

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

**ELECTRICAL SPECIFICATIONS**

<b>VOLTAGE RATINGS</b>				
TYPE NUMBER	VOLTAGE CODE	$V_{DRM}/V_{RRM}$ , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE <sup>(1)</sup> V	$V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK VOLTAGE <sup>(2)</sup> 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/ $\mu$ 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 <sub>T(AV)</sub>	180° sinusoidal conduction			50	A
					94	°C
Maximum RMS on-state current	I <sub>T(RMS)</sub>				80	A
Maximum peak, one-cycle non-repetitive surge current	I <sub>TSM</sub>	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J</sub> maximum	1430	A
		t = 8.3 ms			1490	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied		1200	
		t = 8.3 ms			1255	
Maximum I <sup>2</sup> t for fusing	I <sup>2</sup> t	t = 10 ms	No voltage reapplied		10.18	kA <sup>2</sup> s
		t = 8.3 ms			9.30	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied		7.20	
		t = 8.3 ms			6.56	
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t	t = 0.1 to 10 ms, no voltage reapplied, T <sub>J</sub> = T <sub>J</sub> maximum			101.8	kA <sup>2</sup> √s
Low level value of threshold voltage	V <sub>T(TO)1</sub>	(16.7 % × π × I <sub>T(AV)</sub> < I < π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum			0.94	V
High level value of threshold voltage	V <sub>T(TO)2</sub>	(π × I <sub>T(AV)</sub> < I < 20 × π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum			1.08	
Low level value of on-state slope resistance	r <sub>t1</sub>	(16.7 % × π × I <sub>T(AV)</sub> < I < π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum			4.08	mΩ
High level value of on-state slope resistance	r <sub>t2</sub>	(π × I <sub>T(AV)</sub> < I < 20 × π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum			3.34	
Maximum on-state voltage	V <sub>TM</sub>	I <sub>pk</sub> = 157 A, T <sub>J</sub> = 25 °C			1.60	V
Maximum holding current	I <sub>H</sub>	T <sub>J</sub> = 25 °C, anode supply 22 V, resistive load, initial I <sub>T</sub> = 2 A			200	mA
Latching current	I <sub>L</sub>	Anode supply 6 V, resistive load			400	



<b>SWITCHING</b>					
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 $\Omega$ , $t_p = 6 \mu\text{s}$ , $t_r = 0.1 \mu\text{s}$ maximum $I_{\text{TM}} = (2 \times \text{rated } di/dt) \text{ A}$	200	A/ $\mu\text{s}$
	$V_{\text{DRM}} \leq 1600 \text{ V}$			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 $\Omega$ source, $t_p = 20 \mu\text{s}$	0.9	$\mu\text{s}$
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 <sub>J</sub> = T <sub>J</sub> maximum linear to 100 % rated V <sub>DRM</sub>	200	V/μs
		T <sub>J</sub> = T <sub>J</sub> maximum linear to 67 % rated V <sub>DRM</sub>	500 <sup>(1)</sup>	

**Note**

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

<b>TRIGGERING</b>					
PARAMETER		SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum peak gate power		$P_{\text{GM}}$	$T_J = T_J$ maximum, $t_p \leq 5 \text{ ms}$	10	W
Maximum average gate power		$P_{\text{G(AV)}}$		2.5	
Maximum peak positive gate current		$I_{\text{GM}}$		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		$I_{\text{GT}}$	$T_J = -40^\circ\text{C}$	250	mA
			$T_J = 25^\circ\text{C}$	100	
			$T_J = 125^\circ\text{C}$	50	
DC gate voltage required to trigger		$V_{\text{GT}}$	$T_J = -40^\circ\text{C}$	3.5	V
			$T_J = 25^\circ\text{C}$	2.5	
DC gate current not to trigger		$I_{\text{GD}}$	$T_J = T_J$ maximum, $V_{\text{DRM}} = \text{Rated voltage}$	5.0	mA
DC gate voltage not to trigger		$V_{\text{GD}}$	$T_J = T_J$ 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)	

