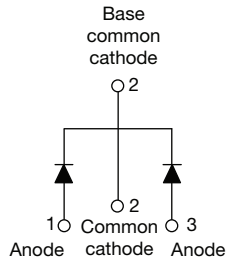
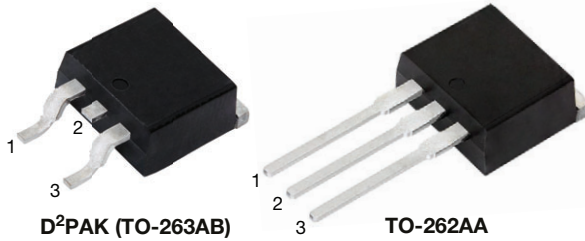
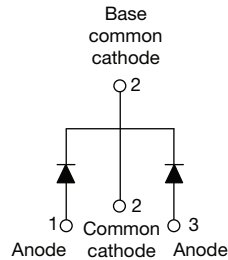


High Performance Schottky Rectifier, 2 x 10 A



VS-20CTQ...S-M3



VS-20CTQ...-1-M3

FEATURES

- 175 °C T_J operation
- Center tap configuration
- 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

The VS-20CTQ... center tap 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

| | |
|-----------------------|---|
| $I_{F(AV)}$ | 2 x 10 A |
| V_R | 35 V, 40 V, 45 V |
| V_F at I_F | 0.57 V |
| I_{RM} | 15 mA at 125 °C |
| T_J max. | 175 °C |
| E_{AS} | 13 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 | 20 | A |
| V_{RRM} | Range | 35 to 45 | V |
| I_{FSM} | $t_p = 5 \mu s$ sine | 1060 | A |
| V_F | 10 A _{pk} , $T_J = 125$ °C (per leg) | 0.57 | V |
| T_J | Range | -55 to +175 | °C |

VOLTAGE RATINGS

| PARAMETER | SYMBOL | VS-20CTQ035S-M3 VS-20CTQ035-1-M3 | VS-20CTQ040S-M3 VS-20CTQ040-1-M3 | VS-20CTQ045S-M3 VS-20CTQ045-1-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 See fig. 5 | $I_{F(AV)}$ | 50 % duty cycle at $T_C = 145\text{ }^\circ\text{C}$, rectangular waveform | | 20 | A |
| Maximum peak one cycle non-repetitive surge current per leg See fig. 7 | I_{FSM} | 5 μs sine or 3 μs rect. pulse | Following any rated load condition and with rated V_{RRM} applied | 1060 | |
| | | 10 ms sine or 6 ms rect. pulse | | 265 | |
| Non-repetitive avalanche energy per leg | E_{AS} | $T_J = 25\text{ }^\circ\text{C}$, $I_{AS} = 2.0\text{ A}$, $L = 6.5\text{ mH}$ | | 13 | 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 | | 2.0 | A |

| ELECTRICAL SPECIFICATIONS | | | | | |
|---|----------------|---|-----------------------------------|--------|------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum forward voltage drop per leg See fig. 1 | $V_{FM}^{(1)}$ | 10 A | $T_J = 25\text{ }^\circ\text{C}$ | 0.64 | V |
| | | 20 A | | 0.76 | |
| | | 10 A | $T_J = 125\text{ }^\circ\text{C}$ | 0.57 | |
| | | 20 A | | 0.68 | |
| Maximum reverse leakage current per leg See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^\circ\text{C}$ | $V_R = \text{Rated } V_R$ | 2 | mA |
| | | $T_J = 125\text{ }^\circ\text{C}$ | | 15 | |
| Maximum junction capacitance per leg | C_T | $V_R = 5 V_{DC}$ (test signal range 100 kHz to 1 MHz), $25\text{ }^\circ\text{C}$ | | 900 | 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 175 | $^\circ\text{C}$ |
| Maximum thermal resistance, junction to case per leg | R_{thJC} | DC operation See fig. 4 | | 3.25 | $^\circ\text{C/W}$ |
| Maximum thermal resistance, junction to case per package | | DC operation | | 1.63 | |
| 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) | |
| | | Case style D ² PAK (TO-263AB) | | 20CTQ035S 20CTQ040S 20CTQ045S | |
| | | Case style TO-262AA | | 20CTQ035-1 20CTQ040-1 20CTQ045-1 | |

