



## Ultrafast Rectifier, 3 A FRED Pt<sup>®</sup>



SMA (DO-214AC)



### FEATURES

- Ultrafast recovery time, reduced  $Q_{rr}$  and soft recovery
- 175 °C maximum operating junction temperature
- For PFC CRM/CCM, snubber operation
- Low forward voltage drop
- Low leakage current
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- 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

State of the art ultrafast recovery rectifiers designed with optimized performance of forward voltage drop, ultrafast recovery time, and soft recovery.

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 PFC Boost stage in the AC/DC section of SMPS, inverters or as freewheeling diodes.

Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

### PRODUCT SUMMARY

Package	SMA (DO-214AC)
$I_{F(AV)}$	3 A
$V_R$	600 V
$V_F$ at $I_F$	1.35 V
$t_{rr}$ typ.	41 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	$I_{F(AV)}$	$T_L = 103\text{ °C}^{(1)}$	3	
Non-repetitive peak surge current per leg	$I_{FSM}$	$T_J = 25\text{ °C}$	55	A
Operating junction and storage temperatures	$T_J, T_{Stg}$		- 55 to 175	°C

#### Note

<sup>(1)</sup> Mounted on PCB with minimum pad size

### ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ °C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	$V_{BR}, V_R$	$I_R = 100\ \mu\text{A}$	600	-	-	V
Forward voltage	$V_F$	$I_F = 3\text{ A}$	-	1.15	1.35	
		$I_F = 3\text{ A}, T_J = 150\text{ °C}$	-	0.99	1.2	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	-	3	$\mu\text{A}$
		$T_J = 150\text{ °C}, V_R = V_R$ rated	-	-	100	
Junction capacitance	$C_T$	$V_R = 600\text{ V}$	-	3.9	-	pF



DYNAMIC RECOVERY CHARACTERISTICS ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS	
Reverse recovery time	$t_{rr}$	$I_F = 1.0\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	41	-	ns	
		$I_F = 1.0\text{ A}$ , $di_F/dt = 50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	52	-		
		$I_F = 0.5\text{ A}$ , $I_R = 1\text{ A}$ , $I_{rr} = 0.25\text{ A}$	-	-	65		
		$T_J = 25\text{ }^\circ\text{C}$	-	38	-		
		$T_J = 125\text{ }^\circ\text{C}$	-	52	-		
Peak recovery current	$I_{RRM}$	$I_F = 3\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 390\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	5.6	-	A
			$T_J = 125\text{ }^\circ\text{C}$	-	7.3	-	
			$T_J = 25\text{ }^\circ\text{C}$	-	108	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	$T_J = 25\text{ }^\circ\text{C}$	-	193	-	nC
			$T_J = 125\text{ }^\circ\text{C}$	-	-	-	

THERMAL - MECHANICAL SPECIFICATIONS						
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 to case	$R_{thJC}^{(1)}$		-	-	20	$^\circ\text{C}/\text{W}$
Thermal resistance, junction to ambient	$R_{thJA}^{(1)}$		-	-	95	
Approximate Weight			0.07			g
			0.002			oz.
Marking device		Case style SMA (DO-214AC)	3U6			

