

International IR Rectifier

SERIES IRK.136, .142, .162

**THYRISTOR/DIODE and
THYRISTOR/THYRISTOR**

NEW INT-A-pak Power Modules

Features

- High Voltage
- Electrically Isolated by DBC Ceramic (Al_2O_3)
- 3500 V_{RMS} Isolating Voltage
- Industrial Standard Package
- High Surge Capability
- Glass Passivated Chips
- Modules uses High Voltage Power thyristor/diodes in three Basic Configurations
- Simple Mounting
- UL E78996 approved 

135 A
140 A
160 A

Applications

- DC Motor Control and Drives
- Battery Charges
- Welders
- Power Converters
- Lighting Control
- Heat and Temperature Control

Major Ratings and Characteristics

| Parameters | IRK.136.. | IRK.142.. | IRK.162.. | Units | |
|---------------|-------------|-----------|-----------|--------------------|-------------------|
| $I_{T(AV)}$ | 135 | 140 | 160 | A | |
| @ T_C | 85 | 85 | 85 | °C | |
| $I_{T(RMS)}$ | 300 | 310 | 355 | A | |
| I_{TSM} | @ 50Hz | 3200 | 4500 | 4870 | A |
| | @ 60Hz | 3360 | 4712 | 5100 | A |
| I^2t | @ 50Hz | 51.5 | 102 | 119 | KA ² s |
| | @ 60Hz | 47 | 92.5 | 108 | KA ² s |
| $I^2\sqrt{t}$ | 515.5 | 1013 | 1190 | KA ² √s | |
| V_{RRM} | 400 to 1600 | | | V | |
| T_J range | -40 to 125 | | | °C | |

CASE STYLE NEW INT-A-PAK



Electrical Specifications

Voltage Ratings

| Type number | Voltage Code | V_{RRM}/V_{DRM} , Maximum repetitive peak reverse voltage V | V_{RSM}/V_{DSM} , Maximum non-repetitive peak reverse voltage V | I_{RRM}/I_{DRM} @ 125°C mA |
|-------------|--------------|------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------|
| IRK.136 | 04 | 400 | 500 | 50 |
| IRK.142 | 08 | 800 | 900 | |
| IRK.162 | 12 | 1200 | 1300 | |
| | 14 | 1400 | 1500 | |
| | 16 | 1600 | 1700 | |

Forward Conduction

| Parameter | IRK.136 | IRK.142 | IRK.162 | Units | Conditions | |
|--------------------------------------------------------------------------|---------|---------|---------|--------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------|
| $I_{T(AV)}$ Max. average on-state current @ Case temperature | 135 | 140 | 160 | A | 180° conduction, half sine wave | |
| | 85 | 85 | 85 | °C | | |
| $I_{T(RMS)}$ Max. RMS on-state current | 300 | 310 | 355 | A | as AC switch | |
| I_{TSM} Maximum peak, one-cycle on-state, non-repetitive surge current | 3200 | 4500 | 4870 | A | t = 10ms No voltage | Sine half wave, Initial $T_J = T_{J \text{ max.}}$ |
| | 3360 | 4712 | 5100 | | t = 8.3ms reappplied | |
| | 2700 | 3785 | 4100 | | t = 10ms 100% V_{RRM} | |
| | 2800 | 3963 | 4300 | | t = 8.3ms reappplied | |
| I^2t Maximum I^2t for fusing | 51.5 | 102 | 119 | KA ² s | t = 10ms No voltage | |
| | 47 | 92.5 | 108 | | t = 8.3ms reappplied | |
| | 36.5 | 71.6 | 84 | | t = 10ms 100% V_{RRM} | |
| | 33.3 | 65.4 | 76.7 | | t = 8.3ms reappplied | |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing | 515.5 | 1013 | 1190 | KA ² √s | t = 0.1 to 10ms, no voltage reappplied | |
| $V_{T(TO)1}$ Low level value of threshold voltage | 0.86 | 0.83 | 0.8 | V | $(16.7\% \times \pi \times I_{T(AV)}) < I < \pi \times I_{T(AV)}$, @ $T_{J \text{ max.}}$ | |
| $V_{T(TO)2}$ High level value of threshold voltage | 1.05 | 1 | 0.98 | | $(I > \pi \times I_{T(AV)})$, @ $T_{J \text{ max.}}$ | |
| $r_{\theta 1}$ Low level value on-state slope resistance | 2.02 | 1.78 | 1.67 | mΩ | $(16.7\% \times \pi \times I_{T(AV)}) < I < \pi \times I_{T(AV)}$, @ $T_{J \text{ max.}}$ | |
| $r_{\theta 2}$ High level value on-state slope resistance | 1.65 | 1.43 | 1.38 | | $(I > \pi \times I_{T(AV)})$, @ $T_{J \text{ max.}}$ | |
| V_{TM} Maximum forward voltage drop | 1.57 | 1.55 | 1.54 | V | $I_{TM} = \pi \times I_{T(AV)}$, $T_J = 25^\circ\text{C}$, 180° conduction | |
| I_H Maximum holding current | 200 | | | mA | Anode supply = 6V initial $I_r = 30A$, $T_J = 25^\circ\text{C}$ | |
| I_L Maximum latching current | 400 | | | mA | Anode supply = 6V resistive load = 1Ω Gate pulse: 10V, 100μs, $T_J = 25^\circ\text{C}$ | |

