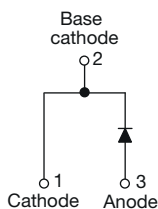


# Ultrafast Rectifier, 15 A FRED Pt®



TO-220AC 2L



## FEATURES

- Ultrafast and soft recovery time
- Optimized forward voltage drop
- 175 °C maximum operating junction temperature
- Polyimide passivation
- Rugged design
- Good thermal performance
- 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 / APPLICATIONS

Ultrafast recovery rectifiers designed with optimized performance of forward voltage drop, recovery time, and soft recovery.

Polyimide passivated, planar structure, and the platinum doped life time control guarantee, ruggedness, reliability characteristics, and solid value position for efficiency and thermal performance.

These devices are intended for use in boost stage in the AC/DC section of SMPS, high frequency output rectification of battery charger, inverters of solar inverters, or as freewheeling diodes in motor drive.

## PRIMARY CHARACTERISTICS

$I_{F(AV)}$	15 A
$V_R$	1200 V
$V_F$ at $I_F$ at 125 °C	2.25 V
$t_{rr}$	44 ns
$T_J$ max.	175 °C
Package	TO-220AC 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	$I_{F(AV)}$	$T_C = 115\text{ °C}$ , $D = 0.50$	15	A
Non-repetitive peak surge current	$I_{FSM}$	$T_C = 25\text{ °C}$ , $t_p = 10\text{ ms}$ , sine wave	150	
Repetitive peak forward current	$I_{FRM}$		30	
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	$V_{BR}$ , $V_R$	$I_R = 250\text{ }\mu\text{A}$	1200	-	-	V
Forward voltage	$V_F$	$I_F = 15\text{ A}$	-	2.3	2.78	
		$I_F = 15\text{ A}$ , $T_J = 125\text{ °C}$	-	2.25	2.7	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	-	80	$\mu\text{A}$
		$T_J = 125\text{ °C}$ , $V_R = V_R$ rated	-	-	150	
Junction capacitance	$C_T$	$V_R = 200\text{ V}$	-	13	-	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body	-	8.0	-	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	$t_{rr}$	$I_F = 1.0\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	44	-	ns
		$T_J = 25\text{ }^{\circ}\text{C}$	-	167	-	
		$T_J = 125\text{ }^{\circ}\text{C}$	-	248	-	
Peak recovery current	$I_{RRM}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	6	-	A
		$T_J = 125\text{ }^{\circ}\text{C}$	-	9	-	
		$I_F = 15\text{ A}$ $di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 390\text{ V}$	-	507	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^{\circ}\text{C}$	-	1110	-	nC
		$T_J = 125\text{ }^{\circ}\text{C}$	-	-	-	

**THERMAL - MECHANICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Thermal resistance, junction to case	$R_{thJC}$		-	1.1	1.3	$^{\circ}\text{C}/\text{W}$
Thermal resistance, junction to ambient	$R_{thJA}$	Typical socket mount	-	54	60	
Thermal resistance, case to heat sink	$R_{thCS}$	Mounting surface, flat, smooth, and greased	-	0.2	0.4	
Weight			-	2	-	g
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Marking device		Case style: TO-220AC 2L	15ETU12			
Maximum junction and storage temperature range	$T_J, T_{Stg}$		-55	-	175	$^{\circ}\text{C}$

