

## 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 V  $V_{DRM}/V_{RRM}$
- RoHS compliant


**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

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

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		50	A
	$T_C$	94	$^{\circ}\text{C}$
$I_{T(RMS)}$		80	A
$I_{TSM}$	50 Hz	1430	A
	60 Hz	1490	
$I^2t$	50 Hz	10.18	$\text{kA}^2\text{s}$
	60 Hz	9.30	
$V_{DRM}/V_{RRM}$		100 to 1200	V
$t_q$	Typical	110	$\mu\text{s}$
$T_J$		- 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 <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	$I_{T(AV)}$	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 reappplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	A
		t = 8.3 ms			
		t = 10 ms	100 % $V_{RRM}$ reappplied		
		t = 8.3 ms			
Maximum $I^2t$ for fusing	$I^2t$	t = 10 ms	No voltage reappplied		kA <sup>2</sup> s
		t = 8.3 ms			
		t = 10 ms	100 % $V_{RRM}$ reappplied		
		t = 8.3 ms			
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		101.8	kA <sup>2</sup> $\sqrt{s}$
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		0.94	V
High level value of threshold voltage	$V_{T(TO)2}$	$(\pi \times I_{T(AV)} < I < 20 \times \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		1.08	
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		4.08	m $\Omega$
High level value of on-state slope resistance	$r_{t2}$	$(\pi \times I_{T(AV)} < I < 20 \times \pi \times I_{T(AV)})$ , $T_J = T_J$ 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	dl/dt	T <sub>C</sub> = 125 °C, V <sub>DM</sub> = Rated V <sub>DRM</sub> , Gate pulse = 20 V, 15 Ω, t <sub>p</sub> = 6 μs, t <sub>r</sub> = 0.1 μs maximum I <sub>TM</sub> = (2 x rated dl/dt) A	200	A/μs
			V <sub>DRM</sub> ≤ 600 V	
			100	
Typical delay time	t <sub>d</sub>	T <sub>C</sub> = 25 °C, V <sub>DM</sub> = Rated V <sub>DRM</sub> , I <sub>TM</sub> = 10 A dc resistive circuit Gate pulse = 10 V, 15 Ω source, t <sub>p</sub> = 20 μs	0.9	μs
Typical turn-off time	t <sub>q</sub>	T <sub>C</sub> = 125 °C, I <sub>TM</sub> = 50 A, reapplied dV/dt = 20 V/μs dI/dt = - 10 A/μs, V <sub>R</sub> = 50 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**

(1) Available with dV/dt = 1000 V/μs, to complete code add S90 i.e. 50RIA120S90

TRIGGERING					
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS	
Maximum peak gate power	P <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> ≤ 5 ms	10	W	
Maximum average gate power	P <sub>G(AV)</sub>		2.5		
Maximum peak positive gate current	I <sub>GM</sub>		2.5	A	
Maximum peak positive gate voltage	+V <sub>GM</sub>		20	V	
Maximum peak negative gate voltage	-V <sub>GM</sub>		10		
DC gate current required to trigger	I <sub>GT</sub>	T <sub>J</sub> = - 40 °C	Maximum required gate trigger current/voltage are the lowest value which will trigger all units 6 V anode to cathode applied	mA	
		T <sub>J</sub> = 25 °C			
		T <sub>J</sub> = 125 °C			
DC gate voltage required to trigger	V <sub>GT</sub>	T <sub>J</sub> = - 40 °C		3.5	V
		T <sub>J</sub> = 25 °C		2.5	
DC gate current not to trigger	I <sub>GD</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, V <sub>DRM</sub> = Rated voltage		5.0	mA
DC gate voltage not to trigger	V <sub>GD</sub>	T <sub>J</sub> = T <sub>J</sub> 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	$T_J = T_J$ 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

