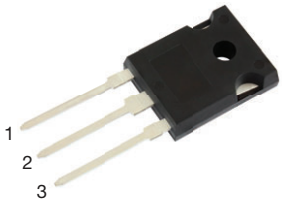
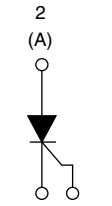
# Thyristor High Voltage, Phase Control SCR, 50 A




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

| 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 |

## 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 | $V_{RRM}$ / $V_{DRM}$ | | 1200 | V |
| On-state voltage | $V_T$ | 50 A, $T_J$ = 125 °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/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 |



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## ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | TEST CONDITIONS | | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Maximum average on-state current | $I_{T(AV)}$ | $T_C$ = 112 °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 | Initial $T_J = T_J$ maximum | - | 530 | |
| | | 10 ms sine pulse, no voltage reapplied | | - | 630 | |
| $I^2t$ for fusing | $I^2t$ | 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 ms to 10 ms, no voltage reapplied, $T_J$ = 125 °C | | - | 19 850 | $A^2\sqrt{s}$ |
| Low level value of threshold voltage | $V_{T(TO)1}$ | $T_J$ = 125 °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 | mΩ |
| High level value of on-state slope resistance | $r_{t2}$ | | | - | 6.32 | |
| On-state voltage | $V_T$ | 50 A, $T_J$ = 25 °C | | 1.2 | 1.32 | V |
| | | 100 A, $T_J$ = 25 °C | | 1.4 | 1.6 | |
| Rate of rise of turned-on current | di/dt | $T_J$ = 25 °C | | - | 150 | A/µs |
| Holding current | $I_H$ | Anode supply = 6 V, resistive load, $T_J$ = 25 °C | | - | 300 | mA |
| Latching current | $I_L$ | | | - | 350 | |
| Reverse and direct leakage current | $I_{RRM}/I_{DRM}$ | $T_J$ = 25 °C | | - | 0.05 | |
| | | $T_J$ = 150 °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 Ω | | - | 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 °C | Anode supply = 6 V resistive load | - | 1.6 | |
| | | $T_J$ = 25 °C | | - | 1.5 | |
| | | $T_J$ = 150 °C | | - | 1 | |
| Required DC gate to trigger | $I_{GT}$ | $T_J$ = -40 °C | Anode supply = 6 V resistive load | - | 160 | mA |
| | | $T_J$ = 25 °C | | 45 | 100 | |
| | | $T_J$ = 150 °C | | - | 60 | |
| DC gate voltage not to trigger | $V_{GD}$ | $T_J$ = 150 °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 A, $V_D$ = 50 % $V_{DRM}$, $I_{gt}$ = 300 mA, $T_J$ = 25 °C | 1.5 | - | µs |
| Turn-off time | $t_q$ | $I_T$ = 50 A, $V_D$ = 80 % $V_{DRM}$, dV/dt = 20 V/µs, $t_p$ = 200 µs<br>$I_{gt}$ = 100 mA, dI/dt = 10 A/µs, $V_R$ = 100 V, $T_J$ = 150 °C | 92 | - | |


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| 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 | | |

| $\Delta R_{thJ\text{-}HS}$ 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 |

