

# DATA SHEET



## **PESDxS2UAT series** Double ESD protection diodes in SOT23 package

Product data sheet

2004 Feb 18

# Double ESD protection diodes in SOT23 package

## PESDxS2UAT series

### FEATURES

- Unidirectional ESD protection of up to two lines
- Common-cathode configuration
- 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  $> 30\text{ kV}$
- 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
- Data lines
- CAN bus protection.

### DESCRIPTION

Unidirectional double ESD protection diodes in common cathode configuration in the SOT23 plastic package. Designed to protect up to two transmission or data lines against damage from ElectroStatic Discharge (ESD) and other transients.

### MARKING

| TYPE NUMBER  | MARKING CODE <sup>(1)</sup> |
|--------------|-----------------------------|
| PESD3V3S2UAT | *7A                         |
| PESD5V0S2UAT | *7B                         |
| PESD12VS2UAT | *7C                         |
| PESD15VS2UAT | *7D                         |
| PESD24VS2UAT | *7E                         |

### Note

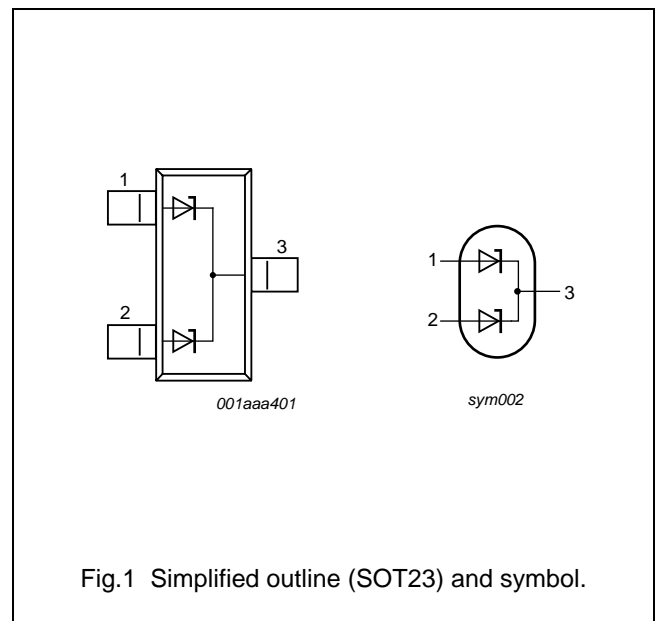
1. \* = p : made in Hong Kong.  
\* = t : made in Malaysia.  
\* = W : made in China.

### QUICK REFERENCE DATA

| SYMBOL    | PARAMETER   | VALUE                   | UNIT |
|-----------|---|-------------------------|------|
| $V_{RWM}$ | reverse stand-off voltage                                       | 3.3, 5, 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   | anode 1        |
| 2   | anode 2        |
| 3   | common cathode |



## Double ESD protection diodes in SOT23 package

## PESDxS2UAT series

### ORDERING INFORMATION

| TYPE NUMBER  | PACKAGE |  |         |
|--------------|---------|--|---------|
|              | NAME    | DESCRIPTION                              | VERSION |
| PESD3V3S2UAT | -       | plastic surface mounted package; 3 leads | SOT23   |
| PESD5V0S2UAT |         |  |         |
| PESD12VS2UAT |         |  |         |
| PESD15VS2UAT |         |  |         |
| PESD24VS2UAT |         |  |         |

### 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 | -    | 330  | W            |                               |     |      |              |
|          | PESD3V3S2UAT         |                                   |      |      |              |                               |     |      |              |
|          | PESD5V0S2UAT         |                                   |      |      |              |                               |     |      |              |
|          | PESD12VS2UAT         |                                   |      |      |              |                               |     |      |              |
|          | PESD15VS2UAT         |                                   |      |      |              |                               |     |      |              |
| $I_{pp}$ | peak pulse current   | 8/20 $\mu$ s pulse; notes 1 and 2 | -    | 18   | A            |                               |     |      |              |
|          | PESD3V3S2UAT         |                                   |      |      |              |                               |     |      |              |
|          | PESD5V0S2UAT         |                                   |      |      |              |                               |     |      |              |
|          | PESD12VS2UAT         |                                   |      |      |              |                               |     |      |              |
|          | PESD15VS2UAT         |                                   |      |      |              |                               |     |      |              |
| $T_j$    | junction temperature |                                   | -    | 150  | $^{\circ}$ C |                               |     |      |              |
|          | $T_{amb}$            |                                   |      |      |              | operating ambient temperature | -65 | +150 | $^{\circ}$ C |
|          | $T_{stg}$            |                                   |      |      |              | storage temperature           |     |      |              |
|          |                      |                                   |      |      |              |                               |     |      |              |
|          |                      |                                   |      |      |              |                               |     |      |              |
|          |                      |                                   |      |      |              |                               |     |      |              |

