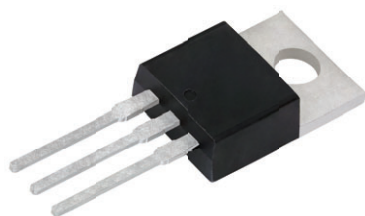
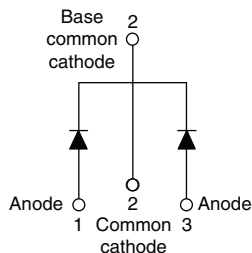




## High Performance Schottky Rectifier, 2 x 30 A



3L TO-220AB



## FEATURES

- 150 °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
- 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

|                       |                  |
|-----------------------|------------------|
| $I_{F(AV)}$           | 2 x 30 A         |
| $V_R$                 | 35 V, 40 V, 45 V |
| $V_F$ at $I_F$        | 0.53 V           |
| $I_{RM}$ max.         | 250 mA at 125 °C |
| $T_J$ max.            | 150 °C           |
| $E_{AS}$              | 20 mJ            |
| Package               | 3L TO-220AB      |
| Circuit configuration | Common cathode   |

## DESCRIPTION

This center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150 °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 (per device) | 60          | A     |
| $V_{RRM}$   |                                   | 35 to 45    | V     |
| $I_{FRM}$   | $T_C = 113$ °C (per leg)          | 60          | A     |
| $I_{FSM}$   | $t_p = 5$ $\mu$ s sine            | 1500        |       |
| $V_F$       | 30 $A_{pk}$ , $T_J = 125$ °C      | 0.53        | V     |
| $T_J$       | Range                             | -65 to +150 | °C    |

## VOLTAGE RATINGS

| PARAMETER                            | SYMBOL    | VS-60CTQ035-M3 | VS-60CTQ040-M3 | VS-60CTQ045-M3 | UNITS |
|--------------------------------------|-----------|----------------|----------------|----------------|-------|
| Maximum DC reverse voltage           | $V_R$     | 35             | 40             | 45             | V     |
| Maximum working peak reverse voltage | $V_{RWM}$ |                |                |                |       |

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                                   | SYMBOL      | TEST CONDITIONS                                                                                                     | VALUES | UNITS |
|-------------------------------------------------------------|-------------|---------------------------------------------------------------------------------------------------------------------|--------|-------|
| Maximum average forward current per leg per device          | $I_{F(AV)}$ | 50 % duty cycle at $T_C = 113$ °C, rectangular waveform                                                             | 30     | A     |
|                                                             |             |                                                                                                                     | 60     |       |
| Peak repetitive forward current per leg                     | $I_{FRM}$   | Rated $V_R$ , square wave, 20 kHz, $T_C = 113$ °C                                                                   | 60     |       |
| Maximum peak one cycle non-repetitive surge current per leg | $I_{FSM}$   | 5 $\mu$ s sine or 3 $\mu$ s rect. pulse                                                                             | 1500   |       |
|                                                             |             | 10 ms sine or 6 ms rect. pulse                                                                                      | 300    |       |
| Non-repetitive avalanche energy per leg                     | $E_{AS}$    | $T_J = 25$ °C, $I_{AS} = 3$ A, $L = 4.40$ mH                                                                        | 20     | 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 | 3      | A     |



| ELECTRICAL SPECIFICATIONS             |                |                                                                                           |                                     |        |      |            |
|---------------------------------------|----------------|-------------------------------------------------------------------------------------------|-------------------------------------|--------|------|------------|
| PARAMETER                             | SYMBOL         | TEST CONDITIONS                                                                           |                                     | TYP.   | MAX. | UNITS      |
| Maximum forward voltage drop          | $V_{FM}^{(1)}$ | 30 A                                                                                      | $T_J = 25\text{ }^{\circ}\text{C}$  | 0.51   | 0.56 | V          |
|                                       |                | 60 A                                                                                      |                                     | 0.66   | 0.72 |            |
|                                       |                | 30 A                                                                                      | $T_J = 125\text{ }^{\circ}\text{C}$ | 0.48   | 0.53 |            |
|                                       |                | 60 A                                                                                      |                                     | 0.68   | 0.75 |            |
| Maximum instantaneous reverse current | $I_{RM}$       | $T_J = 25\text{ }^{\circ}\text{C}$                                                        | Rated DC voltage                    | 0.33   | 2    | mA         |
|                                       |                | $T_J = 125\text{ }^{\circ}\text{C}$                                                       |                                     | 145    | 250  |            |
| Maximum junction capacitance          | $C_T$          | $V_R = 5\text{ }V_{DC}$ (test signal range 100 kHz to 1 MHz) $25\text{ }^{\circ}\text{C}$ |                                     | 2000   |      | pF         |
| Typical series inductance             | $L_S$          | Measured from top of terminal to mounting plane                                           |                                     | 8.0    |      | nH         |
| Maximum voltage rate of change        | dV/dt          | Rated $V_R$                                                                               |                                     | 10 000 |      | V/ $\mu$ s |

