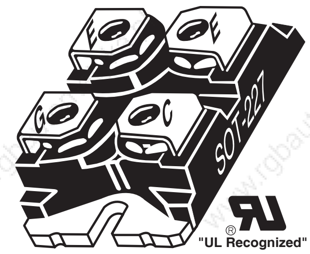
ADVANCED POWER TECHNOLOGY®

APT200GN60J

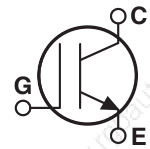
600V

Utilizing the latest Field Stop and Trench Gate technologies, these IGBTs 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.



ISOTOP®

- **600V Field Stop**
- **Trench Gate: Low $V_{CE(on)}$**
- **Easy Paralleling**
- **10µs Short Circuit Capability**
- **Intergrated Gate Resistor: Low EMI, High Reliability**



Applications: **welding, inductive heating, solar inverters, motor drives, UPS, pass transistor**

MAXIMUM RATINGS

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

Symbol	Parameter	APT200GN60J	UNIT
V_{CES}	Collector-Emitter Voltage	600	Volts
V_{GE}	Gate-Emitter Voltage	±20	
I_{C1}	Continuous Collector Current @ T_C = 25°C	250	Amps
I_{C2}	Continuous Collector Current @ T_C = 110°C	110	
I_{CM}	Pulsed Collector Current ① @ T_C = 150°C	600	
SSOA	Switching Safe Operating Area @ T_J = 150°C	600A @600V	
P_D	Total Power Dissipation	568	Watts
T_J,T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	°C

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage (V_{GE} = 0V, I_C = 4mA)	600			Volts
$V_{GE(TH)}$	Gate Threshold Voltage (V_{CE} = V_{GE}, I_C = 3.2mA, T_j = 25°C)	5	5.8	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 200A, T_j = 25°C)	1.05	1.45	1.85	
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 200A, T_j = 125°C)		1.65		
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 100A, T_j = 25°C)		1.15		
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 100A, T_j = 125°C)		1.19		
I_{CES}	Collector Cut-off Current (V_{CE} = 600V, V_{GE} = 0V, T_j = 25°C) ②			4	mA
	Collector Cut-off Current (V_{CE} = 600V, V_{GE} = 0V, T_j = 125°C) ②			TBD	
I_{GES}	Gate-Emitter Leakage Current (V_{GE} = ±20V)			600	nA
R_{GINT}	Intergrated Gate Resistor		2		Ω

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

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

DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{ies}	Input Capacitance	**Capacitance** V_{GE} = 0V, V_{CE} = 25V f = 1 MHz		14100		pF
C_{oes}	Output Capacitance			4610		
C_{res}	Reverse Transfer Capacitance			4000		
V_{GEP}	Gate-to-Emitter Plateau Voltage	Gate Charge V_{GE} = 15V V_{CE} = 300V I_C = 100A		8.2		V
Q_g	Total Gate Charge ③			1180		nC
Q_{ge}	Gate-Emitter Charge			85		
Q_{gc}	Gate-Collector ("Miller") Charge			660		
SSOA	Switching Safe Operating Area	T_J = 150°C, R_G = 5Ω⑦, V_{GE} = 15V, L = 100µH, V_{CE} = 600V	600			A
SCSOA	Short Circuit Safe Operating Area	V_{CC} = 480V, V_{GE} = 15V, T_J = 125°C, R_G = 5Ω⑦	10			µs
$t_{d(on)}$	Turn-on Delay Time	**Inductive Switching (25°C)** V_{CC} = 400V V_{GE} = 15V I_C = 100A R_G = 5Ω⑦ T_J = +25°C		55		ns
t_r	Current Rise Time			20		
$t_{d(off)}$	Turn-off Delay Time			1050		
t_f	Current Fall Time			50		
E_{on1}	Turn-on Switching Energy ④			TBD		µJ
E_{on2}	Turn-on Switching Energy (Diode) ⑤			1720		
E_{off}	Turn-off Switching Energy ⑥			2810		
$t_{d(on)}$	Turn-on Delay Time	**Inductive Switching (125°C)** V_{CC} =400V V_{GE} = 15V I_C = 100A R_G = 5Ω⑦ T_J = +125°C		55		ns
t_r	Current Rise Time			20		
$t_{d(off)}$	Turn-off Delay Time			1150		
t_f	Current Fall Time			60		
E_{on1}	Turn-on Switching Energy ④			TBD		µJ
E_{on2}	Turn-on Switching Energy (Diode) ⑤			1955		
E_{off}	Turn-off Switching Energy ⑥			2865		

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case **(IGBT)**			.22	°C/W
$R_{\theta JC}$	Junction to Case **(DIODE)**			N/A	
$V_{Isolation}$	RMS Voltage (50-60Hz Sinusoidal Wavefom 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 leackage.

