

# 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

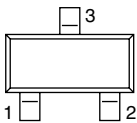
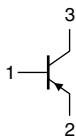
### 1.4 Quick reference data

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  |

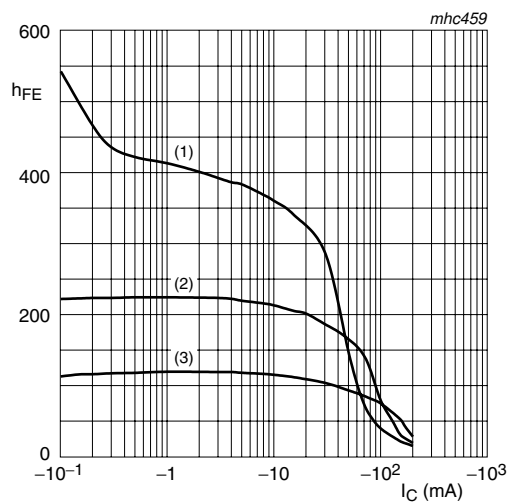
[1] Device mounted on an FR4 PCB.

## 7. Characteristics

**Table 7. Characteristics**

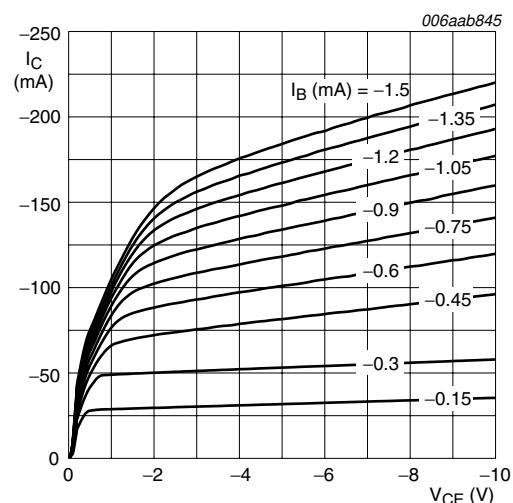
$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

| 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                           | $I_{Con} = -10\text{ mA}$ ;<br>$I_{Bon} = -1\text{ mA}$ ;<br>$I_{Boff} = 1\text{ mA}$                                             | -   | -   | 35   | ns   |
| $t_r$       | rise time                            |                                                                                                                                   | -   | -   | 35   | ns   |
| $t_{on}$    | turn-on time                         |                                                                                                                                   | -   | -   | 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                | $V_{CB} = -5\text{ V}$ ; $I_E = I_C = 0\text{ A}$ ;<br>$f = 1\text{ MHz}$                                                         | -   | -   | 4.5  | pF   |
| $C_e$       | emitter capacitance                  | $V_{EB} = -500\text{ mV}$ ;<br>$I_C = I_E = 0\text{ A}$ ; $f = 1\text{ MHz}$                                                      | -   | -   | 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   |



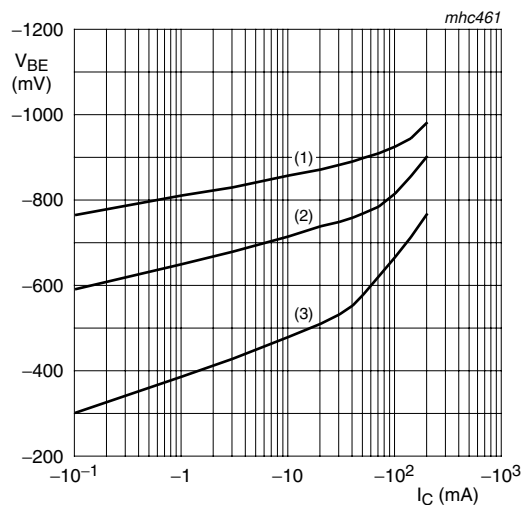
- $V_{CE} = -1\text{ V}$
- (1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



