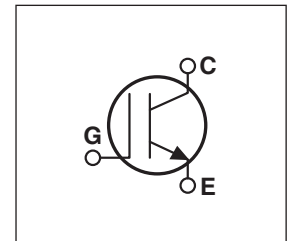


Thunderbolt IGBT®

The Thunderbolt IGBT® is a new generation of high voltage power IGBTs. Using Non-Punch Through Technology, the Thunderbolt IGBT® offers superior ruggedness and ultrafast switching speed.

- Low Forward Voltage Drop
- High Freq. Switching to 20KHz
- Low Tail Current
- Ultra Low Leakage Current
- RBSOA and SCSOA Rated



MAXIMUM RATINGS

All Ratings: $T_C = 25^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	APT75GT120JR	UNIT
V_{CES}	Collector-Emitter Voltage	1200	Volts
V_{GE}	Gate-Emitter Voltage	± 30	
I_{C1}	Continuous Collector Current @ $T_C = 25^\circ\text{C}$	97	Amps
I_{C2}	Continuous Collector Current @ $T_C = 110^\circ\text{C}$	42	
I_{CM}	Pulsed Collector Current ^① @ $T_C = 150^\circ\text{C}$	225	
SSOA	Switching Safe Operating Area @ $T_J = 150^\circ\text{C}$	225A @ 1200V	
P_D	Total Power Dissipation	481	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 ($V_{GE} = 0V, I_C = 4mA$)	1200			Volts
$V_{GE(TH)}$	Gate Threshold Voltage ($V_{CE} = V_{GE}, I_C = 3mA, T_J = 25^\circ\text{C}$)	4.5	5.5	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage ($V_{GE} = 15V, I_C = 75A, T_J = 25^\circ\text{C}$)	2.7	3.2	3.7	
	Collector-Emitter On Voltage ($V_{GE} = 15V, I_C = 75A, T_J = 125^\circ\text{C}$)		3.9		
I_{CES}	Collector Cut-off Current ($V_{CE} = 1200V, V_{GE} = 0V, T_J = 25^\circ\text{C}$) ^②			25	μA
	Collector Cut-off Current ($V_{CE} = 1200V, V_{GE} = 0V, T_J = 125^\circ\text{C}$) ^②			TBD	
I_{GES}	Gate-Emitter Leakage Current ($V_{GE} = \pm 20V$)			480	nA
$R_{G(int)}$	Intergrated Gate Resistor		5		Ω

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

DYNAMIC CHARACTERISTICS

APT75GT120JR

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{ies}	Input Capacitance	Capacitance $V_{GE} = 0V, V_{CE} = 25V$ $f = 1\text{ MHz}$		2570		pF
C_{oes}	Output Capacitance			250		
C_{res}	Reverse Transfer Capacitance			155		
V_{GEP}	Gate-to-Emitter Plateau Voltage	Gate Charge $V_{GE} = 15V$ $V_{CE} = 600V$ $I_C = 75A$		7.5		V
Q_g	Total Gate Charge ^③			240		
Q_{ge}	Gate-Emitter Charge			15		
Q_{gc}	Gate-Collector ("Miller") Charge			110		
SSOA	Switching Safe Operating Area	$T_J = 150^\circ\text{C}, R_G = 4.3\Omega, V_{GE} = 15V, L = 100\mu\text{H}, V_{CE} = 1200V$	225			A
$t_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) $V_{CC} = 800V$ $V_{GE} = 15V$ $I_C = 75A$ $R_G = 1.0\Omega$ $T_J = +25^\circ\text{C}$		50		ns
t_r	Current Rise Time			65		
$t_{d(off)}$	Turn-off Delay Time			375		
t_f	Current Fall Time			25		
E_{on1}	Turn-on Switching Energy ^④			8045		
E_{on2}	Turn-on Switching Energy (Diode) ^⑤			8845		
E_{off}	Turn-off Switching Energy ^⑥			2970		
$t_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) $V_{CC} = 800V$ $V_{GE} = 15V$ $I_C = 75A$ $R_G = 1.0\Omega$ $T_J = +125^\circ\text{C}$		50		ns
t_r	Current Rise Time			65		
$t_{d(off)}$	Turn-off Delay Time			415		
t_f	Current Fall Time			29		
E_{on1}	Turn-on Switching Energy ^④			8050		
E_{on2}	Turn-on Switching Energy (Diode) ^⑤			12660		
E_{off}	Turn-off Switching Energy ^⑥			4215		

