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Medium Power Phase Control Thyristors (Stud Version), 50 A



TO-208AC (TO-65)

FEATURES

- High current rating
- Excellent dynamic characteristics
- $dV/dt = 1000 \text{ V}/\mu\text{s}$ option
- Superior surge capabilities
- Standard package
- Metric threads version available
- Types up to 1200 V $V_{\text{DRM}}/V_{\text{RRM}}$
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT

| PRODUCT SUMMARY | |
|---------------------------------|------------------|
| Package | TO-208AC (TO-65) |
| Diode variation | Single SCR |
| $I_{\text{T(AV)}}$ | 50 A |
| $V_{\text{DRM}}/V_{\text{RRM}}$ | 100 V to 1200 V |
| V_{TM} | 1.60 V |
| I_{GT} | 100 mA |
| T_{J} | -40 °C to 125 °C |

TYPICAL APPLICATIONS

- Phase control applications in converters
- Lighting circuits
- Battery charges
- Regulated power supplies and temperature and speed control circuit

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|-----------------------------------|-----------------|-------------|-------------------|
| PARAMETER | TEST CONDITIONS | VALUES | UNITS |
| $I_{\text{T(AV)}}$ | | 50 | A |
| | T_{C} | 94 | °C |
| $I_{\text{T(RMS)}}$ | | 80 | A |
| I_{TSM} | 50 Hz | 1430 | A |
| | 60 Hz | 1490 | |
| I^2t | 50 Hz | 10.18 | kA ² s |
| | 60 Hz | 9.30 | |
| $V_{\text{DRM}}/V_{\text{RRM}}$ | | 100 to 1200 | V |
| t_{q} | Typical | 110 | μs |
| T_{J} | | -40 to +125 | °C |

ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS | | | | |
|-----------------|--------------|---|--|--|
| TYPE NUMBER | VOLTAGE CODE | $V_{\text{DRM}}/V_{\text{RRM}}$, MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE ⁽¹⁾ V | V_{RSM} , MAXIMUM NON-REPETITIVE PEAK VOLTAGE ⁽²⁾ V | $I_{\text{DRM}}/I_{\text{RRM}}$ MAXIMUM AT $T_{\text{J}} = T_{\text{J}}$ MAXIMUM mA |
| VS-50RIA | 10 | 100 | 150 | 15 |
| | 20 | 200 | 300 | |
| | 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 $t_{\text{p}} \leq 5 \text{ ms}$



| ABSOLUTE MAXIMUM RATINGS | | | | | |
|--|---------------|--|----------------------------|---|--------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum average on-state current at case temperature | $I_{T(AV)}$ | 180° sinusoidal conduction | | 50 | A |
| | | | | 94 | °C |
| Maximum RMS on-state current | $I_{T(RMS)}$ | | | 80 | 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 | A |
| | | t = 8.3 ms | | | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | | |
| | | t = 8.3 ms | | | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reappplied | | kA ² s |
| | | t = 8.3 ms | | | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | | |
| | | t = 8.3 ms | | | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 to 10 ms, no voltage reappplied, $T_J = T_J$ maximum | | 101.8 | 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 | | 0.94 | V |
| High level value of threshold voltage | $V_{T(TO)2}$ | $(\pi \times I_{T(AV)} < I < 20 \times \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 1.08 | |
| 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 | | 4.08 | mΩ |
| High level value of on-state slope resistance | r_{t2} | $(\pi \times I_{T(AV)} < I < 20 \times \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 3.34 | |
| Maximum on-state voltage | V_{TM} | $I_{pk} = 157$ A, $T_J = 25$ °C | | 1.60 | V |
| Maximum holding current | I_H | $T_J = 25$ °C, anode supply 22 V, resistive load, initial $I_T = 2$ A | | 200 | mA |
| Latching current | I_L | Anode supply 6 V, resistive load | | 400 | |

| SWITCHING | | | | | |
|---|--------|---|--|----------------------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum rate of rise of turned-on current | dI/dt | $T_C = 125$ °C, $V_{DM} =$ 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 | |
| Typical delay time | t_d | $T_C = 25$ °C, $V_{DM} =$ Rated V_{DRM} , $I_{TM} = 10$ A dc resistive circuit Gate pulse = 10 V, 15 Ω source, $t_p = 20$ μs | | 0.9 | μs |
| Typical turn-off time | t_q | $T_C = 125$ °C, $I_{TM} = 50$ A, reappplied $dV/dt = 20$ V/μs $dI_r/dt = -10$ A/μs, $V_R = 50$ V | | 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 100 % rated V_{DRM} | | 200 | V/μs |
| | | $T_J = T_J$ maximum linear to 67 % rated V_{DRM} | | 500 ⁽¹⁾ | |

