

## IRGNI200F06

### "CHOPPER" IGBT INT-A-PAK

- Rugged Design
- Simple gate-drive
- Fast operation up to 10KHz hard switching, or 50KHz resonant
- Switching-Loss Rating includes all "tail" losses

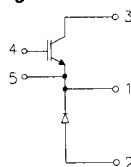
### Fast Speed IGBT

$$V_{CE} = 600V$$

$$I_C = 200A$$

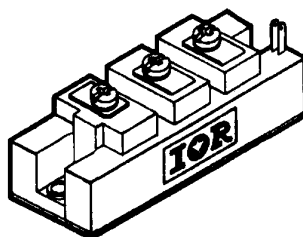
$$V_{CE(ON)} < 2.3V$$

High Side Switch



### Description

IR's advanced IGBT technology is the key to this line of INT-A-pak Power Modules. The efficient geometry and unique processing of the IGBT allow higher current densities than comparable bipolar power module transistors, while at the same time requiring the simpler gate-drive of the familiar power MOSFET. This superior technology has now been coupled to state of the art assembly techniques to produce a higher current module that is highly suited to power applications such as motor drives, uninterruptible power supplies, welding, induction heating and ultrasonics.



INT-A-PAK case

### Absolute Maximum Ratings

| Parameter                 | Description                                              | Value      | Units      |
|---------------------------|----------------------------------------------------------|------------|------------|
| $V_{CES}$                 | Continuous collector to emitter voltage                  | 600        | V          |
| $I_C @ T_C = 25^\circ C$  | Continuous collector current                             | 200        | A          |
| $I_C @ T_C = 85^\circ C$  | Continuous collector current                             | 130        |            |
| $I_C @ T_C = 100^\circ C$ | Continuous collector current                             | 110        |            |
| $I_{LM}$                  | Peak switching current                                   | 400        |            |
| $I_{FM}$                  | Peak diode forward current (1)                           | 500        | V          |
| $V_{GE}$                  | Gate to emitter voltage                                  | $\pm 20$   |            |
| $V_{ISOL}$                | RMS isolation voltage, any terminal to case, $t = 1$ min | 2500       |            |
| $P_D @ T_C = 25^\circ C$  | Power dissipation                                        | 500        | W          |
| $T_J$                     | Operating junction temperature range                     | -40 to 150 | $^\circ C$ |
| $T_{STG}$                 | Storage temperature range                                | -40 to 125 |            |

(1) Duration limited by max junction temperature.

**Electrical Characteristics -  $T_J = 25^\circ\text{C}$ , unless otherwise stated**

| Parameter         | Description                            | Min | Typ | Max     | Units   | Test Conditions                                       |
|-------------------|----------------------------------------|-----|-----|---------|---------|-------------------------------------------------------|
| $BV_{CES}$        | Collector-to-emitter breakdown voltage | 600 | —   | —       | V       | $V_{GE} = 0V, I_C = 2mA$                              |
| $V_{CE(ON)}$      | Collector-to-emitter voltage           | —   | —   | 2.3     |         | $V_{GE} = 15V, I_C = 200A$                            |
|                   |                                        | —   | 2.2 | —       |         | $V_{GE} = 15V, I_C = 200A, T_J = 150^\circ\text{C}$   |
| $V_{FM}$          | Diode forward voltage - maximum        | —   | —   | 2.0     |         | $I_F = 200A, V_{GE} = 0V$                             |
|                   |                                        | —   | 2.0 | —       |         | $I_F = 200A, V_{GE} = 0V, T_J = 150^\circ\text{C}$    |
| $V_{GEth}$        | Gate threshold voltage                 | 3.0 | —   | 5.5     | mV/°C   | $I_C = 1mA$                                           |
| $\Delta V_{GEth}$ | Threshold voltage temp. coefficient    | —   | -11 | —       |         | $V_{CE} = V_{GE}, I_C = 1mA$                          |
| $g_{fe}$          | Forward transconductance               | 104 | —   | 144     |         | $V_{CE} = 25V, I_C = 200A$                            |
| $I_{CES}$         | Collector-to-emitter leakage current   | —   | —   | 2       |         | $V_{GE} = 0V, V_{CE} = 600V$                          |
|                   |                                        | —   | —   | 20      |         | $V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$ |
| $I_{GES}$         | Gate-to-emitter leakage current        | —   | —   | $\pm 2$ | $\mu A$ | $V_{GE} = \pm 20V$                                    |

