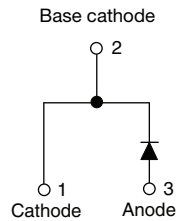


## Hyperfast Rectifier, 15 A FRED Pt® G5


**2L TO-220AC**


### FEATURES

- 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 JESD 201 class 1A whisker test
- 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

### PRIMARY CHARACTERISTICS

$I_{F(AV)}$	15 A
$V_R$	600 V
$V_F$ at $I_F$ at 125 °C	1.15 V
$t_{rr}$ (typ.)	22 ns
$T_J$ max.	175 °C
Package	2L TO-220AC
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 battery charging stations and high frequency stages of UPS applications.

### MECHANICAL DATA

**Case:** 2L TO-220AC

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	$V_{RRM}$		600	V
Average rectified forward current	$I_{F(AV)}$	$T_C = 136\text{ °C}$ , $D = 0.50$	15	A
Repetitive peak forward current	$I_{FRM}$	$T_C = 136\text{ °C}$ , $D = 0.50$ , $f = 20\text{ kHz}$	30	
Non-repetitive peak surge current	$I_{FSM}$	$T_C = 25\text{ °C}$ , $t_p = 10\text{ ms}$ , sine wave	200	
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	$V_F$	$I_F = 15\text{ A}$ $I_F = 15\text{ A}$ , $T_J = 125\text{ °C}$	-	1.3 1.15	1.6 -	
Reverse leakage current	$I_R$	$V_R = V_R$ rated $T_J = 125\text{ °C}$ , $V_R = V_R$ rated	-	-	10 500	$\mu\text{A}$
Junction capacitance	$C_T$	$V_R = 200\text{ V}$	-	25	-	pF
Series inductance	$L_S$	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	$t_{rr}$	$I_F = 1.0\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}, V_R = 30\text{ V}$	-	22	-	ns
		$T_J = 25\text{ }^\circ\text{C}$	-	31	-	
		$T_J = 125\text{ }^\circ\text{C}$	-	43	-	
Peak recovery current	$I_{RRM}$	$T_J = 25\text{ }^\circ\text{C}$	-	15	-	A
		$T_J = 125\text{ }^\circ\text{C}$	-	22	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	255	-	nC
		$T_J = 125\text{ }^\circ\text{C}$	-	622	-	
Reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	38	-	ns
		$T_J = 125\text{ }^\circ\text{C}$	-	49	-	
Peak recovery current	$I_{RRM}$	$T_J = 25\text{ }^\circ\text{C}$	-	16	-	A
		$T_J = 125\text{ }^\circ\text{C}$	-	24	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	316	-	nC
		$T_J = 125\text{ }^\circ\text{C}$	-	782	-	

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Thermal resistance, junction-to-case	$R_{thJC}$		-	-	1.72	$^\circ\text{C}/\text{W}$
Weight			-	2.0	-	g
			-	0.07	-	oz.
Mounting torque			6.0 (5)	-	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 2L TO-220AC	E5TH1506			

