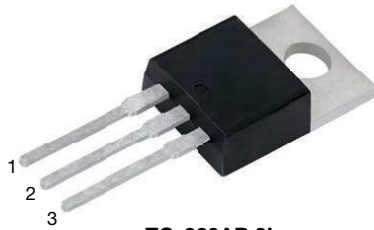
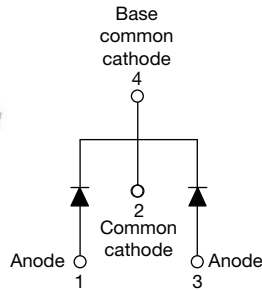


Ultrafast Rectifier, 16 A FRED Pt[®]


TO-220AB 3L


FEATURES

- Ultrafast recovery time
- Low forward voltage drop
- 175 °C operating junction temperature
- Low leakage current
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.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.

PRIMARY CHARACTERISTICS

$I_{F(AV)}$	2 x 8 A
V_R	400 V
V_F at I_F	0.94 V
t_{rr} typ.	See Recovery table
T_J max.	175 °C
Package	TO-220AB 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	$I_{F(AV)}$	$T_C = 155\text{ °C}$, rated V_R	8	A
per leg			16	
total device	$T_C = 25\text{ °C}$	100		
Non-repetitive peak surge current	I_{FSM}	$T_C = 155\text{ °C}$, rated V_R , square wave, 20 kHz	16	
Peak repetitive forward current	I_{FRM}			
Operating junction and storage temperatures	T_J, T_{Stg}		-65 to +175	°C

ELECTRICAL SPECIFICATIONS PER LEG ($T_J = 25\text{ °C}$ 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	$I_F = 8\text{ A}$	-	1.19	1.3	
		$I_F = 8\text{ A}, T_J = 150\text{ °C}$	-	0.94	1.0	
Reverse leakage current	I_R	$V_R = V_R$ rated	-	0.2	10	μA
		$T_J = 150\text{ °C}, V_R = V_R$ rated	-	20	500	
Junction capacitance	C_T	$V_R = 400\text{ V}$	-	14	-	pF
Series inductance	L_S	Measured lead to lead 5 mm from package body	-	8.0	-	nH



DYNAMIC RECOVERY CHARACTERISTICS PER LEG ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS	
Reverse recovery time	t_{rr}	$I_F = 1.0\text{ A}$, $di_F/dt = 50\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$	-	35	60	ns	
		$T_J = 25\text{ }^\circ\text{C}$	-	43	-		
		$T_J = 125\text{ }^\circ\text{C}$	-	67	-		
Peak recovery current	I_{RRM}	$I_F = 8\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 200\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	2.8	-	A
			$T_J = 125\text{ }^\circ\text{C}$	-	6.3	-	
Reverse recovery charge	Q_{rr}		$T_J = 25\text{ }^\circ\text{C}$	-	60	-	nC
			$T_J = 125\text{ }^\circ\text{C}$	-	210	-	

THERMAL MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T_J, T_{Stg}		-65	-	175	$^\circ\text{C}$
Thermal resistance, junction to case per leg per device	R_{thJC}		-	3.6	4	$^\circ\text{C}/\text{W}$
			-	1.8	2	
Thermal resistance, junction to ambient	R_{thJA}	Typical socket mount	-	-	50	
Thermal resistance, case to heatsink	R_{thCS}	Mounting surface, flat, smooth and greased	-	0.5	-	
Weight			-	2.0	-	g
			-	0.07	-	oz.
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Marking device		Case style TO-220AB 3L	16CTU04			

