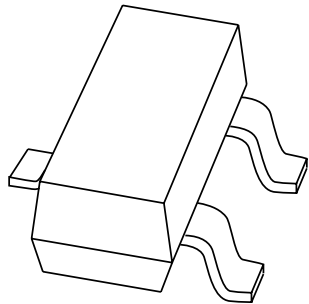


# DATA SHEET



## **MMBT3904** NPN switching transistor

Product specification  
Supersedes data of 2002 May 13

2002 Oct 04

## NPN switching transistor

## MMBT3904

## FEATURES

- Collector current capability  $I_C = 200$  mA
- Collector-emitter voltage  $V_{CE0} = 40$  V.

## APPLICATIONS

- General switching and amplification.

## DESCRIPTION

NPN switching transistor in a SOT23 plastic package.  
PNP complement: MMBT3906.

## MARKING

TYPE NUMBER	MARKING CODE <sup>(1)</sup>
MMBT3904	7A*

## Note

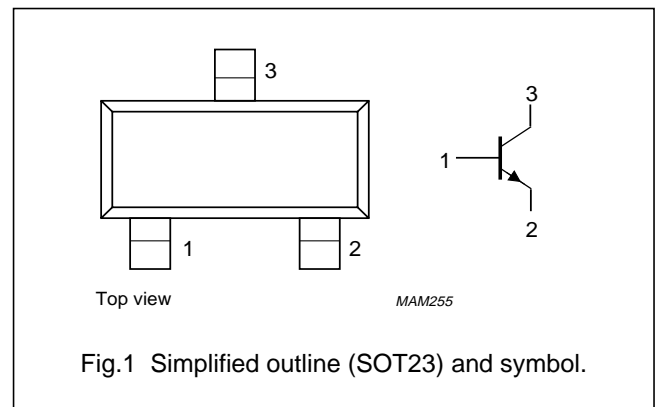
- \* = p: Made in Hong Kong.  
\* = t: Made in Malaysia.

## QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.	UNIT
$V_{CE0}$	collector-emitter voltage	40	V
$I_C$	collector current (DC)	200	mA

## PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



## 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
$V_{CE0}$	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	$T_{amb} \leq 25$ °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

## MMBT3904

## 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 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	$I_C = 10\text{ mA}; I_B = 1\text{ mA}$	–	200	mV
		$I_C = 50\text{ mA}; I_B = 5\text{ mA}$	–	300	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 1\text{ mA}$	650	850	mV
		$I_C = 50\text{ mA}; I_B = 5\text{ mA}$	–	950	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
$f_T$	transition frequency	$I_C = 10\text{ mA}; V_{CE} = 20\text{ V}; f = 100\text{ MHz}$	300	–	MHz
F	noise figure	$I_C = 100\text{ }\mu\text{A}; V_{CE} = 5\text{ V}; R_S = 1\text{ k}\Omega; f = 10\text{ Hz to }15.7\text{ kHz}$	–	5	dB

