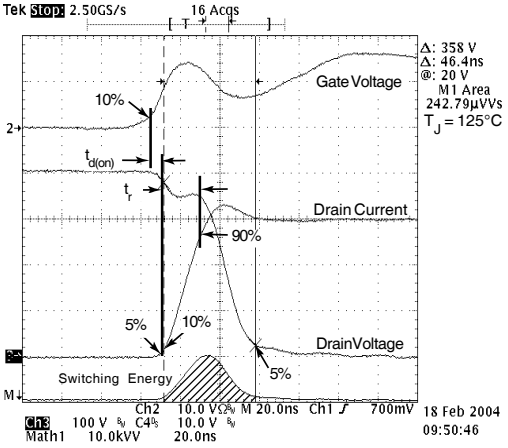


Figure 22, Turn-on Switching Waveforms and Definitions

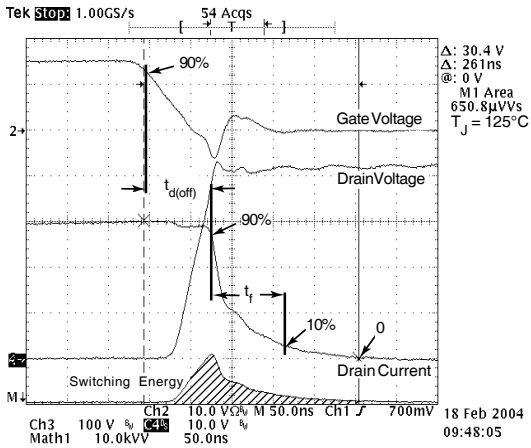


Figure 23, Turn-off Switching Waveforms and Definitions

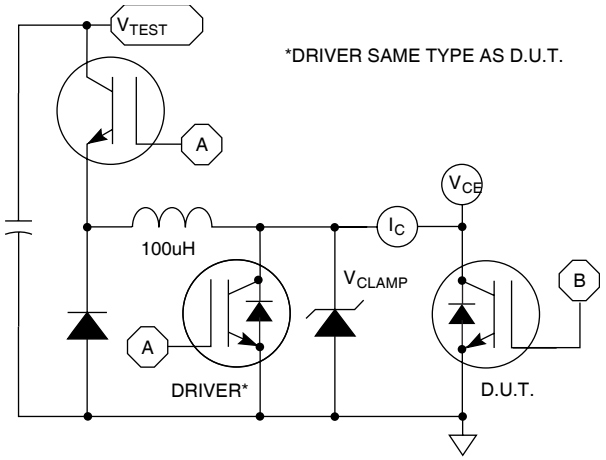


Figure 24, E_{ON1} Test Circuit

SILICON CARBIDE SCHOTTKY RECTIFIER DIODE

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

Symbol	Characteristic / Test Conditions	APT30GP60BSC			UNIT
$I_F(AV)$	Maximum Average Forward Current (T_C = 130°C, Duty Cycle = 0.5)		10		Amps
$I_F(RMS)$	RMS Forward Current		19		
I_{FSM}	Non-Repetitive Forward Surge Current (T_J = 25°C, t_p = 10µs)		250		

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions		MIN	TYP	MAX	UNIT
V_F	Forward Voltage	I_F = 30A		3.1		Volts
		I_F = 60A		5.9		
		I_F = 30A, T_J = 175°C		5.6		

DYNAMIC CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	
C	Capacitance (V_R = 400V, T_C = 25°C, F = 1 MHz)	-	50		
Q_C	Total Capacitive Charge (V_R = 600V, I_F = 20A, di_F/dt = 500A/µs, T_C = 25°C)	-	28		
t_{fr}	Forward Recovery Time①		N/A		
t_{rr}	Reverse Recovery Time①		N/A		
dv/dt	Peak Diode Recovery (V_R = 480V, di/dt = 1000A/µs, T_C = 25°C)	50			

① As a majority carrier device, there is no reverse recovery charge.

