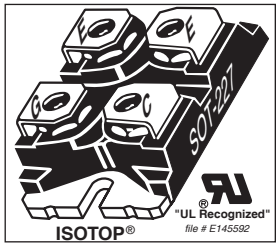
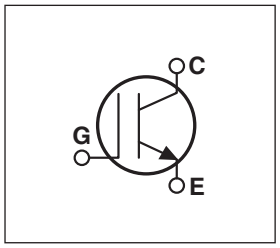
**1200V**

# APT150GN120J

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**
- **Intergrated Gate Resistor: Low EMI, High Reliability**




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

## MAXIMUM RATINGS

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

| Symbol | Parameter | APT150GN120J | UNIT |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | 1200 | Volts |
| $V_{GE}$ | Gate-Emitter Voltage | ±30 | |
| $I_{C1}$ | Continuous Collector Current @ $T_C$ = 25°C | 215 | Amps |
| $I_{C2}$ | Continuous Collector Current @ $T_C$ = 110°C | 99 | |
| $I_{CM}$ | Pulsed Collector Current ① | 450 | |
| SSOA | Switching Safe Operating Area @ $T_J$ = 150°C | 450A @ 1200V | |
| $P_D$ | Total Power Dissipation | 625 | Watts |
| $T_J$,$T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to 150 | °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, $I_C$ = 6mA) | 1200 | | | Volts |
| $V_{GE(TH)}$ | Gate Threshold Voltage ($V_{CE}$ = $V_{GE}$, $I_C$ = 6mA, $T_j$ = 25°C) | 5.0 | 5.8 | 6.5 | |
| $V_{CE(ON)}$ | Collector-Emitter On Voltage ($V_{GE}$ = 15V, $I_C$ = 150A, $T_j$ = 25°C) | 1.4 | 1.7 | 2.1 | |
| | Collector-Emitter On Voltage ($V_{GE}$ = 15V, $I_C$ = 150A, $T_j$ = 125°C) | | 2.08 | | |
| $I_{CES}$ | Collector Cut-off Current ($V_{CE}$ = 1200V, $V_{GE}$ = 0V, $T_j$ = 25°C) ② | | | 100 | 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) | | | 600 | nA |
| $R_{G(int)}$ | Integrated Gate Resistor | | 5 | | Ω |

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

***APT Website - http://www.advancedpower.com***

050-7608 Rev B 11-2005

## DYNAMIC CHARACTERISTICS

**APT150GN120J**

| Symbol | Characteristic | Test Conditions | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $C_{ies}$ | Input Capacitance | **Capacitance** | | 9500 | | pF |
| $C_{oes}$ | Output Capacitance | $V_{GE}$ = 0V, $V_{CE}$ = 25V | | 500 | | |
| $C_{res}$ | Reverse Transfer Capacitance | f = 1 MHz | | 400 | | |
| $V_{GEP}$ | Gate-to-Emitter Plateau Voltage | Gate Charge | | 9.5 | | V |
| $Q_g$ | Total Gate Charge ③ | $V_{GE}$ = 15V | | 800 | | nC |
| $Q_{ge}$ | Gate-Emitter Charge | $V_{CE}$ = 600V | | 70 | | |
| $Q_{gc}$ | Gate-Collector ("Miller") Charge | $I_C$ = 150A | | 430 | | |
| SSOA | Switching Safe Operating Area | $T_J$ = 150°C, $R_G$ = 4.3Ω⑦, $V_{GE}$ = 15V, L = 100µH, $V_{CE}$ = 1200V | 450 | | | A |
| $t_{d(on)}$ | Turn-on Delay Time | **Inductive Switching (25°C)** | | 55 | | ns |
| $t_r$ | Current Rise Time | $V_{CC}$ = 800V | | 65 | | |
| $t_{d(off)}$ | Turn-off Delay Time | $V_{GE}$ = 15V | | 675 | | |
| $t_f$ | Current Fall Time | $I_C$ = 150A | | 85 | | |
| $E_{on1}$ | Turn-on Switching Energy ④ | $R_G$ = 1.0Ω⑦ | | 22 | | mJ |
| $E_{on2}$ | Turn-on Switching Energy (Diode) ⑤ | $T_J$ = +25°C | | 27 | | |
| $E_{off}$ | Turn-off Switching Energy ⑥ | | | 15 | | |
| $t_{d(on)}$ | Turn-on Delay Time | **Inductive Switching (125°C)** | | 55 | | ns |
| $t_r$ | Current Rise Time | $V_{CC}$ = 800V | | 65 | | |
| $t_{d(off)}$ | Turn-off Delay Time | $V_{GE}$ = 15V | | 780 | | |
| $t_f$ | Current Fall Time | $I_C$ = 150A | | 175 | | |
| $E_{on1}$ | Turn-on Switching Energy ④ | $R_G$ = 1.0Ω⑦ | | 23 | | mJ |
| $E_{on2}$ | Turn-on Switching Energy (Diode) ⑤ | $T_J$ = +125°C | | 35 | | |
| $E_{off}$ | Turn-off Switching Energy ⑥ | | | 22 | | |

