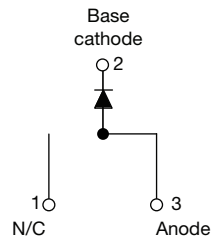


High Performance Schottky Rectifier, 20 A


D²PAK (TO-263AB)


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
- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °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

LINKS TO ADDITIONAL RESOURCES



| PRIMARY CHARACTERISTICS | |
|----------------------------------|-------------------------------|
| I _{F(AV)} | 20 A |
| V _R | 35 V, 40 V, 45 V |
| V _F at I _F | 0.51 V |
| I _{RM} typ. | 105 mA at 125 °C |
| T _J max. | 150 °C |
| E _{AS} | 27 mJ |
| Package | D ² PAK (TO-263AB) |
| Circuit configuration | Single |

DESCRIPTION

The VS-20TQ... Schottky rectifier series has been optimized for very low forward voltage drop, with moderate leakage. 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.

MECHANICAL DATA

Case: D²PAK (TO-268AB)

Molding compound meets UL 94-V0 flammability rating

Terminals: matte tin plated leads, solderable per J-STD-002

MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL | CHARACTERISTICS | VALUES | UNITS |
|--------------------|--|-------------|-------|
| I _{F(AV)} | Rectangular waveform | 20 | A |
| V _{RRM} | Range | 35 to 45 | V |
| I _{FSM} | t _p = 5 μs sine | 1800 | A |
| V _F | 20 A _{pk} , T _J = 125 °C | 0.51 | V |
| T _J | Range | -55 to +150 | °C |

VOLTAGE RATINGS

| PARAMETER | SYMBOL | VS-20TQ035S-M3 | VS-20TQ040S-M3 | VS-20TQ045S-M3 | UNITS |
|--------------------------------------|------------------|----------------|----------------|----------------|-------|
| Maximum DC reverse voltage | V _R | 35 | 40 | 45 | V |
| Maximum working peak reverse voltage | V _{RWM} | | | | |

ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|---|--------------------|--|--------|-------|
| Maximum average forward current See fig. 5 | I _{F(AV)} | 50 % duty cycle at T _C = 116 °C, rectangular waveform | 20 | A |
| Maximum peak one cycle non-repetitive surge current, see fig. 7 | I _{FSM} | 5 μs sine or 3 μs rect. pulse | 1800 | |
| | | 10 ms sine or 6 ms rect. pulse | 400 | |
| Non-repetitive avalanche energy | E _{AS} | T _J = 25 °C, I _{AS} = 4 A, L = 3.40 mH | 27 | mJ |
| Repetitive avalanche current | I _{AR} | Current decaying linearly to zero in 1 μs Frequency limited by T _J maximum V _A = 1.5 x V _R typical | 4 | A |



| ELECTRICAL SPECIFICATIONS | | | | | |
|--|----------------|--|-----------------------------------|--------|------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum forward voltage drop See fig. 1 | $V_{FM}^{(1)}$ | 20 A | $T_J = 25\text{ }^\circ\text{C}$ | 0.57 | V |
| | | 40 A | | 0.73 | |
| | | 20 A | $T_J = 125\text{ }^\circ\text{C}$ | 0.51 | |
| | | 40 A | | 0.67 | |
| Maximum reverse leakage current | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^\circ\text{C}$ | $V_R = \text{Rated } V_R$ | 2.7 | mA |
| | | $T_J = 125\text{ }^\circ\text{C}$ | | 150 | |
| Typical reverse leakage current | $I_{RM}^{(1)}$ | $T_J = 125\text{ }^\circ\text{C}$ | $V_R = \text{Rated } V_R$ | 105 | mA |
| Maximum junction capacitance | C_T | $V_R = 5\text{ }V_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^\circ\text{C}$ | | 1400 | pF |
| Typical series inductance | L_S | Measured lead to lead 5 mm from package body | | 8.0 | 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 | R_{thJC} | DC operation See fig. 4 | 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 | | 6 (5) | kgf · cm (lbf · in) |
| | maximum | | 12 (10) | |
| Marking device | | Case style D ² PAK (TO-263AB) | 20TQ035S 20TQ040S 20TQ045S | |

