



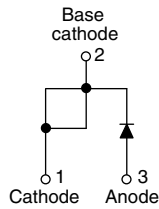
Hyperfast Rectifier, 8 A FRED Pt®



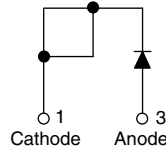
TO-220AC



TO-220 FULL-PAK



VS-8ETH06PbF
VS-8ETH06-N3



VS-8ETH06FPPbF
VS-8ETH06FP-N3

FEATURES

- Hyperfast recovery time
- Low forward voltage drop
- 175 °C operating junction temperature
- Low leakage current
- Fully isolated package ($V_{INS} = 2500 V_{RMS}$)
- UL E78996 approved
- Designed and qualified according to JEDEC®-JESD 47
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



DESCRIPTION / APPLICATIONS

State of the art hyperfast recovery rectifiers designed with optimized performance of forward voltage drop, hyperfast recovery time, and soft recovery.

The planar structure and the platinum doped life time control guarantee the best overall performance, ruggedness and reliability characteristics.

These devices are intended for use in PFC boost stage in the AC/DC section of SMPS, inverters or as freewheeling diodes.

Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

| PRODUCT SUMMARY | |
|-----------------|--------------------|
| Package | TO-220AC, TO-220FP |
| $I_{F(AV)}$ | 8 A |
| V_R | 600 V |
| V_F at I_F | 1.3 V |
| t_{rr} typ. | 18 ns |
| T_J max. | 175 °C |
| Diode variation | Single die |

| ABSOLUTE MAXIMUM RATINGS | | | | |
|---|----------------|-----------------------|-------------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Repetitive peak reverse voltage | V_{RRM} | | 600 | V |
| Average rectified forward current | $I_{F(AV)}$ | $T_C = 144\text{ °C}$ | 8 | A |
| | FULL-PAK | $T_C = 108\text{ °C}$ | | |
| Non-repetitive peak surge current | I_{FSM} | $T_J = 25\text{ °C}$ | 90 | |
| | FULL-PAK | | 100 | |
| Repetitive peak forward current | I_{FM} | | 16 | |
| Operating junction and storage temperatures | T_J, T_{Stg} | | -65 to +175 | °C |

| ELECTRICAL SPECIFICATIONS ($T_J = 25\text{ °C}$ unless otherwise specified) | | | | | | |
|--|---------------|--|------|------|------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Breakdown voltage, blocking voltage | V_{BR}, V_R | $I_R = 100\text{ }\mu\text{A}$ | 600 | - | - | V |
| Forward voltage | V_F | $I_F = 8\text{ A}$ | - | 2.0 | 2.4 | |
| | | $I_F = 8\text{ A}, T_J = 150\text{ °C}$ | - | 1.3 | 1.8 | |
| Reverse leakage current | I_R | $V_R = V_R$ rated | - | 0.3 | 50 | μA |
| | | $T_J = 150\text{ °C}, V_R = V_R$ rated | - | 55 | 500 | |
| Junction capacitance | C_T | $V_R = 600\text{ V}$ | - | 17 | - | pF |
| Series inductance | L_S | Measured lead to lead 5 mm from package body | - | 8.0 | - | nH |



DYNAMIC RECOVERY CHARACTERISTICS ($T_C = 25\text{ }^\circ\text{C}$ unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS | |
|-------------------------|-----------|--|--|------|------|-------|----|
| Reverse recovery time | t_{rr} | $I_F = 1\text{ A}$, $dI_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$ | - | 18 | 22 | ns | |
| | | $I_F = 8\text{ A}$, $dI_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$ | - | 20 | 25 | | |
| | | $T_J = 25\text{ }^\circ\text{C}$ | - | 25 | - | | |
| | | $T_J = 125\text{ }^\circ\text{C}$ | - | 40 | - | | |
| Peak recovery current | I_{RRM} | $I_F = 8\text{ A}$ $dI_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 390\text{ V}$ | $T_J = 25\text{ }^\circ\text{C}$ | - | 2.4 | - | A |
| | | | $T_J = 125\text{ }^\circ\text{C}$ | - | 4.8 | - | |
| Reverse recovery charge | Q_{rr} | $T_J = 25\text{ }^\circ\text{C}$ | $T_J = 25\text{ }^\circ\text{C}$ | - | 25 | - | nC |
| | | | $T_J = 125\text{ }^\circ\text{C}$ | - | 120 | - | |
| Reverse recovery time | t_{rr} | $T_J = 125\text{ }^\circ\text{C}$ | $I_F = 8\text{ A}$ $dI_F/dt = 600\text{ A}/\mu\text{s}$ $V_R = 390\text{ V}$ | - | 33 | - | ns |
| Peak recovery current | I_{RRM} | | | - | 12 | - | A |
| Reverse recovery charge | Q_{rr} | | | - | 220 | - | nC |

