



# PMBT3906

PNP switching transistor

Rev. 06 — 2 March 2010

Product data sheet

## 1. Product profile

### 1.1 General description

PNP switching transistor in a SOT23 (TO-236AB) small Surface-Mounted Device (SMD) plastic package.

NPN complement: PMBT3904.

### 1.2 Features and benefits

- Collector-emitter voltage  $V_{CEO} = -40$  V
- Collector current capability  $I_C = -200$  mA

### 1.3 Applications

- General amplification and switching

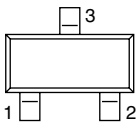
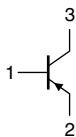
### 1.4 Quick reference data

Table 1. Quick reference data

| Symbol    | Parameter                 | Conditions | Min | Typ | Max  | Unit |
|-----------|---------------------------|------------|-----|-----|------|------|
| $V_{CEO}$ | collector-emitter voltage | open base  | -   | -   | -40  | V    |
| $I_C$     | collector current         |            | -   | -   | -200 | mA   |

## 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 |
| PMBT3906    | -       | plastic surface-mounted package; 3 leads | SOT23   |

### 4. Marking

Table 4. Marking codes

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| PMBT3906    | *2A                         |

- [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                | -                | -40  | V    |
| $V_{CEO}$ | collector-emitter voltage | open base                   | -                | -40  | V    |
| $V_{EBO}$ | emitter-base voltage      | open collector              | -                | -6   | V    |
| $I_C$     | collector current         |                             | -                | -200 | mA   |
| $I_{CM}$  | peak collector current    |                             | -                | -200 | mA   |
| $I_{BM}$  | peak base current         |                             | -                | -100 | mA   |
| $P_{tot}$ | total power dissipation   | $T_{amb} \leq 25\text{ °C}$ | <sup>[1]</sup> - | 250  | mW   |
| $T_j$     | junction temperature      |                             | -                | 150  | °C   |
| $T_{amb}$ | ambient temperature       |                             | -65              | +150 | °C   |
| $T_{stg}$ | storage temperature       |                             | -65              | +150 | °C   |

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB).

## 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 | <a href="#">[1]</a> - | -   | 500 | K/W  |

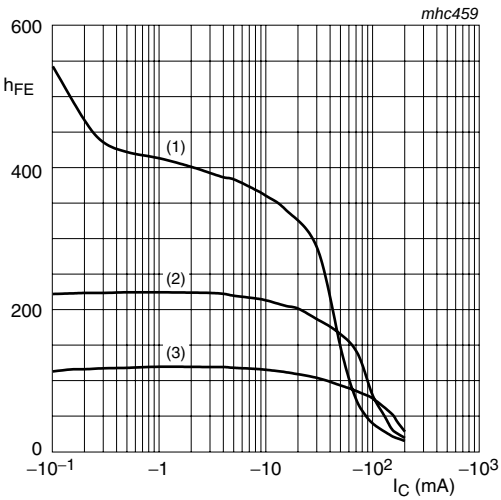
[1] Device mounted on an FR4 PCB.

## 7. Characteristics

**Table 7. Characteristics**

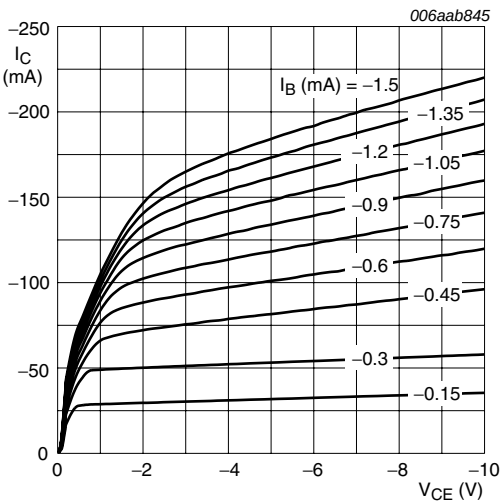
$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

