
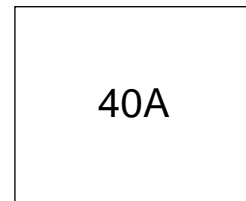


PASSIVATED ASSEMBLED CIRCUIT ELEMENTS

Features

- Glass passivated junctions for greater reliability
- Electrically isolated base plate
- Available up to 1200 V_{RRM}, V_{DRM}
- High dynamic characteristics
- Wide choice of circuit configurations
- Simplified mechanical design and assembly
- UL E78996 approved 



Description

The P400 series of Integrated Power Circuits consists of power thyristors and power diodes configured in a single package. With its isolating base plate, mechanical designs are greatly simplified giving advantages of cost reduction and reduced size.

Applications include power supplies, control circuits and battery chargers.

Major Ratings and Characteristics

| Parameters | P400 | Units |
|-------------------|-------------|-------------------|
| I _D | 40 | A |
| @ T _C | 80 | °C |
| I _{FSM} | 385 | A |
| @ 50Hz | | |
| @ 60Hz | 400 | A |
| I ² t | 745 | A ² s |
| @ 50Hz | | |
| @ 60Hz | 680 | A ² s |
| I ² √t | 7450 | A ² √s |
| V _{RRM} | 400 to 1200 | V |
| V _{INS} | 2500 | V |
| T _J | - 40 to 125 | °C |

P400 Series

Bulletin I2776 rev. E 04/99

International
 Rectifier

ELECTRICAL SPECIFICATIONS

Voltage Ratings

| Type number | V_{RRM} maximum repetitive peak reverse voltage V | V_{RSM} maximum non-repetitive peak reverse voltage V | V_{DRM} maximum repetitive peak off-state voltage V | I_{RRM} max. @ T_J max. mA |
|------------------|--|--|--|-----------------------------------|
| P401, P421, P431 | 400 | 500 | 400 | 10 |
| P402, P422, P432 | 600 | 700 | 600 | |
| P403, P423, P433 | 800 | 900 | 800 | |
| P404, P424, P434 | 1000 | 1100 | 1000 | |
| P405, P425, P435 | 1200 | 1300 | 1200 | |

On-state Conduction

| Parameter | P400 | Units | Conditions | |
|--|------|------------------|---|--|
| I_D Maximum DC output current | 40 | A | @ $T_C = 80^\circ\text{C}$, full bridge circuits | |
| I_{TSM} Max. peak one-cycle non-repetitive on-state or forward current | 385 | A | t = 10ms No voltage reappplied | |
| I_{FSM} | 400 | | t = 8.3ms | 100% V_{RRM} reappplied |
| | 325 | | t = 10ms | Sinusoidal half wave, Initial $T_J = T_J$ max. |
| | 340 | | t = 8.3ms | |
| I^2t Maximum I^2t for fusing | 745 | A^2s | t = 10ms No voltage reappplied | |
| | 680 | | t = 8.3ms | 100% V_{RRM} reappplied |
| | 530 | | t = 10ms | Initial $T_J = T_J$ max. |
| | 480 | | t = 8.3ms | |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing | 7450 | $A^2\sqrt{s}$ | t = 0.1 to 10ms, no voltage reappplied I^2t for time tx = $I^2\sqrt{t} \cdot \sqrt{tx}$ | |
| $V_{T(TO)1}$ Low value of threshold voltage | 0.83 | V | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ max. | |
| $V_{T(TO)2}$ High value of threshold voltage | 1.03 | | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ max. | |
| r_{t1} Low level value of on-state slope resistance | 9.61 | m Ω | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ max. | |
| r_{t2} High level value of on-state slope resistance | 7.01 | | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ max. | |
| V_{TM} Max. peak on-state or forward voltage drop V_{FM} | 1.4 | V | $T_J = 25^\circ\text{C}$, $I_{TM} = \pi \times I_{T(AV)}$ $T_J = 25^\circ\text{C}$, $I_{TM} = \pi \times I_{F(AV)}$ | |
| di/dt Maximum non repetitive rate of rise of turned on current | 200 | A/ μs | $T_J = 125^\circ\text{C}$ from 0.67 V_{DRM} $I_{TM} = \pi \times I_{T(AV)}$, $I_g = 500\text{mA}$, tr < 0.5 μs , tp > 6 μs | |
| I_H Maximum holding current | 130 | mA | $T_J = 25^\circ\text{C}$ anode supply = 6V, resistive load | |
| I_L Maximum latching current | 250 | mA | $T_J = 25^\circ\text{C}$ anode supply = 6V, resistive load | |

