

## Ultrafast Rectifier, 4 A FRED Pt®


**SMB (DO-214AA)**


### 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
- 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**

### LINKS TO ADDITIONAL RESOURCES



### PRIMARY CHARACTERISTICS

|                       |                |
|-----------------------|----------------|
| $I_{F(AV)}$           | 4 A            |
| $V_R$                 | 600 V          |
| $V_F$ at $I_F$        | 0.94 V         |
| $t_{rr}$ typ.         | 45 ns          |
| $T_J$ max.            | 175 °C         |
| Package               | SMB (DO-214AA) |
| Circuit configuration | Single         |

### DESCRIPTION / APPLICATIONS

State of the art ultrafast recovery rectifiers designed with optimized performance of forward voltage drop, ultrafast recovery time, and fast 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 power dissipation in the switching element and snubbers.

### MECHANICAL DATA

**Case:** SMB (DO-214AA)

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

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

**Polarity:** color band denotes the cathode end

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                   | SYMBOL            | TEST CONDITIONS                  | VALUES      | UNITS |
|---|-------------------|----------------------------------|-------------|-------|
| Peak repetitive reverse voltage             | $V_{RRM}$         |                                  | 600         | V     |
| Average rectified forward current           | $I_{F(AV)}$       | $T_L = 103$ °C <sup>(1)</sup>    | 4           | A     |
| Non-repetitive peak surge current           | $I_{FSM}$         | $T_J = 25$ °C, 6 ms square pulse | 100         |       |
| 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 ( $T_J = 25$ °C unless otherwise specified)

| PARAMETER                           | SYMBOL           | TEST CONDITIONS                   | MIN. | TYP. | MAX. | UNITS |
|-------------------------------------|------------------|-----------------------------------|------|------|------|-------|
| Breakdown voltage, blocking voltage | $V_{BR}$ , $V_R$ | $I_R = 100$ µA                    | 600  | -    | -    | V     |
| Forward voltage                     | $V_F$            | $I_F = 4$ A                       | -    | 1.12 | 1.3  |       |
|                                     |                  | $I_F = 4$ A, $T_J = 150$ °C       | -    | 0.94 | 1.15 |       |
| Reverse leakage current             | $I_R$            | $V_R = V_R$ rated                 | -    | -    | 3    | µA    |
|                                     |                  | $T_J = 150$ °C, $V_R = V_R$ rated | -    | -    | 100  |       |
| Junction capacitance                | $C_T$            | $V_R = 600$ V                     | -    | 6.8  | -    | pF    |

**DYNAMIC RECOVERY CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise specified)**

| PARAMETER               | SYMBOL    | TEST CONDITIONS  | MIN. | TYP. | MAX. | UNITS |
|-------------------------|-----------|--|------|------|------|-------|
| Reverse recovery time   | $t_{rr}$  | $I_F = 1.0 \text{ A}$ , $dI_F/dt = 100 \text{ A}/\mu\text{s}$ , $V_R = 30 \text{ V}$ | -    | 45   | -    | ns    |
|                         |           | $I_F = 1.0 \text{ A}$ , $dI_F/dt = 50 \text{ A}/\mu\text{s}$ , $V_R = 30 \text{ V}$  | -    | 50   | -    |       |
|                         |           | $I_F = 0.5 \text{ A}$ , $I_R = 1 \text{ A}$ , $I_{rr} = 0.25 \text{ A}$              | -    | -    | 65   |       |
|                         |           | $T_J = 25^\circ\text{C}$   | -    | 39   | -    |       |
|                         |           | $T_J = 125^\circ\text{C}$  | -    | 61   | -    |       |
| Peak recovery current   | $I_{RRM}$ | $T_J = 25^\circ\text{C}$   | -    | 5.8  | -    | A     |
|                         |           | $T_J = 125^\circ\text{C}$  | -    | 7.7  | -    |       |
| Reverse recovery charge | $Q_{rr}$  | $T_J = 25^\circ\text{C}$   | -    | 119  | -    | nC    |
|                         |           | $T_J = 125^\circ\text{C}$  | -    | 251  | -    |       |

**THERMAL - MECHANICAL SPECIFICATIONS**

| PARAMETER                                      | SYMBOL            | TEST CONDITIONS           | MIN. | TYP.  | MAX. | UNITS |
|--|-------------------|---------------------------|------|-------|------|-------|
| Maximum junction and storage temperature range | $T_J$ , $T_{Stg}$ |                           | -55  | -     | +175 | °C    |
| Thermal resistance, junction to mount          | $R_{thJM}^{(1)}$  |                           | -    | -     | 18   | °C/W  |
| Thermal resistance, junction to ambient        | $R_{thJA}^{(1)}$  |                           | -    | -     | 90   |       |
| Approximate Weight                             |                   |                           |      | 0.1   |      | g     |
| Marking device                                 |                   | Case style SMB (DO-214AA) |      | 0.003 |      | oz.   |
|  |                   |                           |      |       | 4U6  |       |

