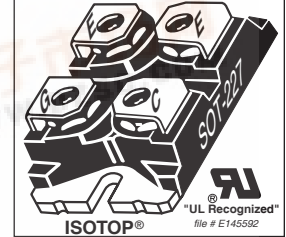




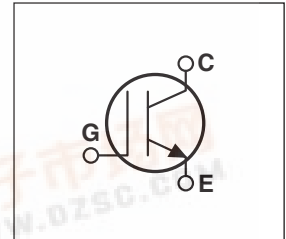
1200V

APT150GN120J

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 circuit fault. Low gate charge simplifies gate drive design and minimizes losses.



- 1200V Field Stop
- Trench Gate: Low  $V_{CE(on)}$
- Easy Paralleling
- Intergrated Gate Resistor: Low EMI, High Reliability



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

**MAXIMUM RATINGS**

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

Symbol	Parameter	APT150GN120J	UNIT
$V_{CES}$	Collector-Emitter Voltage	1200	Volts
$V_{GE}$	Gate-Emitter Voltage	$\pm 30$	
$I_{C1}$	Continuous Collector Current @ $T_C = 25^\circ\text{C}$	215	Amps
$I_{C2}$	Continuous Collector Current @ $T_C = 110^\circ\text{C}$	99	
$I_{CM}$	Pulsed Collector Current <sup>①</sup>	450	
SSOA	Switching Safe Operating Area @ $T_j = 150^\circ\text{C}$	450A @ 1200V	
$P_D$	Total Power Dissipation	625	Watts
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 150	$^\circ\text{C}$
$T_L$	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 ( $V_{GE} = 0V, I_C = 6mA$ )	1200			Volts
$V_{GE(TH)}$	Gate Threshold Voltage ( $V_{CE} = V_{GE}, I_C = 6mA, T_j = 25^\circ\text{C}$ )	5.0	5.8	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage ( $V_{GE} = 15V, I_C = 150A, T_j = 25^\circ\text{C}$ )	1.4	1.7	2.1	
	Collector-Emitter On Voltage ( $V_{GE} = 15V, I_C = 150A, T_j = 125^\circ\text{C}$ )		2.08		
$I_{CES}$	Collector Cut-off Current ( $V_{CE} = 1200V, V_{GE} = 0V, T_j = 25^\circ\text{C}$ ) <sup>②</sup>			100	$\mu\text{A}$
	Collector Cut-off Current ( $V_{CE} = 1200V, V_{GE} = 0V, T_j = 125^\circ\text{C}$ ) <sup>②</sup>			TBD	
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{GE} = \pm 20V$ )			600	nA
$R_{G(int)}$	Integrated Gate Resistor		5		$\Omega$

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

## DYNAMIC CHARACTERISTICS

APT150GN120J

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT	
$C_{ies}$	Input Capacitance	<b>Capacitance</b> $V_{GE} = 0V, V_{CE} = 25V$ $f = 1 \text{ MHz}$		9500		pF	
$C_{oes}$	Output Capacitance			500			
$C_{res}$	Reverse Transfer Capacitance			400			
$V_{GEP}$	Gate-to-Emitter Plateau Voltage	Gate Charge		9.5		V	
$Q_g$	Total Gate Charge <sup>③</sup>	$V_{GE} = 15V$		800		nC	
$Q_{ge}$	Gate-Emitter Charge	$V_{CE} = 600V$		70			
$Q_{gc}$	Gate-Collector ("Miller") Charge	$I_C = 150A$		430			
SSOA	Switching Safe Operating Area	$T_J = 150^\circ\text{C}, R_G = 4.3\Omega^{\text{⑦}}, V_{GE} = 15V, L = 100\mu\text{H}, V_{CE} = 1200V$	450			A	
$t_{d(on)}$	Turn-on Delay Time	<b>Inductive Switching (25°C)</b> $V_{CC} = 800V$ $V_{GE} = 15V$ $I_C = 150A$ $R_G = 1.0\Omega^{\text{⑦}}$ $T_J = +25^\circ\text{C}$		55		ns	
$t_r$	Current Rise Time			65			
$t_{d(off)}$	Turn-off Delay Time			675			
$t_f$	Current Fall Time			85			
$E_{on1}$	Turn-on Switching Energy <sup>④</sup>				22		mJ
$E_{on2}$	Turn-on Switching Energy (Diode) <sup>⑤</sup>				27		
$E_{off}$	Turn-off Switching Energy <sup>⑥</sup>				15		
$t_{d(on)}$	Turn-on Delay Time	<b>Inductive Switching (125°C)</b> $V_{CC} = 800V$ $V_{GE} = 15V$ $I_C = 150A$ $R_G = 1.0\Omega^{\text{⑦}}$ $T_J = +125^\circ\text{C}$		55		ns	
$t_r$	Current Rise Time			65			
$t_{d(off)}$	Turn-off Delay Time			780			
$t_f$	Current Fall Time			175			
$E_{on1}$	Turn-on Switching Energy <sup>④</sup>				23		mJ
$E_{on2}$	Turn-on Switching Energy (Diode) <sup>⑤</sup>				35		
$E_{off}$	Turn-off Switching Energy <sup>⑥</sup>				22		

## THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case ( <b>IGBT</b> )			0.20	°C/W
$R_{\theta JC}$	Junction to Case ( <b>DIODE</b> )			N/A	
$V_{Isolation}$	RMS Voltage (50-60Hz Sinusoidal Waveform from Terminals to Mounting Base for 1 Min.)	2500			Volts
$W_T$	Package Weight		1.03		oz
			29.2		gm
Torque	Maximum Terminal & Mounting Torque			10	lb•in
				1.1	N•m

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.

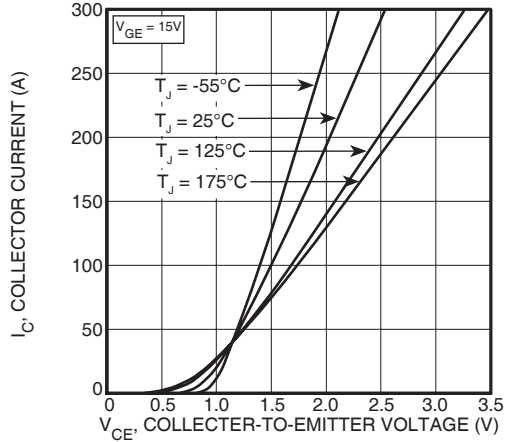
⑤  $E_{on2}$  is the clamped inductive turn-on energy that includes a commutating diode reverse recovery current in the IGBT turn-on switching loss. (See Figures 21, 22.)

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

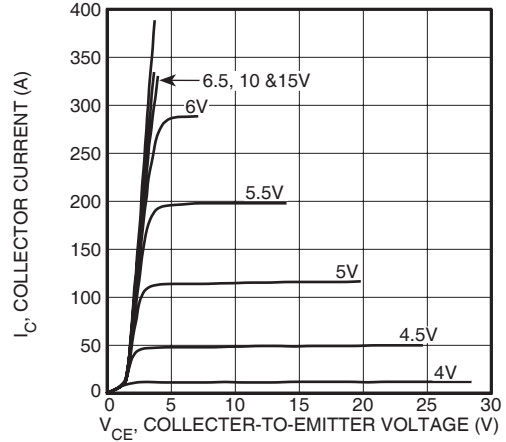
⑦  $R_G$  is external gate resistance, not including  $R_{G(int)}$  nor gate driver impedance. (MIC4452)

