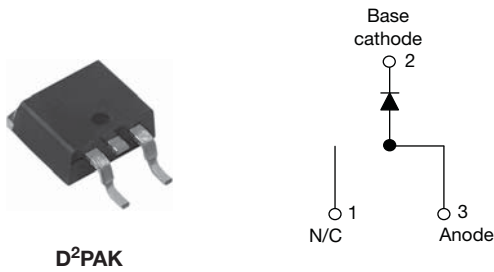


## High Performance Schottky Rectifier, 15 A



### FEATURES

- 150 °C T<sub>J</sub> operation
- Very 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
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### DESCRIPTION

The VS-15TQ060SPbF Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. 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                  |                    |
|----------------------------------|--------------------|
| Package                          | D <sup>2</sup> PAK |
| I <sub>F(AV)</sub>               | 15 A               |
| V <sub>R</sub>                   | 60 V               |
| V <sub>F</sub> at I <sub>F</sub> | 0.56 V             |
| I <sub>RM</sub> max.             | 45 mA at 125 °C    |
| T <sub>J</sub> max.              | 150 °C             |
| Diode variation                  | Single die         |
| E <sub>AS</sub>                  | 6 mJ               |

| MAJOR RATINGS AND CHARACTERISTICS |  |             |       |
|-----------------------------------|--|-------------|-------|
| SYMBOL                            | CHARACTERISTICS                              | VALUES      | UNITS |
| I <sub>F(AV)</sub>                | Rectangular waveform                         | 15          | A     |
| V <sub>RRM</sub>                  |  | 60          | V     |
| I <sub>FSM</sub>                  | t <sub>p</sub> = 5 μs sine                   | 1000        | A     |
| V <sub>F</sub>                    | 15 A <sub>pk</sub> , T <sub>J</sub> = 125 °C | 0.56        | V     |
| T <sub>J</sub>                    | Range  | -55 to +150 | °C    |

| VOLTAGE RATINGS                      |                  |                |       |
|--------------------------------------|------------------|----------------|-------|
| PARAMETER                            | SYMBOL           | VS-15TQ060SPbF | UNITS |
| Maximum DC reverse voltage           | V <sub>R</sub>   | 60             | 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> = 104 °C, rectangular waveform   |  | 15     | A     |
| Maximum peak one cycle<br>non-repetitive surge current<br>See fig. 7 | I <sub>FSM</sub>   | 5 μs sine or 3 μs rect. pulse  | Following any rated<br>load condition and with<br>rated V <sub>RRM</sub> applied | 1000   | A     |
|  |                    | 10 ms sine or 6 ms rect. pulse   |  | 260    |       |
| Non-repetitive avalanche energy                                      | E <sub>AS</sub>    | T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 1.5 A, L = 11.5 mH   |  | 6      | mJ    |
| Repetitive avalanche current   | 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 |  | 1.50   | A     |



| ELECTRICAL SPECIFICATIONS                     |                |   |                                   |        |            |
|---|----------------|---|-----------------------------------|--------|------------|
| PARAMETER                                     | SYMBOL         | TEST CONDITIONS   |                                   | VALUES | UNITS      |
| Maximum forward voltage drop<br>See fig. 1    | $V_{FM}^{(1)}$ | 15 A  | $T_J = 25\text{ }^\circ\text{C}$  | 0.62   | V          |
|   |                | 30 A  |                                   | 0.82   |            |
|   |                | 15 A  | $T_J = 125\text{ }^\circ\text{C}$ | 0.56   |            |
|   |                | 30 A  |                                   | 0.71   |            |
| Maximum reverse leakage current<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^\circ\text{C}$  | $V_R = \text{Rated } V_R$         | 0.80   | mA         |
|   |                | $T_J = 125\text{ }^\circ\text{C}$   |                                   | 45     |            |
| Maximum junction capacitance                  | $C_T$          | $V_R = 5 V_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^\circ\text{C}$ |                                   | 720    | pF         |
| Typical series inductance                     | $L_S$          | 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/ $\mu$ s |

