

## Medium Power Phase Control Thyristors (Stud Version), 10 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  $V_{DRM}/V_{RRM}$
- Designed and qualified for industrial and consumer level
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT

### TYPICAL APPLICATIONS

- Medium power switching
- Phase control applications

PRODUCT SUMMARY	
Package	TO-208AA (TO-48)
Diode variation	Single SCR
$I_{T(AV)}$	10 A
$V_{DRM}/V_{RRM}$	100 V, 200 V, 400 V, 600 V, 800 V, 1000V, 1200 V
$V_{TM}$	1.75 V
$I_{GT}$	60 mA
$T_J$	-65 °C to +125 °C

MAJOR RATINGS AND CHARACTERISTICS			
PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		10	A
	$T_C$	85	°C
$I_{T(RMS)}$		25	A
$I_{TSM}$	50 Hz	225	A
	60 Hz	240	
$I^2t$	50 Hz	255	A <sup>2</sup> s
	60 Hz	233	
$V_{DRM}/V_{RRM}$		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
VS-10RIA	10	100	150	20
	20	200	300	10
	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/μs  
<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 <sub>T(AV)</sub>	180° conduction, half sine wave			10	A
					85	°C
Maximum RMS on-state current	I <sub>T(RMS)</sub>				25	A
Maximum peak, one-cycle non-repetitive surge current	I <sub>TSM</sub>	t = 10 ms	No voltage reappplied	Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J</sub> maximum	225	A
		t = 8.3 ms			240	
		t = 10 ms	100 % V <sub>RRM</sub> reappplied		190	
		t = 8.3 ms			200	
Maximum I <sup>2</sup> t for fusing	I <sup>2</sup> t	t = 10 ms	No voltage reappplied		255	A <sup>2</sup> s
		t = 8.3 ms			233	
		t = 10 ms	100 % V <sub>RRM</sub> reappplied		180	
		t = 8.3 ms			165	
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t	t = 0.1 to 10 ms, no voltage reappplied			2550	A <sup>2</sup> √s
Low level value of threshold voltage	V <sub>T(TO)1</sub>	(16.7 % × π × I <sub>T(AV)</sub> < I < π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum			1.10	V
High level value of threshold voltage	V <sub>T(TO)2</sub>	(I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum			1.39	
Low level value of on-state slope resistance	r <sub>t1</sub>	(16.7 % × π × I <sub>T(AV)</sub> < I < π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum			24.3	mΩ
High level value of on-state slope resistance	r <sub>t2</sub>	(I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum			16.7	
Maximum on-state voltage	V <sub>TM</sub>	I <sub>pk</sub> = 32 A, T <sub>J</sub> = 25 °C, t <sub>p</sub> = 10 ms sine pulse			1.75	V
Maximum holding current	I <sub>H</sub>	T <sub>J</sub> = 25 °C, anode supply 12 V resistive load			130	mA
Typical latching current	I <sub>L</sub>				200	

SWITCHING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum rate of rise of turned-on current	$dl_F/dt$	$T_J = T_J$ maximum, $V_{DM} = \text{Rated } V_{DRM}$ Gate pulse = 20 V, 15 Ω, $t_p = 6$ μs, $t_r = 0.1$ μs maximum $I_{TM} = (2 \times \text{rated } dl_F/dt)$ A	200	A/μs
			180	
			160	
			150	
Typical turn-on time	$t_{gt}$	$T_J = 25$ °C, at rated $V_{DRM}/V_{RRM}$ , $T_J = 125$ °C	0.9	μs
Typical reverse recovery time	$t_{rr}$	$T_J = T_J$ maximum, $I_{TM} = I_{T(AV)}$ , $t_p > 200$ μs, $dl_F/dt = -10$ A/μs	4	
Typical turn-off time	$t_q$	$T_J = T_J$ maximum, $I_{TM} = I_{T(AV)}$ , $t_p > 200$ μs, $V_R = 100$ V, $dl_F/dt = -10$ A/μs, $dV/dt = 20$ V/μs linear to 67 % $V_{DRM}$ , gate bias 0 V to 100 V	110	

**Note**

- $t_q = 10$  μs up to 600 V,  $t_q = 30$  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	$dV/dt$	$T_J = T_J$ maximum linear to 100 % rated $V_{DRM}$	100	V/μs
		$T_J = T_J$ maximum linear to 67 % rated $V_{DRM}$	300 <sup>(1)</sup>	

**Note**

- <sup>(1)</sup> Available with:  $dV/dt = 1000$  V/μs, to complete code add S90 i.e. 10RIA120S90



