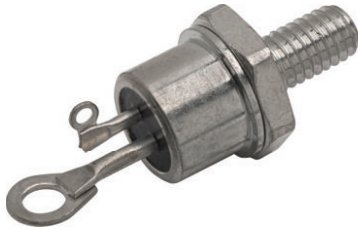


Medium Power Phase Control Thyristors (Stud Version), 10 A



TO-208AA (TO-48)

| PRODUCT SUMMARY | |
|-------------------|------------------|
| Package | TO-208AA (TO-48) |
| Diode variation | Single SCR |
| $I_{T(AV)}$ | 10 A |
| V_{DRM}/V_{RRM} | 100 V to 1200 V |
| V_{TM} | 1.75 V |
| I_{GT} | 60 mA |
| T_J | -65 °C to 125 °C |

FEATURES

- Improved glass passivation for high reliability and exceptional stability at high temperature
- High di_F/dt and dV/dt capabilities
- Standard package
- Low thermal resistance
- Metric threads version available
- Types up to 1200 V V_{DRM}/V_{RRM}
- Designed and qualified for industrial and consumer level
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



TYPICAL APPLICATIONS

- Medium power switching
- Phase control applications
- Can be supplied to meet stringent military, aerospace and other high reliability requirements

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|-----------------------------------|-----------------|-------------|------------------|
| PARAMETER | TEST CONDITIONS | VALUES | UNITS |
| $I_{T(AV)}$ | | 10 | A |
| | T_C | 85 | °C |
| $I_{T(RMS)}$ | | 25 | A |
| I_{TSM} | 50 Hz | 225 | A |
| | 60 Hz | 240 | |
| I^2t | 50 Hz | 255 | A ² s |
| | 60 Hz | 233 | |
| V_{DRM}/V_{RRM} | | 100 to 1200 | V |
| t_q | Typical | 110 | µs |
| T_J | | -65 to 125 | °C |

ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS | | | | |
|-----------------|--------------|---|---|--|
| TYPE NUMBER | VOLTAGE CODE | V_{DRM}/V_{RRM} , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE ⁽¹⁾ V | V_{RSM} , MAXIMUM NON-REPETITIVE PEAK VOLTAGE ⁽²⁾ V | I_{DRM}/I_{RRM} MAXIMUM AT $T_J = T_J$ MAXIMUM mA |
| VS-10RIA | 10 | 100 | 150 | 20 |
| | 20 | 200 | 300 | 10 |
| | 40 | 400 | 500 | |
| | 60 | 600 | 700 | |
| | 80 | 800 | 900 | |
| | 100 | 1000 | 1100 | |
| | 120 | 1200 | 1300 | |

Notes

- ⁽¹⁾ Units may be broken over non-repetitively in the off-state direction without damage, if di/dt does not exceed 20 A/µs
⁽²⁾ For voltage pulses with $t_p \leq 5$ ms



| 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 | | 10 | A | |
| | | | | 85 | °C | |
| Maximum RMS on-state current | $I_{T(RMS)}$ | | | 25 | A | |
| Maximum peak, one-cycle non-repetitive surge current | I_{TSM} | t = 10 ms | No voltage reappplied | Sinusoidal half wave, initial $T_J = T_J$ maximum | 225 | A |
| | | t = 8.3 ms | | | 240 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | | 190 | |
| | | t = 8.3 ms | | | 200 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reappplied | | 255 | A ² s |
| | | t = 8.3 ms | | | 233 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | | 180 | |
| | | t = 8.3 ms | | | 165 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 to 10 ms, no voltage reappplied | | 2550 | A 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 | | 1.10 | V | |
| High level value of threshold voltage | $V_{T(TO)2}$ | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 1.39 | | |
| 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 | | 24.3 | mΩ | |
| High level value of on-state slope resistance | r_{t2} | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 16.7 | | |
| Maximum on-state voltage | V_{TM} | $I_{pk} = 32$ A, $T_J = 25$ °C, $t_p = 10$ ms sine pulse | | 1.75 | V | |
| Maximum holding current | I_H | $T_J = 25$ °C, anode supply 12 V resistive load | | 130 | mA | |
| Typical latching current | I_L | | | 200 | | |

