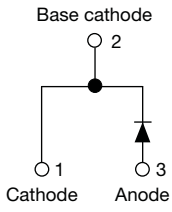
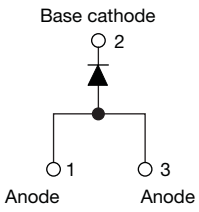
## Fast Soft Recovery Rectifier Diode, 45 A


TO-247AD 2L


TO-247AD 3L




VS-45EPF06LHM3




VS-45APF06LHM3

### FEATURES

- Very low forward voltage drop
- Glass passivated pellet chip junction
- AEC-Q101 qualified meets JESD 201 class 1A whisker test
- Flexible solution for reliable AC power rectification
- High surge, low $V_F$ rugged blocking diode for DC charging stations
- 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

High voltage rectifiers optimized for very low forward voltage drop with moderate leakage, and short reverse recovery time.

These devices are intended for use in main rectification (single or three phase bridge)

| PRIMARY CHARACTERISTICS | |
|---|---|
| $I_{F(AV)}$ | 45 A |
| $V_R$ | 600 V |
| $V_F$ at $I_F$ | 1.31 V |
| $I_{FSM}$ | 550 A |
| $t_{rr}$ | 60 ns |
| $T_J$ max. | 150 °C |
| Package | TO-247AD 2L, TO-247AD 3L |
| Circuit configuration | Single |
| Snap factor | 0.5 |

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|---|---|---|---|
| SYMBOL | CHARACTERISTICS | VALUES | UNITS |
| $I_{F(AV)}$ | Sinusoidal waveform | 45 | A |
| $V_{RRM}$ | | 600 | V |
| $I_{FSM}$ | | 550 | A |
| $V_F$ | 20 A, $T_J$ = 25 °C | 1.09 | V |
| $t_{rr}$ | 1 A, 100 A /µs | 60 | ns |
| $T_J$ | | -40 to +150 | °C |

| VOLTAGE RATINGS | | | |
|---|---|---|---|
| PART NUMBER | $V_{RRM}$, MAXIMUM PEAK REVERSE VOLTAGE V | $V_{RSM}$, MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V | $I_{RRM}$ AT 150 °C mA |
| VS-45EPF06LHM3 | 600 | 700 | 8 |
| VS-45APF06LHM3 | 600 | 700 | |

## ABSOLUTE MAXIMUM RATINGS

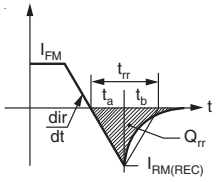
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|---|---|---|---|---|
| Maximum average forward current | $I_{F(AV)}$ | $T_C$ = 108 °C, 180° conduction half sine wave | 45 | A |
| Maximum peak one cycle non-repetitive surge current | $I_{FSM}$ | 10 ms sine pulse, rated $V_{RRM}$ applied | 462 | A |
| | | 10 ms sine pulse, no voltage reapplied | 550 | A |
| Maximum $I^2t$ for fusing | $I^2t$ | 10 ms sine pulse, rated $V_{RRM}$ applied | 1069 | $A^2s$ |
| | | 10 ms sine pulse, no voltage reapplied | 1513 | $A^2s$ |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reapplied | 15 125 | $A^2\sqrt{s}$ |

## ELECTRICAL SPECIFICATIONS

| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
|---|---|---|---|---|---|
| Maximum forward voltage drop | $V_{FM}$ | 45 A, $T_J$ = 25 °C | | 1.31 | V |
| Forward slope resistance | $r_t$ | $T_J$ = 150 °C | | 4.4 | mΩ |
| Threshold voltage | $V_{F(TO)}$ | | | 1.1 | V |
| Maximum reverse leakage current | $I_{RM}$ | $T_J$ = 25 °C | $V_R$ = rated $V_{RRM}$ | 0.1 | mA |
| | | $T_J$ = 150 °C | | 8 | mA |

## RECOVERY CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|---|---|---|---|---|
| Reverse recovery time | $t_{rr}$ | $I_F$ at 40 $A_{pk}$ 25 A/µs 25 °C | 180 | ns |
| Reverse recovery current | $I_{rr}$ | | 3.2 | A |
| Reverse recovery charge | $Q_{rr}$ | | 0.5 | µC |
| Snap factor | S | Typical | 0.5 | |




