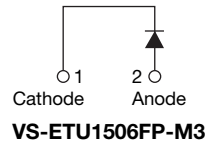
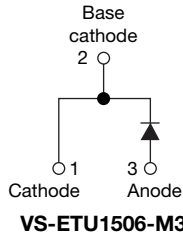


**Ultrafast Rectifier, 15 A FRED Pt®**

**2L TO-220AC**

**2L TO-220 FULL-PAK**

**FEATURES**

- Low forward voltage drop
- Ultrafast soft recovery time
- 175 °C operating junction temperature
- Low leakage current
- Fully isolated package ( $V_{INS} = 2500 V_{RMS}$ )
- True 2 pin package
- Designed and qualified according to JEDEC®-JESD 47
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**
**DESCRIPTION**

State of the art, ultralow  $V_F$ , soft-switching ultrafast rectifiers optimized for Discontinuous (Critical) Mode (DCM) Power Factor Correction (PFC).

The minimized conduction loss, optimized stored charge and low recovery current minimized the switching losses and reduce over dissipation in the switching element and snubbers.

The device is also intended for use as a freewheeling diode in power supplies and other power switching applications.

**APPLICATIONS**

AC/DC SMPS 70 W to 400 W

e.g. laptop and printer AC adaptors, desktop PC, TV and monitor, games units and DVD AC/DC power supplies.

**PRODUCT SUMMARY**

Package	2L TO-220AC, 2L TO-220FP
$I_{F(AV)}$	15 A
$V_R$	600 V
$V_F$ at $I_F$	1.1 V
$t_{rr}$ (typ.)	24 ns
$T_J$ max.	175 °C
Diode variation	Single die

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Peak repetitive reverse voltage	$V_{RRM}$		600	V
Average rectified forward current in DC	$I_{F(AV)}$	$T_C = 151\text{ °C}$	15	A
FULL-PAK		$T_C = 103\text{ °C}$		
Non-repetitive peak surge current	$I_{FSM}$	$T_J = 25\text{ °C}$	160	
Operating junction and storage temperatures	$T_J, T_{Stg}$		-65 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	$V_F$	$I_F = 15\text{ A}$	-	1.35	1.9	
		$I_F = 15\text{ A}, T_J = 150\text{ °C}$	-	1.1	1.3	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	0.01	15	$\mu\text{A}$
		$T_J = 150\text{ °C}, V_R = V_R$ rated	-	20	200	
Junction capacitance	$C_T$	$V_R = 600\text{ V}$	-	12	-	pF
Series inductance	$L_S$	Measured lead 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	$t_{rr}$	$I_F = 1\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	24	28	ns	
		$I_F = 15\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	36	47		
		$T_J = 25\text{ }^\circ\text{C}$	-	40	-		
		$T_J = 125\text{ }^\circ\text{C}$	-	87	-		
Peak recovery current	$I_{RRM}$	$I_F = 15\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 390\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	5	-	A
			$T_J = 125\text{ }^\circ\text{C}$	-	9	-	
Reverse recovery charge	$Q_{rr}$		$T_J = 25\text{ }^\circ\text{C}$	-	107	-	nC
			$T_J = 125\text{ }^\circ\text{C}$	-	430	-	
Reverse recovery time	$t_{rr}$	$T_J = 125\text{ }^\circ\text{C}$	$I_F = 15\text{ A}$ $di_F/dt = 800\text{ A}/\mu\text{s}$ $V_R = 390\text{ V}$	-	53	-	ns
Peak recovery current	$I_{RRM}$			-	25	-	A
Reverse recovery charge	$Q_{rr}$			-	730	-	nC

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>						
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 FULL-PAK	$R_{thJC}$		-	1.2	1.4	$^\circ\text{C}/\text{W}$
			-	3.7	4.3	
Thermal resistance, junction to ambient	$R_{thJA}$	Typical socket mount	-	-	70	
Typical thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, flat, smooth and greased	-	0.5	-	
Weight			-	2	-	g
			-	0.07	-	oz.
Mounting torque			6	-	12	kgf · cm (lbf · in)
			(5)	-	(10)	
Marking device		Case style 2L TO-220AC	ETU1506			
		Case style 2L TO-220 FULL-PAK	ETU1506FP			

