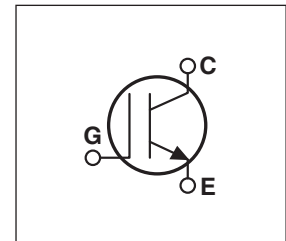
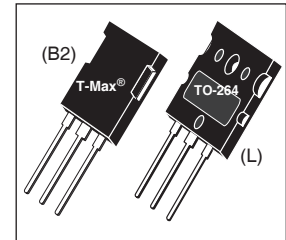


FAST IGBT

The Fast IGBT is a new generation of high voltage power IGBTs. Using Non-Punch through technology, the Fast IGBT offers superior ruggedness, fast switching speed and low Collector-Emitter On voltage.

- **Low Forward Voltage Drop**
- **High Freq. Switching to 20KHz**
- **RBSOA and SCSOA Rated**
- **Ultra Low Leakage Current**
- **Integrated Gate Resistor: Low EMI, High Reliability**



MAXIMUM RATINGS

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

Symbol	Parameter	APT50GF120B2_LR(G)	UNIT
V_{CES}	Collector-Emitter Voltage	1200	Volts
V_{GE}	Gate-Emitter Voltage	± 30	
I_{C1}	Continuous Collector Current ^⑦ @ $T_C = 25^\circ\text{C}$	135	Amps
I_{C2}	Continuous Collector Current @ $T_C = 100^\circ\text{C}$	75	
I_{CM}	Pulsed Collector Current ^①	150	
SSOA	Switching Safe Operating Area @ $T_J = 150^\circ\text{C}$	150A @ 1200V	
P_D	Total Power Dissipation	781	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 ($V_{GE} = 0V, I_C = 500\mu\text{A}$)	1200			Volts
$V_{GE(TH)}$	Gate Threshold Voltage ($V_{CE} = V_{GE}, I_C = 700\mu\text{A}, T_J = 25^\circ\text{C}$)	4.5	5.5	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage ($V_{GE} = 15V, I_C = 50A, T_J = 25^\circ\text{C}$)		2.5	3.0	
	Collector-Emitter On Voltage ($V_{GE} = 15V, I_C = 50A, T_J = 125^\circ\text{C}$)		3.1		
I_{CES}	Collector Cut-off Current ($V_{CE} = 1200V, V_{GE} = 0V, T_J = 25^\circ\text{C}$) ^②			100	μA
	Collector Cut-off Current ($V_{CE} = 1200V, V_{GE} = 0V, T_J = 125^\circ\text{C}$) ^②			1000	
I_{GES}	Gate-Emitter Leakage Current ($V_{GE} = \pm 20V$)			± 100	nA
$R_{G(int)}$	Integrated Gate Resistor		5		Ω

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

DYNAMIC CHARACTERISTICS

APT50GF120B2_LR(G)

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{ies}	Input Capacitance	Capacitance $V_{GE} = 0V, V_{CE} = 25V$ $f = 1 \text{ MHz}$		3460		pF
C_{oes}	Output Capacitance			385		
C_{res}	Reverse Transfer Capacitance			225		
V_{GEP}	Gate-to-Emitter Plateau Voltage	Gate Charge		9.5		V
Q_g	Total Gate Charge ^③	$V_{GE} = 15V$ $V_{CE} = 600V$ $I_C = 50A$		340		nC
Q_{ge}	Gate-Emitter Charge			30		
Q_{gc}	Gate-Collector ("Miller") Charge			205		
SSOA	Switching Safe Operating Area	$T_J = 150^\circ\text{C}, R_G = 1.0\Omega, \textcircled{7}V_{GE} = 15V, L = 100\mu\text{H}, V_{CE} = 1200V$	150			A
$t_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) $V_{CC} = 800V$ $V_{GE} = 15V$ $I_C = 50A$ $R_G = 1.0\Omega \textcircled{7}$ $T_J = +25^\circ\text{C}$		25		ns
t_r	Current Rise Time			43		
$t_{d(off)}$	Turn-off Delay Time			260		
t_f	Current Fall Time			70		μJ
E_{on1}	Turn-on Switching Energy ^④			3600		
E_{on2}	Turn-on Switching Energy (With Diode) ^⑤			4675		
E_{off}	Turn-off Switching Energy ^⑥		2640			
$t_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) $V_{CC} = 800V$ $V_{GE} = 15V$ $I_C = 50A$ $R_G = 1.0\Omega \textcircled{7}$ $T_J = +125^\circ\text{C}$		25		ns
t_r	Current Rise Time			43		
$t_{d(off)}$	Turn-off Delay Time			300		
t_f	Current Fall Time			95		μJ
E_{on1}	Turn-on Switching Energy ^④			3750		
E_{on2}	Turn-on Switching Energy (With Diode) ^⑤			6400		
E_{off}	Turn-off Switching Energy ^⑥		3400			

