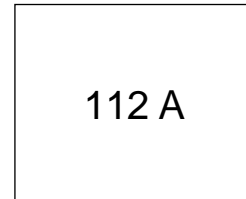



## IRK.F112.. SERIES

**FAST THYRISTOR/ DIODE and  
 THYRISTOR/THYRISTOR**

**INT-A-pak™ Power Modules**



### Features

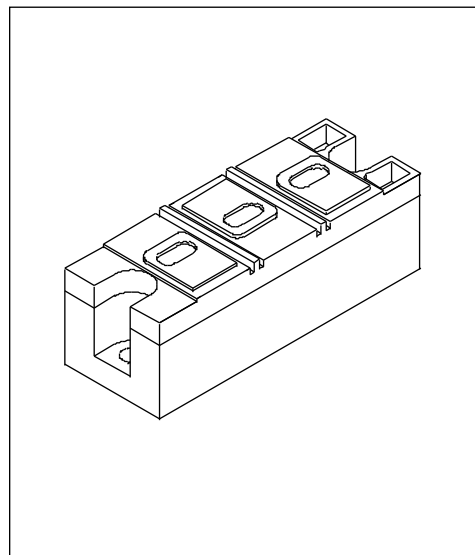
- Fast turn-off thyristor
- Fast recovery diode
- High surge capability
- Electrically isolated baseplate
- 3000 V<sub>RMS</sub> isolating voltage
- Industrial standard package
- UL E78996 approved 

### Description

These series of INT-A-pak modules are intended for applications such as self-commutated inverters, DC choppers, electronic welders, induction heating and others where fast switching characteristics are required.

### Major Ratings and Characteristics

| Parameters        | IRK.F112.. | Units              |
|-------------------|------------|--------------------|
| $I_{T(AV)}$       | 112        | A                  |
| @ $T_C$           | 90         | °C                 |
| $I_{T(RMS)}$      | 250        | A                  |
| $I_{TSM}$ @ 50Hz  | 3090       | A                  |
| @ 60Hz            | 3237       | A                  |
| $I^2t$ @ 50Hz     | 47.8       | KA <sup>2</sup> s  |
| @ 60Hz            | 43.6       | KA <sup>2</sup> s  |
| $I^2\sqrt{t}$     | 478        | KA <sup>2</sup> √s |
| $t_q$             | 10 and 15  | μs                 |
| $t_{rr}$          | 2          | μs                 |
| $V_{DRM}/V_{RRM}$ | up to 800  | V                  |
| $T_J$ range       | -40 to 125 | °C                 |



## IRK.F112.. Series

Bulletin I27091 rev. A 09/97

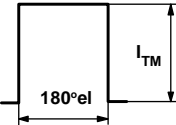
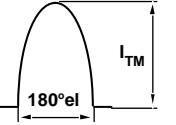
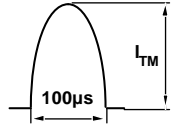
International  
 Rectifier

### ELECTRICAL SPECIFICATIONS

#### Voltage Ratings

| Type number       | Voltage Code | $V_{RRM}/V_{DRM}$ , maximum repetitive peak reverse voltage<br>V | $V_{RSM}$ , maximum non-repetitive peak rev. voltage<br>V | $I_{RRM}/I_{DRM}$ max.<br>@ $T_J = 125^\circ\text{C}$<br>mA |
|-------------------|--------------|--|---|---|
| IRK.F112.. Series | 04           | 400  | 400   | 30  |
|                   | 08           | 800  | 800   |   |

#### Current Carrying Capacity

| Frequency f                      |  |     |  |     |  |      | Units |
|----------------------------------|---|-----|---|-----|---|------|-------|
|                                  | 220   | 220 | 350   | 550 | 2060  | 2900 |       |
| 50Hz                             | 220   | 220 | 350   | 550 | 2060  | 2900 | A     |
| 400Hz                            | 285   | 285 | 425   | 695 | 1230  | 1785 | A     |
| 2500Hz                           | 205   | 205 | 350   | 550 | 460   | 552  | A     |
| 5000Hz                           | 175   | 170 | 295   | 448 | 295   | 448  | A     |
| 10000Hz                          | 125   | 120 | 230   | 337 | -   | -    | A     |
| Recovery voltage Vr              | 50  | 50  | 50  | 50  | 50  | 50   | V     |
| Voltage before turn-on Vd        | 80% $V_{DRM}$   |     | 80% $V_{DRM}$   |     | 80% $V_{DRM}$   |      | V     |
| Rise of on-state current di/dt   | 50  | 50  | -   | -   | -   | -    | A/µs  |
| Case temperature                 | 90  | 60  | 90  | 60  | 90  | 60   | °C    |
| Equivalent values for RC circuit | 47 Ω / 0.22 µF  |     | 47 Ω / 0.22 µF  |     | 47 Ω / 0.22 µF  |      |       |

