

# PESDxS2UQ series

Double ESD protection diodes in SOT663 package

Rev. 03 — 11 September 2008

Product data sheet

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NXP Semiconductors

# Double ESD protection diodes in SOT663 package

## PESDxS2UQ series

### FEATURES

- Uni-directional ESD protection of up to two lines
- Max. peak pulse power:  $P_{pp} = 150 \text{ W}$  at  $t_p = 8/20 \mu\text{s}$
- Low clamping voltage:  $V_{(CL)R} = 20 \text{ V}$  at  $I_{pp} = 15 \text{ A}$
- Low reverse leakage current:  $I_{RM} < 1 \text{ nA}$
- ESD protection  $> 30 \text{ kV}$
- IEC 61000-4-2; level 4 (ESD)
- IEC 61000-4-5 (surge);  $I_{pp} = 15 \text{ A}$  at  $t_p = 8/20 \mu\text{s}$ .

### APPLICATIONS

- Computers and peripherals
- Communication systems
- Audio and video equipment
- High speed data lines
- Parallel ports.

### DESCRIPTION

Uni-directional double ESD protection diodes in a SOT663 plastic package. Designed to protect up to two transmission or data lines from ElectroStatic Discharge (ESD) damage.

### MARKING

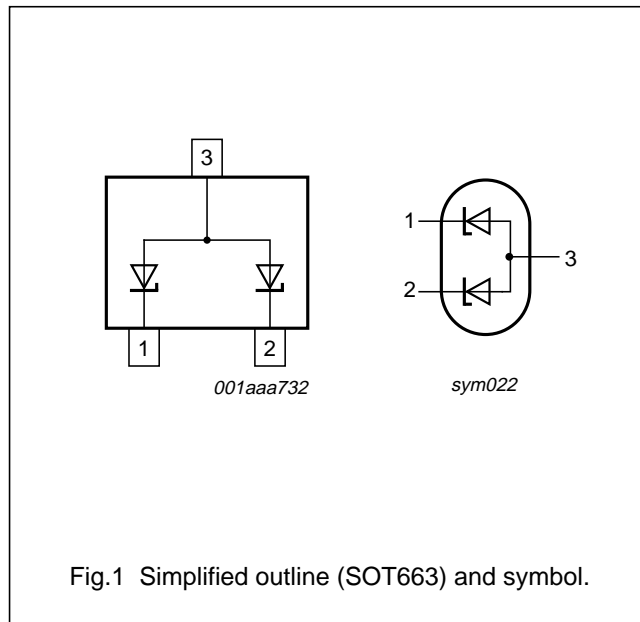
| TYPE NUMBER | MARKING CODE |
|-------------|--------------|
| PESD3V3S2UQ | E1           |
| PESD5V0S2UQ | E2           |
| PESD12VS2UQ | E3           |
| PESD15VS2UQ | E4           |
| PESD24VS2UQ | E5           |

### QUICK REFERENCE DATA

| SYMBOL    | PARAMETER  | VALUE                   | UNIT |
|-----------|--|-------------------------|------|
| $V_{RWM}$ | reverse stand-off voltage  | 3.3, 5, 12, 15 and 24   | V    |
| $C_d$     | diode capacitance<br>$V_R = 0 \text{ V};$<br>$f = 1 \text{ MHz}$ | 200, 150, 38, 32 and 23 | pF   |
|           | number of protected lines  | 2                       |      |

### PINNING

| PIN | DESCRIPTION  |
|-----|--------------|
| 1   | cathode 1    |
| 2   | cathode 2    |
| 3   | common anode |



## Double ESD protection diodes in SOT663 package

## PESDxS2UQ series

### ORDERING INFORMATION

| TYPE NUMBER | PACKAGE |  |         |
|-------------|---------|--|---------|
|             | NAME    | DESCRIPTION                              | VERSION |
| PESD3V3S2UQ | -       | plastic surface mounted package; 3 leads | SOT663  |
| PESD5V0S2UQ |         |  |         |
| PESD12VS2UQ |         |  |         |
| PESD15VS2UQ |         |  |         |
| PESD24VS2UQ |         |  |         |