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case (IGBT)			.16	°C/W
$R_{\theta JC}$	Junction to Case (DIODE)			N/A	
W_T	Package Weight		6.1		gm

① Repetitive Rating: Pulse width limited by maximum junction temperature.

② For Combi devices, I_{ces} includes both IGBT and diode 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)

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

TYPICAL PERFORMANCE CURVES

APT50GF120B2_LR(G)

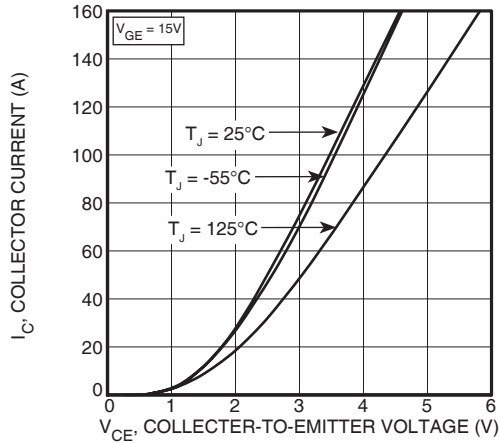


FIGURE 1, Output Characteristics($T_J = 25^\circ\text{C}$)

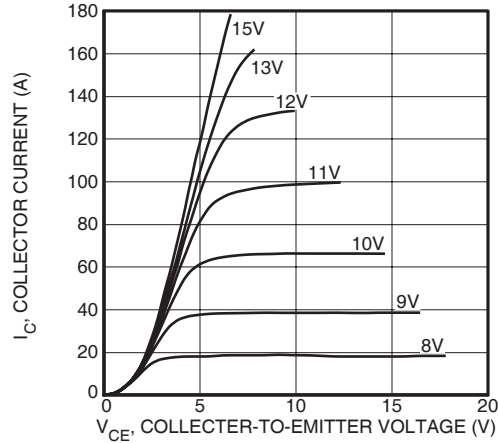


FIGURE 2, Output Characteristics ($T_J = 125^\circ\text{C}$)

