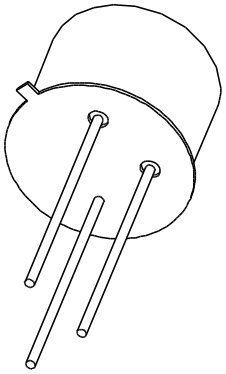
# DATA SHEET



# BSX45; BSX46; BSX47
## NPN medium power transistors

Product specification
Supersedes data of September 1994
File under Discrete Semiconductors, SC04

1997 Apr 23

Philips
Semiconductors

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# NPN medium power transistors BSX45; BSX46; BSX47

## FEATURES

- High current (max. 1 A)
- Low voltage (max. 80 V).

## APPLICATIONS

- General industrial applications.

## DESCRIPTION

NPN medium power transistor in a TO-39 metal package.

## PINNING

| PIN | DESCRIPTION |
|---|---|
| 1 | emitter |
| 2 | base |
| 3 | collector, connected to case |

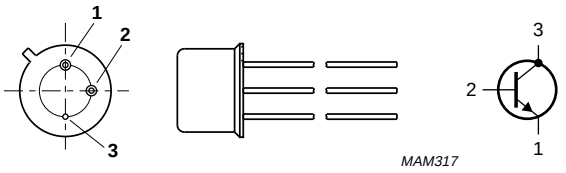



Fig.1 Simplified outline (TO-39) and symbol.

## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | | | | |
| | BSX45 | | – | – | 80 | V |
| | BSX46 | | – | – | 100 | V |
| | BSX47 | | – | – | 120 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | | | | |
| | BSX45 | | – | – | 40 | V |
| | BSX46 | | – | – | 60 | V |
| | BSX47 | | – | – | 80 | V |
| $I_{CM}$ | peak collector current | | – | – | 1.5 | A |
| $P_{tot}$ | total power dissipation | $T_{case} \leq 25$ °C | – | – | 6.25 | W |
| $h_{FE}$ | DC current gain | $I_C$ = 100 mA; $V_{CE}$ = 1 V | | | | |
| | BSX45-10; BSX46-10; BSX47-10 | | 63 | 100 | 160 | |
| | BSX45-16; BSX46-16; BSX47-16 | | 100 | 160 | 250 | |
| $f_T$ | transition frequency | $I_C$ = 50 mA; $V_{CE}$ = 10 V; f = 100 MHz | 50 | – | – | MHz |

## 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 | | | |
| | BSX45 | | – | 80 | V |
| | BSX46 | | – | 100 | V |
| | BSX47 | | – | 120 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | | | |
| | BSX45 | | – | 40 | V |
| | BSX46 | | – | 60 | V |
| | BSX47 | | – | 80 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | 7 | V |
| $I_C$ | collector current (DC) | | – | 1 | A |
| $I_{CM}$ | peak collector current | | – | 1.5 | A |
| $I_{BM}$ | peak base current | | – | 200 | mA |
| $P_{tot}$ | total power dissipation | $T_{case} \leq 25$ °C | – | 6.25 | W |
| $T_{stg}$ | storage temperature | | –65 | +150 | °C |
| $T_j$ | junction temperature | | – | 200 | °C |
| $T_{amb}$ | operating ambient temperature | | –65 | +150 | °C |

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---|---|---|---|---|
| $R_{th\ j\text{-}a}$ | thermal resistance from junction to ambient | in free air | 200 | K/W |
| $R_{th\ j\text{-}c}$ | thermal resistance from junction to case | | 28 | K/W |

