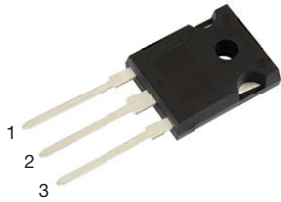
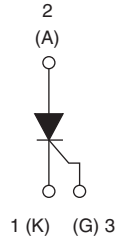


Thyristor High Voltage, Phase Control SCR, 50 A



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-50TPS12 high voltage series of silicon controlled rectifiers are specifically designed for medium power switching, and phase control applications.

| PRIMARY CHARACTERISTICS | |
|-------------------------|-------------|
| $I_{T(AV)}$ | 50 A |
| V_{DRM}/V_{RRM} | 1200 V |
| V_{TM} (typ.) | 1.2 V |
| I_{GT} (typ.) | 40 mA |
| T_J max. | 125 °C |
| Package | TO-247AD 3L |
| Circuit configuration | Single SCR |

| MAJOR RATINGS AND CHARACTERISTICS | | | | |
|--|---------------------|-----------------------------|-------------|------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Peak repetitive reverse voltage | V_{RRM} / V_{DRM} | | 1200 | V |
| On-state voltage | V_T | 50 A, $T_J = 125\text{ °C}$ | 1.2 | |
| Average rectified forward current | $I_{T(AV)}$ | | 50 | A |
| Maximum continuous RMS on-state current | I_{RMS} | | 79 | |
| Non-repetitive peak surge current | I_{TSM} | | 630 | |
| Maximum rate of rise | dv/dt | | 1000 | V/ μ s |
| Operating junction and storage temperature range | T_J, T_{Stg} | | -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-50TPS12LHM3 | 1200 | 1300 | 10 |



| ABSOLUTE MAXIMUM RATINGS | | | | | | |
|--|-------------------|---|-----------------------------|------|------------------|---------------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | TYP. | MAX. | UNITS | |
| Maximum average on-state current | $I_{T(AV)}$ | $T_C = 82\text{ }^\circ\text{C}$, 180° conduction half sine wave | - | 50 | A | |
| Maximum continuous RMS on-state current as AC switch | $I_{T(RMS)}$ | | - | 79 | | |
| Peak, one-cycle non-repetitive surge current | I_{TSM} | 10 ms sine pulse, rated V_{RRM} applied | - | 530 | | |
| I^2t for fusing | I^2t | 10 ms sine pulse, no voltage reapplied | Initial $T_J = T_J$ maximum | - | 630 | |
| | | 10 ms sine pulse, rated V_{RRM} applied | | - | 1405 | |
| $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | 10 ms sine pulse, no voltage reapplied | | - | 1986 | A ² s |
| | | $t = 0.1\text{ ms to }10\text{ ms}$, no voltage reapplied, $T_J = 125\text{ }^\circ\text{C}$ | | - | 19 850 | A ² \sqrt{s} |
| Low level value of threshold voltage | $V_{T(TO)1}$ | $T_J = 125\text{ }^\circ\text{C}$ | - | 0.89 | V | |
| High level value of threshold voltage | $V_{T(TO)2}$ | | - | 0.97 | | |
| Low level value of on-state slope resistance | r_{t1} | | - | 6.77 | m Ω | |
| High level value of on-state slope resistance | r_{t2} | | - | 6.32 | | |
| On-state voltage | V_T | 50 A, $T_J = 25\text{ }^\circ\text{C}$ | 1.2 | 1.32 | V | |
| | | 100 A, $T_J = 25\text{ }^\circ\text{C}$ | 1.4 | 1.6 | | |
| Rate of rise of turned-on current | di/dt | $T_J = 25\text{ }^\circ\text{C}$ | - | 150 | A/ μs | |
| Holding current | I_H | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$ | - | 300 | mA | |
| Latching current | I_L | | - | 350 | | |
| Reverse and direct leakage current | I_{RRM}/I_{DRM} | $T_J = 25\text{ }^\circ\text{C}$ | - | 0.05 | | |
| | | $T_J = 125\text{ }^\circ\text{C}$ | - | 10 | | |
| Rate of rise of off-state voltage | dv/dt | $T_J = T_J$ maximum, linear to 80 % V_{DRM} , $R_g-k = \infty\text{ }\Omega$ | - | 1000 | V/ μs | |

