

## Phase Control Thyristors (Stud Version), 180 A



TO-209AB (TO-93)

### FEATURES

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


**RoHS**  
COMPLIANT

### TYPICAL APPLICATIONS

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

### PRODUCT SUMMARY

$I_{T(AV)}$	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-209AB (TO-93)
Diode variation	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	
	60 Hz	4000	
$I^2t$	50 Hz	72	kA <sup>2</sup> s
	60 Hz	66	
$V_{DRM}/V_{RRM}$		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	



ABSOLUTE MAXIMUM RATINGS						
PARAMETER	SYMBOL	TEST CONDITIONS			VALUES	UNITS
Maximum average on-state current at case temperature	I <sub>T(AV)</sub>	180° conduction, half sine wave			180	A
					80	°C
Maximum RMS on-state current	I <sub>RMS</sub>	DC at 79 °C case temperature			285	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	3800	
		t = 8.3 ms			4000	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied		3500	
		t = 8.3 ms			3660	
Maximum I <sup>2</sup> t for fusing	I <sup>2</sup> t	t = 10 ms	No voltage reapplied		72	kA <sup>2</sup> s
		t = 8.3 ms			66	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied		61	
		t = 8.3 ms			56	
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t	t = 0.1 ms to 10 ms, no voltage reapplied			720	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			0.83	V
High level value of threshold voltage	V <sub>T(TO)2</sub>	(I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum			0.89	
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			0.92	mΩ
High level value of on-state slope resistance	r <sub>t2</sub>	(I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum			0.81	
Maximum on-state voltage	V <sub>TM</sub>	I <sub>pk</sub> = 570 A, T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> = 10 ms sine pulse			1.35	V
Maximum holding current	I <sub>H</sub>	T <sub>J</sub> = 25 °C, anode supply 12 V resistive load			600	mA
Typical latching current	I <sub>L</sub>				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 $\leq 80$ % $V_{DRM}$	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



TRIGGERING						
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES		UNITS
				TYP.	MAX.	
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>	T <sub>J</sub> = T <sub>J</sub> maximum, f = 50 Hz, d% = 50		2.0		
Maximum peak positive gate current	I <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> ≤ 5 ms		3.0		A
Maximum peak positive gate voltage	+ V <sub>GM</sub>			20		V
Maximum peak negative gate voltage	- V <sub>GM</sub>			5.0		
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 12 V anode to cathode applied	130	-	mA
		T <sub>J</sub> = 25 °C		65	150	
		T <sub>J</sub> = 125 °C		35	-	
DC gate voltage required to trigger	V <sub>GT</sub>	T <sub>J</sub> = - 40 °C		2.0	-	V
		T <sub>J</sub> = 25 °C		1.2	2.5	
		T <sub>J</sub> = 125 °C		0.9	-	
DC gate current not to trigger	I <sub>GD</sub>	T <sub>J</sub> = T <sub>J</sub> maximum	Maximum gate current/voltage not to trigger is the maximum value which will not trigger any unit with rated V <sub>DRM</sub> anode to cathode applied	10		mA
DC gate voltage not to trigger	V <sub>GD</sub>			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, $\pm 10$ %		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-209AB (TO-93)	

