

Bulletin I25160 rev.C 02/00

International  
**IOR** Rectifier

**ST280CH..C SERIES**

**PHASE CONTROL THYRISTORS**

**Hockey Puk Version**

Features

- Center amplifying gate
- Metal case with ceramic insulator
- International standard case TO-200AB (A-PUK)
- Extended temperature range

Typical Applications

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

Major Ratings and Characteristics

| Parameters        | ST280CH..C  | Units             |
|-------------------|-------------|-------------------|
| $I_{T(AV)}$       | 500         | A                 |
| @ $T_{hs}$        | 80          | °C                |
| $I_{T(RMS)}$      | 1130        | A                 |
| @ $T_{hs}$        | 25          | °C                |
| $I_{TSM}$         | @ 50Hz 7200 | A                 |
|                   | @ 60Hz 7500 | A                 |
| $I^2t$            | @ 50Hz 260  | KA <sup>2</sup> s |
|                   | @ 60Hz 230  | KA <sup>2</sup> s |
| $V_{DRM}/V_{RRM}$ | 400 to 600  | V                 |
| $t_q$             | typical 100 | μs                |
| $T_J$             | - 40 to 150 | °C                |

500A



case style TO-200AB (A-PUK)



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### ELECTRICAL SPECIFICATIONS

#### Voltage Ratings

| Type number | Voltage Code | $V_{DRM}/V_{RRM}$ , max. repetitive peak and off-state voltage<br>V | $V_{RSM}$ , maximum non-repetitive peak voltage<br>V | $I_{DRM}/I_{RRM}$ max.<br>@ $T_J = T_J \text{ max}$<br>mA |
|-------------|--------------|---------------------------------------------------------------------|------------------------------------------------------|-----------------------------------------------------------|
| ST280CH..C  | 04           | 400                                                                 | 500                                                  | 75                                                        |
|             | 06           | 600                                                                 | 700                                                  |                                                           |

#### On-state Conduction

| Parameter                                                        | ST280CH..C            | Units              | Conditions                                                                                |
|------------------------------------------------------------------|-----------------------|--------------------|-------------------------------------------------------------------------------------------|
| $I_{T(AV)}$ Max. average on-state current @ Heatsink temperature | 500 (185)<br>80 (110) | A<br>°C            | 180° conduction, half sine wave<br>double side (single side) cooled                       |
| $I_{T(RMS)}$ Max. RMS on-state current                           | 1130                  |                    | DC @ 25°C heatsink temperature double side cooled                                         |
| $I_{TSM}$ Max. peak, one-cycle non-repetitive surge current      | 7200                  | A                  | t = 10ms No voltage                                                                       |
|                                                                  | 7500                  |                    | t = 8.3ms reapplied                                                                       |
|                                                                  | 6000                  |                    | t = 10ms 100% $V_{RRM}$                                                                   |
|                                                                  | 6300                  |                    | t = 8.3ms reapplied                                                                       |
| $I^2t$ Maximum $I^2t$ for fusing                                 | 260                   | KA <sup>2</sup> s  | t = 10ms No voltage                                                                       |
|                                                                  | 235                   |                    | t = 8.3ms reapplied                                                                       |
|                                                                  | 180                   |                    | t = 10ms 100% $V_{RRM}$                                                                   |
|                                                                  | 165                   |                    | t = 8.3ms reapplied                                                                       |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing                   | 2600                  | 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                  | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}), T_J = T_J \text{ max.}$ |
| $V_{T(TO)2}$ 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                                   | 1.35                  | V                  | $I_{pk} = 1000A, T_J = T_J \text{ max, } t_p = 10ms \text{ sine pulse}$                   |
| $I_H$ 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                                                     | ST280CH..C | Units | Conditions                                                                                                                                        |
|---------------------------------------------------------------|------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| $di/dt$ Max. non-repetitive rate of rise of turned-on current | 1000       | A/μs  | Gate drive 20V, 20Ω, $t_i \leq 1\mu s$<br>$T_J = T_J \text{ max, anode voltage} \leq 80\% V_{DRM}$                                                |
| $t_d$ Typical delay time                                      | 1.0        | μs    | Gate current 1A, $di_g/dt = 1A/\mu s$<br>$V_d = 0.67\% V_{DRM}, T_J = 25^\circ C$                                                                 |
| $t_q$ Typical turn-off time                                   | 100        |       | $I_{TM} = 300A, T_J = T_J \text{ max, } di/dt = 20A/\mu s, V_R = 50V$<br>$dv/dt = 20V/\mu s, \text{ Gate } 0V \text{ } 100\Omega, t_p = 500\mu s$ |

