



# 2PB1424

20 V, 3 A PNP low  $V_{CEsat}$  (BISS) transistor

Rev. 02 — 15 January 2007

Product data sheet

## 1. Product profile

### 1.1 General description

PNP low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor in a medium power SOT89 (SC-62/TO-243) flat lead Surface-Mounted Device (SMD) plastic package.

NPN complement: 2PD2150.

### 1.2 Features

- Low collector-emitter saturation voltage  $V_{CEsat}$
- High collector current capability  $I_C$  and  $I_{CM}$
- High collector current gain ( $h_{FE}$ ) at high  $I_C$
- High efficiency due to less heat generation
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors

### 1.3 Applications

- DC-to-DC conversion
- MOSFET gate driving
- Motor control
- Charging circuits
- Power switches (e.g. motors, fans)
- Thin Film Transistor (TFT) backlight inverter

### 1.4 Quick reference data

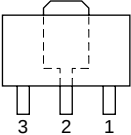
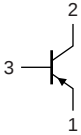
Table 1. Quick reference data

| Symbol      | Parameter                               | Conditions                       | Min                   | Typ  | Max  | Unit |
|-------------|-----------------------------------------|----------------------------------|-----------------------|------|------|------|
| $V_{CEO}$   | collector-emitter voltage               | open base                        | -                     | -    | -20  | V    |
| $I_C$       | collector current                       |                                  | -                     | -    | -3   | A    |
| $I_{CM}$    | peak collector current                  | single pulse;<br>$t_p \leq 1$ ms | -                     | -    | -5   | A    |
| $V_{CEsat}$ | collector-emitter<br>saturation voltage | $I_C = -2$ A;<br>$I_B = -0.1$ A  | <a href="#">[1]</a> - | -0.2 | -0.5 | V    |

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

2. Pinning information

Table 2. Pinning

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

006aaa231

3. Ordering information

Table 3. Ordering information

| Type number | Package |                                                                                |         |
|-------------|---------|--------------------------------------------------------------------------------|---------|
|             | Name    | Description                                                                    | Version |
| 2PB1424     | SC-62   | plastic surface-mounted package; collector pad for good heat transfer; 3 leads | SOT89   |

4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| 2PB1424     | M1           |

