

Inverter Grade Thyristors (Stud Version), 85 A



FEATURES

- Center amplifying gate
- High surge current capability
- Low thermal impedance
- High speed performance
- Compression bonding
- 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-209AC (TO-94) |
| Diode variation | Single SCR |
| $I_{T(AV)}$ | 85 A |
| V_{DRM}/V_{RRM} | 400 V to 1200 V |
| V_{TM} | 2.15 V |
| I_{TSM} at 50 Hz | 2450 A |
| I_{TSM} at 60 Hz | 2560 A |
| I_{GT} | 200 mA |
| T_C/T_{hs} | 85 °C |

TYPICAL APPLICATIONS

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

MAJOR RATINGS AND CHARACTERISTICS

| PARAMETER | TEST CONDITIONS | VALUES | UNITS |
|-------------------|-----------------|-------------|-------------------|
| $I_{T(AV)}$ | | 85 | A |
| | T_C | 85 | °C |
| $I_{T(RMS)}$ | | 135 | A |
| I_{TSM} | 50 Hz | 2450 | A |
| | 60 Hz | 2560 | A |
| I^2t | 50 Hz | 30 | kA ² s |
| | 60 Hz | 27 | |
| V_{DRM}/V_{RRM} | | 400 to 1200 | 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} MAX. AT $T_J = T_J$ MAX. mA |
|-------------|--------------|--|--|--|
| VS-ST083S | 04 | 400 | 500 | 30 |
| | 08 | 800 | 900 | |
| | 10 | 1000 | 1100 | |
| | 12 | 1200 | 1300 | |



| CURRENT CARRYING CAPABILITY | | | | | | | |
|----------------------------------|-----------|-----|-----------|-----|-----------|------|-------|
| FREQUENCY | | | | | | | UNITS |
| 50 Hz | 210 | 120 | 330 | 270 | 2540 | 1930 | A |
| 400 Hz | 200 | 120 | 350 | 210 | 1190 | 810 | |
| 1000 Hz | 150 | 80 | 320 | 190 | 630 | 400 | |
| 2500 Hz | 70 | 25 | 220 | 85 | 250 | 100 | |
| Recovery voltage V_r | 50 | 50 | 50 | 50 | 50 | 50 | V |
| Voltage before turn-on V_d | V_{DRM} | | V_{DRM} | | V_{DRM} | | |
| Rise of on-state current di/dt | 50 | 50 | - | - | - | - | A/µs |
| Case temperature | 60 | 85 | 60 | 85 | 60 | 85 | °C |
| Equivalent values for RC circuit | 22/0.15 | | 22/0.15 | | 22/0.15 | | W/µF |

| ON-STATE CONDUCTION | | | | | |
|--|---------------|---|----------------------------|--------|---------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum average on-state current at case temperature | $I_{T(AV)}$ | 180° conduction, half sine wave | | 85 | A |
| | | | | 85 | °C |
| Maximum RMS on-state current | $I_{T(RMS)}$ | DC at 77 °C case temperature | | 135 | A |
| Maximum peak, one half cycle, non-repetitive surge current | I_{TSM} | t = 10 ms | No voltage reappplied | 2450 | |
| | | t = 8.3 ms | No voltage reappplied | 2560 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 2060 | |
| | | t = 8.3 ms | 100 % V_{RRM} reappplied | 2160 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reappplied | 30 | kA ² s |
| | | t = 8.3 ms | No voltage reappplied | 27 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 21 | |
| | | t = 8.3 ms | 100 % V_{RRM} reappplied | 19 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reappplied | | 300 | kA ² /√s |
| Maximum peak on-state voltage | V_{TM} | $I_{TM} = 300$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine wave pulse | | 2.15 | 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 | | 1.46 | |
| High level value of threshold voltage | $V_{T(TO)2}$ | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 1.52 | |
| 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 | | 2.32 | |
| High level value of forward slope resistance | r_{t2} | $(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum | | 2.34 | mΩ |
| 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 |
| | | | MIN. | MAX. | |
| Maximum non-repetitive rate of rise of turned on current | di/dt | $T_J = T_J$ max., $V_{DRM} = \text{Rated } V_{DRM}$, $I_{TM} = 2 \times di/dt$ | 1000 | | A/µs |
| Typical delay time | t_d | $T_J = 25$ °C, $V_{DM} = \text{Rated } V_{DM}$, $I_{TM} = 50$ A DC, $t_p = 1$ µs Resistive load, gate pulse: 10 V, 5 Ω source | 0.80 | | µs |
| Maximum turn-off time | t_q | $T_J = T_J$ maximum, $I_{TM} = 100$ A, commutating $di/dt = 10$ A/µs $V_R = 50$ V, $t_p = 200$ µs, $dV/dt = 200$ V/µs | 10 | 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/ μ s |
| Maximum peak reverse and off-state leakage current | I_{RRM} , I_{DRM} | $T_J = T_J$ maximum, rated V_{DRM}/V_{RRM} applied | 30 | mA |

