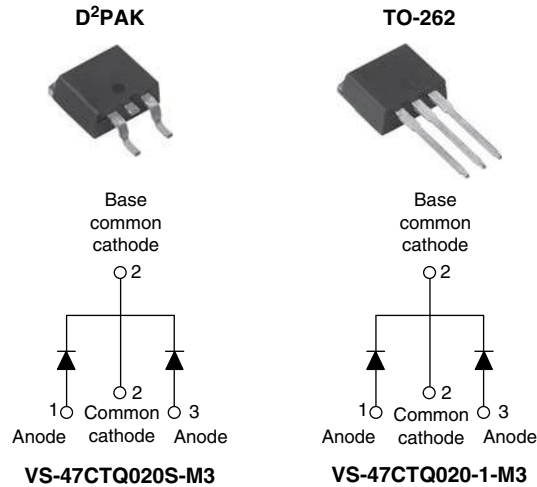


High Performance Schottky Rectifier, 2 x 20 A



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
- Designed and qualified according to JEDEC®-JESD 47
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



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 |
| 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-263AB (D ² PAK), TO-262AA |
| Diode variation | Common cathode |

MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL | CHARACTERISTICS | VALUES | UNITS |
|---------------------|--|------------|-------|
| I _{F(AV)} | Rectangular waveform | 40 | A |
| V _{R(RRM)} | | 20 | V |
| I _{FSM} | t _p = 5 μs sine | 1000 | A |
| V _F | 20 A _{pk} , T _J = 125 °C | 0.34 | V |
| T _J | | -55 to 150 | °C |

VOLTAGE RATINGS

| PARAMETER | SYMBOL | TEST CONDITIONS | VS-47CTQ020S-M3 VS-47CTQ020-1-M3 | 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 per leg per device | $I_{F(AV)}$ | 50 % duty cycle at $T_C = 135\text{ }^\circ\text{C}$, rectangular waveform | | 20 | A |
| | | | | 40 | |
| Maximum peak one cycle non-repetitive surge current per leg | I_{FSM} | 5 μs sine or 3 μs rect. pulse | Following any rated load condition and with rated V_{RRM} applied | 1000 | |
| | | 10 ms sine or 6 ms rect. pulse | | 250 | |
| Non-repetitive avalanche energy per leg | E_{AS} | $T_J = 25\text{ }^\circ\text{C}$, $I_{AS} = 3\text{ A}$, $L = 3\text{ mH}$ | | 18 | mJ |
| Repetitive avalanche current per leg | I_{AR} | Current decaying linearly to zero in 1 μs 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 | $V_{F(TO)}$ | $T_J = T_J$ maximum | | 0.188 | V |
| Forward slope resistance | r_f | | | 5.9 | $\text{m}\Omega$ |
| 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 μs , duty cycle < 2 %

| THERMAL - MECHANICAL SPECIFICATIONS | | | | | |
|--|----------------|--------------------------------------|-------------------------------|-------------|---------------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum junction and storage temperature range | T_J, T_{Stg} | | | - 55 to 150 | $^\circ\text{C}$ |
| Maximum thermal resistance, junction to case per leg | R_{thJC} | DC operation | | 1.5 | $^\circ\text{C}/\text{W}$ |
| Maximum thermal resistance, junction to case per package | | | | 0.75 | |
| 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 | | | 6 (5) | kgf · cm (lbf · in) |
| | maximum | | | 12 (10) | |
| Marking device | | | Case style D ² PAK | 47CTQ020S | |
| | | | Case style TO-262 | 47CTQ020-1 | |

