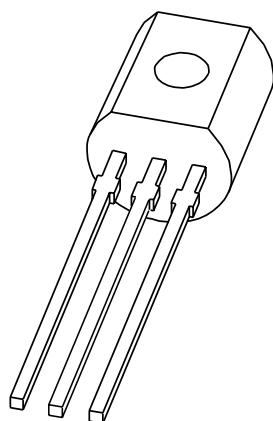


# DATA SHEET



## **MPS3904** NPN switching transistor

Product specification  
Supersedes data of 1999 Apr 12

2004 Oct 11

## NPN switching transistor

## MPS3904

## FEATURES

- Low current (max. 100 mA)
- Low voltage (max. 40 V).

## APPLICATIONS

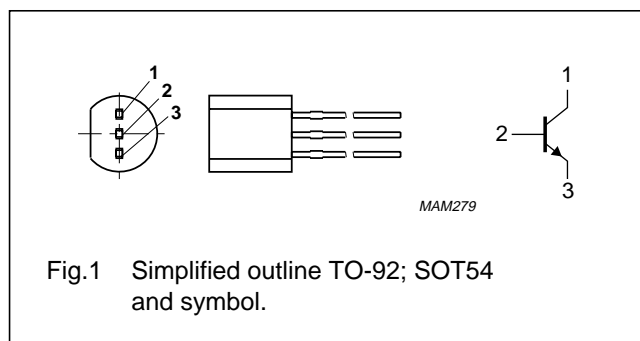
- General purpose switching and amplification.

## DESCRIPTION

NPN transistor in a TO-92; SOT54 plastic package.  
PNP complement: MPS3906.

## PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter



## ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
MPS3904	SC-43A	plastic single-ended leaded (through hole) package; 3 leads	SOT54

## 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)		–	100	mA
$I_{CM}$	peak collector current		–	200	mA
$I_{BM}$	peak base current		–	200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ }^{\circ}\text{C}$	–	500	mW
$T_{stg}$	storage temperature		–65	+150	$^{\circ}\text{C}$
$T_j$	junction temperature		–	150	$^{\circ}\text{C}$
$T_{amb}$	ambient temperature		–65	+150	$^{\circ}\text{C}$

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## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th(j-a)}$	thermal resistance from junction to ambient	note 1	250	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	$V_{CB} = 30\text{ V}; I_E = 0\text{ A}$	–	50	nA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	–	50	nA
$h_{FE}$	DC current gain	$V_{CE} = 1\text{ V}$ ; note 1 $I_C = 0.1\text{ mA}$ $I_C = 1\text{ mA}$ $I_C = 10\text{ mA}$ $I_C = 50\text{ mA}$ $I_C = 100\text{ mA}$	40 70 100 60 30	– – 300 – –	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 1\text{ mA}$ ; note 1	–	200	mV
		$I_C = 50\text{ mA}; I_B = 5\text{ mA}$ ; note 1	–	300	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 1\text{ mA}$ ; note 1	650	850	mV
		$I_C = 50\text{ mA}; I_B = 5\text{ mA}$ ; note 1	–	950	mV
$C_c$	collector capacitance	$V_{CB} = 5\text{ V}; I_E = i_e = 0\text{ A}$ ; $f = 100\text{ kHz to } 1\text{ MHz}$	–	5	pF
$C_e$	emitter capacitance	$V_{EB} = 0.5\text{ V}; I_C = i_c = 0\text{ A}$ ; $f = 100\text{ kHz to } 1\text{ MHz}$	–	15	pF
$f_T$	transition frequency	$V_{CE} = 20\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$	180	–	MHz
$F$	noise figure	$V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}; R_S = 1\text{ k}\Omega$ ; $f = 10\text{ Hz to } 15.7\text{ kHz}$	–	5	dB

## Switching times (between 10 % and 90 % levels); (see Fig.2)

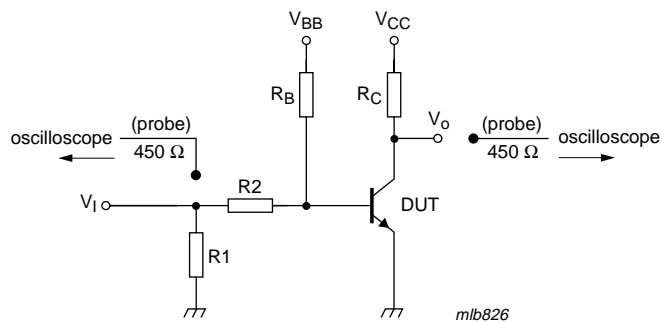
$t_{on}$	turn-on time	$I_{Con} = 10\text{ mA}; I_{Bon} = 1\text{ mA}; I_{Boff} = -1\text{ mA};$ $V_{CC} = 3\text{ V}; V_{BB} = -1.9\text{ V}$	–	110	ns
$t_d$	delay time		–	50	ns
$t_r$	rise time		–	60	ns
$t_{off}$	turn-off time		–	1200	ns
$t_s$	storage time		–	1000	ns
$t_f$	fall time		–	200	ns

## Note

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

## NPN switching transistor

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$V_I = 5\text{ V}$ ;  $t_p \geq 4\ \mu\text{s}$ ;  $t_r = t_f \leq 3\text{ ns}$ .

