**SERIES**

**IRK.136, .142, .162**

**NEW INT-A-pak Power Modules**

**Features**
- High Voltage
- Electrically Isolated by DBC Ceramic (Al₂O₃)
- 3500 VRMS 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

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

**Major Ratings and Characteristics**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>IRK.136..</th>
<th>IRK.142..</th>
<th>IRK.162..</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>I(AV) @ T&lt;sub&gt;c&lt;/sub&gt;</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>°C</td>
</tr>
<tr>
<td>I(RMS)</td>
<td>300</td>
<td>310</td>
<td>355</td>
<td>A</td>
</tr>
<tr>
<td>I&lt;sub&gt;SM&lt;/sub&gt; @ 50Hz</td>
<td>3200</td>
<td>4500</td>
<td>4870</td>
<td>A</td>
</tr>
<tr>
<td>@ 60Hz</td>
<td>3360</td>
<td>4712</td>
<td>5100</td>
<td>A</td>
</tr>
<tr>
<td>P&lt;sub&gt;r&lt;/sub&gt; @ 50Hz</td>
<td>51.5</td>
<td>102</td>
<td>119</td>
<td>KAJ/s</td>
</tr>
<tr>
<td>@ 60Hz</td>
<td>47</td>
<td>92.5</td>
<td>108</td>
<td>KAJ/s</td>
</tr>
<tr>
<td>I&lt;sup&gt;2&lt;/sup&gt;t</td>
<td>515.5</td>
<td>1013</td>
<td>1190</td>
<td>KAJ²/α</td>
</tr>
<tr>
<td>V&lt;sub&gt;RMS&lt;/sub&gt;</td>
<td>400 to 1600</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T&lt;sub&gt;j&lt;/sub&gt; range</td>
<td>-40 to 125</td>
<td>°C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Electrical Specifications

### Voltage Ratings

<table>
<thead>
<tr>
<th>Type number</th>
<th>Voltage Code</th>
<th>( V_{RMS}/V_{DRM} )</th>
<th>( V_{RSM}/V_{DSM} )</th>
<th>( I_{DRM}/I_{DSM} ) @ 125°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRK.136</td>
<td>04</td>
<td>400</td>
<td>500</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>08</td>
<td>800</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>1200</td>
<td>1300</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>1400</td>
<td>1500</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>1600</td>
<td>1700</td>
<td></td>
</tr>
</tbody>
</table>

### 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 |
\( I_{(RMS)} \) Max. RMS on-state current | 3200 | 4500 | 4870 | A | I = 10ms, No voltage reapplied |
\( I_{TM} \) Maximum peak, one-cycle on-state, non-repetitive surge current | 3360 | 4712 | 5100 | A | I = 10ms, 100% \( V_{RMS} \) reapplied |
\( P_{T} \) Maximum \( P_{T} \) for fusing | 51.5 | 102 | 119 | KA/s | I = 10ms, No voltage reapplied |
\( P_{1/T} \) Maximum \( P_{1/T} \) for fusing | 515.5 | 1013 | 1190 | KA/s | I = 0.1 to 10ms, no voltage reapplied |
\( V_{T(0)} \) Low level value of threshold voltage | 0.86 | 0.83 | 0.8 | V | (16.7% × \( π \) \( I_{T(AV)} \) < \( I \) < \( π \) \( I_{T(AV)} \)) @ \( T_{J} \) max. |
\( V_{T(100)} \) High level value of threshold voltage | 1.05 | 1 | 0.98 | (\( I > \pi \times I_{T(AV)} \)) @ \( T_{J} \) max. |
\( \eta_1 \) Low level value on-state slope resistance | 2.02 | 1.78 | 1.67 | mΩ | (16.7% × \( π \) \( I_{T(AV)} \) < \( I \) < \( π \) \( I_{T(AV)} \)) @ \( T_{J} \) max. |
\( \eta_2 \) High level value on-state slope resistance | 1.65 | 1.43 | 1.38 | (\( I > \pi \times I_{T(AV)} \)) @ \( T_{J} \) max. |
\( V_{FM} \) Maximum forward voltage drop | 1.57 | 1.55 | 1.54 | V | \( I_{FM} = \pi \times I_{T(AV)} \), \( T_{J} = 25°C \), 180° conduction |
\( I_{H} \) Maximum holding current | 200 | mA | Anode supply = 6V, initial \( I \) = 30A, \( T_{J} \) = 25°C |
\( I_{L} \) Maximum latching current | 400 | mA | Anode supply = 6V, resistive load = 1Ω Gate pulse: 10V, 100μs, \( T_{J} \) = 25°C |

### Switching

| \( t_{gd} \) | Typical delay time | 1 | μs | \( T_{J} \) = 25°C, Gate Current=1A dI/dt=1A/μs |
| \( t_{gr} \) | Typical rise time | 2 | | \( T_{J} \) = 25°C, \( V_{dd}=0.67\% \( V_{RMS} \) |
| \( t_{q} \) | Typical turn-off time | 50 - 200 | | \( I_{FM} = 300 \text{A} \), dI/dt = 15 A/μs, \( T_{J} \) = \( T_{J} \) max. |

