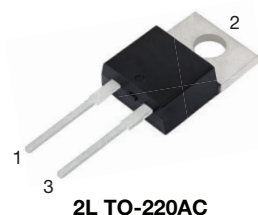
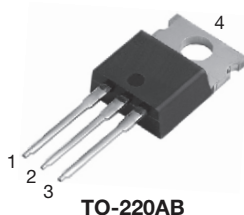
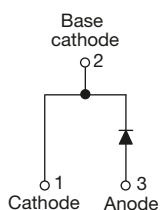
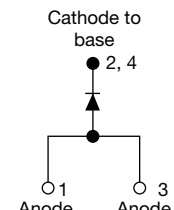


## High Voltage, Input Rectifier Diode, 20 A


**2L TO-220AC**

**TO-220AB**

**VS-20ETS12THM3**

**VS-20ATS12HM3**

### FEATURES

- Glass passivated pellet chip junction
- AEC-Q101 qualified
- Meets JESD 201 class 1A whisker test
- Flexible solution for reliable AC power rectification
- High surge, low  $V_F$  rugged blocking diode for DC charging stations
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### APPLICATIONS

- On-board and off-board EV/HEV battery chargers
- Input rectification

### 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).

### PRIMARY CHARACTERISTICS

|                       |                          |
|-----------------------|--------------------------|
| $I_{F(AV)}$           | 20 A                     |
| $V_R$                 | 1200 V                   |
| $V_F$ at $I_F$        | 1.1 V                    |
| $I_{FSM}$             | 300 A                    |
| $T_J$ max.            | 150 °C                   |
| Package               | 2L TO-220AC, 3L TO-220AB |
| Circuit configuration | Single                   |

### 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     |
| $V_{RRM}$   |                     | 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<br>PEAK REVERSE VOLTAGE<br>V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE<br>PEAK REVERSE VOLTAGE<br>V | $I_{RRM}$<br>AT 150 °C<br>mA |
|-------------------------------|--------------------------------------------------|-----------------------------------------------------------------|------------------------------|
| VS-20ETS12THM3, VS-20ATS12HM3 | 1200                                             | 1300                                                            | 1                            |

**ABSOLUTE MAXIMUM RATINGS**

| 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    | $\text{A}^2\text{s}$        |
|                                                     |               | 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   | $\text{A}^2\sqrt{\text{s}}$ |

**ELECTRICAL SPECIFICATIONS**

| 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   | $\text{m}\Omega$ |
| Threshold voltage               | $V_{F(TO)}$ |                                          | 0.85   | V                |
| Maximum reverse leakage current | $I_{RM}$    | $T_J = 25\text{ }^{\circ}\text{C}$       | 0.1    | mA               |
|                                 |             | $T_J = 150\text{ }^{\circ}\text{C}$      | 1.0    |                  |

**THERMAL - MECHANICAL SPECIFICATIONS**

| PARAMETER                                      | SYMBOL                            | TEST CONDITIONS                       | VALUES      | UNITS                  |
|------------------------------------------------|-----------------------------------|---------------------------------------|-------------|------------------------|
| Maximum junction and storage temperature range | T <sub>J</sub> , T <sub>Stg</sub> |                                       | -40 to +150 | °C                     |
| Maximum thermal resistance, junction to case   | R <sub>thJC</sub>                 | DC operation                          | 1.3         | °C/W                   |
| Typical thermal resistance, case to heatsink   | R <sub>thCS</sub>                 | Mounting surface, smooth, and greased | 0.5         |                        |
| Approximate weight                             |                                   |                                       | 2           | g                      |
|                                                |                                   |                                       | 0.07        | oz.                    |
| Mounting torque                                | minimum                           |                                       | 6 (5)       | kgf · cm<br>(lbf · in) |
|                                                | maximum                           |                                       | 12 (10)     |                        |
| Marking device                                 |                                   | Case style 2L TO-220AC                | 20ETS12TH   |                        |
|                                                |                                   | Case style 3L TO-220AB                | 20ATS12H    |                        |

