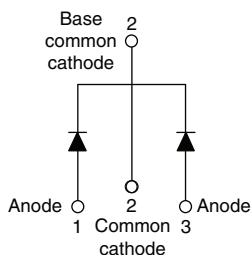


# High Performance Schottky Rectifier, 2 x 10 A



TO-220AB



## FEATURES

- 175 °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
- AEC-Q101 qualified
- Meets JESD 201 class 2 whisker test
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
**HALOGEN**  
**FREE**

## PRODUCT SUMMARY

|                 |                  |
|-----------------|------------------|
| Package         | TO-220AB         |
| $I_{F(AV)}$     | 2 x 10 A         |
| $V_R$           | 35 V, 40 V, 45 V |
| $V_F$ at $I_F$  | 0.57 V           |
| $I_{RM}$ max.   | 15 mA at 125 °C  |
| $T_J$ max.      | 175 °C           |
| Diode variation | Common cathode   |
| $E_{AS}$        | 13 mJ            |

## DESCRIPTION

The VS-20CTQ...HN3 Series 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.

## 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 <sub>pk</sub> , $T_J = 125$ °C (per leg) | 0.57        | V     |
| $T_J$       | Range   | - 55 to 175 | °C    |

## VOLTAGE RATINGS

| PARAMETER                            | SYMBOL    | VS-20CTQ035HN3 | VS-20CTQ040HN3 | VS-20CTQ045HN3 | 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 $T_C = 145$ °C, rectangular waveform   | 20     | A     |
| Maximum peak one cycle non-repetitive surge current per leg<br>See fig. 7 | $I_{FSM}$   | 5 $\mu s$ sine or 3 $\mu s$ rect. pulse   | 1060   |       |
|   |             | 10 ms sine or 6 ms rect. pulse  | 265    |       |
| Non-repetitive avalanche energy per leg                                   | $E_{AS}$    | $T_J = 25$ °C, $I_{AS} = 2.0$ A, $L = 6.5$ mH   | 13     | mJ    |
| Repetitive avalanche current per leg                                      | $I_{AR}$    | Current decaying linearly to zero in 1 $\mu s$<br>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<br>See fig. 1    | $V_{FM}^{(1)}$ | 10 A  | 0.64   | V          |
|   |                | 20 A  | 0.76   |            |
|   |                | 10 A  | 0.57   |            |
|   |                | 20 A  | 0.68   |            |
| Maximum reverse leakage current per leg<br>See fig. 2 | $I_{RM}^{(1)}$ | $T_J = 25\text{ }^{\circ}\text{C}$  | 2      | mA         |
|   |                | $T_J = 125\text{ }^{\circ}\text{C}$   | 15     |            |
| Maximum junction capacitance per leg                  | $C_T$          | $V_R = 5\text{ V}_{DC}$ (test signal range 100 kHz to 1 MHz) $25\text{ }^{\circ}\text{C}$ | 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/ $\mu$ s |

**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                  | 20CTQ035H   |                        |
|  |                                   |                                      | 20CTQ040H   |                        |
|  |                                   |                                      | 20CTQ045H   |                        |

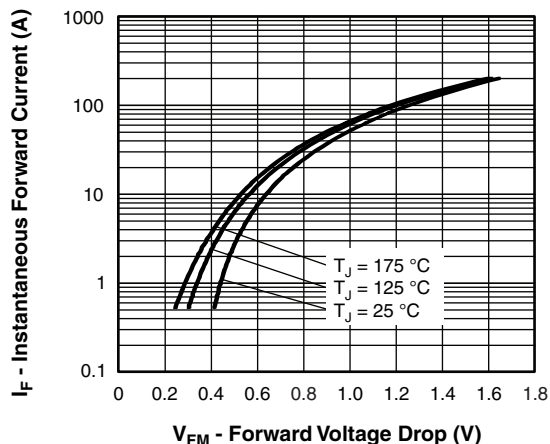


Fig. 1 - Maximum Forward Voltage Drop Characteristics (Per Leg)