### Blocking

| Parameter                                                              | ST280CH..C | Units      | Conditions                                               |
|------------------------------------------------------------------------|------------|------------|----------------------------------------------------------|
| $dv/dt$ Maximum critical rate of rise of off-state voltage             | 500        | V/ $\mu$ s | $T_J = T_J \text{ max.}$ linear to 80% rated $V_{DRM}$   |
| $I_{DRM}$<br>$I_{RRM}$ Max. peak reverse and off-state leakage current | 75         | mA         | $T_J = T_J \text{ max.}$ rated $V_{DRM}/V_{RRM}$ applied |

### Triggering

| Parameter                                    | ST280CH..C  | Units | Conditions                                                                                                                                                                                                            |
|----------------------------------------------|-------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $P_{GM}$ Maximum peak gate power             | 10.0        | W     | $T_J = T_J \text{ max.}$ $t_p \leq 5\text{ms}$                                                                                                                                                                        |
| $P_{G(AV)}$ Maximum average gate power       | 2.0         |       | $T_J = T_J \text{ max.}$ $f = 50\text{Hz}$ , $d\% = 50$                                                                                                                                                               |
| $I_{GM}$ Max. peak positive gate current     | 3.0         | A     | $T_J = T_J \text{ max.}$ $t_p \leq 5\text{ms}$                                                                                                                                                                        |
| $+V_{GM}$ Maximum peak positive gate voltage | 20          | V     | $T_J = T_J \text{ max.}$ $t_p \leq 5\text{ms}$                                                                                                                                                                        |
| $-V_{GM}$ Maximum peak negative gate voltage | 5.0         |       |                                                                                                                                                                                                                       |
| $I_{GT}$ DC gate current required to trigger | TYP.<br>180 | mA    | $T_J = -40^\circ\text{C}$<br>$T_J = 25^\circ\text{C}$<br>$T_J = 150^\circ\text{C}$<br><br>Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied |
|                                              | 90          |       |                                                                                                                                                                                                                       |
|                                              | 30          |       |                                                                                                                                                                                                                       |
| $V_{GT}$ DC gate voltage required to trigger | 2.9         | V     | $T_J = -40^\circ\text{C}$<br>$T_J = 25^\circ\text{C}$<br>$T_J = 150^\circ\text{C}$                                                                                                                                    |
|                                              | 1.8         |       |                                                                                                                                                                                                                       |
|                                              | 1.0         |       |                                                                                                                                                                                                                       |
| $I_{GD}$ DC gate current not to trigger      | 10          | mA    | $T_J = T_J \text{ max}$<br><br>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      | 0.30        | V     |                                                                                                                                                                                                                       |

### Thermal and Mechanical Specification

| Parameter                                                  | ST280CH..C         | Units            | Conditions                                                         |
|------------------------------------------------------------|--------------------|------------------|--------------------------------------------------------------------|
| $T_J$ Max. operating temperature range                     | -40 to 150         | $^\circ\text{C}$ |                                                                    |
| $T_{stg}$ Max. storage temperature range                   | -40 to 150         |                  |                                                                    |
| $R_{thJ-hs}$ Max. thermal resistance, junction to heatsink | 0.17<br>0.08       | K/W              | DC operation single side cooled<br>DC operation double side cooled |
| $R_{thC-hs}$ Max. thermal resistance, case to heatsink     | 0.033<br>0.017     | K/W              | DC operation single side cooled<br>DC operation double side cooled |
| F Mounting force, $\pm 10\%$                               | 4900<br>(500)      | N<br>(Kg)        |                                                                    |
| wt Approximate weight                                      | 50                 | g                |                                                                    |
| Case style                                                 | TO - 200AB (A-PUK) |                  | See Outline Table                                                  |