$R_1 = 56\ \Omega$ ;  $R_2 = 2.5\text{ k}\Omega$ ;  $R_B = 3.9\text{ k}\Omega$ ;  $R_C = 270\ \Omega$ .

Oscilloscope: input impedance  $Z_i = 50\ \Omega$ .

Fig.2 Test circuit for switching times.

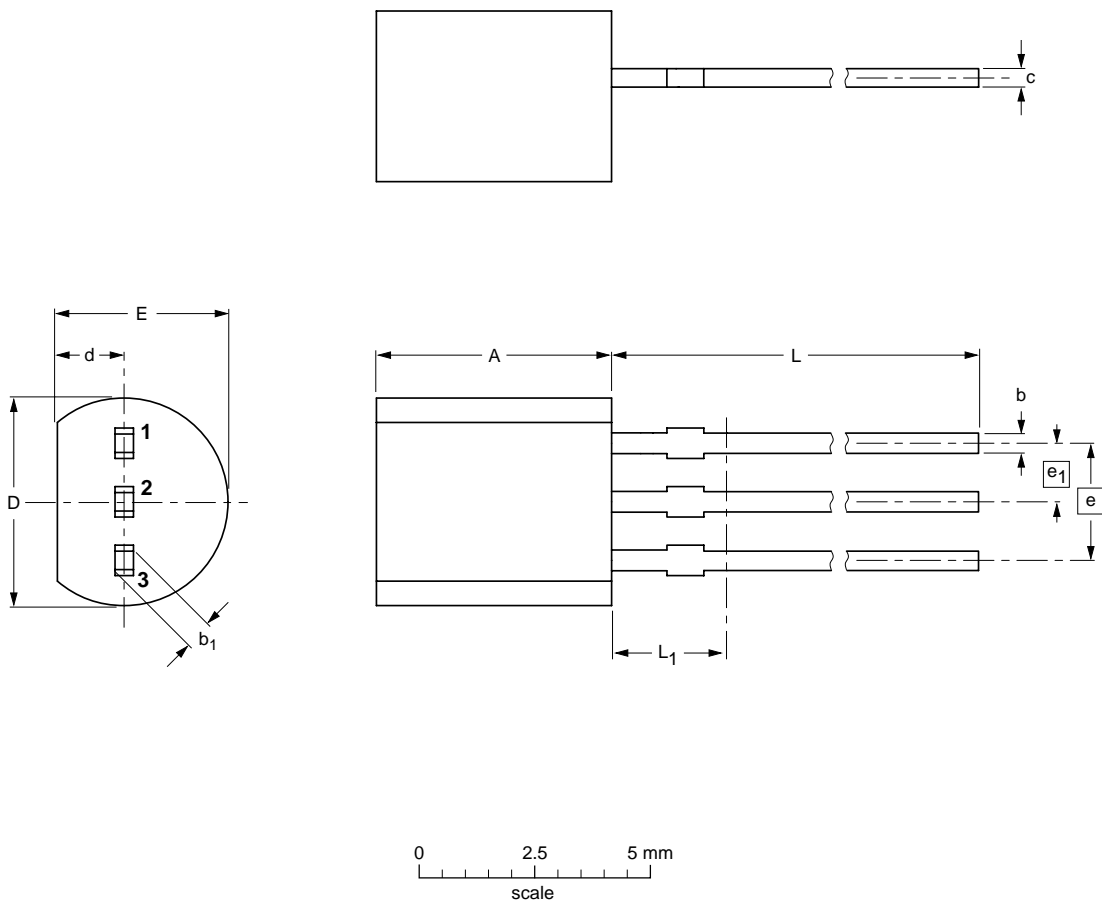
NPN switching transistor

MPS3904

PACKAGE OUTLINE

Plastic single-ended leaded (through hole) package; 3 leads

SOT54




DIMENSIONS (mm are the original dimensions)

UNIT	A	b	b <sub>1</sub>	c	D	d	E	e	e <sub>1</sub>	L	L <sub>1</sub> <sup>(1)</sup> max.
mm	5.2 5.0	0.48 0.40	0.66 0.55	0.45 0.38	4.8 4.4	1.7 1.4	4.2 3.6	2.54	1.27	14.5 12.7	2.5

Note

1. Terminal dimensions within this zone are uncontrolled to allow for flow of plastic and terminal irregularities.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT54		TO-92	SC-43A			<del>97-02-28</del> 04-06-28

## NPN switching transistor

MPS3904

## DATA SHEET STATUS

LEVEL	DATA SHEET STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)(3)</sup>	DEFINITION
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## **Contact information**

For additional information please visit **<http://www.semiconductors.philips.com>**. Fax: **+31 40 27 24825**

For sales offices addresses send e-mail to: **[sales.addresses@www.semiconductors.philips.com](mailto:sales.addresses@www.semiconductors.philips.com)**.

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