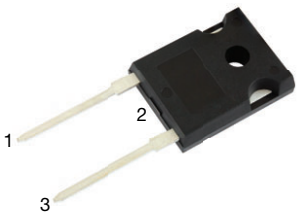
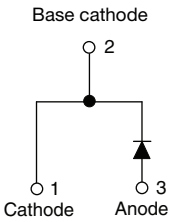
# Ultrafast Rectifier, 50 A FRED Pt®




TO-247AD 2L




## FEATURES

- Ultrafast and soft recovery
- Optimized forward voltage drop
- 175 °C maximum operating junction temperature
- Polyimide passivation
- Rugged design
- Good thermal performance
- AEC-Q101 qualified available
- Meets JESD 201 class 1 whisker test
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
e3
RoHS COMPLIANT
HALOGEN FREE

| PRODUCT SUMMARY | |
|---|---|
| Package | TO-247AD 2L |
| $I_{F(AV)}$ | 50 A |
| $V_R$ | 1200 V |
| $V_F$ at $I_F$ at 125 °C | 1.95 V |
| $t_{rr}$ | 57 ns |
| $T_J$ max. | 175 °C |
| Diode variation | Single die |

## DESCRIPTION / APPLICATIONS

Ultrafast recovery rectifiers designed with optimized performance of forward voltage drop, recovery time, and soft recovery. Polyimide passivated, planar structure, and the platinum doped life time control guarantee, ruggedness, reliability characteristics, and solid value proposition for efficiency and thermal performance.

These devices are intended for use in boost stage in the AC/DC section of SMPS, high frequency output rectification of battery charger, inverters for solar inverters, or as freewheeling diodes in motor drive.

**ABSOLUTE MAXIMUM RATINGS**

| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|---|---|---|---|---|
| Repetitive peak reverse voltage | $V_{RRM}$ | | 1200 | V |
| Average rectified forward current | $I_{F(AV)}$ | $T_C$ = 138 °C, D = 0.50 | 50 | A |
| Non-repetitive peak surge current | $I_{FSM}$ | $T_C$ = 25 °C, $t_p$ = 10 ms, sine wave | 400 | |
| Repetitive peak forward current | $I_{FRM}$ | | 100 | |
| Operating junction and storage temperature | $T_J$, $T_{Stg}$ | | -55 to +175 | °C |

**ELECTRICAL SPECIFICATIONS** ($T_J$ = 25 °C unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Breakdown voltage, blocking voltage | $V_{BR}$, $V_R$ | $I_R$ = 500 μA | 1200 | - | - | V |
| Forward voltage | $V_F$ | $I_F$ = 50 A | - | 2.05 | 2.55 | |
| | | $I_F$ = 50 A, $T_J$ = 125 °C | - | 1.95 | 2.37 | |
| Reverse leakage current | $I_R$ | $V_R$ = $V_R$ rated | - | - | 330 | μA |
| | | $T_J$ = 125 °C, $V_R$ = $V_R$ rated | - | - | 580 | |
| Junction capacitance | $C_T$ | $V_R$ = 200 V | - | 55 | - | pF |
| Series inductance | $L_S$ | Measured to lead 5 mm from package body | - | 8 | - | nH |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| DYNAMIC RECOVERY CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 1.0 A, $dI_F/dt$ = 100 A/μs, $V_R$ = 30 V | | - | 57 | - | ns |
| | | $T_J$ = 25 °C | $I_F$ = 50 A<br>$dI_F/dt$ = 100 A/μs<br>$V_R$ = 390 V | - | 262 | - | |
| | | $T_J$ = 125 °C | | - | 473 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 9.8 | - | A |
| | | $T_J$ = 125 °C | | - | 17 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 1280 | - | nC |
| | | $T_J$ = 125 °C | | - | 4056 | - | |

| THERMAL - MECHANICAL SPECIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Thermal resistance, junction to case | $R_{thJC}$ | | - | 0.2 | 0.28 | °C/W |
| Thermal resistance, junction to ambient | $R_{thJA}$ | Typical socket mount | - | 31 | 34 | |
| Thermal resistance, case to heat sink | $R_{thCS}$ | Mounting surface, flat, smooth and greased | - | 0.22 | 0.32 | |
| Weight | | | - | 0.2 | - | g |
| | | | - | 0.07 | - | oz. |
| Mounting torque | | | 6.0<br>(5.0) | - | 12<br>(10) | kgf · cm<br>(lbf · in) |
| Maximum junction and storage temperature range | $T_J$, $T_{Stg}$ | | -55 | - | 175 | °C |
| Marking device | | Case style: TO-247AD 2L | 50EPU12LH | | | |