③ See MIL-STD-750 Method 3471.

④ E_{on1} is the clamped inductive tun-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 induvtive 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_{Gint} nor gate driver impedance. (MIC4452)

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

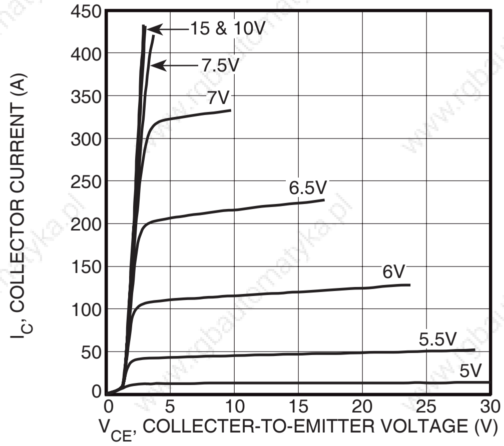


FIGURE 1, Output Characteristics(T_J = 25°C)

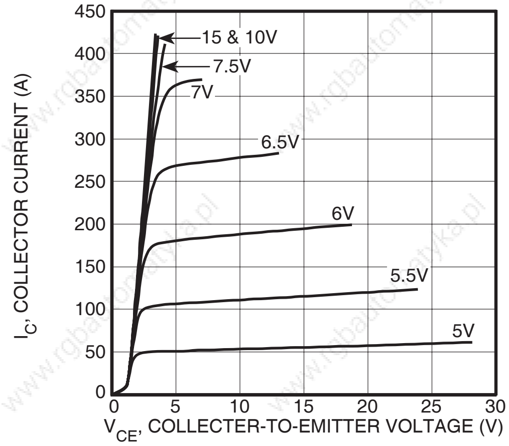


FIGURE 2, Output Characteristics (T_J = 125°C)

