



**THE DATASHEET OF  
PBSS5330PA,115**





# PBSS5330PA

30 V, 3 A PNP low V<sub>CEsat</sub> (BISS) transistor

7 April 2015

Product data sheet

## 1. General description

PNP low V<sub>CEsat</sub> Breakthrough In Small Signal (BISS) transistor, encapsulated in an ultra thin SOT1061 leadless small Surface-Mounted Device (SMD) plastic package with medium power capability.

NPN complement: PBSS4330PA.

## 2. Features and benefits

- Low collector-emitter saturation voltage V<sub>CEsat</sub>
- High collector current capability I<sub>C</sub> and I<sub>CM</sub>
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors
- Exposed heat sink for excellent thermal and electrical conductivity
- Leadless small SMD plastic package with medium power capability

## 3. Applications

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

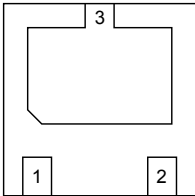
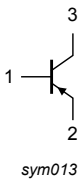
## 4. Quick reference data

Table 1. Quick reference data

| Symbol             | Parameter                               | Conditions   | Min | Typ | Max | Unit |
|--------------------|---|--|-----|-----|-----|------|
| V <sub>CEO</sub>   | collector-emitter voltage               | open base  | -   | -   | -30 | V    |
| I <sub>C</sub>     | collector current                       |  | -   | -   | -3  | A    |
| I <sub>CM</sub>    | peak collector current                  | single pulse; t <sub>p</sub> ≤ 1 ms  | -   | -   | -5  | A    |
| R <sub>CEsat</sub> | collector-emitter saturation resistance | I <sub>C</sub> = -3 A; I <sub>B</sub> = -300 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C | -   | 75  | 107 | mΩ   |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline  | Graphic symbol  |
|-----|--------|-------------|---|---|
| 1   | B      | base        |  <p>Transparent top view</p> <p><b>DFN2020-3 (SOT1061)</b></p> |  <p>sym013</p> |
| 2   | E      | emitter     |   |   |
| 3   | C      | collector   |   |   |

## 6. Ordering information

Table 3. Ordering information

| Type number | Package   |   |         |
|-------------|-----------|---|---------|
|             | Name      | Description   | Version |
| PBSS5330PA  | DFN2020-3 | DFN2020-3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 2 x 2 x 0.65 mm | SOT1061 |

## 7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PBSS5330PA  | AJ           |

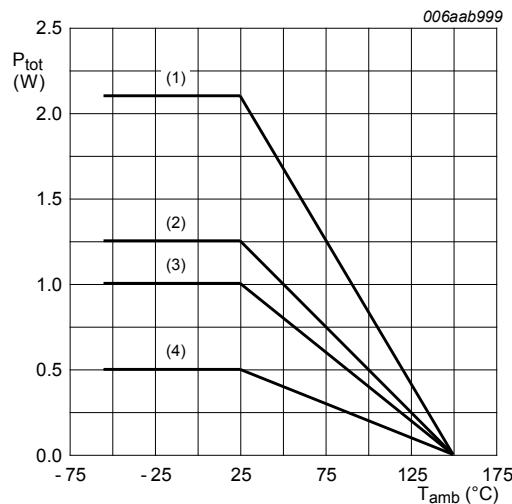
## 8. Limiting values

**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol    | Parameter                 | Conditions                    |     | Min | Max  | Unit |
|-----------|---------------------------|-------------------------------|-----|-----|------|------|
| $V_{CBO}$ | collector-base voltage    | open emitter                  |     | -   | -30  | V    |
| $V_{CEO}$ | collector-emitter voltage | open base                     |     | -   | -30  | V    |
| $V_{EBO}$ | emitter-base voltage      | open collector                |     | -   | -6   | V    |
| $I_C$     | collector current         |                               |     | -   | -3   | A    |
| $I_{CM}$  | peak collector current    | single pulse; $t_p \leq 1$ ms |     | -   | -5   | A    |
| $I_B$     | base current              |                               |     | -   | -500 | mA   |
| $P_{tot}$ | total power dissipation   | $T_{amb} \leq 25$ °C          | [1] | -   | 500  | mW   |
|           |                           |                               | [2] | -   | 1    | W    |
|           |                           |                               | [3] | -   | 1.25 | W    |
|           |                           |                               | [4] | -   | 2.1  | W    |
| $T_j$     | junction temperature      |                               |     | -   | 150  | °C   |
| $T_{amb}$ | ambient temperature       |                               |     | -55 | 150  | °C   |
| $T_{stg}$ | storage temperature       |                               |     | -65 | 150  | °C   |

- [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<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.
- [4] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.



- (1) Ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint
- (2) FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>
- (3) FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>
- (4) FR4 PCB, standard footprint

**Fig. 1. Power derating curves**

## 9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol        | Parameter                                   | Conditions  |     | Min | Typ | Max | Unit |
|---------------|---|-------------|-----|-----|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | -   | -   | 250 | K/W  |
|               |   |             | [2] | -   | -   | 125 | K/W  |
|               |   |             | [3] | -   | -   | 100 | K/W  |
|               |   |             | [4] | -   | -   | 60  | K/W  |

- [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<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.
- [4] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.

