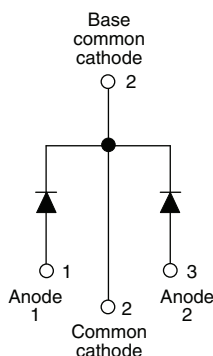
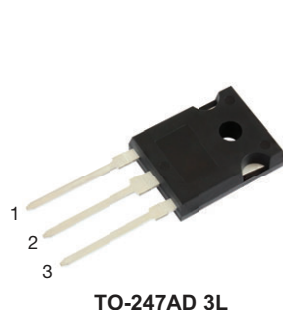


# **FRED Pt® Ultrafast Rectifier, 2 x 15 A**



## **FEATURES**

- Ultrafast recovery time
- Low forward voltage drop
- 175 °C operating junction temperature
- Low leakage current
- AEC-Q101 qualified, 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**

## **DESCRIPTION / APPLICATION**

FRED Pt® series are the state of the art ultrafast recovery rectifiers specifically designed with optimized performance of forward voltage drop and ultrafast recovery time.

The planar structure and the platinum doped life time control, guarantee the best overall performance, ruggedness and reliability characteristics.

These devices are intended for use in the output rectification stage of SMPS, UPS, DC/DC converters as well as freewheeling diodes in low voltage inverters and chopper motor drives.

Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

## **MECHANICAL DATA**

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

Molding compound meets UL 94 V-0 flammability rating

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

## **PRIMARY CHARACTERISTICS**

$I_{F(AV)}$	2 x 15 A
$V_R$	400 V
$V_F$ at $I_F$	0.93 V
$t_{rr}$ typ.	36 ns
$T_J$ max.	175 °C
Package	TO-247AD 3L
Circuit configuration	Common cathode

## **ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Peak repetitive reverse voltage	$V_{RRM}$		400	V
Average rectified forward current	$I_{F(AV)}$	per leg	15	A
		total device	30	
Non-repetitive peak surge current per leg	$I_{FSM}$	$T_C = 25\text{ °C}$	200	
Peak repetitive forward current per leg	$I_{FRM}$	Rated $V_R$ , $T_C = 149\text{ °C}$ , square wave, 20 kHz	30	
Operating junction and storage temperatures	$T_J, T_{Stg}$		-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	$V_{BR}, V_R$	$I_R = 100\text{ }\mu\text{A}$	400	-	-	V
Forward voltage	$V_F$	$I_F = 15\text{ A}$	-	1.17	1.25	
		$I_F = 15\text{ A}, T_J = 150\text{ °C}$	-	0.93	1.12	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	0.3	10	$\mu\text{A}$
		$T_J = 150\text{ °C}, V_R = V_R$ rated	-	30	500	
Junction capacitance	$C_T$	$V_R = 400\text{ V}$	-	28	-	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body	-	12	-	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	$t_{rr}$	$I_F = 1\text{ A}$ , $di_F/dt = 50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	36	-	ns
		$T_J = 25\text{ }^{\circ}\text{C}$	-	46	-	
		$T_J = 125\text{ }^{\circ}\text{C}$	-	80	-	
Peak recovery current	$I_{RRM}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	3.6	-	A
		$T_J = 125\text{ }^{\circ}\text{C}$	-	8.7	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	84	-	nC
		$T_J = 125\text{ }^{\circ}\text{C}$	-	345	-	

**THERMAL - MECHANICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	$T_J$ , $T_{Stg}$		-55	-	175	$^{\circ}\text{C}$
Thermal resistance, junction to case per leg	$R_{thJC}$		-	0.8	1.5	$^{\circ}\text{C}/\text{W}$
Thermal resistance, junction to ambient per leg	$R_{thJA}$	Typical socket mount	-	-	40	
Thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, flat, smooth, and greased	-	0.4	-	
Weight			-	6.0	-	g
			-	0.21	-	oz.
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Marking device		Case style TO-247AD 3L	30CPU04LH			

