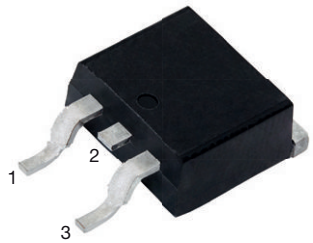
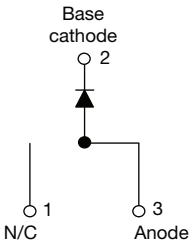
# High Performance Schottky Rectifier, 6 A




D²PAK (TO-263AB)




## FEATURES

- 175 °C $T_J$ operation
- High frequency operation
- Low forward voltage drop
- 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

## DESCRIPTION

The VS-6TQ... Schottky rectifier series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in switching power supplies, converters, freewheeling diodes, and reverse battery protection.

| PRIMARY CHARACTERISTICS | |
|---|---|
| $I_{F(AV)}$ | 6 A |
| $V_R$ | 35 V, 40 V, 45 V |
| $V_F$ at $I_F$ | 0.53 V |
| $I_{RM}$ | 7 mA at 125 °C |
| $T_J$ max. | 175 °C |
| $E_{AS}$ | 8 mJ |
| Package | D²PAK (TO-263AB) |
| Circuit configuration | Single |

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|---|---|---|---|
| SYMBOL | CHARACTERISTICS | VALUES | UNITS |
| $I_{F(AV)}$ | Rectangular waveform | 6 | A |
| $V_{RRM}$ | Range | 35 to 45 | V |
| $I_{FSM}$ | $t_p$ = 5 µs sine | 690 | A |
| $V_F$ | 6 $A_{pk}$, $T_J$ = 125 °C | 0.53 | V |
| $T_J$ | Range | -55 to +175 | °C |

| VOLTAGE RATINGS | | | | | |
|---|---|---|---|---|---|
| PARAMETER | SYMBOL | VS-6TQ035S-M3 | VS-6TQ040S-M3 | VS-6TQ045S-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<br>See fig. 5 | $I_{F(AV)}$ | 50 % duty cycle at $T_C$ = 164 °C, rectangular waveform | | 6 | A |
| Maximum peak one cycle non-repetitive surge current<br>See fig. 7 | $I_{FSM}$ | 5 µs sine or 3 µs rect. pulse | Following any rated load condition and with rated $V_{RRM}$ applied | 690 | |
| | | 10 ms sine or 6 ms rect. pulse | | 140 | |
| Non-repetitive avalanche energy | $E_{AS}$ | $T_J$ = 25 °C, $I_{AS}$ = 1.20 A, L = 11.10 mH | | 8 | mJ |
| Repetitive avalanche current | $I_{AR}$ | Current decaying linearly to zero in 1 µs<br>Frequency limited by $T_J$ maximum $V_A$ = 1.5 x $V_R$ typical | | 1.20 | A |

## ELECTRICAL SPECIFICATIONS

| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
|---|---|---|---|---|---|
| Maximum forward voltage drop<br>See fig. 1 | $V_{FM}$ (1) | 6 A | $T_J$ = 25 °C | 0.60 | V |
| | | 12 A | | 0.73 | |
| | | 6 A | $T_J$ = 125 °C | 0.53 | |
| | | 12 A | | 0.64 | |
| Maximum reverse leakage current<br>See fig. 2 | $I_{RM}$ (1) | $T_J$ = 25 °C | $V_R$ = Rated $V_R$ | 0.8 | mA |
| | | $T_J$ = 125 °C | | 7 | |
| Threshold voltage | $V_{F(TO)}$ | $T_J$ = $T_J$ maximum | | 0.35 | V |
| Forward slope resistance | $r_t$ | | | 18.23 | mΩ |
| Maximum junction capacitance | $C_T$ | $V_R$ = 5 $V_{DC}$ (test signal range 100 kHz to 1 MHz), 25 °C | | 400 | 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 175 | °C |
| Maximum thermal resistance, junction to case | | $R_{thJC}$ | DC operation<br>See fig. 4 | 2.2 | °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 $D^2PAK$ (TO-263AB) | 6TQ035S | |
| | | | | 6TQ040S | |
| | | | | 6TQ045S | |