| SWITCHING | | | | | | |
|---|-----------|--|--|-----------------------|-------|-----|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS | |
| Maximum rate of rise of turned-on current | di_F/dt | $T_J = T_J$ maximum, $V_{DM} = \text{Rated } V_{DRM}$ Gate pulse = 20 V, 15 Ω, $t_p = 6$ μs, $t_r = 0.1$ μs maximum $I_{TM} = (2 \times \text{rated } di/dt)$ A | | 200 | A/μs | |
| | | | | $V_{DRM} \leq 600$ V | | 180 |
| | | | | $V_{DRM} \leq 800$ V | | 160 |
| | | | | $V_{DRM} \leq 1000$ V | | 150 |
| Typical turn-on time | t_{gt} | $T_J = 25$ °C, at rated V_{DRM}/V_{RRM} , $T_J = 125$ °C | | 0.9 | μs | |
| Typical reverse recovery time | t_{rr} | $T_J = T_J$ maximum, $I_{TM} = I_{T(AV)}$, $t_p > 200$ μs, $di_F/dt = -10$ A/μs | | 4 | | |
| Typical turn-off time | t_q | $T_J = T_J$ maximum, $I_{TM} = I_{T(AV)}$, $t_p > 200$ μs, $V_R = 100$ V, $di_F/dt = -10$ A/μs, $dV/dt = 20$ V/μs linear to 67 % V_{DRM} , gate bias 0 V to 100 V | | 110 | | |

Note

- $t_q = 10$ μs up to 600 V, $t_q = 30$ μs up to 1600 V available on special request

| 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 100 % rated V_{DRM} | | 100 | V/μs |
| | | $T_J = T_J$ maximum linear to 67 % rated V_{DRM} | | 300 ⁽¹⁾ | |

Note

- ⁽¹⁾ Available with: $dV/dt = 1000$ V/μs, to complete code add S90 i.e. 10RIA120S90



| TRIGGERING | | | | | |
|-------------------------------------|-------------|--|--|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum peak gate power | P_{GM} | $T_J = T_J$ maximum | | 8.0 | W |
| Maximum average gate power | $P_{G(AV)}$ | | | 2.0 | |
| Maximum peak positive gate current | I_{GM} | $T_J = T_J$ maximum | | 1.5 | A |
| Maximum peak negative gate voltage | $-V_{GM}$ | $T_J = T_J$ maximum | | 10 | V |
| DC gate current required to trigger | I_{GT} | $T_J = -65\text{ }^\circ\text{C}$ | Maximum required gate trigger current/voltage are the lowest value which will trigger all units 6 V anode to cathode applied | 90 | mA |
| | | $T_J = 25\text{ }^\circ\text{C}$ | | 60 | |
| | | $T_J = 125\text{ }^\circ\text{C}$ | | 35 | |
| DC gate voltage required to trigger | V_{GT} | $T_J = -65\text{ }^\circ\text{C}$ | | 3.0 | V |
| | | $T_J = 25\text{ }^\circ\text{C}$ | | 2.0 | |
| | | $T_J = 125\text{ }^\circ\text{C}$ | | 1.0 | |
| DC gate current not to trigger | I_{GD} | $T_J = T_J$ maximum, $V_{DRM} =$ Rated value | | 2.0 | mA |
| DC gate voltage not to trigger | V_{GD} | $T_J = T_J$ maximum, $V_{DRM} =$ Rated value | 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 | 0.2 | V |

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | |
|--|----------------|--|------------------|-----------|------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | | UNITS |
| Maximum operating junction and storage temperature range | T_J, T_{Stg} | | -65 to 125 | | $^\circ\text{C}$ |
| Maximum thermal resistance, junction to case | R_{thJC} | DC operation | 1.85 | | K/W |
| Maximum thermal resistance, case to heatsink | R_{thCS} | Mounting surface, smooth, flat and greased | 0.35 | | |
| Mounting torque | | Lubricated threads (Non-lubricated threads) | TO NUT | TO DEVICE | |
| | | | 20 (27.5) | 25 | lbf · in |
| | | | 0.23 (0.32) | 0.29 | kgf · m |
| Approximate weight | | | 14 | | g |
| | | | 0.49 | | oz. |
| Case style | | See dimensions - link at the end of datasheet | TO-208AA (TO-48) | | |

| ΔR_{thJC} CONDUCTION | | | | |
|------------------------------|-----------------------|------------------------|---------------------|-------|
| CONDUCTION ANGLE | SINUSOIDAL CONDUCTION | RECTANGULAR CONDUCTION | TEST CONDITIONS | UNITS |
| 180° | 0.44 | 0.32 | $T_J = T_J$ maximum | K/W |
| 120° | 0.53 | 0.56 | | |
| 90° | 0.68 | 0.75 | | |
| 60° | 1.01 | 1.05 | | |
| 30° | 1.71 | 1.73 | | |

