

MEDIUM POWER THYRISTORS

Stud Version

Features

- Improved glass passivation for high reliability and exceptional stability at high temperature
- High di/dt and dv/dt capabilities
- Standard package
- Low thermal resistance
- Metric threads version available
- Types up to 1600V V_{DRM}/V_{RRM}

22A

Typical Applications

- Medium power switching
- Phase control applications
- Can be supplied to meet stringent military, aerospace and other high-reliability requirements

Major Ratings and Characteristics

| Parameters | 22RIA | | Units |
|-------------------|-------------|--------------|------------------|
| | 10 to 120 | 140 to 160 | |
| $I_{T(AV)}$ | 22 | 22 | A |
| $@ T_C$ | 85 | 85 | °C |
| $I_{T(RMS)}$ | 35 | 35 | A |
| I_{TSM} | @ 50Hz | 340 | A |
| | @ 60Hz | 355 | A |
| I^2t | @ 50Hz | 575 | A ² s |
| | @ 60Hz | 525 | A ² s |
| V_{DRM}/V_{RRM} | 100 to 1200 | 1400 to 1600 | V |
| t_q | typical | 110 | μs |
| T_J | | - 65 to 125 | °C |



ELECTRICAL SPECIFICATIONS

Voltage Ratings

| Type number | Voltage Code | V_{DRM}/V_{RRM} , max. repetitive peak and off-state voltage (1) V | V_{RSM} , maximum non-repetitive peak voltage (2) V | I_{DRM}/I_{RRM} max. @ $T_J = T_J$ max. mA |
|-------------|--------------|---|--|--|
| 22RIA | 10 | 100 | 150 | 10 |
| | 20 | 200 | 300 | |
| | 40 | 400 | 500 | |
| | 60 | 600 | 700 | |
| | 80 | 800 | 900 | |
| | 100 | 1000 | 1100 | |
| | 120 | 1200 | 1300 | |
| | 140 | 1400 | 1500 | |
| | 160 | 1600 | 1700 | |

(1) Units may be broken over non-repetitively in the off-state direction without damage, if di/dt does not exceed $20A/\mu s$ (2) For voltage pulses with $t_p \leq 5ms$

On-state Conduction

| Parameter | 22RIA | | Units | Conditions | | |
|---|-----------|------------|-----------|--|----------------|---|
| | 10 to 120 | 140 to 160 | | | | |
| $I_{T(AV)}$ Max. average on-state current @ Case temperature | 22 | 22 | A | 180° sinusoidal conduction | | |
| | 85 | 85 | °C | | | |
| $I_{T(RMS)}$ Max. RMS on-state current | 35 | 35 | A | | | |
| I_{TSM} Max. peak, one-cycle non-repetitive surge current | 400 | 340 | A | t = 10ms | No voltage | Sinusoidal half wave, Initial $T_J = T_J$ max. |
| | 420 | 355 | | t = 8.3ms | reapplied | |
| | 335 | 285 | | t = 10ms | 100% V_{RRM} | |
| | 355 | 300 | | t = 8.3ms | reapplied | |
| I^2t Maximum I^2t for fusing | 793 | 575 | A^2s | t = 10ms | No voltage | |
| | 724 | 525 | | t = 8.3ms | reapplied | |
| | 560 | 405 | | t = 10ms | 100% V_{RRM} | |
| | 515 | 370 | | t = 8.3ms | reapplied | |
| I^2/t Maximum I^2/t for fusing | 7930 | 5750 | A^2/s | t = 0.1 to 10ms, no voltage reapplied, $T_J = T_J$ max. | | |
| $V_{T(TO)1}$ Low level value of threshold voltage | 0.83 | 1.01 | 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 | 0.95 | 1.17 | | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ max. | | |
| r_{t1} Low level value of on-state slope resistance | 14.9 | 12.24 | $m\Omega$ | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ max. | | |
| r_{t2} High level value of on-state slope resistance | 13.4 | 10.35 | | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ max. | | |
| V_{TM} Max. on-state voltage | 1.70 | --- | V | $I_{pk} = 70 A$, $T_J = 25^\circ C$ | | |
| | --- | 1.80 | | | | |
| I_H Maximum holding current | 130 | | mA | $T_J = 25^\circ C$. Anode supply 6V, resistive load, | | |
| I_L Latching current | 200 | | | | | |

