

Medium Power 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}
- RoHS compliant
- Designed and qualified for industrial and consumer level



PRODUCT SUMMARY

$I_{T(AV)}$	22 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
$I_{T(AV)}$		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
22RIA	10	100	150	10
	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/ μ s

⁽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 reappplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	400
		t = 8.3 ms			420
		t = 10 ms	100 % V_{RRM} reappplied		335
		t = 8.3 ms			355
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reappplied		793
		t = 8.3 ms			724
		t = 10 ms	100 % V_{RRM} reappplied		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 reappplied, $T_J = T_J$ maximum		7930	$A^2\sqrt{s}$
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		0.83	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	m Ω
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} = Rated V _{DRM} Gate pulse = 20 V, 15 Ω, t _p = 6 μs, t _r = 0.1 μs maximum I _{TM} = (2 x rated di/dt) A	V _{DRM} ≤ 600 V	200	A/μs
			V _{DRM} ≤ 800 V	180	
			V _{DRM} ≤ 1000 V	160	
			V _{DRM} ≤ 1600 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 W	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 °C	Maximum required gate trigger current/voltage are the lowest value which will trigger all units 6 V anode to cathode applied	mA	
		T _J = 25 °C			90
		T _J = 125 °C			60
DC gate voltage required to trigger	V _{GT}	T _J = - 65 °C		V	
		T _J = 25 °C			3.0
		T _J = 125 °C			2.0
DC gate current not to trigger	I _{GD}	T _J = T _J maximum, V _{DRM} = Rated value	1.0		
DC gate voltage not to trigger	V _{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	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

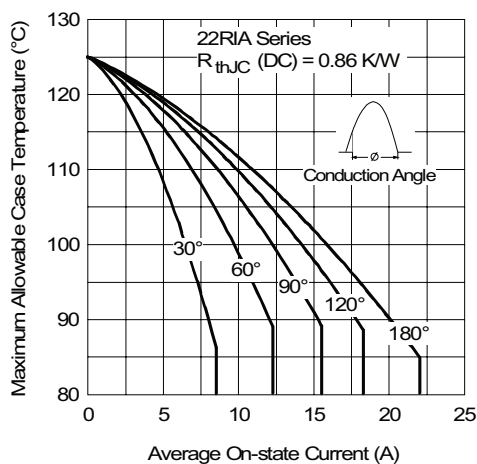


Fig. 1 - Current Ratings Characteristics

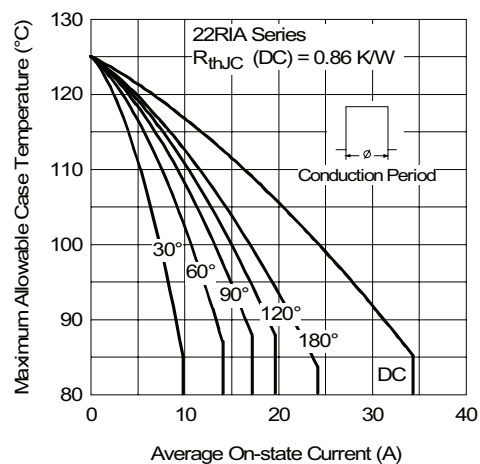


Fig. 2 - Current Ratings Characteristics



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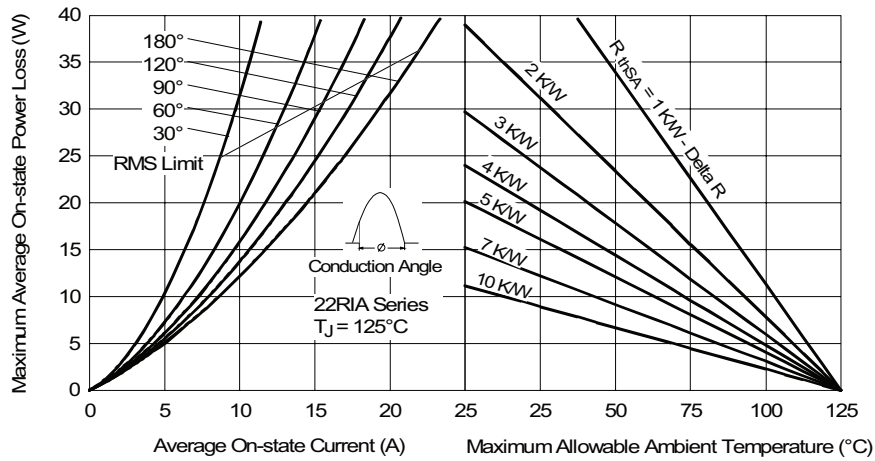