| Symbol      | Parameter                            | Conditions                                                                                                                        | Min | Typ | Max  | Unit |
|-------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----|-----|------|------|
| $I_{CBO}$   | collector-base cut-off current       | $V_{CB} = -30\text{ V}$ ; $I_E = 0\text{ A}$                                                                                      | -   | -   | -50  | nA   |
| $I_{EBO}$   | emitter-base cut-off current         | $V_{EB} = -6\text{ V}$ ; $I_C = 0\text{ A}$                                                                                       | -   | -   | -50  | nA   |
| $h_{FE}$    | DC current gain                      | $V_{CE} = -1\text{ V}$                                                                                                            |     |     |      |      |
|             |                                      | $I_C = -0.1\text{ mA}$                                                                                                            | 60  | -   | -    |      |
|             |                                      | $I_C = -1\text{ mA}$                                                                                                              | 80  | -   | -    |      |
|             |                                      | $I_C = -10\text{ mA}$                                                                                                             | 100 | -   | 300  |      |
|             |                                      | $I_C = -50\text{ mA}$                                                                                                             | 60  | -   | -    |      |
|             |                                      | $I_C = -100\text{ mA}$                                                                                                            | 30  | -   | -    |      |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C = -10\text{ mA}$ ; $I_B = -1\text{ mA}$                                                                                      | -   | -   | -250 | mV   |
|             |                                      | $I_C = -50\text{ mA}$ ; $I_B = -5\text{ mA}$                                                                                      | -   | -   | -400 | mV   |
| $V_{BEsat}$ | base-emitter saturation voltage      | $I_C = -10\text{ mA}$ ; $I_B = -1\text{ mA}$                                                                                      | -   | -   | -850 | mV   |
|             |                                      | $I_C = -50\text{ mA}$ ; $I_B = -5\text{ mA}$                                                                                      | -   | -   | -950 | mV   |
| $t_d$       | delay time                           | $I_{Con} = -10\text{ mA}$ ;                                                                                                       | -   | -   | 35   | ns   |
| $t_r$       | rise time                            | $I_{Bon} = -1\text{ mA}$ ;                                                                                                        | -   | -   | 35   | ns   |
| $t_{on}$    | turn-on time                         | $I_{Boff} = 1\text{ mA}$                                                                                                          | -   | -   | 70   | ns   |
| $t_s$       | storage time                         |                                                                                                                                   | -   | -   | 225  | ns   |
| $t_f$       | fall time                            |                                                                                                                                   | -   | -   | 75   | ns   |
| $t_{off}$   | turn-off time                        |                                                                                                                                   | -   | -   | 300  | ns   |
| $f_T$       | transition frequency                 | $V_{CE} = -20\text{ V}$ ;<br>$I_C = -10\text{ mA}$ ;<br>$f = 100\text{ MHz}$                                                      | 250 | -   | -    | MHz  |
| $C_c$       | collector capacitance                | $V_{CB} = -5\text{ V}$ ; $I_E = I_E = 0\text{ A}$ ;<br>$f = 1\text{ MHz}$                                                         | -   | -   | 4.5  | pF   |
| $C_e$       | emitter capacitance                  | $V_{EB} = -500\text{ mV}$ ;<br>$I_C = I_C = 0\text{ A}$ ; $f = 1\text{ MHz}$                                                      | -   | -   | 10   | pF   |
| NF          | noise figure                         | $I_C = -100\text{ }\mu\text{A}$ ;<br>$V_{CE} = -5\text{ V}$ ; $R_S = 1\text{ k}\Omega$ ;<br>$f = 10\text{ Hz to }15.7\text{ kHz}$ | -   | -   | 4    | dB   |



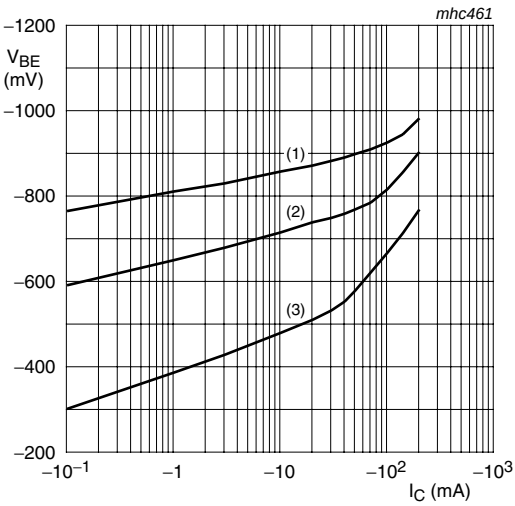
- $V_{CE} = -1\text{ V}$
- (1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

Fig 1. DC current gain as a function of collector current; typical values



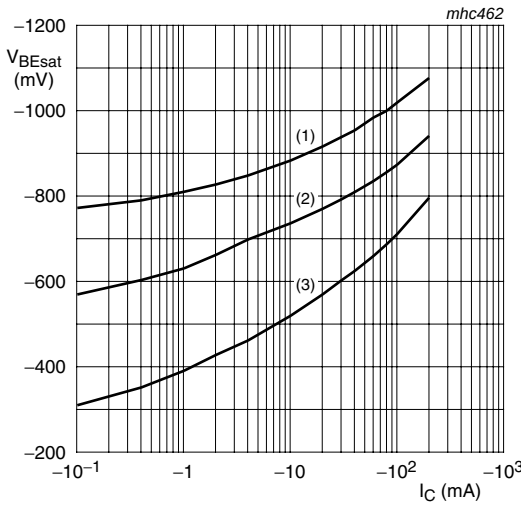
$T_{amb} = 25\text{ }^{\circ}\text{C}$

Fig 2. Collector current as a function of collector-emitter voltage; typical values



