

# DATA SHEET



## **PMBT4401** NPN switching transistor

Product data sheet  
Supersedes data of 1999 Apr 15

2004 Jan 21

# NPN switching transistor

# PMBT4401

### FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

### APPLICATIONS

- Industrial and consumer switching applications.

### DESCRIPTION

NPN switching transistor in a SOT23 plastic package.  
PNP complement: PMBT4403.

### MARKING

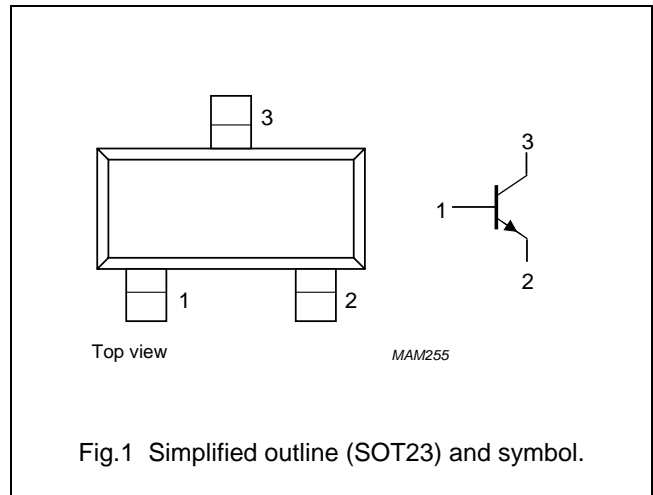
TYPE NUMBER	MARKING CODE <sup>(1)</sup>
PMBT4401	*2X

### Note

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

### PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



### ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
PMBT4401	-	plastic surface mounted package; 3 leads	SOT23

### 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)		-	600	mA
$I_{CM}$	peak collector current		-	800	mA
$I_{BM}$	peak base current		-	200	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.

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## 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

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$I_{CBO}$	collector-base cut-off current	$I_E = 0$ ; $V_{CB} = 60\text{ V}$	–	50	nA
$I_{EBO}$	emitter-base 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)			
		$I_C = 0.1\text{ mA}$ $I_C = 1\text{ mA}$ $I_C = 10\text{ mA}$ $I_C = 150\text{ mA}$ ; note 1	20 40 80 100	– – – 300	
		$I_C = 500\text{ mA}$ ; $V_{CE} = 2\text{ V}$ ; note 1	40	–	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 150\text{ mA}$ ; $I_B = 15\text{ mA}$ ; note 1	–	400	mV
		$I_C = 500\text{ mA}$ ; $I_B = 50\text{ mA}$ ; note 1	–	750	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 150\text{ mA}$ ; $I_B = 15\text{ mA}$ ; note 1	–	950	mV
		$I_C = 500\text{ mA}$ ; $I_B = 50\text{ mA}$ ; note 1	–	1.2	V
$C_c$	collector capacitance	$I_E = I_e = 0$ ; $V_{CB} = 5\text{ V}$ ; $f = 1\text{ MHz}$	–	8	pF
$C_e$	emitter capacitance	$I_C = I_c = 0$ ; $V_{EB} = 500\text{ mV}$ ; $f = 1\text{ MHz}$	–	30	pF
$f_T$	transition frequency	$I_C = 20\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 100\text{ MHz}$	250	–	MHz
<b>Switching times (between 10% and 90% levels); (see Fig.3)</b>					
$t_{on}$	turn-on time	$I_{Con} = 150\text{ mA}$ ; $I_{Bon} = 15\text{ mA}$ ; $I_{Boff} = -15\text{ mA}$	–	35	ns
$t_d$	delay time		–	15	ns
$t_r$	rise time		–	20	ns
$t_{off}$	turn-off time		–	250	ns
$t_s$	storage time		–	200	ns
$t_f$	fall time		–	60	ns

## Note

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

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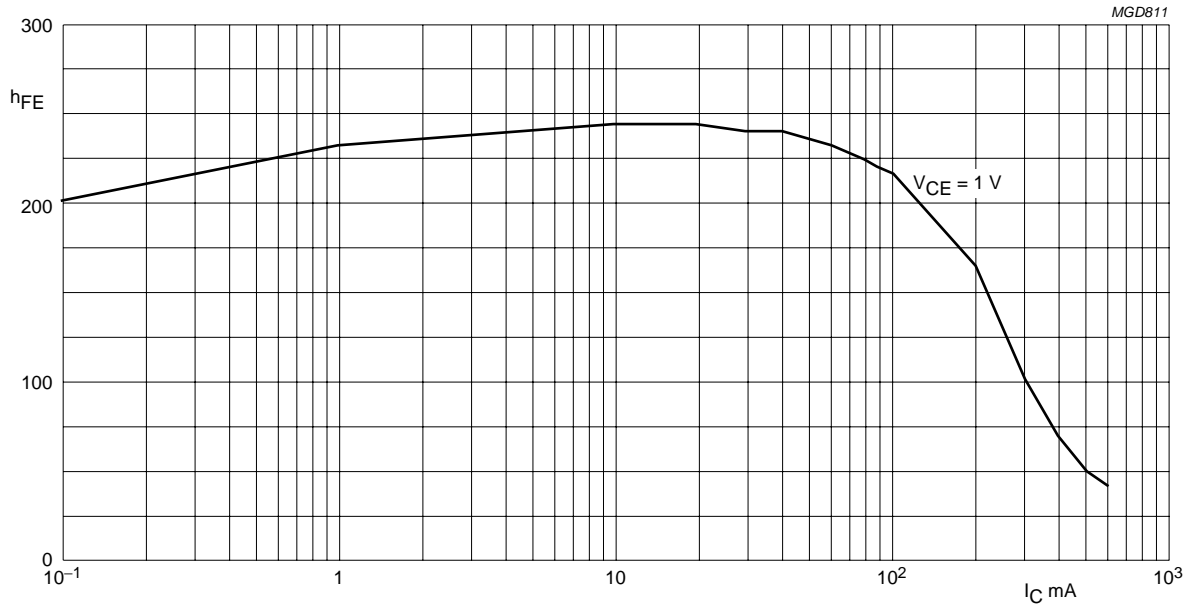
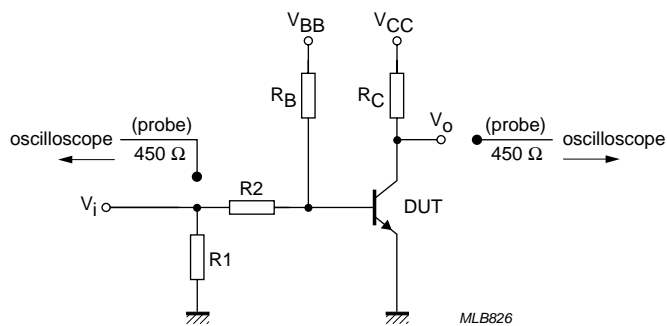


