

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% × π × $I_{T(AV)}$) < I < π × $I_{T(AV)}$, @ $T_J \text{ max.}$ | |
| $V_{T(TO)2}$ High level value of threshold voltage | 1.05 | 1 | 0.98 | | (I > π × $I_{T(AV)}$), @ $T_J \text{ max.}$ | |
| $r_{\theta 1}$ Low level value on-state slope resistance | 2.02 | 1.78 | 1.67 | mΩ | (16.7% × π × $I_{T(AV)}$) < I < π × $I_{T(AV)}$, @ $T_J \text{ max.}$ | |
| $r_{\theta 2}$ High level value on-state slope resistance | 1.65 | 1.43 | 1.38 | | (I > π × $I_{T(AV)}$), @ $T_J \text{ max.}$ | |
| 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 $dI_g/dt=1A/\mu s$ $V_d=0,67\% V_{DRM}$ $I_{TM} = 300 A$; $-dI/dt = 15 A/\mu s$; $T_J = T_J \text{ max}$ $V_r = 50 V$; $dV/dt = 20 V/\mu s$; Gate 0 V, 100Ω |
| t_{gr} Typical rise time | 2 | | $T_J = 25^\circ\text{C}$ | |
| t_q Typical turn-off time | 50 - 200 | | | |

Blocking

| | | | | |
|-----------|--|------|------------------|---|
| I_{RRM} | Maximum peak reverse and off-state leakage current | 50 | mA | $T_J = 125^\circ\text{C}$ |
| 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} | 12 | | | W | $t_p \leq 5\text{ms}$, $T_J = T_{J\text{max.}}$ |
| $P_{G(AV)}$ | 3 | | | W | $f = 50\text{Hz}$, $T_J = T_{J\text{max.}}$ |
| I_{GM} | 3 | | | A | $t_p \leq 5\text{ms}$, $T_J = T_{J\text{max.}}$ |
| $-V_{GT}$ | 10 | | | V | |
| V_{GT} | Max. required DC gate voltage to trigger | 4 | | V | $T_J = -40^\circ\text{C}$ |
| | | 2.5 | | | $T_J = 25^\circ\text{C}$ |
| | | 1.7 | | | $T_J = T_{J\text{max.}}$ |
| I_{GT} | Max. required DC gate current to trigger | 270 | | mA | $T_J = -40^\circ\text{C}$ |
| | | 150 | | | $T_J = 25^\circ\text{C}$ |
| | | 80 | | | $T_J = T_{J\text{max.}}$ |
| 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 | -40 to 125 | | | $^\circ\text{C}$ | |
| T_{stg} | -40 to 150 | | | $^\circ\text{C}$ | |
| R_{thJC} | 0.18 | 0.18 | 0.16 | K/W | DC operation, per junction |
| R_{thCS} | 0.05 | | | K/W | Mounting surface smooth, flat and greased Per module |
| T | Mounting 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. |
| | torque $\pm 10\%$ busbar to IAP | 4 to 6 | | | |
| wt | 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 | |

