



# PESD5V0S2BT

Low capacitance bidirectional double ESD protection diode

Rev. 03 — 9 February 2009

Product data sheet

## 1. Product profile

### 1.1 General description

Low capacitance bidirectional double ElectroStatic Discharge (ESD) protection diode in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package designed to protect two data lines from the damage caused by ESD and other transients.

### 1.2 Features

- Bidirectional ESD protection of two lines
- Low diode capacitance
- Max. peak pulse power:  $P_{PP} = 130 \text{ W}$  at  $t_p = 8/20 \mu\text{s}$
- Low clamping voltage:  $V_{CL} = 14 \text{ V}$  at  $I_{PP} = 12 \text{ A}$
- Ultra low leakage current:  $I_{RM} = 5 \text{ nA}$  at  $V_{RWM} = 5 \text{ V}$
- ESD protection up to 30 kV
- IEC 61000-4-2; level 4 (ESD)
- IEC 61000-4-5 (surge);  $I_{PP} = 12 \text{ A}$  at  $t_p = 8/20 \mu\text{s}$

### 1.3 Applications

- Cellular handsets and accessories
- Portable electronics
- Computers and peripherals
- Communication systems
- Audio and video equipment

### 1.4 Quick reference data

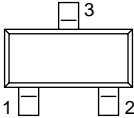
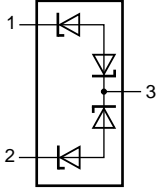
**Table 1. Quick reference data**

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

| Symbol    | Parameter                | Conditions                                  | Min | Typ | Max | Unit |
|-----------|--------------------------|---|-----|-----|-----|------|
| $V_{RWM}$ | reverse standoff voltage |   | -   | -   | 5   | V    |
| $C_d$     | diode capacitance        | $f = 1 \text{ MHz};$<br>$V_R = 0 \text{ V}$ | -   | 35  | 45  | pF   |

## 2. Pinning information

**Table 2. Pinning**

| Pin | Description    | Simplified outline   | Graphic symbol  |
|-----|----------------|--|---|
| 1   | cathode 1      |  | <br>sym031 |
| 2   | cathode 2      |  |   |
| 3   | double cathode |  |   |

## 3. Ordering information

**Table 3. Ordering information**

| Type number | Package |  |         |
|-------------|---------|--|---------|
|             | Name    | Description                              | Version |
| PESD5V0S2BT | -       | plastic surface-mounted package; 3 leads | SOT23   |

## 4. Marking

**Table 4. Marking**

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| PESD5V0S2BT | *G5                         |

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

## 5. Limiting values

**Table 5. Limiting values**

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

| Symbol           | Parameter            | Conditions               | Min    | Max  | Unit  |
|------------------|----------------------|--------------------------|--------|------|-------|
| <b>Per diode</b> |                      |                          |        |      |       |
| P <sub>PP</sub>  | peak pulse power     | t <sub>p</sub> = 8/20 μs | [1][2] | -    | 130 W |
| I <sub>PP</sub>  | peak pulse current   | t <sub>p</sub> = 8/20 μs | [1][2] | -    | 12 A  |
| 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] Non-repetitive current pulse 8/20 μs exponential decay waveform.

[2] Measured from pin 1 to 3 or pin 2 to 3.