5. Limiting values

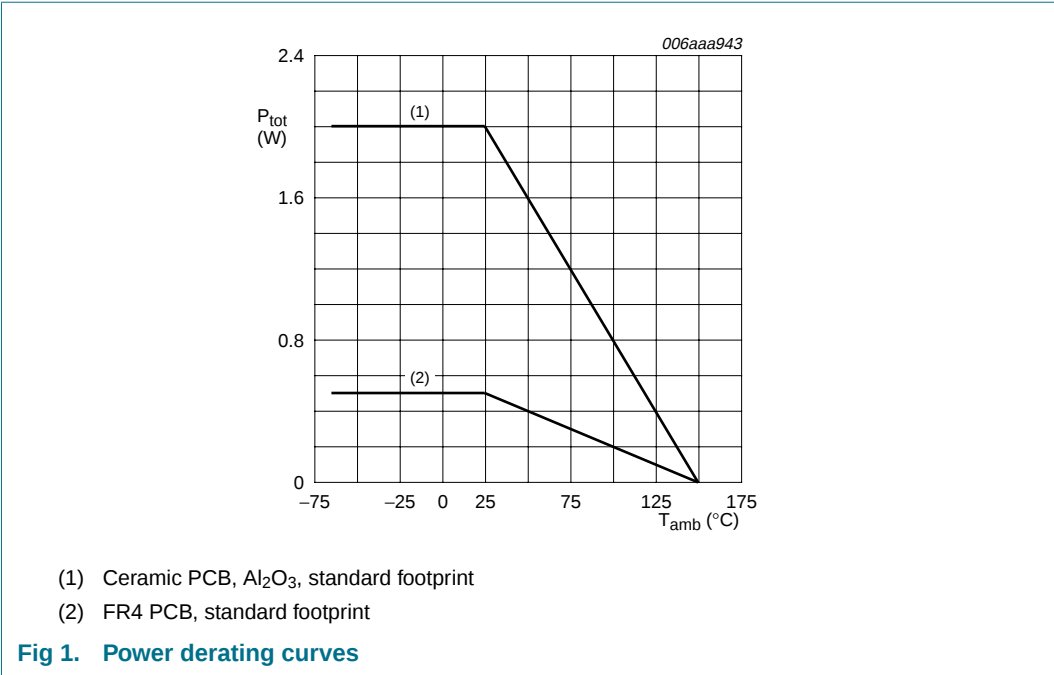
Table 5. Limiting values

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

| Symbol           | Parameter                 | Conditions                             | Min                   | Max  | Unit |
|------------------|---------------------------|----------------------------------------|-----------------------|------|------|
| V <sub>CBO</sub> | collector-base voltage    | open emitter                           | -                     | −20  | V    |
| V <sub>CEO</sub> | collector-emitter voltage | open base                              | -                     | −20  | V    |
| V <sub>EBO</sub> | emitter-base voltage      | open collector                         | -                     | −6   | V    |
| I <sub>C</sub>   | collector current         |                                        | -                     | −3   | A    |
| I <sub>CM</sub>  | peak collector current    | single pulse;<br>t <sub>p</sub> ≤ 1 ms | -                     | −5   | A    |
| P <sub>tot</sub> | total power dissipation   | T <sub>amb</sub> ≤ 25 °C               | <a href="#">[1]</a> - | 0.5  | W    |
|                  |                           |                                        | <a href="#">[2]</a> - | 2    | W    |
| T <sub>j</sub>   | junction temperature      |                                        | -                     | 150  | °C   |
| T <sub>amb</sub> | ambient temperature       |                                        | −65                   | +150 | °C   |
| T <sub>stg</sub> | storage temperature       |                                        | −65                   | +150 | °C   |

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

[2] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.

