

International  
**IR** Rectifier

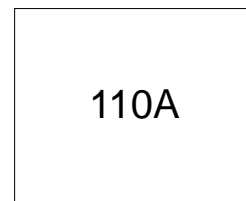
## ST110S SERIES

PHASE CONTROL THYRISTORS

Stud Version

### Features

- Center gate
- Hermetic metal case with ceramic insulator (Glass-metal seal over 1200V)
- International standard case TO-209AC (TO-94)
- Compression Bonded Encapsulation for heavy duty operations such as severe thermal cycling

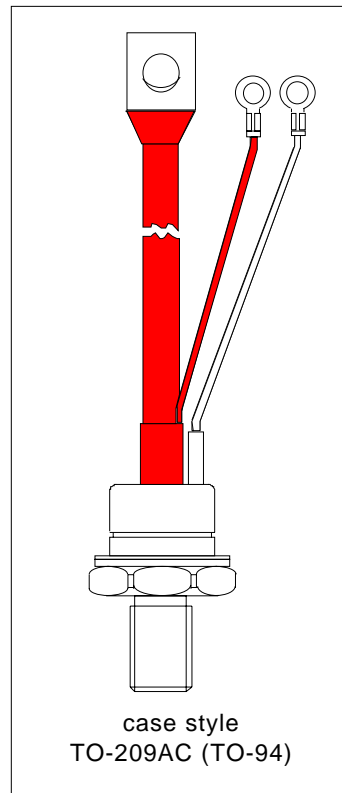


### Typical Applications

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

### Major Ratings and Characteristics

Parameters	ST110S	Units
$I_{T(AV)}$	110	A
@ $T_C$	90	°C
$I_{T(RMS)}$	175	A
$I_{TSM}$ @ 50Hz	2700	A
@ 60Hz	2830	A
$I^2t$ @ 50Hz	36.4	KA <sup>2</sup> s
@ 60Hz	33.2	KA <sup>2</sup> s
$V_{DRM}/V_{RRM}$	400 to 1600	V
$t_q$ typical	100	μs
$T_J$	- 40 to 125	°C



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Bulletin I25167 rev. C 03/03

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### ELECTRICAL SPECIFICATIONS

#### Voltage Ratings

Type number	Voltage Code	$V_{DRM}/V_{RRM}$ , max. repetitive peak and off-state voltage V	$V_{RSM}$ , maximum non-repetitive peak voltage V	$I_{DRM}/I_{RRM}$ max. @ $T_J = T_J$ max mA
ST110S	04	400	500	20
	08	800	900	
	12	1200	1300	
	16	1600	1700	

#### On-state Conduction

Parameter	ST110S	Units	Conditions
$I_{T(AV)}$ Max. average on-state current @ Case temperature	110	A	180° conduction, half sine wave
	90	°C	
$I_{T(RMS)}$ Max. RMS on-state current	175	A	DC @ 85°C case temperature
$I_{TSM}$ Max. peak, one-cycle non-repetitive surge current	2700	A	t = 10ms No voltage
	2830		t = 8.3ms reapplied
	2270		t = 10ms 100% $V_{RRM}$
	2380		t = 8.3ms reapplied
$I^2t$ Maximum $I^2t$ for fusing	36.4	KA <sup>2</sup> s	t = 10ms No voltage
	33.2		t = 8.3ms reapplied
	25.8		t = 10ms 100% $V_{RRM}$
	23.5		t = 8.3ms reapplied
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	364	KA <sup>2</sup> √s	t = 0.1 to 10ms, no voltage reapplied
$V_{T(TO)1}$ Low level value of threshold voltage	0.90	V	(16.7% x $\pi$ x $I_{T(AV)}$ ) < I < $\pi$ x $I_{T(AV)}$ , $T_J = T_J$ max.
$V_{T(TO)2}$ High level value of threshold voltage	0.92		(I > $\pi$ x $I_{T(AV)}$ ), $T_J = T_J$ max.
$r_{t1}$ Low level value of on-state slope resistance	1.79	mΩ	(16.7% x $\pi$ x $I_{T(AV)}$ ) < I < $\pi$ x $I_{T(AV)}$ , $T_J = T_J$ max.
$r_{t2}$ High level value of on-state slope resistance	1.81		(I > $\pi$ x $I_{T(AV)}$ ), $T_J = T_J$ max.
$V_{TM}$ Max. on-state voltage	1.52	V	$I_{pk} = 350A$ , $T_J = T_J$ max, $t_p = 10ms$ sine pulse
$I_H$ Maximum holding current	600	mA	$T_J = 25^\circ C$ , anode supply 12V resistive load
$I_L$ Typical latching current	1000		

