



# 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

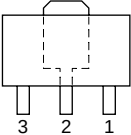
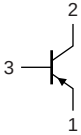
Table 1. Quick reference data

| 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

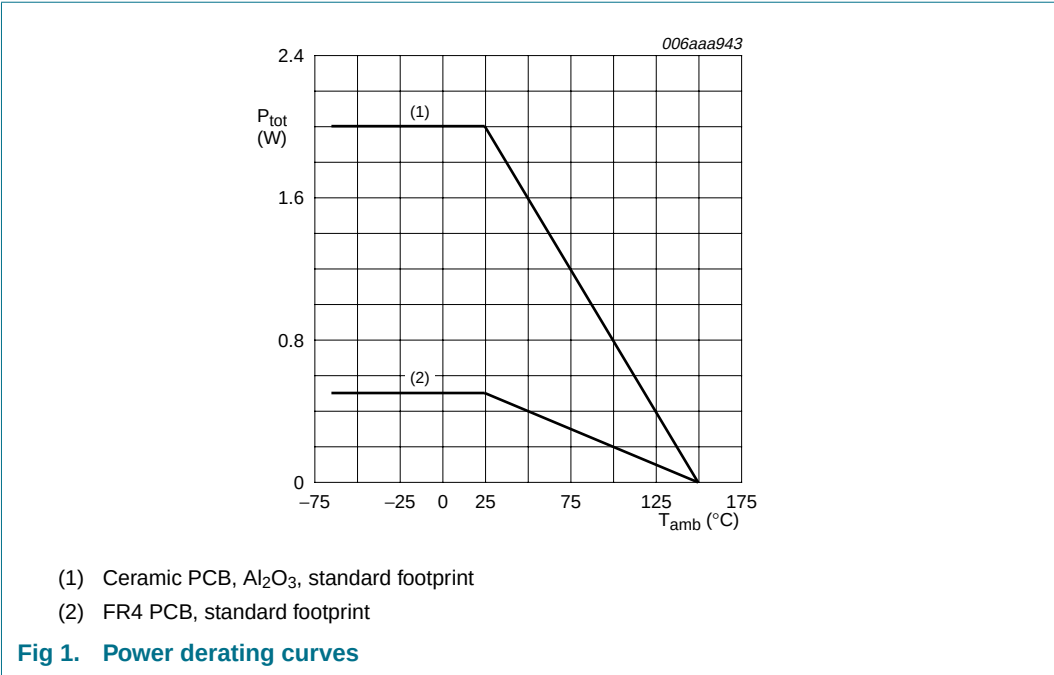
Table 5. Limiting values

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,  $Al_2O_3$ , standard footprint.

