

# PESDxL2BT series

Low capacitance double bidirectional ESD protection diodes in SOT23

Rev. 01 — 1 November 2005

Product data sheet

## 1. Product profile

### 1.1 General description

Low capacitance double bidirectional ElectroStatic Discharge (ESD) protection diodes in a SOT23 small Surface Mounted Device (SMD) plastic package designed to protect two signal lines from the damage caused by ESD and other transients.

### 1.2 Features

- ESD protection of two lines
- Max. peak pulse power:  $P_{PP} = 350$  W
- Low clamping voltage:  $V_{CL} = 26$  V
- Small SMD plastic package
- Ultra low leakage current:  $I_{RM} < 90$  nA
- ESD protection up to 23 kV
- IEC 61000-4-2, level 4 (ESD)
- IEC 61000-4-5 (surge);  $I_{PP} = 15$  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

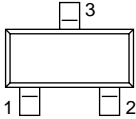
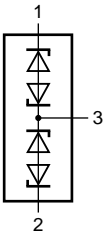
Table 1: Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{RWM}$	reverse standoff voltage					
	PESD3V3L2BT		-	-	3.3	V
	PESD5V0L2BT		-	-	5.0	V
	PESD12VL2BT		-	-	12	V
	PESD15VL2BT		-	-	15	V
	PESD24VL2BT		-	-	24	V
$C_d$	diode capacitance	$V_R = 0$ V; $f = 1$ MHz				
	PESD3V3L2BT		-	101	-	pF
	PESD5V0L2BT		-	75	-	pF
	PESD12VL2BT		-	19	-	pF
	PESD15VL2BT		-	16	-	pF
	PESD24VL2BT		-	11	-	pF

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## 2. Pinning information

**Table 2: Pinning**

Pin	Description	Simplified outline	Symbol
1	cathode 1		
2	cathode 2		
3	double cathode		

006aaa155

## 3. Ordering information

**Table 3: Ordering information**

Type number	Package		
	Name	Description	Version
PESD3V3L2BT	-	plastic surface mounted package; 3 leads	SOT23
PESD5V0L2BT			
PESD12VL2BT			
PESD15VL2BT			
PESD24VL2BT			

## 4. Marking

**Table 4: Marking codes**

Type number	Marking code <sup>[1]</sup>
PESD3V3L2BT	V3*
PESD5V0L2BT	V4*
PESD12VL2BT	V5*
PESD15VL2BT	V6*
PESD24VL2BT	V7*

[1] \* = -: made in Hong Kong  
 \* = p: made in Hong Kong  
 \* = t: made in Malaysia  
 \* = W: made in China

## 5. Limiting values

**Table 5: 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	t <sub>p</sub> = 8/20 μs	[1] [2]		
	PESD3V3L2BT		-	350	W
	PESD5V0L2BT		-	350	W
	PESD12VL2BT		-	200	W
	PESD15VL2BT		-	200	W
	PESD24VL2BT		-	200	W
I <sub>PP</sub>	peak pulse current	t <sub>p</sub> = 8/20 μs	[1] [2]		
	PESD3V3L2BT		-	15	A
	PESD5V0L2BT		-	13	A
	PESD12VL2BT		-	5	A
	PESD15VL2BT		-	5	A
	PESD24VL2BT		-	3	A
T <sub>j</sub>	junction temperature		-	150	°C
T <sub>amb</sub>	ambient temperature		-65	+150	°C
T <sub>stg</sub>	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 to 3 or 2 to 3.