## Switching times (between 10% and 90% levels); see Fig.3

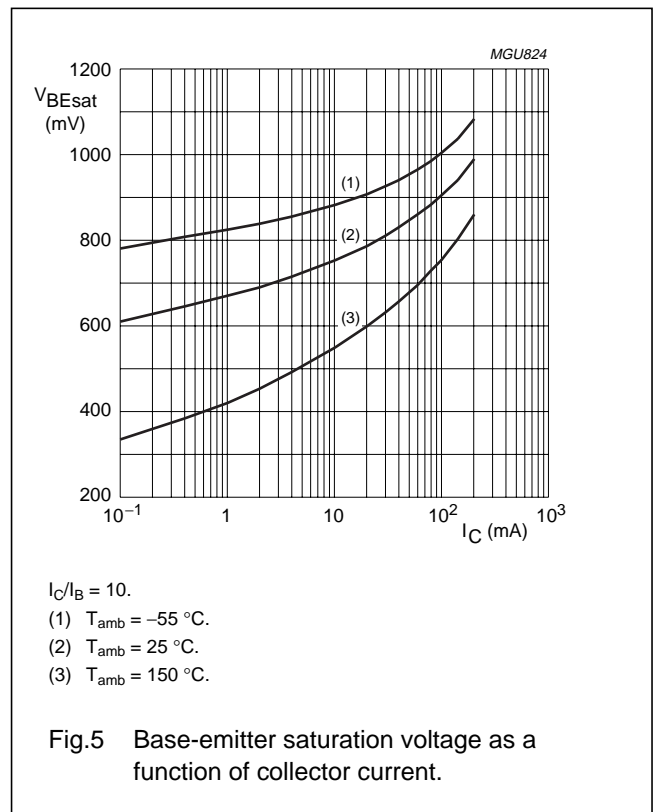
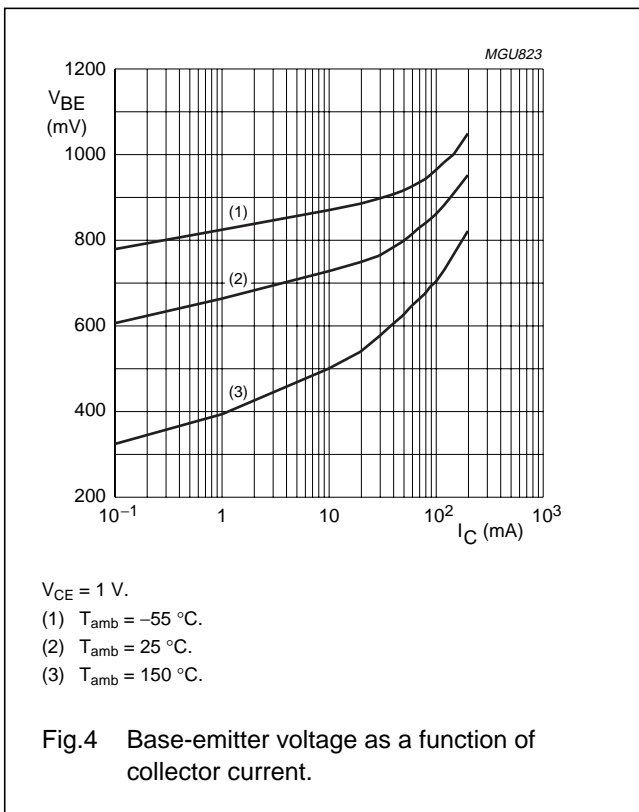
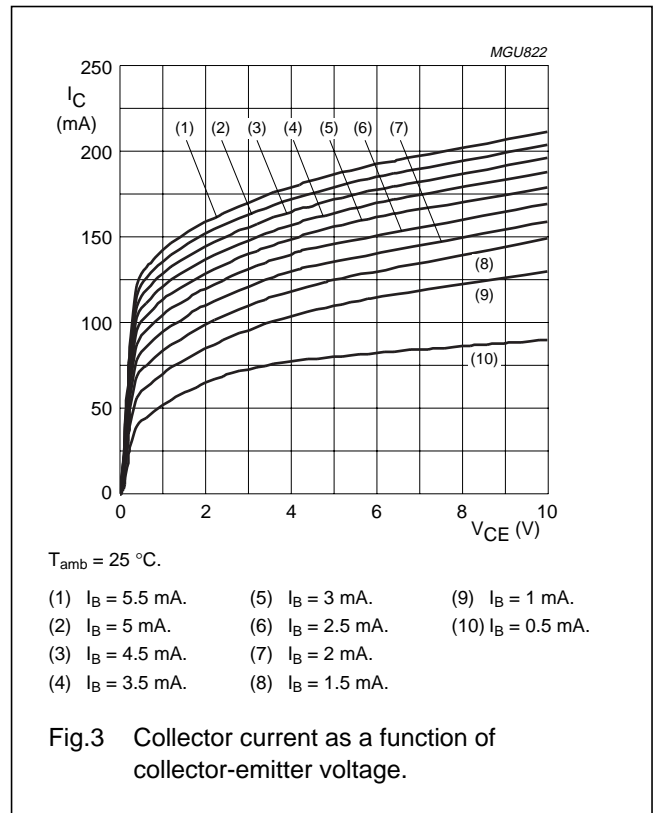
