

## Inverter Grade Thyristors (Hockey PUK Version), 330 A


**TO-200AB (A-PUK)**

### FEATURES

- Metal case with ceramic insulator
- All diffused design
- Center amplifying gate
- Guaranteed high dV/dt
- International standard case TO-200AB (A-PUK)
- Guaranteed high dI/dt
- High surge current capability
- Low thermal impedance
- High speed performance
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### PRODUCT SUMMARY

|                    |                  |
|--------------------|------------------|
| Package            | TO-200AB (A-PUK) |
| Diode variation    | Single SCR       |
| $I_{T(AV)}$        | 330 A            |
| $V_{DRM}/V_{RRM}$  | 1000 V, 1200 V   |
| $V_{TM}$           | 2.07 V           |
| $I_{TSM}$ at 50 Hz | 4680 A           |
| $I_{TSM}$ at 60 Hz | 4900 A           |
| $I_{GT}$           | 200 mA           |
| $T_C/T_{hs}$       | 55 °C            |

### TYPICAL APPLICATIONS

- Inverters
- Choppers
- Induction heating
- All types of force-commutated converters

### MAJOR RATINGS AND CHARACTERISTICS

| PARAMETER         | TEST CONDITIONS | VALUES       | UNITS             |
|-------------------|-----------------|--------------|-------------------|
| $I_{T(AV)}$       |                 | 330          | A                 |
|                   | $T_{hs}$        | 55           | °C                |
| $I_{T(RMS)}$      |                 | 610          | A                 |
|                   | $T_{hs}$        | 25           | °C                |
| $I_{TSM}$         | 50 Hz           | 4680         | A                 |
|                   | 60 Hz           | 4900         |                   |
| $I^2t$            | 50 Hz           | 110          | kA <sup>2</sup> s |
|                   | 60 Hz           | 100          |                   |
| $V_{DRM}/V_{RRM}$ |                 | 1000 to 1200 | V                 |
| $t_q$             | Range           | 15 to 30     | μs                |
| $T_J$             |                 | -40 to 125   | °C                |

### ELECTRICAL SPECIFICATIONS

#### VOLTAGE RATINGS

| TYPE NUMBER  | VOLTAGE CODE | $V_{DRM}/V_{RRM}$ , MAXIMUM REPETITIVE PEAK VOLTAGE<br>V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK VOLTAGE<br>V | $I_{DRM}/I_{RRM}$ MAXIMUM AT $T_J = T_J$ MAXIMUM<br>mA |
|--------------|--------------|----------------------------------------------------------|------------------------------------------------------|--------------------------------------------------------|
| VS-ST173C..C | 10           | 1000                                                     | 1100                                                 | 40                                                     |
|              | 12           | 1200                                                     | 1300                                                 |                                                        |

**CURRENT CARRYING CAPABILITY**

| FREQUENCY                        |           |     |           |      |           |      | UNITS |
|----------------------------------|-----------|-----|-----------|------|-----------|------|-------|
| 50 Hz                            | 760       | 660 | 1200      | 1030 | 5570      | 4920 | A     |
| 400 Hz                           | 730       | 590 | 1260      | 1080 | 2800      | 2460 |       |
| 1000 Hz                          | 600       | 490 | 1200      | 1030 | 1620      | 1390 |       |
| 2500 Hz                          | 350       | 270 | 850       | 720  | 800       | 680  |       |
| Recovery voltage $V_r$           | 50        |     | 50        |      | 50        |      | V     |
| Voltage before turn-on $V_d$     | $V_{DRM}$ |     | $V_{DRM}$ |      | $V_{DRM}$ |      |       |
| Rise of on-state current $di/dt$ | 50        |     | -         |      | -         |      | A/μs  |
| Heatsink temperature             | 40        | 55  | 40        | 55   | 40        | 55   | °C    |
| Equivalent values for RC circuit | 47/0.22   |     | 47/0.22   |      | 47/0.22   |      | Ω/μF  |

