

### PHASE CONTROL THYRISTORS

Stud Version

#### Features

- Center amplifying gate
- Hermetic metal case with ceramic insulator
- International standard case TO-209AE (TO-118)
- Threaded studs UNF 3/4 - 16UNF2A or ISO M24x1.5
- Compression Bonded Encapsulation for heavy duty operations such as severe thermal cycling

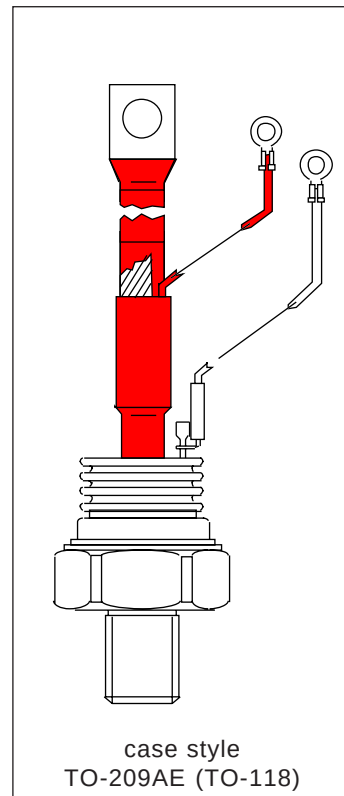
330A

#### Typical Applications

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

#### Major Ratings and Characteristics

| Parameters        | ST330S      | Units             |
|-------------------|-------------|-------------------|
| $I_{T(AV)}$       | 330         | A                 |
| @ $T_C$           | 75          | °C                |
| $I_{T(RMS)}$      | 520         | A                 |
| $I_{TSM}$ @ 50Hz  | 9000        | A                 |
| @ 60Hz            | 9420        | A                 |
| $I^2t$ @ 50Hz     | 405         | KA <sup>2</sup> s |
| @ 60Hz            | 370         | KA <sup>2</sup> s |
| $V_{DRM}/V_{RRM}$ | 400 to 1600 | V                 |
| $t_q$ typical     | 100         | μs                |
| $T_J$             | - 40 to 125 | °C                |



## ST330S Series

Bulletin I25156 rev. B 01/94

International  
IOR 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.<br>@ $T_J = T_J$ max<br>mA |
|-------------|--------------|-------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------|
| ST330S      | 04           | 400                                                               | 500                                                  | 50                                                |
|             | 08           | 800                                                               | 900                                                  |                                                   |
|             | 12           | 1200                                                              | 1300                                                 |                                                   |
|             | 14           | 1400                                                              | 1500                                                 |                                                   |
|             | 16           | 1600                                                              | 1700                                                 |                                                   |

#### On-state Conduction

| Parameter                                                       | ST330S    | Units              | Conditions                                                                        |
|-----------------------------------------------------------------|-----------|--------------------|-----------------------------------------------------------------------------------|
| $I_{T(AV)}$ Max. average on-state current<br>@ Case temperature | 330<br>75 | A<br>°C            | 180° conduction, half sine wave                                                   |
| $I_{T(RMS)}$ Max. RMS on-state current                          | 520       | A                  | DC @ 62°C case temperature                                                        |
| $I_{TSM}$ Max. peak, one-cycle<br>non-repetitive surge current  | 9000      | A                  | t = 10ms No voltage                                                               |
|                                                                 | 9420      |                    | t = 8.3ms reappplied                                                              |
|                                                                 | 7570      |                    | t = 10ms 100% $V_{RRM}$                                                           |
|                                                                 | 7920      |                    | t = 8.3ms reappplied                                                              |
| $I^2t$ Maximum $I^2t$ for fusing                                | 405       | KA <sup>2</sup> s  | t = 10ms No voltage                                                               |
|                                                                 | 370       |                    | t = 8.3ms reappplied                                                              |
|                                                                 | 287       |                    | t = 10ms 100% $V_{RRM}$                                                           |
|                                                                 | 262       |                    | t = 8.3ms reappplied                                                              |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing                  | 4050      | KA <sup>2</sup> √s | t = 0.1 to 10ms, no voltage reappplied                                            |
| $V_{T(TO)1}$ Low level value of threshold<br>voltage            | 0.91      | 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<br>voltage           | 0.92      |                    | $(I > \pi \times I_{T(AV)}), T_J = T_J$ max.                                      |
| $r_{t1}$ Low level value of on-state<br>slope resistance        | 0.58      | 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<br>slope resistance       | 0.57      |                    | $(I > \pi \times I_{T(AV)}), T_J = T_J$ max.                                      |
| $V_{TM}$ Max. on-state voltage                                  | 1.51      | V                  | $I_{pk} = 1040A, T_J = T_J$ max, $t_p = 10ms$ sine pulse                          |
| $I_H$ Maximum holding current                                   | 600       | mA                 | $T_J = 25^\circ C$ , anode supply 12V resistive load                              |
| $I_L$ Typical latching current                                  | 1000      |                    |                                                                                   |

