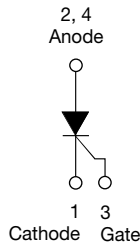




Thyristor Surface Mount Phase Control SCR, 16 A



FEATURES

- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- Designed and qualified according JEDEC®-JESD 47
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS COMPLIANT HALOGEN FREE

APPLICATIONS

- Input rectification (soft start)
- Vishay input diodes, switches and output rectifiers which are in identical package outlines

DESCRIPTION

The VS-16TTS16S-M3 high voltage series of silicon controlled rectifiers are specifically designed for medium power switching and phase control applications. The glass passivation technology used has reliable operation up to 125 °C junction temperature.

| PRIMARY CHARACTERISTICS | |
|-------------------------|-------------------------------|
| $I_{T(AV)}$ | 10 A |
| V_{DRM}/V_{RRM} | 1600 V |
| V_{TM} | 1.4 V |
| I_{GT} | 60 mA |
| T_J | -40 °C to +125 °C |
| Package | D ² PAK (TO-263AB) |
| Circuit configuration | Single SCR |

| OUTPUT CURRENT IN TYPICAL APPLICATIONS | | | |
|---|---------------------|--------------------|-------|
| APPLICATIONS | SINGLE-PHASE BRIDGE | THREE-PHASE BRIDGE | UNITS |
| NEMA FR-4 or G-10 glass fabric-based epoxy with 4 oz. (140 μm) copper | 2.5 | 3.5 | A |
| Aluminum IMS, $R_{thCA} = 15 \text{ °C/W}$ | 6.3 | 9.5 | |
| Aluminum IMS with heatsink, $R_{thCA} = 5 \text{ °C/W}$ | 14.0 | 18.5 | |

Note

- $T_A = 55 \text{ °C}$, $T_J = 125 \text{ °C}$, footprint 300 mm²

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|-----------------------------------|-----------------------------|-------------|-------|
| PARAMETER | TEST CONDITIONS | VALUES | UNITS |
| $I_{T(AV)}$ | Sinusoidal waveform | 10 | A |
| I_{RMS} | | 16 | |
| V_{RRM}/V_{DRM} | | 1600 | V |
| I_{TSM} | | 200 | A |
| V_T | 10 A, $T_J = 25 \text{ °C}$ | 1.4 | 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 V | V_{DRM} , MAXIMUM PEAK DIRECT VOLTAGE V | I_{RRM}/I_{DRM} AT 125 °C mA |
| VS-16TTS16S-M3 | 1600 | 1600 | 10 |



| ABSOLUTE MAXIMUM RATINGS | | | | | |
|---|-----------------|---|---------------------------------------|------|-------------------|
| 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 | 10 | | A |
| Maximum RMS on-state current | I_{RMS} | | 16 | | |
| Maximum peak, one-cycle, non-repetitive surge current | I_{TSM} | 10 ms sine pulse, rated V_{RRM} applied | 170 | | |
| | | 10 ms sine pulse, no voltage reapplied | 200 | | |
| Maximum I^2t for fusing | I^2t | 10 ms sine pulse, rated V_{RRM} applied | 144 | | A ² s |
| | | 10 ms sine pulse, no voltage reapplied | 200 | | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | $t = 0.1\text{ ms to }10\text{ ms}$, no voltage reapplied | 2000 | | A ² √s |
| Maximum on-state voltage drop | V_{TM} | 10 A, $T_J = 25\text{ }^\circ\text{C}$ | 1.4 | | V |
| On-state slope resistance | r_t | $T_J = 125\text{ }^\circ\text{C}$ | 24.0 | | mΩ |
| Threshold voltage | $V_{T(TO)}$ | | 1.1 | | V |
| Maximum reverse and direct leakage current | I_{RM}/I_{DM} | $T_J = 25\text{ }^\circ\text{C}$ | $V_R = \text{rated } V_{RRM}/V_{DRM}$ | | mA |
| | | $T_J = 125\text{ }^\circ\text{C}$ | | | |
| Holding current | I_H | Anode supply = 6 V, resistive load, initial $I_T = 1\text{ A}$, $T_J = 25\text{ }^\circ\text{C}$ | 100 | 150 | mA |
| 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/μs |
| Maximum rate of rise of turned-on current | dI/dt | | 150 | | A/μs |

| TRIGGERING | | | | | |
|---|-------------|---|--------|-------|----|
| 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, $T_J = -10\text{ }^\circ\text{C}$ | 90 | | mA |
| | | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$ | 60 | | |
| | | Anode supply = 6 V, resistive load, $T_J = 125\text{ }^\circ\text{C}$ | 35 | | |
| Maximum required DC gate voltage to trigger | V_{GT} | Anode supply = 6 V, resistive load, $T_J = -10\text{ }^\circ\text{C}$ | 3.0 | | 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 | | mA |
| Maximum DC gate current not to trigger | I_{GD} | | 2.0 | | |

