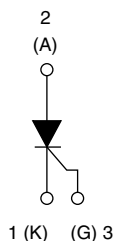
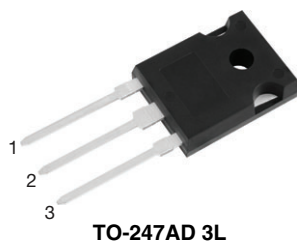


# Thyristor High Voltage, Phase Control SCR, 50 A



## FEATURES

- Designed and qualified according to JEDEC®-JESD 47
- Low  $I_{GT}$  designed
- 150 °C maximum operating junction temperature
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://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.)       | 1.1 V             |
| $I_{GT}$ (typ.)       | 35 mA             |
| $T_J$                 | -40 °C to +150 °C |
| Package               | TO-247AD 3L       |
| Circuit configuration | Single SCR        |

## APPLICATIONS

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

## DESCRIPTION

The VS-50TPS12 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 operation up to 150 °C junction temperature.

## MAJOR RATINGS AND CHARACTERISTICS

| PARAMETER         | TEST CONDITIONS      | VALUES      | UNITS |
|-------------------|----------------------|-------------|-------|
| $V_{RRM}/V_{DRM}$ |                      | 1200        | V     |
| $V_T$             | 50 A, $T_J = 125$ °C | 1.1         |       |
| $I_{T(AV)}$       |                      | 50          | A     |
| $I_{RMS}$         |                      | 79          |       |
| $I_{TSM}$         |                      | 630         |       |
| $dV/dt$           |                      | 500         | V/μs  |
| $T_J, T_{Stg}$    |                      | -40 to +150 | °C    |

## VOLTAGE RATINGS

| PART NUMBER     | $V_{RRM}/V_{DRM}$ , MAXIMUM<br>REPETITIVE PEAK AND<br>OFF-STATE VOLTAGE<br>V | $V_{RSM}$ , MAXIMUM<br>NON-REPETITIVE PEAK<br>REVERSE VOLTAGE<br>V | $I_{RRM}/I_{DRM}$<br>AT 125 °C<br>mA |
|-----------------|------------------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------|
| VS-50TPS12AL-M3 | 1200                                                                         | 1300                                                               | 10                                   |

**ABSOLUTE MAXIMUM RATINGS**

| PARAMETER                                            | SYMBOL            | TEST CONDITIONS                                                                                 | VALUES |        | UNITS             |
|------------------------------------------------------|-------------------|-------------------------------------------------------------------------------------------------|--------|--------|-------------------|
|                                                      |                   |                                                                                                 | TYP.   | MAX.   |                   |
| Maximum average on-state current                     | $I_{T(AV)}$       | $T_C = 112\text{ }^{\circ}\text{C}$ , 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    |                   |
|                                                      |                   | 10 ms sine pulse, no voltage reapplied                                                          | -      | 630    | A <sup>2</sup> s  |
| $I^2t$ for fusing                                    | $I^2t$            | 10 ms sine pulse, rated $V_{RRM}$ applied                                                       | -      | 1405   |                   |
|                                                      |                   | 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, $T_J = 125\text{ }^{\circ}\text{C}$ | -      | 19 850 | A <sup>2</sup> √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   | mΩ                |
| 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                    | $dV/dt$           | $T_J = T_J\text{ maximum}$ , linear to 80 % $V_{DRM}$ , $R_g-k = 100\text{ }^{\circ}\Omega$     | -      | 500    | 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 | $V_{GT}$    | $T_J = -40\text{ }^{\circ}\text{C}$                                  | -    | 1.6  |       |
|                                     |             | $T_J = 25\text{ }^{\circ}\text{C}$                                   | -    | 1.5  |       |
|                                     |             | $T_J = 150\text{ }^{\circ}\text{C}$                                  | -    | 1    |       |
| Required DC gate to trigger         | $I_{GT}$    | $T_J = -40\text{ }^{\circ}\text{C}$                                  | -    | 100  | mA    |
|                                     |             | $T_J = 25\text{ }^{\circ}\text{C}$                                   | 35   | 60   |       |
|                                     |             | $T_J = 150\text{ }^{\circ}\text{C}$                                  | -    | 40   |       |
| DC gate voltage not to trigger      | $V_{GD}$    | $T_J = 150\text{ }^{\circ}\text{C}$ , $V_{DRM} = \text{rated value}$ | -    | 0.15 | V     |
| DC gate current not to trigger      | $I_{GD}$    |                                                                      | -    | 2.5  | mA    |

