

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


**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 ² 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 | 4900 | |
| | | t = 8.3 ms | No voltage reapplied | 5130 | |
| | | t = 10 ms | 100 % V_{RRM} reapplied | 4120 | |
| | | t = 8.3 ms | 100 % V_{RRM} reapplied | 4310 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reapplied | 120 | kA ² s |
| | | t = 8.3 ms | No voltage reapplied | 110 | |
| | | t = 10 ms | 100 % V_{RRM} reapplied | 85 | |
| | | t = 8.3 ms | 100 % V_{RRM} reapplied | 78 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 to 10 ms, no voltage reapplied | | 1200 | kA ² /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 | mΩ |
| 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 _J = T _J maximum, V _{DRM} = Rated V _{DRM} I _{TM} = 2 x di/dt | 1000 | A/μs |
| Typical delay time | t _d | T _J = 25 °C, V _{DM} = Rated V _{DRM} , I _{TM} = 50 A DC, t _p = 1 μs Resistive load, gate pulse: 10 V, 5 Ω source | 1.1 | μs |
| Maximum turn-off time | minimum | T _J = T _J maximum, I _{TM} = 300 A, commutating di/dt = 20 A/μs V _R = 50 V, t _p = 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 _J = T _J maximum, linear to 80 % V _{DRM} , higher value available on request | 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 | 40 | mA |

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

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | |
|--|-------------------|---|------------------|---------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Maximum junction operating 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 | 0.105 | K/W |
| Maximum thermal resistance, case to heatsink | R _{thCS} | Mounting surface, smooth, flat and greased | 0.04 | |
| Mounting torque, ± 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° | 0.016 | 0.012 | T _J = T _J 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_{thJC} when devices operate at different conduction angles than DC

