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

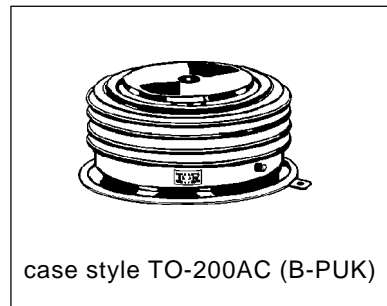
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**PHASE CONTROL THYRISTORS**
**Hockey Puk Version**
**Features**

- Center amplifying gate
- Metal case with ceramic insulator
- International standard case TO-200AC (B-PUK)
- High profile hockey-puk

**650A**
**Typical Applications**

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



case style TO-200AC (B-PUK)

**Major Ratings and Characteristics**

| Parameters        | ST330C..L   | Units             |
|-------------------|-------------|-------------------|
| $I_{T(AV)}$       | 650         | A                 |
| @ $T_{hs}$        | 55          | °C                |
| $I_{T(RMS)}$      | 1230        | A                 |
| @ $T_{hs}$        | 25          | °C                |
| $I_{TSM}$         | @ 50Hz 9000 | A                 |
|                   | @ 60Hz 9420 | A                 |
| $I^2t$            | @ 50Hz 405  | KA <sup>2</sup> s |
|                   | @ 60Hz 370  | KA <sup>2</sup> s |
| $V_{DRM}/V_{RRM}$ | 400 to 1600 | V                 |
| $t_q$             | typical 100 | µs                |
| $T_J$             | - 40 to 125 | °C                |

## ST330C..L Series

### 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>@ $T_J = T_J$ max<br>mA |
|-------------|--------------|---|--|---|
| ST330C..L   | 04           | 400   | 500  | 50  |
|             | 08           | 800   | 900  |   |
|             | 12           | 1200  | 1300   |   |
|             | 14           | 1400  | 1500   |   |
|             | 16           | 1600  | 1700   |   |

#### On-state Conduction

| Parameter  | ST330C..L | Units              | Conditions   |                       |
|--|-----------|--------------------|--|-----------------------|
| $I_{T(AV)}$ Max. average on-state current @ Heatsink temperature | 650 (314) | A                  | 180° conduction, half sine wave double side (single side) cooled                     |                       |
|  | 55 (75)   | °C                 |  |                       |
| $I_{T(RMS)}$ Max. RMS on-state current                           | 1230      | A                  | DC @ 25°C heatsink temperature double side cooled                                    |                       |
| $I_{TSM}$ Max. peak, one-cycle non-repetitive surge current      | 9000      |                    | t = 10ms   | No voltage reappplied |
|  | 9420      |                    | t = 8.3ms  | reappplied            |
|  | 7570      |                    | t = 10ms   | 100% $V_{RRM}$        |
|  | 7920      |                    | t = 8.3ms  | reappplied            |
| $I^2t$ Maximum $I^2t$ for fusing                                 | 405       | KA <sup>2</sup> s  | t = 10ms   | No voltage reappplied |
|  | 370       |                    | t = 8.3ms  | reappplied            |
|  | 287       |                    | t = 10ms   | 100% $V_{RRM}$        |
|  | 262       |                    | t = 8.3ms  | reappplied            |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing                   | 4050      | KA <sup>2</sup> √s | t = 0.1 to 10ms, no voltage reappplied   |                       |
| $V_{T(TO)1}$ Low level value of threshold voltage                | 0.91      | 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               | 0.93      |                    | $(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.                                      |                       |
| $r_{t1}$ Low level value of on-state slope resistance            | 0.57      | 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           | 0.57      |                    | $(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.                                      |                       |
| $V_{TM}$ Max. on-state voltage                                   | 1.90      | V                  | $I_{pk} = 1730A$ , $T_J = T_J$ max, $t_p = 10ms$ sine pulse                          |                       |
| $I_H$ Maximum holding current                                    | 600       | mA                 | $T_J = 25^\circ C$ , anode supply 12V resistive load                                 |                       |
| $I_L$ Typical latching current                                   | 1000      |                    |  |                       |