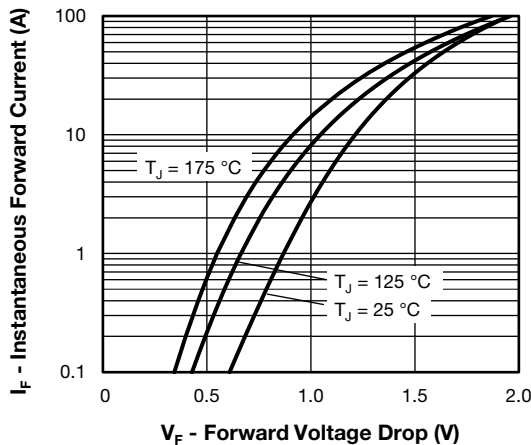


Fig. 1 - Forward Voltage Drop Characteristics, Per Leg

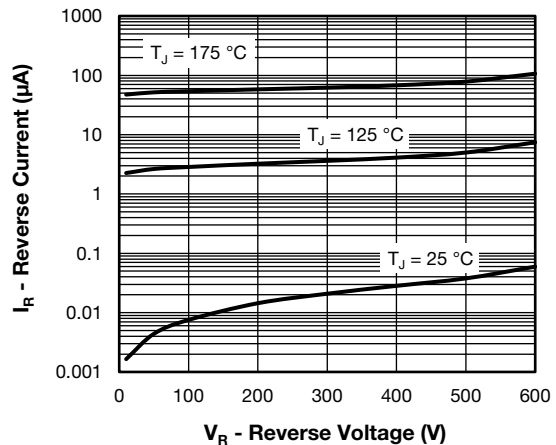


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage, Per Leg

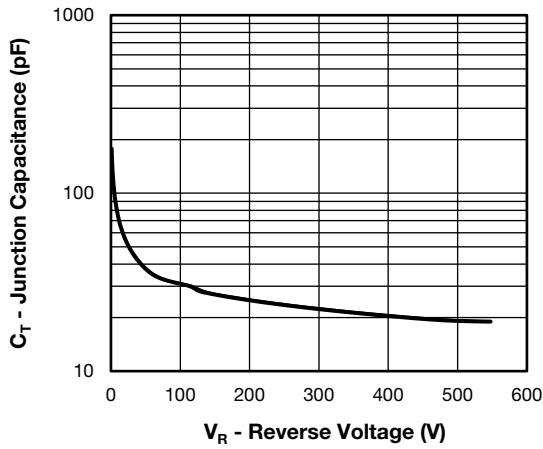


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage, Per Leg

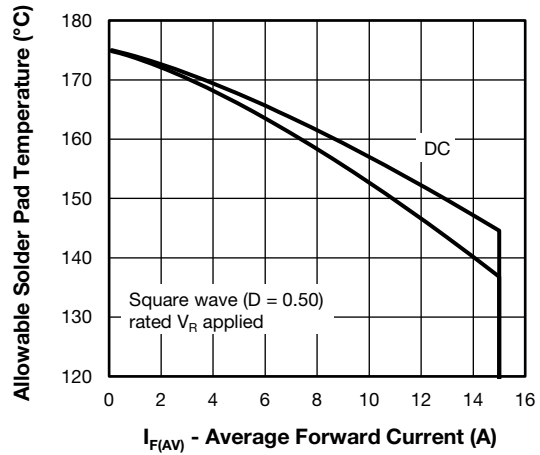


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current, Per Leg

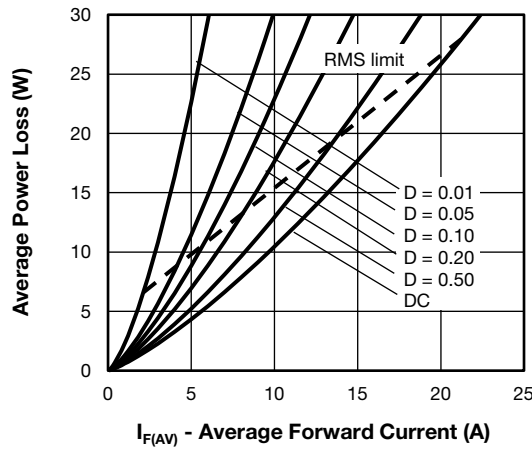


Fig. 5 - Forward Power Loss Characteristics, Per Leg

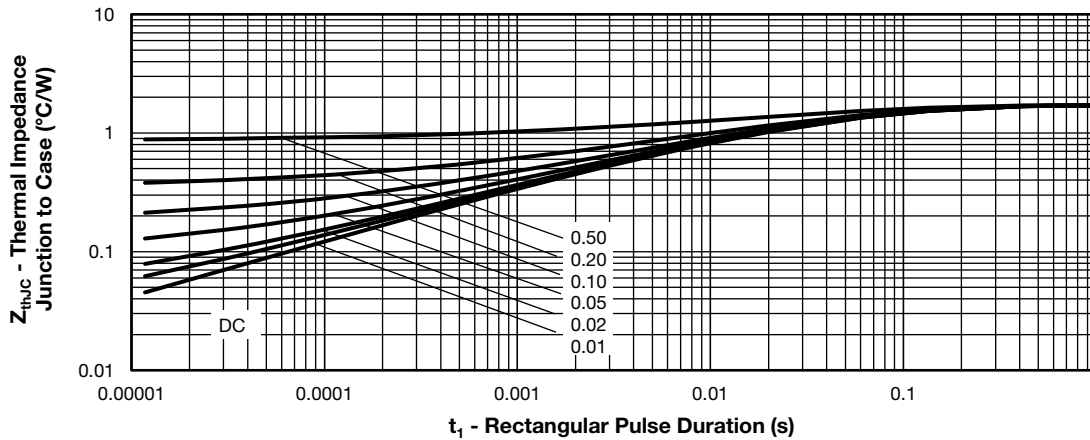


Fig. 6 - Transient Thermal Impedance, Junction to Case, Per Leg

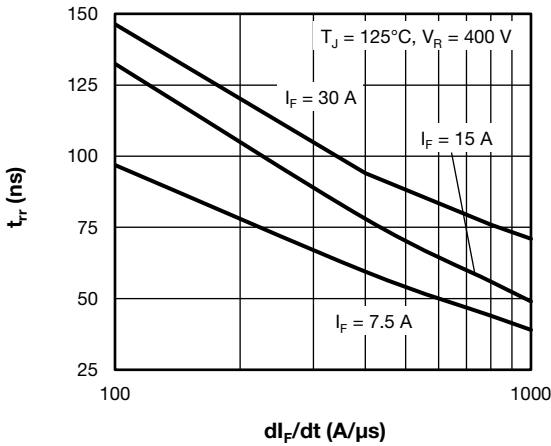


Fig. 7 - Typical Reverse Recovery Time vs.  $di_F/dt$ , Per Leg

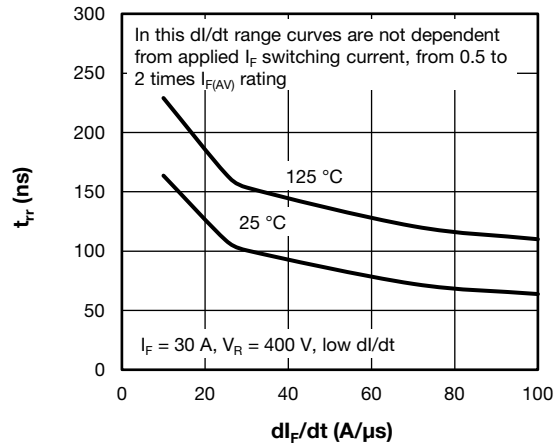


Fig. 10 - Typical Reverse Recovery Time vs.  $di_F/dt$ , Per Leg

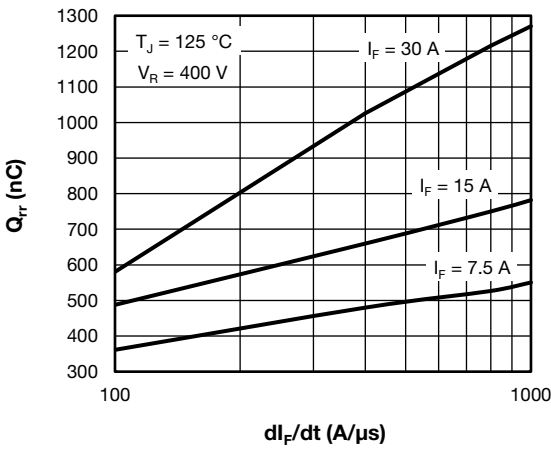


Fig. 8 - Typical Reverse Recovery Charge vs.  $di_F/dt$ , Per Leg

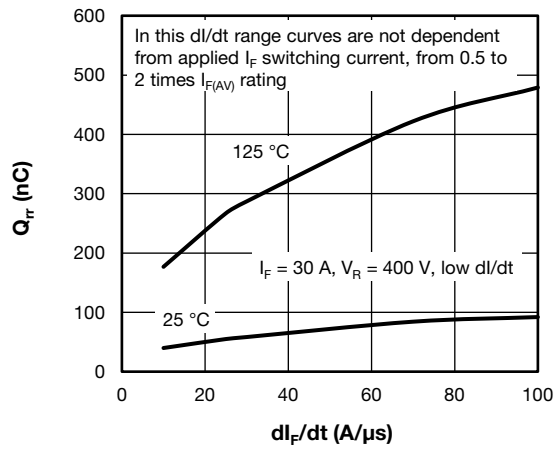


Fig. 11 - Typical Reverse Recovery Charge vs.  $di_F/dt$ , Per Leg

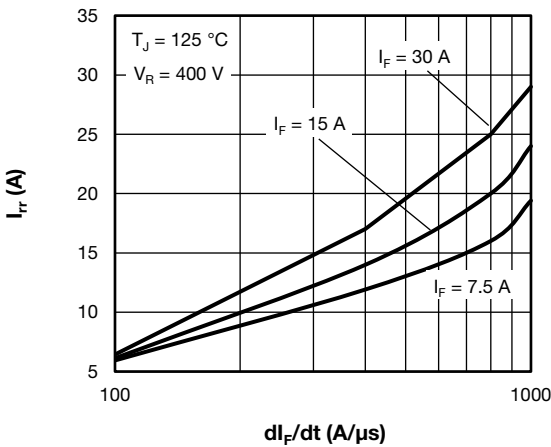


Fig. 9 - Typical Reverse Recovery Current vs.  $di_F/dt$ , Per Leg