**Note**(1) Pulse width < 300  $\mu$ 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 +150 | $^\circ\text{C}$       |
| Maximum thermal resistance, junction to case   | $R_{thJC}$     | DC operation<br>See fig. 4           |  | 3.25        | $^\circ\text{C/W}$     |
| Typical thermal resistance, case to heatsink   | $R_{thCS}$     | 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        |  | 15TQ060S    |                        |

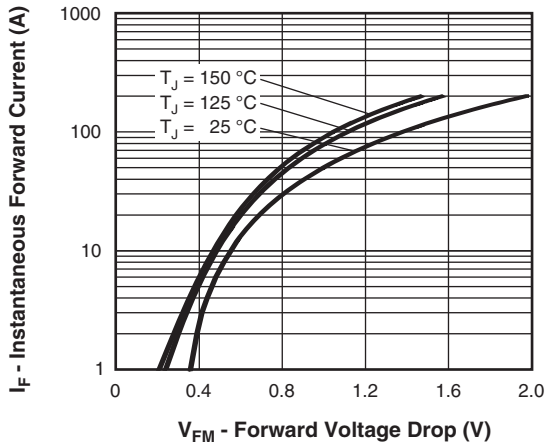


Fig. 1 - Maximum Forward Voltage Drop Characteristics

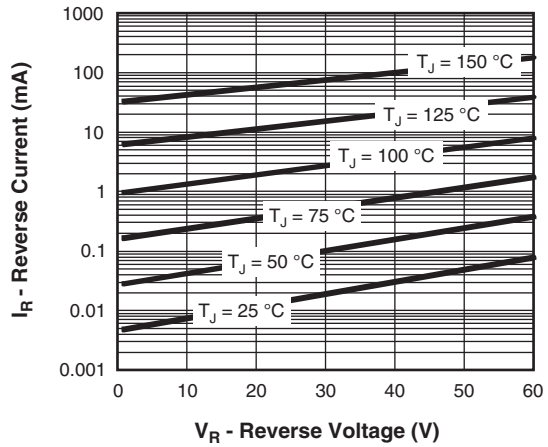


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

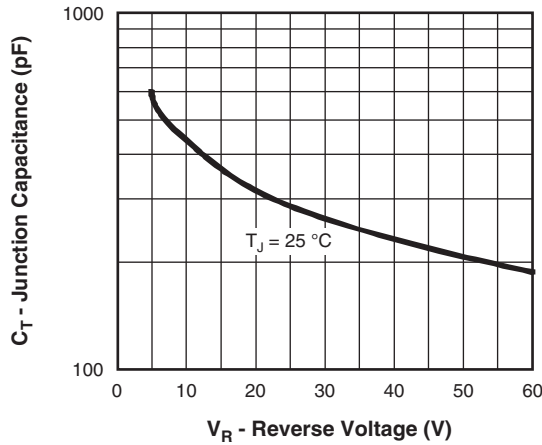


