

FAST SCR / DIODE and SCR / SCR

INT-A-PAK™ Power Modules

Features

- Fast turn-off thyristor
- Fast recovery diode
- High surge capability
- Electrically isolated baseplate
- 3000 V_{RMS} isolating voltage
- Industrial standard package

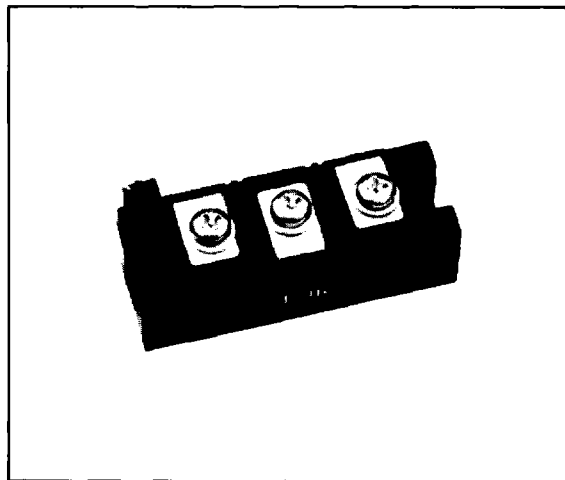
112A

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 | Value | 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 ² s |
| @ 60Hz | 43.6 | kA ² s |
| i^2/t | 478 | kA ² /s |
| V_{TM} | 1.77 | V |
| V_{RRM}/V_{DRM} | 200 to 800 | V |
| t_q range | 10 to 20 | μs |
| t_{rr} (diode) | 2 max | μs |
| T_J | -40 to 125 | °C |
| V_{INS} | 3000 | V |



ELECTRICAL SPECIFICATIONS

Voltage Ratings

| Type number (*) | Voltage code | V _{RRM} , maximum repetitive peak reverse voltage V | V _{DRM} , maximum repetitive peak off-state voltage V | I _{RRM} I _{DRM} max @125°C mA |
|----------------------|--------------|---|---|--|
| IRKT/H/L/U/V/K/NF112 | 02 | 200 | 200 | 30 |
| IRKT/H/L/U/V/K/NF112 | 04 | 400 | 400 | 30 |
| IRKT/H/L/U/V/K/NF112 | 06 | 600 | 600 | 30 |
| IRKT/H/L/U/V/K/NF112 | 08 | 800 | 800 | 30 |

(*) Refer to Ordering Information Table to complete Part number

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/µ s |
| Case temperature | 90 | 60 | 90 | 60 | 90 | 60 | °C |
| Equivalent values for RC circuit | 47Ω/0.22 µF | | 47Ω/0.22 µF | | 47Ω/0.22 µF | | |

On-state Conduction

| Parameters | Values | Units | Conditions | | | |
|---|--------|--------------------|--|----------------------------------|---|--|
| I _{T(AV)} Max. average on-state current | 112 | A | 180° sinusoidal conduction Max. case temperature T _C = 90°C | | | |
| I _{T(RMS)} Maximum RMS current | 250 | A | T _C = 90°C, as AC switch | | | |
| I _{TSM} Maximum peak one half cycle non repetitive surge current | 3090 | A | 10ms | No voltage reappplied | Sinusoidal half Wave Initial T _J = 125°C | |
| | 3237 | A | 8.3ms | | | |
| | 2600 | A | 10ms | 100% V _{RRM} reappplied | Sinusoidal half Wave Initial T _J = 125°C | |
| | 2720 | A | 8.3ms | | | |
| I ² t Maximum I ² t for fusing | 47.8 | kA ² s | 10ms | No voltage reappplied | Initial T _J = 125°C | |
| | 43.6 | kA ² s | 8.3ms | | | |
| | 33.8 | kA ² s | 10ms | 100% V _{RRM} reappplied | Initial T _J = 125°C | |
| | 30.8 | kA ² s | 8.3ms | | | |
| I ² /t Maximum I ² /t for fusing | 478 | kA ² /s | t=0 to 10ms, no voltage reappplied Initial T _J = 125°C | | | |

