

ROHS

HALOGEN FREE

# Hyperfast Rectifier, 60 A FRED Pt® Gen 5



#### **LINKS TO ADDITIONAL RESOURCES**





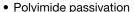
PRIMARY CHARACTERISTICS						
I <sub>F(AV)</sub>	60 A					
$V_{R}$	1200 V					
V <sub>F</sub> at I <sub>F</sub> at 125 °C	2.1 V					
t <sub>rr</sub>	30 ns					
T <sub>J</sub> max.	175 °C					
Package	TO-247AD 2L					
Circuit configuration	Single					

#### **FEATURES**

- Hyperfast and optimized Q<sub>rr</sub>
- Best in class forward voltage drop and switching losses trade off







 Material categorization: for definitions of compliance please see <a href="https://www.vishay.com/doc?99912"><u>www.vishay.com/doc?99912</u></a>



operate with MOSFETs or high speed IGBTs.

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

#### **MECHANICAL DATA**

Case: TO-247AD 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 <sub>F(AV)</sub>	T <sub>C</sub> = 105 °C, D = 0.50	60				
Non-repetitive peak surge current	I <sub>FSM</sub>	$T_C = 45$ °C, $t_p = 10$ ms, sine wave	420	Α			
Repetitive peak forward current	I <sub>FRM</sub>	T <sub>C</sub> = 105 °C, D = 0.50, f = 20 kHz	120				
Operating junction and storage temperature	T <sub>J</sub> , T <sub>Stg</sub>		-55 to +175	°C			

<b>ELECTRICAL SPECIFICATIONS</b> (T <sub>J</sub> = 25 °C unless otherwise specified)								
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS		
Breakdown voltage, blocking voltage	$V_{BR}$ , $V_{R}$	I <sub>R</sub> = 100 μA	1200	-	-			
Forward voltage	V <sub>F</sub>	I <sub>F</sub> = 60 A	ı	2.6	3.15	V		
		I <sub>F</sub> = 60 A, T <sub>J</sub> = 125 °C	ı	2.1	-			
Reverse leakage current	I <sub>R</sub>	$V_R = V_R$ rated	-	-	50			
neverse leakage current		T <sub>J</sub> = 125 °C, V <sub>R</sub> = V <sub>R</sub> rated	-	-	500	μA		
Junction capacitance	C <sub>T</sub>	V <sub>R</sub> = 200 V	-	32	=	pF		
Series inductance	L <sub>S</sub>	Measured to lead 5 mm from package body	-	8	-	nH		



<b>DYNAMIC RECOVERY CHARACTERISTICS</b> (T <sub>J</sub> = 25 °C unless otherwise specified)								
PARAMETER	SYMBOL	TEST CO	MIN.	TYP.	MAX.	UNITS		
		I <sub>F</sub> = 1.0 A, dI <sub>F</sub> /dt =	100 A/ $\mu$ s, V <sub>R</sub> = 30 V	-	30	-		
Reverse recovery time	t <sub>rr</sub>	T <sub>J</sub> = 25 °C		-	120	-	ns	
		T <sub>J</sub> = 125 °C		-	170	-	<b>†</b>	
Dook roopyony ourrent		T <sub>J</sub> = 25 °C	$I_F = 40 \text{ A}$ $dI_F/dt = 600 \text{ A/}\mu\text{s}$ $V_R = 400 \text{ V}$	-	17	-	А	
Peak recovery current	I <sub>RRM</sub>	T <sub>J</sub> = 125 °C		-	32	-		
Doverse recovery charge	0	T <sub>J</sub> = 25 °C		-	970	-	nC	
Reverse recovery charge	Q <sub>rr</sub>	T <sub>J</sub> = 125 °C		-	2950	-		
Reverse recovery time		T <sub>J</sub> = 25 °C	I <sub>F</sub> = 60 A dI <sub>F</sub> /dt = 1000 A/μs · V <sub>B</sub> = 800 V	-	90	-	ns A	
neverse recovery time	t <sub>rr</sub>	T <sub>J</sub> = 125 °C		-	130	-		
Dook roopyony ourrent		T <sub>J</sub> = 25 °C		-	32	-		
Peak recovery current	I <sub>RRM</sub>	T <sub>J</sub> = 125 °C		-	53	-		
Reverse recovery charge	0	T <sub>J</sub> = 25 °C		-	1570	-	nC	
	Q <sub>rr</sub>	T <sub>J</sub> = 125 °C		-	4300	-		