Switching

| Parameter | 22RIA | Units | Conditions |
|--|--------------------------|------------|--|
| di/dt Max. rate of rise of turned-on current $V_{DRM} \leq 600V$ $V_{DRM} \leq 800V$ $V_{DRM} \leq 1000V$ $V_{DRM} \leq 1600V$ | 200 180 160 150 | A/ μs | $T_J = T_J \text{ max.}, V_{DM} = \text{rated } V_{DRM}$ Gate pulse = 20V, 15 Ω , $t_p = 6\mu s$, $t_r = 0.1\mu s \text{ max.}$ $I_{TM} = (2x \text{ rated } di/dt) A$ |
| t_{gt} Typical turn-on time | 0.9 | μs | $T_J = 25^\circ C$, at = rated V_{DRM}/V_{RRM} , $T_J = 125^\circ C$ |
| t_{rr} Typical reverse recovery time | 4 | | $T_J = T_J \text{ max.},$ $I_{TM} = I_{T(AV)}, t_p > 200\mu s, di/dt = -10A/\mu s$ |
| t_q Typical turn-off time | 110 | | $T_J = T_J \text{ max.}, I_{TM} = I_{T(AV)}, t_p > 200\mu s, V_R = 100V,$ $di/dt = -10A/\mu s, dv/dt = 20V/\mu s \text{ linear to}$ $67\% V_{DRM}, \text{ gate bias } 0V-100V$ |

(*) $t_q = 10\mu s$ up to 600V, $t_q = 30\mu s$ up to 1600V available on special request.

Blocking

| Parameter | 22RIA | Units | Conditions |
|---|---------|------------|--|
| dv/dt Max. critical rate of rise of off-state voltage | 100 | V/ μs | $T_J = T_J \text{ max. linear to } 100\% \text{ rated } V_{DRM}$ |
| | 300 (*) | | $T_J = T_J \text{ max. linear to } 67\% \text{ rated } V_{DRM}$ |

(**) Available with: $dv/dt = 1000V/\mu s$, to complete code add S90 i.e. 22RIA160S90.

Triggering

| Parameter | 22RIA | Units | Conditions |
|--|-------|-------|--|
| P_{GM} Maximum peak gate power | 8.0 | W | $T_J = T_J \text{ max.}$ |
| $P_{G(AV)}$ Maximum average gate power | 2.0 | | |
| I_{GM} Max. peak positive gate current | 1.5 | A | $T_J = T_J \text{ max.}$ |
| $-V_{GM}$ Maximum peak negative gate voltage | 10 | V | $T_J = T_J \text{ max.}$ |
| I_{GT} DC gate current required to trigger | 90 | mA | $T_J = -65^\circ C$ Max. required gate trigger current/ voltage are the lowest value which will trigger all units 6V anode-to-cathode applied |
| | 60 | | $T_J = 25^\circ C$ |
| | 35 | | $T_J = 125^\circ C$ |
| V_{GT} DC gate voltage required to trigger | 3.0 | V | $T_J = -65^\circ C$ |
| | 2.0 | | $T_J = 25^\circ C$ |
| | 1.0 | | $T_J = 125^\circ C$ |
| I_{GD} DC gate current not to trigger | 2.0 | mA | $T_J = T_J \text{ max.}, V_{DRM} = \text{rated value}$ |
| V_{GD} DC gate voltage not to trigger | 0.2 | V | $T_J = T_J \text{ max.}$ 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 $V_{DRM} = \text{rated value}$ |

