# Ultrafast Rectifier, 2 A FRED Pt ${ }^{\circledR}$ 



LINKS TO ADDITIONAL RESOURCES


3D Models

| PRIMARY CHARACTERISTICS |  |
| :---: | :---: |
| $\mathrm{I}_{\mathrm{F}(\mathrm{AV})}$ | 2 A |
| $\mathrm{~V}_{\mathrm{R}}$ | 600 V |
| $\mathrm{~V}_{\mathrm{F}}$ at $\mathrm{I}_{\mathrm{F}}$ | 0.95 V |
| $\mathrm{t}_{\mathrm{rr}}$ | 55 ns |
| $\mathrm{~T}_{\mathrm{J}}$ max. | $175^{\circ} \mathrm{C}$ |
| Package | SMF (DO-219AB) |
| Circuit configuration | Single |

## FEATURES

- Ultrafast recovery time, reduced $\mathrm{Q}_{\mathrm{rr}}$, and soft recovery
- $175^{\circ} \mathrm{C}$ maximum operating junction temperature
- For PFC CRM, snubber operation
- Low forward voltage drop
- Low leakage current
- Meets MSL level 1, per J-STD-020, LF maximum peak of $260{ }^{\circ} \mathrm{C}$
- Meets JESD 201 class 2 whisker test
- Wave and reflow solderable
- Compatible to SOD-123W package case outline
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


## DESCRIPTION / APPLICATIONS

State of the art ultrafast recovery rectifiers designed with optimized performance of forward voltage drop, ultrafast 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, lighting, in the AC/DC section of SMPS, freewheeling and clamp diodes.

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

## MECHANICAL DATA

Case: SMF (DO-219AB)
Molding compound meets UL 94 V-0 flammability rating Halogen-free, RoHS-compliant
Terminals: matte tin plated leads, solderable per J-STD-002

Polarity: color band denotes cathode end

| ABSOLUTE MAXIMUM RATINGS |  |  |  |  |  |  | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| PARAMETER | $\mathrm{V}_{\text {RRM }}$ |  | 600 | V |  |  |  |  |  |  |
| Peak repetitive reverse voltage | $\mathrm{I}_{\mathrm{F}(\mathrm{AV})}$ | $\mathrm{T}_{\mathrm{C}}=135^{\circ} \mathrm{C}{ }^{(1)}$ | 2 | A |  |  |  |  |  |  |
| Average rectified forward current | $\mathrm{I}_{\mathrm{FSM}}$ | $\mathrm{T}_{\mathrm{J}}=25^{\circ} \mathrm{C}, 6 \mathrm{~ms}$ square pulse | 30 |  |  |  |  |  |  |  |
| Non-repetitive peak surge current |  | -55 to +175 | ${ }^{\circ}{ }^{\circ} \mathrm{C}$ |  |  |  |  |  |  |
| Operating junction and storage temperature range | $\mathrm{T}_{\mathrm{J}}, \mathrm{T}_{\mathrm{Stg}}$ |  |  |  |  |  |  |  |  |  |

## Note

${ }^{(1)}$ Device on PCB with $8 \mathrm{~mm} \times 16 \mathrm{~mm}$ soldering lands

VS-2EFU06-M3

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Breakdown voltage, blocking voltage | $\mathrm{V}_{\mathrm{BR}}, \mathrm{V}_{\mathrm{R}}$ | $\mathrm{I}_{\mathrm{R}}=100 \mu \mathrm{~A}$ | 600 | - | - | V |
| Forward voltage | $V_{F}$ | $\mathrm{I}_{\mathrm{F}}=2 \mathrm{~A}$ | - | 1.10 | 1.35 |  |
|  |  | $\mathrm{I}_{\mathrm{F}}=2 \mathrm{~A}, \mathrm{~T}_{\mathrm{J}}=150^{\circ} \mathrm{C}$ | - | 0.95 | 1.15 |  |
| Reverse leakage current | $\mathrm{I}_{\mathrm{R}}$ | $\mathrm{V}_{\mathrm{R}}=\mathrm{V}_{\mathrm{R}}$ rated | - | - | 3 | $\mu \mathrm{A}$ |
|  |  | $\mathrm{T}_{\mathrm{J}}=150^{\circ} \mathrm{C}, \mathrm{V}_{\mathrm{R}}=\mathrm{V}_{\mathrm{R}}$ rated | - | 20 | 100 |  |
| Junction capacitance | $\mathrm{C}_{\text {T }}$ | $\mathrm{V}_{\mathrm{R}}=600 \mathrm{~V}$ | - | 5 | - | pF |


| DYNAMIC RECOVERY CHARACTERISTICS ( $\mathrm{T}_{J}=25^{\circ} \mathrm{C}$ unless otherwise specified) |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| PARAMETER | SYMBOL | TEST CONDITIONS |  | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time | $t_{\text {rr }}$ | $\mathrm{I}_{\mathrm{F}}=1 \mathrm{~A}, \mathrm{dl}_{\mathrm{F}}$ | $\mu \mathrm{s}, \mathrm{V}_{\mathrm{R}}=30 \mathrm{~V}$ | - | 42 | - |  |
|  |  | $\mathrm{I}_{\mathrm{F}}=0.5 \mathrm{~A}, \mathrm{I}_{\mathrm{R}}$ | $=0.25 \mathrm{~A}$ | - | - | 55 |  |
|  |  | $\mathrm{T}_{J}=25^{\circ} \mathrm{C}$ | $\begin{aligned} & \mathrm{I}_{\mathrm{F}}=2 \mathrm{~A} \\ & \mathrm{dl}_{\mathrm{F}} / \mathrm{dt}=500 \mathrm{~A} / \mu \mathrm{s} \\ & \mathrm{~V}_{\mathrm{R}}=400 \mathrm{~V} \end{aligned}$ | - | 40 | - | ns |
|  |  | $\mathrm{T}_{J}=125^{\circ} \mathrm{C}$ |  | - | 63 | - |  |
| Peak recovery current | $I_{\text {RRM }}$ | $\mathrm{T}_{J}=25^{\circ} \mathrm{C}$ |  | - | 7.0 | - | A |
|  |  | $\mathrm{T}_{J}=125^{\circ} \mathrm{C}$ |  | - | 8.1 | - |  |
| Reverse recovery charge | $\mathrm{Q}_{\text {rr }}$ | $\mathrm{T}_{J}=25^{\circ} \mathrm{C}$ |  | - | 140 | - | nC |
|  |  | $\mathrm{T}_{\mathrm{J}}=125^{\circ} \mathrm{C}$ |  | - | 255 | - |  |

