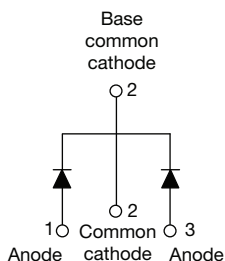
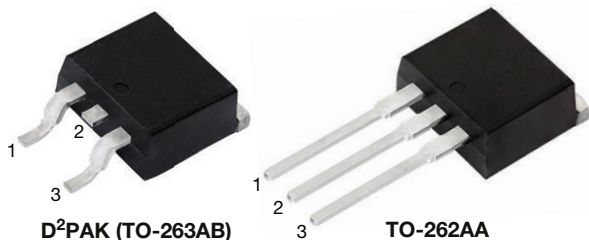
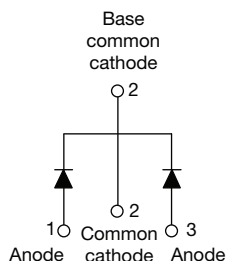


## High Performance Schottky Rectifier, 2 x 20 A


**VS-40CTQ150S-M3**

**VS-40CTQ150-1-M3**

### FEATURES

- Very low forward voltage drop
- 175 °C  $T_J$  operation
- Center tap TO-220 package
- 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

The VS-40CTQ... 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 175 °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                                |
| $V_R$                 | 150 V                                   |
| $V_F$ at $I_F$        | 0.71 V                                  |
| $I_{RM}$              | 15 mA at 125 °C                         |
| $T_J$ max.            | 175 °C                                  |
| $E_{AS}$              | 1 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     |
| $V_{RRM}$   |                                               | 150         | V     |
| $I_{FSM}$   | $t_p = 5 \mu s$ sine                          | 1500        | A     |
| $V_F$       | 20 A <sub>pk</sub> , $T_J = 125$ °C (per leg) | 0.71        | V     |
| $T_J$       |                                               | -55 to +175 | °C    |

### VOLTAGE RATINGS

| PARAMETER                            | SYMBOL    | VS-40CTQ150S-M3<br>VS-40CTQ150-1-M3 | UNITS |
|--------------------------------------|-----------|-------------------------------------|-------|
| Maximum DC reverse voltage           | $V_R$     | 150                                 | 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 $T_C = 140\text{ }^{\circ}\text{C}$ , rectangular waveform                                                | 20<br>40 | A     |
| Maximum peak one cycle non-repetitive surge current per leg, see fig. 7 | $I_{FSM}$   | 5 $\mu\text{s}$ sine or 3 $\mu\text{s}$ rect. pulse                                                                          | 1500     |       |
|                                                                         |             | 10 ms sine or 6 ms rect. pulse                                                                                               | 250      |       |
| Non-repetitive avalanche energy per leg                                 | $E_{AS}$    | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_{AS} = 1.5\text{ A}$ , $L = 0.9\text{ mH}$                                           | 1.0      | 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 $V_A = 1.5 \times V_R$<br>typical | 1.5      | A     |

**ELECTRICAL SPECIFICATIONS**

| PARAMETER                                             | SYMBOL         | TEST CONDITIONS                                                                            | VALUES | UNITS            |
|-------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------|--------|------------------|
| Maximum forward voltage drop per leg<br>See fig. 1    | $V_{FM}^{(1)}$ | 20 A                                                                                       | 0.93   | V                |
|                                                       |                | 40 A                                                                                       | 1.16   |                  |
|                                                       |                | 20 A                                                                                       | 0.71   |                  |
|                                                       |                | 40 A                                                                                       | 0.85   |                  |
| Maximum reverse leakage current per leg<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                                         | 50     | $\mu\text{A}$    |
|                                                       |                | $T_J = 125\text{ }^{\circ}\text{C}$                                                        | 15     | mA               |
| Maximum junction capacitance per leg                  | $C_T$          | $V_R = 5\text{ V}_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^{\circ}\text{C}$ | 450    | 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 <sub>J</sub> , T <sub>Stg</sub> |                                          | -55 to +175 | °C                     |
| Maximum thermal resistance, junction to case per leg     | R <sub>thJC</sub>                 | DC operation<br>See fig. 4               | 1.5         | °C/W                   |
| Maximum thermal resistance, junction to case per package |                                   | DC operation                             | 0.75        |                        |
| Typical thermal resistance, case to heatsink             | R <sub>thCS</sub>                 | Mounting surface, smooth and greased     | 0.5         |                        |
| 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 D <sup>2</sup> PAK (TO-263AB) | 40CTQ150S   |                        |
|                                                          |                                   | Case style TO-262AA                      | 40CTQ150-1  |                        |

