

# PESD5V0L1BSF

Ultra low profile bidirectional low capacitance  
ESD protection diode

Rev. 1 — 18 February 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Low capacitance bidirectional ElectroStatic Discharge (ESD) protection diode in a SOD962 leadless ultra small Surface-Mounted Device (SMD) package designed to protect one signal line from the damage caused by ESD and other transients.

### 1.2 Features and benefits

- Pb-free, Restriction of Hazardous Substances (RoHS) compliant and free of halogen and antimony (Dark Green compliant)
- Bidirectional ESD protection of one line
- Low diode capacitance  $C_d = 12$  pF
- ESD protection up to  $\pm 30$  kV according to IEC 61000-4-2
- Ultra small SMD package
- Symmetrical breakdown voltage

### 1.3 Applications

- Cellular handsets and accessories
- Portable electronics
- Communication systems
- Computers and peripherals

### 1.4 Quick reference data

**Table 1. Quick reference data**

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

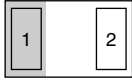
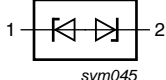
| Symbol    | Parameter                | Conditions               | Min                   | Typ | Max  | Unit |
|-----------|--------------------------|--------------------------|-----------------------|-----|------|------|
| $V_{RWM}$ | reverse standoff voltage |                          | -5                    | -   | 5    | V    |
| $C_d$     | diode capacitance        | $f = 1$ MHz; $V_R = 0$ V | <a href="#">[1]</a> 9 | 12  | 15.4 | pF   |

[1] This parameter is guaranteed by design.



## 2. Pinning information

**Table 2. Pinning**

| Pin | Description       | Simplified outline   | Graphic symbol  |
|-----|-------------------|--|---|
| 1   | cathode (diode 1) |  <p>Transparent top view</p> |  <p>sym045</p> |
| 2   | cathode (diode 2) |  |   |

## 3. Ordering information

**Table 3. Ordering information**

| Type number    | Package |  |         |
|----------------|---------|--|---------|
|                | Name    | Description  | Version |
| PESD5V0L1BSF - |         | leadless ultra small package; 2 terminals; body 0.6 × 0.3 × 0.3 mm | SOD962  |

## 4. Marking

**Table 4. Marking codes**

| Type number  | Marking code |
|--------------|--------------|
| PESD5V0L1BSF | none         |

## 5. Limiting values

**Table 5. Limiting values**

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

| Symbol    | Parameter            | Conditions         | Min      | Max  | Unit |
|-----------|----------------------|--------------------|----------|------|------|
| $P_{PP}$  | peak pulse power     | $t_p = 8/20 \mu s$ | [1][2] - | 35   | W    |
| $I_{PP}$  | peak pulse current   | $t_p = 8/20 \mu s$ | [1][2] - | 3    | A    |
| $T_j$     | junction temperature |                    | -        | 150  | °C   |
| $T_{amb}$ | ambient temperature  |                    | -55      | +150 | °C   |
| $T_{stg}$ | storage temperature  |                    | -65      | +150 | °C   |

[1] Non-repetitive current pulse 8/20  $\mu s$  exponentially decaying waveform according to IEC 61000-4-5; see [Figure 1](#).

[2] Measured from pin 1 to pin 2.

**Table 6. ESD maximum ratings**

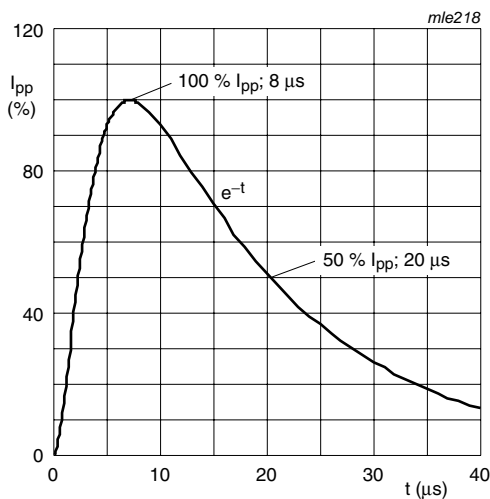
| Symbol    | Parameter                       | Conditions                        | Min      | Max | Unit |
|-----------|---------------------------------|-----------------------------------|----------|-----|------|
| $V_{ESD}$ | electrostatic discharge voltage | IEC 61000-4-2 (contact discharge) | [1][2]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

[1] Measured from pin 1 to pin 2.