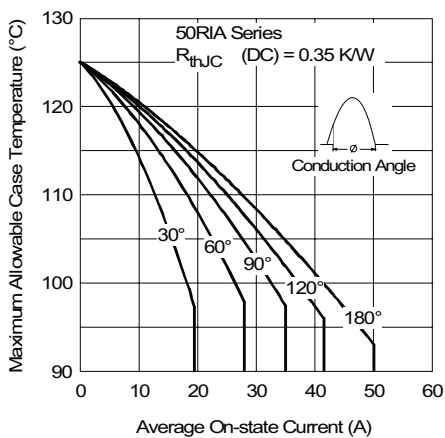


Fig. 1 - Current Ratings Characteristics

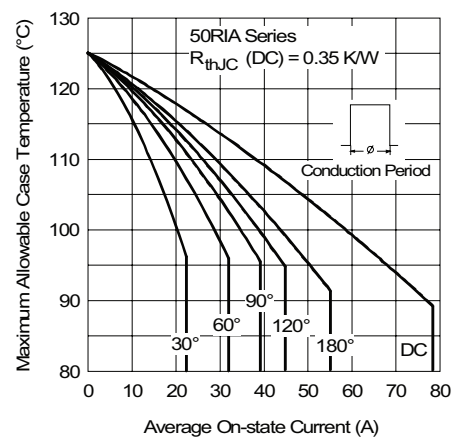


Fig. 2 - Current Ratings Characteristics

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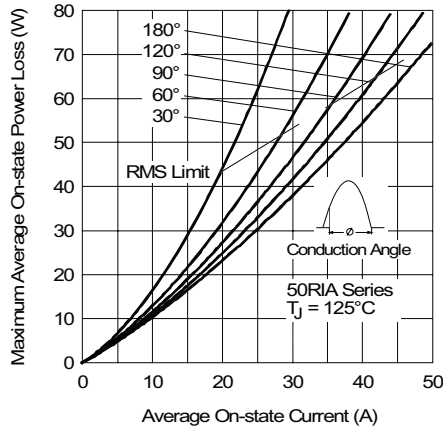


