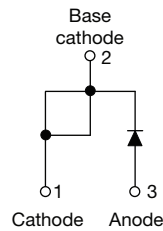


## Schottky Rectifier, 20 A



TO-220AC



### FEATURES

- 125 °C  $T_J$  operation ( $V_R < 5$  V)
- Single diode configuration
- Optimized for OR-ing applications
- Ultra low 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
- Compliant to RoHS Directive 2002/95/EC
- Designed and qualified according to JEDEC-JESD47
- Halogen-free according to IEC 61249-2-21 definition (-N3 only)



| PRODUCT SUMMARY |                      |
|-----------------|----------------------|
| Package         | TO-220AC             |
| $I_{F(AV)}$     | 20 A                 |
| $V_R$           | 15 V                 |
| $V_F$ at $I_F$  | See Electrical table |
| $I_{RM}$ max.   | 600 mA at 100 °C     |
| $T_J$ max.      | 125 °C               |
| Diode variation | Single die           |
| $E_{AS}$        | 10 mJ                |

### 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.

| MAJOR RATINGS AND CHARACTERISTICS |  |             |       |
|-----------------------------------|--|-------------|-------|
| SYMBOL                            | CHARACTERISTICS                        | VALUES      | UNITS |
| $I_{F(AV)}$                       | Rectangular waveform                   | 20          | A     |
| $V_{RRM}$                         |  | 15          | V     |
| $I_{FSM}$                         | $t_p = 5 \mu s$ sine                   | 700         | A     |
| $V_F$                             | 19 $A_{pk}$ , $T_J = 125$ °C (typical) | 0.25        | V     |
| $T_J$                             | Range                                  | - 55 to 125 | °C    |

| VOLTAGE RATINGS                      |           |              |              |       |
|--------------------------------------|-----------|--------------|--------------|-------|
| PARAMETER                            | SYMBOL    | VS-20L15TPbF | VS-20L15T-N3 | UNITS |
| Maximum DC reverse voltage           | $V_R$     | 15           | 15           | 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 $T_C = 85$ °C, rectangular waveform  |   | 20     | A     |
| Maximum peak one cycle non-repetitive surge current<br>See fig. 7 | $I_{FSM}$   | 5 $\mu s$ sine or 3 $\mu s$ rect. pulse   | Following any rated load condition and with rated $V_{RRM}$ applied | 700    |       |
|   |             | 10 ms sine or 6 ms rect. pulse  |   | 330    |       |
| Non-repetitive avalanche energy                                   | $E_{AS}$    | $T_J = 25$ °C, $I_{AS} = 2$ A, $L = 6$ mH   |   | 10     | mJ    |
| Repetitive avalanche current                                      | $I_{AR}$    | Current decaying linearly to zero in 1 $\mu s$<br>Frequency limited by $T_J$ maximum $V_A = 1.5 \times V_R$ typical |   | 2      | A     |



