

## IRK.F102.. 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 

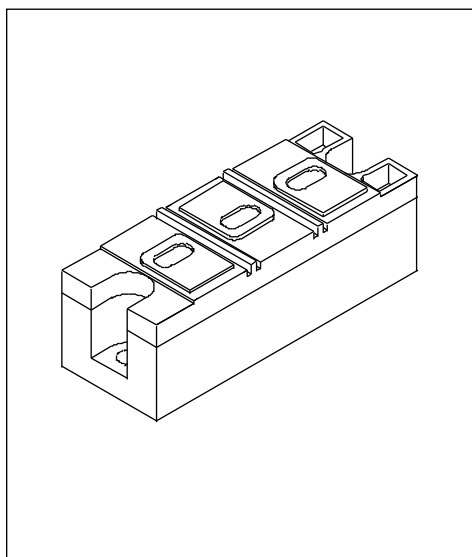
105 A

### 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.F102.. | Units              |
|-------------------|------------|--------------------|
| $I_{T(AV)}$       | 105        | A                  |
| @ $T_C$           | 90         | °C                 |
| $I_{T(RMS)}$      | 233        | A                  |
| $I_{TSM}$ @ 50Hz  | 2850       | A                  |
| @ 60Hz            | 3000       | A                  |
| $I^2t$ @ 50Hz     | 40.8       | KA <sup>2</sup> s  |
| @ 60Hz            | 37.2       | KA <sup>2</sup> s  |
| $I^2\sqrt{t}$     | 408        | KA <sup>2</sup> √s |
| $t_q$             | 20 and 25  | μs                 |
| $t_{rr}$          | 2          | μs                 |
| $V_{DRM}/V_{RRM}$ | upto 1200  | V                  |
| $T_J$ range       | -40 to 125 | °C                 |



## IRK.F102.. Series

Bulletin I27097 rev. A 09/97

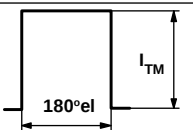
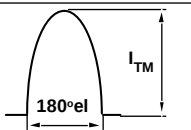
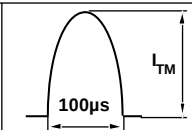
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### ELECTRICAL SPECIFICATIONS

#### 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.F102.. Series | 08           | 800                                                              | 800                                                       | 30                                                          |
|                   | 12           | 1200                                                             | 1200                                                      |                                                             |

#### Current Carrying Capacity

| Frequency f                      |  |     |  |     |  |      | Units |
|----------------------------------|-----------------------------------------------------------------------------------|-----|-----------------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------|------|-------|
| 50Hz                             | 210                                                                               | 340 | 320                                                                               | 500 | 1590                                                                                | 2210 | A     |
| 400Hz                            | 265                                                                               | 415 | 395                                                                               | 625 | 975                                                                                 | 1390 | A     |
| 2500Hz                           | 180                                                                               | 280 | 320                                                                               | 490 | 390                                                                                 | 570  | A     |
| 5000Hz                           | 145                                                                               | 230 | 260                                                                               | 380 | 260                                                                                 | 380  | A     |
| 10000Hz                          | 110                                                                               | 175 | 190                                                                               | 275 | -                                                                                   | -    | A     |
| Recovery voltage Vr              | 50                                                                                | 50  | 50                                                                                | 50  | 50                                                                                  | 50   | V     |
| Voltage before turn-on Vd        | 80%V <sub>DRM</sub>                                                               |     | 80%V <sub>DRM</sub>                                                               |     | 80%V <sub>DRM</sub>                                                                 |      | 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 | 47Ω / 0.22µF                                                                      |     | 47Ω / 0.22µF                                                                      |     | 47Ω / 0.22µF                                                                        |      |       |

