

Inverter Grade Thyristors (Hockey PUK Version), 940 A



TO-200AC (B-PUK)

FEATURES

- Metal case with ceramic insulator
- All diffused design
- Center amplifying gate
- Guaranteed high dV/dt
- Guaranteed high dI/dt
- International standard case TO-200AC (B-PUK)
- High surge current capability
- Low thermal impedance
- High speed performance
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



**RoHS
COMPLIANT**

PRODUCT SUMMARY

| | |
|--------------------|------------------|
| Package | TO-200AC (B-PUK) |
| Diode variation | Single SCR |
| $I_{T(AV)}$ | 940 A |
| V_{DRM}/V_{RRM} | 400 V, 800 V |
| V_{TM} | 1.63 V |
| I_{TSM} at 50 Hz | 20 000 A |
| I_{TSM} at 60 Hz | 20 950 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 |
|-------------------|-----------------|-------------|-------------------|
| $I_{T(AV)}$ | | 940 | A |
| | T_{hs} | 55 | °C |
| $I_{T(RMS)}$ | | 1900 | A |
| | T_{hs} | 25 | °C |
| I_{TSM} | 50 Hz | 20 000 | A |
| | 60 Hz | 20 950 | |
| I^2t | 50 Hz | 2000 | kA ² s |
| | 60 Hz | 1820 | |
| V_{DRM}/V_{RRM} | | 400 to 800 | V |
| t_q | Range | 10 to 20 | μs |
| T_J | | -40 to +125 | °C |

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS

| TYPE NUMBER | VOLTAGE CODE | V_{DRM}/V_{RRM} , MAXIMUM REPETITIVE PEAK VOLTAGE V | V_{RSM} , MAXIMUM NON-REPETITIVE PEAK VOLTAGE V | I_{DRM}/I_{RRM} MAXIMUM AT $T_J = T_J$ MAXIMUM mA |
|--------------|--------------|--|--|--|
| VS-ST733C..L | 04 | 400 | 500 | 75 |
| | 08 | 800 | 900 | |



| CURRENT CARRYING CAPABILITY | | | | | | | |
|----------------------------------|-----------|------|-----------|------|-----------|------|-------|
| FREQUENCY | | | | | | | UNITS |
| 50 Hz | 2200 | 1900 | 3580 | 3100 | 6800 | 5920 | A |
| 400 Hz | 2050 | 1660 | 3600 | 3130 | 3750 | 3240 | |
| 1000 Hz | 1370 | 1070 | 2900 | 2450 | 2120 | 1780 | |
| 2500 Hz | 500 | 370 | 1220 | 980 | 960 | 770 | |
| 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 | 10/0.47 | | 10/0.47 | | 10/0.47 | | Ω/μF |

| ABSOLUTE MAXIMUM RATINGS | | | | | |
|--|---------------|--|----------------------------|-----------|--------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum average on-state current at heatsink temperature | $I_{T(AV)}$ | 180° conduction, half sine wave double side (single side) cooled | | 940 (350) | A |
| | | | | 55 (85) | °C |
| Maximum RMS on-state current | $I_{T(RMS)}$ | DC at 25 °C heatsink temperature double side cooled | | 1900 | A |
| Maximum peak, one half cycle, non-repetitive surge current | I_{TSM} | t = 10 ms | No voltage reappplied | 20 000 | |
| | | t = 8.3 ms | | 20 950 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 16 800 | |
| | | t = 8.3 ms | | 17 600 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reappplied | 2000 | kA ² s |
| | | t = 8.3 ms | | 1820 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 1410 | |
| | | t = 8.3 ms | | 1290 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reappplied | | 20 000 | kA ² √s |
| Maximum peak on-state voltage | V_{TM} | $I_{TM} = 1700$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine wave pulse | | 1.63 | V |
| Low level value of threshold voltage | $V_{T(TO)1}$ | $(16.7 \% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 1.09 | |
| High level value of threshold voltage | $V_{T(TO)2}$ | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 1.20 | |
| Low level value of forward slope resistance | r_{t1} | $(16.7 \% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 0.32 | mΩ |
| High level value of forward slope resistance | r_{t2} | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 0.29 | |
| Maximum holding current | I_H | $T_J = 25$ °C, $I_T > 30$ A | | 600 | mA |
| Typical latching current | I_L | $T_J = 25$ °C, $V_A = 12$ V, $R_a = 6$ Ω, $I_G = 1$ A | | 1000 | |



