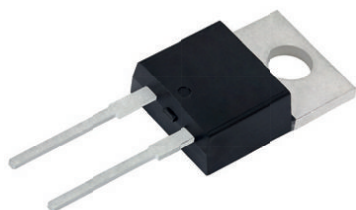
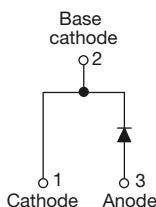


## High Performance Schottky Rectifier, 6 A



TO-220AC 2L



### FEATURES

- 175 °C  $T_J$  operation
- High frequency operation
- Low forward voltage drop
- High purity, high temperature epoxy encapsulation for enhanced mechanical strength and moisture resistance
- Guard ring for enhanced ruggedness and long term reliability
- 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-6TQ... Schottky rectifier 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 switching power supplies, converters, freewheeling diodes, and reverse battery protection.

### PRIMARY CHARACTERISTICS

|                       |                  |
|-----------------------|------------------|
| $I_{F(AV)}$           | 6 A              |
| $V_R$                 | 35 V, 40 V, 45 V |
| $V_F$ at $I_F$        | 0.53 V           |
| $I_{RM}$ max.         | 7 mA at 125 °C   |
| $T_J$ max.            | 175 °C           |
| $E_{AS}$              | 8 mJ             |
| Package               | 2L TO-220AC      |
| Circuit configuration | Single           |

### MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL      | CHARACTERISTICS                    | VALUES      | UNITS |
|-------------|------------------------------------|-------------|-------|
| $I_{F(AV)}$ | Rectangular waveform               | 6           | A     |
| $V_{RRM}$   | Range                              | 35 to 45    | V     |
| $I_{FSM}$   | $t_p = 5 \mu s$ sine               | 690         | A     |
| $V_F$       | 6 A <sub>pk</sub> , $T_J = 125$ °C | 0.53        | V     |
| $T_J$       | Range                              | -55 to +175 | °C    |

### VOLTAGE RATINGS

| PARAMETER                            | SYMBOL    | VS-6TQ035-M3 | VS-6TQ040-M3 | VS-6TQ045-M3 | UNITS |
|--------------------------------------|-----------|--------------|--------------|--------------|-------|
| Maximum DC reverse voltage           | $V_R$     | 35           | 40           | 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                        | $I_{F(AV)}$ | 50 % duty cycle at $T_C = 164$ °C, rectangular waveform                                                             | 6      | A     |
| Maximum peak one cycle<br>non-repetitive surge current<br>See fig. 7 | $I_{FSM}$   | 5 $\mu s$ sine or 3 $\mu s$ rect. pulse                                                                             | 690    | A     |
|                                                                      |             | 10 ms sine or 6 ms rect. pulse                                                                                      | 140    |       |
| Non-repetitive avalanche energy                                      | $E_{AS}$    | $T_J = 25$ °C, $I_{AS} = 1.20$ A, $L = 11.10$ mH                                                                    | 8      | 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 | 1.20   | A     |


**ELECTRICAL SPECIFICATIONS**

| PARAMETER                                     | SYMBOL         | TEST CONDITIONS                                                    |                                     | VALUES | UNITS |      |
|-----------------------------------------------|----------------|--------------------------------------------------------------------|-------------------------------------|--------|-------|------|
| Maximum forward voltage drop<br>See fig. 1    | $V_{FM}^{(1)}$ | 6 A                                                                | $T_J = 25\text{ }^{\circ}\text{C}$  | 0.60   | V     |      |
|                                               |                | 12 A                                                               |                                     | 0.73   |       |      |
|                                               |                | 6 A                                                                | $T_J = 125\text{ }^{\circ}\text{C}$ | 0.53   |       | 0.64 |
|                                               |                | 12 A                                                               |                                     |        |       |      |
| Maximum reverse leakage current<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                 | $V_R = \text{Rated } V_R$           | 0.8    | mA    |      |
|                                               |                | $T_J = 125\text{ }^{\circ}\text{C}$                                |                                     | 7      |       |      |
| Threshold voltage                             | $V_{F(TO)}$    | $T_J = T_J \text{ maximum}$                                        |                                     | 0.35   | V     |      |
| Forward slope resistance                      | $r_t$          |                                                                    |                                     | 18.23  | mΩ    |      |
| Maximum junction capacitance                  | $C_T$          | $V_R = 5\text{ }V_{DC}$ (test signal range 100 kHz to 1 MHz) 25 °C |                                     | 400    | 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/μs  |      |