#### On-state Conduction

| Parameter   | IRK.F112.. | Units              | Conditions   |
|---|------------|--------------------|--|
| $I_{T(AV)}$ Maximum average on-state current @ Case temperature | 112        | A                  | 180° conduction, half sine wave  |
|   | 90         | °C                 |  |
| $I_{T(RMS)}$ Maximum RMS current                                | 250        | A                  | $T_C = 90^\circ\text{C}$ , as AC switch  |
| $I_{TSM}$ Maximum peak, one-cycle, non-repetitive surge current | 3090       | A                  | t = 10ms No voltage reappplied   |
|   | 3237       |                    | t = 8.3ms 100% $V_{RRM}$ reappplied  |
|   | 2600       |                    | t = 10ms 100% $V_{RRM}$ reappplied   |
|   | 2720       |                    | t = 8.3ms 100% $V_{RRM}$ reappplied  |
| $I^2t$ Maximum $I^2t$ for fusing                                | 47.8       | KA <sup>2</sup> s  | t = 10ms No voltage reappplied   |
|   | 43.6       |                    | t = 8.3ms 100% $V_{RRM}$ reappplied  |
|   | 33.8       |                    | t = 10ms 100% $V_{RRM}$ reappplied   |
|   | 30.8       |                    | t = 8.3ms 100% $V_{RRM}$ reappplied  |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing                  | 478        | KA <sup>2</sup> √s | t = 0 to 10ms, no voltage reappplied   |
| $V_{T(TO)1}$ Low level value of threshold voltage               | 1.19       | V                  | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J \text{ max.}$ |
| $V_{T(TO)2}$ High level value of threshold voltage              | 1.43       |                    | $(I > \pi \times I_{T(AV)})$ , $T_J = T_J \text{ max.}$                                      |
| $r_{t1}$ Low level value of on-state slope resistance           | 1.67       | mW                 | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J \text{ max.}$ |
| $r_{t2}$ High level value of on-state slope resistance          | 1.12       |                    | $(I > \pi \times I_{T(AV)})$ , $T_J = T_J \text{ max.}$                                      |
| $V_{TM}$ Maximum on-state voltage drop                          | 1.77       | V                  | $I_{pk} = 350\text{A}$ , $T_J = T_J \text{ max.}$ , $t_p = 10\text{ms}$ sine pulse           |
| $I_H$ Maximum holding current                                   | 600        | mA                 | $T_J = 25^\circ\text{C}$ , $I_T > 30\text{A}$  |
| $I_L$ Typical latching current                                  | 1000       | mA                 | $T_J = 25^\circ\text{C}$ , $V_A = 12\text{V}$ , $R_a = 6\Omega$ , $I_g = 1\text{A}$          |

**Switching**

| Parameter                                 | IRK.F112.. | Units         | Conditions   |
|---|------------|---------------|--|
| di/dt Maximum non-repetitive rate of rise | 800        | A/μs          | Gate drive 20V, 20Ω, tr ≤ 1ms, V <sub>D</sub> = 80% V <sub>DRM</sub><br>T <sub>J</sub> = 125°C   |
| t <sub>rr</sub> Maximum recovery time     | 2          | μs            | I <sub>TM</sub> = 350A, di/dt = -25A/μs, V <sub>R</sub> = 50V, T <sub>J</sub> = 25°C   |
| t <sub>q</sub> Maximum turn-off time      | N<br>10    | L<br>15<br>μs | I <sub>TM</sub> = 350A, T <sub>J</sub> = 125°C, di/dt = -25A/μs,<br>V <sub>R</sub> = 50V, dv/dt = 400V/μs linear to 80% V <sub>DRM</sub> |

