

Medium Power Phase Control Thyristors (Stud Version), 50 A



TO-65 (TO-208AC)

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 $V_{\text{DRM}}/V_{\text{RRM}}$
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT

PRIMARY CHARACTERISTICS

$I_{\text{T(AV)}}$	50 A
$V_{\text{DRM}}/V_{\text{RRM}}$	100 V, 200 V, 400 V, 600 V, 800 V, 1000 V, 1200 V
V_{TM}	1.60 V
I_{GT}	100 mA
T_{J}	-40 °C to 125 °C
Package	TO-65 (TO-208AC)
Circuit configuration	Single SCR

TYPICAL APPLICATIONS

- Phase control applications in converters
- Lighting circuits
- Battery charges
- Regulated power supplies and temperature and speed control circuit

MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{\text{T(AV)}}$		50	A
	T_{C}	94	°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	°C

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS

TYPE NUMBER	VOLTAGE CODE	$V_{\text{DRM}}/V_{\text{RRM}}$, MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE ⁽¹⁾ V	V_{RSM} , MAXIMUM NON-REPETITIVE PEAK VOLTAGE ⁽²⁾ V	$I_{\text{DRM}}/I_{\text{RRM}}$ MAXIMUM AT $T_{\text{J}} = T_{\text{J}}$ MAXIMUM mA
VS-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/ μs

⁽²⁾ For voltage pulses with $t_p \leq 5 \text{ ms}$



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	$T_C = 125$ °C, $V_{DM} = \text{Rated } V_{DRM}$, Gate pulse = 20 V, 15 Ω, $t_p = 6$ μs, $t_r = 0.1$ μs maximum $I_{TM} = (2 \times \text{rated dI/dt})$ A	200	A/μs
			100	
Typical delay time	t_d	$T_C = 25$ °C, $V_{DM} = \text{Rated } V_{DRM}$, $I_{TM} = 10$ A dc resistive circuit Gate pulse = 10 V, 15 Ω source, $t_p = 20$ μs	0.9	μs
Typical turn-off time	t_q	$T_C = 125$ °C, $I_{TM} = 50$ A, reapplied dV/dt = 20 V/μs dI/dt = - 10 A/μs, $V_R = 50$ 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 V/μs, 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, $t_p \leq 5$ 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}	$T_J = -40$ °C	250	mA
		$T_J = 25$ °C	100	
		$T_J = 125$ °C	50	
DC gate voltage required to trigger	V_{GT}	$T_J = -40$ °C	3.5	V
		$T_J = 25$ °C	2.5	
DC gate current not to trigger	I_{GD}	$T_J = T_J$ maximum, $V_{DRM} =$ 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 heat sink	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-65 (TO-208AC)	