#### Switching

Parameter	ST110S	Units	Conditions
di/dt Max. non-repetitive rate of rise of turned-on current	500	A/μs	Gate drive 20V, 20Ω, $t_r \leq 1\mu s$ $T_J = T_J$ max, anode voltage $\leq 80\% V_{DRM}$
$t_d$ Typical delay time	2.0	μs	Gate current 1A, $di_g/dt = 1A/\mu s$ $V_d = 0.67\% V_{DRM}$ , $T_J = 25^\circ C$
$t_q$ Typical turn-off time	100		$I_{TM} = 100A$ , $T_J = T_J$ max, $di/dt = 10A/\mu s$ , $V_R = 50V$ $dv/dt = 20V/\mu s$ , Gate 0V 100Ω, $t_p = 500\mu s$

Blocking

Parameter	ST110S	Units	Conditions
dv/dt Maximum critical rate of rise of off-state voltage	500	V/ $\mu$ s	$T_J = T_J$ max. linear to 80% rated $V_{DRM}$
$I_{RRM}$ $I_{DRM}$ Max. peak reverse and off-state leakage current	20	mA	$T_J = T_J$ max, rated $V_{DRM}/V_{RRM}$ applied

Triggering

Parameter	ST110S		Units	Conditions
$P_{GM}$ Maximum peak gate power	5		W	$T_J = T_J$ max, $t_p \leq 5$ ms
$P_{G(AV)}$ Maximum average gate power	1			
$I_{GM}$ Max. peak positive gate current	2.0		A	$T_J = T_J$ max, $t_p \leq 5$ ms
$+V_{GM}$ Maximum peak positive gate voltage	20		V	$T_J = T_J$ max, $t_p \leq 5$ ms
$-V_{GM}$ Maximum peak negative gate voltage	5.0			
$I_{GT}$ DC gate current required to trigger	TYP.	MAX.	mA	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$  Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
	180	-		
	90	150		
$V_{GT}$ DC gate voltage required to trigger	2.9	-	V	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$
	1.8	3.0		
	1.2	-		
$I_{GD}$ DC gate current not to trigger	10		mA	$T_J = T_J$ max Max. gate current/ voltage not to trigger is the max. value which will not trigger any unit with rated $V_{DRM}$ anode-to-cathode applied
$V_{GD}$ DC gate voltage not to trigger	0.25			

Thermal and Mechanical Specification

Parameter	ST110S	Units	Conditions
$T_J$ Max. operating temperature range	-40 to 125	$^\circ\text{C}$	
$T_{stg}$ Max. storage temperature range	-40 to 150		
$R_{thJC}$ Max. thermal resistance, junction to case	0.195	K/W	DC operation
$R_{thCS}$ Max. thermal resistance, case to heatsink	0.08		Mounting surface, smooth, flat and greased
T Mounting torque, $\pm 10\%$	15.5	Nm (lbf-in)	Non lubricated threads
	(137)		Lubricated threads
	14 (120)		
wt Approximate weight	130	g	
Case style	TO-209AC(TO-94)		See Outline Table

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### $\Delta R_{thJC}$ Conduction

