



# BYV10EX-600P

Ultrafast power diode

25 September 2014

Product data sheet

## 1. General description

Ultrafast power diode in a SOD113 (2-lead TO-220F) plastic package.

## 2. Features and benefits

- Fast switching
- Isolated plastic package
- Low leakage current
- Low forward voltage drop
- Low thermal resistance
- Soft recovery characteristic
- Enhanced avalanche energy capability

## 3. Applications

- High frequency switched-mode power supplies
- Discontinuous Current Mode (DCM) Power Factor Correction (PFC)

## 4. Quick reference data

Table 1. Quick reference data

| Symbol                         | Parameter                       | Conditions  | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------|---|-----|-----|-----|------|
| $V_{RRM}$                      | repetitive peak reverse voltage |   | -   | -   | 600 | V    |
| $I_{F(AV)}$                    | average forward current         | $\delta = 0.5$ ; $T_h \leq 71$ °C; square-wave pulse;<br><a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a> | -   | -   | 10  | A    |
| <b>Static characteristics</b>  |                                 |   |     |     |     |      |
| $V_F$                          | forward voltage                 | $I_F = 10$ A; $T_j = 150$ °C; <a href="#">Fig. 6</a>  | -   | -   | 1.6 | V    |
| <b>Dynamic characteristics</b> |                                 |   |     |     |     |      |
| $t_{rr}$                       | reverse recovery time           | $I_F = 1$ A; $V_R = 30$ V; $di_F/dt = 50$ A/ $\mu$ s;<br>$T_j = 25$ °C; <a href="#">Fig. 7</a>                                    | -   | 35  | 50  | ns   |
| <b>Avalanche energy</b>        |                                 |   |     |     |     |      |
| $E_{AS}$                       | non-repetitive avalanche energy | $I_R = 2.6$ A; $T_{j(init)} = 25$ °C; $L = 15$ mH   | -   | 50  | -   | mJ   |

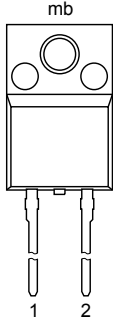
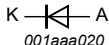


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## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description             | Simplified outline  | Graphic symbol   |
|-----|--------|-------------------------|---|--|
| 1   | K      | cathode                 |  <p style="text-align: center;">mb</p> <p style="text-align: center;">1 2</p> <p style="text-align: center;"><b>TO-220F (SOD113)</b></p> |  <p style="text-align: center;">001aaa020</p> |
| 2   | A      | anode                   |   |  |
| mb  | n.c.   | mounting base; isolated |   |  |

## 6. Ordering information

Table 3. Ordering information

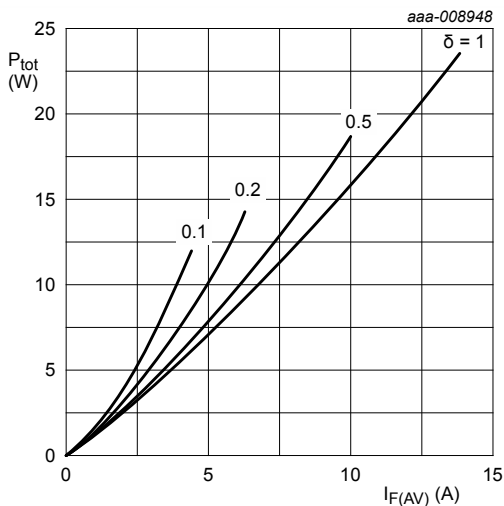
| Type number  | Package |   |         |
|--------------|---------|---|---------|
|              | Name    | Description   | Version |
| BYV10EX-600P | TO-220F | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 2-lead TO-220 "full pack" | SOD113  |

