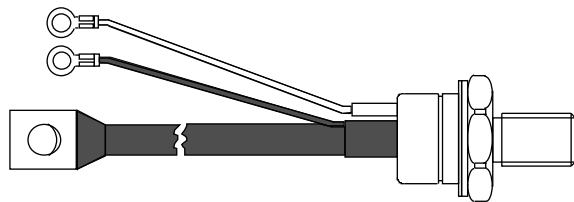


Phase Control Thyristors (Stud Version), 110 A



TO-209AC (TO-94)

FEATURES

- Center gate
- International standard case TO-209AC (TO-94)
- Compression bonded encapsulation for heavy duty operations such as severe thermal cycling
- Hermetic glass-metal case with ceramic insulator (Glass-metal seal over 1200 V)
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level


RoHS
COMPLIANT

PRODUCT SUMMARY

$I_{T(AV)}$	110 A
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TYPICAL APPLICATIONS

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

MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		110	A
	T_C	90	°C
$I_{T(RMS)}$		175	A
I_{TSM}	50 Hz	2700	
	60 Hz	2830	
I^2t	50 Hz	36.4	kA ² s
	60 Hz	33.2	
V_{DRM}/V_{RRM}		400 to 1600	V
t_q	Typical	100	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 V	V_{RSM} , MAXIMUM NON-REPETITIVE PEAK VOLTAGE V	I_{DRM}/I_{RRM} MAXIMUM AT $T_J = T_J$ MAXIMUM mA
ST110S	04	400	500	20
	08	800	900	
	12	1200	1300	
	16	1600	1700	

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	110	A
			90	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 85 °C case temperature	175	
Maximum peak, one-cycle non-repetitive surge current	I_{TSM}	$t = 10$ ms	No voltage reappplied	2700
		$t = 8.3$ ms	No voltage reappplied	2830
		$t = 10$ ms	100 % V_{RRM} reappplied	2270
		$t = 8.3$ ms	100 % V_{RRM} reappplied	2380
Maximum I^2t for fusing	I^2t	$t = 10$ ms	No voltage reappplied	36.4
		$t = 8.3$ ms	No voltage reappplied	33.2
		$t = 10$ ms	100 % V_{RRM} reappplied	25.8
		$t = 8.3$ ms	100 % V_{RRM} reappplied	23.5
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	$t = 0.1$ to 10 ms, no voltage reappplied	364	$kA^2\sqrt{s}$
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	0.90	V
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum	0.92	
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	1.79	mΩ
High level value of on-state slope resistance	r_{t2}	$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum	1.81	
Maximum on-state voltage	V_{TM}	$I_{pk} = 350$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine pulse	1.52	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}	500	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	2.0	μs
Typical turn-off time	t_q	$I_{TM} = 100$ A, $T_J = T_J$ maximum, $di/dt = 10$ A/μs, $V_R = 50$ V, $dV/dt = 20$ V/μs, gate 0 V 100 Ω, $t_p = 500$ 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	20	mA



TRIGGERING						
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES		UNITS
				TYP.	MAX.	
Maximum peak gate power	P _{GM}	T _J = T _J maximum, t _p ≤ 5 ms		5		W
Maximum average gate power	P _{G(AV)}	T _J = T _J maximum, f = 50 Hz, d% = 50		1		
Maximum peak positive gate current	I _{GM}	T _J = T _J maximum, t _p ≤ 5 ms		2.0		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 6 V anode to cathode applied	180	-	mA
		T _J = 25 °C		90	150	
		T _J = 125 °C		40	-	
DC gate voltage required to trigger	V _{GT}	T _J = - 40 °C		2.9	-	V
		T _J = 25 °C		1.8	3.0	
		T _J = 125 °C		1.2	-	
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		0.195	K/W
Maximum thermal resistance, case to heatsink	R_{thCS}	Mounting surface, smooth, flat and greased		0.08	
Mounting torque, ± 10 %		Non-lubricated threads		15.5 (137)	Nm (lbf · in)
		Lubricated threads		14 (120)	
Approximate weight				130	g
Case style		See dimensions - link at the end of datasheet		TO-209AC (TO-94)	

