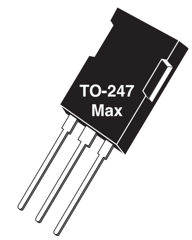
APT200GN60B2G

600V, $V_{CE(ON)}$ = 1.45V Typical

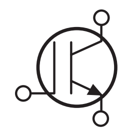
Microsemi POWER PRODUCTS GROUP

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°C unless otherwise specified.

Symbol	Parameter	Ratings	Unit
V_{CES}	Collector-Emitter Voltage	600	Volts
V_{GE}	Gate-Emitter Voltage	±20	
I_{C1}	Continuous Collector Current @ T_C = 25°C	283	Amps
I_{C2}	Continuous Collector Current @ T_C = 110°C	158	
I_{CM}	Pulsed Collector Current ①	600	
SSOA	Switching Safe Operating Area @ T_J = 175°C	600A @ 600V	
P_D	Total Power Dissipation	682	Watts
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to 175	°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°C)	5.0	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	-	
I_{CES}	Collector Cut-off Current (V_{CE} = 600V, V_{GE} = 0V, T_j = 25°C) ②	-	-	25	μA
	Collector Cut-off Current (V_{CE} = 600V, V_{GE} = 0V, T_j = 125°C) ②	-	-	1000	
I_{GES}	Gate-Emitter Leakage Current (V_{GE} = ±20V)	-	-	600	nA
$R_{G(int)}$	Integrated Gate Resistor	-	2	-	Ω

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

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°C, R_G = 1.0Ω⑦, V_{GE} = 15V, L = 100µH, V_{CE}= 600V	600			A
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (25°C) V_{CC} = 400V V_{GE} = 15V I_C = 200A R_G = 1.0Ω T_J = +25°C	-	50	-	ns
t_r	Current Rise Time		-	80	-	
$t_{d(off)}$	Turn-Off Delay Time		-	560	-	
t_f	Current Fall Time		-	100	-	
E_{on1}	Turn-On Switching Energy④		-	13	-	mJ
E_{on2}	Turn-On Switching Energy⑤		-	15	-	
E_{off}	Turn-Off Switching Energy⑥		-	11	-	
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (125°C) V_{CC} = 400V V_{GE} = 15V I_C = 200A R_G = 1.0Ω T_J = +125°C	-	50	-	ns
t_r	Current Rise Time		-	80	-	
$t_{d(off)}$	Turn-Off Delay Time		-	620	-	
t_f	Current Fall Time		-	70	-	
E_{on1}	Turn-On Switching Energy ④		-	14	-	mJ
E_{on2}	Turn-On Switching Energy⑤		-	16	-	
E_{off}	Turn-Off Switching Energy⑥		-	10	-	

Thermal and Mechanical Characteristics

Symbol	Characteristic / Test Conditions	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case **(IGBT)**	-	-	0.13	°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.

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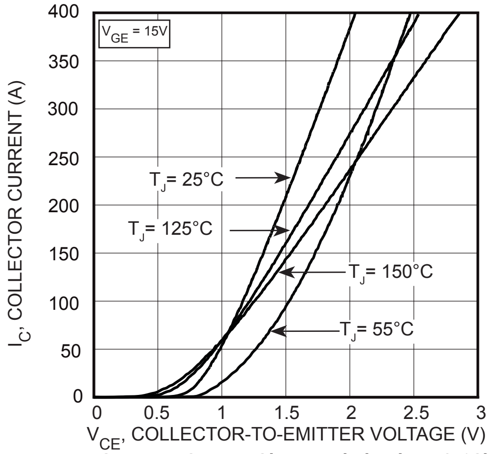


FIGURE 1, Output Characteristics (T_J = 25°C)

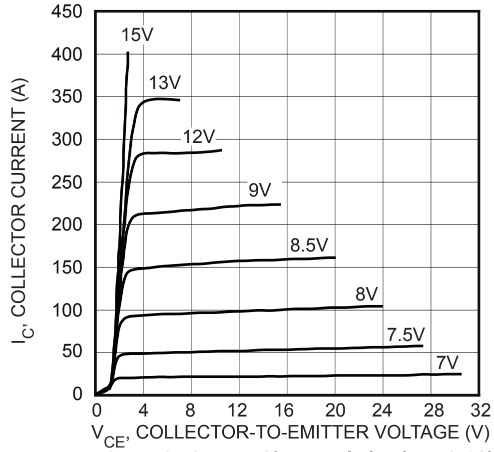


FIGURE 2, Output Characteristics (T_J = 25°C)