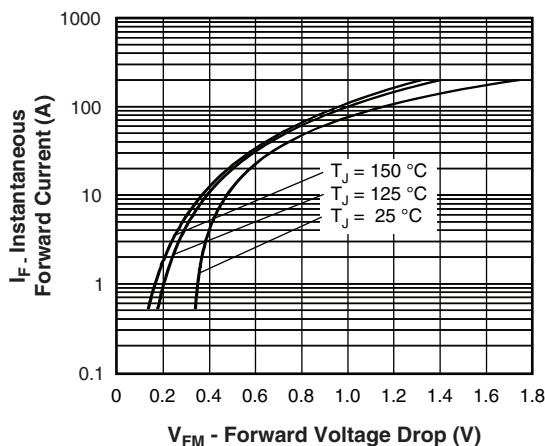


Fig. 1 - Maximum Forward Voltage Drop Characteristics

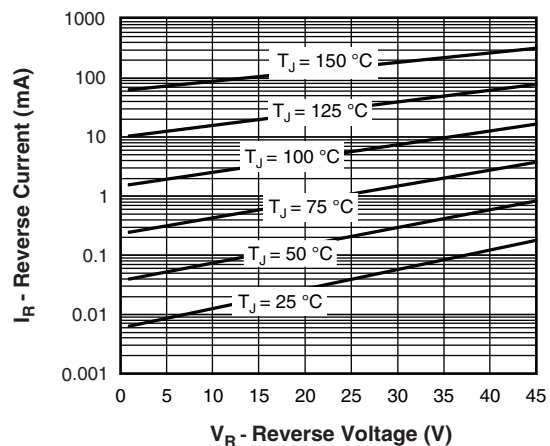


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

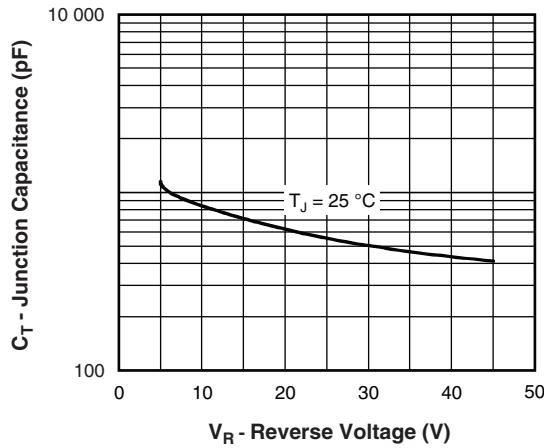


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

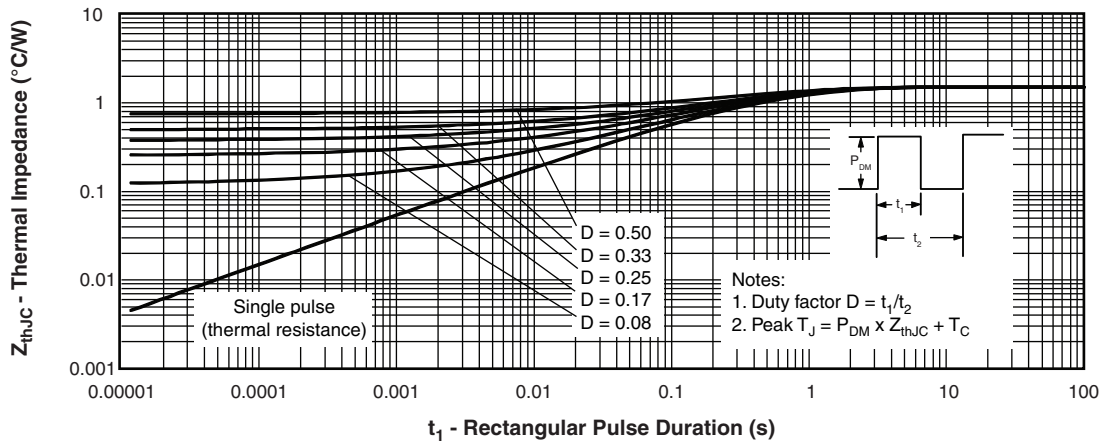


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

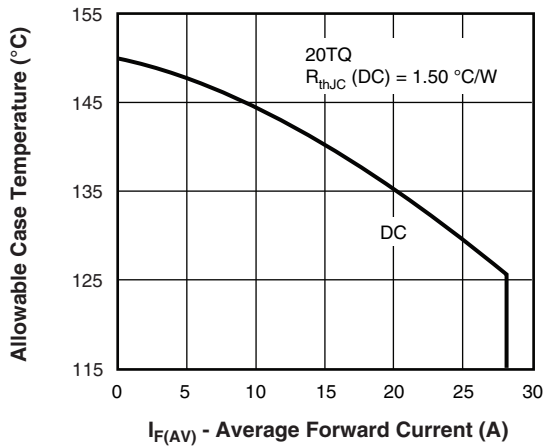


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

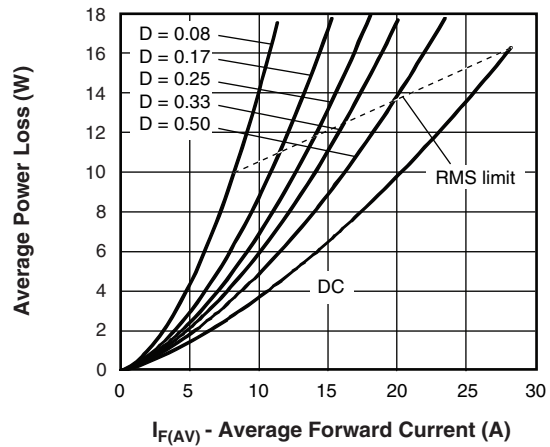


Fig. 6 - Forward Power Loss Characteristics

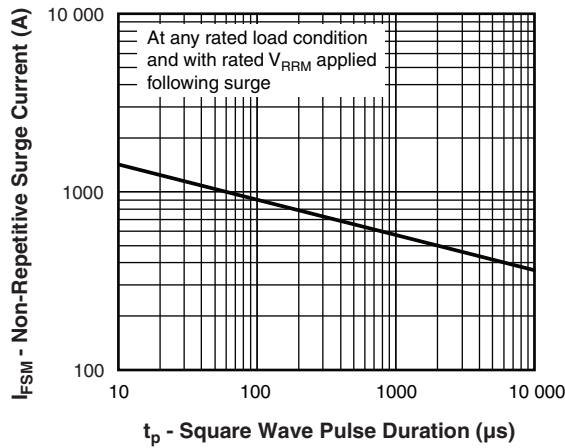


Fig. 7 - Maximum Non-Repetitive Surge Current

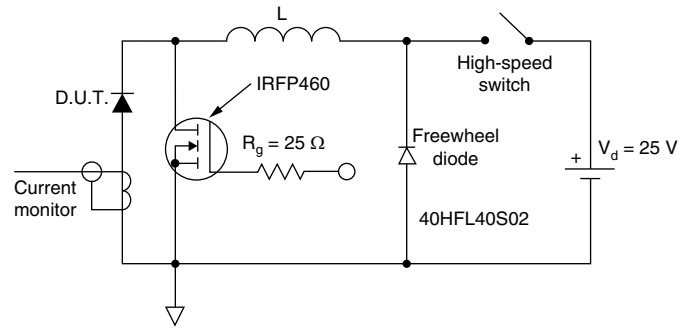


Fig. 8 - Unclamped Inductive Test Circuit

ORDERING INFORMATION TABLE

| | | | | | | | | |
|-------------|------------|-----------|----------|----------|------------|----------|------------|------------|
| Device code | VS- | 20 | T | Q | 045 | S | TRL | -M3 |
| | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ |

| | |
|---|--|
| 1 | - Vishay Semiconductors product |
| 2 | - Current rating (20 A) |
| 3 | - Package: T = TO-220 |
| 4 | - Schottky "Q" series |
| 5 | - Voltage ratings |
| 6 | - S = D ² PAK |
| 7 | - <ul style="list-style-type: none"> • None = tube • TRL = tape and reel (left oriented) • TRR = tape and reel (right oriented) |
| 8 | - -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free |

| |
|------------|
