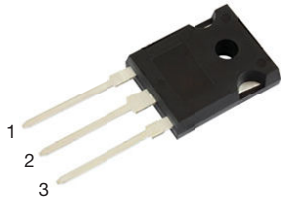
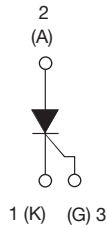


Thyristor High Voltage, Phase Control SCR, 40 A



TO-247AD 3L



FEATURES

- 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



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

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

DESCRIPTION

The VS-40TPS16LHM3 high voltage series of silicon controlled rectifiers are specifically designed for medium power switching and phase control applications.

| PRIMARY CHARACTERISTICS | |
|-------------------------|-------------------|
| $I_{T(AV)}$ | 35 A |
| V_{DRM}/V_{RRM} | 1600 V |
| V_{TM} | 1.45 V |
| I_{GT} | 150 mA |
| T_J | -40 °C to +125 °C |
| Package | TO-247AD 3L |
| Circuit configuration | Single SCR |

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|-----------------------------------|----------------------------|-------------|------------|
| PARAMETER | TEST CONDITIONS | VALUES | UNITS |
| $I_{T(AV)}$ | Sinusoidal waveform | 35 | A |
| I_{RMS} | | 55 | |
| V_{RRM}/V_{DRM} | | 1600 | V |
| I_{TSM} | | 500 | A |
| V_T | 40 A, $T_J = 25\text{ °C}$ | 1.45 | V |
| dv/dt | | 1000 | V/ μ s |
| di/dt | | 100 | A/ μ s |
| T_J | | -40 to +125 | °C |

| VOLTAGE RATINGS | | | |
|-----------------|--|--|-------------------------------------|
| PART NUMBER | V_{RRM} / V_{DRM} , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE V | V_{RSM} , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V | I_{RRM} / I_{DRM} AT 125 °C mA |
| VS-40TPS16LHM3 | 1600 | 1700 | 10 |



| ABSOLUTE MAXIMUM RATINGS | | | | | |
|--|-------------------|---|-----------------------------------|--------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum average on-state current | $I_{T(AV)}$ | $T_C = 79\text{ }^\circ\text{C}$, 180° conduction half sine wave | | 35 | A |
| Maximum continuous RMS on-state current as AC switch | $I_{T(RMS)}$ | | | 55 | |
| Maximum peak, one-cycle non-repetitive surge current | I_{TSM} | 10 ms sine pulse, rated V_{RRM} applied | Initial $T_J = T_{J\text{ max.}}$ | 420 | |
| | | 10 ms sine pulse, no voltage reapplied | | 500 | |
| Maximum I^2t for fusing | I^2t | 10 ms sine pulse, rated V_{RRM} applied | | 880 | A^2s |
| | | 10 ms sine pulse, no voltage reapplied | | 1250 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | $t = 0.1\text{ ms to }10\text{ ms}$, no voltage reapplied | | 12 500 | $A^2\sqrt{s}$ |
| Low level value of threshold voltage | $V_{T(TO)1}$ | $T_J = 125\text{ }^\circ\text{C}$ | | 1.02 | V |
| High level value of threshold voltage | $V_{T(TO)2}$ | | | 1.23 | |
| Low level value of on-state slope resistance | r_{t1} | | | 9.74 | $m\Omega$ |
| High level value of on-state slope resistance | r_{t2} | | | 7.50 | |
| Maximum peak on-state voltage | V_{TM} | 110 A, $T_J = 25\text{ }^\circ\text{C}$ | | 1.92 | V |
| | | 90 A, $T_J = 25\text{ }^\circ\text{C}$ | | 1.82 | |
| Maximum rate of rise of turned-on current | di/dt | $T_J = 25\text{ }^\circ\text{C}$ | | 100 | $A/\mu s$ |
| Maximum holding current | I_H | Anode supply = 6 V, resistive load, initial $T_J = 1\text{ A}$, $I_T = 25\text{ }^\circ\text{C}$ | | 300 | mA |
| Maximum latching current | I_L | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$ | | 350 | |
| Maximum reverse and direct leakage current | I_{RRM}/I_{DRM} | $T_J = 25\text{ }^\circ\text{C}$ | | 0.5 | |
| | | $T_J = 125\text{ }^\circ\text{C}$ | | 10 | |
| Maximum rate of rise of off-state voltage | dV/dt | $T_J = T_{J\text{ maximum}}$, linear to 80 % V_{DRM} , $R_g - k = \text{open}$ | | 1000 | $V/\mu s$ |

