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***DISCRETE POWER DIODES and THYRISTORS***  
***DATA BOOK***

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### PHASE CONTROL THYRISTORS

Stud Version

#### Features

- Center amplifying gate
- Hermetic metal case with ceramic insulator  
(Also available with glass-metal seal up to 1200V)
- International standard case TO-209AB (TO-93)
- Threaded studs UNF 3/4 - 16UNF2A or ISO M16x1.5
- Compression Bonded Encapsulation for heavy duty operations such as severe thermal cycling

200A

#### Typical Applications

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

#### Major Ratings and Characteristics

| Parameters        | ST180S      | Units             |
|-------------------|-------------|-------------------|
| $I_{T(AV)}$       | 200         | A                 |
| @ $T_C$           | 85          | °C                |
| $I_{T(RMS)}$      | 314         | A                 |
| $I_{TSM}$ @ 50Hz  | 5000        | A                 |
| @ 60Hz            | 5230        | A                 |
| $I^2t$ @ 50Hz     | 125         | KA <sup>2</sup> s |
| @ 60Hz            | 114         | KA <sup>2</sup> s |
| $V_{DRM}/V_{RRM}$ | 400 to 2000 | V                 |
| $t_q$ typical     | 100         | μs                |
| $T_J$             | - 40 to 125 | °C                |



case style  
TO-209AB (TO-93)

## ST180S Series

### ELECTRICAL SPECIFICATIONS

#### Voltage Ratings

| Type number | Voltage Code | $V_{DRM}/V_{RRM}$ , max. repetitive peak and off-state voltage<br>V | $V_{RSM}$ , maximum non-repetitive peak voltage<br>V | $I_{DRM}/I_{RRM}$ max.<br>@ $T_J = T_J$ max<br>mA |
|-------------|--------------|---|--|---|
| ST180S      | 04           | 400   | 500  | 30  |
|             | 08           | 800   | 900  |   |
|             | 12           | 1200  | 1300   |   |
|             | 16           | 1600  | 1700   |   |
|             | 18           | 1800  | 1900   |   |
|             | 20           | 2000  | 2100   |   |

#### On-state Conduction

| Parameter   | ST180S     | Units              | Conditions   |
|---|------------|--------------------|--|
| $I_{T(AV)}$ Max. average on-state current<br>@ Case temperature | 200        | A                  | 180° conduction, half sine wave                                  |
|   | 85         | °C                 |  |
| $I_{T(RMS)}$ Max. RMS on-state current                          | 314        | A                  | DC @ 76°C case temperature                                       |
| $I_{TSM}$ Max. peak, one-cycle<br>non-repetitive surge current  | 5000       | A                  | t = 10ms No voltage  |
|   | 5230       |                    | t = 8.3ms reapplied  |
|   | 4200       |                    | t = 10ms 100% $V_{RRM}$  |
|   | 4400       |                    | t = 8.3ms reapplied  |
| $I^2t$ Maximum $I^2t$ for fusing                                | 125        | KA <sup>2</sup> s  | t = 10ms No voltage  |
|   | 114        |                    | t = 8.3ms reapplied  |
|   | 88         |                    | t = 10ms 100% $V_{RRM}$  |
|   | 81         |                    | t = 8.3ms reapplied  |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing                  | 1250       | KA <sup>2</sup> √s | t = 0.1 to 10ms, no voltage reapplied                            |
| $V_{T(TO)1}$ Low level value of threshold<br>voltage            | 1.08       | V                  | (16.7% × π × $I_{T(AV)} < I < π × I_{T(AV)}$ ), $T_J = T_J$ max. |
| $V_{T(TO)2}$ High level value of threshold<br>voltage           | 1.14       |                    | ( $I > π × I_{T(AV)}$ ), $T_J = T_J$ max.                        |
| $r_{t1}$ Low level value of on-state<br>slope resistance        | 1.18       | mΩ                 | (16.7% × π × $I_{T(AV)} < I < π × I_{T(AV)}$ ), $T_J = T_J$ max. |
| $r_{t2}$ High level value of on-state<br>slope resistance       | 1.14       |                    | ( $I > π × I_{T(AV)}$ ), $T_J = T_J$ max.                        |
| $V_{TM}$ Max. on-state voltage                                  | 1.75       | V                  | $I_{pk} = 570A$ , $T_J = 125°C$ , $t_p = 10ms$ sine pulse        |
| $I_H$ Maximum holding current                                   | 600        | mA                 | $T_J = T_J$ max, anode supply 12V resistive load                 |
| $I_L$ Max. (typical) latching current                           | 1000 (300) |                    |  |

