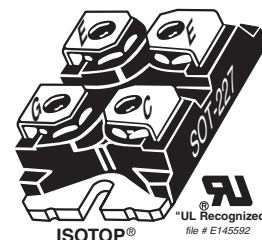


Thunderbolt IGBT®

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: $T_C = 25^\circ C$ 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 @ $T_C = 25^\circ C$	123	Amps
I_{C2}	Continuous Collector Current @ $T_C = 100^\circ C$	67	
I_{CM}	Pulsed Collector Current ^①	200	
SSOA	Switching Safe Operating Area @ $T_J = 150^\circ C$	200A @ 1200V	
P_D	Total Power Dissipation	570	Watts
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to 150	$^\circ C$
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 ($V_{GE} = 0V, I_C = 5mA$)	1200	-	-	Volts
$V_{GE(TH)}$	Gate Threshold Voltage ($V_{CE} = V_{GE}, I_C = 4mA, T_J = 25^\circ C$)	4.5	5.5	6.5	
$V_{CE(ON)}$	Collector Emitter On Voltage ($V_{GE} = 15V, I_C = 100A, T_J = 25^\circ C$)	2.7	3.2	3.7	
	Collector Emitter On Voltage ($V_{GE} = 15V, I_C = 100A, T_J = 125^\circ C$)	-	4.0	-	
I_{CES}	Collector Cut-off Current ($V_{CE} = 1200V, V_{GE} = 0V, T_J = 25^\circ C$) ^②	-	-	100	μA
	Collector Cut-off Current ($V_{CE} = 1200V, V_{GE} = 0V, T_J = 125^\circ C$) ^②	-	-	TBD	
I_{GES}	Gate-Emitter Leakage Current ($V_{GE} = \pm 20V$)	-	-	600	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

APT100GT120JR

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	$V_{GE} = 0V, V_{CE} = 25V$ $f = 1MHz$	-	6700	-	pF
C_{oes}	Output Capacitance		-	653	-	
C_{res}	Reverse Transfer Capacitance		-	440	-	
V_{GEP}	Gate-to-Emitter Plateau Voltage	Gate Charge $V_{GE} = 15V$ $V_{CE} = 600V$ $I_C = 100A$	-	10	-	V
Q_g	Total Gate Charge		-	685	-	nC
Q_{ge}	Gate-Emitter Charge		-	75	-	
Q_{gc}	Gate-Collector Charge		-	400	-	
SSOA	Switching Safe Operating Area	$T_J = 150^{\circ}C, R_G = 1.0\Omega^{(2)}, V_{GE} = 15V,$ $L = 100\mu H, V_{CE} = 1200V$	150			A
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching ($25^{\circ}C$) $V_{CC} = 800V$ $V_{GE} = 15V$ $I_C = 100A$ $R_G = 4.7\Omega$ $T_J = +25^{\circ}C$	-	50	-	ns
t_r	Current Rise Time		-	100	-	
$t_{d(off)}$	Turn-Off Delay Time		-	630	-	
t_f	Current Fall Time		-	36	-	
E_{on1}	Turn-On Switching Energy ⁽⁴⁾		-	TBD	-	μJ
E_{on2}	Turn-On Switching Energy ⁽⁵⁾		-	17600	-	
E_{off}	Turn-Off Switching Energy ⁽⁶⁾		-	7240	-	
$t_{d(on)}$	Turn-On Delay Time	Inductive Switching ($125^{\circ}C$) $V_{CC} = 800V$ $V_{GE} = 15V$ $I_C = 100A$ $R_G = 4.7\Omega$ $T_J = 125^{\circ}C$	-	50	-	ns
t_r	Current Rise Time		-	100	-	
$t_{d(off)}$	Turn-Off Delay Time		-	710	-	
t_f	Current Fall Time		-	37	-	
E_{on1}	Turn-On Switching Energy ⁽⁴⁾		-	TBD	-	μJ
E_{on2}	Turn-On Switching Energy ⁽⁵⁾		-	22380	-	
E_{off}	Turn-Off Switching Energy ⁽⁶⁾		-	10950	-	

Thermal and Mechanical Characteristics

Symbol	Characteristic / Test Conditions	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case	-	-	0.22	$^{\circ}C/W$
W_T	Package Weight	-	29.2	-	gm
$V_{isolation}$	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.