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case (IGBT)			.26	°C/W
$R_{\theta JC}$	Junction to Case (DIODE)			N/A	
W_T	Package Weight		29.2		gm
$V_{Isolation}$	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} □
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} |s|
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.)

APT Reserves the right to change, without notice, the specifications and information contained herein.

TYPICAL PERFORMANCE CURVES

APT75GT120JR

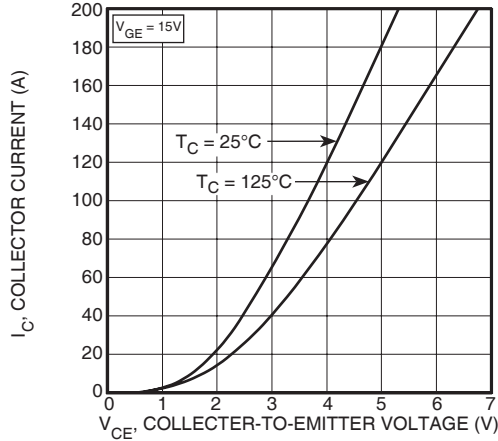


FIGURE 1, Output Characteristics ($V_{GE} = 15V$)

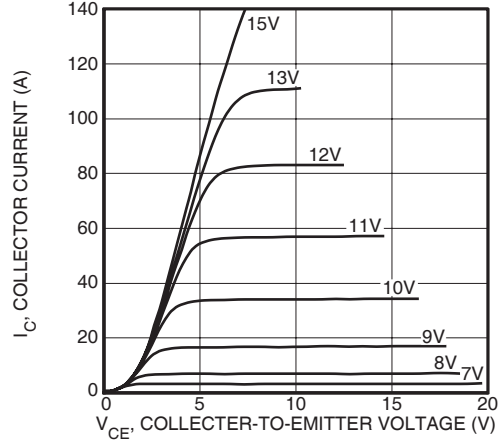


FIGURE 2, Output Characteristics ($T_J = 125^\circ C$)