### Notes

1. Non-repetitive current pulse 8/20  $\mu$ s 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

## PESDxS2UAT series

### ESD maximum ratings

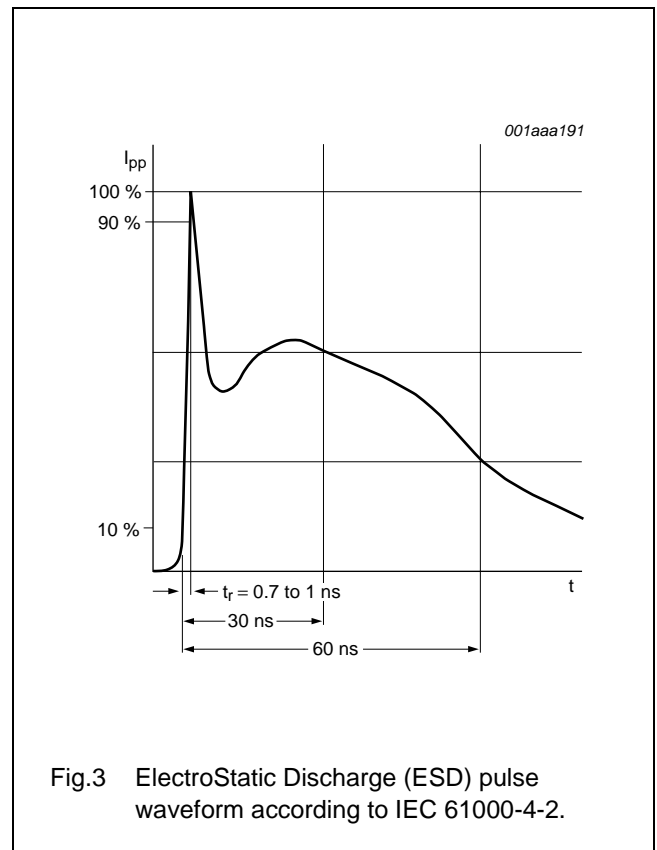
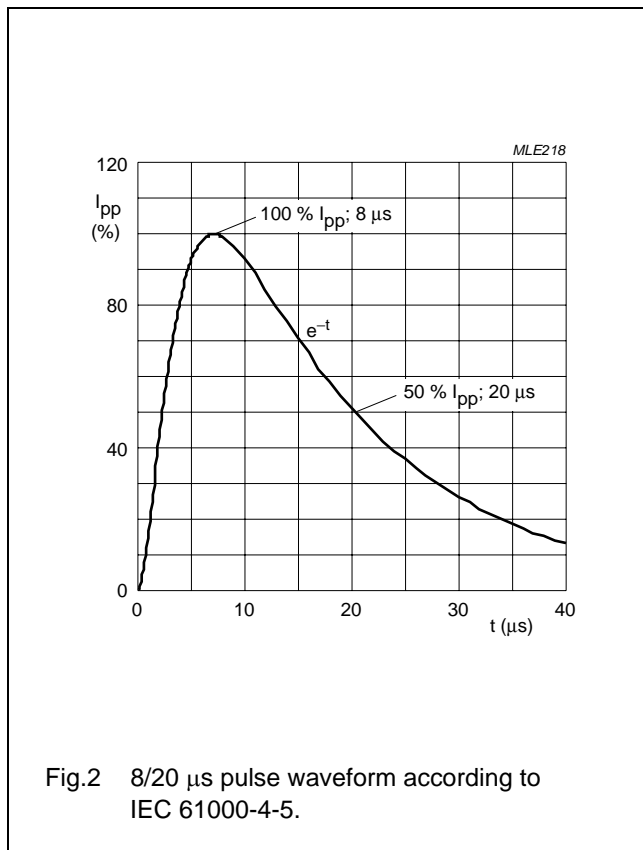
| SYMBOL            | PARAMETER               | CONDITIONS  | VALUE | UNIT |
|-------------------|-------------------------|---|-------|------|
| ESD               | electrostatic discharge | IEC 61000-4-2 (contact discharge);<br>notes 1 and 2 |       |      |
|                   |                         | PESD3V3S2UAT  | 30    | kV   |
|                   |                         | PESD5V0S2UAT  | 30    | kV   |
|                   |                         | PESD12VS2UAT  | 30    | kV   |
|                   |                         | PESD15VS2UAT  | 30    | kV   |
|                   |                         | PESD24VS2UAT  | 23    | kV   |
|                   |                         | HBM MIL-Std 883                                     |       |      |
| PESDxS2UAT-series | 10                      | kV  |       |      |

