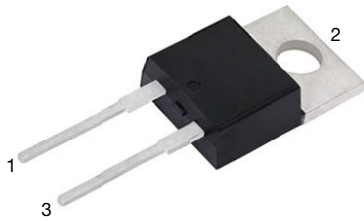
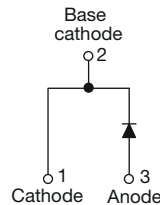


Ultralow V_F Hyperfast Rectifier for Discontinuous Mode PFC, 15 A FRED Pt®


2L TO-220AC

FEATURES

- Hyperfast recovery time
- Benchmark ultralow forward voltage drop
- 175 °C operating junction temperature
- Low leakage current
- 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

State of the art, ultralow V_F , soft-switching hyperfast rectifiers optimized for Discontinuous (Critical) Mode (DCM) Power Factor Correction (PFC).

The minimized conduction loss, optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

The device is also intended for use as a freewheeling diode in power supplies and other power switching applications.

APPLICATIONS

AC/DC SMPS 70 W to 400 W

e.g. laptop and printer AC adaptors, desktop PC, TV and monitor, games units and DVD AC/DC power supplies.

PRIMARY CHARACTERISTICS

| | |
|-----------------------|-------------|
| $I_{F(AV)}$ | 15 A |
| V_R | 600 V |
| V_F at I_F | 0.85 V |
| t_{rr} typ. | 60 ns |
| T_J max. | 175 °C |
| Package | 2L TO-220AC |
| Circuit configuration | Single |

ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|---|----------------|-----------------|-------------|-------|
| Peak repetitive reverse voltage | V_{RRM} | | 600 | V |
| Average rectified forward current | $I_{F(AV)}$ | $T_C = 154$ °C | 15 | A |
| Non-repetitive peak surge current | I_{FSM} | $T_J = 25$ °C | 250 | |
| Peak repetitive forward current | I_{FM} | | 30 | |
| Operating junction and storage temperatures | T_J, T_{Stg} | | -65 to +175 | °C |

ELECTRICAL SPECIFICATIONS ($T_J = 25$ °C unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|-------------------------------------|---------------|--|------|------|------|---------|
| Breakdown voltage, blocking voltage | V_{BR}, V_R | $I_R = 100$ μ A | 600 | - | - | V |
| Forward voltage | V_F | $I_F = 15$ A | - | 0.99 | 1.05 | |
| | | $I_F = 15$ A, $T_J = 150$ °C | - | 0.85 | 0.92 | |
| Reverse leakage current | I_R | $V_R = V_R$ rated | - | 0.1 | 10 | μ A |
| | | $T_J = 150$ °C, $V_R = V_R$ rated | - | 15 | 120 | |
| Junction capacitance | C_T | $V_R = 600$ V | - | 20 | - | 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} | $I_F = 1\text{ A}$, $di_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$ | - | 60 | 120 | ns |
| | | $I_F = 15\text{ A}$, $di_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$ | - | 190 | 270 | |
| | | $T_J = 25\text{ }^\circ\text{C}$ | - | 220 | - | |
| | | $T_J = 125\text{ }^\circ\text{C}$ | - | 320 | - | |
| Peak recovery current | I_{RRM} | $T_J = 25\text{ }^\circ\text{C}$ | - | 19 | - | A |
| | | $T_J = 125\text{ }^\circ\text{C}$ | - | 26 | - | |
| Reverse recovery charge | Q_{rr} | $T_J = 25\text{ }^\circ\text{C}$ | - | 2.2 | - | μC |
| | | $T_J = 125\text{ }^\circ\text{C}$ | - | 4.3 | - | |

| 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 | R_{thJC} | | - | 1.0 | 1.3 | $^\circ\text{C}/\text{W}$ |
| Thermal resistance, junction-to-ambient per leg | R_{thJA} | Typical socket mount | - | - | 70 | |
| Thermal resistance, case-to-heatsink | R_{thCS} | Mounting surface, flat, smooth, and greased | - | 0.5 | - | |
| Weight | | | - | 2.0 | - | g |
| | | | - | 0.07 | - | oz. |
| Mounting torque | | | 6.0 (5.0) | - | 12 (10) | kgf · cm (lbf · in) |
| Marking device | | Case style 2L TO-220AC | 15ETL06 | | | |

