

Bulletin I25167 rev. C 03/03

International IOR 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

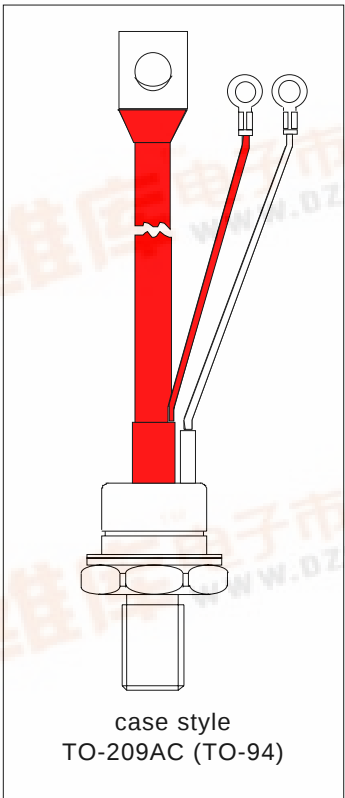
110A

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



ST110S Series

Bulletin I25167 rev. C 03/03

International
IR Rectifier

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. @ $T_J = T_J \text{ max}$ 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	Sinusoidal half wave, Initial $T_J = T_J$ max.	
		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^2s	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	$KA^2\sqrt{s}$	t = 0.1 to 10ms, no voltage reapplied			
$V_{T(TO)1}$	Low level value of threshold voltage	0.90	V	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}), T_J = T_J$ max.			
$V_{T(TO)2}$	High level value of threshold voltage	0.92		$(I > \pi \times I_{T(AV)}), T_J = T_J$ max.			
r_{t1}	Low level value of on-state slope resistance	1.79	mΩ	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}), T_J = T_J$ max.			
r_{t2}	High level value of on-state slope resistance	1.81		$(I > \pi \times I_{T(AV)}), T_J = T_J$ 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, $t_r \leq 1\mu s$ $T_J = T_J \text{ max, anode voltage} \leq 80\% V_{DRM}$
t_d Typical delay time	2.0	μs	Gate current 1A, $di_g/dt = 1A/\mu s$ $V_d = 0.67\% V_{DRM}, T_J = 25^\circ\text{C}$
t_q Typical turn-off time	100		$I_{TM} = 100A, T_J = T_J \text{ max, } di/dt = 10A/\mu s, V_R = 50V$ $dv/dt = 20V/\mu s, \text{ Gate } 0V \text{ } 100\Omega, t_p = 500\mu s$

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		$T_J = T_J$ max, $f = 50$ Hz, $d\% = 50$
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.	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$ 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	-	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$
	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	V	

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)		
	14 (120)		Lubricated threads
wt Approximate weight	130	g	
Case style	TO - 209AC (TO-94)		See Outline Table

