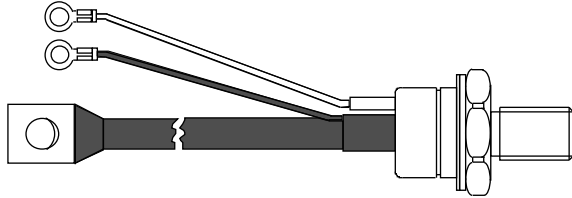


## Phase Control Thyristors (Stud Version), 80 A



TO-209AC (TO-94)

### FEATURES

- Hermetic glass-metal seal
- International standard case TO-209AC (TO-94)
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level



RoHS  
COMPLIANT

### TYPICAL APPLICATIONS

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

### PRODUCT SUMMARY

|             |      |
|-------------|------|
| $I_{T(AV)}$ | 80 A |
|-------------|------|

### 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 <sup>2</sup> 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<br>V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK VOLTAGE<br>V | $I_{DRM}/I_{RRM}$ MAXIMUM AT $T_J = 125$ °C<br>mA |
|----------------|--------------|--|--|---|
| 80RIA<br>81RIA | 40           | 400  | 500  | 15  |
|                | 80           | 800  | 900  |   |
|                | 120          | 1200   | 1300   |   |

# 80RIA...PbF, 81RIA...PbF, 82RIA...PbF Series



Vishay Semiconductors

Phase Control Thyristors  
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| 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    | A                  |
| Maximum peak, one-cycle non-repetitive surge current | $I_{TSM}$     | t = 10 ms   | No voltage reapplied      | 1900   |                    |
|  |               | t = 8.3 ms  |                           | 1990   |                    |
|  |               | t = 10 ms   | 100 % $V_{RRM}$ reapplied | 1600   |                    |
|  |               | t = 8.3 ms  |                           | 1675   |                    |
| Maximum $I^2t$ for fusing                            | $I^2t$        | t = 10 ms   | No voltage                | 18     | kA <sup>2</sup> s  |
|  |               | t = 8.3 ms  |                           | 16     |                    |
|  |               | t = 10 ms   | 100 % $V_{RRM}$ reapplied | 12.7   |                    |
|  |               | 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 <sup>2</sup> /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, $V_d =$ 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, $V_d =$ 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 | $I_{RRM}$ ,<br>$I_{DRM}$ | $T_J = 125$ °C rated $V_{DRM}/V_{RRM}$ applied     |  | 15     | mA    |



# 80RIA...PbF, 81RIA...PbF, 82RIA...PbF Series

Phase Control Thyristors  
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Vishay Semiconductors

| 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/<br>current/voltage are the lowest value<br>which will trigger all units 6 V anode<br>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<br>trigger is the maximum value which<br>will not trigger any unit with rated<br>$V_{DRM}$ 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, $\pm 10$ %                  |            | Non-lubricated threads                        |  | 15.5<br>(137)    | N · m<br>(lbf · in) |
|  |            | Lubricated threads                            |  | 14<br>(120)      |                     |
| Approximate weight                           |            |   |  | 130              | g                   |
| Case style                                   |            | See dimensions - link at the end of datasheet |  | TO-209AC (TO-94) |                     |

# 80RIA...PbF, 81RIA...PbF, 82RIA...PbF Series



Vishay Semiconductors

Phase Control Thyristors  
(Stud Version), 80 A

| $\Delta R_{thJC}$ CONDUCTION |                       |                        |   |       |
|------------------------------|-----------------------|------------------------|---|-------|
| CONDUCTION ANGLE             | SINUSOIDAL CONDUCTION | RECTANGULAR CONDUCTION | TEST CONDITIONS                         | UNITS |
| 180°                         | 0.042                 | 0.030                  | T <sub>J</sub> = T <sub>J</sub> 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<sub>thJC</sub> when devices operate at different conduction angles than DC

