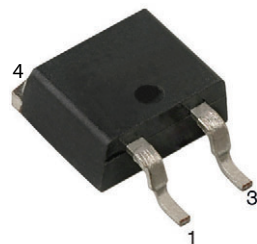


# Hyperfast Rectifier, 15 A FRED Pt® G5



D²PAK 2L (TO-263AB 2L)



## FEATURES

- Minimum creepage and clearance distances are 5.2 mm and 5.4 mm respectively
- Hyperfast and optimized  $Q_{rr}$
- Best in class forward voltage drop and switching losses trade off
- Optimized for high speed operation
- 175 °C maximum operating junction temperature
- Polyimide passivation
- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- AEC-Q101 qualified meets JESD 201 class 2 whisker test
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
FREE

## LINKS TO ADDITIONAL RESOURCES



3D Models



Application Notes

**SPICE**

Models

PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	15 A
$V_R$	1200 V
$V_F$ at $I_F$ at 125 °C	2.1 V
$t_{rr}$	29 ns
$T_J$ max.	175 °C
Package	D²PAK 2L (TO-263AB 2L)
Circuit configuration	Single

## DESCRIPTION / APPLICATIONS

Featuring a unique combination of low conduction and switching losses, this rectifier is the right choice for high frequency converters, both soft switched / resonant. Specifically designed to improve efficiency of PFC and output rectification stages of EV / HEV battery charging stations, booster stage of solar inverters and UPS applications, these devices are perfectly matched to operate with MOSFETs or high speed IGBTs.

## MECHANICAL DATA

**Case:** D²PAK 2L (TO-263AB 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	$V_{RRM}$		1200	V
Average rectified forward current	$I_{F(AV)}$	$T_C = 98\text{ °C}$ , $D = 0.50$	15	A
Repetitive peak forward current	$I_{FRM}$	$T_C = 98\text{ °C}$ , $D = 0.50$ , $f = 20\text{ kHz}$	30	
Non-repetitive peak surge current	$I_{FSM}$	$T_C = 45\text{ °C}$ , $t_p = 10\text{ ms}$ , sine wave	110	
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	$V_{BR}$ , $V_R$	$I_R = 100\text{ }\mu\text{A}$	1200	-	-	V
Forward voltage	$V_F$	$I_F = 15\text{ A}$	-	2.5	3.3	
		$I_F = 15\text{ A}$ , $T_J = 125\text{ °C}$	-	2.1	-	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	-	50	$\mu\text{A}$
		$T_J = 125\text{ °C}$ , $V_R = V_R$ rated	-	-	500	
Junction capacitance	$C_T$	$V_R = 200\text{ V}$	-	10	-	pF
Series inductance	$L_S$	Measured to lead 5 mm from package body	-	8	-	nH

**DYNAMIC RECOVERY CHARACTERISTICS** ( $T_J = 25\text{ }^{\circ}\text{C}$  unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	$t_{rr}$	$I_F = 1.0\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	29	-	ns
		$T_J = 25\text{ }^{\circ}\text{C}$	-	96	-	
		$T_J = 125\text{ }^{\circ}\text{C}$	-	137	-	
Peak recovery current	$I_{RRM}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	11.5	-	A
		$T_J = 125\text{ }^{\circ}\text{C}$	-	16	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	375	-	nC
		$T_J = 125\text{ }^{\circ}\text{C}$	-	900	-	
Reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	77.5	-	ns
		$T_J = 125\text{ }^{\circ}\text{C}$	-	106	-	
Peak recovery current	$I_{RRM}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	21	-	A
		$T_J = 125\text{ }^{\circ}\text{C}$	-	29	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	680	-	nC
		$T_J = 125\text{ }^{\circ}\text{C}$	-	1600	-	

**THERMAL - MECHANICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Thermal resistance, junction-to-case	$R_{thJC}$		-	-	1.7	$^{\circ}\text{C}/\text{W}$
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 D <sup>2</sup> PAK 2L (TO-263AB 2L)	E5TX1512SH			