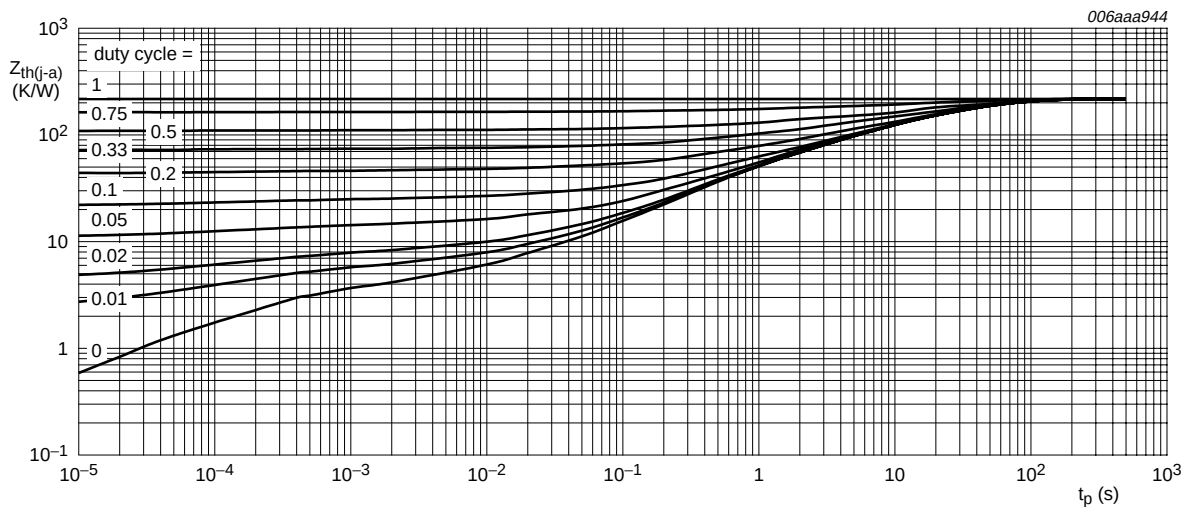


6. Thermal characteristics

Table 6. Thermal characteristics

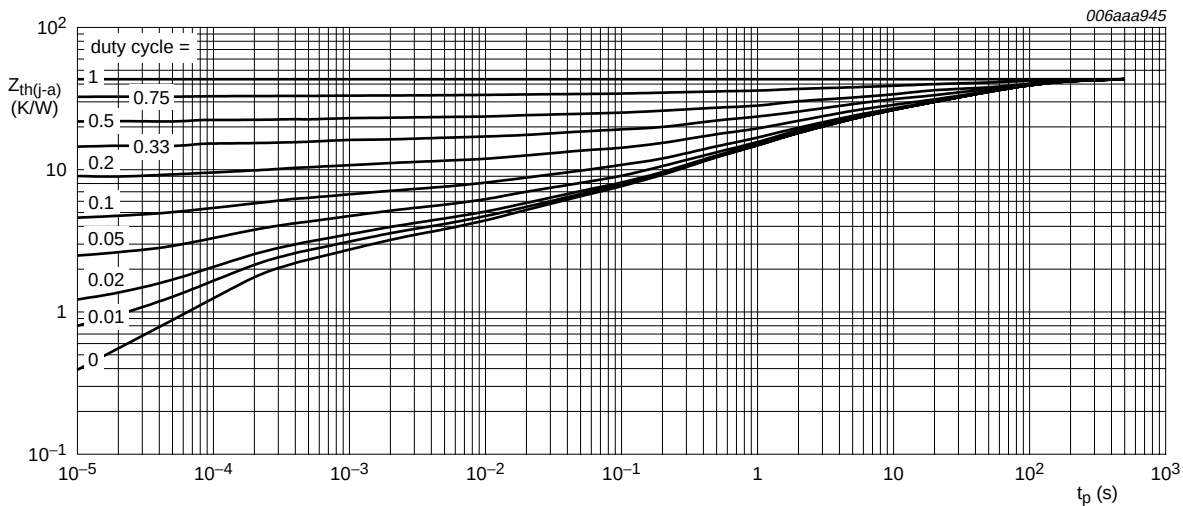
| Symbol               | Parameter                                   | Conditions  | Min | Typ | Max | Unit |
|----------------------|---------------------------------------------|-------------|-----|-----|-----|------|
| R <sub>th(j-a)</sub> | thermal resistance from junction to ambient | in free air | [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<sub>2</sub>O<sub>3</sub>, 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