#### Switching

| Parameter  | ST180S | Units | Conditions   |
|--|--------|-------|--|
| di/dt Max. non-repetitive rate of rise<br>of turned-on current | 1000   | A/μs  | Gate drive 20V, 20Ω, $t_r \leq 1\mu s$<br>$T_J = T_J$ max, anode voltage $\leq 80\% V_{DRM}$                                 |
| $t_d$ Typical delay time                                       | 1.0    | μs    | Gate current 1A, $di_g/dt = 1A/\mu s$<br>$V_d = 0.67\% V_{DRM}$ , $T_J = 25°C$   |
| $t_q$ Typical turn-off time                                    | 100    |       | $I_{TM} = 300A$ , $T_J = T_J$ max, $di/dt = 20A/\mu s$ , $V_R = 50V$<br>$dv/dt = 20V/\mu s$ , Gate 0V 100Ω, $t_p = 500\mu s$ |



Fig. 1 - Current Ratings Characteristics

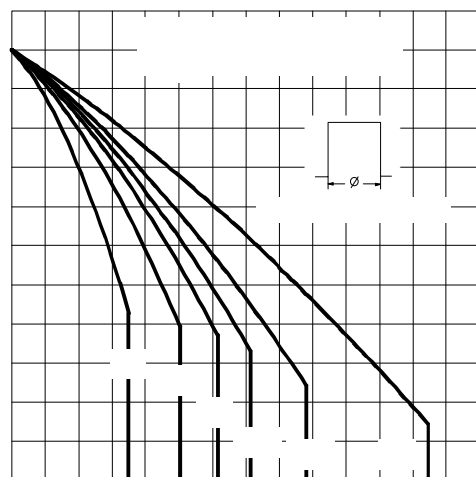


Fig. 2 - Current Ratings Characteristics



Fig. 3 - On-state Power Loss Characteristics





Fig. 5 - Maximum Non-Repetitive Surge Current

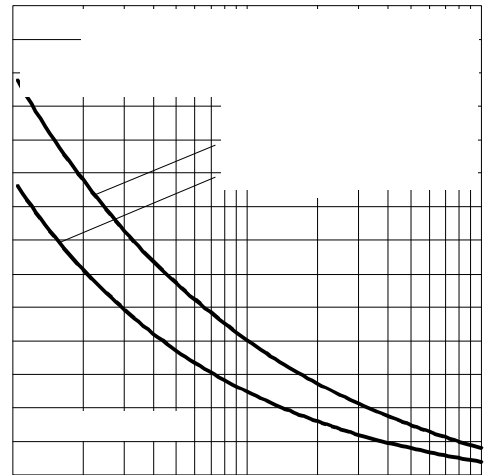


Fig. 6 - Maximum Non-Repetitive Surge Current



Fig. 7 - On-state Voltage Drop Characteristics



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



Fig. 9 - Gate Characteristics

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## Blocking

| Parameter  | ST180S | Units      | Conditions  |
|--|--------|------------|---|
| $\frac{dv}{dt}$ Maximum critical rate of rise of off-state voltage                   | 500    | V/ $\mu$ s | $T_J = T_J \text{ max}$ linear to 80% rated $V_{\text{DRM}}$            |
| $I_{\text{DRM}}$<br>$I_{\text{RRM}}$ Max. peak reverse and off-state leakage current | 30     | mA         | $T_J = T_J \text{ max}$ , rated $V_{\text{DRM}}/V_{\text{RRM}}$ applied |

