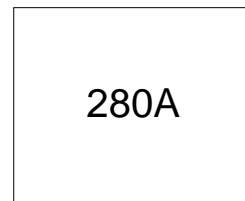


**Features**

- Center amplifying gate
- Hermetic metal case with glass-metal seal insulator
- International standard case TO-209AB (TO-93)
- Compression Bonded Encapsulation for heavy duty operations such as severe thermal cycling

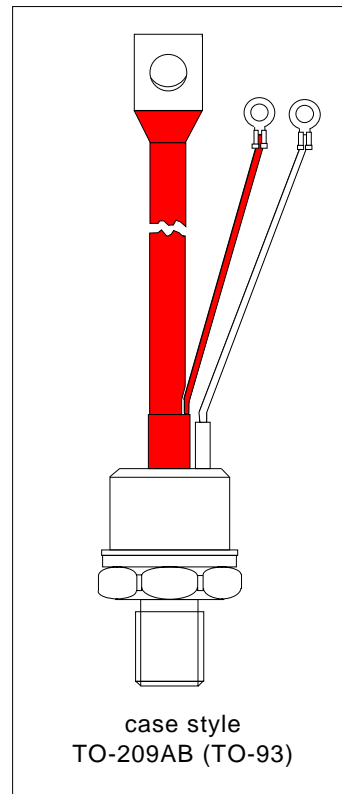


**Typical Applications**

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

**Major Ratings and Characteristics**

| Parameters        | ST280S      | Units             |
|-------------------|-------------|-------------------|
| $I_{T(AV)}$       | 280         | A                 |
| @ $T_C$           | 85          | °C                |
| $I_{T(RMS)}$      | 440         | A                 |
| $I_{TSM}$ @ 50Hz  | 7850        | A                 |
| @ 60Hz            | 8220        | A                 |
| $I^2t$ @ 50Hz     | 308         | KA <sup>2</sup> s |
| @ 60Hz            | 281         | KA <sup>2</sup> s |
| $V_{DRM}/V_{RRM}$ | 400 to 600  | V                 |
| $t_q$ typical     | 100         | μs                |
| $T_J$             | - 40 to 125 | °C                |



## ST280S Series

Bulletin I25161 rev. C 03/03

International  
IRF Rectifier

### 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. @ $T_J = T_J$ max<br>mA |
|-------------|--------------|---|--|--|
| ST280S      | 04           | 400   | 500  | 30   |
|             | 06           | 600   | 700  |  |

#### On-state Conduction

| Parameter  | ST280S     | Units              | Conditions   |
|--|------------|--------------------|--|
| $I_{T(AV)}$ Max. average on-state current @ Case temperature | 280        | A                  | 180° conduction, half sine wave  |
|  | 85         | °C                 |  |
| $I_{T(RMS)}$ Max. RMS on-state current                       | 440        | A                  | DC @ 75°C case temperature   |
| $I_{TSM}$ Max. peak, one-cycle non-repetitive surge current  | 7850       | A                  | t = 10ms No voltage reappplied   |
|  | 8220       |                    | t = 8.3ms reappplied   |
|  | 6600       |                    | t = 10ms 100% $V_{RRM}$ reappplied   |
|  | 6900       |                    | t = 8.3ms reappplied   |
| $I^2t$ Maximum $I^2t$ for fusing                             | 310        | KA <sup>2</sup> s  | t = 10ms No voltage reappplied   |
|  | 220        |                    | t = 8.3ms reappplied   |
|  | 218        |                    | t = 10ms 100% $V_{RRM}$ reappplied   |
|  | 200        |                    | t = 8.3ms reappplied   |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing               | 3100       | KA <sup>2</sup> √s | t = 0.1 to 10ms, no voltage reappplied   |
| $V_{T(TO)1}$ Low level value of threshold voltage            | 0.84       | V                  | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ max. |
| $V_{T(TO)2}$ High level value of threshold voltage           | 0.88       |                    | $(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.                                      |
| $r_{t1}$ Low level value of on-state slope resistance        | 0.50       | mΩ                 | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ max. |
| $r_{t2}$ High level value of on-state slope resistance       | 0.47       |                    | $(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.                                      |
| $V_{TM}$ Max. on-state voltage                               | 1.28       | V                  | $I_{pk} = 880A$ , $T_J = T_J$ max, $t_p = 10ms$ sine pulse                           |
| $I_H$ Maximum holding current                                | 600        | mA                 | $T_J = 25^\circ C$ , anode supply 12V resistive load                                 |
| $I_L$ Max. (typical) latching current                        | 1000 (300) |                    |  |

