APT150GT120JR

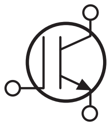
1200V, 150A, $V_{CE(ON)}$ = 3.2V Typical

Thunderbolt IGBT®

The Thunderbolt IGBT® is a new generation of high voltage power IGBTs. Using Non-Punch-Through Technology, the Thunderbolt IGBT® offers superior ruggedness and ultrafast switching speed.

Features

- **Low Forward Voltage Drop**
- **Low Tail Current**
- **Integrated Gate Resistor**
  Low EMI, High Reliability
- **RoHS Compliant**
- **RBSOA and SCSOA Rated**
- **High Frequency Switching to 50KHz**
- **Ultra Low Leakage Current**



Unless stated otherwise, Microsemi discrete IGBTs contain a single IGBT die. This device is made with two parallel IGBT die. It is intended for switch-mode operation. It is not suitable for linear mode operation.

Maximum Ratings

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

Symbol	Parameter	Ratings	Unit
V_{CES}	Collector-Emitter Voltage	1200	Volts
V_{GE}	Gate-Emitter Voltage	±20	
I_{C1}	Continuous Collector Current @ T_C = 25°C	170	Amps
I_{C2}	Continuous Collector Current @ T_C = 100°C	90	
I_{CM}	Pulsed Collector Current①	450	
SSOA	Switching Safe Operating Area @ T_J = 150°C	450	
P_D	Total Power Dissipation	830	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)	1200	-	-	Volts
$V_{GE(TH)}$	Gate Threshold Voltage (V_{CE} = V_{GE}, I_C = 6mA, T_j = 25°C)	4.5	5.5	6.5	
$V_{CE(ON)}$	Collector Emitter On Voltage (V_{GE} = 15V, I_C = 150A, T_j = 25°C)	2.7	3.2	3.7	
	Collector Emitter On Voltage (V_{GE} = 15V, I_C = 150A, T_j = 125°C)	-	4.0	-	
I_{CES}	Collector Cut-off Current (V_{CE} = 1200V, V_{GE} = 0V, T_j = 25°C) ②	-	-	150	µA
	Collector Cut-off Current (V_{CE} = 1200V, V_{GE} = 0V, T_j = 125°C) ②	-	-	TBD	
I_{GES}	Gate-Emitter Leakage Current (V_{GE} = ±20V)	-	-	900	nA
$R_{G(int)}$	Integrated Gate Resistor	1.75	2	3.25	Ω

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

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	V_{GE} = 0V, V_{CE} = 25V f = 1MHz	-	9300	-	pF
C_{oes}	Output Capacitance		-	1400	-	
C_{res}	Reverse Transfer Capacitance		-	700	-	
V_{GEP}	Gate-to-Emitter Plateau Voltage	Gate Charge V_{GE} = 15V V_{CE}= 600V I_C = 150A	-	10	-	V
Q_g	Total Gate Charge		-	995	-	nC
Q_{ge}	Gate-Emitter Charge		-	110	-	
Q_{gc}	Gate-Collector Charge		-	595	-	
SSOA	Switching Safe Operating Area	T_J = 150°C, R_G = 1.0Ω⑦, V_{GE} = 15V, L = 100μH, V_{CE}= 1200V	450			A
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (25°C) V_{CC} = 800V V_{GE} = 15V I_C = 150A R_G = 2.2Ω T_J = +25°C	-	80	-	ns
··t_r	Current Rise Time		-	N/A	-	
$t_{d(off)}$	Turn-Off Delay Time		-	570	-	
t_f	Current Fall Time		-	70	-	
E_{on1}	Turn-On Switching Energy④		-	TBD	-	mJ
E_{on2}	Turn-On Switching Energy⑤		-	24.3	-	
E_{off}	Turn-Off Switching Energy⑥		-	12.7	-	
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching (125°C) V_{CC} = 800V V_{GE} = 15V I_C = 150A R_G = 2.2Ω T_J = 125°C	-	80	-	ns
t_r	Current Rise Time		-	165	-	
$t_{d(off)}$	Turn-Off Delay Time		-	635	-	
t_f	Current Fall Time		-	75	-	
E_{on1}	Turn-On Switching Energy ④		-	TBD	-	mJ
E_{on2}	Turn-On Switching Energy⑤		-	33.5	-	
E_{off}	Turn-Off Switching Energy⑥		-	14.8	-	