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



| THERMAL - 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 | 1.3 | °C/W |
| Typical thermal resistance, junction to ambient | R_{thJA} | PCB mount ⁽¹⁾ | 40 | |
| Approximate weight | | | 2 | g |
| | | | 0.07 | oz. |
| Marking device | | Case style D ² PAK (TO-263AB) | 16TTS16S | |

Note

(1) When mounted on 1" square (650 mm²) PCB of FR-4 or G-10 material 4 oz. (140 μm) copper 40 °C/W. For recommended footprint and soldering techniques refer to application note #AN-994

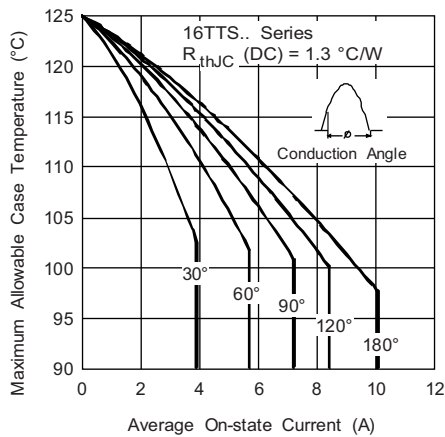


Fig. 1 - Current Rating Characteristics

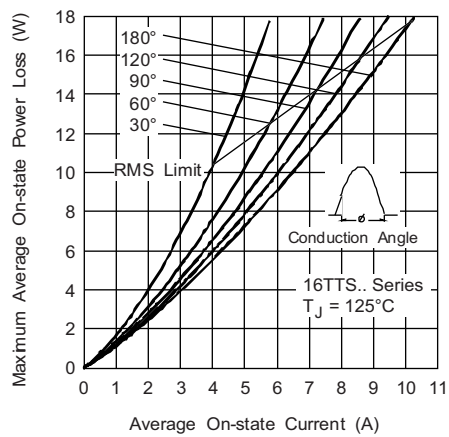


Fig. 3 - On-State Power Loss Characteristics

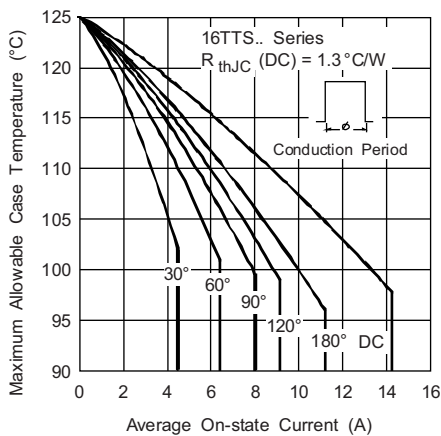


Fig. 2 - Current Rating Characteristics

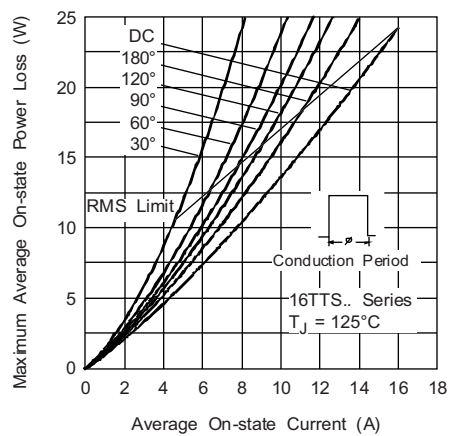


Fig. 4 - On-State Power Loss Characteristics

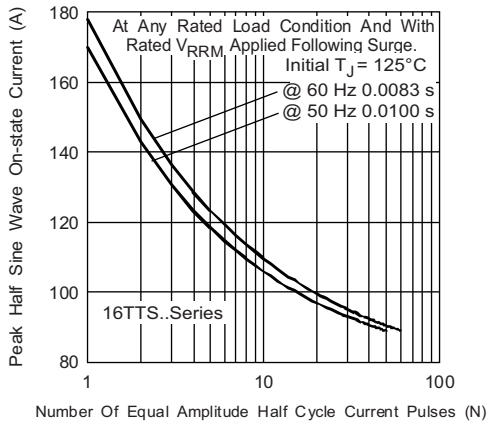


Fig. 5 - Maximum Non-Repetitive Surge Current

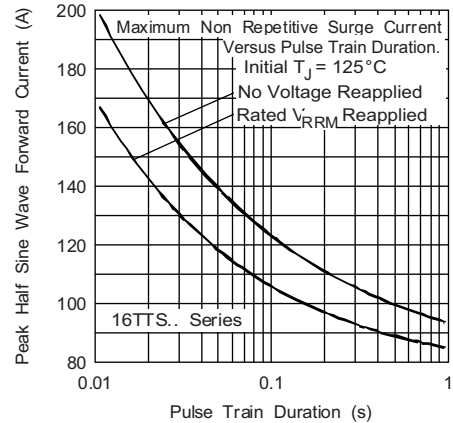


Fig. 6 - Maximum Non-Repetitive Surge Current

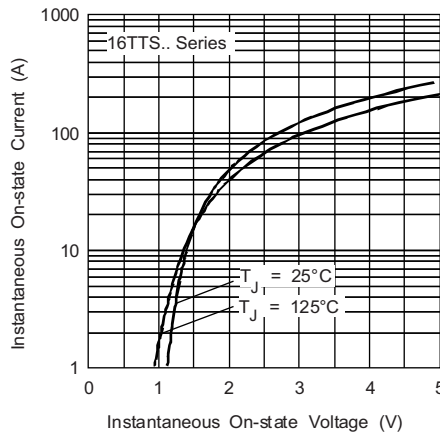


Fig. 7 - On-State Voltage Drop Characteristics

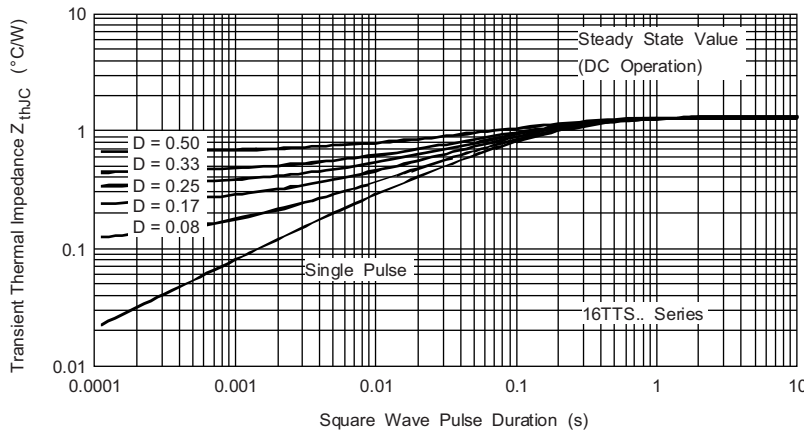


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

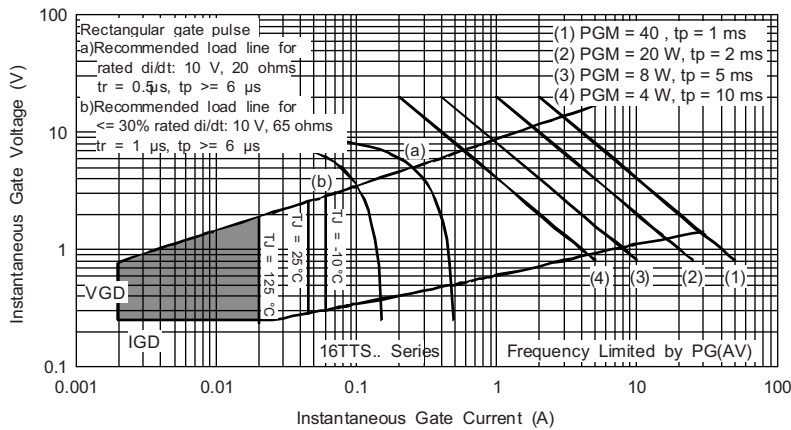


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

| | | | | | | | | | |
|-------------|------------|-----------|----------|----------|----------|-----------|----------|------------|------------|
| Device code | VS- | 16 | T | T | S | 16 | S | TRL | -M3 |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

- 1** - Vishay Semiconductors product
