

**ELECTRICAL SPECIFICATIONS**

| PARAMETER                                             | SYMBOL                         | TEST CONDITIONS                                                               |                                       | VALUES | UNITS |
|-------------------------------------------------------|--------------------------------|-------------------------------------------------------------------------------|---------------------------------------|--------|-------|
| Maximum forward voltage drop per leg<br>See fig. 1    | V <sub>FM</sub> <sup>(1)</sup> | 10 A                                                                          | T <sub>J</sub> = 25 °C                | 0.64   | V     |
|                                                       |                                | 20 A                                                                          |                                       | 0.76   |       |
|                                                       |                                | 10 A                                                                          | T <sub>J</sub> = 125 °C               | 0.57   |       |
|                                                       |                                | 20 A                                                                          |                                       | 0.68   |       |
| Maximum reverse leakage current per leg<br>See fig. 2 | I <sub>RM</sub> <sup>(1)</sup> | T <sub>J</sub> = 25 °C                                                        | V <sub>R</sub> = Rated V <sub>R</sub> | 2      | mA    |
|                                                       |                                | T <sub>J</sub> = 125 °C                                                       |                                       | 15     |       |
| Maximum junction capacitance per leg                  | C <sub>T</sub>                 | V <sub>R</sub> = 5 V <sub>DC</sub> (test signal range 100 kHz to 1 MHz) 25 °C |                                       | 900    | pF    |
| Typical series inductance per leg                     | L <sub>S</sub>                 | Measured lead to lead 5 mm from package body                                  |                                       | 8.0    | nH    |
| Maximum voltage rate of change                        | dV/dt                          | Rated V <sub>R</sub>                                                          |                                       | 10 000 | V/μs  |

**Note**(1) Pulse width < 300  $\mu$ s, 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 per leg     | R <sub>thJC</sub>                 | DC operation<br>See fig. 4           | 3.25        | °C/W                   |
| Maximum thermal resistance, junction to case per package |                                   | DC operation                         | 1.63        |                        |
| 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<br>maximum                |                                      | 6 (5)       | kgf · cm<br>(lbf · in) |
|                                                          |                                   |                                      | 12 (10)     |                        |
| Marking device                                           |                                   | Case style TO-220AB                  | 20CTQ035    |                        |
|                                                          |                                   |                                      | 20CTQ040    |                        |
|                                                          |                                   |                                      | 20CTQ045    |                        |