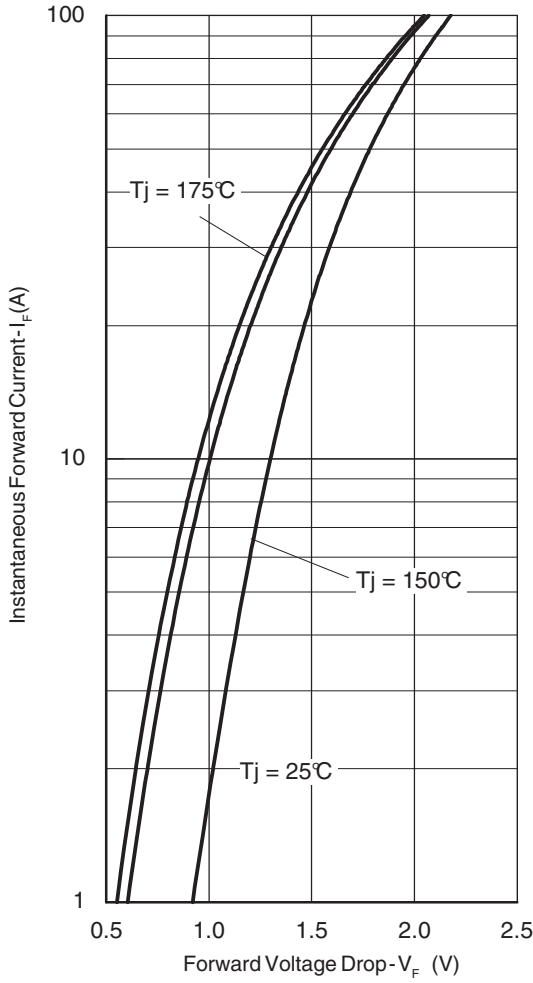


Fig. 1 - Typical Forward Voltage Drop Characteristics

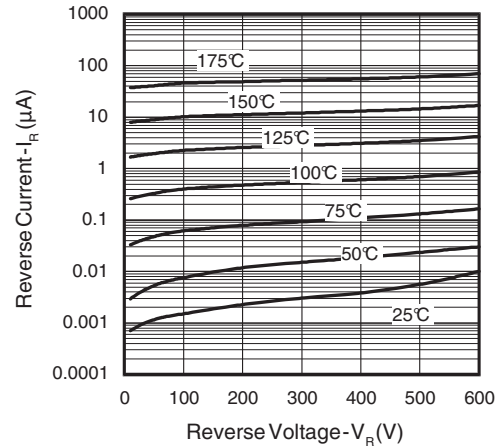


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

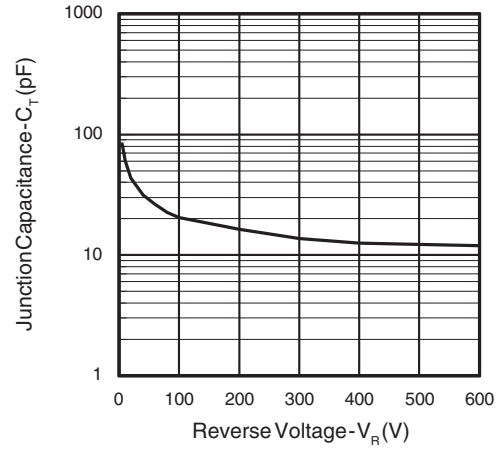


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

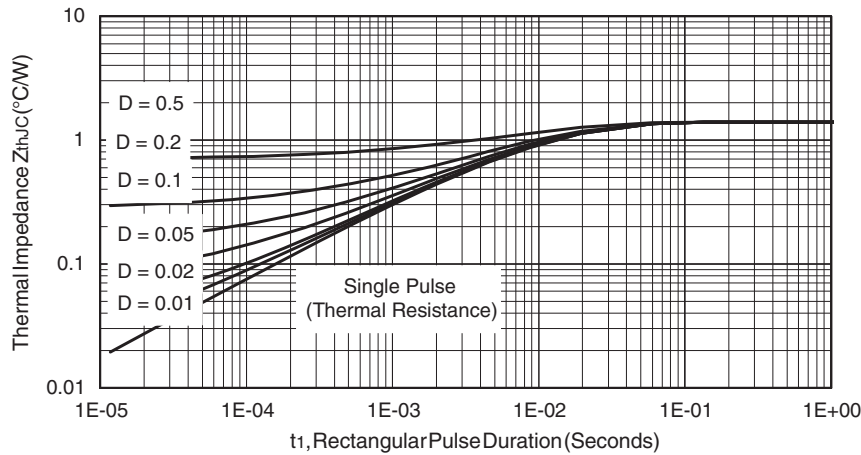


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

