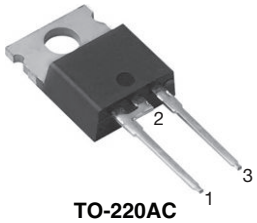
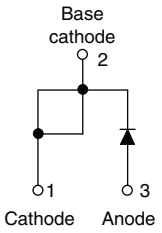
# High Performance Schottky Rectifier, 6 A




TO-220AC




## 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
- AEC-Q101 qualified meets JESD 201 class 2 whisker test
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

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 | 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 µs sine | 690 | A |
| $V_F$ | 6 $A_{pk}$, $T_J$ = 125 °C | 0.53 | V |
| $T_J$ | Range | -55 to 175 | °C |

| VOLTAGE RATINGS | | | | | |
|---|---|---|---|---|---|
| PARAMETER | SYMBOL | VS-6TQ035HN3 | VS-6TQ040HN3 | VS-6TQ045HN3 | 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 non-repetitive surge current<br>See fig. 7 | $I_{FSM}$ | 5 µs sine or 3 µs rect. pulse | Following any rated load condition and with rated $V_{RRM}$ applied | 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 µs<br>Frequency limited by $T_J$ maximum $V_A$ = 1.5 x $V_R$ typical | | 1.20 | A |



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## ELECTRICAL SPECIFICATIONS

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

(1) Pulse width < 300 µs, duty cycle < 2 %

## THERMAL - MECHANICAL SPECIFICATIONS

| PARAMETER | | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|---|---|---|---|---|---|
| Maximum junction and storage temperature range | | $T_J$, $T_{Stg}$ | | -55 to 175 | °C |
| Maximum thermal resistance, junction to case | | $R_{thJC}$ | DC operation<br>See fig. 4 | 2.2 | °C/W |
| Typical thermal resistance, case to heatsink | | $R_{thCS}$ | 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 TO-220AC | 6TQ035H | |
| | | | | 6TQ040H | |
| | | | | 6TQ045H | |


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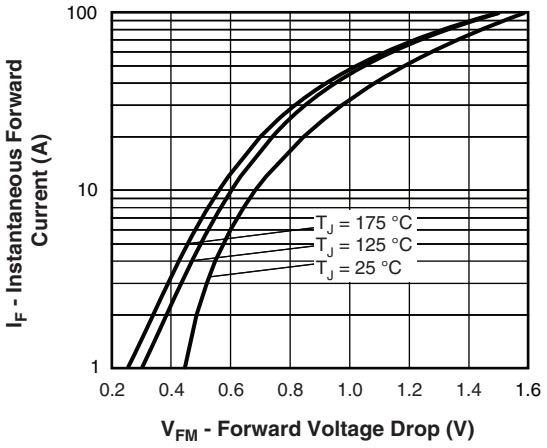



