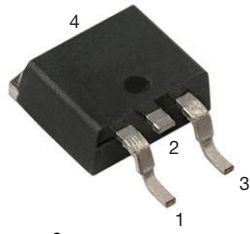
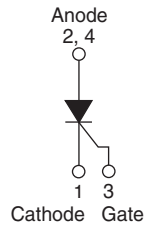


# Thyristor, Surface Mount, Phase Control SCR, 16 A


**D²PAK (TO-263AB)**

**FEATURES**

- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- AEC-Q101 qualified
- Meets JESD 201 class 1A whisker test
- Flexible solution for reliable AC power rectification
- Easy control peak current at charger power up to reduce passive / electromechanical components
- 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 to +125 °C   |
| Package                 | D²PAK (TO-263AB) |
| Circuit configuration   | Single SCR       |

**APPLICATIONS**

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

**DESCRIPTION**

The VS-25TTS12SLHM3 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 |
| NEMA FR-4 or G10 glass fabric-based epoxy with 4 oz. (140 μm) copper | 3.5                 | 5.5                | A     |
| Aluminum IMS, $R_{thCA} = 15$ °C/W                                   | 8.5                 | 13.5               |       |
| Aluminum IMS with heatsink, $R_{thCA} = 5$ °C/W                      | 16.5                | 25.0               |       |

**Note**

- $T_A = 55$  °C,  $T_J = 125$  °C, footprint 300 mm²

| 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     |
| $I_{TSM}$                         |                     | 350         | 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-25TTS12SLHM3 | 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                                   | 300   |      |               |    |
|   |                   | 10 ms sine pulse, no voltage reapplied                                      | 350   |      |               |    |
| Maximum $I^2t$ for fusing                             | $I^2t$            | 10 ms sine pulse, rated $V_{RRM}$ applied                                   | 450   |      | $A^2s$        |    |
|   |                   | 10 ms sine pulse, no voltage reapplied                                      | 630   |      |               |    |
| Maximum $I^2\sqrt{t}$ for fusing                      | $I^2\sqrt{t}$     | $t = 0.1\text{ ms to }10\text{ ms}$ , no voltage reapplied                  | 6300  |      | $A^2\sqrt{s}$ |    |
| 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            | $I_{RM} / I_{DM}$ | $T_J = 25\text{ }^\circ\text{C}$  | $V_R = \text{Rated } V_{RRM}/V_{DRM}$   | 0.5  |               | mA |
|   |                   | $T_J = 125\text{ }^\circ\text{C}$   |   | 10   |               |    |
| Holding current                                       | $I_H$             | VS-25TTS08, VS-25TTS12  | Anode supply = 6 V, resistive load, initial $I_T = 1\text{ A}$ , $T_J = 25\text{ }^\circ\text{C}$ | -    | 150           |    |
|   |                   |   |   | 200  |               |    |
| 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 %, $V_{DRM} = R_g - k = \text{open}$ | 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    |       |

| <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    |
| Soldering temperature                                       | $T_S$            | For 10 s (1.6 mm from case)              | 260         |       |
| Maximum thermal resistance, junction to case                | $R_{thJC}$       | DC operation                             | 1.1         | °C/W  |
| Typical thermal resistance, junction to ambient (PCB mount) | $R_{thJA}^{(1)}$ |  | 40          |       |
| Approximate weight  |                  |  | 2           | g     |
|   |                  |  | 0.07        | oz.   |
| Marking device  |                  | Case style D <sup>2</sup> PAK (TO-263AB) | 25TTS12SH   |       |

**Note**

(1) When mounted on 1" square (650 mm<sup>2</sup>) PCB of FR-4 or G-10 material 4 oz. (140 μm) copper 40 °C/W

