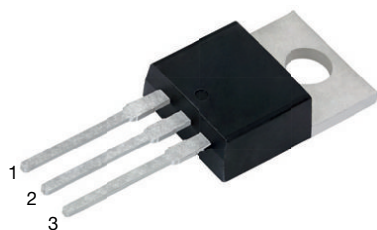
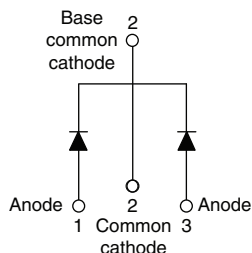


# High Performance Schottky Rectifier, 2 x 20 A



TO-220AB 3L



## FEATURES

- 150 °C  $T_J$  operation
- Optimized for 3.3 V application
- Ultralow forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- 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 ultralow forward voltage drop specifically for 3.3 V output power supplies. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, reverse battery protection, and redundant power subsystems.

## PRIMARY CHARACTERISTICS

|                       |                  |
|-----------------------|------------------|
| $I_{F(AV)}$           | 2 x 20 A         |
| $V_R$                 | 20 V             |
| $V_F$ at $I_F$        | 0.34 V           |
| $I_{RM}$ max.         | 310 mA at 125 °C |
| $T_J$ max.            | 150 °C           |
| $E_{AS}$              | 18 mJ            |
| Package               | TO-220AB 3L      |
| Circuit configuration | Common cathode   |

## MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL      | CHARACTERISTICS                     | VALUES      | UNITS |
|-------------|-------------------------------------|-------------|-------|
| $I_{F(AV)}$ | Rectangular waveform                | 40          | A     |
| $V_{RRM}$   |                                     | 20          | V     |
| $I_{FSM}$   | $t_p = 5 \mu s$ sine                | 1000        | A     |
| $V_F$       | 20 A <sub>pk</sub> , $T_J = 125$ °C | 0.34        | V     |
| $T_J$       |                                     | -55 to +150 | °C    |

## VOLTAGE RATINGS

| PARAMETER                            | SYMBOL    | VS-47CTQ020-M3 | UNITS |
|--------------------------------------|-----------|----------------|-------|
| Maximum DC reverse voltage           | $V_R$     | 20             | V     |
| Maximum working peak reverse voltage | $V_{RWM}$ |                |       |

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER   | SYMBOL      | TEST CONDITIONS   | VALUES | UNITS |
|---|-------------|---|--------|-------|
| Maximum average forward current                             | $I_{F(AV)}$ | 50 % duty cycle at $T_C = 135$ °C, rectangular waveform   | 20     | A     |
| per leg   |             |   | 40     |       |
| Maximum peak one cycle non-repetitive surge current per leg | $I_{FSM}$   | 5 $\mu s$ sine or 3 $\mu s$ rect. pulse   | 1000   |       |
|   |             | 10 ms sine or 6 ms rect. pulse  | 250    |       |
| Non-repetitive avalanche energy per leg                     | $E_{AS}$    | $T_J = 25$ °C, $I_{AS} = 3$ A, $L = 3$ mH   | 18     | 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 per leg    | $V_{FM}^{(1)}$ | 20 A  | $T_J = 25\text{ }^{\circ}\text{C}$  | 0.45   | V     |
|   |                | 40 A  |                                     | 0.51   |       |
|   |                | 20 A  | $T_J = 125\text{ }^{\circ}\text{C}$ | 0.34   |       |
|   |                | 40 A  |                                     | 0.44   |       |
|   |                | 20 A  | $T_J = 150\text{ }^{\circ}\text{C}$ | 0.31   |       |
|   |                | 40 A  |                                     | 0.42   |       |
| Maximum reverse leakage current per leg | $I_{RM}^{(1)}$ | $T_J = 125\text{ }^{\circ}\text{C}$   | $V_R = 5\text{ V}$                  | 60     | mA    |
|   |                |   | $V_R = 3.3\text{ V}$                | 45     |       |
|   |                | $T_J = 150\text{ }^{\circ}\text{C}$   | $V_R = 10\text{ V}$                 | 306    |       |
|   |                | $T_J = 25\text{ }^{\circ}\text{C}$  | $V_R = \text{Rated } V_R$           | 3      |       |
|   |                | $T_J = 125\text{ }^{\circ}\text{C}$   |                                     | 310    |       |
| Threshold voltage                       | $V_{F(TO)}$    | $T_J = T_J \text{ maximum}$   |                                     | 0.188  | V     |
| Forward slope resistance                | $r_t$          |   |                                     | 5.9    | mΩ    |
| Maximum junction capacitance per leg    | $C_T$          | $V_R = 5\text{ V}_{DC}$ (test signal range 100 kHz to 1 MHz) $25\text{ }^{\circ}\text{C}$ |                                     | 3000   | pF    |
| Typical series inductance per leg       | $L_S$          | Measured lead to lead 5 mm from package body  |                                     | 5.5    | 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 and storage temperature range           | T <sub>J</sub> , T <sub>Stg</sub> |                                       | - 55 to 150 | °C         |
| Maximum thermal resistance, junction to case per leg     | R <sub>thJC</sub>                 | DC operation                          | 1.5         | °C/W       |
| Maximum thermal resistance, junction to case per package |                                   |                                       | 0.75        |            |
| Typical thermal resistance, case to heatsink             | R <sub>thCS</sub>                 | Mounting surface, smooth, and greased | 0.50        |            |
| Approximate weight                                       |                                   |                                       | 2           | g          |
|  |                                   |                                       | 0.07        | oz.        |
| Mounting torque  |                                   |                                       | 6 (5)       | kgf · cm   |
|  |                                   |                                       | 12 (10)     | (lbf · in) |
| Marking device   |                                   | Case style 3L TO-220AB                | 47CTQ020    |            |