**Table 6. ESD maximum ratings**

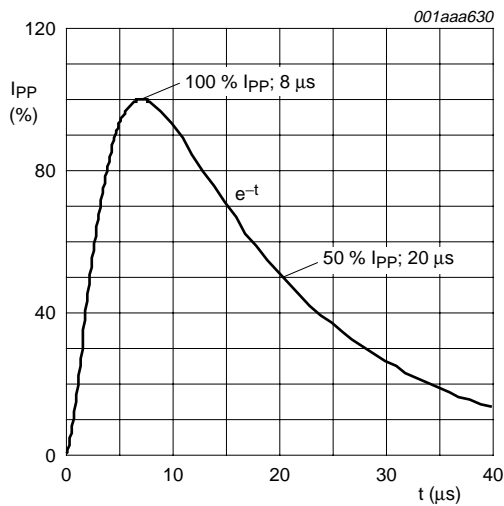
| Symbol    | Parameter                       | Conditions                        | Min      | Max | Unit |
|-----------|---------------------------------|-----------------------------------|----------|-----|------|
| $V_{ESD}$ | electrostatic discharge voltage | IEC 61000-4-2 (contact discharge) | [1][2] - | 30  | kV   |
|           |                                 | MIL-STD-883 (human body model)    | -        | 10  | kV   |

[1] Device stressed with ten non-repetitive ESD pulses.

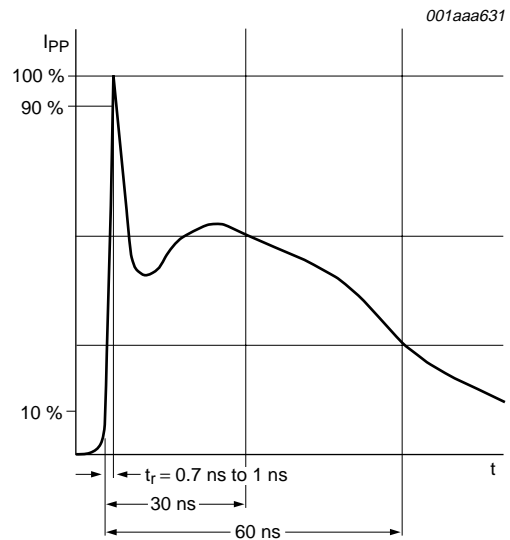
[2] Measured from pin 1 to 3 or pin 2 to 3.

**Table 7. ESD standards compliance**

| Standard                                | Conditions                      |
|---|---------------------------------|
| IEC 61000-4-2; level 4 (ESD)            | > 15 kV (air); > 8 kV (contact) |
| MIL-STD-883; class 3 (human body model) | > 4 kV                          |



**Fig 1. 8/20 μs pulse waveform according to IEC 61000-4-5**



**Fig 2. ESD pulse waveform according to IEC 61000-4-2**

6. Characteristics

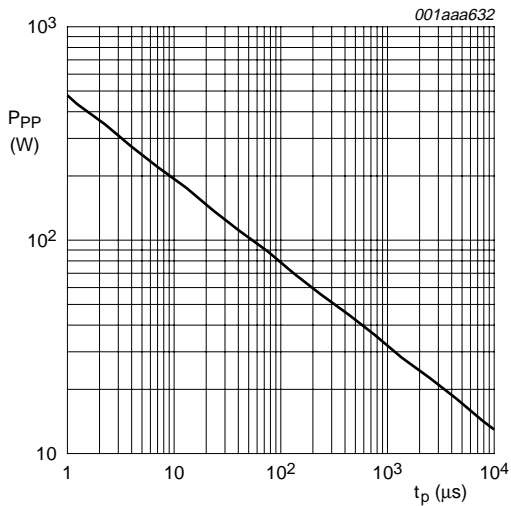
**Table 8. Electrical characteristics**

*T<sub>amb</sub> = 25 °C unless otherwise specified.*

| Symbol           | Parameter                | Conditions                      | Min    | Typ | Max | Unit |
|------------------|--------------------------|---------------------------------|--------|-----|-----|------|
| <b>Per diode</b> |                          |                                 |        |     |     |      |
| V <sub>RWM</sub> | reverse standoff voltage |                                 | -      | -   | 5   | V    |
| I <sub>RM</sub>  | reverse leakage current  | V <sub>RWM</sub> = 5 V          | -      | 5   | 100 | nA   |
| V <sub>CL</sub>  | clamping voltage         | I <sub>PP</sub> = 1 A           | [1][2] | -   | 10  | V    |
|                  |                          | I <sub>PP</sub> = 12 A          | [1][2] | -   | 14  | V    |
| V <sub>BR</sub>  | breakdown voltage        | I <sub>R</sub> = 1 mA           | 5.5    | -   | 9.5 | V    |
| r <sub>dif</sub> | differential resistance  | I <sub>R</sub> = 1 mA           | -      | -   | 50  | Ω    |
| C <sub>d</sub>   | diode capacitance        | f = 1 MHz; V <sub>R</sub> = 0 V | -      | 35  | 45  | pF   |