**TYPICAL PERFORMANCE CURVES**

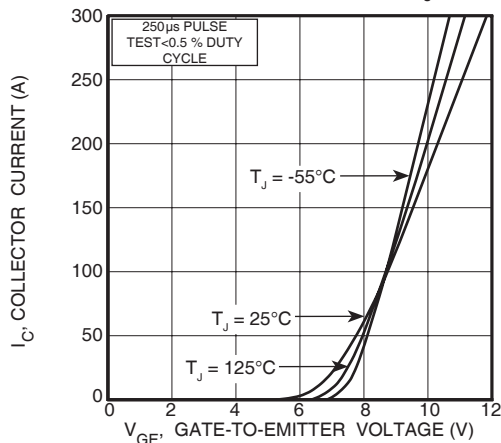
**APT150GN120J**



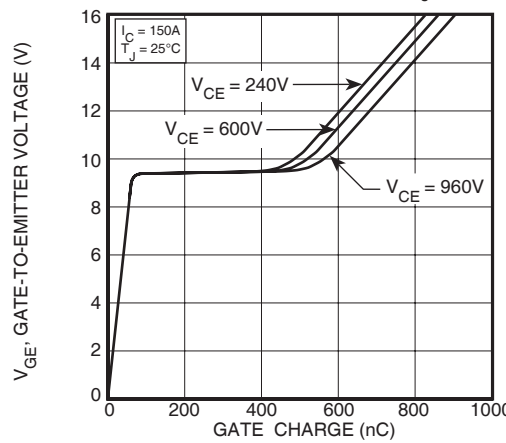
**FIGURE 1, Output Characteristics ( $T_J = 25^\circ\text{C}$ )**



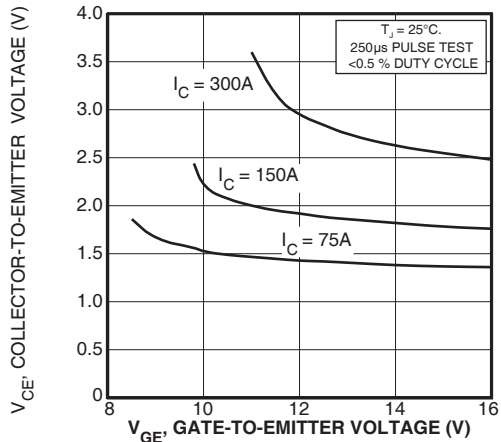
**FIGURE 2, Output Characteristics ( $T_J = 125^\circ\text{C}$ )**



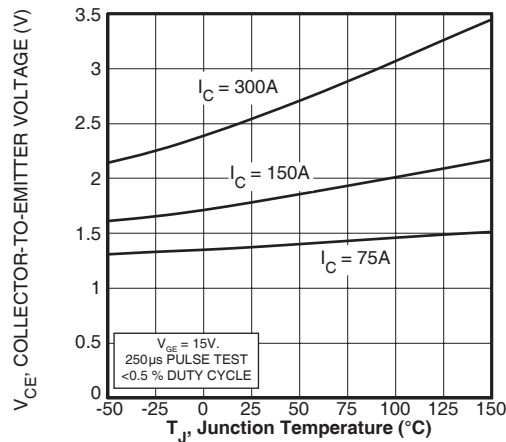
**FIGURE 3, Transfer Characteristics**



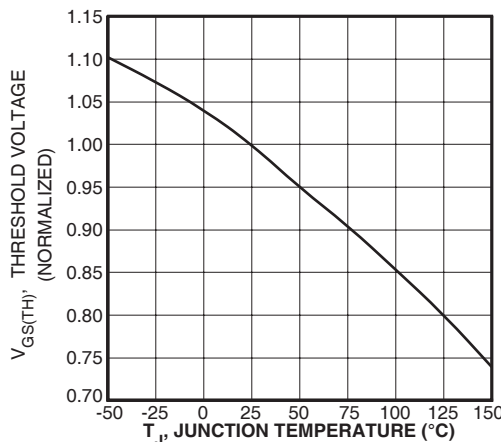
**FIGURE 4, Gate Charge**



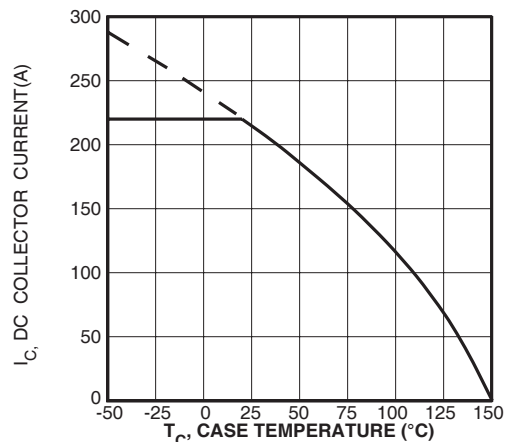
**FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage**