ST110S Series

Bulletin I25167 rev. C 03/03

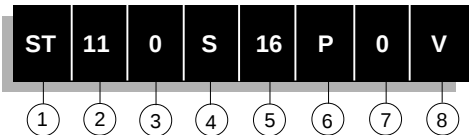
ΔR_{thJC} Conduction

(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		

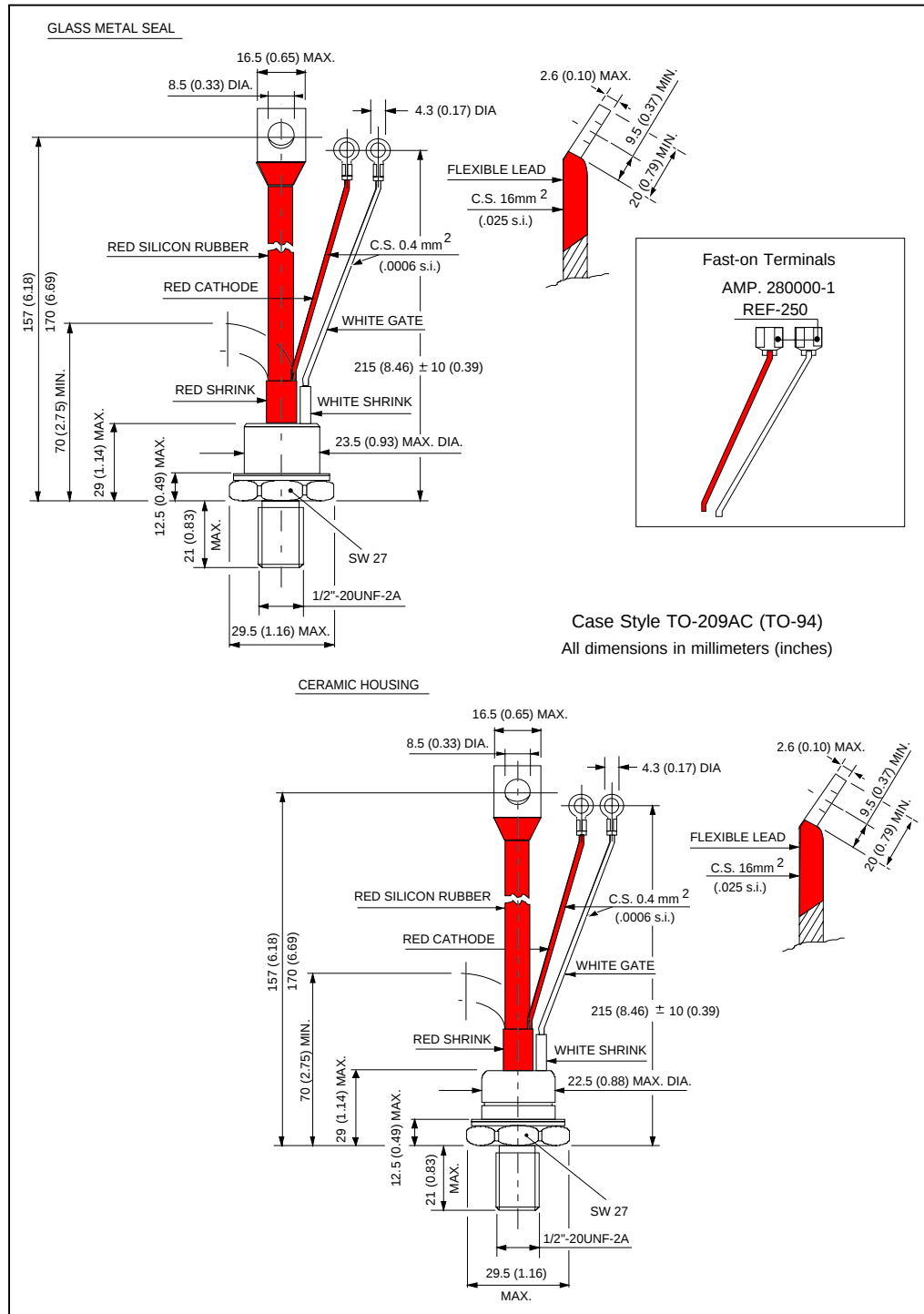
Ordering Information Table

Device Code



- 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)