### Switching

| Parameter                                                      | ST330S | Units | Conditions                                                                                                                            |
|----------------------------------------------------------------|--------|-------|---------------------------------------------------------------------------------------------------------------------------------------|
| di/dt    Max. non-repetitive rate of rise of turned-on current | 1000   | A/μs  | Gate drive 20V, 20Ω, $t_f \leq 1\mu s$<br>$T_J = T_J \text{ max}$ , anode voltage $\leq 80\% V_{DRM}$                                 |
| $t_d$ Typical delay time                                       | 1.0    | μs    | Gate current A, $di_g/dt = 1A/\mu s$<br>$V_d = 0.67\% V_{DRM}$ , $T_J = 25^\circ C$                                                   |
| $t_q$ Typical turn-off time                                    | 100    |       | $I_{TM} = 550A$ , $T_J = T_J \text{ max}$ , $di/dt = 40A/\mu s$ , $V_R = 50V$<br>$dv/dt = 20V/\mu s$ , Gate 0V 100Ω, $t_p = 500\mu s$ |

### Blocking

| Parameter                                                              | ST330S | Units | Conditions                                                |
|------------------------------------------------------------------------|--------|-------|-----------------------------------------------------------|
| dv/dt    Maximum critical rate of rise of off-state voltage            | 500    | V/μs  | $T_J = T_J \text{ max}$ , linear to 80% rated $V_{DRM}$   |
| $I_{RRM}$<br>$I_{DRM}$ Max. peak reverse and off-state leakage current | 50     | mA    | $T_J = T_J \text{ max}$ , rated $V_{DRM}/V_{RRM}$ applied |

### Triggering

| Parameter          |                                     | ST330S |      | Units | Conditions                                                                 |                                                                                                                             |                                                                                                                                                  |
|--------------------|-------------------------------------|--------|------|-------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| P <sub>GM</sub>    | Maximum peak gate power             | 10.0   |      | W     | T <sub>J</sub> = T <sub>J</sub> max, t <sub>p</sub> ≤ 5ms                  |                                                                                                                             |                                                                                                                                                  |
| P <sub>G(AV)</sub> | Maximum average gate power          | 2.0    |      |       | T <sub>J</sub> = T <sub>J</sub> max, f = 50Hz, d% = 50                     |                                                                                                                             |                                                                                                                                                  |
| I <sub>GM</sub>    | Max. peak positive gate current     | 3.0    |      | A     | T <sub>J</sub> = T <sub>J</sub> max, t <sub>p</sub> ≤ 5ms                  |                                                                                                                             |                                                                                                                                                  |
| +V <sub>GM</sub>   | Maximum peak positive gate voltage  | 20     |      | V     | T <sub>J</sub> = T <sub>J</sub> max, t <sub>p</sub> ≤ 5ms                  |                                                                                                                             |                                                                                                                                                  |
| -V <sub>GM</sub>   | Maximum peak negative gate voltage  | 5.0    |      |       |                                                                            |                                                                                                                             |                                                                                                                                                  |
| I <sub>GT</sub>    | DC gate current required to trigger | TYP.   | MAX. | mA    | T <sub>J</sub> = - 40°C<br>T <sub>J</sub> = 25°C<br>T <sub>J</sub> = 125°C | Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied |                                                                                                                                                  |
|                    |                                     | 200    | -    |       |                                                                            |                                                                                                                             |                                                                                                                                                  |
|                    |                                     | 100    | 200  |       |                                                                            |                                                                                                                             |                                                                                                                                                  |
|                    |                                     | 50     | -    |       |                                                                            |                                                                                                                             |                                                                                                                                                  |
| V <sub>GT</sub>    | DC gate voltage required to trigger | 2.5    | -    | V     | T <sub>J</sub> = - 40°C                                                    |                                                                                                                             |                                                                                                                                                  |
|                    |                                     | 1.8    | 3.0  |       | T <sub>J</sub> = 25°C                                                      |                                                                                                                             |                                                                                                                                                  |
|                    |                                     | 1.1    | -    |       | T <sub>J</sub> = 125°C                                                     |                                                                                                                             |                                                                                                                                                  |
| I <sub>GD</sub>    | DC gate current not to trigger      | 10     |      | mA    | T <sub>J</sub> = T <sub>J</sub> max                                        |                                                                                                                             | Max. gate current/ voltage not to trigger is the max. value which will not trigger any unit with rated V <sub>DRM</sub> anode-to-cathode applied |
| V <sub>GD</sub>    | DC gate voltage not to trigger      | 0.25   |      | V     |                                                                            |                                                                                                                             |                                                                                                                                                  |