**Note**

(1) Pulse width < 300  $\mu$ s, duty cycle < 2 %

| THERMAL - MECHANICAL SPECIFICATIONS                  |                   |                                      |             |                        |
|------------------------------------------------------|-------------------|--------------------------------------|-------------|------------------------|
| PARAMETER                                            | SYMBOL            | TEST CONDITIONS                      | VALUES      | UNITS                  |
| Maximum junction temperature range                   | T <sub>J</sub>    |                                      | -65 to +150 | °C                     |
| Maximum storage temperature range                    | T <sub>Stg</sub>  |                                      | -65 to +175 |                        |
| Maximum thermal resistance, junction to case per leg | R <sub>thJC</sub> | DC operation                         | 1.2         | °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           | Non-lubricated threads               | 6 (5)       | kgf · cm<br>(lbf · in) |
|                                                      | maximum           |                                      | 12 (10)     |                        |
| Marking device                                       |                   | Case style 3L TO-220AB               | 60CTQ035    |                        |
|                                                      |                   |                                      | 60CTQ040    |                        |
|                                                      |                   |                                      | 60CTQ045    |                        |

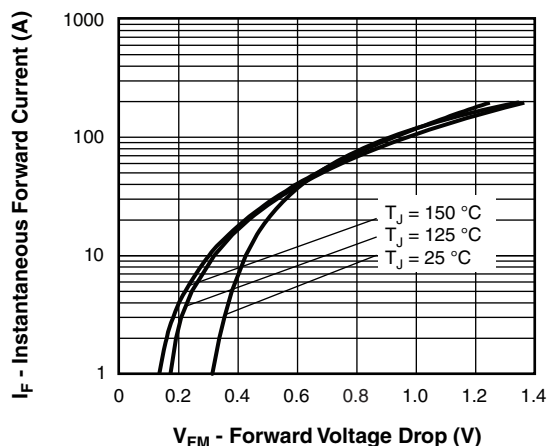


Fig. 1 - Maximum Forward Voltage Drop Characteristics

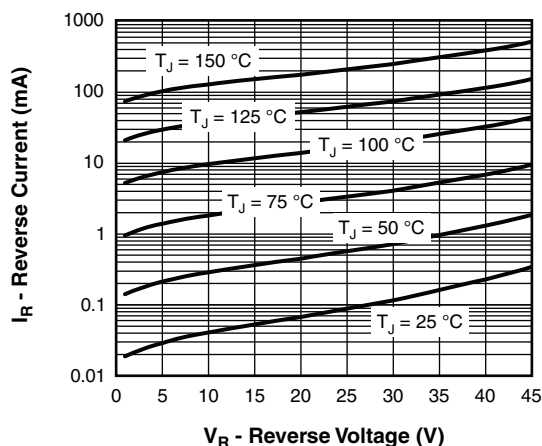


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

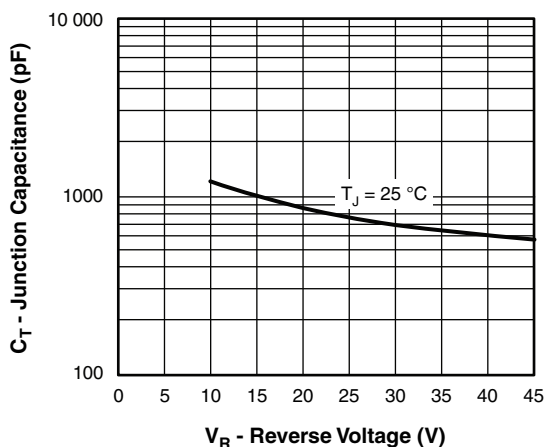
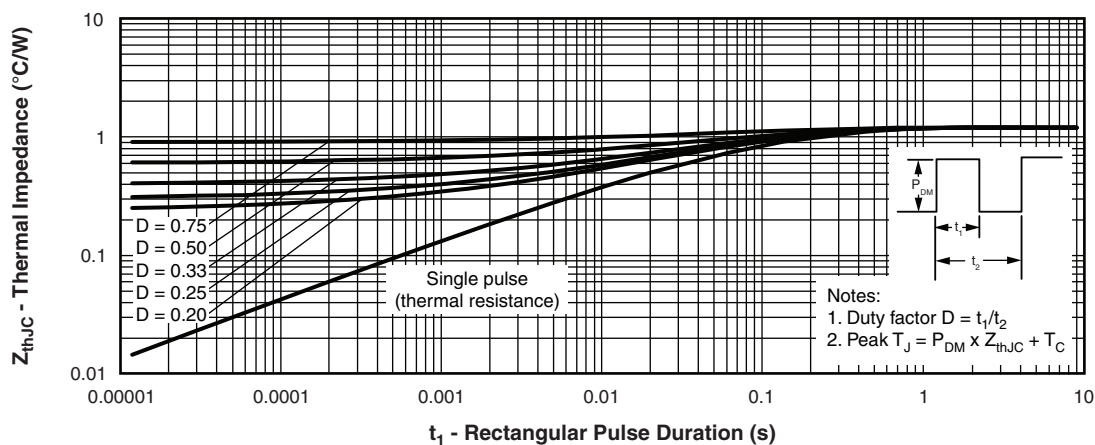