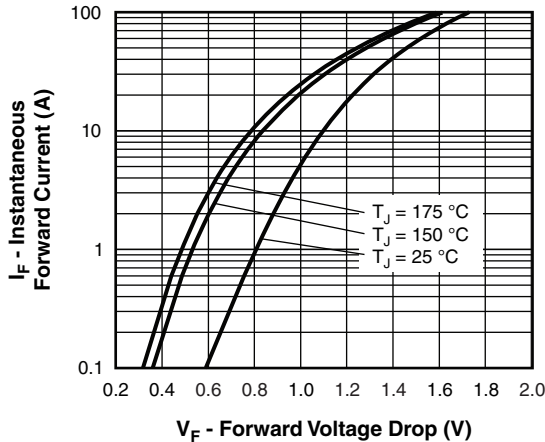


Fig. 1 - Typical Forward Voltage Drop Characteristics

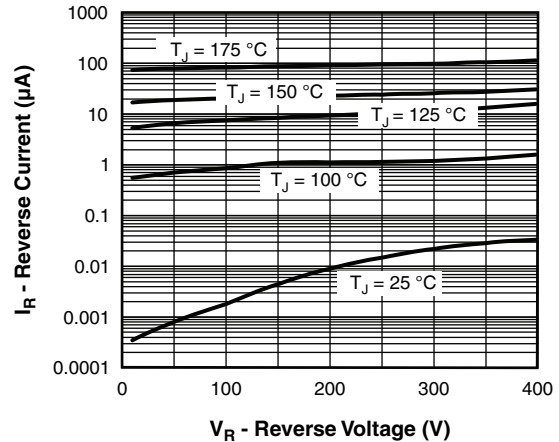


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

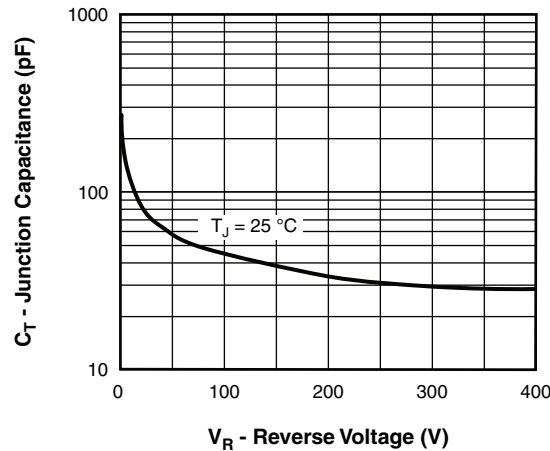
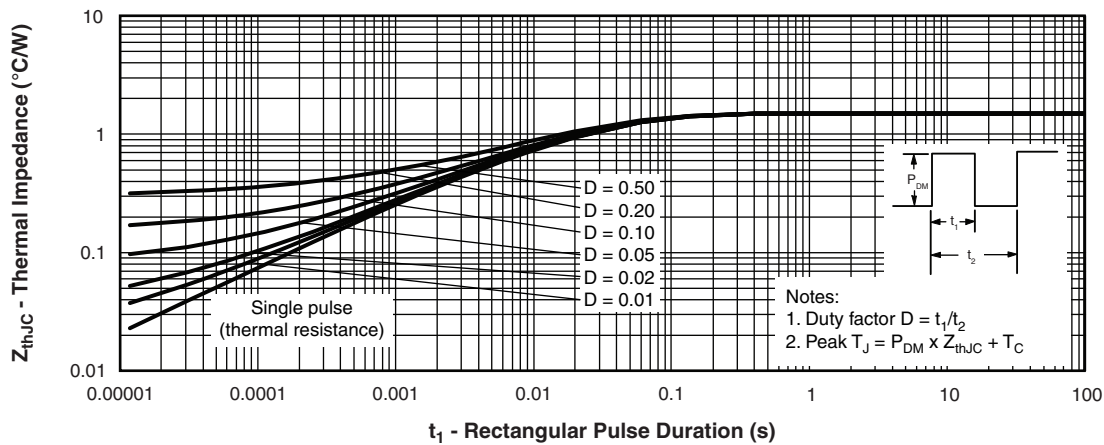