## THERMAL AND MECHANICAL CHARACTERISTICS

| Symbol | Characteristic | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Junction to Case **(IGBT)** | | | 0.20 | °C/W |
| $R_{\theta JC}$ | Junction to Case **(DIODE)** | | | N/A | |
| $V_{Isolation}$ | RMS Voltage (50-60Hz Sinusoidal Waveform from Terminals to Mounting Base for 1 Min.) | 2500 | | | Volts |
| $W_T$ | Package Weight | | 1.03 | | oz |
| | | | 29.2 | | gm |
| Torque | Maximum Terminal & Mounting Torque | | | 10 | lb•in |
| | | | | 1.1 | N•m |

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 $R_{G(int)}$ nor gate driver impedance. (MIC4452)

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

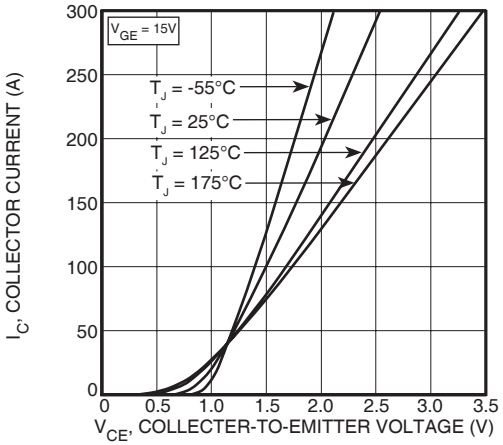



**FIGURE 1, Output Characteristics($T_J$ = 25°C)**

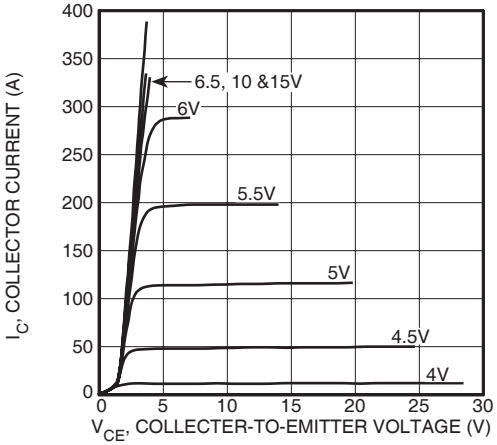



**FIGURE 2, Output Characteristics ($T_J$ = 125°C)**

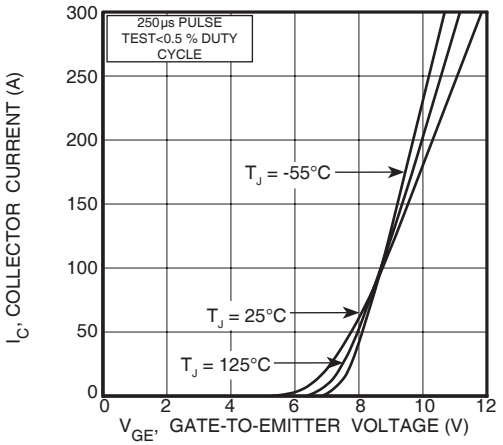



**FIGURE 3, Transfer Characteristics**

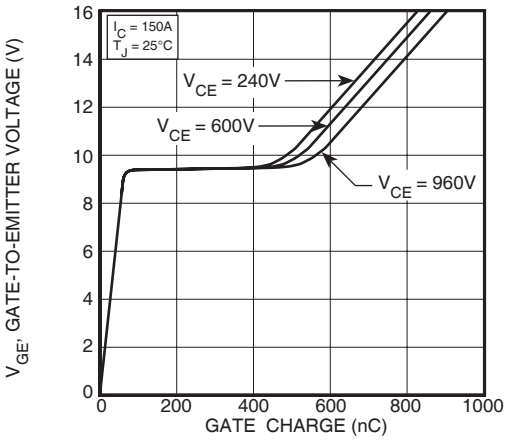



**FIGURE 4, Gate Charge**

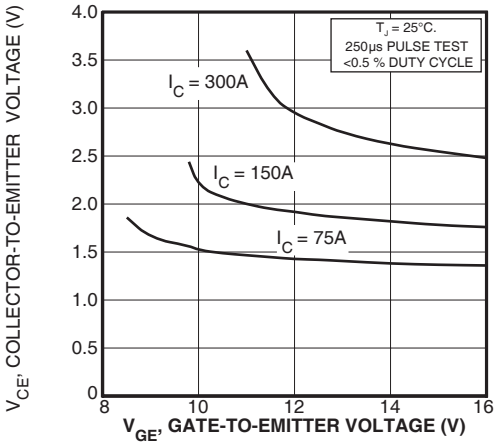



