**Important notice**

Dear Customer,

On 7 February 2017 the former NXP Standard Product business became a new company with the tradename **Nexperia**. Nexperia is an industry leading supplier of Discrete, Logic and PowerMOS semiconductors with its focus on the automotive, industrial, computing, consumer and wearable application markets

In data sheets and application notes which still contain NXP or Philips Semiconductors references, use the references to Nexperia, as shown below.

Instead of http://www.nxp.com, http://www.philips.com/ or http://www.semiconductors.philips.com/, use **http://www.nexperia.com**

Instead of sales.addresses@www.nxp.com or sales.addresses@www.semiconductors.philips.com, use **salesaddresses@nexperia.com** (email)

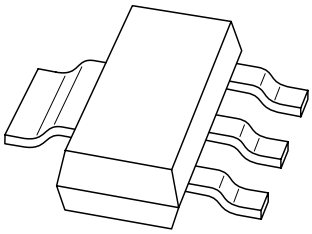
Replace the copyright notice at the bottom of each page or elsewhere in the document, depending on the version, as shown below:
- © NXP N.V. (year). All rights reserved or © Koninklijke Philips Electronics N.V. (year). All rights reserved
Should be replaced with:
- **© Nexperia B.V. (year). All rights reserved**.

If you have any questions related to the data sheet, please contact our nearest sales office via e-mail or telephone (details via **salesaddresses@nexperia.com**). Thank you for your cooperation and understanding,

Kind regards,

Team Nexperia

# DATA SHEET



## PZT4401
NPN switching transistor

Product data sheet

1999 May 10

# NPN switching transistor PZT4401

## FEATURES

- High current (max. 600 mA)
- Low voltage.

## APPLICATIONS

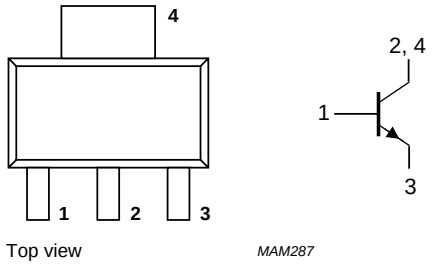
- Switching and linear amplification in industrial and consumer applications.

## DESCRIPTION

NPN switching transistor in a SOT223 plastic package. PNP complement: PZT4403.

## PINNING

| PIN | DESCRIPTION |
|---|---|
| 1 | base |
| 2, 4 | collector |
| 3 | emitter |




**Marking code:** ZT4401

Fig.1 Simplified outline (SOT223) and symbol.

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

| 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) | | – | 600 | mA |
| $I_{CM}$ | peak collector current | | – | 800 | mA |
| $I_{BM}$ | peak base current | | – | 200 | mA |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C; note 1 | – | 1150 | mW |
| $T_{stg}$ | storage temperature | | −65 | +150 | °C |
| $T_j$ | junction temperature | | – | 150 | °C |
| $T_{amb}$ | operating ambient temperature | | −65 | +150 | °C |

**Note**

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 $cm^2$. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook".*

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---|---|---|---|---|
| $R_{th\ j\text{-}a}$ | thermal resistance from junction to ambient | note 1 | 109 | K/W |
| $R_{th\ j\text{-}s}$ | thermal resistance from junction to soldering point | | 28 | K/W |

**Note**

1. Device mounted on a printed-circuit board, single-sided copper, tinplated, mounting pad for collector 1 $cm^2$. For other mounting conditions, see *"Thermal considerations for SOT223 in the General Part of associated Handbook".*