Blocking

| Parameter | P400 | Units | Conditions |
|--|------|------------|--|
| dv/dt Maximum critical rate of rise of off-state voltage | 200 | V/ μ s | $T_J = 125^\circ\text{C}$, exponential to $0.67 V_{\text{DRM}}$ gate open |
| I_{RRM} Max. peak reverse and off-state leakage current at $V_{\text{RRM}}, V_{\text{DRM}}$ | 10 | mA | $T_J = 125^\circ\text{C}$, gate open circuit |
| I_{RRM} Max peak reverse leakage current | 100 | μ A | $T_J = 25^\circ\text{C}$ |
| V_{INS} RMS isolation voltage | 2500 | V | 50Hz, circuit to base, all terminal shorted, $T_J = 25^\circ\text{C}$, $t = 1\text{s}$ |

Triggering

| Parameter | P400 | Units | Conditions |
|--|----------------|-------|--|
| P_{GM} Maximum peak gate power | 8 | W | |
| $P_{\text{G(AV)}}$ Maximum average gate power | 2 | | |
| I_{GM} Maximum peak gate current | 2 | A | |
| $-V_{\text{GM}}$ Maximum peak negative gate voltage | 10 | V | $T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$ Anode Supply = 6V resistive load |
| V_{GT} Maximum gate voltage required to trigger | 3 2 1 | | |
| I_{GD} Maximum gate current required to trigger | 90 60 35 | | |
| V_{GD} Maximum gate voltage that will not trigger | 0.2 | V | $T_J = 125^\circ\text{C}$, rated V_{DRM} applied |
| I_{GD} Maximum gate current that will not trigger | 2 | mA | $T_J = 125^\circ\text{C}$, rated V_{DRM} applied |

Thermal and Mechanical Specification

| Parameter | P400 | Units | Conditions |
|---|------------|------------------|---|
| T_J Max. operating temperature range | -40 to 125 | $^\circ\text{C}$ | |
| T_{stg} Max. storage temperature range | -40 to 125 | | |
| R_{thJC} Max. thermal resistance, junction to case | 1.05 | K/W | DC operation per junction |
| R_{thCS} Max. thermal resistance, case to heatsink | 0.10 | K/W | Mounting surface, smooth and greased |
| T Mounting torque, base to heatsink | 4 | Nm | A mounting compound is recommended and the torque should be checked after a period of 3 hours to allow for the spread of the compound |
| wt Approximate weight | 58 (2.0) | g (oz) | |

P400 Series

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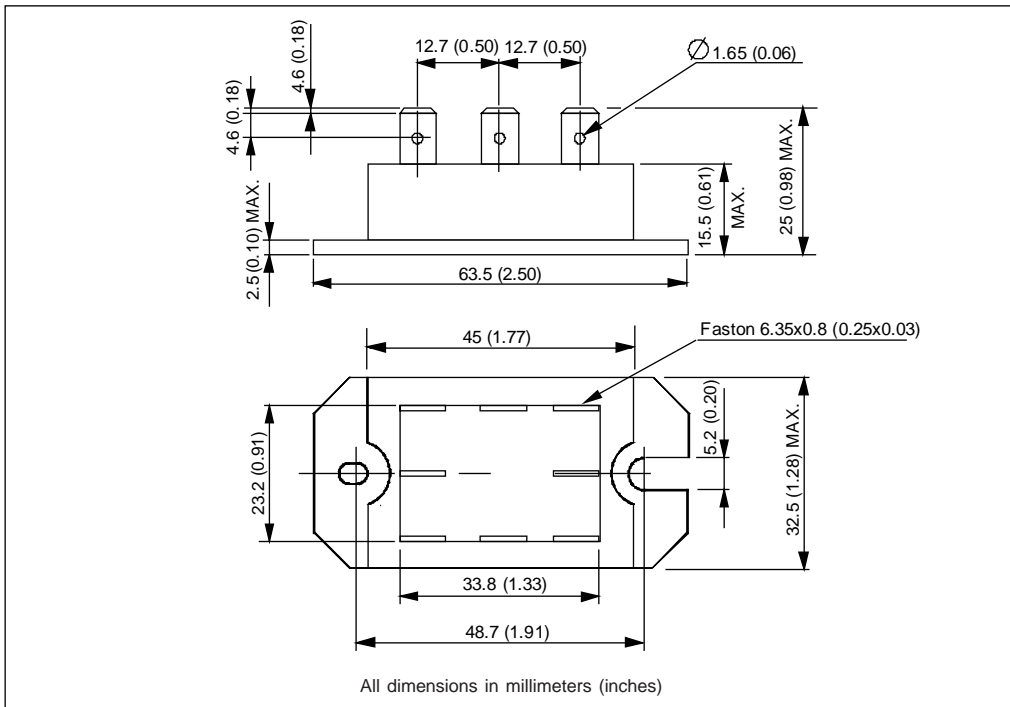
International
IRF Rectifier

