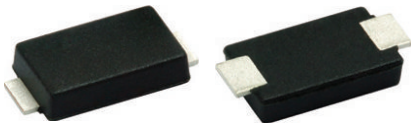
# Ultrafast Rectifier, 3 A FRED Pt®

**eSMP® Series**



Top View Bottom View

**SlimSMA (DO-221AC)**




## FEATURES

- Ultrafast recovery time, reduced $Q_{rr}$, and soft recovery
- 175 °C maximum operating junction temperature
- 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

AUTOMOTIVE GRADE

RoHS COMPLIANT

HALOGEN FREE

## LINKS TO ADDITIONAL RESOURCES

3D Models

## DESCRIPTION / APPLICATIONS

State of the art ultrafast recovery rectifiers designed with optimized performance of forward voltage drop and 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 snubber, output operation, inverters or as 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:** SlimSMA (DO-221AC)
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

| PRIMARY CHARACTERISTICS | |
|---|---|
| $I_{F(AV)}$ | 3 A |
| $V_R$ | 600 V |
| $V_F$ at $I_F$ | 0.99 V |
| $t_{rr}$ | 50 ns |
| $T_J$ max. | 175 °C |
| Package | SlimSMA (DO-221AC) |
| Circuit configuration | Single |

| ABSOLUTE MAXIMUM RATINGS | | | | |
|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Peak repetitive reverse voltage | $V_{RRM}$ | | 600 | V |
| Average rectified forward current | $I_{F(AV)}$ | $T_C$ = 117 °C (1) | 3 | A |
| Non-repetitive peak surge current | $I_{FSM}$ | $T_J$ = 25 °C | 43 | |
| Operating junction and storage temperatures | $T_J$, $T_{Stg}$ | | -55 to +175 | °C |

**Note**

(1) Device on PCB with 8 mm x 16 mm soldering lands

| 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 | $V_F$ | $I_F$ = 3 A | - | 1.15 | 1.35 | |
| | | $I_F$ = 3 A, $T_J$ = 150 °C | - | 0.99 | 1.2 | |
| 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 | - | 6.2 | - | pF |



For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

| DYNAMIC RECOVERY CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 1.0 A, $dI_F/dt$ = 50 A/µs, $V_R$ = 30 V | | - | 45 | - | ns |
| | | $I_F$ = 0.5 A, $I_R$ = 1 A, $I_{rr}$ = 0.25 A | | - | - | 50 | |
| | | $T_J$ = 25 °C | $I_F$ = 3 A<br>$dI_F/dt$ = 500 A/µs<br>$V_R$ = 400 V | - | 52 | - | |
| | | $T_J$ = 125 °C | | - | 82 | - | |
| Peak recovery current | $I_{RRM}$ | $T_J$ = 25 °C | | - | 7.3 | - | A |
| | | $T_J$ = 125 °C | | - | 10 | - | |
| Reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C | | - | 210 | - | nC |
| | | $T_J$ = 125 °C | | - | 400 | - | |

| 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 | $R_{thJM}$ | Device mounted on PCB with 8 mm x 16 mm soldering lands | - | 16 | - | °C/W |
| Thermal resistance, junction to ambient | $R_{thJA}$ | Device mounted on PCB with 3 mm x 3 mm soldering lands | - | 115 | - | |
| Approximate Weight | | | 0.032 | | | g |
| | | | 0.0011 | | | oz. |
| Marking device | | Case style SlimSMA (DO-221AC) | 3U6 | | | |