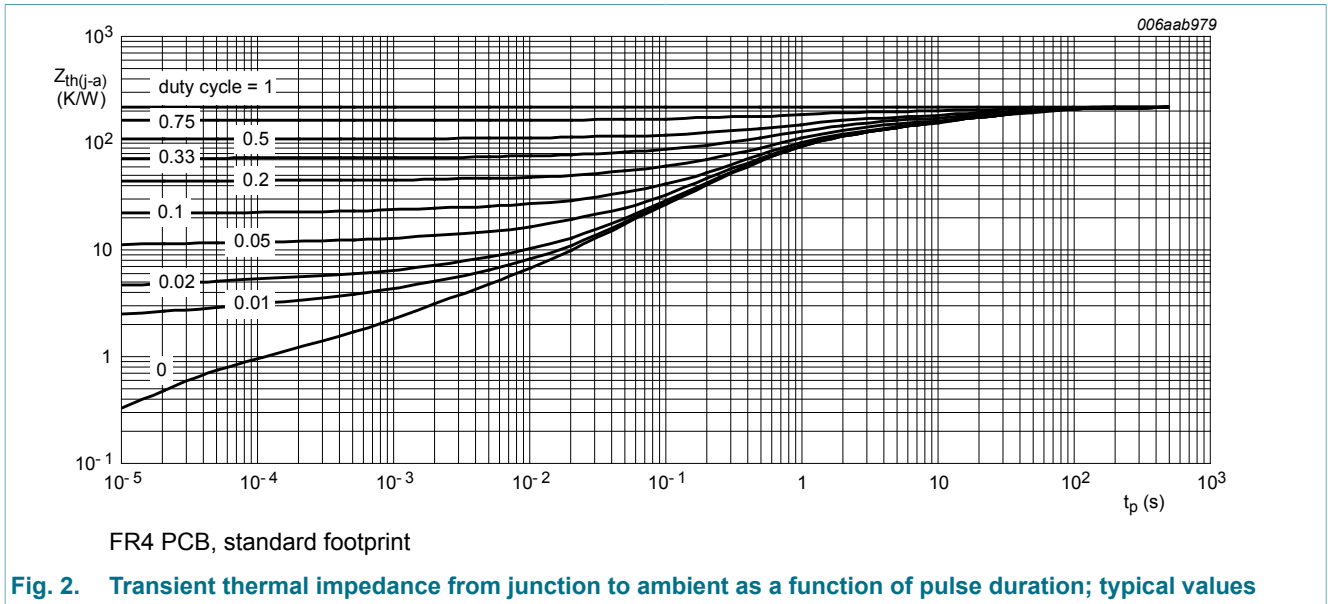
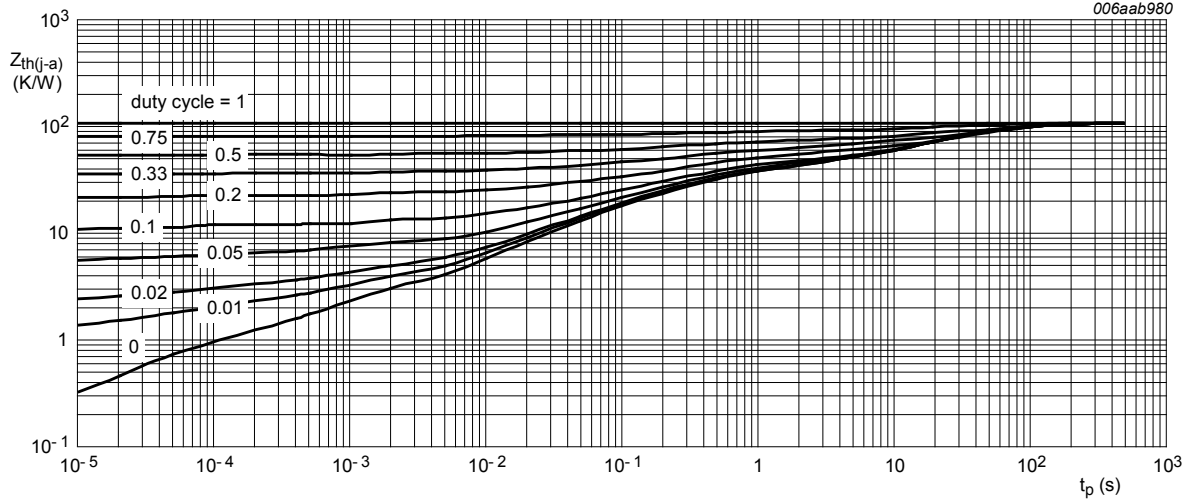
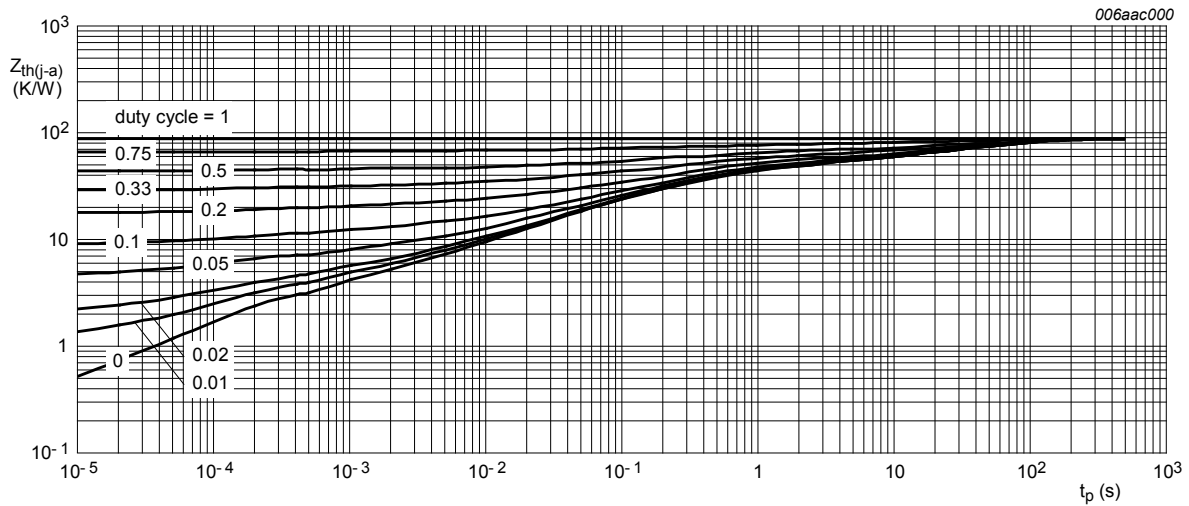