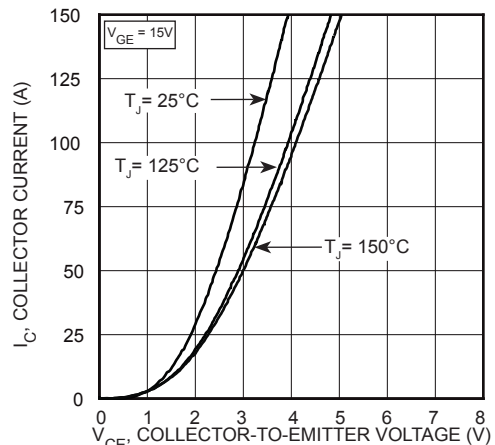


FIGURE 1, Output Characteristics ($T_J = 25^\circ\text{C}$)

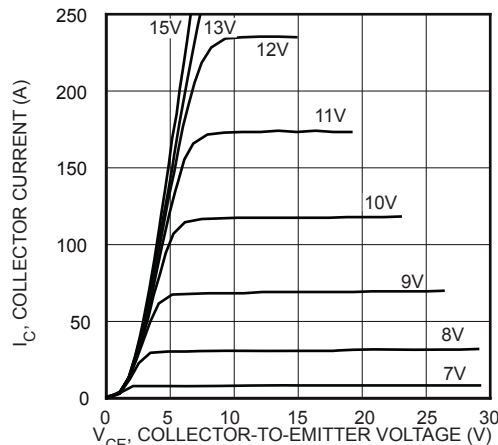


FIGURE 2, Output Characteristics ($T_J = 25^\circ\text{C}$)

