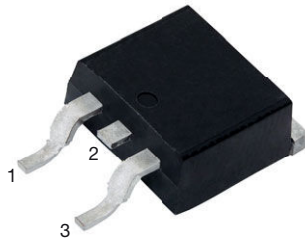
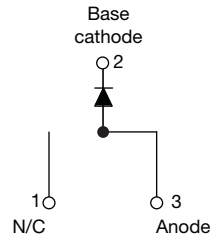




**THE DATASHEET OF  
VS-20TQ045STRR-M3**



## High Performance Schottky Rectifier, 20 A


**D<sup>2</sup>PAK (TO-263AB)**


### FEATURES

- 150 °C T<sub>J</sub> 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](http://www.vishay.com/doc?99912)


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

### PRIMARY CHARACTERISTICS

|                                  |                               |
|----------------------------------|-------------------------------|
| I <sub>F(AV)</sub>               | 20 A                          |
| V <sub>R</sub>                   | 35 V, 40 V, 45 V              |
| V <sub>F</sub> at I <sub>F</sub> | 0.51 V                        |
| I <sub>RM</sub>                  | 105 mA at 125 °C              |
| T <sub>J</sub> max.              | 150 °C                        |
| E <sub>AS</sub>                  | 27 mJ                         |
| Package                          | D <sup>2</sup> 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.

### MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL             | CHARACTERISTICS                              | VALUES      | UNITS |
|--------------------|--|-------------|-------|
| I <sub>F(AV)</sub> | Rectangular waveform                         | 20          | A     |
| V <sub>RRM</sub>   | Range  | 35 to 45    | V     |
| I <sub>FSM</sub>   | t <sub>p</sub> = 5 μs sine                   | 1800        | A     |
| V <sub>F</sub>     | 20 A <sub>pk</sub> , T <sub>J</sub> = 125 °C | 0.51        | V     |
| T <sub>J</sub>     | Range  | -55 to +150 | °C    |

### VOLTAGE RATINGS

| PARAMETER                            | SYMBOL           | VS-20TQ035S-M3 | VS-20TQ040S-M3 | VS-20TQ045S-M3 | UNITS |
|--------------------------------------|------------------|----------------|----------------|----------------|-------|
| Maximum DC reverse voltage           | V <sub>R</sub>   | 35             | 40             | 45             | V     |
| Maximum working peak reverse voltage | V <sub>RWM</sub> |                |                |                |       |

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER  | SYMBOL             | TEST CONDITIONS  | VALUES | UNITS |
|--|--------------------|--|--------|-------|
| Maximum average forward current<br>See fig. 5                        | I <sub>F(AV)</sub> | 50 % duty cycle at T <sub>C</sub> = 116 °C, rectangular waveform   | 20     | A     |
| Maximum peak one cycle<br>non-repetitive surge current<br>See fig. 7 | I <sub>FSM</sub>   | 5 μs sine or 3 μs rect. pulse  | 1800   |       |
|  |                    | 10 ms sine or 6 ms rect. pulse   | 400    |       |
| Non-repetitive avalanche energy                                      | E <sub>AS</sub>    | T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 4 A, L = 3.40 mH   | 27     | mJ    |
| Repetitive avalanche current   | 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 | 4      | A     |



| ELECTRICAL SPECIFICATIONS                     |                |   |                                   |                  |    |
|---|----------------|---|-----------------------------------|------------------|----|
| PARAMETER                                     | SYMBOL         | TEST CONDITIONS   | VALUES                            | UNITS            |    |
| Maximum forward voltage drop<br>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<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^\circ\text{C}$  | $V_R = \text{Rated } V_R$         | 2.7              | mA |
|   |                | $T_J = 125\text{ }^\circ\text{C}$   |                                   | 105              |    |
| Maximum junction capacitance                  | $C_T$          | $V_R = 5 V_{DC}$ (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/ $\mu\text{s}$ |    |

**Note**

(1) Pulse width < 300  $\mu\text{s}$ , 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<br>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<br>(lbf · in) |
|  | maximum        |  | 12 (10)                          |                        |
| Marking device                                 |                | Case style D <sup>2</sup> PAK (TO-263AB) | 20TQ035S<br>20TQ040S<br>20TQ045S |                        |