Thermal and Mechanical Characteristics

Symbol	Characteristic / Test Conditions	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case	-	-	0.15	°C/W
W_T	Package Weight	-	29.2	-	gm
Torque	Terminals and Mounting Screws.	-	-	10	in·lbf
		-	-	1.1	N·m
$V_{Isolation}$	RMS Voltage (50-60Hz Sinusoidal Waveform from Terminals to Mounting Base for 1 Min.)	2500	-	-	Volts

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.

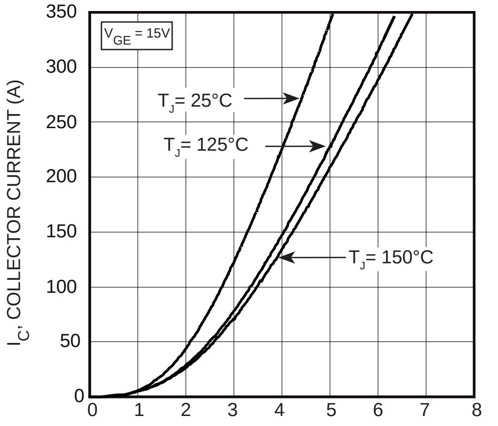


FIGURE 1, Output Characteristics (T_J = 25°C)

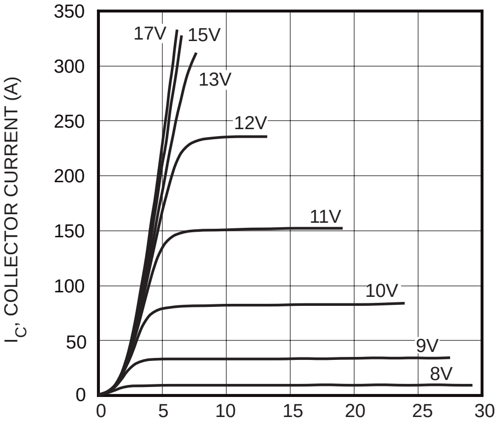


FIGURE 2, Output Characteristics (T_J = 25°C)

