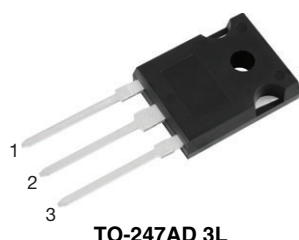
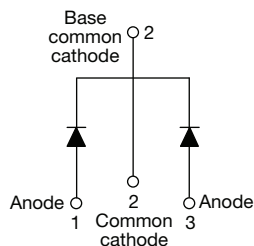


# Hyperfast Rectifier, 2 x 15 A FRED Pt® G5



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 2 whisker test
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

## LINKS TO ADDITIONAL RESOURCES



3D Models


Application  
Notes

| PRIMARY CHARACTERISTICS  |                |
|--------------------------|----------------|
| $I_{F(AV)}$ , per leg    | 15 A           |
| $V_R$                    | 1200 V         |
| $V_F$ at $I_F$ at 125 °C | 1.7 V          |
| $t_{rr}$                 | 37 ns          |
| $T_J$ 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

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

| ABSOLUTE MAXIMUM RATINGS                   |                   |  |             |       |
|--|-------------------|--|-------------|-------|
| PARAMETER                                  | SYMBOL            | TEST CONDITIONS  | VALUES      | UNITS |
| Repetitive peak reverse voltage, per leg   | $V_{RRM}$         |  | 1200        | V     |
| Average rectified forward current, per leg | $I_{F(AV)}$       | $T_C = 122\text{ °C}$ , $D = 0.50$                       | 15          | A     |
| Repetitive peak forward current, per leg   | $I_{FRM}$         | $T_C = 122\text{ °C}$ , $D = 0.50$ , $f = 20\text{ kHz}$ | 30          |       |
| Non-repetitive peak surge current, per leg | $I_{FSM}$         | $T_C = 45\text{ °C}$ , $t_p = 10\text{ ms}$ , sine wave  | 125         |       |
| Operating junction and storage temperature | $T_J$ , $T_{Stg}$ |  | -55 to +175 | °C    |

| ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ °C}$ unless otherwise specified) |                  |   |      |      |      |               |
|--|------------------|---|------|------|------|---------------|
| PARAMETER  | SYMBOL           | TEST CONDITIONS                             | MIN. | TYP. | MAX. | UNITS         |
| Breakdown voltage, blocking voltage, per leg                                 | $V_{BR}$ , $V_R$ | $I_R = 100\text{ }\mu\text{A}$              | 1200 | -    | -    | V             |
| Forward voltage, per leg   | $V_F$            | $I_F = 15\text{ A}$                         | -    | 1.9  | 2.5  |               |
|  |                  | $I_F = 15\text{ A}$ , $T_J = 125\text{ °C}$ | -    | 1.7  | -    |               |
| Reverse leakage current, per leg   | $I_R$            | $V_R = V_R$ rated                           | -    | -    | 50   | $\mu\text{A}$ |
|  |                  | $T_J = 125\text{ °C}$ , $V_R = V_R$ rated   | -    | -    | 500  |               |
| Junction capacitance, per leg  | $C_T$            | $V_R = 200\text{ V}$                        | -    | 10   | -    | pF            |
| Series inductance, per leg   | $L_S$            | Measured to lead 5 mm from package body     | -    | 8    | -    | nH            |