$\Delta R_{thJC}$ 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

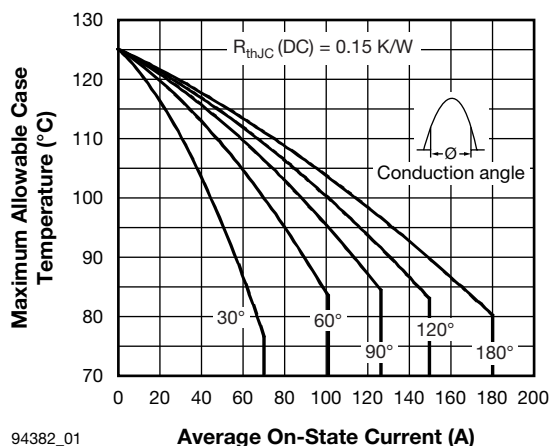


Fig. 1 - Current Ratings Characteristics

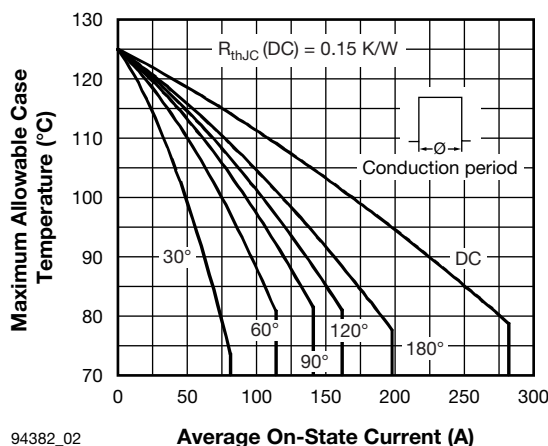


Fig. 2 - Current Ratings Characteristics

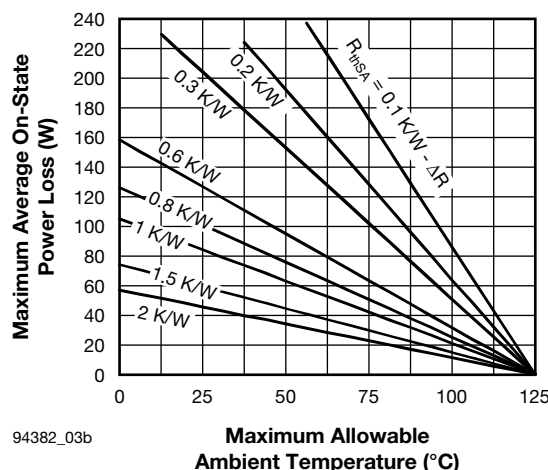
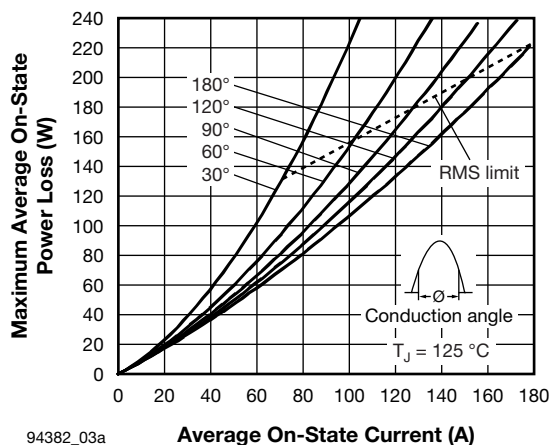


Fig. 3 - On-State Power Loss Characteristics

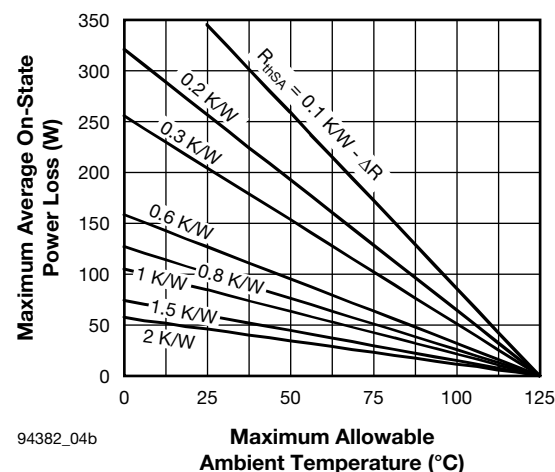
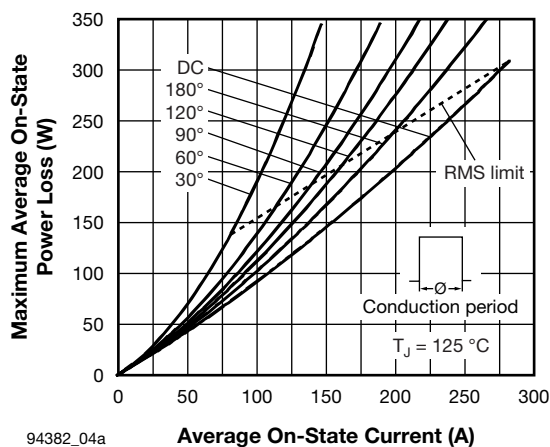


