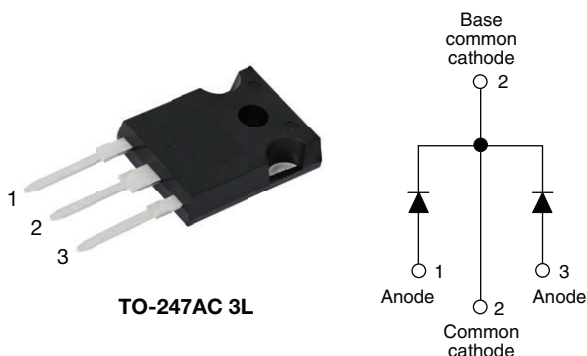


# High Performance Schottky Rectifier, 2 x 20 A


**TO-247AC 3L**

## FEATURES

- 150 °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
- 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 20 A         |
| $V_R$                 | 35 V, 40 V, 45 V |
| $V_F$ at $I_F$        | 0.43 V           |
| $I_{RM}$ typ.         | 150 mA at 125 °C |
| $T_J$ max.            | 150 °C           |
| $E_{AS}$              | 27 mJ            |
| Package               | TO-247AC 3L      |
| Circuit configuration | Common cathode   |

## DESCRIPTION

The VS-40CPQ... 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 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                          | 40          | A     |
| $V_{RRM}$   |                                               | 35 to 45    | V     |
| $I_{FSM}$   | $t_p = 5 \mu s$ sine                          | 3500        | A     |
| $V_F$       | 20 A <sub>pk</sub> , $T_J = 125$ °C (per leg) | 0.43        | V     |
| $T_J$       |                                               | -55 to +150 | °C    |

## VOLTAGE RATINGS

| PARAMETER                            | SYMBOL    | VS-40CPQ035-N3 | VS-40CPQ040-N3 | VS-40CPQ045-N3 | 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<br>See fig. 5                                | $I_{F(AV)}$ | 50 % duty cycle at $T_C = 120$ °C, rectangular waveform                                                             | 40     | A     |
| Maximum peak one cycle non-repetitive<br>surge current per leg<br>See fig. 7 | $I_{FSM}$   | 5 $\mu s$ sine or 3 $\mu s$ rect. pulse                                                                             | 3500   |       |
|                                                                              |             | 10 ms sine or 6 ms rect. pulse                                                                                      | 430    |       |
| Non-repetitive avalanche energy per leg                                      | $E_{AS}$    | $T_J = 25$ °C, $I_{AS} = 4$ A, $L = 3.4$ mH                                                                         | 27     | 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 | 4      | A     |

**ELECTRICAL SPECIFICATIONS**

| PARAMETER                                          | SYMBOL         | TEST CONDITIONS                                                                           |                                     | VALUES | UNITS            |
|----------------------------------------------------|----------------|-------------------------------------------------------------------------------------------|-------------------------------------|--------|------------------|
| Maximum forward voltage drop per leg<br>See fig. 1 | $V_{FM}^{(1)}$ | 20 A                                                                                      | $T_J = 25\text{ }^{\circ}\text{C}$  | 0.49   | V                |
|                                                    |                | 40 A                                                                                      |                                     | 0.59   |                  |
|                                                    |                | 20 A                                                                                      | $T_J = 125\text{ }^{\circ}\text{C}$ | 0.43   |                  |
|                                                    |                | 40 A                                                                                      |                                     | 0.56   |                  |
| Maximum reverse leakage current per leg            | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                                        | $V_R = \text{Rated } V_R$           | 4      | mA               |
|                                                    |                | $T_J = 125\text{ }^{\circ}\text{C}$                                                       |                                     | 200    |                  |
| Typical reverse leakage current per leg            | $I_{RM}^{(1)}$ | $T_J = 125\text{ }^{\circ}\text{C}$                                                       | $V_R = \text{Rated } V_R$           | 150    | mA               |
| Maximum junction capacitance per leg               | $C_T$          | $V_R = 5\text{ }V_{DC}$ (test signal range 100 kHz to 1 MHz) $25\text{ }^{\circ}\text{C}$ |                                     | 1850   | pF               |
| Typical series inductance per leg                  | $L_S$          | Measured lead to lead 5 mm from package body                                              |                                     | 7.5    | 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 %**THERMAL - MECHANICAL SPECIFICATIONS**

