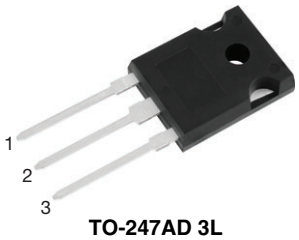
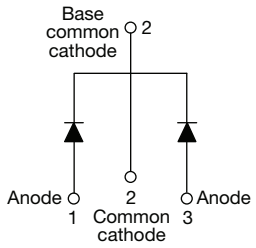
# Hyperfast Rectifier, 2 x 30 A FRED Pt® G5




TO-247AD 3L




## FEATURES

- Hyperfast and optimized $Q_{rr}$
- Best in class forward voltage drop and switching losses trade off
- Optimized for high speed operation
- 175 °C maximum operating junction temperature
- Polyimide passivation
- AEC-Q101 qualified meets JESD 201 class 1A whisker test
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

HALOGEN FREE

## LINKS TO ADDITIONAL RESOURCES

3D Models

Application Notes

## PRIMARY CHARACTERISTICS

| | |
|---|---|
| $I_{F(AV)}$, per leg | 30 A |
| $V_R$ | 600 V |
| $V_F$ at $I_F$ at 125 °C, per leg | 1.3 V |
| $t_{rr}$ (typ.) | 22 |
| $I_{FSM}$, per leg | 310 |
| $T_J$ max. | 175 °C |
| Package | TO-247AD 3L |
| Circuit configuration | Common cathode |

## DESCRIPTION / APPLICATIONS

Featuring a unique combination of low conduction and switching losses, this rectifier is the right choice for high frequency converters, both soft switched / resonant.
Specifically designed to improve efficiency of PFC and output rectification stages of EV / HEV battery charging stations, booster stage of solar inverters and UPS applications, these devices are perfectly matched to operate with MOSFETs or high speed IGBTs.

## MECHANICAL DATA

**Case:** TO-247AD 3L
Molding compound meets UL 94 V-0 flammability rating

**Terminal:** matte tin plated leads, solderable per J-STD-002

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|---|---|---|---|---|
| Repetitive peak reverse voltage, per leg | $V_{RRM}$ | | 600 | V |
| Average rectified forward current, per leg | $I_{F(AV)}$ | $T_C$ = 117 °C, D = 0.50 | 30 | A |
| Non-repetitive peak surge current, per leg | $I_{FSM}$ | $T_C$ = 25 °C, $t_p$ = 10 ms, sine wave | 310 | |
| Repetitive peak forward current, per leg | $I_{FRM}$ | $T_C$ = 117 °C, D = 0.50, f = 20 kHz | 60 | |
| 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, per leg | $V_{BR}$,$V_R$ | $I_R$ = 100 µA | 600 | - | - | V |
| Forward voltage, per leg | $V_F$ | $I_F$ = 30 A | - | 1.6 | 2.1 | |
| | | $I_F$ = 30 A, $T_J$ = 125 °C | - | 1.3 | - | |
| Reverse leakage current, per leg | $I_R$ | $V_R$ = $V_R$ rated | - | - | 20 | µA |
| | | $T_J$ = 125 °C, $V_R$ = $V_R$ rated | - | - | 500 | |
| Junction capacitance, per leg | $C_T$ | $V_R$ = 200 V | - | 36 | - | pF |
| Series inductance, per leg | $L_S$ | Measured to lead 5 mm from package body | - | 8 | - | nH |

| DYNAMIC RECOVERY CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time, per leg | $t_{rr}$ | $I_F$ = 1.0 A, $dI_F/dt$ = 100 A/μs, $V_R$ = 30 V | | - | 22 | - | ns |
| | | $T_J$ = 25 °C | $I_F$ = 20 A<br>$dI_F/dt$ = 1000 A/μs<br>$V_R$ = 400 V | - | 39 | - | |
| | | $T_J$ = 125 °C | | - | 50 | - | |
| Peak recovery current, per leg | $I_{RRM}$ | $T_J$ = 25 °C | | - | 14 | - | A |
| | | $T_J$ = 125 °C | | - | 24 | - | |
| Reverse recovery charge, per leg | $Q_{rr}$ | $T_J$ = 25 °C | | - | 253 | - | nC |
| | | $T_J$ = 125 °C | | - | 785 | - | |
| Reverse recovery time, per leg | $t_{rr}$ | $T_J$ = 25 °C | $I_F$ = 30 A<br>$dI_F/dt$ = 1000 A/μs<br>$V_R$ = 400 V | - | 41 | - | ns |
| | | $T_J$ = 125 °C | | - | 56 | - | |
| Peak recovery current, per leg | $I_{RRM}$ | $T_J$ = 25 °C | | - | 16 | - | A |
| | | $T_J$ = 125 °C | | - | 27 | - | |
| Reverse recovery charge, per leg | $Q_{rr}$ | $T_J$ = 25 °C | | - | 306 | - | nC |
| | | $T_J$ = 125 °C | | - | 952 | - | |