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

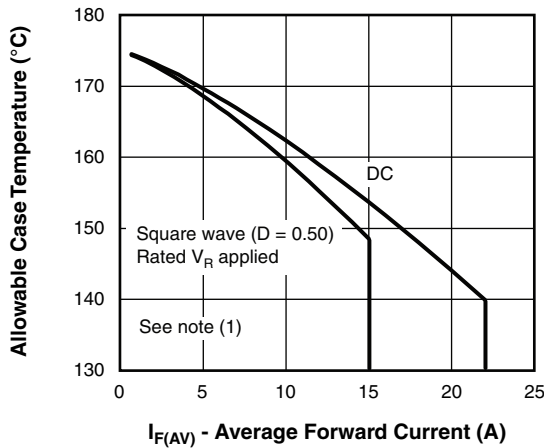


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

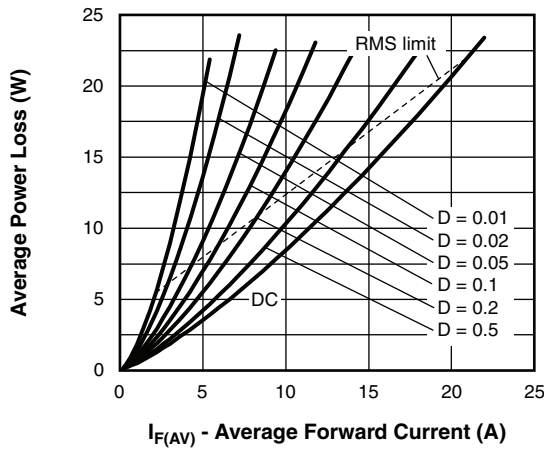


Fig. 6 - Forward Power Loss Characteristics

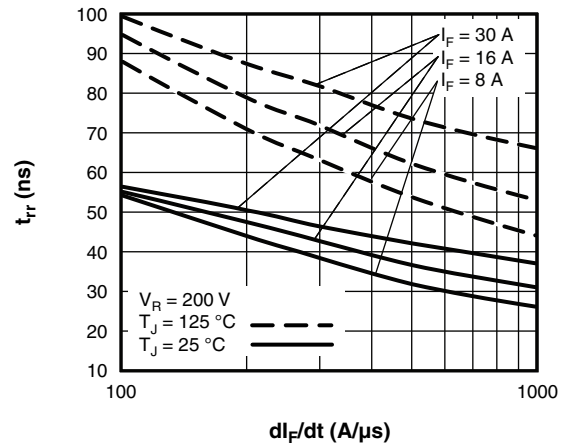


Fig. 7 - Typical Reverse Recovery Time vs.  $dI_F/dt$

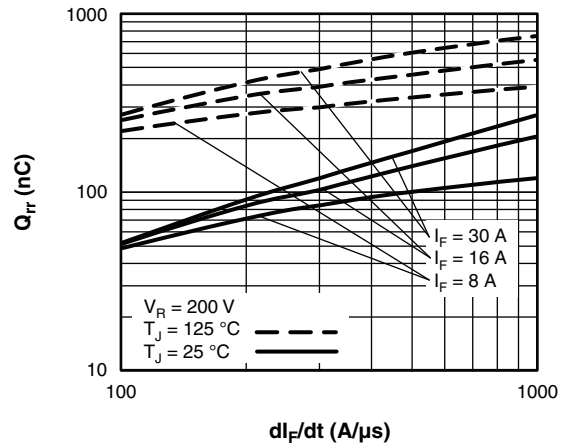


Fig. 8 - Typical Stored Charge vs.  $dI_F/dt$

#### Note

- (1) Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d$  = forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);  
 $P_{dREV}$  = inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1}$  = rated  $V_R$