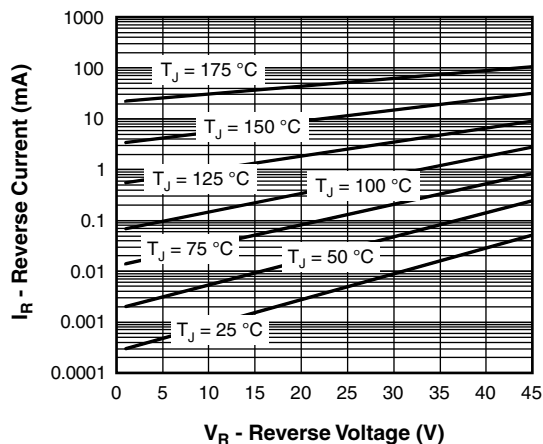


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage (Per Leg)

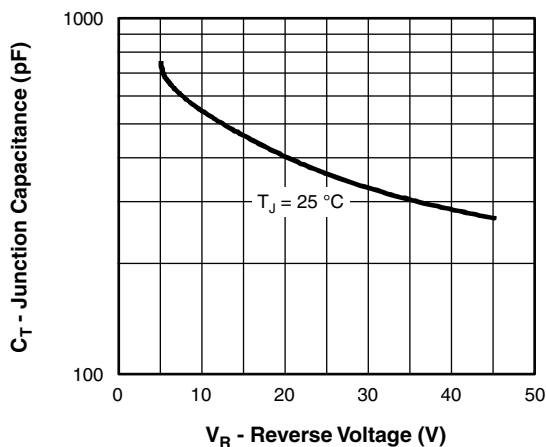


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

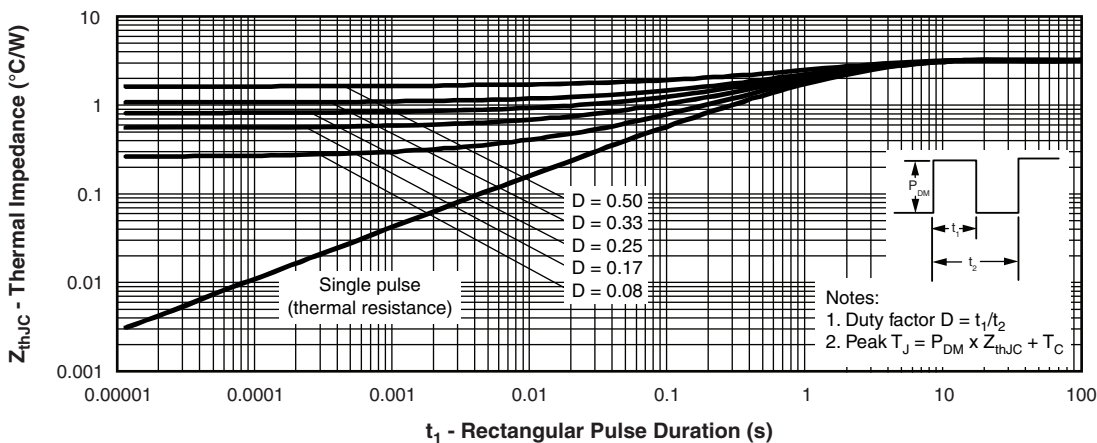


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

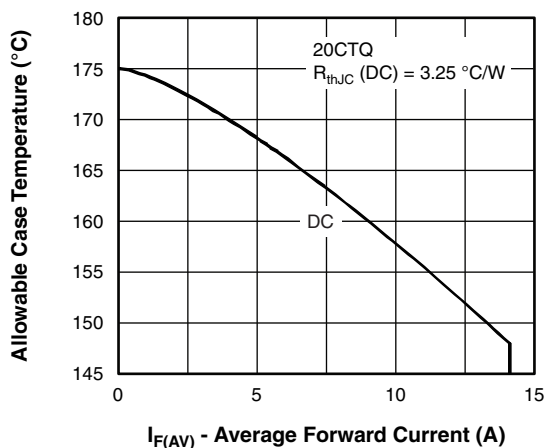


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Leg)

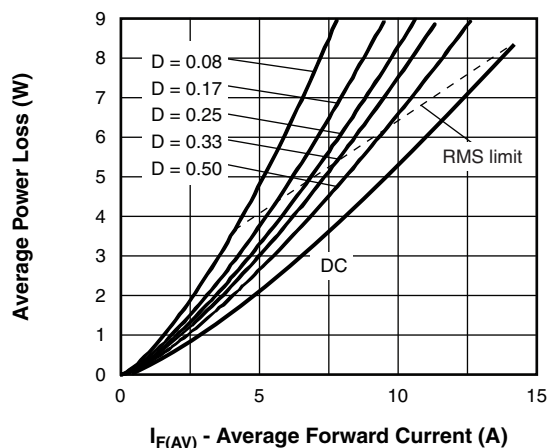


Fig. 6 - Forward Power Loss Characteristics (Per Leg)