| TRIGGERING | | | | |
|---|-------------|--|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Maximum peak gate power | P_{GM} | $T_J = T_J$ maximum, f = 50 Hz, d% = 50 | 40 | W |
| Maximum average gate power | $P_{G(AV)}$ | | 5 | |
| Maximum peak positive gate current | I_{GM} | $T_J = T_J$ maximum, $t_p \leq 5$ ms | 5 | 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}/V_{RRM} 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 junction operating temperature range | T_J | | -40 to 125 | °C |
| Maximum storage temperature range | T_{Stg} | | -40 to 150 | |
| Maximum thermal resistance, junction to case | R_{thJC} | DC operation | 0.195 | K/W |
| Maximum thermal resistance, case to heatsink | R_{thCS} | Mounting surface, smooth, flat and greased | 0.08 | |
| Mounting torque, ± 10 % | | Non-lubricated threads | 15.5 (137) | N · m (lbf · in) |
| | | Lubricated threads | 14 (120) | |
| Approximate weight | | | 130 | g |
| Case style | | See dimensions - link at the end of datasheet | TO-209AC (TO-94) | |

| ΔR_{thJC} CONDUCTION | | | | |
|------------------------------|-----------------------|------------------------|---------------------|-------|
| CONDUCTION ANGLE | SINUSOIDAL CONDUCTION | RECTANGULAR CONDUCTION | TEST CONDITIONS | UNITS |
| 180° | 0.034 | 0.025 | $T_J = T_J$ maximum | K/W |
| 120° | 0.041 | 0.042 | | |
| 90° | 0.052 | 0.056 | | |
| 60° | 0.076 | 0.079 | | |
| 30° | 0.126 | 0.127 | | |