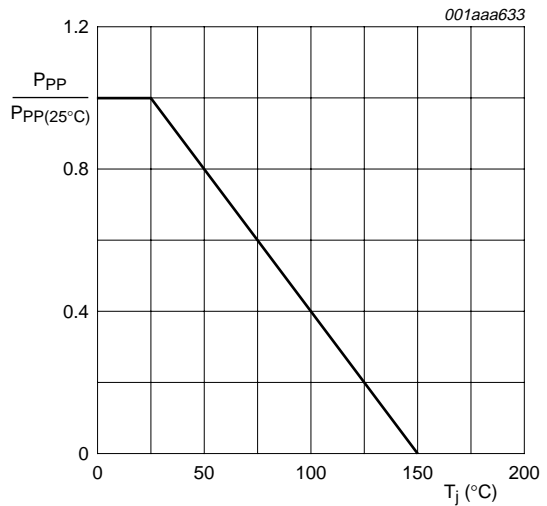
[1] Non-repetitive current pulse 8/20 μs exponential decay waveform.

[2] Measured from pin 1 to 3 or pin 2 to 3.

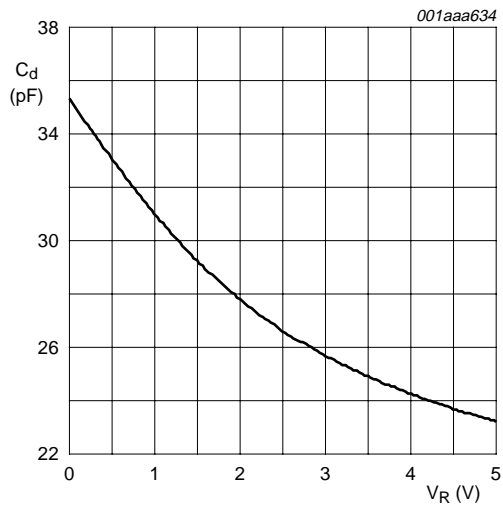


T<sub>amb</sub> = 25 °C  
t<sub>p</sub> = 8/20 μs exponential decay waveform

