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>
</thead>
<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 surface-mounted package with increased heatsink; 4 leads</td>
<td>SOT223</td>
<td></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>Parameter 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_CE</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>0.5</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>P_tot</td>
<td>total power dissipation</td>
<td>T_amb ≤ 25 °C</td>
<td>[1]</td>
<td>-</td>
<td>0.65 W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[2]</td>
<td>1.4 W</td>
</tr>
<tr>
<td>T_j</td>
<td>junction temperature</td>
<td>-</td>
<td>150</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>T_amb</td>
<td>ambient temperature</td>
<td>-55</td>
<td>150</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>T_stg</td>
<td>storage temperature</td>
<td>-65</td>
<td>150</td>
<td>°C</td>
<td></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 6. 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>$R_{\text{th(j-a)}}$</td>
<td>thermal resistance from junction to ambient</td>
<td>in free air</td>
<td>[1]</td>
<td>-</td>
<td>-</td>
<td>190 K/W</td>
</tr>
<tr>
<td>$R_{\text{th(j-sp)}}$</td>
<td>thermal resistance from junction to solder point</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>89 K/W</td>
<td></td>
</tr>
<tr>
<td>$R_{\text{th(j-sp)}}$</td>
<td>thermal resistance from junction to solder point</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>20 K/W</td>
<td></td>
</tr>
</tbody>
</table>


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values
## 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>$V_{CB} = 400 , \text{V}; , I_E = 0 , \text{A}; , T_{amb} = 25 , ^\circ\text{C}$</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CB} = 400 , \text{V}; , I_E = 0 , \text{A}; , T_J = 150 , ^\circ\text{C}$</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>$V_{CE} = 400 , \text{V}; , V_{BE} = 0 , \text{V}; , T_{amb} = 25 , ^\circ\text{C}$</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>$V_{EB} = 4 , \text{V}; , I_C = 0 , \text{A}; , T_{amb} = 25 , ^\circ\text{C}$</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>DC current gain</td>
<td>$V_{CE} = 10 , \text{V}; , I_C = 50 , \text{mA}; , T_{amb} = 25 , ^\circ\text{C}$</td>
<td>70</td>
<td>135</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CE} = 10 , \text{V}; , I_C = 100 , \text{mA}; , t_p \leq 300 , \mu\text{s}; , \delta \leq 0.02,; , T_{amb} = 25 , ^\circ\text{C}$</td>
<td>70</td>
<td>135</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>$V_{CEsat}$</td>
<td>collector-emitter saturation voltage</td>
<td>$I_C = 50 , \text{mA}; , I_B = 5 , \text{mA}; , T_{amb} = 25 , ^\circ\text{C}$</td>
<td>-</td>
<td>50</td>
<td>100</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = 100 , \text{mA}; , I_B = 20 , \text{mA}; , t_p \leq 300 , \mu\text{s}; , \delta \leq 0.02,; , T_{amb} = 25 , ^\circ\text{C}$</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>$I_C = 50 , \text{mA}; , I_B = 5 , \text{mA};$ pulsed; $t_p \leq 300 , \mu\text{s}; , \delta \leq 0.02,; , T_{amb} = 25 , ^\circ\text{C}$</td>
<td>-</td>
<td>-</td>
<td>950</td>
<td>mV</td>
</tr>
<tr>
<td>$C_c$</td>
<td>collector capacitance</td>
<td>$V_{CB} = 20 , \text{V}; , I_E = 0 , \text{A}; , i_e = 0 , \text{A}; , f = 1 , \text{MHz}; , T_{amb} = 25 , ^\circ\text{C}$</td>
<td>-</td>
<td>7.5</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>$C_e$</td>
<td>emitter capacitance</td>
<td>$V_{EB} = 0.5 , \text{V}; , I_C = 0 , \text{A}; , I_E = 0 , \text{A}; , f = 1 , \text{MHz}; , T_{amb} = 25 , ^\circ\text{C}$</td>
<td>-</td>
<td>710</td>
<td>-</td>
<td>pF</td>
</tr>
</tbody>
</table>
PBHV8560Z

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

Fig. 4. DC current gain as a function of collector current; typical values

\[ V_{CE} = 10 \text{ V} \]

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

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

\[ T_{amb} = 25 \text{ °C} \]

(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

\[ T_{amb} = 25 \text{ °C} \]

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

\[ V_{CE} = 10 \text{ V} \]

(1) \( T_{amb} = -55 \text{ °C} \)
(2) \( T_{amb} = 25 \text{ °C} \)
(3) \( T_{amb} = 100 \text{ °C} \)
chieve-013431

0.6

0.8

0.4

1.0

1.2

V_{BE_{sat}} (V)

10^{-1} 1 10 10^2 10^3

I_C (mA)

aaa-013432

10^{-2} 1 10 10^2 10^3

V_{CE_{sat}} (V)

10^{-1} 1 10 10^2 10^3

I_C (mA)

aaa-013433

T_{amb} = 25 °C
(1) I_C/I_B = 10
(2) I_C/I_B = 5
(3) I_C/I_B = 2.5

aaa-013434

R_{CE_{sat}} (Ω)

10^{-1} 1 10 10^2 10^3

I_C (mA)

aaa-013435

T_{amb} = 25 °C
(1) I_C/I_B = 10
(2) I_C/I_B = 5
(3) I_C/I_B = 2.5

aaa-013436

10^{-1} 1 10 10^2 10^3

I_C (mA)
PBHV8560Z
600 V, 0.5 A NPN high-voltage low VCEsat (BISS) transistor

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. 12. Collector-emitter saturation resistance as a function of collector current; typical values

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

T_{amb} = 25 °C
(1) I_{C}/I_{B} = 10
(2) I_{C}/I_{B} = 5
(3) I_{C}/I_{B} = 2.5
13. Soldering

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

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

Table 8. Revision history

<table>
<thead>
<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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<tbody>
<tr>
<td>PBHV8560Z v.1</td>
<td>20150313</td>
<td>Product data sheet</td>
<td>-</td>
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</table>
15. Legal information

15.1 Data sheet status

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<thead>
<tr>
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</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>

[1] Please consult the most recently issued document before initiating or completing a design.

[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.nexperia.com.

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