

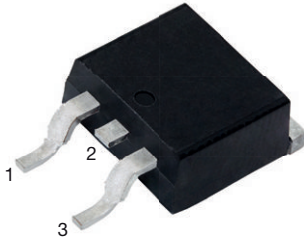


**THE DATASHEET OF  
VS-12TQ045S-M3**

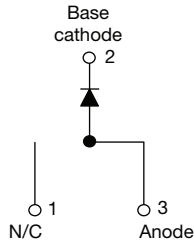




## High Performance Schottky Rectifier, 15 A



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



### FEATURES

- 150 °C T<sub>J</sub> operation
- Very 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>               | 15 A                          |
| V <sub>R</sub>                   | 35 V, 40 V, 45 V              |
| V <sub>F</sub> at I <sub>F</sub> | 0.50 V                        |
| I <sub>RM</sub> typ.             | 70 mA at 125 °C               |
| T <sub>J</sub> max.              | 150 °C                        |
| E <sub>AS</sub>                  | 16 mJ                         |
| Package                          | D <sup>2</sup> PAK (TO-263AB) |
| Circuit configuration            | Single                        |

### DESCRIPTION

The VS-12TQ...S-M3 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                         | 15          | A     |
| V <sub>RRM</sub>   | Range  | 35 to 45    | V     |
| I <sub>FSM</sub>   | t <sub>p</sub> = 5 μs sine                   | 990         | A     |
| V <sub>F</sub>     | 15 A <sub>pk</sub> , T <sub>J</sub> = 125 °C | 0.50        | V     |
| T <sub>J</sub>     | Range  | -55 to +150 | °C    |

### VOLTAGE RATINGS

| PARAMETER                            | SYMBOL           | VS-12TQ035S-M3 | VS-12TQ040S-M3 | VS-12TQ045S-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> = 120 °C, rectangular waveform   | 15     | 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  | 990    | A     |
|  |                    | 10 ms sine or 6 ms rect. pulse   | 250    |       |
| Non-repetitive avalanche energy                                      | E <sub>AS</sub>    | T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 2.4 A, L = 5.5 mH  | 16     | 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 | 2.4    | A     |



| ELECTRICAL SPECIFICATIONS                  |                |  |                                   |        |                  |
|--|----------------|--|-----------------------------------|--------|------------------|
| PARAMETER                                  | SYMBOL         | TEST CONDITIONS  |                                   | VALUES | UNITS            |
| Maximum forward voltage drop<br>See fig. 1 | $V_{FM}^{(1)}$ | 15 A   | $T_J = 25\text{ }^\circ\text{C}$  | 0.56   | V                |
|  |                | 30 A   |                                   | 0.71   |                  |
|  |                | 15 A   | $T_J = 125\text{ }^\circ\text{C}$ | 0.50   |                  |
|  |                | 30 A   |                                   | 0.64   |                  |
| Maximum reverse leakage current            | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^\circ\text{C}$   | $V_R = \text{Rated } V_R$         | 1.75   | mA               |
|  |                | $T_J = 125\text{ }^\circ\text{C}$  |                                   | 110    |                  |
| Typical reverse leakage current            | $I_{RM}^{(1)}$ | $T_J = 125\text{ }^\circ\text{C}$  | $V_R = \text{Rated } V_R$         | 70     | mA               |
| Maximum junction capacitance               | $C_T$          | $V_R = 5\text{ }V_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^\circ\text{C}$ |                                   | 900    | 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               |  | 2.0                              | $^\circ\text{C}/\text{W}$ |
| 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>(lb · in)     |
|  | maximum        |  |  | 12 (10)                          |                           |
| Marking device                                 |                | Case style D <sup>2</sup> PAK (TO-263AB) |  | 12TQ030S<br>12TQ044S<br>12TQ045S |                           |