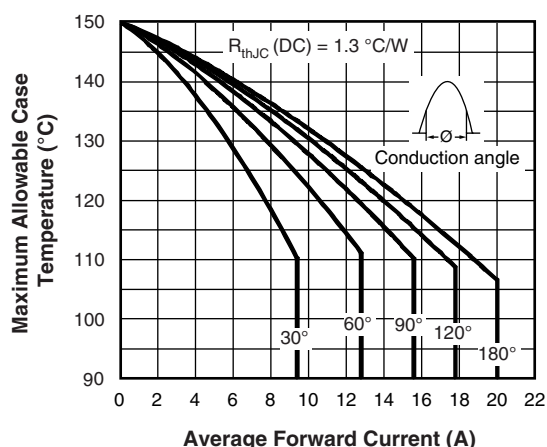


Fig. 1 - Current Rating Characteristics

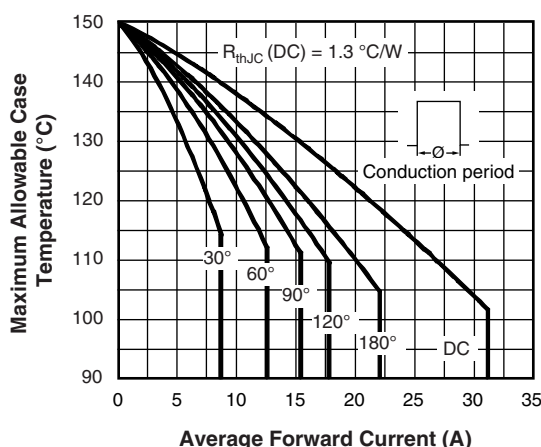


Fig. 2 - Current Rating Characteristics

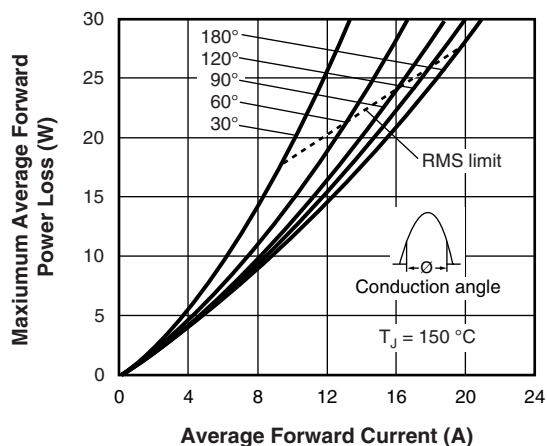


Fig. 3 - Forward Power Loss Characteristics

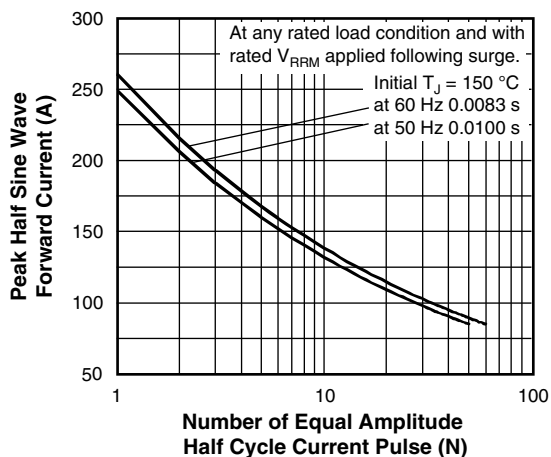


Fig. 5 - Maximum Non-Repetitive Surge Current

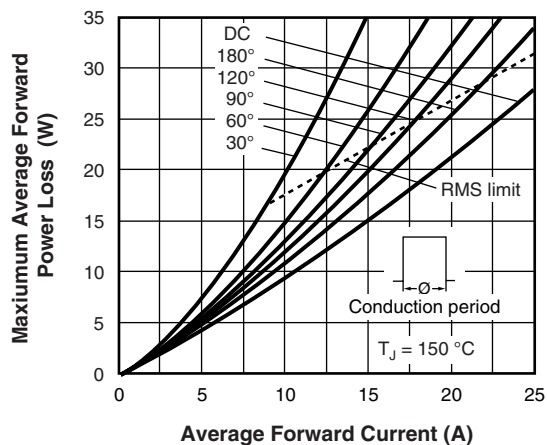


Fig. 4 - Forward Power Loss Characteristics

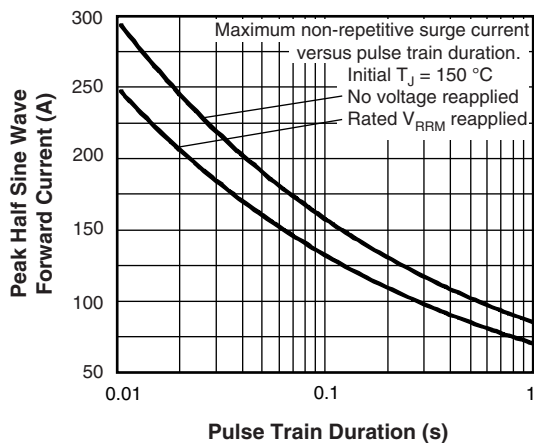


Fig. 6 - Maximum Non-Repetitive Surge Current

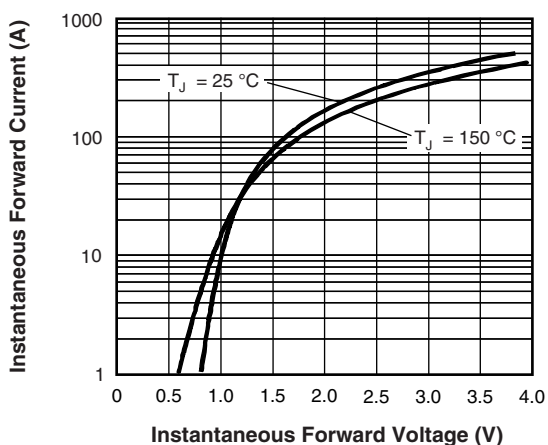
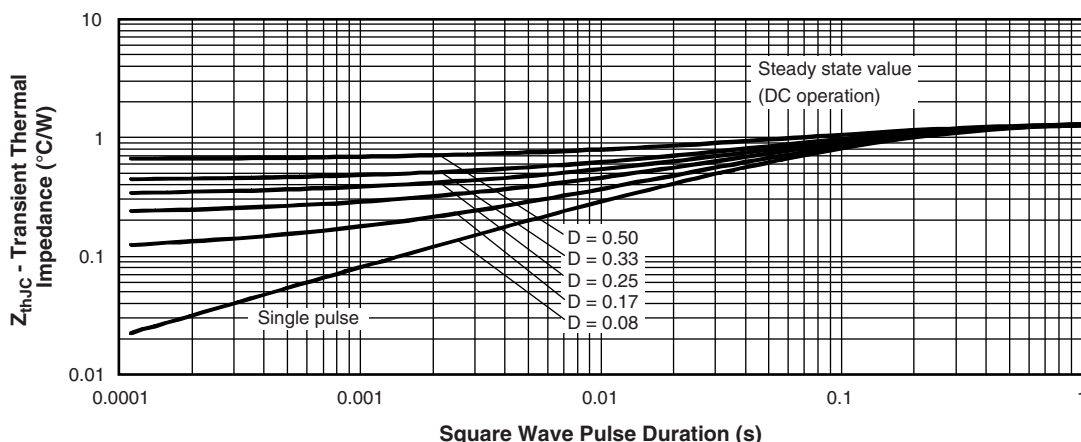


Fig. 7 - Forward Voltage Drop Characteristics


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

**ORDERING INFORMATION TABLE**

| Device code | VS-                                                                                            | 20 | E | T | S | 12 | T | H | M3 |
|-------------|------------------------------------------------------------------------------------------------|----|---|---|---|----|---|---|----|
|             | 1                                                                                              | 2  | 3 | 4 | 5 | 6  | 7 | 8 | 9  |
| 1           | Vishay Semiconductors product                                                                  |    |   |   |   |    |   |   |    |
| 2           | Current rating (20 = 20 A)                                                                     |    |   |   |   |    |   |   |    |
| 3           | Circuit configuration:<br>E = 2L TO-220AC<br>A = 3L TO-220AB                                   |    |   |   |   |    |   |   |    |
| 4           | Package:<br>T = TO-220                                                                         |    |   |   |   |    |   |   |    |
| 5           | Type of silicon:<br>S = standard recovery rectifier                                            |    |   |   |   |    |   |   |    |
| 6           | Voltage code x 100 = $V_{RRM}$ ——— 12 = 1200 V                                                 |    |   |   |   |    |   |   |    |
| 7           | <ul style="list-style-type: none"> <li>None = TO-220AB</li> <li>T = True pin TO-220</li> </ul> |    |   |   |   |    |   |   |    |
| 8           | H = AEC-Q101 qualified                                                                         |    |   |   |   |    |   |   |    |
| 9           | Environmental digit:<br>M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free     |    |   |   |   |    |   |   |    |