Note

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

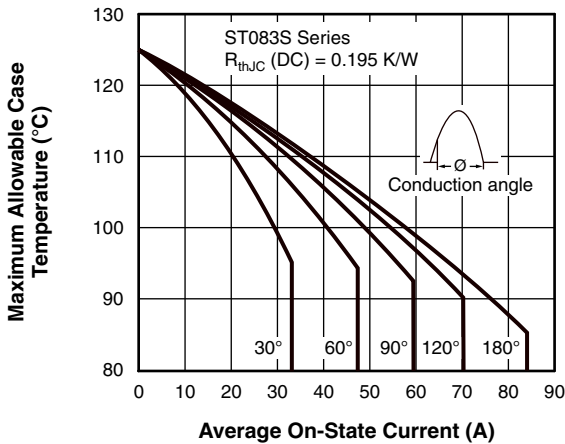


Fig. 1 - Current Ratings Characteristics

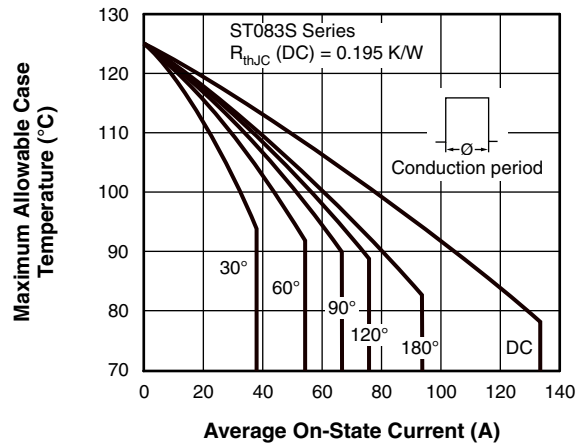


Fig. 2 - Current Ratings Characteristics

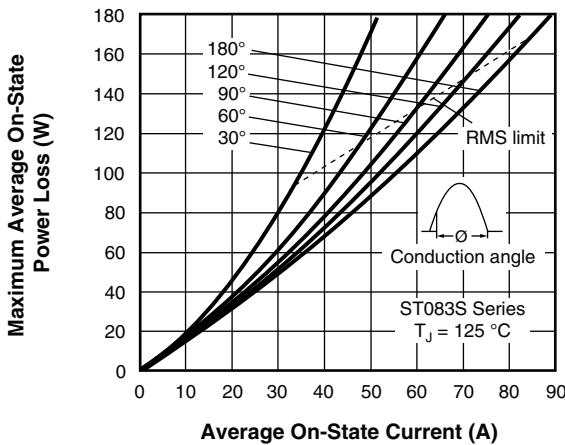


Fig. 3 - On-State Power Loss Characteristics

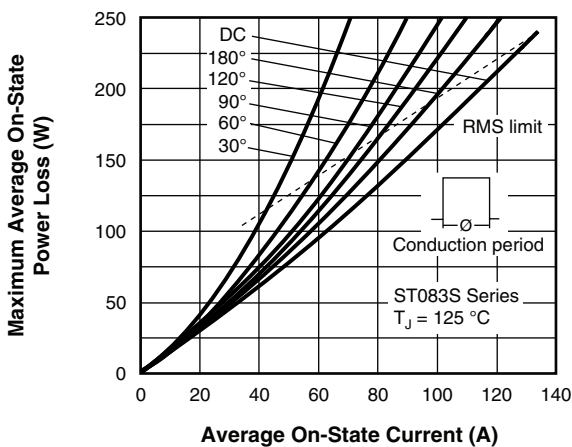


Fig. 4 - On-State Power Loss Characteristics



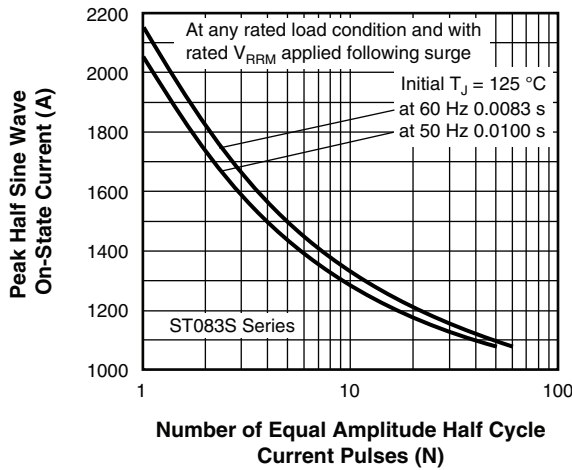


Fig. 5 - Maximum Non-Repetitive Surge Current



Fig. 8 - Thermal Impedance Z_{thJC} Characteristic



Fig. 6 - Maximum Non-Repetitive Surge Current



Fig. 9 - Reverse Recovered Charge Characteristics



Fig. 7 - On-State Voltage Drop Characteristics



Fig. 10 - Reverse Recovery Current Characteristics



Fig. 11 - Frequency Characteristics



Fig. 12 - Frequency Characteristics



Fig. 13 - Frequency Characteristics

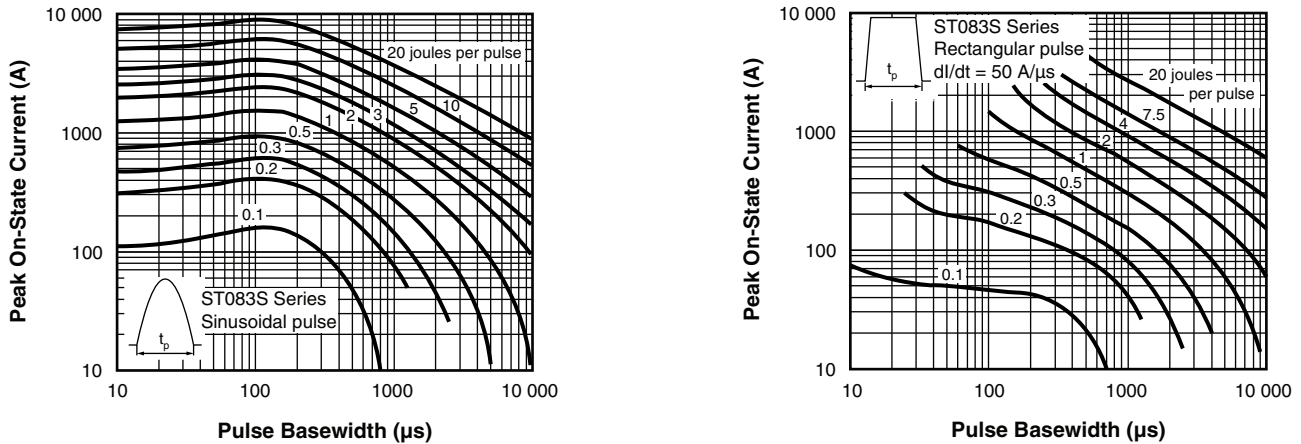


Fig. 14 - Maximum On-State Energy Power Loss Characteristics

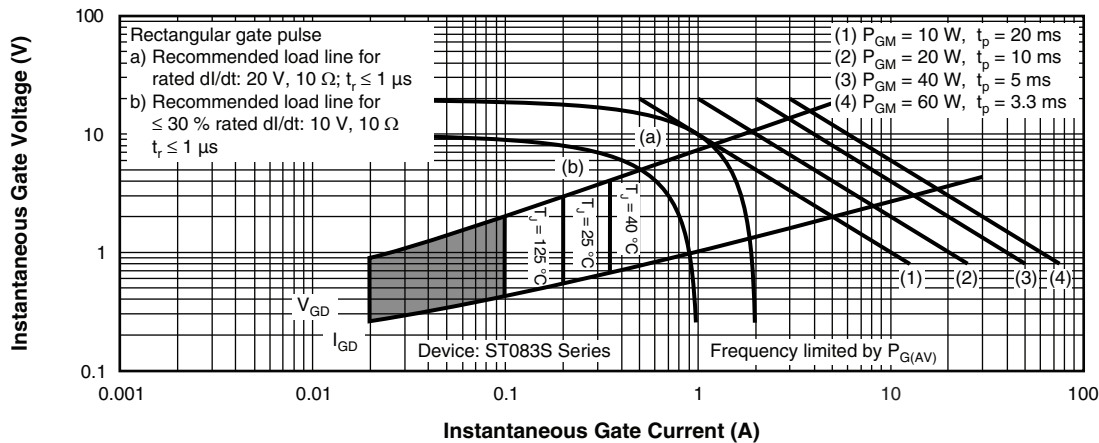


Fig. 15 - Gate Characteristics



ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Thyristor