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

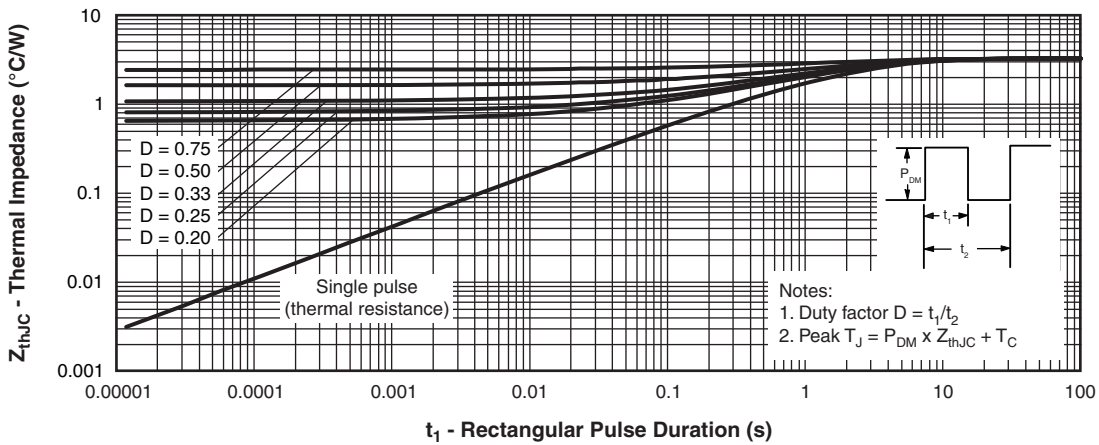


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

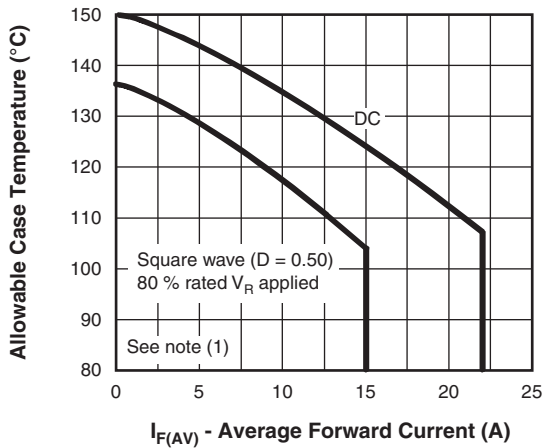


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

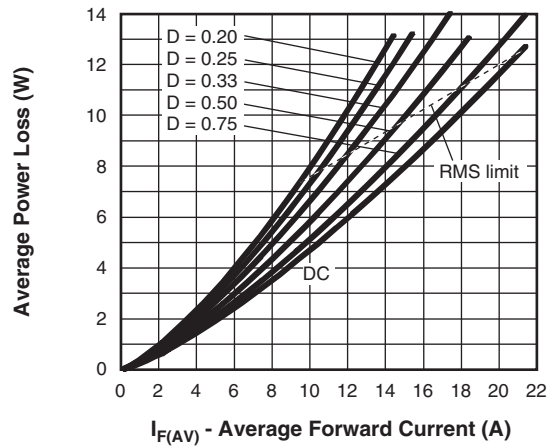


Fig. 6 - Forward Power Loss Characteristics

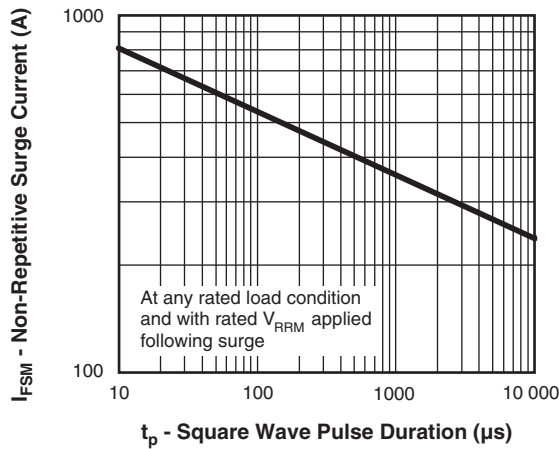


Fig. 7 - Maximum Non-Repetitive Surge Current

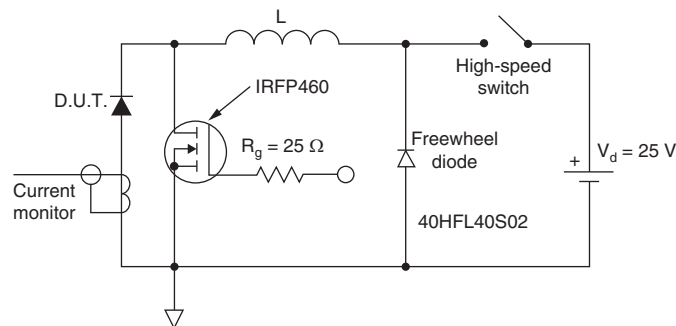


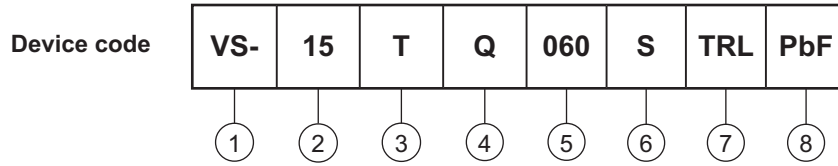
Fig. 8 - Unclamped Inductive Test Circuit

**Note**

- (1) Formula used:  $T_C = T_J - (P_d + P_{d_{REV}}) \times R_{thJC}$ ;
- $P_d$  = Forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);