### LIMITING VALUES

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

| SYMBOL    | PARAMETER                     | CONDITIONS                        | MIN. | MAX. | UNIT         |   |    |   |
|-----------|-------------------------------|-----------------------------------|------|------|--------------|---|----|---|
| $P_{pp}$  | peak pulse power              | 8/20 $\mu$ s pulse; notes 1 and 2 | -    | 150  | W            |   |    |   |
| $I_{pp}$  | peak pulse current            | 8/20 $\mu$ s pulse; notes 1 and 2 |      |      |              |   |    |   |
|           | PESD3V3S2UQ                   |                                   |      |      |              | - | 15 | A |
|           | PESD5V0S2UQ                   |                                   |      |      |              | - | 15 | A |
|           | PESD12VS2UQ                   |                                   |      |      |              | - | 5  | A |
|           | PESD15VS2UQ                   |                                   |      |      |              | - | 5  | A |
|           | PESD24VS2UQ                   | -                                 | 3    | A    |              |   |    |   |
| $T_j$     | junction temperature          |                                   | -    | 150  | $^{\circ}$ C |   |    |   |
| $T_{amb}$ | operating ambient temperature |                                   | -65  | +150 | $^{\circ}$ C |   |    |   |
| $T_{stg}$ | storage temperature           |                                   | -65  | +150 | $^{\circ}$ C |   |    |   |

### Notes

1. Non-repetitive current pulse 8/20  $\mu$ s exponential decaying waveform; see Fig.2.
2. Measured across either pins 1 and 3 or pins 2 and 3.

# Double ESD protection diodes in SOT663 package

## PESDxS2UQ series

### ESD maximum ratings

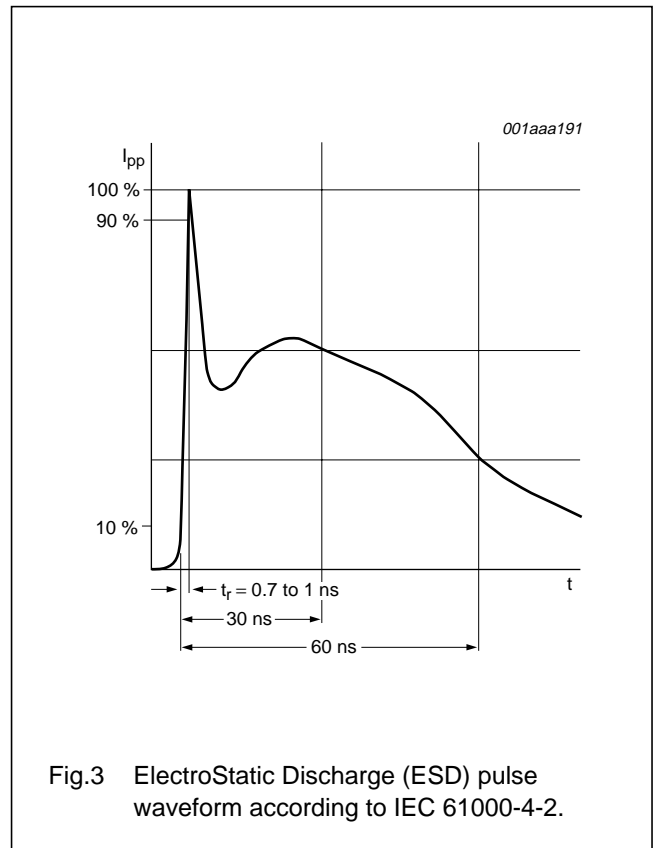
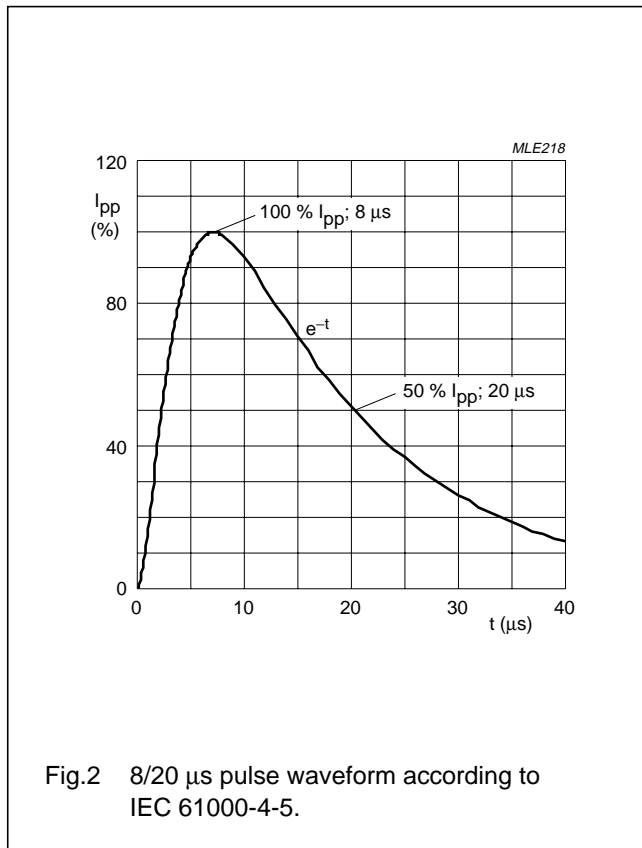
| SYMBOL | PARAMETER                           | CONDITIONS  | VALUE | UNIT |
|--------|-------------------------------------|---|-------|------|
| ESD    | electrostatic discharge capability  | IEC 61000-4-2 (contact discharge);<br>notes 1 and 2 |       |      |
|        |                                     | PESD3V3S2UQ   | 30    | kV   |
|        |                                     | PESD5V0S2UQ   | 30    | kV   |
|        |                                     | PESD12VS2UQ   | 30    | kV   |
|        |                                     | PESD15VS2UQ   | 30    | kV   |
|        |                                     | PESD24VS2UQ   | 23    | kV   |
|        | HBM MIL-Std 883<br>PESDxS2UQ series | 10  | kV    |      |

