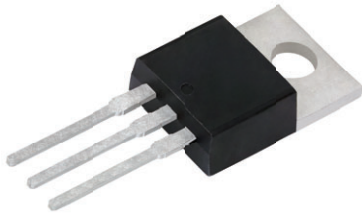
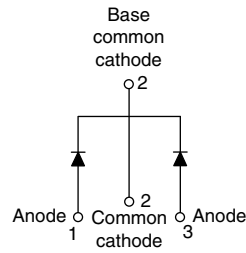




## High Performance Schottky Rectifier, 2 x 10 A



3L TO-220AB



### FEATURES

- 175 °C T<sub>J</sub> 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
- 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>               | 2 x 10 A         |
| V <sub>R</sub>                   | 35 V, 40 V, 45 V |
| V <sub>F</sub> at I <sub>F</sub> | 0.57 V           |
| I <sub>RM</sub> max.             | 15 mA at 125 °C  |
| T <sub>J</sub> max.              | 175 °C           |
| E <sub>AS</sub>                  | 13 mJ            |
| Package                          | 3L TO-220AB      |
| Circuit configuration            | Common cathode   |

### DESCRIPTION

The VS-20CTQ... center tap 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 <sub>F(AV)</sub>                | Rectangular waveform                                   | 20          | A     |
| V <sub>RRM</sub>                  | Range  | 35 to 45    | V     |
| I <sub>FSM</sub>                  | t <sub>p</sub> = 5 μs sine                             | 1060        | A     |
| V <sub>F</sub>                    | 10 A <sub>pk</sub> , T <sub>J</sub> = 125 °C (per leg) | 0.57        | V     |
| T <sub>J</sub>                    | Range  | -55 to +175 | °C    |

| VOLTAGE RATINGS                      |                  |                |                |                |       |
|--------------------------------------|------------------|----------------|----------------|----------------|-------|
| PARAMETER                            | SYMBOL           | VS-20CTQ035-M3 | VS-20CTQ040-M3 | VS-20CTQ045-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 see fig. 5                              | I <sub>F(AV)</sub> | 50 % duty cycle at T <sub>C</sub> = 145 °C, rectangular waveform   |  | 20     | A     |
| Maximum peak one cycle non-repetitive surge current per leg, see fig. 7 | I <sub>FSM</sub>   | 5 μs sine or 3 μs rect. pulse  | Following any rated load condition and with rated V <sub>RRM</sub> applied | 1060   |       |
|   |                    | 10 ms sine or 6 ms rect. pulse   |  | 265    |       |
| Non-repetitive avalanche energy per leg                                 | E <sub>AS</sub>    | T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 2.0 A, L = 6.5 mH  |  | 13     | mJ    |
| Repetitive avalanche current per leg                                    | 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 |  | 2.0    | A     |



| <b>ELECTRICAL SPECIFICATIONS</b>                      |                |  |                                   |        |                  |
|---|----------------|--|-----------------------------------|--------|------------------|
| PARAMETER   | SYMBOL         | TEST CONDITIONS  |                                   | VALUES | UNITS            |
| Maximum forward voltage drop per leg<br>See fig. 1    | $V_{FM}^{(1)}$ | 10 A   | $T_J = 25\text{ }^\circ\text{C}$  | 0.64   | V                |
|   |                | 20 A   |                                   | 0.76   |                  |
|   |                | 10 A   | $T_J = 125\text{ }^\circ\text{C}$ | 0.57   |                  |
|   |                | 20 A   |                                   | 0.68   |                  |
| Maximum reverse leakage current per leg<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^\circ\text{C}$   | $V_R = \text{Rated } V_R$         | 2      | mA               |
|   |                | $T_J = 125\text{ }^\circ\text{C}$  |                                   | 15     |                  |
| Maximum junction capacitance per leg                  | $C_T$          | $V_R = 5 V_{DC}$ (test signal range 100 kHz to 1 MHz) $25\text{ }^\circ\text{C}$ |                                   | 900    | 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           |  | 3.25        | $^\circ\text{C/W}$     |
| Maximum thermal resistance, junction to case per package |                | DC operation                         |  | 1.63        |                        |
| Typical thermal resistance, case to heatsink             | $R_{thCS}$     | Mounting surface, smooth and greased |  | 0.50        |                        |
| Approximate weight                                       |                |                                      |  | 2           | g                      |
|  |                |                                      |  | 0.07        | oz.                    |
| Mounting torque  |                |                                      |  | 6 (5)       | kgf · cm<br>(lbf · in) |
|  |                |                                      |  | 12 (10)     |                        |
| Marking device   |                | Case style 3L TO-220AB               |  | 20CTQ035    |                        |
|  |                |                                      |  | 20CTQ040    |                        |
|  |                |                                      |  | 20CTQ045    |                        |