On-state Conduction

| Parameters | Values | Units | Conditions |
|--|--------|------------|---|
| V_{TM} Max. peak on-state voltage | 1.77 | V | $I_T = 350A$ (peak) half sine wave, $T_J = T_{Jmax}$, $t_p = 10ms$ |
| $V_{T(TO)1}$ Low level value of threshold voltage | 1.19 | V | $T_J = 125^\circ C$ ($16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$) |
| $V_{T(TO)2}$ High level value of threshold voltage | 1.43 | V | $T_J = 125^\circ C$ ($\pi \times I_{T(AV)} < I < 20 \times \pi \times I_{T(AV)}$) |
| r_{t1} Low level value of on-state slope resistance | 1.67 | m Ω | $T_J = 125^\circ C$ ($16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$) |
| r_{t2} High level value of on-state slope resistance | 1.12 | m Ω | $T_J = 125^\circ C$ ($\pi \times I_{T(AV)} < I < 20 \times \pi \times I_{T(AV)}$) |
| I_H Maximum holding current | 600 | mA | $T_J = 25^\circ C$, $I_T > 30A$ |
| I_L Latching current | 1000 | mA | $T_J = 25^\circ C$, $V_A = 12V$, $R_a = 6\Omega$, $I_g = 1A$ |

Triggering

| Parameters | Values | Units | Conditions |
|--|--------|-------|--|
| P_{GM} Maximum peak gate power | 60 | W | $f = 50$ Hz, $d\% = 50$ |
| $P_{G(AV)}$ Maximum average gate power | 10 | W | $T_J = 125^\circ C$, $f = 50$ Hz, $d\% = 50$ |
| I_{GM} Maximum peak gate current | 10 | A | $T_J = 125^\circ C$, $t_p \leq 5ms$ |
| $-V_{GM}$ Maximum peak negative gate voltage | 5 | V | $T_J = 125^\circ C$, $t_p \leq 5ms$ |
| V_{GT} Maximum gate voltage required to fire all devices | 3 | V | $T_J = 25^\circ C$, $V_A = 12V$, $R_a = 6\Omega$ |
| I_{GT} Maximum gate current required to fire all devices | 200 | mA | $T_J = 25^\circ C$, $V_A = 12V$, $R_a = 6\Omega$ |
| V_{GD} Maximum gate voltage | 0.25 | V | $T_J = 125^\circ C$, rated V_{DRM} applied |
| I_{GD} Maximum gate current that will not trigger any device | 20 | mA | $T_J = 125^\circ C$, rated V_{DRM} applied |

Blocking

| | | | |
|--|------|------------|---|
| dv/dt Maximum critical rate of rise of off-state voltage | 400 | V/ μs | $T_J = 125^\circ C$ linear to 80% V_{DRM} (*) |
| I_{RRM} I_{DRM} Max. peak reverse and off-state leakage current | 30 | mA | $T_J = 125^\circ C$ rated V_{DRM} , V_{RRM} applied |
| V_{INS} RMS isolation voltage | 3000 | V | 50 Hz, circuit to base, $T_J = 25^\circ C$, 1s |

(*) Contact factory for other selections

Switching

| | | | | | | | |
|--|-----|----|----|----|----|------------|---|
| t_q Maximum turn-off time | N | M | L | P | K | μs | $I_T = 350A$, $T_J = 125^\circ C$ $-di/dt = 25 A/\mu s$, $V_R = 50V$ $dv/dt = 50 V/\mu s$ linear to 80% V_{DRM} |
| | 10 | 12 | 15 | 18 | 20 | | |
| t_{rr} Maximum recovery time | 2 | | | | | μs | $I_T = 350A$, $-di/dt = 25 A/\mu s$, $V_R = 50V$, $T_J = 25^\circ C$ |
| di/dt Max. non-repetitive rate of rise | 800 | | | | | A/ μs | Gate drive 20V, 20 Ω , $t_r \leq 1\mu s$, $V_D = 80\% V_{DRM}$ $T_J = 125^\circ C$ |