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$\Delta R_{thJ-hs}$  Conduction

(The following table shows the increment of thermal resistance  $R_{thJ-hs}$  when devices operate at different conduction angles than DC)

| Conduction angle | Sinusoidal conduction |             | Rectangular conduction |             | Units | Conditions                 |
|------------------|-----------------------|-------------|------------------------|-------------|-------|----------------------------|
|                  | Single Side           | Double Side | Single Side            | Double Side |       |                            |
| 180°             | 0.016                 | 0.017       | 0.011                  | 0.011       | K/W   | $T_J = T_{J \text{ max.}}$ |
| 120°             | 0.019                 | 0.019       | 0.019                  | 0.019       |       |                            |
| 90°              | 0.024                 | 0.024       | 0.026                  | 0.026       |       |                            |
| 60°              | 0.035                 | 0.035       | 0.036                  | 0.037       |       |                            |
| 30°              | 0.060                 | 0.060       | 0.060                  | 0.061       |       |                            |

Ordering Information Table

Device Code

|    |    |   |    |    |   |   |   |
|----|----|---|----|----|---|---|---|
| ST | 28 | 0 | CH | 06 | C | 1 |   |
| 1  | 2  | 3 | 4  | 5  | 6 | 7 | 8 |

- 1** - Thyristor
- 2** - Essential part number
- 3** - 0 = Converter grade
- 4** - CH = Ceramic Puk, High temperature
- 5** - Voltage code: Code x 100 =  $V_{RRM}$  (See Voltage Rating Table)
- 6** - C = Puk Case TO-200AB (A-PUK)
- 7** - 0 = Eyelet terminals (Gate and Auxiliary Cathode Unsoldered Leads)  
1 = Fast-on terminals (Gate and Auxiliary Cathode Unsoldered Leads)  
2 = Eyelet terminals (Gate and Auxiliary Cathode Soldered Leads)  
3 = Fast-on terminals (Gate and Auxiliary Cathode Soldered Leads)
- 8** - Critical dv/dt: None = 500V/ $\mu$ sec (Standard selection)  
L = 1000V/ $\mu$ sec (Special selection)

