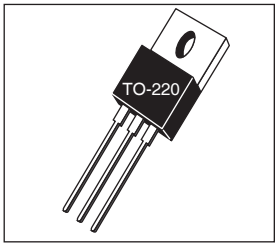
ADVANCED POWER TECHNOLOGY®

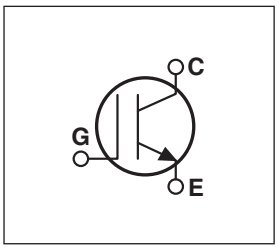
1200V
APT11GF120KR
APT11GF120KRG*
***G Denotes RoHS Compliant, Pb Free Terminal Finish.**

FAST IGBT & FRED



The Fast IGBT is a new generation of high voltage power IGBTs. Using Non-Punch through technology, the Fast IGBT combined with an APT free wheeling Ultra Fast Recovery Epitaxial Diode (FRED) offers superior ruggedness and fast switching speed.

- **Low Forward Voltage Drop**
- **High Freq. Switching to 20KHz**
- **RBSOA and SCSOA Rated**
- **Ultra Low Leakage Current**
- **Ultrafast Soft Recovery Anti-parallel Diode**



MAXIMUM RATINGS

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

Symbol	Parameter	APT11GF120KR(G)	UNIT
V_{CES}	Collector-Emitter Voltage	1200	Volts
V_{GE}	Gate-Emitter Voltage	±30	
I_{C1}	Continuous Collector Current @ T_C = 25°C	25	Amps
I_{C2}	Continuous Collector Current @ T_C = 100°C	14	
I_{CM}	Pulsed Collector Current ①	44	
SSOA	Switching Safe Operating Area @ T_J = 150°C	44A @ 1200V	
P_D	Total Power Dissipation	156	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	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage (V_{GE} = 0V, I_C = 400µA)	1200			Volts
$V_{GE(TH)}$	Gate Threshold Voltage (V_{CE} = V_{GE}, I_C = 350µA, T_j = 25°C)	4.5	5.5	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 8A, T_j = 25°C)		2.5	3.0	
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 8A, T_j = 125°C)		3.1		
I_{CES}	Collector Cut-off Current (V_{CE} = 1200V, V_{GE} = 0V, T_j = 25°C) ②			400	µA
	Collector Cut-off Current (V_{CE} = 1200V, V_{GE} = 0V, T_j = 125°C) ②			2000	
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.

APT Website - http://www.advancedpower.com

052-6213 Rev C 1-2006

DYNAMIC CHARACTERISTICS

APT11GF120KR(G)

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{ies}	Input Capacitance	**Capacitance**		620		pF
C_{oes}	Output Capacitance	V_{GE} = 0V, V_{CE} = 25V		90		
C_{res}	Reverse Transfer Capacitance	f = 1 MHz		40		
V_{GEP}	Gate-to-Emitter Plateau Voltage	Gate Charge		10.0		V
Q_g	Total Gate Charge ③	V_{GE} = 15V		65		nC
Q_{ge}	Gate-Emitter Charge	V_{CE} = 600V		10		
Q_{gc}	Gate-Collector ("Miller") Charge	I_C = 8A		35		
SSOA	Switching Safe Operating Area	T_J = 150°C, R_G = 10Ω, V_{GE} = 15V, L = 100µH, V_{CE} = 1200V	44			A
$t_{d(on)}$	Turn-on Delay Time	**Inductive Switching (25°C)**		7		ns
t_r	Current Rise Time	V_{CC} = 800V		5		
$t_{d(off)}$	Turn-off Delay Time	V_{GE} = 15V		100		
t_f	Current Fall Time	I_C = 8A		55		
E_{on1}	Turn-on Switching Energy ④	R_G = 10Ω		300		µJ
E_{on2}	Turn-on Switching Energy (Diode) ⑤	T_J = +25°C		485		
E_{off}	Turn-off Switching Energy ⑥			285		
$t_{d(on)}$	Turn-on Delay Time	**Inductive Switching (125°C)**		7		ns
t_r	Current Rise Time	V_{CC} = 800V		5		
$t_{d(off)}$	Turn-off Delay Time	V_{GE} = 15V		115		
t_f	Current Fall Time	I_C = 8A		46		
E_{on1}	Turn-on Switching Energy ④	R_G = 10Ω		295		µJ
E_{on2}	Turn-on Switching Energy (Diode) ⑤	T_J = +125°C		915		
E_{off}	Turn-off Switching Energy ⑥			325		