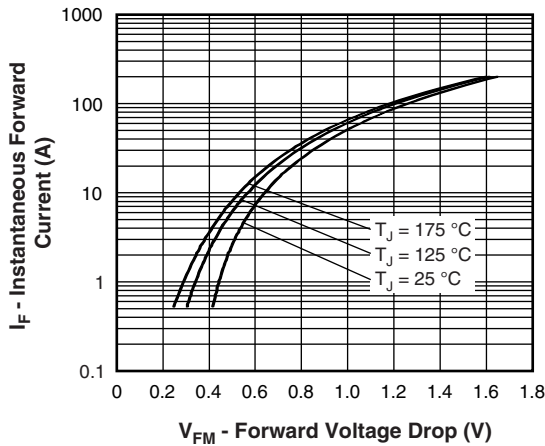


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

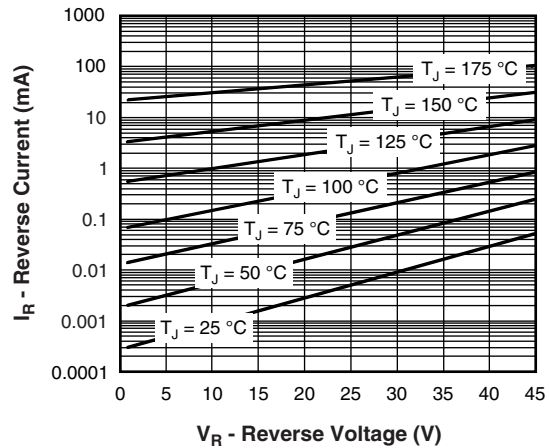


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

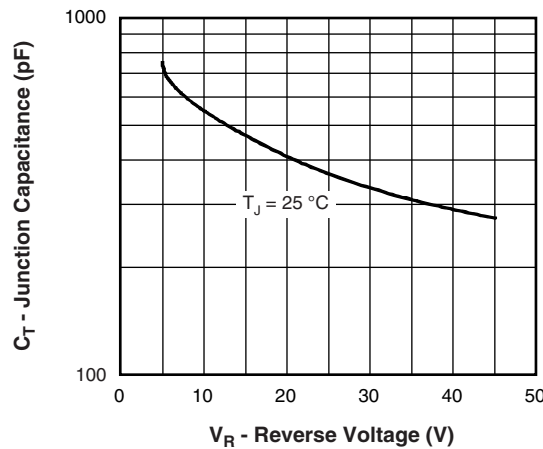


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

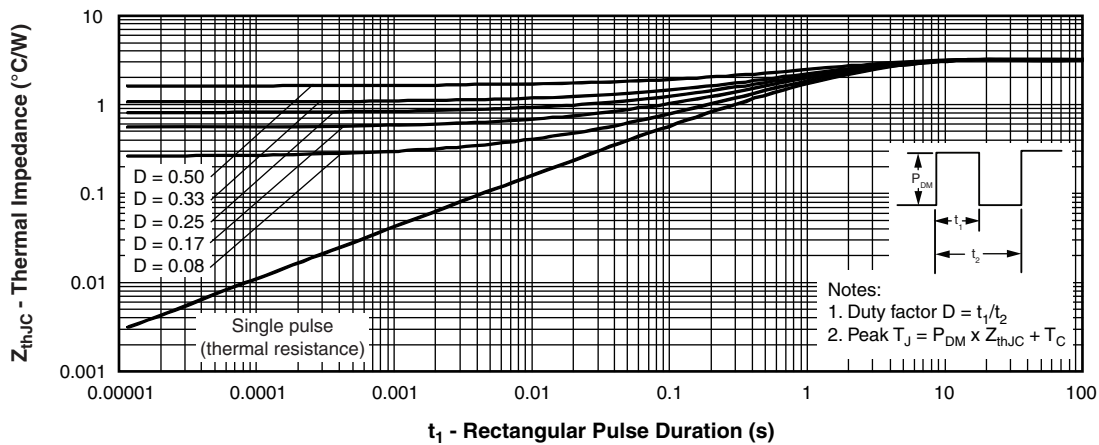


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics (Per Leg)