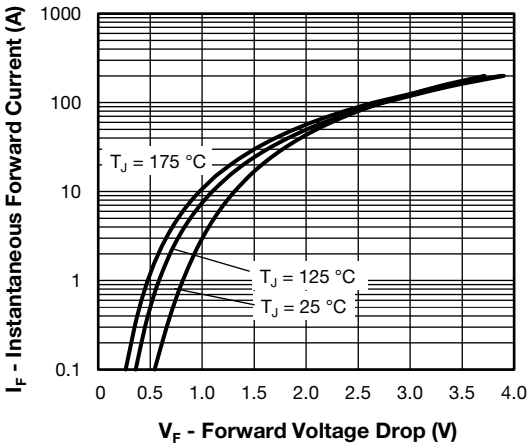


Fig. 1 - Typical Forward Voltage Drop Characteristics

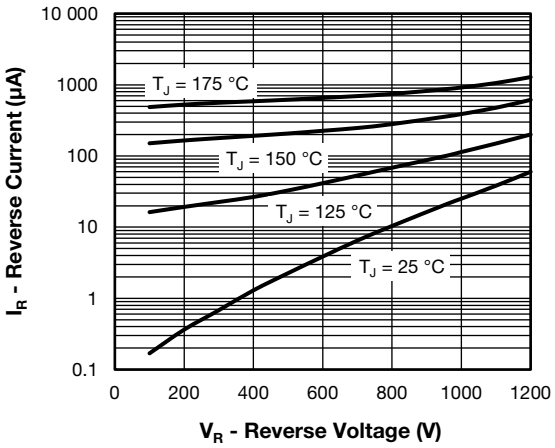


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage


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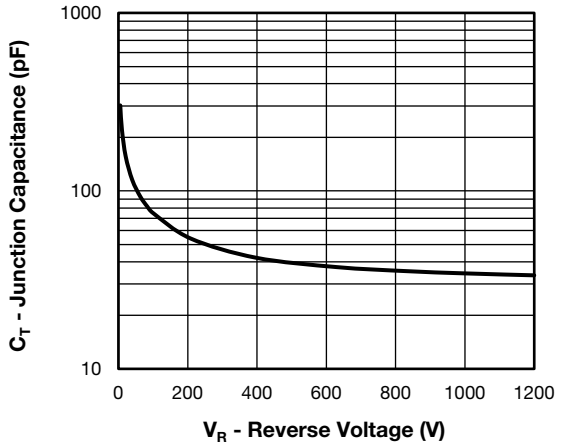