#### On-state Conduction

| Parameter           |                                                       | IRK.F102.. | Units               | Conditions                                                                                            |                       |                                                      |  |
|---------------------|-------------------------------------------------------|------------|---------------------|-------------------------------------------------------------------------------------------------------|-----------------------|------------------------------------------------------|--|
| I <sub>T(AV)</sub>  | Maximum average on-state current                      | 105        | A                   | 180° conduction, half sine wave                                                                       |                       |                                                      |  |
|                     | @ Case temperature                                    | 90         | °C                  |                                                                                                       |                       |                                                      |  |
| I <sub>T(RMS)</sub> | Maximum RMS current                                   | 233        | A                   | T <sub>C</sub> = 90°C, as AC switch                                                                   |                       |                                                      |  |
| I <sub>TSM</sub>    | Maximum peak, one-cycle, non-repetitive surge current | 2850       | A                   | t = 10ms                                                                                              | No voltage            | Sinusoidal half wave, Initial T <sub>J</sub> = 125°C |  |
|                     |                                                       | t = 8.3ms  |                     | reapplied                                                                                             |                       |                                                      |  |
|                     |                                                       | t = 10ms   |                     | 100% V <sub>RRM</sub>                                                                                 |                       |                                                      |  |
|                     |                                                       | t = 8.3ms  |                     | reapplied                                                                                             |                       |                                                      |  |
| I <sup>2</sup> t    | Maximum I <sup>2</sup> t for fusing                   | 40.8       | KA <sup>2</sup> s   | t = 10ms                                                                                              | No voltage            |                                                      |  |
|                     |                                                       | 37.2       |                     | t = 8.3ms                                                                                             | reapplied             |                                                      |  |
|                     |                                                       | 28.8       |                     | t = 10ms                                                                                              | 100% V <sub>RRM</sub> |                                                      |  |
|                     |                                                       | 26.3       |                     | t = 8.3ms                                                                                             | reapplied             |                                                      |  |
| I <sup>2</sup> √t   | Maximum I <sup>2</sup> √t for fusing                  | 408        | KA <sup>2</sup> /√s | t = 0 to 10ms, no voltage reapplied                                                                   |                       |                                                      |  |
| V <sub>T(TO)1</sub> | Low level value of threshold voltage                  | 1.12       | V                   | (16.7% × π × I <sub>T(AV)</sub> ) < I < π × I <sub>T(AV)</sub> , T <sub>J</sub> = T <sub>J</sub> max. |                       |                                                      |  |
| V <sub>T(TO)2</sub> | High level value of threshold voltage                 | 1.28       |                     | (I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> max.                                   |                       |                                                      |  |
| r <sub>t1</sub>     | Low level value of on-state slope resistance          | 2.43       | mW                  | (16.7% × π × I <sub>T(AV)</sub> ) < I < π × I <sub>T(AV)</sub> , T <sub>J</sub> = T <sub>J</sub> max. |                       |                                                      |  |
| r <sub>t2</sub>     | High level value of on-state slope resistance         | 2.00       |                     | (I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> max.                                   |                       |                                                      |  |
| V <sub>TM</sub>     | Maximum on-state voltage drop                         | 1.97       | V                   | I <sub>pk</sub> = 350A, T <sub>J</sub> = T <sub>J</sub> max., t <sub>p</sub> = 10ms sine pulse        |                       |                                                      |  |
| I <sub>H</sub>      | Maximum holding current                               | 600        | mA                  | T <sub>J</sub> = 25°C, I <sub>T</sub> > 30 A                                                          |                       |                                                      |  |
| I <sub>L</sub>      | Typical latching current                              | 1000       | mA                  | T <sub>J</sub> = 25°C, V <sub>A</sub> = 12V, R <sub>a</sub> = 6Ω, I <sub>g</sub> = 1A                 |                       |                                                      |  |

### Switching

| Parameter                                 | IRK.F102.. | 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> = 25°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      | K          | J     | 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> |
|                                           | 20         | 25    |                                                                                                                                          |

### Blocking

| Parameter                                                                               | IRK.F102.. | 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>RRM</sub> Maximum peak reverse and off-state leakage current<br>I <sub>DRM</sub> | 30         | mA    | T <sub>J</sub> = 125°C, rated V <sub>DRM</sub> /V <sub>RRM</sub> applied |