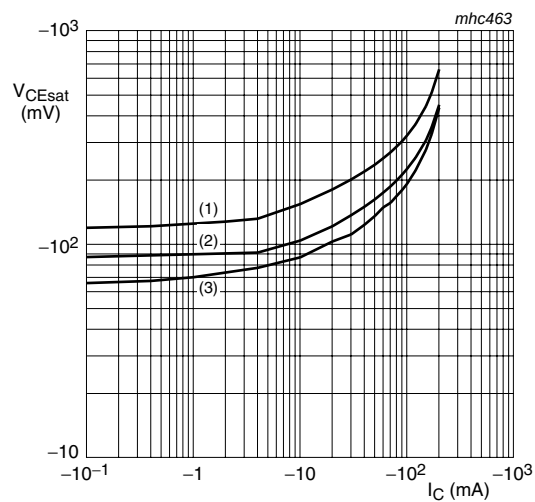
- $V_{CE} = -1\text{ V}$
- (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

Fig 3. Base-emitter voltage as a function of collector current; typical values



- $I_C/I_B = 10$
- (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

Fig 4. Base-emitter saturation voltage as a function of collector current; typical values

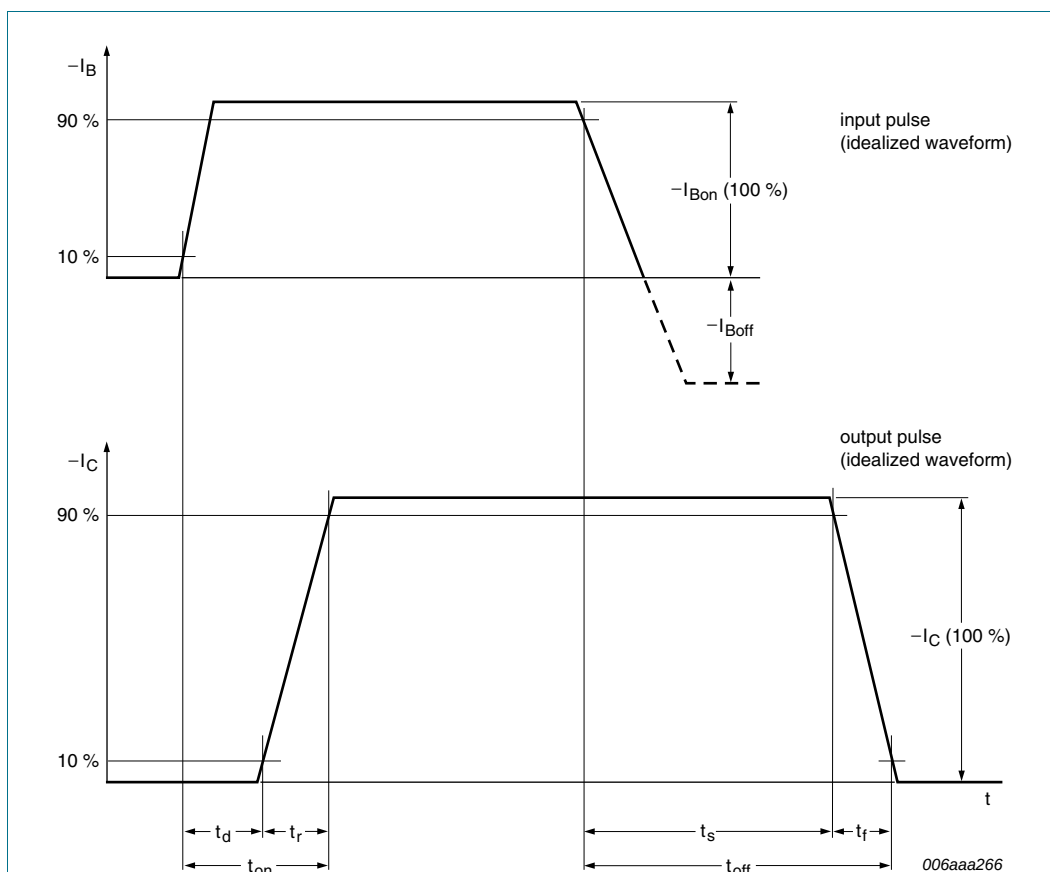


$$I_C/I_B = 10$$

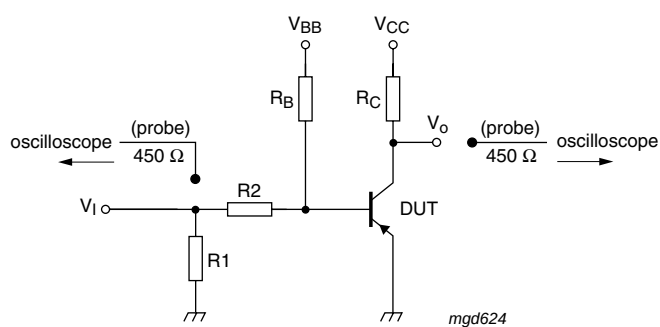
- (1)  $T_{amb} = 150\text{ °C}$
- (2)  $T_{amb} = 25\text{ °C}$
- (3)  $T_{amb} = -55\text{ °C}$