Fig. 3 - On-State Power Loss Characteristics

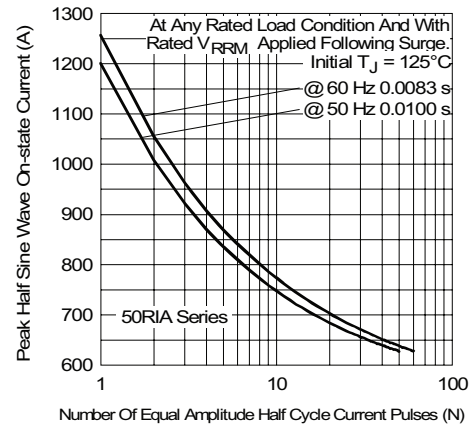


Fig. 5 - Maximum Non-Repetitive Surge Current

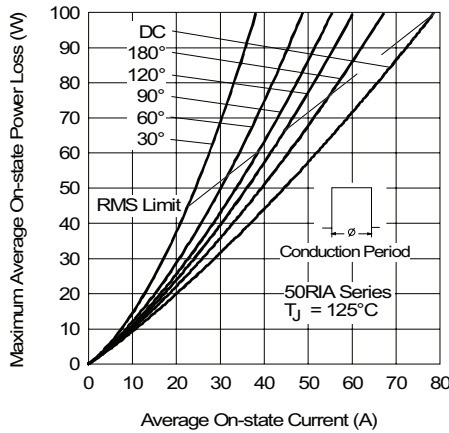


Fig. 4 - On-State Power Loss Characteristics

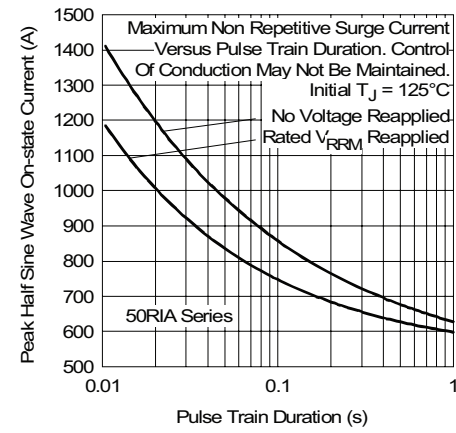


Fig. 6 - Maximum Non-Repetitive Surge Current

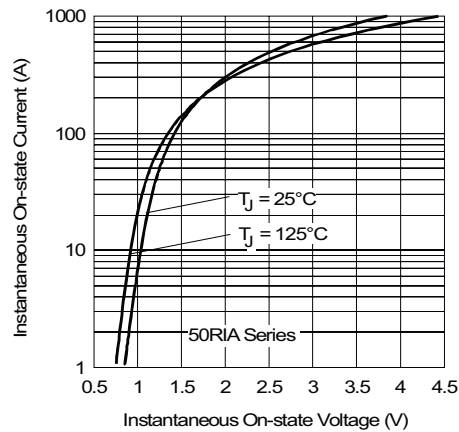


Fig. 7 - Forward Voltage Drop Characteristics

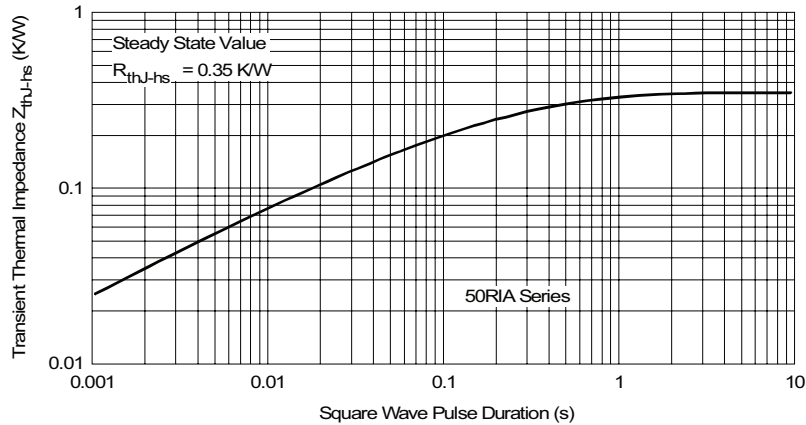


Fig. 8 - Thermal Impedance  $Z_{thJc}$  Characteristics

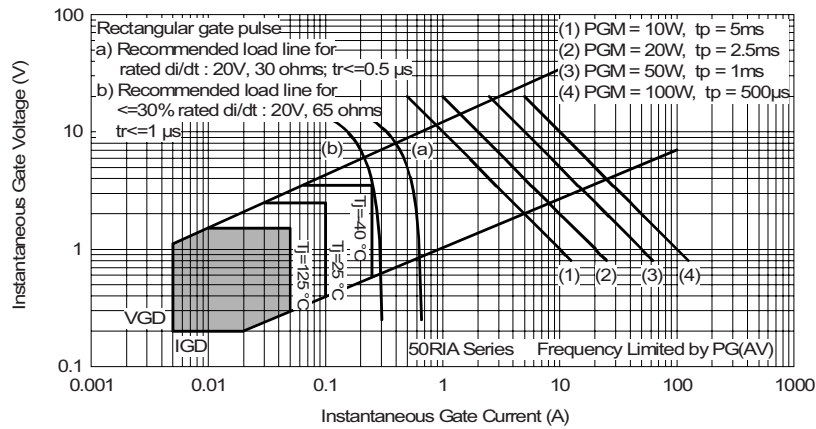


Fig. 9 - Gate Characteristics

### ORDERING INFORMATION TABLE

Device code	<b>50</b>	<b>RIA</b>	<b>120</b>	<b>S90</b>	<b>M</b>
	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/ $\mu$ 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  $\times$  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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