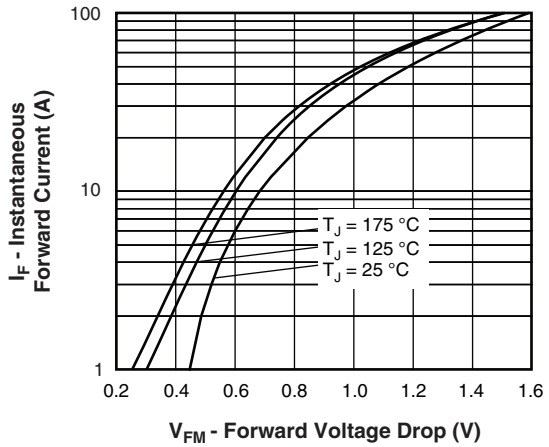



Fig. 1 - Maximum Forward Voltage Drop Characteristics

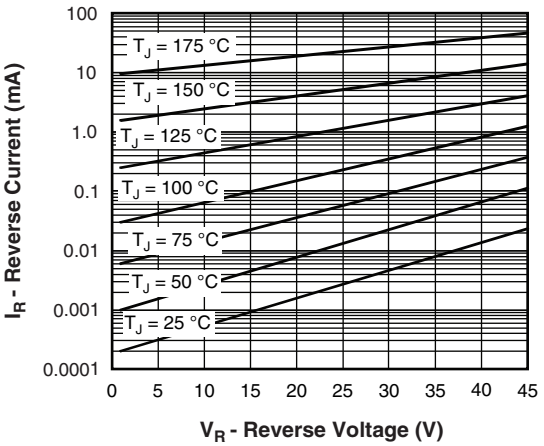



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

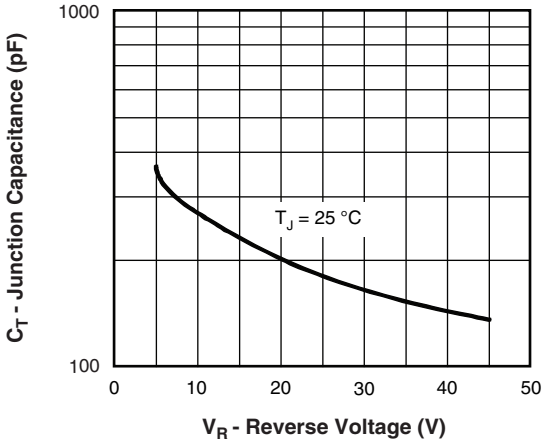



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

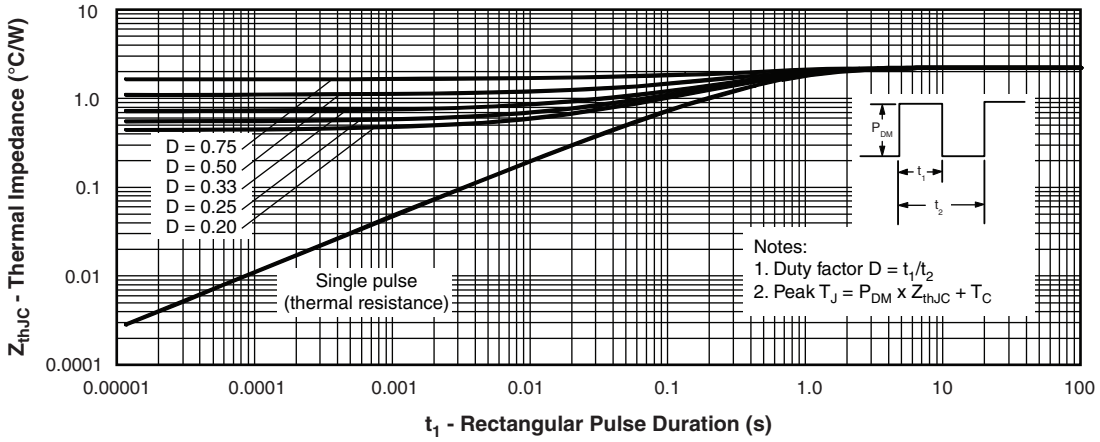



Fig. 4 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics

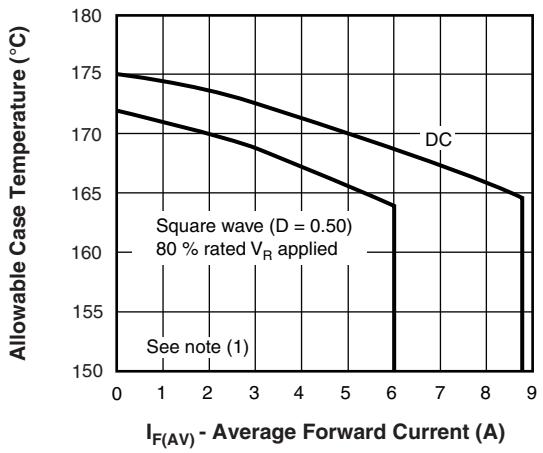



Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

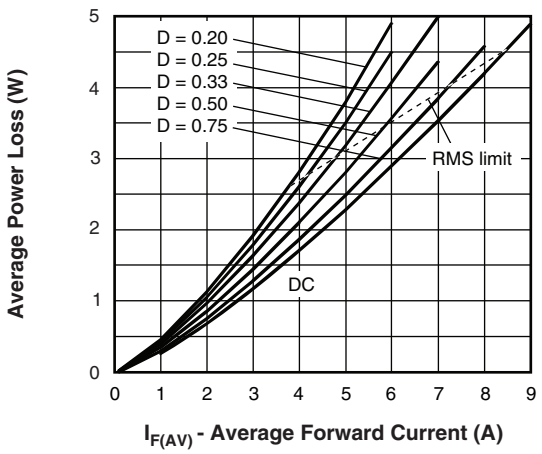



Fig. 6 - Forward Power Loss Characteristics

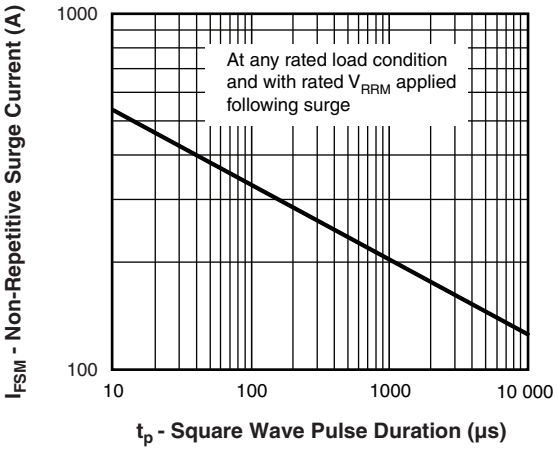



Fig. 7 - Maximum Non-Repetitive Surge Current

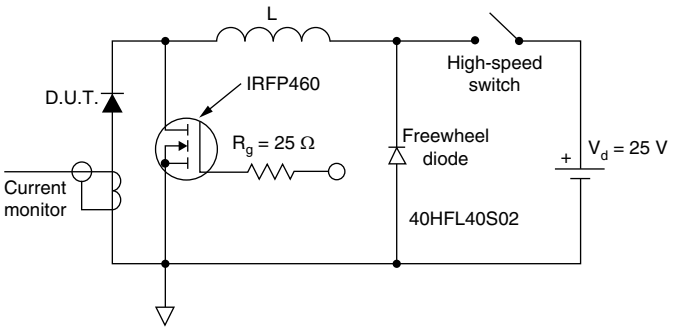



Fig. 8 - Unclamped Inductive Test Circuit

**Note**

(1) Formula used: $T_C = T_J - (Pd + Pd_{REV}) \times R_{thJC}$;
Pd = forward power loss = $I_{F(AV)} \times V_{FM}$ at ($I_{F(AV)}$/D) (see fig. 6);
$Pd_{REV}$ = inverse power loss = $V_{R1} \times I_R$ (1 - D); $I_R$ at $V_{R1}$ = 80 % rated $V_R$

## ORDERING INFORMATION TABLE

Device code

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

1 - Vishay Semiconductors product

2 - Current rating (6 A)

3 - Package: T = TO-220

4 - Schottky "Q" series

5 - Voltage ratings (035 = 35 V, 040 = 40 V, 045 = 45 V)

6 - S = $D^2PAK$ (TO-263AB)

7 - • None = tube
• TRL = tape and reel (left oriented)
• TRR = tape and reel (right oriented)

