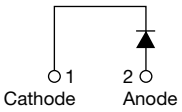
# Ultrafast Rectifier, 15 A FRED Pt®




TO-220 FullPAK 2L




## FEATURES

- State of the art low forward voltage drop
- Ultrafast soft recovery time
- 175 °C operating junction temperature
- Low leakage current
- Fully isolated package ($V_{INS}$ = 2500 $V_{RMS}$)
- True 2 pin package
- Designed and qualified according to JEDEC®-JESD 47
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

HALOGEN FREE

## 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 | TO-220 FullPAK 2L |
| Circuit configuration | Single |

## DESCRIPTION

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

The minimized conduction loss, optimized stored charge and low recovery current minimized 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.

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|---|---|---|---|---|
| Peak repetitive reverse voltage | $V_{RRM}$ | | 600 | V |
| Average rectified forward current in DC | $I_{F(AV)}$ | $T_C$ = 120 °C | 15 | A |
| Non-repetitive peak surge current | $I_{FSM}$ | $T_J$ = 25 °C | 200 | |
| 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 µA | 600 | - | - | V |
| Forward voltage | $V_F$ | $I_F$ = 15 A | - | 0.99 | 1.07 | |
| | | $I_F$ = 15 A, $T_J$ = 150 °C | - | 0.85 | 0.91 | |
| Reverse leakage current | $I_R$ | $V_R$ = $V_R$ rated | - | 0.01 | 15 | µA |
| | | $T_J$ = 150 °C, $V_R$ = $V_R$ rated | - | 6 | 100 | |
| Junction capacitance | $C_T$ | $V_R$ = 600 V | - | 12 | - | pF |
| Series inductance | $L_S$ | Measured lead to lead 5 mm from package body | - | 8 | - | nH |



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| DYNAMIC RECOVERY CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 1 A, $dI_F/dt$ = 100 A/µs, $V_R$ = 30 V | | - | 60 | 110 | ns |
| | | $I_F$ = 15 A, $dI_F/dt$ = 100 A/µs, $V_R$ = 30 V | | - | 185 | 270 | |
| | | $T_J$ = 25 °C | $I_F$ = 15 A, $dI_F/dt$ = 200 A/µs, $V_R$ = 390 V, | - | 210 | - | |
| | | $T_J$ = 125 °C | | - | 290 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 20 | - | A |
| | | $T_J$ = 125 °C | | - | 26 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 2.2 | - | µC |
| | | $T_J$ = 125 °C | | - | 4.0 | - | |

| THERMAL - MECHANICAL SPECIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Maximum junction and storage temperature range | $T_J$, $T_{Stg}$ | | -65 | - | 175 | °C |
| Thermal resistance, junction-to-case | $R_{thJC}$ | | - | 3.7 | 4.3 | °C/W |
| Thermal resistance, junction-to-ambient | $R_{thJA}$ | Typical socket mount | - | - | 70 | |
| Typical thermal resistance, case-to-heatsink | $R_{thCS}$ | Mounting surface, flat, smooth, and greased | - | 0.5 | - | |
| Weight | | | - | 2 | - | g |
| | | | - | 0.07 | - | oz. |
| Mounting torque | | | 6 (5) | - | 12 (10) | kgf · cm (lbf · in) |
| Marking device | | Case style TO-220 FullPAK 2L | ETL1506FP | | | |