**Table 6: ESD maximum ratings**

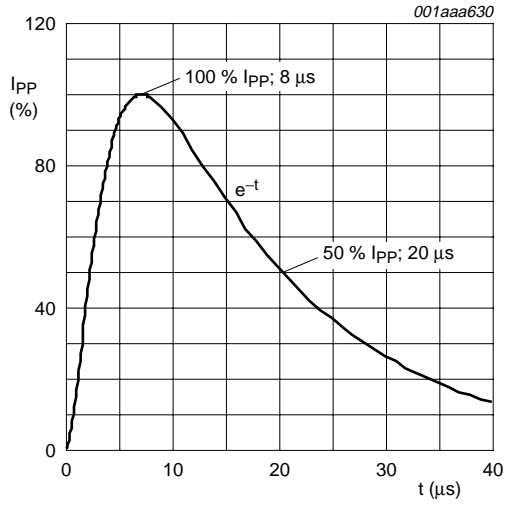
Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>ESD</sub>	electrostatic discharge voltage	IEC 61000-4-2 (contact discharge)	[1] [2]		
	PESD3V3L2BT		-	30	kV
	PESD5V0L2BT				
	PESD12VL2BT				
	PESD15VL2BT				
	PESD24VL2BT		-	23	kV
	PESDxL2BT series	HBM MIL-STD883	-	10	kV

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

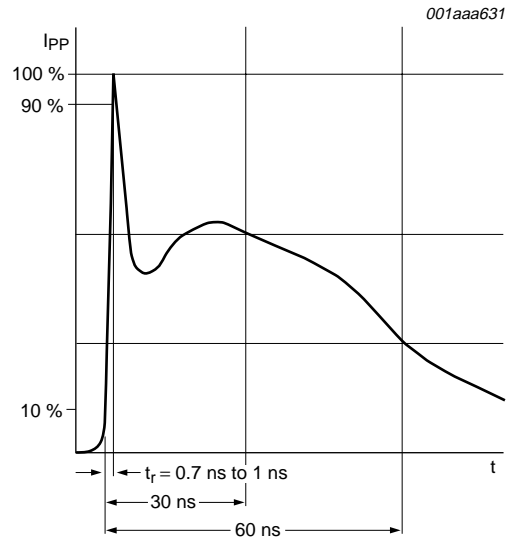
[2] Measured from pin 1 to 3 or 2 to 3.

**Table 7: ESD standards compliance**

ESD Standard	Conditions
IEC 61000-4-2, level 4 (ESD)	> 15 kV (air); > 8 kV (contact)
HBM MIL-STD883, class 3	> 4 kV



**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**

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

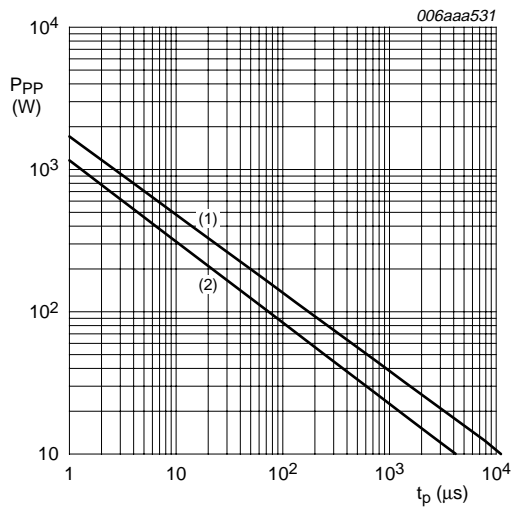
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{RWM}$	reverse standoff voltage					
	PESD3V3L2BT		-	-	3.3	V
	PESD5V0L2BT		-	-	5.0	V
	PESD12VL2BT		-	-	12	V
	PESD15VL2BT		-	-	15	V
	PESD24VL2BT		-	-	24	V
$I_{RM}$	reverse leakage current					
	PESD3V3L2BT	$V_{RWM} = 3.3\text{ V}$	-	0.09	2	$\mu\text{A}$
	PESD5V0L2BT	$V_{RWM} = 5.0\text{ V}$	-	0.01	1	$\mu\text{A}$
	PESD12VL2BT	$V_{RWM} = 12\text{ V}$	-	< 1	50	nA
	PESD15VL2BT	$V_{RWM} = 15\text{ V}$	-	< 1	50	nA
	PESD24VL2BT	$V_{RWM} = 24\text{ V}$	-	< 1	50	nA
$V_{BR}$	breakdown voltage	$I_R = 5\text{ mA}$				
	PESD3V3L2BT		5.8	6.4	6.9	V
	PESD5V0L2BT		7.0	7.6	8.2	V
	PESD12VL2BT		14.2	15.8	16.7	V
	PESD15VL2BT		17.1	18.8	20.3	V
	PESD24VL2BT		25.4	27.8	30.3	V
$C_d$	diode capacitance	$V_R = 0\text{ V};$ $f = 1\text{ MHz}$				
	PESD3V3L2BT		-	101	-	pF
	PESD5V0L2BT		-	75	-	pF
	PESD12VL2BT		-	19	-	pF
	PESD15VL2BT		-	16	-	pF
	PESD24VL2BT		-	11	-	pF
$V_{CL}$	clamping voltage					
	PESD3V3L2BT	$I_{PP} = 1\text{ A}$	-	-	8	V
		$I_{PP} = 15\text{ A}$	-	-	26	V
	PESD5V0L2BT	$I_{PP} = 1\text{ A}$	-	-	10	V
		$I_{PP} = 13\text{ A}$	-	-	28	V
	PESD12VL2BT	$I_{PP} = 1\text{ A}$	-	-	20	V
		$I_{PP} = 5\text{ A}$	-	-	37	V
	PESD15VL2BT	$I_{PP} = 1\text{ A}$	-	-	25	V
		$I_{PP} = 5\text{ A}$	-	-	44	V
	PESD24VL2BT	$I_{PP} = 1\text{ A}$	-	-	40	V
		$I_{PP} = 3\text{ A}$	-	-	70	V

