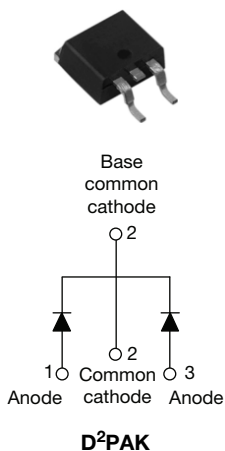
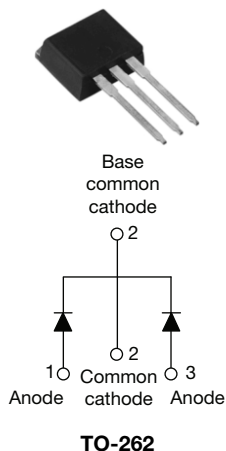


## Schottky Rectifier, 2 x 20 A

VS-48CTQ060SPbF



VS-48CTQ060-1PbF



### FEATURES

- 150 °C  $T_J$  operation
- Center tap configuration
- Low forward voltage drop
- High frequency operation
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Guard ring for enhanced ruggedness and long term reliability
- 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

This center tap Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, freewheeling diodes, and reverse battery protection.

### PRODUCT SUMMARY

|             |          |
|-------------|----------|
| $I_{F(AV)}$ | 2 x 20 A |
| $V_R$       | 60 V     |

### MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL      | CHARACTERISTICS                       | VALUES      | UNITS |
|-------------|---------------------------------------|-------------|-------|
| $I_{F(AV)}$ | Rectangular waveform                  | 40          | A     |
| $V_{RRM}$   |                                       | 60          | V     |
| $I_{FSM}$   | $t_p = 5 \mu s$ sine                  | 1000        | A     |
| $V_F$       | 20 Apk, $T_J = 125^\circ C$ (per leg) | 0.58        | V     |
| $T_J$       | Range                                 | - 55 to 150 | °C    |

### VOLTAGE RATINGS

| PARAMETER                            | SYMBOL    | VS-48CTQ060SPbF<br>VS-48CTQ060-1PbF | UNITS |
|--------------------------------------|-----------|-------------------------------------|-------|
| Maximum DC reverse voltage           | $V_R$     | 60                                  | V     |
| Maximum working peak reverse voltage | $V_{RWM}$ |                                     |       |

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                                                 | SYMBOL      | TEST CONDITIONS                                                                                                     | VALUES | UNITS |
|---------------------------------------------------------------------------|-------------|---------------------------------------------------------------------------------------------------------------------|--------|-------|
| Maximum average forward current<br>See fig. 5                             | $I_{F(AV)}$ | 50 % duty cycle at $T_C = 111^\circ C$ , rectangular waveform                                                       | 20     | A     |
| per leg                                                                   |             |                                                                                                                     | 40     |       |
| Maximum peak one cycle non-repetitive surge current per leg<br>See fig. 7 | $I_{FSM}$   | 5 $\mu s$ sine or 3 $\mu s$ rect. pulse                                                                             | 1000   |       |
|                                                                           |             | 10 ms sine or 6 ms rect. pulse                                                                                      | 260    |       |
| Non-repetitive avalanche energy per leg                                   | $E_{AS}$    | $T_J = 25^\circ C$ , $I_{AS} = 1.50 A$ , $L = 11.5 mH$                                                              | 13     | mJ    |
| Repetitive avalanche current per leg                                      | $I_{AR}$    | Current decaying linearly to zero in 1 $\mu s$<br>Frequency limited by $T_J$ maximum $V_A = 1.5 \times V_R$ typical | 1.50   | A     |