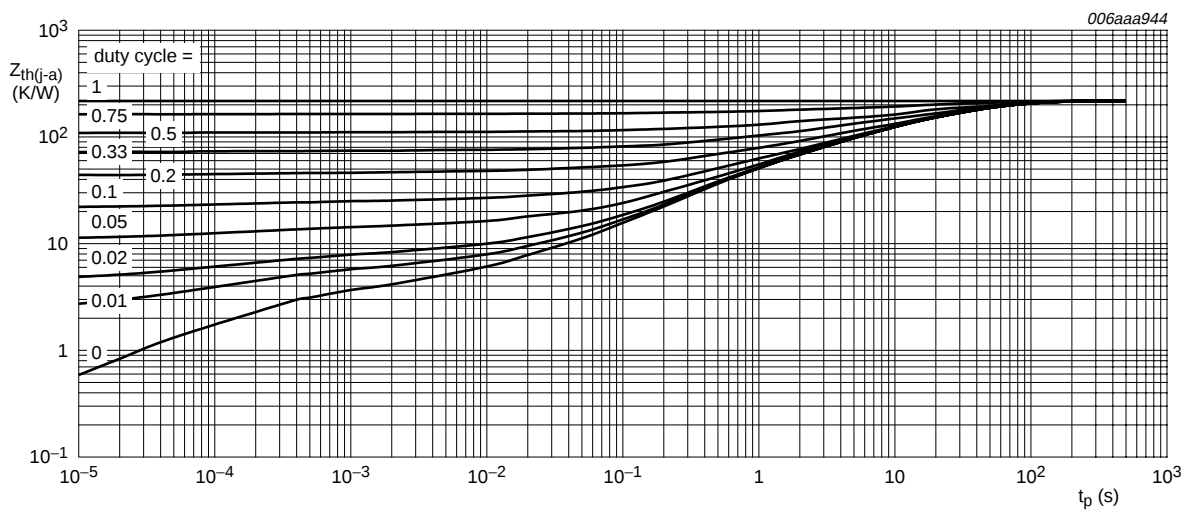


6. Thermal characteristics

Table 6. Thermal characteristics

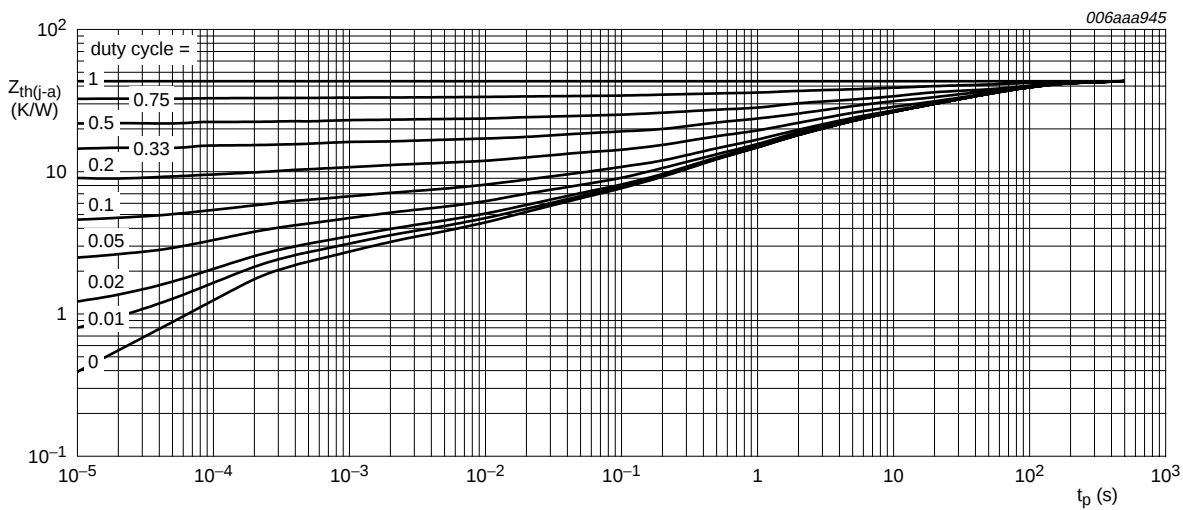
| Symbol        | Parameter                                   | Conditions  | Min | Typ | Max | Unit |
|---------------|---------------------------------------------|-------------|-----|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | -   | 250 | K/W  |
|               |                                             |             | [2] | -   | 62  | K/W  |

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.  
[2] Device mounted on a ceramic PCB,  $Al_2O_3$ , standard footprint.



FR4 PCB, standard footprint

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



Ceramic PCB,  $Al_2O_3$ , standard footprint

Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 7. Characteristics

**Table 7. Characteristics**

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

| Symbol      | Parameter                            | Conditions                                                                 | Min                   | Typ  | Max  | Unit          |
|-------------|--------------------------------------|----------------------------------------------------------------------------|-----------------------|------|------|---------------|
| $I_{CBO}$   | collector-base cut-off current       | $V_{CB} = -20\text{ V}$ ; $I_E = 0\text{ A}$                               | -                     | -    | -0.1 | $\mu\text{A}$ |
| $I_{EBO}$   | emitter-base cut-off current         | $V_{EB} = -5\text{ V}$ ; $I_C = 0\text{ A}$                                | -                     | -    | -0.1 | $\mu\text{A}$ |
| $h_{FE}$    | DC current gain                      | $V_{CE} = -2\text{ V}$ ; $I_C = -0.1\text{ A}$                             | 180                   | -    | 390  |               |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C = -2\text{ A}$ ; $I_B = -0.1\text{ A}$                                | <a href="#">[1]</a> - | -0.2 | -0.5 | V             |
| $f_T$       | transition frequency                 | $V_{CE} = -2\text{ V}$ ; $I_E = 0.5\text{ A}$ ;<br>$f = 100\text{ MHz}$    | -                     | 125  | -    | MHz           |
| $C_{ib}$    | common-base input capacitance        | $V_{EB} = -5\text{ V}$ ; $I_E = I_E = 0\text{ A}$ ;<br>$f = 1\text{ MHz}$  | -                     | 130  | -    | pF            |
| $C_{ob}$    | common-base output capacitance       | $V_{CB} = -10\text{ V}$ ; $I_E = I_E = 0\text{ A}$ ;<br>$f = 1\text{ MHz}$ | -                     | 37   | -    | pF            |