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



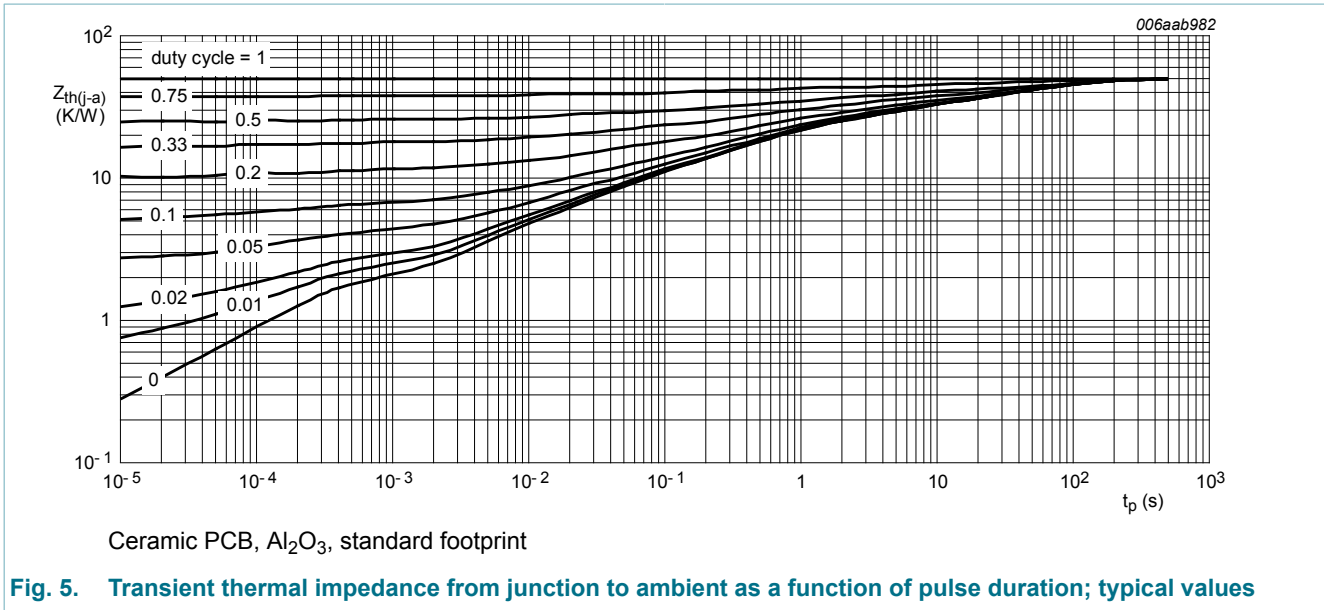
FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

