

Medium Power Phase Control Thyristors (Stud Version), 22 A



TO-48 (TO-208AA)

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



PRIMARY CHARACTERISTICS	
$I_{T(AV)}$	22 A
V_{DRM}/V_{RRM}	100 V, 200 V, 400 V, 600 V, 800 V, 1000 V, 1200 V
V_{TM}	1.70 V
I_{GT}	60 mA
T_J	-65 °C to +125 °C
Package	TO-48 (TO-208AA)
Circuit configuration	Single SCR

TYPICAL APPLICATIONS

- Medium power switching
- Phase control applications

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	
	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	400	A
		t = 8.3 ms		420	
		t = 10 ms	100 % V_{RRM} reapplied	335	
		t = 8.3 ms		355	
Maximum I^2t for fusing	I^2t	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 $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied, $T_J = T_J$ maximum		7930	A ² √s
Low level value of threshold voltage	$V_{T(TO)1}$	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ 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	mΩ
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	$T_J = T_J$ maximum, $V_{DM} = \text{Rated } V_{DRM}$ Gate pulse = 20 V, 15 Ω, $t_p = 6$ μs, $t_r = 0.1$ μs maximum $I_{TM} = (2 \times \text{rated } di/dt)$ A		200	A/μs	
				$V_{DRM} \leq 600$ V		180
				$V_{DRM} \leq 800$ V		160
				$V_{DRM} \leq 1000$ V		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, $di/dt = -10$ 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, $di/dt = -10$ 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 ⁽¹⁾	

Note

- ⁽¹⁾ 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_{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}	$T_J = -65\text{ }^\circ\text{C}$	Maximum required gate trigger current/voltage are the lowest value which will trigger all units 6 V anode to cathode applied	90	mA
		$T_J = 25\text{ }^\circ\text{C}$		60	
		$T_J = 125\text{ }^\circ\text{C}$		35	
DC gate voltage required to trigger	V_{GT}	$T_J = -65\text{ }^\circ\text{C}$		3.0	V
		$T_J = 25\text{ }^\circ\text{C}$		2.0	
		$T_J = 125\text{ }^\circ\text{C}$		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		$^\circ\text{C}$
Maximum thermal resistance, junction to case	R_{thJC}	DC operation	0.86		K/W
Maximum thermal resistance, case to heat sink	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-48 (TO-208AA)		

