

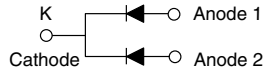


**THE DATASHEET OF  
VS-4CSH02HM3/86A**



## Hyperfast Rectifier, 2 x 2 A FRED Pt<sup>®</sup>

**eSMP<sup>®</sup> Series**

**SMPC (TO-277A)**

**LINKS TO ADDITIONAL RESOURCES**

**FEATURES**

- Hyperfast recovery time, reduced  $Q_{rr}$ , and soft recovery
- 175 °C maximum operating junction temperature
- Specified for output and snubber operation
- Low forward voltage drop
- Low leakage current
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- AEC-Q101 qualified, meets JESD 201 class 2 whisker test
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

**DESCRIPTION / APPLICATIONS**

State of the art hyperfast recovery rectifiers specifically designed with optimized performance of forward voltage drop and hyperfast 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 snubber, boost, lighting, piezo-injection, as high frequency rectifiers, and freewheeling diodes.

The extremely optimized stored charge and low recovery current minimize the switching losses and reduce power dissipation in the switching element.

**MECHANICAL DATA**

**Case:** SMPC (TO-277A)

Molding compound meets UL 94 V-0 flammability rating  
Halogen-free, RoHS compliant

**Terminals:** matte tin plated leads, solderable per J-STD-002

**PRIMARY CHARACTERISTICS**

$I_{F(AV)}$	2 x 2 A
$V_R$	200 V
$V_F$ at $I_F$	0.75 V
$t_{rr}$ (typ.)	24 ns
$T_J$ max.	175 °C
Package	SMPC (TO-277A)
Circuit configuration	Common cathode

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Peak repetitive reverse voltage	$V_{RRM}$		200	V
Average rectified forward current	$I_{F(AV)}$	$T_{Sp} = 165$ °C	4	A
per device			2	
Non-repetitive peak surge current	$I_{FSM}$	$T_J = 25$ °C	90	
per diode			50	
Operating junction and storage temperatures	$T_J, T_{Stg}$		-65 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	200	-	-	V
Forward voltage, per diode	$V_F$	$I_F = 2$ A	-	0.88	0.95	
		$I_F = 2$ A, $T_J = 125$ °C	-	0.75	0.82	
Reverse leakage current, per diode	$I_R$	$V_R = V_R$ rated	-	-	2	$\mu$ A
		$T_J = 125$ °C, $V_R = V_R$ rated	-	1	8	
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	$t_{rr}$	$I_F = 1.0\text{ A}$ , $di_F/dt = 50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	24	-	ns	
		$I_F = 0.5\text{ A}$ , $I_R = 1\text{ A}$ , $I_{rr} = 0.25\text{ A}$	-	-	25		
		$T_J = 25\text{ }^\circ\text{C}$	-	16	-		
		$T_J = 125\text{ }^\circ\text{C}$	-	22	-		
Peak recovery current	$I_{RRM}$	$I_F = 2\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 160\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	2	-	A
			$T_J = 125\text{ }^\circ\text{C}$	-	3	-	
Reverse recovery charge	$Q_{rr}$		$T_J = 25\text{ }^\circ\text{C}$	-	16	-	nC
			$T_J = 125\text{ }^\circ\text{C}$	-	30	-	

<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 mount, per diode	$R_{thJM}$		-	4.5	5.5	$^\circ\text{C}/\text{W}$
Approximate weight			0.1			g
			0.0035			oz.
Marking device		Case style SMPC (TO-277A)	JCH2			

