# BYC20X-600P

## Hyperfast power diode

4 February 2013 **Product data sheet**

## 1. General description

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

## 2. Features and benefits

- Isolated plastic package
- Low leakage current
- Low reverse recovery current
- Low thermal resistance
- Reduces switching losses in associated MOSFET or IGBT

## 3. Applications

- Active PFC in air conditioner
- Continuous Current Mode (CCM) Power Factor Correction (PFC)
- Half-bridge/full-bridge switched-mode power supplies

## 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 | $\delta = 0.5$ ; $T_h \leq 51$ °C; square-wave pulse; Fig. 1; Fig. 2; Fig. 3 | | - | - | 20 | A |
| **Static characteristics** | | | | | | | |
| $V_F$ | forward voltage | $I_F = 20$ A; $T_j = 150$ °C; Fig. 6 | | - | 1.2 | 1.6 | V |
| **Dynamic characteristics** | | | | | | | |
| $t_{rr}$ | reverse recovery time | $I_F = 1$ A; $V_R = 30$ V; $dI_F/dt = 50$ A/µs; $T_j = 25$ °C; Fig. 7 | | - | - | 35 | ns |

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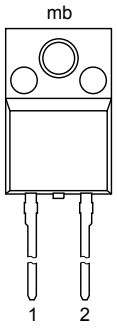
## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | K | cathode |   TO-220F (SOD113) |   |
| 2 | A | anode | | |
| mb | n.c. | mounting base; isolated | | |

## 6. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BYC20X-600P | TO-220F | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 2-lead TO-220 "full pack" | SOD113 |

## 7. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| BYC20X-600P | BYC20X-600P |

## 8. Limiting values

**Table 5. 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 | $\delta = 0.5$ ; $T_h \leq 51$ °C; square-wave pulse; Fig. 1; Fig. 2; Fig. 3 | | - | 20 | A |
| $I_{FRM}$ | repetitive peak forward current | $\delta = 0.5$ ; $t_p = 25$ µs; $T_h \leq 51$ °C; square-wave pulse | | - | 40 | A |

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{FSM}$ | non-repetitive peak forward current | $t_p$ = 10 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; Fig. 4 | | - | 200 | A |
| | | $t_p$ = 8.3 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; Fig. 4 | | - | 220 | A |
| $T_{stg}$ | storage temperature | | | -65 | 175 | °C |
| $T_j$ | junction temperature | | | - | 175 | °C |

