

## Medium Power Thyristors (Stud Version), 22 A



TO-208AA (TO-48)

### 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 1200 V  $V_{DRM}/V_{RRM}$
- RoHS compliant
- Designed and qualified for industrial and consumer level



### PRODUCT SUMMARY

$I_{T(AV)}$	22 A
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### 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

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		22	A
	$T_C$	85	°C
$I_{T(RMS)}$		35	A
$I_{TSM}$	50 Hz	400	A
	60 Hz	420	
$I^2t$	50 Hz	793	A <sup>2</sup> s
	60 Hz	724	
$V_{DRM}/V_{RRM}$		100 to 1200	V
$t_q$	Typical	110	μs
$T_J$		- 65 to 125	°C

## ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS				
TYPE NUMBER	VOLTAGE CODE	$V_{DRM}/V_{RRM}$ , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE <sup>(1)</sup> V	$V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK VOLTAGE <sup>(2)</sup> V	$I_{DRM}/I_{RRM}$ MAXIMUM AT $T_J = T_J$ MAXIMUM mA
22RIA	10	100	150	10
	20	200	300	
	40	400	500	
	60	600	700	
	80	800	900	
	100	1000	1100	
	120	1200	1300	

### Notes

<sup>(1)</sup> Units may be broken over non-repetitively in the off-state direction without damage, if  $di/dt$  does not exceed 20 A/ $\mu$ s

<sup>(2)</sup> For voltage pulses with  $t_p \leq 5$  ms

ABSOLUTE MAXIMUM RATINGS						
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS	
Maximum average on-state current at case temperature	$I_{T(AV)}$	180° sinusoidal conduction		22	A	
				85	°C	
Maximum RMS on-state current	$I_{T(RMS)}$			35	A	
Maximum peak, one-cycle non-repetitive surge current	$I_{TSM}$	t = 10 ms	No voltage reappplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	400	A
		t = 8.3 ms			420	
		t = 10 ms	100 % $V_{RRM}$ reappplied		335	
		t = 8.3 ms			355	
Maximum $I^2t$ for fusing	$I^2t$	t = 10 ms	No voltage reappplied		793	$A^2s$
		t = 8.3 ms			724	
		t = 10 ms	100 % $V_{RRM}$ reappplied		560	
		t = 8.3 ms			515	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reappplied, $T_J = T_J$ maximum		7930	$A^2\sqrt{s}$	
Low level value of threshold voltage	$V_{T(TO)1}$	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		0.83	V	
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		0.95		
Low level value of on-state slope resistance	$r_{t1}$	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		14.9	m $\Omega$	
High level value of on-state slope resistance	$r_{t2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		13.4		
Maximum on-state voltage	$V_{TM}$	$I_{pk} = 70$ A, $T_J = 25$ °C		1.70	V	
Maximum holding current	$I_H$	$T_J = 25$ °C, anode supply 6 V, resistive load		130	mA	
Latching current	$I_L$			200		



SWITCHING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum rate of rise of turned-on current	di/dt	T <sub>J</sub> = T <sub>J</sub> maximum, V <sub>DM</sub> = Rated V <sub>DRM</sub> Gate pulse = 20 V, 15 Ω, t <sub>p</sub> = 6 μs, t <sub>r</sub> = 0.1 μs maximum I <sub>TM</sub> = (2 x rated di/dt) A	200	A/μs
			180	
			160	
			150	
Typical turn-on time	t <sub>gt</sub>	T <sub>J</sub> = 25 °C, at rated V <sub>DRM</sub> /V <sub>RRM</sub> , T <sub>J</sub> = 125 °C	0.9	μs
Typical reverse recovery time	t <sub>rr</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, I <sub>TM</sub> = I <sub>T(AV)</sub> , t <sub>p</sub> > 200 μs, di/dt = - 10 A/μs	4	
Typical turn-off time	t <sub>q</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, I <sub>TM</sub> = I <sub>T(AV)</sub> , t <sub>p</sub> > 200 μs, V <sub>R</sub> = 100 V, di/dt = - 10 A/μs, dV/dt = 20 V/μs linear to 67 % V <sub>DRM</sub> , gate bias 0 V to 100 W	110	

**Note**

- t<sub>q</sub> = 10 μs up to 600 V, t<sub>q</sub> = 30 μs up to 1600 V available on special request