**DYNAMIC RECOVERY CHARACTERISTICS** ( $T_J = 25\text{ }^{\circ}\text{C}$  unless otherwise specified)

| PARAMETER                        | SYMBOL    | TEST CONDITIONS                     |  | MIN. | TYP. | MAX. | UNITS |
|----------------------------------|-----------|-------------------------------------|--|------|------|------|-------|
| Reverse recovery time, per leg   | $t_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$  | 1 A, 30 V, 100 A/ $\mu\text{s}$  | -    | 37   | -    | ns    |
|                                  |           | $T_J = 25\text{ }^{\circ}\text{C}$  | $I_F = 10\text{ A}$<br>$di_F/dt = 600\text{ A}/\mu\text{s}$<br>$V_R = 400\text{ V}$  | -    | 95   | -    |       |
|                                  |           | $T_J = 125\text{ }^{\circ}\text{C}$ |  | -    | 146  | -    |       |
| Peak recovery current, per leg   | $I_{RRM}$ | $T_J = 25\text{ }^{\circ}\text{C}$  |  | -    | 14   | -    | A     |
|                                  |           | $T_J = 125\text{ }^{\circ}\text{C}$ |  | -    | 19   | -    |       |
| Reverse recovery charge, per leg | $Q_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$  |  | -    | 545  | -    | nC    |
|                                  |           | $T_J = 125\text{ }^{\circ}\text{C}$ |  | -    | 1200 | -    |       |
| Reverse recovery time, per leg   | $t_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$  | $I_F = 15\text{ A}$<br>$di_F/dt = 1000\text{ A}/\mu\text{s}$<br>$V_R = 800\text{ V}$ | -    | 75.5 | -    | ns    |
|                                  |           | $T_J = 125\text{ }^{\circ}\text{C}$ |  | -    | 100  | -    |       |
| Peak recovery current, per leg   | $I_{RRM}$ | $T_J = 25\text{ }^{\circ}\text{C}$  |  | -    | 23   | -    | A     |
|                                  |           | $T_J = 125\text{ }^{\circ}\text{C}$ |  | -    | 35   | -    |       |
| Reverse recovery charge, per leg | $Q_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$  |  | -    | 935  | -    | nC    |
|                                  |           | $T_J = 125\text{ }^{\circ}\text{C}$ |  | -    | 1985 | -    |       |

**THERMAL - MECHANICAL SPECIFICATIONS**

| PARAMETER                                      | SYMBOL         | TEST CONDITIONS        | MIN.         | TYP. | MAX.       | UNITS                       |
|--|----------------|------------------------|--------------|------|------------|-----------------------------|
| Thermal resistance, junction-to-case, per leg  | $R_{thJC}$     |                        | -            | -    | 1.4        | $^{\circ}\text{C}/\text{W}$ |
| Weight   |                |                        | -            | 6.0  | -          | g                           |
| 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        | $^{\circ}\text{C}$          |
| Marking device                                 |                | Case style TO-247AD 3L | C5PH3012LH   |      |            |                             |

