

Bulletin I2403 rev. A 07/00

International
IOR Rectifier

22RIA SERIES

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	400	340	A
@ 60Hz	420	355	A
I^2t @ 50Hz	793	575	A ² s
@ 60Hz	724	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



Case Style
TO-208AA (TO-48)



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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	20
	20	200	300	10
	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/ μ s

(2) For voltage pulses with $t_p \leq 5$ ms

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		
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	7930	5750	$A^2\sqrt{s}$	$t = 0.1$ 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	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	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	$V_{DRM} \leq 600V$ 200 $V_{DRM} \leq 800V$ 180 $V_{DRM} \leq 1000V$ 160 $V_{DRM} \leq 1600V$ 150	A/ μs	$T_J = T_J \text{ max.}, V_{DM} = \text{rated } V_{DRM}$ Gate pulse = 20V, 15 Ω , $t_p = 6\mu s$, $t_r = 0.1\mu s \text{ max.}$ $I_{TM} = (2 \times \text{rated di/dt}) A$
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/ μs
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/ μs , dv/dt = 20V/ μs linear to 67% V_{DRM} , 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/ μs , 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 60 35	mA	$T_J = -65^\circ C$ $T_J = 25^\circ C$ $T_J = 125^\circ C$
V_{GT} DC gate voltage required to trigger	3.0 2.0 1.0		$T_J = -65^\circ C$ $T_J = 25^\circ C$ $T_J = 125^\circ C$
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		$T_J = T_J \text{ max.}$ $V_{DRM} = \text{rated value}$ 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

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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	Lubricated threads (Non-lubricated threads)
	20(27.5)	25	
	0.23(0.32)	0.29	
	2.3(3.1)	2.8	
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 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				
22	RIA	160	M	S90
①	②	③	④	⑤
1	- Current code			
2	- Essential part number			
3	- Voltage code: Code x 10 = V _{RRM} (See Voltage Rating Table)			
4	- None = Stud base TO-208AA (TO-48) 1/4" 28UNF-2A M = Stud base TO-208AA (TO-48) M6 X 1			
5	- Critical dv/dt: None = 300V/μs (Standard value) S90 = 1000V/μs (Special selection)			

Technical drawing of Case Style TO-208AA (TO-48) showing front, side, and top views with dimensions in millimeters and inches.

Front View Dimensions:

- Top mounting hole diameter: $\varnothing 1.7/1.8$ (0.06/0.07)
- Distance from top mounting hole to center of base: 22.2 MAX. (0.87 MAX.)
- Distance from top mounting hole to base: 12.8 MAX. (0.5 MAX.)
- Base diameter: $\varnothing 15.5$ (0.61 DIA)
- Base thread: 1/4"-28 UNF-2A
- For Metric Device M6x1

Side View Dimensions:

- Maximum height: 30.2 MAX. (0.18 MAX.)
- Base diameter: $\varnothing 3.9/4.1$ (0.15/0.16 DIA)

Top View Dimensions:

- Distance from center to mounting hole: 13.8/14.3 (0.54/0.56) ACROSS FLATS
- Distance from center to mounting hole: 1.24/1.44 (0.04/0.05)
- Distance from center to mounting hole: 3.1/3.3 (0.12/0.13)
- Angle: 45°

Case Style TO-208AA (TO-48)

All dimensions in millimeters (inches)



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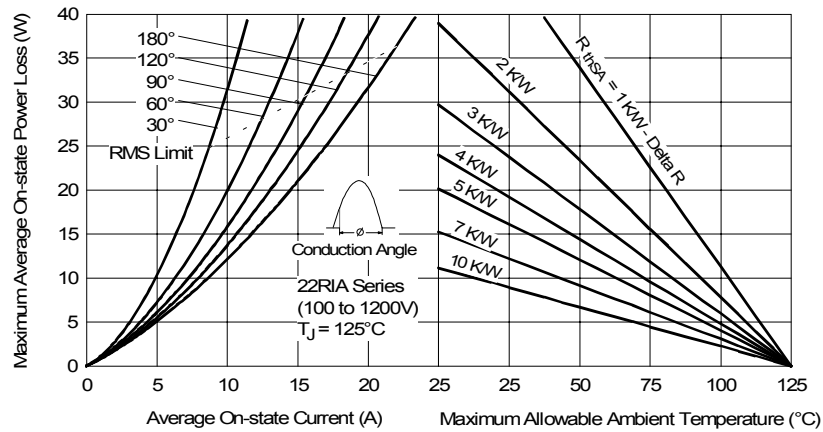


