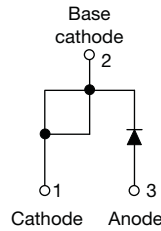


## Schottky Rectifier, 10 A


**TO-220AC**


### FEATURES

- 175 °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
- 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)



| PRODUCT SUMMARY |                  |
|-----------------|------------------|
| Package         | TO-220AC         |
| $I_{F(AV)}$     | 10 A             |
| $V_R$           | 35 V, 40 V, 45 V |
| $V_F$ at $I_F$  | 0.49 V           |
| $I_{RM}$        | 15 mA at 125 °C  |
| $T_J$ max.      | 175 °C           |
| Diode variation | Single die       |
| $E_{AS}$        | 13 mJ            |

### DESCRIPTION

The VS-10TQ... 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         | 10          | A     |
| $V_{RRM}$                         |                              | 35/45       | V     |
| $I_{FSM}$                         | $t_p = 5 \mu s$ sine         | 1050        | A     |
| $V_F$                             | 10 $A_{pk}$ , $T_J = 125$ °C | 0.49        | V     |
| $T_J$                             | Range                        | - 55 to 175 | °C    |

| VOLTAGE RATINGS                      |           |               |               |               |               |               |               |       |
|--------------------------------------|-----------|---------------|---------------|---------------|---------------|---------------|---------------|-------|
| PARAMETER                            | SYMBOL    | VS-10TQ035PbF | VS-10TQ035-N3 | VS-10TQ040PbF | VS-10TQ040-N3 | VS-10TQ045PbF | VS-10TQ045-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 $T_C = 151$ °C, rectangular waveform   | 10     | 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   | 1050   |       |
|   |             | 10 ms sine or 6 ms rect. pulse  | 280    |       |
| Non-repetitive avalanche energy                                   | $E_{AS}$    | $T_J = 25$ °C, $I_{AS} = 2$ A, $L = 6.5$ mH   | 13     | 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 | 2      | A     |



| ELECTRICAL SPECIFICATIONS                     |                                |   |                                       |        |       |
|---|--------------------------------|---|---------------------------------------|--------|-------|
| PARAMETER                                     | SYMBOL                         | TEST CONDITIONS   |                                       | VALUES | UNITS |
| Maximum forward voltage drop<br>See fig. 1    | V <sub>FM</sub> <sup>(1)</sup> | 10 A  | T <sub>J</sub> = 25 °C                | 0.57   | V     |
|   |                                | 20 A  |                                       | 0.67   |       |
|   |                                | 10 A  | T <sub>J</sub> = 125 °C               | 0.49   |       |
|   |                                | 20 A  |                                       | 0.61   |       |
| 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> | 2      | mA    |
|   |                                | T <sub>J</sub> = 125 °C   |                                       | 15     |       |
| 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 |                                       | 900    | pF    |
| Typical series inductance                     | L <sub>S</sub>                 | Measured lead to lead 5 mm from package body                                  |                                       | 8.0    | nH    |
| Maximum voltage rate of change                | dV/dt                          | Rated V <sub>R</sub>  |                                       | 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 <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           |  | 2.0         | °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                  |  | 10TQ035     |                        |
|  |                                   |                                      |  | 10TQ045     |                        |

