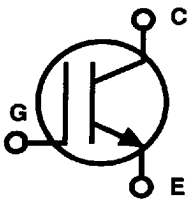


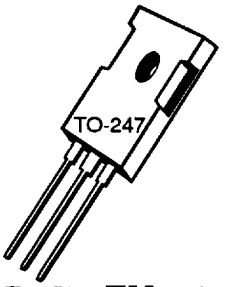


ADVANCED POWER TECHNOLOGY®

**APT50GL60BN 600V 50A**

# POWER MOS IV™ IGBT

## N - CHANNEL ENHANCEMENT MODE HIGH VOLTAGE POWER INSULATED GATE BIPOLAR TRANSISTOR

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

| Symbol | Parameter | | APT50GL60BN | UNIT |
|---|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | | 600 | Volts |
| $V_{GE}$ | Gate-Emitter Voltage | | ±20 | |
| $I_{C1}$* | Continuous Collector Current | | 50 | Amps |
| $I_{C2}$ | Continuous Collector Current @ $T_C$ = 90°C | | 30 | |
| $I_{CM}$ | Pulsed Collector Current ① | | 100 | |
| $I_{LM}$ | Clamped Inductive Load Current @ $T_J$ = +125°C ② | | 60 | |
| $E_{ARV}$ | Reverse Voltage Avalanche Energy | | 100 | mJ |
| $P_D$ | Total Power Dissipation | | 200 | 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 / Part Number | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $BV_{CES}$ | Collector-Emitter Breakdown Voltage ($V_{GE}$ = 0V, $I_C$ = 2.0mA) | APT50GL60BN | 600 | | | Volts |
| | | | | | | |
| $RBV_{CES}$ | Collector-Emitter Reverse Breakdown Voltage ($V_{GE}$ = 0V, $I_C$ = -1.0A) | | -15 | -25 | | |
| $V_{GE(TH)}$ | Gate Threshold Voltage ($V_{CE}$ = $V_{GE}$, $I_C$ = 1.0mA) | | 3 | | 6 | |
| $V_{CE(ON)}$ | Collector-Emitter On Voltage ($V_{GE}$ = 15V, $I_C$ = $I_{C2}$) | | | 2.0 | 2.5 | |
| $I_{CES}$ | Collector Cut-off Current ($V_{CE}$ = 0.8 $V_{CES}$, $V_{GE}$ = 0V) | | | | 500 | µA |
| | Collector Cut-off Current ($V_{CE}$ = 0.8 $V_{CES}$, $V_{GE}$ = 0V, $T_C$ = 125°C) | | | | 1.0 | mA |
| $I_{GES}$ | Gate-Emitter Leakage Current ($V_{GE}$ = ±20V, $V_{CE}$ = 0V) | | | | ±100 | nA |
| $V_{GE}/\Delta T_J$ | Gate-Emitter Threshold Voltage Temperature Coefficient | | | -7.4 | | mV/°C |
| gfe | Forward Transconductance ($V_{CE}$ = 10V, $I_C$ = $I_{C2}$) | | | 14 | | S |