## THERMAL - MECHANICAL SPECIFICATIONS

| PARAMETER | | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|---|---|---|---|---|---|
| Maximum junction and storage temperature range | | $T_J$, $T_{Stg}$ | | -40 to +150 | °C |
| Maximum thermal resistance, unction to case | | $R_{thJC}$ | DC operation | 0.4 | °C/W |
| Maximum thermal resistance, junction to ambient | | $R_{thJA}$ | | 40 | °C/W |
| Typical thermal resistance, case to heatsink | | $R_{thCS}$ | Mounting surface, smooth, and greased | 0.25 | °C/W |
| Approximate weight | | | | 6 | g |
| | | | | 0.21 | oz. |
| Mounting torque | minimum | | | 6 (5) | kgf · cm (lbf · in) |
| | maximum | | | 12 (10) | kgf · cm (lbf · in) |
| Marking device | | | Case style TO-247AD 2L | 45EPF06LH | |
| | | | Case style TO-247AD 3L | 45APF06LH | |

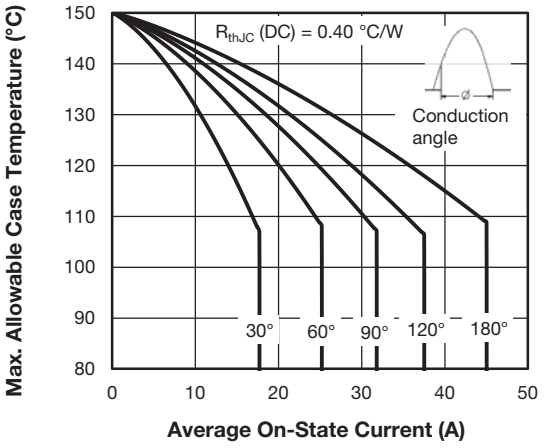



Fig. 1 - Current Rating Characteristics

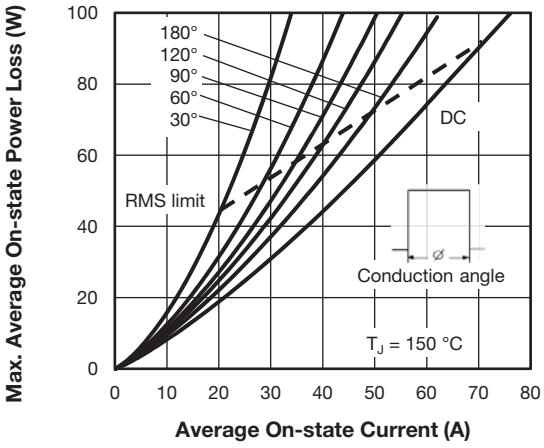



Fig. 4 - Forward Power Loss Characteristics

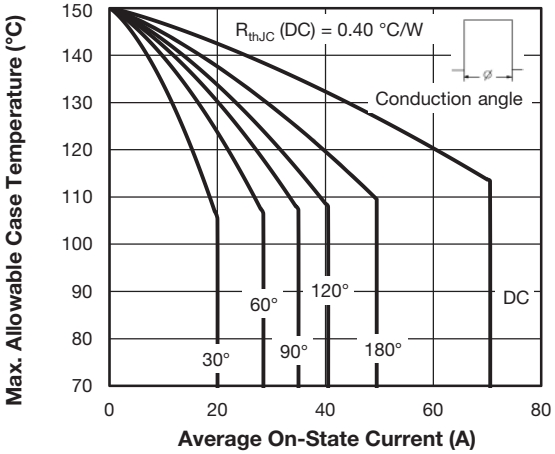



Fig. 2 - Current Rating Characteristics

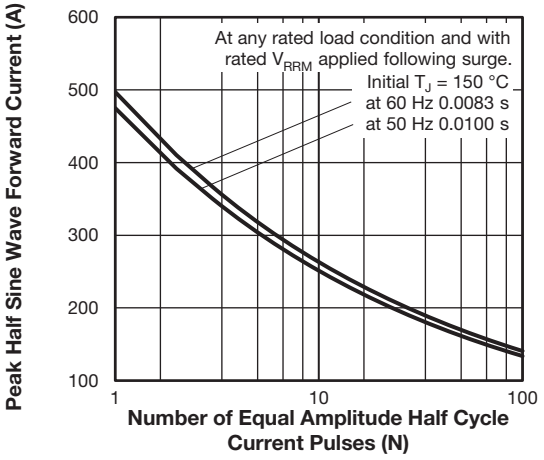



Fig. 5 - Maximum Non-Repetitive Surge Current

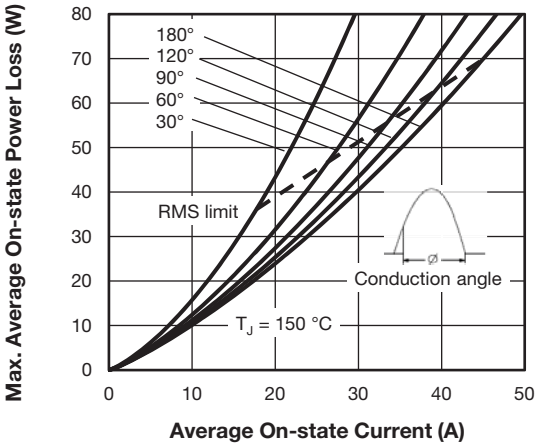



Fig. 3 - Forward Power Loss Characteristics

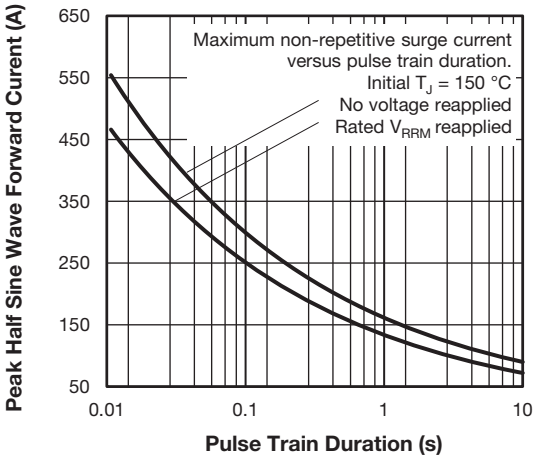



Fig. 6 - Maximum Non-Repetitive Surge Current

