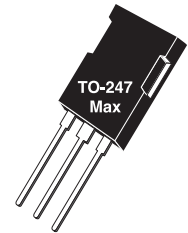


## Field Stop IGBT

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**
- **Integrated Gate Resistor :Low EMI, High Reliability**
- **RoHS Compliant**

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

### Maximum Ratings

All Ratings:  $T_c = 25^\circ C$  unless otherwise specified.

Symbol	Parameter	Ratings	Unit
$V_{CES}$	Collector-Emitter Voltage	600	Volts
$V_{GE}$	Gate-Emitter Voltage	$\pm 20$	
$I_{C1}$	Continuous Collector Current @ $T_c = 25^\circ C$	283	Amps
$I_{C2}$	Continuous Collector Current @ $T_c = 110^\circ C$	158	
$I_{CM}$	Pulsed Collector Current <sup>①</sup>	600	
SSOA	Switching Safe Operating Area @ $T_j = 175^\circ C$	600A @ 600V	
$P_D$	Total Power Dissipation	682	Watts
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 175	$^\circ C$
$T_L$	Max. Lead Temp. for Soldering: 0.063" from Case for 10 Sec.	300	

### Static Electrical Characteristics

Symbol	Characteristic / Test Conditions	Min	Typ	Max	Unit
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage ( $V_{GE} = 0V, I_C = 4mA$ )	600	-	-	Volts
$V_{GE(TH)}$	Gate Threshold Voltage ( $V_{CE} = V_{GE}, I_C = 3.2mA, T_j = 25^\circ C$ )	5.0	5.8	6.5	
$V_{CE(ON)}$	Collector Emitter On Voltage ( $V_{GE} = 15V, I_C = 200A, T_j = 25^\circ C$ )	1.05	1.45	1.85	
	Collector Emitter On Voltage ( $V_{GE} = 15V, I_C = 200A, T_j = 125^\circ C$ )	-	1.65	-	
$I_{CES}$	Collector Cut-off Current ( $V_{CE} = 600V, V_{GE} = 0V, T_j = 25^\circ C$ ) <sup>②</sup>	-	-	25	$\mu A$
	Collector Cut-off Current ( $V_{CE} = 600V, V_{GE} = 0V, T_j = 125^\circ C$ ) <sup>②</sup>	-	-	1000	
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{GE} = \pm 20V$ )	-	-	600	nA
$R_{G(int)}$	Integrated Gate Resistor	-	2	-	$\Omega$

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

## Dynamic Characteristics

APT200GN60B2G

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$C_{ies}$	Input Capacitance	$V_{GE} = 0V, V_{CE} = 25V$ $f = 1MHz$	-	14100	-	pF
$C_{oes}$	Output Capacitance		-	461	-	
$C_{res}$	Reverse Transfer Capacitance		-	393	-	
$V_{GEP}$	Gate-to-Emitter Plateau Voltage	Gate Charge $V_{GE} = 15V$ $V_{CE} = 300V$ $I_C = 100A$	-	8.2	-	V
$Q_g$	Total Gate Charge		-	1180	-	nC
$Q_{ge}$	Gate-Emitter Charge		-	85	-	
$Q_{gc}$	Gate-Collector Charge		-	660	-	
SSOA	Switching Safe Operating Area	$T_J = 150^\circ C, R_G = 1.0\Omega^{(2)}, V_{GE} = 15V,$ $L = 100\mu H, V_{CE} = 600V$	600			A
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching ( $25^\circ C$ ) $V_{CC} = 400V$ $V_{GE} = 15V$ $I_C = 200A$ $R_G = 1.0\Omega$ $T_J = +25^\circ C$	-	50	-	ns
$t_r$	Current Rise Time		-	80	-	
$t_{d(off)}$	Turn-Off Delay Time		-	560	-	
$t_f$	Current Fall Time		-	100	-	mJ
$E_{on1}$	Turn-On Switching Energy <sup>(4)</sup>		-	13	-	
$E_{on2}$	Turn-On Switching Energy <sup>(5)</sup>		-	15	-	
$E_{off}$	Turn-Off Switching Energy <sup>(6)</sup>	-	11	-		
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching ( $125^\circ C$ ) $V_{CC} = 400V$ $V_{GE} = 15V$ $I_C = 200A$ $R_G = 1.0\Omega$ $T_J = +125^\circ C$	-	50	-	ns
$t_r$	Current Rise Time		-	80	-	
$t_{d(off)}$	Turn-Off Delay Time		-	620	-	
$t_f$	Current Fall Time		-	70	-	mJ
$E_{on1}$	Turn-On Switching Energy <sup>(4)</sup>		-	14	-	
$E_{on2}$	Turn-On Switching Energy <sup>(5)</sup>		-	16	-	
$E_{off}$	Turn-Off Switching Energy <sup>(6)</sup>	-	10	-		

