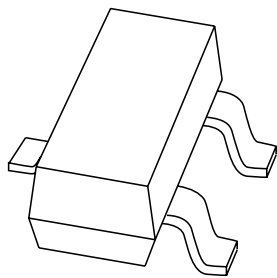


# DATA SHEET



## **PMBT3904** NPN switching transistor

Product specification  
Supersedes data of 1999 Apr 27

2004 Jan 12

# NPN switching transistor

# PMBT3904

### FEATURES

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

### APPLICATIONS

- General switching and amplification.

### DESCRIPTION

NPN switching transistor in a SOT23 plastic package.  
PNP complement: PMBT3906.

### MARKING

TYPE NUMBER	MARKING CODE <sup>(1)</sup>
PMBT3904	*1A

### Note

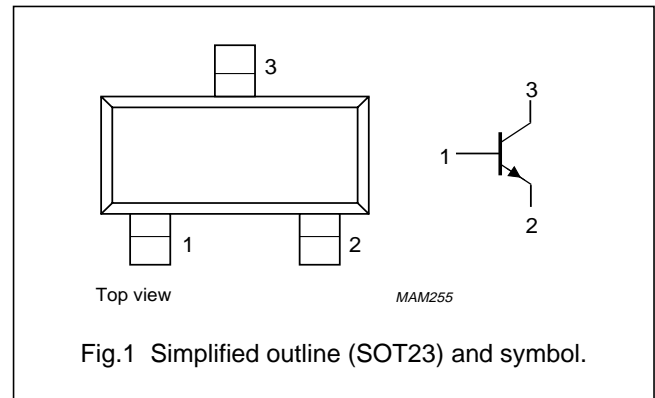
- \* = p : Made in Hong Kong.  
\* = t : Made in Malaysia.  
\* = W : Made in China.

### QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.	UNIT
$V_{CEO}$	collector-emitter voltage	40	V
$I_C$	collector current (DC)	200	mA

### PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



### ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
PMBT3904	–	plastic surface mounted package; 3 leads	SOT23

## NPN switching transistor

## PMBT3904

**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	–	60	V
$V_{CEO}$	collector-emitter voltage	open base	–	40	V
$V_{EBO}$	emitter-base voltage	open collector	–	6	V
$I_C$	collector current (DC)		–	200	mA
$I_{CM}$	peak collector current		–	200	mA
$I_{BM}$	peak base current		–	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$ ; note 1	–	250	mW
$T_{stg}$	storage temperature		–65	+150	°C
$T_j$	junction temperature		–	150	°C
$T_{amb}$	operating ambient temperature		–65	+150	°C

**Note**

1. Transistor mounted on an FR4 printed-circuit board.

**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th(j-a)}$	thermal resistance from junction to ambient	note 1	500	K/W

**Note**

1. Transistor mounted on an FR4 printed-circuit board.

**CHARACTERISTICS** $T_{amb} = 25\text{ °C}$  unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$I_{CBO}$	collector cut-off current	$I_E = 0$ ; $V_{CB} = 30\text{ V}$	–	50	nA
$I_{EBO}$	emitter cut-off current	$I_C = 0$ ; $V_{EB} = 6\text{ V}$	–	50	nA
$h_{FE}$	DC current gain	$V_{CE} = 1\text{ V}$ ; see Fig.2; note 1 $I_C = 0.1\text{ mA}$ $I_C = 1\text{ mA}$ $I_C = 10\text{ mA}$ $I_C = 50\text{ mA}$ $I_C = 100\text{ mA}$	60 80 100 60 30	– – 300 – –	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10\text{ mA}$ ; $I_B = 1\text{ mA}$ $I_C = 50\text{ mA}$ ; $I_B = 5\text{ mA}$	– –	200 300	mV mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 10\text{ mA}$ ; $I_B = 1\text{ mA}$ $I_C = 50\text{ mA}$ ; $I_B = 5\text{ mA}$	650 –	850 950	mV mV
$C_c$	collector capacitance	$I_E = I_e = 0$ ; $V_{CB} = 5\text{ V}$ ; $f = 1\text{ MHz}$	–	4	pF
$C_e$	emitter capacitance	$I_C = I_c = 0$ ; $V_{BE} = 500\text{ mV}$ ; $f = 1\text{ MHz}$	–	8	pF