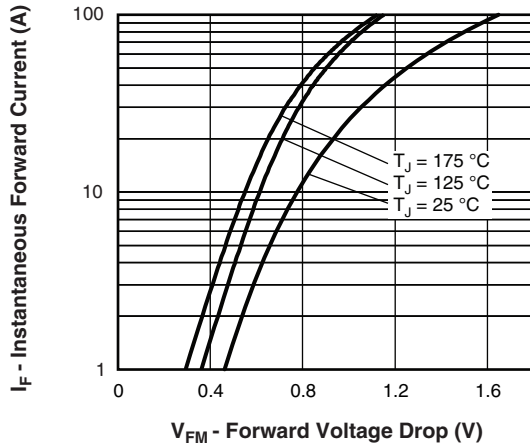


Fig. 1 - Maximum Forward Voltage Drop Characteristics

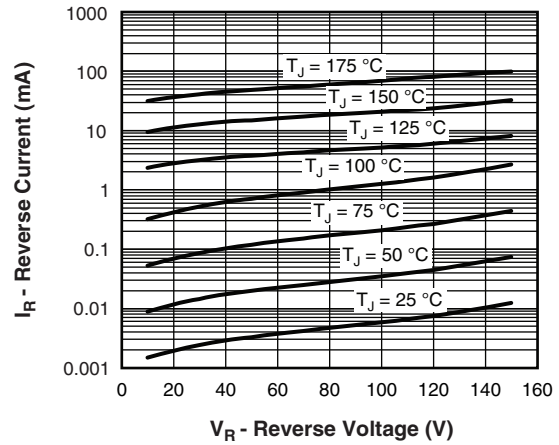


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

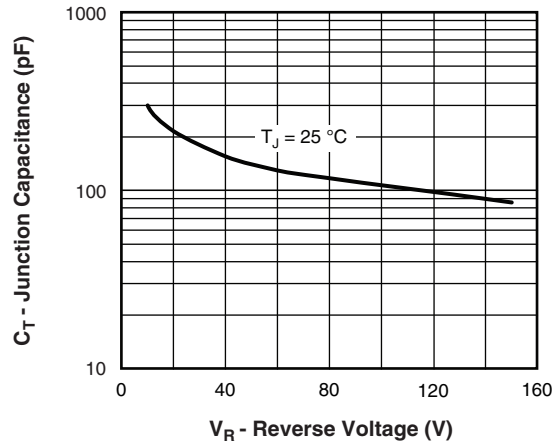
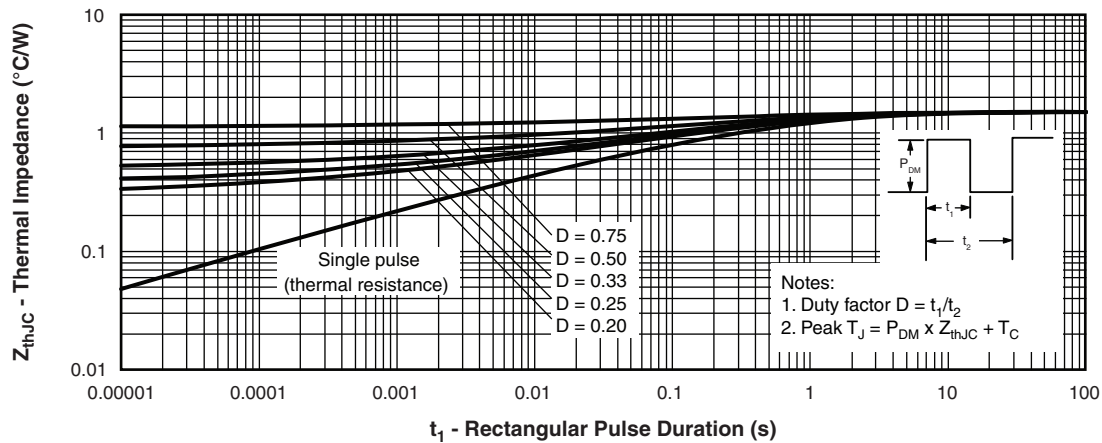


