

## DYNAMIC CHARACTERISTICS

APT30GP60B\_S

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT	
$C_{ies}$	Input Capacitance	<b>Capacitance</b> $V_{GE} = 0V, V_{CE} = 25V$ $f = 1 \text{ MHz}$		3200		pF	
$C_{oes}$	Output Capacitance			295			
$C_{res}$	Reverse Transfer Capacitance			20			
$V_{GEP}$	Gate-to-Emitter Plateau Voltage	<b>Gate Charge</b> $V_{GE} = 15V$ $V_{CE} = 300V$ $I_C = 30A$		7.5		V	
$Q_g$	Total Gate Charge <sup>③</sup>			90		nC	
$Q_{ge}$	Gate-Emitter Charge			20			
$Q_{gc}$	Gate-Collector ("Miller") Charge			30			
SSOA	Switching SOA	$T_J = 150^\circ\text{C}, R_G = 5\Omega, V_{GE} = 15V, L = 100\mu\text{H}, V_{CE} = 600V$	120			A	
$t_{d(on)}$	Turn-on Delay Time	<b>Inductive Switching (25°C)</b> $V_{CC}(\text{Peak}) = 400V$ $V_{GE} = 15V$ $I_C = 30A$ $R_G = 5\Omega$ $T_J = +25^\circ\text{C}$		13		ns	
$t_r$	Current Rise Time			18			
$t_{d(off)}$	Turn-off Delay Time			55			
$t_f$	Current Fall Time			46			
$E_{on1}$	Turn-on Switching Energy <sup>④</sup>				260		$\mu\text{J}$
$E_{on2}$	Turn-on Switching Energy (Diode) <sup>⑤</sup>				335		
$E_{off}$	Turn-off Switching Energy <sup>⑥</sup>				250	330	
$t_{d(on)}$	Turn-on Delay Time		<b>Inductive Switching (125°C)</b> $V_{CC}(\text{Peak}) = 400V$ $V_{GE} = 15V$ $I_C = 30A$ $R_G = 5\Omega$ $T_J = +125^\circ\text{C}$		13		ns
$t_r$	Current Rise Time			18			
$t_{d(off)}$	Turn-off Delay Time			84			
$t_f$	Current Fall Time			80			
$E_{on1}$	Turn-on Switching Energy <sup>④</sup>				260		$\mu\text{J}$
$E_{on2}$	Turn-on Switching Energy (Diode) <sup>⑤</sup>				508		
$E_{off}$	Turn-off Switching Energy <sup>⑥</sup>				518	750	

## THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case (IGBT)			.27	$^\circ\text{C/W}$
$R_{\theta JC}$	Junction to Case (DIODE)			N/A	
$W_T$	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 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. (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.)

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

# TYPICAL PERFORMANCE CURVES

APT30GP60B

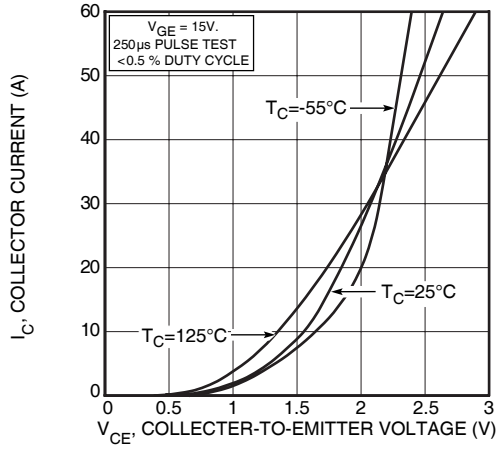


FIGURE 1, Output Characteristics ( $V_{GE} = 15V$ )

