# 2PB709BRL; 2PB709BSL

## 50 V, 200 mA PNP general-purpose transistors

Rev. 1 — 28 June 2010 Product data sheet

## 1. Product profile

### 1.1 General description

PNP general-purpose transistors in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

**Table 1. Product overview**

| Type number | Package | | NPN complement |
|---|---|---|---|
| | Nexperia | JEDEC | |
| 2PB709BRL | SOT23 | TO-236AB | 2PD601BRL |
| 2PB709BSL | | | 2PD601BSL |

### 1.2 Features and benefits

- Collector current $I_C \leq -200$ mA
- Two current gain selections
- AEC-Q101 qualified
- Small SMD plastic package

### 1.3 Applications

- General-purpose switching and amplification

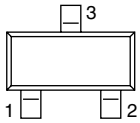
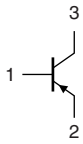
### 1.4 Quick reference data

**Table 2. Quick reference data**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CEO}$ | collector-emitter voltage | open base | - | - | –50 | V |
| $I_C$ | collector current | | - | - | –200 | mA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = –10 V; $I_C$ = –2 mA | 210 | - | 460 | |
| | $h_{FE}$ group R | | 210 | - | 340 | |
| | $h_{FE}$ group S | | 290 | - | 460 | |

## 2. Pinning information

**Table 3. Pinning**

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| 1 | base |  |  |
| 2 | emitter | | |
| 3 | collector | | |





*sym013*

## 3. Ordering information

**Table 4. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| 2PB709BRL | - | plastic surface-mounted package; 3 leads | SOT23 |
| 2PB709BSL | | | |

## 4. Marking

**Table 5. Marking codes**

| Type number | Marking code[1] |
|---|---|
| 2PB709BRL | MN* |
| 2PB709BSL | MP* |

[1] * = -: made in Hong Kong
* = p: made in Hong Kong
* = t: made in Malaysia
* = W: made in China

## 5. Limiting values

**Table 6. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134).*

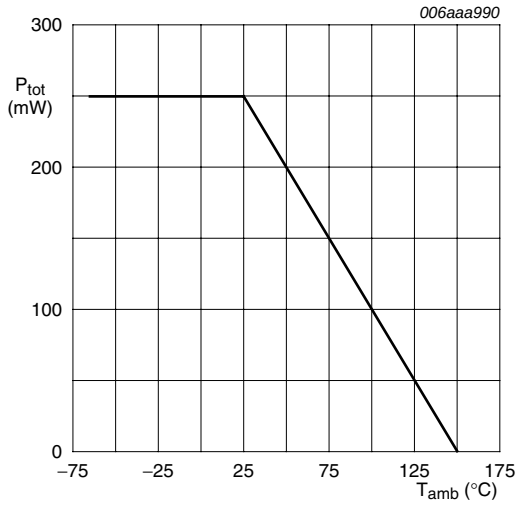
| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | - | –60 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | - | –50 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | - | –6 | V |
| $I_C$ | collector current | | - | –200 | mA |
| $I_{CM}$ | peak collector current | single pulse; $t_p \leq 1$ ms | - | –250 | mA |
| $I_{BM}$ | peak base current | single pulse; $t_p \leq 1$ ms | - | –200 | mA |

**Table 6. Limiting values** *...continued*

*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | [1] | - | 250 | mW |
| $T_j$ | junction temperature | | | - | 150 | °C |
| $T_{amb}$ | ambient temperature | | | –55 | +150 | °C |
| $T_{stg}$ | storage temperature | | | –65 | +150 | °C |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.