Fig. 3 - On-State Power Loss Characteristics

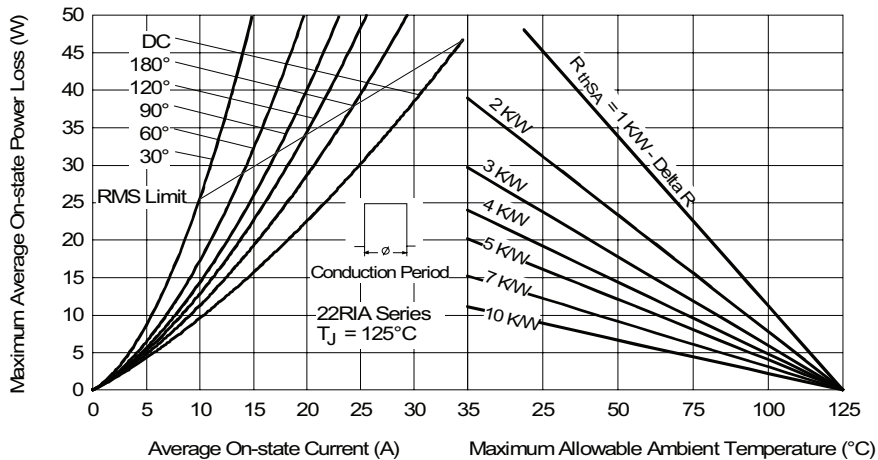


Fig. 4 - On-State Power Loss Characteristics

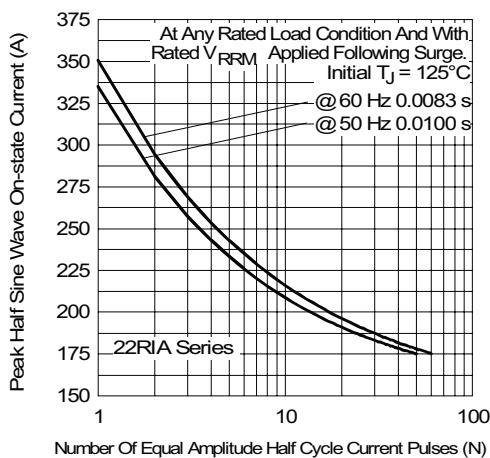


Fig. 5 - Maximum Non-Repetitive Surge Current

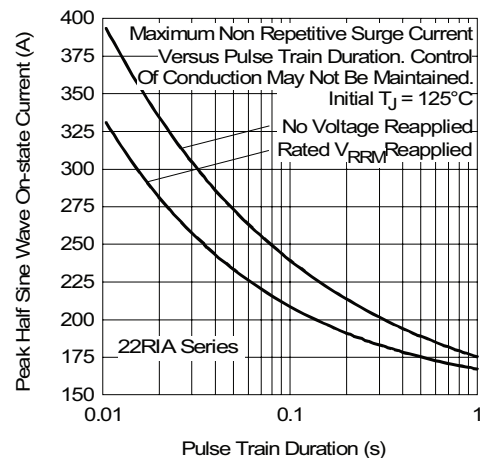


Fig. 6 - Maximum Non-Repetitive Surge Current

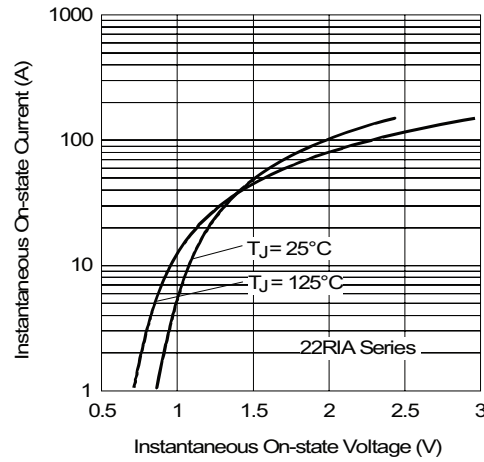


Fig. 7 - Forward Voltage Drop Characteristics

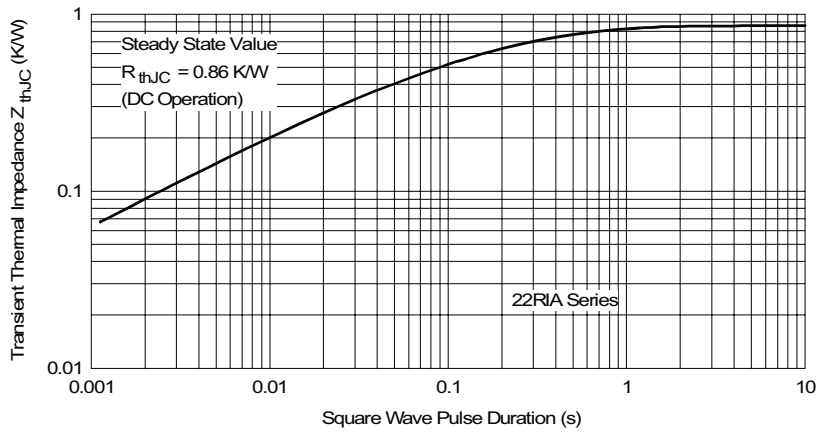


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

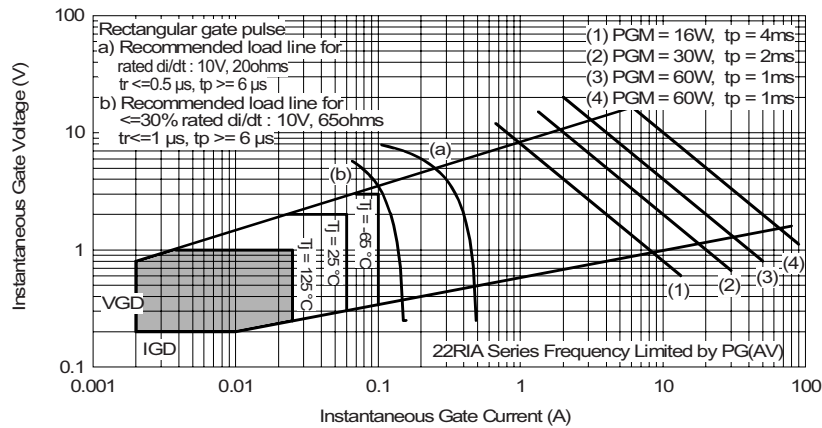
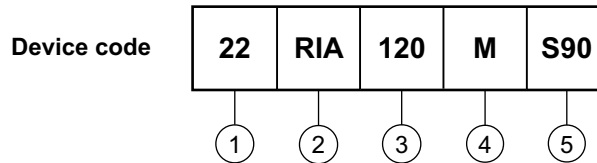


Fig. 9 - Gate Characteristics



ORDERING INFORMATION TABLE



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

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



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