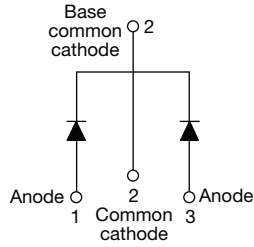
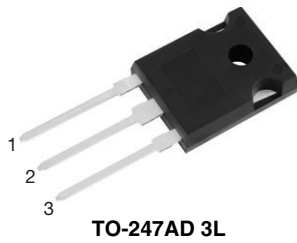


# Hyperfast Rectifier, 2 x 30 A FRED Pt® G5



## 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
- AEC-Q101 qualified meets JESD 201 class 1A whisker test
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?999912](http://www.vishay.com/doc?999912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

## LINKS TO ADDITIONAL RESOURCES



PRIMARY CHARACTERISTICS	
$I_{F(AV)}$ , per leg	30 A
$V_R$	600 V
$V_F$ at $I_F$ at 125 °C, per leg	1.15 V
$t_{rr}$ (typ.)	25
$I_{FSM}$ , per leg	330
$T_J$ max.	175 °C
Package	TO-247AD 3L
Circuit configuration	Common cathode

## 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 efficiency of high speed LLC output rectification stages of EV / HEV on-board battery chargers

## MECHANICAL DATA

**Case:** TO-247AD 3L

Molding compound meets UL 94 V-0 flammability rating

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

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Repetitive peak reverse voltage, per leg	$V_{RRM}$		600	V
Average rectified forward current, per leg	$I_{F(AV)}$	$T_C = 123\text{ °C}$ , $D = 0.50$	30	A
Non-repetitive peak surge current, per leg	$I_{FSM}$	$T_C = 25\text{ °C}$ , $t_p = 10\text{ ms}$ , sine wave	330	
Repetitive peak forward current, per leg	$I_{FRM}$	$T_C = 123\text{ °C}$ , $D = 0.50$ , $f = 20\text{ kHz}$	60	
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, per leg	$V_{BR}, V_R$	$I_R = 100\text{ }\mu\text{A}$	600	-	-	V
Forward voltage, per leg	$V_F$	$I_F = 30\text{ A}$ $I_F = 30\text{ A}$ , $T_J = 125\text{ °C}$	-	1.3 1.15	-	
Reverse leakage current, per leg	$I_R$	$V_R = V_R$ rated $T_J = 125\text{ °C}$ , $V_R = V_R$ rated	-	-	20 500	$\mu\text{A}$
Junction capacitance, per leg	$C_T$	$V_R = 200\text{ V}$	-	36	-	pF
Series inductance, per leg	$L_S$	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, per leg	$t_{rr}$	$I_F = 1.0\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	25	-	ns
		$T_J = 25\text{ }^\circ\text{C}$	-	41	-	
		$T_J = 125\text{ }^\circ\text{C}$	-	58	-	
Peak recovery current, per leg	$I_{RRM}$	$T_J = 25\text{ }^\circ\text{C}$	-	19	-	A
		$T_J = 125\text{ }^\circ\text{C}$	-	32	-	
Reverse recovery charge, per leg	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	419	-	nC
		$T_J = 125\text{ }^\circ\text{C}$	-	1176	-	
Reverse recovery time, per leg	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	46	-	ns
		$T_J = 125\text{ }^\circ\text{C}$	-	65	-	
Peak recovery current, per leg	$I_{RRM}$	$T_J = 25\text{ }^\circ\text{C}$	-	21	-	A
		$T_J = 125\text{ }^\circ\text{C}$	-	36	-	
Reverse recovery charge, per leg	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	550	-	nC
		$T_J = 125\text{ }^\circ\text{C}$	-	1560	-	

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Thermal resistance, junction-to-case, per leg	$R_{thJC}$		-	-	1.1	$^\circ\text{C}/\text{W}$
Weight			-	5.5	-	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-247AD 3L	C5PH6006LH			