**ON-STATE CONDUCTION**

| PARAMETER                                                  | SYMBOL              | TEST CONDITIONS                                                                                           |                                  |                                                                       | VALUES    | UNITS              |                   |
|------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------|-----------|--------------------|-------------------|
| Maximum average on-state current at heatsink temperature   | I <sub>T(AV)</sub>  | 180° conduction, half sine wave double side (single side) cooled                                          |                                  |                                                                       | 330 (120) | A                  |                   |
|                                                            |                     |                                                                                                           |                                  |                                                                       | 55 (85)   | °C                 |                   |
| Maximum RMS on-state current                               | I <sub>T(RMS)</sub> | DC at 25 °C heatsink temperature double side cooled                                                       |                                  |                                                                       | 610       | A                  |                   |
| Maximum peak, one half cycle, non-repetitive surge current | I <sub>TSM</sub>    | t = 10 ms                                                                                                 | No voltage reapplied             | Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J</sub> maximum | 4680      |                    |                   |
|                                                            |                     | t = 8.3 ms                                                                                                |                                  |                                                                       | 4900      |                    |                   |
|                                                            |                     | t = 10 ms                                                                                                 | 100 % V <sub>RRM</sub> reapplied |                                                                       | 3940      |                    |                   |
|                                                            |                     | t = 8.3 ms                                                                                                |                                  |                                                                       | 4120      |                    |                   |
| Maximum I <sup>2</sup> t for fusing                        | I <sup>2</sup> t    | t = 10 ms                                                                                                 | No voltage reapplied             |                                                                       | 110       |                    | kA <sup>2</sup> s |
|                                                            |                     | t = 8.3 ms                                                                                                |                                  |                                                                       | 100       |                    |                   |
|                                                            |                     | t = 10 ms                                                                                                 | 100 % V <sub>RRM</sub> reapplied |                                                                       | 77        |                    |                   |
|                                                            |                     | t = 8.3 ms                                                                                                |                                  |                                                                       | 71        |                    |                   |
| Maximum I <sup>2</sup> √t for fusing                       | I <sup>2</sup> √t   | t = 0.1 to 10 ms, no voltage reapplied                                                                    |                                  |                                                                       | 1100      | kA <sup>2</sup> √s |                   |
| Maximum peak on-state voltage                              | V <sub>TM</sub>     | I <sub>TM</sub> = 600 A, T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> = 10 ms sine wave pulse  |                                  |                                                                       | 2.07      | V                  |                   |
| Low level value of threshold voltage                       | V <sub>T(TO)1</sub> | (16.7 % × π × I <sub>T(AV)</sub> ) < I < π × I <sub>T(AV)</sub> , T <sub>J</sub> = T <sub>J</sub> maximum |                                  |                                                                       | 1.55      |                    |                   |
| High level value of threshold voltage                      | V <sub>T(TO)2</sub> | (I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum                                    |                                  |                                                                       | 1.61      |                    |                   |
| Low level value of forward slope resistance                | r <sub>t1</sub>     | (16.7 % × π × I <sub>T(AV)</sub> ) < I < π × I <sub>T(AV)</sub> , T <sub>J</sub> = T <sub>J</sub> maximum |                                  |                                                                       | 0.87      | mΩ                 |                   |
| High level value of forward slope resistance               | r <sub>t2</sub>     | (I > π × I <sub>T(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum                                    |                                  |                                                                       | 0.77      |                    |                   |
| Maximum holding current                                    | I <sub>H</sub>      | T <sub>J</sub> = 25 °C, I <sub>T</sub> > 30 A                                                             |                                  |                                                                       | 600       | mA                 |                   |
| Typical latching current                                   | I <sub>L</sub>      | T <sub>J</sub> = 25 °C, V <sub>A</sub> = 12 V, R <sub>a</sub> = 6 Ω, I <sub>G</sub> = 1 A                 |                                  |                                                                       | 1000      |                    |                   |

**SWITCHING**

| PARAMETER                                                | SYMBOL  | TEST CONDITIONS                                                                                                                          | VALUES | UNITS |
|----------------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|
| Maximum non-repetitive rate of rise of turned on current | $di/dt$ | $T_J = T_J$ maximum, $V_{DRM} = \text{Rated } V_{DRM}$ , $I_{TM} = 2 \times di/dt$                                                       | 1000   | A/μs  |
| Typical delay time                                       | $t_d$   | $T_J = 25$ °C, $V_{DM} = \text{Rated } V_{DRM}$ , $I_{TM} = 50$ A DC, $t_p = 1$ μs<br>Resistive load, gate pulse: 10 V, 5 Ω source       | 1.1    | μs    |
| Maximum turn-off time                                    | minimum | $T_J = T_J$ maximum, $I_{TM} = 300$ A, commutating $di/dt = 20$ A/μs<br>$V_R = 50$ V, $t_p = 500$ μs, $dV/dt$ : See table in device code | 15     |       |
|                                                          | maximum |                                                                                                                                          | 30     |       |

**BLOCKING**

| PARAMETER                                          | SYMBOL                   | TEST CONDITIONS                                                                   | VALUES | UNITS      |
|----------------------------------------------------|--------------------------|-----------------------------------------------------------------------------------|--------|------------|
| Maximum critical rate of rise of off-state voltage | dV/dt                    | $T_J = T_J$ maximum, linear to 80 % $V_{DRM}$ , higher value available on request | 500    | V/ $\mu$ s |
| Maximum peak reverse and off-state leakage current | $I_{RRM}$ ,<br>$I_{DRM}$ | $T_J = T_J$ maximum, rated $V_{DRM}/V_{RRM}$ applied                              | 40     | mA         |

