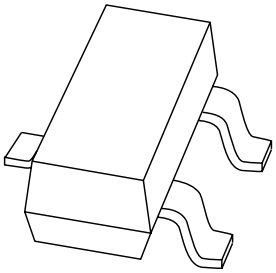
# DATA SHEET



# BSR15; BSR16
## PNP switching transistors

Product data sheet
Supersedes data of 1999 Apr 15

2004 Jan 13

# PNP switching transistors BSR15; BSR16

## FEATURES

- High current (max. 600 mA)
- Low voltage (max. 60 V).

## APPLICATIONS

- Medium power switching.

## DESCRIPTION

PNP switching transistor in a SOT23 plastic package.
NPN complements: BSR13 and BSR14.

## MARKING

| TYPE NUMBER | MARKING CODE(1) |
|---|---|
| BSR15 | T7* |
| BSR16 | T8* |

**Note**

1. * = p : Made in Hong Kong.
   * = t : Made in Malaysia.
   * = W : Made in China.

## PINNING

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

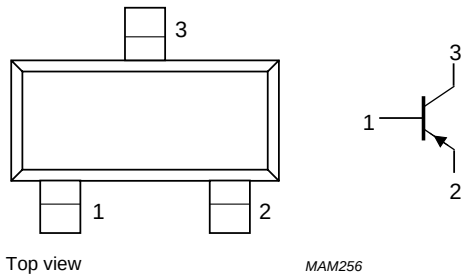



Fig.1 Simplified outline (SOT23) and symbol.

## ORDERING INFORMATION

| TYPE NUMBER | PACKAGE | | |
|---|---|---|---|
| | NAME | DESCRIPTION | VERSION |
| BSR15 | – | plastic surface mounted package; 3 leads | SOT23 |
| BSR16 | | | |

## 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 | | | |
| | BSR15 | | – | −40 | V |
| | BSR16 | | – | −60 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | −5 | 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 | – | 250 | mW |
| $T_{stg}$ | storage temperature | | −65 | +150 | °C |
| $T_j$ | junction temperature | | – | 150 | °C |
| $T_{amb}$ | operating ambient temperature | | −65 | +150 | °C |

## 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.

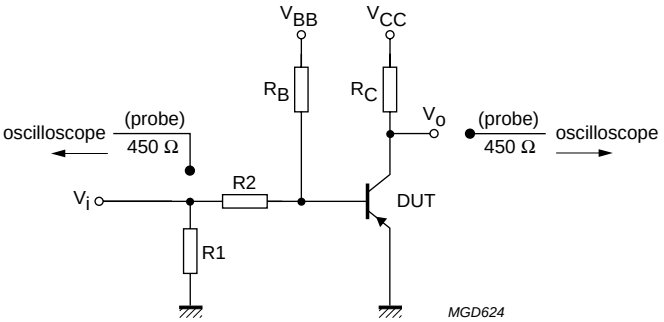
## CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $I_{CBO}$ | collector cut-off current | | | | |
| | BSR15 | $I_E$ = 0; $V_{CB}$ = –50 V | – | –20 | nA |
| | | $I_E$ = 0; $V_{CB}$ = –50 V; $T_j$ = 150 °C | – | –20 | μA |
| | collector cut-off current | | | | |
| | BSR16 | $I_E$ = 0; $V_{CB}$ = –50 V | – | –10 | nA |
| | | $I_E$ = 0; $V_{CB}$ = –50 V; $T_j$ = 150 °C | – | –10 | μA |
| $I_{EBO}$ | emitter cut-off current | $I_C$ = 0; $V_{EB}$ = –5 V | – | –50 | nA |
| $h_{FE}$ | DC current gain | $I_C$ = –0.1 mA; $V_{CE}$ = –10 V | | | |
| | BSR15 | | 35 | – | |
| | BSR16 | | 75 | – | |
| | DC current gain | $I_C$ = –1 mA; $V_{CE}$ = –10 V | | | |
| | BSR15 | | 50 | – | |
| | BSR16 | | 100 | – | |
| | DC current gain | $I_C$ = –10 mA; $V_{CE}$ = –10 V | | | |
| | BSR15 | | 75 | – | |
| | BSR16 | | 100 | – | |
| | DC current gain | $I_C$ = –150 mA; $V_{CE}$ = –10 V; note 1 | 100 | 300 | |
| | DC current gain | $I_C$ = –500 mA; $V_{CE}$ = –10 V; note 1 | | | |
| | BSR15 | | 30 | – | |
| | BSR16 | | 50 | – | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = –150 mA; $I_B$ = –15 mA | – | –400 | mV |
| | | $I_C$ = –500 mA; $I_B$ = –50 mA | – | –1.6 | V |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = –150 mA; $I_B$ = –15 mA | – | –1.3 | V |
| | | $I_C$ = –500 mA; $I_B$ = –50 mA | – | –2.6 | V |
| $C_c$ | collector capacitance | $I_E$ = $i_e$ = 0; $V_{CB}$ = –10 V; f = 1 MHz | – | 8 | pF |
| $C_e$ | emitter capacitance | $I_C$ = $i_c$ = 0; $V_{EB}$ = –2 V; f = 1 MHz | – | 30 | pF |
| $f_T$ | transition frequency | $I_C$ = –50 mA; $V_{CE}$ = –20 V; f = 100 MHz | 200 | – | MHz |
| **Switching times (between 10% and 90% levels);** (see Fig.2) | | | | | |
| $t_{on}$ | turn-on time | $I_{Con}$ = –150 mA; $I_{Bon}$ = –15 mA; $I_{Boff}$ = 15 mA | – | 40 | ns |
| $t_d$ | delay time | | – | 12 | ns |
| $t_r$ | rise time | | – | 30 | ns |
| $t_{off}$ | turn-off time | | – | 365 | ns |
| $t_s$ | storage time | | – | 300 | ns |
| $t_f$ | fall time | | – | 65 | ns |