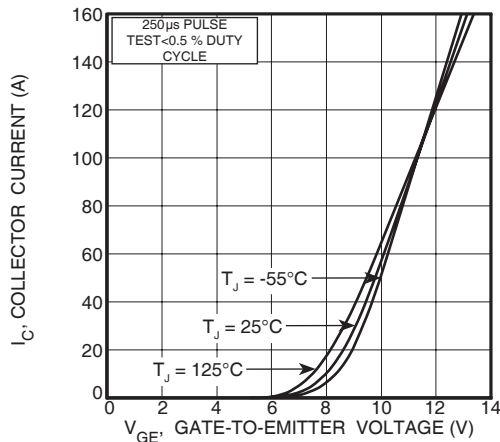


FIGURE 3, Transfer Characteristics

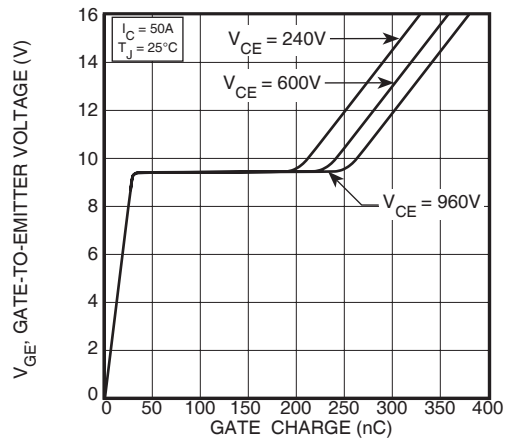


FIGURE 4, Gate Charge

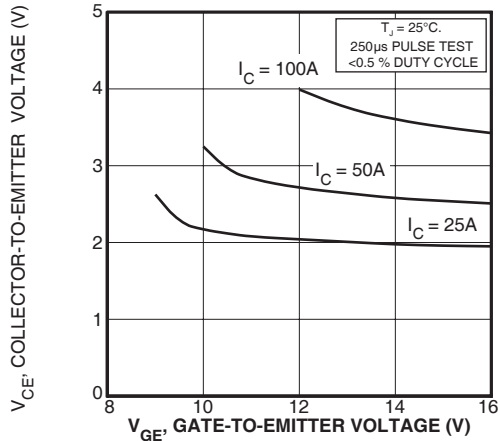


FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage

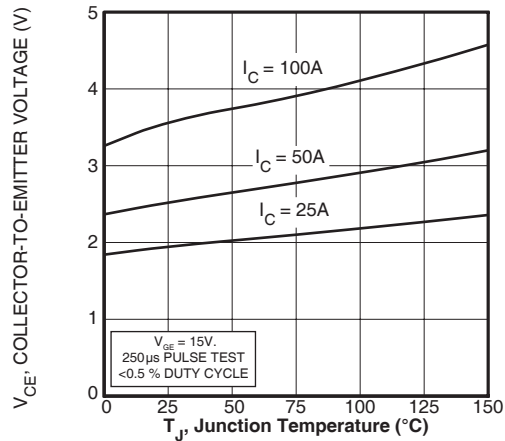


FIGURE 6, On State Voltage vs Junction Temperature

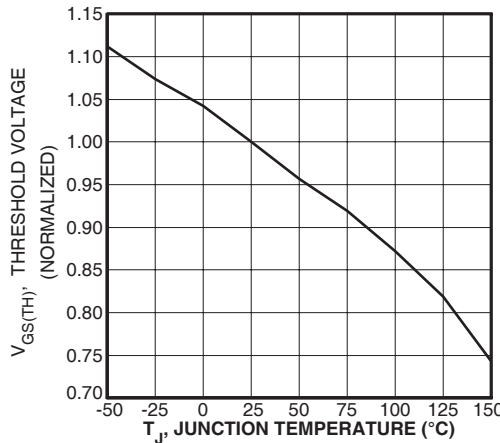


FIGURE 7, Threshold Voltage vs. Junction Temperature

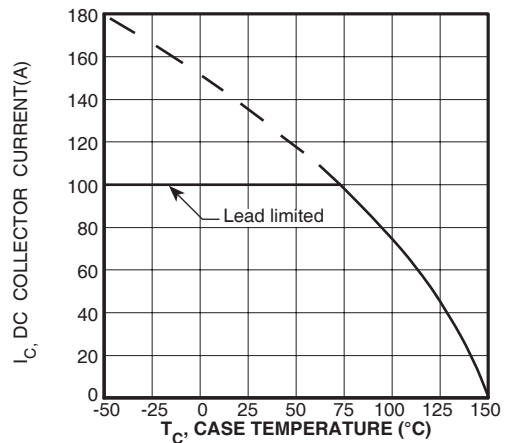


