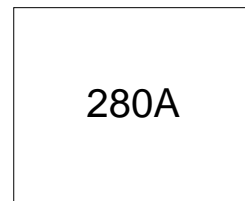


**Features**

- 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

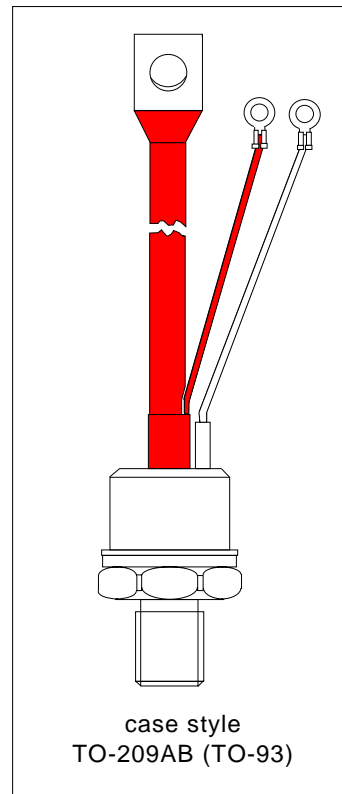


**Typical Applications**

- 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

International  
IRF 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. @ $T_J = T_J$ 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	A	180° conduction, half sine wave
	85	°C	
$I_{T(RMS)}$ Max. RMS on-state current	440	A	DC @ 75°C case temperature
$I_{TSM}$ Max. peak, one-cycle non-repetitive surge current	7850	A	t = 10ms No voltage
	8220		t = 8.3ms reapplied
	6600		t = 10ms 100% $V_{RRM}$
	6900		t = 8.3ms reapplied
$I^2t$ Maximum $I^2t$ for fusing	310	KA <sup>2</sup> s	t = 10ms No voltage
	220		t = 8.3ms reapplied
	218		t = 10ms 100% $V_{RRM}$
	200		t = 8.3ms reapplied
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	3100	KA <sup>2</sup> √s	t = 0.1 to 10ms, no voltage reapplied
$V_{T(TO)1}$ Low level value of threshold voltage	0.84	V	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ max.
$V_{T(TO)2}$ High level value of threshold voltage	0.88		$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.
$r_{t1}$ Low level value of on-state slope resistance	0.50	mΩ	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ max.
$r_{t2}$ High level value of on-state slope resistance	0.47		$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.
$V_{TM}$ Max. on-state voltage	1.28	V	$I_{pk} = 880A$ , $T_J = T_J$ max, $t_p = 10ms$ sine pulse
$I_H$ Maximum holding current	600	mA	$T_J = 25^\circ C$ , anode supply 12V resistive load
$I_L$ 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, $t_r \leq 1\mu s$ $T_J = T_J$ 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		$I_{TM} = 300A$ , $T_J = T_J$ 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, $t_p \leq 5$ ms
$P_{G(AV)}$ Maximum average gate power	2.0		
$I_{GM}$ Max. peak positive gate current	3.0	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	ST280S	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	0.105	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	Nm (lbf-in)	Non lubricated threads
	(275)		Lubricated threads
	24.5 (210)		
wt Approximate weight	280	g	
Case style	TO-209AB (TO-93)		See Outline Table

## ST280S Series

Bulletin I25161 rev. C 03/03

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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

<p><b>Device Code</b></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;">28</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;">06</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	28	0	S	06	P	0	V	①	②	③	④	⑤	⑥	⑦	⑧	<ul style="list-style-type: none"> <li><b>1</b> - Thyristor</li> <li><b>2</b> - Essential part number</li> <li><b>3</b> - 0 = Converter grade</li> <li><b>4</b> - S = Compression bonding Stud</li> <li><b>5</b> - Voltage code: Code x 100 = <math>V_{RRM}</math> (See Voltage Rating Table)</li> <li><b>6</b> - P = Stud base 3/4"-16UNF-2A threads</li> <li><b>7</b> - 0 = Eyelet terminals (Gate and Auxiliary Cathode Leads) 1 = Fast - on terminals (Gate and Auxiliary Cathode Leads)</li> <li><b>8</b> - V = Glass-metal seal</li> </ul> <p style="text-align: center; margin-top: 20px;">NOTE: For Metric Device M16 x 1.5 Contact Factory</p>
ST	28	0	S	06	P	0	V										
①	②	③	④	⑤	⑥	⑦	⑧										