Fig. 4 - On-State Power Loss Characteristics

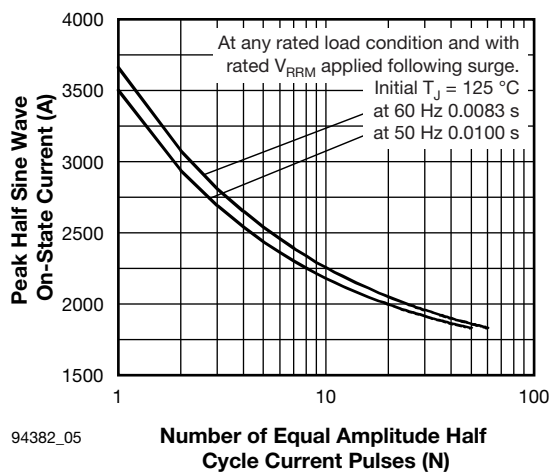


Fig. 5 - Maximum Non-Repetitive Surge Current

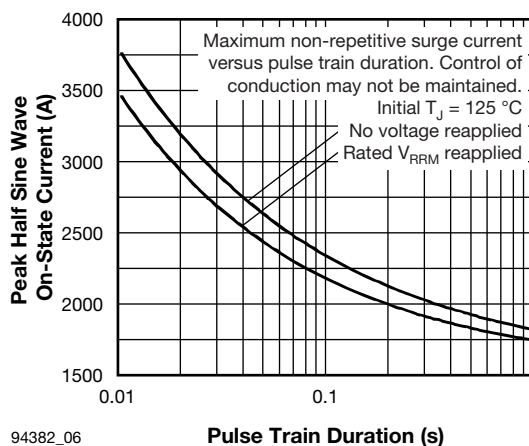


Fig. 6 - Maximum Non-Repetitive Surge Current

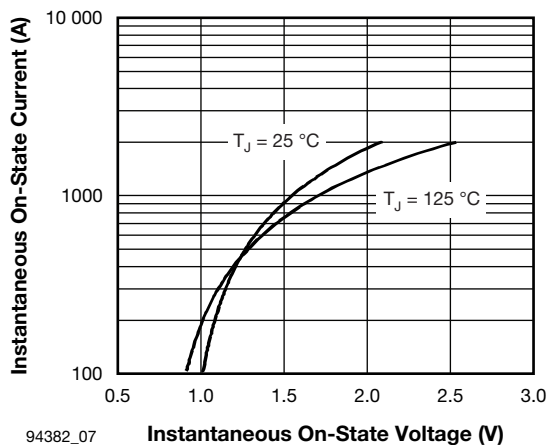


Fig. 7 - On-State Voltage Drop Characteristics

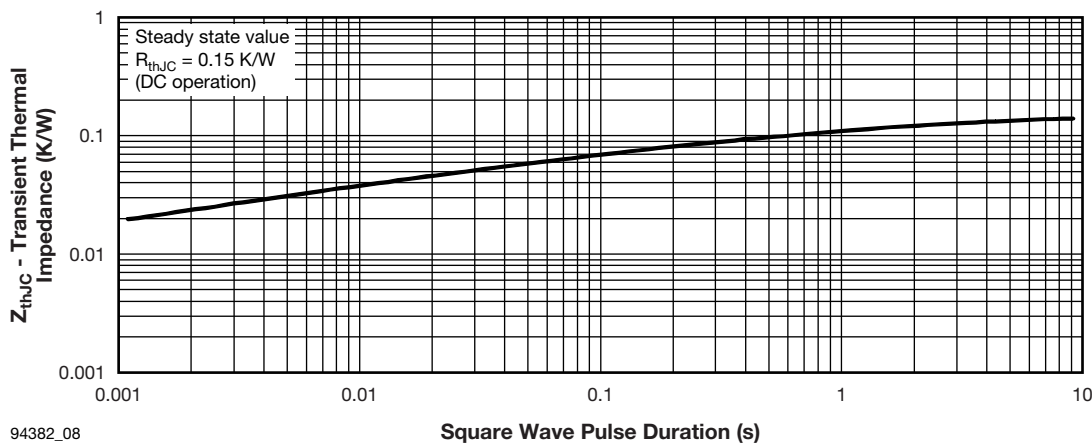


Fig. 8 - Thermal impedance  $Z_{thJC}$  Characteristics

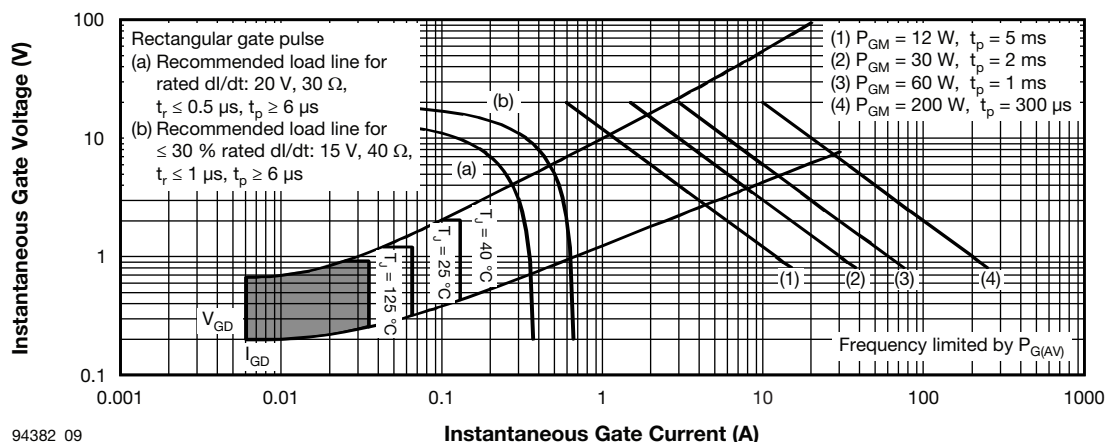


Fig. 9 - Gate Characteristics

## 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	<ul style="list-style-type: none"> <li>0 = Eyelet terminals (gate and auxiliary cathode leads)</li> <li>1 = Fast-on terminals (gate and auxiliary cathode leads)</li> </ul>					
4	- Thyristor					
5	- Voltage code x 10 = $V_{RRM}$ (see Voltage Ratings table)					
6	<ul style="list-style-type: none"> <li>None = Standard production</li> <li>PbF = Lead (Pb)-free</li> </ul>					