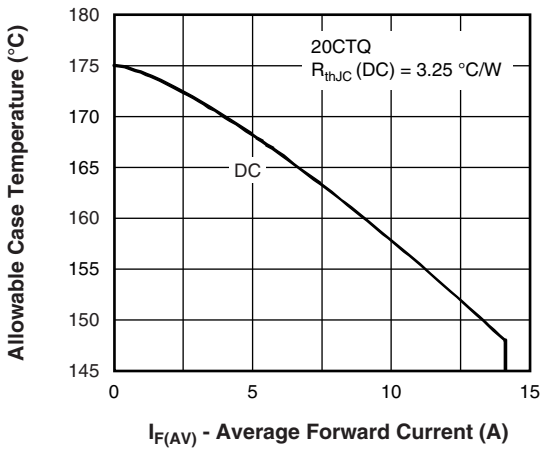


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

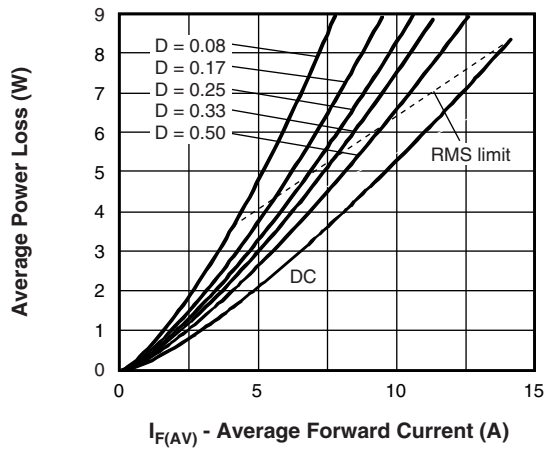


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

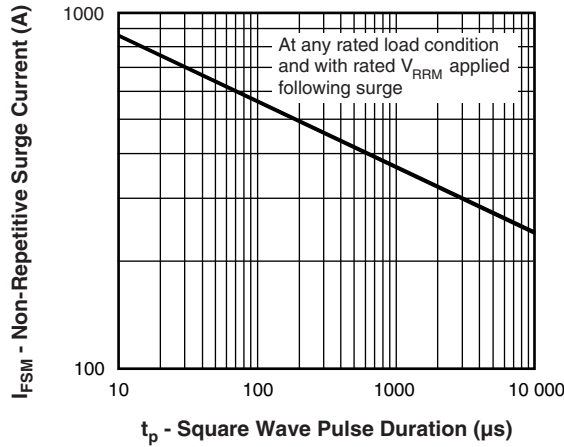


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

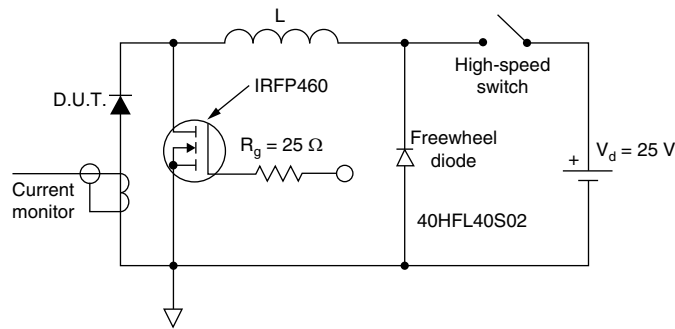


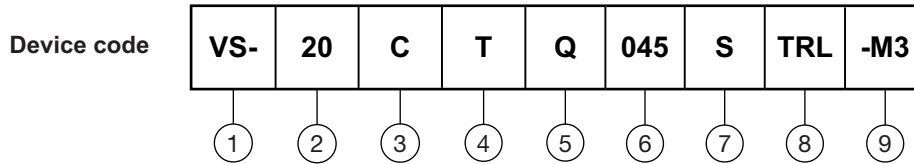
Fig. 8 - Unclamped Inductive Test Circuit

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 $V_{R1} = 80\%$ rated V_R applied



ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current rating (20 A)
- 3** - Circuit configuration: C = common cathode
- 4** - T = TO-220
- 5** - Schottky "Q" series
- 6** - Voltage ratings

| |
|------------|
| 035 = 35 V |
| 040 = 40 V |
| 045 = 45 V |
- 7** -
 - S = D²PAK (TO-263AB)
 - -1 = TO-262AA
- 8** -
 - None = tube
 - TRL = tape and reel (left oriented - for D²PAK (TO-263AB) only)
 - TRR = tape and reel (right oriented - for D²PAK (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-20CTQ035S-M3 | 50 | 1000 | Antistatic plastic tubes |
| VS-20CTQ035STRR-M3 | 800 | 800 | 13" diameter reel |
| VS-20CTQ035STRL-M3 | 800 | 800 | 13" diameter reel |
| VS-20CTQ035-1-M3 | 50 | 1000 | Antistatic plastic tubes |
| VS-20CTQ040S-M3 | 50 | 1000 | Antistatic plastic tubes |
| VS-20CTQ040STRR-M3 | 800 | 800 | 13" diameter reel |
| VS-20CTQ040STRL-M3 | 800 | 800 | 13" diameter reel |
