

### 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 <sup>2</sup> s
	@ 60Hz	525	A <sup>2</sup> 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		Sinusoidal half wave, Initial $T_J = T_J$ max.
	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	V	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ 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	$m\Omega$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.			
$V_{TM}$ Max. on-state voltage	1.70	---	V	$I_{pk} = 70 A$ , $T_J = 25^\circ C$			
$I_H$ 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/ $\mu s$	$T_J = T_J \text{ max.}, V_{DM} = \text{rated } V_{DRM}$ Gate pulse = 20V, 15 $\Omega$ , $t_p = 6\mu s$ , $t_r = 0.1\mu s \text{ max.}$ $I_{TM} = (2x \text{ rated } di/dt) A$
$t_{gt}$ Typical turn-on time	0.9	$\mu s$	$T_J = 25^\circ C$ , at = rated $V_{DRM}/V_{RRM}$ , $T_J = 125^\circ C$
$t_{fr}$ 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/ $\mu s$	$T_J = T_J \text{ max. linear to } 100\% \text{ rated } V_{DRM}$
	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	$T_J = -65^\circ C$
	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	$T_J = T_J \text{ max.}$ $V_{DRM} = \text{rated value}$ 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

## 22RIA Series

Bulletin I2403 rev. A 07/00

### Thermal and Mechanical Specification

Parameter	22RIA	Units	Conditions
T <sub>J</sub> Max. operating temperature range	- 65 to 125	°C	
T <sub>stg</sub> Max. storage temperature range	- 65 to 125	°C	
R <sub>thJC</sub> Max. thermal resistance, junction to case	0.86	K/W	DC operation
R <sub>thCS</sub> 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
	0.23(0.32)	0.29	kgf.m
	2.3(3.1)	2.8	Nm
wt Approximate weight	14 (0.49)	g (oz)	
Case style	TO-208AA (TO-48)		See Outline Table

### $\Delta R_{thJC}$ 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°	0.21	0.15	K/W	T <sub>J</sub> = T <sub>J</sub> 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;"> <span>①</span> <span>②</span> <span>③</span> <span>④</span> <span>⑤</span> </div>
<p><b>1</b> - Current code</p> <p><b>2</b> - Essential part number</p> <p><b>3</b> - Voltage code: Code x 10 = V<sub>RRM</sub> (See Voltage Rating Table)</p> <p><b>4</b> - None = Stud base TO-208AA (TO-48) 1/4" 28UNF-2A M = Stud base TO-208AA (TO-48) M6 X 1</p> <p><b>5</b> - Critical dv/dt: None = 300V/μs (Standard value) S90 = 1000V/μs (Special selection)</p>