**FIGURE 5, On State Voltage vs Gate-to- Emitter Voltage**

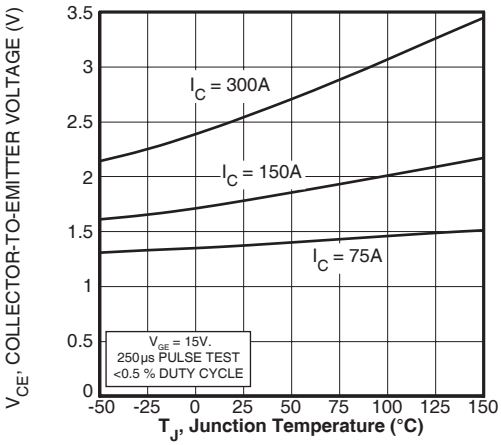



**FIGURE 6, On State Voltage vs Junction Temperature**

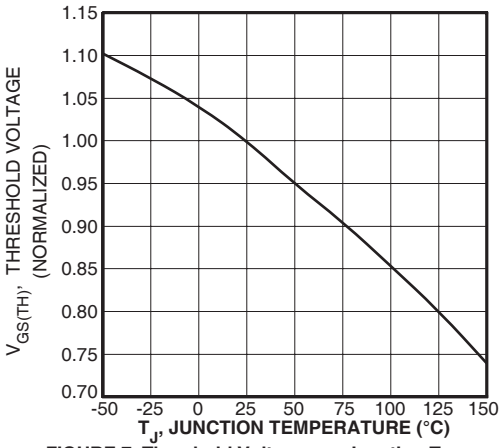



**FIGURE 7, Threshold Voltage vs. Junction Temperature**

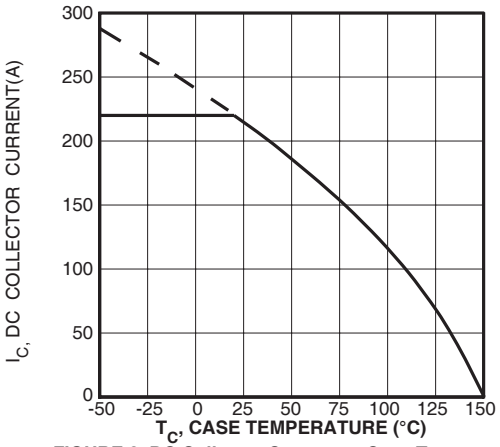



**FIGURE 8, DC Collector Current vs Case Temperature**

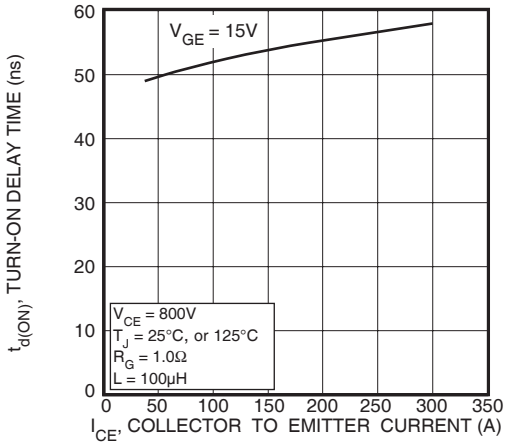



**FIGURE 9, Turn-On Delay Time vs Collector Current**

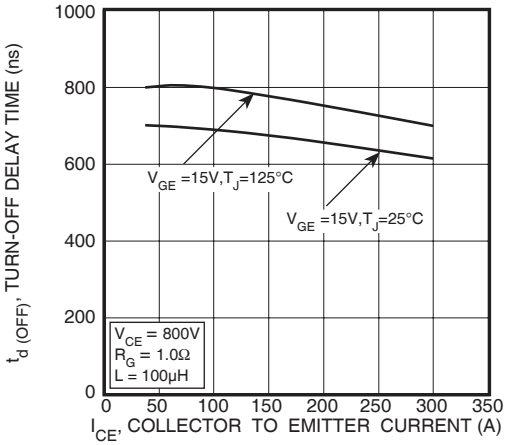



