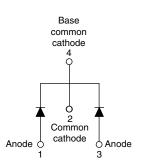


Ultrafast Rectifier, 16 A FRED Pt®





PRIMARY CHARACTERISTICS								
I _{F(AV)} 2 x 8 A								
V_{R}	400 V							
V _F at I _F	0.94 V							
t _{rr} (typ.)	24 ns							
T _J max.	175 °C							
Package	TO-220AB							
Circuit configuration	Common cathode							

FEATURES

- Ultrafast recovery time
- Low forward voltage drop
- 175 °C operating junction temperature
- · Low leakage current
- AEC-Q101 qualified, meets JESD 201 class 2 whisker test
- Material categorization: for definitions of compliance please see www.vishav.com/doc?99912





ROHS COMPLIANT HALOGEN FREE

DESCRIPTION / APPLICATIONS

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 diode 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.

ABSOLUTE MAXIMUM RATINGS								
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS				
Peak repetitive reverse voltage	V_{RRM}		400	V				
Average restified forward ourrent	I _{F(AV)}		8					
Average rectified forward current total device		T _C = 155 °C, rated V _R	16	Α				
Non-repetitive peak surge current	I _{FSM}	T _C = 25 °C	100	A				
Peak repetitive forward current	I _{FRM}	T_C = 155 °C, rated V_R , square wave, 20 kHz	16					
Operating junction and storage temperatures	T _J , T _{Stg}		-65 to +175	°C				

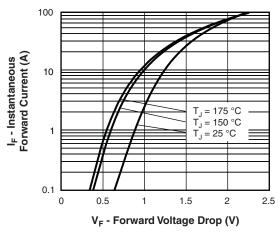
ELECTRICAL SPECIFICATIONS PER LEG (T _J = 25 °C unless otherwise specified)									
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS			
Breakdown voltage, blocking voltage	V _{BR} , V _R	Ι _R = 100 μΑ	400	-	-				
Forward voltage	V _F	I _F = 8 A	-	1.19	1.3	V			
		I _F = 8 A, T _J = 150 °C	-	0.94	1.0				
Reverse leakage current	I _R	$V_R = V_R$ rated	-	0.2	10				
		T _J = 150 °C, V _R = V _R rated	-	20	500	μΑ			
Junction capacitance	C _T	V _R = 400 V	-	14	-	pF			
Series inductance	L _S	Measured lead to lead 5 mm from package body	-	8.0	-	nH			





DYNAMIC RECOVERY CHARACTERISTICS PER LEG (T _J = 25 °C unless otherwise specified)									
PARAMETER	SYMBOL	TEST CO	MIN.	TYP.	MAX.	UNITS			
		$I_F = 1.0 \text{ A}, dI_F/dt =$	50 A/ μ A, $V_R = 30 V$	-	35	-			
Reverse recovery time	t _{rr}	$I_F = 1.0 \text{ A, } dI_F/dt =$	-	24	-	no			
		T _J = 25 °C		-	43	-	A A		
		T _J = 125 °C		-	67	-			
Peak recovery current	I _{RRM}	T _J = 25 °C	I _F = 8 A dI _F /dt = 200 A/μs	-	2.8	-			
		T _J = 125 °C	$V_{\rm R} = 200 \text{ V}$	-	6.3	-			
Reverse recovery charge	Q _{rr}	T _J = 25 °C		-	60	-			
		T _J = 125 °C		-	210	-	nC		

THERMAL MECHANICAL SPECIFICATIONS									
PARAMETER		SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS		
Maximum junction and temperature range	Maximum junction and storage temperature range			-65	-	175	°C		
Thermal resistance,	per leg	D		-	3.6	4			
junction to case	per device	R_{thJC}		-	1.8	2			
Thermal resistance, junction to ambient	,		Typical socket mount	-	-	50	°C/W		
Thermal resistance, case to heatsink		R _{thCS}	Mounting surface, flat, smooth, and greased	-	0.5	-			
Majaht				-	2.0	=	g		
Weight				-	0.07	-	OZ.		
Mounting torque				6.0	_	12	kgf · cm		
wounting torque	Mounting torque			(5.0)	_	(10)	(lbf · in)		
Marking device			Case style TO-220AB	16CTU04H					





