# THE DATASHEET OF

# PESD24VS5UD,115

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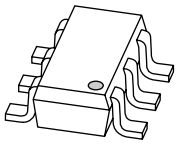

# PESDxS5UD series

## Fivefold ESD protection diode arrays

Rev. 02 — 7 December 2006 Product data sheet

## 1. Product profile

### 1.1 General description

Fivefold ElectroStatic Discharge (ESD) protection diode arrays in a SOT457 (SC-74) small Surface-Mounted Device (SMD) plastic package designed to protect up to five signal lines from the damage caused by ESD and other transients.

### 1.2 Features

- ESD protection of up to five lines
- Max. peak pulse power: $P_{PP}$ = 200 W
- Ultra low leakage current: $I_{RM}$ = 50 pA
- Low clamping voltage: $V_{CL}$ = 12 V at $I_{PP}$ = 20 A
- ESD protection up to 30 kV
- IEC 61000-4-2; level 4 (ESD)
- IEC 61000-4-5 (surge); $I_{PP}$ up to 20 A

### 1.3 Applications

- Computers and peripherals
- Audio and video equipment
- Cellular handsets and accessories
- Communication systems
- Portable electronics
- Subscriber Identity Module (SIM) card protection

### 1.4 Quick reference data

**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Per diode** | | | | | | |
| $V_{RWM}$ | reverse standoff voltage | | | | | |
| | PESD3V3S5UD | | - | - | 3.3 | V |
| | PESD5V0S5UD | | - | - | 5 | V |
| | PESD12VS5UD | | - | - | 12 | V |
| | PESD15VS5UD | | - | - | 15 | V |
| | PESD24VS5UD | | - | - | 24 | V |

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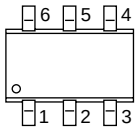
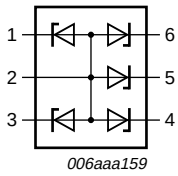
**Table 1. Quick reference data** *...continued*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $C_d$ | diode capacitance | f = 1 MHz; $V_R$ = 0 V | | | | |
| | PESD3V3S5UD | | - | 215 | 300 | pF |
| | PESD5V0S5UD | | - | 165 | 220 | pF |
| | PESD12VS5UD | | - | 73 | 100 | pF |
| | PESD15VS5UD | | - | 60 | 90 | pF |
| | PESD24VS5UD | | - | 45 | 70 | pF |

## 2. Pinning information

**Table 2. Pinning**

| Pin | Description | Simplified outline | Symbol |
|---|---|---|---|
| 1 | cathode 1 |   |   |
| 2 | common anode | | |
| 3 | cathode 2 | | |
| 4 | cathode 3 | | |
| 5 | cathode 4 | | |
| 6 | cathode 5 | | |

## 3. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PESD3V3S5UD | SC-74 | plastic surface-mounted package (TSOP6); 6 leads | SOT457 |
| PESD5V0S5UD | | | |
| PESD12VS5UD | | | |
| PESD15VS5UD | | | |
| PESD24VS5UD | | | |

## 4. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| PESD3V3S5UD | E1 |
| PESD5V0S5UD | E2 |
| PESD12VS5UD | E3 |
| PESD15VS5UD | E4 |
| PESD24VS5UD | E5 |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## 5. Limiting values

**Table 5. Limiting values**

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| **Per diode** | | | | | | |
| $P_{PP}$ | peak pulse power | $t_p$ = 8/20 µs | [1][2] | - | 200 | W |
| $I_{PP}$ | peak pulse current | $t_p$ = 8/20 µs | [1][2] | | | |
| | PESD3V3S5UD | | | - | 20 | A |
| | PESD5V0S5UD | | | - | 20 | A |
| | PESD12VS5UD | | | - | 10 | A |
| | PESD15VS5UD | | | - | 6 | A |
| | PESD24VS5UD | | | - | 4 | A |
| **Per device** | | | | | | |
| $T_j$ | junction temperature | | | - | 150 | °C |
| $T_{amb}$ | ambient temperature | | | –65 | +150 | °C |
| $T_{stg}$ | storage temperature | | | –65 | +150 | °C |

[1] Non-repetitive current pulse 8/20 µs exponential decay waveform according to IEC 61000-4-5.

