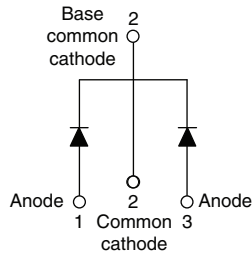


## High Performance Schottky Rectifier, 2 x 10 A


**TO-220AB**

**FEATURES**

- 150 °C  $T_J$  operation
- 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
- AEC-Q101 qualified meets JESD 201 class 2 whisker test
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?999912](http://www.vishay.com/doc?999912)



| PRODUCT SUMMARY |                 |
|-----------------|-----------------|
| $I_{F(AV)}$     | 2 x 10 A        |
| $V_R$           | 35 V, 45 V      |
| $V_F$ at $I_F$  | 0.57 V          |
| $I_{FRM}$ max.  | 15 mA at 125 °C |
| $T_J$ max.      | 150 °C          |
| $E_{AS}$        | 8 mJ            |
| Package         | TO-220AB        |
| 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 150 °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 |
| $I_{F(AV)}$                       | Rectangular waveform (per device) | 20         | A     |
| $V_{RRM}$                         |                                   | 35/45      | V     |
| $I_{FRM}$                         | $T_C = 135$ °C (per leg)          | 20         | A     |
| $I_{FSM}$                         | $t_p = 5$ $\mu$ s sine            | 1060       |       |
| $V_F$                             | 10 $A_{pk}$ , $T_J = 125$ °C      | 0.57       | V     |
| $T_J$                             | Range                             | -65 to 150 | °C    |

| VOLTAGE RATINGS                      |           |                 |                 |       |
|--------------------------------------|-----------|-----------------|-----------------|-------|
| PARAMETER                            | SYMBOL    | VS-MBR2035CTHN3 | VS-MBR2045CTHN3 | UNITS |
| Maximum DC reverse voltage           | $V_R$     | 35              | 45              | V     |
| Maximum working peak reverse voltage | $V_{RWM}$ |                 |                 |       |

| ABSOLUTE MAXIMUM RATINGS                |             |   |   |        |       |
|---|-------------|---|---|--------|-------|
| PARAMETER                               | SYMBOL      | TEST CONDITIONS   |   | VALUES | UNITS |
| Maximum average forward current         | $I_{F(AV)}$ | $T_C = 135$ °C, rated $V_R$   |   | 10     | A     |
|   |             |   |   | 20     |       |
| Peak repetitive forward current per leg | $I_{FRM}$   | Rated $V_R$ , square wave, 20 kHz, $T_C = 135$ °C   |   | 20     |       |
| Non-repetitive peak surge current       | $I_{FSM}$   | 5 $\mu$ s sine or 3 $\mu$ s rect. pulse   | Following any rated load condition and with rated $V_{RRM}$ applied | 1060   |       |
|   |             | Surge applied at rated load condition half wave, single phase, 60 Hz  |   | 150    |       |
| Repetitive avalanche current per leg    | $I_{AR}$    | Current decaying linearly to zero in 1 $\mu$ s<br>Frequency limited by $T_J$ maximum $V_A = 1.5 \times V_R$ typical |   | 2      |       |
| Non-repetitive avalanche energy per leg | $E_{AS}$    | $T_J = 25$ °C, $I_{AS} = 2$ A, $L = 4$ mH   |   | 8      | mJ    |