### Triggering

| Parameter                                                | IRK.F102.. | Units | Conditions                                             |
|----------------------------------------------------------|------------|-------|--------------------------------------------------------|
| P <sub>GM</sub> Maximum peak gate power                  | 40         | W     | f = 50 Hz, d% = 50                                     |
| P <sub>G(AV)</sub> Maximum peak average gate power       | 2          | W     | T <sub>J</sub> = 125°C, f = 50Hz, d% = 50              |
| I <sub>GM</sub> Maximum peak positive gate current       | 5          | 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.F102..      | 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   | 0.25            | 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) | 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 |
|                                                               | busbar to IAP   | 4 - 6 (35 - 53) |                                                                                                                                                                                                                                                                                 |
| wt Approximate weight                                         | 500 (17.8)      | g (oz)          |                                                                                                                                                                                                                                                                                 |

## IRK.F102.. Series

Bulletin I27097 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°             | 0.016                 | 0.011                  | K/W   | $T_J = 125^\circ\text{C}$ |
| 120°             | 0.019                 | 0.020                  |       |                           |
| 90°              | 0.024                 | 0.026                  |       |                           |
| 60°              | 0.035                 | 0.037                  |       |                           |
| 30°              | 0.060                 | 0.060                  |       |                           |

### Ordering Information Table

| Device Code |                                                                                                  |   |    |   |   |    |   |   |   |
|-------------|--------------------------------------------------------------------------------------------------|---|----|---|---|----|---|---|---|
| IRK         | T                                                                                                | F | 10 | 2 | - | 08 | H | L | N |
| ①           | ②                                                                                                | ③ | ④  | ⑤ |   | ⑥  | ⑦ | ⑧ | ⑧ |
| 1           | - Module type                                                                                    |   |    |   |   |    |   |   |   |
| 2           | - Circuit configuration                                                                          |   |    |   |   |    |   |   |   |
| 3           | - Fast SCR                                                                                       |   |    |   |   |    |   |   |   |
| 4           | - Current rating: $I_{T(AV)} \times 10$ rounded                                                  |   |    |   |   |    |   |   |   |
| 5           | - 1 = option with spacers and longer terminal screws<br>2 = option with standard terminal screws |   |    |   |   |    |   |   |   |
| 6           | - Voltage code: Code $\times 100 = V_{RRM}$ (See Voltage Ratings Table)                          |   |    |   |   |    |   |   |   |
| 7           | - dv/dt code: $H \leq 400\text{V}/\mu\text{s}$                                                   |   |    |   |   |    |   |   |   |
| 8           | - $t_q$ code: $K \leq 20\mu\text{s}$<br>$J \leq 25\mu\text{s}$                                   |   |    |   |   |    |   |   |   |
| 9           | - None = Standard devices<br>N = Aluminum nitride substrate                                      |   |    |   |   |    |   |   |   |