#### Switching

| Parameter   | ST280S | Units | Conditions   |
|---|--------|-------|--|
| $di/dt$ Max. non-repetitive rate of rise 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>$V_d = 0.67\% V_{DRM}$ , $T_J = 25^\circ C$   |
| $t_q$ 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, $t_p = 500\mu s$ |

Blocking

| Parameter   | ST280S | Units      | Conditions                                       |
|---|--------|------------|--|
| dv/dt<br>Maximum critical rate of rise of off-state voltage               | 500    | V/ $\mu$ s | $T_J = T_J$ max linear to 80% rated $V_{DRM}$    |
| $I_{DRM}$<br>$I_{RRM}$<br>Max. peak reverse and off-state leakage current | 30     | mA         | $T_J = T_J$ max, rated $V_{DRM}/V_{RRM}$ applied |

Triggering

| Parameter                                       | ST280S | Units | Conditions  |
|---|--------|-------|---|
| $P_{GM}$<br>Maximum peak gate power             | 10.0   | W     | $T_J = T_J$ max, $t_p \leq 5$ ms  |
| $P_{G(AV)}$<br>Maximum average gate power       | 2.0    |       |   |
| $I_{GM}$<br>Max. peak positive gate current     | 3.0    | A     | $T_J = T_J$ max, $t_p \leq 5$ ms  |
| $+V_{GM}$<br>Maximum peak positive gate voltage | 20     | V     | $T_J = T_J$ max, $t_p \leq 5$ ms  |
| $-V_{GM}$<br>Maximum peak negative gate voltage | 5.0    |       |   |
| $I_{GT}$<br>DC gate current required to trigger | TYP.   | MAX.  | $T_J = -40^\circ\text{C}$<br>$T_J = 25^\circ\text{C}$<br>$T_J = 125^\circ\text{C}$<br>Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied |
|   | 180    | -     |   |
|   | 90     | 150   |   |
| $V_{GT}$<br>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    | -     |   |
| $I_{GD}$<br>DC gate current not to trigger      | 10     | mA    | $T_J = T_J$ max<br>Max. gate current/ voltage not to trigger is the max. value which will not trigger any unit with rated $V_{DRM}$ anode-to-cathode applied  |
| $V_{GD}$<br>DC gate voltage not to trigger      | 0.25   | V     |   |

Thermal and Mechanical Specification

| Parameter   | ST280S           | Units            | Conditions                                 |
|---|------------------|------------------|--|
| $T_J$<br>Max. operating temperature range               | -40 to 125       | $^\circ\text{C}$ |  |
| $T_{stg}$<br>Max. storage temperature range             | -40 to 150       |                  |  |
| $R_{thJC}$<br>Max. thermal resistance, junction to case | 0.105            | K/W              | DC operation                               |
| $R_{thCS}$<br>Max. thermal resistance, case to heatsink | 0.04             |                  | Mounting surface, smooth, flat and greased |
| T<br>Mounting torque, $\pm 10\%$                        | 31               | Nm<br>(lbf-in)   | Non lubricated threads                     |
|   | (275)            |                  | Lubricated threads                         |
|   | 24.5<br>(210)    |                  |  |
| wt<br>Approximate weight                                | 280              | g                |  |
| Case style  | TO-209AB (TO-93) |                  | See Outline Table                          |

## ST280S Series

Bulletin I25161 rev. C 03/03

International  
**IR** Rectifier

### $\Delta R_{thJC}$ 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°             | 0.016                 | 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**

|    |    |   |   |    |   |   |   |
|----|----|---|---|----|---|---|---|
| ST | 28 | 0 | S | 06 | P | 0 | V |
| ①  | ②  | ③ | ④ | ⑤  | ⑥ | ⑦ | ⑧ |

