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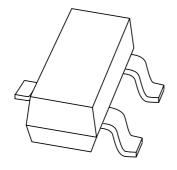
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Kind regards,

Team Nexperia

# DISCRETE SEMICONDUCTORS

# DATA SHEET



# MMBT3904 NPN switching transistor

Product data sheet Supersedes data of 2002 Oct 04 2004 Feb 03



# **NPN** switching transistor

# **MMBT3904**

#### **FEATURES**

- Collector current capability I<sub>C</sub> = 200 mA
- Collector-emitter voltage V<sub>CEO</sub> = 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

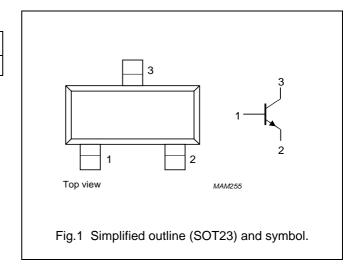
- 1. \* = p: Made in Hong Kong.
  - \* = t: Made in Malaysia.
  - \* = W: Made in China.

#### **QUICK REFERENCE DATA**

SYMBOL	PARAMETER	MAX.	UNIT
V <sub>CEO</sub>	collector-emitter voltage	40	V
I <sub>C</sub>	collector current (DC)	200	mA

## **PINNING**

PIN	DESCRIPTION
1	base
2	emitter
3	collector



## **ORDERING INFORMATION**

TYPE NUMBER		PACKAGE	
TIPE NUMBER	NAME	DESCRIPTION	VERSION
MMBT3904	_	plastic surface mounted package; 3 leads	SOT23

# NPN switching transistor

MMBT3904

## **LIMITING VALUES**

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>CBO</sub>	collector-base voltage	open emitter	_	60	V
$V_{CEO}$	collector-emitter voltage	open base	_	40	V
V <sub>EBO</sub>	emitter-base voltage	open collector	_	6	V
I <sub>C</sub>	collector current (DC)		_	200	mA
I <sub>CM</sub>	peak collector current		-	200	mA
I <sub>BM</sub>	peak base current		_	100	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C; note 1	_	250	mW
T <sub>stg</sub>	storage temperature		-65	+150	°C
Tj	junction temperature		_	150	°C
T <sub>amb</sub>	operating ambient temperature		-65	+150	°C

## Note

# THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	note 1	500	K/W

#### Note

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

<sup>1.</sup> Transistor mounted on an FR4 printed-circuit board.

# NPN switching transistor

MMBT3904

## **CHARACTERISTICS**

 $T_{amb}$  = 25 °C unless otherwise specified.

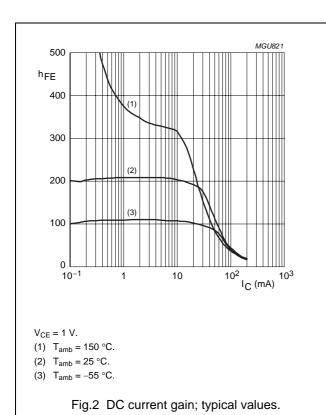
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I <sub>CBO</sub>	collector cut-off current	I <sub>E</sub> = 0; V <sub>CB</sub> = 30 V	_	50	nA
I <sub>EBO</sub>	emitter cut-off current	I <sub>C</sub> = 0; V <sub>EB</sub> = 6 V	_	50	nA
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = 1 V; see Fig.2; note 1			
		$I_{\rm C} = 0.1  {\rm mA}$	60	_	
		I <sub>C</sub> = 1 mA	80	_	
		I <sub>C</sub> = 10 mA	100	300	
		I <sub>C</sub> = 50 mA	60	_	
		I <sub>C</sub> = 100 mA	30	_	
V <sub>CEsat</sub>	collector-emitter saturation	I <sub>C</sub> = 10 mA; I <sub>B</sub> = 1 mA	_	200	mV
	voltage	I <sub>C</sub> = 50 mA; I <sub>B</sub> = 5 mA	_	300	mV
V <sub>BEsat</sub>	base-emitter saturation voltage	I <sub>C</sub> = 10 mA; I <sub>B</sub> = 1 mA	650	850	mV
		I <sub>C</sub> = 50 mA; I <sub>B</sub> = 5 mA	_	950	mV
C <sub>c</sub>	collector capacitance	$I_E = I_e = 0$ ; $V_{CB} = 5$ V; $f = 1$ MHz	_	4	pF
C <sub>e</sub>	emitter capacitance	nitter capacitance $I_C = I_c = 0$ ; $V_{BE} = 500 \text{ mV}$ ; $f = 1 \text{ MHz}$		8	pF
f <sub>T</sub>	transition frequency	$I_C = 10 \text{ mA}; V_{CE} = 20 \text{ V};$ f = 100 MHz	300	_	MHz
F	noise figure	$I_C$ = 100 μA; $V_{CE}$ = 5 V; $R_S$ = 1 kΩ; $f$ = 10 Hz to 15.7 kHz	-	5	dB
Switching ti	mes (between 10% and 90% lev	els); see Fig.3	•	•	<u> </u>
t <sub>d</sub>	delay time	I <sub>Con</sub> = 10 mA; I <sub>Bon</sub> = 1 mA;	_	35	ns
t <sub>r</sub>	rise time	I <sub>Boff</sub> = -1 mA	_	35	ns
t <sub>s</sub>	storage time		_	200	ns
t <sub>f</sub>	fall time		_	50	ns

