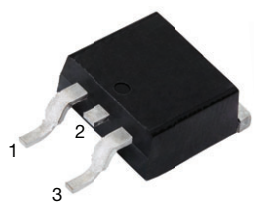
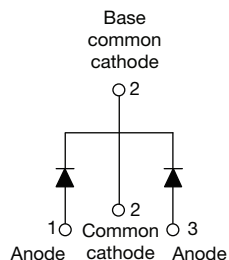
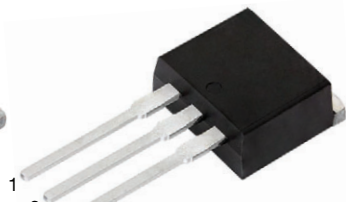
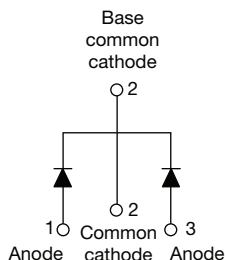


## High Performance Schottky Rectifier, 2 x 10 A


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

**VS-20CTQ150S-M3**

**TO-262AA**

**VS-20CTQ150-1-M3**

### 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 245 °C
- Designed and qualified according to JEDEC®-JESD 47
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### 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.

### PRIMARY CHARACTERISTICS

|                                  |                                         |
|----------------------------------|-----------------------------------------|
| 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                                  |
| Package                          | D <sup>2</sup> PAK (TO-263AB), TO-262AA |
| Circuit configuration            | Common cathode                          |

### 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-20CTQ150S-M3<br>VS-20CTQ150-1-M3 | 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                             | $I_{F(AV)}$ | 50 % duty cycle at $T_C = 154\text{ }^{\circ}\text{C}$ , rectangular waveform                                             | 10     | A     |
| per leg                                                                   |             |                                                                                                                           | 20     |       |
| per device                                                                |             |                                                                                                                           |        |       |
| Maximum peak one cycle non-repetitive surge current per leg<br>See fig. 7 | $I_{FSM}$   | 5 $\mu\text{s}$ sine or 3 $\mu\text{s}$ rect. pulse                                                                       | 1030   |       |
|                                                                           |             | 10 ms sine or 6 ms rect. pulse                                                                                            | 180    |       |
| Following any rated load condition and with rated $V_{RRM}$ applied       |             |                                                                                                                           |        |       |
| Non-repetitive avalanche energy per leg                                   | $E_{AS}$    | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_{AS} = 1\text{ A}$ , $L = 2\text{ mH}$                                            | 1.0    | mJ    |
| Repetitive avalanche current per leg                                      | $I_{AR}$    | Current decaying linearly to zero in 1 $\mu\text{s}$<br>Frequency limited by $T_J$ maximum $V_A = 1.5 \times V_R$ 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                                                                                       | 0.80 | 0.88   | V                |
|                                                       |                | 20 A                                                                                       | 0.90 | 1.0    |                  |
|                                                       |                | $T_J = 25\text{ }^{\circ}\text{C}$                                                         |      |        |                  |
|                                                       |                | 10 A                                                                                       | 0.63 | 0.66   |                  |
| Maximum reverse leakage current per leg<br>See fig. 2 | $I_{RM}^{(1)}$ | 20 A                                                                                       | 0.73 | 0.77   |                  |
|                                                       |                | $T_J = 125\text{ }^{\circ}\text{C}$                                                        |      |        |                  |
|                                                       |                | $T_J = 25\text{ }^{\circ}\text{C}$                                                         | 3.0  | 25     |                  |
|                                                       |                | $T_J = 125\text{ }^{\circ}\text{C}$                                                        | 2.7  | 5.0    |                  |
| Maximum reverse leakage current per leg               |                | $V_R = \text{Rated } V_R$                                                                  |      |        | $\mu\text{A}$    |
| 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, per leg            | $R_{thJC}$     | DC operation                                              | 2.0         | $^{\circ}\text{C/W}$ |
| junction to case                               |                |                                                           | 1.0         |                      |
| per package                                    |                |                                                           |             |                      |
| Typical thermal resistance, 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                                | minimum        |                                                           | 6 (5)       | kgf · cm             |
|                                                | maximum        |                                                           | 12 (10)     | (lbf · in)           |
| Marking device                                 |                | Case style D <sup>2</sup> PAK (TO-263AB)                  | 20CTQ150S   |                      |
|                                                |                | Case style TO-262AA                                       | 20CTQ150-1  |                      |

