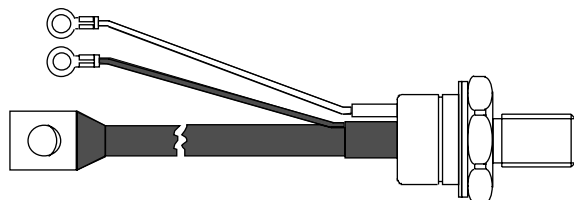


Phase Control Thyristors (Stud Version), 110 A



TO-209AC (TO-94)

FEATURES

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



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 | Sinusoidal half wave, initial T _J = T _J maximum | 2080 | A |
| | | t = 8.3 ms | | | 2180 | |
| | | t = 10 ms | 100 % V _{RRM} reapplied | | 1750 | |
| | | t = 8.3 ms | | | 1830 | |
| Maximum I ² t for fusing | I ² t | 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 √t for fusing | I ² √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 % × π × I _{T(AV)}) < I < π × I _{T(AV)} , T _J = T _J maximum | | | 0.82 | V |
| High level value of threshold voltage | V _{T(TO)2} | (I > π × I _{T(AV)}), T _J = T _J maximum | | | 1.02 | |
| Low level value of on-state slope resistance | r _{t1} | (16.7 % × π × I _{T(AV)}) < I < π × I _{T(AV)} , T _J = T _J maximum | | | 2.16 | mΩ |
| High level value of on-state slope resistance | r _{t2} | (I > π × 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 ≤ 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 ≤ 5 ms | | 3.0 | | A |
| Maximum peak positive gate voltage | +V _{GM} | T _J = T _J maximum, t _p ≤ 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 (lbf · 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