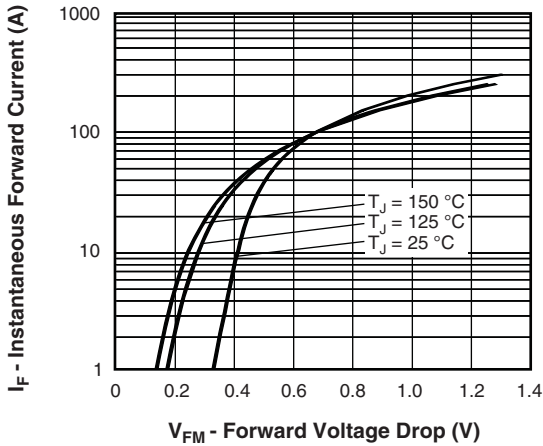


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

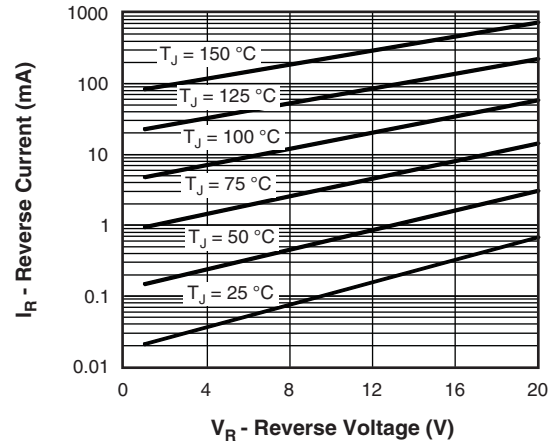


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

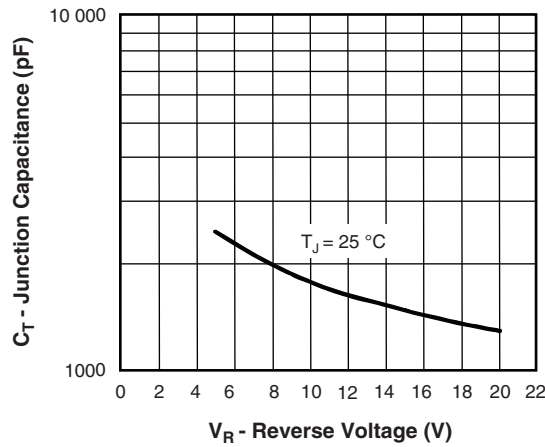


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

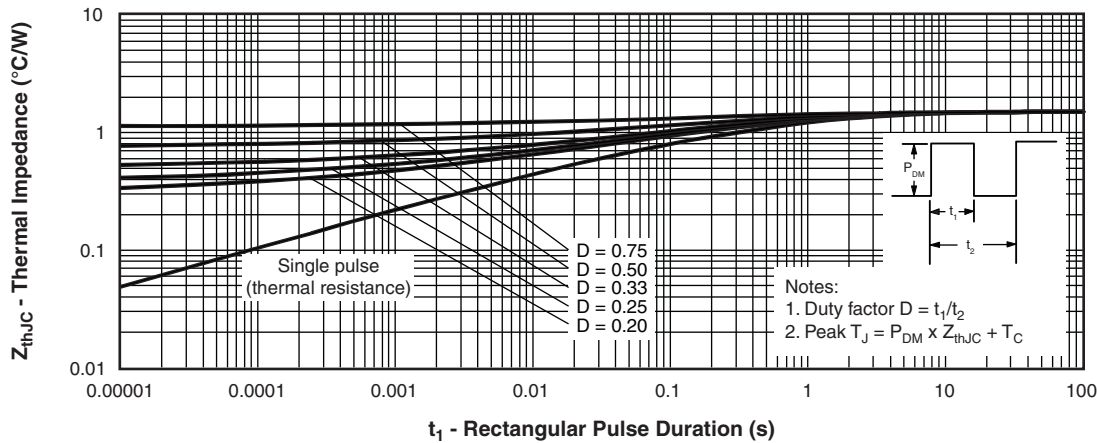


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics (Per Leg)