| TRIGGERING | | | | | |
|---|-------------|--|--|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum peak gate power | P_{GM} | | | 10 | W |
| Maximum average gate power | $P_{G(AV)}$ | | | 2.5 | |
| Maximum peak gate current | I_{GM} | | | 2.5 | A |
| Maximum peak negative gate voltage | $-V_{GM}$ | | | 10 | V |
| Maximum required DC gate voltage to trigger | V_{GT} | $T_J = -40\text{ }^\circ\text{C}$ | | 4.0 | V |
| | | $T_J = 25\text{ }^\circ\text{C}$ | | 2.5 | |
| | | $T_J = 125\text{ }^\circ\text{C}$ | | 1.7 | |
| Maximum required DC gate current to trigger | I_{GT} | $T_J = -40\text{ }^\circ\text{C}$ | | 270 | mA |
| | | $T_J = 25\text{ }^\circ\text{C}$ | | 150 | |
| | | $T_J = 125\text{ }^\circ\text{C}$ | | 80 | |
| Maximum DC gate voltage not to trigger | V_{GD} | $T_J = 125\text{ }^\circ\text{C}$, $V_{DRM} = \text{rated value}$ | | 0.25 | V |
| Maximum DC gate current not to trigger | I_{GD} | | | 6 | mA |



| 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 | 0.6 | °C/W |
| Maximum thermal resistance, junction to ambient | R_{thJA} | | 40 | |
| Maximum thermal resistance, case to heat sink | R_{thCS} | Mounting surface, smooth, and greased | 0.2 | |
| Approximate weight | | | 6 | g |
| | | | 0.21 | oz. |
| Mounting torque | minimum | | 6 (5) | kgf · cm (lbf · in) |
| | maximum | | 12 (10) | |
| Marking device | | Case style TO-247AD 3L | 40TPS16LH | |