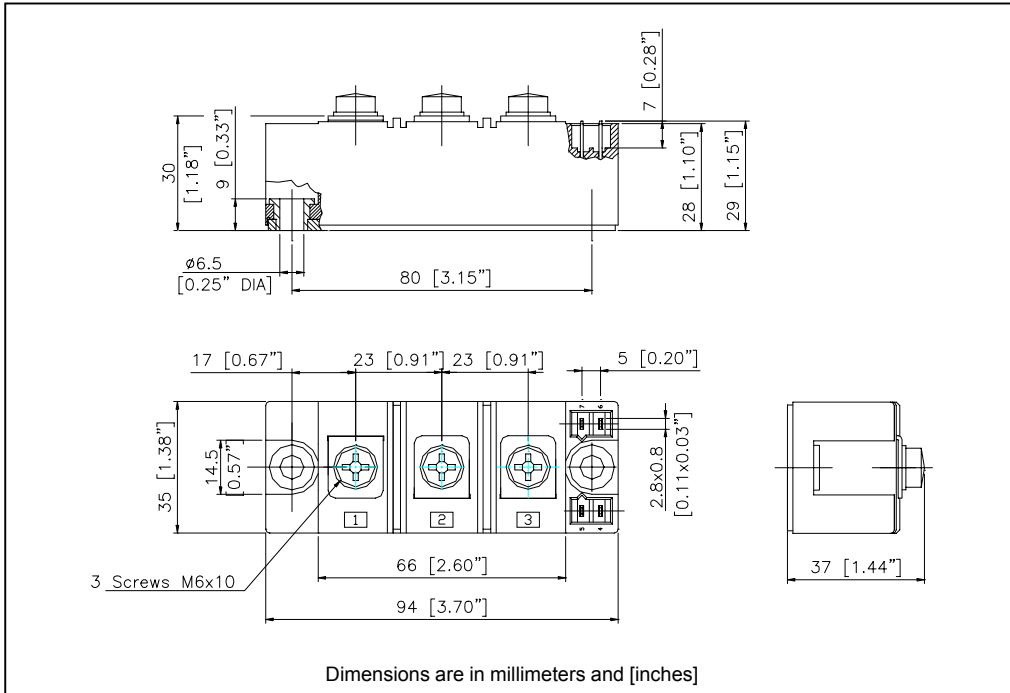
IRK.136, .142, .162 Series

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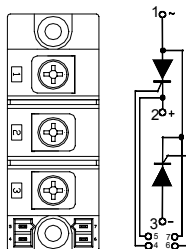
Ordering Information Table