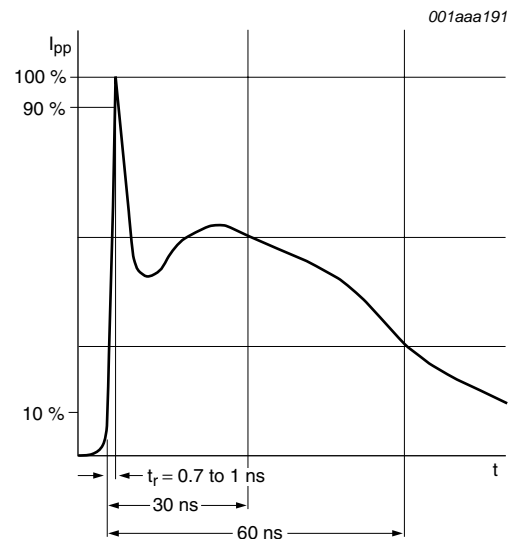
[2] Device stressed with ten non-repetitive ESD pulses; see [Figure 2](#).

**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  $\mu$ s pulse waveform according to IEC 61000-4-5**



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

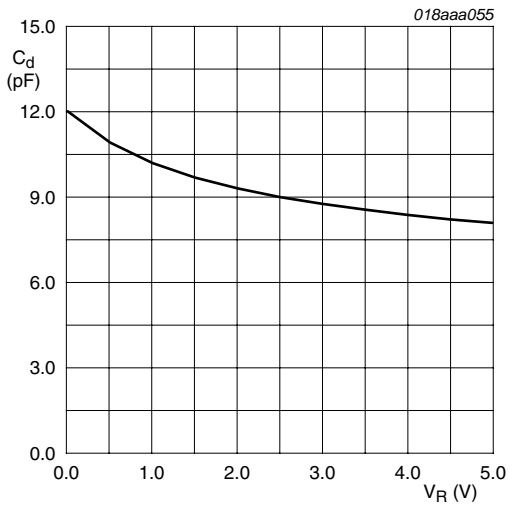
## 6. Characteristics

**Table 8. Characteristics**

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

| Symbol           | Parameter                | Conditions             | Min    | Typ | Max  | Unit |          |
|------------------|--------------------------|------------------------|--------|-----|------|------|----------|
| <b>Per diode</b> |                          |                        |        |     |      |      |          |
| $V_{RWM}$        | reverse standoff voltage |                        | -5     | -   | 5    | V    |          |
| $I_{RM}$         | reverse leakage current  | $V_{RWM} = 5\text{ V}$ | -      | 1   | 100  | nA   |          |
| $V_{CL}$         | clamping voltage         | $I_{PP} = 1\text{ A}$  | [1][2] | -   | -    | 11.5 | V        |
|                  |                          | $I_{PP} = 3\text{ A}$  | [1][2] | -   | -    | 13.5 | V        |
| $V_{BR}$         | breakdown voltage        | $I_R = 1\text{ mA}$    | [3]    | 6   | -    | 10   | V        |
|                  |                          | $I_R = -1\text{ mA}$   | [3]    | -10 | -    | -6   | V        |
| $C_d$            | diode capacitance        | $f = 1\text{ MHz}$     | [4]    |     |      |      |          |
|                  |                          | $V_R = 0\text{ V}$     |        | 9   | 12   | 15.4 | pF       |
|                  |                          | $V_R = 2.5\text{ V}$   |        | -   | 8.9  | 11.4 | pF       |
|                  |                          | $V_R = 5\text{ V}$     |        | -   | 8    | 10.2 | pF       |
| $L_S$            | series inductance        |                        | [5]    | -   | 0.05 | -    | nH       |
| $R_{dyn}$        | dynamic resistance       |                        | [6]    | -   | 1    | -    | $\Omega$ |

