1. General description

Hyperfast power diode in a TO263 plastic package.

2. Features and benefits

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

3. Applications

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

4. Quick reference data

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Notes</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{RRM}$</td>
<td>repetitive peak reverse voltage</td>
<td>$\delta = 0.5$ ; square-wave pulse; $T_{mb} \leq 120 ^\circ C$; Fig. 1; Fig. 2; Fig. 3</td>
<td></td>
<td>650</td>
<td>V</td>
</tr>
<tr>
<td>$I_{F(AV)}$</td>
<td>average forward current</td>
<td>$\delta = 0.5$ ; $t_p = 25 \mu s$; $T_{mb} \leq 120 ^\circ C$; square-wave pulse Fig. 1; Fig. 2; Fig. 3</td>
<td></td>
<td>15</td>
<td>A</td>
</tr>
<tr>
<td>$I_{FRM}$</td>
<td>repetitive peak forward current</td>
<td>$\delta = 0.5$ ; $t_p = 25 \mu s$; $T_{mb} \leq 120 ^\circ C$; square-wave pulse</td>
<td></td>
<td>30</td>
<td>A</td>
</tr>
<tr>
<td>$I_{FSM}$</td>
<td>non-repetitive peak forward current</td>
<td>$t_p = 10 ms$; $T_{j(init)} = 25 ^\circ C$; sine-wave pulse; Fig. 4</td>
<td></td>
<td>180</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$t_p = 8.3 ms$; $T_{j(init)} = 25 ^\circ C$; sine-wave pulse</td>
<td></td>
<td>198</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Notes</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_F$</td>
<td>forward voltage</td>
<td>$I_F = 15 A$; $T_j = 25 ^\circ C$; Fig. 6</td>
<td></td>
<td>-</td>
<td>2.50</td>
<td>3.20</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_F = 15 A$; $T_j = 150 ^\circ C$; Fig. 6</td>
<td></td>
<td>-</td>
<td>1.60</td>
<td>2.30</td>
<td>V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Notes</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tau_r$</td>
<td>reverse recovery time</td>
<td>$I_F = 1 A$; $V_R = 30 V$; $dI_F/dt = 200 A/\mu s$; $T_j = 25 ^\circ C$; Fig. 7</td>
<td></td>
<td>-</td>
<td>14</td>
<td></td>
<td>ns</td>
</tr>
</tbody>
</table>
5. Pinning information

Table 2. Pinning information

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
<th>Simplified outline</th>
<th>Graphic symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>nc</td>
<td>no connected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>K</td>
<td>cathode [1]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>anode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mb</td>
<td>mb</td>
<td>mounting base; connected to cathod</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[1] It is not possible to connect to pin 2 of the TO-263 package.

6. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package name</th>
<th>Orderable part number</th>
<th>Packing method</th>
<th>Small packing quantity</th>
<th>Package version</th>
<th>Package issue date</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYC15MB-650P</td>
<td>TO263</td>
<td>BYC15MB-650PJ</td>
<td>Reel</td>
<td>800</td>
<td>TO263d</td>
<td>17-Mar-2023</td>
</tr>
</tbody>
</table>

7. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYC15MB-650P</td>
<td>BYC15MB 650P</td>
</tr>
</tbody>
</table>
### 8. Limiting values