**Note**

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

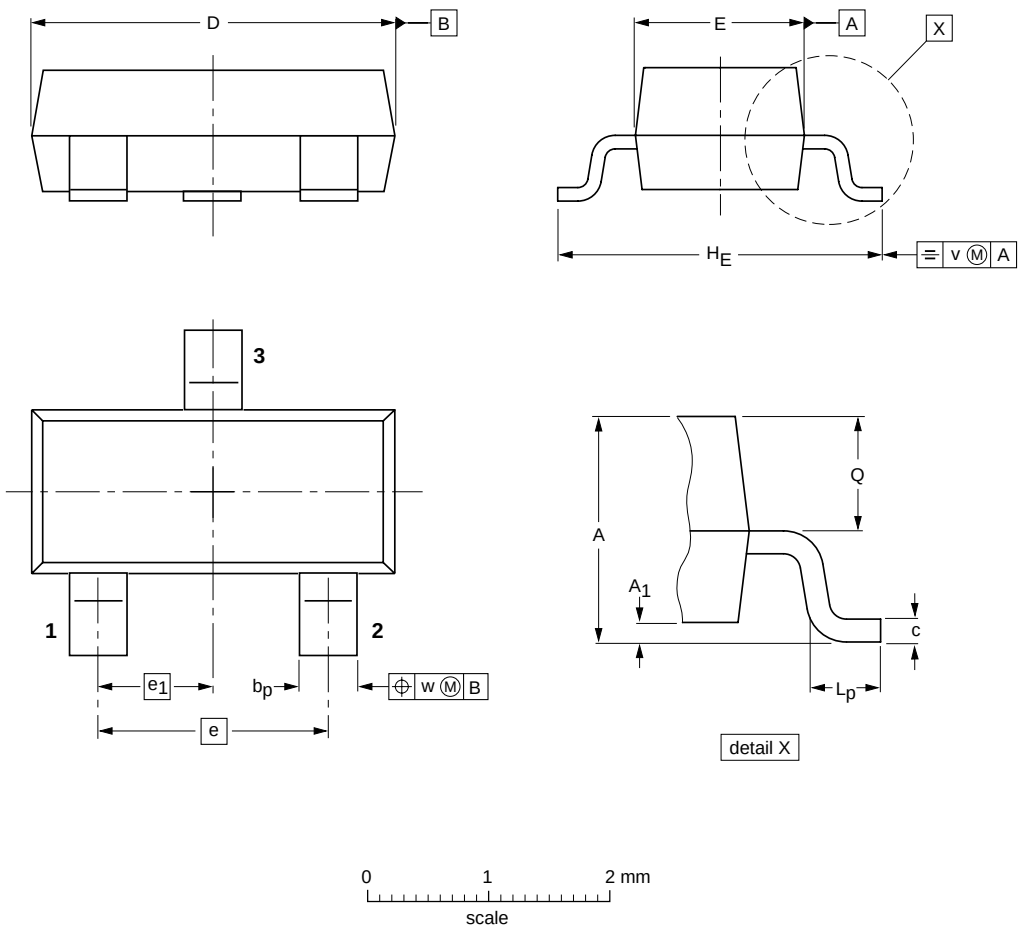



$V_i$ = −9.5 V; T = 500 μs; $t_p$ = 10 μs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; $R_B$ = 325 Ω; $R_C$ = 160 Ω.
$V_{BB}$ = 3.5 V; $V_{CC}$ = −29.5 V.
Oscilloscope: input impedance $Z_i$ = 50 Ω.

Fig.2 Test circuit for switching times.

## PACKAGE OUTLINE

**Plastic surface-mounted package; 3 leads** **SOT23**




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

| UNIT | A | $A_1$ max. | $b_p$ | c | D | E | e | $e_1$ | $H_E$ | $L_p$ | 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 |

**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. |

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# *NXP Semiconductors*

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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.

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