# Ruttonsha International Rectifier Ltd.
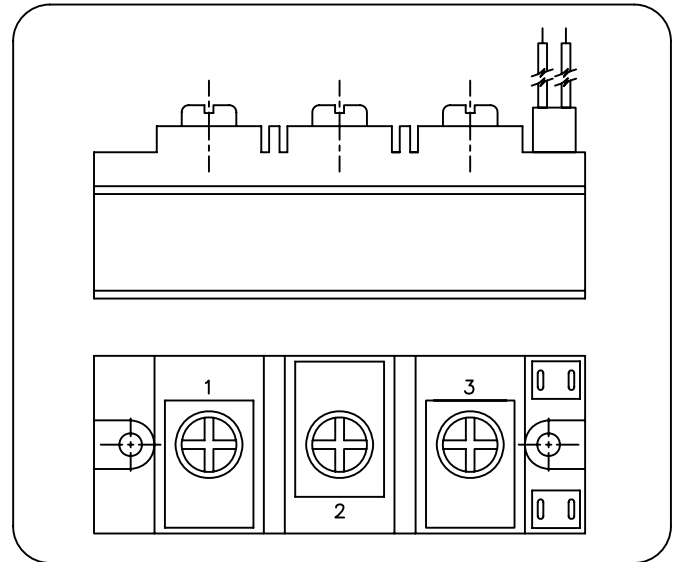
## POWER MODULES

## IRK. 136 Series
## High Voltage Thyristor/ Diode and Thyristor/ Thyristor



## FEATURES

# Electrically isolated base plate.
# 3000Vrms isolating  voltage.
# Industrial standard package.
# Simplified mechanical designs, rapid assembly.
# High surge capability.
# Large creepage distance.
# Aluminum Nitride.

## DESCRIPTION

These IRK series of Power Modules use power diodes and thyristor in four basic configuration. The semiconductors are electrically isolated from the metal base, allowing common heat sinks and compact assemblies to be built. They can be interconnected to form single phase or three phase bridges or AC controller. These modules are connected in anti-parallel

These module are intended for general purpose applications such as battery chargers.welders and plating equipment.

## MAJOR RATING & CHARACTERISTICS

| Parameters | | IRK. 136 | Units |
|---|---|---|---|
| $I_{T(AV)}$ | @Tc-85°C | 135 | A |
| $I_{T(RMS)}$ | | 300 | A |
| $I_{TSM}$ | @ 50Hz | 3200 | A |
| $I^2t$ | @ 50Hz | 51.5 | kA²s |
| $V_{RRM}$ | | 400 to 1600 | V |
| $T_J$ | | -40 to 130 | °C |

# POWER MODULES

## IRK. 136 Series

### ELECTRICAL SPECIFICATION
### VOLTAGE RATINGS

| Type Number | Voltage Code | $V_{RRM}$ max. repetitive peak reverse and off-state blocking voltage V | $V_{RSM}$ max.non-repetitive peak reverse voltage V | $I_{DRM}$ / $I_{RRM}$ max. @ 130°C Max. mA |
|---|---|---|---|---|
| IRK.136 | 04 | 400 | 500 | 50 |
| | 06 | 600 | 700 | |
| | 08 | 800 | 900 | |
| | 10 | 1000 | 1100 | |
| | 12 | 1200 | 1300 | |
| | 14 | 1400 | 1500 | |
| | 16 | 1600 | 1700 | |

### ON-STATE CONDUCTION

| | Parameter | IRK. 136 | Unit | Conditions |
|---|---|---|---|---|
| $I_{T(AV)}$ | Max, average On-state current @ case temperature | 135￼ 85 | A ￼°C | 180°C conduction, half sine wave |
| $I_{T(RMS)}$ | Max, RMS on-state current | 300 | A | as AC switch |
| $I_{TSM}$ | Max, peak, one cycle on-state, non-repetitive surge current | 3200 | A | t = 10ms ⎫ Sinusoidal half wave initial Tj = Tj max. |
| $I^2t$ | Maximum $I^2t$ for fusing | 51.5 | kA²s | t = 10ms ⎭ |
| $V_{T(TO)}$ | Max, value of Threshold voltage | 0.98 | V | Tj = Tj max. |
| $r_t$ | Max, value of on-state slope resistance | 1.62 | mΩ | Tj = Tj max, |
| $V_{TM}$ | Max, on-state voltage drop | 1.66 | V | $I_{TM} = \pi \times I_{T(AV)}$, $T_j$ = Tj Max, 180° conduction AV Power = $V_{T(TO)} \times I_{T(AV)} + r1 \times (I_{T(RMS)})^2$ |
| $I_H$ | Maximum holding current | 500 | mA | Anode supply = 12V initial $I_T$ = 30A, TJ = 25°C |
| $I_L$ | Max, latching current | 300 | mA | Anode supply = 12V resistive Load = 1Ω, gate pulse. 10V, 100µs, Tj = 25°C |