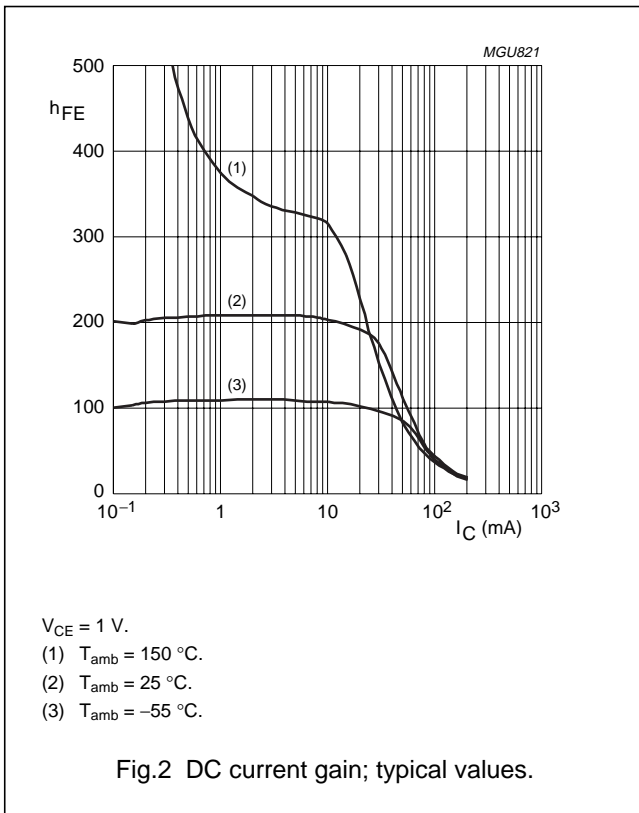
$t_d$	delay time	$I_{Con} = 10\text{ mA}; I_{Bon} = 1\text{ mA}; I_{Boff} = -1\text{ mA}$	–	35	ns
$t_r$	rise time		–	35	ns
$t_s$	storage time		–	200	ns
$t_f$	fall time		–	50	ns

