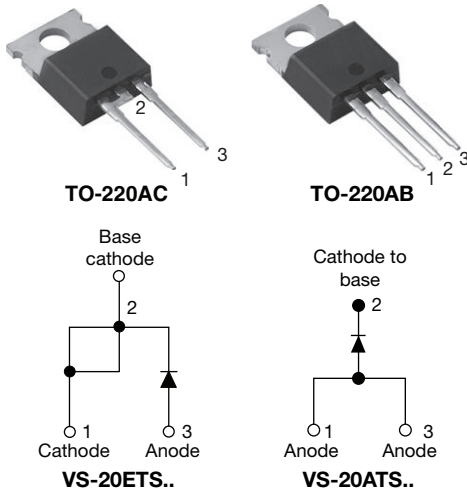




## High Voltage, Input Rectifier Diode, 20 A



### FEATURES

- Very low forward voltage drop
- 150 °C max. operating junction temperature
- Glass passivated pellet chip junction
- 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**

### APPLICATIONS

- Input rectification
- Vishay Semiconductors switches and output rectifiers which are available in identical package outlines

### DESCRIPTION

High voltage rectifiers optimized for very low forward voltage drop with moderate leakage.

These devices are intended for use in main rectification (single or three phase bridge).

| PRODUCT SUMMARY |                          |
|-----------------|--------------------------|
| Package         | TO-220AC, TO-220AB       |
| $I_{F(AV)}$     | 20 A                     |
| $V_R$           | 800 V to 1200 V          |
| $V_F$ at $I_F$  | 1.1 V                    |
| $I_{FSM}$       | 300 A                    |
| $T_J$ max.      | 150 °C                   |
| Diode variation | Single die, common anode |

| OUTPUT CURRENT IN TYPICAL APPLICATIONS  |                     |                    |       |
|---|---------------------|--------------------|-------|
| APPLICATIONS  | SINGLE-PHASE BRIDGE | THREE-PHASE BRIDGE | UNITS |
| Capacitive input filter $T_A = 55$ °C, $T_J = 125$ °C common heatsink of 1 °C/W | 16.3                | 21                 | A     |

| MAJOR RATINGS AND CHARACTERISTICS |                     |             |       |
|-----------------------------------|---------------------|-------------|-------|
| SYMBOL                            | CHARACTERISTICS     | VALUES      | UNITS |
| $I_{F(AV)}$                       | Sinusoidal waveform | 20          | A     |
| $V_{RRM}$                         |                     | 800/1200    | V     |
| $I_{FSM}$                         |                     | 300         | A     |
| $V_F$                             | 10 A, $T_J = 25$ °C | 1.0         | V     |
| $T_J$                             |                     | -40 to +150 | °C    |

| VOLTAGE RATINGS  |   |  |                           |
|--|---|--|---------------------------|
| PART NUMBER  | $V_{RRM}$ , MAXIMUM PEAK REVERSE VOLTAGE<br>V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE<br>V | $I_{RRM}$ AT 150 °C<br>mA |
| VS-20ETS08PbF, VS-20ETS08-M3<br>VS-20ATS08PbF, VS-20ATS08-M3 | 800   | 900  | 1                         |
| VS-20ETS12PbF, VS-20ETS12-M3<br>VS-20ATS12PbF, VS-20ATS12-M3 | 1200  | 1300   |                           |



| <b>ABSOLUTE MAXIMUM RATINGS</b>                     |               |  |        |               |
|---|---------------|--|--------|---------------|
| PARAMETER   | SYMBOL        | TEST CONDITIONS  | VALUES | UNITS         |
| Maximum average forward current                     | $I_{F(AV)}$   | $T_C = 105\text{ }^\circ\text{C}$ , 180° conduction half sine wave | 20     | A             |
| Maximum peak one cycle non-repetitive surge current | $I_{FSM}$     | 10 ms sine pulse, rated $V_{RRM}$ applied                          | 250    |               |
|   |               | 10 ms sine pulse, no voltage reapplied                             | 300    |               |
| Maximum $I^2t$ for fusing                           | $I^2t$        | 10 ms sine pulse, rated $V_{RRM}$ applied                          | 316    | $A^2s$        |
|   |               | 10 ms sine pulse, no voltage reapplied                             | 442    |               |
| Maximum $I^2\sqrt{t}$ for fusing                    | $I^2\sqrt{t}$ | $t = 0.1\text{ ms to }10\text{ ms}$ , no voltage reapplied         | 4420   | $A^2\sqrt{s}$ |

