

## Inverter Grade Thyristors (Stud Version), 195 A



TO-209AB (TO-93)

**FEATURES**

- Center amplifying gate
- High surge current capability
- Low thermal impedance
- High speed performance
- Compression bonding
- Designed and qualified for industrial level
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS  
COMPLIANT**

| PRODUCT SUMMARY    |                  |
|--------------------|------------------|
| $I_{T(AV)}$        | 195 A            |
| $V_{DRM}/V_{RRM}$  | 400 V, 800 V     |
| $V_{TM}$           | 1.80 V           |
| $I_{TSM}$ at 50 Hz | 4900 A           |
| $I_{TSM}$ at 60 Hz | 5130 A           |
| $I_{GT}$           | 200 mA           |
| $T_J$              | -40 °C to 125 °C |
| Package            | TO-209AB (TO-93) |
| Diode variation    | Single SCR       |

**TYPICAL APPLICATIONS**

- Inverters
- Choppers
- Induction heating
- All types of force-commutated converters

| MAJOR RATINGS AND CHARACTERISTICS |                 |            |                   |
|-----------------------------------|-----------------|------------|-------------------|
| PARAMETER                         | TEST CONDITIONS | VALUES     | UNITS             |
| $I_{T(AV)}$                       |                 | 195        | A                 |
|                                   | $T_C$           | 85         | °C                |
| $I_{T(RMS)}$                      |                 | 306        | A                 |
| $I_{TSM}$                         | 50 Hz           | 4900       |                   |
|                                   | 60 Hz           | 5130       |                   |
| $I^2t$                            | 50 Hz           | 120        | kA <sup>2</sup> s |
|                                   | 60 Hz           | 110        |                   |
| $V_{DRM}/V_{RRM}$                 |                 | 400 to 800 | V                 |
| $t_q$                             |                 | 15 to 20   | µs                |
| $T_J$                             |                 | -40 to 125 | °C                |

**ELECTRICAL SPECIFICATIONS**

| VOLTAGE RATINGS |              |   |   |   |
|-----------------|--------------|---|---|---|
| TYPE NUMBER     | VOLTAGE CODE | $V_{DRM}/V_{RRM}$ , MAXIMUM REPETITIVE PEAK VOLTAGE V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK VOLTAGE V | $I_{DRM}/I_{RRM}$ MAXIMUM AT $T_J = T_J$ MAXIMUM mA |
| VS-ST183S       | 04           | 400   | 500   | 40  |
|                 | 08           | 800   | 900   |   |



| CURRENT CARRYING CAPABILITY      |           |     |           |     |           |      |       |
|----------------------------------|-----------|-----|-----------|-----|-----------|------|-------|
| FREQUENCY                        |           |     |           |     |           |      | UNITS |
| 50 Hz                            | 570       | 370 | 900       | 610 | 7040      | 5220 | A     |
| 400 Hz                           | 560       | 360 | 940       | 630 | 3200      | 2280 |       |
| 1000 Hz                          | 500       | 300 | 925       | 610 | 1780      | 1200 |       |
| 2500 Hz                          | 340       | 190 | 760       | 490 | 880       | 560  |       |
| Recovery voltage $V_r$           | 50        |     | 50        |     | 50        |      | V     |
| Voltage before turn-on $V_d$     | $V_{DRM}$ |     | $V_{DRM}$ |     | $V_{DRM}$ |      |       |
| Rise of on-state current $di/dt$ | 50        |     | -         |     | -         |      | A/μs  |
| Case temperature                 | 60        | 85  | 60        | 85  | 60        | 85   | °C    |
| Equivalent values for RC circuit | 47/0.22   |     | 47/0.22   |     | 47/0.22   |      | Ω/μF  |

