1. General description

PNP low V\textsubscript{CEsat} transistor in a SOT223 (SC-73) medium power Surface-Mounted Device (SMD) plastic package.

NPN complement: PBSS4021NZ-Q

2. Features and benefits

- Very low collector-emitter saturation voltage V\textsubscript{CEsat}
- High collector current capability I\textsubscript{C} and I\textsubscript{CM}
- High collector current gain (h\textsubscript{FE}) at high I\textsubscript{C}
- High energy efficiency due to less heat generation
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- Loadswitch
- Battery-driven devices
- Power management
- Charging circuits
- Power switches (e.g. motors, fans)

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\textsubscript{CEO}</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>-</td>
<td>-20</td>
<td>V</td>
</tr>
<tr>
<td>I\textsubscript{C}</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-6.6</td>
<td>A</td>
</tr>
<tr>
<td>I\textsubscript{CM}</td>
<td>peak collector current</td>
<td>single pulse; t\textsubscript{p} \leq 1 ms</td>
<td>-</td>
<td>-</td>
<td>-20</td>
<td>A</td>
</tr>
<tr>
<td>R\textsubscript{CEsat}</td>
<td>collector-emitter saturation resistance</td>
<td>I\textsubscript{C} = -6 A; I\textsubscript{B} = -600 mA; pulsed; t\textsubscript{p} \leq 300 \mu s; \delta \leq 0.02; T\textsubscript{amb} = 25 °C</td>
<td>-</td>
<td>22</td>
<td>33</td>
<td>mΩ</td>
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</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>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>
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6. Ordering information

Table 3. Ordering information

<table>
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<th>Type number</th>
<th>Package Name</th>
<th>Description</th>
<th>Version</th>
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</thead>
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<tr>
<td>PBSS4021PZ-Q</td>
<td>SC-73</td>
<td>plastic, surface-mounted package with increased heatsink; 4 leads; 2.3 mm pitch; 6.5 mm x 3.5 mm x 1.65 mm body</td>
<td>SOT223</td>
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7. Marking

Table 4. Marking codes

<table>
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<tr>
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<th>Marking code</th>
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<tr>
<td>PBSS4021PZ-Q</td>
<td>PB4021PZ</td>
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# 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>-20</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>-20</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>-6.6</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>-20</td>
<td>A</td>
</tr>
<tr>
<td>$I_B$</td>
<td>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>$T_{amb} \leq 25$ °C</td>
<td>[1]</td>
<td>770</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2]</td>
<td>1700</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[3]</td>
<td>2600</td>
<td>mW</td>
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<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>


![Power derating curves](image)

Fig. 1. Power derating curves

(1) Ceramic PCB, Al$\text{}_2$O$\text{}_3$, standard footprint
(2) FR4 PCB, mounting pad for collector 6 cm$^2$
(3) 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>$R_{th(j-a)}$</td>
<td>thermal resistance from junction to ambient</td>
<td>in free air</td>
<td></td>
<td></td>
<td>160</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[1]</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2]</td>
<td>-</td>
<td>75</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[3]</td>
<td>-</td>
<td>50</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>11</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

**Fig. 3.** Transient thermal impedance from junction to ambient as a function of pulse duration; typical values
Ceramic PCB, Al₂O₃, standard footprint