- [1] Non-repetitive current pulse 8/20  $\mu\text{s}$  exponentially decaying waveform according to IEC 61000-4-5; see [Figure 1](#).
- [2] Measured from pin 1 to pin 2.
- [3] Breakdown voltage is always symmetrical within the characterized range, which means no difference in breakdown voltage from pin 1 to pin 2 and vice versa.
- [4] This parameter is guaranteed by design.
- [5] Calculated from S-parameter values.
- [6] Non-repetitive current pulse, Transmission Line Pulse (TLP)  $t_p = 100\text{ ns}$ ; square pulse; ANS/IESD STM5.1-2008.



f = 1 MHz; T<sub>amb</sub> = 25 °C

Fig 3. Diode capacitance as a function of reverse voltage; typical values

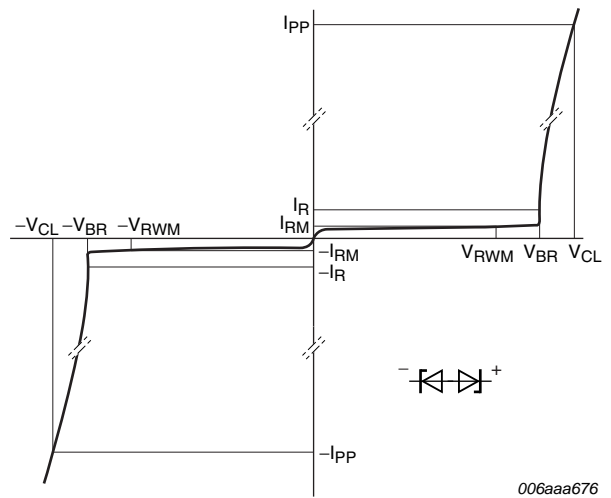


Fig 4. V-I characteristics for a bidirectional ESD protection diode

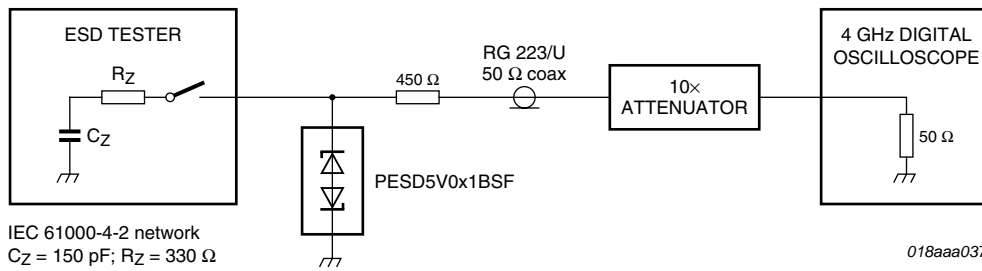
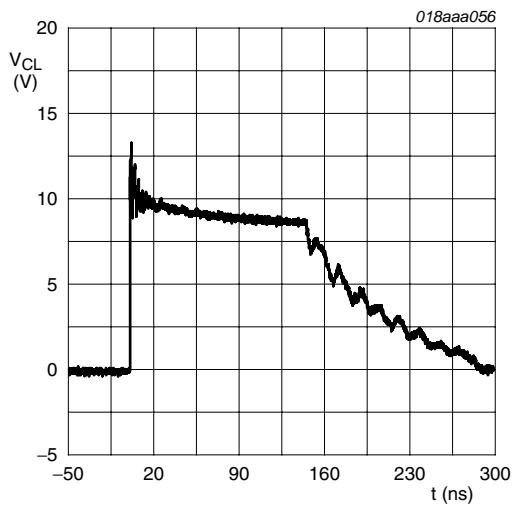
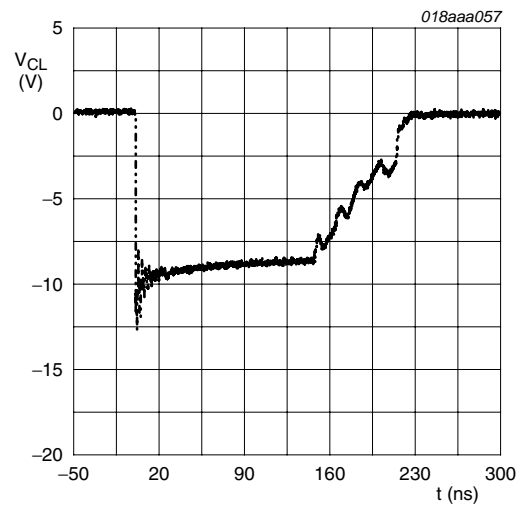