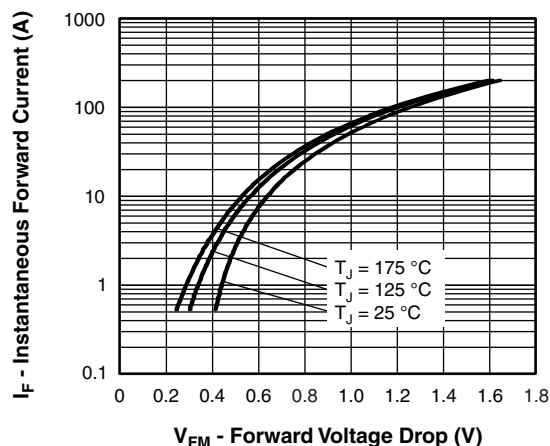


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

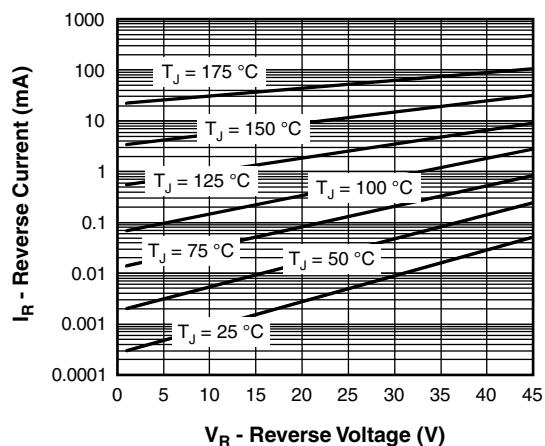


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

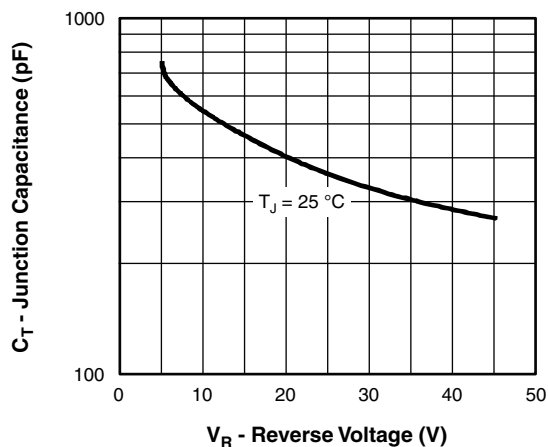


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

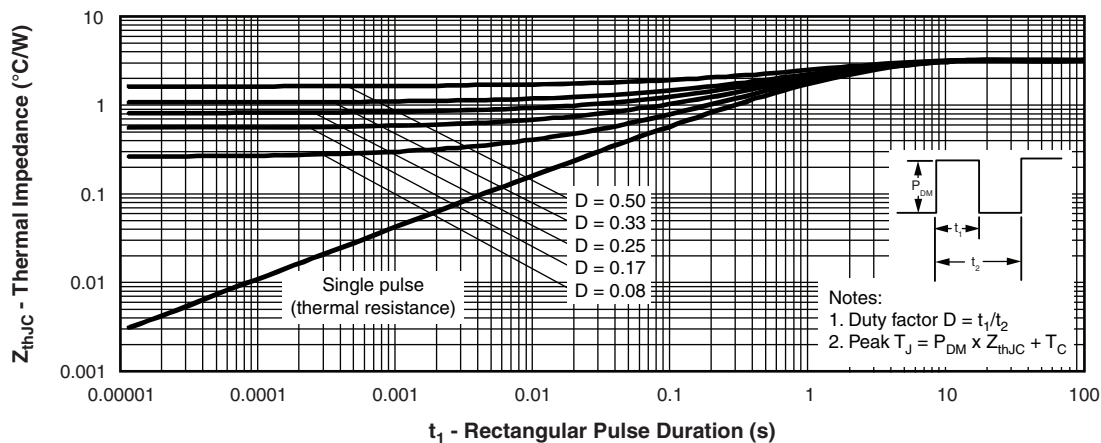


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

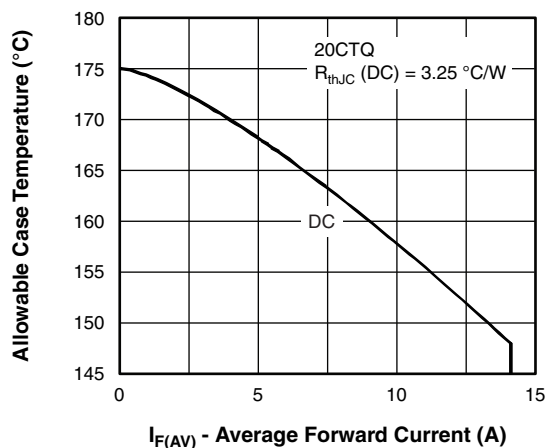


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

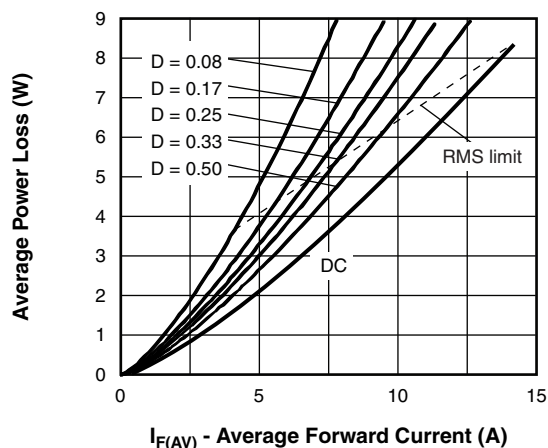


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

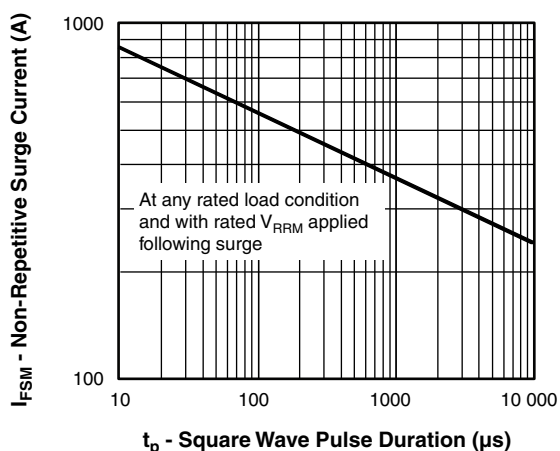


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

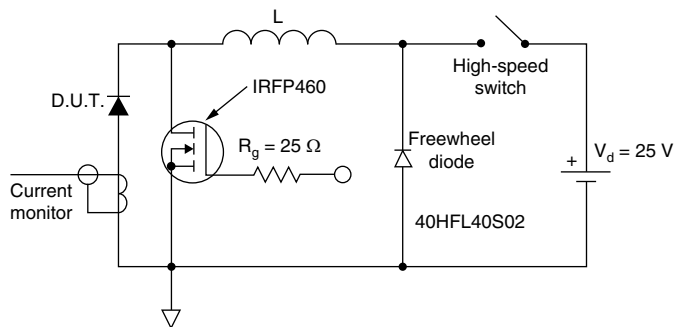


Fig. 8 - Unclamped Inductive Test Circuit

**ORDERING INFORMATION TABLE**

|             |            |           |          |          |          |            |            |
|-------------|------------|-----------|----------|----------|----------|------------|------------|