| 035 = 35 V |
| 040 = 40 V |
| 045 = 45 V |



| ORDERING INFORMATION | | |
|-----------------------------|----------------------|------------------------------------|
| PREFERRED P/N | BASE QUANTITY | PACKAGING DESCRIPTION |
| VS-20TQ035S-M3 | 50 | Antistatic plastic tubes |
| VS-20TQ035STRL-M3 | 800 | 13" diameter plastic tape and reel |
| VS-20TQ035STRR-M3 | 800 | 13" diameter plastic tape and reel |
| VS-20TQ040S-M3 | 50 | Antistatic plastic tubes |
| VS-20TQ040STRL-M3 | 800 | 13" diameter plastic tape and reel |
| VS-20TQ040STRR-M3 | 800 | 13" diameter plastic tape and reel |
| VS-20TQ045S-M3 | 50 | Antistatic plastic tubes |
| VS-20TQ045STRL-M3 | 800 | 13" diameter plastic tape and reel |
| VS-20TQ045STRR-M3 | 800 | 13" diameter plastic tape and reel |

| LINKS TO RELATED DOCUMENTS | |
|-----------------------------------|--|
| Dimensions | www.vishay.com/doc?96164 |
| Part marking information | www.vishay.com/doc?95444 |
| Packaging information | www.vishay.com/doc?96424 |
| SPICE model | www.vishay.com/doc?96917 |

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



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

- (1) Dimensioning and tolerancing per ASME Y14.5 M-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) Datum A and B to be determined at datum plane H
- (6) Controlling dimension: inches
- (7) Outline conforms to JEDEC® outline TO-263AB



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