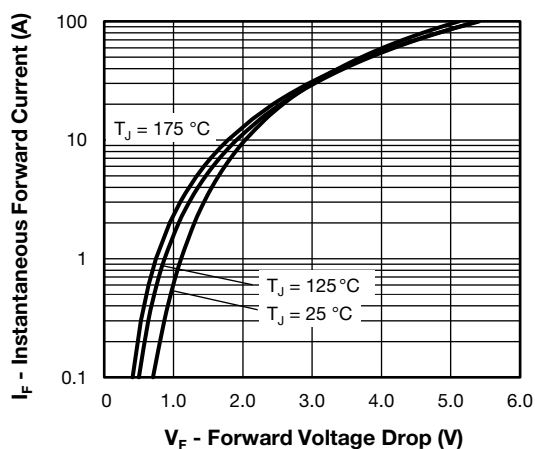


Fig. 1 - Typical Forward Voltage Drop Characteristics

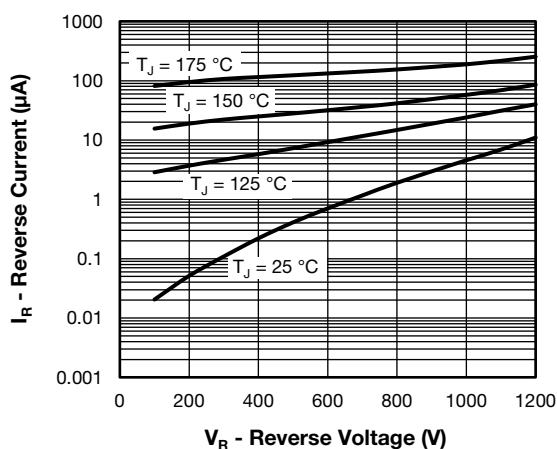


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

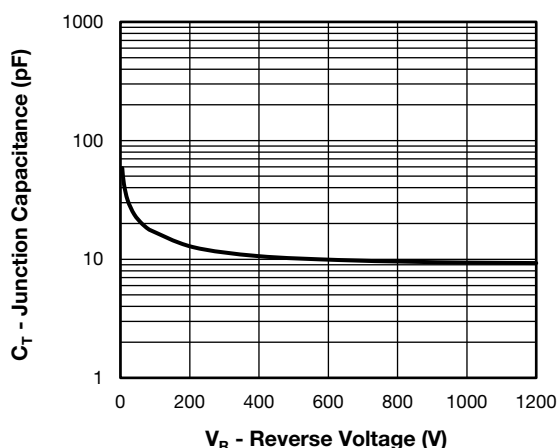


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

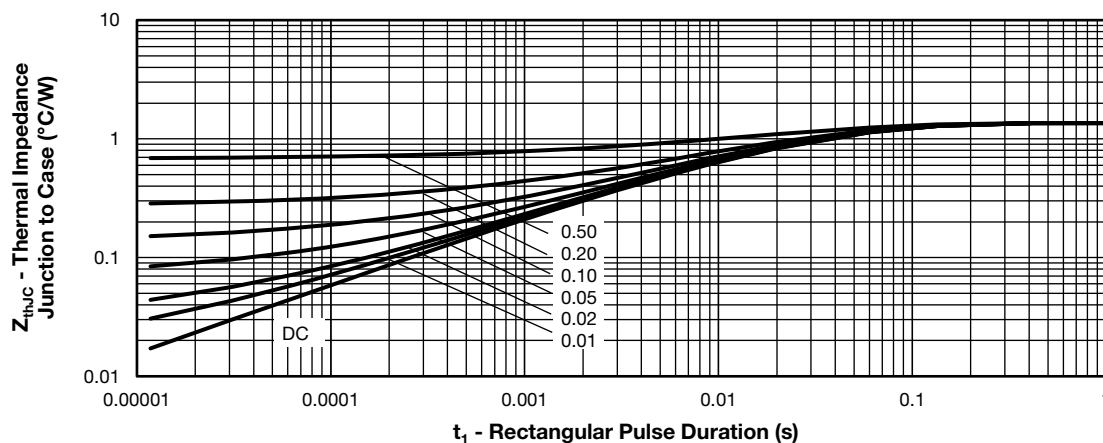


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

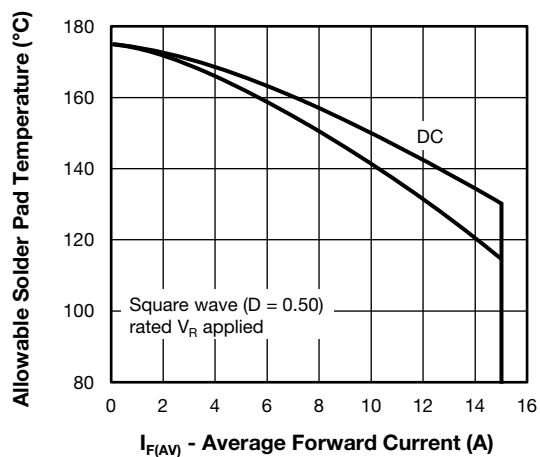


