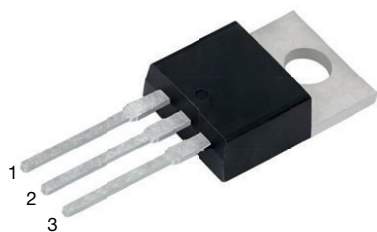
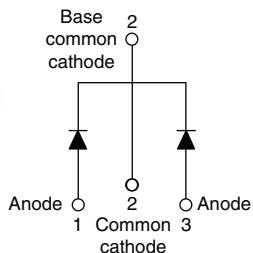


# High Performance Schottky Rectifier, 2 x 20 A


**TO-220AB 3L**


## FEATURES

- 125 °C  $T_J$  operation ( $V_R < 5$  V)
- 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
- 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**

## DESCRIPTION

This 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 125 °C junction temperature. Typical applications are in switching power supplies, converters, freewheeling diodes, and reverse battery protection.

## PRIMARY CHARACTERISTICS

|                       |                      |
|-----------------------|----------------------|
| $I_{F(AV)}$           | 2 x 20 A             |
| $V_R$                 | 15 V                 |
| $V_F$ at $I_F$        | See Electrical table |
| $I_{RM}$ max.         | 600 mA at 100 °C     |
| $T_J$ max.            | 125 °C               |
| $E_{AS}$              | 10 mJ                |
| Package               | TO-220AB 3L          |
| Circuit configuration | Common cathode       |

## MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL      | CHARACTERISTICS                               | VALUES      | UNITS |
|-------------|-----------------------------------------------|-------------|-------|
| $I_{F(AV)}$ | Rectangular waveform                          | 40          | A     |
| $V_{RRM}$   |                                               | 15          | V     |
| $I_{FSM}$   | $t_p = 5$ $\mu$ s sine                        | 700         | A     |
| $V_F$       | 19 A <sub>pk</sub> , $T_J = 125$ °C (per leg) | 0.25        | V     |
| $T_J$       | Range                                         | -55 to +125 | °C    |

## VOLTAGE RATINGS

| PARAMETER                            | SYMBOL    | VS-40L15CT-M3 | UNITS |
|--------------------------------------|-----------|---------------|-------|
| Maximum DC reverse voltage           | $V_R$     | 15            | V     |
| Maximum working peak reverse voltage | $V_{RWM}$ |               |       |

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                                               | SYMBOL      | TEST CONDITIONS                                                                                                     | VALUES | UNITS |
|-------------------------------------------------------------------------|-------------|---------------------------------------------------------------------------------------------------------------------|--------|-------|
| Maximum average forward current, see fig. 5                             | $I_{F(AV)}$ | 50 % duty cycle at $T_C = 85$ °C, rectangular waveform                                                              | 20     | A     |
| per leg                                                                 |             |                                                                                                                     | 40     |       |
| Maximum peak one cycle non-repetitive surge current per leg, see fig. 7 | $I_{FSM}$   | 5 $\mu$ s sine or 3 $\mu$ s rect. pulse                                                                             | 700    |       |
|                                                                         |             | 10 ms sine or 6 ms rect. pulse                                                                                      | 330    |       |
| Non-repetitive avalanche energy per leg                                 | $E_{AS}$    | $T_J = 25$ °C, $I_{AS} = 2$ A, $L = 6$ mH                                                                           | 10     | 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 | 2      | A     |

**ELECTRICAL SPECIFICATIONS**

| PARAMETER                                     | SYMBOL         | TEST CONDITIONS                                                                           | TYP.   | MAX. | UNITS      |
|-----------------------------------------------|----------------|-------------------------------------------------------------------------------------------|--------|------|------------|
| Forward voltage drop per leg<br>See fig. 1    | $V_{FM}^{(1)}$ | 19 A                                                                                      | -      | 0.41 | V          |
|                                               |                | 40 A                                                                                      |        | 0.52 |            |
|                                               |                | 19 A                                                                                      | 0.25   | 0.33 |            |
|                                               |                | 40 A                                                                                      |        | 0.50 |            |
| Reverse leakage current per leg<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                                        | -      | 10   | mA         |
|                                               |                | $T_J = 100\text{ }^{\circ}\text{C}$                                                       |        | 600  |            |
| Threshold voltage                             | $V_{F(TO)}$    | $T_J = T_J \text{ maximum}$                                                               | 0.182  |      | V          |
| Forward slope resistance                      | $r_t$          |                                                                                           | 7.6    |      | m $\Omega$ |
| Maximum junction capacitance per leg          | $C_T$          | $V_R = 5\text{ V}_{DC}$ (test signal range 100 kHz to 1 MHz) $25\text{ }^{\circ}\text{C}$ | -      | 2000 | pF         |
| Typical series inductance per leg             | $L_S$          | Measured lead to lead 5 mm from package body                                              | 8      | -    | nH         |
| Maximum voltage rate of change                | dV/dt          | Rated $V_R$                                                                               | 10 000 |      | V/ $\mu$ s |

