

International
IRF Rectifier

110/111RIA SERIES

PHASE CONTROL THYRISTORS

Stud Version

Features

- High current and high surge ratings
- Hermetic glass-metal seal up to 1200V

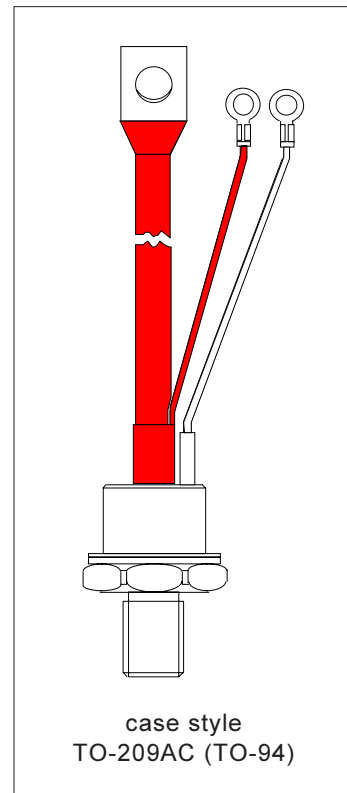
110A

Typical Applications

- DC motor controls
- Controlled DC power supplies
- AC controllers

Major Ratings and Characteristics

| Parameters | 110/111RIA | Units |
|-------------------|-------------|-------------------|
| $I_{T(AV)}$ | 110 | A |
| @ T_C | 90 | °C |
| $I_{T(RMS)}$ | 172 | A |
| I_{TSM} @ 50Hz | 2080 | A |
| @ 60Hz | 2180 | A |
| I^2t @ 50Hz | 21.7 | KA ² s |
| @ 60Hz | 19.8 | KA ² s |
| V_{DRM}/V_{RRM} | 800 to 1200 | V |
| t_q typical | 110 | μs |
| T_J | - 40 to 140 | °C |



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Bulletin I25204 rev. B 09/03

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ELECTRICAL SPECIFICATIONS

Voltage Ratings

| Type number | Voltage Code | V_{DRM}/V_{RRM} , max. repetitive peak and off-state voltage V | V_{RSM} , maximum non-repetitive peak voltage V | I_{DRM}/I_{RRM} max. @ $T_J = T_J$ max. mA |
|-------------|--------------|--|---|--|
| 110/111RIA | 80 | 800 | 900 | 20 |
| | 120 | 1200 | 1300 | |

On-state Conduction

| Parameter | 110/111RIA | Units | Conditions | |
|--|------------|--------------------|--|---------------------------|
| $I_{T(AV)}$ Max. average on-state current @ Case temperature | 110 | A | 180° conduction, half sine wave | |
| | 90 | °C | | |
| $I_{T(RMS)}$ Max. RMS on-state current | 172 | A | DC @ 83°C case temperature | |
| I_{TSM} Max. peak, one-cycle non-repetitive surge current | 2080 | | t = 10ms | No voltage reappplied |
| | 2180 | | t = 8.3ms | reappplied |
| | 1750 | | t = 10ms | 100% V_{RRM} reappplied |
| 1830 | t = 8.3ms | reappplied | | |
| I^2t Maximum I^2t for fusing | 21.7 | KA ² s | t = 10ms | No voltage reappplied |
| | 19.8 | | t = 8.3ms | reappplied |
| | 15.3 | | t = 10ms | 100% V_{RRM} reappplied |
| | 14.0 | | t = 8.3ms | reappplied |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing | 217 | KA ² √s | t = 0.1 to 10ms, no voltage reappplied | |
| $V_{T(TO)1}$ Low level value of threshold voltage | 0.82 | 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 level value of threshold voltage | 1.02 | | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ max. | |
| r_{t1} Low level value of on-state slope resistance | 2.16 | mΩ | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ max. | |
| r_{t2} High level value of on-state slope resistance | 1.70 | | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ max. | |
| V_{TM} Max. on-state voltage | 1.57 | V | $I_{pk} = 350A$, $T_J = T_J$ max., $t_p = 10ms$ sine pulse | |
| I_H Maximum holding current | 150 | mA | $T_J = 25^\circ C$, anode supply 6V resistive load | |
| I_L Typical latching current | 400 | | | |