| ON-STATE CONDUCTION  |               |   |                           |   |        |                |
|--|---------------|---|---------------------------|---|--------|----------------|
| PARAMETER  | SYMBOL        | TEST CONDITIONS   |                           |   | VALUES | UNITS          |
| Maximum average on-state current at case temperature       | $I_{T(AV)}$   | 180° conduction, half sine wave   |                           |   | 195    | A              |
|  |               |   |                           |   | 85     | °C             |
| Maximum RMS on-state current                               | $I_{T(RMS)}$  | DC at 74 °C case temperature  |                           |   | 306    | A              |
| Maximum peak, one half cycle, non-repetitive surge current | $I_{TSM}$     | t = 10 ms   | No voltage reapplied      | Sinusoidal half wave, initial $T_J = T_J$ maximum | 4900   |                |
|  |               | t = 8.3 ms  |                           |   | 5130   |                |
|  |               | t = 10 ms   | 100 % $V_{RRM}$ reapplied |   | 4120   |                |
|  |               | t = 8.3 ms  |                           |   | 4310   |                |
| Maximum $I^2t$ for fusing                                  | $I^2t$        | t = 10 ms   | No voltage reapplied      |   | 120    |                |
|  |               | t = 8.3 ms  |                           |   | 110    |                |
|  |               | t = 10 ms   | 100 % $V_{RRM}$ reapplied |   | 85     |                |
|  |               | t = 8.3 ms  |                           |   | 78     |                |
| Maximum $I^2\sqrt{t}$ for fusing                           | $I^2\sqrt{t}$ | t = 0.1 to 10 ms, no voltage reapplied  |                           |   | 1200   | $kA^2\sqrt{s}$ |
| Maximum peak on-state voltage                              | $V_{TM}$      | $I_{TM} = 600$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine wave pulse                    |                           |   | 1.80   | V              |
| 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 |                           |   | 1.40   |                |
| High level value of threshold voltage                      | $V_{T(TO)2}$  | $I > \pi \times I_{T(AV)}$ , $T_J = T_J$ maximum  |                           |   | 1.45   |                |
| Low level value of forward slope resistance                | $r_{t1}$      | $(16.7\% \times \pi \times I_{T(AV)}) < I < \pi \times I_{T(AV)}$ , $T_J = T_J$ maximum |                           |   | 0.67   | $m\Omega$      |
| High level value of forward slope resistance               | $r_{t2}$      | $I > \pi \times I_{T(AV)}$ , $T_J = T_J$ maximum  |                           |   | 0.58   |                |
| Maximum holding current                                    | $I_H$         | $T_J = 25$ °C, $I_T > 30$ A   |                           |   | 600    | mA             |
| Typical latching current                                   | $I_L$         | $T_J = 25$ °C, $V_A = 12$ V, $R_a = 6$ Ω, $I_G = 1$ A                                   |                           |   | 1000   |                |



| SWITCHING  |                |   |        |       |
|--|----------------|---|--------|-------|
| PARAMETER  | SYMBOL         | TEST CONDITIONS   | VALUES | UNITS |
| Maximum non-repetitive rate of rise of turned-on current | di/dt          | T <sub>J</sub> = T <sub>J</sub> maximum, V <sub>DRM</sub> = Rated V <sub>DRM</sub><br>I <sub>TM</sub> = 2 x di/dt   | 1000   | A/μs  |
| Typical delay time                                       | t <sub>d</sub> | T <sub>J</sub> = 25 °C, V <sub>DM</sub> = Rated V <sub>DRM</sub> , I <sub>TM</sub> = 50 A DC, t <sub>p</sub> = 1 μs<br>Resistive load, gate pulse: 10 V, 5 Ω source | 1.1    | μs    |
| Maximum turn-off time                                    | minimum        | T <sub>J</sub> = T <sub>J</sub> maximum,<br>I <sub>TM</sub> = 300 A, commutating di/dt = 20 A/μs<br>V <sub>R</sub> = 50 V, t <sub>p</sub> = 500 μs, dV/dt: 200 V/μs | 15     |       |
|  | maximum        |   | 20     |       |

| BLOCKING   |  |   |        |       |
|--|--|---|--------|-------|
| PARAMETER  | SYMBOL                                 | TEST CONDITIONS   | VALUES | UNITS |
| Maximum critical rate of rise of off-state voltage | dV/dt                                  | T <sub>J</sub> = T <sub>J</sub> maximum, linear to 80 % V <sub>DRM</sub> ,<br>higher value available on request | 500    | V/μs  |
| Maximum peak reverse and off-state leakage current | I <sub>RRM</sub> ,<br>I <sub>DRM</sub> | T <sub>J</sub> = T <sub>J</sub> maximum, rated V <sub>DRM</sub> /V <sub>RRM</sub> applied                       | 40     | mA    |

