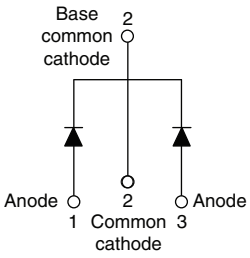
# High Performance Schottky Rectifier, 2 x 30 A


TO-220AB 3L




## FEATURES

- 150 °C $T_J$ operation
- Low forward voltage drop
- High frequency operation
- 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

RoHS COMPLIANT
HALOGEN FREE

## DESCRIPTION

This center tap Schottky rectifier has been optimized for low reverse leakage at high temperature. The proprietary barrier technology allows for reliable operation up to 150 °C junction temperature. Typical applications are in switching power supplies, converters, freewheeling diodes, and reverse battery protection.

| PRIMARY CHARACTERISTICS | |
|---|---|
| $I_{F(AV)}$ | 2 x 30 A |
| $V_R$ | 35 V, 40 V, 45 V |
| $V_F$ at $I_F$ | 0.53 V |
| $I_{RM}$ max. | 250 mA at 125 °C |
| $T_J$ max. | 150 °C |
| $E_{AS}$ | 20 mJ |
| Package | TO-220AB 3L |
| Circuit configuration | Common cathode |

| MAJOR RATINGS AND CHARACTERISTICS | | | |
|---|---|---|---|
| SYMBOL | CHARACTERISTICS | VALUES | UNITS |
| $I_{F(AV)}$ | Rectangular waveform (per device) | 60 | A |
| $V_{RRM}$ | | 35 to 45 | V |
| $I_{FRM}$ | $T_C$ = 113 °C (per leg) | 60 | A |
| $I_{FSM}$ | $t_p$ = 5 µs sine | 1500 | |
| $V_F$ | 30 $A_{pk}$, $T_J$ = 125 °C | 0.53 | V |
| $T_J$ | Range | -65 to +150 | °C |

| VOLTAGE RATINGS | | | | | |
|---|---|---|---|---|---|
| PARAMETER | SYMBOL | VS-60CTQ035-M3 | VS-60CTQ040-M3 | VS-60CTQ045-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 | per leg | $I_{F(AV)}$ | 50 % duty cycle at $T_C$ = 113 °C, rectangular waveform | | 30 | A |
| | per device | | | | 60 | |
| Peak repetitive forward current per leg | | $I_{FRM}$ | Rated $V_R$, square wave, 20 kHz, $T_C$ = 113 °C | | 60 | |
| Maximum peak one cycle non-repetitive surge current per leg | | $I_{FSM}$ | 5 µs sine or 3 µs rect. pulse | Following any rated load condition and with rated $V_{RRM}$ applied | 1500 | |
| | | | 10 ms sine or 6 ms rect. pulse | | 300 | |
| Non-repetitive avalanche energy per leg | | $E_{AS}$ | $T_J$ = 25 °C, $I_{AS}$ = 3 A, L = 4.40 mH | | 20 | mJ |
| Repetitive avalanche current per leg | | $I_{AR}$ | Current decaying linearly to zero in 1 µs<br>Frequency limited by $T_J$ maximum $V_A$ = 1.5 x $V_R$ typical | | 3 | A |

## ELECTRICAL SPECIFICATIONS

| PARAMETER | SYMBOL | TEST CONDITIONS | | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Maximum forward voltage drop | $V_{FM}$ (1) | 30 A | $T_J$ = 25 °C | 0.51 | 0.56 | V |
| | | 60 A | | 0.66 | 0.72 | |
| | | 30 A | $T_J$ = 125 °C | 0.48 | 0.53 | |
| | | 60 A | | 0.68 | 0.75 | |
| Maximum instantaneous reverse current | $I_{RM}$ | $T_J$ = 25 °C | Rated DC voltage | 0.33 | 2 | mA |
| | | $T_J$ = 125 °C | | 145 | 250 | |
| Maximum junction capacitance | $C_T$ | $V_R$ = 5 $V_{DC}$ (test signal range 100 kHz to 1 MHz) 25 °C | | 2000 | | pF |
| Typical series inductance | $L_S$ | Measured from top of terminal to mounting plane | | 8.0 | | 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 temperature range | | $T_J$ | | -65 to +150 | °C |
| Maximum storage temperature range | | $T_{Stg}$ | | -65 to +175 | |
| Maximum thermal resistance, junction to case per leg | | $R_{thJC}$ | DC operation | 1.2 | °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 | | Non-lubricated threads | 6 (5) | kgf · cm (lbf · in) |
| | maximum | | | 12 (10) | |
| Marking device | | | Case style TO-220AB 3L | 60CTQ035 | |
| | | | | 60CTQ040 | |
| | | | | 60CTQ045 | |

