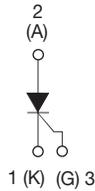




Thyristor High Voltage, Phase Control SCR, 16 A



TO-220AB



FEATURES

- Designed and qualified according to JEDEC®-JESD 47
- 125 °C max. operating junction temperature
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS COMPLIANT
HALOGEN FREE Available

APPLICATIONS

- Typical usage is in input rectification crowbar (soft start) and AC switch in motor control, UPS, welding, and battery charge

DESCRIPTION

The VS-16TTS... 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 operating up to 125 °C junction temperature.

| PRIMARY CHARACTERISTICS | |
|-------------------------|------------------|
| $I_{T(AV)}$ | 10 A |
| V_{DRM}/V_{RRM} | 800 V, 1200 V |
| V_{TM} | 1.4 V |
| I_{GT} | 60 mA |
| T_J | -40 °C to 125 °C |
| Package | TO-220AB |
| Circuit configuration | Single SCR |

| 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 | 13.5 | 17 | A |

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|-----------------------------------|----------------------|------------|-------|
| PARAMETER | TEST CONDITIONS | VALUES | UNITS |
| $I_{T(AV)}$ | Sinusoidal waveform | 10 | A |
| I_{RMS} | | 16 | |
| V_{DRM}/V_{RRM} | Range ⁽¹⁾ | 800/1200 | V |
| I_{TSM} | | 200 | A |
| V_T | 10 A, $T_J = 25$ °C | 1.4 | V |
| dV/dt | | 500 | V/μs |
| dI/dt | | 150 | A/μs |
| T_J | Range | -40 to 125 | °C |

Note

⁽¹⁾ For higher voltage up to 1600 V contact factory

| 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-16TTS08PbF, VS-16TTS08-M3 | 800 | 800 | 10 |
| VS-16TTS12PbF, VS-16TTS12-M3 | 1200 | 1200 | |



| ABSOLUTE MAXIMUM RATINGS | | | | | | |
|---|-----------------|---|-----------------------------------|------|---------------|----|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | | UNITS | |
| | | | TYP. | MAX. | | |
| Maximum average on-state current | $I_{T(AV)}$ | $T_C = 98\text{ }^\circ\text{C}$, 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^2s | |
| | | 10 ms sine pulse, no voltage reapplied | 200 | | | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | $t = 0.1$ to 10 ms, no voltage reapplied | 2000 | | $A^2\sqrt{s}$ | |
| 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 | | $m\Omega$ | |
| Threshold voltage | $V_{T(TO)}$ | | 1.1 | | 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 16TTS08PbF, 16TTS12PbF, $T_J = 25\text{ }^\circ\text{C}$ | - | 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 $80\text{ }^\circ\text{C}$, $V_{DRM} = R_g - k = \text{Open}$ | 500 | | $V/\mu s$ | |
| Maximum rate of rise of turned-on current | di/dt | | 150 | | $A/\mu s$ | |

| 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, $T_J = -65\text{ }^\circ\text{C}$ | 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, $T_J = -65\text{ }^\circ\text{C}$ | 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 | |
| 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 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 | 1.3 | °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 (lbf · in) |
| | maximum | | 12 (10) | |
| Marking device | | Case style TO-220AB | 16TTS08 | |
| | | | 16TTS12 | |

