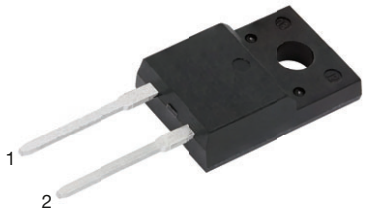
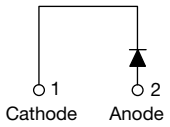
# Hyperfast Rectifier, 15 A FRED Pt®




TO-220 FullPAK 2L




VS-15ETH06FP-N3

## FEATURES

- Hyperfast recovery time
- Low forward voltage drop
- 175 °C operating junction temperature
- Low leakage current
- Single die center tap module
- Fully isolated package ($V_{INS}$ = 2500 $V_{RMS}$)
- 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

## 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.

| PRIMARY CHARACTERISTICS | |
|---|---|
| $I_{F(AV)}$ | 15 A |
| $V_R$ | 600 V |
| $V_F$ at $I_F$ | 1.3 V |
| $t_{rr}$ typ. | 22 ns |
| $T_J$ max. | 175 °C |
| Package | TO-220 FullPAK 2L |
| Circuit configuration | Single |

| ABSOLUTE MAXIMUM RATINGS | | | | |
|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Peak repetitive reverse voltage | $V_{RRM}$ | | 600 | V |
| Average rectified forward current | $I_{F(AV)}$ | $T_C$ = 80 °C | 15 | A |
| Non-repetitive peak surge current | $I_{FSM}$ | $T_J$ = 25 °C | 180 | |
| 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 µA | 600 | - | - | V |
| Forward voltage | $V_F$ | $I_F$ = 15 A | - | 1.8 | 2.2 | |
| | | $I_F$ = 15 A, $T_J$ = 150 °C | - | 1.3 | 1.6 | |
| Reverse leakage current | $I_R$ | $V_R$ = $V_R$ rated | - | 0.2 | 50 | µA |
| | | $T_J$ = 150 °C, $V_R$ = $V_R$ rated | - | 30 | 500 | |
| 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 °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 | | - | 22 | 30 | ns |
| | | $I_F$ = 15 A, $dI_F/dt$ = 100 A/µs, $V_R$ = 30 V | | - | 28 | 35 | |
| | | $T_J$ = 25 °C | $I_F$ = 15 A<br>$dI_F/dt$ = 200 A/µs<br>$V_R$ = 390 V | - | 29 | - | |
| | | $T_J$ = 125 °C | | - | 75 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 3.5 | - | A |
| | | $T_J$ = 125 °C | | - | 7 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 57 | - | nC |
| | | $T_J$ = 125 °C | | - | 300 | - | |
| Reverse recovery time | $t_{rr}$ | $T_J$ = 125 °C | $I_F$ = 15 A<br>$dI_F/dt$ = 800 A/µs<br>$V_R$ = 390 V | - | 51 | - | ns |
| Peak recovery current | $I_{RRM}$ | | | - | 20 | - | A |
| Reverse recovery charge | $Q_{rr}$ | | | - | 580 | - | nC |

| 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 | $R_{thJC}$ | | - | 3.0 | 3.5 | °C/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 TO-220 FullPAK 2L | 15ETH06FP | | | |