| ELECTRICAL SPECIFICATIONS                             |                |                                                                                            |                                     |        |       |  |
|-------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------|-------------------------------------|--------|-------|--|
| PARAMETER                                             | SYMBOL         | TEST CONDITIONS                                                                            |                                     | VALUES | UNITS |  |
| Maximum forward voltage drop per leg<br>See fig. 1    | $V_{FM}^{(1)}$ | 20 A                                                                                       | $T_J = 25\text{ }^{\circ}\text{C}$  | 0.61   | V     |  |
|                                                       |                | 40 A                                                                                       |                                     | 0.83   |       |  |
|                                                       |                | 20 A                                                                                       | $T_J = 125\text{ }^{\circ}\text{C}$ | 0.58   |       |  |
|                                                       |                | 40 A                                                                                       |                                     | 0.75   |       |  |
| Maximum reverse leakage current per leg<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                                         | $V_R = \text{Rated } V_R$           | 2      | mA    |  |
|                                                       |                | $T_J = 125\text{ }^{\circ}\text{C}$                                                        |                                     | 89     |       |  |
| Threshold Voltage                                     | $V_{F(TO)}$    | $T_J = T_J \text{ maximum}$                                                                |                                     | 0.37   | V     |  |
| Forward slope resistance                              | $r_t$          |                                                                                            |                                     | 8.26   | mΩ    |  |
| Maximum junction capacitance per leg                  | $C_T$          | $V_R = 5\text{ }V_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^{\circ}\text{C}$ |                                     | 1220   | pF    |  |
| Typical series inductance per leg                     | $L_S$          | Measured lead to lead 5 mm from package body                                               |                                     | 8.0    | nH    |  |
| Maximum voltage rate of change                        | dV/dt          | Rated $V_R$                                                                                |                                     | 10 000 | V/μs  |  |

### Note

<sup>(1)</sup> Pulse width < 300  $\mu$ s, duty cycle < 2 %

| THERMAL - MECHANICAL SPECIFICATIONS                      |         |                                   |                                      |             |                        |
|----------------------------------------------------------|---------|-----------------------------------|--------------------------------------|-------------|------------------------|
| PARAMETER                                                |         | SYMBOL                            | TEST CONDITIONS                      | VALUES      | UNITS                  |
| Maximum junction and storage temperature range           |         | T <sub>J</sub> , T <sub>Stg</sub> |                                      | - 55 to 150 | °C                     |
| Maximum thermal resistance, junction to case per leg     |         | R <sub>thJC</sub>                 | DC operation                         | 2.0         | °C/W                   |
| Maximum thermal resistance, junction to case per package |         |                                   |                                      | 1.0         |                        |
| Typical thermal resistance, case to heatsink             |         | R <sub>thCS</sub>                 | Mounting surface, smooth and greased | 0.50        |                        |
| Approximate weight                                       |         |                                   |                                      | 2           | g                      |
|                                                          |         |                                   |                                      | 0.07        | oz.                    |
| Mounting torque                                          | minimum |                                   |                                      | 6 (5)       | kgf · cm<br>(lbf · in) |
|                                                          | maximum |                                   |                                      | 12 (10)     |                        |
| Marking device                                           |         | Case style D <sup>2</sup> PAK     |                                      | 48CTQ060S   |                        |
|                                                          |         | Case style TO-262                 |                                      | 48CTQ060-1  |                        |