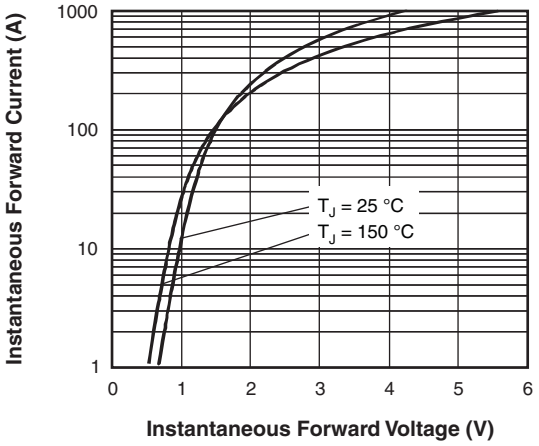



Fig. 7 - Forward Voltage Drop Characteristics

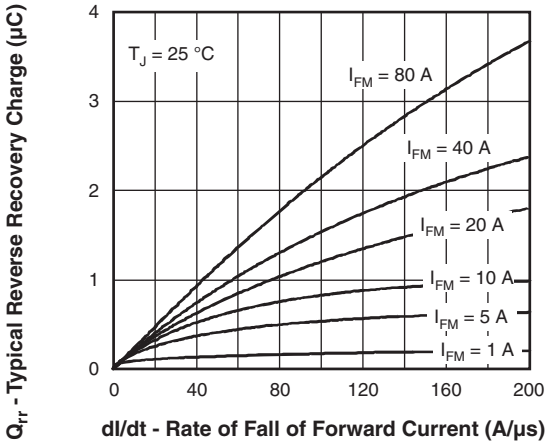



Fig. 10 - Recovery Charge Characteristics, $T_J$ = 25 °C

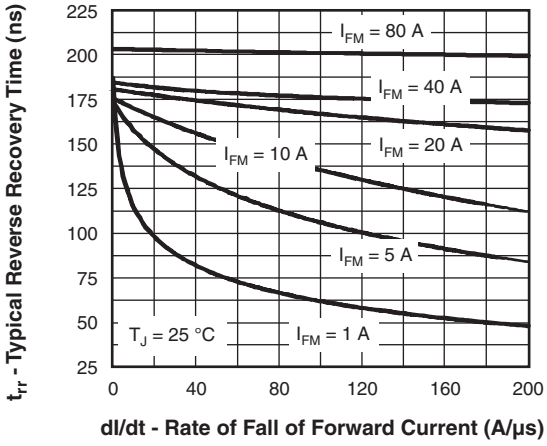



Fig. 8 - Thermal Impedance $Z_{thJC}$ Characteristics

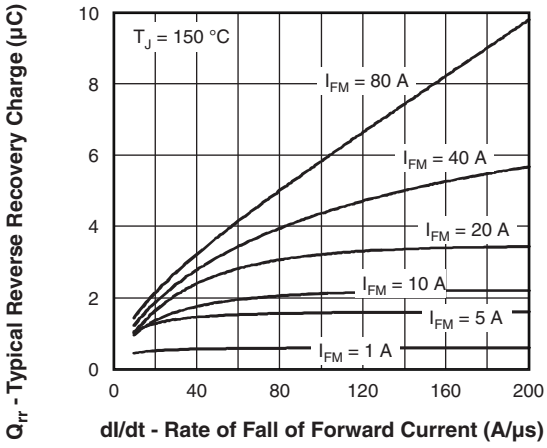



Fig. 11 - Recovery Charge Characteristics, $T_J$ = 150 °C

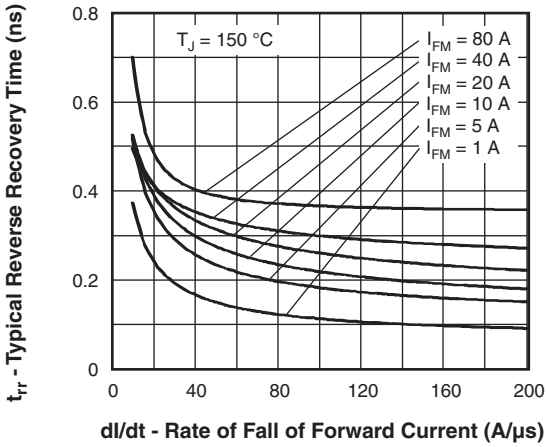



Fig. 9 - Recovery Time Characteristics, $T_J$ = 150 °C

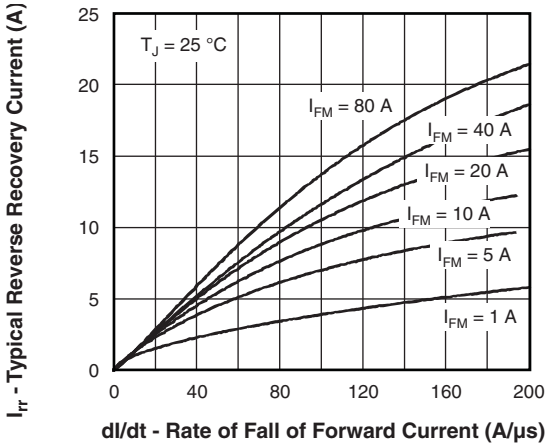



Fig. 12 - Recovery Current Characteristics, $T_J$ = 25 °C

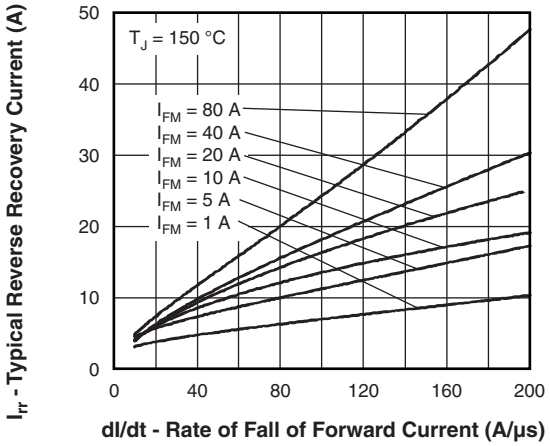