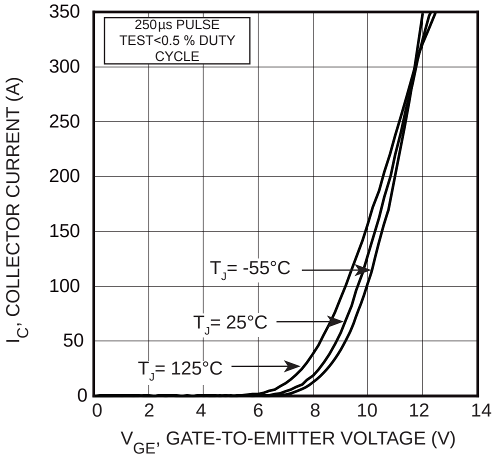


FIGURE 3, Transfer Characteristics

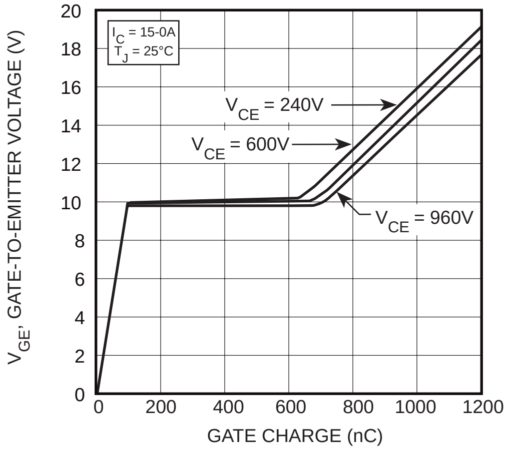


FIGURE 4, Gate charge

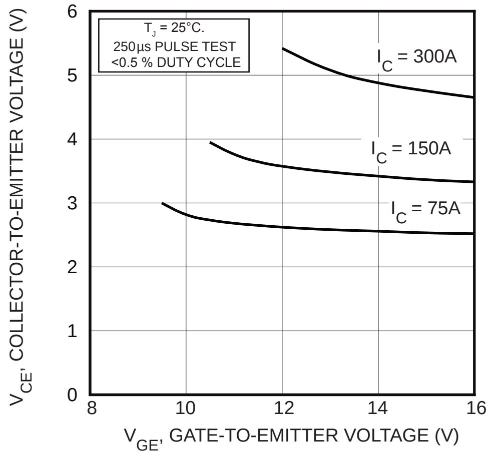


FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage

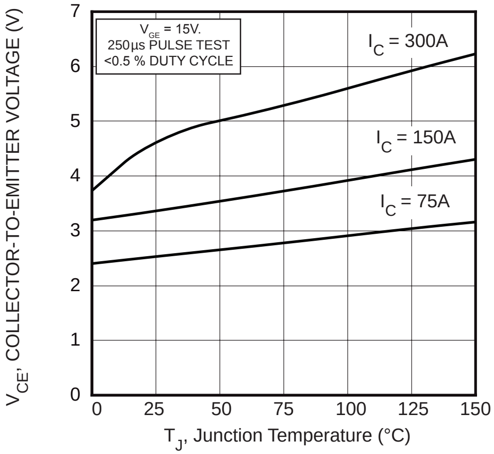


FIGURE 6, On State Voltage vs Junction Temperature

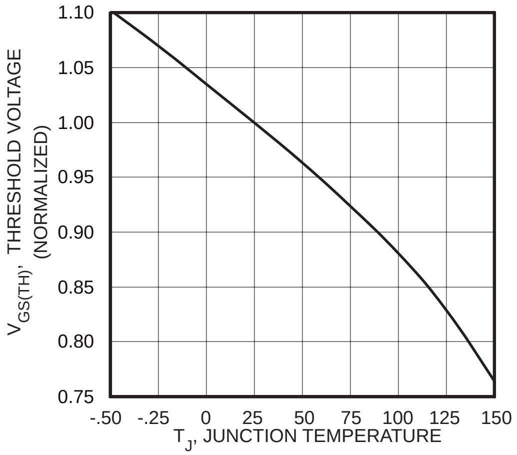


FIGURE 7, Threshold Voltage vs Junction Temperature

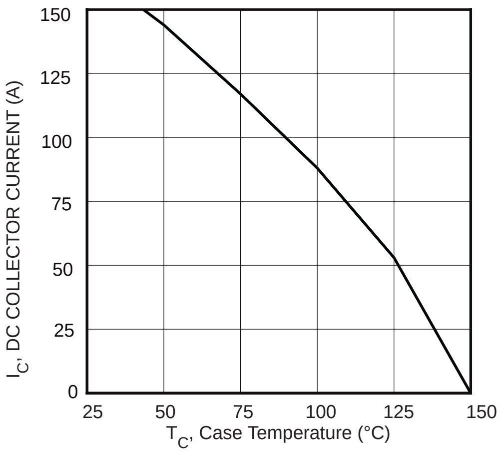


FIGURE 8, DC Collector Current vs Case Temperature

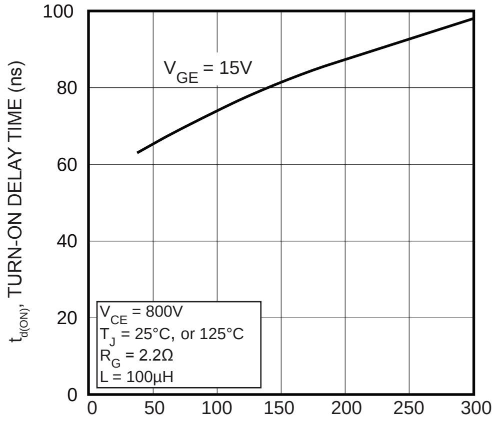


