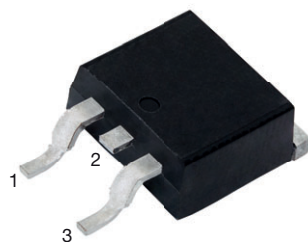
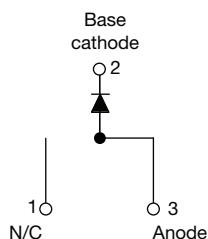


# High Performance Schottky Rectifier, 20 A


**D<sup>2</sup>PAK (TO-263AB)**


## FEATURES

- 125 °C T<sub>J</sub> operation (V<sub>R</sub> < 5 V)
- Single diode configuration
- Optimized for OR-ing applications
- Ultralow forward voltage drop
- Guard ring for enhanced ruggedness and long term reliability
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- 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 Schottky rectifier module has been optimized for ultra low forward voltage drop specifically for the OR-ing of parallel power supplies. The proprietary barrier technology allows for reliable operation up to 125 °C junction temperature. Typical applications are in parallel switching power supplies, converters, reverse battery protection, and redundant power subsystems.

## PRIMARY CHARACTERISTICS

|                                  |                               |
|----------------------------------|-------------------------------|
| I <sub>F(AV)</sub>               | 20 A                          |
| V <sub>R</sub>                   | 15 V                          |
| V <sub>F</sub> at I <sub>F</sub> | 0.33 V                        |
| I <sub>RM</sub> max.             | 600 mA at 100 °C              |
| T <sub>J</sub> max.              | 125 °C                        |
| E <sub>AS</sub>                  | 10 mJ                         |
| Package                          | D <sup>2</sup> PAK (TO-263AB) |
| Circuit configuration            | Single                        |

## MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL             | CHARACTERISTICS                                        | VALUES      | UNITS |
|--------------------|--------------------------------------------------------|-------------|-------|
| I <sub>F(AV)</sub> | Rectangular waveform                                   | 20          | A     |
| V <sub>RRM</sub>   |                                                        | 15          | V     |
| I <sub>FSM</sub>   | t <sub>p</sub> = 5 μs sine                             | 700         | A     |
| V <sub>F</sub>     | 19 A <sub>pk</sub> , T <sub>J</sub> = 125 °C (typical) | 0.25        | V     |
| T <sub>J</sub>     | Range                                                  | -55 to +125 | °C    |

## VOLTAGE RATINGS

| PARAMETER                            | SYMBOL           | TEST CONDITIONS         | VS-20L15TS-M3 | UNITS |
|--------------------------------------|------------------|-------------------------|---------------|-------|
| Maximum DC reverse voltage           | V <sub>R</sub>   | T <sub>J</sub> = 100 °C | 15            | V     |
| Maximum working peak reverse voltage | V <sub>RWM</sub> |                         |               |       |

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                                         | SYMBOL             | TEST CONDITIONS                                                                                                                        | VALUES | UNITS |
|-------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------|-------|
| Maximum average forward current<br>See fig. 5                     | I <sub>F(AV)</sub> | 50 % duty cycle at T <sub>C</sub> = 85 °C, rectangular waveform                                                                        | 20     | A     |
| Maximum peak one cycle non-repetitive surge current<br>See fig. 7 | I <sub>FSM</sub>   | 5 μs sine or 3 μs rect. pulse                                                                                                          | 700    |       |
|                                                                   |                    | 10 ms sine or 6 ms rect. pulse                                                                                                         | 330    |       |
| Non-repetitive avalanche energy                                   | E <sub>AS</sub>    | T <sub>J</sub> = 25 °C, I <sub>AS</sub> = 2 A, L = 6 mH                                                                                | 10     | mJ    |
| Repetitive avalanche current                                      | 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 | 2      | A     |