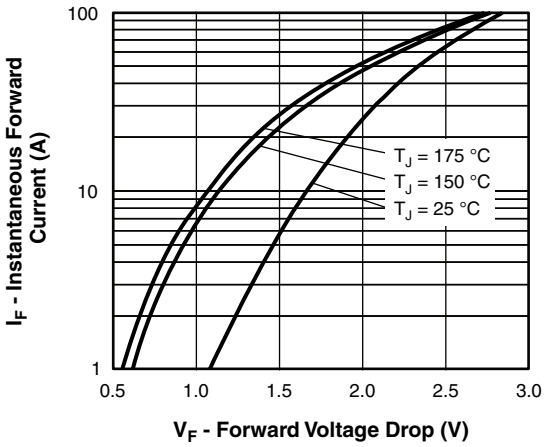



Fig. 1 - Typical Forward Voltage Drop Characteristics

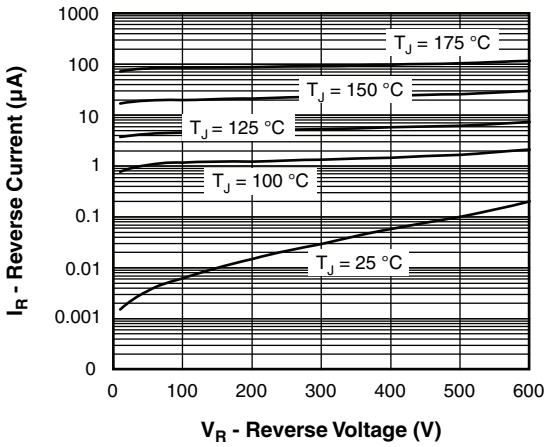



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

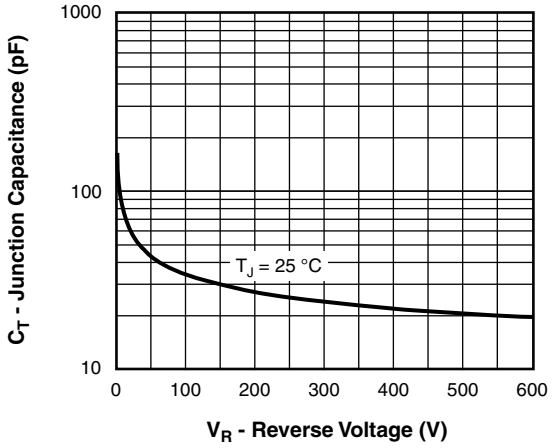



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

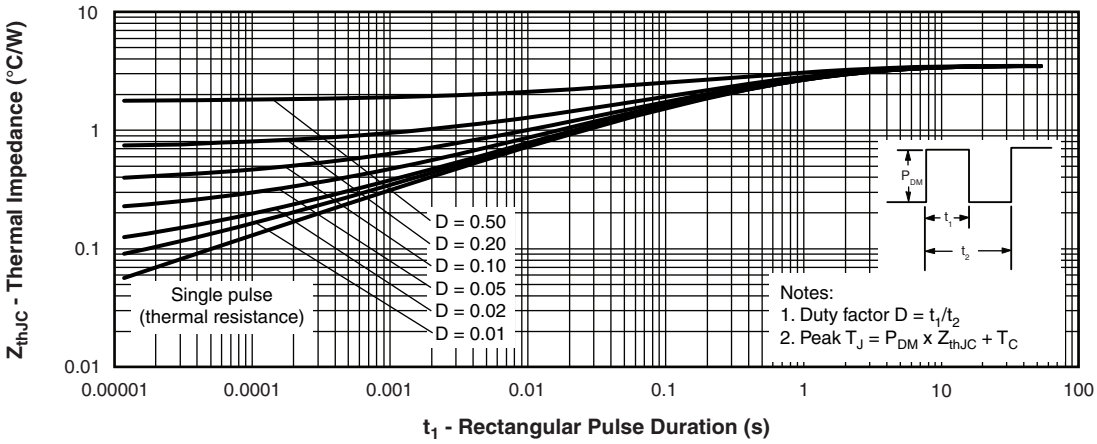



Fig. 4 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics

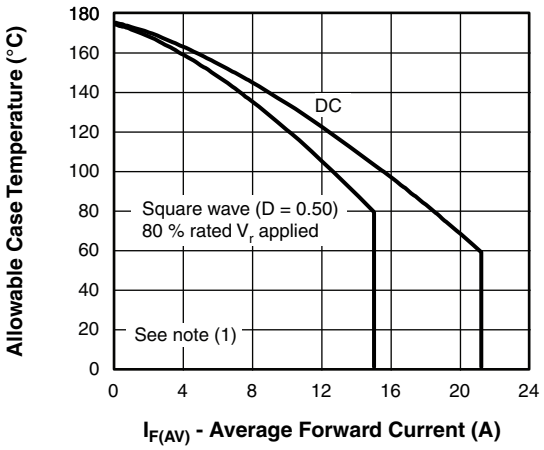



Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

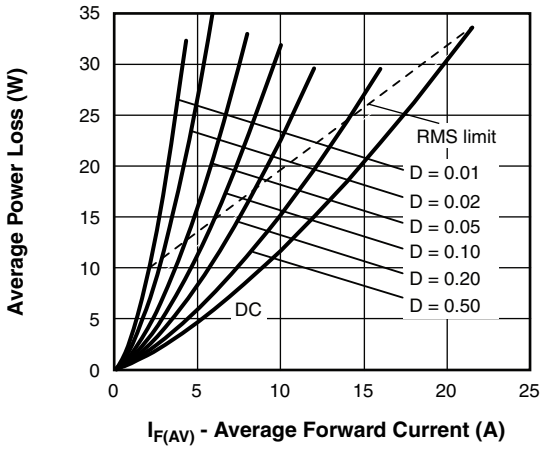