**Blocking**

| Parameter   | IRK.F112.. | Units | Conditions   |
|---|------------|-------|--|
| dv/dt Maximum critical rate of rise of off-state voltage  | 1000       | V/μs  | T <sub>J</sub> = 125°C., exponential to 67% V <sub>DRM</sub>                         |
| V <sub>INS</sub> RMS isolation voltage  | 3000       | V     | 50 Hz, circuit to base, T <sub>J</sub> = 25°C, t = 1 s                               |
| I <sub>R<sub>RRM</sub></sub><br>I <sub>DRM</sub> Maximum peak reverse and off-state leakage current | 30         | mA    | T <sub>J</sub> = 125°C, rated V <sub>DRM</sub> /V <sub>R<sub>RRM</sub></sub> applied |

**Triggering**

| Parameter  | IRK.F112.. | Units | Conditions   |
|--|------------|-------|--|
| P <sub>GM</sub> Maximum peak gate power                  | 60         | W     | f = 50 Hz, d% = 50                                     |
| P <sub>G(AV)</sub> Maximum peak average gate power       | 10         | W     | T <sub>J</sub> = 125°C, f = 50Hz, d% = 50              |
| I <sub>GM</sub> Maximum peak positive gate current       | 10         | A     | T <sub>J</sub> = 125°C, t <sub>p</sub> ≤ 5ms           |
| - V <sub>GM</sub> Maximum peak negative gate voltage     | 5          | V     |  |
| I <sub>GT</sub> Max. DC gate current required to trigger | 200        | mA    | T <sub>J</sub> = 25°C, V <sub>ak</sub> 12V, Ra = 6     |
| V <sub>GT</sub> DC gate voltage required to trigger      | 3          | V     |  |
| I <sub>GD</sub> DC gate current not to trigger           | 20         | mA    | T <sub>J</sub> = 125°C, rated V <sub>DRM</sub> applied |
| V <sub>GD</sub> DC gate voltage not to trigger           | 0.25       | V     |  |

**Thermal and Mechanical Specifications**

| Parameter   | IRK.F112..      | Units           | Conditions  |
|---|-----------------|-----------------|---|
| T <sub>J</sub> Max. junction operating temperature range      | - 40 to 125     | °C              |   |
| T <sub>stg</sub> Max. storage temperature range               | - 40 to 150     |                 |   |
| R <sub>thJC</sub> Max. thermal resistance, junction to case   | 0.17            | K/W             | Per junction, DC operation  |
| R <sub>thC-hs</sub> Max. thermal resistance, case to heatsink | 0.035           | K/W             | Mounting surface flat and greased<br>Per module   |
| T Mounting torque ± 10%                                       | IAP to heatsink | 4 - 6 (35 - 53) | Nm<br>(lb*in)   |
|   | busbar to IAP   | 4 - 6 (35 - 53) |   |
| wt Approximate weight   | 500 (17.8)      | g (oz)          | A mounting compound is recommended. The torque should be rechecked after a period of 3 hours to allow for the spread of the compound. Use of cable lugs is not recommended, busbars should be used and restrained during tightening. Threads must be lubricated with a compound |

## IRK.F112.. Series

Bulletin I27091 rev. A 09/97

International  
**IR** Rectifier

### $\Delta R_{thJC}$ Conduction

(The following table shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC)

| Conduction angle | Sinusoidal conduction | Rectangular conduction | Units | Conditions                |
|------------------|-----------------------|------------------------|-------|---------------------------|
| 180°             | 0.015                 | 0.012                  | K/W   | $T_J = 125^\circ\text{C}$ |
| 120°             | 0.018                 | 0.020                  |       |                           |
| 90°              | 0.024                 | 0.027                  |       |                           |
| 60°              | 0.036                 | 0.037                  |       |                           |
| 30°              | 0.060                 | 0.060                  |       |                           |