THERMAL - MECHANICAL SPECIFICATIONS

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|----------------|--|--------------|------|------------|---------------------------|
| Maximum junction and storage temperature range | T_J, T_{Stg} | | -65 | - | 175 | $^\circ\text{C}$ |
| Thermal resistance, junction to case (FULL-PAK) | R_{thJC} | | - | 1.4 | 2 | $^\circ\text{C}/\text{W}$ |
| | | | - | 3.4 | 4.3 | |
| Thermal resistance, junction to ambient per leg | R_{thJA} | Typical socket mount | - | - | 70 | $^\circ\text{C}/\text{W}$ |
| Thermal resistance, case to heatsink | R_{thCS} | Mounting surface, flat, smooth and greased | - | 0.5 | - | $^\circ\text{C}/\text{W}$ |
| Weight | | | - | 2.0 | - | g |
| | | | - | 0.07 | - | oz. |
| Mounting torque | | | 6.0 (5.0) | - | 12 (10) | kgf · cm (lbf · in) |
| Marking device | | Case style TO-220AC | 8ETH06 | | | |
| | | Case style TO-220 FULL-PAK | 8ETH06FP | | | |

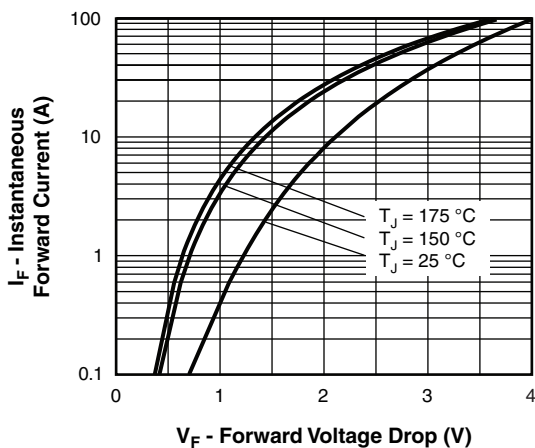


Fig. 1 - Typical Forward Voltage Drop Characteristics

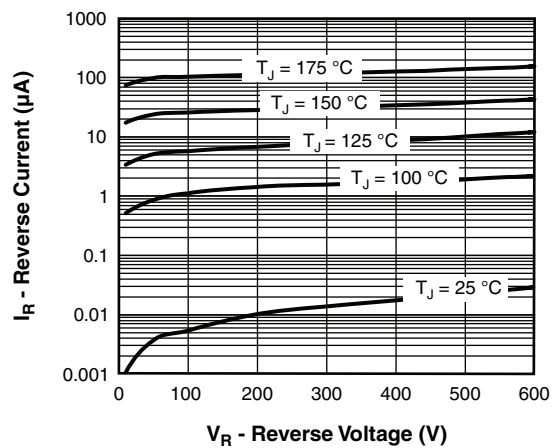


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

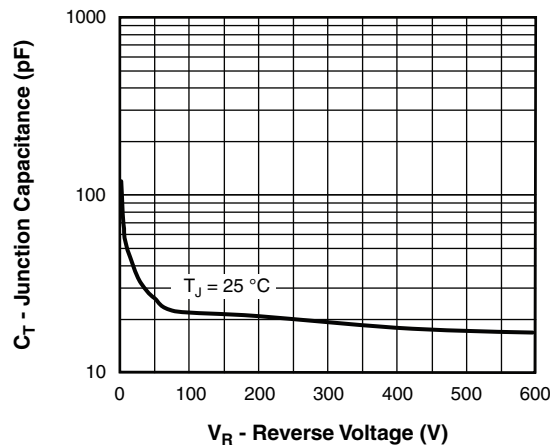


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

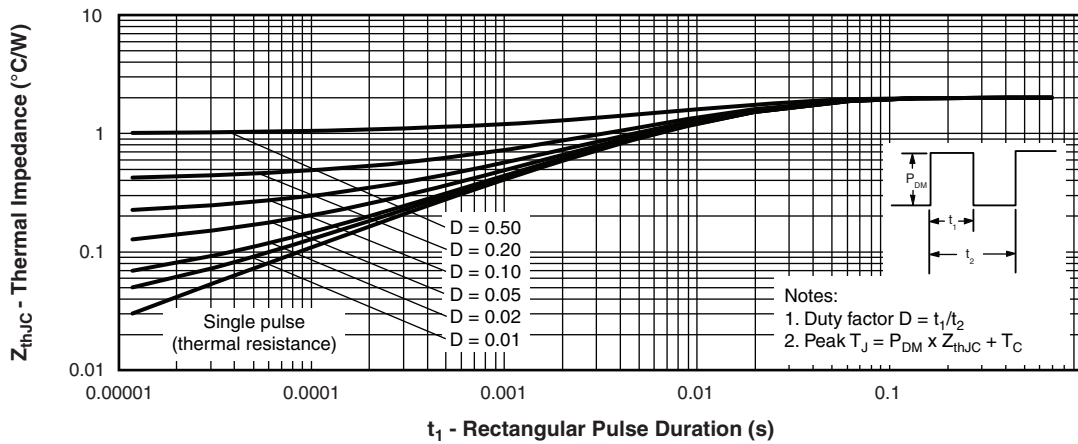


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

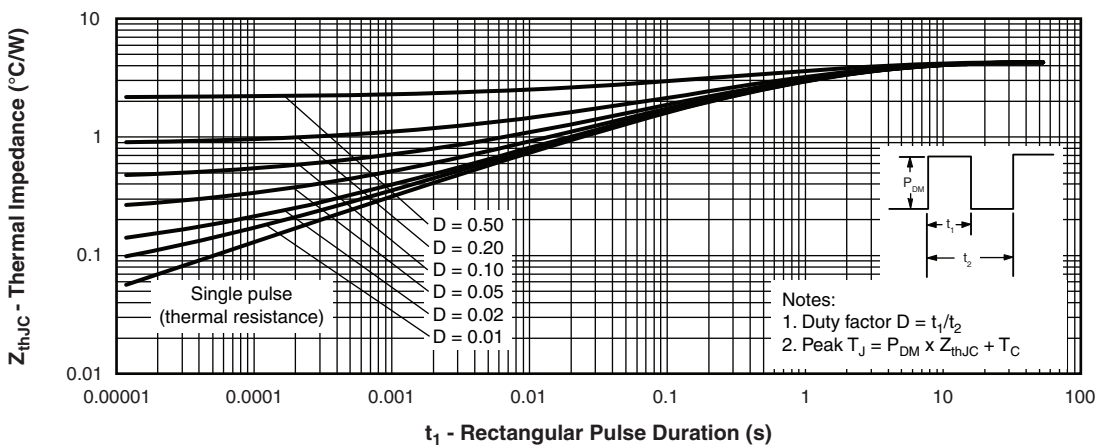


Fig. 5 - Maximum Thermal Impedance Z_{thJC} Characteristics (FULL-PAK)