**FIGURE 6, On State Voltage vs Junction Temperature**



**FIGURE 7, Threshold Voltage vs. Junction Temperature**



**FIGURE 8, DC Collector Current vs Case Temperature**

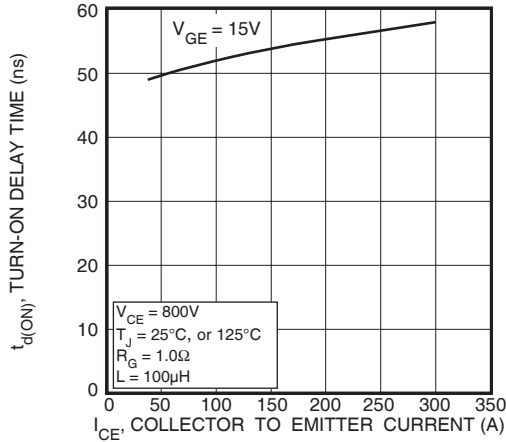


FIGURE 9, Turn-On Delay Time vs Collector Current

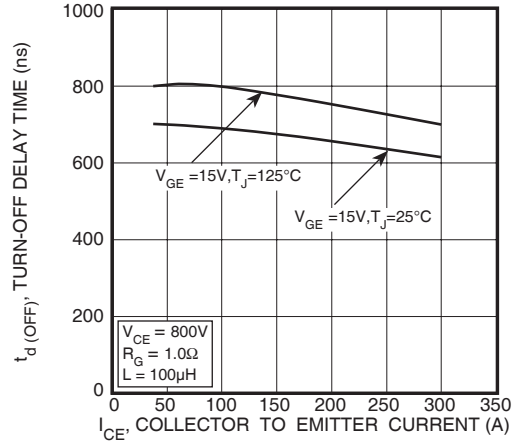


FIGURE 10, Turn-Off Delay Time vs Collector Current

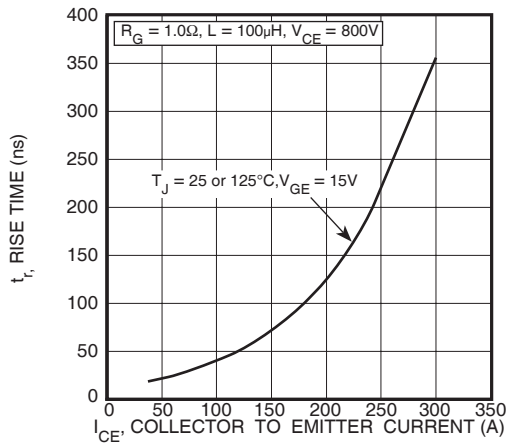


FIGURE 11, Current Rise Time vs Collector Current