ST330S Series

Bulletin I25156 rev. B 01/94

Thermal and Mechanical Specification

| Parameter                                                   | ST330S              | Units          | Conditions                                 |
|-------------------------------------------------------------|---------------------|----------------|--------------------------------------------|
| T <sub>j</sub> Max. 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 | 0.10                | K/W            | DC operation                               |
| R <sub>thCS</sub> Max. thermal resistance, case to heatsink | 0.03                |                | Mounting surface, smooth, flat and greased |
| T Mounting torque, ± 10%                                    | 48.5<br>(425)       | Nm<br>(lbf-in) | Non lubricated threads                     |
| wt Approximate weight                                       | 535                 | g              |                                            |
| Case style                                                  | TO - 209AE (TO-118) |                | See Outline Table                          |

ΔR<sub>thJC</sub> Conduction

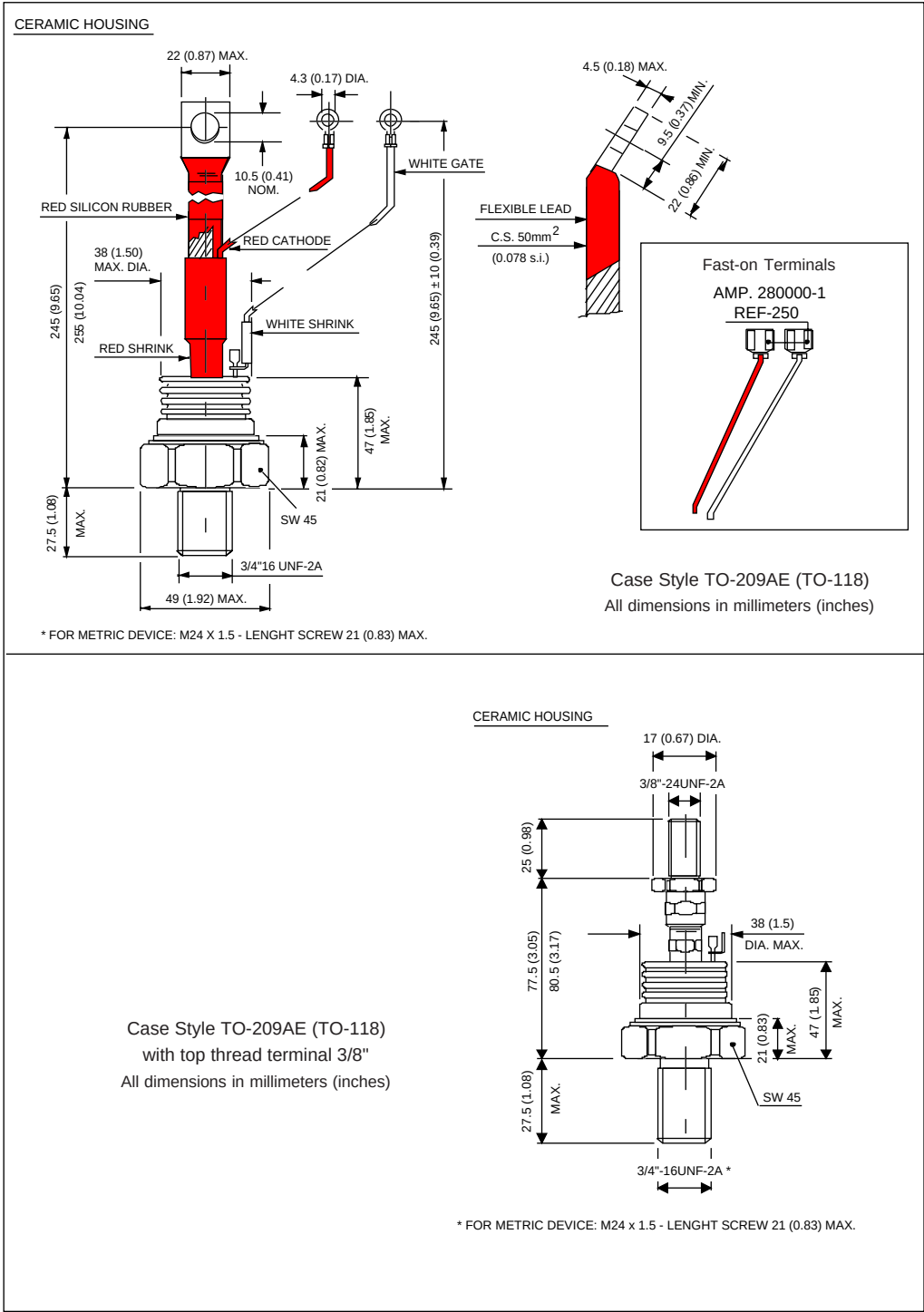
(The following table shows the increment of thermal resistance R<sub>thJC</sub> when devices operate at different conduction angles than DC)

