

# Hyperfast Rectifier, 3 A FRED Pt®



SlimSMA (DO-221AC)



## FEATURES

- Hyperfast recovery time, reduced  $Q_{rr}$ , and soft recovery
- 175 °C maximum operating junction temperature
- Low forward voltage drop
- Low leakage current
- Specific for output and snubber operation
- 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)



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

## 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, 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.

## PRODUCT SUMMARY

|                 |                    |
|-----------------|--------------------|
| Package         | DO-221AC (SlimSMA) |
| $I_{F(AV)}$     | 3 A                |
| $V_R$           | 200 V              |
| $V_F$ at $I_F$  | 0.93 V             |
| $t_{rr}$        | 30 ns              |
| $T_J$ max.      | 175 °C             |
| Diode variation | Single die         |

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                   | SYMBOL         | TEST CONDITIONS             | VALUES      | UNITS |
|---|----------------|-----------------------------|-------------|-------|
| Peak repetitive reverse voltage             | $V_{RRM}$      |                             | 200         | V     |
| Average rectified forward current           | $I_{F(AV)}$    | $T_C = 145\text{ °C}^{(1)}$ | 3           |       |
| Non-repetitive peak surge current           | $I_{FSM}$      | $T_J = 25\text{ °C}$        | 85          | A     |
| Operating junction and storage temperatures | $T_J, T_{Stg}$ |                             | -65 to +175 | °C    |

### Note

<sup>(1)</sup> Device on PCB with 8 mm x 16 mm soldering lands

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

| PARAMETER                           | SYMBOL        | TEST CONDITIONS                         | MIN. | TYP. | MAX. | UNITS         |
|-------------------------------------|---------------|---|------|------|------|---------------|
| Breakdown voltage, blocking voltage | $V_{BR}, V_R$ | $I_R = 100\text{ }\mu\text{A}$          | 200  | -    | -    | V             |
| Forward voltage                     | $V_F$         | $I_F = 3\text{ A}$                      | -    | 0.86 | 0.93 |               |
|                                     |               | $I_F = 3\text{ A}, T_J = 125\text{ °C}$ | -    | 0.74 | 0.78 |               |
| Reverse leakage current             | $I_R$         | $V_R = V_R$ rated                       | -    | -    | 2    | $\mu\text{A}$ |
|                                     |               | $T_J = 125\text{ °C}, V_R = V_R$ rated  | -    | 1    | 8    |               |
| Junction capacitance                | $C_T$         | $V_R = 200\text{ V}$                    | -    | 13   | -    | 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   | $t_{rr}$  | $I_F = 1.0\text{ A}$ , $dI_F/dt = 50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ | -    | 26   | -    | ns    |
|                         |           | $I_F = 0.5\text{ A}$ , $I_R = 1\text{ A}$ , $I_{rr} = 0.25\text{ A}$             | -    | -    | 30   |       |
|                         |           | $T_J = 25\text{ }^{\circ}\text{C}$   | -    | 18   | -    |       |
|                         |           | $T_J = 125\text{ }^{\circ}\text{C}$  | -    | 26   | -    |       |
| Peak recovery current   | $I_{RRM}$ | $T_J = 25\text{ }^{\circ}\text{C}$   | -    | 2.5  | -    | A     |
|                         |           | $T_J = 125\text{ }^{\circ}\text{C}$  | -    | 4    | -    |       |
| Reverse recovery charge | $Q_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$   | -    | 23   | -    | nC    |
|                         |           | $T_J = 125\text{ }^{\circ}\text{C}$  | -    | 50   | -    |       |

**THERMAL - MECHANICAL SPECIFICATIONS**

| 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 case           | $R_{thJC}$        | Device mounted on PCB with 8 mm x 16 mm soldering lands  | -      | -    | 10   | $^{\circ}\text{C}/\text{W}$ |
| Thermal resistance, junction to ambient        | $R_{thJA}$        | Device mounted on PCB with 2 mm x 3.5 mm soldering lands | -      | -    | 110  |                             |
| Approximate Weight                             |                   |  | 0.032  |      |      | g                           |
|  |                   |  | 0.0011 |      |      | oz.                         |
| Marking device                                 |                   | Case style SlimSMA (DO-221AC)                            | 3H2    |      |      |                             |