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case **(IGBT)**			.80	°C/W
$R_{\theta JC}$	Junction to Case **(DIODE)**			N/A	
W_T	Package Weight	5.9			gm

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 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.)

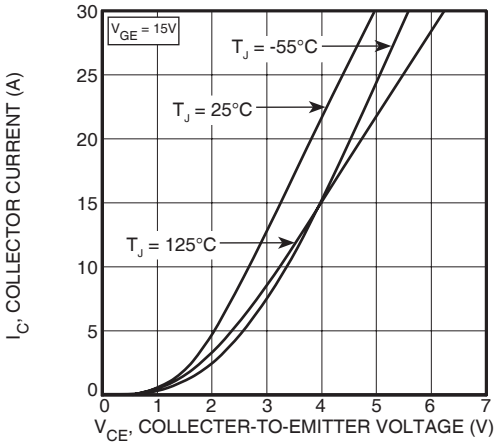


FIGURE 1, Output Characteristics(T_J = 25°C)

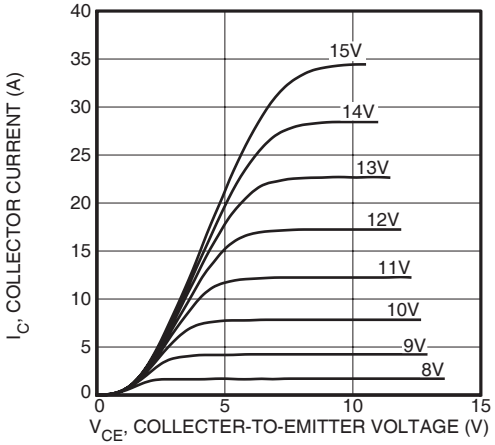


FIGURE 2, Output Characteristics (T_J = 125°C)