## 7. Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

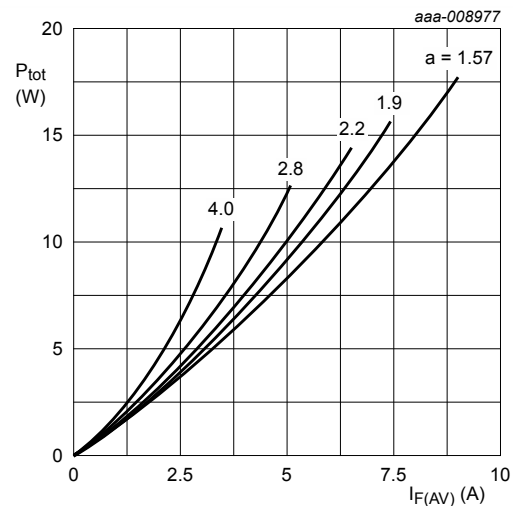
| Symbol      | Parameter                           | Conditions   | Min | Max | Unit             |
|-------------|-------------------------------------|--|-----|-----|------------------|
| $V_{RRM}$   | repetitive peak reverse voltage     |  | -   | 600 | V                |
| $V_{RWM}$   | crest working reverse voltage       |  | -   | 600 | V                |
| $V_R$       | reverse voltage                     | DC   | -   | 600 | V                |
| $I_{F(AV)}$ | average forward current             | $\delta = 0.5$ ; $T_h \leq 71\text{ }^\circ\text{C}$ ; square-wave pulse; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a> | -   | 10  | A                |
| $I_{FRM}$   | repetitive peak forward current     | $\delta = 0.5$ ; $t_p = 25\text{ }\mu\text{s}$ ; $T_h \leq 71\text{ }^\circ\text{C}$ ; square-wave pulse   | -   | 20  | A                |
| $I_{FSM}$   | non-repetitive peak forward current | $t_p = 10\text{ ms}$ ; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$ ; sine-wave pulse; <a href="#">Fig. 4</a>                                   | -   | 75  | A                |
|             |                                     | $t_p = 8.3\text{ ms}$ ; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$ ; sine-wave pulse; <a href="#">Fig. 4</a>                                  | -   | 83  | A                |
| $T_{stg}$   | storage temperature                 |  | -65 | 175 | $^\circ\text{C}$ |
| $T_j$       | junction temperature                |  | -   | 175 | $^\circ\text{C}$ |



$$I_{F(AV)} = I_{F(RMS)} \times \sqrt{\delta}$$

$$V_o = 1.268\text{ V}; R_s = 0.031\text{ }\Omega$$

**Fig. 1. Forward power dissipation as a function of average forward current; square waveform; maximum values**



$$a = \text{form factor} = I_{F(RMS)} / I_{F(AV)}$$

$$V_o = 1.268\text{ V}; R_s = 0.031\text{ }\Omega$$

**Fig. 2. Forward power dissipation as a function of average forward current; sinusoidal waveform; maximum values**

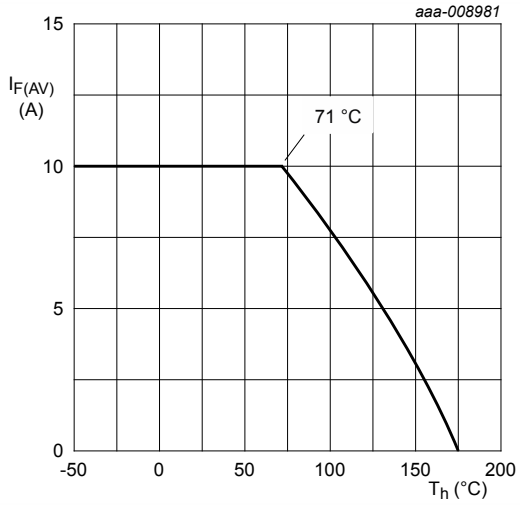


Fig. 3. Forward current as a function of heatsink temperature; maximum values

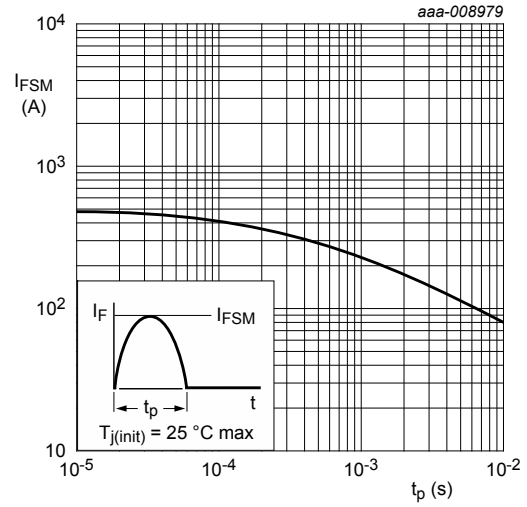


Fig. 4. Non-repetitive peak forward current as a function of pulse width; sinusoidal waveform; maximum values

## 8. Thermal characteristics

Table 5. Thermal characteristics

| Symbol        | Parameter                                    | Conditions                                     | Min | Typ | Max | Unit |
|---------------|--|--|-----|-----|-----|------|
| $R_{th(j-h)}$ | thermal resistance from junction to heatsink | without heatsink compound                      | -   | -   | 7.2 | K/W  |
|               |  | with heatsink compound; <a href="#">Fig. 5</a> | -   | -   | 5.5 | K/W  |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient  | in free air                                    | -   | 55  | -   | K/W  |