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

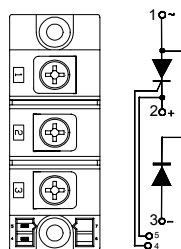
Outline Table



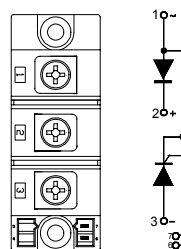
IRKT



IRKH



IRKL



NOTE: To order the Optional Hardware see Bulletin I27900



Fig. 1 - Current Ratings Characteristics

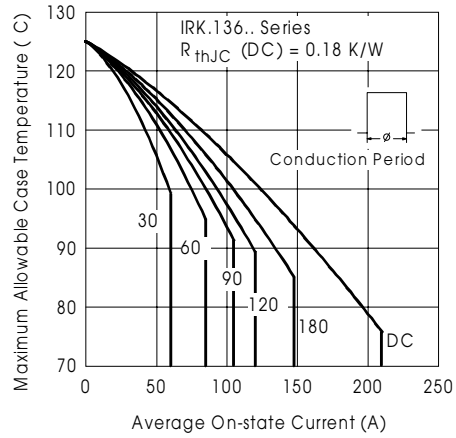


Fig. 2 - Current Ratings Characteristics



Fig. 3 - On-State Power Loss Characteristics

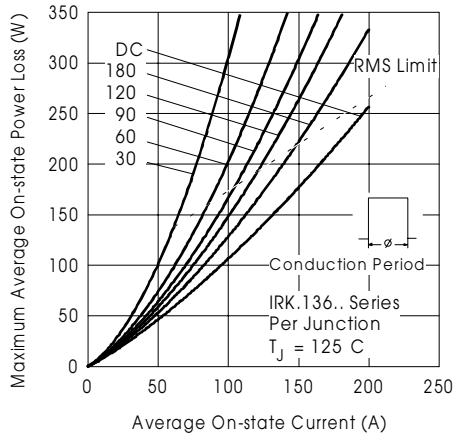


Fig. 4 - On-State Power Loss Characteristics



Fig. 5 - Maximum Non-Repetitive Surge Current

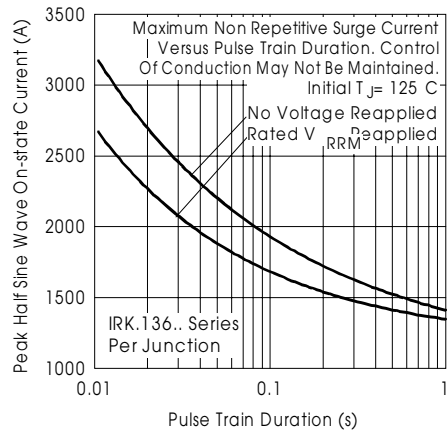


