

# Hyperfast Rectifier, 15 A FRED Pt®



D-PAK (TO-252AA)



## FEATURES

- Hyperfast recovery time, extremely low  $Q_{rr}$
- 175 °C maximum operating junction temperature
- For PFC CCM operation
- Low forward voltage drop
- Low leakage current
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Compliant to RoHS Directive 2002/95/EC
- Halogen-free according to IEC 61249-2-21 definition



**RoHS**  
COMPLIANT  
HALOGEN  
FREE

## PRODUCT SUMMARY

|                 |                  |
|-----------------|------------------|
| Package         | D-PAK (TO-252AA) |
| $I_{F(AV)}$     | 15 A             |
| $V_R$           | 600 V            |
| $V_F$ at $I_F$  | 3.2 V            |
| $t_{rr}$ (typ.) | 18 ns            |
| $T_J$ max.      | 175 °C           |
| Diode variation | Single die       |

## DESCRIPTION/APPLICATIONS

State of the art hyperfast recovery rectifiers designed with optimized performance of forward voltage drop, hyperfast recovery time, and soft 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 over dissipation in the switching element and snubbers.

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                   | SYMBOL            | TEST CONDITIONS                                          | VALUES      | UNITS |
|---------------------------------------------|-------------------|----------------------------------------------------------|-------------|-------|
| Peak repetitive reverse voltage             | $V_{RRM}$         |                                                          | 600         | V     |
| Average rectified forward current           | $I_{F(AV)}$       | $T_C = 117\text{ °C}$                                    | 15          | A     |
| Non-repetitive peak surge current           | $I_{FSM}$         | $T_J = 25\text{ °C}$                                     | 120         |       |
| Peak repetitive forward current             | $I_{FM}$          | $T_C = 117\text{ °C}$ , $f = 20\text{ kHz}$ , $d = 50\%$ | 30          |       |
| Operating junction and storage temperatures | $T_J$ , $T_{Stg}$ |                                                          | - 65 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 | $V_{BR}$ , $V_R$ | $I_R = 100\text{ }\mu\text{A}$               | 600  | -    | -    | V             |
| Forward voltage                     | $V_F$            | $I_F = 15\text{ A}$                          | -    | 2.3  | 3.2  |               |
|                                     |                  | $I_F = 15\text{ A}$ , $T_J = 125\text{ °C}$  | -    | 1.6  | 1.9  |               |
|                                     |                  | $I_F = 15\text{ A}$ , $T_J = 150\text{ °C}$  | -    | 1.5  | 1.8  |               |
| Reverse leakage current             | $I_R$            | $V_R = V_R$ rated                            | -    | -    | 50   | $\mu\text{A}$ |
|                                     |                  | $T_J = 125\text{ °C}$ , $V_R = V_R$ rated    | -    | -    | 200  |               |
|                                     |                  | $T_J = 150\text{ °C}$ , $V_R = V_R$ rated    | -    | -    | 300  |               |
| Junction capacitance                | $C_T$            | $V_R = 600\text{ V}$                         | -    | 11   | -    | pF            |
| Series inductance                   | $L_S$            | Measured lead to lead 5 mm from package body | -    | 8    | -    | nH            |

**VS-15EWX06FN-M3**

Vishay Semiconductors Hyperfast Rectifier, 15 A FRED Pt®

| <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                                                                                    | $t_{rr}$  | $I_F = 1\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$  | -    | 18   | 22   | ns    |
|                                                                                                          |           | $I_F = 1\text{ A}$ , $di_F/dt = 50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$   | -    | 22   | -    |       |
|                                                                                                          |           | $I_F = 15\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ | -    | 17   | 32   |       |
|                                                                                                          |           | $T_J = 25\text{ }^{\circ}\text{C}$                                               | -    | 22   | -    |       |
|                                                                                                          |           | $T_J = 125\text{ }^{\circ}\text{C}$                                              | -    | 38   | -    |       |
| Peak recovery current                                                                                    | $I_{RRM}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                               | -    | 3.1  | -    | A     |
|                                                                                                          |           | $T_J = 125\text{ }^{\circ}\text{C}$                                              | -    | 4.6  | -    |       |
| Reverse recovery charge                                                                                  | $Q_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$                                               | -    | 37   | -    | nC    |
|                                                                                                          |           | $T_J = 125\text{ }^{\circ}\text{C}$                                              | -    | 92   | -    |       |

