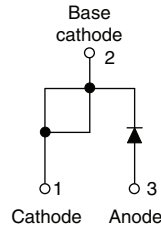


## Schottky Rectifier, 6 A


**TO-220AC**


### 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
- Compliant to RoHS Directive 2002/95/EC
- Designed and qualified according to JEDEC-JESD47
- Halogen-free according to IEC 61249-2-21 definition (-N3 only)



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

### PRODUCT SUMMARY

|                 |                  |
|-----------------|------------------|
| Package         | TO-220AC         |
| $I_{F(AV)}$     | 6 A              |
| $V_R$           | 35 V, 40 V, 45 V |
| $V_F$ at $I_F$  | 0.53 V           |
| $I_{RM}$ max.   | 7 mA at 125 °C   |
| $T_J$ max.      | 175 °C           |
| Diode variation | Single die       |
| $E_{AS}$        | 8 mJ             |

### 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.

### MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL      | CHARACTERISTICS                    | VALUES      | UNITS |
|-------------|------------------------------------|-------------|-------|
| $I_{F(AV)}$ | Rectangular waveform               | 6           | A     |
| $V_{RRM}$   | Range                              | 35 to 45    | V     |
| $I_{FSM}$   | $t_p = 5 \mu s$ sine               | 690         | A     |
| $V_F$       | 6 A <sub>pk</sub> , $T_J = 125$ °C | 0.53        | V     |
| $T_J$       | Range                              | - 55 to 175 | °C    |

### VOLTAGE RATINGS

| PARAMETER                            | SYMBOL    | VS-6TQ035PbF | VS-6TQ035-N3 | VS-6TQ040PbF | VS-6TQ040-N3 | VS-6TQ045PbF | VS-6TQ045-N3 | UNITS |
|--------------------------------------|-----------|--------------|--------------|--------------|--------------|--------------|--------------|-------|
| Maximum DC reverse voltage           | $V_R$     | 35           | 35           | 40           | 40           | 45           | 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 $\mu s$ sine or 3 $\mu s$ rect. pulse                                                                             | 690    | A     |
|                                                                   |             | 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 $\mu s$<br>Frequency limited by $T_J$ maximum $V_A = 1.5 \times V_R$ typical | 1.20   | A     |



| ELECTRICAL SPECIFICATIONS                     |                                |                                                                               |                                       |        |       |  |
|-----------------------------------------------|--------------------------------|-------------------------------------------------------------------------------|---------------------------------------|--------|-------|--|
| PARAMETER                                     | SYMBOL                         | TEST CONDITIONS                                                               |                                       | VALUES | UNITS |  |
| Maximum forward voltage drop<br>See fig. 1    | V <sub>FM</sub> <sup>(1)</sup> | 6 A                                                                           | T <sub>J</sub> = 25 °C                | 0.60   | V     |  |
|                                               |                                | 12 A                                                                          |                                       | 0.73   |       |  |
|                                               |                                | 6 A                                                                           | T <sub>J</sub> = 125 °C               | 0.53   |       |  |
|                                               |                                | 12 A                                                                          |                                       | 0.64   |       |  |
| Maximum reverse leakage current<br>See fig. 2 | I <sub>RM</sub> <sup>(1)</sup> | T <sub>J</sub> = 25 °C                                                        | V <sub>R</sub> = Rated V <sub>R</sub> | 0.8    | mA    |  |
|                                               |                                | T <sub>J</sub> = 125 °C                                                       |                                       | 7      |       |  |
| Threshold voltage                             | V <sub>F(TO)</sub>             | T <sub>J</sub> = T <sub>J</sub> maximum                                       |                                       | 0.35   | V     |  |
| Forward slope resistance                      | r <sub>t</sub>                 |                                                                               |                                       | 18.23  | mΩ    |  |
| Maximum junction capacitance                  | C <sub>T</sub>                 | V <sub>R</sub> = 5 V <sub>DC</sub> (test signal range 100 kHz to 1 MHz) 25 °C |                                       | 400    | pF    |  |
| Typical series inductance                     | L <sub>S</sub>                 | Measured lead to lead 5 mm from package body                                  |                                       | 8      | nH    |  |
| Maximum voltage rate of change                | dV/dt                          | Rated V <sub>R</sub>                                                          |                                       | 10 000 | V/μs  |  |