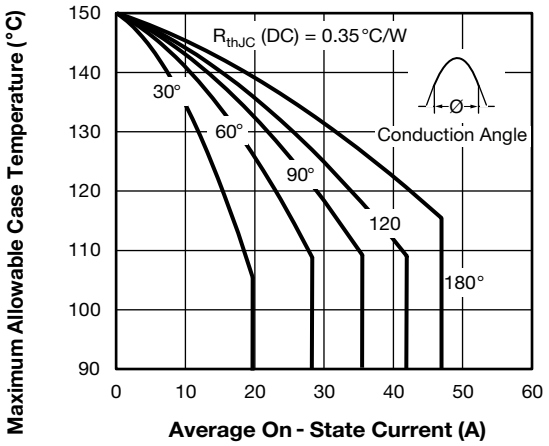



Fig. 1 - Current Rating Characteristics

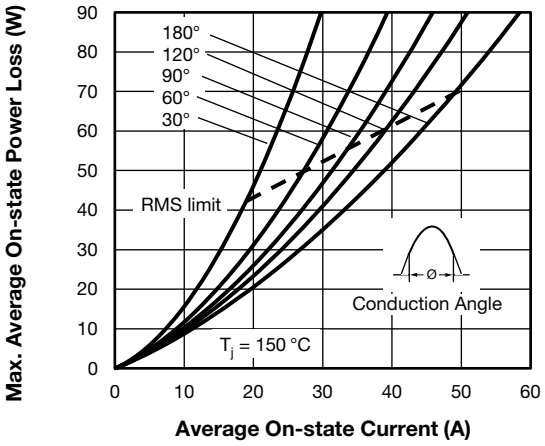



Fig. 3 - On-State Power Loss Characteristics

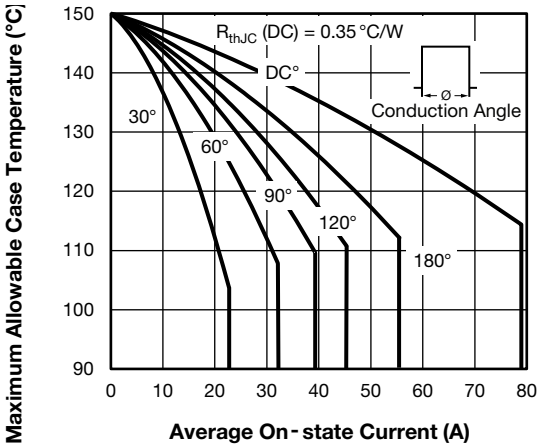



Fig. 2 - Current Rating Characteristics

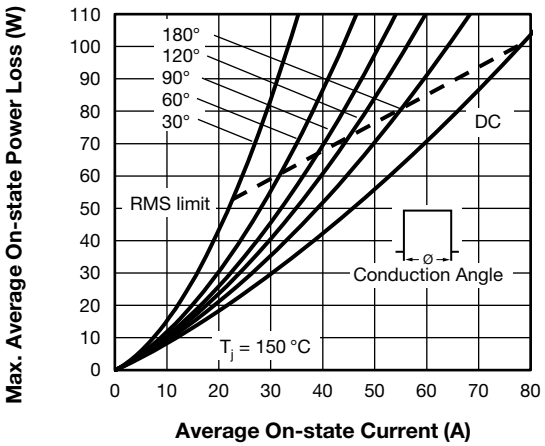



Fig. 4 - On-State Power Loss Characteristics



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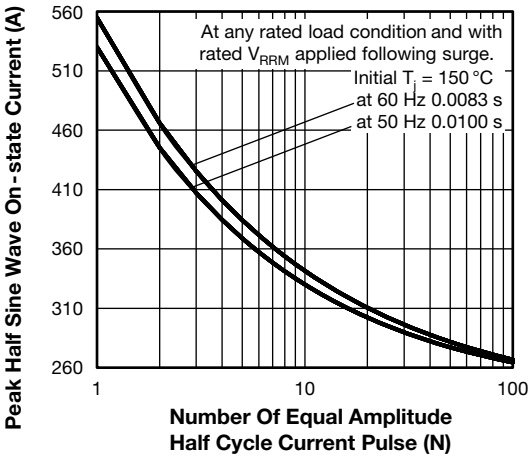



