Hyperfast Rectifier, 60 A FRED Pt® Gen 5

Base cathode

TO-247AD 2L

Cathode   Anode
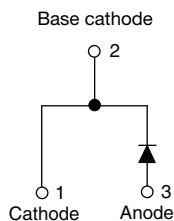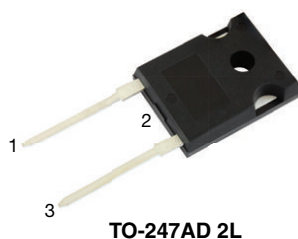
FEATURES

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

Pb-free

RoHS
COMPLIANT

HALOGEN
FREE

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: TO-247AD 2L
Molding compound meets UL 94 V-0 flammability rating
Terminals: matte tin plated leads, solderable per J-STD-002

LINKS TO ADDITIONAL RESOURCES

3D Models   Application Notes

PRIMARY CHARACTERISTICS

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$I_{F(AV)}$	60 A
V_R	1200 V
V_F at I_F at 125 °C	2.1 V
t_{rr}	30 ns
T_J max.	175 °C
Package	TO-247AD 2L
Circuit configuration	Single

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Repetitive peak reverse voltage	V_{RRM}		1200	V
Average rectified forward current	$I_{F(AV)}$	$T_C = 105 °C$, D = 0.50	60	
Non-repetitive peak surge current	I_{FSM}	$T_C = 45 °C$, $t_p = 10$ ms, sine wave	420	A
Repetitive peak forward current	I_{FRM}	$T_C = 105 °C$, D = 0.50, f = 20 kHz	120	
Operating junction and storage temperature	T_J, T_{Stg}		-55 to +175	°C

ELECTRICAL SPECIFICATIONS (T_J = 25 °C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	V_{BR}, V_R	$I_R = 100$ μA	1200	-	-	
Forward voltage	V_F	$I_F = 60$ A	-	2.6	3.15	V
		$I_F = 60$ A, $T_J = 125 °C$	-	2.1	-	
Reverse leakage current	I_R	$V_R = V_R$ rated	-	-	50	μA
		$T_J = 125 °C$, $V_R = V_R$ rated	-	-	500	
Junction capacitance	C_T	$V_R = 200$ V	-	32	-	pF
Series inductance	L_S	Measured to lead 5 mm from package body	-	8	-	nH

DYNAMIC RECOVERY CHARACTERISTICS (T_J = 25 °C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Reverse recovery time	t_{rr}	I_F = 1.0 A, dI_F/dt = 100 A/μs, V_R = 30 V		-	30	-	ns
		T_J = 25 °C	I_F = 40 A dI_F/dt = 600 A/μs V_R = 400 V	-	120	-	
		T_J = 125 °C		-	170	-	
Peak recovery current	I_{RRM}	T_J = 25 °C		-	17	-	A
		T_J = 125 °C		-	32	-	
Reverse recovery charge	Q_{rr}	T_J = 25 °C		-	970	-	nC
		T_J = 125 °C		-	2950	-	
Reverse recovery time	t_{rr}	T_J = 25 °C	I_F = 60 A dI_F/dt = 1000 A/μs V_R = 800 V	-	90	-	ns
		T_J = 125 °C		-	130	-	
Peak recovery current	I_{RRM}	T_J = 25 °C		-	32	-	A
		T_J = 125 °C		-	53	-	
Reverse recovery charge	Q_{rr}	T_J = 25 °C		-	1570	-	nC
		T_J = 125 °C		-	4300	-	

THERMAL - MECHANICAL SPECIFICATIONS

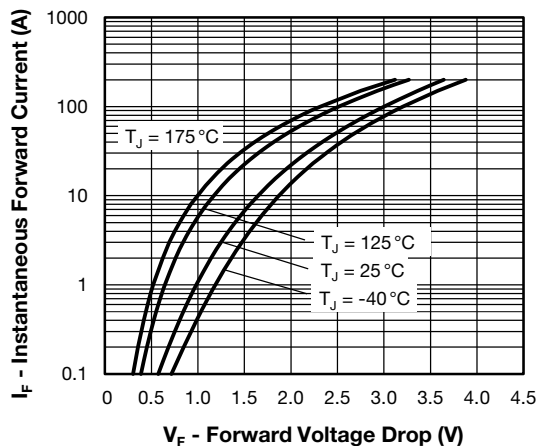| PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Thermal resistance, junction-to-case	R_{thJC}		-	-	0.4	°C/W
Weight			-	5.5	-	g
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Maximum junction and storage temperature range	T_J, T_{Stg}		-55	-	175	°C
Marking device		Case style: TO-247AD 2L	E5PX6012L			