FR4 PCB, standard footprint

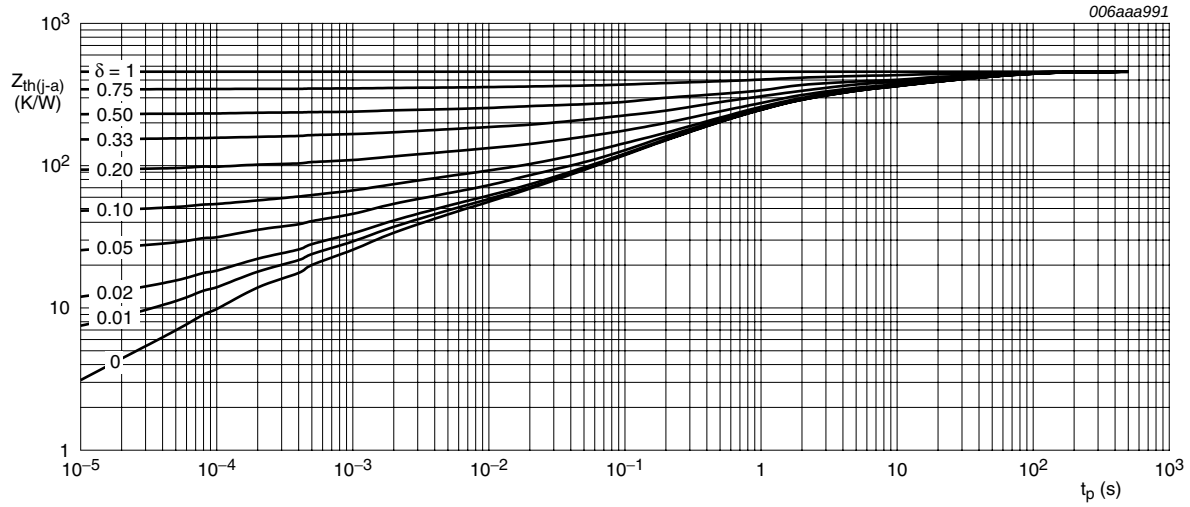
**Fig 1. Power derating curve**

## 6. Thermal characteristics

**Table 7. Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 500 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | | - | - | 140 | K/W |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.




FR4 PCB, standard footprint

**Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

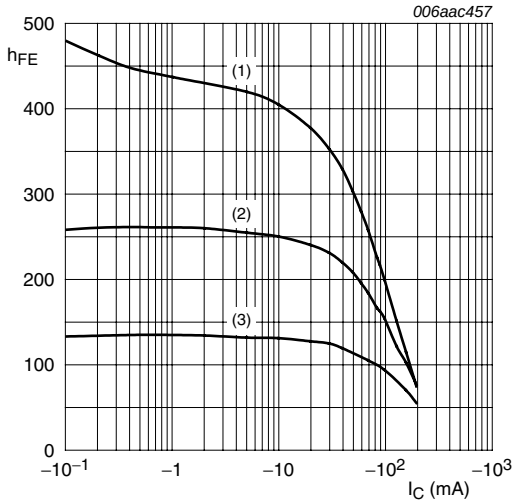
## 7. Characteristics

**Table 8. Characteristics**

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

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = –60 V; $I_E$ = 0 A | | - | - | –10 | nA |
| | | $V_{CB}$ = –60 V; $I_E$ = 0 A; $T_j$ = 150 °C | | - | - | –5 | µA |
| $I_{EBO}$ | emitter-base cut-off current | $V_{EB}$ = –5 V; $I_C$ = 0 A | | - | - | –10 | nA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = –10 V; $I_C$ = –2 mA | | 210 | - | 460 | |
| | $h_{FE}$ group R | | | 210 | - | 340 | |
| | $h_{FE}$ group S | | | 290 | - | 460 | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = –100 mA; $I_B$ = –10 mA | [1] | - | - | –250 | mV |
| $f_T$ | transition frequency | $V_{CE}$ = –6 V; $I_C$ = –10 mA; f = 100 MHz | | 100 | 200 | - | MHz |
| $C_c$ | collector capacitance | $V_{CB}$ = –10 V; $I_E$ = $i_e$ = 0 A; f = 1 MHz | | - | - | 3 | pF |

