Bulletin I27090 rev. C 05/02

International
IOR Rectifier

# IRK. SERIES

**STANDARD RECOVERY DIODES** **MAGN-A-pak™ Power Modules**

## Features

- High voltage
- Electrically isolated base plate
- 3000 $V_{RMS}$ isolating voltage
- Industrial standard package
- Simplified mechanical designs, rapid assembly
- High surge capability
- Large creepage distances
- UL E78996 approved

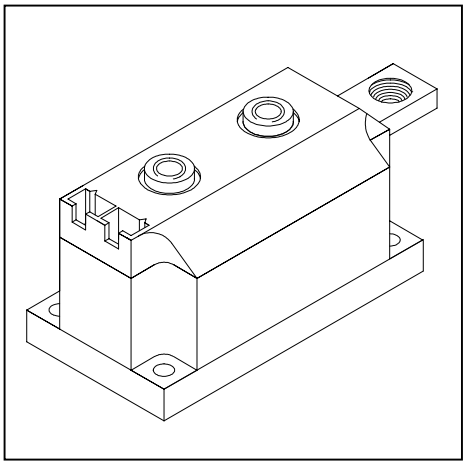
250A
270A
320A

## Description

This new IRK series of MAGN-A-paks uses high voltage power diodes in two basic configurations. The semiconductors are electrically isolated from the metal base , allowing common heatsinks and compact assemblies to be built. They can be interconnected to form single phase or three phase bridges and the single diode module can be used in conjunction with the thyristor modules as a freewheel diode. These modules are intended for general purpose applications such as battery chargers, welders and plating equipment and where high voltage and high current are required (motor drives, etc.).

## Major Ratings and Characteristics

| Parameters | | IRK.250.. | IRK.270.. | IRK.320.. | Units |
|---|---|---|---|---|---|
| $I_{F(AV)}$ | | 250 | 270 | 320 | A |
| | @ $T_C$ | 100 | 100 | 100 | °C |
| $I_{F(RMS)}$ | | 393 | 424 | 502 | A |
| $I_{FSM}$ | @ 50Hz | 7015 | 8920 | 10110 | A |
| | @ 60Hz | 7345 | 9430 | 10580 | A |
| $I^2t$ | @ 50Hz | 246 | 398 | 511 | $KA^2s$ |
| | @ 60Hz | 225 | 363 | 466 | $KA^2s$ |
| $I^2\sqrt{t}$ | | 2460 | 3980 | 5110 | $KA^2\sqrt{s}$ |
| $V_{RRM}$ | | Up to 2000 | Up to 3000 | Up to 2000 | V |
| $T_J$ | | -40 to 150 | | | °C |



## ELECTRICAL SPECI ICATIONS

### Voltage Ratings

| Type number | Voltage Code | $V_{RRM}$ , Maximum repetitive peak reverse voltage V | $V_{RSM}$ , Maximum non-repetitive peak reverse voltage V | $I_{RRM}$ Max @ 150°C m A |
|---|---|---|---|---|
| IRK.250- | 04 | 400 | 500 | 50 |
| IRK.270- | 08 | 800 | 900 | |
| IRK.320- | 12 | 1200 | 1300 | |
| | 16 | 1600 | 1700 | |
| | 20 | 2000 | 2100 | |
| IRK.320- | 24 | 2400 | 2500 | 50 |
| | 30 | 3000 | 3100 | |

### Forward Conduction

| | Parameters | IRK.250 | IRK.270 | IRK.320 | Units | Conditions | | |
|---|---|---|---|---|---|---|---|---|
| $I_{F(AV)}$ | Maximum average forward current | 250 | 270 | 320 | A | 180° conduction, half sine wave | | |
| | @ Case temperature | 100 | 100 | 100 | °C | | | |
| $I_{F(RMS)}$ | Maximum RMS forward current | 393 | 424 | 502 | A | as AC switch | | |
| $I_{FSM}$ | Maximum peak, one-cycle forward, non-repetitive surge current | 7015 | 8920 | 10110 | A | t = 10ms | No voltage | Sinusoidal half wave, Initial $T_J = T_J$ max |
| | | 7345 | 9340 | 10580 | | t = 8.3ms | reapplied | |
| | | 5900 | 7500 | 8500 | | t = 10ms | 100% $V_{RRM}$ | |
| | | 6180 | 7850 | 8900 | | t = 8.3ms | reapplied | |
| $I^2t$ | Maximum $I^2t$ for fusing | 246 | 398 | 511 | $KA^2s$ | t = 10ms | No voltage | |
| | | 225 | 363 | 466 | | t = 8.3ms | reapplied | |
| | | 174 | 281 | 361 | | t = 10ms | 100% $V_{RRM}$ | |
| | | 159 | 257 | 330 | | t = 8.3ms | reapplied | |
| $I^2\sqrt{t}$ | Maximum $I^2\sqrt{t}$ for fusing | 2460 | 3980 | 5110 | $KA^2\sqrt{s}$ | t = 0.1 to 10ms, no voltage reapplied | | |
| $V_{F(TO)1}$ | Low level val. of threshold voltage | 0.79 | 0.74 | 0.69 | V | $(16.7\% \times \pi \times I_{F(AV)} < I < \pi \times I_{FAV})$, $T_J = T_J$ max. | | |
| $V_{F(TO)2}$ | High level val. of threshold voltage | 0.92 | 0.87 | 0.86 | V | $(I > \pi \times I_{F(AV)})$, $T_J = T_J$ max. | | |
| $r_{t1}$ | Low level forward slope resistance | 0.63 | 0.94 | 0.59 | mΩ | $(16.7\% \times \pi \times I_{F(AV)} < I < \pi \times I_{F(AV)})$ $T_J = T_J$ max. | | |
| $r_{t2}$ | High level forward slope resistance | 0.49 | 0.81 | 0.44 | mΩ | $(I > \pi \times I_{F(AV)})$, $T_J = T_J$ max. | | |
| $V_{FM}$ | Maximum forward voltage drop | 1.29 | 1.48 | 1.28 | V | $I_{FM} = \pi \times I_{F(AV)}$, $T_J = T_J$ max., 180° conduction<br>Av. power = $V_{F(TO)} \times I_{F(AV)} + r_f \times (I_{F(RMS)})^2$ | | |