| SWITCHING | | | | |
|--|----------------|---|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Maximum non-repetitive rate of rise of turned-on current | dl/dt | T _J = T _J maximum, V _{DRM} = Rated V _{DRM} , I _{TM} = 2 x dl/dt Gate pulse: 20 V 20 Ω, 10 μs 0.5 μs rise time | 1000 | A/μs |
| Typical delay time | t _d | T _J = 25 °C, V _{DM} = Rated V _{DRM} , I _{TM} = 50 A DC, t _p = 1 μs Resistive load, gate pulse: 10 V, 5 Ω source | 1.5 | μs |
| Maximum turn-off time | minimum | T _J = T _J maximum, I _{TM} = 550 A, commutating dl/dt = 40 A/μs, V _R = 50 V, t _p = 500 μs, dV/dt: see table in device code | 10 | |
| | maximum | | 20 | |

| 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/μs |
| Maximum peak reverse and off-state leakage current | I _{RRM} , I _{DRM} | T _J = T _J maximum, rated V _{DRM} /V _{RRM} applied | 75 | 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 ≤ 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 Ω | 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 | 0.073 | K/W |
| | | DC operation double side cooled | 0.031 | |
| Maximum thermal resistance, case to heatsink | R _{thC-hs} | DC operation single side cooled | 0.011 | |
| | | DC operation double side cooled | 0.005 | |
| Mounting force, ± 10 % | | | 14 700 (1500) | N (kg) |
| Approximate weight | | | 255 | g |
| Case style | | See dimensions - link at the end of datasheet | TO-200AC (B-PUK) | |



| ΔR_{thJ-hs} CONDUCTION | | | | | | |
|--|-----------------------|-------------|------------------------|-------------|---|-------|
| CONDUCTION ANGLE | SINUSOIDAL CONDUCTION | | RECTANGULAR CONDUCTION | | TEST CONDITIONS | UNITS |
| | SINGLE SIDE | DOUBLE SIDE | SINGLE SIDE | DOUBLE SIDE | | |
| 180° | 0.009 | 0.009 | 0.006 | 0.006 | T _J = T _J maximum | K/W |
| 120° | 0.011 | 0.011 | 0.011 | 0.011 | | |
| 90° | 0.014 | 0.014 | 0.015 | 0.015 | | |
| 60° | 0.020 | 0.021 | 0.021 | 0.022 | | |
| 30° | 0.036 | 0.036 | 0.036 | 0.036 | | |