Circuit Type and Coding *

| | Circuit"0" | Circuit"2" | Circuit"3" |
|---|--|-----------------------------------|---------------------------|
| Terminal Positions | | | |
| Schematic diagram | | | |
| | SinglePhase Hybrid Bridge Common Cathode | SinglePhase Hybrid Bridge Doubler | SinglePhase AllSCR Bridge |
| Basic series | P40. | P42. | P43. |
| With voltage suppression | P40.K | P42.K | P43.K |
| With free-wheeling diode | P40.W | - | - |
| With both voltage suppression and free-wheeling diode | P40.KW | - | - |

* To complete code refer to voltage ratings table, i.e.: for 600V P410.W complete code is P402W

Outline Table



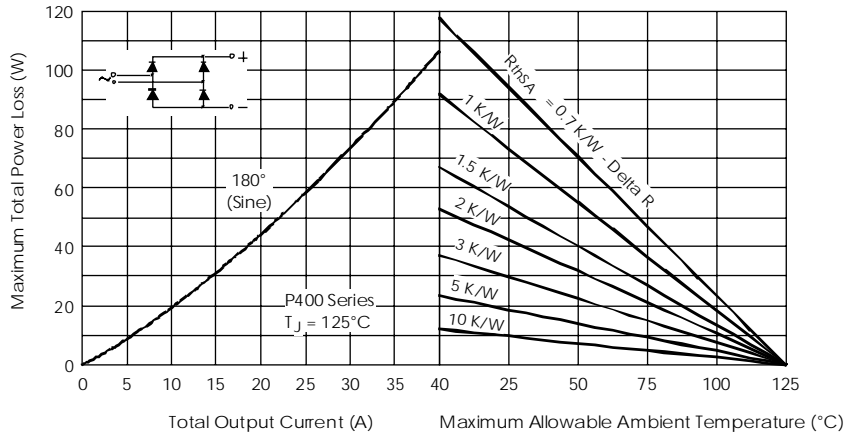


Fig. 1 - Current Ratings Nomogram (1 Module Per Heatsink)