***zero recovery*™, is a Trademark of CREE INC.**

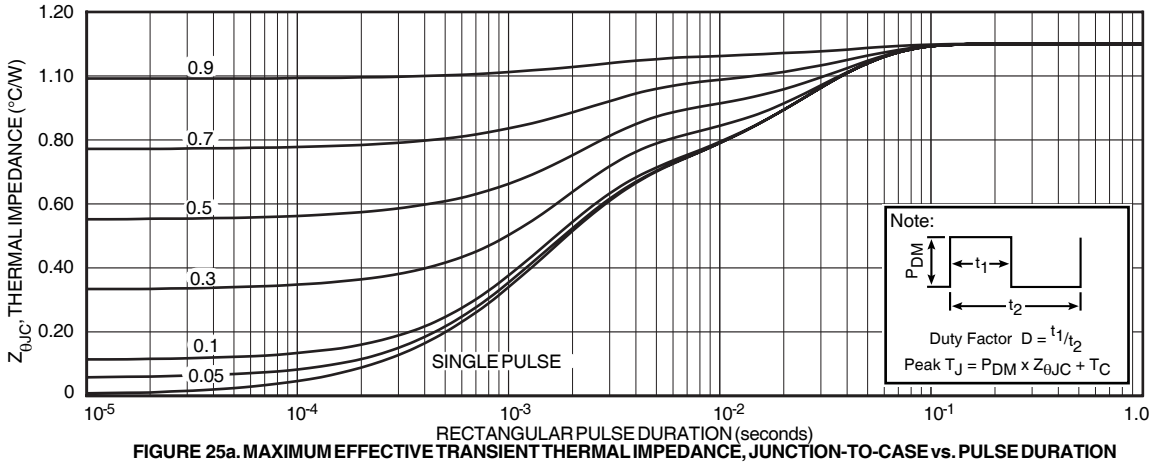


FIGURE 25a. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

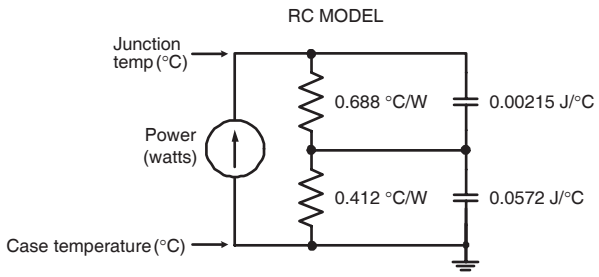


FIGURE 25b, TRANSIENT THERMAL IMPEDANCE MODEL

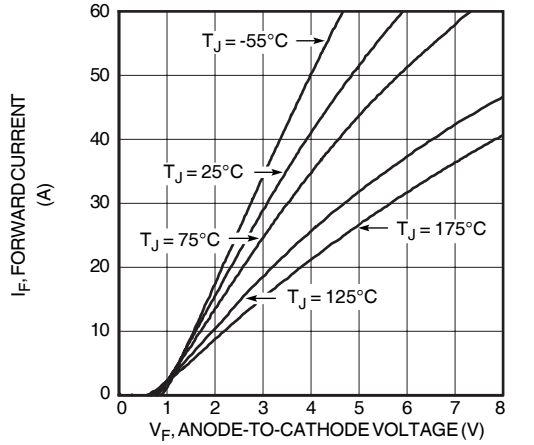


Figure 26. Forward Current *vs.* Forward Voltage

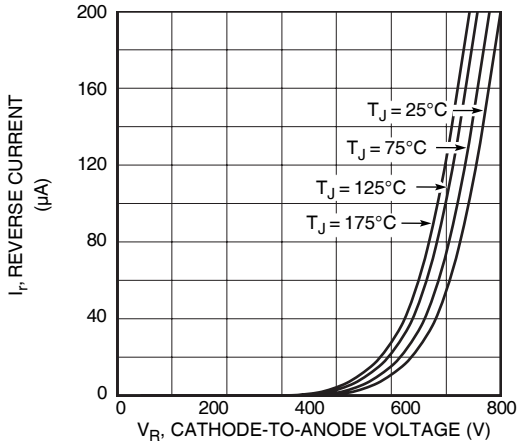


Figure 27. Reverse Current *vs.* Reverse Voltage

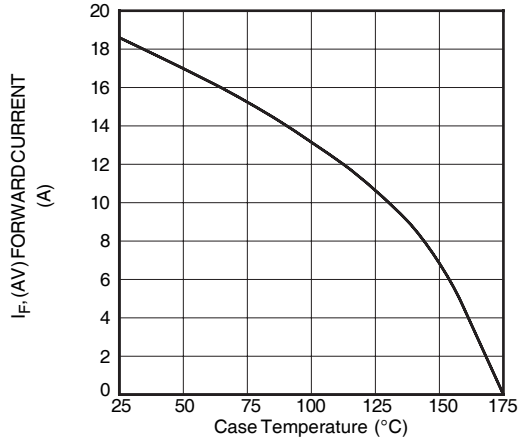


Figure 28. Current Derating

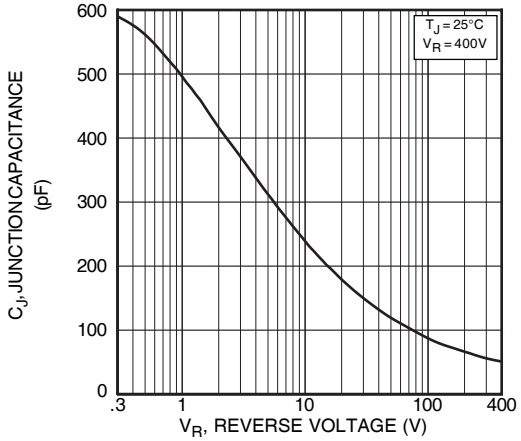
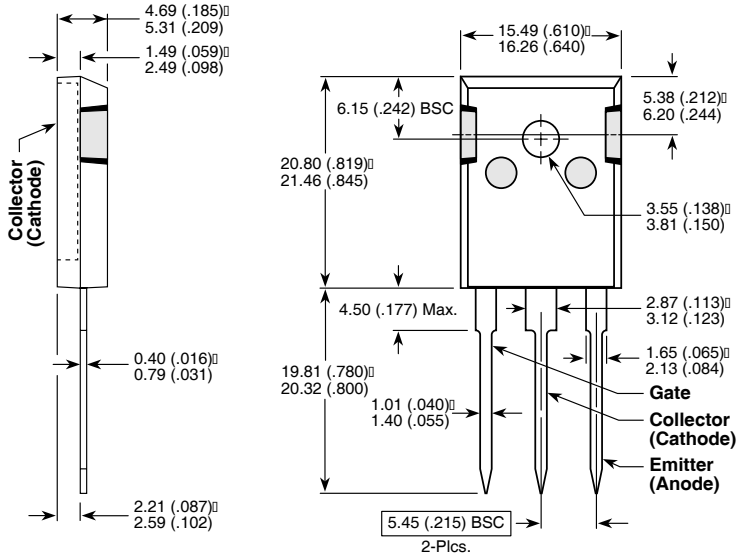


Figure 29. Junction Capacitance *vs.* Reverse Voltage

T0-247 Package Outline



Dimensions in Millimeters and (Inches)