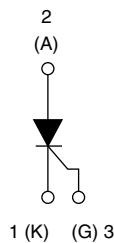


Thyristor High Voltage, Phase Control SCR, 50 A



PRIMARY CHARACTERISTICS

| | |
|-----------------------|-------------|
| $I_{T(AV)}$ | 50 A |
| V_{DRM}/V_{RRM} | 1200 V |
| V_{TM} (typ.) | 1.2 V |
| I_{GT} (typ.) | 45 mA |
| T_J max. | 150 °C |
| Package | TO-247AD 3L |
| Circuit configuration | Single SCR |

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.

MAJOR RATINGS AND CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|--|---------------------|----------------------|-------------|-------|
| Peak repetitive reverse voltage | V_{RRM} / V_{DRM} | 50 A, $T_J = 125$ °C | 1200 | V |
| On-state voltage | V_T | | 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/μs |
| Operating junction and storage temperature range | T_J, T_{Stg} | | -40 to +150 | °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 150 °C mA |
|----------------|---|---|----------------------------------|
| VS-50TPS12LHM3 | 1200 | 1300 | 70 |

| ABSOLUTE MAXIMUM RATINGS | | | | | | | |
|--|---------------------|--|-----------------------------|------|--------|-----------------------------|--|
| PARAMETER | SYMBOL | TEST CONDITIONS | | TYP. | MAX. | UNITS | |
| Maximum average on-state current | $I_{T(AV)}$ | $T_J = 112^\circ\text{C}$, 180° conduction half sine wave | | - | 50 | A | |
| Maximum continuous RMS on-state current as AC switch | $I_{T(\text{RMS})}$ | | | - | 79 | | |
| Peak, one-cycle non-repetitive surge current | I_{TSM} | 10 ms sine pulse, rated V_{RRM} applied | Initial $T_J = T_J$ maximum | - | 530 | A | |
| | | 10 ms sine pulse, no voltage reapplied | | - | 630 | | |
| | I^2t | 10 ms sine pulse, rated V_{RRM} applied | | - | 1405 | A^2s | |
| | | 10 ms sine pulse, no voltage reapplied | | - | 1986 | | |
| $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | $t = 0.1 \text{ ms to } 10 \text{ ms}$, no voltage reapplied, $T_J = 125^\circ\text{C}$ | | - | 19 850 | $\text{A}^2\sqrt{\text{s}}$ | |
| Low level value of threshold voltage | $V_{T(TO)1}$ | $T_J = 125^\circ\text{C}$ | | - | 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 | $\text{m}\Omega$ | |
| High level value of on-state slope resistance | r_{t2} | | | - | 6.32 | | |
| On-state voltage | V_T | 50 A, $T_J = 25^\circ\text{C}$ | | 1.2 | 1.32 | V | |
| | | 100 A, $T_J = 25^\circ\text{C}$ | | 1.4 | 1.6 | | |
| Rate of rise of turned-on current | di/dt | $T_J = 25^\circ\text{C}$ | | - | 150 | $\text{A}/\mu\text{s}$ | |
| Holding current | I_H | Anode supply = 6 V, resistive load, $T_J = 25^\circ\text{C}$ | | - | 300 | mA | |
| Latching current | I_L | | | - | 350 | | |
| Reverse and direct leakage current | I_{RRM}/I_{DRM} | $T_J = 25^\circ\text{C}$ | | - | 0.05 | | |
| | | $T_J = 150^\circ\text{C}$ | | - | 70 | | |
| Rate of rise of off-state voltage | dv/dt | $T_J = T_J$ maximum, linear to 80 % V_{DRM} , $R_g-k = 100 \Omega$ | | - | 1000 | $\text{V}/\mu\text{s}$ | |

| 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} | $T_J = -40^\circ\text{C}$ | Anode supply = 6 V resistive load | - | 1.6 | | |
| | | $T_J = 25^\circ\text{C}$ | | - | 1.5 | | |
| | | $T_J = 150^\circ\text{C}$ | | - | 1 | | |
| Required DC gate to trigger | I_{GT} | $T_J = -40^\circ\text{C}$ | Anode supply = 6 V resistive load | - | 160 | mA | |
| | | $T_J = 25^\circ\text{C}$ | | 45 | 100 | | |
| | | $T_J = 150^\circ\text{C}$ | | - | 60 | | |
| DC gate voltage not to trigger | V_{GD} | $T_J = 150^\circ\text{C}$, V_{DRM} = rated value | | - | 0.2 | V | |
| DC gate current not to trigger | I_{GD} | | | - | 3 | mA | |

