1. General description

PNP low $V_{CE_{Sat}}$ Breakthrough In Small Signal (BISS) transistor in a leadless ultra small DFN1010D-3 (SOT1215) Surface-Mounted Device (SMD) plastic package with visible and solderable side pads.

NPN complement: PBSS4160QA.

2. Features and benefits

- Very low collector-emitter saturation voltage $V_{CE_{Sat}}$
- High collector current capability $I_C$ and $I_{CM}$
- High collector current gain $h_{FE}$ at high $I_C$
- High energy efficiency due to less heat generation
- Reduced Printed-Circuit Board (PCB) area requirements
- Solderable side pads
- AEC-Q101 qualified

3. Applications

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

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>-60</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>$t_p \leq 1 \text{ ms};$ pulsed</td>
<td>-</td>
<td>-</td>
<td>-1.5</td>
<td>A</td>
</tr>
<tr>
<td>$R_{CE_{Sat}}$</td>
<td>collector-emitter saturation resistance</td>
<td>$I_C = -1 \text{ A};$ $I_B = -100 \text{ mA};$ pulsed; $t_p \leq 300 \mu$s; $\delta \leq 0.02; \ T_{amb} = 25 \ ^\circ\text{C}$</td>
<td>-</td>
<td>225</td>
<td>330</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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<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>
<tr>
<td>4</td>
<td>C</td>
<td>collector</td>
<td></td>
<td></td>
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DFN1010D-3 (SOT1215)

6. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package</th>
<th>Description</th>
<th>Version</th>
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<tr>
<td>PBSS5160QA</td>
<td>DFN1010D-3</td>
<td>plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals</td>
<td>SOT1215</td>
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7. Marking

Table 4. Marking codes

<table>
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<th>Marking code</th>
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<tr>
<td>PBSS5160QA</td>
<td>10 10 10</td>
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Fig. 1. DFN1010D-3 (SOT1215) binary marking code description
8. Limiting values

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<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>-60</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>-60</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>-1</td>
<td>A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>peak collector current</td>
<td>$t_p \leq 1$ ms; pulsed</td>
<td>-</td>
<td>-1.5</td>
<td>A</td>
</tr>
<tr>
<td>$I_B$</td>
<td>base current</td>
<td></td>
<td>-</td>
<td>-0.3</td>
<td>A</td>
</tr>
<tr>
<td>$I_{BM}$</td>
<td>peak base current</td>
<td>$t_p \leq 1$ ms; pulsed</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>325</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2]</td>
<td>600</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[3]</td>
<td>740</td>
<td>mW</td>
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<td></td>
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<td></td>
<td>[4]</td>
<td>540</td>
<td>mW</td>
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<td></td>
<td></td>
<td></td>
<td>[5]</td>
<td>1000</td>
<td>mW</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>

[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated mounting pad for collector 1 cm$^2$. 
9. Thermal characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter Description</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>-</td>
<td>385</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2]</td>
<td>-</td>
<td>-</td>
<td>209</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[3]</td>
<td>-</td>
<td>-</td>
<td>169</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[5]</td>
<td>-</td>
<td>-</td>
<td>125</td>
</tr>
</tbody>
</table>

1. Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
2. Device mounted on an FR4 PCB, single-sided copper, tin-plated mounting pad for collector 1 cm$^2$.
3. Device mounted on an FR4 PCB, single-sided copper, tin-plated mounting pad for collector 6 cm$^2$.
4. Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.
5. Device mounted on an FR4 PCB, 4-layer copper, tin-plated mounting pad for collector 1 cm$^2$.
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, 1 cm$^2$

**Fig. 4.** Transient thermal impedance from junction to ambient as a function of pulse duration; typical values
Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values
FR4 PCB, 4-layer copper, 1 cm²