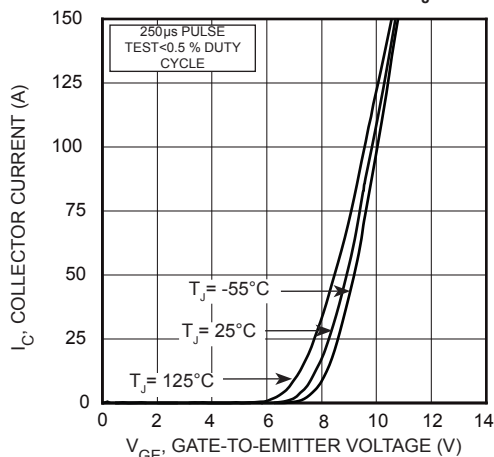


FIGURE 3, Transfer Characteristics

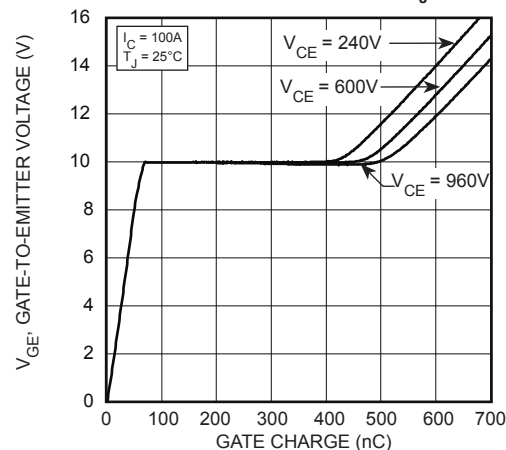


FIGURE 4, Gate charge

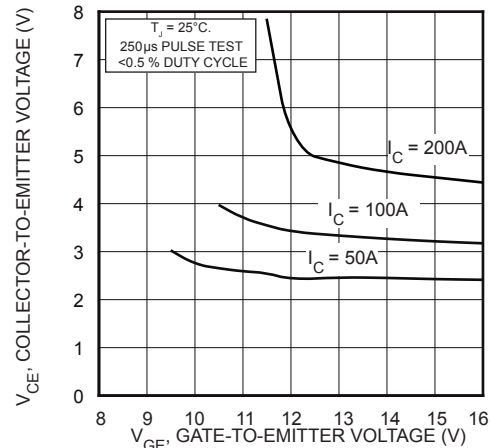


FIGURE 5, On State Voltage vs Gate-to-Emitter Voltage

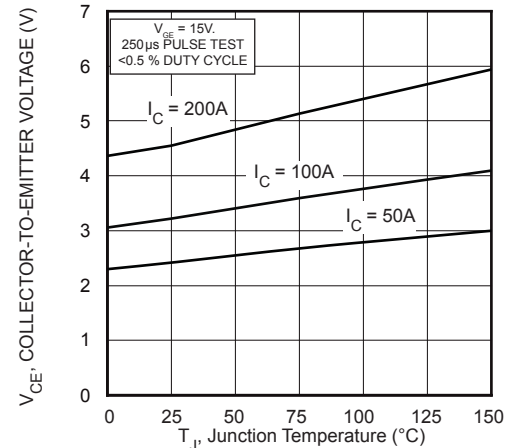


FIGURE 6, On State Voltage vs Junction Temperature

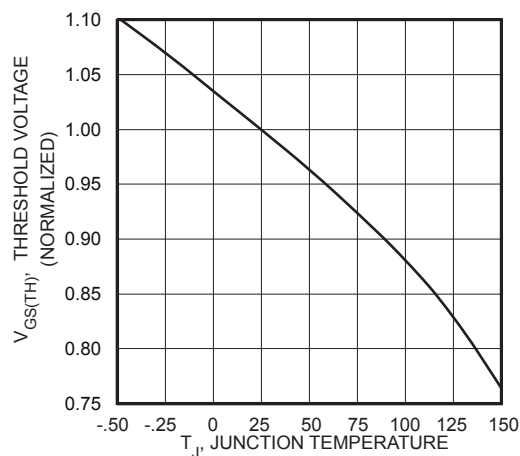


FIGURE 7, Threshold Voltage vs Junction Temperature

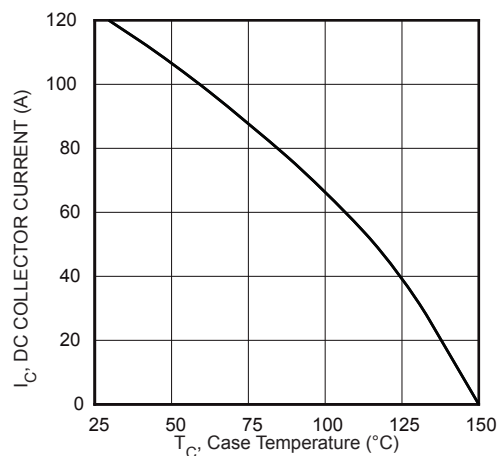


FIGURE 8, DC Collector Current vs Case Temperature

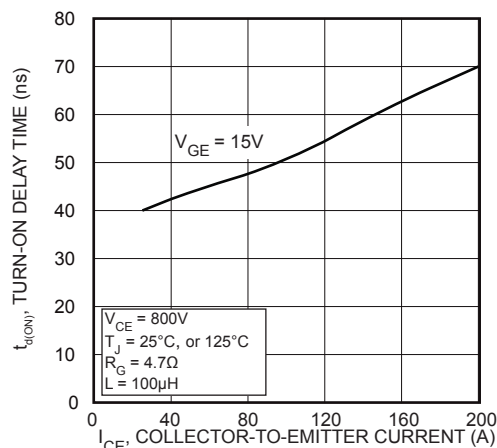


FIGURE 9, Turn-On Delay Time vs Collector Current

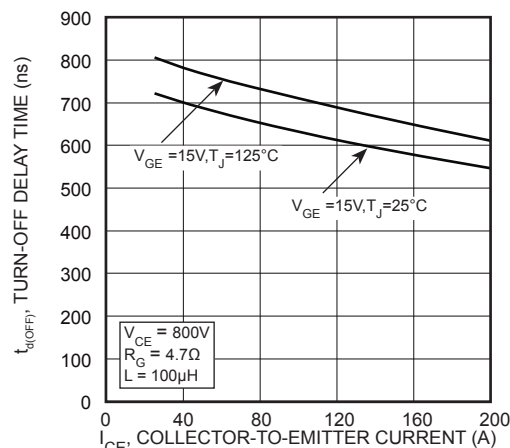