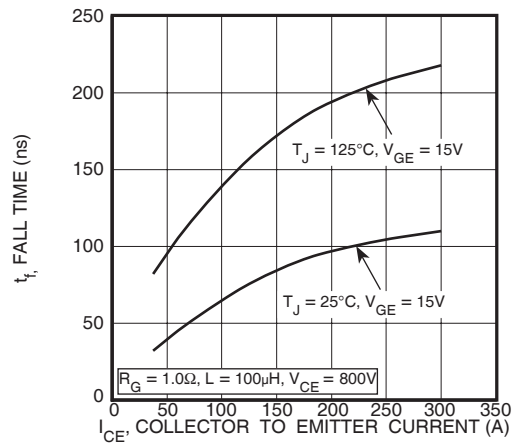


FIGURE 12, Current Fall Time vs Collector Current

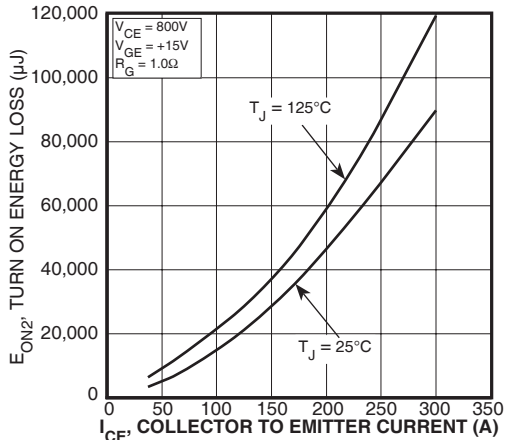


FIGURE 13, Turn-On Energy Loss vs Collector Current

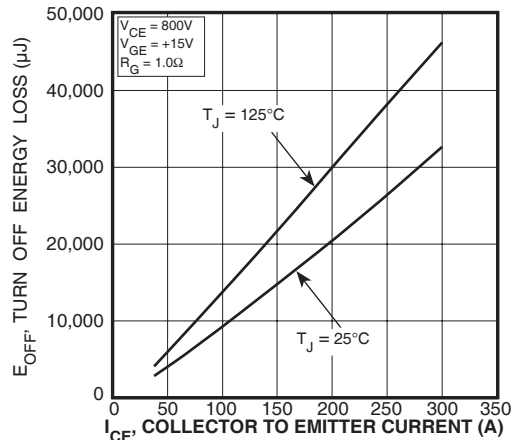


FIGURE 14, Turn Off Energy Loss vs Collector Current

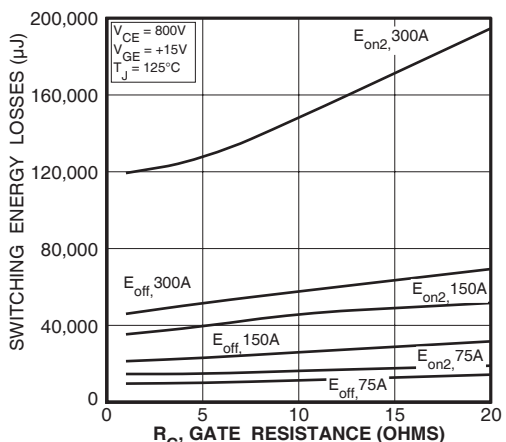


FIGURE 15, Switching Energy Losses vs. Gate Resistance

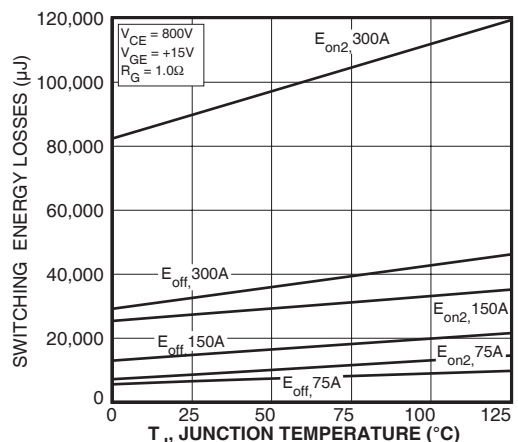


FIGURE 16, Switching Energy Losses vs Junction Temperature