### Notes

1. Device stressed with ten non-repetitive ESD pulses; see Fig.3.
2. Measured from pin 1, 2, 3, 4, 5 or 8 to pin 6 or 7.

### 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

## PESDxS2UAT 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 |                                      |      |      |      |               |
|             | PESD3V3S2UAT              |                                      | –    | –    | 3.3  | V             |
|             | PESD5V0S2UAT              |                                      | –    | –    | 5    | V             |
|             | PESD12VS2UAT              |                                      | –    | –    | 12   | V             |
|             | PESD15VS2UAT              |                                      | –    | –    | 15   | V             |
|             | PESD24VS2UAT              |                                      | –    | –    | 24   | V             |
| $I_{RM}$    | reverse leakage current   |                                      |      |      |      |               |
|             | PESD3V3S2UAT              | $V_{RWM} = 3.3\text{ V}$             | –    | 0.7  | 2    | $\mu\text{A}$ |
|             | PESD5V0S2UAT              | $V_{RWM} = 5\text{ V}$               | –    | 0.1  | 1    | $\mu\text{A}$ |
|             | PESD12VS2UAT              | $V_{RWM} = 12\text{ V}$              | –    | <1   | 50   | nA            |
|             | PESD15VS2UAT              | $V_{RWM} = 15\text{ V}$              | –    | <1   | 50   | nA            |
|             | PESD24VS2UAT              | $V_{RWM} = 24\text{ V}$              | –    | <1   | 50   | nA            |
| $V_{BR}$    | breakdown voltage         | $I_Z = 5\text{ mA}$                  |      |      |      |               |
|             | PESD3V3S2UAT              |                                      | 5.2  | 5.6  | 6.0  | V             |
|             | PESD5V0S2UAT              |                                      | 6.4  | 6.8  | 7.2  | V             |
|             | PESD12VS2UAT              |                                      | 14.7 | 15.0 | 15.3 | V             |
|             | PESD15VS2UAT              |                                      | 17.6 | 18.0 | 18.4 | V             |
|             | PESD24VS2UAT              |                                      | 26.5 | 27.0 | 27.5 | V             |
| $C_d$       | diode capacitance         | $f = 1\text{ MHz}; V_R = 0\text{ V}$ |      |      |      |               |
|             | PESD3V3S2UAT              |                                      | –    | 207  | 300  | pF            |
|             | PESD5V0S2UAT              |                                      | –    | 152  | 200  | pF            |
|             | PESD12VS2UAT              |                                      | –    | 38   | 75   | pF            |
|             | PESD15VS2UAT              |                                      | –    | 32   | 70   | pF            |
|             | PESD24VS2UAT              |                                      | –    | 23   | 50   | pF            |
| $V_{(CL)R}$ | clamping voltage          | notes 1 and 2                        |      |      |      |               |
|             | PESD3V3S2UAT              | $I_{pp} = 1\text{ A}$                | –    | –    | 7    | V             |
|             |                           | $I_{pp} = 18\text{ A}$               | –    | –    | 20   | V             |
|             | PESD5V0S2UAT              | $I_{pp} = 1\text{ A}$                | –    | –    | 9    | V             |
|             |                           | $I_{pp} = 15\text{ A}$               | –    | –    | 20   | V             |
|             | PESD12VS2UAT              | $I_{pp} = 1\text{ A}$                | –    | –    | 19   | V             |
|             |                           | $I_{pp} = 5\text{ A}$                | –    | –    | 35   | V             |
|             | PESD15VS2UAT              | $I_{pp} = 1\text{ A}$                | –    | –    | 23   | V             |
|             |                           | $I_{pp} = 5\text{ A}$                | –    | –    | 40   | V             |
|             | PESD24VS2UAT              | $I_{pp} = 1\text{ A}$                | –    | –    | 36   | V             |
|             |                           | $I_{pp} = 3\text{ A}$                | –    | –    | 70   | V             |