**SWITCHING**

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

**THERMAL AND MECHANICAL SPECIFICATIONS**

| PARAMETER                                       | SYMBOL                            | TEST CONDITIONS                       | TYP.      | MAX. | UNITS                  |
|-------------------------------------------------|-----------------------------------|---------------------------------------|-----------|------|------------------------|
| Maximum junction and storage temperature range  | T <sub>J</sub> , T <sub>Stg</sub> |                                       | -40       | 150  | °C                     |
| Maximum thermal resistance, junction to case    | R <sub>thJC</sub>                 |                                       | -         | 0.35 | °C/W                   |
| Maximum thermal resistance, junction to ambient | R <sub>thJA</sub>                 |                                       | -         | 40   |                        |
| Typical thermal resistance, case to heatsink    | R <sub>thCS</sub>                 | Mounting surface, smooth, and greased | 0.2       | -    |                        |
| Mounting torque                                 | minimum                           |                                       | 6 (5)     |      | kgf · cm<br>(lbf · in) |
|                                                 | maximum                           |                                       | 12 (10)   |      |                        |
| Marking device                                  |                                   | Case style Super TO-247AD 3L          | 50TPS12AL |      |                        |

 **$\Delta R_{thJ-HS}$  CONDUCTION PER JUNCTION**

| DEVICE         | SINE HALF-WAVE CONDUCTION |       |       |       |       | RECTANGULAR WAVE CONDUCTION |       |       |       |       | UNITS |
|----------------|---------------------------|-------|-------|-------|-------|-----------------------------|-------|-------|-------|-------|-------|
|                | 180°                      | 120°  | 90°   | 60°   | 30°   | 180°                        | 120°  | 90°   | 60°   | 30°   |       |
| VS-50TPS12L-M3 | 0.143                     | 0.166 | 0.208 | 0.299 | 0.490 | 0.099                       | 0.168 | 0.223 | 0.311 | 0.494 | °C/W  |