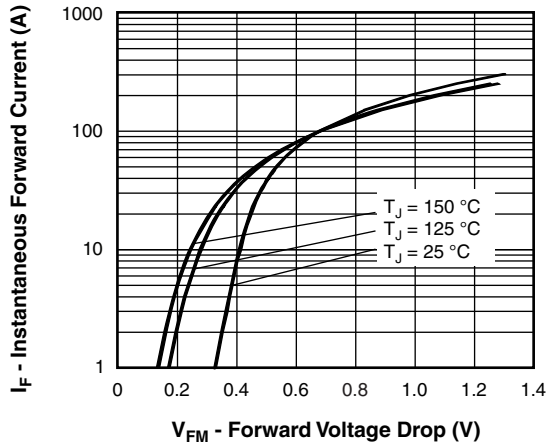


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

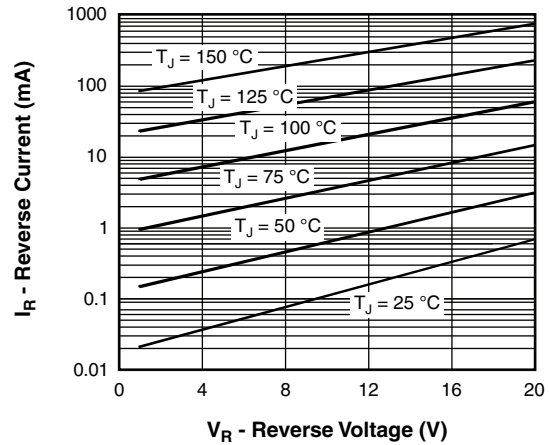


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

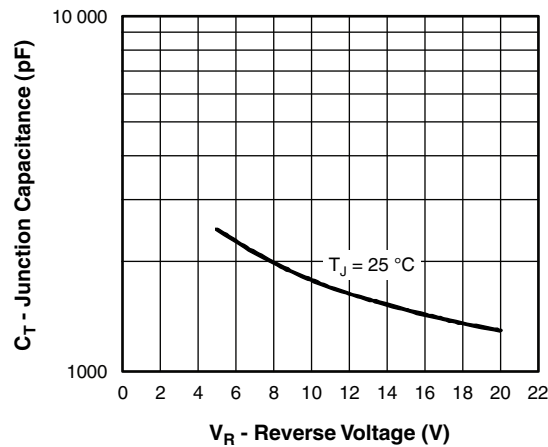
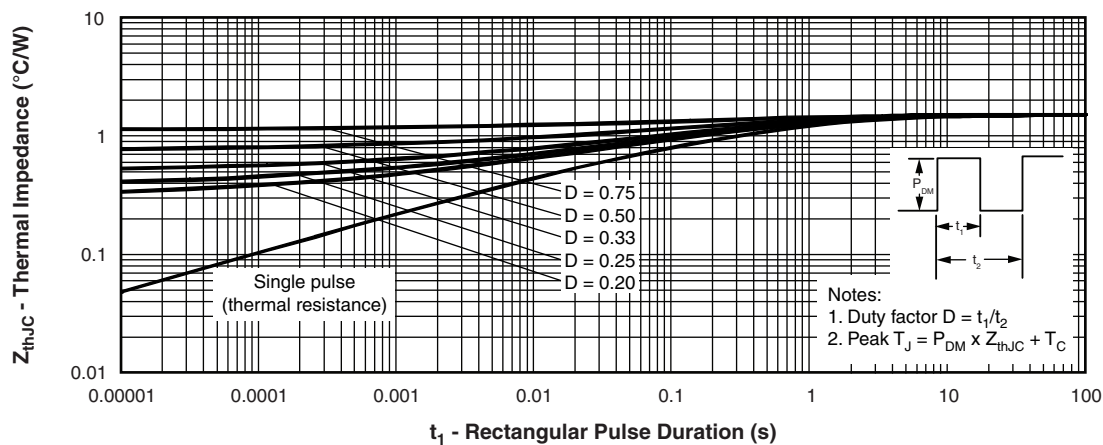