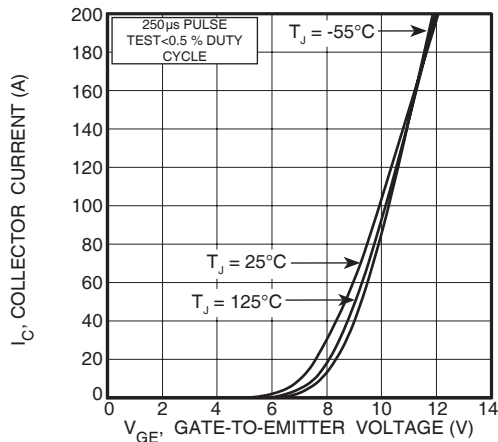


FIGURE 3, Transfer Characteristics

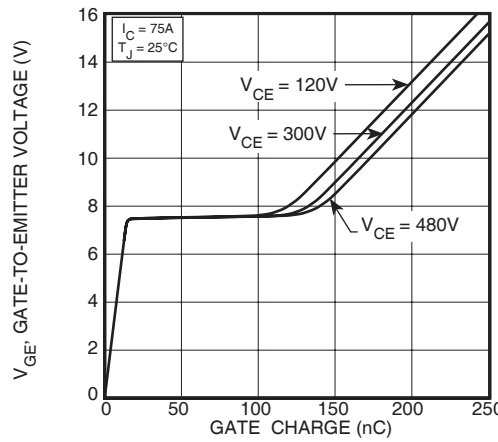


FIGURE 4, Gate Charge

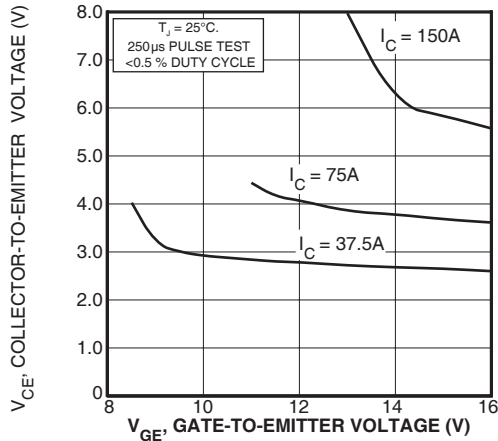


FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage

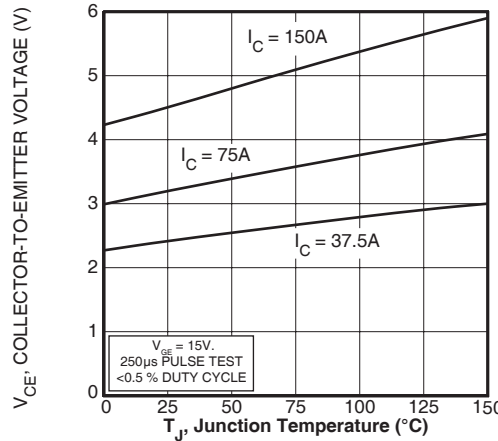


FIGURE 6, On State Voltage vs Junction Temperature

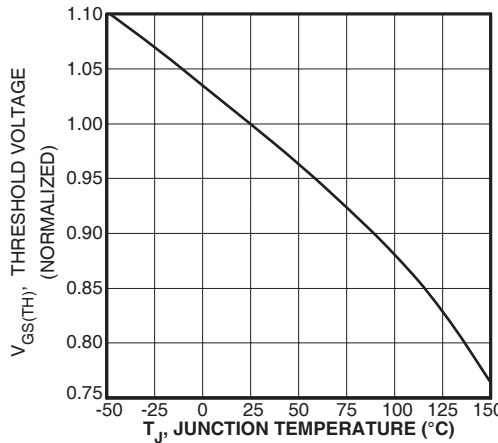


FIGURE 7, Threshold Voltage vs. Junction Temperature