Outline Table

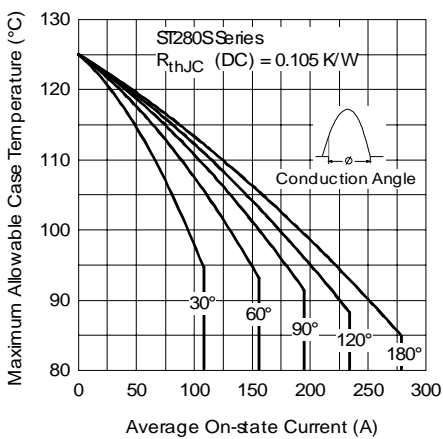
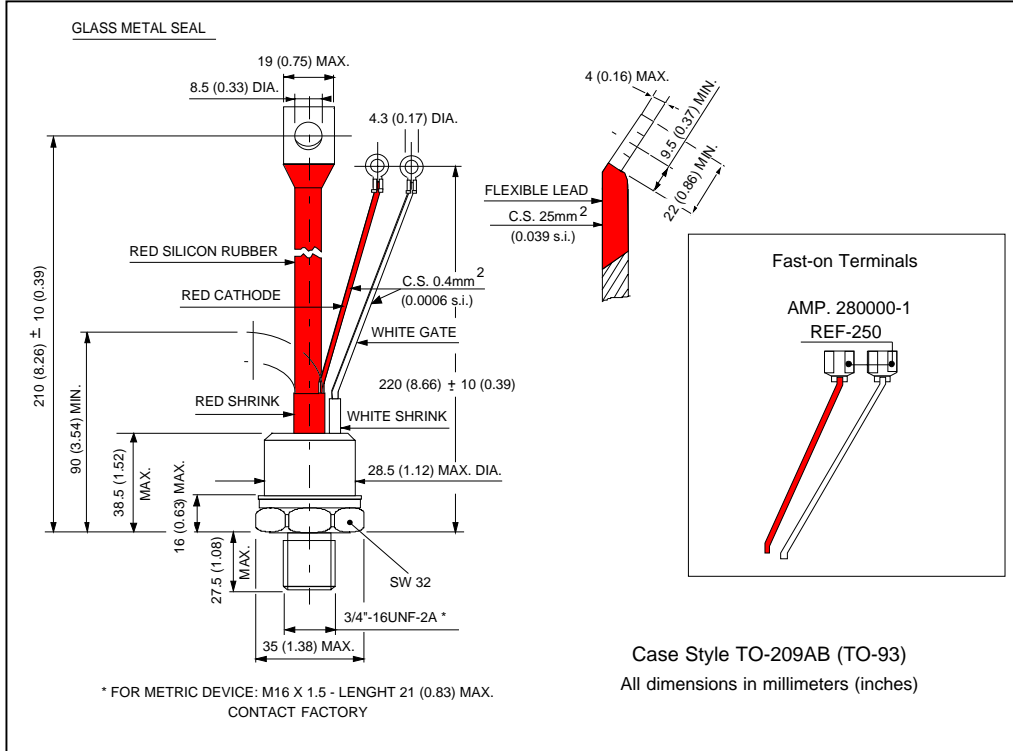


