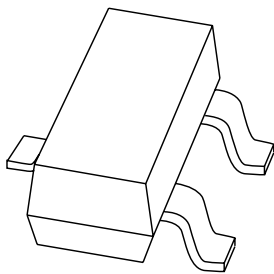


# DATA SHEET



## **PESDxS2UT series**

Double ESD protection diodes in  
SOT23 package

Product specification  
Supersedes data of 2003 Aug 20

2004 Apr 15

# Double ESD protection diodes in SOT23 package

## PESDxS2UT series

### FEATURES

- Uni-directional ESD protection of up to two lines
- Max. peak pulse power:  $P_{pp} = 330 \text{ W}$  at  $t_p = 8/20 \mu\text{s}$
- Low clamping voltage:  $V_{(CL)R} = 20 \text{ V}$  at  $I_{pp} = 18 \text{ A}$
- Ultra-low reverse leakage current:  $I_{RM} < 700 \text{ nA}$
- ESD protection  $> 23 \text{ kV}$
- IEC 61000-4-2; level 4 (ESD)
- IEC 61000-4-5 (surge);  $I_{pp} = 18 \text{ A}$  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 SOT23 plastic package. Designed to protect up to two transmission or data lines from ElectroStatic Discharge (ESD) damage.

### MARKING

| TYPE NUMBER | MARKING CODE <sup>(1)</sup> |
|-------------|-----------------------------|
| PESD3V3S2UT | *U9                         |
| PESD5V2S2UT | *U1                         |
| PESD12VS2UT | *U2                         |
| PESD15VS2UT | *U3                         |
| PESD24VS2UT | *U4                         |

### Note

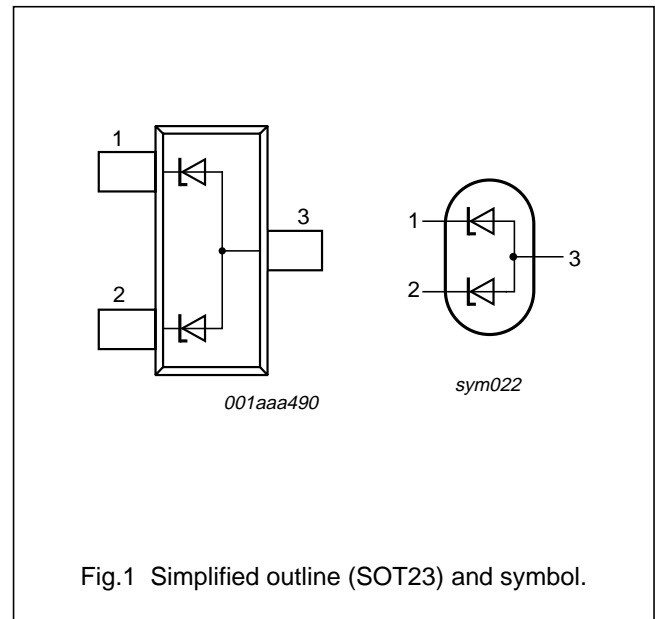
1. \* = p : made in Hong Kong.  
 \* = t : made in Malaysia.  
 \* = W : made in China.

### QUICK REFERENCE DATA

| SYMBOL    | PARAMETER  | VALUE                   | UNIT |
|-----------|--|-------------------------|------|
| $V_{RWM}$ | reverse stand-off voltage  | 3.3, 5.2, 12, 15 and 24 | V    |
| $C_d$     | diode capacitance<br>$V_R = 0 \text{ V};$<br>$f = 1 \text{ MHz}$ | 207, 152, 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 SOT23 package

## PESDxS2UT series

### ORDERING INFORMATION

| TYPE NUMBER | PACKAGE |  |         |
|-------------|---------|--|---------|
|             | NAME    | DESCRIPTION                              | VERSION |
| PESD3V3S2UT | –       | plastic surface mounted package; 3 leads | SOT23   |
| PESD5V2S2UT |         |  |         |
| PESD12VS2UT |         |  |         |
| PESD15VS2UT |         |  |         |
| PESD24VS2UT |         |  |         |