22RIA Series

Bulletin I2403 rev. A 07/00

Thermal and Mechanical Specification

| Parameter | 22RIA | Units | Conditions |
|--|------------------|-----------|--|
| T_J Max. operating temperature range | - 65 to 125 | °C | |
| T_{stg} Max. storage temperature range | - 65 to 125 | °C | |
| R_{thJC} Max. thermal resistance, junction to case | 0.86 | K/W | DC operation |
| R_{thCS} Max. thermal resistance, case to heatsink | 0.35 | K/W | Mounting surface, smooth, flat and greased |
| T Mounting torque | to nut | to device | |
| | 20(27.5) | 25 | lbf-in Lubricated threads |
| | 0.23(0.32) | 0.29 | kgf.m (Non-lubricated threads) |
| | 2.3(3.1) | 2.8 | Nm |
| wt Approximate weight | 14 (0.49) | g (oz) | |
| Case style | TO-208AA (TO-48) | | See Outline Table |

ΔR_{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° | 0.21 | 0.15 | K/W | $T_J = T_J \text{ max.}$ |
| 120° | 0.25 | 0.25 | | |
| 90° | 0.31 | 0.34 | | |
| 60° | 0.45 | 0.47 | | |
| 30° | 0.76 | 0.76 | | |

Ordering Information Table

| Device Code |
|---|
| <div style="display: flex; justify-content: center; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px; background-color: black; color: white;">22</div> <div style="border: 1px solid black; padding: 2px 5px; background-color: black; color: white;">RIA</div> <div style="border: 1px solid black; padding: 2px 5px; background-color: black; color: white;">160</div> <div style="border: 1px solid black; padding: 2px 5px; background-color: black; color: white;">M</div> <div style="border: 1px solid black; padding: 2px 5px; background-color: black; color: white;">S90</div> </div> <div style="display: flex; justify-content: center; gap: 10px; margin-top: 5px;"> ① ② ③ ④ ⑤ </div> |
| <p>1 - Current code</p> <p>2 - Essential part number</p> <p>3 - Voltage code: Code x 10 = V_{RRM} (See Voltage Rating Table)</p> <p>4 - None = Stud base TO-208AA (TO-48) 1/4" 28UNF-2A M = Stud base TO-208AA (TO-48) M6 X 1</p> <p>5 - Critical dv/dt: None = 300V/μs (Standard value) S90 = 1000V/μs (Special selection)</p> |

Outline Table

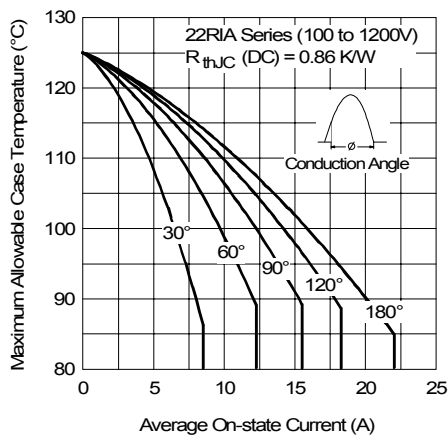
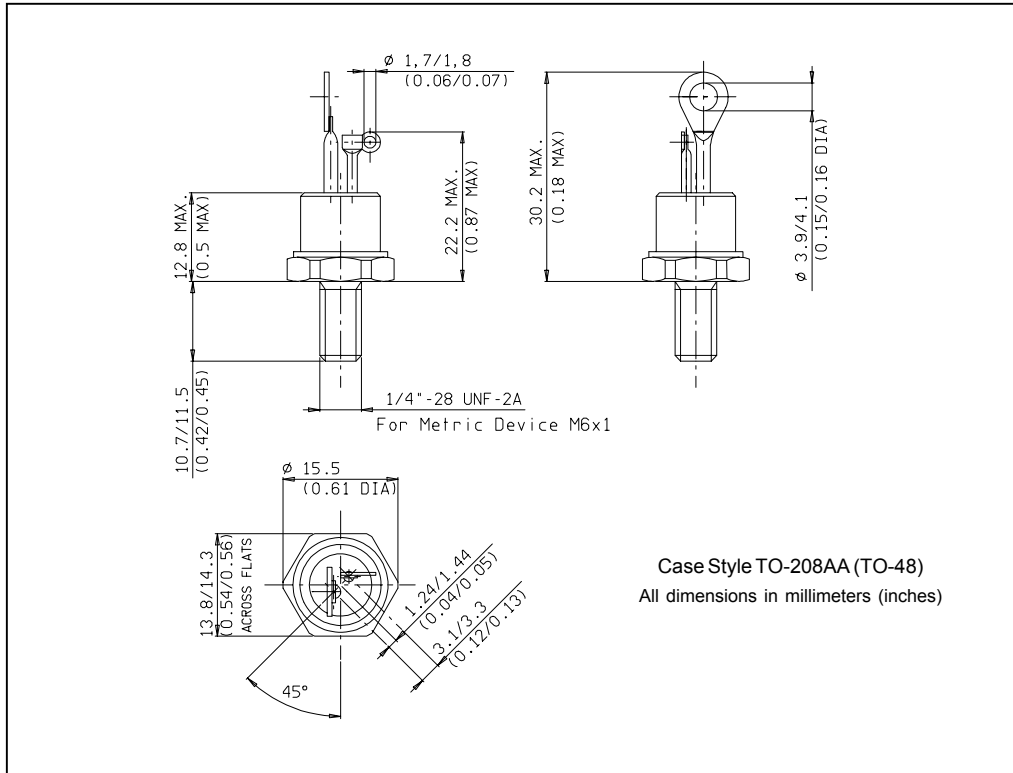