**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 +125 | °C                     |
| Maximum thermal resistance, junction to case per leg | R <sub>thJC</sub>                 | DC operation                          | 1.5         | °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 3L TO-220AB                | 40L15CT     |                        |

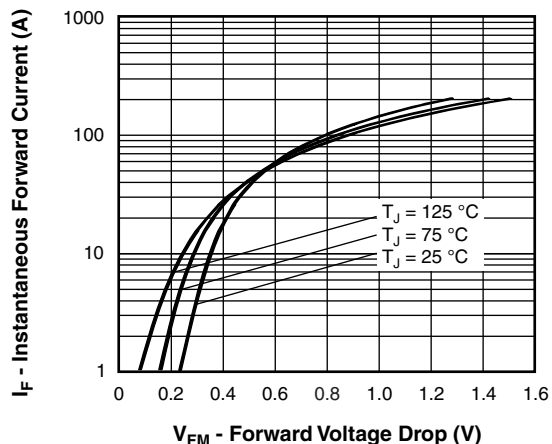


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

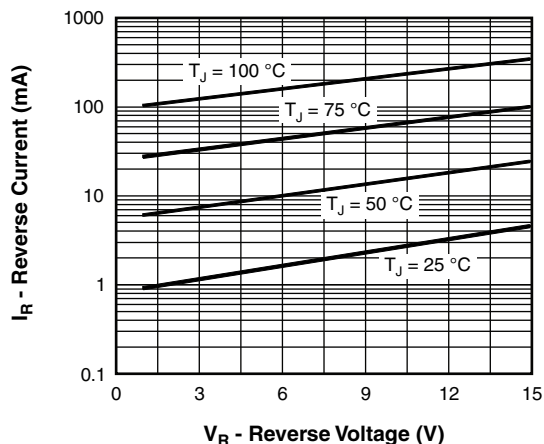


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

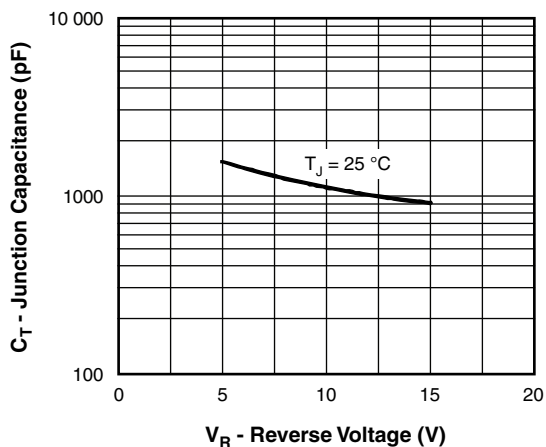
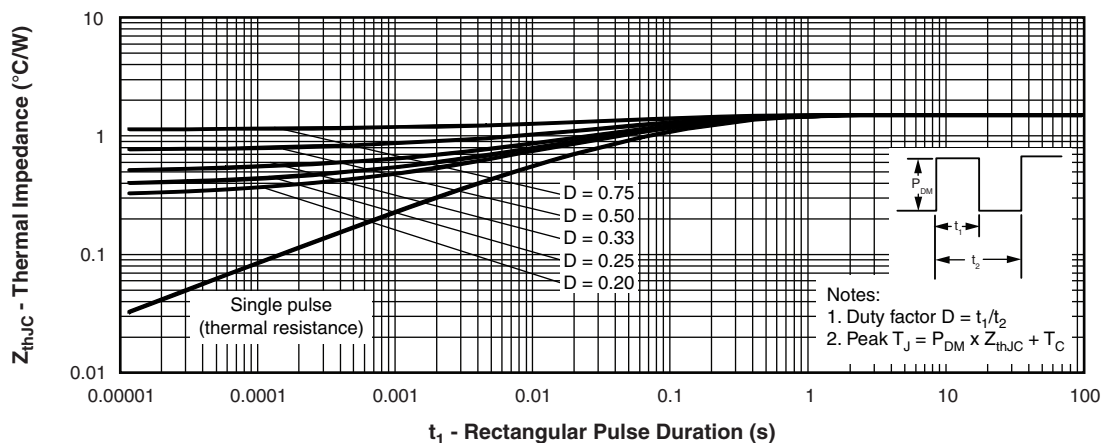


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)


