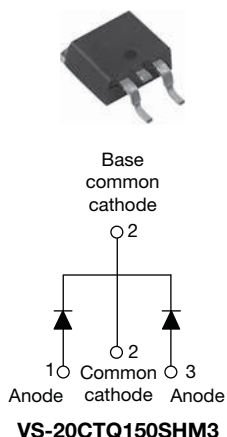
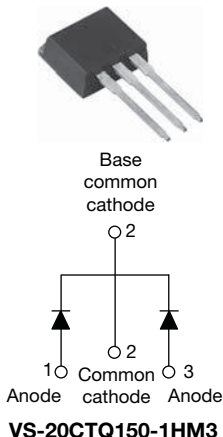


## High Performance Schottky Rectifier, 2 x 10 A

**TO-263AB (D<sup>2</sup>PAK)**

**TO-262AA**


### FEATURES

- 175 °C T<sub>J</sub> 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
- AEC-Q101 qualified meets JESD-201 class 1A 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

### PRODUCT SUMMARY

|                                  |                                         |
|----------------------------------|-----------------------------------------|
| Package                          | TO-263AB (D <sup>2</sup> PAK), TO-262AA |
| I <sub>F(AV)</sub>               | 2 x 10 A                                |
| V <sub>R</sub>                   | 150 V                                   |
| V <sub>F</sub> at I <sub>F</sub> | 0.66 V                                  |
| I <sub>RM</sub> max.             | 5.0 mA at 125 °C                        |
| T <sub>J</sub> max.              | 175 °C                                  |
| E <sub>AS</sub>                  | 1.0 mJ                                  |
| Diode variation                  | Common cathode                          |

### DESCRIPTION

This center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in switching power supplies, converters, freewheeling diodes, and reverse battery protection.

### MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL             | CHARACTERISTICS                                        | VALUES      | UNITS |
|--------------------|--------------------------------------------------------|-------------|-------|
| I <sub>F(AV)</sub> | Rectangular waveform                                   | 20          | A     |
| V <sub>RRM</sub>   |                                                        | 150         | V     |
| I <sub>FSM</sub>   | t <sub>p</sub> = 5 μs sine                             | 1030        | A     |
| V <sub>F</sub>     | 10 A <sub>pk</sub> , T <sub>J</sub> = 125 °C (per leg) | 0.66        | V     |
| T <sub>J</sub>     | Range                                                  | -55 to +175 | °C    |

### VOLTAGE RATINGS

| PARAMETER                            | SYMBOL           | VS-20CTQ150SHM3<br>VS-20CTQ150-1HM3 | UNITS |
|--------------------------------------|------------------|-------------------------------------|-------|
| Maximum DC reverse voltage           | V <sub>R</sub>   | 150                                 | V     |
| Maximum working peak reverse voltage | V <sub>RWM</sub> |                                     |       |

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                                                 | SYMBOL             | TEST CONDITIONS                                                                                                                        | VALUES | UNITS |
|---------------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------|-------|
| Maximum average forward current<br>See fig. 5                             | I <sub>F(AV)</sub> | 50 % duty cycle at T <sub>C</sub> = 154 °C, rectangular waveform                                                                       | 10     | A     |
|                                                                           |                    |                                                                                                                                        | 20     |       |
| Maximum peak one cycle non-repetitive surge current per leg<br>See fig. 7 | I <sub>FSM</sub>   | 5 μs sine or 3 μs rect. pulse                                                                                                          | 1030   |       |
|                                                                           |                    | 10 ms sine or 6 ms rect. pulse                                                                                                         | 180    |       |
| Non-repetitive avalanche energy per leg                                   | E <sub>AS</sub>    | T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 1 A, L = 2 mH                                                                                | 1.0    | mJ    |
| Repetitive avalanche current per leg                                      | I <sub>AR</sub>    | Current decaying linearly to zero in 1 μs<br>Frequency limited by T <sub>J</sub> maximum V <sub>A</sub> = 1.5 x V <sub>R</sub> typical | 1      | A     |

**ELECTRICAL SPECIFICATIONS**

| PARAMETER                                             | SYMBOL         | TEST CONDITIONS                                                                            |                                     | TYP. | MAX.   | UNITS            |
|-------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------|-------------------------------------|------|--------|------------------|
| Maximum forward voltage drop per leg<br>See fig. 1    | $V_{FM}^{(1)}$ | 10 A                                                                                       | $T_J = 25\text{ }^{\circ}\text{C}$  | 0.80 | 0.88   | V                |
|                                                       |                | 20 A                                                                                       |                                     | 0.90 | 1.0    |                  |
|                                                       |                | 10 A                                                                                       | $T_J = 125\text{ }^{\circ}\text{C}$ | 0.63 | 0.66   |                  |
|                                                       |                | 20 A                                                                                       |                                     | 0.73 | 0.77   |                  |
| Maximum reverse leakage current per leg<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                                         | $V_R = \text{Rated } V_R$           | 3.0  | 25     | $\mu\text{A}$    |
|                                                       |                | $T_J = 125\text{ }^{\circ}\text{C}$                                                        |                                     | 2.7  | 5.0    | mA               |
| Typical junction capacitance per leg                  | $C_T$          | $V_R = 5\text{ V}_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^{\circ}\text{C}$ |                                     | -    | 280    | 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/ $\mu\text{s}$ |