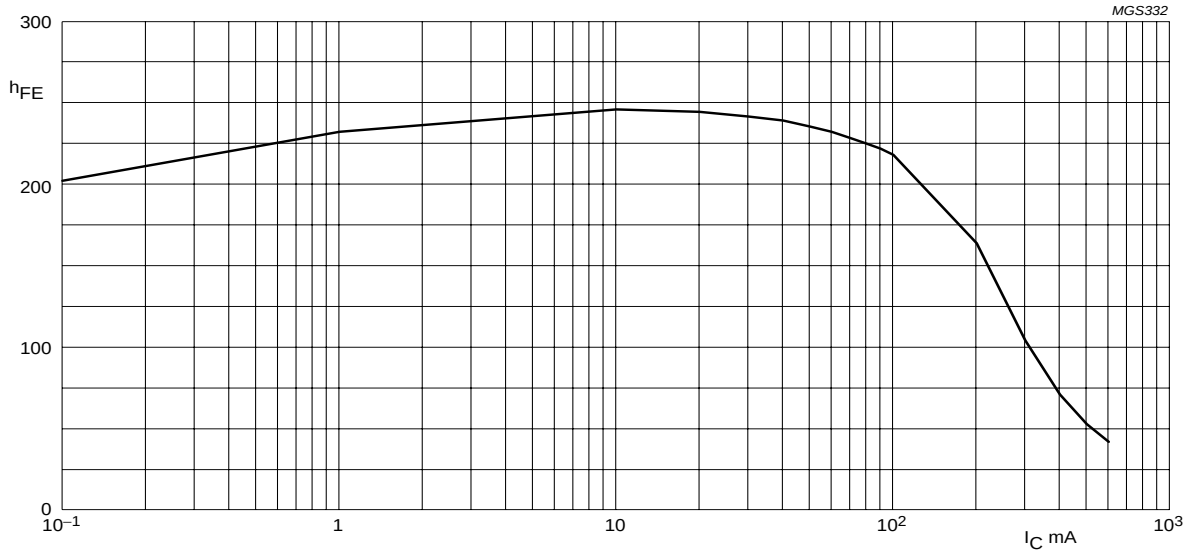
## CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $I_{CBO}$ | collector cut-off current | $I_E$ = 0; $V_{CB}$ = 60 V | – | 50 | nA |
| $I_{EBO}$ | emitter cut-off current | $I_C$ = 0; $V_{EB}$ = 6 V | – | 50 | nA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 1 V; see Fig.2 | | | |
| | | $I_C$ = 0.1 mA | 20 | – | |
| | | $I_C$ = 1 mA | 40 | – | |
| | | $I_C$ = 10 mA | 80 | – | |
| | | IC = 150 mA; note 1 | 100 | 300 | |
| | | $V_{CE}$ = 2 V; $I_C$ = 500 mA; note 1 | 40 | – | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 150 mA; $I_B$ = 15 mA; note 1 | – | 400 | mV |
| | | $I_C$ = 500 mA; $I_B$ = 50 mA; note 1 | – | 750 | mV |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = 150 mA; $I_B$ = 15 mA; note 1 | – | 950 | mV |
| | | IC = 500 mA; IB = 50 mA; note 1 | – | 1200 | mV |
| $C_c$ | collector capacitance | $I_E = i_e$ = 0; $V_{CB}$ = 5 V; f = 1 MHz | – | 8 | pF |
| $C_e$ | emitter capacitance | $I_C = i_c$ = 0; $V_{EB}$ = 500 mV; f = 1 MHz | – | 30 | pF |
| $f_T$ | transition frequency | $I_C$ = 20 mA; $V_{CE}$ = 10 V; f = 100 MHz | 250 | – | MHz |
| **Switching times (between 10% and 90% levels);** see Fig.3 | | | | | |
| $t_{on}$ | turn-on time | $I_{Con}$ = 150 mA; $I_{Bon}$ = 15 mA; $I_{Boff}$ = −15 mA; $V_{BB}$ = −3.5 V; $V_{CC}$ = 29.5 V | – | 35 | ns |
| $t_d$ | delay time | | – | 15 | ns |
| $t_r$ | rise time | | – | 20 | ns |
| $t_{off}$ | turn-off time | | – | 250 | ns |
| $t_s$ | storage time | | – | 200 | ns |
| $t_f$ | fall time | | – | 60 | ns |

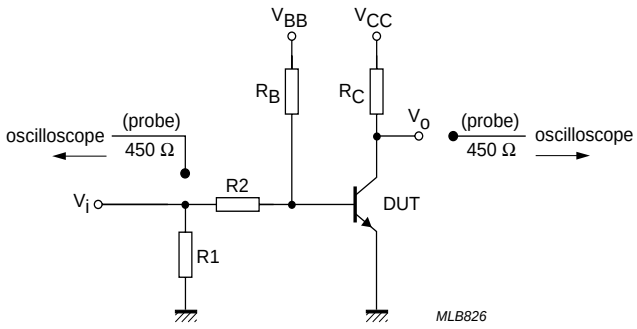
**Note**

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




$V_{CE}$ = 1 V.

Fig.2 DC current gain; typical values.