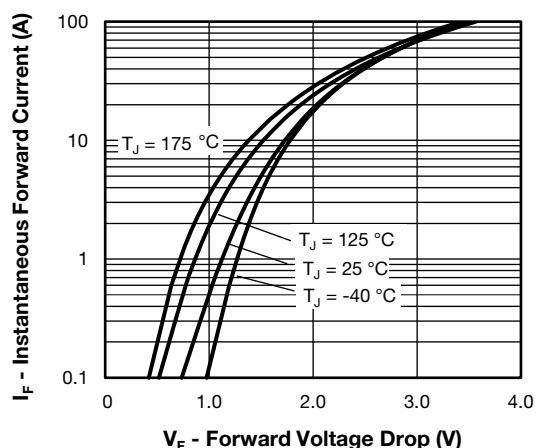


Fig. 1 - Forward Voltage Drop Characteristics, Per Leg

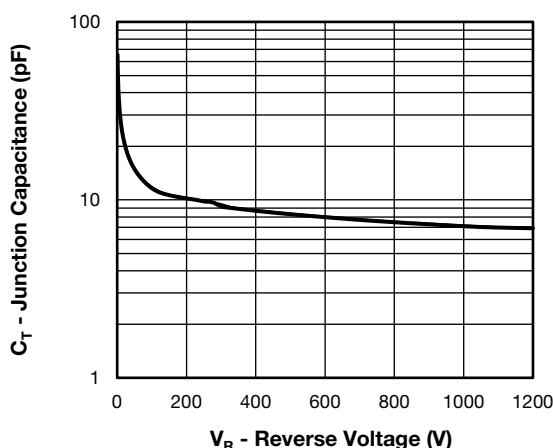


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage, Per Leg

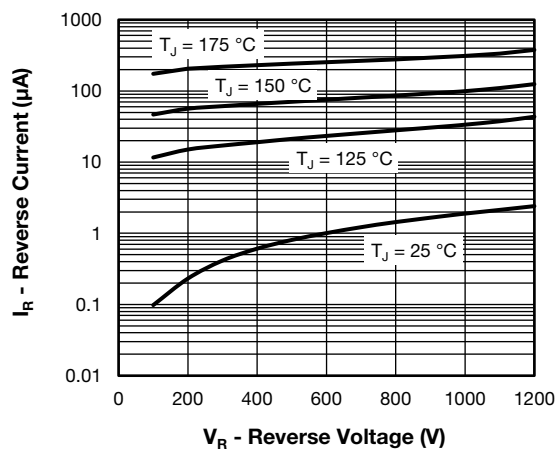


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage, Per Leg

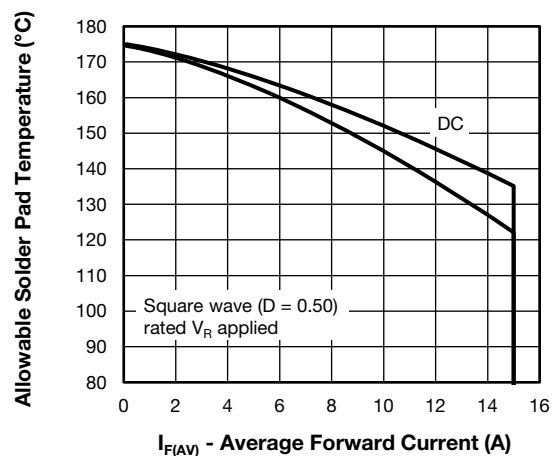