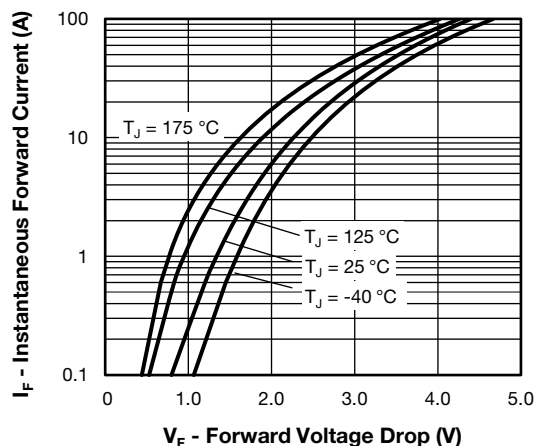


Fig. 1 - Forward Voltage Drop Characteristics

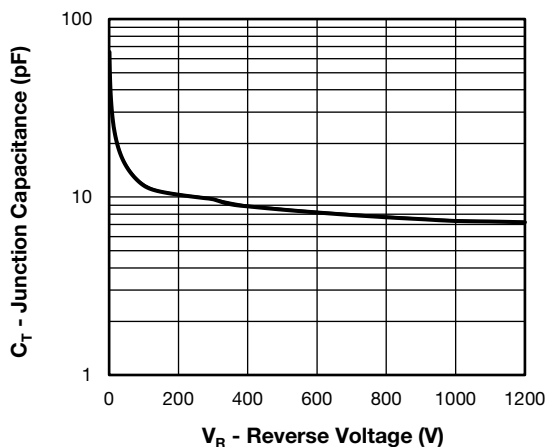


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

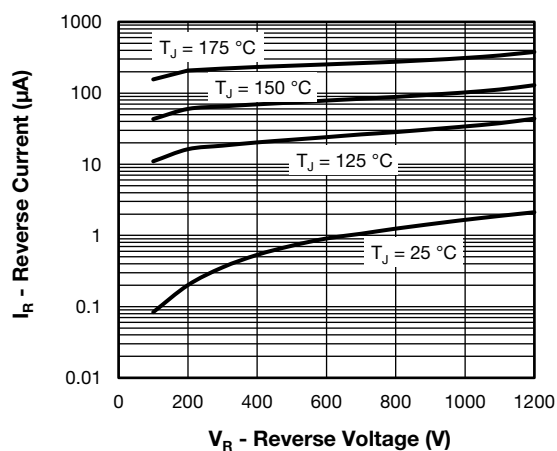


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

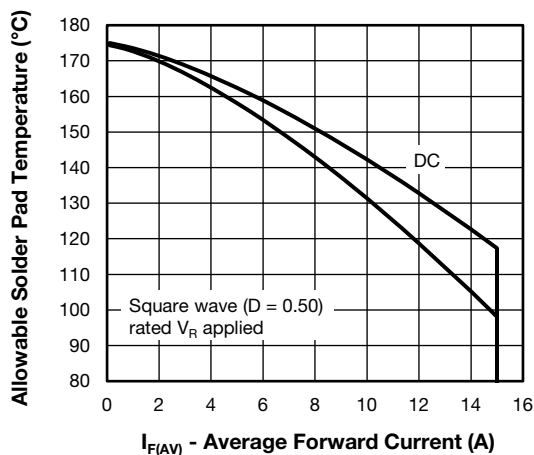