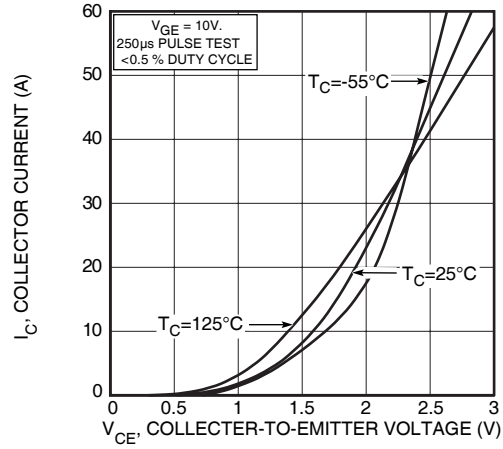


FIGURE 2, Output Characteristics ( $V_{GE} = 10V$ )

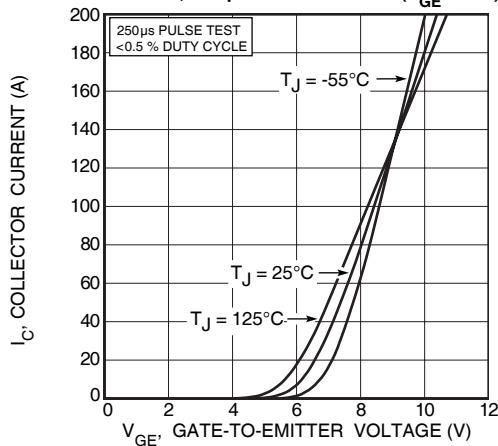


FIGURE 3, Transfer Characteristics

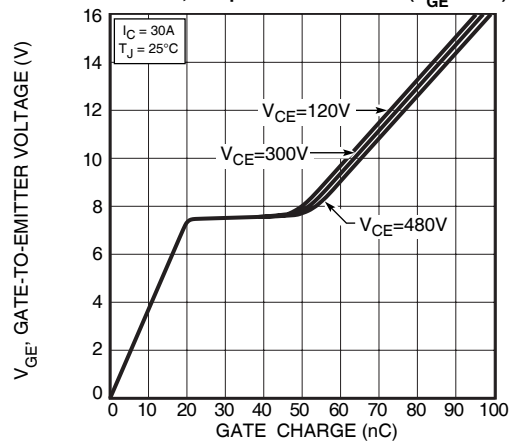


FIGURE 4, Gate Charge

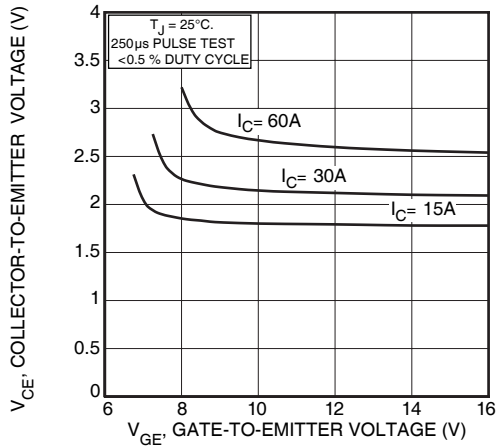


FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage

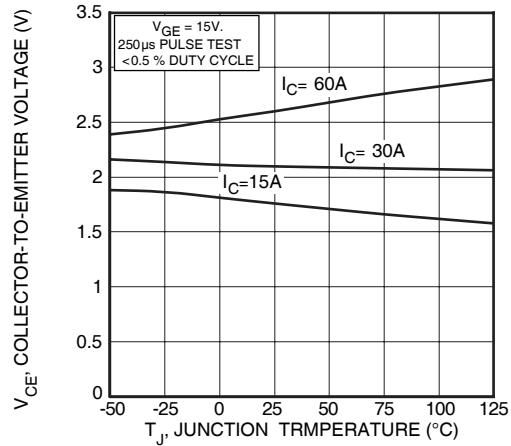


FIGURE 6, On State Voltage vs Junction Temperature