Thermal and Mechanical Specifications

| | | | | |
|------------|---|------------|---------|--|
| T_J | Junction temperature range | -40 to 125 | °C | |
| T_{stg} | Storage temperature range | -40 to 150 | °C | |
| R_{thJC} | Internal thermal resistance, junction to case | 0.170 | K/W | DC operation per junction |
| R_{thCS} | Thermal resistance case to sink | 0.035 | K/W | Mounting surface flat and greased - Per module |
| T | Mounting torque, $\pm 10\%$ | 4 to 6 | Nm | A mounting compound is recommended. The torque should be rechecked after a period of about 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. |
| | | 35 to 53 | lb * in | |
| | | 4 to 6 | Nm | |
| | | 35 to 53 | lb * in | |
| wt | Approximate weight | 500/17.8 | g/oz | |
| | Case style | INT-A-pak | | |

ΔR Conduction (per Junction)

(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 | K/W | |
| 90° | 0.024 | 0.027 | K/W | |
| 60° | 0.036 | 0.037 | K/W | |
| 30° | 0.060 | 0.060 | K/W | |

Outline Table

(SEE TABLE) A A

CONTAINS BERYLLIUM OXIDE CERAMIC

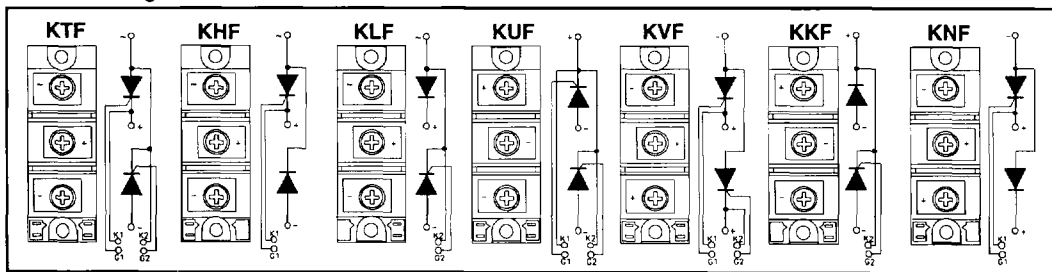
- May contain Beryllium Oxide Ceramic, and under normal circumstances is non hazardous.
- Do not open, cut or grind.
- Unserviceable parts must be disposed of as harmful waste.

HARMFUL

- All dimensions in millimetres (inches)
- Dimensions are nominal
- Full engineering drawings are available on request
- UL identification number for 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) | --- | --- |

Circuit Configuration Table



Ordering Information Table

Device Code

| | | | | | | | | |
|-----|---|---|----|---|---|----|---|---|
| IRK | T | F | 11 | 2 | - | 08 | D | M |
| ① | ② | ③ | ④ | ⑤ | | ⑥ | ⑦ | ⑧ |

- 1** - Module type
- 2** - Circuit configuration (See Circuit Configuration Table)
- 3** - Fast SCR
- 4** - Current rating: Code x 10 = $I_{T(AV)}$
- 5** - 1 = option with spacers and longer terminal screws
2 = option with standard terminal screws
- 6** - Voltage code: Code x 100 = V_{RRM}
- 7** - dv/dt code (See table)
- 8** - tq code (See table)

| |
|-------------------|
| dv/dt |
| C = 20V/ μ s |
| D = 50V/ μ s |
| E = 100V/ μ s |
| F = 200V/ μ s |
| G = 300V/ μ s |
| H = 400V/ μ s |

| |
|---------------------|
| tq |
| N \leq 10 μ s |
| M \leq 12 μ s |
| L \leq 15 μ s |
| P \leq 18 μ s |
| K \leq 20 μ s |

