



# 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

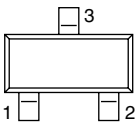
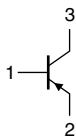
### 1.4 Quick reference data

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	[1]	-	500	K/W

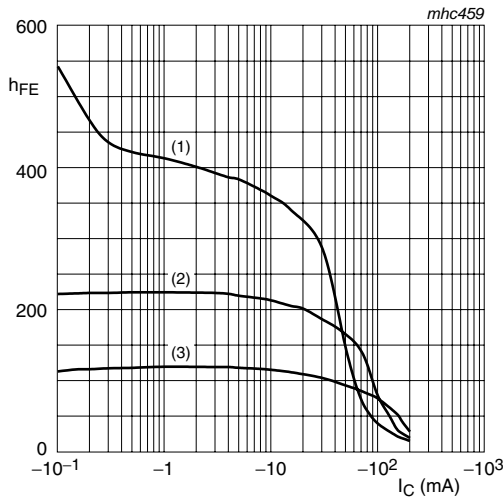
[1] Device mounted on an FR4 PCB.

## 7. Characteristics

**Table 7. Characteristics**

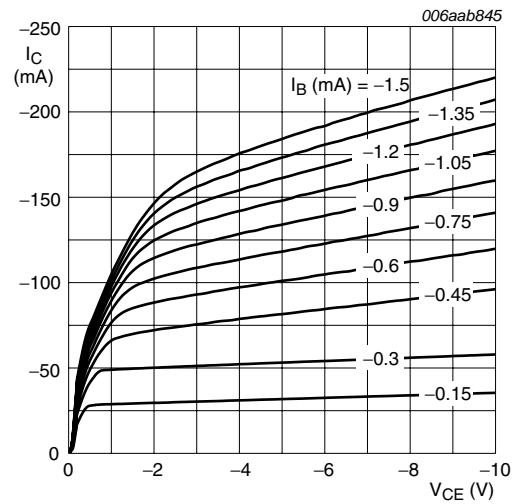
$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

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	$V_{CE} = -20\text{ V}$ ; $I_C = -10\text{ mA}$ ; $f = 100\text{ MHz}$	250	-	-	MHz
$C_C$	collector capacitance	$V_{CB} = -5\text{ V}$ ; $I_E = I_C = 0\text{ A}$ ; $f = 1\text{ MHz}$	-	-	4.5	pF
$C_e$	emitter capacitance	$V_{EB} = -500\text{ mV}$ ; $I_C = I_E = 0\text{ A}$ ; $f = 1\text{ MHz}$	-	-	10	pF
NF	noise figure	$I_C = -100\text{ }\mu\text{A}$ ; $V_{CE} = -5\text{ V}$ ; $R_S = 1\text{ k}\Omega$ ; $f = 10\text{ Hz to }15.7\text{ kHz}$	-	-	4	dB



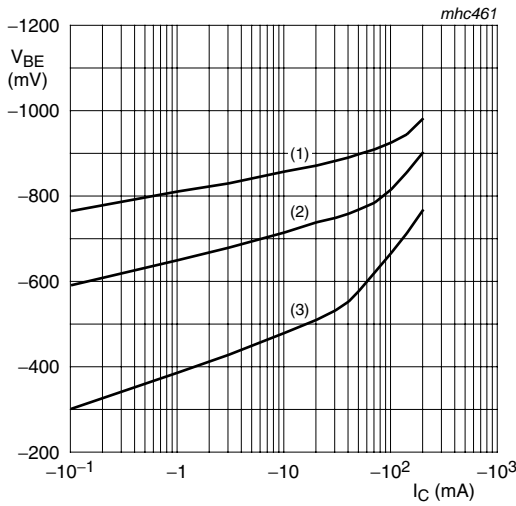
$V_{CE} = -1 \text{ V}$   
 (1)  $T_{amb} = 150 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

