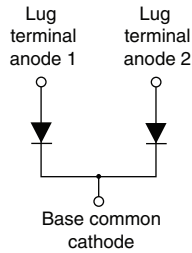


# High Performance Schottky Rectifier, 400 A


**TO-244**


## FEATURES

- 175 °C T<sub>J</sub> operation
- Center tap module
- Low forward voltage drop
- High frequency operation
- Guard ring for enhanced ruggedness and long term reliability
- UL approved file E222165 
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

## PRIMARY CHARACTERISTICS

|                       |                           |
|-----------------------|---------------------------|
| I <sub>F(AV)</sub>    | 400 A                     |
| V <sub>R</sub>        | 40 V, 45 V                |
| Package               | TO-244                    |
| Circuit configuration | Two diodes common cathode |

## DESCRIPTION / APPLICATIONS

The VS-401CNQ... center tap Schottky rectifier module series has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 175 °C junction temperature. Typical applications are in high current switching power supplies, converters, freewheeling diodes, welding and reverse battery protection.

## MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL             | CHARACTERISTICS                                         | VALUES      | UNITS |
|--------------------|---------------------------------------------------------|-------------|-------|
| I <sub>F(AV)</sub> | Rectangular waveform                                    | 400         | A     |
| V <sub>RRM</sub>   | Range                                                   | 40/45       | V     |
| I <sub>FSM</sub>   | t <sub>p</sub> = 5 μs sine                              | 25 000      | A     |
| V <sub>F</sub>     | 200 A <sub>pk</sub> , T <sub>J</sub> = 125 °C (per leg) | 0.56        | V     |
| T <sub>J</sub>     | Range                                                   | -55 to +175 | °C    |

## VOLTAGE RATINGS

| PARAMETER                            | SYMBOL           | VS-401CNQ040PbF | VS-401CNQ045PbF | UNITS |
|--------------------------------------|------------------|-----------------|-----------------|-------|
| Maximum DC reverse voltage           | V <sub>R</sub>   | 40              | 45              | V     |
| Maximum working peak reverse voltage | V <sub>RWM</sub> |                 |                 |       |

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                                            | SYMBOL             | TEST CONDITIONS                                                                                                                        |                                                                            | VALUES | UNITS |
|----------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|--------|-------|
| Maximum average forward current (fig. 5)                             | I <sub>F(AV)</sub> | 50 % duty cycle at T <sub>C</sub> = 147 °C, rectangular waveform                                                                       |                                                                            | 200    | A     |
|                                                                      |                    |                                                                                                                                        |                                                                            | 400    |       |
| Maximum peak one cycle non-repetitive surge current per leg (fig. 7) | I <sub>FSM</sub>   | 5 μs sine or 3 μs rect. pulse                                                                                                          | Following any rated load condition and with rated V <sub>RRM</sub> applied | 25 000 |       |
|                                                                      |                    | 10 ms sine or 6 ms rect. pulse                                                                                                         |                                                                            | 3450   |       |
| Non-repetitive avalanche energy per leg                              | E <sub>AS</sub>    | T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 24 A, L = 1 mH                                                                               |                                                                            | 270    | mJ    |
| Repetitive avalanche current per leg                                 | I <sub>AR</sub>    | Current decaying linearly to zero in 1 μs<br>Frequency limited by T <sub>J</sub> maximum V <sub>A</sub> = 1.5 x V <sub>R</sub> typical |                                                                            | 40     | A     |

