

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



RoHS
COMPLIANT

TYPICAL APPLICATIONS

- Medium power switching
- Phase control applications

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

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	$V_{DRM} \leq 600\text{ V}$	dl/dt	$T_J = T_J$ maximum, $V_{DM} = \text{Rated } V_{DRM}$ Gate pulse = 20 V, 15 Ω , $t_p = 6\text{ }\mu\text{s}$, $t_r = 0.1\text{ }\mu\text{s}$ maximum $I_{TM} = (2 \times \text{rated dl/dt})\text{ A}$	200	A/ μs
	$V_{DRM} \leq 800\text{ V}$			180	
	$V_{DRM} \leq 1000\text{ V}$			160	
	$V_{DRM} \leq 1600\text{ V}$			150	
Typical turn-on time		t_{gt}	$T_J = 25\text{ }^\circ\text{C}$, at rated V_{DRM}/V_{RRM} , $T_J = 125\text{ }^\circ\text{C}$	0.9	μs
Typical reverse recovery time		t_{rr}	$T_J = T_J$ maximum, $I_{TM} = I_{T(AV)}$, $t_p > 200\text{ }\mu\text{s}$, dl/dt = - 10 A/ μs	4	
Typical turn-off time		t_q	$T_J = T_J$ maximum, $I_{TM} = I_{T(AV)}$, $t_p > 200\text{ }\mu\text{s}$, $V_R = 100\text{ V}$, dl/dt = - 10 A/ μs , dV/dt = 20 V/ μs 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 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