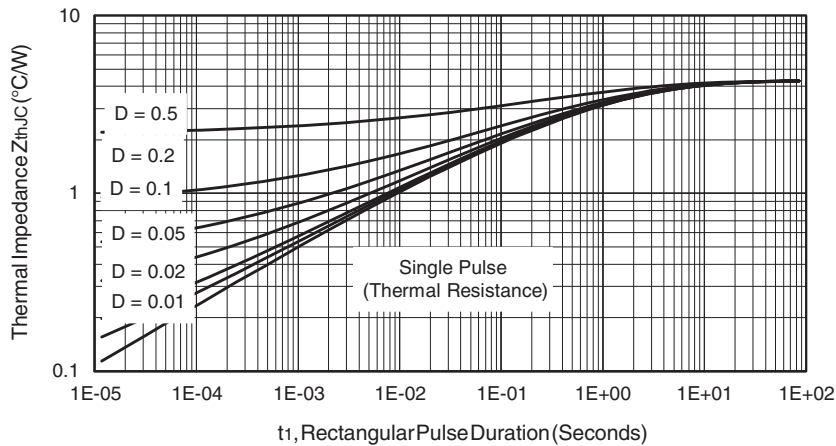


Fig. 5 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (FULL-PAK)

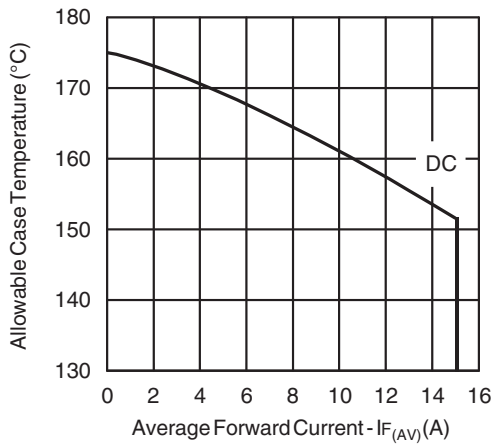


Fig. 6 - Maximum Allowable Case Temperature vs. Average Forward Current

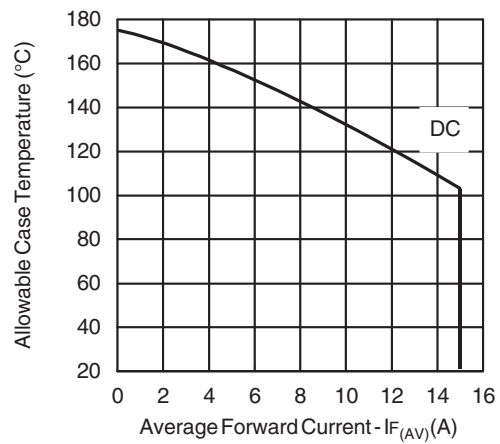


Fig. 7 - Maximum Allowable Case Temperature vs. Average Forward Current (FULL-PAK)

