



# PBSS5160T

60 V, 1 A PNP low  $V_{CEsat}$  (BISS) transistor

Rev. 04 — 15 January 2010

Product data sheet

## 1. Product profile

### 1.1 General description

PNP low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

NPN complement: PBSS4160T.

### 1.2 Features

- Low collector-emitter saturation voltage  $V_{CEsat}$
- High collector current capability  $I_C$  and  $I_{CM}$
- High efficiency due to less heat generation
- Reduces Printed-Circuit Board (PCB) area required
- Cost-effective replacement for medium power transistors BCP52 and BCX52

### 1.3 Applications

- Major application segments:
  - ◆ Automotive
  - ◆ Telecom infrastructure
  - ◆ Industrial
- Power management:
  - ◆ DC-to-DC conversion
  - ◆ Supply line switching
- Peripheral driver:
  - ◆ Driver in low supply voltage applications (e.g. lamps and LEDs)
  - ◆ Inductive load drivers (e.g. relays, buzzers and motors)

### 1.4 Quick reference data

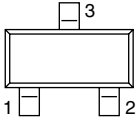
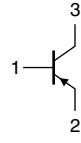
Table 1. Quick reference data

| Symbol      | Parameter                               | Conditions                            | Min                   | Typ | Max | Unit       |
|-------------|-----------------------------------------|---------------------------------------|-----------------------|-----|-----|------------|
| $V_{CEO}$   | collector-emitter voltage               | open base                             | -                     | -   | -60 | V          |
| $I_C$       | collector current                       |                                       | -                     | -   | -1  | A          |
| $I_{CM}$    | peak collector current                  | $t = 1$ ms or limited by $T_{j(max)}$ | -                     | -   | -2  | A          |
| $R_{CEsat}$ | collector-emitter saturation resistance | $I_C = -1$ A;<br>$I_B = -100$ mA      | <a href="#">[1]</a> - | 220 | 330 | m $\Omega$ |

[1] Pulse test:  $t_p \leq 300$   $\mu$ s;  $\delta \leq 0.02$ .

## 2. Pinning information

Table 2. Pinning

| Pin | Description | Simplified outline                                                                  | Graphic symbol                                                                      |
|-----|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | base        |  |  |
| 2   | emitter     |                                                                                     |                                                                                     |
| 3   | collector   |                                                                                     |                                                                                     |

006aab25

## 3. Ordering information

Table 3. Ordering information

| Type number | Package |                                          |         |
|-------------|---------|------------------------------------------|---------|
|             | Name    | Description                              | Version |
| PBSS5160T   | -       | plastic surface-mounted package; 3 leads | SOT23   |

## 4. Marking

Table 4. Marking codes

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| PBSS5160T   | *U6                         |

- [1] \* = -: made in Hong Kong  
 \* = p: made in Hong Kong  
 \* = t: made in Malaysia  
 \* = W: made in China