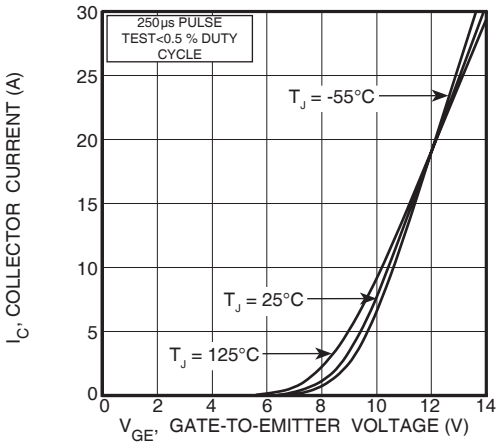


FIGURE 3, Transfer Characteristics

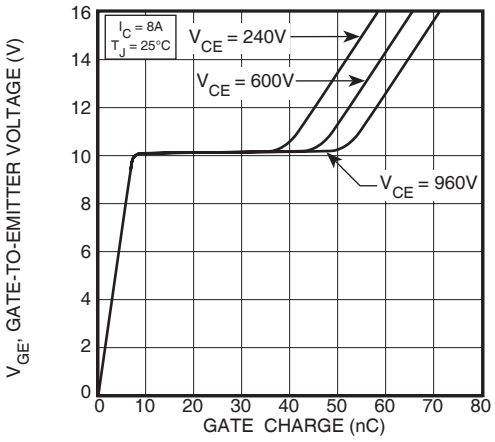


FIGURE 4, Gate Charge

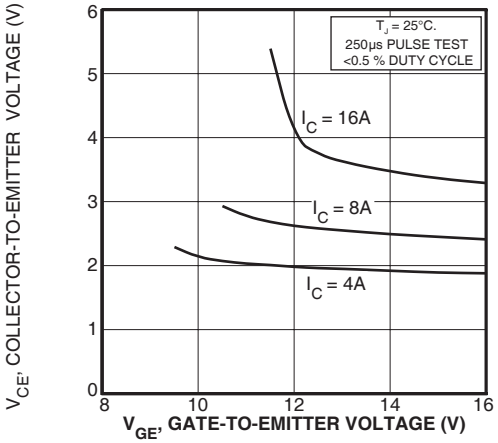


FIGURE 5, On State Voltage vs Gate-to- Emitter Voltage

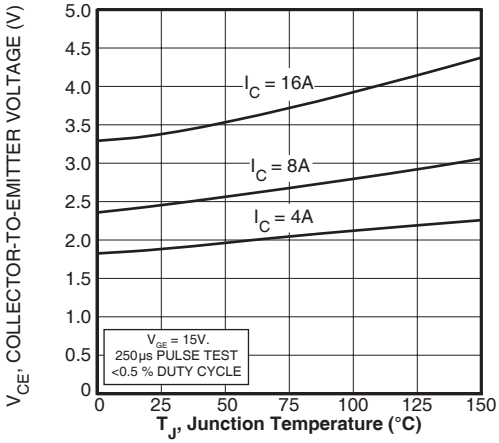


FIGURE 6, On State Voltage vs Junction Temperature

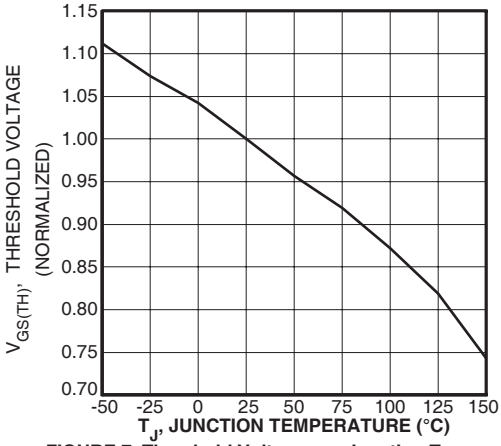


FIGURE 7, Threshold Voltage vs. Junction Temperature

