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

TO-65 (TO-208AC)

FEATURES

- High current rating
- Excellent dynamic characteristics
- dV/dt = 1000 V/μs option
- Superior surge capabilities
- Standard package
- Metric threads version available
- Types up to 1200 V V_{DRM}/V_{RRM}
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

TYPICAL APPLICATIONS

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

PRIMARY CHARACTERISTICS	
$I_{T(AV)}$	50 A
V_{DRM}/V_{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

MAJOR RATINGS AND CHARACTERISTICS			
PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		50	A
	T_C	94	°C
$I_{T(RMS)}$		80	A
I_{TSM}	50 Hz	1430	A
	60 Hz	1490	
I^2t	50 Hz	10.18	kA^2s
	60 Hz	9.30	
V_{DRM}/V_{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_{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
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 $t_p \leq 5$ ms

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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^2t for fusing	I^2t	t = 10 ms	No voltage reapplied		10.18	kA^2s
		t = 8.3 ms			9.30	
		t = 10 ms	100 % V_{RRM} reapplied		7.20	
		t = 8.3 ms			6.56	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied, $T_J = T_J$ maximum			101.8	$kA^2\sqrt{s}$
Low level value of threshold voltage	$V_{T(TO)1}$	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.94	V
High level value of threshold voltage	$V_{T(TO)2}$	(π x $I_{T(AV)}$ < I < 20 x π x $I_{T(AV)}$), $T_J = T_J$ maximum			1.08	
Low level value of on-state slope resistance	r_{t1}	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			4.08	mΩ
High level value of on-state slope resistance	r_{t2}	(π x $I_{T(AV)}$ < I < 20 x π x $I_{T(AV)}$), $T_J = T_J$ 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	$V_{DRM} \leq 600$ V	dI/dt	T_C = 125 °C, V_{DM} = Rated V_{DRM}, Gate pulse = 20 V, 15 Ω, t_p = 6 µs, t_r = 0.1 µs maximum I_{TM} = (2 x rated dI/dt) A	200	A/µs
	$V_{DRM} \leq 1600$ V			100	
Typical delay time		t_d	T_C = 25 °C, V_{DM} = 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 dIr/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

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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	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 °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	Maximum gate current/voltage not to trigger is the maximum value which will not trigger any unit with rated V_{DRM} anode to cathode applied	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

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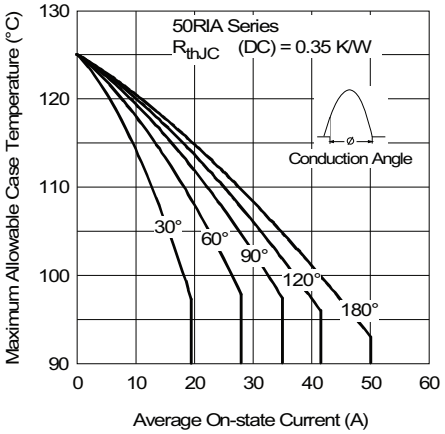