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



FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>

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



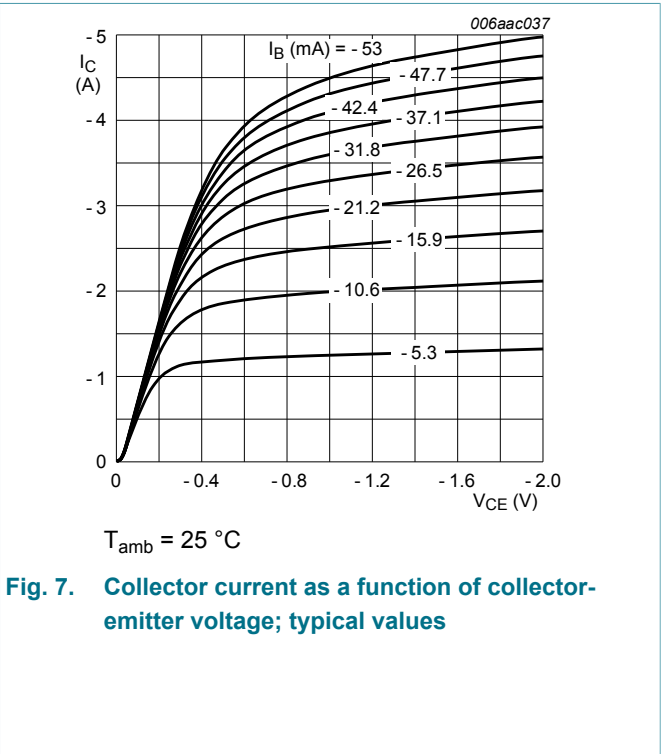
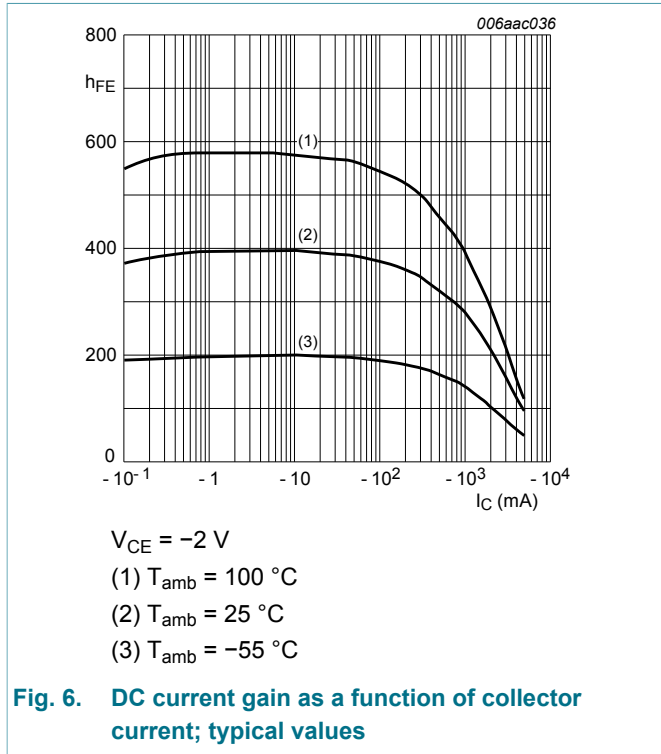
## 10. Characteristics

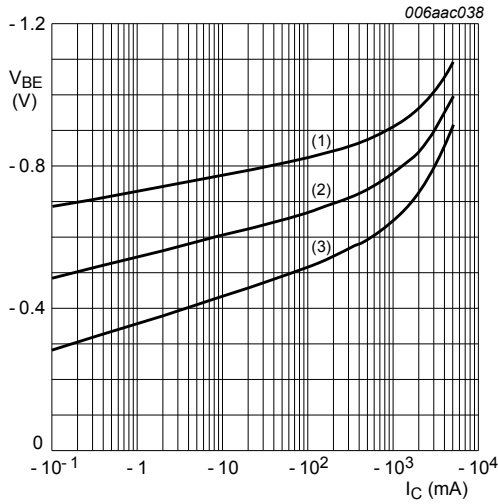
Table 7. Characteristics

| Symbol             | Parameter                               | Conditions   | Min | Typ   | Max  | Unit |
|--------------------|---|--|-----|-------|------|------|
| I <sub>CBO</sub>   | collector-base cut-off current          | V <sub>CB</sub> = -30 V; I <sub>E</sub> = 0 A; T <sub>amb</sub> = 25 °C  | -   | -     | -100 | nA   |
|                    |   | V <sub>CB</sub> = -30 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C   | -   | -     | -50  | μA   |
| I <sub>CES</sub>   | collector-emitter cut-off current       | V <sub>CE</sub> = -24 V; V <sub>BE</sub> = 0 V; T <sub>amb</sub> = 25 °C   | -   | -     | -100 | nA   |
| I <sub>EBO</sub>   | emitter-base cut-off current            | V <sub>EB</sub> = -5 V; I <sub>C</sub> = 0 A; T <sub>amb</sub> = 25 °C   | -   | -     | -100 | nA   |
| h <sub>FE</sub>    | DC current gain                         | V <sub>CE</sub> = -2 V; I <sub>C</sub> = -0.5 A; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C         | 200 | 320   | -    |      |
|                    |   | V <sub>CE</sub> = -2 V; I <sub>C</sub> = -1 A; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C           | 175 | 280   | 450  |      |
|                    |   | V <sub>CE</sub> = -2 V; I <sub>C</sub> = -2 A; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C           | 140 | 210   | -    |      |
|                    |   | V <sub>CE</sub> = -2 V; I <sub>C</sub> = -3 A; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C           | 100 | 160   | -    |      |
| V <sub>CEsat</sub> | collector-emitter saturation voltage    | I <sub>C</sub> = -0.5 A; I <sub>B</sub> = -50 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C        | -   | -45   | -70  | mV   |
|                    |   | I <sub>C</sub> = -1 A; I <sub>B</sub> = -50 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C          | -   | -90   | -130 | mV   |
|                    |   | I <sub>C</sub> = -2 A; I <sub>B</sub> = -100 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C         | -   | -170  | -240 | mV   |
|                    |   | I <sub>C</sub> = -3 A; I <sub>B</sub> = -300 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C         | -   | -230  | -320 | mV   |
| R <sub>CEsat</sub> | collector-emitter saturation resistance | t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C   | -   | 75    | 107  | mΩ   |
| V <sub>BEsat</sub> | base-emitter saturation voltage         | I <sub>C</sub> = -2 A; I <sub>B</sub> = -100 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C         | -   | -0.89 | -1.1 | V    |
|                    |   | I <sub>C</sub> = -3 A; I <sub>B</sub> = -300 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C         | -   | -0.97 | -1.2 | V    |
| V <sub>BEon</sub>  | base-emitter turn-on voltage            | V <sub>CE</sub> = -2 V; I <sub>C</sub> = -1 A; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C           | -   | -0.75 | -1   | V    |
| t <sub>d</sub>     | delay time                              | V <sub>CC</sub> = -9 V; I <sub>C</sub> = -2 A; I <sub>Bon</sub> = -0.1 A;<br>I <sub>Boff</sub> = 0.1 A; T <sub>amb</sub> = 25 °C | -   | 11    | -    | ns   |
| t <sub>r</sub>     | rise time                               |  | -   | 59    | -    | ns   |
| t <sub>on</sub>    | turn-on time                            |  | -   | 70    | -    | ns   |
| t <sub>s</sub>     | storage time                            |  | -   | 165   | -    | ns   |
| t <sub>f</sub>     | fall time                               |  | -   | 35    | -    | ns   |
| t <sub>off</sub>   | turn-off time                           |  | -   | 200   | -    | ns   |