[2] Measured from pin 1, 3, 4, 5 or 6 to 2.

**Table 6. ESD maximum ratings**

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| **Per diode** | | | | | | |
| $V_{ESD}$ | electrostatic discharge voltage | IEC 61000-4-2 (contact discharge) | [1][2] | | | |
| | PESD3V3S5UD | | | - | 30 | kV |
| | PESD5V0S5UD | | | - | 30 | kV |
| | PESD12VS5UD | | | - | 30 | kV |
| | PESD15VS5UD | | | - | 30 | kV |
| | PESD24VS5UD | | | - | 23 | kV |
| | PESDxS5UD series | MIL-STD-883 (human body model) | | - | 10 | kV |

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

[2] Measured from pin 1, 3, 4, 5 or 6 to 2.

**Table 7. ESD standards compliance**

| Standard | Conditions |
|---|---|
| **Per diode** | |
| IEC 61000-4-2; level 4 (ESD) | > 15 kV (air); > 8 kV (contact) |
| MIL-STD-883; class 3 (human body model) | > 10 kV |


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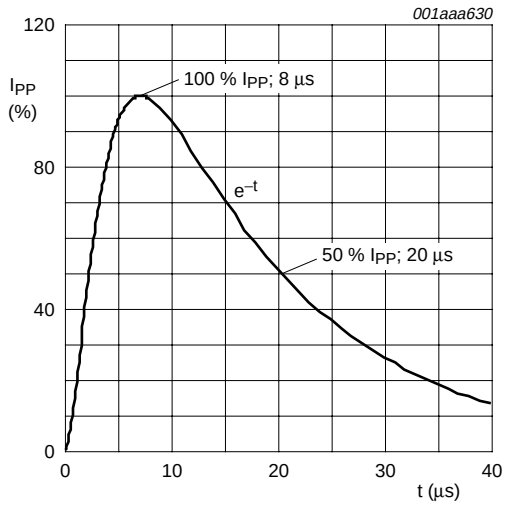


**Fig 1. 8/20 µs pulse waveform according to IEC 61000-4-5**

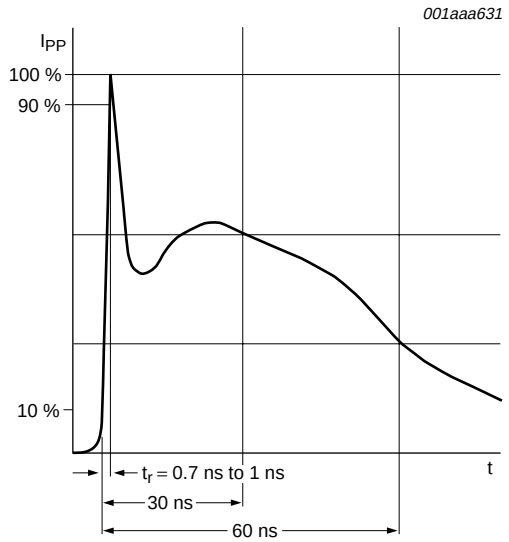


**Fig 2. ESD pulse waveform according to IEC 61000-4-2**

## 6. Characteristics

**Table 8. Characteristics**

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Per diode** | | | | | | |
| $V_{RWM}$ | reverse standoff voltage | | | | | |
| | PESD3V3S5UD | | - | - | 3.3 | V |
| | PESD5V0S5UD | | - | - | 5 | V |
| | PESD12VS5UD | | - | - | 12 | V |
| | PESD15VS5UD | | - | - | 15 | V |
| | PESD24VS5UD | | - | - | 24 | V |
| $I_{RM}$ | reverse leakage current | | | | | |
| | PESD3V3S5UD | $V_{RWM}$ = 3.3 V | - | 300 | 800 | nA |
| | PESD5V0S5UD | $V_{RWM}$ = 5 V | - | 80 | 200 | nA |
| | PESD12VS5UD | $V_{RWM}$ = 12 V | - | 0.05 | 15 | nA |
| | PESD15VS5UD | $V_{RWM}$ = 15 V | - | 0.05 | 15 | nA |
| | PESD24VS5UD | $V_{RWM}$ = 24 V | - | 0.05 | 15 | nA |
| $V_{BR}$ | breakdown voltage | $I_R$ = 1 mA | | | | |
| | PESD3V3S5UD | | 5.3 | 5.6 | 5.9 | V |
| | PESD5V0S5UD | | 6.4 | 6.8 | 7.2 | V |
| | PESD12VS5UD | | 12.5 | 14.5 | 16 | V |
| | PESD15VS5UD | | 17 | 18 | 19 | V |
| | PESD24VS5UD | | 25.5 | 27 | 29 | V |


