

Phase Control Thyristors (Stud Version), 110 A



TO-209AC (TO-94)

FEATURES

- High current and high surge ratings
- Hermetic ceramic housing
- RoHS compliant
- Designed and qualified for industrial level


**RoHS
COMPLIANT**
TYPICAL APPLICATIONS

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

PRODUCT SUMMARY

| | |
|-------------|-------|
| $I_{T(AV)}$ | 110 A |
|-------------|-------|

MAJOR RATINGS AND CHARACTERISTICS

| PARAMETER | TEST CONDITIONS | VALUES | UNITS |
|-------------------|-----------------|-------------|-------------------|
| $I_{T(AV)}$ | | 110 | A |
| | T_C | 90 | °C |
| $I_{T(RMS)}$ | | 172 | A |
| I_{TSM} | 50 Hz | 2080 | A |
| | 60 Hz | 2180 | |
| I^2t | 50 Hz | 21.7 | kA ² s |
| | 60 Hz | 19.8 | |
| V_{DRM}/V_{RRM} | | 400 to 1200 | V |
| t_q | Typical | 110 | μs |
| T_J | | - 40 to 140 | °C |

ELECTRICAL SPECIFICATIONS
VOLTAGE RATINGS

| TYPE NUMBER | VOLTAGE CODE | V_{DRM}/V_{RRM} , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE V | V_{RSM} , MAXIMUM NON-REPETITIVE PEAK VOLTAGE V | I_{DRM}/I_{RRM} MAXIMUM AT $T_J = T_J$ MAXIMUM mA |
|-------------|--------------|--|--|--|
| 110/111RKI | 40 | 400 | 500 | 20 |
| | 80 | 800 | 900 | |
| | 120 | 1200 | 1300 | |

| ABSOLUTE MAXIMUM RATINGS | | | | | |
|--|---------------|--|---------------------------|---|--------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum average on-state current at case temperature | $I_{T(AV)}$ | 180° conduction, half sine wave | | 110 | A |
| | | | | 90 | °C |
| Maximum RMS on-state current | $I_{T(RMS)}$ | DC at 83 °C case temperature | | 172 | A |
| Maximum peak, one-cycle non-repetitive surge current | I_{TSM} | t = 10 ms | No voltage reapplied | 2080 | A |
| | | t = 8.3 ms | | Sinusoidal half wave, initial $T_J = T_J$ maximum | |
| | | t = 10 ms | 100 % V_{RRM} reapplied | | |
| | | t = 8.3 ms | | 1830 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reapplied | 21.7 | kA ² s |
| | | t = 8.3 ms | | 19.8 | |
| | | t = 10 ms | 100 % V_{RRM} reapplied | 15.3 | |
| | | t = 8.3 ms | | 14.0 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 to 10 ms, no voltage reapplied | | 217 | kA ² /s |
| Low level value of threshold voltage | $V_{T(TO)1}$ | $(16.7 \% \times \pi \times I_{T(AV)}) < I < \pi \times I_{T(AV)}$, $T_J = T_J$ maximum | | 0.82 | V |
| High level value of threshold voltage | $V_{T(TO)2}$ | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 1.02 | |
| Low level value of on-state slope resistance | r_{t1} | $(16.7 \% \times \pi \times I_{T(AV)}) < I < \pi \times I_{T(AV)}$, $T_J = T_J$ maximum | | 2.16 | mΩ |
| High level value of on-state slope resistance | r_{t2} | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 1.70 | |
| Maximum on-state voltage | V_{TM} | $I_{pk} = 350$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine pulse | | 1.57 | V |
| Maximum holding current | I_H | $T_J = 25$ °C, anode supply 6 V resistive load | | 200 | mA |
| Typical latching current | I_L | | | 400 | |

| SWITCHING | | | | | |
|--|---------|--|--|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum non-repetitive rate of rise of turned-on current | di/dt | Gate drive 20 V, 20 Ω, $t_r \leq 1$ μs $T_J = T_J$ maximum, anode voltage ≤ 80 % V_{DRM} | | 300 | A/μs |
| Typical delay time | t_d | Gate current 1 A, $di_g/dt = 1$ A/μs $V_d = 0.67$ % V_{DRM} , $T_J = 25$ °C | | 1.0 | μs |
| Typical turn-off time | t_q | $I_{TM} = 50$ A, $T_J = T_J$ maximum, $di/dt = -5$ A/μs, $V_R = 50$ V, $dV/dt = 20$ V/μs; gate 0 V 25 Ω | | 110 | |

| BLOCKING | | | | | |
|--|--------------------------|--|--|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum critical rate of rise of off-state voltage | dV/dt | $T_J = T_J$ maximum linear to 80 % rated V_{DRM} | | 500 | V/μs |
| Maximum peak reverse and off-state leakage current | I_{RRM} , I_{DRM} | $T_J = T_J$ maximum, rated V_{DRM}/V_{RRM} applied | | 20 | mA |