Outline Table

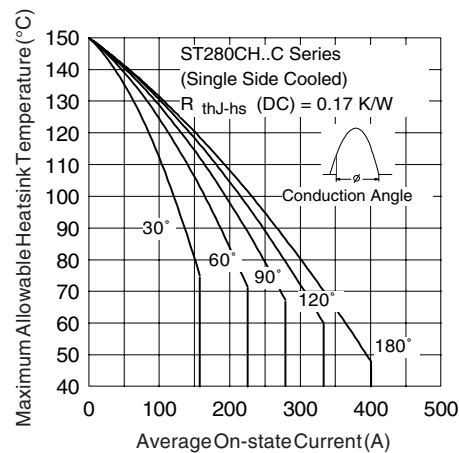
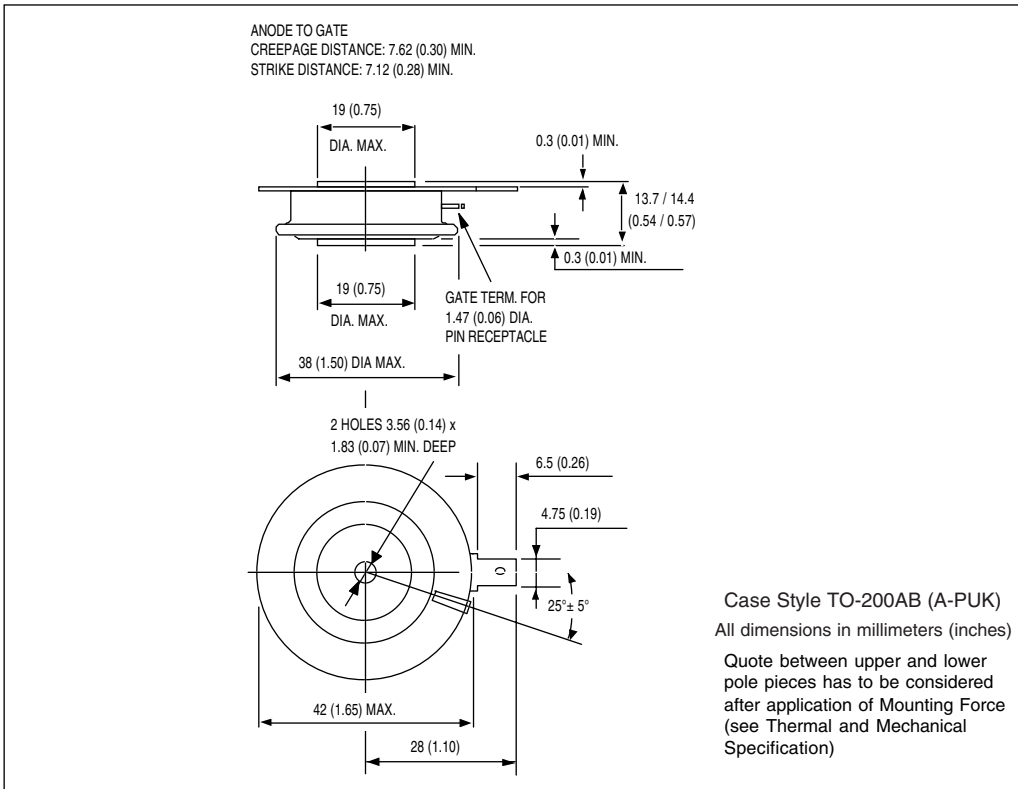


Fig. 1 - Current Ratings Characteristics

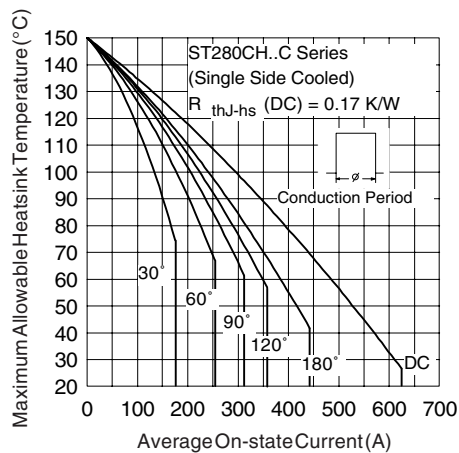


Fig. 2 - Current Ratings Characteristics

## ST280C..H Series

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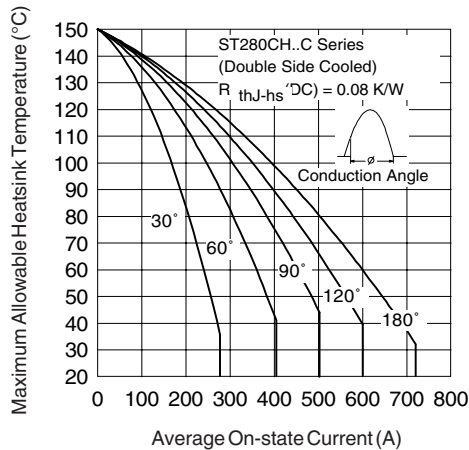