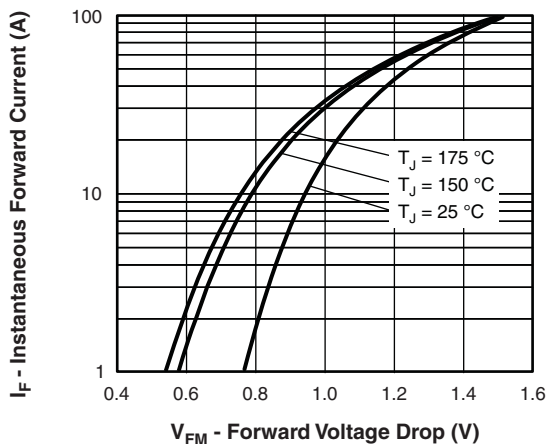


Fig. 1 - Maximum Forward Voltage Drop Characteristics

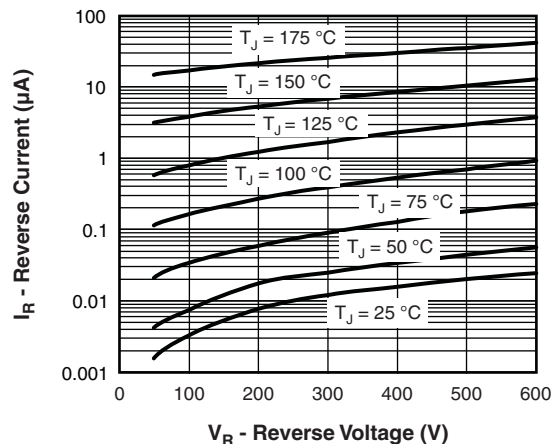


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

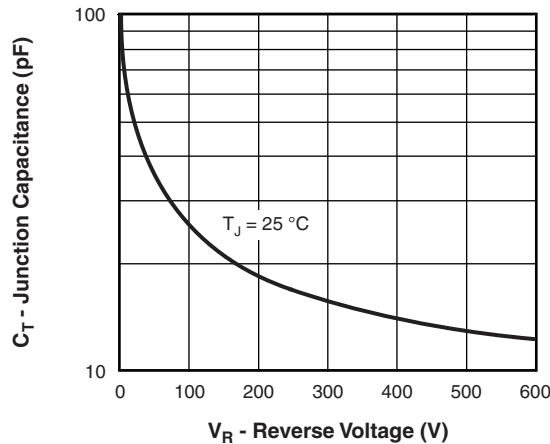


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

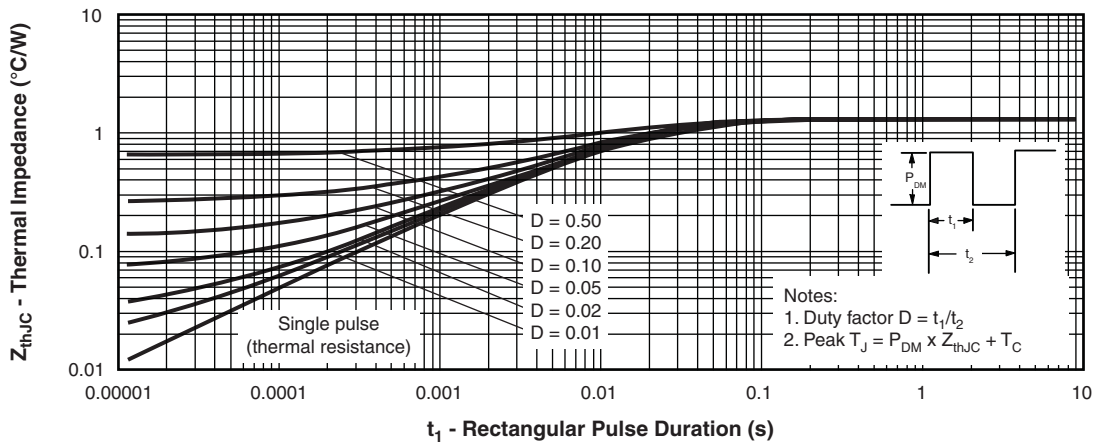


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

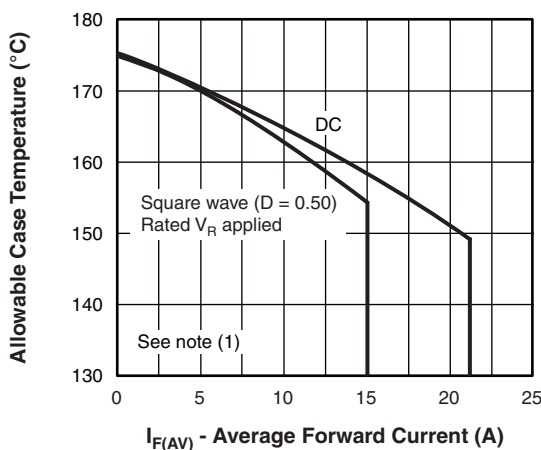


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

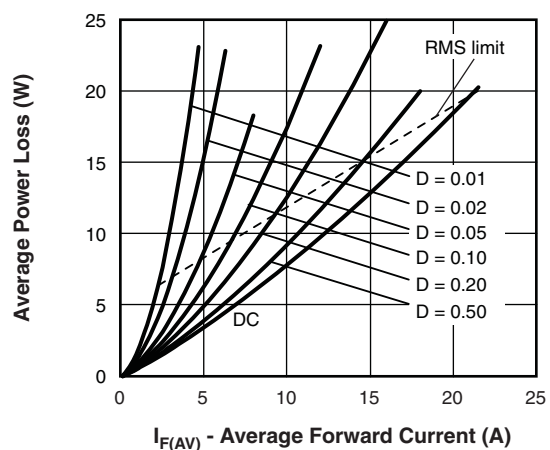


Fig. 6 - Forward Power Loss Characteristics

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. 5);
 P_{dREV} = inverse power loss = $V_{R1} \times I_R (1 - D)$; I_R at V_{R1} = rated V_R

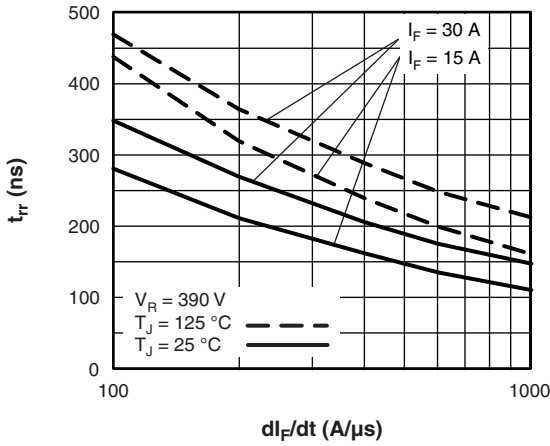


Fig. 7 - Typical Reverse Recovery Time vs. di_F/dt

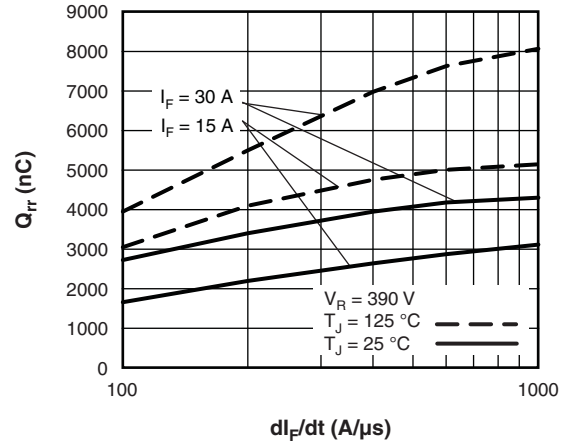
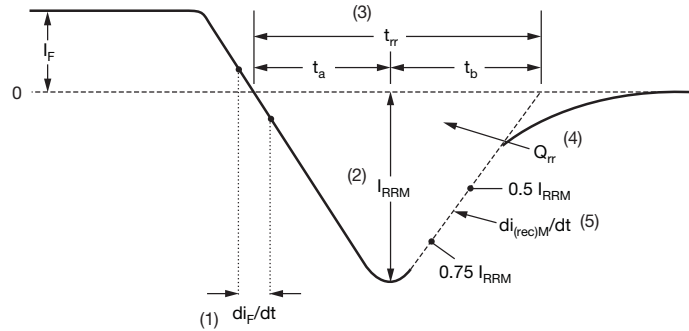


Fig. 8 - Typical Stored Charge vs. di_F/dt