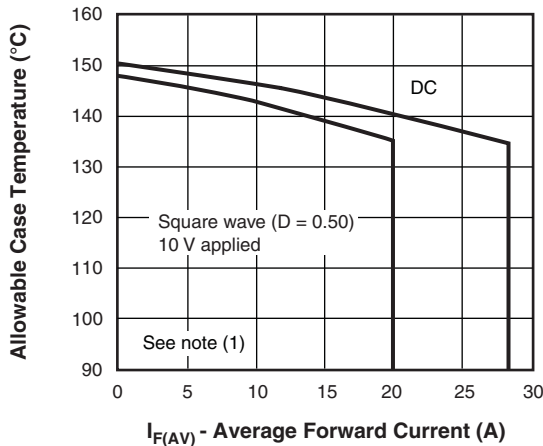


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

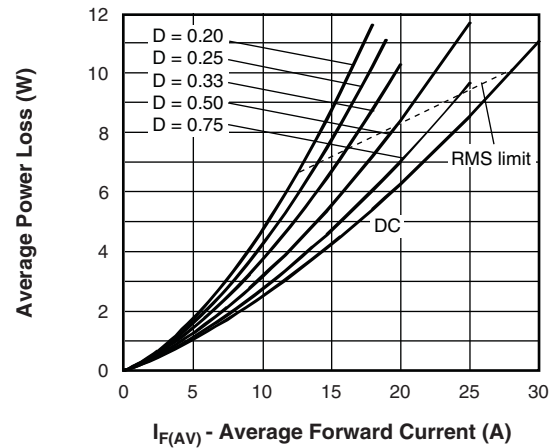


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

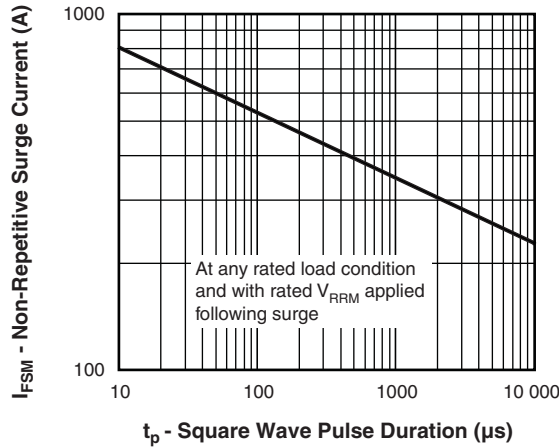


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

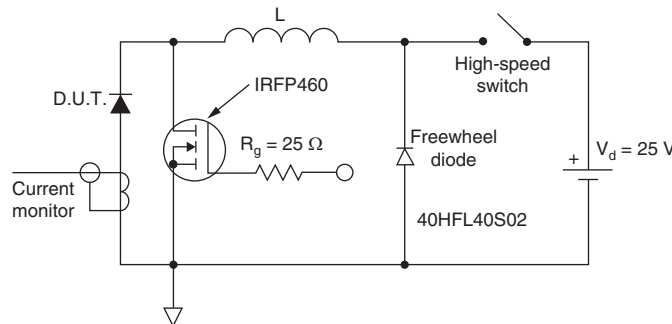


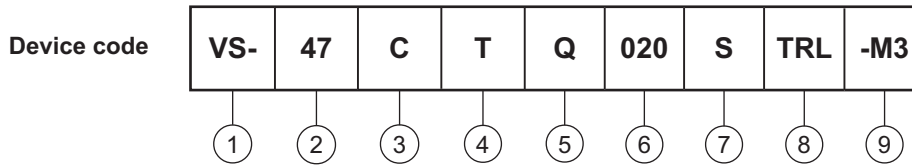
Fig. 8 - Unclamped Inductive Test Circuit

Note

- (1) Formula used: $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$;
 $P_d =$ 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 $V_{R1} = 10$ V



ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current rating (40 A)
- 3** - Circuit configuration: C = Common cathode
- 4** - T = TO-220
- 5** - Schottky "Q" series
- 6** - Voltage rating (020 = 20 V)
- 7** -
 - S = D²PAK
 - -1 = TO-262
- 8** -
 - None = Tube
 - TRL = Tape and reel (left oriented - for D²PAK only)
 - TRR = Tape and reel (right oriented - for D²PAK only)
- 9** - -M3 = Halogen-free, RoHS-compliant and termination lead (Pb)-free

| ORDERING INFORMATION | | | |
|----------------------|------------------|------------------------|--------------------------|
| PREFERRED P/N | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
| VS-47CTQ020S-M3 | 50 | 1000 | Antistatic plastic tubes |
| VS-47CTQ020STRR-M3 | 800 | 800 | 13" diameter reel |
| VS-47CTQ020STRL-M3 | 800 | 800 | 13" diameter reel |
| VS-47CTQ020-1-M3 | 50 | 1000 | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS | | |
|----------------------------|-------------------------------|--|
| Dimensions | TO-263AB (D ² PAK) | www.vishay.com/doc?95046 |
| Dimensions | TO-262AA | www.vishay.com/doc?95419 |
| Part marking information | TO-263AB (D ² PAK) | www.vishay.com/doc?95444 |
| Part marking information | TO-262AA | www.vishay.com/doc?95443 |
| Packaging information | | www.vishay.com/doc?95032 |