**ELECTRICAL SPECIFICATIONS**

| PARAMETER                             | SYMBOL         | TEST CONDITIONS                                                                              | TYP.   | MAX. | UNITS            |
|---------------------------------------|----------------|----------------------------------------------------------------------------------------------|--------|------|------------------|
| Forward voltage drop<br>See fig. 1    | $V_{FM}^{(1)}$ | 19 A                                                                                         | -      | 0.41 | V                |
|                                       |                | 40 A                                                                                         |        | 0.52 |                  |
|                                       |                | 19 A                                                                                         | 0.25   | 0.33 |                  |
|                                       |                | 40 A                                                                                         |        | 0.50 |                  |
| Reverse leakage current<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                                           | -      | 10   | mA               |
|                                       |                | $T_J = 100\text{ }^{\circ}\text{C}$                                                          | -      | 600  |                  |
| Threshold voltage                     | $V_{F(To)}$    | $T_J = T_J \text{ maximum}$                                                                  | 0.182  |      | V                |
| Forward slope resistance              | $r_t$          |                                                                                              | 7.6    |      | m $\Omega$       |
| 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 lead to lead 5 mm from package body                                                 | 8      | -    | 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 temperature range              | T <sub>J</sub>    |                                                      | -55 to +125 | °C                     |
| Maximum storage temperature range               | T <sub>Stg</sub>  |                                                      | -55 to +150 |                        |
| Maximum thermal resistance, junction to case    | R <sub>thJC</sub> | DC operation<br>See fig. 4                           | 1.5         | °C/W                   |
| Typical thermal resistance, case to heatsink    | R <sub>thCS</sub> | Mounting surface, smooth and greased<br>(For TO-220) | 0.50        |                        |
| Maximum thermal resistance, junction to ambient | R <sub>thJA</sub> | DC operation                                         | 40          |                        |
| 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)             | 20L15TS     |                        |