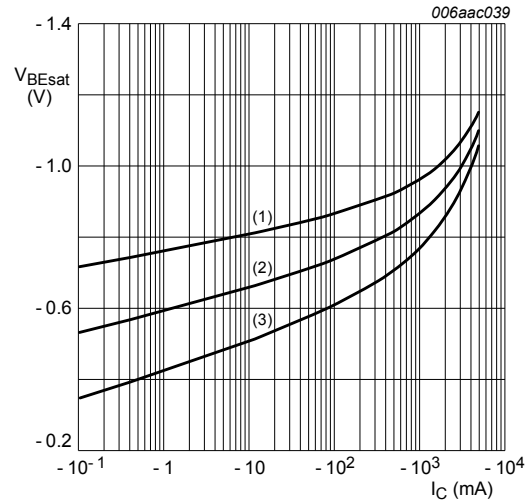
| Symbol | Parameter             | Conditions   | Min | Typ | Max | Unit |
|--------|-----------------------|--|-----|-----|-----|------|
| $f_T$  | transition frequency  | $V_{CE} = -5 \text{ V}; I_C = -100 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$               | 100 | 165 | -   | MHz  |
| $C_c$  | collector capacitance | $V_{CB} = -10 \text{ V}; I_E = 0 \text{ A}; i_e = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$ | -   | 38  | 45  | pF   |





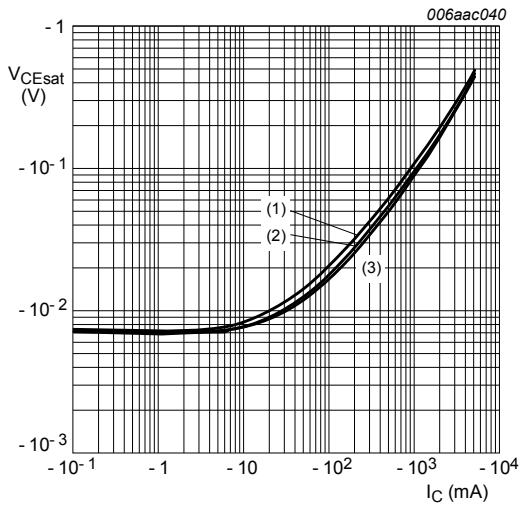
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

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



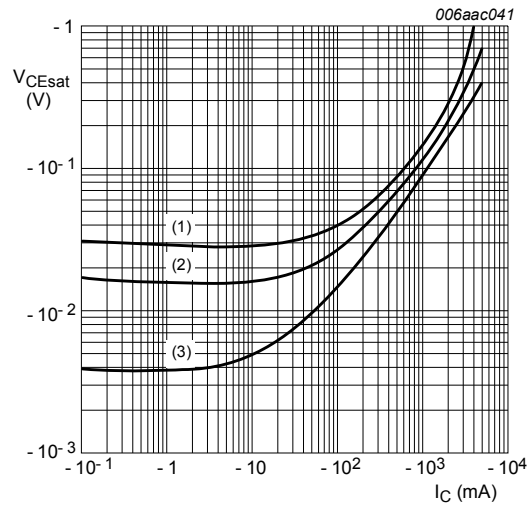
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