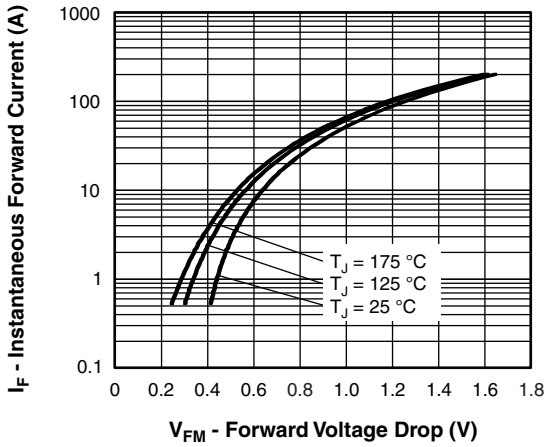


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

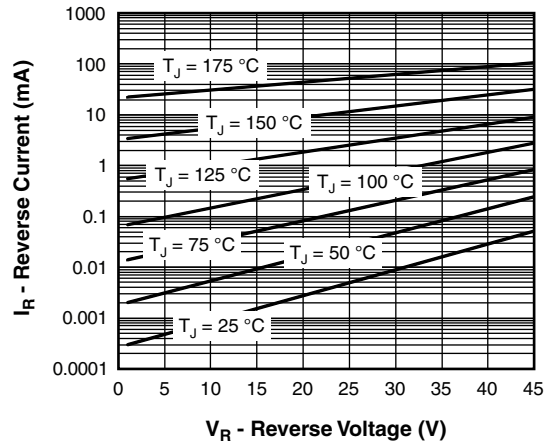


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

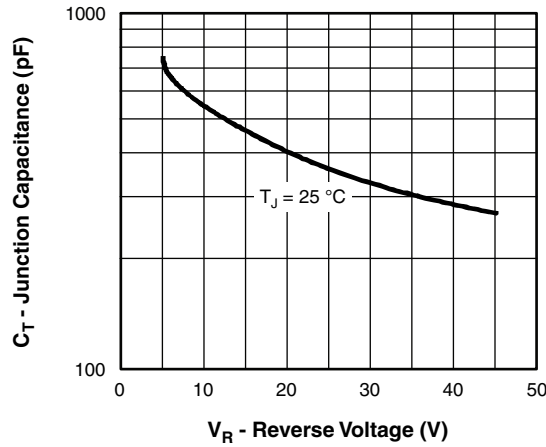


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

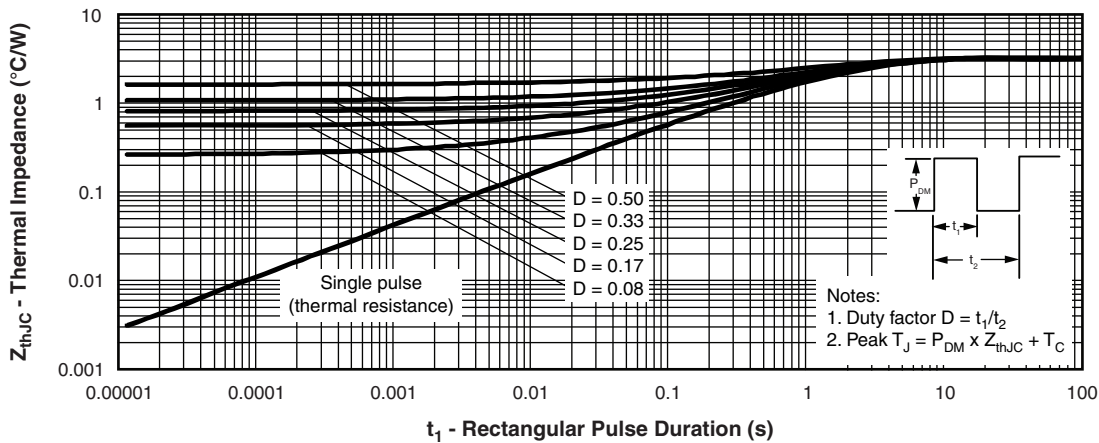


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

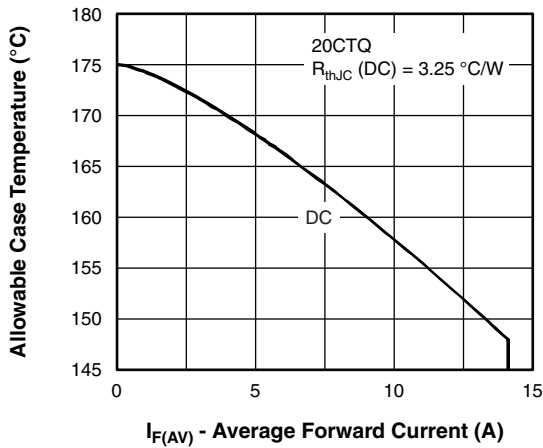


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

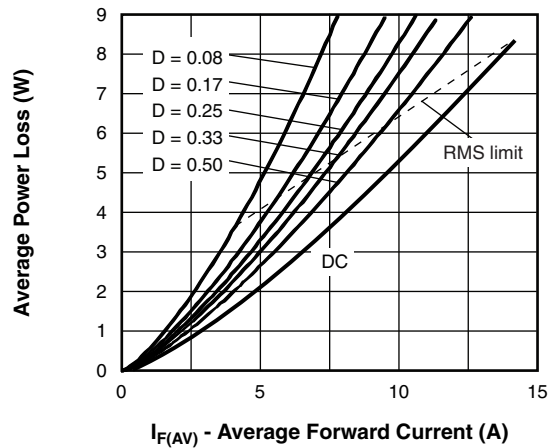


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