Switching

| | | | | |
|-----------------------------|----------|----|-------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| t_{gd} Typical delay time | 1 | μs | $T_J = 25^\circ\text{C}$ | Gate Current=1A $dI_g/dt=1A/\mu s$ |
| t_{gr} Typical rise time | 2 | | $T_J = 25^\circ\text{C}$ | $V_d=0,67\% V_{DRM}$ |
| t_q Typical turn-off time | 50 - 200 | | $I_{TM} = 300A$; $-dI/dt = 15A/\mu s$; $T_J = T_{J \text{ max}}$ $V_r = 50V$; $dV/dt = 20V/\mu s$; Gate 0V, 100Ω | |

Blocking

| | | | | |
|-----------|----------------------------------------------------|------|------------------|---------------------------------------------------------------|
| I_{RRM} | Maximum peak reverse and off-state leakage current | 50 | mA | $T_J = 125^\circ\text{C}$ |
| I_{DRM} | Maximum peak reverse and off-state leakage current | | | |
| V_{INS} | RMS isolation voltage | 3500 | V | 50Hz, circuit to base, all terminals shorted, $t = 1\text{s}$ |
| dV/dt | critical rate of rise of off-state voltage | 1000 | V/ μs | $T_J = T_{J\text{max.}}$, exponential to 67% rated V_{DRM} |

Triggering

| Parameter | IRK.136 | IRK.142 | IRK.162 | Units | Conditions | |
|-------------|------------------------------------------|---------|---------|-------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| P_{GM} | Max. peak gate power | | | 12 | W | $t_p \leq 5\text{ms}$, $T_J = T_{J\text{max.}}$ |
| $P_{G(AV)}$ | Max. average gate power | | | 3 | W | $f = 50\text{Hz}$, $T_J = T_{J\text{max.}}$ |
| I_{GM} | Max. peak gate current | | | 3 | A | $t_p \leq 5\text{ms}$, $T_J = T_{J\text{max.}}$ |
| $-V_{GT}$ | Max. peak negative gate voltage | | | 10 | V | |
| V_{GT} | Max. required DC gate voltage to trigger | | | 4 | V | $T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = T_{J\text{max.}}$ Anode supply = 6V, resistive load; $R_a = 1\Omega$ |
| | | | | 2.5 | | |
| | | | | 1.7 | | |
| I_{GT} | Max. required DC gate current to trigger | | | 270 | mA | $T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = T_{J\text{max.}}$ Anode supply = 6V, resistive load; $R_a = 1\Omega$ |
| | | | | 150 | | |
| | | | | 80 | | |
| V_{GD} | Max. gate voltage that will not trigger | | | 0.3 | V | @ $T_J = T_{J\text{max.}}$, rated V_{DRM} applied |
| I_{GD} | Max. gate current that will not trigger | | | 10 | mA | |
| di/dt | Max. rate of rise of turned-on current | | | 300 | A/ μs | @ $T_J = T_{J\text{max.}}$, $I_{TM} = 400\text{A}$ rated V_{DRM} applied |

Thermal and Mechanical Specifications

| Parameter | IRK.136 | IRK.142 | IRK.162 | Units | Conditions | |
|------------|-------------------------------------------|-----------------|---------|---------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| T_J | Max. junction operating temperature range | | | -40 to 125 | $^\circ\text{C}$ | |
| T_{stg} | Max. storage temperature range | | | -40 to 150 | $^\circ\text{C}$ | |
| R_{thJC} | 0.18 | 0.18 | 0.16 | K/W | DC operation, per junction | |
| R_{thCS} | Max. thermal resistance, case to heatsink | | | 0.05 | K/W | Mounting surface smooth, flat and greased Per module |
| T | Mounting torque $\pm 10\%$ | IAP 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. Lubricated threads. |
| | | busbar to IAP | | 4 to 6 | | |
| wt | Approximate weight | | | 200 (7.1) | g(oz) | |
| | Case Style | | | New 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)

| Devices | Sinusoidal conduction @ $T_J\text{max.}$ | | | | | Rectangular conduction @ $T_J\text{max.}$ | | | | | Units |
|---------|------------------------------------------|--------|--------|--------|--------|-------------------------------------------|--------|--------|--------|--------|-------|
| | 180° | 120° | 90° | 60° | 30° | 180° | 120° | 90° | 60° | 30° | |
| IRK.136 | 0.007 | 0.01 | 0.013 | 0.0155 | 0.017 | 0.009 | 0.012 | 0.014 | 0.015 | 0.017 | K/W |
| IRK.142 | 0.0019 | 0.0019 | 0.0020 | 0.0020 | 0.0021 | 0.0018 | 0.0022 | 0.0023 | 0.0023 | 0.0020 | |
| IRK.162 | 0.0030 | 0.0031 | 0.0032 | 0.0033 | 0.0034 | 0.0029 | 0.0036 | 0.0039 | 0.0041 | 0.0040 | |