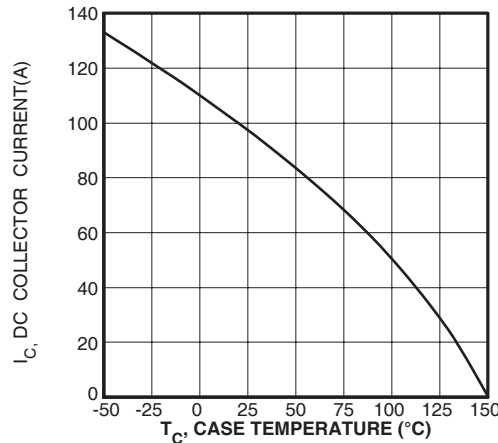


FIGURE 8, DC Collector Current vs Case Temperature

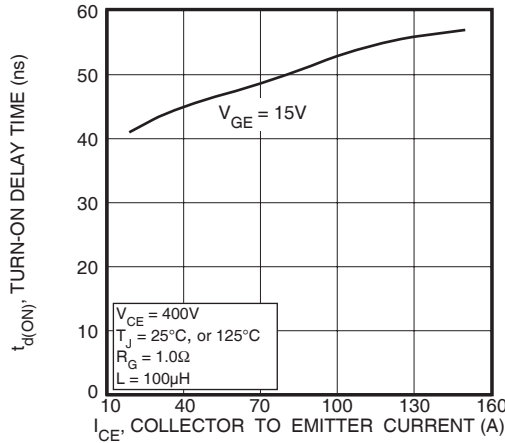


FIGURE 9, Turn-On Delay Time vs Collector Current

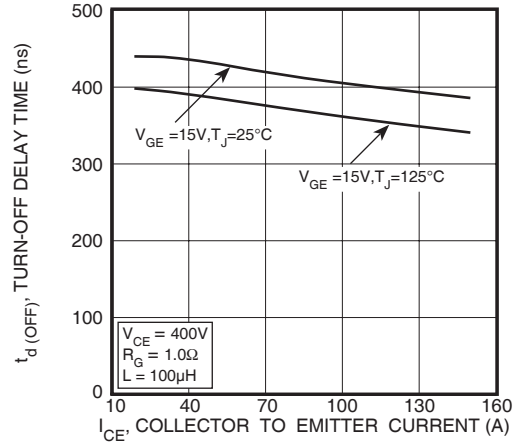


FIGURE 10, Turn-Off Delay Time vs Collector Current

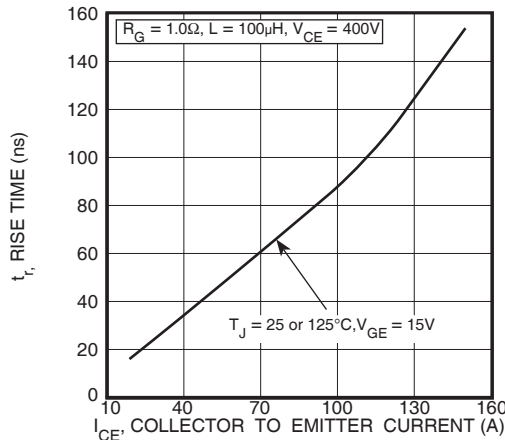


FIGURE 11, Current Rise Time vs Collector Current

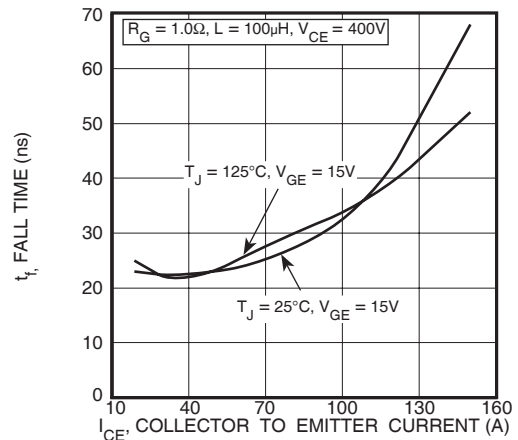


FIGURE 12, Current Fall Time vs Collector Current