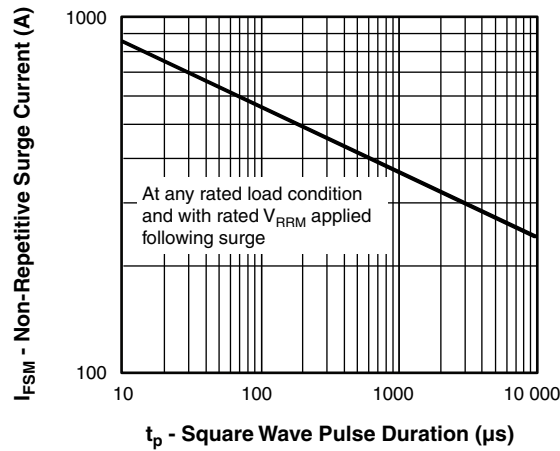


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

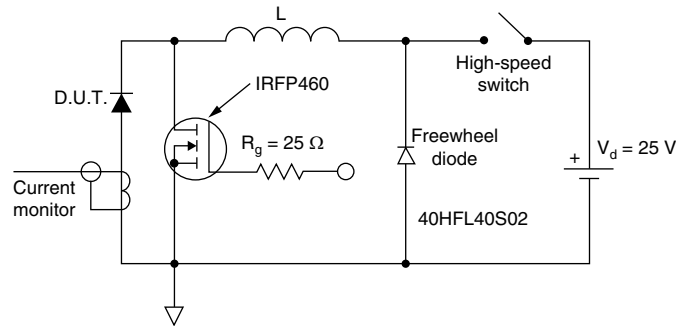
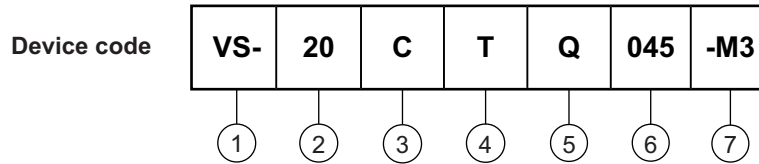


Fig. 8 - Unclamped Inductive Test Circuit



## ORDERING INFORMATION TABLE



- 1 - Vishay Semiconductors product
  - 2 - Current rating (20 = 20 A)
  - 3 - Circuit configuration  
C = Common cathode
  - 4 - Package  
T = TO-220
  - 5 - Schottky "Q" series
  - 6 - Voltage rating
  - 7 - Environmental digit
- 035 = 35 V  
 040 = 40 V  
 045 = 45 V
- M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