## Thermal and Mechanical Characteristics

Symbol	Characteristic / Test Conditions	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case (IGBT)	-	-	0.13	$^\circ C/W$
$R_{\theta JC}$	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 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 gate driver impedance.

Microsemi reserves the right to change, without notice, the specifications and information contained herein.

# Typical Performance Curves

APT200GN60B2G

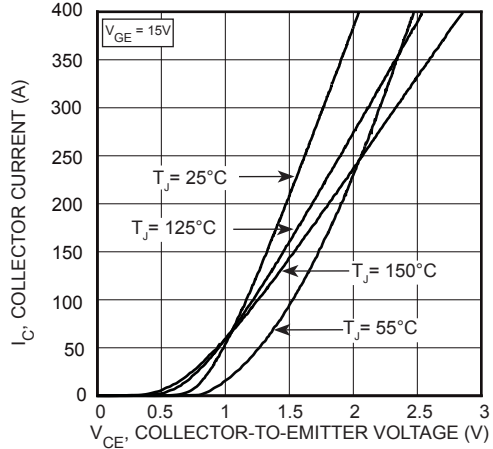


FIGURE 1, Output Characteristics ( $T_J = 25^\circ\text{C}$ )

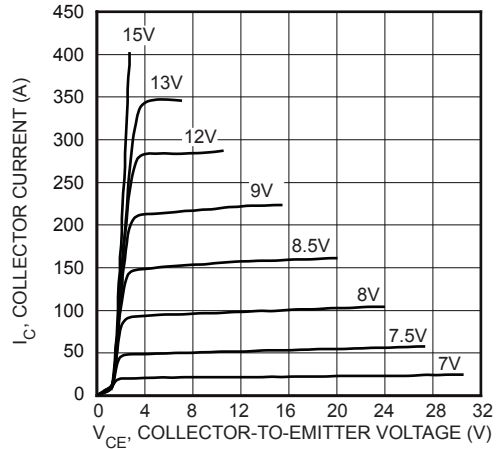


FIGURE 2, Output Characteristics ( $T_J = 25^\circ\text{C}$ )