ΔR_{thJC} CONDUCTION				
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	UNITS
180°	0.035	0.025	$T_J = T_J \text{ maximum}$	K/W
120°	0.041	0.042		
90°	0.052	0.056		
60°	0.076	0.079		
30°	0.126	0.127		

Note

- The table above shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC

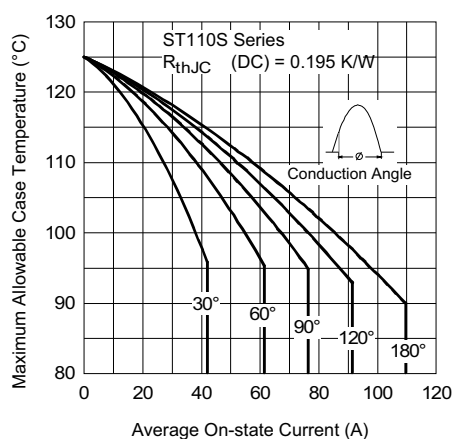


Fig. 1 - Current Ratings Characteristics

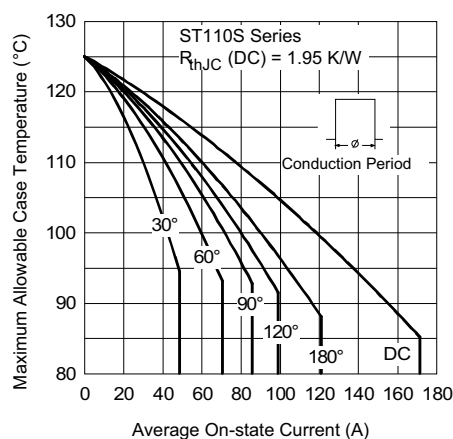


Fig. 2 - Current Ratings Characteristics

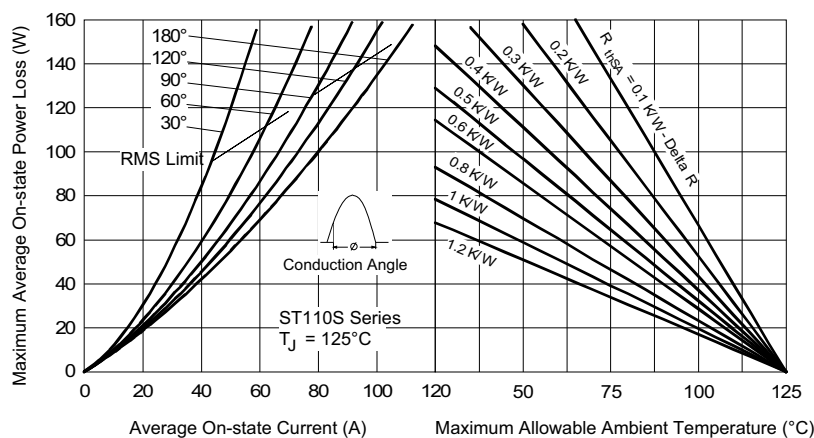


Fig. 3 - On-State Power Loss Characteristics

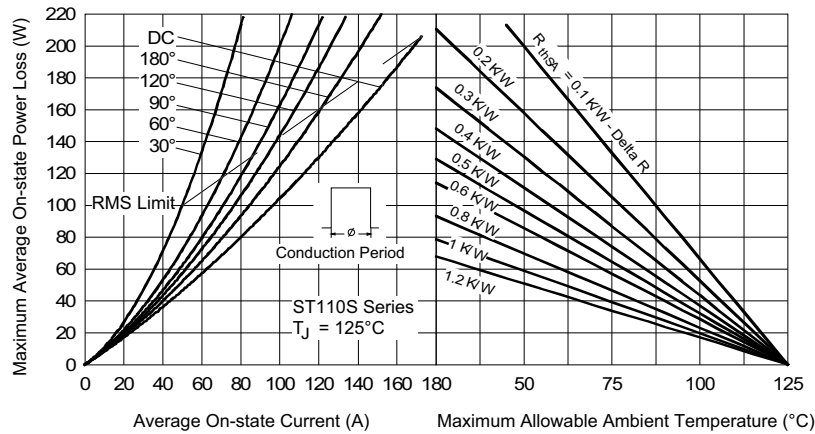


Fig. 4 - On-State Power Loss Characteristics

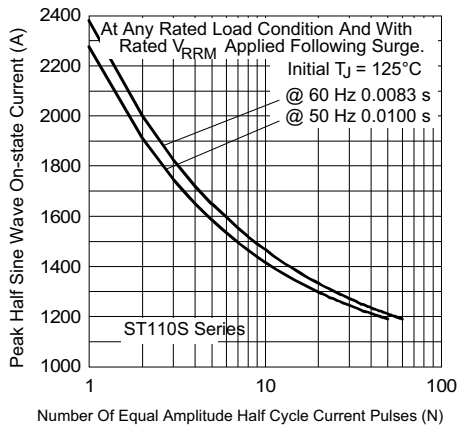


Fig. 5 - Maximum Non-Repetitive Surge Current

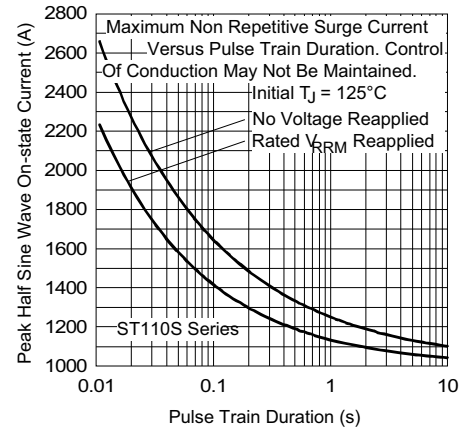


Fig. 6 - Maximum Non-Repetitive Surge Current

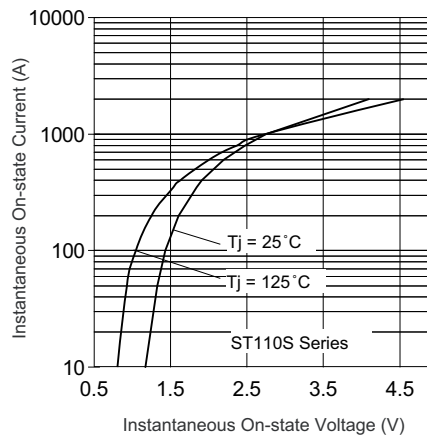


Fig. 7 - On-State Voltage Drop Characteristics