### LIMITING VALUES

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

| SYMBOL           | PARAMETER                     | CONDITIONS                   | MIN. | MAX. | UNIT |
|------------------|-------------------------------|------------------------------|------|------|------|
| P <sub>pp</sub>  | peak pulse power              | 8/20 μs pulse; notes 1 and 2 | –    | 330  | W    |
|                  | PESD3V3S2UT                   |                              |      |      |      |
|                  | PESD5V2S2UT                   |                              |      |      |      |
|                  | PESD12VS2UT                   |                              |      |      |      |
|                  | PESD15VS2UT                   |                              |      |      |      |
|                  | PESD24VS2UT                   |                              |      |      |      |
| I <sub>pp</sub>  | peak pulse current            | 8/20 μs pulse; notes 1 and 2 | –    | 18   | A    |
|                  | PESD3V3S2UT                   |                              |      |      |      |
|                  | PESD5V2S2UT                   |                              |      |      |      |
|                  | PESD12VS2UT                   |                              |      |      |      |
|                  | PESD15VS2UT                   |                              |      |      |      |
|                  | PESD24VS2UT                   |                              |      |      |      |
| T <sub>j</sub>   | junction temperature          |                              | –    | 150  | °C   |
| T <sub>amb</sub> | operating ambient temperature |                              | –65  | +150 | °C   |
| T <sub>stg</sub> | storage temperature           |                              | –65  | +150 | °C   |

### Notes

1. Non-repetitive current pulse 8/20 μs exponential decay waveform; see Fig.2.
2. Measured across either pins 1 and 3 or pins 2 and 3.

# Double ESD protection diodes in SOT23 package

## PESDxS2UT series

### ESD maximum ratings

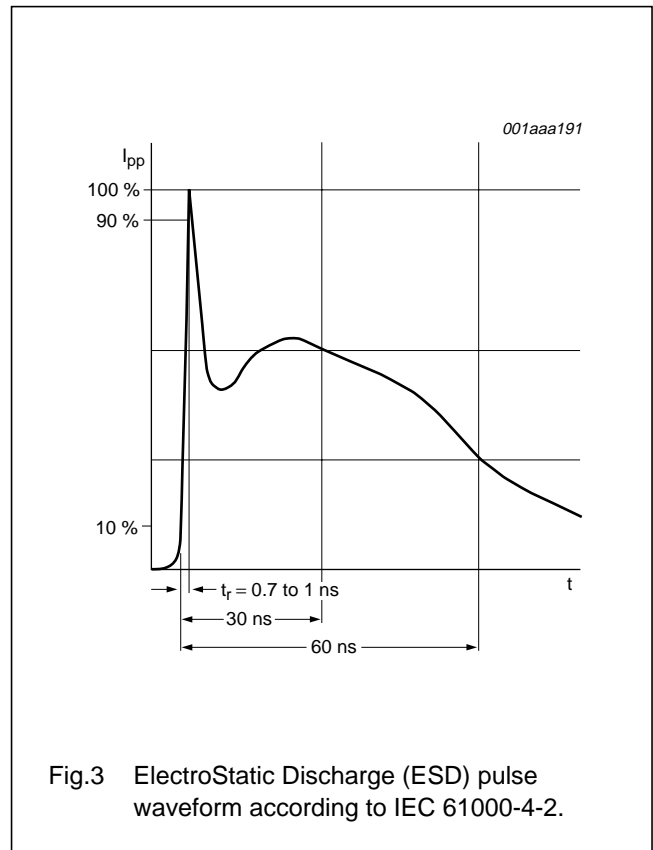
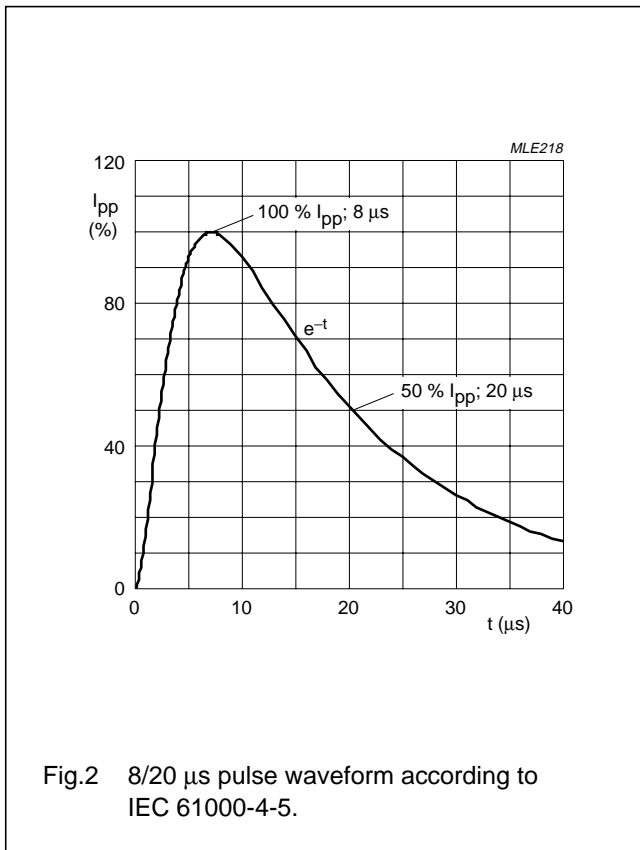
| SYMBOL | PARAMETER                          | CONDITIONS                                       | VALUE | UNIT |
|--------|------------------------------------|--|-------|------|
| ESD    | electrostatic discharge capability | IEC 61000-4-2 (contact discharge); notes 1 and 2 |       |      |
|        |                                    | PESD3V3S2UT                                      | 30    | kV   |
|        |                                    | PESD5V2S2UT                                      | 30    | kV   |
|        |                                    | PESD12VS2UT                                      | 30    | kV   |
|        |                                    | PESD15VS2UT                                      | 30    | kV   |
|        |                                    | PESD24VS2UT                                      | 23    | kV   |
|        |                                    | HBM MIL-Std 883<br>PESDxS2UT 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 SOT23 package