### Notes

1. Device stressed with ten non-repetitive ElectroStatic Discharge (ESD) pulses; see Fig.3.
2. Measured across either pins 1 and 3 or pins 2 and 3.

### ESD standards compliance

| ESD STANDARD                            | CONDITIONS                     |
|---|--------------------------------|
| IEC 61000-4-2; level 4 (ESD); see Fig.3 | >15 kV (air); > 8 kV (contact) |
| HBM MIL-Std 883; class 3                | >4 kV                          |



## Double ESD protection diodes in SOT663 package

## PESDxS2UQ series

### ELECTRICAL CHARACTERISTICS

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

| SYMBOL                | PARAMETER                 | CONDITIONS                           | MIN. | TYP. | MAX. | UNIT          |
|-----------------------|---------------------------|--------------------------------------|------|------|------|---------------|
| $V_{RWM}$             | reverse stand-off voltage |                                      |      |      |      |               |
|                       | PESD3V3S2UQ               |                                      | –    | –    | 3.3  | V             |
|                       | PESD5V0S2UQ               |                                      | –    | –    | 5    | V             |
|                       | PESD12VS2UQ               |                                      | –    | –    | 12   | V             |
|                       | PESD15VS2UQ               |                                      | –    | –    | 15   | V             |
|                       | PESD24VS2UQ               |                                      | –    | –    | 24   | V             |
| $I_{RM}$              | reverse leakage current   |                                      |      |      |      |               |
|                       | PESD3V3S2UQ               | $V_{RWM} = 3.3\text{ V}$             | –    | 0.55 | 3    | $\mu\text{A}$ |
|                       | PESD5V0S2UQ               | $V_{RWM} = 5\text{ V}$               | –    | 50   | 300  | nA            |
|                       | PESD12VS2UQ               | $V_{RWM} = 12\text{ V}$              | –    | <1   | 30   | nA            |
|                       | PESD15VS2UQ               | $V_{RWM} = 15\text{ V}$              | –    | <1   | 50   | nA            |
|                       | PESD24VS2UQ               | $V_{RWM} = 24\text{ V}$              | –    | <1   | 50   | nA            |
| $V_{BR}$              | breakdown voltage         | $I_Z = 5\text{ mA}$                  |      |      |      |               |
|                       | PESD3V3S2UQ               |                                      | 5.2  | 5.6  | 6.0  | V             |
|                       | PESD5V0S2UQ               |                                      | 6.4  | 6.8  | 7.2  | V             |
|                       | PESD12VS2UQ               |                                      | 14.7 | 15.0 | 15.3 | V             |
|                       | PESD15VS2UQ               |                                      | 17.6 | 18.0 | 18.4 | V             |
|                       | PESD24VS2UQ               |                                      | 26.5 | 27.0 | 27.5 | V             |
| $C_d$                 | diode capacitance         | $f = 1\text{ MHz}; V_R = 0\text{ V}$ |      |      |      |               |
|                       | PESD3V3S2UQ               |                                      | –    | 200  | 275  | pF            |
|                       | PESD5V0S2UQ               |                                      | –    | 150  | 215  | pF            |
|                       | PESD12VS2UQ               |                                      | –    | 38   | 100  | pF            |
|                       | PESD15VS2UQ               |                                      | –    | 32   | 70   | pF            |
|                       | PESD24VS2UQ               |                                      | –    | 23   | 50   | pF            |
| $V_{(CL)R}$           | clamping voltage          | notes 1 and 2                        |      |      |      |               |
|                       | PESD3V3S2UQ               | $I_{pp} = 1\text{ A}$                | –    | –    | 8    | V             |
|                       |                           | $I_{pp} = 15\text{ A}$               | –    | –    | 20   | V             |
|                       | PESD5V0S2UQ               | $I_{pp} = 1\text{ A}$                | –    | –    | 9    | V             |
|                       |                           | $I_{pp} = 15\text{ A}$               | –    | –    | 20   | V             |
|                       | PESD12VS2UQ               | $I_{pp} = 1\text{ A}$                | –    | –    | 19   | V             |
|                       |                           | $I_{pp} = 5\text{ A}$                | –    | –    | 35   | V             |
|                       | PESD15VS2UQ               | $I_{pp} = 1\text{ A}$                | –    | –    | 23   | V             |
|                       |                           | $I_{pp} = 5\text{ A}$                | –    | –    | 40   | V             |
|                       | PESD24VS2UQ               | $I_{pp} = 1\text{ A}$                | –    | –    | 36   | V             |
| $I_{pp} = 3\text{ A}$ |                           | –                                    | –    | 70   | V    |               |

