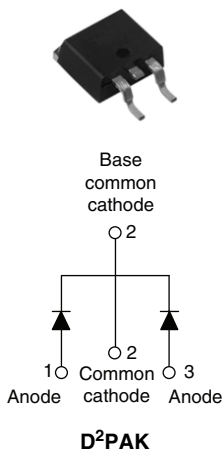
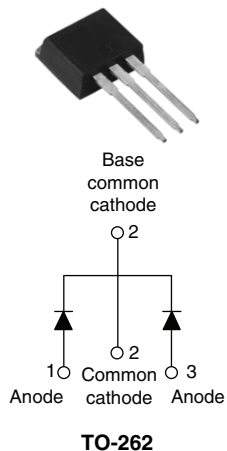


## Schottky Rectifier, 2 x 20 A

VS-47CTQ020SPbF



VS-47CTQ020-1PbF



### FEATURES

- 150 °C  $T_J$  operation
- Center tap configuration
- 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
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Halogen-free according to IEC 61249-2-21 definition
- Compliant to RoHS directive 2002/95/EC
- AEC-Q101 qualified



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### DESCRIPTION

This center tap Schottky rectifier module 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 parallel switching power supplies, converters, reverse battery protection, and redundant power subsystems.

### PRODUCT SUMMARY

|             |                  |
|-------------|------------------|
| $I_{F(AV)}$ | 2 x 20 A         |
| $V_R$       | 20 V             |
| $I_{RM}$    | 310 mA at 125 °C |

### 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 Apk, $T_J = 125 \text{ }^\circ\text{C}$ | 0.34        | V     |
| $T_J$       |  | - 55 to 150 | °C    |

### VOLTAGE RATINGS

| PARAMETER                  | SYMBOL | TEST CONDITIONS | VS-47CTQ020SPbF<br>VS-47CTQ020-1PbF | UNITS |
|----------------------------|--------|-----------------|-------------------------------------|-------|
| Maximum DC reverse voltage | $V_R$  | 125 °C          | 20                                  | V     |
|                            |        | 150 °C          | 10                                  |       |

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER   | SYMBOL             | TEST CONDITIONS  |  | VALUES | UNITS |
|---|--------------------|--|--|--------|-------|
| Maximum average forward current                             | I <sub>F(AV)</sub> | 50 % duty cycle at T <sub>C</sub> = 135 °C, rectangular waveform   |  | 20     | A     |
| per leg<br>per device                                       |                    |  |  | 40     |       |
| Maximum peak one cycle non-repetitive surge current per leg | I <sub>FSM</sub>   | 5 μs sine or 3 μs rect. pulse  | Following any rated load condition and with rated V <sub>RRM</sub> applied | 1000   |       |
|   |                    | 10 ms sine or 6 ms rect. pulse   |  | 250    |       |
| Non-repetitive avalanche energy per leg                     | E <sub>AS</sub>    | T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 3 A, L = 3 mH  |  | 18     | 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     |

# VS-47CTQ020SPbF, VS-47CTQ020-1PbF



Vishay High Power Products Schottky Rectifier, 2 x 20 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

<sup>(1)</sup> 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  | minimum                           |                                      | 6 (5)       | kgf · cm<br>(lbf · in) |
|  | maximum                           |                                      | 12 (10)     |                        |
| Marking device   |                                   | Case style D <sup>2</sup> PAK        | 47CTQ020S   |                        |
|  |                                   | Case style TO-262                    | 47CTQ020-1  |                        |

