



Phase Control Thyristors (Stud Version), 80 A



TO-94 (TO-209AC)

FEATURES

- Hermetic glass-metal seal
- International standard case TO-94 (TO-209AC)
- Designed and qualified for industrial level
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT

TYPICAL APPLICATIONS

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

| PRIMARY CHARACTERISTICS | |
|-------------------------|----------------------|
| $I_{T(AV)}$ | 80 A |
| V_{DRM}/V_{RRM} | 400 V, 800 V, 1200 V |
| V_{TM} | 1.60 V |
| I_{GT} | 120 mA |
| T_J | -40 °C to +125 °C |
| Package | TO-94 (TO-209AC) |
| Circuit configuration | Single SCR |

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|-----------------------------------|-----------------|-------------|-------------------|
| PARAMETER | TEST CONDITIONS | VALUES | UNITS |
| $I_{T(AV)}$ | | 80 | A |
| | T_C | 85 | °C |
| $I_{T(RMS)}$ | | 125 | A |
| I_{TSM} | 50 Hz | 1900 | |
| | 60 Hz | 1990 | |
| I^2t | 50 Hz | 18 | kA ² s |
| | 60 Hz | 16 | |
| V_{DRM}/V_{RRM} | | 400 to 1200 | V |
| t_q | Typical | 110 | µs |
| T_J | | -40 to +125 | °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 $T_J = 125\text{ °C}$ mA |
| VS-80RIA VS-81RIA | 40 | 400 | 500 | 15 |
| | 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 | | 80 | A |
| | | | | 85 | °C |
| Maximum RMS on-state current | $I_{T(RMS)}$ | DC at 75 °C case temperature | | 125 | |
| Maximum peak, one-cycle non-repetitive surge current | I_{TSM} | t = 10 ms | No voltage reapplied | 1900 | A |
| | | t = 8.3 ms | | 100 % V_{RRM} reapplied | |
| | | t = 10 ms | Sinusoidal half wave, initial $T_J = T_J$ maximum | | |
| | | t = 8.3 ms | | 1675 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage | 18 | kA ² s |
| | | t = 8.3 ms | | 100 % V_{RRM} reapplied | |
| | | t = 10 ms | 100 % V_{RRM} reapplied | | |
| | | t = 8.3 ms | | 11.7 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reapplied | | 180.5 | 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 | | 0.99 | V |
| High level value of threshold voltage | $V_{T(TO)2}$ | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 1.13 | |
| 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 | | 2.29 | mΩ |
| High level value of on-state slope resistance | r_{t2} | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 1.84 | |
| Maximum on-state voltage | V_{TM} | $I_{pk} = 250$ A, $T_J = 25$ °C, $t_p = 10$ ms sine pulse | | 1.60 | V |
| Maximum holding current | I_H | $T_J = 25$ °C, anode supply 12 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 | $T_J = 125$ °C, $V_d = \text{Rated } V_{DRM}$, $I_{TM} = 2 \times di/dt$ snubber 0.2 μF, 15 Ω, gate pulse: 20 V, 65 Ω, $t_p = 6$ μs, $t_r = 0.5$ μs Per JEDEC standard RS-397, 5.2.2.6. | | 300 | A/μs |
| Typical delay time | t_d | Gate pulse: 10 V, 15 Ω source, $t_p = 6$ μs, $t_r = 0.1$ μs, $V_d = \text{Rated } V_{DRM}$, $I_{TM} = 50$ Adc, $T_J = 25$ °C | | 1 | 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 bias: 0 V 25 Ω, $t_p = 500$ μs | | 110 | |

| BLOCKING | | | | | |
|--|-----------------------|--|--|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum critical rate of rise of off-state voltage | dV/dt | $T_J = 125$ °C exponential to 67 % rated V_{DRM} | | 500 | V/μs |
| Maximum peak reverse and off-state leakage current | I_{RRM} , I_{DRM} | $T_J = 125$ °C rated V_{DRM}/V_{RRM} applied | | 15 | mA |