Fig. 3 - Current Ratings Characteristics

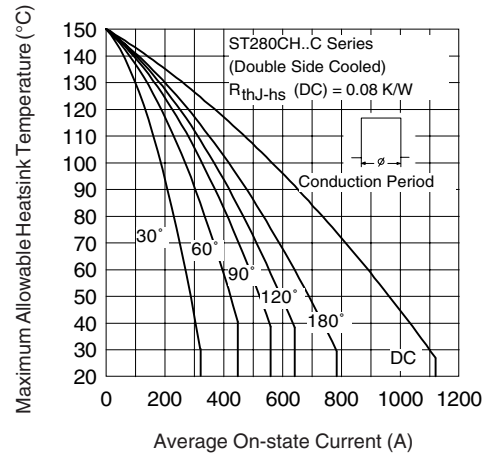


Fig. 4 - Current Ratings Characteristics

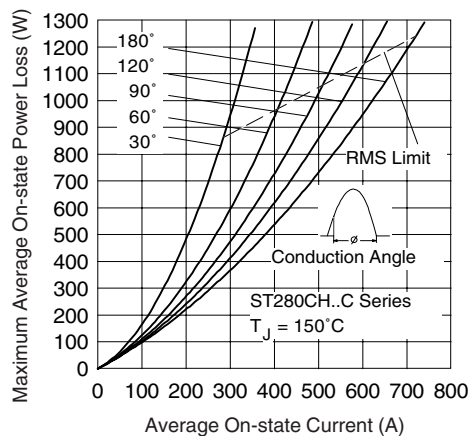


Fig. 5 - On-state Power Loss Characteristics

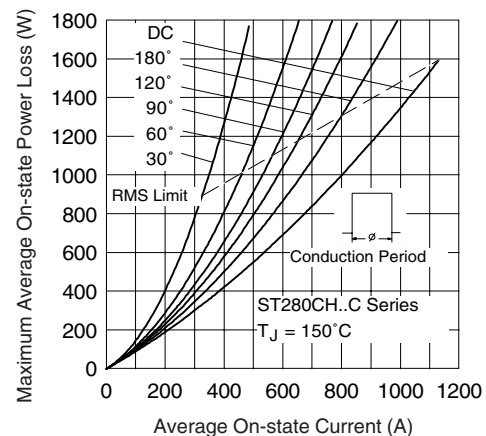


Fig. 6 - On-state Power Loss Characteristics

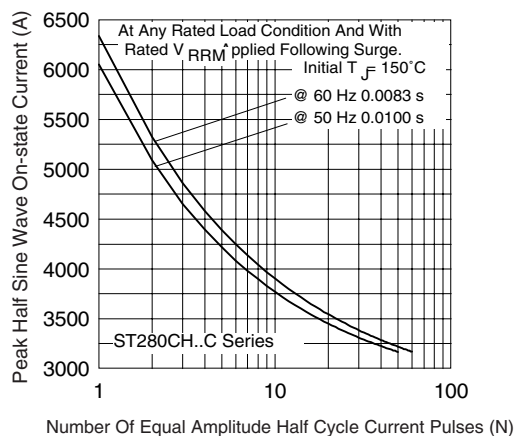


Fig. 7 - Maximum Non-Repetitive Surge Current  
Single and Double Side Cooled

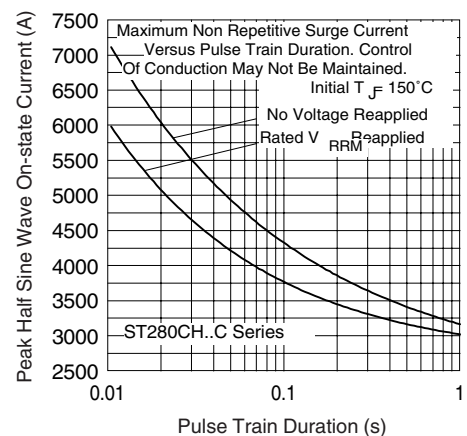


Fig. 8 - Maximum Non-Repetitive Surge Current  
Single and Double Side Cooled

Instantaneous On-state Current (A)

Instantaneous On-state Voltage (V)

Fig. 9 - On-state Voltage Drop Characteristics

Transient Thermal Impedance  $Z_{thJ-HS}$  (K/W)

Square Wave Pulse Duration (s)

Fig. 10 - Thermal Impedance  $Z_{thJ-HS}$  Characteristics

Instantaneous Gate Voltage (V)

Instantaneous Gate Current (A)

Fig. 11 - Gate Characteristics