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

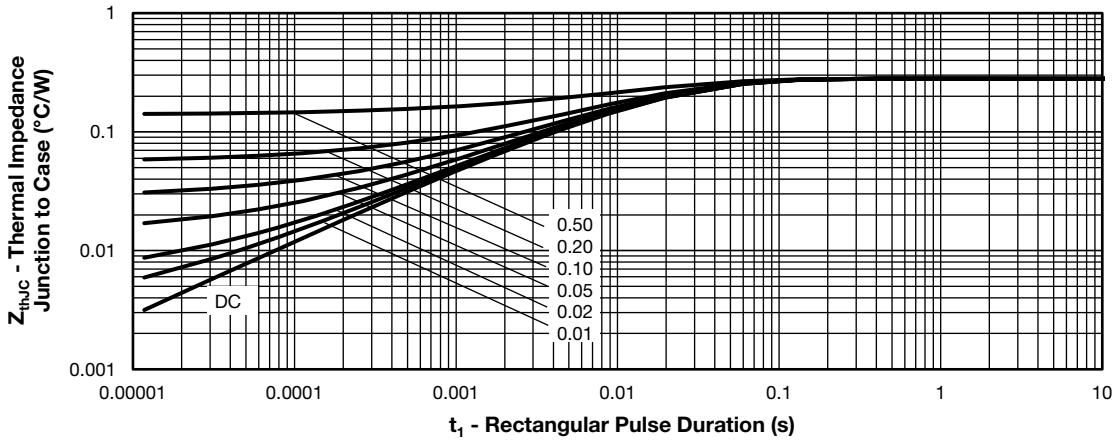


Fig. 4 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics

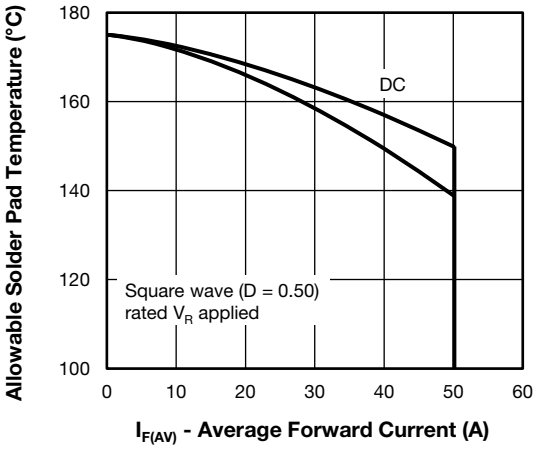


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

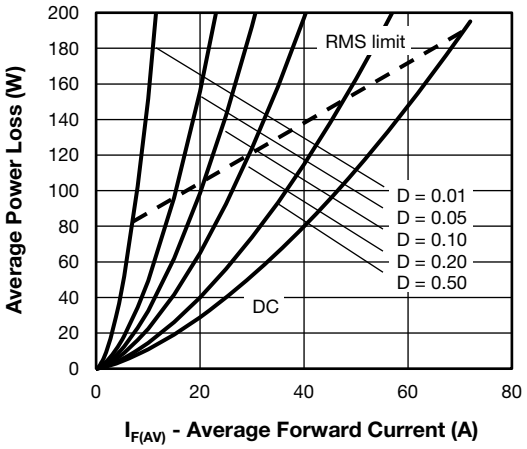


Fig. 6 - Forward Power Loss Characteristics


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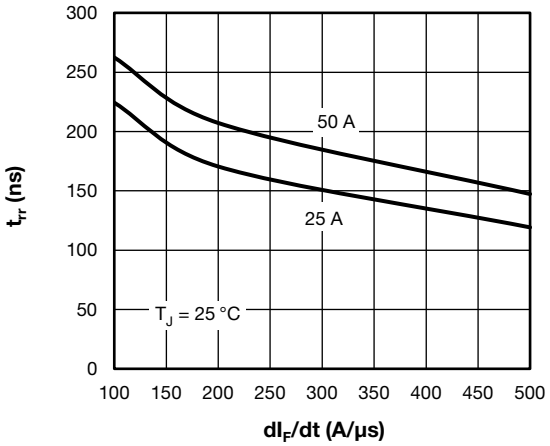