**TRIGGERING**

| PARAMETER                                   | SYMBOL      | TEST CONDITIONS                                 | VALUES | UNITS |
|---------------------------------------------|-------------|-------------------------------------------------|--------|-------|
| Maximum peak gate power                     | $P_{GM}$    | $T_J = T_J$ maximum, $f = 50$ Hz, $d\% = 50$    | 60     | W     |
| Maximum average gate power                  | $P_{G(AV)}$ |                                                 | 10     |       |
| Maximum peak positive gate current          | $I_{GM}$    | $T_J = T_J$ maximum, $t_p \leq 5$ ms            | 10     | A     |
| Maximum peak positive gate voltage          | + $V_{GM}$  |                                                 | 20     | V     |
| Maximum peak negative gate voltage          | - $V_{GM}$  |                                                 | 5      |       |
| Maximum DC gate current required to trigger | $I_{GT}$    | $T_J = 25$ °C, $V_A = 12$ V, $R_a = 6$ $\Omega$ | 200    | mA    |
| Maximum DC gate voltage required to trigger | $V_{GT}$    |                                                 | 3      | V     |
| Maximum DC gate current not to trigger      | $I_{GD}$    | $T_J = T_J$ maximum, rated $V_{DRM}$ applied    | 20     | mA    |
| Maximum DC gate voltage not to trigger      | $V_{GD}$    |                                                 | 0.25   | V     |

**THERMAL AND MECHANICAL SPECIFICATIONS**

| PARAMETER                                        | SYMBOL       | TEST CONDITIONS                               | VALUES           | UNITS     |
|--------------------------------------------------|--------------|-----------------------------------------------|------------------|-----------|
| Maximum operating junction temperature range     | $T_J$        |                                               | - 40 to 125      | °C        |
| Maximum storage temperature range                | $T_{Stg}$    |                                               | - 40 to 150      |           |
| Maximum thermal resistance, junction to heatsink | $R_{thJ-hs}$ | DC operation single side cooled               | 0.17             | K/W       |
|                                                  |              | DC operation double side cooled               | 0.08             |           |
| Maximum thermal resistance, case to heatsink     | $R_{thC-hs}$ | DC operation single side cooled               | 0.033            |           |
|                                                  |              | DC operation double side cooled               | 0.017            |           |
| Mounting force, $\pm 10$ %                       |              |                                               | 4900<br>(500)    | N<br>(kg) |
| Approximate weight                               |              |                                               | 50               | g         |
| Case style                                       |              | See dimensions - link at the end of datasheet | TO-200AB (A-PUK) |           |

 **$\Delta R_{thJ-hs}$  CONDUCTION**

| CONDUCTION ANGLE | SINUSOIDAL CONDUCTION |             | RECTANGULAR CONDUCTION |             | TEST CONDITIONS     | UNITS |
|------------------|-----------------------|-------------|------------------------|-------------|---------------------|-------|
|                  | Single Side           | Double Side | Single Side            | Double Side |                     |       |
| 180°             | 0.015                 | 0.016       | 0.011                  | 0.011       | $T_J = T_J$ maximum | K/W   |
| 120°             | 0.018                 | 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       |                     |       |

