

### INVERTER GRADE THYRISTORS

### Stud Version

#### Features

- All diffused design
- Center amplifying gate
- Guaranteed high  $dv/dt$
- Guaranteed high  $di/dt$
- High surge current capability
- Low thermal impedance
- High speed performance

85A

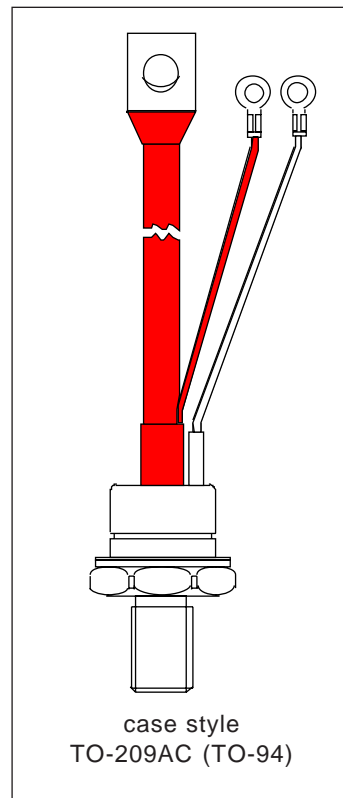
#### Typical Applications

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

#### Major Ratings and Characteristics

| Parameters        | ST083S      | Units             |
|-------------------|-------------|-------------------|
| $I_{T(AV)}$       | 85          | A                 |
| @ $T_C$           | 85          | °C                |
| $I_{T(RMS)}$      | 135         | A                 |
| $I_{TSM}$ @ 50Hz  | 2450        | A                 |
| @ 60Hz            | 2560        | A                 |
| $I^2t$ @ 50Hz     | 30          | KA <sup>2</sup> s |
| @ 60Hz            | 27          | KA <sup>2</sup> s |
| $V_{DRM}/V_{RRM}$ | 400 to 1200 | V                 |
| $t_q$ range (*)   | 10 to 30    | μs                |
| $T_J$             | - 40 to 125 | °C                |

(\*)  $t_q = 10$  to  $20\mu s$  for 400 to 800V devices  
 $t_q = 15$  to  $30\mu s$  for 1000 to 1200V devices



## ST083S Series

Bulletin I25185 rev. B 03/94

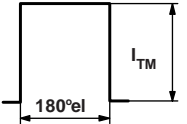
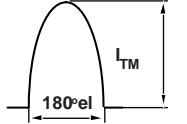
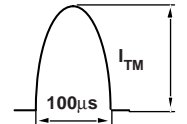
International  
**IRF** Rectifier

### ELECTRICAL SPECIFICATIONS

#### Voltage Ratings

| Type number | Voltage Code | $V_{DRM}/V_{RRM}$ , maximum repetitive peak 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 |
|-------------|--------------|--|--|--|
| ST083S      | 04           | 400  | 500  | 30   |
|             | 08           | 800  | 900  |  |
|             | 10           | 1000   | 1100   |  |
|             | 12           | 1200   | 1300   |  |

#### Current Carrying Capability

| Frequency                        |  |  |  | Units |              |      |      |
|----------------------------------|---|--|---|-------|--------------|------|------|
| 50Hz                             | 210   | 120  | 330   | 270   | 2540         | 1930 | A    |
| 400Hz                            | 200   | 120  | 350   | 210   | 1190         | 810  |      |
| 1000Hz                           | 150   | 80   | 320   | 190   | 630          | 400  |      |
| 2500Hz                           | 70  | 25   | 220   | 85    | 250          | 100  |      |
| Recovery voltage Vr              | 50  | 50   | 50  | 50    | 50           | 50   | V    |
| Voltage before turn-on Vd        | $V_{DRM}$   |  | $V_{DRM}$   |       | $V_{DRM}$    |      |      |
| Rise of on-state current di/dt   | 50  | 50   | -   | -     | -            | -    | A/µs |
| Case temperature                 | 60  | 85   | 60  | 85    | 60           | 85   | °C   |
| Equivalent values for RC circuit | 22Ω / 0.15µF  |  | 22Ω / 0.15µF  |       | 22Ω / 0.15µF |      |      |