Switching

| Parameter | 110/111RIA | Units | Conditions |
|---|------------|-------|---|
| di/dt Max. non-repetitive rate of rise of turned-on current | 300 | A/μs | Gate drive 20V, 20Ω, $t_r \leq 1\mu s$ $T_J = T_J$ max, anode voltage $\leq 80\% V_{DRM}$ |
| t_d Typical delay time | 1 | μs | Gate current 1A, $di_g/dt = 1A/\mu s$ $V_d = 0.67\% V_{DRM}$, $T_J = 25^\circ C$ |
| t_q Typical turn-off time | 110 | | $I_{TM} = 50A$, $T_J = T_J$ max., $di/dt = -5A/\mu s$, $V_R = 50V$ $dv/dt = 20V/\mu s$, Gate 0V 25Ω |

Blocking

| Parameter | 110/111RIA | Units | Conditions |
|--|------------|------------|--|
| dv/dt Maximum critical rate of rise of off-state voltage | 500 | V/ μ s | $T_J = T_J$ max. linear to 80% rated V_{DRM} |
| I_{RRM} I_{DRM} Max. peak reverse and off-state leakage current | 20 | mA | $T_J = T_J$ max, rated V_{DRM}/V_{RRM} applied |

Triggering

| Parameter | 110/111RIA | Units | Conditions |
|--|------------|----------|---|
| P_{GM} Maximum peak gate power | 12 | W | $T_J = T_J$ max, $t_p \leq 5$ ms |
| $P_{G(AV)}$ Maximum average gate power | 3.0 | | $T_J = T_J$ max, $f = 50$ Hz, $d\% = 50$ |
| I_{GM} Max. peak positive gate current | 3.0 | A | $T_J = T_J$ max, $t_p \leq 5$ ms |
| $+V_{GM}$ Maximum peak positive gate voltage | 20 | V | $T_J = T_J$ max, $t_p \leq 5$ ms |
| $-V_{GM}$ Maximum peak negative gate voltage | 10 | | |
| I_{GT} DC gate current required to trigger | TYP. | MAX. | $T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 140^\circ\text{C}$ Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied |
| | 180 | - | |
| | 80 40 | 120 - | |
| V_{GT} DC gate voltage required to trigger | 2.5 | - | $T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 140^\circ\text{C}$ |
| | 1.6 | 2 | |
| | 1 | - | |
| I_{GD} DC gate current not to trigger | 6.0 | mA | $T_J = T_J$ max Max. gate current/ voltage not to trigger is the max. value which will not trigger any unit with rated V_{DRM} anode-to-cathode applied |
| V_{GD} DC gate voltage not to trigger | 0.25 | V | |

Thermal and Mechanical Specification

| Parameter | 110/111RIA | Units | Conditions |
|--|------------------|------------------|--|
| T_J Max. operating temperature range | -40 to 140 | $^\circ\text{C}$ | |
| T_{stg} Max. storage temperature range | -40 to 150 | | |
| R_{thJC} Max. thermal resistance, junction to case | 0.27 | K/W | DC operation |
| R_{thCS} Max. thermal resistance, case to heatsink | 0.1 | | Mounting surface, smooth, flat and greased |
| T Mounting torque, $\pm 10\%$ | 15.5 | Nm (lbf-in) | Non lubricated threads |
| | (137) | | Lubricated threads |
| | 14 (120) | | |
| wt Approximate weight | 130 | g | |
| Case style | TO-209AC (TO-94) | | See Outline Table |

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ΔR_{thJC} Conduction

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

| Conduction angle | Sinusoidal conduction | Rectangular conduction | Units | Conditions |
|------------------|-----------------------|------------------------|-------|--------------------------|
| 180° | 0.043 | 0.031 | K/W | $T_J = T_J \text{ max.}$ |
| 120° | 0.052 | 0.053 | | $T_J = T_J \text{ max.}$ |
| 90° | 0.066 | 0.071 | | $T_J = T_J \text{ max.}$ |
| 60° | 0.096 | 0.101 | | $T_J = T_J \text{ max.}$ |
| 30° | 0.167 | 0.169 | | $T_J = T_J \text{ max.}$ |