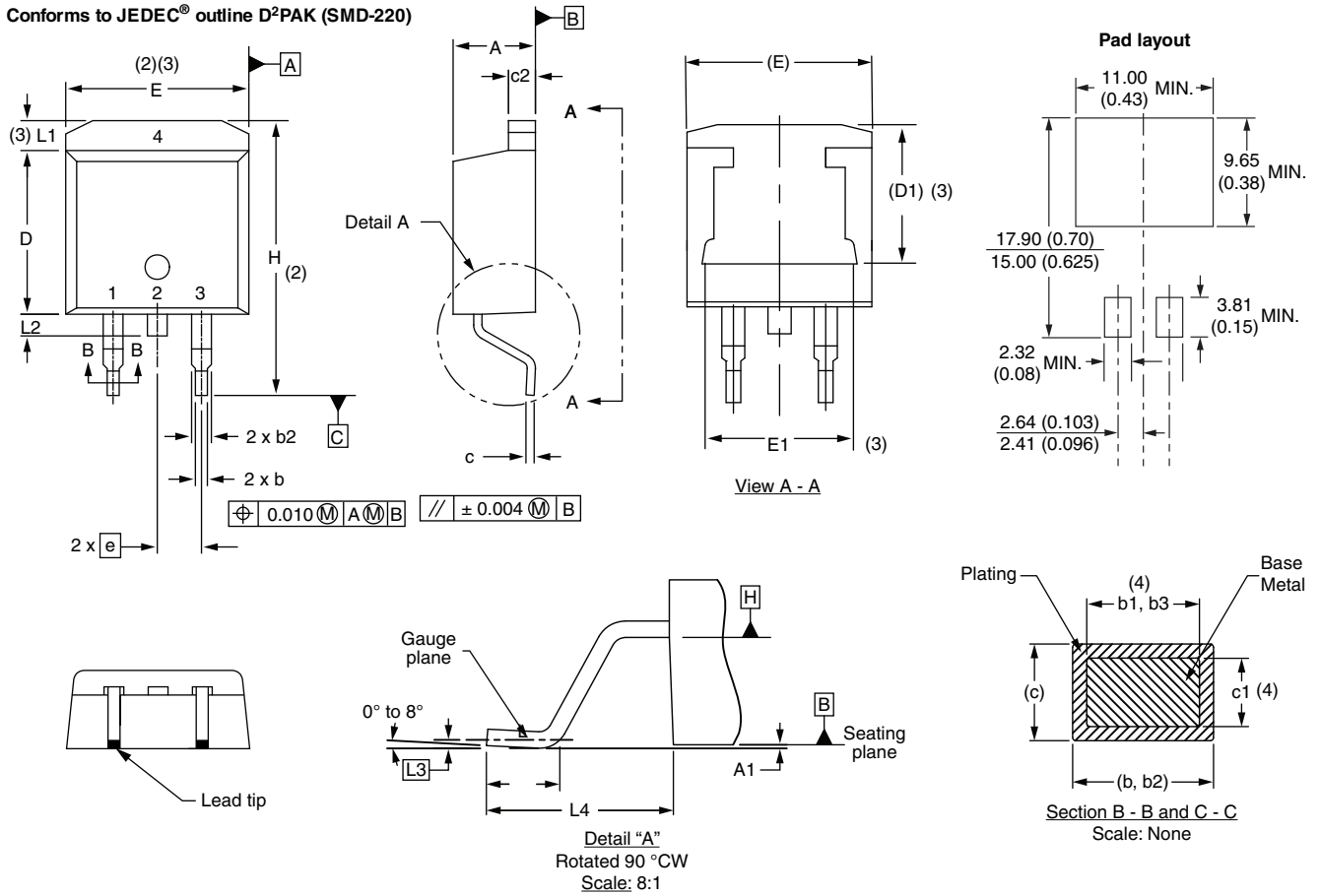
8 - -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

| ORDERING INFORMATION | | |
|---|---|---|
| **PREFERRED P/N** | **BASE QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-6TQ035S-M3 | 50 | Antistatic plastic tubes |
| VS-6TQ035STRL-M3 | 800 | 13" diameter plastic tape and reel |
| VS-6TQ035STRR-M3 | 800 | 13" diameter plastic tape and reel |
| VS-6TQ040S-M3 | 50 | Antistatic plastic tubes |
| VS-6TQ040STRL-M3 | 800 | 13" diameter plastic tape and reel |
| VS-6TQ040STRR-M3 | 800 | 13" diameter plastic tape and reel |
| VS-6TQ045S-M3 | 50 | Antistatic plastic tubes |
| VS-6TQ045STRL-M3 | 800 | 13" diameter plastic tape and reel |
| VS-6TQ045STRR-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 |

# $D^2PAK$

**DIMENSIONS** in millimeters and inches




| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | 0.160 | 0.190 | |
| A1 | 0.00 | 0.254 | 0.000 | 0.010 | |
| 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 |

| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| 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 | | |
| H | 14.61 | 15.88 | 0.575 | 0.625 | |
| L | 1.78 | 2.79 | 0.070 | 0.110 | |
| L1 | - | 1.65 | - | 0.066 | 3 |
| L2 | 1.27 | 1.78 | 0.050 | 0.070 | |
| L3 | 0.25 BSC | | 0.010 BSC | | |
| 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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