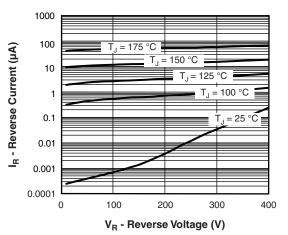


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

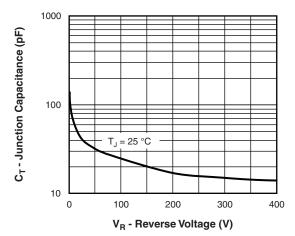


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

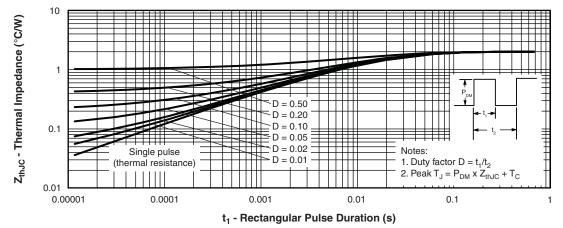


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics



www.vishay.com

Vishay Semiconductors

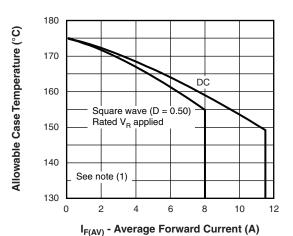


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

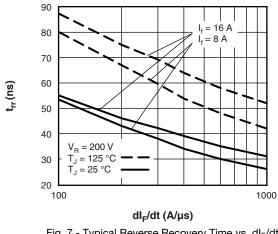


Fig. 7 - Typical Reverse Recovery Time vs. dl_F/dt

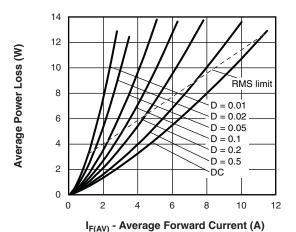


Fig. 6 - Forward Power Loss Characteristics

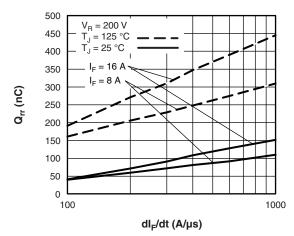
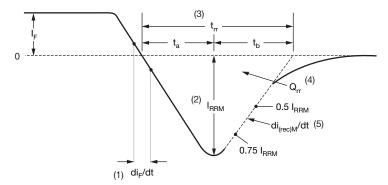


Fig. 8 - Typical Stored Charge vs. dl_F/dt

Note

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



- (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 zero crossing point of negative going I_F to point where a line passing through 0.75 I_{RRM} and 0.50 I_{RRM} extrapolated to zero current.
- (4) $\mathbf{Q}_{\rm rr}$ area under curve defined by $\mathbf{t}_{\rm rr}$ and $\mathbf{I}_{\rm RRM}$

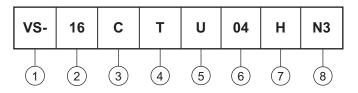
$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(5) di_{(rec)M}/dt - peak rate of change of current during t_b portion of t_{rr}

Fig. 1 - Reverse Recovery Waveform and Definitions

ORDERING INFORMATION TABLE

Device code



Vishay Semiconductors product

2 - Current rating (16 = 16 A)

3 - Circuit configuration:

C = Common cathode

4 - Package:

T = TO-220

5 - Ultrafast recovery

6 - Voltage rating (04 = 400 V)

7 - H = AEC-Q101 qualified

8 - Environmental digit:

N3 = Halogen-free, RoHS-compliant, and totally lead (Pb)-free

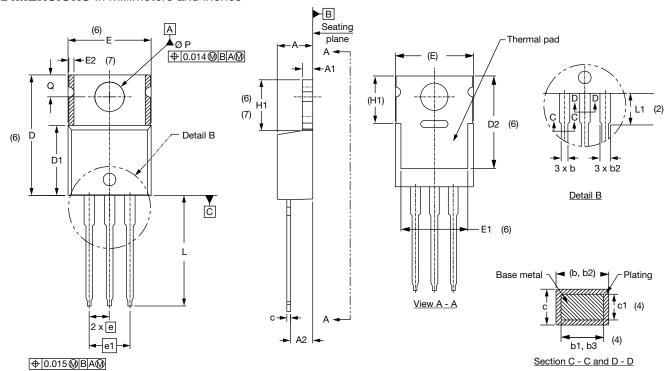
ORDERING INFORMATION (Example)								
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION					
VS-16CTU04HN3	50	1000	Antistatic plastic tube					

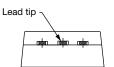
LINKS TO RELATED DOCUMENTS						
Dimensions <u>www.vishay.com/doc?95222</u>						
Part marking information	www.vishay.com/doc?95028					
SPICE model	www.vishay.com/doc?96565					



TO-220AB

DIMENSIONS in millimeters and inches





Conforms to JEDEC® outline TO-220AB

SYMBOL	MILLIMETERS		INC	INCHES		SYMBOL	MILLIM	IETERS	INC	HES	NOTES
STINIBUL	MIN.	MAX.	MIN.	MAX.	NOTES	STIVIDOL	MIN.	MAX.	MIN.	MAX.	NOTES
Α	4.25	4.65	0.167	0.183		D2	11.68	12.88	0.460	0.507	6
A1	1.14	1.40	0.045	0.055		Е	10.11	10.51	0.398	0.414	3, 6
A2	2.56	2.92	0.101	0.115		E1	6.86	8.89	0.270	0.350	6
b	0.69	1.01	0.027	0.040		E2	ı	0.76	-	0.030	7
b1	0.38	0.97	0.015	0.038	4	е	2.41	2.67	0.095	0.105	
b2	1.20	1.73	0.047	0.068		e1	4.88	5.28	0.192	0.208	
b3	1.14	1.73	0.045	0.068	4	H1	5.84	6.86	0.230	0.270	6, 7
С	0.36	0.61	0.014	0.024		L	13.52	14.02	0.532	0.552	
c1	0.36	0.56	0.014	0.022	4	L1	3.32	3.82	0.131	0.150	2
D	14.85	15.25	0.585	0.600	3	ØΡ	3.54	3.73	0.139	0.147	
D1	8.38	9.02	0.330	0.355		Q	2.60	3.00	0.102	0.118	

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) Dimensions E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC® TO-220, except A2 (maximum) and D2 (minimum) where dimensions are derived from the actual package outline

Revision: 23-Feb-2024 1 Document Number: 95222



Legal Disclaimer Notice

Vishay

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.