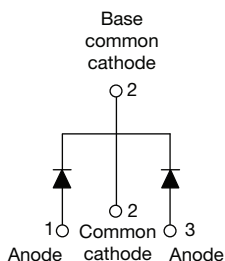
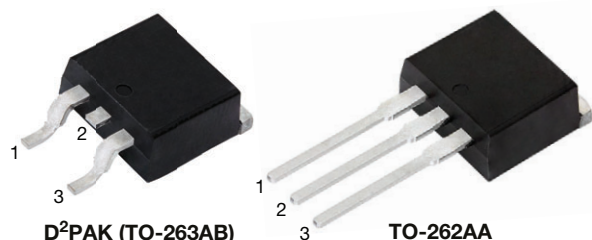
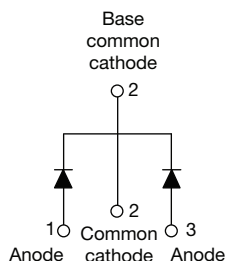


High Performance Schottky Rectifier, 2 x 20 A


VS-40CTQ045S-M3

VS-40CTQ045-1-M3

FEATURES

- 150 °C T_J operation
- Center tap configuration
- Very 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
- 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



RoHS
COMPLIANT
HALOGEN
FREE

DESCRIPTION

This center tap Schottky rectifier has been optimized for very low forward voltage drop, with moderate leakage. 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 20 A |
| V_R | 45 V |
| V_F at I_F | 0.48 V |
| I_{RM} typ. | 115 mA at 125 °C |
| T_J max. | 150 °C |
| E_{AS} | 20 mJ |
| Package | D ² PAK (TO-263AB), TO-262AA |
| Circuit configuration | Common cathode |

MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL | CHARACTERISTICS | VALUES | UNITS |
|-------------|---|-------------|-------|
| $I_{F(AV)}$ | Rectangular waveform | 40 | A |
| V_{RRM} | | 45 | V |
| I_{FSM} | $t_p = 5 \mu s$ sine | 1240 | A |
| V_F | 20 A _{pk} , $T_J = 125$ °C (per leg) | 0.48 | V |
| T_J | Range | -55 to +150 | °C |

VOLTAGE RATINGS

| PARAMETER | SYMBOL | VS-40CTQ045S-M3 VS-40CTQ045-1-M3 | UNITS |
|--------------------------------------|-----------|-------------------------------------|-------|
| Maximum DC reverse voltage | V_R | 45 | V |
| Maximum working peak reverse voltage | V_{RWM} | | |

**ABSOLUTE MAXIMUM RATINGS**

| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|---|-------------|---|--------|-------|
| Maximum average forward current See fig. 5 | $I_{F(AV)}$ | 50 % duty cycle at $T_C = 116\text{ }^{\circ}\text{C}$, rectangular waveform | 20 | A |
| per leg | | | 40 | |
| Maximum peak one cycle non-repetitive surge current per leg See fig. 7 | I_{FSM} | 5 μs sine or 3 μs rect. pulse | 1240 | |
| | | 10 ms sine or 6 ms rect. pulse | 350 | |
| Non-repetitive avalanche energy per leg | E_{AS} | $T_J = 25\text{ }^{\circ}\text{C}$, $I_{AS} = 3\text{ A}$, $L = 4.40\text{ mH}$ | 20 | mJ |
| Repetitive avalanche current per leg | I_{AR} | Current decaying linearly to zero in 1 μs Frequency limited by T_J maximum $V_A = 1.5 \times V_R$ typical | 3 | A |