**Dynamic Characteristics -  $T_J = 150^\circ\text{C}$** 

| Parameter     | Description                        | Min | Typ   | Max | Units   | Test Conditions                       |
|---------------|------------------------------------|-----|-------|-----|---------|---------------------------------------|
| $E_{on}$      | Turn-on switching energy           | —   | 0.05  | —   | mJ/A    | $R_{G1} = 27\Omega, R_{G2} = 0\Omega$ |
| $E_{off} (1)$ | Turn-off switching energy          | —   | 0.17  | —   |         | $I_C = 200A, L_S = 100nH$             |
| $E_{ts} (1)$  | Total switching energy             | —   | —     | 0.3 |         | $V_{CC} = 360V, V_{GE} = \pm 15V$     |
| $t_{d(on)}$   | Turn-on delay time                 | —   | 80    | —   | ns      | $R_{G1} = 27\Omega, R_{G2} = 0\Omega$ |
| $t_r$         | Rise time                          | —   | 150   | —   |         | $I_C = 200A$                          |
| $t_{d(off)}$  | Turn-off delay time                | —   | 450   | —   |         | $V_{CC} = 360V, V_{GE} = \pm 15V$     |
| $t_f$         | Fall time                          | —   | 900   | —   |         | $L_S = 100nH$                         |
| $I_{rr}$      | Diode peak recovery current        | —   | 108   | —   | A       | $R_{G1} = 27\Omega, R_{G2} = 0\Omega$ |
| $t_{rr}$      | Diode recovery time                | —   | 115   | —   | ns      | $I_C = 200A$                          |
| $Q_{rr}$      | Diode recovery charge              | —   | 6.5   | —   | $\mu C$ | $V_{CC} = 360V, V_{GE} = \pm 15V$     |
| $Q_{ge}$      | Gate-to-emitter charge (turn-on)   | 300 | —     | 560 | nC      | $V_{CC} = 360V$                       |
| $Q_{gc}$      | Gate-to-collector charge (turn-on) | 140 | —     | 280 |         | $I_C = 108A$                          |
| $Q_g$         | Total gate charge (turn-on)        | 52  | —     | 84  |         | $V_{GE} = 15V$                        |
| $C_{ies}$     | Input capacitance                  | —   | 11600 | —   | pF      | $V_{GE} = 0V$                         |
| $C_{oes}$     | Output capacitance                 | —   | 1320  | —   |         | $V_{CC} = 30V$                        |
| $C_{res}$     | Reverse transfer capacitance       | —   | 160   | —   |         | $f = 1MHz$                            |

(1) Includes tail losses

**Thermal and Mechanical Characteristics**

| Parameter           | Description                                      | Typ | Max  | Units              |
|---------------------|--------------------------------------------------|-----|------|--------------------|
| $R_{thJC}$ (IGBT)   | Thermal resistance, junction to case, each IGBT  | —   | 0.25 | $^\circ\text{C/W}$ |
| $R_{thJC}$ (Diode)  | Thermal resistance, junction to case, each diode | —   | 0.28 |                    |
| $R_{thCS}$ (Module) | Thermal resistance, case to sink                 | 0.1 | —    |                    |
| Wt                  | Weight of module                                 | 140 | —    | g                  |

