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***DISCRETE POWER DIODES and THYRISTORS***  
***DATA BOOK***

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### PHASE CONTROL THYRISTORS

Stud Version

#### Features

- Center amplifying gate
- Hermetic metal case with ceramic insulator  
(Also available with glass-metal seal up to 1200V)
- International standard case TO-209AB (TO-93)
- Threaded studs UNF 3/4 - 16UNF2A or ISO M16x1.5
- Compression Bonded Encapsulation for heavy duty operations such as severe thermal cycling

200A

#### Typical Applications

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

#### Major Ratings and Characteristics

Parameters	ST180S	Units
$I_{T(AV)}$	200	A
@ $T_C$	85	°C
$I_{T(RMS)}$	314	A
$I_{TSM}$ @ 50Hz	5000	A
@ 60Hz	5230	A
$I^2t$ @ 50Hz	125	KA <sup>2</sup> s
@ 60Hz	114	KA <sup>2</sup> s
$V_{DRM}/V_{RRM}$	400 to 2000	V
$t_q$ typical	100	μs
$T_J$	- 40 to 125	°C



case style  
TO-209AB (TO-93)

## ST180S Series

### 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
ST180S	04	400	500	30
	08	800	900	
	12	1200	1300	
	16	1600	1700	
	18	1800	1900	
	20	2000	2100	

#### On-state Conduction

Parameter	ST180S	Units	Conditions
$I_{T(AV)}$ Max. average on-state current @ Case temperature	200	A	180° conduction, half sine wave
	85	°C	
$I_{T(RMS)}$ Max. RMS on-state current	314	A	DC @ 76°C case temperature
$I_{TSM}$ Max. peak, one-cycle non-repetitive surge current	5000	A	t = 10ms No voltage
	5230		t = 8.3ms reapplied
	4200		t = 10ms 100% $V_{RRM}$
	4400		t = 8.3ms reapplied
$I^2t$ Maximum $I^2t$ for fusing	125	KA <sup>2</sup> s	t = 10ms No voltage
	114		t = 8.3ms reapplied
	88		t = 10ms 100% $V_{RRM}$
	81		t = 8.3ms reapplied
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	1250	KA <sup>2</sup> √s	t = 0.1 to 10ms, no voltage reapplied
$V_{T(TO)1}$ Low level value of threshold voltage	1.08	V	(16.7% × π × $I_{T(AV)} < I < π × I_{T(AV)}$ ), $T_J = T_J$ max.
$V_{T(TO)2}$ High level value of threshold voltage	1.14		( $I > π × I_{T(AV)}$ ), $T_J = T_J$ max.
$r_{t1}$ Low level value of on-state slope resistance	1.18	mΩ	(16.7% × π × $I_{T(AV)} < I < π × I_{T(AV)}$ ), $T_J = T_J$ max.
$r_{t2}$ High level value of on-state slope resistance	1.14		( $I > π × I_{T(AV)}$ ), $T_J = T_J$ max.
$V_{TM}$ Max. on-state voltage	1.75	V	$I_{pk} = 570A$ , $T_J = 125°C$ , $t_p = 10ms$ sine pulse
$I_H$ Maximum holding current	600	mA	$T_J = T_J$ max, anode supply 12V resistive load
$I_L$ Max. (typical) latching current	1000 (300)		

#### Switching

Parameter	ST180S	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, $di_g/dt = 1A/\mu s$ $V_d = 0.67\% V_{DRM}$ , $T_J = 25°C$
$t_q$ 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, $t_p = 500\mu s$



