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Should be replaced with:

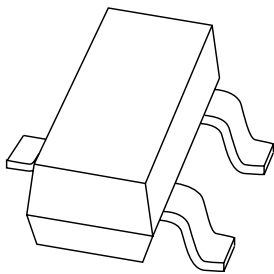
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Kind regards,

Team Nexperia

# DATA SHEET



**PMBS3904**

NPN general purpose transistor

Product data sheet  
Supersedes data of 1999 Apr 22

2004 Feb 02

## NPN general purpose transistor

## PMBS3904

## FEATURES

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

## APPLICATIONS

- General purpose switching and amplification, e.g. telephony and professional communication equipment.

## DESCRIPTION

NPN transistor in a plastic SOT23 package.  
PNP complement: PMBS3906.

## MARKING

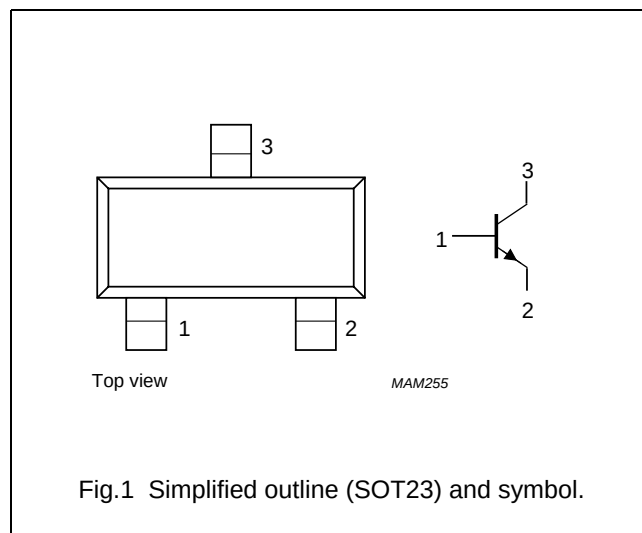
| TYPE NUMBER | MARKING CODE <sup>(1)</sup> |
|-------------|-----------------------------|
| PMBS3904    | *O4                         |

## Note

- \* = 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 |
| PMBS3904    | —       | 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                | —    | 60   | V    |
| $V_{CEO}$ | collector-emitter voltage     | open base                   | —    | 40   | V    |
| $V_{EBO}$ | emitter-base voltage          | open collector              | —    | 6    | V    |
| $I_C$     | collector current capability  |                             | —    | 100  | mA   |
| $I_{CM}$  | peak collector current        |                             | —    | 200  | mA   |
| $I_{BM}$  | peak base current             |                             | —    | 200  | mA   |
| $P_{tot}$ | total power dissipation       | $T_{amb} \leq 25\text{ °C}$ | —    | 250  | mW   |
| $T_{stg}$ | storage temperature           |                             | −65  | +150 | °C   |
| $T_j$     | junction temperature          |                             | —    | 150  | °C   |
| $T_{amb}$ | operating ambient temperature |                             | −65  | +150 | °C   |

## NPN general purpose transistor

## PMBS3904

## 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              | $I_C = 0$ ; $V_{EB} = 5\text{ V}$                                                                                                                                    | –                           | 50                      | nA   |
| $h_{FE}$    | DC current gain                      | $V_{CE} = 1\text{ V}$ ; note 1; (see Fig.2)<br>$I_C = 0.1\text{ mA}$<br>$I_C = 1\text{ mA}$<br>$I_C = 10\text{ mA}$<br>$I_C = 50\text{ mA}$<br>$I_C = 100\text{ mA}$ | 40<br>70<br>100<br>60<br>30 | –<br>–<br>300<br>–<br>– |      |
| $V_{CEsat}$ | 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                  | $I_C = i_c = 0$ ; $V_{EB} = 0.5\text{ V}$ ; $f = 1\text{ MHz}$                                                                                                       | –                           | 12                      | pF   |
| $f_T$       | transition frequency                 | $I_C = 10\text{ mA}$ ; $V_{CE} = 20\text{ V}$ ; $f = 100\text{ MHz}$                                                                                                 | 180                         | –                       | 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)

|           |               |                                                                                                                                         |   |      |    |
|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------|---|------|----|
| $t_{on}$  | turn-on time  | $I_{Con} = 10\text{ mA}$ ; $I_{Bon} = 1\text{ mA}$ ;<br>$I_{Boff} = -1\text{ mA}$ ; $V_{CC} = 3\text{ V}$ ;<br>$V_{BB} = -1.9\text{ V}$ | – | 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:  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta \leq 0.02$ .