Fig. 6 - Maximum Non-Repetitive Surge Current

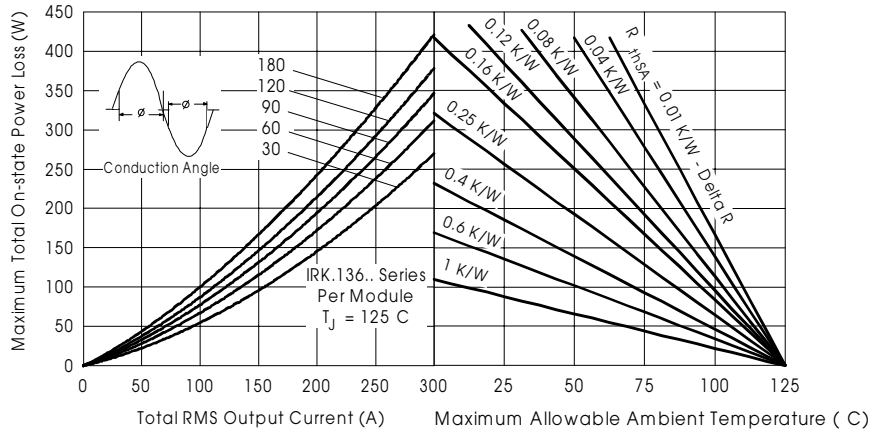


Fig.7 - On State Power Loss Characteristics

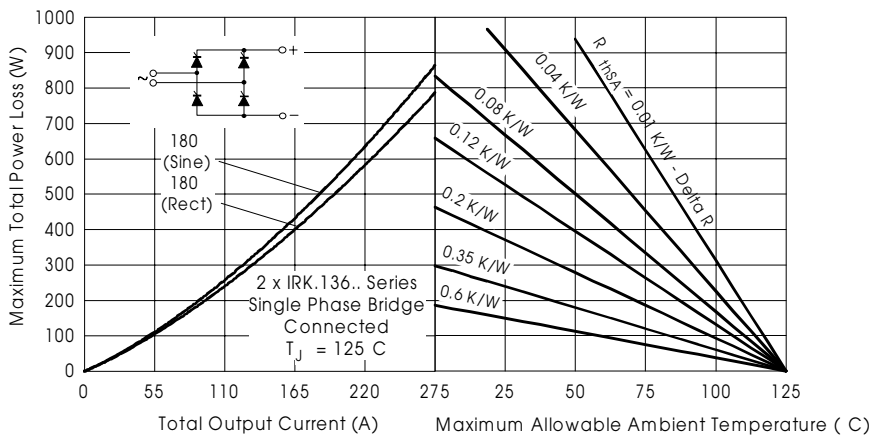


Fig.8 - On State Power Loss Characteristics

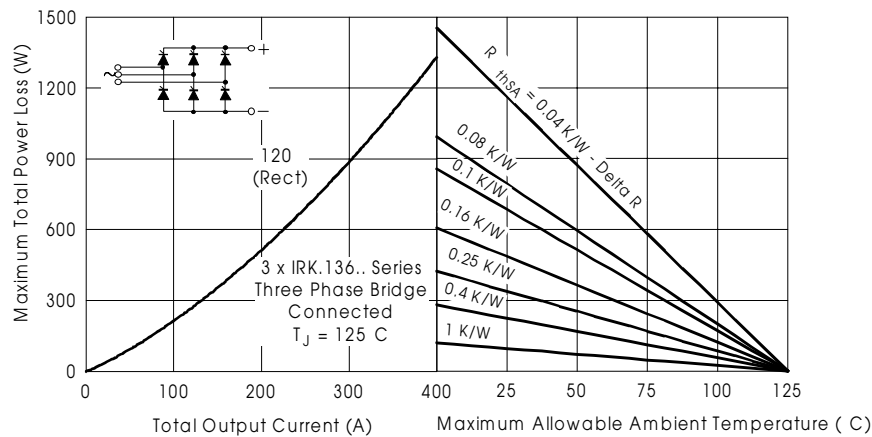


Fig.9 - On State Power Loss Characteristics

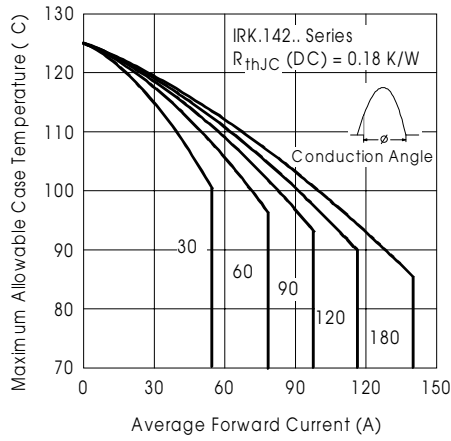


Fig. 10 - Current Ratings Characteristics

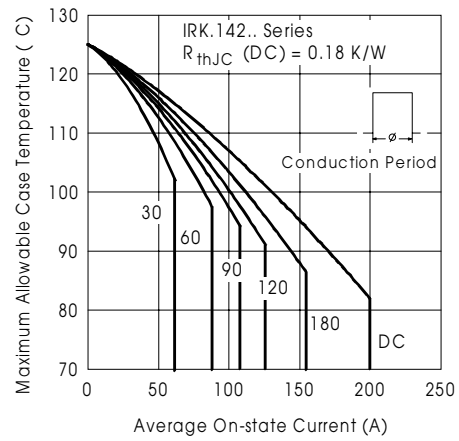


Fig. 11 - Current Ratings Characteristics

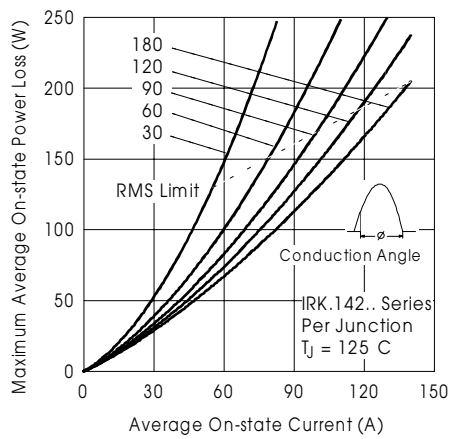


Fig. 12 - On-State Power Loss Characteristics