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

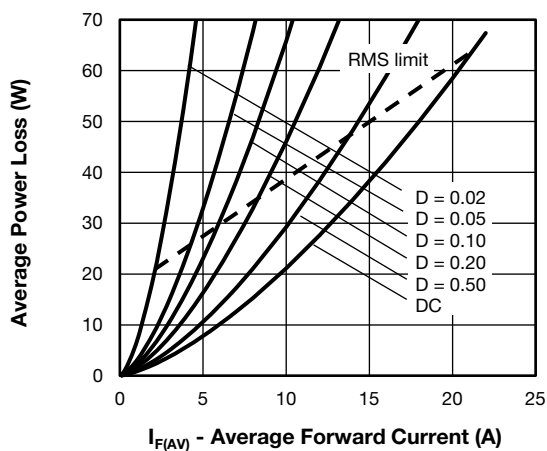


Fig. 6 - Forward Power Loss Characteristics

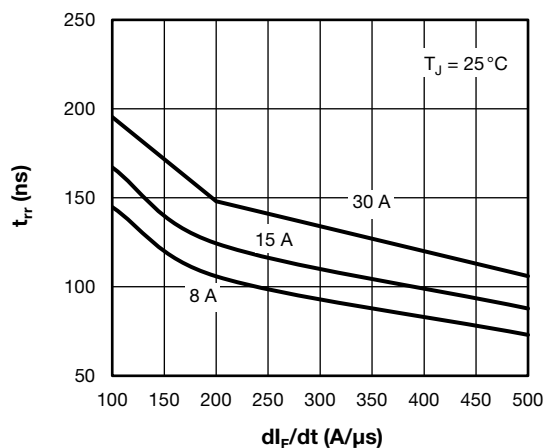


Fig. 7 - Typical Reverse Recovery Time vs.  $dI_F/dt$

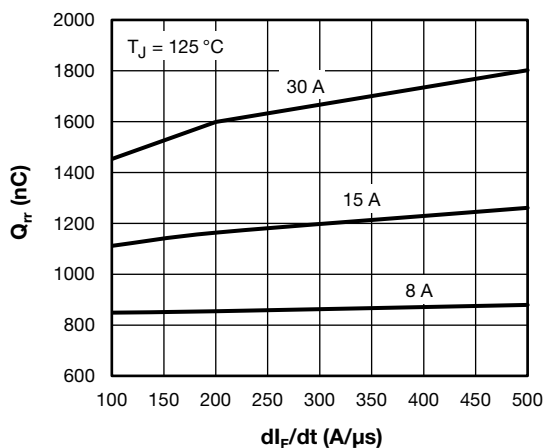


Fig. 10 - Typical Stored Charge vs.  $dI_F/dt$

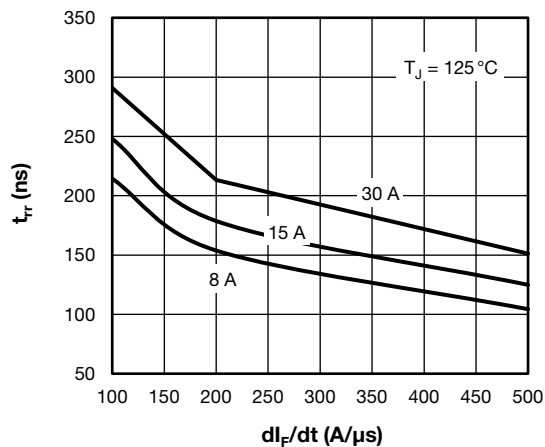


Fig. 8 - Typical Reverse Recovery Time vs.  $dI_F/dt$