Fig. 3 - On-state Power Loss Characteristics

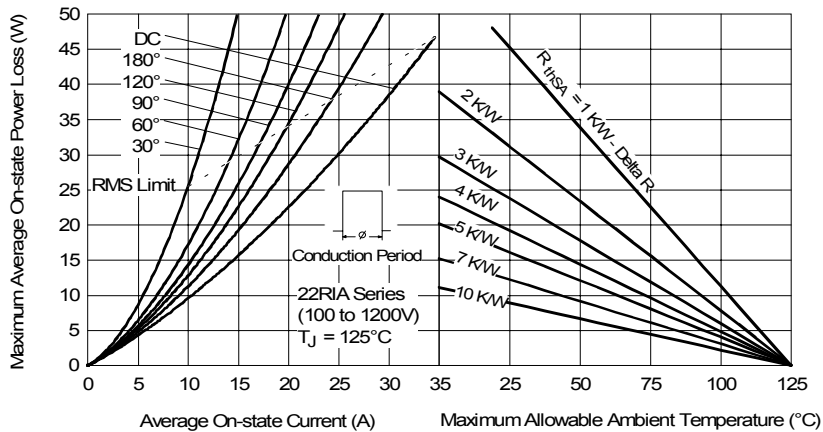


Fig. 4 - On-state Power Loss Characteristics

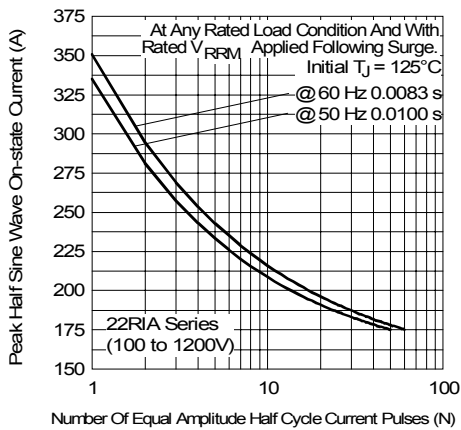


Fig. 5 - Maximum Non-Repetitive Surge Current

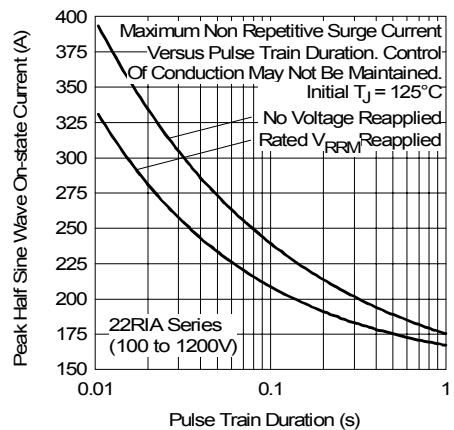


Fig. 6 - Maximum Non-Repetitive Surge Current

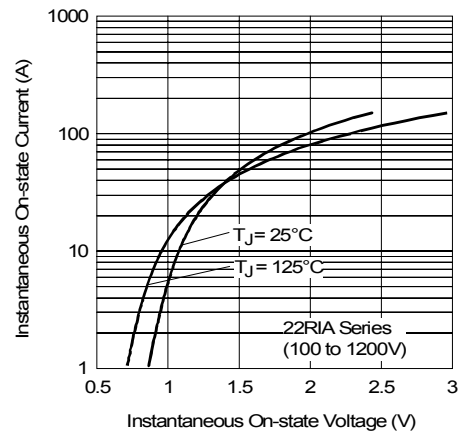