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

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | |
|--|------------|---|------------------|--------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Maximum operating junction temperature range | T_J | | - 40 to 140 | °C |
| Maximum storage temperature range | T_{Stg} | | - 40 to 150 | |
| Maximum thermal resistance, junction to case | R_{thJC} | DC operation | 0.27 | K/W |
| Maximum thermal resistance, case to heatsink | R_{thCS} | Mounting surface, smooth, flat and greased | 0.1 | |
| Mounting torque, ± 10 % | | Non-lubricated threads | 15.5 (137) | N · m (lb · in) |
| | | Lubricated threads | 14 (120) | |
| Approximate weight | | | 130 | g |
| Case style | | See dimensions - link at the end of datasheet | TO-209AC (TO-94) | |

| ΔR_{thJC} CONDUCTION | | | | |
|------------------------------|-----------------------|------------------------|---------------------|-------|
| CONDUCTION ANGLE | SINUSOIDAL CONDUCTION | RECTANGULAR CONDUCTION | TEST CONDITIONS | UNITS |
| 180° | 0.043 | 0.031 | $T_J = T_J$ maximum | K/W |
| 120° | 0.052 | 0.053 | | |
| 90° | 0.066 | 0.071 | | |
| 60° | 0.096 | 0.101 | | |
| 30° | 0.167 | 0.169 | | |