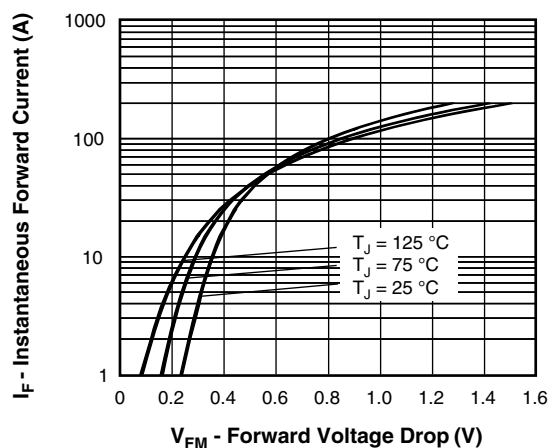


Fig. 1 - Maximum Forward Voltage Drop Characteristics

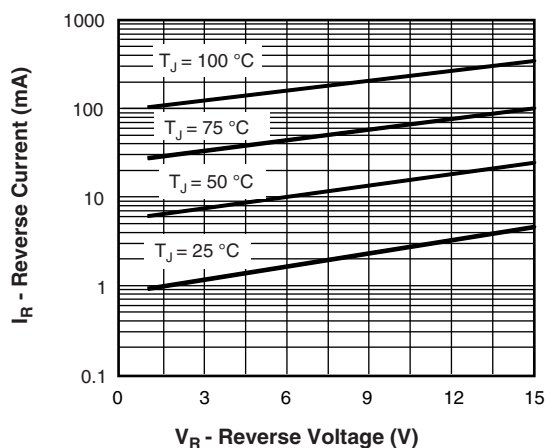


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

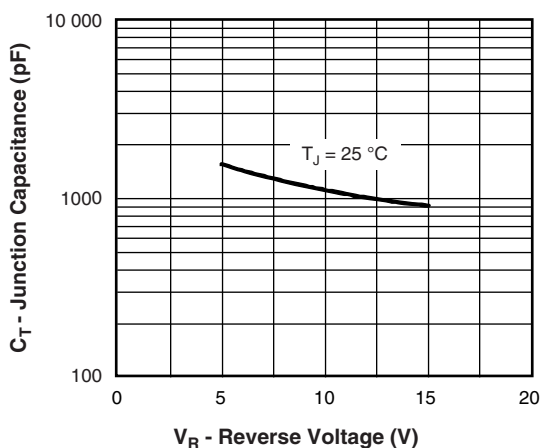


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

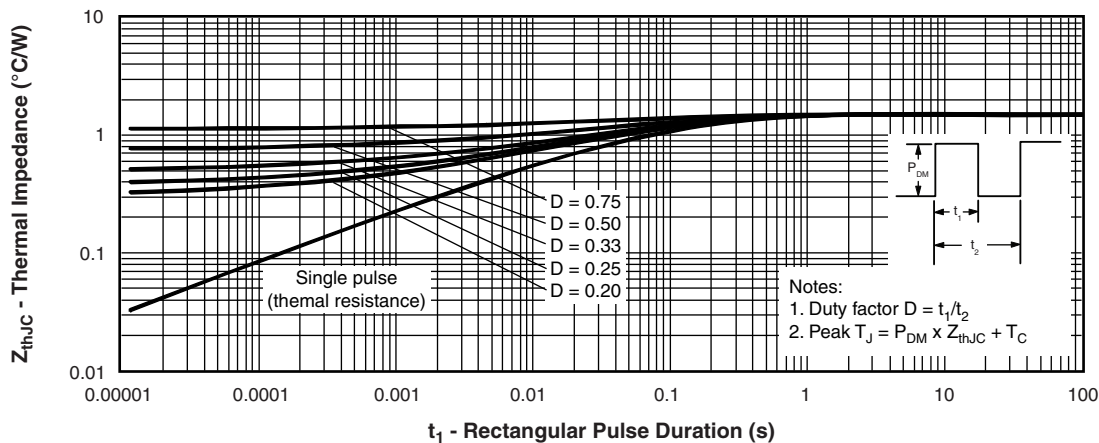
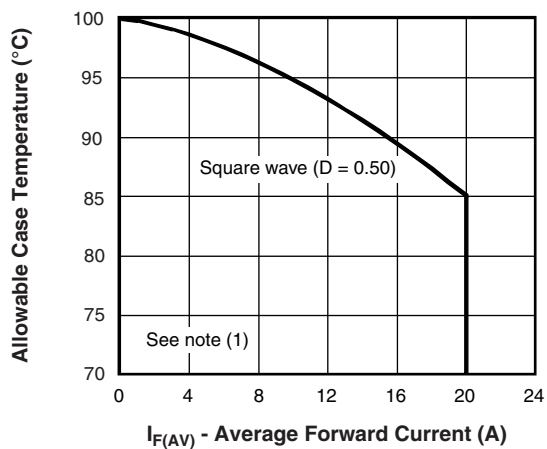

Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics


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

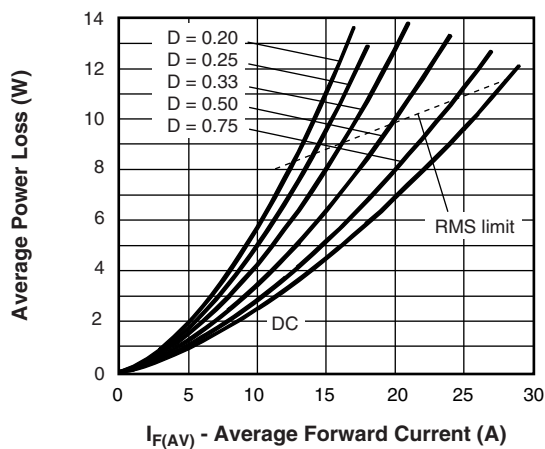


Fig. 6 - Forward Power Loss Characteristics

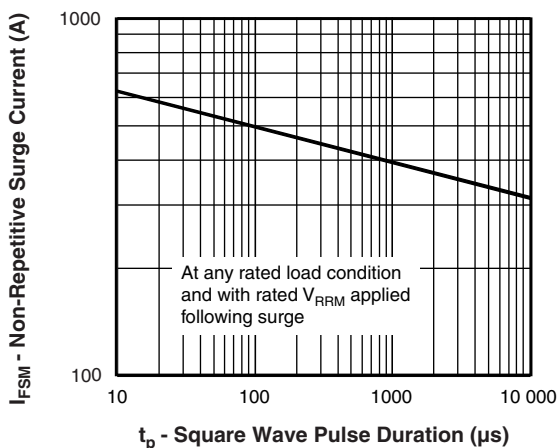


Fig. 7 - Maximum Non-Repetitive Surge Current

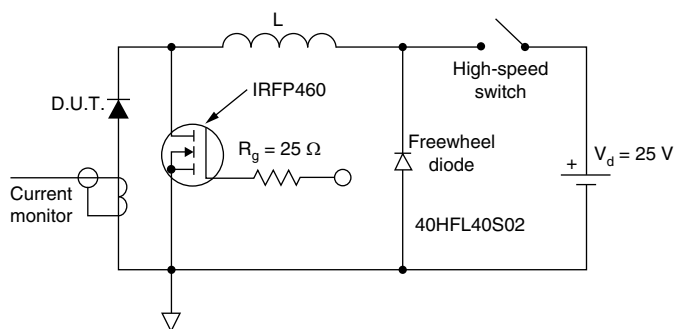


Fig. 8 - Unclamped Inductive Test Circuit

#### 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-                                                                                                | 20 | L | 15 | T | S | TRL | -M3 |
|-------------|----------------------------------------------------------------------------------------------------|----|---|----|---|---|-----|-----|
|             | 1                                                                                                  | 2  | 3 | 4  | 5 | 6 | 7   | 8   |
| 1           | - Vishay Semiconductors product                                                                    |    |   |    |   |   |     |     |
| 2           | - Current rating (20 A)                                                                            |    |   |    |   |   |     |     |
| 3           | - L = Low $V_F$                                                                                    |    |   |    |   |   |     |     |
| 4           | - Voltage rating (15 = 15 V)                                                                       |    |   |    |   |   |     |     |
| 5           | - T = Schottky series                                                                              |    |   |    |   |   |     |     |
| 6           | - S = D <sup>2</sup> PAK (TO-263AB)                                                                |    |   |    |   |   |     |     |
| 7           | - • None = tube<br>• TRL = tape and reel (left oriented)<br>• TRR = tape and reel (right oriented) |    |   |    |   |   |     |     |
| 8           | - -M3 = halogen-free, RoHS-compliant and termination lead (Pb)-free                                |    |   |    |   |   |     |     |

**ORDERING INFORMATION** (Example)

| PREFERRED P/N    | BASE QUANTITY | PACKAGING DESCRIPTION              |
|------------------|---------------|------------------------------------|
| VS-20L15TS-M3    | 50            | Antistatic plastic tubes           |
| VS-20L15TSTRL-M3 | 800           | 13" diameter plastic tape and reel |
| VS-20L15TSTRR-M3 | 800           | 13" diameter plastic tape and reel |

**LINKS TO RELATED DOCUMENTS**

|                          |                                                                        |
|--------------------------|------------------------------------------------------------------------|
| Dimensions               | <a href="http://www.vishay.com/doc?96164">www.vishay.com/doc?96164</a> |
| Part marking information | <a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</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?97117">www.vishay.com/doc?97117</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

- (1) Dimensioning and tolerancing per ASME Y14.5 M-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) Datum A and B to be determined at datum plane H
- (6) Controlling dimension: inch
- (7) Outline conforms to JEDEC® outline TO-263AB



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