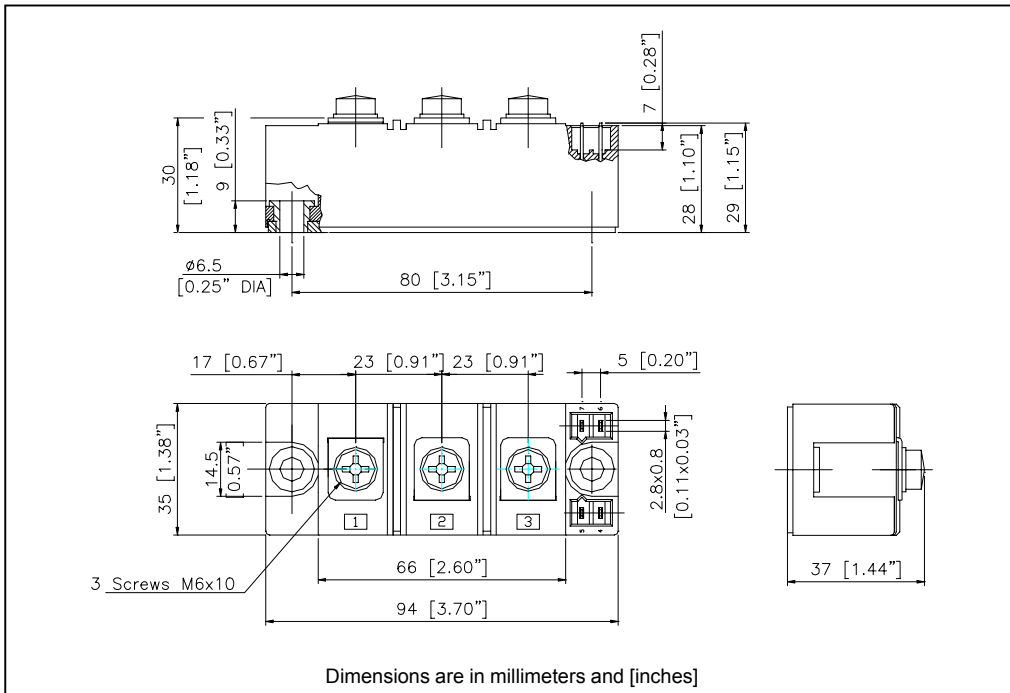
IRK.136, .142, .162 Series

Bulletin I27117 rev. C 03/02

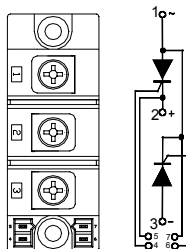
Ordering Information Table

| Device Code | | | | |
|-------------|----------------------------------------|-----|---|----|
| IRK | T | 162 | / | 16 |
| ① | ② | ③ | | |
| 1 | - Module Type | | | |
| 2 | - Circuit Configuration | | | |
| 3 | - Current Rating: $I_{T(AV)}$ | | | |
| 4 | - Voltage Code: Code x 100 = V_{RRM} | | | |

