Phase Control Thyristors (Stud Version), 180 A

TO-93 (TO-209AB)

FEATURES

- Hermetic glass-metal seal
- International standard case TO-93 (TO-209AB)
- Designed and qualified for industrial level
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

TYPICAL APPLICATIONS

- DC motor controls
- Controlled DC power supplies
- AC controllers

PRIMARY CHARACTERISTICS	
$I_{T(AV)}$	180 A
V_{DRM}/V_{RRM}	400 V, 800 V, 1000 V
V_{TM}	1.35 V
I_{GT}	65 mA
T_J	-40 °C to +125 °C
Package	TO-93 (TO-209AB)
Circuit configuration	Single SCR

MAJOR RATINGS AND CHARACTERISTICS			
PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		180	A
	T_C	80	°C
$I_{T(RMS)}$		285	A
I_{TSM}	50 Hz	3800	A
	60 Hz	4000	A
I^2t	50 Hz	72	kA^2s
	60 Hz	66	kA^2s
V_{DRM}/V_{RRM}		400 to 1000	V
t_q	Typical	100	µs
T_J		-40 to +125	°C

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS				
PART NUMBER	VOLTAGE CODE	V_{DRM}/V_{RRM}, MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE V	V_{RSM}, MAXIMUM NON-REPETITIVE PEAK VOLTAGE V	I_{DRM}/I_{RRM} MAXIMUM AT $T_J = T_J$ MAXIMUM mA
VS-180RKI VS-181RKI	40	400	500	30
	80	800	900	
	100	1000	1100	

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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° conduction, half sine wave			180	A
					80	°C
Maximum RMS on-state current	I_{RMS}	DC at 79 °C case temperature			285	A
Maximum peak, one-cycle non-repetitive surge current	I_{TSM}	t = 10 ms	No voltage reapplied	Sinusoidal half wave, intial $T_J = T_J$ maximum	3800	
		t = 8.3 ms			4000	
		t = 10 ms	100 % V_{RRM} reapplied		3500	
		t = 8.3 ms			3660	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied		72	kA^2s
		t = 8.3 ms			66	
		t = 10 ms	100 % V_{RRM} reapplied		61	
		t = 8.3 ms			56	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied			720	$kA^2\sqrt{s}$
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			0.83	V
High level value of threshold voltage	$V_{T(TO)2}$	(I > π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.89	
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			0.92	mΩ
High level value of on-state slope resistance	r_{t2}	(I > π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.81	
Maximum on-state voltage	V_{TM}	I_{pk} = 570 A, $T_J = T_J$ maximum, t_p = 10 ms sine pulse			1.35	V
Maximum holding current	I_H	T_J = 25 °C, anode supply 12 V resistive load			600	mA
Typical latching current	I_L				1000	

SWITCHING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum non-repetitive rate of rise of turned-on current	dI/dt	Gate drive 20 V, 20 Ω, $t_r \leq 1$ µs $T_J = T_J$ maximum, anode voltage ≤ 80 % V_{DRM}	300	A/µs
Typical delay time	t_d	Gate current 1 A, dI_g/dt = 1 A/µs V_d = 0.67 % V_{DRM}, T_J = 25 °C	1.0	µs
Typical turn-off time	t_q	I_{TM} = 50 A, $T_J = T_J$ maximum, dI/dt = 10 A/µs, V_R = 100 V, dV/dt = 20 V/µs	100	

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 80 % rated V_{DRM}	500	V/µs
Maximum peak reverse and off-state leakage current	I_{RRM}, I_{DRM}	$T_J = T_J$ maximum rated V_{DRM}/V_{RRM} applied	30	mA

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TRIGGERING						
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES		UNITS
				TYP.	MAX.	
Maximum peak gate power	P_{GM}	$T_J = T_J$ maximum, $t_p \leq 5$ ms		10		W
Maximum average gate power	$P_{G(AV)}$	$T_J = T_J$ maximum, f = 50 Hz, d% = 50		2.0		
Maximum peak positive gate current	I_{GM}	$T_J = T_J$ maximum, $t_p \leq 5$ ms		3.0		A
Maximum peak positive gate voltage	$+ V_{GM}$			20		V
Maximum peak negative gate voltage	$- V_{GM}$			5.0		
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 12 V anode to cathode applied	130	-	mA
		$T_J = 25$ °C		65	150	
		$T_J = 125$ °C		35	-	
DC gate voltage required to trigger	V_{GT}	$T_J = -40$ °C		2.0	-	V
		$T_J = 25$ °C		1.2	2.5	
		$T_J = 125$ °C		0.9	-	
DC gate current not to trigger	I_{GD}	$T_J = T_J$ maximum	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	10		mA
DC gate voltage not to trigger	V_{GD}			0.25		V