- 1** - Thyristor
- 2** - Essential part number
- 3** - 0 = Converter grade
- 4** - S = Compression bonding Stud
- 5** - Voltage code: Code x 100 =  $V_{RRM}$  (See Voltage Rating Table)
- 6** - P = Stud base 3/4"-16UNF-2A threads
- 7** - 0 = Eyelet terminals (Gate and Auxiliary Cathode Leads)  
 1 = Fast - on terminals (Gate and Auxiliary Cathode Leads)
- 8** - V = Glass-metal seal

NOTE: For Metric Device M16 x 1.5 Contact Factory

Outline Table

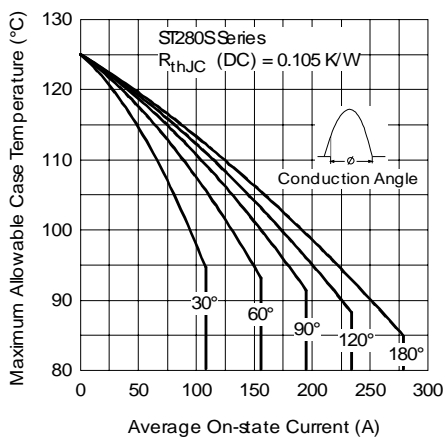
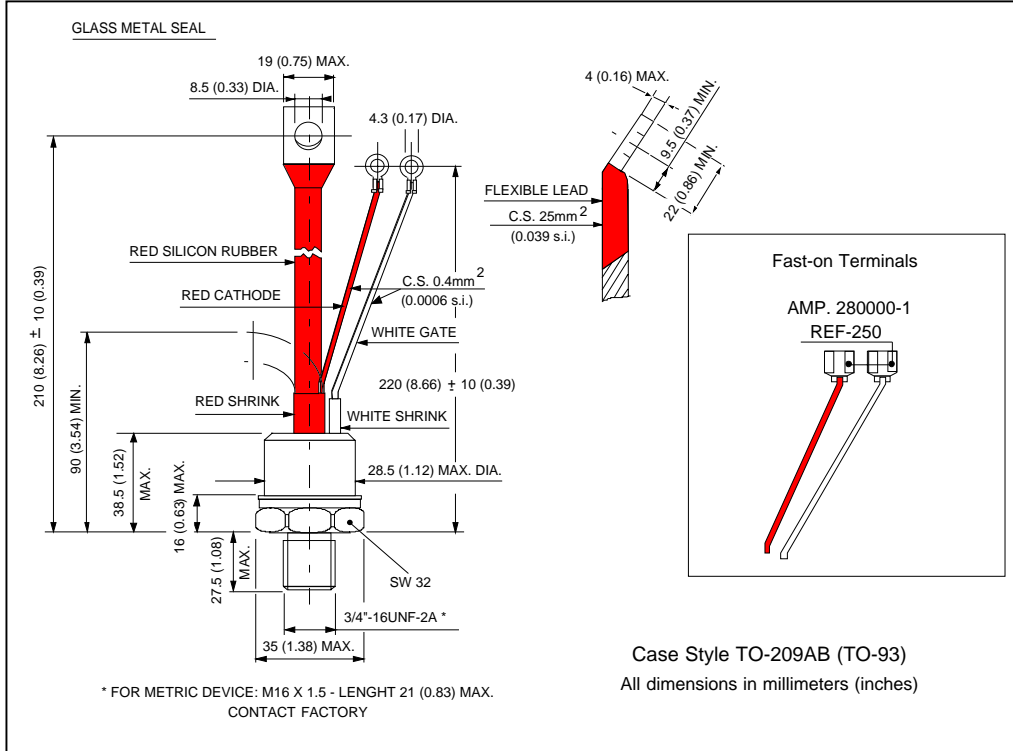