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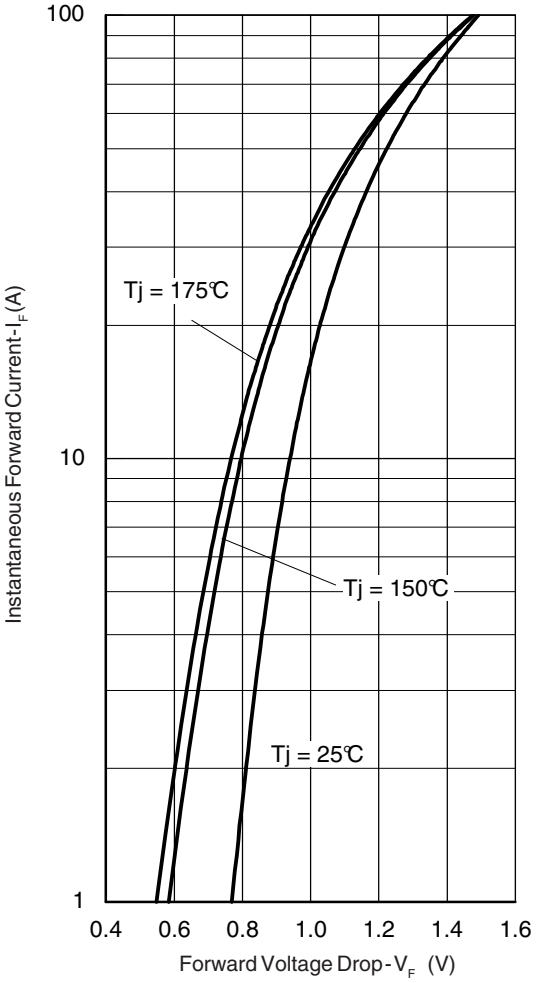


Fig. 1 - Typical Forward Voltage Drop Characteristics

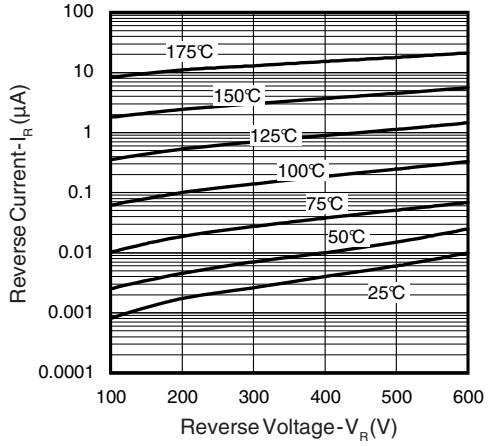


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

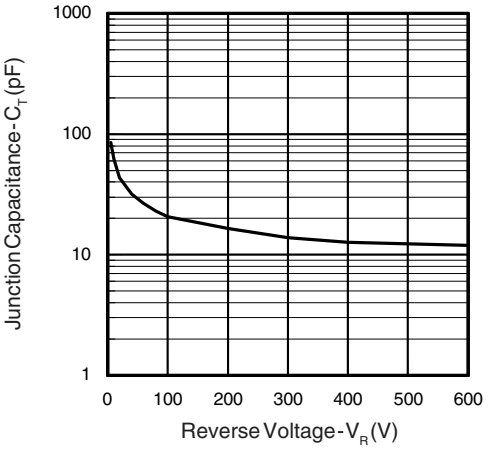


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

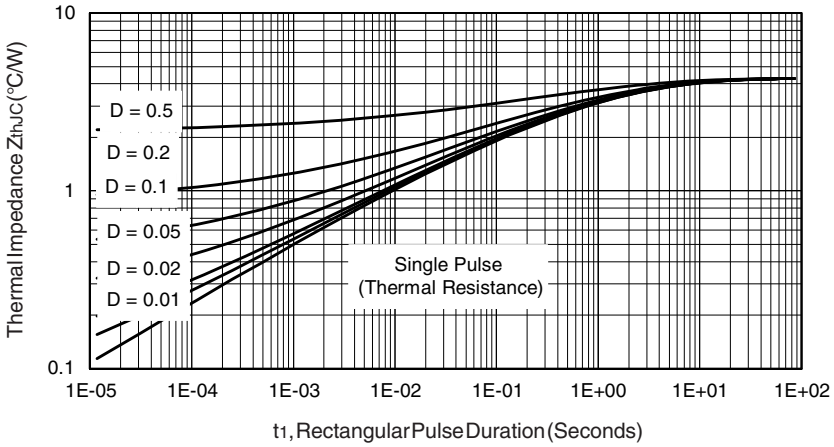


Fig. 4 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics


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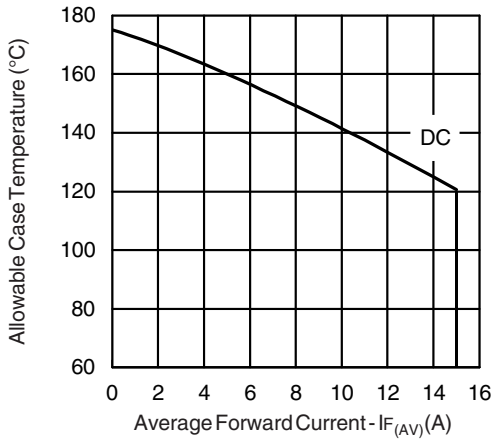