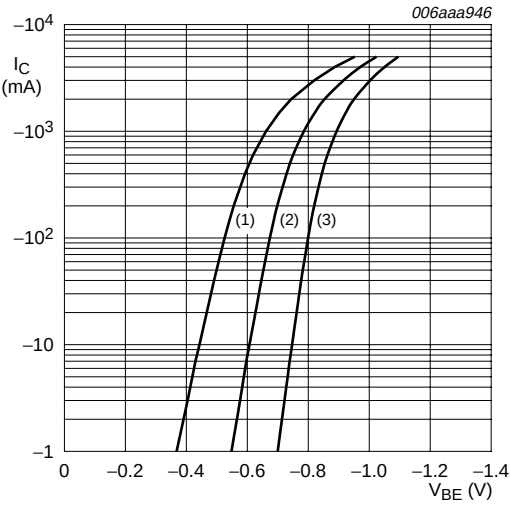
## 7. Characteristics

**Table 7. Characteristics**

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

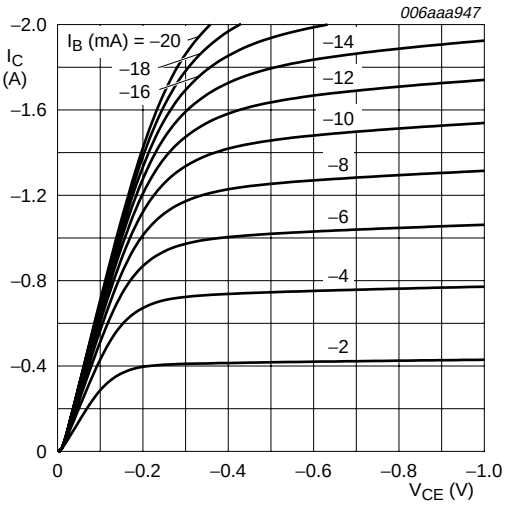
| Symbol      | Parameter                            | Conditions                                                                 | Min                   | Typ  | Max  | Unit          |
|-------------|--------------------------------------|----------------------------------------------------------------------------|-----------------------|------|------|---------------|
| $I_{CBO}$   | 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:  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta \leq 0.02$ .



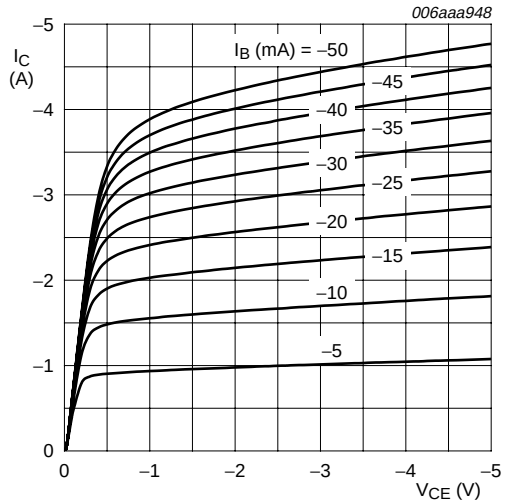
$V_{CE} = -2\text{ V}$   
(1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



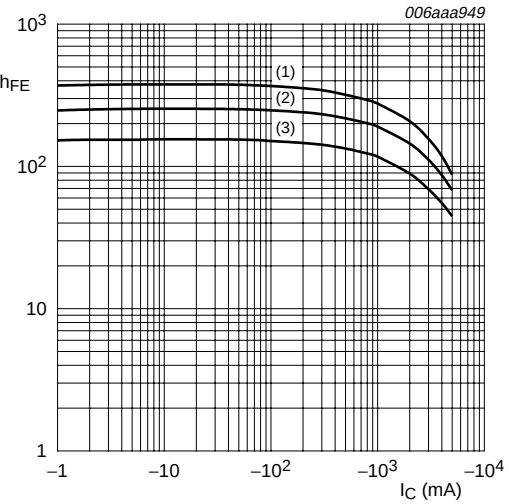
$T_{amb} = 25\text{ }^{\circ}\text{C}$

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



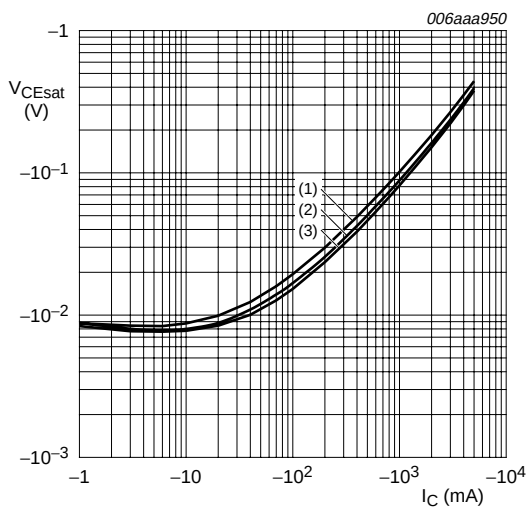
$T_{amb} = 25\text{ }^{\circ}\text{C}$

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



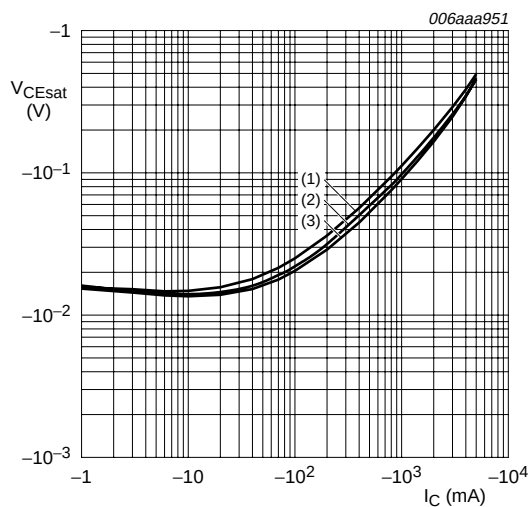
$V_{CE} = -2\text{ V}$   
(1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