Note

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

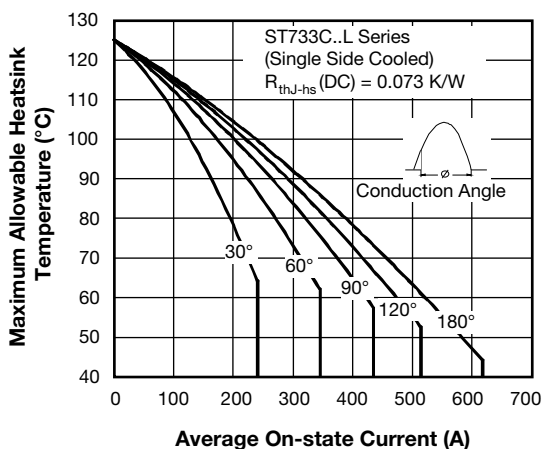


Fig. 1 - Current Ratings Characteristics

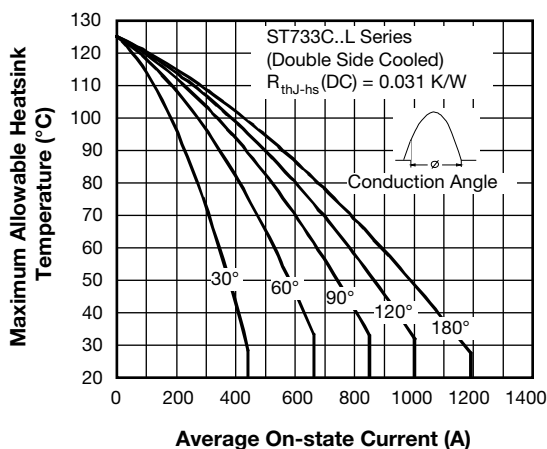


Fig. 3 - Current Ratings Characteristics

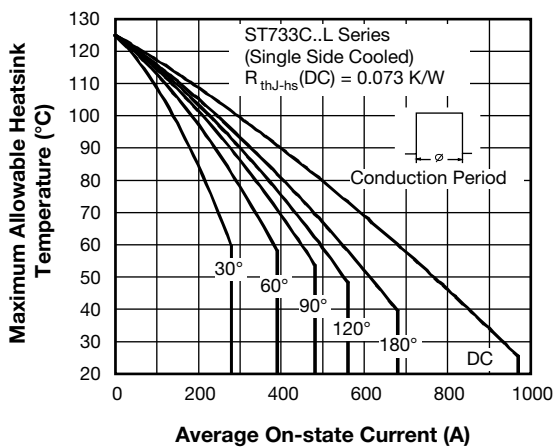


Fig. 2 - Current Ratings Characteristics

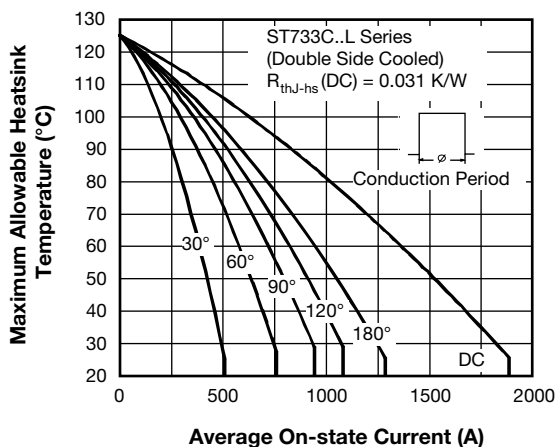


Fig. 4 - Current Ratings Characteristics

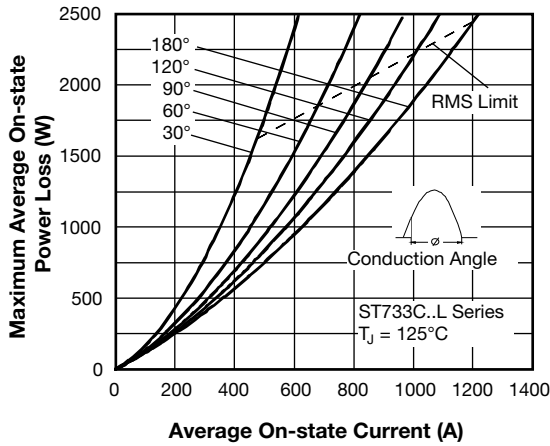