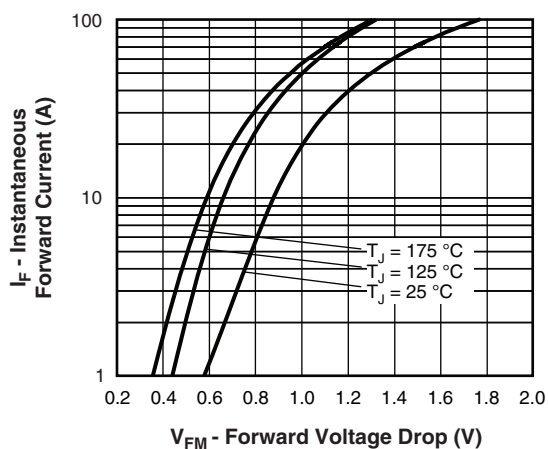


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

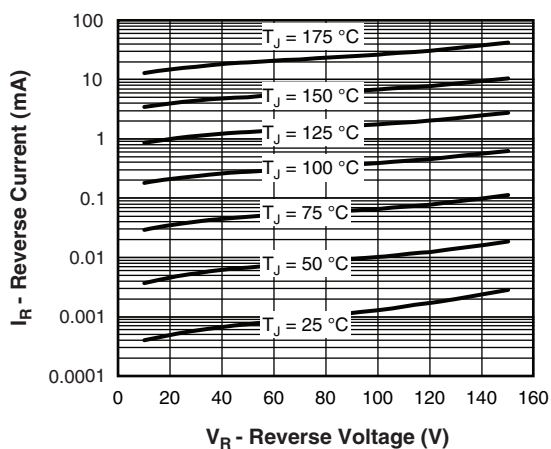


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

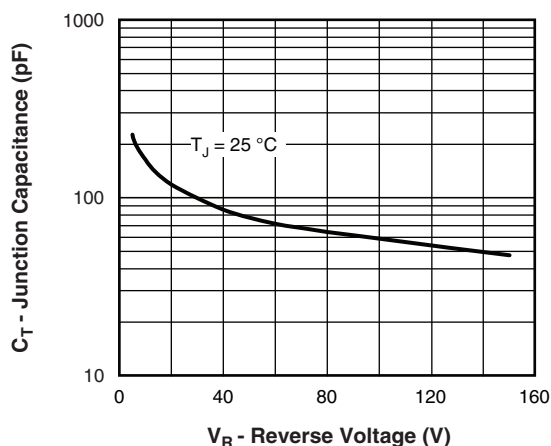


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

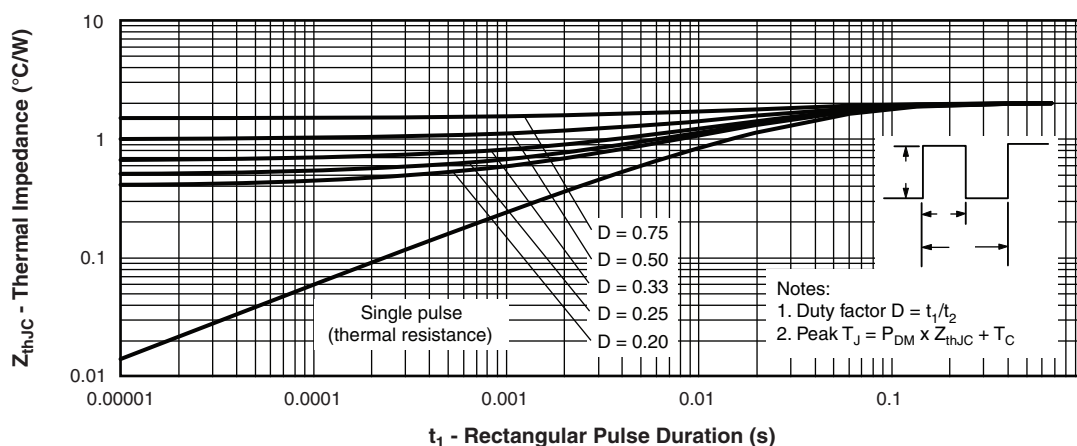


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

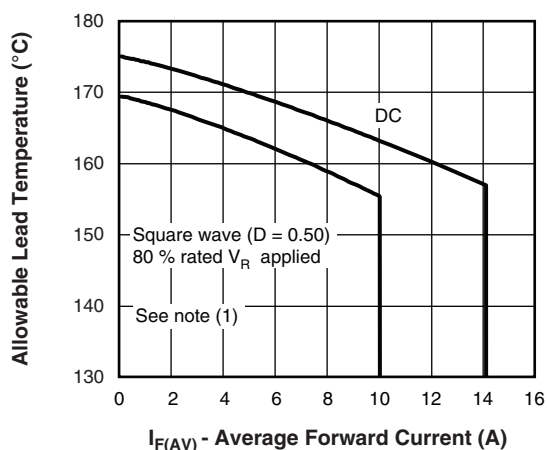


Fig. 5 - Maximum Average Forward Current vs. Allowable Lead Temperature

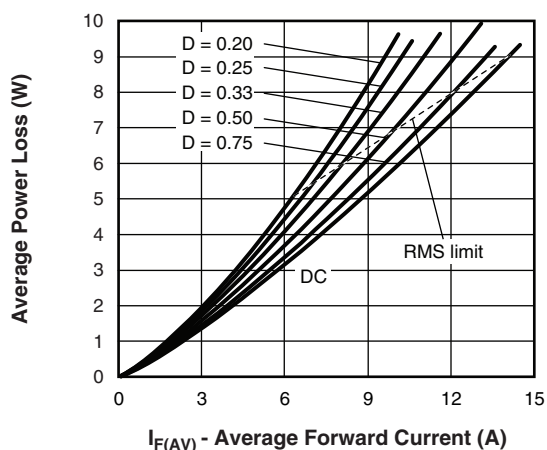


Fig. 6 - Maximum Average Forward Dissipation vs. Average Forward Current

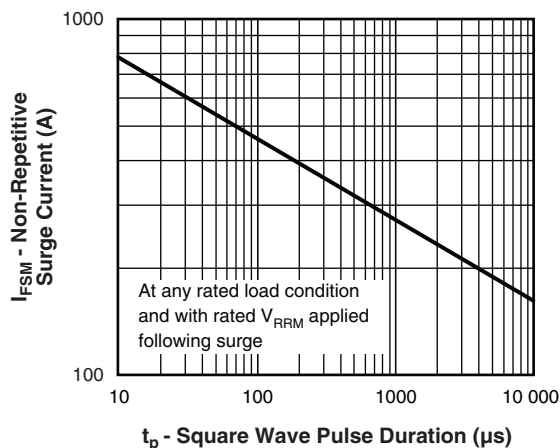


Fig. 7 - Maximum Peak Surge Forward Current vs. Pulse Duration

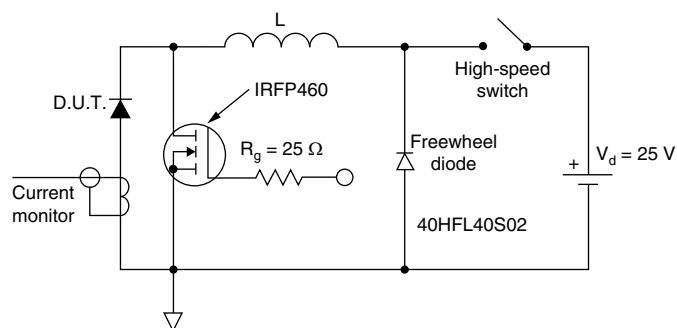


Fig. 8 - Unclamped Inductive Test Circuit

#### 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 | <b>VS-</b>                                                                                                                                                                           | <b>20</b> | <b>C</b> | <b>T</b> | <b>Q</b> | <b>150</b> | <b>S</b> | <b>TRL</b> | <b>-M3</b> |
|             | 1                                                                                                                                                                                    | 2         | 3        | 4        | 5        | 6          | 7        | 8          | 9          |
| <b>1</b>    | - Vishay Semiconductors product                                                                                                                                                      |           |          |          |          |            |          |            |            |
| <b>2</b>    | - Current rating (20 = 20 A)                                                                                                                                                         |           |          |          |          |            |          |            |            |