ΔR_{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

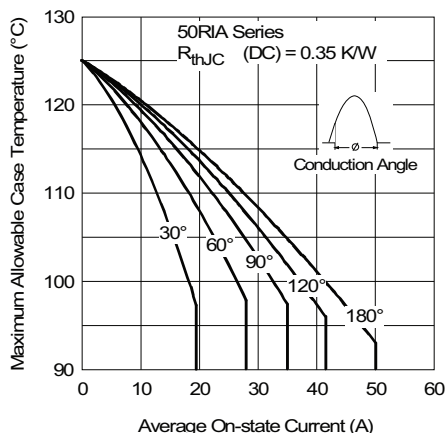


Fig. 1 - Current Ratings Characteristics

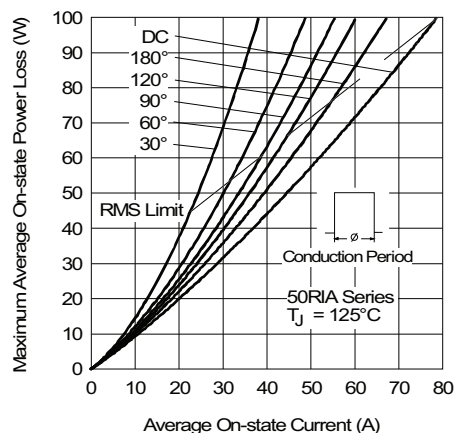


Fig. 4 - On-State Power Loss Characteristics

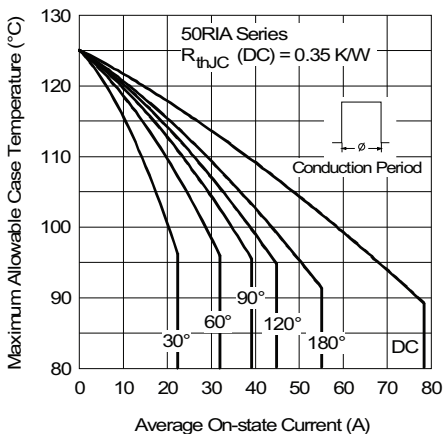


Fig. 2 - Current Ratings Characteristics

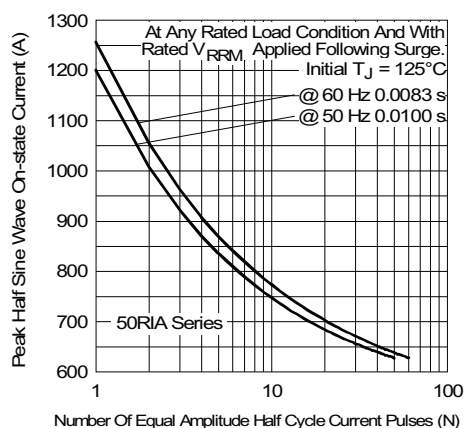


Fig. 5 - Maximum Non-Repetitive Surge Current

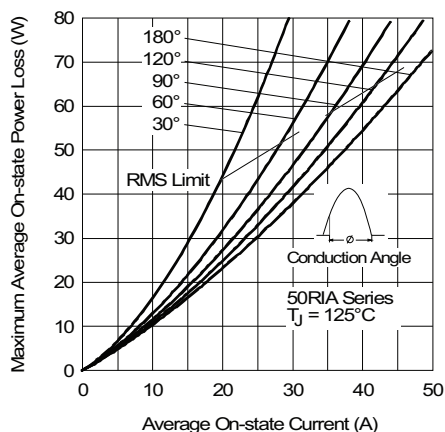


Fig. 3 - On-State Power Loss Characteristics

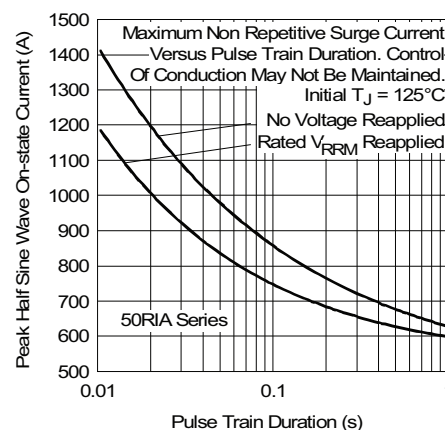


Fig. 6 - Maximum Non-Repetitive Surge Current

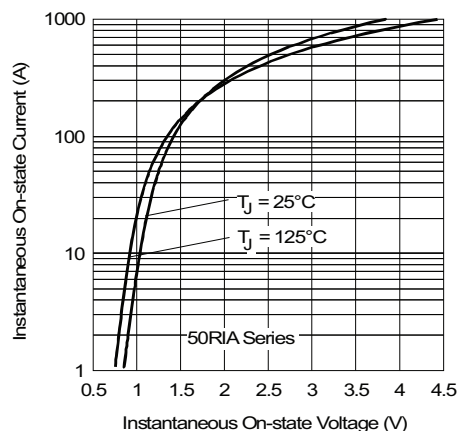


Fig. 7 - Forward Voltage Drop Characteristics

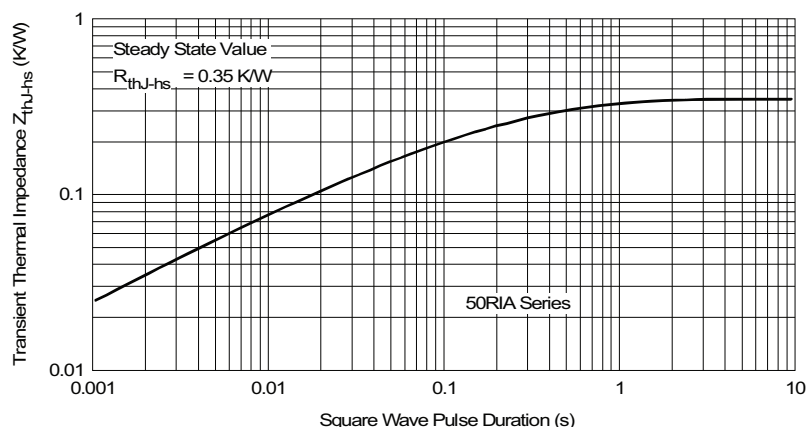


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

