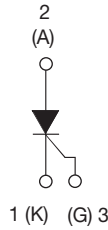
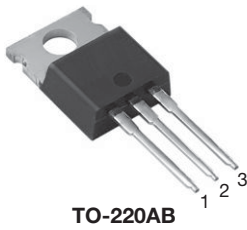


## Thyristor High Voltage, Phase Control SCR, 25 A



### FEATURES

- Easy control peak current at charger power up to reduce passive / electromechanical components
- Meets JESD 201 class 1A whisker test
- Flexible solution for reliable AC power rectification
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

| PRIMARY CHARACTERISTICS |                   |
|-------------------------|-------------------|
| $I_{T(AV)}$             | 16 A              |
| $V_{DRM}/V_{RRM}$       | 1200 V            |
| $V_{TM}$                | 1.25 V            |
| $I_{GT}$                | 45 mA             |
| $T_J$                   | -40 °C to +125 °C |
| Package                 | TO-220AB          |
| Circuit configuration   | Single SCR        |

### APPLICATIONS

- On-board and off-board EV/HEV battery chargers
- Renewable energy inverters

### DESCRIPTION

The VS-25TTS12HM3 high voltage series of silicon controlled rectifiers are specifically designed for medium power switching and phase control applications.

| OUTPUT CURRENT IN TYPICAL APPLICATIONS   |                     |                    |       |
|--|---------------------|--------------------|-------|
| APPLICATIONS   | SINGLE-PHASE BRIDGE | THREE-PHASE BRIDGE | UNITS |
| Capacitive input filter $T_A = 55$ °C, $T_J = 125$ °C, common heatsink of 1 °C/W | 18                  | 22                 | A     |

| MAJOR RATINGS AND CHARACTERISTICS |                     |             |       |
|-----------------------------------|---------------------|-------------|-------|
| PARAMETER                         | TEST CONDITIONS     | VALUES      | UNITS |
| $I_{T(AV)}$                       | Sinusoidal waveform | 16          | A     |
| $I_{RMS}$                         |                     | 25          |       |
| $V_{RRM}/V_{DRM}$                 |                     | 1200        | V     |
| $I_{TSM}$                         |                     | 320         | A     |
| $V_T$                             | 16 A, $T_J = 25$ °C | 1.25        | V     |
| dV/dt                             |                     | 500         | V/μs  |
| dI/dt                             |                     | 150         | A/μs  |
| $T_J$                             |                     | -40 to +125 | °C    |

| VOLTAGE RATINGS |   |  |                                   |
|-----------------|---|--|-----------------------------------|
| PART NUMBER     | $V_{RRM}$ , MAXIMUM PEAK REVERSE VOLTAGE<br>V | $V_{DRM}$ , MAXIMUM PEAK DIRECT VOLTAGE<br>V | $I_{RRM}/I_{DRM}$ AT 125 °C<br>mA |
| VS-25TTS12HM3   | 1200  | 1200   | 10                                |



| <b>ABSOLUTE MAXIMUM RATINGS</b>                       |                 |   |                                   |      |               |    |
|---|-----------------|---|-----------------------------------|------|---------------|----|
| PARAMETER   | SYMBOL          | TEST CONDITIONS   | VALUES                            |      | UNITS         |    |
|   |                 |   | TYP.                              | MAX. |               |    |
| Maximum average on-state current                      | $I_{T(AV)}$     | $T_C = 93\text{ }^\circ\text{C}$ , 180° conduction half sine wave                         | 16                                |      | A             |    |
| Maximum RMS on-state current                          | $I_{RMS}$       |   | 25                                |      |               |    |
| Maximum peak, one-cycle, non-repetitive surge current | $I_{TSM}$       | 10 ms sine pulse, rated $V_{RRM}$ applied   | 270                               |      |               |    |
|   |                 | 10 ms sine pulse, no voltage reapplied  | 320                               |      |               |    |
| Maximum $I^2t$ for fusing                             | $I^2t$          | 10 ms sine pulse, rated $V_{RRM}$ applied   | 365                               |      | $A^2s$        |    |
|   |                 | 10 ms sine pulse, no voltage reapplied  | 515                               |      |               |    |
| Maximum $I^2\sqrt{t}$ for fusing                      | $I^2\sqrt{t}$   | $t = 0.1$ to 10 ms, no voltage reapplied  | 5152                              |      | $A^2\sqrt{s}$ |    |
| Maximum on-state voltage drop                         | $V_{TM}$        | 16 A, $T_J = 25\text{ }^\circ\text{C}$  | 1.25                              |      | V             |    |
| On-state slope resistance                             | $r_t$           | $T_J = 125\text{ }^\circ\text{C}$   | 12.0                              |      | $m\Omega$     |    |
| Threshold voltage                                     | $V_{T(TO)}$     |   | 1.0                               |      | V             |    |
| Maximum reverse and direct leakage current            | $I_{RM}/I_{DM}$ | $V_R = \text{rated } V_{RRM}/V_{DRM}$   | $T_J = 25\text{ }^\circ\text{C}$  | 0.5  |               | mA |
|   |                 |   | $T_J = 125\text{ }^\circ\text{C}$ | 10   |               |    |
| Holding current                                       | $I_H$           | Anode supply = 6 V, resistive load, initial $I_T = 1$ A, $T_J = 25\text{ }^\circ\text{C}$ | -                                 | 150  |               |    |
| Maximum latching current                              | $I_L$           | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$                      | 200                               |      |               |    |
| Maximum rate of rise of off-state voltage             | $dV/dt$         | $T_J = T_{J\text{ max.}}$ , linear to 80 °C, $V_{DRM} = R_g - k = \text{open}$            | 500                               |      | $V/\mu s$     |    |
| Maximum rate of rise of turned-on current             | $dI/dt$         |   | 150                               |      | $A/\mu s$     |    |