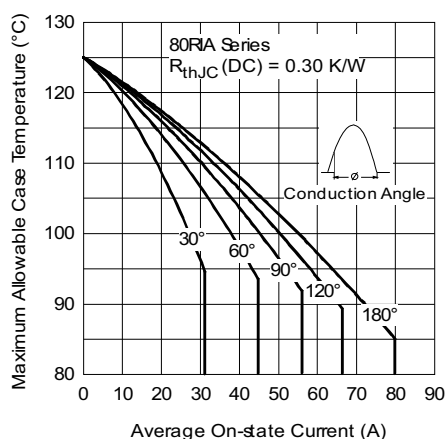


Fig. 1 - Current Ratings Characteristics

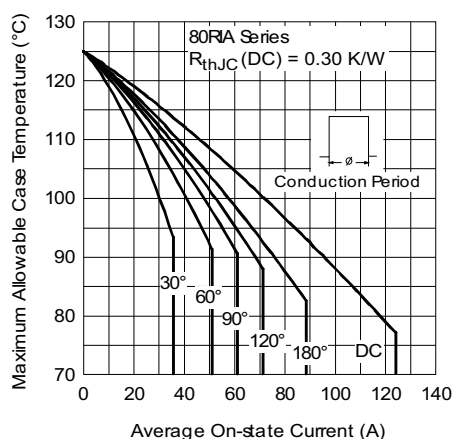


Fig. 2 - Current Ratings Characteristics

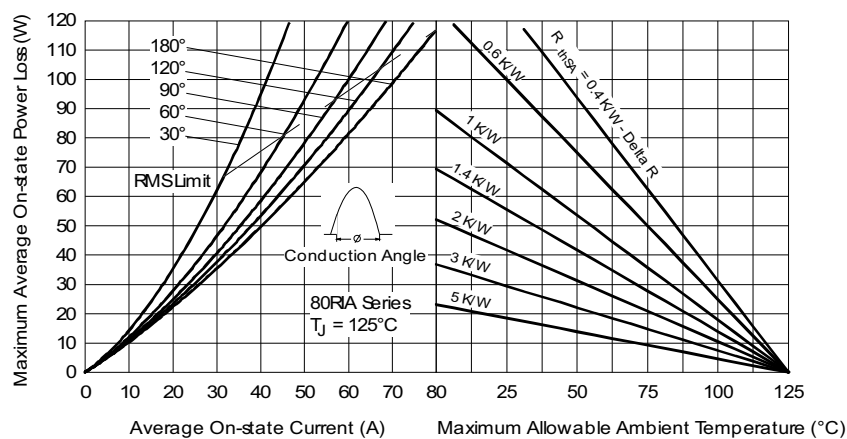


Fig. 3 - On-State Power Loss Characteristics



# 80RIA...PbF, 81RIA...PbF, 82RIA...PbF Series

Phase Control Thyristors  
(Stud Version), 80 A

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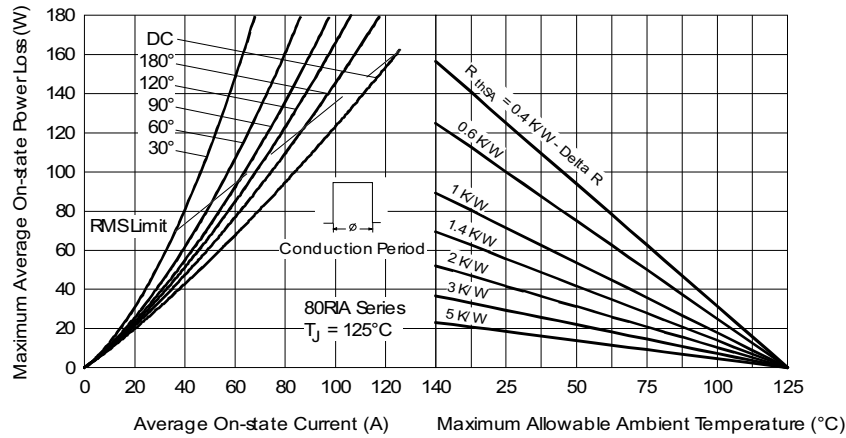