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum operating junction temperature range	T_J		-40 to 125	°C
Maximum storage temperature range	T_{Stg}		-40 to 150	
Maximum thermal resistance, junction to case	R_{thJC}	DC operation	0.15	K/W
Maximum thermal resistance, junction to ambient	R_{thCS}	Mounting surface, smooth, flat and greased	0.04	
Mounting force, ± 10 %		Non-lubricated threads	31 (275)	N · m (lbf · in)
		Lubricated threads	24.5 (210)	
Approximate weight			280	g
Case style		See dimensions - link at the end of datasheet	TO-93 (TO-209AB)	

ΔR_{thJC} CONDUCTION				
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	UNITS
180°	0.050	0.032	$T_J = T_J$ maximum	K/W
120°	0.063	0.059		
90°	0.080	0.082		
60°	0.118	0.124		
30°	0.225	0.228		

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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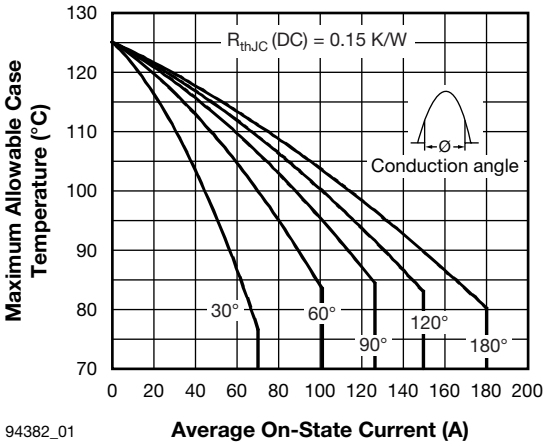


Fig. 1 - Current Ratings Characteristics

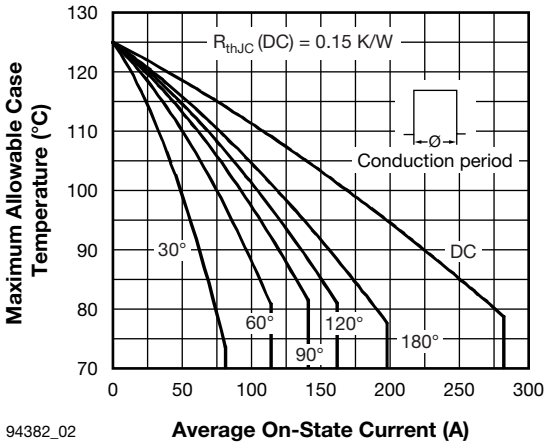
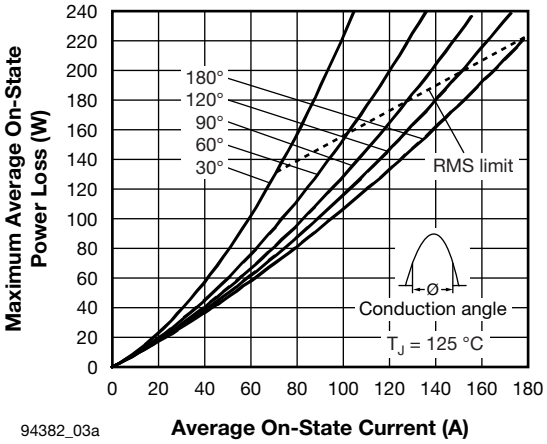


