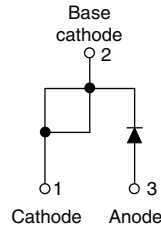


## Schottky Rectifier, 16 A



TO-220AC



### 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
- Compliant to RoHS Directive 2002/95/EC
- Designed and qualified according to JEDEC-JESD47
- Halogen-free according to IEC 61249-2-21 definition (-N3 only)



| PRODUCT SUMMARY |                 |
|-----------------|-----------------|
| Package         | TO-220AC        |
| $I_{F(AV)}$     | 16 A            |
| $V_R$           | 35 V, 45 V      |
| $V_F$ at $I_F$  | 0.57 V          |
| $I_{RM}$ max.   | 40 mA at 125 °C |
| $T_J$ max.      | 150 °C          |
| Diode variation | Single die      |
| $E_{AS}$        | 24 mJ           |

### DESCRIPTION

The VS-MBR16... 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                             | 16          | A     |
| $V_{RRM}$                         |  | 35/45       | V     |
| $I_{FSM}$                         | $t_p = 5 \mu s$ sine                             | 1800        | A     |
| $V_F$                             | 16 $A_{pk}$ , $T_J = 125 \text{ }^\circ\text{C}$ | 0.57        | V     |
| $T_J$                             | Range  | - 65 to 150 | °C    |

| VOLTAGE RATINGS                      |           |               |               |               |               |       |
|--------------------------------------|-----------|---------------|---------------|---------------|---------------|-------|
| PARAMETER                            | SYMBOL    | VS-MBR1635PbF | VS-MBR1635-N3 | VS-MBR1645PbF | VS-MBR1645-N3 | UNITS |
| Maximum DC reverse voltage           | $V_R$     | 35            | 35            | 45            | 45            | V     |
| Maximum working peak reverse voltage | $V_{RWM}$ |               |               |               |               |       |

| ABSOLUTE MAXIMUM RATINGS          |             |   |   |        |       |
|-----------------------------------|-------------|---|---|--------|-------|
| PARAMETER                         | SYMBOL      | TEST CONDITIONS   |   | VALUES | UNITS |
| Maximum average forward current   | $I_{F(AV)}$ | $T_C = 134 \text{ }^\circ\text{C}$ , rated $V_R$  |   | 16     | A     |
| 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 | 1800   | A     |
|                                   |             | Surge applied at rated load condition half wave single phase, 60 Hz   |   | 150    |       |
| Non-repetitive avalanche energy   | $E_{AS}$    | $T_J = 25 \text{ }^\circ\text{C}$ , $I_{AS} = 3.6 \text{ A}$ , $L = 3.7 \text{ mH}$                                 |   | 24     | mJ    |
| Repetitive avalanche current      | $I_{AR}$    | Current decaying linearly to zero in 1 $\mu s$<br>Frequency limited by $T_J$ maximum $V_A = 1.5 \times V_R$ typical |   | 3.6    | A     |



| ELECTRICAL SPECIFICATIONS             |                |  |                                   |        |            |
|---------------------------------------|----------------|--|-----------------------------------|--------|------------|
| PARAMETER                             | SYMBOL         | TEST CONDITIONS  |                                   | VALUES | UNITS      |
| Maximum forward voltage drop          | $V_{FM}^{(1)}$ | 16 A   | $T_J = 25\text{ }^\circ\text{C}$  | 0.63   | V          |
|                                       |                |  | $T_J = 125\text{ }^\circ\text{C}$ | 0.57   |            |
| Maximum instantaneous reverse current | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^\circ\text{C}$                                   | Rated DC voltage                  | 0.2    | mA         |
|                                       |                | $T_J = 125\text{ }^\circ\text{C}$                                  |                                   | 40     |            |
| Maximum junction capacitance          | $C_T$          | $V_R = 5\text{ }V_{DC}$ (test signal range 100 kHz to 1 MHz) 25 °C |                                   | 1400   | 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 | $R_{thJC}$         | DC operation                         |  | 1.50        | $^\circ\text{C/W}$     |
| Typical thermal resistance, case to heatsink | $R_{thCS}$         | Mounting surface, smooth and greased |  | 0.50        |                        |
| Approximate weight                           |                    |                                      |  | 2           | g                      |
|  |                    |                                      |  | 0.07        | oz.                    |
| Mounting torque                              | minimum<br>maximum |                                      |  | 6 (5)       | kgf · cm<br>(lbf · in) |
|  |                    |                                      |  | 12 (10)     |                        |
| Marking device                               |                    | Case style TO-220AC (JEDEC)          |  | MBR1635     |                        |
|  |                    |                                      |  | MBR1645     |                        |

