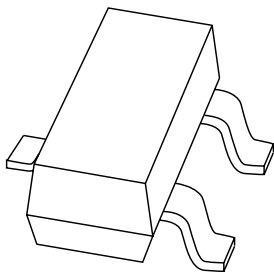


# DATA SHEET



## **PESDxS2UT series**

Double ESD protection diodes in  
SOT23 package

Product data sheet  
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  $t_p = 8/20 \text{ } \mu\text{s}$
- 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  $t_p = 8/20 \text{ } \mu\text{s}$ .

### 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

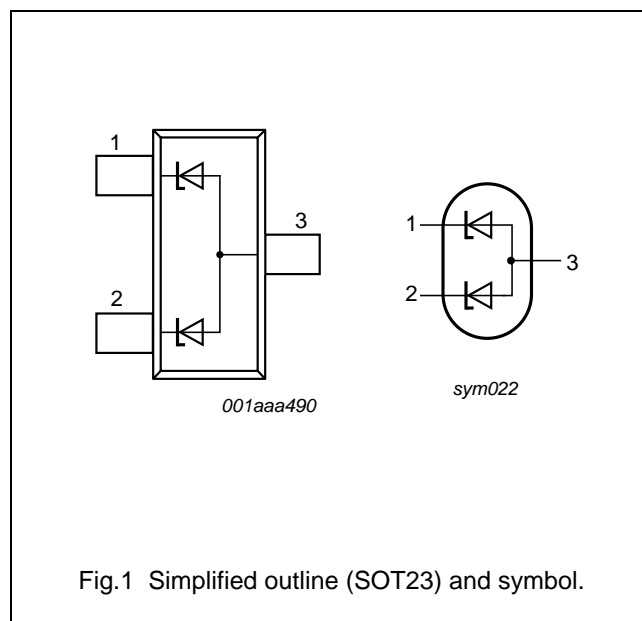
1. \* = p : made in Hong Kong.  
\* = t : made in Malaysia.  
\* = W : made in China.

### 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 $V_R = 0 \text{ V}$ ; $f = 1 \text{ MHz}$	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
$P_{pp}$	peak pulse power	8/20 $\mu$ s pulse; notes 1 and 2			
	PESD3V3S2UT		–	330	W
	PESD5V2S2UT		–	260	W
	PESD12VS2UT		–	180	W
	PESD15VS2UT		–	160	W
	PESD24VS2UT		–	160	W
$I_{pp}$	peak pulse current	8/20 $\mu$ s pulse; notes 1 and 2			
	PESD3V3S2UT		–	18	A
	PESD5V2S2UT		–	15	A
	PESD12VS2UT		–	5	A
	PESD15VS2UT		–	5	A
	PESD24VS2UT		–	3	A
$T_j$	junction temperature		–	150	°C
$T_{amb}$	operating ambient temperature		–65	+150	°C
$T_{stg}$	storage temperature		–65	+150	°C