## Triggering

| Parameter   | ST180S | Units | Conditions  |
|---|--------|-------|---|
| $P_{\text{GM}}$ Maximum peak gate power             | 10     | W     | $T_J = T_J \text{ max}$ , $t_p \leq 5\text{ms}$   |
| $P_{\text{G(AV)}}$ Maximum average gate power       | 2.0    |       | $T_J = T_J \text{ max}$ , $f = 50\text{Hz}$ , $d\% = 50$  |
| $I_{\text{GM}}$ Max. peak positive gate current     | 3.0    | A     | $T_J = T_J \text{ max}$ , $t_p \leq 5\text{ms}$   |
| $+V_{\text{GM}}$ Maximum peak positive gate voltage | 20     | V     | $T_J = T_J \text{ max}$ , $t_p \leq 5\text{ms}$   |
| $-V_{\text{GM}}$ Maximum peak negative gate voltage | 5.0    |       |   |
| $I_{\text{GT}}$ DC gate current required to trigger | TYP.   | MAX.  | $T_J = -40^\circ\text{C}$<br>$T_J = 25^\circ\text{C}$<br>$T_J = 125^\circ\text{C}$  |
|   | 180    | -     |   |
|   | 90     | 150   |   |
| $V_{\text{GT}}$ DC gate voltage required to trigger | 2.9    | -     | $T_J = -40^\circ\text{C}$<br>$T_J = 25^\circ\text{C}$<br>$T_J = 125^\circ\text{C}$  |
|   | 1.8    | 3.0   |   |
|   | 1.2    | -     |   |
| $I_{\text{GD}}$ DC gate current not to trigger      | 10     | mA    | $T_J = T_J \text{ max}$<br>Max. gate current/ voltage not to trigger is the max. value which will not trigger any unit with rated $V_{\text{DRM}}$ anode-to-cathode applied |
| $V_{\text{GD}}$ DC gate voltage not to trigger      | 0.25   | V     |   |

## Thermal and Mechanical Specification

| Parameter   | ST180S             | Units            | Conditions                                 |
|---|--------------------|------------------|--|
| $T_J$ Max. operating temperature range                      | -40 to 125         | $^\circ\text{C}$ |  |
| $T_{\text{stg}}$ Max. storage temperature range             | -40 to 150         |                  |  |
| $R_{\text{thJC}}$ Max. thermal resistance, junction to case | 0.105              | K/W              | DC operation                               |
| $R_{\text{thCS}}$ Max. thermal resistance, case to heatsink | 0.04               |                  | Mounting surface, smooth, flat and greased |
| T Mounting torque, $\pm 10\%$                               | 31                 | Nm<br>(lbf-in)   | Non lubricated threads                     |
|   | (275)              |                  |  |
|   | 24.5               |                  | Lubricated threads                         |
| wt Approximate weight                                       | 280                | g                |  |
| Case style  | TO - 209AB (TO-93) |                  | See Outline Table                          |

## ST180S Series

### $\Delta R_{thJC}$ Conduction

(The following table shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC)