THERMAL - MECHANICAL SPECIFICATIONS								
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS		
Thermal resistance, junction-to-case	R <sub>thJC</sub>		-	-	0.4	°C/W		
Weight			-	5.5	-	g		
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)		
Maximum junction and storage temperature range	T <sub>J</sub> , T <sub>Stg</sub>		-55	-	175	°C		
Marking device		Case style: TO-247AD 2L	E5PX6012L					

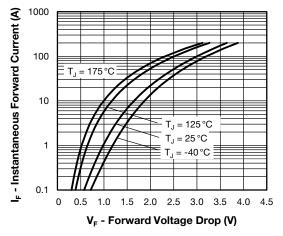


Fig. 1 - Typical Forward Voltage Drop Characteristics

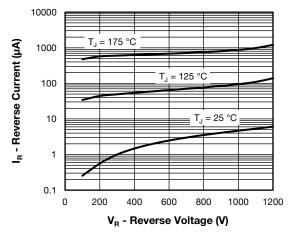


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage



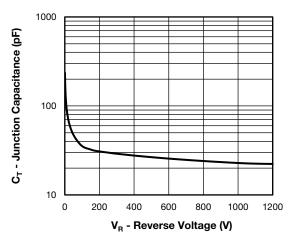


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

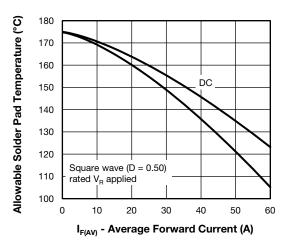


Fig. 4 - Maximum Allowable Case Temperature vs.
Average Forward Current

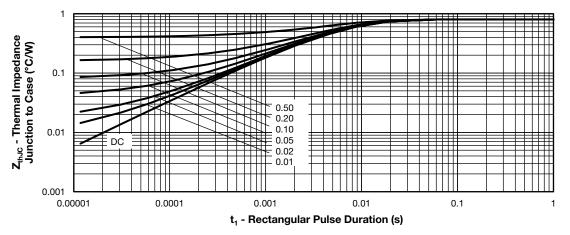


Fig. 5 - Thermal Impedance Z<sub>thJC</sub> - Characteristics

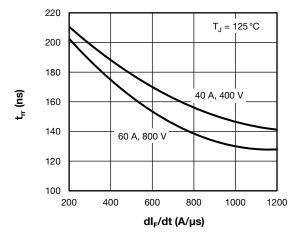


Fig. 6 - Typical Reverse Recovery Time vs.  $dI_F/dt$ 

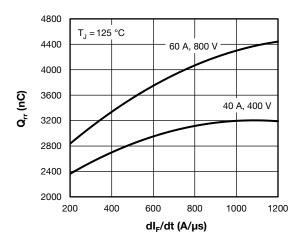


Fig. 7 - Typical Stored Charge vs. dl<sub>F</sub>/dt

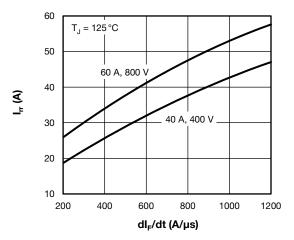


Fig. 8 - Typical Recovery Current vs. dl<sub>F</sub>/dt

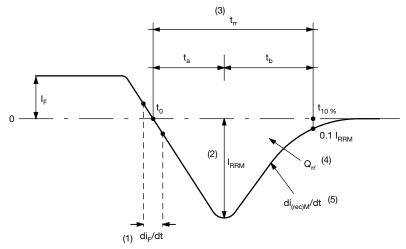


Fig. 9 - Reverse Recovery Waveform and Definitions

#### Notes

- (1) di<sub>F</sub>/dt rate of change of current through zero crossing
- (2) I<sub>RRM</sub> 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  $t_{10\ \%}$

