

Medium Power Phase Control 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}
- Designed and qualified for industrial and consumer level
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT

PRODUCT SUMMARY

Package	TO-208AA (TO-48)
Diode variation	Single SCR
$I_{T(AV)}$	22 A
V_{DRM}/V_{RRM}	100 V to 1200 V
V_{TM}	1.70 V
I_{GT}	60 mA
T_J	-65 °C to 125 °C

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

Notes

- ⁽¹⁾ Units may be broken over non-repetitively in the off-state direction without damage, if di/dt does not exceed 20 A/μs
- ⁽²⁾ 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 reapplied	Sinusoidal half wave, initial T _J = T _J maximum	400	A	
		t = 8.3 ms			420		
		t = 10 ms	100 % V _{RRM} reapplied		335		
		t = 8.3 ms			355		
Maximum I ² t for fusing	I ² t	t = 10 ms	No voltage reapplied		793	A ² s	
		t = 8.3 ms			724		
		t = 10 ms	100 % V _{RRM} reapplied		560		
		t = 8.3 ms			515		
Maximum I ² √t for fusing	I ² √t	t = 0.1 to 10 ms, no voltage reapplied, T _J = T _J maximum			7930	A ² √s	
Low level value of threshold voltage	V _{T(TO)1}	(16.7 % x π x I _{T(AV)}) < I < π x I _{T(AV)} , T _J = T _J maximum			0.83	V	
High level value of threshold voltage	V _{T(TO)2}	(I > π x I _{T(AV)}), T _J = T _J maximum			0.95		
Low level value of on-state slope resistance	r _{t1}	(16.7 % x π x I _{T(AV)}) < I < π x I _{T(AV)} , T _J = T _J maximum			14.9	mΩ	
High level value of on-state slope resistance	r _{t2}	(I > π x 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	$T_J = T_J$ maximum, $V_{DM} = \text{Rated } V_{DRM}$ Gate pulse = 20 V, 15 Ω , $t_p = 6\text{ }\mu s$, $t_r = 0.1\text{ }\mu s$ maximum $I_{TM} = (2 \times \text{rated } dI/dt)\text{ A}$	200	A/ μs
			180	
			160	
			150	
Typical turn-on time	t_{gt}	$T_J = 25\text{ °C}$, at rated V_{DRM}/V_{RRM} , $T_J = 125\text{ °C}$	0.9	μs
Typical reverse recovery time	t_{rr}	$T_J = T_J$ maximum, $I_{TM} = I_{T(AV)}$, $t_p > 200\text{ }\mu s$, $dI/dt = -10\text{ A}/\mu s$	4	
Typical turn-off time	t_q	$T_J = T_J$ maximum, $I_{TM} = I_{T(AV)}$, $t_p > 200\text{ }\mu s$, $V_R = 100\text{ V}$, $dI/dt = -10\text{ A}/\mu s$, $dV/dt = 20\text{ V}/\mu s$ linear to 67 % V_{DRM} , gate bias 0 V to 100 W	110	

Note

- $t_q = 10\text{ }\mu s$ up to 600 V, $t_q = 30\text{ }\mu s$ 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 ⁽¹⁾	

Note

- ⁽¹⁾ Available with: $dV/dt = 1000\text{ V}/\mu s$, to complete code add S90 i.e. 22RIA120S90



TRIGGERING					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum peak gate power	P _{GM}	T _J = T _J maximum		8.0	W
Maximum average gate power	P _{G(AV)}			2.0	
Maximum peak positive gate current	I _{GM}	T _J = T _J maximum		1.5	A
Maximum peak negative gate voltage	-V _{GM}	T _J = T _J maximum		10	V
DC gate current required to trigger	I _{GT}	T _J = - 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 _J = 25 °C		60	
		T _J = 125 °C		35	
DC gate voltage required to trigger	V _{GT}	T _J = - 65 °C		3.0	V
		T _J = 25 °C		2.0	
		T _J = 125 °C		1.0	
DC gate current not to trigger	I _{GD}	T _J = T _J maximum, V _{DRM} = Rated value		2.0	mA
DC gate voltage not to trigger	V _{GD}	T _J = T _J maximum, V _{DRM} = Rated value	Maximum gate current/voltage not to trigger is the maximum value which will not trigger any unit with rated V _{DRM} 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 _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		
			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)		