Fig. 5 - On-State Power Loss Characteristics

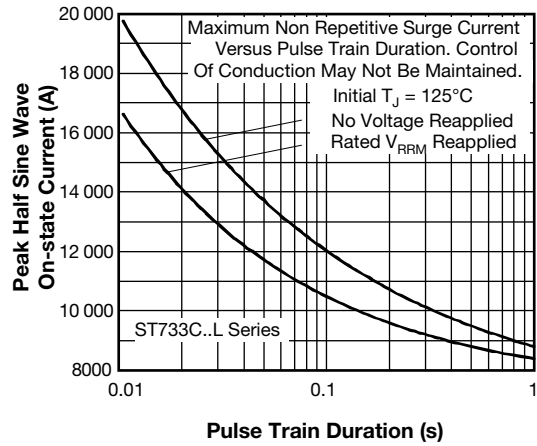


Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

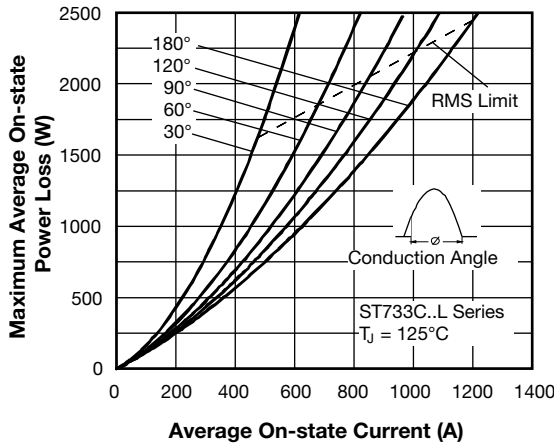


Fig. 6 - On-State Power Loss Characteristics

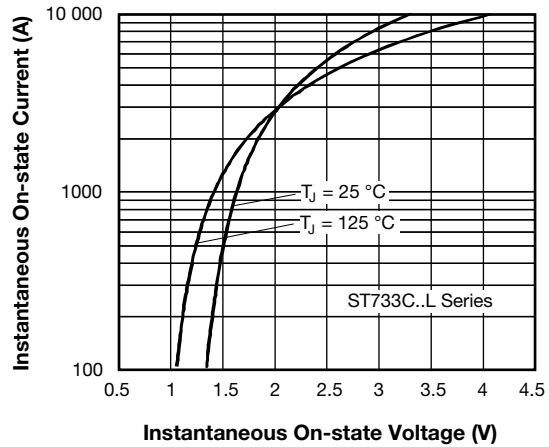


Fig. 9 - On-State Voltage Drop Characteristics

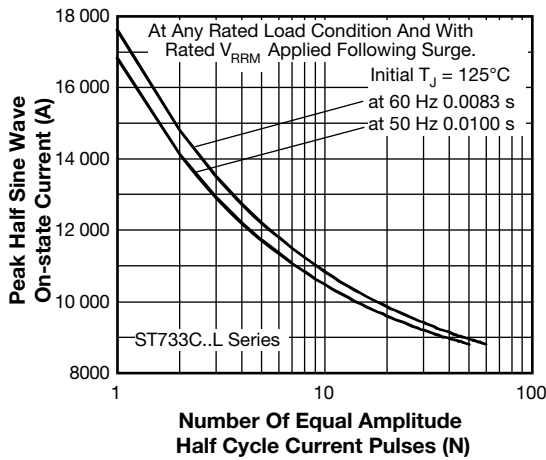


Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

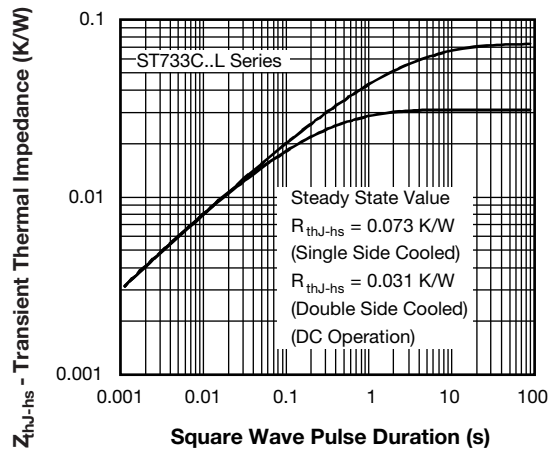