# Double ESD protection diodes in SOT23 package

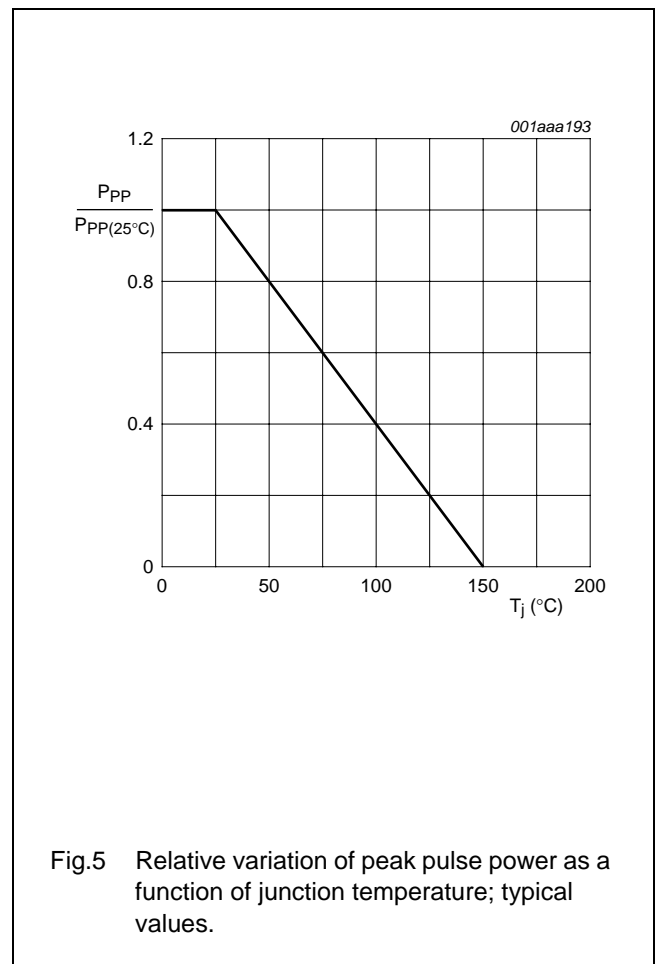
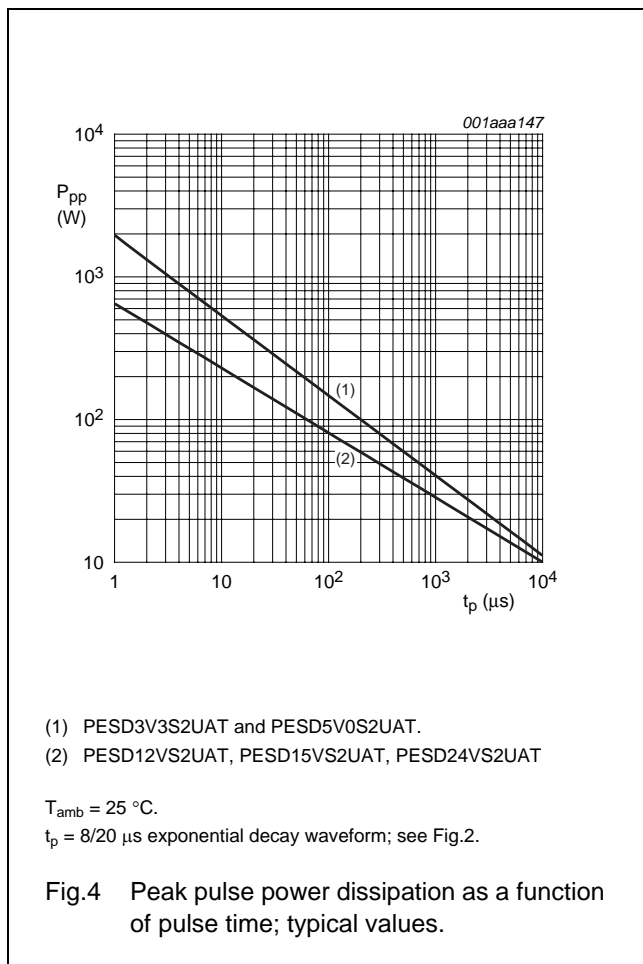
## PESDxS2UAT series

| SYMBOL            | PARAMETER               | CONDITIONS              | MIN. | TYP. | MAX. | UNIT |
|-------------------|-------------------------|-------------------------|------|------|------|------|
| R <sub>diff</sub> | differential resistance |                         |      |      |      |      |
|                   | PESD3V3S2UAT            | I <sub>R</sub> = 1 mA   | –    | –    | 400  | Ω    |
|                   | PESD5V0S2UAT            | I <sub>R</sub> = 1 mA   | –    | –    | 80   | Ω    |
|                   | PESD12VS2UAT            | I <sub>R</sub> = 1 mA   | –    | –    | 200  | Ω    |
|                   | PESD15VS2UAT            | I <sub>R</sub> = 1 mA   | –    | –    | 225  | Ω    |
|                   | PESD24VS2UAT            | I <sub>R</sub> = 0.5 mA | –    | –    | 300  | Ω    |

