

## Hyperfast Rectifier, 20 A FRED Pt® G5


**D²PAK 2L (TO-263AB 2L)**


### FEATURES

- 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
- 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**

### LINKS TO ADDITIONAL RESOURCES



3D Models



Application Notes

PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	20 A
$V_R$	1200 V
$V_F$ at $I_F$ at 125 °C	1.88 V
$t_{rr}$	37 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	$I_{F(AV)}$	$T_C = 103\text{ °C}$	20	A
Repetitive peak forward current	$I_{FRM}$	$T_C = 103\text{ °C}, D = 0.50, f = 20\text{ kHz}$	32	
Non-repetitive peak surge current	$I_{FSM}$	$T_C = 45\text{ °C}, t_p = 10\text{ ms}, \text{ sine wave}$	125	
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	$V_F$	$I_F = 20\text{ A}$ $I_F = 20\text{ A}, T_J = 125\text{ °C}$	-	2.04 1.88	- -	
Reverse leakage current	$I_R$	$V_R = V_R \text{ rated}$ $T_J = 125\text{ °C}, V_R = V_R \text{ rated}$	-	-	50 500	$\mu\text{A}$
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 <sub>J</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> = 1.0 A, dI <sub>F</sub> /dt = 100 A/μs, V <sub>R</sub> = 30 V	-	37	-	
		T <sub>J</sub> = 25 °C	-	125	-	ns
		T <sub>J</sub> = 125 °C	-	188	-	
Peak recovery current	I <sub>RRM</sub>	T <sub>J</sub> = 25 °C	-	14	-	A
		T <sub>J</sub> = 125 °C	-	19	-	
Reverse recovery charge	Q <sub>rr</sub>	T <sub>J</sub> = 25 °C	-	670	-	nC
		T <sub>J</sub> = 125 °C	-	1450	-	
Reverse recovery time	t <sub>rr</sub>	T <sub>J</sub> = 25 °C	-	90	-	ns
		T <sub>J</sub> = 125 °C	-	107	-	
Peak recovery current	I <sub>RRM</sub>	T <sub>J</sub> = 25 °C	-	28	-	A
		T <sub>J</sub> = 125 °C	-	48	-	
Reverse recovery charge	Q <sub>rr</sub>	T <sub>J</sub> = 25 °C	-	1450	-	nC
		T <sub>J</sub> = 125 °C	-	2930	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Thermal resistance, junction-to-case	R <sub>thJC</sub>		-	-	1.7	°C/W
Weight			-	2.0	-	g
Maximum junction and storage temperature range	T <sub>J</sub> , T <sub>Stg</sub>		-55	-	175	°C
Marking device		Case style D <sup>2</sup> PAK 2L (TO-263AB 2L)	E5TH2112S			