### SWITCHING

| $t_d$ | Typical delay time | 2.0 | µs | Tj = 25°C | Gate current = 1A dig/dt = 1A/µS |
|---|---|---|---|---|---|
| $T_R$ | Typical rise time | 3.0 | µs | Tj = 25°C | Vd = 0.67% $V_{DRM}$ |
| $r_q$ | Typical turn-off time | 50-150 | µs | $I_{TM}$ = 300A, di/dt = 15A/µs, Tj = Tj max, $V_r$ = 50V, dv/dt = 20/µs. Gate 0V, 100Ω | |

# POWER MODULES

## IRK. 136 Series

### BLOCKING

| | Parameter | IRK. 136 | Unit | Conditions |
|---|---|---|---|---|
| dv/dt | Max, critical rate of rise of off-state voltage | 1000 | V/µs | $T_j = 125°C$ exponential to 0.67% rated $V_{DRM}$. |
| $I_{RRM}$ $I_{DRM}$ | Max. peak reverse and off state leakage current at $V_{RRM}$ $V_{DRM}$ | 50 | mA | $T_j = 125°C$, rated $V_{DRM}/V_{RRM}$ Applied |
| $V_{INS}$ | RMS Isolation voltage | 3000 | V | 50Hz, Circuit to base, all terminal shorted, 25°C t=1 sec. |

### ELECTRICAL SPECIFICATION TRIGGERING

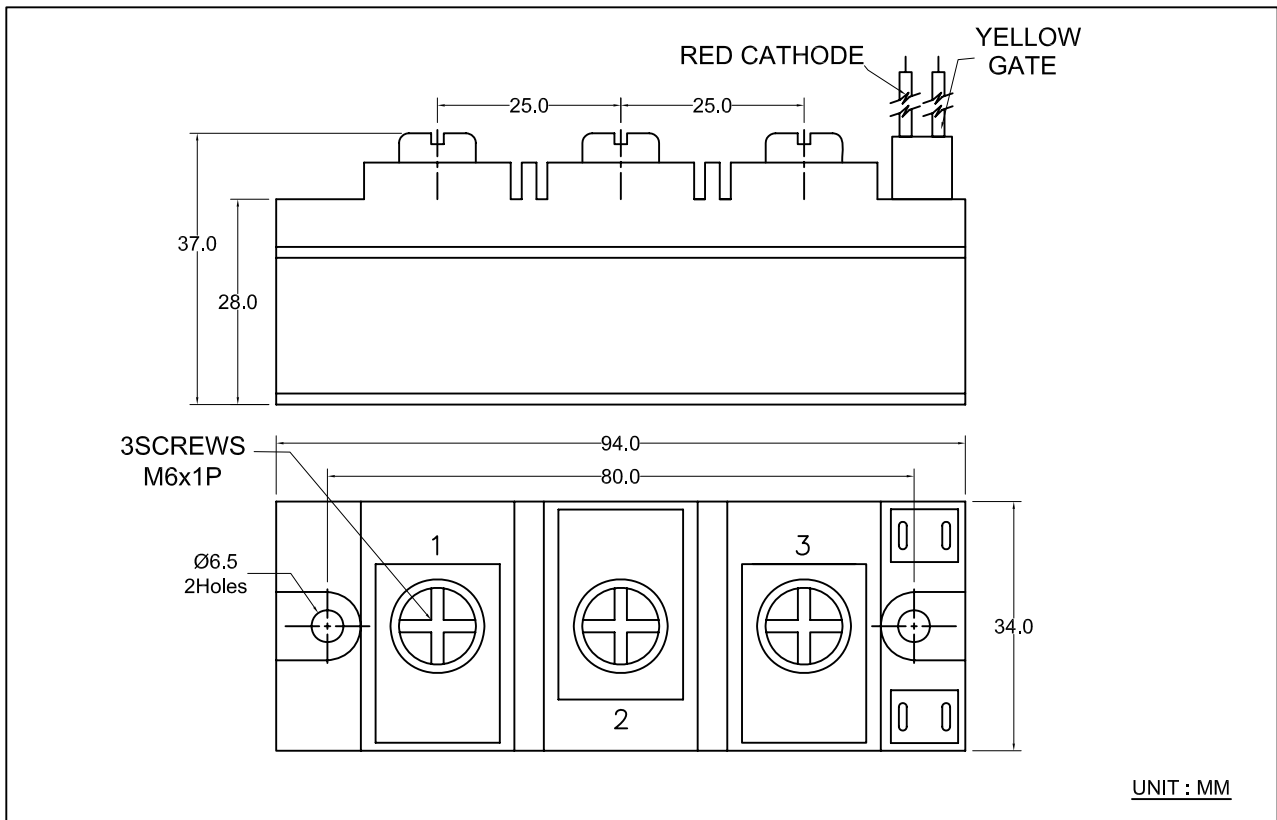| | Parameter | IRK. 136 | Unit | Conditions | |
|---|---|---|---|---|---|
| $P_{GM}$ | Max, peak gate power | 5 | W | $T_j = 125°C$, $t_P \leq 5ms$ | |
| $P_{G(AV)}$ | Maximum average gate power | 1.0 | | $T_j = 125°C$, f = 50Hz, d% = 50 | |
| $I_{GM}$ | Max, peak positive gate current | 2.0 | A | $T_j = 125°C$, $t_P \leq 5ms$ | |
| $+V_{GM}$ | Max. peak positive gate voltage | 20 | V | $T_j = 125°C$, $t_P \leq 5ms$ | |
| $-V_{GM}$ | Max. peak negative gate voltage | 5.0 | V | | |
| $I_{GT}$ | DC gate current required to trigger | 200 | mA | $T_j = 25°C$ | Max required gate trigger/current/voltage are the lowest value which will trigger all units 12V anode-to-cathode applied. |
| $V_{GT}$ | DC gate voltage required to trigger | 3.0 | V | $T_j = 25°C$ | |
| $V_{GD}$ | DC gate voltage not to trigger | 0.25 | V | $T_j = 125°C$ | Max required gate trigger/current/voltage are the lowest value which will trigger all units 12V anode-to-cathode applied. |
| $I_{GD}$ | DC gate current not to trigger | 10 | mA | | |
| dv/dt | Max, critical rate of rise of turneed-on current | 300 | A/µs | $T_j = 125°C$ $I_{TM} = 400A$, rated $V_{DRM}$ applied. | |