| <b>ELECTRICAL SPECIFICATIONS</b> |             |  |        |           |
|----------------------------------|-------------|--|--------|-----------|
| PARAMETER                        | SYMBOL      | TEST CONDITIONS                        | VALUES | UNITS     |
| Maximum forward voltage drop     | $V_{FM}$    | 20 A, $T_J = 25\text{ }^\circ\text{C}$ | 1.1    | V         |
| Forward slope resistance         | $r_t$       | $T_J = 150\text{ }^\circ\text{C}$      | 10.4   | $m\Omega$ |
| Threshold voltage                | $V_{F(TO)}$ |  | 0.85   | V         |
| Maximum reverse leakage current  | $I_{RM}$    | $T_J = 25\text{ }^\circ\text{C}$       | 0.1    | $mA$      |
|                                  |             | $T_J = 150\text{ }^\circ\text{C}$      |        |           |

| <b>THERMAL - MECHANICAL SPECIFICATIONS</b>     |                |                                       |             |  |
|--|----------------|---------------------------------------|-------------|--|
| PARAMETER                                      | SYMBOL         | TEST CONDITIONS                       | VALUES      | UNITS  |
| Maximum junction and storage temperature range | $T_J, T_{Stg}$ |                                       | -40 to +150 | $^\circ\text{C}$   |
| Maximum thermal resistance, junction to case   | $R_{thJC}$     | DC operation                          | 1.3         | $^\circ\text{C/W}$   |
| Typical thermal resistance, case to heatsink   | $R_{thCS}$     | Mounting surface, smooth, and greased | 0.5         |  |
| Approximate weight                             |                |                                       | 2           | g  |
|  |                |                                       | 0.07        | oz.  |
| Mounting torque                                | minimum        |                                       | 6 (5)       | $\text{kgf} \cdot \text{cm}$<br>$(\text{lbf} \cdot \text{in})$ |
|  | maximum        |                                       | 12 (10)     |  |
| Marking device                                 |                | Case style TO-220AC                   | 20ETS08     |  |
|  |                |                                       | 20ETS12     |  |
|  |                | Case style TO-220AB                   | 20ATS08     |  |
|  |                |                                       | 20ATS12     |  |