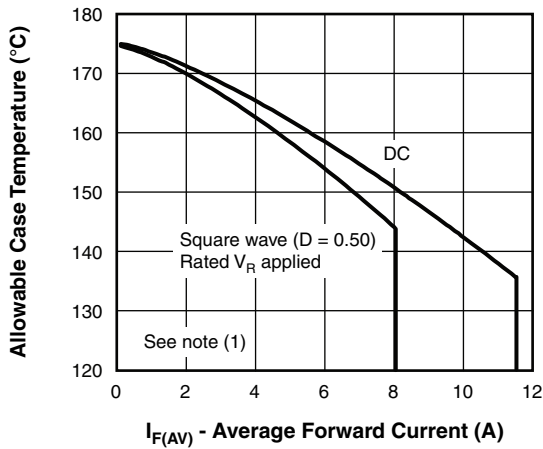


Fig. 6 - Maximum Allowable Case Temperature vs. Average Forward Current

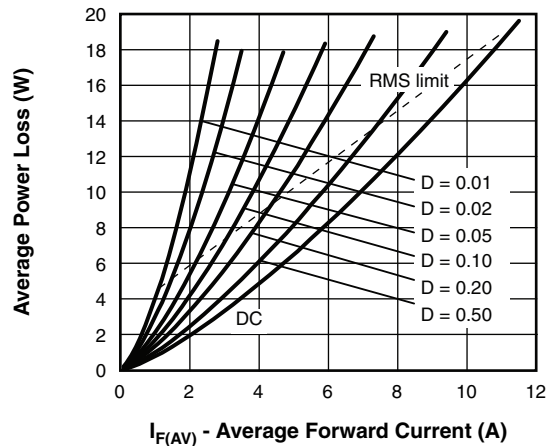


Fig. 8 - Forward Power Loss Characteristics

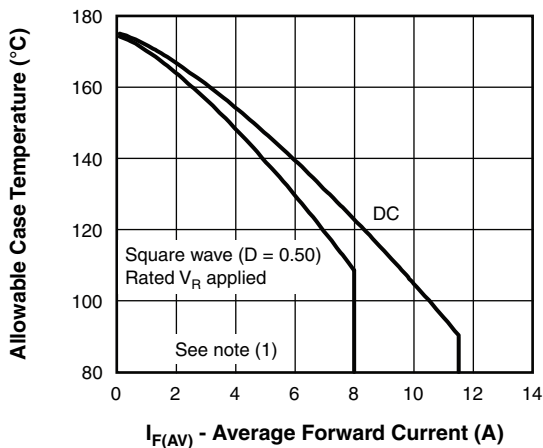


Fig. 7 - Maximum Allowable Case Temperature vs. Average Forward Current (FULL-PAK)

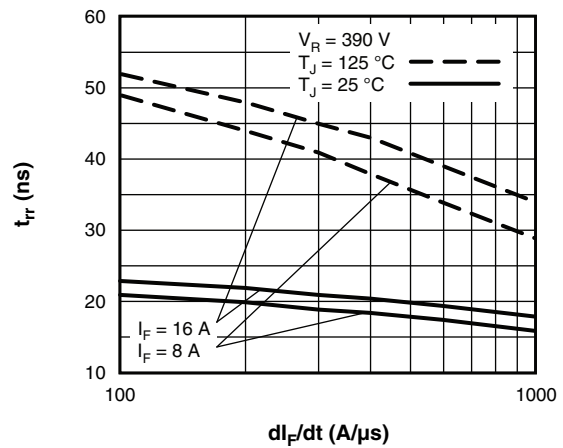


Fig. 9 - Typical Reverse Recovery Time vs. dI_F/dt

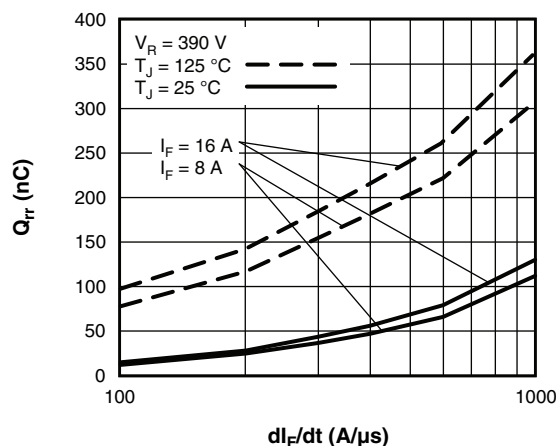


Fig. 10 - Typical Stored Charge vs. dI_F/dt

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. 8);
- Pd_{REV} = Inverse power loss = $V_{R1} \times I_R (1 - D)$; I_R at V_{R1} = Rated V_R

