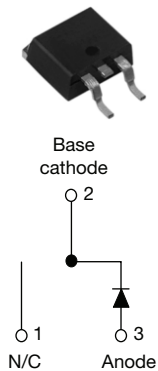


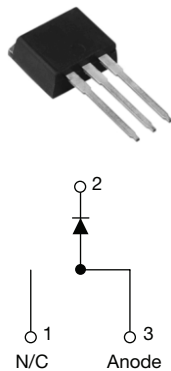
## Hyperfast Rectifier, 15 A FRED Pt®

VS-15ETH03SPbF



D²PAK

VS-15ETH03-1PbF



TO-262

### FEATURES

- Hyperfast recovery time
- Low forward voltage drop
- Low leakage current
- 175 °C operating junction temperature
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Halogen-free according to IEC 61249-2-21 definition
- Compliant to RoHS directive 2002/95/EC
- AEC-Q101 qualified



**RoHS**  
COMPLIANT  
HALOGEN  
FREE

### DESCRIPTION/APPLICATIONS

Vishay HPP's 300 V series are the state of the art hyperfast recovery rectifiers designed with optimized performance of forward voltage drop and hyperfast recovery time.

The planar structure and the platinum doped life time control guarantee the best overall performance, ruggedness and reliability characteristics.

These devices are intended for use in the output rectification stage of SMPS, UPS, dc-to-dc converters as well as freewheeling diodes in low voltage inverters and chopper motor drives.

Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

### PRODUCT SUMMARY

|             |       |
|-------------|-------|
| $t_{rr}$    | 40 ns |
| $I_{F(AV)}$ | 15 A  |
| $V_R$       | 300 V |

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                   | SYMBOL         | TEST CONDITIONS       | MAX.        | UNITS |
|---------------------------------------------|----------------|-----------------------|-------------|-------|
| Repetitive peak reverse voltage             | $V_{RRM}$      |                       | 300         | V     |
| Average rectified forward current           | $I_{F(AV)}$    | $T_C = 142\text{ °C}$ | 15          | A     |
| Non-repetitive peak surge current           | $I_{FSM}$      | $T_J = 25\text{ °C}$  | 140         |       |
| Operating junction and storage temperatures | $T_J, T_{Stg}$ |                       | - 65 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 | $V_{BR}, V_R$ | $I_R = 100\text{ }\mu\text{A}$                | 300  | -    | -    | V             |
| Forward voltage                     | $V_F$         | $I_F = 15\text{ A}$                           | -    | 1.05 | 1.25 |               |
|                                     |               | $I_F = 15\text{ A}, T_J = 125\text{ °C}$      | -    | 0.85 | 1.00 |               |
| Reverse leakage current             | $I_R$         | $V_R = V_R\text{ rated}$                      | -    | 0.05 | 40   | $\mu\text{A}$ |
|                                     |               | $T_J = 125\text{ °C}, V_R = V_R\text{ rated}$ | -    | 12   | 400  |               |
| Junction capacitance                | $C_T$         | $V_R = 300\text{ V}$                          | -    | 45   | -    | pF            |
| Series inductance                   | $L_S$         | Measured lead to lead 5 mm from package body  | -    | 8    | -    | nH            |

# VS-15ETH03SPbF, VS-15ETH03-1PbF

Vishay High Power Products

Hyperfast Rectifier,  
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| DYNAMIC RECOVERY CHARACTERISTICS ( $T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified) |           |                                                                                  |      |      |      |       |
|---------------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------|------|------|------|-------|
| PARAMETER                                                                                         | SYMBOL    | TEST CONDITIONS                                                                  | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time                                                                             | $t_{rr}$  | $I_F = 1.0\text{ A}$ , $di_F/dt = 50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ | -    | -    | 40   | ns    |
|                                                                                                   |           | $T_J = 25\text{ }^{\circ}\text{C}$                                               | -    | 32   | -    |       |
|                                                                                                   |           | $T_J = 125\text{ }^{\circ}\text{C}$                                              | -    | 45   | -    |       |
| Peak recovery current                                                                             | $I_{RRM}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                               | -    | 2.4  | -    | A     |
|                                                                                                   |           | $T_J = 125\text{ }^{\circ}\text{C}$                                              | -    | 6.1  | -    |       |
| Reverse recovery charge                                                                           | $Q_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$                                               | -    | 38   | -    | nC    |
|                                                                                                   |           | $T_J = 125\text{ }^{\circ}\text{C}$                                              | -    | 137  | -    |       |