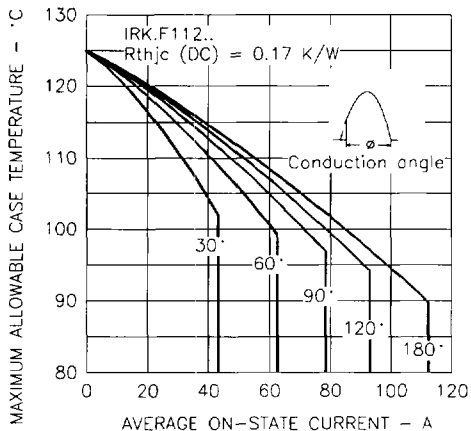


Fig. 1 - Current Ratings Characteristics

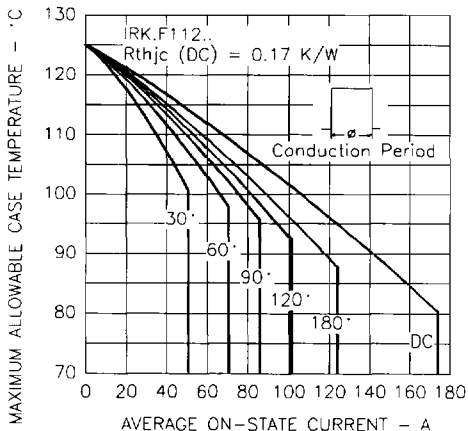


Fig. 2 - Current Ratings Characteristics

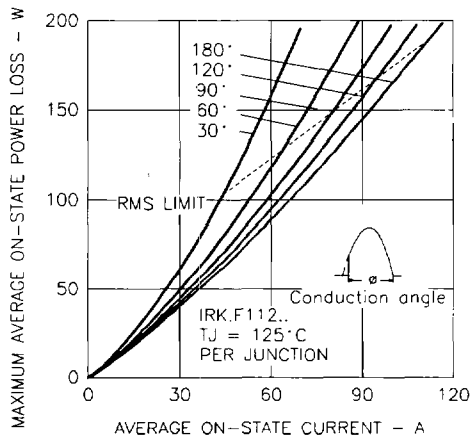


Fig. 3 - On-state Power Loss Characteristics

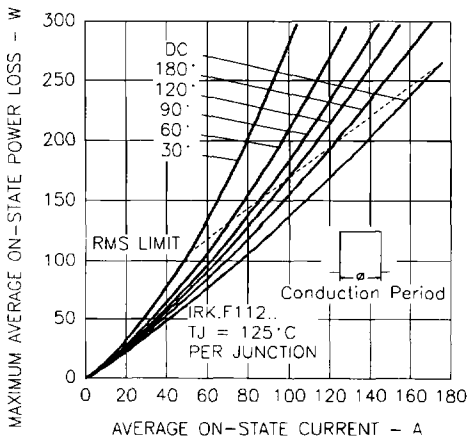


Fig. 4 - On-state Power Loss Characteristics

DATA SHEETS

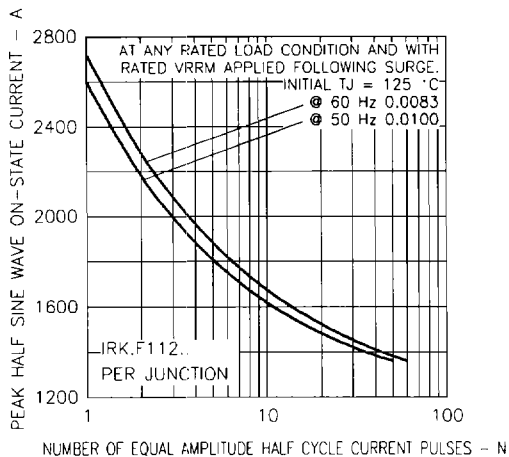


Fig. 5 - Maximum Non - Repetitive Surge