| ELECTRICAL SPECIFICATIONS             |                |  |                                   |      |                  |    |
|---------------------------------------|----------------|--|-----------------------------------|------|------------------|----|
| PARAMETER                             | SYMBOL         | TEST CONDITIONS  | TYP.                              | MAX. | UNITS            |    |
| Forward voltage drop<br>See fig. 1    | $V_{FM}^{(1)}$ | 19 A   | $T_J = 25\text{ }^\circ\text{C}$  | -    | 0.41             | V  |
|                                       |                | 40 A   |                                   | -    | 0.52             |    |
|                                       |                | 19 A   | $T_J = 125\text{ }^\circ\text{C}$ | 0.25 | 0.33             |    |
|                                       |                | 40 A   |                                   | 0.37 | 0.50             |    |
| Reverse leakage current<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^\circ\text{C}$   | $V_R = \text{Rated } V_R$         | -    | 10               | mA |
|                                       |                | $T_J = 100\text{ }^\circ\text{C}$  |                                   | -    | 600              |    |
| Threshold voltage                     | $V_{F(TO)}$    | $T_J = T_J \text{ max.}$   | 0.182                             |      | V                |    |
| Forward slope resistance              | $r_t$          |  | 7.6                               |      | $\text{m}\Omega$ |    |
| Maximum junction capacitance          | $C_T$          | $V_R = 5 V_{DC}$ , (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              | $T_J$              |  | - 55 to 125 | $^\circ\text{C}$       |
| Maximum storage temperature range               | $T_{Stg}$          |  | - 50 to 150 |                        |
| Maximum thermal resistance, junction to case    | $R_{thJC}$         | DC operation<br>See fig. 4                           | 1.5         | $^\circ\text{C/W}$     |
| Typical thermal resistance, case to heatsink    | $R_{thCS}$         | Mounting surface, smooth and greased<br>(for TO-220) | 0.50        |                        |
| Maximum thermal resistance, junction to ambient | $R_{thJA}$         | DC operation<br>(for D <sup>2</sup> PAK)             | 40          |                        |
| Approximate weight                              |                    |  | 2           | g                      |
|   |                    |  | 0.07        | oz.                    |
| Mounting torque                                 | minimum<br>maximum | Non-lubricated threads                               | 6 (5)       | kgf · cm<br>(lbf · in) |
|   |                    |  | 12 (10)     |                        |
| Marking device                                  |                    | Case style TO-220AC                                  | 20L15T      |                        |

