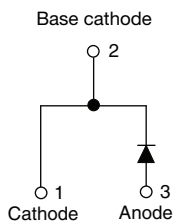


Hyperfast Rectifier, 60 A FRED Pt® G5



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 2 whisker test
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

LINKS TO ADDITIONAL RESOURCES



PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	60 A
V_R	600 V
V_F at I_F at 125 °C	1.2 V
t_{rr} (typ.)	29 ns
I_{FSM}	500 A
T_J max.	175 °C
Package	TO-247AD 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 efficiency of high speed LLC output rectification stages of EV / HEV on-board battery chargers

MECHANICAL DATA

Case: TO-247AD 2L

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	V_{RRM}		600	V
Average rectified forward current	$I_{F(AV)}$	$T_C = 110\text{ °C}$, $D = 0.50$	60	A
Non-repetitive peak surge current	I_{FSM}	$T_C = 25\text{ °C}$, $t_p = 10\text{ ms}$, sine wave both anodes, (1) and (3) connected	500	
Repetitive peak forward current	I_{FRM}	$T_C = 110\text{ °C}$, $D = 0.50$, $f = 20\text{ kHz}$	120	
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	$I_F = 60\text{ A}$	-	1.4	1.7	
		$I_F = 60\text{ A}$, $T_J = 125\text{ °C}$	-	1.2	-	
Reverse leakage current	I_R	$V_R = V_R$ rated	-	-	25	μA
		$T_J = 125\text{ °C}$, $V_R = V_R$ rated	-	-	500	
Junction capacitance	C_T	$V_R = 200\text{ V}$	-	65	-	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}	$I_F = 1\text{ A}$, $di_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$	-	29	-	ns
		$T_J = 25\text{ }^{\circ}\text{C}$	-	49	-	
		$T_J = 125\text{ }^{\circ}\text{C}$	-	74	-	
Peak recovery current	I_{RRM}	$T_J = 25\text{ }^{\circ}\text{C}$	-	21	-	A
		$T_J = 125\text{ }^{\circ}\text{C}$	-	43	-	
Reverse recovery charge	Q_{rr}	$T_J = 25\text{ }^{\circ}\text{C}$	-	640	-	nC
		$T_J = 125\text{ }^{\circ}\text{C}$	-	1979	-	
Reverse recovery time	t_{rr}	$T_J = 25\text{ }^{\circ}\text{C}$	-	54	-	ns
		$T_J = 125\text{ }^{\circ}\text{C}$	-	82	-	
Peak recovery current	I_{RRM}	$T_J = 25\text{ }^{\circ}\text{C}$	-	22	-	A
		$T_J = 125\text{ }^{\circ}\text{C}$	-	47	-	
Reverse recovery charge	Q_{rr}	$T_J = 25\text{ }^{\circ}\text{C}$	-	790	-	nC
		$T_J = 125\text{ }^{\circ}\text{C}$	-	2385	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Thermal resistance, junction-to-case	R_{thJC}		-	-	0.63	$^{\circ}\text{C}/\text{W}$
Weight			-	5.5	-	g
Mounting torque			1.2 (5.0)	-	24 (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 2L	E5PH6006LH			