Outline Table

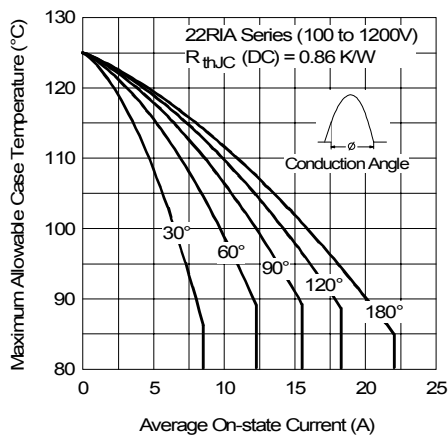
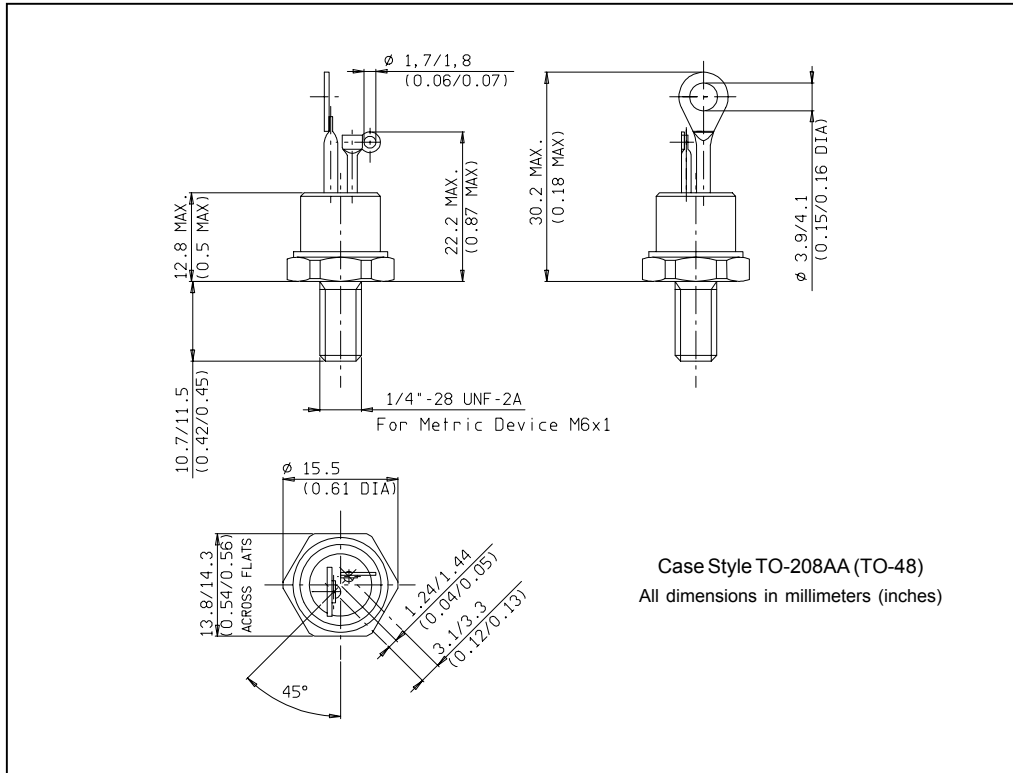