# Double ESD protection diodes in SOT663 package

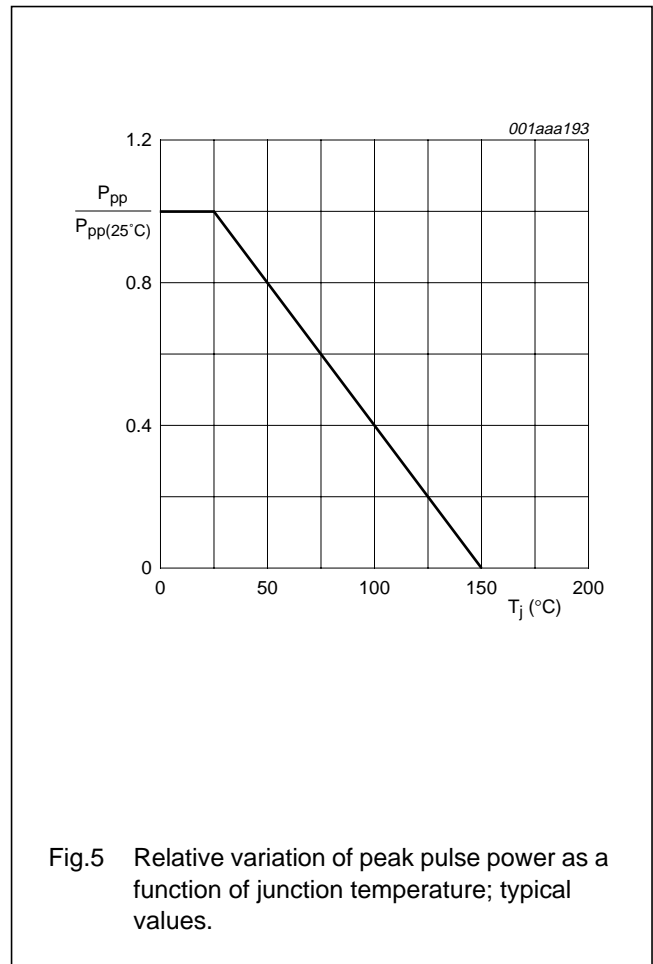
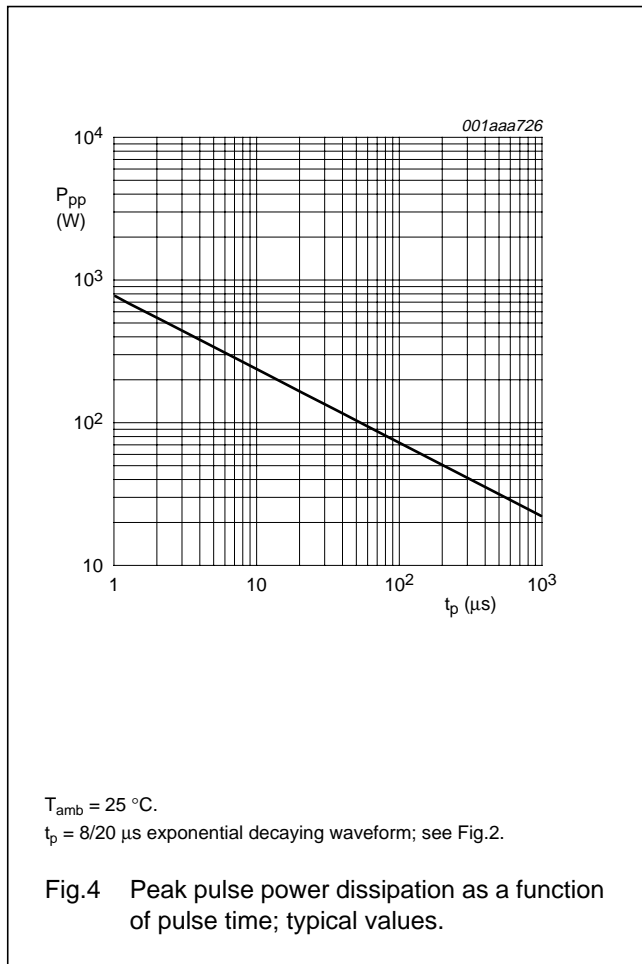
## PESDxS2UQ series