Fig 5. ESD clamping test setup



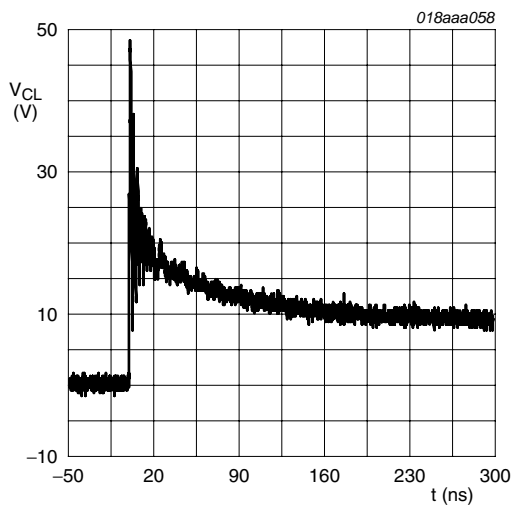
$f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig 6. Clamped +1 kV ESD pulse waveform (IEC 61000-4-2 network)**



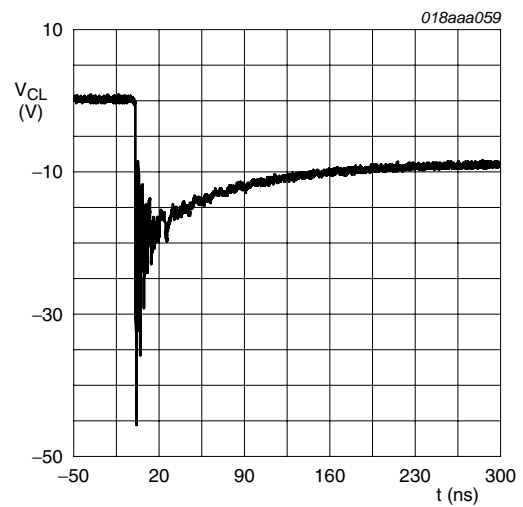
$f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig 7. Clamped -1 kV ESD pulse waveform (IEC 61000-4-2 network)**



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

**Fig 8. Clamped +8 kV ESD pulse waveform (IEC 61000-4-2 network)**



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

**Fig 9. Clamped -8 kV ESD pulse waveform (IEC 61000-4-2 network)**

## 7. Application information

The PESD5V0L1BSF is designed for the protection of one data or signal line from the damage caused by ESD and/or other surge pulses. The device may be used on lines where the signal polarities are both, positive and negative with respect to ground. It provides protection against surges with up to 35 W per line.