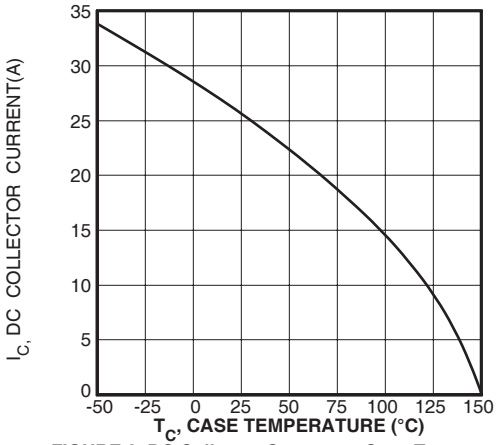


FIGURE 8, DC Collector Current vs Case Temperature

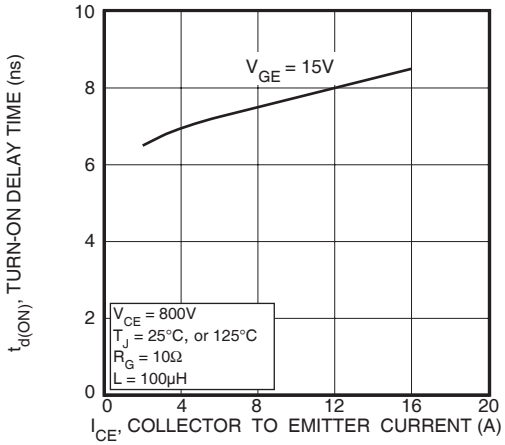


FIGURE 9, Turn-On Delay Time vs Collector Current

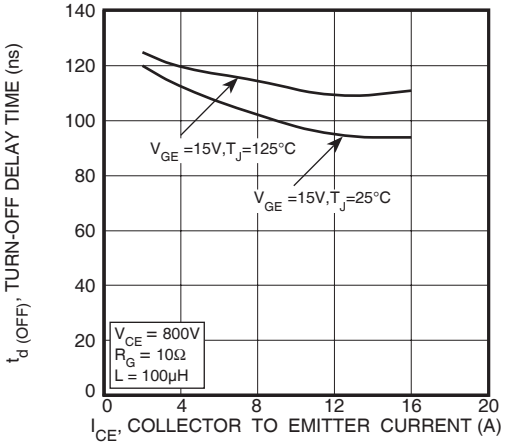


FIGURE 10, Turn-Off Delay Time vs Collector Current

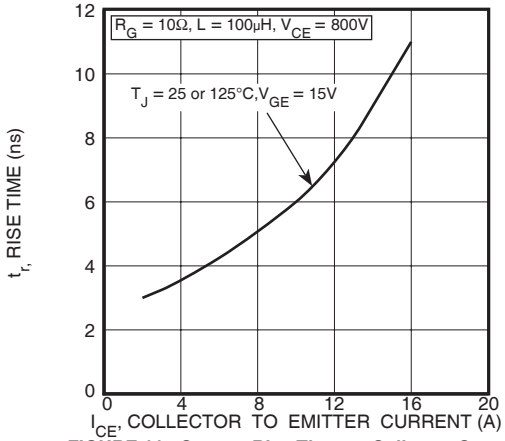


FIGURE 11, Current Rise Time vs Collector Current

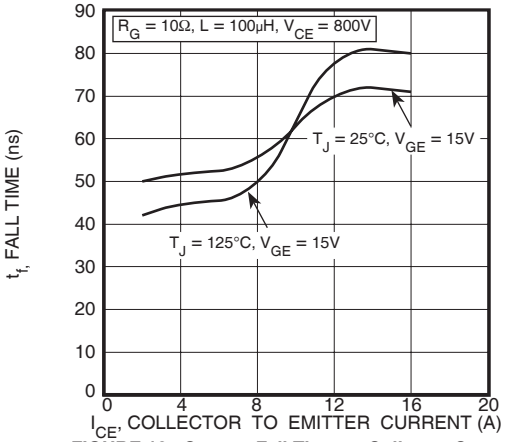