Fig. 1 - Current Ratings Characteristic

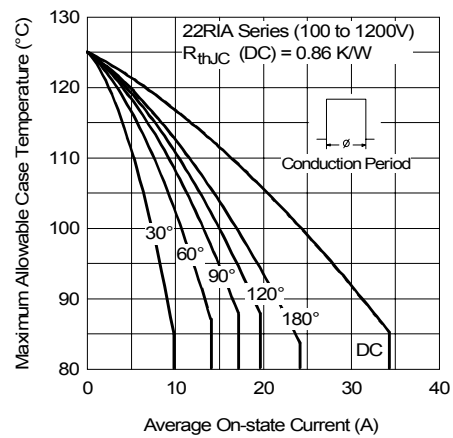


Fig. 2 - Current Ratings Characteristic

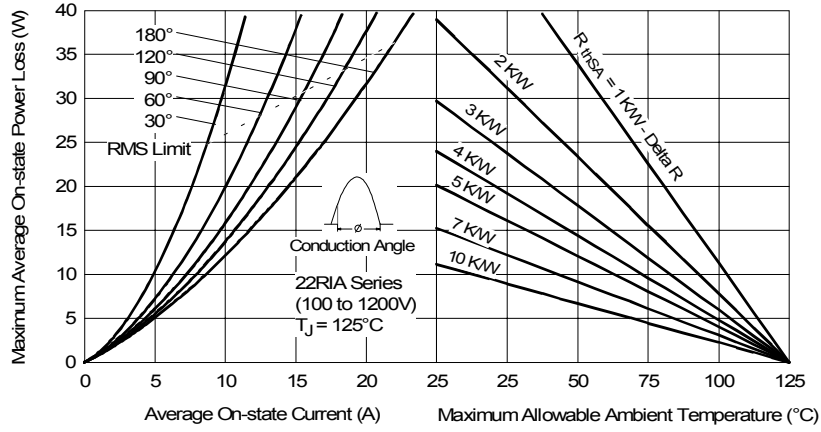


Fig. 3 - On-state Power Loss Characteristics

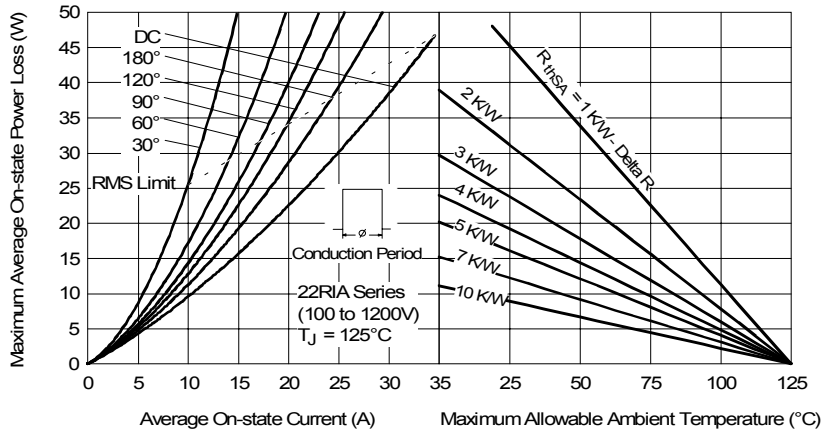


Fig. 4 - On-state Power Loss Characteristics

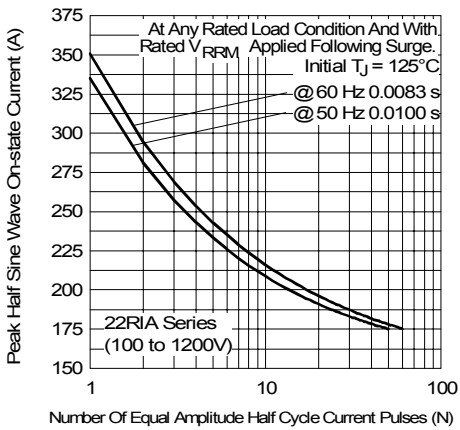


Fig. 5 - Maximum Non-Repetitive Surge Current

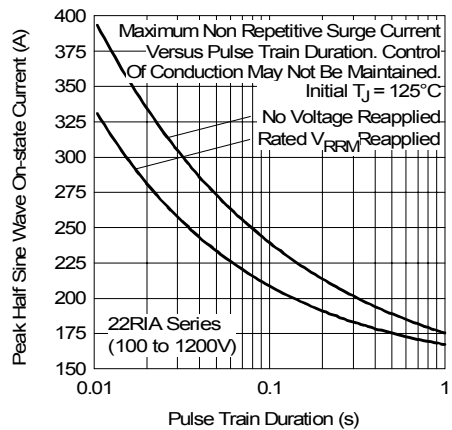


Fig. 6 - Maximum Non-Repetitive Surge Current