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

Outline Table

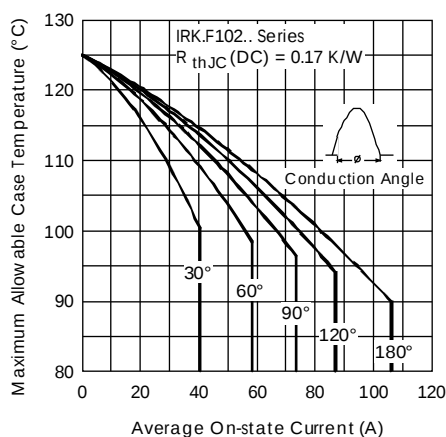
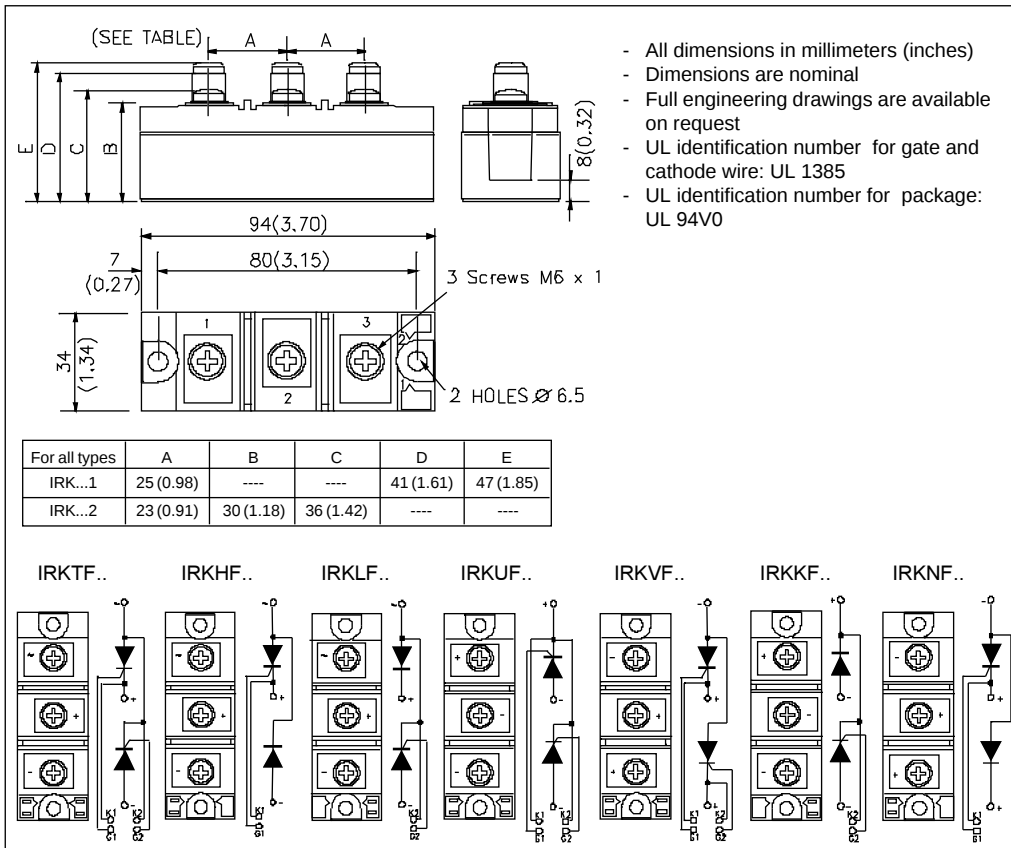