ELECTRICAL SPECIFICATIONS

| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|--|----------------|--|--------|------------------|
| Maximum forward voltage drop per leg See fig. 1 | $V_{FM}^{(1)}$ | 20 A | 0.53 | V |
| | | 40 A | 0.68 | |
| | | 20 A | 0.48 | |
| | | 40 A | 0.67 | |
| Maximum reverse leakage current per leg | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^{\circ}\text{C}$ | 3 | mA |
| | | $T_J = 125\text{ }^{\circ}\text{C}$ | 150 | |
| Typical reverse leakage current | $I_{RM}^{(1)}$ | $T_J = 125\text{ }^{\circ}\text{C}$ | 115 | mA |
| Threshold voltage | $V_{F(TO)}$ | $T_J = T_J$ maximum | 0.27 | V |
| Forward slope resistance | r_t | | 8.72 | m Ω |
| Maximum junction capacitance per leg | C_T | $V_R = 5\text{ V}_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^{\circ}\text{C}$ | 2800 | pF |
| Typical series inductance per leg | L_S | Measured lead to lead 5 mm from package body | 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 and storage temperature range | T _J , T _{Stg} | | -55 to 150 | °C |
| Maximum thermal resistance, junction to case per leg | R _{thJC} | DC operation | 2.0 | °C/W |
| Maximum thermal resistance, junction to case per package | | | 1.0 | |
| 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 (lbf · in) |
| | maximum | | 12 (10) | |
| Marking device | | Case style D ² PAK (TO-263AB) | 40CTQ045S | |
| | | Case style TO-262AA | 40CTQ045-1 | |

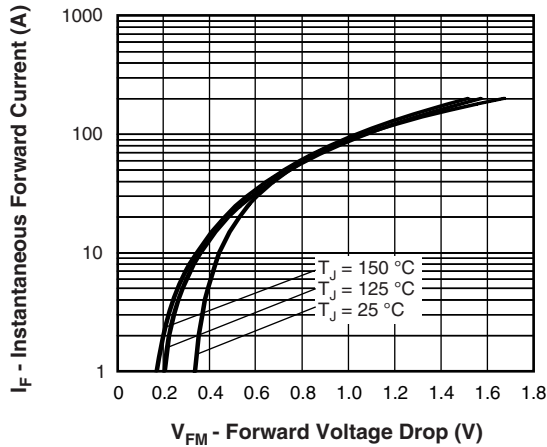


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

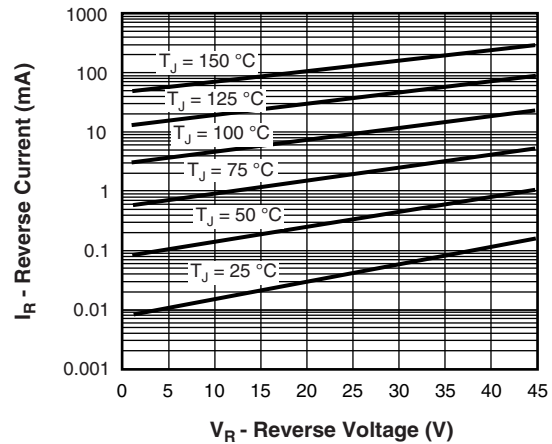


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

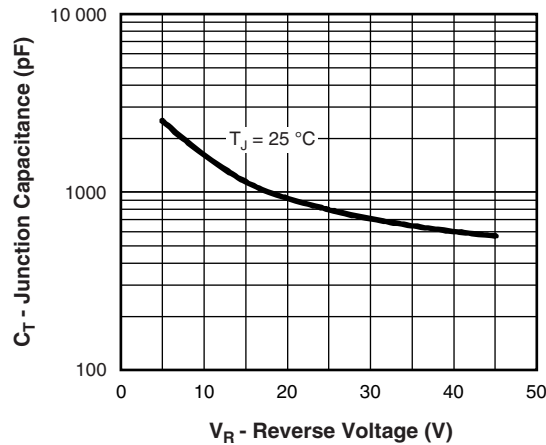


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

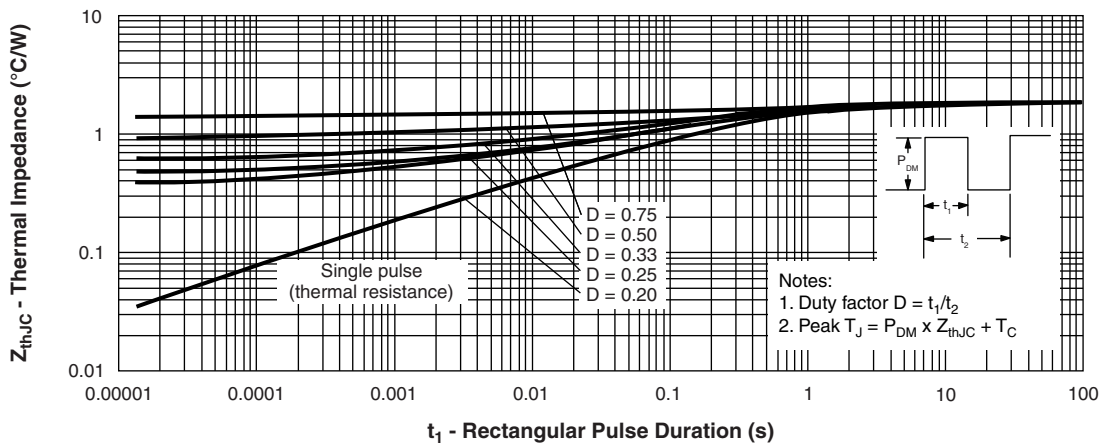


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics (Per Leg)