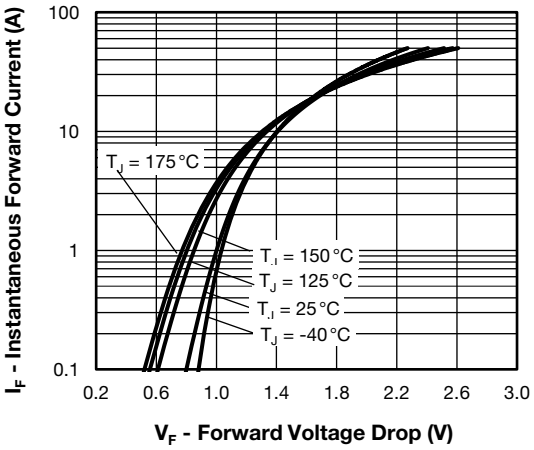



Fig. 1 - Typical Forward Voltage Drop Characteristics

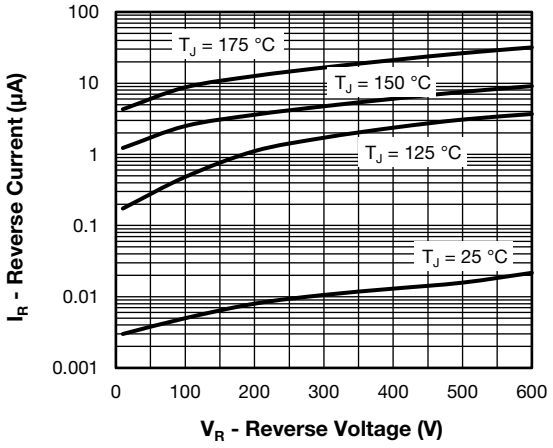



Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

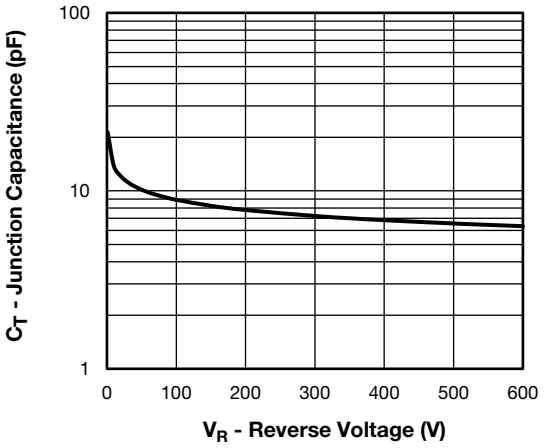



Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

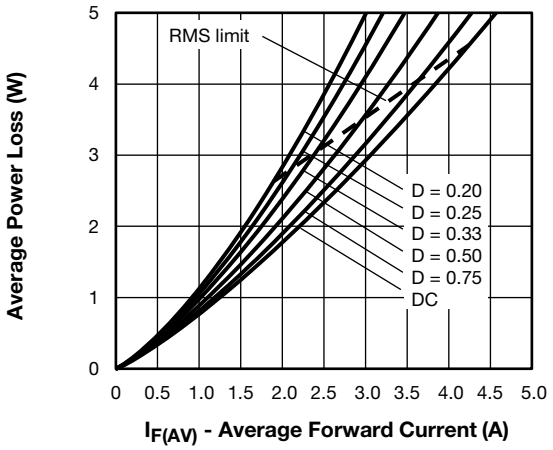



Fig. 5 - Forward Power Loss Characteristics

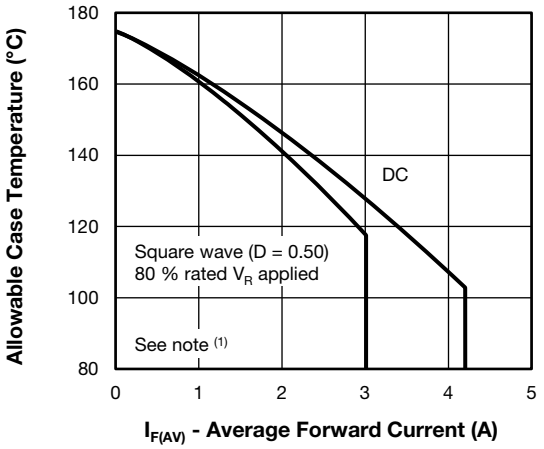



Fig. 4 - Maximum Allowable Case Temperature vs. Average Forward Current

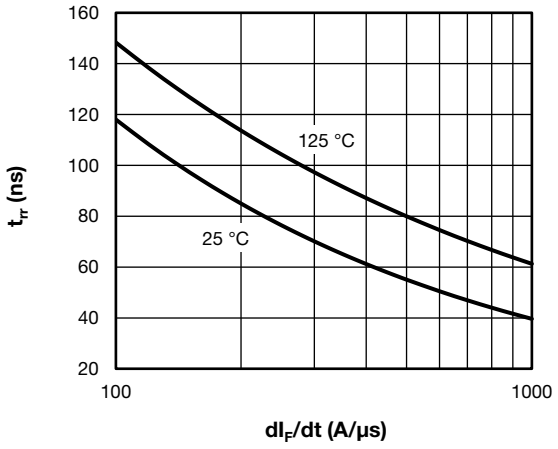



