

## Medium Power Thyristors (Stud Version), 25 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

$I_{T(AV)}$	25 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
$I_{T(AV)}$		25	A
	$T_C$	85	°C
$I_{T(RMS)}$		40	A
$I_{TSM}$	50 Hz	420	A
	60 Hz	440	
$I^2t$	50 Hz	867	A <sup>2</sup> s
	60 Hz	790	
$V_{DRM}/V_{RRM}$		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
25RIA	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		25	A	
				85	°C	
Maximum RMS on-state current	$I_{T(RMS)}$			40	A	
Maximum peak, one-cycle non-repetitive surge current	$I_{TSM}$	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	A	
		t = 8.3 ms	100 % $V_{RRM}$ reapplied			440
		t = 10 ms				350
		t = 8.3 ms	370			
Maximum $I^2t$ for fusing	$I^2t$	t = 10 ms	No voltage reapplied		A <sup>2</sup> s	
		t = 8.3 ms	100 % $V_{RRM}$ reapplied			867
		t = 10 ms				790
		t = 8.3 ms	615			
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied, $T_J = T_J$ maximum		8670	A <sup>2</sup> $\sqrt{s}$	
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		0.99	V	
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		1.40		
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		10.1	m $\Omega$	
High level value of on-state slope resistance	$r_{t2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		5.7		
Maximum on-state voltage	$V_{TM}$	$I_{pk} = 79$ 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	V <sub>DRM</sub> ≤ 600 V	200	A/μs
			V <sub>DRM</sub> ≤ 800 V	180	
			V <sub>DRM</sub> ≤ 1000 V	160	
			V <sub>DRM</sub> ≤ 1600 V	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. 25RIA120S90

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	Maximum required gate trigger current/voltage are the lowest value which will trigger all units 6 V anode to cathode applied	mA	
		T <sub>J</sub> = 25 °C			90
		T <sub>J</sub> = 125 °C			60
DC gate voltage required to trigger	V <sub>GT</sub>	T <sub>J</sub> = - 65 °C		V	
		T <sub>J</sub> = 25 °C			35
		T <sub>J</sub> = 125 °C			3.0
DC gate current not to trigger	I <sub>GD</sub>	T <sub>J</sub> = - 65 °C			
		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	0.75	K/W
Maximum thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, smooth, flat and greased	0.35	
Allowable mounting torque		Non-lubricated threads	3.4 + 0 - 10 % (30)	N · m (lbf · in)
		Lubricated threads	23 + 0 - 10 % (20)	
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°	0.17	0.13	$T_J = T_J$ maximum	K/W
120°	0.21	0.22		
90°	0.27	0.30		
60°	0.40	0.42		
30°	0.69	0.70		