| SYMBOL     | PARAMETER               | CONDITIONS             | MIN. | TYP. | MAX. | UNIT     |
|------------|-------------------------|------------------------|------|------|------|----------|
| $R_{diff}$ | differential resistance |                        |      |      |      |          |
|            | PESD3V3S2UQ             | $I_R = 5 \text{ mA}$   | –    | –    | 40   | $\Omega$ |
|            | PESD5V0S2UQ             | $I_R = 5 \text{ mA}$   | –    | –    | 15   | $\Omega$ |
|            | PESD12VS2UQ             | $I_R = 5 \text{ mA}$   | –    | –    | 15   | $\Omega$ |
|            | PESD15VS2UQ             | $I_R = 1 \text{ mA}$   | –    | –    | 225  | $\Omega$ |
|            | PESD24VS2UQ             | $I_R = 0.5 \text{ mA}$ | –    | –    | 300  | $\Omega$ |

**Notes**

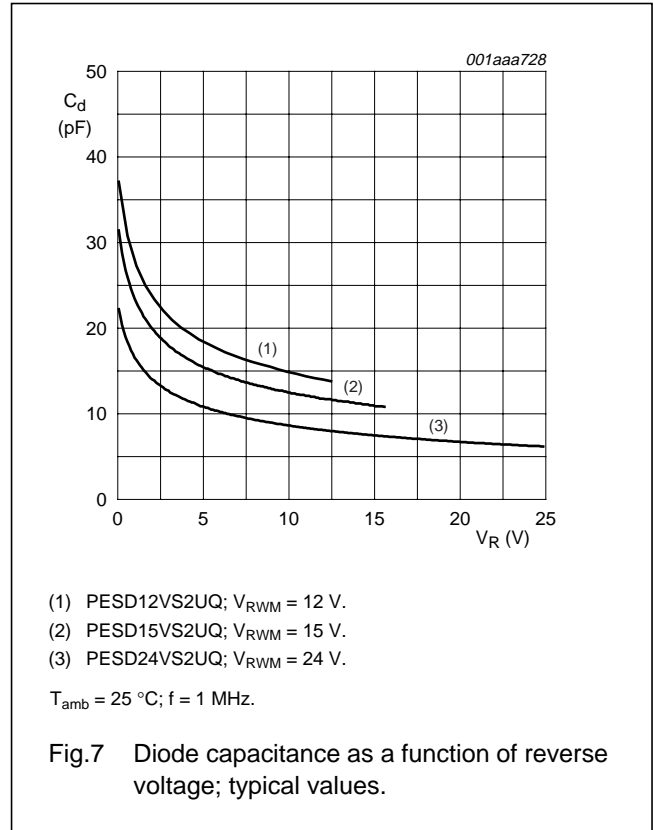
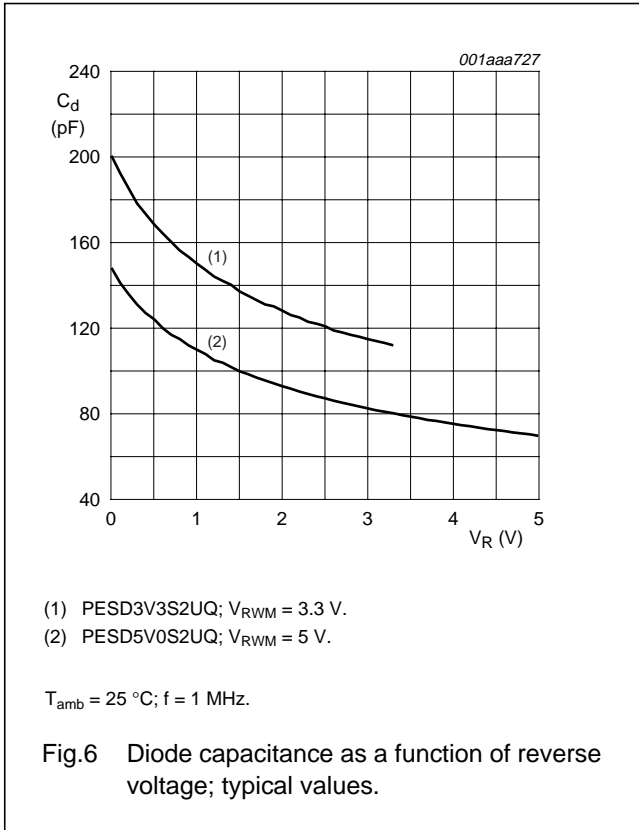
1. Non-repetitive current pulse 8/20  $\mu\text{s}$  exponential decay waveform; see Fig.2.
2. Measured either across pins 1 and 3 or pins 2 and 3.