Note

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

110/111RKI Series



Vishay High Power Products Phase Control Thyristors (Stud Version), 110 A

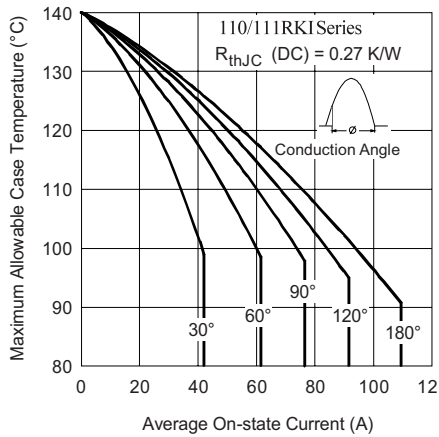


Fig. 1 - Current Ratings Characteristics

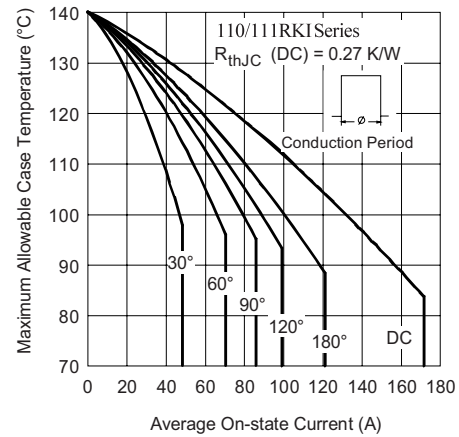


Fig. 2 - Current Ratings Characteristics

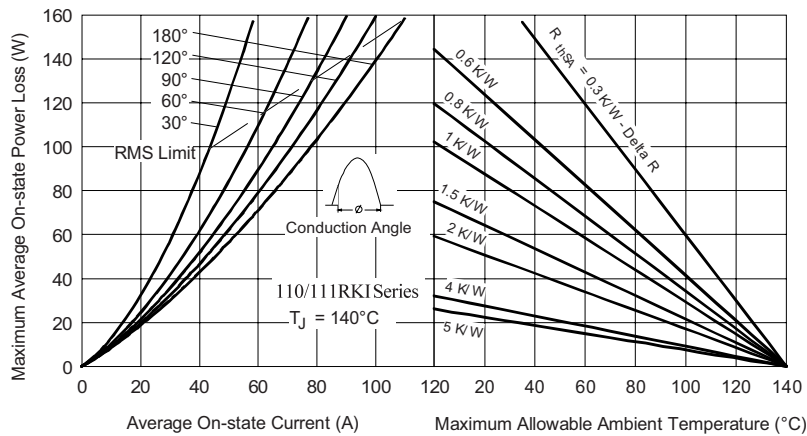


Fig. 3 - On-State Power Loss Characteristics

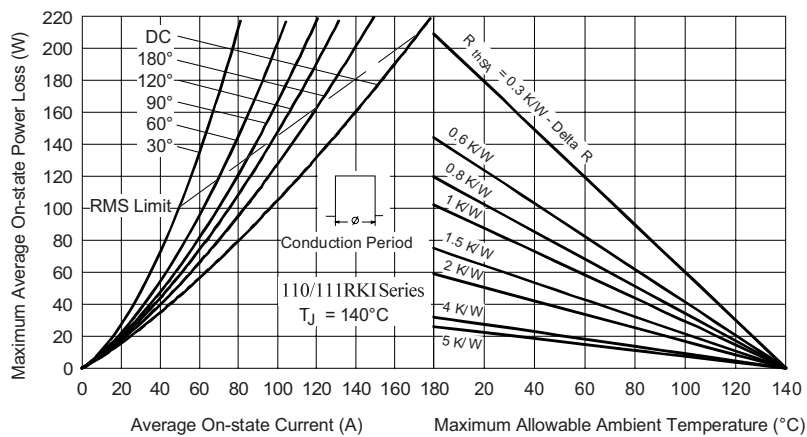


Fig. 4 - On-State Power Loss Characteristics

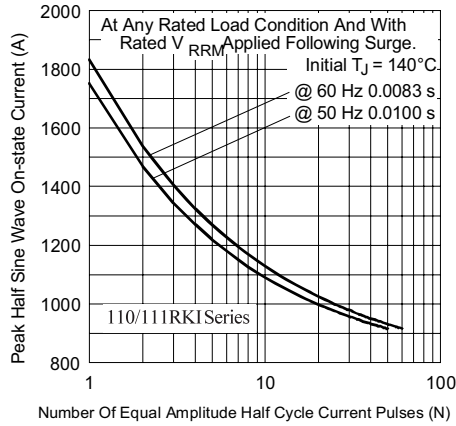


Fig. 5 - Maximum Non-Repetitive Surge Current

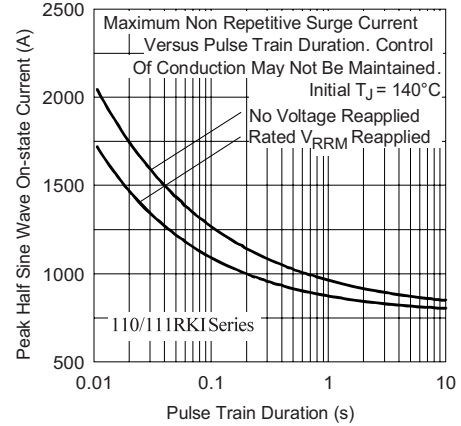


Fig. 6 - Maximum Non-Repetitive Surge Current

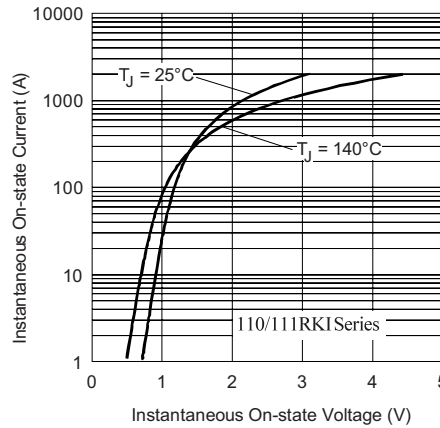


Fig. 7 - On-State Voltage Drop Characteristics

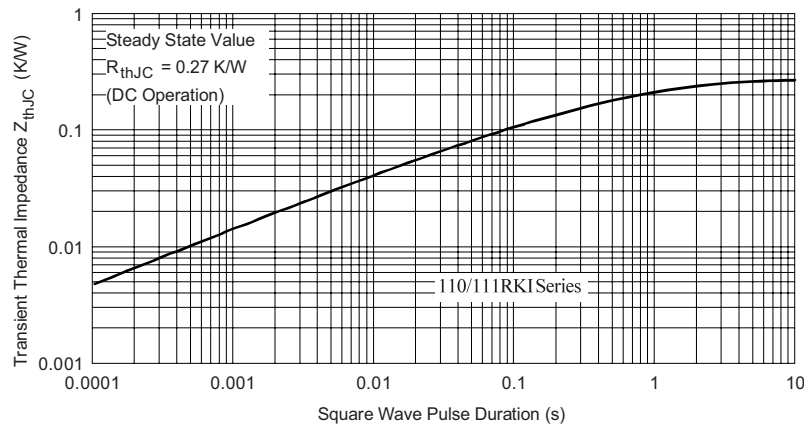


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

110/111RKI Series

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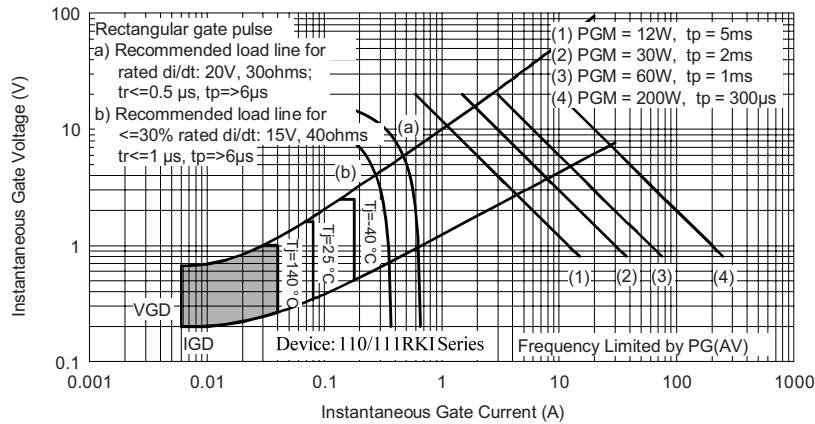


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

| | | | | |
|-------------|-----------|----------|------------|------------|
| Device code | 11 | 1 | RKI | 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 x 10 = V_{RRM} (see Voltage Ratings table)

LINKS TO RELATED DOCUMENTS

| | |
|------------|---|
| Dimensions | http://www.vishay.com/doc?95003 |
|------------|---|

TO-209AC (TO-94) for 110RKI and 111RKI Series

DIMENSIONS in millimeters (inches)



Note

- For metric device: M12 x 1.75 contact factory



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