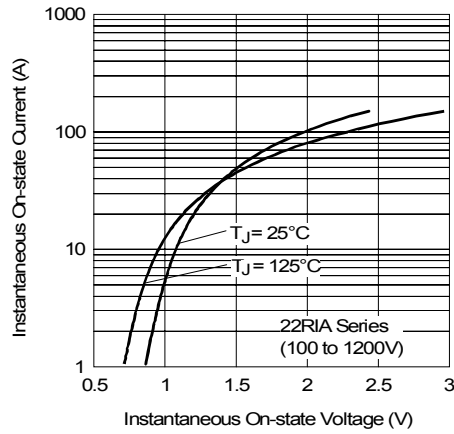


Fig. 7 - Forward Voltage Drop Characteristics

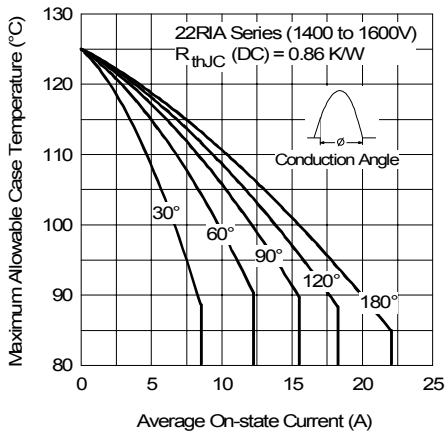


Fig. 8 - Current Ratings Characteristics

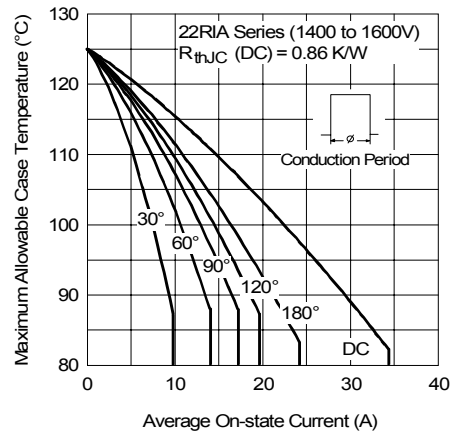


Fig. 9 - Current Ratings Characteristics

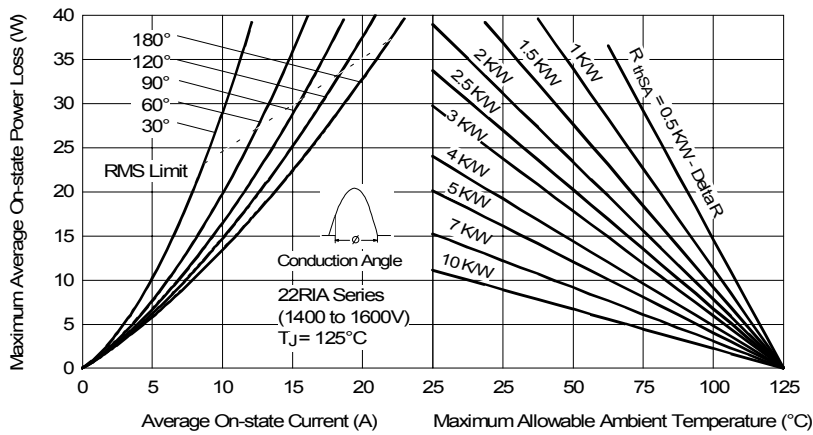


Fig. 10 - On-state Power Loss Characteristics

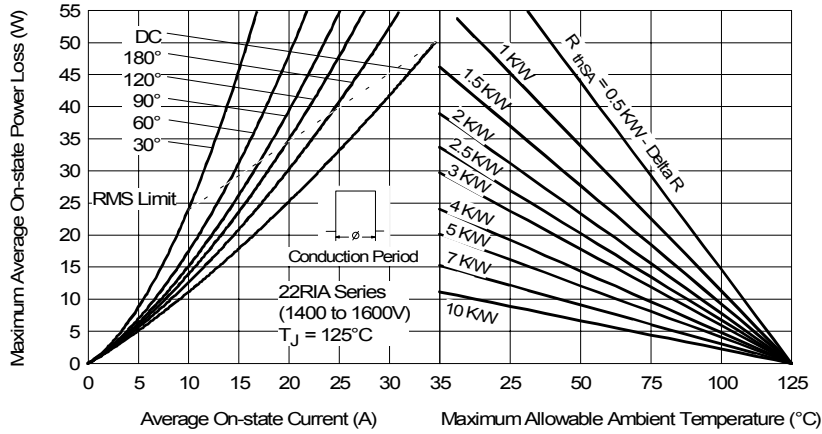


Fig. 11 - On-state Power Loss Characteristics

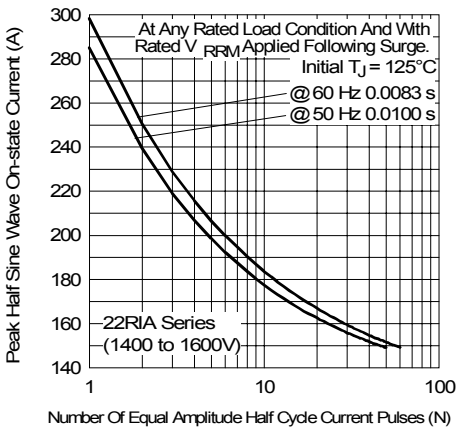