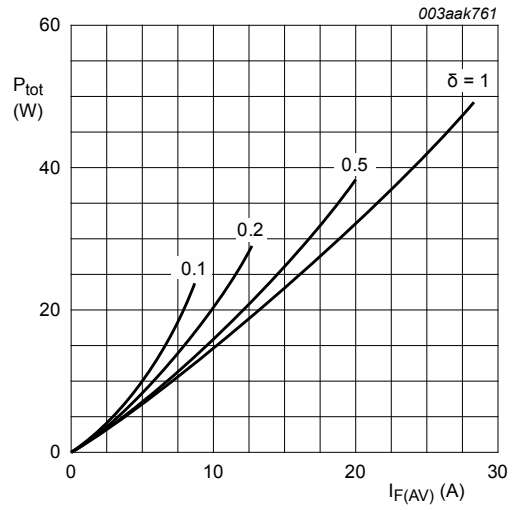



**Fig. 1. Forward power dissipation as a function of average forward current; square waveform; maximum values**

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

$V_O = 1.311\ V;\ R_S = 0.015\ \Omega$

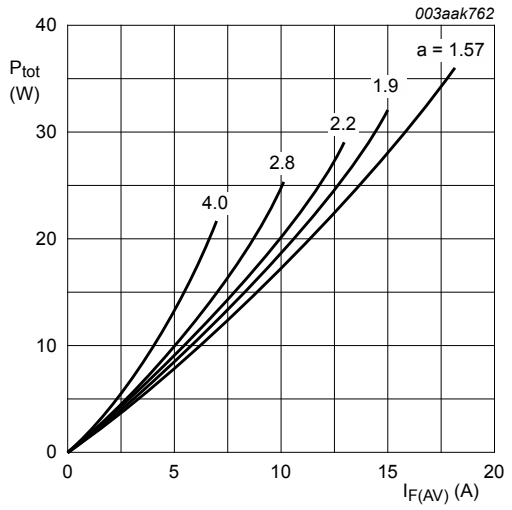



**Fig. 2. Forward power dissipation as a function of average forward current; sinusoidal waveform; maximum values**

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

$V_O = 1.311\ V;\ R_S = 0.015\ \Omega$

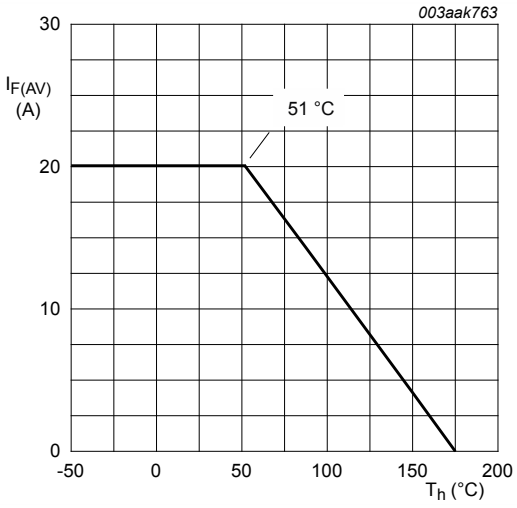



**Fig. 3. Forward current as a function of heatsink temperature; maximum values**

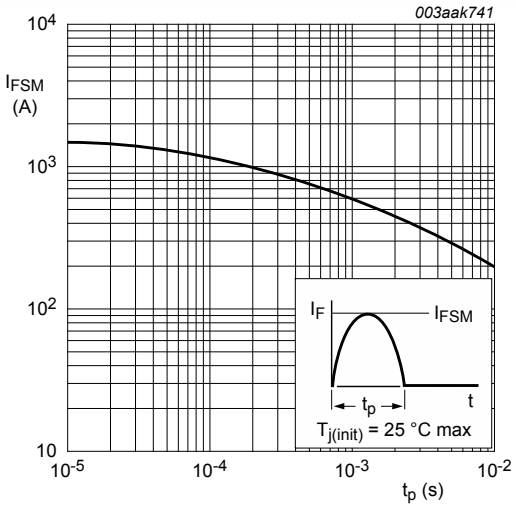



**Fig. 4. Non-repetitive peak forward current as a function of pulse width; sinusoidal waveform; maximum values**

# 9. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-h)}$ | thermal resistance from junction to heatsink | with heatsink compound ; Fig. 5 | | - | - | 3.5 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient free air | | | - | 55 | - | K/W |