Fig. 4. 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>$V_{CB} = -20 V; I_E = 0 A; T_{amb} = 25 °C$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CB} = -20 V; I_E = 0 A; T_J = 150 °C$</td>
<td>-</td>
<td>-</td>
<td>-55</td>
<td>μA</td>
</tr>
<tr>
<td>I_{EBO}</td>
<td>emitter-base cut-off current</td>
<td>$V_{EB} = -5 V; I_C = 0 A; T_{amb} = 25 °C$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
<tr>
<td>I_{CES}</td>
<td>collector-emitter cut-off current</td>
<td>$V_{CE} = -16 V; V_{BE} = 0 V; T_{amb} = 25 °C$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>DC current gain</td>
<td>$V_{CE} = -2 V; I_C = -500 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>250</td>
<td>400</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CE} = -2 V; I_C = -1 A; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>250</td>
<td>400</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CE} = -2 V; I_C = -2 A; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>200</td>
<td>350</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CE} = -2 V; I_C = -4 A; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>150</td>
<td>250</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CE} = -2 V; I_C = -7 A; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>100</td>
<td>180</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$V_{CE\text{sat}}$</td>
<td>collector-emitter saturation voltage</td>
<td>$I_C = -1 A; I_B = -50 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>-</td>
<td>-31</td>
<td>-50</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = -1 A; I_B = -10 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>-</td>
<td>-53</td>
<td>-80</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = -2 A; I_B = -40 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>-</td>
<td>-66</td>
<td>-100</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = -4 A; I_B = -200 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>-</td>
<td>-95</td>
<td>-140</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = -4 A; I_B = -40 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>-</td>
<td>-150</td>
<td>-225</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = -7 A; I_B = -350 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>-</td>
<td>-160</td>
<td>-240</td>
<td>mV</td>
</tr>
<tr>
<td>$R_{CE\text{sat}}$</td>
<td>collector-emitter saturation resistance</td>
<td>$I_C = -6 A; I_B = -600 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>-</td>
<td>22</td>
<td>33</td>
<td>mΩ</td>
</tr>
<tr>
<td>$V_{BE\text{sat}}$</td>
<td>base-emitter saturation voltage</td>
<td>$I_C = -1 A; I_B = -50 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>-</td>
<td>-0.79</td>
<td>-0.9</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = -4 A; I_B = -400 mA; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>-</td>
<td>-0.94</td>
<td>-1.05</td>
<td>V</td>
</tr>
<tr>
<td>$V_{BE\text{on}}$</td>
<td>base-emitter turn-on voltage</td>
<td>$V_{CE} = -2 V; I_C = -2 A; pulsed; t_p ≤ 300 μs; δ ≤ 0.02; T_{amb} = 25 °C$</td>
<td>-</td>
<td>-0.73</td>
<td>-0.85</td>
<td>V</td>
</tr>
<tr>
<td>$t_d$</td>
<td>delay time</td>
<td>$V_{CC} = -12.5 V; I_C = -1 A; I_{pon} = -0.05 A; I_{Boff} = 0.05 A; T_{amb} = 25 °C$</td>
<td>-</td>
<td>55</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_r$</td>
<td>rise time</td>
<td>$I_{Boff} = 0.05 A; T_{amb} = 25 °C$</td>
<td>-</td>
<td>60</td>
<td>-</td>
<td>ns</td>
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<tr>
<td>$t_{on}$</td>
<td>turn-on time</td>
<td>-</td>
<td>115</td>
<td>-</td>
<td>ns</td>
<td></td>
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<tr>
<td>$t_s$</td>
<td>storage time</td>
<td>-</td>
<td>400</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>$t_{f}$</td>
<td>fall time</td>
<td>-</td>
<td>110</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>$t_{off}$</td>
<td>turn-off time</td>
<td>-</td>
<td>510</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>$f_T$</td>
<td>transition frequency</td>
<td>$V_{CE} = -10 V; I_C = -100 mA; f = 100 MHz; T_{amb} = 25 °C$</td>
<td>-</td>
<td>85</td>
<td>-</td>
<td>MHz</td>
</tr>
<tr>
<td>$C_c$</td>
<td>collector capacitance</td>
<td>$V_{CE} = -10 V; I_E = 0 A; I_L = 0 A; f = 1 MHz; T_{amb} = 25 °C$</td>
<td>-</td>
<td>125</td>
<td>-</td>
<td>pF</td>
</tr>
</tbody>
</table>
Nexperia

PBSS4021PZ-Q

20 V, 6.6 A PNP low VCEsat transistor

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

- $V_{CE} = -2 \text{ V}$
- (1) $T_{amb} = 100 \degree \text{C}$
- (2) $T_{amb} = 25 \degree \text{C}$
- (3) $T_{amb} = -55 \degree \text{C}$

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

- $T_{amb} = 25 \degree \text{C}$

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

- $V_{CE} = -2 \text{ V}$
- (1) $T_{amb} = -55 \degree \text{C}$
- (2) $T_{amb} = 25 \degree \text{C}$
- (3) $T_{amb} = 100 \degree \text{C}$

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

- $I_C/I_B = 20$
- (1) $T_{amb} = -55 \degree \text{C}$
- (2) $T_{amb} = 25 \degree \text{C}$
- (3) $T_{amb} = 100 \degree \text{C}$

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PBSS4021PZ-Q
20 V, 6.6 A PNP low VCEsat transistor

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

\[ V_{CE\text{sat}} (\text{V}) \]

-1

-10

-100

-1000

-10000

-100000

-1000000

-10000000

-100000000

\[ I_{C} (\text{mA}) \]

-1

-10

-100

-1000

-10000

-100000

-1000000

-10000000

-100000000

\[ I_{C}/I_{B} = 20 \]

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

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

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

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

\[ V_{CE\text{sat}} (\text{V}) \]

-1

-10

-100

-1000

\[ I_{C} (\text{mA}) \]

-10000

-100000

-1000000

-10000000

-100000000

\[ I_{C}/I_{B} = 20 \]

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

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

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

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

\[ R_{CE\text{sat}} (\Omega) \]

10

100

1000

\[ I_{C} (\text{mA}) \]

-1000

-10000

-100000

-1000000

-10000000

\[ I_{C}/I_{B} = 20 \]

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

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

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

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

\[ R_{CE\text{sat}} (\Omega) \]

10

100

1000

\[ I_{C} (\text{mA}) \]

-1000

-10000

-100000

-1000000

-10000000

\[ I_{C}/I_{B} = 20 \]

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

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

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

Fig. 13. Transistor switching time definition

Fig. 14. 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 SC-73 (SOT223)](image1)

Fig. 15. Package outline SC-73 (SOT223)

13. Soldering

![Reflow soldering footprint for SC-73 (SOT223)](image2)

Fig. 16. Reflow soldering footprint for SC-73 (SOT223)
Fig. 17. Wave soldering footprint for SC-73 (SOT223)
## 14. 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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<tr>
<td>PBSS4021PZ-Q v.1</td>
<td>20240212</td>
<td>Product data sheet</td>
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15. Legal information

Data sheet status

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<tbody>
<tr>
<td>Objective [short] data sheet</td>
<td>Development</td>
<td>This document contains data from the objective specification for product development.</td>
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<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>
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</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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