

## Ultrafast Rectifier, 1 A FRED Pt<sup>®</sup>

 eSMP<sup>®</sup> Series

**SMP (DO-220AA)**

Cathode Anode

**DESIGN SUPPORT TOOLS**
[click logo to get started](#)
**3D**  
Models  
Available

**FEATURES**

- Very low profile - typical height of 1.0 mm
- Ideal for automated placement
- Low forward voltage drop, low power losses
- Low leakage current
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- For PFC, CRM snubber operation
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**
**TYPICAL APPLICATION**

For use in high frequency, freewheeling, DC/DC converters, PFC, and in snubber industrial and automotive applications.

**MECHANICAL DATA**
**Case:** SMP (DO-220AA)

Molding compound meets UL 94 V-0 flammability rating

**Terminals:** matte tin plated leads, solderable per J-STD-002 and JESD 33-N102

**Polarity:** color band denotes cathode end

**PRIMARY CHARACTERISTICS**

$I_{F(AV)}$	1 A
$V_R$	100 V, 200 V
$V_F$ at $I_F$	0.69 V
$I_{FSM}$	40 A
$t_{rr}$ (typ.)	23 ns
$T_J$ max.	175 °C
Package	SMP (DO-220AA)
Circuit configuration	Single

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Peak repetitive reverse voltage	VS-1ENH01-M3	$V_{RRM}$	100	V
	VS-1ENH02-M3		200	
Average rectified forward current	$I_{F(AV)}$	$T_C = 168$ °C	1	A
Non-repetitive peak surge current	$I_{FSM}$	$T_J = 25$ °C, 10 ms sine pulse	40	
Operating junction and storage temperatures	$T_J, T_{Stg}$		-55 to +175	°C

**ELECTRICAL SPECIFICATIONS** ( $T_J = 25$  °C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	$V_{BR}, V_R$	$I_R = 100$ $\mu$ A	100	-	-	V
			200	-	-	
Forward voltage	$V_F$	$I_F = 1$ A	-	0.86	0.92	
		$I_F = 1$ A, $T_J = 150$ °C	-	0.69	0.74	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	-	2	$\mu$ A
		$T_J = 150$ °C, $V_R = V_R$ rated	-	-	20	
Junction capacitance	$C_T$	$V_R = 200$ V	-	8	-	pF

<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	$t_{rr}$	$I_F = 1.0\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	23	-	ns	
		$I_F = 0.5\text{ A}$ , $I_R = 1\text{ A}$ , $I_{rr} = 0.25\text{ A}$	-	-	28		
		$T_J = 25\text{ }^\circ\text{C}$	-	14	-		
		$T_J = 125\text{ }^\circ\text{C}$	-	22	-		
Peak recovery current	$I_{RRM}$	$I_F = 1\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	1.7	-	A
			$T_J = 125\text{ }^\circ\text{C}$	-	2.7	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	$T_J = 25\text{ }^\circ\text{C}$	-	10	-	nC
			$T_J = 125\text{ }^\circ\text{C}$	-	29	-	

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>							
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 mount	$R_{thJM}^{(1)}$	Infinite heatsink	-	7	9	$^\circ\text{C}/\text{W}$	
Thermal resistance, junction to ambient	$R_{thJA}$	PCB footprint 4.8 mm x 4.8 mm	-	107	-		
Marking device	VS-1ENH01-M3	Case style SMP (DO-220AA)	1H1				
	VS-1ENH02-M3		1H2				

**Note**

(1) Thermal resistance junction to mount follows JEDEC® 51-14 transient dual interface test method (TDIM)