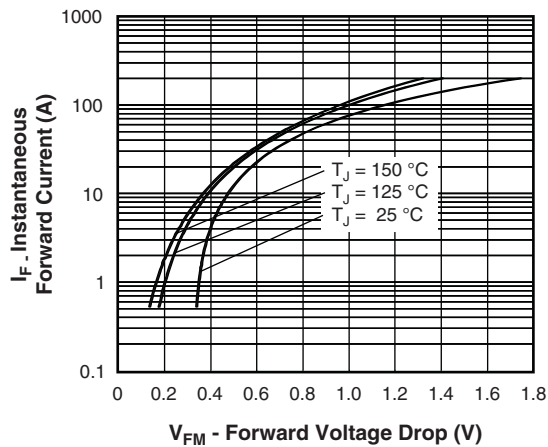


Fig. 1 - Maximum Forward Voltage Drop Characteristics

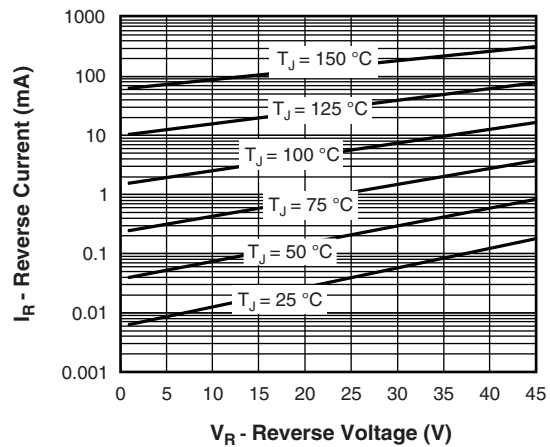


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

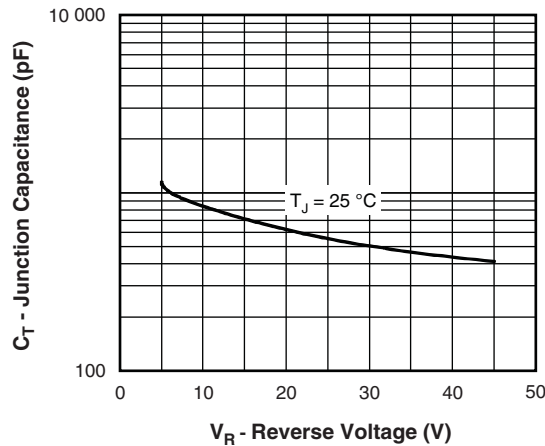


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

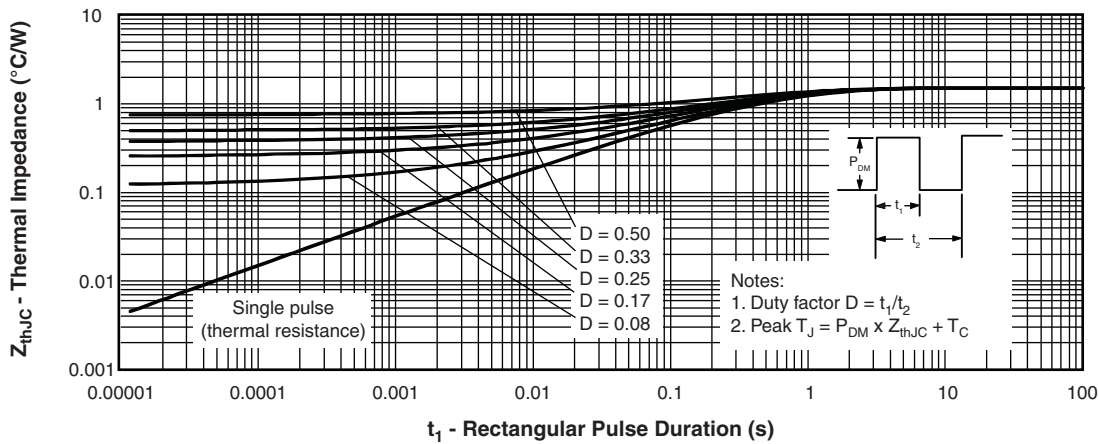


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

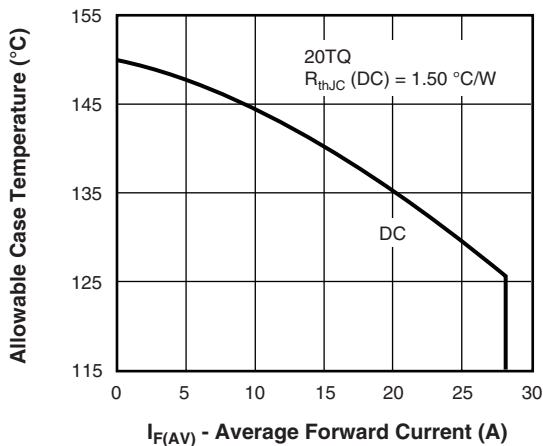


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

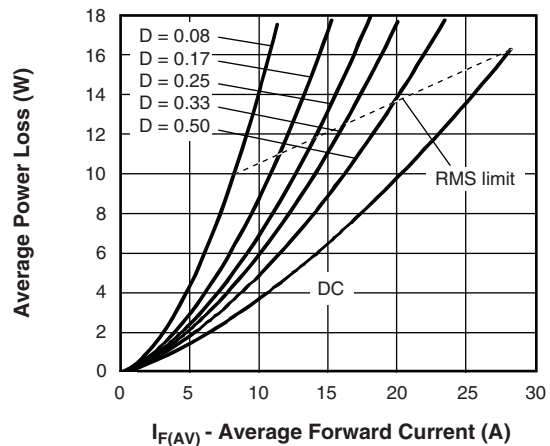


Fig. 6 - Forward Power Loss Characteristics

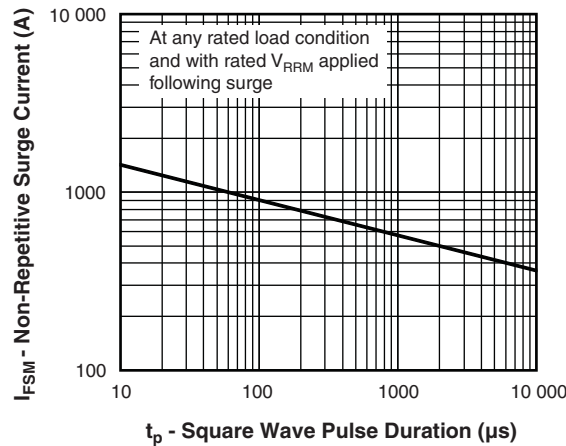


Fig. 7 - Maximum Non-Repitive Surge Current

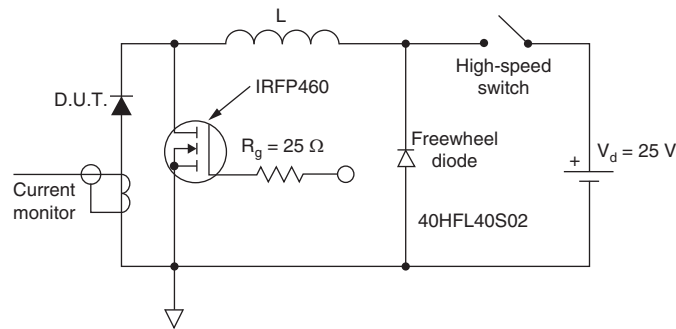


Fig. 8 - Unclamped Inductive Test Circuit

## ORDERING INFORMATION TABLE

|             |            |           |          |          |            |          |            |            |
|-------------|------------|-----------|----------|----------|------------|----------|------------|------------|
| Device code | <b>VS-</b> | <b>20</b> | <b>T</b> | <b>Q</b> | <b>045</b> | <b>S</b> | <b>TRL</b> | <b>-M3</b> |
|             | 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
 

|            |
|------------|
| 035 = 35 V |
| 040 = 40 V |
| 045 = 45 V |
- 6** - S = D<sup>2</sup>PAK
- 7** -
  - 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



| <b>ORDERING INFORMATION</b> |                         |                               |                              |
|-----------------------------|-------------------------|-------------------------------|------------------------------|
| <b>PREFERRED P/N</b>        | <b>QUANTITY PER T/R</b> | <b>MINIMUM ORDER QUANTITY</b> | <b>PACKAGING DESCRIPTION</b> |