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

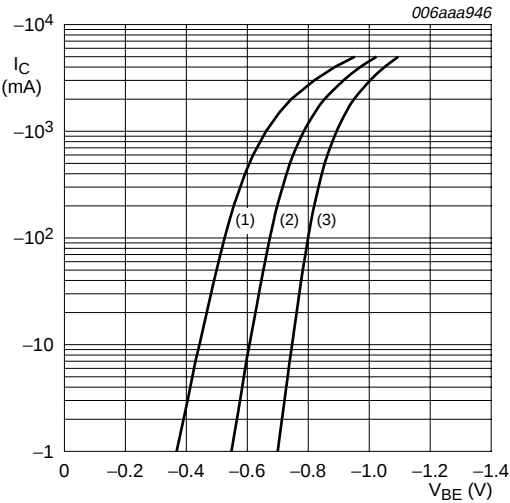


Fig 4. Collector current as a function of base-emitter voltage; typical values

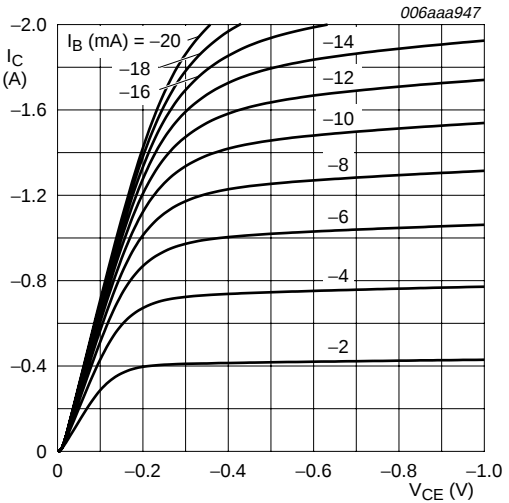


Fig 5. Collector current as a function of collector-emitter voltage; typical values

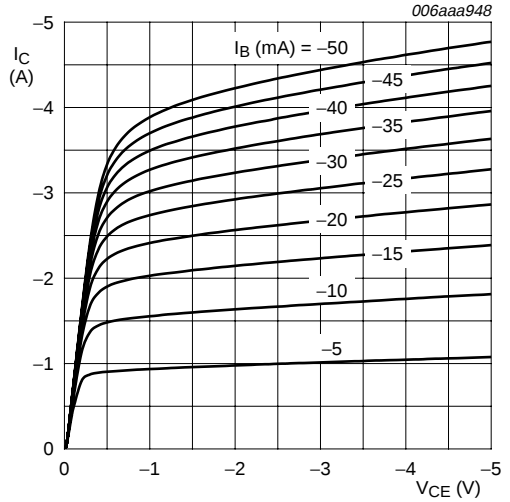


Fig 6. Collector current as a function of collector-emitter voltage; typical values

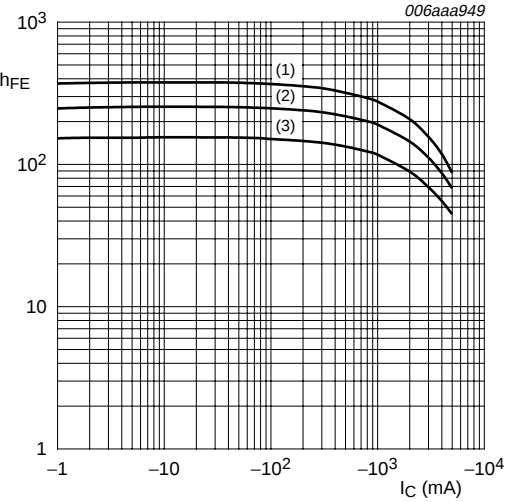
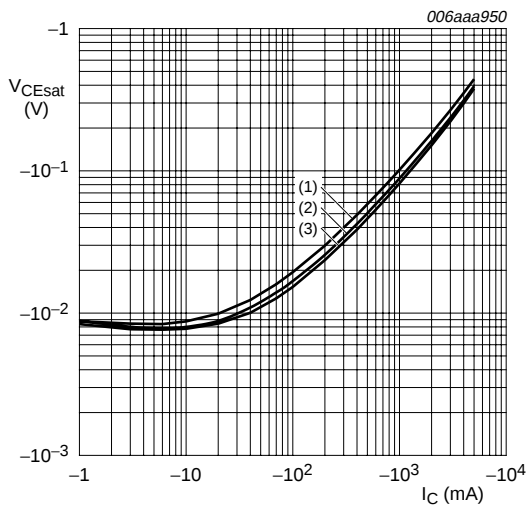
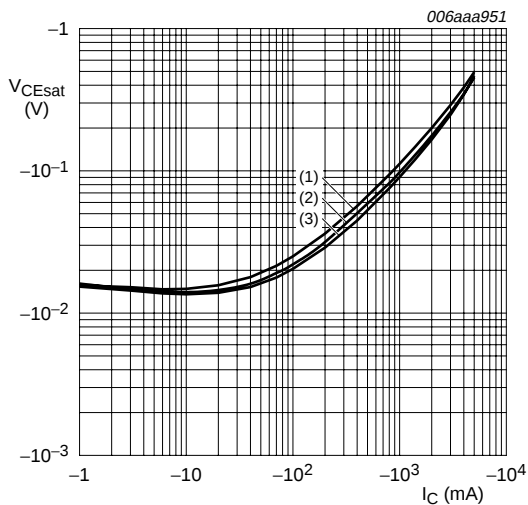


