

International
IRF Rectifier

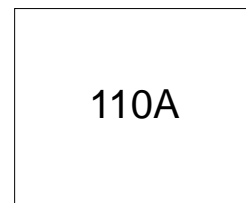
ST110S SERIES

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

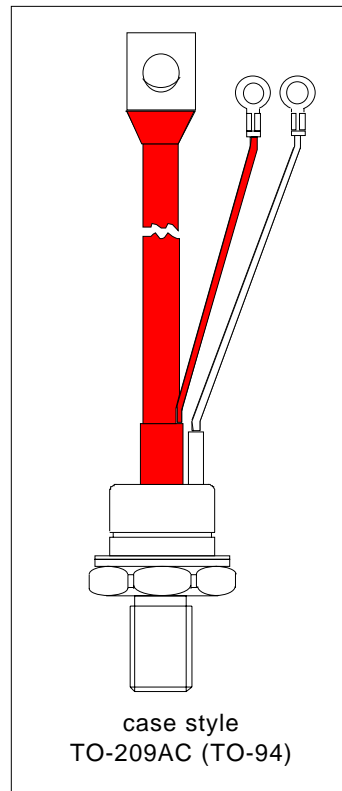


Typical Applications

- 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 ² s
@ 60Hz	33.2	KA ² 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 ² 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 ² √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 π x $I_{T(AV)}$) < I < π x $I_{T(AV)}$, $T_J = T_J$ max.
$V_{T(TO)2}$ High level value of threshold voltage	0.92		(I > π 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 π x $I_{T(AV)}$) < I < π x $I_{T(AV)}$, $T_J = T_J$ max.
r_{t2} High level value of on-state slope resistance	1.81		(I > π 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/ μ 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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ΔR_{thJC} Conduction

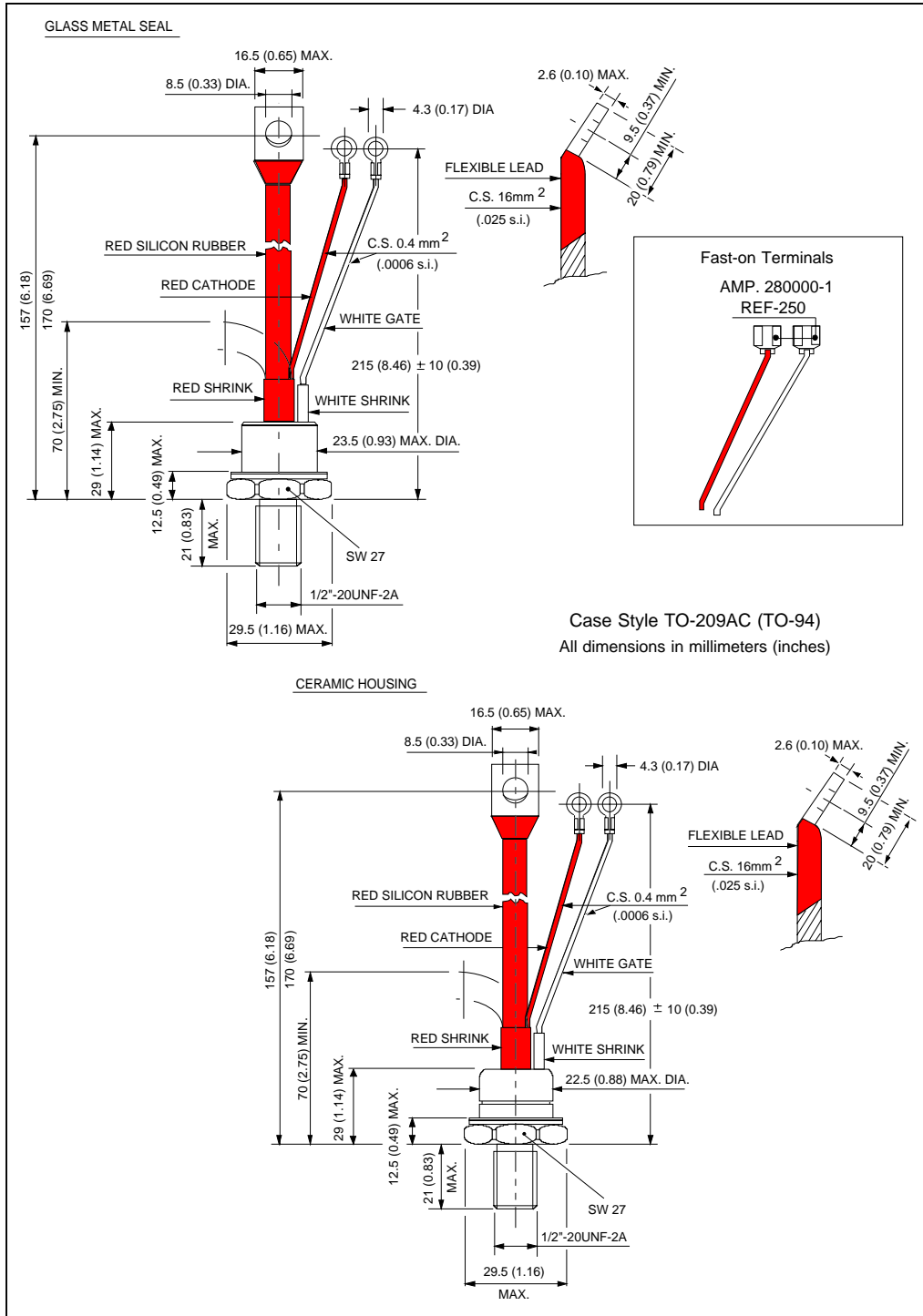
(The following table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC)