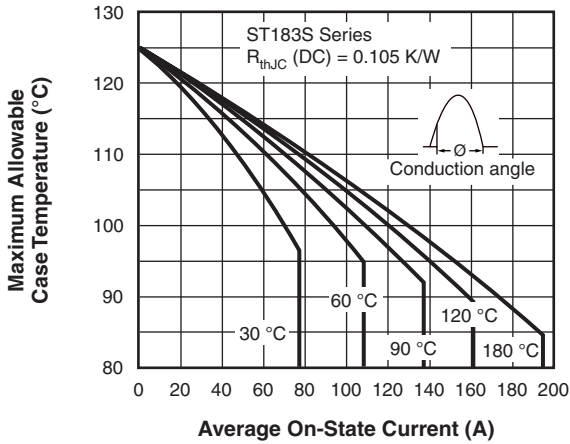


Fig. 1 - Current Ratings Characteristics

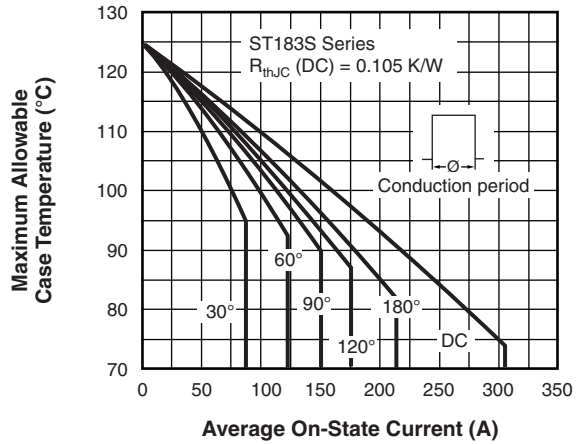


Fig. 2 - Current Ratings Characteristics

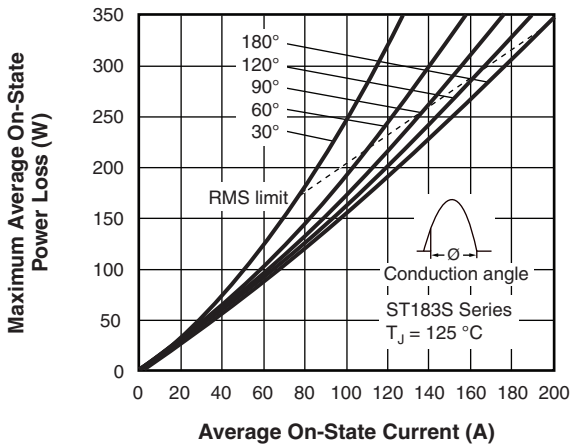


Fig. 3 - On-State Power Loss Characteristics

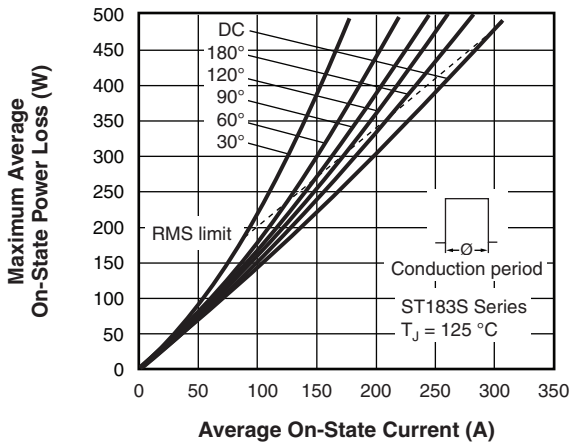
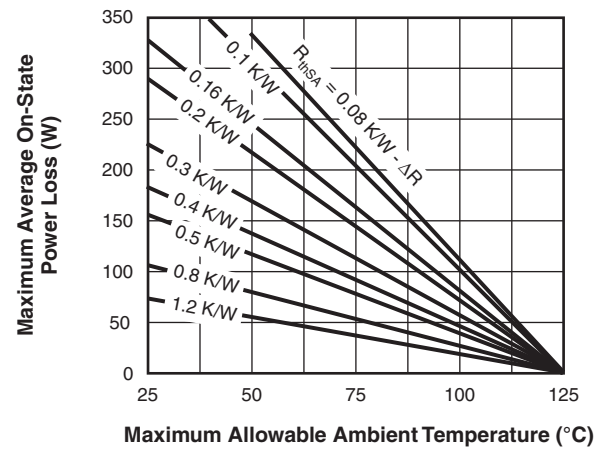
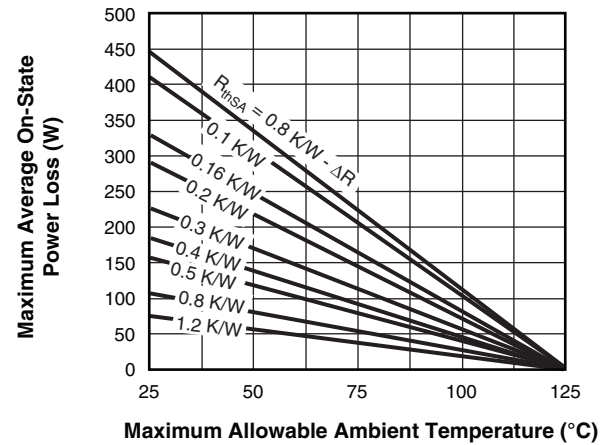