**Notes**

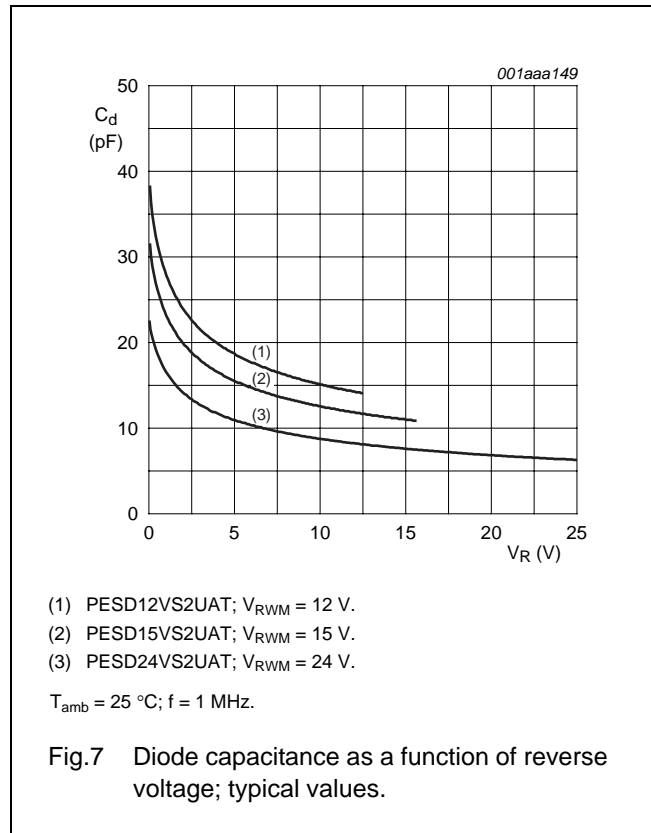
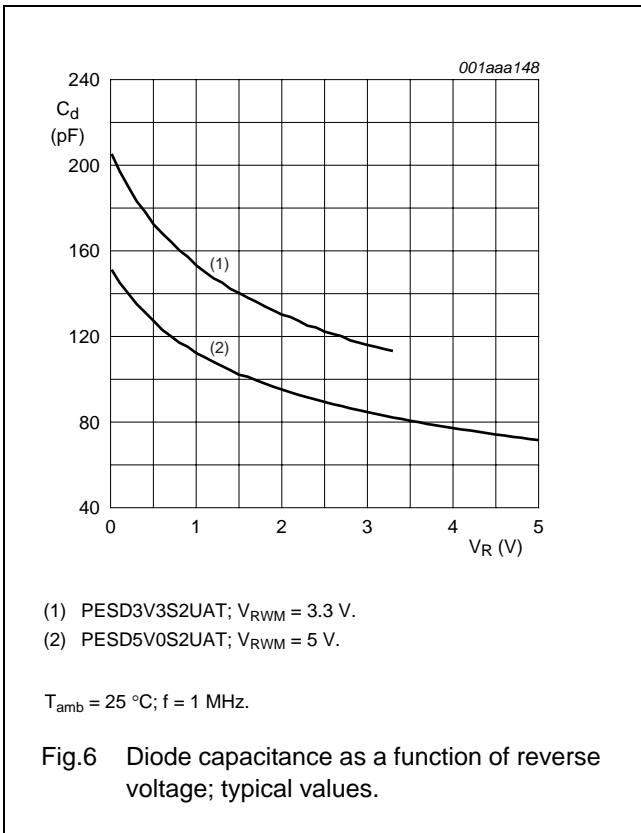
1. Non-repetitive current pulse 8/20 μs exponential decay waveform; see Fig.2.
2. Measured either across pins 1 and 3 or pins 2 and 3.

