

Medium Power 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_{DRM}/V_{RRM}
- RoHS compliant


RoHS
COMPLIANT

TYPICAL APPLICATIONS

- Phase control applications in converters
- Lighting circuits
- Battery charges
- Regulated power supplies and temperature and speed control circuit
- Can be supplied to meet stringent military, aerospace and other high reliability requirements

PRODUCT SUMMARY

| | |
|-------------|------|
| $I_{T(AV)}$ | 50 A |
|-------------|------|

MAJOR RATINGS AND CHARACTERISTICS

| PARAMETER | TEST CONDITIONS | VALUES | UNITS |
|-------------------|-----------------|-------------|-----------------------|
| $I_{T(AV)}$ | | 50 | A |
| | T_C | 94 | $^{\circ}\text{C}$ |
| $I_{T(RMS)}$ | | 80 | A |
| I_{TSM} | 50 Hz | 1430 | A |
| | 60 Hz | 1490 | |
| I^2t | 50 Hz | 10.18 | kA^2s |
| | 60 Hz | 9.30 | |
| V_{DRM}/V_{RRM} | | 100 to 1200 | V |
| t_q | Typical | 110 | μs |
| T_J | | - 40 to 125 | $^{\circ}\text{C}$ |

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 |
| 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/ μ s

(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° 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 \sqrt{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 | m Ω |
| 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 x rated di/dt) A | 200 | A/μs |
| | | | 100 | |
| 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, reapplied 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 ≤ 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 | mA |
| | | T _J = 25 °C | | |
| | | T _J = 125 °C | | |
| 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 | 5.0 | mA |
| 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 heatsink | R_{thCS} | Mounting surface, smooth, flat and greased | 0.25 | |
| Allowable mounting torque | | Non-lubricated threads | 3.4 + 0 - 10 % (30) | N · m (lbf · 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