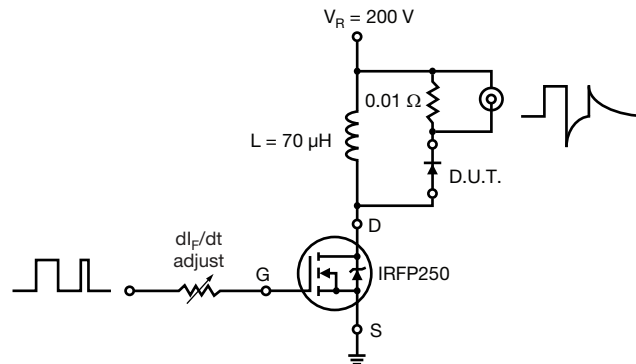
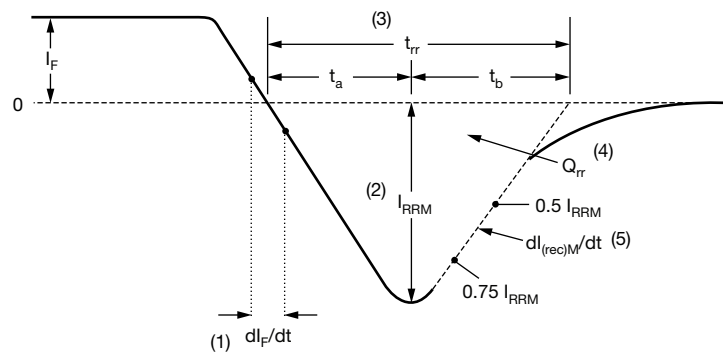


Fig. 11 - Reverse Recovery Parameter Test Circuit



(1) dI_F/dt - rate of change of current through zero crossing

(2) I_{RRM} - peak reverse recovery current

(3) t_{rr} - reverse recovery time measured from zero crossing point of negative going I_F to point where a line passing through $0.75 I_{RRM}$ and $0.50 I_{RRM}$ extrapolated to zero current.

(4) Q_{rr} - area under curve defined by t_{rr} and I_{RRM}

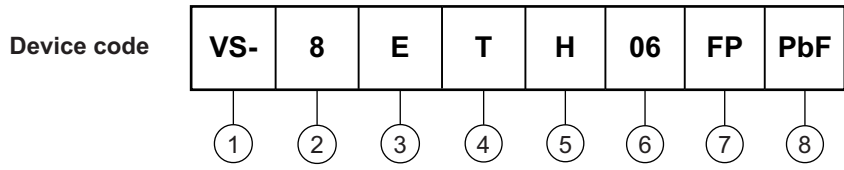
$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(5) $dI_{(rec)M}/dt$ - peak rate of change of current during t_b portion of t_{rr}