| ELECTRICAL SPECIFICATIONS             |                |   |                                   |        |                  |
|---------------------------------------|----------------|---|-----------------------------------|--------|------------------|
| PARAMETER                             | SYMBOL         | TEST CONDITIONS   |                                   | VALUES | UNITS            |
| Maximum forward voltage drop          | $V_{FM}^{(1)}$ | 20 A  | $T_J = 25\text{ }^\circ\text{C}$  | 0.84   | V                |
|                                       |                | 10 A  | $T_J = 125\text{ }^\circ\text{C}$ | 0.57   |                  |
|                                       |                | 20 A  |                                   | 0.72   |                  |
| Maximum instantaneous reverse current | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^\circ\text{C}$  | Rated DC voltage                  | 0.1    | mA               |
|                                       |                | $T_J = 125\text{ }^\circ\text{C}$   |                                   | 15     |                  |
| Threshold voltage                     | $V_{F(TO)}$    | $T_J = T_J$ maximum   |                                   | 0.354  | V                |
| Forward slope resistance              | $r_t$          |   |                                   | 17.6   | m $\Omega$       |
| Maximum junction capacitance          | $C_T$          | $V_R = 5 V_{DC}$ (test signal range 100 kHz to 1 MHz) 25 $^\circ\text{C}$ |                                   | 600    | pF               |
| Typical series inductance             | $L_S$          | Measured from top of terminal to mounting plane                           |                                   | 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 temperature range                   | $T_J$      |  |                        | -65 to 150 | $^\circ\text{C}$          |
| Maximum storage temperature range                    | $T_{Stg}$  |  |                        | -65 to 175 |                           |
| Maximum thermal resistance, junction to case per leg | $R_{thJC}$ | DC operation   |                        | 2.0        | $^\circ\text{C}/\text{W}$ |
| Typical thermal resistance, case to heatsink         | $R_{thCS}$ | Mounting surface, smooth and greased (only for TO-220) |                        | 0.50       |                           |
| Approximate weight                                   |            |  |                        | 2          | g                         |
|  |            |  |                        | 0.07       | oz.                       |
| Mounting torque                                      | minimum    |  | Non-lubricated threads | 6 (5)      | kgf · cm<br>(lbf · in)    |
|  | maximum    |  |                        | 12 (10)    |                           |
| Marking device                                       |            | Case style TO-220AB                                    |                        | MBR2035CTH |                           |
|  |            |  |                        | MBR2045CTH |                           |