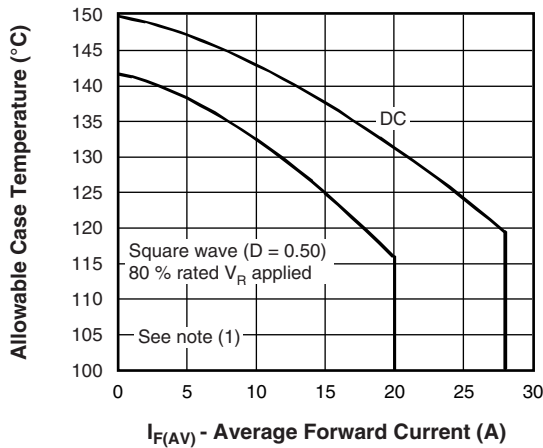


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

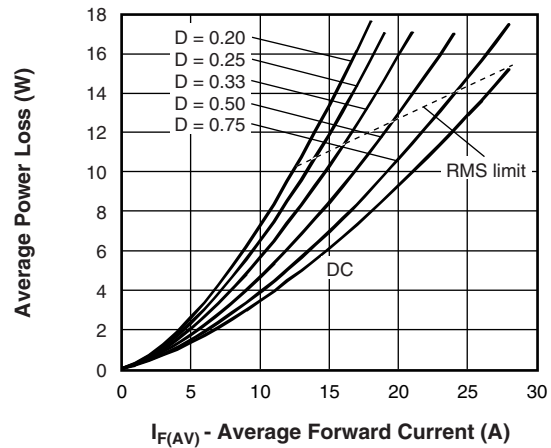


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

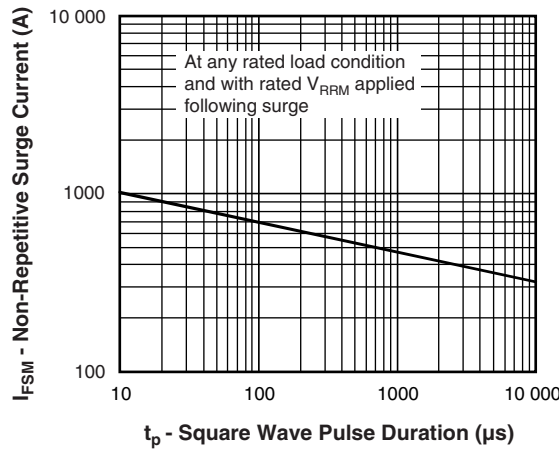


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

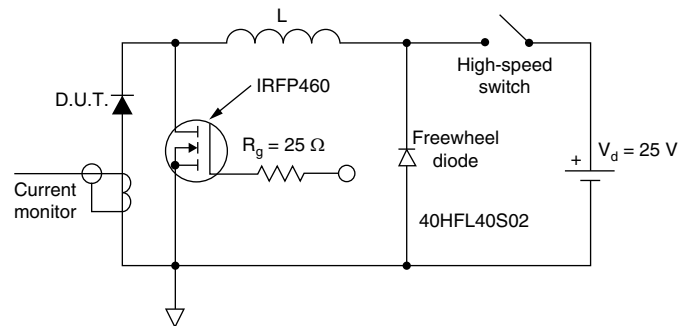


Fig. 8 - Unclamped Inductive Test Circuit

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 $V_{R1} = 10 V$

**ORDERING INFORMATION TABLE**

| | | | | | | | | | |
|-------------|--|-----------|----------|----------|----------|------------|----------|------------|------------|
| Device code | VS- | 40 | C | T | Q | 045 | S | TRL | -M3 |
| | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ |
| ① | - Vishay Semiconductors product | | | | | | | | |
| ② | - Current rating (40 A) | | | | | | | | |
| ③ | - Circuit configuration: C = common cathode | | | | | | | | |
| ④ | - T = TO-220 | | | | | | | | |
| ⑤ | - Schottky "Q" series | | | | | | | | |
| ⑥ | - Voltage rating (045 = 45 V) | | | | | | | | |
| ⑦ | - • S = D ² PAK (TO-263AB) • -1 = TO-262AA | | | | | | | | |
| ⑧ | - • None = tube • TRL = tape and reel (left oriented - for D ² PAK (TO-263AB) only) • TRR = tape and reel (right oriented - for D ² PAK (TO-263AB) only) | | | | | | | | |
| ⑨ | - -M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free | | | | | | | | |

