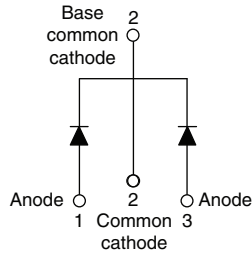


## Schottky Rectifier, 2 x 20 A


**TO-220AB**


### FEATURES

- 175 °C  $T_J$  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
- 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-220AB        |
| $I_{F(AV)}$     | 2 x 20 A        |
| $V_R$           | 150 V           |
| $V_F$ at $I_F$  | 0.71 V          |
| $I_{RM}$ max.   | 15 mA at 125 °C |
| $T_J$ max.      | 175 °C          |
| Diode variation | Common cathode  |
| $E_{AS}$        | 1.0 mJ          |

### DESCRIPTION

The VS-40CTQ... center tap Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. 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                   | 40          | A     |
| $V_{RRM}$                         |  | 150         | V     |
| $I_{FSM}$                         | $t_p = 5 \mu s$ sine                   | 1500        | A     |
| $V_F$                             | 20 $A_{pk}$ , $T_J = 125$ °C (per leg) | 0.71        | V     |
| $T_J$                             |  | - 55 to 175 | °C    |

| VOLTAGE RATINGS                      |           |                |                |       |
|--------------------------------------|-----------|----------------|----------------|-------|
| PARAMETER                            | SYMBOL    | VS-40CTQ150PbF | VS-40CTQ150-N3 | UNITS |
| Maximum DC reverse voltage           | $V_R$     | 150            | 150            | 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 $T_C = 140$ °C, rectangular waveform   |   | 20     | A     |
|   |             |   |   | 40     |       |
| Maximum peak one cycle non-repetitive surge current per leg<br>See fig. 7 | $I_{FSM}$   | 5 $\mu s$ sine or 3 $\mu s$ rect. pulse   | Following any rated load condition and with rated $V_{RRM}$ applied | 1500   | A     |
|   |             | 10 ms sine or 6 ms rect. pulse  |   | 250    |       |
| Non-repetitive avalanche energy per leg                                   | $E_{AS}$    | $T_J = 25$ °C, $I_{AS} = 1.5$ A, $L = 0.9$ mH   |   | 1.0    | mJ    |
| Repetitive avalanche current per leg                                      | $I_{AR}$    | Current decaying linearly to zero in 1 $\mu s$<br>Frequency limited by $T_J$ maximum $V_A = 1.5 \times V_R$ typical |   | 1.5    | A     |



| <b>ELECTRICAL SPECIFICATIONS</b>                      |                |  |                                   |        |                  |
|---|----------------|--|-----------------------------------|--------|------------------|
| PARAMETER   | SYMBOL         | TEST CONDITIONS  |                                   | VALUES | UNITS            |
| Maximum forward voltage drop per leg<br>See fig. 1    | $V_{FM}^{(1)}$ | 20 A   | $T_J = 25\text{ }^\circ\text{C}$  | 0.93   | V                |
|   |                | 40 A   |                                   | 1.16   |                  |
|   |                | 20 A   | $T_J = 125\text{ }^\circ\text{C}$ | 0.71   |                  |
|   |                | 40 A   |                                   | 0.85   |                  |
| Maximum reverse leakage current per leg<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^\circ\text{C}$   | $V_R = \text{Rated } V_R$         | 50     | $\mu\text{A}$    |
|   |                | $T_J = 125\text{ }^\circ\text{C}$  |                                   | 15     | mA               |
| Maximum junction capacitance per leg                  | $C_T$          | $V_R = 5 V_{DC}$ (test signal range 100 kHz to 1 MHz) $25\text{ }^\circ\text{C}$ |                                   | 450    | pF               |
| Typical series inductance per leg                     | $L_S$          | 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 %

| <b>THERMAL - MECHANICAL SPECIFICATIONS</b>               |                |                                      |  |             |                           |
|--|----------------|--------------------------------------|--|-------------|---------------------------|
| PARAMETER  | SYMBOL         | TEST CONDITIONS                      |  | VALUES      | UNITS                     |
| Maximum junction and storage temperature range           | $T_J, T_{Stg}$ |                                      |  | - 55 to 175 | $^\circ\text{C}$          |
| Maximum thermal resistance, junction to case per leg     | $R_{thJC}$     | DC operation<br>See fig. 4           |  | 1.5         | $^\circ\text{C}/\text{W}$ |
| Maximum thermal resistance, junction to case per package |                | DC operation                         |  | 0.75        |                           |
| Typical thermal resistance, case to heatsink             | $R_{thCS}$     | Mounting surface, smooth and greased |  | 0.5         |                           |
| Approximate weight                                       |                |                                      |  | 2           | g                         |
|  |                |                                      |  | 0.07        | oz.                       |
| Mounting torque  | minimum        | Non-lubricated threads               |  | 6 (5)       | kgf · cm<br>(lbf · in)    |
|  | maximum        |                                      |  | 12 (10)     |                           |
| Marking device   |                | Case style TO-220AB                  |  | 40CTQ150    |                           |