**Fig 3. Peak pulse power dissipation as a function of pulse duration; typical values**

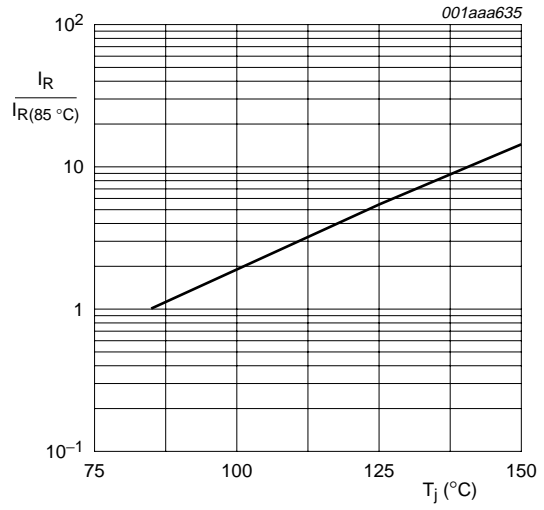


**Fig 4. Relative variation of peak pulse power as a function of junction temperature; typical values**



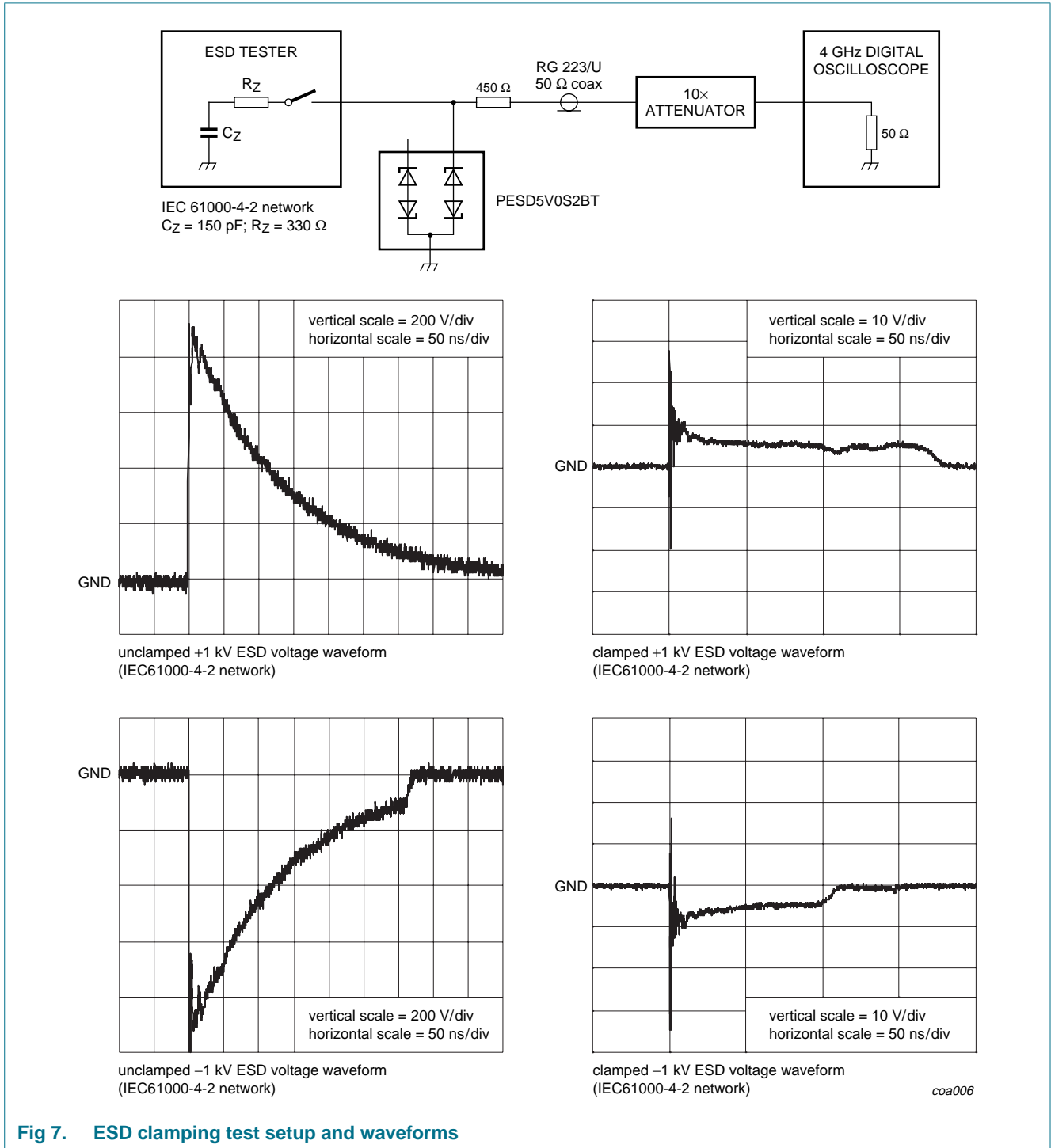
$T_{amb} = 25\text{ }^\circ\text{C}$ ;  $f = 1\text{ MHz}$