**GRAPHICAL DATA**



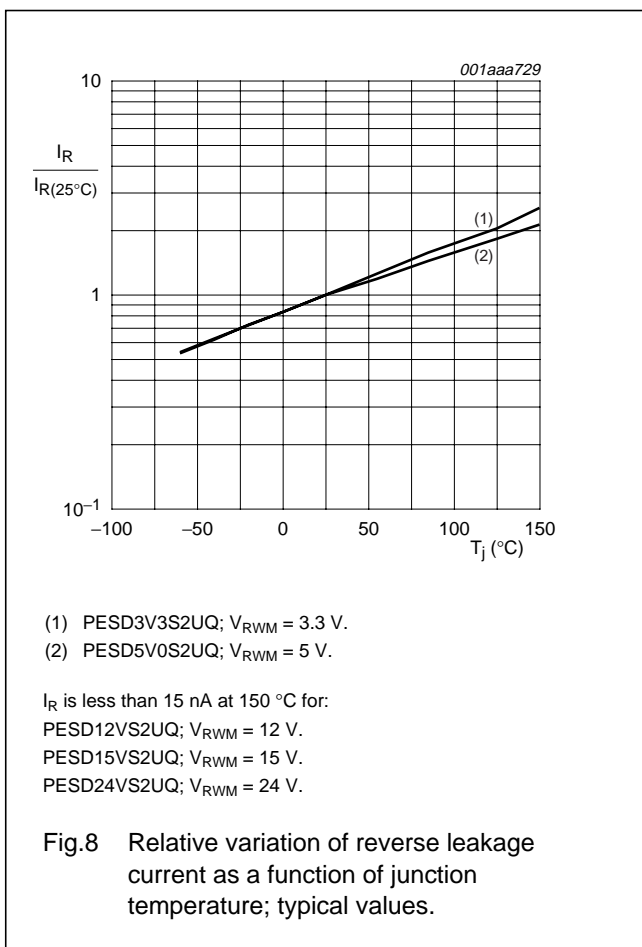
Double ESD protection diodes  
in SOT663 package

PESDxS2UQ series



Double ESD protection diodes  
in SOT663 package

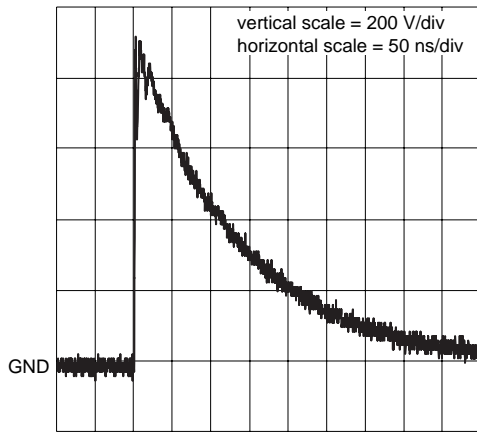
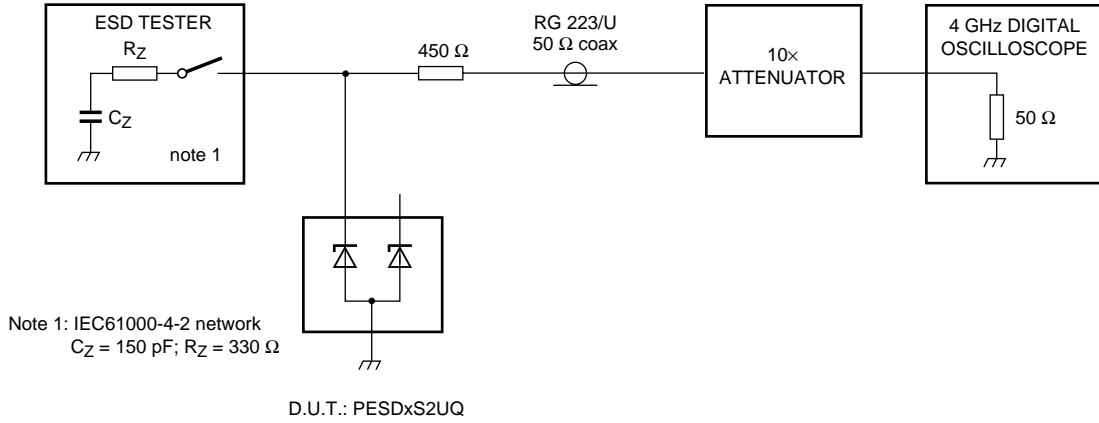
PESDxS2UQ series