**Note**

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

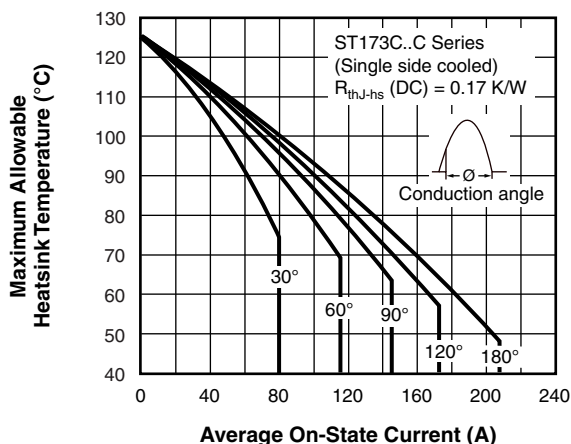


Fig. 1 - Current Ratings Characteristics

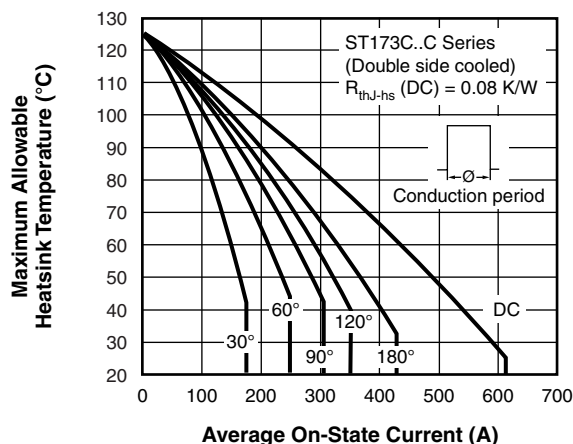


Fig. 4 - Current Ratings Characteristics

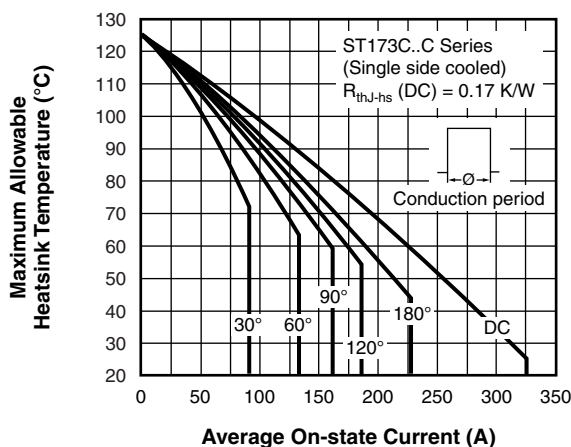


Fig. 2 - Current Ratings Characteristics

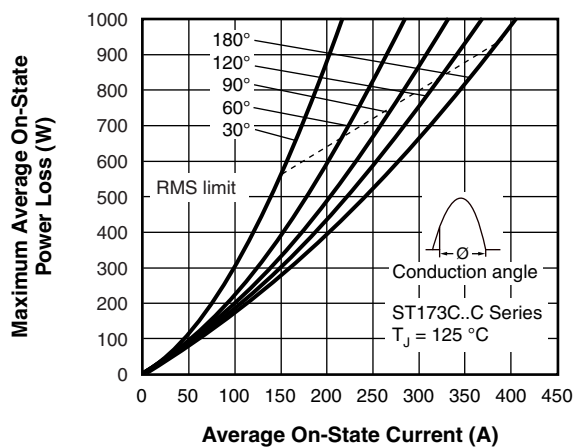


Fig. 5 - On-State Power Loss Characteristics

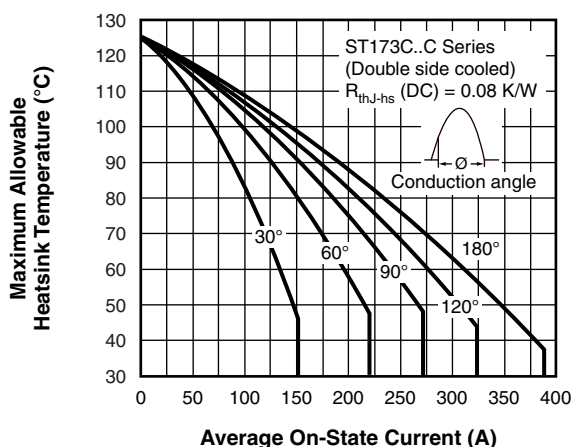


Fig. 3 - Current Ratings Characteristics