| THERMAL - MECHANICAL SPECIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Thermal resistance, junction-to-case, per leg | $R_{thJC}$ | | - | - | 1.1 | °C/W |
| Weight | | | - | 5.5 | - | g |
| | | | - | 0.2 | - | oz. |
| Mounting torque | | | 6<br>(5) | - | 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 3L | C5PX6006L | | | |

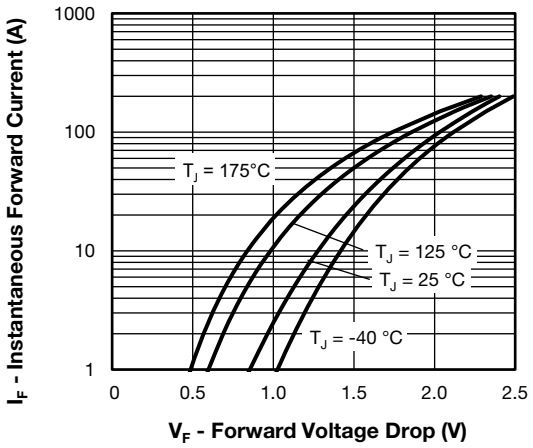



Fig. 1 - Typical Forward Voltage Drop Characteristics, per Leg

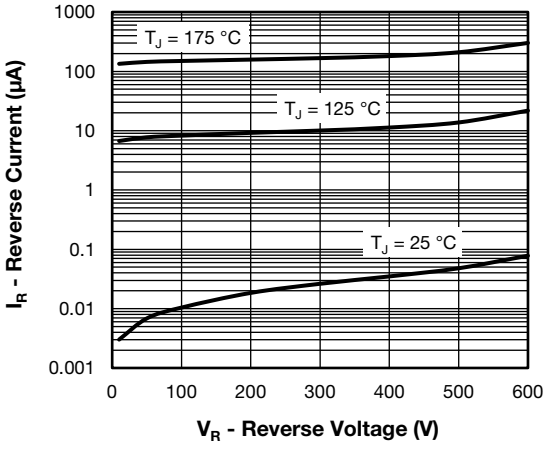



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage, per Leg

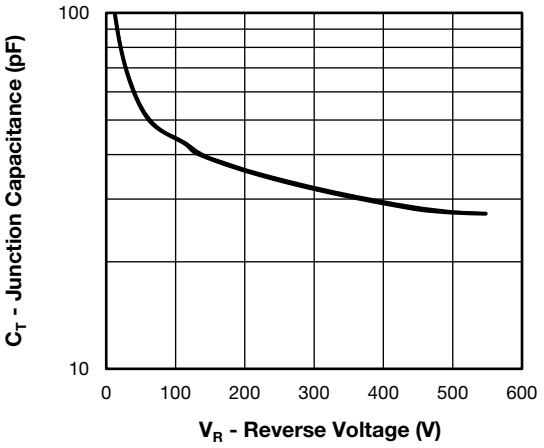