| TRIGGERING                                  |                    |   |        |       |
|---|--------------------|---|--------|-------|
| PARAMETER                                   | SYMBOL             | TEST CONDITIONS   | VALUES | UNITS |
| Maximum peak gate power                     | P <sub>GM</sub>    | T <sub>J</sub> = T <sub>J</sub> maximum, f = 50 Hz, d% = 50                         | 60     | W     |
| Maximum average gate power                  | P <sub>G(AV)</sub> |   | 10     |       |
| Maximum peak positive gate current          | I <sub>GM</sub>    | T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> ≤ 5 ms                      | 10     | A     |
| Maximum peak positive gate voltage          | +V <sub>GM</sub>   |   | 20     | V     |
| Maximum peak negative gate voltage          | -V <sub>GM</sub>   |   | 5      |       |
| Maximum DC gate current required to trigger | I <sub>GT</sub>    | T <sub>J</sub> = T <sub>J</sub> maximum V <sub>A</sub> = 12 V, R <sub>a</sub> = 6 Ω | 200    | mA    |
| Maximum DC gate voltage required to trigger | V <sub>GT</sub>    |   | 3      | V     |
| Maximum DC gate current not to trigger      | I <sub>GD</sub>    | T <sub>J</sub> = T <sub>J</sub> maximum, rated V <sub>DRM</sub> applied             | 20     | mA    |
| Maximum DC gate voltage not to trigger      | V <sub>GD</sub>    |   | 0.25   | V     |

| THERMAL AND MECHANICAL SPECIFICATIONS        |                   |   |                  |                     |
|--|-------------------|---|------------------|---------------------|
| PARAMETER                                    | SYMBOL            | TEST CONDITIONS                               | VALUES           | UNITS               |
| Maximum junction operating temperature range | T <sub>J</sub>    |   | -40 to 125       | °C                  |
| Maximum storage temperature range            | T <sub>Stg</sub>  |   | -40 to 150       |                     |
| Maximum thermal resistance, junction to case | R <sub>thJC</sub> | DC operation                                  | 0.105            | K/W                 |
| Maximum thermal resistance, case to heatsink | R <sub>thCS</sub> | Mounting surface, smooth, flat and greased    | 0.04             |                     |
| Mounting torque, ± 10 %                      |                   | Non-lubricated threads                        | 31 (275)         | N · m<br>(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 <sub>thJC</sub> CONDUCTION |                       |                        |   |       |
|-------------------------------|-----------------------|------------------------|---|-------|
| CONDUCTION ANGLE              | SINUSOIDAL CONDUCTION | RECTANGULAR CONDUCTION | TEST CONDITIONS                         | UNITS |
| 180°                          | 0.016                 | 0.012                  | T <sub>J</sub> = T <sub>J</sub> maximum | K/W   |
| 120°                          | 0.019                 | 0.020                  |   |       |
| 90°                           | 0.025                 | 0.027                  |   |       |
| 60°                           | 0.036                 | 0.037                  |   |       |
| 30°                           | 0.060                 | 0.060                  |   |       |

**Note**

- The table above shows the increment of thermal resistance R<sub>thJC</sub> when devices operate at different conduction angles than DC