| <b>TRIGGERING</b>                           |             |   |        |       |
|---|-------------|---|--------|-------|
| PARAMETER                                   | SYMBOL      | TEST CONDITIONS   | VALUES | UNITS |
| Maximum peak gate power                     | $P_{GM}$    |   | 8.0    | W     |
| Maximum average gate power                  | $P_{G(AV)}$ |   | 2.0    |       |
| Maximum peak positive gate current          | $+I_{GM}$   |   | 1.5    | A     |
| Maximum peak negative gate voltage          | $-V_{GM}$   |   | 10     | V     |
| Maximum required DC gate current to trigger | $I_{GT}$    | Anode supply = 6 V, resistive load, $T_J = -10\text{ }^\circ\text{C}$ | 60     | mA    |
|   |             | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$  | 45     |       |
|   |             | Anode supply = 6 V, resistive load, $T_J = 125\text{ }^\circ\text{C}$ | 20     |       |
| Maximum required DC gate voltage to trigger | $V_{GT}$    | Anode supply = 6 V, resistive load, $T_J = -10\text{ }^\circ\text{C}$ | 2.5    | V     |
|   |             | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$  | 2.0    |       |
|   |             | Anode supply = 6 V, resistive load, $T_J = 125\text{ }^\circ\text{C}$ | 1.0    |       |
| Maximum DC gate voltage not to trigger      | $V_{GD}$    | $T_J = 125\text{ }^\circ\text{C}$ , $V_{DRM} = \text{rated value}$    | 0.25   |       |
| Maximum DC gate current not to trigger      | $I_{GD}$    |   | 2.0    | mA    |

| <b>SWITCHING</b>              |          |                                   |        |         |
|-------------------------------|----------|-----------------------------------|--------|---------|
| PARAMETER                     | SYMBOL   | TEST CONDITIONS                   | VALUES | UNITS   |
| Typical turn-on time          | $t_{gt}$ | $T_J = 25\text{ }^\circ\text{C}$  | 0.9    | $\mu s$ |
| Typical reverse recovery time | $t_{rr}$ | $T_J = 125\text{ }^\circ\text{C}$ | 4      |         |
| Typical turn-off time         | $t_q$    |                                   | 110    |         |



| THERMAL AND MECHANICAL SPECIFICATIONS           |                |                                      |            |                        |
|---|----------------|--------------------------------------|------------|------------------------|
| PARAMETER                                       | SYMBOL         | TEST CONDITIONS                      | VALUES     | UNITS                  |
| Maximum junction and storage temperature range  | $T_J, T_{Stg}$ |                                      | -40 to 125 | °C                     |
| Maximum thermal resistance, junction to case    | $R_{thJC}$     | DC operation                         | 1.1        | °C/W                   |
| Maximum thermal resistance, junction to ambient | $R_{thJA}$     |                                      | 62         |                        |
| Typical thermal resistance, case to heatsink    | $R_{thCS}$     | Mounting surface, smooth and greased | 0.5        |                        |
| Approximate weight                              |                |                                      | 2          | g                      |
|   |                |                                      | 0.07       | oz.                    |
| Mounting torque                                 | minimum        |                                      | 6 (5)      | kgf · cm<br>(lbf · in) |
|   | maximum        |                                      | 12 (10)    |                        |
| Marking device                                  |                | Case style TO-220AB                  | 25TTS12H   |                        |