FIGURE 8, DC Collector Current vs Case Temperature

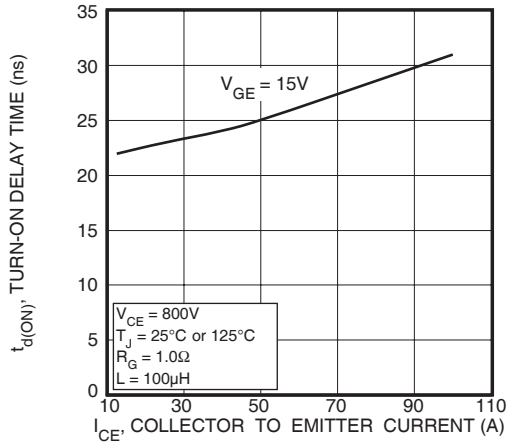


FIGURE 9, Turn-On Delay Time vs Collector Current

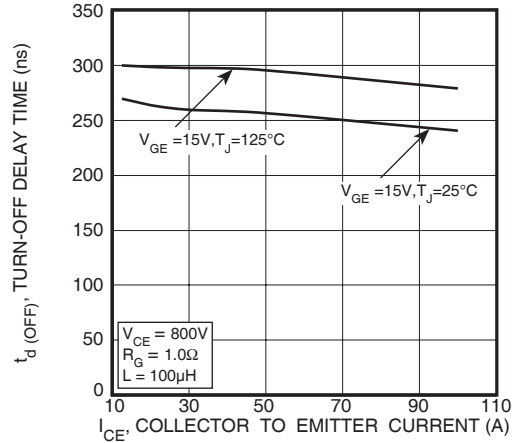


FIGURE 10, Turn-Off Delay Time vs Collector Current

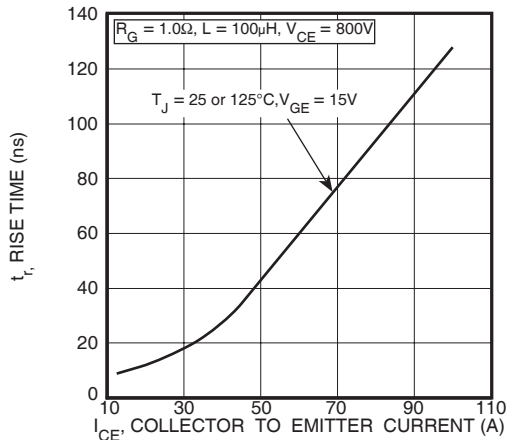


FIGURE 11, Current Rise Time vs Collector Current

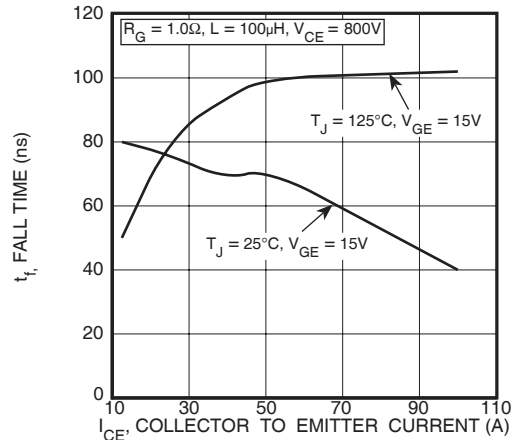


FIGURE 12, Current Fall Time vs Collector Current

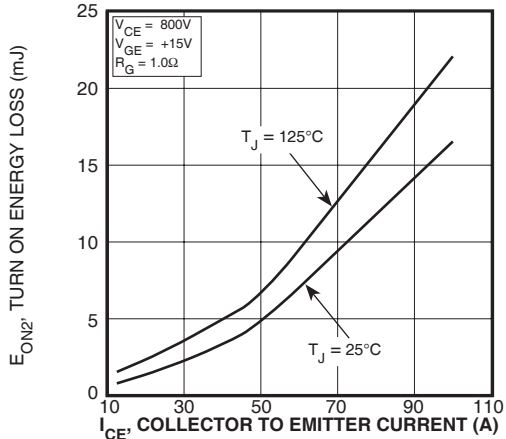