### THERMAL AND MECHANICAL SPECIFICATION

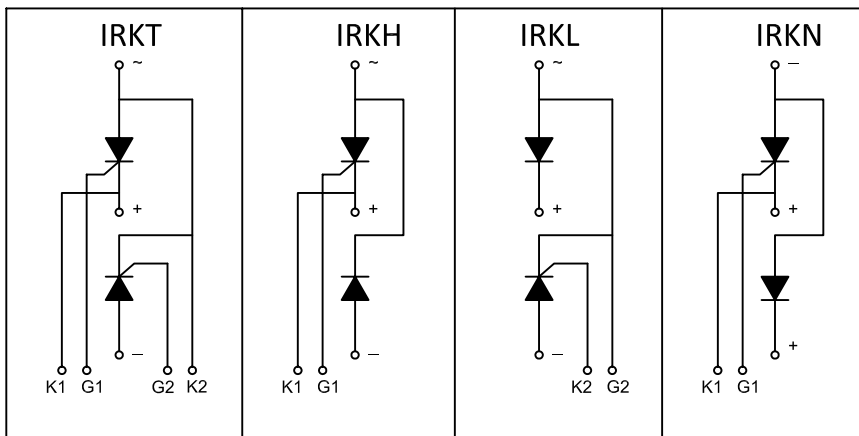| | Parameter | IRK. 136 | Unit | Conditions |
|---|---|---|---|---|
| $T_J$ | Junction operating temperature | -40 to 130 | °C | |
| $T_{stg}$ | Max, storage temperature range | -40 to 150 | | |
| $R_{thJ-C}$ | Max. thermal resistance, junction to case | 0.20 | K/W | Per Junction, DC operation |
| $R_{thC-h}$ | Max. thermal resistance junction to heatsink | 0.035 | K/W | Mounting surface flat smooth and greased (per Module) |
| T | Mounting torque ±10% | 4 to 6 | Nm | For module to heat sink and bus bar to module |
| Wt | Approximate Weight | 500 | g | |
| | Case style | INT-A-PAK | | |

# POWER MODULES

## IRK. 136 Series

OUTLINE DIAGRAM



RED CATHODE
YELLOW GATE

25.0    25.0

37.0
28.0

3SCREWS
M6x1P

94.0
80.0

Ø6.5
2Holes

1    3    2

34.0

UNIT : MM

CIRCUIT CONFIGURATION TABLE



| IRKT | IRKH | IRKL | IRKN |
|------|------|------|------|
| K1 G1 G2 K2 | K1 G1 | K2 G2 | K1 G1 |

CIRCUIT CONFIGURATION TABLE

| IRK | T | 136 | / | 16 |
|-----|---|-----|---|----|
| 1 | 2 | 3 | | 4 |
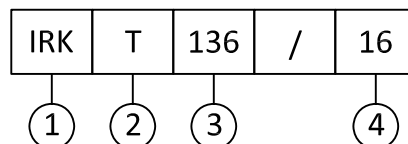
1). - Module Type
2). - Circuit configuration (See Circuit Configuration table)
3). - Current Code
4). - Voltage Code (See Voltage Rating Table)