Note

⁽¹⁾ Available with $dV/dt = 1000$ V/μs, to complete code add S90 i.e. 50RIA120S90



| TRIGGERING | | | | | |
|-------------------------------------|-------------|--|--|--|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum peak gate power | P_{GM} | $T_J = T_J$ maximum, $t_p \leq 5$ ms | | 10 | W |
| Maximum average gate power | $P_{G(AV)}$ | | | 2.5 | |
| Maximum peak positive gate current | I_{GM} | | | 2.5 | A |
| Maximum peak positive gate voltage | $+V_{GM}$ | | | 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 6 V anode to cathode applied | 250 | mA |
| | | $T_J = 25$ °C | | 100 | |
| | | $T_J = 125$ °C | | 50 | |
| DC gate voltage required to trigger | V_{GT} | $T_J = -40$ °C | | 3.5 | V |
| | | $T_J = 25$ °C | | 2.5 | |
| DC gate current not to trigger | I_{GD} | $T_J = T_J$ maximum, $V_{DRM} =$ Rated voltage | | 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 | 5.0 |
| DC gate voltage not to trigger | V_{GD} | $T_J = T_J$ maximum | 0.2 | | V |

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | |
|--|----------------|---|--|------------------------|--------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum operating junction and storage temperature range | T_J, T_{Stg} | | | -40 to +125 | °C |
| Maximum thermal resistance, junction to case | R_{thJC} | DC operation | | 0.35 | K/W |
| Maximum thermal resistance, case to heat sink | R_{thCS} | Mounting surface, smooth, flat and greased | | 0.25 | |
| Allowable mounting torque | | Non-lubricated threads | | 3.4 + 0 - 10 % (30) | N · m (lb · in) |
| | | Lubricated threads | | 2.3 + 0 - 10 % (20) | |
| Approximate weight | | | | 28 | g |
| | | | | 1.0 | oz. |
| Case style | | See dimensions - link at the end of datasheet | | TO-208AC (TO-65) | |

| ΔR_{thJC} CONDUCTION | | | | |
|--|-----------------------|------------------------|---------------------|-------|
| CONDUCTION ANGLE | SINUSOIDAL CONDUCTION | RECTANGULAR CONDUCTION | TEST CONDITIONS | UNITS |
| 180° | 0.078 | 0.057 | $T_J = T_J$ maximum | K/W |
| 120° | 0.094 | 0.098 | | |
| 90° | 0.120 | 0.130 | | |
| 60° | 0.176 | 0.183 | | |
| 30° | 0.294 | 0.296 | | |