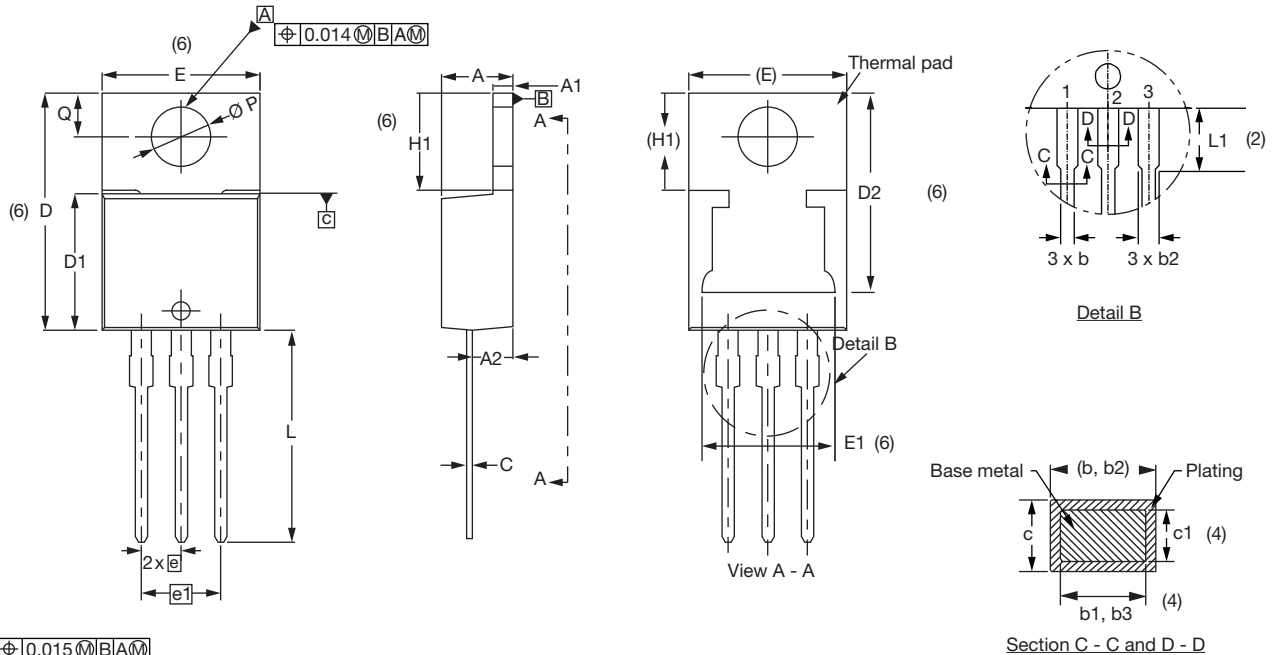
| ORDERING INFORMATION (Example) |                  |                        |                         |
|--------------------------------|------------------|------------------------|-------------------------|
| PREFERRED P/N                  | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
| VS-20CTQ035-M3                 | 50               | 1000                   | Antistatic plastic tube |
| VS-20CTQ040-M3                 | 50               | 1000                   | Antistatic plastic tube |
| VS-20CTQ045-M3                 | 50               | 1000                   | Antistatic plastic tube |

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| Dimensions                 | <a href="http://www.vishay.com/doc?96154">www.vishay.com/doc?96154</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a> |



# 3L TO-220AB

**DIMENSIONS** in millimeters and inches



Conforms to JEDEC® outline TO-220AB

| 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 |       | D2     | 11.68       | 13.30 | 0.460  | 0.524 | 6, 7  |
| A1     | 1.14        | 1.40  | 0.045  | 0.055 |       | E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |
| A2     | 2.50        | 2.92  | 0.098  | 0.115 |       | E1     | 6.86        | 8.89  | 0.270  | 0.350 | 6     |
| b      | 0.69        | 1.01  | 0.027  | 0.040 |       | e      | 2.41        | 2.67  | 0.095  | 0.105 |       |
| b1     | 0.38        | 0.97  | 0.015  | 0.038 | 4     | e1     | 4.88        | 5.28  | 0.192  | 0.208 |       |
| b2     | 1.20        | 1.73  | 0.047  | 0.068 |       | H1     | 6.09        | 6.48  | 0.240  | 0.255 | 6     |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     | L      | 13.52       | 14.02 | 0.532  | 0.552 |       |
| c      | 0.36        | 0.61  | 0.014  | 0.024 |       | L1     | 3.32        | 3.82  | 0.131  | 0.150 | 2     |
| c1     | 0.36        | 0.56  | 0.014  | 0.022 | 4     | ∅ P    | 3.54        | 3.91  | 0.139  | 0.154 |       |
| D      | 14.85       | 15.35 | 0.585  | 0.604 | 3     | Q      | 2.60        | 3.00  | 0.102  | 0.118 |       |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       |        |             |       |        |       |       |

**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) Outline conforms to JEDEC® TO-220, except D2



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