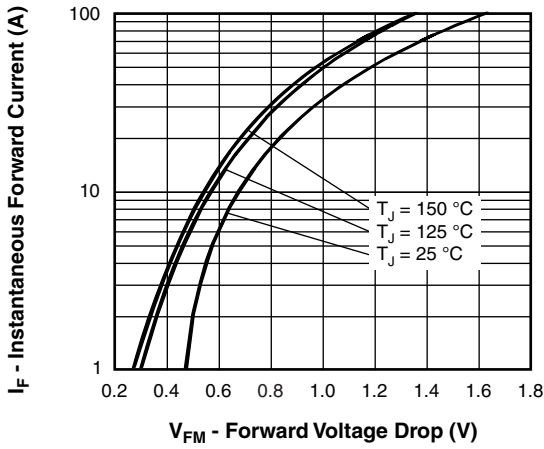


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

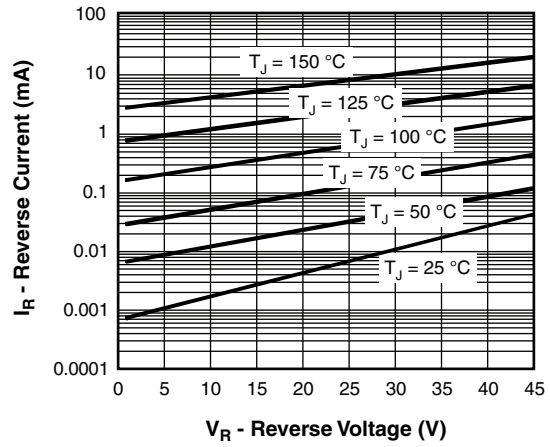


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

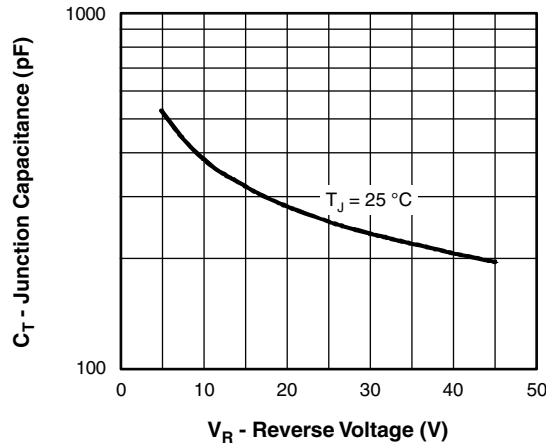


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

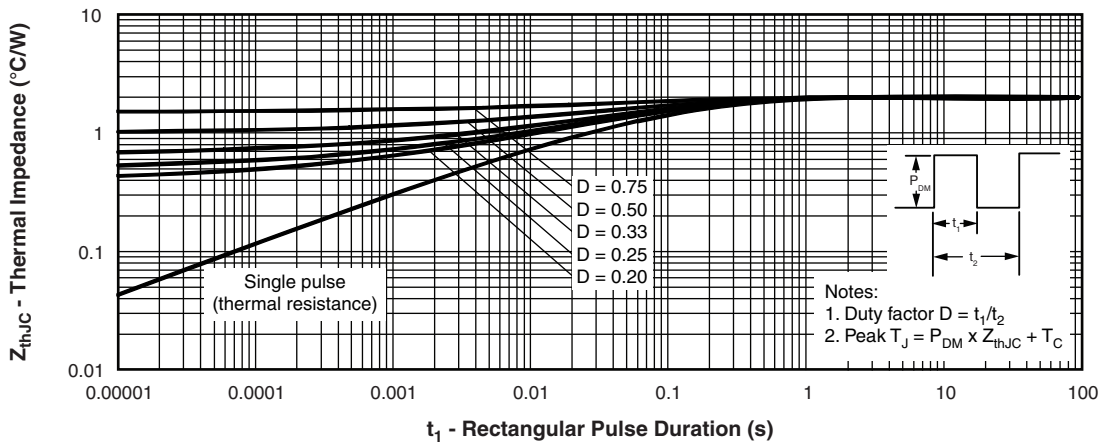


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

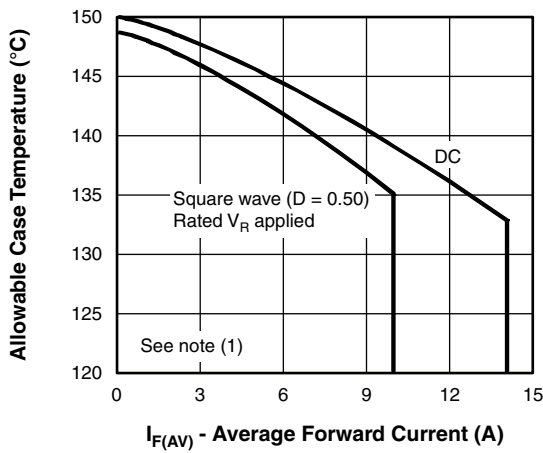


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

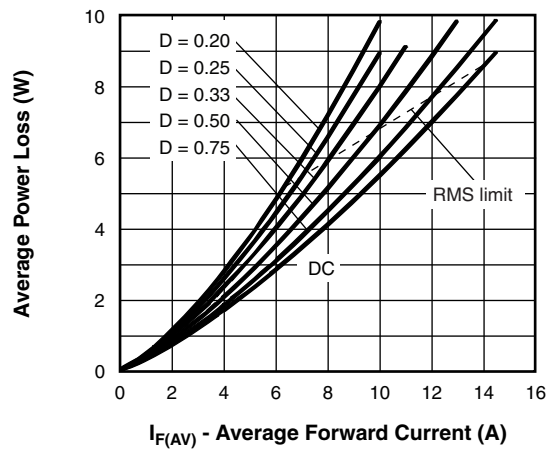


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