ΔR_{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

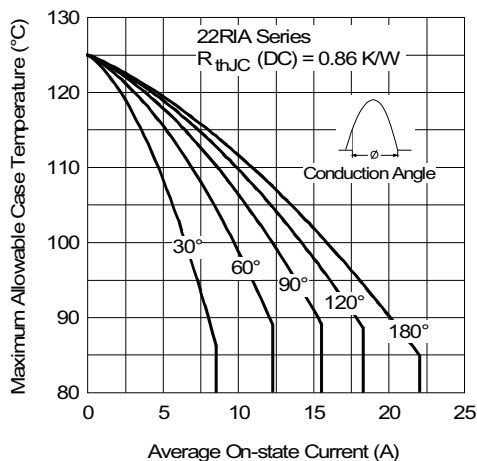


Fig. 1 - Current Ratings Characteristics

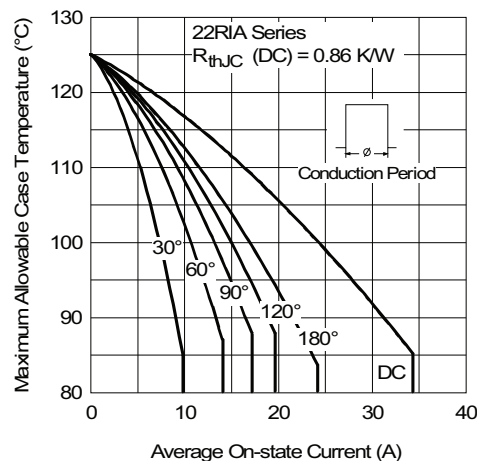


Fig. 1 - Current Ratings Characteristics

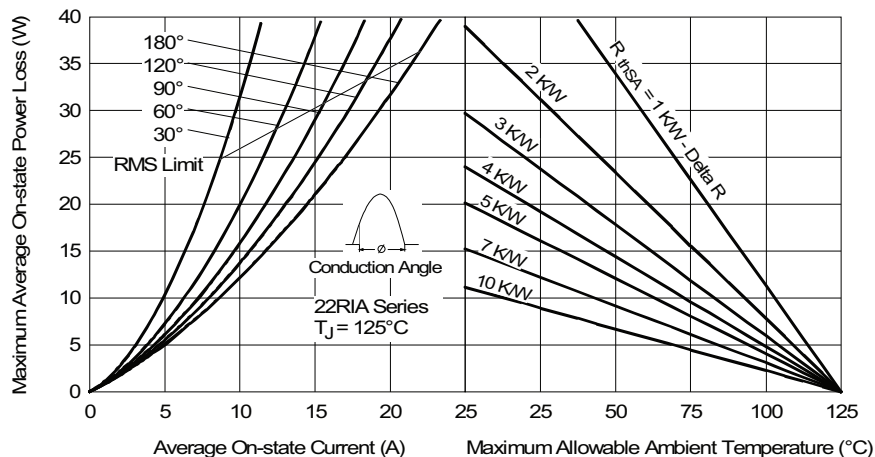


Fig. 2 - On-State Power Loss Characteristics

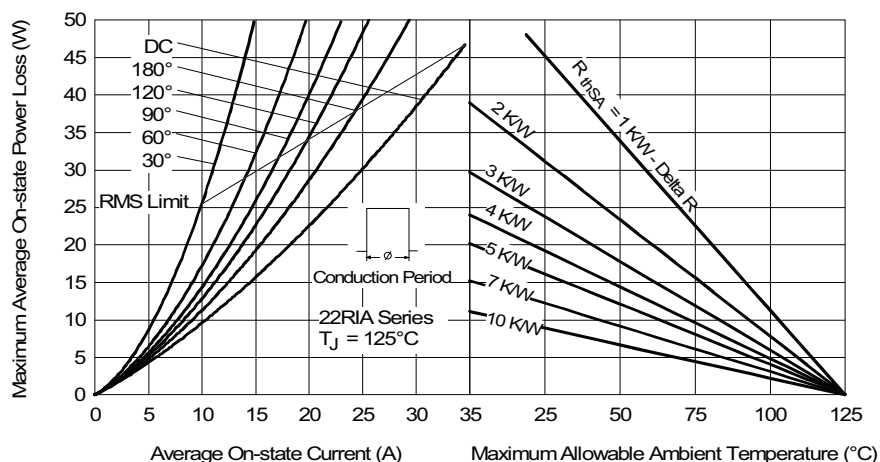


Fig. 3 - On-State Power Loss Characteristics

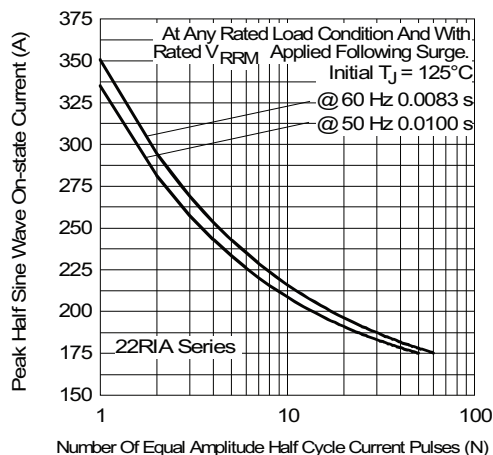


Fig. 4 - Maximum Non-Repetitive Surge Current