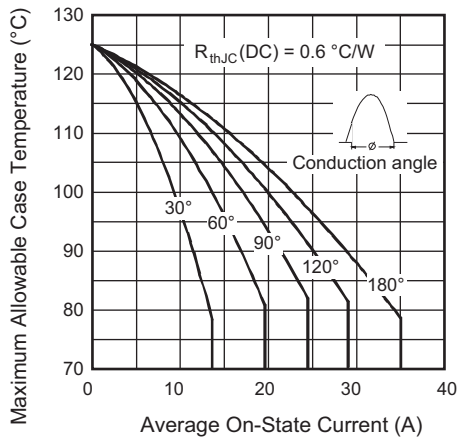


Fig. 1 - Current Rating Characteristics

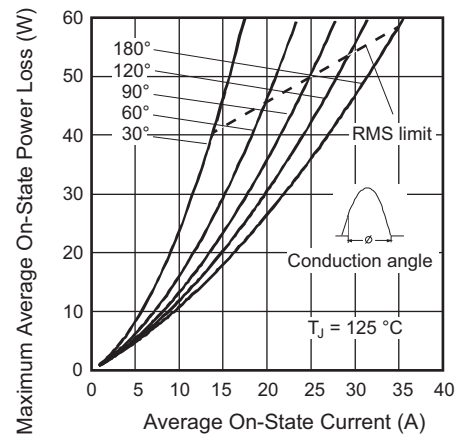


Fig. 3 - On-State Power Loss Characteristics

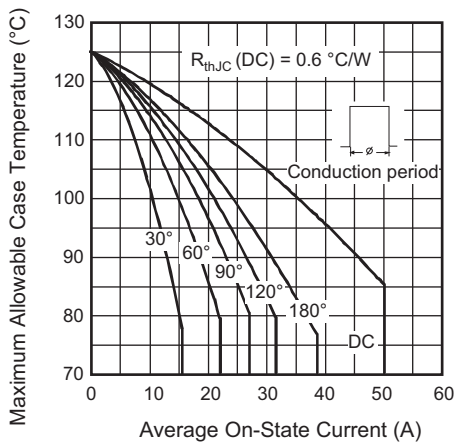


Fig. 2 - Current Rating Characteristics

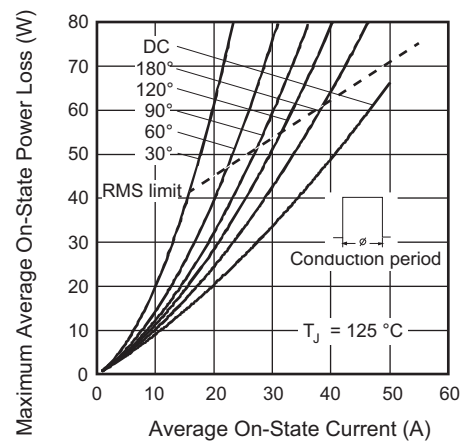


Fig. 4 - On-State Power Loss Characteristics

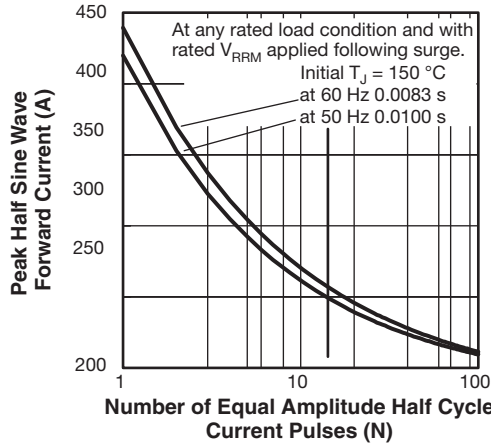


Fig. 5 - Maximum Non-Repetitive Surge Current

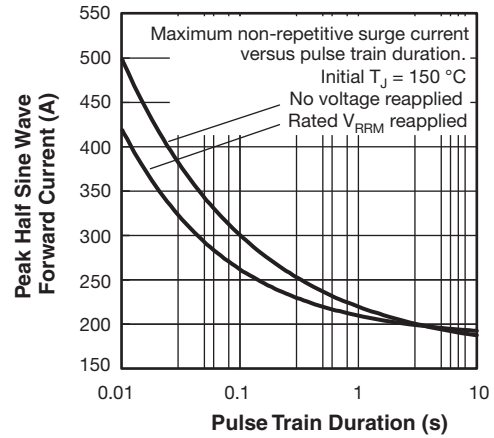


Fig. 6 - Maximum Non-Repetitive Surge Current

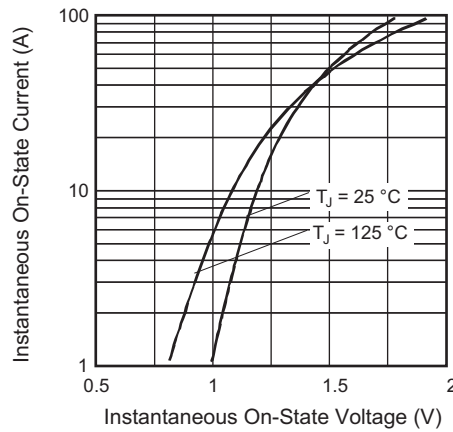


Fig. 7 - On-State Voltage Drop Characteristics

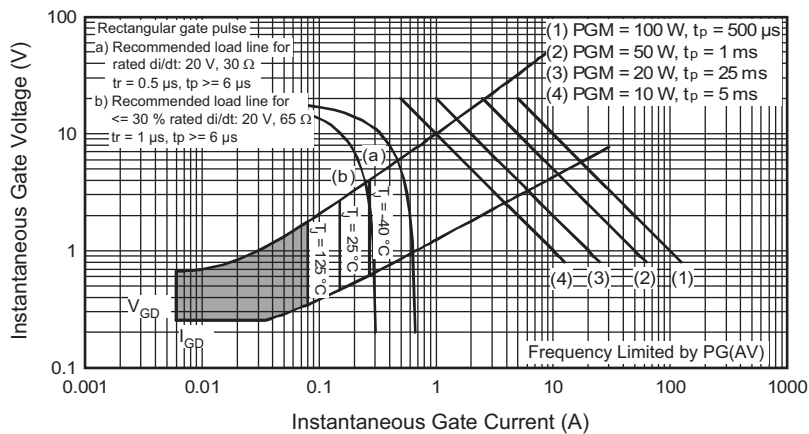


Fig. 8 - Gate Characteristics

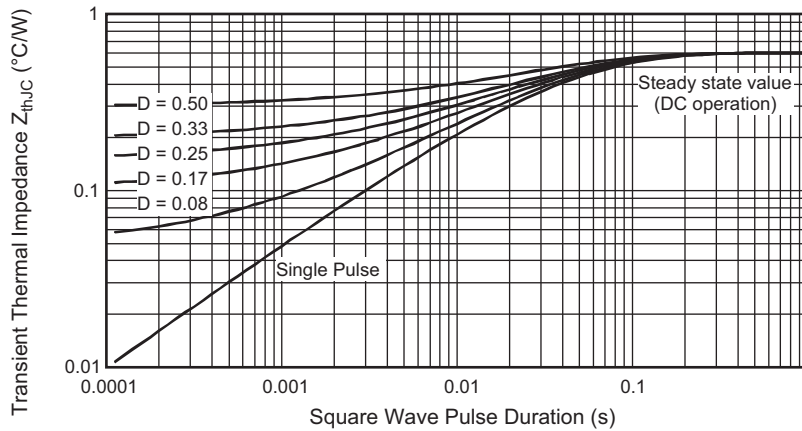


Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

| | | | | | | | | | | |
|-------------|------------|-----------|--|----------|----------|-----------|-------------|----------|-----------|--|
| Device code | VS- | 40 | T | P | S | 16 | L | H | M3 | |
| | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ | |
| | 1 | - | Vishay Semiconductors product | | | | | | | |
| | 2 | - | Current rating (40 = 40 A) | | | | | | | |
| | 3 | - | Circuit configuration: T = thyristor | | | | | | | |
| | 4 | - | Package: P = TO-247 | | | | | | | |
| | 5 | - | Type of silicon: S = standard recovery rectifier | | | | | | | |
| | 6 | - | Voltage ratings | | | | 16 = 1600 V | | | |
| | 7 | - | L = long leads | | | | | | | |
| | 8 | - | H = AEC-Q101 qualified | | | | | | | |
| | 9 | - | Environmental digit: M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free | | | | | | | |

| ORDERING INFORMATION (Example) | | | |
|---------------------------------------|-------------------|------------------------|--------------------------|
| PREFERRED P/N | QUANTITY PER TUBE | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
| VS-40TPS16LHM3 | 25 | 500 | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS | | |