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	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	Maximum gate current/voltage not to trigger is the maximum value which will not trigger any unit with rated V <sub>DRM</sub> anode to cathode applied	0.2	V

THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES		UNITS
Maximum operating junction and storage temperature range	T <sub>J</sub> , T <sub>Stg</sub>		-65 to +125		°C
Maximum thermal resistance, junction to case	R <sub>thJC</sub>	DC operation	1.85		K/W
Maximum thermal resistance, case to heat sink	R <sub>thCS</sub>	Mounting surface, smooth, flat and greased	0.35		
			TO NUT	TO DEVICE	
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°	0.44	0.32	$T_J = T_J$ maximum	K/W
120°	0.53	0.56		
90°	0.68	0.75		
60°	1.01	1.05		
30°	1.71	1.73		

**Note**

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

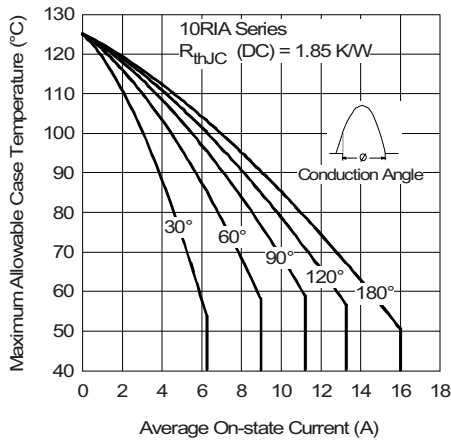


Fig. 1 - Current Ratings Characteristics

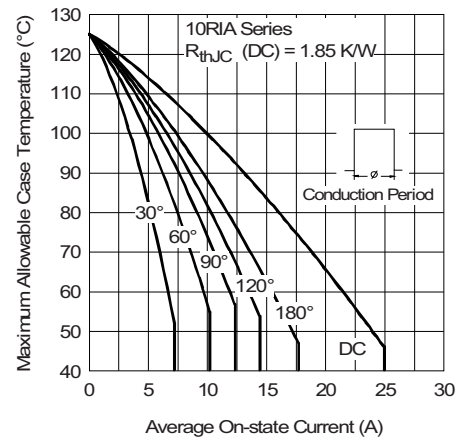


Fig. 2 - Current Ratings Characteristics

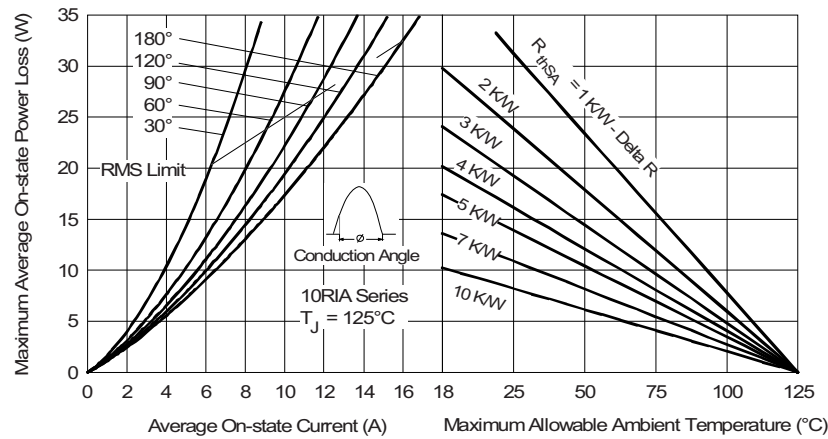


Fig. 3 - On-State Power Loss Characteristics

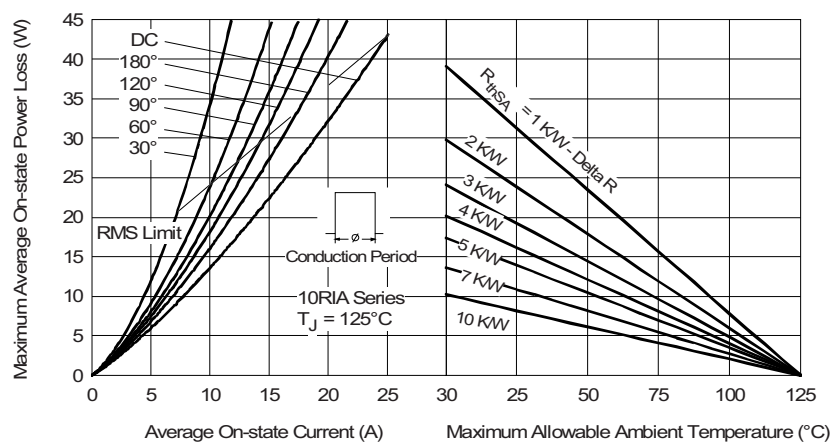


Fig. 4 - On-State Power Loss Characteristics

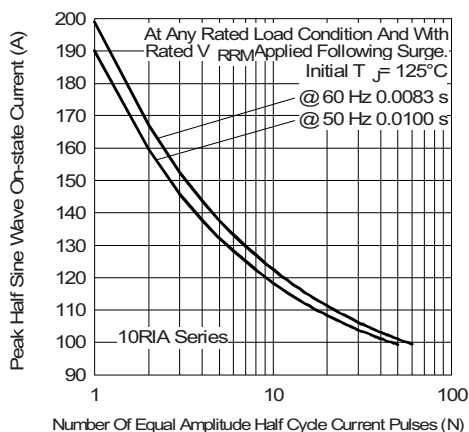


Fig. 5 - Maximum Non-Repetitive Surge Current

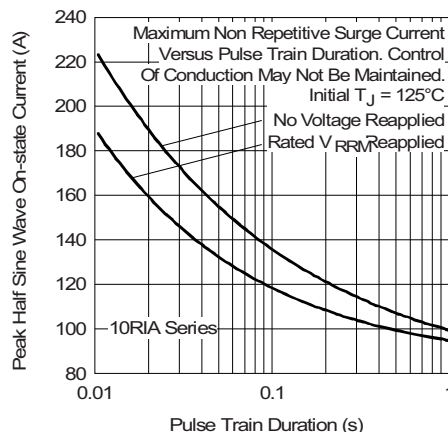


Fig. 6 - Maximum Non-Repetitive Surge Current

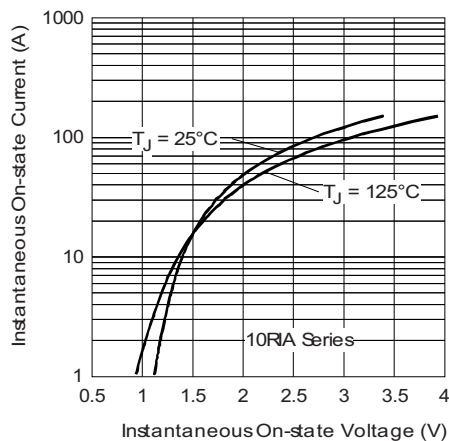


Fig. 7 - Forward Voltage Drop Characteristics

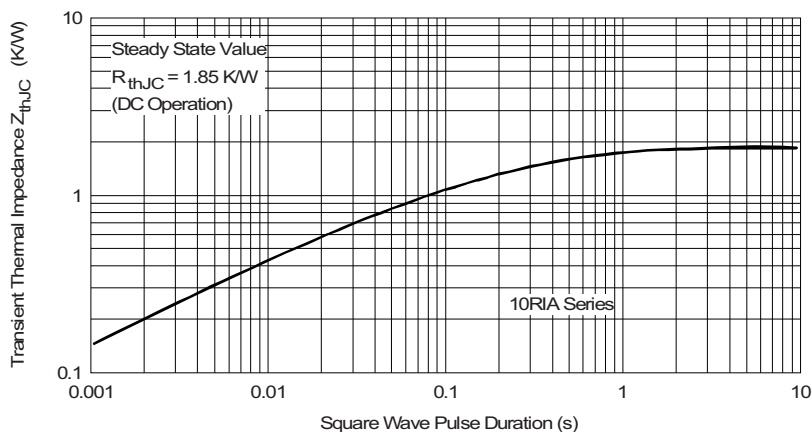


