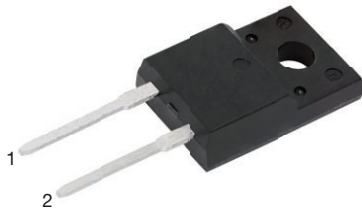


## Hyperfast Rectifier, 12 A FRED Pt® G5



TO-220 FullPAK 2L



### FEATURES

- Best in class forward voltage drop and switching losses trade off
- Optimized for high speed operation
- 175 °C maximum operating junction temperature
- Polyimide passivation
- 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](http://www.vishay.com/doc?99912)



### LINKS TO ADDITIONAL RESOURCES



PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	12 A
$V_R$	600 V
$V_F$ at $I_F$ at 125 °C	1.36 V
$t_{rr}$ (typ.)	17 ns
$T_J$ max.	175 °C
Package	TO-220 FullPAK 2L
Circuit configuration	Single

### DESCRIPTION / APPLICATIONS

Featuring a unique combination of low conduction and switching losses, this rectifier is the right choice for soft switched and resonant converters, as well as medium frequency hard switching converters. This device is specifically designed to improve as output rectifier for DC/DC stage in resonant converters and as PFC rectifier for aircon and industrial power supplies.

### MECHANICAL DATA

**Case:** TO-220 FullPAK 2L

Molding compound meets UL 94 V-0 flammability rating

**Terminals:** matte tin plated leads, solderable per J-STD-002

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Repetitive peak reverse voltage	$V_{RRM}$		600	V
Average rectified forward current in DC	$I_{F(AV)}$	$T_C = 110\text{ °C}$ , DC	12	A
Non-repetitive peak surge current	$I_{FSM}$	$T_C = 25\text{ °C}$ , $t_p = 10\text{ ms}$ , sine wave	155	
Operating junction and storage temperature	$T_J, T_{Stg}$		-55 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	$V_F$	$I_F = 12\text{ A}$	-	1.66	2.23	
		$I_F = 12\text{ A}$ , $T_J = 125\text{ °C}$	-	1.36	-	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	-	10	$\mu\text{A}$
		$T_J = 125\text{ °C}$ , $V_R = V_R$ rated	-	-	500	
Junction capacitance	$C_T$	$V_R = 600\text{ V}$	-	10	-	pF
Series inductance	$L_S$	Measured to lead 5 mm from package body	-	8	-	nH



<b>DYNAMIC RECOVERY CHARACTERISTICS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS	
Reverse recovery time	$t_{rr}$	$I_F = 1.0\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}, V_R = 30\text{ V}$	-	17	-	ns	
		$T_J = 25\text{ }^\circ\text{C}$	-	26	-		
		$T_J = 125\text{ }^\circ\text{C}$	-	37	-		
Peak recovery current	$I_{RRM}$	$I_F = 8\text{ A}$ $di_F/dt = 1000\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	11	-	A
			$T_J = 125\text{ }^\circ\text{C}$	-	17	-	
Reverse recovery charge	$Q_{rr}$	$I_F = 8\text{ A}$ $di_F/dt = 1000\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	130	-	nC
			$T_J = 125\text{ }^\circ\text{C}$	-	380	-	
Reverse recovery time	$t_{rr}$	$I_F = 12\text{ A}$ $di_F/dt = 1000\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	29	-	ns
			$T_J = 125\text{ }^\circ\text{C}$	-	43	-	
Peak recovery current	$I_{RRM}$	$I_F = 12\text{ A}$ $di_F/dt = 1000\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	12	-	A
			$T_J = 125\text{ }^\circ\text{C}$	-	18	-	
Reverse recovery charge	$Q_{rr}$	$I_F = 12\text{ A}$ $di_F/dt = 1000\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	150	-	nC
			$T_J = 125\text{ }^\circ\text{C}$	-	480	-	

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Thermal resistance, junction-to-case	$R_{thJC}$		-	-	3.5	$^\circ\text{C}/\text{W}$
Weight			-	2.0	-	g
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Maximum junction and storage temperature range	$T_J, T_{Stg}$		-55	-	175	$^\circ\text{C}$
Marking device		Case style TO-220 FullPAK 2L	E5TX1206FP			

