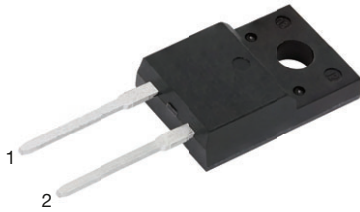
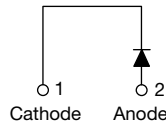


## Hyperfast Rectifier, 15 A FRED Pt®


**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](http://www.vishay.com/doc?99912)



**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	$I_{F(AV)}$	$T_C = 80\text{ °C}$	15	A
Non-repetitive peak surge current	$I_{FSM}$	$T_J = 25\text{ °C}$	180	
Peak repetitive forward current	$I_{FM}$		30	
Operating junction and storage temperatures	$T_J, T_{Stg}$		-65 to +175	°C

ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ °C}$ 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	$V_F$	$I_F = 15\text{ A}$	-	1.8	2.2	
		$I_F = 15\text{ A}, T_J = 150\text{ °C}$	-	1.3	1.6	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	0.2	50	$\mu\text{A}$
		$T_J = 150\text{ °C}, V_R = V_R$ rated	-	30	500	
Junction capacitance	$C_T$	$V_R = 600\text{ V}$	-	20	-	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body	-	8.0	-	nH



DYNAMIC RECOVERY CHARACTERISTICS (T <sub>C</sub> = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 1 A, di <sub>F</sub> /dt = 100 A/μs, V <sub>R</sub> = 30 V	-	22	30	ns
		I <sub>F</sub> = 15 A, di <sub>F</sub> /dt = 100 A/μs, V <sub>R</sub> = 30 V	-	28	35	
		T <sub>J</sub> = 25 °C	-	29	-	
		T <sub>J</sub> = 125 °C	-	75	-	
Peak recovery current	I <sub>RRM</sub>	T <sub>J</sub> = 25 °C	-	3.5	-	A
		T <sub>J</sub> = 125 °C	-	7	-	
Reverse recovery charge	Q <sub>rr</sub>	T <sub>J</sub> = 25 °C	-	57	-	nC
		T <sub>J</sub> = 125 °C	-	300	-	
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 15 A di <sub>F</sub> /dt = 800 A/μs V <sub>R</sub> = 390 V	-	51	-	ns
Peak recovery current	I <sub>RRM</sub>		-	20	-	A
Reverse recovery charge	Q <sub>rr</sub>		-	580	-	nC

THERMAL MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T <sub>J</sub> , T <sub>Stg</sub>		-65	-	175	°C
Thermal resistance, junction-to-case	R <sub>thJC</sub>		-	3.0	3.5	°C/W
Thermal resistance, junction-to-ambient per leg	R <sub>thJA</sub>	Typical socket mount	-	-	70	
Thermal resistance, case-to-heatsink	R <sub>thCS</sub>	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			