### 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

PESDxS2UT series

ESD maximum ratings

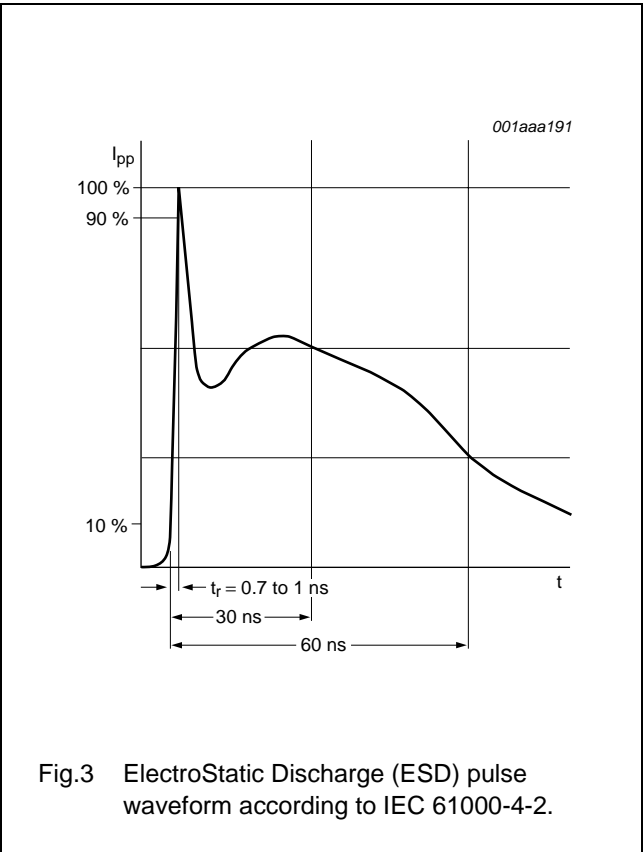
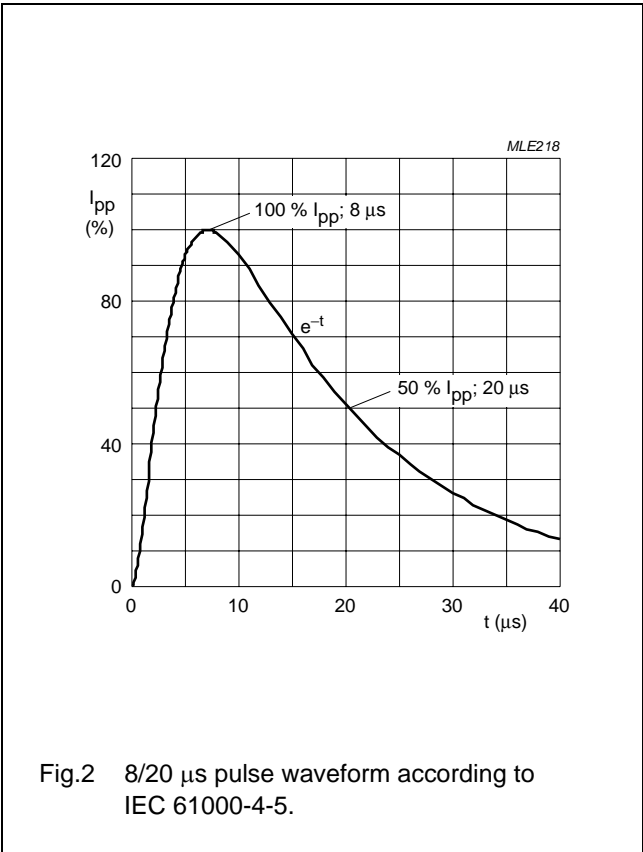
SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
ESD	electrostatic discharge capability	IEC 61000-4-2 (contact discharge); notes 1 and 2		
		PESD3V3S2UT	30	kV
		PESD5V2S2UT	30	kV
		PESD12VS2UT	30	kV
		PESD15VS2UT	30	kV
		PESD24VS2UT	23	kV
		HBM MIL-Std 883 PESDxS2UT series	10	kV