**Note**(1) Pulse width < 300  $\mu\text{s}$ , duty cycle < 2 %**THERMAL - MECHANICAL SPECIFICATIONS**

| PARAMETER                                                                 | SYMBOL         | TEST CONDITIONS                                           | VALUES      | UNITS                |
|---------------------------------------------------------------------------|----------------|-----------------------------------------------------------|-------------|----------------------|
| Maximum junction and storage temperature range                            | $T_J, T_{Stg}$ |                                                           | -55 to +175 | $^{\circ}\text{C}$   |
| Maximum thermal resistance,<br>junction to case<br>per leg<br>per package | $R_{thJC}$     | DC operation                                              | 2.0         | $^{\circ}\text{C/W}$ |
|                                                                           |                |                                                           | 1.0         |                      |
| Typical thermal resistance,<br>case to heatsink                           | $R_{thCS}$     | Mounting surface, smooth and greased<br>(Only for TO-262) | 0.50        |                      |
| Approximate weight                                                        |                |                                                           | 2           | g                    |
|                                                                           |                |                                                           | 0.07        | oz.                  |
| Mounting torque<br>minimum<br>maximum                                     |                |                                                           | 6 (5)       | kgf · cm             |
|                                                                           |                |                                                           | 12 (10)     | (lbf · in)           |
| Marking device                                                            |                | Case style D <sup>2</sup> PAK                             | 20CTQ150SH  |                      |
|                                                                           |                | Case style TO-262                                         | 20CTQ150-1H |                      |