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage


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

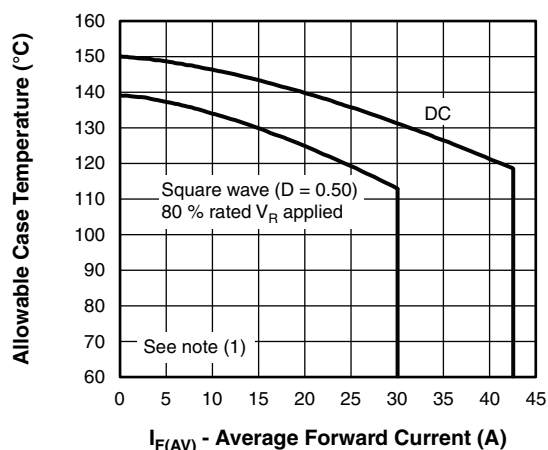


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

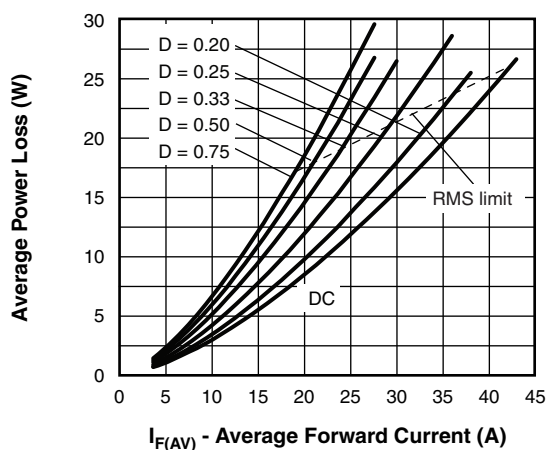


Fig. 6 - Forward Power Loss Characteristics

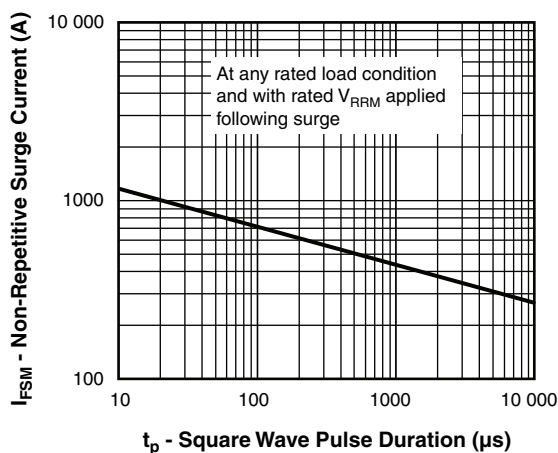


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

## 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  $V_{R1} = 80\%$  rated  $V_R$



## ORDERING INFORMATION TABLE

| Device code                                                        | VS-                                           | 60 | C | T | Q                                      | 045 | -M3 |
|--------------------------------------------------------------------|-----------------------------------------------|----|---|---|----------------------------------------|-----|-----|
|                                                                    | 1                                             | 2  | 3 | 4 | 5                                      | 6   | 7   |
| 1                                                                  | - Vishay Semiconductors product               |    |   |   |                                        |     |     |
| 2                                                                  | - Current rating (60 = 60 A)                  |    |   |   |                                        |     |     |
| 3                                                                  | - Circuit configuration<br>C = common cathode |    |   |   |                                        |     |     |
| 4                                                                  | - Package<br>T = TO-220                       |    |   |   |                                        |     |     |
| 5                                                                  | - Schottky "Q" series                         |    |   |   |                                        |     |     |
| 6                                                                  | - Voltage ratings                             |    |   |   |                                        |     |     |
| 7                                                                  | - Environmental digit                         |    |   |   |                                        |     |     |
|                                                                    |                                               |    |   |   | 035 = 35 V<br>040 = 40 V<br>045 = 45 V |     |     |
| -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free |                                               |    |   |   |                                        |     |     |