FIGURE 10, Turn-Off Delay Time vs Collector Current

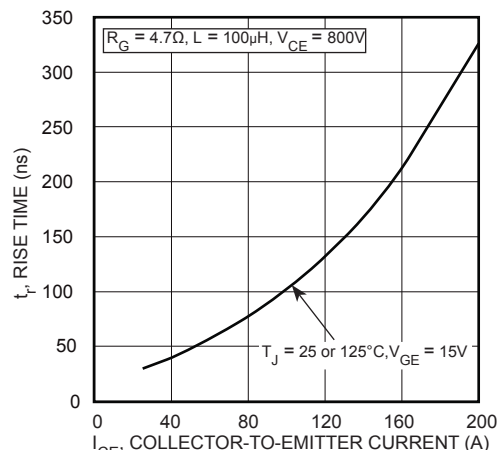


FIGURE 11, Current Rise Time vs Collector Current

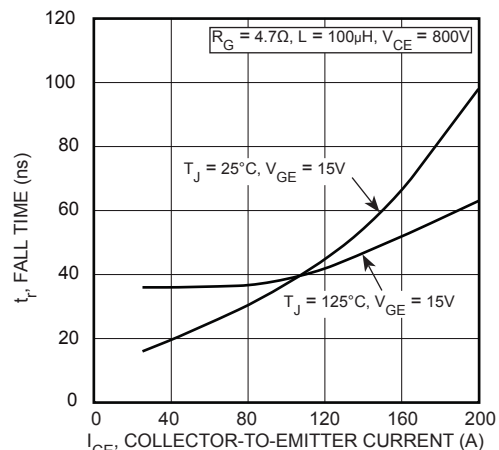


FIGURE 12, Current Fall Time vs Collector Current

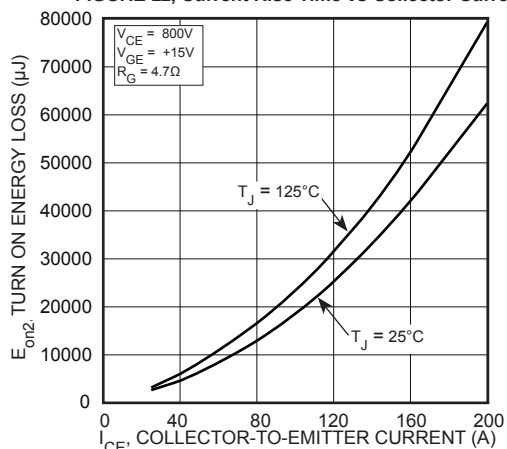


FIGURE 13, Turn-On Energy Loss vs Collector Current

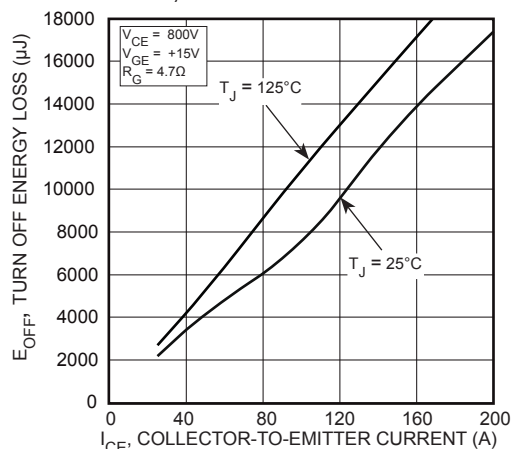


FIGURE 14, Turn-Off Energy Loss vs Collector Current

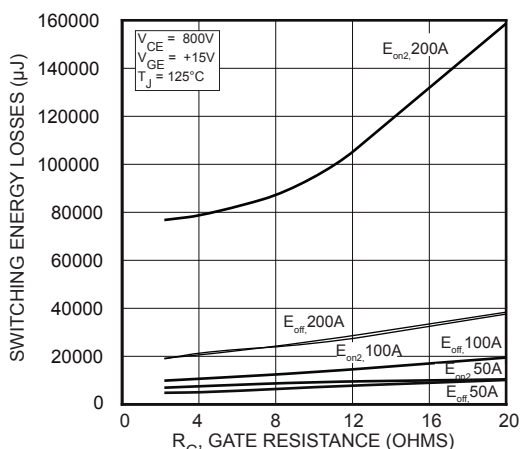


FIGURE 15, Switching Energy Losses vs Gate Resistance

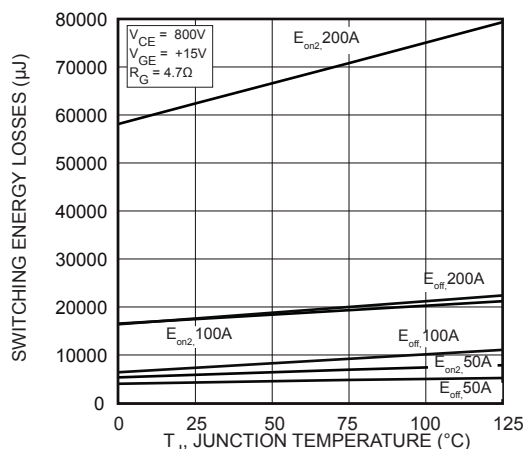


FIGURE 16, Switching Energy Losses vs Junction Temperature