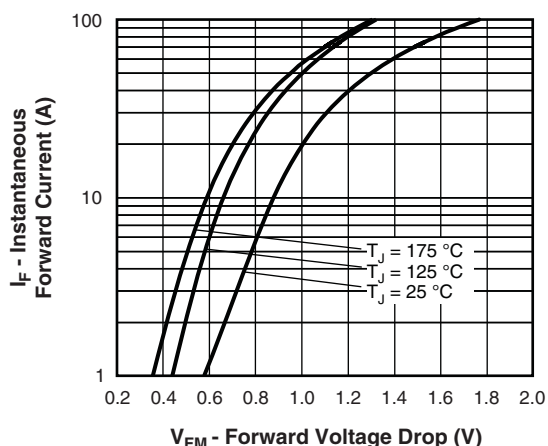


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

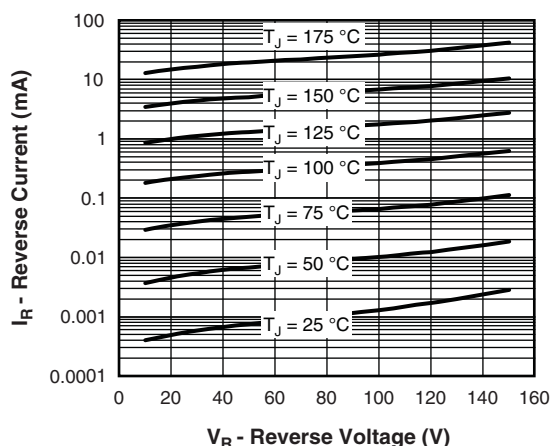


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

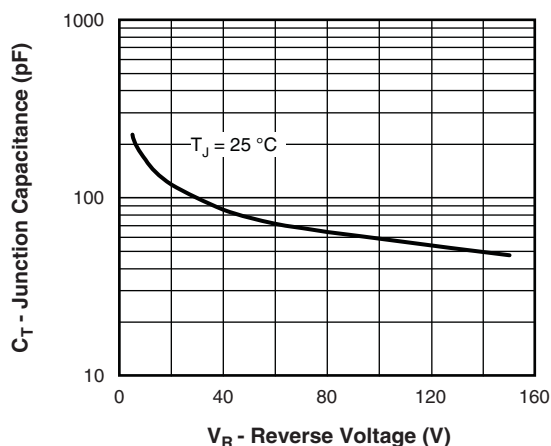


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

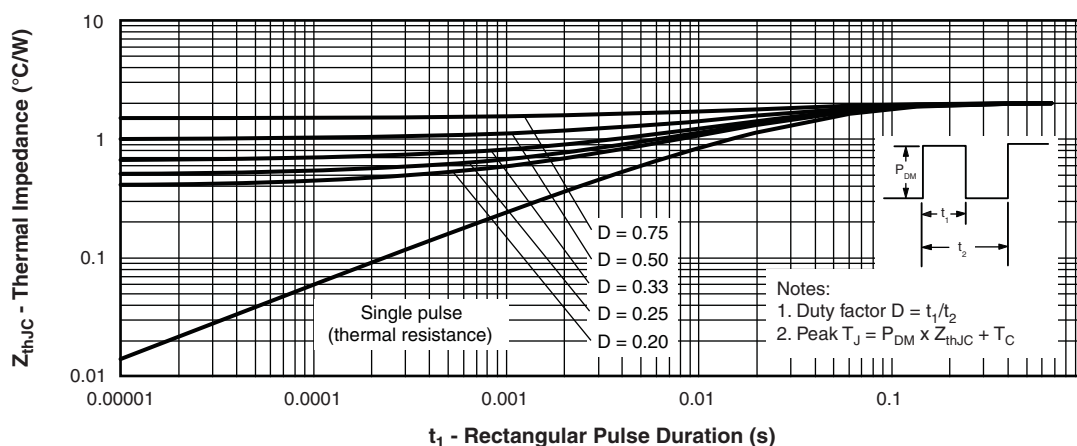


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

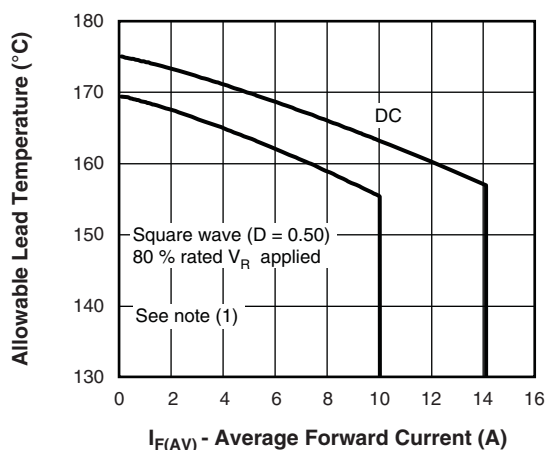


Fig. 5 - Maximum Average Forward Current vs. Allowable Lead Temperature

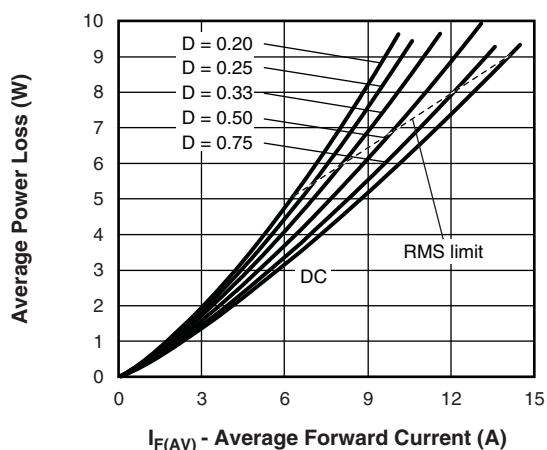


Fig. 6 - Maximum Average Forward Dissipation vs. Average Forward Current

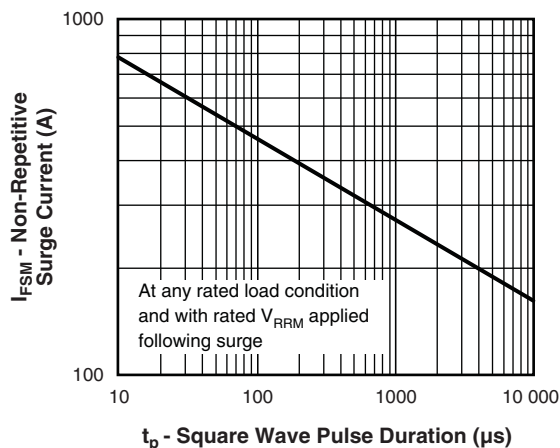


Fig. 7 - Maximum Peak Surge Forward Current vs. Pulse Duration

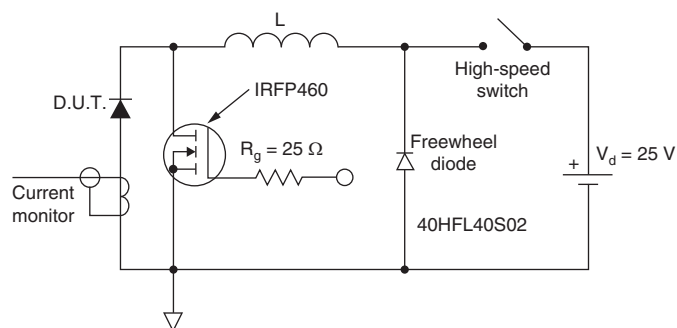


Fig. 8 - Unclamped Inductive Test Circuit

## 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  $V_{R1} = 80\%$  rated  $V_R$

**ORDERING INFORMATION TABLE**

| Device code | VS-                                                                                                                                                          | 20 | C | T | Q | 150 | S | TRL | H | M3 |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|---|---|-----|---|-----|---|----|
|             | 1                                                                                                                                                            | 2  | 3 | 4 | 5 | 6   | 7 | 8   | 9 | 10 |
| 1           | Vishay Semiconductors product                                                                                                                                |    |   |   |   |     |   |     |   |    |
| 2           | Current rating (20 = 20 A)                                                                                                                                   |    |   |   |   |     |   |     |   |    |
| 3           | C = common cathode                                                                                                                                           |    |   |   |   |     |   |     |   |    |
| 4           | T = TO-220                                                                                                                                                   |    |   |   |   |     |   |     |   |    |
| 5           | Schottky "Q" series                                                                                                                                          |    |   |   |   |     |   |     |   |    |
| 6           | Voltage rating (150 = 150 V)                                                                                                                                 |    |   |   |   |     |   |     |   |    |
| 7           | • S = D <sup>2</sup> PAK<br>• -1 = TO-262                                                                                                                    |    |   |   |   |     |   |     |   |    |