#### Switching

| Parameter   | ST330C..L | Units | Conditions   |
|---|-----------|-------|--|
| $di/dt$ Max. non-repetitive rate of rise of turned-on current | 1000      | A/μs  | Gate drive 20V, 20Ω, $t_r \leq 1\mu s$<br>$T_J = T_J$ max, anode voltage $\leq 80\% V_{DRM}$                                 |
| $t_d$ Typical delay time                                      | 1.0       | μs    | Gate current 1A, $di_g/dt = 1A/\mu s$<br>$V_d = 0.67\% V_{DRM}$ , $T_J = 25^\circ C$   |
| $t_q$ Typical turn-off time                                   | 100       |       | $I_{TM} = 550A$ , $T_J = T_J$ max, $di/dt = 40A/\mu s$ , $V_R = 50V$<br>$dv/dt = 20V/\mu s$ , Gate 0V 100Ω, $t_p = 500\mu s$ |

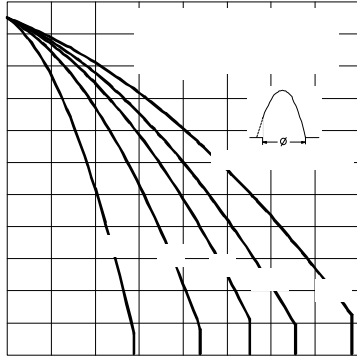


Fig. 3 - Current Ratings Characteristics

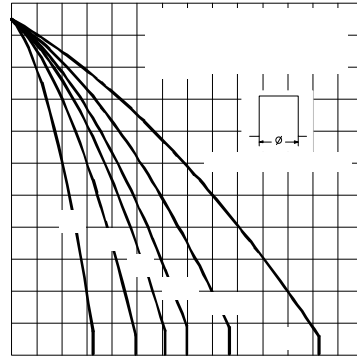


Fig. 4 - Current Ratings Characteristics

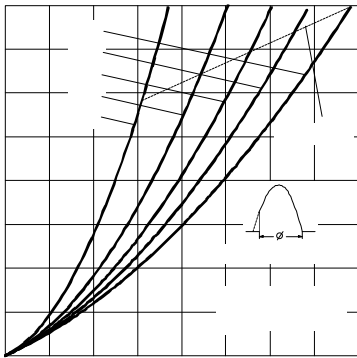


Fig. 5 - On-state Power Loss Characteristics

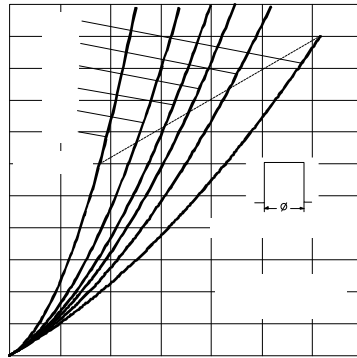


Fig. 6 - On-state Power Loss Characteristics

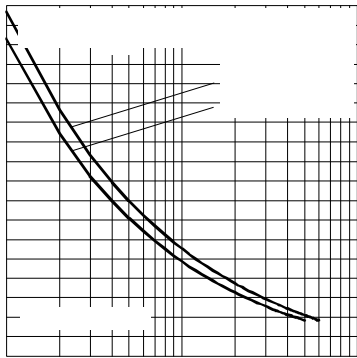


Fig. 7 - Maximum Non-Repetitive Surge Current  
Single and Double Side Cooled

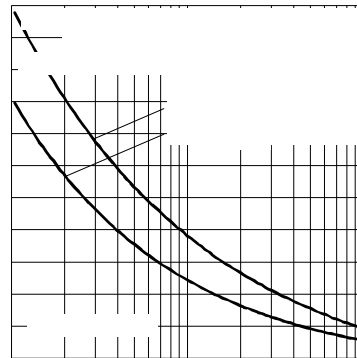


Fig. 8 - Maximum Non-Repetitive Surge Current  
Single and Double Side Cooled

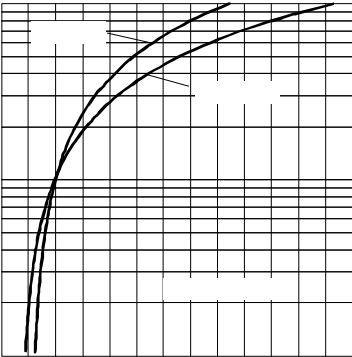


Fig. 9 - On-state Voltage Drop Characteristics

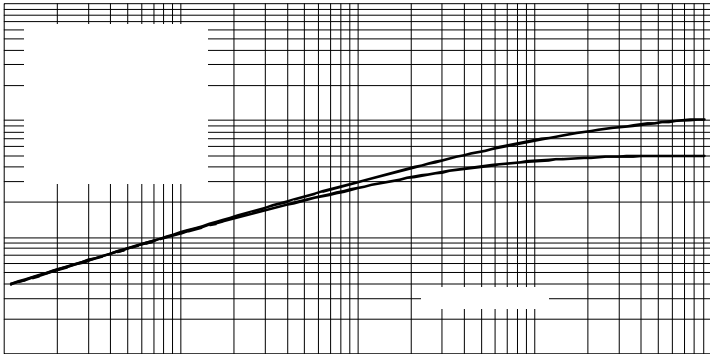


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

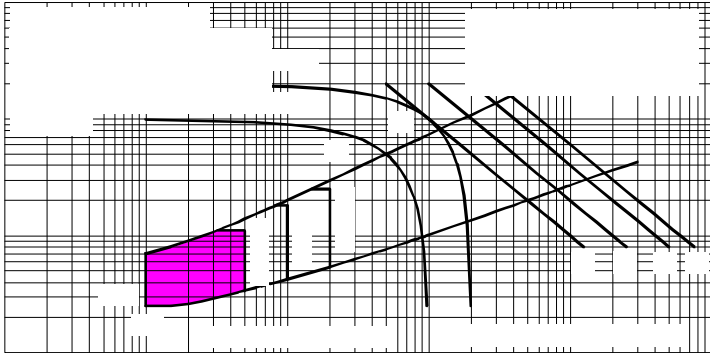


Fig. 11 - Gate Characteristics

## Blocking

| Parameter  | ST330C..L | 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 $V_{DRM}$   |
| $I_{RRM}$<br>$I_{DRM}$ Max. peak reverse and off-state leakage current | 50        | mA         | $T_J = T_J$ max, rated $V_{DRM}/V_{RRM}$ applied |

## Triggering

| Parameter                                    | ST330C..L | 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       |       | $T_J = T_J$ 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.  | $T_J = -40^\circ\text{C}$<br>$T_J = 25^\circ\text{C}$<br>$T_J = 125^\circ\text{C}$<br>Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied |
|  | 200       | -     |   |
|  | 100       | 200   |   |
| $V_{GT}$ DC gate voltage required to trigger | 2.5       | -     | $T_J = -40^\circ\text{C}$<br>$T_J = 25^\circ\text{C}$<br>$T_J = 125^\circ\text{C}$  |