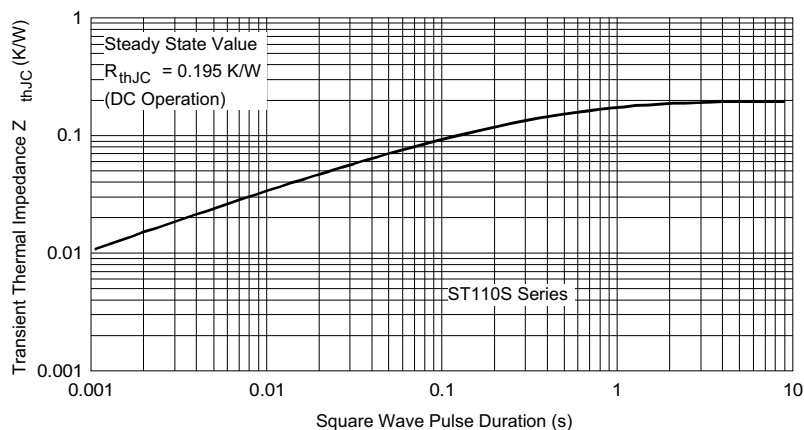


Fig. 8 - Thermal Impedance Z_{thJC} Characteristic

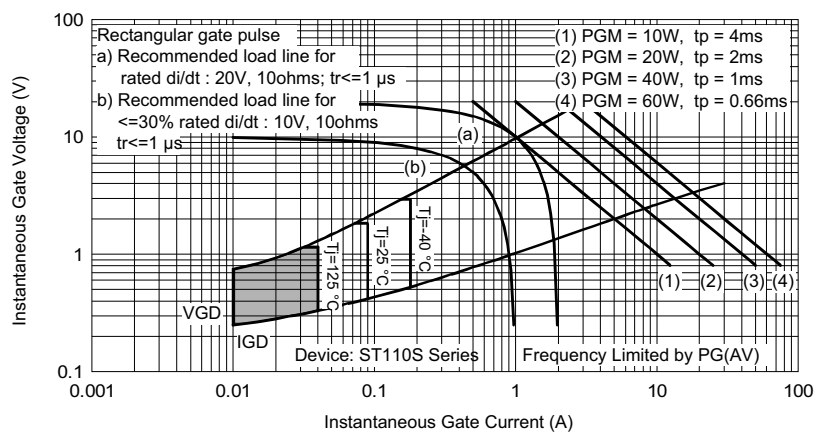


Fig. 9 - Gate Characteristics



ORDERING INFORMATION TABLE

Device code	ST	11	0	S	16	P	0	V	L	PbF
	1	2	3	4	5	6	7	8	9	10

- 1** - Thyristor
- 2** - Essential part marking
- 3** - 0 = Converter grade
- 4** - S = Compression bonding stud
- 5** - Voltage code x 100 = V_{RRM} (see Voltage Ratings table)
- 6** - P = Stud base 20UNF threads
- 7** - 0 = Eyelet terminals (gate and auxiliary cathode leads)
1 = Fast-on terminals (gate and auxiliary cathode leads)
2 = Flag terminals (for cathode and gate terminals)
- 8** -
 - V = Glass-metal seal (only up to 1200 V)
 - None = Ceramic housing (over 1200 V)
- 9** - Critical dV/dt:
 - None = 500 V/ μ s (standard value)
 - L = 1000 V/ μ s (special selection)
- 10** - Lead (Pb)-free

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95078

DIMENSIONS in millimeters (inches)

Technical drawing of a cathode assembly. The drawing shows a central vertical assembly with a red cathode and a red silicon rubber seal. The assembly is mounted on a base with a 1/2"-20UNF-2A thread. Dimensions are given in inches and millimeters. Labels include: 16.5 (0.65) MAX., Ø 8.5 (0.33), Ø 4.3 (0.17), Red silicon rubber, Red cathode, C.S. 0.4 mm² (0.0006 s.i.), White gate, 215 ± 10 (8.46 ± 0.39), White shrink, Ø 23.5 (0.93) MAX., 12.5 (0.49) MAX., 21 (0.83) MAX., 1/2"-20UNF-2A, 29.5 (1.16) MAX., 70 (2.75) MIN., 29 (1.14) MAX., 157 (6.18), 170 (6.69), SW 27.

Diagram illustrating the dimensions and materials for a cable joint:

- Dimensions:
 - 2.6 (0.10) MAX. (Length of the joint section)
 - 9.5 (0.37) MIN. (Length of the joint section)
 - 20 (0.79) MIN. (Length of the joint section)
- Materials:
 - Flexible lead
 - C.S. 16 mm² (0.025 s.i.)