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

<p>Device Code</p> <table style="margin: auto; text-align: center;"> <tr> <td style="background-color: black; color: white; padding: 5px;">ST</td> <td style="background-color: black; color: white; padding: 5px;">11</td> <td style="background-color: black; color: white; padding: 5px;">0</td> <td style="background-color: black; color: white; padding: 5px;">S</td> <td style="background-color: black; color: white; padding: 5px;">16</td> <td style="background-color: black; color: white; padding: 5px;">P</td> <td style="background-color: black; color: white; padding: 5px;">0</td> <td style="background-color: black; color: white; padding: 5px;">V</td> </tr> <tr> <td>①</td> <td>②</td> <td>③</td> <td>④</td> <td>⑤</td> <td>⑥</td> <td>⑦</td> <td>⑧</td> </tr> </table>	ST	11	0	S	16	P	0	V	①	②	③	④	⑤	⑥	⑦	⑧	<ul style="list-style-type: none"> 1 - Thyristor 2 - Essential part number 3 - 0 = Converter grade 4 - S = Compression bonding Stud 5 - Voltage code: Code x 100 = V_{RRM} (See Voltage Rating Table) 6 - P = Stud base 1/2"-20UNF-2A threads 7 - 0 = Eyelet terminals (Gate and Auxiliary Cathode Leads) 1 = Fast - on terminals (Gate and Auxiliary Cathode Leads) 8 - V = Glass-metal seal (only up to 1200V) None = Ceramic housing (over 1200V)
ST	11	0	S	16	P	0	V										
①	②	③	④	⑤	⑥	⑦	⑧										

Outline Table



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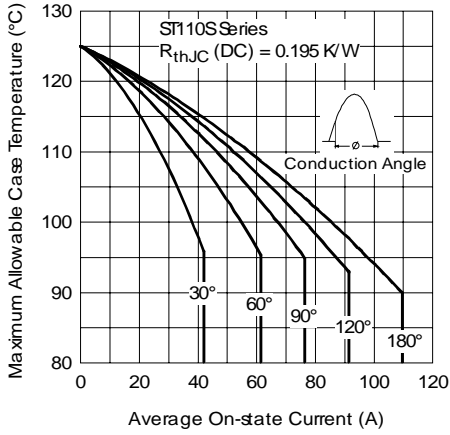


