

Phase Control Thyristors (Stud Version), 110 A



TO-94 (TO-209AC)

FEATURES

- Center gate
- International standard case TO-94 (TO-209AC)
- 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)
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

PRIMARY CHARACTERISTICS

$I_{T(AV)}$	110 A
V_{DRM}/V_{RRM}	400 V, 800 V, 1200 V, 1600 V
V_{TM}	1.52 V
I_{GT}	150 mA
T_J	-40 °C to +125 °C
Package	TO-94 (TO-209AC)
Circuit configuration	Single SCR

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
VS-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 reapplied	Sinusoidal half wave, initial T _J = T _J maximum	2700	A
		t = 8.3 ms			2830	
		t = 10 ms	100 % V _{RRM}		2270	
		t = 8.3 ms	reapplied		2380	
Maximum I ² t for fusing	I ² t	t = 10 ms	No voltage reapplied		36.4	kA ² s
		t = 8.3 ms			33.2	
		t = 10 ms	100 % V _{RRM}		25.8	
		t = 8.3 ms	reapplied		23.5	
Maximum I ² √t for fusing	I ² √t	t = 0.1 to 10 ms, no voltage reapplied			364	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			0.90	V
High level value of threshold voltage	V _{T(TO)2}	(I > π × I _{T(AV)}), T _J = T _J maximum			0.92	
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			1.79	mΩ
High level value of on-state slope resistance	r _{t2}	(I > π × 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-94 (TO-209AC)	

ΔR_{thJC} CONDUCTION				
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	UNITS
180°	0.035	0.025	$T_J = T_J$ 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