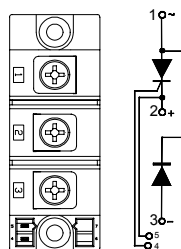
Outline Table



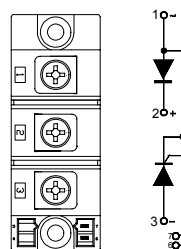
IRKT



IRKH



IRKL



NOTE: To order the Optional Hardware see Bulletin I27900

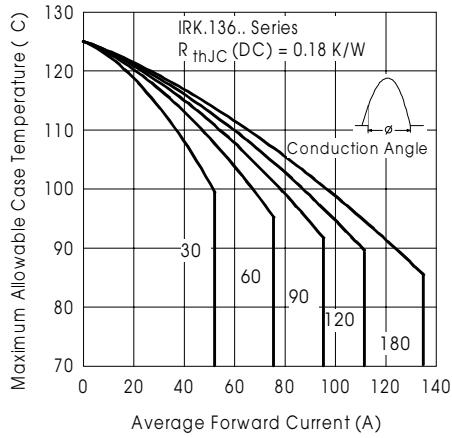


Fig. 1 - Current Ratings Characteristics

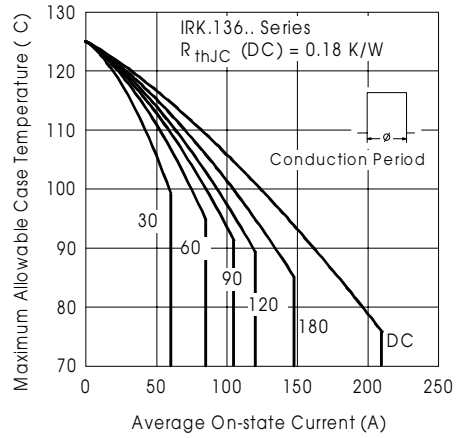


Fig. 2 - Current Ratings Characteristics

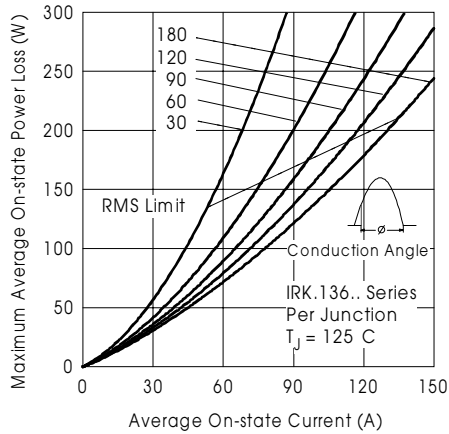


Fig. 3 - On-State Power Loss Characteristics

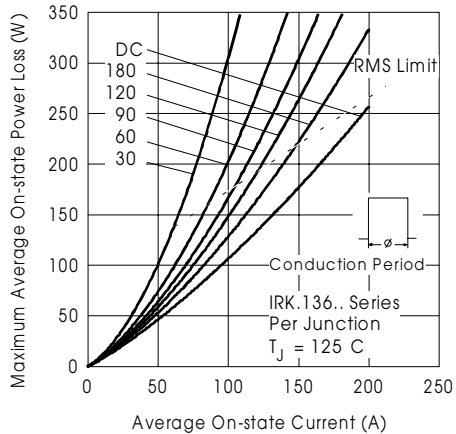


Fig. 4 - On-State Power Loss Characteristics

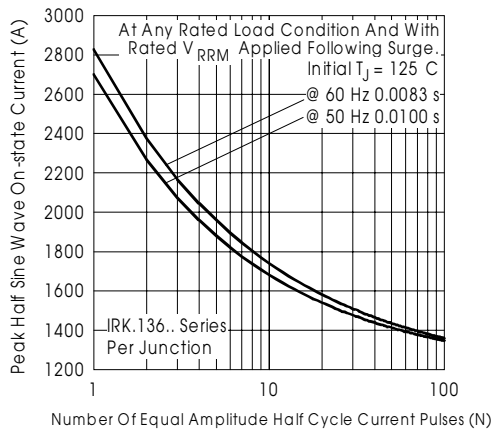


Fig. 5 - Maximum Non-Repetitive Surge Current

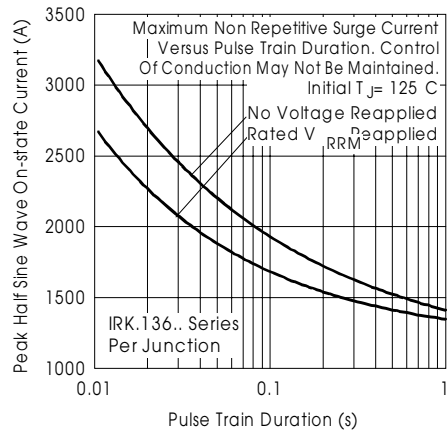


Fig. 6 - Maximum Non-Repetitive Surge Current