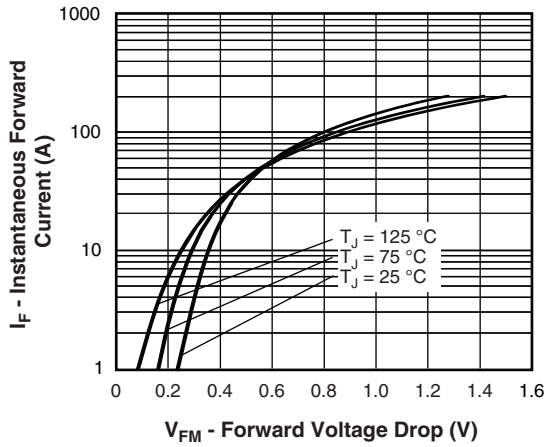


Fig. 1 - Maximum Forward Voltage Drop Characteristics

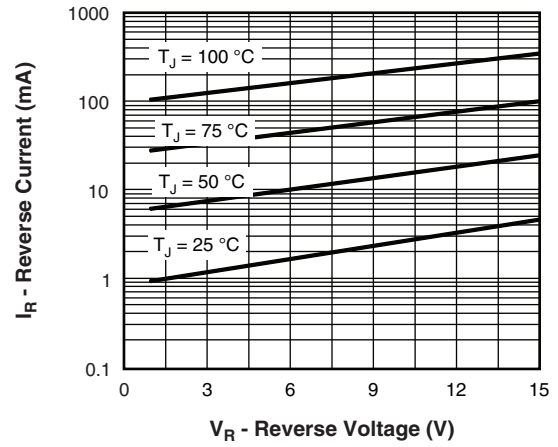


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

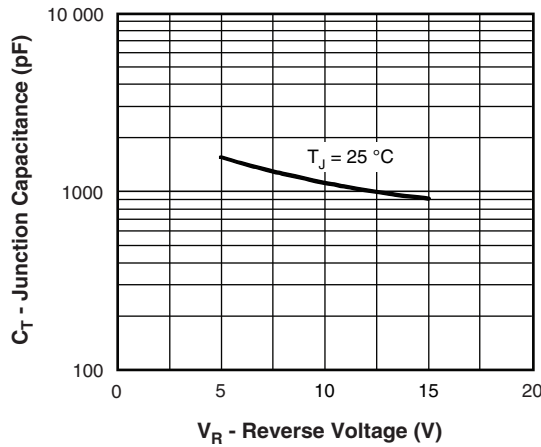


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

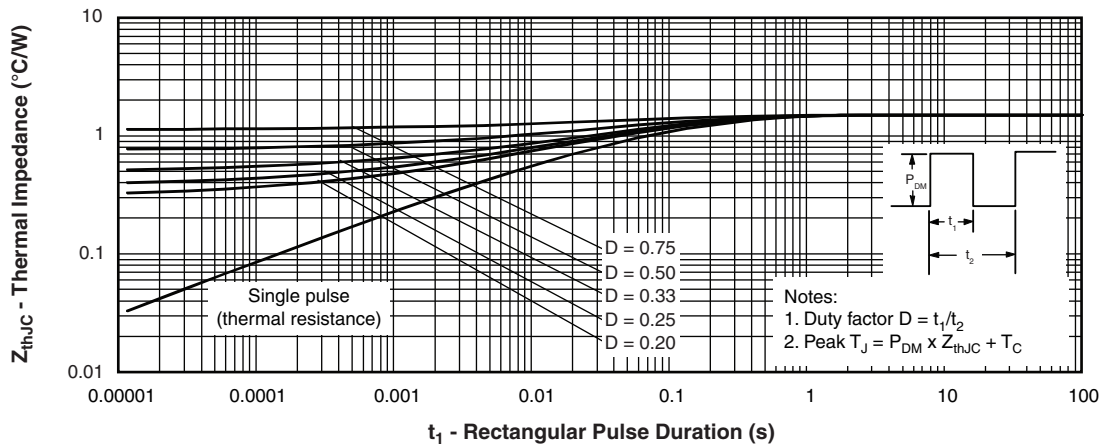


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

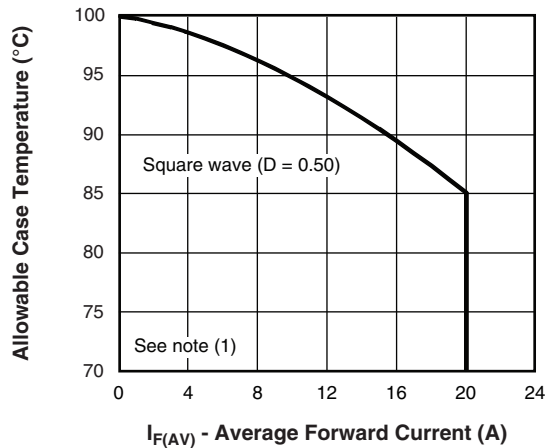


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

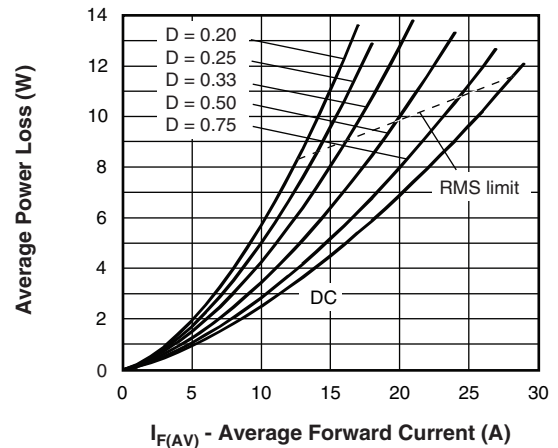


Fig. 6 - Forward Power Loss Characteristics

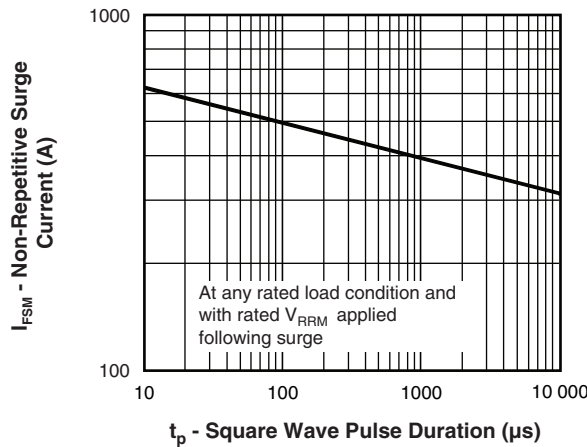


Fig. 7 - Maximum Non-Repetitive Surge Current

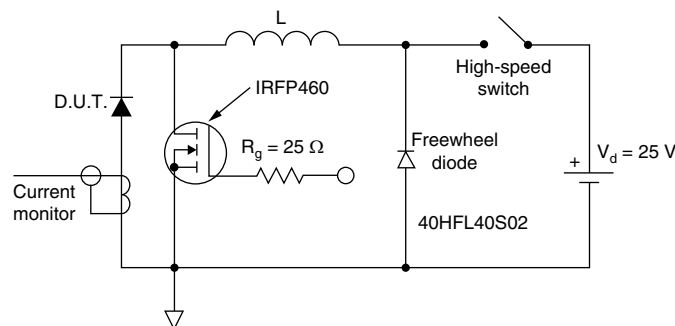