| <b>3</b>    | - C = common cathode                                                                                                                                                                 |           |          |          |          |            |          |            |            |
| <b>4</b>    | - T = TO-220                                                                                                                                                                         |           |          |          |          |            |          |            |            |
| <b>5</b>    | - Schottky "Q" series                                                                                                                                                                |           |          |          |          |            |          |            |            |
| <b>6</b>    | - Voltage rating (150 = 150 V)                                                                                                                                                       |           |          |          |          |            |          |            |            |
| <b>7</b>    | - • S = D <sup>2</sup> PAK (TO-263AB)<br>• -1 = TO-262AA                                                                                                                             |           |          |          |          |            |          |            |            |
| <b>8</b>    | - • None = tube<br>• TRL = tape and reel (left oriented - for D <sup>2</sup> PAK (TO-263AB) only)<br>• TRR = tape and reel (right oriented - for D <sup>2</sup> PAK (TO-263AB) only) |           |          |          |          |            |          |            |            |
| <b>9</b>    | - -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-20CTQ150S-M3    | 50               | 1000                   | Antistatic plastic tubes |
| VS-20CTQ150STRL-M3 | 800              | 800                    | 13" diameter reel        |
| VS-20CTQ150STRR-M3 | 800              | 800                    | 13" diameter reel        |
| VS-20CTQ150-1-M3   | 50               | 1000                   | Antistatic plastic tubes |