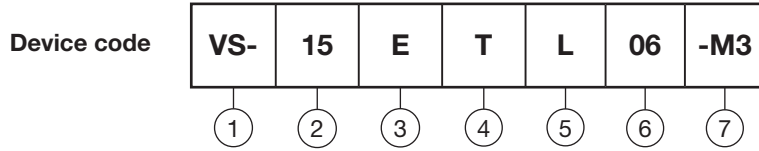
- (1) di_F/dt - rate of change of current through zero crossing
- (2) I_{RRM} - peak reverse recovery current
- (3) t_{rr} - reverse recovery time measured from zero crossing point of negative going I_F to point where a line passing through $0.75 I_{RRM}$ and $0.50 I_{RRM}$ extrapolated to zero current.
- (4) Q_{rr} - area under curve defined by t_{rr} and I_{RRM}
- (5) $di_{(rec)M}/dt$ - peak rate of change of current during t_b portion of t_{rr}

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

Fig. 9 - Reverse Recovery Waveform and Definitions



ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current rating (15 = 15 A)
- 3** - E = single diode
- 4** - T = TO-220, D²PAK (TO-263AB)
- 5** - L = ultralow V_F hyperfast recovery
- 6** - Voltage rating (06 = 600 V)
- 7** - Environmental digit:
-M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