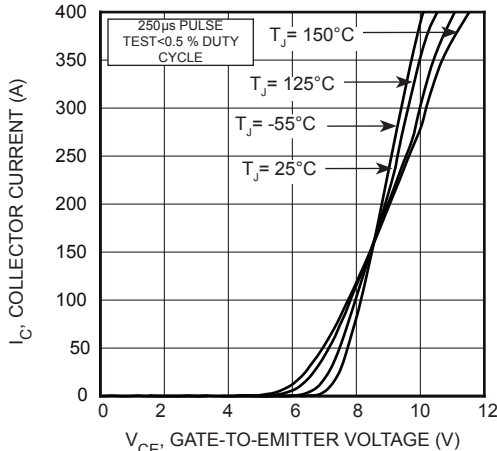


FIGURE 3, Transfer Characteristics

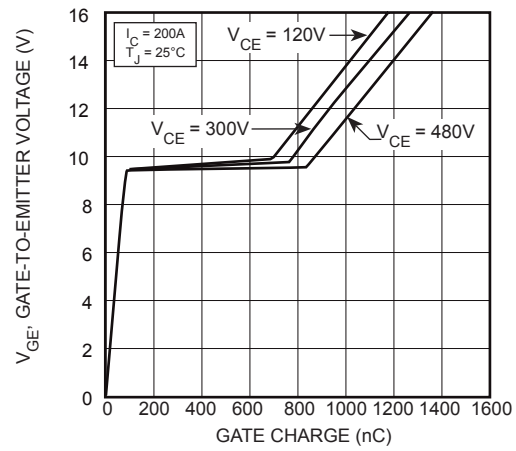


FIGURE 4, Gate charge

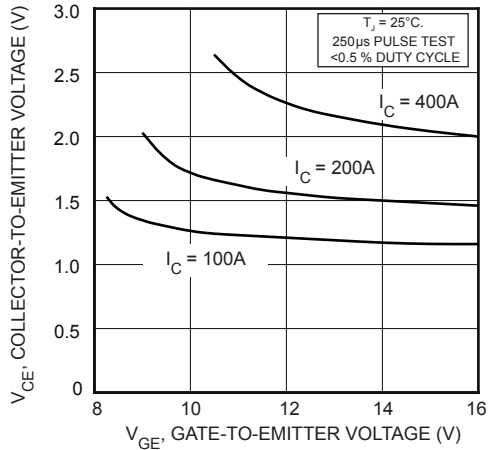


FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage

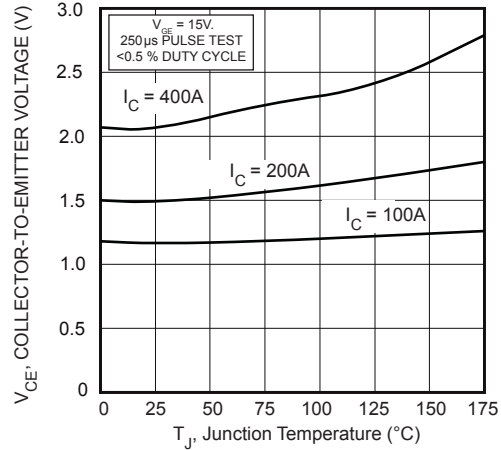


FIGURE 6, On State Voltage vs Junction Temperature

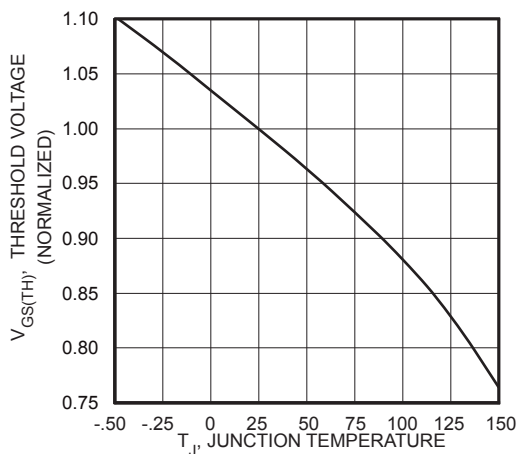


FIGURE 7, Threshold Voltage vs Junction Temperature

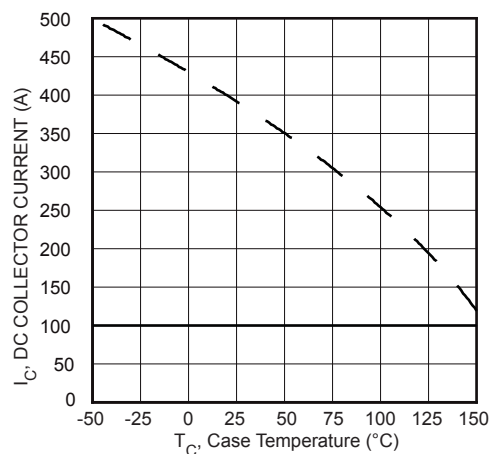