Fig. 6 - Typical Reverse Recovery vs. $dI_F/dt$

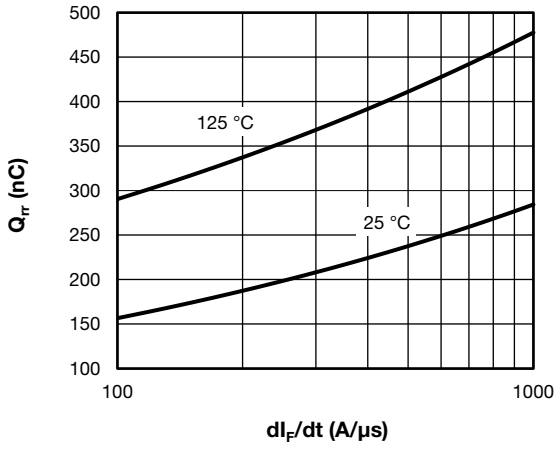



Fig. 7 - Typical Stored Charge vs. $dI_F/dt$

**Note**

(1) Formula used: $T_C = T_J - (Pd + Pd_{REV}) \times R_{thJC}$;
Pd = forward power loss = $I_{F(AV)} \times V_{FM}$ at ($I_{F(AV)}$/D) (see Fig. 6);
$Pd_{REV}$ = inverse power loss = $V_{R1} \times I_R$ (1 - D); $I_R$ at $V_{R1}$ = rated $V_R$


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

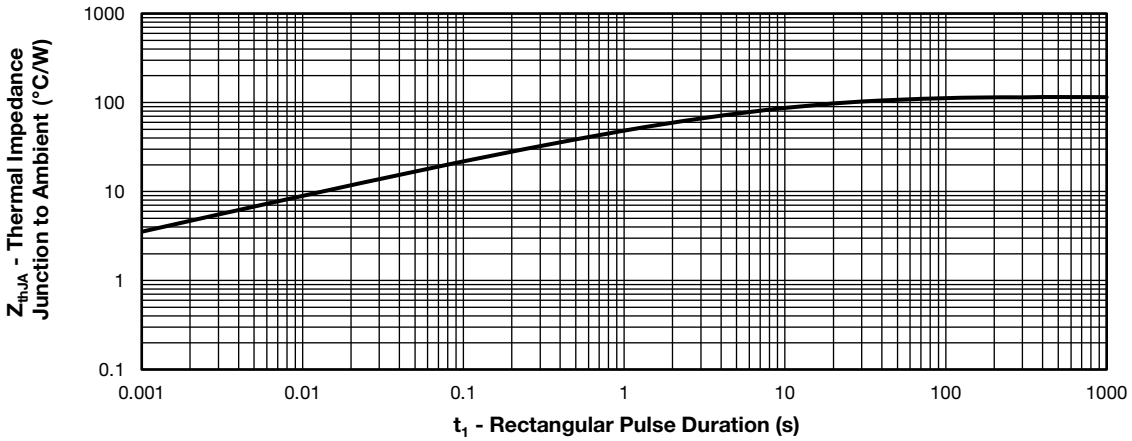
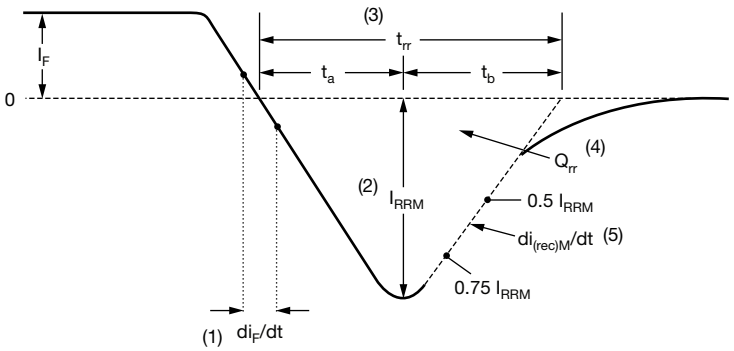