**Note**
<sup>(1)</sup> Pulse width < 300 μs, 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   | R <sub>thJC</sub>                 | DC operation<br>See fig. 4            | 2.2         | °C/W                   |
| Typical thermal resistance, case to heatsink   | R <sub>thCS</sub>                 | 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 2L TO-220AC                | 6TQ035      |                        |
|                                                |                                   |                                       | 6TQ040      |                        |
|                                                |                                   |                                       | 6TQ045      |                        |

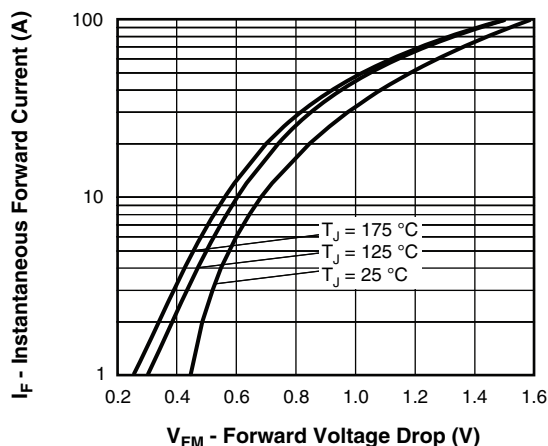


Fig. 1 - Maximum Forward Voltage Drop Characteristics

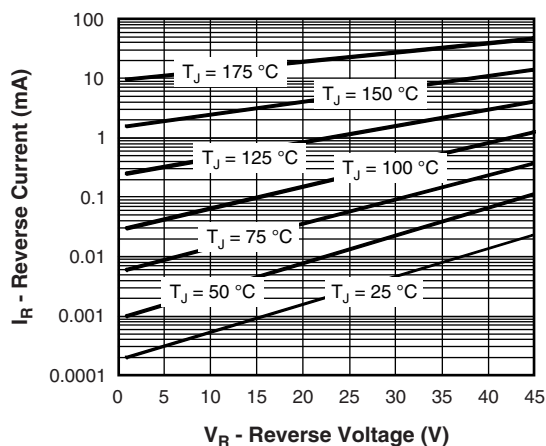


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

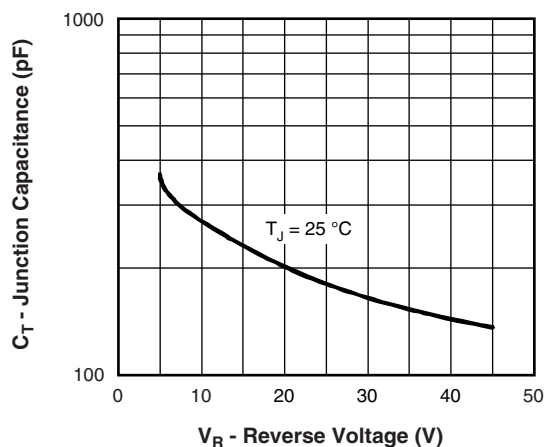
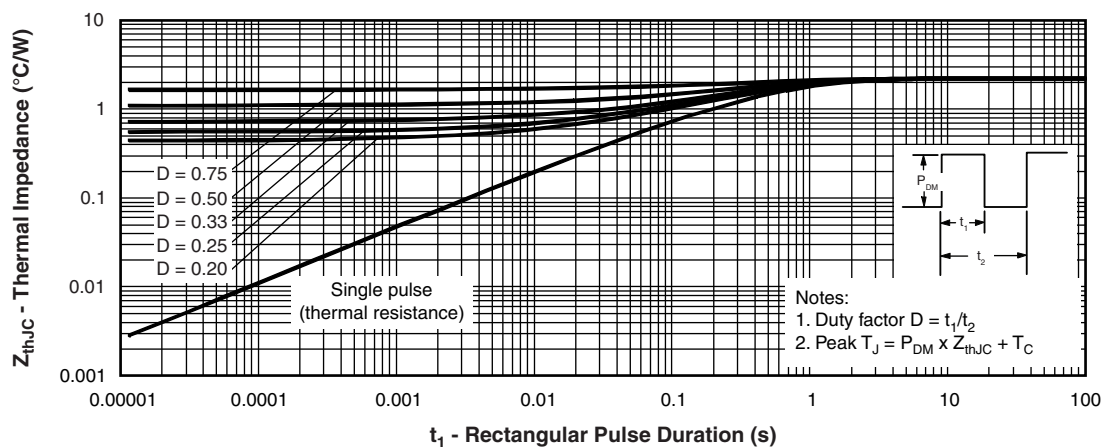