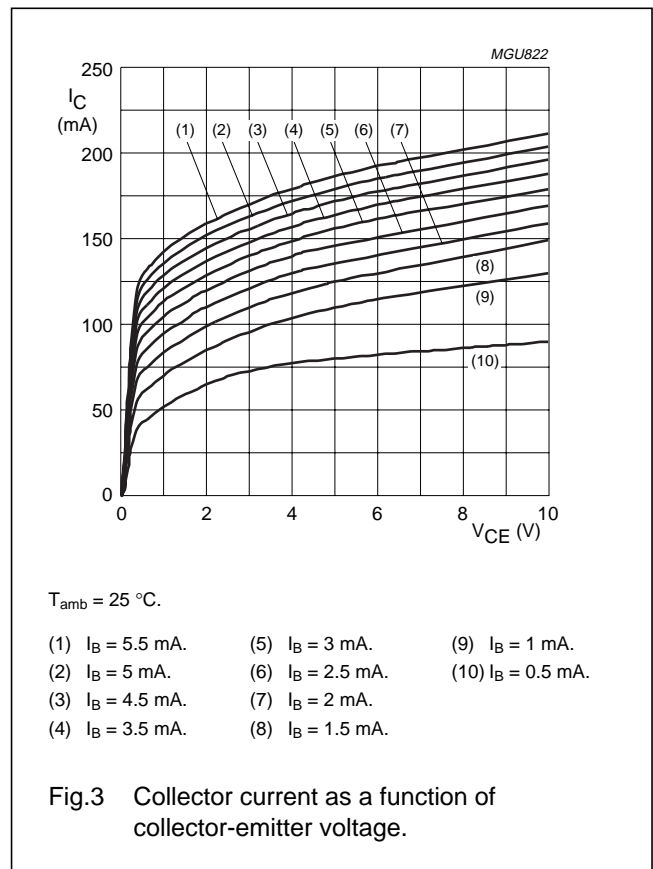
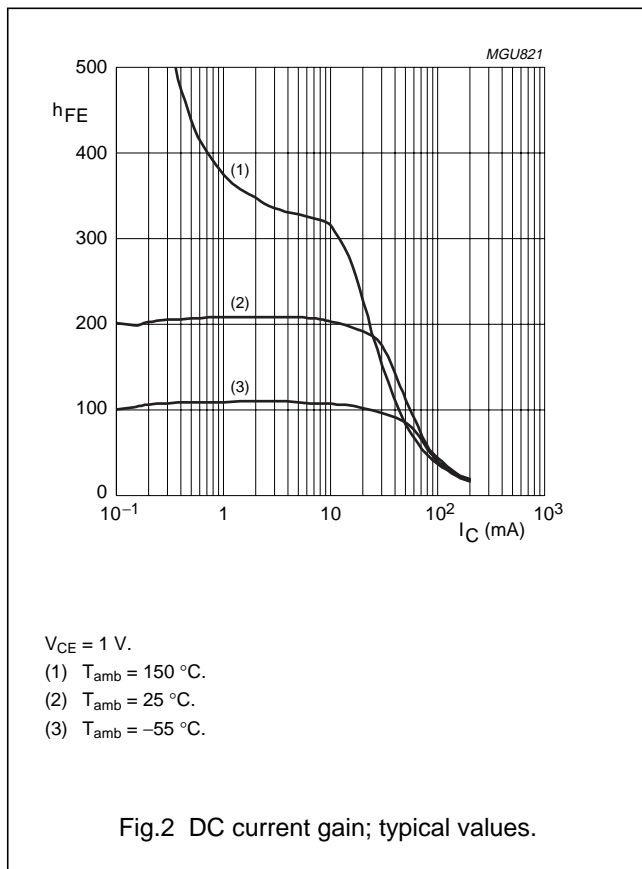
NPN switching transistor

PMBT3904

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$f_T$	transition frequency	$I_C = 10 \text{ mA}; V_{CE} = 20 \text{ V};$ $f = 100 \text{ MHz}$	300	–	MHz
F	noise figure	$I_C = 100 \mu\text{A}; V_{CE} = 5 \text{ V}; R_S = 1 \text{ k}\Omega;$ $f = 10 \text{ Hz to } 15.7 \text{ kHz}$	–	5	dB
<b>Switching times (between 10% and 90% levels); see Fig.3</b>					
$t_d$	delay time	$I_{Con} = 10 \text{ mA}; I_{Bon} = 1 \text{ mA};$ $I_{Boff} = -1 \text{ mA}$	–	35	ns
$t_r$	rise time		–	35	ns
$t_s$	storage time		–	200	ns
$t_f$	fall time		–	50	ns