THERMAL - MECHANICAL SPECIFICATIONS

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Maximum junction and storage <br> temperature range | $\mathrm{T}_{\mathrm{J},}, \mathrm{T}_{\text {Stg }}$ |  | -55 | - | +175 | ${ }^{\circ} \mathrm{C}$ |
| Thermal resistance, junction to mount | $\mathrm{R}_{\text {thJM }}$ | Device mounted on PCB with $8 \mathrm{~mm} \times 16 \mathrm{~mm}$ <br> soldering lands | - | - | 15 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
| Thermal resistance, junction to ambient | $\mathrm{R}_{\text {thJA }}$ | Device mounted on PCB with $2 \mathrm{~mm} \times 3.5 \mathrm{~mm}$ <br> soldering lands | - | - | 130 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
| Approximate weight |  |  | 0.015 |  | g |  |
| Marking device |  |  | 0.0005 |  | $\circ$ |  |



Fig. 1 - Typical Forward Voltage Drop Characteristics


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage


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

Vishay Semiconductors


Fig. 5 - Forward Power Loss Characteristics


Fig. 6 - Typical Reverse Recovery Time vs. $\mathrm{dl}_{\mathrm{F}} / \mathrm{dt}$


Fig. 7 - Typical Stored Charge vs. $\mathrm{dl}_{\mathrm{F}} / \mathrm{dt}$

## Note

(1) Formula used: $T_{C}=T_{J}-\left(P d+P d_{R E V}\right) \times R_{\text {thJC }}$;
$\mathrm{Pd}=$ forward power loss $=\mathrm{I}_{\mathrm{F}(\mathrm{AV})} \times \mathrm{V}_{\mathrm{FM}}$ at $\left(\mathrm{I}_{\mathrm{F}(\mathrm{AV})} / \mathrm{D}\right)$ (see fig. 5);
$\mathrm{Pd}_{\mathrm{REV}}=$ inverse power loss $=\mathrm{V}_{\mathrm{R} 1} \times \mathrm{I}_{\mathrm{R}}(1-\mathrm{D})$; $I_{\mathrm{R}}$ at $\mathrm{V}_{\mathrm{R} 1}=$ rated $\mathrm{V}_{\mathrm{R}}$

(1) $\mathrm{di}_{\mathrm{F}} / \mathrm{dt}$ - rate of change of current through zero crossing
(2) $I_{\text {RRM }}$ - peak reverse recovery current
(3) $t_{r r}$ - reverse recovery time measured from zero crossing point of negative going $I_{F}$ to point where a line passing through $0.75 \mathrm{I}_{\text {RRM }}$ and $0.50 \mathrm{I}_{\text {RRM }}$ extrapolated to zero current.
(4) $Q_{r r}$ - area under curve defined by $t_{r r}$ and $I_{\text {RRM }}$

$$
Q_{\mathrm{rr}}=\frac{\mathrm{t}_{\mathrm{rr}} \times \mathrm{I}_{\mathrm{RRM}}}{2}
$$

(5) $\mathrm{di}_{(r e c) \mathrm{M}} / \mathrm{dt}$ - peak rate of change of current during $t_{b}$ portion of $t_{r r}$

Fig. 8 - Reverse Recovery Waveform and Definitions

## ORDERING INFORMATION TABLE



1 - Vishay Semiconductors product
2 - Current rating (2 = 2 A )
3 - Circuit configuration:
$E=$ single diode
$4 \quad$ - $\quad$ F $=$ SMF package
5 - Process type,
$\mathrm{U}=$ ultrafast recovery
6 - Voltage code $(06=600 \mathrm{~V})$
$7 \quad-\quad-\mathrm{M} 3=$ halogen-free, RoHS-compliant, and terminations lead (Pb)-free

## ORDERING INFORMATION (Example)

| PREFERRED P/N | QUANTITY PER REEL | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
| :--- | :---: | :---: | :---: |
| VS-2EFU06-M3/I | 10000 | 10000 | 13 "diameter plastic tape and reel |


| LINKS TO RELATED DOCUMENTS |  |
| :--- | :--- |
| Dimensions | $\underline{\text { www.vishay.com/doc?95572 }}$ |
| Part marking information | $\underline{\text { www.vishay.com/doc?95618 }}$ |
| Packaging information | $\underline{w w w . v i s h a y . c o m / d o c ? 95577 ~}$ |
| SPICE model | $\underline{w w w . v i s h a y . c o m / d o c ? 96867 ~}$ |

## SMF (DO-219AB)

DIMENSIONS in millimeters (inches)


Foot print recommendation:

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17247


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