D²PAK

DIMENSIONS in millimeters and inches

Conforms to JEDEC® outline D²PAK (SMD-220)



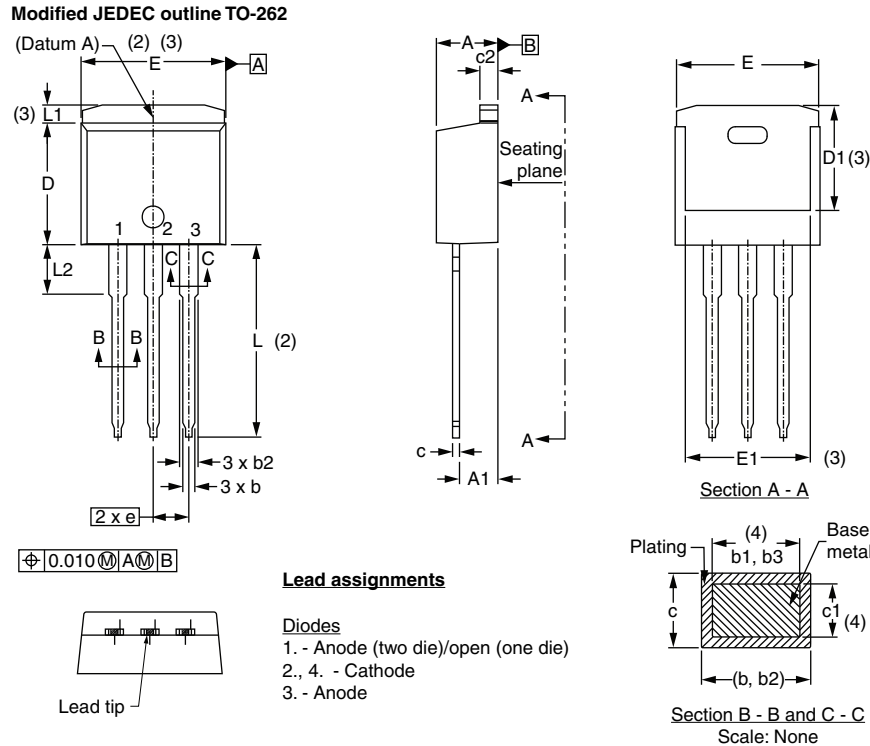
| SYMBOL | MILLIMETERS | | INCHES | | NOTES | SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|--------|-------------|-------|--------|-------|-------|--------|-------------|-------|-----------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. | | | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | 0.160 | 0.190 | | D1 | 6.86 | 8.00 | 0.270 | 0.315 | 3 |
| A1 | 0.00 | 0.254 | 0.000 | 0.010 | | E | 9.65 | 10.67 | 0.380 | 0.420 | 2, 3 |
| b | 0.51 | 0.99 | 0.020 | 0.039 | | E1 | 7.90 | 8.80 | 0.311 | 0.346 | 3 |
| b1 | 0.51 | 0.89 | 0.020 | 0.035 | 4 | e | 2.54 BSC | | 0.100 BSC | | |
| b2 | 1.14 | 1.78 | 0.045 | 0.070 | | H | 14.61 | 15.88 | 0.575 | 0.625 | |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 | 4 | L | 1.78 | 2.79 | 0.070 | 0.110 | |
| c | 0.38 | 0.74 | 0.015 | 0.029 | | L1 | - | 1.65 | - | 0.066 | 3 |
| c1 | 0.38 | 0.58 | 0.015 | 0.023 | 4 | L2 | 1.27 | 1.78 | 0.050 | 0.070 | |
| c2 | 1.14 | 1.65 | 0.045 | 0.065 | | L3 | 0.25 BSC | | 0.010 BSC | | |
| D | 8.51 | 9.65 | 0.335 | 0.380 | 2 | L4 | 4.78 | 5.28 | 0.188 | 0.208 | |

Notes

- Dimensioning and tolerancing per ASME Y14.5 M-1994
- 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
- Thermal pad contour optional within dimension E, L1, D1 and E1
- Dimension b1 and c1 apply to base metal only
- Datum A and B to be determined at datum plane H
- Controlling dimension: inch
- Outline conforms to JEDEC® outline TO-263AB

TO-262

DIMENSIONS 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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