| Device code | <b>VS-</b> | <b>20</b> | <b>C</b> | <b>T</b> | <b>Q</b> | <b>045</b> | <b>PbF</b> |
|             | 1          | 2         | 3        | 4        | 5        | 6          | 7          |

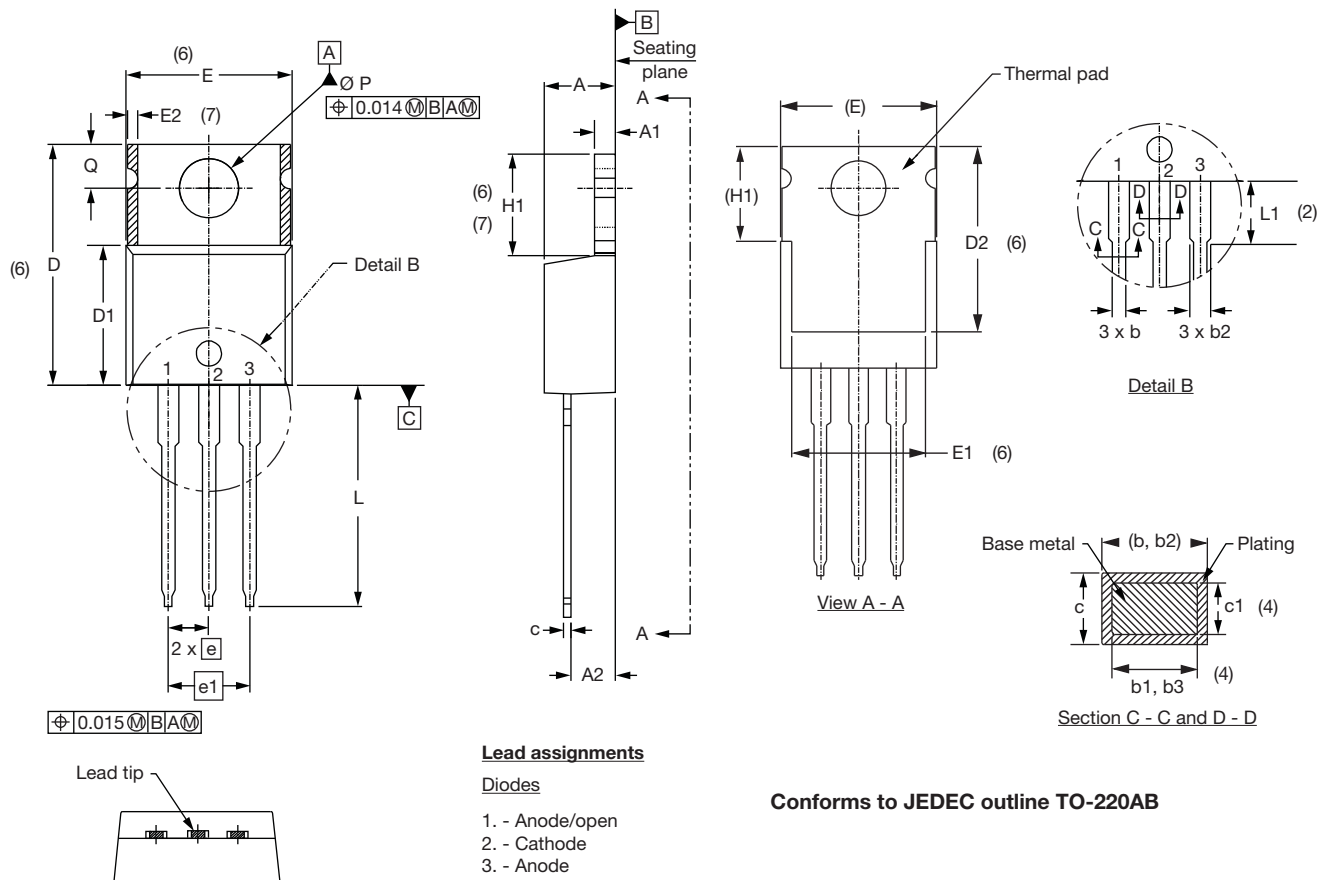
- |          |   |                                             |
|----------|---|---------------------------------------------|
| <b>1</b> | - | Vishay Semiconductors product               |
| <b>2</b> | - | Current rating (20 = 20 A)                  |
| <b>3</b> | - | Circuit configuration<br>C = Common cathode |
| <b>4</b> | - | Package<br>T = TO-220                       |
| <b>5</b> | - | Schottky "Q" series                         |
| <b>6</b> | - | Voltage rating                              |
| <b>7</b> | - | Environmental digit                         |
- |            |
|------------|
| 035 = 35 V |
| 040 = 40 V |
| 045 = 45 V |
- PbF = Lead (Pb)-free and RoHS compliant
  - -N3 = Halogen-free, RoHS compliant, and totally lead (Pb)-free