FIGURE 13, Turn-On Energy Loss vs Collector Current

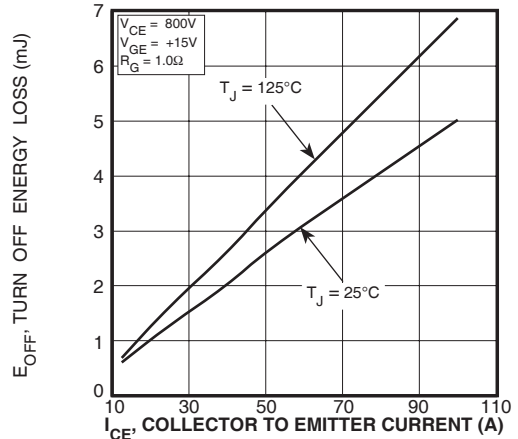


FIGURE 14, Turn Off Energy Loss vs Collector Current

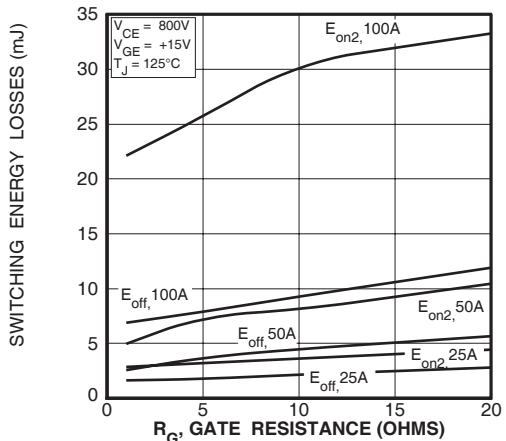


FIGURE 15, Switching Energy Losses vs. Gate Resistance

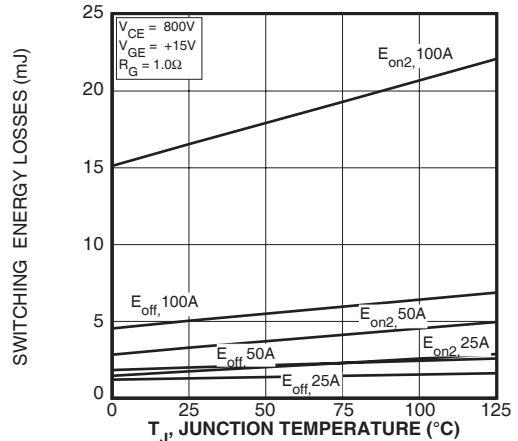


FIGURE 16, Switching Energy Losses vs Junction Temperature

TYPICAL PERFORMANCE CURVES

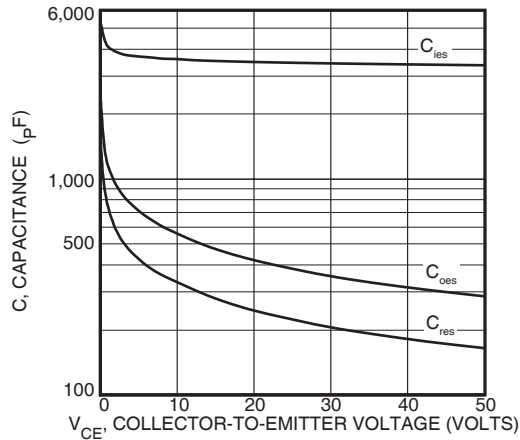


Figure 17, Capacitance vs Collector-To-Emitter Voltage

APT50GF120B2_LR(G)

