1. General description

PNP low $V_{CE\text{sat}}$ transistor in a SOT23 (TO-236AB) small Surface-Mounted Device (SMD) plastic package.

NPN complement: PBSS4140T-Q

2. Features and benefits

- Low collector-emitter saturation voltage $V_{CE\text{sat}}$
- High collector current capability $I_C$ and $I_{CM}$
- High collector current gain ($h_{FE}$) at high $I_C$
- High efficiency due to less heat generation
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- General-purpose switching and muting
- LCD backlighting
- Supply line switching circuits
- Battery-driven equipment (mobile phones, video cameras and handheld devices)

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>-40</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-1</td>
<td>A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>peak collector current</td>
<td>single pulse; $t_p \leq$ 1 ms</td>
<td>-</td>
<td>-</td>
<td>-2</td>
<td>A</td>
</tr>
<tr>
<td>$R_{CE\text{sat}}$</td>
<td>collector-emitter saturation resistance</td>
<td>$I_C = -500$ mA; $I_B = -50$ mA; pulsed; $t_p \leq 300$ µs; $5 \leq 0.02$; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>300</td>
<td>500</td>
<td>mΩ</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>
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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>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</th>
<th>Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBSS5140T-Q</td>
<td>SOT23</td>
<td>plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body</td>
<td>SOT23</td>
<td></td>
</tr>
</tbody>
</table>

7. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code[1]</th>
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</thead>
<tbody>
<tr>
<td>PBSS5140T-Q</td>
<td>%2H</td>
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</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>-40</td>
<td>V</td>
</tr>
<tr>
<td>V_{CEO}</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>-40</td>
<td>V</td>
</tr>
<tr>
<td>V_{EBO}</td>
<td>emitter-base voltage</td>
<td>open collector</td>
<td>-</td>
<td>-5</td>
<td>V</td>
</tr>
<tr>
<td>I_C</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>-1</td>
<td>A</td>
</tr>
<tr>
<td>I_{CM}</td>
<td>peak collector current</td>
<td>single pulse; ( t_p \leq 1 \text{ ms} )</td>
<td>-</td>
<td>-2</td>
<td>A</td>
</tr>
<tr>
<td>I_{BM}</td>
<td>peak base current</td>
<td></td>
<td>-</td>
<td>-1</td>
<td>A</td>
</tr>
<tr>
<td>P_{tot}</td>
<td>total power dissipation</td>
<td>( T_{amb} \leq 25 \degree \text{C} )</td>
<td>[1]</td>
<td>300</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2]</td>
<td>450</td>
<td>mW</td>
</tr>
<tr>
<td>T_j</td>
<td>junction temperature</td>
<td></td>
<td>-</td>
<td>150</td>
<td>\degree \text{C}</td>
</tr>
<tr>
<td>T_{amb}</td>
<td>ambient temperature</td>
<td></td>
<td>-65</td>
<td>150</td>
<td>\degree \text{C}</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>storage temperature</td>
<td></td>
<td>-65</td>
<td>150</td>
<td>\degree \text{C}</td>
</tr>
</tbody>
</table>


![Power derating curves](image)

(1) FR4 PCB, mounting pad for collector 1 cm²
(2) FR4 PCB, standard footprint

Fig. 1. Power derating curves
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>$R_{th(j-a)}$</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>278</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](image1)

![Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values](image2)
# 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>$V_{CB} = -40 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \text{ °C}$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
<tr>
<td>$I_{CEO}$</td>
<td>collector-emitter cut-off current (base open)</td>
<td>$I_E = 0 \text{ A}; V_{CE} = -30 \text{ V}; T_{amb} = 25 \text{ °C}$</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>$V_{EB} = -5 \text{ V}; I_C = 0 \text{ A}; T_{amb} = 25 \text{ °C}$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>DC current gain</td>
<td>$V_{CE} = -5 \text{ V}; I_C = -1 \text{ mA}; T_{amb} = 25 \text{ °C}$</td>
<td>300</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$V_{CEsat}$</td>
<td>collector-emitter saturation voltage</td>
<td>$I_C = -100 \text{ mA}; I_B = -1 \text{ mA}; T_{amb} = 25 \text{ °C}$</td>
<td>-</td>
<td>-</td>
<td>-200</td>
<td>mV</td>
</tr>
<tr>
<td>$R_{CEsat}$</td>
<td>collector-emitter saturation resistance</td>
<td>$I_C = -500 \text{ mA}; I_B = -50 \text{ mA}; T_{amb} = 25 \text{ °C}$</td>
<td>-</td>
<td>-</td>
<td>-250</td>
<td>mV</td>
</tr>
<tr>
<td>$V_{BEon}$</td>
<td>base-emitter turn-on voltage</td>
<td>$V_{CE} = -5 \text{ V}; I_C = -1 \text{ A}; T_{amb} = 25 \text{ °C}$</td>
<td>-</td>
<td>-</td>
<td>-1</td>
<td>V</td>
</tr>
<tr>
<td>$t_d$</td>
<td>delay time</td>
<td>$V_{CC} = -10 \text{ V}; I_C = -0.5 \text{ A}; I_{Bon} = -25 \text{ mA}; I_{Boff} = 25 \text{ mA}; T_{amb} = 25 \text{ °C}$</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_r$</td>
<td>rise time</td>
<td>$I_{Bon} = 25 \text{ mA}; T_{amb} = 25 \text{ °C}$</td>
<td>-</td>
<td>31</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_{on}$</td>
<td>turn-on time</td>
<td>$I_{Boff} = 25 \text{ mA}; T_{amb} = 25 \text{ °C}$</td>
<td>-</td>
<td>41</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_s$</td>
<td>storage time</td>
<td></td>
<td>-</td>
<td>195</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_f$</td>
<td>fall time</td>
<td></td>
<td>-</td>
<td>65</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_{off}$</td>
<td>turn-off time</td>
<td></td>
<td>-</td>
<td>260</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$f_T$</td>
<td>transition frequency</td>
<td>$V_{CE} = -10 \text{ V}; I_C = -50 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ °C}$</td>
<td>150</td>
<td>-</td>
<td>-</td>
<td>MHz</td>
</tr>
<tr>
<td>$C_C$</td>
<td>collector capacitance</td>
<td>$V_{CB} = -10 \text{ V}; I_E = 0 \text{ A}; I_C = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ °C}$</td>
<td>-</td>
<td>-</td>
<td>12</td>
<td>pF</td>
</tr>
</tbody>
</table>
**PBSS5140T-Q**

40 V, 1 A PNP low VCEsat transistor

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

\[ V_{CE} = -5 \text{ V} \]

(1) \( T_{amb} = 100 \, ^\circ \text{C} \)

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

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

**Fig. 5.** Collector current as a function of collector-emitter voltage; typical values

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

\[ V_{CE} = -5 \text{ V} \]

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

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

(3) \( T_{amb} = 100 \, ^\circ \text{C} \)

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

\[ I_C/I_B = 20 \]

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

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

(3) \( T_{amb} = 100 \, ^\circ \text{C} \)
Fig. 8. Collector-emitter saturation voltage as a function of collector current; typical values

\[
\begin{align*}
I_C/I_B &= 20 \\
(1) &\ T_{amb} = 100 \, ^\circ C \\
(2) &\ T_{amb} = 25 \, ^\circ C \\
(3) &\ T_{amb} = -55 \, ^\circ C
\end{align*}
\]

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

\[
\begin{align*}
T_{amb} &= 25 \, ^\circ C \\
(1) &\ I_C/I_B = 100 \\
(2) &\ I_C/I_B = 50 \\
(3) &\ I_C/I_B = 10
\end{align*}
\]

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

\[
\begin{align*}
I_C/I_B &= 20 \\
(1) &\ T_{amb} = 100 \, ^\circ C \\
(2) &\ T_{amb} = 25 \, ^\circ C \\
(3) &\ T_{amb} = -55 \, ^\circ C
\end{align*}
\]

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

\[
\begin{align*}
T_{amb} &= 25 \, ^\circ C \\
(1) &\ I_C/I_B = 100 \\
(2) &\ I_C/I_B = 50 \\
(3) &\ I_C/I_B = 10
\end{align*}
\]
11. Test information

![Diagram of transistor switching time definition]

**Fig. 12. Transistor switching time definition**

![Test circuit for switching times](image)

**Fig. 13. Test circuit for switching times**

**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

![Package outline SOT23](image)

Fig. 14. Package outline SOT23

13. Soldering

![Reflow soldering footprint for SOT23](image)

Fig. 15. Reflow soldering footprint for SOT23
Nexperia

PBSS5140T-Q

40 V, 1 A PNP low VCEsat transistor

Fig. 16. Wave soldering footprint for SOT23
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>PBSS5140T-Q v.1</td>
<td>20231004</td>
<td>Product data sheet</td>
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</tbody>
</table>

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Data sheet status

<table>
<thead>
<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
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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>

[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 https://www.nexperia.com.

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