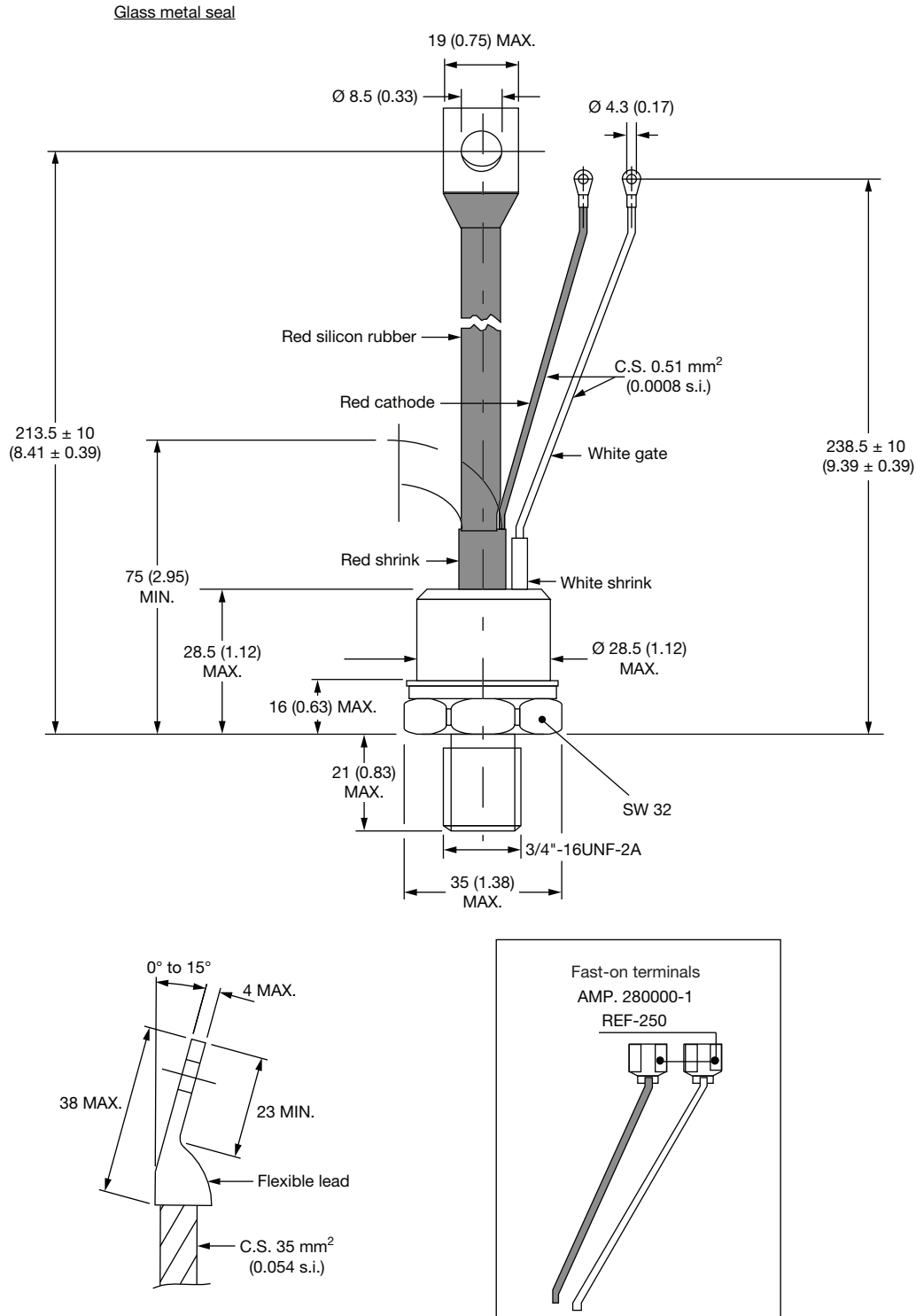
## LINKS TO RELATED DOCUMENTS

Dimensions

[www.vishay.com/doc?95077](http://www.vishay.com/doc?95077)

## TO-209AB (TO-93)

**DIMENSIONS** in millimeters (inches)





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