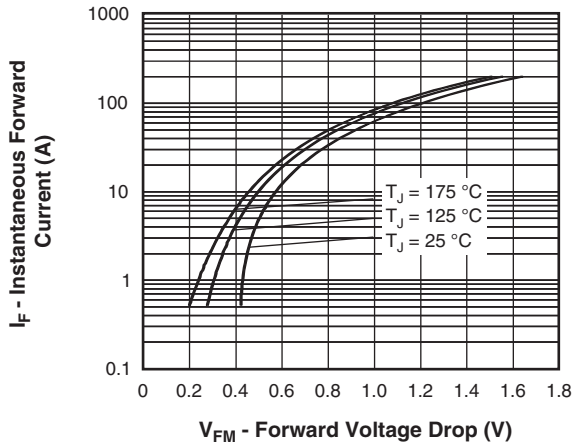


Fig. 1 - Maximum Forward Voltage Drop Characteristics

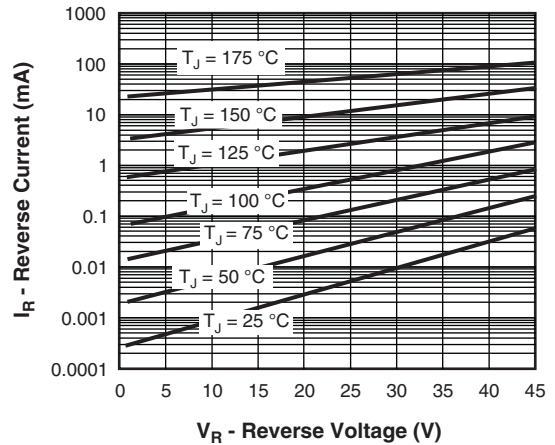


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

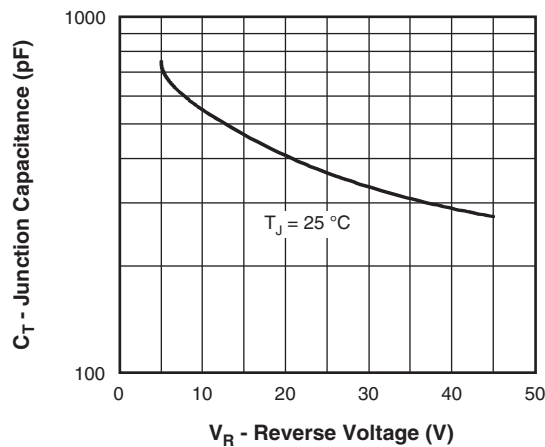


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

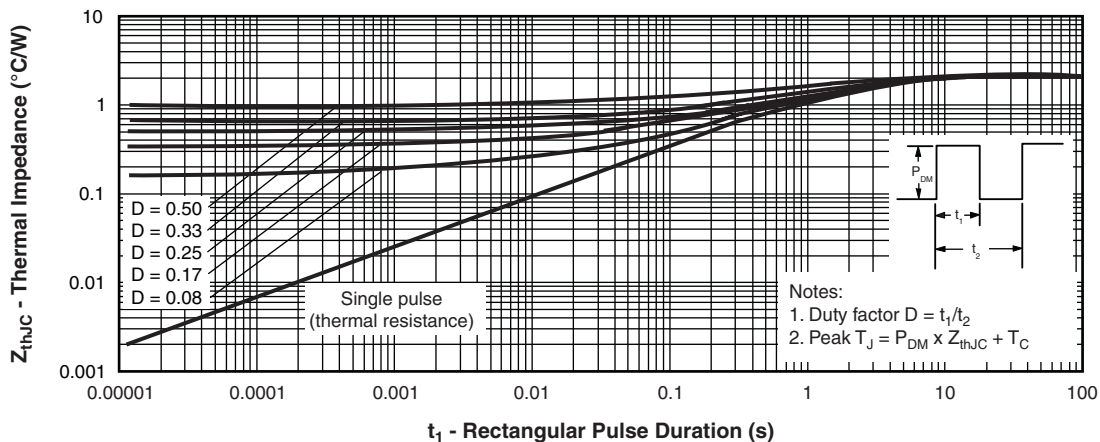


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

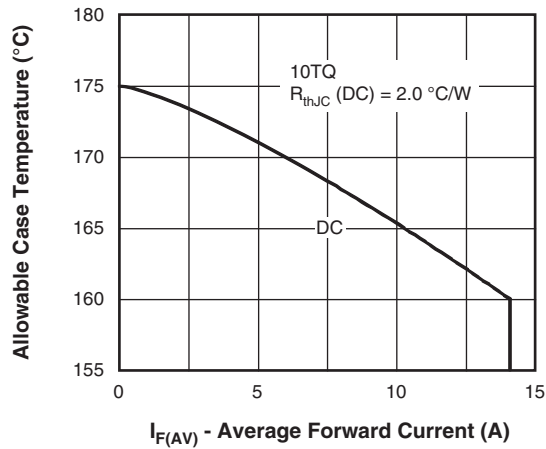


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

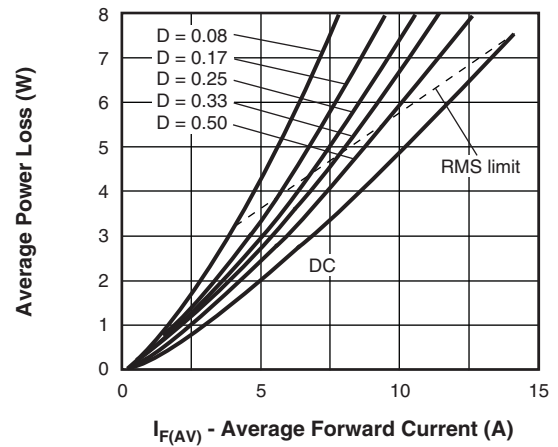


Fig. 6 - Forward Power Loss Characteristics

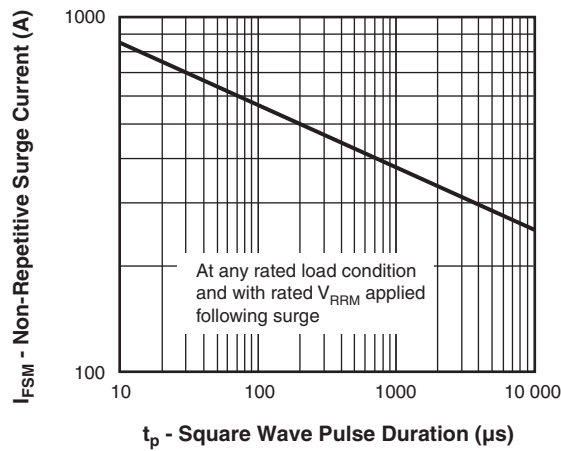


Fig. 7 - Maximum Non-Repetitive Surge Current

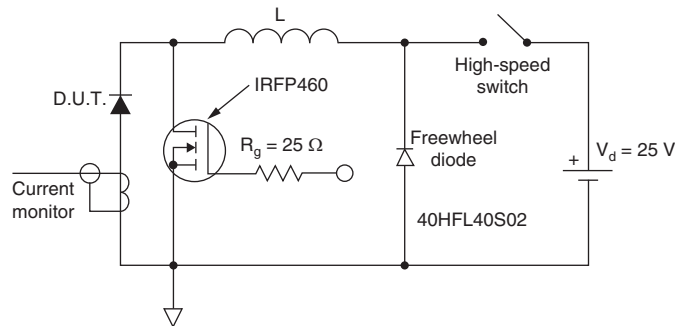
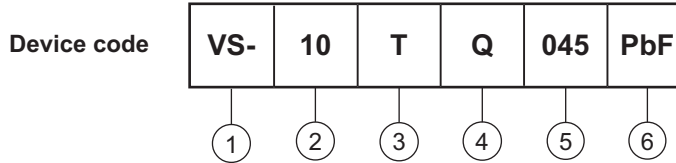


Fig. 8 - Unclamped Inductive Test Circuit



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current rating (10 = 10 A)
- 3** - Package:  
T = TO-220
- 4** - Schottky "Q" series
- 5** - Voltage ratings
- 6** - Environmental digit
  - PbF = Lead (Pb)-free and RoHS compliant
  - -N3 = Halogen-free, RoHS compliant, and totally lead (Pb)-free

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

| ORDERING INFORMATION (Example) |                  |                        |                         |
|--------------------------------|------------------|------------------------|-------------------------|
| PREFERRED P/N                  | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
| VS-10TQ035PbF                  | 50               | 1000                   | Antistatic plastic tube |
| VS-10TQ035-N3                  | 50               | 1000                   | Antistatic plastic tube |
| VS-10TQ040PbF                  | 50               | 1000                   | Antistatic plastic tube |
| VS-10TQ040-N3                  | 50               | 1000                   | Antistatic plastic tube |
| VS-10TQ045PbF                  | 50               | 1000                   | Antistatic plastic tube |