**FIGURE 10, Turn-Off Delay Time vs Collector Current**

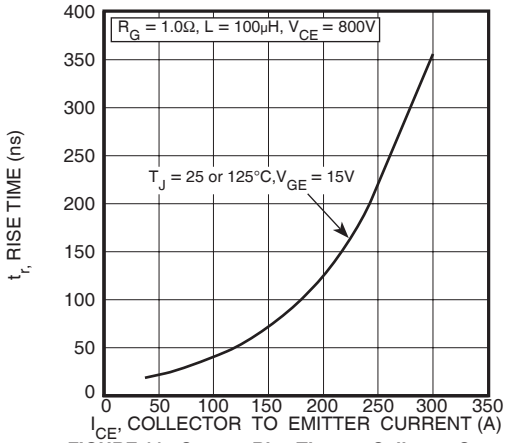



**FIGURE 11, Current Rise Time vs Collector Current**

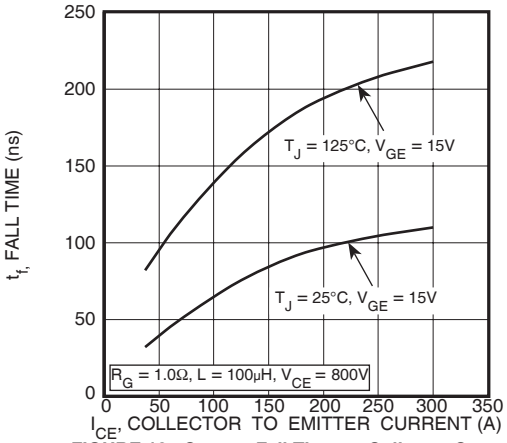



**FIGURE 12, Current Fall Time vs Collector Current**

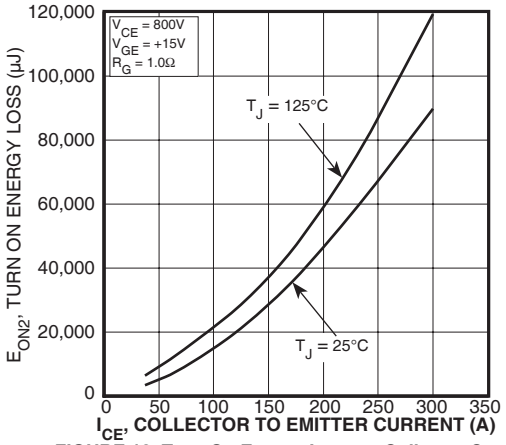



**FIGURE 13, Turn-On Energy Loss vs Collector Current**

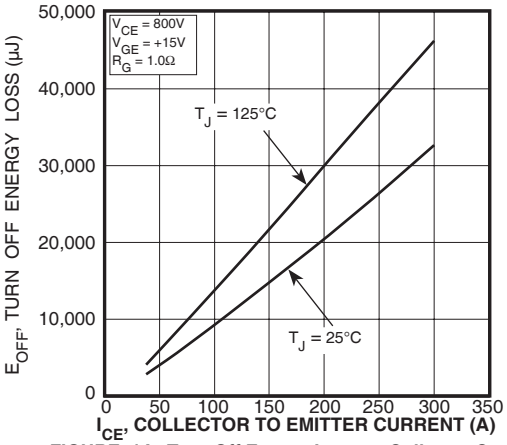



**FIGURE 14, Turn Off Energy Loss vs Collector Current**

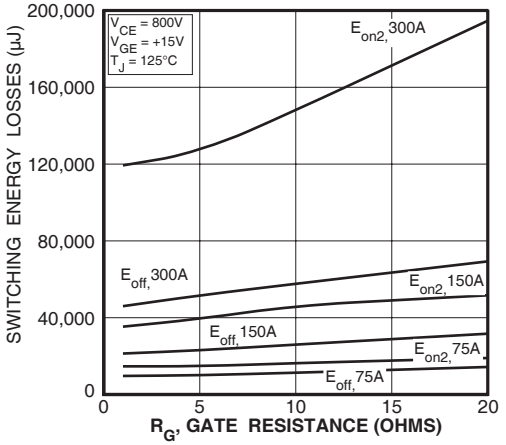



**FIGURE 15, Switching Energy Losses vs. Gate Resistance**

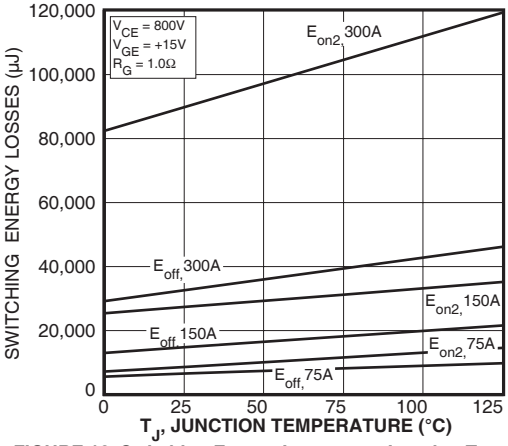