| Conduction angle | Sinusoidal conduction | Rectangular conduction | Units | Conditions                           |
|------------------|-----------------------|------------------------|-------|--------------------------------------|
| 180°             | 0.011                 | 0.008                  | K/W   | T <sub>j</sub> = T <sub>j</sub> max. |
| 120°             | 0.013                 | 0.014                  |       |                                      |
| 90°              | 0.017                 | 0.018                  |       |                                      |
| 60°              | 0.025                 | 0.026                  |       |                                      |
| 30°              | 0.041                 | 0.041                  |       |                                      |

Ordering Information Table

|             |   |                                                                                                                                                                  |  |  |  |  |  |  |  |
|-------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|
| Device Code |   | <div><div>ST330S16P0</div><div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div></div></div>                      |  |  |  |  |  |  |  |
| 1           | - | Thyristor                                                                                                                                                        |  |  |  |  |  |  |  |
| 2           | - | Essential part number                                                                                                                                            |  |  |  |  |  |  |  |
| 3           | - | 0 = Converter grade                                                                                                                                              |  |  |  |  |  |  |  |
| 4           | - | S = Compression bonding Stud                                                                                                                                     |  |  |  |  |  |  |  |
| 5           | - | Voltage code: Code x 100 = V <sub>RRM</sub> (See Voltage Rating Table)                                                                                           |  |  |  |  |  |  |  |
| 6           | - | P = Stud base 16UNF threads<br>M = Stud base metric threads (M24 x 1.5)                                                                                          |  |  |  |  |  |  |  |
| 7           | - | 0 = Eyelet terminals (Gate and Auxiliary Cathode Leads)<br>1 = Fast - on terminals (Gate and Auxiliary Cathode Leads)<br>3 = Threaded top terminal 3/8" 24UNF-2A |  |  |  |  |  |  |  |
| 8           | - | Critical dv/dt: None = 500V/μsec (Standard selection)<br>L = 1000V/μsec (Special selection)                                                                      |  |  |  |  |  |  |  |

Outline Table



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International  
**IR** Rectifier

