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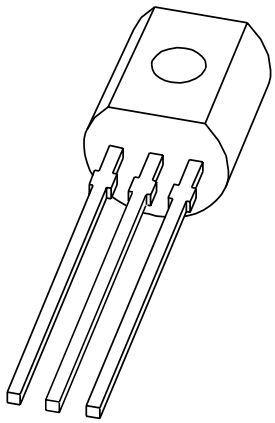
DATA SHEET



MPS3904
NPN switching transistor

Product specification
Supersedes data of 1999 Apr 12

2004 Oct 11

Philips
Semiconductors

PHILIPS

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

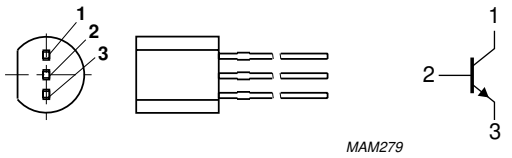


Fig.1 Simplified outline TO-92; SOT54 and symbol.

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	$T_{amb} \leq 25$ °C	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	ambient temperature		–65	+150	°C

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.

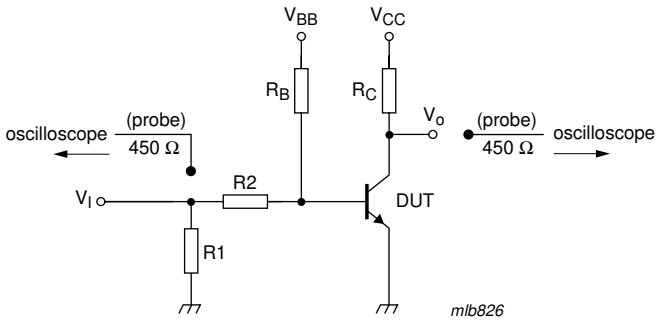
CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector-base cut-off current	V_{CB} = 30 V; I_E = 0 A	–	50	nA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A	–	50	nA
h_{FE}	DC current gain	V_{CE} = 1 V; note 1			
		I_C = 0.1 mA	40	–	
		I_C = 1 mA	70	–	
		I_C = 10 mA	100	300	
		I_C = 50 mA	60	–	
		I_C = 100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA; note 1	–	200	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	300	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA; note 1	650	850	mV
		I_C = 50 mA; I_B = 5 mA; note 1	–	950	mV
C_c	collector capacitance	V_{CB} = 5 V; $I_E = i_e$ = 0 A; f = 100 kHz to 1 MHz	–	5	pF
C_e	emitter capacitance	V_{EB} = 0.5 V; $I_C = i_c$ = 0 A; f = 100 kHz to 1 MHz	–	15	pF
f_T	transition frequency	V_{CE} = 20 V; I_C = 10 mA; f = 100 MHz	180	–	MHz
F	noise figure	V_{CE} = 5 V; I_C = 100 μA; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	5	dB
Switching times (between 10 % and 90 % levels); (see Fig.2)					
t_{on}	turn-on time	I_{Con} = 10 mA; I_{Bon} = 1 mA; I_{Boff} = −1 mA; V_{CC} = 3 V; V_{BB} = −1.9 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: $t_p \leq 300$ μs; $\delta = 0.02$.

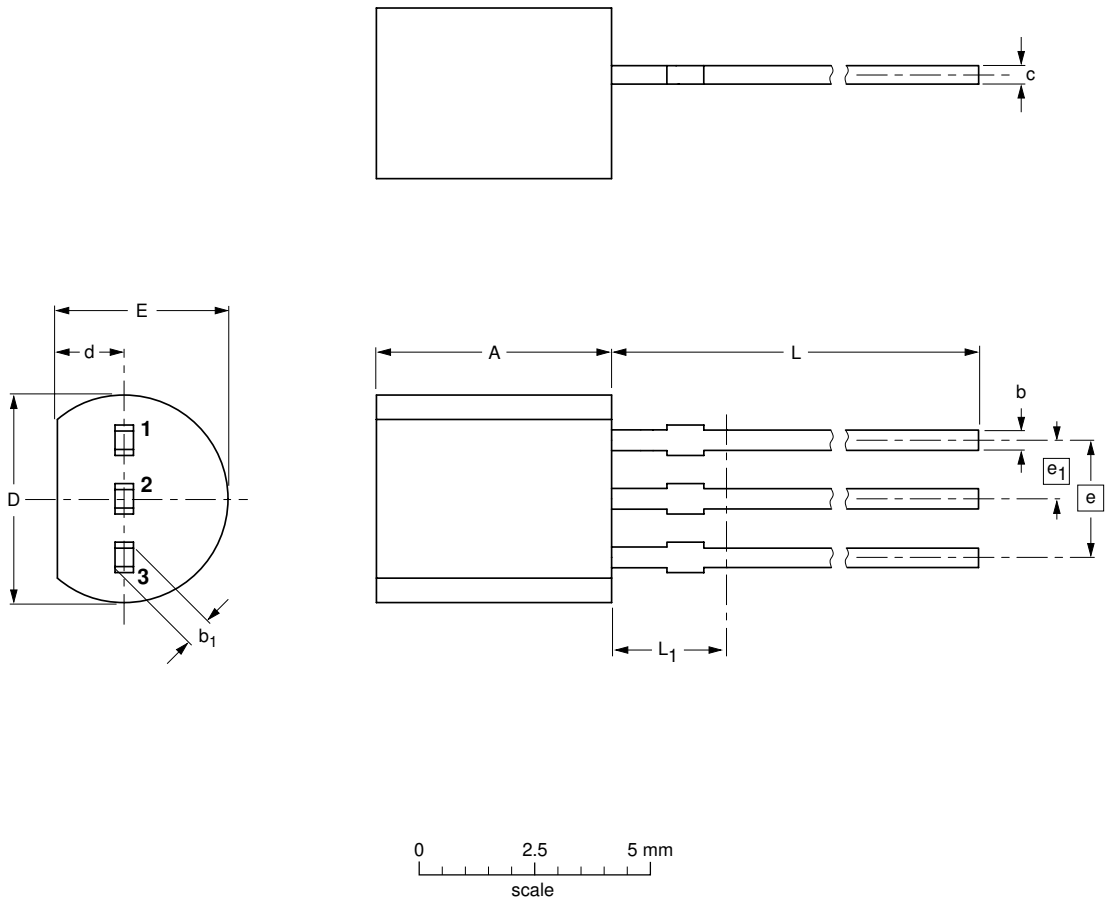


V_i = 5 V; $t_p \geq 4$ µs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; R_B = 3.9 kΩ; R_C = 270 Ω.
Oscilloscope: input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

PACKAGE OUTLINE

Plastic single-ended leaded (through hole) package; 3 leads **SOT54**



DIMENSIONS (mm are the original dimensions)

UNIT	A	b	b_1	c	D	d	E	e	e_1	L	L_1(1) 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			~~97-02-28~~ 04-06-28

DATA SHEET STATUS

LEVEL	DATA SHEET STATUS[1]	PRODUCT STATUS[2][3]	DEFINITION
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3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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.

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