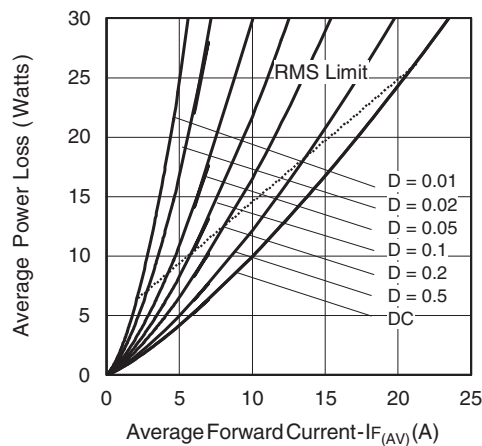


Fig. 8 - Forward Power Loss Characteristics

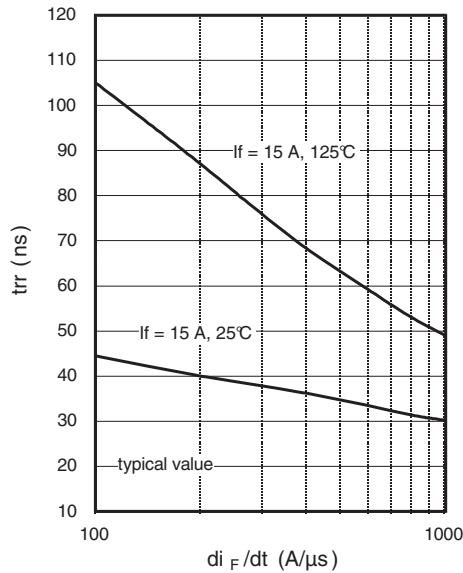


Fig. 9 - Typical Reverse Recovery vs.  $di_F/dt$

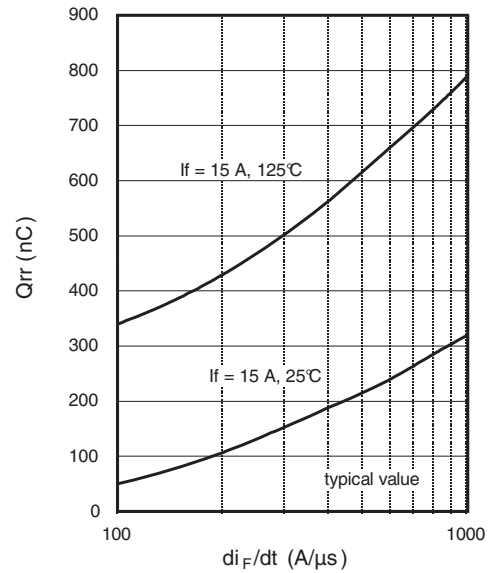


Fig. 10 - Typical Stored Charge vs.  $di_F/dt$

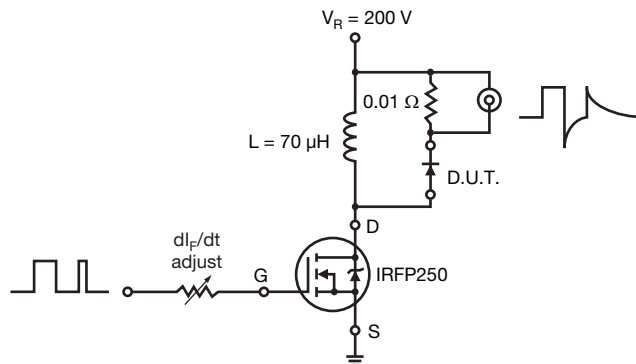
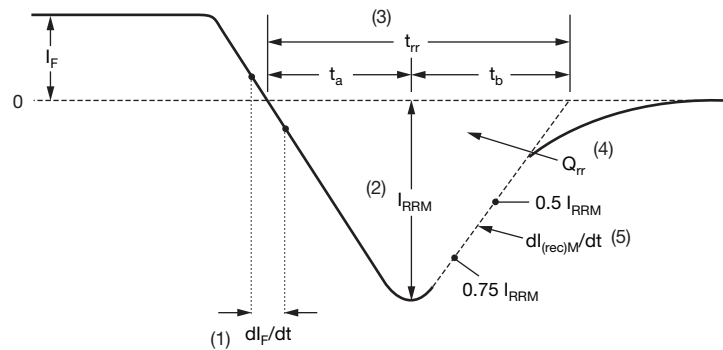


Fig. 11 - Reverse Recovery Parameter Test Circuit



(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  $I_F$  and  $0.5 I_{RRM}$  intersects the current curve.