| THERMAL - MECHANICAL SPECIFICATIONS             |                   |                                            |              |      |            |                             |
|-------------------------------------------------|-------------------|--------------------------------------------|--------------|------|------------|-----------------------------|
| PARAMETER                                       | SYMBOL            | TEST CONDITIONS                            | MIN.         | TYP. | MAX.       | UNITS                       |
| Maximum junction and storage temperature range  | $T_J$ , $T_{Stg}$ |                                            | - 65         | -    | 175        | $^{\circ}\text{C}$          |
| Thermal resistance, junction to case per leg    | $R_{thJC}$        |                                            | -            | 1.02 | 2.0        | $^{\circ}\text{C}/\text{W}$ |
| Thermal resistance, junction to ambient per leg | $R_{thJA}$        | Typical socket mount                       | -            | -    | 70         |                             |
| Thermal resistance, case to heatsink            | $R_{thCS}$        | Mounting surface, flat, smooth and greased | -            | 0.2  | -          |                             |
| Weight                                          |                   |                                            | -            | 2.0  | -          | g                           |
|                                                 |                   |                                            | -            | 0.07 | -          | oz.                         |
| Mounting torque                                 |                   |                                            | 6.0<br>(5.0) | -    | 12<br>(10) | kgf · cm<br>(lbf · in)      |
| Marking device                                  |                   | Case style D <sup>2</sup> PAK              | 15ETH03S     |      |            |                             |
|                                                 |                   | Case style TO-262                          | 15ETH03-1    |      |            |                             |



# VS-15ETH03SPbF, VS-15ETH03-1PbF

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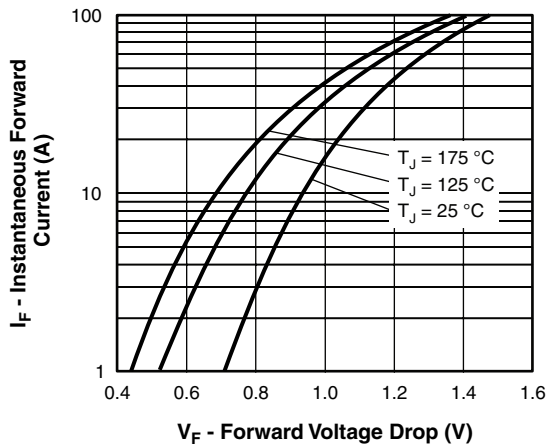