Note

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

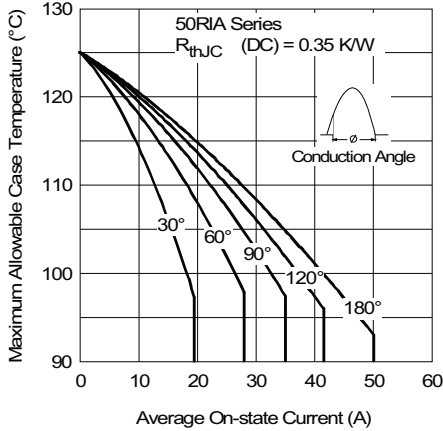


Fig. 1 - Current Ratings Characteristics

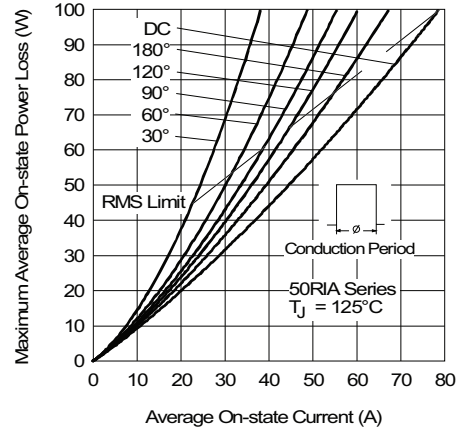


Fig. 4 - On-State Power Loss Characteristics

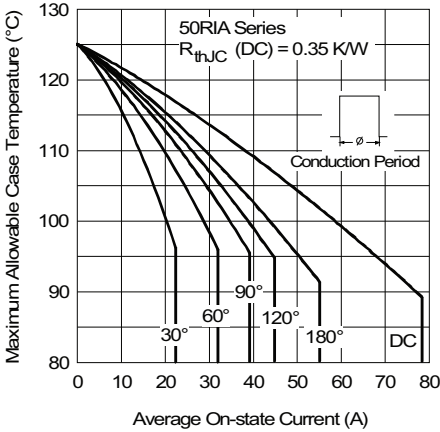


Fig. 2 - Current Ratings Characteristics

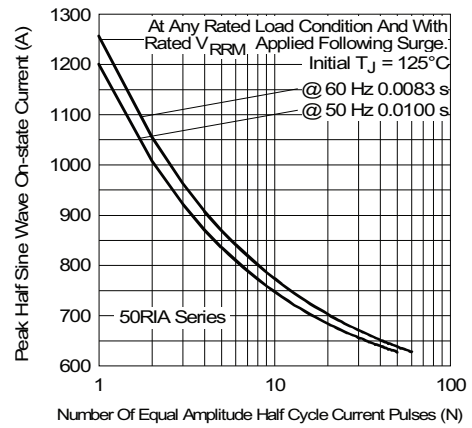


Fig. 5 - Maximum Non-Repetitive Surge Current

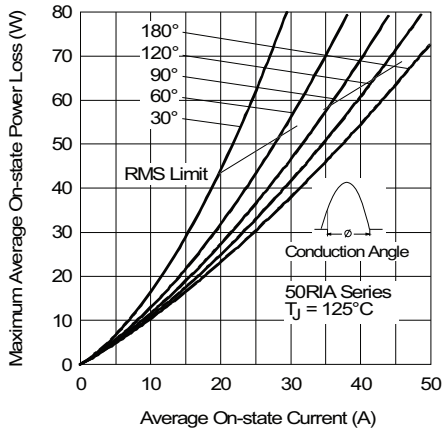


Fig. 3 - On-State Power Loss Characteristics

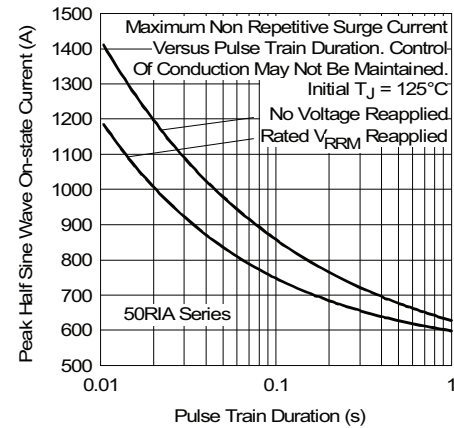


Fig. 6 - Maximum Non-Repetitive Surge Current

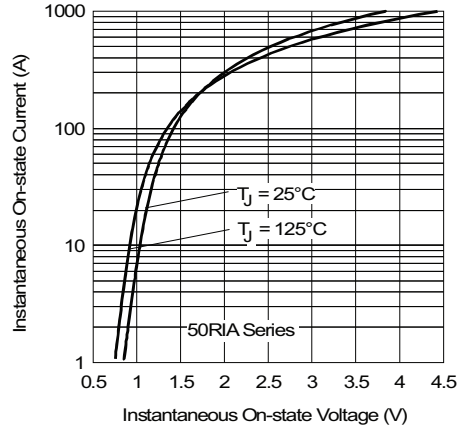


Fig. 7 - Forward Voltage Drop Characteristics

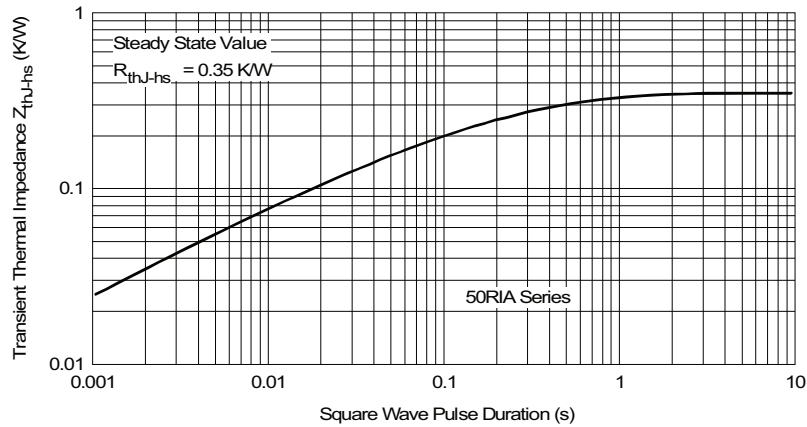


Fig. 8 - Thermal Impedance Z_{thJc} Characteristics