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage, per Leg

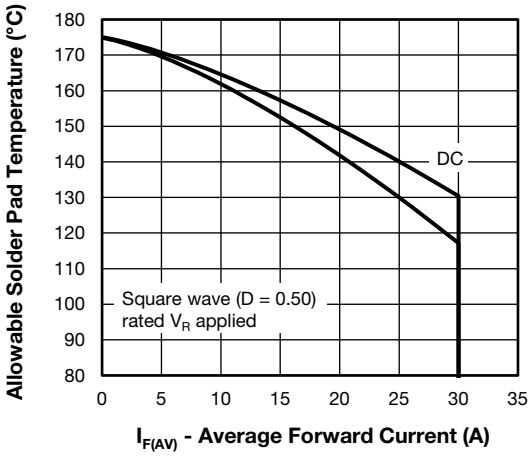



Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current, per Leg

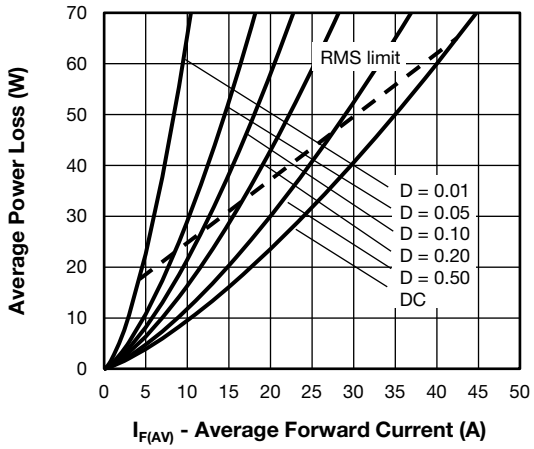



Fig. 5 - Average Power Loss vs. Average Forward Current, per Leg

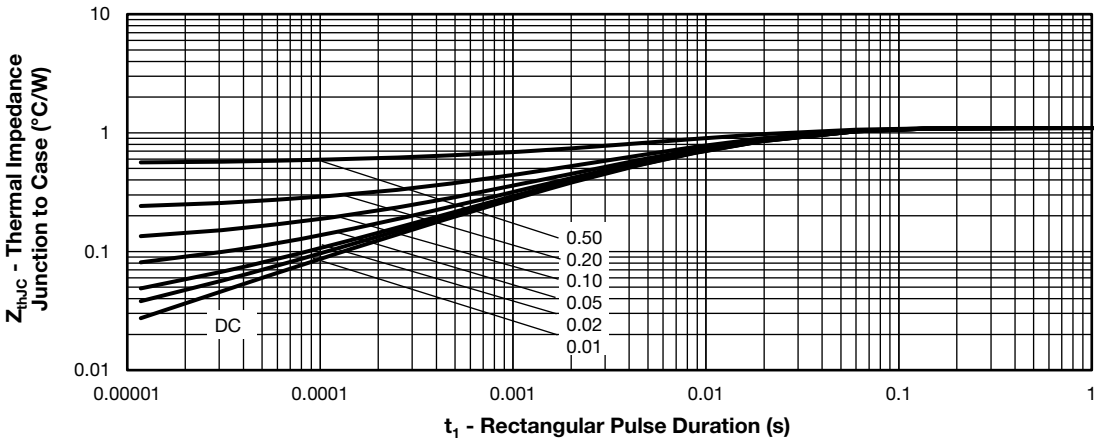



Fig. 6 - Thermal Impedance $Z_{thJC}$ - Characteristics, per Leg

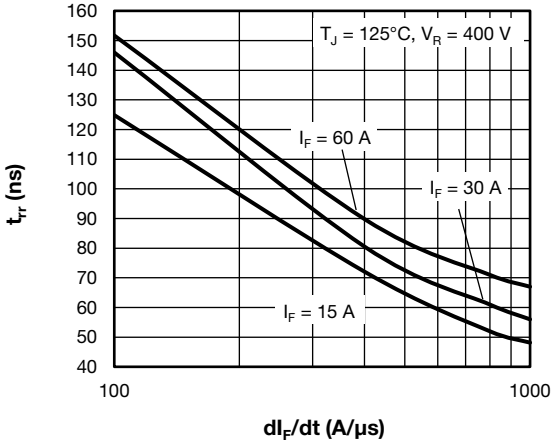



Fig. 7 - Typical Reverse Recovery Time vs. $dI_F/dt$, per Leg

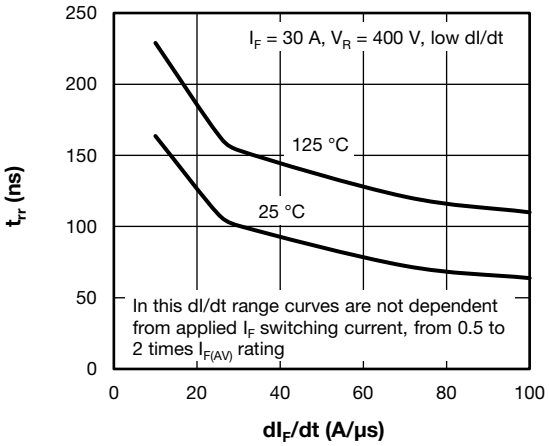



Fig. 10 - Typical Reverse Recovery Time vs. $dI_F/dt$, per Leg

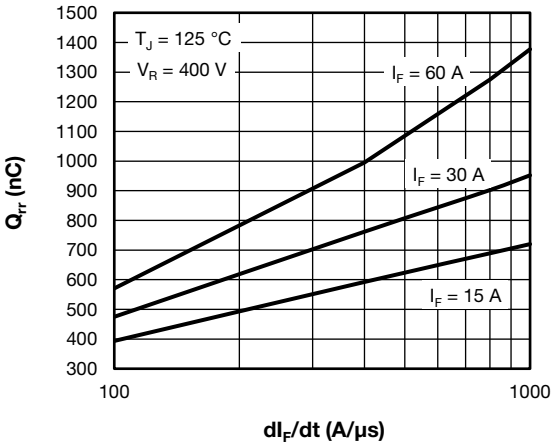