Fig. 1 - Typical Forward Voltage Drop Characteristics

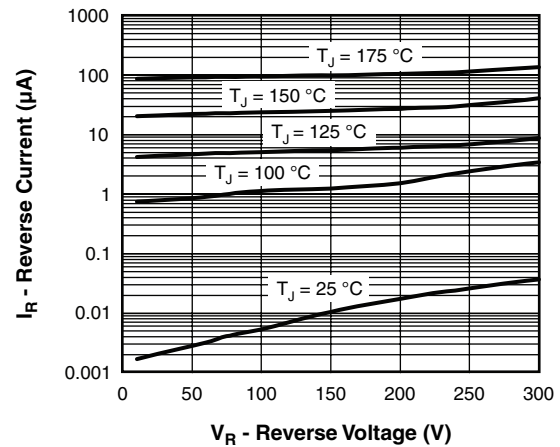


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

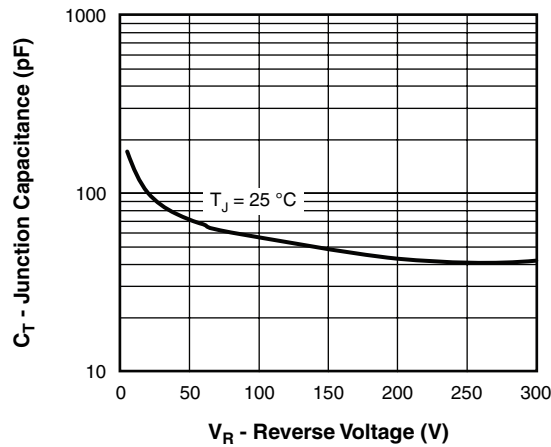


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

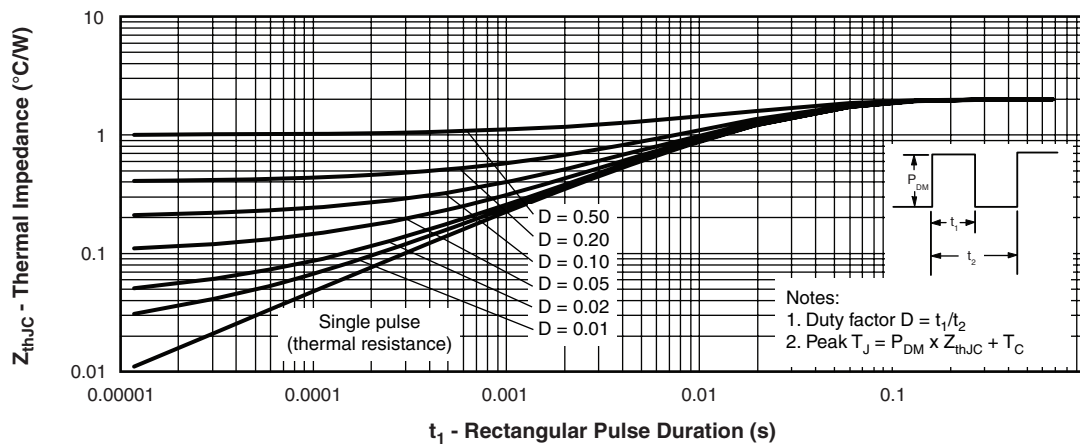


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

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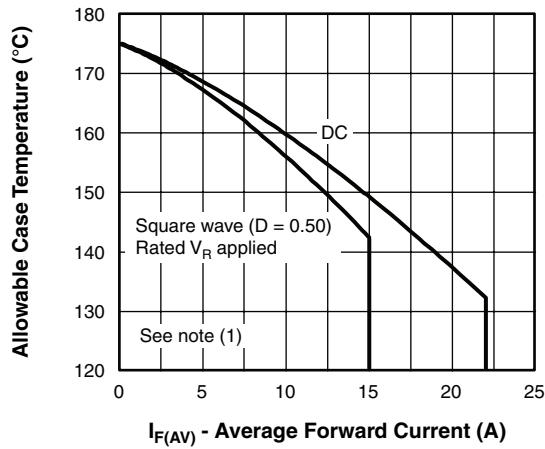