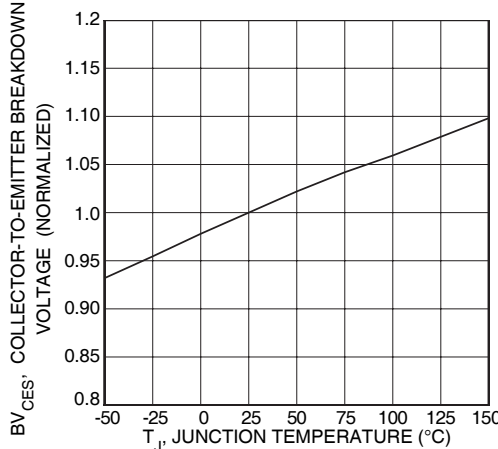


FIGURE 7, Breakdown Voltage vs. Junction Temperature

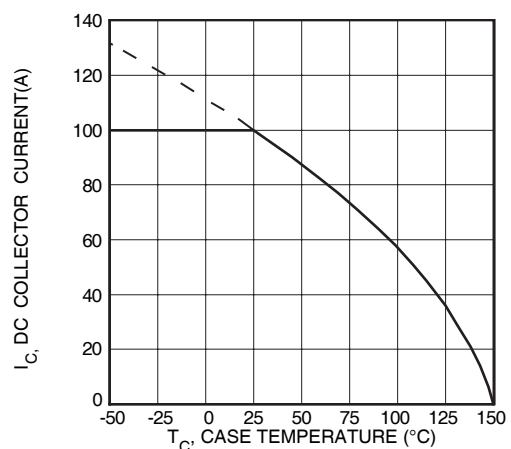


FIGURE 8, DC Collector Current vs Case Temperature

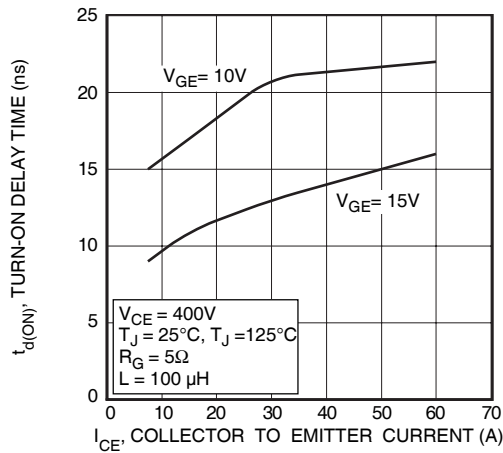


FIGURE 9, Turn-On Delay Time vs Collector Current

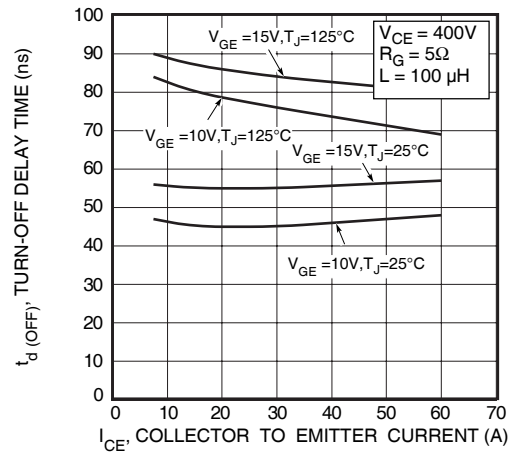


FIGURE 10, Turn-Off Delay Time vs Collector Current

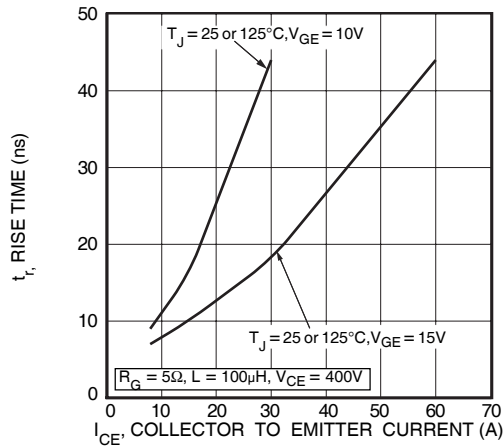


FIGURE 11, Current Rise Time vs Collector Current