### Blocking

| | Parameter | IRK.250/.270/.320 | Units | Conditions |
|---|---|---|---|---|
| $I_{RRM}$ | Max. peak reverse leakage current | 50 | mA | $T_J$ = 150°C |
| $V_{INS}$ | RMS isolation voltage | 3000 | V | 50Hz, circuit to base, all terminals shorted, t =1sec |

## Thermal and Mechanical Specifications

| | Parameter | IRK.250 / .270 / .320 | Units | Conditions |
|---|---|---|---|---|
| $T_J$ | Max. junction operating temperature range | -40 to 150 | °C | |
| $T_{stg}$ | Max. storage temperature range | -40 to 150 | °C | |
| $R_{thJC}$ | Max. thermal resistance, junction to case | 0.16 0.125 0.125 | K/W | Per junction, DC operation |
| $R_{thCS}$ | Max. thermal resistance, case to heatsink | 0.035 | K/W | Mounting surface flat, smooth and greased Per module |
| T | Mounting torque ±10% MAP to heatsink | 4 to 6 | Nm | A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound |
| | busbar to MAP | 8 to 10 | | |
| wt | Approximate weight | 800 (30) | g (oz) | |

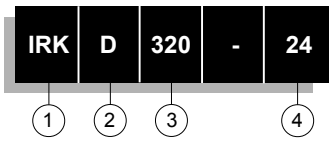
## ΔR Conduction (per Junction)

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

| Devices | Sinusoidal conduction @ $T_J$ max. | | | | | Rectangular conduction @ $T_J$ max. | | | | | Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 180° | 120° | 90° | 60° | 30° | 180° | 120° | 90° | 60° | 30° | |
| IRK.250- | 0.009 | 0.010 | 0.014 | 0.020 | 0.032 | 0.007 | 0.011 | 0.015 | 0.021 | 0.033 | K/W |
| IRK.270- | 0.008 | 0.012 | 0.014 | 0.020 | 0.032 | 0.007 | 0.011 | 0.015 | 0.020 | 0.033 | |
| IRK.320- | 0.008 | 0.010 | 0.013 | 0.020 | 0.032 | 0.007 | 0.011 | 0.015 | 0.020 | 0.033 | |

