1. General description

PNP low $V_{CEsat}$ Breakthrough in a Small Signal (BISS) transistor, encapsulated in an ultra thin DFN2020D-3 (SOT1061D) leadless small Surface-Mounted Device (SMD) plastic package with medium power capability and visible and solderable side pads.

NPN complement: PBSS4360PAS

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 $I_C$
- High efficiency due to less heat generation
- High temperature applications up to 175 °C
- Reduced Printed-Circuit Board (PCB) area requirements
- Leadless small SMD plastic package with solderable side pads
- Exposed heat sink for excellent thermal and electrical conductivity
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- 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>-3</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>-6</td>
<td>A</td>
</tr>
<tr>
<td>$R_{CEsat}$</td>
<td>collector-emitter saturation resistance</td>
<td>$I_C = -3$ A; $I_B = -300$ mA; pulsed; $t_p \leq 300$ µs; $\delta \leq 0.02$ ; $T_{amb} = 25$ °C</td>
<td>-</td>
<td>87</td>
<td>150</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>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B</td>
<td>base</td>
</tr>
<tr>
<td>2</td>
<td>E</td>
<td>emitter</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>collector</td>
</tr>
</tbody>
</table>

6. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBSS5360PAS</td>
<td>DFN2020D-3</td>
<td>DFN2020D-3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 2 x 2 x 0.65 mm</td>
<td>SOT1061D</td>
</tr>
</tbody>
</table>

7. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBSS5360PAS</td>
<td>EA</td>
</tr>
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</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>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>-80</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>-8</td>
<td>V</td>
</tr>
<tr>
<td>I_C</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>-3</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>-6</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>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_{\text{amb}} \leq 25 ) °C</td>
<td>[1]</td>
<td>0.6</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2][3]</td>
<td>1.2</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[4]</td>
<td>1.5</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[5][6]</td>
<td>2.5</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>

[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm².
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>250</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2][3]</td>
<td>-</td>
<td>125</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[4]</td>
<td>-</td>
<td>100</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[5][6]</td>
<td>-</td>
<td>60</td>
<td>K/W</td>
</tr>
</tbody>
</table>

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

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

FR4 PCB, mounting pad for collector 1 cm²

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

![Graph](aaa-013300)

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

<table>
<thead>
<tr>
<th>Duty Cycle</th>
<th>0.10</th>
<th>0.05</th>
<th>0.02</th>
<th>0.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z	h(j-a) (K/W)</td>
<td>0.75</td>
<td>0.50</td>
<td>0.20</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Ceramic PCB, Al₂O₃, standard footprint

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

![Graph](005pad-BB2)

Ceramic PCB, Al₂O₃, standard footprint

<table>
<thead>
<tr>
<th>Duty Cycle</th>
<th>0.10</th>
<th>0.05</th>
<th>0.02</th>
<th>0.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z	h(j-a) (K/W)</td>
<td>0.75</td>
<td>0.50</td>
<td>0.33</td>
<td>0.20</td>
</tr>
</tbody>
</table>


