# BYC31MY-650PS

## Hyperfast power diode

Rev.01 - 15 October 2024 Product data sheet

## 1. General description

Hyperfast power diode in a IITO220F-2L plastic package

## 2. Features and benefits

- Soft reverse recovery
- Fast switching
- Isolated plastic package
- Low leakage current
- Low reverse recovery current
- Low thermal resistance
- Reduces switching losses in associated MOSFET or IGBT
- Package meets UL94V0 which guaranteed by Epoxy Mold Compound

## 3. Applications

- Active PFC in air conditioner
- High frequency switched-mode power supplies
- Power Factor Correction (PFC)

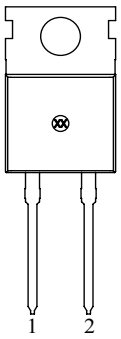
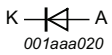
## 4. Quick reference data

**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | Notes | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| **Absolute maximum rating** | | | | | | | |
| $V_{RRM}$ | repetitive peak reverse voltage | | | 650 | | | V |
| $I_{F(AV)}$ | average forward current | δ = 0.5 ; square-wave pulse; Fig. 1; Fig. 2 | | 30 | | | A |
| $I_{FRM}$ | repetitive peak forward current | δ = 0.5 ; $t_p$ = 25 µs; square-wave pulse | | 60 | | | A |
| $I_{FSM}$ | non-repetitive peak forward current | $t_p$ = 10 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; Fig. 3 | | 250 | | | A |
| | | $t_p$ = 8.3 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse | | 275 | | | A |
| **Symbol** | **Parameter** | **Conditions** | **Notes** | **Min** | **Typ** | **Max** | **Unit** |
| **Static characteristics** | | | | | | | |
| $V_F$ | forward voltage | $I_F$ = 30 A; $T_j$ = 25 °C; Fig. 5 | | - | 1.85 | 2.50 | V |
| | | $I_F$ = 30 A; $T_j$ = 150 °C; Fig. 5 | | - | 1.45 | 2.10 | V |
| **Dynamic characteristics** | | | | | | | |
| $t_{rr}$ | reverse recovery time | $I_F$ = 1 A; $V_R$ = 30 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 25 °C; Fig. 6 | | - | 23 | - | ns |

## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | K | cathode |   |   |
| 2 | A | anode | | |
| mb | n.c. | mounting base; isolated | | |

## 6. Ordering information

**Table 3. Ordering information**

| Type number | Package name | Orderable part number | Packing method | Small packing quantity | Package version | Package issue date |
|---|---|---|---|---|---|---|
| BYC31MY-650PS | IITO220-2L | BYC31MY-650PSQ | Tube | 50 | IITO220P-2L | 13-Mar-2023 |

## 7. Marking

**Table 4. Marking codes**

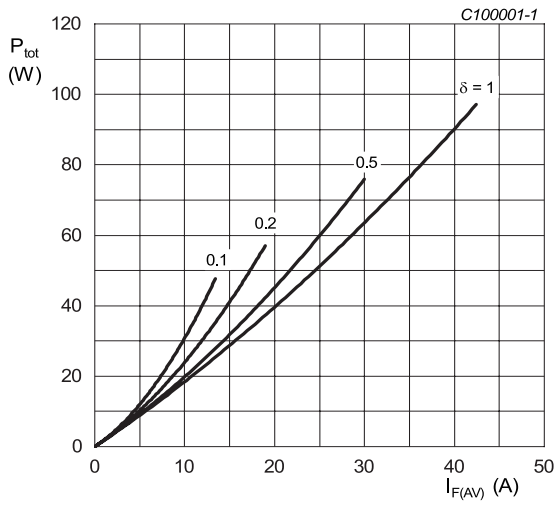
| Type number | Marking codes |
|---|---|
| BYC31MY-650PS | BYC31MY<br>650PS |