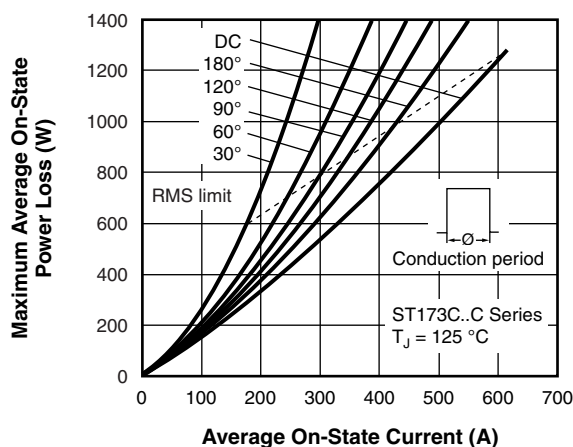


Fig. 6 - On-State Power Loss Characteristics

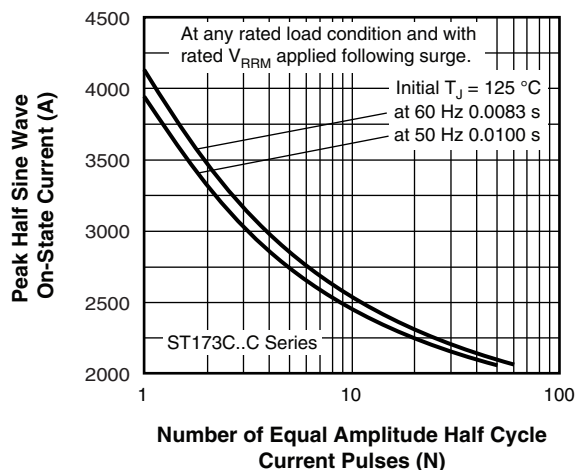


Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

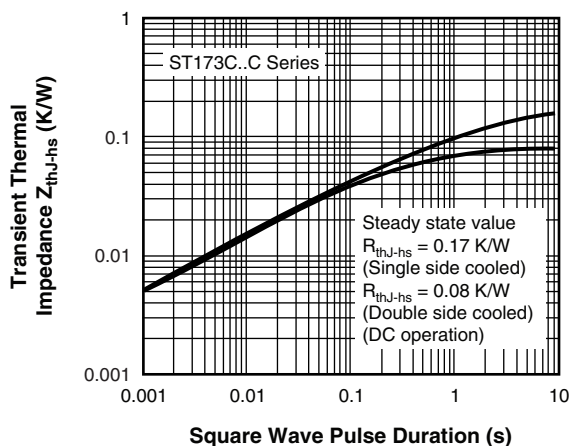


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

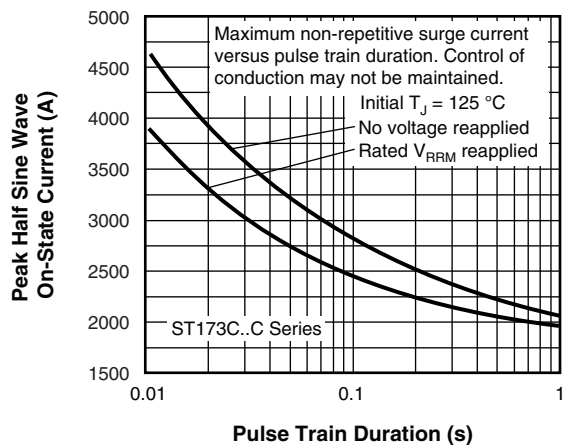


Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

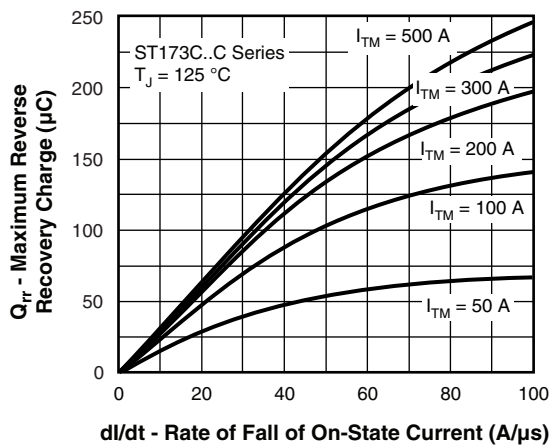


Fig. 11 - Reverse Recovered Charge Characteristics