Fig. 7. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

### 10. 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>$V_{CB} = -48 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \degree \text{C}$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CB} = -48 \text{ V}; I_E = 0 \text{ A}; T_J = 150 \degree \text{C}$</td>
<td>-</td>
<td>-</td>
<td>-50</td>
<td>µA</td>
</tr>
<tr>
<td>$I_{CES}$</td>
<td>collector-emitter cut-off current</td>
<td>$V_{CE} = -48 \text{ V}; V_{BE} = 0 \text{ V}; T_{amb} = 25 \degree \text{C}$</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>$V_{EB} = -5 \text{ V}; I_C = 0 \text{ A}; T_{amb} = 25 \degree \text{C}$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>DC current gain</td>
<td>$V_{CE} = -2 \text{ V}; I_C = -100 \text{ mA}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \degree \text{C}$</td>
<td>160</td>
<td>250</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CE} = -2 \text{ V}; I_C = -500 \text{ mA}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \degree \text{C}$</td>
<td>120</td>
<td>185</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CE} = -2 \text{ V}; I_C = -1 \text{ A}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \degree \text{C}$</td>
<td>85</td>
<td>125</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$V_{CEsat}$</td>
<td>collector-emitter saturation voltage</td>
<td>$I_C = -500 \text{ mA}; I_B = -50 \text{ mA}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \degree \text{C}$</td>
<td>-</td>
<td>-125</td>
<td>-190</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = -1 \text{ A}; I_B = -50 \text{ mA}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \degree \text{C}$</td>
<td>-</td>
<td>-315</td>
<td>-460</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = -1 \text{ A}; I_B = -100 \text{ mA}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \degree \text{C}$</td>
<td>-</td>
<td>-225</td>
<td>-330</td>
<td>mV</td>
</tr>
<tr>
<td>$R_{CEsat}$</td>
<td>collector-emitter saturation resistance</td>
<td>$I_C = -1 \text{ A}; I_B = -100 \text{ mA}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \degree \text{C}$</td>
<td>-</td>
<td>225</td>
<td>330</td>
<td>mΩ</td>
</tr>
</tbody>
</table>
### Symbol | Parameter | Conditions | Min | Typ | Max | Unit
--- | --- | --- | --- | --- | --- | ---
$V_{\text{BE}_{\text{sat}}}$ | base-emitter saturation voltage | $I_C = -500 \text{ mA}; I_B = -50 \text{ mA}; $ pulse; $t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 ^\circ\text{C}$ | - | -0.88 | -1 | V
 | | $I_C = -1 \text{ A}; I_B = -50 \text{ mA}; $ pulse; $t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 ^\circ\text{C}$ | - | -0.94 | -1.05 | V
 | | $I_C = -1 \text{ A}; I_B = -100 \text{ mA}; $ pulse; $t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 ^\circ\text{C}$ | - | -0.97 | -1.1 | V
$V_{\text{BE}_{\text{on}}}$ | base-emitter turn-on voltage | $V_{\text{CE}} = -2 \text{ V}; I_C = -0.5 \text{ A};$ pulse; $t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 ^\circ\text{C}$ | - | -0.8 | -0.9 | V
$t_d$ | delay time | $V_{\text{CC}} = -10 \text{ V}; I_C = -0.5 \text{ A}; I_{\text{Bon}} = -25 \text{ mA};$ $I_{\text{Buffer}} = 25 \text{ mA}; T_{\text{amb}} = 25 ^\circ\text{C}$ | - | 15 | - | ns
$t_r$ | rise time | | - | 35 | - | ns
$t_{\text{on}}$ | turn-on time | | - | 50 | - | ns
$t_s$ | storage time | | - | 300 | - | ns
$t_f$ | fall time | | - | 50 | - | ns
$t_{\text{off}}$ | turn-off time | | - | 350 | - | ns
$f_T$ | transition frequency | $V_{\text{CE}} = -10 \text{ V}; I_C = -50 \text{ mA}; f = 100 \text{ MHz}; T_{\text{amb}} = 25 ^\circ\text{C}$ | 100 | 150 | - | MHz
$C_c$ | collector capacitance | $V_{\text{CE}} = -10 \text{ V}; I_C = 0 \text{ A}; I_E = 0 \text{ A}; f = 1 \text{ MHz}; T_{\text{amb}} = 25 ^\circ\text{C}$ | - | 12 | 15 | pF

Fig. 8. DC current gain as a function of collector current; typical values

![Fig. 8](aaa-007887)

$V_{\text{CE}} = -2 \text{ V}$
(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. 9. Collector current as a function of collector-emitter voltage; typical values

![Fig. 9](aaa-007888)

$T_{\text{amb}} = 25 ^\circ\text{C}$
**Nexperia**

**PBSS5160QA**

60 V, 1 A PNP low VCEsat (BISS) transistor

---

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

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

---

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

- $I_{C}/I_B = 20$
- (1) $T_{amb} = -55 \, ^\circ C$
- (2) $T_{amb} = 25 \, ^\circ C$
- (3) $T_{amb} = 100 \, ^\circ C$

---

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

- $I_{C}/I_B = 20$
- (1) $T_{amb} = 100 \, ^\circ C$
- (2) $T_{amb} = 25 \, ^\circ C$
- (3) $T_{amb} = -55 \, ^\circ C$

---

**Fig. 13.** Collector-emitter saturation voltage as a function of collector current; typical values

- $T_{amb} = 25 \, ^\circ C$
- (1) $I_{C}/I_B = 100$
- (2) $I_{C}/I_B = 50$
- (3) $I_{C}/I_B = 10$
Fig. 14. Collector-emitter saturation resistance as a function of collector current; typical values

\[
\frac{I_C}{I_B} = 20 \\
(1) \ T_{amb} = 100 \ ^\circ C \\
(2) \ T_{amb} = 25 \ ^\circ C \\
(3) \ T_{amb} = -55 \ ^\circ C
\]

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

\[
T_{amb} = 25 \ ^\circ C \\
(1) \ \frac{I_C}{I_B} = 100 \\
(2) \ \frac{I_C}{I_B} = 50 \\
(3) \ \frac{I_C}{I_B} = 10
\]
11. Test information

![Graphical representation of BISS transistor switching time definition](image)

**Fig. 16.** BISS transistor switching time definition

![Test circuit for switching times](image)

**Fig. 17.** Test circuit for switching times

### 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. 18. Package outline DFN1010D-3 (SOT1215)
13. Soldering

Footprint information for reflow soldering of DFN1010D-3 package

_sot1215_fr_

**Fig. 19. Reflow soldering footprint for DFN1010D-3 (SOT1215)**
# 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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</thead>
<tbody>
<tr>
<td>PBSS5160QA v.1</td>
<td>20130823</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
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15. Legal information

15.1 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>
</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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