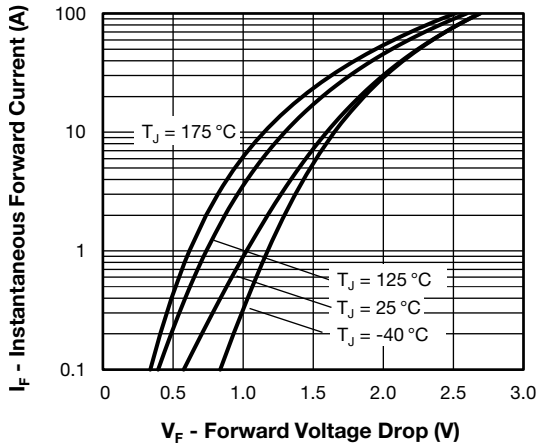


Fig. 1 - Forward Voltage Drop Characteristics

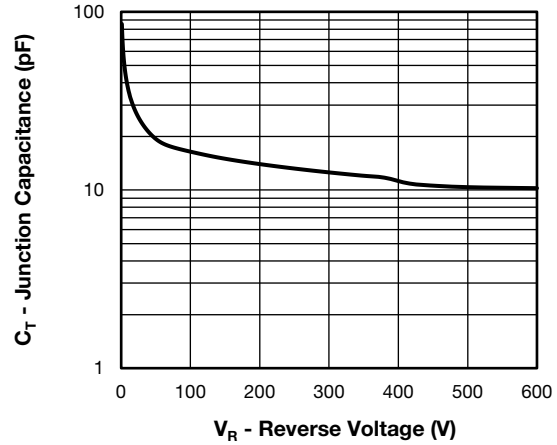


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

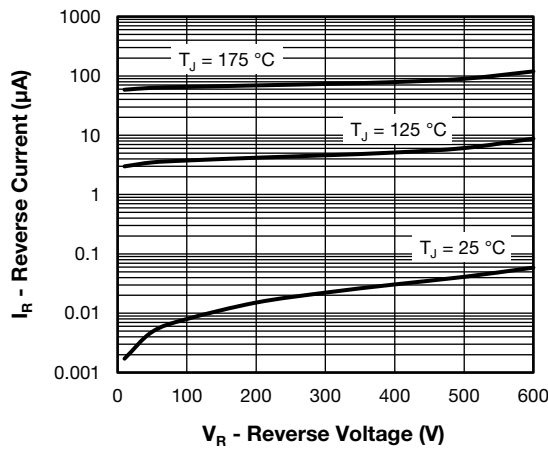


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

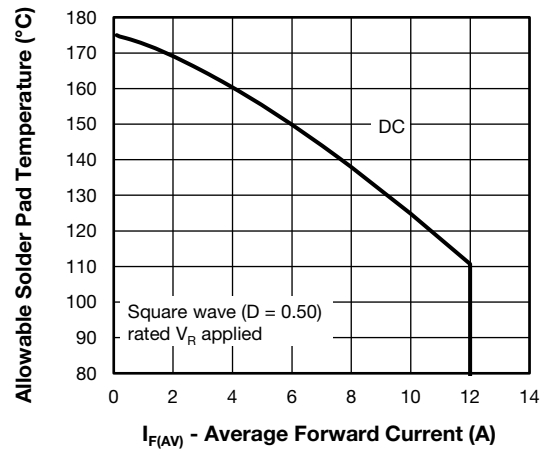


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

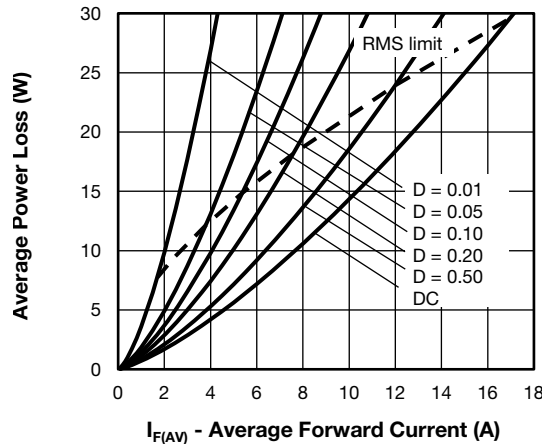


Fig. 5 - Forward Power Loss Characteristics

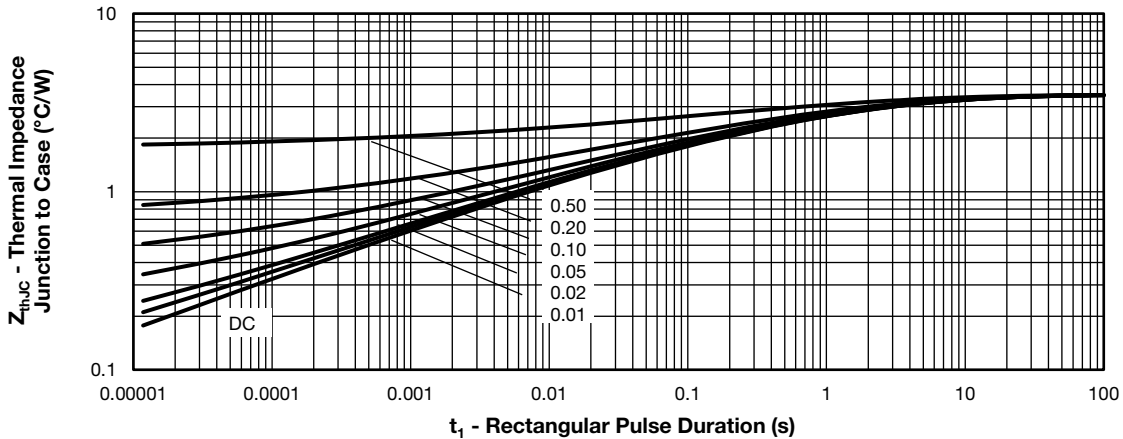


Fig. 6 - Transient Thermal Impedance, Junction to Case

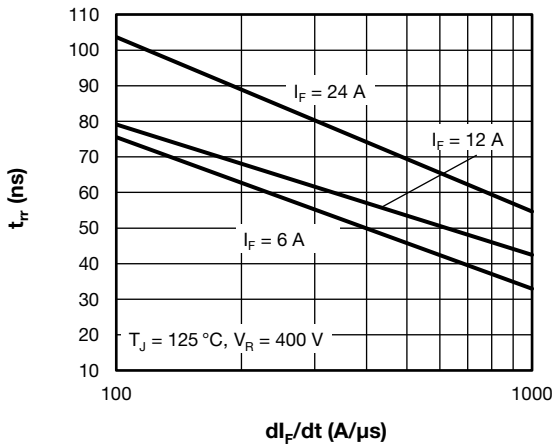


Fig. 7 - Typical Reverse Recovery Time vs.  $di/dt$

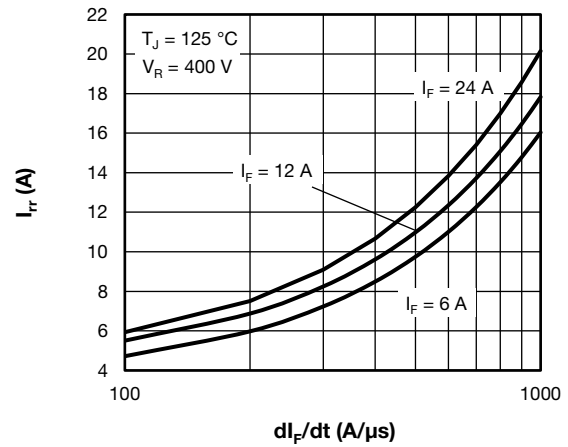


Fig. 9 - Typical Reverse Recovery Current vs.  $di/dt$

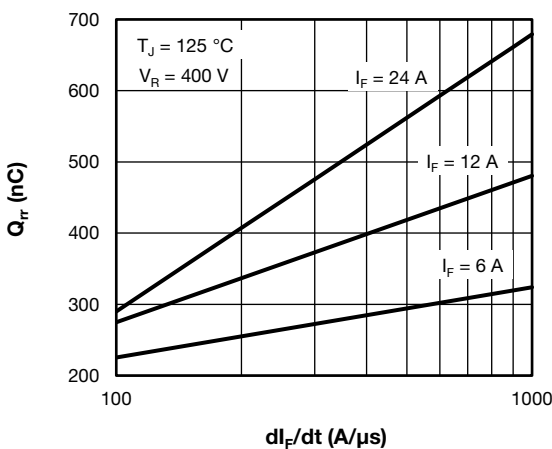


Fig. 8 - Typical Reverse Recovery Charge vs.  $di/dt$