| VS-10TQ045-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-220ACPbF <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 | SYMBOL        | MILLIMETERS |       | INCHES     |       | NOTES |
|--------|-------------|-------|--------|-------|-------|---------------|-------------|-------|------------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |               | MIN.        | MAX.  | MIN.       | MAX.  |       |
| A      | 4.25        | 4.65  | 0.167  | 0.183 |       | E1            | 6.86        | 8.89  | 0.270      | 0.350 | 6     |
| A1     | 1.14        | 1.40  | 0.045  | 0.055 |       | E2            | -           | 0.76  | -          | 0.030 | 7     |
| A2     | 2.56        | 2.92  | 0.101  | 0.115 |       | e             | 2.41        | 2.67  | 0.095      | 0.105 |       |
| b      | 0.69        | 1.01  | 0.027  | 0.040 |       | e1            | 4.88        | 5.28  | 0.192      | 0.208 |       |
| b1     | 0.38        | 0.97  | 0.015  | 0.038 | 4     | H1            | 6.09        | 6.48  | 0.240      | 0.255 | 6, 7  |
| b2     | 1.20        | 1.73  | 0.047  | 0.068 |       | L             | 13.52       | 14.02 | 0.532      | 0.552 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     | L1            | 3.32        | 3.82  | 0.131      | 0.150 | 2     |
| c      | 0.36        | 0.61  | 0.014  | 0.024 |       | L3            | 1.78        | 2.13  | 0.070      | 0.084 |       |
| c1     | 0.36        | 0.56  | 0.014  | 0.022 | 4     | L4            | 0.76        | 1.27  | 0.030      | 0.050 | 2     |
| D      | 14.85       | 15.25 | 0.585  | 0.600 | 3     | $\emptyset P$ | 3.54        | 3.73  | 0.139      | 0.147 |       |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       | Q             | 2.60        | 3.00  | 0.102      | 0.118 |       |
| D2     | 11.68       | 12.88 | 0.460  | 0.507 | 6     | $\theta$      | 90° to 93°  |       | 90° to 93° |       |       |
| E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |               |             |       |            |       |       |

**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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