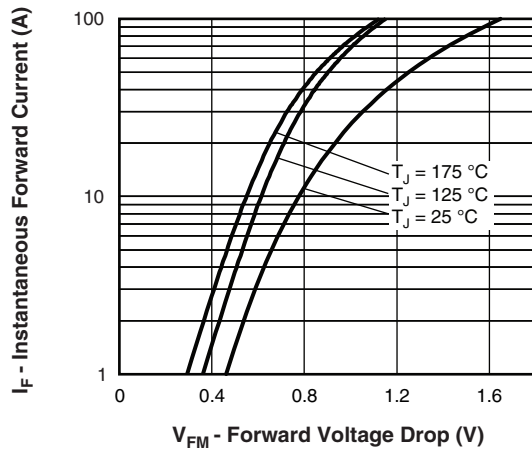


Fig. 1 - Maximum Forward Voltage Drop Characteristics

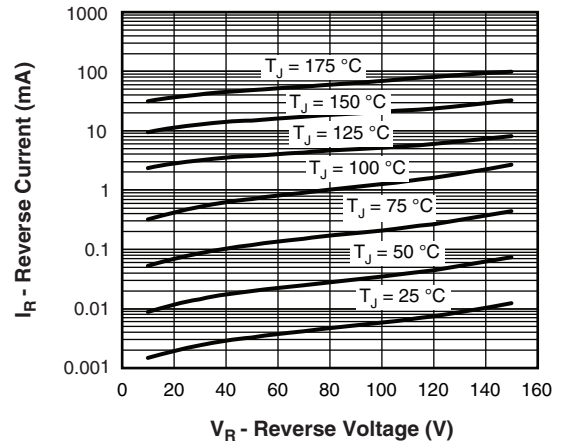


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

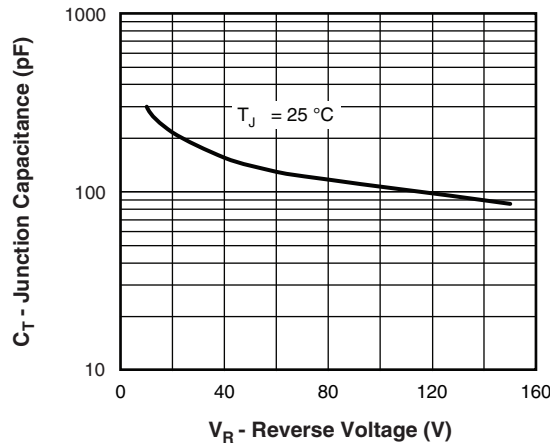


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

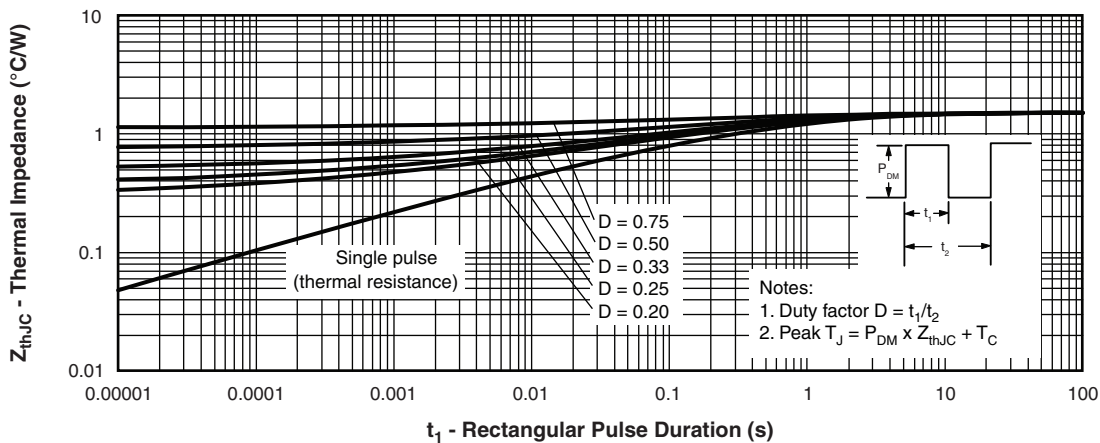


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

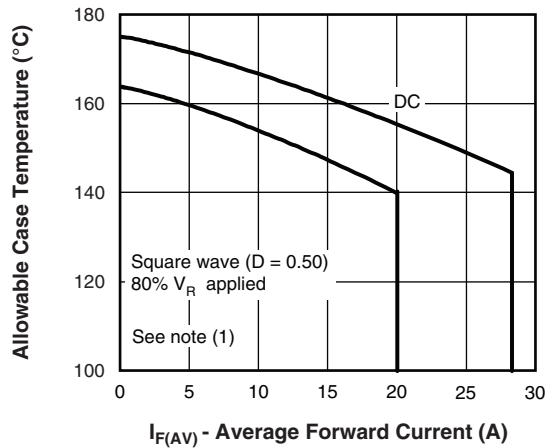


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

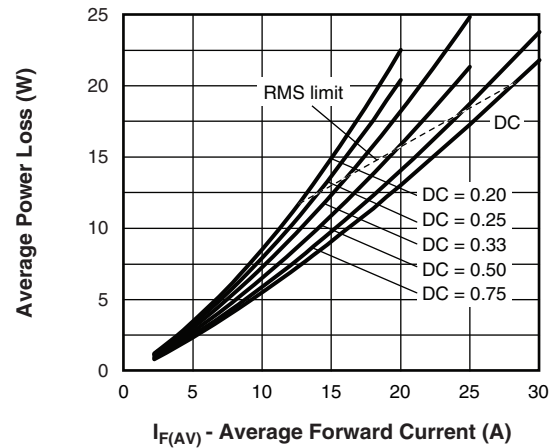


Fig. 6 - Forward Power Loss Characteristics

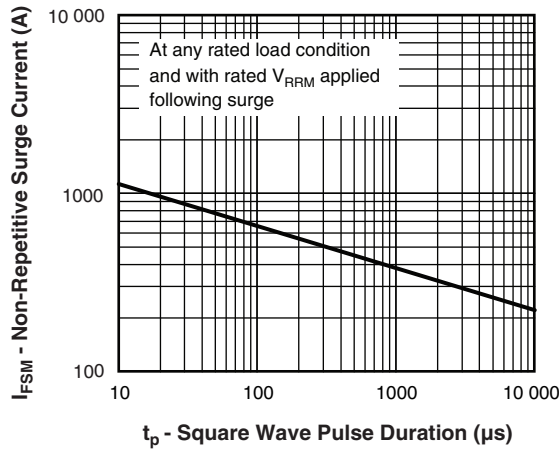


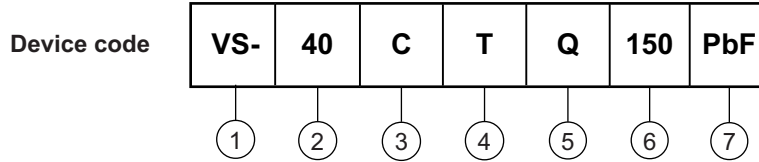
Fig. 7 - Maximum Non-Repetitive Surge Current

**Note**

- (1) Formula used:  $T_C = T_J - (P_d + P_{d_{REV}}) \times R_{thJC}$ ;  
 $P_d$  = Forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);  
 $P_{d_{REV}}$  = Inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1} = 80\% V_R$  applied



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current rating (40 = 40 A)
- 3** - Circuit configuration:  
C = Common cathode
- 4** - Package:  
T = TO-220
- 5** - Schottky "Q" series
- 6** - Voltage ratings (150 = 150 V)
- 7** - Environmental digit
  - PbF = Lead (Pb)-free and RoHS compliant
  - -N3 = Halogen-free, RoHS compliant, and totally lead (Pb)-free

| ORDERING INFORMATION (Example) |                  |                        |                         |
|--------------------------------|------------------|------------------------|-------------------------|