Fast-on terminals

AMP. 280000-1

REF-250

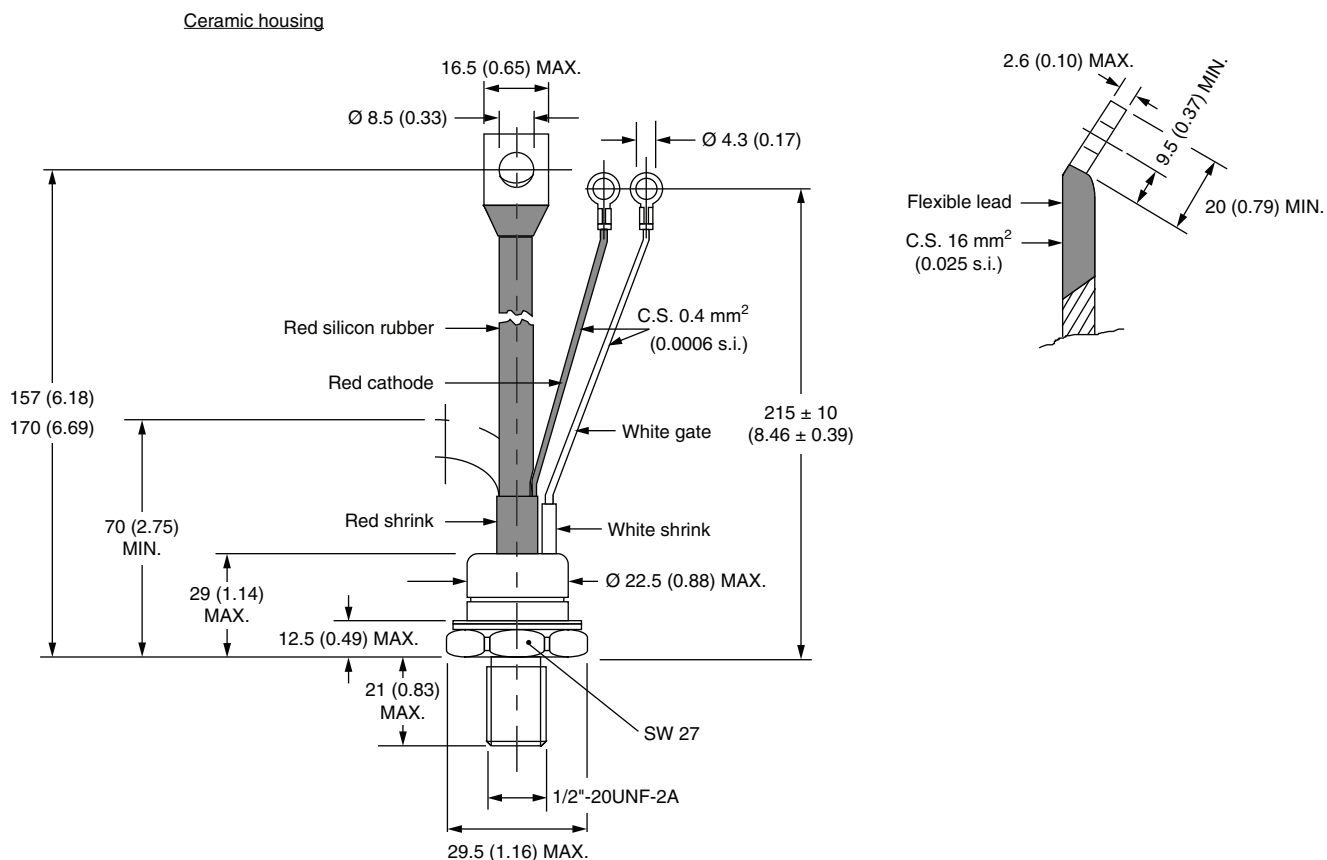
The diagram shows two AMP 280000-1 Fast-on terminals. A single wire, labeled REF-250, is shown passing through both terminals. The wire is depicted as a single line, indicating it is a single conductor. The terminals are shown in a perspective view, with the wire entering from the bottom and exiting from the top. The wire is shown as a single line, indicating it is a single conductor.

Outline Dimensions

Vishay Semiconductors TO-209AC (TO-94) for ST110S Series



DIMENSIONS in millimeters (inches)





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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9