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

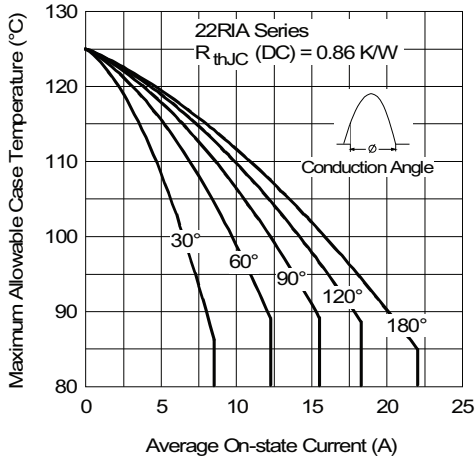


Fig. 1 - Current Ratings Characteristics

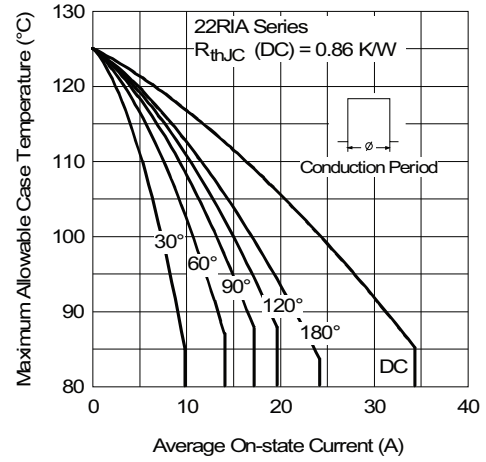


Fig. 1 - Current Ratings Characteristics

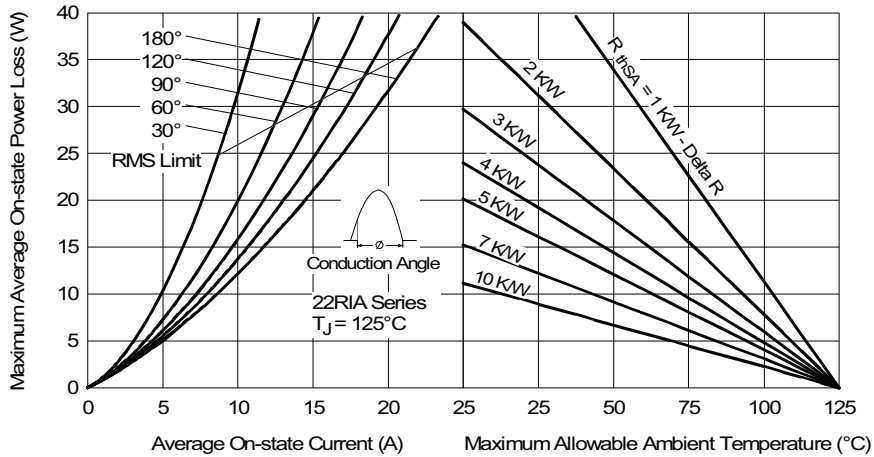


Fig. 2 - On-State Power Loss Characteristics

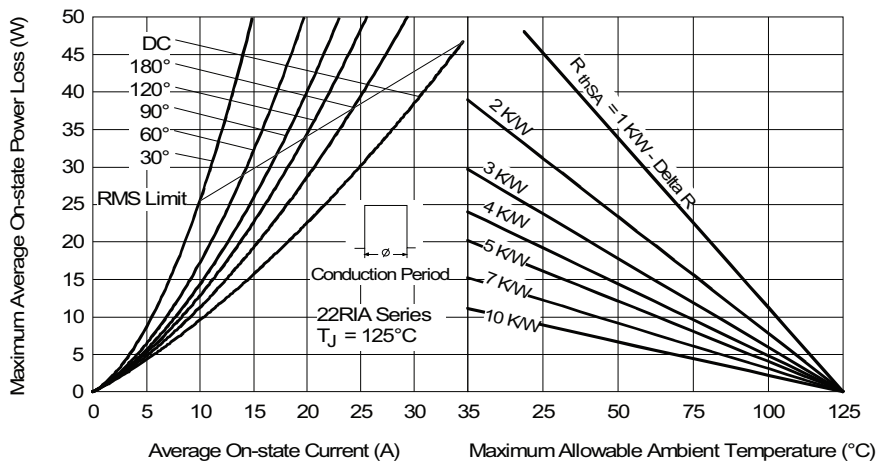


Fig. 3 - On-State Power Loss Characteristics

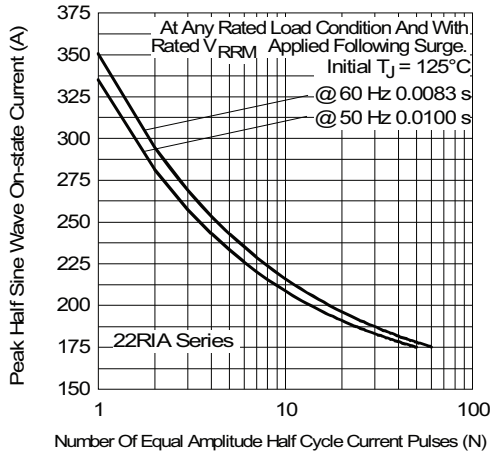


Fig. 4 - Maximum Non-Repetitive Surge Current

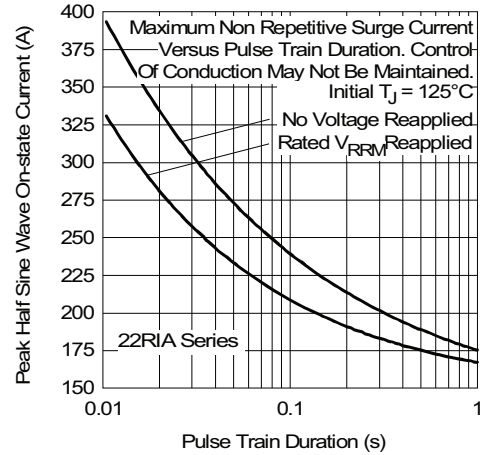


Fig. 5 - Maximum Non-Repetitive Surge Current

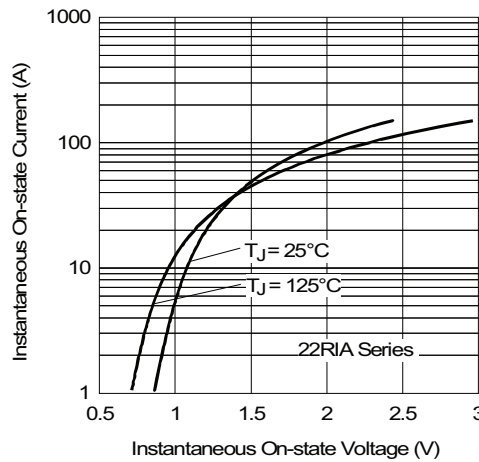


Fig. 6 - Forward Voltage Drop Characteristics

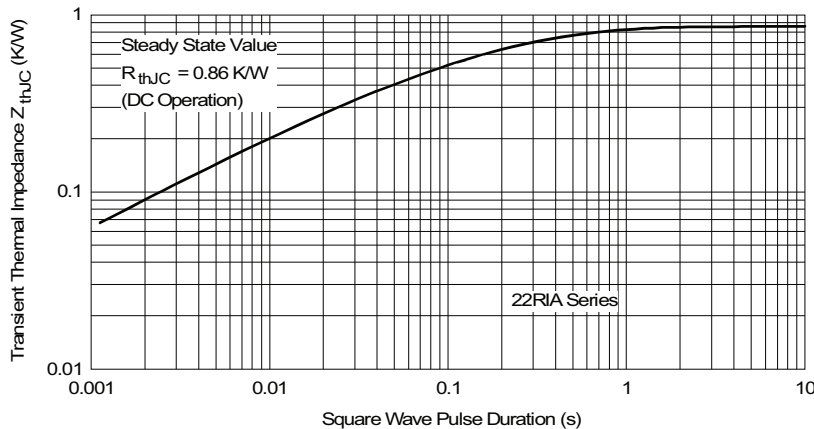