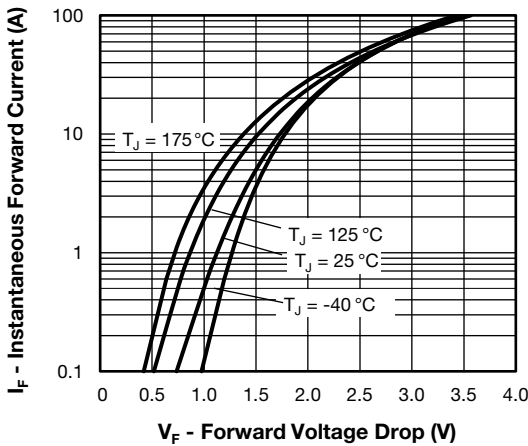


Fig. 1 - Forward Voltage Drop Characteristics

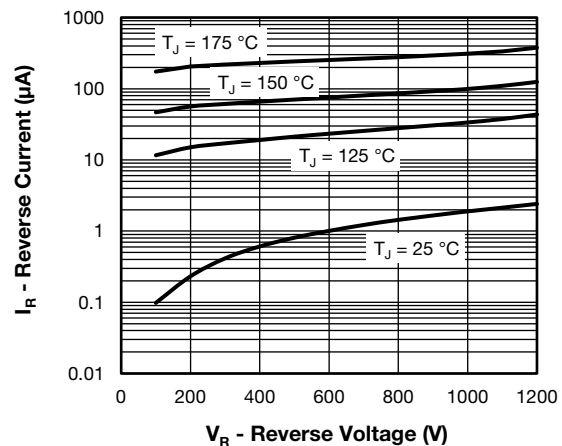


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

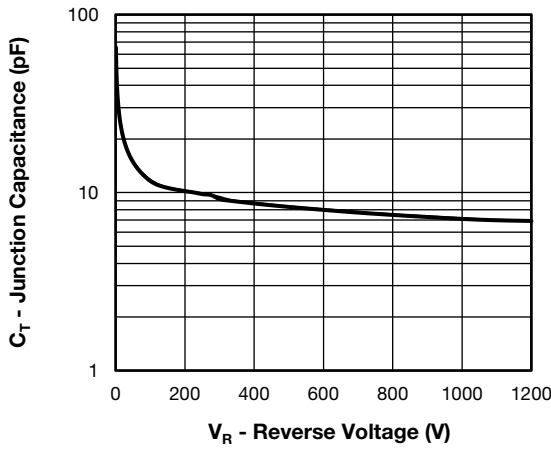


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

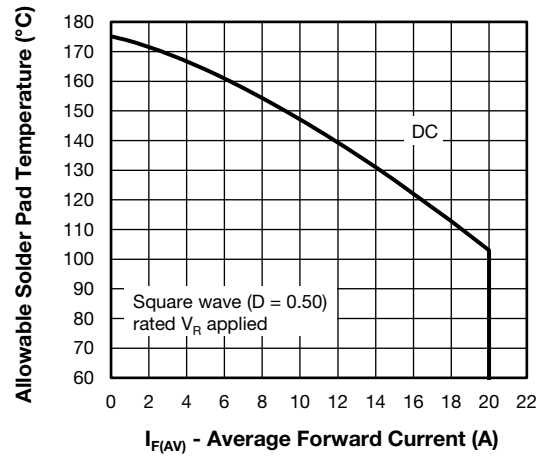


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

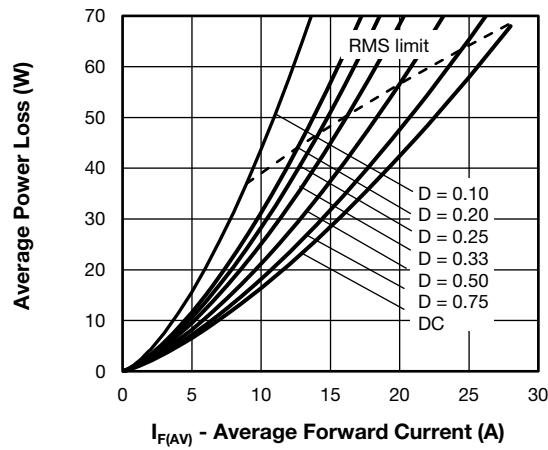


Fig. 5 - Forward Power Loss Characteristics

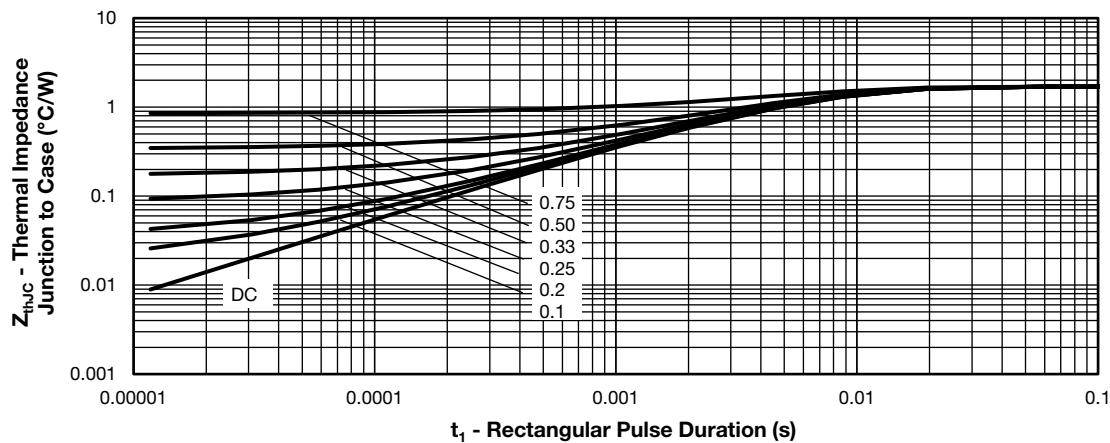


Fig. 6 - Transient Thermal Impedance, Junction to Case

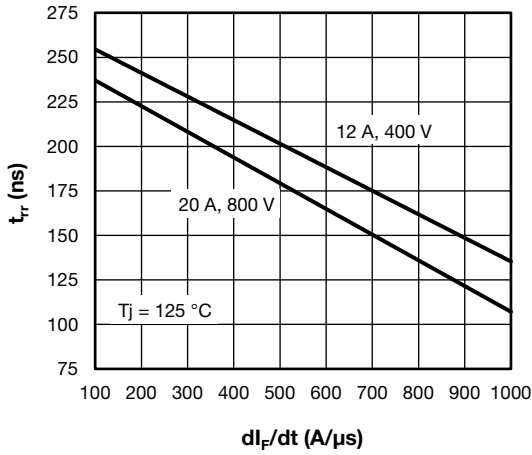


Fig. 7 - Typical Reverse Recovery Time vs.  $di_F/dt$

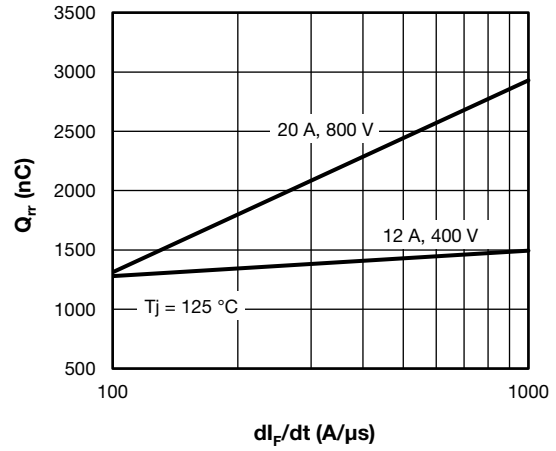


Fig. 8 - Typical Stored Charge vs.  $di_F/dt$

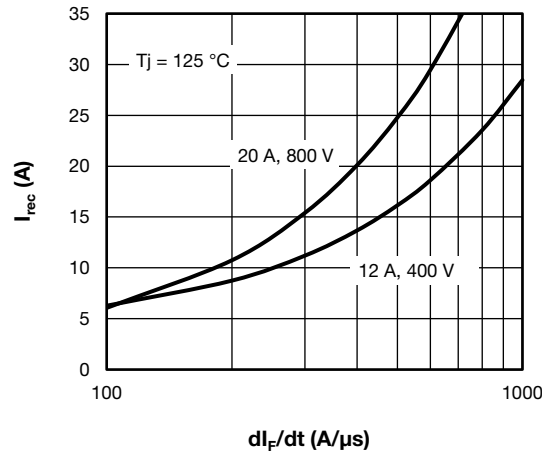


Fig. 9 - Typical Stored Charge vs.  $di_F/dt$

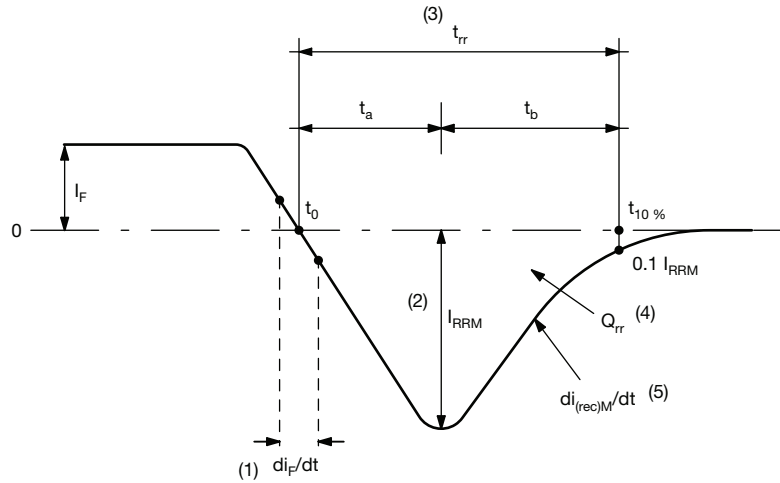


Fig. 10 - Reverse Recovery Waveform and Definitions

**Notes**

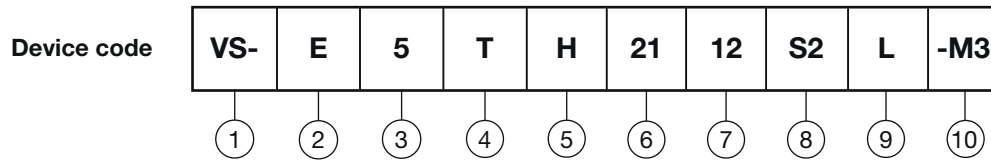
- (1)  $di_F/dt$  - rate of change of current through zero crossing
- (2)  $I_{RRM}$  - peak reverse recovery current
- (3)  $t_{rr}$  - reverse recovery time measured from  $t_0$ , crossing point of negative going  $I_F$ , to point  $t_{10\%}$ ,  $0.1 I_{RRM}$
- (4)  $Q_{rr}$  - area under curve defined 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



- 1** - Vishay Semiconductors product