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

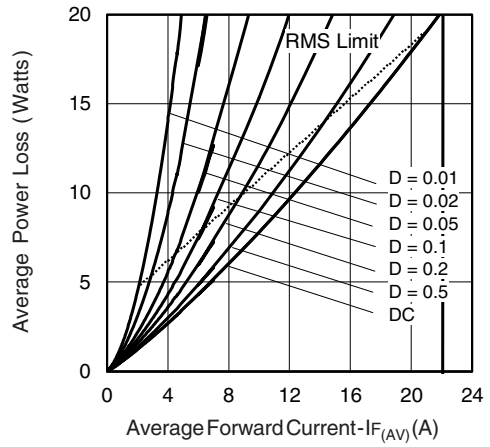


Fig. 6 - Forward Power Loss Characteristics

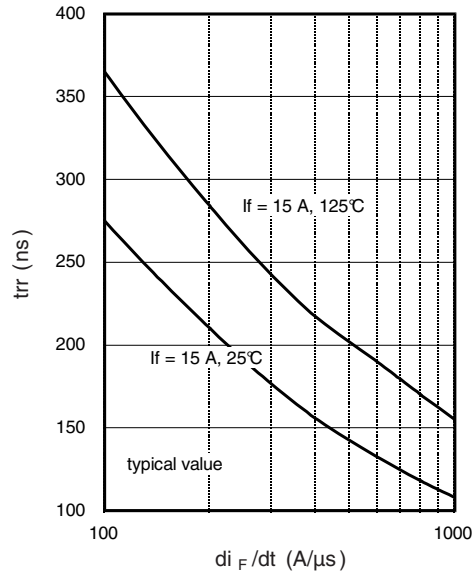


Fig. 7 - Typical Reverse Recovery vs. $dI_F/dt$

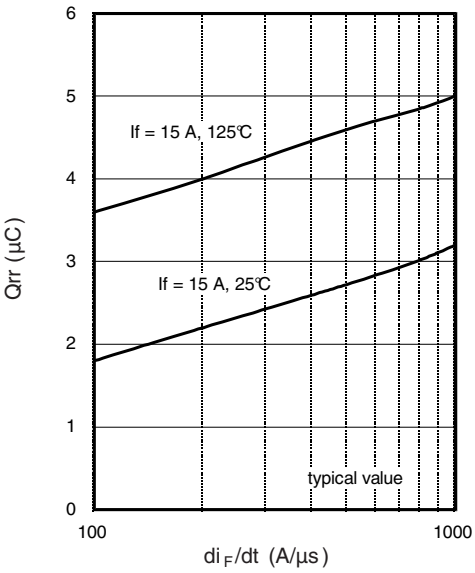


Fig. 8 - Typical Stored Charge vs. $dI_F/dt$


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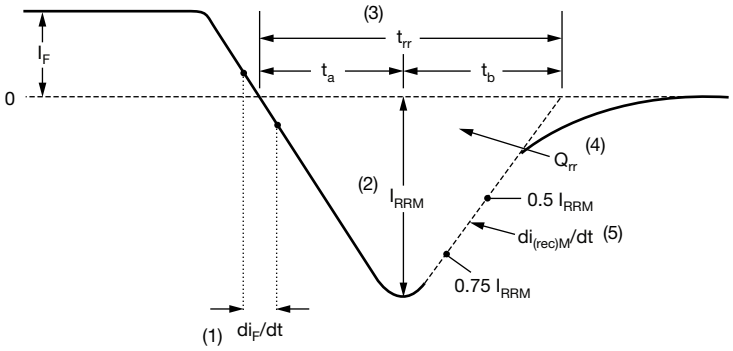


(1) $di_F/dt$ - rate of change of current through zero crossing

(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. 9 - Reverse Recovery Waveform and Definitions

## ORDERING INFORMATION TABLE

**Device code**

| VS- | E | T | L | 15 | 06 | FP | -M3 |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