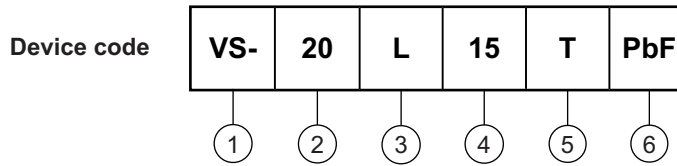
Fig. 8 - Unclamped Inductive Test Circuit

**Note**

- (1) Formula used:  $T_C = T_J - (P_d + P_{d_{REV}}) \times R_{thJC}$ ;
- $P_d$  = Forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);
- $P_{d_{REV}}$  = Inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1} = 80\%$  rated  $V_R$



## ORDERING INFORMATION TABLE



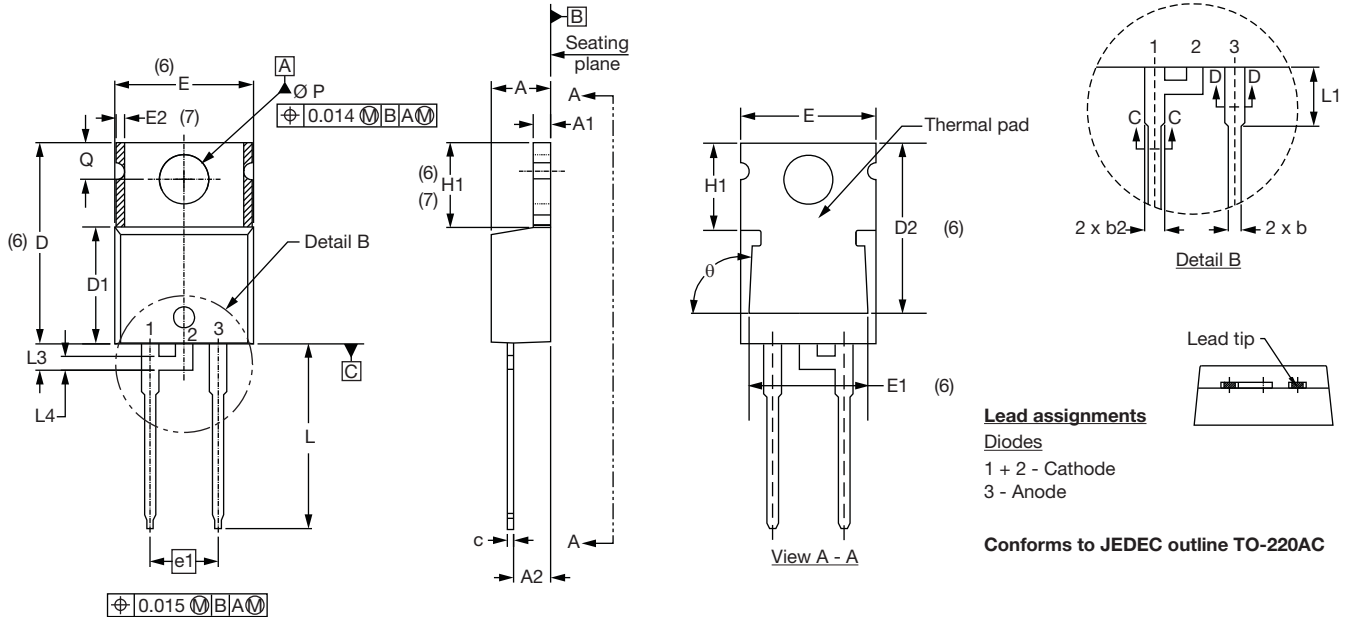
- 1** - Vishay Semiconductors product
- 2** - Current rating (20 = 20 A)
- 3** - Schottky "L" series
- 4** - Voltage code (15 = 15 V)
- 5** - Package  
T = TO-220
- 6** - Environmental digit
  - PbF = Lead (Pb)-free and RoHS compliant
  - -N3 = Halogen-free, RoHS compliant, and totally lead (Pb)-free