**Note**

(1) Mounted on PCB with minimum pad size

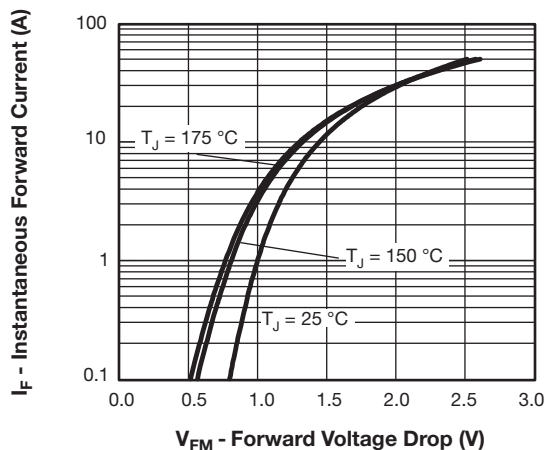


Fig. 1 - Typical Forward Voltage Drop Characteristics

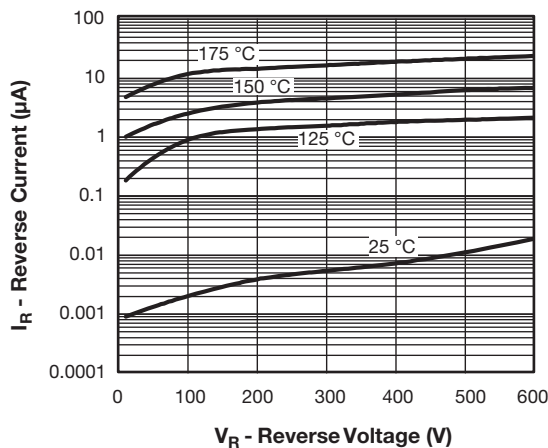


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

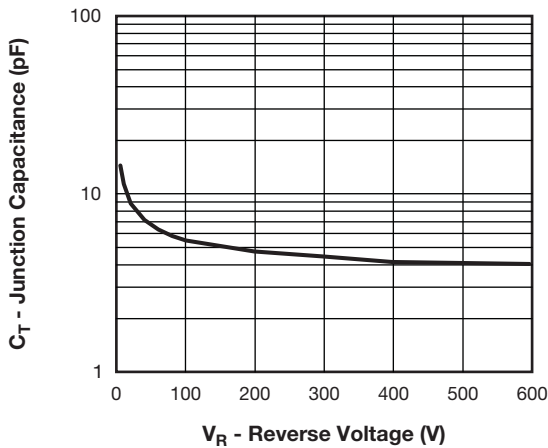


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

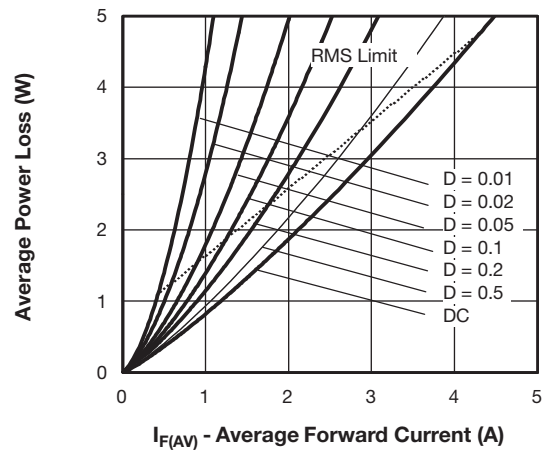


Fig. 5 - Forward Power Loss Characteristics

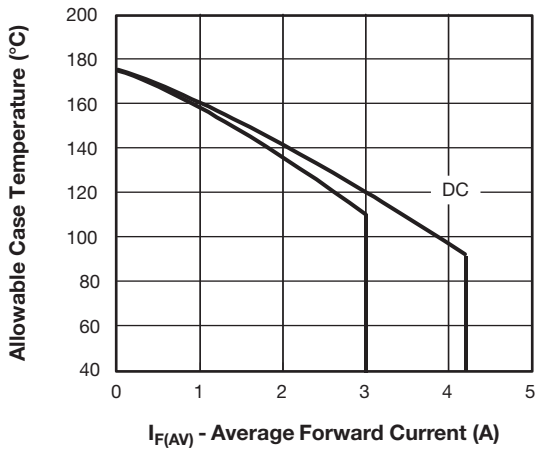


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

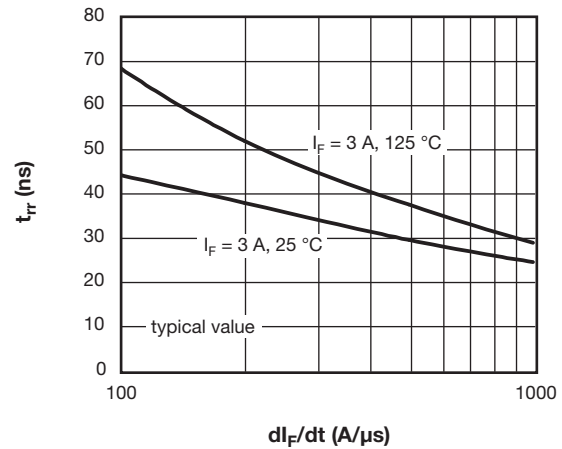


Fig. 6 - Typical Reverse Recovery Time vs.  $di_F/dt$

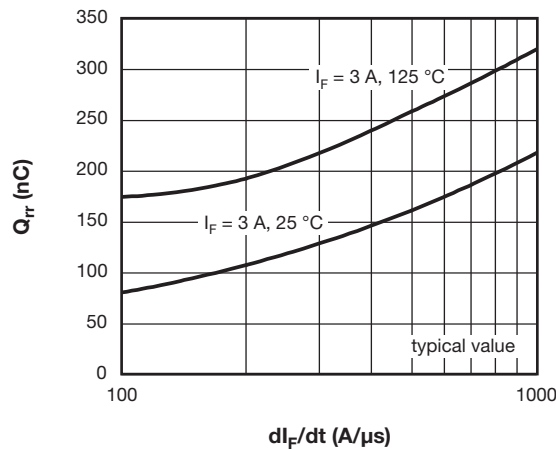
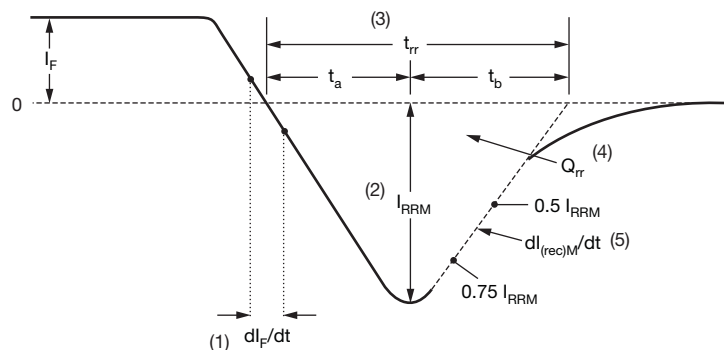


Fig. 7 - Typical Stored Charge vs.  $di_F/dt$



- (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>3</b>	<b>E</b>	<b>M</b>	<b>U</b>	<b>06</b>	<b>-M3</b>
	1	2	3	4	5	6	7

- 1** - Vishay Semiconductors product
- 2** - Current rating (3 = 3 A)
- 3** - Circuit configuration:  
E = Single diode
- 4** - M = SMA package
- 5** - Process type,  
U = Ultrafast recovery
- 6** - Voltage code (06 = 600 V)
- 7** - 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-3EMU06-M3/5AT	5AT	7500	13" diameter plastic tape and reel

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95400">www.vishay.com/doc?95400</a>
Part marking information	<a href="http://www.vishay.com/doc?95472">www.vishay.com/doc?95472</a>
Packaging information	<a href="http://www.vishay.com/doc?95404">www.vishay.com/doc?95404</a>

## SMA

**DIMENSIONS** in inches (millimeters)





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