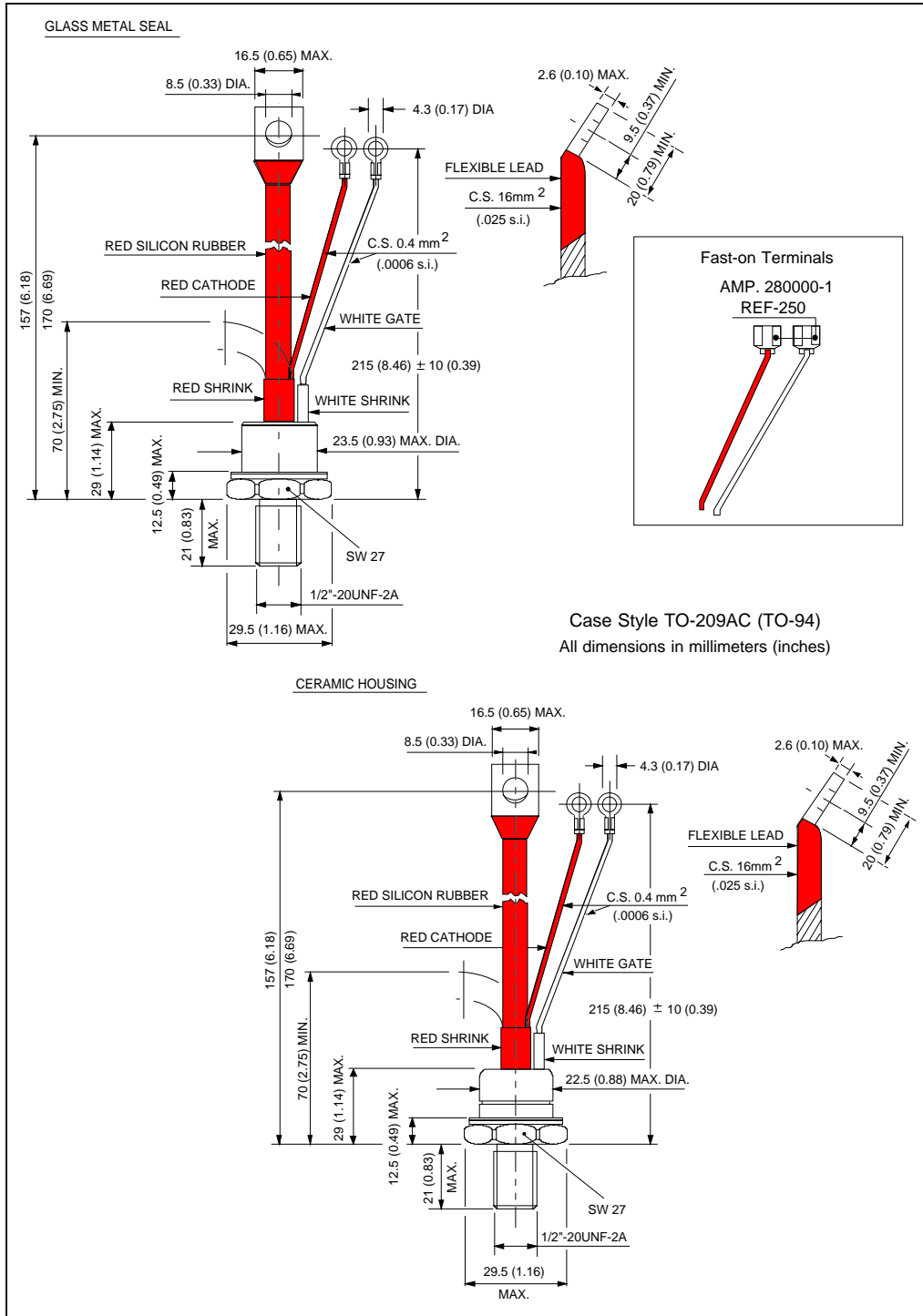
(The following table shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC)

Conduction angle	Sinusoidal conduction	Rectangular conduction	Units	Conditions
180°	0.035	0.025	K/W	$T_J = T_J \text{ max.}$
120°	0.041	0.042		
90°	0.052	0.056		
60°	0.076	0.079		
30°	0.126	0.127		

### Ordering Information Table

Device Code							
ST	11	0	S	16	P	0	V
①	②	③	④	⑤	⑥	⑦	⑧
<b>1</b>	- Thyristor						
<b>2</b>	- Essential part number						
<b>3</b>	- 0 = Converter grade						
<b>4</b>	- S = Compression bonding Stud						
<b>5</b>	- Voltage code: Code x 100 = $V_{RRM}$ (See Voltage Rating Table)						
<b>6</b>	- P = Stud base 1/2"-20UNF-2A threads						
<b>7</b>	- 0 = Eyelet terminals (Gate and Auxiliary Cathode Leads) 1 = Fast - on terminals (Gate and Auxiliary Cathode Leads)						
<b>8</b>	- V = Glass-metal seal (only up to 1200V) None = Ceramic housing (over 1200V)						