- $P_{d_{REV}}$  = Inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1} = 80\%$  rated  $V_R$



ORDERING INFORMATION TABLE



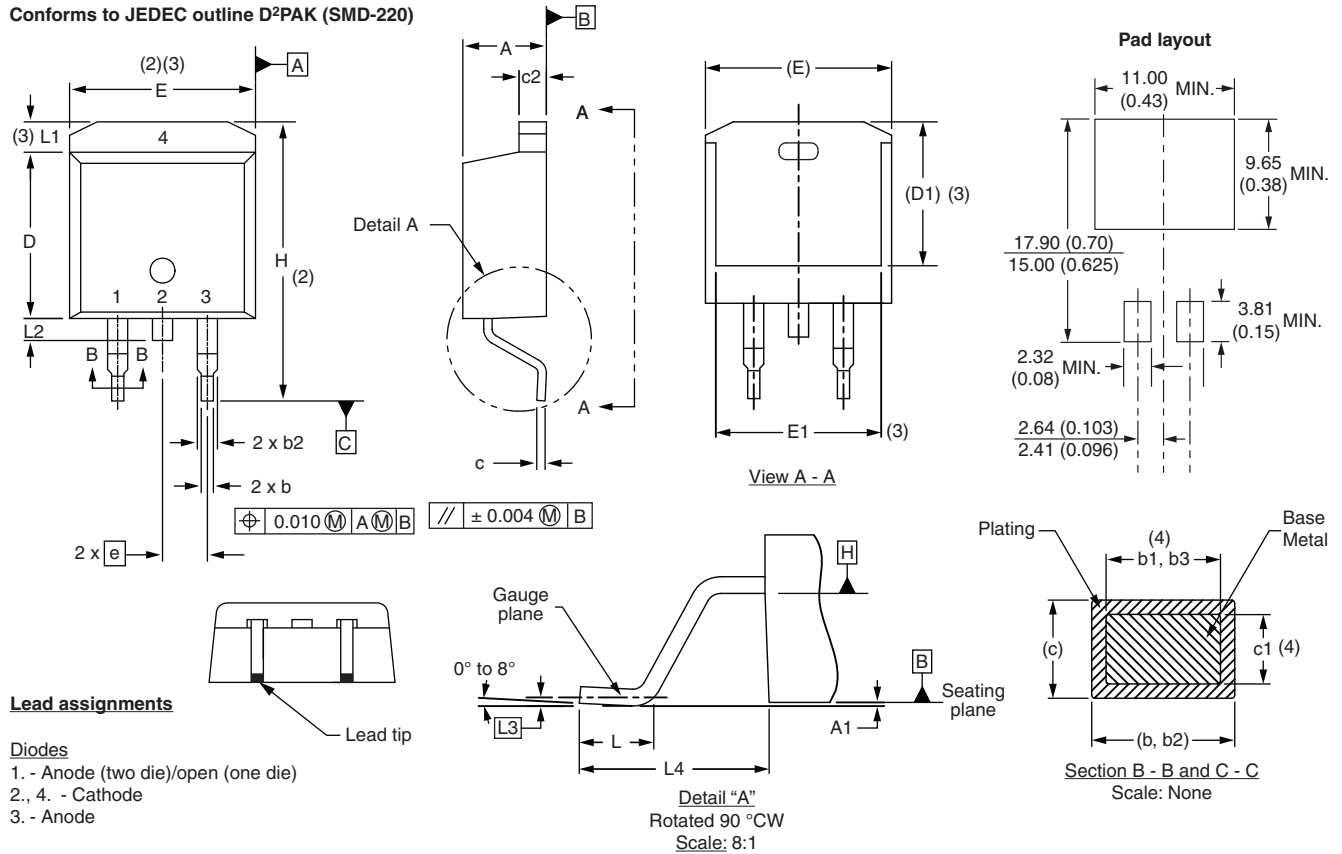
- 1** - Vishay Semiconductors product
- 2** - Current rating (15 A)
- 3** - Circuit configuration: T = TO-220
- 4** - Schottky "Q" series
- 5** - Voltage rating (060 = 60 V)
- 6** - S = D<sup>2</sup>PAK
- 7** -
  - None = tube (50 pieces)
  - TRL = tape and reel (left oriented)
  - TRR = tape and reel (right oriented)
- 8** - 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> |
| SPIICE model               | <a href="http://www.vishay.com/doc?95600">www.vishay.com/doc?95600</a> |