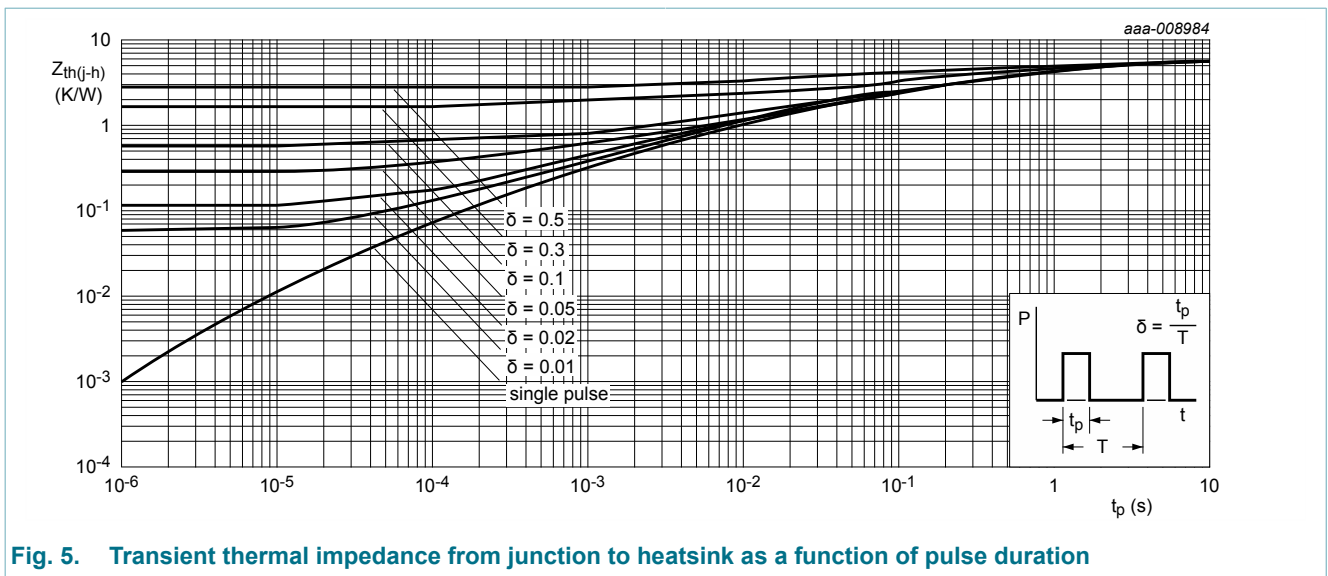


Fig. 5. Transient thermal impedance from junction to heatsink as a function of pulse duration

## 9. Isolation characteristics

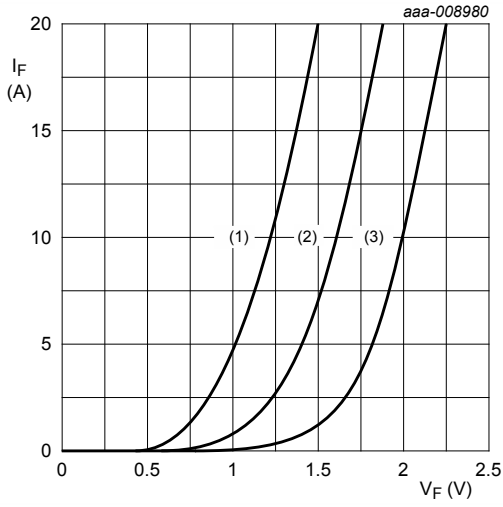
Table 6. Isolation characteristics

| Symbol          | Parameter             | Conditions  | Min | Typ | Max  | Unit |
|-----------------|-----------------------|---|-----|-----|------|------|
| $V_{isol(RMS)}$ | RMS isolation voltage | 50 Hz $\leq$ f $\leq$ 60 Hz; RH $\leq$ 65 %; from all pins to external heatsink; sinusoidal waveform; clean and dust free | -   | -   | 2500 | V    |
| $C_{isol}$      | isolation capacitance | f = 1 MHz; from cathode to external heatsink  | -   | 10  | -    | pF   |