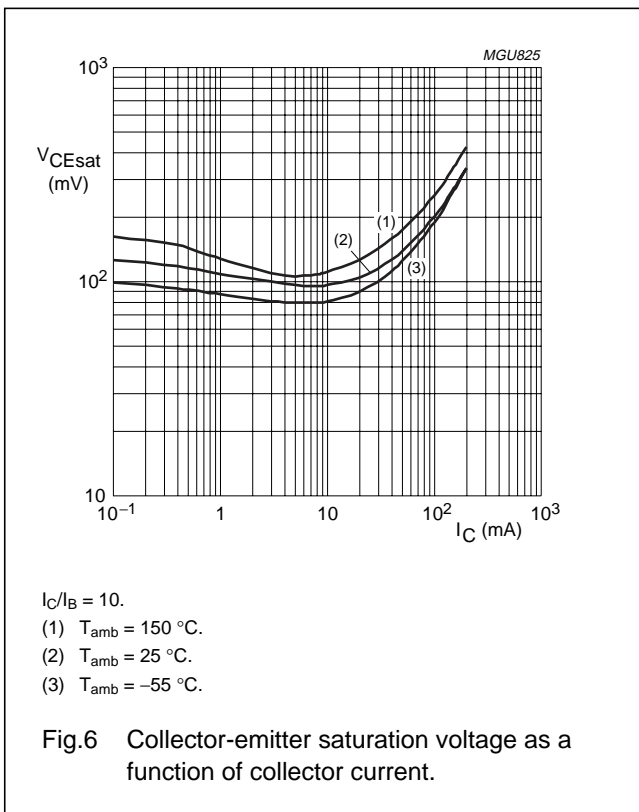
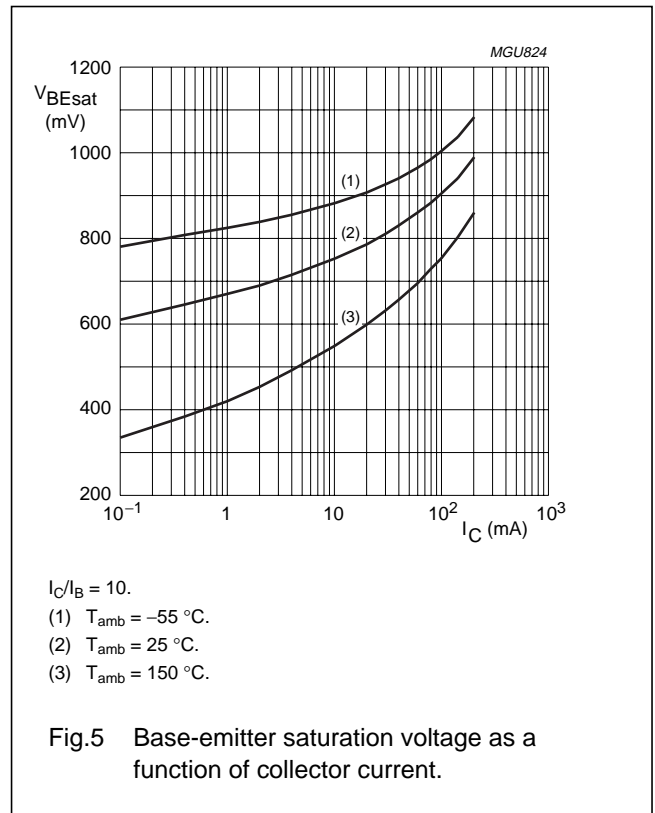
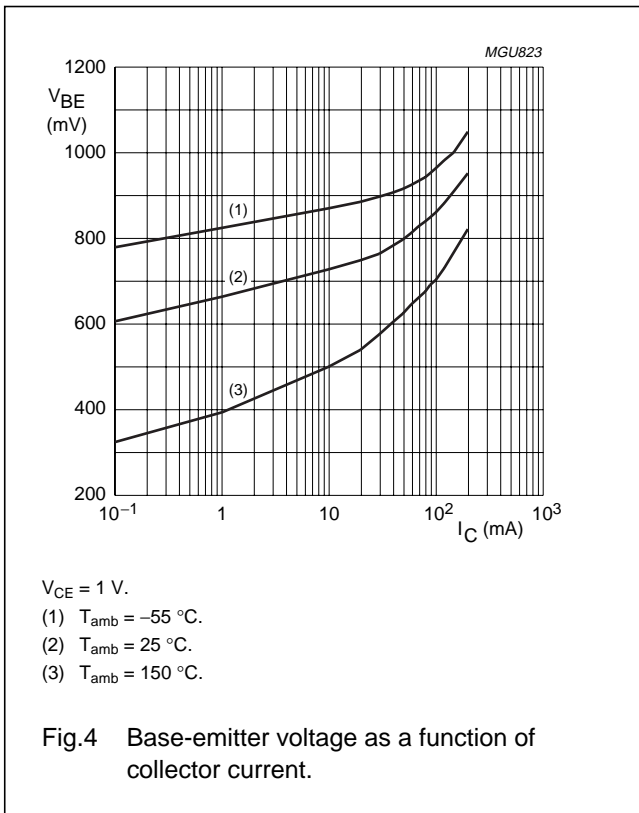
Note

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



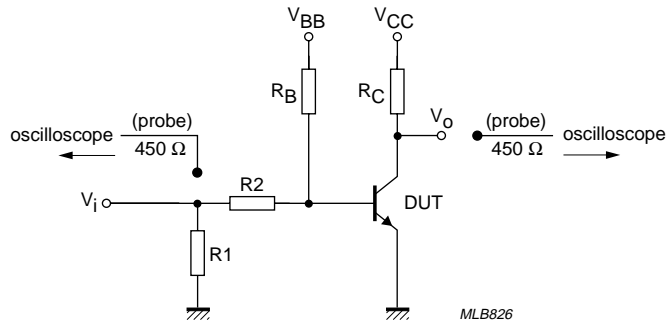
NPN switching transistor

PMBT3904



NPN switching transistor

PMBT3904



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

Fig.7 Test circuit for switching times.