Fig. 10 - Thermal Impedance Z_{thJC} Characteristics

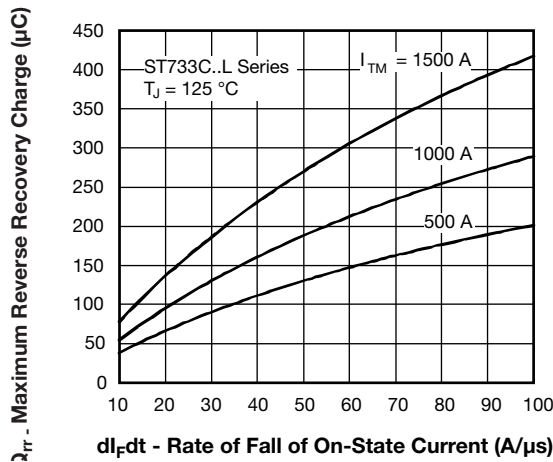


Fig. 11 - Reverse Recovered Charge Characteristics

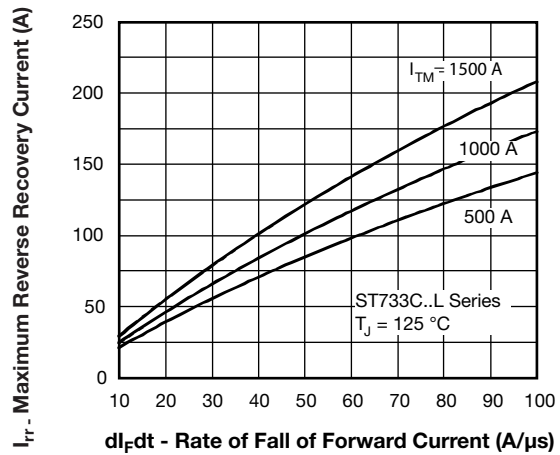


Fig. 12 - Reverse Recovered Current Characteristics

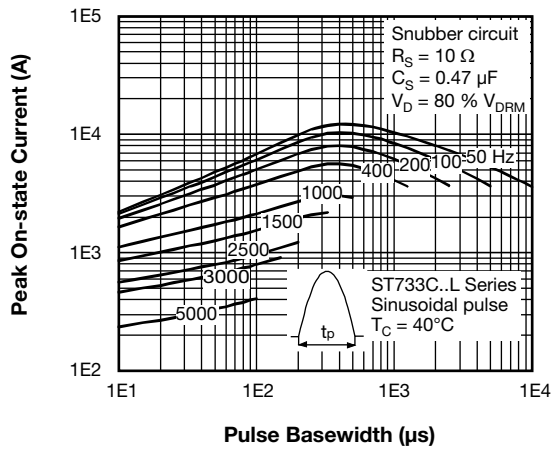


Fig. 13 - Frequency Characteristics

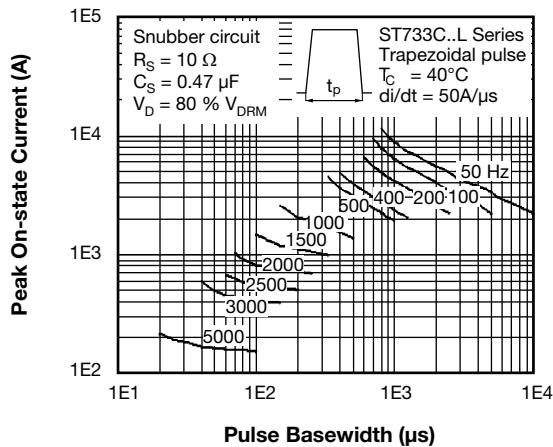
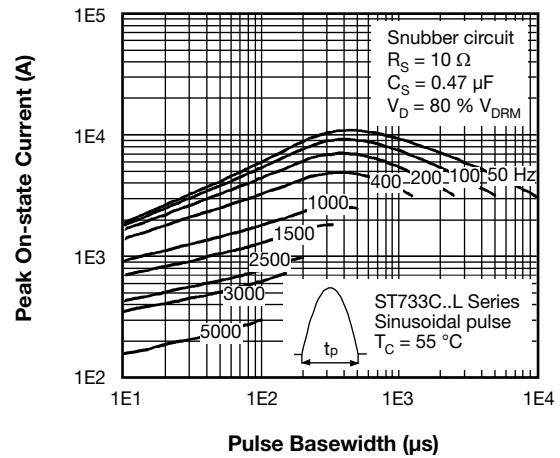
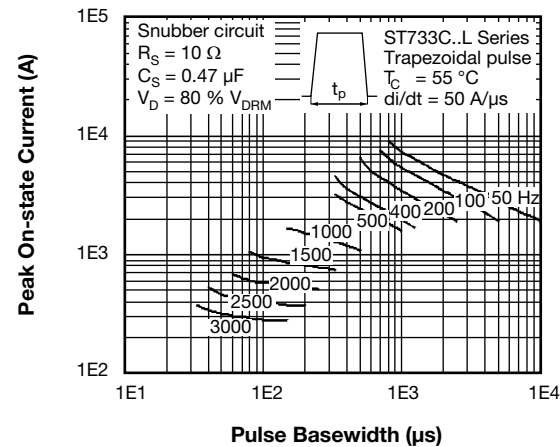