## PESDxS2UT 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 |                                      |      |       |      |               |
|                       | PESD3V3S2UT               |                                      | –    | –     | 3.3  | V             |
|                       | PESD5V2S2UT               |                                      | –    | –     | 5.2  | V             |
|                       | PESD12VS2UT               |                                      | –    | –     | 12   | V             |
|                       | PESD15VS2UT               |                                      | –    | –     | 15   | V             |
|                       | PESD24VS2UT               |                                      | –    | –     | 24   | V             |
| $I_{RM}$              | reverse leakage current   |                                      |      |       |      |               |
|                       | PESD3V3S2UT               | $V_{RWM} = 3.3\text{ V}$             | –    | 0.7   | 2    | $\mu\text{A}$ |
|                       | PESD5V2S2UT               | $V_{RWM} = 5.2\text{ V}$             | –    | 0.15  | 1    | $\mu\text{A}$ |
|                       | PESD12VS2UT               | $V_{RWM} = 12\text{ V}$              | –    | <0.02 | 1    | $\mu\text{A}$ |
|                       | PESD15VS2UT               | $V_{RWM} = 15\text{ V}$              | –    | <0.02 | 1    | $\mu\text{A}$ |
|                       | PESD24VS2UT               | $V_{RWM} = 24\text{ V}$              | –    | <0.02 | 1    | $\mu\text{A}$ |
| $V_{BR}$              | breakdown voltage         | $I_Z = 5\text{ mA}$                  |      |       |      |               |
|                       | PESD3V3S2UT               |                                      | 5.2  | 5.6   | 6.0  | V             |
|                       | PESD5V2S2UT               |                                      | 6.4  | 6.8   | 7.2  | V             |
|                       | PESD12VS2UT               |                                      | 14.7 | 15.0  | 15.3 | V             |
|                       | PESD15VS2UT               |                                      | 17.6 | 18.0  | 18.4 | V             |
|                       | PESD24VS2UT               |                                      | 26.5 | 27.0  | 27.5 | V             |
| $C_d$                 | diode capacitance         | $f = 1\text{ MHz}; V_R = 0\text{ V}$ |      |       |      |               |
|                       | PESD3V3S2UT               |                                      | –    | 207   | 300  | pF            |
|                       | PESD5V2S2UT               |                                      | –    | 152   | 200  | pF            |
|                       | PESD12VS2UT               |                                      | –    | 38    | 75   | pF            |
|                       | PESD15VS2UT               |                                      | –    | 32    | 70   | pF            |
|                       | PESD24VS2UT               |                                      | –    | 23    | 50   | pF            |
| $V_{(CL)R}$           | clamping voltage          | notes 1 and 2                        |      |       |      |               |
|                       | PESD3V3S2UT               | $I_{pp} = 1\text{ A}$                | –    | –     | 7    | V             |
|                       |                           | $I_{pp} = 18\text{ A}$               | –    | –     | 20   | V             |
|                       | PESD5V2S2UT               | $I_{pp} = 1\text{ A}$                | –    | –     | 9    | V             |
|                       |                           | $I_{pp} = 15\text{ A}$               | –    | –     | 20   | V             |
|                       | PESD12VS2UT               | $I_{pp} = 1\text{ A}$                | –    | –     | 19   | V             |
|                       |                           | $I_{pp} = 5\text{ A}$                | –    | –     | 35   | V             |
|                       | PESD15VS2UT               | $I_{pp} = 1\text{ A}$                | –    | –     | 23   | V             |
|                       |                           | $I_{pp} = 5\text{ A}$                | –    | –     | 40   | V             |
|                       | PESD24VS2UT               | $I_{pp} = 1\text{ A}$                | –    | –     | 36   | V             |
| $I_{pp} = 3\text{ A}$ |                           | –                                    | –    | 70    | V    |               |

