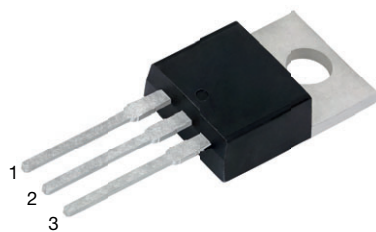
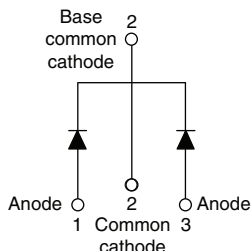


# High Performance Schottky Rectifier, 2 x 20 A


**TO-220AB 3L**


## FEATURES

- 150 °C T<sub>J</sub> 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
- 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 150 °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 20 A        |
| V <sub>R</sub>                   | 45 V            |
| V <sub>F</sub> at I <sub>F</sub> | 0.58 V          |
| I <sub>RM</sub> max.             | 95 mA at 125 °C |
| T <sub>J</sub> max.              | 150 °C          |
| E <sub>AS</sub>                  | 20 mJ           |
| Package                          | TO-220AB 3L     |
| Circuit configuration            | Common cathode  |

## MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL             | CHARACTERISTICS                              | VALUES      | UNITS |
|--------------------|--|-------------|-------|
| I <sub>F(AV)</sub> | Rectangular waveform (per device)            | 40          | A     |
| V <sub>RRM</sub>   |  | 45          | V     |
| I <sub>FRM</sub>   | T <sub>C</sub> = 118 °C (per leg)            | 40          | A     |
| I <sub>FSM</sub>   | t <sub>p</sub> = 5 μs sine                   | 900         |       |
| V <sub>F</sub>     | 20 A <sub>pk</sub> , T <sub>J</sub> = 125 °C | 0.58        | V     |
| T <sub>J</sub>     | Range  | -65 to +150 | °C    |

## VOLTAGE RATINGS

| PARAMETER                            | SYMBOL           | VS-MBR4045CT-M3 | UNITS |
|--------------------------------------|------------------|-----------------|-------|
| Maximum DC reverse voltage           | V <sub>R</sub>   | 45              | V     |
| Maximum working peak reverse voltage | V <sub>RWM</sub> |                 |       |

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER   | SYMBOL             | TEST CONDITIONS  | VALUES | UNITS |
|---|--------------------|--|--------|-------|
| Maximum average forward current<br>per leg<br>per device    | I <sub>F(AV)</sub> | T <sub>C</sub> = 118 °C, rated V <sub>R</sub>  | 20     | A     |
|   |                    |  | 40     |       |
| Peak repetitive forward current per leg                     | I <sub>FRM</sub>   | Rated V <sub>R</sub> , square wave, 20 kHz, T <sub>C</sub> = 118 °C  | 40     |       |
| Maximum peak one cycle non-repetitive surge current per leg | I <sub>FSM</sub>   | 5 μs sine or 3 μs rect. pulse  | 900    |       |
|   |                    | 10 ms sine or 6 ms rect. pulse   | 210    |       |
| Non-repetitive avalanche energy per leg                     | E <sub>AS</sub>    | T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 3 A, L = 4.40 mH   | 20     | mJ    |
| Repetitive avalanche current per leg                        | 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 | 3      | A     |



| ELECTRICAL SPECIFICATIONS             |                |   |                                     |        |       |  |
|---------------------------------------|----------------|---|-------------------------------------|--------|-------|--|
| PARAMETER                             | SYMBOL         | TEST CONDITIONS   |                                     | VALUES | UNITS |  |
| Maximum forward voltage drop          | $V_{FM}^{(1)}$ | 20 A  | $T_J = 25\text{ }^{\circ}\text{C}$  | 0.60   | V     |  |
|                                       |                | 40 A  |                                     | 0.78   |       |  |
|                                       |                | 20 A  | $T_J = 125\text{ }^{\circ}\text{C}$ | 0.58   |       |  |
|                                       |                | 40 A  |                                     | 0.75   |       |  |
| Maximum instantaneous reverse current | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^{\circ}\text{C}$  | Rated DC voltage                    | 1      | mA    |  |
|                                       |                | $T_J = 100\text{ }^{\circ}\text{C}$   |                                     | 50     |       |  |
|                                       |                | $T_J = 125\text{ }^{\circ}\text{C}$   |                                     | 95     |       |  |
| Maximum junction capacitance          | $C_T$          | $V_R = 5\text{ }V_{DC}$ , (test signal range 100 kHz to 1 MHz) $25\text{ }^{\circ}\text{C}$ |                                     | 900    | 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/μs  |  |