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



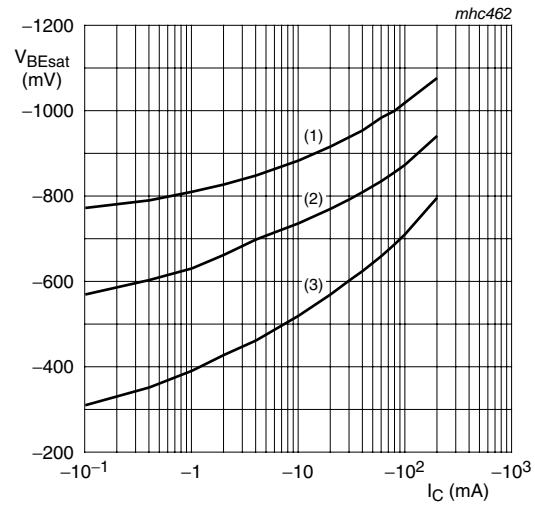
$T_{amb} = 25 \text{ }^\circ\text{C}$

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



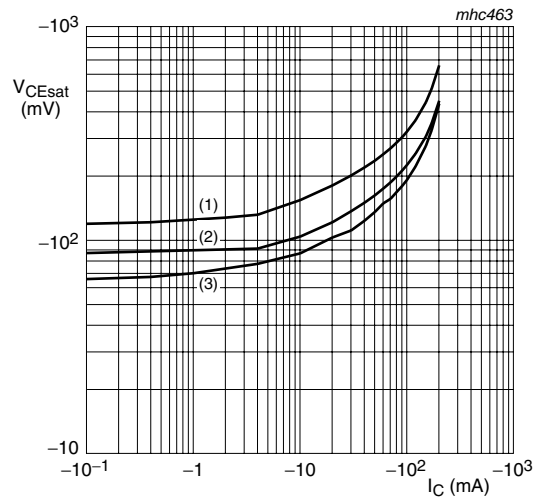
$V_{CE} = -1 \text{ V}$   
 (1)  $T_{amb} = -55 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 150 \text{ }^\circ\text{C}$

**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)  $T_{amb} = 150 \text{ }^\circ\text{C}$

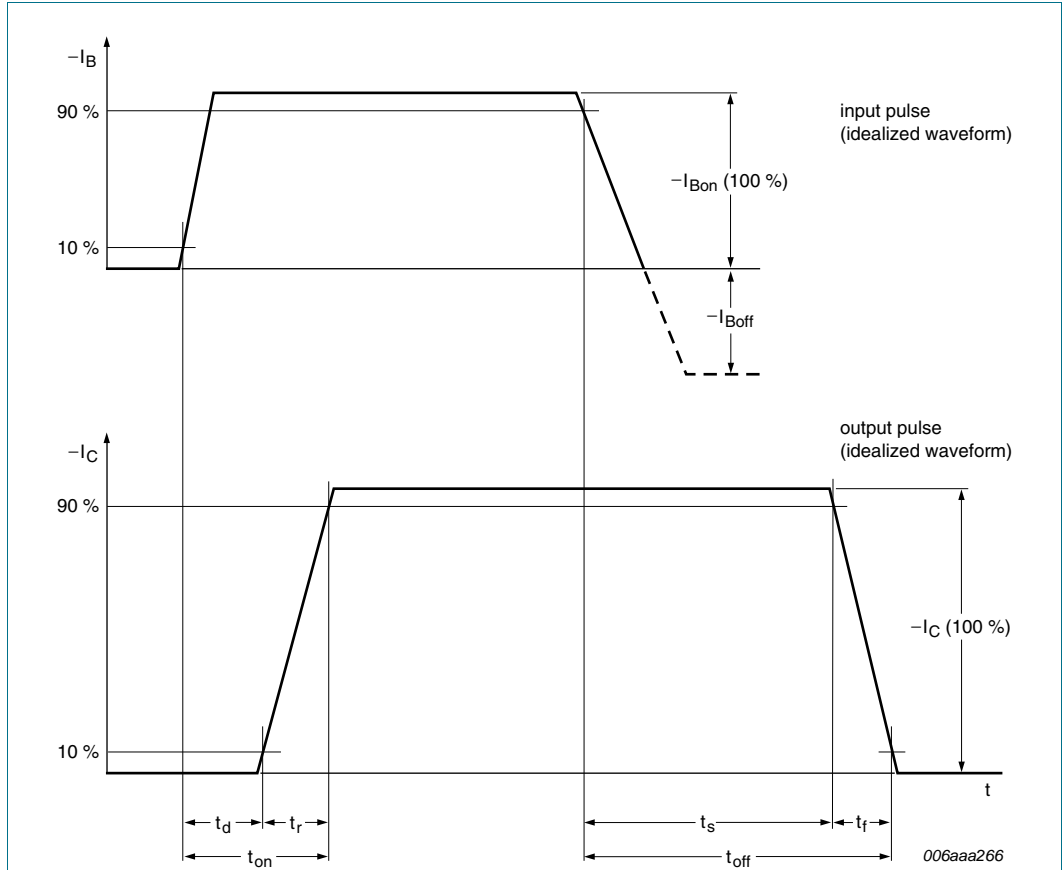
**Fig 4. Base-emitter saturation voltage as a function of collector current; typical values**