### Ordering Information Table

| Device Code |  |          |          |          |          |          |          |          |   |
|-------------|--|----------|----------|----------|----------|----------|----------|----------|---|
| 1           | 2  | 3        | 4        | 5        | 6        | 7        | 8        | 9        |   |
| IRK         | T  | F        | 11       | 2        | -        | 08       | H        | L        | N |
| <b>1</b>    | <b>2</b>   | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> |   |
| <b>1</b>    | - Module type  |          |          |          |          |          |          |          |   |
| <b>2</b>    | - Circuit configuration  |          |          |          |          |          |          |          |   |
| <b>3</b>    | - Fast SCR   |          |          |          |          |          |          |          |   |
| <b>4</b>    | - Current rating: $I_{T(AV)} \times 10$ rounded  |          |          |          |          |          |          |          |   |
| <b>5</b>    | - 1 = option with spacers and longer terminal screws<br>2 = option with standard terminal screws |          |          |          |          |          |          |          |   |
| <b>6</b>    | - Voltage code: Code $\times 100 = V_{RRM}$ (See Voltage Ratings Table)                          |          |          |          |          |          |          |          |   |
| <b>7</b>    | - dv/dt code: H $\leq 400\text{V}/\mu\text{s}$   |          |          |          |          |          |          |          |   |
| <b>8</b>    | - $t_q$ code: N $\leq 10\mu\text{s}$<br>L $\leq 15\mu\text{s}$                                   |          |          |          |          |          |          |          |   |
| <b>9</b>    | - None = Standard devices<br>N = Aluminum nitride substrate                                      |          |          |          |          |          |          |          |   |

**NOTE: To order the Optional Hardware see Bulletin I27900**

Outline Table

- All dimensions in millimeters (inches)
- Dimensions are nominal
- Full engineering drawings are available on request
- UL identification number for gate and cathode wire: UL 1385
- UL identification number for package: UL 94V0

| For all types | A         | B         | C         | D         | E         |
|---------------|-----------|-----------|-----------|-----------|-----------|
| IRK...1       | 25 (0.98) | ----      | ----      | 41 (1.61) | 47 (1.85) |
| IRK...2       | 23 (0.91) | 30 (1.18) | 36 (1.42) | ----      | ----      |

IRKTF.. IRKHF.. IRKLF.. IRKUF.. IRKVF.. IRKKF.. IRKNF..