| SWITCHING | | | | | | |
|---------------|----------|---|--|------|------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | TYP. | MAX. | UNITS |
| Turn-on time | t_{gt} | $I_T = 50 \text{ A}$, $V_D = 50\%$ V_{DRM} , $I_{gt} = 300 \text{ mA}$, $T_J = 25^\circ\text{C}$ | | 1.5 | - | μs |
| Turn-off time | t_q | $I_T = 50 \text{ A}$, $V_D = 80\%$ V_{DRM} , $dV/dt = 20 \text{ V}/\mu\text{s}$, $t_p = 200 \mu\text{s}$, $I_{gt} = 100 \text{ mA}$, $di/dt = 10 \text{ A}/\mu\text{s}$, $V_R = 100 \text{ V}$, $T_J = 150^\circ\text{C}$ | | 92 | - | |

THERMAL AND MECHANICAL SPECIFICATIONS

| PARAMETER | SYMBOL | TEST CONDITIONS | TYP. | MAX. | UNITS |
|---|----------------|---------------------------------------|-----------|---------|------------------------|
| Maximum junction and storage temperature range | T_J, T_{Stg} | | -40 | 150 | °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 |

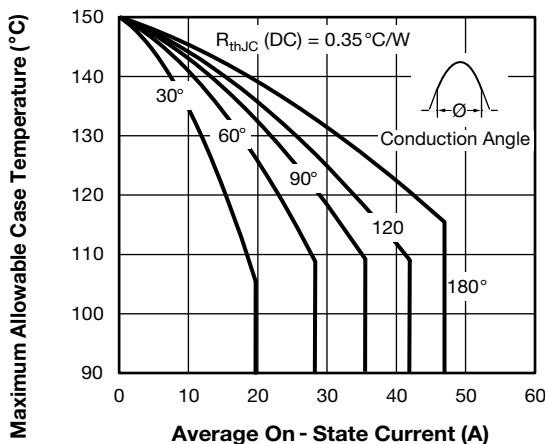


Fig. 1 - Current Rating Characteristics

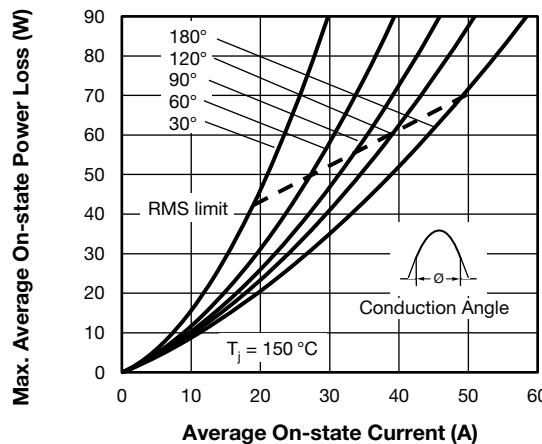


Fig. 3 - On-State Power Loss Characteristics

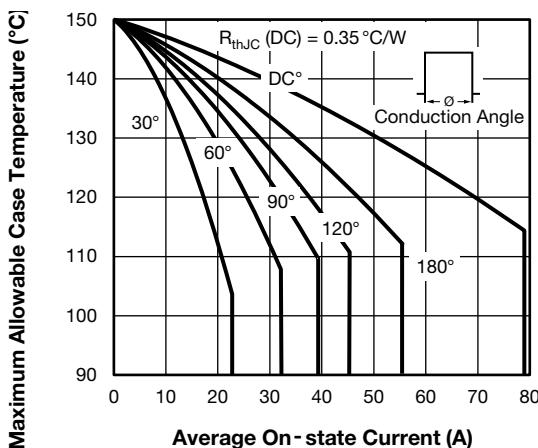


Fig. 2 - Current Rating Characteristics

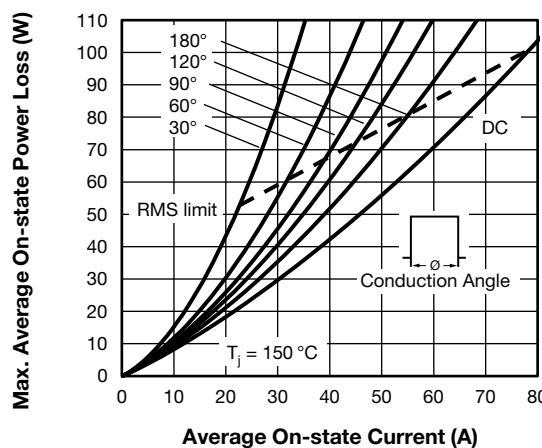


Fig. 4 - On-State Power Loss Characteristics

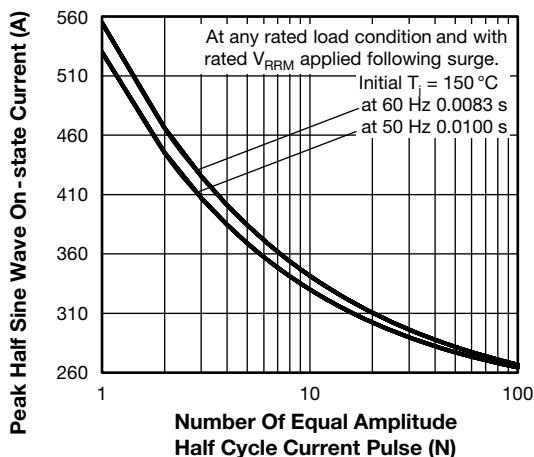


Fig. 5 - Maximum Non-Repetitive Surge Current

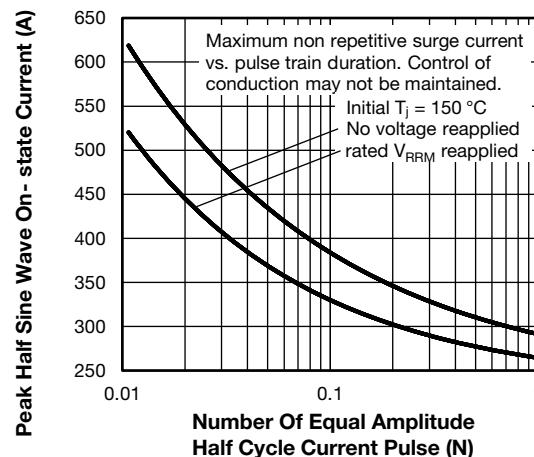


Fig. 6 - Maximum Non-Repetitive Surge Current

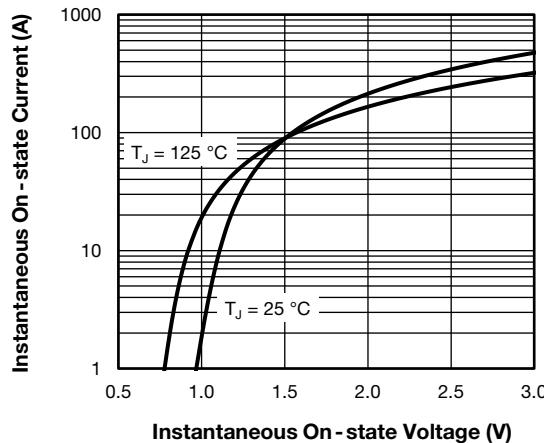


Fig. 7 - On-State Voltage Drop Characteristics

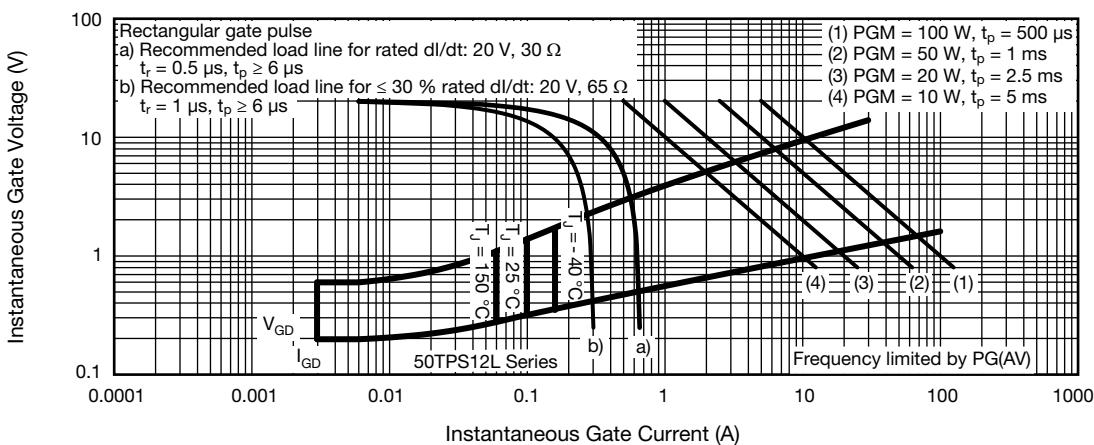
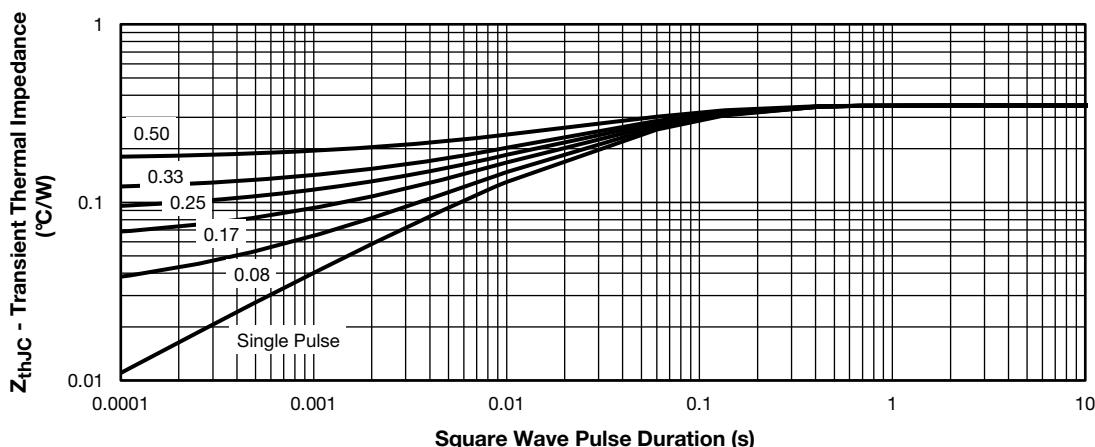