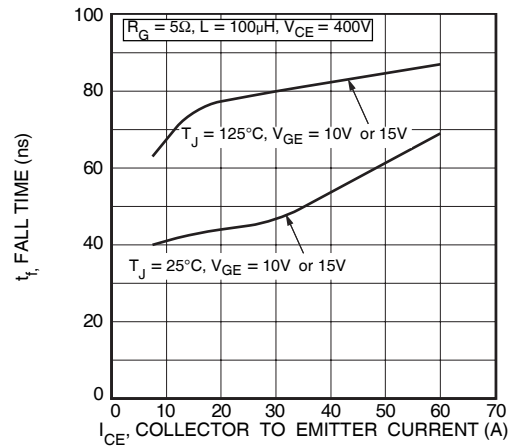


FIGURE 12, Current Fall Time vs Collector Current

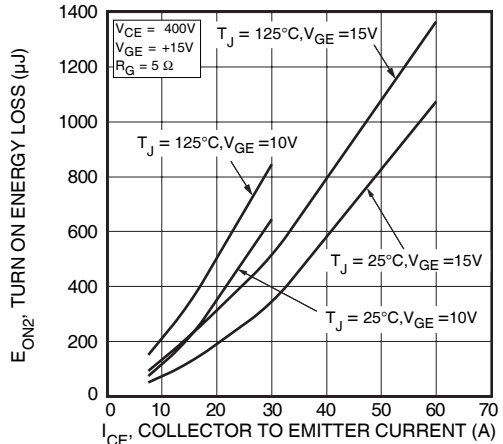


FIGURE 13, Turn-On Energy Loss vs Collector Current

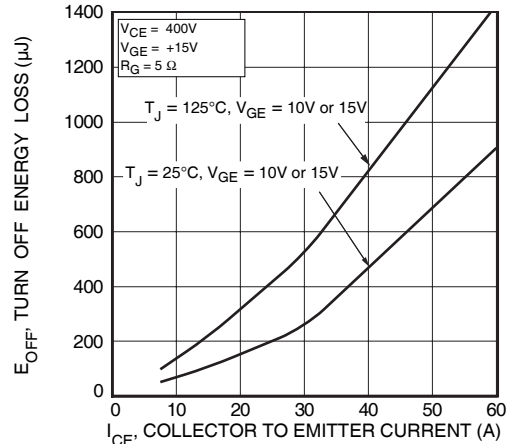


FIGURE 14, Turn Off Energy Loss vs Collector Current

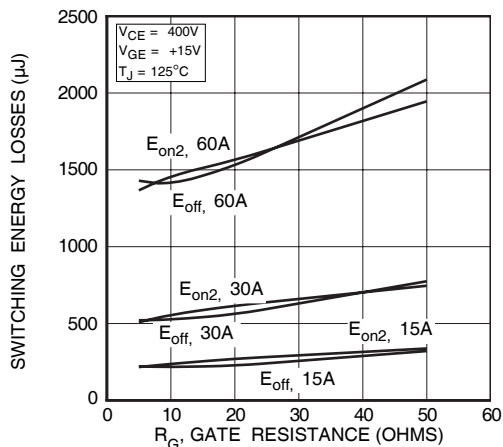


FIGURE 15, Switching Energy Losses vs. Gate Resistance

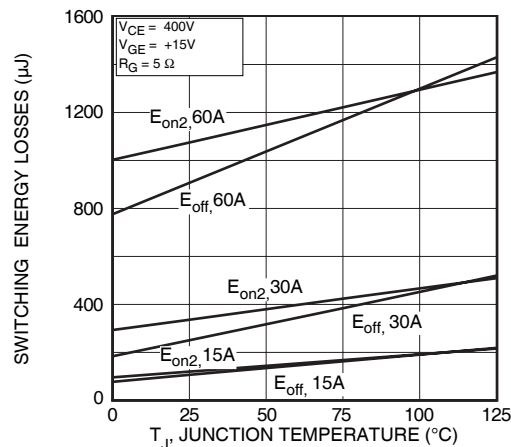