| 8           | • None = tube<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) |    |   |   |   |     |   |     |   |    |
| 9           | H = AEC-Q101 qualified                                                                                                                                       |    |   |   |   |     |   |     |   |    |
| 10          | M3 = halogen-free, RoHS -compliant and termination lead (Pb)-free                                                                                            |    |   |   |   |     |   |     |   |    |

| ORDERING INFORMATION (Example) |                  |                        |                          |
|--------------------------------|------------------|------------------------|--------------------------|
| PREFERRED P/N                  | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION    |
| VS-20CTQ150SHM3                | 50               | 1000                   | Antistatic plastic tubes |
| VS-20CTQ150STRLHM3             | 800              | 800                    | 13" diameter reel        |
| VS-20CTQ150STRRHM3             | 800              | 800                    | 13" diameter reel        |
| VS-20CTQ150-1HM3               | 50               | 1000                   | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS |                               |                                                                        |
|----------------------------|-------------------------------|------------------------------------------------------------------------|
| Dimensions                 | TO-263AB (D <sup>2</sup> PAK) | <a href="http://www.vishay.com/doc?95046">www.vishay.com/doc?95046</a> |
|                            | TO-262AA                      | <a href="http://www.vishay.com/doc?95419">www.vishay.com/doc?95419</a> |
| Part marking information   | TO-263AB (D <sup>2</sup> PAK) | <a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</a> |
|                            | TO-262AA                      | <a href="http://www.vishay.com/doc?95443">www.vishay.com/doc?95443</a> |
| Packaging information      |                               | <a href="http://www.vishay.com/doc?95032">www.vishay.com/doc?95032</a> |



## D<sup>2</sup>PAK

### DIMENSIONS 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 |       |

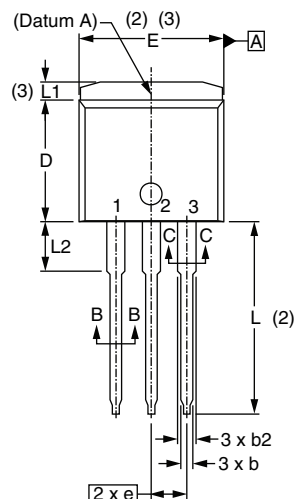
#### Notes

- (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

## TO-262

### DIMENSIONS in millimeters and inches

#### Modified JEDEC outline TO-262



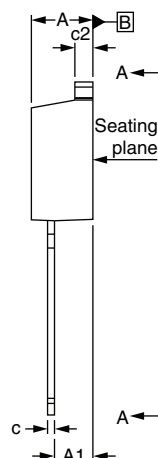
$\pm 0.010$  (M) (A) (B)



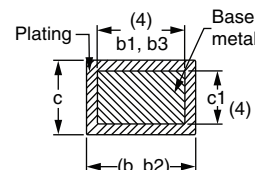
#### Lead assignments

##### Diodes

1. - Anode (two die)/open (one die)
2. - Cathode
3. - Anode



Section A - A



Section B - B and C - C

Scale: None

| 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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