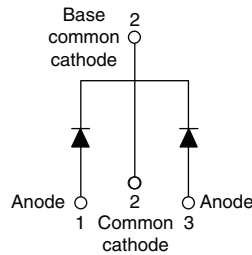


## High Performance Schottky Rectifier, 2 x 20 A



### 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
- 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

| PRIMARY CHARACTERISTICS |                 |
|-------------------------|-----------------|
| $I_{F(AV)}$             | 2 x 20 A        |
| $V_R$                   | 45 V            |
| $V_F$ at $I_F$          | 0.58 V          |
| $I_{RM}$ max.           | 95 mA at 125 °C |
| $T_J$ max.              | 150 °C          |
| $E_{AS}$                | 20 mJ           |
| Package                 | TO-220AB 3L     |
| Circuit configuration   | 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) | 40          | A     |
| $V_{RRM}$                         |                                   | 45          | V     |
| $I_{FRM}$                         | $T_C = 118$ °C (per leg)          | 40          | A     |
| $I_{FSM}$                         | $t_p = 5$ $\mu$ s sine            | 900         |       |
| $V_F$                             | 20 $A_{pk}$ , $T_J = 125$ °C      | 0.58        | V     |
| $T_J$                             | Range                             | -65 to +150 | °C    |

| VOLTAGE RATINGS                      |           |                 |       |
|--------------------------------------|-----------|-----------------|-------|
| PARAMETER                            | SYMBOL    | VS-MBR4045CT-M3 | UNITS |
| Maximum DC reverse voltage           | $V_R$     | 45              | V     |
| Maximum working peak reverse voltage | $V_{RWM}$ |                 |       |

| ABSOLUTE MAXIMUM RATINGS                                    |             |   |        |       |
|---|-------------|---|--------|-------|
| PARAMETER   | SYMBOL      | TEST CONDITIONS   | VALUES | UNITS |
| Maximum average forward current<br>per leg<br>per device    | $I_{F(AV)}$ | $T_C = 118$ °C, rated $V_R$   | 20     | A     |
|   |             |   | 40     |       |
| Peak repetitive forward current per leg                     | $I_{FRM}$   | Rated $V_R$ , square wave, 20 kHz, $T_C = 118$ °C   | 40     |       |
| Maximum peak one cycle non-repetitive surge current per leg | $I_{FSM}$   | 5 $\mu$ s sine or 3 $\mu$ s rect. pulse   | 900    |       |
|   |             | 10 ms sine or 6 ms rect. pulse  | 210    |       |
| Non-repetitive avalanche energy per leg                     | $E_{AS}$    | $T_J = 25$ °C, $I_{AS} = 3$ A, $L = 4.40$ mH  | 20     | mJ    |
| 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 | 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/ $\mu$ s |

**Note**(1) Pulse width < 300  $\mu$ 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   |                        | 1.5         | $^\circ\text{C/W}$     |
| Typical thermal resistance, case to heatsink         | $R_{thCS}$         | Mounting surface, smooth and greased (Only for TO-220) |                        | 0.50        |                        |
| Maximum thermal resistance, junction to ambient      | $R_{thJA}$         | DC operation (For D <sup>2</sup> PAK and TO-262)       |                        | 50          |                        |
| Approximate weight                                   |                    |  |                        | 2           | g                      |
|  |                    |  |                        | 0.07        | oz.                    |
| Mounting torque                                      | minimum<br>maximum |  | Non-lubricated threads | 6 (5)       | kgf · cm<br>(lbf · in) |
|  |                    |  |                        | 12 (10)     |                        |
| Marking device                                       |                    | Case style TO-220AB 3L                                 |                        | MBR4045CT   |                        |