#### On-state Conduction

| Parameter  | ST083S  | Units              | Conditions                                    |                         |                         |
|--|---|--------------------|---|-------------------------|-------------------------|
| $I_{T(AV)}$ Max. average on-state current @ Case temperature | 85  | A                  | 180° conduction, half sine wave               |                         |                         |
|  | 85  | °C                 |   |                         |                         |
| $I_{T(RMS)}$ Max. RMS on-state current                       | 135   | A                  | DC @ 77°C case temperature                    |                         |                         |
|  | $I_{TSM}$ Max. peak, one half cycle, non-repetitive surge current |                    |   | 2450                    | t = 10ms No voltage     |
|  |   |                    |   | 2560                    | t = 8.3ms reapplied     |
|  |   |                    |   | 2060                    | t = 10ms 100% $V_{RRM}$ |
| 2160   | t = 8.3ms reapplied   |                    |   |                         |                         |
| $I^2t$ Maximum $I^2t$ for fusing                             | 30  | KA <sup>2</sup> s  | Sinusoidal half wave, Initial $T_J = T_J$ max |                         |                         |
|  | 27  |                    |   | t = 10ms No voltage     |                         |
|  | 21  |                    |   | t = 8.3ms reapplied     |                         |
|  | 19  |                    |   | t = 10ms 100% $V_{RRM}$ |                         |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing               | 300   | KA <sup>2</sup> √s | t = 0.1 to 10ms, no voltage reapplied         |                         |                         |

On-state Conduction

| Parameter   | ST083S | Units      | Conditions   |
|---|--------|------------|--|
| $V_{TM}$ Max. peak on-state voltage                   | 2.15   | V          | $I_{TM} = 300A, T_J = T_J \text{ max}, t_p = 10\text{ms sine wave pulse}$                |
| $V_{T(TO)1}$ Low level value of threshold voltage     | 1.46   |            | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}, T_J = T_J \text{ max.}$ |
| $V_{T(TO)2}$ High level value of threshold voltage    | 1.52   |            | $(I > \pi \times I_{T(AV)}, T_J = T_J \text{ max.}$                                      |
| $r_{t1}$ Low level value of forward slope resistance  | 2.32   | m $\Omega$ | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}, T_J = T_J \text{ max.}$ |
| $r_{t2}$ High level value of forward slope resistance | 2.34   |            | $(I > \pi \times I_{T(AV)}, T_J = T_J \text{ max.}$                                      |
| $I_H$ Maximum holding current                         | 600    | mA         | $T_J = 25^\circ\text{C}, I_T > 30A$  |
| $I_L$ Typical latching current                        | 1000   |            | $T_J = 25^\circ\text{C}, V_A = 12V, R_a = 6\Omega, I_G = 1A$                             |

Switching

| Parameter   | ST083S           | Units            | Conditions  |
|---|------------------|------------------|---|
| $di/dt$ Max. non-repetitive rate of rise of turned-on current | 1000             | A/ $\mu\text{s}$ | $T_J = T_J \text{ max}, V_{DRM} = \text{rated } V_{DRM}$<br>$I_{TM} = 2 \times di/dt$   |
| $t_d$ Typical delay time                                      | 0.80             | $\mu\text{s}$    | $T_J = 25^\circ\text{C}, V_{DM} = \text{rated } V_{DRM}, I_{TM} = 50A \text{ DC}, t_p = 1\mu\text{s}$<br>Resistive load, Gate pulse: 10V, 5 $\Omega$ source       |
| $t_q$ Max. turn-off time (*)                                  | Min 10<br>Max 30 |                  | $T_J = T_J \text{ max}, I_{TM} = 100A, \text{commutating } di/dt = 10A/\mu\text{s}$<br>$V_R = 50V, t_p = 200\mu\text{s}, dv/dt: \text{ see table in device code}$ |

(\*)  $t_q = 10$  to  $20\mu\text{s}$  for 400 to 800V devices;  $t_q = 15$  to  $30\mu\text{s}$  for 1000 to 1200V devices.