| <b>THERMAL - MECHANICAL SPECIFICATIONS</b>      |                |                             |           |      |      |                             |
|-------------------------------------------------|----------------|-----------------------------|-----------|------|------|-----------------------------|
| 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 per leg    | $R_{thJC}$     |                             | -         | 1.4  | 1.8  | $^{\circ}\text{C}/\text{W}$ |
| Thermal resistance, junction to ambient per leg | $R_{thJA}$     |                             | -         | -    | 70   |                             |
| Approximate weight                              |                |                             | 0.3       |      |      | g                           |
|                                                 |                |                             | 0.01      |      |      | oz.                         |
| Marking device                                  |                | Case style D-PAK (TO-252AA) | 15EWX06FN |      |      |                             |

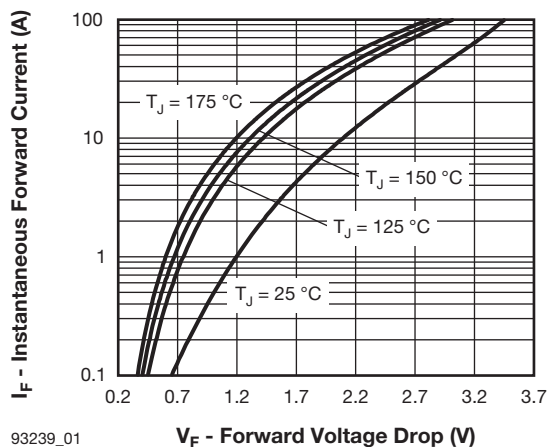


Fig. 1 - Typical Forward Voltage Drop Characteristics

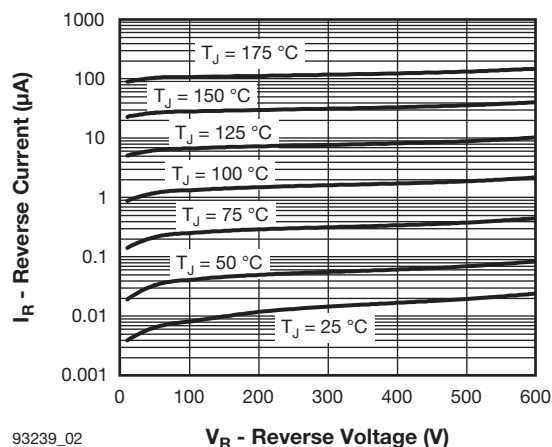


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

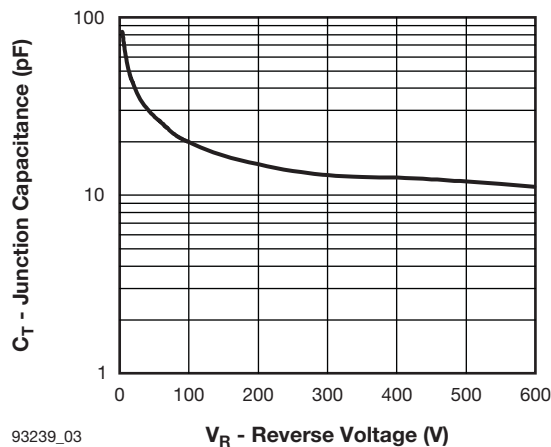
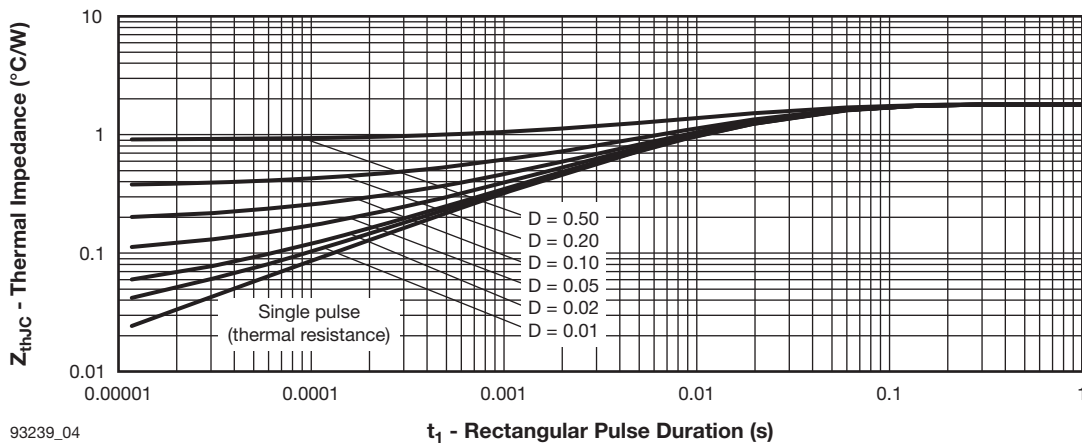


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

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

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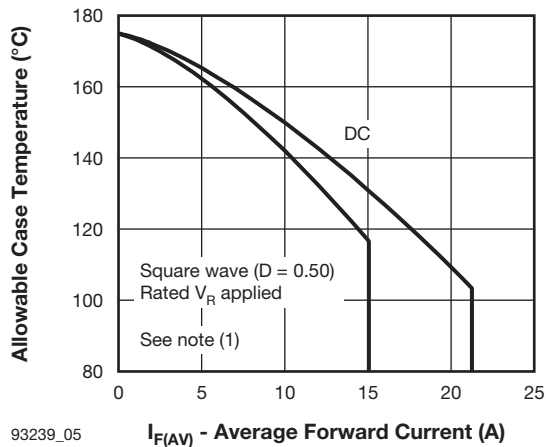


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

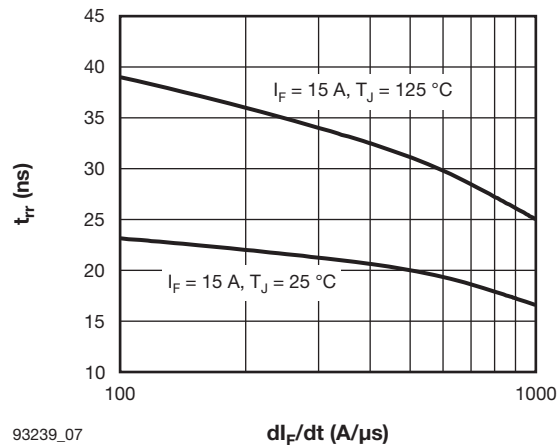
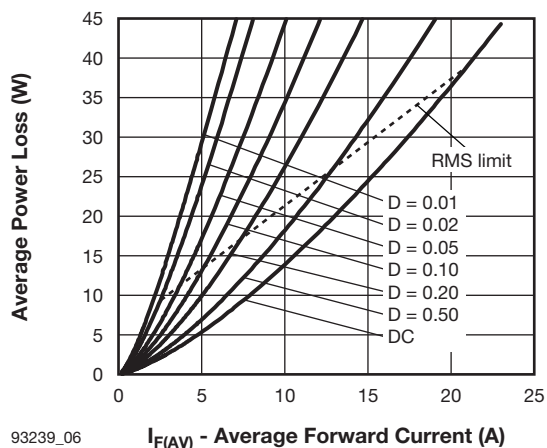
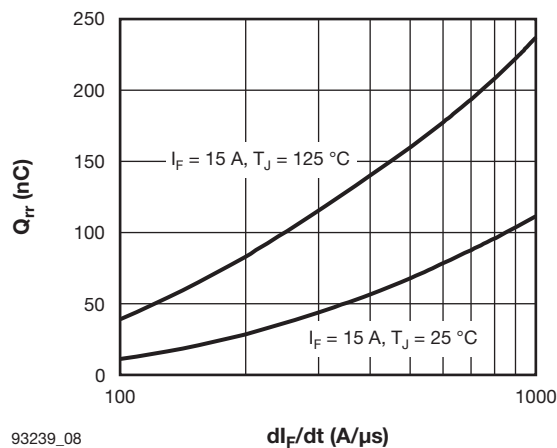
Fig. 7 - Typical Reverse Recovery Time vs.  $dI_F/dt$ 