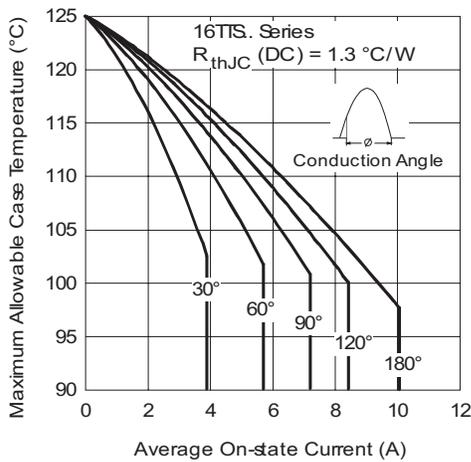


Fig. 1 - Current Rating Characteristics

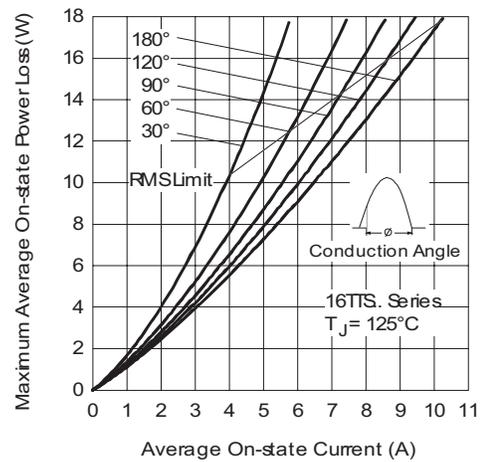


Fig. 3 - On-State Power Loss Characteristics

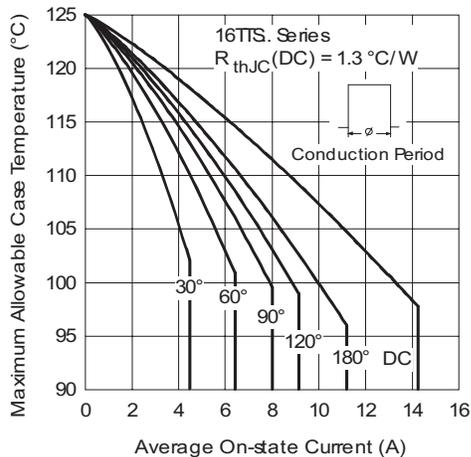


Fig. 2 - Current Rating Characteristics

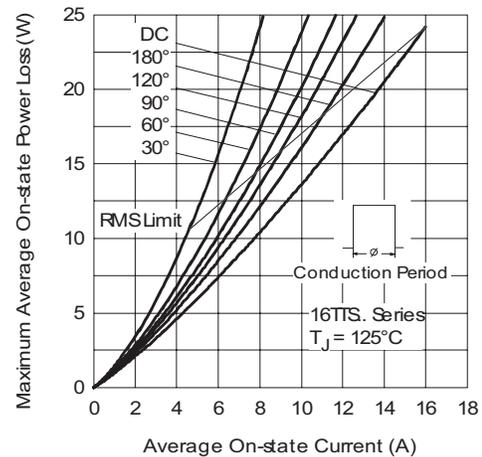


Fig. 4 - On-State Power Loss Characteristics

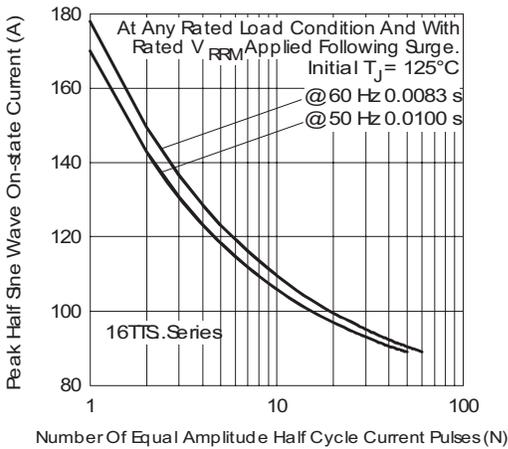


Fig. 5 - Maximum Non-Repetitive Surge Current

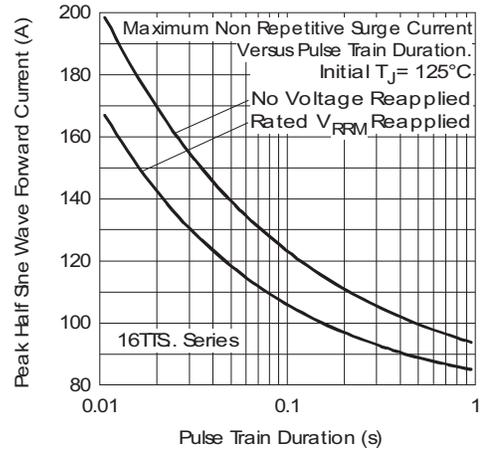


Fig. 6 - Maximum Non-Repetitive Surge Current

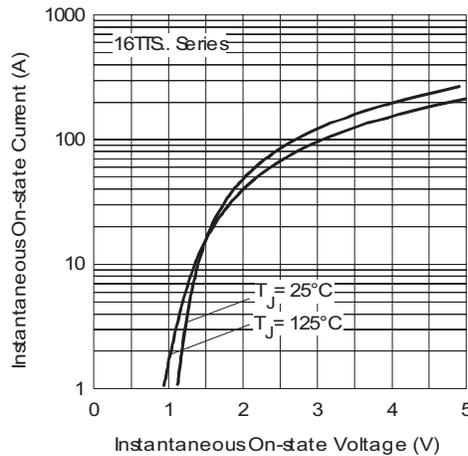


Fig. 7 - On-State Voltage Drop Characteristics