Fig. 1 - Current Ratings Characteristics

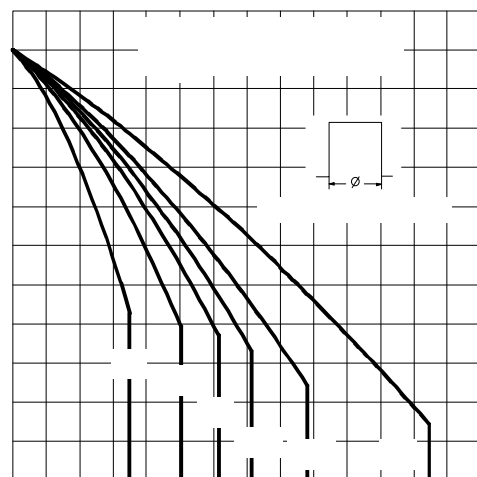


Fig. 2 - Current Ratings Characteristics



Fig. 3 - On-state Power Loss Characteristics





Fig. 5 - Maximum Non-Repetitive Surge Current

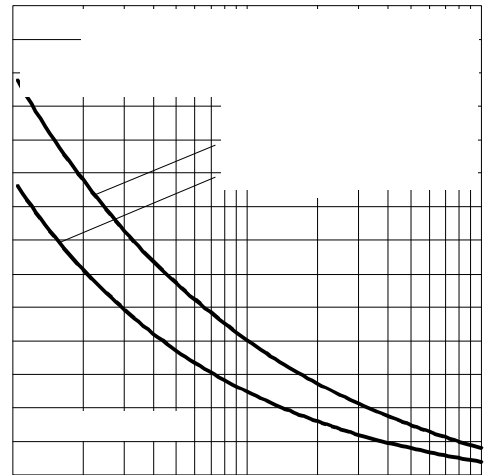


Fig. 6 - Maximum Non-Repetitive Surge Current

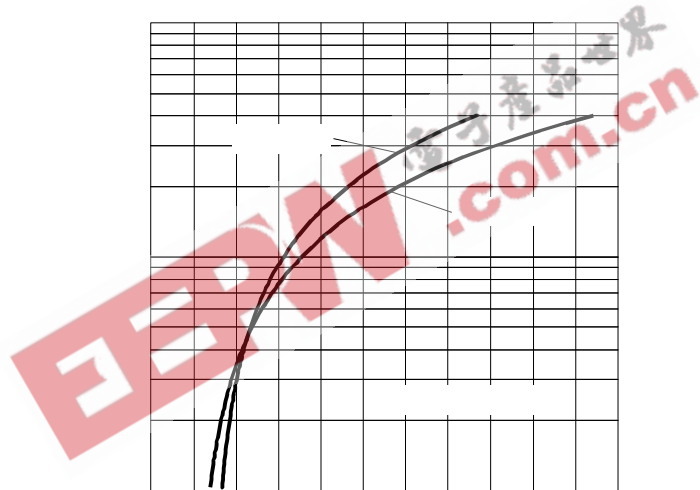


Fig. 7 - On-state Voltage Drop Characteristics



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



Fig. 9 - Gate Characteristics

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## Blocking

Parameter	ST180S	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	ST180S	Units	Conditions
$P_{GM}$ Maximum peak gate power	10	W	$T_J = T_J$ max, $t_p \leq 5$ ms
$P_{G(AV)}$ Maximum average gate power	2.0		$T_J = T_J$ max, $f = 50$ Hz, $d\% = 50$
$I_{GM}$ 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.	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$
	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	ST180S	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)		
	24.5		Lubricated threads
wt Approximate weight	280	g	
Case style	TO - 209AB (TO-93)		See Outline Table

# ST180S Series

## $\Delta R_{thJC}$ 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°	0.015	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**