**ELECTRICAL SPECIFICATIONS**

| PARAMETER                                             | SYMBOL         | TEST CONDITIONS                                                                           |                                    | VALUES | UNITS      |  |
|-------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------|------------------------------------|--------|------------|--|
| Maximum forward voltage drop per leg<br>See fig. 1    | $V_{FM}^{(1)}$ | 200 A                                                                                     | $T_J = 25\text{ }^{\circ}\text{C}$ | 0.67   | V          |  |
|                                                       |                | 400 A                                                                                     |                                    | 0.78   |            |  |
|                                                       |                | 200 A                                                                                     | $T_J = T_J \text{ maximum}$        | 0.56   |            |  |
|                                                       |                | 400 A                                                                                     |                                    | 0.69   |            |  |
| Maximum reverse leakage current per leg<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                                        | $V_R = \text{Rated } V_R$          | 20     | mA         |  |
|                                                       |                | $T_J = 125\text{ }^{\circ}\text{C}$                                                       |                                    | 180    |            |  |
| Maximum junction capacitance per leg                  | $C_T$          | $V_R = 5\text{ }V_{DC}$ (test signal range 100 kHz to 1 MHz) $25\text{ }^{\circ}\text{C}$ |                                    | 10 300 | pF         |  |
| Typical series inductance per leg                     | $L_S$          | From top of terminal hole to mounting plane                                               |                                    | 5.0    | 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         | MIN.     | TYP. | MAX.     | UNITS                |
|-------------------------------------------------|----------------|----------|------|----------|----------------------|
| Maximum junction and storage temperature range  | $T_J, T_{Stg}$ | -55      | -    | 175      | $^{\circ}\text{C}$   |
| Thermal resistance, junction to case per leg    | $R_{thJC}$     | -        | -    | 0.19     | $^{\circ}\text{C/W}$ |
| Thermal resistance, junction to case per module |                | -        | -    | 0.095    |                      |
| Thermal resistance, case to heatsink            | $R_{thCS}$     | -        | 0.10 | -        |                      |
| Weight                                          |                | -        | 68   | -        | g                    |
|                                                 |                | -        | 2.4  | -        | oz.                  |
| Mounting torque                                 |                | 35.4 (4) |      | 53.1 (6) | lbf · in<br>(N · m)  |
| Mounting torque center hole                     |                | 30 (3.4) |      | 40 (4.6) |                      |
| Terminal torque                                 |                | 30 (3.4) | -    | 44.2 (5) |                      |
| Vertical pull                                   |                | -        | -    | 80       | lbf · in             |
| 2" lever pull                                   |                | -        | -    | 35       |                      |