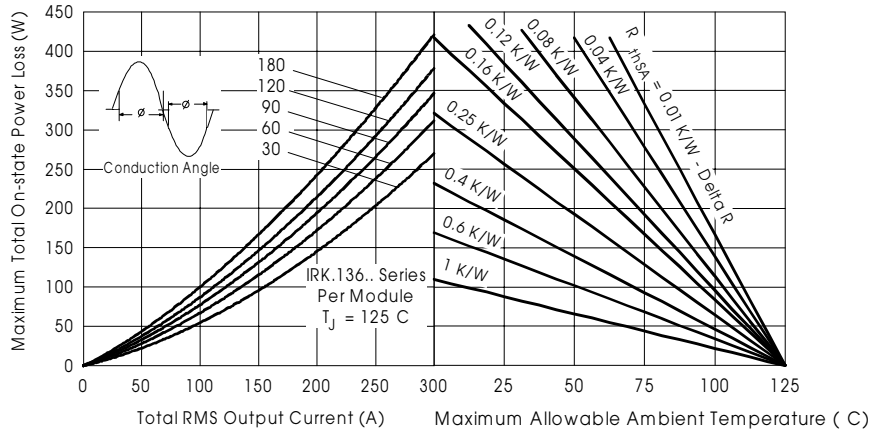


Fig.7 - On State Power Loss Characteristics

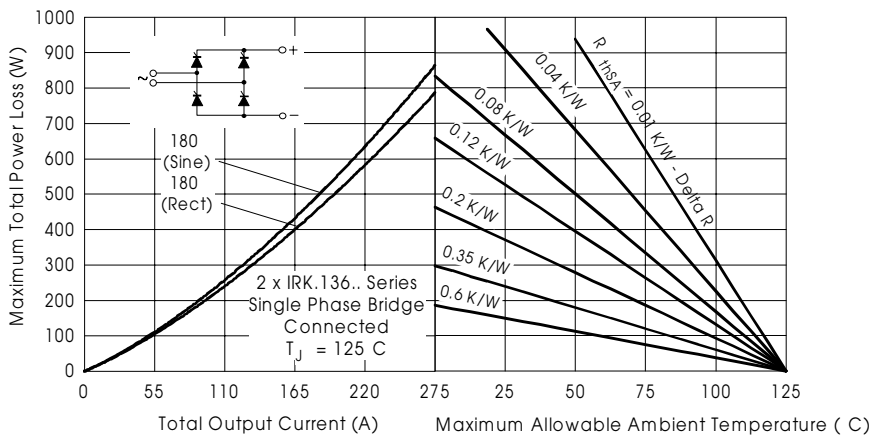


Fig.8 - On State Power Loss Characteristics

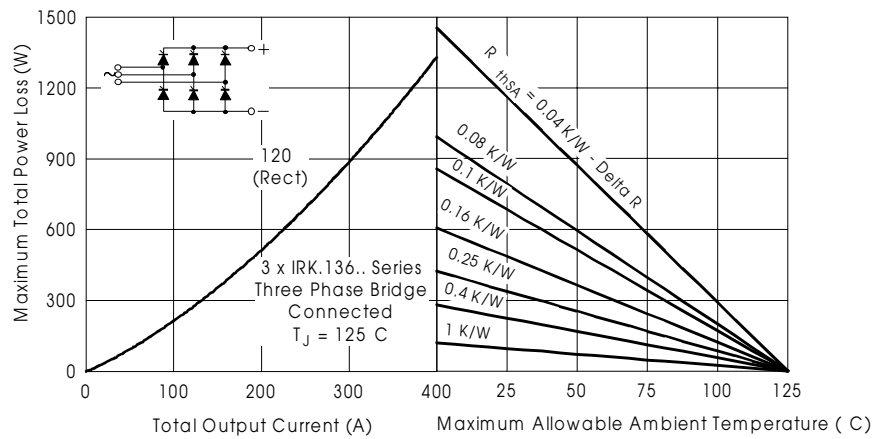


Fig.9 - On State Power Loss Characteristics

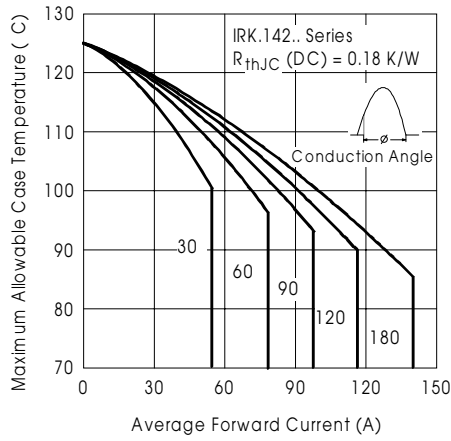


Fig. 10 - Current Ratings Characteristics

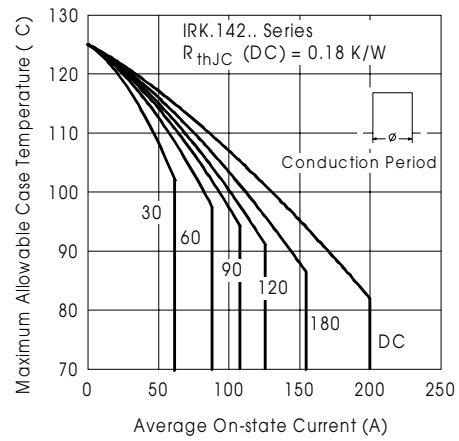


Fig. 11 - Current Ratings Characteristics

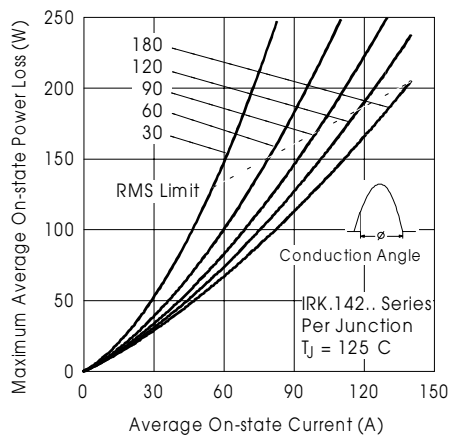


Fig. 12 - On-State Power Loss Characteristics

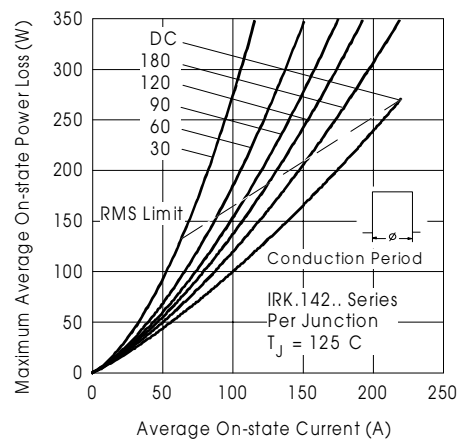


Fig. 13 - On-State Power Loss Characteristics

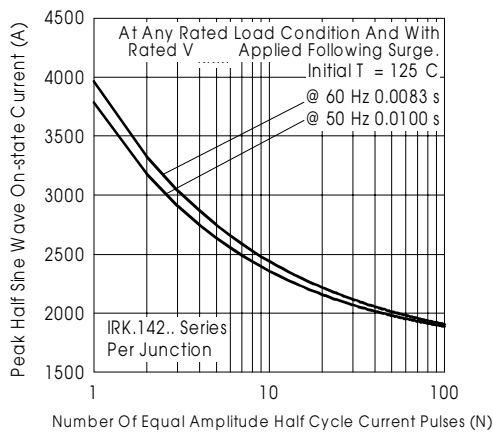


Fig. 14 - Maximum Non-Repetitive Surge Current