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

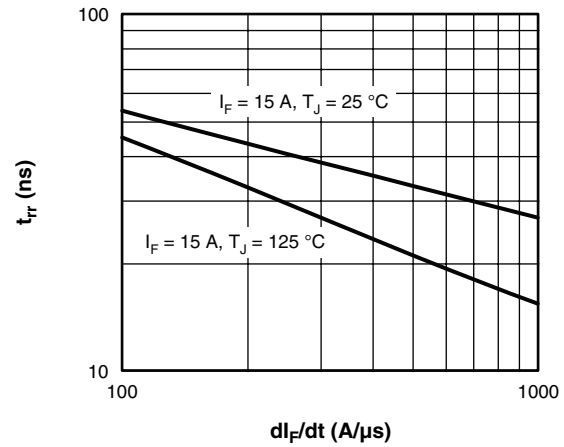


Fig. 7 - Typical Reverse Recovery Time vs.  $dI_F/dt$

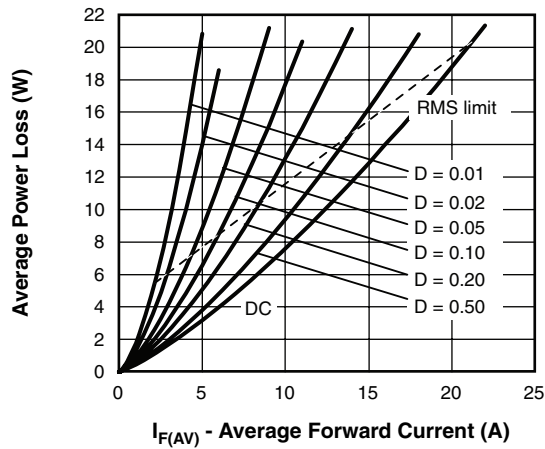


Fig. 6 - Forward Power Loss Characteristics

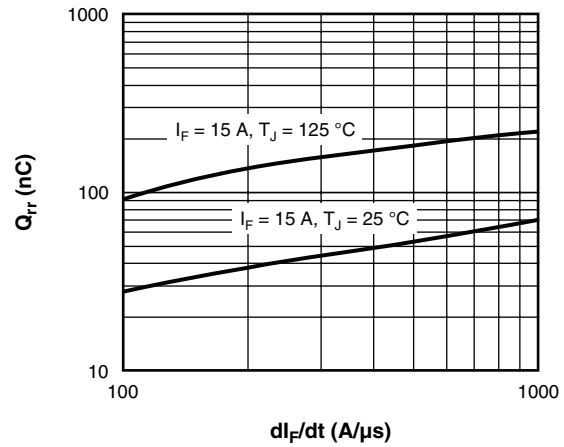


Fig. 8 - Typical Stored Charge vs.  $dI_F/dt$

## Note

- (1) Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d$  = Forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);  
 $P_{dREV}$  = Inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1}$  = Rated  $V_R$

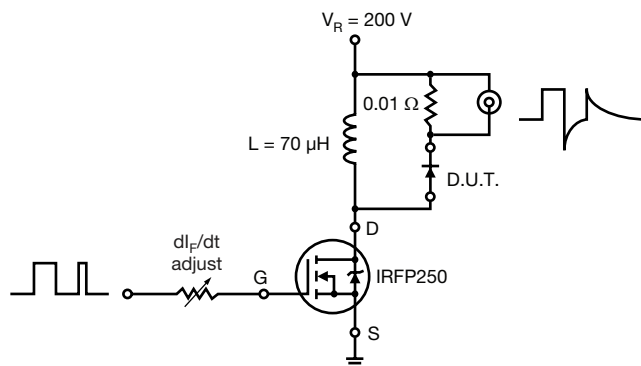


Fig. 9 - Reverse Recovery Parameter Test Circuit

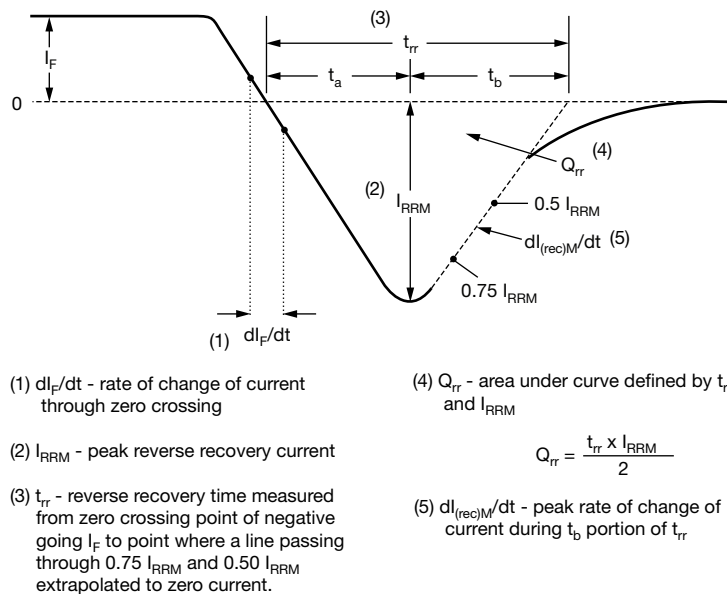


Fig. 10 - Reverse Recovery Waveform and Definitions

# VS-15ETH03SPbF, VS-15ETH03-1PbF

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## ORDERING INFORMATION TABLE

|             |     |    |   |   |   |    |   |     |     |
|-------------|-----|----|---|---|---|----|---|-----|-----|
| Device code | VS- | 15 | E | T | H | 03 | S | TRL | PbF |
|             | 1   | 2  | 3 | 4 | 5 | 6  | 7 | 8   | 9   |