- 2** - Current rating
- 3** - Circuit configuration:
T = single thyristor
- 4** - Package:
T = D²PAK (TO-263AB)
- 5** - Type of silicon:
S = standard recovery rectifier
- 6** - Voltage rating: Voltage code x 100 = V_{RRM} (16 = 1600 V)
- 7** - S = surface mountable
- 8** - • None = tube
• TRL = tape and reel (left oriented)
• TRR = tape and reel (right oriented)
- 9** - -M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

| ORDERING INFORMATION (Example) | | | |
|---------------------------------------|------------------|------------------------|--------------------------|
| PREFERRED P/N | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
| VS-16TTS16S-M3 | 50 | 1000 | Antistatic plastic tubes |
| VS-16TTS16STRR-M3 | 800 | 800 | 13" diameter reel |
| VS-16TTS16STRL-M3 | 800 | 800 | 13" diameter reel |

| LINKS TO RELATED DOCUMENTS | |
|-----------------------------------|--|
| Dimensions | www.vishay.com/doc?96164 |
| Part marking information | www.vishay.com/doc?95444 |
| Packaging information | www.vishay.com/doc?96424 |



D²PAK

DIMENSIONS in millimeters and inches

Conforms to JEDEC[®] outline D²PAK (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

- (1) Dimensioning and tolerancing per ASME Y14.5 M-1994
- (2) 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
- (3) Thermal pad contour optional within dimension E, L1, D1 and E1
- (4) Dimension b1 and c1 apply to base metal only
- (5) Datum A and B to be determined at datum plane H
- (6) Controlling dimension: inches
- (7) Outline conforms to JEDEC[®] outline TO-263AB



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