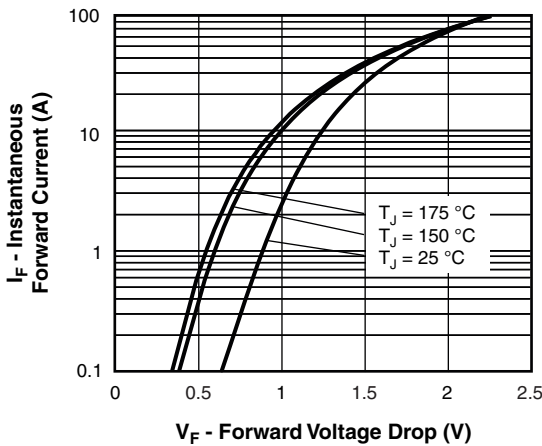


Fig. 1 - Typical Forward Voltage Drop Characteristics

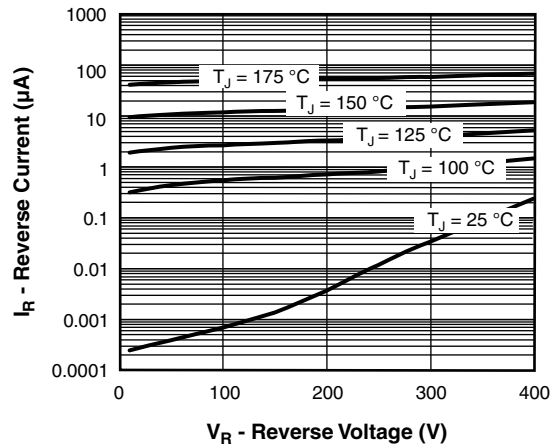


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

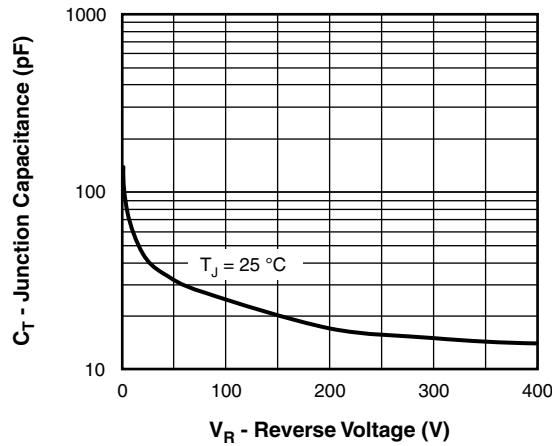


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

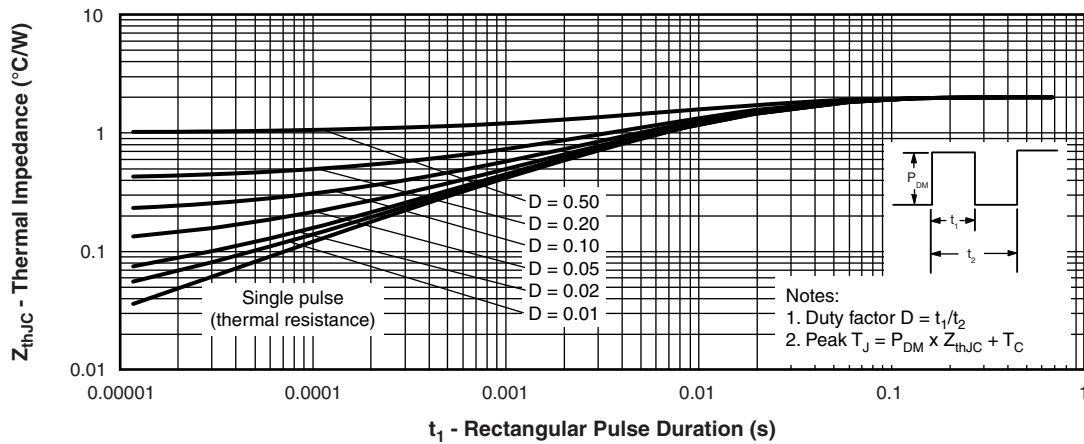


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

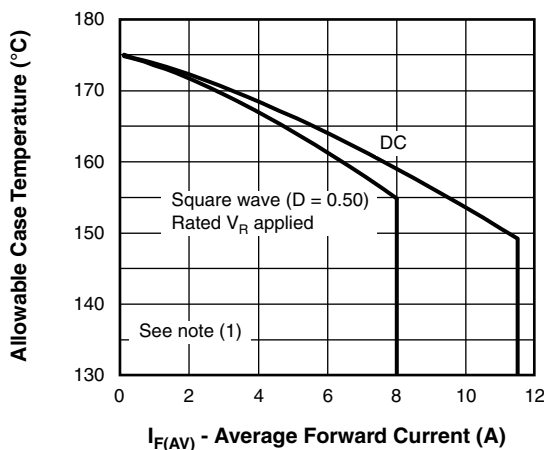


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

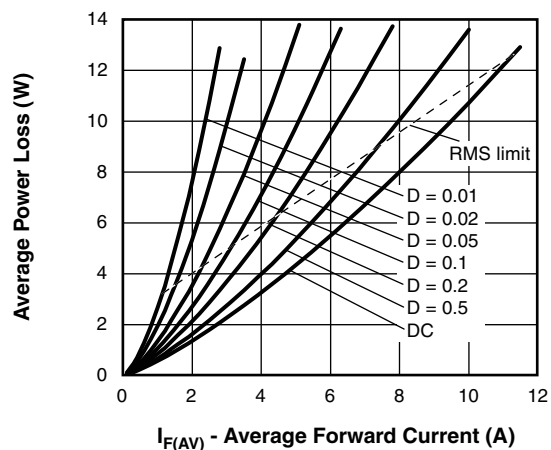


Fig. 6 - Forward Power Loss Characteristics

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

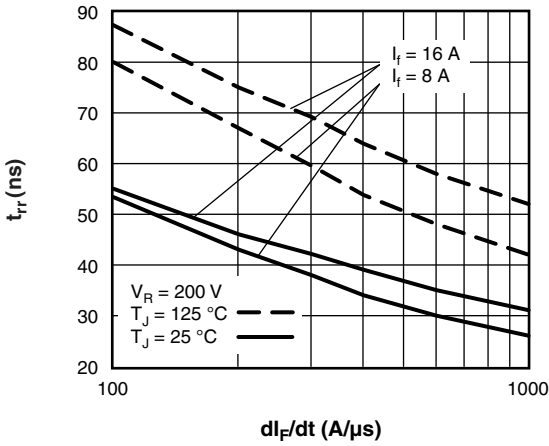


