

International  
**IOR** Rectifier

## ST280S SERIES

### PHASE CONTROL THYRISTORS

Stud Version

#### Features

- Center amplifying gate
- Hermetic metal case with glass-metal seal insulator
- International standard case TO-209AB (TO-93)
- Compression Bonded Encapsulation for heavy duty operations such as severe thermal cycling

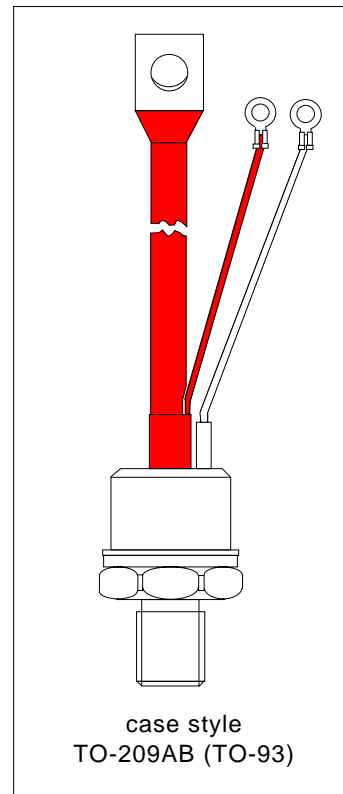
280A

#### Typical Applications

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

#### Major Ratings and Characteristics

Parameters	ST280S	Units
$I_{T(AV)}$	280	A
@ $T_C$	85	°C
$I_{T(RMS)}$	440	A
$I_{TSM}$ @ 50Hz	7850	A
@ 60Hz	8220	A
$I^2t$ @ 50Hz	308	KA <sup>2</sup> s
@ 60Hz	281	KA <sup>2</sup> s
$V_{DRM}/V_{RRM}$	400 to 600	V
$t_q$ typical	100	μs
$T_J$	- 40 to 125	°C



## ST280S Series

Bulletin I25161 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. @ $T_J = T_J \text{ max}$ mA
ST280S	04	400	500	30
	06	600	700	

#### On-state Conduction

Parameter	ST280S	Units	Conditions
$I_{T(AV)}$ Max. average on-state current @ Case temperature	280 85	A °C	180° conduction, half sine wave
$I_{T(RMS)}$ Max. RMS on-state current	440	A	DC @ 75°C case temperature
$I_{TSM}$ Max. peak, one-cycle non-repetitive surge current	7850 8220 6600 6900	A	t = 10ms No voltage t = 8.3ms reapplied t = 10ms 100% $V_{RRM}$ t = 8.3ms reapplied Sinusoidal half wave, Initial $T_J = T_J \text{ max}$ .
$I^2t$ Maximum $I^2t$ for fusing	310 220 218 200		
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	3100		
$V_{T(TO)1}$ Low level value of threshold voltage	0.84	V	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}), T_J = T_J \text{ max}$ .
$V_{T(TO)2}$ High level value of threshold voltage	0.88		$(I > \pi \times I_{T(AV)}), T_J = T_J \text{ max}$ .
$r_{t1}$ Low level value of on-state slope resistance	0.50	mΩ	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}), T_J = T_J \text{ max}$ .
$r_{t2}$ High level value of on-state slope resistance	0.47		$(I > \pi \times I_{T(AV)}), T_J = T_J \text{ max}$ .
$V_{TM}$ Max. on-state voltage	1.28	V	$I_{pk} = 880A, T_J = T_J \text{ max}, t_p = 10ms$ sine pulse
$I_H$ Maximum holding current	600	mA	$T_J = 25^\circ C$ , anode supply 12V resistive load
$I_L$ Max. (typical) latching current	1000 (300)		

#### Switching

Parameter	ST280S	Units	Conditions
$di/dt$ Max. non-repetitive rate of rise of turned-on current	1000	A/μs	Gate drive 20V, 20Ω, $t_f \leq 1\mu s$ $T_J = T_J \text{ max}$ , anode voltage $\leq 80\% V_{DRM}$
$t_d$ Typical delay time	1.0	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		$I_{TM} = 300A, T_J = T_J \text{ max}, di/dt = 20A/\mu s, V_R = 50V$ $dv/dt = 20V/\mu s$ , Gate 0V 100Ω, $t_p = 500\mu s$

### Blocking

Parameter	ST280S	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 $V_{DRM}$
$I_{DRM}$ $I_{RRM}$ Max. peak reverse and off-state leakage current	30	mA	$T_J = T_J$ max, rated $V_{DRM}/V_{RRM}$ applied