1 - Vishay Semiconductors product

2 - Circuit configuration:
E = single

3 - T = TO-220

4 - L = hyperfast recovery time

5 - Current code: 15 = 15 A

6 - Voltage code: 06 = 600 V

7 - FP = TO-220 FullPAK 2L

8 - Environmental digit:
-M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

| **ORDERING INFORMATION** (Example) | | | |
|---|---|---|---|
| **PREFERRED P/N** | **QUANTITY PER TUBE** | **MINIMUM ORDER QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-ETL1506FP-M3 | 50 | 1000 | Antistatic plastic tube |

| **LINKS TO RELATED DOCUMENTS** | |
|---|---|
| Dimensions | www.vishay.com/doc?96157 |
| Part marking information | www.vishay.com/doc?95392 |


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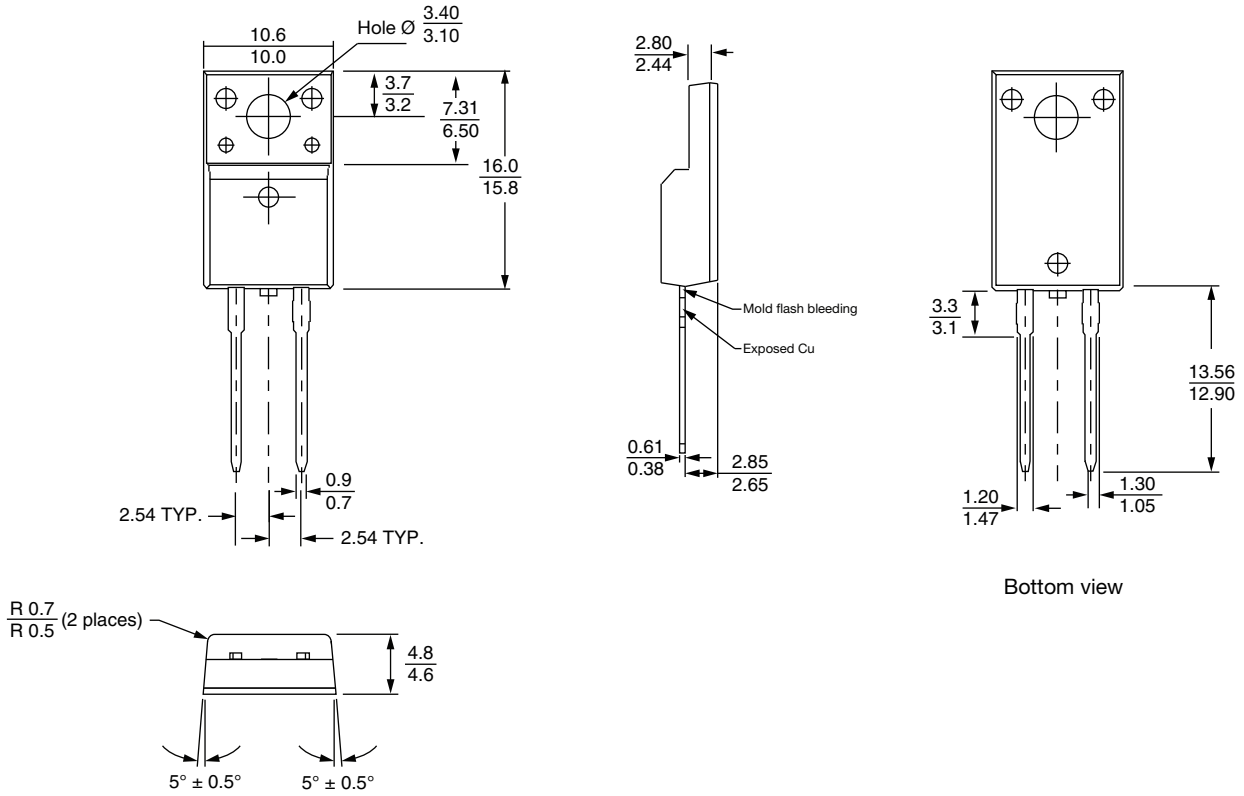
# 2L TO-220 FullPAK

**DIMENSIONS** in millimeters



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