## 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>$V_{CB} = -64 \text{ V} ; I_E = 0 \text{ A} ; T_{amb} = 25 ^\circ \text{C}$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CB} = -64 \text{ V} ; I_E = 0 \text{ A} ; T_J = 150 ^\circ \text{C}$</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>$V_{CE} = -48 \text{ V} ; V_{BE} = 0 \text{ V} ; T_{amb} = 25 ^\circ \text{C}$</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>$V_{EB} = -6.4 \text{ V} ; I_C = 0 \text{ A} ; T_{amb} = 25 ^\circ \text{C}$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
</tbody>
</table>
| $h_{FE}$ | DC current gain                                | $V_{CE} = -5 \text{ V} ; I_C = -50 \text{ mA} ; \text{pulsed}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; \delta \leq 0.02 ; T_{amb} = 25 ^\circ \text{C}$ | 150 | 250 | -    |       |
|         |                                               | $V_{CE} = -5 \text{ V} ; I_C = -500 \text{ mA} ; \text{pulsed}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; \delta \leq 0.02 ; T_{amb} = 25 ^\circ \text{C}$ | 130 | 220 | -    |       |
|         |                                               | $V_{CE} = -5 \text{ V} ; I_C = -2 \text{ A} ; \text{pulsed}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; \delta \leq 0.02 ; T_{amb} = 25 ^\circ \text{C}$ | 100 | 160 | -    |       |
|         |                                               | $V_{CE} = -5 \text{ V} ; I_C = -3 \text{ A} ; \text{pulsed}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; \delta \leq 0.02 ; T_{amb} = 25 ^\circ \text{C}$ | 80  | 125 | -    |       |
| $V_{CESat}$ | collector-emitter saturation voltage         | $I_C = -0.5 \text{ A} ; I_B = -50 \text{ mA} ; \text{pulsed}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; \delta \leq 0.02 ; T_{amb} = 25 ^\circ \text{C}$ | -   | -55 | -100 | mV    |
|         |                                               | $I_C = -1 \text{ A} ; I_B = -100 \text{ mA} ; \text{pulsed}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; \delta \leq 0.02 ; T_{amb} = 25 ^\circ \text{C}$ | -   | -95 | -170 | mV    |
|         |                                               | $I_C = -2 \text{ A} ; I_B = -200 \text{ mA} ; \text{pulsed}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; \delta \leq 0.02 ; T_{amb} = 25 ^\circ \text{C}$ | -   | -170| -320 | mV    |
|         |                                               | $I_C = -3 \text{ A} ; I_B = -300 \text{ mA} ; \text{pulsed}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; \delta \leq 0.02 ; T_{amb} = 25 ^\circ \text{C}$ | -   | -260| -450 | mV    |
| $R_{CESat}$ | collector-emitter saturation resistance      | $I_C = -2 \text{ A} ; I_B = -100 \text{ mA} ; \text{pulsed}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; \delta \leq 0.02 ; T_{amb} = 25 ^\circ \text{C}$ | -   | 87  | 150  | mΩ    |
| $V_{BEsat}$ | base-emitter saturation voltage              | $I_C = -2 \text{ A} ; I_B = -100 \text{ mA} ; \text{pulsed}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; \delta \leq 0.02 ; T_{amb} = 25 ^\circ \text{C}$ | -   | -0.9| -1    | V     |
| $V_{BEon}$ | base-emitter turn-on voltage                | $V_{CE} = -5 \text{ V} ; I_C = -1 \text{ A} ; \text{pulsed}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; \delta \leq 0.02 ; T_{amb} = 25 ^\circ \text{C}$ | -   | -0.8| -1    | V     |
| $t_d$ | delay time                                   | $I_C = -2 \text{ A} ; I_{Bon} = -0.1 \text{ A} ; I_{Boff} = 0.1 \text{ A}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; T_{amb} = 25 ^\circ \text{C}$ | -   | 12  | -    | ns    |
| $t_r$ | rise time                                    | $I_C = -2 \text{ A} ; I_{Bon} = -0.1 \text{ A} ; I_{Boff} = 0.1 \text{ A}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; T_{amb} = 25 ^\circ \text{C}$ | -   | 95  | -    | ns    |
| $t_{on}$ | turn-on time                                 | $I_C = -2 \text{ A} ; I_{Bon} = -0.1 \text{ A} ; I_{Boff} = 0.1 \text{ A}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; T_{amb} = 25 ^\circ \text{C}$ | -   | 107 | -    | ns    |
| $t_s$ | storage time                                 | $I_C = -2 \text{ A} ; I_{Bon} = -0.1 \text{ A} ; I_{Boff} = 0.1 \text{ A}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; T_{amb} = 25 ^\circ \text{C}$ | -   | 160 | -    | ns    |
| $t_{fr}$ | fall time                                    | $I_C = -2 \text{ A} ; I_{Bon} = -0.1 \text{ A} ; I_{Boff} = 0.1 \text{ A}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; T_{amb} = 25 ^\circ \text{C}$ | -   | 50  | -    | ns    |
| $t_{off}$ | turn-off time                                | $I_C = -2 \text{ A} ; I_{Bon} = -0.1 \text{ A} ; I_{Boff} = 0.1 \text{ A}; \ 
$                      \quad \quad \ t_p \leq 300 \mu\text{s} ; T_{amb} = 25 ^\circ \text{C}$ | -   | 210 | -    | ns    |
| $f_T$ | transition frequency                         | $V_{CE} = -10 \text{ V} ; I_C = -100 \text{ mA}; \ 
$                      \quad \quad \ f = 100 \text{ MHz} ; T_{amb} = 25 ^\circ \text{C}$ | 65  | 120 | -    | MHz   |
### Symbol Table

<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>( C_C )</td>
<td>collector capacitance</td>
<td>( V_{CB} = -10 , \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>28</td>
<td>32</td>
<td>( \text{pF} )</td>
</tr>
</tbody>
</table>

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

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

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

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

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

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

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

- \( I_C/I_B = 20 \)
- (1) \( T_{amb} = -55 \, ^\circ\text{C} \)
- (2) \( T_{amb} = 25 \, ^\circ\text{C} \)
- (3) \( T_{amb} = 100 \, ^\circ\text{C} \)
Fig. 12. Collector-emitter saturation voltage as a function of collector current; typical values

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

-1

\[ I_C \text{ (mA)} \]

-10^{-1}

(1) \( T_{amb} = 100 \degree C \)

(2) \( T_{amb} = 25 \degree C \)

(3) \( T_{amb} = -55 \degree C \)

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

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

-1

\[ I_C \text{ (mA)} \]

-10^{-1}

(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

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

10^3

\[ I_C \text{ (mA)} \]

-10^{-1}

(1) \( I_C/I_B = 100 \)

(2) \( I_C/I_B = 50 \)

(3) \( I_C/I_B = 10 \)

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

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

10^2
11. Test information

Fig. 16. BISS transistor switching time definition

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 DFN2020D-3 (SOT1061D)
13. Soldering

Footprint information for reflow soldering of DFN2020D-3 package

Fig. 19. Reflow soldering footprint for DFN2020D-3 (SOT1061D)
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>
</tr>
</thead>
<tbody>
<tr>
<td>PBSS5360PAS v.1</td>
<td>20151012</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
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</table>
15. Legal information

15.1 Data sheet status

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<thead>
<tr>
<th></th>
<th></th>
<th></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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