## 5. Limiting values

Table 5. Limiting values

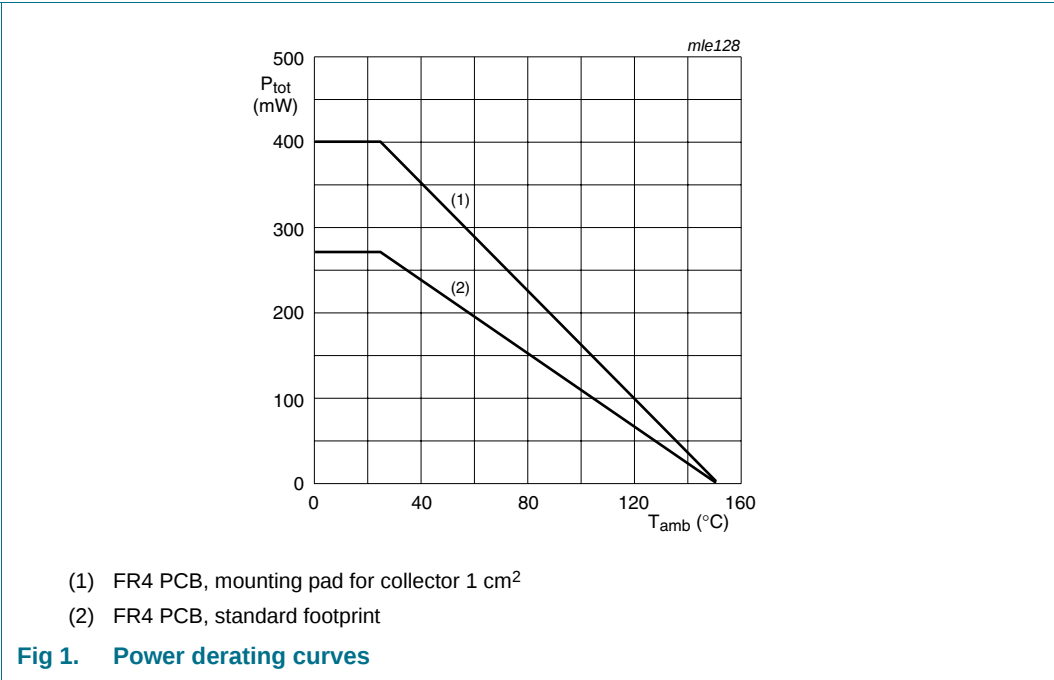
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol    | Parameter                 | Conditions                                | Min              | Max  | Unit |
|-----------|---------------------------|-------------------------------------------|------------------|------|------|
| $V_{CBO}$ | collector-base voltage    | open emitter                              | -                | -80  | V    |
| $V_{CEO}$ | collector-emitter voltage | open base                                 | -                | -60  | V    |
| $V_{EBO}$ | emitter-base voltage      | open collector                            | -                | -5   | V    |
| $I_C$     | collector current         |                                           | <sup>[1]</sup> - | -0.9 | A    |
|           |                           |                                           | <sup>[2]</sup> - | -1   | A    |
| $I_{CM}$  | peak collector current    | $t = 1$ ms or limited by $T_{j(max)}$     | -                | -2   | A    |
| $I_B$     | base current              |                                           | -                | -300 | mA   |
| $I_{BM}$  | peak base current         | $t_p \leq 300 \mu s$ ; $\delta \leq 0.02$ | -                | -1   | A    |

**Table 5. Limiting values ...continued**  
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol    | Parameter               | Conditions                                | Min    | Max  | Unit               |
|-----------|-------------------------|-------------------------------------------|--------|------|--------------------|
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25\text{ }^{\circ}\text{C}$ | [1]    | -    | 270 mW             |
|           |                         |                                           | [2]    | -    | 400 mW             |
|           |                         |                                           | [1][3] | -    | 1.25 W             |
| $T_j$     | junction temperature    |                                           | -      | 150  | $^{\circ}\text{C}$ |
| $T_{amb}$ | ambient temperature     |                                           | -65    | +150 | $^{\circ}\text{C}$ |
| $T_{stg}$ | storage temperature     |                                           | -65    | +150 | $^{\circ}\text{C}$ |

- [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] Operated under pulse conditions: duty cycle  $\delta \leq 20\%$ , pulse width  $t_p \leq 10\text{ ms}$ .