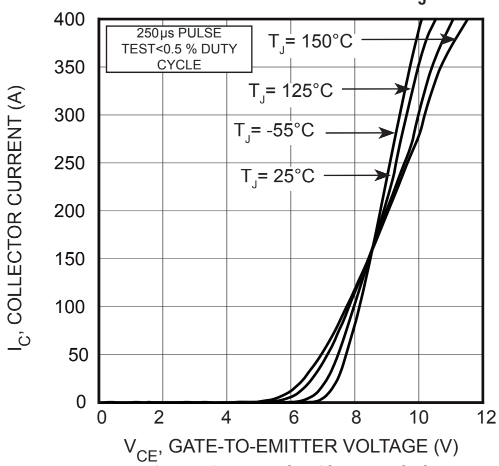


FIGURE 3, Transfer Characteristics

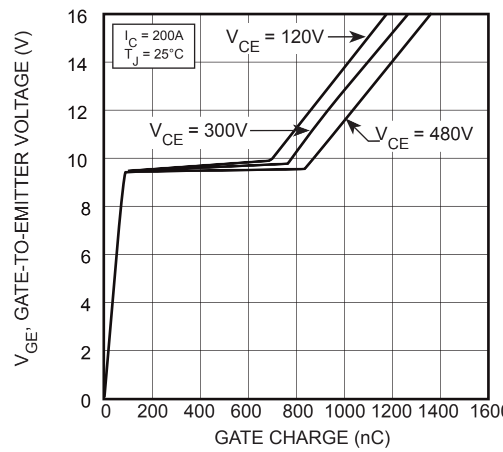


FIGURE 4, Gate charge

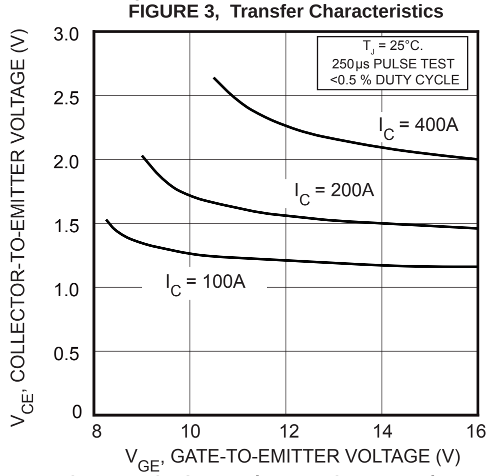


FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage

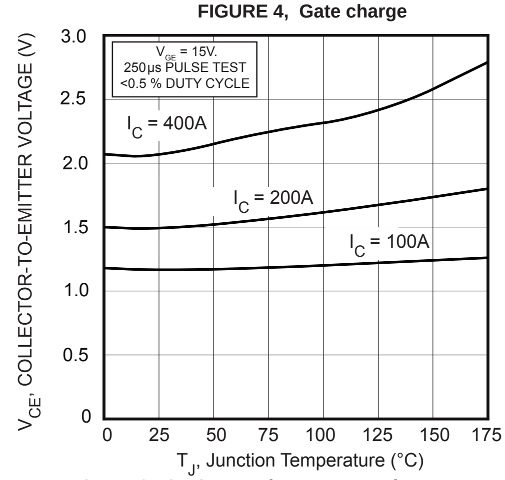


FIGURE 6, On State Voltage vs Junction Temperature

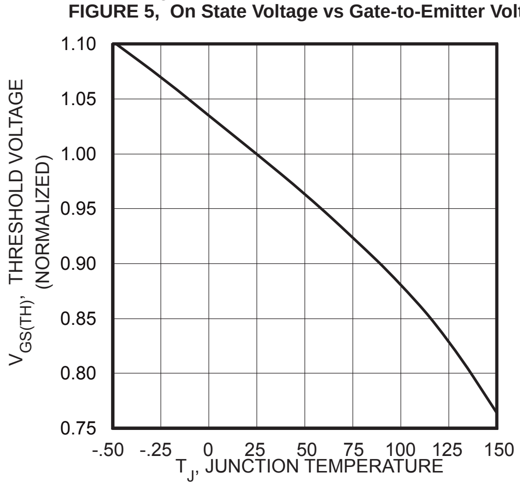


FIGURE 7, Threshold Voltage vs Junction Temperature

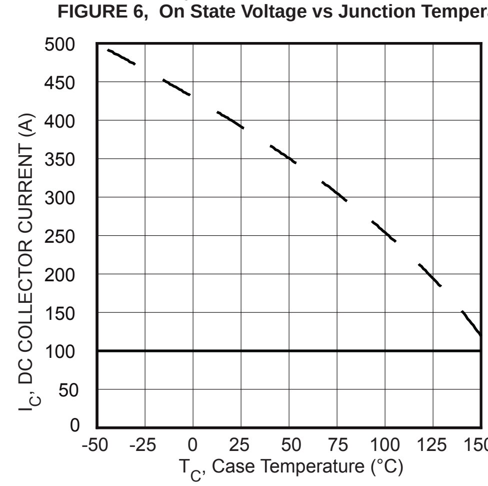