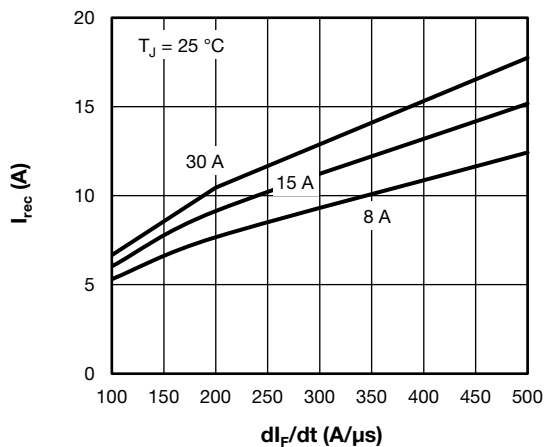


Fig. 11 - Typical Reverse Current vs.  $dI_F/dt$

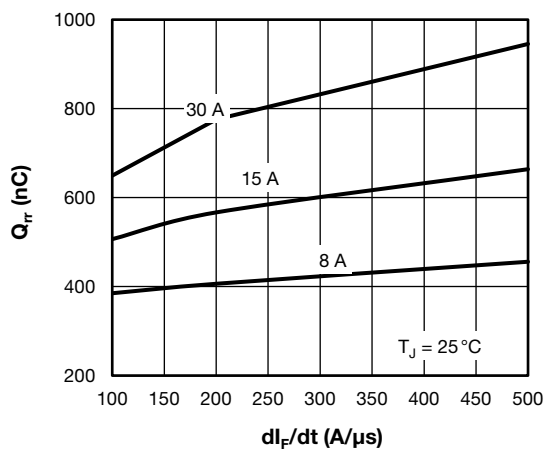


Fig. 9 - Typical Stored Charge vs.  $dI_F/dt$

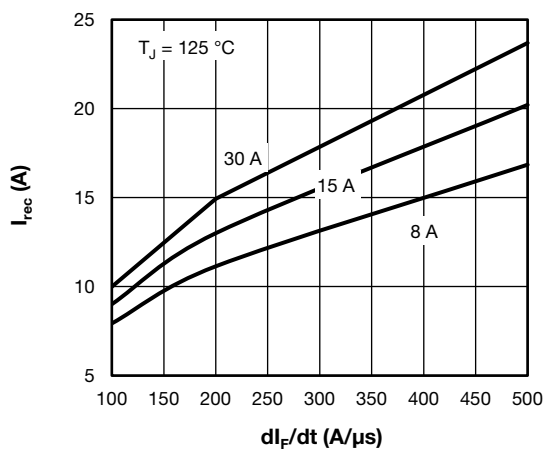
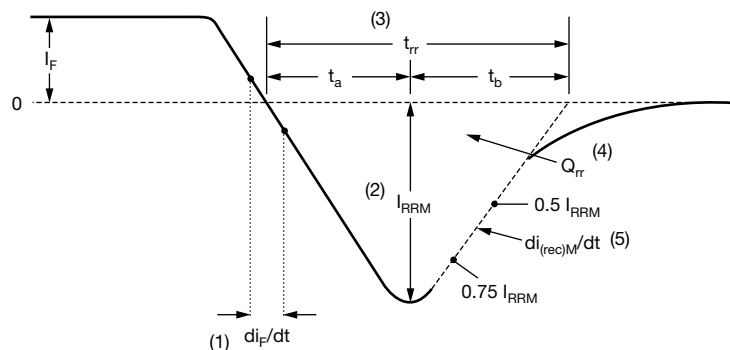


Fig. 12 - Typical Reverse Current vs.  $dI_F/dt$



- (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. 13 - Reverse Recovery Waveform and Definitions