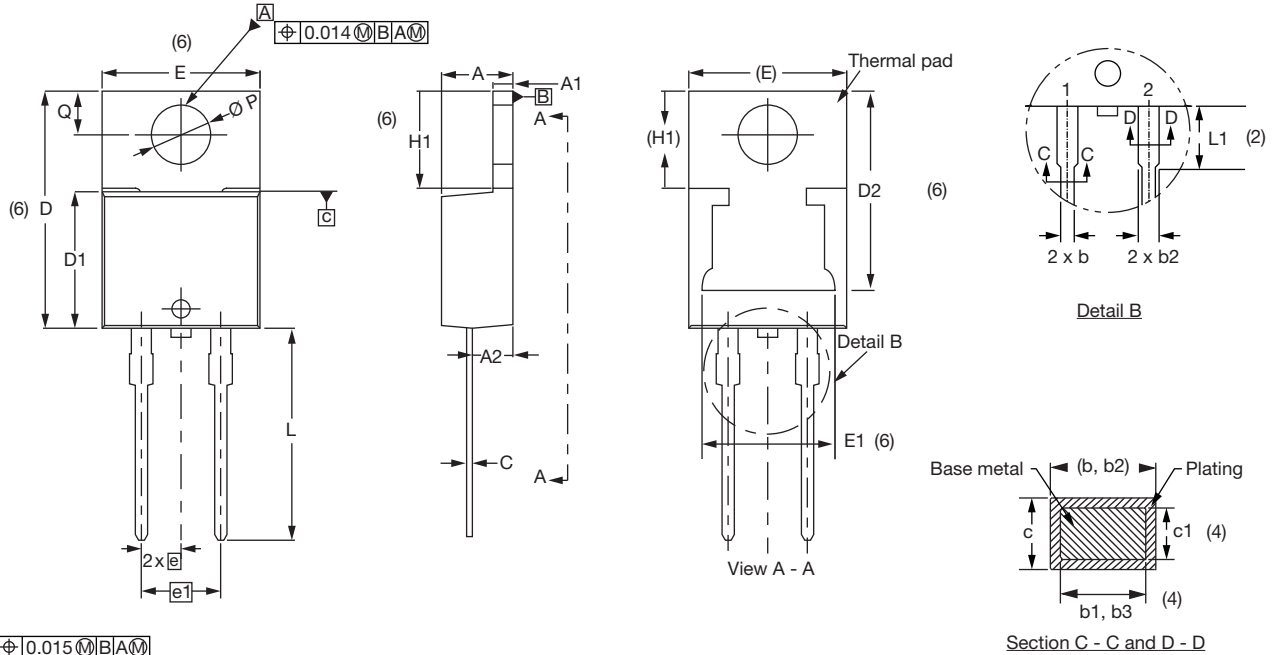
| ORDERING INFORMATION (Example) | | | |
|--------------------------------|------------------|------------------------|-------------------------|
| PREFERRED P/N | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
| VS-15ETL06-M3 | 50 | 1000 | Antistatic plastic tube |

| LINKS TO RELATED DOCUMENTS | |
|----------------------------|--|
| Dimensions | www.vishay.com/doc?96156 |
| Part marking information | www.vishay.com/doc?95391 |
| SPIICE model | www.vishay.com/doc?96051 |



2L TO-220AC

DIMENSIONS in millimeters and inches



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 | | D2 | 11.68 | 13.30 | 0.460 | 0.524 | 6, 7 |
| A1 | 1.14 | 1.40 | 0.045 | 0.055 | | E | 10.11 | 10.51 | 0.398 | 0.414 | 3, 6 |
| A2 | 2.50 | 2.92 | 0.098 | 0.115 | | E1 | 6.86 | 8.89 | 0.270 | 0.350 | 6 |
| b | 0.69 | 1.01 | 0.027 | 0.040 | | e | 2.41 | 2.67 | 0.095 | 0.105 | |
| b1 | 0.38 | 0.97 | 0.015 | 0.038 | 4 | e1 | 4.88 | 5.28 | 0.192 | 0.208 | |
| b2 | 1.20 | 1.73 | 0.047 | 0.068 | | H1 | 6.09 | 6.48 | 0.240 | 0.255 | 6 |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 | 4 | L | 13.52 | 14.02 | 0.532 | 0.552 | |
| c | 0.36 | 0.61 | 0.014 | 0.024 | | L1 | 3.32 | 3.82 | 0.131 | 0.150 | 2 |
| c1 | 0.36 | 0.56 | 0.014 | 0.022 | 4 | ∅ P | 3.54 | 3.91 | 0.139 | 0.154 | |
| D | 14.85 | 15.35 | 0.585 | 0.604 | 3 | Q | 2.60 | 3.00 | 0.102 | 0.118 | |
| D1 | 8.38 | 9.02 | 0.330 | 0.355 | | | | | | | |

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) Outline conforms to JEDEC® TO-220, except D2



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