Blocking

| Parameter  | ST083S | Units            | Conditions   |
|--|--------|------------------|--|
| $dv/dt$ Maximum critical rate of rise of off-state voltage             | 500    | V/ $\mu\text{s}$ | $T_J = T_J \text{ max.}, \text{ linear to } 80\% V_{DRM}, \text{ higher value available on request}$ |
| $I_{RRM}$<br>$I_{DRM}$ Max. peak reverse and off-state leakage current | 30     | mA               | $T_J = T_J \text{ max}, \text{ rated } V_{DRM}/V_{RRM} \text{ applied}$                              |

Triggering

| Parameter   | ST083S | Units | Conditions  |
|---|--------|-------|---|
| $P_{GM}$ Maximum peak gate power                  | 40     | W     | $T_J = T_J \text{ max}, f = 50\text{Hz}, d\% = 50$              |
| $P_{G(AV)}$ Maximum average gate power            | 5      |       |   |
| $I_{GM}$ Max. peak positive gate current          | 5      | A     | $T_J = T_J \text{ max}, t_p \leq 5\text{ms}$                    |
| $+V_{GM}$ Maximum peak positive gate voltage      | 20     | V     | $T_J = T_J \text{ max}, t_p \leq 5\text{ms}$                    |
| $-V_{GM}$ Maximum peak negative gate voltage      | 5      |       |   |
| $I_{GT}$ Max. DC gate current required to trigger | 200    | mA    | $T_J = 25^\circ\text{C}, V_A = 12V, R_a = 6\Omega$              |
| $V_{GT}$ Max. DC gate voltage required to trigger | 3      | V     |   |
| $I_{GD}$ Max. DC gate current not to trigger      | 20     | mA    | $T_J = T_J \text{ max}, \text{ rated } V_{DRM} \text{ applied}$ |
| $V_{GD}$ Max. DC gate voltage not to trigger      | 0.25   |       |   |

## ST083S Series

Bulletin I25185 rev. B 03/94

International  
**IR** Rectifier

### Thermal and Mechanical Specifications

| Parameter   | ST083S           | Units          | Conditions                                 |
|---|------------------|----------------|--|
| T <sub>J</sub> Max. junction operating temperature range    | -40 to 125       | °C             |  |
| T <sub>stg</sub> Max. storage temperature range             | -40 to 150       |                |  |
| R <sub>thJC</sub> Max. thermal resistance, junction to case | 0.195            | K/W            | DC operation                               |
| R <sub>thCS</sub> Max. thermal resistance, case to heatsink | 0.08             |                | Mounting surface, smooth, flat and greased |
| T Mounting torque, ± 10%                                    | 15.5<br>(137)    | Nm<br>(lbf-in) | Non lubricated threads                     |
|   | 14<br>(120)      | Nm<br>(lbf-in) | Lubricated threads                         |
| wt Approximate weight                                       | 130              | g              |  |
| Case style  | TO-209AC (TO-94) |                | See Outline Table                          |

### ΔR<sub>thJC</sub> Conduction

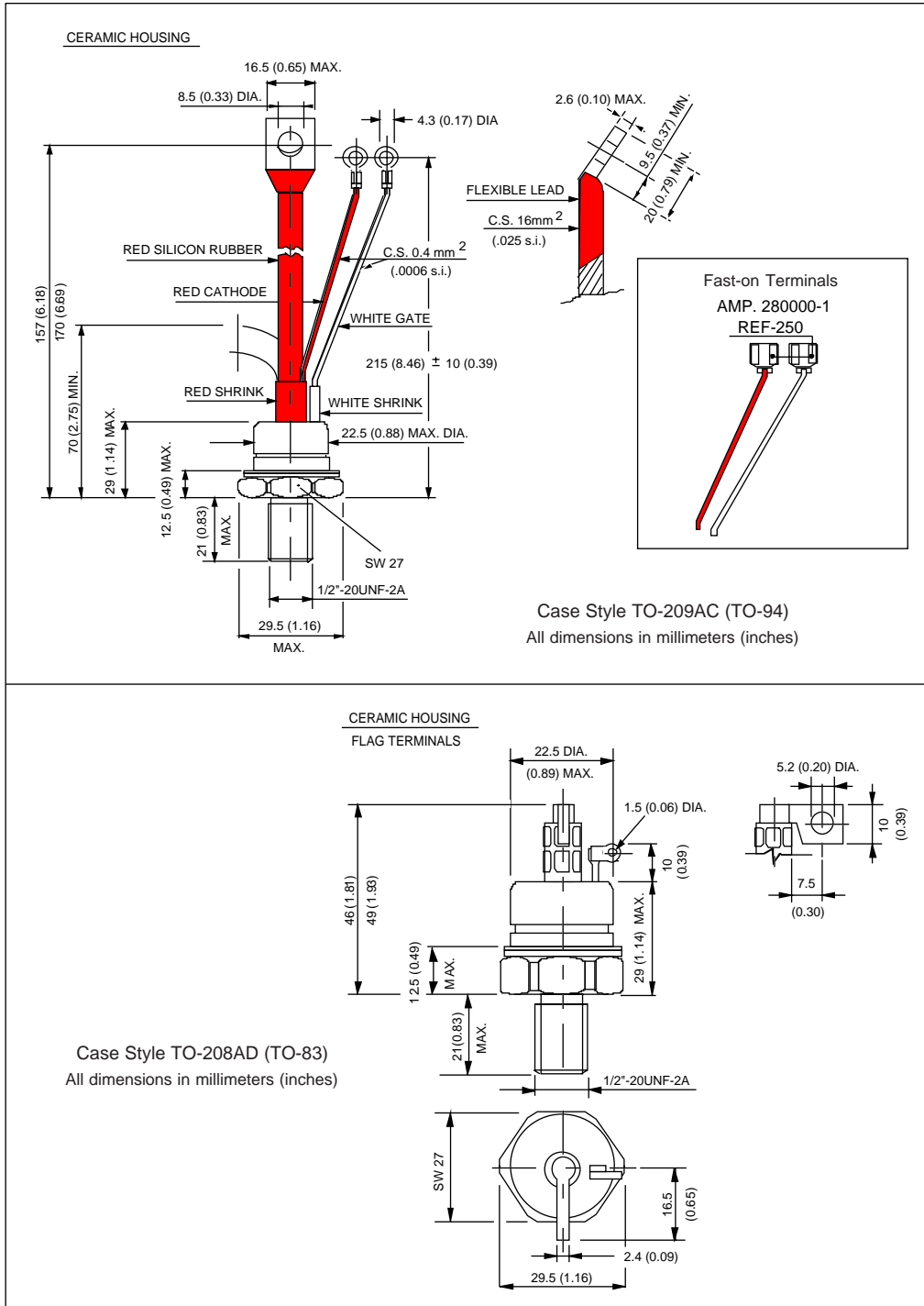
(The following table shows the increment of thermal resistance R<sub>thJC</sub> when devices operate at different conduction angles than DC)