Fig. 4 - On-State Power Loss Characteristics



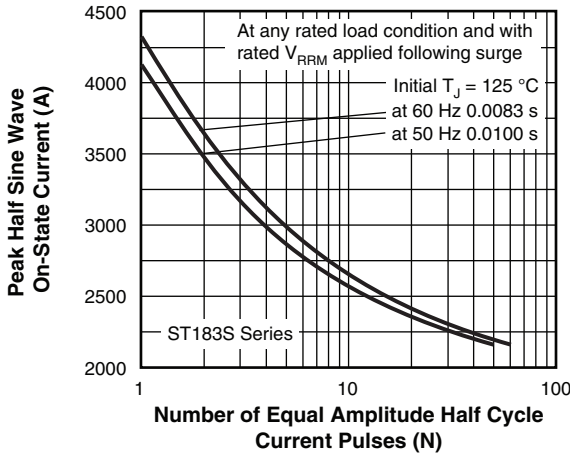


Fig. 5 - Maximum Non-Repetitive Surge Current

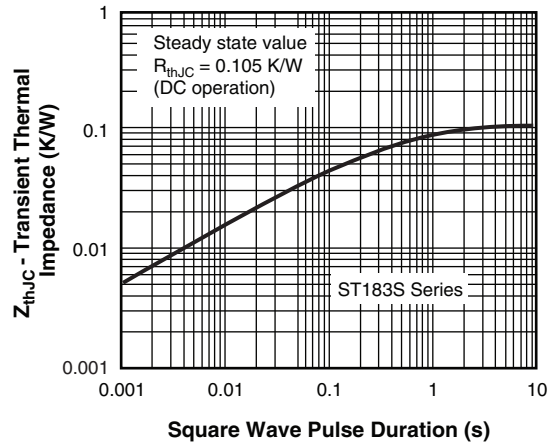


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

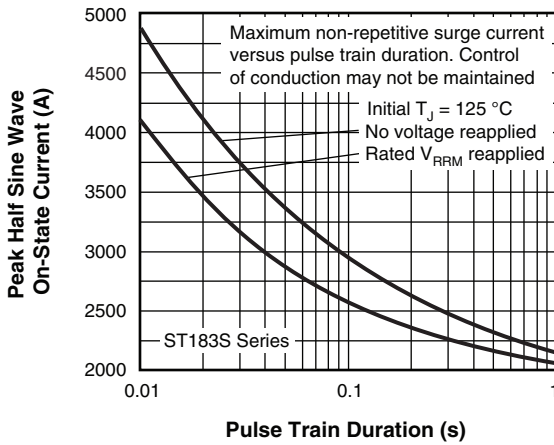


Fig. 6 - Maximum Non-Repetitive Surge Current

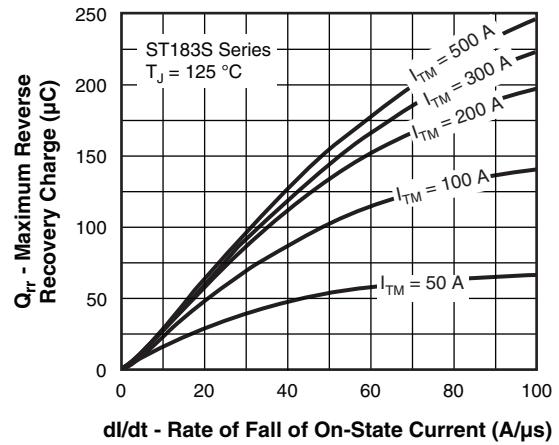


Fig. 9 - Reverse Recovered Charge Characteristics

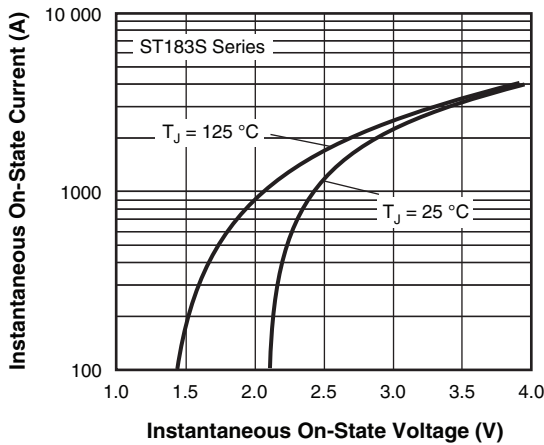


Fig. 7 - On-State Voltage Drop Characteristics

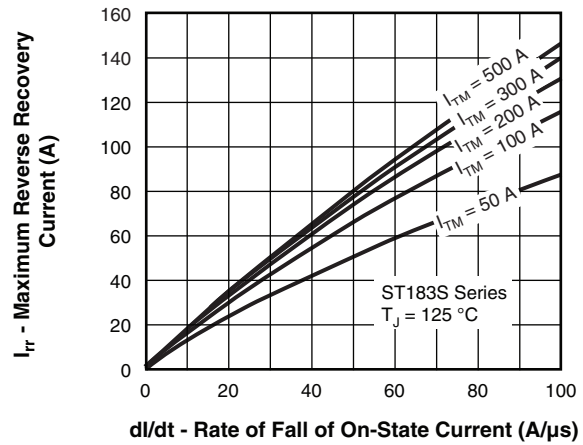


Fig. 10 - Reverse Recovery Current Characteristics



Fig. 11 - Frequency Characteristics

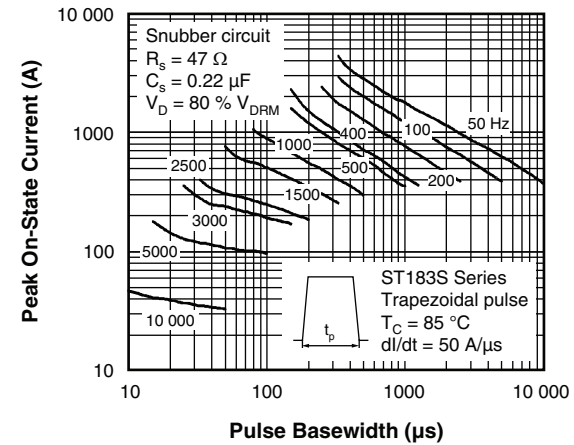


Fig. 12 - Frequency Characteristics



Fig. 13 - Frequency Characteristics



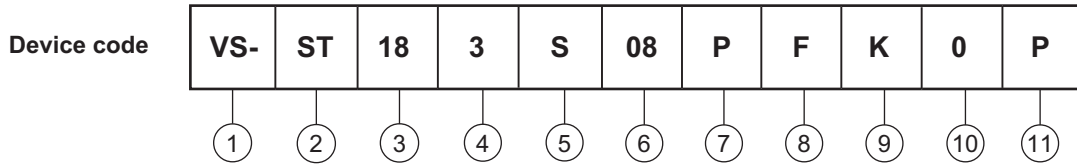
Fig. 14 - Maximum On-State Energy Power Loss Characteristics