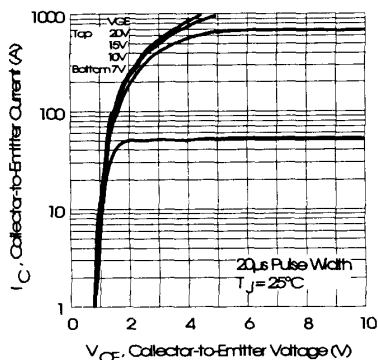


Fig. 1 - Typical Output Characteristics,  $T_j = 25^\circ\text{C}$

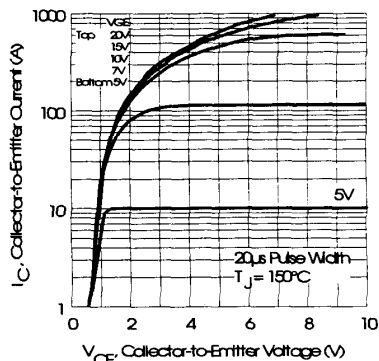


Fig. 2 - Typical Output Characteristics,  $T_j = 150^\circ\text{C}$

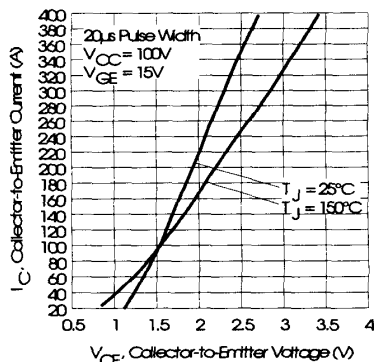


Fig. 3 - Typical Output Characteristics

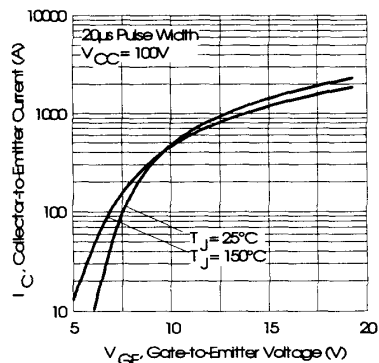


Fig. 4 - Typical Transfer Characteristics

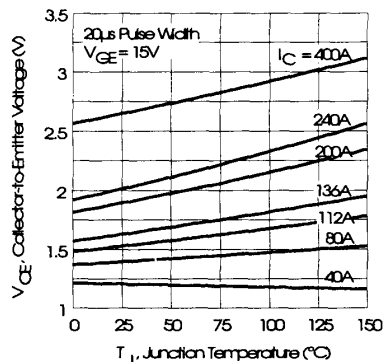


Fig. 5 - Collector-to-Emitter Saturation Typical Voltage vs. Junction Temperature