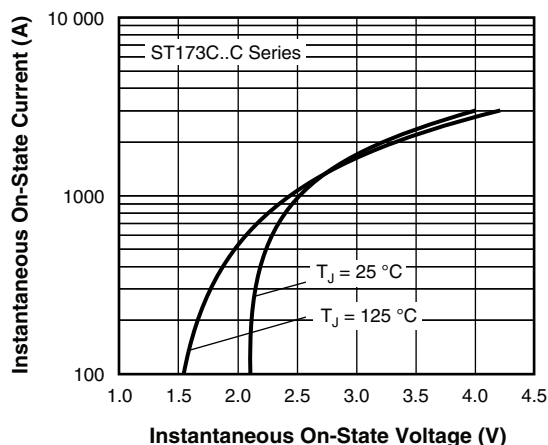


Fig. 9 - On-State Voltage Drop Characteristics

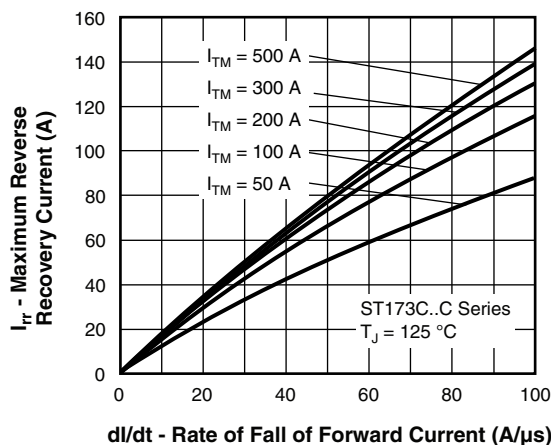


Fig. 12 - Reverse Recovered Current Characteristics

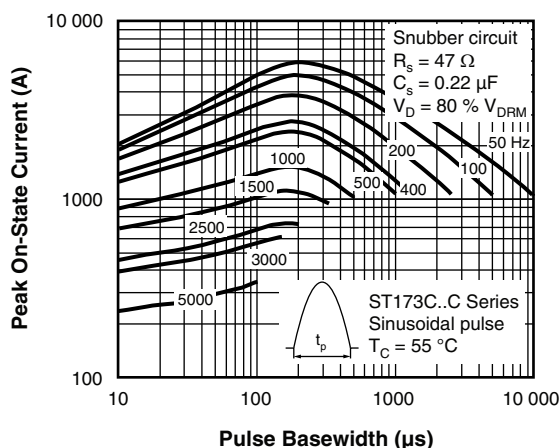
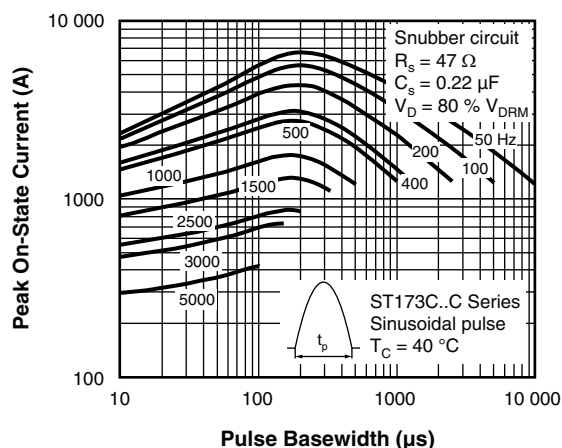


Fig. 13 - Frequency Characteristics

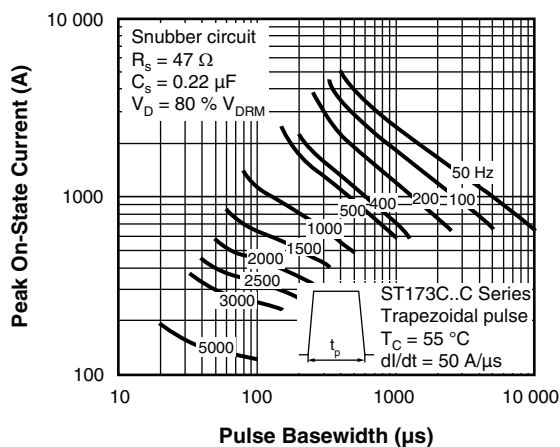
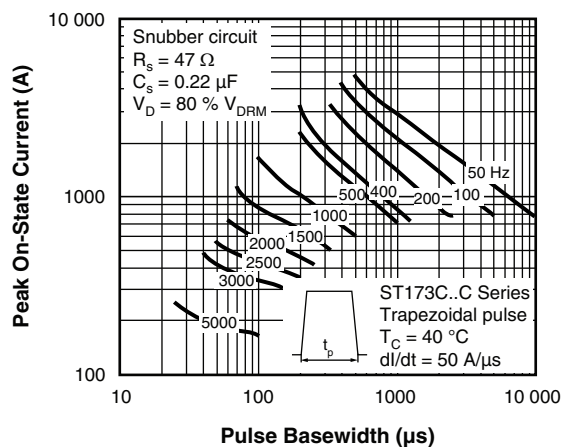


Fig. 14 - Frequency Characteristics

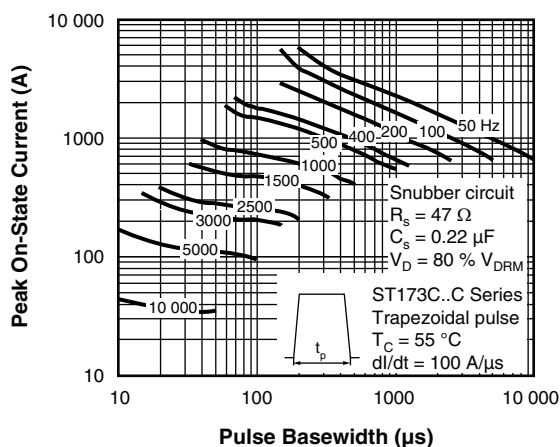
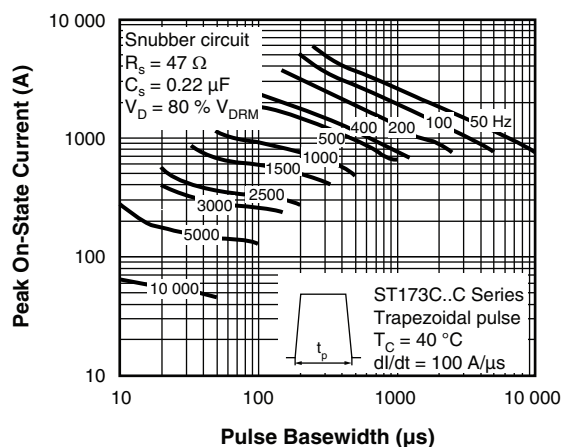