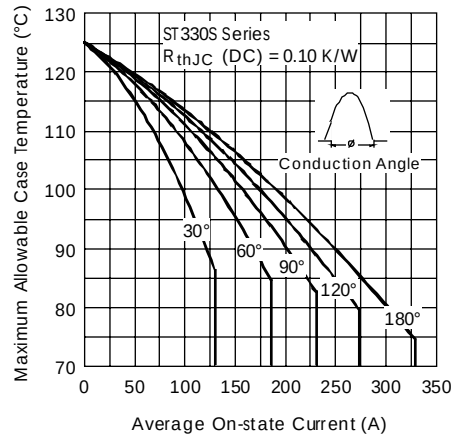


Fig. 1 - Current Ratings Characteristics

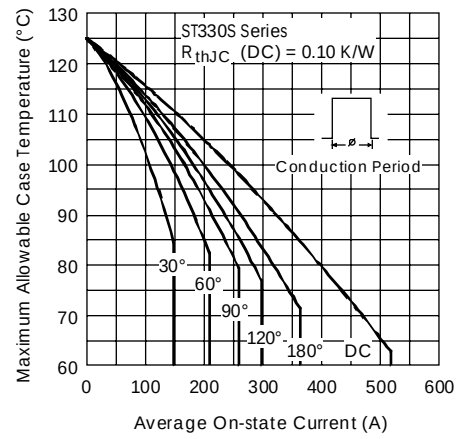


Fig. 2 - Current Ratings Characteristics

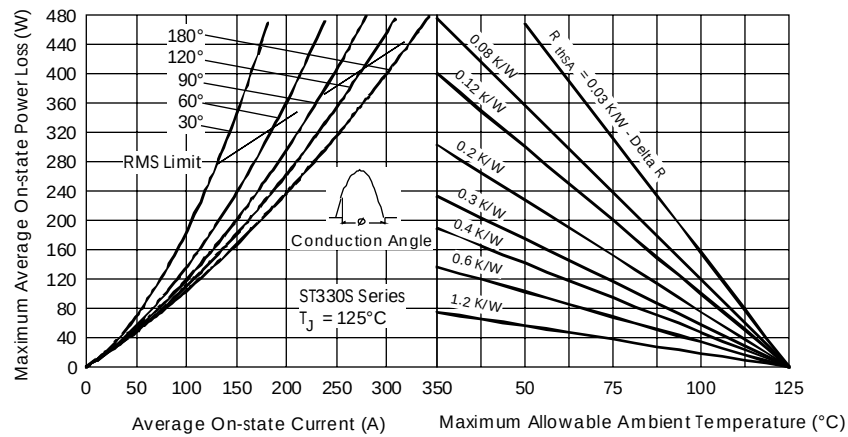


Fig. 3 - On-state Power Loss Characteristics

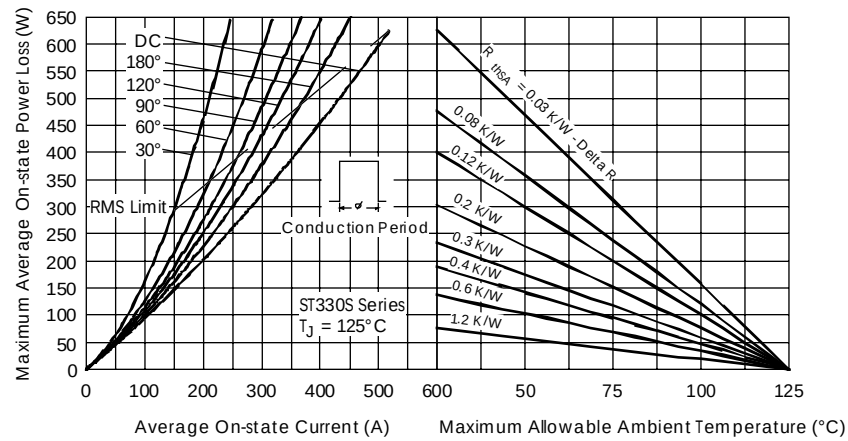


Fig. 4 - On-state Power Loss Characteristics

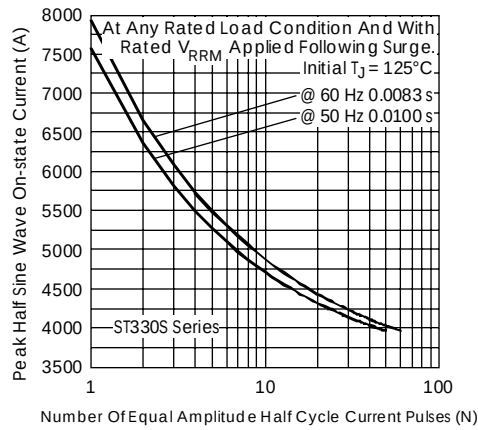


Fig. 5 - Maximum Non-Repetitive Surge Current