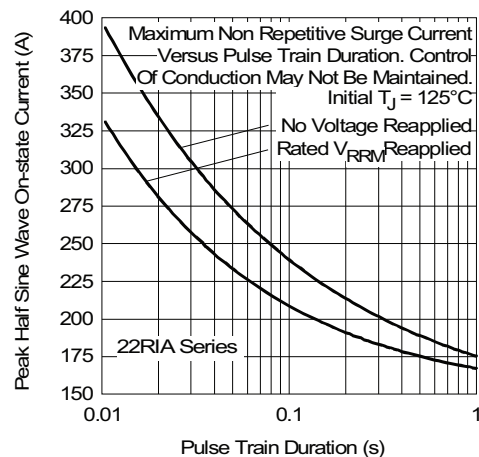


Fig. 5 - Maximum Non-Repetitive Surge Current

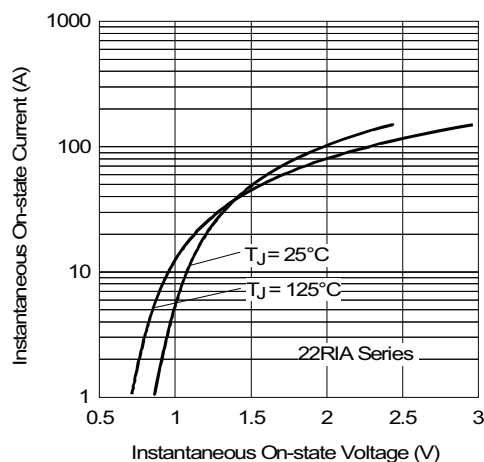


Fig. 6 - Forward Voltage Drop Characteristics

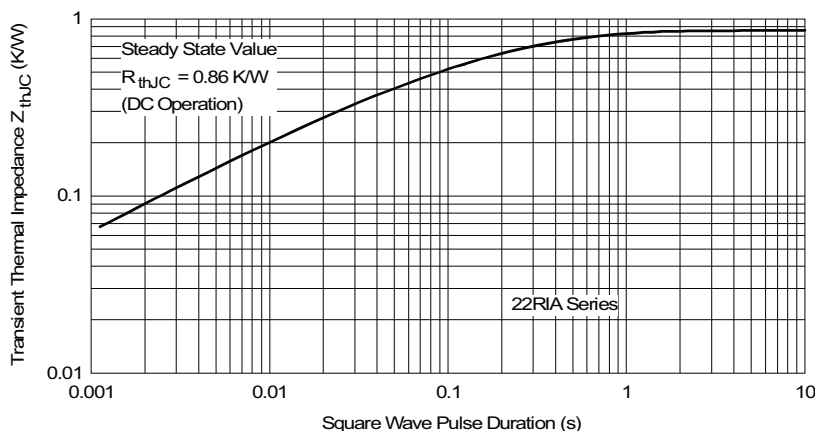


Fig. 7 - Thermal Impedance Z_{thJC} Characteristics

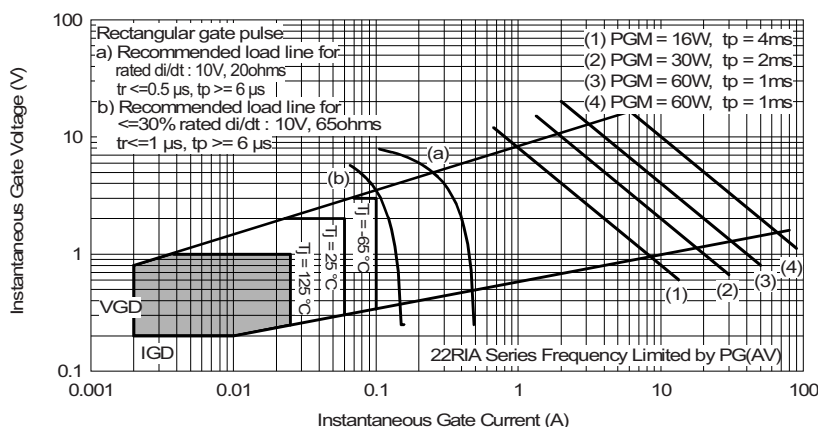


Fig. 8 - Gate Characteristics

ORDERING INFORMATION TABLE

Device code

VS-	22	RIA	120	M	S90
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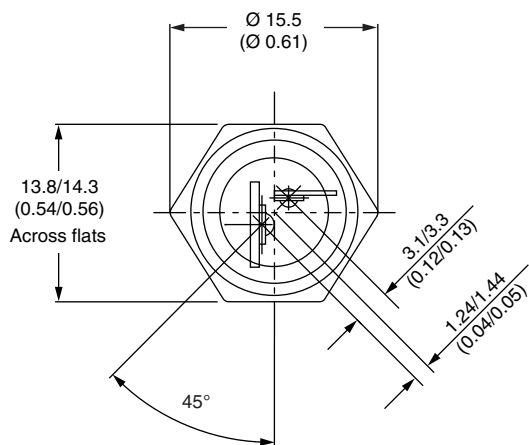