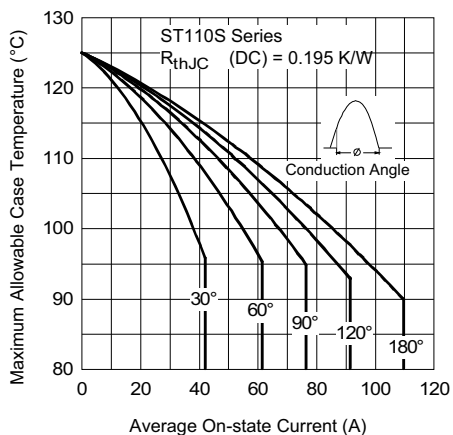


Fig. 1 - Current Ratings Characteristics

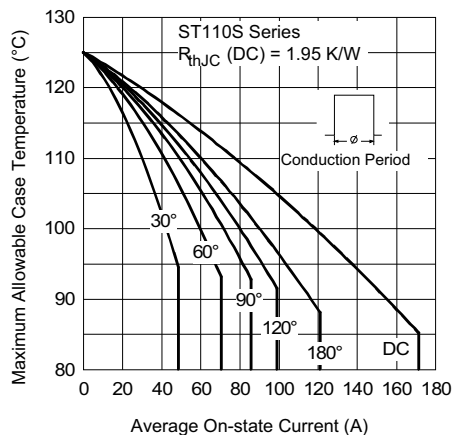


Fig. 2 - Current Ratings Characteristics

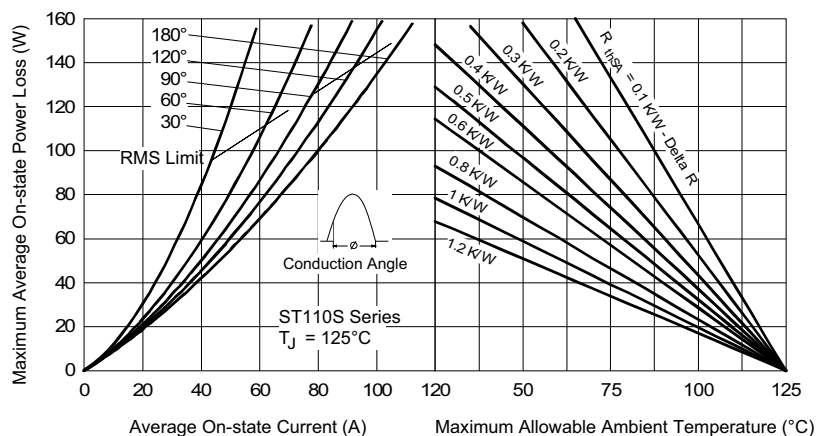


Fig. 3 - On-State Power Loss Characteristics

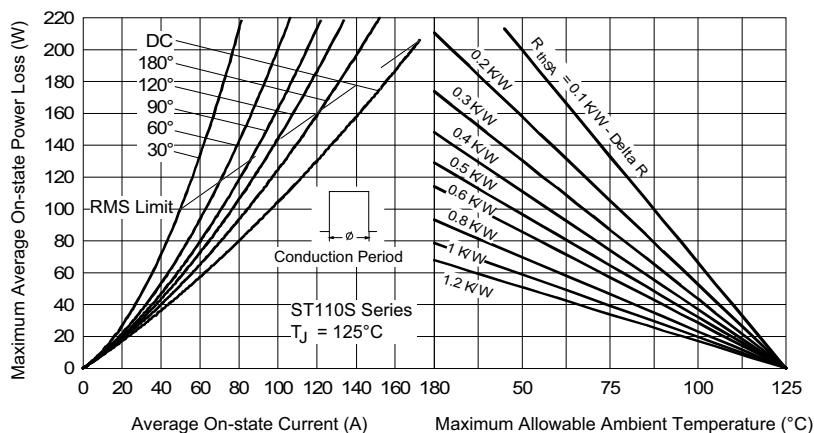


Fig. 4 - On-State Power Loss Characteristics

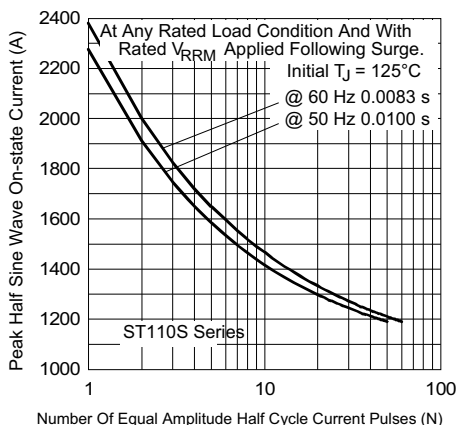


Fig. 5 - Maximum Non-Repetitive Surge Current

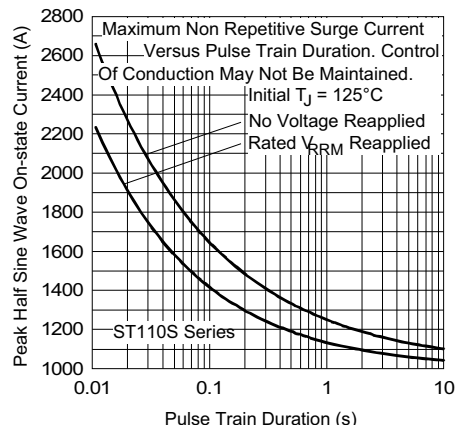


Fig. 6 - Maximum Non-Repetitive Surge Current

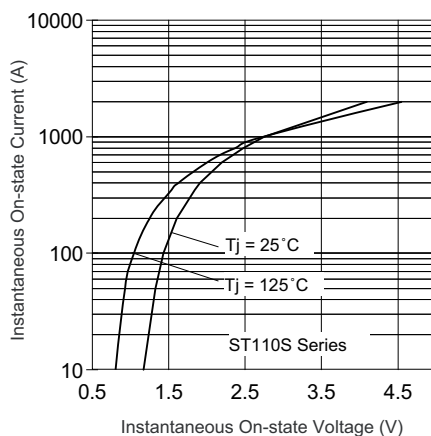


Fig. 7 - On-State Voltage Drop Characteristics

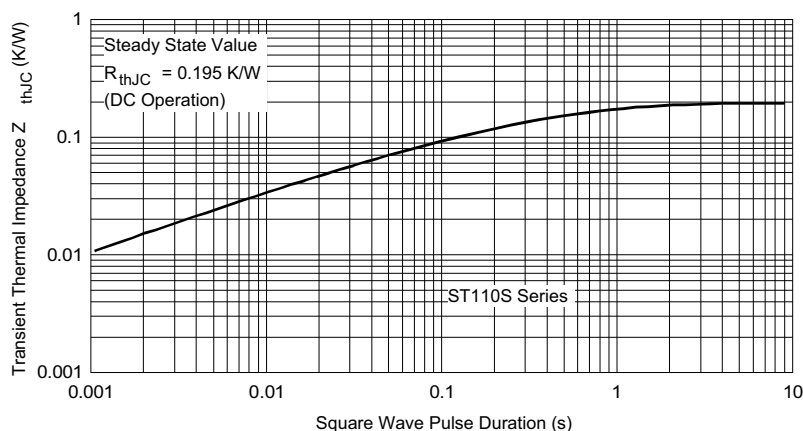


Fig. 8 - Thermal Impedance Z_{thJC} Characteristic

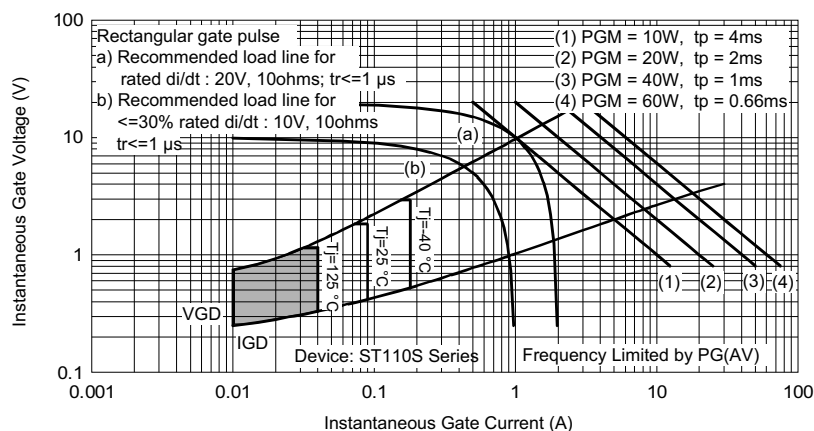


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

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

- 1** - Vishay Semiconductors product
- 2** - Thyristor
- 3** - Essential part marking
- 4** - 0 = converter grade
- 5** - S = compression bonding stud
- 6** - Voltage code $\times 100 = V_{RRM}$ (see Voltage Ratings table)
- 7** - P = stud base 20UNF threads
- 8** - 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)
- 9** - • V = glass-metal seal (only up to 1200 V)