Fig. 1 - Current Ratings Characteristics

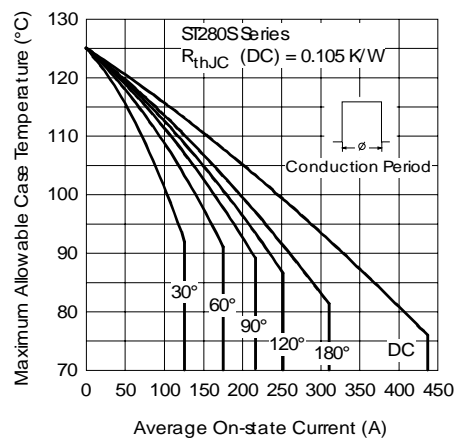


Fig. 2 - Current Ratings Characteristics

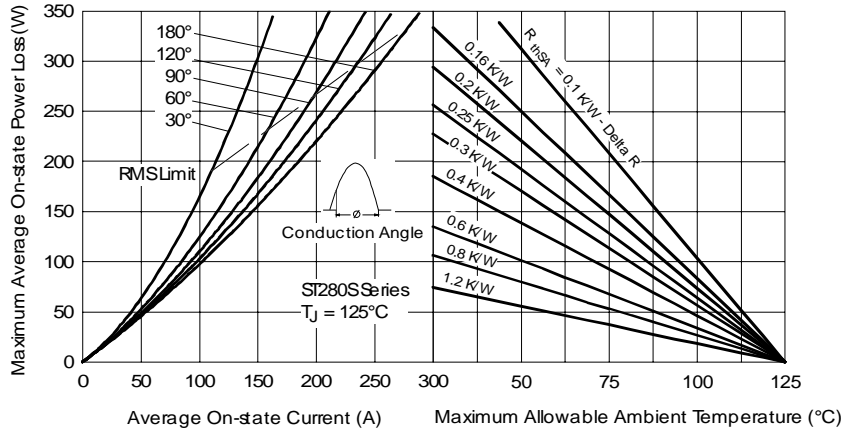


Fig. 3 - On-state Power Loss Characteristics

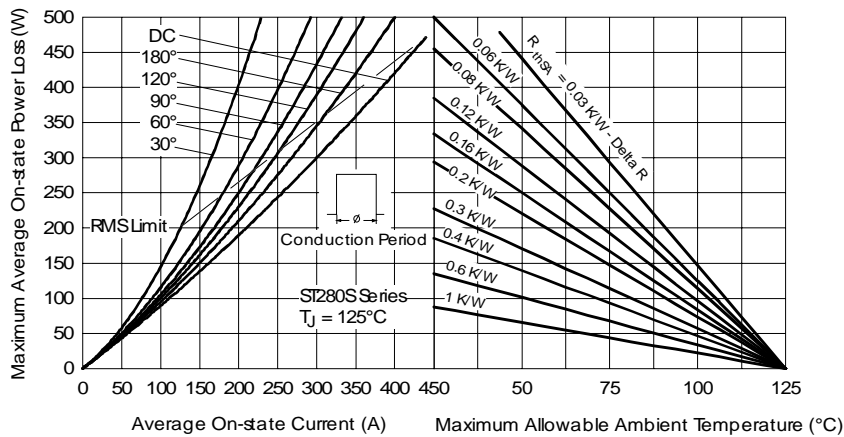


Fig. 4 - On-state Power Loss Characteristics

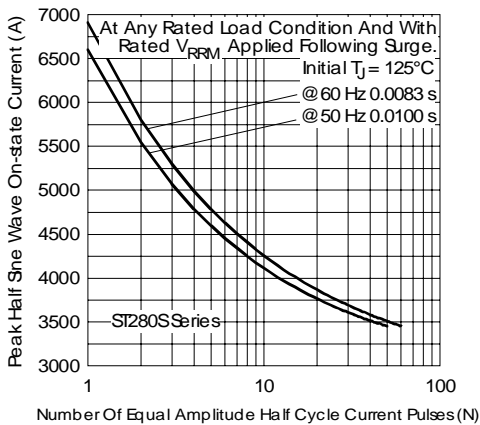


Fig. 5 - Maximum Non-Repetitive Surge Current

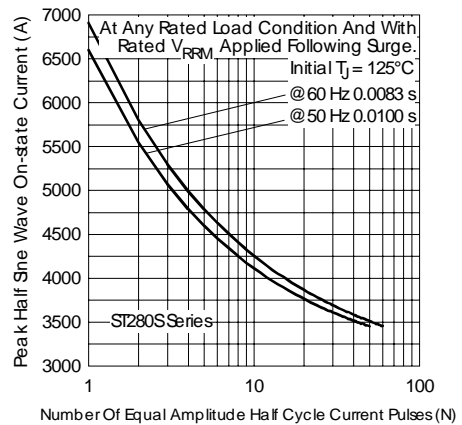


Fig. 6 - Maximum Non-Repetitive Surge Current