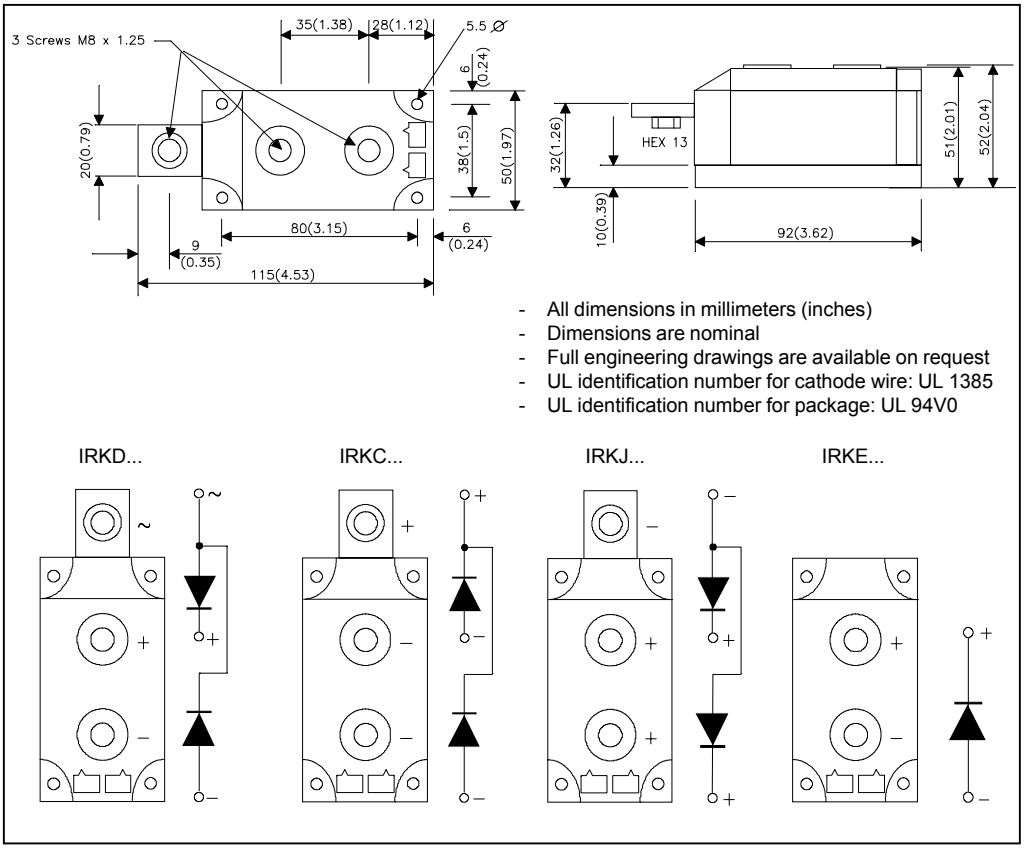
## Ordering Information Table

**De e Code**




**1** - Module type
**2** - Circuit configuration
**3** - Current rating: $I_{F(AV)}$ x 10 rounded
**4** - Voltage code: Code x 100 = $V_{RRM}$ (see Voltage Rating Table)