| <b>ORDERING INFORMATION</b> (Example) |                  |                        |                         |
|---------------------------------------|------------------|------------------------|-------------------------|
| PREFERRED P/N                         | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
| VS-20L15TPbF                          | 50               | 1000                   | Antistatic plastic tube |
| VS-20L15T-N3                          | 50               | 1000                   | Antistatic plastic tube |

| <b>LINKS TO RELATED DOCUMENTS</b> |   |
|-----------------------------------|---|
| Dimensions                        | <a href="http://www.vishay.com/doc?95221">www.vishay.com/doc?95221</a>              |
| Part marking information          | TO-220AC PbF <a href="http://www.vishay.com/doc?95224">www.vishay.com/doc?95224</a> |
|                                   | TO-220AC -N3 <a href="http://www.vishay.com/doc?95068">www.vishay.com/doc?95068</a> |

## TO-220AC

**DIMENSIONS** in millimeters and inches



| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES | SYMBOL | MILLIMETERS |       | INCHES     |       | NOTES |
|--------|-------------|-------|--------|-------|-------|--------|-------------|-------|------------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |        | MIN.        | MAX.  | MIN.       | MAX.  |       |
| A      | 4.25        | 4.65  | 0.167  | 0.183 |       | E1     | 6.86        | 8.89  | 0.270      | 0.350 | 6     |
| A1     | 1.14        | 1.40  | 0.045  | 0.055 |       | E2     | -           | 0.76  | -          | 0.030 | 7     |
| A2     | 2.56        | 2.92  | 0.101  | 0.115 |       | e      | 2.41        | 2.67  | 0.095      | 0.105 |       |
| b      | 0.69        | 1.01  | 0.027  | 0.040 |       | e1     | 4.88        | 5.28  | 0.192      | 0.208 |       |
| b1     | 0.38        | 0.97  | 0.015  | 0.038 | 4     | H1     | 6.09        | 6.48  | 0.240      | 0.255 | 6, 7  |
| b2     | 1.20        | 1.73  | 0.047  | 0.068 |       | L      | 13.52       | 14.02 | 0.532      | 0.552 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     | L1     | 3.32        | 3.82  | 0.131      | 0.150 | 2     |
| c      | 0.36        | 0.61  | 0.014  | 0.024 |       | L3     | 1.78        | 2.13  | 0.070      | 0.084 |       |
| c1     | 0.36        | 0.56  | 0.014  | 0.022 | 4     | L4     | 0.76        | 1.27  | 0.030      | 0.050 | 2     |
| D      | 14.85       | 15.25 | 0.585  | 0.600 | 3     | Ø P    | 3.54        | 3.73  | 0.139      | 0.147 |       |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       | Q      | 2.60        | 3.00  | 0.102      | 0.118 |       |
| D2     | 11.68       | 12.88 | 0.460  | 0.507 | 6     | θ      | 90° to 93°  |       | 90° to 93° |       |       |
| E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |        |             |       |            |       |       |

**Notes**

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1 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) Dimension b1, b3 and c1 apply to base metal only
- (5) Controlling dimension: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimension E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, D2 (minimum) where dimensions are derived from the actual package outline



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