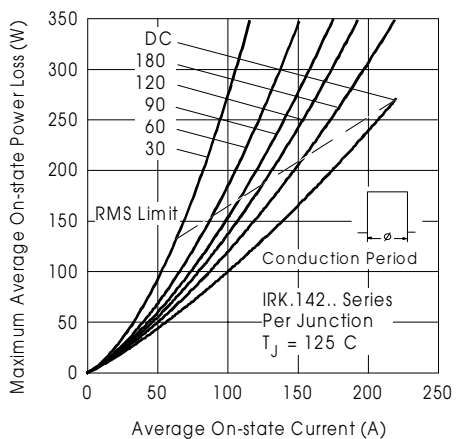


Fig. 13 - On-State Power Loss Characteristics

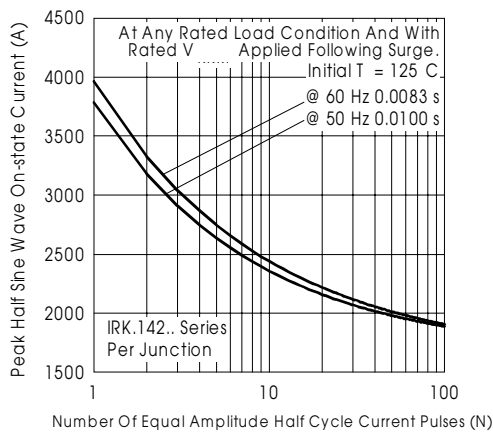


Fig. 14 - Maximum Non-Repetitive Surge Current

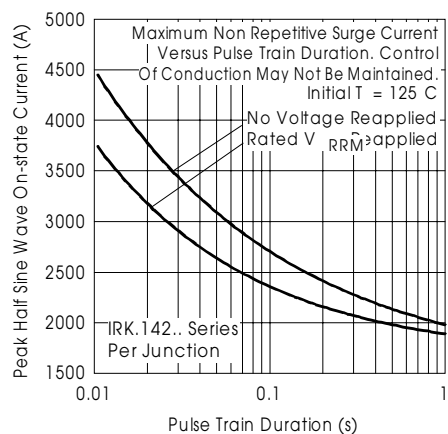


Fig. 15 - Maximum Non-Repetitive Surge Current

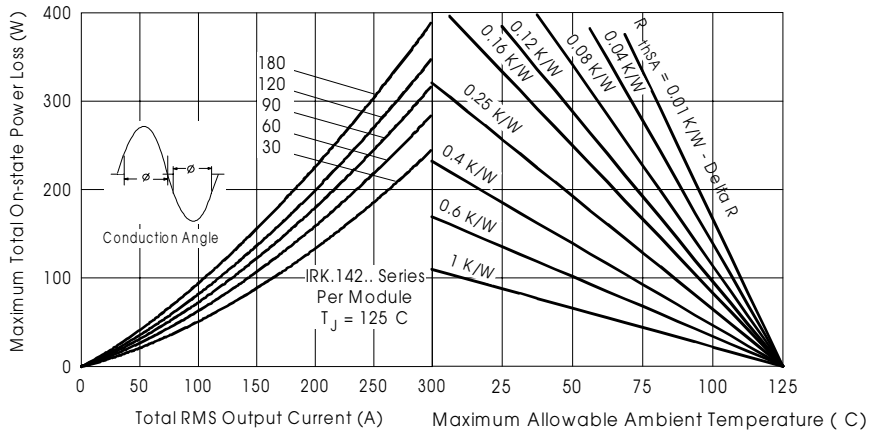


Fig.16 - On State Power Loss Characteristics

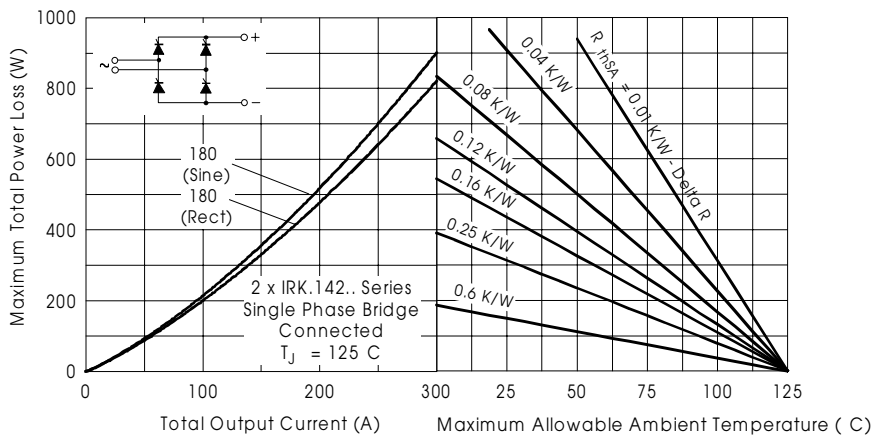


Fig.17 - On State Power Loss Characteristics

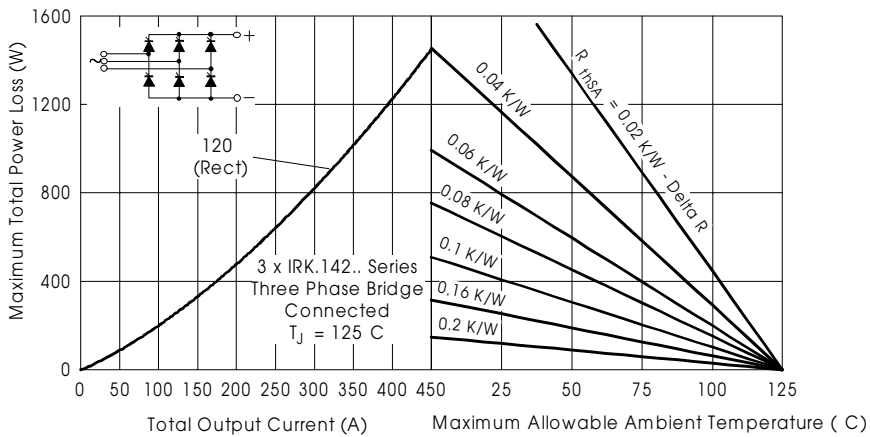


Fig.18 - On State Power Loss Characteristics