### Triggering

Parameter	ST280S	Units	Conditions
$P_{GM}$ Maximum peak gate power	10.0	W	$T_J = T_J$ max, $t_p \leq 5ms$
$P_{G(AV)}$ Maximum average gate power	2.0		$T_J = T_J$ max, $f = 50Hz$ , $d\% = 50$
$I_{GM}$ Max. peak positive gate current	3.0	A	$T_J = T_J$ max, $t_p \leq 5ms$
$+V_{GM}$ Maximum peak positive gate voltage	20	V	$T_J = T_J$ max, $t_p \leq 5ms$
$-V_{GM}$ Maximum peak negative gate voltage	5.0		
$I_{GT}$ DC gate current required to trigger	TYP. 180	mA	$T_J = -40^\circ C$ $T_J = 25^\circ C$ $T_J = 125^\circ C$ Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
	90		
	40		
$V_{GT}$ DC gate voltage required to trigger	2.9	V	$T_J = -40^\circ C$ $T_J = 25^\circ C$ $T_J = 125^\circ C$
	1.8		
	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	ST280S	Units	Conditions
$T_J$ Max. operating temperature range	-40 to 125	$^\circ C$	
$T_{stg}$ Max. storage temperature range	-40 to 150		
$R_{thJC}$ Max. thermal resistance, junction to case	0.105	K/W	DC operation
$R_{thCS}$ Max. thermal resistance, case to heatsink	0.04		Mounting surface, smooth, flat and greased
T Mounting torque, $\pm 10\%$	31 (275)	Nm (lbf-in)	Non lubricated threads
	24.5 (210)		Lubricated threads
wt Approximate weight	280	g	
Case style	TO-209AB (TO-93)		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°	0.016	0.012	K/W	$T_J = T_J \text{ max.}$
120°	0.019	0.020		
90°	0.025	0.027		
60°	0.036	0.037		
30°	0.060	0.060		

**Ordering Information Table**

**Device Code**

ST	28	0	S	06	P	0	V
1	2	3	4	5	6	7	8

- 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 3/4"-16UNF-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

NOTE: For Metric Device M16 x 1.5 Contact Factory

Outline Table

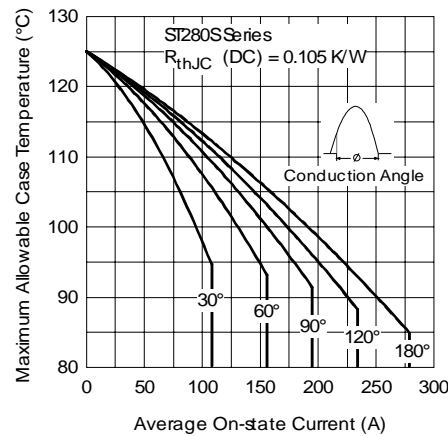
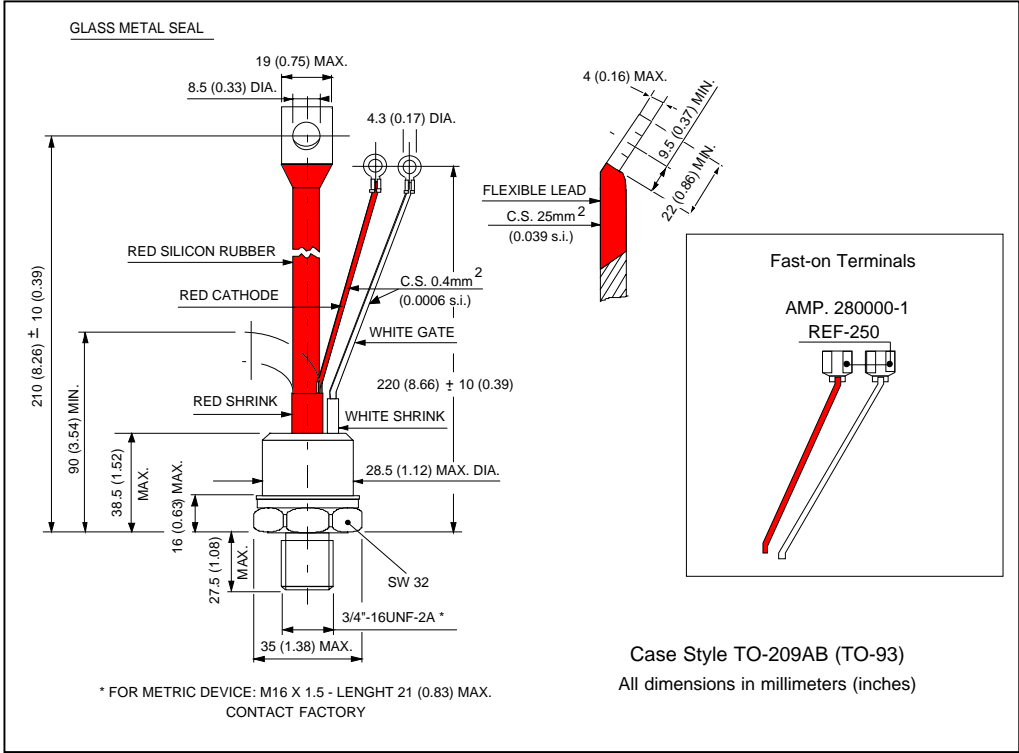