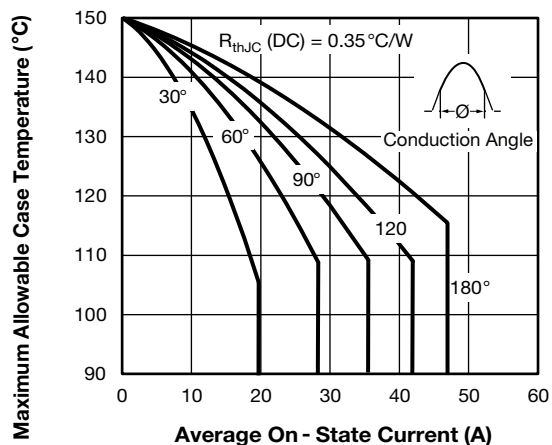


Fig. 1 - Current Rating Characteristics

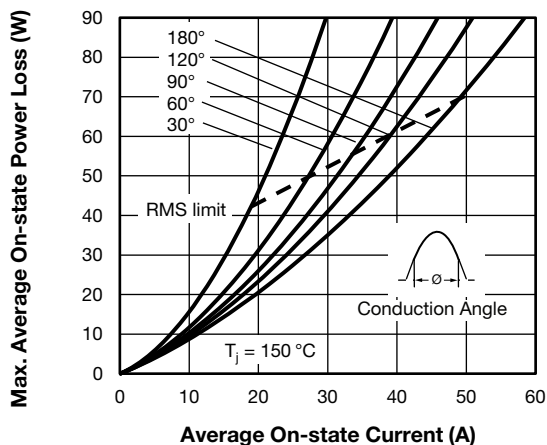


Fig. 3 - On-State Power Loss Characteristics

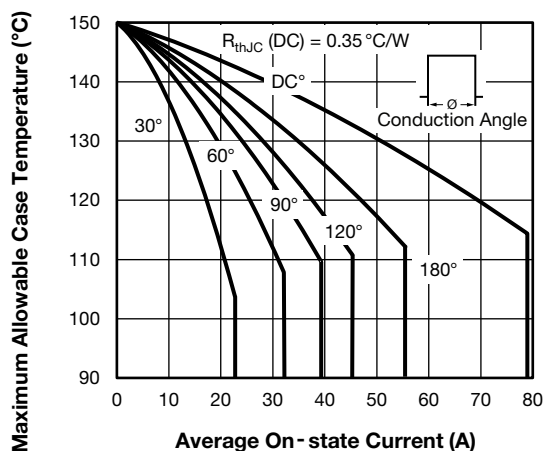


Fig. 2 - Current Rating Characteristics

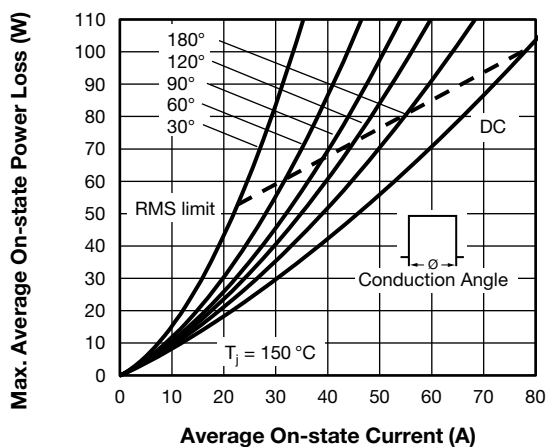


Fig. 4 - On-State Power Loss Characteristics

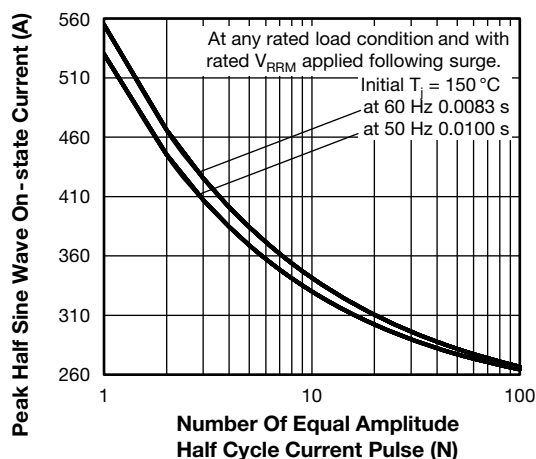


Fig. 5 - Maximum Non-Repetitive Surge Current

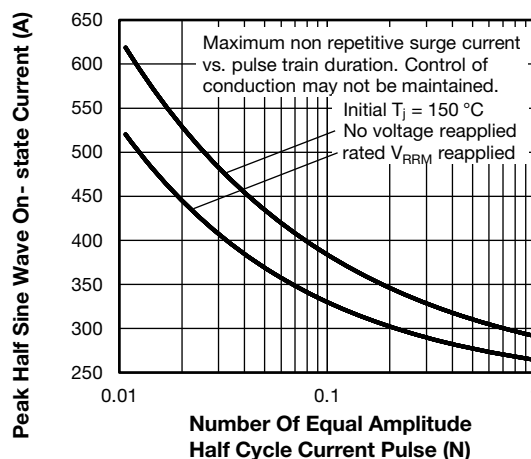


Fig. 6 - Maximum Non-Repetitive Surge Current

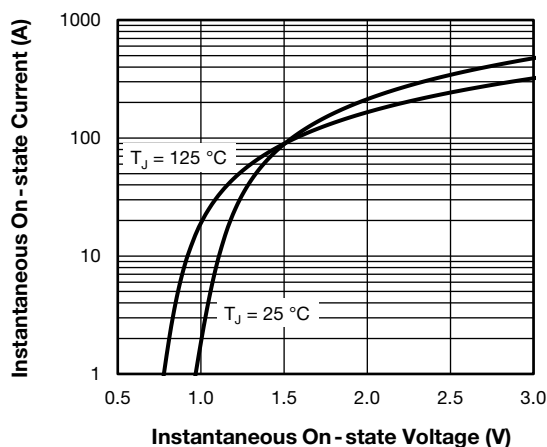


Fig. 7 - On-State Voltage Drop Characteristics

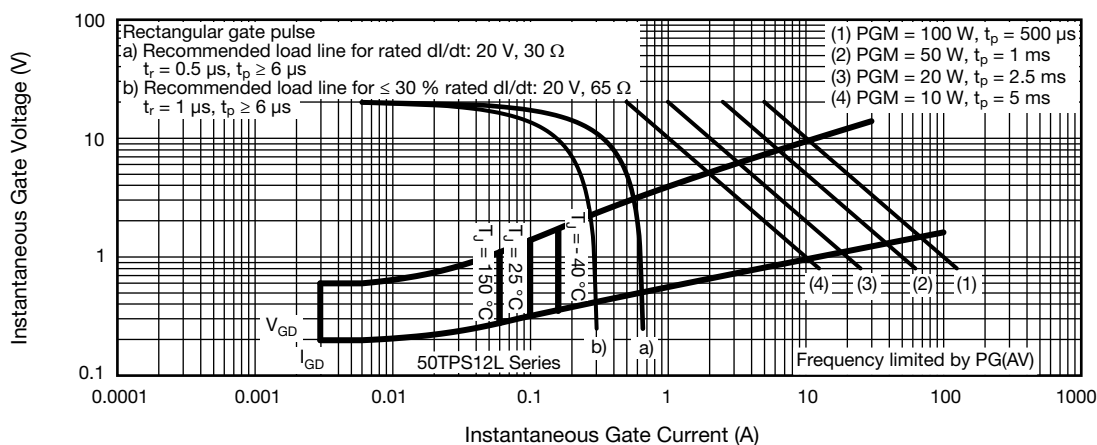
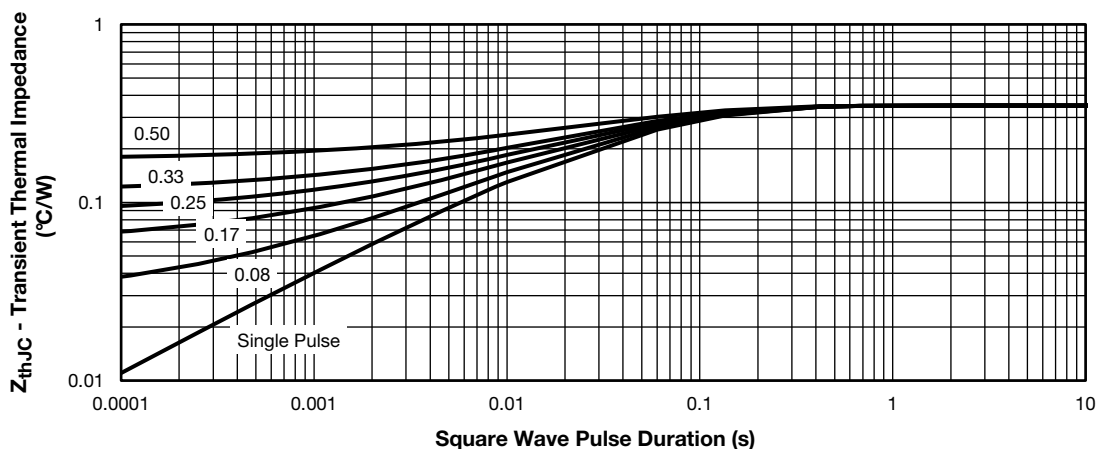


Fig. 8 - Gate Characteristics


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

## ORDERING INFORMATION TABLE

|             |            |           |          |          |          |           |          |          |            |
|-------------|------------|-----------|----------|----------|----------|-----------|----------|----------|------------|
| Device code | <b>VS-</b> | <b>50</b> | <b>T</b> | <b>P</b> | <b>S</b> | <b>12</b> | <b>A</b> | <b>L</b> | <b>-M3</b> |
|             | 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 3L package
- 5** - Type of silicon:  
S = standard recovery rectifier
- 6** - Voltage code (12 = 1200 V)
- 7** - A = Low  $I_{GT}$  selection
- 8** - Package L = long lead
- 9** - -M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