FIGURE 8, DC Collector Current vs Case Temperature

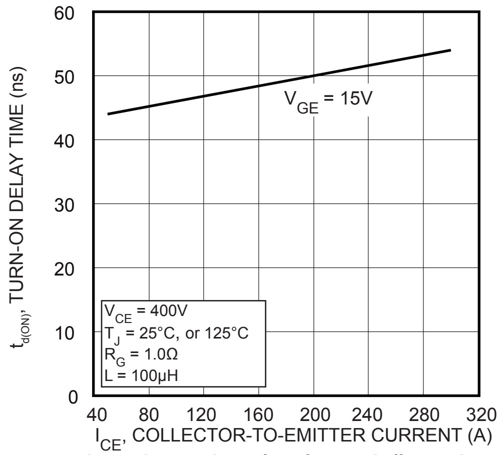


FIGURE 9, Turn-On Delay Time vs Collector Current

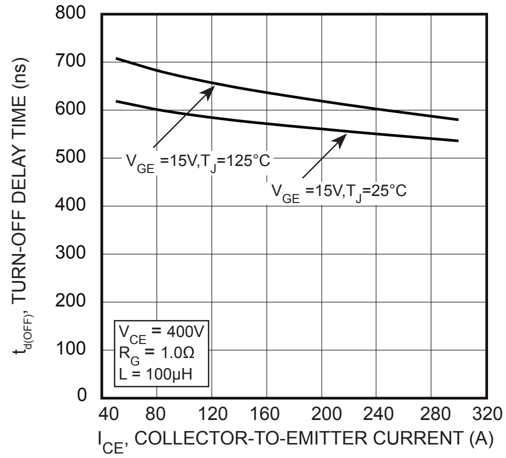


FIGURE 10, Turn-Off Delay Time vs Collector Current

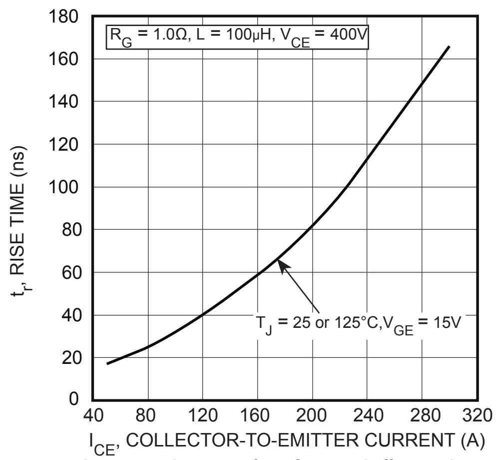


FIGURE 11, Current Rise Time vs Collector Current

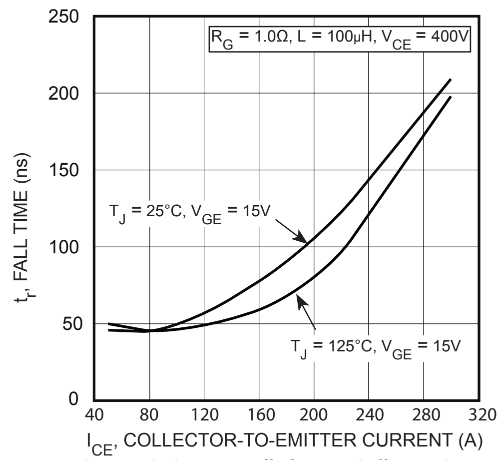


FIGURE 12, Current Fall Time vs Collector Current

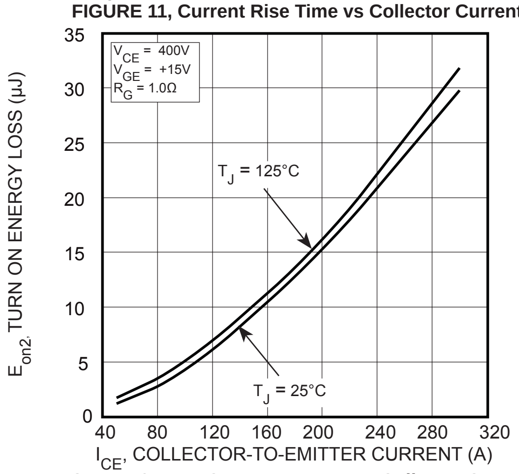


FIGURE 13, Turn-On Energy Loss vs Collector Current