| Conduction angle | Sinusoidal conduction | Rectangular conduction | Units | Conditions                           |
|------------------|-----------------------|------------------------|-------|--------------------------------------|
| 180°             | 0.034                 | 0.025                  | K/W   | T <sub>J</sub> = T <sub>J</sub> max. |
| 120°             | 0.041                 | 0.042                  |       |                                      |
| 90°              | 0.052                 | 0.056                  |       |                                      |
| 60°              | 0.076                 | 0.079                  |       |                                      |
| 30°              | 0.126                 | 0.127                  |       |                                      |

### Ordering Information Table

| Device Code  |   |          |          |          |             |          |          |          |           |
|--|---|----------|----------|----------|-------------|----------|----------|----------|-----------|
| <b>1</b>   | <b>2</b>  | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b>    | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> |
| 1  | 2   | 3        | 4        | 5        | 6           | 7        | 8        | 9        | 10        |
| <b>1</b>   | - Thyristor   |          |          |          |             |          |          |          |           |
| <b>2</b>   | - Essential part number   |          |          |          |             |          |          |          |           |
| <b>3</b>   | - 3 = Fast turn off   |          |          |          |             |          |          |          |           |
| <b>4</b>   | - S = Compression bonding Stud  |          |          |          |             |          |          |          |           |
| <b>5</b>   | - Voltage code: Code x 100 = V <sub>RRM</sub> (See Voltage Ratings Table) |          |          |          |             |          |          |          |           |
| <b>6</b>   | - P = Stud Base 1/2" 20UNF  |          |          |          |             |          |          |          |           |
| <b>7</b>   | - Reapplied dv/dt code (for t <sub>q</sub> Test Condition)                |          |          |          |             |          |          |          |           |
| <b>8</b>   | - t <sub>q</sub> code   |          |          |          |             |          |          |          |           |
| <b>9</b>   | - 0 = Eyelet terminals (Gate and Aux. Cathode Leads)                      |          |          |          |             |          |          |          |           |
|  | 1 = Fast-on terminals (Gate and Aux. Cathode Leads)                       |          |          |          |             |          |          |          |           |
|  | 2 = Flag terminals (For Cathode and Gate Terminals)                       |          |          |          |             |          |          |          |           |
| <b>10</b>  | - Critical dv/dt:   |          |          |          |             |          |          |          |           |
|  | None = 500V/μsec (Standard value)   |          |          |          |             |          |          |          |           |
|  | L = 1000V/μsec (Special selection)  |          |          |          |             |          |          |          |           |
| <b>dv/dt - t<sub>q</sub> combinations available</b>                  |   |          |          |          |             |          |          |          |           |
| <b>dv/dt (V/μs)</b>  |   |          |          |          |             |          |          |          |           |
| t <sub>q</sub> (μs)  | 10  | CN       | DN       | EN       | <b>FN</b> * | HN       |          |          |           |
|  | 12  | CM       | DM       | EM       | <b>FM</b> * | HM       |          |          |           |
|  | 15  | CL       | DL       | EL       | FL          | HL       |          |          |           |
|  | 18  | CP       | DP       | EP       | <b>FP</b> * | HP       |          |          |           |
|  | 20  | CK       | DK       | EK       | <b>FK</b> * | HK       |          |          |           |
| t <sub>q</sub> (μs)  | 15  | CL       | --       | --       | --          | --       |          |          |           |
|  | 18  | CP       | DP       | EP       | <b>FP</b> * | --       |          |          |           |
|  | 20  | CK       | DK       | EK       | <b>FK</b> * | HK       |          |          |           |
|  | 25  | CJ       | DJ       | EJ       | FJ          | HJ       |          |          |           |
|  | 30  | --       | DH       | EH       | FH          | HH       |          |          |           |
| *Standard part number.<br>All other types available only on request. |   |          |          |          |             |          |          |          |           |