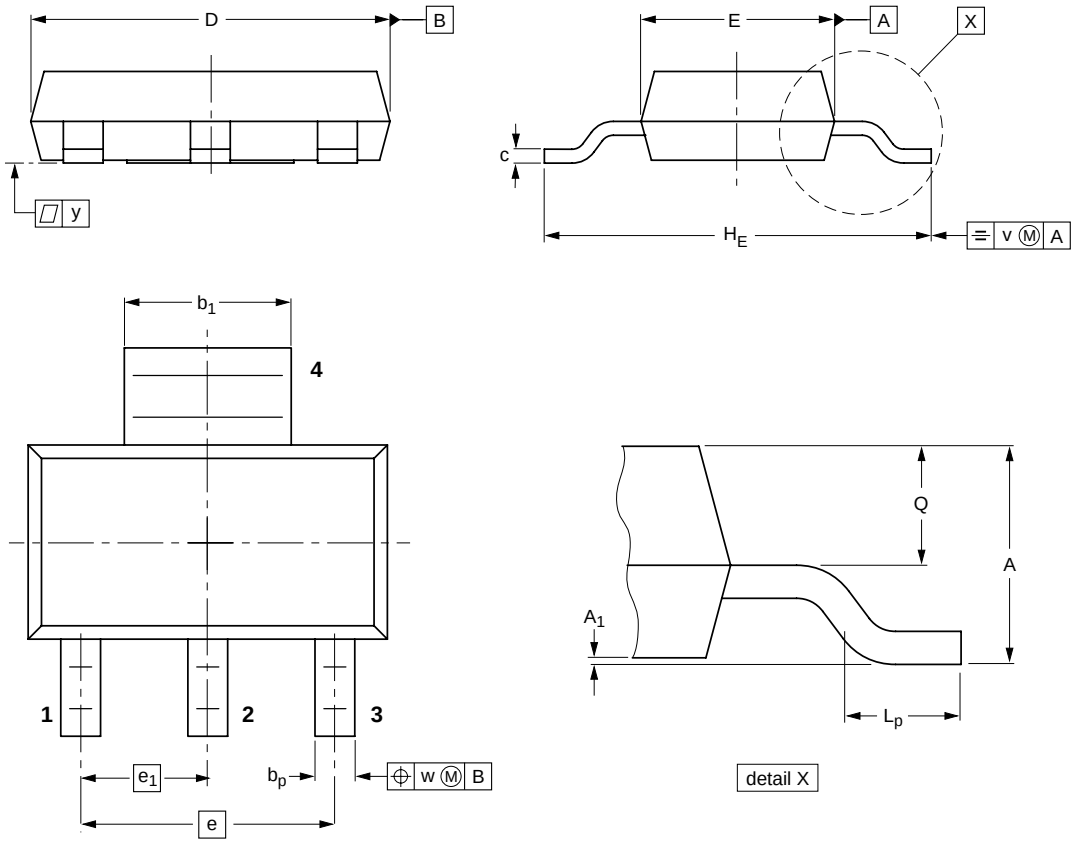



$V_i$ = 9.5 V; T = 500 μs; $t_p$ = 10 μs.
R1 = 68 Ω; R2 = 325 Ω; $R_B$ = 325 Ω; $R_C$ = 160 Ω.
$V_{BB}$ = −3.5 V; $V_{CC}$ = 29.5 V.
Oscilloscope input impedance $Z_i$ = 50 Ω.

Fig.3 Test circuit for switching times.

## PACKAGE OUTLINE

**Plastic surface mounted package; collector pad for good heat transfer; 4 leads** **SOT223**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | $A_1$ | $b_p$ | $b_1$ | c | D | E | e | $e_1$ | $H_E$ | $L_p$ | Q | v | w | y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.8<br>1.5 | 0.10<br>0.01 | 0.80<br>0.60 | 3.1<br>2.9 | 0.32<br>0.22 | 6.7<br>6.3 | 3.7<br>3.3 | 4.6 | 2.3 | 7.3<br>6.7 | 1.1<br>0.7 | 0.95<br>0.85 | 0.2 | 0.1 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT223 | | | SC-73 | | | ~~97-02-28~~<br>99-09-13 |

**DATA SHEET STATUS**

| DOCUMENT STATUS[1] | PRODUCT STATUS[2] | 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. |

**Notes**

1. Please consult the most recently issued document before initiating or completing a design.
2. The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

**DISCLAIMERS**

**General** — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

**Right to make changes** — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use** — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in medical, military, aircraft, space or life support equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors accepts no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

**Applications** — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

**Limiting values** — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) may cause permanent damage to the device. Limiting values are stress ratings only and operation of the device at these or any other conditions above those given in the Characteristics sections of this document is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Terms and conditions of sale** — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nxp.com/profile/terms, including those pertaining to warranty, intellectual property rights infringement and limitation of liability, unless explicitly otherwise agreed to in writing by NXP Semiconductors. In case of any inconsistency or conflict between information in this document and such terms and conditions, the latter will prevail.

**No offer to sell or license** — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

**Export control** — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from national authorities.

**Quick reference data** — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

# *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**
For sales offices addresses send e-mail to: **salesaddresses@nxp.com**



Printed in The Netherlands 115002/00/01/pp7 Date of release: 1999 May 10 Document order number: 9397 750 05286