FIGURE 12, Current Fall Time vs Collector Current

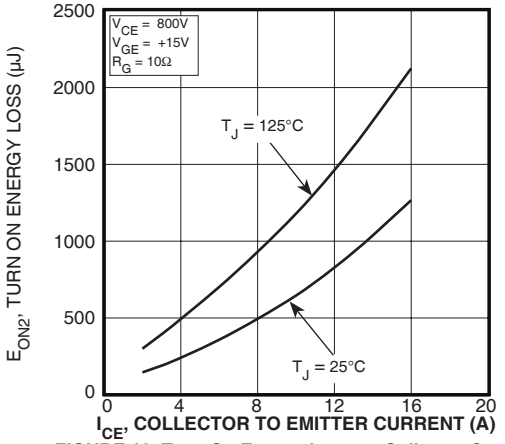


FIGURE 13, Turn-On Energy Loss vs Collector Current

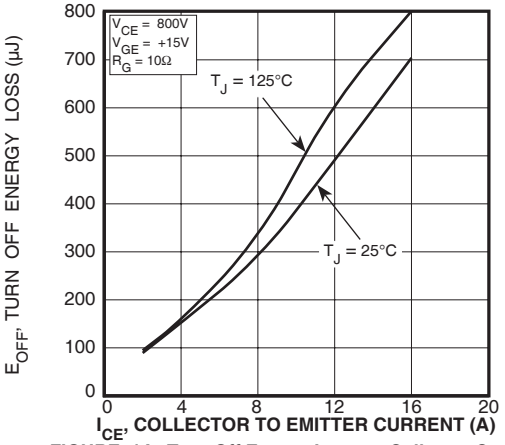


FIGURE 14, Turn Off Energy Loss vs Collector Current

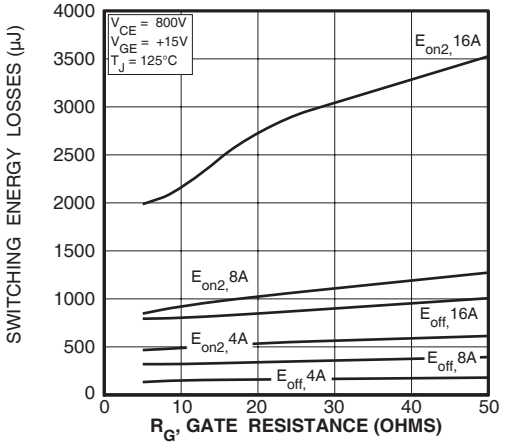


FIGURE 15, Switching Energy Losses vs. Gate Resistance

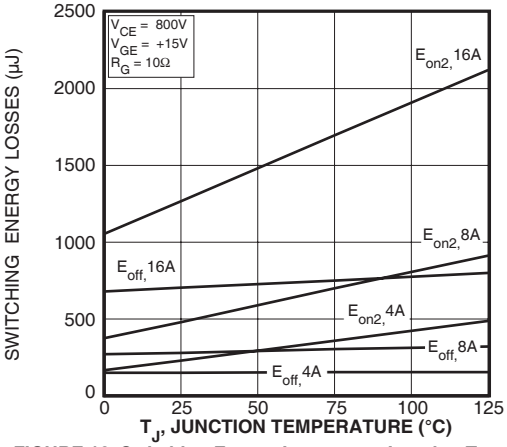


FIGURE 16, Switching Energy Losses vs Junction Temperature