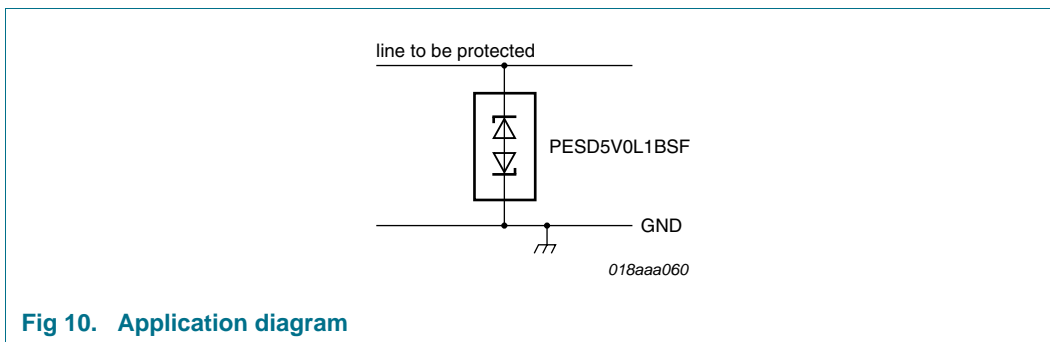


Fig 10. Application diagram

### Circuit board layout and protection device placement

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

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

## 8. Package outline

Leadless ultra small package; 2 terminals; body 0.6 x 0.3 x 0.3 mm

SOD962

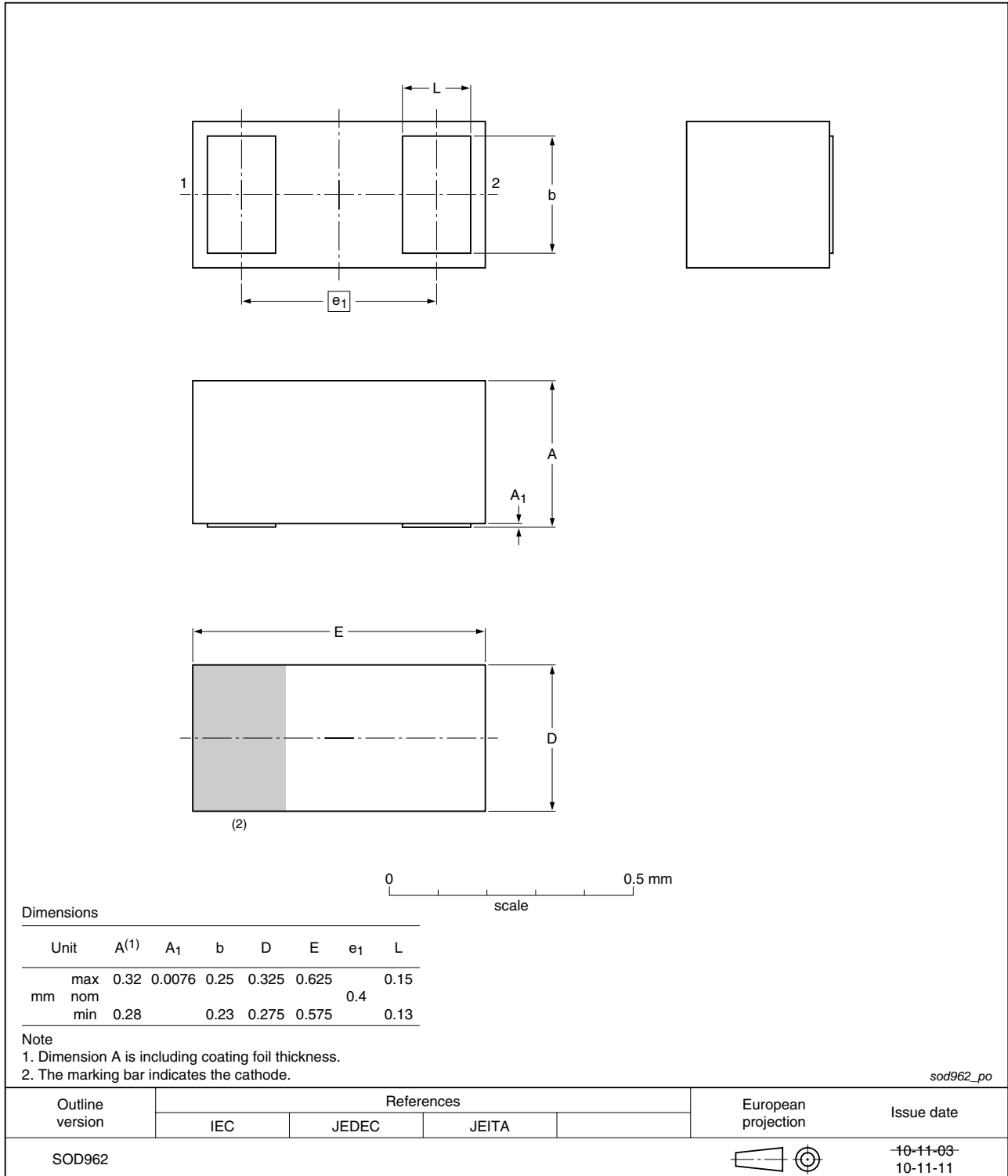


Fig 11. Package outline PESD5V0L1BSF (SOD962)