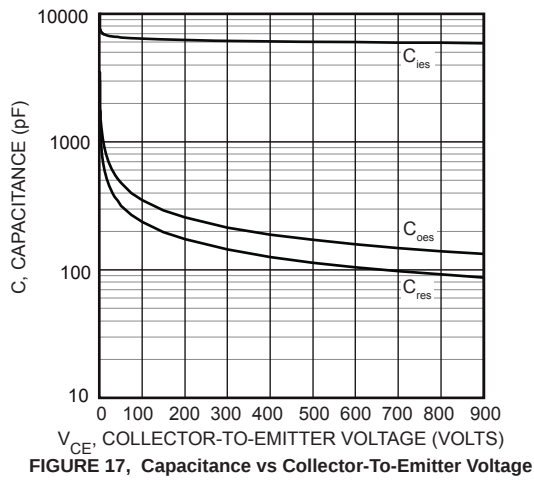


FIGURE 17, Capacitance vs Collector-To-Emitter Voltage

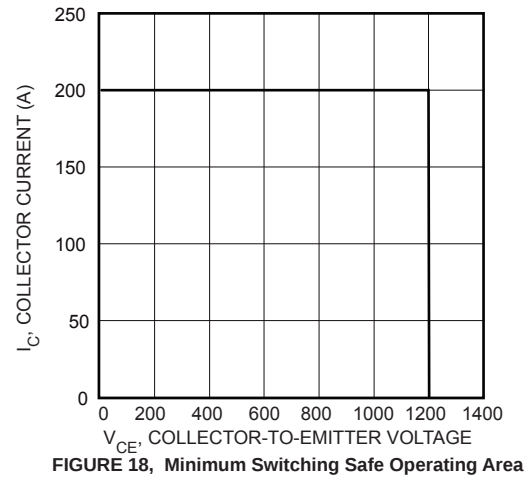


FIGURE 18, Minimum Switching Safe Operating Area

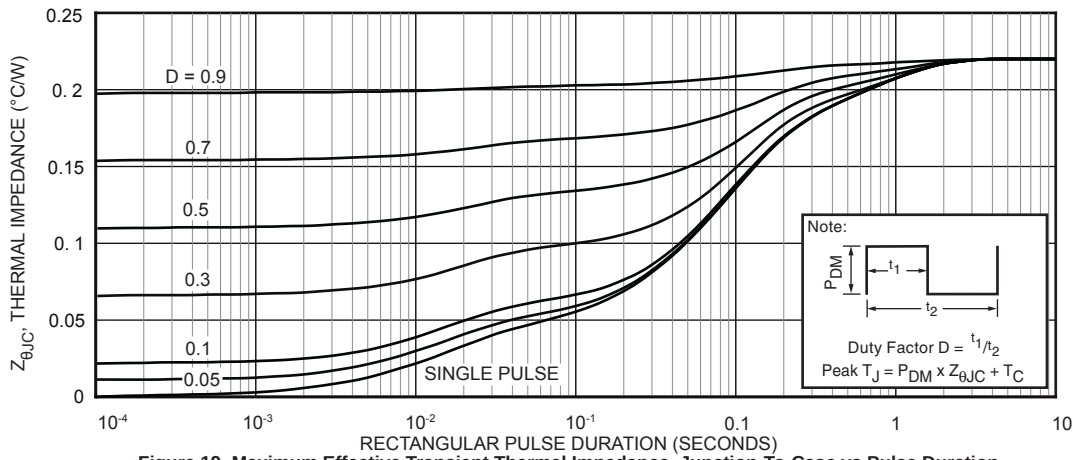


Figure 19, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

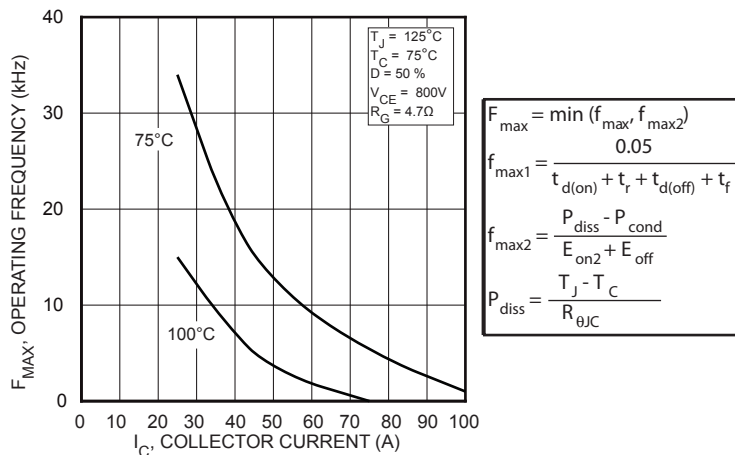


Figure 20, Operating Frequency vs Collector Current

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

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

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

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

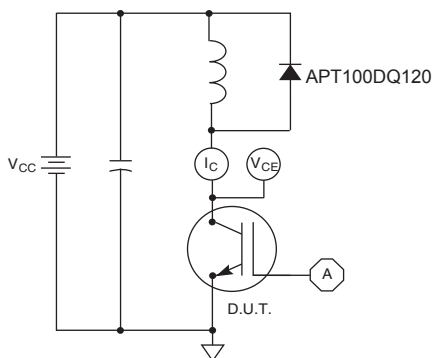