| TRIGGERING | | | | | |
|---|-------------|--|--|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| 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 | |
| Maximum peak positive gate current | I_{GM} | $T_J = T_J$ maximum, $t_p \leq 5$ ms | | 3 | A |
| Maximum peak positive gate voltage | $+V_{GM}$ | | | 20 | V |
| Maximum peak negative gate voltage | $-V_{GM}$ | | | 10 | |
| Maximum 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 | 270 | mA |
| | | $T_J = 25$ °C | | 120 | |
| | | $T_J = 125$ °C | | 60 | |
| Maximum DC gate voltage required to trigger | V_{GT} | $T_J = -40$ °C | | 3.5 | V |
| | | $T_J = 25$ °C | | 2.5 | |
| | | $T_J = 125$ °C | | 1.5 | |
| 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 | 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 125 | °C |
| Maximum storage temperature range | T_{Stg} | | | - 40 to 150 | |
| Maximum thermal resistance, junction to case | R_{thJC} | DC operation | | 0.30 | 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-94 (TO-209AC) | |

| ΔR_{thJC} CONDUCTION | | | | |
|--|-----------------------|------------------------|---------------------|-------|
| CONDUCTION ANGLE | SINUSOIDAL CONDUCTION | RECTANGULAR CONDUCTION | TEST CONDITIONS | UNITS |
| 180° | 0.042 | 0.030 | $T_J = T_J$ maximum | K/W |
| 120° | 0.050 | 0.052 | | |
| 90° | 0.064 | 0.070 | | |
| 60° | 0.095 | 0.100 | | |
| 30° | 0.164 | 0.165 | | |