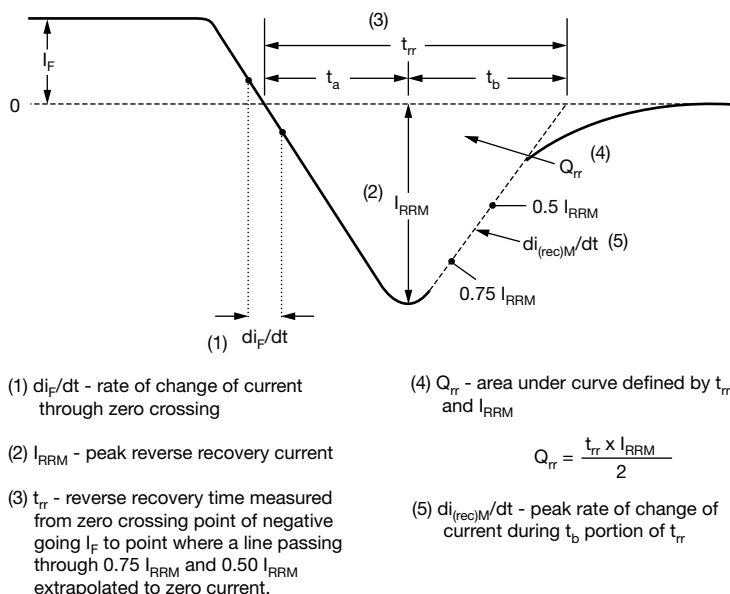


Fig. 9 - Reverse Recovery Waveform and Definitions

## ORDERING INFORMATION TABLE

Device code	VS-	30	C	P	U	04	L	H	N3
	①	②	③	④	⑤	⑥	⑦	⑧	⑨

- ① - Vishay Semiconductors product
- ② - Current rating (30 = 30 A)
- ③ - Circuit configuration: C = common cathode
- ④ - TO-247AC
- ⑤ - Ultrafast recovery
- ⑥ - Voltage rating (04 = 400 V)
- ⑦ - L = long lead (TO-247AD)
- ⑧ - H = AEC-Q101 qualified
- 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-30CPU04LHN3	25	500	Antistatic plastic tube

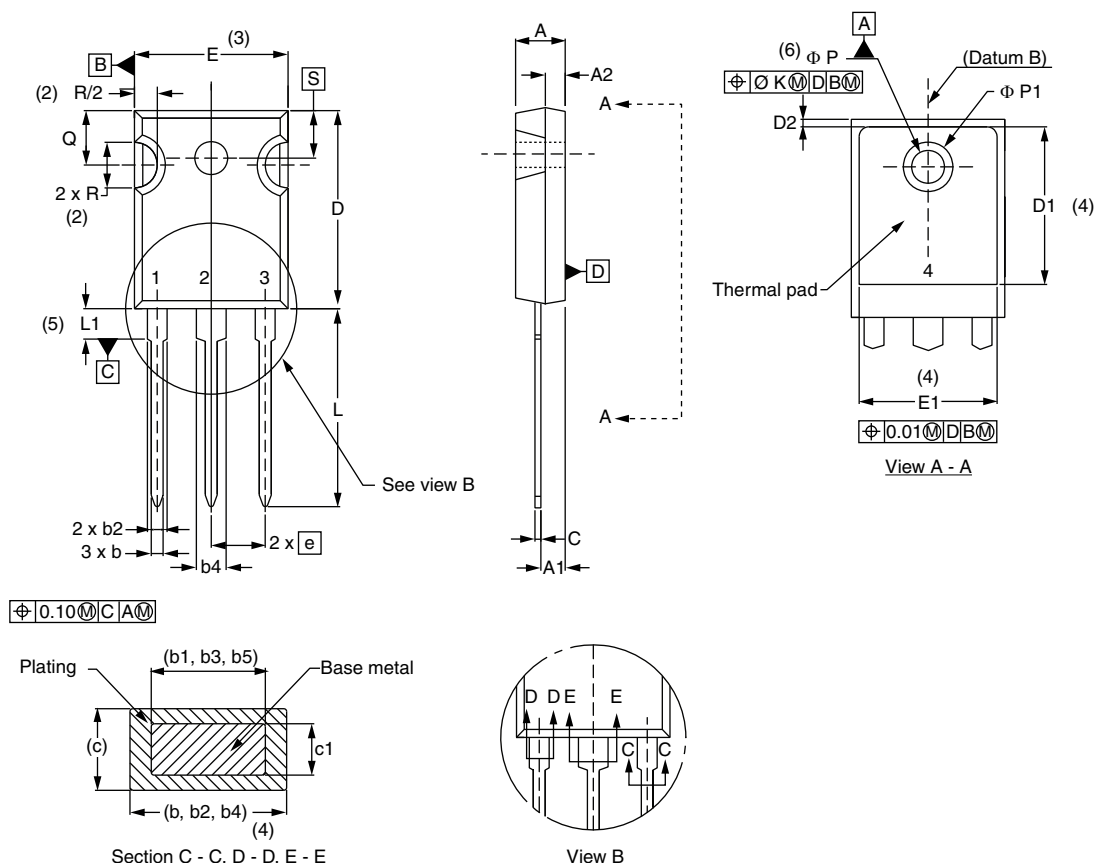
## LINKS TO RELATED DOCUMENTS

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
	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	
b4	2.59	3.43	0.102	0.135	
b5	2.59	3.38	0.102	0.133	
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

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
D2	0.51	1.30	0.020	0.051	
E	15.29	15.87	0.602	0.625	3
E1	13.46	-	0.53	-	
e	5.46 BSC		0.215 BSC		
$\phi K$	0.254		0.010		
L	19.81	20.32	0.780	0.800	
L1	3.71	4.29	0.146	0.169	
$\phi P$	3.56	3.66	0.14	0.144	
$\phi P1$	-	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
- $\phi P$  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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