**Fig 5. Diode capacitance as a function of reverse voltage; typical values**



$I_R < 1\text{ nA}$  measured at  $T_{amb} = 25\text{ }^\circ\text{C}$

**Fig 6. Relative variation of reverse current as a function of junction temperature; typical values**

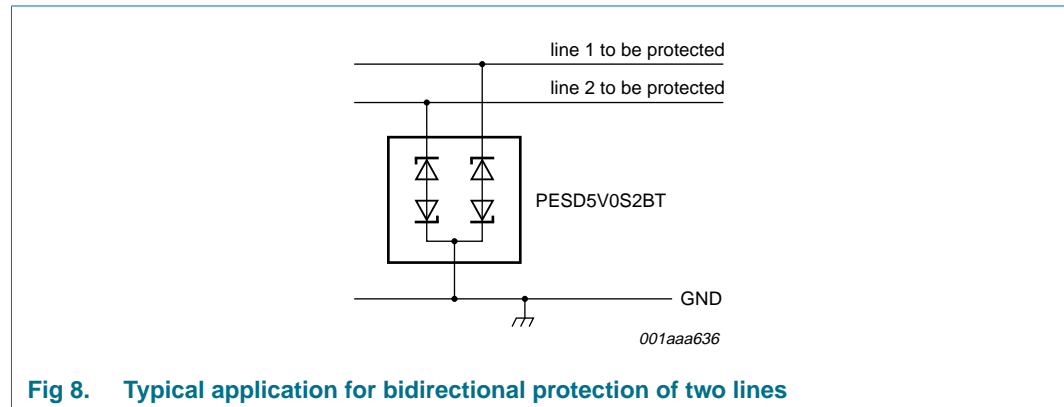


**Fig 7. ESD clamping test setup and waveforms**

## 7. Application information

The PESD5V0S2BT is designed for the bidirectional protection of two lines from the damage caused by ElectroStatic Discharge (ESD) and surge pulses.

The PESD5V0S2BT may be used on lines where the signal polarities are both, positive and negative with respect to ground. The PESD5V0S2BT provides a surge capability of 130 W per line for an 8/20  $\mu$ s waveform.



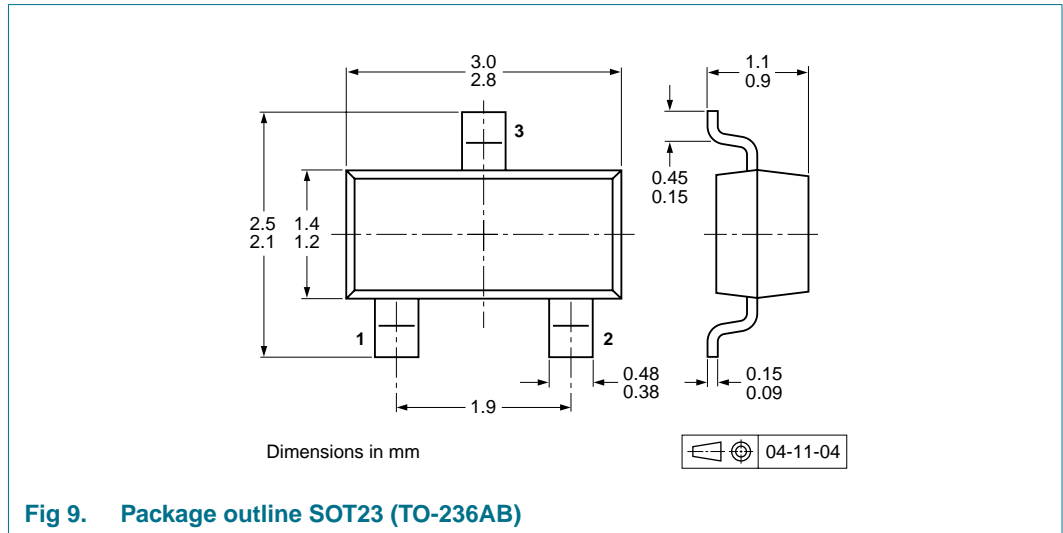
**Fig 8. Typical application for bidirectional protection of two lines**