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current, Per Leg

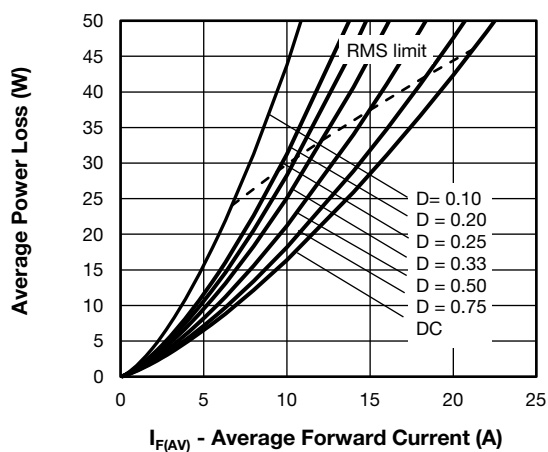


Fig. 5 - Forward Power Loss Characteristics, Per Leg

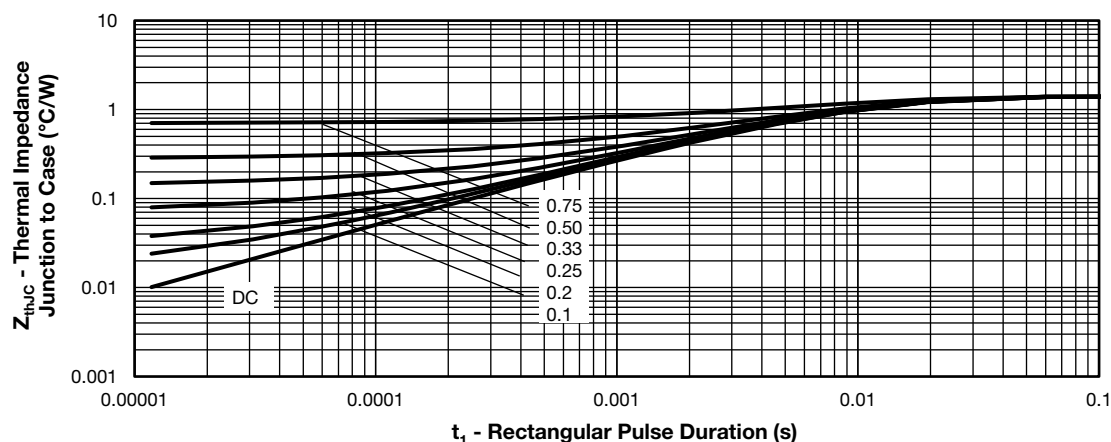
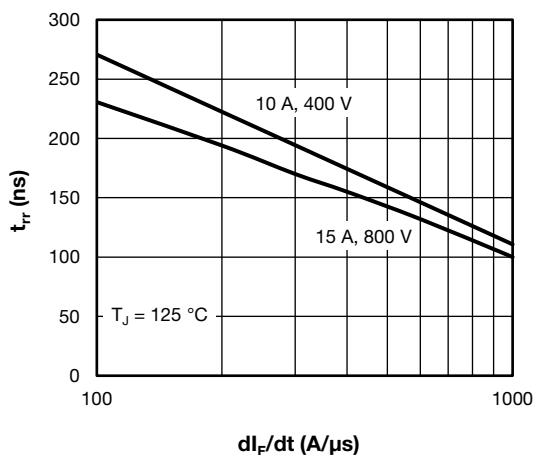
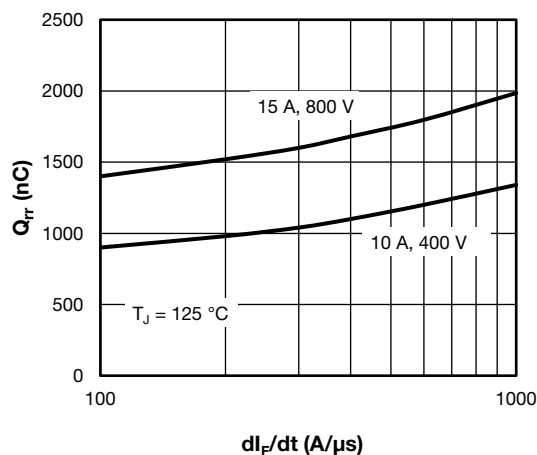
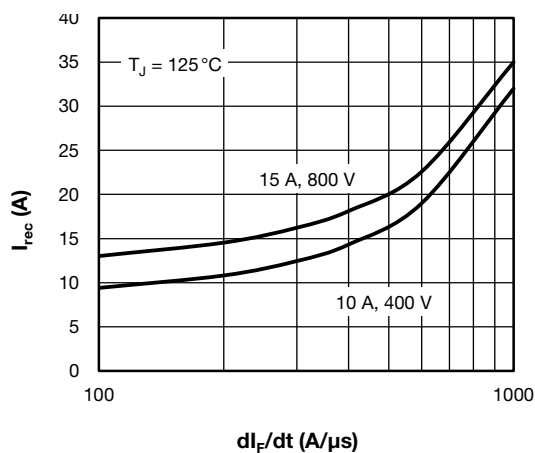