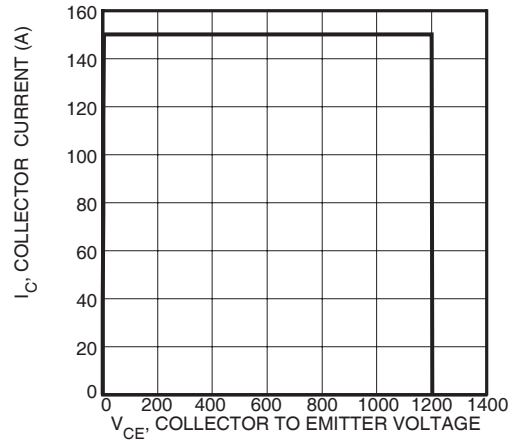


Figure 18, Minimum Switching Safe Operating Area

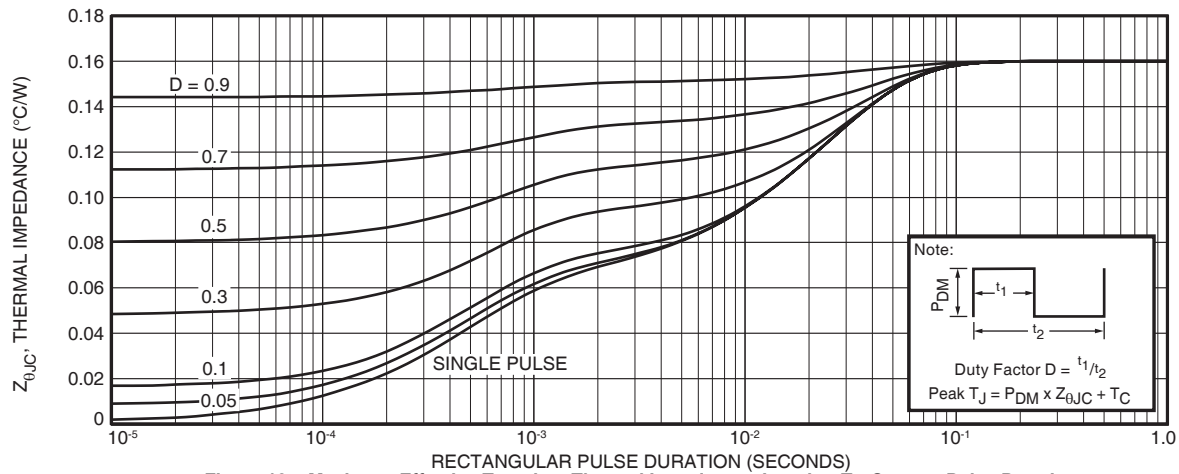


Figure 19a, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

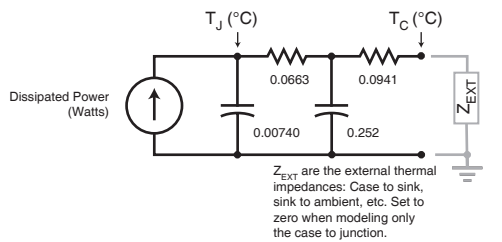


FIGURE 19b, TRANSIENT THERMAL IMPEDANCE MODEL

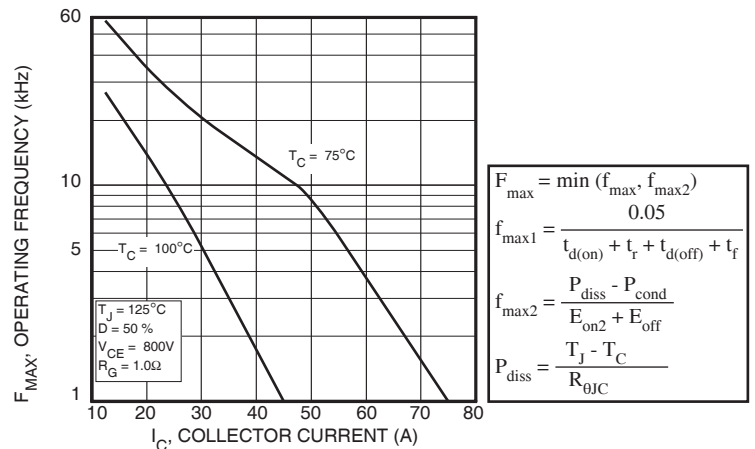


Figure 20, Operating Frequency vs Collector Current

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

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

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

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