Outline Table



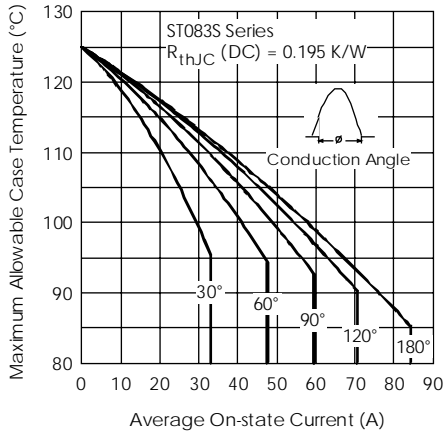


Fig. 1 - Current Ratings Characteristics

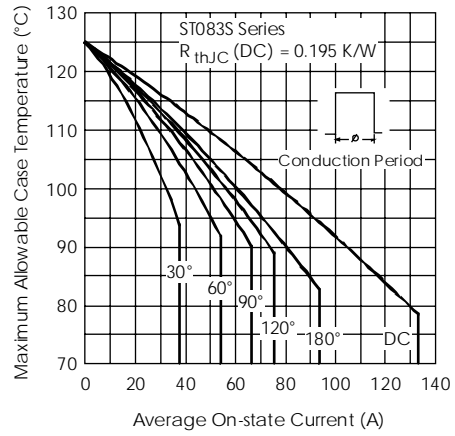


Fig. 2 - Current Ratings Characteristics

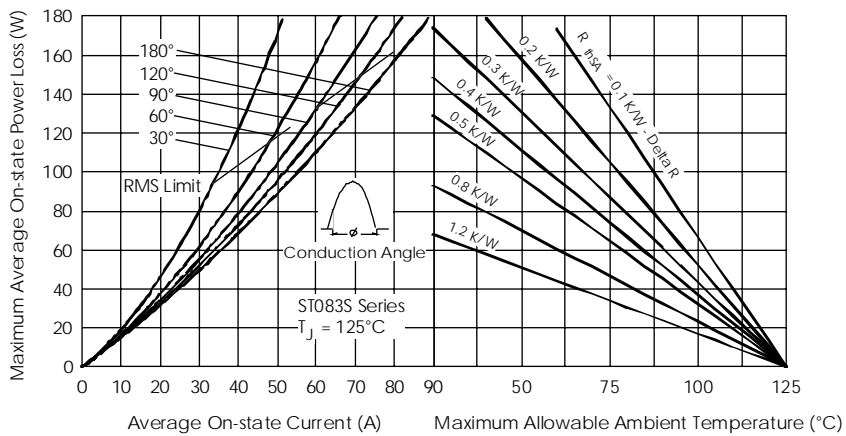


Fig. 3 - On-state Power Loss Characteristics

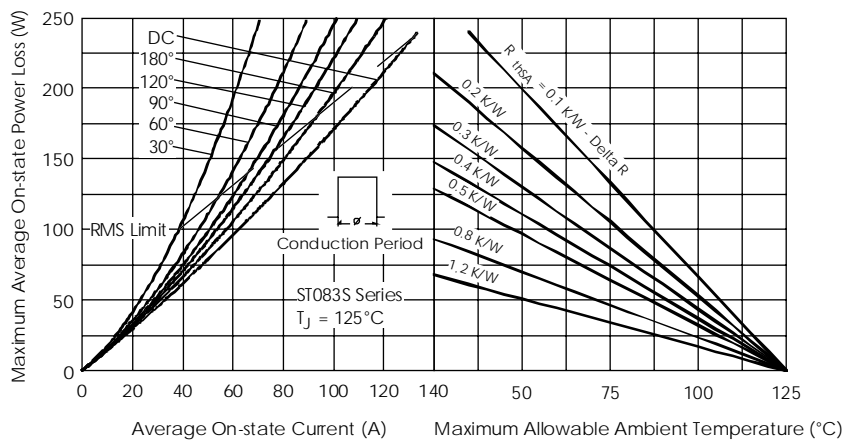