| VS-20CTQ040-1-M3 | 50 | 1000 | Antistatic plastic tubes |
| VS-20CTQ045S-M3 | 50 | 1000 | Antistatic plastic tubes |
| VS-20CTQ045STRR-M3 | 800 | 800 | 13" diameter reel |
| VS-20CTQ045STRL-M3 | 800 | 800 | 13" diameter reel |
| VS-20CTQ045-1-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 | SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|--------|-------------|-------|--------|-------|-------|--------|-------------|-------|-----------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. | | | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | 0.160 | 0.190 | | D1 | 6.86 | 8.00 | 0.270 | 0.315 | 3 |
| A1 | 0.00 | 0.254 | 0.000 | 0.010 | | E | 9.65 | 10.67 | 0.380 | 0.420 | 2, 3 |
| b | 0.51 | 0.99 | 0.020 | 0.039 | | E1 | 7.90 | 8.80 | 0.311 | 0.346 | 3 |
| b1 | 0.51 | 0.89 | 0.020 | 0.035 | 4 | e | 2.54 BSC | | 0.100 BSC | | |
| b2 | 1.14 | 1.78 | 0.045 | 0.070 | | H | 14.61 | 15.88 | 0.575 | 0.625 | |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 | 4 | L | 1.78 | 2.79 | 0.070 | 0.110 | |
| c | 0.38 | 0.74 | 0.015 | 0.029 | | L1 | - | 1.65 | - | 0.066 | 3 |
| c1 | 0.38 | 0.58 | 0.015 | 0.023 | 4 | L2 | 1.27 | 1.78 | 0.050 | 0.070 | |
| c2 | 1.14 | 1.65 | 0.045 | 0.065 | | L3 | 0.25 BSC | | 0.010 BSC | | |
| D | 8.51 | 9.65 | 0.335 | 0.380 | 2 | 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



| 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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