|  | 1.8       | 3.0   |   |
|  | 1.1       | -     |   |
| $I_{GD}$ DC gate current not to trigger      | 10        | mA    | $T_J = T_J$ max<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      | 0.25      | V     |   |

## Thermal and Mechanical Specification

| Parameter  | ST330C..L          | Units            | Conditions                      |
|--|--------------------|------------------|---------------------------------|
| $T_J$ Max. operating temperature range                     | -40 to 125         | $^\circ\text{C}$ |                                 |
| $T_{stg}$ Max. storage temperature range                   | -40 to 150         |                  |                                 |
| $R_{thJ-hs}$ Max. thermal resistance, junction to heatsink | 0.11               | K/W              | DC operation single side cooled |
|  | 0.06               |                  | DC operation double side cooled |
| $R_{thC-hs}$ Max. thermal resistance, case to heatsink     | 0.011              | K/W              | DC operation single side cooled |
|  | 0.005              |                  | DC operation double side cooled |
| F Mounting force, $\pm 10\%$                               | 9800               | N                |                                 |
|  | (1000)             | (Kg)             |                                 |
| wt Approximate weight                                      | 250                | g                |                                 |
| Case style   | TO - 200AC (B-PUK) |                  | See Outline Table               |

## ST330C..L Series

### $\Delta R_{thJ-hs}$ 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°             | 0.012                 | 0.010       | 0.008                  | 0.008       | K/W   | $T_J = T_{J \text{ max.}}$ |
| 120°             | 0.014                 | 0.015       | 0.014                  | 0.014       |       |                            |
| 90°              | 0.018                 | 0.018       | 0.019                  | 0.019       |       |                            |
| 60°              | 0.026                 | 0.027       | 0.027                  | 0.028       |       |                            |
| 30°              | 0.045                 | 0.046       | 0.046                  | 0.046       |       |                            |