# Double ESD protection diodes in SOT23 package

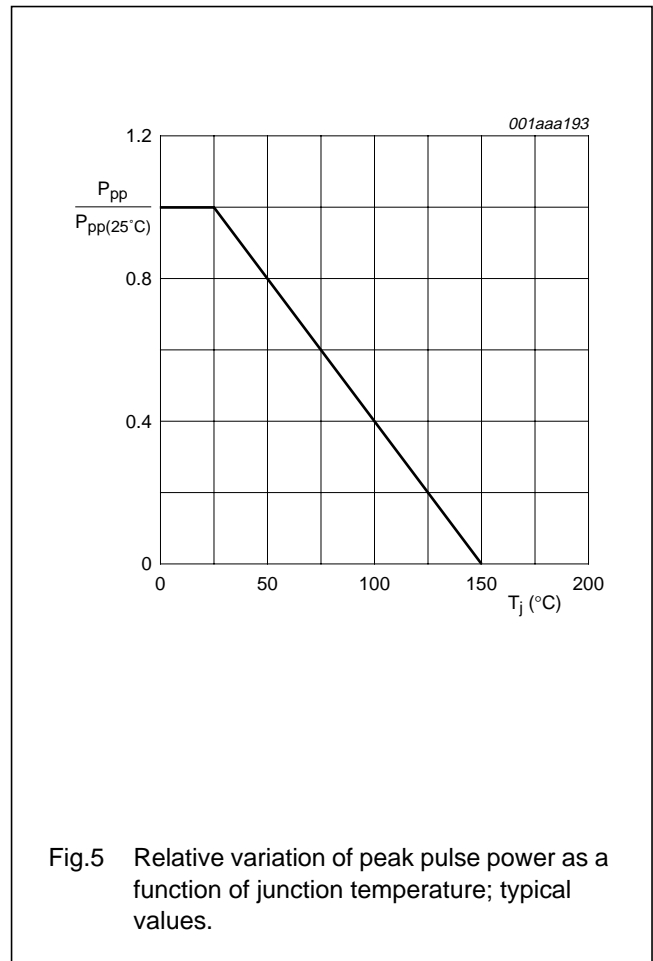
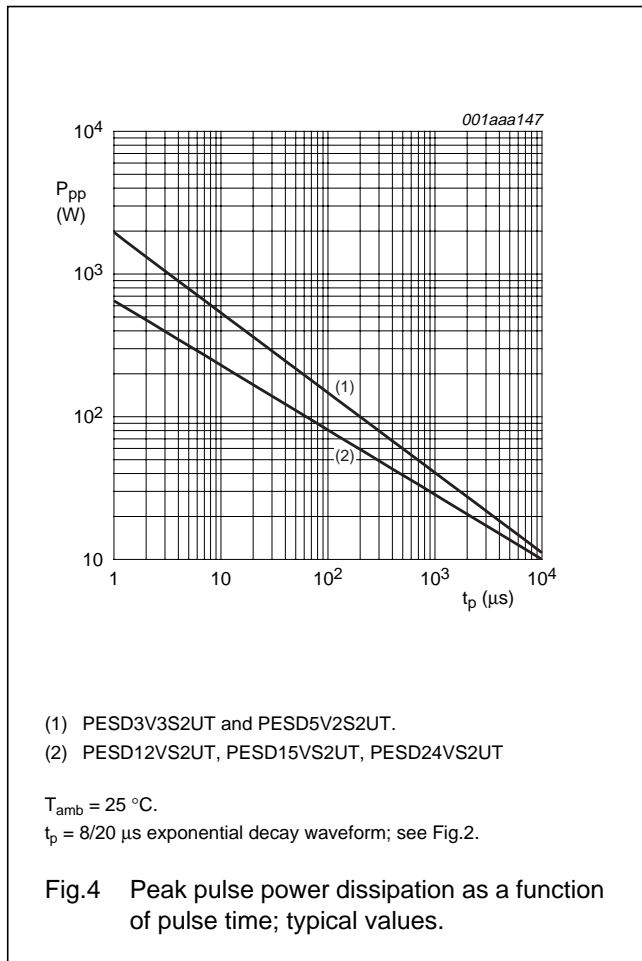
## PESDxS2UT series