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)


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

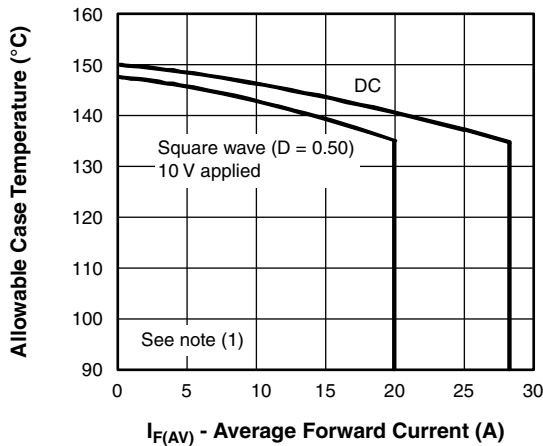


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

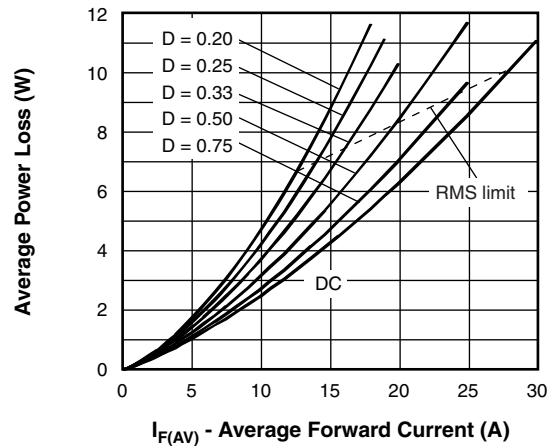


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

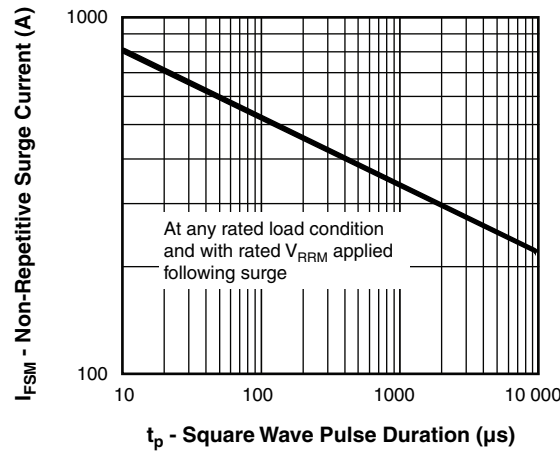


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

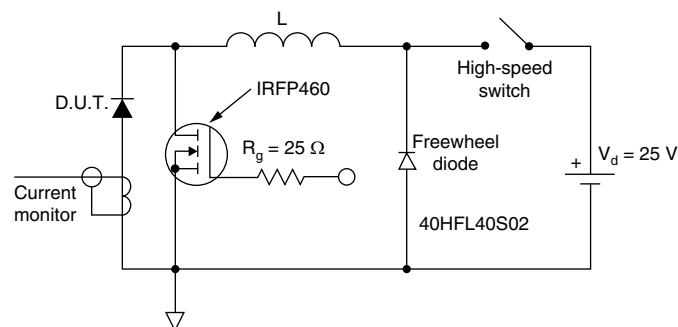


Fig. 8 - Unclamped Inductive Test Circuit

#### 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  $V_{R1} = 10\text{ V}$



## ORDERING INFORMATION TABLE

|             |     |    |   |   |   |     |     |
|-------------|-----|----|---|---|---|-----|-----|
| Device code | VS- | 47 | C | T | Q | 020 | -M3 |
|             | 1   | 2  | 3 | 4 | 5 | 6   | 7   |

- |   |   |  |
|---|---|--|
| 1 | - | Vishay Semiconductors product  |
| 2 | - | Current rating (40 A)  |
| 3 | - | Circuit configuration<br>C = common cathode  |
| 4 | - | Package<br>T = TO-220  |
| 5 | - | Schottky "Q" series  |
| 6 | - | Voltage rating (020 = 20 V)  |
| 7 | - | Environmental digit<br>-M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free |