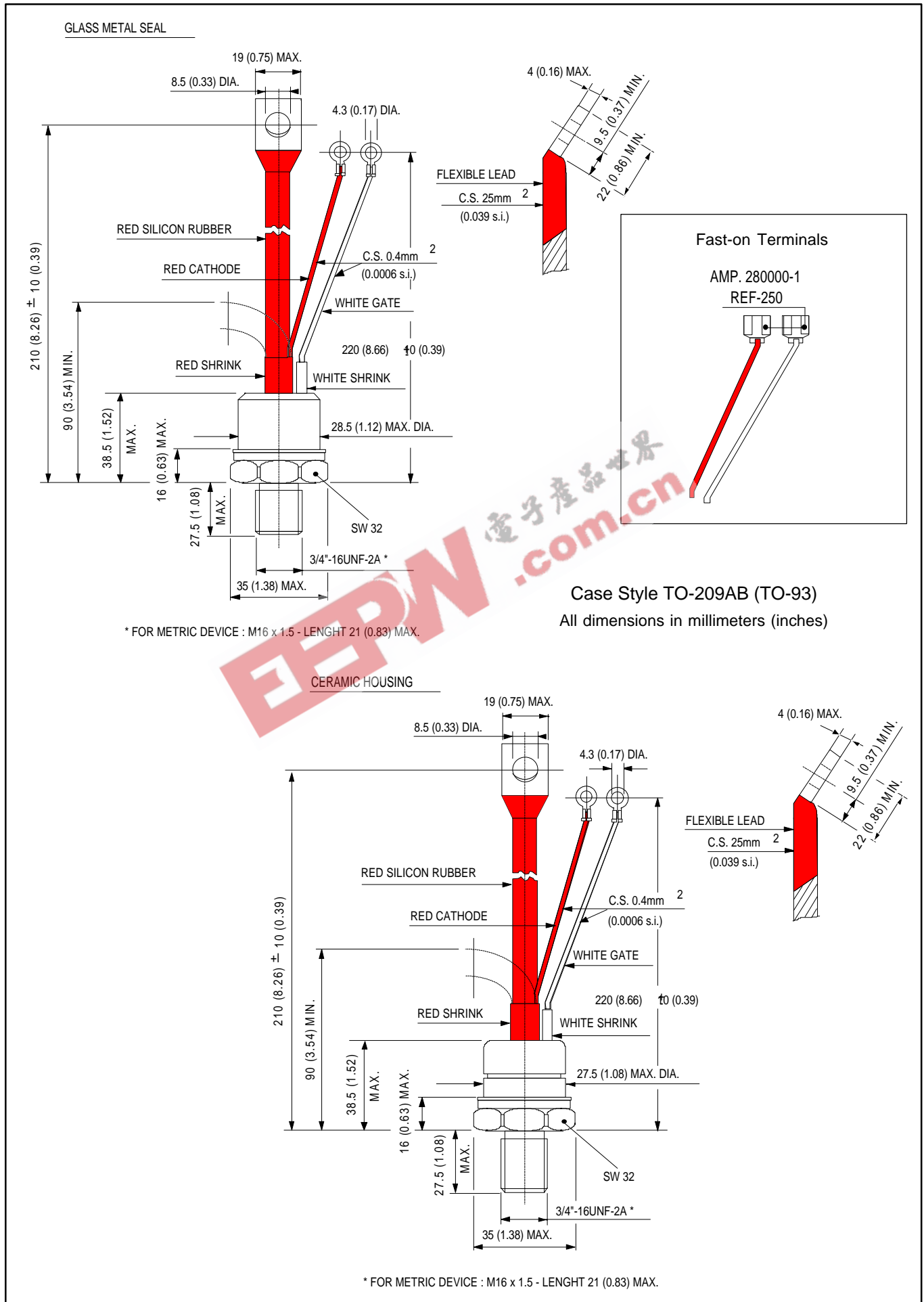
| Conduction angle | Sinusoidal conduction | Rectangular conduction | Units | Conditions                 |
|------------------|-----------------------|------------------------|-------|----------------------------|
| 180°             | 0.015                 | 0.012                  | K/W   | $T_J = T_{J \text{ max.}}$ |
| 120°             | 0.019                 | 0.020                  |       |                            |
| 90°              | 0.025                 | 0.027                  |       |                            |
| 60°              | 0.036                 | 0.037                  |       |                            |
| 30°              | 0.060                 | 0.060                  |       |                            |

### Ordering Information Table

| Device Code |  |
|-------------|--|
|             |  |
| <b>1</b>    | - Thyristor  |
| <b>2</b>    | - Essential part number  |
| <b>3</b>    | - 0 = Converter grade  |
| <b>4</b>    | - S = Compression bonding Stud   |
| <b>5</b>    | - Voltage code: Code x 100 = $V_{RRM}$ (See Voltage Rating Table)  |
| <b>6</b>    | - P = Stud base 16UNF threads<br>M = Stud base metric threads (M16 x 1.5)  |
| <b>7</b>    | - 0 = Eyelet terminals (Gate and Auxiliary Cathode Leads)<br>1 = Fast - on terminals (Gate and Auxiliary Cathode Leads)<br>2 = Flag terminals (For Cathode and Gate Terminals) |
| <b>8</b>    | - V = Glass-metal seal (only up to 1200V)<br>None = Ceramic housing (over 1200V)   |
| <b>9</b>    | - Critical dv/dt: None = 500V/ $\mu$ sec (Standard value)<br>L = 1000V/ $\mu$ sec (Special selection)  |