| SYMBOL     | PARAMETER               | CONDITIONS             | MIN. | TYP. | MAX. | UNIT     |
|------------|-------------------------|------------------------|------|------|------|----------|
| $R_{diff}$ | differential resistance |                        |      |      |      |          |
|            | PESD3V3S2UT             | $I_R = 1 \text{ mA}$   | –    | –    | 400  | $\Omega$ |
|            | PESD5V2S2UT             | $I_R = 1 \text{ mA}$   | –    | –    | 80   | $\Omega$ |
|            | PESD12VS2UT             | $I_R = 1 \text{ mA}$   | –    | –    | 200  | $\Omega$ |
|            | PESD15VS2UT             | $I_R = 1 \text{ mA}$   | –    | –    | 225  | $\Omega$ |
|            | PESD24VS2UT             | $I_R = 0.5 \text{ mA}$ | –    | –    | 300  | $\Omega$ |

**Notes**

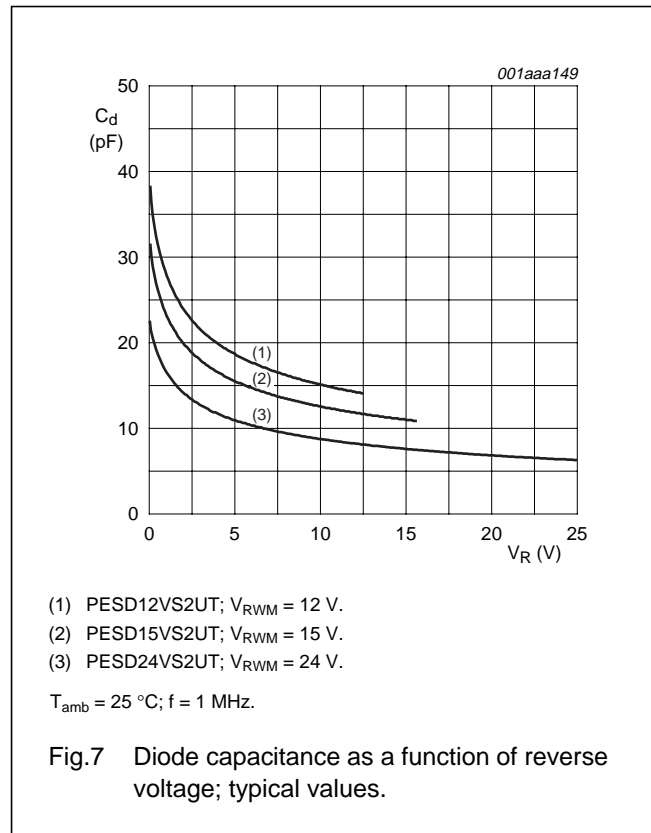
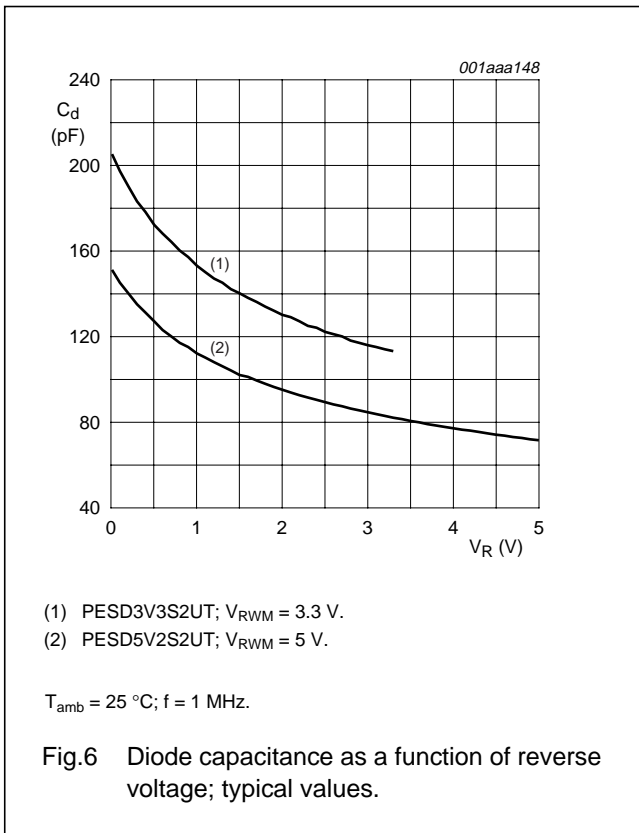
1. Non-repetitive current pulse 8/20  $\mu\text{s}$  exponential decay waveform; see Fig.2.
2. Measured either across pins 1 and 3 or pins 2 and 3.