Fig. 1 - Current Ratings Characteristics

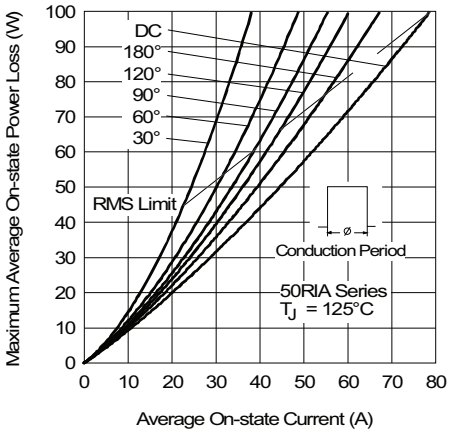

Fig. 4 - On-State Power Loss Characteristics

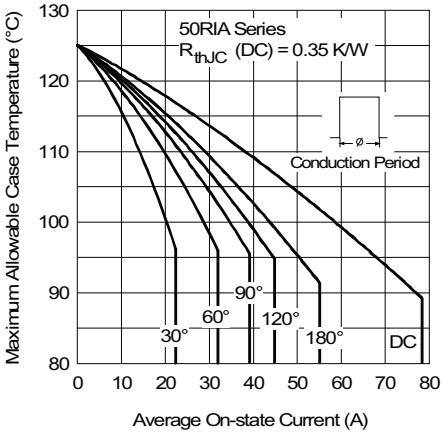

Fig. 2 - Current Ratings Characteristics

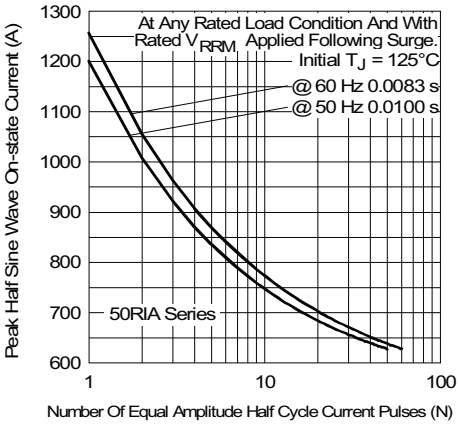

Fig. 5 - Maximum Non-Repetitive Surge Current

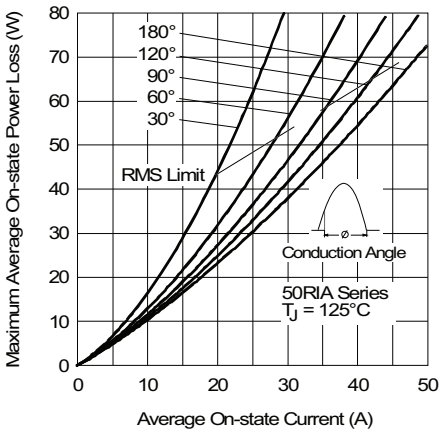

Fig. 3 - On-State Power Loss Characteristics

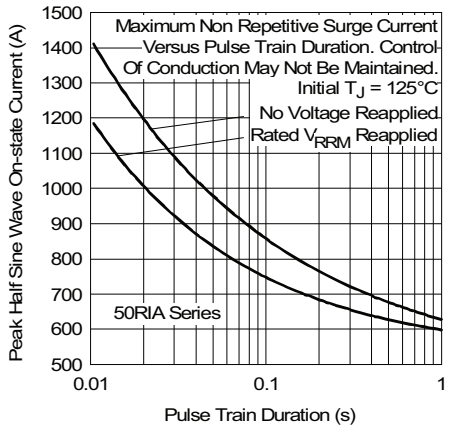

Fig. 6 - Maximum Non-Repetitive Surge Current

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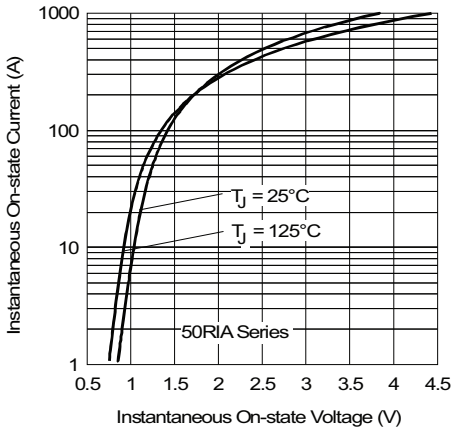