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

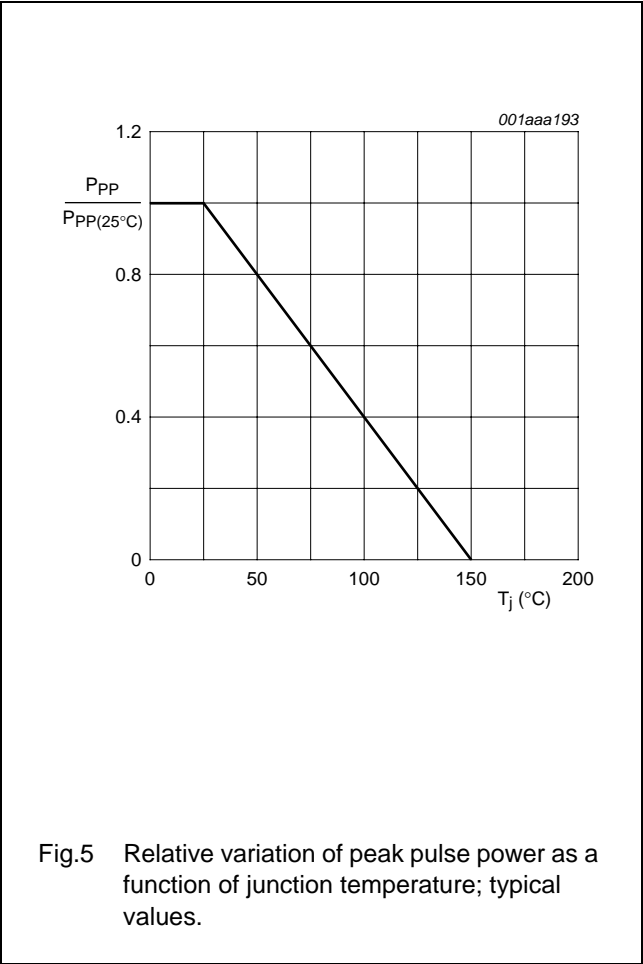
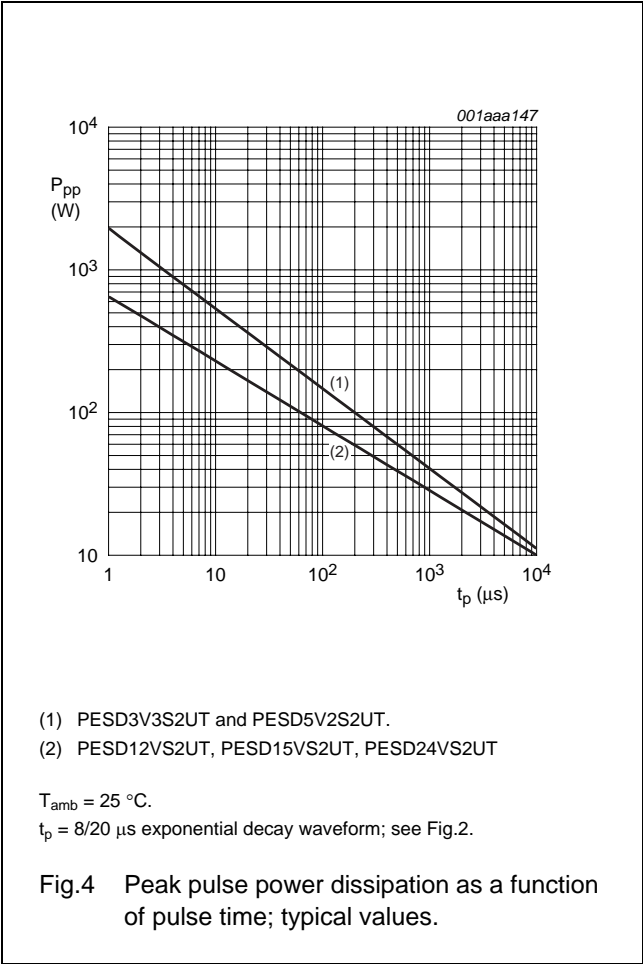
PESDxS2UT series

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

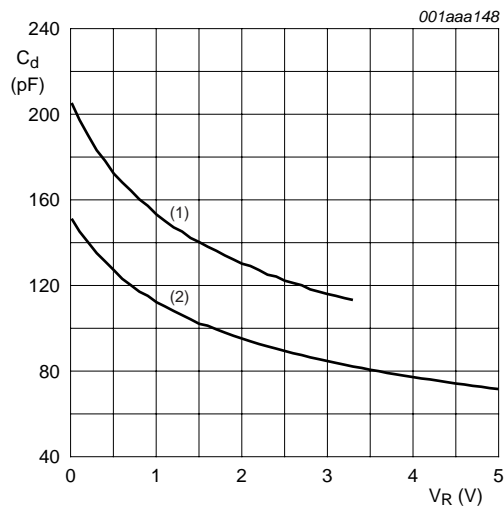
1. Non-repetitive current pulse 8/20  $\mu\text{s}$  exponential decay waveform; see Fig.2.
2. Measured either across pins 1 and 3 or pins 2 and 3.