FIGURE 8, DC Collector Current vs Case Temperature

# Typical Performance Curves

APT200GN60B2G

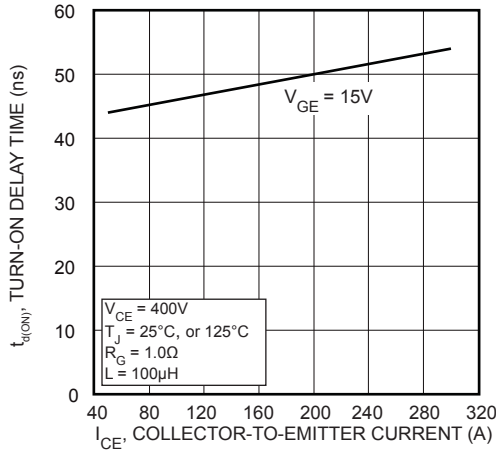


FIGURE 9, Turn-On Delay Time vs Collector Current

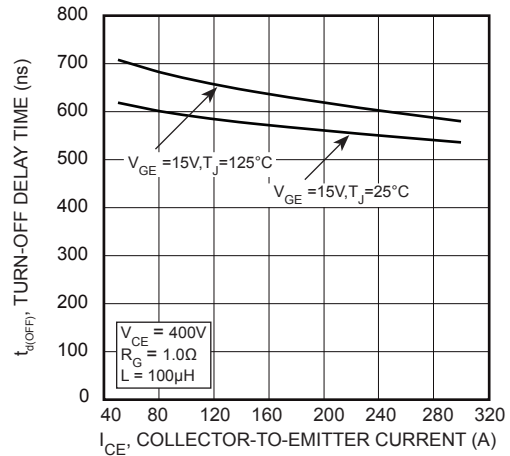


FIGURE 10, Turn-Off Delay Time vs Collector Current

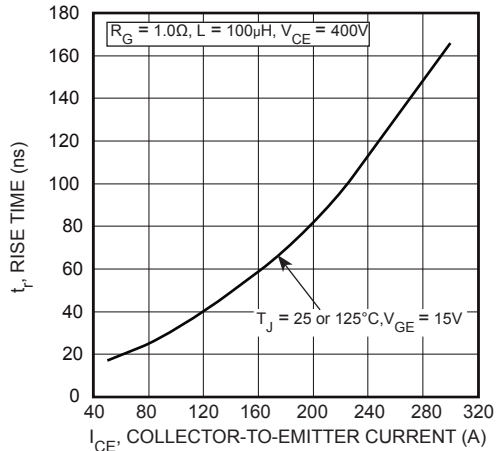


FIGURE 11, Current Rise Time vs Collector Current

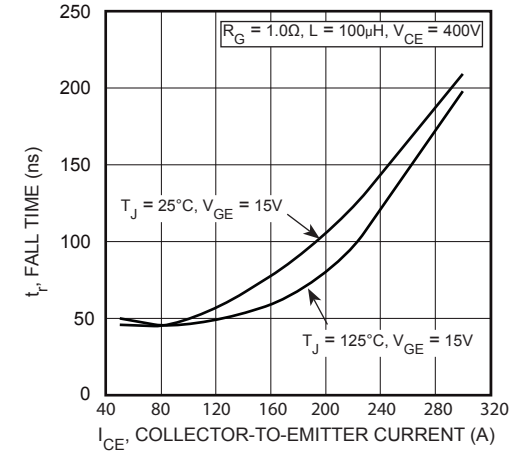


FIGURE 12, Current Fall Time vs Collector Current

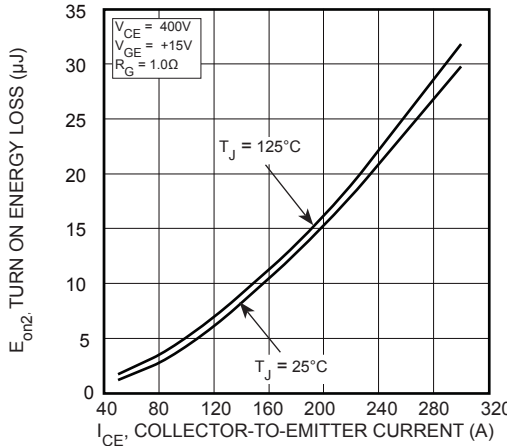