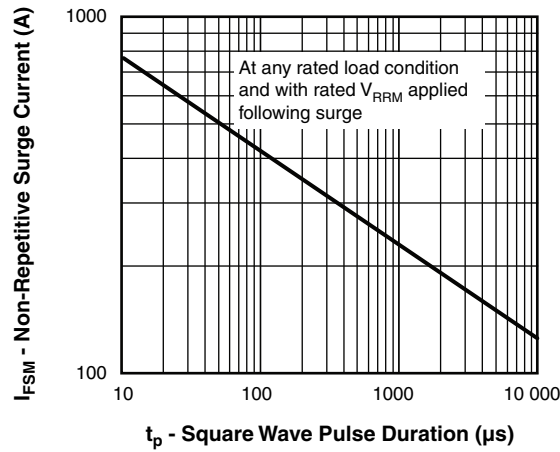


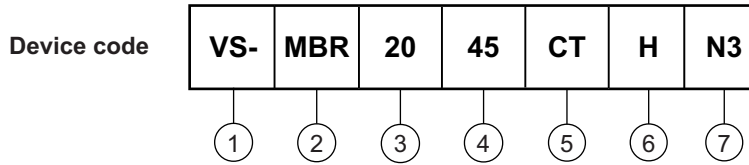
Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

**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  $V_{R1}$  = Rated  $V_R$



## ORDERING INFORMATION TABLE



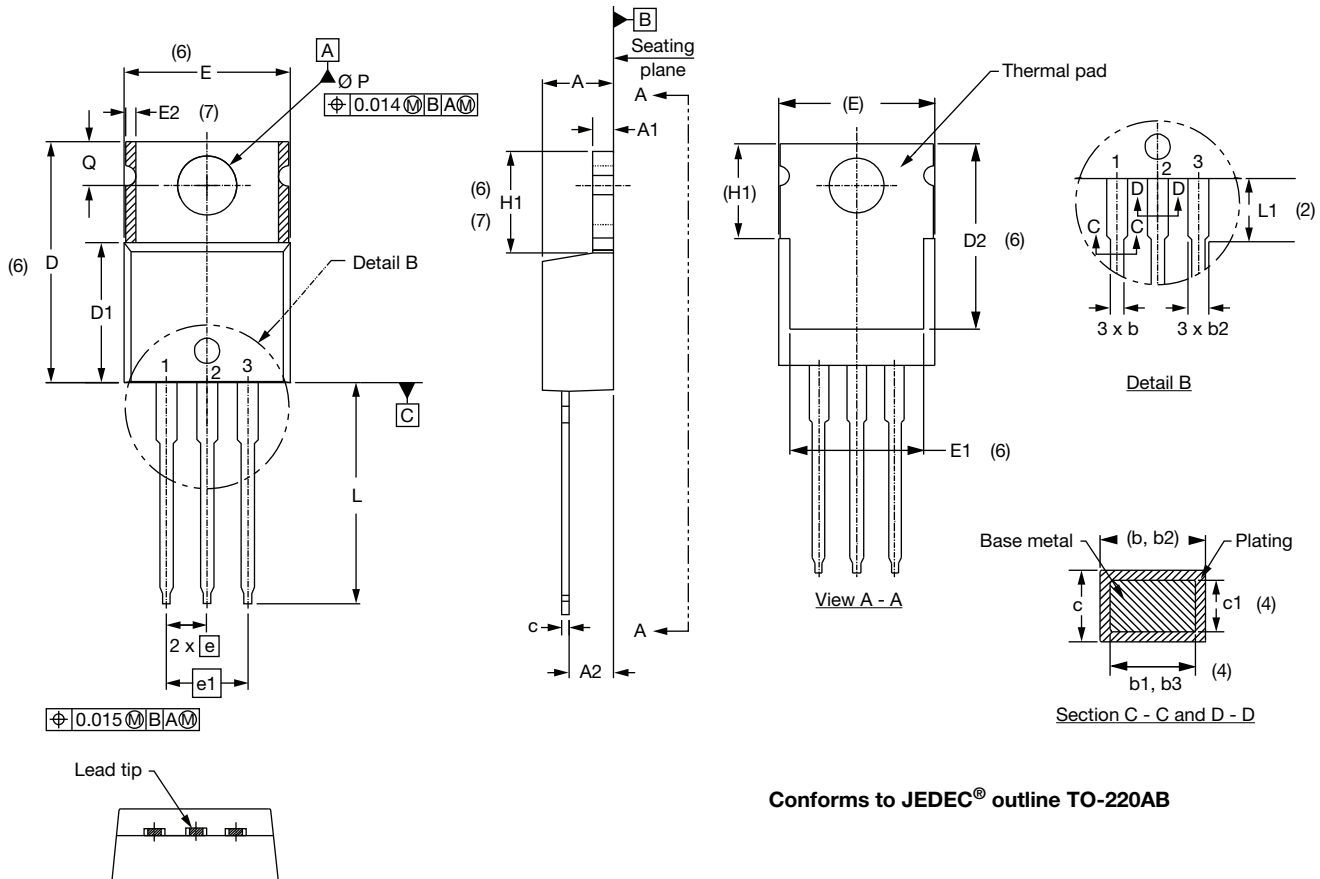
- 1** - Vishay Semiconductors product
- 2** - Schottky MBR series
- 3** - Current rating (20 = 20 A)
- 4** - Voltage ratings 35 = 35 V  
45 = 45 V
- 5** - CT = Essential part number
- 6** - H = AEC-Q101 qualified
- 7** - Environmental digit
  - N3 = Halogen-free, RoHS-compliant, and totally lead (Pb)-free