| TRIGGERING | | | | | | |
|-------------------------------------|-------------|--|-----------------------------------|------|-------|-----|
| PARAMETER | SYMBOL | TEST CONDITIONS | TYP. | MAX. | UNITS | |
| Peak gate power | P_{GM} | 10 ms sine pulse, no voltage reapplied | - | 10 | W | |
| Average gate power | $P_{G(AV)}$ | | - | 2.5 | | |
| Peak gate current | I_{GM} | | - | 2.5 | A | |
| Peak negative gate voltage | $-V_{GM}$ | | - | 10 | V | |
| Required DC gate voltage to trigger | V_{GT} | $T_J = -40\text{ }^\circ\text{C}$ | Anode supply = 6 V resistive load | - | | 1.6 |
| | | $T_J = 25\text{ }^\circ\text{C}$ | | - | | 1.5 |
| | | $T_J = 125\text{ }^\circ\text{C}$ | | - | 1.1 | |
| Required DC gate to trigger | I_{GT} | $T_J = -40\text{ }^\circ\text{C}$ | Anode supply = 6 V resistive load | - | 160 | |
| | | $T_J = 25\text{ }^\circ\text{C}$ | | 45 | 100 | |
| | | $T_J = 125\text{ }^\circ\text{C}$ | | - | 70 | |
| DC gate voltage not to trigger | V_{GD} | $T_J = 125\text{ }^\circ\text{C}$, $V_{DRM} = \text{rated value}$ | - | 0.25 | V | |
| DC gate current not to trigger | I_{GD} | | - | 4.5 | mA | |

| SWITCHING | | | | | |
|---------------|----------|---|------|------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | TYP. | MAX. | UNITS |
| Turn-on time | t_{gt} | $I_T = 50\text{ A}$, $V_D = 50\text{ }\%$ V_{DRM} , $I_{gt} = 300\text{ mA}$, $T_J = 25\text{ }^\circ\text{C}$ | 1.5 | - | μs |
| Turn-off time | t_q | $I_T = 50\text{ A}$, $V_D = 80\text{ }\%$ V_{DRM} , $dV/dt = 20\text{ V}/\mu\text{s}$, $t_p = 200\text{ }\mu\text{s}$, $I_{gt} = 100\text{ mA}$, $dI/dt = 10\text{ A}/\mu\text{s}$, $V_R = 100\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ | 85 | - | |



| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | |
|---|----------------|---------------------------------------|-----------|------|------------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | TYP. | MAX. | UNITS |
| Maximum junction and storage temperature range | T_J, T_{Stg} | | -40 | 125 | °C |
| Maximum thermal resistance, junction to case | R_{thJC} | | - | 0.35 | °C/W |
| Maximum thermal resistance, junction to ambient | R_{thJA} | | - | 40 | |
| Typical thermal resistance, case to heatsink | R_{thCS} | Mounting surface, smooth, and greased | 0.2 | - | |
| Mounting torque | minimum | | 6 (5) | | kgf · cm (lbf · in) |
| | maximum | | 12 (10) | | |
| Marking device | | Case style Super TO-247AD 3L | 50TPS12LH | | |

| ΔR_{thJ-HS} CONDUCTION PER JUNCTION | | | | | | | | | | | |
|---|---------------------------|-------|-------|-------|-------|-----------------------------|-------|-------|-------|-------|-------|
| DEVICE | SINE HALF-WAVE CONDUCTION | | | | | RECTANGULAR WAVE CONDUCTION | | | | | UNITS |
| | 180° | 120° | 90° | 60° | 30° | 180° | 120° | 90° | 60° | 30° | |
| VS-50TPS12LHM3 | 0.143 | 0.166 | 0.208 | 0.299 | 0.490 | 0.099 | 0.168 | 0.223 | 0.311 | 0.494 | °C/W |