FIGURE 16, Switching Energy Losses vs Junction Temperature

TYPICAL PERFORMANCE CURVES

APT30GP60B

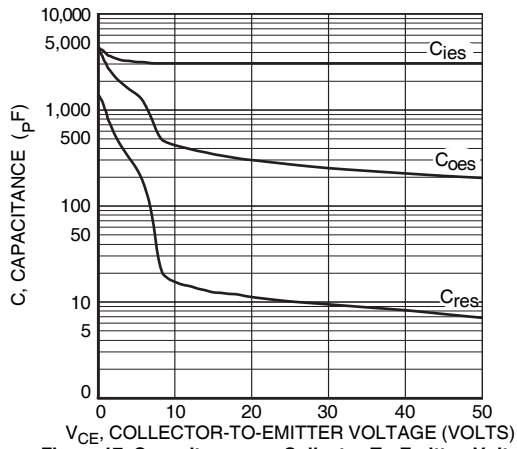


Figure 17, Capacitance vs Collector-To-Emitter Voltage

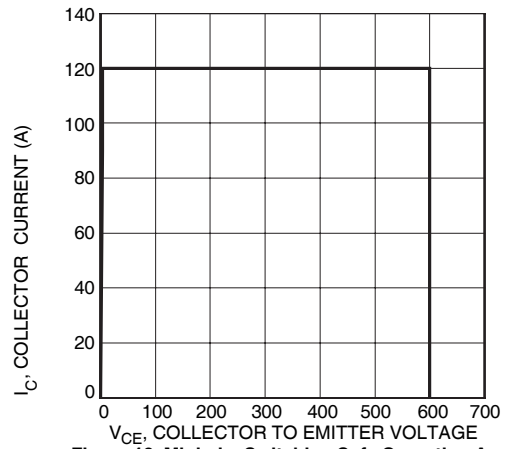


Figure 18, Minimum Switching Safe Operating Area

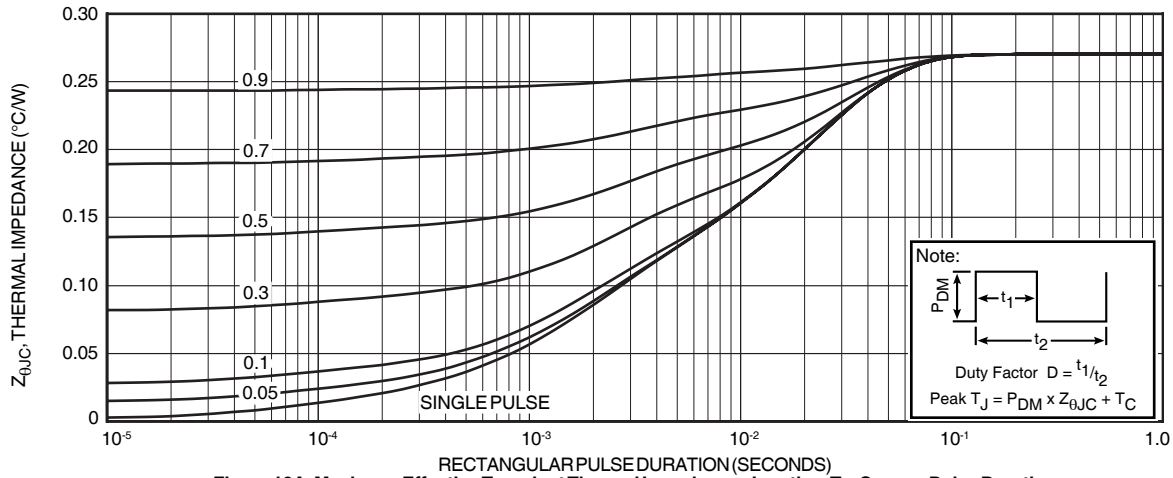


Figure 19A, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

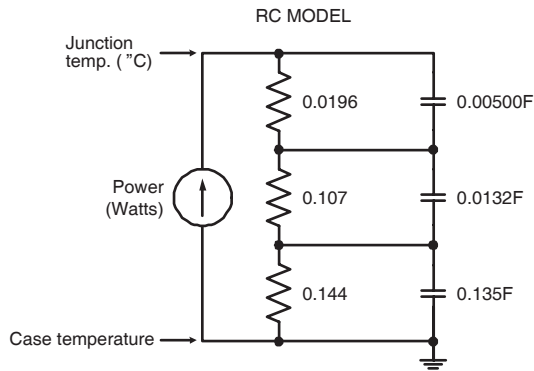


FIGURE 19B, TRANSIENT THERMAL IMPEDANCE MODEL