**FIGURE 16, Switching Energy Losses vs Junction Temperature**

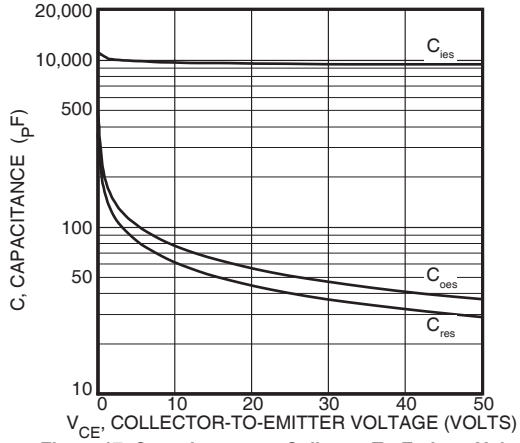



**Figure 17, Capacitance vs Collector-To-Emitter Voltage**

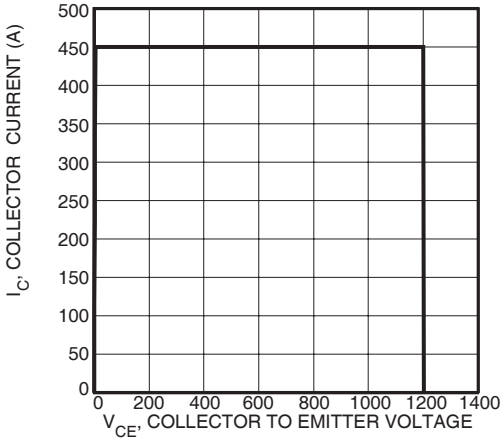



**Figure 18,Minimim Switching Safe Operating Area**

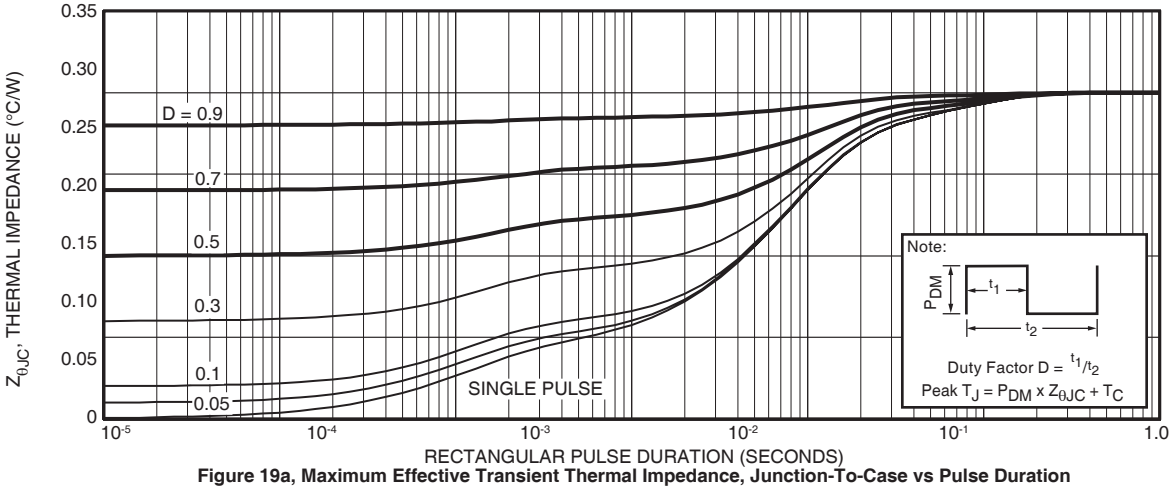



**Figure 19a, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration**

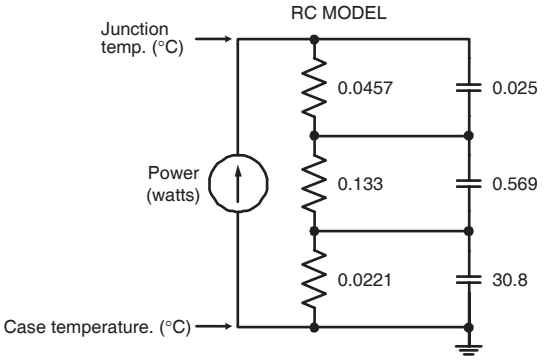



**FIGURE 19b, TRANSIENT THERMAL IMPEDANCE MODEL**

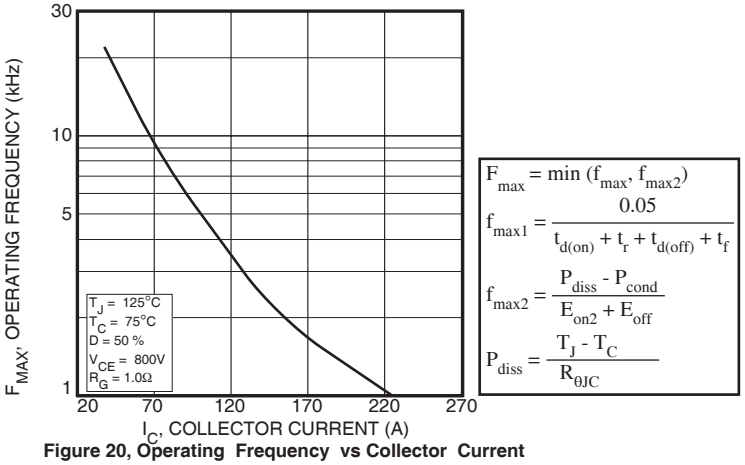