Fig. 13 - Recovery Current Characteristics, $T_J$ = 150 °C

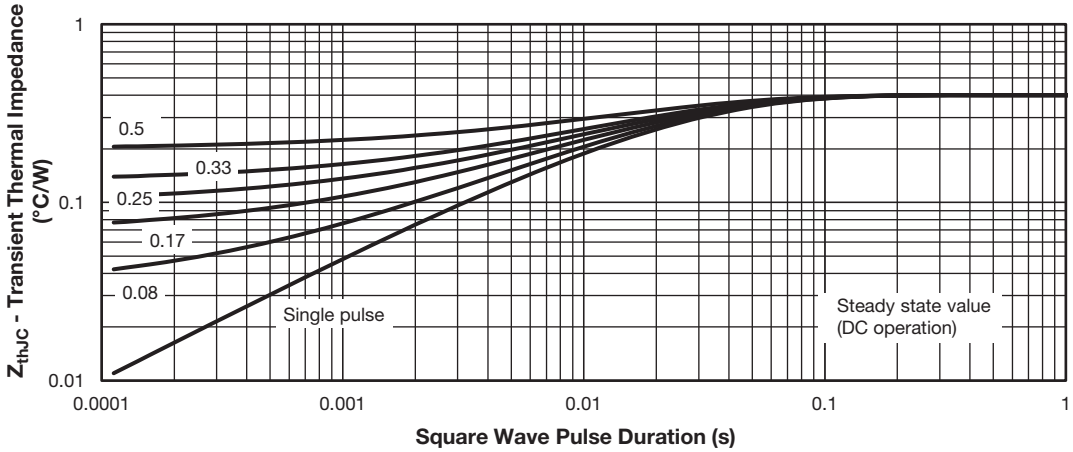
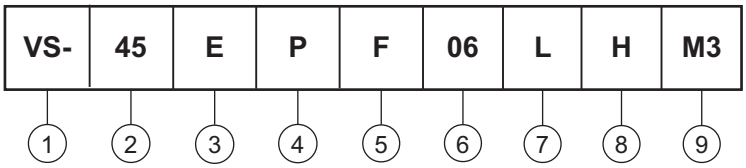



Fig. 14 - Thermal Impedance $Z_{thJC}$ Characteristics

## ORDERING INFORMATION TABLE

Device code



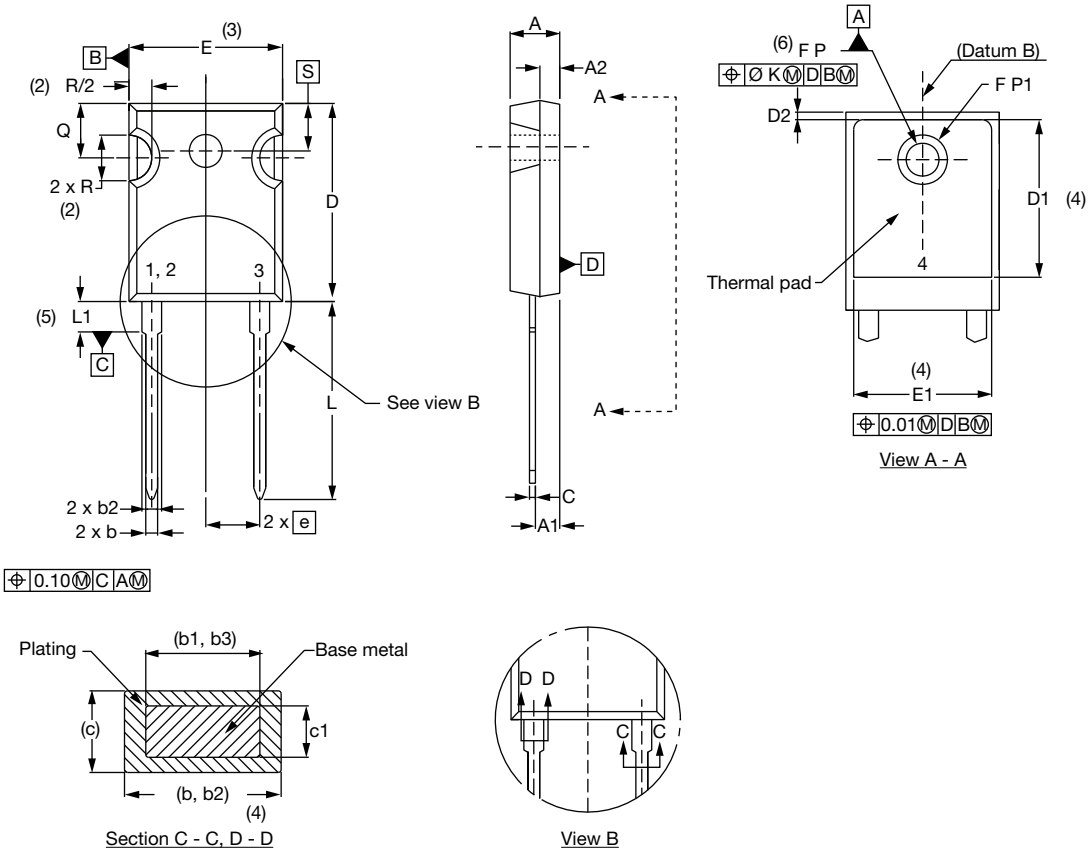

1 - Vishay Semiconductors product
2 - Current rating (45 = 45 A)
3 - Circuit configuration:
E = single, 2 pins
A = single, 3 pins
4 - Package:
P = TO-247AD
5 - Type of silicon:
F = fast recovery rectifier
6 - Voltage code x 100 = $V_{RRM}$ — 06 = 600 V
7 - L = long leads
8 - H = AEC-Q101 qualified
9 - Environmental digit:
M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