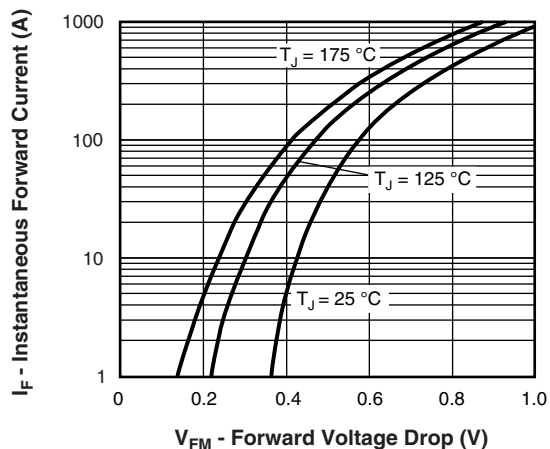


Fig. 1 - Maximum Forward Voltage Drop Characteristics

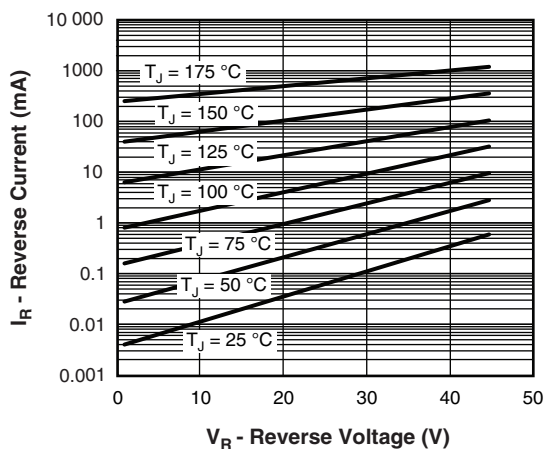


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

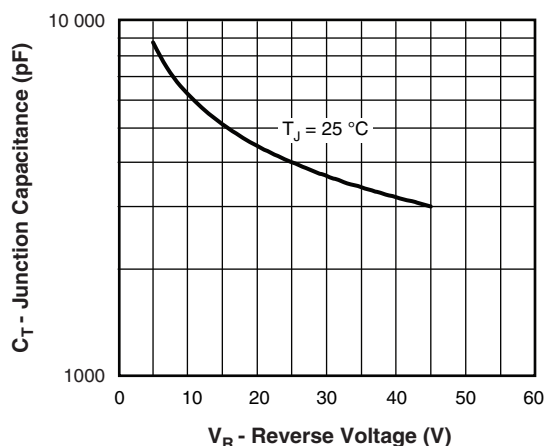


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

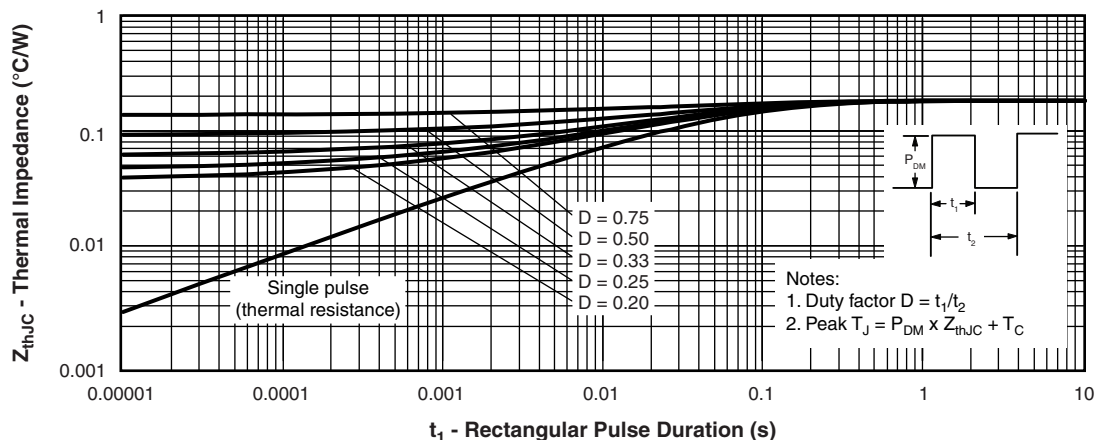
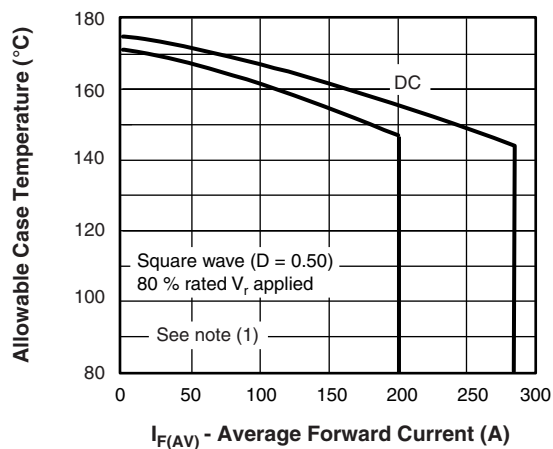

Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)


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

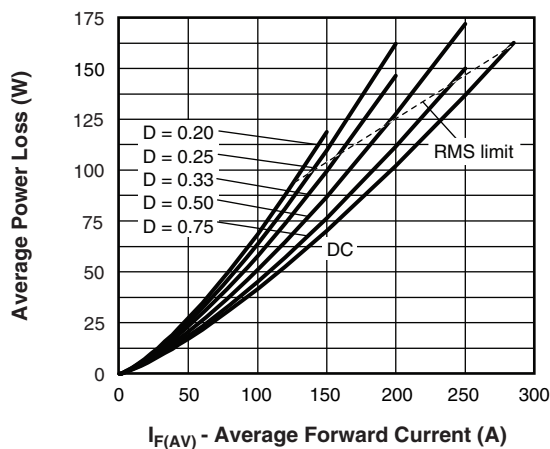


Fig. 6 - Forward Power Loss Characteristics

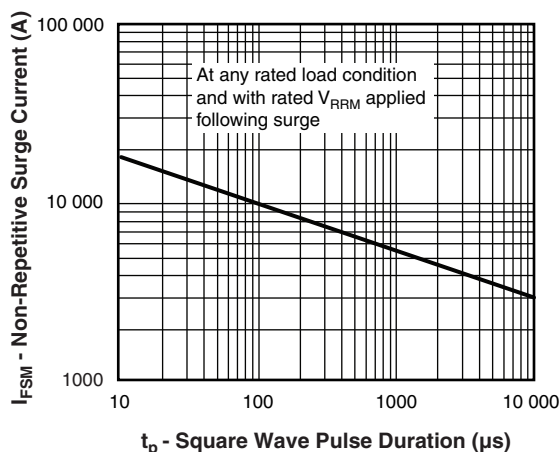


Fig. 7 - Maximum Non-Repertive Surge Current

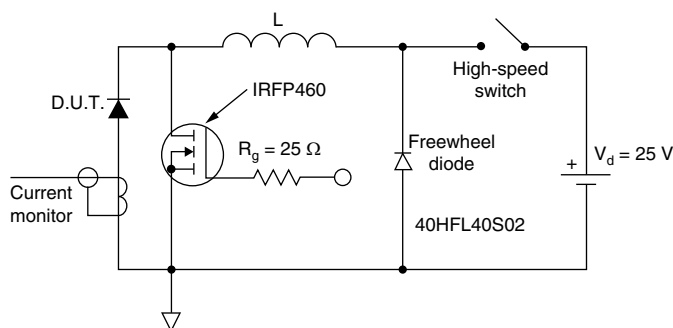


Fig. 8 - Unclamped Inductive Test Circuit

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

**ORDERING INFORMATION TABLE**

| Device code | VS- | 40 | 1 | C | N | Q | 045 | PbF |
|-------------|-----|----|---|---|---|---|-----|-----|
|             | 1   | 2  | 3 | 4 | 5 | 6 | 7   | 8   |