**GRAPHICAL DATA**



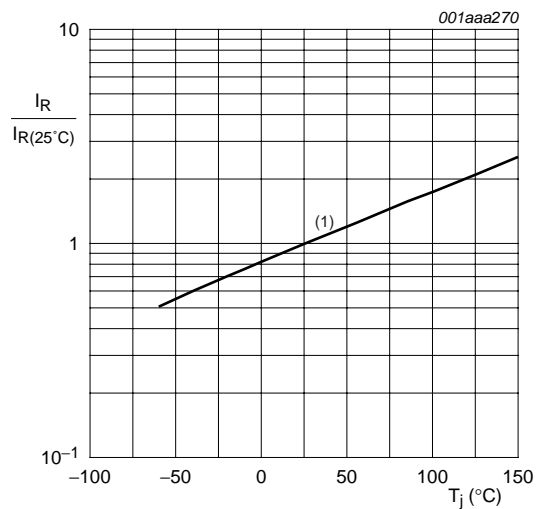
Double ESD protection diodes  
in SOT23 package

PESDxS2UAT series



Double ESD protection diodes  
in SOT23 package

PESDxS2UAT series



(1) PESD3V3S2UAT;  $V_{RWM} = 3.3$  V.  
 PESD5V0S2UAT;  $V_{RWM} = 5$  V.

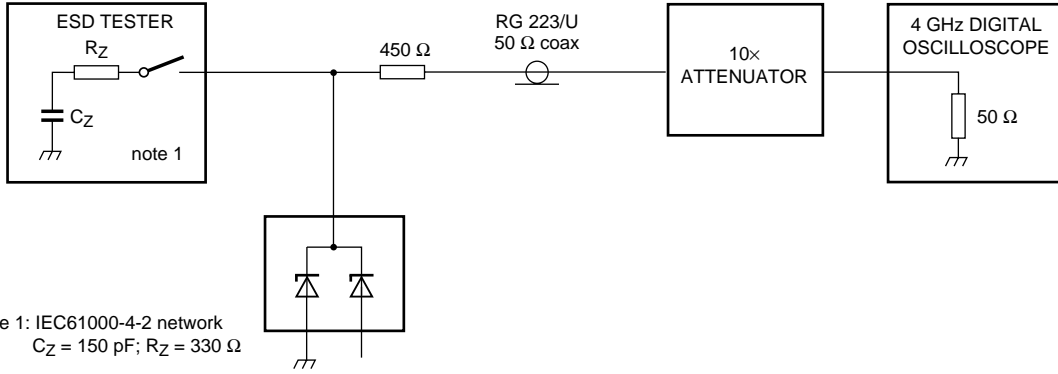
$I_R$  is less than 10 nA at 150 °C for:  
 PESD12V52UAT;  $V_{RWM} = 12$  V.  
 PESD15VS2UAT;  $V_{RWM} = 15$  V.  
 PESD24VS2UAT;  $V_{RWM} = 24$  V.

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



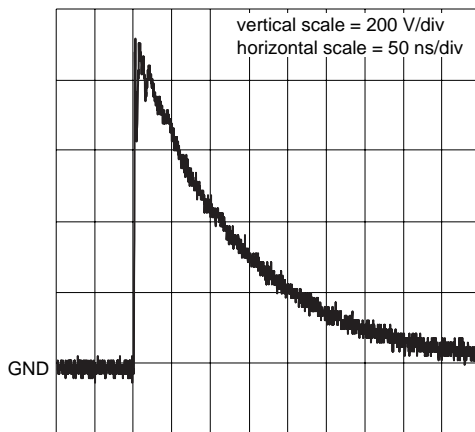
# Double ESD protection diodes in SOT23 package

## PESDxS2UAT series

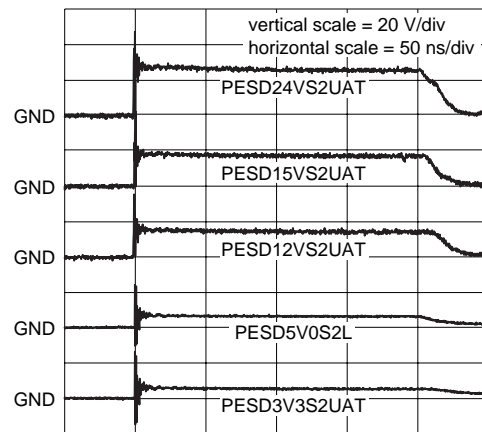


Note 1: IEC61000-4-2 network  
 $C_Z = 150 \text{ pF}$ ;  $R_Z = 330 \text{ } \Omega$

