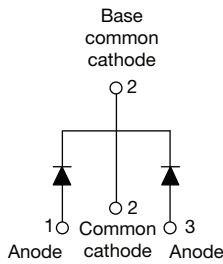
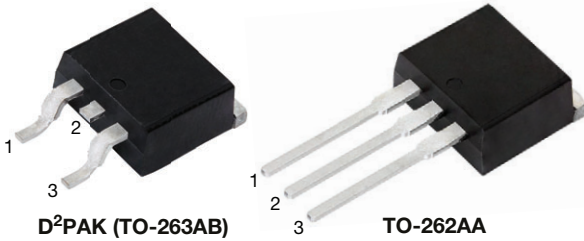
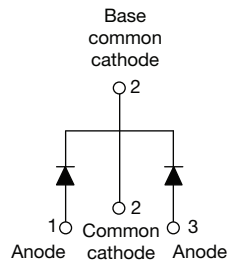


## High Performance Schottky Rectifier, 2 x 20 A


**VS-40CTQ045S-M3**

**VS-40CTQ045-1-M3**

### FEATURES

- 150 °C  $T_J$  operation
- Center tap configuration
- 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
- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- 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 150 °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                                |
| $V_R$                 | 45 V                                    |
| $V_F$ at $I_F$        | 0.48 V                                  |
| $I_{RM}$ typ.         | 115 mA at 125 °C                        |
| $T_J$ max.            | 150 °C                                  |
| $E_{AS}$              | 20 mJ                                   |
| Package               | D <sup>2</sup> PAK (TO-263AB), TO-262AA |
| Circuit configuration | Common cathode                          |

### MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL      | CHARACTERISTICS                               | VALUES      | UNITS |
|-------------|---|-------------|-------|
| $I_{F(AV)}$ | Rectangular waveform                          | 40          | A     |
| $V_{RRM}$   |   | 45          | V     |
| $I_{FSM}$   | $t_p = 5 \mu s$ sine                          | 1240        | A     |
| $V_F$       | 20 A <sub>pk</sub> , $T_J = 125$ °C (per leg) | 0.48        | V     |
| $T_J$       | Range   | -55 to +150 | °C    |

### VOLTAGE RATINGS

| PARAMETER                            | SYMBOL    | VS-40CTQ045S-M3<br>VS-40CTQ045-1-M3 | UNITS |
|--------------------------------------|-----------|-------------------------------------|-------|
| Maximum DC reverse voltage           | $V_R$     | 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                             | per leg<br>$I_{F(AV)}$<br>per device | 50 % duty cycle at $T_C = 116\text{ }^\circ\text{C}$ , rectangular waveform   | 20     | A     |
|   |                                      |   | 40     |       |
| Maximum peak one cycle non-repetitive surge current per leg<br>See fig. 7 | $I_{FSM}$                            | 5 $\mu\text{s}$ sine or 3 $\mu\text{s}$ rect. pulse   | 1240   |       |
|   |                                      | 10 ms sine or 6 ms rect. pulse  | 350    |       |
| Non-repetitive avalanche energy per leg                                   | $E_{AS}$                             | $T_J = 25\text{ }^\circ\text{C}$ , $I_{AS} = 3\text{ A}$ , $L = 4.40\text{ mH}$   | 20     | mJ    |
| Repetitive avalanche current per leg                                      | $I_{AR}$                             | Current decaying linearly to zero in 1 $\mu\text{s}$<br>Frequency limited by $T_J$ maximum $V_A = 1.5 \times V_R$ typical | 3      | A     |