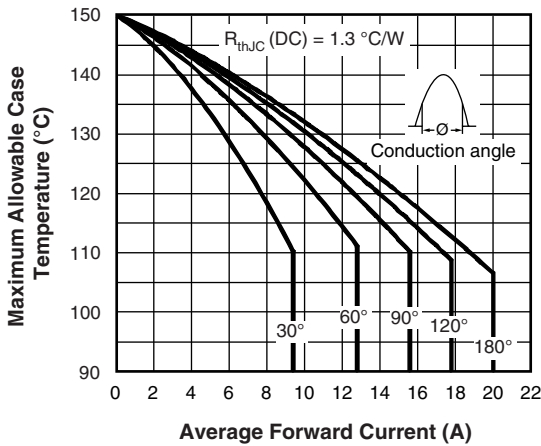


Fig. 1 - Current Rating Characteristics

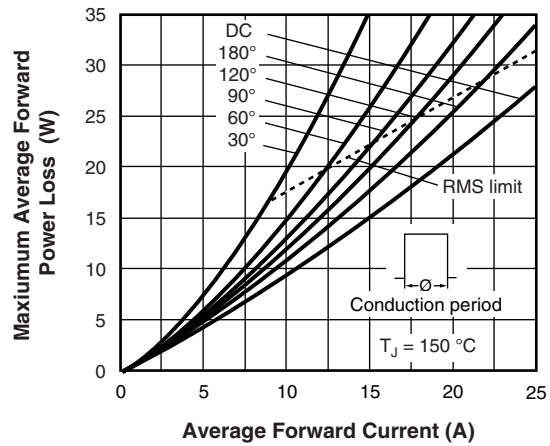


Fig. 4 - Forward Power Loss Characteristics

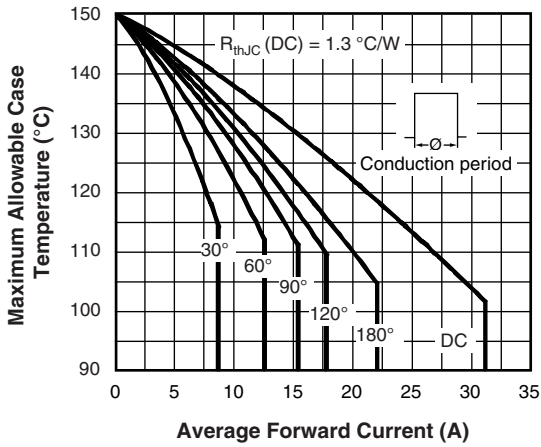


Fig. 2 - Current Rating Characteristics

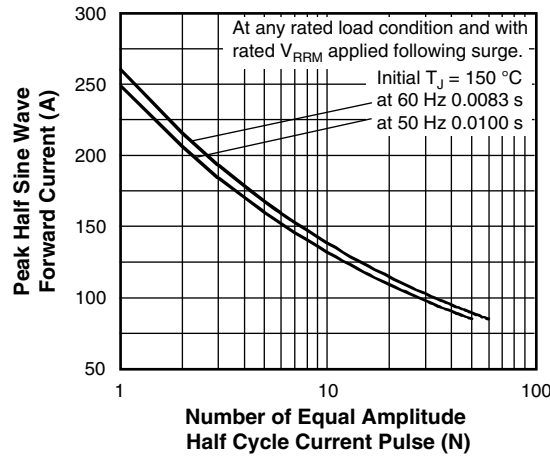


Fig. 5 - Maximum Non-Repetitive Surge Current