**Note**(1) Pulse width < 300  $\mu$ s, duty cycle < 2 %

| THERMAL - MECHANICAL SPECIFICATIONS                  |                   |   |             |                        |
|--|-------------------|---|-------------|------------------------|
| PARAMETER  | SYMBOL            | TEST CONDITIONS   | VALUES      | UNITS                  |
| Maximum junction temperature range                   | T <sub>J</sub>    |   | -65 to +150 | °C                     |
| Maximum storage temperature range                    | T <sub>Stg</sub>  |   | -65 to +175 |                        |
| Maximum thermal resistance, junction to case per leg | R <sub>thJC</sub> | DC operation  | 1.5         | °C/W                   |
| Typical thermal resistance, case to heatsink         | R <sub>thCS</sub> | Mounting surface, smooth and greased<br>(Only for TO-220) | 0.50        |                        |
| Maximum thermal resistance, junction to ambient      | R <sub>thJA</sub> | DC operation<br>(For D <sup>2</sup> PAK and TO-262)       | 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 3L                                    | MBR4045CT   |                        |

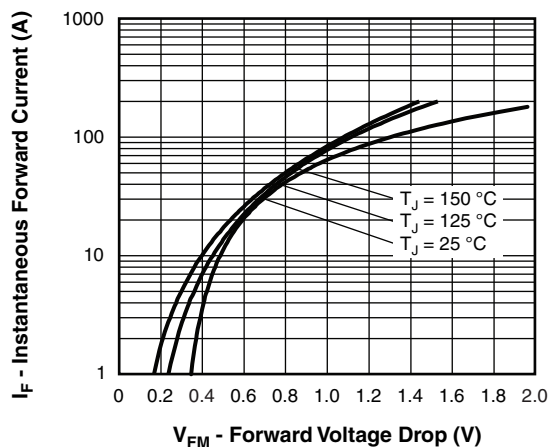


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

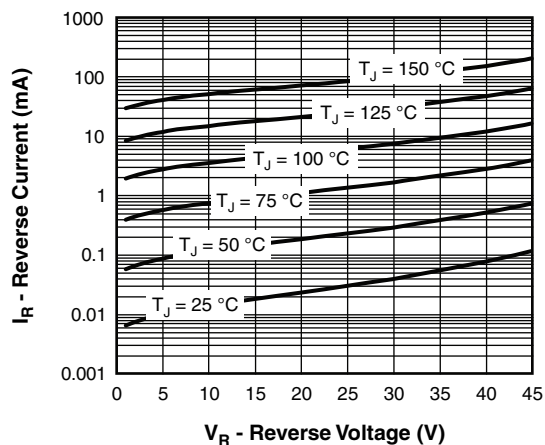


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

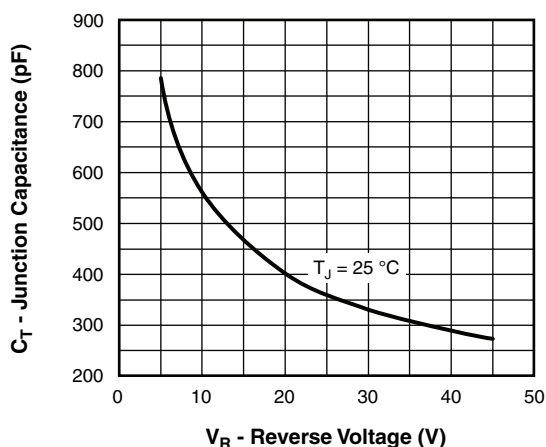
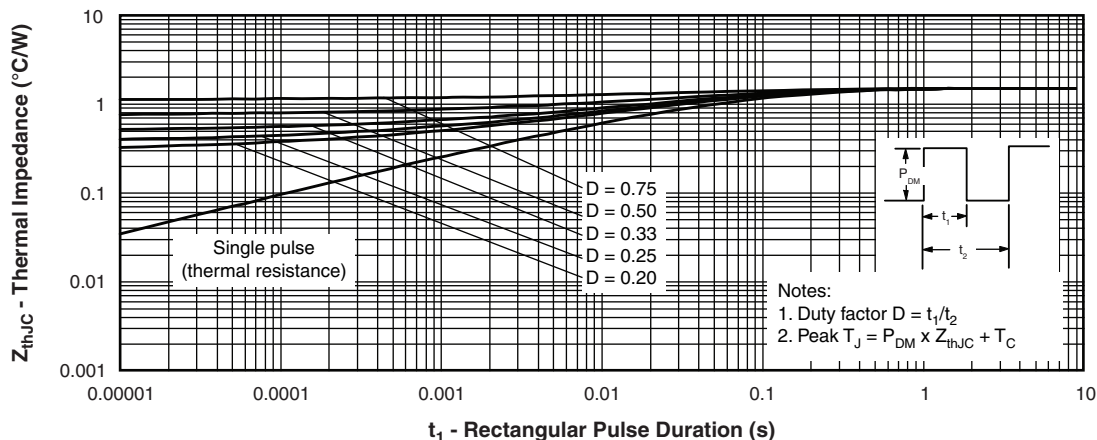