Fig. 8 - Typical Reverse Recovery Charge vs. $dI_F/dt$, per Leg

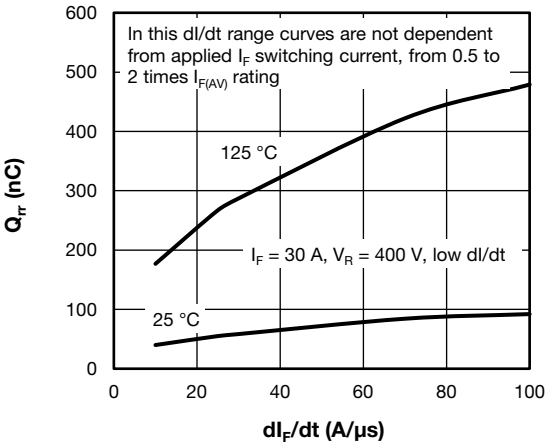



Fig. 11 - Typical Reverse Recovery Charge vs. $dI_F/dt$, per Leg

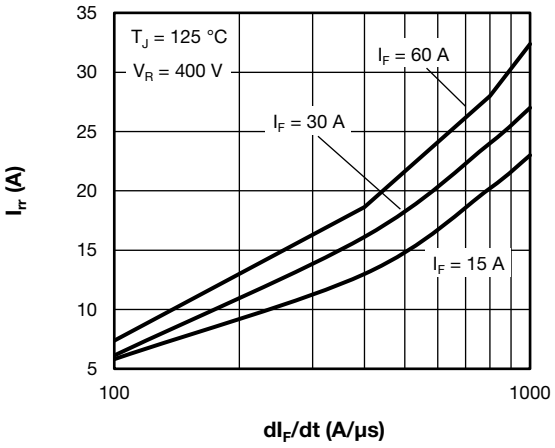



Fig. 9 - Typical Reverse Recovery Current vs. $dI_F/dt$, per Leg

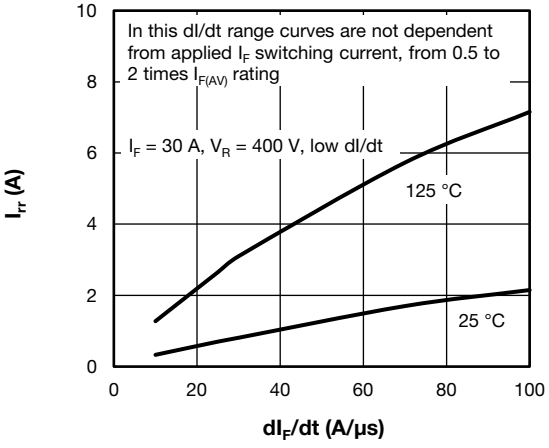



Fig. 12 - Typical Reverse Recovery Current vs. $dI_F/dt$, per Leg

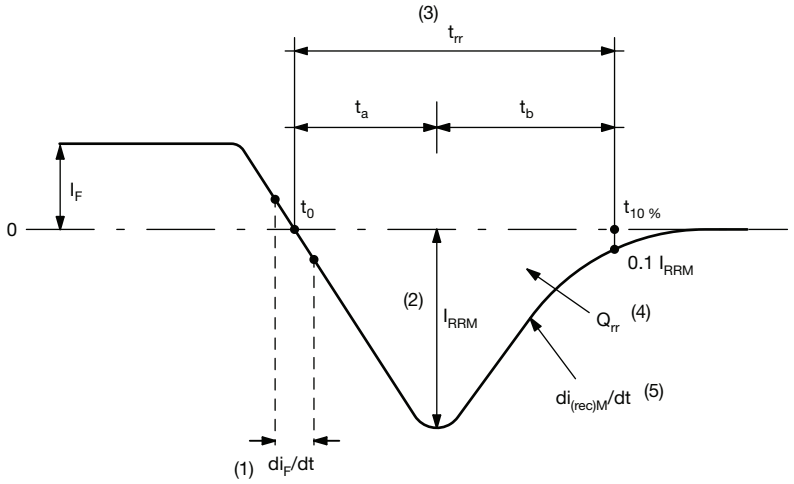



Fig. 13 - Reverse Recovery Waveform and Definitions

**Notes**

(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 $t_0$, crossing point of negative going $I_F$, to point $t_{10\%}$, 0.1 $I_{RRM}$