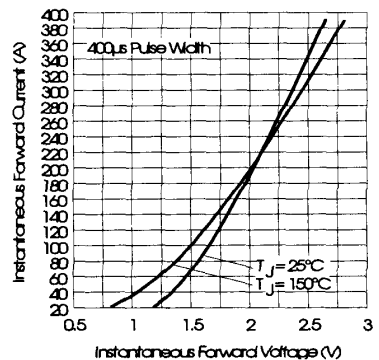


Fig. 6 - Forward Voltage Drop Characteristics

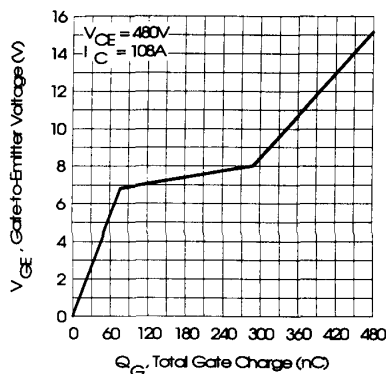


Fig. 7 - Typical Gate Charge vs. Gate-to-Emitter Voltage

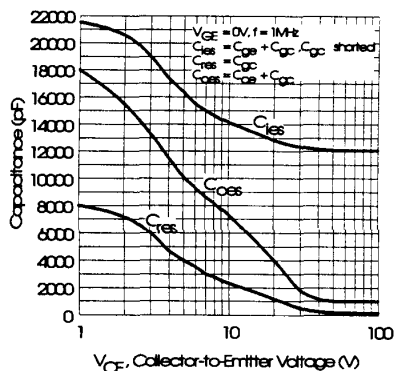


Fig. 8 - Typical Capacitance vs. Collector-to-Emitter Voltage

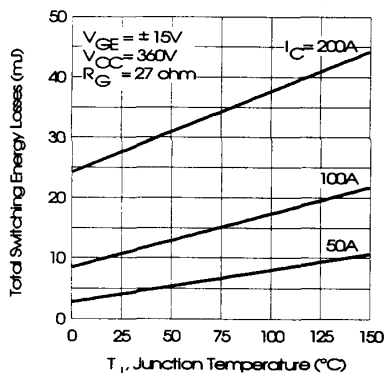


Fig. 9 - Typical Switching Losses vs. Junction Temperature

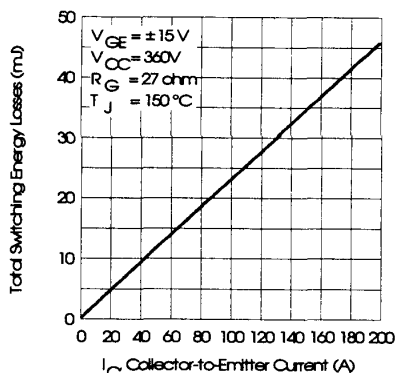


Fig. 10 - Typical Switching Losses vs. Collector-to-Emitter Current

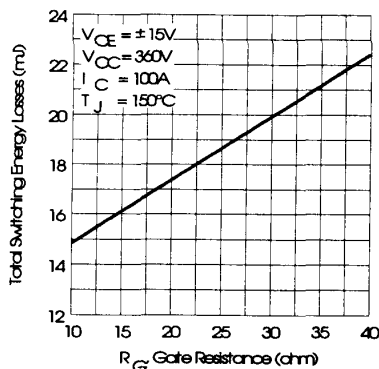


Fig. 11 - Typical Switching Losses vs. Gate Resistance

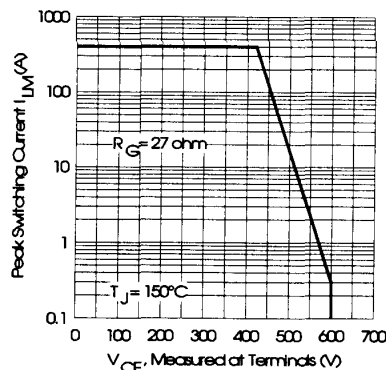


Fig. 12 - Reverse Bias Safe Operating Area

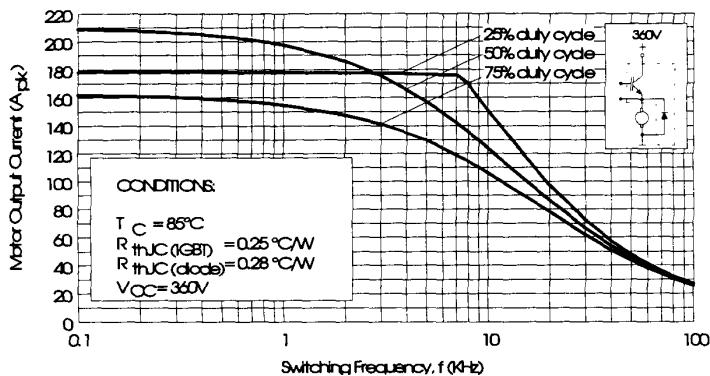


Fig. 13 - RMS Output Current vs. Frequency

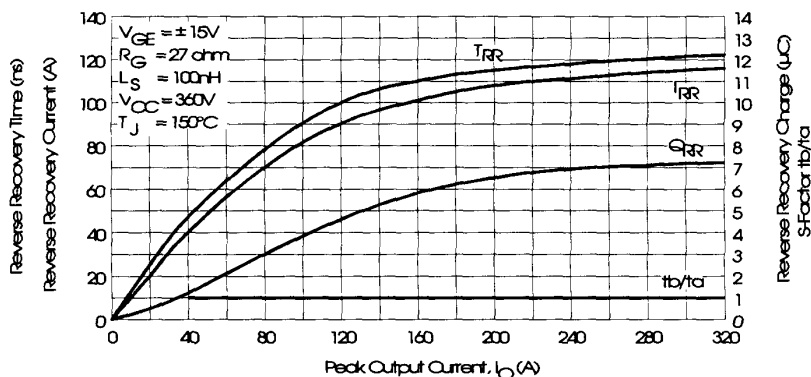


Fig. 14 - Typical Diode Recovery Characteristics as Function of Output Current  $I_O$