Fig. 2 - Current Ratings Characteristics



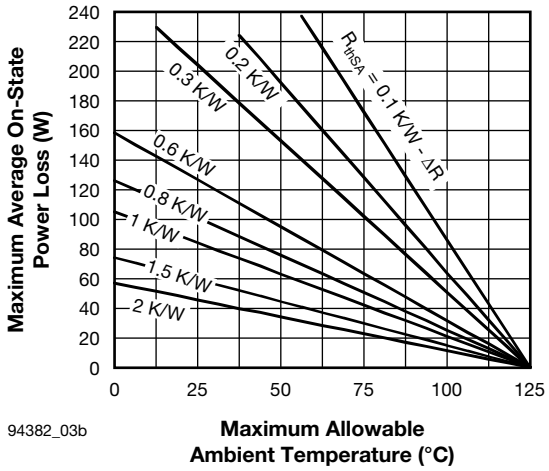
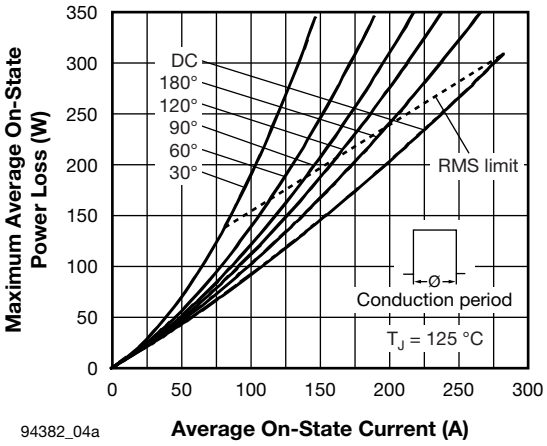


Fig. 3 - On-State Power Loss Characteristics



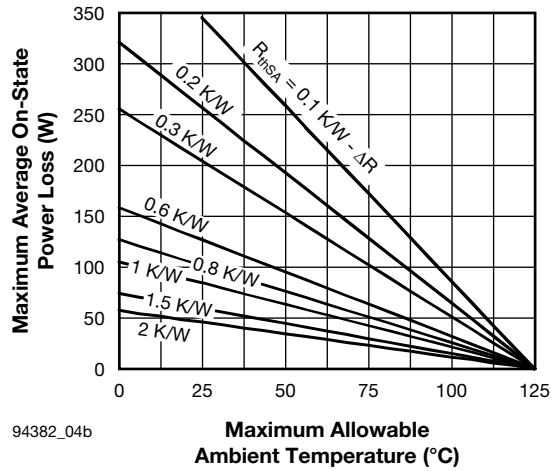


Fig. 4 - On-State Power Loss Characteristics

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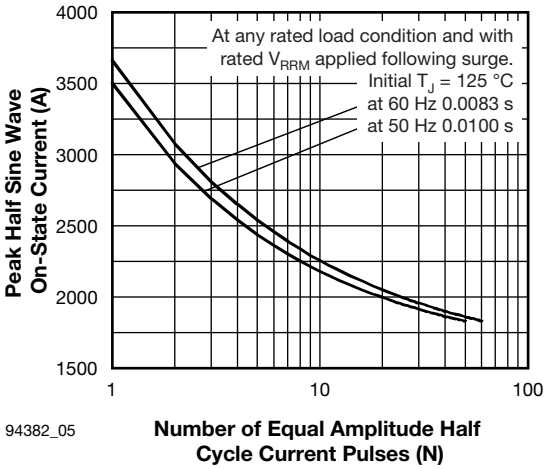