Fig. 7 - Forward Voltage Drop Characteristics

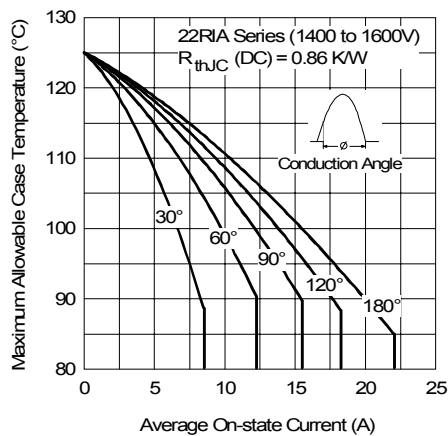


Fig. 8 - Current Ratings Characteristics

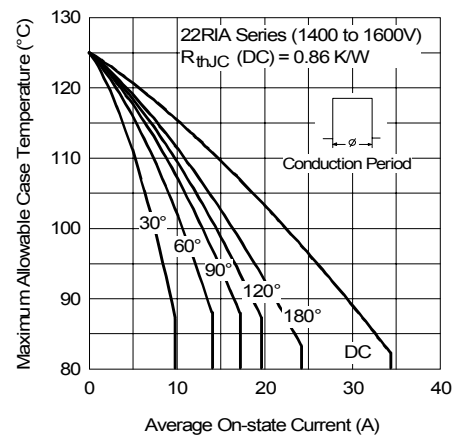


Fig. 9 - Current Ratings Characteristics

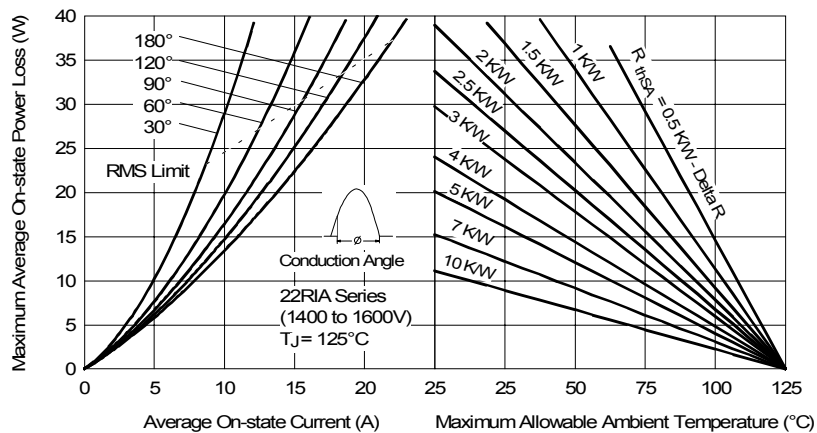


Fig. 10 - On-state Power Loss Characteristics

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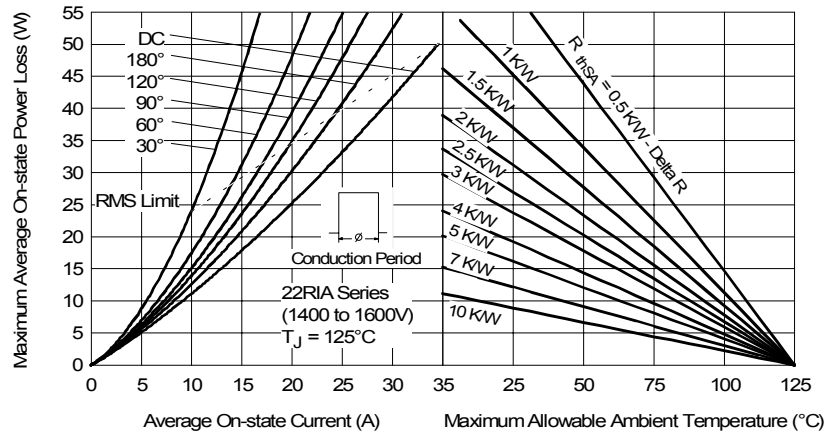