GRAPHICAL DATA



# Double ESD protection diodes in SOT23 package

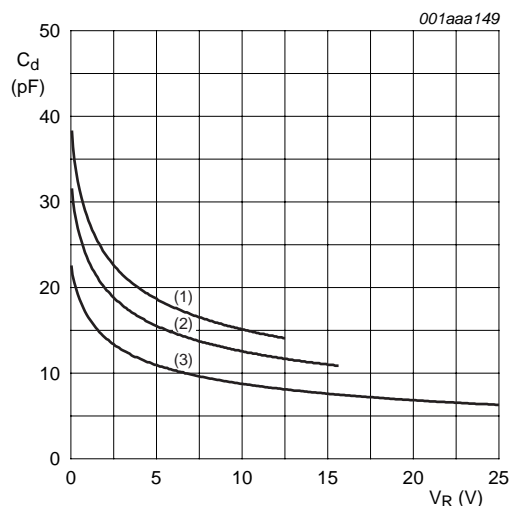
## PESDxS2UT series



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

$T_{amb} = 25$  °C;  $f = 1$  MHz.

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



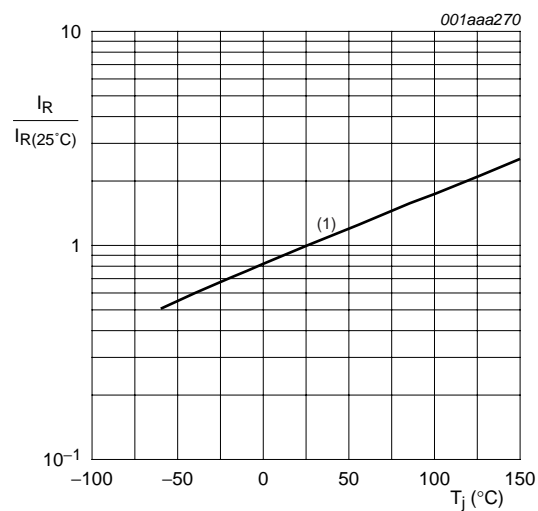
- (1) PESD12VS2UT;  $V_{RWM} = 12$  V.  
 (2) PESD15VS2UT;  $V_{RWM} = 15$  V.  
 (3) PESD24VS2UT;  $V_{RWM} = 24$  V.

$T_{amb} = 25$  °C;  $f = 1$  MHz.

Fig.7 Diode capacitance as a function of reverse voltage; typical values.

# 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.

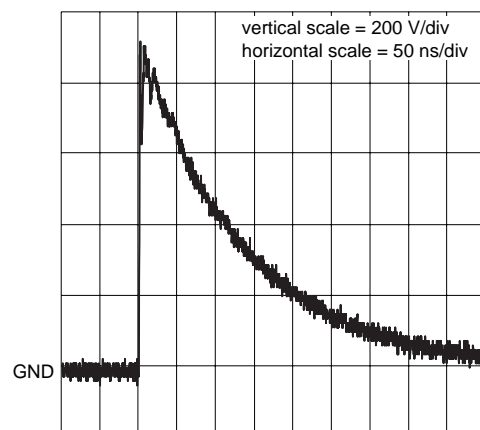
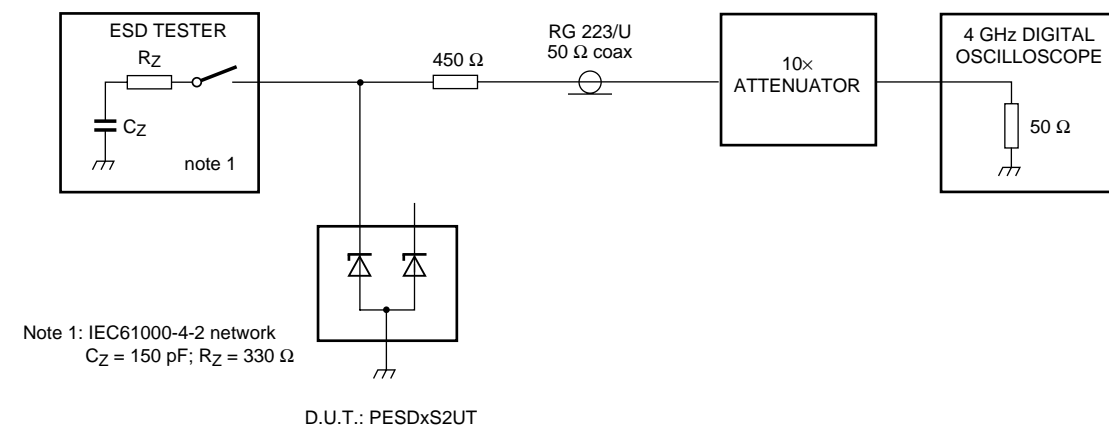
PESD24VS2UT;  $V_{RWM} = 24$  V.

