

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



PRODUCT SUMMARY

$I_{\text{T(AV)}}$	50 A
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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

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	di/dt	$T_C = 125\text{ }^{\circ}\text{C}$, $V_{DM} = \text{Rated } V_{DRM}$, Gate pulse = 20 V, 15 Ω , $t_p = 6\text{ }\mu\text{s}$, $t_r = 0.1\text{ }\mu\text{s}$ maximum $I_{TM} = (2 \times \text{rated } di/dt)\text{ A}$	200	A/ μs
			100	
Typical delay time	t_d	$T_C = 25\text{ }^{\circ}\text{C}$, $V_{DM} = \text{Rated } V_{DRM}$, $I_{TM} = 10\text{ A}$ dc resistive circuit Gate pulse = 10 V, 15 Ω source, $t_p = 20\text{ }\mu\text{s}$	0.9	μs
Typical turn-off time	t_q	$T_C = 125\text{ }^{\circ}\text{C}$, $I_{TM} = 50\text{ A}$, 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	$P_{G(AV)}$		2.5	
Maximum peak positive gate current	I_{GM}		2.5	A
Maximum peak positive gate voltage	$+V_{GM}$		20	V
Maximum peak negative gate voltage	$-V_{GM}$		10	
DC gate current required to trigger	I_{GT}	$T_J = -40\text{ }^{\circ}\text{C}$	250	mA
		$T_J = 25\text{ }^{\circ}\text{C}$	100	
		$T_J = 125\text{ }^{\circ}\text{C}$	50	
DC gate voltage required to trigger	V_{GT}	$T_J = -40\text{ }^{\circ}\text{C}$	3.5	V
		$T_J = 25\text{ }^{\circ}\text{C}$	2.5	
DC gate current not to trigger	I_{GD}	$T_J = T_J$ maximum, $V_{DRM} = \text{Rated voltage}$	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 + 0 - 10 % (30)	N · m (lbf · in)
		Lubricated threads	2.3 + 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

