1. General description

NPN high-voltage low $V_{CEsat}$ Breakthrough In Small Signal (BISS) transistor in a SOT223 (SC-73) medium power Surface-Mounted Device (SMD) plastic package.

PNP complement: PBHV9560Z

2. Features and benefits

- Low collector-emitter saturation voltage $V_{CEsat}$
- High collector current capability
- High collector current gain $h_{FE}$ at high $I_C$
- AEC-Q101 qualified

3. Applications

- Electronic ballast for fluorescent lighting
- LED driver for LED chain module
- LCD backlighting
- High Intensity Discharge (HID) front lighting
- Automotive motor management
- Hook switch for wired telecom
- Switch Mode Power Supply (SMPS)

4. Quick reference data

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CEO}$</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>-</td>
<td>600</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>-</td>
<td>0.5</td>
<td>A</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>DC current gain</td>
<td>$V_{CE} = 10$ V; $I_C = 50$ mA; $T_{amb} = 25$ °C</td>
<td>70</td>
<td>135</td>
<td>-</td>
<td></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>
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<tbody>
<tr>
<td>1</td>
<td>B</td>
<td>base</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>C</td>
<td>collector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>E</td>
<td>emitter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>C</td>
<td>collector</td>
<td></td>
<td></td>
</tr>
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</table>

6. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package</th>
<th>Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBHV8560Z</td>
<td>SC-73</td>
<td>plastic</td>
<td>surface-mounted package with increased heatsink; 4 leads</td>
<td>SOT223</td>
</tr>
</tbody>
</table>

7. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBHV8560Z</td>
<td>HV856Z</td>
</tr>
</tbody>
</table>
8. Limiting values

Table 5. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CBO}</td>
<td>collector-base voltage</td>
<td>open emitter</td>
<td>-</td>
<td>600</td>
<td>V</td>
</tr>
<tr>
<td>V_{CEO}</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>600</td>
<td>V</td>
</tr>
<tr>
<td>V_{CESM}</td>
<td>collector-emitter peak voltage</td>
<td>V_{BE} = 0 V</td>
<td>-</td>
<td>600</td>
<td>V</td>
</tr>
<tr>
<td>V_{EBO}</td>
<td>emitter-base voltage</td>
<td>open collector</td>
<td>-</td>
<td>6</td>
<td>V</td>
</tr>
<tr>
<td>I_C</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>0.5</td>
<td>A</td>
</tr>
<tr>
<td>P_{tot}</td>
<td>total power dissipation</td>
<td>T_{amb} ≤ 25 °C</td>
<td>[1]</td>
<td>0.65</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2]</td>
<td>1.4</td>
<td>W</td>
</tr>
<tr>
<td>T_j</td>
<td>junction temperature</td>
<td></td>
<td>-</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>T_{amb}</td>
<td>ambient temperature</td>
<td></td>
<td>-55</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>storage temperature</td>
<td></td>
<td>-65</td>
<td>150</td>
<td>°C</td>
</tr>
</tbody>
</table>


Fig. 1. Power derating curves

(1) FR4 PCB, mounting pad for collector 6 cm²
(2) FR4 PCB, standard footprint
9. Thermal characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th(j-a)}$</td>
<td>thermal resistance from junction to ambient</td>
<td>in free air</td>
<td>[1]</td>
<td>-</td>
<td>190</td>
<td>K/W</td>
</tr>
<tr>
<td>$R_{th(j-sp)}$</td>
<td>thermal resistance from junction to solder point</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>89</td>
<td>K/W</td>
</tr>
</tbody>
</table>


![Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values](image)

**FR4 PCB, single-sided copper, tin-plated and standard footprint.**

![Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values](image)

**FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².**
## 10. Characteristics

Table 7. Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{CBO}$</td>
<td>collector-base cut-off current</td>
<td>$V_{CB} = 400$ V; $I_E = 0$ A; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CB} = 400$ V; $I_E = 0$ A; $T_j = 150$ °C</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>µA</td>
</tr>
<tr>
<td>$I_{CES}$</td>
<td>collector-emitter cut-off current</td>
<td>$V_{CE} = 400$ V; $V_{BE} = 0$ V; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>$I_{EBO}$</td>
<td>emitter-base cut-off current</td>
<td>$V_{EB} = 4$ V; $I_C = 0$ A; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>DC current gain</td>
<td>$V_{CE} = 10$ V; $I_C = 50$ mA; $T_{amb} = 25$ °C</td>
<td>70</td>
<td>135</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CE} = 10$ V; $I_C = 100$ mA; $t_p \leq 300$ µs; $\delta \leq 0.02$; $T_{amb} = 25$ °C</td>
<td>70</td>
<td>135</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>$V_{CEsat}$</td>
<td>collector-emitter saturation voltage</td>
<td>$I_C = 50$ mA; $I_B = 5$ mA; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>50</td>
<td>100</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = 100$ mA; $I_B = 20$ mA; $t_p \leq 300$ µs; $\delta \leq 0.02$; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>50</td>
<td>100</td>
<td>mV</td>
</tr>
<tr>
<td>$V_{BEsat}$</td>
<td>base-emitter saturation voltage</td>
<td>$I_C = 50$ mA; $I_B = 5$ mA; pulsed; $t_p \leq 300$ µs; $\delta \leq 0.02$; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>-</td>
<td>950</td>
<td>mV</td>
</tr>
<tr>
<td>$C_c$</td>
<td>collector capacitance</td>
<td>$V_{CB} = 20$ V; $I_E = 0$ A; $i_e = 0$ A; $f = 1$ MHz; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>7.5</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>$C_e$</td>
<td>emitter capacitance</td>
<td>$V_{EB} = 0.5$ V; $I_C = 0$ A; $i_c = 0$ A; $f = 1$ MHz; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>710</td>
<td>-</td>
<td>pF</td>
</tr>
</tbody>
</table>
Fig. 4. DC current gain as a function of collector current; typical values

\( V_{CE} = 10 \text{ V} \)

1. \( T_{\text{amb}} = 100 \text{ °C} \)
2. \( T_{\text{amb}} = 25 \text{ °C} \)
3. \( T_{\text{amb}} = -55 \text{ °C} \)

Fig. 5. DC current gain as a function of collector current; typical values

\( T_{\text{amb}} = 25 \text{ °C} \)

1. \( V_{CE} = 10 \text{ V} \)
2. \( V_{CE} = 25 \text{ V} \)
3. \( V_{CE} = 50 \text{ V} \)

Fig. 6. Collector current as a function of collector-emitter voltage; typical values

\( T_{\text{amb}} = 25 \text{ °C} \)

Fig. 7. Base-emitter voltage as a function of collector current; typical values

\( V_{CE} = 10 \text{ V} \)

1. \( T_{\text{amb}} = -55 \text{ °C} \)
2. \( T_{\text{amb}} = 25 \text{ °C} \)
3. \( T_{\text{amb}} = 100 \text{ °C} \)
**PBHV8560Z**

**600 V, 0.5 A NPN high-voltage low VCEsat (BISS) transistor**

---

**Fig. 8.** Base-emitter saturation voltage as a function of collector current; typical values

\[ V_{BE_{sat}}(V) \]

\[ I_C(mA) \]

- \( I_C/I_B = 5 \)
  - (1) \( T_{amb} = -55 \, ^\circ C \)
  - (2) \( T_{amb} = 25 \, ^\circ C \)
  - (3) \( T_{amb} = 100 \, ^\circ C \)

**Fig. 9.** Collector-emitter saturation voltage as a function of collector current; typical values

\[ V_{CE_{sat}}(V) \]

\[ I_C(mA) \]

- \( I_C/I_B = 5 \)
  - (1) \( T_{amb} = 100 \, ^\circ C \)
  - (2) \( T_{amb} = 25 \, ^\circ C \)
  - (3) \( T_{amb} = -55 \, ^\circ C \)

**Fig. 10.** Collector-emitter saturation voltage as a function of collector current; typical values

\[ V_{CE_{sat}}(V) \]

\[ I_C(mA) \]

- \( T_{amb} = 25 \, ^\circ C \)
  - (1) \( I_C/I_B = 10 \)
  - (2) \( I_C/I_B = 5 \)
  - (3) \( I_C/I_B = 2.5 \)

**Fig. 11.** Collector-emitter saturation resistance as a function of collector current; typical values

\[ R_{CE_{sat}}(\Omega) \]

\[ I_C(mA) \]

- \( I_C/I_B = 5 \)
  - (1) \( T_{amb} = 100 \, ^\circ C \)
  - (2) \( T_{amb} = 25 \, ^\circ C \)
  - (3) \( T_{amb} = -55 \, ^\circ C \)
11. Test information

11.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.

12. Package outline

Fig. 13. Package outline SC-73 (SOT223)
13. Soldering

Fig. 14. Reflow soldering footprint for SC-73 (SOT223)

Fig. 15. Wave soldering footprint for SC-73 (SOT223)
### 14. Revision history

<table>
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<tr>
<th>Data sheet ID</th>
<th>Release date</th>
<th>Data sheet status</th>
<th>Change notice</th>
<th>Supersedes</th>
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<tr>
<td>PBHV8560Z v.1</td>
<td>20150313</td>
<td>Product data sheet</td>
<td>-</td>
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15. Legal information

15.1 Data sheet status

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<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
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<tr>
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<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".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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