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

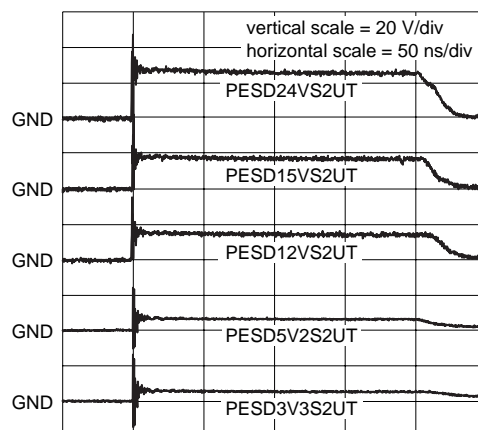


## Double ESD protection diodes in SOT23 package

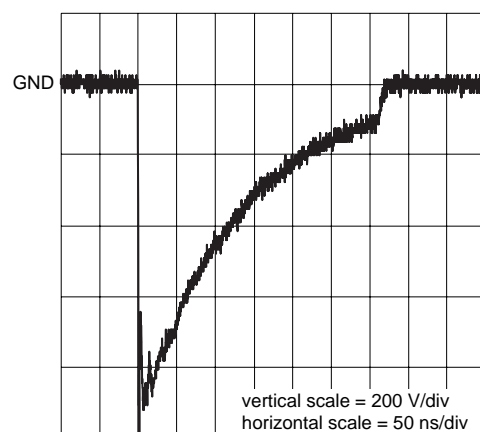
## PESDxS2UT series



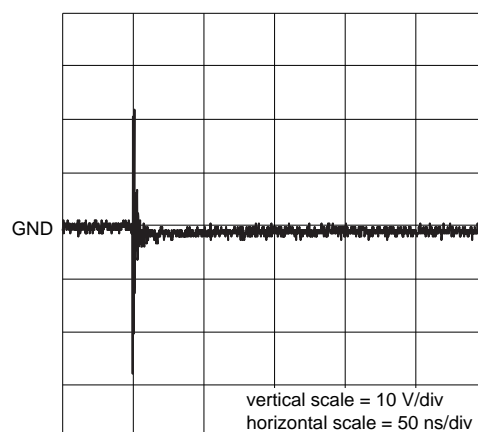
unclamped +1 kV ESD voltage waveform  
(IEC61000-4-2 network)



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)

001aaa492

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.

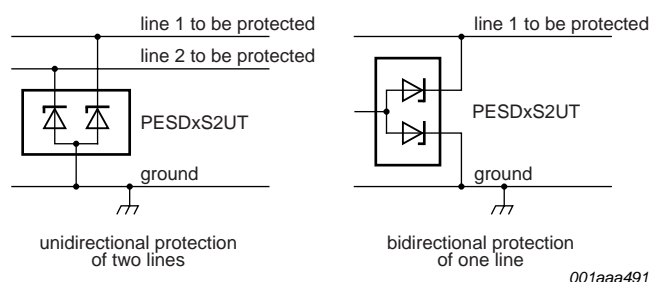


Fig.10 Typical application: ESD protection of data lines.

### 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 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

0 1 2 mm  
scale

DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub> max.	b <sub>p</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	Q	v	w
mm	1.1 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT23		TO-236AB				04-11-04 06-03-16

# Double ESD protection diodes in SOT23 package

## PESDxS2UT 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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## **Customer notification**

This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content, except for package outline drawings which were updated to the latest version.

## **Contact information**

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

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