Note

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

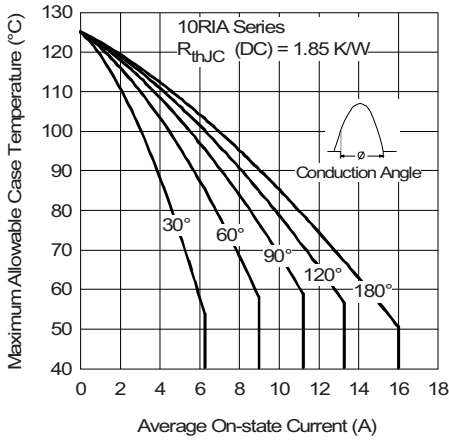


Fig. 1 - Current Ratings Characteristics

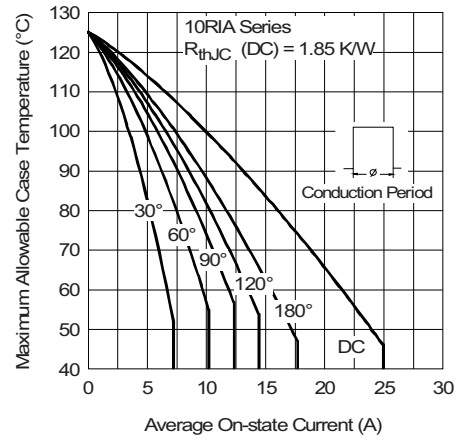


Fig. 2 - Current Ratings Characteristics

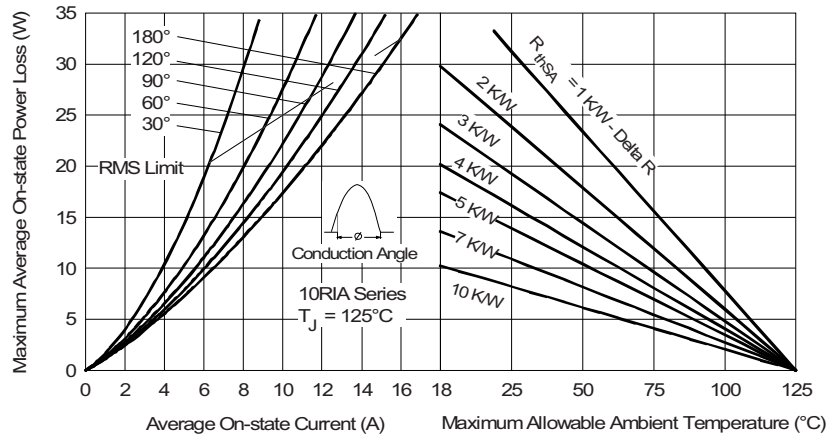


Fig. 3 - On-State Power Loss Characteristics

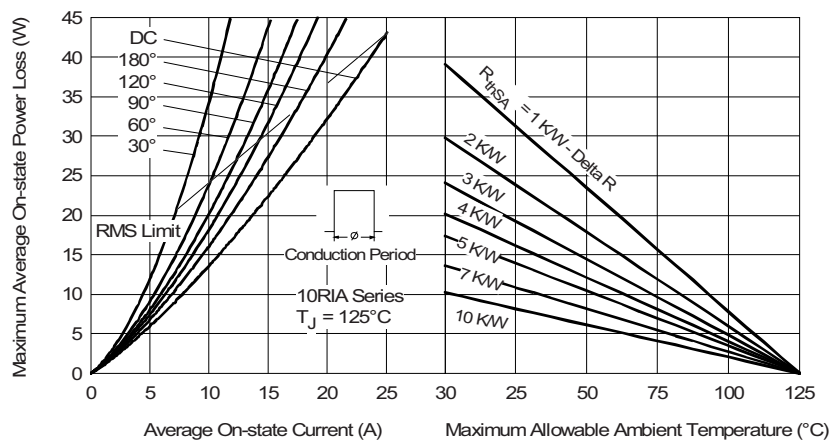


Fig. 4 - On-State Power Loss Characteristics

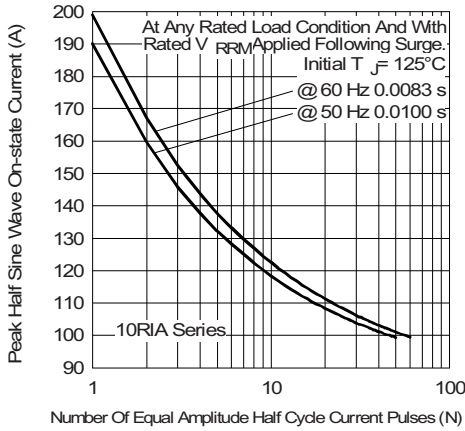


Fig. 5 - Maximum Non-Repetitive Surge Current

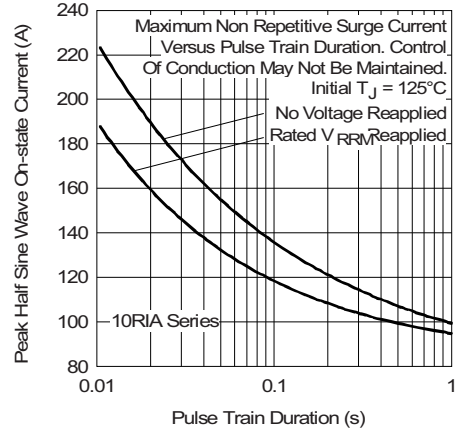


Fig. 6 - Maximum Non-Repetitive Surge Current