Fig. 7 - Thermal Impedance Z_{thJC} Characteristics



Fig. 8 - Gate Characteristics

ORDERING INFORMATION TABLE

Device code	VS-	22	RIA	120	M	S90
	①	②	③	④	⑤	⑥

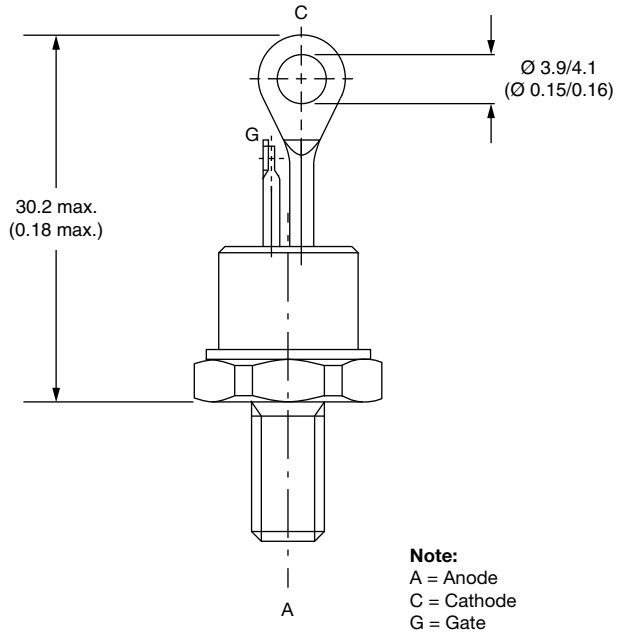
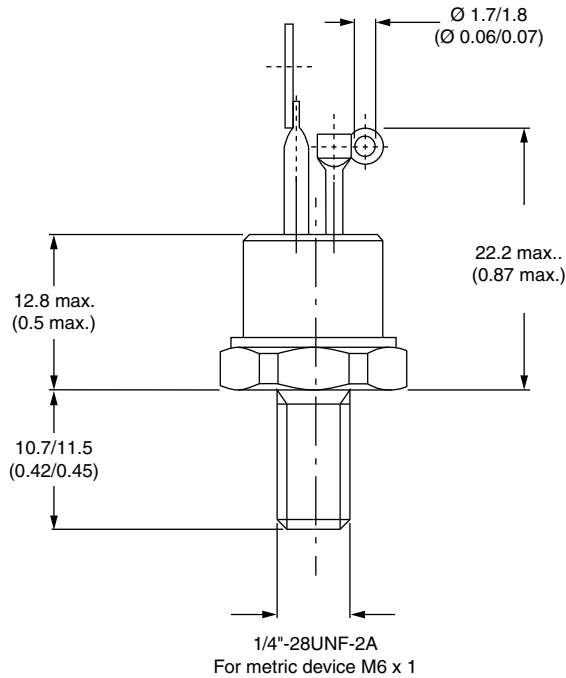
- 1** - Vishay Semiconductors product
- 2** - Current code
- 3** - Essential part number
- 4** - Voltage code x 10 = V_{RRM} (see Voltage Ratings table)
- 5** - None = stud base TO-48 (TO-208AA) 1/4" 28UNF-2A
M = stud base TO-48 (TO-208AA) M6 x 1
- 6** - Critical dV/dt:
None = 300 V/μs (standard value)
S90 = 1000 V/μs (special selection)

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



TO-208AA (TO-48)

DIMENSIONS in millimeters (inches)





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