**LINKS TO RELATED DOCUMENTS**

|                          |                               |                                                                        |
|--------------------------|-------------------------------|------------------------------------------------------------------------|
| Dimensions               | D <sup>2</sup> PAK (TO-263AB) | <a href="http://www.vishay.com/doc?96164">www.vishay.com/doc?96164</a> |
|                          | TO-262AA                      | <a href="http://www.vishay.com/doc?96165">www.vishay.com/doc?96165</a> |
| Part marking information | D <sup>2</sup> PAK (TO-263AB) | <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?96424">www.vishay.com/doc?96424</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

- Dimensioning and tolerancing per ASME Y14.5 M-1994
- 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
- Thermal pad contour optional within dimension E, L1, D1 and E1
- Dimension b1 and c1 apply to base metal only
- Datum A and B to be determined at datum plane H
- Controlling dimension: inch
- Outline conforms to JEDEC® outline TO-263AB



## TO-262

### DIMENSIONS in millimeters and inches

#### Modified JEDEC outline TO-262



$\pm 0.010$  A A B



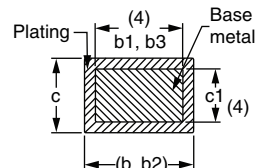
#### Lead assignments

##### 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

## TO-262



Example: This is a xxxxxx-1 <sup>(1)</sup> with assembly lot code AC, assembled on WW 19, 2001 in the assembly line "X"

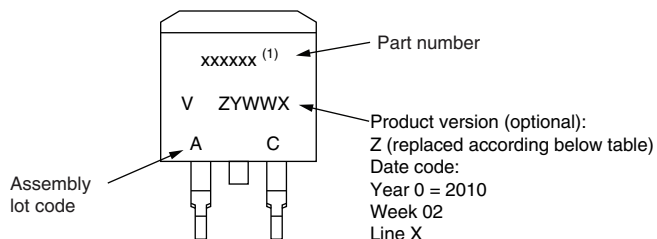
### Note

<sup>(1)</sup> If part number contain "H" as last digit, product is AEC-Q101 qualified

| ENVIRONMENTAL NAMING CODE (Z) | PRODUCT DEFINITION                                          |
|-------------------------------|-------------------------------------------------------------|
| A                             | Termination lead (Pb)-free                                  |
| B                             | Totally lead (Pb)-free                                      |
| E                             | RoHS-compliant and termination lead (Pb)-free               |
| F                             | RoHS-compliant and totally lead (Pb)-free                   |
| M                             | Halogen-free, RoHS-compliant and termination lead (Pb)-free |
| N                             | Halogen-free, RoHS-compliant and totally lead (Pb)-free     |
| G                             | Green                                                       |



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



Example: This is a xxxxxx <sup>(1)</sup> with assembly lot code AC, assembled on WW 02, 2010

### Note

(1) If part number contain "H" as last digit, product is AEC-Q101 qualified

| ENVIRONMENTAL NAMING CODE (Z) | PRODUCT DEFINITION                                           |
|-------------------------------|--------------------------------------------------------------|
| A                             | Termination lead (Pb)-free                                   |
| B                             | Totally lead (Pb)-free                                       |
| E                             | RoHS-compliant and termination lead (Pb)-free                |
| F                             | RoHS-compliant and totally lead (Pb)-free                    |
| M                             | Halogen-free, RoHS-compliant, and termination lead (Pb)-free |
| N                             | Halogen-free, RoHS-compliant, and totally lead (Pb)-free     |
| G                             | Green                                                        |



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