Outline Table



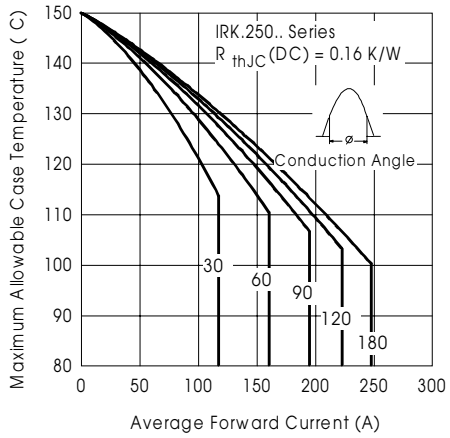




Fig. 1 - Current Ratings Characteristics

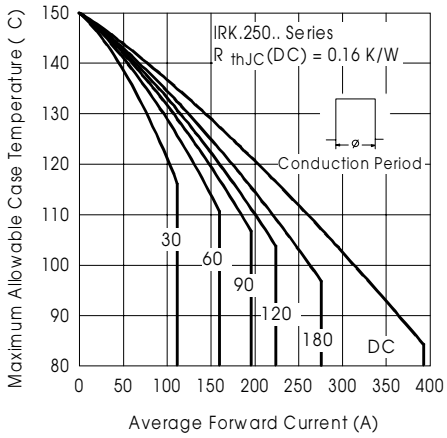



Fig. 2 - Current Ratings Characteristics

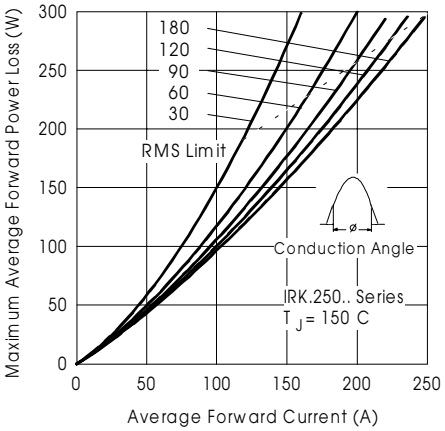



Fig. 3 - Forward Power Loss Characteristics

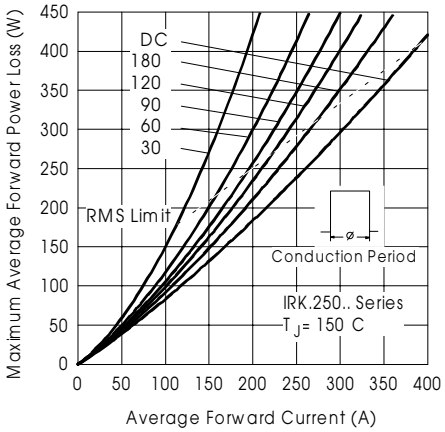



Fig. 4 - Forward Power Loss Characteristics

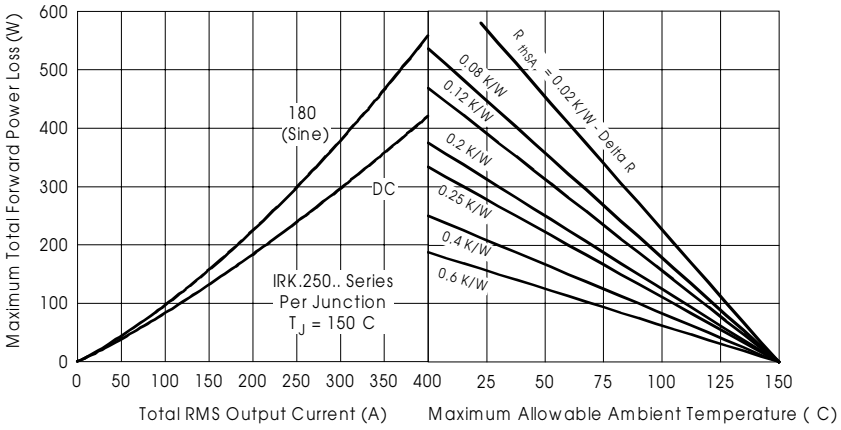



Fig. 5 - Forward Power Loss Characteristics

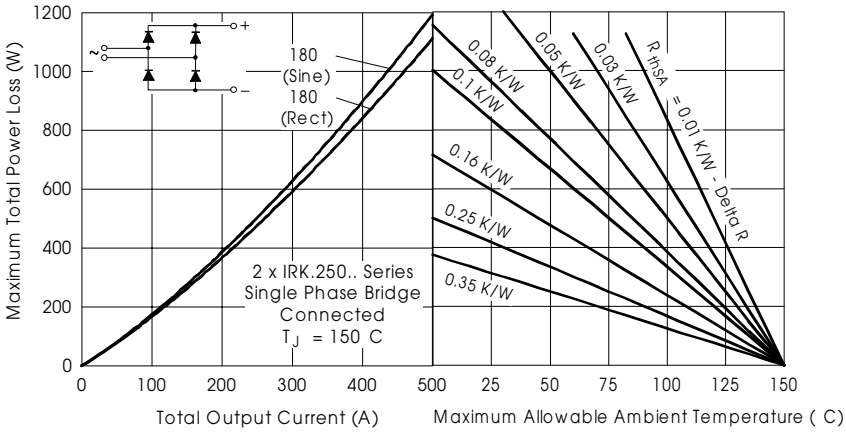



Fig. 6 - Forward Power Loss Characteristics

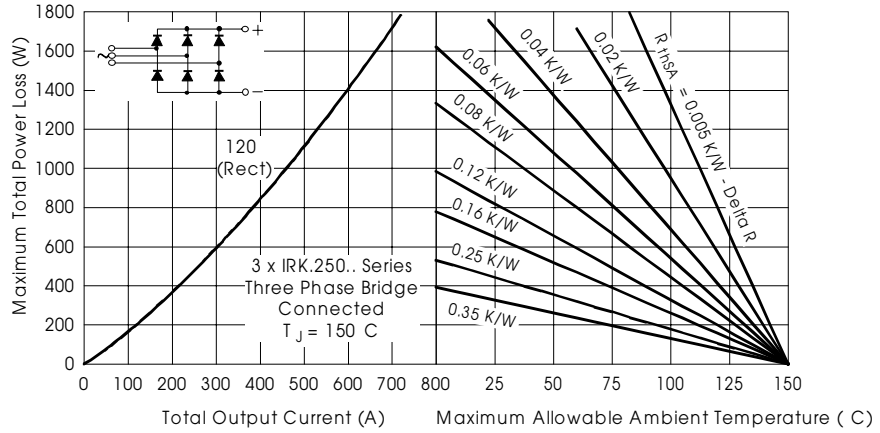



Fig. 7 - Forward Power Loss Characteristics