Fig. 11 - On-state Power Loss Characteristics

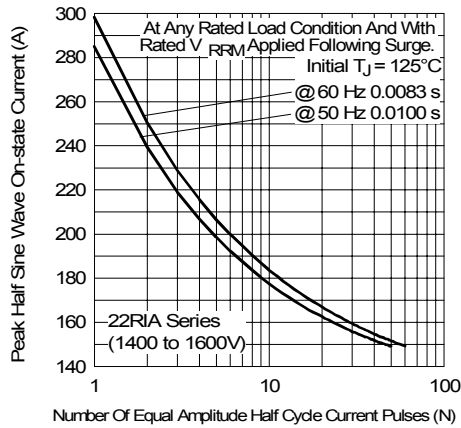


Fig. 12 - Maximum Non-Repetitive Surge Current

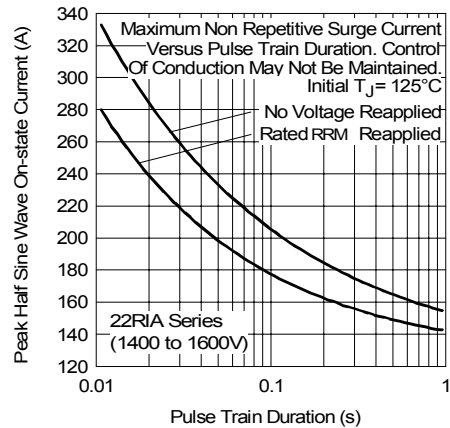


Fig. 13 - Maximum Non-Repetitive Surge Current

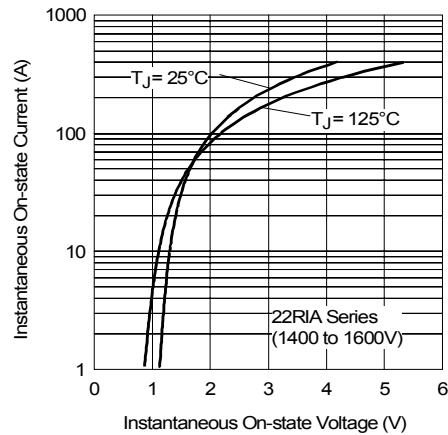


Fig. 14 - Forward Voltage Drop Characteristics

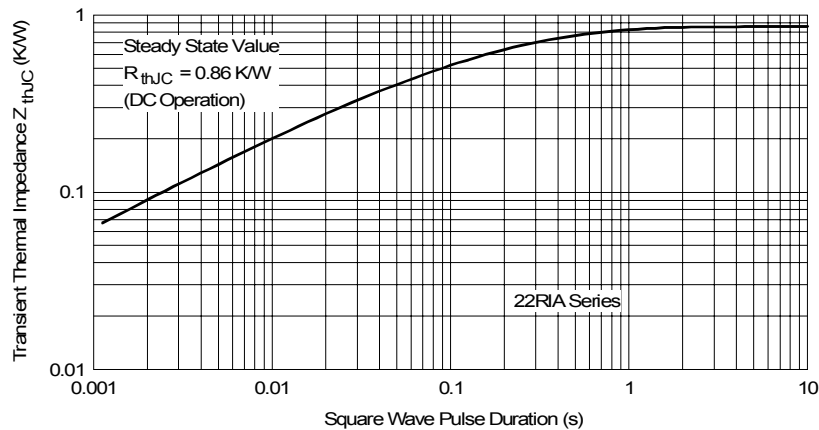


Fig. 15 - Thermal Impedance Z_{thJC} Characteristics

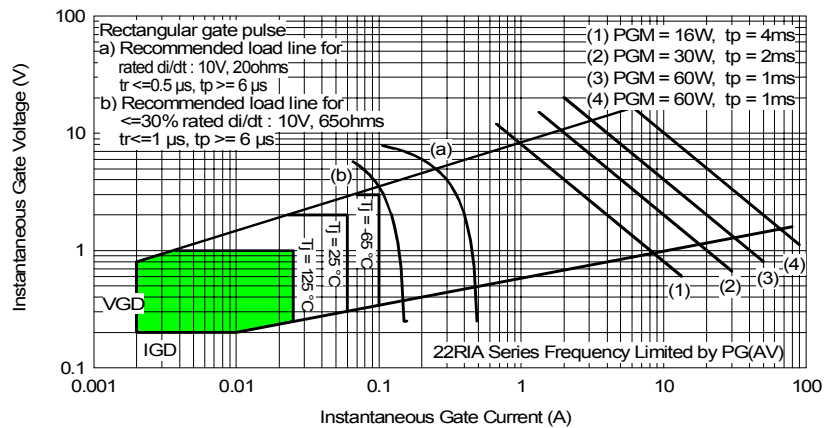


Fig. 16 - Gate Characteristics