\( V_{dd} = 50 \text{V}, dV/dt = 20 \text{V/μs}, \text{Gate 0 V, 100Ω} \)
Thermal and Mechanical Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>IRK.136</th>
<th>IRK.142</th>
<th>IRK.162</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_J$ Max. junction operating temperature range</td>
<td>-40 to 125</td>
<td>°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_{s4}$ Max. storage temperature range</td>
<td>-40 to 150</td>
<td>°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R_{thJC}$ Max. thermal resistance, junction to case</td>
<td>0.18</td>
<td>0.18</td>
<td>0.16</td>
<td>K/W</td>
</tr>
<tr>
<td>$R_{thCS}$ Max. thermal resistance, case to heatsink</td>
<td>0.05</td>
<td>K/W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T$ Torque to heatsink</td>
<td>4 to 6</td>
<td>Nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$wt$ Approximate weight</td>
<td>200 (7.1)</td>
<td>g(oz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case Style</td>
<td>New Int-A-Pak</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$\Delta R$ Conduction (per Junction)

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

<table>
<thead>
<tr>
<th>Devices</th>
<th>180°</th>
<th>120°</th>
<th>90°</th>
<th>60°</th>
<th>30°</th>
<th>180°</th>
<th>120°</th>
<th>90°</th>
<th>60°</th>
<th>30°</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRK.136</td>
<td>0.007</td>
<td>0.01</td>
<td>0.013</td>
<td>0.0155</td>
<td>0.017</td>
<td>0.009</td>
<td>0.012</td>
<td>0.014</td>
<td>0.015</td>
<td>0.017</td>
</tr>
<tr>
<td>IRK.142</td>
<td>0.0019</td>
<td>0.0019</td>
<td>0.0002</td>
<td>0.0020</td>
<td>0.0021</td>
<td>0.0018</td>
<td>0.0022</td>
<td>0.0023</td>
<td>0.0023</td>
<td>0.0020</td>
</tr>
<tr>
<td>IRK.162</td>
<td>0.0030</td>
<td>0.0031</td>
<td>0.0032</td>
<td>0.0033</td>
<td>0.0034</td>
<td>0.0029</td>
<td>0.0036</td>
<td>0.0039</td>
<td>0.0041</td>
<td>0.0040</td>
</tr>
</tbody>
</table>
Ordering Information Table

<table>
<thead>
<tr>
<th>Device Code</th>
<th>IRK</th>
<th>T</th>
<th>162</th>
<th>/</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 - Module Type
2 - Circuit Configuration
3 - Current Rating: \( I_{T(AV)} \)
4 - Voltage Code: Code \( \times 100 = V_{\text{RM}} \)

Outline Table

Dimensions are in millimeters and [inches]

NOTE: To order the Optional Hardware see Bulletin I27900
**Fig. 1 - Current Ratings Characteristics**

- Maximum Allowable Case Temperature (°C)
- Average Forward Current (A)

**Fig. 2 - Current Ratings Characteristics**

- Maximum Allowable Case Temperature (°C)
- Average On-state Current (A)

**Fig. 3 - On-State Power Loss Characteristics**

- Maximum Average On-state Power Loss (W)
- Average On-state Current (A)

**Fig. 4 - On-State Power Loss Characteristics**

- Maximum Average On-state Power Loss (W)
- Average On-state Current (A)

**Fig. 5 - Maximum Non-Repetitive Surge Current**

- Peak Half Wave On-state Current (A)
- Number of Equal Amplitude Half Cycle Current Pulses (N)

**Fig. 6 - Maximum Non-Repetitive Surge Current**

- Peak Half Wave On-state Current (A)
- Pulse Train Duration (s)

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**IRK.136, .142, .162 Series**

Bulletin 127117 rev. C 03/02

- IRK.136, Series
- $R_{thJC} (DC) = 0.18 \text{kW}$

- Conduction Angle
- Conduction Period

- Initial $T_j = 125$°C

- No Voltage Reapplied

- Rated $V_{RRM}$ Reapplied

- Control Of Conduction May Not Be Maintained

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Fig. 16 - On State Power Loss Characteristics

Fig. 17 - On State Power Loss Characteristics

Fig. 18 - On State Power Loss Characteristics
Maximum Allowable Ambient Temperature (°C)

IRK.136, .142, .162 Series

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 $Z_{thJC}$ Characteristics

Fig. 32 - Thermal Impedance $Z_{thJC}$ Characteristics

Fig. 33 - Thermal Impedance $Z_{thJC}$ Characteristics
Fig. 34 - Gate Characteristics

(a) Rectangular gate pulse
(b) Recommended load line for

- TJ = -40°C
- TJ = 25°C
- TJ = 125°C

(a) Recommended load line for
- <= 30% rated di/dt: 15 V, 40 ohms
  - tr = 1 s, tp >= 6 s
- rated di/dt: 20 V, 20 ohms
  - tr = 0.5 s, tp >= 6 s

1) PGM = 200 W, tp = 300 s
2) PGM = 60 W, tp = 1 ms
3) PGM = 30 W, tp = 2 ms
4) PGM = 12 W, tp = 5 ms

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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IRKH142/12PBF  IRKH142/14PBF  IRKH142/16PBF  IRKH162/04PBF  IRKH162/08PBF  IRKH162/12PBF
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