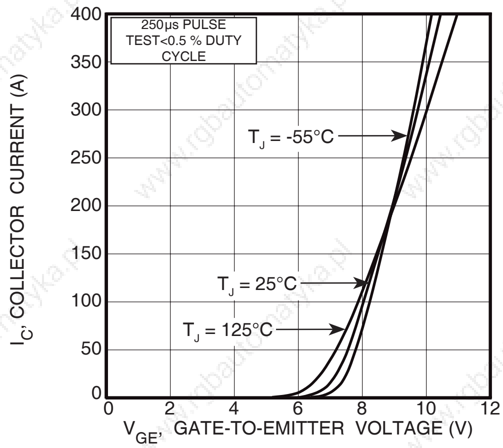


FIGURE 3, Transfer Characteristics

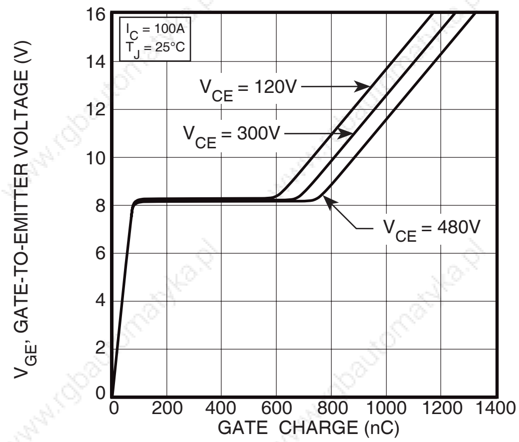


FIGURE 4, Gate Charge

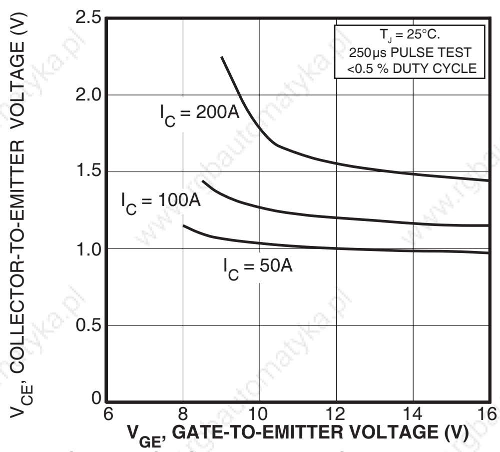


FIGURE 5, On State Voltage vs Gate-to- Emitter Voltage

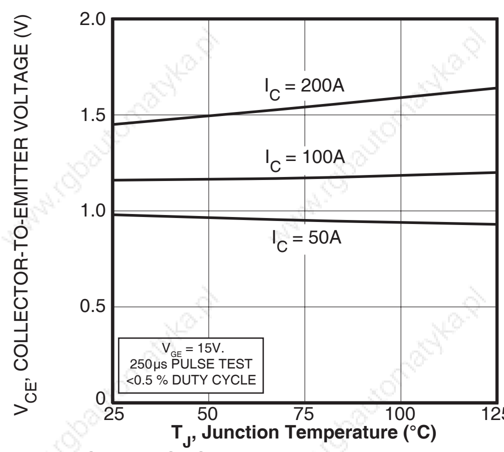


FIGURE 6, On State Voltage vs Junction Temperature

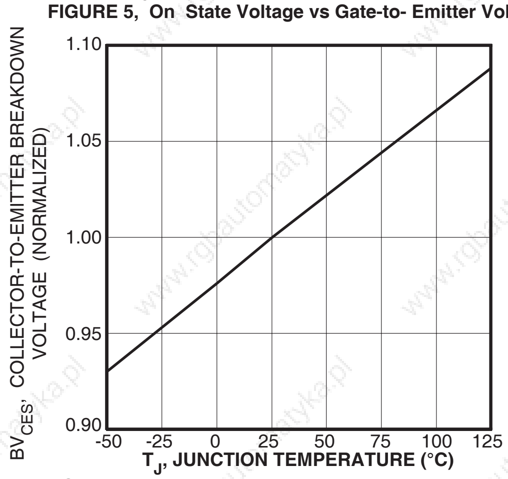


FIGURE 7, Breakdown Voltage vs. Junction Temperature

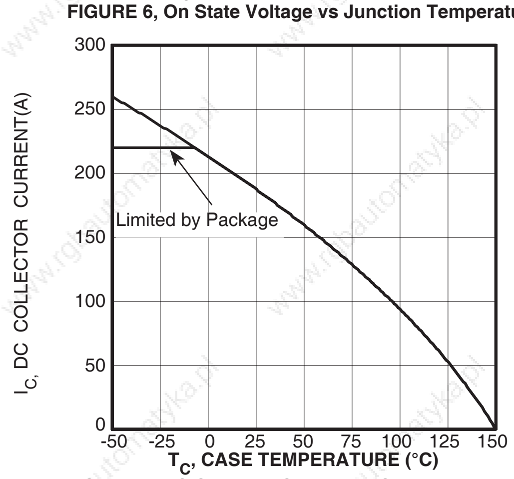