| **ORDERING INFORMATION** (Example) | | | |
|---|---|---|---|
| **PREFERRED P/N** | **QUANTITY PER T/R** | **MINIMUM ORDER QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-45EPF06LHM3 | 25 | 500 | Antistatic plastic tubes |
| VS-45APF06LHM3 | 25 | 500 | Antistatic plastic tubes |

| **LINKS TO RELATED DOCUMENTS** | | |
|---|---|---|
| Dimensions | TO-247AD 2L | www.vishay.com/doc?95536 |
| | TO-247AD 3L | www.vishay.com/doc?95626 |
| Part marking information | TO-247AD 2L | www.vishay.com/doc?95648 |
| | TO-247AD 3L | www.vishay.com/doc?95007 |

# TO-247AD 2L

**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 | |
| 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 |
| D2 | 0.51 | 1.35 | 0.020 | 0.053 | |

| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| 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

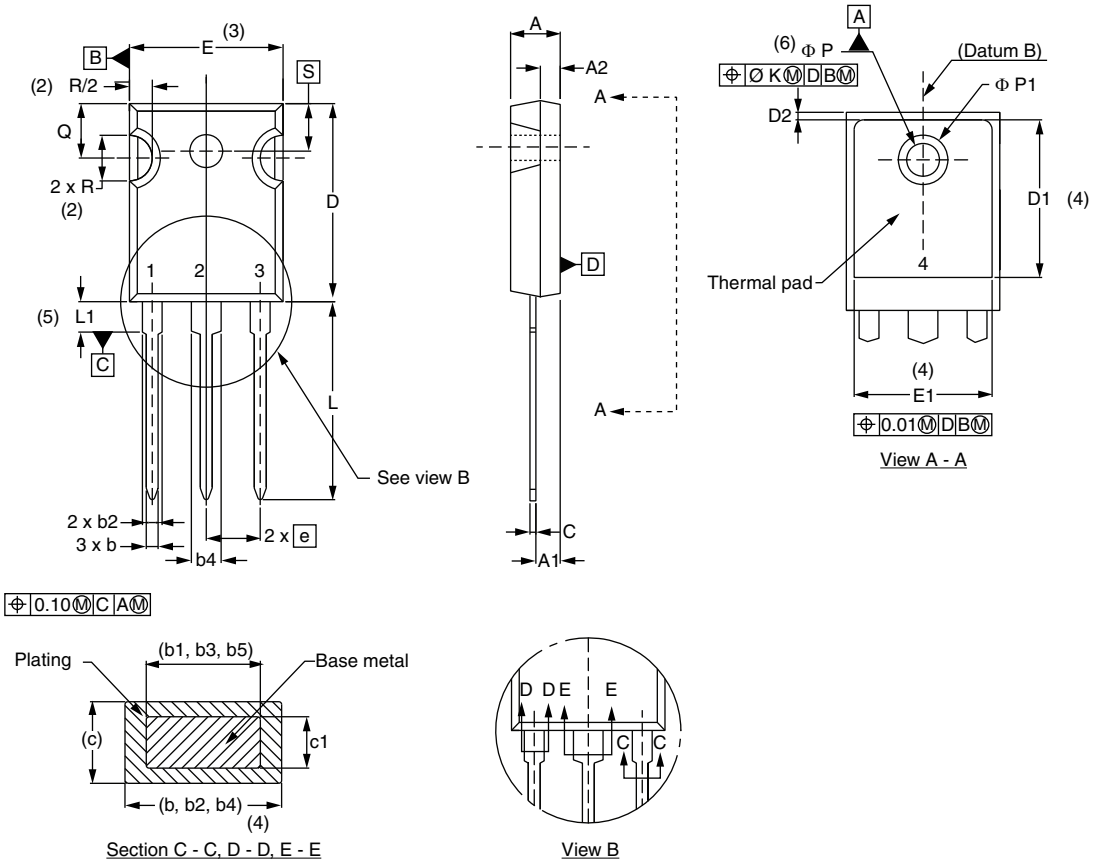
(5) Lead finish uncontrolled in L1

(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

# 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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