Figure 21, Inductive Switching Test Circuit

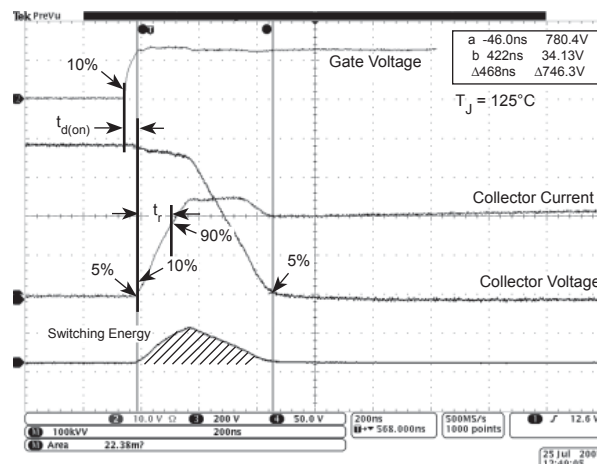


Figure 22, Turn-on Switching Waveforms and Definitions

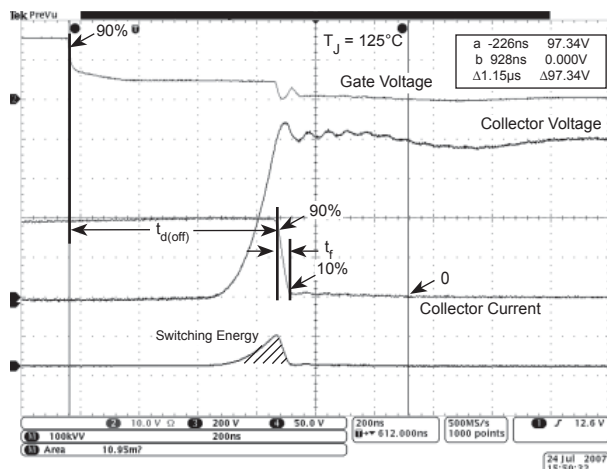
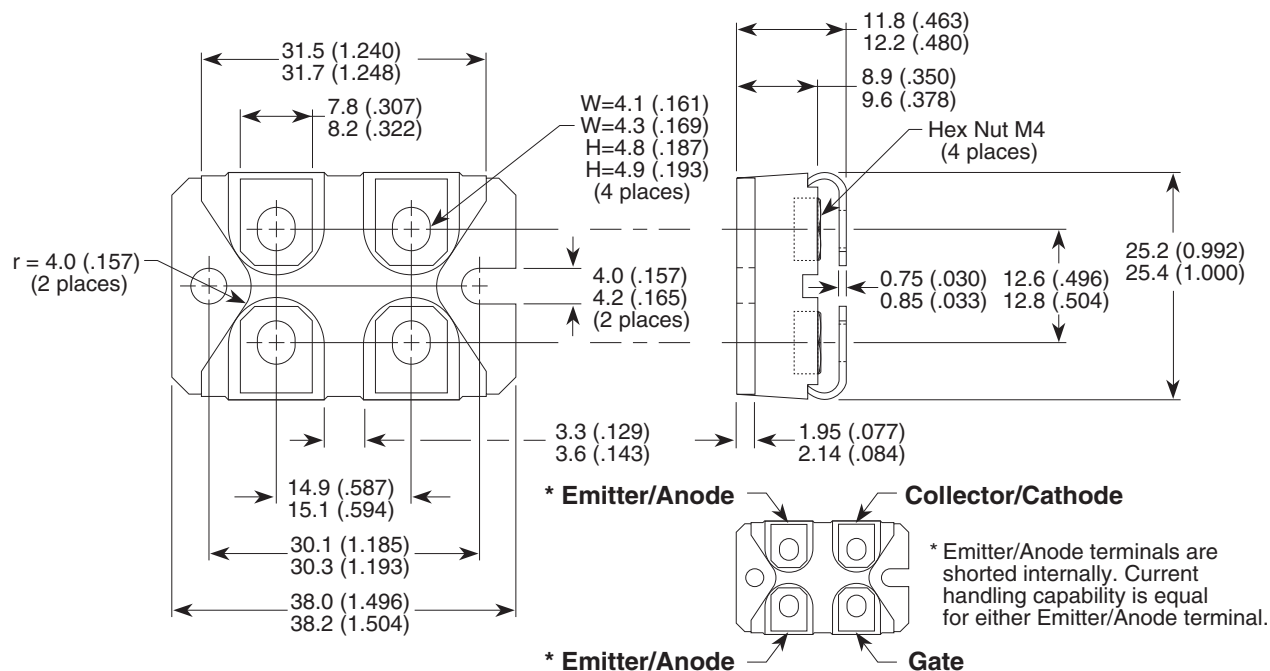


Figure 23, Turn-off Switching Waveforms and Definitions

SOT-227 (ISOTOP®) Package Outline



Dimensions in Millimeters and (Inches)

Mouser Electronics

Authorized Distributor

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[Microchip:](#)

[APT150GT120JR](#) [APT33GF120BRG](#) [APT25GT120BRDQ2G](#) [APT15GT120BRDQ1G](#) [APT25GT120BRG](#)
[APT50GF120JRDQ3](#) [APT40GR120B2D30](#) [APT25GR120BD15](#) [APT85GR120JD60](#) [APT50GF120LRG](#)
[APT85GR120B2](#) [APT50GR120JD30](#) [APT70GR120B2](#) [APT100GT120JR](#) [APT75GT120JRDQ3](#) [APT50GR120B2](#)
[APT70GR120JD60](#) [APT50GR120L](#) [APT85GR120J](#) [APT25GR120SD15](#) [APT70GR120L](#) [APT25GR120S](#)
[APT50GT120B2RG](#) [APT40GR120S](#) [APT85GR120L](#) [APT50GF120B2RG](#) [APT70GR120J](#) [APT50GT120LRDQ2G](#)
[APT50GT120B2RDQ2G](#) [APT15GT120BRG](#) [APT25GR120B](#) [APT60GF120JRDQ3](#) [APT100GT120JRDQ4](#)
[APT40GF120JRDQ2](#) [APT33GF120B2RDQ2G](#) [APT33GF120LRDQ2G](#) [APT50GT120LRG](#) [APT40GR120B](#)
[APT20GF120BRDG](#) [APT60GF120JRD](#) [APT40GF120JRD](#) [APT50GF120JRD](#) [APT50GT120JRDQ2](#)