BLOCKING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum critical rate of rise of off-state voltage	dV/dt	T <sub>J</sub> = T <sub>J</sub> maximum linear to 100 % rated V <sub>DRM</sub>	100	V/μs
		T <sub>J</sub> = T <sub>J</sub> maximum linear to 67 % rated V <sub>DRM</sub>	300 <sup>(1)</sup>	

**Note**

- <sup>(1)</sup> Available with: dV/dt = 1000 V/μs, to complete code add S90 i.e. 22RIA120S90

TRIGGERING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum peak gate power	P <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum	8.0	W
Maximum average gate power	P <sub>G(AV)</sub>		2.0	
Maximum peak positive gate current	I <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum	1.5	A
Maximum peak negative gate voltage	-V <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum	10	V
DC gate current required to trigger	I <sub>GT</sub>	T <sub>J</sub> = - 65 °C	90	mA
		T <sub>J</sub> = 25 °C	60	
		T <sub>J</sub> = 125 °C	35	
DC gate voltage required to trigger	V <sub>GT</sub>	T <sub>J</sub> = - 65 °C	3.0	V
		T <sub>J</sub> = 25 °C	2.0	
		T <sub>J</sub> = 125 °C	1.0	
DC gate current not to trigger	I <sub>GD</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, V <sub>DRM</sub> = Rated value	2.0	mA
DC gate voltage not to trigger	V <sub>GD</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, V <sub>DRM</sub> = Rated value	0.2	V

THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS	
Maximum operating junction and storage temperature range	$T_J, T_{Stg}$		- 65 to 125	°C	
Maximum thermal resistance, junction to case	$R_{thJC}$	DC operation	0.86	K/W	
Maximum thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, smooth, flat and greased	0.35		
			<b>TO NUT</b>	<b>TO DEVICE</b>	
Mounting torque		Lubricated threads (Non-lubricated threads)	20 (27.5)	25	lbf · in
			0.23 (0.32)	0.29	kgf · m
			2.3 (3.1)	2.8	N · m
Approximate weight			14		g
			0.49		oz.
Case style		See dimensions - link at the end of datasheet	TO-208AA (TO-48)		

$\Delta R_{thJC}$ CONDUCTION				
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	UNITS
180°	0.21	0.15	$T_J = T_J$ maximum	K/W
120°	0.25	0.25		
90°	0.31	0.34		
60°	0.45	0.47		
30°	0.76	0.76		