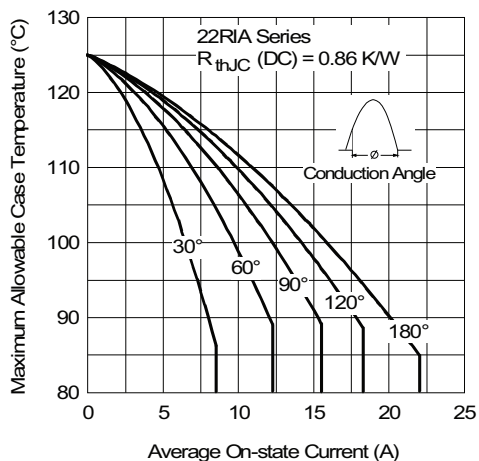


Fig. 1 - Current Ratings Characteristics

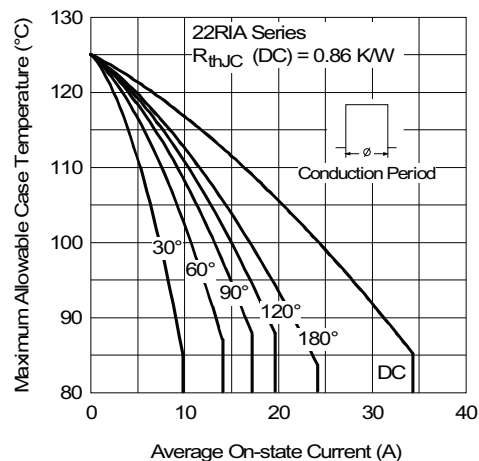


Fig. 1 - Current Ratings Characteristics

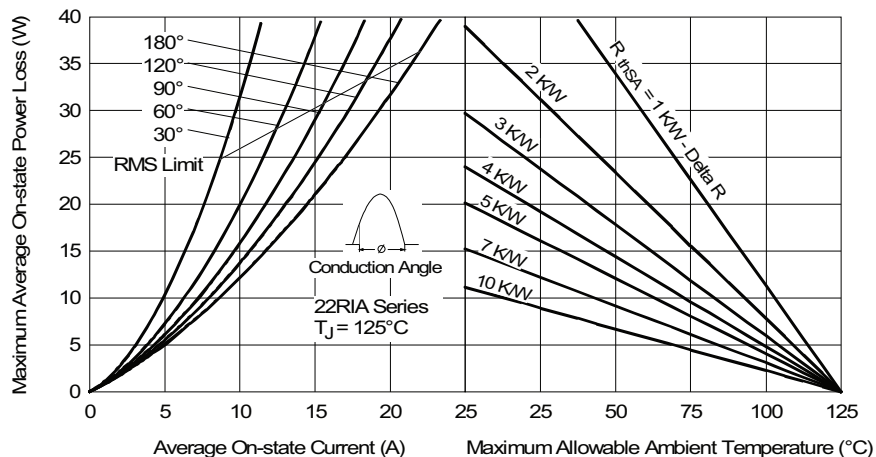


Fig. 2 - On-State Power Loss Characteristics

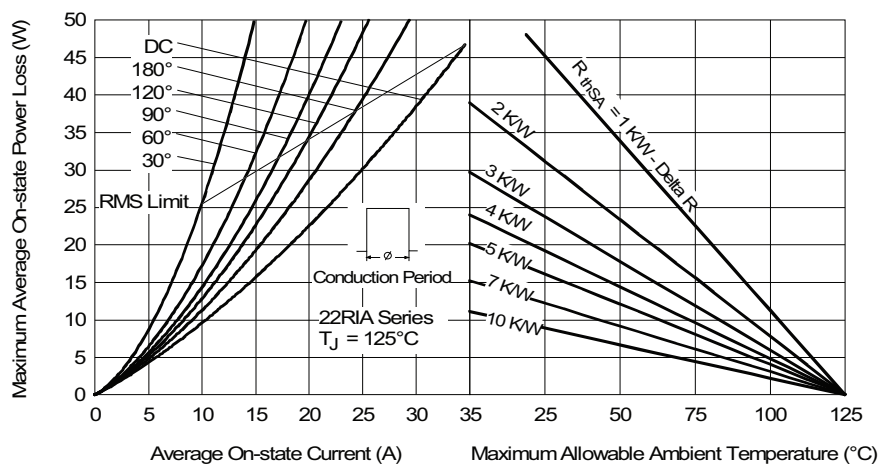


Fig. 3 - On-State Power Loss Characteristics

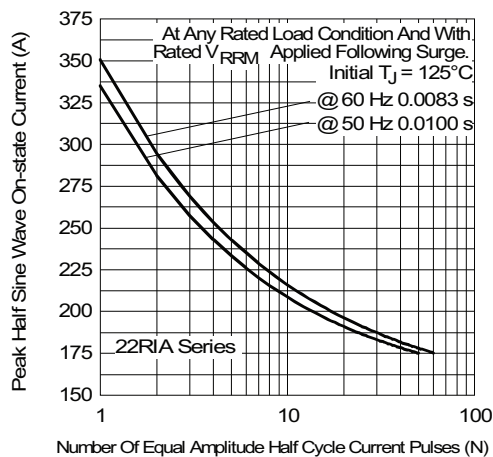


Fig. 4 - Maximum Non-Repetitive Surge Current

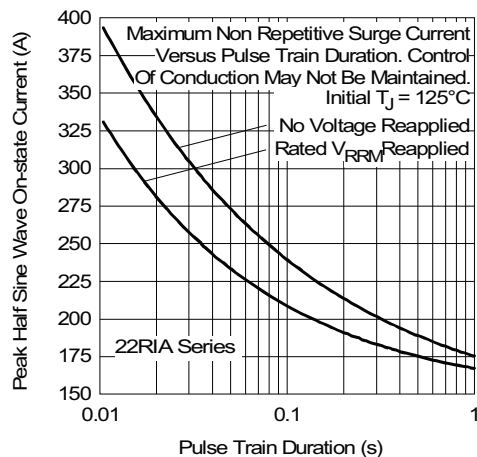


Fig. 5 - Maximum Non-Repetitive Surge Current

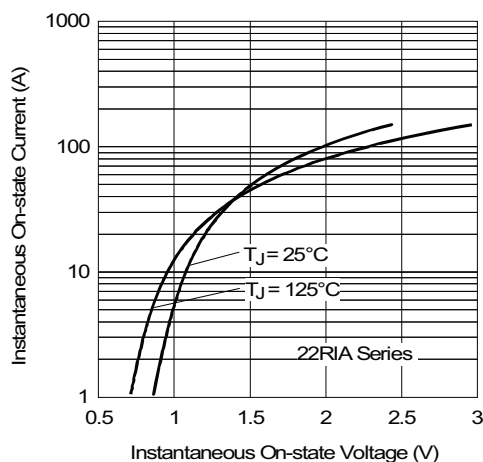


Fig. 6 - Forward Voltage Drop Characteristics

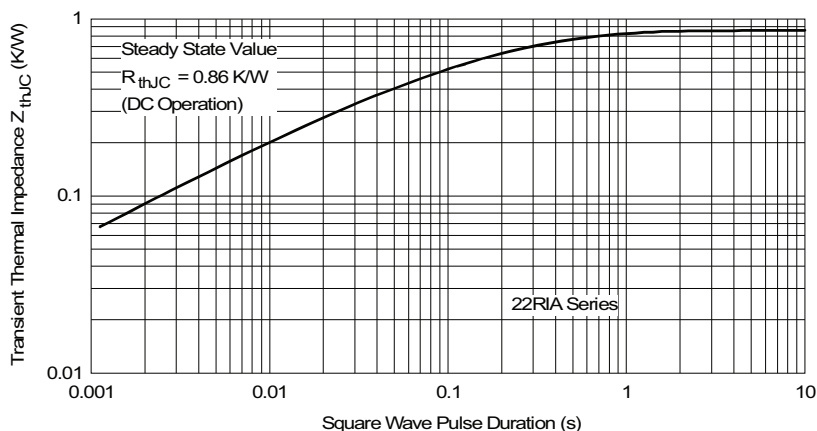


Fig. 7 - Thermal Impedance Z_{thJC} Characteristics

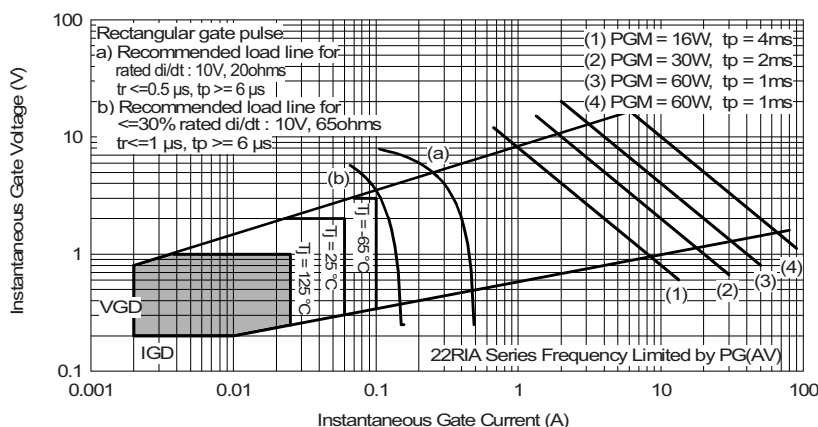


Fig. 8 - Gate Characteristics

