1. General description

PNP low $V_{CEsat}$ Breakthrough In Small Signal (BISS) transistor in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

2. Features and benefits

- Low collector-emitter saturation voltage $V_{CEsat}$
- High collector current capability: $I_C$ and $I_{CM}$
- High collector current gain ($h_{FE}$) at high $I_C$
- Higher efficiency leading to less heat generation
- High temperature applications up to 175 °C
- AEC-Q101 qualified

3. Applications

- Power management
- DC-to-DC conversion
- Supply line switches
- Battery charger switches
- Peripheral drivers
- Driver in low supply voltage applications (e.g. lamps and LEDs)
- Inductive load driver

4. Quick reference data

Table 1. 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>-50</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-2</td>
<td>A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>peak collector current</td>
<td>pulsed</td>
<td>-</td>
<td>-</td>
<td>-3</td>
<td>A</td>
</tr>
<tr>
<td>$R_{CEsat}$</td>
<td>collector-emitter saturation resistance</td>
<td>$I_C = -2 A; I_B = -200 mA; T_{amb} = 25 ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>135</td>
<td>mΩ</td>
</tr>
</tbody>
</table>

[1] Pulse conditions: pulse width $t_p \leq 100$ ms; duty cycle $\delta \leq 0.25$

[2] Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$
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>E</td>
<td>emitter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</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 Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBSS5350TH</td>
<td>TO-236AB</td>
<td>plastic surface-mounted package; 3 leads</td>
<td>SOT23</td>
</tr>
</tbody>
</table>

7. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code[1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBSS5350TH</td>
<td>FJ%</td>
</tr>
</tbody>
</table>

[1] % = placeholder for manufacturing site code
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>-50</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>-50</td>
<td>V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>emitter-base voltage</td>
<td>open collector</td>
<td>-</td>
<td>-7</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>-2</td>
<td>A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>peak collector current</td>
<td>pulsed</td>
<td>[1]</td>
<td>-3</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>single pulse; $t_p &lt; 1$ ms</td>
<td></td>
<td>-5</td>
<td>A</td>
</tr>
<tr>
<td>$I_B$</td>
<td>base current</td>
<td></td>
<td>-</td>
<td>-500</td>
<td>mA</td>
</tr>
<tr>
<td>$P_{tot}$</td>
<td>total power dissipation</td>
<td>$T_{amb} \leq 25$ °C</td>
<td>[2]</td>
<td>360</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[3]</td>
<td>575</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[4]</td>
<td>600</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[5]</td>
<td>700</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[1]</td>
<td>1.44</td>
<td>W</td>
</tr>
<tr>
<td>$T_j$</td>
<td>junction temperature</td>
<td></td>
<td>-</td>
<td>175</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{amb}$</td>
<td>ambient temperature</td>
<td></td>
<td>-55</td>
<td>175</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>storage temperature</td>
<td></td>
<td>-65</td>
<td>175</td>
<td>°C</td>
</tr>
</tbody>
</table>

[1] Pulse conditions: pulse width $t_p \leq 100$ ms; duty cycle $\delta \leq 0.25$
[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm$^2$.

Fig. 1. Power derating curves for SOT23

(1) FR4 PCB, 4-layer copper, 1 cm$^2$
(2) FR4 PCB, 4-layer copper, standard footprint
(3) FR4 PCB, single sided copper, 1 cm$^2$
(4) FR4 PCB, single sided copper, 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>$R_{\theta(j-a)}$</td>
<td>thermal resistance from junction to ambient</td>
<td>in free air</td>
<td>[1] -</td>
<td>-</td>
<td>417</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2] -</td>
<td>-</td>
<td>261</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[3] -</td>
<td>-</td>
<td>250</td>
<td>K/W</td>
</tr>
<tr>
<td>$R_{\theta(j-sp)}$</td>
<td>thermal resistance from junction to solder point</td>
<td></td>
<td>-</td>
<td>75</td>
<td>-</td>
<td>K/W</td>
</tr>
</tbody>
</table>

[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm².
[5] Operated under pulse conditions: pulse width $t_p \leq 100$ ms; duty cycle $\delta \leq 0.25$
FR4 PCB, single sided copper, standard footprint

**Fig. 3.** Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

FR4 PCB, single sided copper, mounting pad for drain 1 cm²

**Fig. 4.** Transient thermal impedance from junction to ambient as a function of pulse duration; typical values
FR4 PCB, 4-layer copper, standard footprint