### TYPICAL PERFORMANCE CURVES

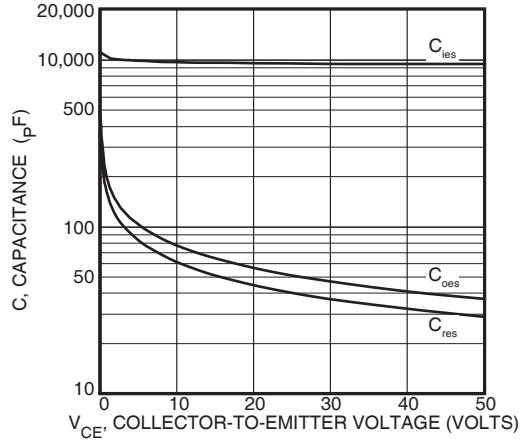


Figure 17, Capacitance vs Collector-To-Emitter Voltage

### APT150GN120J

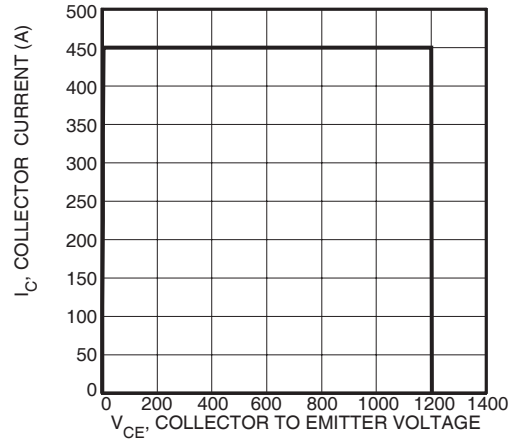


Figure 18, Minimum Switching Safe Operating Area

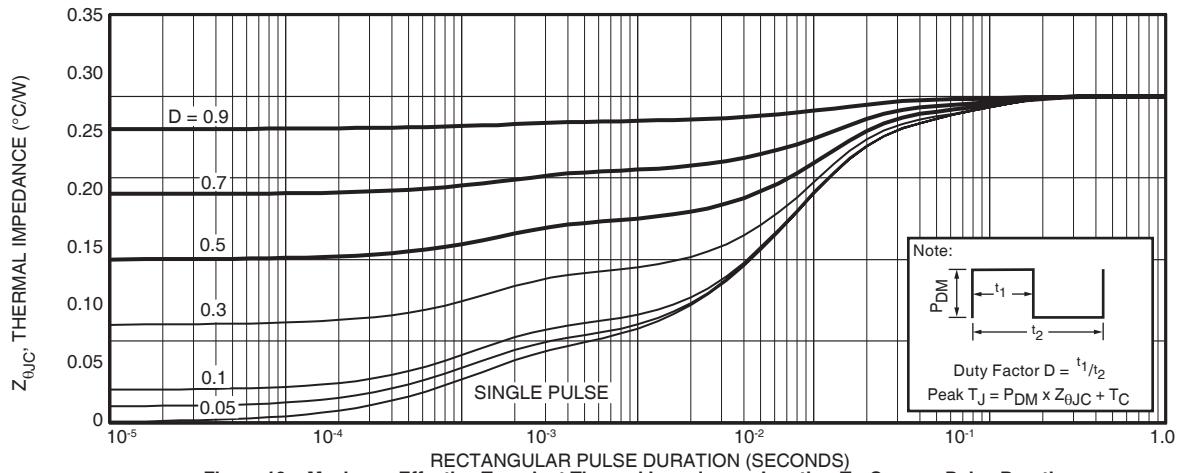


Figure 19a, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

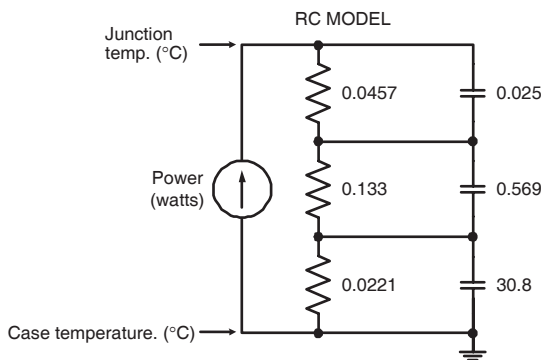


FIGURE 19b, TRANSIENT THERMAL IMPEDANCE MODEL