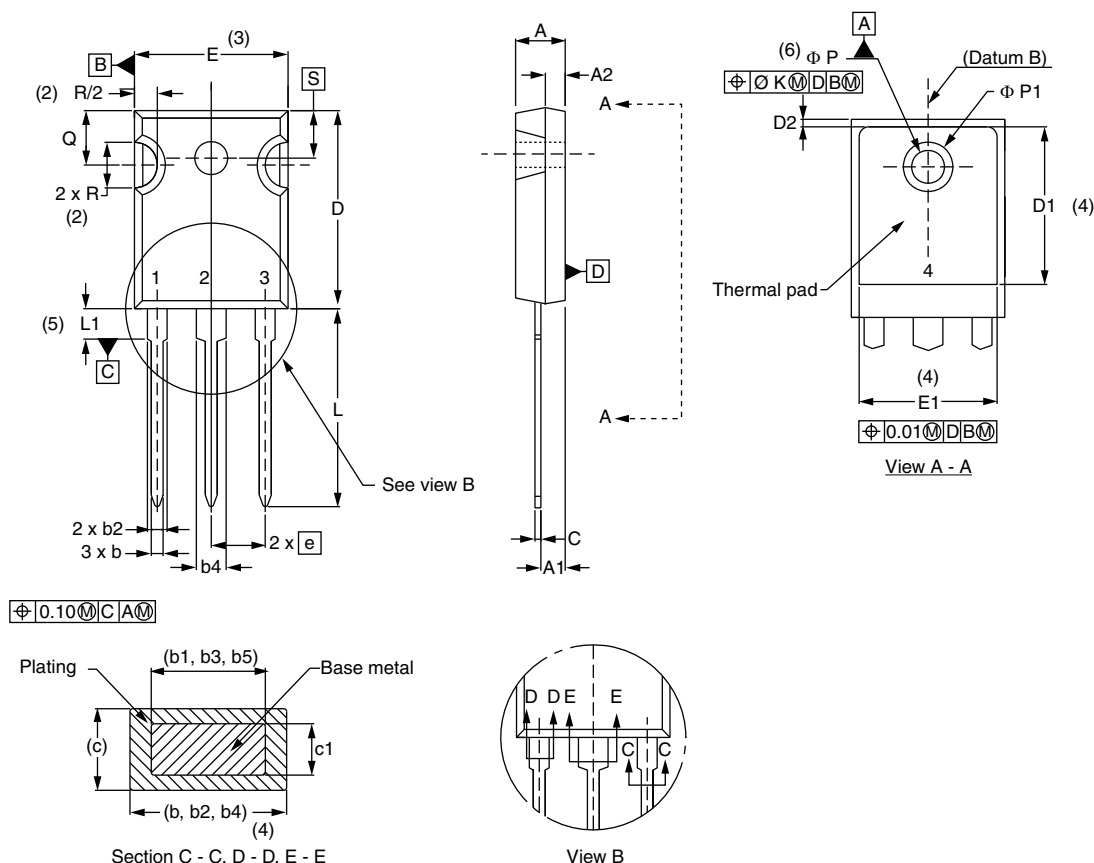
| ORDERING INFORMATION (example) |                   |                        |                          |
|--------------------------------|-------------------|------------------------|--------------------------|
| PREFERRED P/N                  | QUANTITY PER TUBE | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION    |
| VS-50TPS12AL-M3                | 25                | 500                    | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS |                                                                        |
|----------------------------|------------------------------------------------------------------------|
| Dimensions                 | <a href="http://www.vishay.com/doc?95626">www.vishay.com/doc?95626</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95007">www.vishay.com/doc?95007</a> |



### 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 |       |       |
| $\Phi K$  | 0.254       |       | 0.010     |       |       |
| L         | 19.81       | 20.32 | 0.780     | 0.800 |       |
| L1        | 3.71        | 4.29  | 0.146     | 0.169 |       |
| $\Phi P$  | 3.56        | 3.66  | 0.14      | 0.144 |       |
| $\Phi P1$ | -           | 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

- Dimensioning and tolerancing per ASME Y14.5M-1994
- Contour of slot optional
- Dimension D and E do not include mold flash. These dimensions are measured at the outermost extremes of the plastic body
- Thermal pad contour optional with dimensions D1 and E1
- Lead finish uncontrolled in L1
- $\Phi P$  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")
- 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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