- 2** - E = single diode
- 3** - 5 = FRED generation 5
- 4** - Package:  
T = TO-263 / D<sup>2</sup>PAK package
- 5** - H = hyperfast recovery
- 6** - Current rating (21 = 20 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** - Environmental digit:  
-M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

ORDERING INFORMATION (Example)		
PREFERRED P/N	BASE QUANTITY	PACKAGING DESCRIPTION
VS-E5TH2112S2L-M3	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>

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

### DIMENSIONS in millimeters and inches

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



SYMBOL	MILLIMETERS		INCHES		NOTES	SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.			MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190		D1	6.86	8.00	0.270	0.315	3
A1	0.00	0.254	0.000	0.010		E	9.65	10.67	0.380	0.420	2, 3
b	0.51	0.99	0.020	0.039		E1	7.90	8.80	0.311	0.346	3
b1	0.51	0.89	0.020	0.035	4	e	2.54 BSC		0.100 BSC		
b2	1.14	1.78	0.045	0.070		H	14.61	15.88	0.575	0.625	
b3	1.14	1.73	0.045	0.068	4	L	1.78	2.79	0.070	0.110	
c	0.38	0.74	0.015	0.029		L1	-	1.65	-	0.066	3
c1	0.38	0.58	0.015	0.023	4	L3	0.25 BSC		0.010 BSC		
c2	1.14	1.65	0.045	0.065		L4	4.78	5.28	0.188	0.208	
D	8.51	9.65	0.335	0.380	2						

#### 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<sup>®</sup> outline TO-263AB



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