Fig. 4 - On-state Power Loss Characteristics

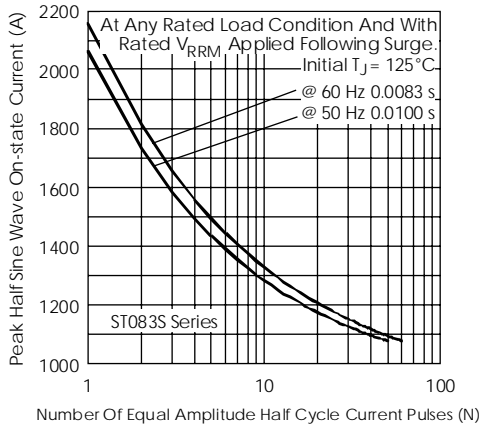


Fig. 5 - Maximum Non-repetitive Surge Current

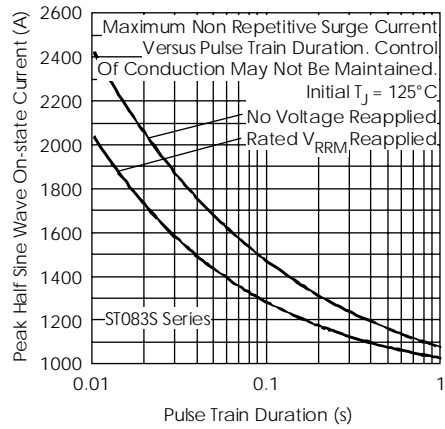


Fig. 6 - Maximum Non-repetitive Surge Current

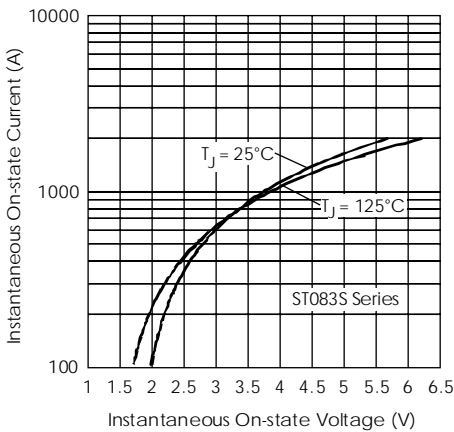


Fig. 7 - On-state Voltage Drop Characteristics

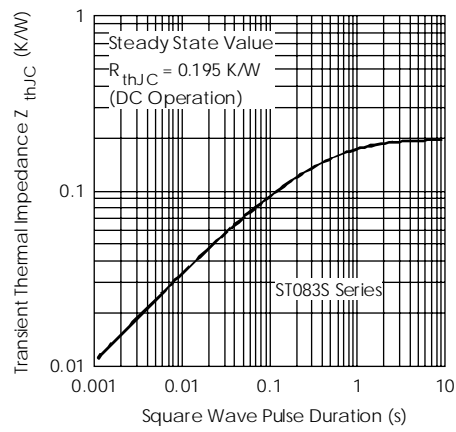