Fig. 1 - Current Ratings Characteristics

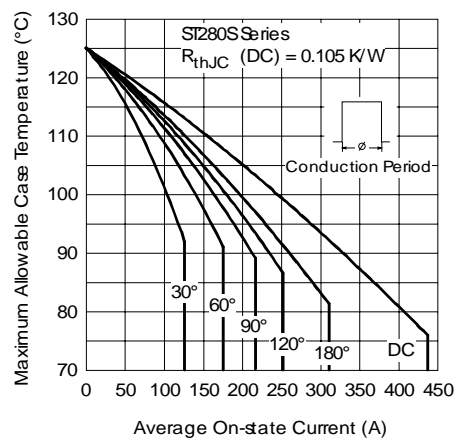


Fig. 2 - Current Ratings Characteristics

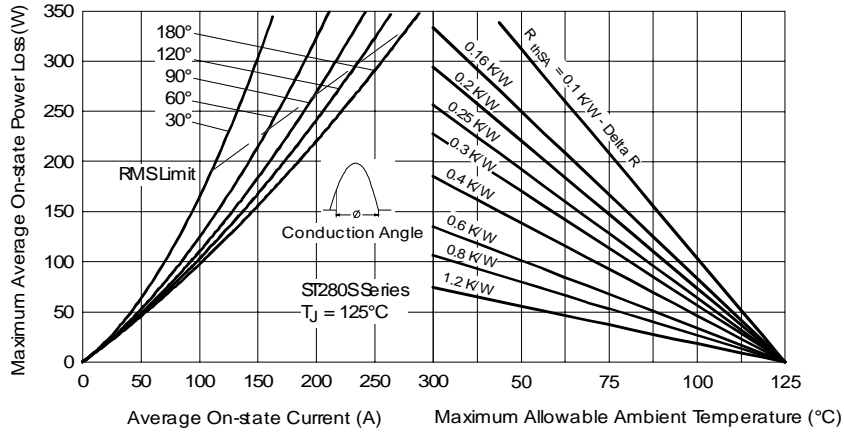


Fig. 3 - On-state Power Loss Characteristics

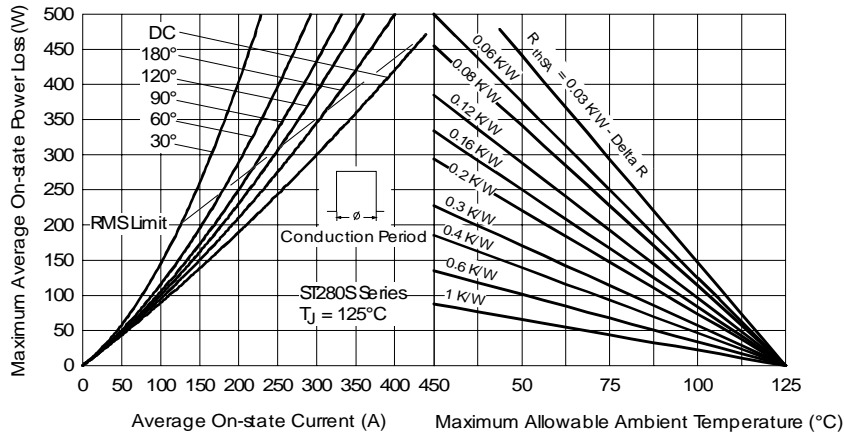


Fig. 4 - On-state Power Loss Characteristics

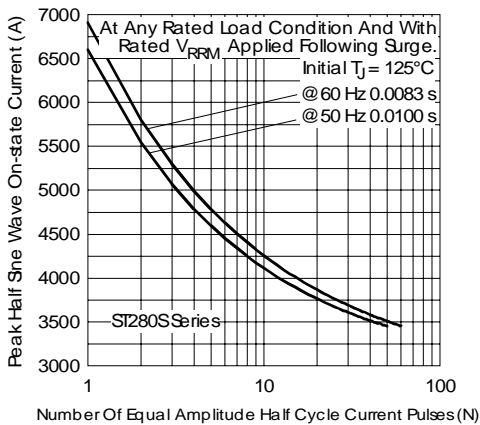


Fig. 5 - Maximum Non-Repetitive Surge Current

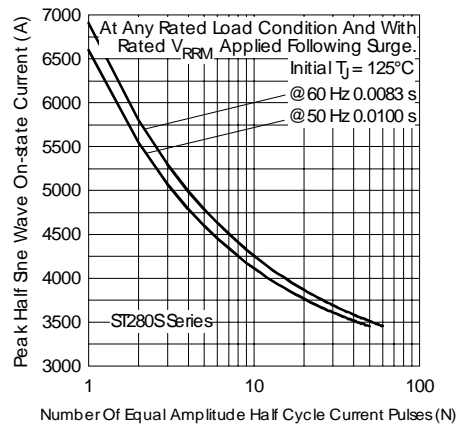


Fig. 6 - Maximum Non-Repetitive Surge Current

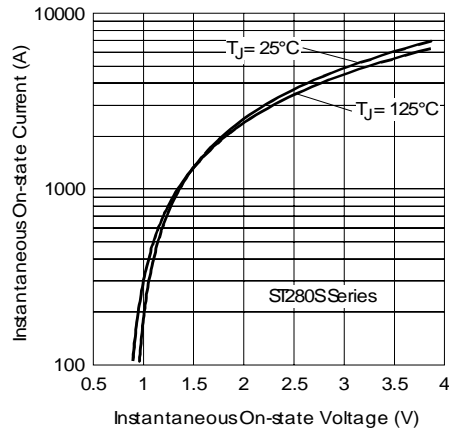


Fig. 7 - On-state Voltage Drop Characteristics