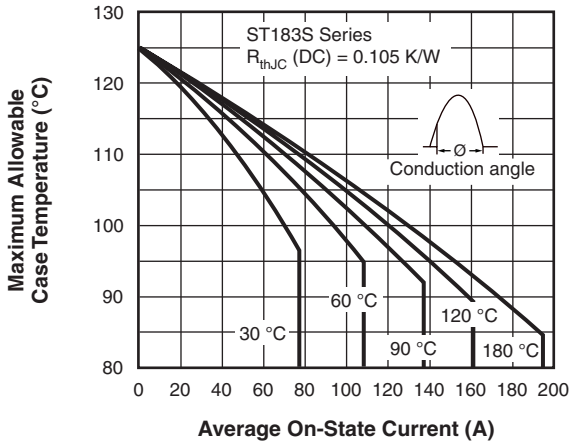


Fig. 1 - Current Ratings Characteristics

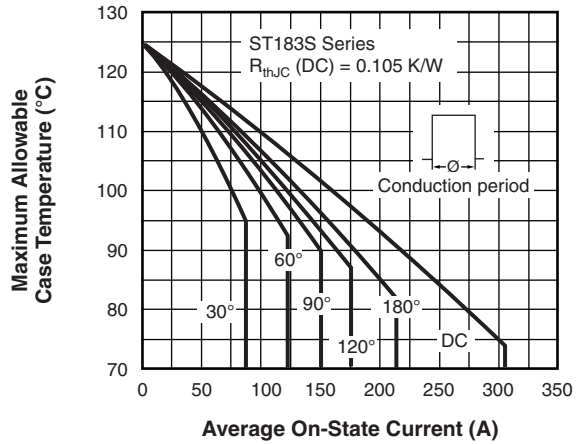


Fig. 2 - Current Ratings Characteristics

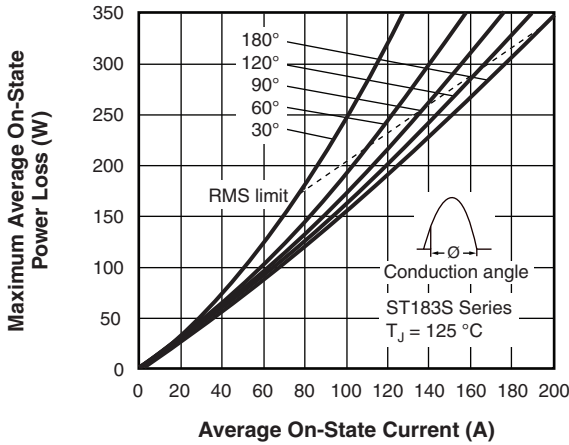


Fig. 3 - On-State Power Loss Characteristics

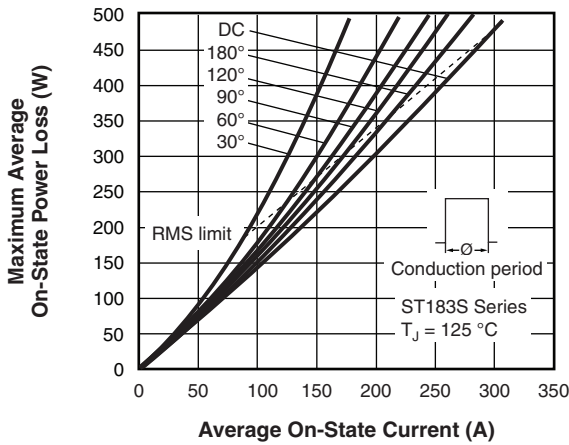
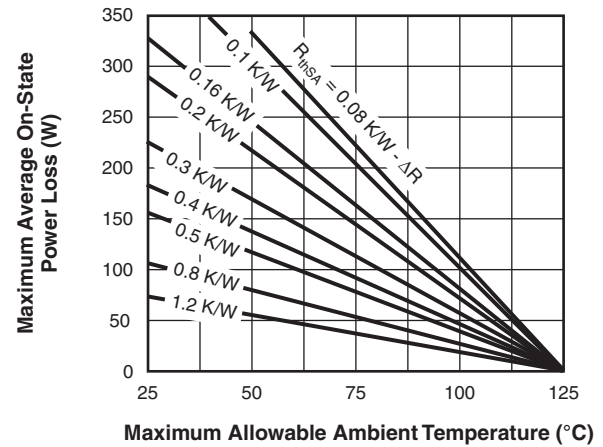
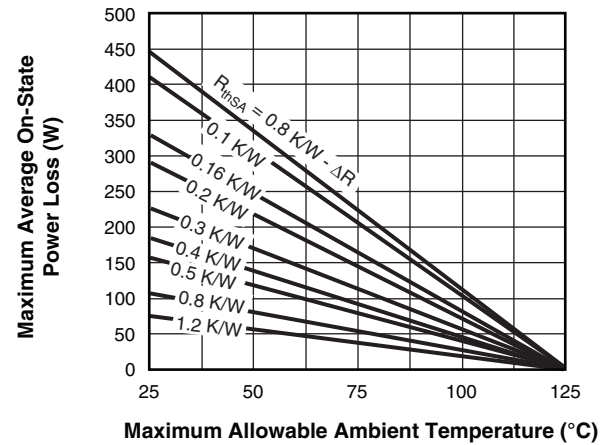