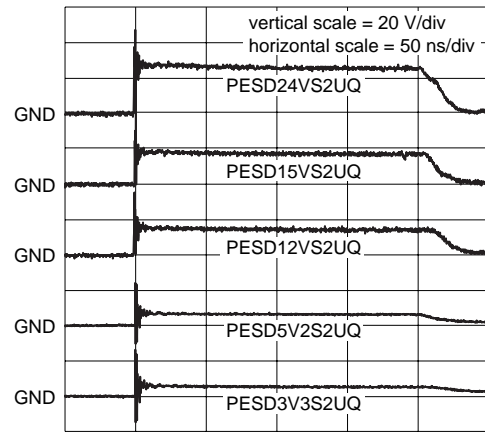


# Double ESD protection diodes in SOT663 package

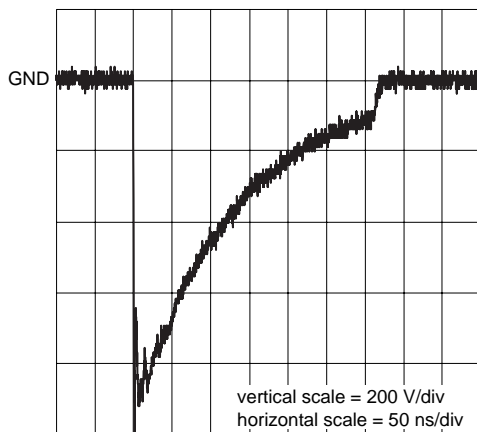
## PESDxS2UQ series



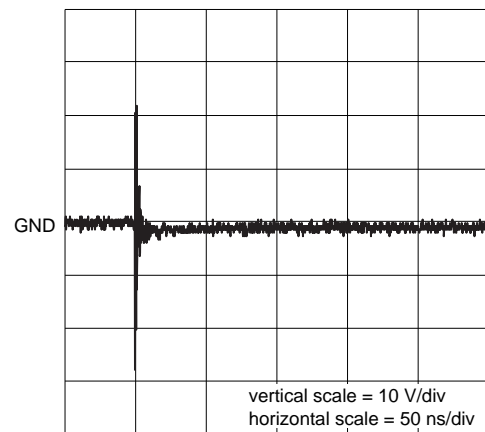
unclamped +1 kV ESD voltage waveform  
(IEC61000-4-2 network)



clamped +1 kV ESD voltage waveform  
(IEC61000-4-2 network)



unclamped -1 kV ESD voltage waveform  
(IEC61000-4-2 network)



clamped -1 kV ESD voltage waveform  
(IEC61000-4-2 network)

001aaa731

Fig.9 ESD clamping test set-up and waveforms.

# Double ESD protection diodes in SOT663 package

## PESDxS2UQ series

### APPLICATION INFORMATION

The PESDxS2UQ series is designed for uni-directional protection for up to two data lines against damage caused by ElectroStatic Discharge (ESD) and surge pulses. The PESDxS2UQ series may be used on lines where the signal polarities are below ground. PESDxS2UQ series provide a surge capability of up to 150 W ( $P_{pp}$ ) per line for an 8/20  $\mu$ s waveform.

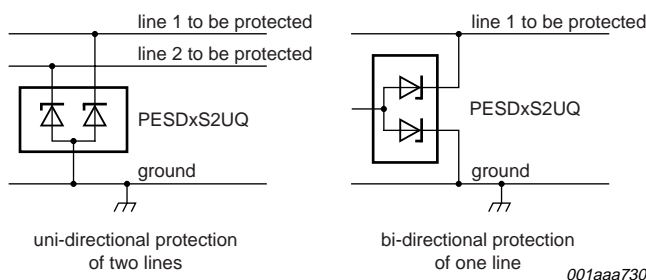


Fig.10 Typical application: ESD protection of data lines.