Fig. 7 - Typical Reverse Recovery Time vs. $dI_F/dt$

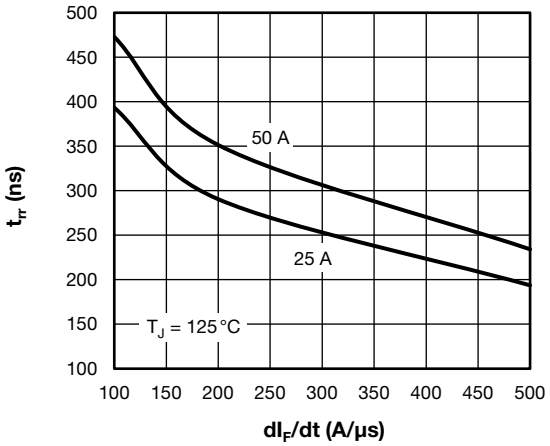


Fig. 8 - Typical Reverse Recovery Time vs. $dI_F/dt$

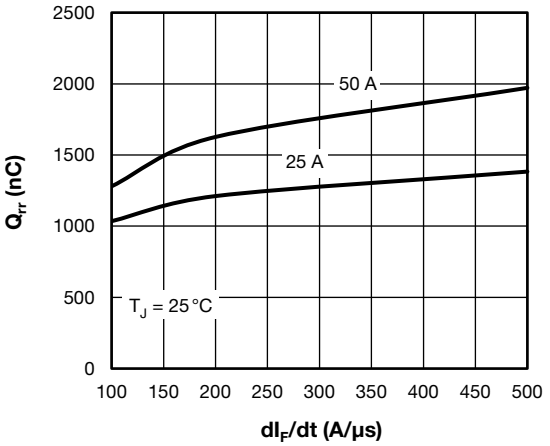


Fig. 9 - Typical Stored Charge vs. $dI_F/dt$

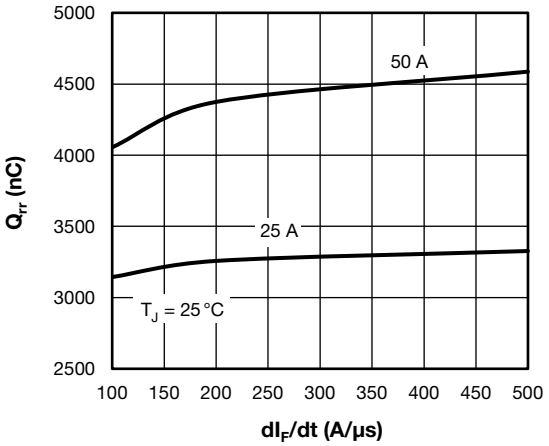


Fig. 10 - Typical Stored Charge vs. $dI_F/dt$

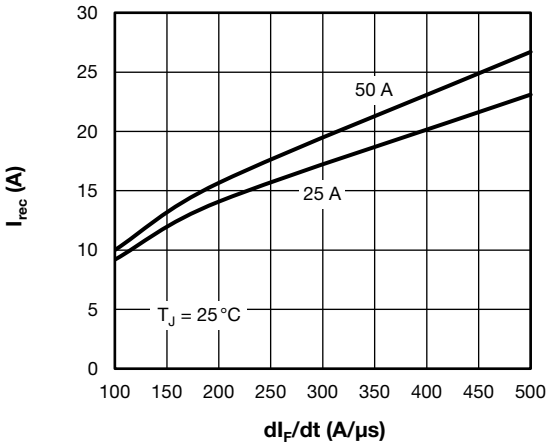


Fig. 11 - Typical Reverse Current vs. $dI_F/dt$

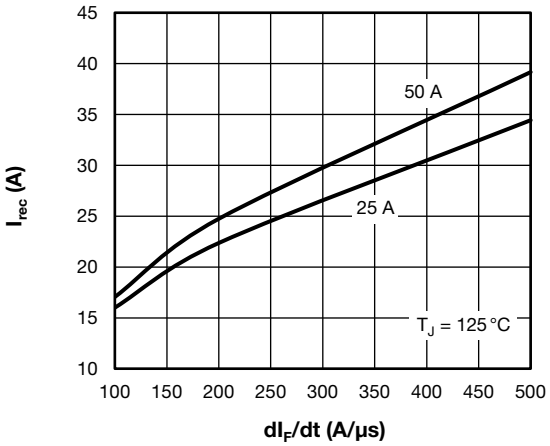


Fig. 12 - Typical Reverse Current vs. $dI_F/dt$


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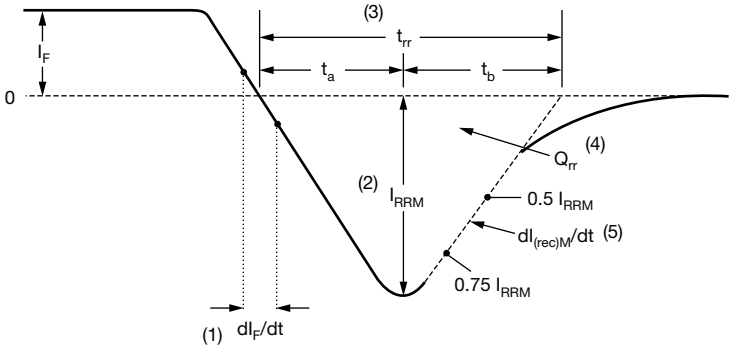


(1) $dI_F/dt$ - rate of change of current through zero crossing

(2) $I_{RRM}$ - peak reverse recovery current

(3) $t_{rr}$ - reverse recovery time measured from zero crossing point of negative going $I_F$ to point where a line passing through 0.75 $I_{RRM}$ and 0.50 $I_{RRM}$ extrapolated to zero current.