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

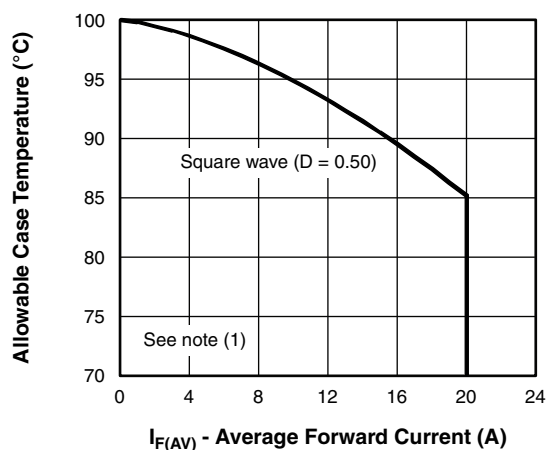


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

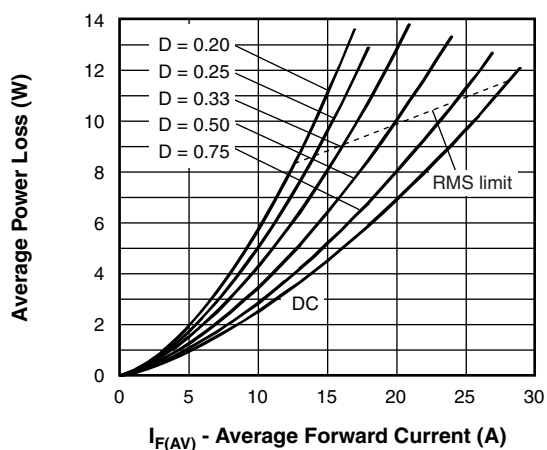


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

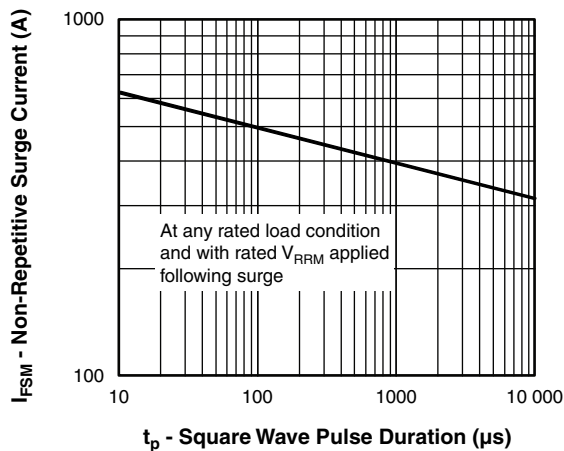


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

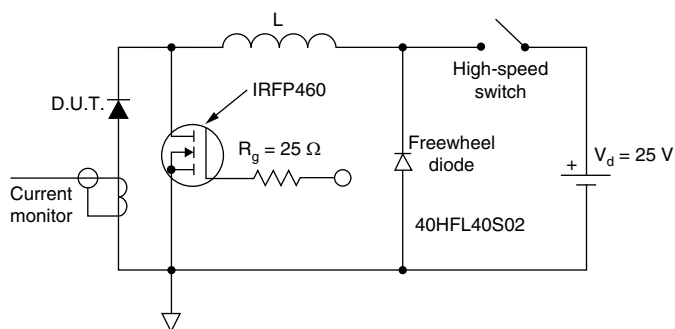


Fig. 8 - Unclamped Inductive Test Circuit

#### 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  $V_{R1} = 10 V$

**ORDERING INFORMATION TABLE**

|             |            |           |          |           |          |          |           |
|-------------|------------|-----------|----------|-----------|----------|----------|-----------|
| Device code | <b>VS-</b> | <b>40</b> | <b>L</b> | <b>15</b> | <b>C</b> | <b>T</b> | <b>-M</b> |
|             | 1          | 2         | 3        | 4         | 5        | 6        | 7         |