### ORDERING INFORMATION (Example)

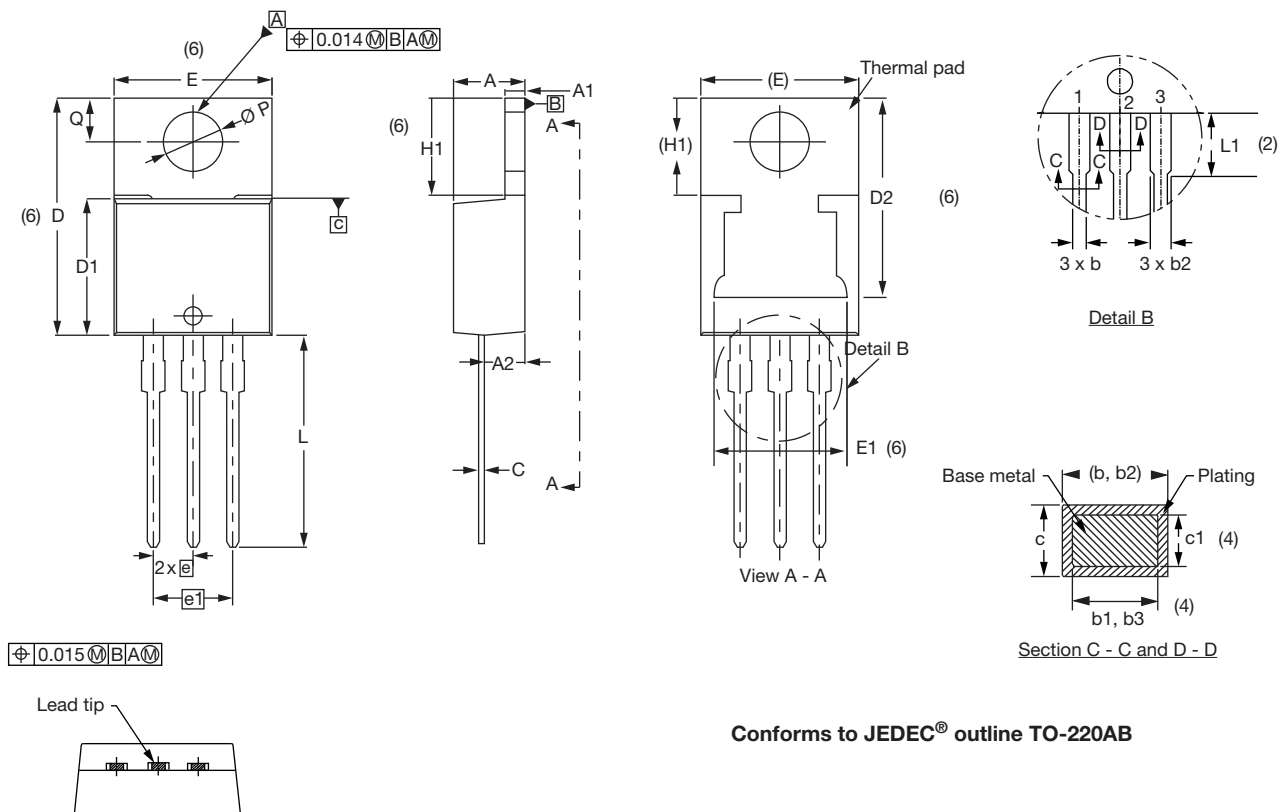
| PREFERRED P/N  | BASE QUANTITY | PACKAGING DESCRIPTION    |
|----------------|---------------|--------------------------|
| VS-47CTQ020-M3 | 50            | Antistatic plastic tubes |

### 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> |

# 3L 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.  |        |       |       |
| A      | 4.25        | 4.65  | 0.167  | 0.183 |       |  | D2     | 11.68       | 13.30 | 0.460  | 0.524 | 6, 7  |
| A1     | 1.14        | 1.40  | 0.045  | 0.055 |       |  | E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |
| A2     | 2.50        | 2.92  | 0.098  | 0.115 |       |  | E1     | 6.86        | 8.89  | 0.270  | 0.350 | 6     |
| b      | 0.69        | 1.01  | 0.027  | 0.040 |       |  | e      | 2.41        | 2.67  | 0.095  | 0.105 |       |
| b1     | 0.38        | 0.97  | 0.015  | 0.038 | 4     |  | e1     | 4.88        | 5.28  | 0.192  | 0.208 |       |
| b2     | 1.20        | 1.73  | 0.047  | 0.068 |       |  | H1     | 6.09        | 6.48  | 0.240  | 0.255 | 6     |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     |  | L      | 13.52       | 14.02 | 0.532  | 0.552 |       |
| c      | 0.36        | 0.61  | 0.014  | 0.024 |       |  | L1     | 3.32        | 3.82  | 0.131  | 0.150 | 2     |
| c1     | 0.36        | 0.56  | 0.014  | 0.022 | 4     |  | Ø P    | 3.54        | 3.91  | 0.139  | 0.154 |       |
| D      | 14.85       | 15.35 | 0.585  | 0.604 | 3     |  | Q      | 2.60        | 3.00  | 0.102  | 0.118 |       |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       |  |        |             |       |        |       |       |

## 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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