Fig. 12 - Reverse Recovery Waveform and Definitions



ORDERING INFORMATION TABLE



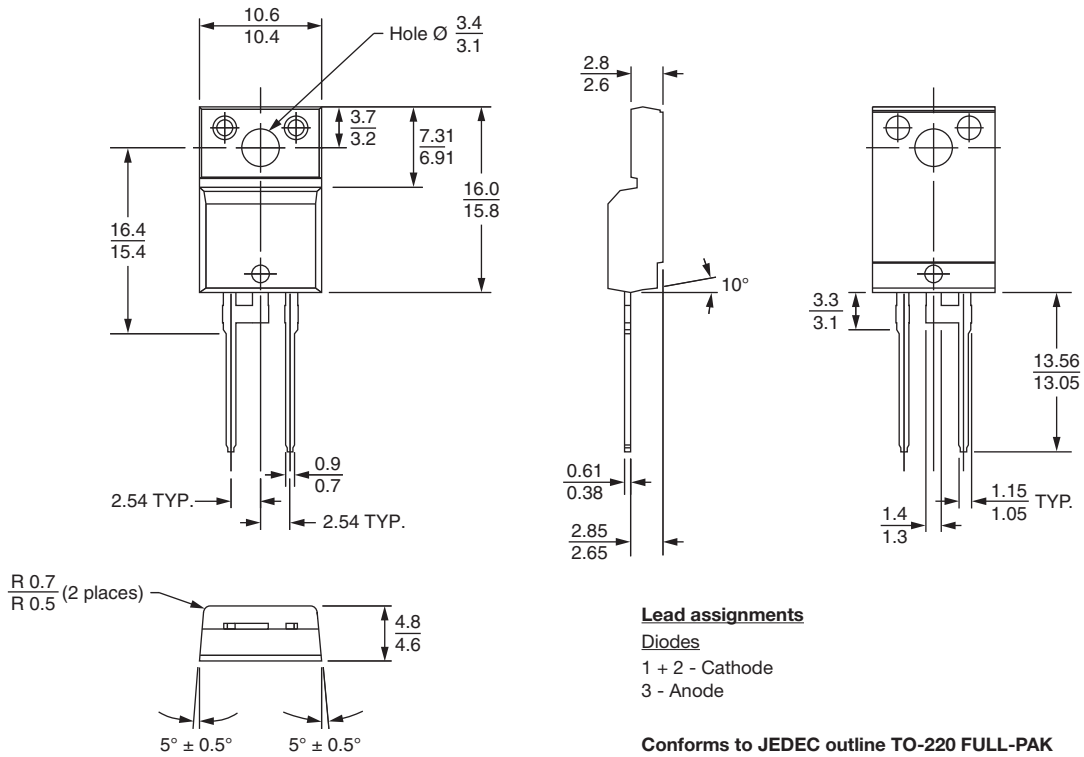
- 1** - Vishay Semiconductors product
- 2** - Current rating (8 = 8 A)
- 3** - E = single diode
- 4** - T = TO-220, D²PAK
- 5** - H = hyperfast recovery
- 6** - Voltage rating (06 = 600 V)
- 7** -
 - None = TO-220AC
 - FP = TO-220 FULL-PAK
- 8** - Environmental digit:
 - PbF = lead (Pb)-free and RoHS-compliant
 - 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-8ETH06PbF | 50 | 1000 | Antistatic plastic tube |
| VS-8ETH06-N3 | 50 | 1000 | Antistatic plastic tube |
| VS-8ETH06FPPbF | 50 | 1000 | Antistatic plastic tube |
| VS-8ETH06FP-N3 | 50 | 1000 | Antistatic plastic tube |

| LINKS TO RELATED DOCUMENTS | | |
|----------------------------|-------------|--|
| Dimensions | TO-220AC | www.vishay.com/doc?95221 |
| | TO-220FP | www.vishay.com/doc?95005 |
| Part marking information | TO-220ACPbF | www.vishay.com/doc?95224 |
| | TO-220AC-N3 | www.vishay.com/doc?95068 |
| | TO-220FPPbF | www.vishay.com/doc?95009 |
| | TO-220FP-N3 | www.vishay.com/doc?95440 |