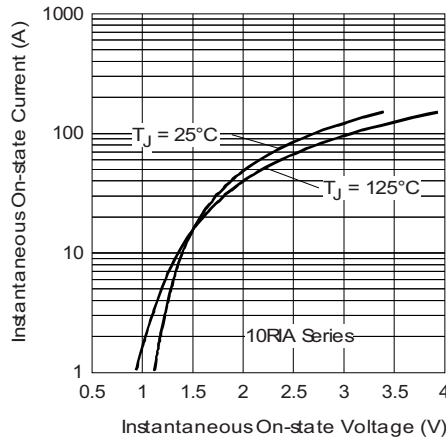


Fig. 7 - Forward Voltage Drop Characteristics

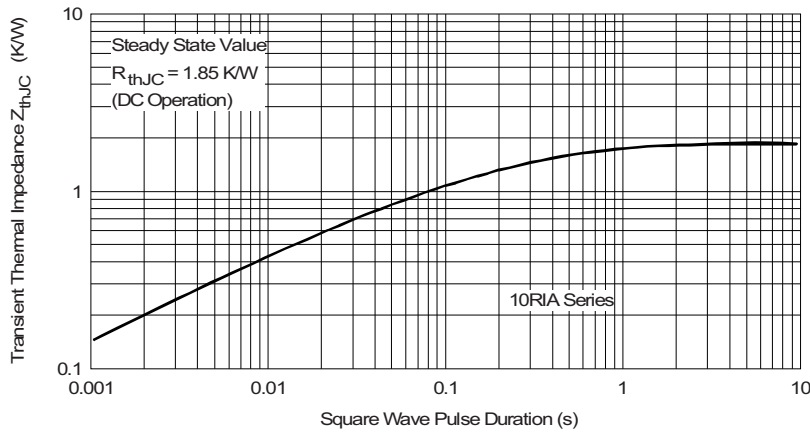


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

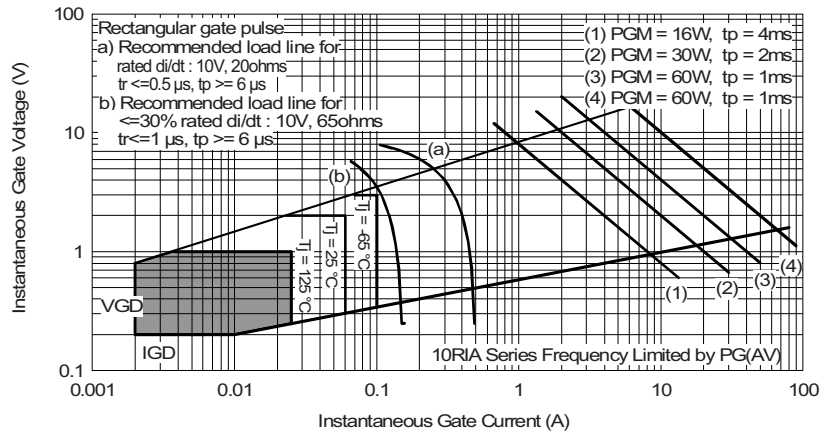


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

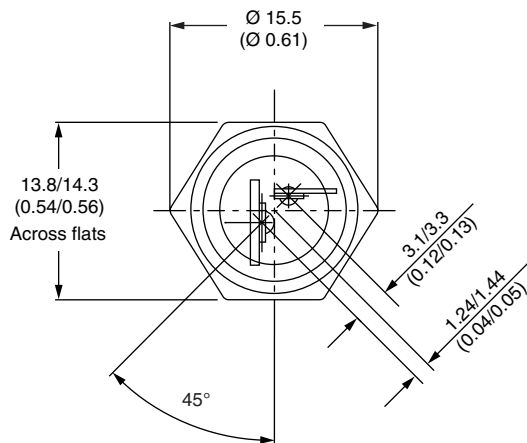
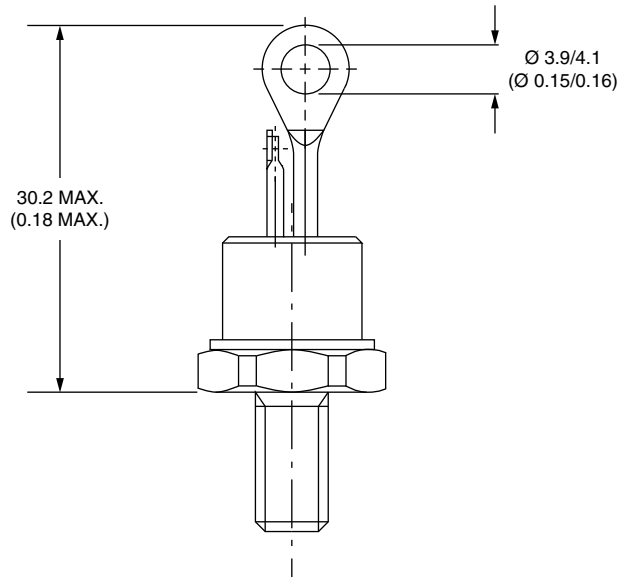
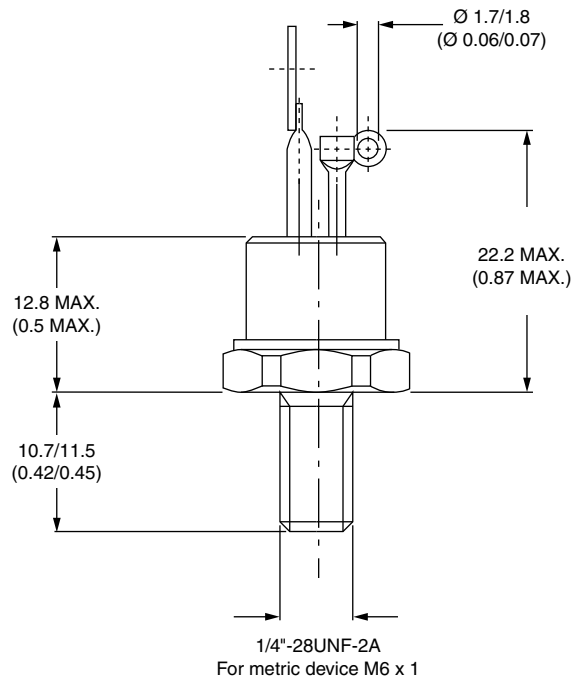
| | | | | | | |
|-------------|------------|-----------|------------|------------|----------|------------|
| Device code | VS- | 10 | RIA | 120 | M | S90 |
| | ① | ② | ③ | ④ | ⑤ | ⑥ |
| | 1 | 2 | 3 | 4 | 5 | 6 |

- 1 - Vishay Semiconductors product
- 2 - Current code
- 3 - Essential part number
- 4 - Voltage code x 10 = V_{RRM} (see Voltage Ratings table)
- 5 - None = Stud base TO-208AA (TO-48) 1/4" 28UNF-2A
M = Stud base TO-208AA (TO-48) M6 x 1
- 6 - Critical dV/dt:
None = 300 V/ μs (standard value)
S90 = 1000 V/ μs (special selection)

| LINKS TO RELATED DOCUMENTS | |
|----------------------------|--|
| Dimensions | www.vishay.com/doc?95333 |

TO-208AA (TO-48)

DIMENSIONS in millimeters (inches)





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