FIGURE 13, Turn-On Energy Loss vs Collector Current

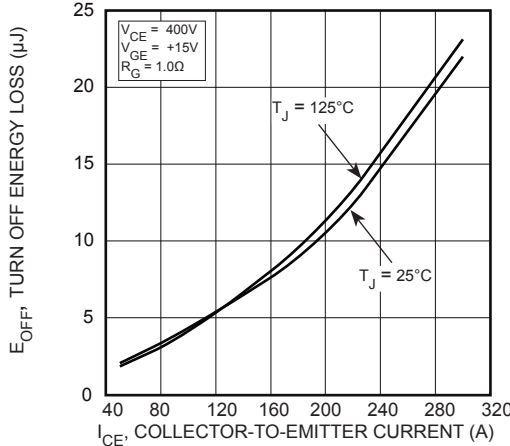


FIGURE 14, Turn-Off Energy Loss vs Collector Current

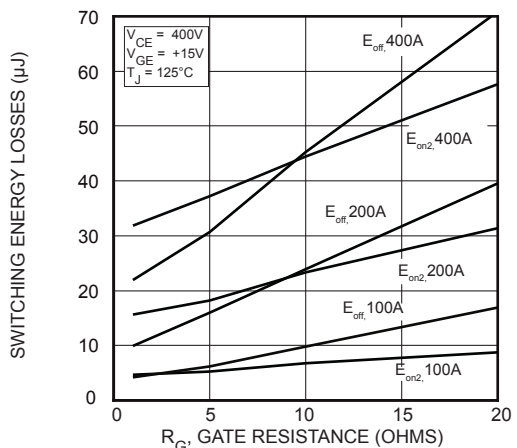


FIGURE 15, Switching Energy Losses vs Gate Resistance

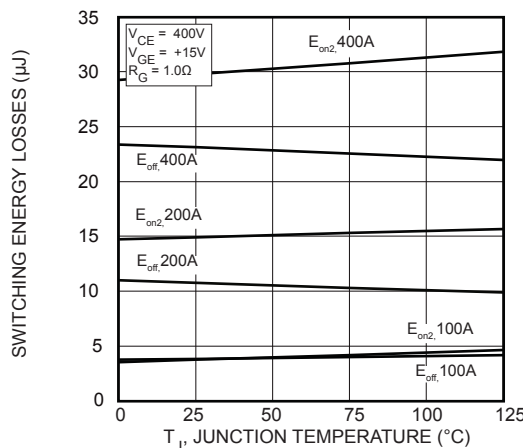


FIGURE 16, Switching Energy Losses vs Junction Temperature

# Typical Performance Curves

APT200GN60B2G

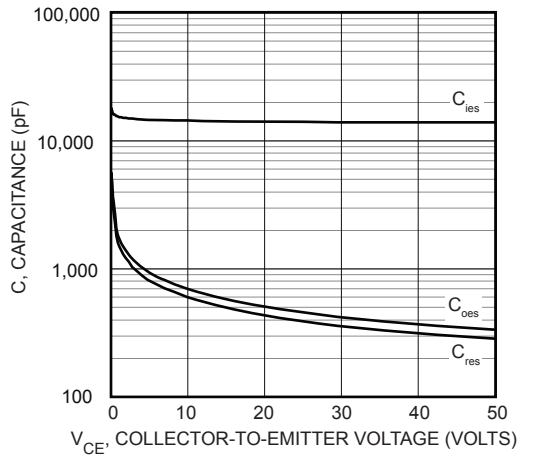


FIGURE 17, Capacitance vs Collector-To-Emitter Voltage