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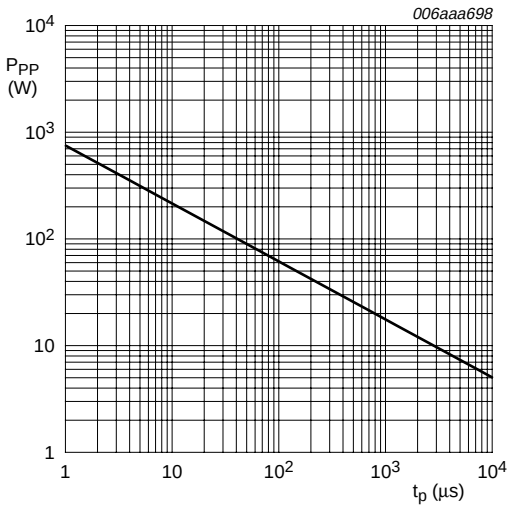
**Table 8. Characteristics** *...continued*

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

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $C_d$ | diode capacitance | f = 1 MHz; $V_R$ = 0 V | | | | | |
| | PESD3V3S5UD | | | - | 215 | 300 | pF |
| | PESD5V0S5UD | | | - | 165 | 220 | pF |
| | PESD12VS5UD | | | - | 73 | 100 | pF |
| | PESD15VS5UD | | | - | 60 | 90 | pF |
| | PESD24VS5UD | | | - | 45 | 70 | pF |
| $V_{CL}$ | clamping voltage | | [1][2] | | | | |
| | PESD3V3S5UD | $I_{PP}$ = 1 A | | - | - | 8 | V |
| | | $I_{PP}$ = 20 A | | - | - | 12 | V |
| | PESD5V0S5UD | $I_{PP}$ = 1 A | | - | - | 8 | V |
| | | $I_{PP}$ = 20 A | | - | - | 13 | V |
| | PESD12VS5UD | $I_{PP}$ = 1 A | | - | - | 17 | V |
| | | $I_{PP}$ = 10 A | | - | - | 24 | V |
| | PESD15VS5UD | $I_{PP}$ = 1 A | | - | - | 22 | V |
| | | $I_{PP}$ = 6 A | | - | - | 33 | V |
| | PESD24VS5UD | $I_{PP}$ = 1 A | | - | - | 33 | V |
| | | $I_{PP}$ = 4 A | | - | - | 52 | V |
| $r_{dif}$ | differential resistance | $I_R$ = 5 mA | | - | - | 25 | Ω |

[1] Non-repetitive current pulse 8/20 µs exponential decay waveform according to IEC 61000-4-5.

[2] Measured from pin 1, 3, 4, 5 or 6 to 2.