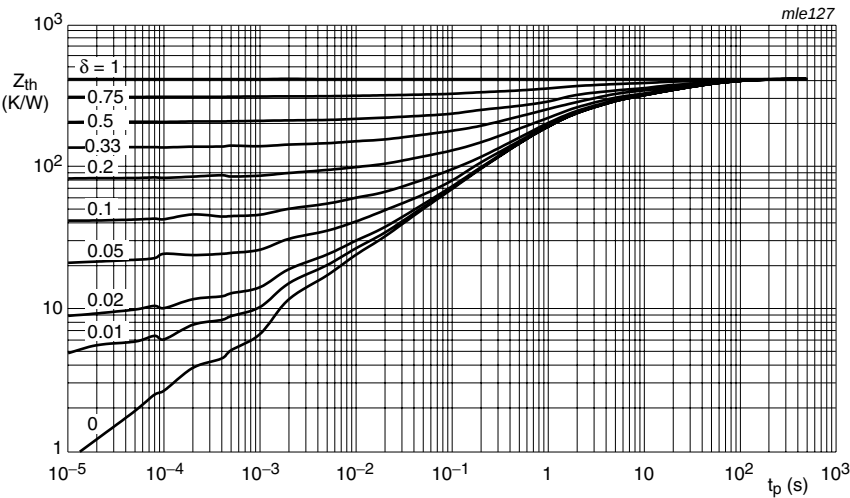


6. Thermal characteristics

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] -    | -   | 465 | K/W  |
|               |                                             |             | [2] -    | -   | 312 | K/W  |
|               |                                             |             | [1][3] - | -   | 100 | 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] Operated under pulse conditions: duty cycle  $\delta \leq 20\%$ , pulse width  $t_p \leq 10\text{ ms}$ .



FR4 PCB, standard footprint

Fig 2. Transient thermal impedance as a function of pulse duration; typical values

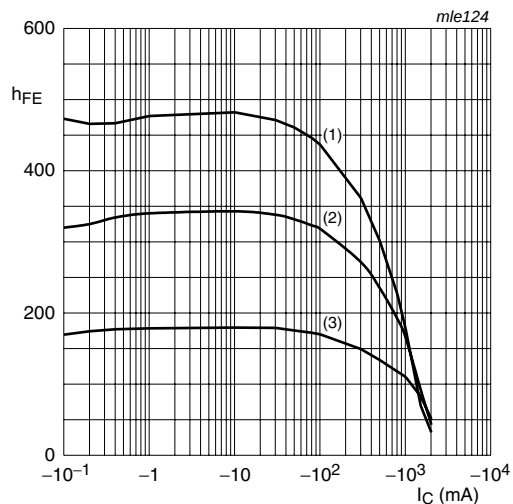
## 7. Characteristics

**Table 7. Characteristics**

$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

| Symbol      | Parameter                               | Conditions                                                                   | Min     | Typ   | Max  | Unit             |
|-------------|-----------------------------------------|------------------------------------------------------------------------------|---------|-------|------|------------------|
| $I_{CBO}$   | collector-base cut-off current          | $V_{CB} = -60\text{ V}; I_E = 0\text{ A}$                                    | -       | -     | -100 | nA               |
|             |                                         | $V_{CB} = -60\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | -       | -     | -50  | $\mu\text{A}$    |
|             |                                         |                                                                              |         |       |      |                  |
| $I_{CES}$   | collector-emitter cut-off current       | $V_{CE} = -60\text{ V}; V_{BE} = 0\text{ V}$                                 | -       | -     | -100 | nA               |
| $I_{EBO}$   | emitter-base cut-off current            | $V_{EB} = -5\text{ V}; I_C = 0\text{ A}$                                     | -       | -     | -100 | nA               |
| $h_{FE}$    | DC current gain                         | $V_{CE} = -5\text{ V}$                                                       |         |       |      |                  |
|             |                                         | $I_C = -1\text{ mA}$                                                         | 200     | 350   | -    |                  |
|             |                                         | $I_C = -500\text{ mA}$                                                       | [1] 150 | 250   | -    |                  |
|             |                                         | $I_C = -1\text{ A}$                                                          | [1] 100 | 160   | -    |                  |
| $V_{CEsat}$ | collector-emitter saturation voltage    | $I_C = -100\text{ mA}; I_B = -1\text{ mA}$                                   | -       | -110  | -160 | mV               |
|             |                                         | $I_C = -500\text{ mA}; I_B = -50\text{ mA}$                                  | -       | -120  | -175 | mV               |
|             |                                         | $I_C = -1\text{ A}; I_B = -100\text{ mA}$                                    | [1] -   | -220  | -330 | mV               |
| $R_{CEsat}$ | collector-emitter saturation resistance | $I_C = -1\text{ A}; I_B = -100\text{ mA}$                                    | [1] -   | 220   | 330  | $\text{m}\Omega$ |
| $V_{BEsat}$ | base-emitter saturation voltage         | $I_C = -1\text{ A}; I_B = -50\text{ mA}$                                     | -       | -0.95 | -1.1 | V                |
| $V_{BEon}$  | base-emitter turn-on voltage            | $V_{CE} = -5\text{ V}; I_C = -1\text{ A}$                                    | -       | -0.82 | -0.9 | V                |
| $f_T$       | transition frequency                    | $V_{CE} = -10\text{ V}; I_C = -50\text{ mA}; f = 100\text{ MHz}$             | 150     | 220   | -    | MHz              |
| $C_c$       | collector capacitance                   | $V_{CB} = -10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$            | -       | 9     | 15   | pF               |