Ordering Information Table

Device Code

| | | | |
|----|---|-----|-----|
| 11 | 1 | RIA | 120 |
| ① | ② | ③ | ④ |

- 1** - $I_{T(AV)}$ rated average output current (rounded/10)
- 2** - 0 = Eyelet terminals (Gate and Auxiliary Cathode Leads)
 1 = Fast - on terminals (Gate and Auxiliary Cathode Leads)
- 3** - Thyristor
- 4** - Voltage code: Code x 10 = V_{RRM} (See Voltage Rating Table)

NOTE: For Metric Device M12 x 1.75 Contact Factory

Outline Table

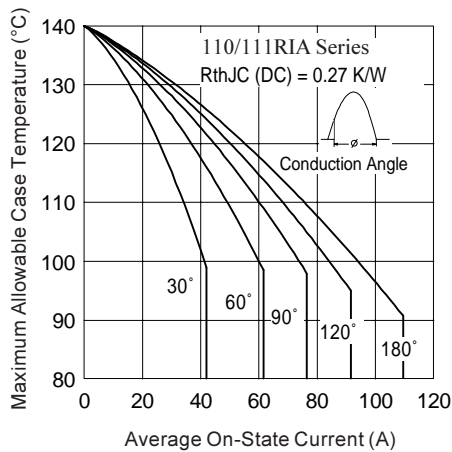
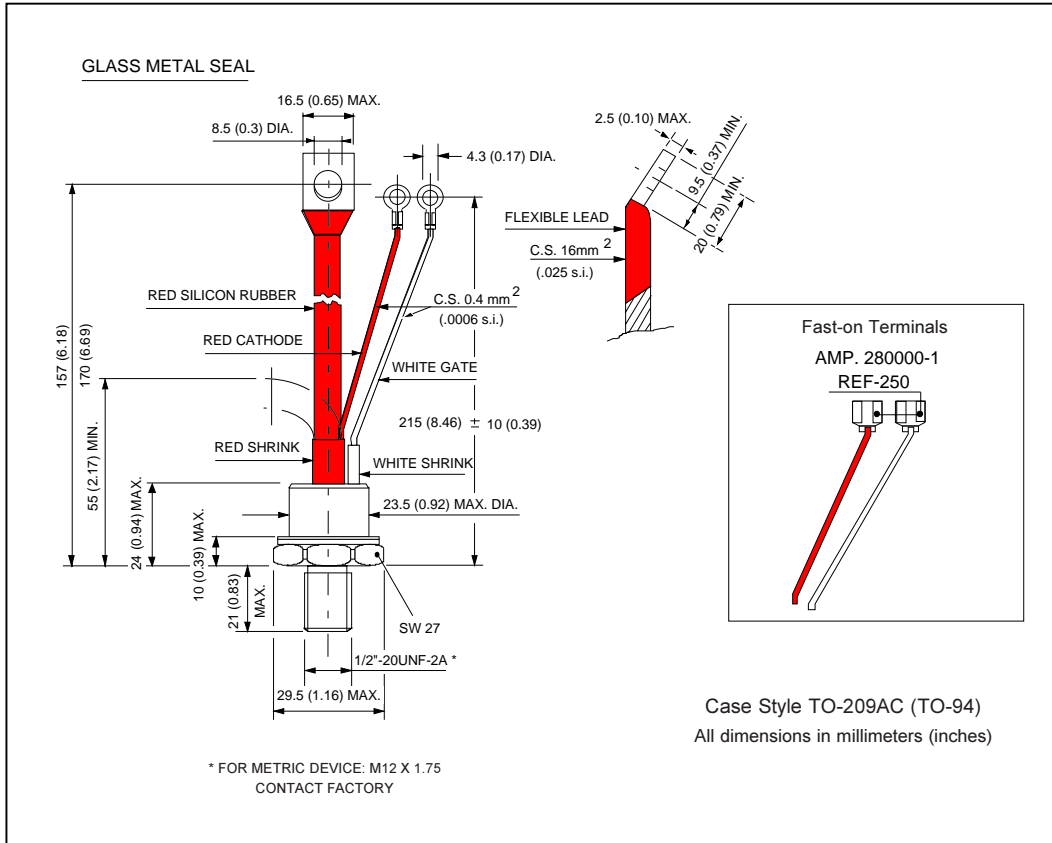