| THERMAL MECHANICAL CHARACTERISTICS                       |                                   |                                      |            |                        |
|----------------------------------------------------------|-----------------------------------|--------------------------------------|------------|------------------------|
| PARAMETER                                                | SYMBOL                            | TEST CONDITIONS                      | VALUES     | UNITS                  |
| Maximum junction and storage temperature range           | T <sub>J</sub> , T <sub>Stg</sub> |                                      | -55 to 150 | °C                     |
| Maximum thermal resistance, junction to case per leg     | R <sub>thJC</sub>                 | DC operation<br>See fig. 4           | 1.25       | °C/W                   |
| Maximum thermal resistance, junction to case per package |                                   | DC operation                         | 0.63       |                        |
| Typical thermal resistance, case to heatsink             | R <sub>thCS</sub>                 | Mounting surface, smooth and greased | 0.24       |                        |
| Approximate weight                                       |                                   |                                      | 6          | g                      |
|                                                          |                                   |                                      | 0.21       | oz.                    |
| Mounting torque                                          | minimum                           | Non-lubricated threads               | 6 (5)      | kgf · cm<br>(lbf · in) |
|                                                          | maximum                           |                                      | 12 (10)    |                        |
| Marking device                                           |                                   | Case style TO-247AC 3L               | 40CPQ035   |                        |
|                                                          |                                   |                                      | 40CPQ040   |                        |
|                                                          |                                   |                                      | 40CPQ045   |                        |