Fig. 8 - Thermal Impedance $Z_{thJA}$




(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 $I_{RRM}$

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

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

Fig. 9 - Reverse Recovery Waveform and Definitions


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

## ORDERING INFORMATION TABLE

Device code

| VS- | 3 | E | J | U | 06 | H | M3 |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |

- 1 - Vishay Semiconductors product
- 2 - Current rating (3 = 3 A)
- 3 - Circuit configuration:
  E = single diode
- 4 - J = SlimSMA package
- 5 - Process type,
  U = ultrafast recovery
- 6 - Voltage code (06 = 600 V)
- 7 - H = AEC-Q101 qualified
- 8 - M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

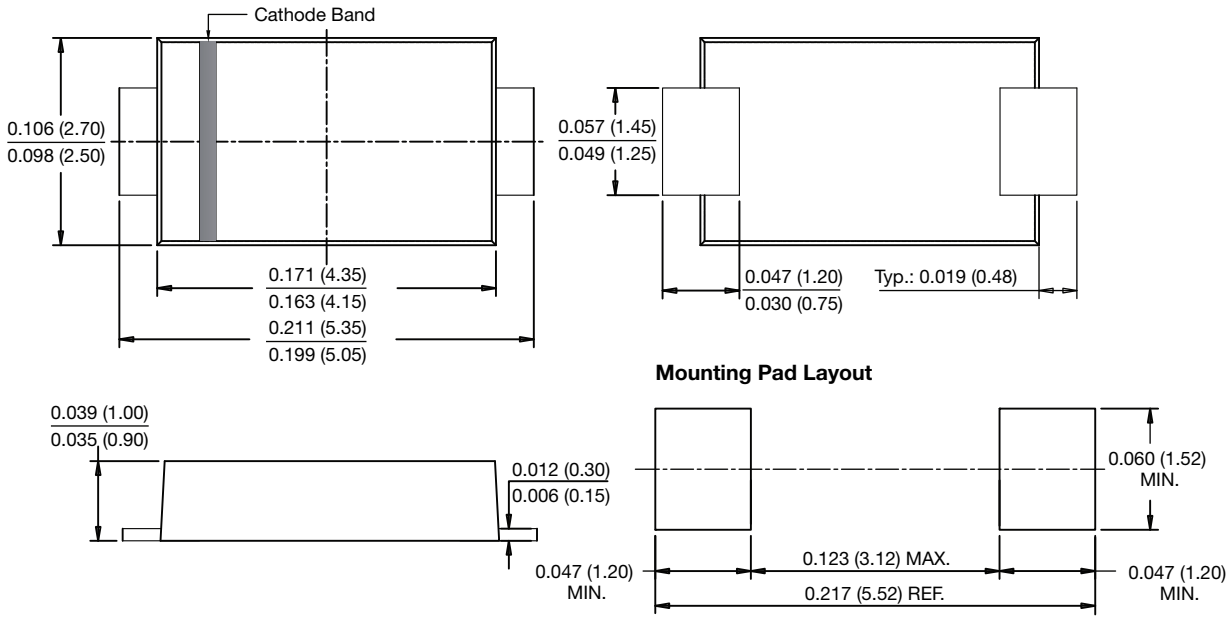
| **ORDERING INFORMATION** (Example) | | | |
|---|---|---|---|
| **PREFERRED P/N** | **QUANTITY PER REEL** | **MINIMUM ORDER QUANTITY** | **PACKAGING DESCRIPTION** |
| VS-3EJU06HM3/6A | 3500 | 3500 | 7" diameter plastic tape and reel |
| VS-3EJU06HM3/6B | 14 000 | 14 000 | 13" diameter plastic tape and reel |

| **LINKS TO RELATED DOCUMENTS** | |
|---|---|
| Dimensions | www.vishay.com/doc?95571 |
| Part marking information | www.vishay.com/doc?95562 |
| Packaging information | www.vishay.com/doc?88869 |
| SPICE model | www.vishay.com/doc?96589 |


For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

# DO-221AC (SlimSMA)

**DIMENSIONS** in inches (millimeters)






For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

# 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.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

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.

*© 2024 VISHAY INTERTECHNOLOGY, INC. ALL RIGHTS RESERVED*