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



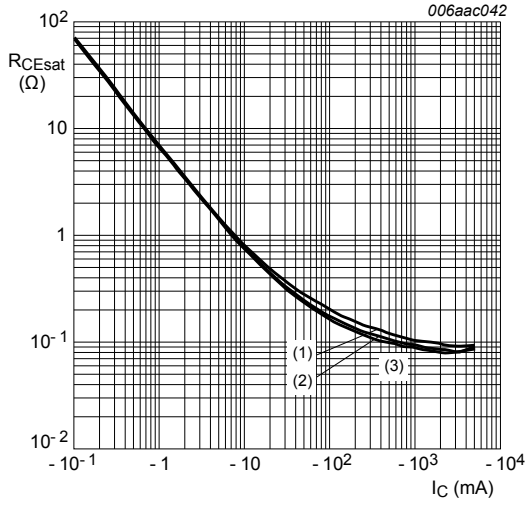
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



$T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

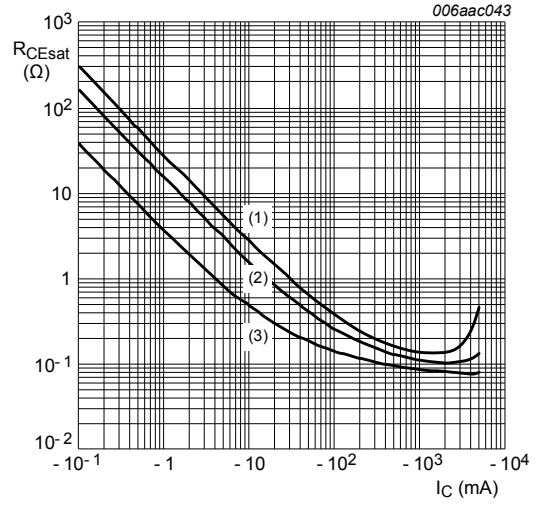
**Fig. 11. Collector-emitter saturation voltage as a function of collector current; typical values**



$I_C/I_B = 20$

- (1)  $T_{amb} = 100\text{ °C}$
- (2)  $T_{amb} = 25\text{ °C}$
- (3)  $T_{amb} = -55\text{ °C}$