$T_{amb}$ = 25 °C

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

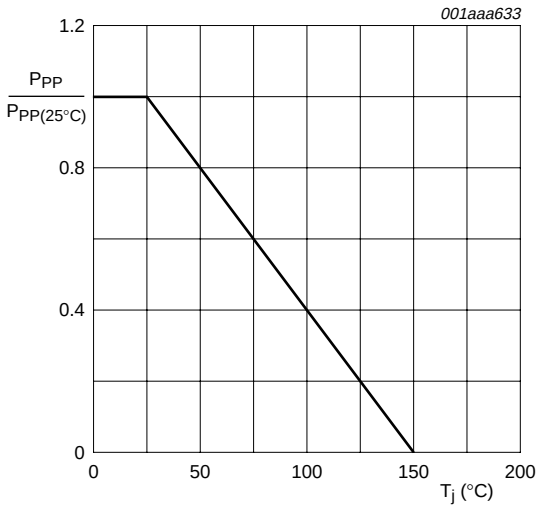



**Fig 4. Relative variation of peak pulse power as a function of junction temperature; typical values**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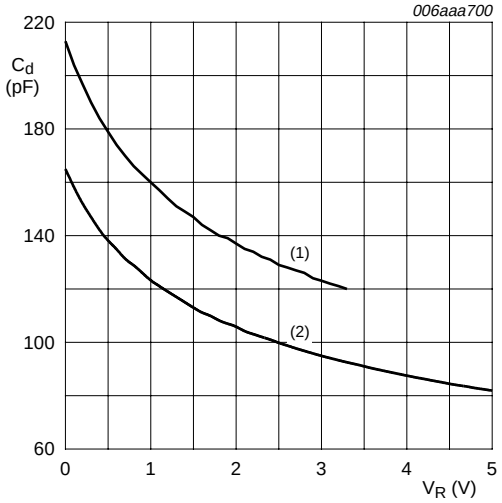
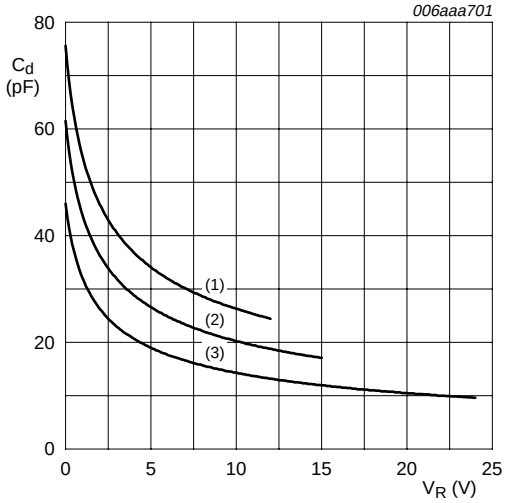



f = 1 MHz; $T_{amb}$ = 25 °C

(1) PESD3V3S5UD

(2) PESD5V0S5UD

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



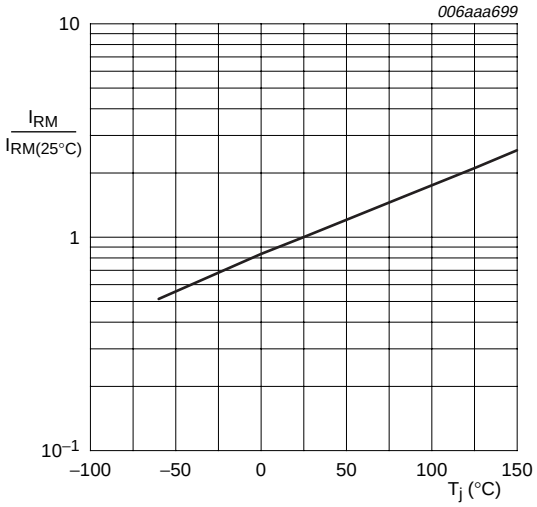

f = 1 MHz; $T_{amb}$ = 25 °C

(1) PESD12VS5UD

(2) PESD15VS5UD

(3) PESD24VS5UD

**Fig 6. Diode capacitance as a function of reverse voltage; typical values**




PESD3V3S5UD; PESD5V0S5UD

$I_R$ is less than 5 nA at 150 °C for:

PESD12VS5UD; PESD15VS5UD; PESD24VS5UD

**Fig 7. Relative variation of reverse leakage current as a function of junction temperature; typical values**

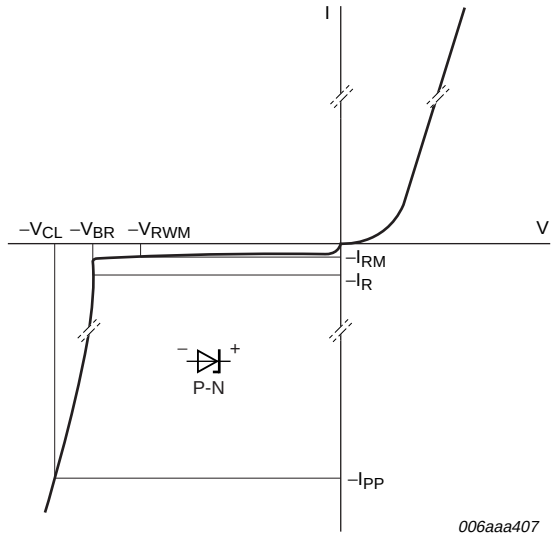



**Fig 8. V-I characteristics for a unidirectional ESD protection diode**



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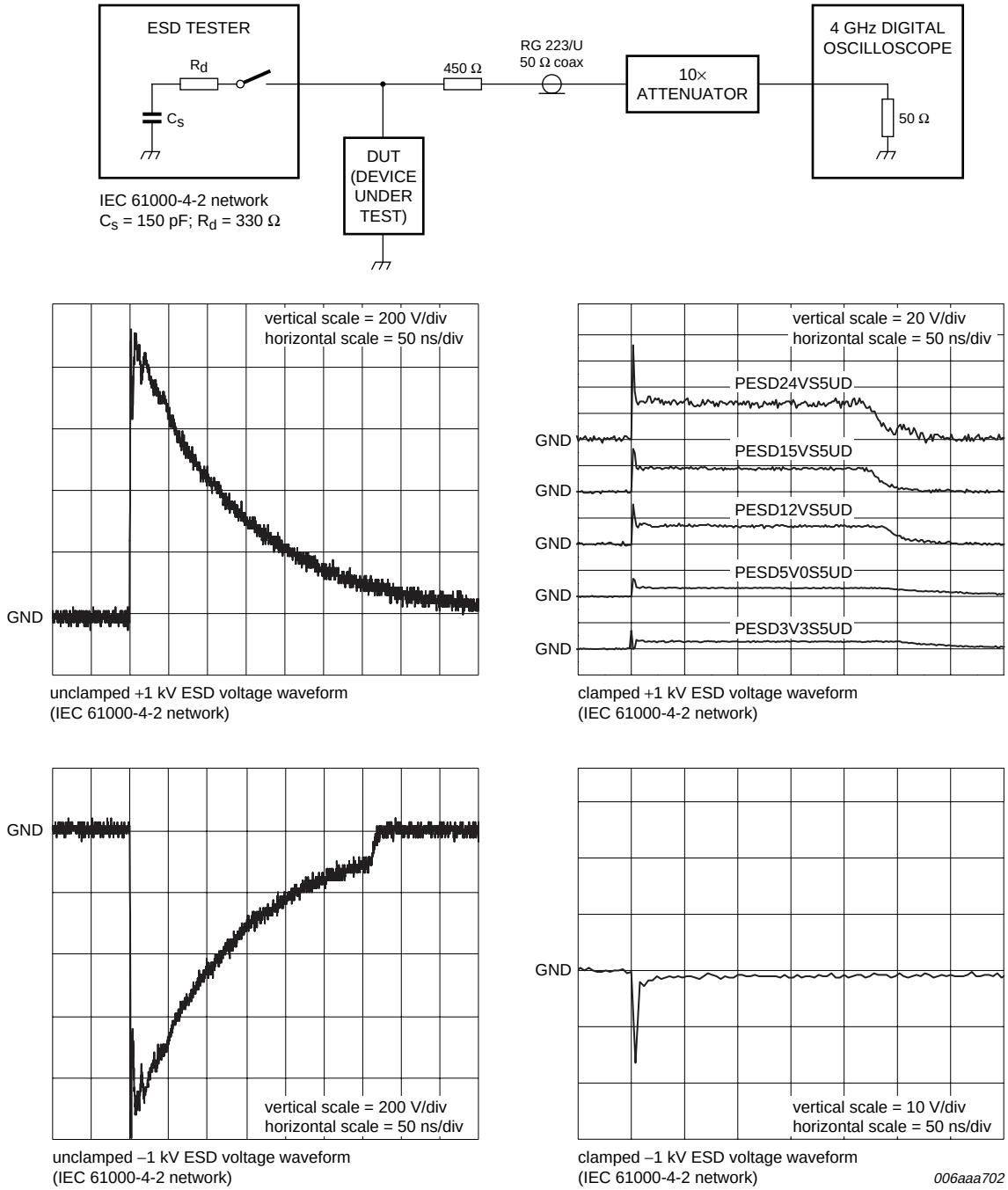


**Fig 9. ESD clamping test setup and waveforms**


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## 7. Application information

The PESDxS5UD series is designed for the protection of up to five unidirectional data lines from the damage caused by ESD and surge pulses. The PESDxS5UD series may be used on lines where the signal polarities are both, positive and negative with respect to ground. The PESDxS5UD series provides a surge capability of 200 W per line for an 8/20 µs waveform.