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage


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

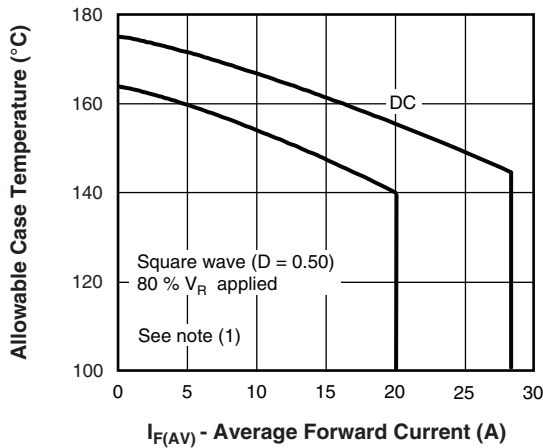


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

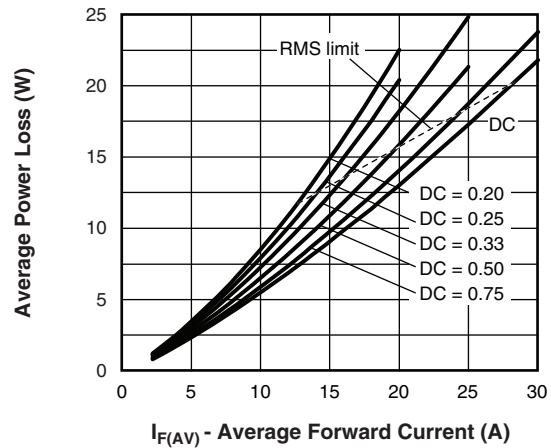


Fig. 6 - Forward Power Loss Characteristics

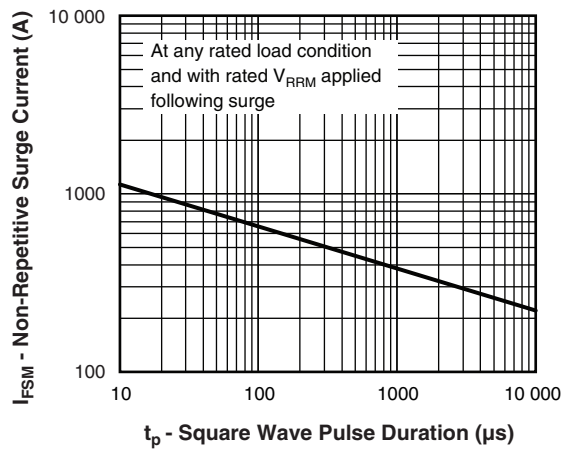


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

#### Note

- (1) Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d$  = 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  $V_{R1} = 80\% V_R$  applied



## ORDERING INFORMATION TABLE

|             |                                                                                                                                                                                                  |    |   |   |   |     |   |     |     |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|---|---|-----|---|-----|-----|
| Device code | VS-                                                                                                                                                                                              | 40 | C | T | Q | 150 | S | TRL | -M3 |
|             | 1                                                                                                                                                                                                | 2  | 3 | 4 | 5 | 6   | 7 | 8   | 9   |
| 1           | - Vishay Semiconductors product                                                                                                                                                                  |    |   |   |   |     |   |     |     |
| 2           | - Current rating (40 A)                                                                                                                                                                          |    |   |   |   |     |   |     |     |
| 3           | - Circuit configuration:<br>C = common cathode                                                                                                                                                   |    |   |   |   |     |   |     |     |
| 4           | - T = TO-220                                                                                                                                                                                     |    |   |   |   |     |   |     |     |
| 5           | - Schottky "Q" series                                                                                                                                                                            |    |   |   |   |     |   |     |     |
| 6           | - Voltage rating (150 = 150 V)                                                                                                                                                                   |    |   |   |   |     |   |     |     |
| 7           | - • S = D <sup>2</sup> PAK (TO-263AB)<br>• -1 = TO-262AA                                                                                                                                         |    |   |   |   |     |   |     |     |
| 8           | - • None = tube (50 pieces)<br>• TRL = tape and reel (left oriented - for D <sup>2</sup> PAK (TO-263AB) only)<br>• 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 (Example)