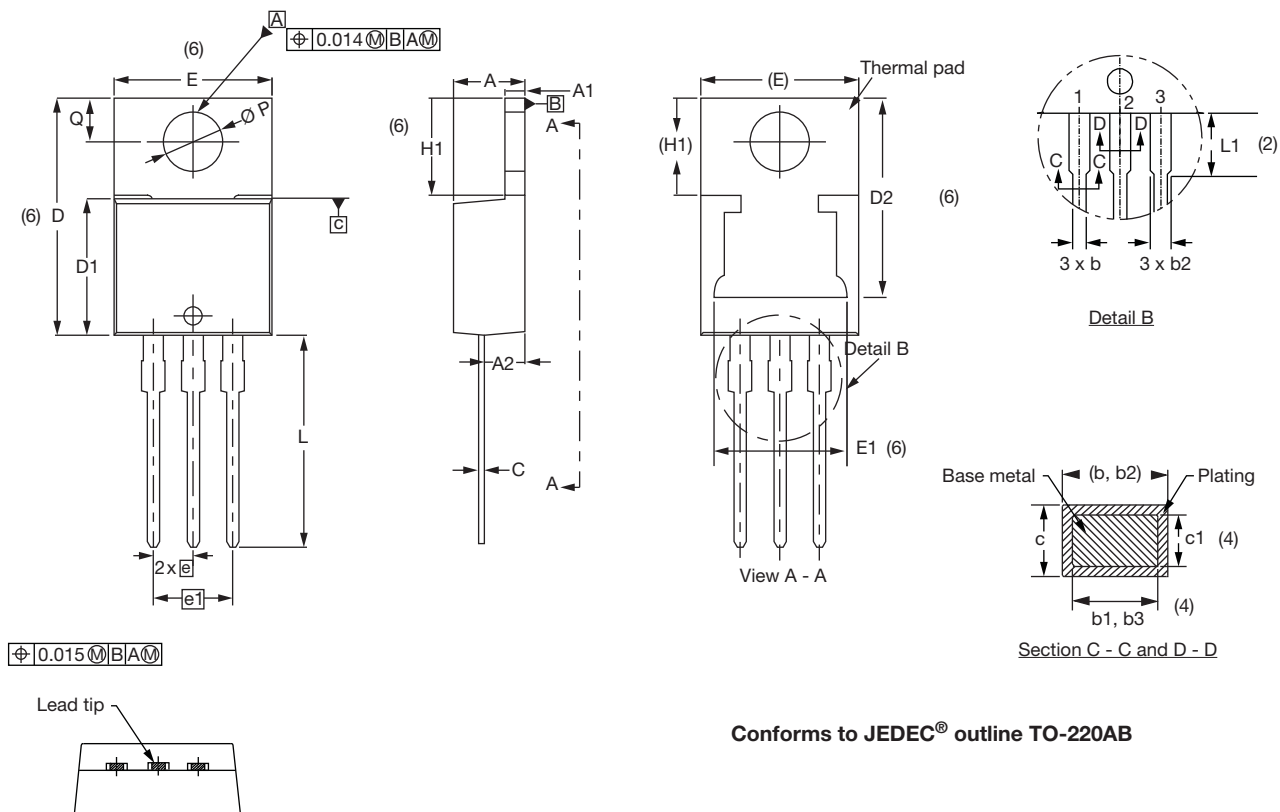
| ORDERING INFORMATION (Example) |                  |                        |                         |
|--------------------------------|------------------|------------------------|-------------------------|
| PREFERRED P/N                  | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
| VS-60CTQ035-M3                 | 50               | 1000                   | Antistatic plastic tube |
| VS-60CTQ040-M3                 | 50               | 1000                   | Antistatic plastic tube |
| VS-60CTQ045-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 |
|--------|-------------|-------|--------|-------|-------|
|        | 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 |       |
| 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

- Dimensioning and tolerancing as per ASME Y14.5M-1994
- Lead dimension and finish uncontrolled in L1
- 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
- Dimension b1, b3, and c1 apply to base metal only
- Controlling dimensions: inches
- Thermal pad contour optional within dimensions E, H1, D2, and E1
- Outline conforms to JEDEC® TO-220, except D2



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