Fig. 6 - Forward Power Loss Characteristics

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

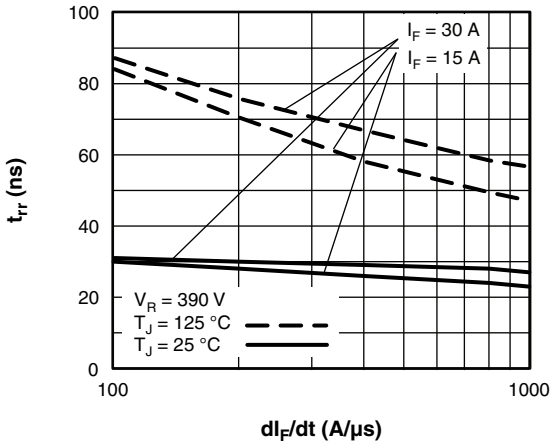



Fig. 7 - Typical Reverse Recovery Time vs. $dI_F/dt$

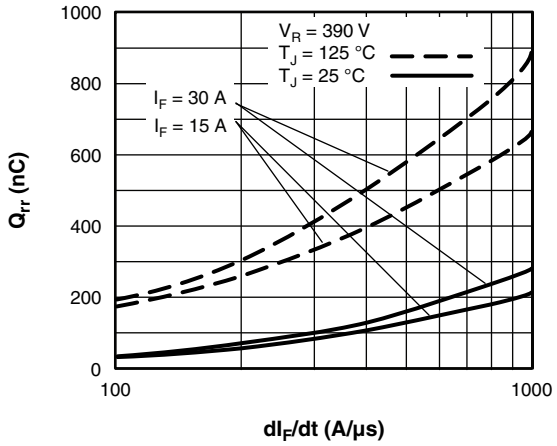
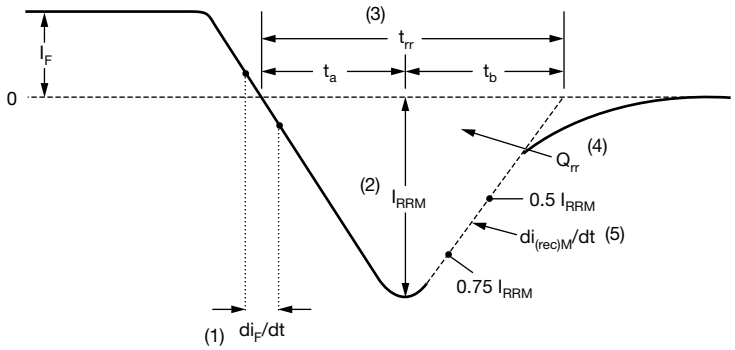



Fig. 8 - Typical Stored Charge vs. $dI_F/dt$




(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 $I_{RRM}$

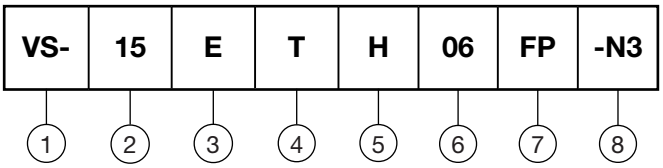
$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(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