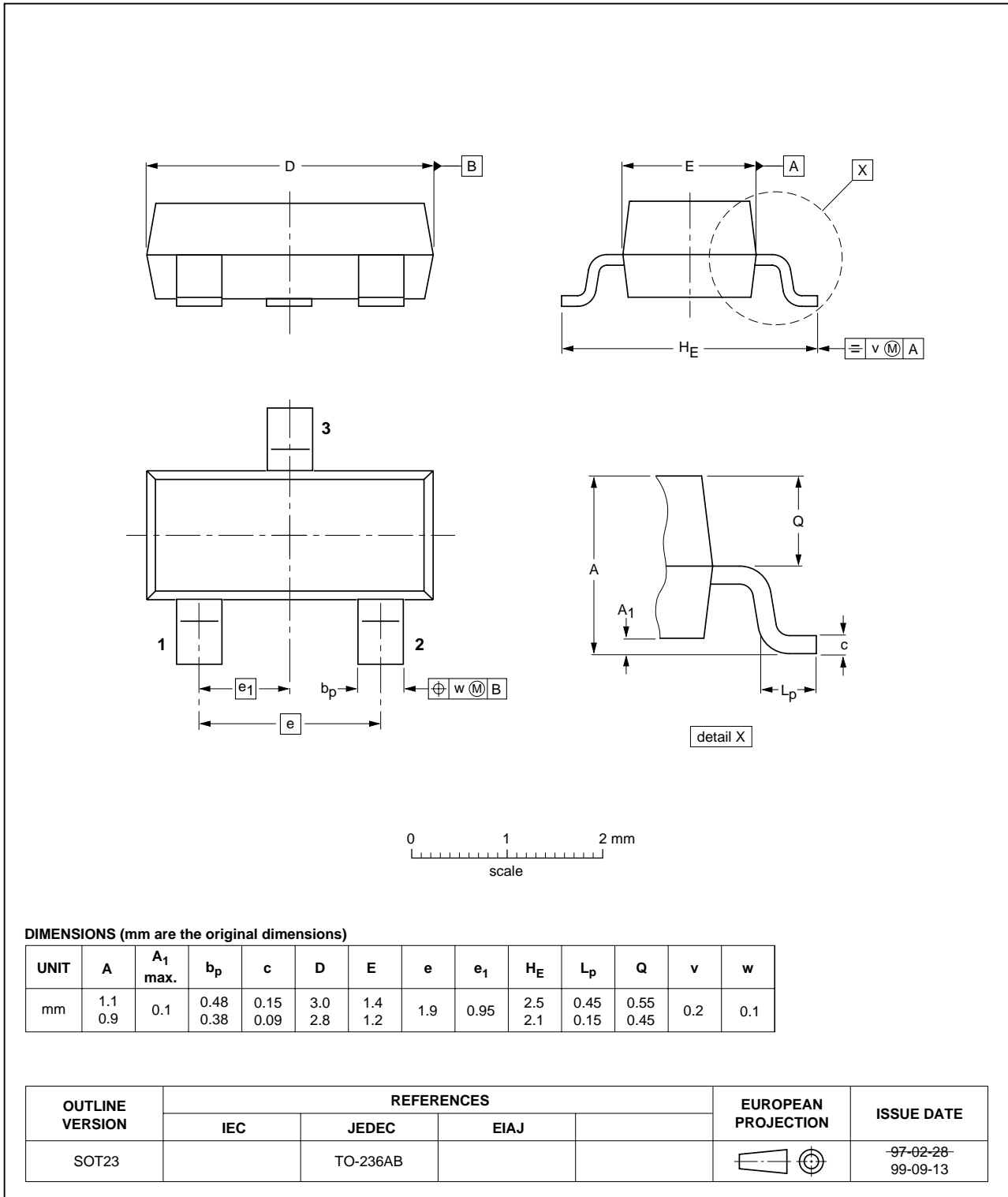
NPN switching transistor

PMBT3904

PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT23



## NPN switching transistor

PMBT3904

## DATA SHEET STATUS

LEVEL	DATA SHEET STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)(3)</sup>	DEFINITION
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