FIGURE 8, DC Collector Current vs Case Temperature

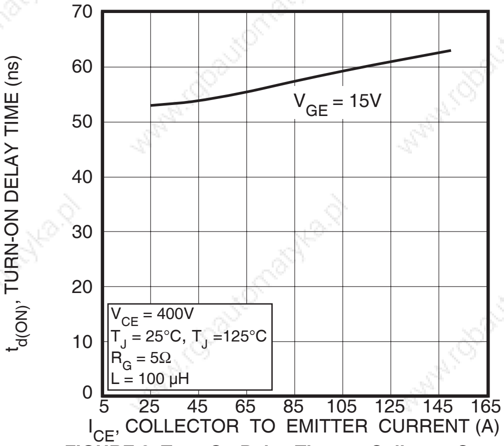


FIGURE 9, Turn-On Delay Time vs Collector Current

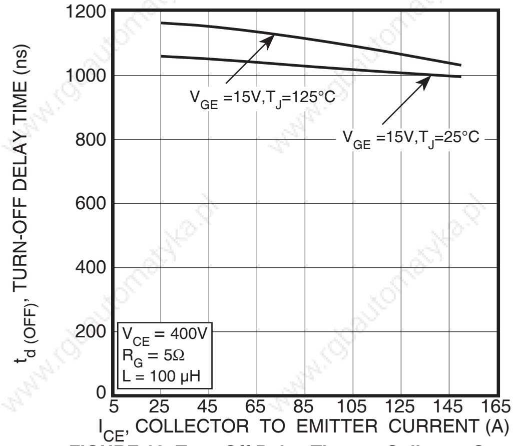


FIGURE 10, Turn-Off Delay Time vs Collector Current

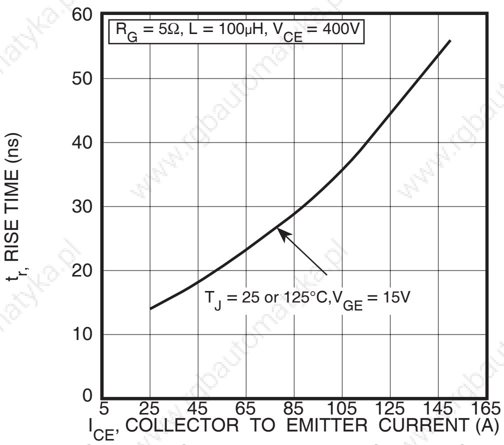


FIGURE 11, Current Rise Time vs Collector Current

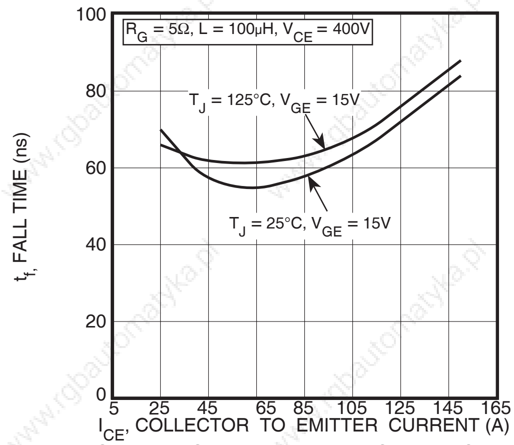


FIGURE 12, Current Fall Time vs Collector Current

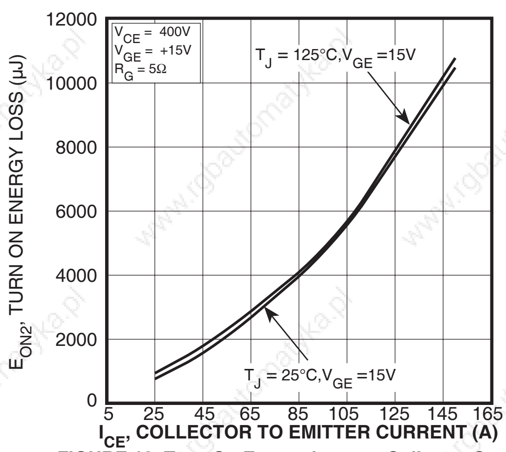


FIGURE 13, Turn-On Energy Loss vs Collector Current