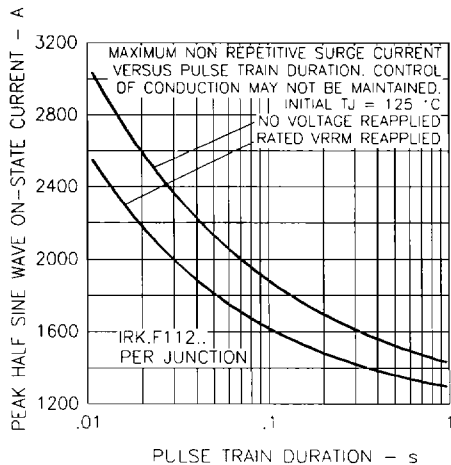


Fig. 6 - Maximum Non - Repetitive Surge

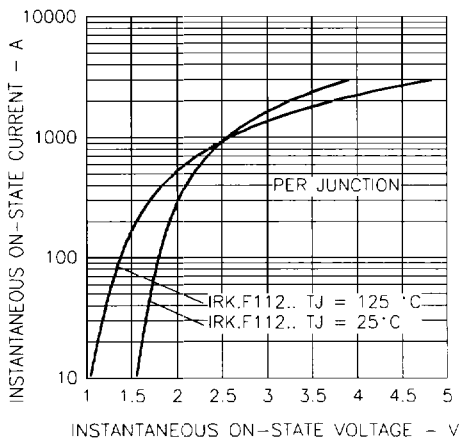


Fig. 7 - On-State Voltage Drop Characteristics

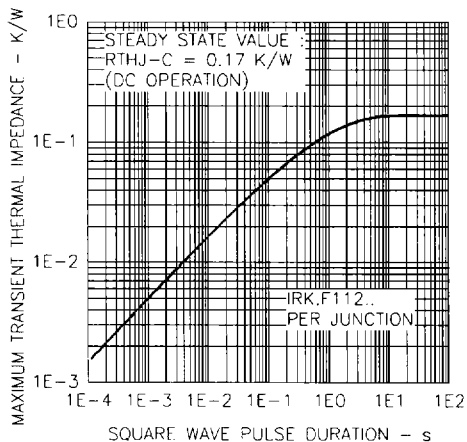


Fig. 8 - Thermal Impedance ZthJC Characteristics

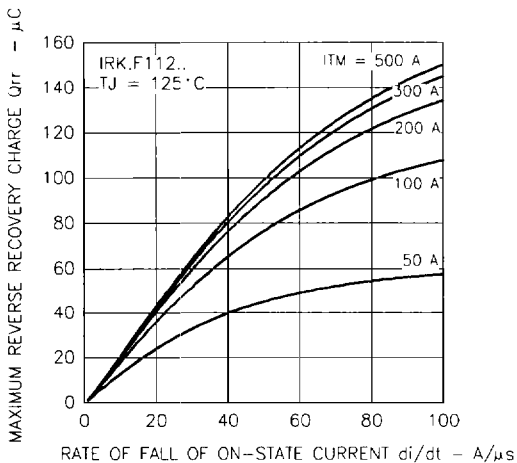


Fig. 9 - Reverse Recovery Charge Characteristics (Thyristor)

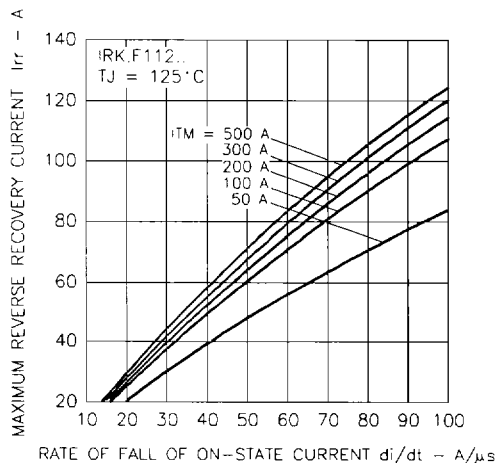


Fig. 10 - Reverse Recovery Current Characteristics (Thyristor)