FIGURE 9, Turn-On Delay Time vs Collector Current

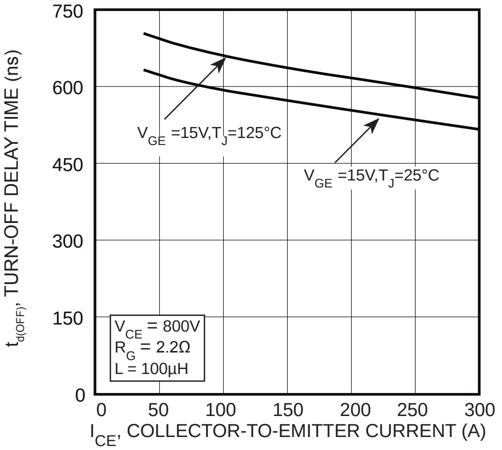


FIGURE 10, Turn-Off Delay Time vs Collector Current

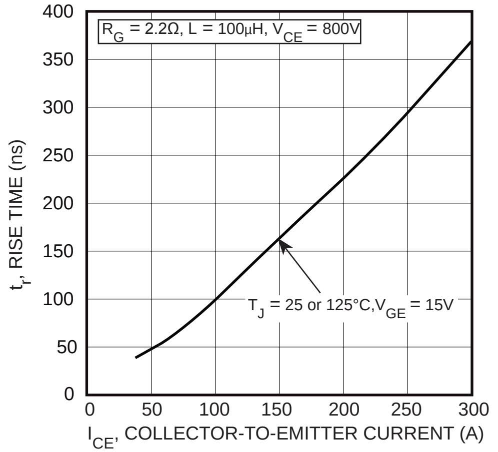


FIGURE 11, Current Rise Time vs Collector Current

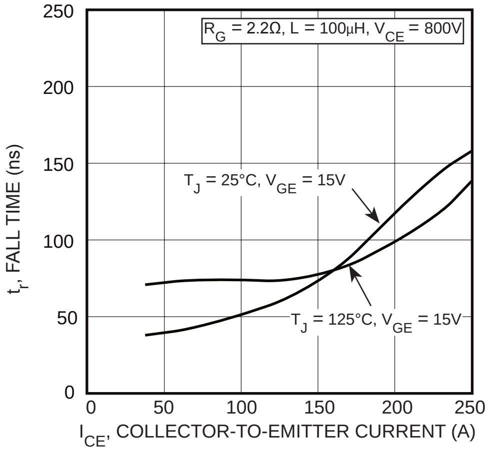


FIGURE 12, Current Fall Time vs Collector Current

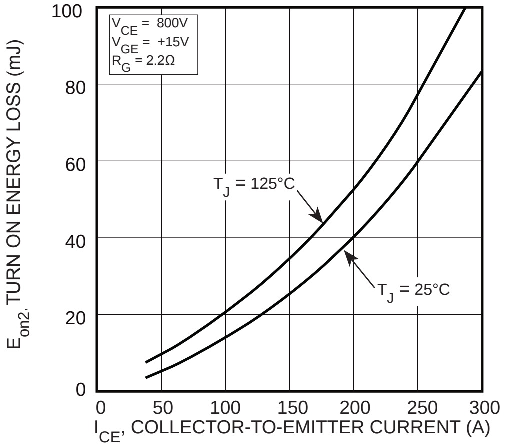


FIGURE 13, Turn-On Energy Loss vs Collector Current

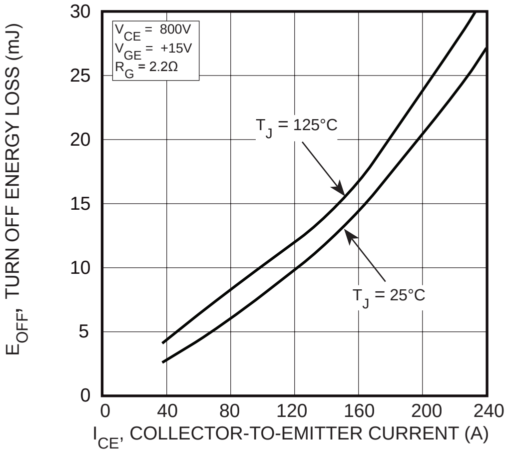


FIGURE 14, Turn-Off Energy Loss vs Collector Current

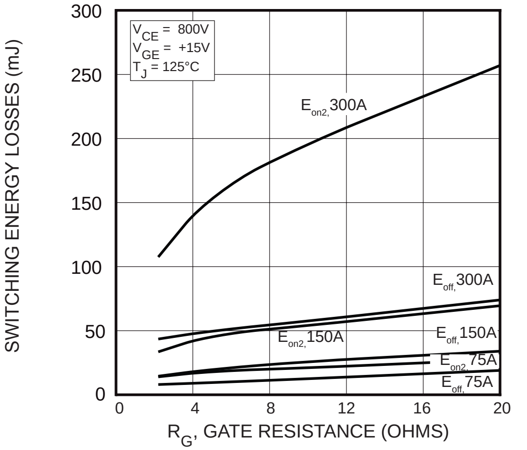