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



$T_{amb} = 25\text{ °C}$

- (1)  $I_C/I_B = 100$
- (2)  $I_C/I_B = 50$
- (3)  $I_C/I_B = 10$

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

### 11. Test information

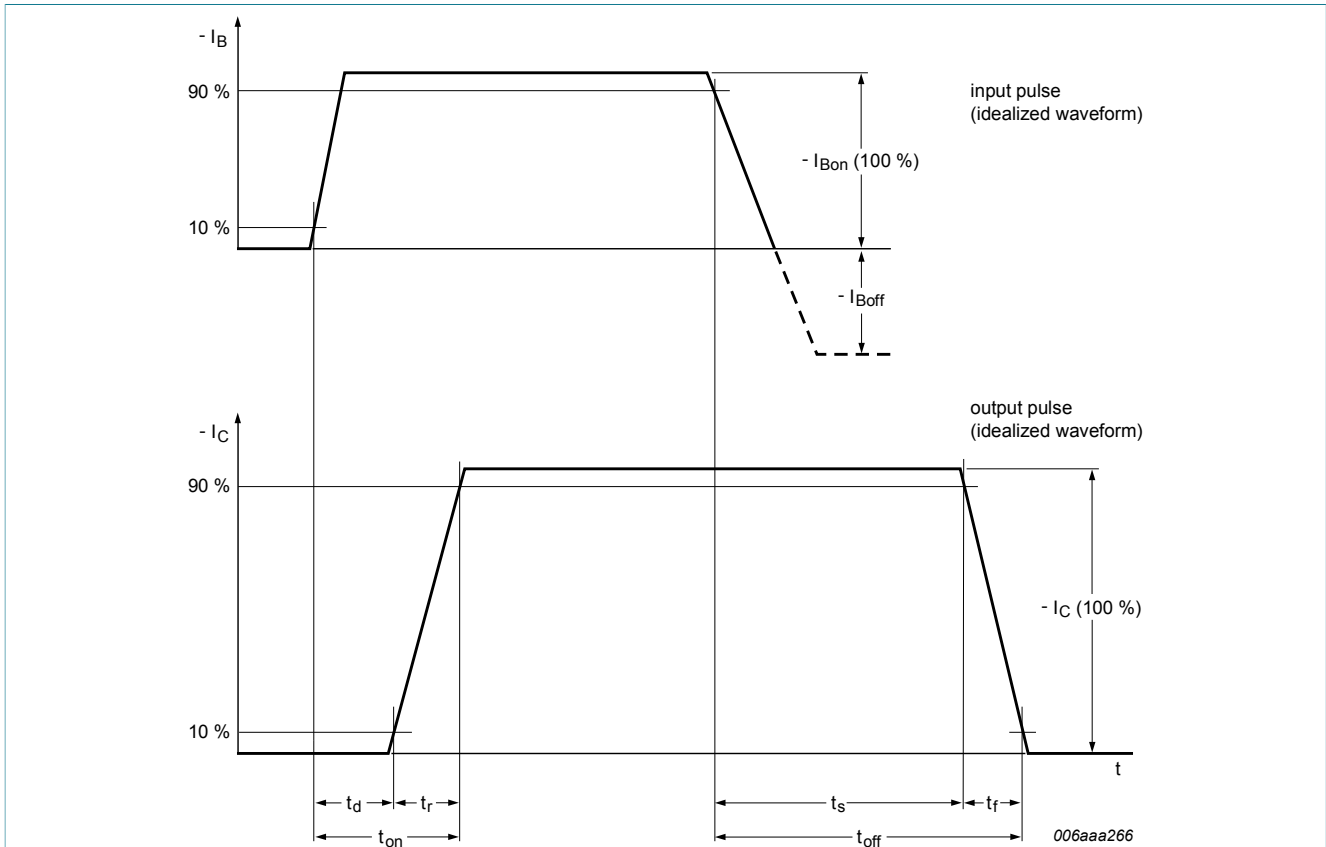


Fig. 14. BISS transistor switching time definition

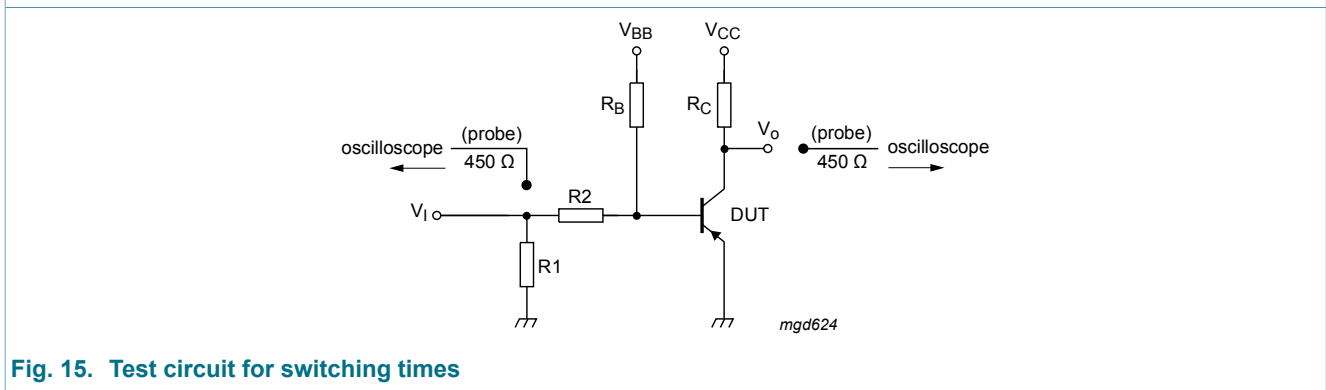


Fig. 15. Test circuit for switching times

### 12. Package outline

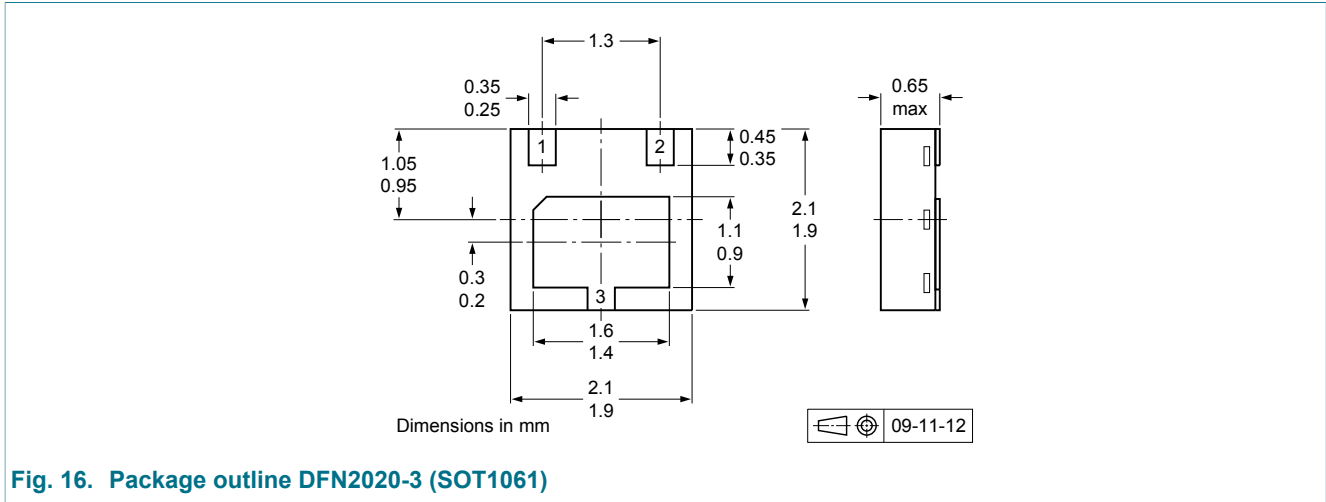


Fig. 16. Package outline DFN2020-3 (SOT1061)