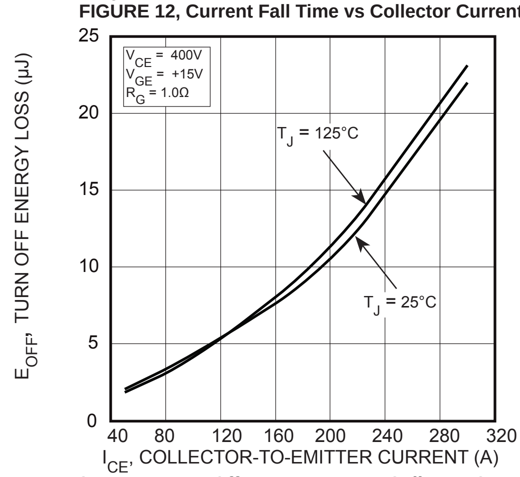


FIGURE 14, Turn-Off Energy Loss vs Collector Current

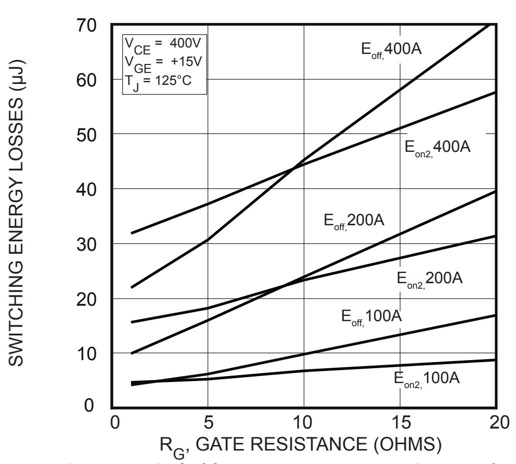


FIGURE 15, Switching Energy Losses vs Gate Resistance

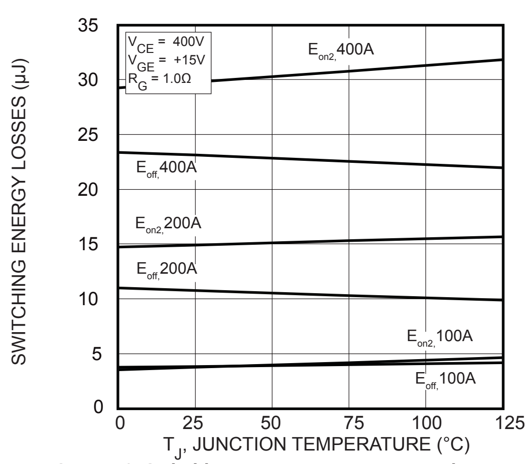


FIGURE 16, Switching Energy Losses vs Junction Temperature

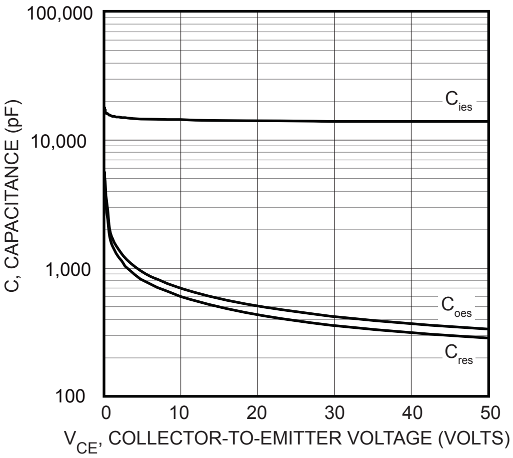


FIGURE 17, Capacitance vs Collector-To-Emitter Voltage

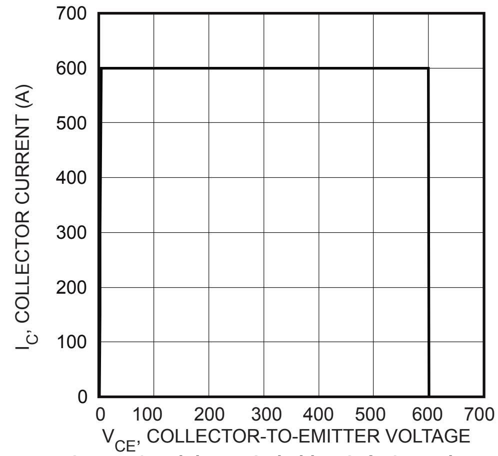


FIGURE 18, Minimum Switching Safe Operating Area