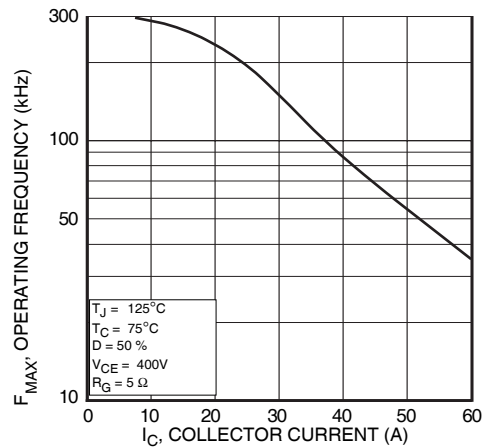


Figure 20, Operating Frequency vs Collector Current

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

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

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

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

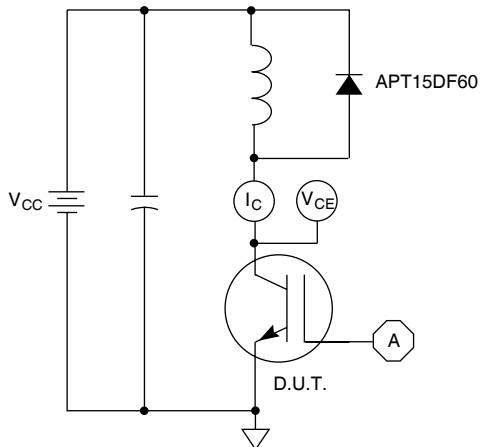


Figure 21, Inductive Switching Test Circuit

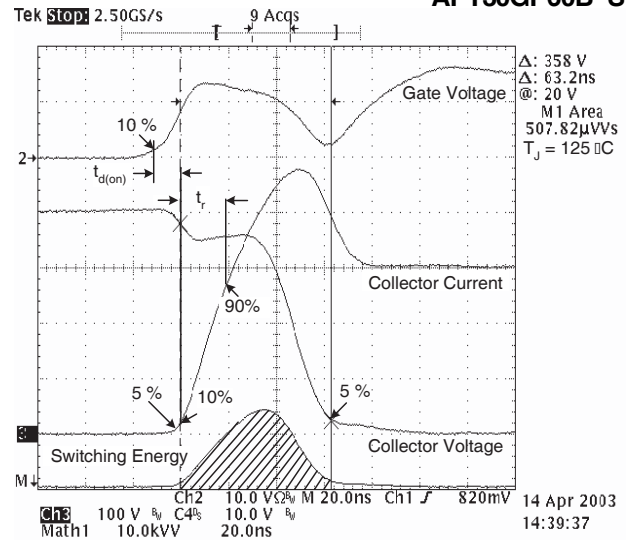