FIGURE 15, Switching Energy Losses vs Gate Resistance

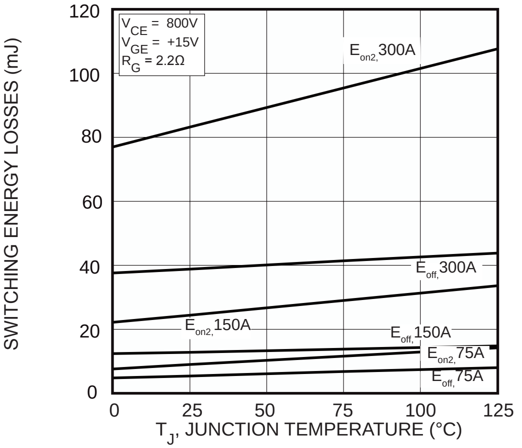


FIGURE 16, Switching Energy Losses vs Junction Temperature

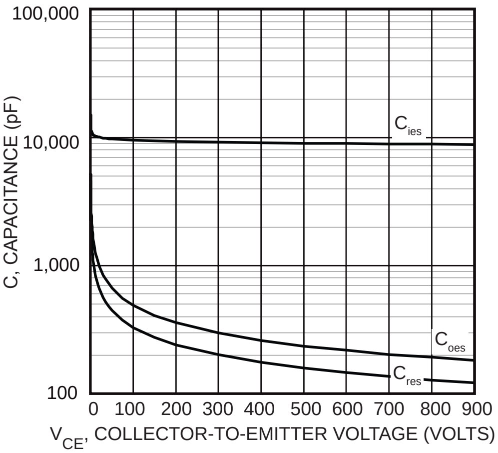


FIGURE 17, Capacitance vs Collector-To-Emitter Voltage

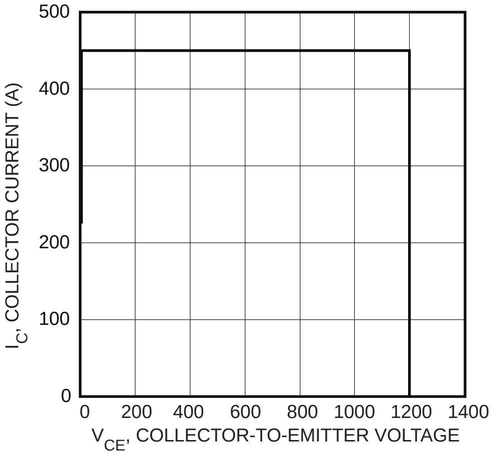


FIGURE 18, Minimum Switching Safe Operating Area

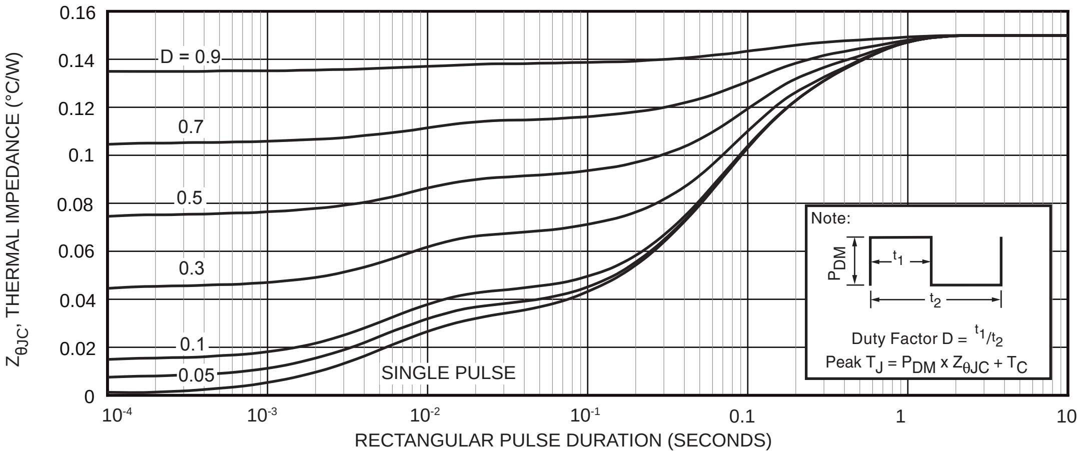


Figure 19a, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

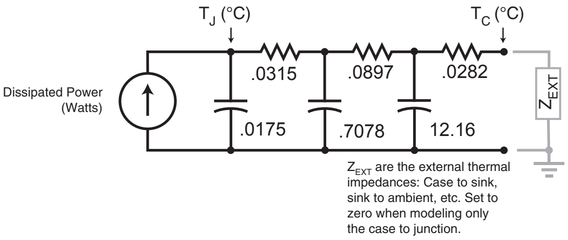


FIGURE 19b, TRANSIENT THERMAL IMPEDANCE MODEL

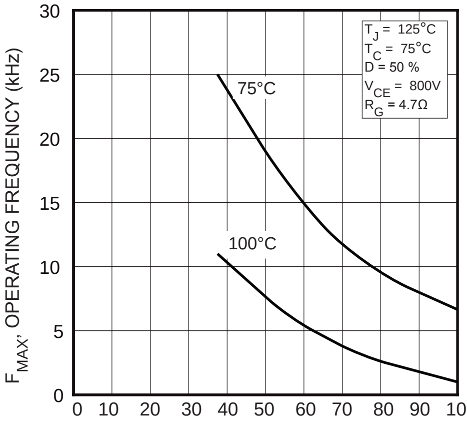