Fig. 8 - Gate Characteristics


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 |

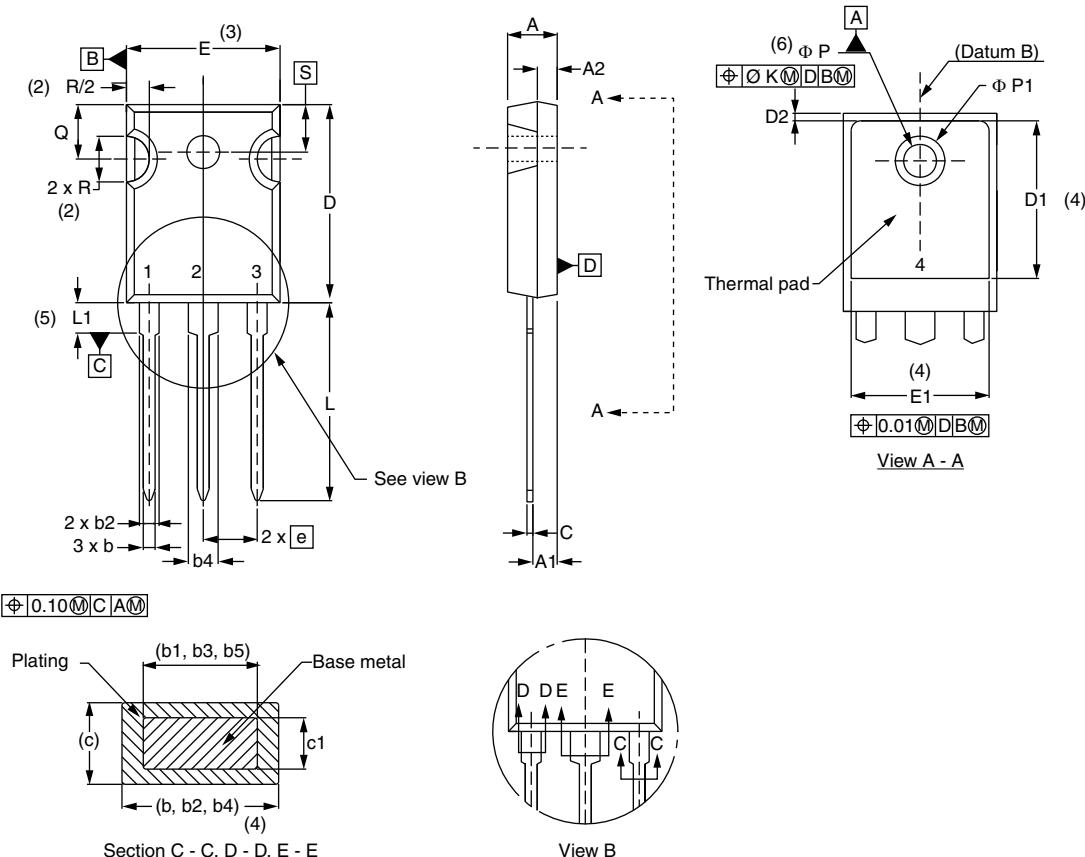
- 1** - Vishay Semiconductors product
- 2** - Current code (50 = 50 A)
- 3** - Circuit configuration:
T = thyristor
- 4** - P = TO-247AD package
- 5** - Type of silicon:
S = standard recovery rectifier
- 6** - Voltage code (12 = 1200 V)
- 7** - Package L = long lead
- 8** - H = AEC-Q101 qualified
- 9**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

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 | 0.254 | | 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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