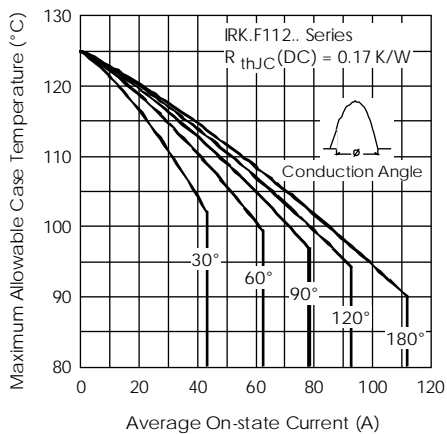


Fig. 1 - Current Ratings Characteristics

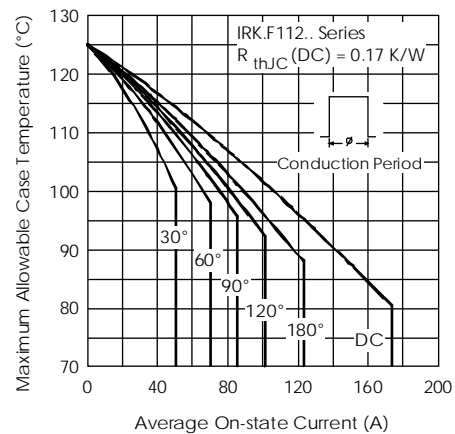


Fig. 2 - Current Ratings Characteristics

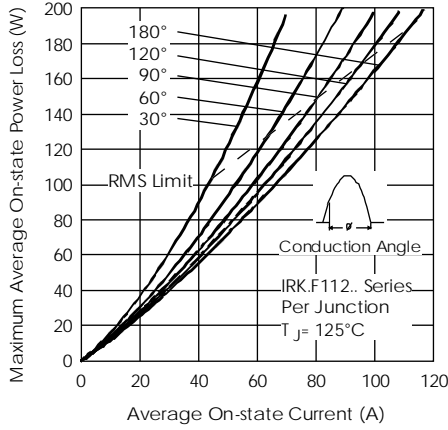


Fig. 3 - On-state Power Loss Characteristics

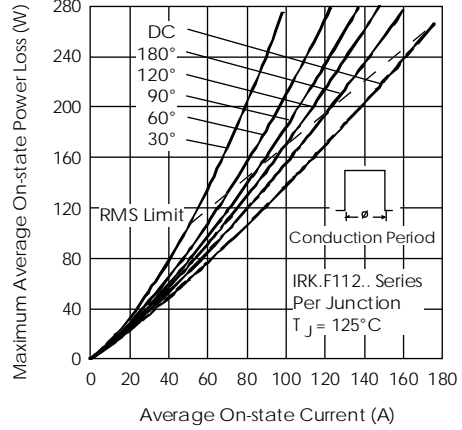


Fig. 4 - On-state Power Loss Characteristics

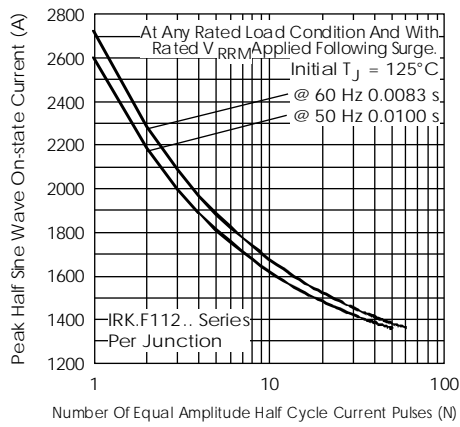


Fig. 5 - Maximum Non-Repetitive Surge Current

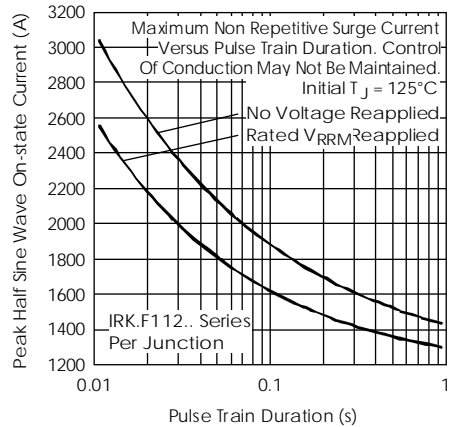


Fig. 6 - Maximum Non-Repetitive Surge Current

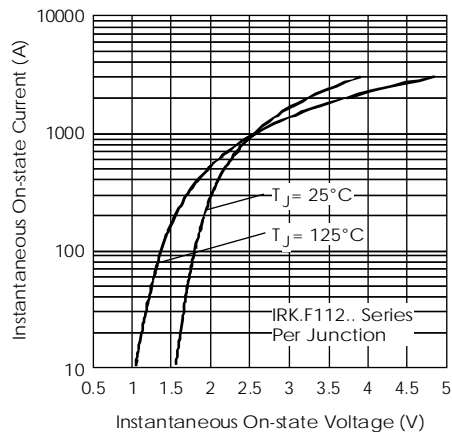