Fig. 14 - Frequency Characteristics



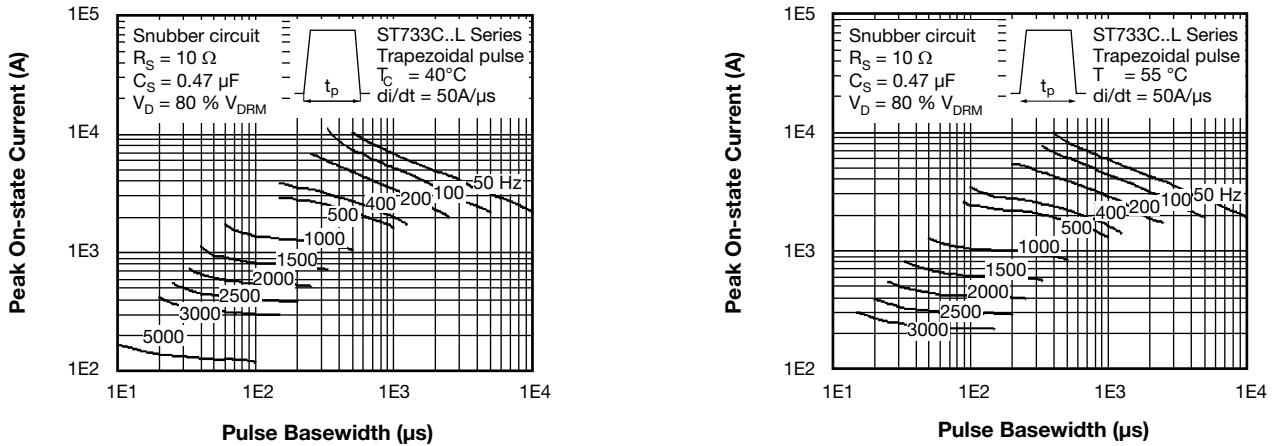


Fig. 15 - Frequency Characteristics

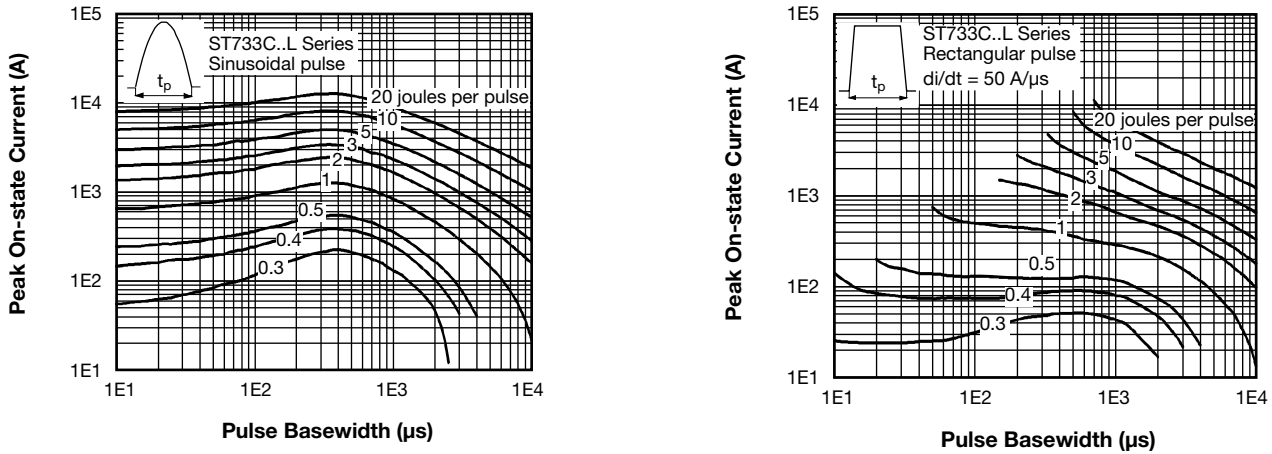


Fig. 16 - Maximum On-State Energy Power Loss Characteristics

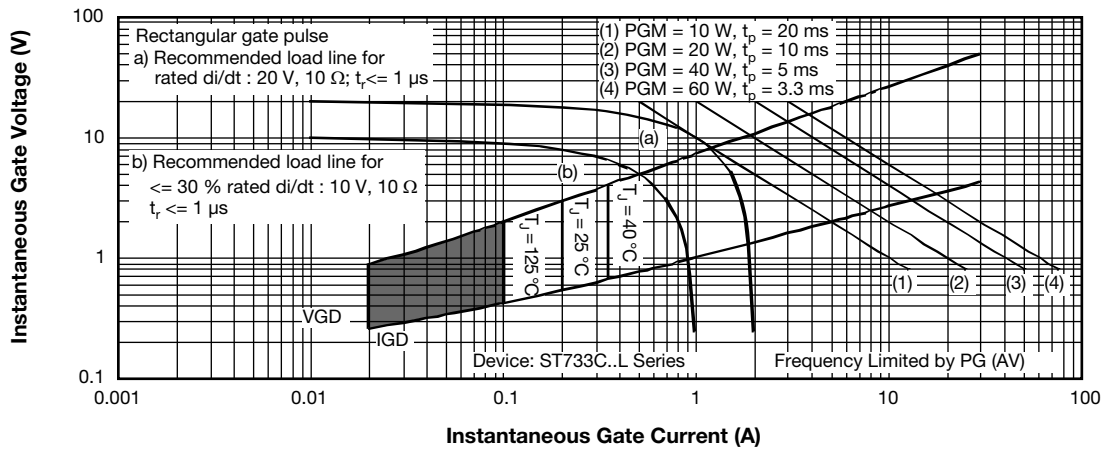


Fig. 17 - Gate Characteristics



ORDERING INFORMATION TABLE

| | | | | | | | | | | | |
|-------------|------------|-----------|-----------|----------|----------|-----------|----------|----------|----------|----------|----------|
| Device code | VS- | ST | 73 | 3 | C | 08 | L | 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** - L = PUK case TO-200AC (B-PUK)
- 8** - Reapplied dV/dt code (for t_q test condition)
- 9** - t_q code
- 10** - 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)
- 11** - Critical dV/dt:
 - None = 500 V/ μ s (standard value)
 - L = 1000 V/ μ s (special selection)