# 8. Limiting values

**Table 5. Limiting values**

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

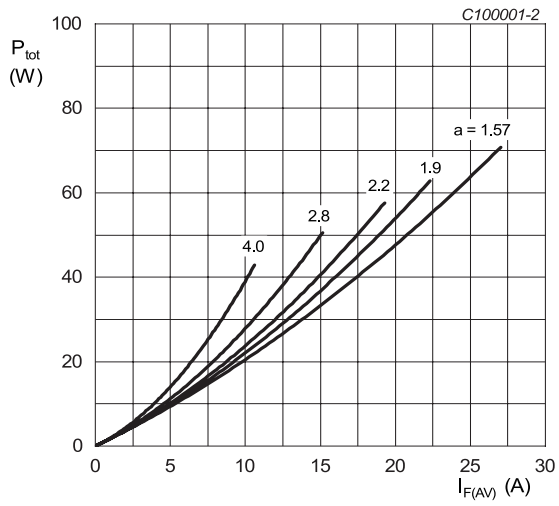
| Symbol | Parameter | Conditions | Notes | Values | Unit |
|---|---|---|---|---|---|
| $V_{RRM}$ | repetitive peak reverse voltage | | | 650 | V |
| $V_{RWM}$ | crest working reverse voltage | | | 650 | V |
| $V_R$ | reverse voltage | DC | | 650 | V |
| $I_{F(AV)}$ | average forward current | δ = 0.5 ; square-wave pulse; Fig. 1; Fig. 2 | | 30 | A |
| $I_{FRM}$ | repetitive peak forward current | δ = 0.5 ; $t_p$ = 25 µs; square-wave pulse | | 60 | A |
| $I_{FSM}$ | non-repetitive peak forward current | $t_p$ = 10 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; Fig. 3 | | 250 | A |
| | | $t_p$ = 8.3 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse | | 275 | A |
| $T_{stg}$ | storage temperature | | | -65 to 175 | °C |
| $T_j$ | junction temperature | | | -65 to 175 | °C |




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

$V_o$ = 1.705 V; $R_s$ = 0.0138 Ω

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




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

$V_o$ = 1.705 V; $R_s$ = 0.0138 Ω

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

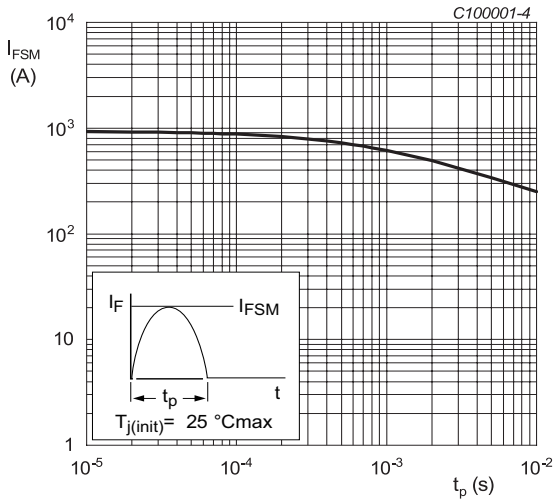



**Fig. 3. Non-repetitive peak forward current as a function of pulse width; sinusoidal waveform; maximum values**

# 9. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | Notes | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | Fig. 4 | | - | - | 2.3 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient free air | in free air | | - | 60 | - | K/W |