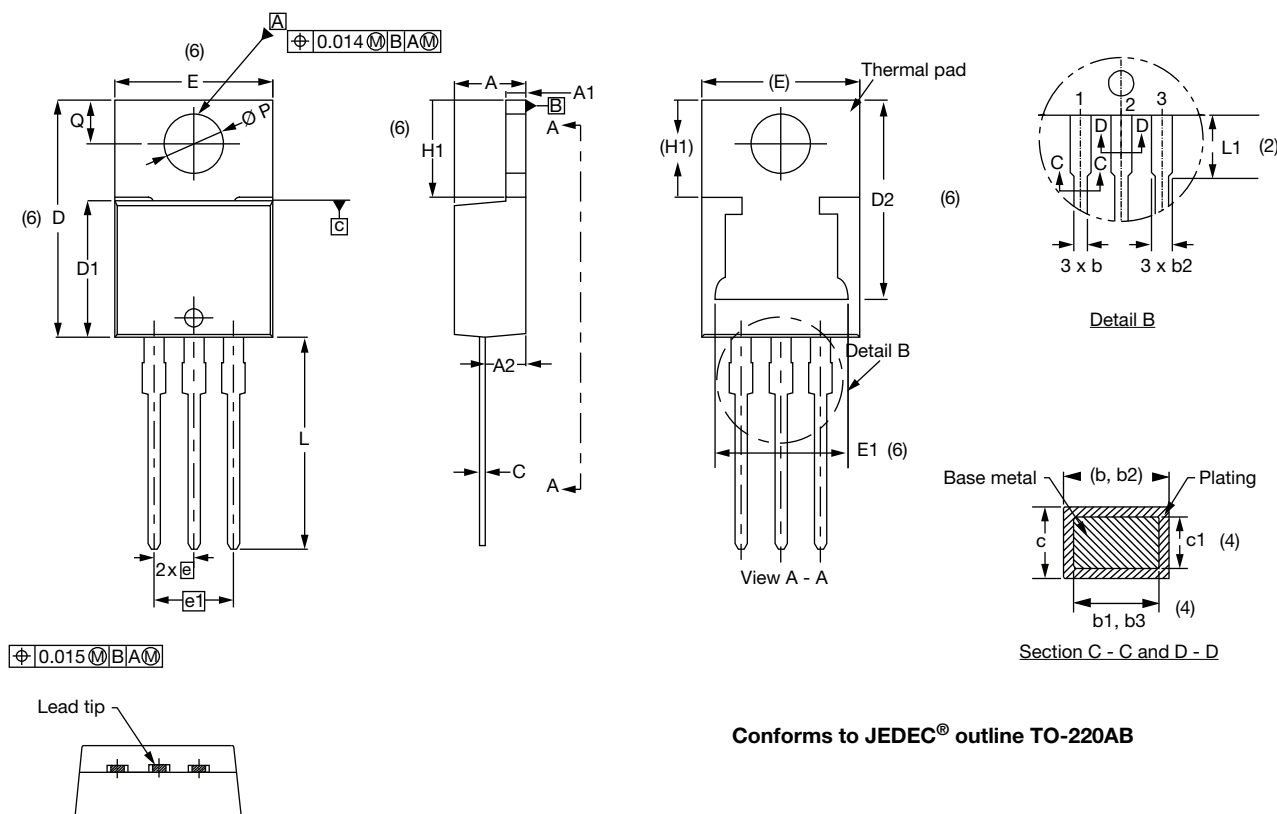
- |          |   |                                                                                           |
|----------|---|-------------------------------------------------------------------------------------------|
| <b>1</b> | - | Vishay Semiconductors product                                                             |
| <b>2</b> | - | Current rating (40 = 40 A)                                                                |
| <b>3</b> | - | Schottky "L" series                                                                       |
| <b>4</b> | - | Voltage rating (15 = 15 V)                                                                |
| <b>5</b> | - | C = Common cathode                                                                        |
| <b>6</b> | - | Package:<br>T = TO-220                                                                    |
| <b>7</b> | - | Environmental digit<br>-M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free |

| <b>ORDERING INFORMATION</b> (Example) |                      |                              |
|---------------------------------------|----------------------|------------------------------|
| <b>PREFERRED P/N</b>                  | <b>BASE QUANTITY</b> | <b>PACKAGING DESCRIPTION</b> |
| VS-40L15CT-M3                         | 50                   | Antistatic plastic tubes     |

| <b>LINKS TO RELATED DOCUMENTS</b> |                                                                        |
|-----------------------------------|------------------------------------------------------------------------|
| 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> |
| SPIICE model                      | <a href="http://www.vishay.com/doc?97118">www.vishay.com/doc?97118</a> |



## TO-220AB 3L

**DIMENSIONS** in millimeters and inches

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     | 2.50        | 2.92  | 0.098  | 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       | 15.35 | 0.585  | 0.604 | 3     |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       |

| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| D2     | 11.68       | 13.30 | 0.460  | 0.524 | 6, 7  |
| E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |
| E1     | 6.86        | 8.89  | 0.270  | 0.350 | 6     |
| 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     |
| L      | 13.52       | 14.02 | 0.532  | 0.552 |       |
| L1     | 3.32        | 3.82  | 0.131  | 0.150 | 2     |
| Ø P    | 3.54        | 3.91  | 0.139  | 0.154 |       |
| Q      | 2.60        | 3.00  | 0.102  | 0.118 |       |

**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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