Table 5. Limiting values

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Notes</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{RRM}$</td>
<td>repetitive peak reverse voltage</td>
<td></td>
<td></td>
<td>650</td>
<td>V</td>
</tr>
<tr>
<td>$V_{RWM}$</td>
<td>crest working reverse voltage</td>
<td></td>
<td></td>
<td>650</td>
<td>V</td>
</tr>
<tr>
<td>$V_R$</td>
<td>reverse voltage</td>
<td>DC</td>
<td></td>
<td>650</td>
<td>V</td>
</tr>
<tr>
<td>$I_{(AV)}$</td>
<td>average forward current</td>
<td>$\delta = 0.5$ ; square-wave pulse; $T_{mb} \leq 120 , ^\circ C$; [Fig. 1; Fig. 2; Fig. 3]</td>
<td></td>
<td>15</td>
<td>A</td>
</tr>
<tr>
<td>$I_{FRM}$</td>
<td>repetitive peak forward current</td>
<td>$\delta = 0.5$ ; $t_p = 25 , \mu s$; $T_{mb} \leq 120 , ^\circ C$; square-wave pulse</td>
<td></td>
<td>30</td>
<td>A</td>
</tr>
<tr>
<td>$I_{FSM}$</td>
<td>non-repetitive peak forward current</td>
<td>$t_p = 10 , ms$; $T_{j(init)} = 25 , ^\circ C$; sine-wave pulse; [Fig. 4]</td>
<td></td>
<td>180</td>
<td>A</td>
</tr>
<tr>
<td>$I_{FSM}$</td>
<td>non-repetitive peak forward current</td>
<td>$t_p = 8.3 , ms$; $T_{j(init)} = 25 , ^\circ C$; sine-wave pulse</td>
<td></td>
<td>198</td>
<td>A</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>storage temperature</td>
<td></td>
<td></td>
<td>-65 to 175</td>
<td>°C</td>
</tr>
<tr>
<td>$T_j$</td>
<td>junction temperature</td>
<td></td>
<td></td>
<td>-65 to 175</td>
<td>°C</td>
</tr>
</tbody>
</table>

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

Fig. 2. Forward power dissipation as a function of average forward current; sinusoidal waveform; maximum values
Fig. 3. Forward current as a function of mounting base 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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Notes</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th(j-mb)}$</td>
<td>thermal resistance from junction to mounting base</td>
<td>Fig. 5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.3</td>
<td>K/W</td>
</tr>
<tr>
<td>$R_{th(j-a)}$</td>
<td>thermal resistance from junction to ambient free air</td>
<td>in free air</td>
<td>-</td>
<td>60</td>
<td>-</td>
<td></td>
<td>K/W</td>
</tr>
</tbody>
</table>

Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration
### 10. Characteristics

#### Table 7. Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Notes</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_F$</td>
<td>forward voltage</td>
<td>$I_F = 15 , A; , T_j = 25 , ^\circ C$;  \textit{Fig. 6}</td>
<td>-</td>
<td>2.50</td>
<td>3.20</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$I_F$</td>
<td>forward current</td>
<td>$I_F = 15 , A; , T_j = 150 , ^\circ C$;  \textit{Fig. 6}</td>
<td>-</td>
<td>1.60</td>
<td>2.30</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$I_R$</td>
<td>reverse current</td>
<td>$V_R = 650 , V; , T_j = 25 , ^\circ C$</td>
<td>-</td>
<td>0.5</td>
<td>30</td>
<td>$\mu A$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_R = 650 , V; , T_j = 150 , ^\circ C$</td>
<td>-</td>
<td>0.15</td>
<td>0.8</td>
<td>mA</td>
<td></td>
</tr>
</tbody>
</table>

#### Static characteristics

- **Symbol**: $V_F$
- **Parameter**: forward voltage
- **Conditions**: $I_F = 15 \, A; \, T_j = 25 \, ^\circ C$;  \textit{Fig. 6}
- **Notes**: -
- **Min**: 2.50
- **Typ**: 3.20
- **Max**: -
- **Unit**: V

- **Symbol**: $I_F$
- **Parameter**: forward current
- **Conditions**: $I_F = 15 \, A; \, T_j = 150 \, ^\circ C$;  \textit{Fig. 6}
- **Notes**: -
- **Min**: 1.60
- **Typ**: 2.30
- **Max**: -
- **Unit**: V

- **Symbol**: $I_R$
- **Parameter**: reverse current
- **Conditions**: $V_R = 650 \, V; \, T_j = 25 \, ^\circ C$
- **Notes**: -
- **Min**: 0.5
- **Typ**: 30
- **Max**: -
- **Unit**: $\mu A$

