

# Hyperfast Rectifier, 1 A FRED Pt®

**eSMP® Series  
SMF (DO-219AB)**



Top view

Bottom view

Cathode Anode



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

## 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
- 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 as clamp, snubber and freewheeling diode in a flyback aux power supplies, bootstrap and desaturate for HV MOSFET and IGBT driver, high frequency rectifiers in a cuk and sepic circuit for LED lighting.

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

## MECHANICAL DATA

**Case:** SMF (DO-219AB)

Molding compound meets UL 94 V-0 flammability rating

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

**Polarity:** color band denotes cathode end

## LINKS TO ADDITIONAL RESOURCES



3D Models



Application Notes

| PRIMARY CHARACTERISTICS |                |
|-------------------------|----------------|
| $I_{F(AV)}$             | 1 A            |
| $V_R$                   | 1200 V         |
| $V_F$ at $I_F$          | 1.45 V         |
| $t_{rr}$                | 50 ns          |
| $T_J$ max.              | 175 °C         |
| Package                 | SMF (DO-219AB) |
| Circuit configuration   | Single         |

| ABSOLUTE MAXIMUM RATINGS                    |                |                                  |             |       |
|---------------------------------------------|----------------|----------------------------------|-------------|-------|
| PARAMETER                                   | SYMBOL         | TEST CONDITIONS                  | VALUES      | UNITS |
| Peak repetitive reverse voltage             | $V_{RRM}$      |                                  | 1200        | V     |
| Average rectified forward current           | $I_{F(AV)}$    | $T_{Sp} = 135$ °C, DC conduction | 1           | A     |
| Non-repetitive peak surge current           | $I_{FSM}$      | $T_J = 25$ °C, 8.3 ms sine pulse | 14          |       |
| 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               | 1200 | -    | -    | V       |
| Forward voltage, per diode                                            | $V_F$         | $I_F = 1$ A                       | -    | 1.85 | 2.30 |         |
|                                                                       |               | $I_F = 1$ A, $T_J = 125$ °C       | -    | 1.55 | 1.75 |         |
|                                                                       |               | $I_F = 1$ A, $T_J = 150$ °C       | -    | 1.45 | 1.65 |         |
| Reverse leakage current, per diode                                    | $I_R$         | $V_R = V_R$ rated                 | -    | -    | 2    | $\mu$ A |
|                                                                       |               | $T_J = 125$ °C, $V_R = V_R$ rated | -    | -    | 20   |         |
| Junction capacitance                                                  | $C_T$         | $V_R = 1200$ V                    | -    | 3.0  | -    | 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                                                                                    | $t_{rr}$  | $I_F = 0.5\text{ A}$ , $I_R = 1\text{ A}$ , $I_{rr} = 0.25\text{ A}$ | -    | 40   | 50   | ns    |
|                                                                                                          |           | $T_J = 25\text{ }^{\circ}\text{C}$                                   | -    | 91   | -    |       |
|                                                                                                          |           | $T_J = 125\text{ }^{\circ}\text{C}$                                  | -    | 120  | -    |       |
| Peak recovery current                                                                                    | $I_{RRM}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                   | -    | 3.0  | -    | A     |
|                                                                                                          |           | $T_J = 125\text{ }^{\circ}\text{C}$                                  | -    | 4.0  | -    |       |
| Reverse recovery charge                                                                                  | $Q_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$                                   | -    | 105  | -    | nC    |
|                                                                                                          |           | $T_J = 125\text{ }^{\circ}\text{C}$                                  | -    | 200  | -    |       |

| <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 to mount          | $R_{thJM}^{(1)}$ | Device mounted on PCB with 2 x 3.5 mm soldering lands | -     | 23   | 26   | $^{\circ}\text{C/W}$ |
| Thermal resistance, junction to ambient        | $R_{thJA}$       | Device mounted on PCB with recommended pad size       | -     | 125  | -    | $^{\circ}\text{C/W}$ |
| Approximate weight                             |                  |                                                       | 0.015 |      |      | g                    |
| Marking device                                 |                  | Case style SMF (DO-219AB)                             | MRX   |      |      |                      |