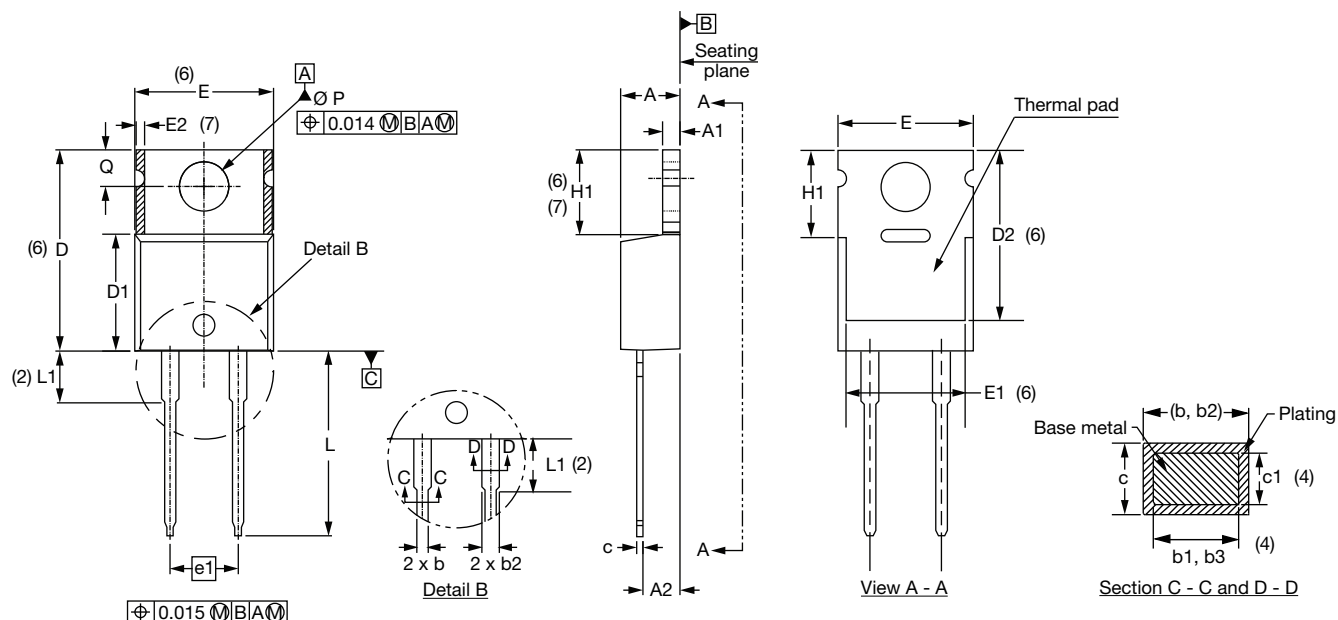
| ORDERING INFORMATION (Example) |                  |                        |                          |
|--------------------------------|------------------|------------------------|--------------------------|
| PREFERRED P/N                  | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION    |
| VS-20ETS12THM3                 | 50               | 1000                   | Antistatic plastic tubes |
| VS-20ATS12HM3                  | 50               | 1000                   | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS |             |                                                                        |
|----------------------------|-------------|------------------------------------------------------------------------|
| Dimensions                 | 2L TO-220AC | <a href="http://www.vishay.com/doc?96069">www.vishay.com/doc?96069</a> |
|                            | 3L TO-220AB | <a href="http://www.vishay.com/doc?95222">www.vishay.com/doc?95222</a> |
| Part marking information   | 2L TO-220AC | <a href="http://www.vishay.com/doc?95391">www.vishay.com/doc?95391</a> |
|                            | 3L TO-220AB | <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a> |
| SPIICE model               |             | <a href="http://www.vishay.com/doc?97266">www.vishay.com/doc?97266</a> |



# TO-220AC 2L

**DIMENSIONS** in millimeters and inches



| 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  |

## 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, except D2, where JEDEC® minimum is 0.480"



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