Outline Table



ST110S Series

Bulletin I25167 rev. C 03/03

International
IR Rectifier

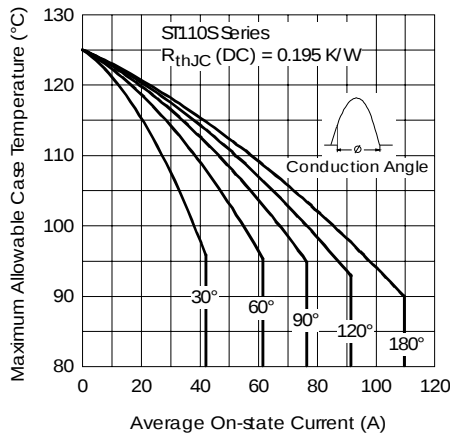


Fig. 1 - Current Ratings Characteristics

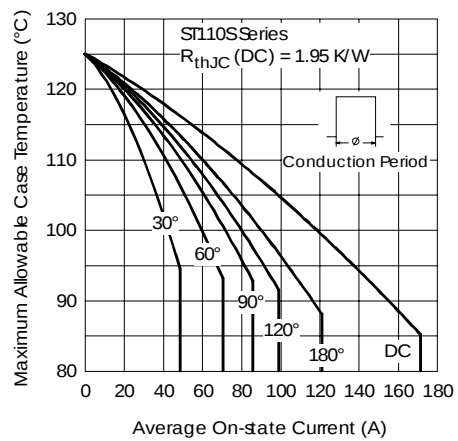


Fig. 2 - Current Ratings Characteristics

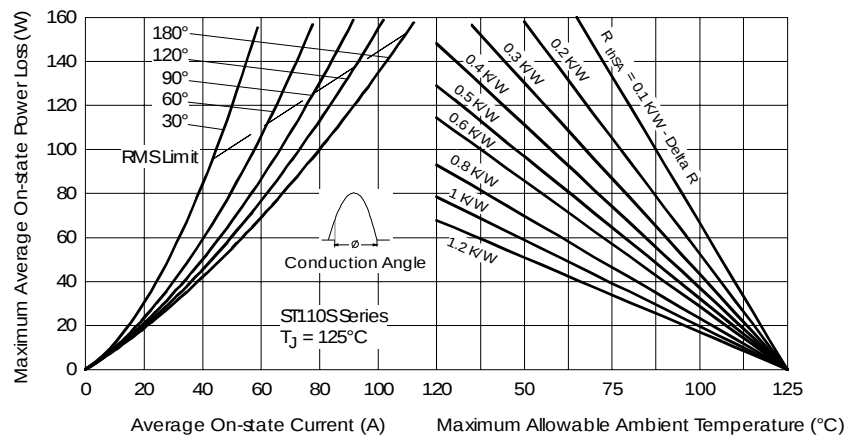


Fig. 3 - On-state Power Loss Characteristics

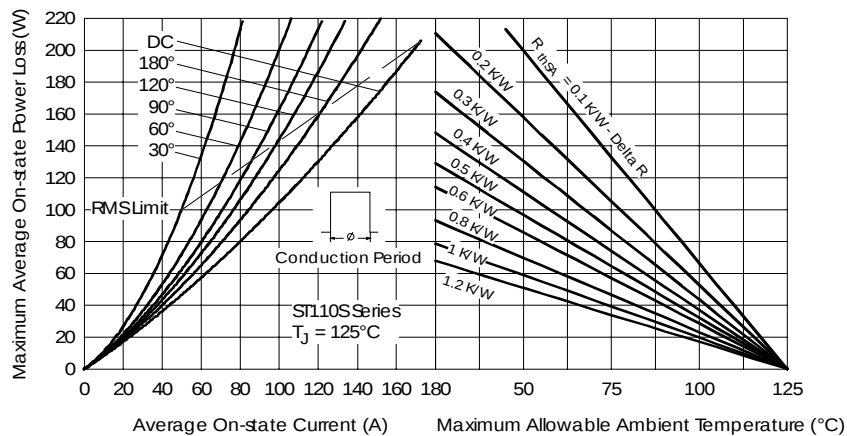


Fig. 4 - On-state Power Loss Characteristics

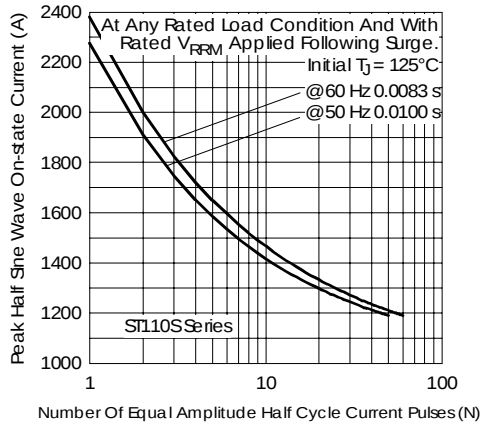


Fig. 5 - Maximum Non-Repetitive Surge Current

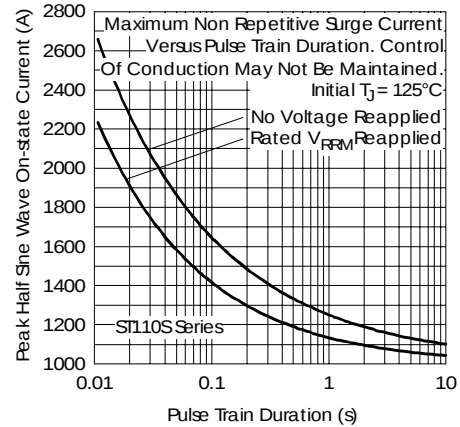