Fig. 1 - Current Ratings Characteristics

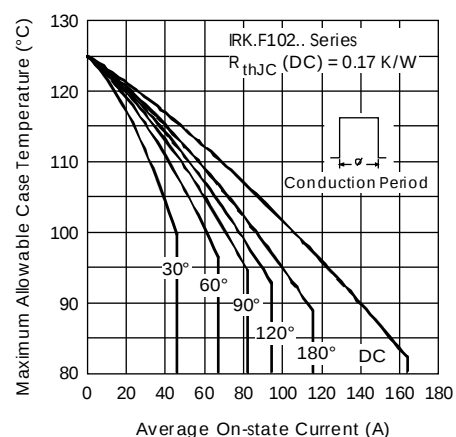


Fig. 2 - Current Ratings Characteristics

## IRK.F102.. Series

Bulletin I27097 rev. A 09/97

International  
**IR** Rectifier

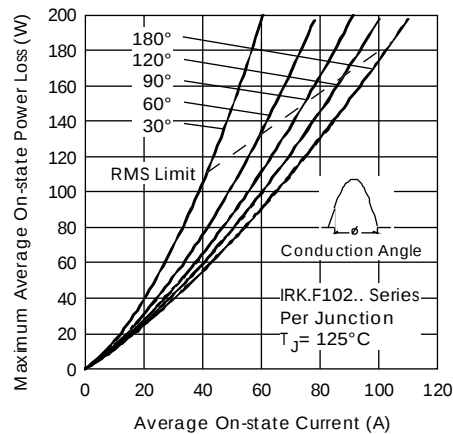


Fig. 3 - On-state Power Loss Characteristics

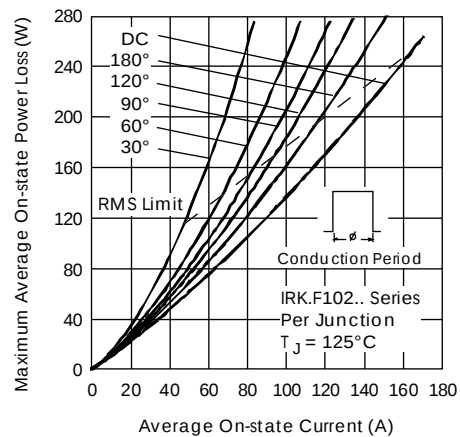


Fig. 4 - On-state Power Loss Characteristics

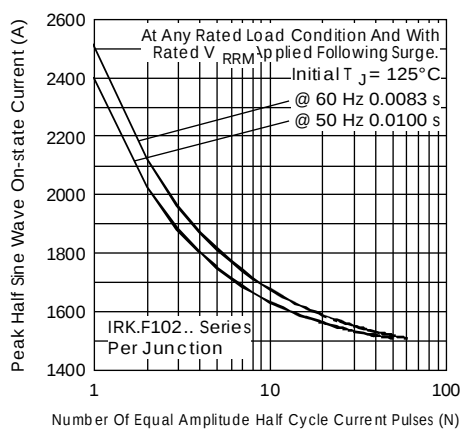


Fig. 5 - Maximum Non-Repetitive Surge Current

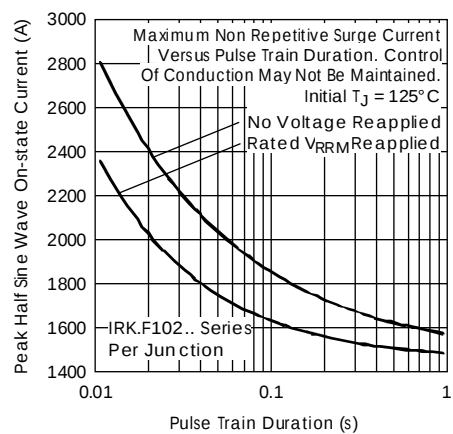


Fig. 6 - Maximum Non-Repetitive Surge Current