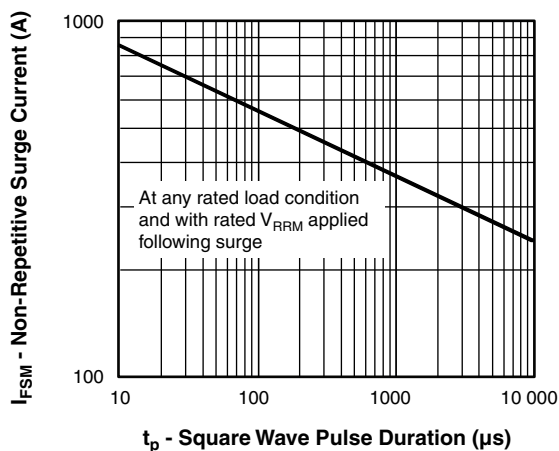


Fig. 7 - Maximum Non-Repetitive Surge Current (Per Leg)

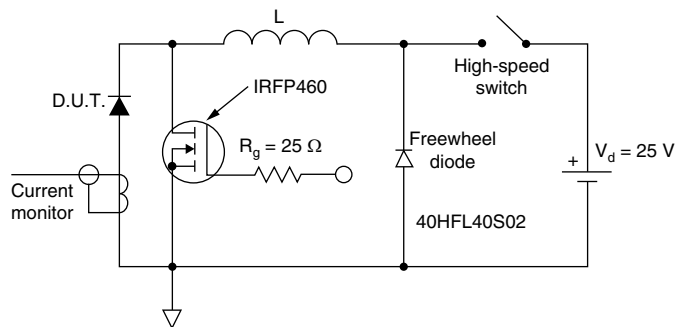


Fig. 8 - Unclamped Inductive Test Circuit



## ORDERING INFORMATION TABLE

|             |     |    |   |   |   |     |   |    |
|-------------|-----|----|---|---|---|-----|---|----|
| Device code | VS- | 20 | C | T | Q | 045 | H | N3 |
|             | 1   | 2  | 3 | 4 | 5 | 6   | 7 | 8  |

- |          |   |   |  |
|----------|---|---|--|
| <b>1</b> | - | Vishay Semiconductors product                                 |  |
| <b>2</b> | - | Current rating (20 = 20 A)                                    |  |
| <b>3</b> | - | Circuit configuration   |  |
|          |   | C = Common cathode  |  |
| <b>4</b> | - | Package   |  |
|          |   | T = TO-220  |  |
| <b>5</b> | - | Schottky "Q" series   |  |
| <b>6</b> | - | Voltage rating  | 035 = 35 V<br>040 = 40 V<br>045 = 45 V |
| <b>7</b> | - | H = AEC-Q101 qualified  |  |
| <b>8</b> | - | Environmental digit:  |  |
|          |   | N3 = Halogen-free, RoHS-compliant, and totally lead (Pb)-free |  |