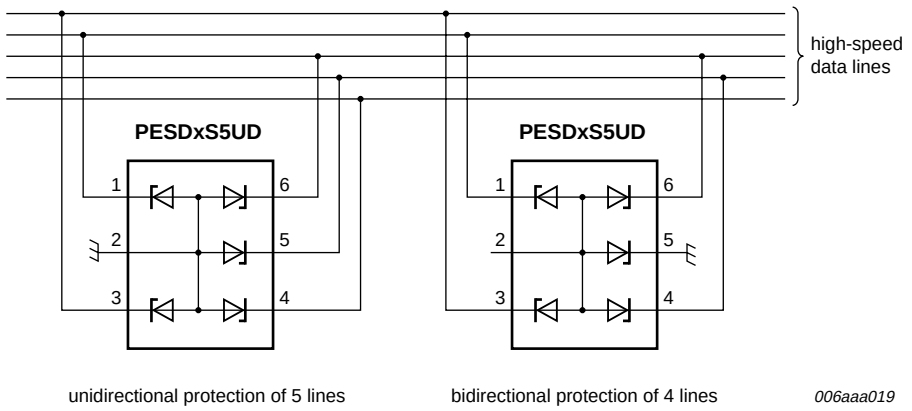


**Fig 10. Application diagram**

**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 PESDxS5UD as close to the input terminal or connector as possible.
2. The path length between the PESDxS5UD 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.


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## 8. Package outline

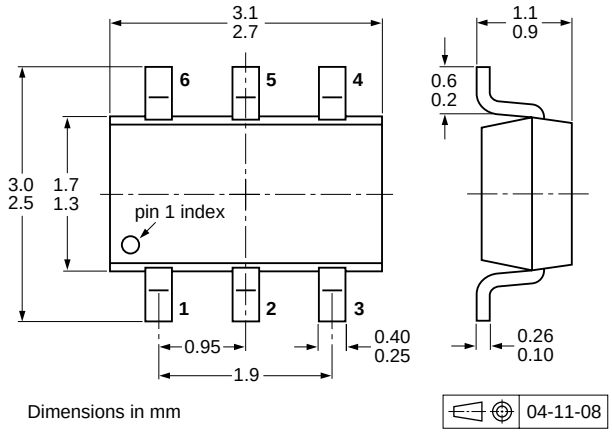


**Fig 11. Package outline SOT457 (SC-74)**

## 9. 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 |
| PESD3V3S5UD | SOT457 | 4 mm pitch, 8 mm tape and reel; T1 | [2] | -115 | -135 |
| | | 4 mm pitch, 8 mm tape and reel; T2 | [3] | -125 | -165 |
| PESD5V0S5UD | SOT457 | 4 mm pitch, 8 mm tape and reel; T1 | [2] | -115 | -135 |
| | | 4 mm pitch, 8 mm tape and reel; T2 | [3] | -125 | -165 |
| PESD12VS5UD | SOT457 | 4 mm pitch, 8 mm tape and reel; T1 | [2] | -115 | -135 |
| | | 4 mm pitch, 8 mm tape and reel; T2 | [3] | -125 | -165 |
| PESD15VS5UD | SOT457 | 4 mm pitch, 8 mm tape and reel; T1 | [2] | -115 | -135 |
| | | 4 mm pitch, 8 mm tape and reel; T2 | [3] | -125 | -165 |
| PESD24VS5UD | SOT457 | 4 mm pitch, 8 mm tape and reel; T1 | [2] | -115 | -135 |
| | | 4 mm pitch, 8 mm tape and reel; T2 | [3] | -125 | -165 |