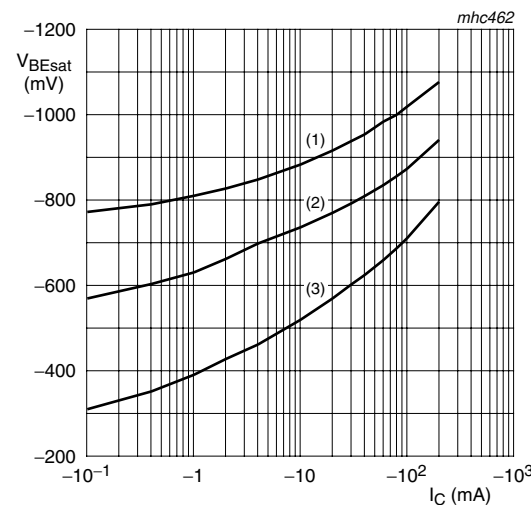
$T_{amb} = 25\text{ }^{\circ}\text{C}$

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



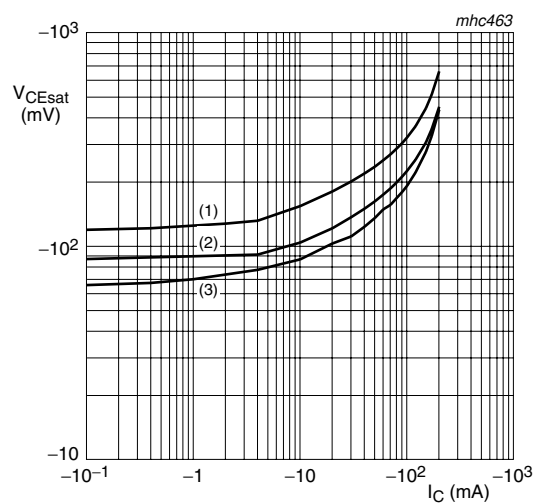
- $V_{CE} = -1\text{ V}$
- (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

