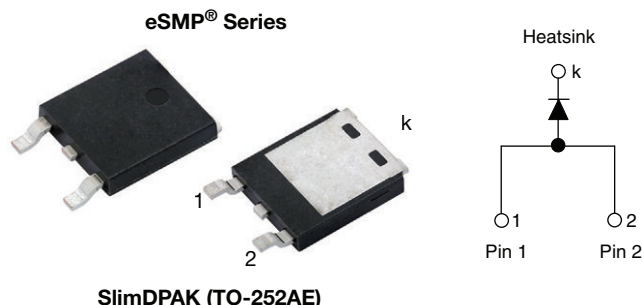


# Hyperfast Rectifier, 4 A FRED Pt®



SlimDPAK (TO-252AE)

## LINKS TO ADDITIONAL RESOURCES



## FEATURES

- Hyperfast recovery time
- 175 °C max. operating junction temperature
- Low forward voltage drop reduced  $Q_{rr}$  and soft recovery
- Low leakage current
- Very low profile - typical height of 1.3 mm
- Ideal for automated placement
- Polyimide passivation for high reliability standard
- 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 hyper fast recovery rectifiers with optimized performance of forward voltage drop and hyper fast 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 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.

## MECHANICAL DATA

**Case:** SlimDPAK (TO-252AE)

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

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

| PRIMARY CHARACTERISTICS |                     |
|-------------------------|---------------------|
| $I_{F(AV)}$             | 4 A                 |
| $V_R$                   | 200 V               |
| $V_F$ at $I_F$          | 0.71 V              |
| $t_{rr}$ (typ.)         | 16 ns               |
| $T_J$ max.              | 175 °C              |
| Package                 | SlimDPAK (TO-252AE) |
| Circuit configuration   | Single              |

| ABSOLUTE MAXIMUM RATINGS                    |                |  |             |       |
|---|----------------|--|-------------|-------|
| PARAMETER                                   | SYMBOL         | TEST CONDITIONS                              | VALUES      | UNITS |
| Peak repetitive reverse voltage             | $V_{RRM}$      |  | 200         | V     |
| Average rectified forward current           | $I_{F(AV)}$    | $T_C = 167\text{ °C}$                        | 4           | A     |
| Non-repetitive peak surge current           | $I_{FSM}$      | $T_J = 25\text{ °C}$ , 10 ms sine pulse wave | 100         |       |
| Operating junction and storage temperatures | $T_J, T_{Stg}$ |  | -55 to +175 | °C    |

| 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  | $V_F$         | $I_F = 4\text{ A}$                         | -    | 0.88 | 1.0  |               |
|  |               | $I_F = 4\text{ A}$ , $T_J = 150\text{ °C}$ | -    | 0.71 | 0.80 |               |
| Reverse leakage current  | $I_R$         | $V_R = V_R$ rated                          | -    | -    | 3    | $\mu\text{A}$ |
|  |               | $T_J = 150\text{ °C}$ , $V_R = V_R$ rated  | -    | -    | 80   |               |
| Junction capacitance   | $C_T$         | $V_R = 200\text{ V}$                       | -    | 17   | -    | 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  | $t_{rr}$  | $I_F = 1.0\text{ A}$ , $dI_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ | -    | 16   | -    | ns    |
|  |           | $I_F = 0.5\text{ A}$ , $I_R = 1\text{ A}$ , $I_{RR} = 0.25\text{ A}$              | -    | -    | 25   |       |
|  |           | $T_J = 25\text{ }^{\circ}\text{C}$  | -    | 20   | -    |       |
|  |           | $T_J = 125\text{ }^{\circ}\text{C}$   | -    | 30   | -    |       |
| 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  | $Q_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$  | -    | 25   | -    | nC    |
|  |           | $T_J = 125\text{ }^{\circ}\text{C}$   | -    | 60   | -    |       |

| <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 ambient        | $R_{thJA}$ <sup>(1)(2)</sup> |                                | -      | 73   | 90   | $^{\circ}\text{C}/\text{W}$ |
| Thermal resistance, junction to mount          | $R_{thJM}$ <sup>(3)</sup>    |                                | -      | 2.1  | 2.5  | $^{\circ}\text{C}/\text{W}$ |
| Weight   |                              |                                | -      | 0.20 | -    | g                           |
| Marking device                                 |                              | Case style SlimDPAK (TO-252AE) | 4EVH02 |      |      |                             |

**Notes**

- (1) The heat generated must be less than thermal conductivity from junction to ambient;  $dP_D/dT_J < 1/R_{thJA}$
- (2) Free air, mounted or recommended copper pad area; thermal resistance  $R_{thJA}$  - junction to ambient
- (3) Mounted on infinite heatsink