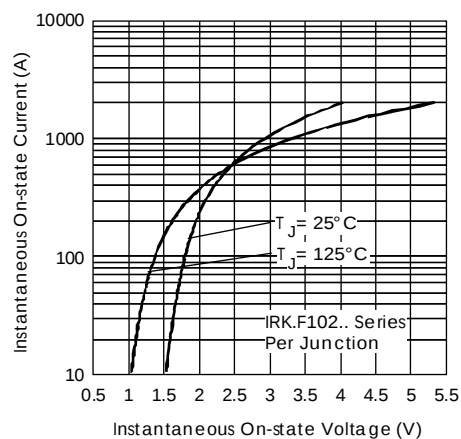


Fig. 7 - On-state Voltage Drop Characteristics

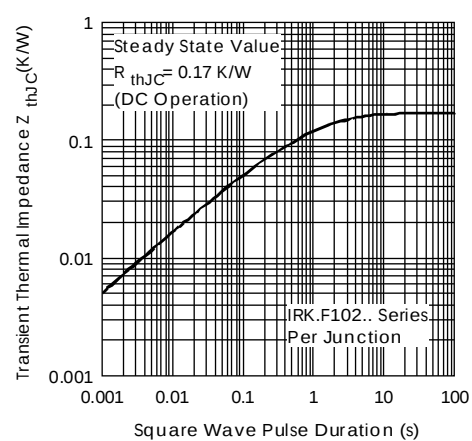


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

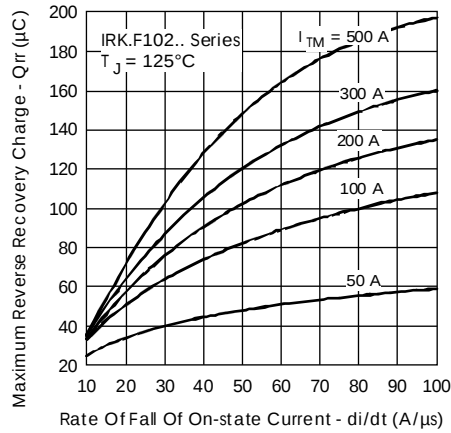


Fig. 9 - Reverse Recovery Charge Characteristics

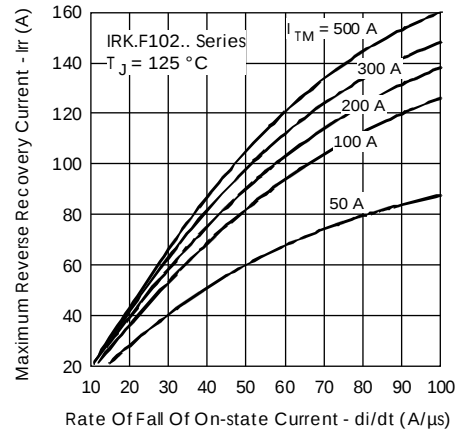


Fig. 10 - Reverse Recovery Current Characteristics

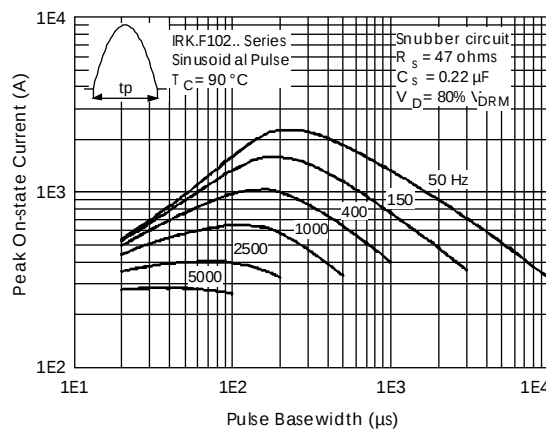


Fig. 11 - Frequency Characteristics

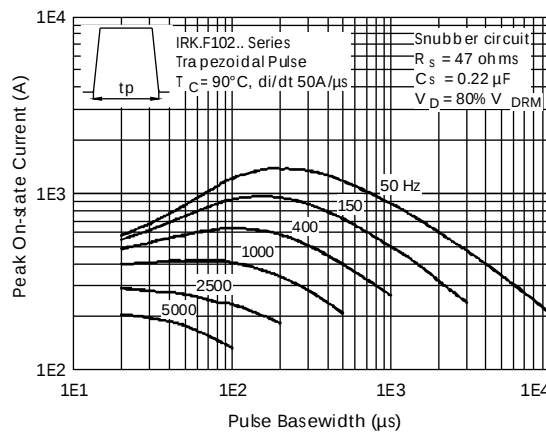
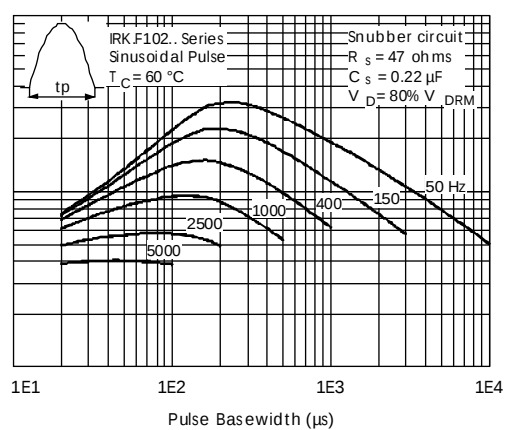
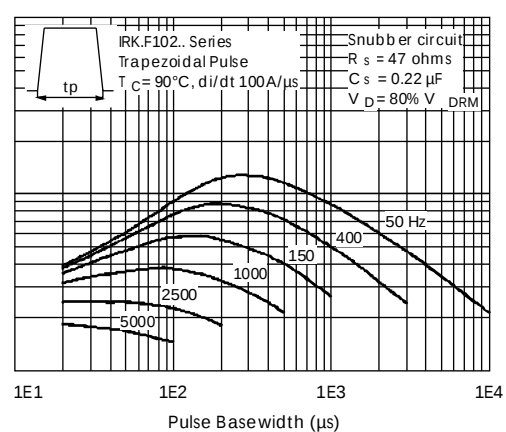


