
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 ² s |
| @ 60Hz | 114 | KA ² 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 ² 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 ² √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

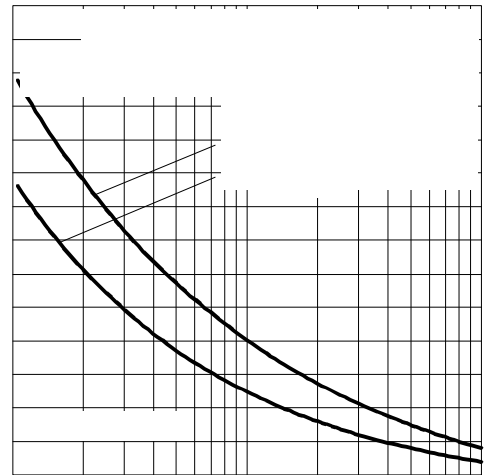


Fig. 6 - Maximum Non-Repetitive Surge Current



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/ μ 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

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° | 0.015 | 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 | |
|-------------|--|
| | |
| | |
| 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/ μ sec (Standard value) L = 1000V/ μ sec (Special selection) |

Outline Table

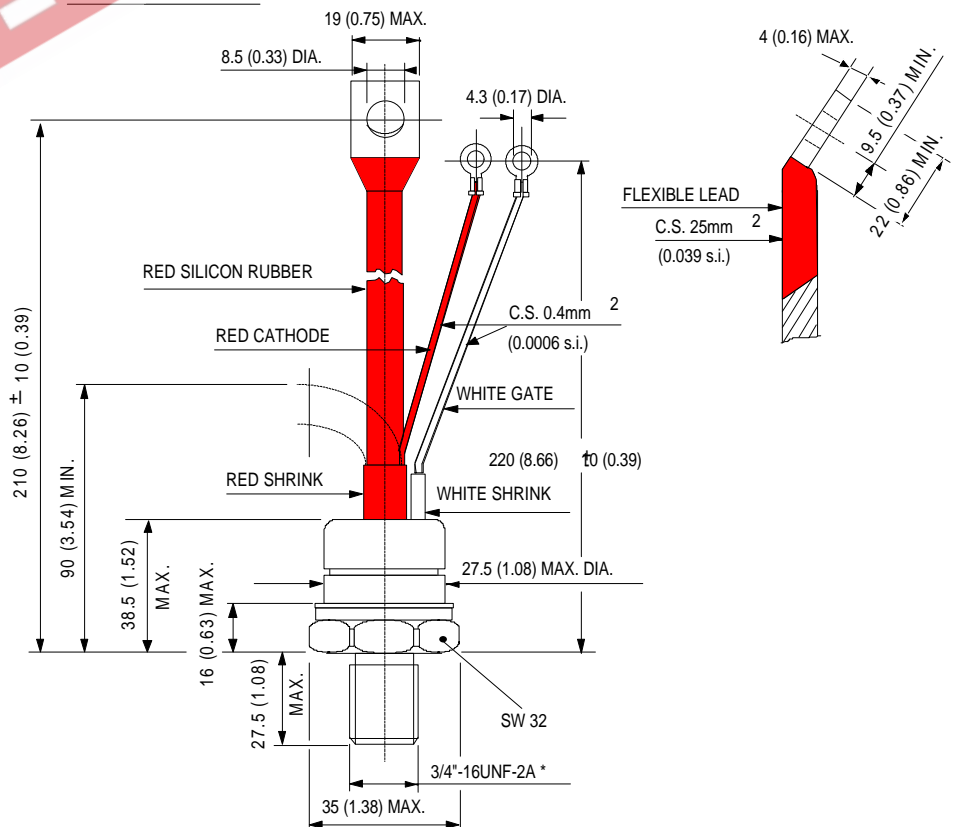
GLASS METAL SEAL



* 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.