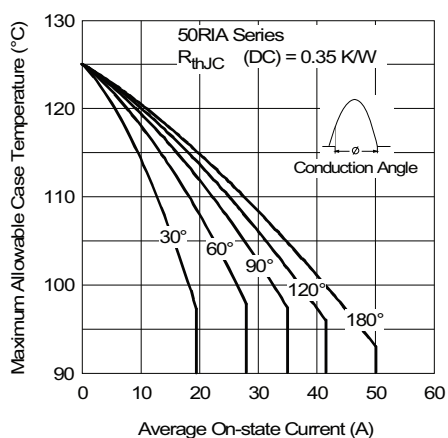


Fig. 1 - Current Ratings Characteristics

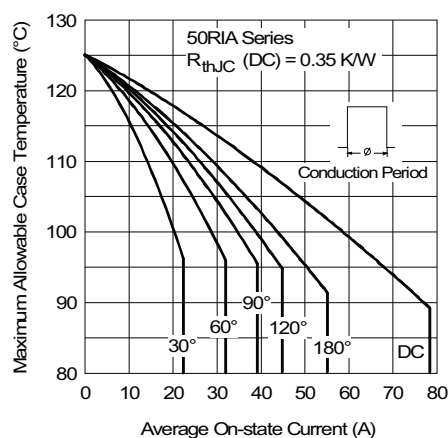


Fig. 2 - Current Ratings Characteristics

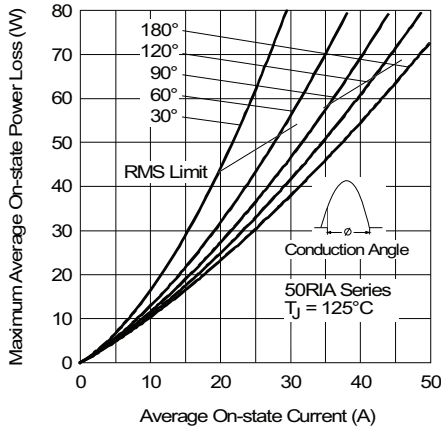


Fig. 3 - On-State Power Loss Characteristics

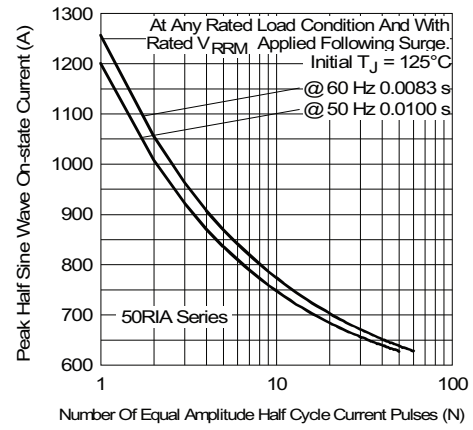


Fig. 5 - Maximum Non-Repetitive Surge Current

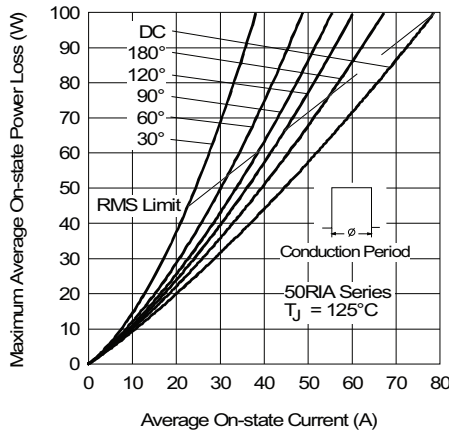


Fig. 4 - On-State Power Loss Characteristics

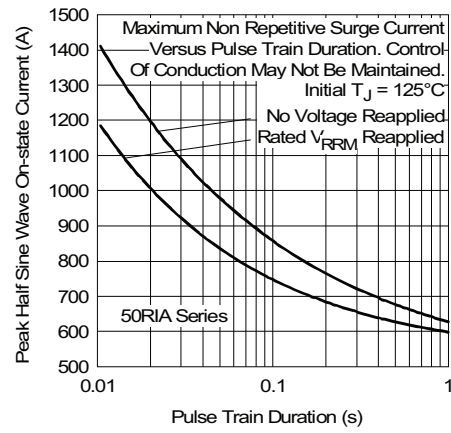


Fig. 6 - Maximum Non-Repetitive Surge Current

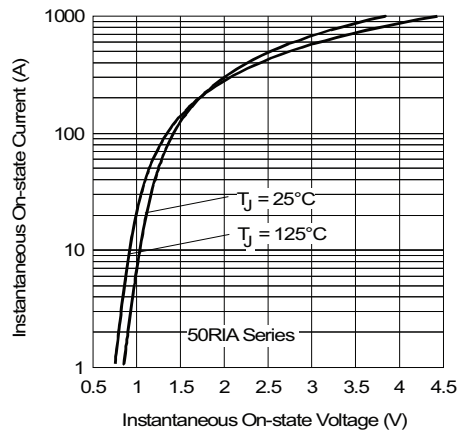


Fig. 7 - Forward Voltage Drop Characteristics

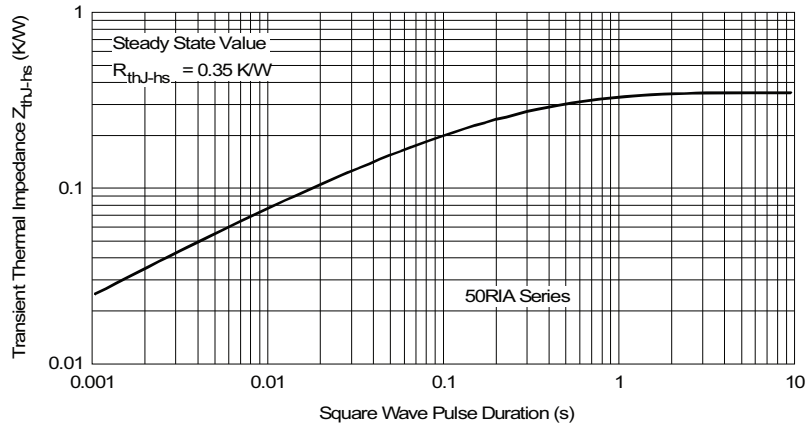


Fig. 8 - Thermal Impedance Z_{thJc} Characteristics

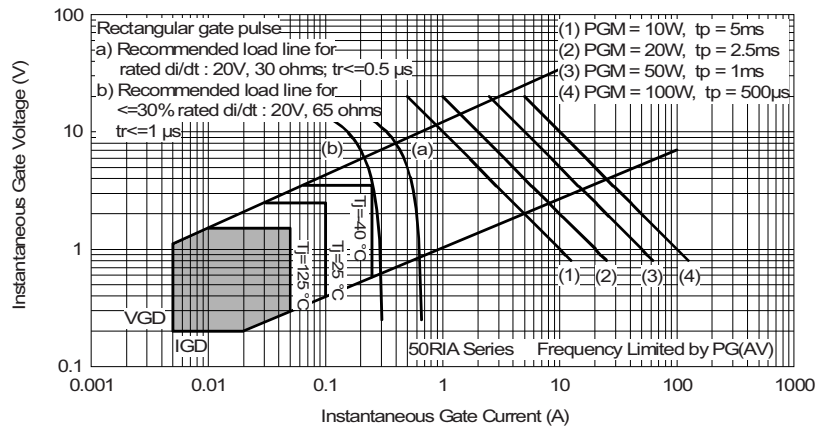


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

| | | | | | |
|-------------|-----------|------------|------------|------------|----------|
| Device code | 50 | RIA | 120 | S90 | M |
| | ① | ② | ③ | ④ | ⑤ |

- 1** - Current code
- 2** - Essential part number
- 3** - Voltage code x 10 = V_{RRM} (see Voltage Ratings table)
- 4** - Critical dV/dt :
 - None = 500 V/µs (standard value)
 - S90 = 1000 V/µs (special selection)
- 5** -
 - 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 | http://www.vishay.com/doc?95334 |



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