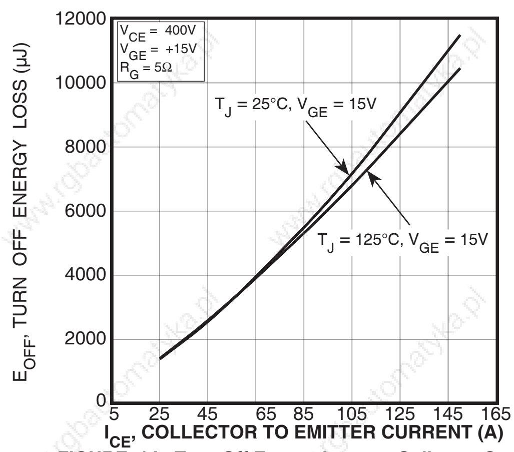


FIGURE 14, Turn Off Energy Loss vs Collector Current

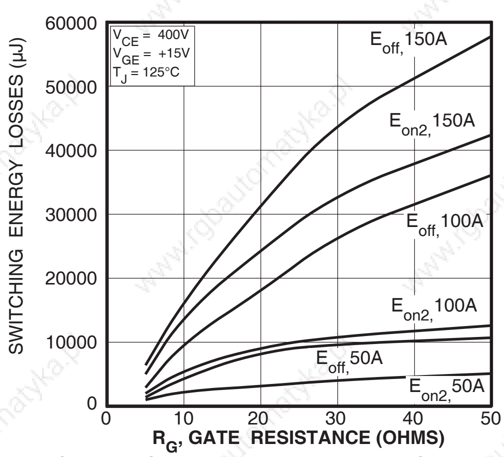


FIGURE 15, Switching Energy Losses vs. Gate Resistance

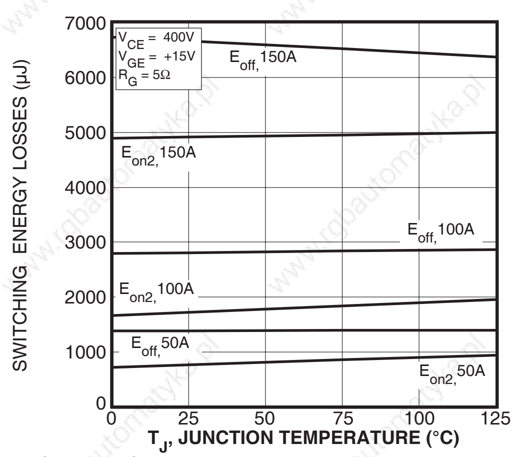


FIGURE 16, Switching Energy Losses vs Junction Temperature

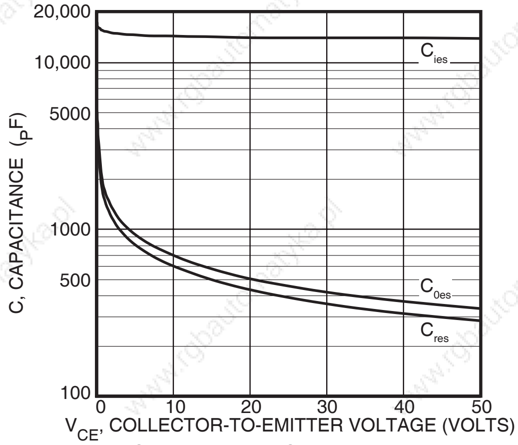


Figure 17, Capacitance vs Collector-To-Emitter Voltage

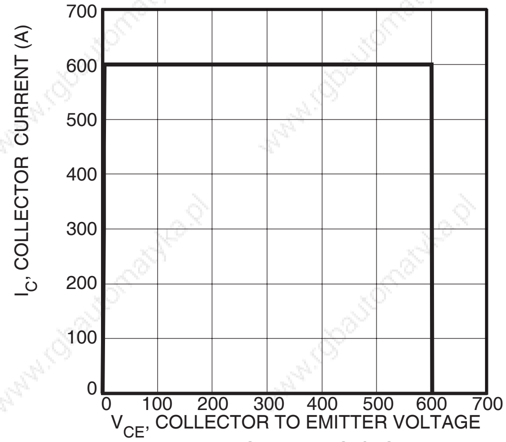


Figure 18,Minimim Switching Safe Operating Area