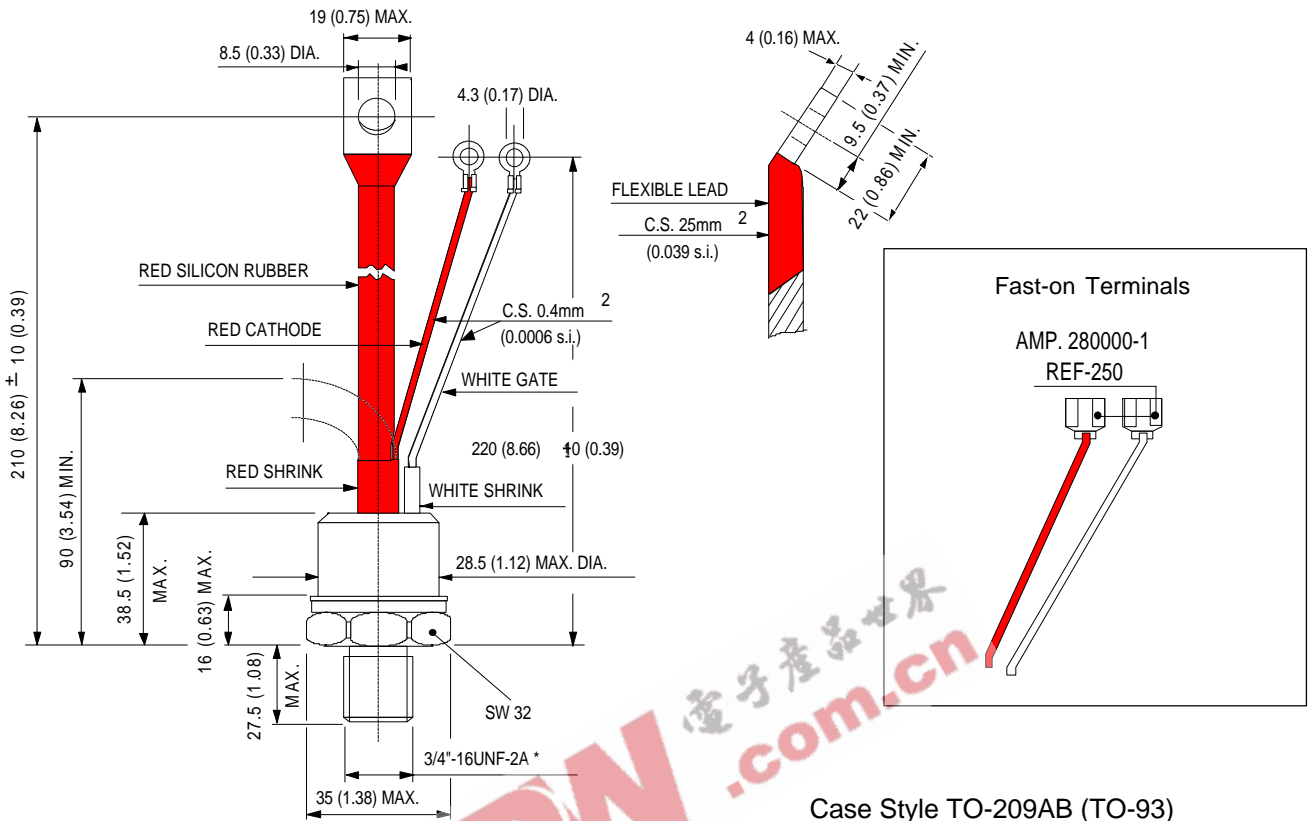
ST	18	0	S	20	P	0		
①	②	③	④	⑤	⑥	⑦	⑧	⑨

- 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 16UNF threads  
M = Stud base metric threads (M16 x 1.5)
- 7** - 0 = Eyelet terminals (Gate and Auxiliary Cathode Leads)  
1 = Fast - on terminals (Gate and Auxiliary Cathode Leads)  
2 = Flag terminals (For Cathode and Gate Terminals)
- 8** - V = Glass-metal seal (only up to 1200V)  
None = Ceramic housing (over 1200V)
- 9** - Critical dv/dt: None = 500V/ $\mu$ sec (Standard value)  
L = 1000V/ $\mu$ sec (Special selection)



Outline Table

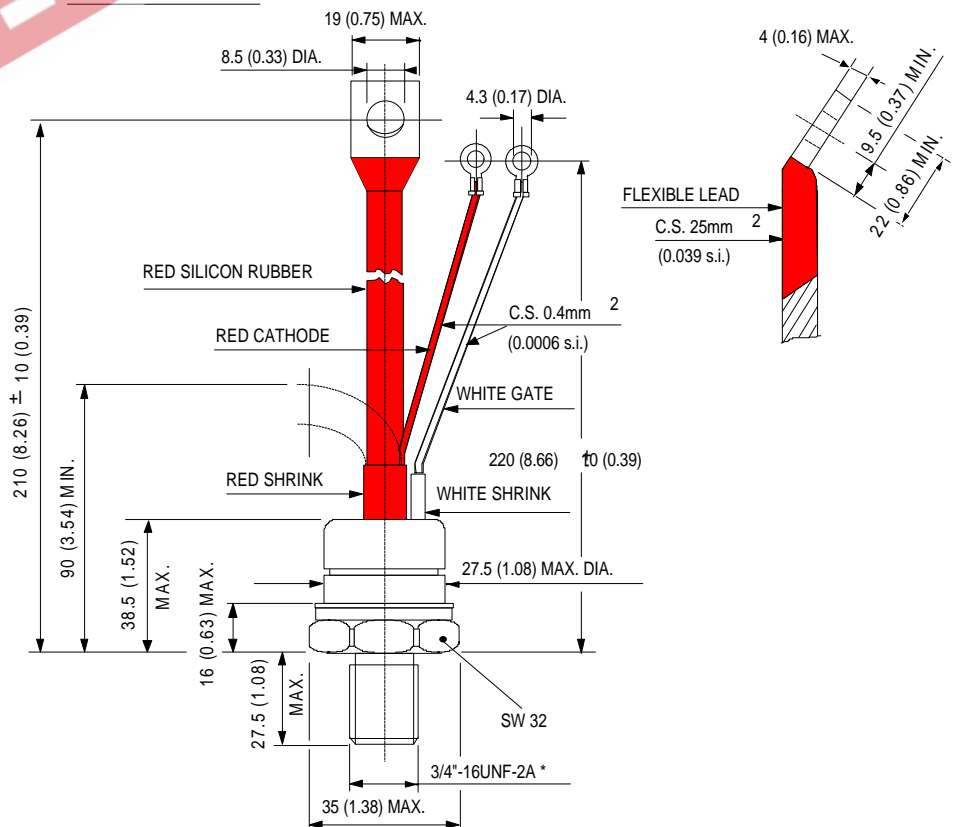
GLASS METAL SEAL



\* FOR METRIC DEVICE : M16 x 1.5 - LENGHT 21 (0.83) MAX.