**Note**

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

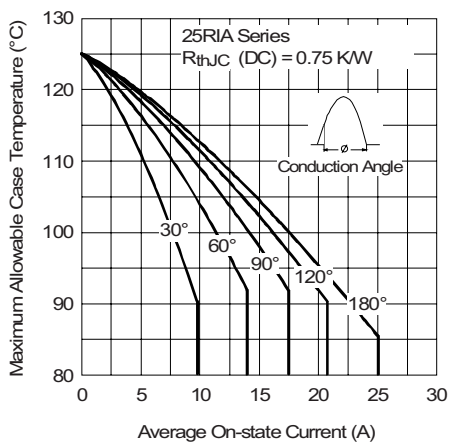


Fig. 1 - Current Ratings Characteristics

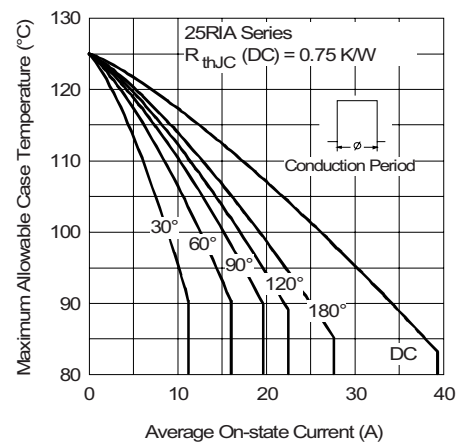


Fig. 2 - Current Ratings Characteristics

## Medium Power Thyristors Vishay High Power Products (Stud Version), 25 A

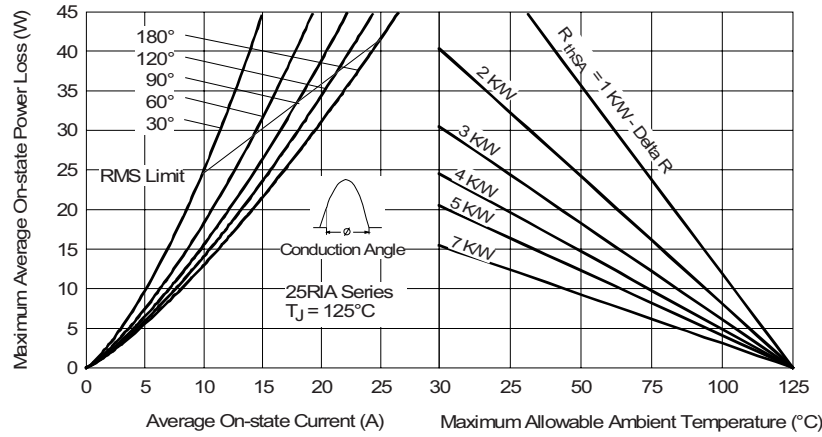


Fig. 3 - On-State Power Loss Characteristics

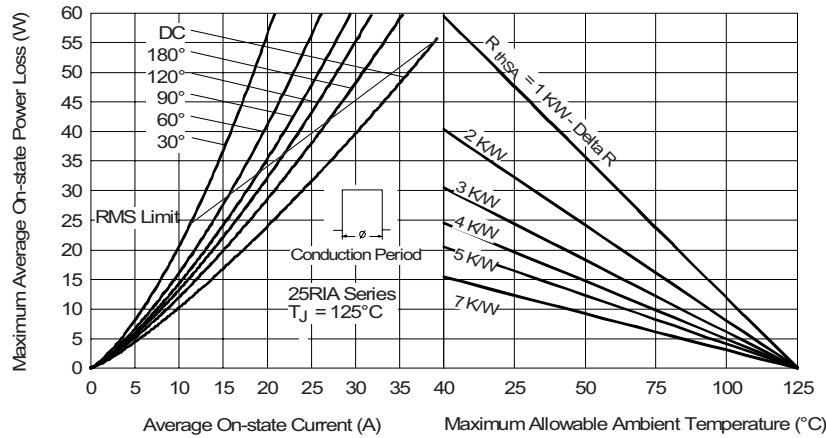


Fig. 4 - On-State Power Loss Characteristics

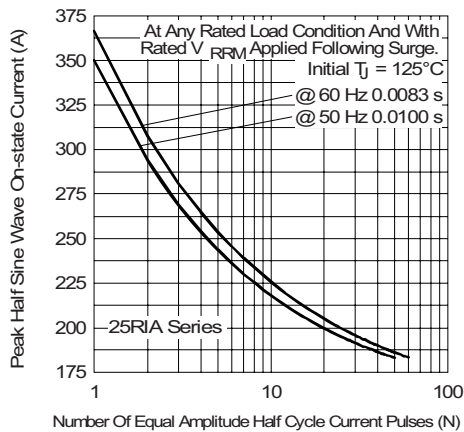


Fig. 5 - Maximum Non-Repetitive Surge Current

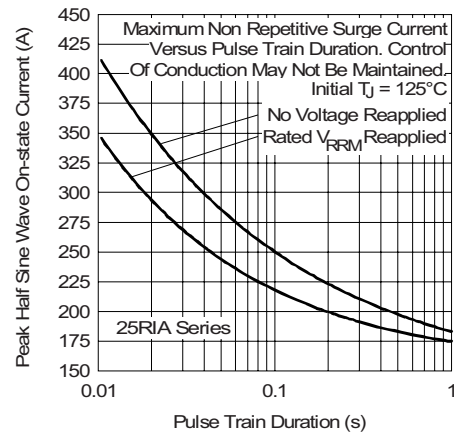


