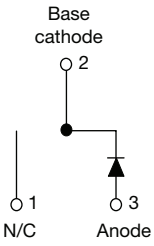
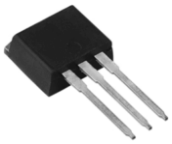
# Hyperfast Rectifier, 15 A FRED Pt®

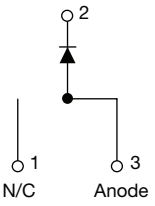
VS-15ETH03SPbF




D²PAK

VS-15ETH03-1PbF






TO-262

## FEATURES

- Hyperfast recovery time
- Low forward voltage drop
- Low leakage current
- 175 °C operating junction temperature
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Halogen-free according to IEC 61249-2-21 definition
- Compliant to RoHS directive 2002/95/EC
- AEC-Q101 qualified

Pb e3 RoHS COMPLIANT HALOGEN FREE

## DESCRIPTION/APPLICATIONS

Vishay HPP's 300 V series are the state of the art hyperfast recovery rectifiers designed with optimized performance of forward voltage drop and hyperfast recovery time.
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 the output rectification stage of SMPS, UPS, dc-to-dc converters as well as freewheeling diodes in low voltage inverters and chopper motor drives.
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 | |
|---|---|
| $t_{rr}$ | 40 ns |
| $I_{F(AV)}$ | 15 A |
| $V_R$ | 300 V |

| ABSOLUTE MAXIMUM RATINGS | | | | |
|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MAX. | UNITS |
| Repetitive peak reverse voltage | $V_{RRM}$ | | 300 | V |
| Average rectified forward current | $I_{F(AV)}$ | $T_C$ = 142 °C | 15 | A |
| Non-repetitive peak surge current | $I_{FSM}$ | $T_J$ = 25 °C | 140 | |
| 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 | 300 | - | - | V |
| Forward voltage | $V_F$ | $I_F$ = 15 A | - | 1.05 | 1.25 | |
| | | $I_F$ = 15 A, $T_J$ = 125 °C | - | 0.85 | 1.00 | |
| Reverse leakage current | $I_R$ | $V_R$ = $V_R$ rated | - | 0.05 | 40 | µA |
| | | $T_J$ = 125 °C, $V_R$ = $V_R$ rated | - | 12 | 400 | |
| Junction capacitance | $C_T$ | $V_R$ = 300 V | - | 45 | - | pF |
| Series inductance | $L_S$ | Measured lead to lead 5 mm from package body | - | 8 | - | nH |

| **DYNAMIC RECOVERY CHARACTERISTICS** ($T_J$ = 25 °C unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 1.0 A, $dI_F/dt$ = 50 A/μs, $V_R$ = 30 V | | - | - | 40 | ns |
| | | $T_J$ = 25 °C | $I_F$ = 15 A<br>$dI_F/dt$ = - 200 A/μs<br>$V_R$ = 200 V | - | 32 | - | |
| | | $T_J$ = 125 °C | | - | 45 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 2.4 | - | A |
| | | $T_J$ = 125 °C | | - | 6.1 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 38 | - | nC |
| | | $T_J$ = 125 °C | | - | 137 | - | |

| **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 per leg | $R_{thJC}$ | | - | 1.02 | 2.0 | °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 | - | 0.2 | - | |
| Weight | | | - | 2.0 | - | g |
| | | | - | 0.07 | - | oz. |
| Mounting torque | | | 6.0 (5.0) | - | 12 (10) | kgf · cm (lbf · in) |
| Marking device | | Case style $D^2PAK$ | 15ETH03S | | | |
| | | Case style TO-262 | 15ETH03-1 | | | |