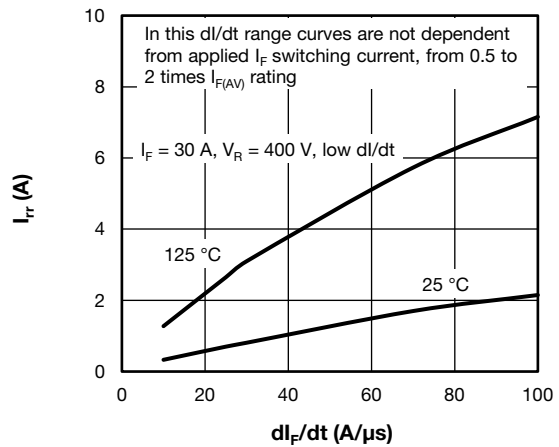


Fig. 12 - Typical Reverse Recovery Current vs.  $di_F/dt$ , Per Leg

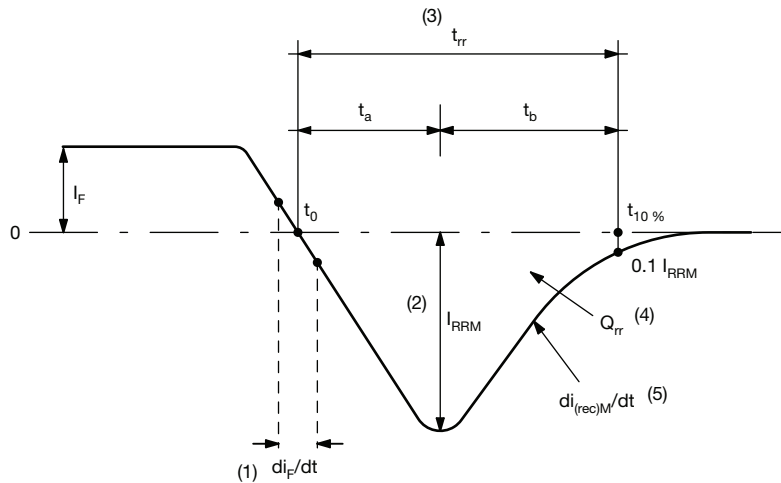


Fig. 13 - Reverse Recovery Waveform and Definitions

**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>E</b>	<b>5</b>	<b>T</b>	<b>H</b>	<b>15</b>	<b>06</b>	<b>-M3</b>
	1	2	3	4	5	6	7	8

- 1** - Vishay Semiconductors product
- 2** - E = single diode
- 3** - 5 = FRED generation 5
- 4** - Package:  
T = 2L TO-220AC
- 5** - H = hyperfast recovery
- 6** - Current rating (15 = 15 A)
- 7** - Voltage rating (06 = 600 V)
- 8** - Environmental digit:  
-M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

<b>ORDERING INFORMATION</b> (Example)			
PREFERRED P/N	QUANTITY PER TUBE	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-E5TH1506-M3	50	1000	Antistatic plastic tube

<b>LINKS TO RELATED DOCUMENTS</b>	
Dimensions	<a href="http://www.vishay.com/doc?96156">www.vishay.com/doc?96156</a>
Part marking information	<a href="http://www.vishay.com/doc?95391">www.vishay.com/doc?95391</a>

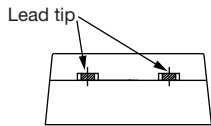


# 2L TO-220AC

**DIMENSIONS** in millimeters and inches



$\oplus 0.015 \text{ (M) B (A) (M)}$