| ORDERING INFORMATION (Example) |                  |                        |                         |
|--------------------------------|------------------|------------------------|-------------------------|
| PREFERRED P/N                  | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
| VS-MBR2035CTHN3                | 50               | 1000                   | Antistatic plastic tube |
| VS-MBR2045CTHN3                | 50               | 1000                   | Antistatic plastic tube |

| LINKS TO RELATED DOCUMENTS  |  |
|---|--|
| Dimensions  | <a href="http://www.vishay.com/doc?95222">www.vishay.com/doc?95222</a> |
| Part marking information <span style="float: right;">TO-220AB-N3</span> | <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a> |
| SPIICE model  | <a href="http://www.vishay.com/doc?95295">www.vishay.com/doc?95295</a> |

### TO-220AB

**DIMENSIONS** in millimeters and inches



Conforms to JEDEC® outline TO-220AB

| 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 |       | D2     | 11.68       | 12.88 | 0.460  | 0.507 | 6     |
| A1     | 1.14        | 1.40  | 0.045  | 0.055 |       | E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |
| A2     | 2.56        | 2.92  | 0.101  | 0.115 |       | E1     | 6.86        | 8.89  | 0.270  | 0.350 | 6     |
| b      | 0.69        | 1.01  | 0.027  | 0.040 |       | E2     | -           | 0.76  | -      | 0.030 | 7     |
| b1     | 0.38        | 0.97  | 0.015  | 0.038 | 4     | e      | 2.41        | 2.67  | 0.095  | 0.105 |       |
| b2     | 1.20        | 1.73  | 0.047  | 0.068 |       | e1     | 4.88        | 5.28  | 0.192  | 0.208 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     | H1     | 5.84        | 6.86  | 0.230  | 0.270 | 6, 7  |
| c      | 0.36        | 0.61  | 0.014  | 0.024 |       | L      | 13.52       | 14.02 | 0.532  | 0.552 |       |
| c1     | 0.36        | 0.56  | 0.014  | 0.022 | 4     | L1     | 3.32        | 3.82  | 0.131  | 0.150 | 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 |       |

**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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