Outline Table



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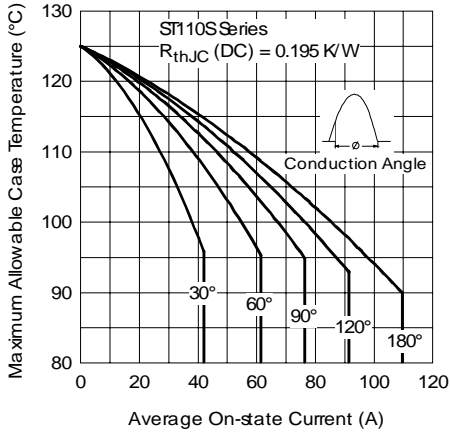


Fig. 1 - Current Ratings Characteristics

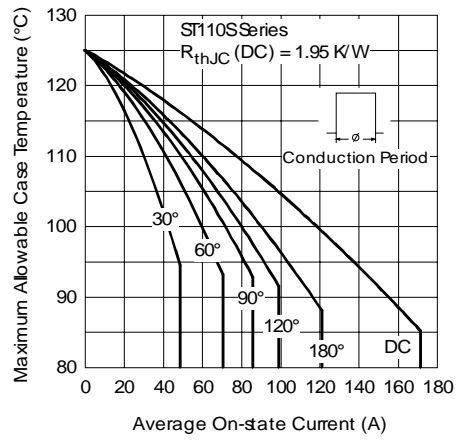


Fig. 2 - Current Ratings Characteristics

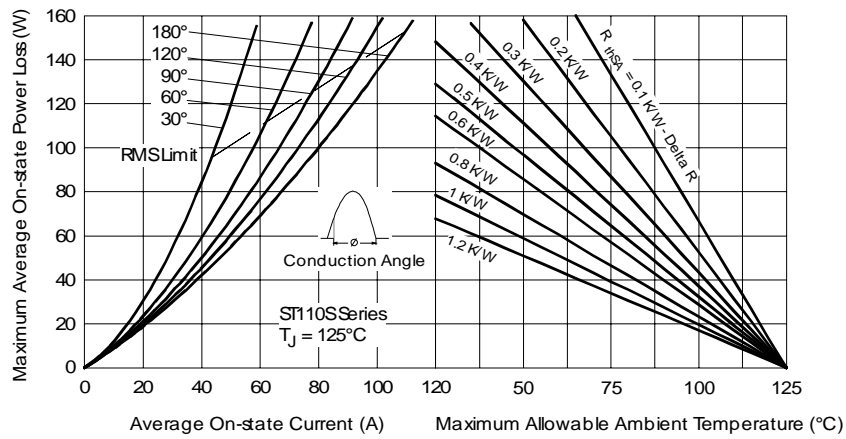


Fig. 3 - On-state Power Loss Characteristics

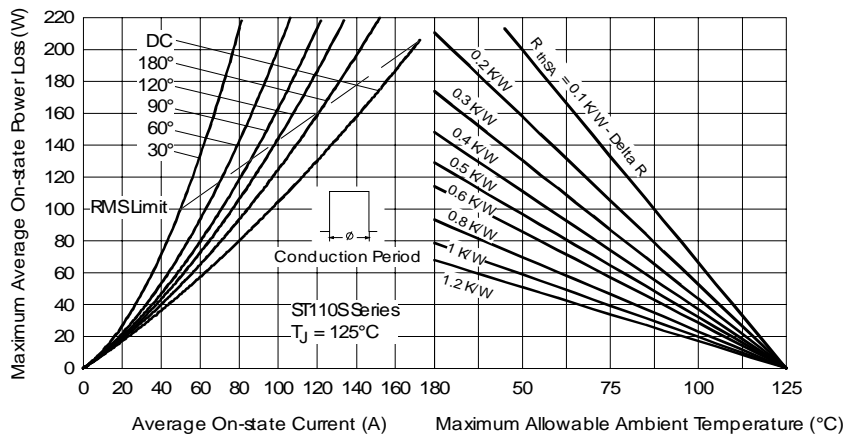


Fig. 4 - On-state Power Loss Characteristics

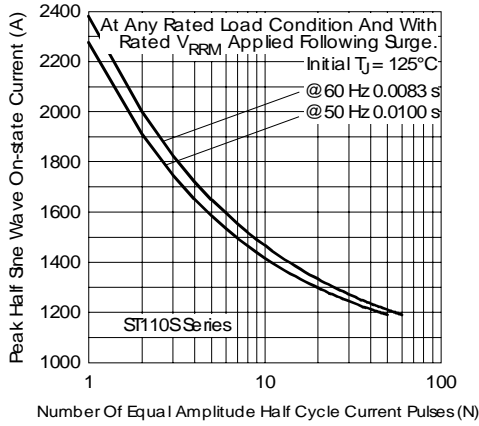


Fig. 5 - Maximum Non-Repetitive Surge Current

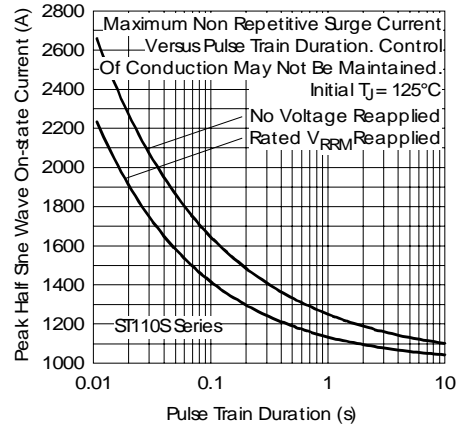


Fig. 6 - Maximum Non-Repetitive Surge Current

