



Phase Control Thyristors (Stud Version), 180 A



TO-209AB (TO-93)

FEATURES

- Hermetic glass-metal seal
- International standard case TO-209AB (TO-93)
- 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

| PRODUCT SUMMARY | |
|-------------------|----------------------|
| $I_{T(AV)}$ | 180 A |
| V_{DRM}/V_{RRM} | 400 V, 800 V, 1000 V |
| V_{TM} | 1.35 V |
| I_{GT} | 65 mA |
| T_J | -40 °C to 125 °C |
| Package | TO-209AB (TO-93) |
| Diode variation | Single SCR |

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|-----------------------------------|-----------------|-------------|-------------------|
| PARAMETER | TEST CONDITIONS | VALUES | UNITS |
| $I_{T(AV)}$ | | 180 | A |
| | T_C | 80 | °C |
| $I_{T(RMS)}$ | | 285 | A |
| I_{TSM} | 50 Hz | 3800 | |
| | 60 Hz | 4000 | |
| I^2t | 50 Hz | 72 | kA ² s |
| | 60 Hz | 66 | |
| V_{DRM}/V_{RRM} | | 400 to 1000 | V |
| t_q | Typical | 100 | µs |
| T_J | | -40 to 125 | °C |

ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS | | | | |
|------------------------|--------------|------------------------------------------------------------------------|------------------------------------------------------|--------------------------------------------------------|
| PART 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 $T_J = T_J$ MAXIMUM mA |
| VS-180RKI VS-181RKI | 40 | 400 | 500 | 30 |
| | 80 | 800 | 900 | |
| | 100 | 1000 | 1100 | |



| 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 | | 180 | A |
| | | | | 80 | °C |
| Maximum RMS on-state current | I_{RMS} | DC at 79 °C case temperature | | 285 | A |
| Maximum peak, one-cycle non-repetitive surge current | I_{TSM} | t = 10 ms | No voltage reappplied | 3800 | |
| | | t = 8.3 ms | | 4000 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 3500 | |
| | | t = 8.3 ms | | 3660 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reappplied | 72 | kA ² s |
| | | t = 8.3 ms | | 66 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 61 | |
| | | t = 8.3 ms | | 56 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reappplied | | 720 | 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 | | 0.83 | V |
| High level value of threshold voltage | $V_{T(TO)2}$ | (I > $\pi \times I_{T(AV)}$), $T_J = T_J$ maximum | | 0.89 | |
| 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 | | 0.92 | mΩ |
| High level value of on-state slope resistance | r_{t2} | (I > $\pi \times I_{T(AV)}$), $T_J = T_J$ maximum | | 0.81 | |
| Maximum on-state voltage | V_{TM} | $I_{pk} = 570$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine pulse | | 1.35 | V |
| Maximum holding current | I_H | $T_J = 25$ °C, anode supply 12 V resistive load | | 600 | mA |
| Typical latching current | I_L | | | 1000 | |

| SWITCHING | | | | | |
|----------------------------------------------------------|--------|----------------------------------------------------------------------------------------------------|--|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum non-repetitive rate of rise of turned-on current | dI/dt | Gate drive 20 V, 20 Ω, $t_r \leq 1$ μs $T_J = T_J$ maximum, anode voltage ≤ 80 % V_{DRM} | | 300 | A/μs |
| Typical delay time | t_d | Gate current 1 A, $dI_g/dt = 1$ A/μs $V_d = 0.67$ % V_{DRM} , $T_J = 25$ °C | | 1.0 | μs |
| Typical turn-off time | t_q | $I_{TM} = 50$ A, $T_J = T_J$ maximum, dI/dt = 10 A/μs, $V_R = 100$ V, dV/dt = 20 V/μs | | 100 | |

| 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 80 % rated V_{DRM} | | 500 | V/μs |
| Maximum peak reverse and off-state leakage current | I_{RRM} , I_{DRM} | $T_J = T_J$ maximum rated V_{DRM}/V_{RRM} applied | | 30 | mA |



| TRIGGERING | | | | | | |
|-------------------------------------|-------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | | UNITS |
| | | | | TYP. | MAX. | |
| Maximum peak gate power | P_{GM} | $T_J = T_J$ maximum, $t_p \leq 5$ ms | | 10 | | W |
| Maximum average gate power | $P_{G(AV)}$ | $T_J = T_J$ maximum, $f = 50$ Hz, $d\% = 50$ | | 2.0 | | |
| Maximum peak positive gate current | I_{GM} | $T_J = T_J$ maximum, $t_p \leq 5$ ms | | 3.0 | | A |
| Maximum peak positive gate voltage | $+V_{GM}$ | | | 20 | | V |
| Maximum peak negative gate voltage | $-V_{GM}$ | | | 5.0 | | |
| 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 12 V anode to cathode applied | 130 | - | mA |
| | | $T_J = 25$ °C | | 65 | 150 | |
| | | $T_J = 125$ °C | | 35 | - | |
| DC gate voltage required to trigger | V_{GT} | $T_J = -40$ °C | | 2.0 | - | V |
| | | $T_J = 25$ °C | | 1.2 | 2.5 | |
| | | $T_J = 125$ °C | | 0.9 | - | |
| 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 | 10 | | 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 | 0.15 | K/W |
| Maximum thermal resistance, junction to ambient | R_{thCS} | Mounting surface, smooth, flat and greased | 0.04 | |
| Mounting force, ± 10 % | | Non-lubricated threads | 31 (275) | N · m (lbf · in) |
| | | Lubricated threads | 24.5 (210) | |
| Approximate weight | | | 280 | g |
| Case style | | See dimensions - link at the end of datasheet | TO-209AB (TO-93) | |

| ΔR_{thJC} CONDUCTION | | | | |
|------------------------------|-----------------------|------------------------|---------------------|-------|
| CONDUCTION ANGLE | SINUSOIDAL CONDUCTION | RECTANGULAR CONDUCTION | TEST CONDITIONS | UNITS |
| 180° | 0.050 | 0.032 | $T_J = T_J$ maximum | K/W |
| 120° | 0.063 | 0.059 | | |
| 90° | 0.080 | 0.082 | | |
| 60° | 0.118 | 0.124 | | |
| 30° | 0.225 | 0.228 | | |