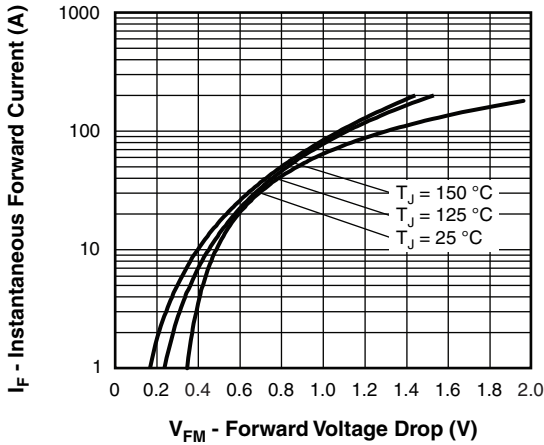


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

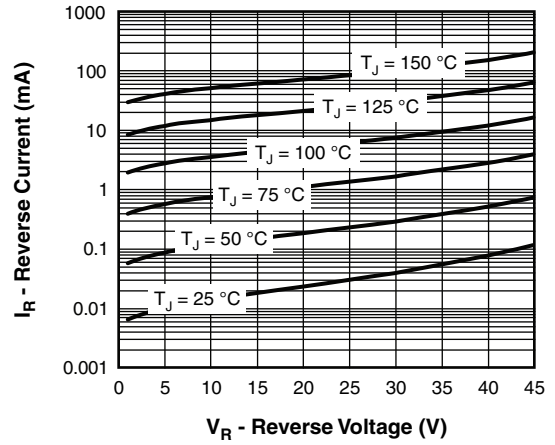


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

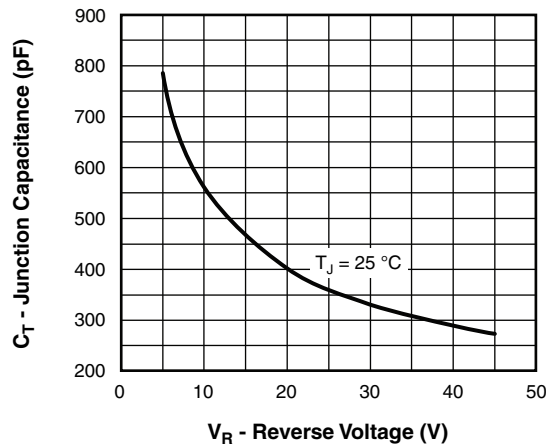


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

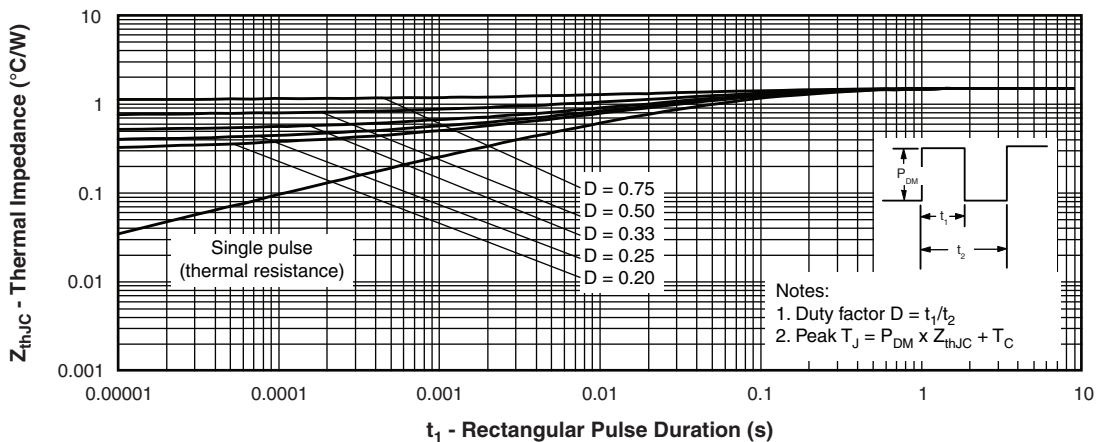


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

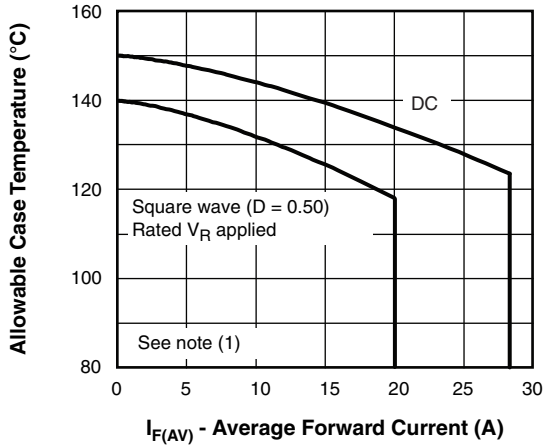


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

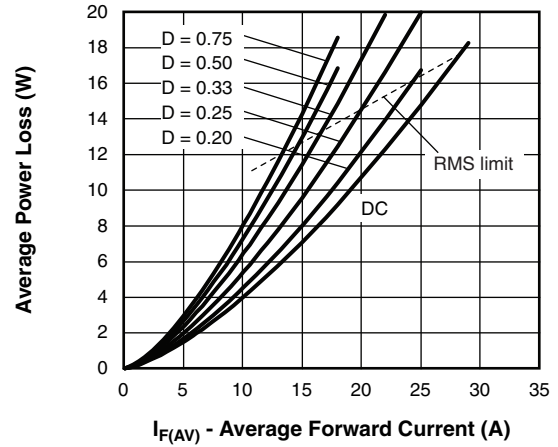


Fig. 6 - Forward Power Loss Characteristics

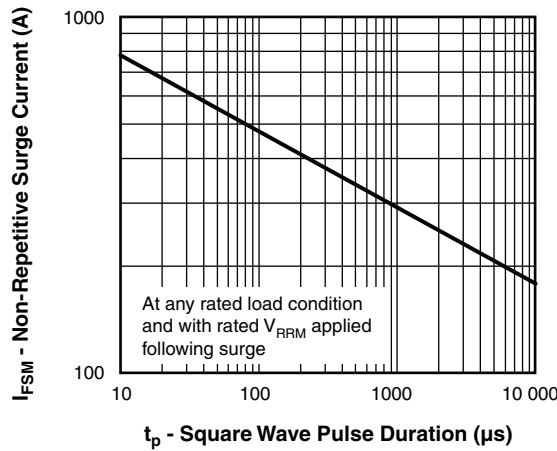


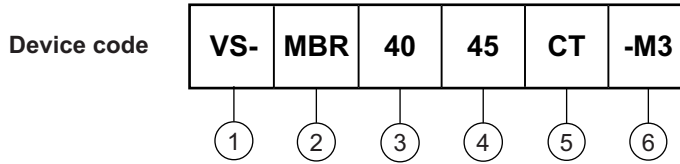
Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