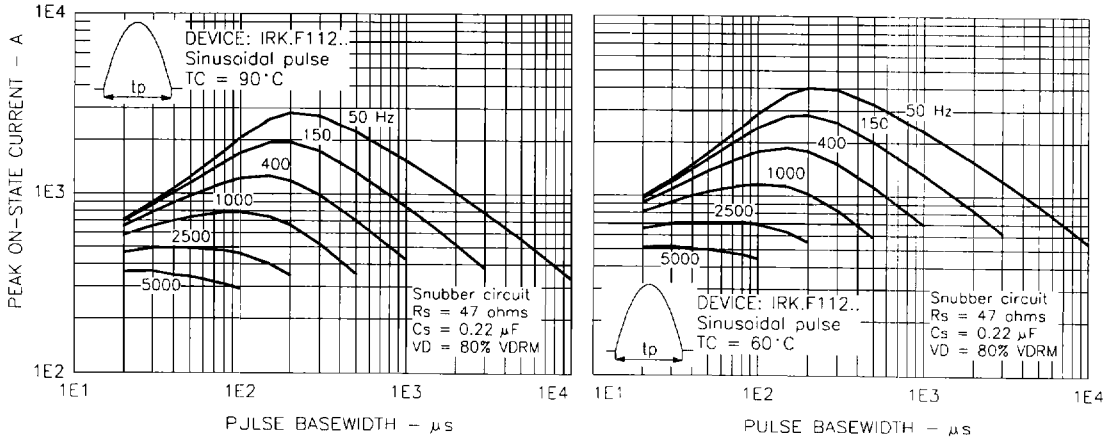


Fig. 11 - Frequency Characteristics

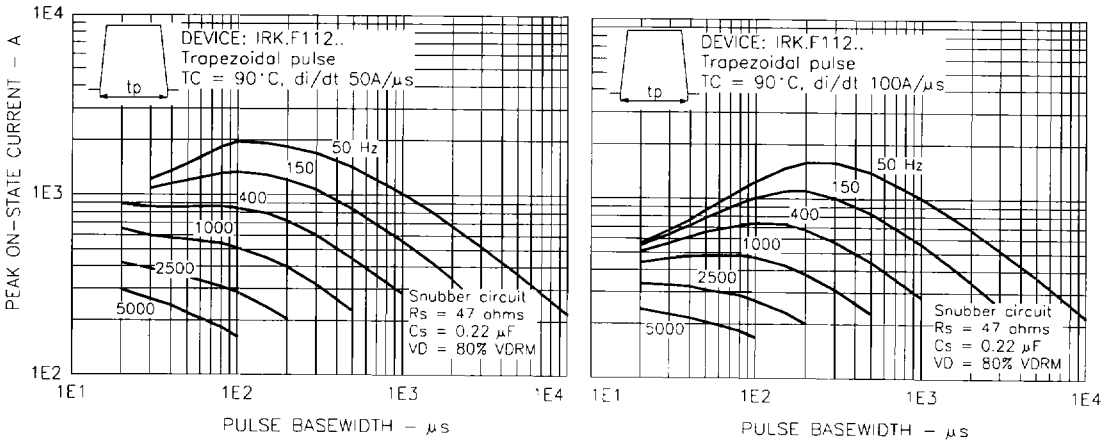


Fig. 12 - Frequency Characteristics

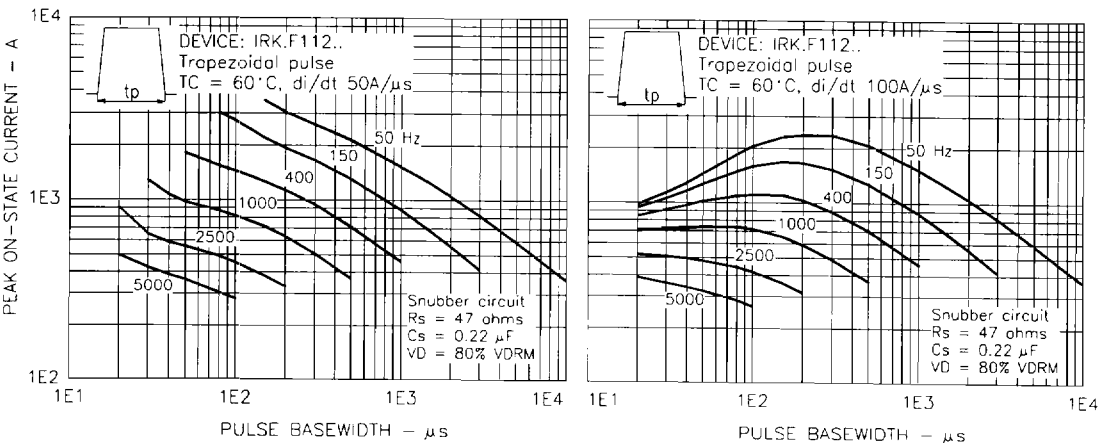