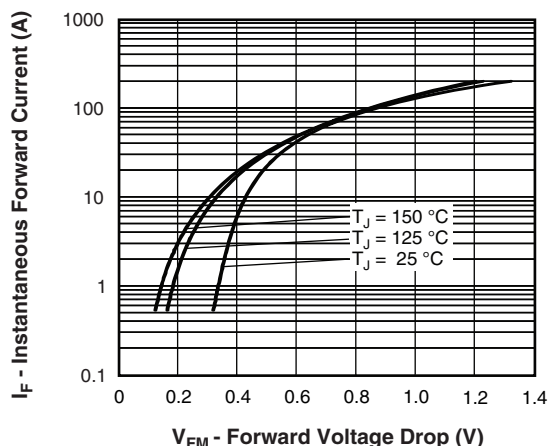


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

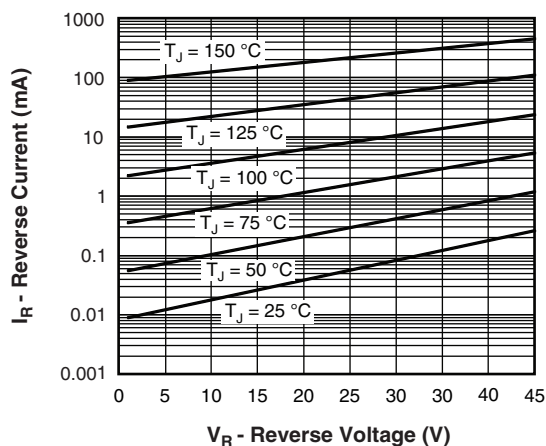


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

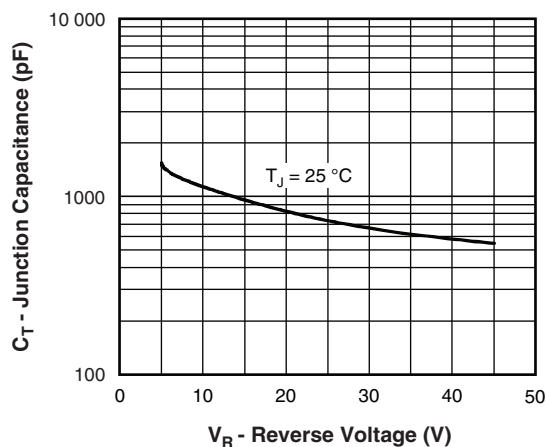


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

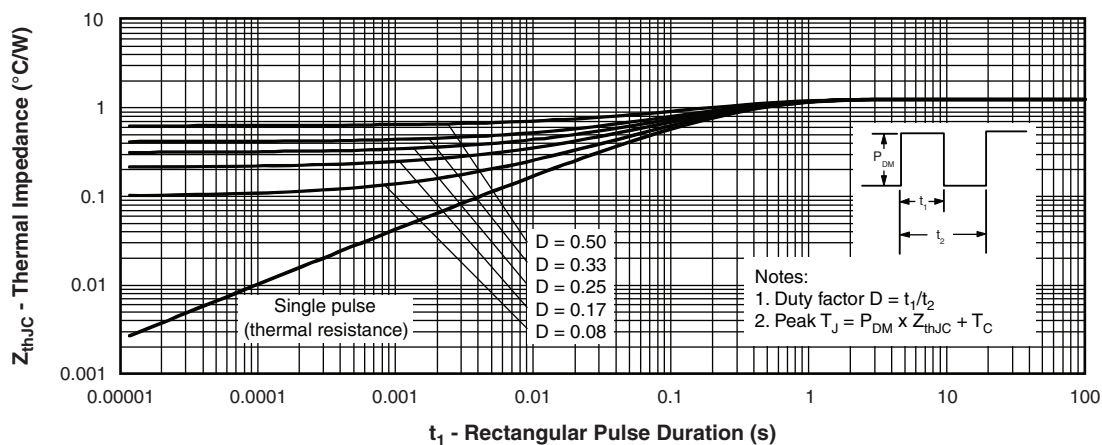


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

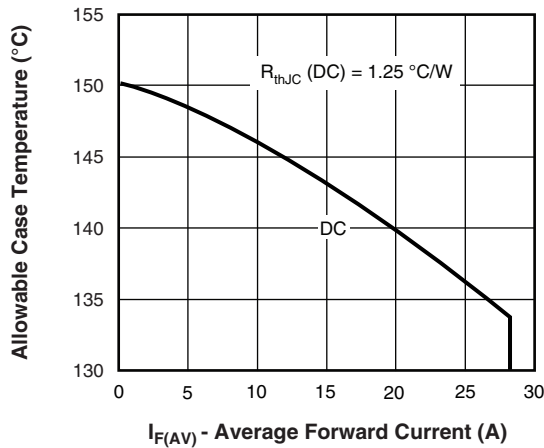


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

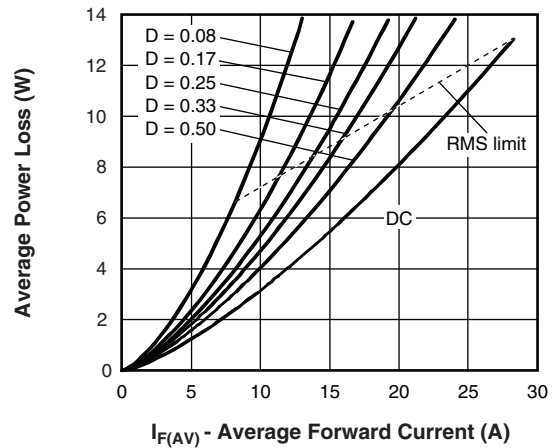


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

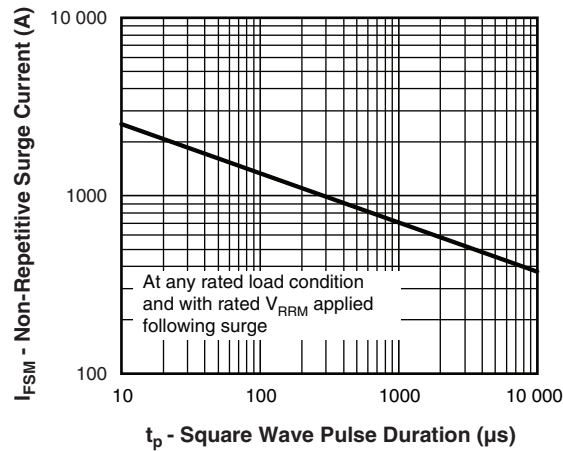


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

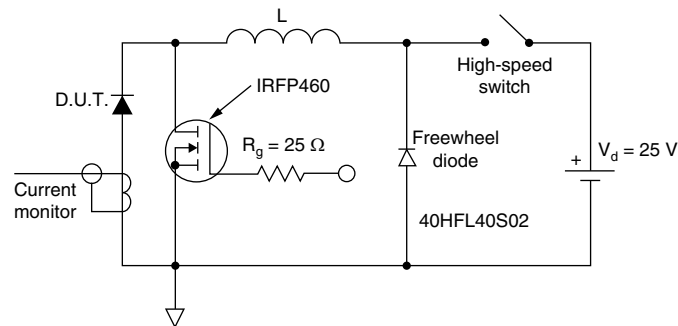


Fig. 8 - Unclamped Inductive Test Circuit



## ORDERING INFORMATION TABLE

|             |     |    |   |   |   |     |     |
|-------------|-----|----|---|---|---|-----|-----|
| Device code | VS- | 40 | C | P | Q | 045 | -N3 |
|             | 1   | 2  | 3 | 4 | 5 | 6   | 7   |