Note

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



VS-80RIA...PbF, VS-81RIA...PbF, VS-82RIA...PbF Series

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Vishay Semiconductors

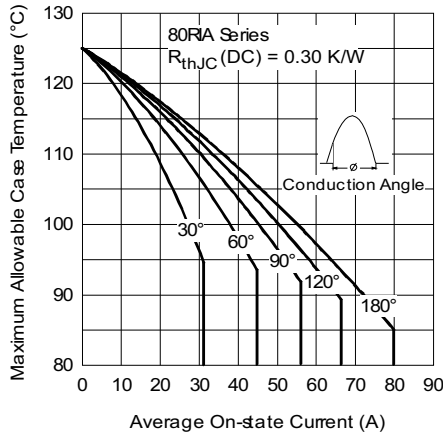


Fig. 1 - Current Ratings Characteristics

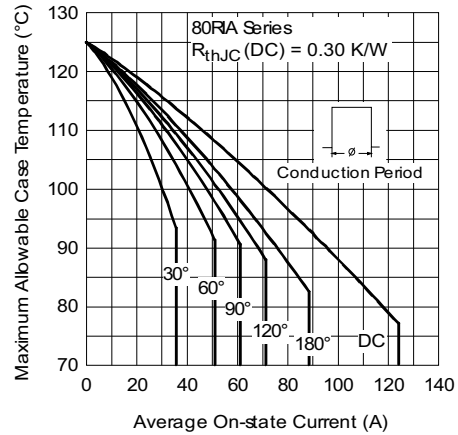


Fig. 2 - Current Ratings Characteristics

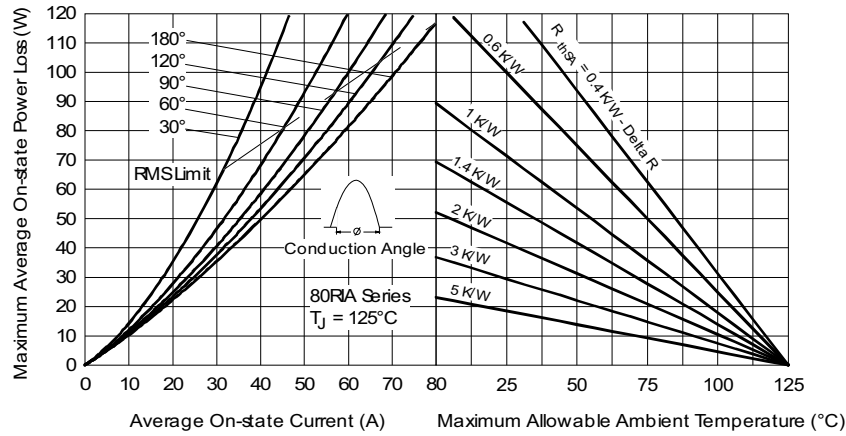


Fig. 3 - On-State Power Loss Characteristics

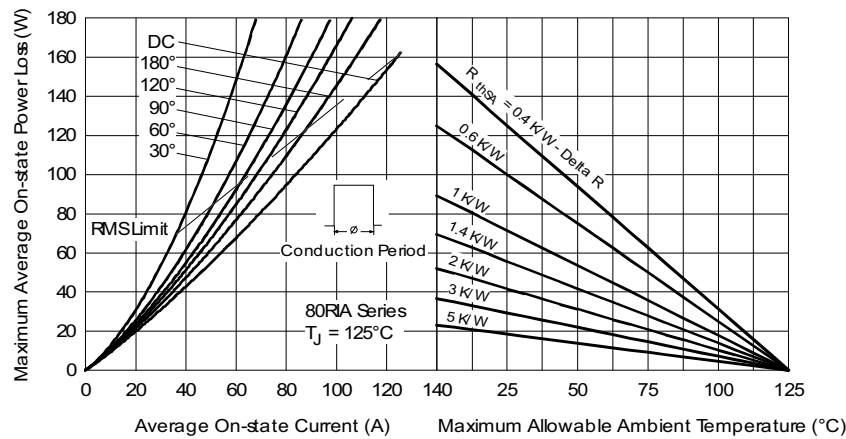


Fig. 4 - On-State Power Loss Characteristics

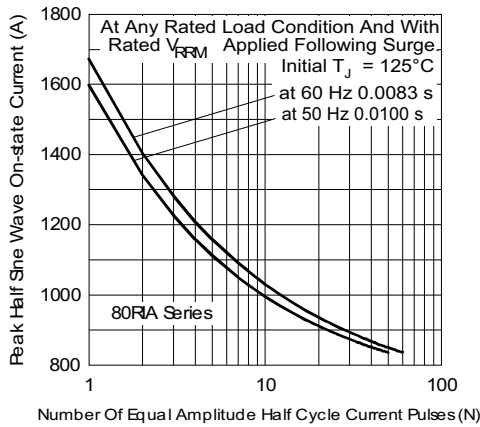


Fig. 5 - Maximum Non-Repetitive Surge Current

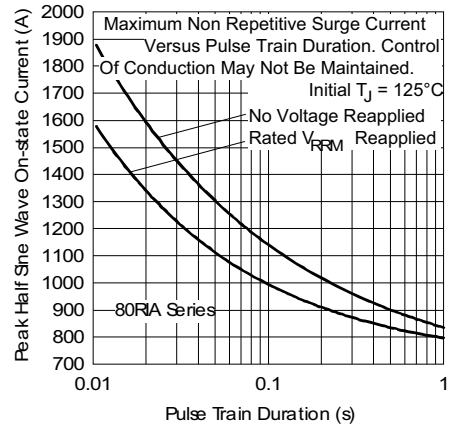


Fig. 6 - Maximum Non-Repetitive Surge Current

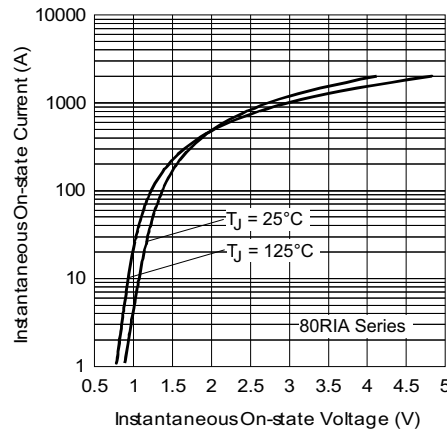


Fig. 7 - On-State Voltage Drop Characteristics

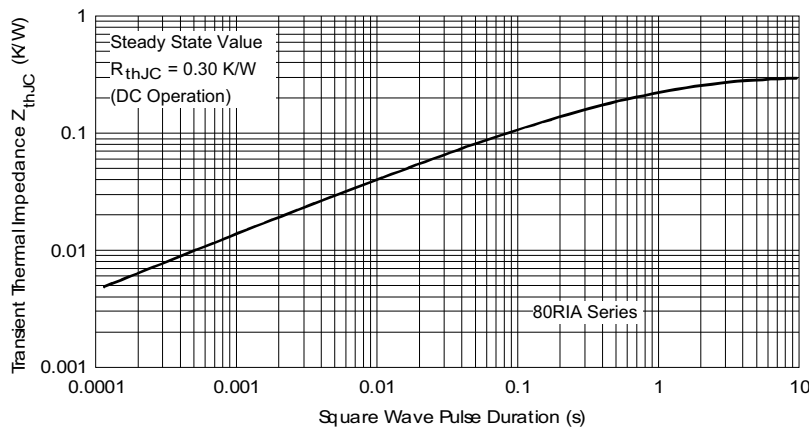


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

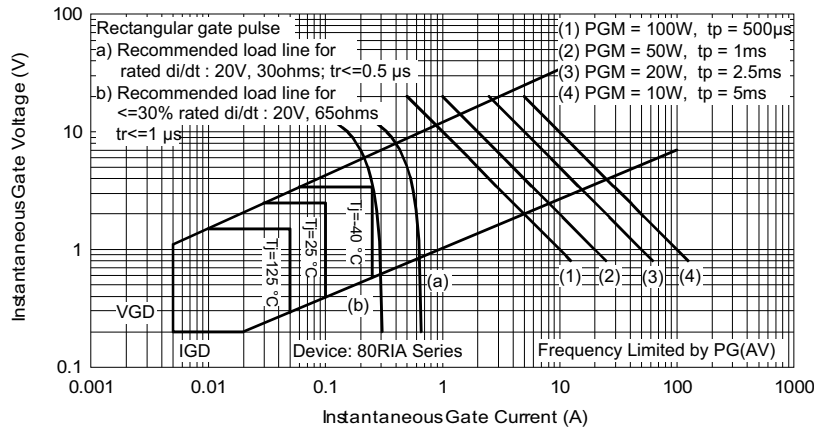


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

| | | | | | | | |
|-------------|------------|----------|----------|------------|------------|----------|------------|
| Device code | VS- | 8 | 0 | RIA | 120 | M | PbF |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |

- 1** - Vishay Semiconductors product
- 2** - $I_{TAV} \times 10$ A
- 3** -
 - 0 = eyelet terminals (gate and auxiliary cathode leads)
 - 1 = fast-on terminals (gate and auxiliary cathode leads)
 - 2 = flag terminals (gate and auxiliary cathode terminals)
- 4** - RIA = essential part number
- 5** - Voltage code $\times 100 = V_{RRM}$ (see Voltage Ratings table)
- 6** -
 - None = stud base 1/2"-20UNF- 2 A threads
 - M = stud base metric threads M12 x 1.75 E 6
- 7** -
 - None = standard production
 - PbF = lead (Pb)-free

| LINKS TO RELATED DOCUMENTS | |
|----------------------------|--|
| Dimensions | www.vishay.com/doc?95362 |

TO-209AC (TO-94) for 80RIA Series

DIMENSIONS in millimeters (inches)





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