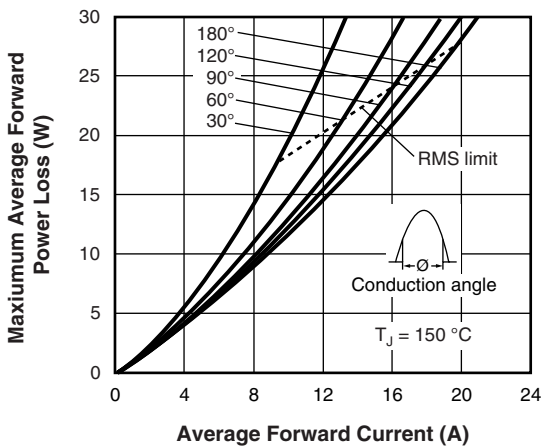


Fig. 3 - Forward Power Loss Characteristics

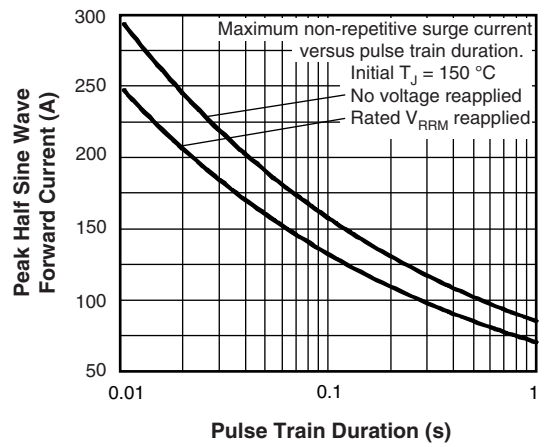


Fig. 6 - Maximum Non-Repetitive Surge Current

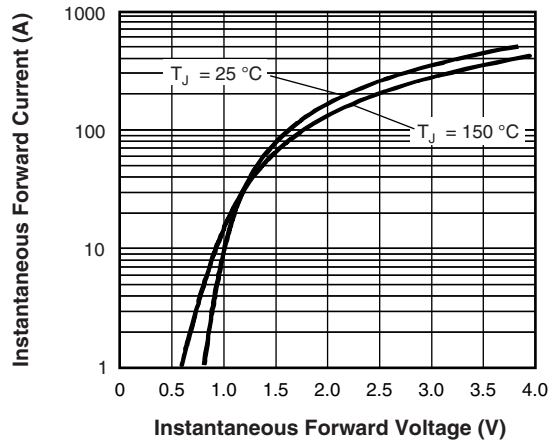


Fig. 7 - Forward Voltage Drop Characteristics

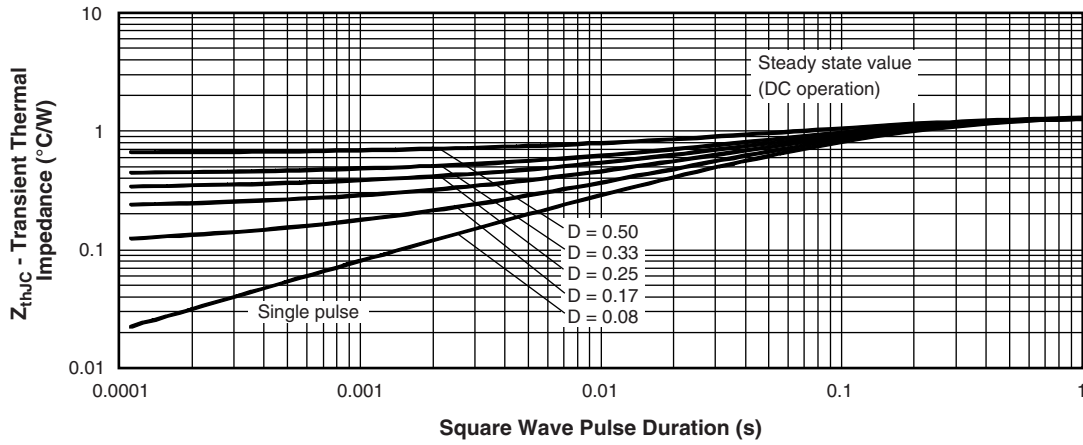
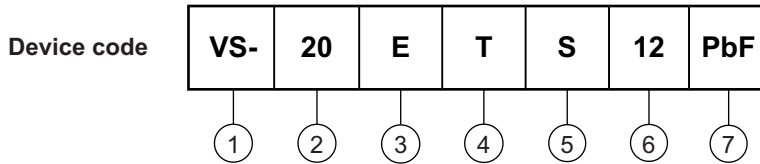