Fig. 4 - On-State Power Loss Characteristics



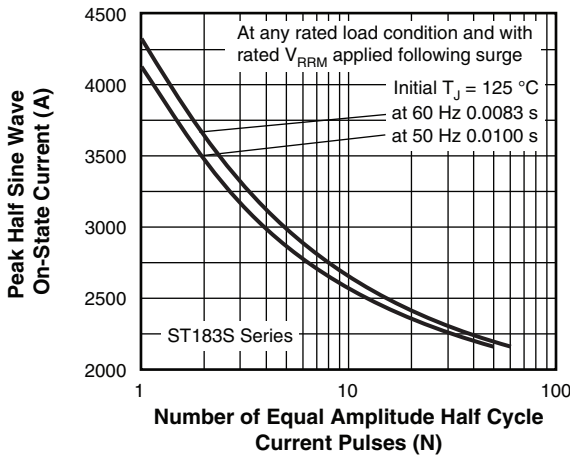


Fig. 5 - Maximum Non-Repetitive Surge Current

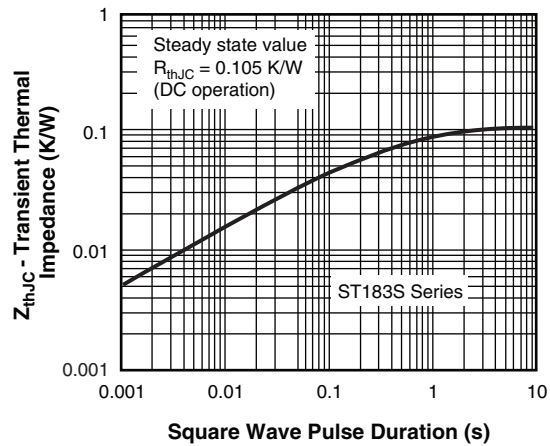


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

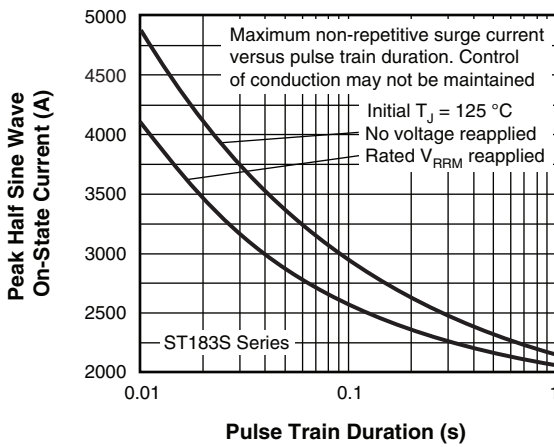


Fig. 6 - Maximum Non-Repetitive Surge Current

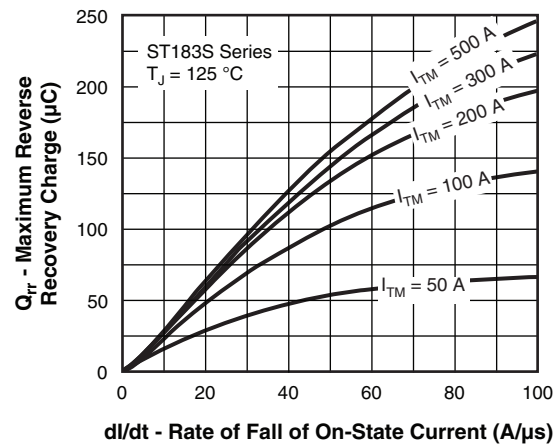


Fig. 9 - Reverse Recovered Charge Characteristics

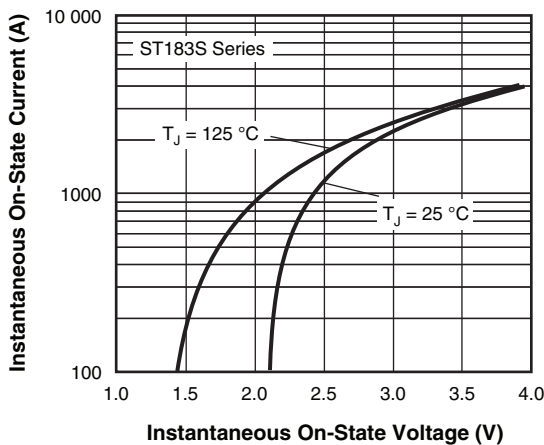


Fig. 7 - On-State Voltage Drop Characteristics

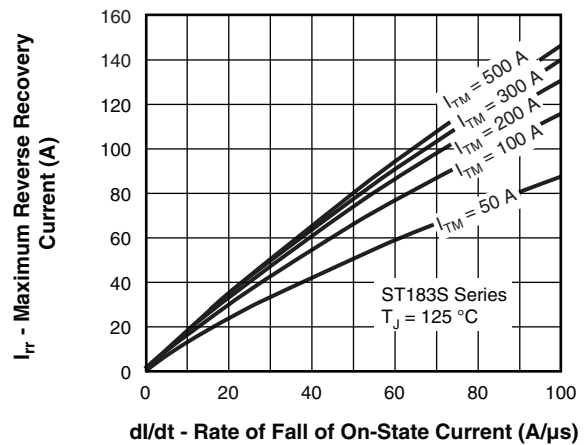


Fig. 10 - Reverse Recovery Current Characteristics



Fig. 11 - Frequency Characteristics

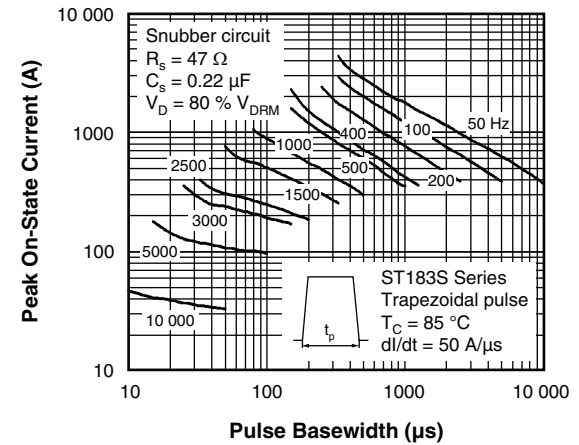


Fig. 12 - Frequency Characteristics



Fig. 13 - Frequency Characteristics



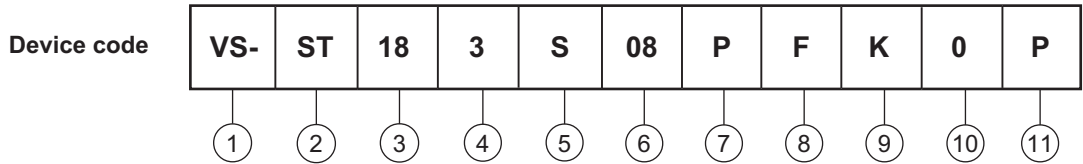
Fig. 14 - Maximum On-State Energy Power Loss Characteristics



Fig. 15 - Gate Characteristics



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Thyristor
- 3** - Essential part number
- 4** - 3 = Fast turn-off
- 5** - S = Compression bonding stud
- 6** - Voltage code x 100 =  $V_{RRM}$  (see Voltage Ratings table)
- 7** - P = Stud base 3/4" 16UNF-2A
- 8** - Reapplied dV/dt code (for  $t_q$  test condition)
- 9** -  $t_q$  code
- 10** - 0 = Eyelet terminals  
(gate and auxiliary cathode leads)  
1 = Fast-on terminals  
(gate and auxiliary cathode leads)
- 11** - None = standard production  
P = Lead (Pb)-free

| dV/dt - $t_q$ combinations available |    |     |
|--------------------------------------|----|-----|
| dV/dt (V/ $\mu$ s)                   |    | 200 |
| $t_q$ ( $\mu$ s)                     | 15 | FL  |
|                                      | 20 | FK  |