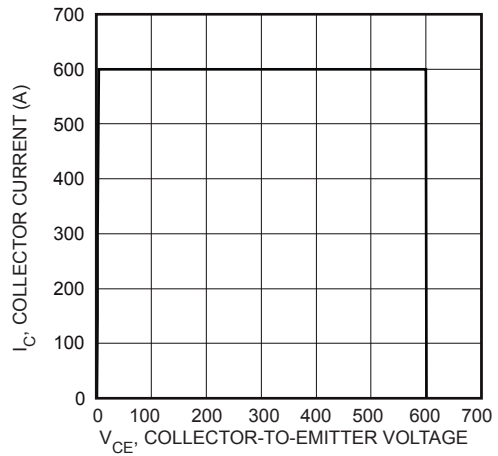


FIGURE 18, Minimum Switching Safe Operating Area

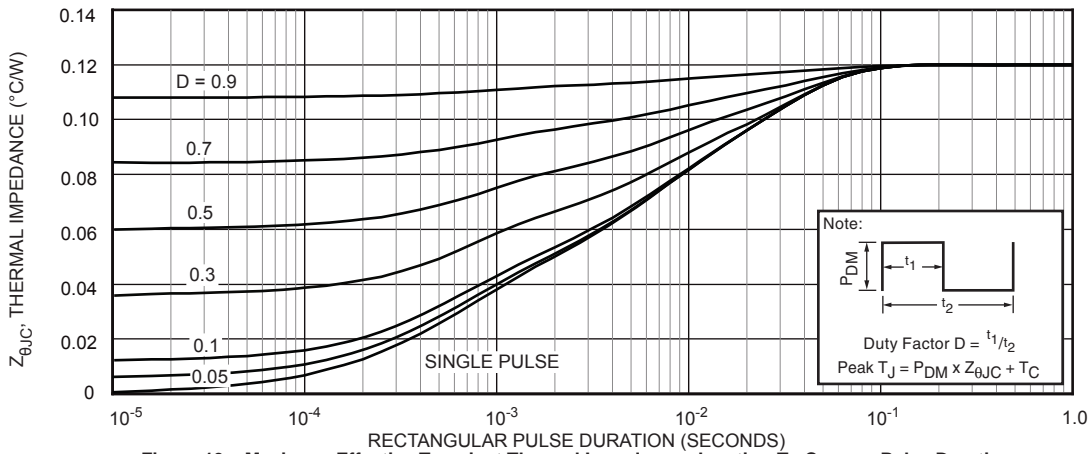


Figure 19a, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

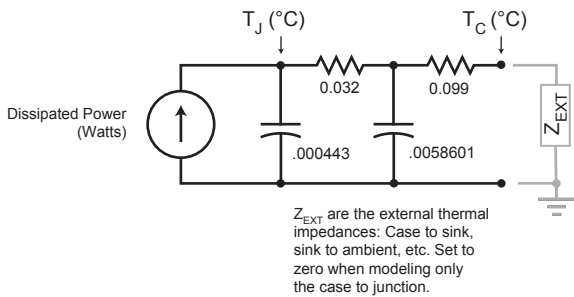


FIGURE 19b, TRANSIENT THERMAL IMPEDANCE MODEL

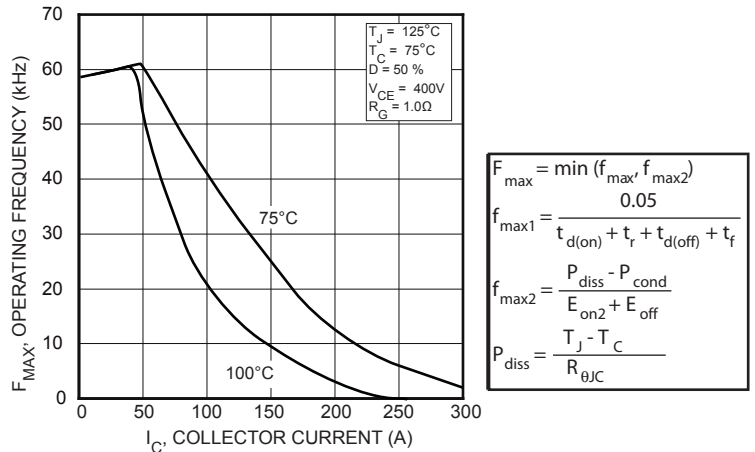


Figure 20, Operating Frequency vs Collector Current

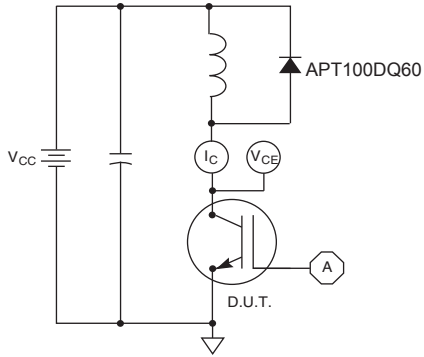


Figure 21, Inductive Switching Test Circuit

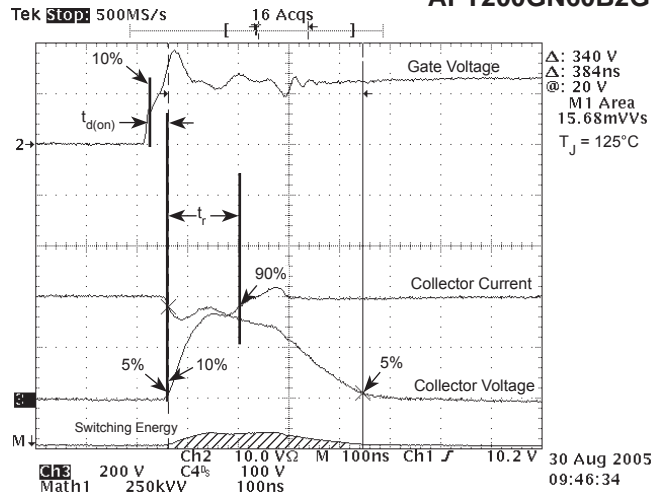