Fig. 1 - Current Ratings Characteristics

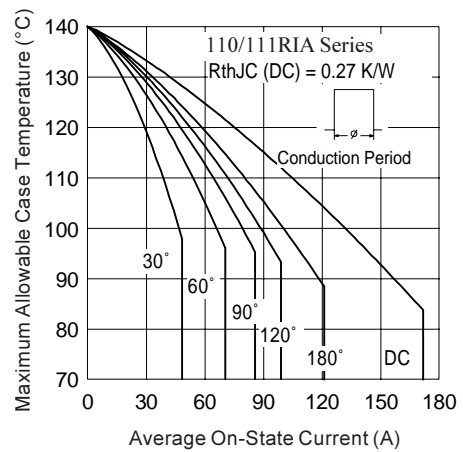


Fig. 2 - Current Ratings Characteristics

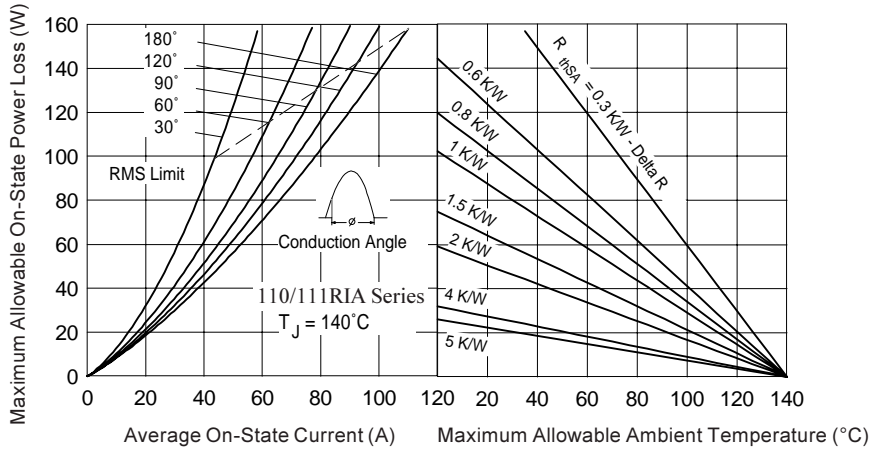


Fig. 3 - On-State Power Loss Characteristics

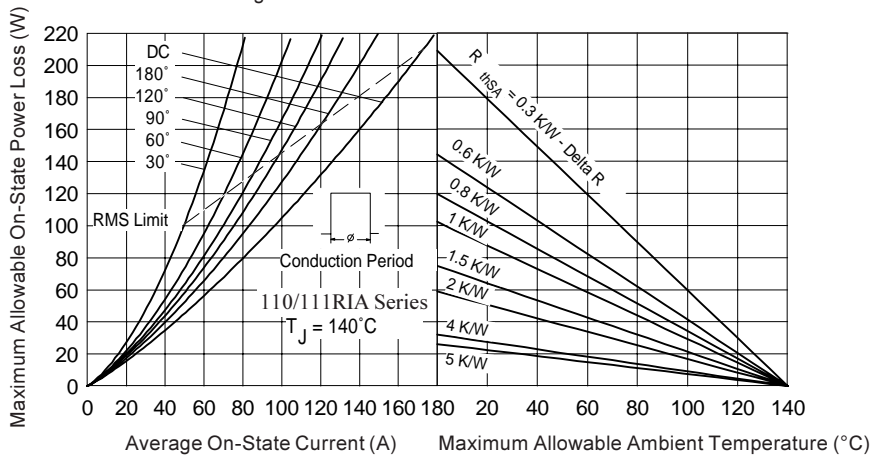


Fig. 4 - On-state Power Loss Characteristics

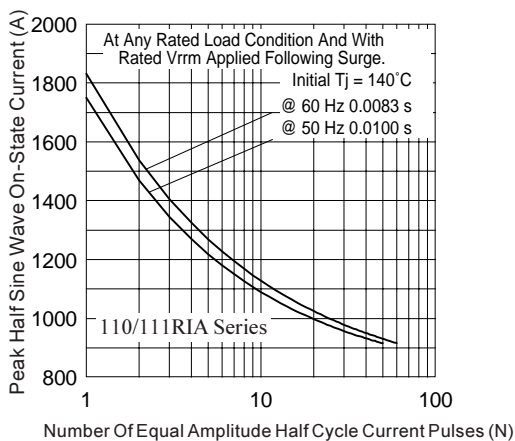


Fig. 5 - Maximum Non-Repetitive Surge Current