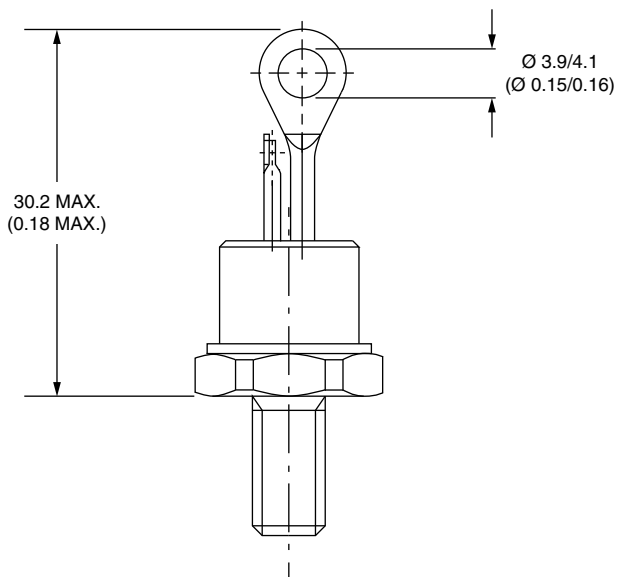
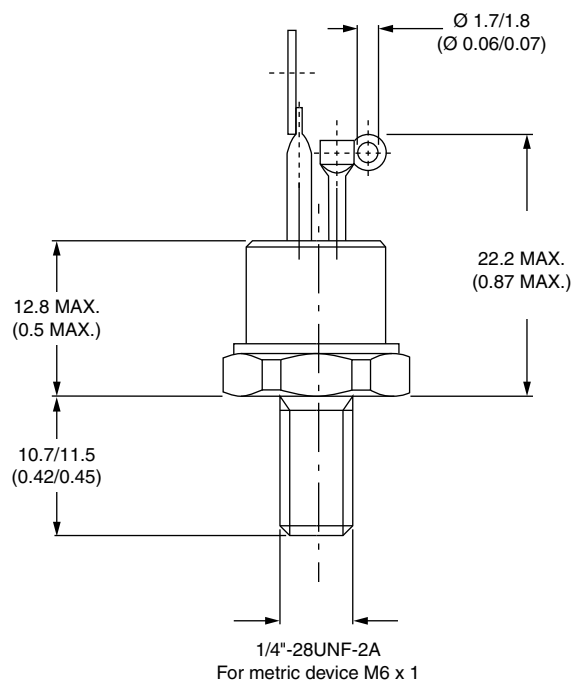
Diagram illustrating the device code structure (VS-22-RIA-120-M-S90) and its corresponding pin numbers (1-6):

- 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/ μ s (standard value)
S90 = 1000 V/ μ s (special selection)

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95333

TO-208AA (TO-48)

DIMENSIONS in millimeters (inches)





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