Fig. 12 - Frequency Characteristics



## IRK.F102.. Series

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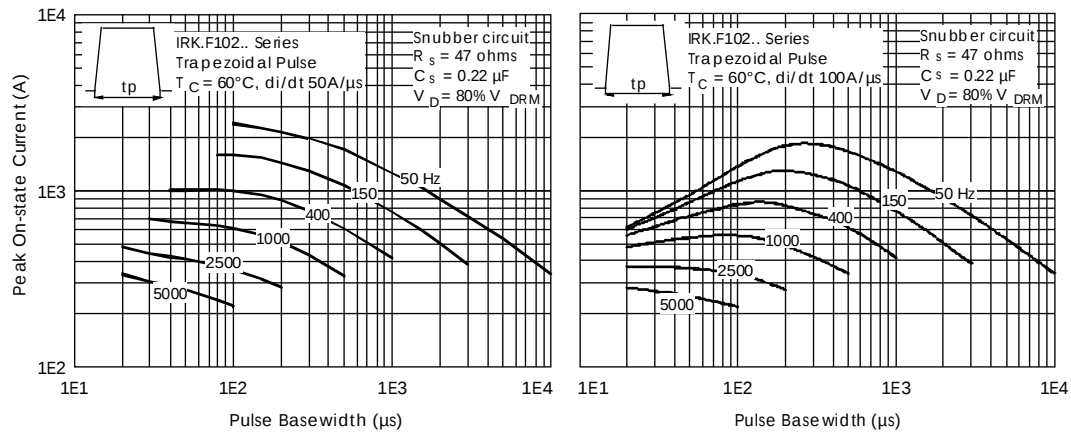


Fig. 13 - Frequency Characteristics

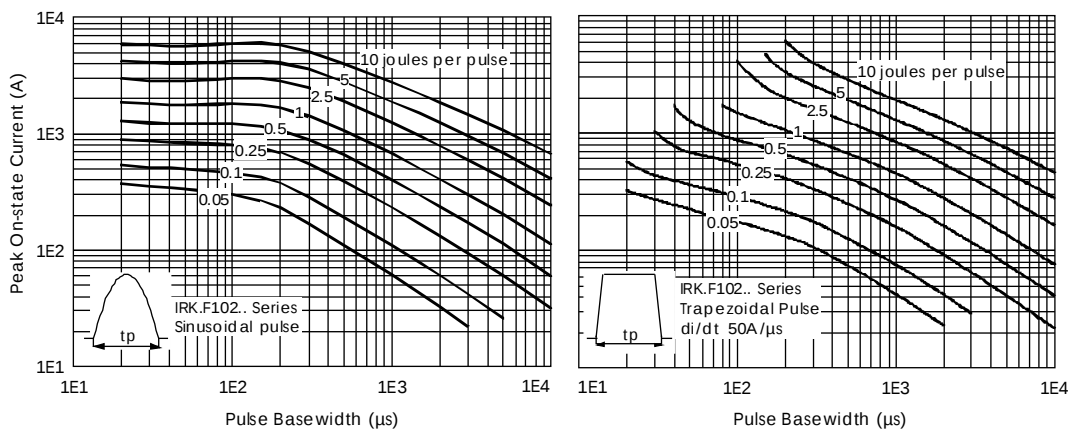


Fig. 14 - Maximum On-state Energy Power Loss Characteristics

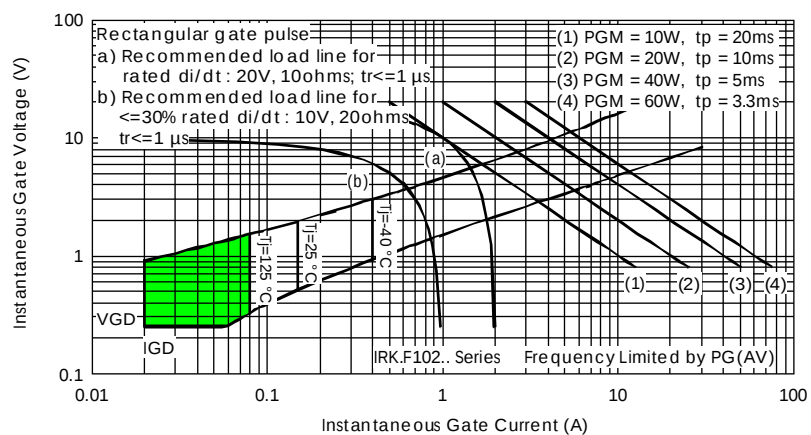


Fig. 15 - Gate Characteristics