| dV/dt - t_q combinations available | | | | | | |
|--------------------------------------|--------------------|----|----|-----|-----|-----|
| | dV/dt (V/ μ s) | 20 | 50 | 100 | 200 | 400 |
| t_q (μ s) | 10 | CN | DN | EN | - | - |
| | 12 | CM | DM | EM | FM* | - |
| | 15 | CL | DL | EL | FL* | HL |
| | 18 | CP | DP | EP | FP | HP |
| | 20 | CK | DK | EK | FK | H |

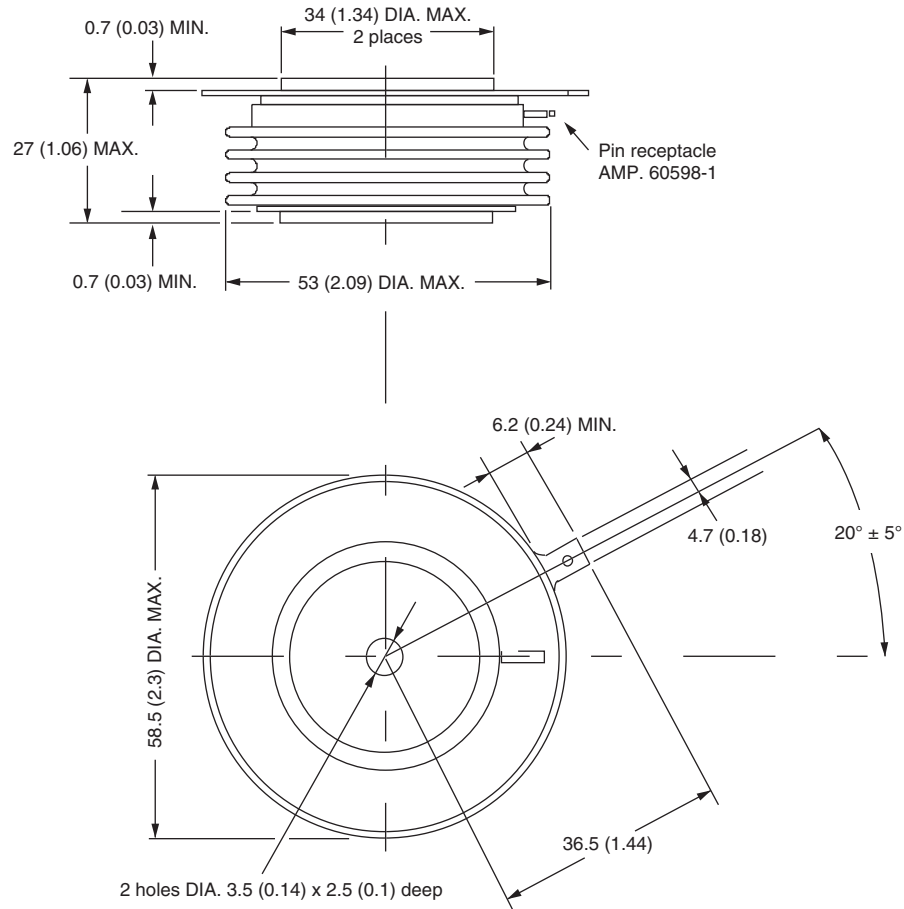
* Standard part number.
All other types available only on request.

| LINKS TO RELATED DOCUMENTS | |
|----------------------------|--|
| Dimensions | www.vishay.com/doc?95076 |

TO-200AC (B-PUK)

DIMENSIONS in millimeters (inches)

Creepage distance: 36.33 (1.430) minimum
 Strike distance: 17.43 (0.686) minimum



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



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