**Note**
<sup>(1)</sup> Pulse width < 300  $\mu$ s, duty cycle < 2 %

| THERMAL - MECHANICAL SPECIFICATIONS            |                                   |                                      |             |                        |
|------------------------------------------------|-----------------------------------|--------------------------------------|-------------|------------------------|
| PARAMETER                                      | SYMBOL                            | TEST CONDITIONS                      | VALUES      | UNITS                  |
| Maximum junction and storage temperature range | T <sub>J</sub> , T <sub>Stg</sub> |                                      | - 55 to 175 | °C                     |
| Maximum thermal resistance, junction to case   | R <sub>thJC</sub>                 | DC operation<br>See fig. 4           | 2.2         | °C/W                   |
| Typical thermal resistance, case to heatsink   | R <sub>thCS</sub>                 | 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 TO-220AC                  | 6TQ035      |                        |
|                                                |                                   |                                      | 6TQ040      |                        |
|                                                |                                   |                                      | 6TQ045      |                        |

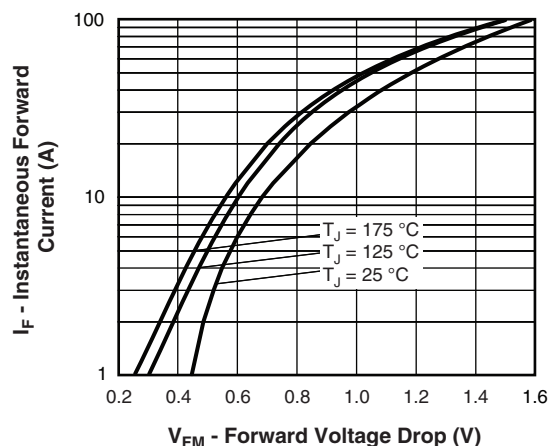


Fig. 1 - Maximum Forward Voltage Drop Characteristics

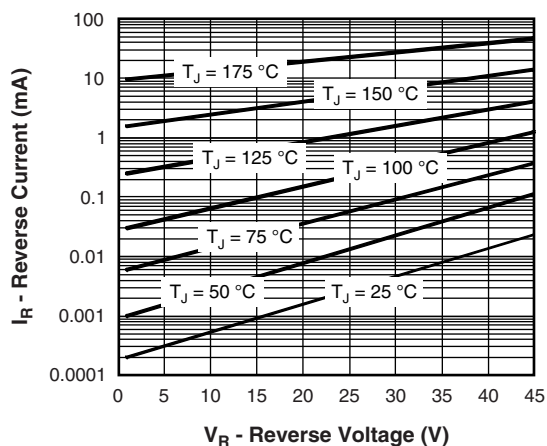


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

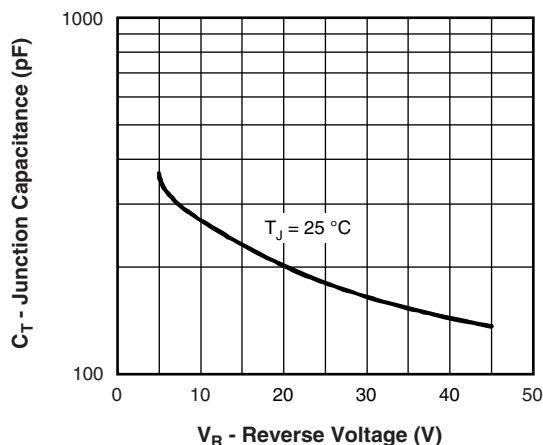
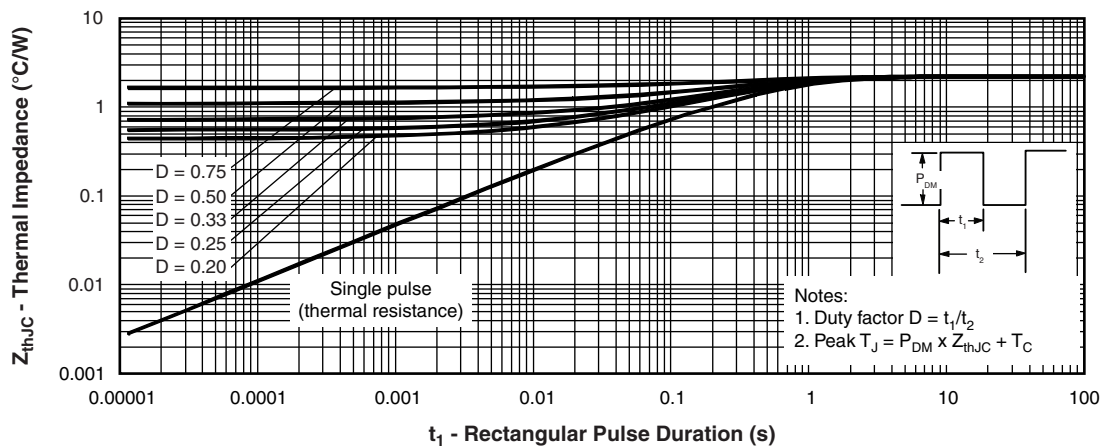