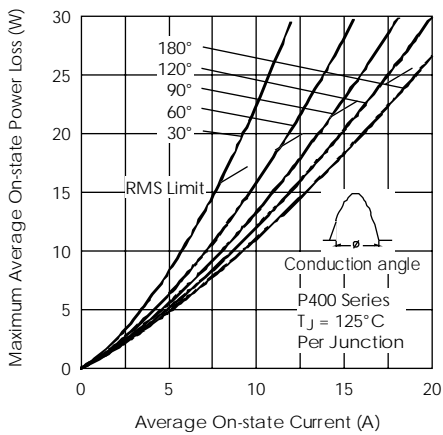


Fig. 2 - On-state Power Loss Characteristics

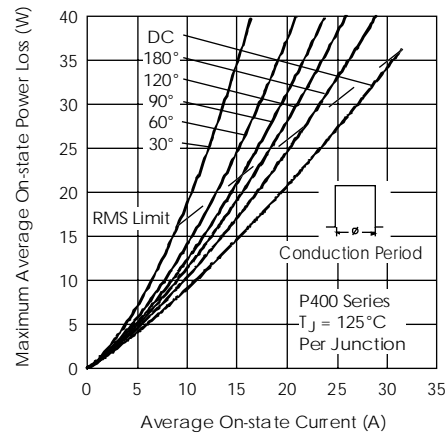


Fig. 3 - On-state Power Loss Characteristics

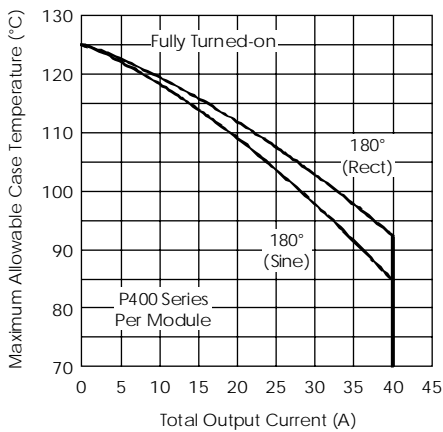


Fig. 4 - Current Ratings Characteristics

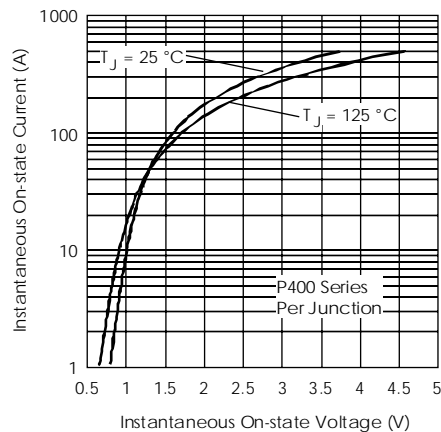


Fig. 5 - On-state Voltage Drop Characteristics

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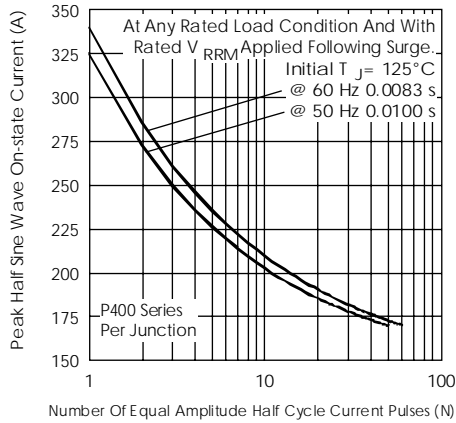


Fig. 6 - Maximum Non-Repetitive Surge Current

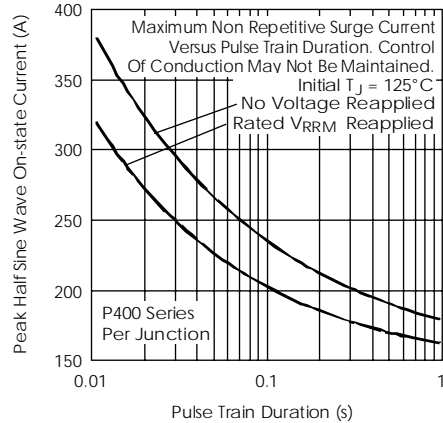


Fig. 7 - Maximum Non-Repetitive Surge Current

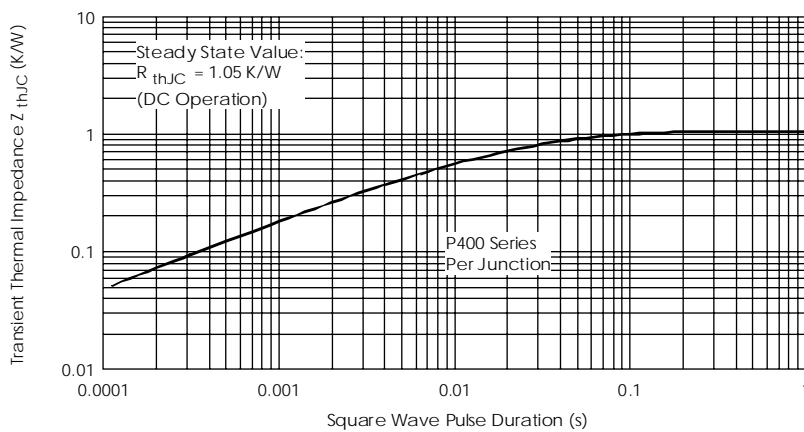


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

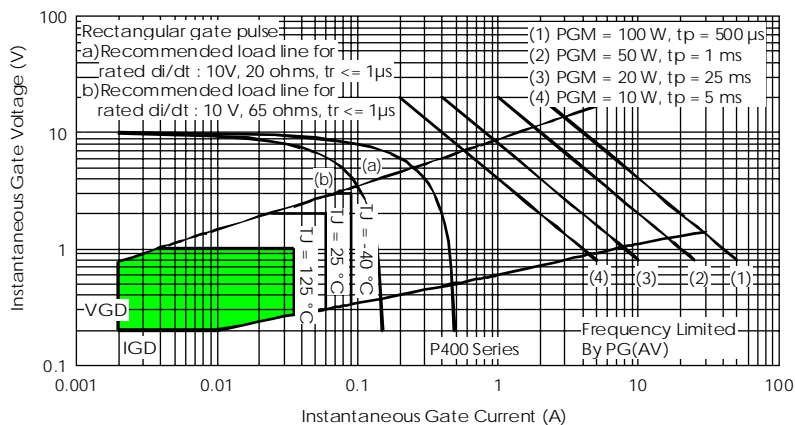


Fig. 9 - Gate Characteristics

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Data and specifications subject to change without notice.