### ORDERING INFORMATION (Example)

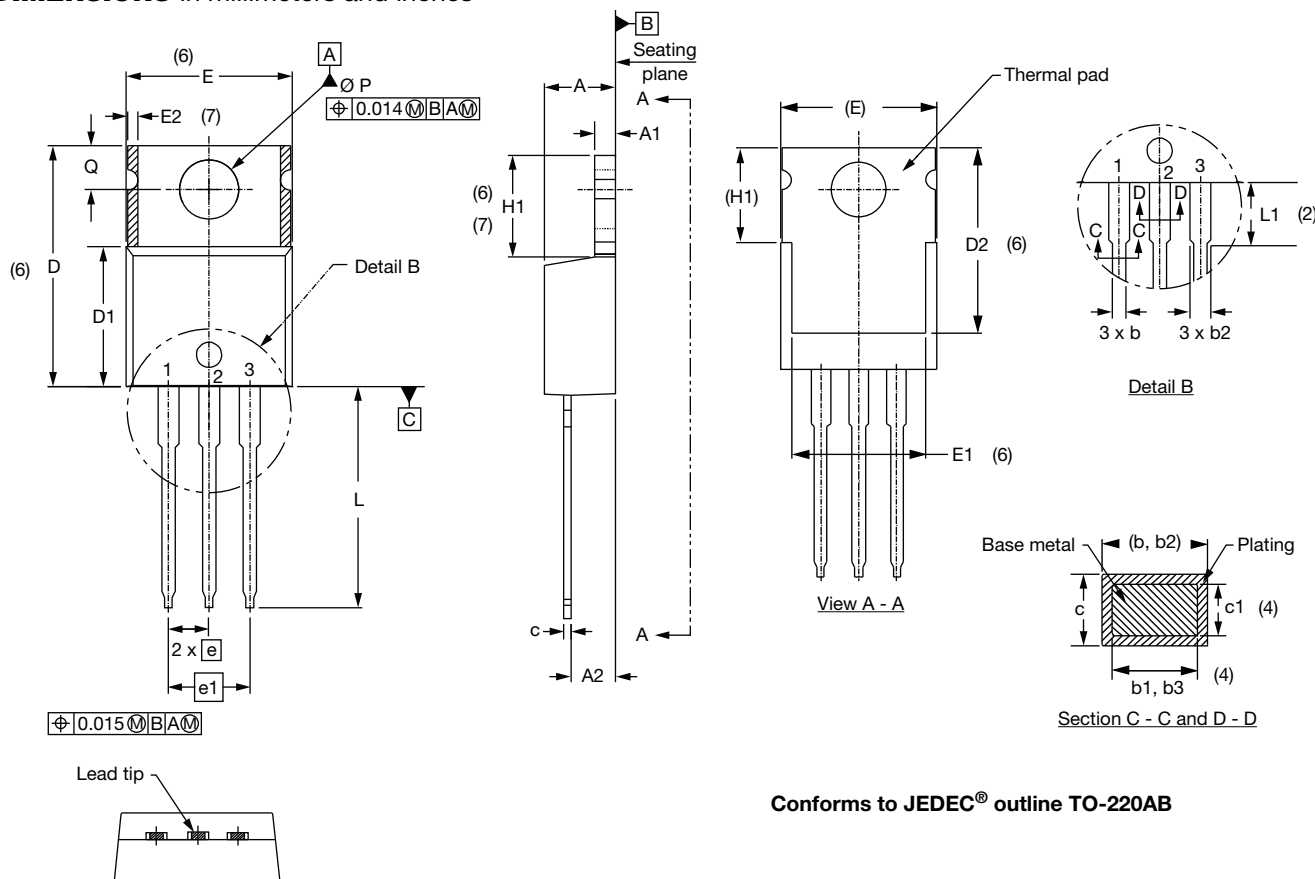
| PREFERRED P/N  | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
|----------------|------------------|------------------------|-------------------------|
| VS-20CTQ035HN3 | 50               | 1000                   | Antistatic plastic tube |
| VS-20CTQ040HN3 | 50               | 1000                   | Antistatic plastic tube |
| VS-20CTQ045HN3 | 50               | 1000                   | Antistatic plastic tube |

### LINKS TO RELATED DOCUMENTS

|                          |   |
|--------------------------|---|
| Dimensions               | <a href="http://www.vishay.com/doc?95222">www.vishay.com/doc?95222</a>          |
| Part marking information | TO-220AB <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a> |

