

# DATA SHEET



## **2N3906** PNP switching transistor

Product specification  
Supersedes data of 1999 Apr 23

2004 Oct 11

# PNP switching transistor

2N3906

## FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 40 V).

## APPLICATIONS

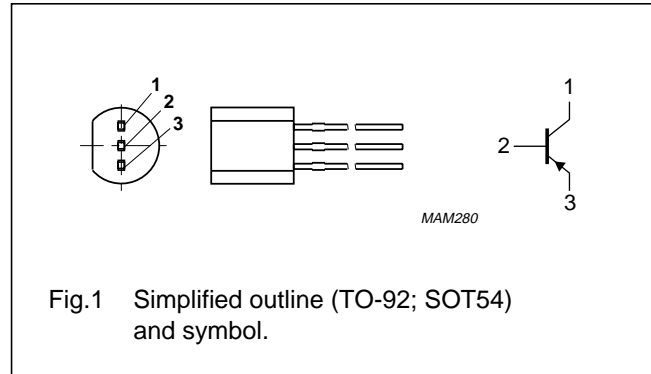
- High-speed switching in industrial applications.

## DESCRIPTION

PNP switching transistor in a TO-92; SOT54 plastic package. NPN complement: 2N3904.

## PINNING

| PIN | DESCRIPTION |
|-----|-------------|
| 1   | collector   |
| 2   | base        |
| 3   | emitter     |



## ORDERING INFORMATION

| TYPE NUMBER | PACKAGE |   |         |
|-------------|---------|---|---------|
|             | NAME    | DESCRIPTION   | VERSION |
| 2N3906      | 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                | –    | –40  | V    |
| $V_{CEO}$ | 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    |                             | –    | –300 | mA   |
| $I_{BM}$  | peak base current         |                             | –    | –100 | mA   |
| $P_{tot}$ | total power dissipation   | $T_{amb} \leq 25\text{ °C}$ | –    | 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.

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**CHARACTERISTICS** $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