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage


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

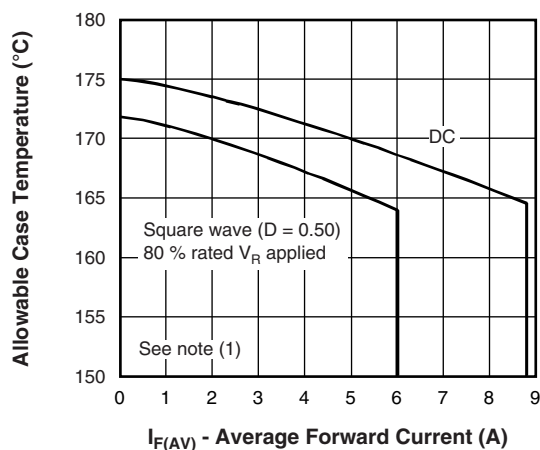


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

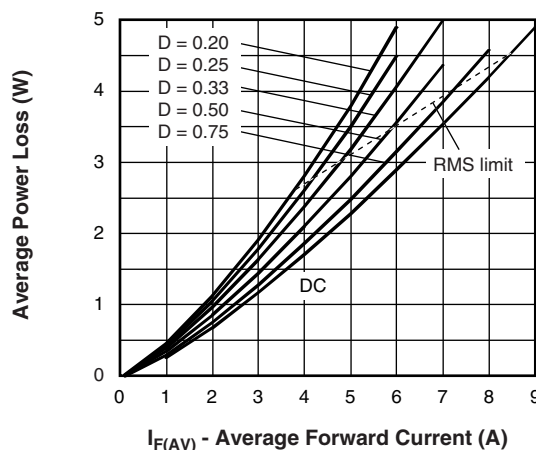


Fig. 6 - Forward Power Loss Characteristics

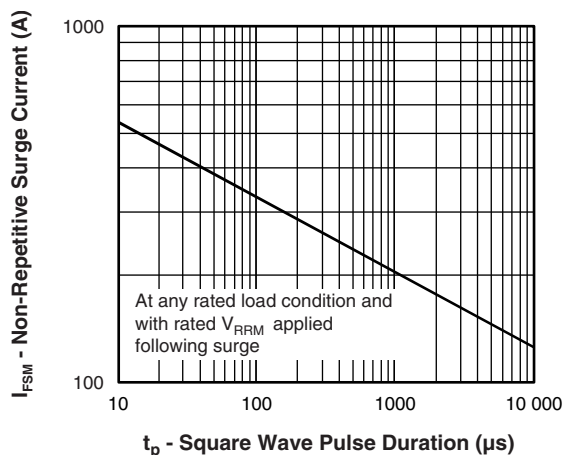


Fig. 7 - Maximum Non-Repetitive Surge Current



Fig. 8 - Unclamped Inductive Test Circuit

## Note

- (1) Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d$  = 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  $V_{R1} = 80\%$  rated  $V_R$