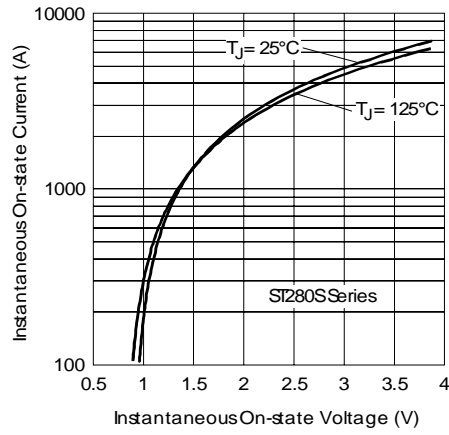


Fig. 7 - On-state Voltage Drop Characteristics

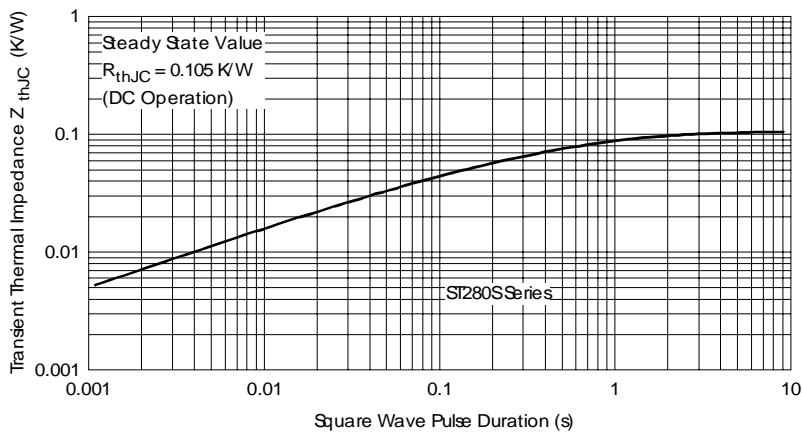


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

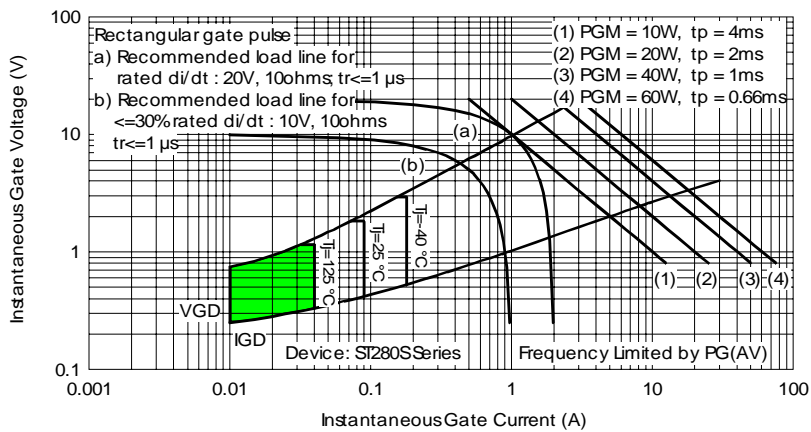


Fig. 9 - Gate Characteristics

## **ST280S Series**

Bulletin I25161 rev. C 03/03

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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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