Fig. 15 - Frequency Characteristics

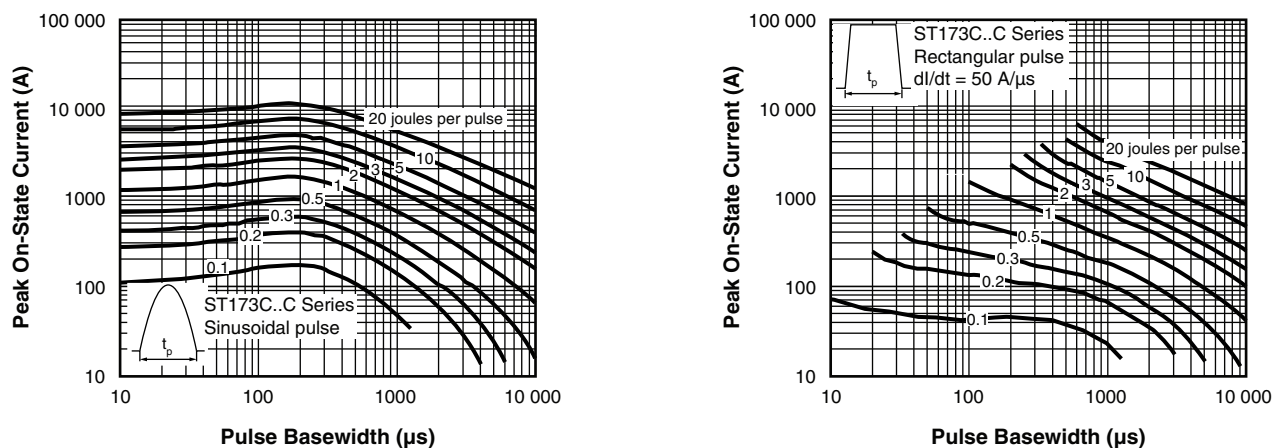


Fig. 16 - Maximum On-State Energy Power Loss Characteristics

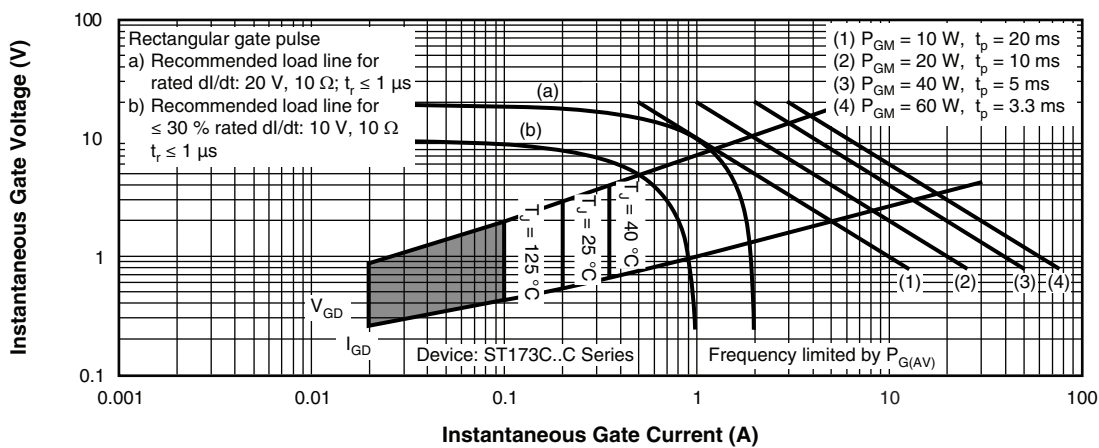


Fig. 17 - Gate Characteristics



## ORDERING INFORMATION TABLE

| Device code | VS- | ST | 17 | 3 | C | 12 | C | H | K | 1  | -  |
|-------------|-----|----|----|---|---|----|---|---|---|----|----|
|             | 1   | 2  | 3  | 4 | 5 | 6  | 7 | 8 | 9 | 10 | 11 |