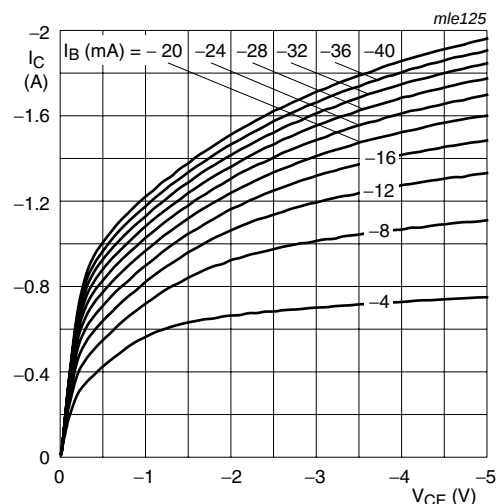
[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta \leq 0.02$ .



$V_{CE} = -5 \text{ V}$

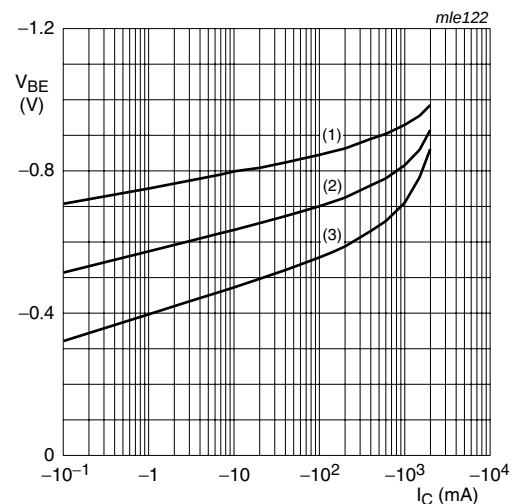
- (1)  $T_{amb} = 100 \text{ }^{\circ}\text{C}$
- (2)  $T_{amb} = 25 \text{ }^{\circ}\text{C}$
- (3)  $T_{amb} = -55 \text{ }^{\circ}\text{C}$

**Fig 3. DC current gain as a function of collector current; typical values**



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

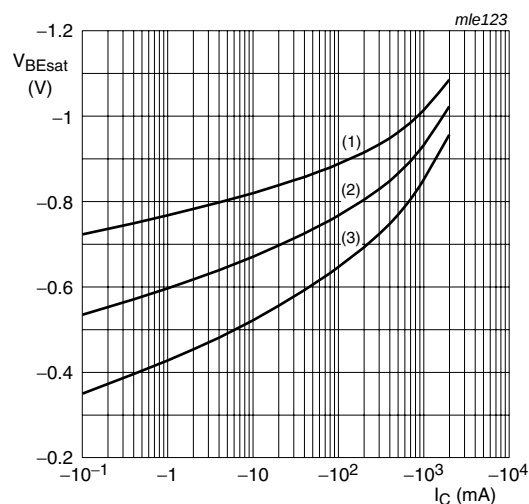
**Fig 4. Collector current as a function of collector-emitter voltage; typical values**