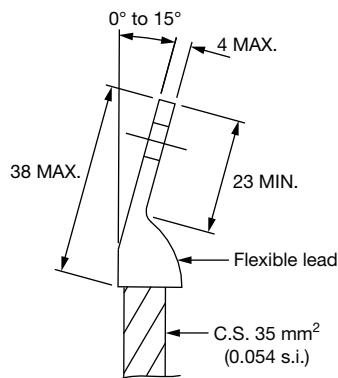
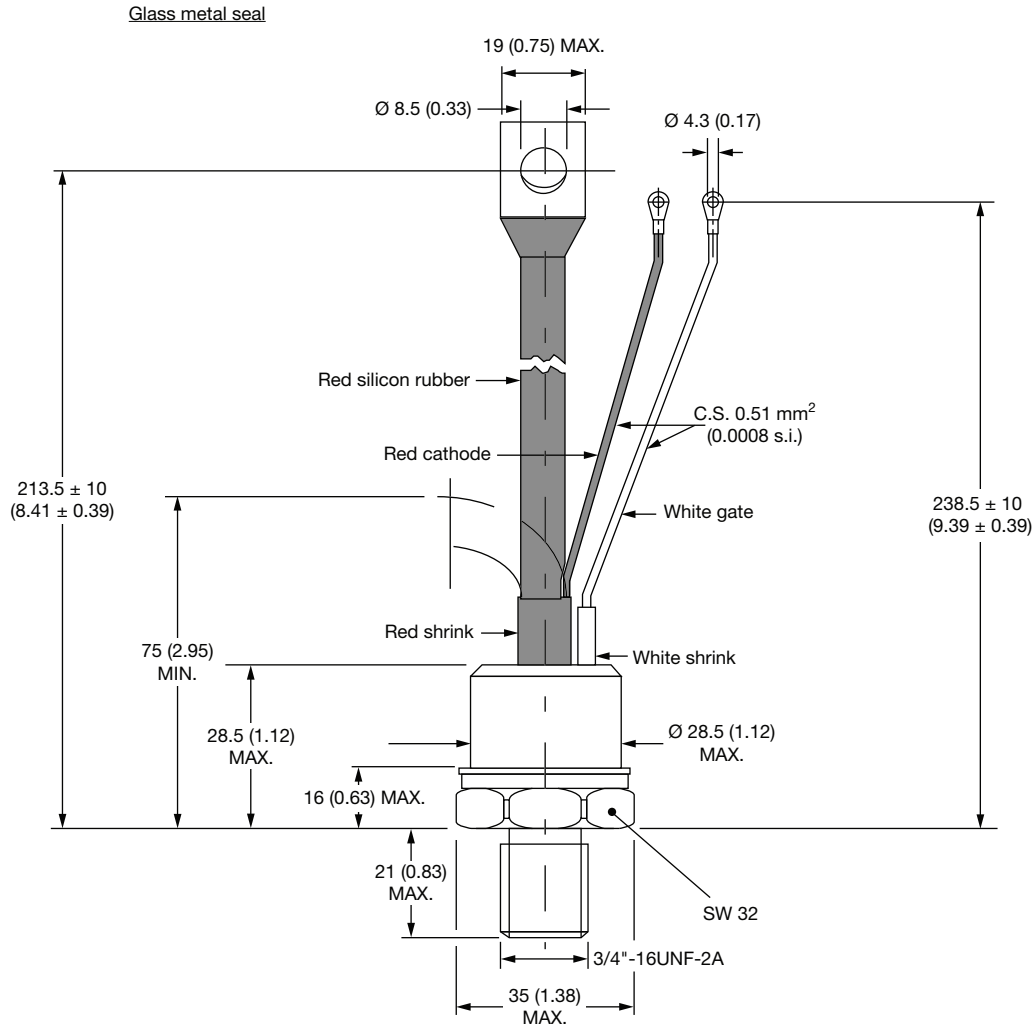
Note: For metric device M16 x 1.5 contact factory

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| Dimensions                 | <a href="http://www.vishay.com/doc?95077">www.vishay.com/doc?95077</a> |



## TO-209AB (TO-93)

**DIMENSIONS** in millimeters (inches)





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## JONHON

«JONHON» (основан в 1970 г.)

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(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

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