- 1** - Vishay Semiconductors product  
**2** - Thyristor  
**3** - Essential part number  
**4** - 3 = Fast turn-off  
**5** - C = Ceramic PUK  
**6** - Voltage code x 100 =  $V_{RRM}$  (see Voltage Ratings table)  
**7** - C = PUK case TO-200AB (A-PUK)  
**8** - Reapplied  $dV/dt$  code (for  $t_q$  test condition)  
**9** -  $t_q$  code  
**10** - 0 = Eyelet terminals  
 (gate and aux. cathode unsoldered leads)  
 1 = Fast-on terminals  
 (gate and aux. cathode unsoldered leads)  
 2 = Eyelet terminals  
 (gate and aux. cathode soldered leads)  
 3 = Fast-on terminals  
 (gate and aux. cathode soldered leads)  
**11** - Critical  $dV/dt$ :  
 • None = 500 V/ $\mu$ s (standard value)  
 • L = 1000 V/ $\mu$ s (special selection)

| $dV/dt$ - $t_q$ combinations available |    |    |     |             |     |
|----------------------------------------|----|----|-----|-------------|-----|
| $dV/dt$ (V/ $\mu$ s)                   | 20 | 50 | 100 | 200         | 400 |
| 15                                     | CL | -- | --  | --          | --  |
| 18                                     | CP | DP | EP  | <b>FP</b> * | --  |
| 20                                     | CK | DK | EK  | <b>FK</b> * | HK  |
| 25                                     | CJ | DJ | EJ  | FJ          | HJ  |
| 30                                     | -- | DH | EH  | FH          | HH  |

\* Standard part number.

All other types available only on request.

## LINKS TO RELATED DOCUMENTS

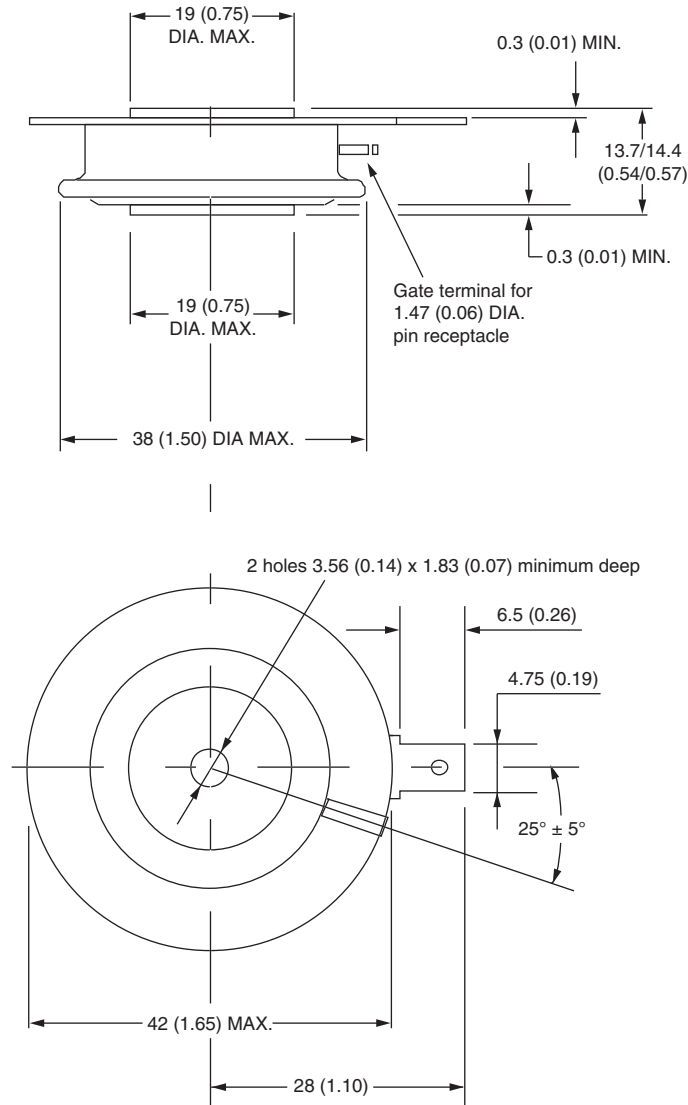
Dimensions

[www.vishay.com/doc?95074](http://www.vishay.com/doc?95074)

## TO-200AB (A-PUK)

### DIMENSIONS in millimeters (inches)

Anode to gate  
Creepage distance: 7.62 (0.30) minimum  
Strike distance: 7.12 (0.28) minimum



Quote between upper and lower pole pieces has to be considered after application of mounting force (see thermal and mechanical specification)



## Disclaimer

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