Fig.2 DC current gain; typical values.



$V_i = 9.5 \text{ V}$ ;  $T = 500 \text{ } \mu\text{s}$ ;  $t_p = 10 \text{ } \mu\text{s}$ ;  $t_r = t_f \leq 3 \text{ ns}$ .  
 $R_1 = 68 \text{ } \Omega$ ;  $R_2 = 325 \text{ } \Omega$ ;  $R_B = 325 \text{ } \Omega$ ;  $R_C = 160 \text{ } \Omega$ .  
 $V_{BB} = -3.5 \text{ V}$ ;  $V_{CC} = 29.5 \text{ V}$ .  
 Oscilloscope: input impedance  $Z_i = 50 \text{ } \Omega$ .

Fig.3 Test circuit for switching times.

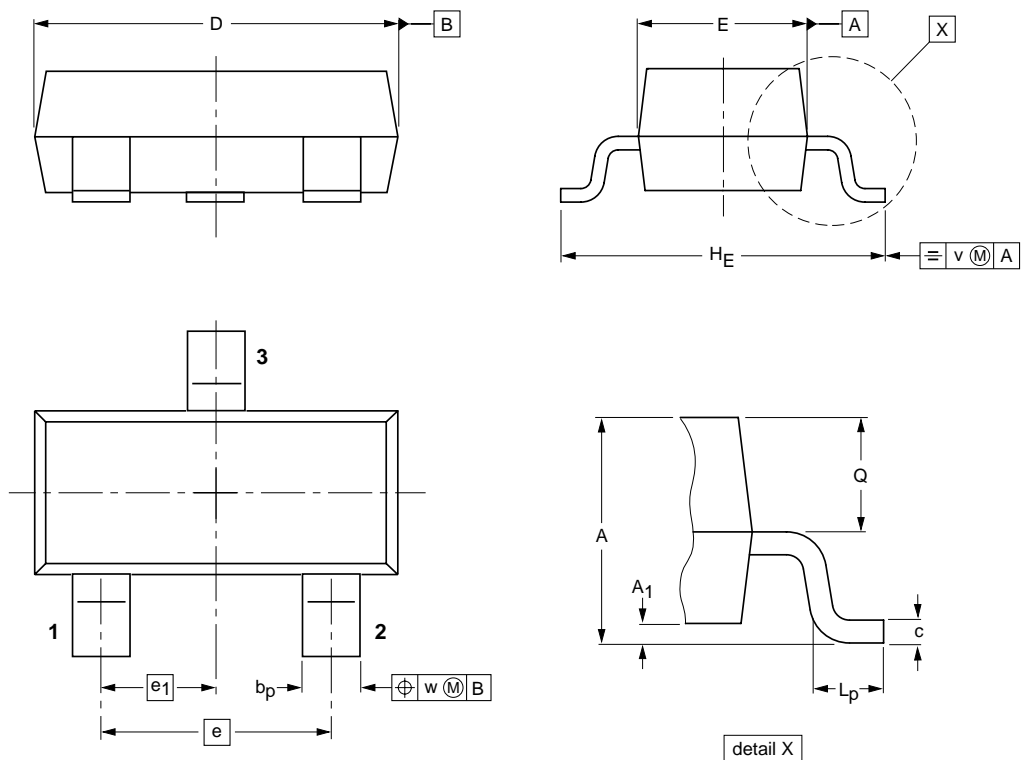
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PACKAGE OUTLINE

Plastic surface-mounted package; 3 leads

SOT23



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub> max.	b <sub>p</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	Q	v	w
mm	1.1 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT23		TO-236AB				04-11-04 06-03-16

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## DATA SHEET STATUS

DOCUMENT STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)</sup>	DEFINITION
Objective data sheet	Development	This document contains data from the objective specification for product development.
Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
Product data sheet	Production	This document contains the product specification.

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## **Customer notification**

This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content, except for package outline drawings which were updated to the latest version.

## **Contact information**

For additional information please visit: <http://www.nxp.com>

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