### 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:

- Place the PESDxS2UQ as close as possible to the input terminal or connector.
- The path length between the PESDxS2UQ and the protected line should be minimized.
- Keep parallel signal paths to a minimum.
- Avoid running protected conductors in parallel with unprotected conductors.
- Minimize all printed-circuit board conductive loops including power and ground loops.
- Minimize the length of transient return paths to ground.
- Avoid using shared return paths to a common ground point.
- Ground planes should be used whenever possible. For multilayer printed-circuit boards use ground vias.

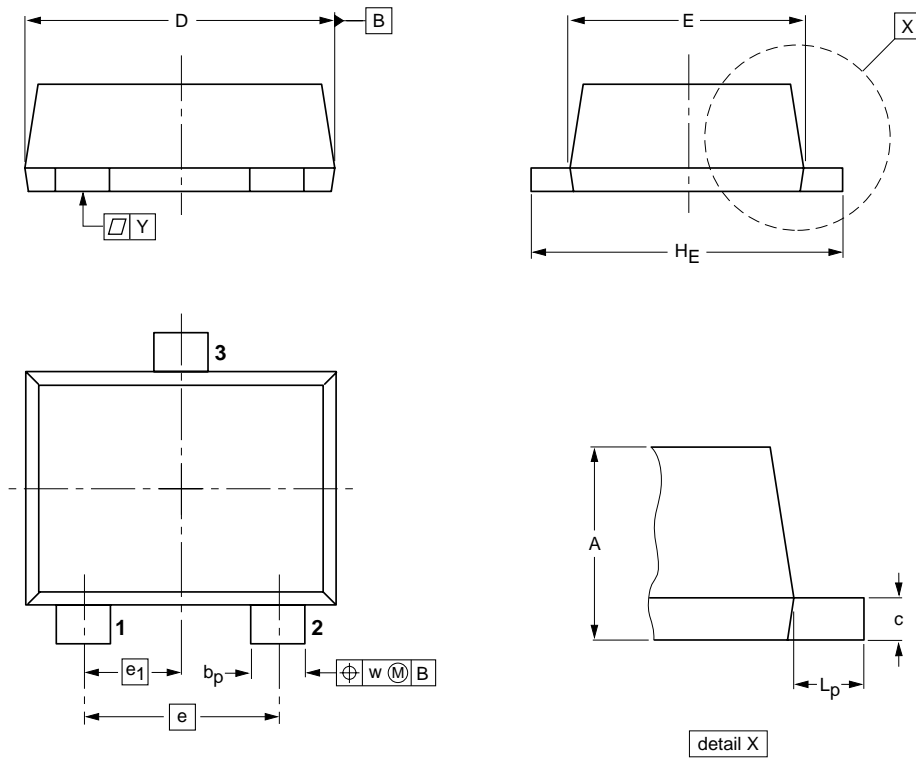
# Double ESD protection diodes in SOT663 package

## PESDxS2UQ series

### PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT663



**DIMENSIONS (mm are the original dimensions)**

| UNIT | A          | $b_p$        | c            | D          | E          | e   | $e_1$ | $H_E$      | $L_p$      | w   | y   |
|------|------------|--------------|--------------|------------|------------|-----|-------|------------|------------|-----|-----|
| mm   | 0.6<br>0.5 | 0.33<br>0.23 | 0.18<br>0.08 | 1.7<br>1.5 | 1.3<br>1.1 | 1.0 | 0.5   | 1.7<br>1.5 | 0.3<br>0.1 | 0.1 | 0.1 |

| OUTLINE VERSION | REFERENCES |       |       |  | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|-------|-------|--|---------------------|----------------------|
|                 | IEC        | JEDEC | JEITA |  |                     |                      |
| SOT663          |            |       |       |  |                     | 01-12-04<br>02-05-21 |

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### 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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## Revision history

**Table 1. Revision history**

| Document ID        | Release date                                    | Data sheet status     | Change notice | Supersedes         |
|--------------------|---|-----------------------|---------------|--------------------|
| PESDXS2UQ_SER_N_3  | 20080911  | Product data sheet    | -             | PESDXS2UQ_SERIES_2 |
| Modifications:     | • Asterisks and note 1 removed in Marking Table |                       |               |                    |
| PESDXS2UQ_SERIES_2 | 20040427  | Product specification | -             | PESDXS2UQ_SERIES_1 |
| PESDXS2UQ_SERIES_1 | 20031215  | Product specification | -             | -                  |

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Date of release: 11 September 2008

Document identifier: PESDXS2UQ\_SER\_N\_3