Fig. 1 - Current Ratings Characteristics

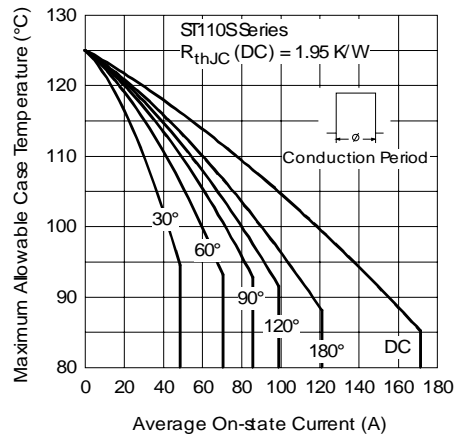


Fig. 2 - Current Ratings Characteristics

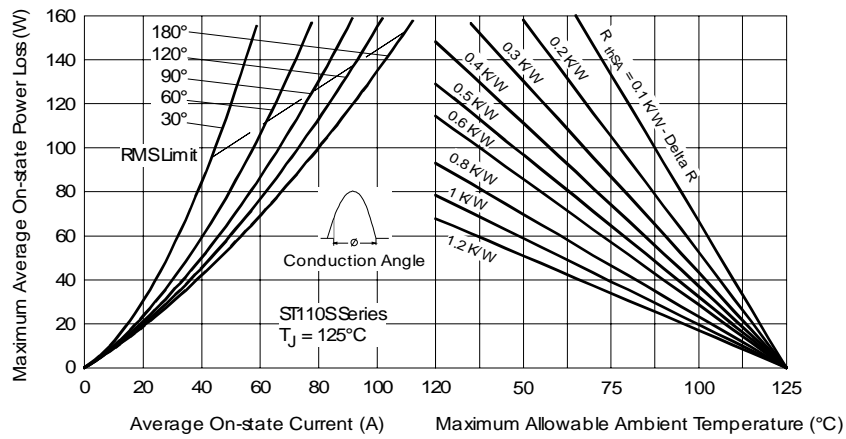


Fig. 3 - On-state Power Loss Characteristics

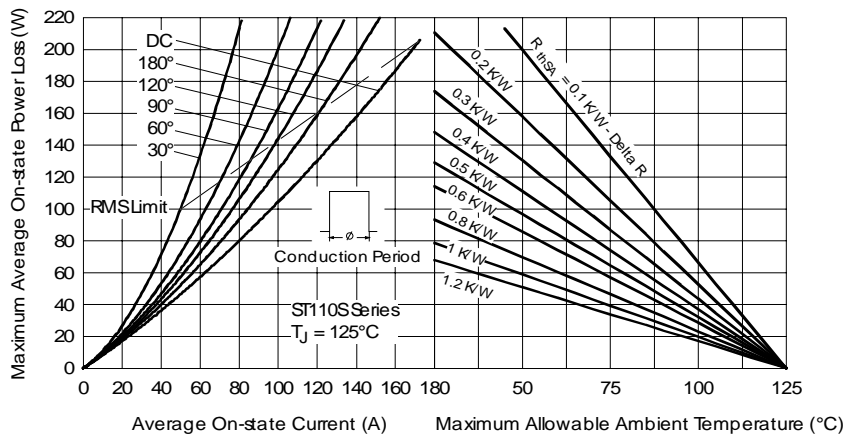


Fig. 4 - On-state Power Loss Characteristics

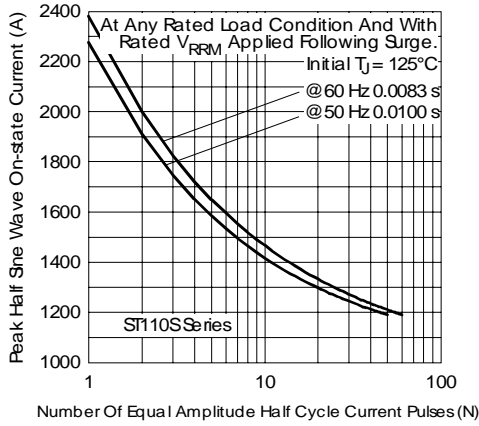


Fig. 5 - Maximum Non-Repetitive Surge Current

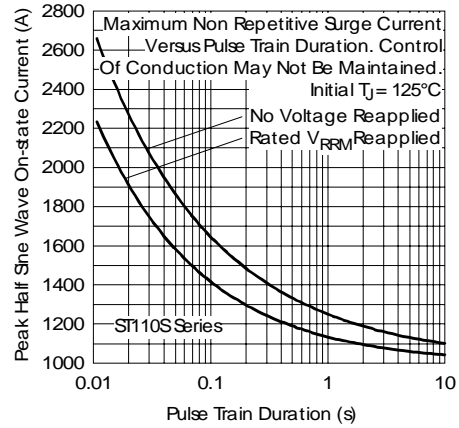