**GRAPHICAL DATA**



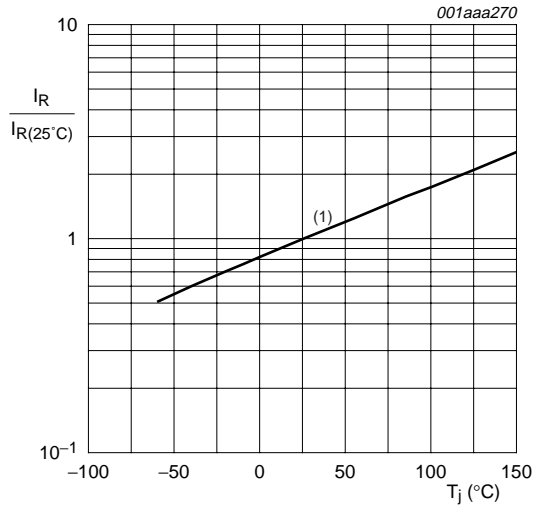
Double ESD protection diodes  
in SOT23 package

PESDxS2UT series



Double ESD protection diodes  
in SOT23 package

PESDxS2UT series



(1) PESD3V3S2UT;  $V_{RWM} = 3.3$  V.  
 PESD5V2S2UT;  $V_{RWM} = 5$  V.

$I_R$  is less than 10 nA at 150 °C for:  
 PESD12V52UT;  $V_{RWM} = 12$  V.  
 PESD15VS2UT;  $V_{RWM} = 15$  V.  
 PESD24VS2UT;  $V_{RWM} = 24$  V.

Fig.8 Relative variation of reverse leakage current as a function of junction temperature; typical values.