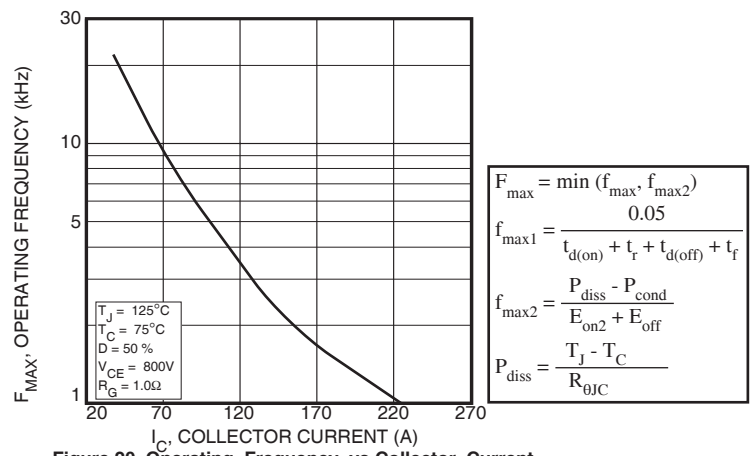


Figure 20, Operating Frequency vs Collector Current

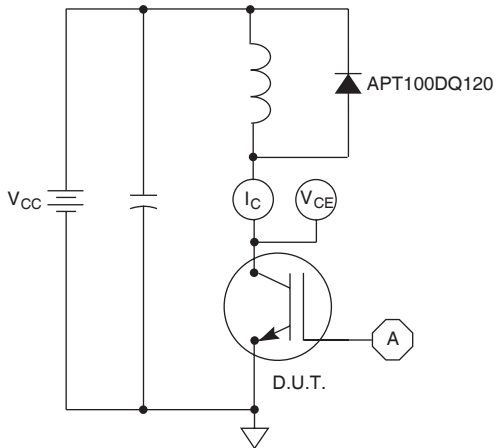


Figure 21, Inductive Switching Test Circuit

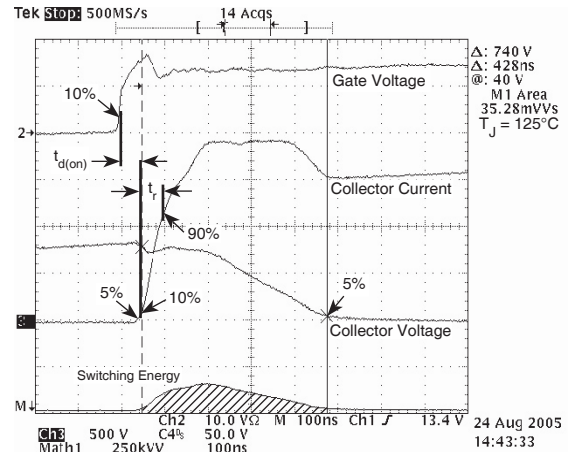


Figure 22, Turn-on Switching Waveforms and Definitions

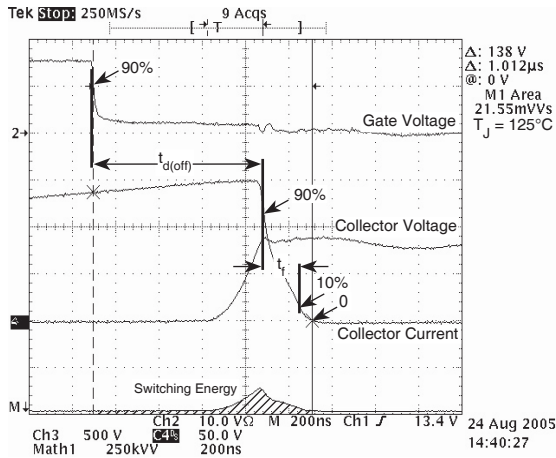
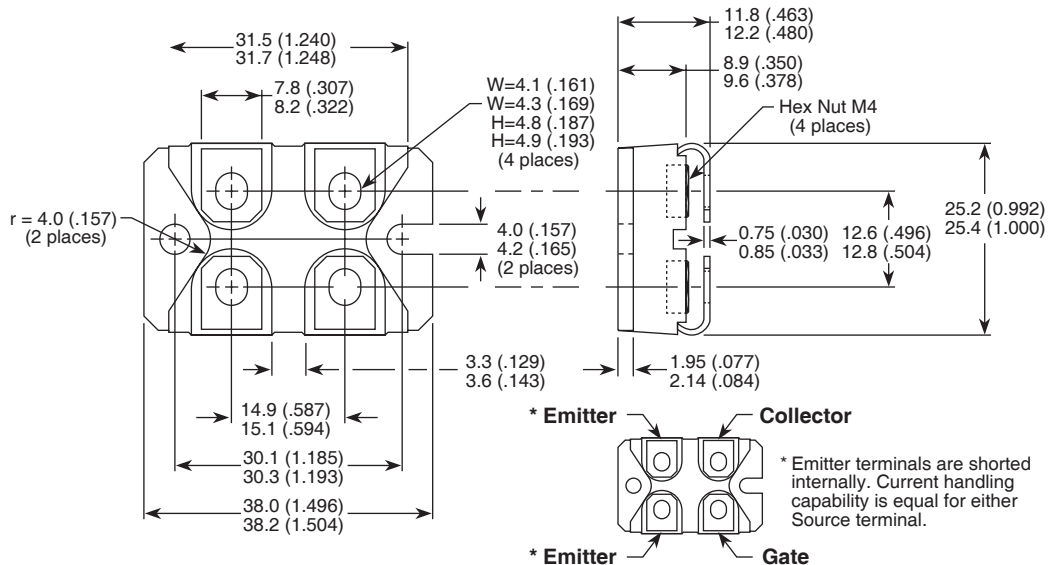


Figure 23, Turn-off Switching Waveforms and Definitions

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)