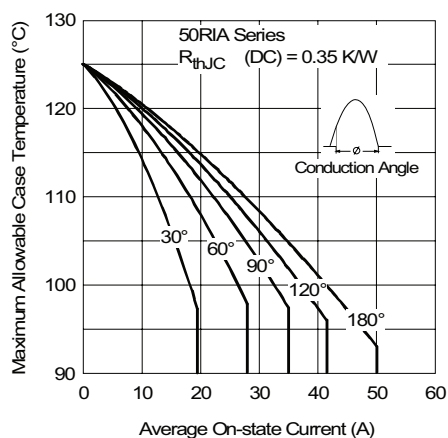


Fig. 1 - Current Ratings Characteristics

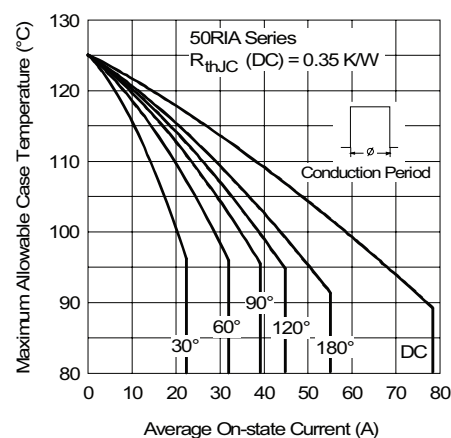


Fig. 2 - Current Ratings Characteristics

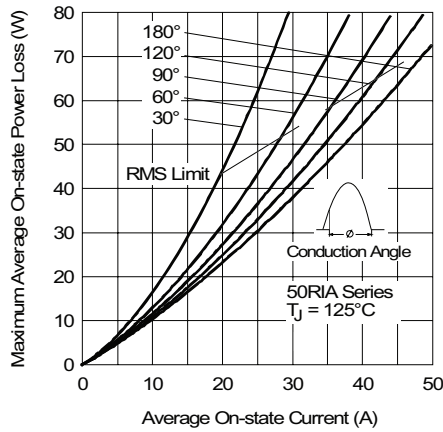


Fig. 3 - On-State Power Loss Characteristics

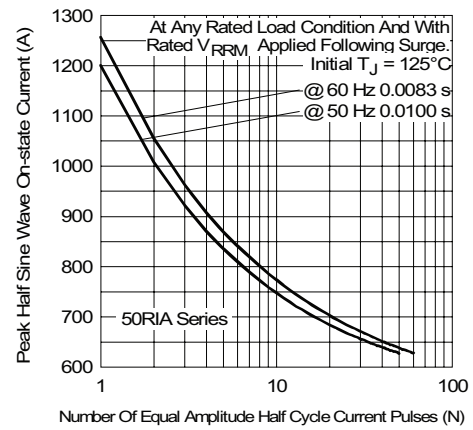


Fig. 5 - Maximum Non-Repetitive Surge Current

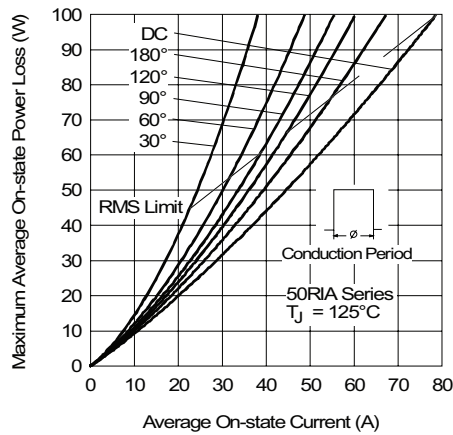


Fig. 4 - On-State Power Loss Characteristics

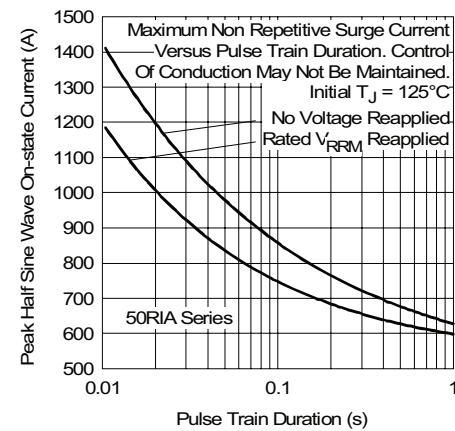


Fig. 6 - Maximum Non-Repetitive Surge Current

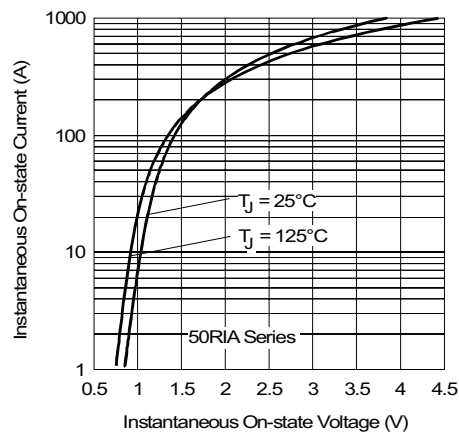


Fig. 7 - Forward Voltage Drop Characteristics

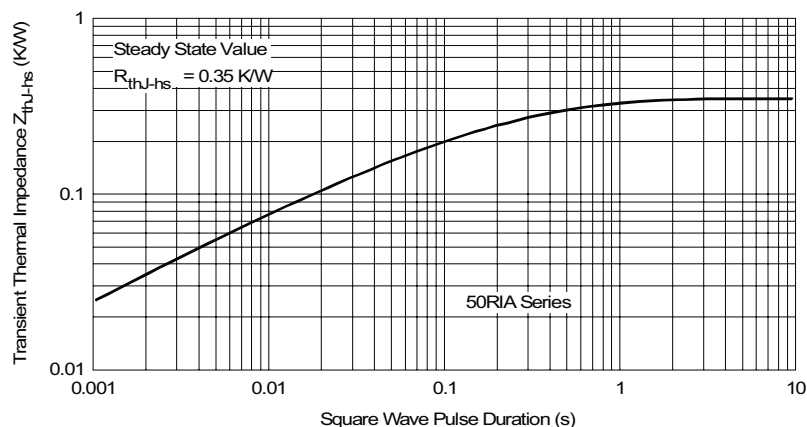


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

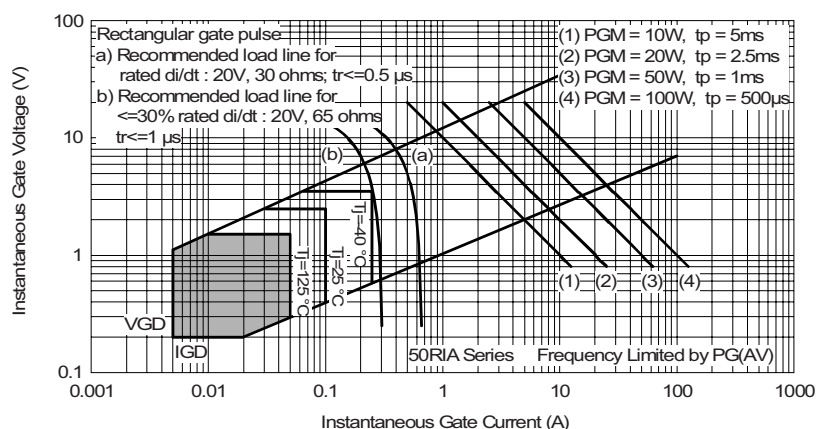


Fig. 9 - Gate Characteristics

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 $\times 10 = V_{RRM}$ (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 $\times$ 1

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



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