(4)  $Q_{rr}$  - area under curve defined by  $t_{rr}$  and  $I_{RRM}$

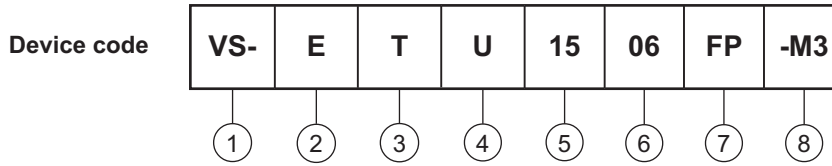
$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

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

Fig. 12 - Reverse Recovery Waveform and Definitions



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Circuit configuration:  
E = single diode
- 3** - T = TO-220
- 4** - U = hyperfast recovery time
- 5** - Current code: 15 = 15 A
- 6** - Voltage code: 06 = 600 V
- 7** -
  - None = TO-220
  - FP = FULL-PAK
- 8** - Environmental digit:  
-M3 = halogen-free, RoHS-compliant and terminations lead (Pb)-free

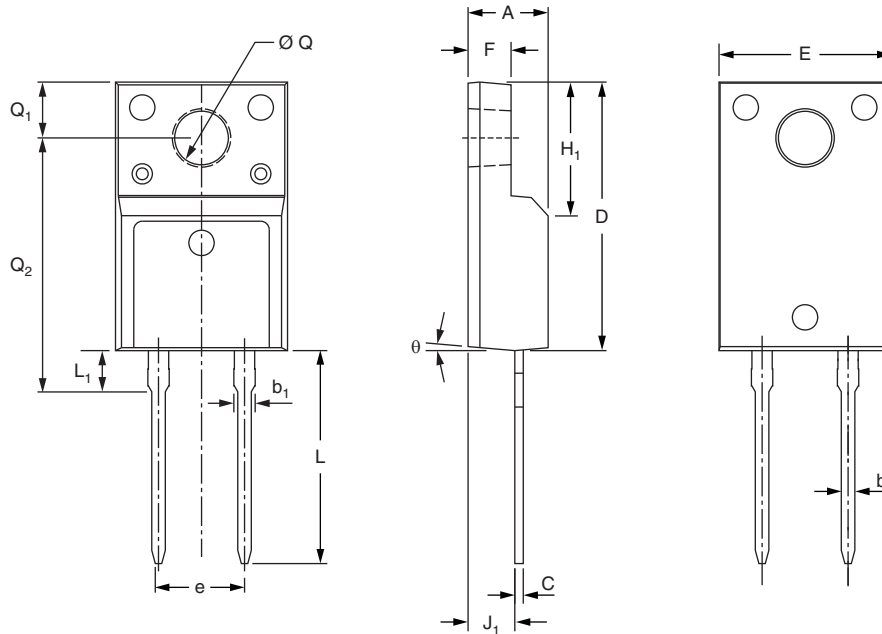
ORDERING INFORMATION (Example)			
PREFERRED P/N	QUANTITY PER TUBE	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-ETU1506-M3	50	1000	Antistatic plastic tube
VS-ETU1506FP-M3	50	1000	Antistatic plastic tube

LINKS TO RELATED DOCUMENTS			
Dimensions	2L TO-220AC	<a href="http://www.vishay.com/doc?95259">www.vishay.com/doc?95259</a>	
	2L TO-220 FULL-PAK	<a href="http://www.vishay.com/doc?95260">www.vishay.com/doc?95260</a>	
Part marking information	2L TO-220AC	<a href="http://www.vishay.com/doc?95391">www.vishay.com/doc?95391</a>	
	2L TO-220 FULL-PAK	<a href="http://www.vishay.com/doc?95392">www.vishay.com/doc?95392</a>	



## True 2 Pin TO-220 FULL-PAK

**DIMENSIONS** in millimeters and inches



SYMBOL	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.53	4.93	0.178	0.194
b	0.71	0.91	0.028	0.036
b <sub>1</sub>	1.15	1.39	0.045	0.055
C	0.36	0.53	0.014	0.021
D	15.67	16.07	0.617	0.633
E	9.96	10.36	0.392	0.408
e	5.08 typical		0.200 typical	
F	2.34	2.74	0.092	0.107
H <sub>1</sub>	6.50	6.90	0.256	0.272
J <sub>1</sub>	2.56	2.96	0.101	0.117
L	12.78	13.18	0.503	0.519
L <sub>1</sub>	2.23	2.63	0.088	0.104
Ø Q	2.98	3.38	0.117	0.133
Q <sub>1</sub>	3.10	3.50	0.122	0.138
Q <sub>2</sub>	14.80	15.20	0.583	0.598
θ	0°	5°	0°	5°



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