Fig. 1 - Current Ratings Characteristics

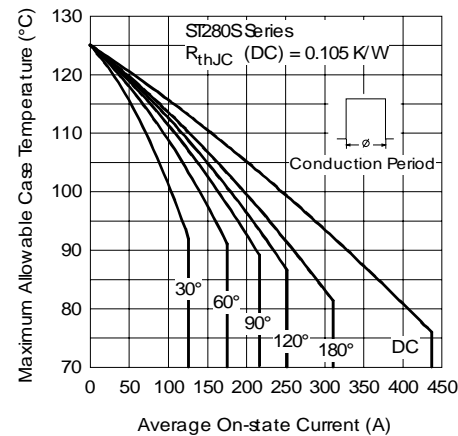


Fig. 2 - Current Ratings Characteristics

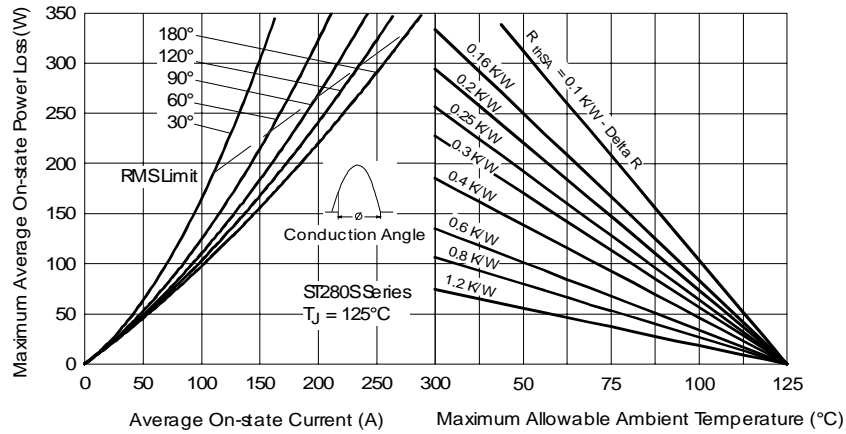


Fig. 3 - On-state Power Loss Characteristics

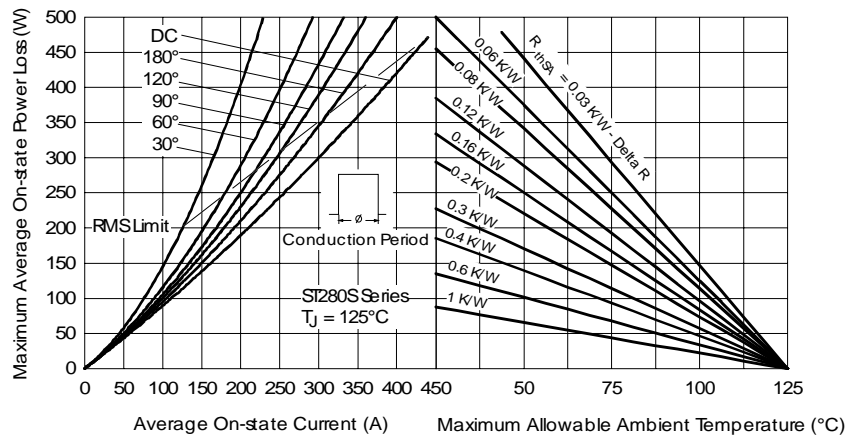


Fig. 4 - On-state Power Loss Characteristics

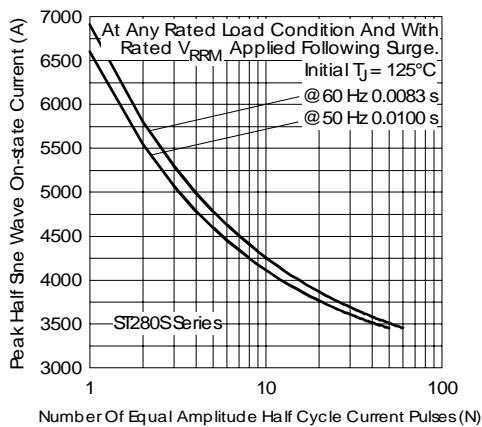


Fig. 5 - Maximum Non-Repetitive Surge Current

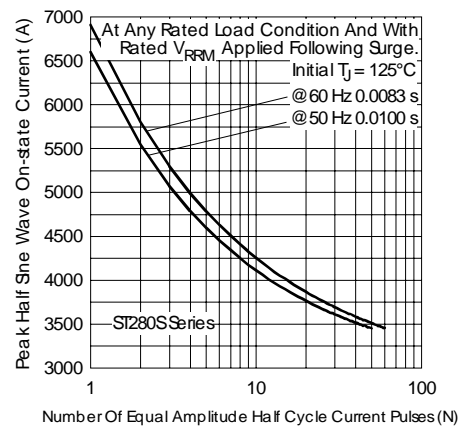