**Figure 20, Operating Frequency vs Collector Current**

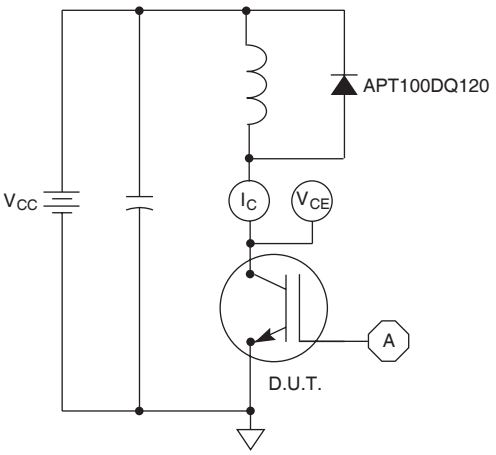



**Figure 21, Inductive Switching Test Circuit**

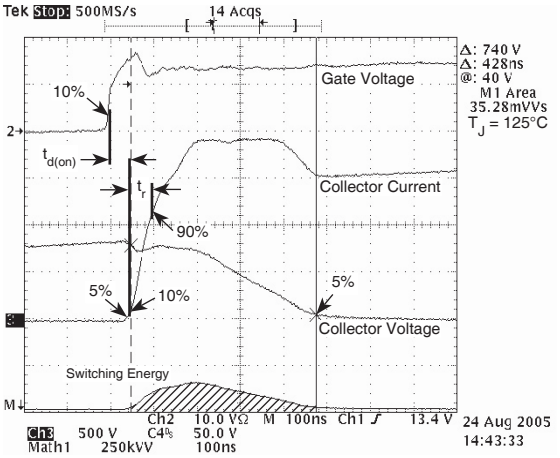



**Figure 22, Turn-on Switching Waveforms and Definitions**

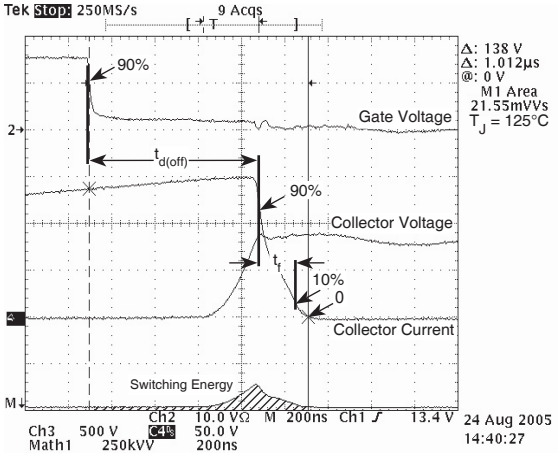
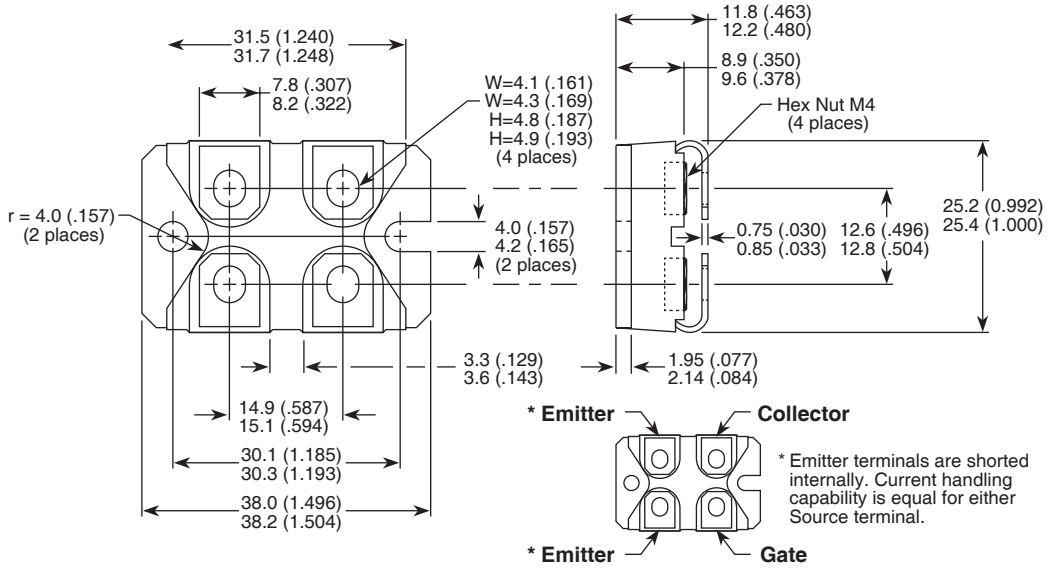



**Figure 23, Turn-off Switching Waveforms and Definitions**

## SOT-227 (ISOTOP®) Package Outline




Dimensions in Millimeters and (Inches)

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