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)


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

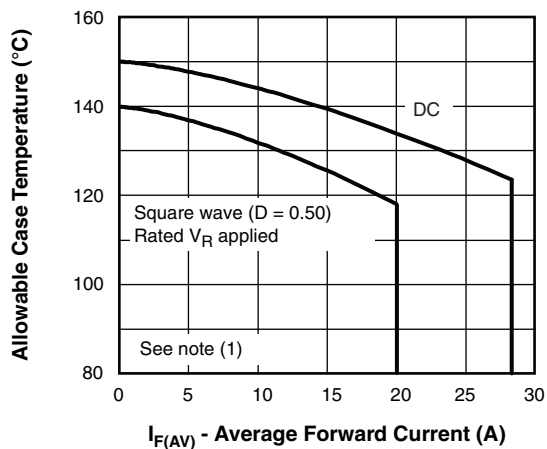


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

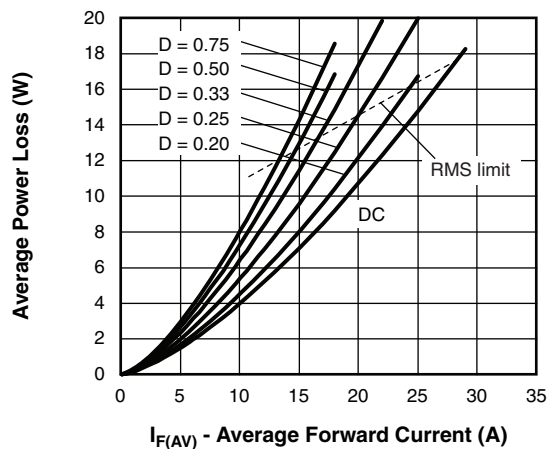


Fig. 6 - Forward Power Loss Characteristics

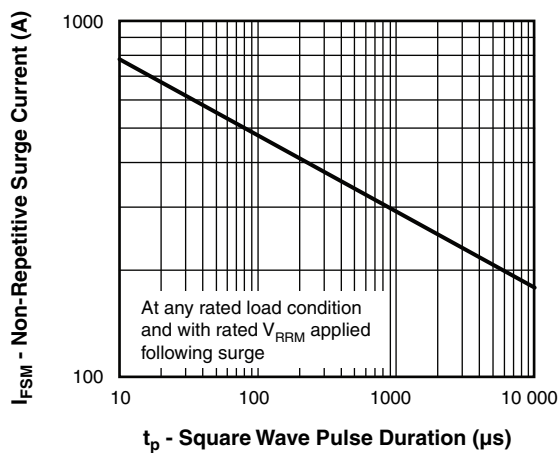


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

#### 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

|             |     |     |    |    |    |     |
|-------------|-----|-----|----|----|----|-----|
| Device code | VS- | MBR | 40 | 45 | CT | -M3 |
|             | 1   | 2   | 3  | 4  | 5  | 6   |

- |   |   |                               |
|---|---|-------------------------------|
| 1 | - | Vishay Semiconductors product |
| 2 | - | Schottky MBR series           |
| 3 | - | Current rating (40 = 40 A)    |
| 4 | - | Voltage rating (45 = 45 V)    |
| 5 | - | CT = essential part number    |
| 6 | - | Environmental digit           |
- M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

| ORDERING INFORMATION (Example) |               |                          |
|--------------------------------|---------------|--------------------------|
| PREFERRED P/N                  | BASE QUANTITY | PACKAGING DESCRIPTION    |
| VS-MBR4045CT-M3                | 50            | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| Dimensions                 | <a href="http://www.vishay.com/doc?96154">www.vishay.com/doc?96154</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a> |
| SPIICE model               | <a href="http://www.vishay.com/doc?95296">www.vishay.com/doc?95296</a> |



### TO-220AB 3L

**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     | 2.50        | 2.92  | 0.098  | 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       | 15.35 | 0.585  | 0.604 | 3     |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       |
| D2     | 11.68       | 13.30 | 0.460  | 0.524 | 6, 7  |
| E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |
| E1     | 6.86        | 8.89  | 0.270  | 0.350 | 6     |
| 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     |
| L      | 13.52       | 14.02 | 0.532  | 0.552 |       |
| L1     | 3.32        | 3.82  | 0.131  | 0.150 | 2     |
| Ø P    | 3.54        | 3.91  | 0.139  | 0.154 |       |
| 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) Outline conforms to JEDEC® TO-220, except D2



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