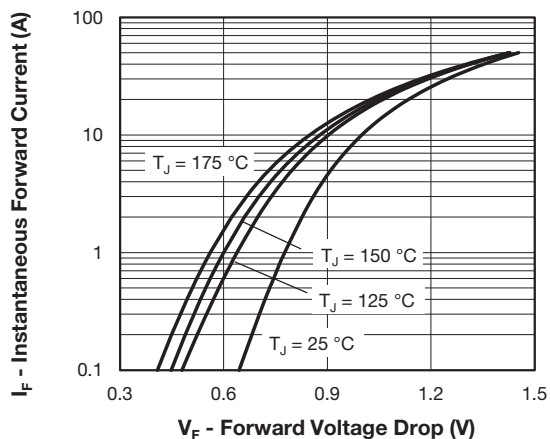


Fig. 1 - Typical Forward Voltage Drop Characteristics

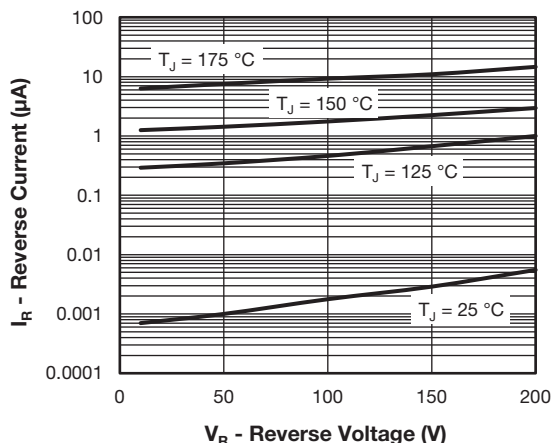


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

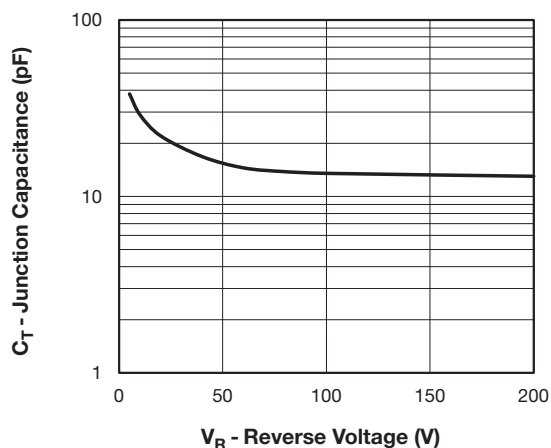


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

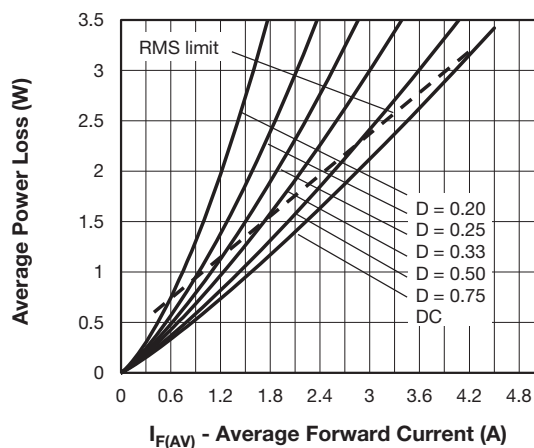


Fig. 5 - Forward Power Loss Characteristics

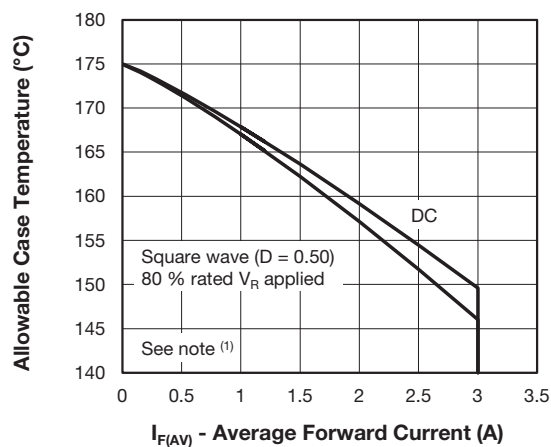
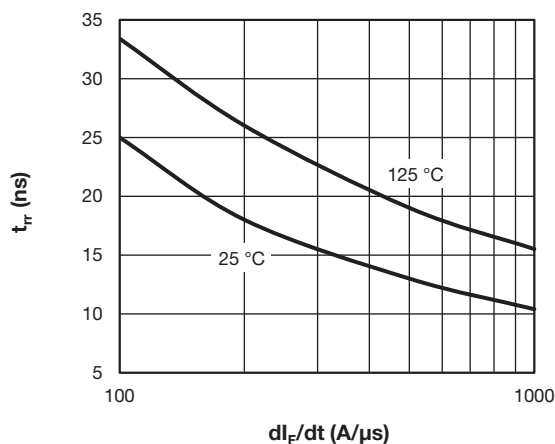
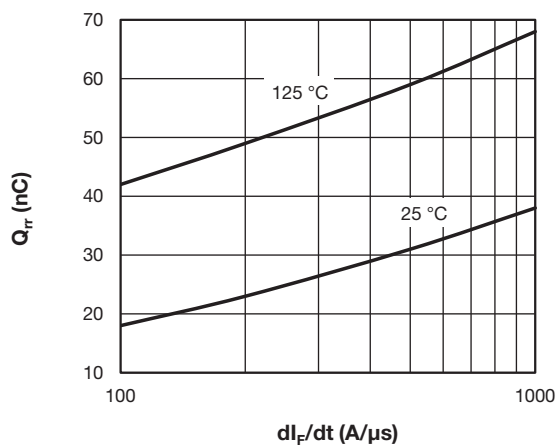
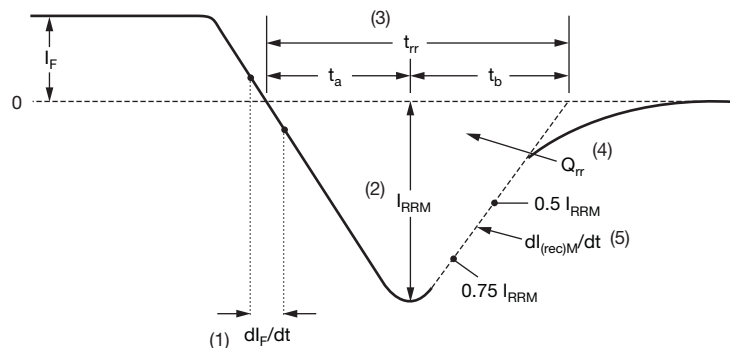


Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current


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

Fig. 7 - Typical Stored Charge 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. 6);  
 $P_{dREV}$  = inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1}$  = rated  $V_R$



(1)  $dl_F/dt$  - 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  $I_{RRM}$

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

(5)  $dl_{(rec)M}/dt$  - 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 | VS- | 3 | E | J | H | 02 | -M3 |
|-------------|-----|---|---|---|---|----|-----|
|             | 1   | 2 | 3 | 4 | 5 | 6  | 7   |

- 1** - Vishay Semiconductors product
- 2** - Current rating (3 = 3 A)
- 3** - Circuit configuration:  
E = single diode
- 4** - J = SlimSMA package
- 5** - Process type,  
H = hyperfast recovery
- 6** - Voltage code (02 = 200 V)
- 7** - -M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

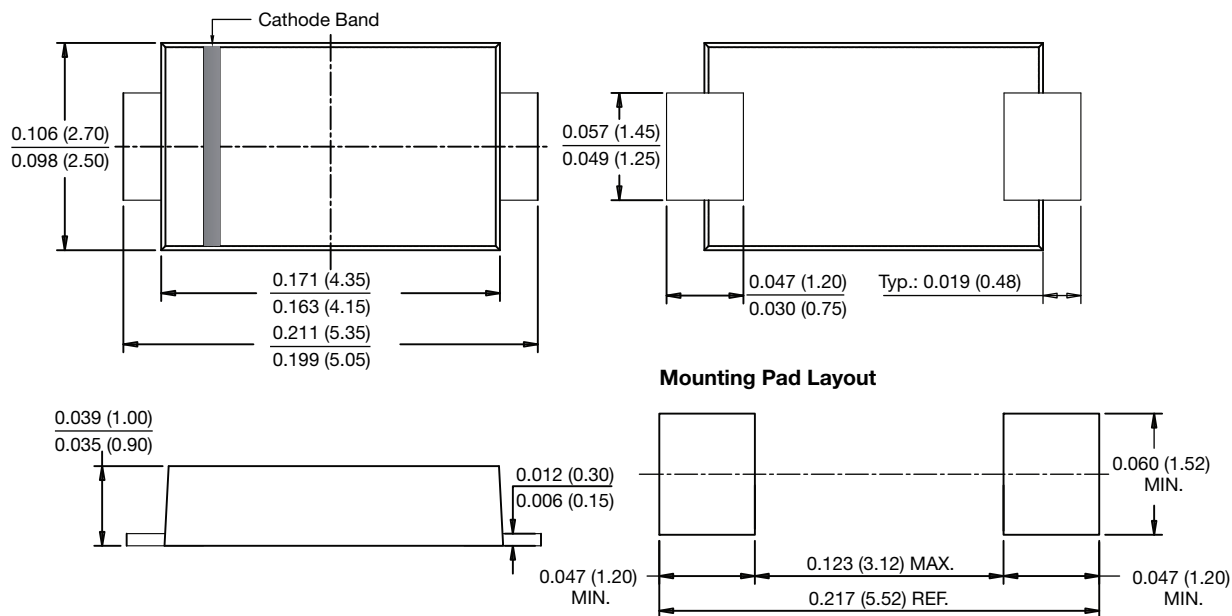
| ORDERING INFORMATION (Example) |                   |                        |                                    |
|--------------------------------|-------------------|------------------------|------------------------------------|
| PREFERRED P/N                  | QUANTITY PER REEL | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION              |
| VS-3EJH02-M3/6A                | 3500              | 3500                   | 7" diameter plastic tape and reel  |
| VS-3EJH02-M3/6B                | 14 000            | 14 000                 | 13" diameter plastic tape and reel |

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| Dimensions                 | <a href="http://www.vishay.com/doc?95571">www.vishay.com/doc?95571</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95562">www.vishay.com/doc?95562</a> |
| Packaging information      | <a href="http://www.vishay.com/doc?88869">www.vishay.com/doc?88869</a> |



## DO-221AC (SlimSMA)

**DIMENSIONS** in inches (millimeters)





## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**