Fig. 1 - Current Ratings Characteristic

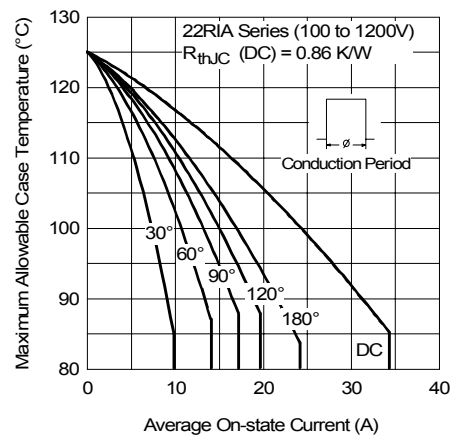


Fig. 2 - Current Ratings Characteristic

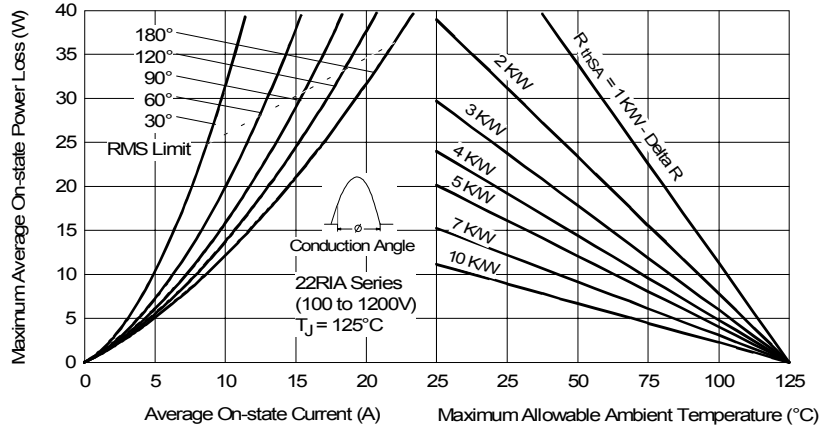


Fig. 3 - On-state Power Loss Characteristics

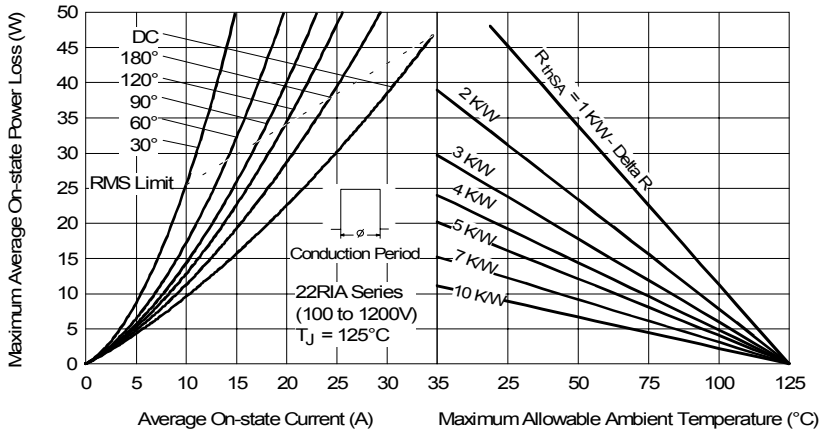


Fig. 4 - On-state Power Loss Characteristics

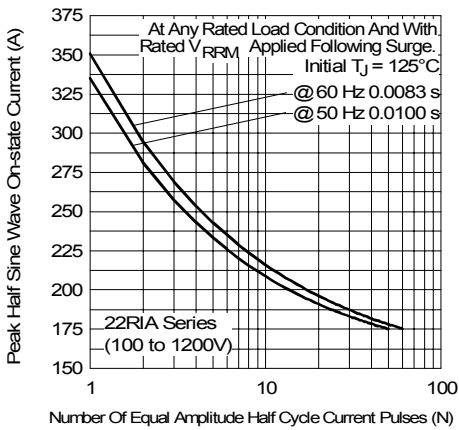