**ELECTRICAL SPECIFICATIONS**

| PARAMETER  | SYMBOL         | TEST CONDITIONS  | VALUES                            | UNITS            |
|--|----------------|--|-----------------------------------|------------------|
| Maximum forward voltage drop per leg<br>See fig. 1 | $V_{FM}^{(1)}$ | $T_J = 25\text{ }^\circ\text{C}$   | 20 A                              | 0.53             |
|  |                |  | 40 A                              | 0.68             |
|  |                | $T_J = 125\text{ }^\circ\text{C}$  | 20 A                              | 0.48             |
|  |                |  | 40 A                              | 0.67             |
| Maximum reverse leakage current per leg            | $I_{RM}^{(1)}$ | $V_R = \text{Rated } V_R$  | $T_J = 25\text{ }^\circ\text{C}$  | 3                |
|  |                |  | $T_J = 125\text{ }^\circ\text{C}$ | 150              |
| Typical reverse leakage current                    | $I_{RM}^{(1)}$ | $T_J = 125\text{ }^\circ\text{C}$  | $V_R = \text{Rated } V_R$         | 115              |
| Threshold voltage                                  | $V_{F(TO)}$    | $T_J = T_J \text{ maximum}$  | 0.27                              | V                |
| Forward slope resistance                           | $r_t$          |  | 8.72                              | $\text{m}\Omega$ |
| Maximum junction capacitance per leg               | $C_T$          | $V_R = 5\text{ V}_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^\circ\text{C}$ | 2800                              | 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 %**THERMAL - MECHANICAL SPECIFICATIONS**

| PARAMETER  | SYMBOL         | TEST CONDITIONS                          | VALUES     | UNITS                  |
|--|----------------|--|------------|------------------------|
| Maximum junction and storage temperature range           | $T_J, T_{Stg}$ |  | -55 to 150 | $^\circ\text{C}$       |
| Maximum thermal resistance, junction to case per leg     | $R_{thJC}$     | DC operation                             | 2.0        | $^\circ\text{C/W}$     |
| Maximum thermal resistance, junction to case per package |                |  | 1.0        |                        |
| Typical thermal resistance, case to heatsink             | $R_{thCS}$     | 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 D <sup>2</sup> PAK (TO-263AB) | 40CTQ045S  |                        |
|  |                | Case style TO-262AA                      | 40CTQ045-1 |                        |