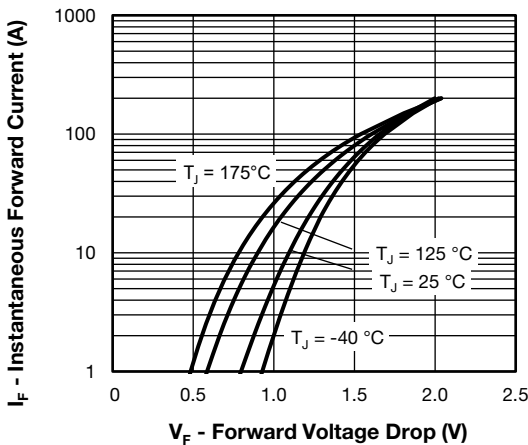


Fig. 1 - Forward Voltage Drop Characteristics, per Leg

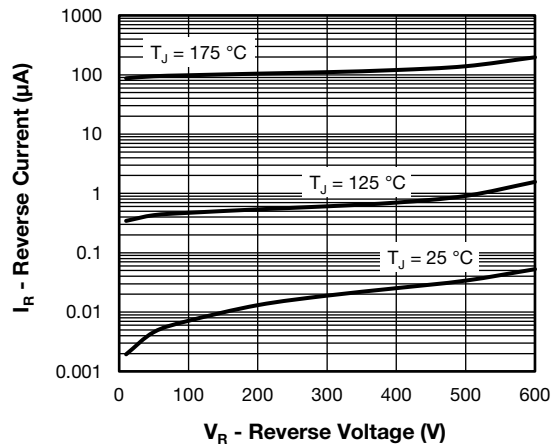


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage, per Leg

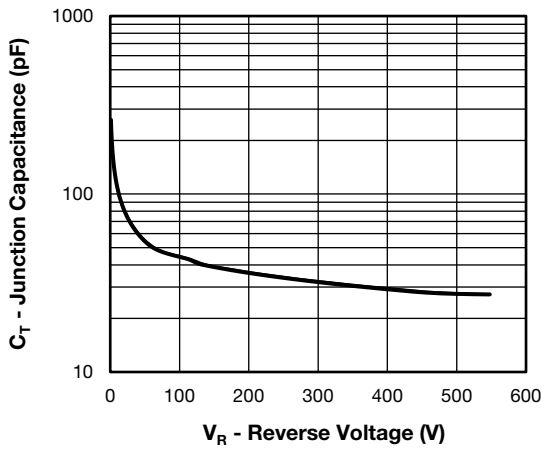


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage, per Leg

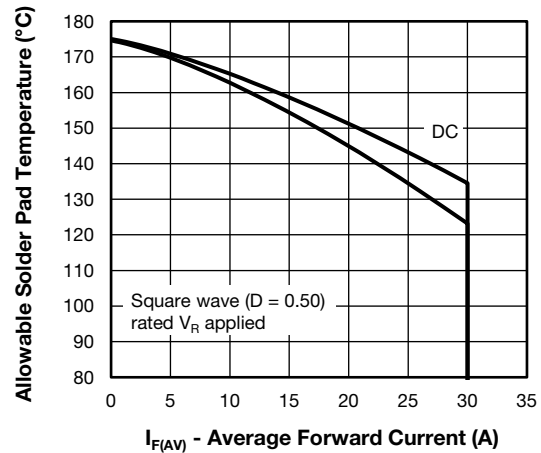


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current, per Leg

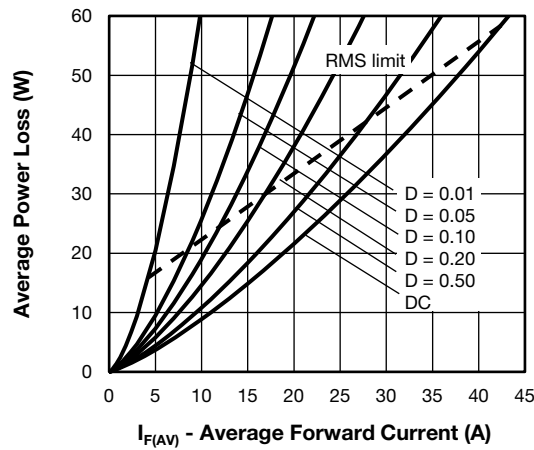


Fig. 5 - Forward Power Loss Characteristics, per Leg

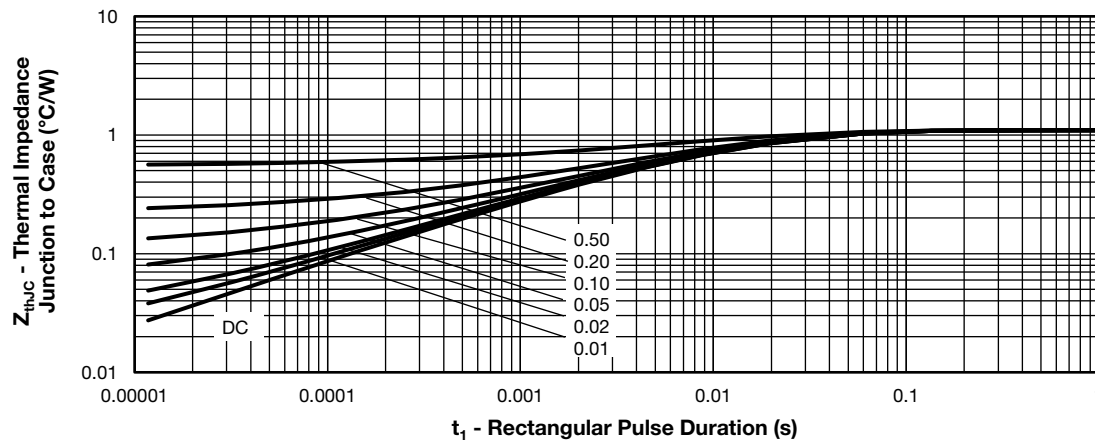


Fig. 6 - Transient Thermal Impedance, Junction to Case, per Leg

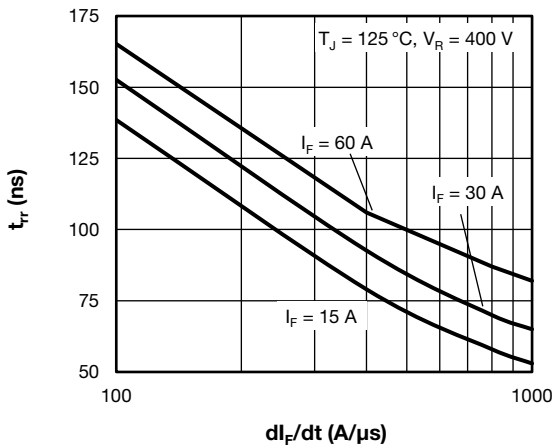


Fig. 7 - Typical Reverse Recovery Time vs.  $di_F/dt$ , per Leg

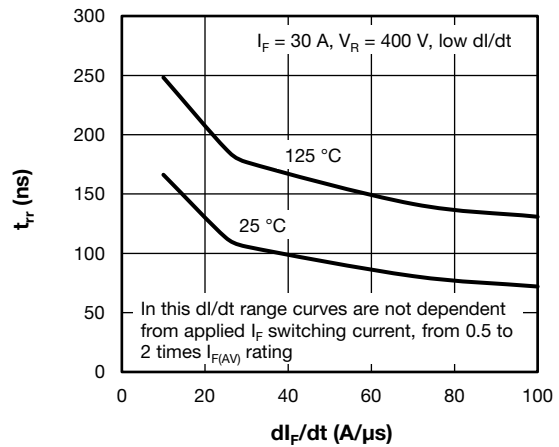


Fig. 10 - Typical Reverse Recovery Time vs.  $di_F/dt$ , per Leg