ORDERING INFORMATION

| PREFERRED P/N | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
|--------------------|------------------|------------------------|--------------------------|
| VS-40CTQ045S-M3 | 50 | 1000 | Antistatic plastic tubes |
| VS-40CTQ045STRR-M3 | 800 | 800 | 13" diameter reel |
| VS-40CTQ045STRL-M3 | 800 | 800 | 13" diameter reel |
| VS-40CTQ045-1-M3 | 50 | 1000 | Antistatic plastic tubes |

LINKS TO RELATED DOCUMENTS

| | | |
|--------------------------|-------------------------------|--|
| Dimensions | D ² PAK (TO-263AB) | www.vishay.com/doc?96164 |
| | TO-262AA | www.vishay.com/doc?96165 |
| Part marking information | D ² PAK (TO-263AB) | www.vishay.com/doc?95444 |
| | TO-262AA | www.vishay.com/doc?95443 |
| Packaging information | | www.vishay.com/doc?96424 |

D²PAK

DIMENSIONS in millimeters and inches

Conforms to JEDEC® outline D²PAK (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 | |

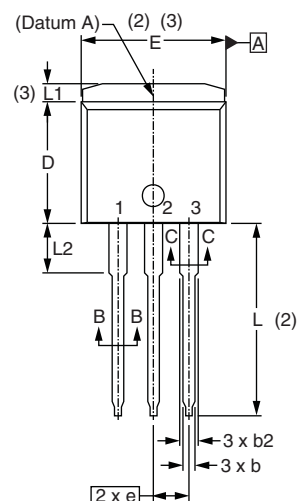
Notes

- Dimensioning and tolerancing per ASME Y14.5 M-1994
- 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
- Thermal pad contour optional within dimension E, L1, D1 and E1
- Dimension b1 and c1 apply to base metal only
- Datum A and B to be determined at datum plane H
- Controlling dimension: inch
- Outline conforms to JEDEC® outline TO-263AB

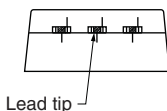
TO-262

DIMENSIONS in millimeters and inches

Modified JEDEC® outline TO-262

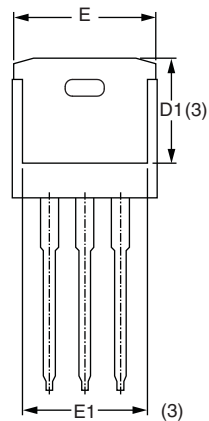
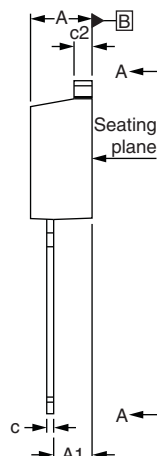


$\Phi 0.010 \text{ (A) (B)}$

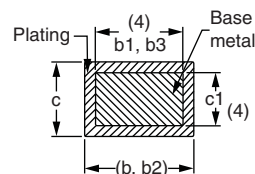


Lead assignments

- Diodes**
 1. - Anode (two die)/open (one die)
 2., 4. - Cathode
 3. - Anode



Section A - A



Section B - B and C - C
 Scale: None

| SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|--------|-------------|-------|-----------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | 0.160 | 0.190 | |
| A1 | 2.03 | 3.02 | 0.080 | 0.119 | |
| 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 |
| 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 | | |
| L | 13.46 | 14.10 | 0.530 | 0.555 | |
| L1 | - | 1.65 | - | 0.065 | 3 |
| L2 | 3.36 | 3.71 | 0.132 | 0.146 | |

Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-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) Controlling dimension: inches
- (6) Outline conform to JEDEC TO-262 except A1 (maximum), b (minimum), D1 (minimum) and L2 where dimensions derived the actual package outline



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