### Circuit board layout and protection device placement:

Circuit board layout is critical for the suppression of ESD, Electrical Fast Transient (EFT) and surge transients. The following guidelines are recommended:

1. Place the PESD5V0S2BT as close to the input terminal or connector as possible.
2. The path length between the PESD5V0S2BT and the protected line should be minimized.
3. Keep parallel signal paths to a minimum.
4. Avoid running protected conductors in parallel with unprotected conductors.
5. Minimize all Printed-Circuit Board (PCB) conductive loops including power and ground loops.
6. Minimize the length of the transient return path to ground.
7. Avoid using shared transient return paths to a common ground point.
8. Ground planes should be used whenever possible. For multilayer PCBs, use ground vias.

## 8. Package outline



## 9. Packing information

**Table 9. Packing methods**

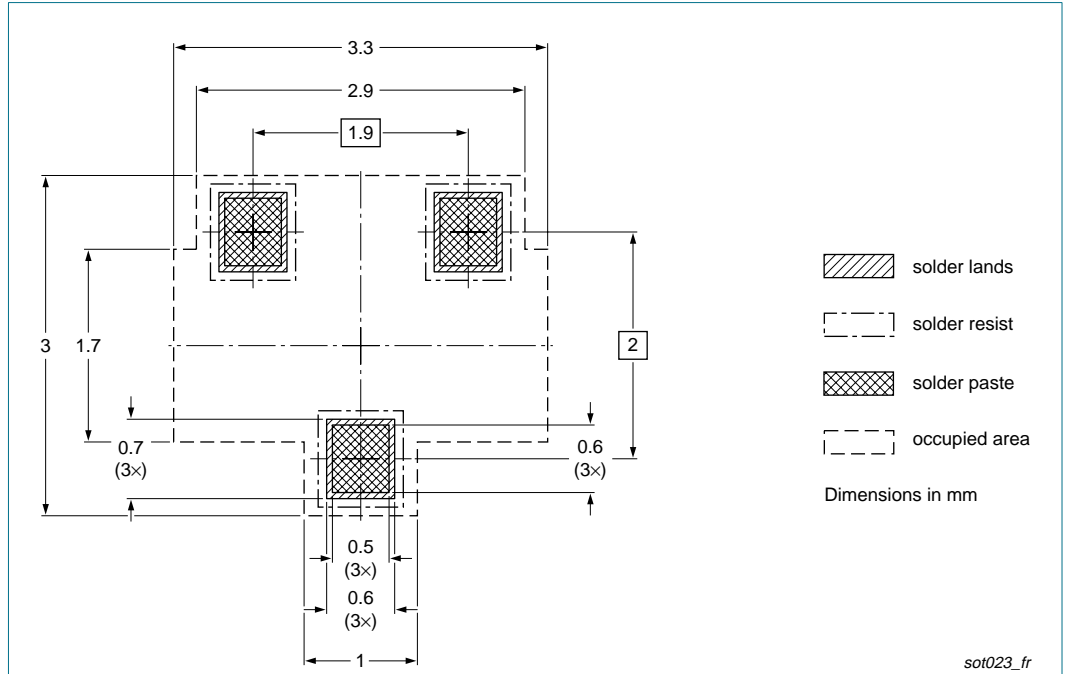
The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

| Type number | Package | Description                    | Packing quantity |       |
|-------------|---------|--------------------------------|------------------|-------|
|             |         |                                | 3000             | 10000 |
| PESD5V0S2BT | SOT23   | 4 mm pitch, 8 mm tape and reel | -215             | -235  |