Conforms to JEDEC® outline TO-220AC

SYMBOL	MILLIMETERS		INCHES		NOTES	SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.			MIN.	MAX.	MIN.	MAX.	
A	4.25	4.65	0.167	0.183		D2	11.68	13.30	0.460	0.524	6, 7
A1	1.14	1.40	0.045	0.055		E	10.11	10.51	0.398	0.414	3, 6
A2	2.50	2.92	0.098	0.115		E1	6.86	8.89	0.270	0.350	6
b	0.69	1.01	0.027	0.040		e	2.41	2.67	0.095	0.105	
b1	0.38	0.97	0.015	0.038	4	e1	4.88	5.28	0.192	0.208	
b2	1.20	1.73	0.047	0.068		H1	6.09	6.48	0.240	0.255	6
b3	1.14	1.73	0.045	0.068	4	L	13.52	14.02	0.532	0.552	
c	0.36	0.61	0.014	0.024		L1	3.32	3.82	0.131	0.150	2
c1	0.36	0.56	0.014	0.022	4	$\varnothing P$	3.54	3.91	0.139	0.154	
D	14.85	15.35	0.585	0.604	3	Q	2.60	3.00	0.102	0.118	
D1	8.38	9.02	0.330	0.355							

**Notes**

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1, 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 outermost extremes of the plastic body
- (4) Dimension b1, b3, and c1 apply to base metal only
- (5) Controlling dimensions: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2, and E1
- (7) Outline conforms to JEDEC® TO-220, except D2



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