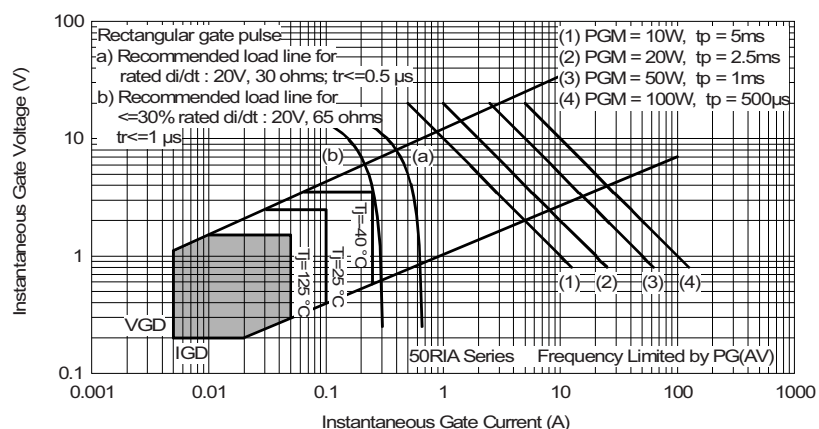


Fig. 9 - Gate Characteristics



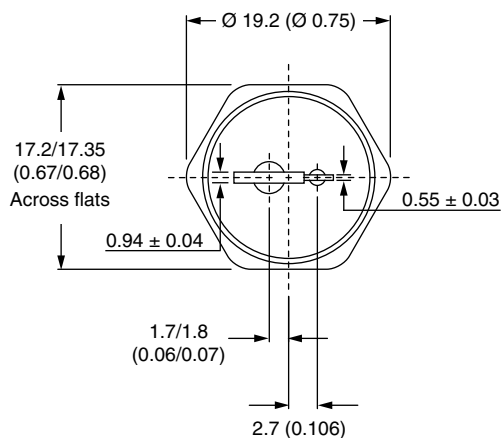
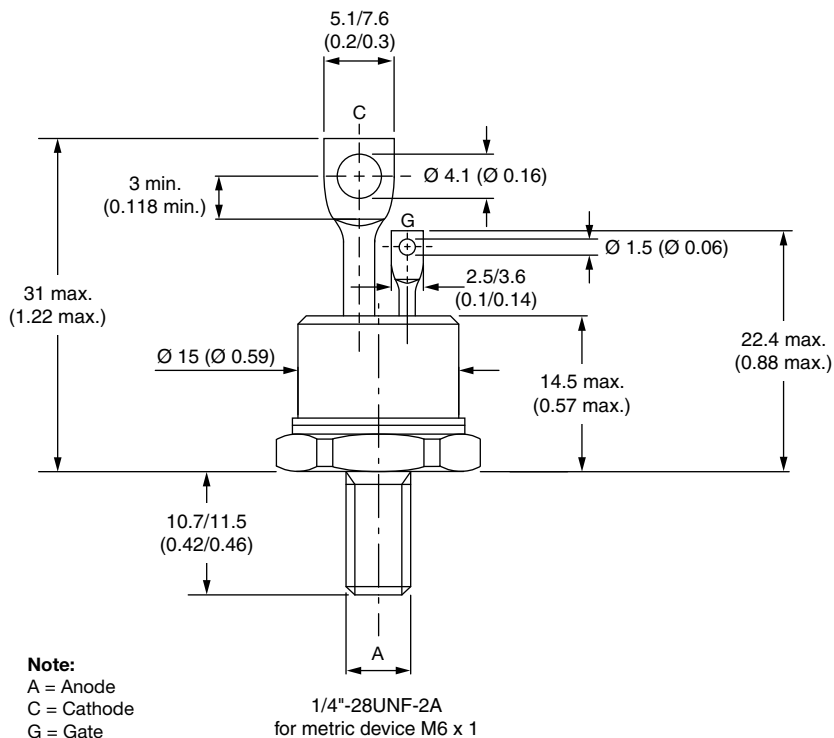
ORDERING INFORMATION TABLE

Device code	VS-	50	RIA	120	S90	M
	1	2	3	4	5	6
1	- Vishay Semiconductors product					
2	- Current code					
3	- Essential part number					
4	- Voltage code x 10 = V_{RRM} (see Voltage Ratings table)					
5	- Critical dV/dt: • None = 500 V/μs (standard value) • S90 = 1000 V/μs (special selection)					
6	- • None = stud base TO-65 (TO-208AC) 1/4" 28UNF-2A • M = stud base TO-65 (TO-208AC) M6 x 1					

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

TO-208AC (TO-65)

DIMENSIONS in millimeters (inches)





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