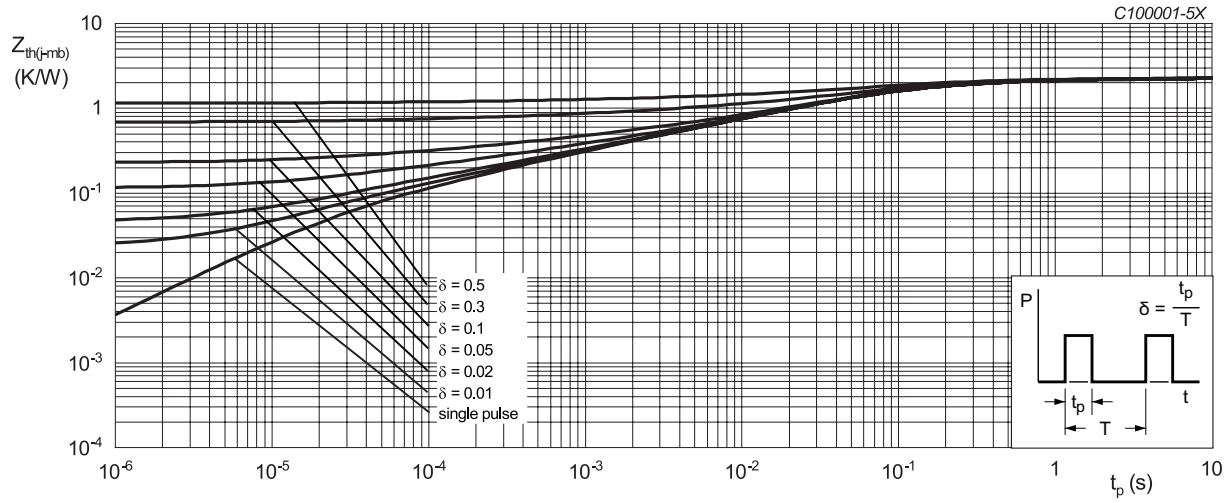



**Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; maximum values**

# 10. Isolation characteristics

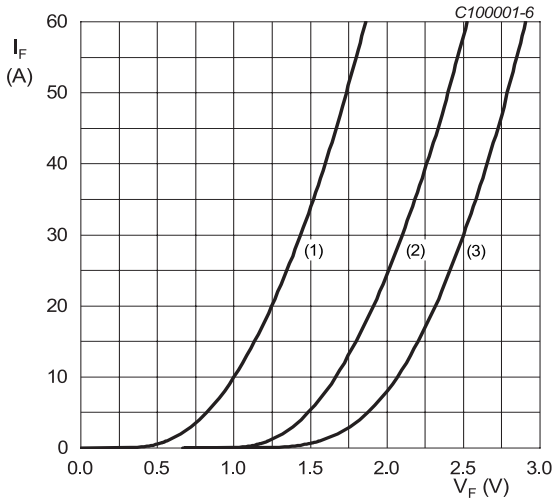
**Table 7. Isolation characteristics**

| Symbol | Parameter | Conditions | Notes | 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 | Notes | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | | |
| $V_F$ | forward voltage | $I_F$ = 30 A; $T_j$ = 25 °C; Fig. 5 | | - | 1.85 | 2.50 | V |
| | | $I_F$ = 30 A; $T_j$ = 150 °C; Fig. 5 | | - | 1.45 | 2.10 | V |
| $I_R$ | reverse current | $V_R$ = 650 V; $T_j$ = 25 °C | | - | 0.2 | 30 | µA |
| | | $V_R$ = 650 V; $T_j$ = 150 °C | | - | 0.05 | - | mA |
| **Dynamic characteristics** | | | | | | | |
| $Q_r$ | reverse charge | $I_F$ = 30 A; $V_R$ = 200 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 25 °C; Fig. 6 | | - | 200 | - | nC |
| | | $I_F$ = 30 A; $V_R$ = 200 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 125 °C; Fig. 6 | | - | 650 | - | nC |
| $t_{rr}$ | reverse recovery time | $I_F$ = 0.5 A; $I_R$ = 1 A; $I_{rr}$ = 0.25 A; $T_j$ = 25 °C | | - | 36 | - | ns |
| | | $I_F$ = 1 A; $V_R$ = 30 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 25 °C; Fig. 6 | | - | 23 | - | ns |
| | | $I_F$ = 30 A; $V_R$ = 200 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 25 °C; Fig. 6 | | - | 72 | - | ns |
| | | $I_F$ = 30 A; $V_R$ = 200 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 125 °C; Fig. 6 | | - | 121 | - | ns |
| $I_{RM}$ | peak reverse recovery current | $I_F$ = 30 A; $V_R$ = 200 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 25 °C; Fig. 6 | | - | 5.4 | - | A |
| | | $I_F$ = 30 A; $V_R$ = 200 V; $dI_F/dt$ = 200 A/µs; $T_j$ = 125 °C; Fig. 6 | | - | 10.8 | - | A |
| $E_{as}$ | non-repetitive avalanche energy | $T_{j(init)}$ = 25 °C | | 16.8 | - | - | mJ |




$V_o$ = 1.705 V; $R_s$ = 0.0138 Ω
(1) $T_j$ = 150 °C; typical values
(2) $T_j$ = 150 °C; maximum values
(3) $T_j$ = 25 °C; maximum values