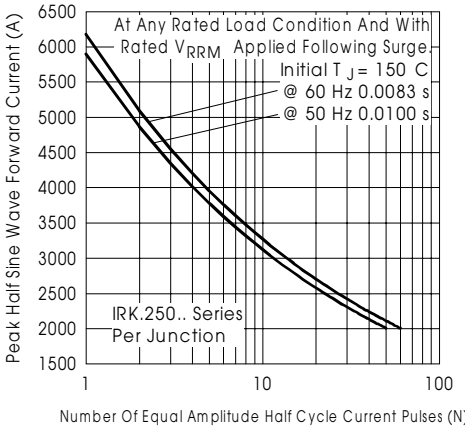



Fig. 8 - Maximum Non-Repetitive Surge Current

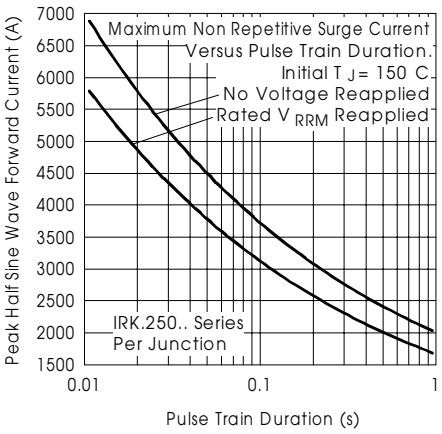



Fig. 9 - Maximum Non-Repetitive Surge Current

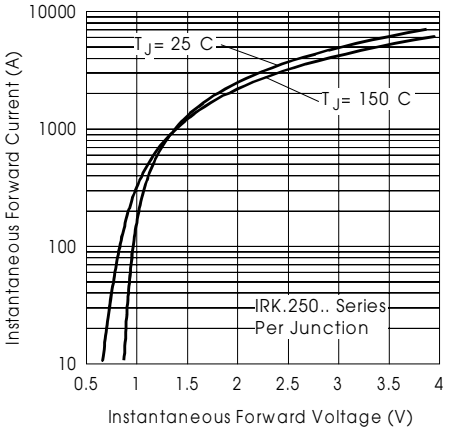



Fig. 10 - Forward Voltage Drop Characteristics

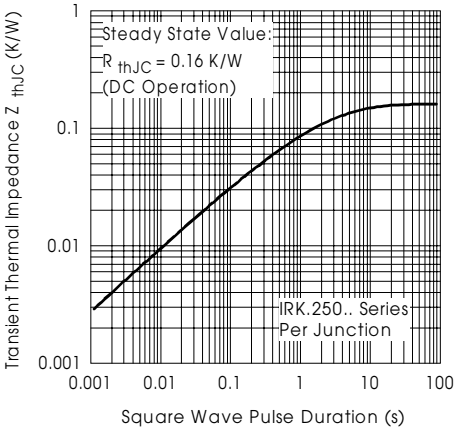



Fig. 11 - Thermal Impedance $Z_{thJC}$ Characteristics

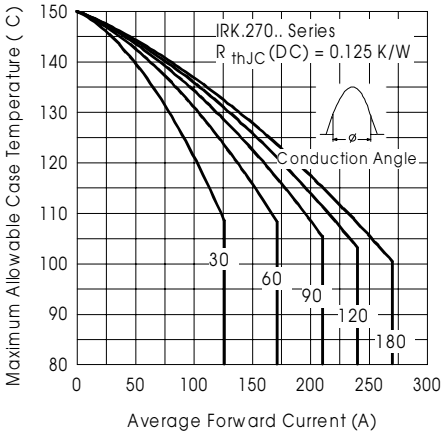



Fig. 12 - Current Ratings Characteristics

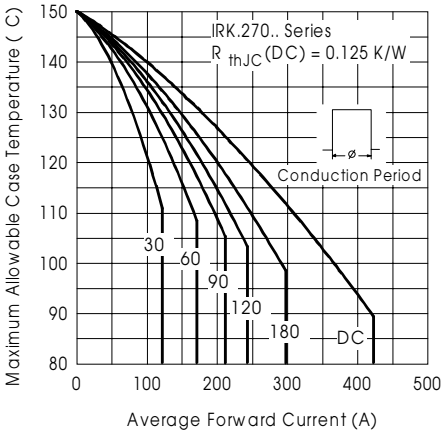



Fig. 13 - Current Ratings Characteristics

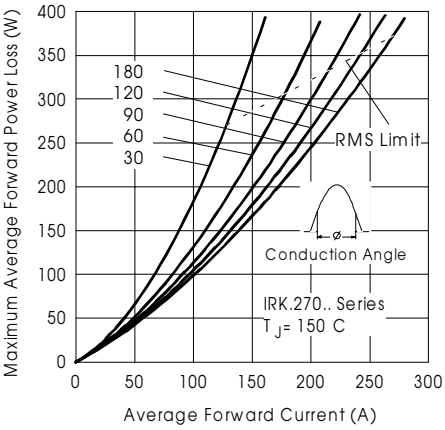



Fig. 14 - Forward Power Loss Characteristics