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

## 8. Test information



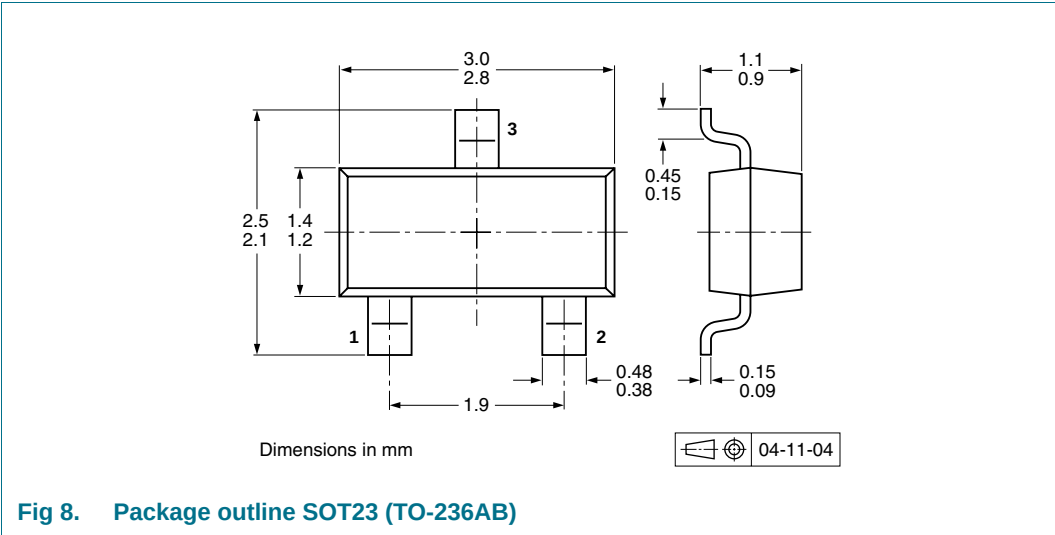
**Fig 6. BISS transistor switching time definition**



$V_I = 5 \text{ V}$ ;  $T = 500 \text{ } \mu\text{s}$ ;  $t_p = 10 \text{ } \mu\text{s}$ ;  $t_r = t_f \leq 3 \text{ ns}$   
 $R_1 = 56 \text{ } \Omega$ ;  $R_2 = 2.5 \text{ k}\Omega$ ;  $R_B = 3.9 \text{ k}\Omega$ ;  $R_C = 270 \text{ } \Omega$   
 $V_{BB} = 1.9 \text{ V}$ ;  $V_{CC} = -3 \text{ V}$   
 Oscilloscope: input impedance  $Z_i = 50 \text{ } \Omega$

**Fig 7. Test circuit for switching times**

9. Package outline



10. 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 |
| PMBT3906    | SOT23   | 4 mm pitch, 8 mm tape and reel | -215             | -235  |

[1] For further information and the availability of packing methods, see [Section 13](#).

## 11. Revision history

Table 9. Revision history

| Document ID    | Release date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Data sheet status     | Change notice | Supersedes     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|----------------|
| PMBT3906_6     | 20100302                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Product data sheet    | -             | PMBT3906_N_5   |
| 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="#">Section 4 "Marking"</a>: amended</li><li>• <a href="#">Table 7 "Characteristics"</a>: F redefined to NF noise figure</li><li>• <a href="#">Section 8 "Test information"</a>: added</li><li>• <a href="#">Figure 6</a>: added</li><li>• <a href="#">Figure 8</a>: superseded by minimized package outline drawing</li><li>• <a href="#">Section 10 "Packing information"</a>: added</li><li>• <a href="#">Section 12 "Legal information"</a>: updated</li></ul> |                       |               |                |
| PMBT3906_N_5   | 20071004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Product data sheet    | -             | PMBT3906_4     |
| PMBT3906_4     | 20040121                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Product specification | -             | PMBT3906_3     |
| PMBT3906_3     | 19990427                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Product specification | -             | PMBT3906_CNV_2 |
| PMBT3906_CNV_2 | 19970505                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Product specification | -             | -              |



## 12. Legal information

### 12.1 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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