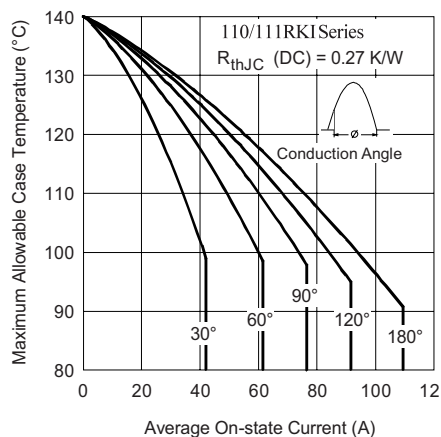


Fig. 1 - Current Ratings Characteristics

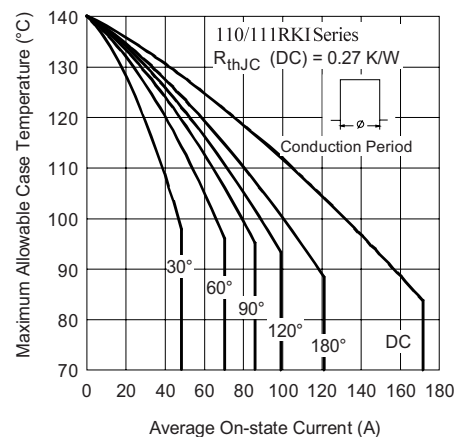


Fig. 2 - Current Ratings Characteristics

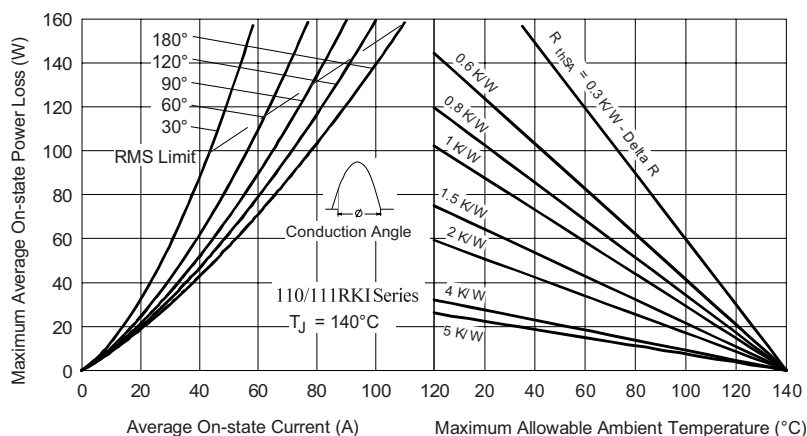


Fig. 3 - On-State Power Loss Characteristics

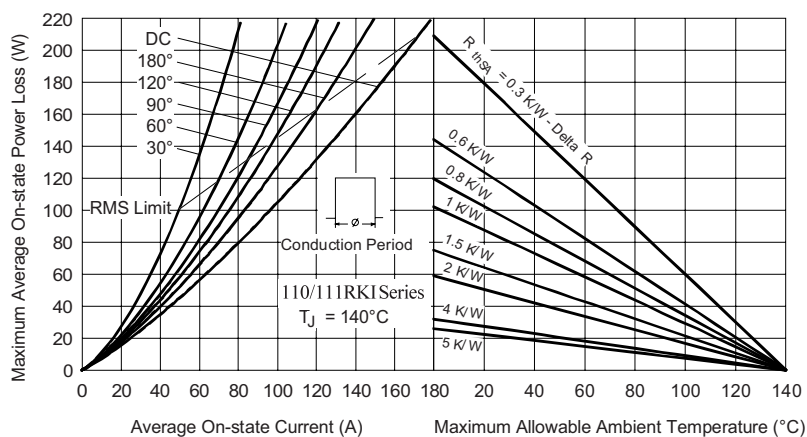


Fig. 4 - On-State Power Loss Characteristics

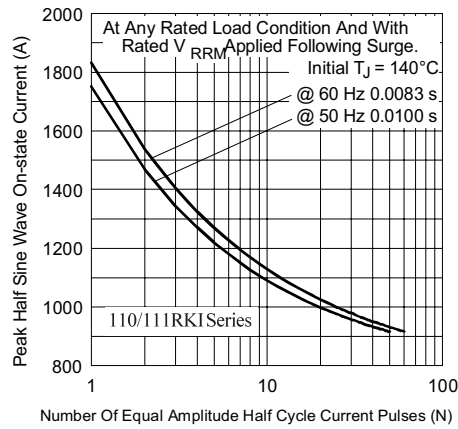


Fig. 5 - Maximum Non-Repetitive Surge Current

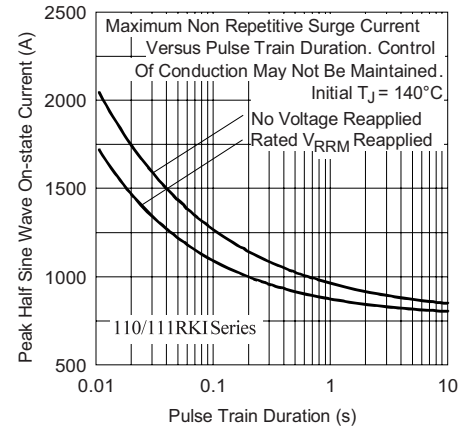


Fig. 6 - Maximum Non-Repetitive Surge Current

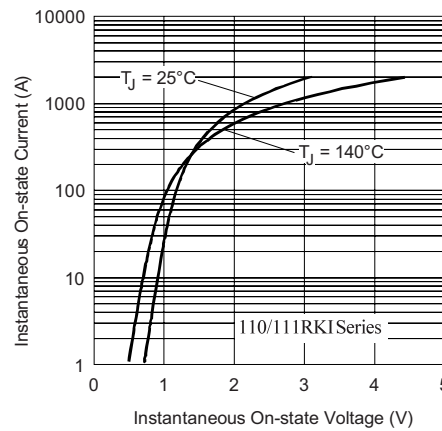


Fig. 7 - On-State Voltage Drop Characteristics

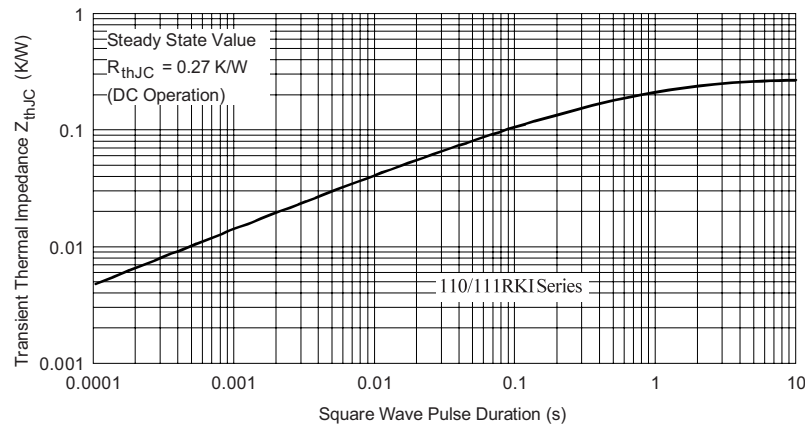


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

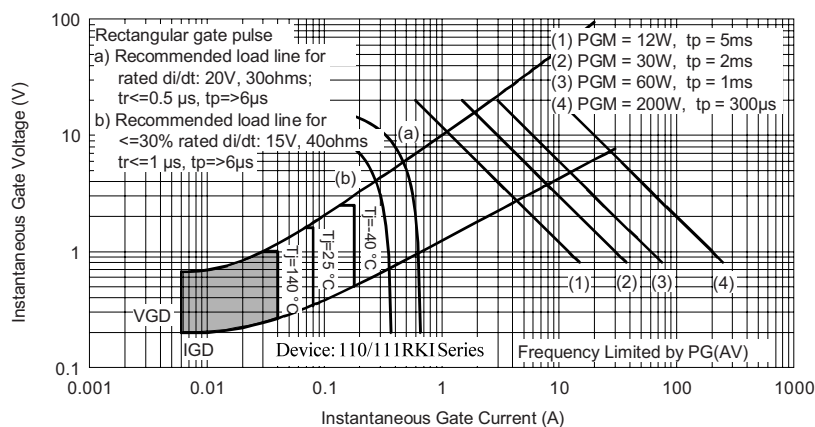


Fig. 9 - Gate Characteristics

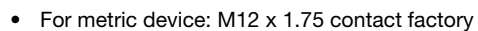
ORDERING INFORMATION TABLE

| | | | | |
|--------------------|-----------|----------|------------|------------|
| 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 |

DIMENSIONS in millimeters (inches)





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