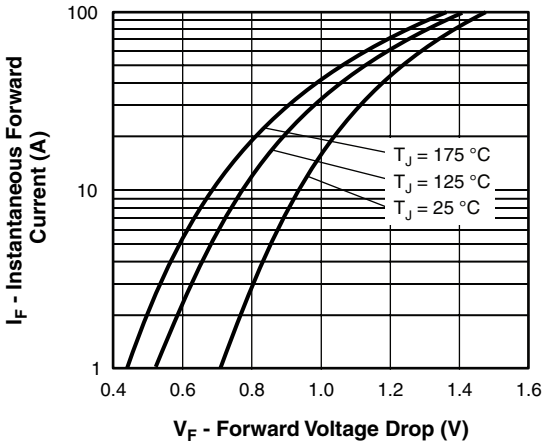



Fig. 1 - Typical Forward Voltage Drop Characteristics

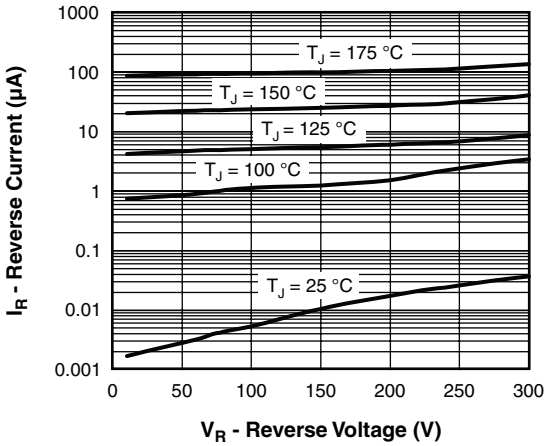



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

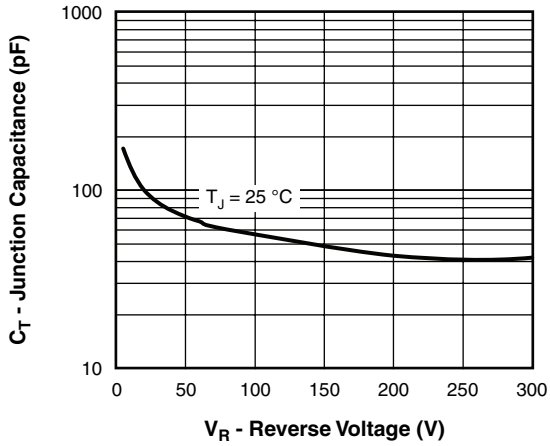



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

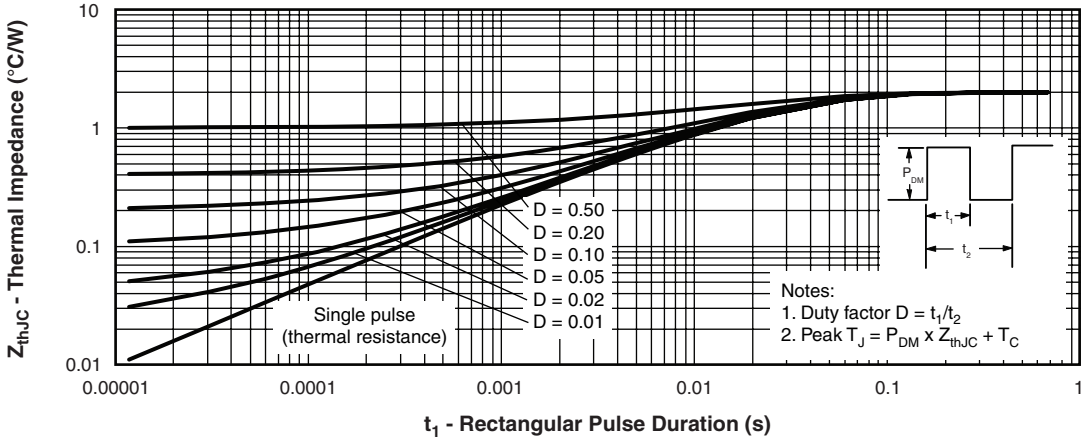



Fig. 4 - Maximum Thermal Impedance $Z_{thJC}$ Characteristics

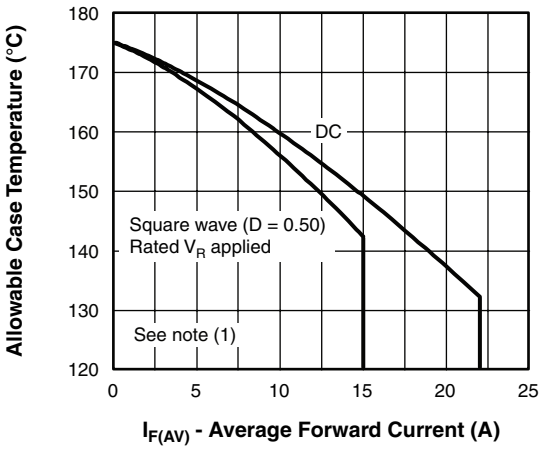



Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

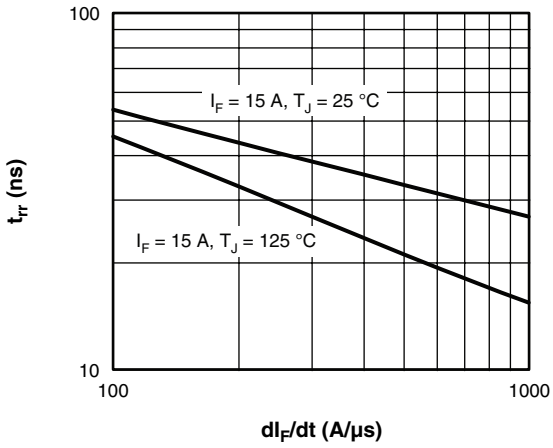



Fig. 7 - Typical Reverse Recovery Time vs. $dI_F/dt$

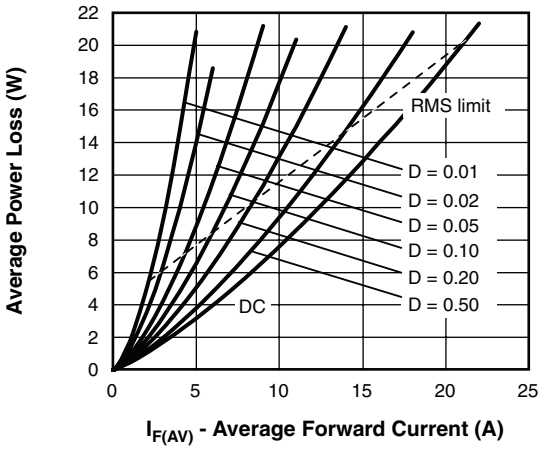



Fig. 6 - Forward Power Loss Characteristics

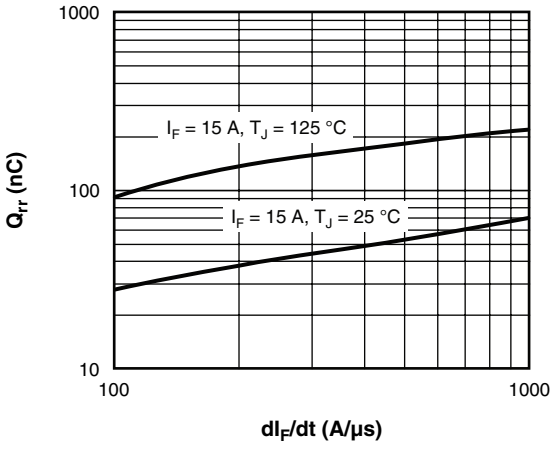



Fig. 8 - Typical Stored Charge vs. $dI_F/dt$

**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. 6);
$Pd_{REV}$ = Inverse power loss = $V_{R1} \times I_R$ (1 - D); $I_R$ at $V_{R1}$ = Rated $V_R$

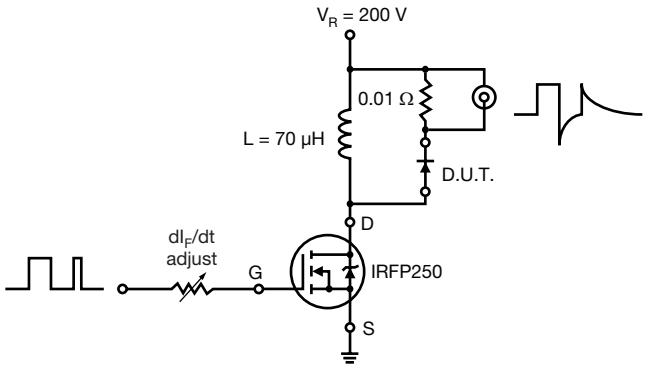