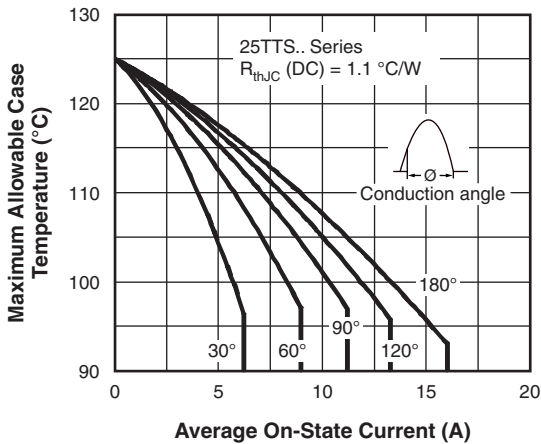


Fig. 1 - Current Rating Characteristics

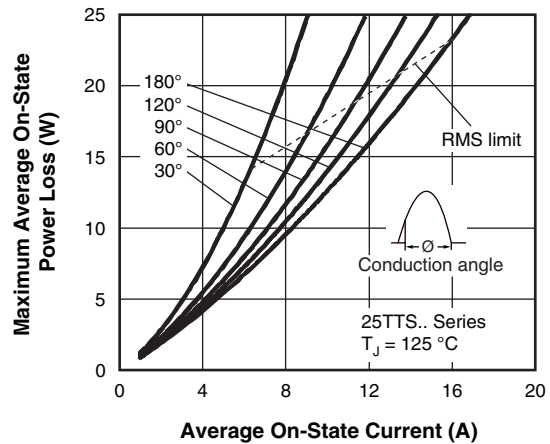


Fig. 3 - On-State Power Loss Characteristics

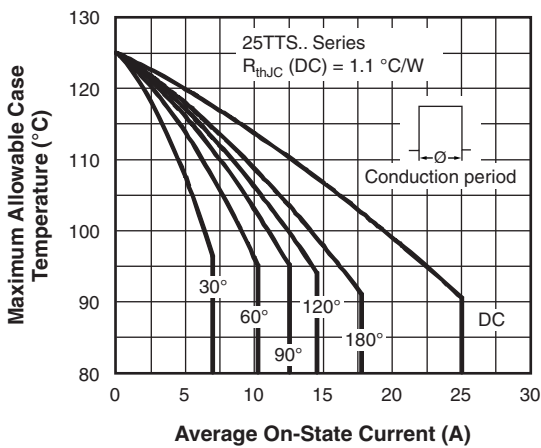


Fig. 2 - Current Rating Characteristics

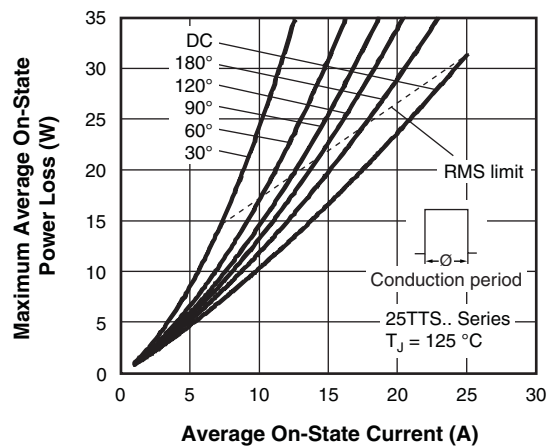


Fig. 4 - On-State Power Loss Characteristics

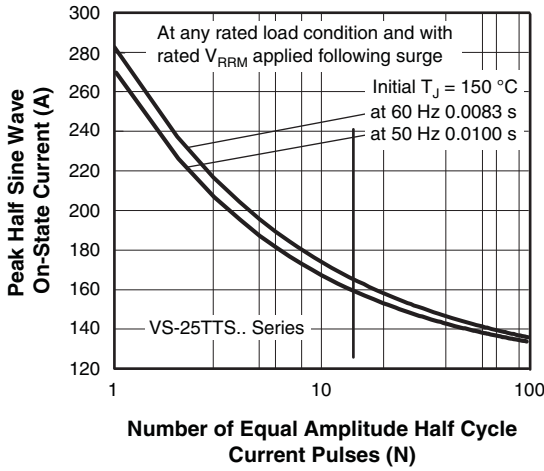


Fig. 5 - Maximum Non-Repetitive Surge Current

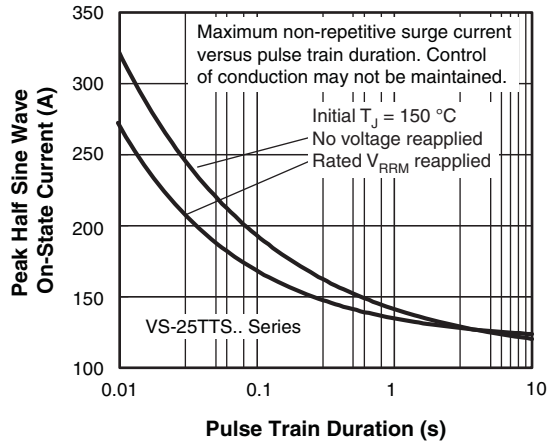


Fig. 6 - Maximum Non-Repetitive Surge Current

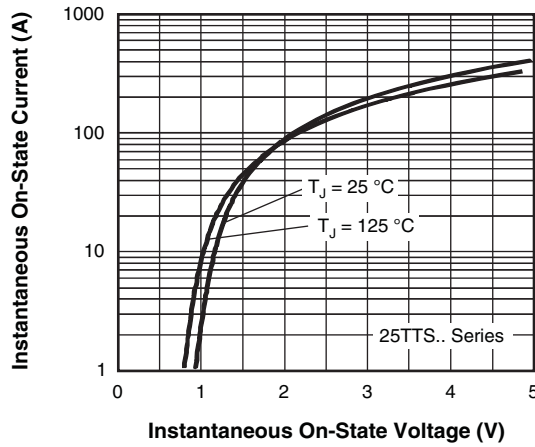


Fig. 7 - On-State Voltage Drop Characteristics

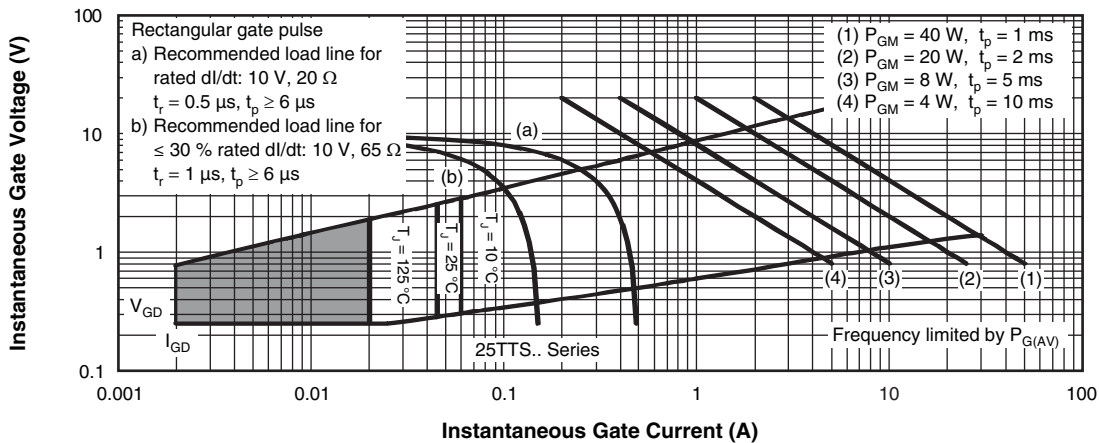


Fig. 8 - Gate Characteristics

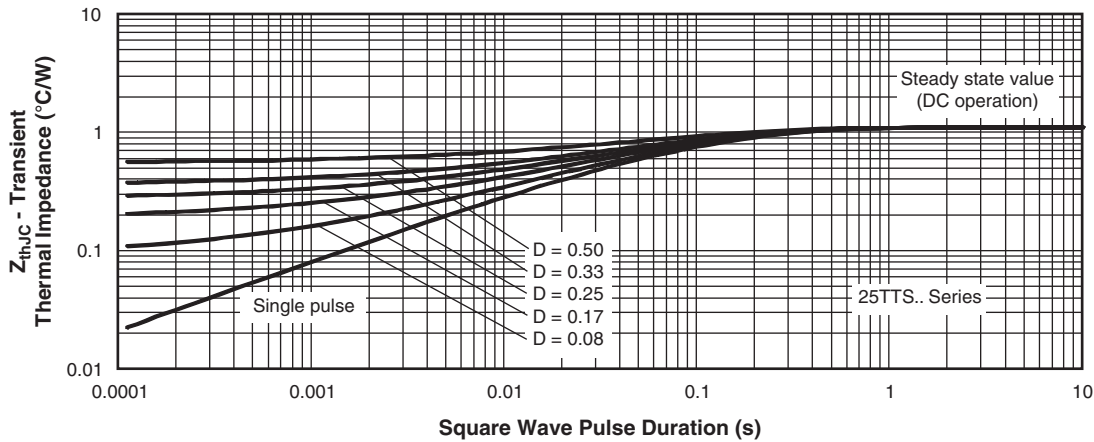


Fig. 9 - Thermal Impedance  $Z_{thJC}$  Characteristics

**ORDERING INFORMATION TABLE**

|             |            |           |          |          |          |           |          |           |
|-------------|------------|-----------|----------|----------|----------|-----------|----------|-----------|
| Device code | <b>VS-</b> | <b>25</b> | <b>T</b> | <b>T</b> | <b>S</b> | <b>12</b> | <b>H</b> | <b>M3</b> |
|             | ①          | ②         | ③        | ④        | ⑤        | ⑥         | ⑦        | ⑧         |

- 1** - Vishay Semiconductors product
- 2** - Current rating (25 = 25 A)
- 3** - Circuit configuration:  
T = single thyristor
- 4** - Package:  
T = TO-220AB
- 5** - Type of silicon:  