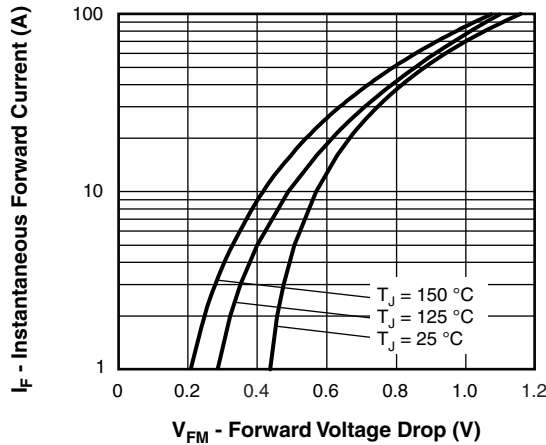


Fig. 1 - Maximum Forward Voltage Drop Characteristics

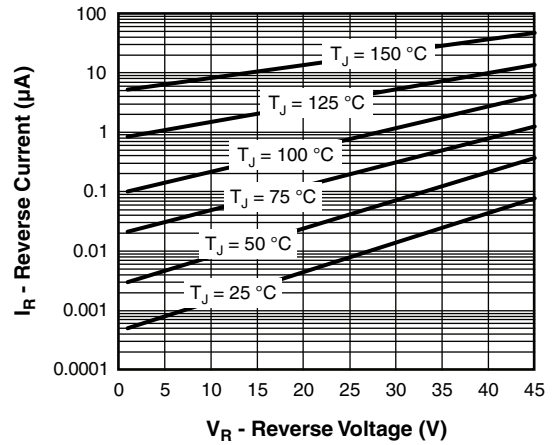


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

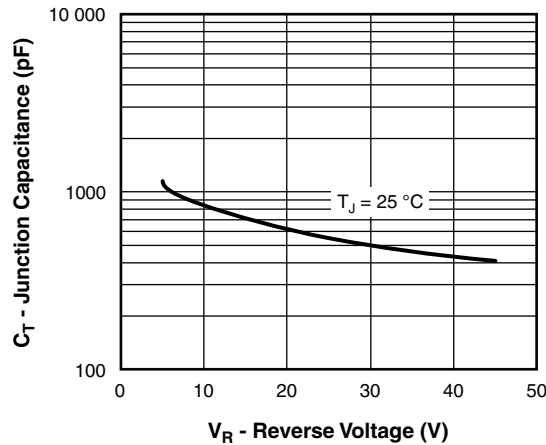


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

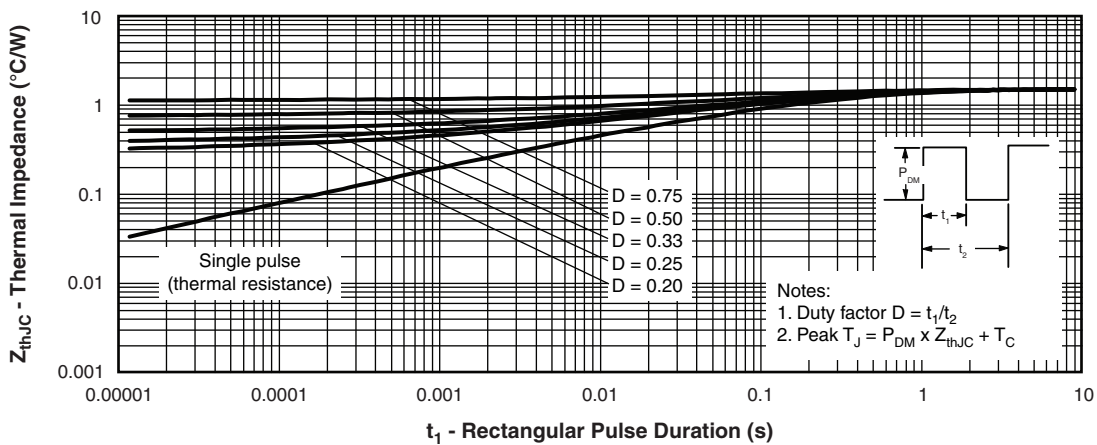


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

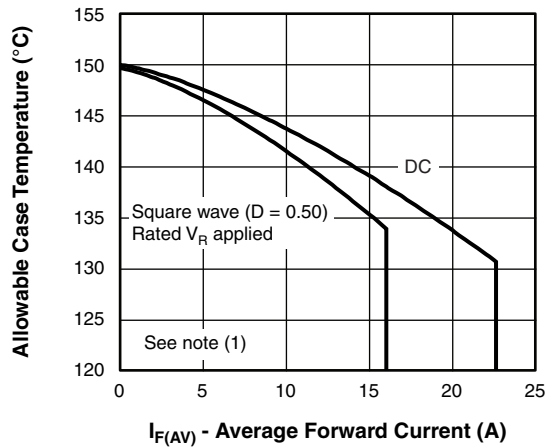


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

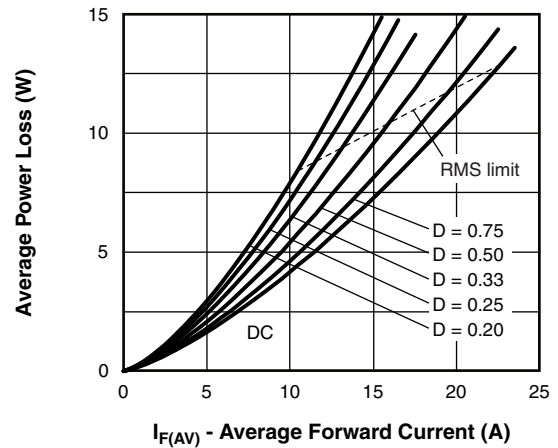


Fig. 6 - Forward Power Loss Characteristics

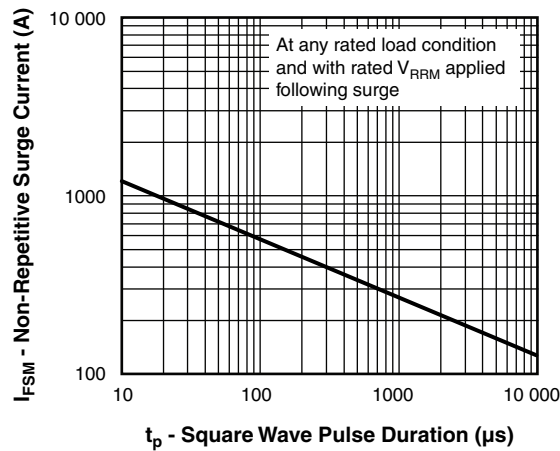


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

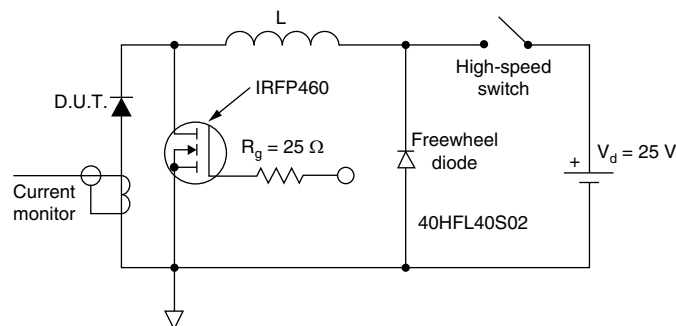


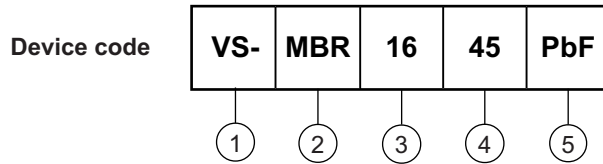
Fig. 8 - Unclamped Inductive Test Circuit

**Note**

- (1) Formula used:  $T_C = T_J - (P_d + P_{d_{REV}}) \times R_{thJC}$ ;
- $P_d$  = Forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);
- $P_{d_{REV}}$  = Inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1}$  = Rated  $V_R$  applied



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Schottky MBR series
- 3** - Current rating (16 = 16 A)
- 4** - Voltage ratings 35 = 35 V  
45 = 45 V
- 5** - Environmental digit
  - PbF = Lead (Pb)-free and RoHS compliant
  - -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-MBR1635PbF                  | 50               | 1000                   | Antistatic plastic tube |
| VS-MBR1635-N3                  | 50               | 1000                   | Antistatic plastic tube |
| VS-MBR1645PbF                  | 50               | 1000                   | Antistatic plastic tube |
| VS-MBR1645-N3                  | 50               | 1000                   | Antistatic plastic tube |

| LINKS TO RELATED DOCUMENTS |   |
|----------------------------|---|
| Dimensions                 | <a href="http://www.vishay.com/doc?95221">www.vishay.com/doc?95221</a>              |
| Part marking information   | TO-220AC PbF <a href="http://www.vishay.com/doc?95224">www.vishay.com/doc?95224</a> |
|                            | TO-220AC -N3 <a href="http://www.vishay.com/doc?95068">www.vishay.com/doc?95068</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     | $\varnothing P$ | 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     | $\theta$        | 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



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