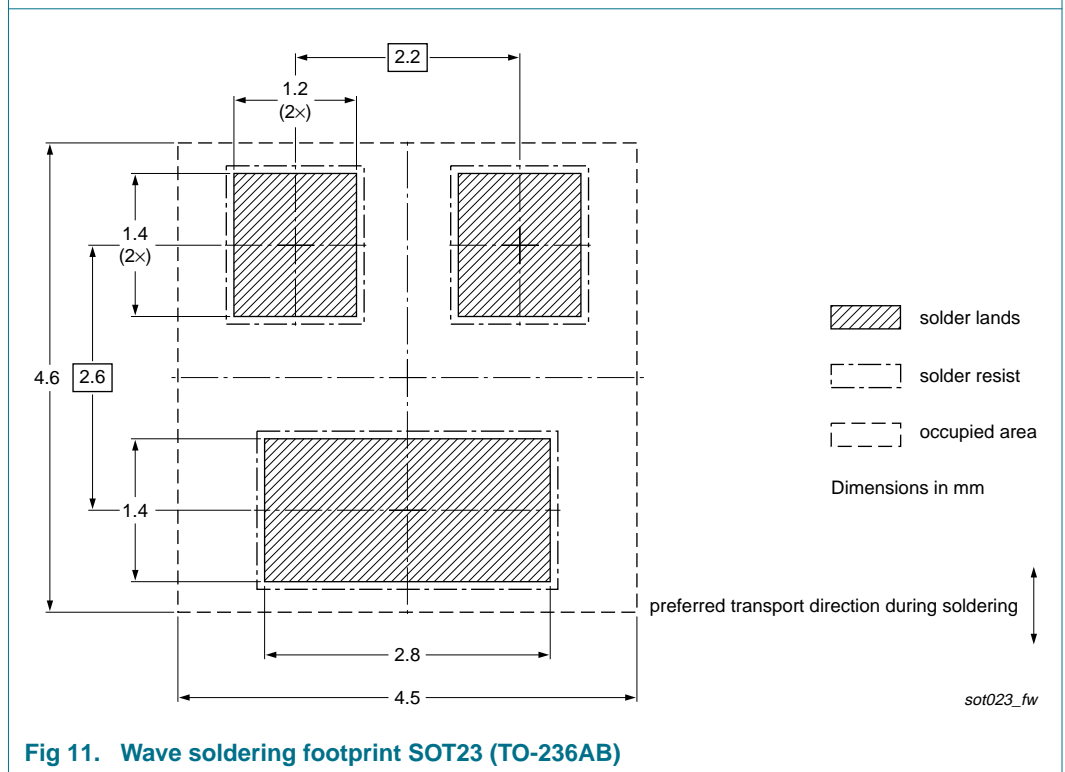
[1] For further information and the availability of packing methods, see [Section 13](#).



**10. Soldering**



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



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

## 11. Revision history

Table 10. Revision history

| Document ID    | Release date | Data sheet status   | Change notice | Supersedes    |
|----------------|--------------|---|---------------|---------------|
| PESD5V0S2BT_3  | 20090209     | Product data sheet  | -             | PESD5V0S2BT_2 |
| 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 6</a>: ESD electro static discharge capability redefined to <math>V_{ESD}</math> electrostatic discharge voltage</li> <li>• <a href="#">Table 8</a>: <math>V_{(CL)R}</math> clamping voltage redefined to <math>V_{CL}</math></li> <li>• <a href="#">Figure 4</a>: figure notes removed</li> <li>• <a href="#">Section 7 "Application information"</a>: updated</li> <li>• <a href="#">Figure 9</a>: superseded by minimized package outline drawing</li> <li>• <a href="#">Section 9 "Packing information"</a>: added</li> <li>• <a href="#">Section 10 "Soldering"</a>: added</li> <li>• <a href="#">Section 12 "Legal information"</a>: updated</li> </ul> |               |               |
| PESD5V0S2BT_2  | 20040527     | Product data sheet  | -             | PESD5V0S2BT_1 |
| PESD5V0S2BT_1  | 20040517     | 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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