- |          |   |                                              |            |
|----------|---|----------------------------------------------|------------|
| <b>1</b> | - | Vishay Semiconductors product                |            |
| <b>2</b> | - | Current rating (40 = 40 A)                   |            |
| <b>3</b> | - | Circuit configuration:<br>C = common cathode |            |
| <b>4</b> | - | Package:<br>P = TO-247                       |            |
| <b>5</b> | - | Schottky "Q" series                          | 035 = 35 V |
| <b>6</b> | - | Voltage code                                 | 040 = 40 V |
| <b>7</b> | - | Environmental digit                          | 045 = 45 V |
- 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-40CPQ035-N3                 | 25               | 500                    | Antistatic plastic tube |
| VS-40CPQ040-N3                 | 25               | 500                    | Antistatic plastic tube |
| VS-40CPQ045-N3                 | 25               | 500                    | Antistatic plastic tube |

| LINKS TO RELATED DOCUMENTS |                                                                        |
|----------------------------|------------------------------------------------------------------------|
| Dimensions                 | <a href="http://www.vishay.com/doc?93138">www.vishay.com/doc?93138</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95007">www.vishay.com/doc?95007</a> |



## TO-247AC 3L

DIMENSIONS in millimeters and inches



| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| A      | 4.65        | 5.31  | 0.183  | 0.209 |       |
| A1     | 2.21        | 2.59  | 0.087  | 0.102 |       |
| A2     | 1.17        | 1.37  | 0.046  | 0.054 |       |
| b      | 0.99        | 1.40  | 0.039  | 0.055 |       |
| b1     | 0.99        | 1.35  | 0.039  | 0.053 |       |
| b2     | 1.65        | 2.39  | 0.065  | 0.094 |       |
| b3     | 1.65        | 2.34  | 0.065  | 0.092 |       |
| b4     | 2.59        | 3.43  | 0.102  | 0.135 |       |
| b5     | 2.59        | 3.38  | 0.102  | 0.133 |       |
| c      | 0.38        | 0.89  | 0.015  | 0.035 |       |
| c1     | 0.38        | 0.84  | 0.015  | 0.033 |       |
| D      | 19.71       | 20.70 | 0.776  | 0.815 | 3     |
| D1     | 13.08       | -     | 0.515  | -     | 4     |

| SYMBOL    | MILLIMETERS |       | INCHES    |       | NOTES |
|-----------|-------------|-------|-----------|-------|-------|
|           | MIN.        | MAX.  | MIN.      | MAX.  |       |
| D2        | 0.51        | 1.35  | 0.020     | 0.053 |       |
| E         | 15.29       | 15.87 | 0.602     | 0.625 | 3     |
| E1        | 13.46       | -     | 0.53      | -     |       |
| e         | 5.46 BSC    |       | 0.215 BSC |       |       |
| $\phi K$  | 0.254       |       | 0.010     |       |       |
| L         | 14.20       | 16.10 | 0.559     | 0.634 |       |
| L1        | 3.71        | 4.29  | 0.146     | 0.169 |       |
| $\phi P$  | 3.56        | 3.66  | 0.14      | 0.144 |       |
| $\phi P1$ | -           | 7.39  | -         | 0.291 |       |
| Q         | 5.31        | 5.69  | 0.209     | 0.224 |       |
| R         | 4.52        | 5.49  | 0.178     | 0.216 |       |
| S         | 5.51 BSC    |       | 0.217 BSC |       |       |

## Notes

- (1) Dimensioning and tolerancing per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D 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) Thermal pad contour optional with dimensions D1 and E1
- (5) Lead finish uncontrolled in L1
- (6)  $\phi P$  to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- (7) Outline conforms to JEDEC® outline TO-247 with exception of dimension Q



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