$\Delta R_{thJC}$ 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

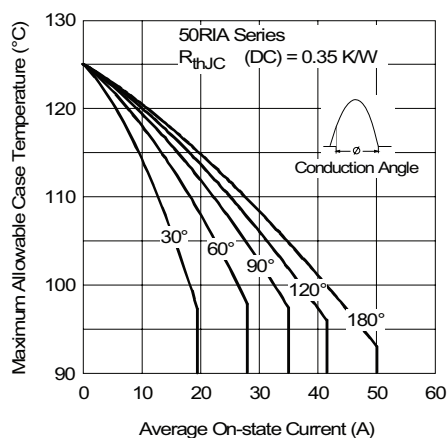


Fig. 1 - Current Ratings Characteristics

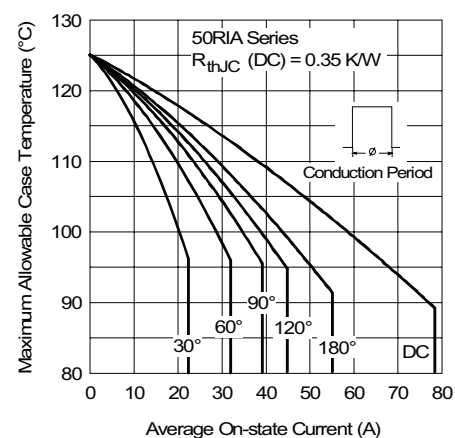


Fig. 2 - Current Ratings Characteristics

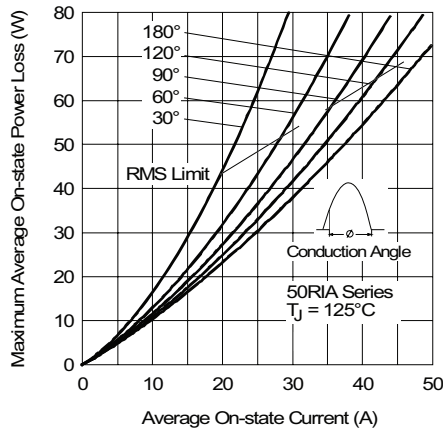


Fig. 3 - On-State Power Loss Characteristics

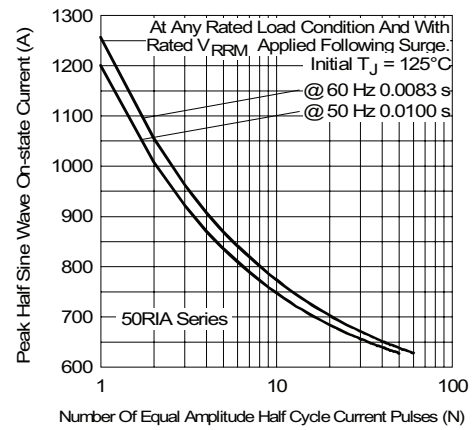


Fig. 5 - Maximum Non-Repetitive Surge Current

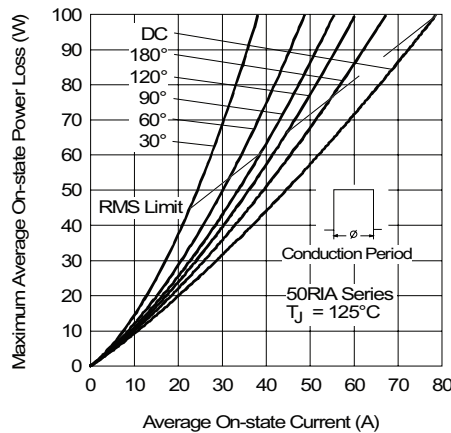


Fig. 4 - On-State Power Loss Characteristics

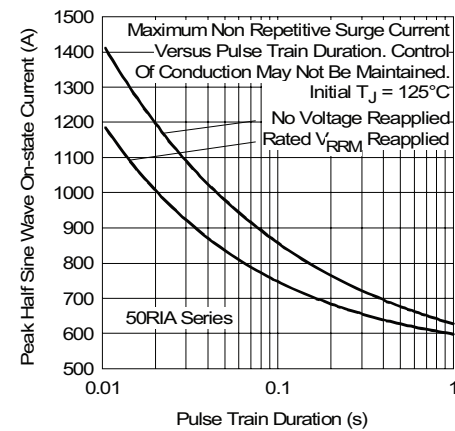


Fig. 6 - Maximum Non-Repetitive Surge Current

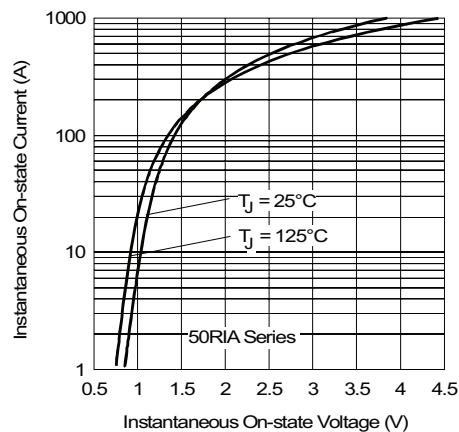