Figure 22, Turn-on Switching Waveforms and Definitions

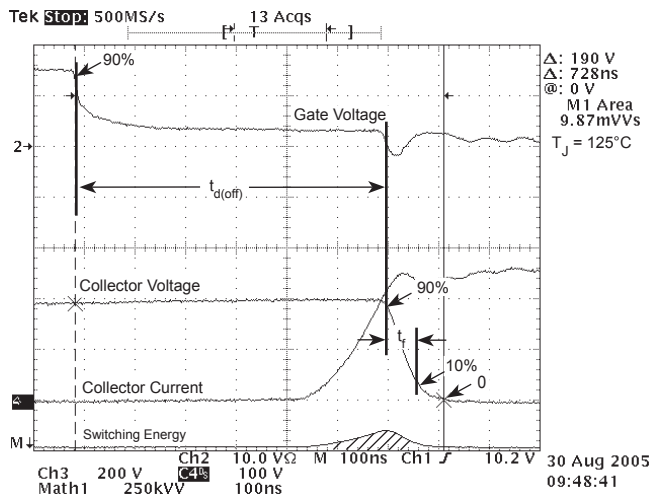
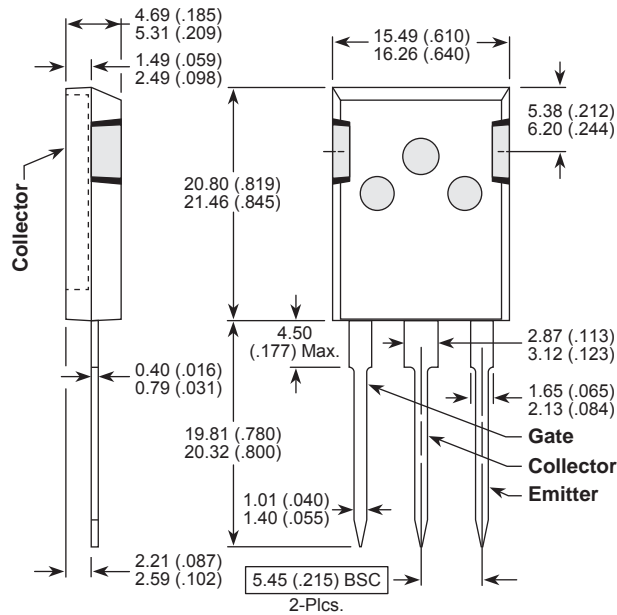


Figure 23, Turn-off Switching Waveforms and Definitions

T-MAX® Package Outline



Dimensions in Millimeters and (Inches)

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[FGH75T65UPD](#) [STGWA15H120F2](#) [IKA10N60TXKSA1](#) [IHW20N120R5XKSA1](#) [RJH60D2DPP-M0#T2](#) [IKP20N60TXKSA1](#)  
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