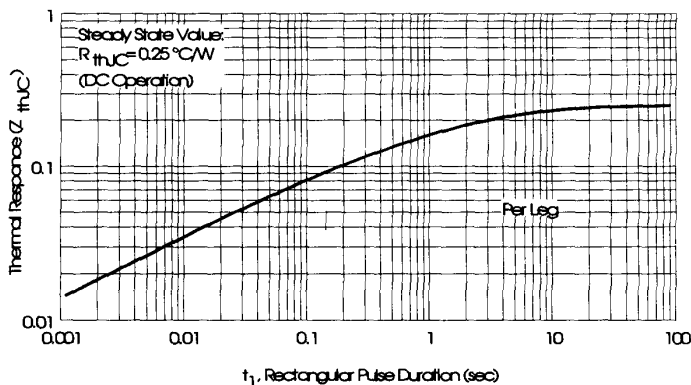


Fig. 15 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

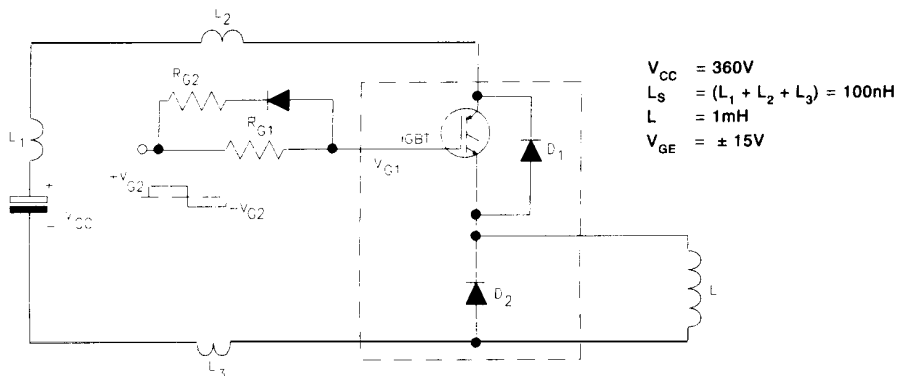


Fig. 16 - Test Circuit for Measurement of  $I_{LM}$ ,  $E_{ON}$ ,  $E_{OFF}$ ,  $Q_{RR}$ ,  $I_{RR}$ ,  $t_{D(ON)}$ ,  $t_r$ ,  $t_{D(OFF)}$ ,  $t_f$

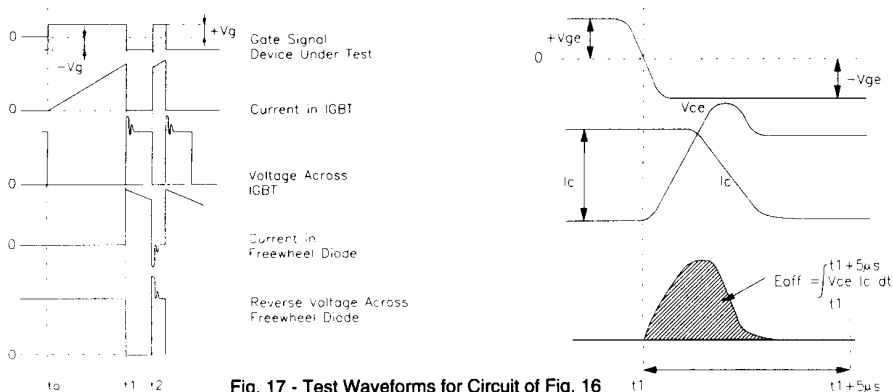


Fig. 17 - Test Waveforms for Circuit of Fig. 16

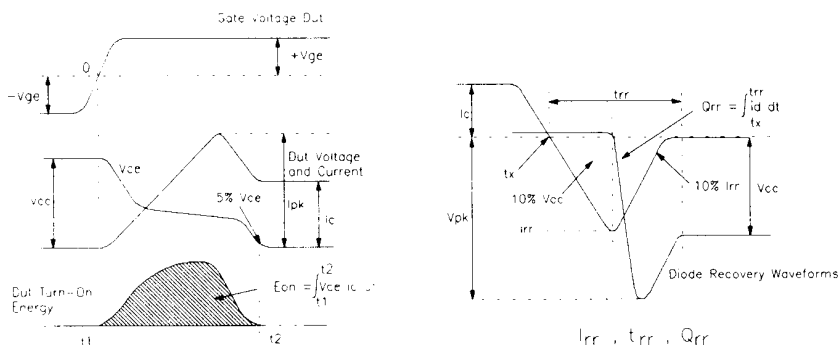


Fig. 18 - Test Waveforms for Circuit of Fig. 16, Defining  $E_{ON}$ ,  $E_{REC}$ ,  $t_{D(ON)}$ ,  $t_r$ ,  $I_{RR}$ ,  $t_{RR}$ ,  $Q_{RR}$

Refer to Section D for the following:

Appendix E: Section D - page D-7

Fig. 19 - Waveforms for Switching Time

Package Outline 8 -INT-A-PAK High Side Switch

Section D - page D-15