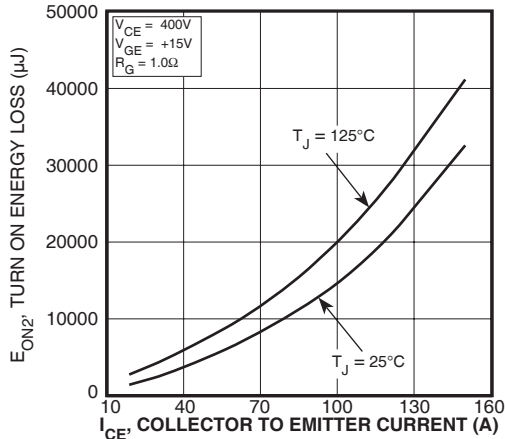


FIGURE 13, Turn-On Energy Loss vs Collector Current

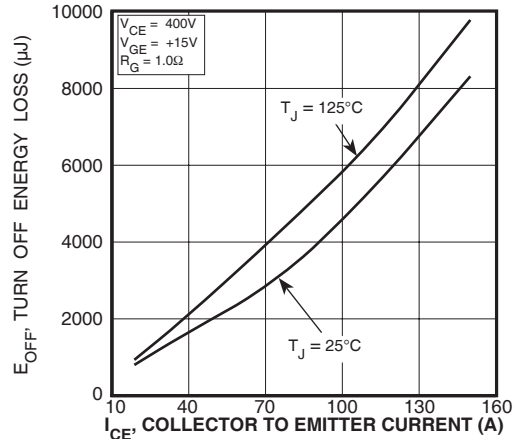


FIGURE 14, Turn Off Energy Loss vs Collector Current

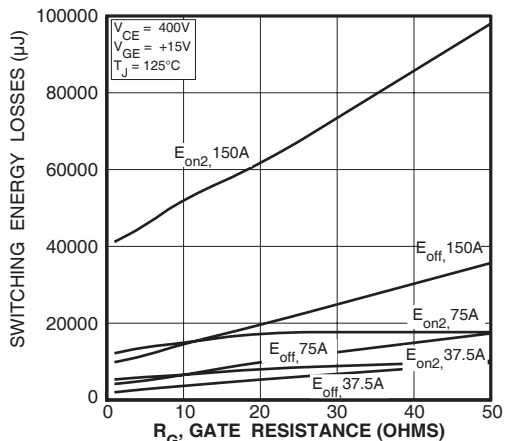


FIGURE 15, Switching Energy Losses vs. Gate Resistance

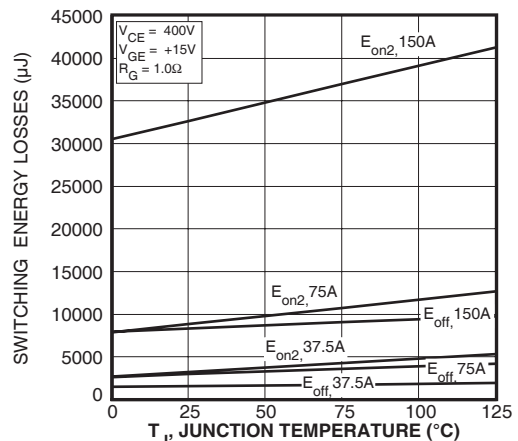


FIGURE 16, Switching Energy Losses vs Junction Temperature

TYPICAL PERFORMANCE CURVES

APT75GT120JR