- 3** - Essential part number
- 4** - 3 = Fast turn-off
- 5** - S = Compression bonding stud
- 6** - Voltage code x 100 = V_{RRM} (see Voltage Ratings table)
- 7** -
 - P = Stud base 1/2"-20UNF-2A threads
 - M = Metric M12, contact factory for availability
- 8** - Reapplied dV/dt code (for t_q test condition)
- 9** - t_q code
- 10** -
 - 0 = Eyelet terminals (gate and aux. cathode leads)
 - 1 = Fast-on terminals (gate and aux. cathode leads)
 - 2 = Flag terminals (gate and aux. cathode leads)
- 11** - Critical dV/dt:
 - None = 500 V/ μ s (standard value)
 - L = 1000 V/ μ s (special selection)
- 12** - None = Standard production; P = Lead (Pb)-free

| dV/dt - t_q combinations available | | |
|---|--------------------|-----|
| | dV/dt (V/ μ s) | 200 |
| t_q (μ s) up to 800V | 10 | FN |
| | 20 | FK |
| t_q (μ s) only for 1000/1200 V | 20 | FK |

| LINKS TO RELATED DOCUMENTS | |
|----------------------------|--|
| Dimensions | www.vishay.com/doc?95003 |

TO-209AC (TO-94) for ST083S and ST103S Series

DIMENSIONS in millimeters (inches)





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