Fig. 7 - On-state Voltage Drop Characteristics

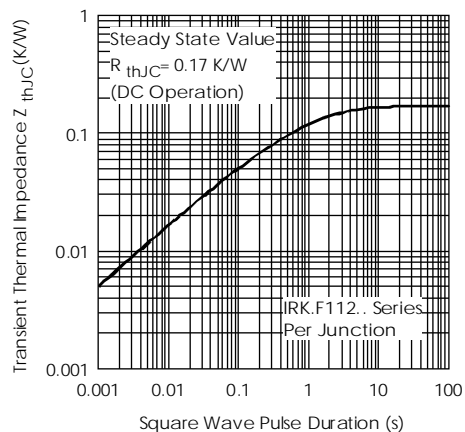


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

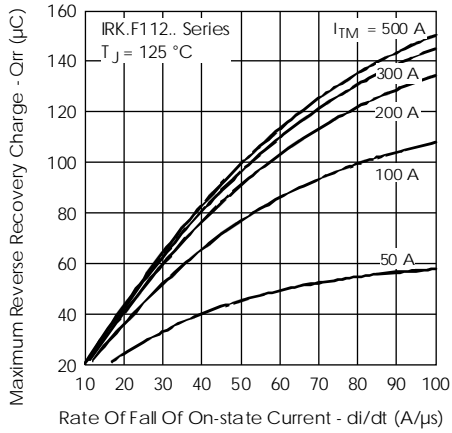


Fig. 9 - Reverse Recovery Charge Characteristics

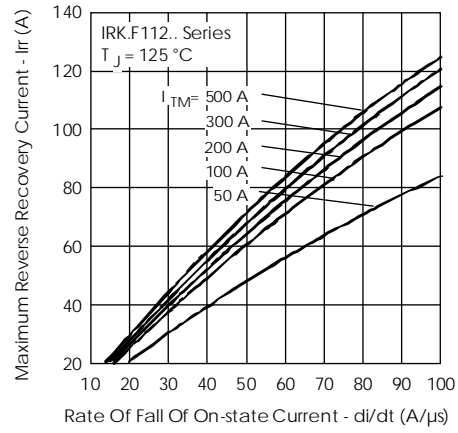


Fig. 10 - Reverse Recovery Current Characteristics

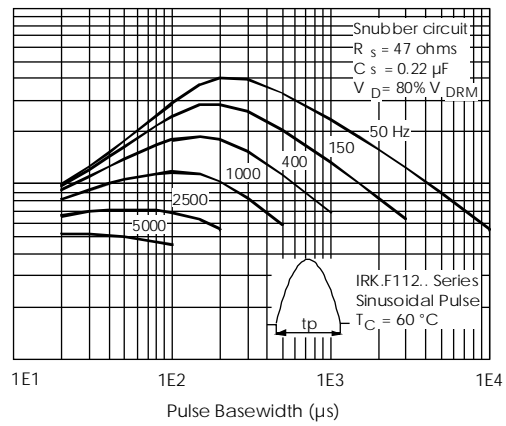
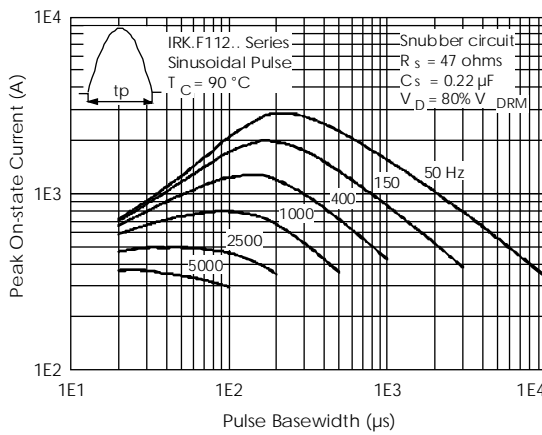


Fig. 11 - Frequency Characteristics

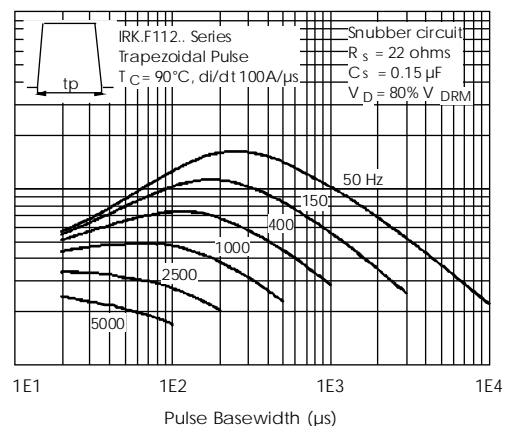
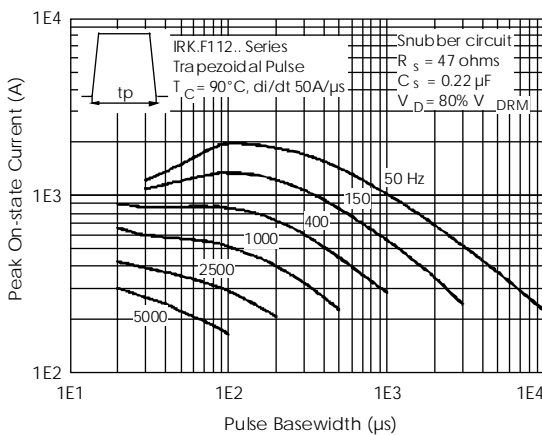