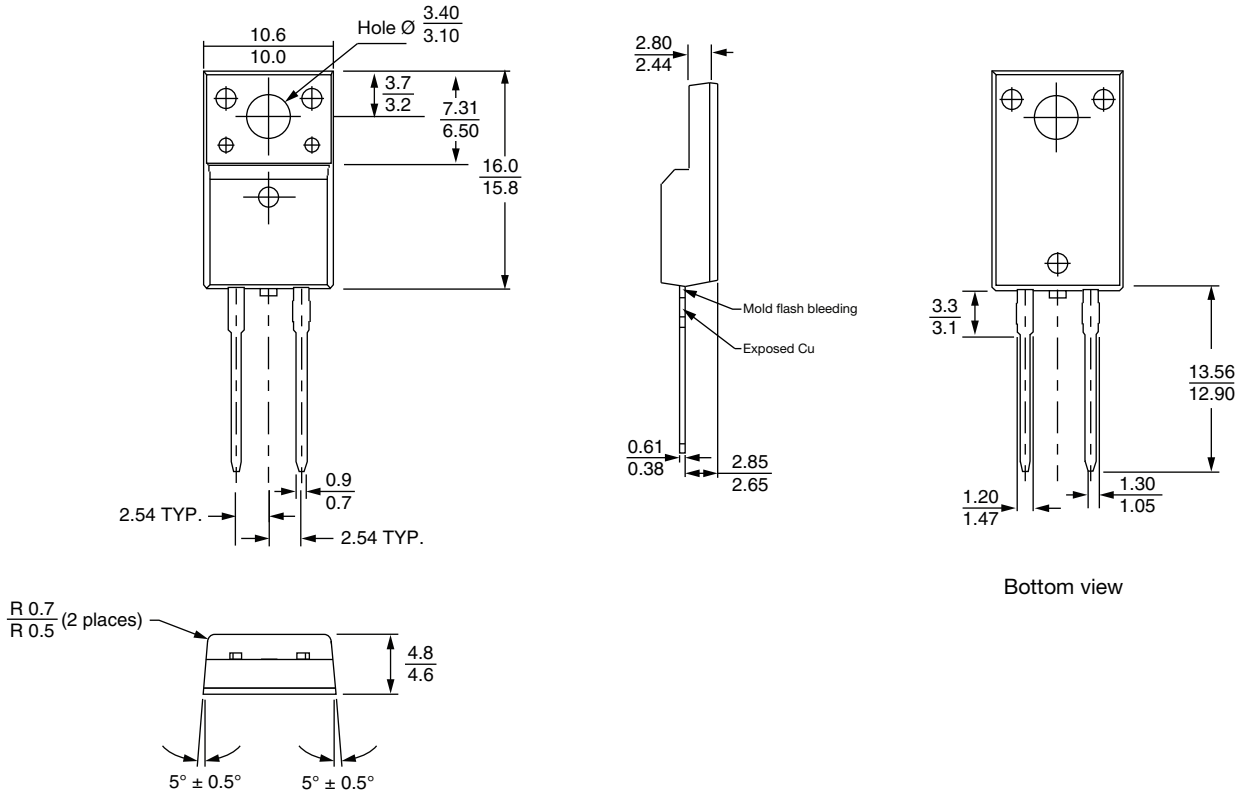

1 - Vishay Semiconductors product
2 - Current rating (15 = 15 A)
3 - E = single
4 - T = TO-220, $D^2PAK$ (TO-263AB)
5 - H = hyperfast recovery
6 - Voltage rating (06 = 600 V)
7 - FP = TO-220 FullPAK 2L
8 - Environmental digit:
-N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

| **ORDERING INFORMATION** (Example) | | | |
|---|---|---|---|
| **PREFERRED P/N** | **QUANTITY PER T/R** | **MINIMUM ORDER QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-15ETH06FP-N3 | 50 | 1000 | Antistatic plastic tube |

| **LINKS TO RELATED DOCUMENTS** | |
|---|---|
| Dimensions | www.vishay.com/doc?96157 |
| Part marking information | www.vishay.com/doc?95392 |
| SPICE model | www.vishay.com/doc?96618 |

# 2L TO-220 FullPAK

**DIMENSIONS** in millimeters



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