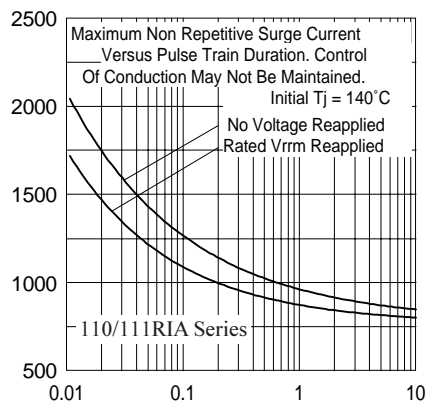


Fig. 6 - Maximum Non-Repetitive Surge Current

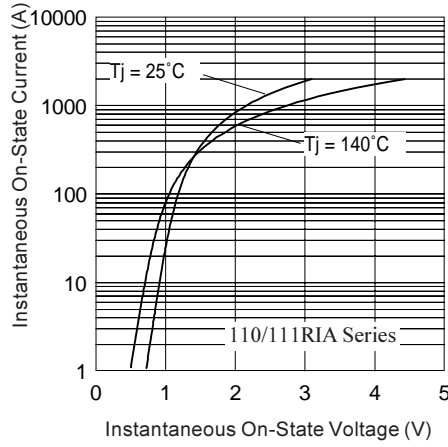


Fig. 7 - On-State Voltage Drop Characteristics

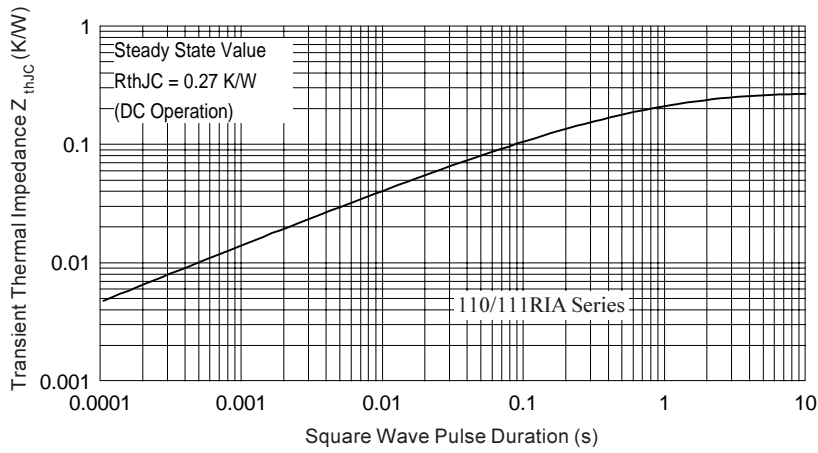


Fig. 8 - Thermal Impedance Z_{thJC} Characteristic

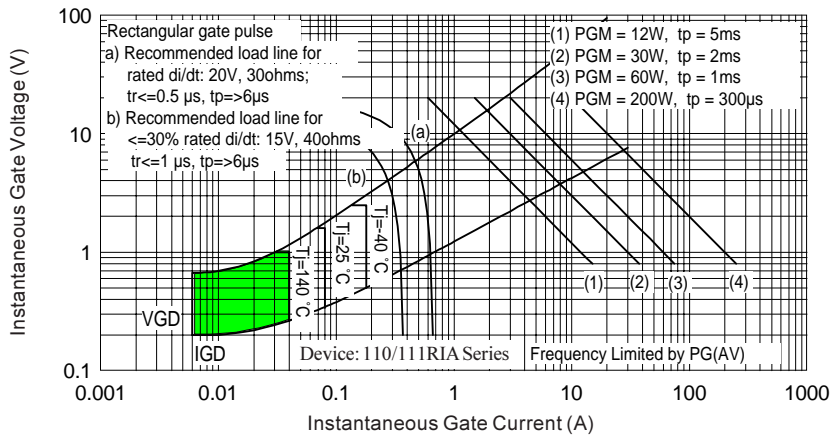


Fig. 9 - Gate Characteristics

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