**Note**

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

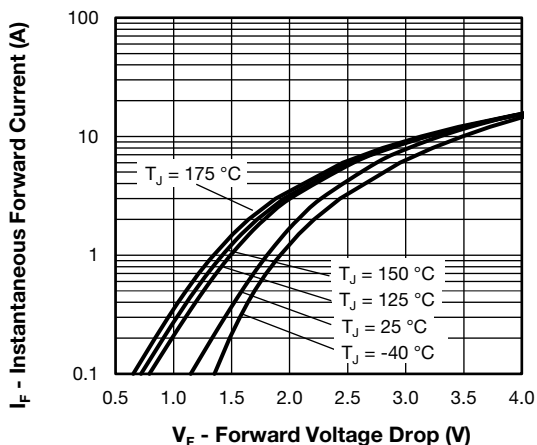


Fig. 1 - Typical Forward Voltage Drop Characteristics

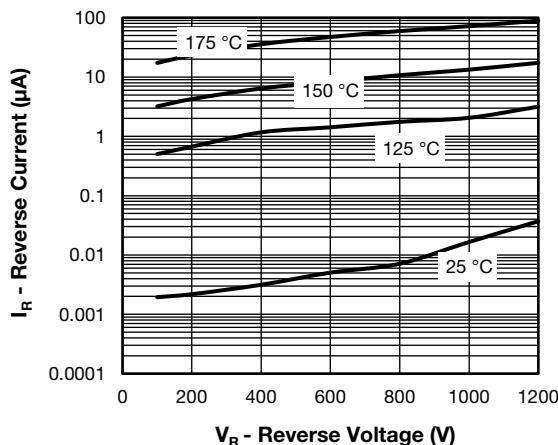


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

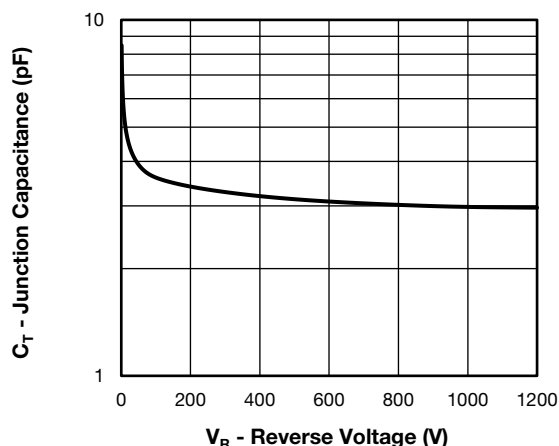


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

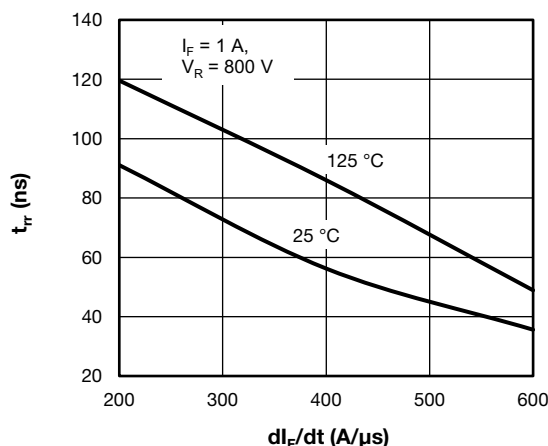


Fig. 6 - Typical Reverse Recovery Time vs.  $dI_F/dt$

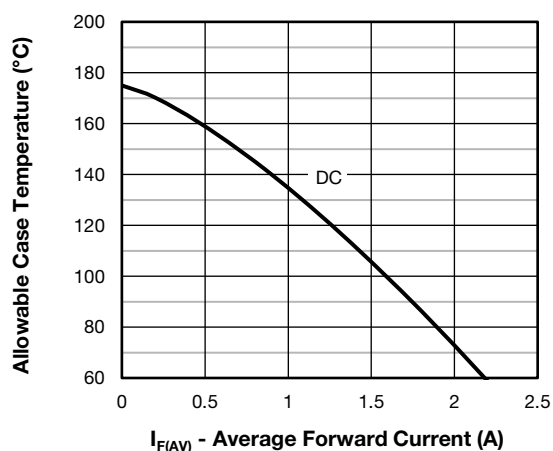


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

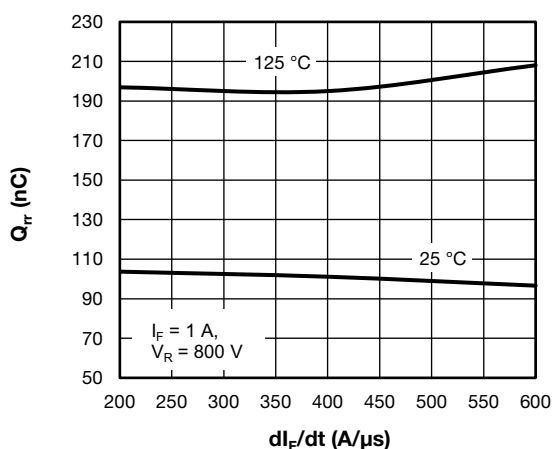


Fig. 7 - Typical Stored Charge vs.  $dI_F/dt$

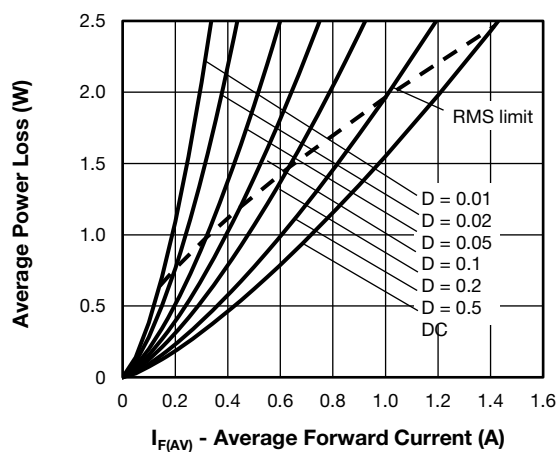


Fig. 5 - Forward Power Loss Characteristics