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics



**ORDERING INFORMATION TABLE**



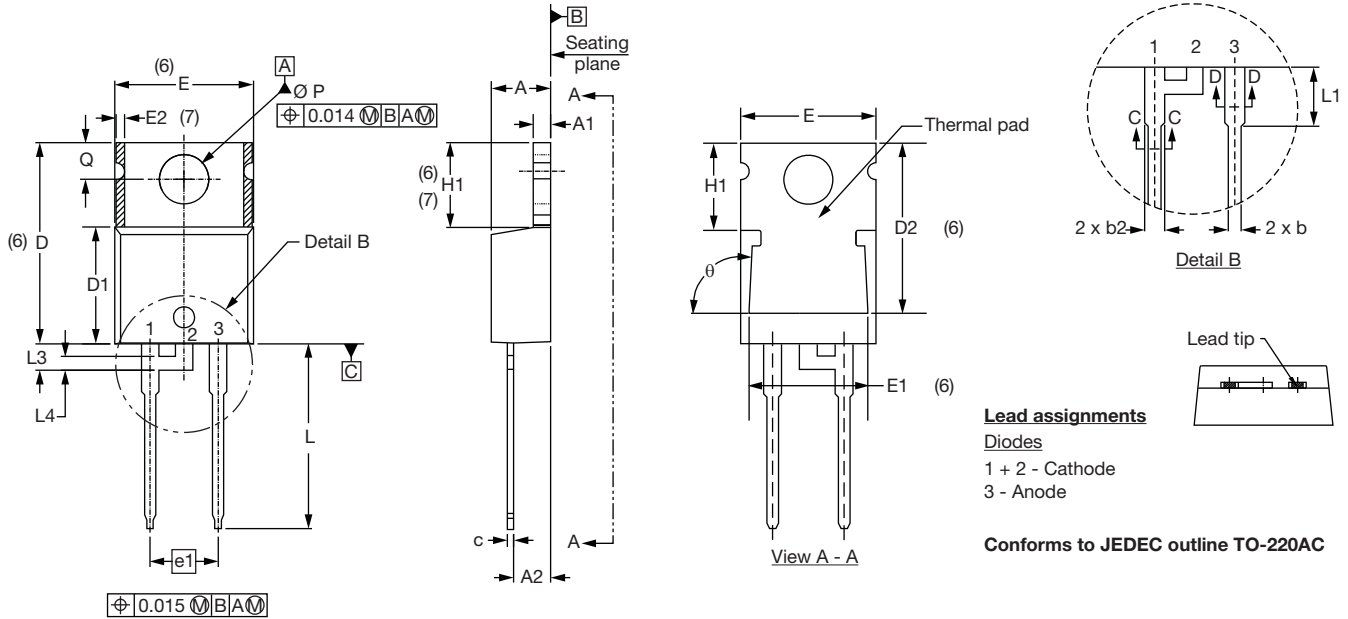
- 1** - Vishay Semiconductors product
- 2** - Current rating (20 = 20 A)
- 3** - Circuit configuration:  
E = TO-220AC  
A = TO-220AB
- 4** - Package:  
T = TO-220
- 5** - Type of silicon:  
S = standard recovery rectifier
- 6** - Voltage code x 100 =  $V_{RRM}$  08 = 800 V  
12 = 1200 V
- 7** - Environmental digit:  
PbF = lead (Pb)-free and RoHS-compliant  
-M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

| <b>ORDERING INFORMATION (Example)</b> |                  |                        |                          |
|---------------------------------------|------------------|------------------------|--------------------------|
| PREFERRED P/N                         | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION    |
| VS-20ETS08PbF                         | 50               | 1000                   | Antistatic plastic tubes |
| VS-20ETS08-M3                         | 50               | 1000                   | Antistatic plastic tubes |
| VS-20ATS08PbF                         | 50               | 1000                   | Antistatic plastic tubes |
| VS-20ATS08-M3                         | 50               | 1000                   | Antistatic plastic tubes |
| VS-20ETS12PbF                         | 50               | 1000                   | Antistatic plastic tubes |
| VS-20ETS12-M3                         | 50               | 1000                   | Antistatic plastic tubes |
| VS-20ATS12PbF                         | 50               | 1000                   | Antistatic plastic tubes |
| VS-20ATS12-M3                         | 50               | 1000                   | Antistatic plastic tubes |

| <b>LINKS TO RELATED DOCUMENTS</b> |              |  |
|-----------------------------------|--------------|--|
| Dimensions                        | TO-220AC     | <a href="http://www.vishay.com/doc?95221">www.vishay.com/doc?95221</a> |
|                                   | TO-220AB     | <a href="http://www.vishay.com/doc?95222">www.vishay.com/doc?95222</a> |
| Part marking information          | TO-220AC PbF | <a href="http://www.vishay.com/doc?95224">www.vishay.com/doc?95224</a> |
|                                   | TO-220AB PbF | <a href="http://www.vishay.com/doc?95225">www.vishay.com/doc?95225</a> |
|                                   | TO-220AC -M3 | <a href="http://www.vishay.com/doc?95068">www.vishay.com/doc?95068</a> |
|                                   | TO-220AB -M3 | <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a> |
| SPICE model                       |              | <a href="http://www.vishay.com/doc?96046">www.vishay.com/doc?96046</a> |