## 9. Packing information

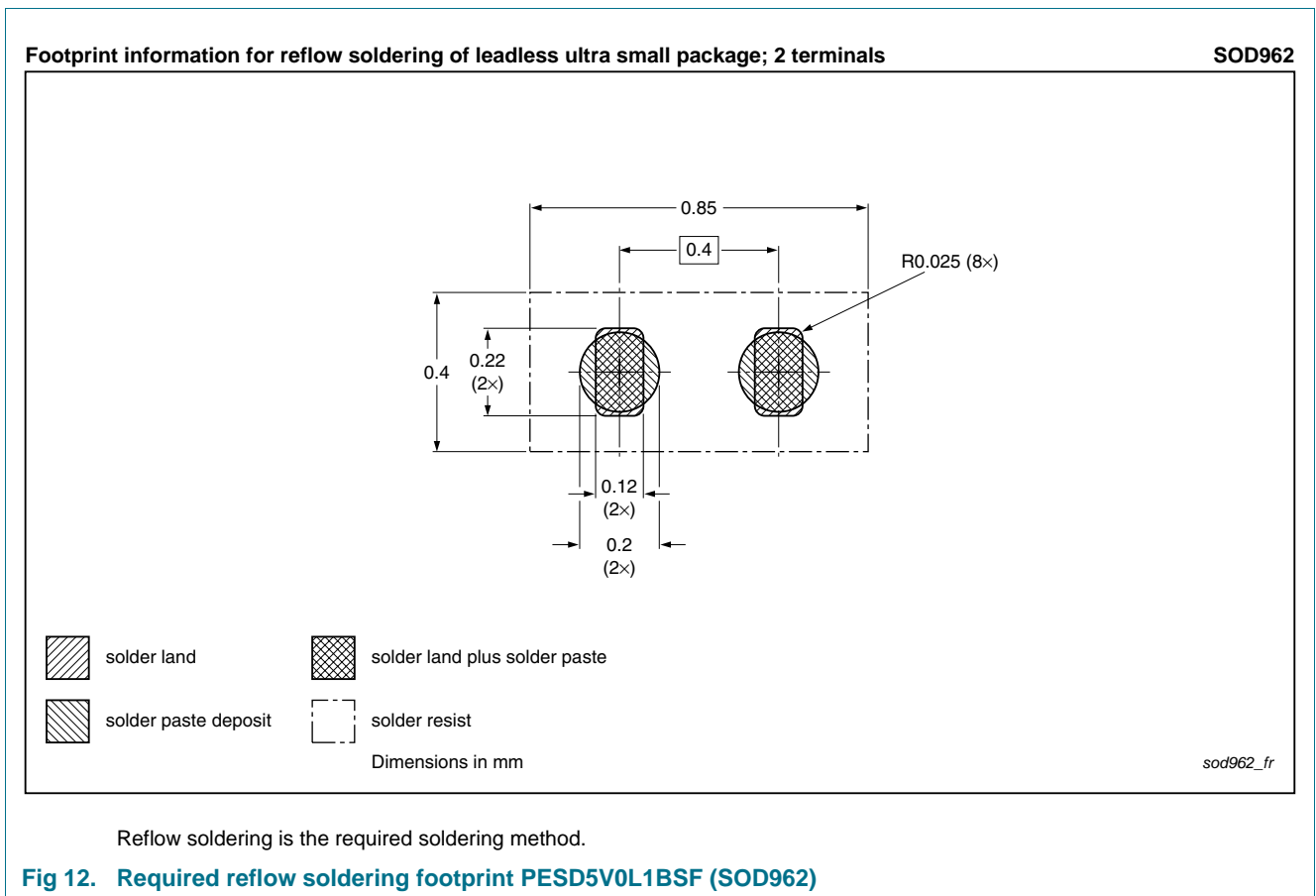
**Table 9. Packing methods**

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

| Type number  | Package | Description                    | Packing quantity |
|--------------|---------|--------------------------------|------------------|
|              |         |                                | <b>9000</b>      |
| PESD5V0L1BSF | SOD962  | 2 mm pitch, 8 mm tape and reel | -315             |

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

## 10. Soldering



Based on results of board mount testing, NXP Semiconductors requires the following soldering guidelines:

1. Soldering footprint as indicated in [Figure 12](#): solder paste has to cover the whole solder land area.
2. Non-solder mask defined (copper-defined) solder lands.
3. Minimum stencil thickness of 100  $\mu\text{m}$ .
4. Paste type 4 or smaller sphere size.
5. Pick and placement accuracy of  $\pm 50 \mu\text{m}$ .

## 11. Revision history

Table 10. Revision history

| Document ID      | Release date | Data sheet status  | Change notice | Supersedes |
|------------------|--------------|--------------------|---------------|------------|
| PESD5V0L1BSF v.1 | 20110218     | Product data sheet | -             | -          |

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|-----------------------------------|-------------------------------|---|
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| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
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## 14. Contents

|           |  |           |
|-----------|--|-----------|
