

Medium Power Thyristors (Stud Version), 50 A



TO-208AC (TO-65)

FEATURES

- High current rating
- Excellent dynamic characteristics
- $dV/dt = 1000 \text{ V}/\mu\text{s}$ option
- Superior surge capabilities
- Standard package
- Metric threads version available
- Types up to $1200 \text{ V } V_{\text{DRM}}/V_{\text{RRM}}$
- RoHS compliant



TYPICAL APPLICATIONS

- Phase control applications in converters
- Lighting circuits
- Battery charges
- Regulated power supplies and temperature and speed control circuit
- Can be supplied to meet stringent military, aerospace and other high reliability requirements

PRODUCT SUMMARY

$I_{\text{T(AV)}}$	50 A
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MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{\text{T(AV)}}$		50	A
	T_{C}	94	$^{\circ}\text{C}$
$I_{\text{T(RMS)}}$		80	A
I_{TSM}	50 Hz	1430	A
	60 Hz	1490	
I^2t	50 Hz	10.18	kA^2s
	60 Hz	9.30	
$V_{\text{DRM}}/V_{\text{RRM}}$		100 to 1200	V
t_{q}	Typical	110	μs
T_{J}		- 40 to 125	$^{\circ}\text{C}$

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
50RIA	10	100	150	15
	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			50	A
					94	°C
Maximum RMS on-state current	I _{T(RMS)}				80	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	1430	A
		t = 8.3 ms			1490	
		t = 10 ms	100 % V _{RRM} reapplied		1200	
		t = 8.3 ms			1255	
Maximum I ² t for fusing	I ² t	t = 10 ms	No voltage reapplied		10.18	kA ² s
		t = 8.3 ms			9.30	
		t = 10 ms	100 % V _{RRM} reapplied		7.20	
		t = 8.3 ms			6.56	
Maximum I ² √t for fusing	I ² √t	t = 0.1 to 10 ms, no voltage reapplied, T _J = T _J maximum			101.8	kA ² √s
Low level value of threshold voltage	V _{T(TO)1}	(16.7 % × π × I _{T(AV)} < I < π × I _{T(AV)}), T _J = T _J maximum			0.94	V
High level value of threshold voltage	V _{T(TO)2}	(π × I _{T(AV)} < I < 20 × π × I _{T(AV)}), T _J = T _J maximum			1.08	
Low level value of on-state slope resistance	r _{t1}	(16.7 % × π × I _{T(AV)} < I < π × I _{T(AV)}), T _J = T _J maximum			4.08	mΩ
High level value of on-state slope resistance	r _{t2}	(π × I _{T(AV)} < I < 20 × π × I _{T(AV)}), T _J = T _J maximum			3.34	
Maximum on-state voltage	V _{TM}	I _{pk} = 157 A, T _J = 25 °C			1.60	V
Maximum holding current	I _H	T _J = 25 °C, anode supply 22 V, resistive load, initial I _T = 2 A			200	mA
Latching current	I _L	Anode supply 6 V, resistive load			400	



SWITCHING					
PARAMETER		SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum rate of rise of turned-on current	$V_{\text{DRM}} \leq 600 \text{ V}$	di/dt	$T_C = 125^\circ\text{C}$, $V_{\text{DM}} = \text{Rated } V_{\text{DRM}}$, Gate pulse = 20 V, 15 Ω , $t_p = 6 \mu\text{s}$, $t_r = 0.1 \mu\text{s}$ maximum $I_{\text{TM}} = (2 \times \text{rated } di/dt) \text{ A}$	200	A/ μs
	$V_{\text{DRM}} \leq 1600 \text{ V}$			100	
Typical delay time		t_d	$T_C = 25^\circ\text{C}$, $V_{\text{DM}} = \text{Rated } V_{\text{DRM}}$, $I_{\text{TM}} = 10 \text{ A}$ dc resistive circuit Gate pulse = 10 V, 15 Ω source, $t_p = 20 \mu\text{s}$	0.9	μs
Typical turn-off time		t_q	$T_C = 125^\circ\text{C}$, $I_{\text{TM}} = 50 \text{ A}$, reapplied $dV/dt = 20 \text{ V}/\mu\text{s}$ $dI_r/dt = -10 \text{ A}/\mu\text{s}$, $V_R = 50 \text{ V}$	110	

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}	200	V/μs
		T _J = T _J maximum linear to 67 % rated V _{DRM}	500 ⁽¹⁾	

Note

⁽¹⁾ Available with $dV/dt = 1000 \text{ V}/\mu\text{s}$, to complete code add S90 i.e. 50RIA120S90