- |          |   |                                                                                                                                                                              |
|----------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b> | - | HPP product suffix                                                                                                                                                           |
| <b>2</b> | - | Current rating (15 A)                                                                                                                                                        |
| <b>3</b> | - | E = Single diode                                                                                                                                                             |
| <b>4</b> | - | T = TO-220, D <sup>2</sup> PAK                                                                                                                                               |
| <b>5</b> | - | H = Hyperfast rectifier                                                                                                                                                      |
| <b>6</b> | - | Voltage rating (03 = 300 V)                                                                                                                                                  |
| <b>7</b> | - | • S = D <sup>2</sup> PAK<br>• -1 = TO-262                                                                                                                                    |
| <b>8</b> | - | • None = Tube (50 pieces)<br>• TRL = Tape and reel (left oriented, for D <sup>2</sup> PAK package)<br>• TRR = Tape and reel (right oriented, for D <sup>2</sup> PAK package) |
| <b>9</b> | - | PbF = Lead (Pb)-free                                                                                                                                                         |

| LINKS TO RELATED DOCUMENTS |                                                                        |
|----------------------------|------------------------------------------------------------------------|
| Dimensions                 | <a href="http://www.vishay.com/doc?95014">www.vishay.com/doc?95014</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95008">www.vishay.com/doc?95008</a> |
| Packaging information      | <a href="http://www.vishay.com/doc?95032">www.vishay.com/doc?95032</a> |

## D<sup>2</sup>PAK, TO-262

### DIMENSIONS FOR D<sup>2</sup>PAK in millimeters and inches

Conforms to JEDEC outline D<sup>2</sup>PAK (SMD-220)



| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| A      | 4.06        | 4.83  | 0.160  | 0.190 |       |
| A1     | 0.00        | 0.254 | 0.000  | 0.010 |       |
| b      | 0.51        | 0.99  | 0.020  | 0.039 |       |
| b1     | 0.51        | 0.89  | 0.020  | 0.035 | 4     |
| b2     | 1.14        | 1.78  | 0.045  | 0.070 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     |
| c      | 0.38        | 0.74  | 0.015  | 0.029 |       |
| c1     | 0.38        | 0.58  | 0.015  | 0.023 | 4     |
| c2     | 1.14        | 1.65  | 0.045  | 0.065 |       |
| D      | 8.51        | 9.65  | 0.335  | 0.380 | 2     |