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

**405 S.W. COLUMBIA STREET**
**BEND, OREGON 97702-1035**
**U.S.A.**

**PHONE . . . (503) 382-8028**
**FAX . . . . . (503) 388-0364**

## DYNAMIC CHARACTERISTICS

**APT50GL60BN**

| Symbol | Characteristic | Test Conditions | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $C_{ies}$ | Input Capacitance | **Capacitance** $V_{GE}$ = 0V, $V_{CE}$ = 10V, f = 1 MHz | | 2165 | 2550 | pF |
| $C_{oes}$ | Output Capacitance | | | 440 | 600 | |
| $C_{res}$ | Reverse Transfer Capacitance | | | 130 | 200 | |
| $Q_g$ | Total Gate Charge ③ | **Gate Charge** $V_{GE}$ = 10V, $V_{CC}$ = 0.5 $V_{CES}$, $I_C$ = $I_{C1}$ | | 70 | 110 | nC |
| $Q_{ge}$ | Gate-Emitter Charge | | | 13 | 20 | |
| $Q_{gc}$ | Gate-Collector ("Miller") Charge | | | 40 | 60 | |
| $t_d(on)$ | Turn-on Delay Time | **Resistive Switching (25°C)** $V_{GE}$ = 15V, $V_{CC}$ = 0.5 $V_{CES}$, $I_C$ = $I_{C2}$, $R_G$ = 2Ω | | 15 | 30 | ns |
| $t_r$ | Rise Time | | | 50 | 100 | |
| $t_d(off)$ | Turn-off Delay Time | | | 55 | 85 | |
| $t_f$ | Fall Time | | | 350 | 700 | |
| $t_d(on)$ | Turn-on Delay Time | **Inductive Switching (125°C)** $V_{CLAMP}$(Peak) = 0.8$V_{CES}$, $V_{GE}$ = 15V, $I_C$ = $I_{C2}$, $R_G$ = 2Ω, $T_J$ = +125°C | | 15 | 30 | ns |
| $t_r$ | Rise Time | | | 15 | 40 | |
| $t_d(off)$ | Turn-off Delay Time | | | 350 | 525 | |
| $t_f$ | Fall Time | | | 500 | 1000 | |
| $E_{on}$ | Turn-on Switching Energy | | | 0.2 | 0.4 | mJ |
| $E_{off}$ | Turn-off Switching Energy | | | 4.7 | 9.4 | |
| $E_{ts}$ | Total Switching Losses | | | 4.9 | 9.8 | |
| $t_d(on)$ | Turn-on Delay Time | **Inductive Switching (25°C)** $V_{CLAMP}$(Peak) = 0.8$V_{CES}$, $V_{GE}$ = 15V, $I_C$ = $I_{C2}$, $R_G$ = 2Ω, $T_J$ = +25°C | | 15 | 30 | ns |
| $t_r$ | Rise Time | | | 15 | 30 | |
| $t_d(off)$ | Turn-off Delay Time | | | 175 | 350 | |
| $t_f$ | Fall Time | | | 250 | 500 | |
| $E_{ts}$ | Total Switching Losses | | | 2.5 | 5 | mJ |
| $L_E$ | Internal Emitter Inductance Measured 5mm/0.197in. From Package | | | 5 | | nH |

## THERMAL CHARACTERISTICS

| Symbol | Characteristic | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| $R_{\Theta JC}$ | Junction to Case | | | 0.625 | °C/W |
| $R_{\Theta JA}$ | Junction to Ambient | | | 40 | |
| Torque | Mounting Torque using a 6-32 or 3mm Binding Head Machine Screw. | | 10 | | in-Lbs. |

① Repetitive Rating: Pulse width limited by maximum junction temperature.

② $V_{CLAMP}$ = 0.8$V_{CES}$ Volts, $R_G$ = 2Ω.

③ See MIL-STD-750 Method 3471

* This product when used in very fast switching circuits (turn-off $^{dv}/_{dt}$ > 15 volts per ns) and under operating conditions of $T_c$ = +150°C and $I_c$ > $I_{c1}$ will latch in a thyristor mode of operation. When device latches, it must be commutated with minimum energy to prevent damage.