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

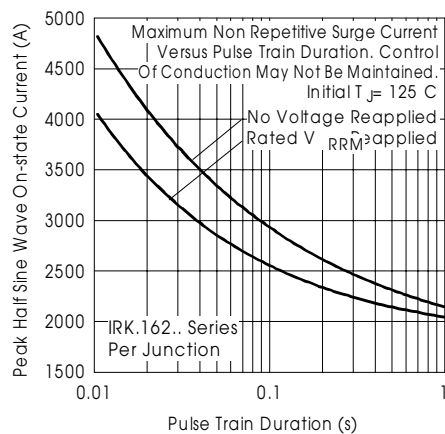


Fig. 24 - Maximum Non-Repetitive Surge Current

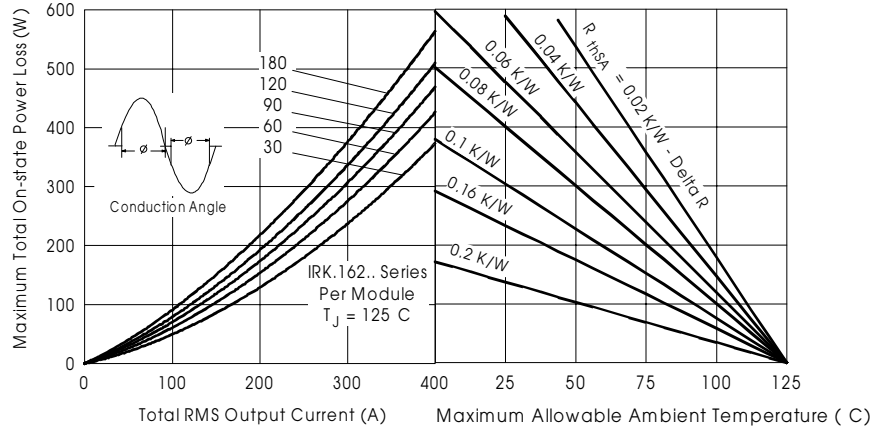


Fig.25 - On State Power Loss Characteristics

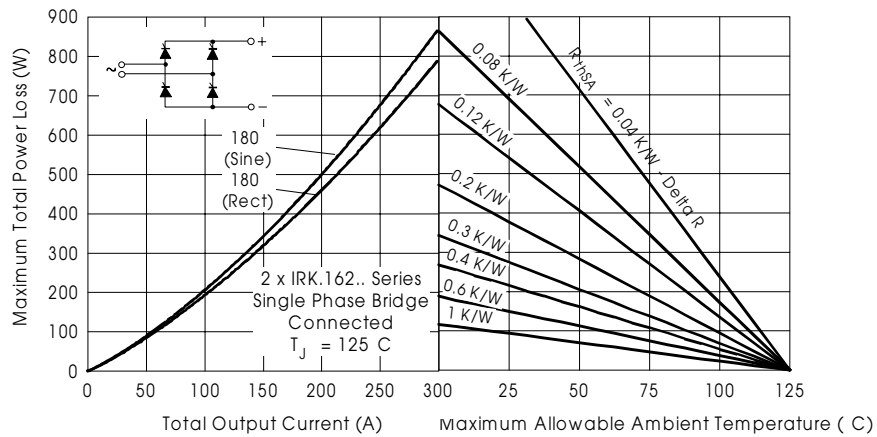


Fig.26 - On State Power Loss Characteristics

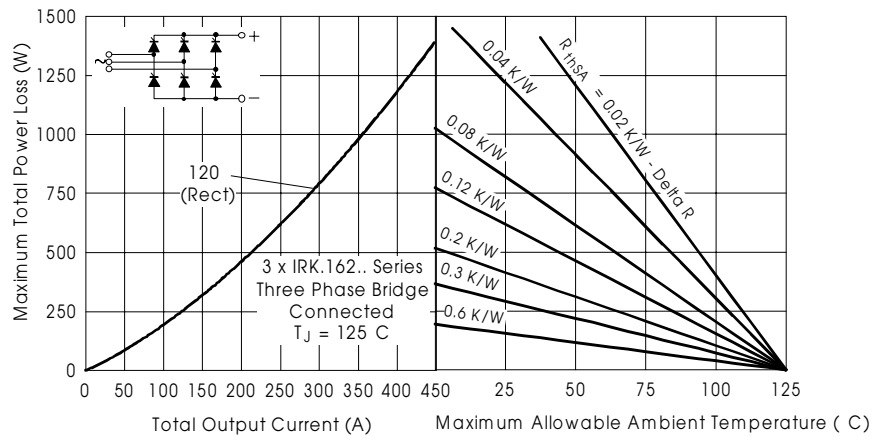


Fig.27 - On State Power Loss Characteristics



Fig.28 - On State Voltage Drop Characteristics



Fig.29 - On State Voltage Drop Characteristics

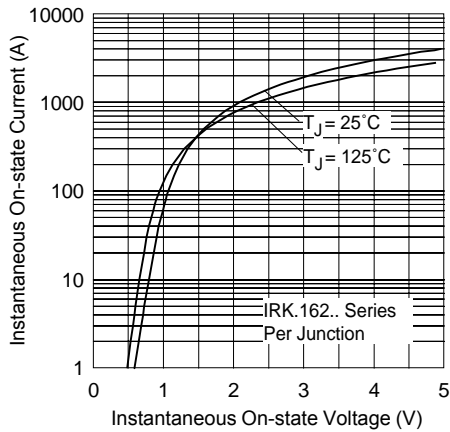


Fig.30 - On State Voltage Drop Characteristics