- **Symbol**: $V_R$
- **Parameter**: reverse voltage
- **Conditions**: $V_R = 650 \, V; \, T_j = 150 \, ^\circ C$
- **Notes**: -
- **Min**: 0.15
- **Typ**: 0.8
- **Max**: -
- **Unit**: mA

#### Dynamic characteristics

- **Symbol**: $Q_r$
- **Parameter**: reverse charge
- **Conditions**: $I_F = 15 \, A; \, V_R = 200 \, V; \, df/dt = 200 \, A/\mu s$;  \textit{T_j = 25 \, ^\circ C};  \textit{Fig. 7}
- **Notes**: -
- **Min**: 42
- **Typ**: -
- **Max**: -
- **Unit**: nC

- **Symbol**: $T_{rr}$
- **Parameter**: reverse recovery time
- **Conditions**: $I_F = 0.5 \, A; \, I_R = 1 \, A; \, T_j = 25 \, ^\circ C$
- **Notes**: -
- **Min**: 20
- **Typ**: -
- **Max**: -
- **Unit**: ns

- **Symbol**: $I_{RM}$
- **Parameter**: peak reverse recovery current
- **Conditions**: $I_F = 15 \, A; \, V_R = 200 \, V; \, df/dt = 200 \, A/\mu s$;  \textit{T_j = 25 \, ^\circ C};  \textit{Fig. 7}
- **Notes**: -
- **Min**: 2.8
- **Typ**: -
- **Max**: -
- **Unit**: A

- **Symbol**: $E_{as}$
- **Parameter**: non-repetitive avalanche energy
- **Conditions**: $T_{(init)} = 25 \, ^\circ C$ (1)
- **Notes**: -
- **Min**: 16.8
- **Typ**: -
- **Max**: -
- **Unit**: mJ

#### Figures

- **Fig. 6**: Forward current as a function of forward voltage
- **Fig. 7**: Reverse recovery definitions; ramp recovery

\[ V_F = 1.844 \, V; \, R_s = 0.0318 \, \Omega \]

(1) $T_j = 150 \, ^\circ C$; typical values
(2) $T_j = 150 \, ^\circ C$; maximum values
(3) $T_j = 25 \, ^\circ C$; maximum values
11. Package outline

Plastic single-ended surface-mounted package (D2PAK);

Note:
All dimensions do not include mold flash or protrusion.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>min</td>
<td>4.30</td>
<td>1.27</td>
<td>0.00</td>
<td>0.75</td>
<td>1.20</td>
<td>0.45</td>
<td>9.00</td>
<td>7.65</td>
<td>3.54</td>
<td>9.85</td>
<td>7.80</td>
<td>14.84</td>
<td>1.90</td>
<td>0.90</td>
<td>--</td>
<td>2.20</td>
</tr>
<tr>
<td>max</td>
<td>4.60</td>
<td>1.37</td>
<td>0.25</td>
<td>0.90</td>
<td>1.36</td>
<td>0.60</td>
<td>9.45</td>
<td>8.05</td>
<td>3.94</td>
<td>10.10</td>
<td>8.20</td>
<td>15.64</td>
<td>2.60</td>
<td>1.35</td>
<td>1.50</td>
<td>2.40</td>
</tr>
</tbody>
</table>
12. Legal information

**Data sheet status**

<table>
<thead>
<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective [short] data sheet</td>
<td>Development</td>
<td>This document contains data from the objective specification for product development.</td>
</tr>
<tr>
<td>Preliminary [short] data sheet</td>
<td>Qualification</td>
<td>This document contains data from the preliminary specification.</td>
</tr>
<tr>
<td>Product [short] data sheet</td>
<td>Production</td>
<td>This document contains the product specification.</td>
</tr>
</tbody>
</table>

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[2] The term 'short data sheet' is explained in section "Definitions".
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