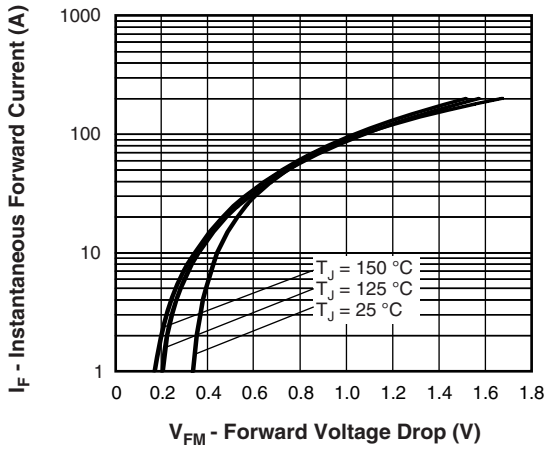


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

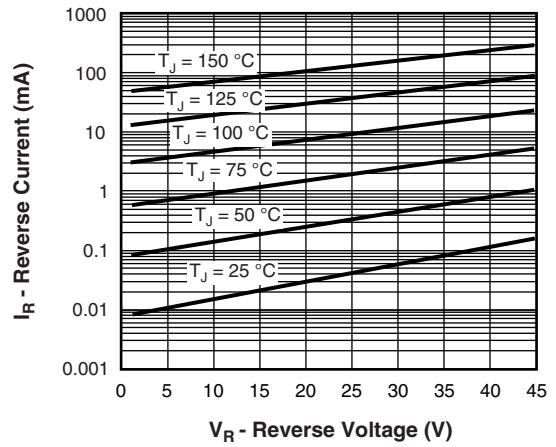


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

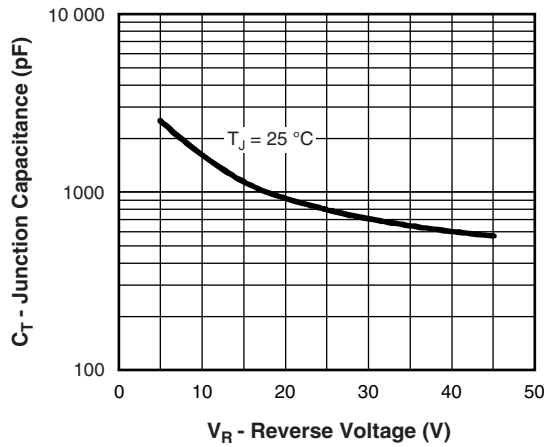


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

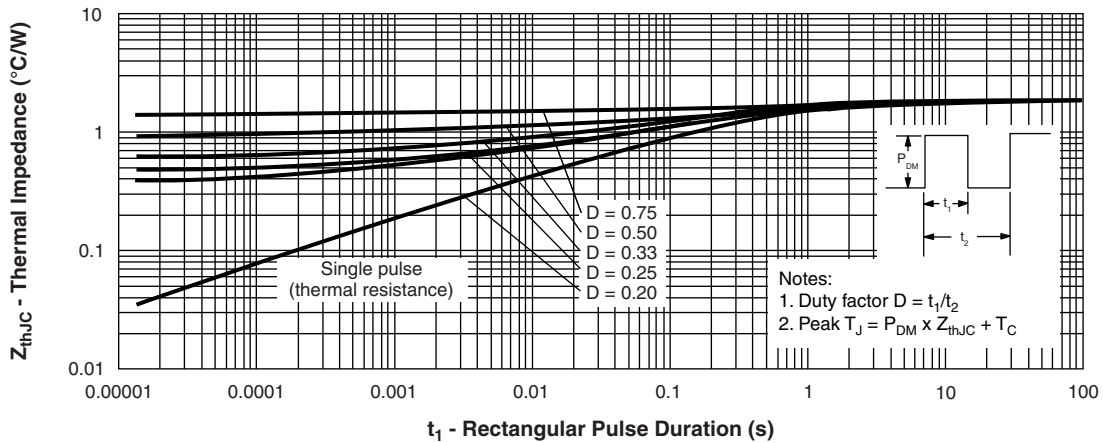


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

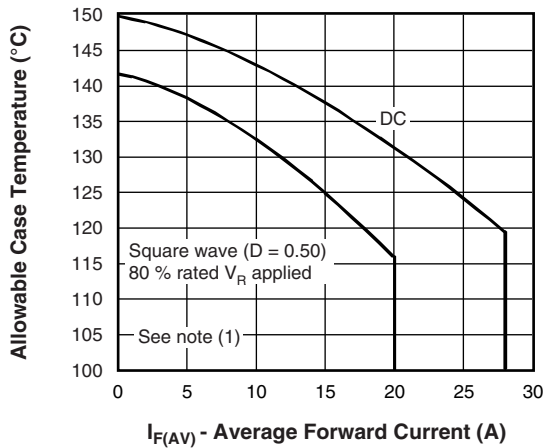


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

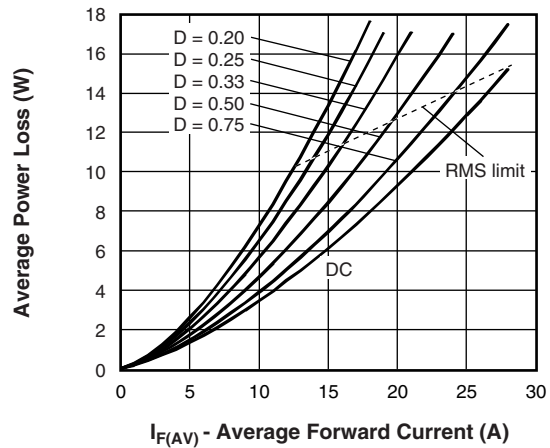


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

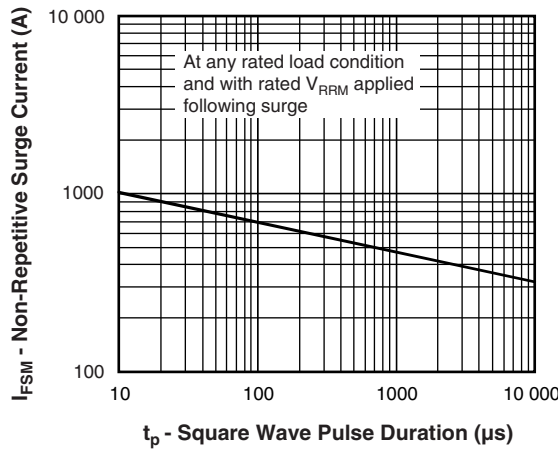


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)



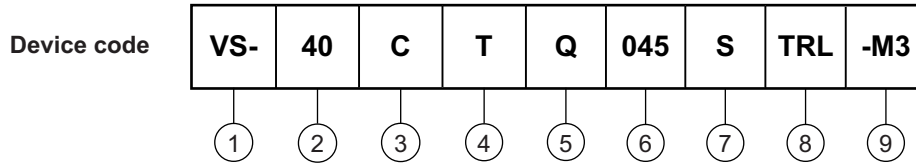
Fig. 8 - Unclamped Inductive Test Circuit