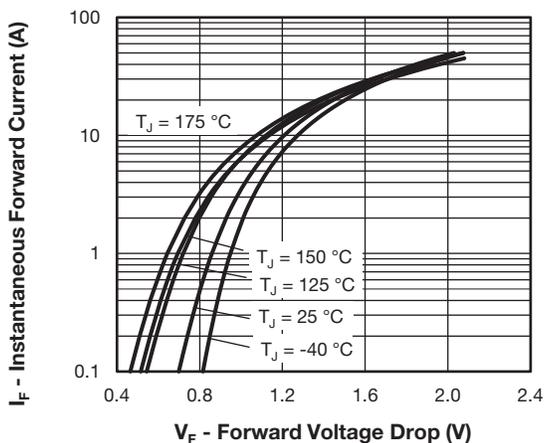


Fig. 1 - Typical Forward Voltage Drop Characteristics

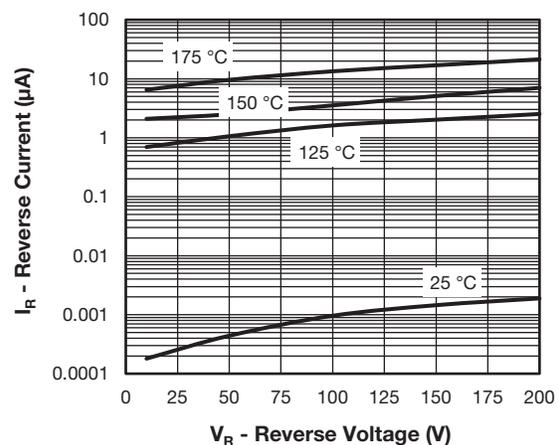


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

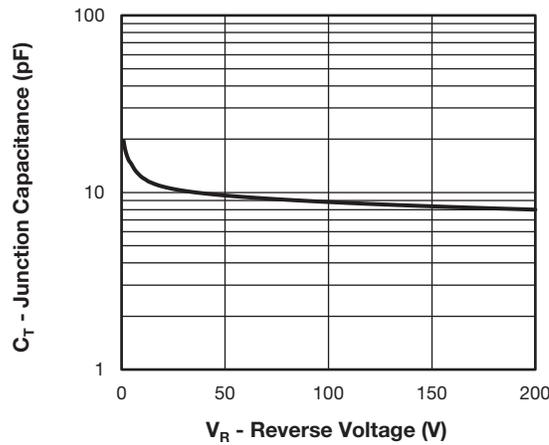


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

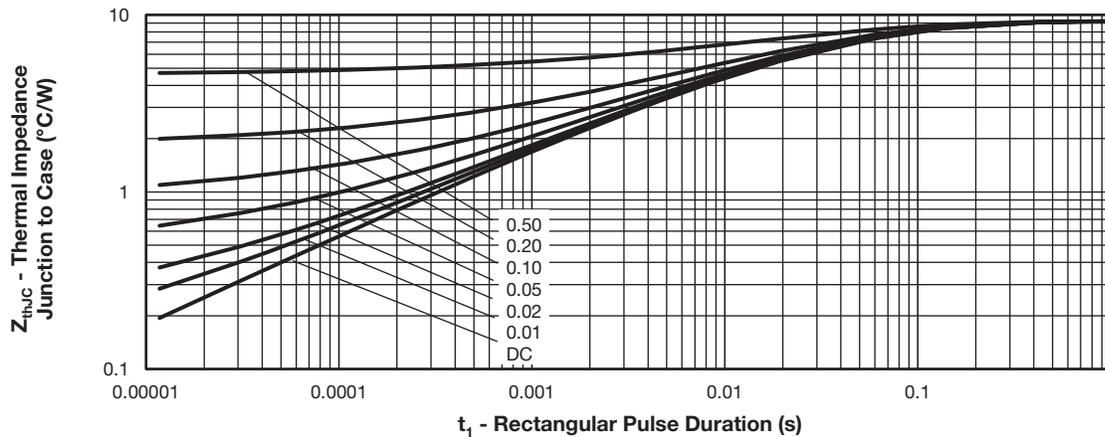


Fig. 4 - Transient Thermal Impedance, Junction to Case

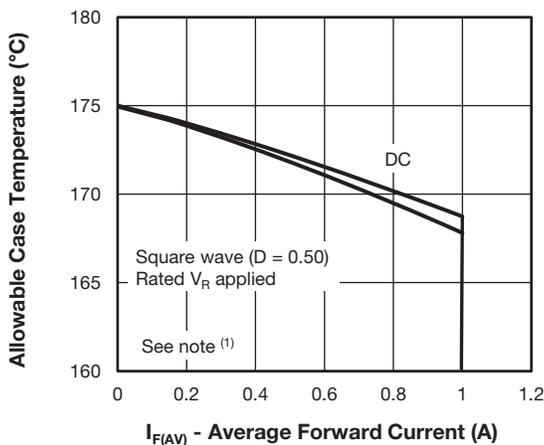