Fig. 7 - Forward Voltage Drop Characteristics

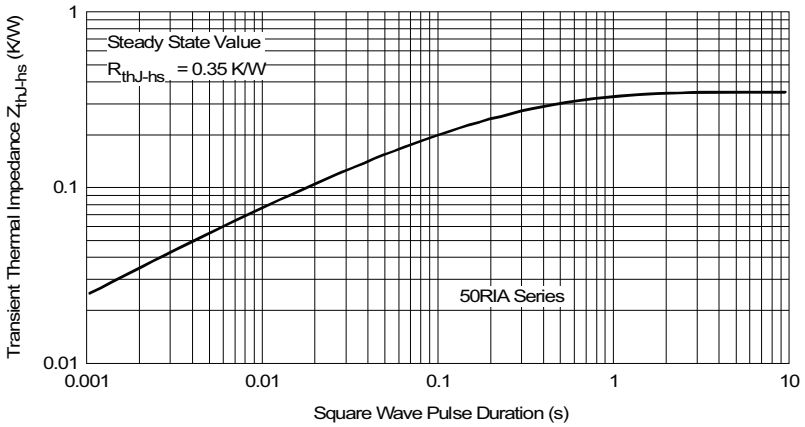

Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

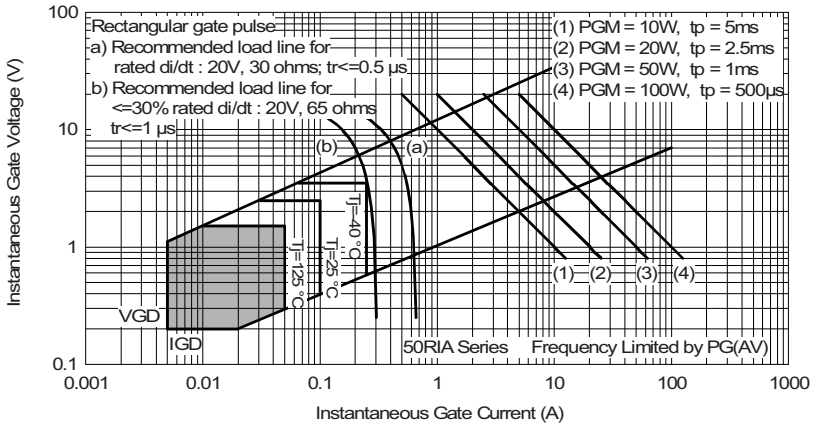

Fig. 9 - Gate Characteristics

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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

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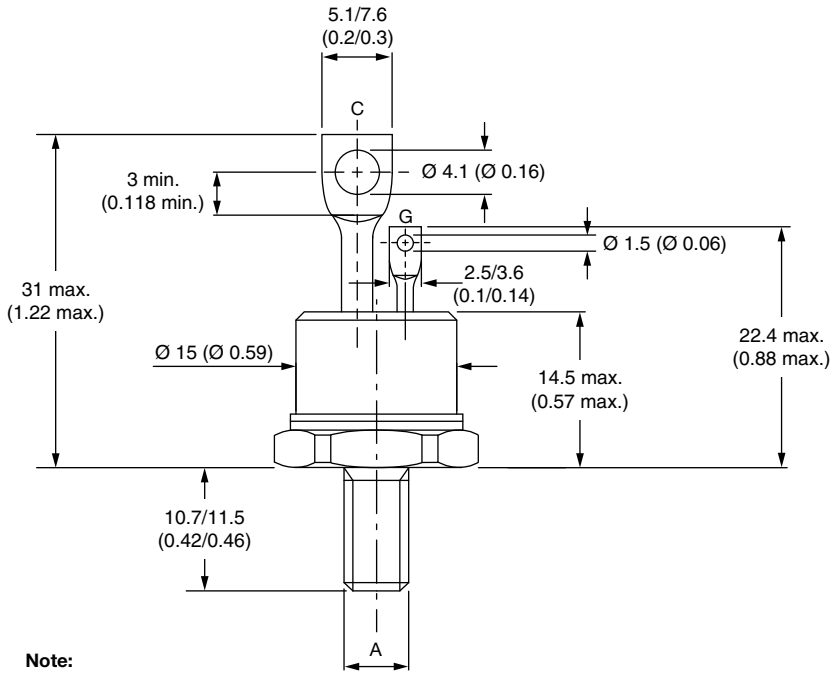
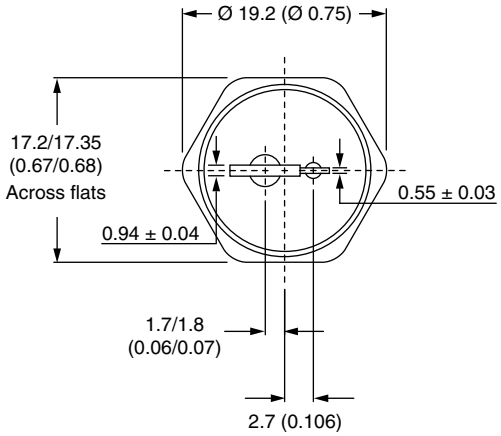
TO-208AC (TO-65)

DIMENSIONS in millimeters (inches)



Note:
A = Anode
C = Cathode
G = Gate

1/4"-28UNF-2A
for metric device M6 x 1



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