**Note**

- The table above shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC

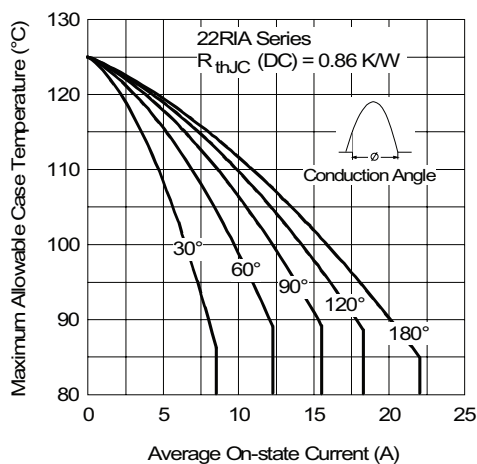


Fig. 1 - Current Ratings Characteristics

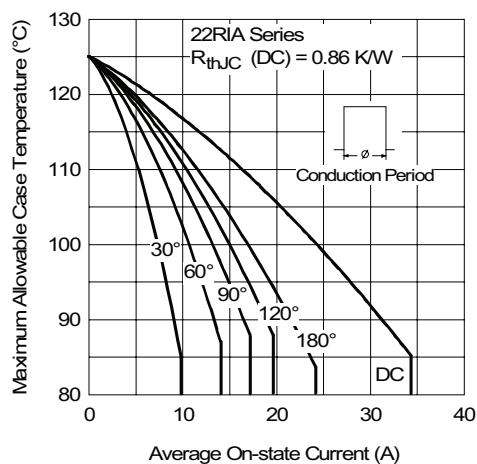


Fig. 2 - Current Ratings Characteristics



Medium Power Thyristors Vishay High Power Products  
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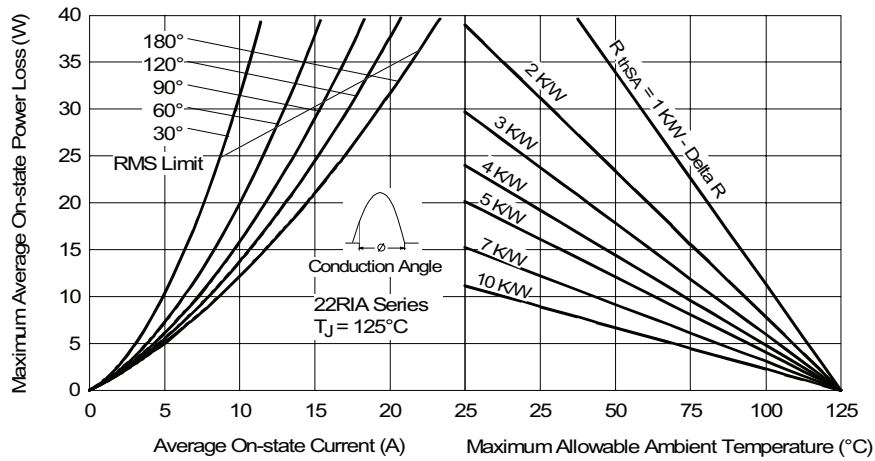