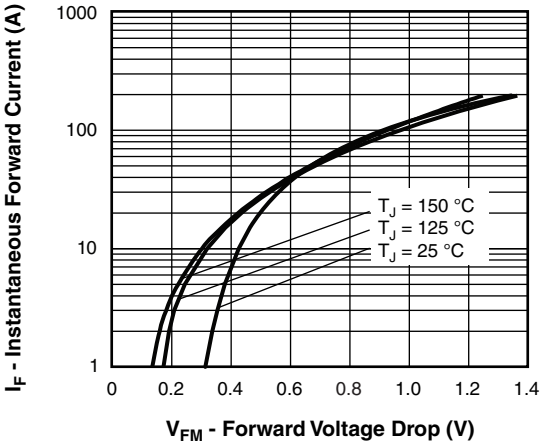



Fig. 1 - Maximum Forward Voltage Drop Characteristics

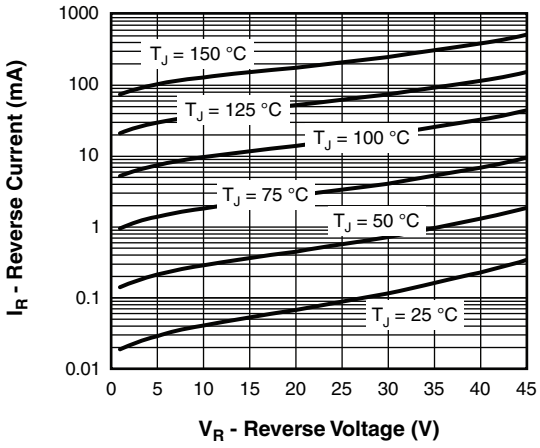



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

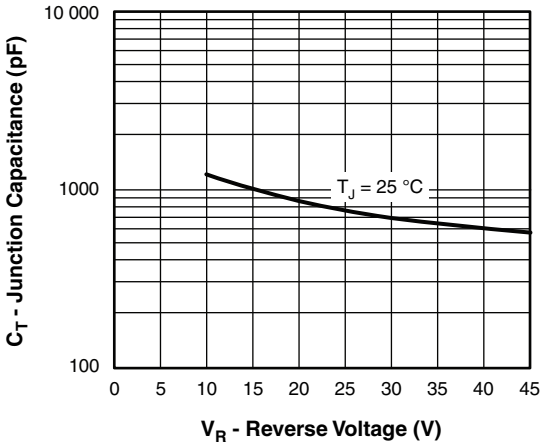



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

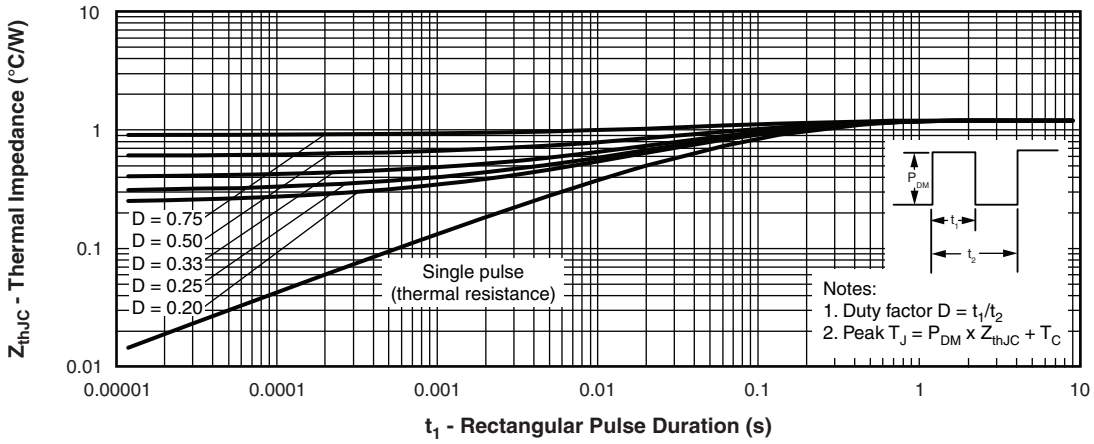