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



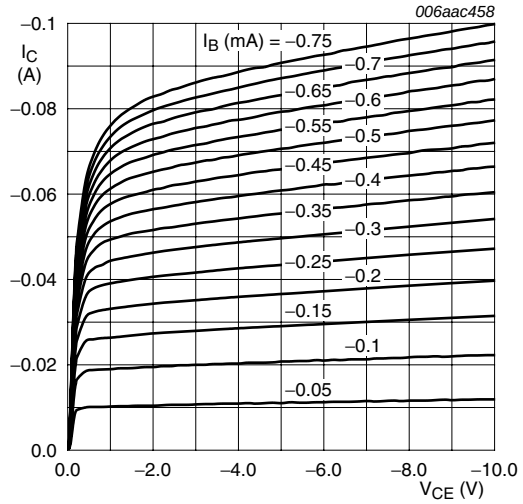

$V_{CE}$ = −10 V

(1) $T_{amb}$ = 150 °C

(2) $T_{amb}$ = 25 °C

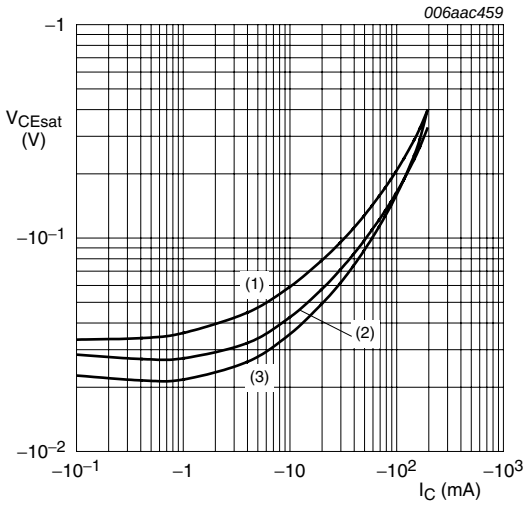
(3) $T_{amb}$ = −55 °C

**Fig 3. 2PB709BRL: DC current gain as a function of collector current; typical values**




$T_{amb}$ = 25 °C

**Fig 4. 2PB709BRL: Collector current as a function of collector-emitter voltage; typical values**



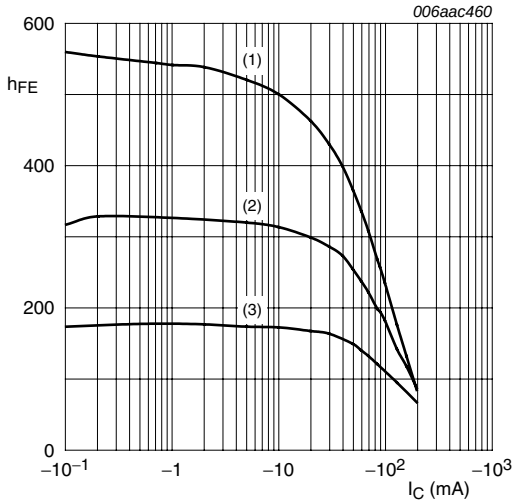

$I_C/I_B$ = 10

(1) $T_{amb}$ = 150 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −55 °C

**Fig 5. 2PB709BRL: Collector-emitter saturation voltage as a function of collector current; typical values**



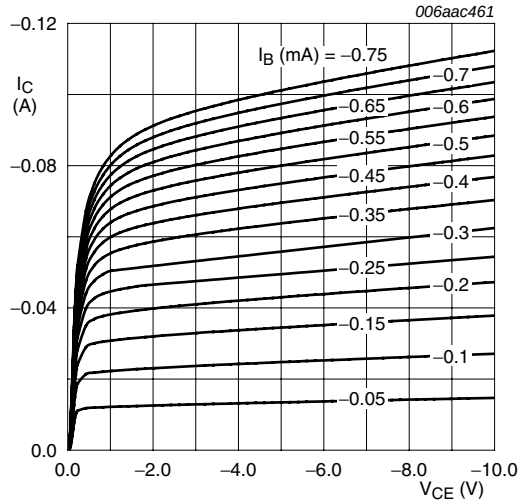

$V_{CE}$ = −10 V

(1) $T_{amb}$ = 150 °C

(2) $T_{amb}$ = 25 °C

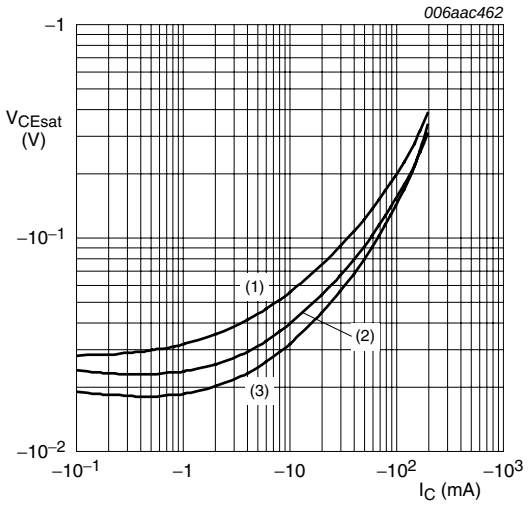
(3) $T_{amb}$ = −55 °C

**Fig 6. 2PB709BSL: DC current gain as a function of collector current; typical values**




$T_{amb}$ = 25 °C