**Fig. 5. Forward current as a function of forward voltage**

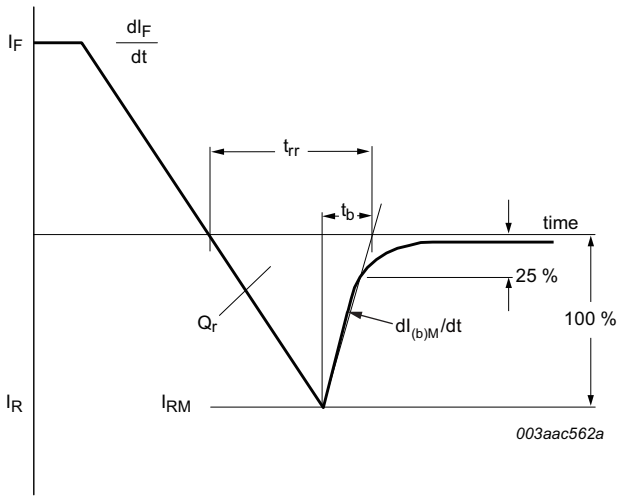
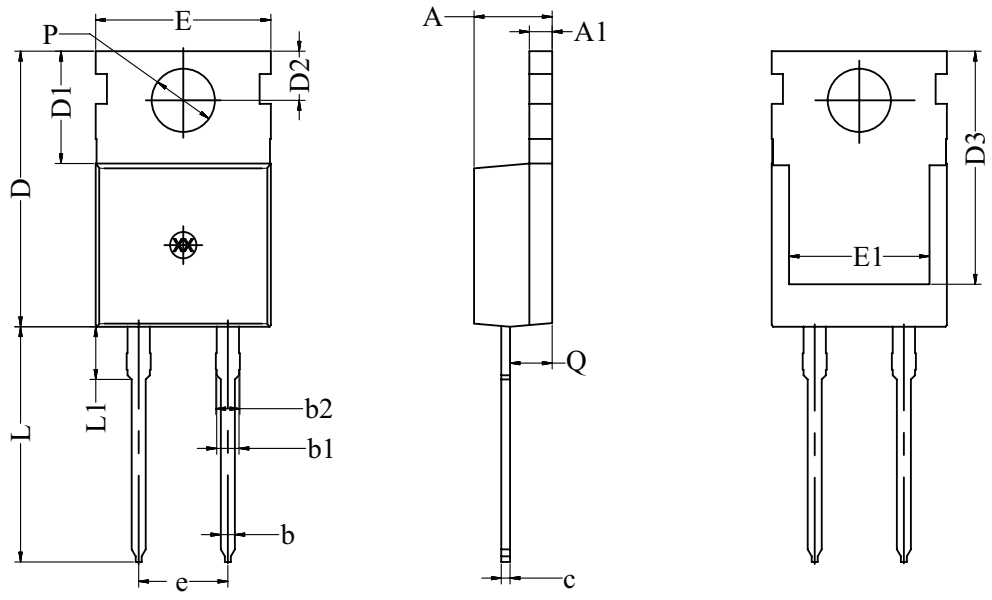



**Fig. 6. Reverse recovery definitions; ramp recovery**

## 12. Package outline

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 2 leads TO-220 IITO220-2L




| Dim | All Dimensions in Millimeters | | |
|---|---|---|---|
| | Min | Typ | Max |
| A | 4.30 | 4.45 | 4.70 |
| A1 | 1.25 | 1.30 | 1.40 |
| b | 0.60 | 0.80 | 0.90 |
| b1 | 1.10 | 1.27 | 1.40 |
| b2 | 1.32 | 1.37 | 1.72 |
| c | 0.40 | 0.50 | 0.60 |
| D | 15.20 | 15.70 | 16.00 |
| D1 | 6.20 | 6.40 | 6.60 |
| D2 | 2.70 | 2.80 | 3.00 |
| D3 | 12.98 | 13.28 | 13.58 |
| E | 9.70 | 10.00 | 10.30 |
| E1 | 7.50 | 8.00 | 8.50 |
| e | 5.08(BSC) | | |
| L | 12.80 | 13.40 | 14.00 |
| L1 | 2.80 | 3.00 | 3.20 |
| P | 3.50 | 3.60 | 3.70 |
| Q | 2.20 | 2.40 | 2.60 |

# 13. Legal information

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|---|---|---|
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# 14. Contents





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