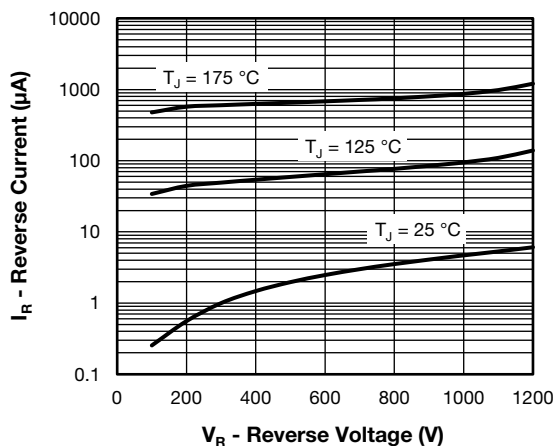Fig. 1 - Typical Forward Voltage Drop Characteristics
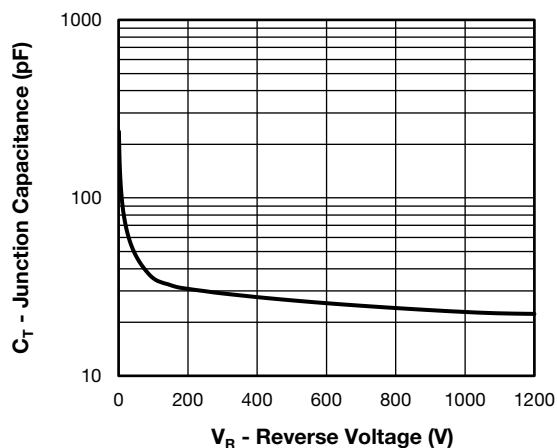

Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

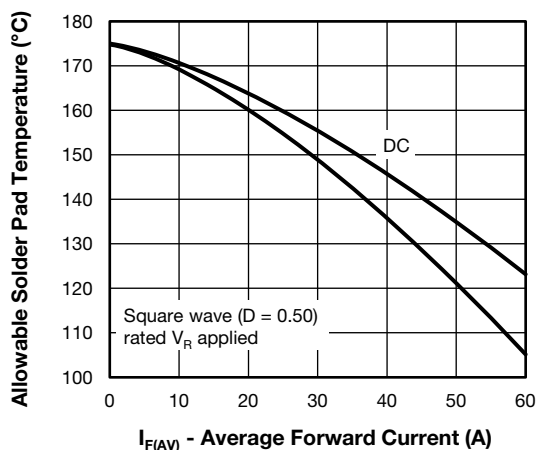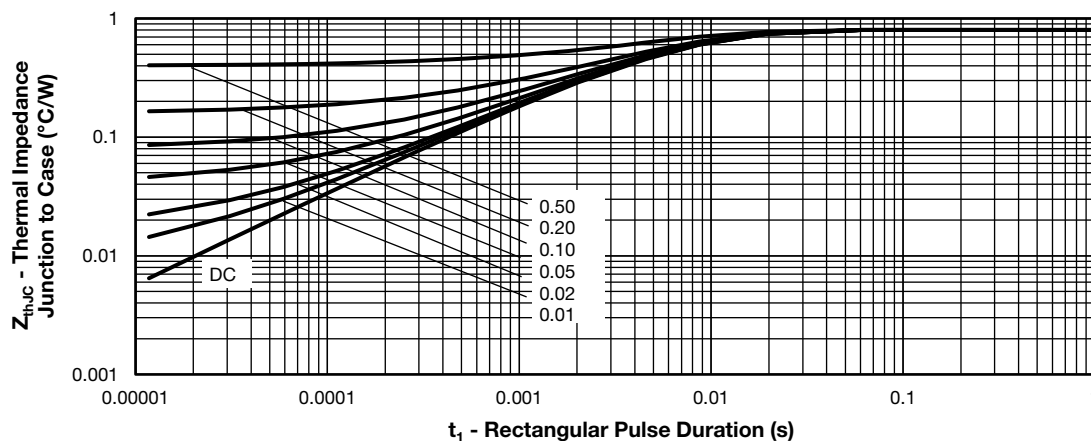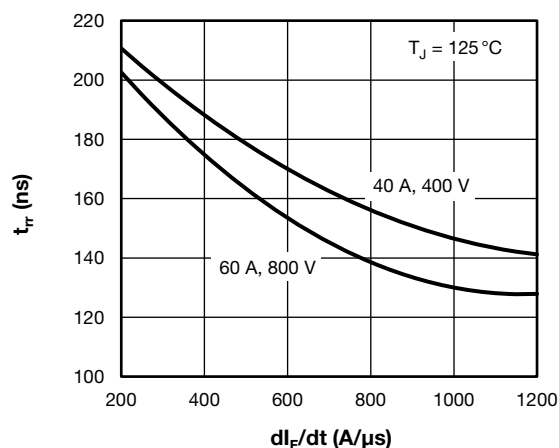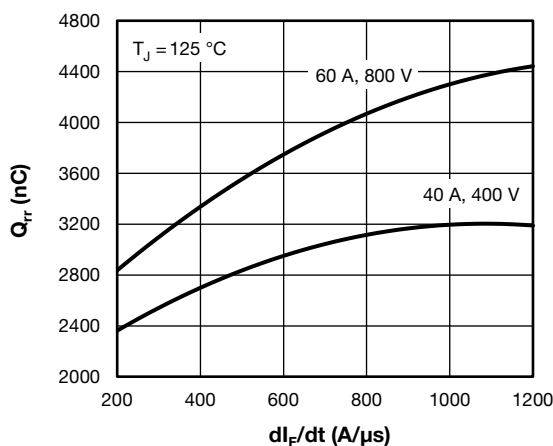Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