Fig. 6 - Maximum Non-Repetitive Surge Current

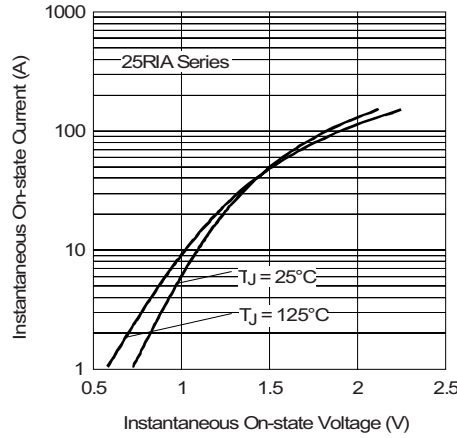


Fig. 7 - Forward Voltage Drop Characteristics

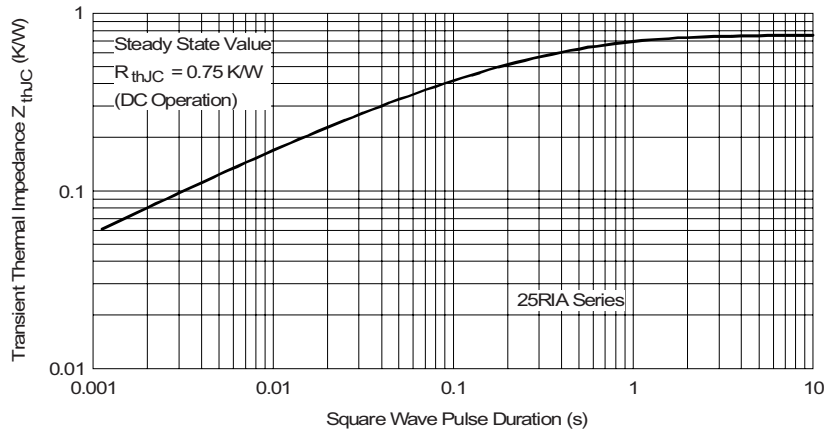


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

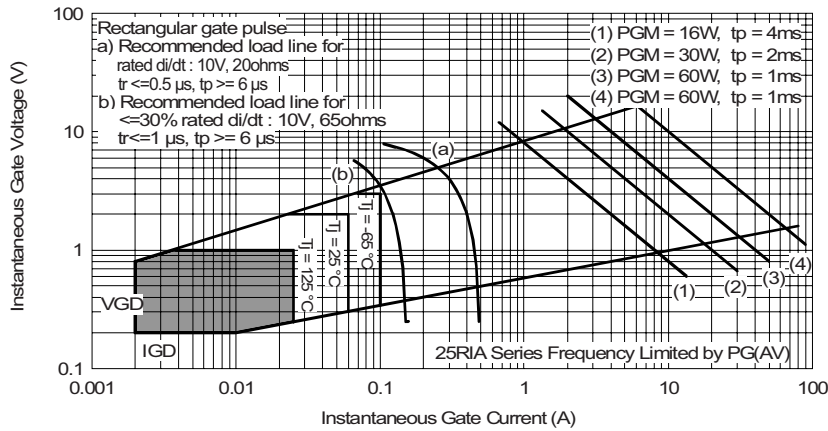


Fig. 9 - Gate Characteristics



### ORDERING INFORMATION TABLE

Device code	<b>25</b>	<b>RIA</b>	<b>120</b>	<b>M</b>	<b>S90</b>
	①	②	③	④	⑤

- 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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### TO-208AA (TO-48)

**DIMENSIONS** in millimeters (inches)