Fig. 5 - Maximum Non-Repetitive Surge Current

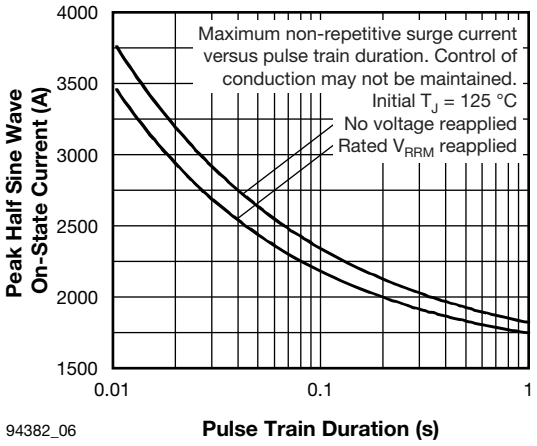

Fig. 6 - Maximum Non-Repetitive Surge Current

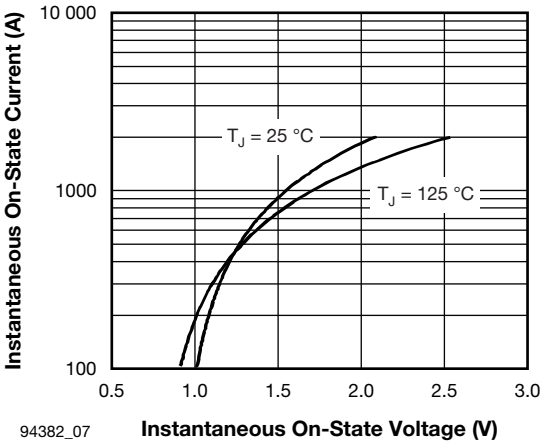

Fig. 7 - On-State Voltage Drop Characteristics

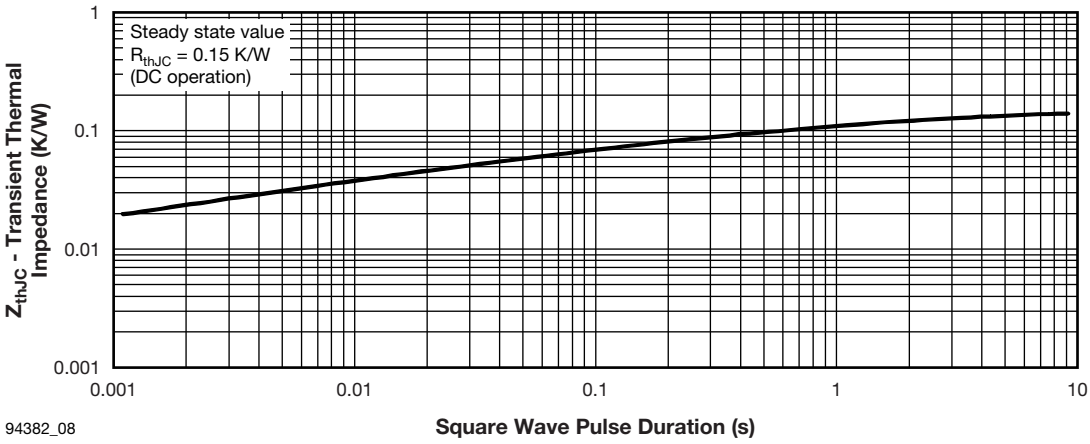

Fig. 8 - Thermal impedance Z_{thJC} Characteristics

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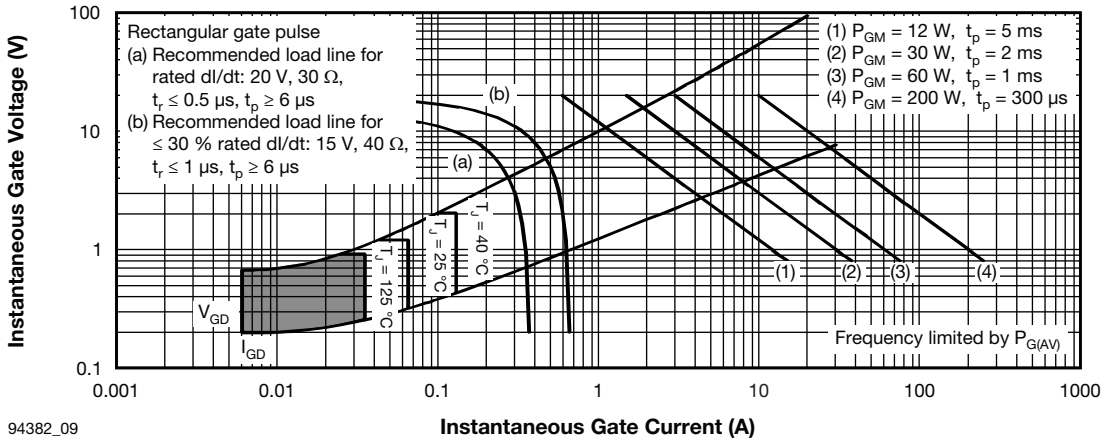

Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

Device code	VS-	18	1	RKI	100	PbF
	1	2	3	4	5	6

1 - Vishay Semiconductors product

2 - $I_{T(AV)}$ rated average output current (rounded/10)