Fig. 5 - Maximum Non-Repetitive Surge Current

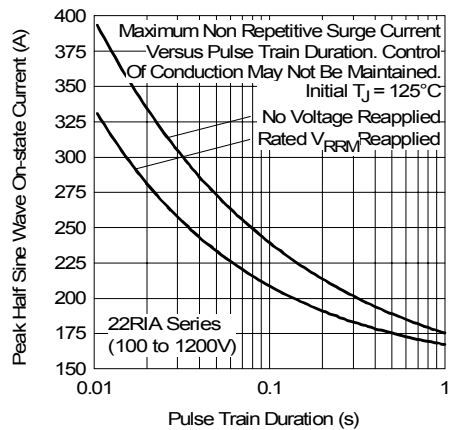


Fig. 6 - Maximum Non-Repetitive Surge Current

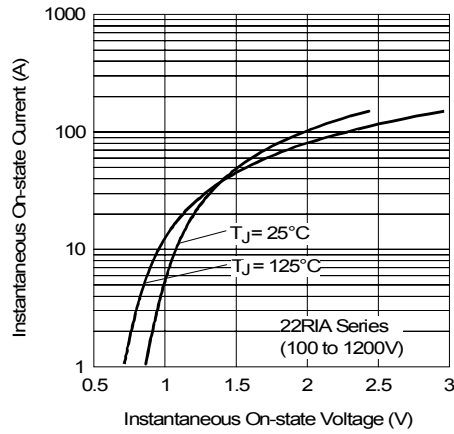


Fig. 7 - Forward Voltage Drop Characteristics

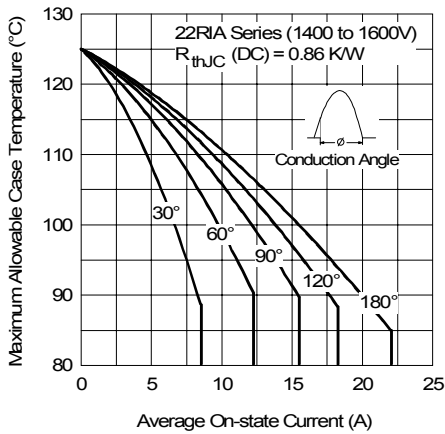


Fig. 8 - Current Ratings Characteristics

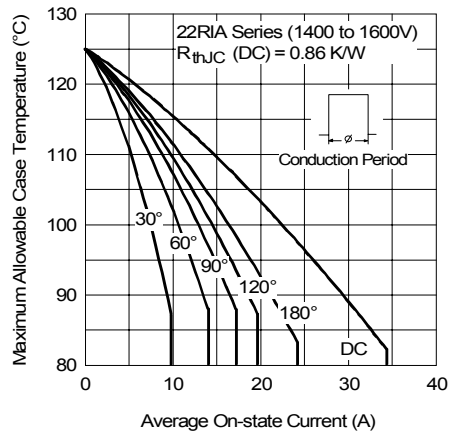