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

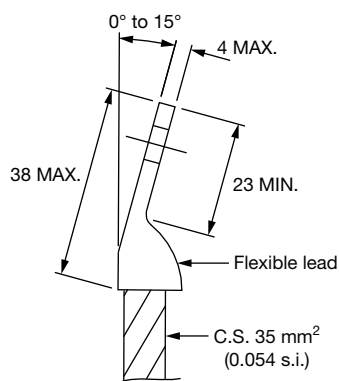
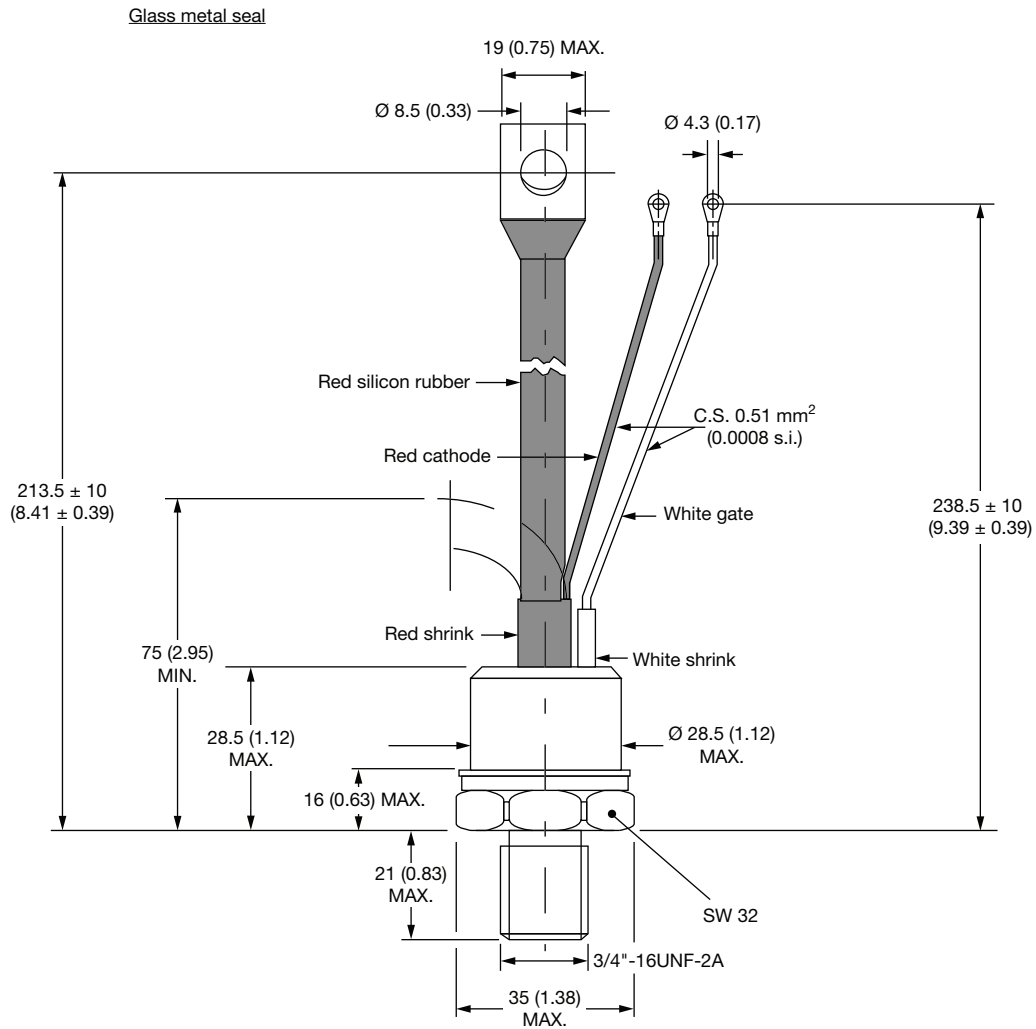
| dV/dt - t_q combinations available | | |
|--------------------------------------|--------------------|-----|
| | dV/dt (V/ μ s) | 200 |
| t_q (μ s) | 15 | FL |
| | 20 | FK |

Note: For metric device M16 x 1.5 contact factory

| LINKS TO RELATED DOCUMENTS | |
|----------------------------|--|
| Dimensions | www.vishay.com/doc?95077 |

TO-209AB (TO-93)

DIMENSIONS in millimeters (inches)





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- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



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