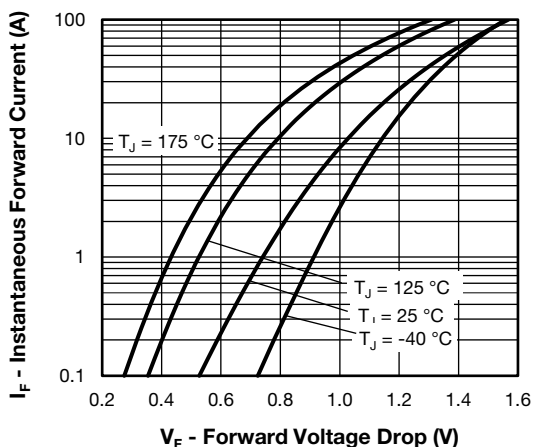


Fig. 1 - Typical Forward Voltage Drop Characteristics

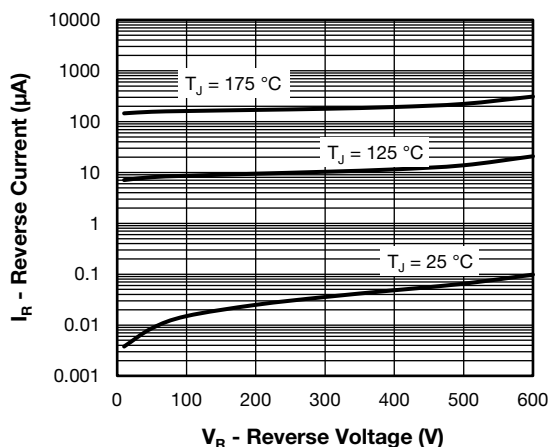


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

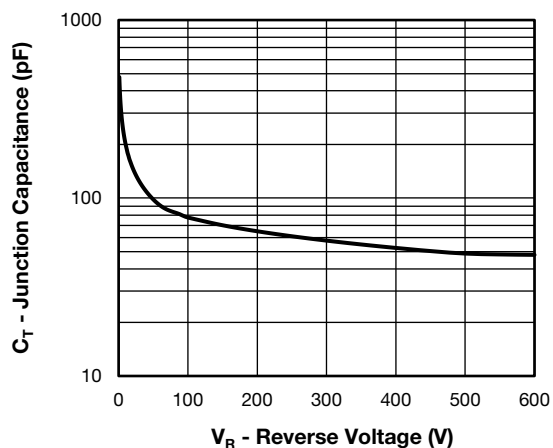


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

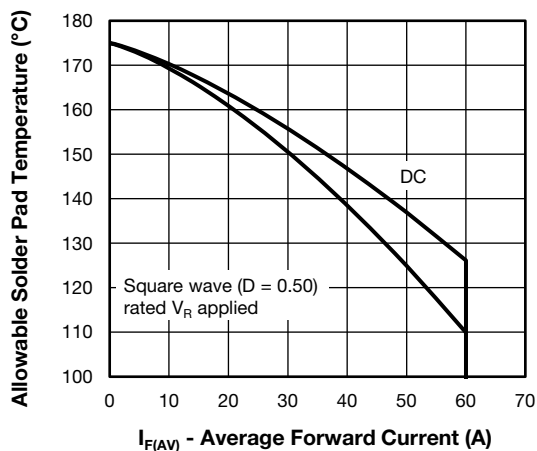