Fig. 1 - Maximum Forward Voltage Drop Characteristics

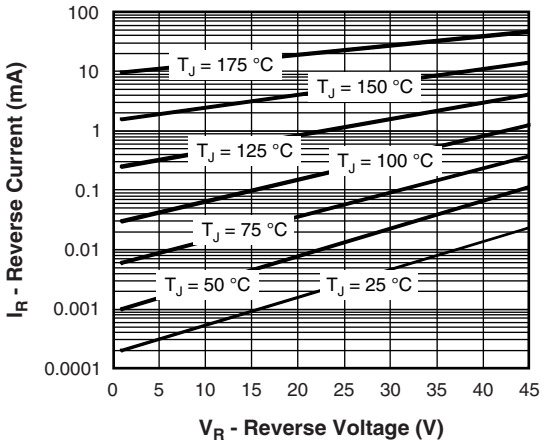



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

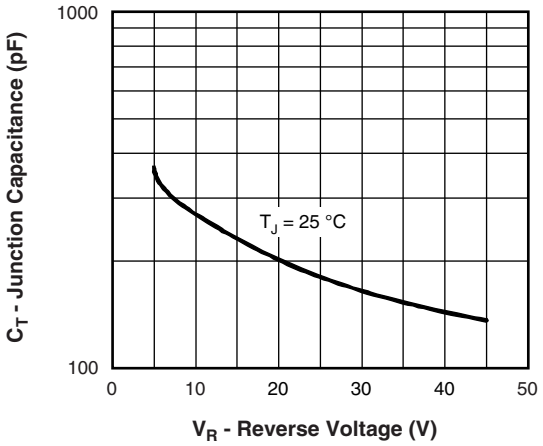



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

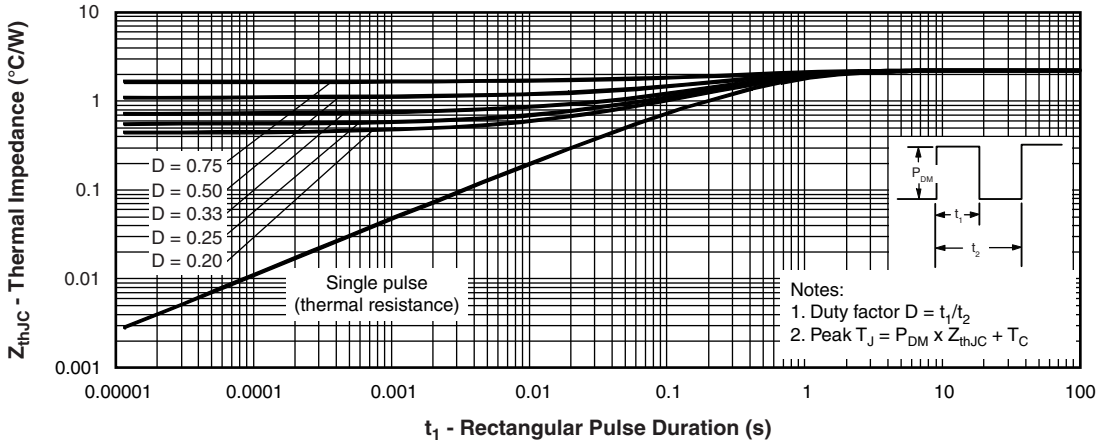



Fig. 4 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics


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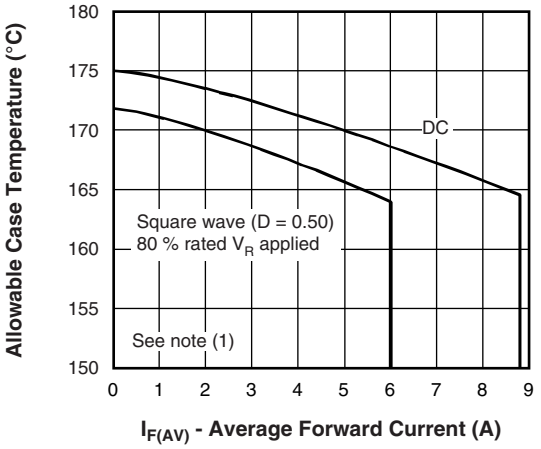



Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

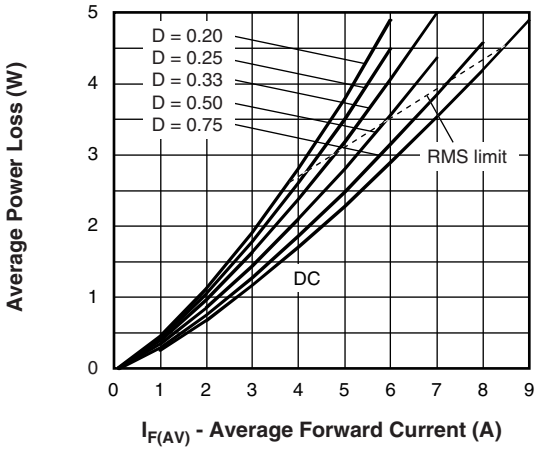



Fig. 6 - Forward Power Loss Characteristics

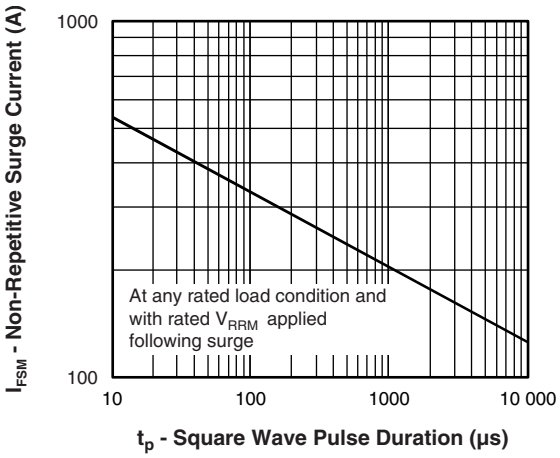



Fig. 7 - Maximum Non-Repetitive Surge Current

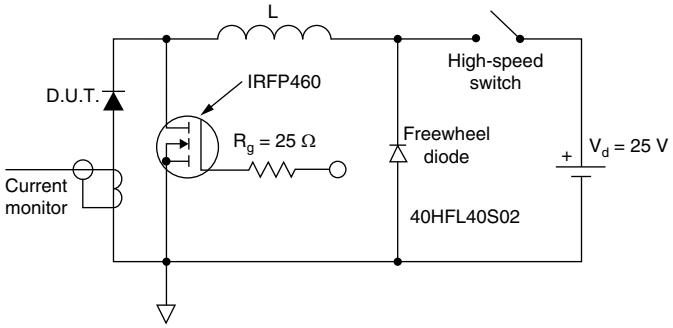



Fig. 8 - Unclamped Inductive Test Circuit

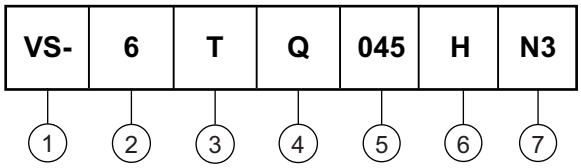
**Note**

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


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## ORDERING INFORMATION TABLE