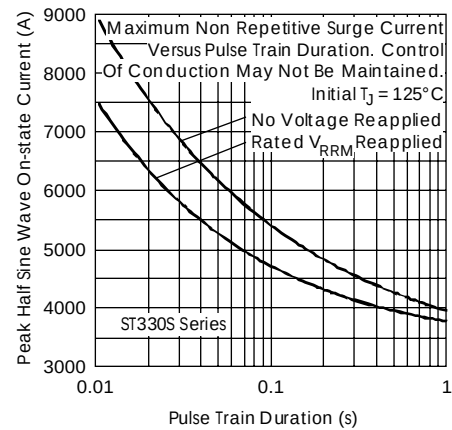


Fig. 6 - Maximum Non-Repetitive Surge Current

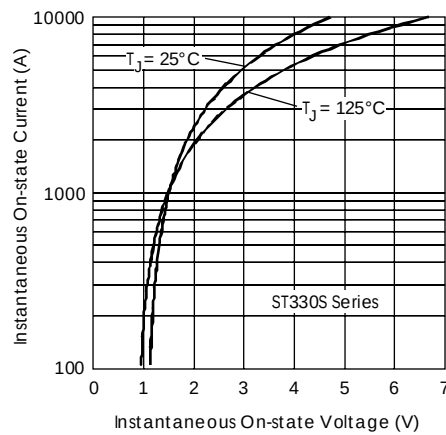


Fig. 7 - On-state Voltage Drop Characteristics

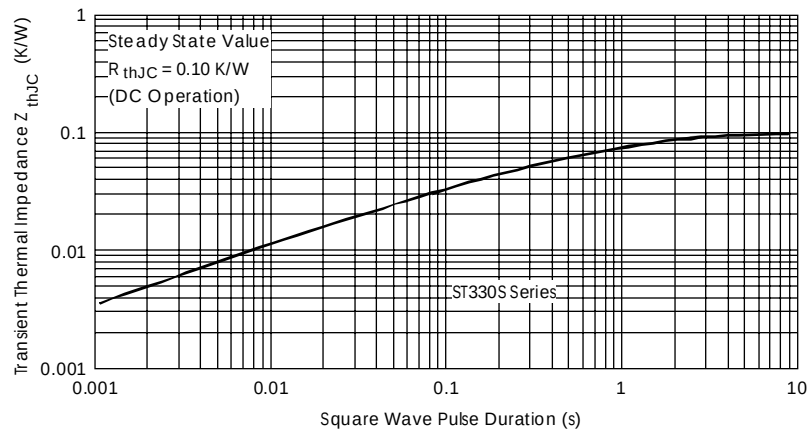


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

**ST330S Series**

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International  
**IR** Rectifier

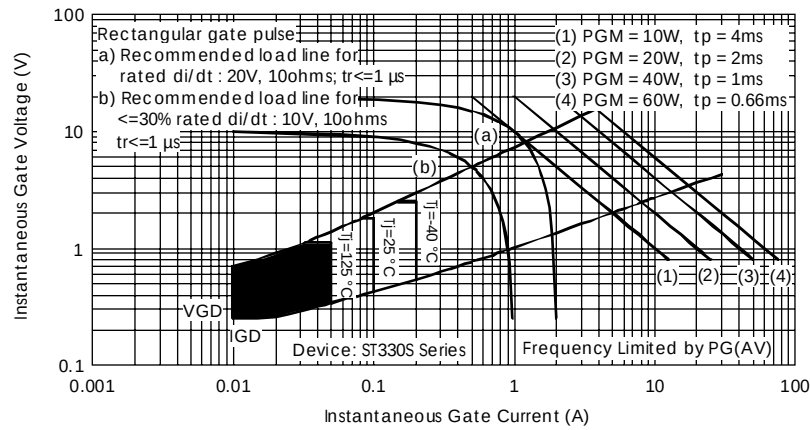


Fig. 9 - Gate Characteristics