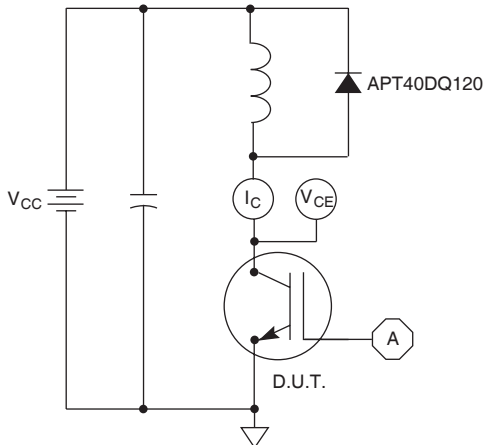


Figure 21, Inductive Switching Test Circuit

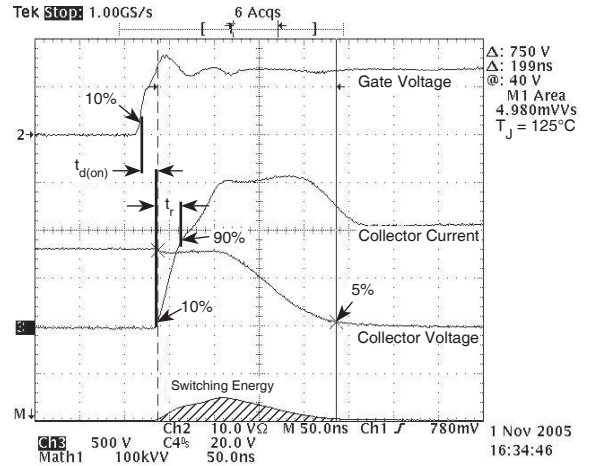


Figure 22, Turn-on Switching Waveforms and Definitions

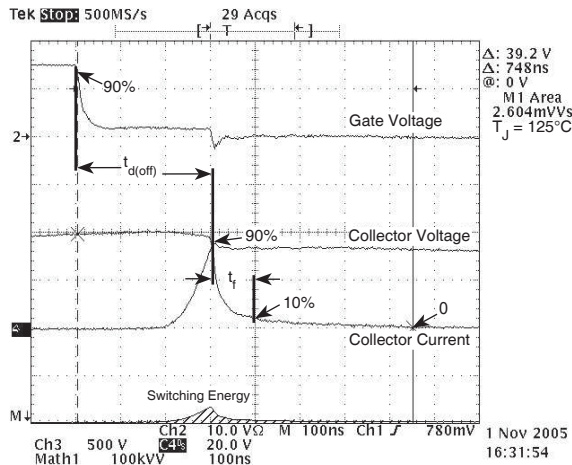
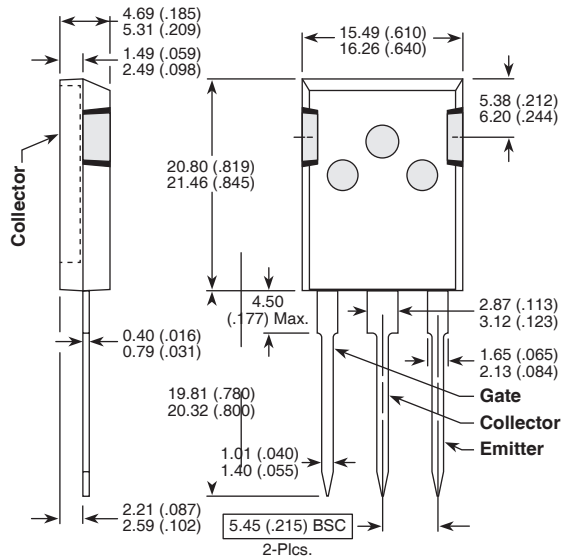


Figure 23, Turn-off Switching Waveforms and Definitions

T-MAX® (B2) Package Outline

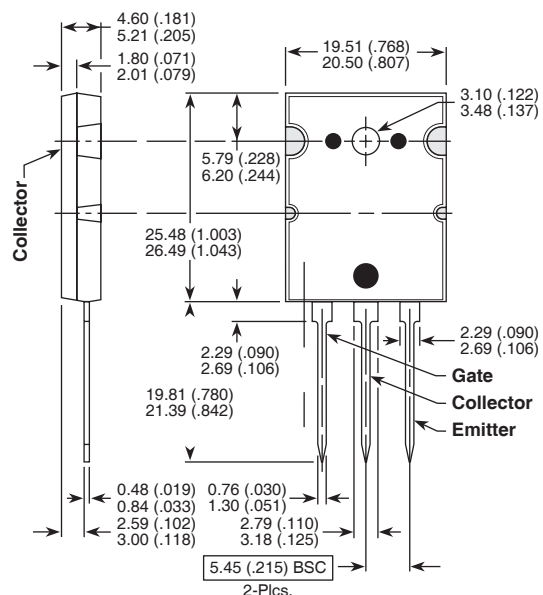
① SAC: Tin, Silver, Copper



Dimensions in Millimeters and (Inches)

TO-264(L) Package Outline

① SAC: Tin, Silver, Copper



Dimensions in Millimeters and (Inches)