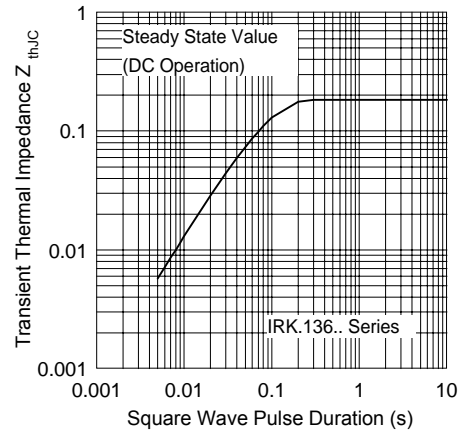


Fig.31 - Thermal Impedance ZthJC Characteristics



Fig.32 - Thermal Impedance ZthJC Characteristics

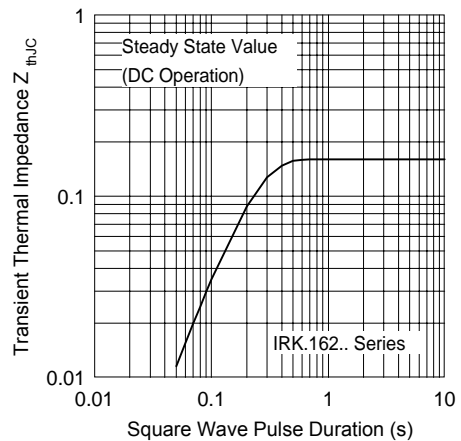


Fig.33 - Thermal Impedance ZthJC Characteristics

IRK.136, .142, .162 Series

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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.

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IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
 TAC Fax: (310) 252-7309
 Visit us at www.irf.com for sales contact information. 03/02