## Note

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

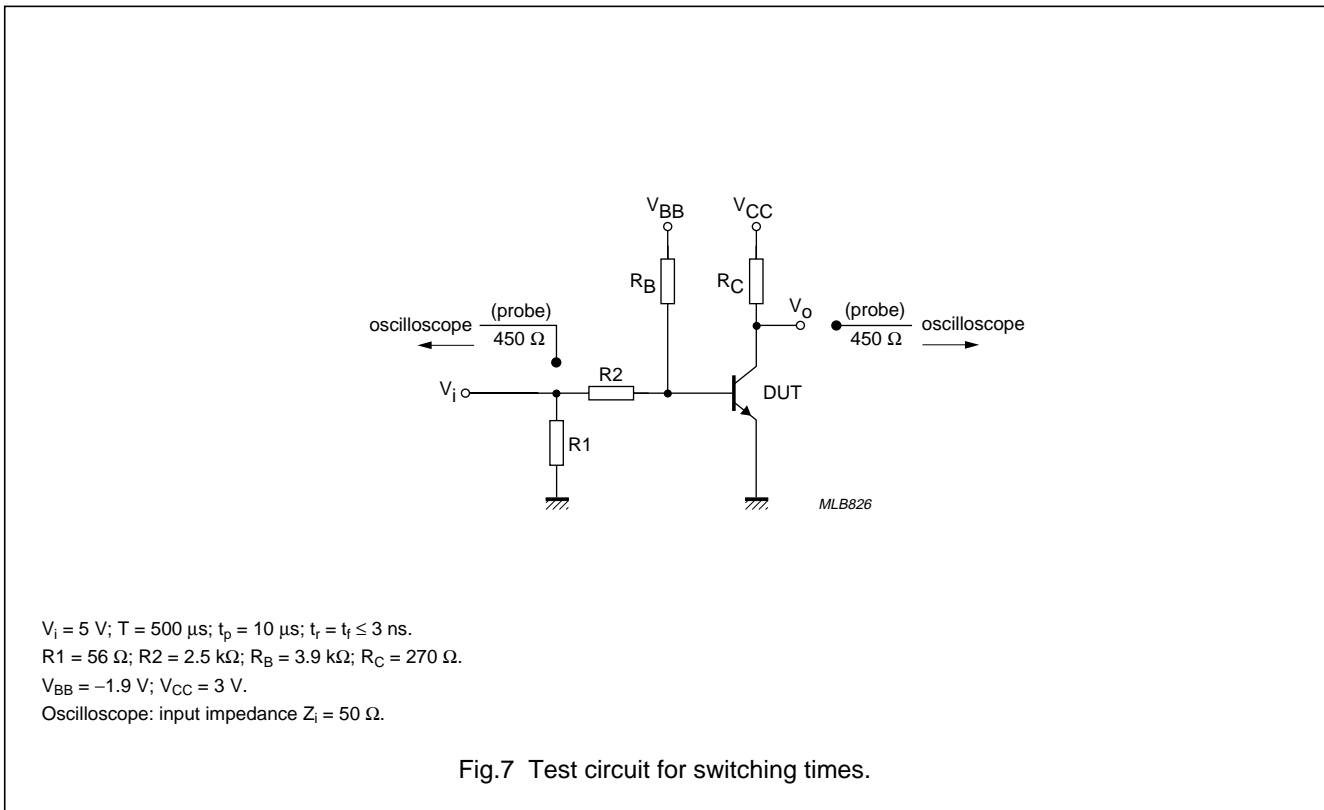
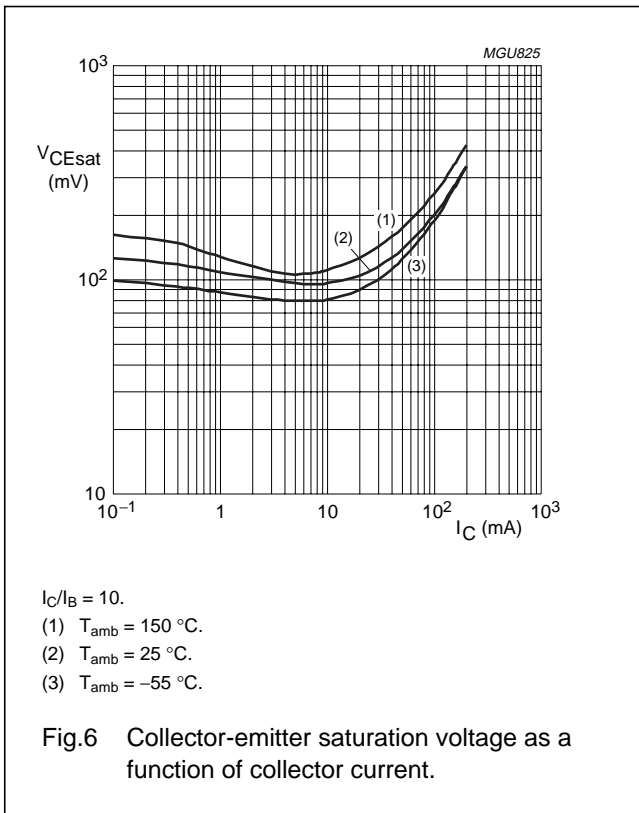
NPN switching transistor