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

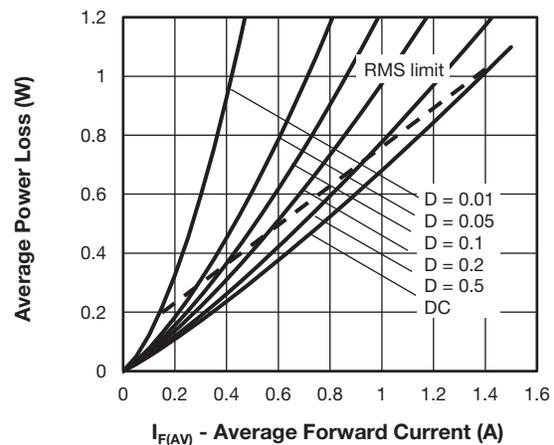


Fig. 6 - Forward Power Loss Characteristics

**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. 5);  
 $P_{dREV}$  = inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1}$  = rated  $V_R$

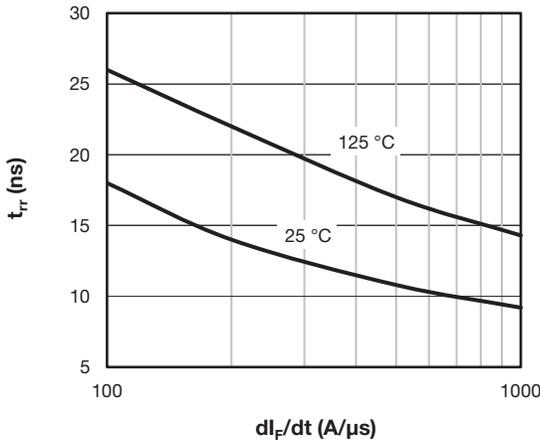


Fig. 7 - Typical Reverse Recovery Time vs.  $di_F/dt$

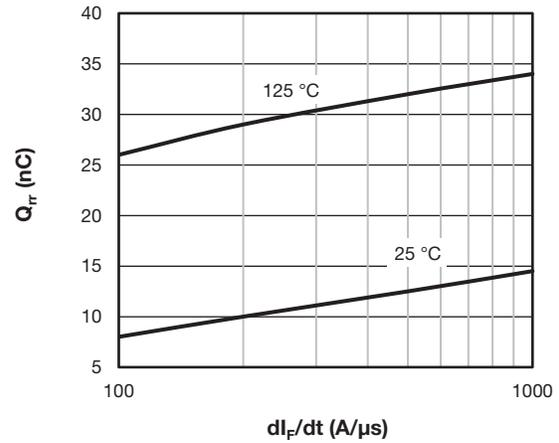
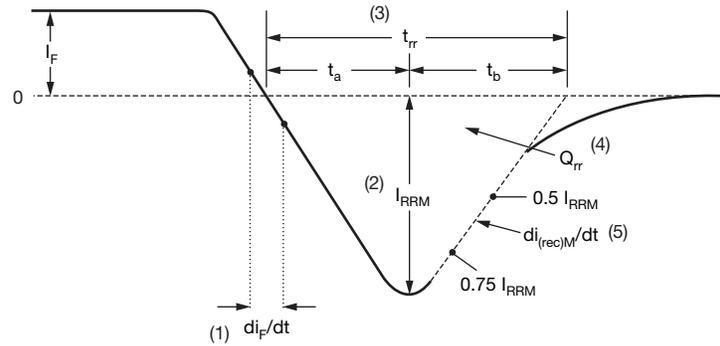