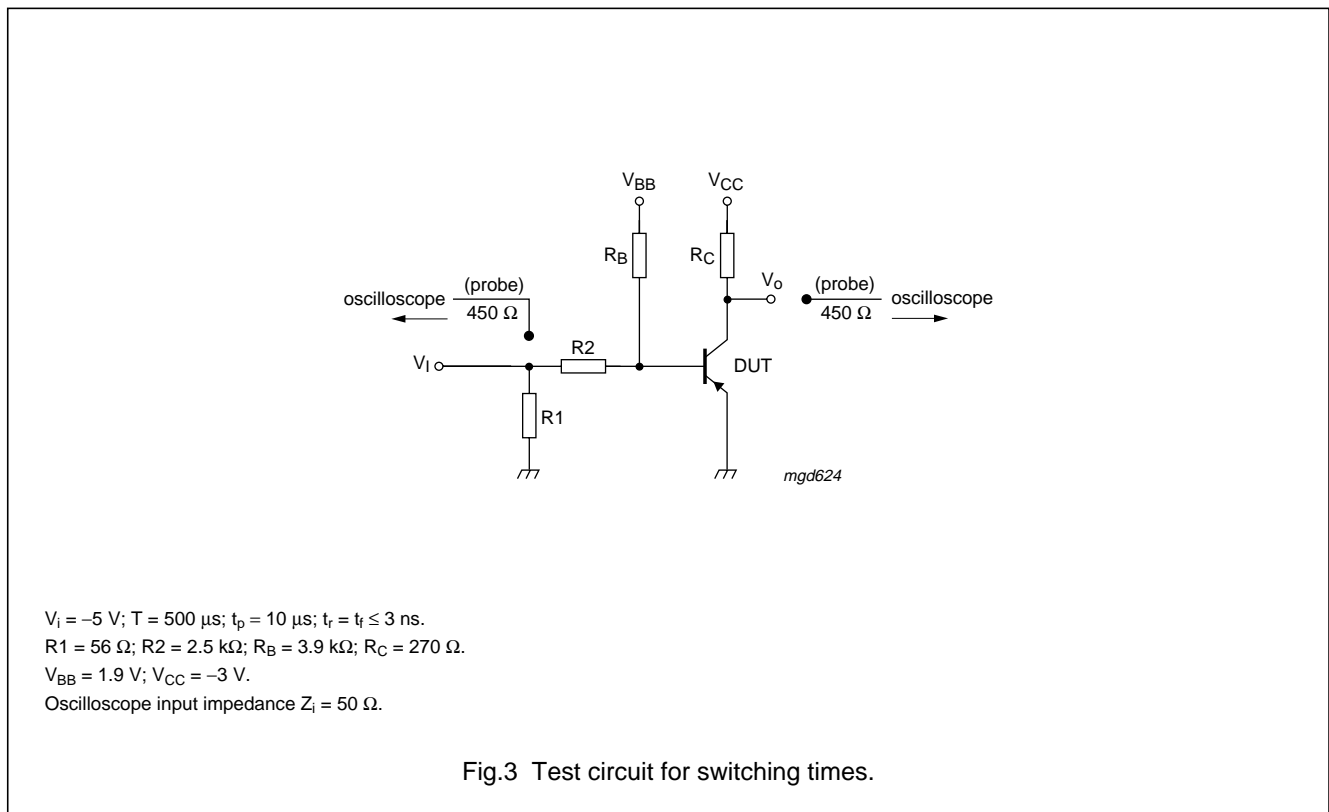
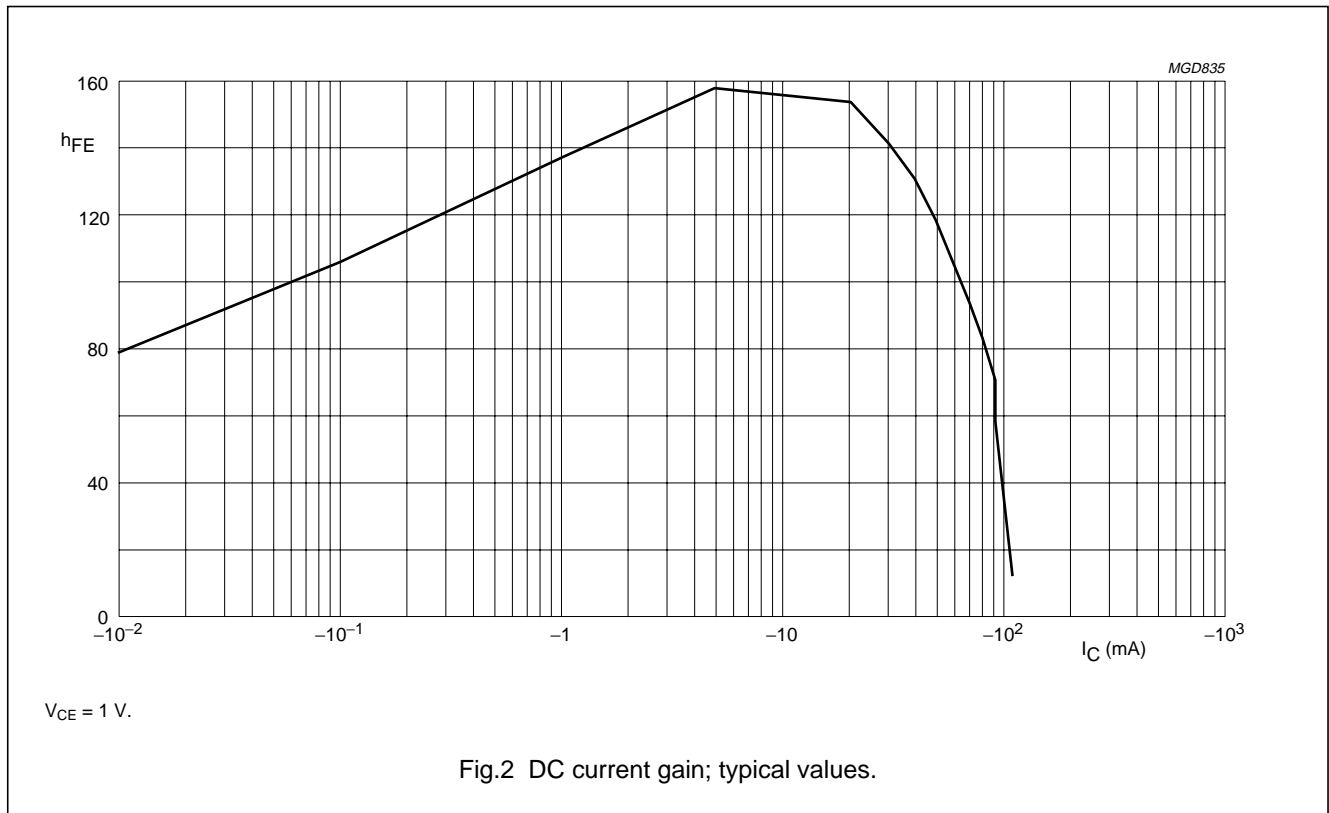
| SYMBOL   | PARAMETER                            | CONDITIONS   | MIN.                        | MAX.                    | UNIT |
|--|--------------------------------------|--|-----------------------------|-------------------------|------|
| $I_{CBO}$  | collector-base cut-off current       | $V_{CB} = -30\text{ V}; I_E = 0\text{ A}$  | –                           | –50                     | nA   |
| $I_{EBO}$  | emitter-base cut-off current         | $V_{EB} = -6\text{ V}; I_C = 0\text{ A}$   | –                           | –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>$I_C = -100\text{ mA}$ | 60<br>80<br>100<br>60<br>30 | –<br>–<br>300<br>–<br>– |      |
| $V_{CEsat}$  | collector-emitter saturation voltage | $I_C = -10\text{ mA}; I_B = -1\text{ mA}$ ; note 1   | –                           | –200                    | mV   |
|  |                                      | $I_C = -50\text{ mA}; I_B = -5\text{ mA}$ ; note 1   | –                           | –200                    | mV   |
| $V_{BEsat}$  | base-emitter saturation voltage      | $I_C = -10\text{ mA}; I_B = -1\text{ mA}$ ; note 1   | –                           | –850                    | mV   |
|  |                                      | $I_C = -50\text{ mA}; I_B = -5\text{ mA}$ ; note 1   | –                           | –950                    | mV   |
| $C_c$  | collector capacitance                | $V_{CB} = -5\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$   | –                           | 4.5                     | pF   |