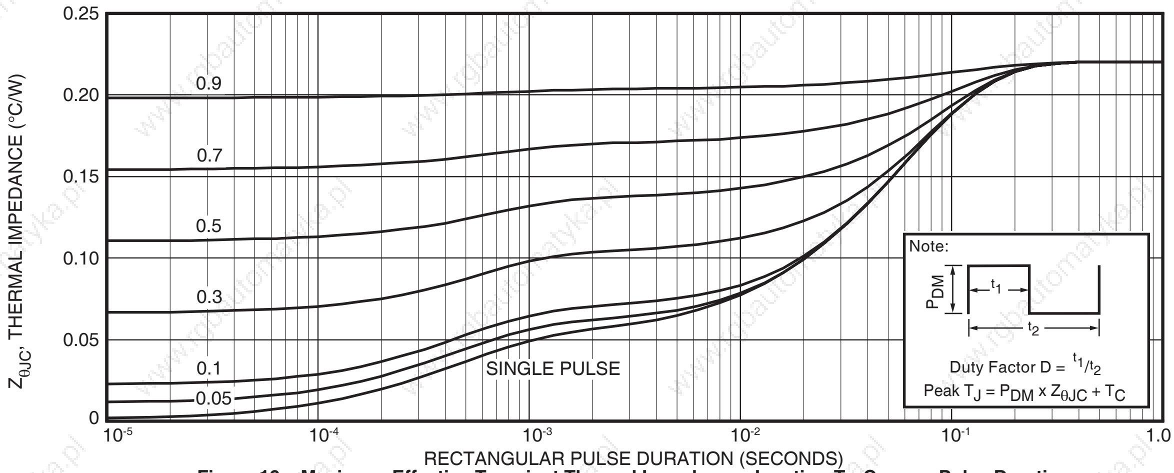


Figure 19a, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

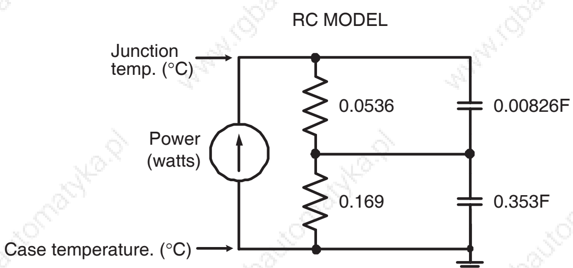


FIGURE 19b, TRANSIENT THERMAL IMPEDANCE MODEL

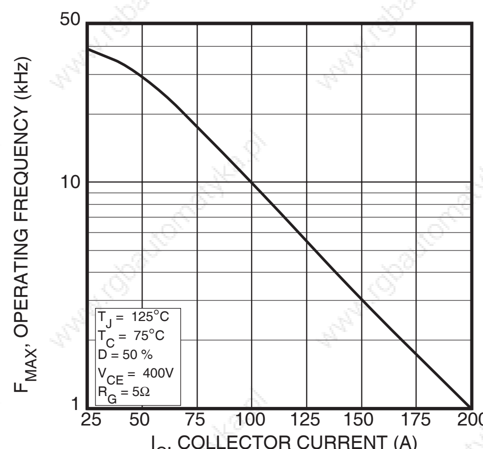


Figure 20, Operating Frequency vs Collector Current

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

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

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