Fig. 5 - Maximum Non-Repetitive Surge Current

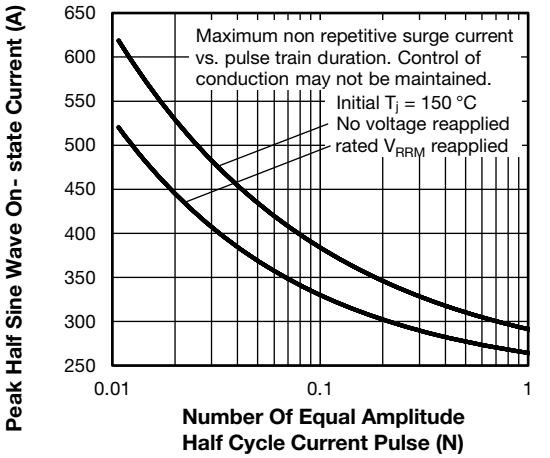



Fig. 6 - Maximum Non-Repetitive Surge Current

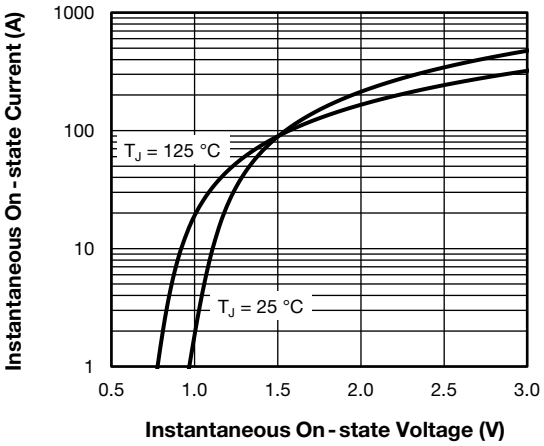



Fig. 7 - On-State Voltage Drop Characteristics

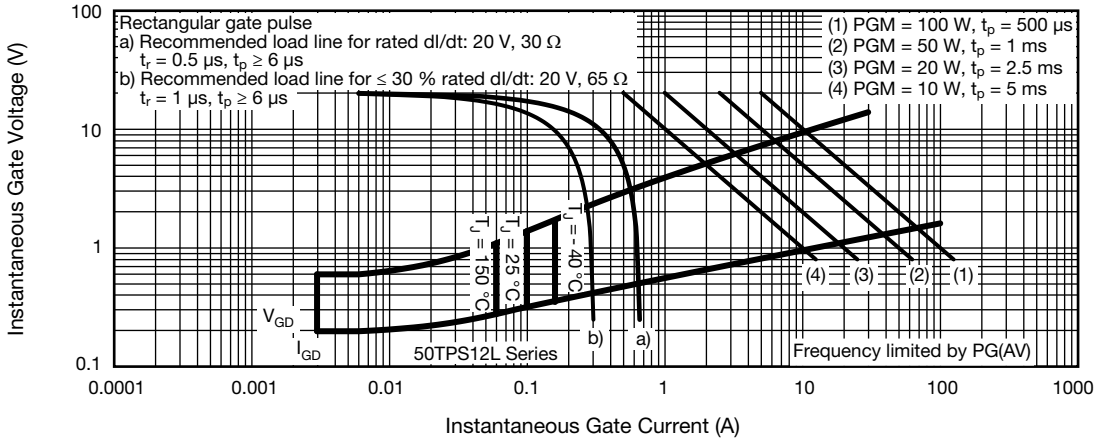



Fig. 8 - Gate Characteristics


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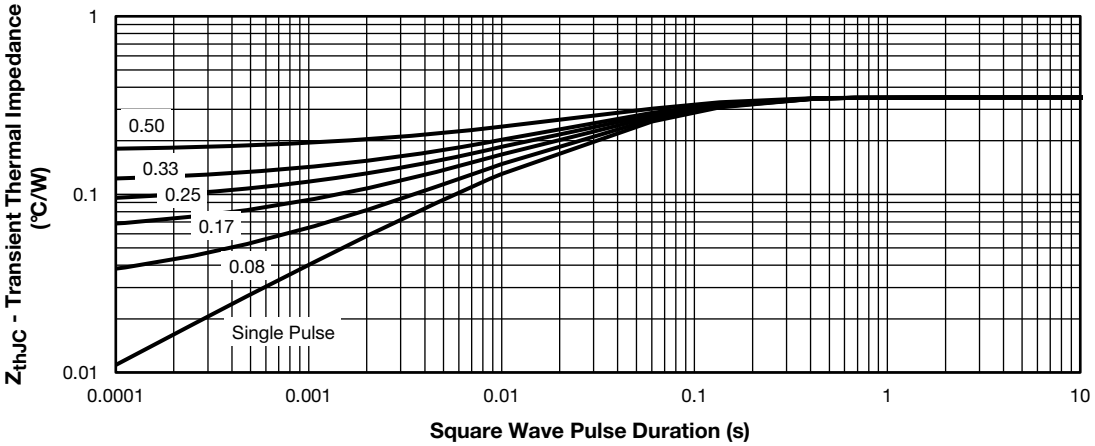