Fig. 12 - Frequency Characteristics

# IRK.F112.. Series

Bulletin I27091 rev. A 09/97

International  
**IR** Rectifier

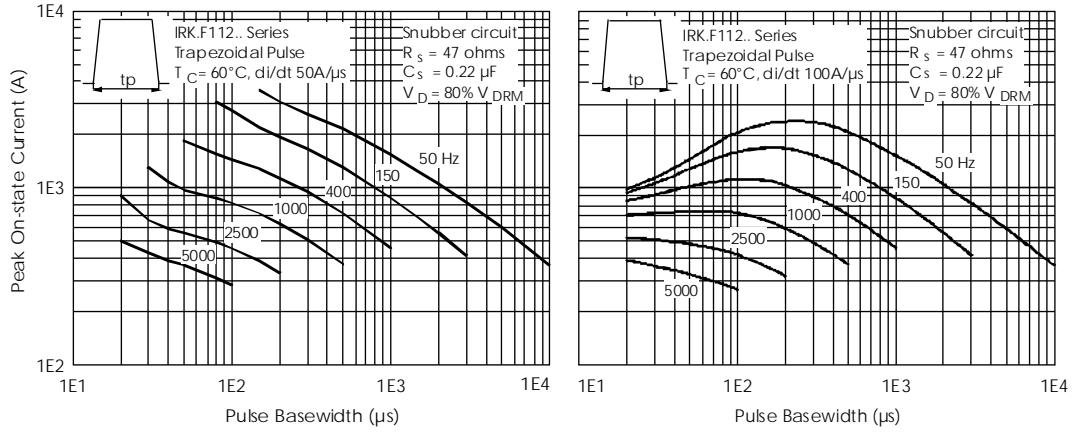


Fig. 13 - Frequency Characteristics

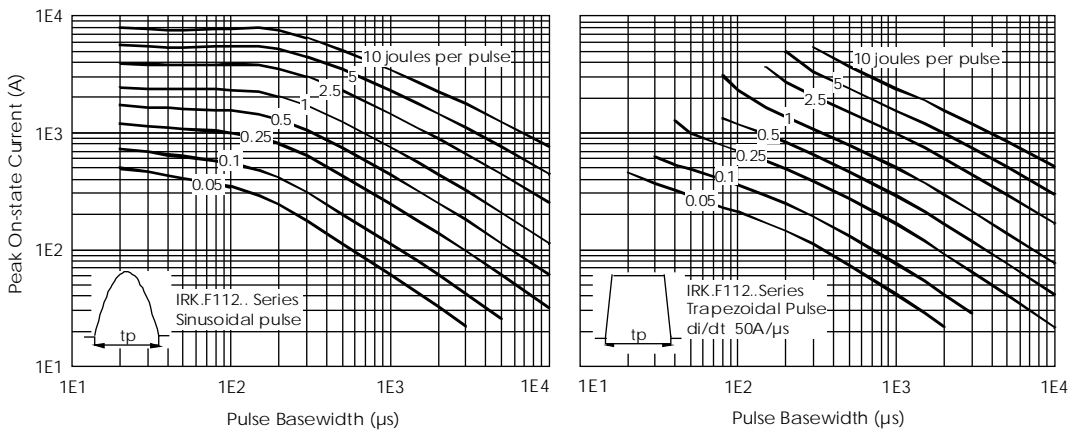


Fig. 14 - Maximum On-state Energy Power Loss Characteristics

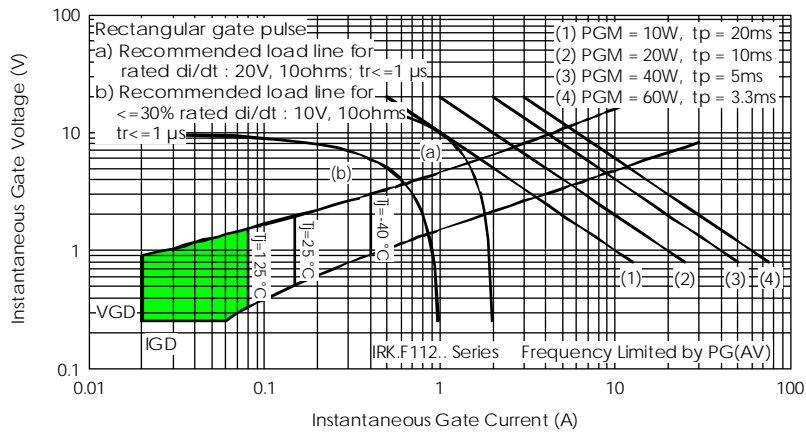


Fig. 15 - Gate Characteristics