| PREFERRED P/N                  | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
| VS-40CTQ150PbF                 | 50               | 1000                   | Antistatic plastic tube |
| VS-40CTQ150-N3                 | 50               | 1000                   | Antistatic plastic tube |

| LINKS TO RELATED DOCUMENTS |   |
|----------------------------|---|
| Dimensions                 | <a href="http://www.vishay.com/doc?95222">www.vishay.com/doc?95222</a>              |
| Part marking information   | TO-220AB PbF <a href="http://www.vishay.com/doc?95225">www.vishay.com/doc?95225</a> |
|                            | TO-220AB -N3 <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a> |

## TO-220AB

**DIMENSIONS** in millimeters and inches



**Lead assignments**

Diodes

- 1. - Anode/open
- 2. - Cathode
- 3. - Anode

Conforms to JEDEC outline TO-220AB

| 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     |

| SYMBOL | MILLIMETERS |       | INCHES     |       | NOTES |
|--------|-------------|-------|------------|-------|-------|
|        | MIN.        | MAX.  | MIN.       | MAX.  |       |
| E      | 10.11       | 10.51 | 0.398      | 0.414 | 3, 6  |
| 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     |
| 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 dimensions: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimensions E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, except A2 (maximum) and D2 (minimum) where dimensions are derived from the actual package outline



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