Fig. 13 - Frequency Characteristics

DATA SHEETS

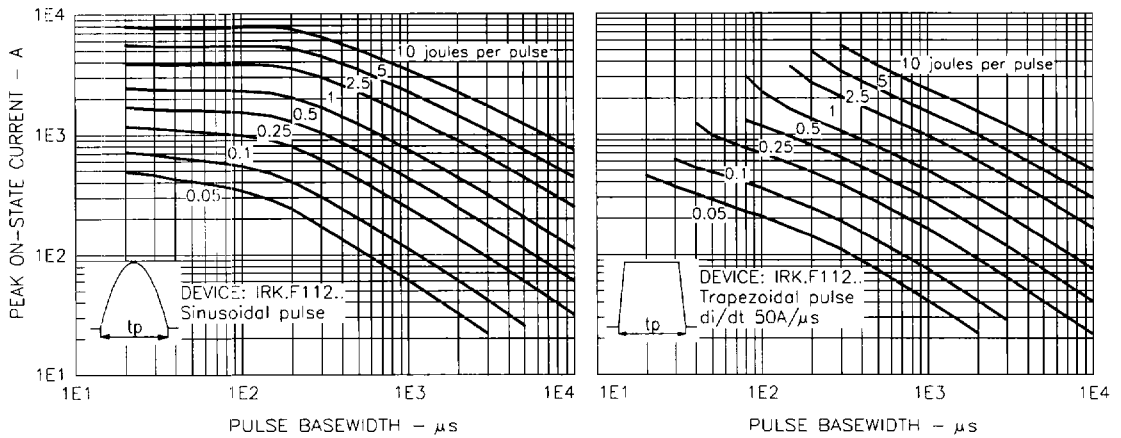


Fig. 14 - Maximum On-state Energy Power Loss Characteristics

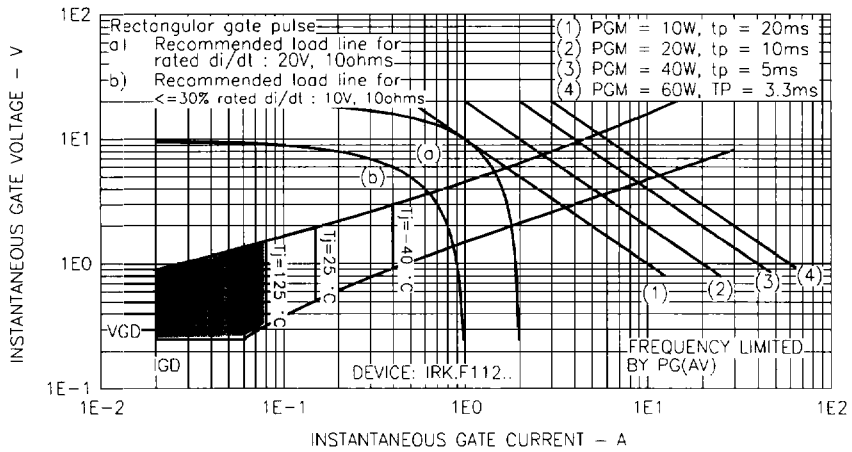


Fig. 15 - Gate Characteristics