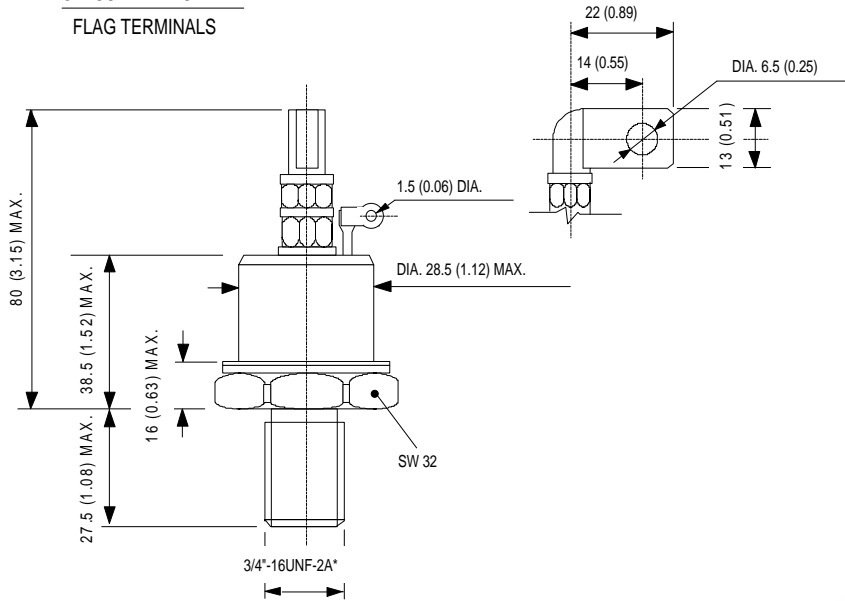
Outline Table



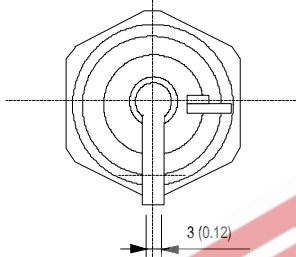
# ST180S Series

## Outline Table

### GLASS-METAL SEAL FLAG TERMINALS

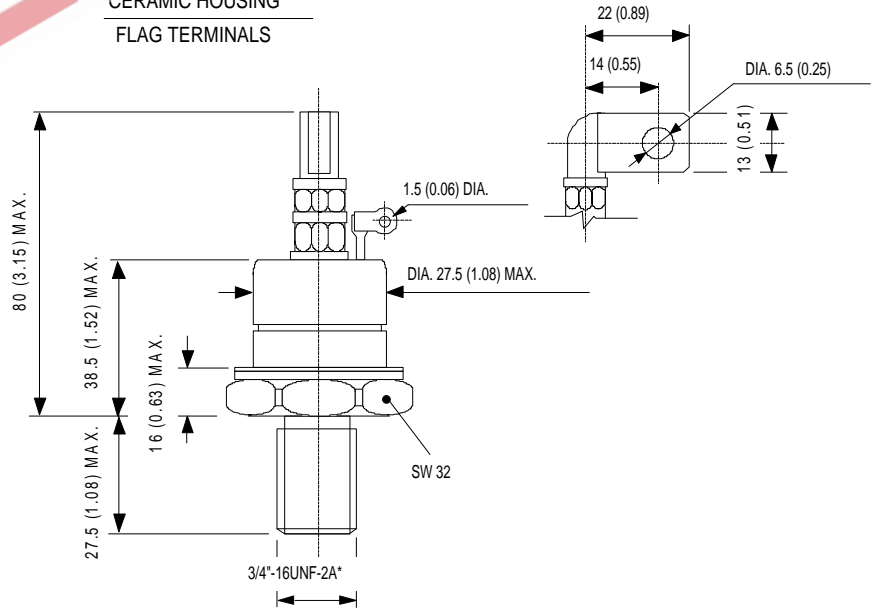


\*FOR METRIC DEVICE. M16 X 1.5 - LENGHT 21 (0.83) MAX.



Case Style TO-209AB (TO-93) Flag  
All dimensions in millimeters (inches)

### CERAMIC HOUSING FLAG TERMINALS



\*FOR METRIC DEVICE. M16 X 1.5 - LENGHT 21 (0.83) MAX.