- 1** - Vishay Semiconductors product
- 2** - Average current rating (x 10)
- 3** - Product silicon identification
- 4** - C = circuit configuration
- 5** - N = not isolated
- 6** - Q = Schottky rectifier diode
- 7** - Voltage ratings
- 8** - Lead (Pb)-free

040 = 40 V  
045 = 45 V

**LINKS TO RELATED DOCUMENTS**

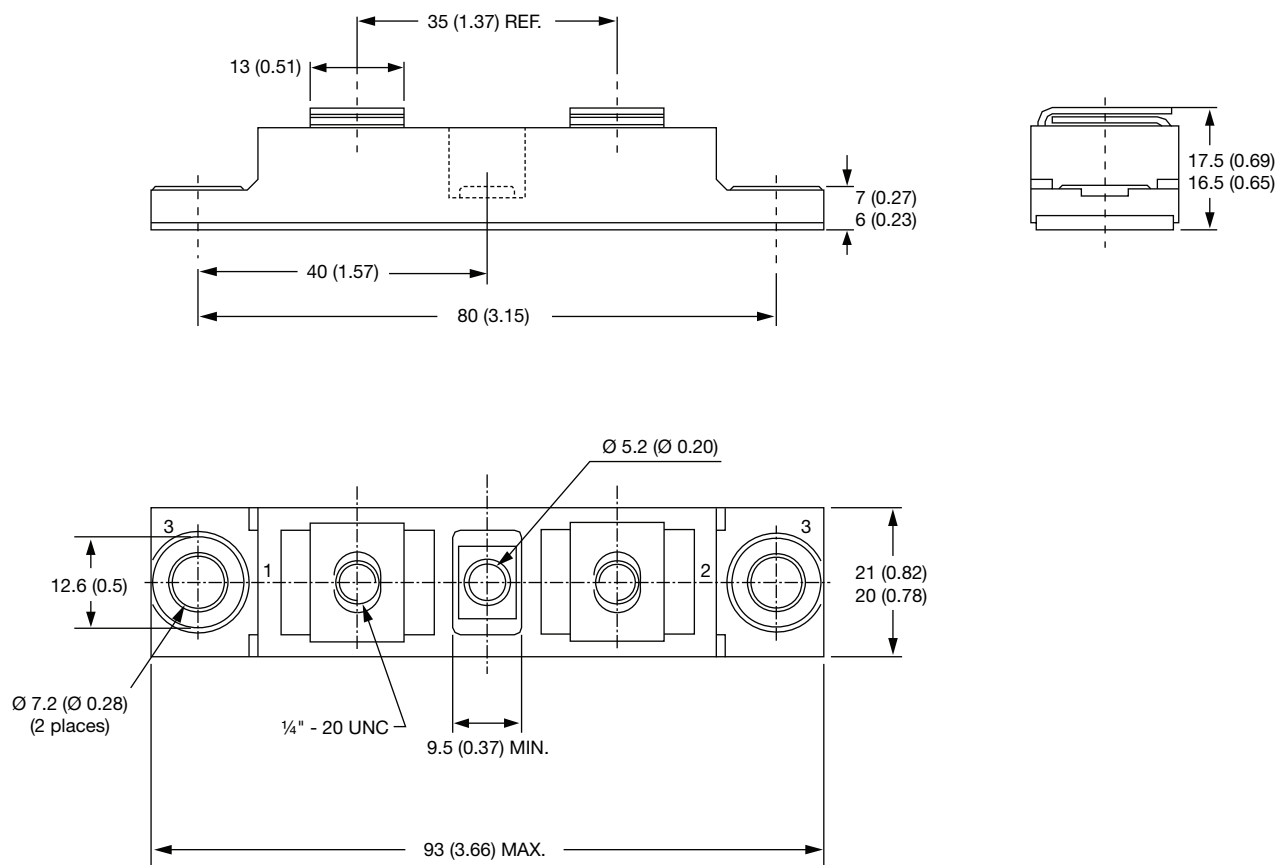
Dimensions

[www.vishay.com/doc?95021](http://www.vishay.com/doc?95021)



## TO-244

**DIMENSIONS** in millimeters (inches)





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