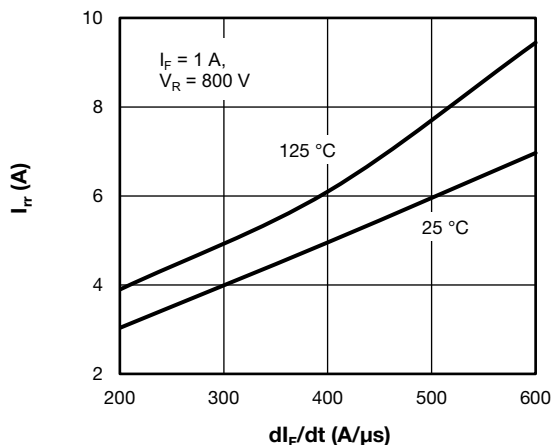


Fig. 8 -  $I_{rr}$  (A) vs.  $dI_F/dt$

#### 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  $V_R$

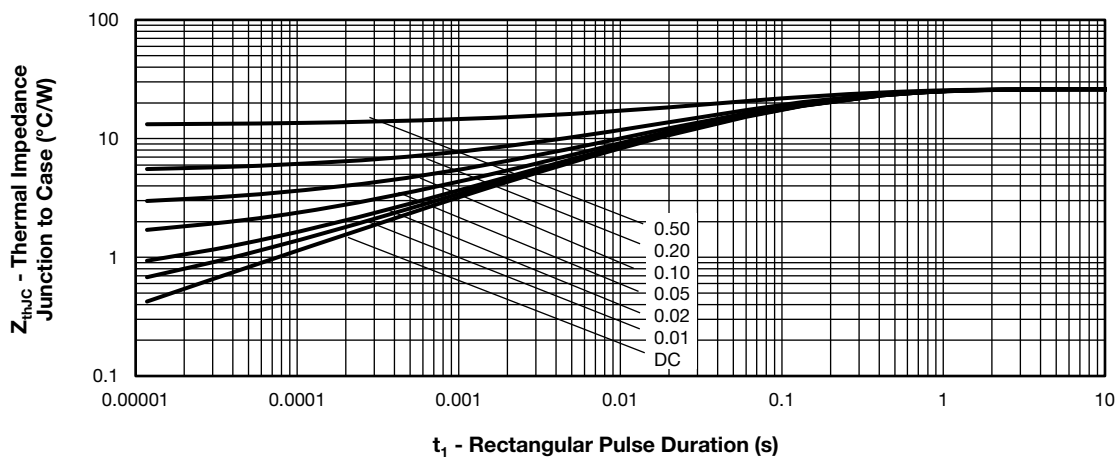


Fig. 9 - Transient Thermal Impedance, Junction to Case

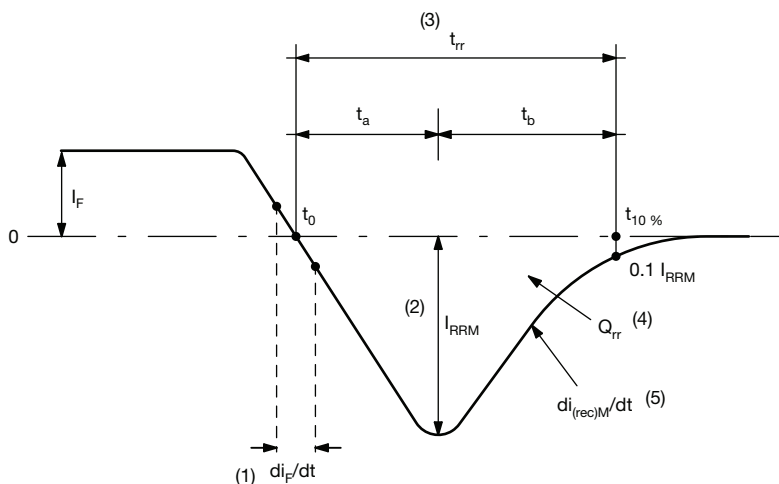


Fig. 10 - Reverse Recovery Waveform and Definitions

#### Notes

- (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  $t_0$ , crossing point of negative going  $I_F$ , to point  $t_{10\%}$ ,  $0.1 I_{RRM}$
- (4)  $Q_{rr}$  - area under curve defined by  $t_0$  and  $t_{10\%}$ 

$$Q_{rr} = \int_{t_0}^{t_{10\%}} I(t) dt$$
- (5)  $di_{(rec)M}/dt$  - peak rate of change of current during  $t_b$  portion of  $t_{rr}$