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

Fig. 5 - Thermal Impedance Z_{thJC} - Characteristics

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

Fig. 7 - Typical Stored Charge vs. dI_F/dt
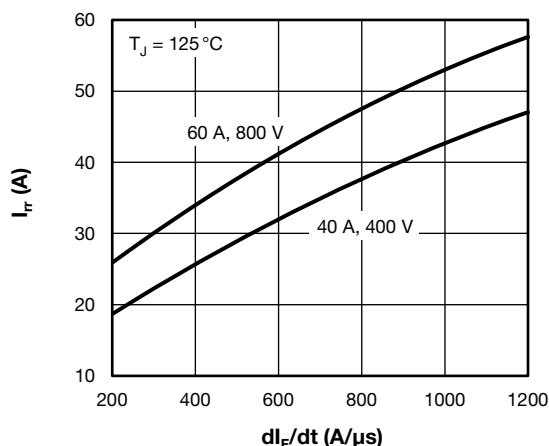
Fig. 8 - Typical Recovery Current vs. dI_F/dt
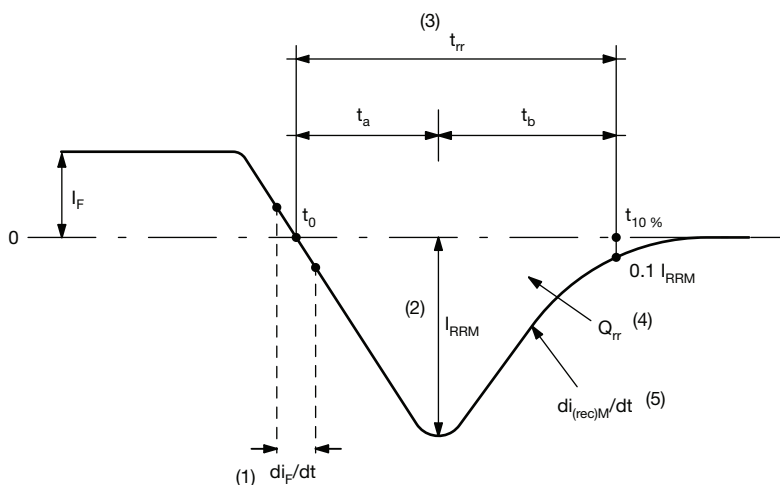
Fig. 9 - Reverse Recovery Waveform and Definitions

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	X	60	12	L	-N3
	1	2	3	4	5	6	7	8	9

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

Section C - C, D - D

View B

View A - A

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

[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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