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

### DIMENSIONS - 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     |

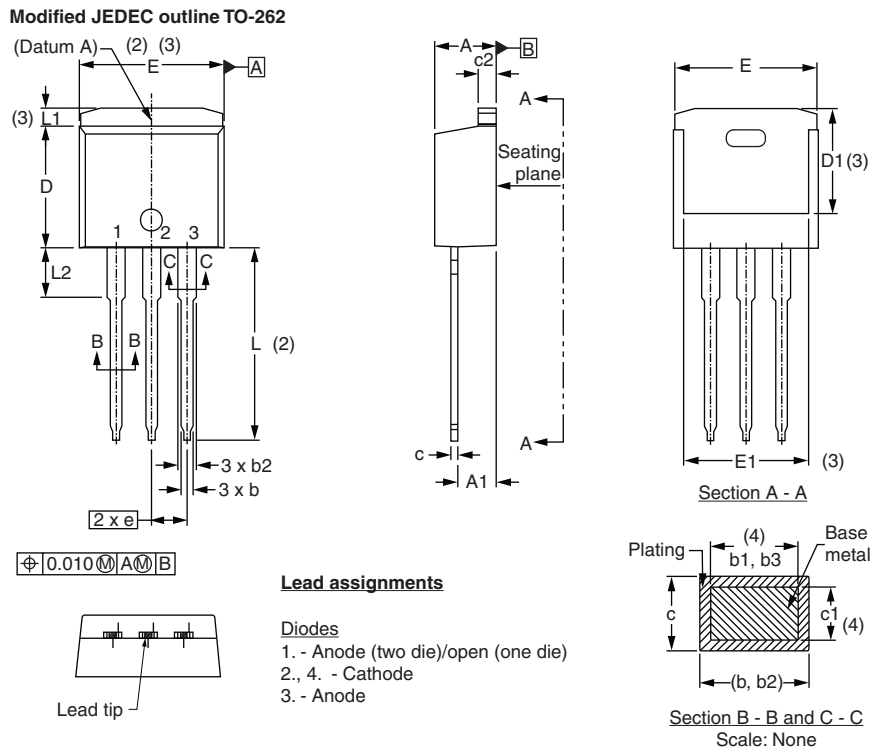
| SYMBOL | MILLIMETERS |       | INCHES    |       | NOTES |
|--------|-------------|-------|-----------|-------|-------|
|        | MIN.        | MAX.  | MIN.      | MAX.  |       |
| D1     | 6.86        | 8.00  | 0.270     | 0.315 | 3     |
| E      | 9.65        | 10.67 | 0.380     | 0.420 | 2, 3  |
| 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 - 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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