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

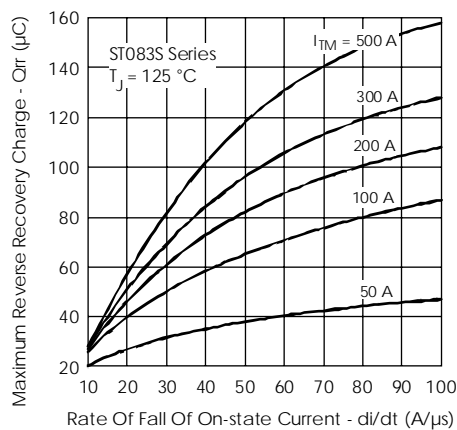


Fig. 9 - Reverse Recovered Charge Characteristics

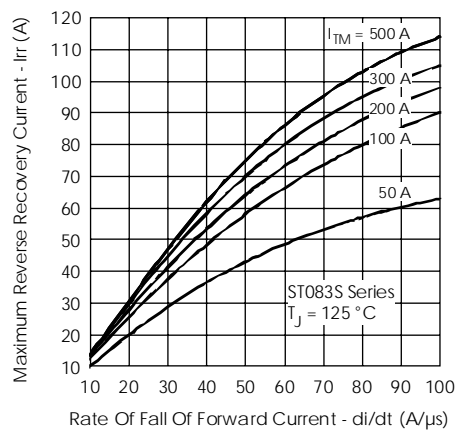


Fig. 10 - Reverse Recovery Current Characteristics

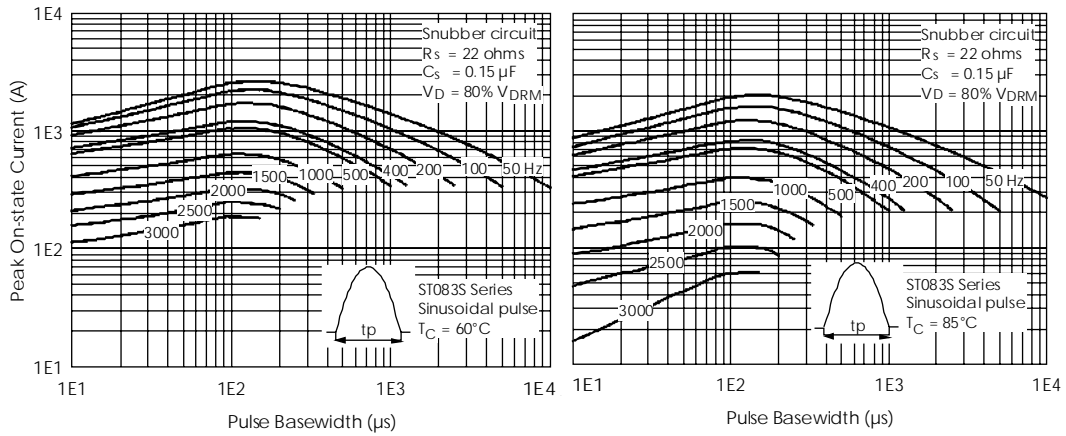


Fig. 11 - Frequency Characteristics