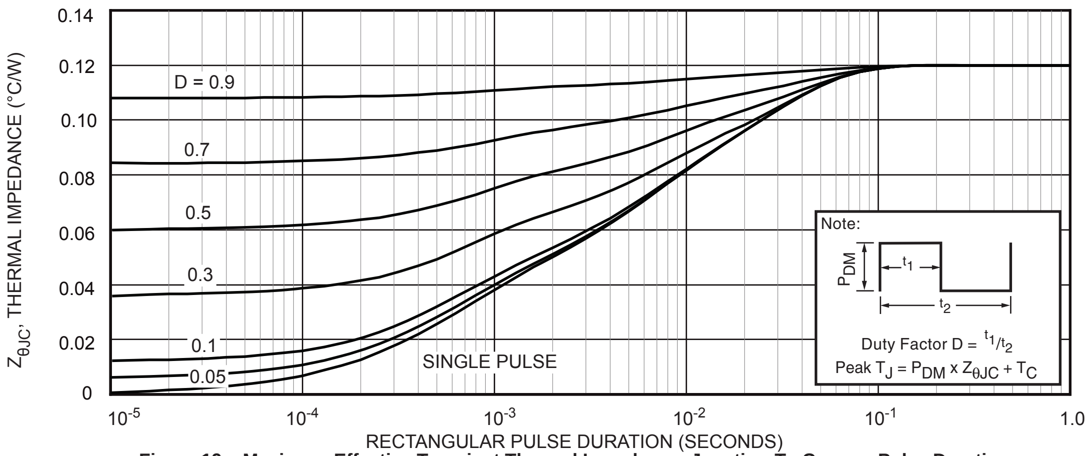


Figure 19a, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

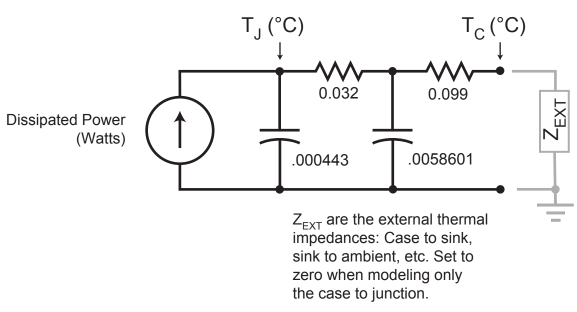
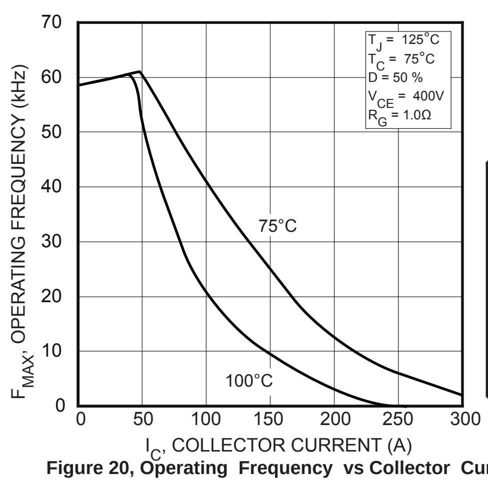


FIGURE 19b, TRANSIENT THERMAL IMPEDANCE MODEL



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

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

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

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

Figure 20, Operating Frequency vs Collector Current