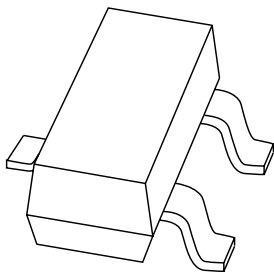


# DATA SHEET



## **MMBT2222A** NPN switching transistor

Product data sheet  
Supersedes data of 2000 Apr 11

2004 Jan 16

## NPN switching transistor

## MMBT2222A

## 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 complement: PMBT2907A.

## MARKING

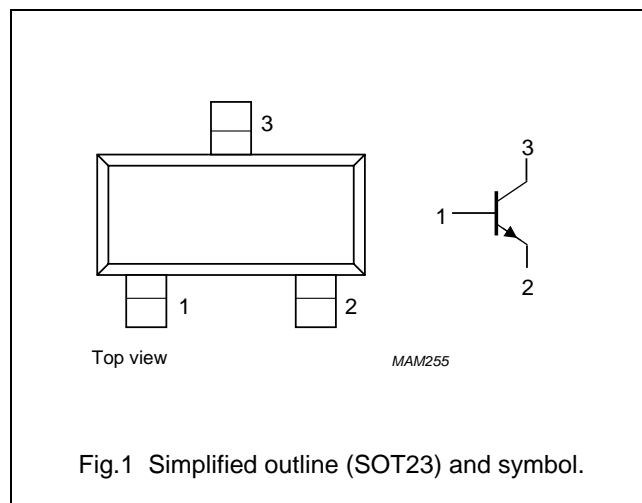
TYPE NUMBER	MARKING CODE <sup>(1)</sup>
MMBT2222A	7C*

## Note

1. \* = 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
MMBT2222A	–	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	–	75	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.

## NPN switching transistor

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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

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

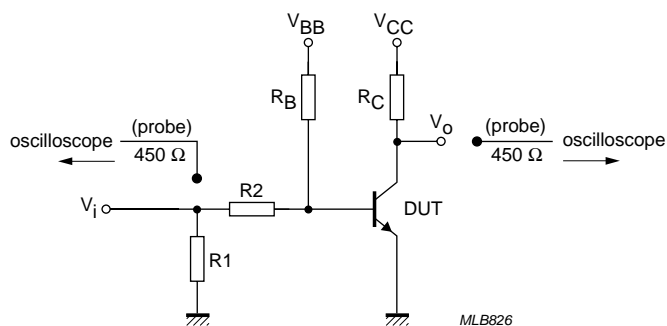
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$I_{CBO}$	collector cut-off current	$I_E = 0$ ; $V_{CB} = 60\text{ V}$	–	10	nA
		$I_E = 0$ ; $V_{CB} = 60\text{ V}$ ; $T_j = 125\text{ }^{\circ}\text{C}$	–	10	$\mu\text{A}$
$I_{EBO}$	emitter cut-off current	$I_C = 0$ ; $V_{EB} = 5\text{ V}$	–	10	nA
$h_{FE}$	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	–	
		$I_C = 10\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $T_{amb} = -55\text{ }^{\circ}\text{C}$	35	–	
		$I_C = 150\text{ mA}$ ; $V_{CE} = 10\text{ V}$	100	300	
		$I_C = 150\text{ mA}$ ; $V_{CE} = 1\text{ V}$	50	–	
		$I_C = 500\text{ mA}$ ; $V_{CE} = 10\text{ V}$	40	–	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 150\text{ mA}$ ; $I_B = 15\text{ mA}$ ; note 1	–	300	mV
		$I_C = 500\text{ mA}$ ; $I_B = 50\text{ mA}$ ; note 1	–	1	V
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 150\text{ mA}$ ; $I_B = 15\text{ mA}$ ; note 1	0.6	1.2	V
		$I_C = 500\text{ mA}$ ; $I_B = 50\text{ mA}$ ; note 1	–	2	V
$C_c$	collector capacitance	$I_E = i_e = 0$ ; $V_{CB} = 10\text{ V}$ ; $f = 1\text{ MHz}$	–	8	pF
$C_e$	emitter capacitance	$I_C = i_c = 0$ ; $V_{EB} = 500\text{ mV}$ ; $f = 1\text{ MHz}$	–	25	pF
$f_T$	transition frequency	$I_C = 20\text{ mA}$ ; $V_{CE} = 20\text{ V}$ ; $f = 100\text{ MHz}$	300	–	MHz
F	noise figure	$I_C = 100\text{ }\mu\text{A}$ ; $V_{CE} = 5\text{ V}$ ; $R_S = 1\text{ k}\Omega$ ; $f = 1\text{ kHz}$	–	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:  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta \leq 0.02$ .

## NPN switching transistor

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

Fig.2 Test circuit for switching times.

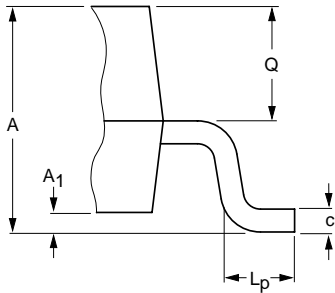
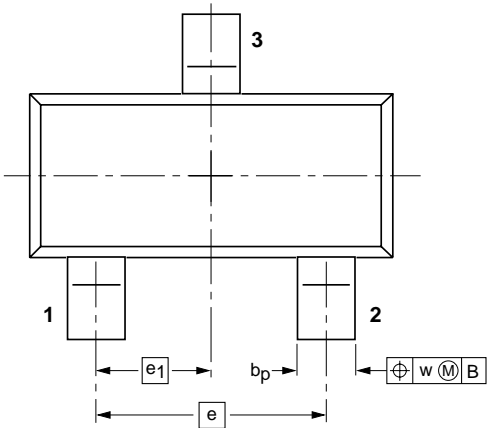
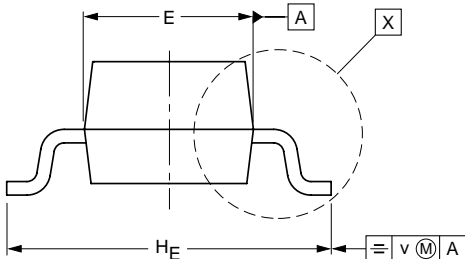
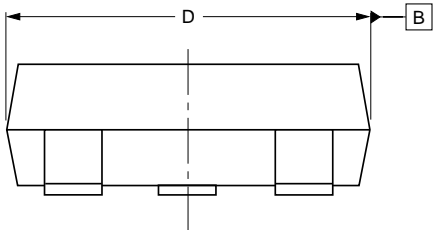
NPN switching transistor

MMBT2222A

PACKAGE OUTLINE

Plastic surface-mounted package; 3 leads

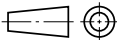
SOT23



012 mm  
scale

**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

## NPN switching transistor

## MMBT2222A

## 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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