**APT50GL60BN**

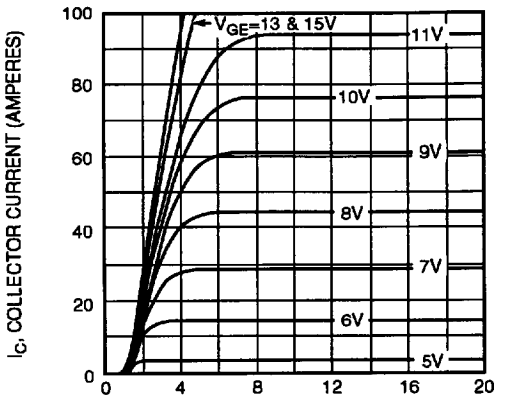


**Figure 1, Typical Output Characteristics ($T_J$ = 25°C)**

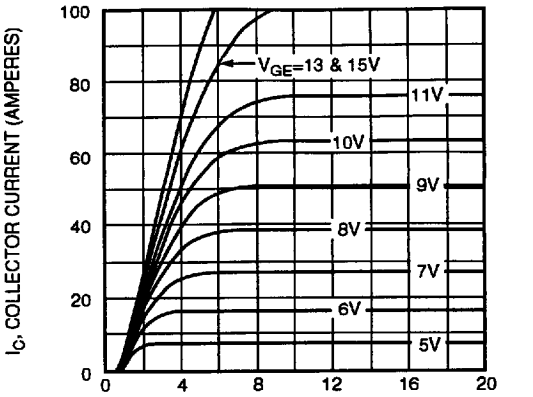


**Figure 2, Typical Output Characteristics ($T_J$ = 150°C)**

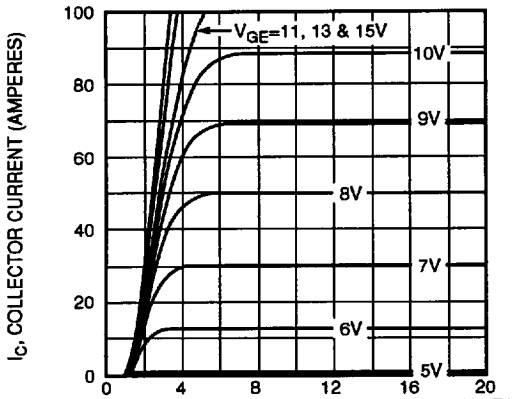


**Figure 3, Typical Output Characteristics ($T_J$ = -55°C)**

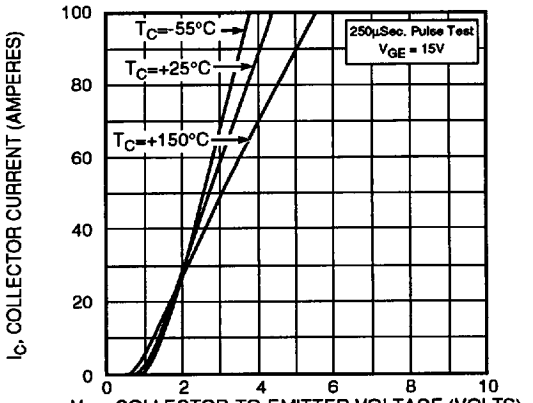


**Figure 4, Typical Output Characteristics @ $V_{GE}$ = 15V**

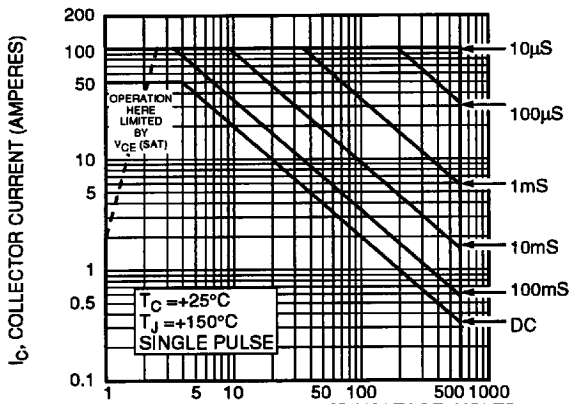


**Figure 5, Maximum Forward Bias Safe Operating Area**

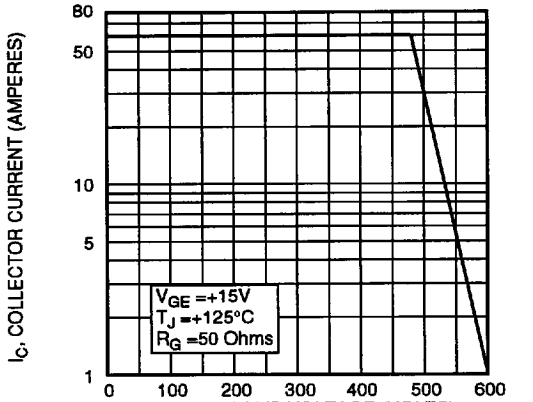