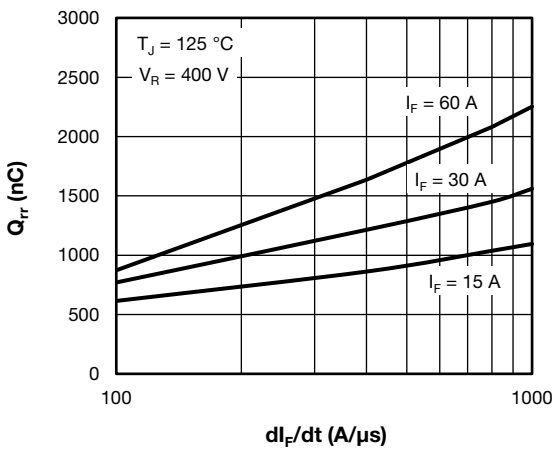


Fig. 8 - Typical Reverse Recovery Charge vs.  $di_F/dt$ , per Leg

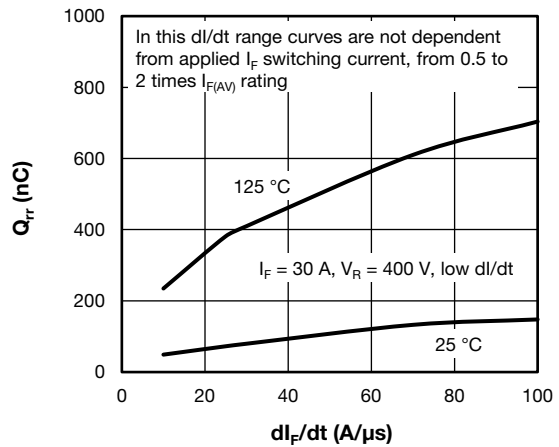


Fig. 11 - Typical Reverse Recovery Charge vs.  $di_F/dt$ , per Leg

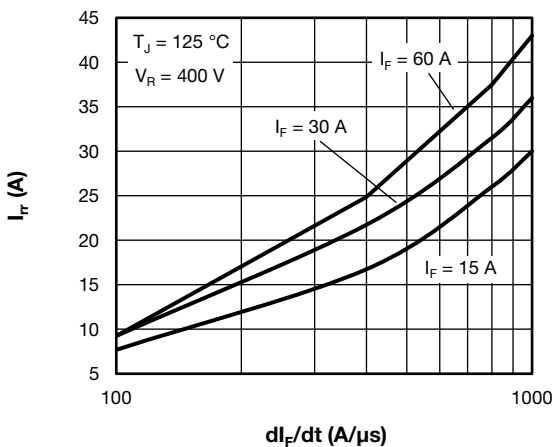


Fig. 9 - Typical Reverse Recovery Current vs.  $di_F/dt$ , per Leg

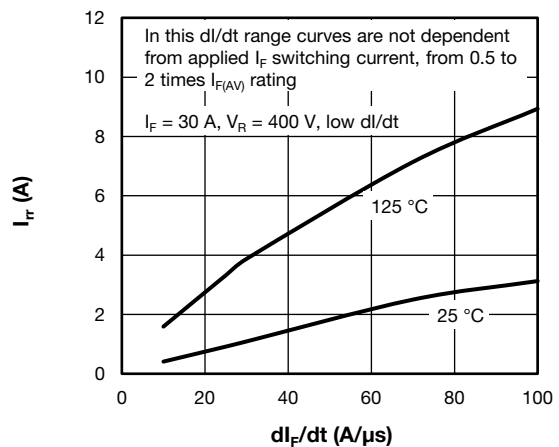


Fig. 12 - Typical Reverse Recovery Current vs.  $di_F/dt$ , per Leg

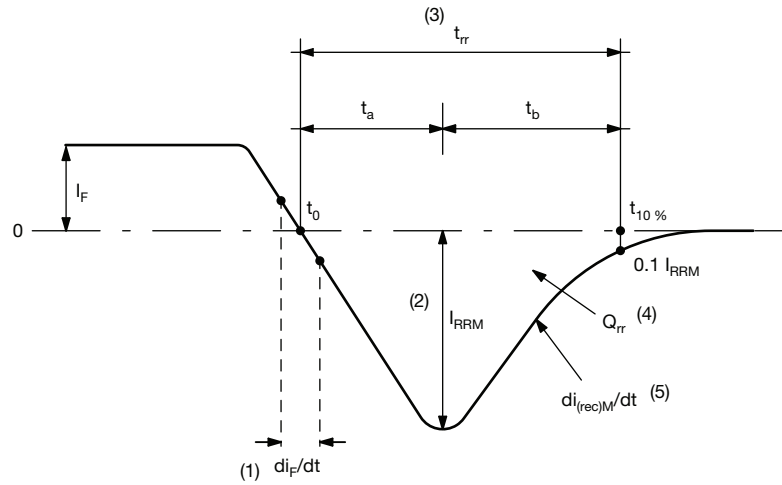


Fig. 13 - Reverse Recovery Waveform and Definitions

**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>C</b>	<b>5</b>	<b>P</b>	<b>H</b>	<b>60</b>	<b>06</b>	<b>L</b>	<b>H</b>	<b>N3</b>																					
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩																					