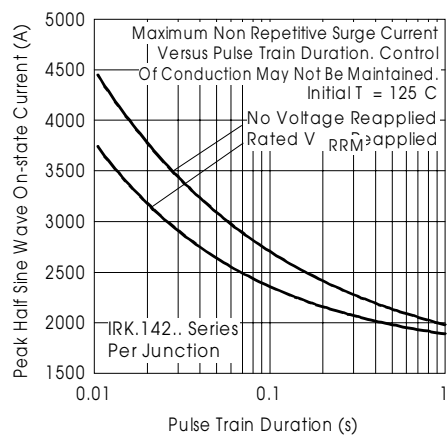


Fig. 15 - Maximum Non-Repetitive Surge Current

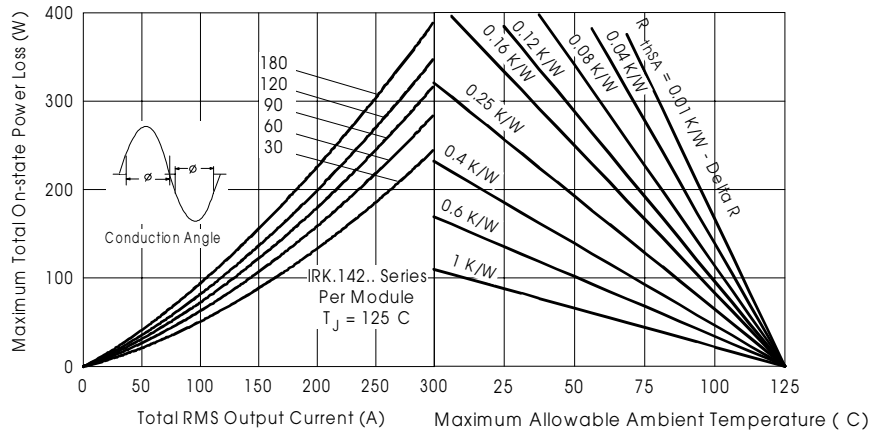


Fig.16 - On State Power Loss Characteristics

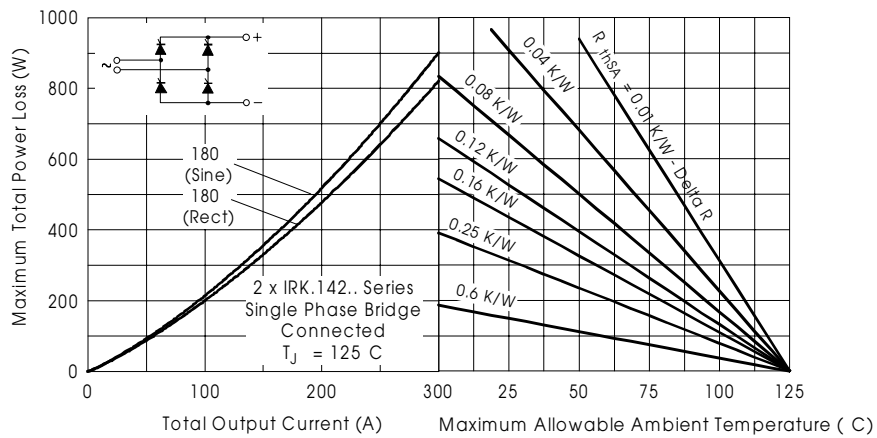


Fig.17 - On State Power Loss Characteristics

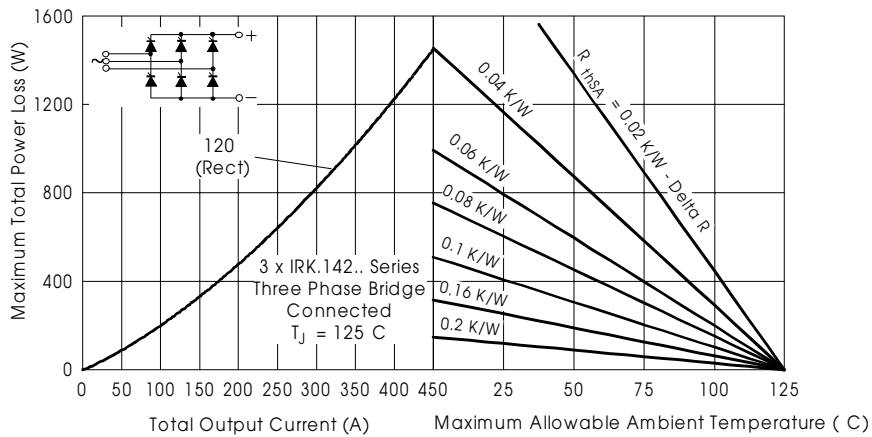


Fig.18 - On State Power Loss Characteristics

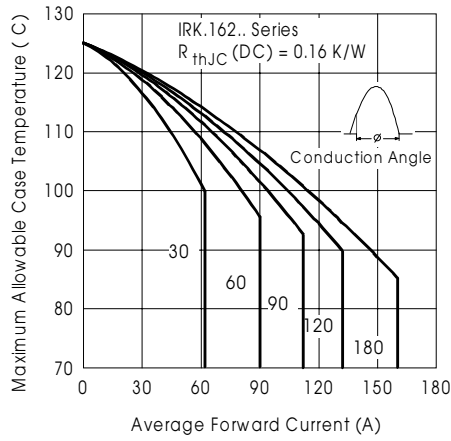


Fig. 19 - Current Ratings Characteristics

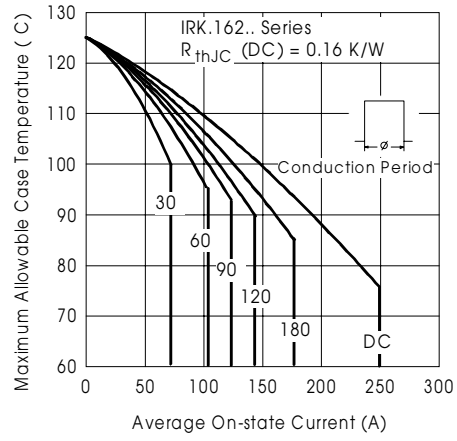


Fig. 20 - Current Ratings Characteristics

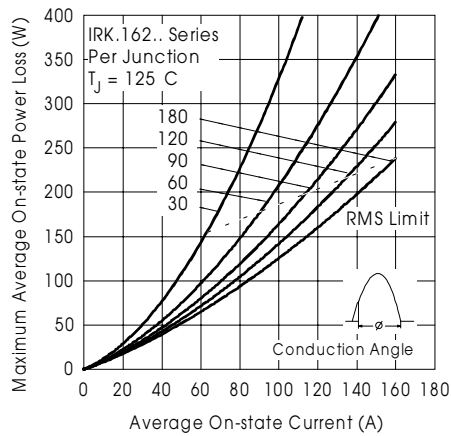


Fig. 21 - On-State Power Loss Characteristics

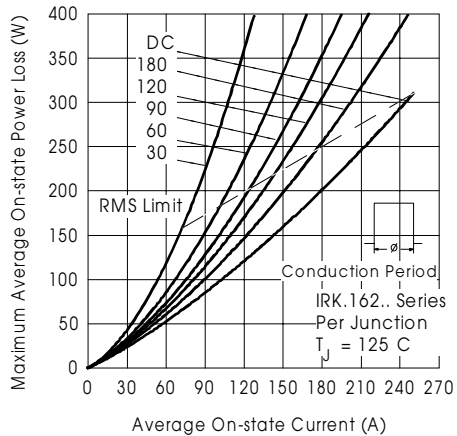