Fig. 7 - Forward Voltage Drop Characteristics

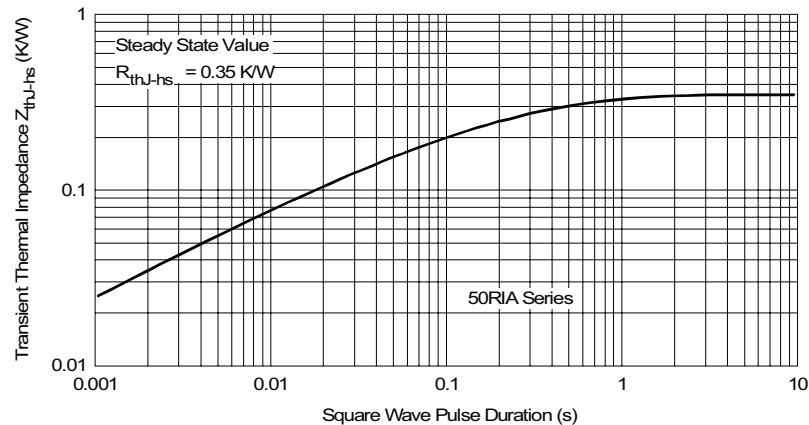


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

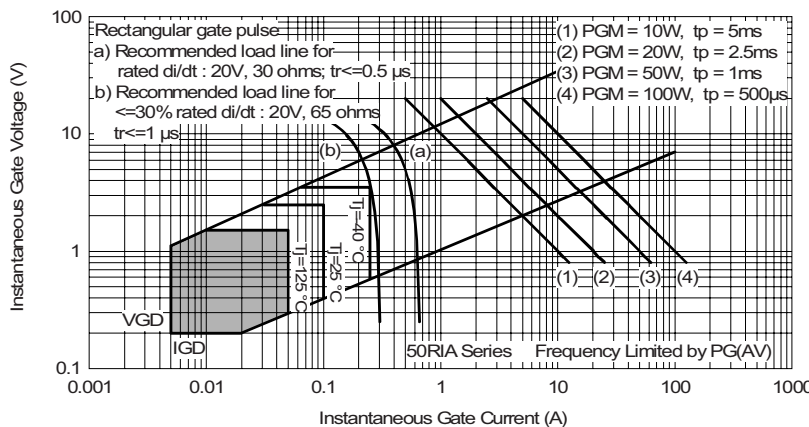


Fig. 9 - Gate Characteristics

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 x 10 = $V_{RRM}$ (see Voltage Ratings table)				
4	- Critical dV/dt:				
	• None = 500 V/ $\mu$ s (standard value)				
	• S90 = 1000 V/ $\mu$ 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	<a href="http://www.vishay.com/doc?95334">http://www.vishay.com/doc?95334</a>



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