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

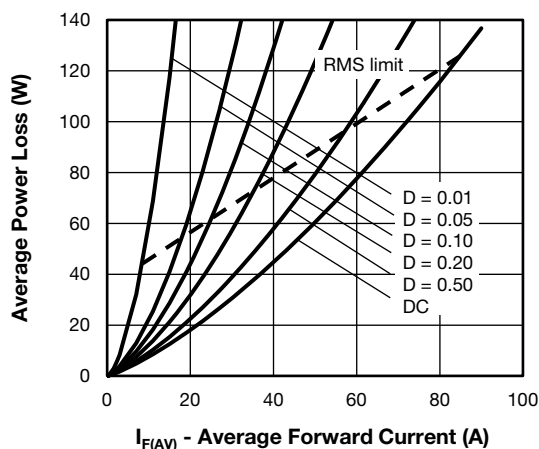
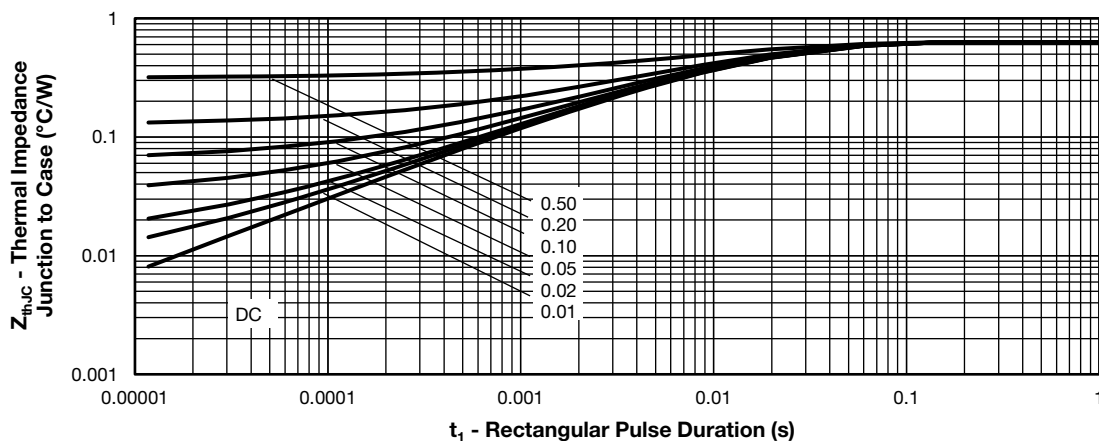
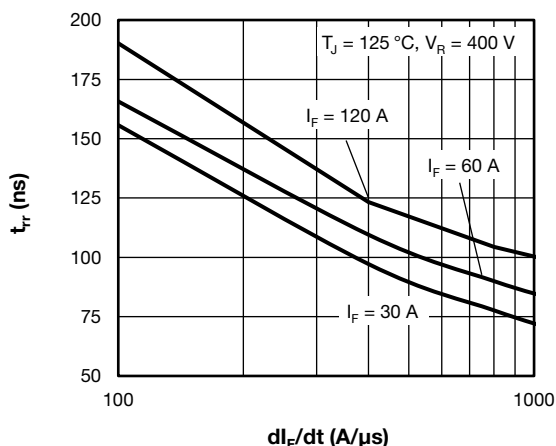
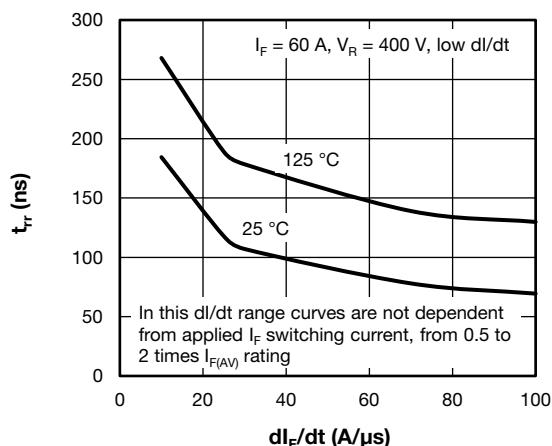
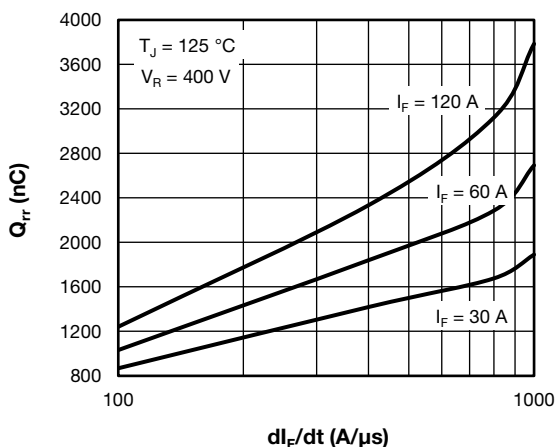
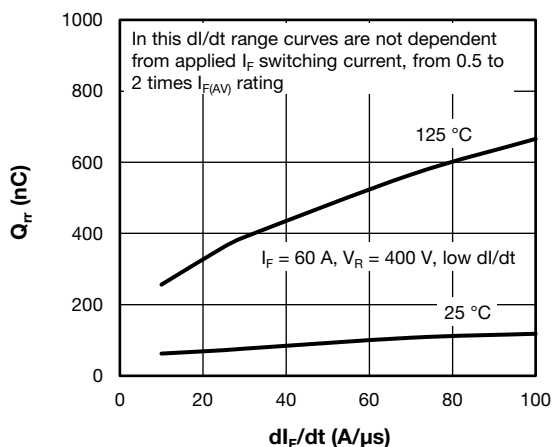
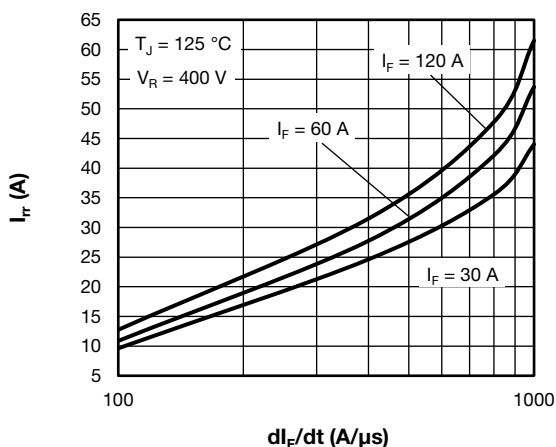
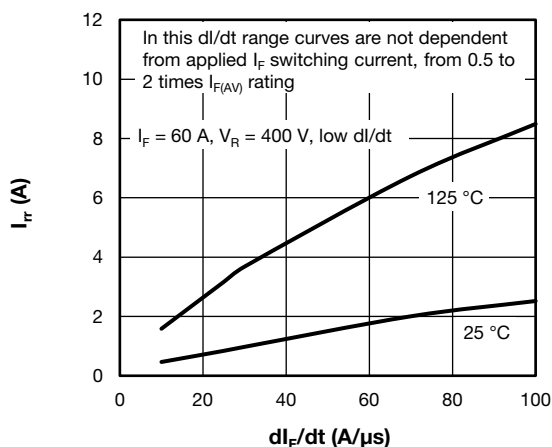