**Note**

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

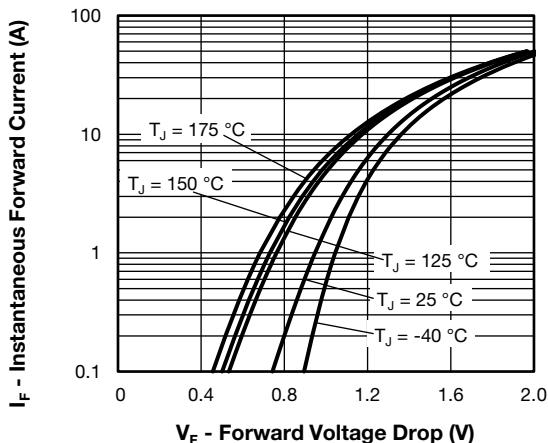


Fig. 1 - Typical Forward Voltage Drop Characteristics

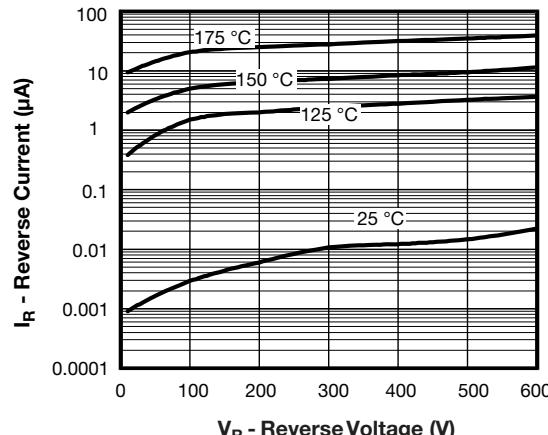


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

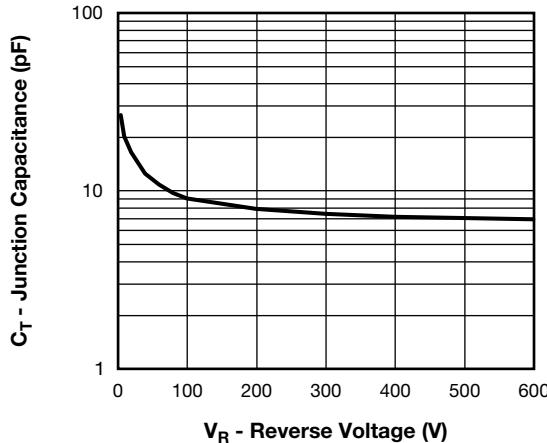


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

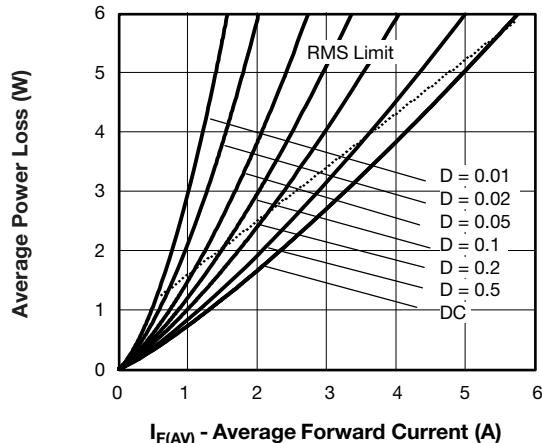


Fig. 5 - Forward Power Loss Characteristics

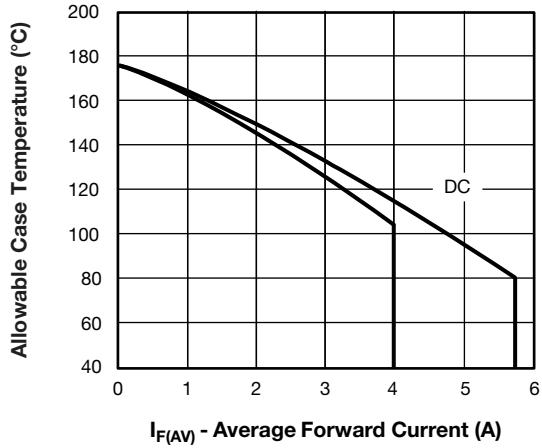


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

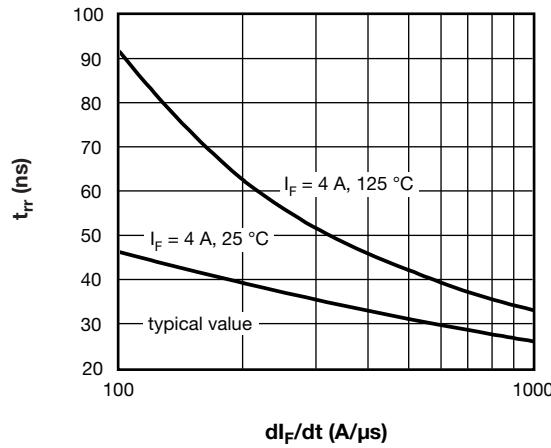


Fig. 6 - Typical Reverse Recovery Time vs.  $dI_F/dt$

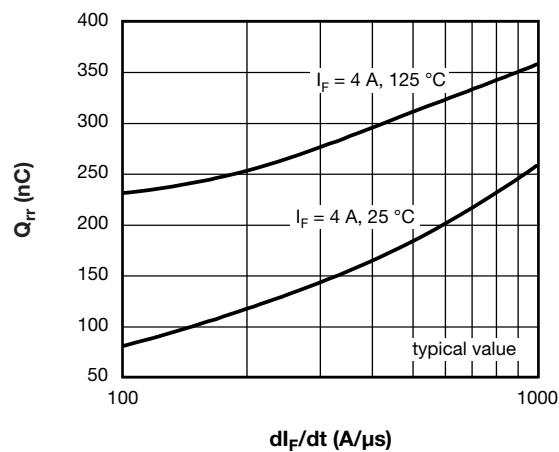
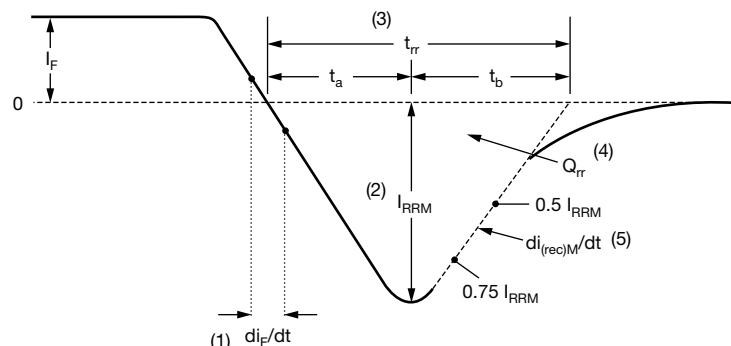


Fig. 7 - Typical Stored Charge vs.  $dI_F/dt$



(1)  $di_F/dt$  - rate of change of current through zero crossing

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

(2)  $I_{RRM}$  - peak reverse recovery current

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

(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.

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

Fig. 8 - Reverse Recovery Waveform and Definitions