Fig 7. DC current gain as a function of collector current; typical values



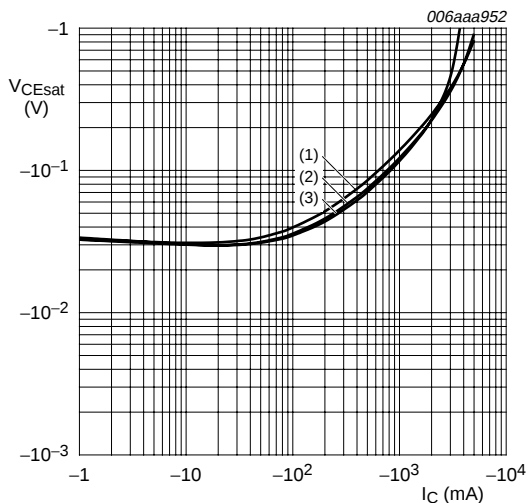
- $I_C/I_B = 10$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



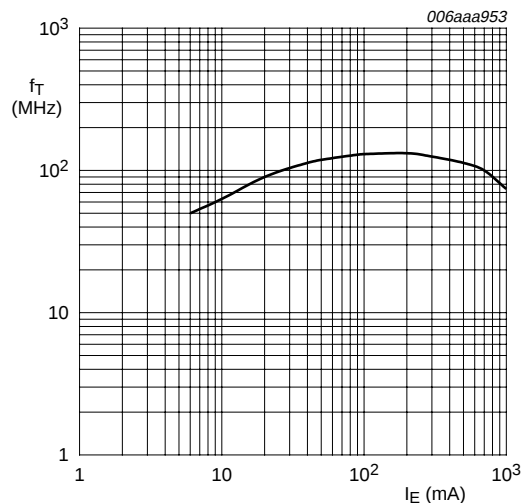
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

Fig 9. Collector-emitter saturation voltage as a function of collector current; typical values



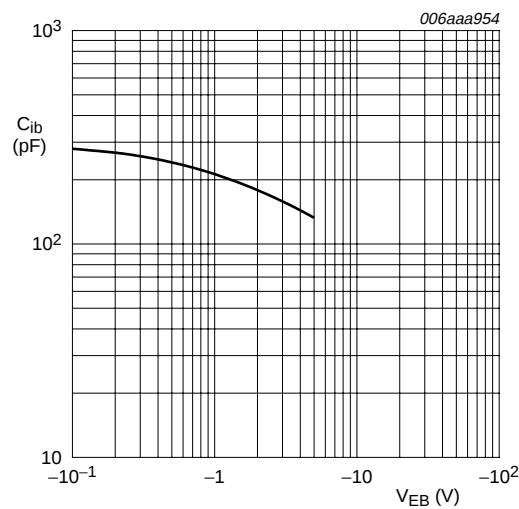
- $I_C/I_B = 50$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

Fig 10. Collector-emitter saturation voltage as a function of collector current; typical values