Fig. 5 - Average Power Loss vs. Average Forward Current


Fig. 6 - Thermal Impedance Z_{thJC} Characteristics


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

Fig. 10 - Typical Reverse Recovery Time vs. dI_F/dt

Fig. 8 - Typical Reverse Recovery Charge vs. dI_F/dt

Fig. 11 - Typical Reverse Recovery Charge vs. dI_F/dt

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

Fig. 12 - Typical Reverse Recovery Current vs. dI_F/dt

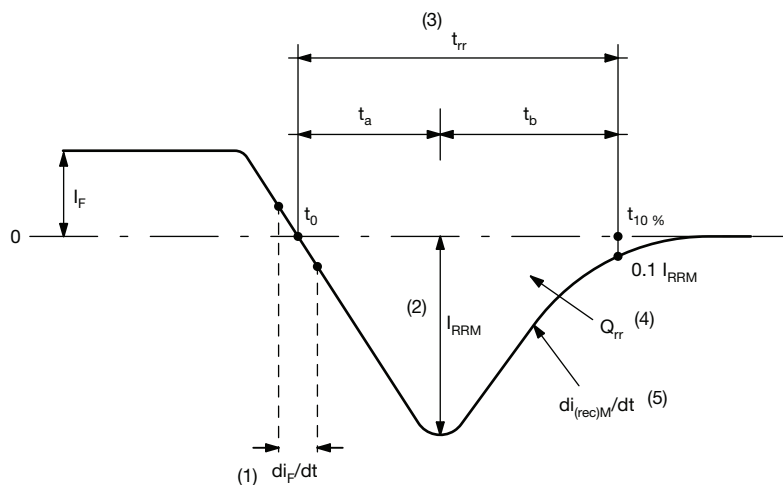


Fig. 13 - Reverse Recovery Waveform and Definitions

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	VS-	E	5	P	H	60	06	L	H	N3
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
1	- Vishay Semiconductors product									
2	- Circuit configuration E = single diode									
3	- FRED Pt [®] Gen 5									
4	- P = TO-247 package									
5	- Process type: H = hyperfast recovery									
6	- Current rating 60 = 60 A)									
7	- Voltage rating (06 = 600 V)									
8	- Package: L = long lead (TO-247AD)									
9	- H = AEC-Q101 qualified									
10	- 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-E5PH6006LHN3	25	500	Antistatic plastic tube