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

[2] T1: normal taping

[3] T2: reverse taping


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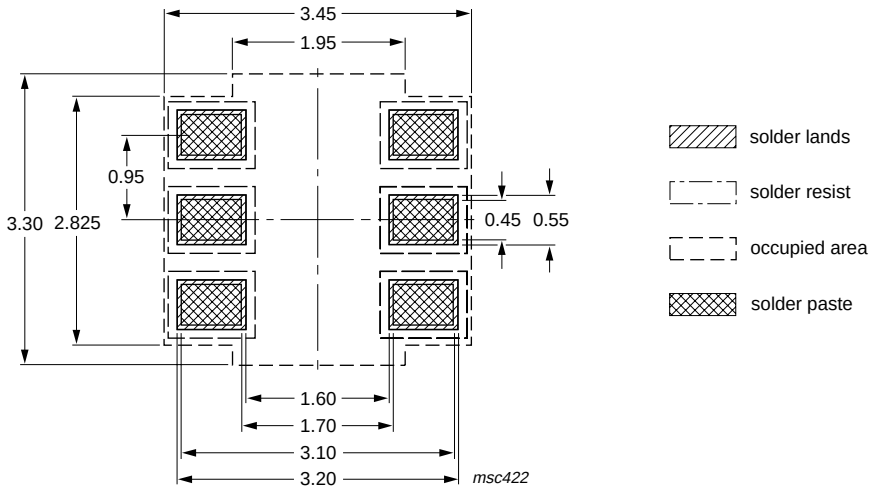
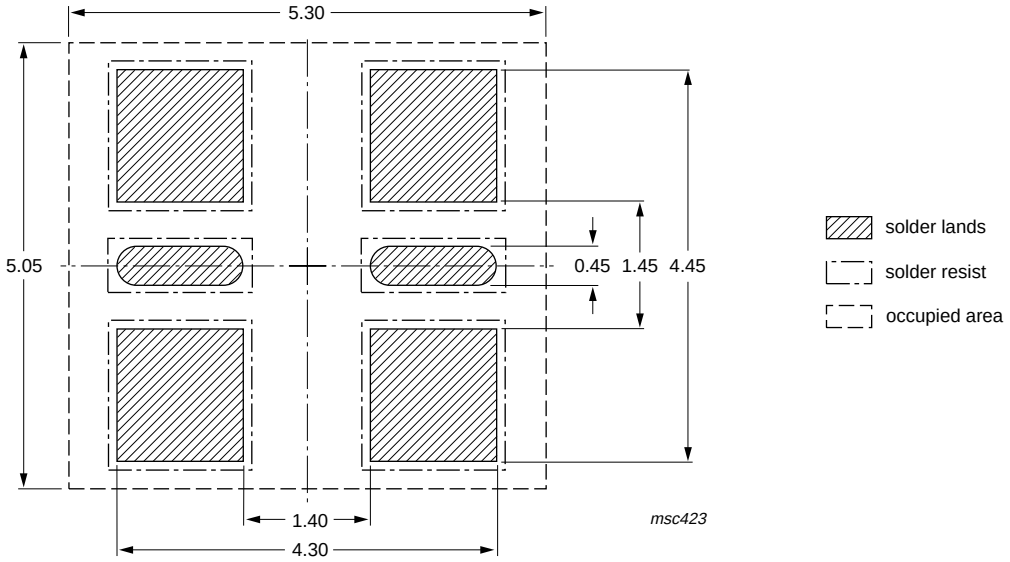
## 10. Soldering




Dimensions in mm

**Fig 12. Reflow soldering footprint SOT457 (SC-74)**




Dimensions in mm

**Fig 13. Wave soldering footprint SOT457 (SC-74)**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## 11. Revision history

**Table 10. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PESDXS5UD_SER_2 | 20061207 | Product data sheet | - | PESDXS5UD_SER_1 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Table 2 “Pinning”: symbol drawing amended<br>• Table 5 “Limiting values”: amended<br>• Table 6 “ESD maximum ratings”: amended<br>• Table 7 “ESD standards compliance”: amended<br>• Table 8 “Characteristics”: $V_{BR}$ minimum and maximum values for PESD15VS5UD adapted<br>• Figure 7: figure notes adapted<br>• Section 10 “Soldering”: added | | | |
| PESDXS5UD_SER_1 | 20060404 | Product data sheet | - | - |


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## 12.1 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".

[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.nxp.com.

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