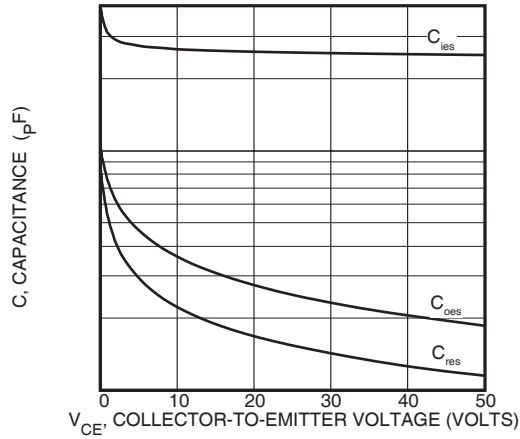


Figure 17, Capacitance vs Collector-To-Emitter Voltage

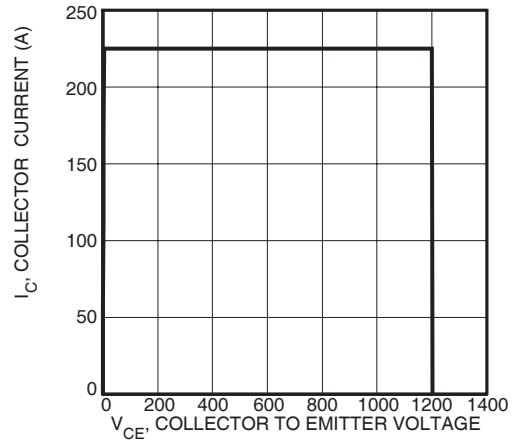


Figure 18, Minimum Switching Safe Operating Area

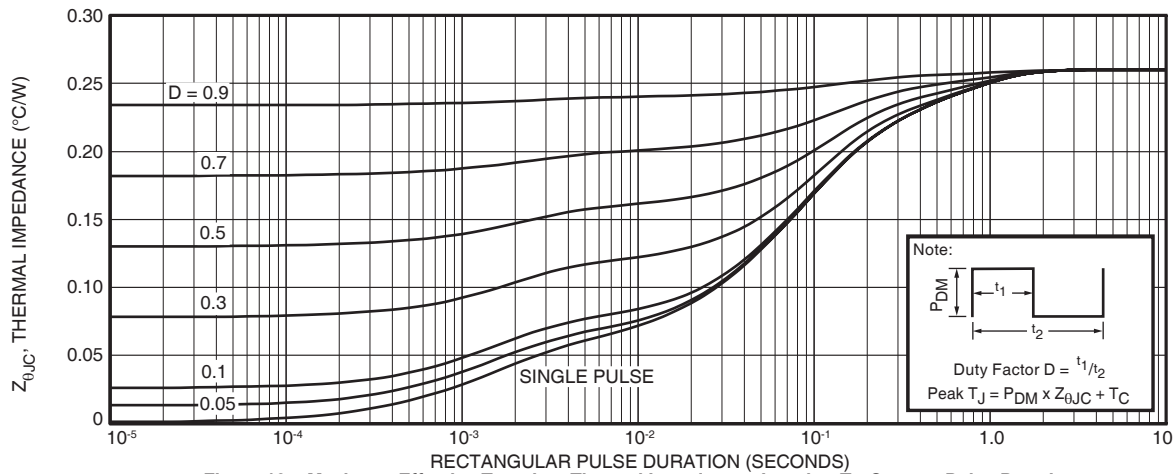


Figure 19a, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

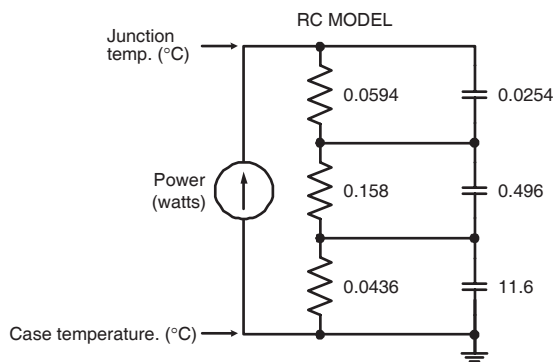


Figure 19b, TRANSIENT THERMAL IMPEDANCE MODEL

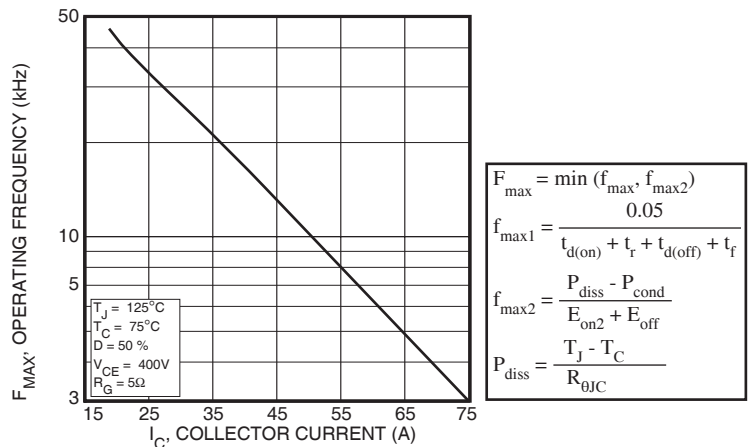


Figure 20, Operating Frequency vs Collector Current