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

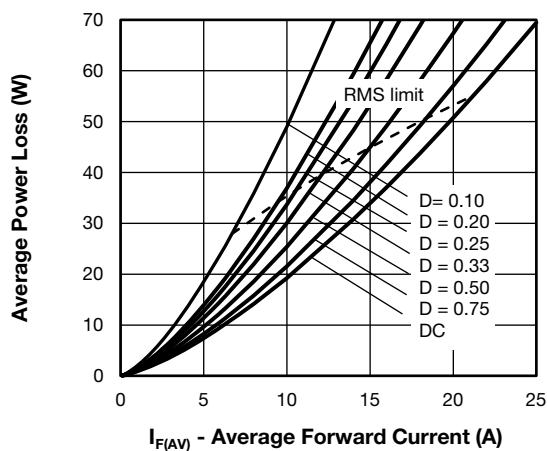


Fig. 5 - Forward Power Loss Characteristics

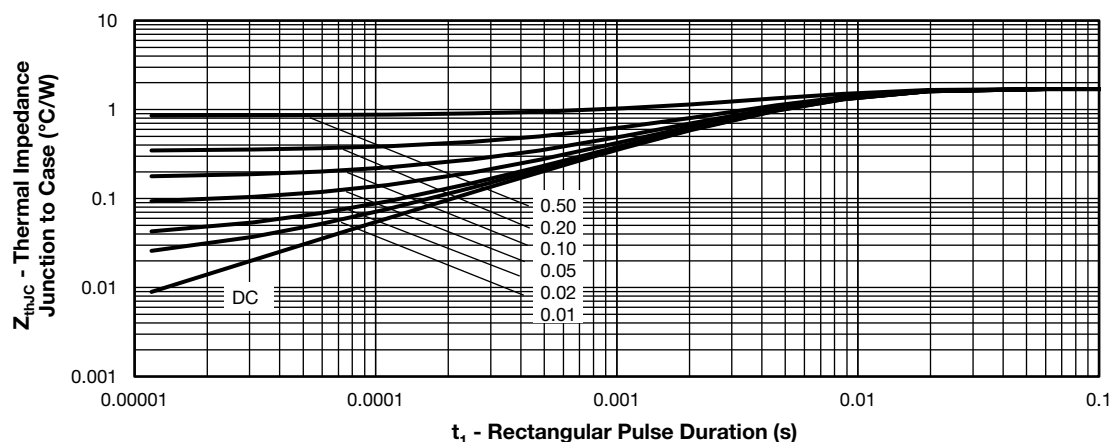
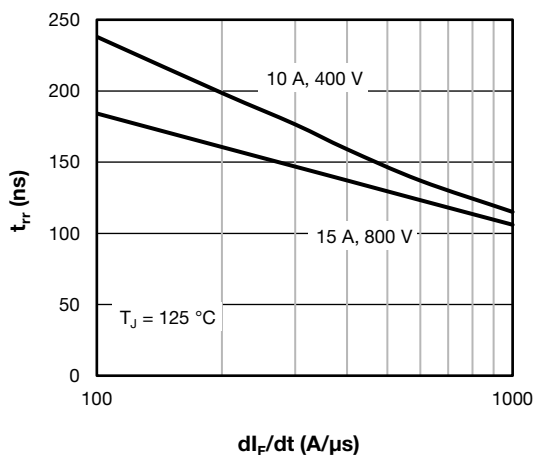
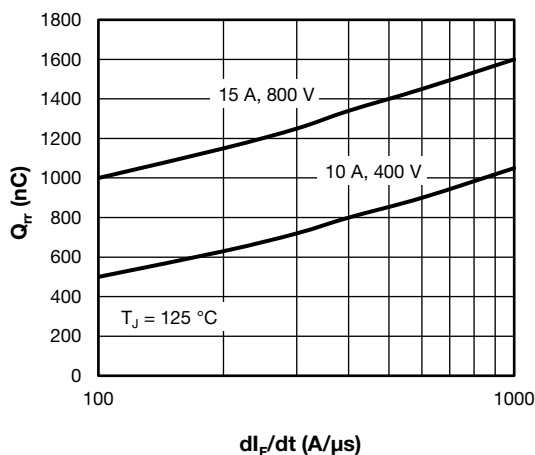
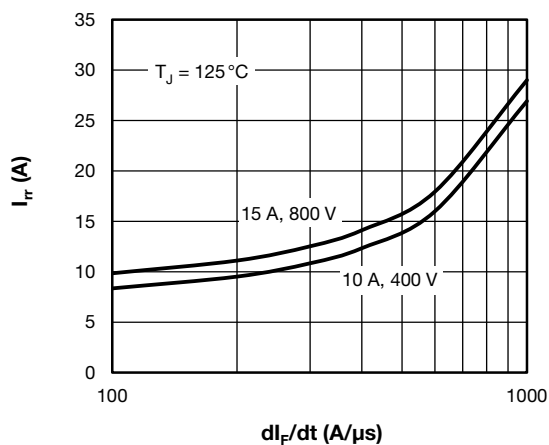