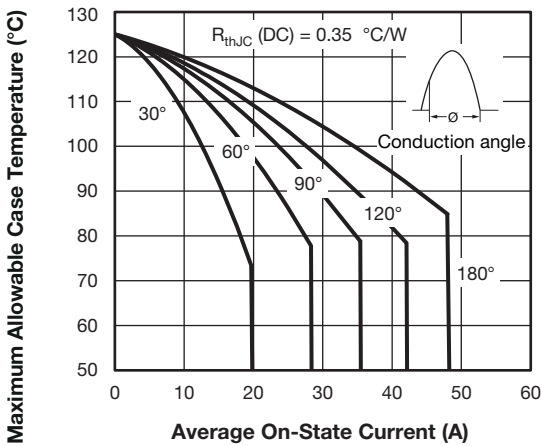


Fig. 1 - Current Rating Characteristics

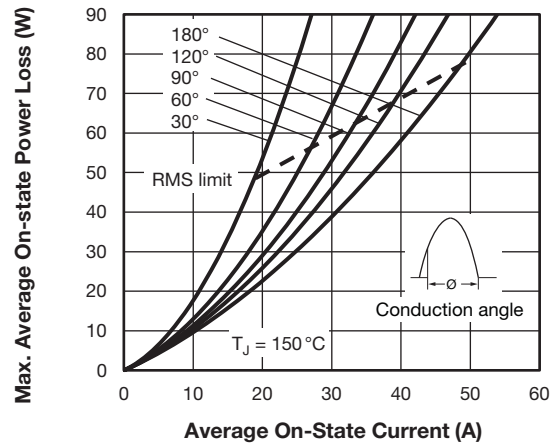


Fig. 3 - On-State Power Loss Characteristics

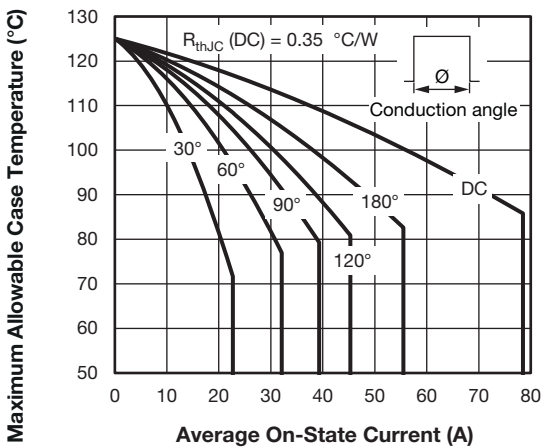


Fig. 2 - Current Rating Characteristics

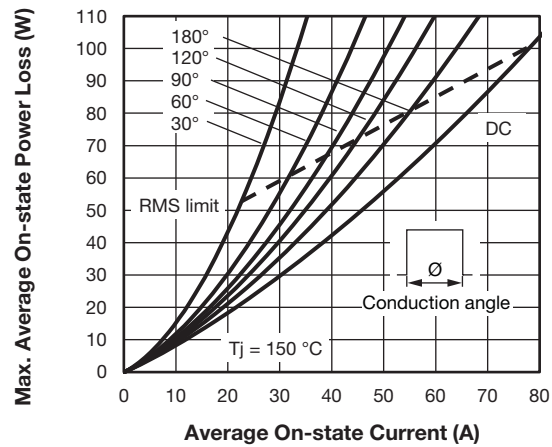


Fig. 4 - On-State Power Loss Characteristics

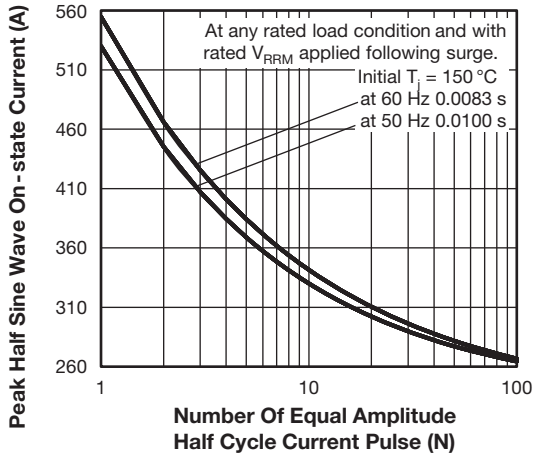


Fig. 5 - Maximum Non-Repetitive Surge Current

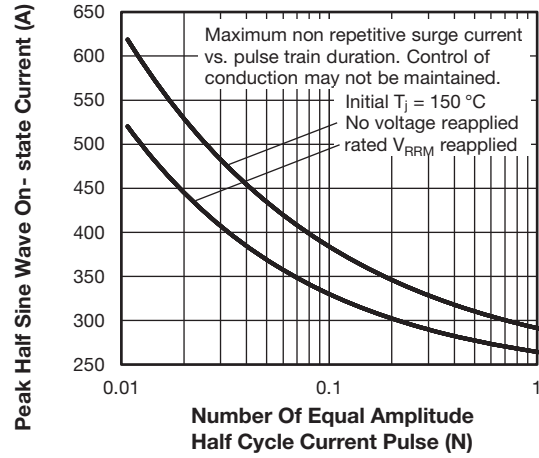


Fig. 6 - Maximum Non-Repetitive Surge Current

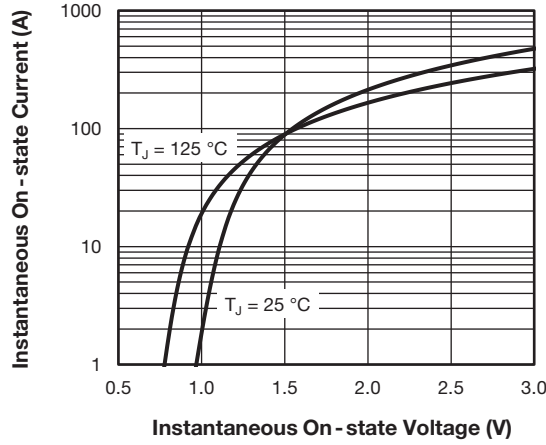


Fig. 7 - On-State Voltage Drop Characteristics

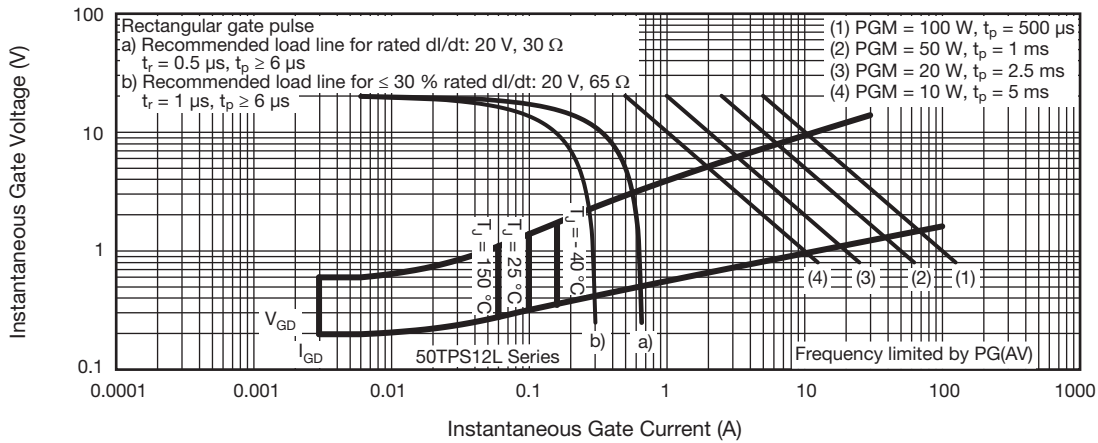


Fig. 8 - Gate Characteristics

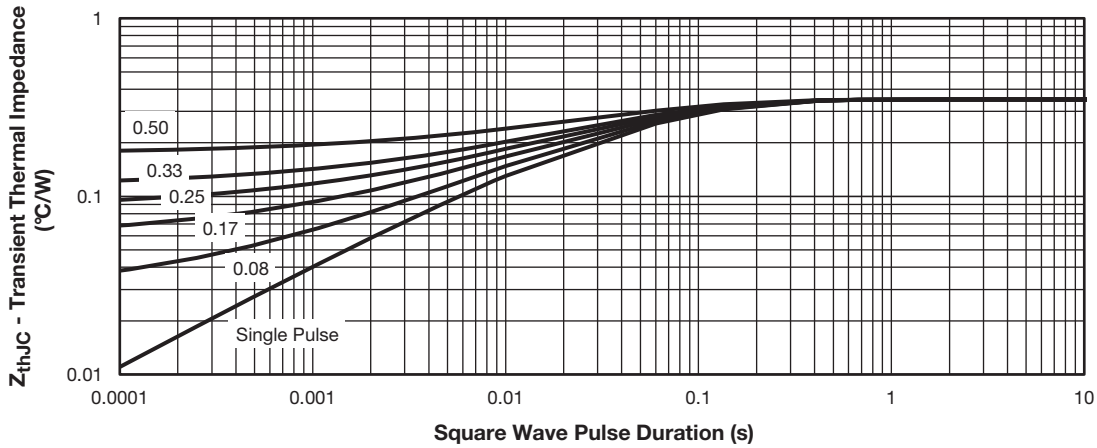


Fig. 9 - Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

| | | | | | | | | | |
|-------------|------------|-----------|----------|----------|----------|-----------|----------|----------|-----------|
| Device code | VS- | 50 | T | P | S | 12 | L | H | M3 |
| | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ |

- 1** - Vishay Semiconductors product
- 2** - Current code (50 = 50 A)
- 3** - Circuit configuration:
T = thyristor
- 4** - P = TO-247AD package
- 5** - Type of silicon:
S = standard recovery rectifier
- 6** - Voltage code (12 = 1200 V)
- 7** - Package L = long lead
- 8** - H = AEC-Q101 qualified
- 9** - 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-50TPS12LHM3 | 25 | contact factory | 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 |



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