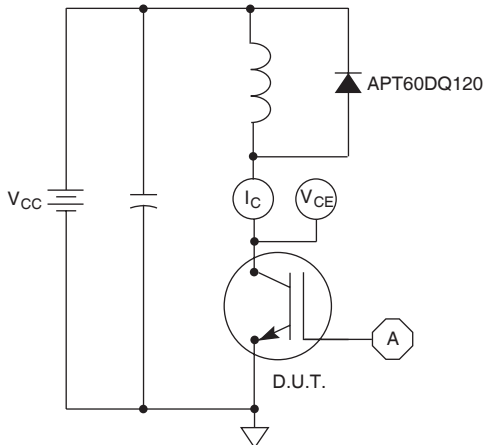


Figure 21, Inductive Switching Test Circuit

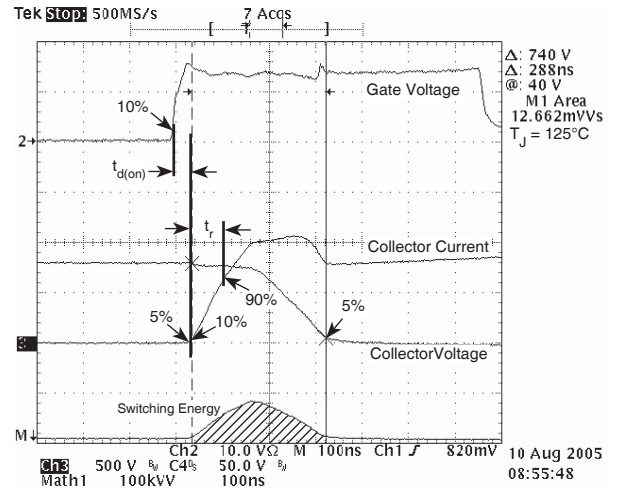


Figure 22, Turn-on Switching Waveforms and Definitions

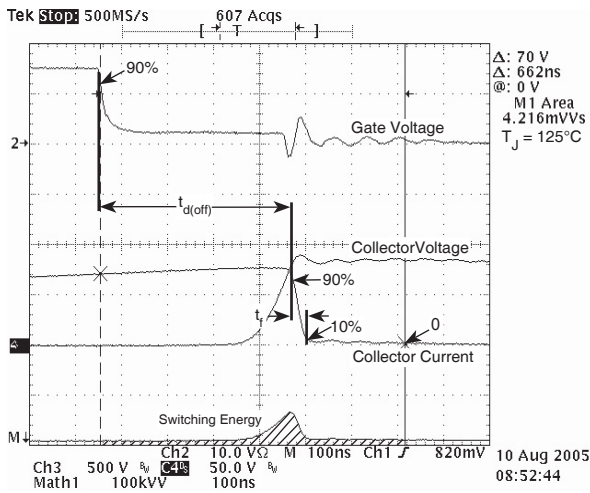
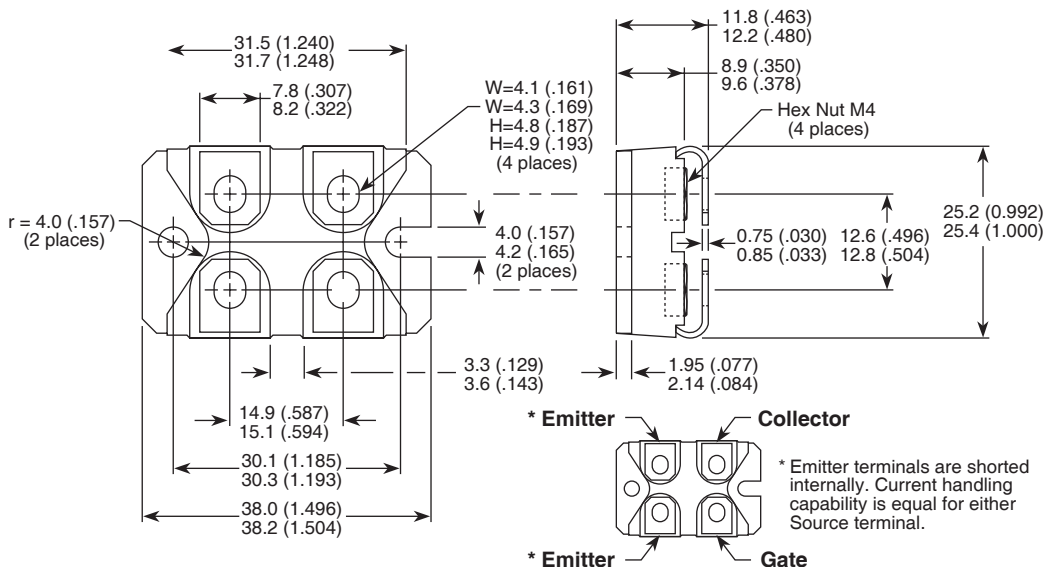


Figure 23, Turn-off Switching Waveforms and Definitions

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)

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