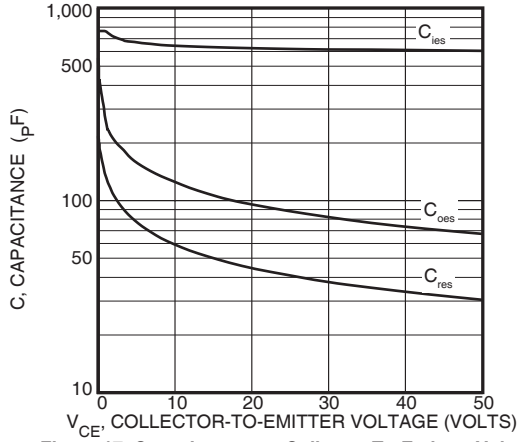


Figure 17, Capacitance vs Collector-To-Emitter Voltage

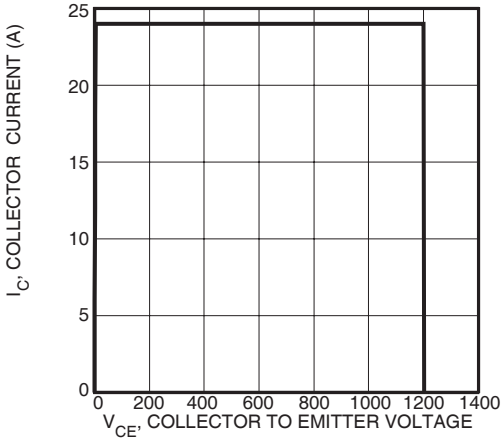


Figure 18,Minimim Switching Safe Operating Area

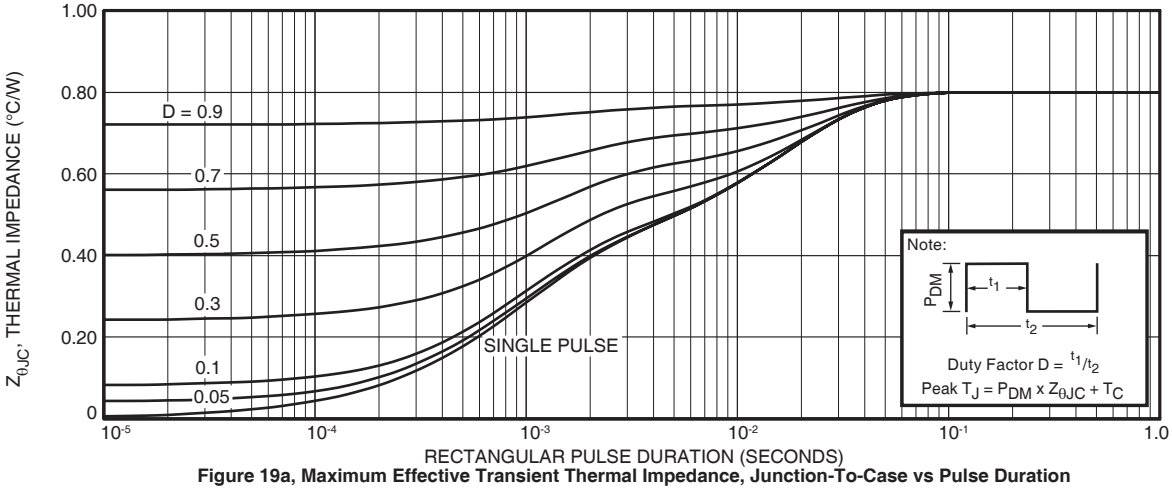


Figure 19a, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

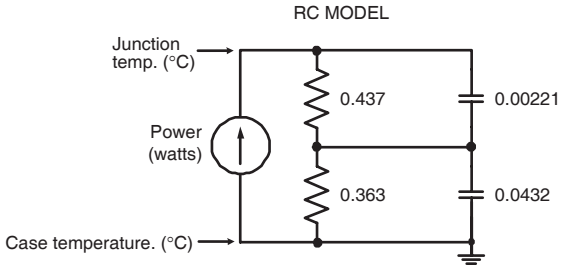


FIGURE 19b, TRANSIENT THERMAL IMPEDANCE MODEL

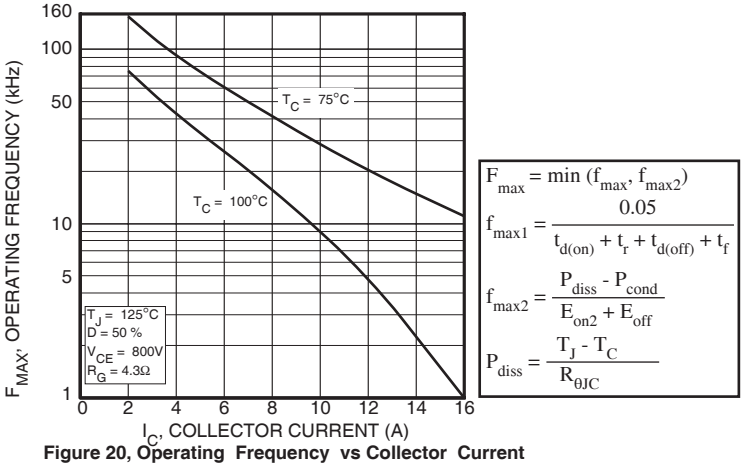