Fig. 22 - On-State Power Loss Characteristics

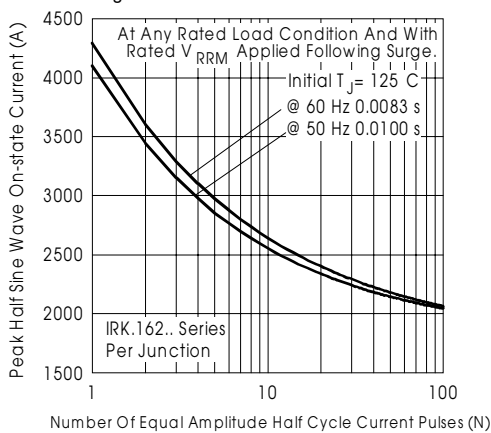


Fig. 23 - Maximum Non-Repetitive Surge Current

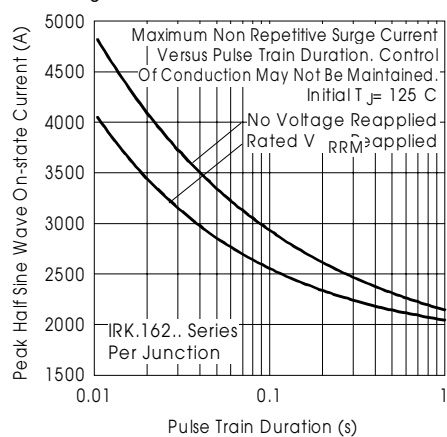


Fig. 24 - Maximum Non-Repetitive Surge Current

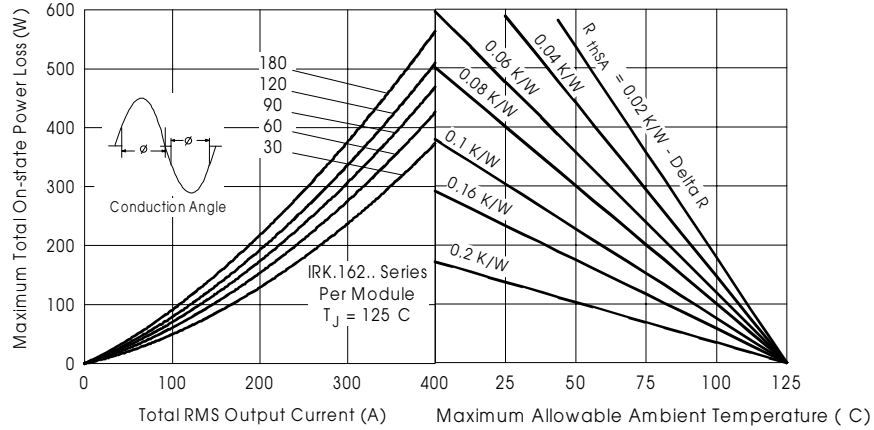


Fig.25 - On State Power Loss Characteristics

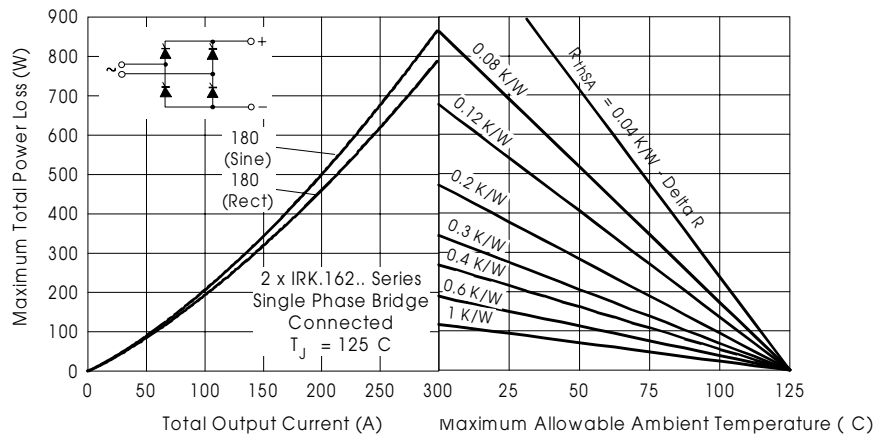


Fig.26 - On State Power Loss Characteristics

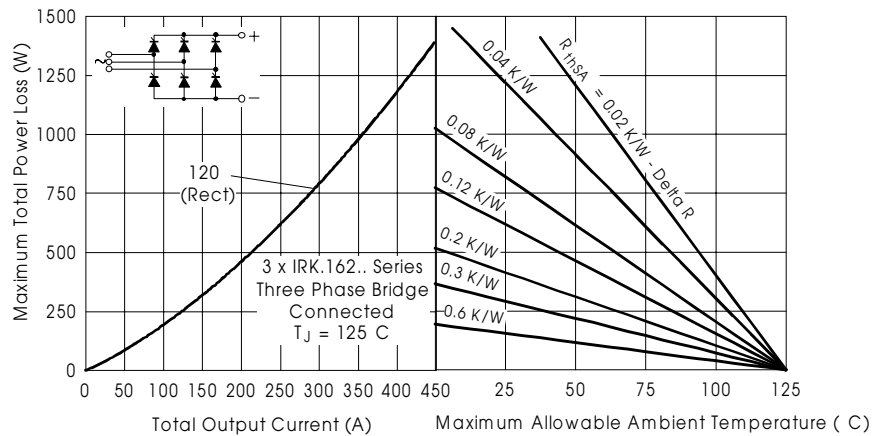


Fig.27 - On State Power Loss Characteristics

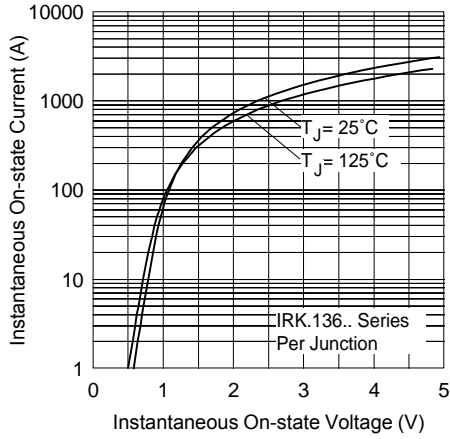


Fig.28 - On State Voltage Drop Characteristics

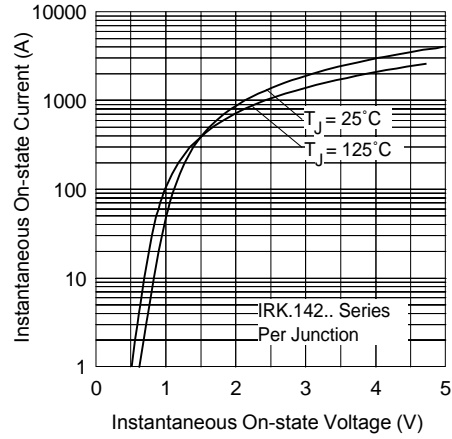


Fig.29 - On State Voltage Drop Characteristics

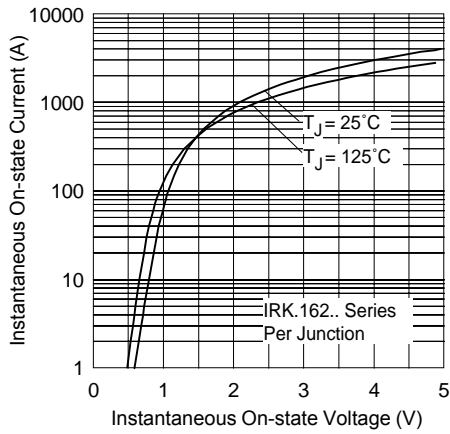