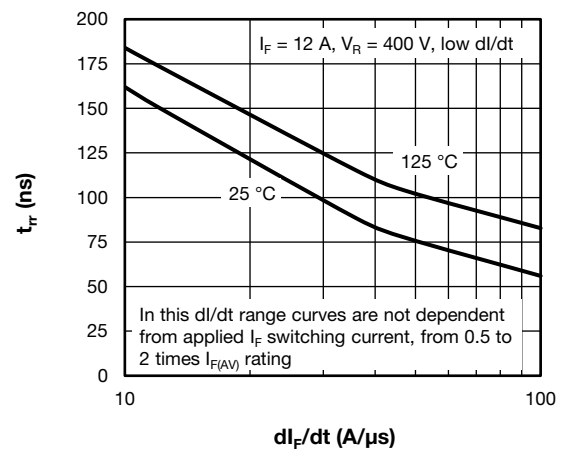


Fig. 10 - Typical Reverse Recovery Time vs.  $di/dt$

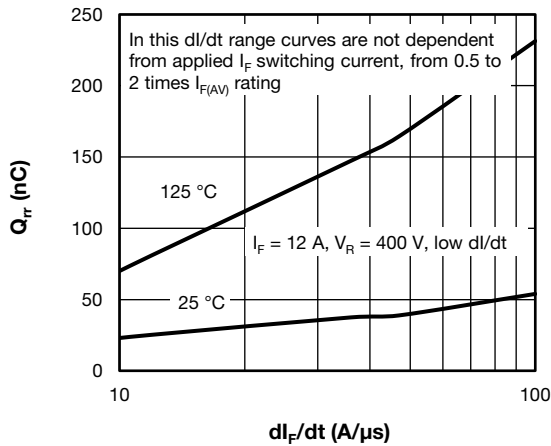


Fig. 11 - Typical Reverse Recovery Charge vs.  $di_F/dt$

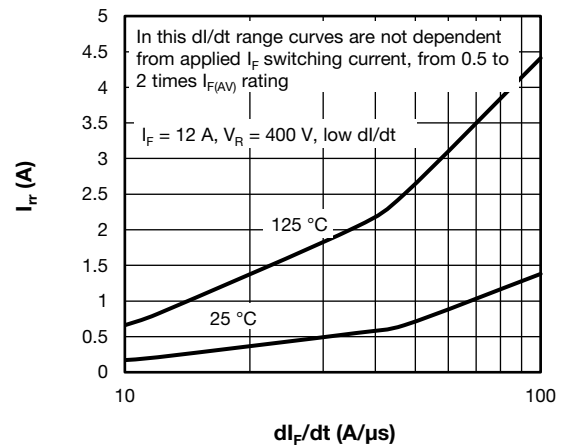


Fig. 12 - Typical Reverse Recovery Current vs.  $di_F/dt$

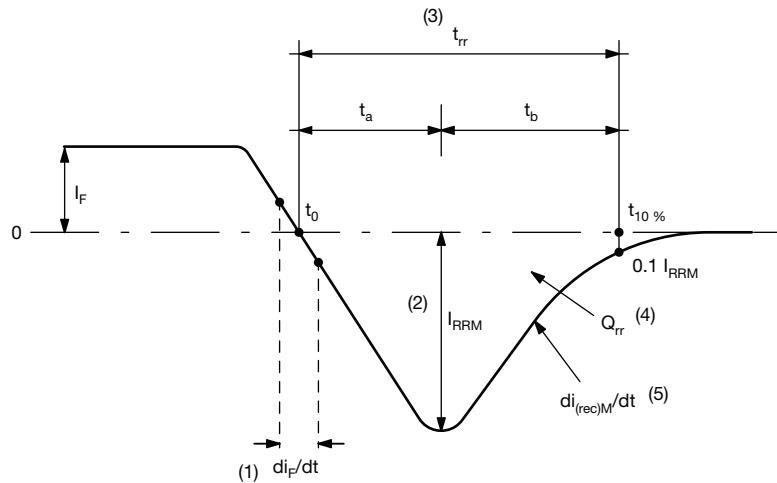


Fig. 13 - Reverse Recovery Waveform and Definitions

**Notes**

- (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  $t_0$ , crossing point of negative going  $I_F$ , to point  $t_{10\%}$ ,  $0.1 I_{RRM}$
- (4)  $Q_{rr}$  - area under curve defined by  $t_0$  and  $t_{10\%}$

$$Q_{rr} = \int_{t_0}^{t_{10\%}} I(t) dt$$

- (5)  $di_{(rec)M}/dt$  - peak rate of change of current during  $t_b$  portion of  $t_{rr}$



## ORDERING INFORMATION TABLE

Device code	<b>VS-</b>	<b>E</b>	<b>5</b>	<b>T</b>	<b>X</b>	<b>12</b>	<b>06</b>	<b>FP</b>	<b>-N3</b>
	①	②	③	④	⑤	⑥	⑦	⑧	⑨
	<b>1</b>	-	Vishay Semiconductors product						
	<b>2</b>	-	E = single diode						
	<b>3</b>	-	5 = FRED generation 5						
	<b>4</b>	-	Package: T = TO-220 package						
	<b>5</b>	-	X = hyperfast recovery						
	<b>6</b>	-	Current rating (12 = 12 A)						
	<b>7</b>	-	Voltage rating (06 = 600 V)						
	<b>8</b>	-	FP = TO-220 FullPAK 2L						
	<b>9</b>	-	Environmental digit: N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free						

<b>ORDERING INFORMATION</b> (Example)			
PREFERRED P/N	QUANTITY PER TUBE	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-E5TX1206FP-N3	50	1000	Antistatic plastic tube

<b>LINKS TO RELATED DOCUMENTS</b>	
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>



## 2L TO-220 FullPAK

**DIMENSIONS** in millimeters



Bottom view





## Disclaimer

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