Figure 20, Operating Frequency vs Collector Current

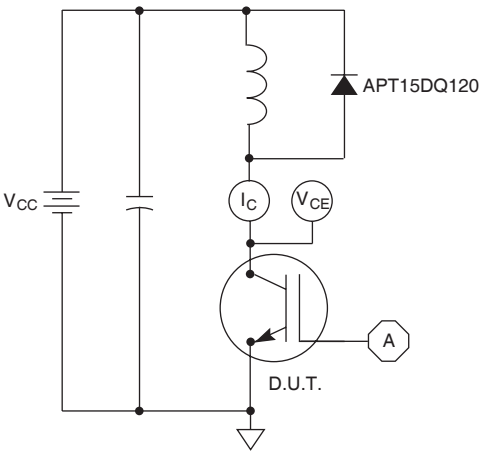


Figure 21, Inductive Switching Test Circuit

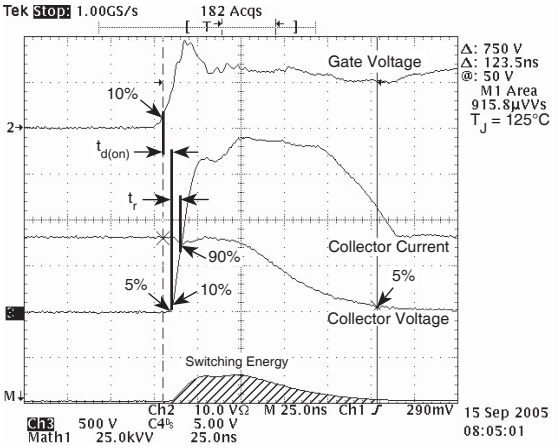


Figure 22, Turn-on Switching Waveforms and Definitions

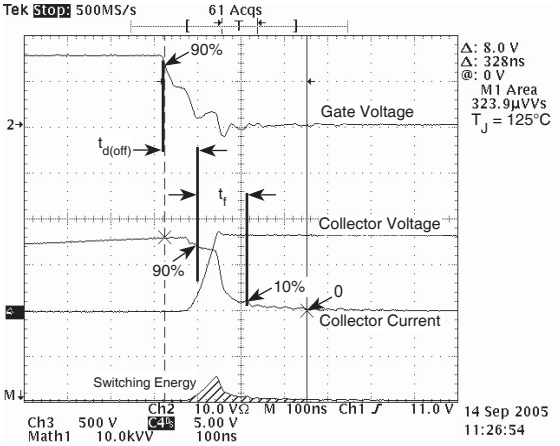
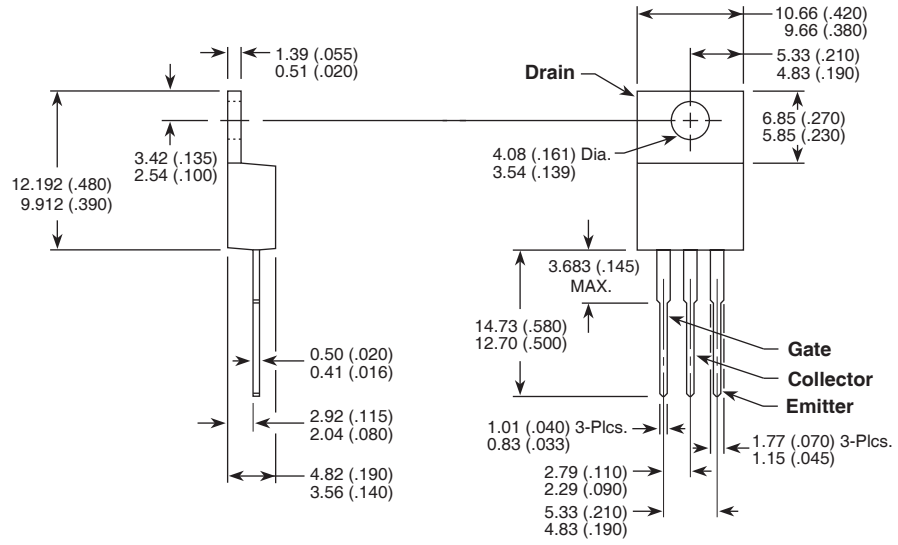


Figure 23, Turn-off Switching Waveforms and Definitions

TO-220 (K) Package Outline

e3 100% Sn



Dimensions in Millimeters and (Inches)