## ORDERING INFORMATION TABLE

|             |                             |
|-------------|-----------------------------|
| Device code | <b>VS- 4 E G U 06 -M3</b>   |
|             | (1) (2) (3) (4) (5) (6) (7) |

- 1** - Vishay Semiconductors product
- 2** - Current rating (4 = 4 A)
- 3** - Circuit configuration:  
E = single diode
- 4** - G = SMB 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)

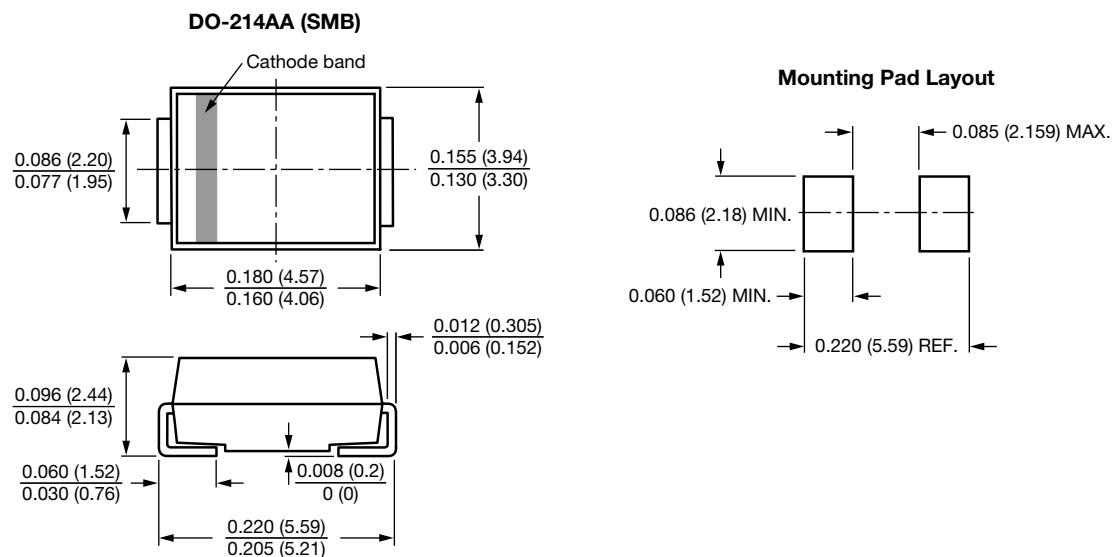
| PREFERRED P/N    | QUANTITY PER TUBE | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION              |
|------------------|-------------------|------------------------|------------------------------------|
| VS-4EGU06-M3/5BT | 5BT               | 3200                   | 13" diameter plastic tape and reel |

### LINKS TO RELATED DOCUMENTS

|                          |  |
|--------------------------|--|
| Dimensions               | <a href="http://www.vishay.com/doc?95401">www.vishay.com/doc?95401</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> |
| SPICE model              | <a href="http://www.vishay.com/doc?96770">www.vishay.com/doc?96770</a> |

### SMB

#### DIMENSIONS in inches (millimeters)



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