$V_{CE} = -5 \text{ V}$

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

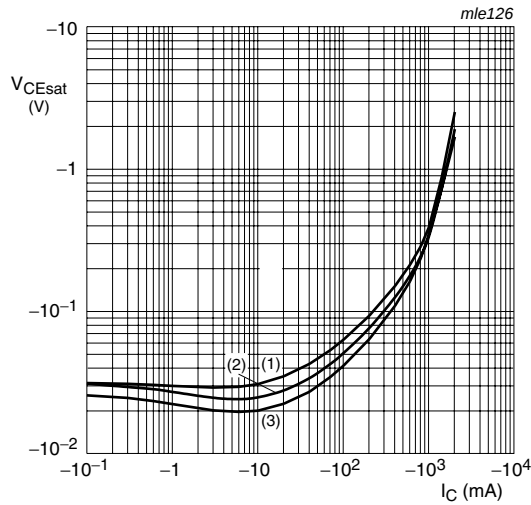
**Fig 5. Base-emitter voltage as a function of collector current; typical values**



$I_C/I_B = 20$

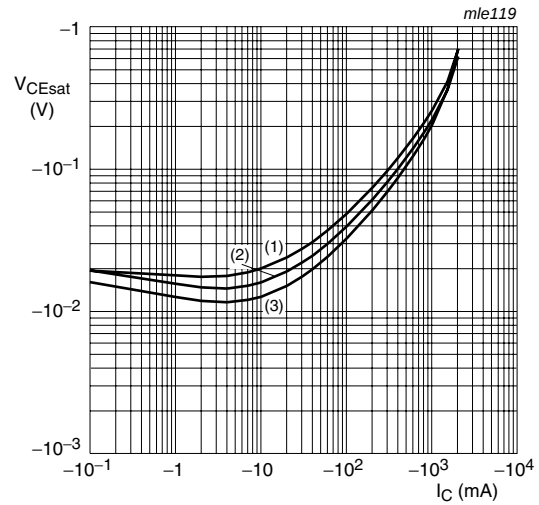
- (1)  $T_{amb} = -55 \text{ }^{\circ}\text{C}$
- (2)  $T_{amb} = 25 \text{ }^{\circ}\text{C}$
- (3)  $T_{amb} = 100 \text{ }^{\circ}\text{C}$

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



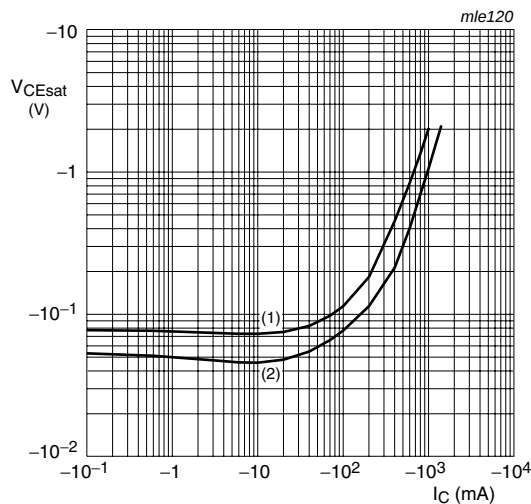
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



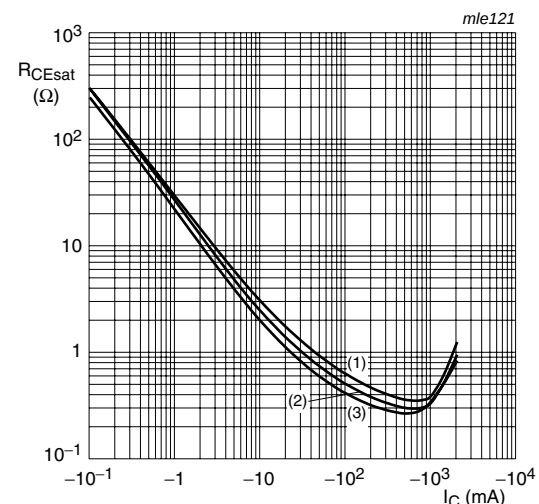
- $I_C/I_B = 10$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