Fig. 9 - Current Ratings Characteristics

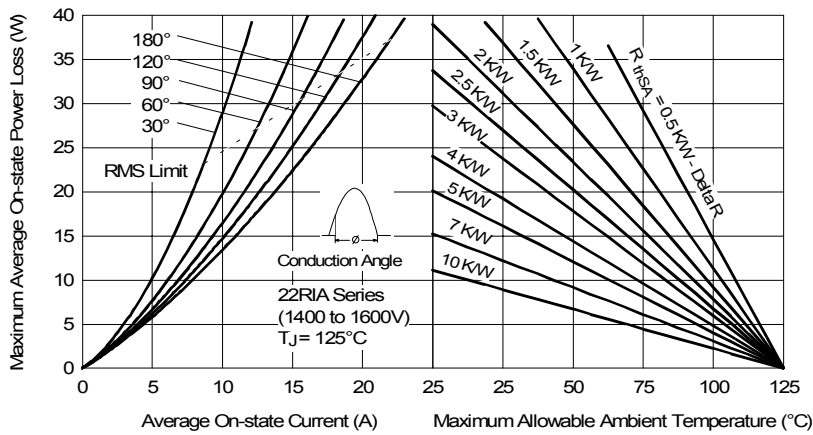


Fig. 10 - On-state Power Loss Characteristics

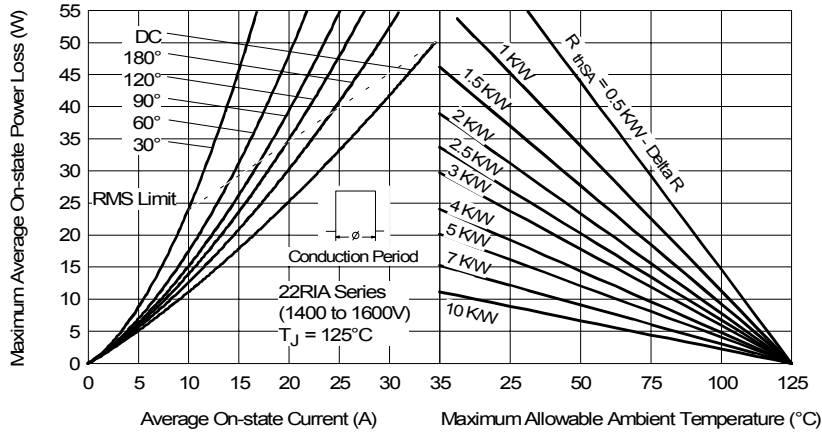


Fig. 11 - On-state Power Loss Characteristics

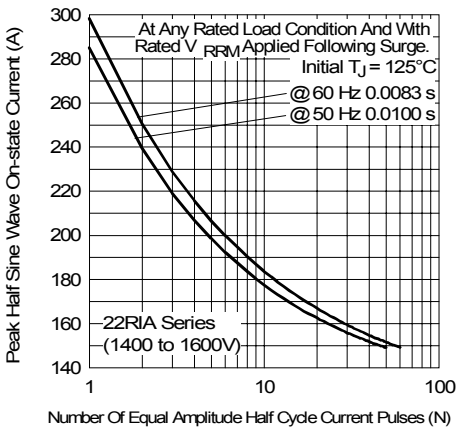


Fig. 12 - Maximum Non-Repetitive Surge Current