Fig. 4 - On-State Power Loss Characteristics

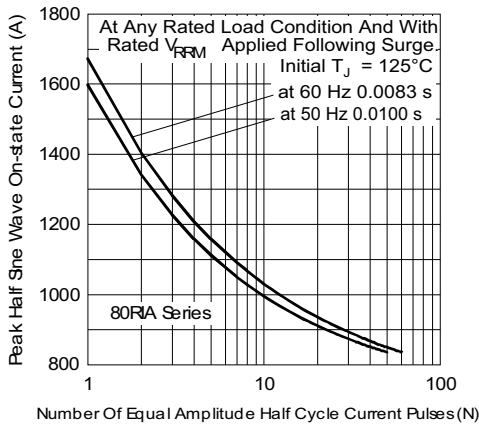


Fig. 5 - Maximum Non-Repetitive Surge Current

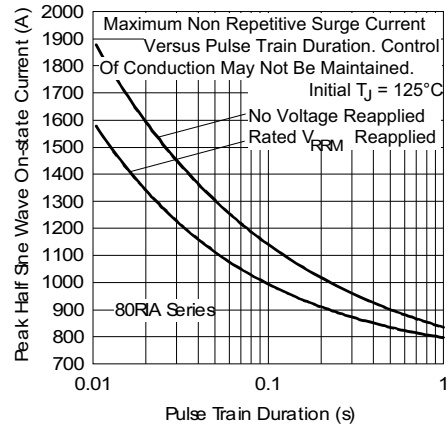


Fig. 6 - Maximum Non-Repetitive Surge Current

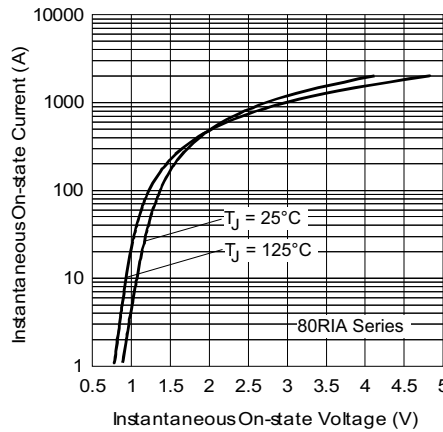


Fig. 7 - On-State Voltage Drop Characteristics

# 80RIA...PbF, 81RIA...PbF, 82RIA...PbF Series



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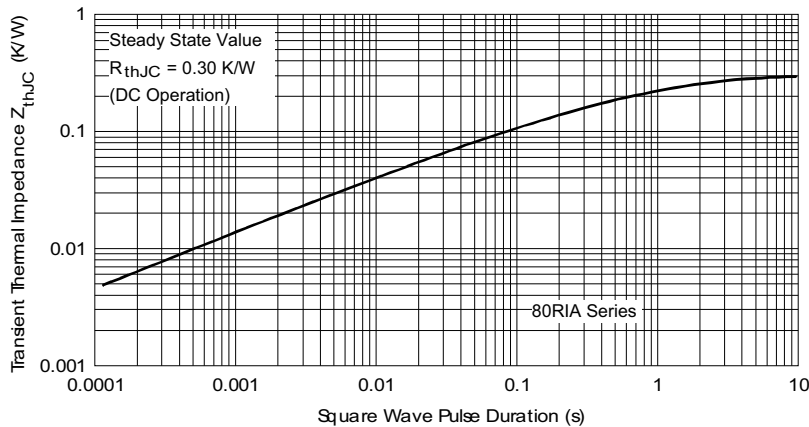


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

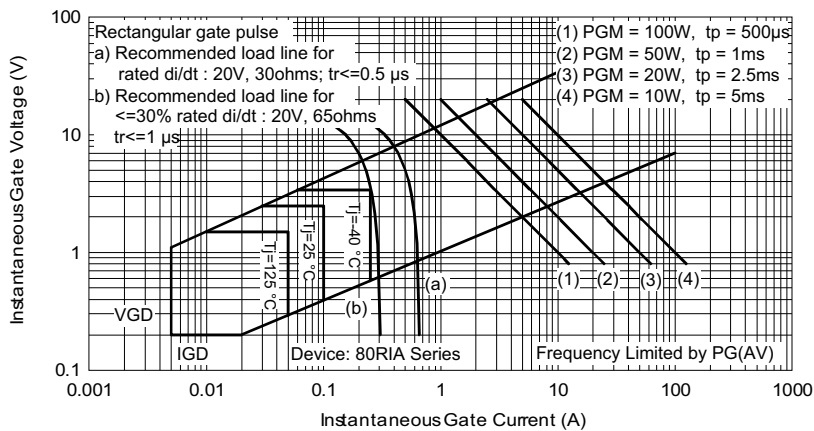


Fig. 9 - Gate Characteristics

## ORDERING INFORMATION TABLE

|             |          |          |            |            |          |            |
|-------------|----------|----------|------------|------------|----------|------------|
| Device code | <b>8</b> | <b>0</b> | <b>RIA</b> | <b>120</b> | <b>M</b> | <b>PbF</b> |
|             | (1)      | (2)      | (3)        | (4)        | (5)      | (6)        |

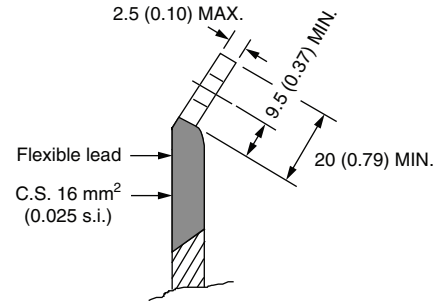
- 1** -  $I_{TAV} \times 10 \text{ A}$
- 2** -
  - 0 = Eyelet terminals (gate and auxiliary cathode leads)
  - 1 = Fast-on terminals (gate and auxiliary cathode leads)
  - 2 = Flag terminals (gate and auxiliary cathode terminals)
- 3** - RIA = Essential part number
- 4** - Voltage code  $\times 100 = V_{RRM}$  (see Voltage Ratings table)
- 5** -
  - None = Stud base 1/2"-20UNF- 2 A threads
  - M = Stud base metric threads M12 x 1.75 E 6
- 6** - Lead (Pb)-free

### LINKS TO RELATED DOCUMENTS

|            |  |
|------------|--|
| Dimensions | <a href="http://www.vishay.com/doc?95362">www.vishay.com/doc?95362</a> |
|------------|--|

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

**DIMENSIONS** in millimeters (inches)





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