## ORDERING INFORMATION TABLE

Device code	VS-	15	E	T	U	12	-M3
	1	2	3	4	5	6	7

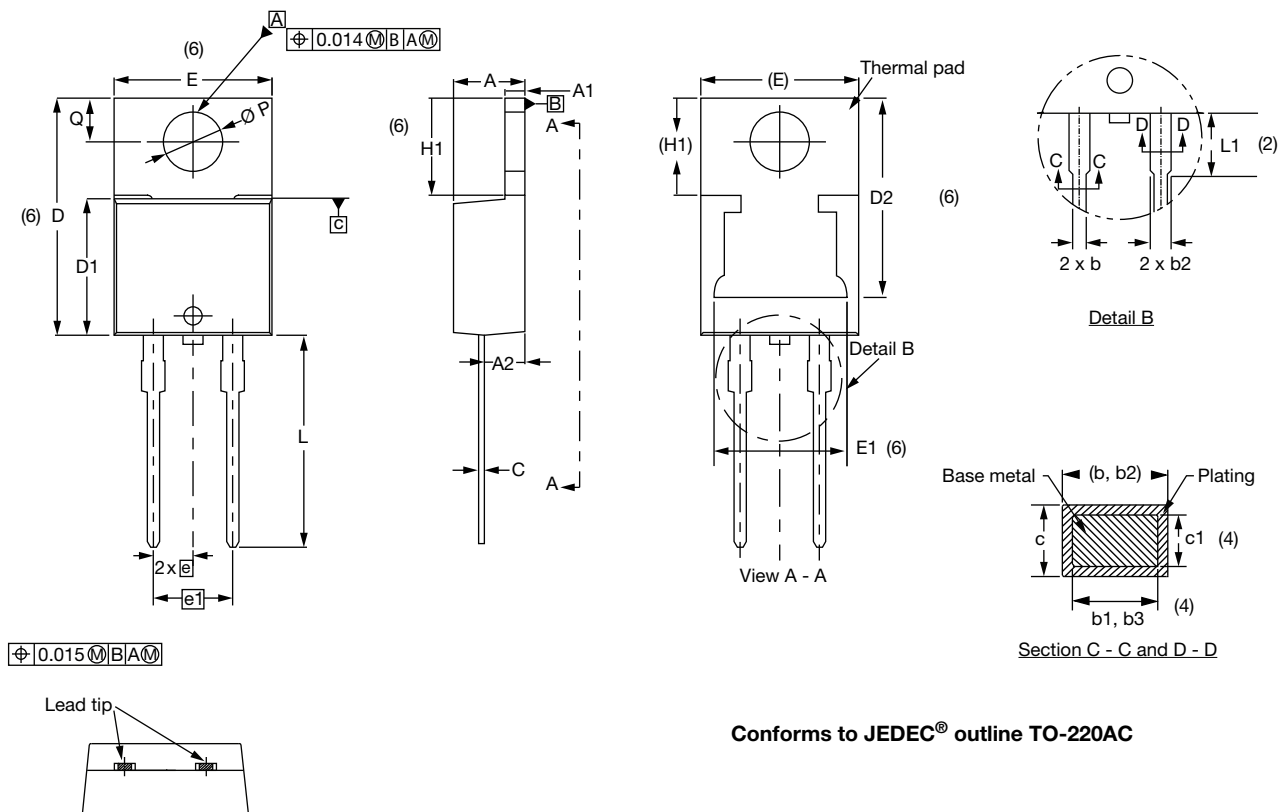
- 1** - Vishay Semiconductors product
- 2** - Current rating (15 = 15 A)
- 3** - E = single
- 4** - Package:  
T = TO-220AC 2L
- 5** - U = ultrafast recovery
- 6** - Voltage rating (12 = 1200 V)
- 7** - Environmental digit:  
-M3 = halogen-free, RoHS-compliant, and termination lead (Pb)-free

ORDERING INFORMATION (Example)		
PREFERRED P/N	BASE QUANTITY	PACKAGING DESCRIPTION
VS-15ETU12-M3	50	Antistatic plastic tubes

LINKS TO RELATED DOCUMENTS	
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>

# TO-220AC 2L

**DIMENSIONS** in millimeters and inches



**Conforms to JEDEC® outline TO-220AC**

SYMBOL	MILLIMETERS		INCHES		NOTES		SYMBOL	MILLIMETERS		INCHES		NOTES
	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		Ø 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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