Fig. 9 - Thermal Impedance $Z_{thJC}$ Characteristics

## 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

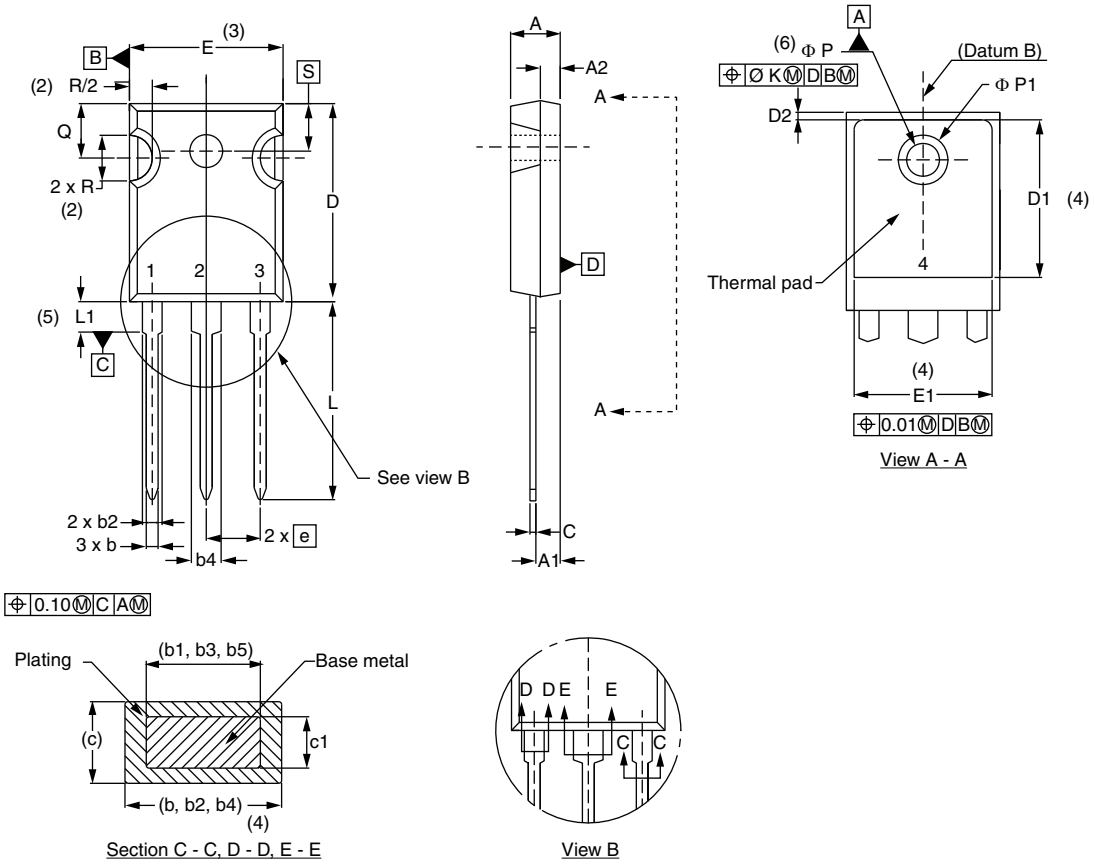
| **ORDERING INFORMATION** (example) | | | |
|---|---|---|---|
| **PREFERRED P/N** | **QUANTITY PER TUBE** | **MINIMUM ORDER QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-50TPS12LHM3 | 25 | contact factory | Antistatic plastic tubes |

| **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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# TO-247AD 3L

**DIMENSIONS** in millimeters and inches




| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.65 | 5.31 | 0.183 | 0.209 | |
| A1 | 2.21 | 2.59 | 0.087 | 0.102 | |
| A2 | 1.50 | 2.49 | 0.059 | 0.098 | |
| b | 0.99 | 1.40 | 0.039 | 0.055 | |
| b1 | 0.99 | 1.35 | 0.039 | 0.053 | |
| b2 | 1.65 | 2.39 | 0.065 | 0.094 | |
| b3 | 1.65 | 2.34 | 0.065 | 0.092 | |
| b4 | 2.59 | 3.43 | 0.102 | 0.135 | |
| b5 | 2.59 | 3.38 | 0.102 | 0.133 | |
| c | 0.38 | 0.89 | 0.015 | 0.035 | |
| c1 | 0.38 | 0.84 | 0.015 | 0.033 | |
| D | 19.71 | 20.70 | 0.776 | 0.815 | 3 |
| D1 | 13.08 | - | 0.515 | - | 4 |

| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| D2 | 0.51 | 1.30 | 0.020 | 0.051 | |
| E | 15.29 | 15.87 | 0.602 | 0.625 | 3 |
| E1 | 13.46 | - | 0.53 | - | |
| e | 5.46 BSC | | 0.215 BSC | | |
| Ø K | 0.254 | | 0.010 | | |
| L | 19.81 | 20.32 | 0.780 | 0.800 | |
| L1 | 3.71 | 4.29 | 0.146 | 0.169 | |
| Ø P | 3.56 | 3.66 | 0.14 | 0.144 | |
| Ø P1 | - | 6.98 | - | 0.275 | |
| Q | 5.31 | 5.69 | 0.209 | 0.224 | |
| R | 4.52 | 5.49 | 0.178 | 0.216 | |
| S | 5.51 BSC | | 0.217 BSC | | |

**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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