Fig. 6 - Transient Thermal Impedance, Junction to Case


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

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

Fig. 9 - Typical Recovery Current vs.  $dI_F/dt$

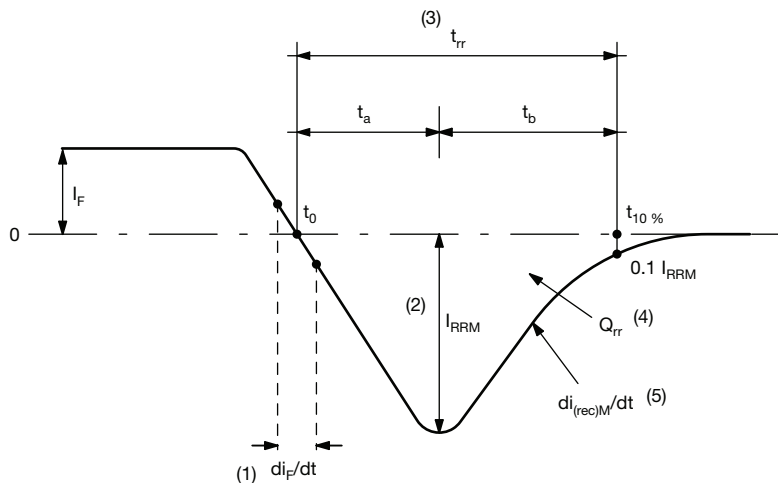


Fig. 10 - Reverse Recovery Waveform and Definitions

#### 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	VS-	E	5	T	X	15	12	S2	L	H	M3
	1	2	3	4	5	6	7	8	9	10	11
	1	-	Vishay Semiconductors product								
	2	-	E = single diode								
	3	-	5 = FRED generation 5								
	4	-	Package: T = D <sup>2</sup> PAK 2L (TO-263 2L) package								
	5	-	X = hyperfast recovery								
	6	-	Current rating (15 = 15 A)								
	7	-	Voltage rating (12 = 1200 V)								
	8	-	S2 = true 2 pin D <sup>2</sup> PAK								
	9	-	None = tube (50 pieces) • L = tape and reel (left oriented, for D <sup>2</sup> PAK package) If needed different orientation/packaging, please contact factory								
	10	-	H = AEC-Q101 qualified								
	11	-	Environmental digit: M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free								

**ORDERING INFORMATION** (Example)

PREFERRED P/N	BASE QUANTITY	PACKAGING DESCRIPTION
VS-E5TX1512S2LHM3	800	13" diameter reel

**LINKS TO RELATED DOCUMENTS**

Dimensions	<a href="http://www.vishay.com/doc?96683">www.vishay.com/doc?96683</a>
Part marking information	<a href="http://www.vishay.com/doc?96693">www.vishay.com/doc?96693</a>
Packaging information	<a href="http://www.vishay.com/doc?95032">www.vishay.com/doc?95032</a>
SPIICE Model	<a href="http://www.vishay.com/doc?97160">www.vishay.com/doc?97160</a>

### D<sup>2</sup>PAK 2L (TO-263AB 2L)

#### DIMENSIONS in millimeters and inches

Conforms to JEDEC® outline D<sup>2</sup>PAK (SMD-220)



#### Notes

- (1) Dimensioning and tolerancing per ASME Y14.5 M-1994
- (2) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body
- (3) Thermal pad contour optional within dimension E, L1, D1 and E1
- (4) Dimension b1 and c1 apply to base metal only
- (5) Datum A and B to be determined at datum plane H
- (6) Controlling dimension: inch
- (7) Outline conforms to JEDEC® outline TO-263AB



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