3 - • 0 = eyelet terminals (gate and auxiliary cathode leads)
• 1 = fast-on terminals (gate and auxiliary cathode leads)

4 - Thyristor

5 - Voltage code x 10 = V_{RRM} (see Voltage Ratings table)

6 - • None = standard production
• PbF = lead (Pb)-free

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95077

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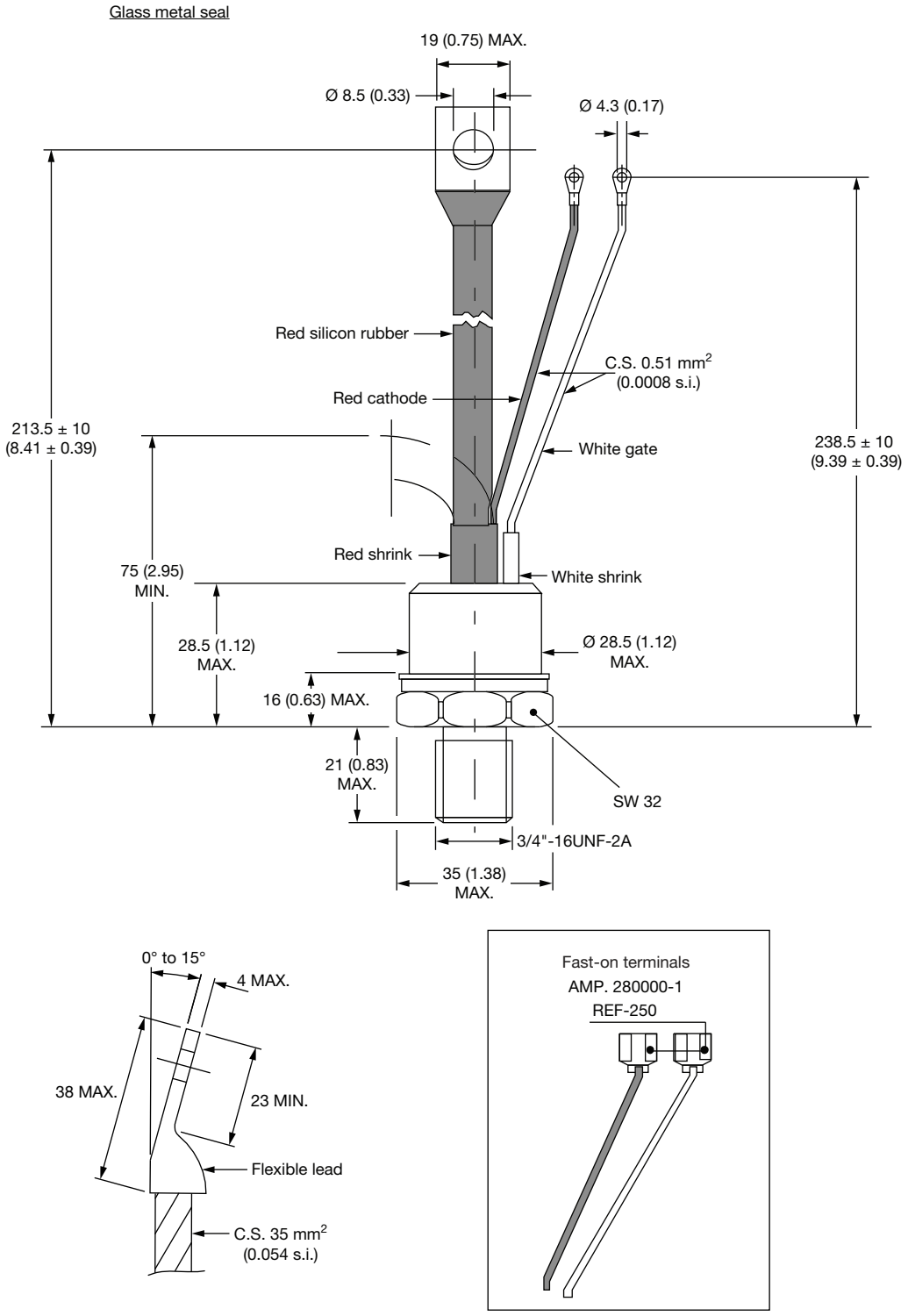
TO-209AB (TO-93)

DIMENSIONS in millimeters (inches)



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