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage


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

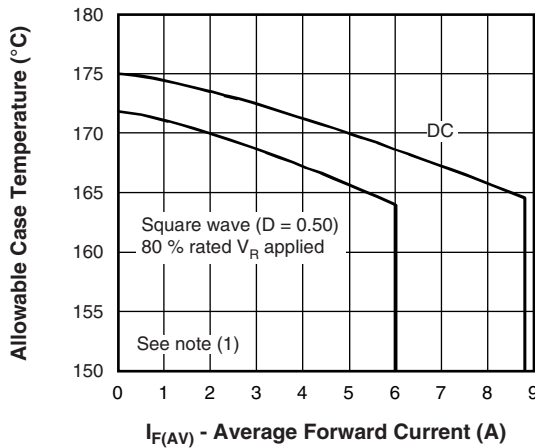


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

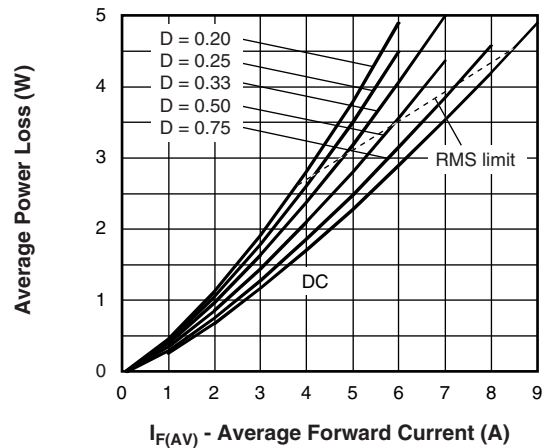


Fig. 6 - Forward Power Loss Characteristics

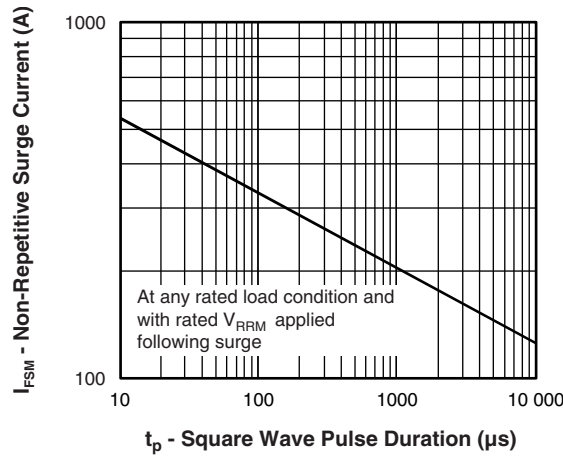


Fig. 7 - Maximum Non-Repetitive Surge Current

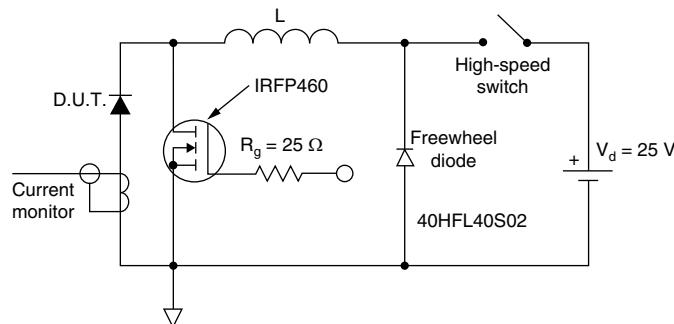


Fig. 8 - Unclamped Inductive Test Circuit

#### 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- | 6                             | T | Q | 045 | -M3                                    |
|                                                                    | 1   | 2                             | 3 | 4 | 5   | 6                                      |
| 1                                                                  | -   | Vishay Semiconductors product |   |   |     |                                        |
| 2                                                                  | -   | Current rating (6 = 6 A)      |   |   |     |                                        |
| 3                                                                  | -   | Package:<br>T = TO-220        |   |   |     |                                        |
| 4                                                                  | -   | Schottky "Q" series           |   |   |     |                                        |
| 5                                                                  | -   | Voltage ratings               |   |   |     |                                        |
| 6                                                                  | -   | Environmental digit           |   |   |     |                                        |
|                                                                    |     |                               |   |   |     | 035 = 35 V<br>040 = 40 V<br>045 = 45 V |
| -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free |     |                               |   |   |     |                                        |

### ORDERING INFORMATION (Example)

| PREFERRED P/N | BASE QUANTITY | PACKAGING DESCRIPTION    |
|---------------|---------------|--------------------------|
| VS-6TQ035-M3  | 50            | Antistatic plastic tubes |
| VS-6TQ040-M3  | 50            | Antistatic plastic tubes |
| VS-6TQ045-M3  | 50            | Antistatic plastic tubes |