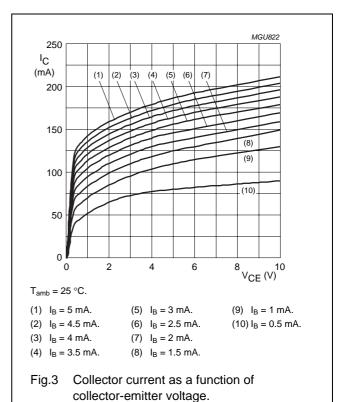
# Note

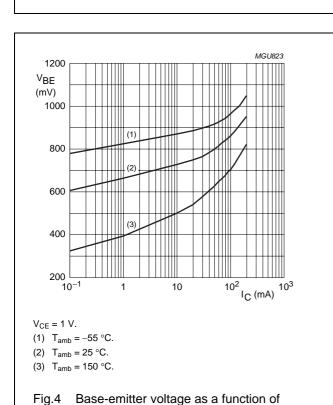
1. Pulse test:  $t_p \leq 300~\mu s;~\delta \leq 0.02.$ 

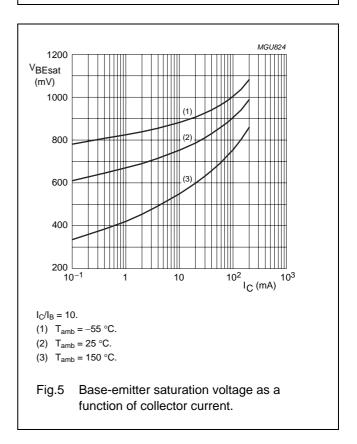
# NPN switching transistor

# MMBT3904







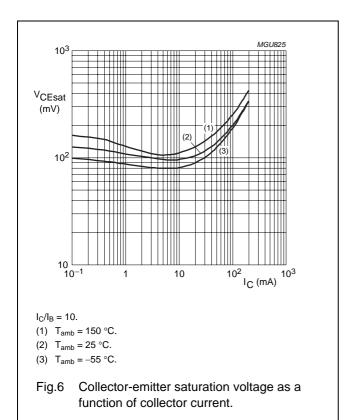


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collector current.

# NPN switching transistor

MMBT3904



 $V_{i} = 5 \text{ V; } T = 500 \text{ µs; } t_{p} = 10 \text{ µs; } t_{r} = t_{f} \leq 3 \text{ ns.} \\ R_{1} = 56 \text{ } \Omega; R_{2} = 2.5 \text{ k} \Omega; R_{B} = 3.9 \text{ k} \Omega; R_{C} = 270 \text{ } \Omega. \\ V_{BB} = -1.9 \text{ V; } V_{CC} = 3 \text{ V.} \\ Oscilloscope: input impedance } Z_{i} = 50 \text{ } \Omega. \\ Fig. 7 \text{ Test circuit for switching times.}$ 

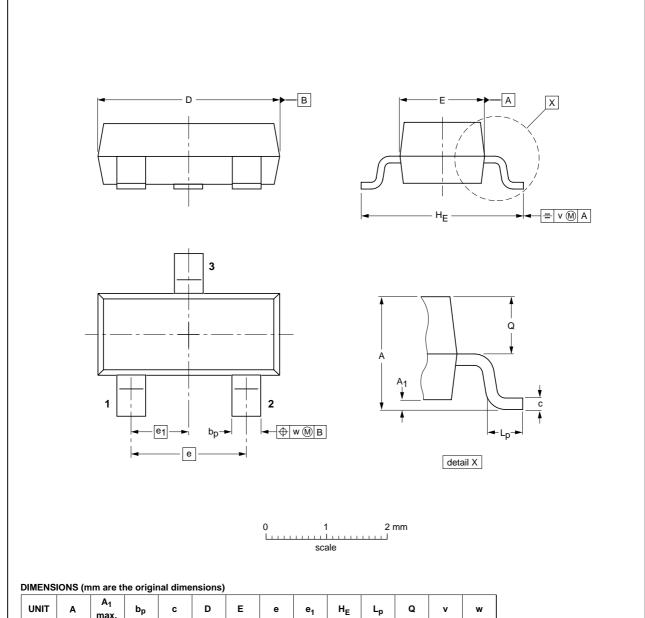
# NPN switching transistor

# MMBT3904

## **PACKAGE OUTLINE**

# Plastic surface-mounted package; 3 leads

SOT23



ι	JNIT	Α	A <sub>1</sub> max.	bp	С	D	E	е	e <sub>1</sub>	HE	Lp	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	LINE REFERENCES					ICCUE DATE	
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
SOT23		TO-236AB				<del>-04-11-04</del> 06-03-16	

# NPN switching transistor

MMBT3904

#### **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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# **NXP Semiconductors**

## **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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# Офис по работе с юридическими лицами:

105318, г. Москва, ул. Щербаковская д. 3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru moschip.ru\_6 moschip.ru\_4 moschip.ru\_9