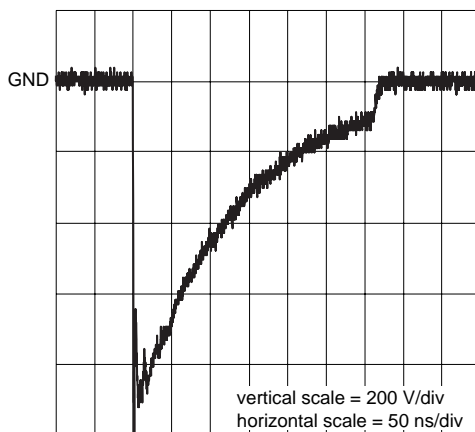
D.U.T.: PESDxS2UAT



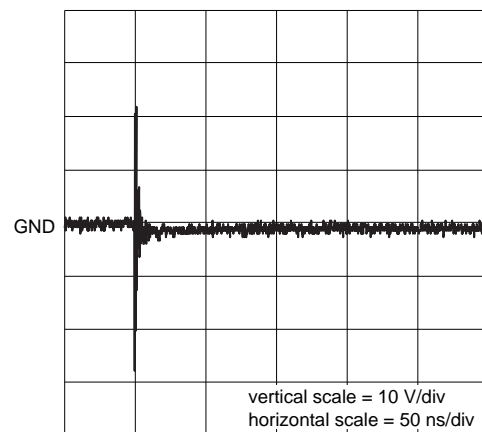
unclamped +1 kV ESD voltage waveform (IEC61000-4-2 network)



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)

001aaa151

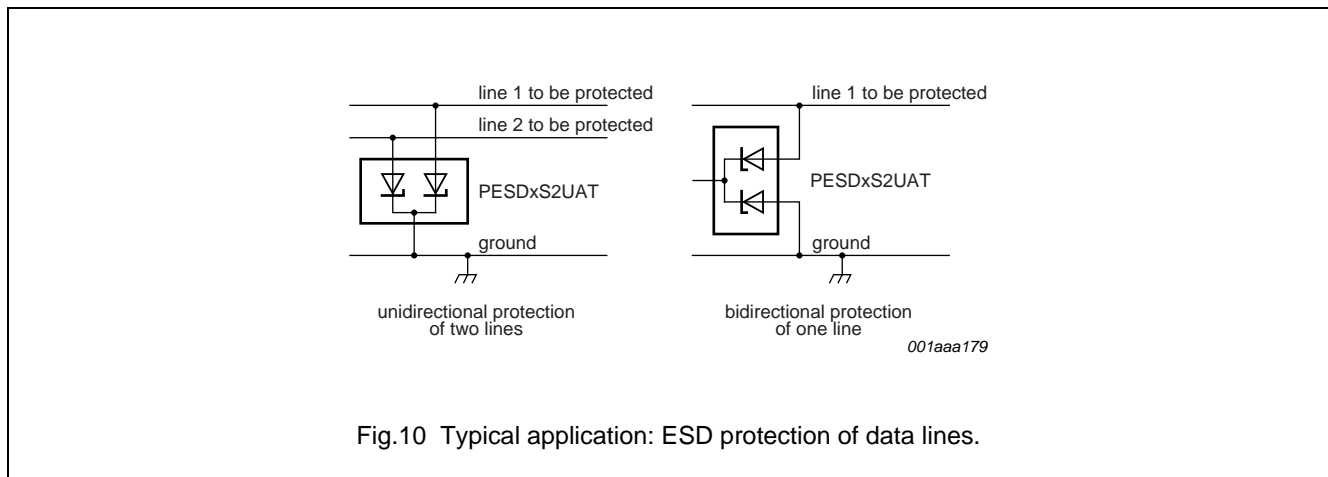
Fig.9 ESD clamping test set-up and waveforms.

## Double ESD protection diodes in SOT23 package

## PESDxS2UAT series

### APPLICATION INFORMATION

The PESDxS2UAT series can protect up to two lines against damage caused by unidirectional ElectroStatic Discharge (ESD) and surge pulses. The PESDxS2UAT series can protect lines whose signal polarities are below ground. PESDxS2UAT series provide a surge capability of up to 330 Watts peak pulse power per line for a 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:

1. Place the PESDxS2UAT as close as possible to the input terminal or connector.
2. Minimize the path length between the PESDxS2UAT and the protected line.
3. Keep parallel signal paths to a minimum.
4. Avoid running protected conductors in parallel with unprotected conductors.
5. Minimize all printed-circuit board conductive loops including power and ground loops.
6. Minimize the length of transient return paths to ground.
7. Avoid using shared transient return paths to a common ground point.
8. Ground planes should be used whenever possible.
9. Use vias for multi-layer printed-circuit boards.