Fig. 8 - Typical Stored Charge vs.  $di_F/dt$



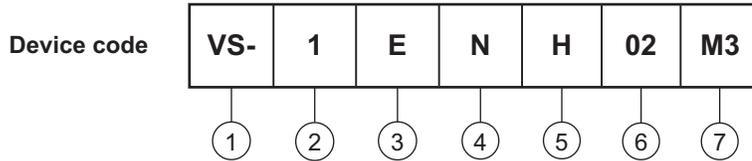
- (1)  $di_F/dt$  - rate of change of current through zero crossing
- (2)  $I_{RRM}$  - peak reverse recovery current
- (3)  $t_{rr}$  - reverse recovery time measured from zero crossing point of negative going  $I_F$  to point where a line passing through  $0.75 I_{RRM}$  and  $0.50 I_{RRM}$  extrapolated 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 (1 = 1 A)
- 3** - Circuit configuration:  
E = single diode
- 4** - N = SMP package
- 5** - Process type,  
H = ultrafast recovery
- 6** - Voltage code (02 = 200 V)
- 7** - M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

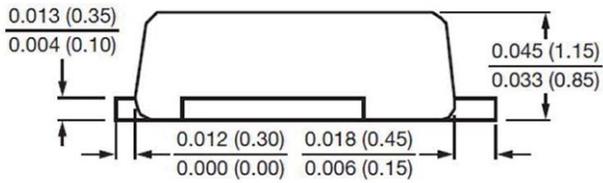
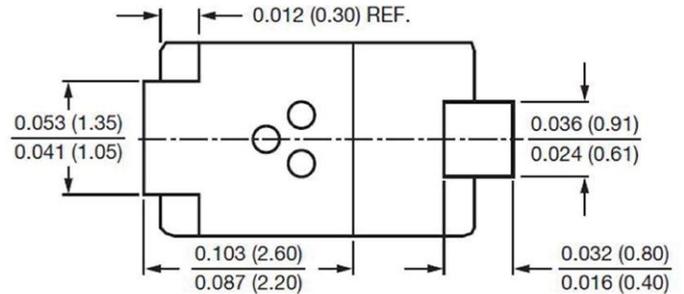
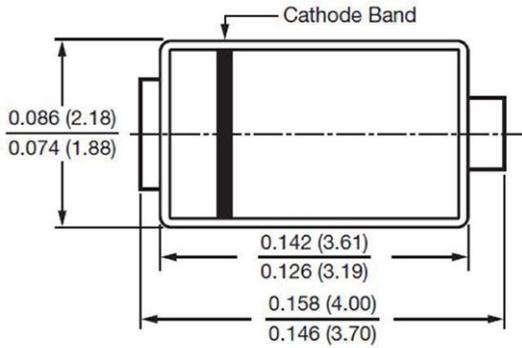
ORDERING INFORMATION (Example)			
PREFERRED P/N	PREFERRED PACKAGE CODE	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-1ENH01-M3/84A	84A	3000	7" diameter plastic tape and reel
VS-1ENH01-M3/85A	85A	10 000	13" diameter plastic tape and reel
VS-1ENH02-M3/84A	84A	3000	7" diameter plastic tape and reel
VS-1ENH02-M3/85A	85A	10 000	13" diameter plastic tape and reel

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?96547">www.vishay.com/doc?96547</a>
Part marking information	<a href="http://www.vishay.com/doc?96574">www.vishay.com/doc?96574</a>
Packaging information	<a href="http://www.vishay.com/doc?88869">www.vishay.com/doc?88869</a>
SPICE model	<a href="http://www.vishay.com/doc?96550">www.vishay.com/doc?96550</a>

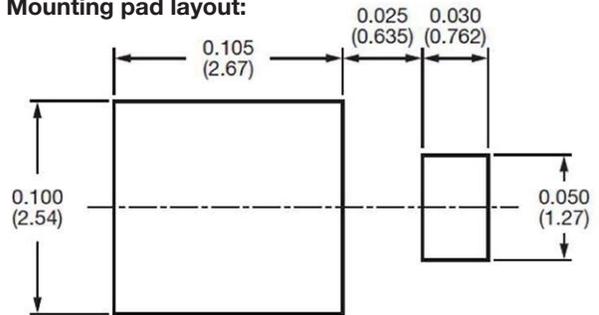


## SMP (DO-220AA)

**DIMENSIONS** in inches (millimeters)



### Mounting pad layout:





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