## TO-220AC

**DIMENSIONS** in millimeters and inches



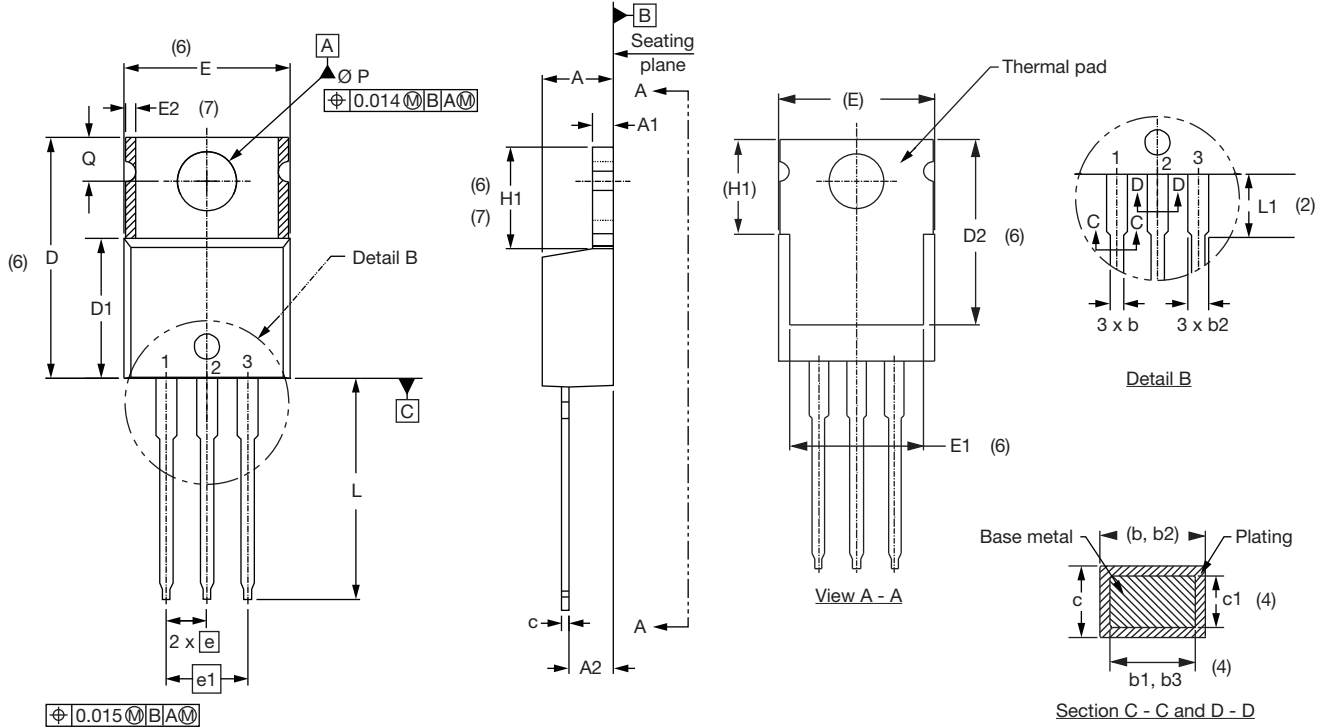
| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES | SYMBOL | MILLIMETERS |       | INCHES     |       | NOTES |
|--------|-------------|-------|--------|-------|-------|--------|-------------|-------|------------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |        | MIN.        | MAX.  | MIN.       | MAX.  |       |
| A      | 4.25        | 4.65  | 0.167  | 0.183 |       | E1     | 6.86        | 8.89  | 0.270      | 0.350 | 6     |
| A1     | 1.14        | 1.40  | 0.045  | 0.055 |       | E2     | -           | 0.76  | -          | 0.030 | 7     |
| A2     | 2.56        | 2.92  | 0.101  | 0.115 |       | e      | 2.41        | 2.67  | 0.095      | 0.105 |       |
| b      | 0.69        | 1.01  | 0.027  | 0.040 |       | e1     | 4.88        | 5.28  | 0.192      | 0.208 |       |
| b1     | 0.38        | 0.97  | 0.015  | 0.038 | 4     | H1     | 6.09        | 6.48  | 0.240      | 0.255 | 6, 7  |
| b2     | 1.20        | 1.73  | 0.047  | 0.068 |       | L      | 13.52       | 14.02 | 0.532      | 0.552 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     | L1     | 3.32        | 3.82  | 0.131      | 0.150 | 2     |
| c      | 0.36        | 0.61  | 0.014  | 0.024 |       | L3     | 1.78        | 2.13  | 0.070      | 0.084 |       |
| c1     | 0.36        | 0.56  | 0.014  | 0.022 | 4     | L4     | 0.76        | 1.27  | 0.030      | 0.050 | 2     |
| D      | 14.85       | 15.25 | 0.585  | 0.600 | 3     | Ø P    | 3.54        | 3.73  | 0.139      | 0.147 |       |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       | Q      | 2.60        | 3.00  | 0.102      | 0.118 |       |
| D2     | 11.68       | 12.88 | 0.460  | 0.507 | 6     | θ      | 90° to 93°  |       | 90° to 93° |       |       |
| E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |        |             |       |            |       |       |