| <b>ORDERING INFORMATION</b> (Example) |                  |                        |                         |
|---------------------------------------|------------------|------------------------|-------------------------|
| PREFERRED P/N                         | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
| VS-20CTQ035PbF                        | 50               | 1000                   | Antistatic plastic tube |
| VS-20CTQ035-N3                        | 50               | 1000                   | Antistatic plastic tube |
| VS-20CTQ040PbF                        | 50               | 1000                   | Antistatic plastic tube |
| VS-20CTQ040-N3                        | 50               | 1000                   | Antistatic plastic tube |
| VS-20CTQ045PbF                        | 50               | 1000                   | Antistatic plastic tube |
| VS-20CTQ045-N3                        | 50               | 1000                   | Antistatic plastic tube |

| <b>LINKS TO RELATED DOCUMENTS</b> |                                                                                     |
|-----------------------------------|-------------------------------------------------------------------------------------|
| Dimensions                        | <a href="http://www.vishay.com/doc?95222">www.vishay.com/doc?95222</a>              |
| Part marking information          | TO-220AB PbF <a href="http://www.vishay.com/doc?95225">www.vishay.com/doc?95225</a> |
|                                   | TO-220AB -N3 <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a> |

## TO-220AB

**DIMENSIONS** in millimeters and inches



| 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     |

| SYMBOL | MILLIMETERS |       | INCHES     |       | NOTES |
|--------|-------------|-------|------------|-------|-------|
|        | MIN.        | MAX.  | MIN.       | MAX.  |       |
| E      | 10.11       | 10.51 | 0.398      | 0.414 | 3, 6  |
| E1     | 6.86        | 8.89  | 0.270      | 0.350 | 6     |
| E2     | -           | 0.76  | -          | 0.030 | 7     |
| 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, 7  |
| L      | 13.52       | 14.02 | 0.532      | 0.552 |       |
| L1     | 3.32        | 3.82  | 0.131      | 0.150 | 2     |
| Ø P    | 3.54        | 3.73  | 0.139      | 0.147 |       |
| Q      | 2.60        | 3.00  | 0.102      | 0.118 |       |
| θ      | 90° to 93°  |       | 90° to 93° |       |       |

### 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) Dimensions E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, except A2 (maximum) and D2 (minimum) where dimensions are derived from the actual package outline



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