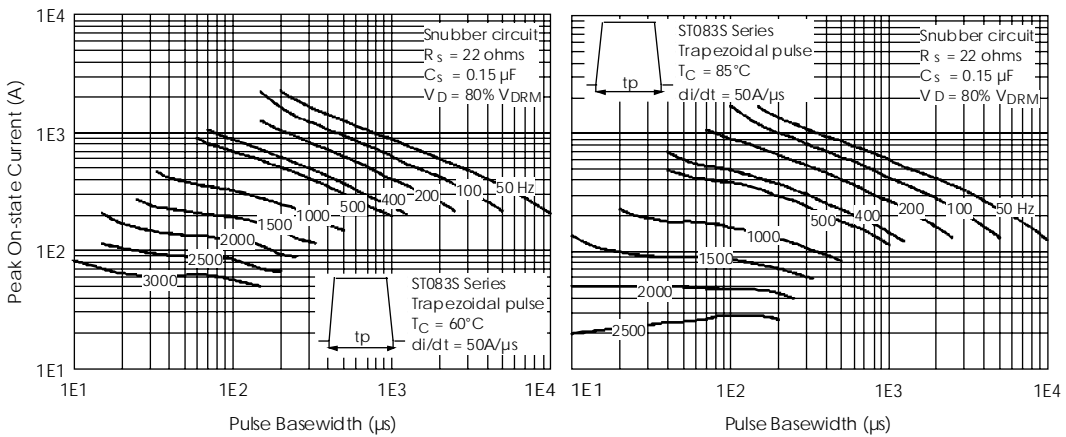


Fig. 12 - Frequency Characteristics

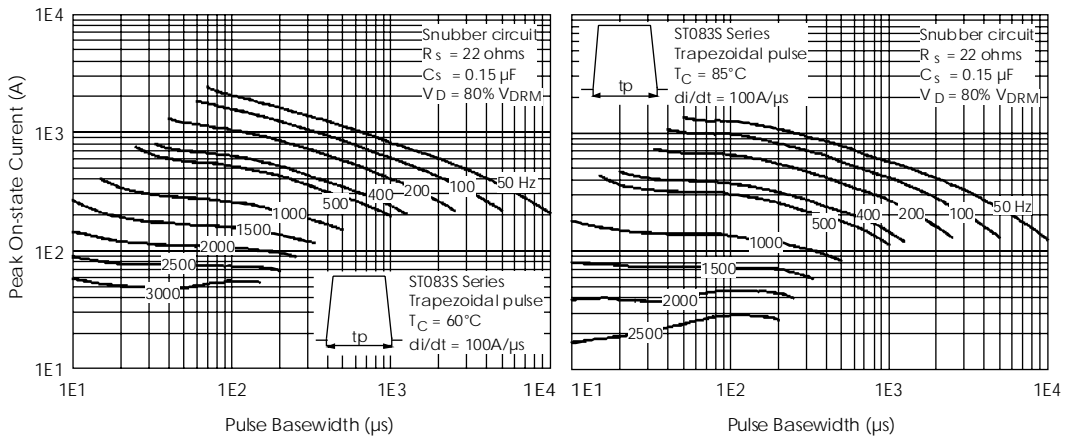


Fig. 13 - Frequency Characteristics



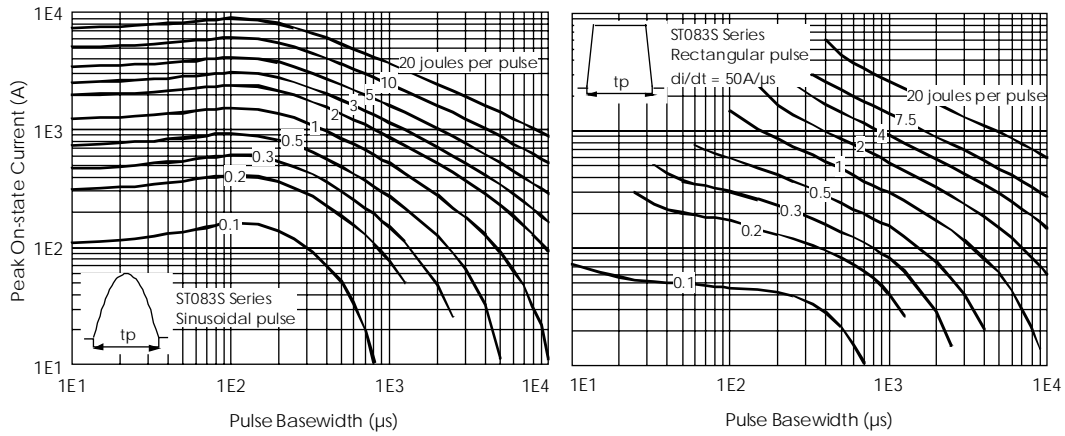


Fig. 14 - Maximum On-state Energy Power Loss Characteristics

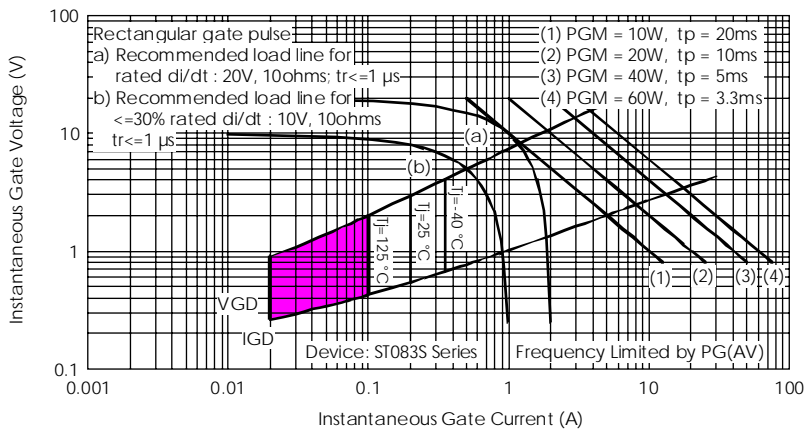


Fig. 15 - Gate Characteristics