Case Style TO-209AB (TO-93)  
All dimensions in millimeters (inches)

CERAMIC HOUSING

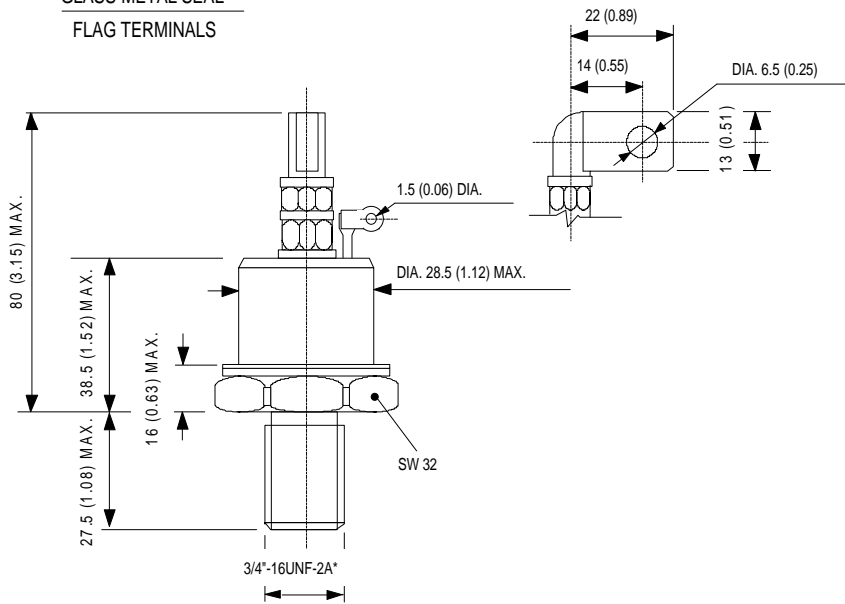


\* FOR METRIC DEVICE : M16 x 1.5 - LENGHT 21 (0.83) MAX.

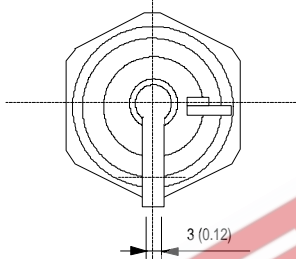
# ST180S Series

## Outline Table

### GLASS-METAL SEAL FLAG TERMINALS

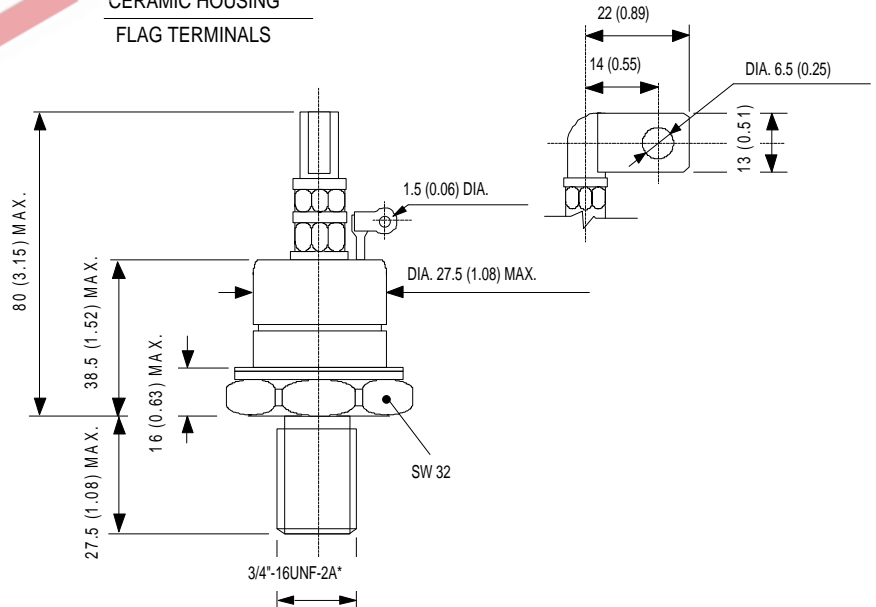


\*FOR METRIC DEVICE. M16 X 1.5 - LENGHT 21 (0.83) MAX.



Case Style TO-209AB (TO-93) Flag  
All dimensions in millimeters (inches)

### CERAMIC HOUSING FLAG TERMINALS



\*FOR METRIC DEVICE. M16 X 1.5 - LENGHT 21 (0.83) MAX.