Fig. 6 - Maximum Non-Repetitive Surge Current

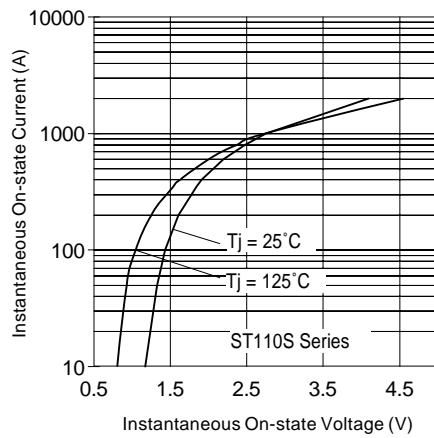


Fig. 7 - On-state Voltage Drop Characteristics

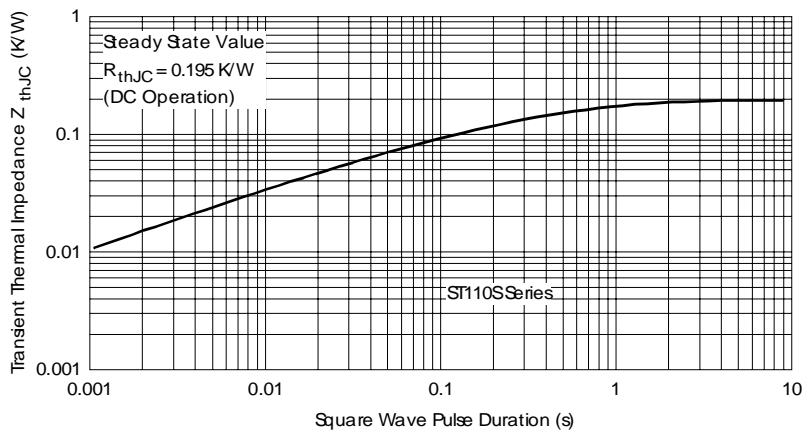


Fig. 8 - Thermal Impedance Z_{thJC} Characteristic

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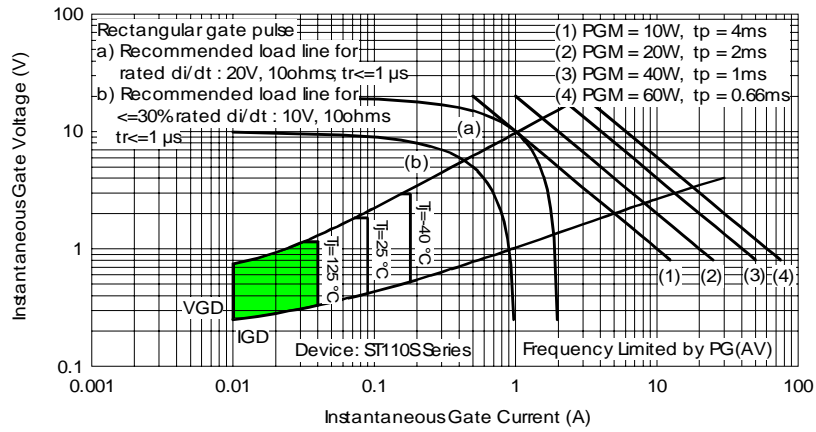


Fig. 9 - Gate Characteristics

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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