## ORDERING INFORMATION TABLE

|             |            |          |          |          |          |           |           |            |
|-------------|------------|----------|----------|----------|----------|-----------|-----------|------------|
| Device code | <b>VS-</b> | <b>E</b> | <b>7</b> | <b>F</b> | <b>X</b> | <b>01</b> | <b>12</b> | <b>-M3</b> |
|             | 1          | 2        | 3        | 4        | 5        | 6         | 7         | 8          |

- 1 - Vishay Semiconductors product
- 2 - Circuit configuration:  
E = single diode
- 3 - 7 = FRED generation 7
- 4 - F = SMF package
- 5 - Process type,  
X = hyperfast recovery
- 6 - Current rating (01 = 1 A)
- 7 - Voltage code (12 = 1200 V)
- 8 - -M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

### ORDERING INFORMATION (Example)

| PREFERRED P/N    | QUANTITY PER REEL | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION              |
|------------------|-------------------|------------------------|------------------------------------|
| VS-E7FX0112-M3/I | 10 000            | 10 000                 | 13" diameter plastic tape and reel |

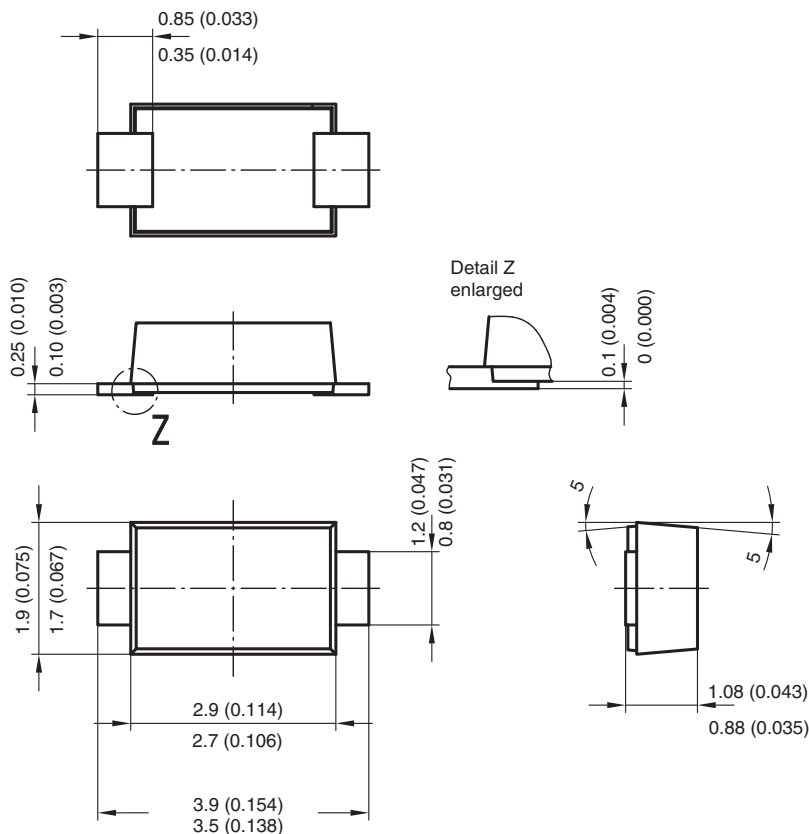
## LINKS TO RELATED DOCUMENTS

|                          |                                                                        |
|--------------------------|------------------------------------------------------------------------|
| Dimensions               | <a href="http://www.vishay.com/doc?95572">www.vishay.com/doc?95572</a> |
| Part marking information | <a href="http://www.vishay.com/doc?95618">www.vishay.com/doc?95618</a> |
| Packaging information    | <a href="http://www.vishay.com/doc?95577">www.vishay.com/doc?95577</a> |
| SPICE model              | <a href="http://www.vishay.com/doc?97264">www.vishay.com/doc?97264</a> |

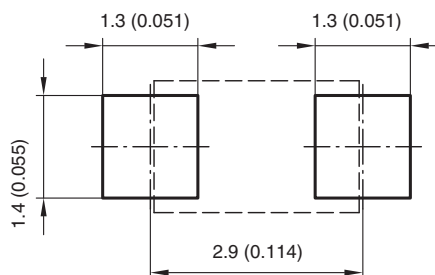


## SMF (DO-219AB)

**DIMENSIONS** in millimeters (inches)



Foot print recommendation:



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17247



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