# VS-48CTQ060SPbF, VS-48CTQ060-1PbF

Schottky Rectifier, 2 x 20 A Vishay High Power Products

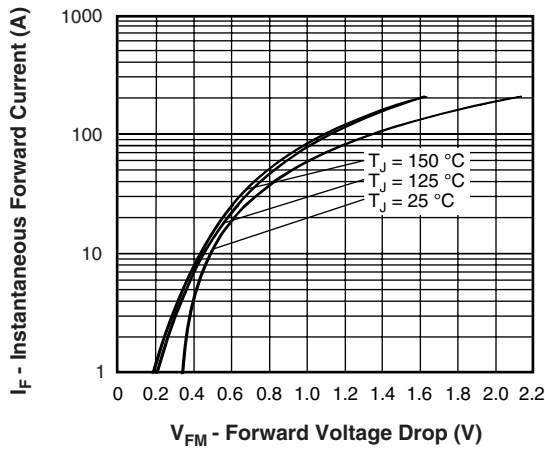


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

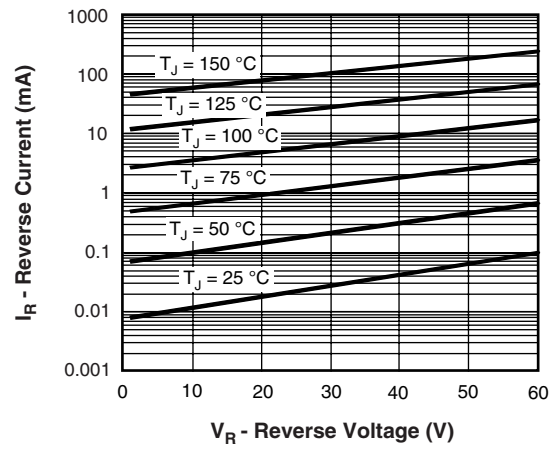


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

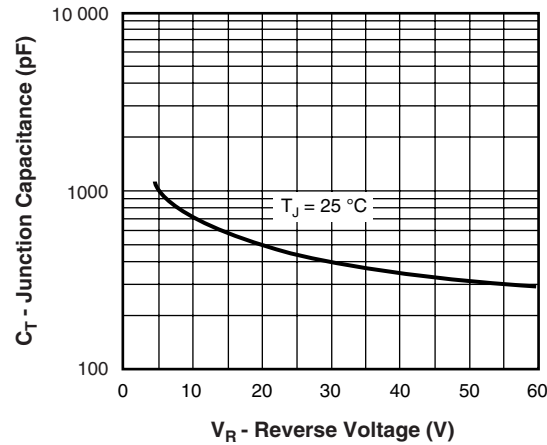


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

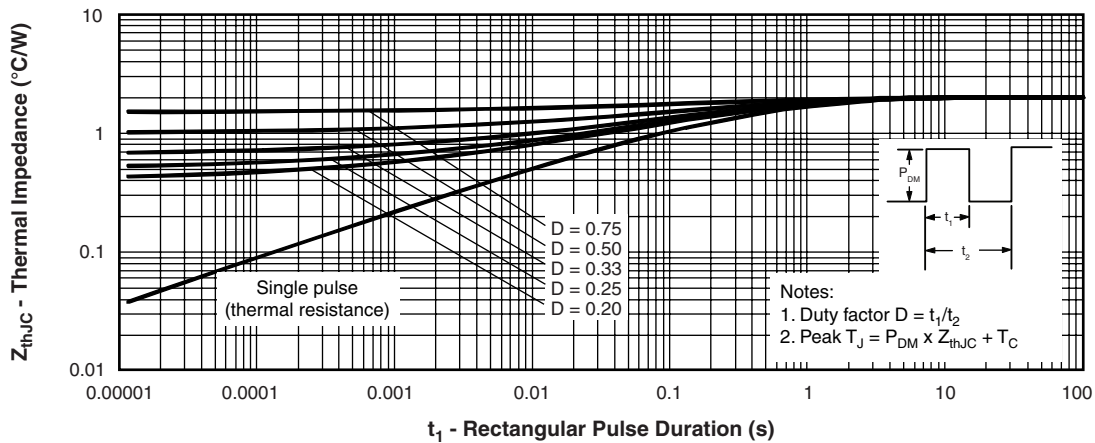


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

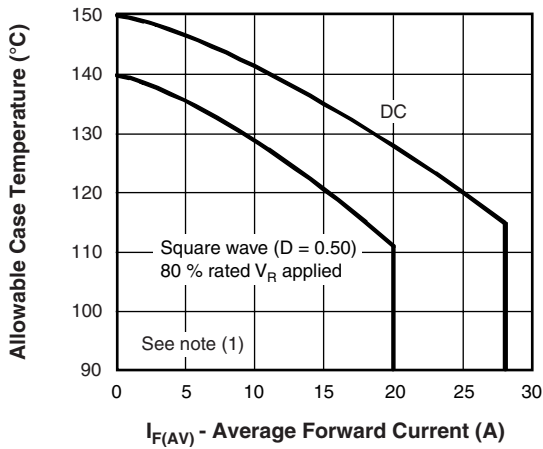


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

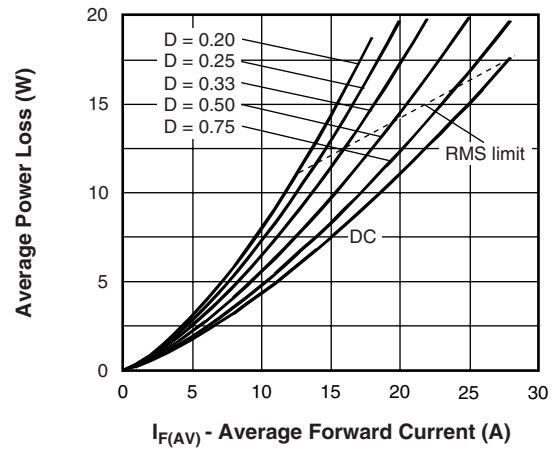


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

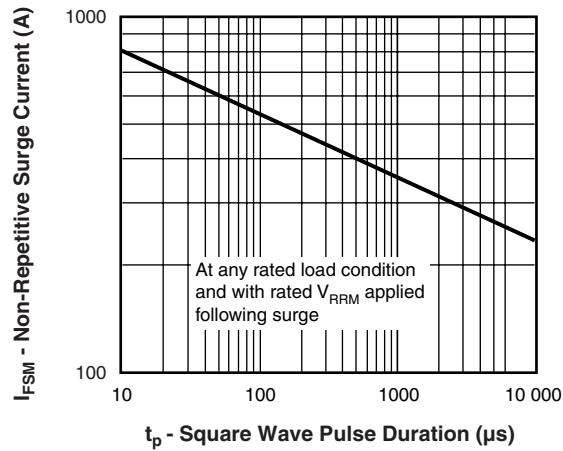


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

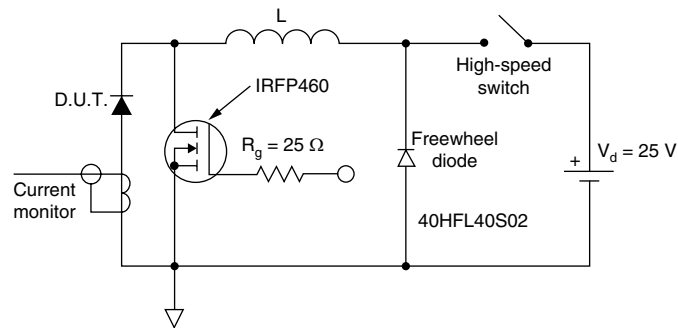


Fig. 8 - Unclamped Inductive Test Circuit

### 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  $V_{R1} = 10\text{ V}$



# VS-48CTQ060SPbF, VS-48CTQ060-1PbF

Schottky Rectifier, 2 x 20 A Vishay High Power Products

## ORDERING INFORMATION TABLE

|             |     |    |   |   |   |     |   |     |     |
|-------------|-----|----|---|---|---|-----|---|-----|-----|
| Device code | VS- | 48 | C | T | Q | 060 | S | TRL | PbF |
|             | 1   | 2  | 3 | 4 | 5 | 6   | 7 | 8   | 9   |

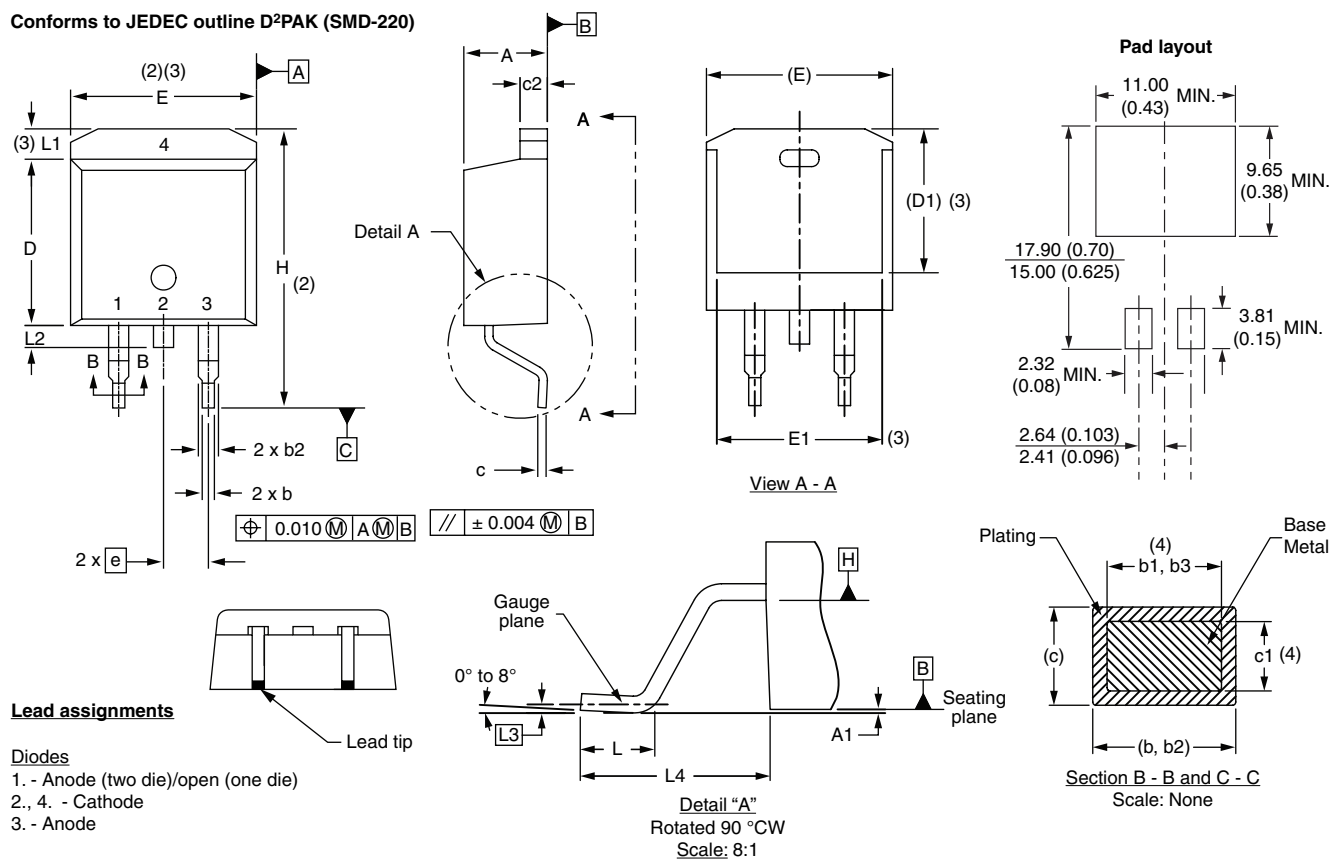
- |          |   |                                                                                                                                                                          |
|----------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b> | - | HPP product suffix                                                                                                                                                       |
| <b>2</b> | - | Current rating (40 A)                                                                                                                                                    |
| <b>3</b> | - | Circuit configuration: C = Common cathode                                                                                                                                |
| <b>4</b> | - | T = TO-220                                                                                                                                                               |
| <b>5</b> | - | Schottky "Q" series                                                                                                                                                      |
| <b>6</b> | - | Voltage rating (060 = 60 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 only)<br>• TRR = Tape and reel (right oriented - for D <sup>2</sup> PAK only) |
| <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> |