Device code




1 - Vishay Semiconductors product

2 - Current rating (6 = 6 A)

3 - Package:
T = TO-220

4 - Schottky “Q” series

5 - Voltage ratings
035 = 35 V
040 = 40 V
045 = 45 V

6 - H = AEC-Q101 qualified

7 - Environmental digit
- N3 = Halogen-free, RoHS compliant, and totally lead (Pb)-free

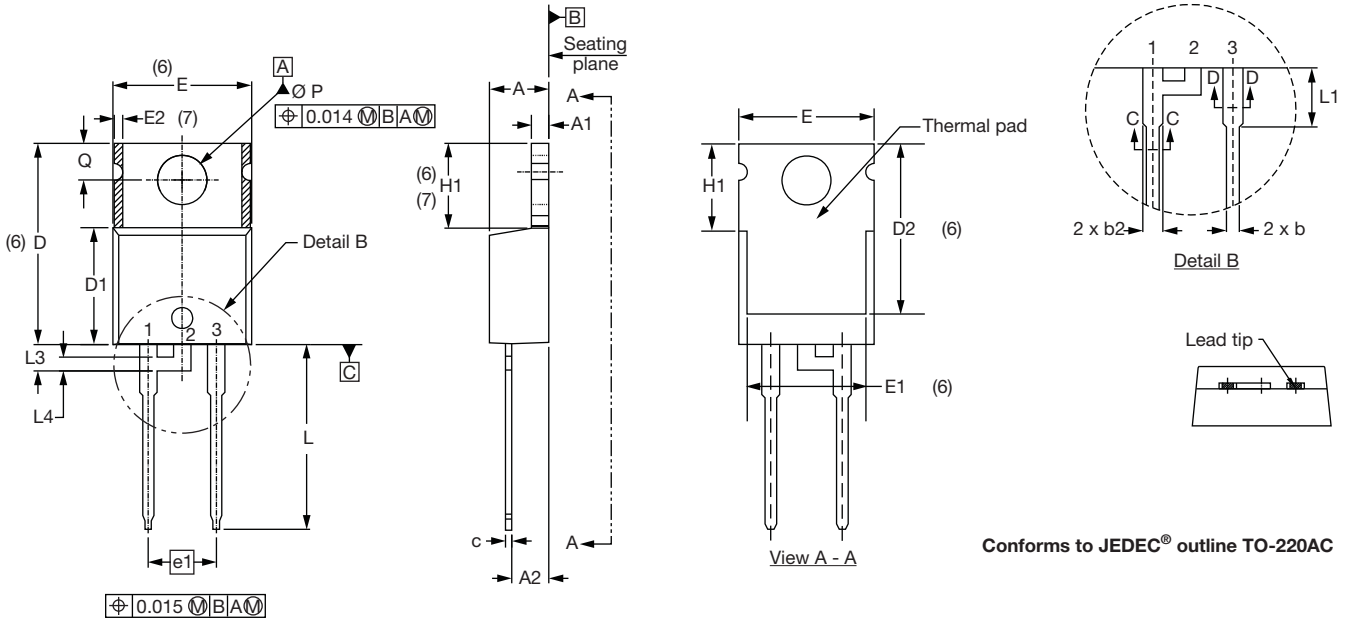
| ORDERING INFORMATION (Example) | | | |
|---|---|---|---|
| PREFERRED P/N | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
| VS-6TQ035HN3 | 50 | 1000 | Antistatic plastic tube |
| VS-6TQ040HN3 | 50 | 1000 | Antistatic plastic tube |
| VS-6TQ045HN3 | 50 | 1000 | Antistatic plastic tube |

| LINKS TO RELATED DOCUMENTS | | |
|---|---|---|
| Dimensions | | www.vishay.com/doc?95221 |
| Part marking information | TO-220AC-N3 | www.vishay.com/doc?95068 |


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# TO-220AC

**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 | 2.56 | 2.92 | 0.101 | 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 | 15.25 | 0.585 | 0.600 | 3 |
| D1 | 8.38 | 9.02 | 0.330 | 0.355 | |
| D2 | 11.68 | 12.88 | 0.460 | 0.507 | 6 |
| E | 10.11 | 10.51 | 0.398 | 0.414 | 3, 6 |

| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| E1 | 6.86 | 8.89 | 0.270 | 0.350 | 6 |
| E2 | - | 0.76 | - | 0.030 | 7 |
| e1 | 4.88 | 5.28 | 0.192 | 0.208 | |
| H1 | 5.84 | 6.86 | 0.230 | 0.270 | 6, 7 |
| L | 13.52 | 14.02 | 0.532 | 0.552 | |
| L1 | 3.32 | 3.82 | 0.131 | 0.150 | 2 |
| L3 | 1.78 | 2.13 | 0.070 | 0.084 | |
| L4 | 0.76 | 1.27 | 0.030 | 0.050 | 2 |
| Ø P | 3.54 | 3.73 | 0.139 | 0.147 | |
| 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 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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