## 10. Characteristics

Table 7. Characteristics

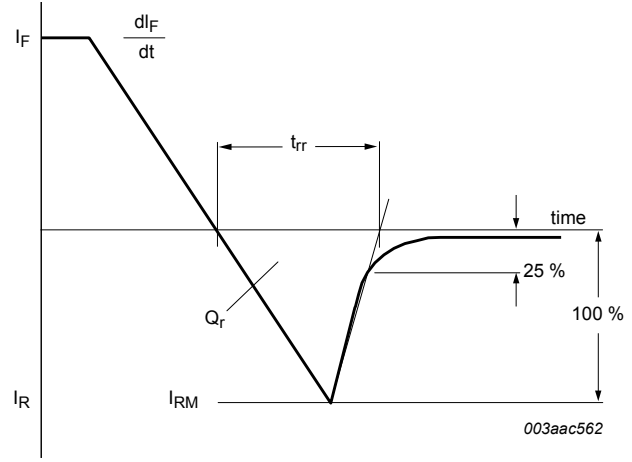
| Symbol                         | Parameter                       | Conditions   | Min | Typ  | Max | Unit          |
|--------------------------------|---------------------------------|--|-----|------|-----|---------------|
| <b>Static characteristics</b>  |                                 |  |     |      |     |               |
| $V_F$                          | forward voltage                 | $I_F = 10\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 6</a>  | -   | 1.55 | 2   | V             |
|                                |                                 | $I_F = 10\text{ A}$ ; $T_j = 150\text{ °C}$ ; <a href="#">Fig. 6</a>   | -   | -    | 1.6 | V             |
| $I_R$                          | reverse current                 | $V_R = 600\text{ V}$ ; $T_j = 25\text{ °C}$  | -   | -    | 10  | $\mu\text{A}$ |
|                                |                                 | $V_R = 500\text{ V}$ ; $T_j = 150\text{ °C}$   | -   | -    | 250 | $\mu\text{A}$ |
| <b>Dynamic characteristics</b> |                                 |  |     |      |     |               |
| $Q_r$                          | recovered charge                | $I_F = 10\text{ A}$ ; $V_R = 200\text{ V}$ ; $di_F/dt = 200\text{ A}/\mu\text{s}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>  | -   | 123  | -   | nC            |
|                                |                                 | $I_F = 10\text{ A}$ ; $V_R = 200\text{ V}$ ; $di_F/dt = 200\text{ A}/\mu\text{s}$ ; $T_j = 125\text{ °C}$ ; <a href="#">Fig. 7</a> | -   | 305  | -   | nC            |
| $t_{rr}$                       | reverse recovery time           | $I_F = 1\text{ A}$ ; $V_R = 30\text{ V}$ ; $di_F/dt = 50\text{ A}/\mu\text{s}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>     | -   | 35   | 50  | ns            |
|                                |                                 | $I_F = 10\text{ A}$ ; $V_R = 200\text{ V}$ ; $di_F/dt = 200\text{ A}/\mu\text{s}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>  | -   | 50   | -   | ns            |
|                                |                                 | $I_F = 10\text{ A}$ ; $V_R = 200\text{ V}$ ; $di_F/dt = 200\text{ A}/\mu\text{s}$ ; $T_j = 125\text{ °C}$ ; <a href="#">Fig. 7</a> | -   | 78   | -   | ns            |
|                                |                                 | $I_F = 10\text{ A}$ ; $V_R = 400\text{ V}$ ; $di_F/dt = 500\text{ A}/\mu\text{s}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>  | -   | 42   | -   | ns            |
| $I_{RM}$                       | peak reverse recovery current   | $I_F = 10\text{ A}$ ; $V_R = 200\text{ V}$ ; $di_F/dt = 200\text{ A}/\mu\text{s}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>  | -   | 4.9  | -   | A             |
|                                |                                 | $I_F = 10\text{ A}$ ; $V_R = 200\text{ V}$ ; $di_F/dt = 200\text{ A}/\mu\text{s}$ ; $T_j = 125\text{ °C}$ ; <a href="#">Fig. 7</a> | -   | 7.8  | -   | A             |
| <b>Avalanche energy</b>        |                                 |  |     |      |     |               |
| $E_{AS}$                       | non-repetitive avalanche energy | $I_R = 2.6\text{ A}$ ; $T_{j(\text{init})} = 25\text{ °C}$ ; $L = 15\text{ mH}$  | -   | 50   | -   | mJ            |



$V_o = 1.268 \text{ V}; R_s = 0.031 \Omega$

- (1)  $T_j = 150 \text{ }^\circ\text{C}$ ; typical values
- (2)  $T_j = 150 \text{ }^\circ\text{C}$ ; maximum values
- (3)  $T_j = 25 \text{ }^\circ\text{C}$ ; maximum values