# TO-220AB

**DIMENSIONS** in millimeters and inches



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

| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |  | SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|--|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |  |        | MIN.        | MAX.  |        |       |       |
| A      | 4.25        | 4.65  | 0.167  | 0.183 |       |  | D2     | 11.68       | 12.88 | 0.460  | 0.507 | 6     |
| A1     | 1.14        | 1.40  | 0.045  | 0.055 |       |  | E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |
| A2     | 2.56        | 2.92  | 0.101  | 0.115 |       |  | E1     | 6.86        | 8.89  | 0.270  | 0.350 | 6     |
| b      | 0.69        | 1.01  | 0.027  | 0.040 |       |  | E2     | -           | 0.76  | -      | 0.030 | 7     |
| b1     | 0.38        | 0.97  | 0.015  | 0.038 | 4     |  | e      | 2.41        | 2.67  | 0.095  | 0.105 |       |
| b2     | 1.20        | 1.73  | 0.047  | 0.068 |       |  | e1     | 4.88        | 5.28  | 0.192  | 0.208 |       |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     |  | H1     | 5.84        | 6.86  | 0.230  | 0.270 | 6, 7  |
| c      | 0.36        | 0.61  | 0.014  | 0.024 |       |  | L      | 13.52       | 14.02 | 0.532  | 0.552 |       |
| c1     | 0.36        | 0.56  | 0.014  | 0.022 | 4     |  | L1     | 3.32        | 3.82  | 0.131  | 0.150 | 2     |
| D      | 14.85       | 15.25 | 0.585  | 0.600 | 3     |  | Ø P    | 3.54        | 3.73  | 0.139  | 0.147 |       |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       |  | 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) Dimensions E2 x H1 define a zone where stamping and singulation irregularities are allowed
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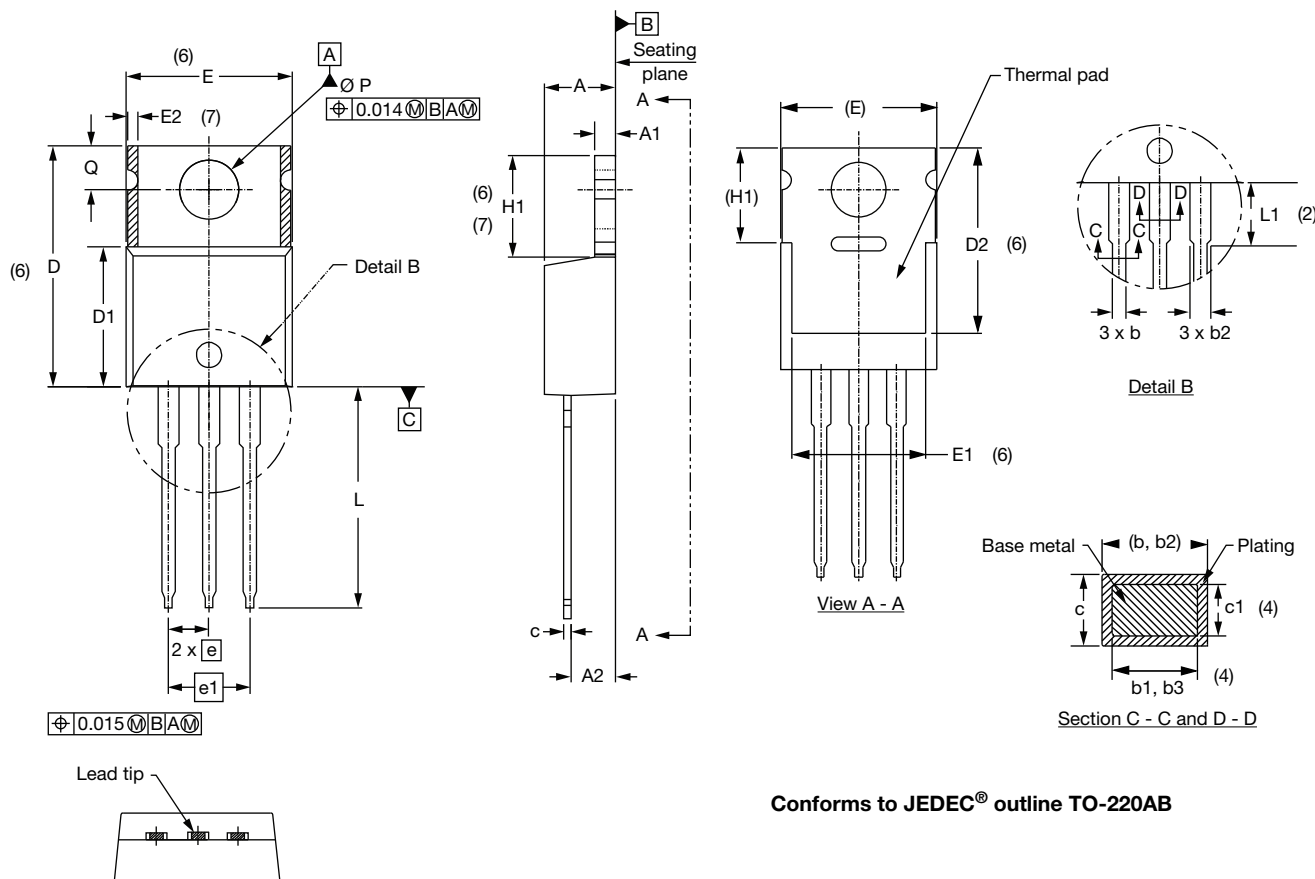
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