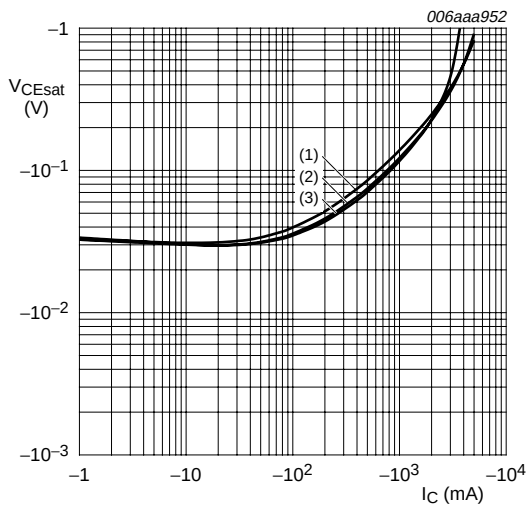
- $I_C/I_B = 10$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



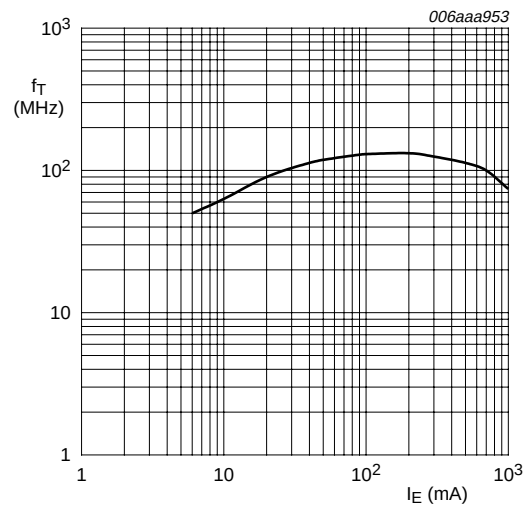
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



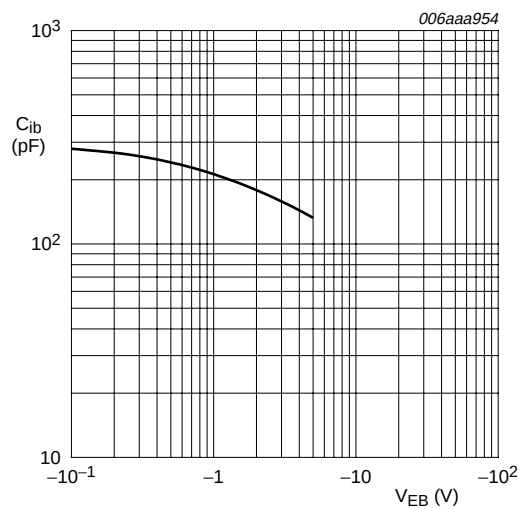
- $I_C/I_B = 50$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



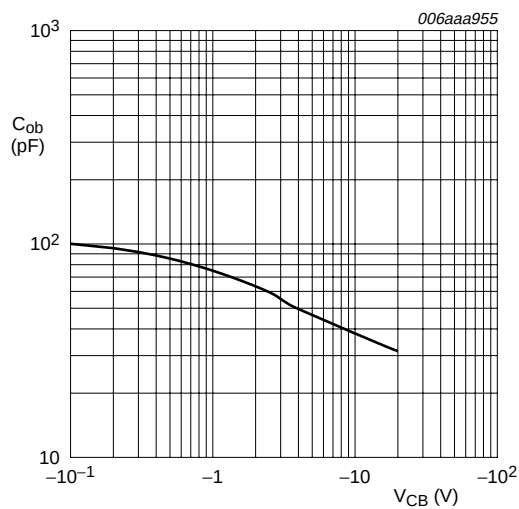
$T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $V_{CE} = -2\text{ V}$