**Fig 8.** 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)  $I_C/I_B = 50$

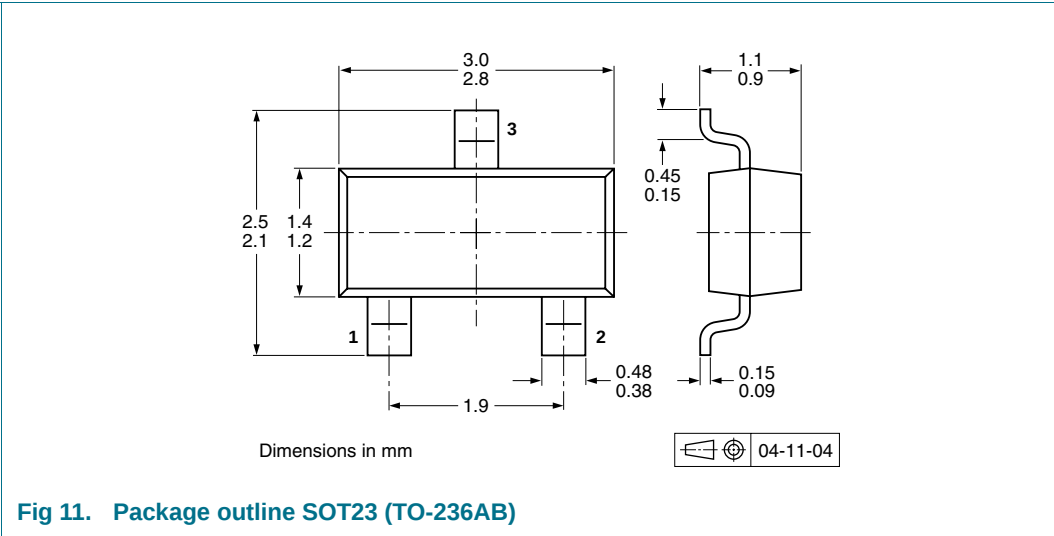
**Fig 9.** Collector-emitter saturation voltage as a function of collector current; typical values



- $I_C/I_B = 20$
- (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 resistance as a function of collector current; typical values

8. Package outline



9. Packing information

Table 8. Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

| Type number | Package | Description                    | Packing quantity |       |
|-------------|---------|--------------------------------|------------------|-------|
|             |         |                                | 3000             | 10000 |
| PBSS5160T   | SOT23   | 4 mm pitch, 8 mm tape and reel | -215             | -235  |

[1] For further information and the availability of packing methods, see [Section 12](#).

## 10. Revision history

Table 9. Revision history

| Document ID    | Release date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Data sheet status     | Change notice | Supersedes    |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|---------------|
| PBSS5160T_4    | 20100115                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Product data sheet    | -             | PBSS5160T_N_3 |
| Modifications: | <ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li><li>• <a href="#">Table 1 "Quick reference data"</a>: amended</li><li>• <a href="#">Section 4 "Marking"</a>: amended</li><li>• <a href="#">Figure 4</a>: updated</li><li>• <a href="#">Figure 11</a>: superseded by minimized package outline drawing</li><li>• <a href="#">Section 9 "Packing information"</a>: added</li><li>• <a href="#">Section 11 "Legal information"</a>: updated</li></ul> |                       |               |               |
| PBSS5160T_N_3  | 20080718                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Product data sheet    | -             | PBSS5160T_2   |
| PBSS5160T_2    | 20040527                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Product specification | -             | PBSS5160T_1   |
| PBSS5160T_1    | 20030623                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Product specification | -             | -             |

## 11. Legal information

### 11.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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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(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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