Fig. 6 - Maximum Non-Repetitive Surge Current

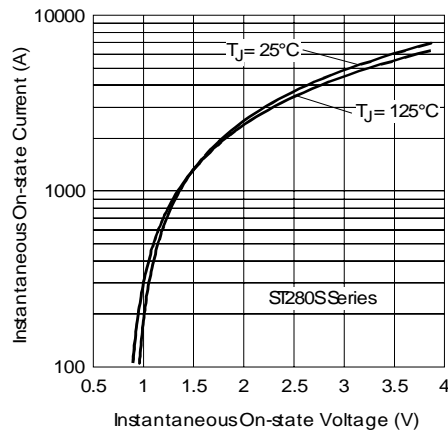


Fig. 7 - On-state Voltage Drop Characteristics

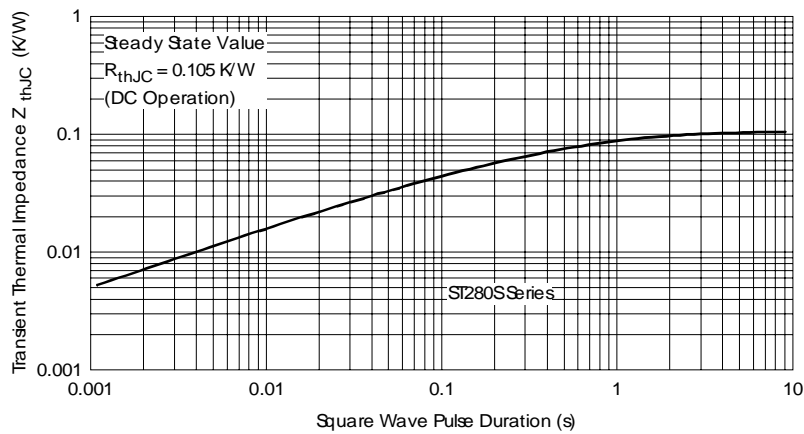


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

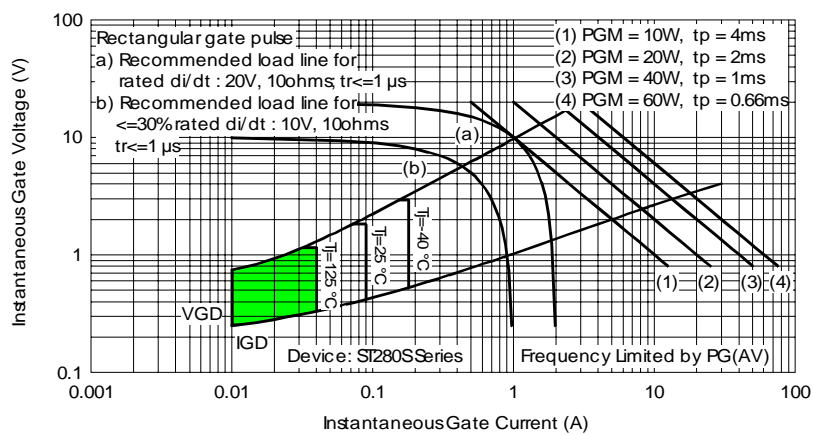


Fig. 9 - Gate Characteristics

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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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