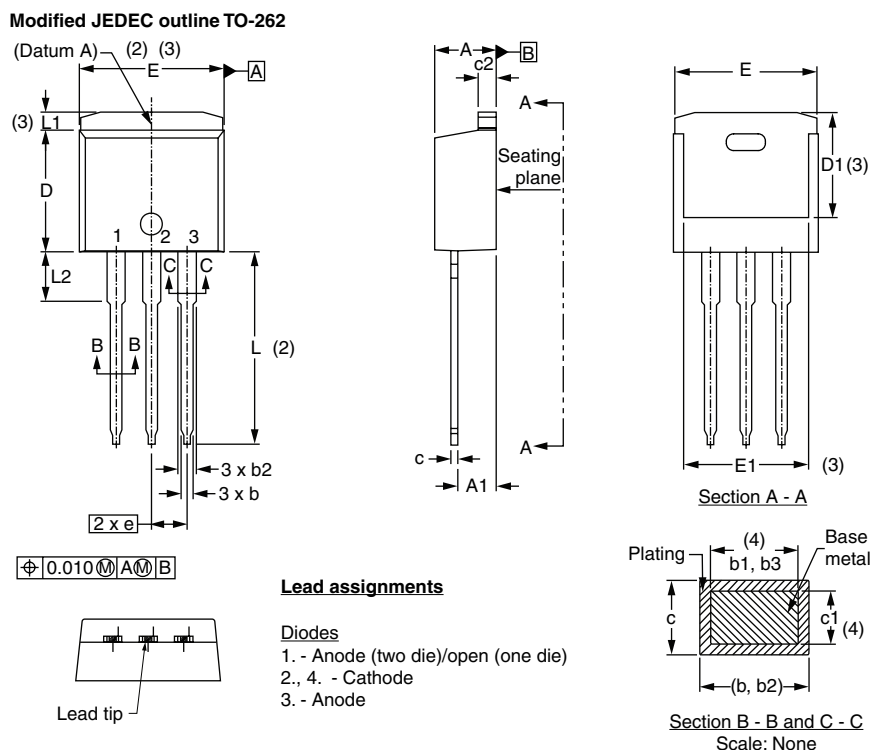
## D<sup>2</sup>PAK, TO-262

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

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



## 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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