| VS-20TQ035S-M3              | 50                      | 1000                          | Antistatic plastic tubes     |
| VS-20TQ035STRR-M3           | 800                     | 800                           | 13" diameter reel            |
| VS-20TQ035STRL-M3           | 800                     | 800                           | 13" diameter reel            |
| VS-20TQ040S-M3              | 50                      | 1000                          | Antistatic plastic tubes     |
| VS-20TQ040STRR-M3           | 800                     | 800                           | 13" diameter reel            |
| VS-20TQ040STRL-M3           | 800                     | 800                           | 13" diameter reel            |
| VS-20TQ045S-M3              | 50                      | 1000                          | Antistatic plastic tubes     |
| VS-20TQ045STRR-M3           | 800                     | 800                           | 13" diameter reel            |
| VS-20TQ045STRL-M3           | 800                     | 800                           | 13" diameter reel            |

| <b>LINKS TO RELATED DOCUMENTS</b> |  |
|-----------------------------------|--|
| Dimensions                        | <a href="http://www.vishay.com/doc?96164">www.vishay.com/doc?96164</a> |
| Part marking information          | <a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</a> |
| Packaging information             | <a href="http://www.vishay.com/doc?96424">www.vishay.com/doc?96424</a> |

## D<sup>2</sup>PAK

### DIMENSIONS in millimeters and inches

Conforms to JEDEC® outline D<sup>2</sup>PAK (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



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