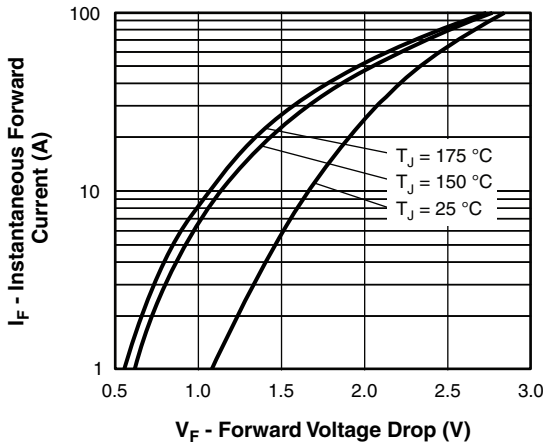


Fig. 1 - Typical Forward Voltage Drop Characteristics

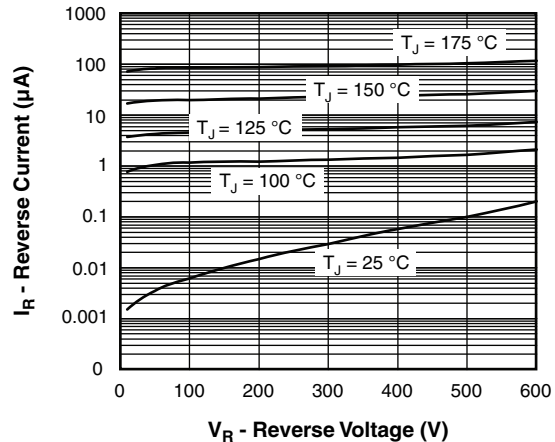


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

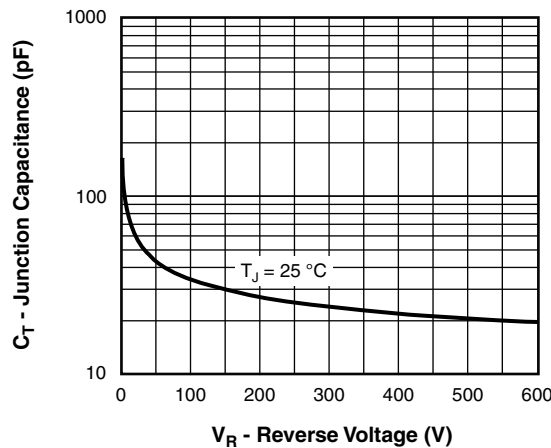


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

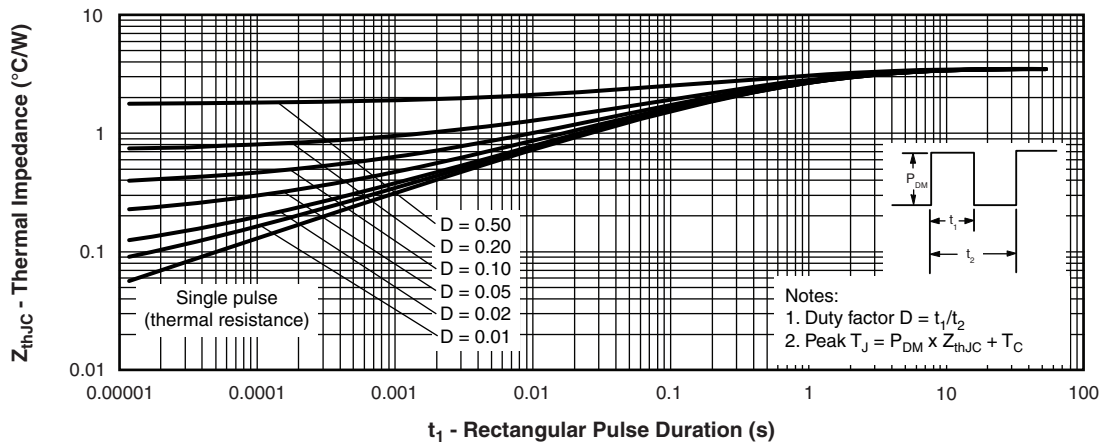


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

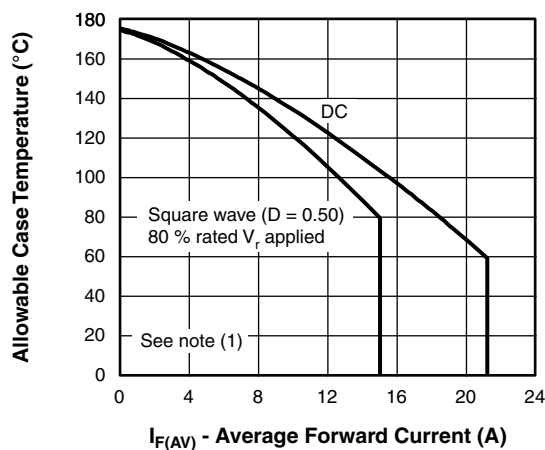


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

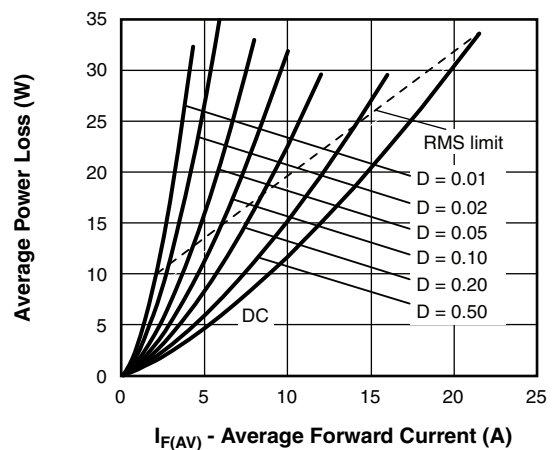


Fig. 6 - Forward Power Loss Characteristics

**Note**

- (1) Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d$  = 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  $V_R$