Fig. 7 - Typical Reverse Recovery Time vs. di_F/dt

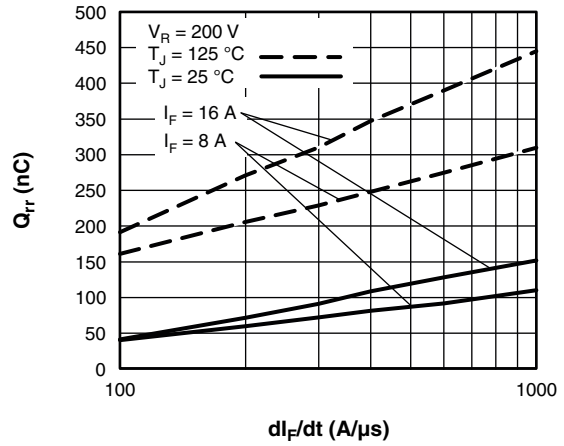
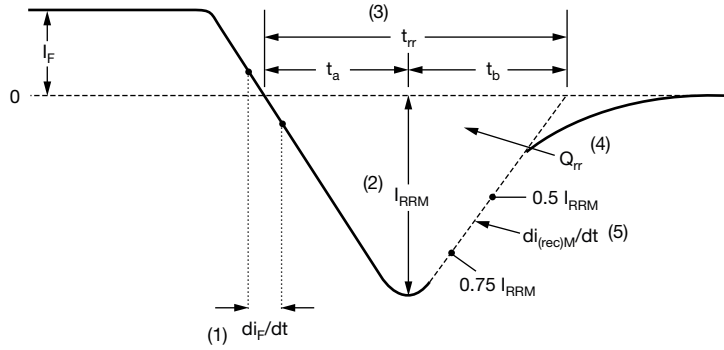


Fig. 8 - Typical Stored Charge vs. di_F/dt



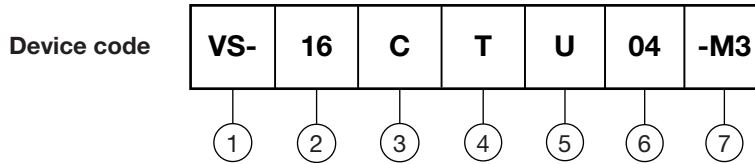
- (1) di_F/dt - rate of change of current through zero crossing
- (2) I_{RRM} - peak reverse recovery current
- (3) t_{rr} - reverse recovery time measured from zero crossing point of negative going I_F to point where a line passing through $0.75 I_{RRM}$ and $0.50 I_{RRM}$ extrapolated to zero current.
- (4) Q_{rr} - area under curve defined by t_{rr} and I_{RRM}
- (5) $di_{(rec)M}/dt$ - peak rate of change of current during t_b portion of t_{rr}