S = standard recovery rectifier
- 6** - Voltage rating ————— **12 = 1200 V**
- 7** - H = AEC-Q101 qualified
- 8** - Environmental digit:  
M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

| <b>ORDERING INFORMATION</b> (Example) |                  |                        |                          |
|---------------------------------------|------------------|------------------------|--------------------------|
| PREFERRED P/N                         | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION    |
| VS-25TTS12HM3                         | 50               | 1000                   | Antistatic plastic tubes |

| <b>LINKS TO RELATED DOCUMENTS</b> |  |
|-----------------------------------|--|
| Dimensions                        | <a href="http://www.vishay.com/doc?95222">www.vishay.com/doc?95222</a> |
| Part marking information          | <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a> |

### TO-220AB

**DIMENSIONS** in millimeters and inches



Conforms to JEDEC® outline TO-220AB

| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES | SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| A      | 4.25        | 4.65  | 0.167  | 0.183 |       | D2     | 11.68       | 12.88 | 0.460  | 0.507 | 6     |
| A1     | 1.14        | 1.40  | 0.045  | 0.055 |       | E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |
| A2     | 2.56        | 2.92  | 0.101  | 0.115 |       | E1     | 6.86        | 8.89  | 0.270  | 0.350 | 6     |
| b      | 0.69        | 1.01  | 0.027  | 0.040 |       | E2     | -           | 0.76  | -      | 0.030 | 7     |
| b1     | 0.38        | 0.97  | 0.015  | 0.038 | 4     | e      | 2.41        | 2.67  | 0.095  | 0.105 |       |
| b2     | 1.20        | 1.73  | 0.047  | 0.068 |       | e1     | 4.88        | 5.28  | 0.192  | 0.208 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     | H1     | 5.84        | 6.86  | 0.230  | 0.270 | 6, 7  |
| c      | 0.36        | 0.61  | 0.014  | 0.024 |       | L      | 13.52       | 14.02 | 0.532  | 0.552 |       |
| c1     | 0.36        | 0.56  | 0.014  | 0.022 | 4     | L1     | 3.32        | 3.82  | 0.131  | 0.150 | 2     |
| D      | 14.85       | 15.25 | 0.585  | 0.600 | 3     | ∅ P    | 3.54        | 3.73  | 0.139  | 0.147 |       |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       | Q      | 2.60        | 3.00  | 0.102  | 0.118 |       |

**Notes**

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1 and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- (4) Dimension b1, b3 and c1 apply to base metal only
- (5) Controlling dimensions: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimensions E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC® TO-220, except A2 (maximum) and D2 (minimum) where dimensions are derived from the actual package outline



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