| <b>1</b>  | <b>Product profile</b> . . . . .         | <b>1</b>  |
| 1.1       | General description . . . . .            | 1         |
| 1.2       | Features and benefits . . . . .          | 1         |
| 1.3       | Applications . . . . .                   | 1         |
| 1.4       | Quick reference data . . . . .           | 1         |
| <b>2</b>  | <b>Pinning information</b> . . . . .     | <b>2</b>  |
| <b>3</b>  | <b>Ordering information</b> . . . . .    | <b>2</b>  |
| <b>4</b>  | <b>Marking</b> . . . . .                 | <b>2</b>  |
| <b>5</b>  | <b>Limiting values</b> . . . . .         | <b>2</b>  |
| <b>6</b>  | <b>Characteristics</b> . . . . .         | <b>4</b>  |
| <b>7</b>  | <b>Application information</b> . . . . . | <b>7</b>  |
| <b>8</b>  | <b>Package outline</b> . . . . .         | <b>8</b>  |
| <b>9</b>  | <b>Packing information</b> . . . . .     | <b>9</b>  |
| <b>10</b> | <b>Soldering</b> . . . . .               | <b>9</b>  |
| <b>11</b> | <b>Revision history</b> . . . . .        | <b>10</b> |
| <b>12</b> | <b>Legal information</b> . . . . .       | <b>11</b> |
| 12.1      | Data sheet status . . . . .              | 11        |
| 12.2      | Definitions . . . . .                    | 11        |
| 12.3      | Disclaimers . . . . .                    | 11        |
| 12.4      | Trademarks . . . . .                     | 12        |
| <b>13</b> | <b>Contact information</b> . . . . .     | <b>12</b> |
| <b>14</b> | <b>Contents</b> . . . . .                | <b>13</b> |

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Date of release: 18 February 2011

Document identifier: PESD5V0L1BSF