**ORDERING INFORMATION TABLE**

|             |                                                                                                                                                                |   |   |   |     |     |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----|-----|
| Device code | VS-                                                                                                                                                            | 6 | T | Q | 045 | PbF |
|             | 1                                                                                                                                                              | 2 | 3 | 4 | 5   | 6   |
| 1           | Vishay Semiconductors product                                                                                                                                  |   |   |   |     |     |
| 2           | Current rating (6 = 6 A)                                                                                                                                       |   |   |   |     |     |
| 3           | Package:<br>T = TO-220                                                                                                                                         |   |   |   |     |     |
| 4           | Schottky "Q" series                                                                                                                                            |   |   |   |     |     |
| 5           | Voltage ratings                                                                                                                                                |   |   |   |     |     |
| 6           | Environmental digit                                                                                                                                            |   |   |   |     |     |
|             | <div>035 = 35 V<br/>040 = 40 V<br/>045 = 45 V</div>                                                                                                            |   |   |   |     |     |
|             | <ul style="list-style-type: none"><li>PbF = Lead (Pb)-free and RoHS compliant</li><li>-N3 = Halogen-free, RoHS compliant, and totally lead (Pb)-free</li></ul> |   |   |   |     |     |

| ORDERING INFORMATION (Example) |                  |                        |                         |
|--------------------------------|------------------|------------------------|-------------------------|
| PREFERRED P/N                  | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
| VS-6TQ035PbF                   | 50               | 1000                   | Antistatic plastic tube |
| VS-6TQ035-N3                   | 50               | 1000                   | Antistatic plastic tube |
| VS-6TQ040PbF                   | 50               | 1000                   | Antistatic plastic tube |
| VS-6TQ040-N3                   | 50               | 1000                   | Antistatic plastic tube |
| VS-6TQ045PbF                   | 50               | 1000                   | Antistatic plastic tube |
| VS-6TQ045-N3                   | 50               | 1000                   | Antistatic plastic tube |

| LINKS TO RELATED DOCUMENTS |              |                                                                        |
|----------------------------|--------------|------------------------------------------------------------------------|
| Dimensions                 |              | <a href="http://www.vishay.com/doc?95221">www.vishay.com/doc?95221</a> |
| Part marking information   | TO-220AC PbF | <a href="http://www.vishay.com/doc?95224">www.vishay.com/doc?95224</a> |
|                            | TO-220AC -N3 | <a href="http://www.vishay.com/doc?95068">www.vishay.com/doc?95068</a> |

### TO-220AC

**DIMENSIONS** in millimeters and inches



| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| A      | 4.25        | 4.65  | 0.167  | 0.183 |       |
| A1     | 1.14        | 1.40  | 0.045  | 0.055 |       |
| A2     | 2.56        | 2.92  | 0.101  | 0.115 |       |
| b      | 0.69        | 1.01  | 0.027  | 0.040 |       |
| b1     | 0.38        | 0.97  | 0.015  | 0.038 | 4     |
| b2     | 1.20        | 1.73  | 0.047  | 0.068 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     |
| c      | 0.36        | 0.61  | 0.014  | 0.024 |       |
| c1     | 0.36        | 0.56  | 0.014  | 0.022 | 4     |
| D      | 14.85       | 15.25 | 0.585  | 0.600 | 3     |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       |
| D2     | 11.68       | 12.88 | 0.460  | 0.507 | 6     |
| E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |

| SYMBOL | MILLIMETERS |       | INCHES     |       | NOTES |
|--------|-------------|-------|------------|-------|-------|
|        | MIN.        | MAX.  | MIN.       | MAX.  |       |
| E1     | 6.86        | 8.89  | 0.270      | 0.350 | 6     |
| E2     | -           | 0.76  | -          | 0.030 | 7     |
| e      | 2.41        | 2.67  | 0.095      | 0.105 |       |
| e1     | 4.88        | 5.28  | 0.192      | 0.208 |       |
| H1     | 6.09        | 6.48  | 0.240      | 0.255 | 6, 7  |
| L      | 13.52       | 14.02 | 0.532      | 0.552 |       |
| L1     | 3.32        | 3.82  | 0.131      | 0.150 | 2     |
| L3     | 1.78        | 2.13  | 0.070      | 0.084 |       |
| L4     | 0.76        | 1.27  | 0.030      | 0.050 | 2     |
| Ø P    | 3.54        | 3.73  | 0.139      | 0.147 |       |
| Q      | 2.60        | 3.00  | 0.102      | 0.118 |       |
| θ      | 90° to 93°  |       | 90° to 93° |       |       |

#### Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1 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 outermost extremes of the plastic body
- (4) Dimension b1, b3 and c1 apply to base metal only
- (5) Controlling dimension: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimension E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, D2 (minimum) where dimensions are derived from the actual package outline



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