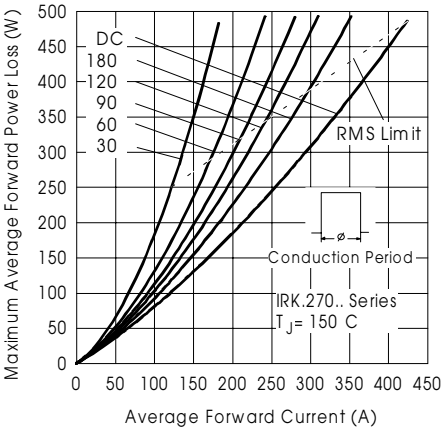



Fig. 15 - Forward Power Loss Characteristics

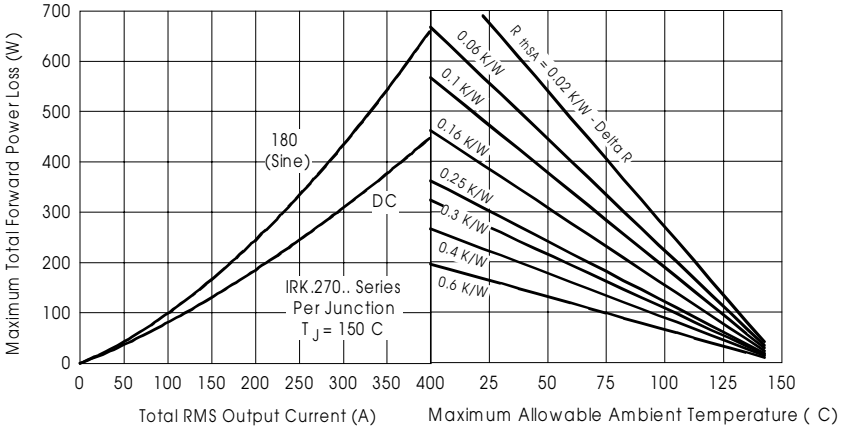



Fig. 16 - Forward Power Loss Characteristics

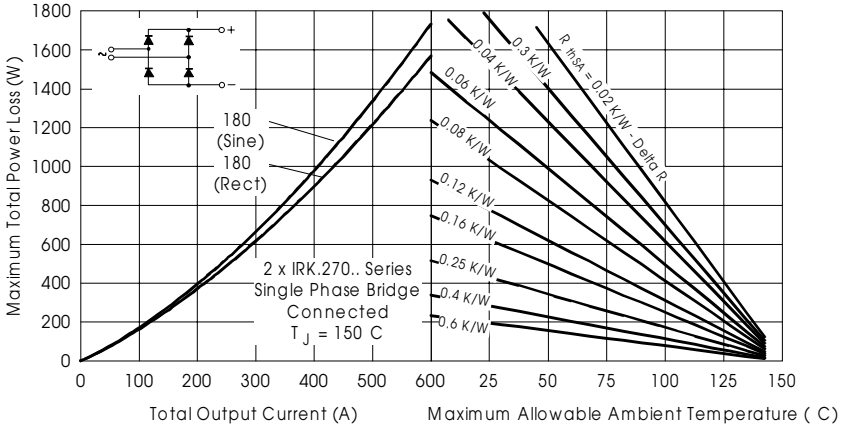



Fig. 17 - Forward Power Loss Characteristics

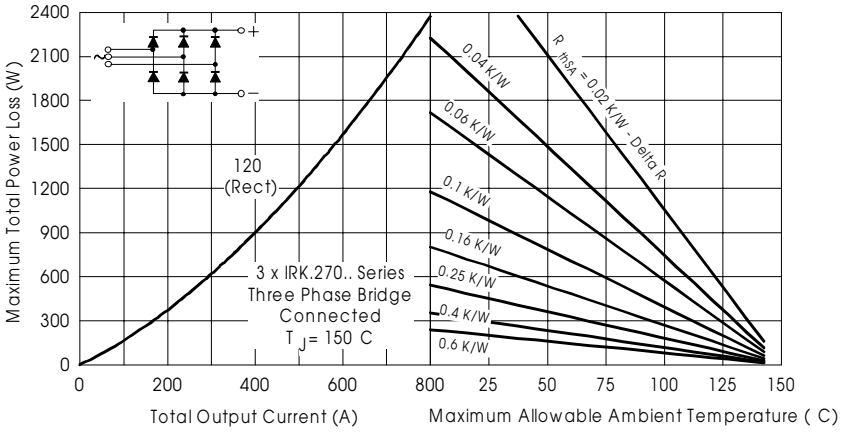



Fig. 18 - Forward Power Loss Characteristics

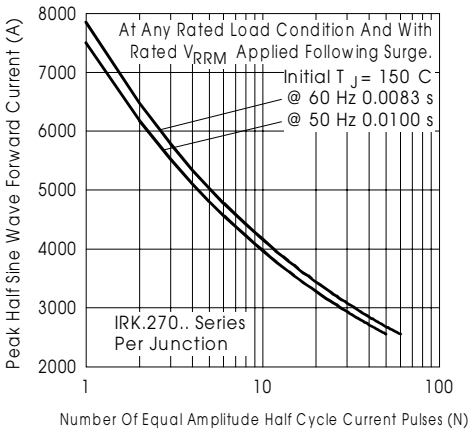



Fig. 19 - Maximum Non-Repetitive Surge Current

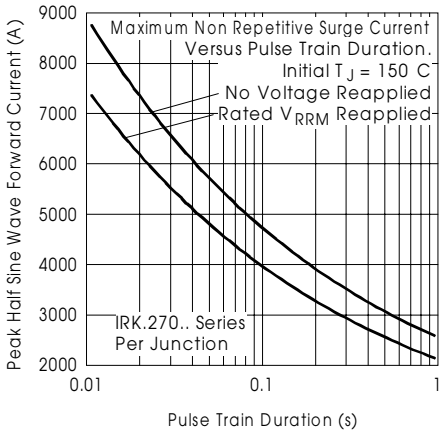



Fig. 20 - Maximum Non-Repetitive Surge Current

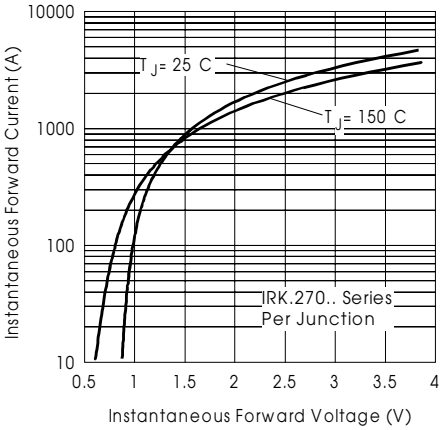



Fig. 21 - Forward Voltage Drop Characteristics