**Notes**

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1 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 outermost extremes of the plastic body
- (4) Dimension b1, b3 and c1 apply to base metal only
- (5) Controlling dimension: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimension E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, D2 (minimum) where dimensions are derived from the actual package outline

## TO-220AB

### DIMENSIONS in millimeters and inches



#### Lead assignments

#### Diodes

1. - Anode/open
2. - Cathode
3. - Anode

Conforms to JEDEC outline TO-220AB

| SYMBOL | MILLIMETERS |       | INCHES     |       | NOTES |
|--------|-------------|-------|------------|-------|-------|
|        | MIN.        | MAX.  | MIN.       | MAX.  |       |
| A      | 4.25        | 4.65  | 0.167      | 0.183 |       |
| A1     | 1.14        | 1.40  | 0.045      | 0.055 |       |
| A2     | 2.56        | 2.92  | 0.101      | 0.115 |       |
| b      | 0.69        | 1.01  | 0.027      | 0.040 |       |
| b1     | 0.38        | 0.97  | 0.015      | 0.038 | 4     |
| b2     | 1.20        | 1.73  | 0.047      | 0.068 |       |
| b3     | 1.14        | 1.73  | 0.045      | 0.068 | 4     |
| c      | 0.36        | 0.61  | 0.014      | 0.024 |       |
| c1     | 0.36        | 0.56  | 0.014      | 0.022 | 4     |
| D      | 14.85       | 15.25 | 0.585      | 0.600 | 3     |
| D1     | 8.38        | 9.02  | 0.330      | 0.355 |       |
| D2     | 11.68       | 12.88 | 0.460      | 0.507 | 6     |
| E      | 10.11       | 10.51 | 0.398      | 0.414 | 3, 6  |
| E1     | 6.86        | 8.89  | 0.270      | 0.350 | 6     |
| E2     | -           | 0.76  | -          | 0.030 | 7     |
| e      | 2.41        | 2.67  | 0.095      | 0.105 |       |
| e1     | 4.88        | 5.28  | 0.192      | 0.208 |       |
| H1     | 6.09        | 6.48  | 0.240      | 0.255 | 6, 7  |
| L      | 13.52       | 14.02 | 0.532      | 0.552 |       |
| L1     | 3.32        | 3.82  | 0.131      | 0.150 | 2     |
| Ø P    | 3.54        | 3.73  | 0.139      | 0.147 |       |
| Q      | 2.60        | 3.00  | 0.102      | 0.118 |       |
| θ      | 90° to 93°  |       | 90° to 93° |       |       |

#### Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1 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 outermost extremes of the plastic body
- (4) Dimension b1, b3 and c1 apply to base metal only
- (5) Controlling dimensions: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimensions E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, except A2 (maximum) and D2 (minimum) where dimensions are derived from the actual package outline



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