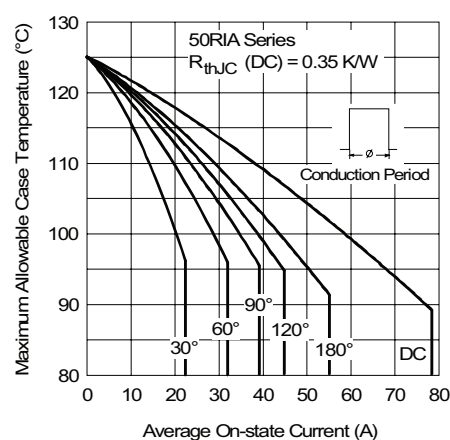
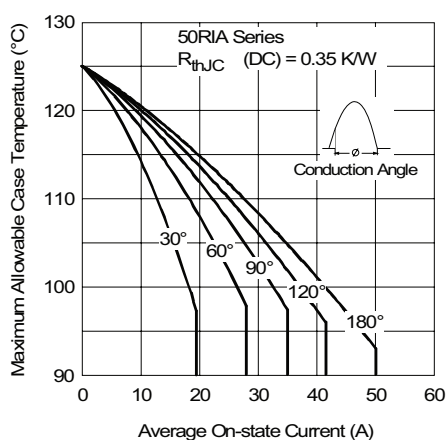
TRIGGERING					
PARAMETER		SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum peak gate power		P_{GM}	$T_J = T_J$ maximum, $t_p \leq 5 \text{ ms}$	10	W
Maximum average gate power		$P_{\text{G(AV)}}$		2.5	
Maximum peak positive gate current		I_{GM}		2.5	A
Maximum peak positive gate voltage		$+V_{\text{GM}}$		20	V
Maximum peak negative gate voltage		$-V_{\text{GM}}$		10	
DC gate current required to trigger	I_{GT}	$T_J = -40^\circ\text{C}$	Maximum required gate trigger current/voltage are the lowest value which will trigger all units 6 V anode to cathode applied	250	mA
		$T_J = 25^\circ\text{C}$		100	
		$T_J = 125^\circ\text{C}$		50	
DC gate voltage required to trigger	V_{GT}	$T_J = -40^\circ\text{C}$		3.5	V
		$T_J = 25^\circ\text{C}$		2.5	
DC gate current not to trigger		I_{GD}	$T_J = T_J$ maximum, $V_{\text{DRM}} = \text{Rated voltage}$	5.0	mA
DC gate voltage not to trigger		V_{GD}	$T_J = T_J$ maximum	0.2	V

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum operating junction and storage temperature range	T_J, T_{Stg}		- 40 to 125	°C
Maximum thermal resistance, junction to case	R_{thJC}	DC operation	0.35	K/W
Maximum thermal resistance, case to heatsink	R_{thCS}	Mounting surface, smooth, flat and greased	0.25	
Allowable mounting torque		Non-lubricated threads	$3.4 \pm 0.10\%$ (30)	N · m (lbf · in)
		Lubricated threads	$2.3 \pm 0.10\%$ (20)	
Approximate weight			28	g
			1.0	oz.
Case style		See dimensions - link at the end of datasheet	TO-208AC (TO-65)	

ΔR_{thJC} CONDUCTION				
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	UNITS
180°	0.078	0.057	$T_J = T_J \text{ maximum}$	K/W
120°	0.094	0.098		
90°	0.120	0.130		
60°	0.176	0.183		
30°	0.294	0.296		