**Figure 6, Maximum Reverse Bias Safe Operating Area**

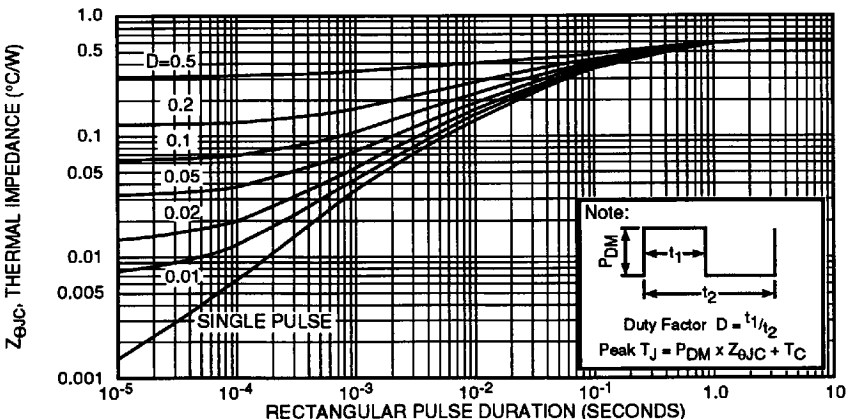


**Figure 7, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration**

052-6015
Rev B

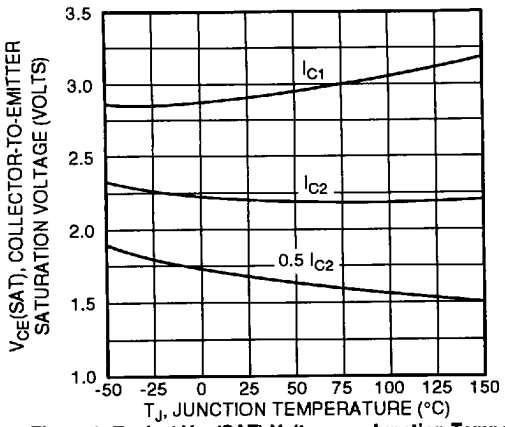


Figure 8, Typical $V_{CE}$(SAT) Voltage vs Junction Temperature

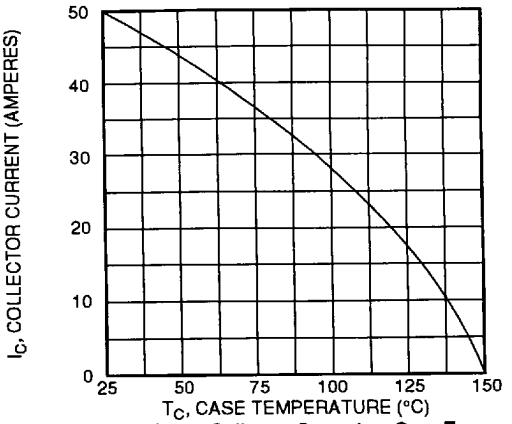


Figure 9, Maximum Collector Current vs Case Temperature

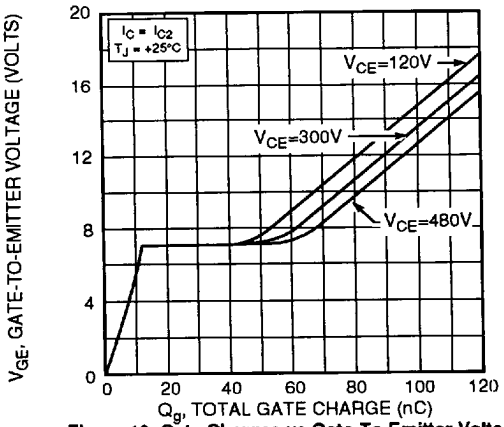


Figure 10, Gate Charges vs Gate-To-Emitter Voltage