• None = ceramic housing (over 1200 V)
- 10** - Critical dV/dt :
• None = 500 V/ μs (standard value)
• L = 1000 V/ μs (special selection)
- 11** - None = standard production
- PbF = lead (Pb)-free

LINKS TO RELATED DOCUMENTS

Dimensions	www.vishay.com/doc?95078
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DIMENSIONS in millimeters (inches)

Technical drawing of a catheter assembly with dimensions and labels:

- Top Dimensions:**
 - 16.5 (0.65) MAX. (Top section width)
 - Ø 8.5 (0.33) (Top section diameter)
 - Ø 4.3 (0.17) (Side connection diameter)
- Material Labels:**
 - Red silicon rubber
 - Red cathode
 - Red shrink
 - White gate
 - White shrink
 - C.S. 0.4 mm² (0.0006 s.i.) (Cathode wire)
- Dimensions and Tolerances:**
 - 157 (6.18) (Total height)
 - 170 (6.69) (Height to top of main body)
 - 70 (2.75) MIN. (Height of main body)
 - 29 (1.14) MAX. (Height of main body section)
 - 12.5 (0.49) MAX. (Height of main body section)
 - 21 (0.83) MAX. (Height of main body section)
 - 215 ± 10 (8.46 ± 0.39) (Total height to base)
 - Ø 23.5 (0.93) MAX. (Base diameter)
 - 29.5 (1.16) MAX. (Base width)
 - 1/2"-20UNF-2A (Thread specification)
- Other Labels:**
 - SW 27 (Switch)