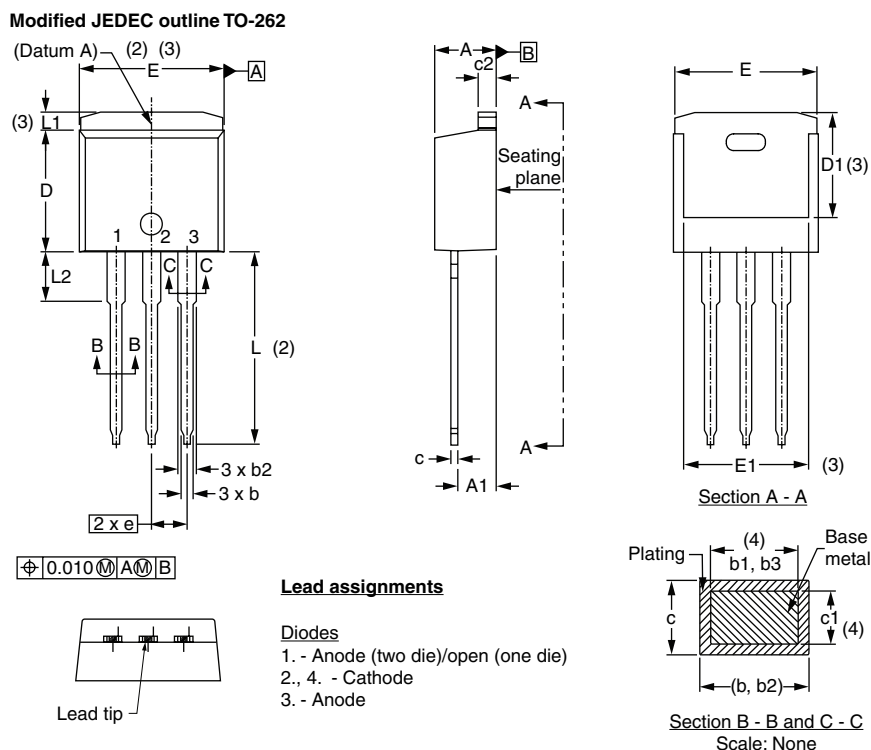
| SYMBOL | MILLIMETERS |       | INCHES    |       | NOTES |
|--------|-------------|-------|-----------|-------|-------|
|        | MIN.        | MAX.  | MIN.      | MAX.  |       |
| D1     | 6.86        | 8.00  | 0.270     | 0.315 | 3     |
| E      | 9.65        | 10.67 | 0.380     | 0.420 | 2, 3  |
| E1     | 7.90        | 8.80  | 0.311     | 0.346 | 3     |
| e      | 2.54 BSC    |       | 0.100 BSC |       |       |
| H      | 14.61       | 15.88 | 0.575     | 0.625 |       |
| L      | 1.78        | 2.79  | 0.070     | 0.110 |       |
| L1     | -           | 1.65  | -         | 0.066 | 3     |
| L2     | 1.27        | 1.78  | 0.050     | 0.070 |       |
| L3     | 0.25 BSC    |       | 0.010 BSC |       |       |
| L4     | 4.78        | 5.28  | 0.188     | 0.208 |       |

#### Notes

- (1) Dimensioning and tolerancing per ASME Y14.5 M-1994
- (2) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body
- (3) Thermal pad contour optional within dimension E, L1, D1 and E1
- (4) Dimension b1 and c1 apply to base metal only
- (5) Datum A and B to be determined at datum plane H
- (6) Controlling dimension: inch

- (7) Outline conforms to JEDEC outline TO-263AB

### DIMENSIONS FOR TO-262 in millimeters and inches



| SYMBOL | MILLIMETERS |       | INCHES    |       | NOTES |
|--------|-------------|-------|-----------|-------|-------|
|        | MIN.        | MAX.  | MIN.      | MAX.  |       |
| A      | 4.06        | 4.83  | 0.160     | 0.190 |       |
| A1     | 2.03        | 3.02  | 0.080     | 0.119 |       |
| b      | 0.51        | 0.99  | 0.020     | 0.039 |       |
| b1     | 0.51        | 0.89  | 0.020     | 0.035 | 4     |
| b2     | 1.14        | 1.78  | 0.045     | 0.070 |       |
| b3     | 1.14        | 1.73  | 0.045     | 0.068 | 4     |
| c      | 0.38        | 0.74  | 0.015     | 0.029 |       |
| c1     | 0.38        | 0.58  | 0.015     | 0.023 | 4     |
| c2     | 1.14        | 1.65  | 0.045     | 0.065 |       |
| D      | 8.51        | 9.65  | 0.335     | 0.380 | 2     |
| D1     | 6.86        | 8.00  | 0.270     | 0.315 | 3     |
| E      | 9.65        | 10.67 | 0.380     | 0.420 | 2, 3  |
| E1     | 7.90        | 8.80  | 0.311     | 0.346 | 3     |
| e      | 2.54 BSC    |       | 0.100 BSC |       |       |
| L      | 13.46       | 14.10 | 0.530     | 0.555 |       |
| L1     | -           | 1.65  | -         | 0.065 | 3     |
| L2     | 3.56        | 3.71  | 0.140     | 0.146 |       |

## Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body
- (3) Thermal pad contour optional within dimension E, L1, D1 and E1
- (4) Dimension b1 and c1 apply to base metal only
- (5) Controlling dimension: inches
- (6) Outline conform to JEDEC TO-262 except A1 (maximum), b (minimum) and D1 (minimum) where dimensions derived the actual package outline



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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

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[15ETH03STRR](#) [VS-15ETH03STRRPBF](#)