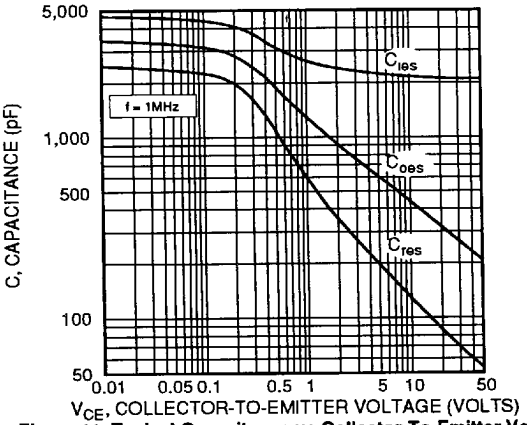


Figure 11, Typical Capacitance vs Collector-To-Emitter Voltage

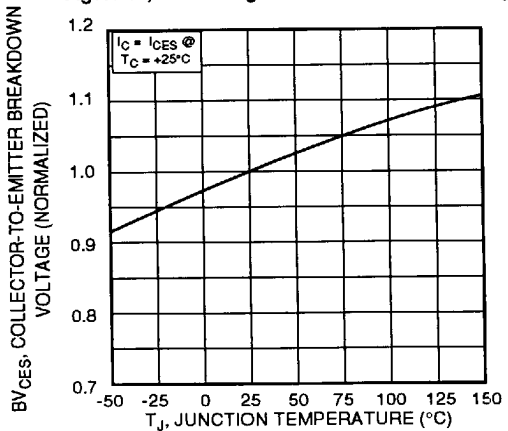


Figure 12, Breakdown Voltage vs Junction Temperature

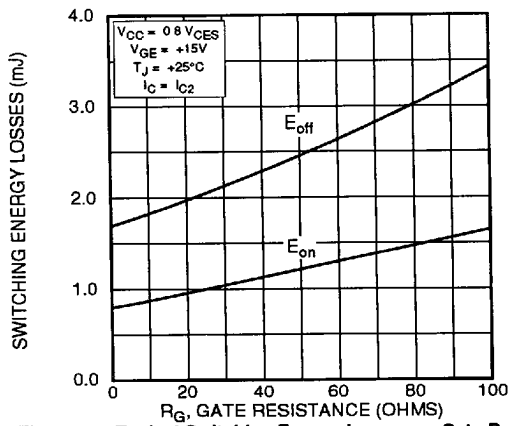


Figure 13, Typical Switching Energy Losses vs Gate Resistance

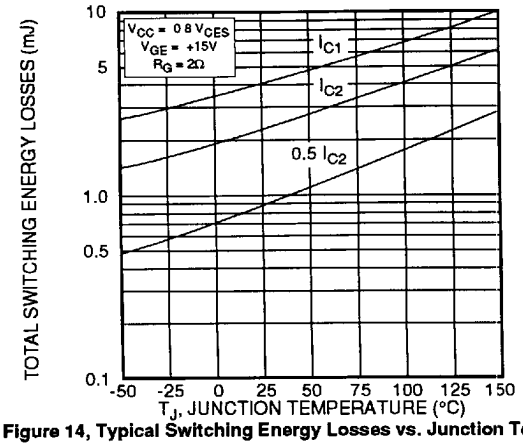


Figure 14, Typical Switching Energy Losses vs. Junction Temperature

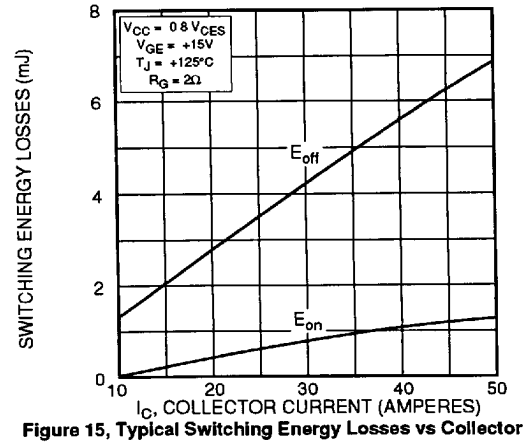


Figure 15, Typical Switching Energy Losses vs Collector Current