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



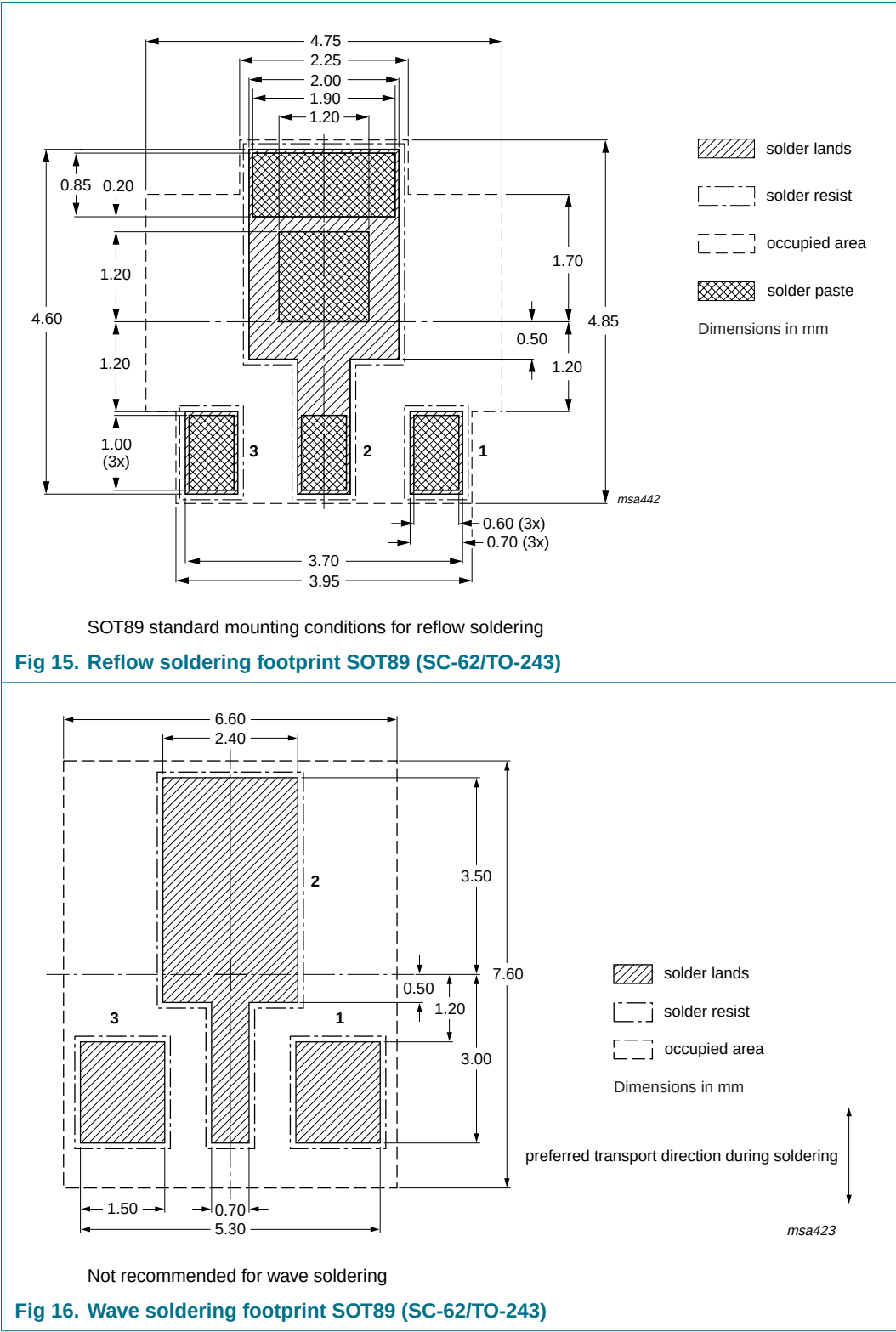
$T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $f = 1\text{ MHz}$ ;  $I_E = I_C = 0\text{ A}$

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".

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