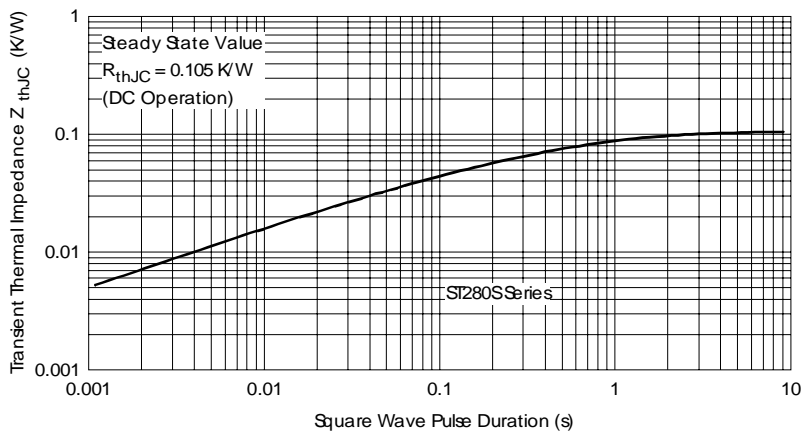


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

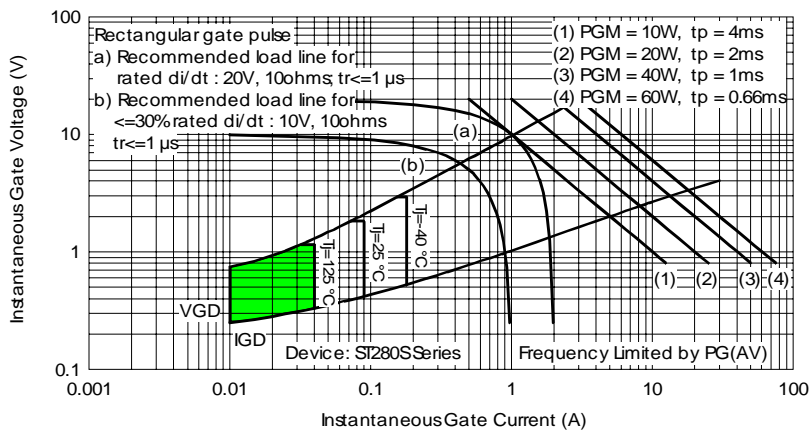


Fig. 9 - Gate Characteristics

## **ST280S Series**

Bulletin I25161 rev. C 03/03

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Data and specifications subject to change without notice.  
This product has been designed and qualified for Industrial Level.  
Qualification Standards can be found on IR's Web site.

International  
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