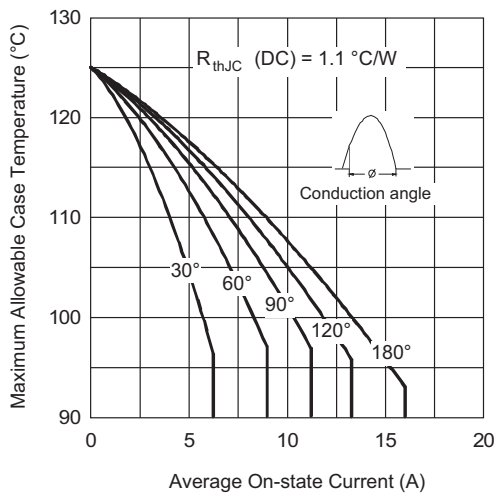


Fig. 1 - Current Rating Characteristics

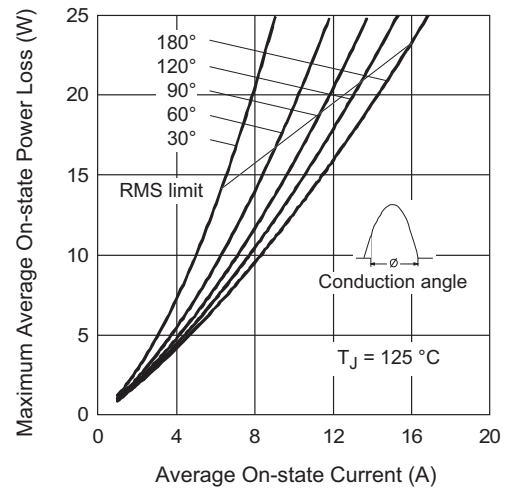


Fig. 3 - On-State Power Loss Characteristics

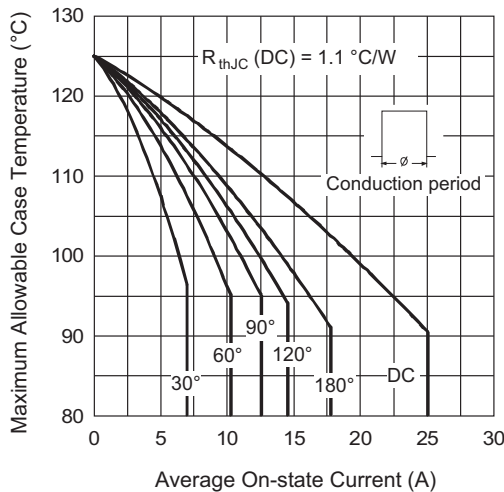


Fig. 2 - Current Rating Characteristics

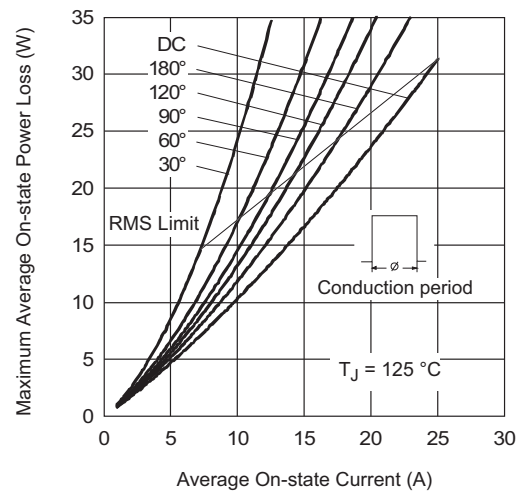


Fig. 4 - On-State Power Loss Characteristics