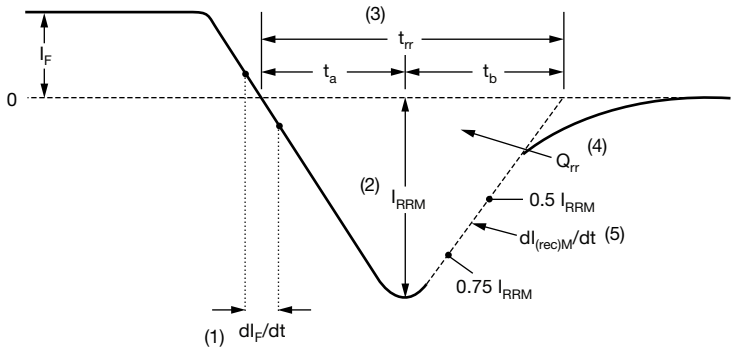



Fig. 9 - Reverse Recovery Parameter Test Circuit




(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. 10 - Reverse Recovery Waveform and Definitions

## ORDERING INFORMATION TABLE

**Device code**

| VS- | 15 | E | T | H | 03 | S | TRL | PbF |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |

- 1 - HPP product suffix
- 2 - Current rating (15 A)
- 3 - E = Single diode
- 4 - T = TO-220, $D^2PAK$
- 5 - H = Hyperfast rectifier
- 6 - Voltage rating (03 = 300 V)
- 7 - • S = $D^2PAK$
  • -1 = TO-262
- 8 - • None = Tube (50 pieces)
  • TRL = Tape and reel (left oriented, for $D^2PAK$ package)
  • TRR = Tape and reel (right oriented, for $D^2PAK$ package)
- 9 - PbF = Lead (Pb)-free

| LINKS TO RELATED DOCUMENTS | |
|---|---|
| Dimensions | www.vishay.com/doc?95014 |
| Part marking information | www.vishay.com/doc?95008 |
| Packaging information | www.vishay.com/doc?95032 |

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