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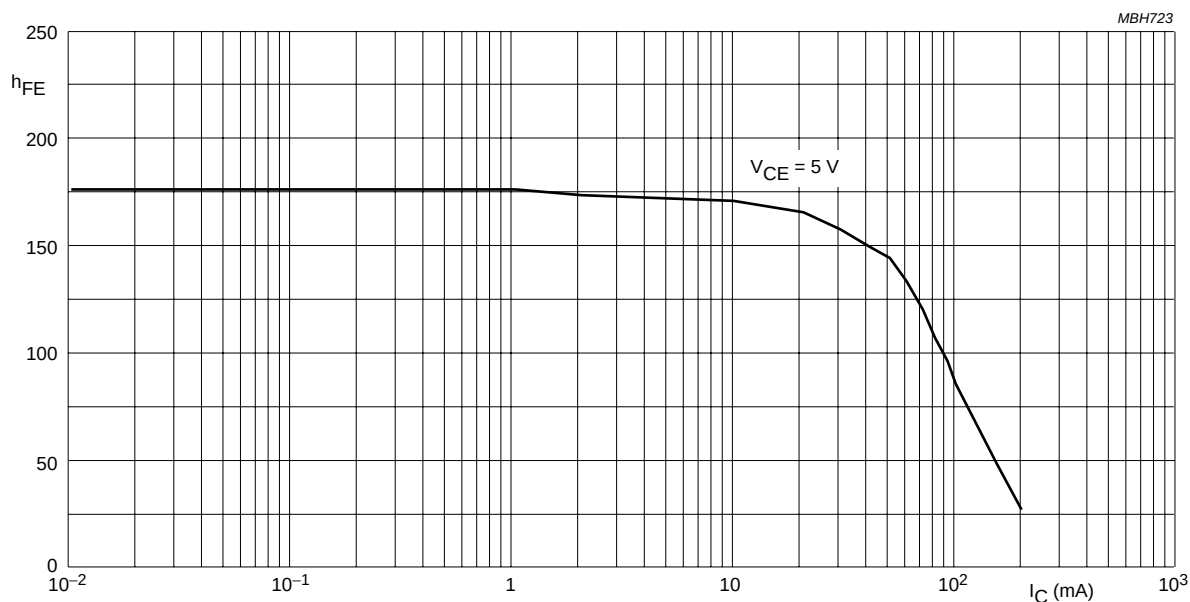
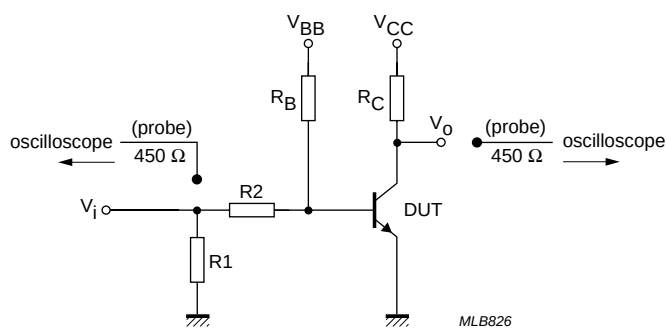


Fig.2 DC current gain; typical values.



$V_i = 5\text{ V}$ ;  $T = 500\text{ }\mu\text{s}$ ;  $t_p = 10\text{ }\mu\text{s}$ ;  $t_r = t_f \leq 3\text{ ns}$ .  
 $R_1 = 56\text{ }\Omega$ ;  $R_2 = 2.5\text{ k}\Omega$ ;  $R_B = 3.9\text{ k}\Omega$ ;  $R_C = 270\text{ }\Omega$ .  
 Oscilloscope: input impedance  $Z_i = 50\text{ }\Omega$ .

Fig.3 Test circuit for switching times.

NPN general purpose transistor
PMBS3904

PACKAGE OUTLINE

Plastic surface-mounted package; 3 leads
SOT23

The diagrams illustrate the SOT23 package dimensions. The top view shows the overall width D and lead spacing e. The side view shows the maximum height A, lead height A1, and lead thickness c. The bottom view shows the lead pitch e1 and the distance from the lead center to the package edge b\_p. A detail X shows the lead profile with dimensions L\_p and Q. A scale bar indicates 0 to 2 mm.

**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<br>0.9 | 0.1                 | 0.48<br>0.38   | 0.15<br>0.09 | 3.0<br>2.8 | 1.4<br>1.2 | 1.9 | 0.95           | 2.5<br>2.1     | 0.45<br>0.15   | 0.55<br>0.45 | 0.2 | 0.1 |

| OUTLINE VERSION | REFERENCES |          |       |  | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|----------|-------|--|---------------------|----------------------|
|                 | IEC        | JEDEC    | JEITA |  |                     |                      |
| SOT23           |            | TO-236AB |       |  |                     | 04-11-04<br>06-03-16 |

## NPN general purpose transistor

PMBS3904

## 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**

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## **Contact information**

For additional information please visit: **<http://www.nxp.com>**

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