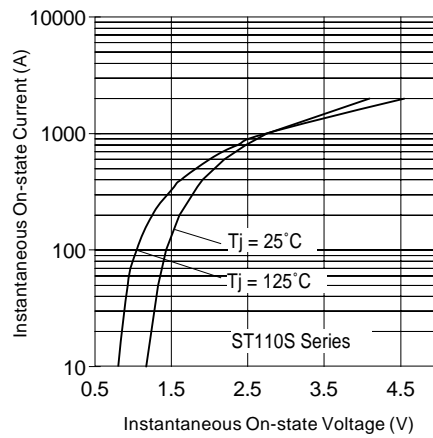


Fig. 7 - On-state Voltage Drop Characteristics

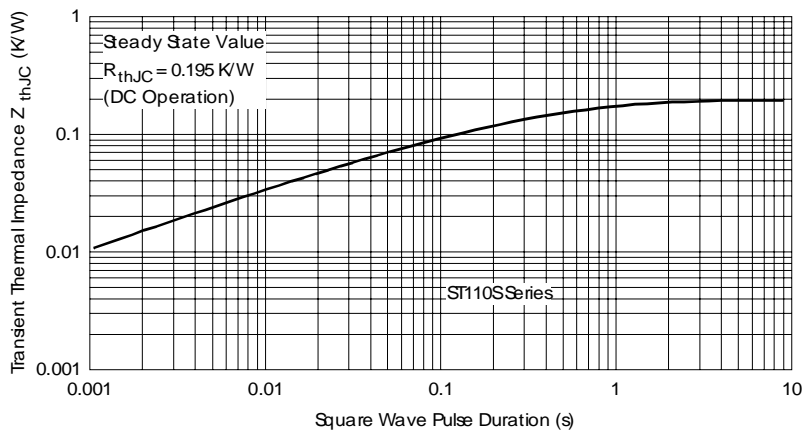


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

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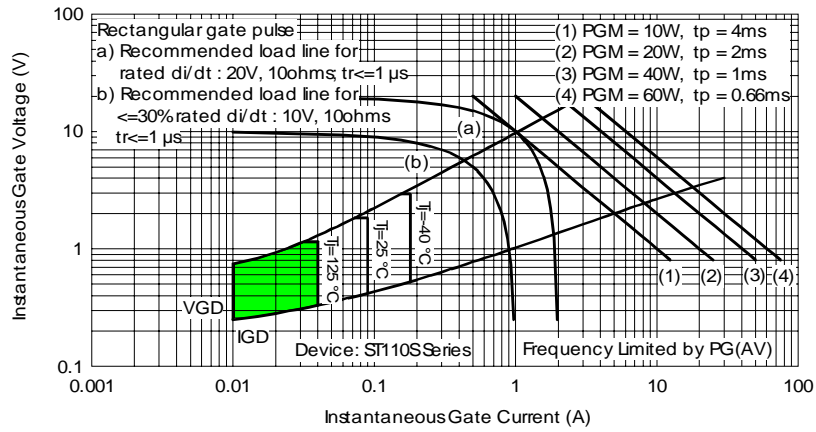


Fig. 9 - Gate Characteristics

Data and specifications subject to change without notice.  
This product has been designed and qualified for Industrial Level.  
Qualification Standards can be found on IR's Web site.

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