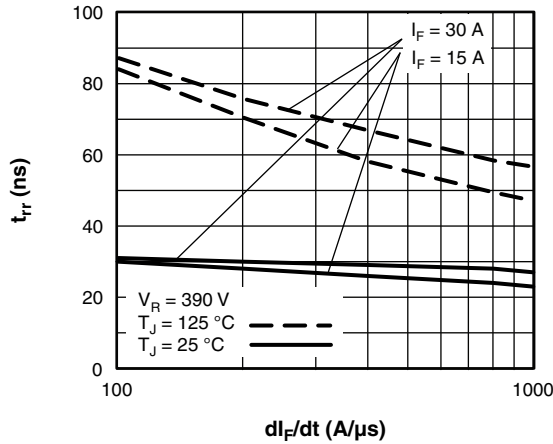


Fig. 7 - Typical Reverse Recovery Time vs.  $di_F/dt$

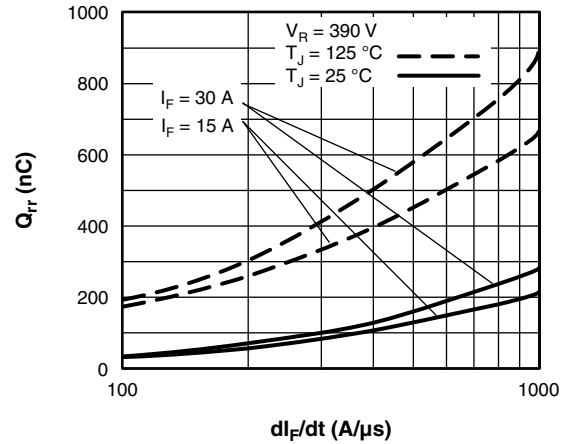
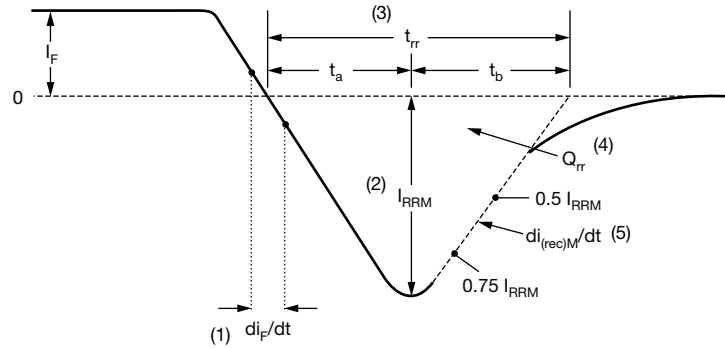


Fig. 8 - Typical Stored Charge vs.  $di_F/dt$



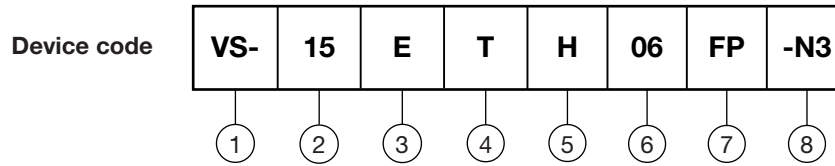
- (1)  $di_F/dt$  - rate of change of current through zero crossing
- (2)  $I_{RRM}$  - peak reverse recovery current
- (3)  $t_{rr}$  - reverse recovery time measured from zero crossing point of negative going  $I_F$  to point where a line passing through  $0.75 I_{RRM}$  and  $0.50 I_{RRM}$  extrapolated 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
- 4** - T = TO-220, D<sup>2</sup>PAK (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	<a href="http://www.vishay.com/doc?96157">www.vishay.com/doc?96157</a>
Part marking information	<a href="http://www.vishay.com/doc?95392">www.vishay.com/doc?95392</a>
SPIICE model	<a href="http://www.vishay.com/doc?96618">www.vishay.com/doc?96618</a>



## 2L TO-220 FullPAK

**DIMENSIONS** in millimeters



Bottom view





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