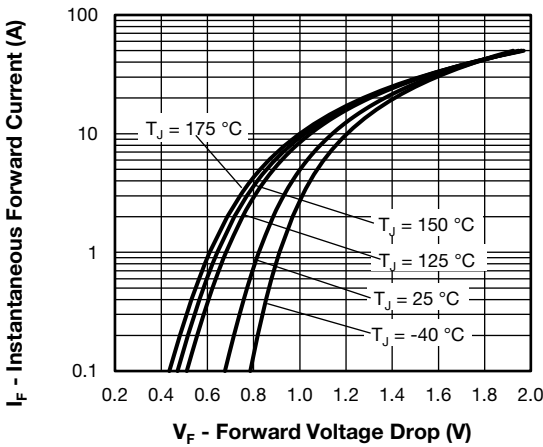


Fig. 1 - Typical Forward Voltage Drop Characteristics

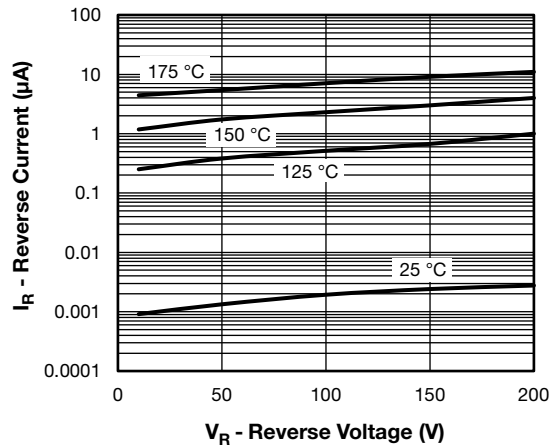


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

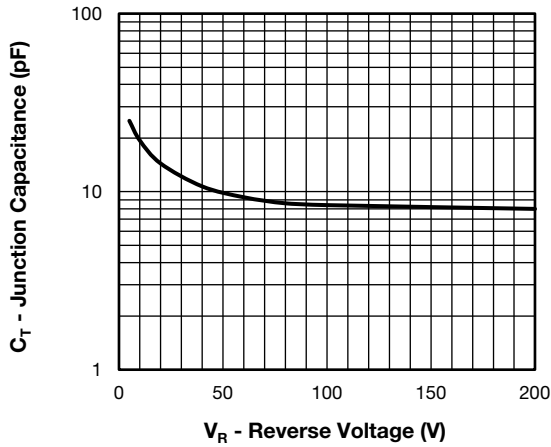


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

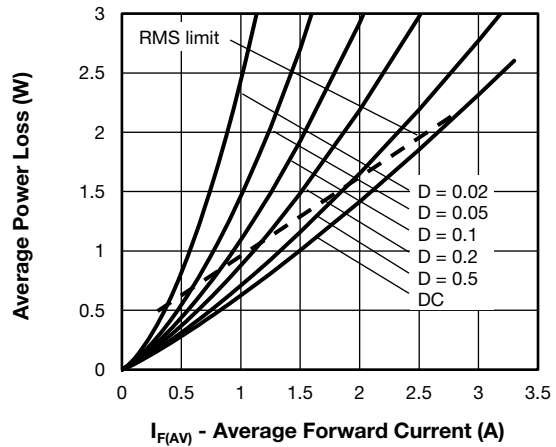


Fig. 5 - Forward Power Loss Characteristics

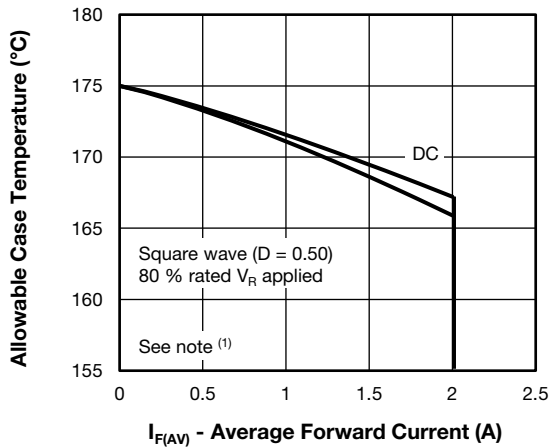


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

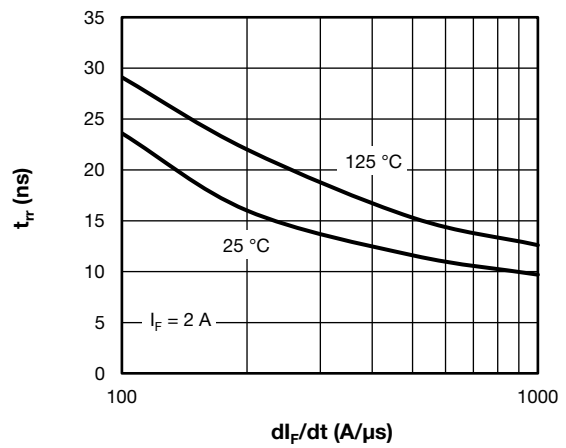


Fig. 6 - Typical Reverse Recovery Time vs.  $di_F/dt$

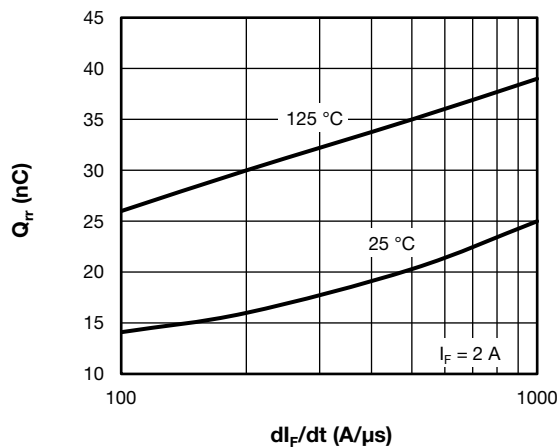
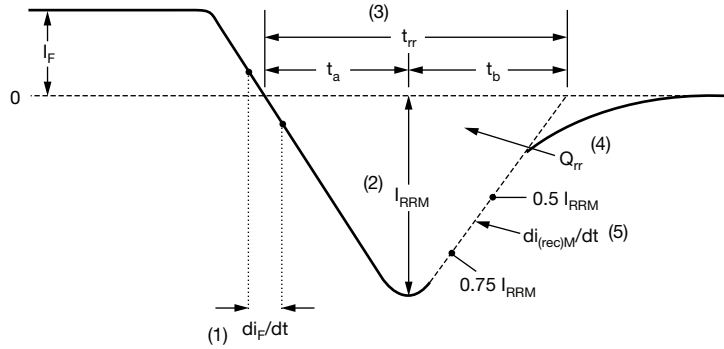