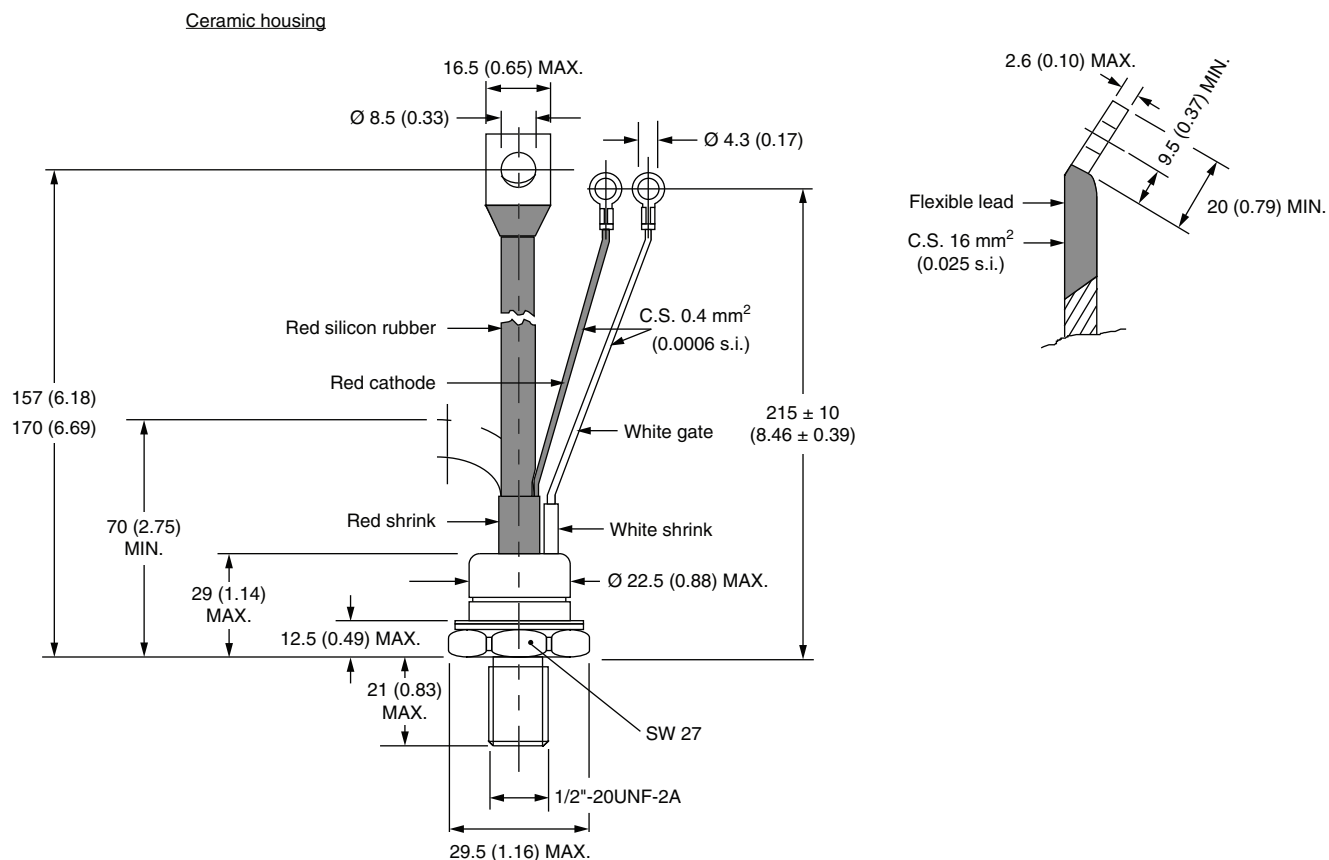
Diagram illustrating the dimensions and materials for a cable joint:

- 2.6 (0.10) MAX. (Dimension of the top section)
- 9.5 (0.37) MIN. (Dimension of the middle section)
- 20 (0.79) MIN. (Dimension of the bottom section)
- Flexible lead (Material of the top section)
- C.S. 16 mm² (0.025 s.i.) (Material of the middle and bottom sections)

Fast-on terminals
AMP. 280000-1
REF-250

The diagram shows two AMP 280000-1 Fast-on terminals connected to a REF-250 cable. The terminals are shown in a perspective view, with the top terminal connected to the left conductor (dark grey) and the bottom terminal connected to the right conductor (light grey). The terminals are labeled 'AMP. 280000-1' and 'REF-250'.

DIMENSIONS in millimeters (inches)





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