MMBT3904



NPN switching transistor

MMBT3904



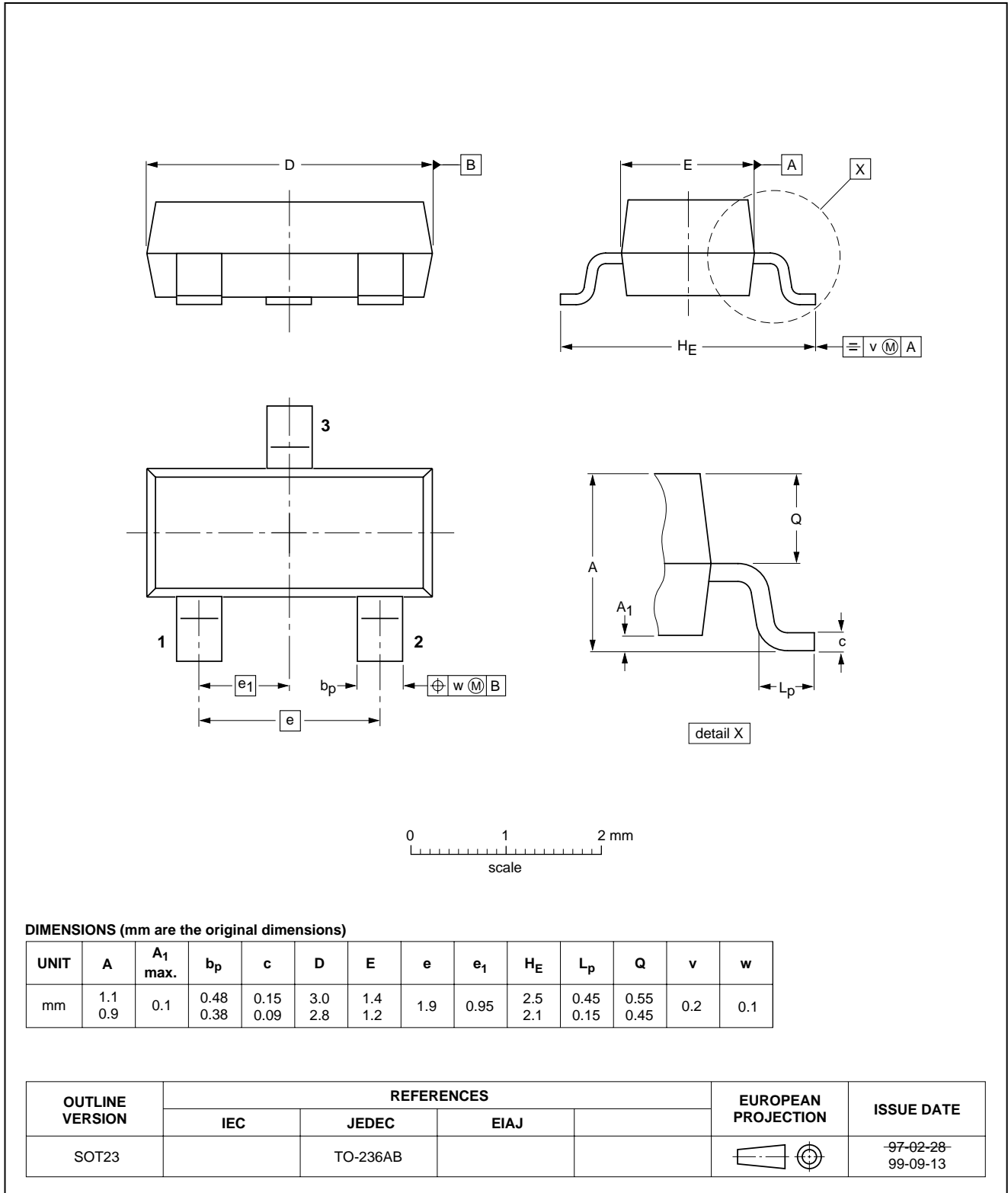
NPN switching transistor

MMBT3904

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		TO-236AB				97-02-28- 99-09-13

## NPN switching transistor

MMBT3904

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