Fig. 6 - Maximum Non-Repetitive Surge Current

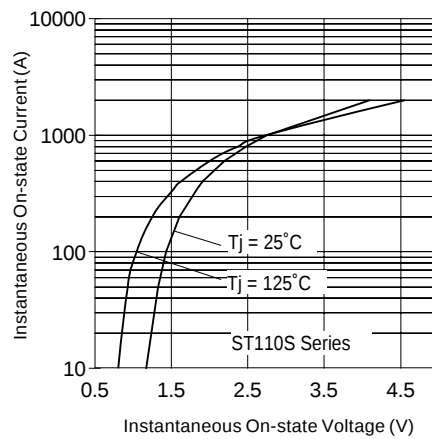


Fig. 7 - On-state Voltage Drop Characteristics

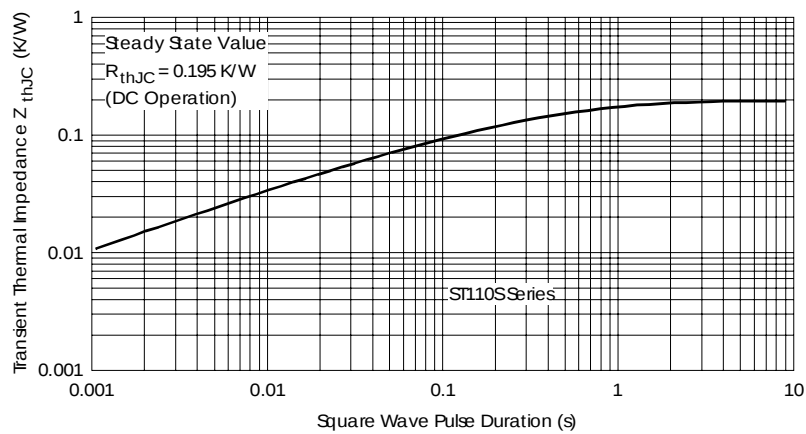


Fig. 8 - Thermal Impedance Z_{thJC} Characteristic

ST110S Series

Bulletin I25167 rev. C 03/03

International
IR Rectifier

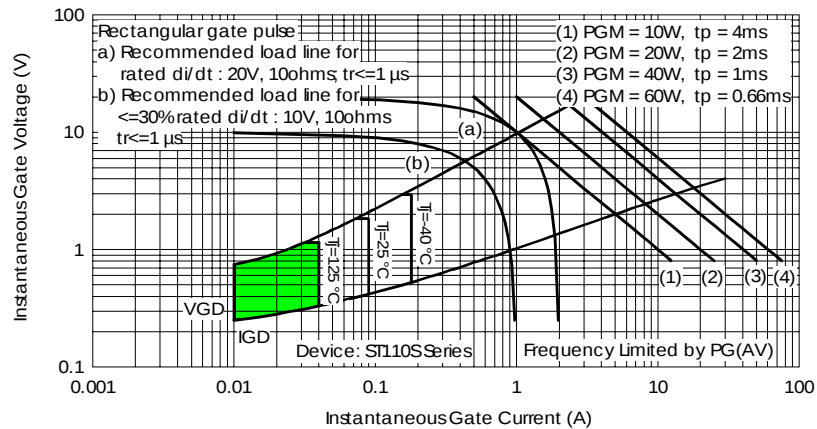


Fig. 9 - Gate Characteristics

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.

International
IR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7309
Visit us at www.irf.com for sales contact information. 03/03