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

Fig. 9 - Reverse Recovery Waveform and Definitions



ORDERING INFORMATION TABLE



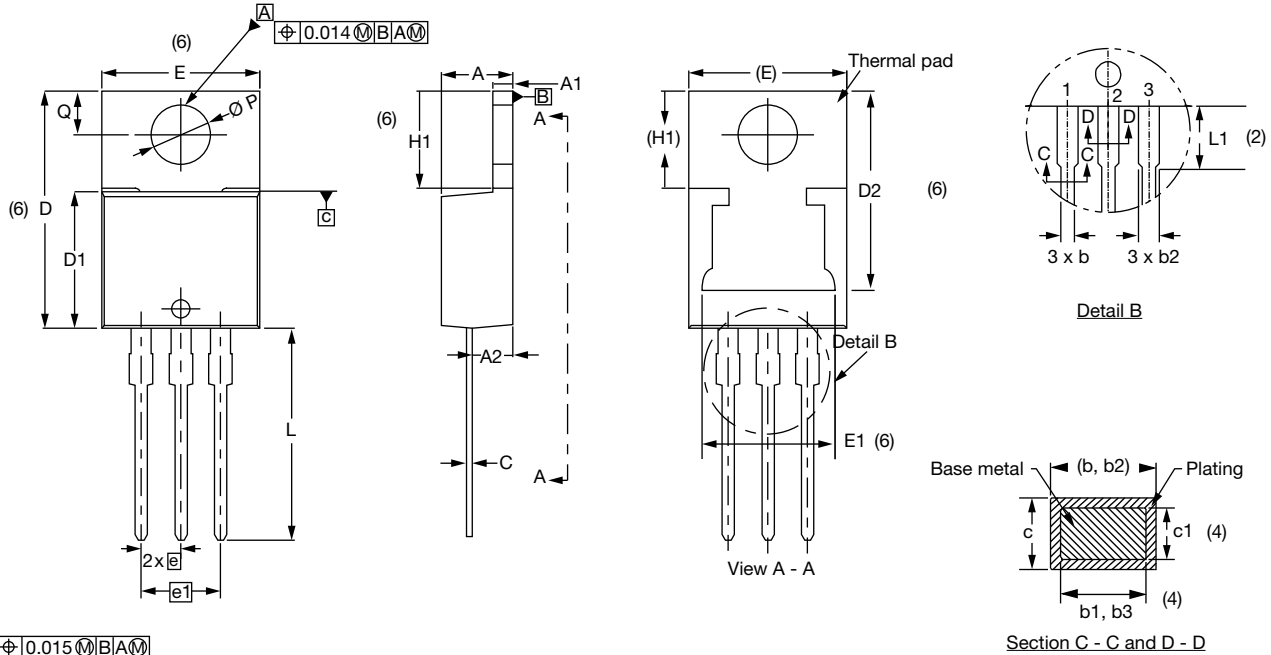
- 1** - Vishay Semiconductors product
- 2** - Current rating (16 = 16 A)
- 3** - Circuit configuration:
- 4** C = common cathode
- 4** - Package:
- 4** T = 3L TO-220AB
- 5** - Ultrafast recovery
- 6** - Voltage rating (04 = 400 V)
- 7** - Environmental digit:
- M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

ORDERING INFORMATION (Example)		
PREFERRED P/N	BASE QUANTITY	PACKAGING DESCRIPTION
VS-16CTU04-M3	50	Antistatic plastic tubes

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?96154
Part marking information	www.vishay.com/doc?95028
SPICE model	www.vishay.com/doc?96565

TO-220AB 3L

DIMENSIONS in millimeters and inches



Conforms to JEDEC® outline TO-220AB

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.25	4.65	0.167	0.183	
A1	1.14	1.40	0.045	0.055	
A2	2.50	2.92	0.098	0.115	
b	0.69	1.01	0.027	0.040	
b1	0.38	0.97	0.015	0.038	4
b2	1.20	1.73	0.047	0.068	
b3	1.14	1.73	0.045	0.068	4
c	0.36	0.61	0.014	0.024	
c1	0.36	0.56	0.014	0.022	4
D	14.85	15.35	0.585	0.604	3
D1	8.38	9.02	0.330	0.355	
D2	11.68	13.30	0.460	0.524	6, 7
E	10.11	10.51	0.398	0.414	3, 6
E1	6.86	8.89	0.270	0.350	6
e	2.41	2.67	0.095	0.105	
e1	4.88	5.28	0.192	0.208	
H1	6.09	6.48	0.240	0.255	6
L	13.52	14.02	0.532	0.552	
L1	3.32	3.82	0.131	0.150	2
∅ P	3.54	3.91	0.139	0.154	
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) Outline conforms to JEDEC® TO-220, except D2



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