Fig. 6 - Forward Power Loss Characteristics

Fig. 8 - 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  $V_R$

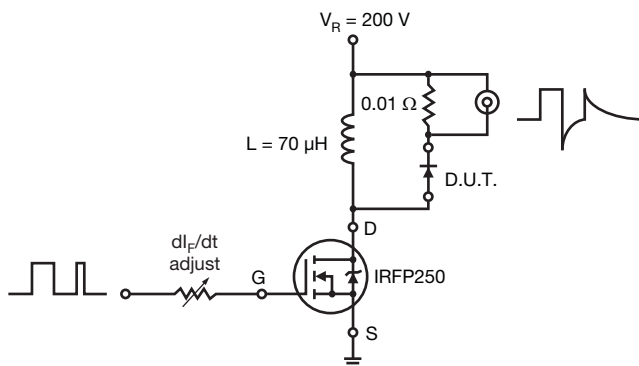


Fig. 9 - Reverse Recovery Parameter Test Circuit



Fig. 10 - Reverse Recovery Waveform and Definitions

**VS-15EWX06FN-M3**

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**ORDERING INFORMATION TABLE**

| Device code | VS- | 15 | E | W | X | 06 | FN | TRL | -M3 |
|-------------|-----|----|---|---|---|----|----|-----|-----|
|             | 1   | 2  | 3 | 4 | 5 | 6  | 7  | 8   | 9   |

- 1** - Vishay Semiconductors product
- 2** - Current rating (15 = 15 A)
- 3** - Circuit configuration:  
E = Single diode
- 4** - Package identifier:  
W = D-PAK
- 5** - X = Hyperfast recovery time
- 6** - Voltage rating (06 = 600 V)
- 7** - FN = TO-252AA
- 8** -
  - None = Tube
  - TR = Tape and reel
  - TRL = Tape and reel (left oriented)
  - TRR = Tape and reel (right oriented)
- 9** - Environmental digit:  
-M3 = Halogen-free, RoHS compliant and terminations lead (Pb)-free

**ORDERING INFORMATION** (Example)

| PREFERRED P/N      | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
|--------------------|------------------|------------------------|-------------------------|
| VS-15EWX06FN-M3    | 75               | 3000                   | Antistatic plastic tube |
| VS-15EWX06FNTR-M3  | 2000             | 2000                   | 13" diameter reel       |
| VS-15EWX06FNTRL-M3 | 3000             | 3000                   | 13" diameter reel       |
| VS-15EWX06FNTRR-M3 | 3000             | 3000                   | 13" diameter reel       |

**LINKS TO RELATED DOCUMENTS**

|                          |                                                                        |
|--------------------------|------------------------------------------------------------------------|
| Dimensions               | <a href="http://www.vishay.com/doc?95016">www.vishay.com/doc?95016</a> |
| Part marking information | <a href="http://www.vishay.com/doc?95176">www.vishay.com/doc?95176</a> |
| Packaging information    | <a href="http://www.vishay.com/doc?95033">www.vishay.com/doc?95033</a> |
| SPIICE model             | <a href="http://www.vishay.com/doc?95387">www.vishay.com/doc?95387</a> |





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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

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