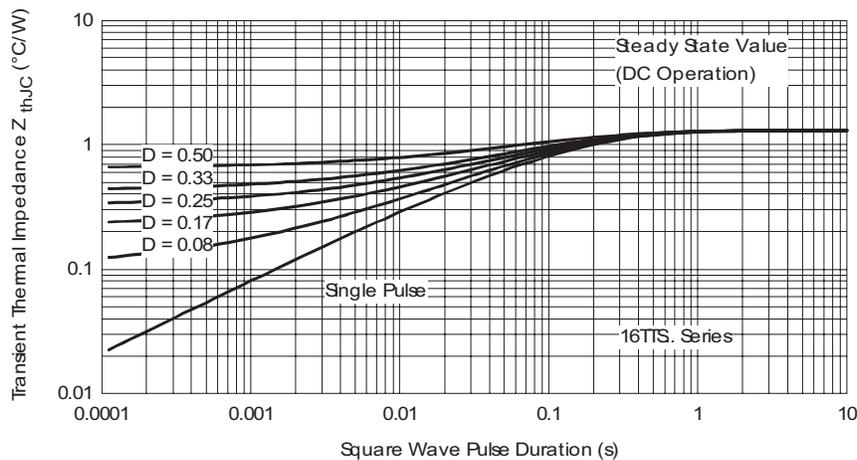


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

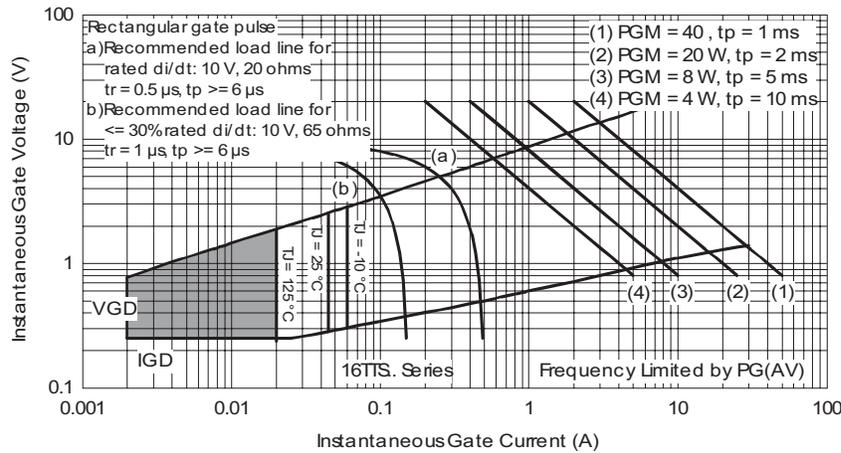


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

| | | | | | | | |
|-------------|------------|-----------|----------|----------|----------|-----------|------------|
| Device code | VS- | 16 | T | T | S | 12 | PbF |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |

- 1** - Vishay Semiconductors product
- 2** - Current rating
- 3** - Circuit configuration:
T = Single thyristor
- 4** - Package:
T = TO-220AB
- 5** - Type of silicon:
S = Converter grade
- 6** - Voltage code x 100 = V_{RRM} —