Fig.30 - On State Voltage Drop Characteristics

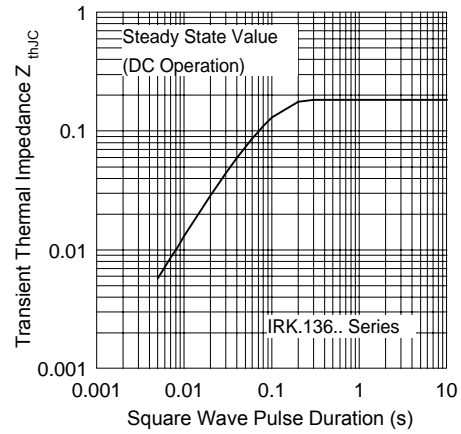


Fig.31 - Thermal Impedance ZthJC Characteristics

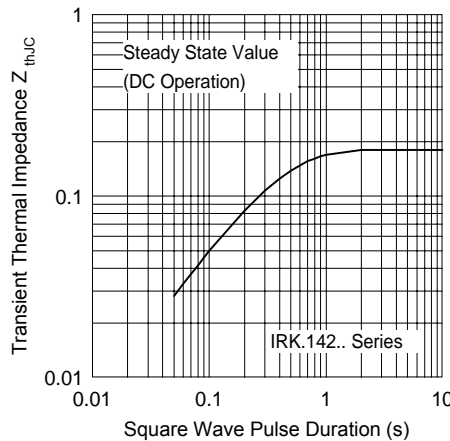


Fig.32 - Thermal Impedance ZthJC Characteristics

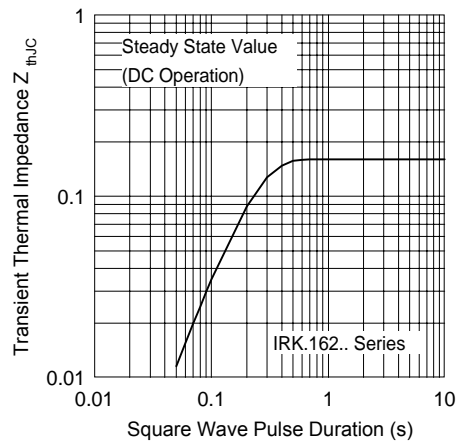


Fig.33 - Thermal Impedance ZthJC Characteristics

IRK.136, .142, .162 Series

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IR Rectifier

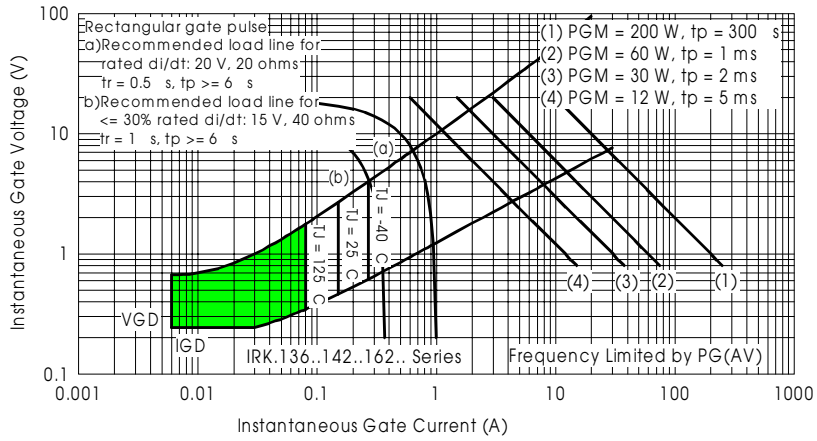


Fig. 34 - Gate Characteristics

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

International
IR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
 TAC Fax: (310) 252-7309
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