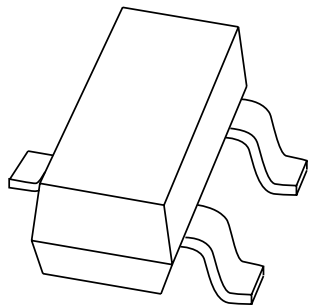


# DATA SHEET



## **PMBT2222; PMBT2222A** NPN switching transistors

Product specification  
Supersedes data of 1997 Sep 09

1999 Apr 27

# NPN switching transistors

# PMBT2222; PMBT2222A

### FEATURES

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

### APPLICATIONS

- Switching and linear amplification.

### DESCRIPTION

NPN switching transistor in a SOT23 plastic package.  
PNP complements: PMBT2907 and PMBT2907A.

### MARKING

TYPE NUMBER	MARKING CODE <sup>(1)</sup>
PMBT2222	*1B
PMBT2222A	*1P

### Note

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

### PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

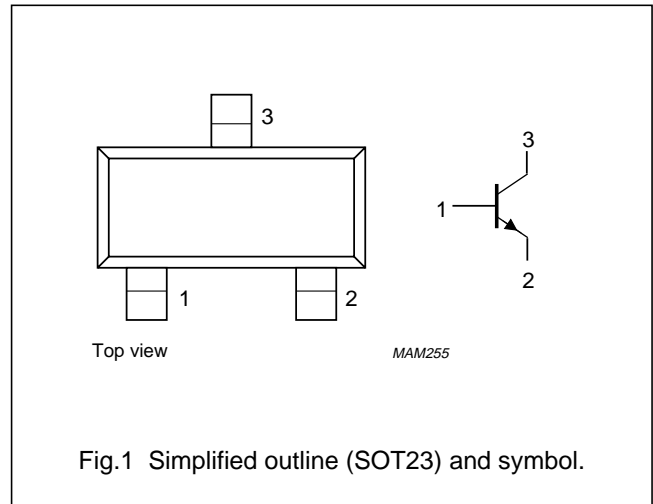


Fig.1 Simplified outline (SOT23) and symbol.

### LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{CBO}$	collector-base voltage	open emitter			
	PMBT2222		–	60	V
	PMBT2222A		–	75	V
$V_{CEO}$	collector-emitter voltage	open base			
	PMBT2222		–	30	V
	PMBT2222A		–	40	V
$V_{EBO}$	emitter-base voltage	open collector			
	PMBT2222		–	5	V
	PMBT2222A		–	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	$T_{amb} \leq 25\text{ }^\circ\text{C}$ ; note 1	–	250	mW
$T_{stg}$	storage temperature		–65	+150	$^\circ\text{C}$
$T_j$	junction temperature		–	150	$^\circ\text{C}$
$T_{amb}$	operating ambient temperature		–65	+150	$^\circ\text{C}$

### Note

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

## NPN switching transistors

## PMBT2222; PMBT2222A

## 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

$T_j = 25\text{ °C}$  unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$I_{CBO}$	collector cut-off current PMBT2222	$I_E = 0; V_{CB} = 50\text{ V}$	–	10	nA
		$I_E = 0; V_{CB} = 50\text{ V}; T_j = 125\text{ °C}$	–	10	$\mu\text{A}$
	collector cut-off current PMBT2222A	$I_E = 0; V_{CB} = 60\text{ V}$	–	10	nA
		$I_E = 0; V_{CB} = 60\text{ V}; T_j = 125\text{ °C}$	–	10	$\mu\text{A}$
$I_{EBO}$	emitter cut-off current PMBT2222A	$I_C = 0; V_{EB} = 5\text{ V}$	–	10	nA
$h_{FE}$	DC current gain	$I_C = 0.1\text{ mA}; V_{CE} = 10\text{ V}$	35	–	
		$I_C = 1\text{ mA}; V_{CE} = 10\text{ V}$	50	–	
		$I_C = 10\text{ mA}; V_{CE} = 10\text{ V}$	75	–	
		$I_C = 10\text{ mA}; V_{CE} = 10\text{ V}; T_{amb} = -55\text{ °C}$	35	–	
		$I_C = 150\text{ mA}; V_{CE} = 10\text{ V}$	100	300	
		$I_C = 150\text{ mA}; V_{CE} = 1\text{ V}$	50	–	
	DC current gain PMBT2222 PMBT2222A	$I_C = 500\text{ mA}; V_{CE} = 10\text{ V}$	30 40	– –	
$V_{CEsat}$	collector-emitter saturation voltage PMBT2222 PMBT2222A	$I_C = 150\text{ mA}; I_B = 15\text{ mA}; \text{note 1}$	– –	400 300	mV mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}; \text{note 1}$	– –	1.6 1	V V
	base-emitter saturation voltage PMBT2222 PMBT2222A	$I_C = 150\text{ mA}; I_B = 15\text{ mA}; \text{note 1}$	– 0.6	1.3 1.2	V V
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}; \text{note 1}$	– –	2.6 2	V V
$C_c$	collector capacitance	$I_E = I_e = 0; V_{CB} = 10\text{ V}; f = 1\text{ MHz}$	–	8	pF

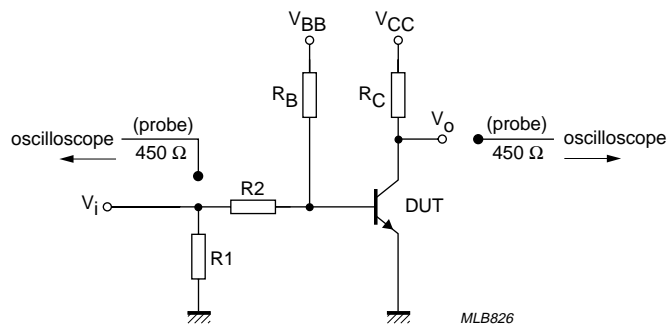
NPN switching transistors

PMBT2222; PMBT2222A

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$C_e$	emitter capacitance	$I_C = i_c = 0; V_{EB} = 500 \text{ mV}; f = 1 \text{ MHz}$	-	30	
	PMBT2222			25	
$f_T$	transition frequency	$I_C = 20 \text{ mA}; V_{CE} = 20 \text{ V}; f = 100 \text{ MHz}$	250	-	MHz
	PMBT2222A		300	-	MHz
F	noise figure	$I_C = 100 \mu\text{A}; V_{CE} = 5 \text{ V}; R_S = 1 \text{ k}\Omega; f = 1 \text{ kHz}$	-	4	dB
<b>Switching times (between 10% and 90% levels); (see Fig.2)</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:  $t_p \leq 300 \mu\text{s}; \delta \leq 0.02$ .



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

Fig.2 Test circuit for switching times.

NPN switching transistors

PMBT2222; PMBT2222A

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	EIAJ			
SOT23						97-02-28

## NPN switching transistors

## PMBT2222; PMBT2222A

**DEFINITIONS**

<b>Data sheet status</b>	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
<b>Limiting values</b>	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

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NPN switching transistors

PMBT2222; PMBT2222A

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