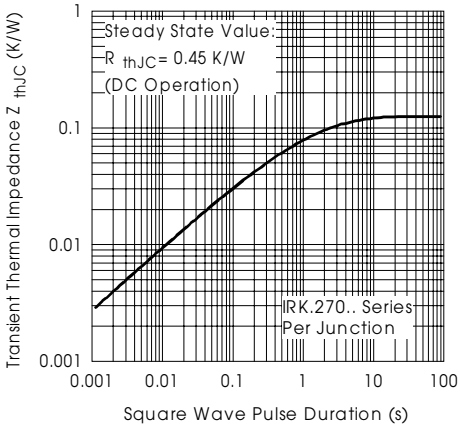



Fig. 22 - Thermal Impedance $Z_{thJC}$ Characteristics

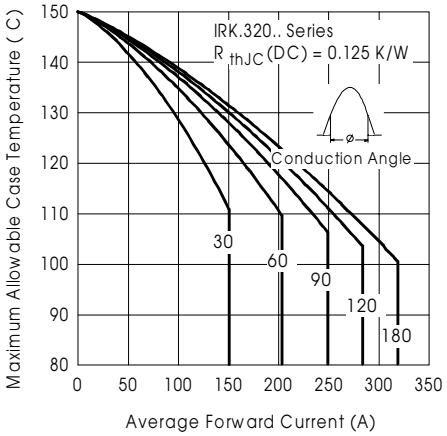



Fig. 23 - Current Ratings Characteristics

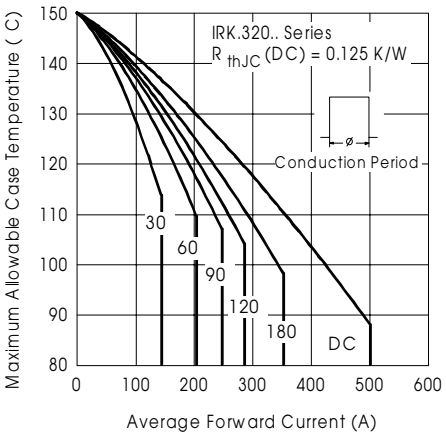



Fig. 24 - Current Ratings Characteristics

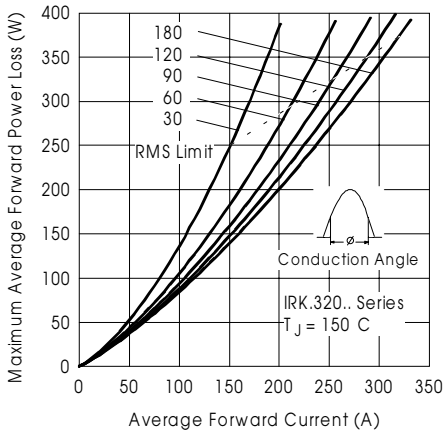



Fig. 25 - Forward Power Loss Characteristics

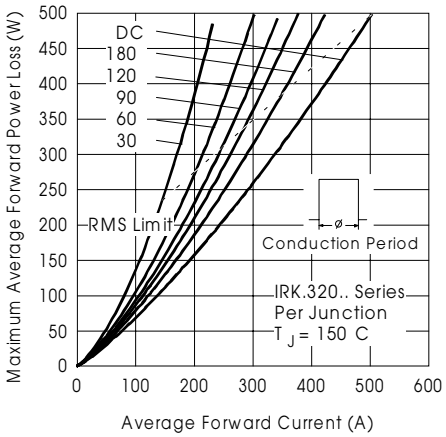



Fig. 26 - Forward Power Loss Characteristics

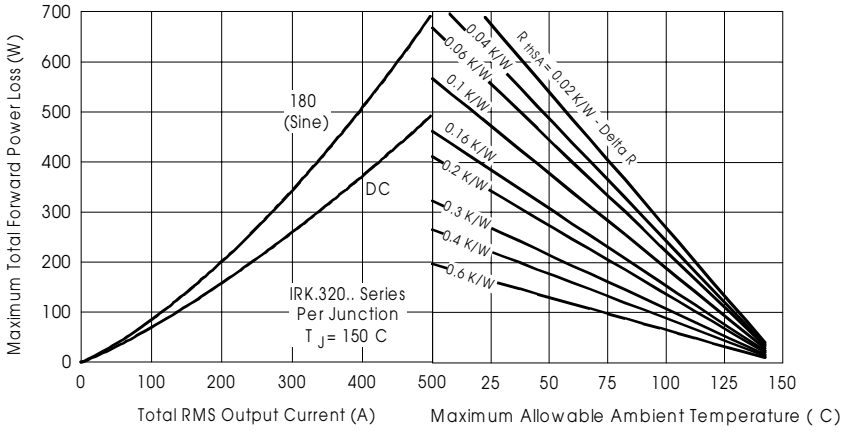



Fig. 27 - Forward Power Loss Characteristics

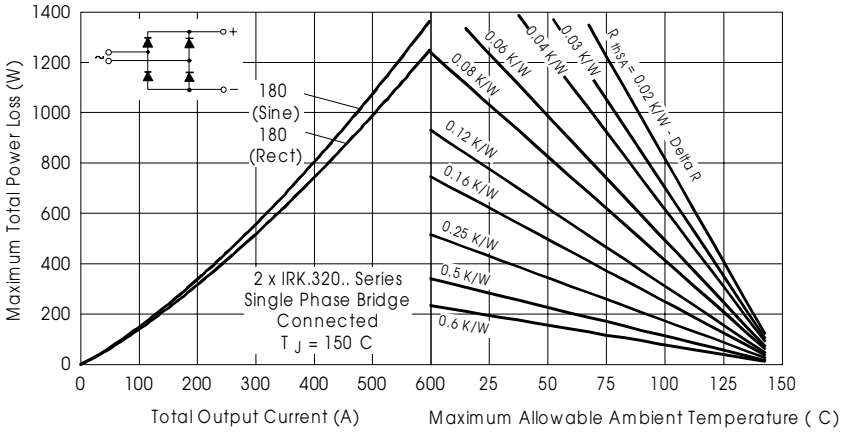



Fig. 28 - Forward Power Loss Characteristics