### 13. Soldering

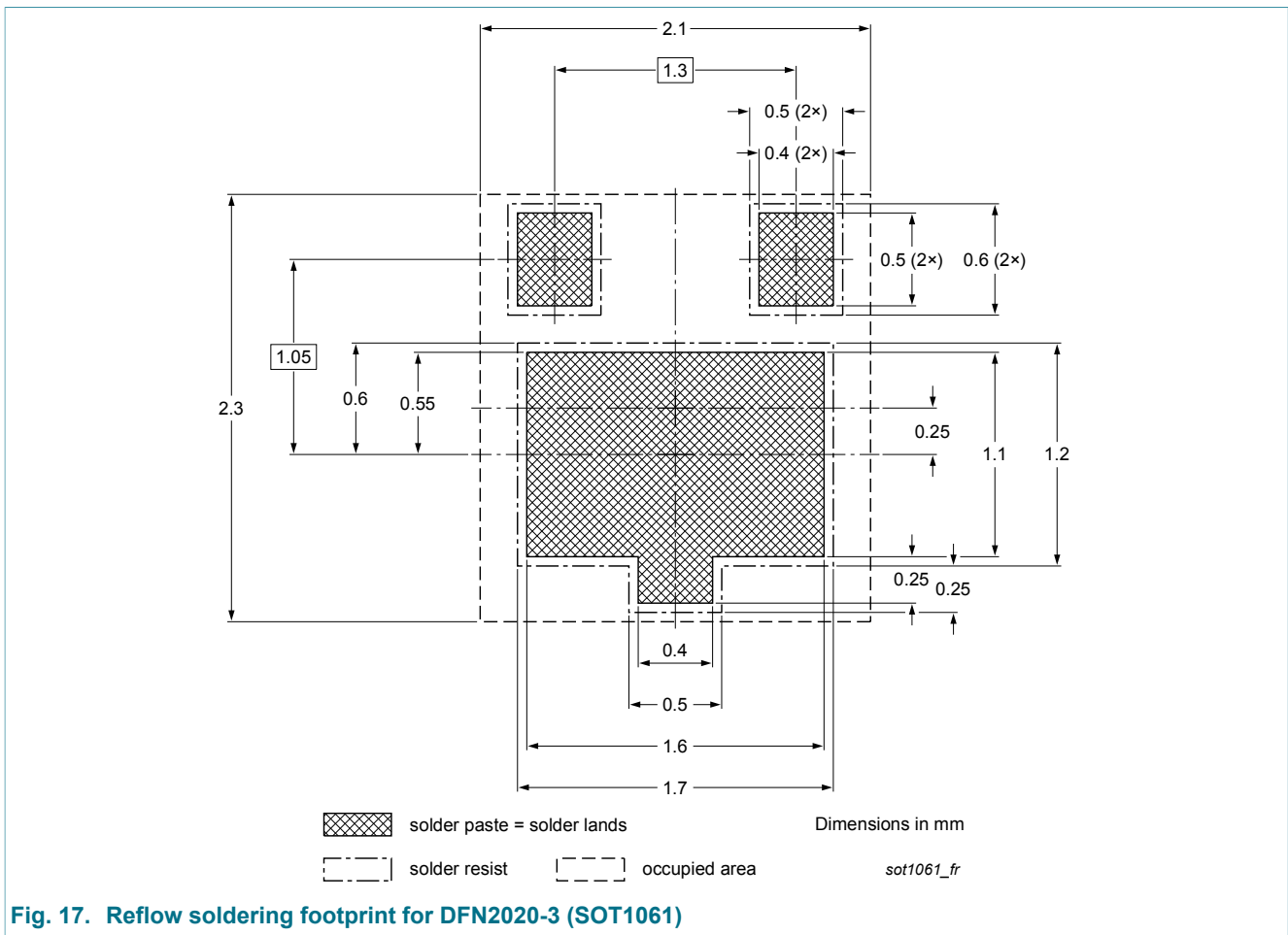


Fig. 17. Reflow soldering footprint for DFN2020-3 (SOT1061)

## 14. Revision history

Table 8. Revision history

| Data sheet ID  | Release date   | Data sheet status  | Change notice | Supersedes     |
|----------------|--|--------------------|---------------|----------------|
| PBSS5330PA v.2 | 20150407   | Product data sheet | -             | PBSS5330PA v.1 |
| Modifications: | <ul style="list-style-type: none"><li>Condition <math>V_{CE}</math> changed for parameter <math>I_{CES}</math> in Table 7, Characteristics</li></ul> |                    |               |                |
| PBSS5330PA v.1 | 20100419   | Product data sheet | -             | -              |

## 15. Legal information

### 15.1 Data sheet status

| Document status [1][2]         | Product status [3] | Definition  |
|--------------------------------|--------------------|---|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

- [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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## 16. Contents

|      |                               |    |
|------|-------------------------------|----|
| 1    | General description .....     | 1  |
| 2    | Features and benefits .....   | 1  |
| 3    | Applications .....            | 1  |
| 4    | Quick reference data .....    | 1  |
| 5    | Pinning information .....     | 2  |
| 6    | Ordering information .....    | 2  |
| 7    | Marking .....                 | 2  |
| 8    | Limiting values .....         | 3  |
| 9    | Thermal characteristics ..... | 4  |
| 10   | Characteristics .....         | 7  |
| 11   | Test information .....        | 11 |
| 12   | Package outline .....         | 12 |
| 13   | Soldering .....               | 12 |
| 14   | Revision history .....        | 13 |
| 15   | Legal information .....       | 14 |
| 15.1 | Data sheet status .....       | 14 |
| 15.2 | Definitions .....             | 14 |
| 15.3 | Disclaimers .....             | 14 |
| 15.4 | Trademarks .....              | 15 |

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