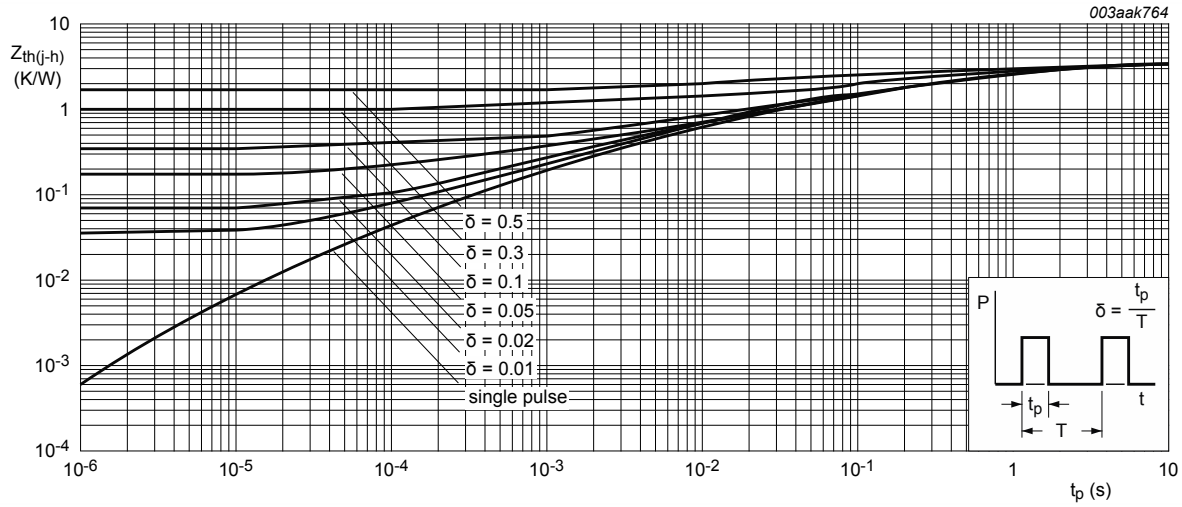



**Fig. 5. Transient thermal impedance from junction to heatsink as a function of pulse duration**

# 10. Isolation characteristics

**Table 7. Isolation characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{isol(RMS)}$ | RMS isolation voltage | 50 Hz ≤ f ≤ 60 Hz; RH ≤ 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 |

# 11. Characteristics

**Table 8. Characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | | |
| $V_F$ | forward voltage | $I_F$ = 20 A; $T_j$ = 25 °C; Fig. 6 | | - | 1.8 | 2.5 | V |

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| | | $I_F$ = 20 A; $T_j$ = 150 °C; Fig. 6 | | - | 1.2 | 1.6 | V |
| $I_R$ | reverse current | $V_R$ = 600 V; $T_j$ = 25 °C | | - | - | 10 | µA |
| | | $V_R$ = 600 V; $T_j$ = 150 °C | | - | - | 600 | µA |
| **Dynamic characteristics** | | | | | | | |
| $Q_r$ | recovered charge | $I_F$ = 20 A; $V_R$ = 200 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 25 °C; Fig. 7 | | - | 50 | - | nC |
| | | $I_F$ = 20 A; $V_R$ = 200 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 125 °C; Fig. 7 | | - | 220 | - | nC |
| $t_{rr}$ | reverse recovery time | $I_F$ = 1 A; $V_R$ = 30 V; $dI_F/dt$ = 50 A/µs; $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | ns |
| | | $I_F$ = 20 A; $V_R$ = 200 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 25 °C; Fig. 7 | | - | 32 | - | ns |
| | | $I_F$ = 20 A; $V_R$ = 200 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 125 °C; Fig. 7 | | - | 55 | - | ns |
| $I_{RM}$ | peak reverse recovery current | $I_F$ = 20 A; $V_R$ = 200 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 25 °C; Fig. 7 | | - | 2.9 | - | A |
| | | $I_F$ = 20 A; $V_R$ = 200 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 125 °C; Fig. 7 | | - | 8 | - | A |

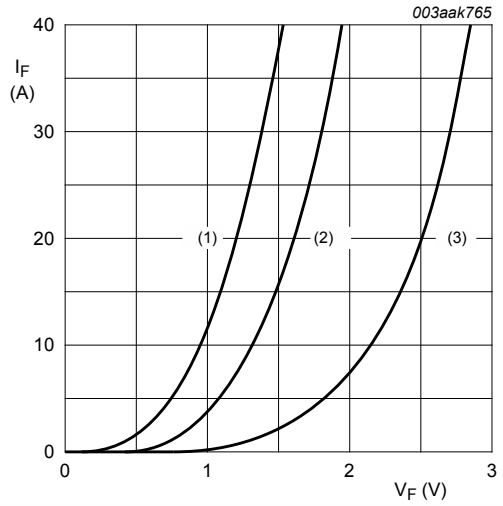



**Fig. 6. Forward current as a function of forward voltage**

(1) $T_j$ = 150 °C; typical values;
(2) $T_j$ = 150 °C; maximum values;
(3) $T_j$ = 25 °C; maximum values;
$V_O$ = 1.311 V; $R_S$ = 0.015 Ω