	<b>1</b>	-	Vishay Semiconductors product	<b>2</b>	-	Circuit configuration	<b>3</b>	-	FRED Pt® Gen 5	<b>4</b>	-	P = TO-247 package	<b>5</b>	-	Process type:	<b>6</b>	-	Current rating (60 = 60 A)	<b>7</b>	-	Voltage rating (06 = 600 V)	<b>8</b>	-	Package: L = long lead (TO-247AD)	<b>9</b>	-	H = AEC-Q101 qualified	<b>10</b>	-	Environmental digit:	N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

<b>ORDERING INFORMATION (Example)</b>			
PREFERRED P/N	QUANTITY PER TUBE	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-C5PH6006LHN3	25	500	Antistatic plastic tube

<b>LINKS TO RELATED DOCUMENTS</b>	
Dimensions	<a href="http://www.vishay.com/doc?95626">www.vishay.com/doc?95626</a>
Part marking information	<a href="http://www.vishay.com/doc?95007">www.vishay.com/doc?95007</a>

### TO-247AD 3L

**DIMENSIONS** in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES	SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.			MIN.	MAX.	MIN.	MAX.	
A	4.65	5.31	0.183	0.209		D2	0.51	1.30	0.020	0.051	
A1	2.21	2.59	0.087	0.102		E	15.29	15.87	0.602	0.625	3
A2	1.50	2.49	0.059	0.098		E1	13.46	-	0.53	-	
b	0.99	1.40	0.039	0.055		e	5.46 BSC		0.215 BSC		
b1	0.99	1.35	0.039	0.053		Ø K	0.254		0.010		
b2	1.65	2.39	0.065	0.094		L	19.81	20.32	0.780	0.800	
b3	1.65	2.34	0.065	0.092		L1	3.71	4.29	0.146	0.169	
b4	2.59	3.43	0.102	0.135		Ø P	3.56	3.66	0.14	0.144	
b5	2.59	3.38	0.102	0.133		Ø P1	-	6.98	-	0.275	
c	0.38	0.89	0.015	0.035		Q	5.31	5.69	0.209	0.224	
c1	0.38	0.84	0.015	0.033		R	4.52	5.49	0.178	0.216	
D	19.71	20.70	0.776	0.815	3	S	5.51 BSC		0.217 BSC		
D1	13.08	-	0.515	-	4						

**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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