**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  $V_{R1} = 10\text{ V}$



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current rating (40 A)
- 3** - Circuit configuration: C = common cathode
- 4** - T = TO-220
- 5** - Schottky "Q" series
- 6** - Voltage rating (045 = 45 V)
- 7** -
  - S = D<sup>2</sup>PAK (TO-263AB)
  - -1 = TO-262AA
- 8** -
  - None = tube
  - TRL = tape and reel (left oriented - for D<sup>2</sup>PAK (TO-263AB) only)
  - TRR = tape and reel (right oriented - for D<sup>2</sup>PAK (TO-263AB) only)
- 9** - -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

| ORDERING INFORMATION |                  |                        |                          |
|----------------------|------------------|------------------------|--------------------------|
| PREFERRED P/N        | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION    |
| VS-40CTQ045S-M3      | 50               | 1000                   | Antistatic plastic tubes |
| VS-40CTQ045STRR-M3   | 800              | 800                    | 13" diameter reel        |
| VS-40CTQ045STRL-M3   | 800              | 800                    | 13" diameter reel        |
| VS-40CTQ045-1-M3     | 50               | 1000                   | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS |                               |  |
|----------------------------|-------------------------------|--|
| Dimensions                 | D <sup>2</sup> PAK (TO-263AB) | <a href="http://www.vishay.com/doc?96164">www.vishay.com/doc?96164</a> |
|                            | TO-262AA                      | <a href="http://www.vishay.com/doc?96165">www.vishay.com/doc?96165</a> |
| Part marking information   | D <sup>2</sup> PAK (TO-263AB) | <a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</a> |
|                            | TO-262AA                      | <a href="http://www.vishay.com/doc?95443">www.vishay.com/doc?95443</a> |
| Packaging information      |                               | <a href="http://www.vishay.com/doc?96424">www.vishay.com/doc?96424</a> |

## D<sup>2</sup>PAK

### DIMENSIONS in millimeters and inches

Conforms to JEDEC® outline D<sup>2</sup>PAK (SMD-220)



| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES | SYMBOL | MILLIMETERS |       | INCHES    |       | NOTES |
|--------|-------------|-------|--------|-------|-------|--------|-------------|-------|-----------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |        | MIN.        | MAX.  | MIN.      | MAX.  |       |
| A      | 4.06        | 4.83  | 0.160  | 0.190 |       | D1     | 6.86        | 8.00  | 0.270     | 0.315 | 3     |
| A1     | 0.00        | 0.254 | 0.000  | 0.010 |       | E      | 9.65        | 10.67 | 0.380     | 0.420 | 2, 3  |
| b      | 0.51        | 0.99  | 0.020  | 0.039 |       | E1     | 7.90        | 8.80  | 0.311     | 0.346 | 3     |
| b1     | 0.51        | 0.89  | 0.020  | 0.035 | 4     | e      | 2.54 BSC    |       | 0.100 BSC |       |       |
| b2     | 1.14        | 1.78  | 0.045  | 0.070 |       | H      | 14.61       | 15.88 | 0.575     | 0.625 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     | L      | 1.78        | 2.79  | 0.070     | 0.110 |       |
| c      | 0.38        | 0.74  | 0.015  | 0.029 |       | L1     | -           | 1.65  | -         | 0.066 | 3     |
| c1     | 0.38        | 0.58  | 0.015  | 0.023 | 4     | L2     | 1.27        | 1.78  | 0.050     | 0.070 |       |
| c2     | 1.14        | 1.65  | 0.045  | 0.065 |       | L3     | 0.25 BSC    |       | 0.010 BSC |       |       |
| D      | 8.51        | 9.65  | 0.335  | 0.380 | 2     | L4     | 4.78        | 5.28  | 0.188     | 0.208 |       |

#### Notes

- Dimensioning and tolerancing per ASME Y14.5 M-1994
- 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 outmost extremes of the plastic body
- Thermal pad contour optional within dimension E, L1, D1 and E1
- Dimension b1 and c1 apply to base metal only
- Datum A and B to be determined at datum plane H
- Controlling dimension: inch
- Outline conforms to JEDEC® outline TO-263AB





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