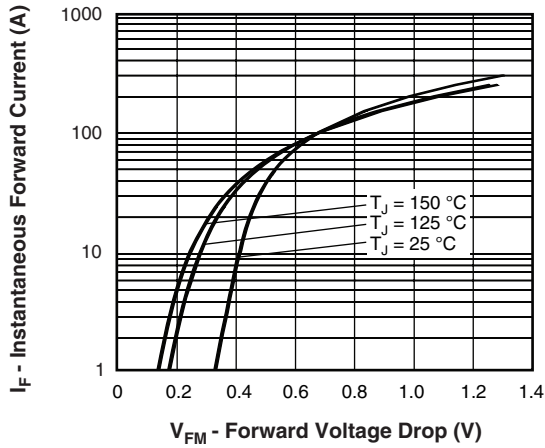


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

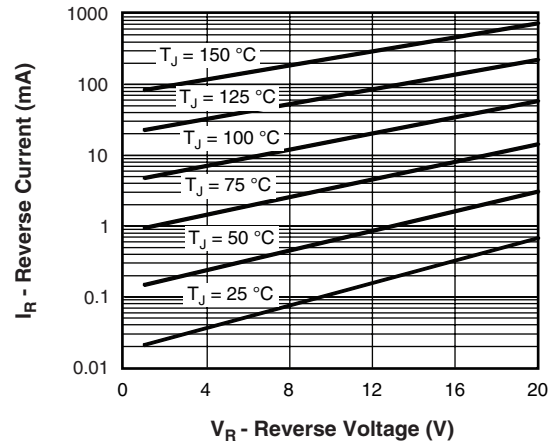


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

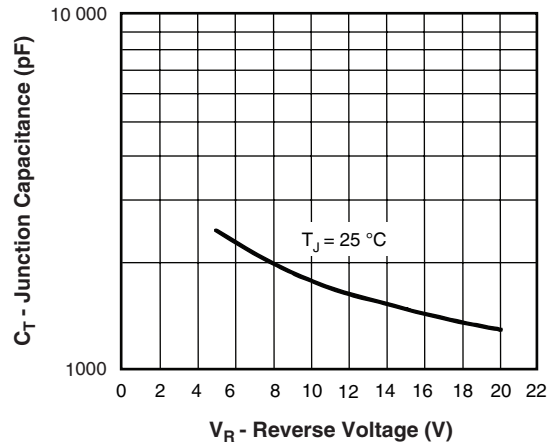


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

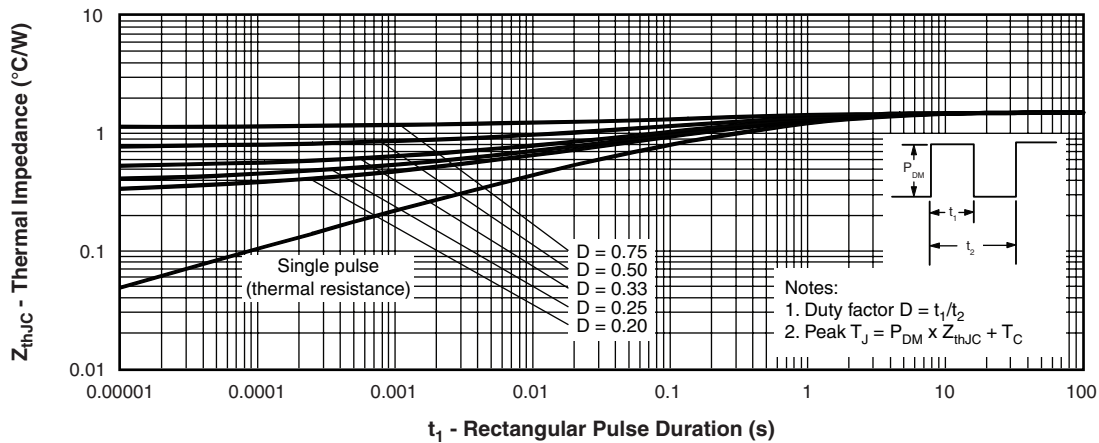


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

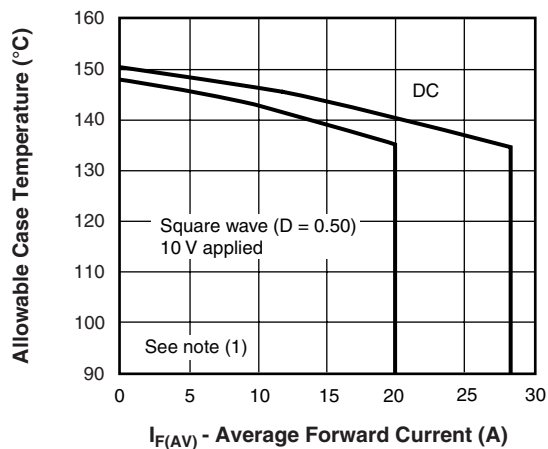


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

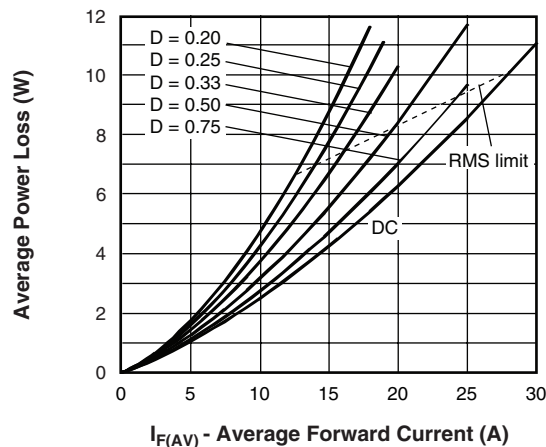


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

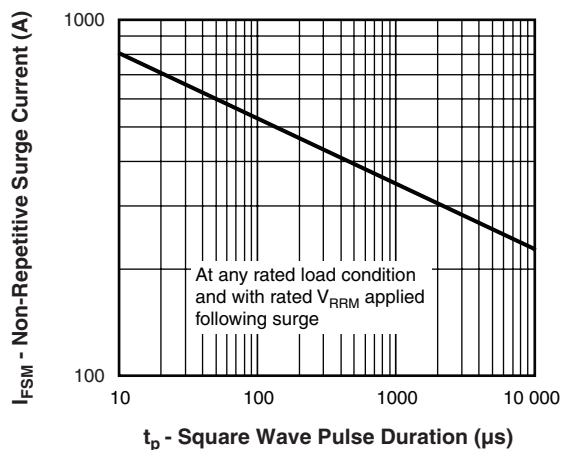


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

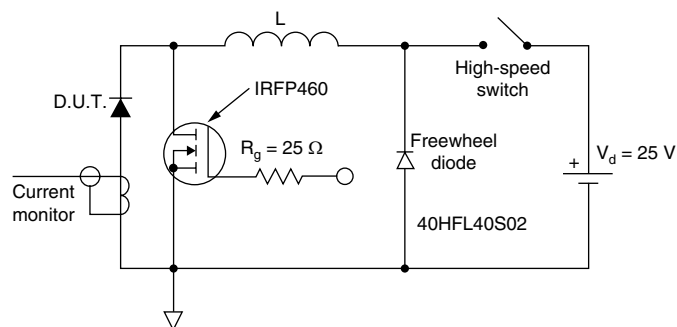


Fig. 8 - Unclamped Inductive Test Circuit

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



# VS-47CTQ020SPbF, VS-47CTQ020-1PbF

Schottky Rectifier, 2 x 20 A Vishay High Power Products

## ORDERING INFORMATION TABLE

|             |     |    |   |   |   |     |   |     |     |
|-------------|-----|----|---|---|---|-----|---|-----|-----|
| Device code | VS- | 47 | C | T | Q | 020 | S | TRL | PbF |
|             | 1   | 2  | 3 | 4 | 5 | 6   | 7 | 8   | 9   |

- |          |   |  |
|----------|---|--|
| <b>1</b> | - | HPP product suffix   |
| <b>2</b> | - | Current rating (40 A)  |
| <b>3</b> | - | Circuit configuration: C = Common cathode  |
| <b>4</b> | - | T = TO-220   |
| <b>5</b> | - | Schottky "Q" series  |
| <b>6</b> | - | Voltage rating (020 = 20 V)  |
| <b>7</b> | - | <ul style="list-style-type: none"><li>• S = D<sup>2</sup>PAK</li><li>• -1 = TO-262</li></ul>   |
| <b>8</b> | - | <ul style="list-style-type: none"><li>• None = Tube (50 pieces)</li><li>• TRL = Tape and reel (left oriented - for D<sup>2</sup>PAK only)</li><li>• TRR = Tape and reel (right oriented - for D<sup>2</sup>PAK only)</li></ul> |
| <b>9</b> | - | PbF = Lead (Pb)-free   |

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| Dimensions                 | <a href="http://www.vishay.com/doc?95014">www.vishay.com/doc?95014</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95008">www.vishay.com/doc?95008</a> |