**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



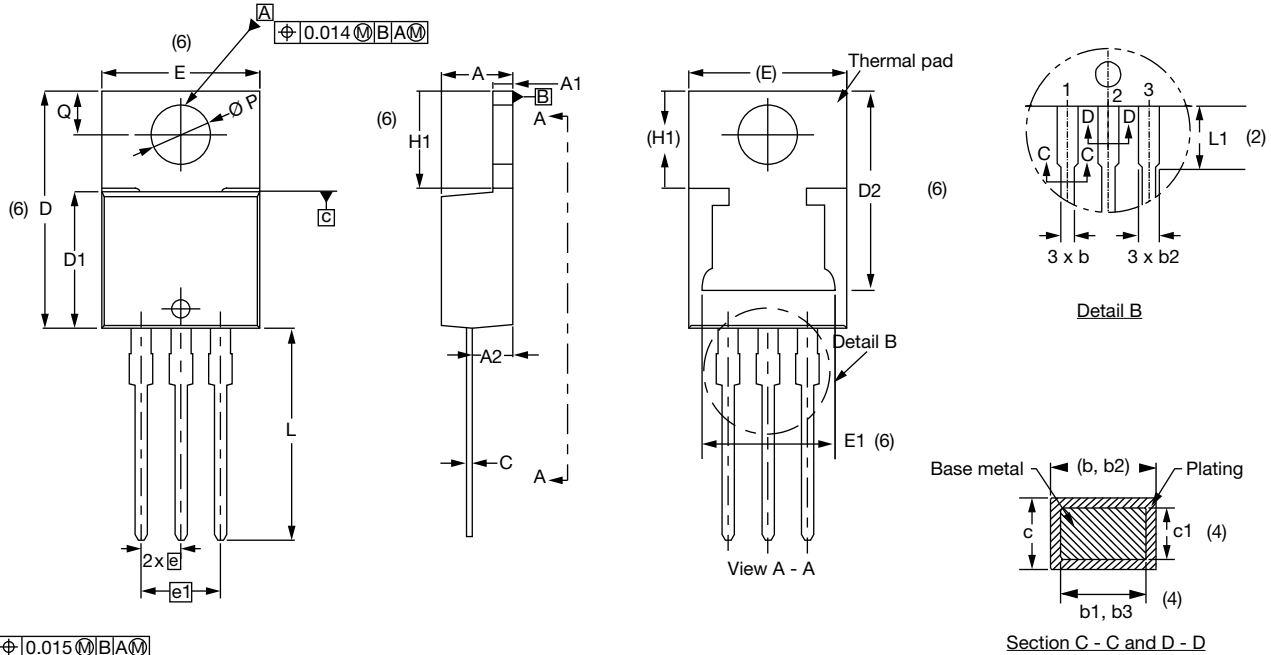
- 1** - Vishay Semiconductors product
  - 2** - Schottky MBR series
  - 3** - Current rating (40 = 40 A)
  - 4** - Voltage rating (45 = 45 V)
  - 5** - CT = essential part number
  - 6** - Environmental digit
- M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

| 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



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     | 2.50        | 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     |
| ∅ 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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