| PREFERRED P/N      | BASE QUANTITY | PACKAGING DESCRIPTION              |
|--------------------|---------------|------------------------------------|
| VS-40CTQ150S-M3    | 50            | Antistatic plastic tubes           |
| VS-40CTQ150STRL-M3 | 800           | 13" diameter plastic tape and reel |
| VS-40CTQ150STRR-M3 | 800           | 13" diameter plastic tape and reel |
| VS-40CTQ150-1-M3   | 50            | 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> |
| SPICE model              |                               | <a href="http://www.vishay.com/doc?95434">www.vishay.com/doc?95434</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 |
|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| A      | 4.06        | 4.83  | 0.160  | 0.190 |       |
| A1     | 0.00        | 0.254 | 0.000  | 0.010 |       |
| b      | 0.51        | 0.99  | 0.020  | 0.039 |       |
| b1     | 0.51        | 0.89  | 0.020  | 0.035 | 4     |
| b2     | 1.14        | 1.78  | 0.045  | 0.070 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     |
| c      | 0.38        | 0.74  | 0.015  | 0.029 |       |
| c1     | 0.38        | 0.58  | 0.015  | 0.023 | 4     |
| c2     | 1.14        | 1.65  | 0.045  | 0.065 |       |
| D      | 8.51        | 9.65  | 0.335  | 0.380 | 2     |

| SYMBOL | MILLIMETERS |       | INCHES    |       | NOTES |
|--------|-------------|-------|-----------|-------|-------|
|        | MIN.        | MAX.  | MIN.      | MAX.  |       |
| D1     | 6.86        | 8.00  | 0.270     | 0.315 | 3     |
| E      | 9.65        | 10.67 | 0.380     | 0.420 | 2, 3  |
| E1     | 7.90        | 8.80  | 0.311     | 0.346 | 3     |
| e      | 2.54 BSC    |       | 0.100 BSC |       |       |
| H      | 14.61       | 15.88 | 0.575     | 0.625 |       |
| L      | 1.78        | 2.79  | 0.070     | 0.110 |       |
| L1     | -           | 1.65  | -         | 0.066 | 3     |
| L2     | 1.27        | 1.78  | 0.050     | 0.070 |       |
| L3     | 0.25 BSC    |       | 0.010 BSC |       |       |
| 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

### TO-262

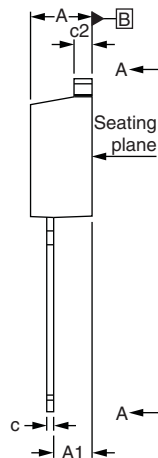
**DIMENSIONS** in millimeters and inches

Modified JEDEC® outline TO-262



#### Lead assignments

- Diodes**  
 1. - Anode (two die)/open (one die)  
 2., 4. - Cathode  
 3. - Anode



Section B - B and C - C  
Scale: None

| SYMBOL | MILLIMETERS |       | INCHES    |       | NOTES |
|--------|-------------|-------|-----------|-------|-------|
|        | MIN.        | MAX.  | MIN.      | MAX.  |       |
| A      | 4.06        | 4.83  | 0.160     | 0.190 |       |
| A1     | 2.03        | 3.02  | 0.080     | 0.119 |       |
| b      | 0.51        | 0.99  | 0.020     | 0.039 |       |
| b1     | 0.51        | 0.89  | 0.020     | 0.035 | 4     |
| b2     | 1.14        | 1.78  | 0.045     | 0.070 |       |
| b3     | 1.14        | 1.73  | 0.045     | 0.068 | 4     |
| c      | 0.38        | 0.74  | 0.015     | 0.029 |       |
| c1     | 0.38        | 0.58  | 0.015     | 0.023 | 4     |
| c2     | 1.14        | 1.65  | 0.045     | 0.065 |       |
| D      | 8.51        | 9.65  | 0.335     | 0.380 | 2     |
| D1     | 6.86        | 8.00  | 0.270     | 0.315 | 3     |
| E      | 9.65        | 10.67 | 0.380     | 0.420 | 2, 3  |
| E1     | 7.90        | 8.80  | 0.311     | 0.346 | 3     |
| e      | 2.54 BSC    |       | 0.100 BSC |       |       |
| L      | 13.46       | 14.10 | 0.530     | 0.555 |       |
| L1     | -           | 1.65  | -         | 0.065 | 3     |
| L2     | 3.36        | 3.71  | 0.132     | 0.146 |       |

#### Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) 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
- (3) Thermal pad contour optional within dimension E, L1, D1 and E1
- (4) Dimension b1 and c1 apply to base metal only
- (5) Controlling dimension: inches
- (6) Outline conform to JEDEC TO-262 except A1 (maximum), b (minimum), D1 (minimum) and L2 where dimensions derived the actual package outline



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