Figure 22, Turn-on Switching Waveforms and Definitions

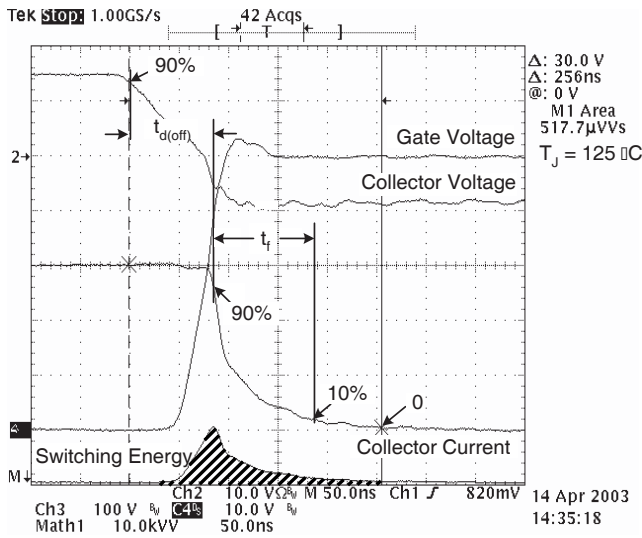


Figure 23, Turn-off Switching Waveforms and Definitions

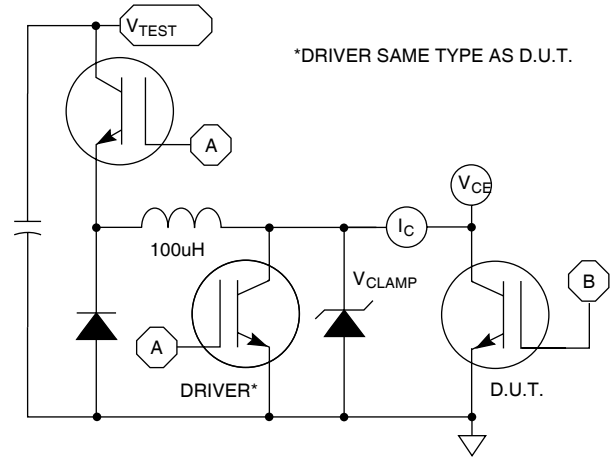
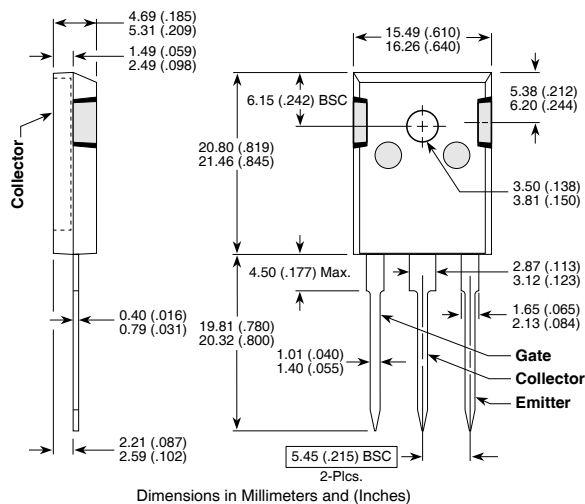
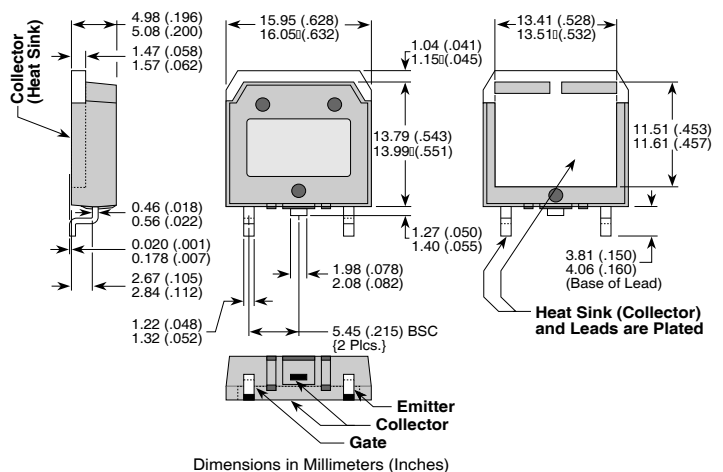


Figure 24, E<sub>ON1</sub> Test Circuit

TO-247 Package Outline



D<sup>3</sup>PAK Package Outline



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