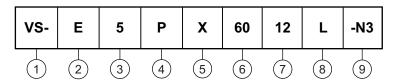
$$Q_{rr} = \int_{t_0}^{t_{10}\%} I(t)dt$$

 $^{(5)}$  di<sub>(rec)</sub>M/dt - peak rate of change of current during  $t_{\text{b}}$  portion of  $t_{\text{rr}}$ 



#### **ORDERING INFORMATION TABLE**

Device code



1 - Vishay Semiconductors product

2 - E = single diode

3 - 5 = Fred generation 5

4 - Package:

P = TO-247 package

5 - X = hyperfast recovery

6 - Current rating (60 = 60 A)

7 - Voltage rating (12 = 1200 V)
 8 - Package: L = long lead (TO-247AD)

9 - Environmental digit:

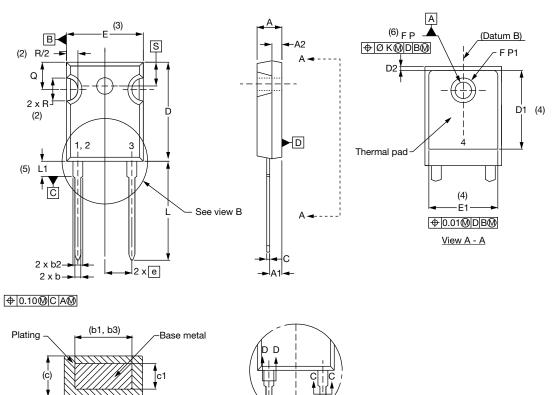
-N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

ORDERING INFORMATION (Example)							
PREFERRED P/N	QUANTITY PER TUBE	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION				
VS-E5PX6012L-N3	25	500	Antistatic plastic tube				

LINKS TO RELATED DOCUMENTS				
Dimensions	www.vishay.com/doc?95536			
Part marking information	www.vishay.com/doc?95648			
SPICE model	www.vishay.com/doc?96556			

### **TO-247AD 2L**

#### **DIMENSIONS** in millimeters and inches



View B

SYMBOL	MILLIN	IMETERS INCHES		NOTES	
SYMBOL	MIN.	MAX.	MIN.	MAX.	NOTES
А	4.65	5.31	0.183	0.209	
A1	2.21	2.59	0.087	0.102	
A2	1.50	2.49	0.059	0.098	
b	0.99	1.40	0.039	0.055	
b1	0.99	1.35	0.039	0.053	
b2	1.65	2.39	0.065	0.094	
b3	1.65	2.34	0.065	0.092	
С	0.38	0.89	0.015	0.035	
c1	0.38	0.84	0.015	0.033	
D	19.71	20.70	0.776	0.815	3
D1	13.08	-	0.515	-	4
D2	0.51	1.35	0.020	0.053	

Section C - C, D - D

SYMBOL	MILLIN	IETERS	INC	INCHES		
STWIBOL	MIN.	MAX.	MIN.	MAX.	NOTES	
Е	15.29	15.87	0.602	0.625	3	
E1	13.46	-	0.53	-		
е	5.46	BSC	0.215	BSC		
ØK	0.2	0.254		0.010		
L	19.81	20.32	0.780	0.800		
L1	3.71	4.29	0.146	0.169		
ØΡ	3.56	3.66	0.14	0.144		
Ø P1	-	6.98	-	0.275		
Q	5.31	5.69	0.209	0.224		
R	4.52	5.49	0.178	0.216		
S	5.51 BSC		0.217 BSC			
	•		•	•		

#### **Notes**

- (1) Dimensioning and tolerancing per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D and E do not include mold flash. These dimensions are measured at the outermost extremes of the plastic body
- (4) Thermal pad contour optional with dimensions D1 and E1
- (5) Lead finish uncontrolled in L1
- (6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- (7) Outline conforms to JEDEC® outline TO-247 with exception of dimension A min., D, E min., Q min., S, and note 4



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