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

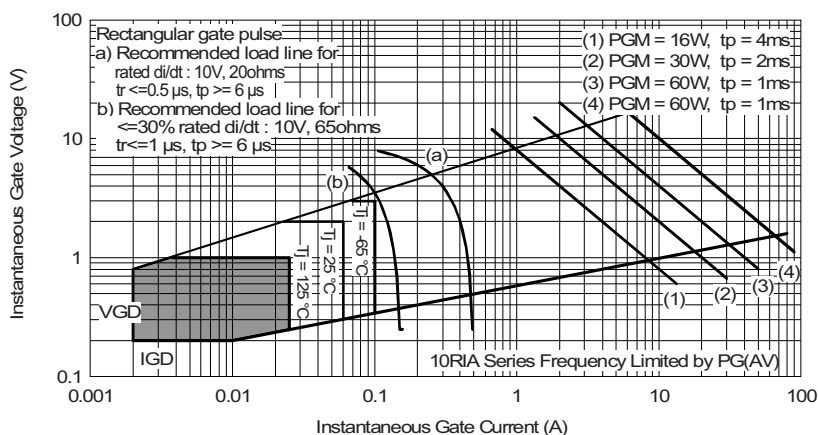


Fig. 9 - Gate Characteristics

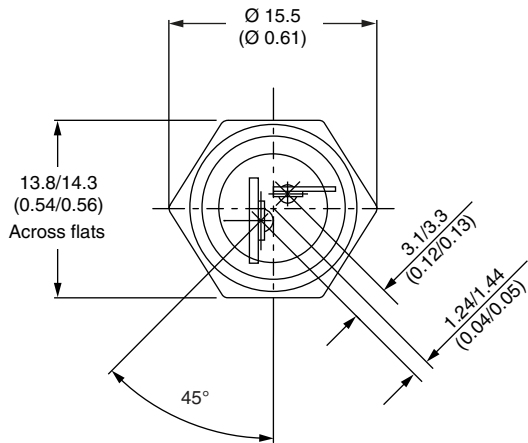
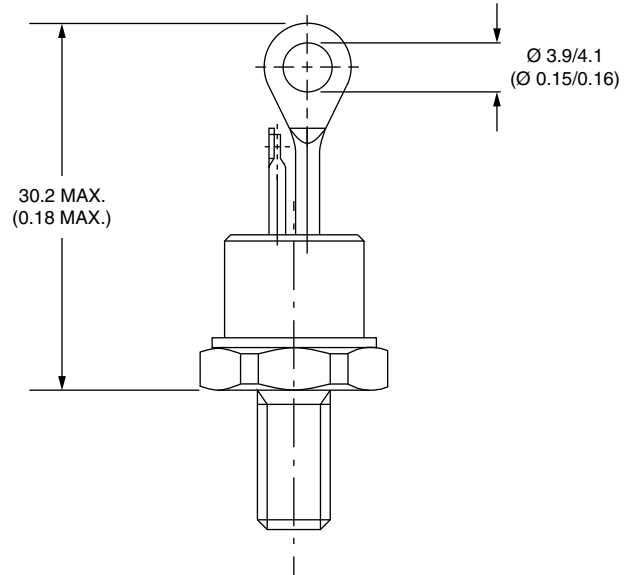
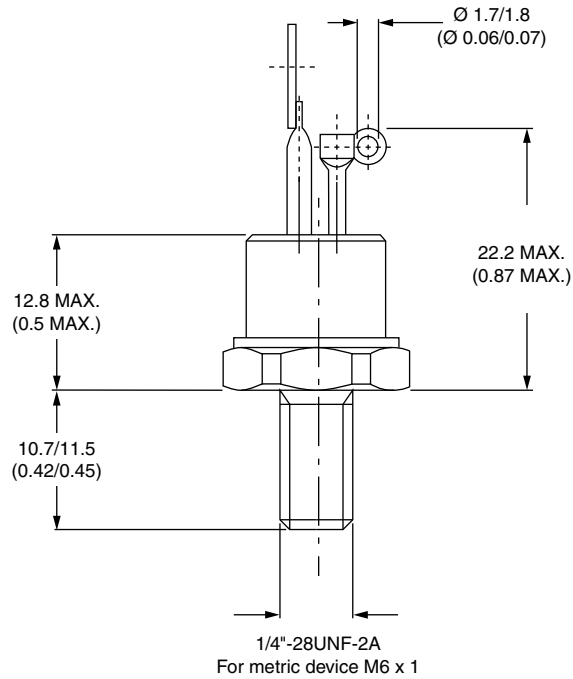
## ORDERING INFORMATION TABLE

Device code	VS-	10	RIA	120	M	S90
	1	2	3	4	5	6
1	Vishay Semiconductors product					
2	Current code					
3	Essential part number					
4	Voltage code x 10 = $V_{RRM}$ (see Voltage Ratings table)					
5	None = Stud base TO-208AA (TO-48) 1/4" 28UNF-2A M = Stud base TO-208AA (TO-48) M6 x 1					
6	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">www.vishay.com/doc?95333</a>

## TO-208AA (TO-48)

**DIMENSIONS** in millimeters (inches)





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