Fig. 4 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics

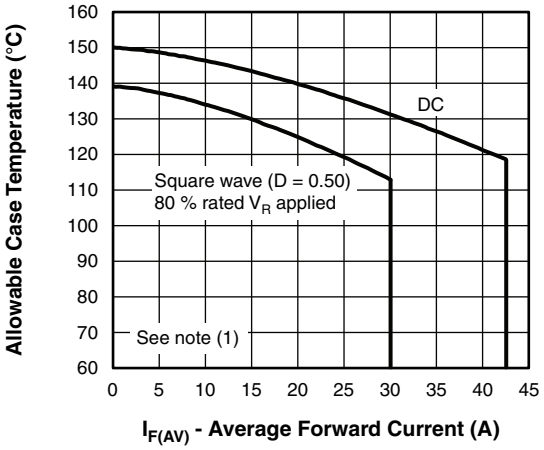



Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

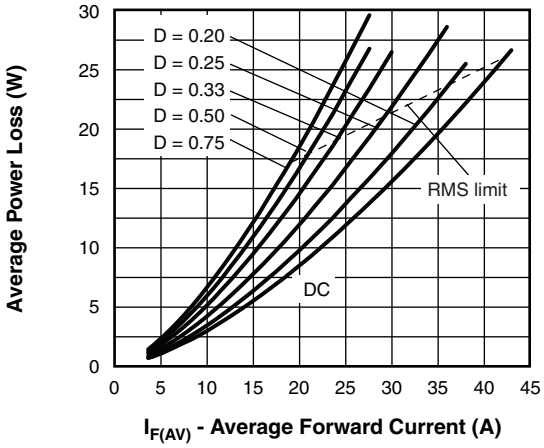



Fig. 6 - Forward Power Loss Characteristics

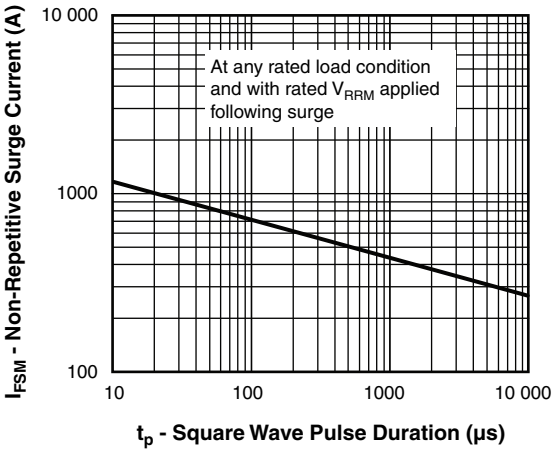
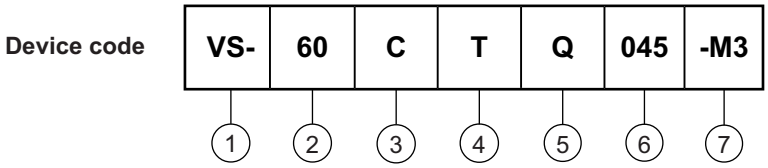



Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

**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 $V_R$

## ORDERING INFORMATION TABLE



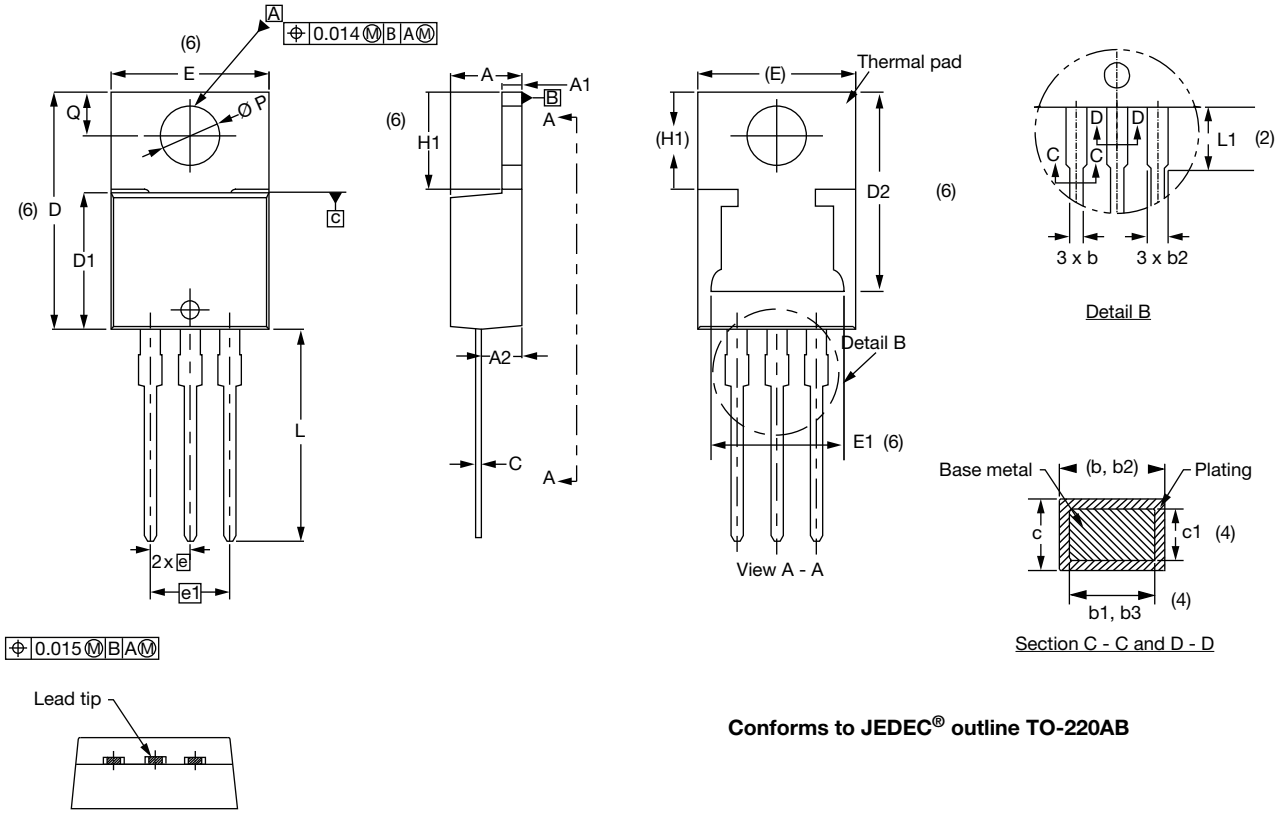

1 - Vishay Semiconductors product
2 - Current rating (60 = 60 A)
3 - Circuit configuration
C = common cathode
4 - Package
T = TO-220
5 - Schottky "Q" series
6 - Voltage ratings — 035 = 35 V, 040 = 40 V, 045 = 45 V
7 - Environmental digit
-M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

| **ORDERING INFORMATION** (Example) | | |
|---|---|---|
| **PREFERRED P/N** | **BASE QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-60CTQ035-M3 | 50 | Antistatic plastic tubes |
| VS-60CTQ040-M3 | 50 | Antistatic plastic tubes |
| VS-60CTQ045-M3 | 50 | Antistatic plastic tubes |

| **LINKS TO RELATED DOCUMENTS** | |
|---|---|
| Dimensions | www.vishay.com/doc?96154 |
| Part marking information | www.vishay.com/doc?95028 |

# TO-220AB 3L

**DIMENSIONS** in millimeters and inches




**Conforms to JEDEC® outline TO-220AB**

| 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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