|-----------------------------------|-------------|--|
| Dimensions | TO-247AD 3L | www.vishay.com/doc?95626 |
| Part marking information | TO-247AD 3L | www.vishay.com/doc?95007 |

TO-247AD 3L

DIMENSIONS in millimeters and inches



| SYMBOL | MILLIMETERS | | INCHES | | NOTES | SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|--------|-------------|-------|--------|-------|-------|--------|-------------|-------|-----------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. | | | MIN. | MAX. | MIN. | MAX. | |
| A | 4.65 | 5.31 | 0.183 | 0.209 | | D2 | 0.51 | 1.30 | 0.020 | 0.051 | |
| A1 | 2.21 | 2.59 | 0.087 | 0.102 | | E | 15.29 | 15.87 | 0.602 | 0.625 | 3 |
| A2 | 1.50 | 2.49 | 0.059 | 0.098 | | E1 | 13.46 | - | 0.53 | - | |
| b | 0.99 | 1.40 | 0.039 | 0.055 | | e | 5.46 BSC | | 0.215 BSC | | |
| b1 | 0.99 | 1.35 | 0.039 | 0.053 | | Ø K | 2.54 | | 0.010 | | |
| b2 | 1.65 | 2.39 | 0.065 | 0.094 | | L | 19.81 | 20.32 | 0.780 | 0.800 | |
| b3 | 1.65 | 2.34 | 0.065 | 0.092 | | L1 | 3.71 | 4.29 | 0.146 | 0.169 | |
| b4 | 2.59 | 3.43 | 0.102 | 0.135 | | Ø P | 3.56 | 3.66 | 0.14 | 0.144 | |
| b5 | 2.59 | 3.38 | 0.102 | 0.133 | | Ø P1 | - | 6.98 | - | 0.275 | |
| c | 0.38 | 0.89 | 0.015 | 0.035 | | Q | 5.31 | 5.69 | 0.209 | 0.224 | |
| c1 | 0.38 | 0.84 | 0.015 | 0.033 | | R | 4.52 | 5.49 | 0.178 | 0.216 | |
| D | 19.71 | 20.70 | 0.776 | 0.815 | 3 | S | 5.51 BSC | | 0.217 BSC | | |
| D1 | 13.08 | - | 0.515 | - | 4 | | | | | | |

Notes

- (1) Dimensioning and tolerancing per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D and E do not include mold flash. These dimensions are measured at the outermost extremes of the plastic body
- (4) Thermal pad contour optional with dimensions D1 and E1
- (5) Lead finish uncontrolled in L1
- (6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- (7) Outline conforms to JEDEC® outline TO-247 with exception of dimension A min., D, E min., Q min., S, and note 4



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