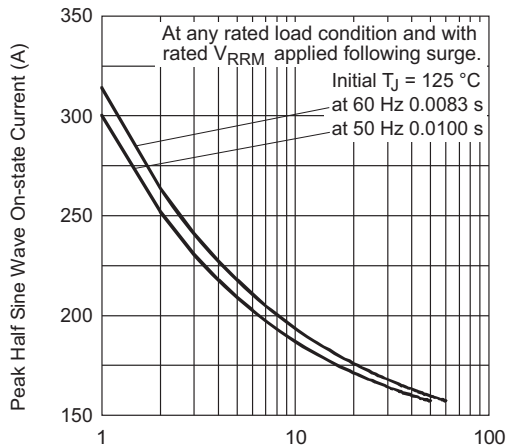


Fig. 5 - Maximum Non-Repetitive Surge Current

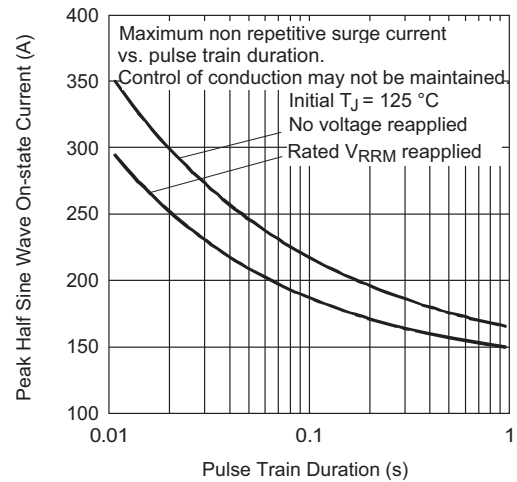


Fig. 6 - Maximum Non-Repetitive Surge Current

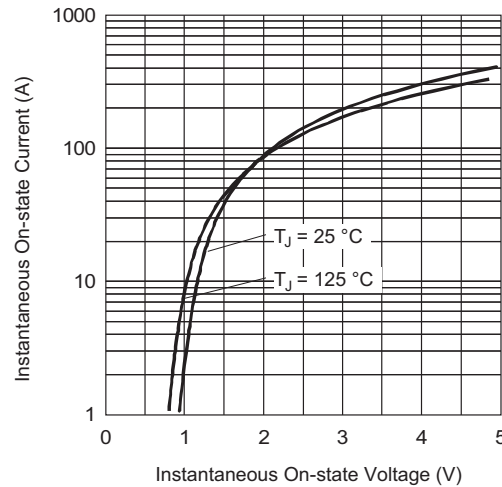


Fig. 7 - On-State Voltage Drop Characteristics

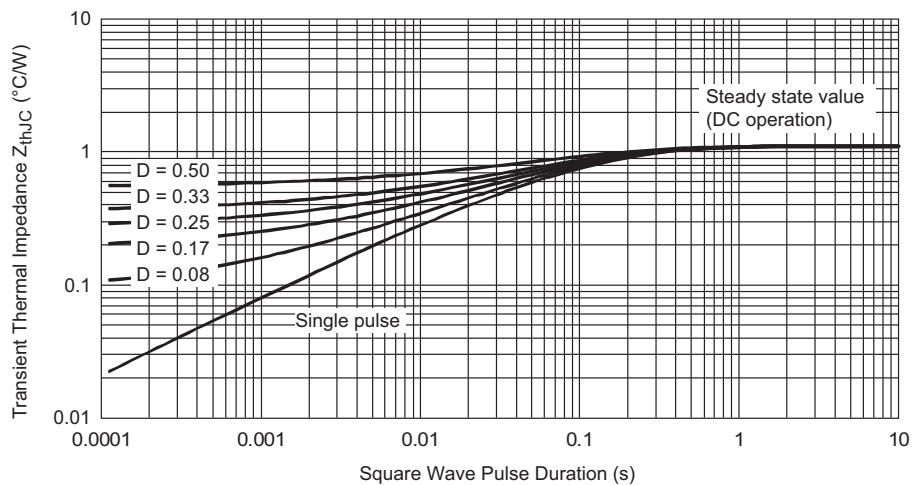
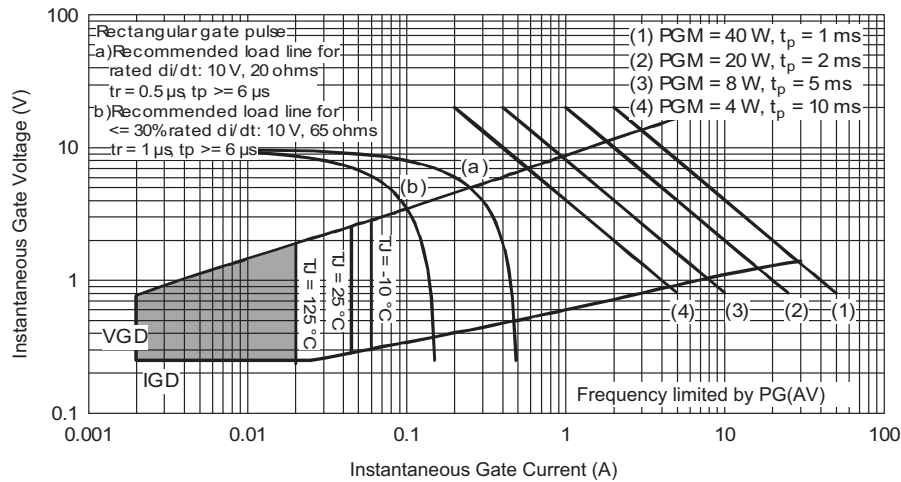