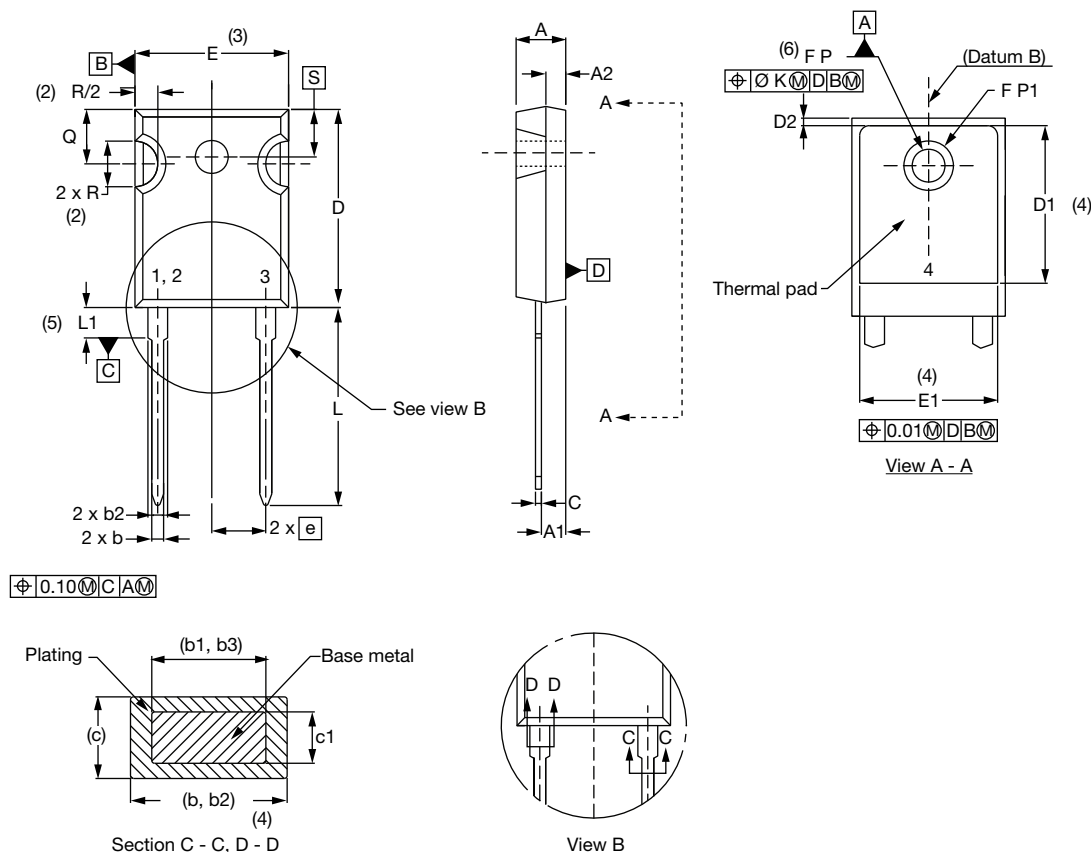
LINKS TO RELATED DOCUMENTS

Dimensions	www.vishay.com/doc?95536
Part marking information	www.vishay.com/doc?95648
SPIICE model	www.vishay.com/doc?96957



TO-247AD 2L

DIMENSIONS in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	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	
c	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	

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
E	15.29	15.87	0.602	0.625	3
E1	13.46	-	0.53	-	
e	5.46 BSC		0.215 BSC		
Ø K	0.254		0.010		
L	19.81	20.32	0.780	0.800	
L1	3.71	4.29	0.146	0.169	
Ø P	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

- Dimensioning and tolerancing per ASME Y14.5M-1994
- Contour of slot optional
- Dimension D and E do not include mold flash. These dimensions are measured at the outermost extremes of the plastic body
- Thermal pad contour optional with dimensions D1 and E1
- Lead finish uncontrolled in L1
- 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")
- 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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