Figure 20, Operating Frequency vs Collector Current

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

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

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

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

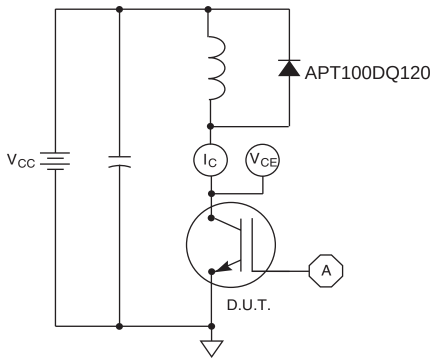


Figure 21, Inductive Switching Test Circuit

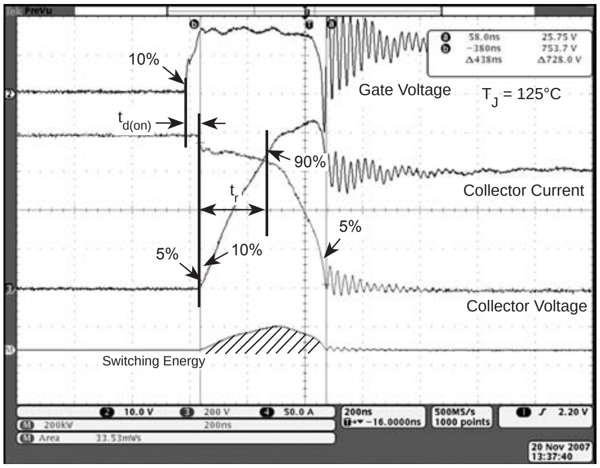


Figure 22, Turn-on Switching Waveforms and Definitions

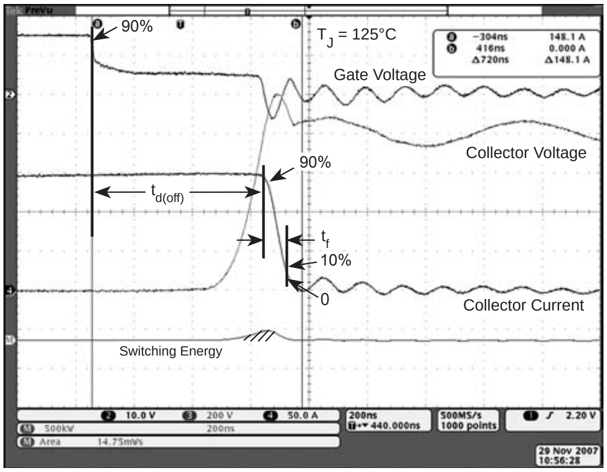
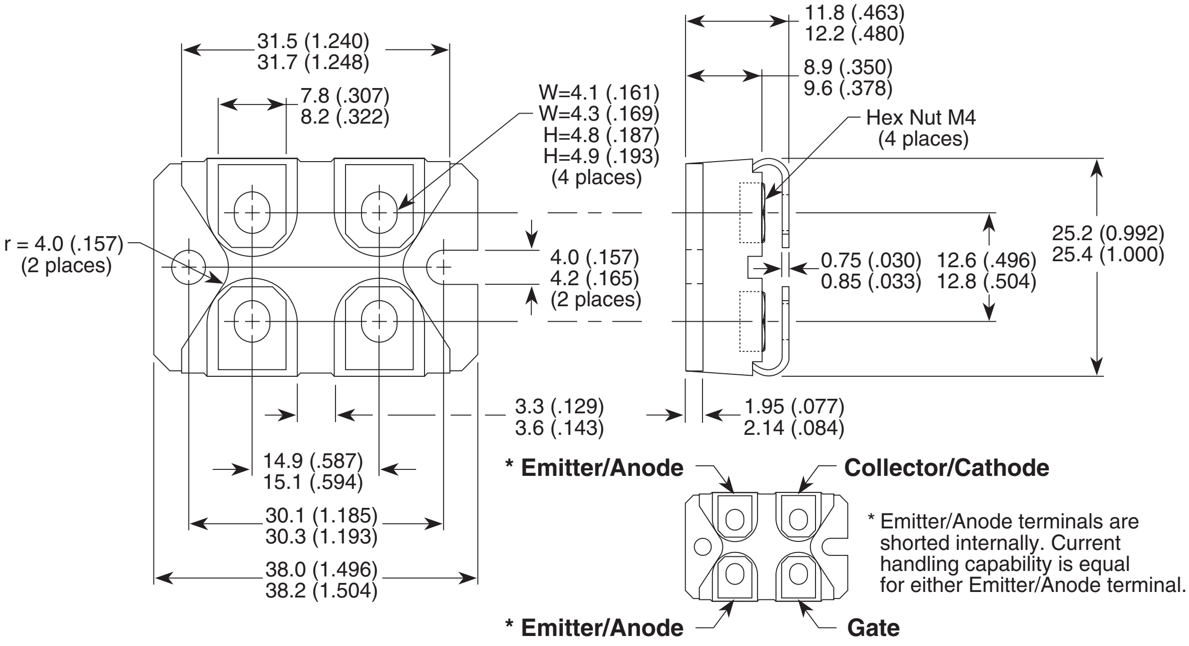


Figure 23, Turn-off Switching Waveforms and Definitions

SOT-227 (ISOTOP®) Package Outline



* Emitter/Anode terminals are shorted internally. Current handling capability is equal for either Emitter/Anode terminal.

Dimensions in Millimeters and (Inches)

Microsemi's products are covered by one or more of U.S. patents 4,895,810 5,045,903 5,089,434 5,182,234 5,019,522 5,262,336 6,503,786 5,256,583 4,748,103 5,283,202 5,231,474 5,434,095 5,528,058 6,939,743 and foreign patents. US and Foreign patents pending. All Rights Reserved.

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