Fig. 7 - Typical Stored Charge vs.  $di_F/dt$

**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. 5);  
 $Pd_{REV}$  = 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)  $Q_{rr}$  - 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. 8 - Reverse Recovery Waveform and Definitions

**ORDERING INFORMATION TABLE**

Device code	<b>VS-</b>	<b>4</b>	<b>C</b>	<b>S</b>	<b>H</b>	<b>02</b>	<b>H</b>	<b>M3</b>
	1	2	3	4	5	6	7	8

- 1** - Vishay Semiconductors product
- 2** - Current rating (4 = 4 A)
- 3** - Circuit configuration:  
C = common cathode
- 4** - S = SMPC package
- 5** - Process type,  
H = hyper fast recovery
- 6** - Voltage code (02 = 200 V)
- 7** - H = AEC-Q101 qualified
- 8** - M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

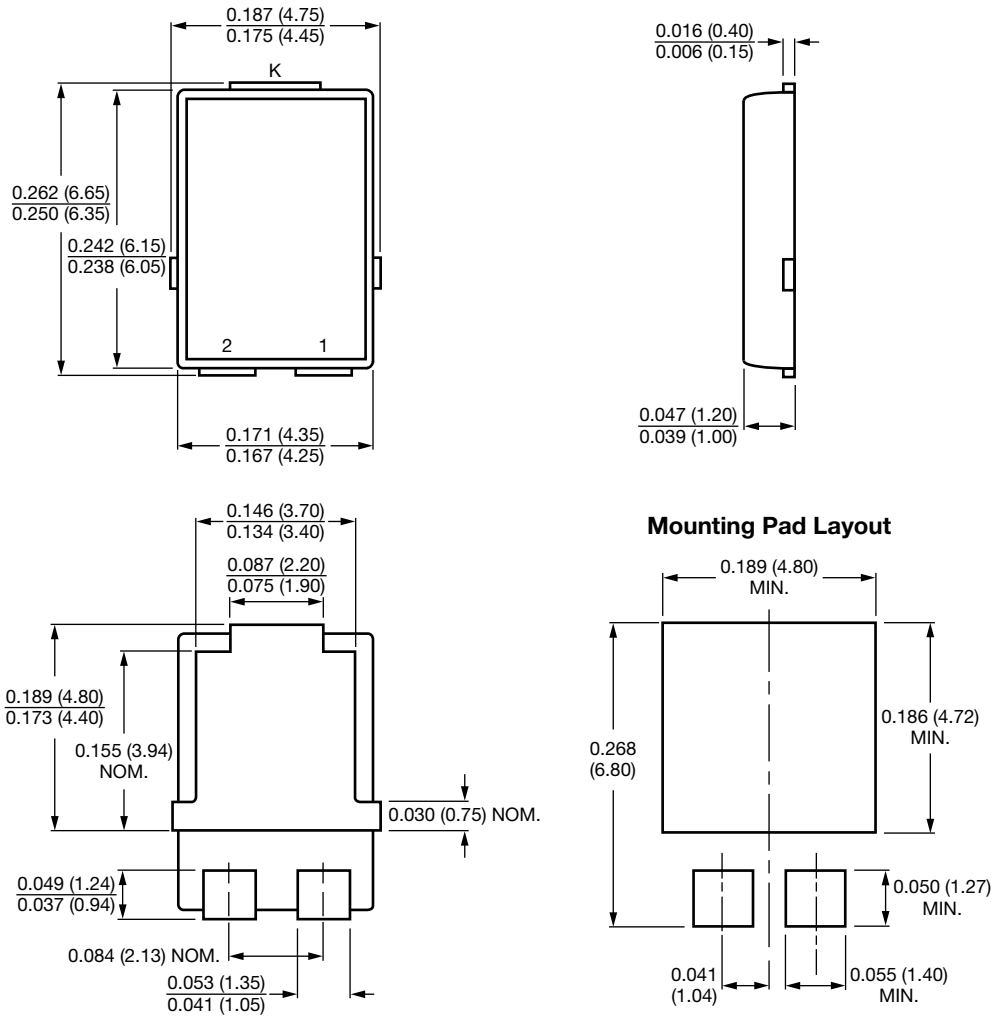
<b>ORDERING INFORMATION (Example)</b>			
PREFERRED P/N	QUANTITY PER REEL	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-4CSH02HM3/86A	1500	1500	7" diameter plastic tape and reel
VS-4CSH02HM3/87A	6500	6500	13" diameter plastic tape and reel

<b>LINKS TO RELATED DOCUMENTS</b>	
Dimensions	<a href="http://www.vishay.com/doc?95570">www.vishay.com/doc?95570</a>
Part marking information	<a href="http://www.vishay.com/doc?95565">www.vishay.com/doc?95565</a>
Packaging information	<a href="http://www.vishay.com/doc?88869">www.vishay.com/doc?88869</a>



## SMPC (TO-277A)

**DIMENSIONS** in inches (millimeters)



Conform to JEDEC® TO-277A



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