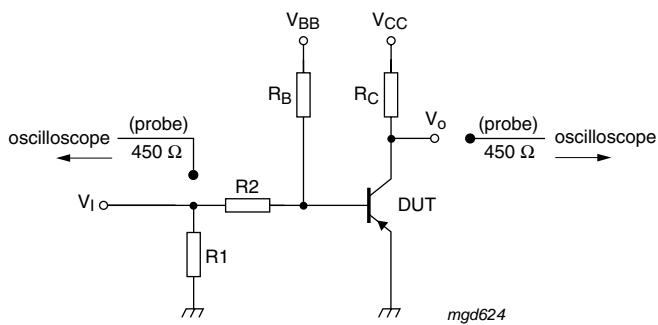
- $I_C/I_B = 10$
- (1)  $T_{amb} = 150\text{ °C}$
  - (2)  $T_{amb} = 25\text{ °C}$
  - (3)  $T_{amb} = -55\text{ °C}$

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

**8. Test information**



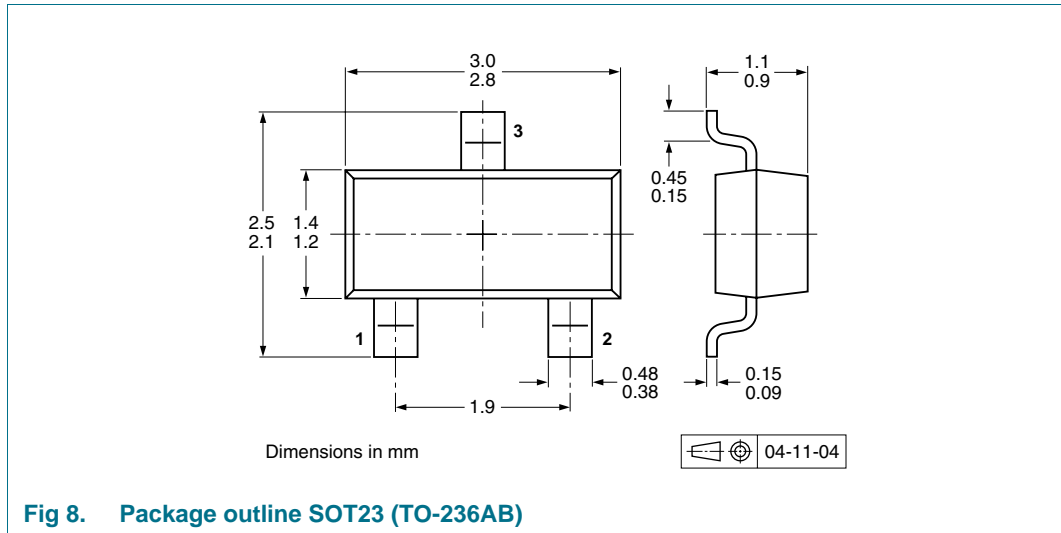
**Fig 6. BISS transistor switching time definition**



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

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