ORDERING INFORMATION TABLE

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

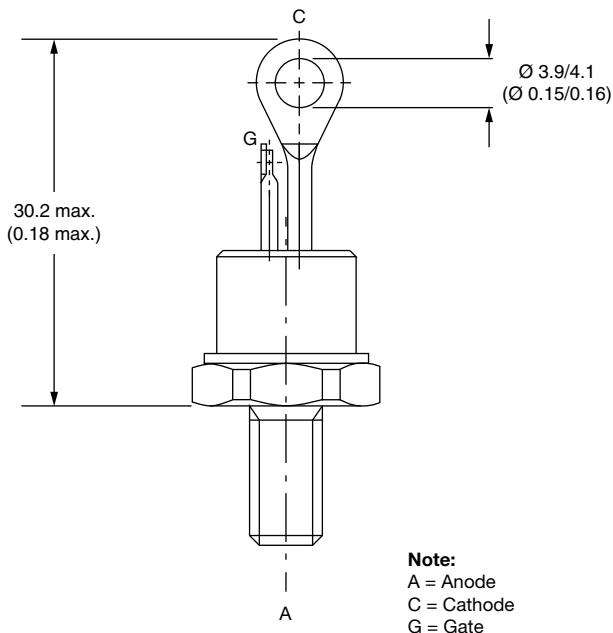
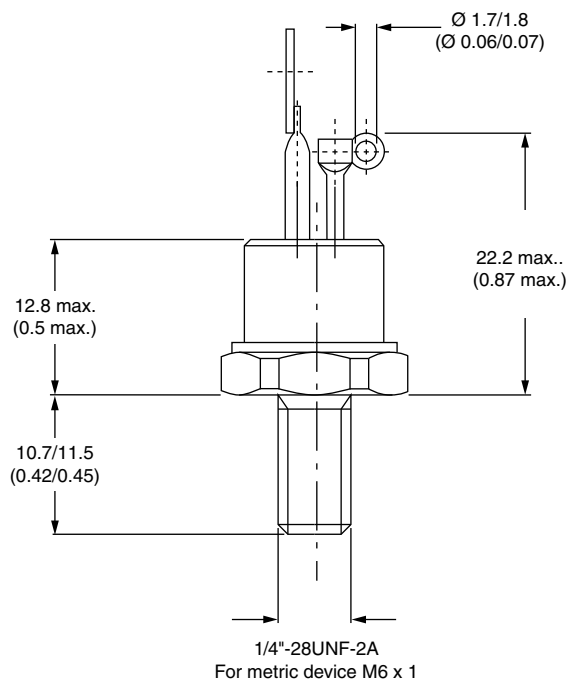
- 1 - Vishay Semiconductors product
- 2 - Current code
- 3 - Essential part number
- 4 - Voltage code x 10 = V_{RRM} (see Voltage Ratings table)
- 5 - None = stud base TO-48 (TO-208AA) 1/4" 28UNF-2A
M = stud base TO-48 (TO-208AA) M6 x 1
- 6 - Critical dV/dt:
None = 300 V/ μ s (standard value)
S90 = 1000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

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

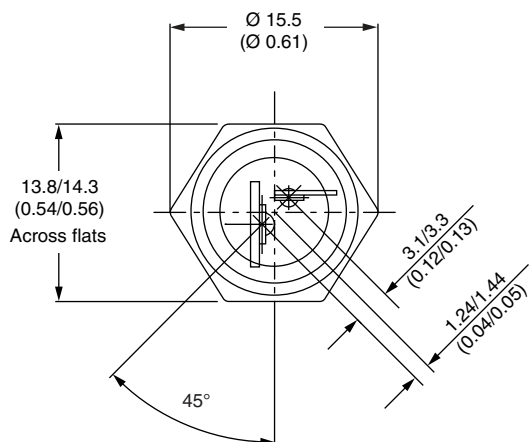


TO-208AA (TO-48)

DIMENSIONS in millimeters (inches)



Note:
A = Anode
C = Cathode
G = Gate





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