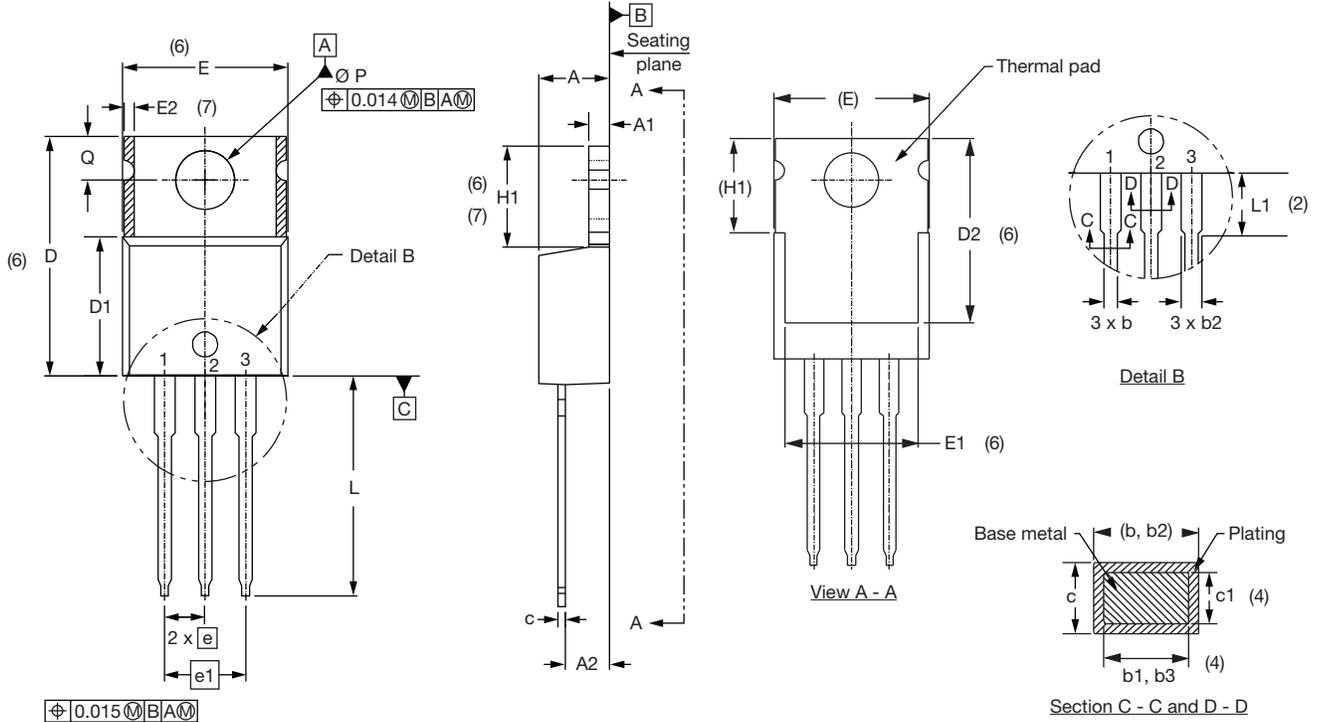
| |
|-------------|
| 08 = 800 V |
| 12 = 1200 V |
- 7** - Environmental digit:
PbF = Lead (Pb)-free and RoHS compliant
-M3 = Halogen-free, RoHS compliant, and terminations lead (Pb)-free

| ORDERING INFORMATION (Example) | | | |
|---------------------------------------|------------------|------------------------|--------------------------|
| PREFERRED P/N | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
| VS-16TTS08PbF | 50 | 1000 | Antistatic plastic tubes |
| VS-16TTS08-M3 | 50 | 1000 | Antistatic plastic tubes |
| VS-16TTS12PbF | 50 | 1000 | Antistatic plastic tubes |
| VS-16TTS12-M3 | 50 | 1000 | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS | |
|-----------------------------------|---|
| Dimensions | www.vishay.com/doc?95222 |
| Part marking information | TO-220AB PbF www.vishay.com/doc?95225 |
| | TO-220AB -M3 www.vishay.com/doc?95028 |

TO-220AB

DIMENSIONS in millimeters and inches



Lead assignments

Diodes

- 1. - Anode/open
- 2. - Cathode
- 3. - Anode

Conforms to JEDEC outline TO-220AB

| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|----------|-------------|-------|------------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.25 | 4.65 | 0.167 | 0.183 | |
| A1 | 1.14 | 1.40 | 0.045 | 0.055 | |
| A2 | 2.56 | 2.92 | 0.101 | 0.115 | |
| b | 0.69 | 1.01 | 0.027 | 0.040 | |
| b1 | 0.38 | 0.97 | 0.015 | 0.038 | 4 |
| b2 | 1.20 | 1.73 | 0.047 | 0.068 | |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 | 4 |
| c | 0.36 | 0.61 | 0.014 | 0.024 | |
| c1 | 0.36 | 0.56 | 0.014 | 0.022 | 4 |
| D | 14.85 | 15.25 | 0.585 | 0.600 | 3 |
| D1 | 8.38 | 9.02 | 0.330 | 0.355 | |
| D2 | 11.68 | 12.88 | 0.460 | 0.507 | 6 |
| E | 10.11 | 10.51 | 0.398 | 0.414 | 3, 6 |
| E1 | 6.86 | 8.89 | 0.270 | 0.350 | 6 |
| E2 | - | 0.76 | - | 0.030 | 7 |
| e | 2.41 | 2.67 | 0.095 | 0.105 | |
| e1 | 4.88 | 5.28 | 0.192 | 0.208 | |
| H1 | 6.09 | 6.48 | 0.240 | 0.255 | 6, 7 |
| L | 13.52 | 14.02 | 0.532 | 0.552 | |
| L1 | 3.32 | 3.82 | 0.131 | 0.150 | 2 |
| ϕP | 3.54 | 3.73 | 0.139 | 0.147 | |
| Q | 2.60 | 3.00 | 0.102 | 0.118 | |
| θ | 90° to 93° | | 90° to 93° | | |

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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