| Packaging information      | <a href="http://www.vishay.com/doc?95032">www.vishay.com/doc?95032</a> |

## D<sup>2</sup>PAK, TO-262

### DIMENSIONS FOR D<sup>2</sup>PAK in millimeters and inches

Conforms to JEDEC outline D<sup>2</sup>PAK (SMD-220)



## DIMENSIONS FOR TO-262 in millimeters and inches



| SYMBOL | MILLIMETERS |       | INCHES    |       | NOTES |
|--------|-------------|-------|-----------|-------|-------|
|        | MIN.        | MAX.  | MIN.      | MAX.  |       |
| A      | 4.06        | 4.83  | 0.160     | 0.190 |       |
| A1     | 2.03        | 3.02  | 0.080     | 0.119 |       |
| b      | 0.51        | 0.99  | 0.020     | 0.039 |       |
| b1     | 0.51        | 0.89  | 0.020     | 0.035 | 4     |
| b2     | 1.14        | 1.78  | 0.045     | 0.070 |       |
| b3     | 1.14        | 1.73  | 0.045     | 0.068 | 4     |
| c      | 0.38        | 0.74  | 0.015     | 0.029 |       |
| c1     | 0.38        | 0.58  | 0.015     | 0.023 | 4     |
| c2     | 1.14        | 1.65  | 0.045     | 0.065 |       |
| D      | 8.51        | 9.65  | 0.335     | 0.380 | 2     |
| D1     | 6.86        | 8.00  | 0.270     | 0.315 | 3     |
| E      | 9.65        | 10.67 | 0.380     | 0.420 | 2, 3  |
| E1     | 7.90        | 8.80  | 0.311     | 0.346 | 3     |
| e      | 2.54 BSC    |       | 0.100 BSC |       |       |
| L      | 13.46       | 14.10 | 0.530     | 0.555 |       |
| L1     | -           | 1.65  | -         | 0.065 | 3     |
| L2     | 3.56        | 3.71  | 0.140     | 0.146 |       |

### Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Dimension D 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 outmost extremes of the plastic body
- (3) Thermal pad contour optional within dimension E, L1, D1 and E1
- (4) Dimension b1 and c1 apply to base metal only
- (5) Controlling dimension: inches

- (6) Outline conform to JEDEC TO-262 except A1 (maximum), b (minimum) and D1 (minimum) where dimensions derived the actual package outline



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