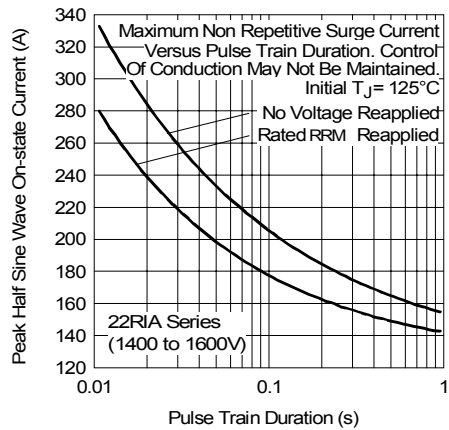


Fig. 13 - Maximum Non-Repetitive Surge Current

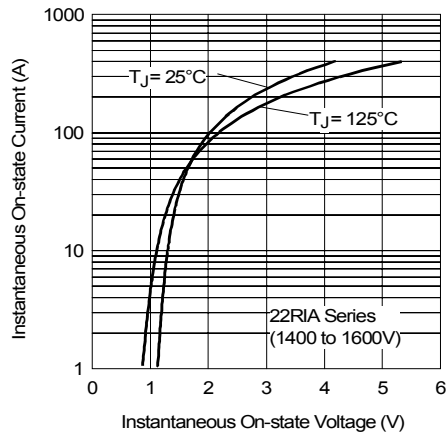


Fig. 14 - Forward Voltage Drop Characteristics

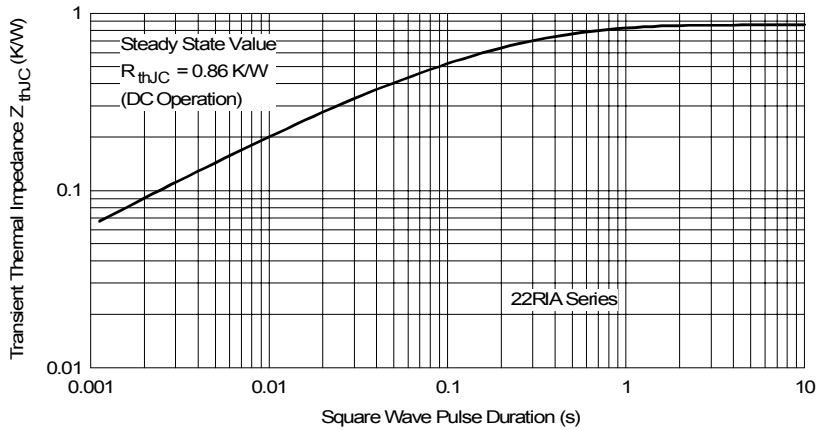


Fig. 15 - Thermal Impedance Z_{thJC} Characteristics

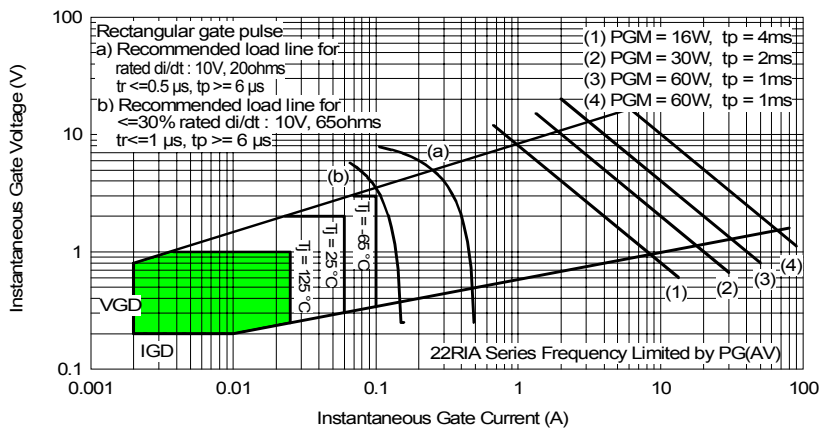


Fig. 16 - Gate Characteristics