(4) $Q_{rr}$ - area under curve defined by $t_0$ and $t_{10\ \%}$

$$Q_{rr} = \int_{t_0}^{t_{10\ \%}} I(t)dt$$

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

## ORDERING INFORMATION TABLE

**Device code**

| VS- | C | 5 | P | X | 60 | 06 | L | -N3 |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

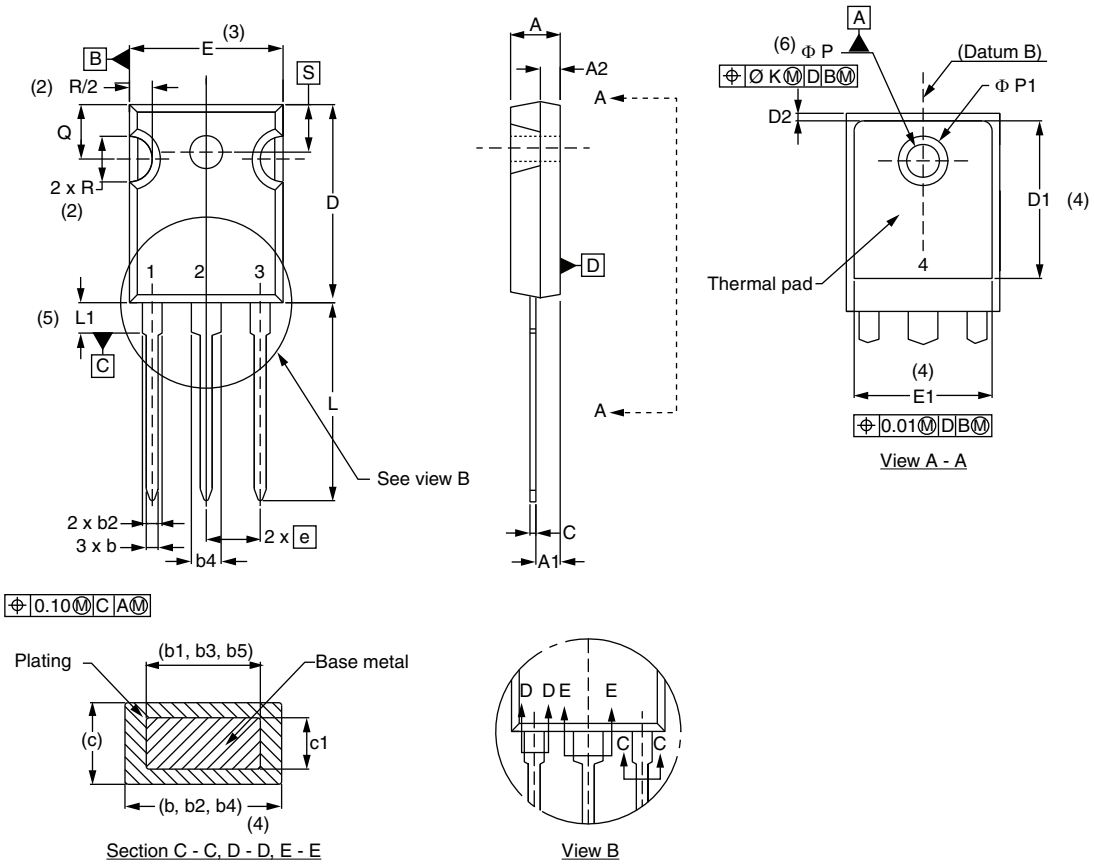
- 1 - Vishay Semiconductors product
- 2 - Circuit configuration
  C = common cathode
- 3 - FRED Pt® Gen 5
- 4 - P = TO-247 package
- 5 - Process type:
  X = hyperfast recovery
- 6 - Current rating (60 = 60 A)
- 7 - Voltage rating (06 = 600 V)
- 8 - Package: L = long lead (TO-247AD)
- 9 - Environmental digit:
  -N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

| **ORDERING INFORMATION** (Example) | | | |
|---|---|---|---|
| **PREFERRED P/N** | **QUANTITY PER TUBE** | **BASE QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-C5PX6006L-N3 | 25 | 500 | Antistatic plastic tube |

| **LINKS TO RELATED DOCUMENTS** | |
|---|---|
| Dimensions | www.vishay.com/doc?95626 |
| Part marking information | www.vishay.com/doc?95007 |

# 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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