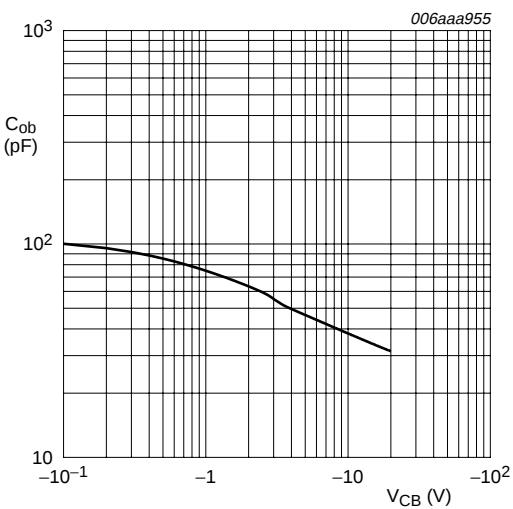
$T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $V_{CE} = -2\text{ V}$

Fig 11. Transition frequency as a function of emitter current; typical values



$T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $f = 1\text{ MHz}$ ;  $I_E = I_C = 0\text{ A}$

Fig 12. Common-base input capacitance as a function of emitter-base voltage; typical values

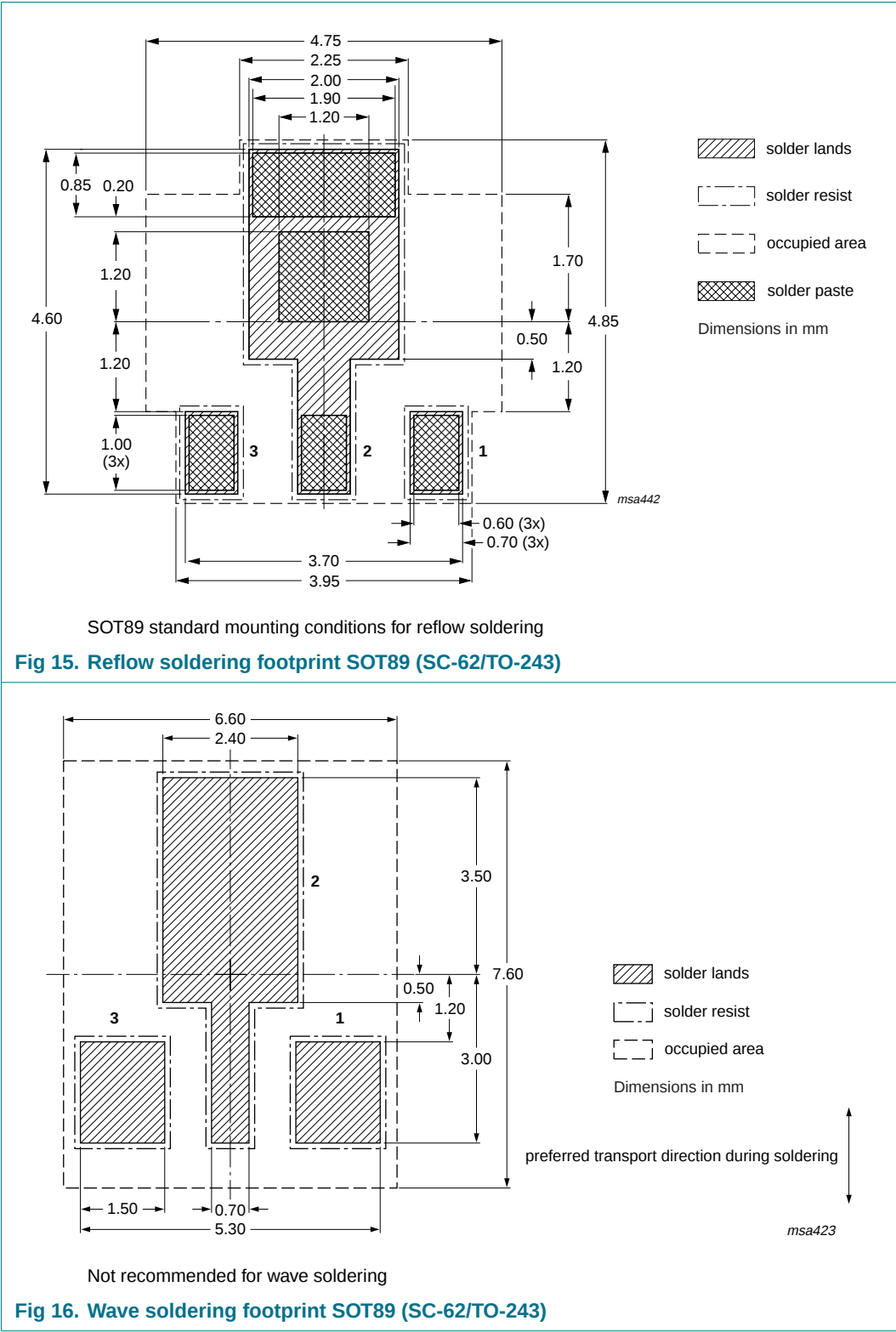


$T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $f = 1\text{ MHz}$ ;  $I_E = I_C = 0\text{ A}$

Fig 13. Common-base output capacitance as a function of collector-base voltage; typical values



10. Soldering



## 11. Revision history

**Table 9.** Revision history

| Document ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Release date | Data sheet status  | Change notice | Supersedes |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------------|---------------|------------|
| 2PB1424_2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 20070115     | Product data sheet | -             | 2PB1424_1  |
| Modifications: <ul style="list-style-type: none"> <li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• <a href="#">Table 1 “Quick reference data”</a>: <math>I_C</math> collector current added</li> <li>• <a href="#">Table 1 “Quick reference data”</a>: <math>I_{CM}</math> peak collector current maximum value adapted</li> <li>• <a href="#">Table 1 “Quick reference data”</a>: <math>V_{CEsat}</math> collector-emitter saturation voltage added</li> <li>• <a href="#">Table 5 “Limiting values”</a>: <math>V_{CBO}</math> collector-base voltage maximum value adapted</li> <li>• <a href="#">Table 5 “Limiting values”</a>: <math>V_{EBO}</math> emitter-base voltage maximum value adapted</li> <li>• <a href="#">Table 5 “Limiting values”</a>: <math>I_C</math> collector current maximum value adapted</li> <li>• <a href="#">Table 5 “Limiting values”</a>: <math>I_{CM}</math> peak collector current maximum value adapted</li> <li>• <a href="#">Table 5 “Limiting values”</a>: <math>P_{tot}</math> total power dissipation for ceramic PCB condition added</li> <li>• <a href="#">Figure 1 “Power derating curves”</a>: adapted</li> <li>• <a href="#">Table 6 “Thermal characteristics”</a>: adapted</li> <li>• <a href="#">Table 6 “Thermal characteristics”</a>: <math>R_{th(j-a)}</math> thermal resistance from junction to ambient for ceramic PCB condition added</li> <li>• <a href="#">Figure 2</a>: <math>t_p</math> pulse time redefined to pulse duration</li> <li>• <a href="#">Figure 3</a>: added</li> <li>• <a href="#">Table 7 “Characteristics”</a>: <math>I_{CBO}</math> collector-base cut-off current conditions adapted</li> <li>• <a href="#">Table 7 “Characteristics”</a>: <math>V_{CEsat}</math> collector-emitter saturation voltage typical value added</li> <li>• <a href="#">Table 7 “Characteristics”</a>: <math>f_T</math> transition frequency conditions and typical value adapted</li> <li>• <a href="#">Table 7 “Characteristics”</a>: <math>C_{ib}</math> common-base input capacitance added</li> <li>• <a href="#">Table 7 “Characteristics”</a>: <math>C_{ob}</math> common-base output capacitance added</li> <li>• <a href="#">Figure 4</a>, <a href="#">6</a>, <a href="#">10</a>, <a href="#">11</a>, <a href="#">12</a>, <a href="#">13</a> and <a href="#">16</a>: added</li> <li>• <a href="#">Figure 5</a>, <a href="#">7</a>, <a href="#">8</a> and <a href="#">9</a>: adapted</li> <li>• <a href="#">Section 12 “Legal information”</a>: updated</li> </ul> |              |                    |               |            |
| 2PB1424_1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 20050502     | Product data sheet | -             | -          |

## 12. Legal information

### 12.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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".

[3] 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.nexperia.com>.

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Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.