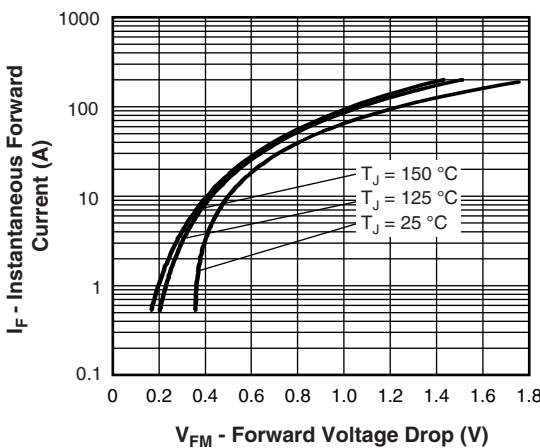


Fig. 1 - Maximum Forward Voltage Drop Characteristics

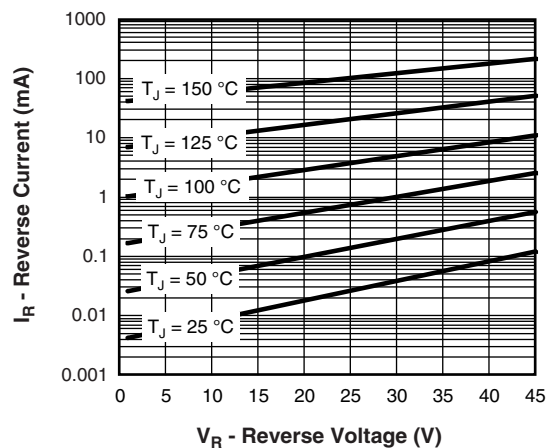


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

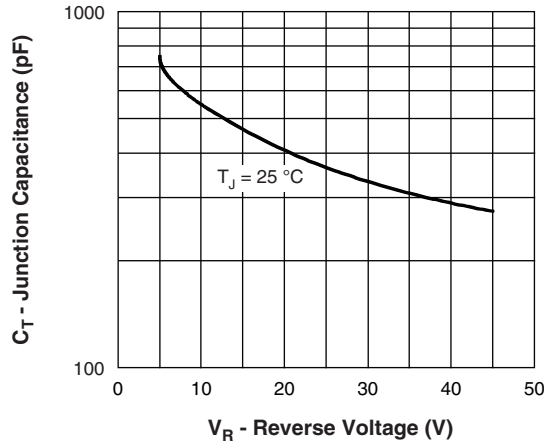


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

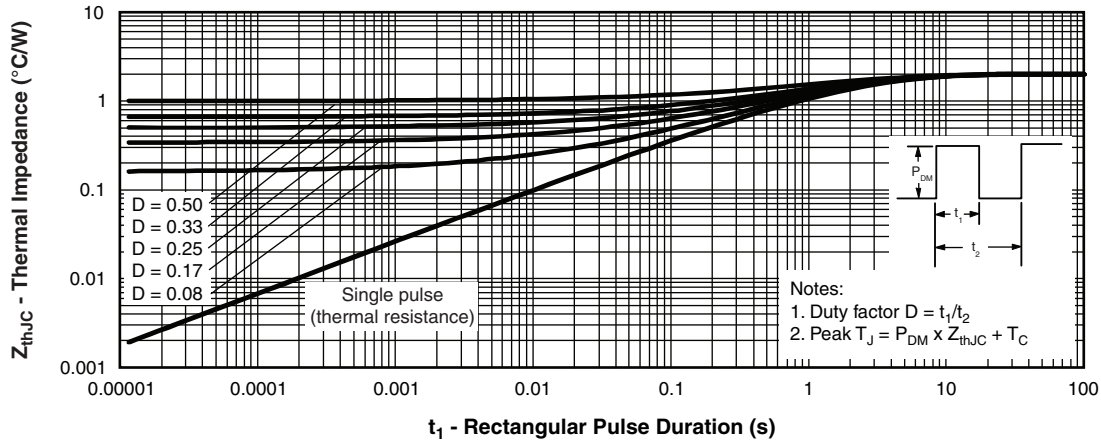


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

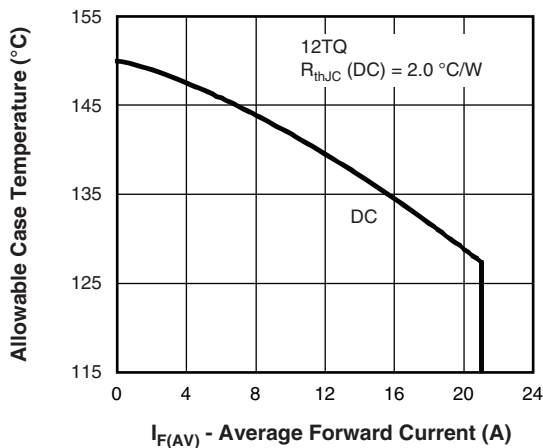


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

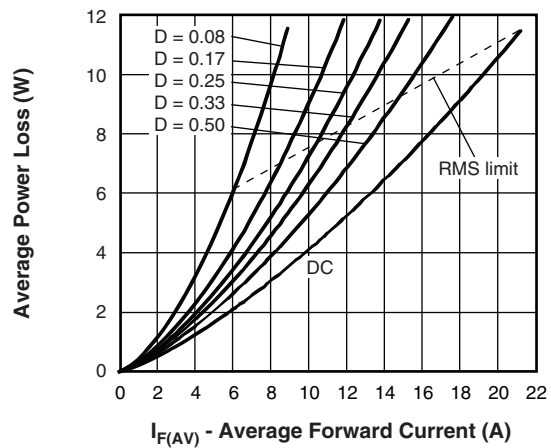


Fig. 6 - Forward Power Loss Characteristics

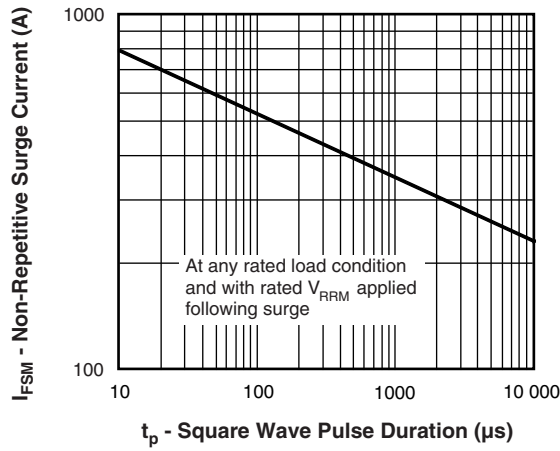


Fig. 7 - Maximum Non-Repetitive Surge Current

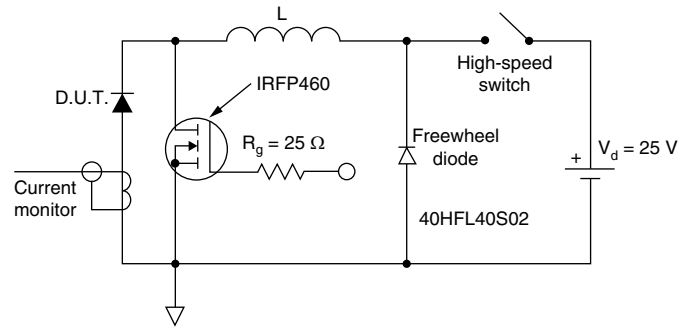
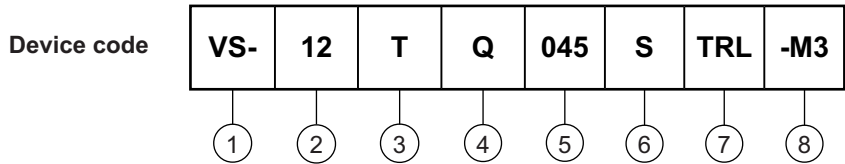


Fig. 8 - Unclamped Inductive Test Circuit



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current rating
- 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 (TO-263AB)
- 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

| ORDERING INFORMATION |               |                                    |
|----------------------|---------------|------------------------------------|
| PREFERRED P/N        | BASE QUANTITY | PACKAGING DESCRIPTION              |
| VS-12TQ035S-M3       | 50            | Antistatic plastic tubes           |
| VS-12TQ035STRL-M3    | 800           | 13" diameter plastic tape and reel |
| VS-12TQ035STRR-M3    | 800           | 13" diameter plastic tape and reel |
| VS-12TQ040S-M3       | 50            | Antistatic plastic tubes           |
| VS-12TQ040STRL-M3    | 800           | 13" diameter plastic tape and reel |
| VS-12TQ040STRR-M3    | 800           | 13" diameter plastic tape and reel |
| VS-12TQ045S-M3       | 50            | Antistatic plastic tubes           |
| VS-12TQ045STRL-M3    | 800           | 13" diameter plastic tape and reel |
| VS-12TQ045STRR-M3    | 800           | 13" diameter plastic tape and reel |

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| 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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