# Double ESD protection diodes in SOT23 package

## PESDxS2UT series

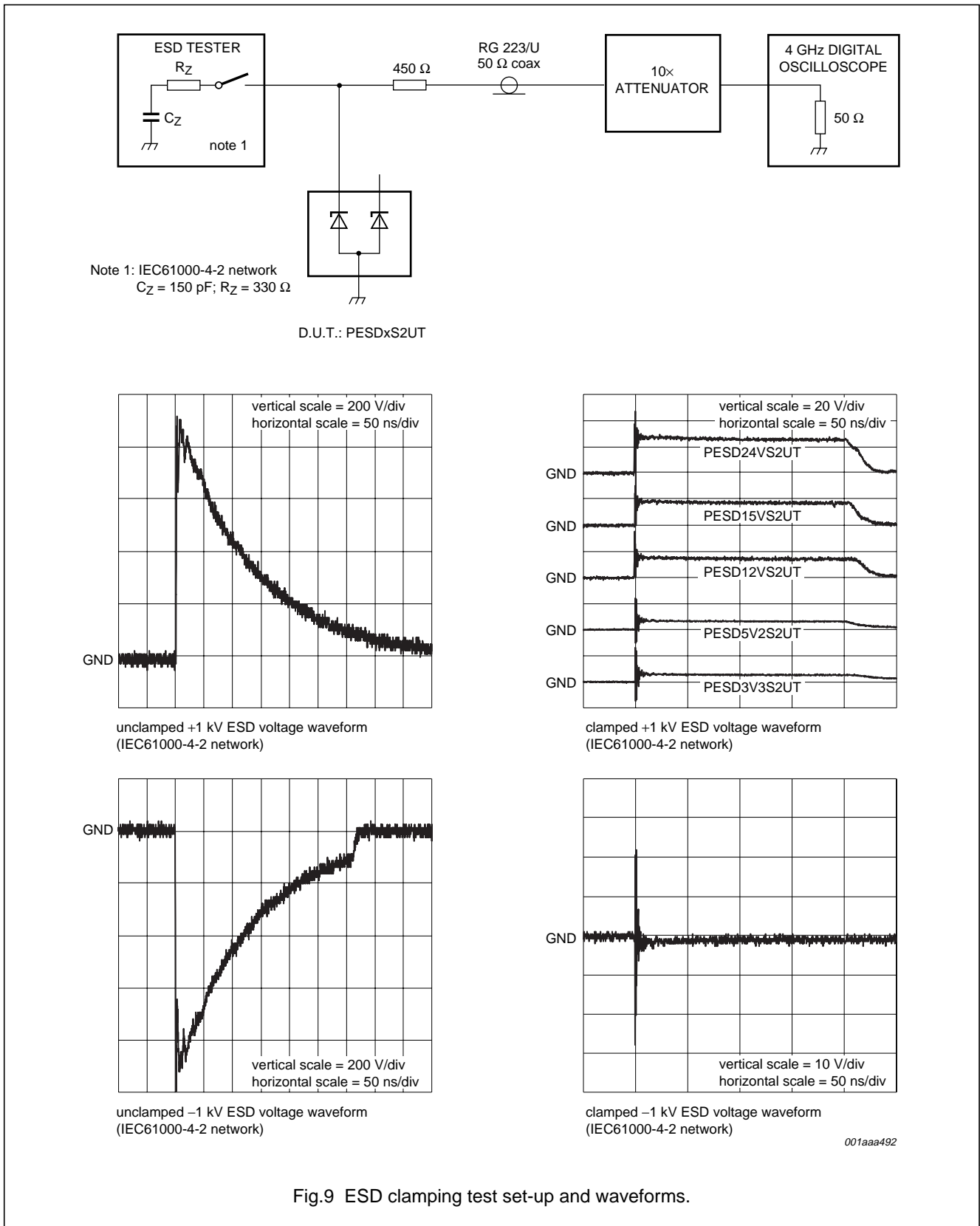


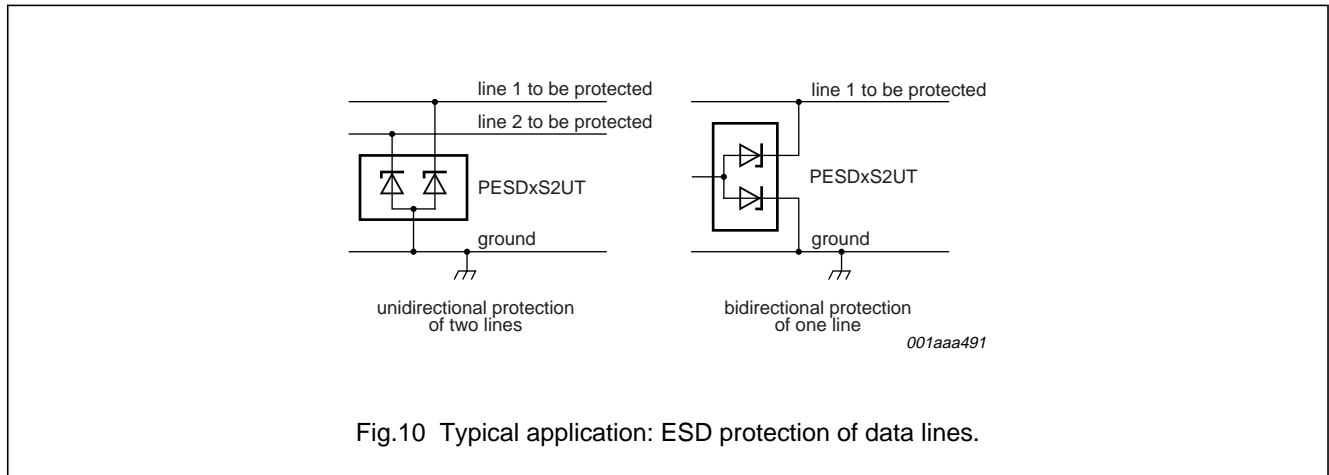
Fig.9 ESD clamping test set-up and waveforms.

## Double ESD protection diodes in SOT23 package

## PESDxS2UT series

### APPLICATION INFORMATION

The PESDxS2UT series is designed for uni-directional protection for up to two lines against damage caused by ElectroStatic Discharge (ESD) and surge pulses. The PESDxS2UT series may be used on lines where the signal polarities are below ground. PESDxS2UT series provide a surge capability of up to 330 W ( $P_{pp}$ ) per line for an 8/20  $\mu$ s waveform.