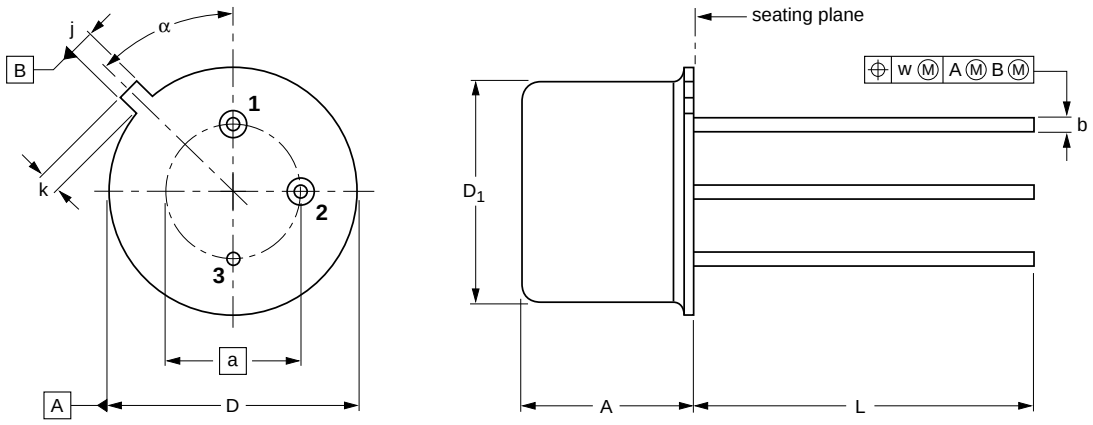
## CHARACTERISTICS

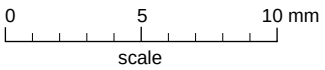
$T_{amb}$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $I_{CBO}$ | collector cut-off current | | | | | |
| | BSX45; BSX46 | $I_E$ = 0; $V_{CB}$ = 60 V | – | – | 30 | nA |
| | | $I_E$ = 0; $V_{CB}$ = 60 V; $T_{amb}$ = 150 °C | – | – | 10 | µA |
| $I_{CBO}$ | collector cut-off current | | | | | |
| | BSX47 | $I_E$ = 0; $V_{CB}$ = 80 V | – | – | 30 | nA |
| | | $I_E$ = 0; $V_{CB}$ = 80 V; $T_{amb}$ = 150 ° | – | – | 10 | µA |
| $I_{EBO}$ | emitter cut-off current | $I_C$ = 0; $V_{EB}$ = 5 V | – | – | 10 | nA |
| $h_{FE}$ | DC current gain | $I_C$ = 100 µA; $V_{CE}$ = 1 V | | | | |
| | BSX45-10; BSX46-10; BSX47-10 | | 15 | 40 | – | |
| | BSX45-16; BSX46-16 | | 25 | 90 | – | |
| $h_{FE}$ | DC current gain | $I_C$ = 100 mA; $V_{CE}$ = 1 V | | | | |
| | BSX45-10; BSX46-10; BSX47-10 | | 63 | 100 | 160 | |
| | BSX45-16; BSX46-16; BSX47-16 | | 100 | 160 | 250 | |
| $h_{FE}$ | DC current gain | $I_C$ = 500 mA; $V_{CE}$ = 1 V | | | | |
| | BSX45-10; BSX46-10; BSX47-10 | | 25 | 40 | – | |
| | BSX45-16; BSX46-16 | | 35 | 60 | – | |
| $h_{FE}$ | DC current gain | $I_C$ = 1 A; $V_{CE}$ = 1 V | | | | |
| | BSX45-10; BSX46-10; BSX47-10 | | – | 20 | – | |
| | BSX45-16; BSX46-16 | | – | 30 | – | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 1 A; $I_B$ = 100 mA | | | | |
| | BSX45; BSX46 | | – | – | 1 | V |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 500 mA; $I_B$ = 25 mA | | | | |
| | BSX47 | | – | – | 900 | mV |
| $V_{BE}$ | base-emitter voltage | $I_C$ = 100 mA; $V_{CE}$ = 1 V | – | – | 1 | V |
| | | $I_C$ = 500 mA; $V_{CE}$ = 1 V | 0.75 | – | 1.5 | V |
| | | $I_C$ = 1 A; $V_{CE}$ = 1 V | – | – | 2 | V |
| $C_c$ | collector capacitance | $I_E$ = $i_e$ = 0; $V_{CB}$ = 10 V; f = 1 MHz | | | | |
| | BSX45 | | – | – | 25 | pF |
| | BSX46 | | – | – | 20 | pF |
| | BSX47 | | – | – | 15 | pF |
| $C_e$ | emitter capacitance | $I_C$ = $i_c$ = 0; $V_{EB}$ = 0.5 V; f = 1 MHz | – | – | 80 | pF |
| $f_T$ | transition frequency | $I_C$ = 50 mA; $V_{CE}$ = 10 V; f = 100 MHz | 50 | – | – | MHz |
| F | noise figure | $I_C$ = 100 µA; $V_{CE}$ = 5 V; $R_S$ = 1 kΩ; f = 1 kHz; B = 200 Hz | – | 3.5 | – | dB |
| **Switching times (between 10% and 90% levels)** | | | | | | |
| $t_{on}$ | turn-on time | $I_{Con}$ = 100 mA; $I_{Bon}$ = 5 mA; $I_{Boff}$ = –5 mA | – | – | 200 | ns |
| $t_{off}$ | turn-off time | | – | – | 850 | ns |

## PACKAGE OUTLINE

**Metal-can cylindrical single-ended package; 3 leads** **SOT5/11**




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

| UNIT | A | a | b | D | $D_1$ | j | k | L | w | α |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | 6.60<br>6.35 | 5.08 | 0.48<br>0.41 | 9.39<br>9.08 | 8.33<br>8.18 | 0.85<br>0.75 | 0.95<br>0.75 | 14.2<br>12.7 | 0.2 | 45° |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT5/11 | | TO-39 | | | | 97-04-11 |

## DEFINITIONS

| **Data Sheet Status** | |
|---|---|
| Objective specification | This data sheet contains target or goal specifications for product development. |
| Preliminary specification | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification | This data sheet contains final product specifications. |
| **Limiting values** | |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). 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. | |
| **Application information** | |
| Where application information is given, it is advisory and does not form part of the specification. | |

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