**Fig 7. 2PB709BSL: Collector current as a function of collector-emitter voltage; typical values**




$I_C/I_B$ = 10

(1) $T_{amb}$ = 150 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −55 °C

**Fig 8. 2PB709BSL: Collector-emitter saturation voltage as a function of collector current; typical values**

# 8. Test information

## 8.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

# 9. Package outline

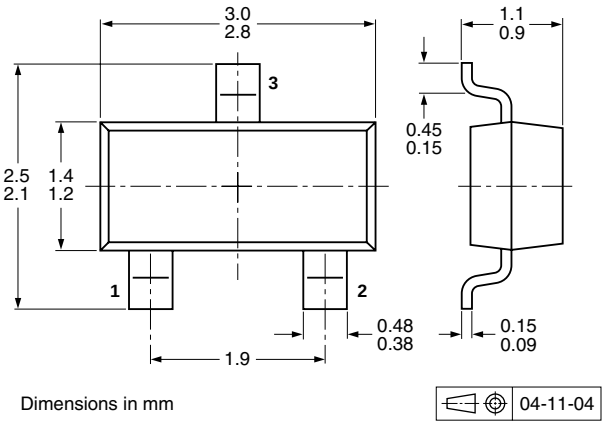



**Fig 9. Package outline SOT23 (TO-236AB)**

## 10. Packing information

**Table 9. Packing methods**

*The indicated -xxx are the last three digits of the 12NC ordering code.*[1]

| Type number | Package | Description | Packing quantity | |
|---|---|---|---|---|
| | | | 3000 | 10000 |
| 2PB709BRL | SOT23 | 4 mm pitch, 8 mm tape and reel | -215 | -235 |
| 2PB709BSL | | | | |

[1] For further information and the availability of packing methods, see Section 14.