### 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 PESDxS2UT as close as possible to the input terminal or connector.
- The path length between the PESDxS2UT 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.

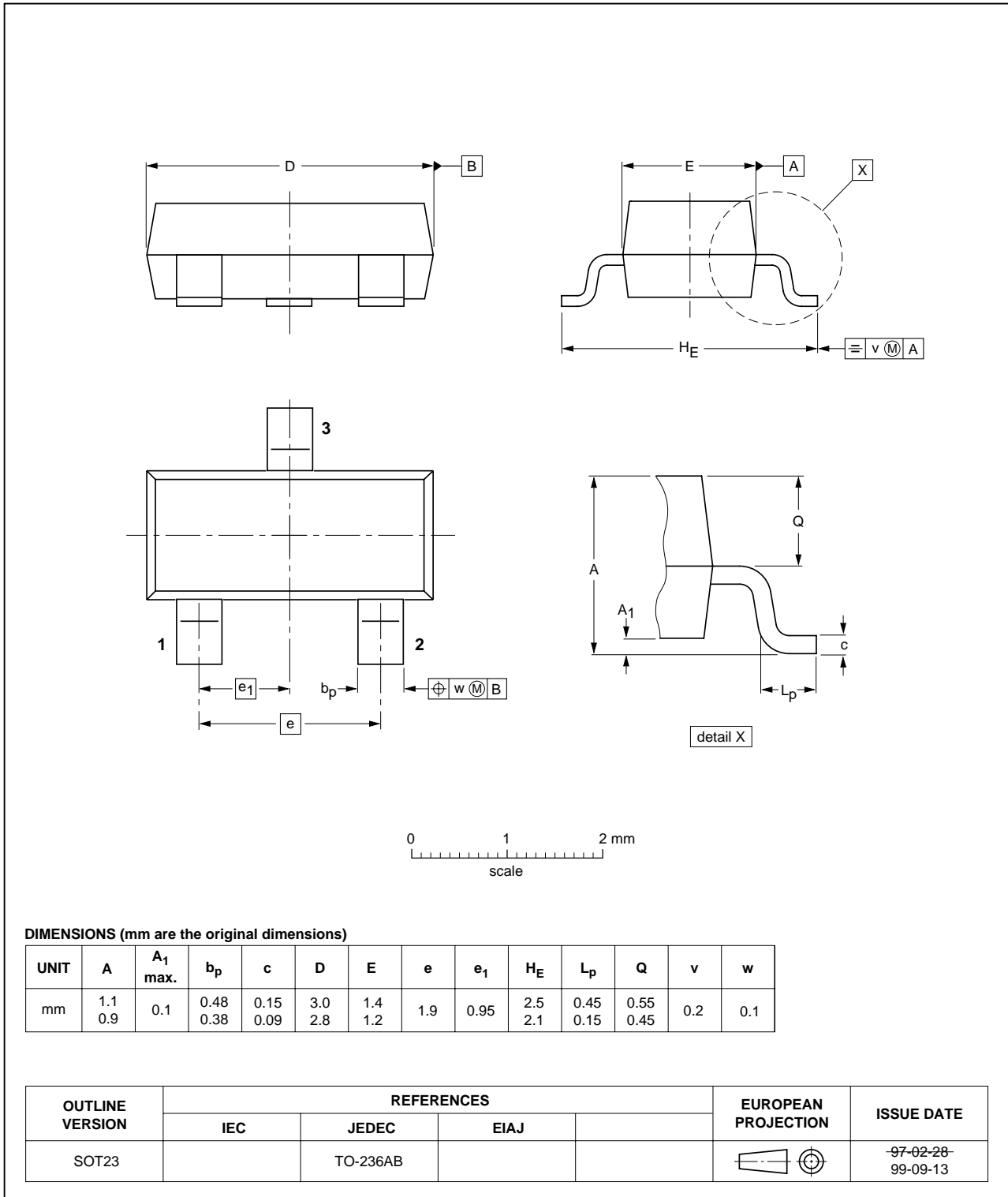
# Double ESD protection diodes in SOT23 package

## PESDxS2UT series

### PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT23



## Double ESD protection diodes in SOT23 package

## PESDxS2UT series

### DATA SHEET STATUS

| LEVEL | DATA SHEET STATUS <sup>(1)</sup> | PRODUCT STATUS <sup>(2)(3)</sup> | DEFINITION   |
|-------|----------------------------------|----------------------------------|--|
| I     | Objective data                   | Development                      | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.  |
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