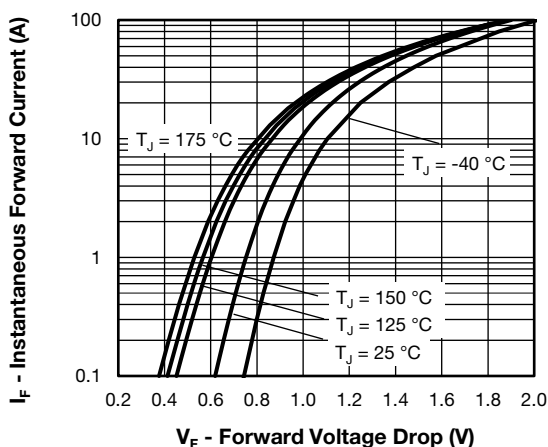


Fig. 1 - Typical Forward Voltage Drop Characteristics

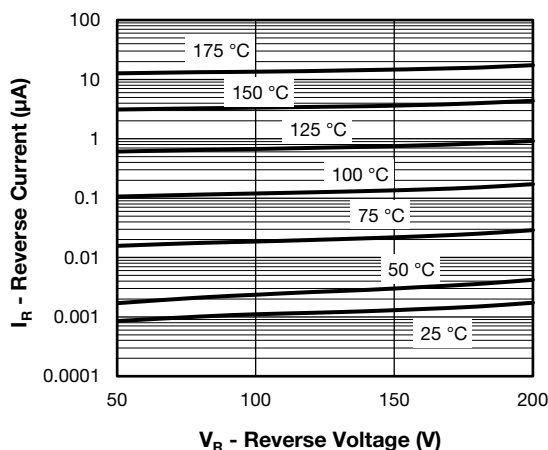


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

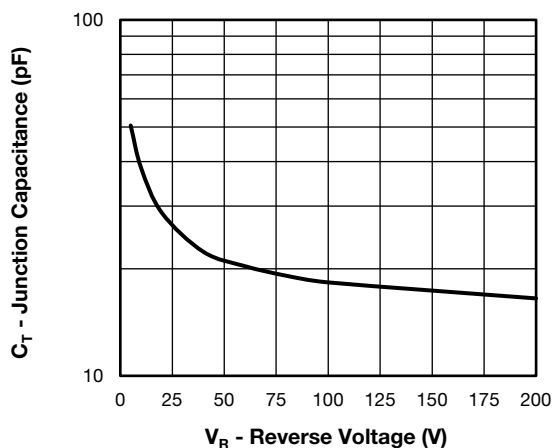


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

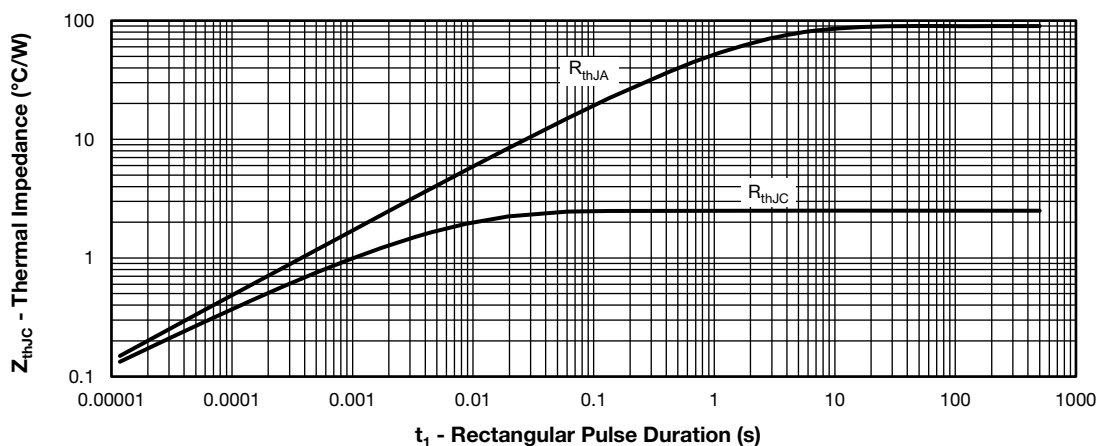
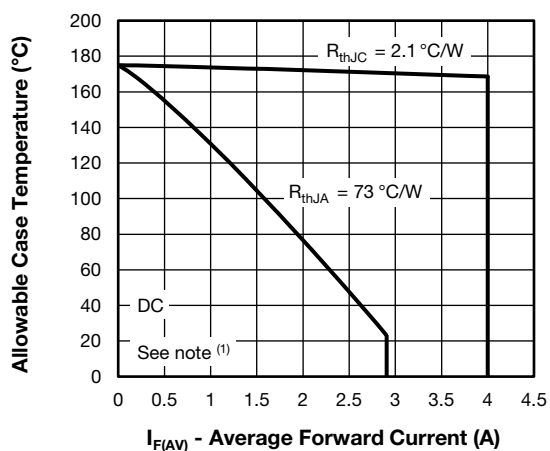

Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

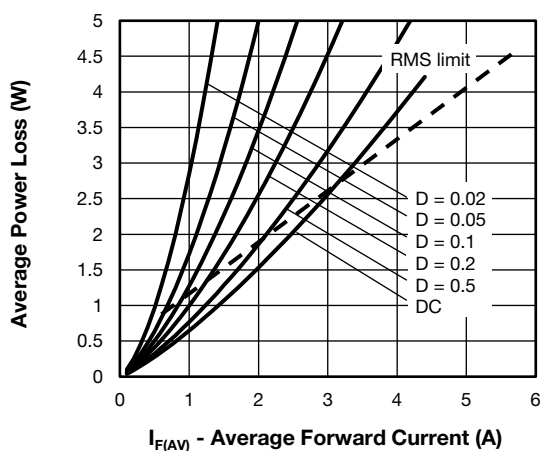


Fig. 6 - Forward Power Loss Characteristics

**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  $V_R$


Fig. 7 - Typical Reverse Recovery Time vs.  $dI_F/dt$ 

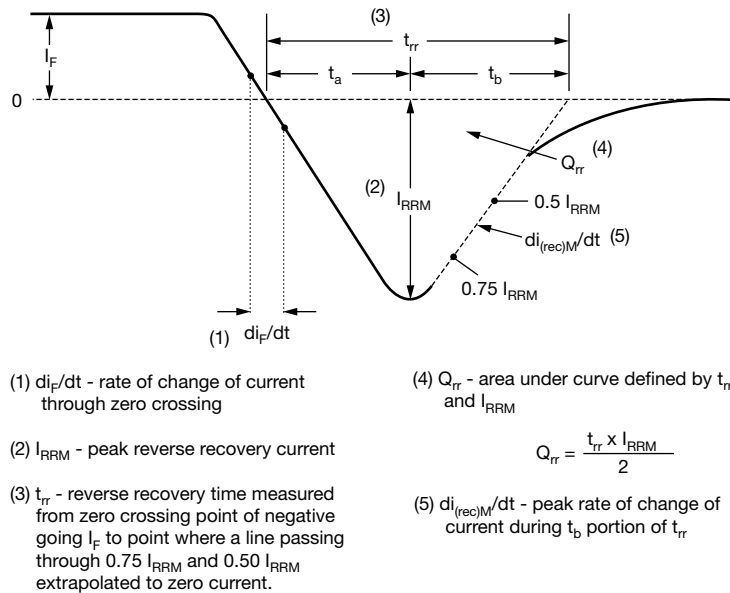
Fig. 8 - Typical Stored Charge vs.  $dI_F/dt$ 


Fig. 9 - Reverse Recovery Waveform and Definitions



ORDERING INFORMATION TABLE

|             |   |   |   |   |   |    |     |
|-------------|---|---|---|---|---|----|-----|
| Device code | VS-   | 4 | E | V | H | 02 | -M3 |
|             | 1   | 2 | 3 | 4 | 5 | 6  | 7   |
| 1           | - Vishay Semiconductors product   |   |   |   |   |    |     |
| 2           | - Current rating (4 = 4 A)  |   |   |   |   |    |     |
| 3           | - Circuit configuration:<br>E = single die  |   |   |   |   |    |     |
| 4           | - V = SlimDPAK  |   |   |   |   |    |     |
| 5           | - Process type:<br>H = hyper fast recovery  |   |   |   |   |    |     |
| 6           | - Voltage code (02 = 200 V)   |   |   |   |   |    |     |
| 7           | - Environmental digit:<br>-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-4EVH02-M3/I                 | 4500              | 4500                   | 13" diameter plastic tape and reel |

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| Dimensions                 | <a href="http://www.vishay.com/doc?96081">www.vishay.com/doc?96081</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?96085">www.vishay.com/doc?96085</a> |
| Packaging information      | <a href="http://www.vishay.com/doc?88869">www.vishay.com/doc?88869</a> |
| SPIICE model               | <a href="http://www.vishay.com/doc?97123">www.vishay.com/doc?97123</a> |



## SlimDPAK

**DIMENSIONS** in inches (millimeters)



### Mounting Pad Layout





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