## 11. Soldering

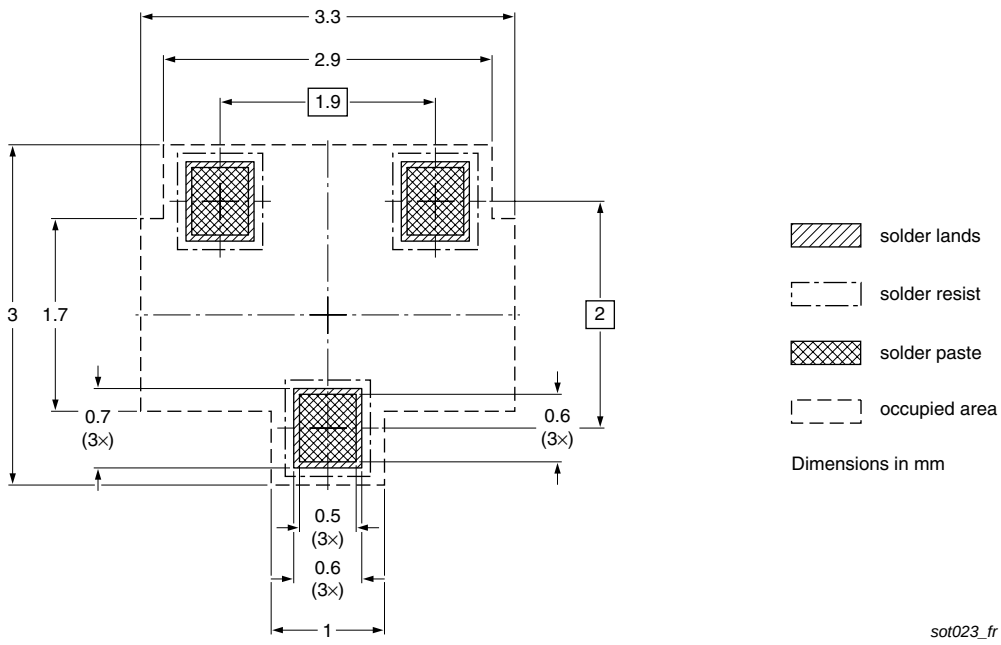



**Fig 10. Reflow soldering footprint SOT23 (TO-236AB)**

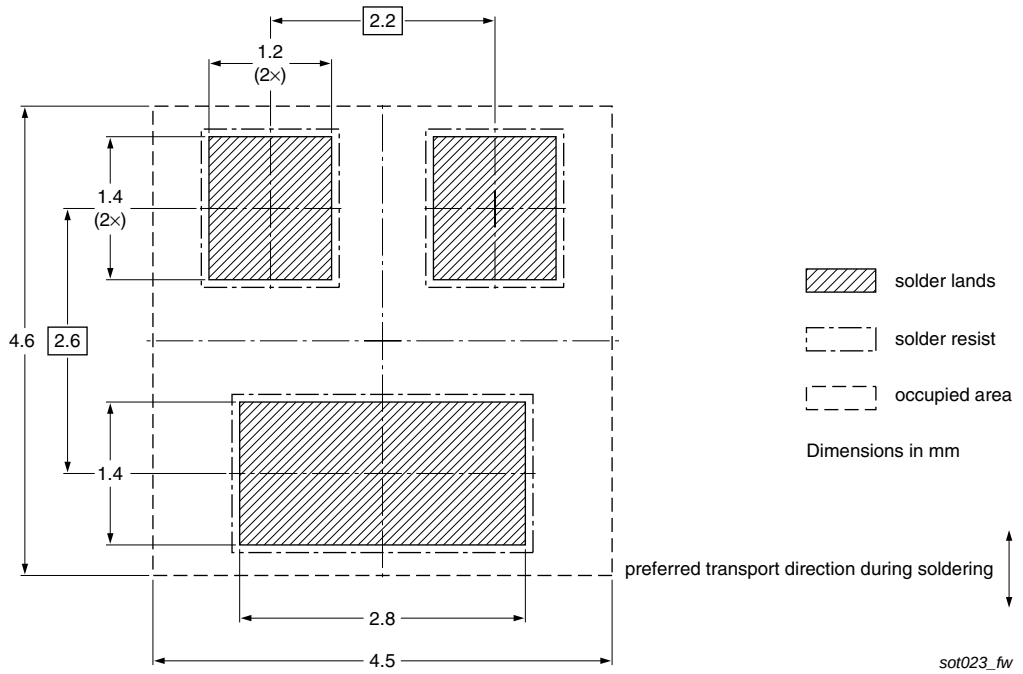



**Fig 11. Wave soldering footprint SOT23 (TO-236AB)**

## 12. Revision history

**Table 10. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| 2PB709BRL_2PB709BSL v.1 | 20100628 | Product data sheet | - | - |

# 13. Legal information

## 13.1 Data sheet status

| Document status[1][2] | Product status[3] | Definition |
|---|---|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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## 15. Contents





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**Date of release: 28 June 2010**