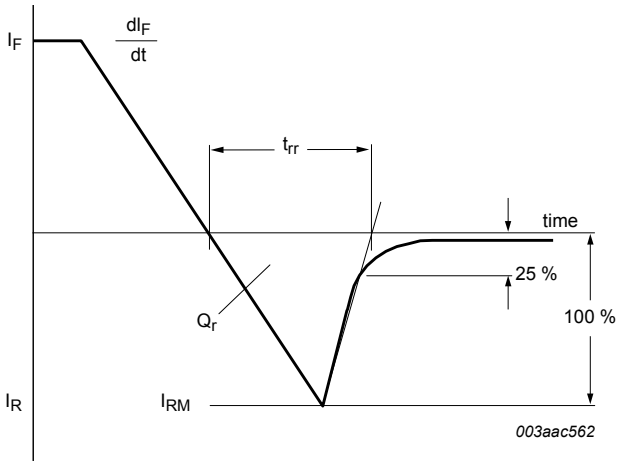
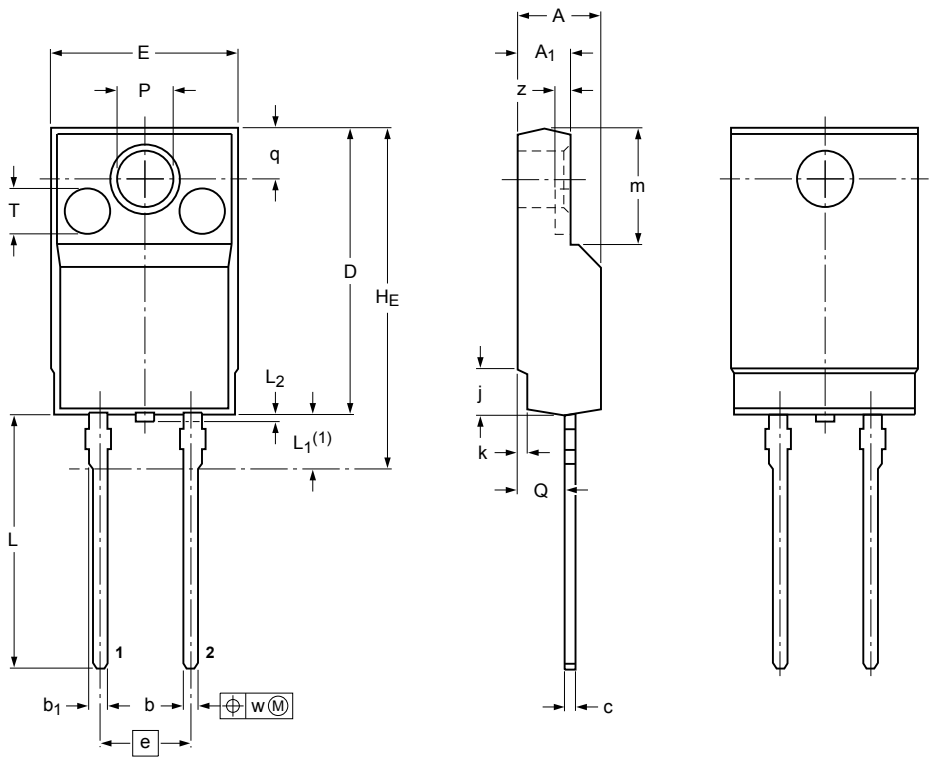



**Fig. 7. Reverse recovery definitions; ramp recovery**

## 12. 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 | $A_1$ | b | $b_1$ | c | D | E | e | $H_E$ max | j | k | L | $L_1$(1) | $L_2$ max | 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 $L_1$.
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)**

# 13. Legal information

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|---|---|---|
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