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

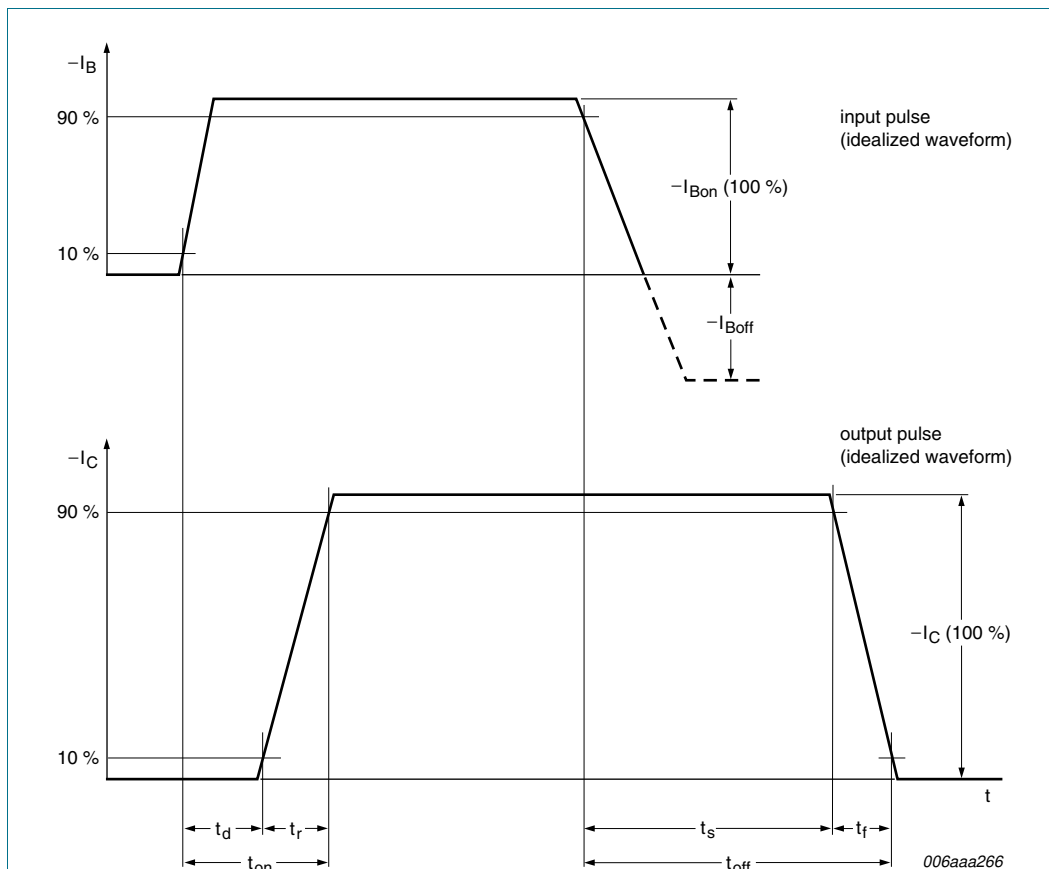


$$I_C/I_B = 10$$

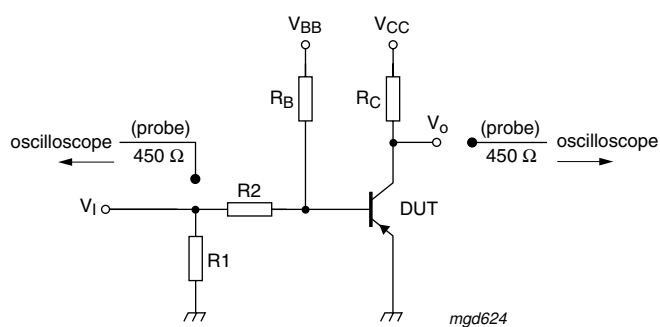
- (1)  $T_{amb} = 150\text{ °C}$
- (2)  $T_{amb} = 25\text{ °C}$
- (3)  $T_{amb} = -55\text{ °C}$

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

## 8. Test information



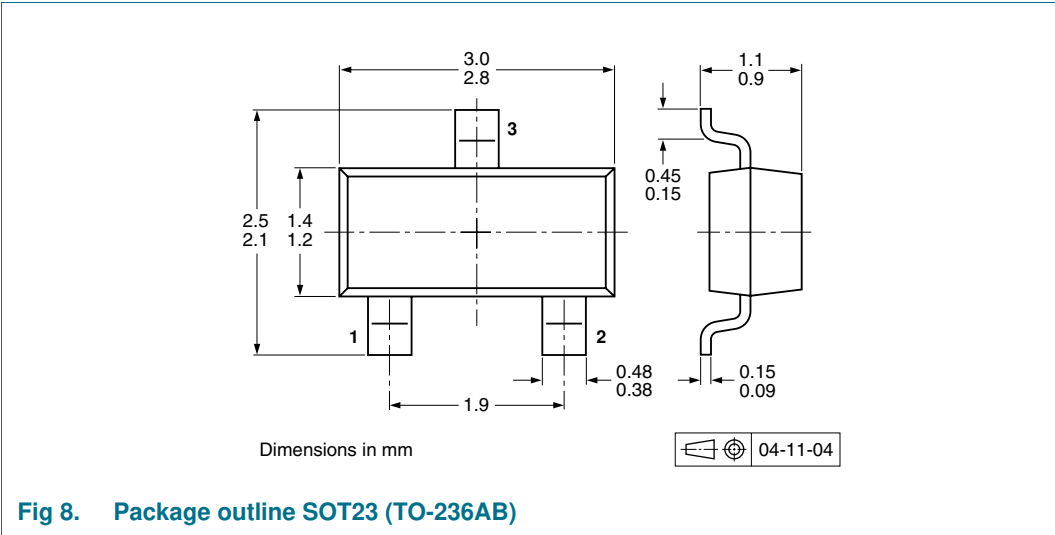
**Fig 6. BISS transistor switching time definition**


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

Oscilloscope: input impedance  $Z_i = 50 \, \Omega$

**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".

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