Note

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



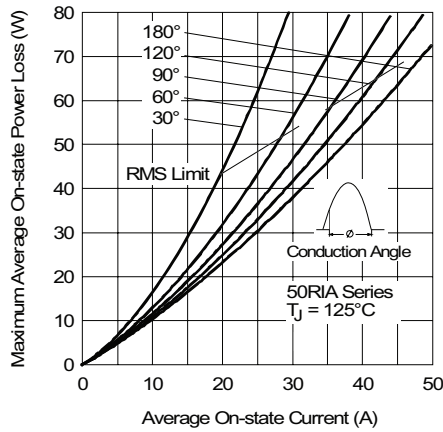


Fig. 3 - On-State Power Loss Characteristics

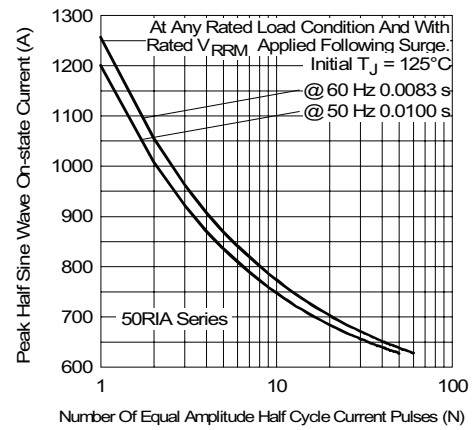


Fig. 5 - Maximum Non-Repetitive Surge Current

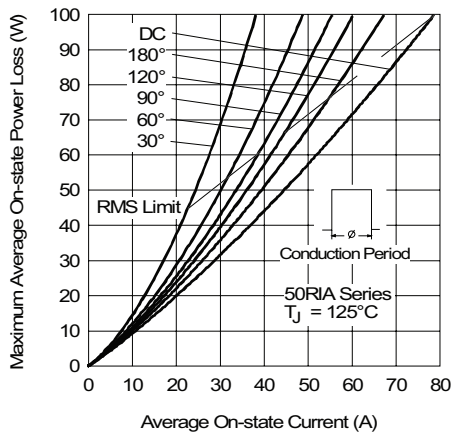


Fig. 4 - On-State Power Loss Characteristics

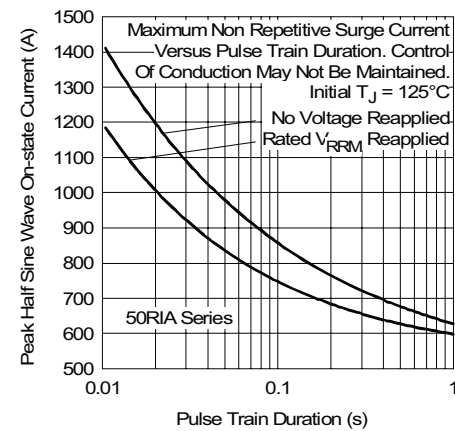


Fig. 6 - Maximum Non-Repetitive Surge Current

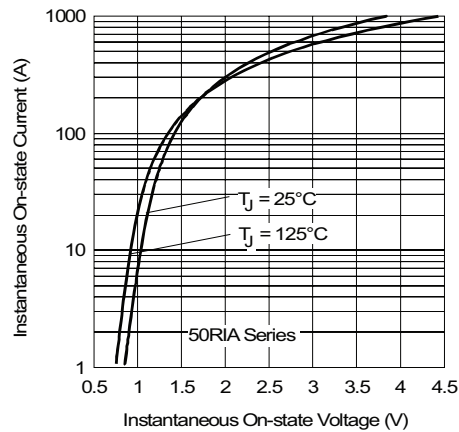


Fig. 7 - Forward Voltage Drop Characteristics

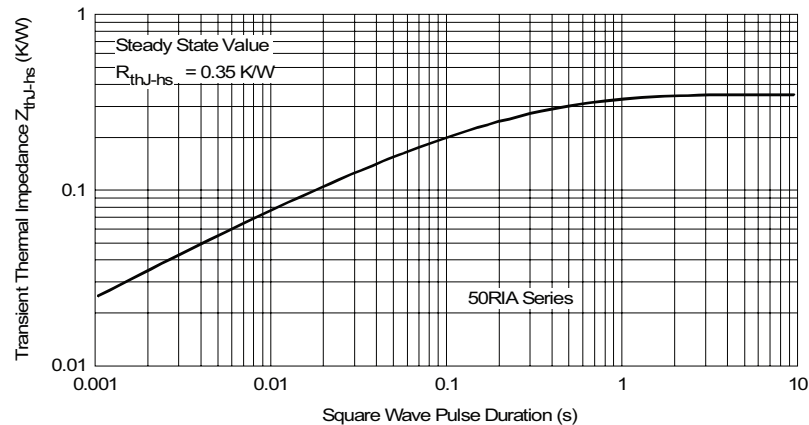


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

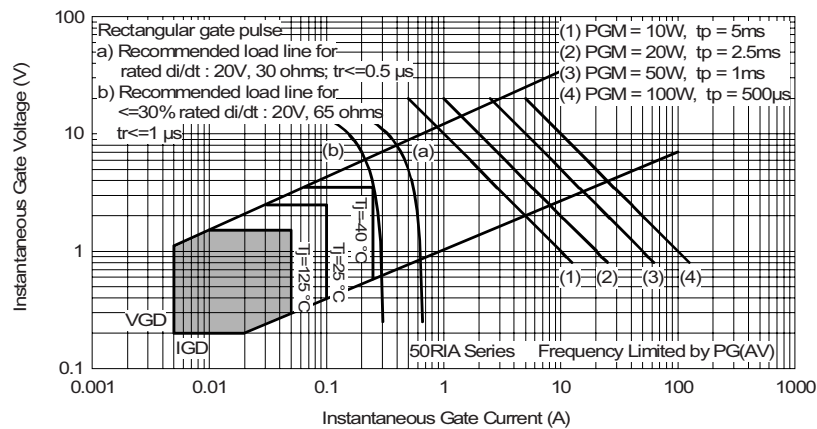


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

Device code	50	RIA	120	S90	M
	1	2	3	4	5
1	- Current code				
2	- Essential part number				
3	- Voltage code x 10 = V_{RRM} (see Voltage Ratings table)				
4	- Critical dV/dt:				
	• None = 500 V/ μ s (standard value)				
	• S90 = 1000 V/ μ s (special selection)				
5	- • None = Stud base TO-208AC (TO-65) 1/4" 28UNF-2A				
	• M = Stud base TO-208AC (TO-65) M6 x 1				

LINKS TO RELATED DOCUMENTS	
Dimensions	http://www.vishay.com/doc?95334



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