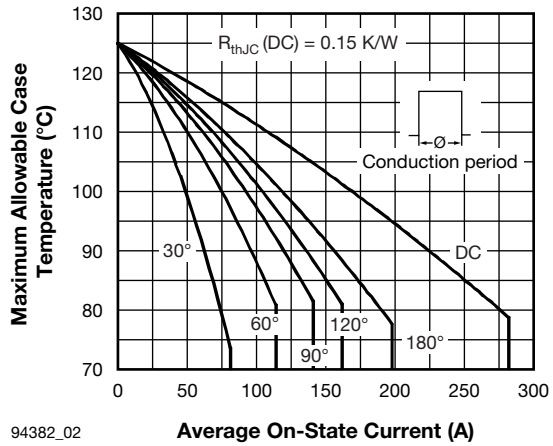
Note

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



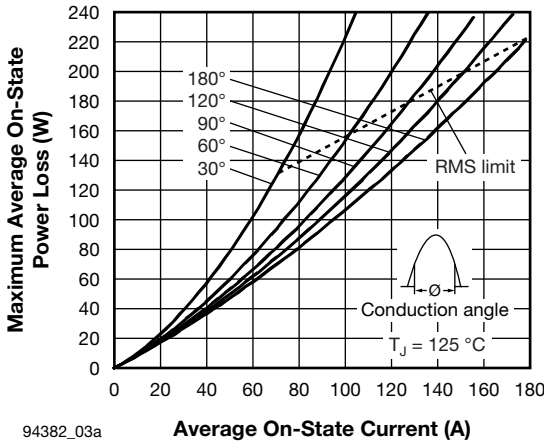
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Fig. 1 - Current Ratings Characteristics

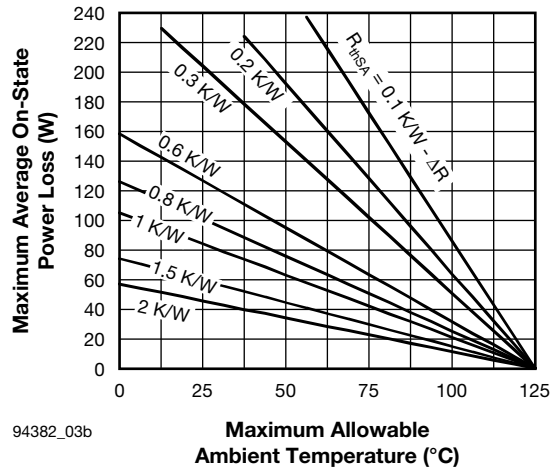


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Fig. 2 - Current Ratings Characteristics

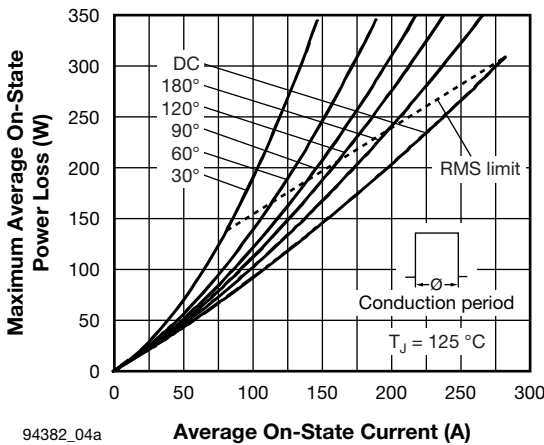


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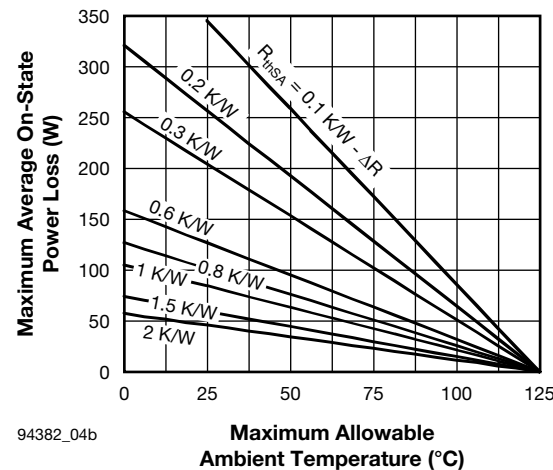


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Fig. 3 - On-State Power Loss Characteristics



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94382_04b

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- | 18 | 1 | RKI | 100 | PbF |
| | (1) | (2) | (3) | (4) | (5) | (6) |

- 1** - Vishay Semiconductors product
- 2** - $I_{T(AV)}$ rated average output current (rounded/10)
- 3** -
 - 0 = Eyelet terminals (gate and auxiliary cathode leads)
 - 1 = Fast-on terminals (gate and auxiliary cathode leads)
- 4** - Thyristor
- 5** - Voltage code x 10 = V_{RRM} (see Voltage Ratings table)
- 6** -
 - None = Standard production
 - PbF = Lead (Pb)-free

LINKS TO RELATED DOCUMENTS

| | |
|------------|------------------------------------------------------------------------|
| Dimensions | www.vishay.com/doc?95077 |
|------------|------------------------------------------------------------------------|

TO-209AB (TO-93)

DIMENSIONS in millimeters (inches)





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