(4) $Q_{rr}$ - area under curve defined by $t_{rr}$ and $I_{RRM}$

$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(5) $dI_{(rec)M}/dt$ - peak rate of change of current during $t_b$ portion of $t_{rr}$

Fig. 13 - Reverse Recovery Waveform and Definitions

## ORDERING INFORMATION TABLE

| Device code | VS- | 50 | E | P | U | 12 | L | H | N3 |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

1 - Vishay Semiconductors product
2 - Current rating (50 = 50 A)
3 - Circuit configuration: E = single diode
4 - P = TO-247 package
5 - Process type:
U = ultrafast recovery
6 - Voltage rating (12 = 1200 V)
7 - L = long lead
8 - H = AEC-Q101 qualified
9 - Environmental digit:
N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

| **ORDERING INFORMATION** (Example) | | | |
|---|---|---|---|
| **PREFERRED P/N** | **QUANTITY PER TUBE** | **MINIMUM ORDER QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-50EPU12LHN3 | 25 | 500 | Antistatic plastic tube |

| **LINKS TO RELATED DOCUMENTS** | |
|---|---|
| Dimensions | www.vishay.com/doc?95536 |
| Part marking information | www.vishay.com/doc?95648 |


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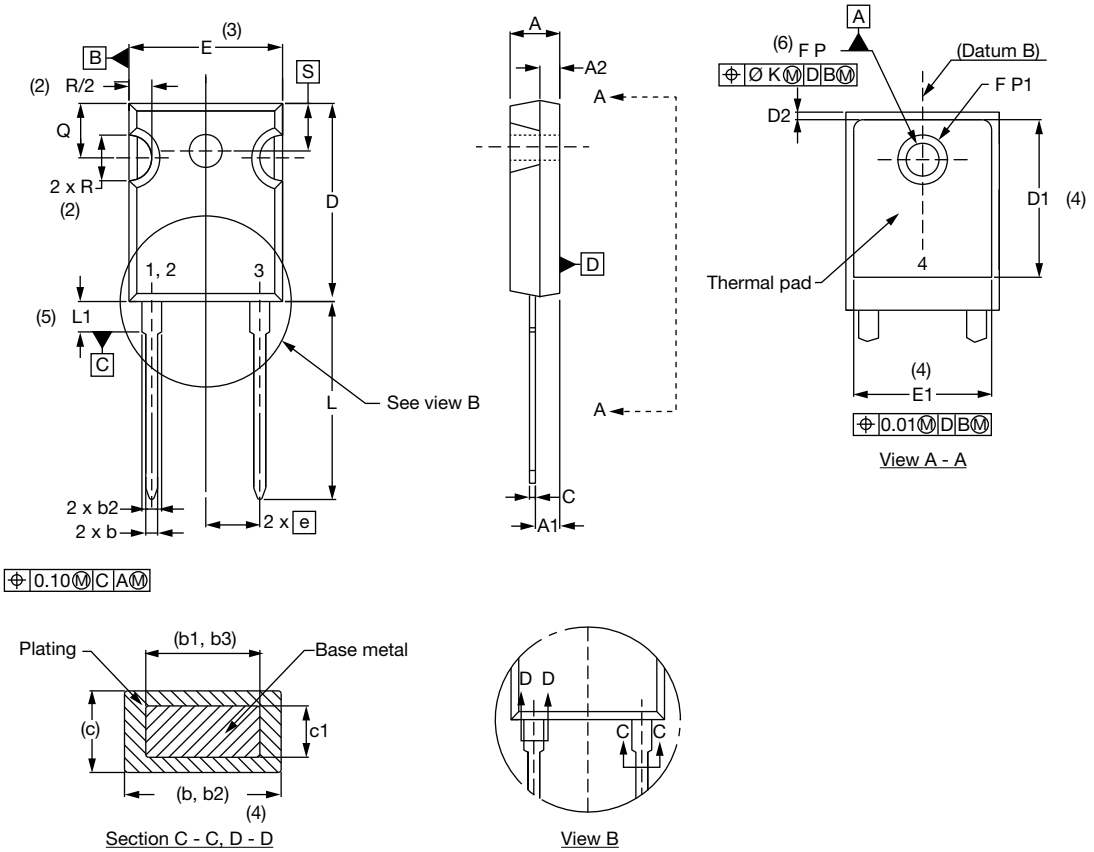
# TO-247AD 2L

**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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