Fig. 12 - Maximum Non-Repetitive Surge Current

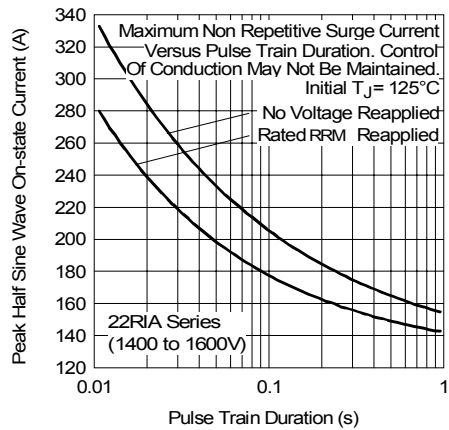


Fig. 13 - Maximum Non-Repetitive Surge Current

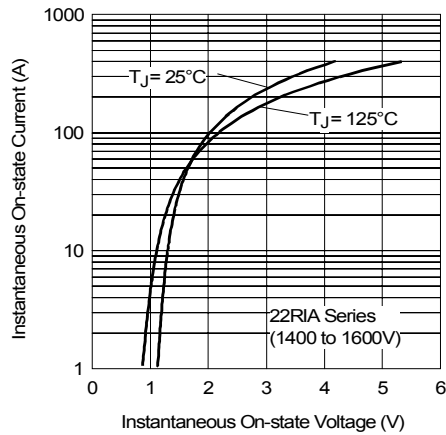


Fig. 14 - Forward Voltage Drop Characteristics

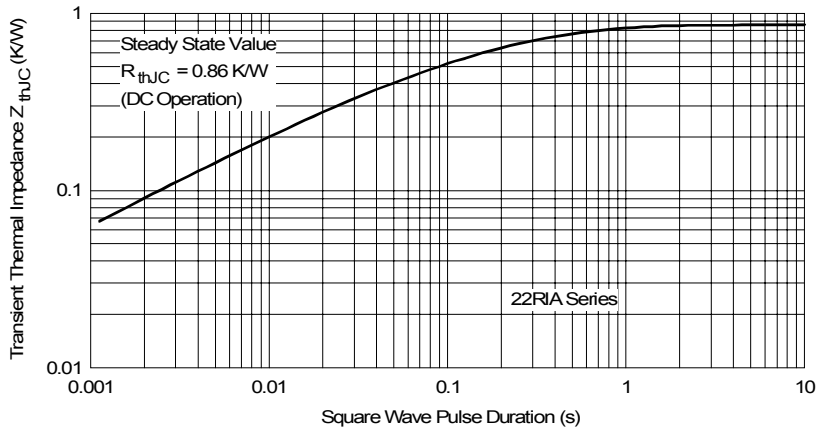


Fig. 15 - Thermal Impedance  $Z_{thJC}$  Characteristics

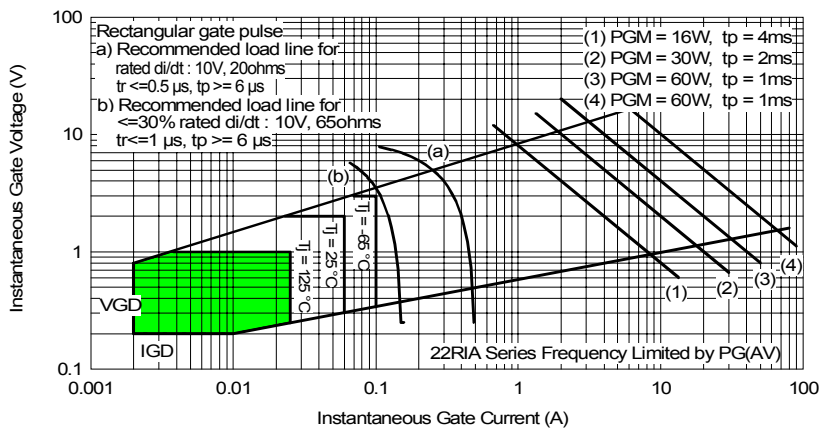


Fig. 16 - Gate Characteristics



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