| $C_e$  | emitter capacitance                  | $I_C = i_c = 0; V_{EB} = -500\text{ mV}; f = 1\text{ MHz}$   | –                           | 10                      | pF   |
| $f_T$  | transition frequency                 | $V_{CE} = -20\text{ V}; I_C = -10\text{ mA}; f = 100\text{ MHz}$   | 250                         | –                       | MHz  |
| F  | noise figure                         | $V_{CE} = -5\text{ V}; I_C = -100\text{ }\mu\text{A}; R_S = 1\text{ k}\Omega;$<br>$f = 10\text{ Hz to }15.7\text{ kHz}$  | –                           | 4                       | dB   |
| <b>Switching times (between 10 % and 90 % levels); see Fig.3</b> |                                      |  |                             |                         |      |
| $t_{on}$   | turn-on time                         | $I_{Con} = -10\text{ mA}; I_{Bon} = -1\text{ mA};$<br>$I_{Boff} = 1\text{ mA}$   | –                           | 65                      | ns   |
| $t_d$  | delay time                           |  | –                           | 35                      | ns   |
| $t_r$  | rise time                            |  | –                           | 35                      | ns   |
| $t_{off}$  | turn-off time                        |  | –                           | 300                     | ns   |
| $t_s$  | storage time                         |  | –                           | 225                     | ns   |
| $t_f$  | fall time                            |  | –                           | 75                      | ns   |