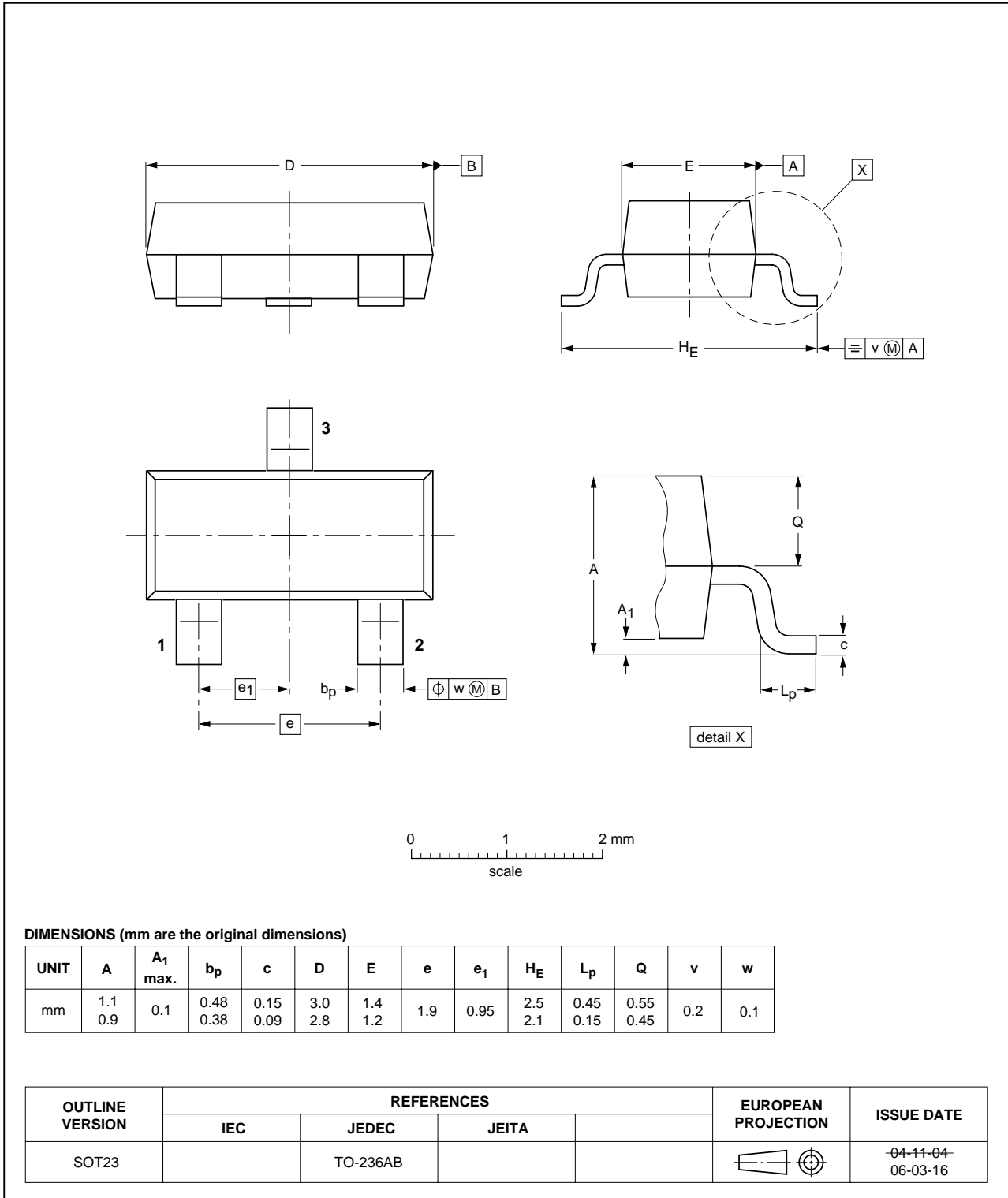
# Double ESD protection diodes in SOT23 package

## PESDxS2UAT series

### PACKAGE OUTLINE

Plastic surface-mounted package; 3 leads

SOT23



# Double ESD protection diodes in SOT23 package

## PESDxS2UAT series

### DATA SHEET STATUS

| DOCUMENT STATUS <sup>(1)</sup> | PRODUCT STATUS <sup>(2)</sup> | DEFINITION  |
|--------------------------------|-------------------------------|---|
| Objective data sheet           | Development                   | This document contains data from the objective specification for product development. |
| Preliminary data sheet         | Qualification                 | This document contains data from the preliminary specification.                       |
| Product data sheet             | Production                    | This document contains the product specification.                                     |

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## **Contact information**

For additional information please visit: <http://www.nxp.com>

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