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

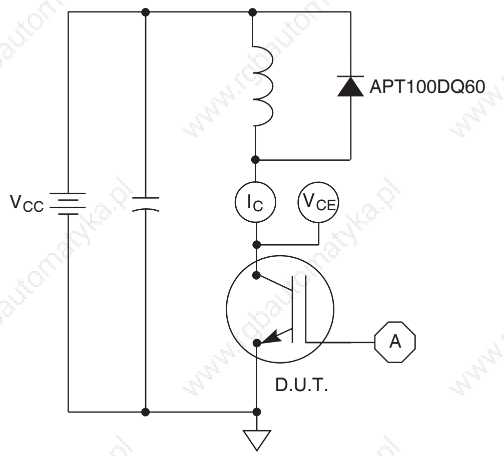


Figure 21, Inductive Switching Test Circuit

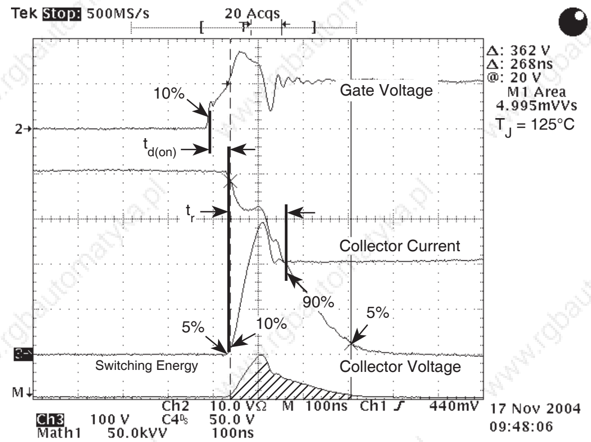


Figure 22, Turn-on Switching Waveforms and Definitions

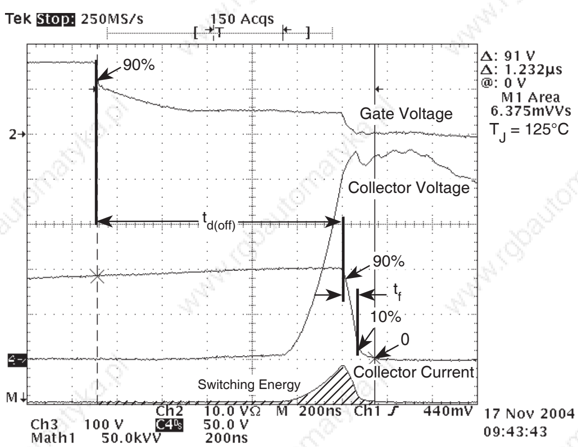


Figure 23, Turn-off Switching Waveforms and Definitions

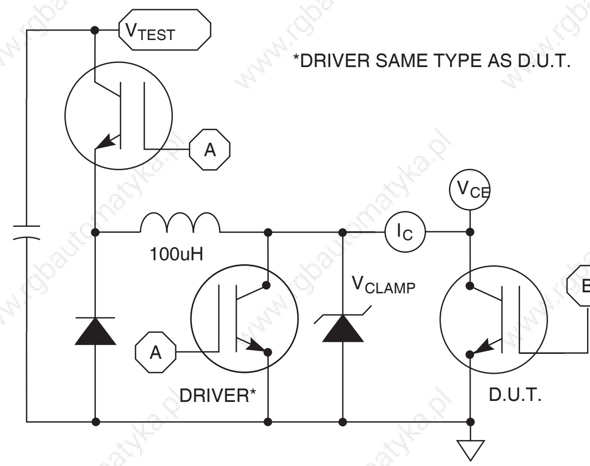
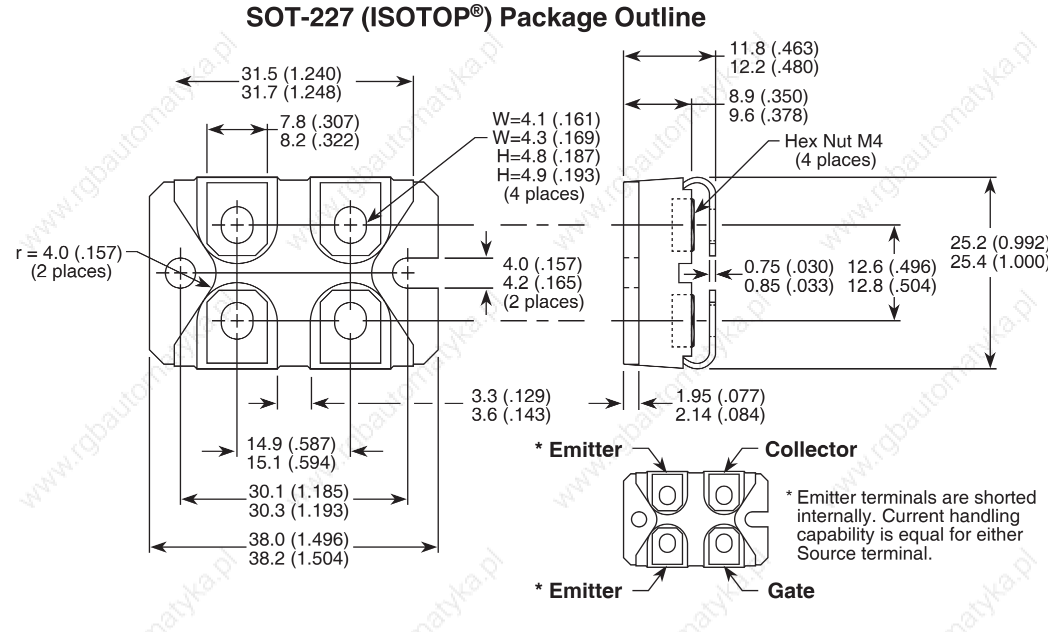


Figure 24, E_{ON1} Test Circuit

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)