**Note**

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

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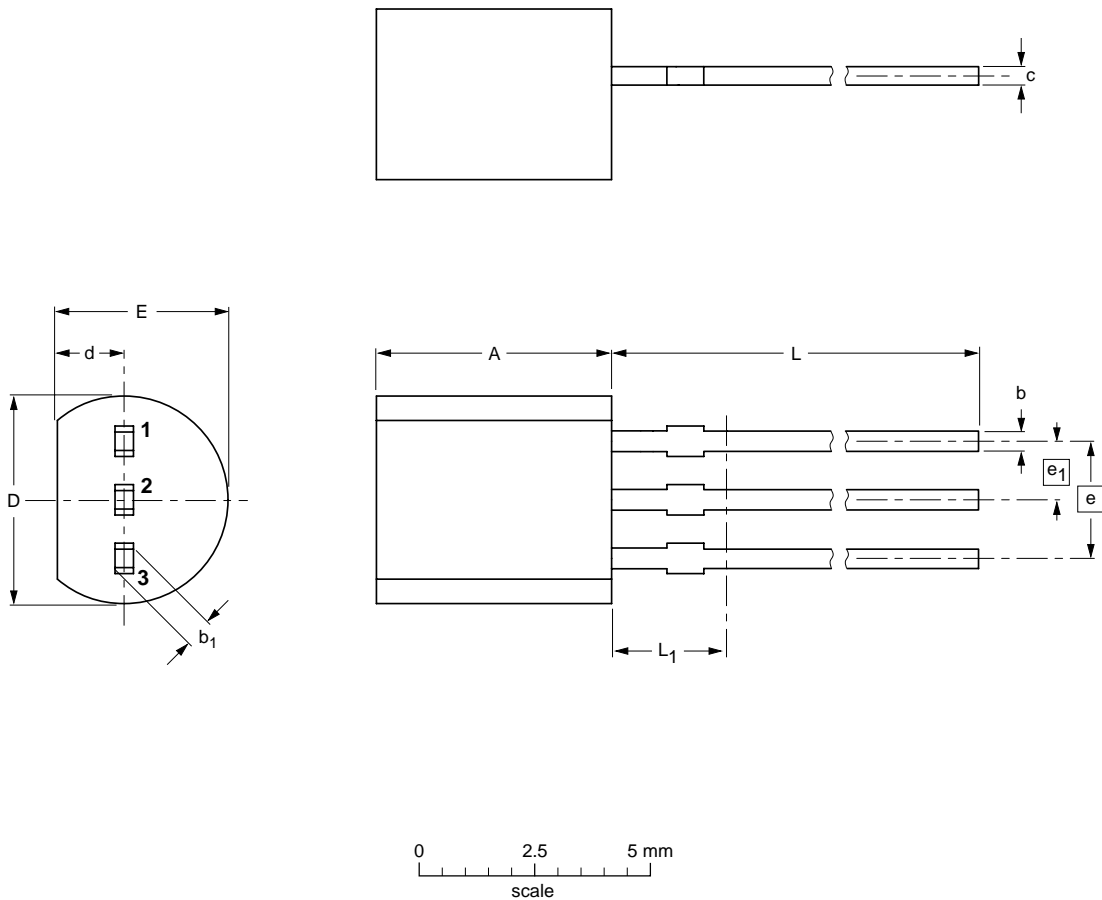
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PACKAGE OUTLINE

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><br>max. |
|------|------------|--------------|----------------|--------------|------------|------------|------------|------|----------------|--------------|---------------------------------------|
| mm   | 5.2<br>5.0 | 0.48<br>0.40 | 0.66<br>0.55   | 0.45<br>0.38 | 4.8<br>4.4 | 1.7<br>1.4 | 4.2<br>3.6 | 2.54 | 1.27           | 14.5<br>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><br>04-06-28 |

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| LEVEL | DATA SHEET STATUS <sup>(1)</sup> | PRODUCT STATUS <sup>(2)(3)</sup> | DEFINITION   |
|-------|----------------------------------|----------------------------------|--|
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