**Fig. 5.** Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

FR4 PCB, 4-layer copper, mounting pad for collector 1 cm²

**Fig. 6.** 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>$V_{(BR)CBO}$</td>
<td>collector-base breakdown voltage</td>
<td>$I_C = -100 \mu A; I_E = 0 A; T_{amb} = 25 ^\circ C$</td>
<td>-50</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td>collector-emitter breakdown voltage</td>
<td>$I_C = -10 mA; I_B = 0 A; T_{amb} = 25 ^\circ C$</td>
<td>-50</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_{(BR)EBO}$</td>
<td>emitter-base breakdown voltage (collector open)</td>
<td>$I_C = 0 A; I_E = -100 \mu A; T_{amb} = 25 ^\circ C$</td>
<td>-7</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$I_{CBO}$</td>
<td>collector-base cut-off current</td>
<td>$V_{CB} = -50 V; I_E = 0 A; T_{amb} = 25 ^\circ C$</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>$V_{EB} = -5 V; I_C = 0 A; T_{amb} = 25 ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>DC current gain</td>
<td></td>
<td></td>
<td>200</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$V_{CESat}$</td>
<td>collector-emitter saturation voltage</td>
<td>$I_C = -500 mA; I_B = -50 mA; T_{amb} = 25 ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>-90</td>
<td>mV</td>
</tr>
<tr>
<td>$R_{CESat}$</td>
<td>collector-emitter saturation resistance</td>
<td>$I_C = -1 A; I_B = -50 mA; T_{amb} = 25 ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>-180</td>
<td>mV</td>
</tr>
<tr>
<td>$V_{BEsat}$</td>
<td>base-emitter saturation voltage</td>
<td>$I_C = -1 A; I_B = -50 mA; T_{amb} = 25 ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>-320</td>
<td>mV</td>
</tr>
<tr>
<td>$R_C$</td>
<td>collector capacitance</td>
<td></td>
<td></td>
<td>-</td>
<td>-390</td>
<td>mV</td>
</tr>
<tr>
<td>$V_{BE}$</td>
<td>base-emitter voltage</td>
<td>$V_{CE} = -5 V; I_C = -100 mA; f = 100 MHz; T_{amb} = 25 ^\circ C$</td>
<td>100</td>
<td>-</td>
<td>-1.2</td>
<td>V</td>
</tr>
<tr>
<td>$f_T$</td>
<td>transition frequency</td>
<td></td>
<td></td>
<td>-</td>
<td>-1.2</td>
<td>V</td>
</tr>
<tr>
<td>$C_C$</td>
<td>collector capacitance</td>
<td>$V_{CB} = -10 V; I_C = 0 A; I_B = 0 A; f = 1 MHz; T_{amb} = 25 ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>35</td>
<td>pF</td>
</tr>
</tbody>
</table>

[1] Pulse test: $t_p \leq 300 \mu s; \delta \leq 0.02$
Fig. 7. DC current gain as a function of collector current; typical values

\[
V_{CE} = -2 \text{ V} \\
1. T_{\text{amb}} = 175 \degree \text{C} \\
2. T_{\text{amb}} = 150 \degree \text{C} \\
3. T_{\text{amb}} = 125 \degree \text{C} \\
4. T_{\text{amb}} = 100 \degree \text{C} \\
5. T_{\text{amb}} = 85 \degree \text{C} \\
6. T_{\text{amb}} = 25 \degree \text{C} \\
7. T_{\text{amb}} = -40 \degree \text{C} \\
8. T_{\text{amb}} = -55 \degree \text{C}
\]

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

\[
V_{CE} = -2 \text{ V} \\
1. T_{\text{amb}} = -55 \degree \text{C} \\
2. T_{\text{amb}} = 25 \degree \text{C} \\
3. T_{\text{amb}} = 150 \degree \text{C}
\]

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

\[
\frac{I_C}{I_B} = 10 \\
1. T_{\text{amb}} = -55 \degree \text{C} \\
2. T_{\text{amb}} = 25 \degree \text{C} \\
3. T_{\text{amb}} = 150 \degree \text{C}
\]

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

\[
\frac{I_C}{I_B} = 20 \\
1. T_{\text{amb}} = -55 \degree \text{C} \\
2. T_{\text{amb}} = 25 \degree \text{C} \\
3. T_{\text{amb}} = 150 \degree \text{C}
\]
11. Test information

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

\[ I_c/I_b = 20 \]

(1) \( T_{amb} = 150 \, ^\circ C \)

(2) \( T_{amb} = 25 \, ^\circ C \)

(3) \( T_{amb} = -55 \, ^\circ C \)

Fig. 16. Package outline TO-236AB (SOT23)
13. Soldering

Fig. 17. Reflow soldering footprint for TO-236AB (SOT23)

Fig. 18. Wave soldering footprint for TO-236AB (SOT23)
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>PBSS5350TH v.1</td>
<td>20170621</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
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</tbody>
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15. Legal information

Data sheet status

<table>
<thead>
<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
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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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For more information, please visit: http://www.nexperia.com
For sales office addresses, please send an email to: salesaddresses@nexperia.com

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