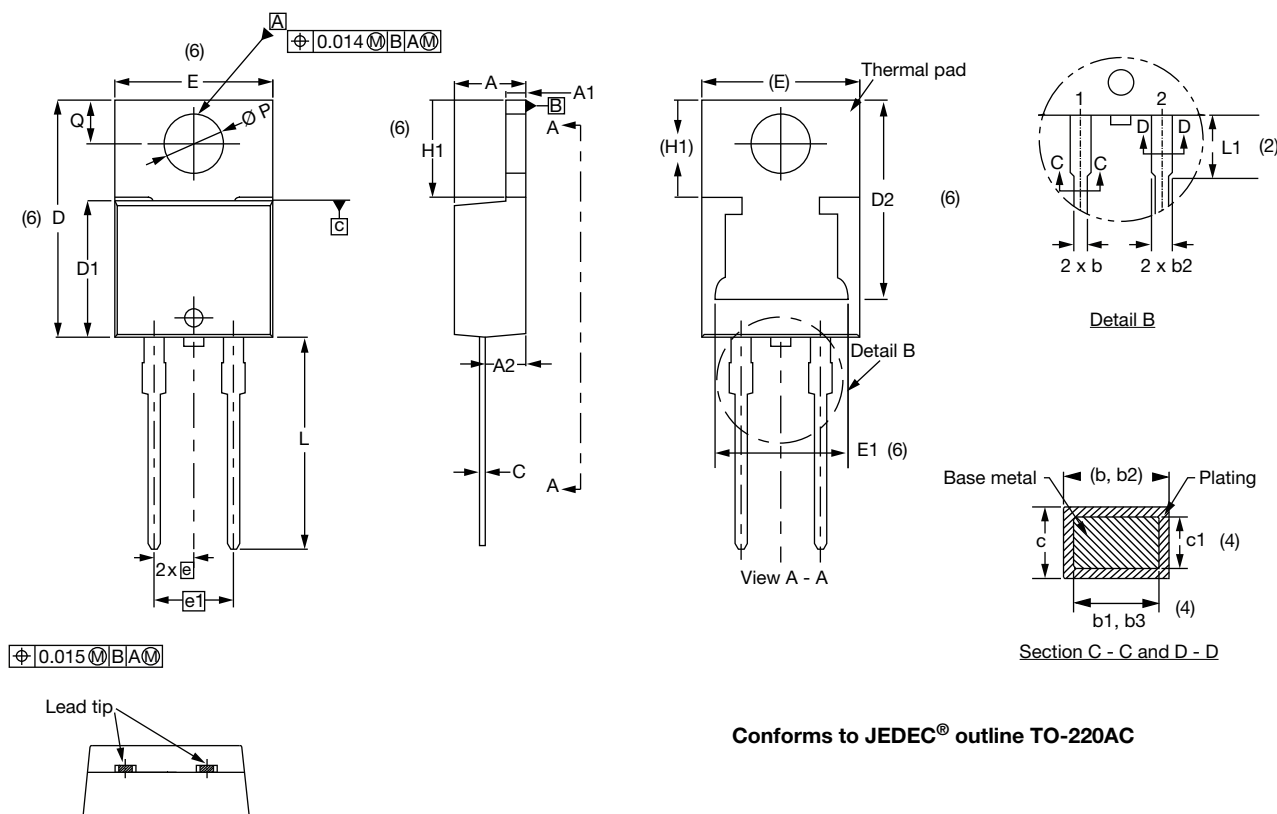
### LINKS TO RELATED DOCUMENTS

|                          |                                                                        |
|--------------------------|------------------------------------------------------------------------|
| Dimensions               | <a href="http://www.vishay.com/doc?96156">www.vishay.com/doc?96156</a> |
| Part marking information | <a href="http://www.vishay.com/doc?95391">www.vishay.com/doc?95391</a> |



## TO-220AC 2L

DIMENSIONS in millimeters and inches



Conforms to JEDEC® outline TO-220AC

| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| A      | 4.25        | 4.65  | 0.167  | 0.183 |       |
| A1     | 1.14        | 1.40  | 0.045  | 0.055 |       |
| A2     | 2.50        | 2.92  | 0.098  | 0.115 |       |
| b      | 0.69        | 1.01  | 0.027  | 0.040 |       |
| b1     | 0.38        | 0.97  | 0.015  | 0.038 | 4     |
| b2     | 1.20        | 1.73  | 0.047  | 0.068 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     |
| c      | 0.36        | 0.61  | 0.014  | 0.024 |       |
| c1     | 0.36        | 0.56  | 0.014  | 0.022 | 4     |
| D      | 14.85       | 15.35 | 0.585  | 0.604 | 3     |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       |

| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| D2     | 11.68       | 13.30 | 0.460  | 0.524 | 6, 7  |
| E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |
| E1     | 6.86        | 8.89  | 0.270  | 0.350 | 6     |
| e      | 2.41        | 2.67  | 0.095  | 0.105 |       |
| e1     | 4.88        | 5.28  | 0.192  | 0.208 |       |
| H1     | 6.09        | 6.48  | 0.240  | 0.255 | 6     |
| L      | 13.52       | 14.02 | 0.532  | 0.552 |       |
| L1     | 3.32        | 3.82  | 0.131  | 0.150 | 2     |
| Ø P    | 3.54        | 3.91  | 0.139  | 0.154 |       |
| Q      | 2.60        | 3.00  | 0.102  | 0.118 |       |

## 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 dimensions: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2, and E1
- (7) Outline conforms to JEDEC® TO-220, except D2



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