Fig. 8 - Gate Characteristics


 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>S</b> | <b>L</b> | <b>H</b> | <b>M3</b> |
|             | ①          | ②         | ③        | ④        | ⑤        | ⑥         | ⑦        | ⑧        | ⑨        | ⑩         |

- 1** - Vishay Semiconductors product
- 2** - Current rating (25 = 25 A)
- 3** - Circuit configuration:  
T = single thyristor
- 4** - Package:  
T = D<sup>2</sup>PAK (TO-263AB)
- 5** - Type of silicon:  
S = standard recovery rectifier
- 6** - Voltage rating: voltage code x 100 =  $V_{RRM}$  ——— **12 = 1200 V**
- 7** - S = surface mountable
- 8** - L = tape and reel (left oriented), for different orientation contact factory
- 9** - H = AEC-Q101 qualified
- 10** - 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-25TTS12SLHM3                       | 800              | 800                    | 13" diameter reel     |

| <b>LINKS TO RELATED DOCUMENTS</b> |  |
|-----------------------------------|--|
| Dimensions                        | <a href="http://www.vishay.com/doc?95046">www.vishay.com/doc?95046</a> |
| Part marking information          | <a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</a> |
| Packaging information             | <a href="http://www.vishay.com/doc?96317">www.vishay.com/doc?96317</a> |

## D<sup>2</sup>PAK

### DIMENSIONS in millimeters and inches

Conforms to JEDEC® outline D<sup>2</sup>PAK (SMD-220)



| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES | SYMBOL | MILLIMETERS |       | INCHES    |       | NOTES |
|--------|-------------|-------|--------|-------|-------|--------|-------------|-------|-----------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |        | MIN.        | MAX.  | MIN.      | MAX.  |       |
| A      | 4.06        | 4.83  | 0.160  | 0.190 |       | D1     | 6.86        | 8.00  | 0.270     | 0.315 | 3     |
| A1     | 0.00        | 0.254 | 0.000  | 0.010 |       | E      | 9.65        | 10.67 | 0.380     | 0.420 | 2, 3  |
| b      | 0.51        | 0.99  | 0.020  | 0.039 |       | E1     | 7.90        | 8.80  | 0.311     | 0.346 | 3     |
| b1     | 0.51        | 0.89  | 0.020  | 0.035 | 4     | e      | 2.54 BSC    |       | 0.100 BSC |       |       |
| b2     | 1.14        | 1.78  | 0.045  | 0.070 |       | H      | 14.61       | 15.88 | 0.575     | 0.625 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     | L      | 1.78        | 2.79  | 0.070     | 0.110 |       |
| c      | 0.38        | 0.74  | 0.015  | 0.029 |       | L1     | -           | 1.65  | -         | 0.066 | 3     |
| c1     | 0.38        | 0.58  | 0.015  | 0.023 | 4     | L2     | 1.27        | 1.78  | 0.050     | 0.070 |       |
| c2     | 1.14        | 1.65  | 0.045  | 0.065 |       | L3     | 0.25 BSC    |       | 0.010 BSC |       |       |
| D      | 8.51        | 9.65  | 0.335  | 0.380 | 2     | L4     | 4.78        | 5.28  | 0.188     | 0.208 |       |

#### Notes

- Dimensioning and tolerancing per ASME Y14.5 M-1994
- Dimension D 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 outmost extremes of the plastic body
- Thermal pad contour optional within dimension E, L1, D1 and E1
- Dimension b1 and c1 apply to base metal only
- Datum A and B to be determined at datum plane H
- Controlling dimension: inch
- Outline conforms to JEDEC® outline TO-263AB



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