Fig. 6 - Transient Thermal Impedance, Junction to Case, Per Leg


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

Fig. 8 - Typical Stored Charge vs.  $dI_F/dt$ , Per Leg

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

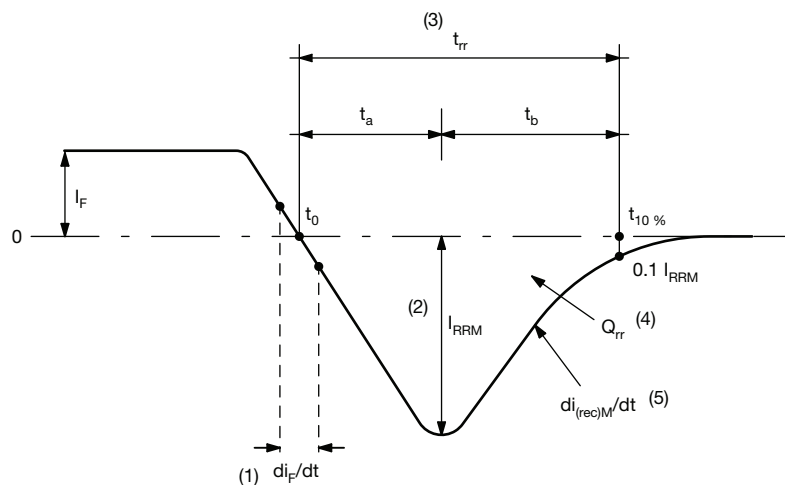


Fig. 10 - Reverse Recovery Waveform and Definitions

#### 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 | H | 30 | 12 | L | H | N3 |
|-------------|-----|---|---|---|---|----|----|---|---|----|
|             | 1   | 2   | 3 | 4 | 5 | 6  | 7  | 8 | 9 | 10 |
| 1           | -   | Vishay Semiconductors product   |   |   |   |    |    |   |   |    |
| 2           | -   | C = common cathode  |   |   |   |    |    |   |   |    |
| 3           | -   | 5 = FRED generation 5   |   |   |   |    |    |   |   |    |
| 4           | -   | Package: P = TO-247AD 3L  |   |   |   |    |    |   |   |    |
| 5           | -   | H = hyperfast recovery  |   |   |   |    |    |   |   |    |
| 6           | -   | Current rating (30 = 30 A)  |   |   |   |    |    |   |   |    |
| 7           | -   | Voltage rating (12 = 1200 V)  |   |   |   |    |    |   |   |    |
| 8           | -   | L = long lead   |   |   |   |    |    |   |   |    |
| 8           | -   | H = AEC-Q101 qualified  |   |   |   |    |    |   |   |    |
| 10          | -   | Environmental digit:<br>N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free |   |   |   |    |    |   |   |    |

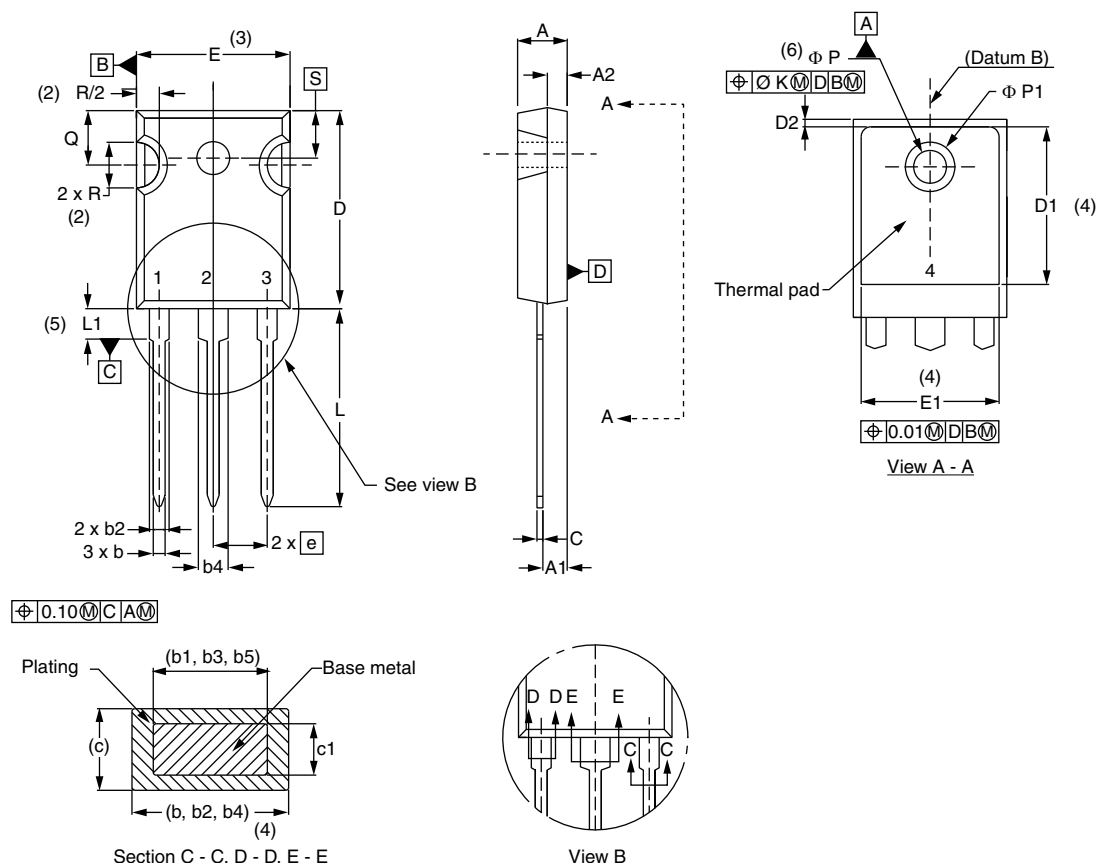
| ORDERING INFORMATION (Example) |                   |                        |                         |
|--------------------------------|-------------------|------------------------|-------------------------|
| PREFERRED P/N                  | QUANTITY PER TUBE | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
| VS-C5PH3012LHN3                | 25                | 500                    | Antistatic plastic tube |

| 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

- (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)  $\Phi P$  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")
- (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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