DIMENSIONS in millimeters



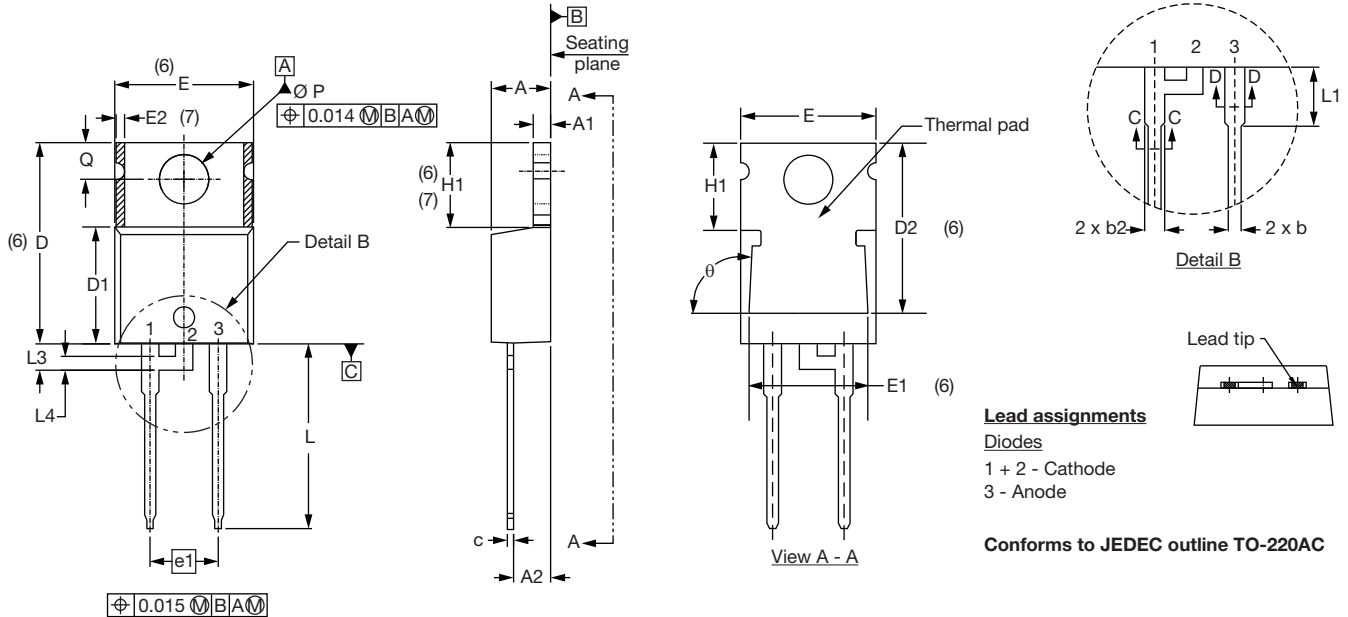
Lead assignments

- Diodes**
- 1 + 2 - Cathode
 - 3 - Anode

Conforms to JEDEC outline TO-220 FULL-PAK

TO-220AC

DIMENSIONS in millimeters and inches



Lead assignments

Diodes
1 + 2 - Cathode
3 - Anode

Conforms to JEDEC outline TO-220AC

| SYMBOL | MILLIMETERS | | INCHES | | NOTES | SYMBOL | MILLIMETERS | | INCHES | | NOTES |
|--------|-------------|-------|--------|-------|-------|-----------------|-------------|-------|------------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. | | | MIN. | MAX. | MIN. | MAX. | |
| A | 4.25 | 4.65 | 0.167 | 0.183 | | E1 | 6.86 | 8.89 | 0.270 | 0.350 | 6 |
| A1 | 1.14 | 1.40 | 0.045 | 0.055 | | E2 | - | 0.76 | - | 0.030 | 7 |
| A2 | 2.56 | 2.92 | 0.101 | 0.115 | | e | 2.41 | 2.67 | 0.095 | 0.105 | |
| b | 0.69 | 1.01 | 0.027 | 0.040 | | e1 | 4.88 | 5.28 | 0.192 | 0.208 | |
| b1 | 0.38 | 0.97 | 0.015 | 0.038 | 4 | H1 | 6.09 | 6.48 | 0.240 | 0.255 | 6, 7 |
| b2 | 1.20 | 1.73 | 0.047 | 0.068 | | L | 13.52 | 14.02 | 0.532 | 0.552 | |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 | 4 | L1 | 3.32 | 3.82 | 0.131 | 0.150 | 2 |
| c | 0.36 | 0.61 | 0.014 | 0.024 | | L3 | 1.78 | 2.13 | 0.070 | 0.084 | |
| c1 | 0.36 | 0.56 | 0.014 | 0.022 | 4 | L4 | 0.76 | 1.27 | 0.030 | 0.050 | 2 |
| D | 14.85 | 15.25 | 0.585 | 0.600 | 3 | $\varnothing P$ | 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 | |
| D2 | 11.68 | 12.88 | 0.460 | 0.507 | 6 | θ | 90° to 93° | | 90° to 93° | | |
| E | 10.11 | 10.51 | 0.398 | 0.414 | 3, 6 | | | | | | |

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 dimension: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimension E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, D2 (minimum) where dimensions are derived from the actual package outline



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