**Fig. 6. Forward current as a function of forward voltage**

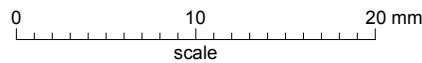
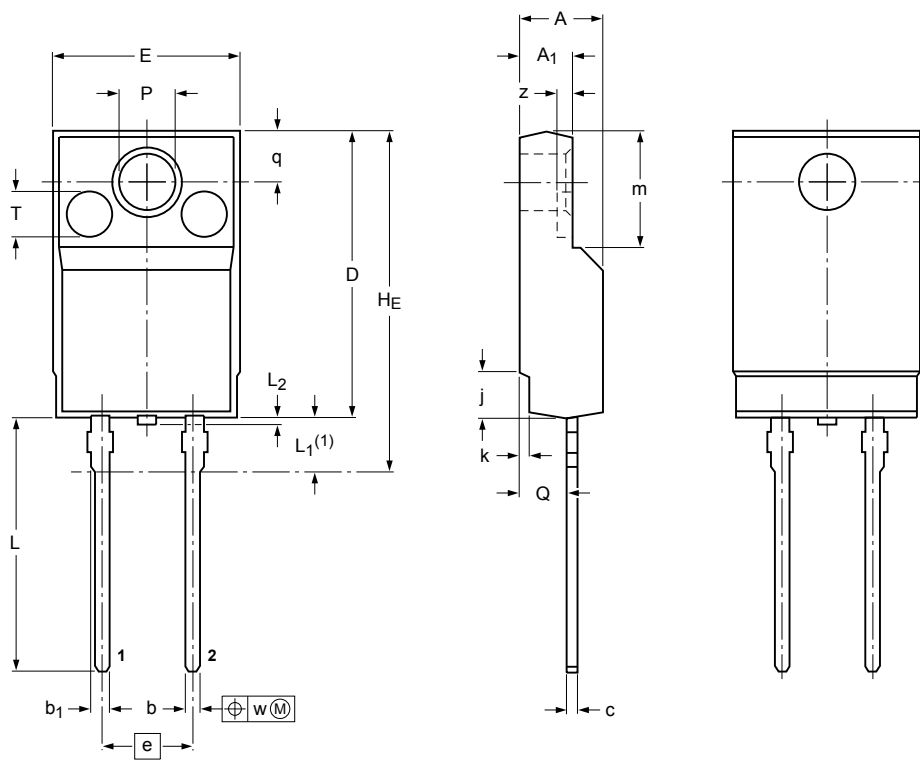


**Fig. 7. Reverse recovery definitions; ramp recovery**

### 11. Package outline

Plastic single-ended package; isolated heatsink mounted;  
1 mounting hole; 2-lead TO-220 'full pack'

SOD113



|      |
|------|
| z(2) |
| 0.8  |

DIMENSIONS (mm are the original dimensions)

| UNIT | A          | A <sub>1</sub> | b          | b <sub>1</sub> | c          | D            | E           | e    | H <sub>E max</sub> | j          | k          | L            | L <sub>1</sub> (1) | L <sub>2 max</sub> | m          | P          | Q          | q   | T    | w   |
|------|------------|----------------|------------|----------------|------------|--------------|-------------|------|--------------------|------------|------------|--------------|--------------------|--------------------|------------|------------|------------|-----|------|-----|
| mm   | 4.6<br>4.0 | 2.9<br>2.5     | 0.9<br>0.7 | 1.1<br>0.9     | 0.7<br>0.4 | 15.8<br>15.2 | 10.3<br>9.7 | 5.08 | 19.0               | 2.7<br>1.7 | 0.6<br>0.4 | 14.4<br>13.5 | 3.3<br>2.8         | 0.5                | 6.5<br>6.3 | 3.2<br>3.0 | 2.6<br>2.3 | 2.6 | 2.55 | 0.4 |

Notes

- 1. Terminals are uncontrolled within zone L<sub>1</sub>.
- 2. z is depth of T.

| OUTLINE VERSION | REFERENCES |                |       | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|----------------|-------|---------------------|----------------------|
|                 | IEC        | JEDEC          | JEITA |                     |                      |
| SOD113          |            | 2-lead TO-220F |       |                     | 02-04-09<br>07-06-18 |

Fig. 8. Package outline TO-220F (SOD113)



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|--------------------------------|--------------------|---|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

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