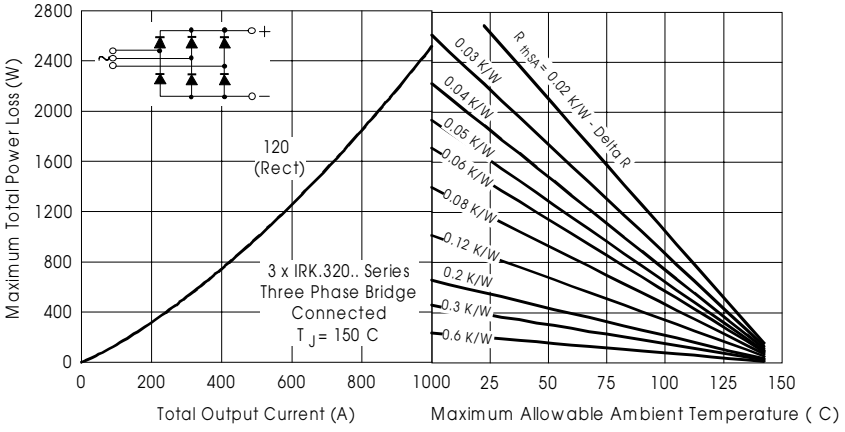



Fig. 29 - Forward Power Loss Characteristics

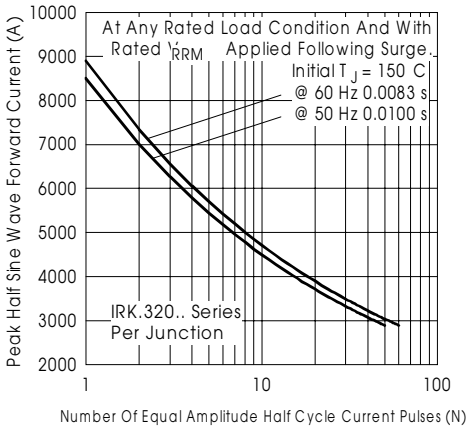



Fig. 30 - Maximum Non-Repetitive Surge Current

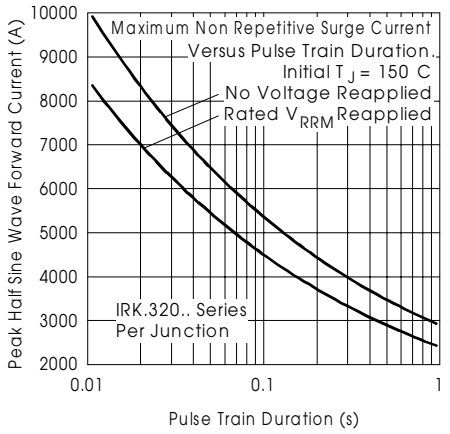



Fig. 31 - Maximum Non-Repetitive Surge Current

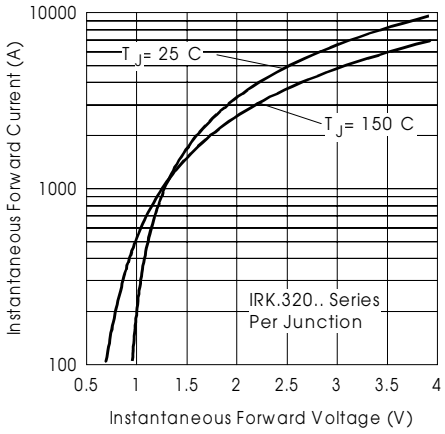



Fig. 32 - Forward Voltage Drop Characteristics

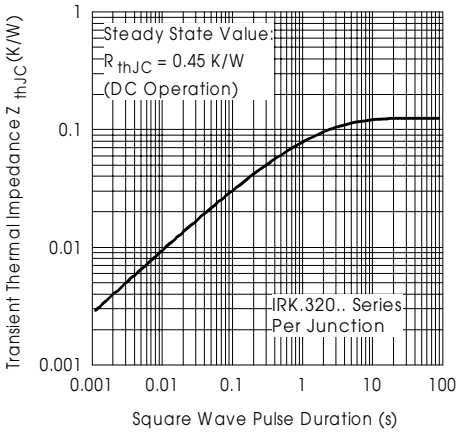



Fig. 33 - Thermal Impedeance $Z_{thJC}$ Characteristics

Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial Level.
Qualification Standards can be found on IR's Web site.

International
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