Fig. 3 - On-State Power Loss Characteristics

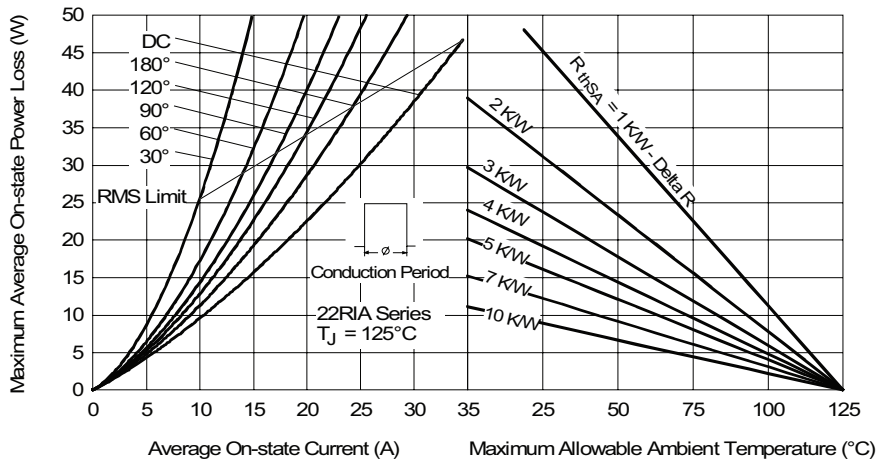


Fig. 4 - On-State Power Loss Characteristics

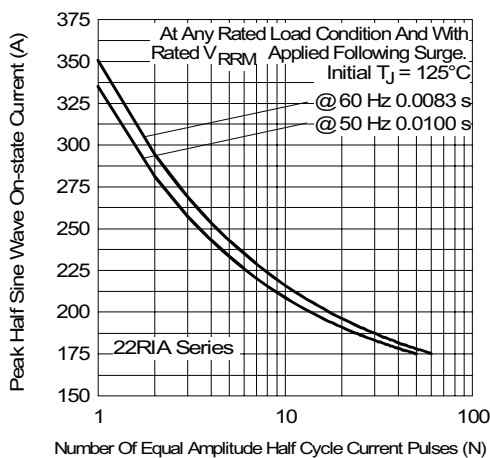


Fig. 5 - Maximum Non-Repetitive Surge Current

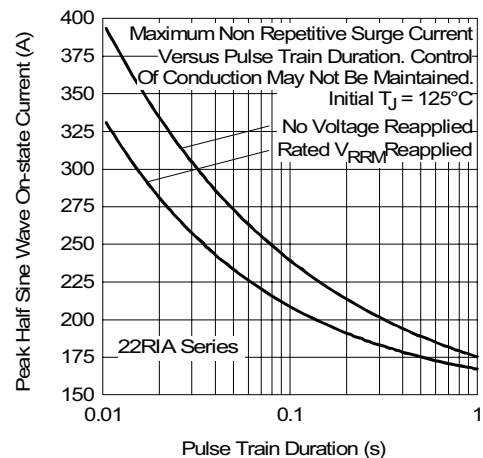


Fig. 6 - Maximum Non-Repetitive Surge Current

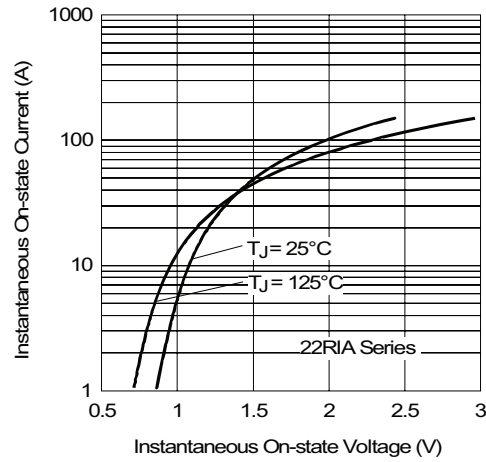


Fig. 7 - Forward Voltage Drop Characteristics

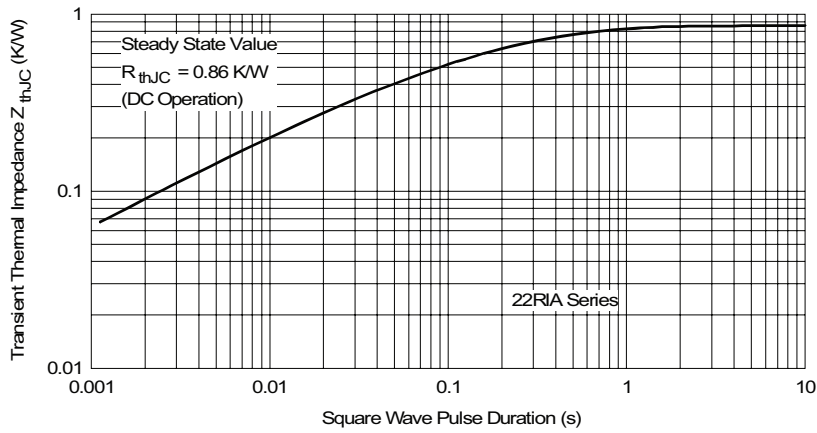


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

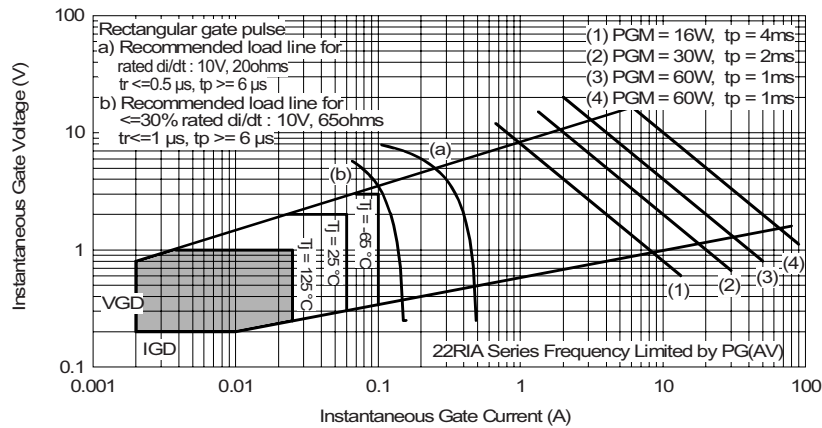
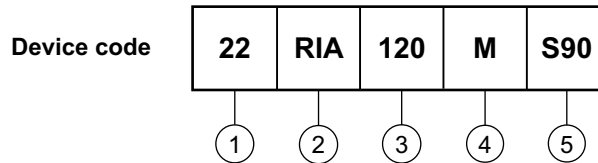


Fig. 9 - Gate Characteristics



### ORDERING INFORMATION TABLE



- 1** - Current code
- 2** - Essential part number
- 3** - Voltage code x 10 =  $V_{RRM}$  (see Voltage Ratings 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 = 300 V/ $\mu$ s (standard value)  
S90 = 1000 V/ $\mu$ s (special selection)

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95333">http://www.vishay.com/doc?95333</a>



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