### Ordering Information Table

| Device Code |   |          |  |          |  |   |  |
|-------------|---|----------|--|----------|--|---|--|
| ST          | 33  | 0        | C                                      | 16       | L  | 1   |  |
| ①           | ②   | ③        | ④                                      | ⑤        | ⑥  | ⑦   | ⑧  |
| <b>1</b>    | - Thyristor   | <b>2</b> | - Essential part number                | <b>3</b> | - 0 = Converter grade  | <b>4</b>  | - C = Ceramic Puk  |
| <b>5</b>    | - Voltage code: Code x 100 = $V_{RRM}$ (See Voltage Rating Table) | <b>6</b> | - L = Puk Case TO-200AC (B-PUK)        | <b>7</b> | - 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) |
| <b>8</b>    | - Critical dv/dt: None = 500V/ $\mu$ sec (Standard selection)     | L        | = 1000V/ $\mu$ sec (Special selection) | <b>3</b> | - Fast-on terminals (Gate and Auxiliary Cathode Soldered Leads)      |   |  |

Outline Table

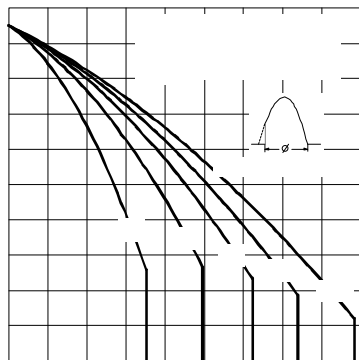
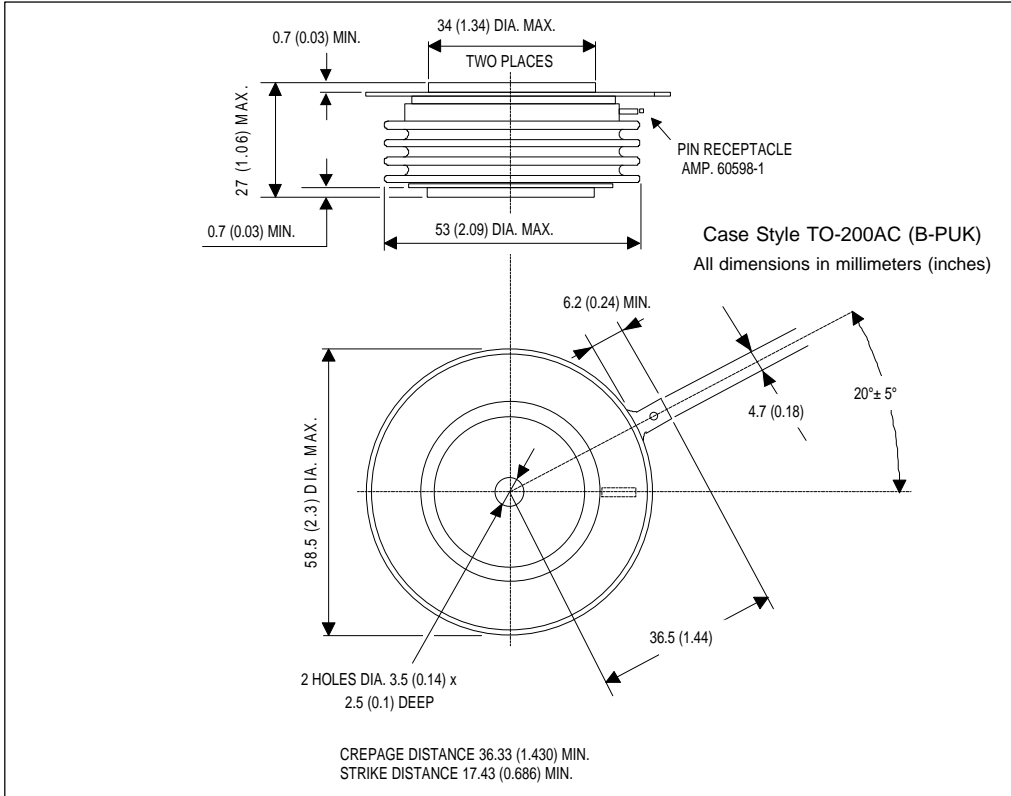


Fig. 1 - Current Ratings Characteristics

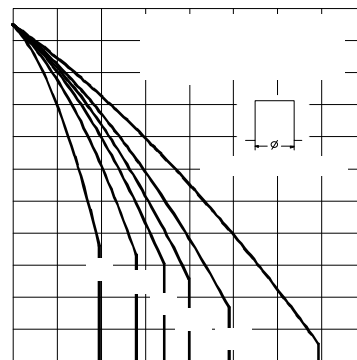


Fig. 2 - Current Ratings Characteristics