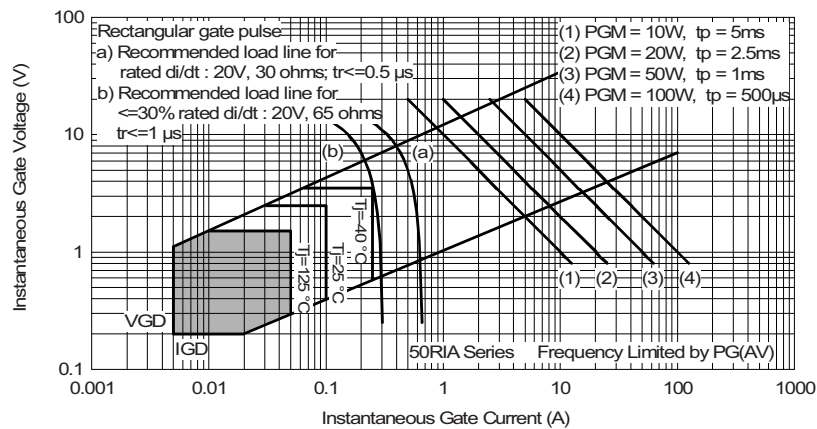
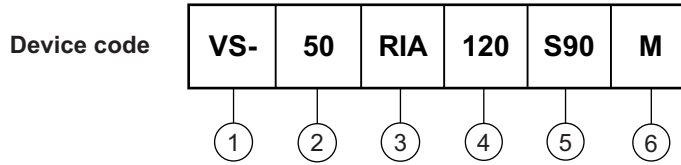


Fig. 9 - Gate Characteristics



ORDERING INFORMATION TABLE



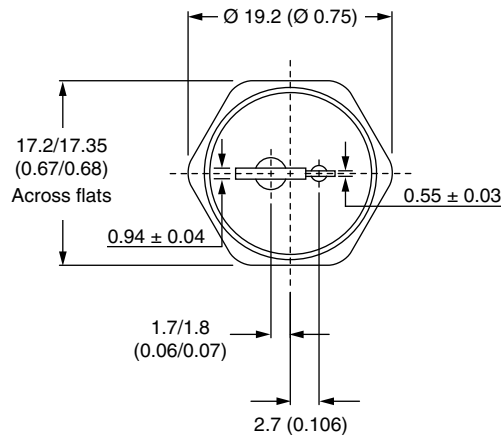
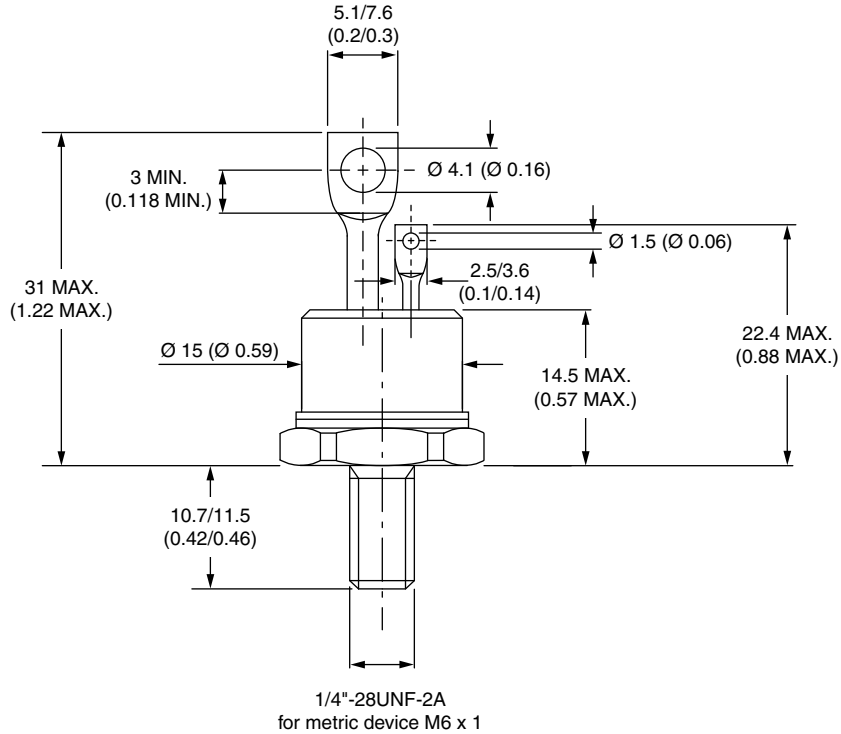
- 1** - Vishay Semiconductors product
- 2** - Current code
- 3** - Essential part number
- 4** - Voltage code x 10 = V_{RRM} (see Voltage Ratings table)
- 5** - Critical dV/dt:
 - None = 500 V/ μ s (standard value)
 - S90 = 1000 V/ μ s (special selection)
- 6** -
 - None = Stud base TO-208AC (TO-65) 1/4" 28UNF-2A
 - M = Stud base TO-208AC (TO-65) M6 x 1

| LINKS TO RELATED DOCUMENTS | |
|----------------------------|--|
| Dimensions | www.vishay.com/doc?95334 |



TO-208AC (TO-65)

DIMENSIONS in millimeters (inches)





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