**Table 8: Characteristics ...continued**  
 $T_{amb} = 25^{\circ}\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$r_{dif}$	differential resistance	$I_R = 1\text{ mA}$				
	PESD3V3L2BT		-	-	400	$\Omega$
	PESD5V0L2BT		-	-	80	$\Omega$
	PESD12VL2BT		-	-	200	$\Omega$
	PESD15VL2BT		-	-	225	$\Omega$
PESD24VL2BT		-	-	300	$\Omega$	

[1] Non-repetitive current pulse 8/20  $\mu\text{s}$  exponential decay waveform according to IEC 61000-4-5.

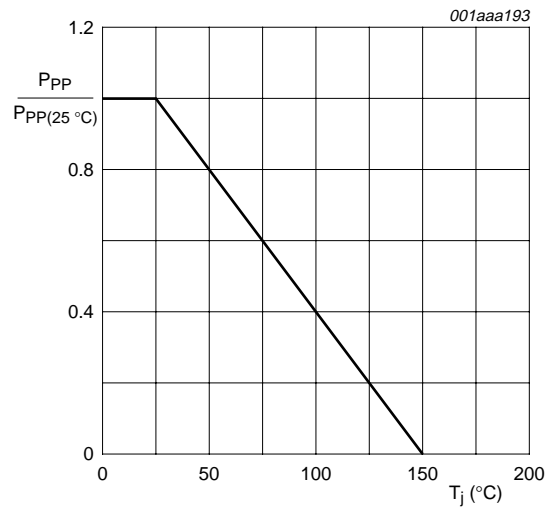
[2] Measured from pin 1 to 3 or 2 to 3.



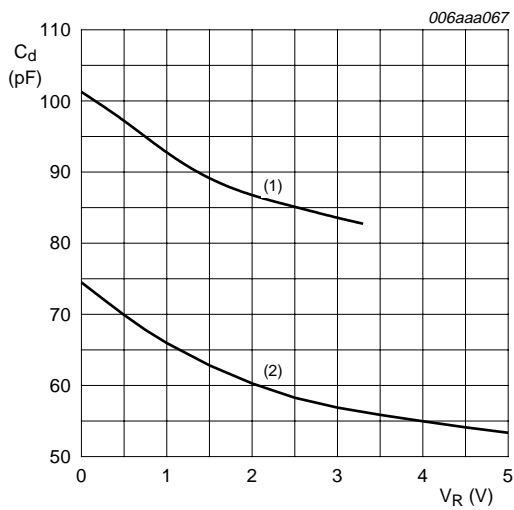
$T_{amb} = 25\text{ }^\circ\text{C}$

- (1) PESD3V3L2BT and PESD5V0L2BT
- (2) PESD12VL2BT, PESD15VL2BT, PESD24VL2BT

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



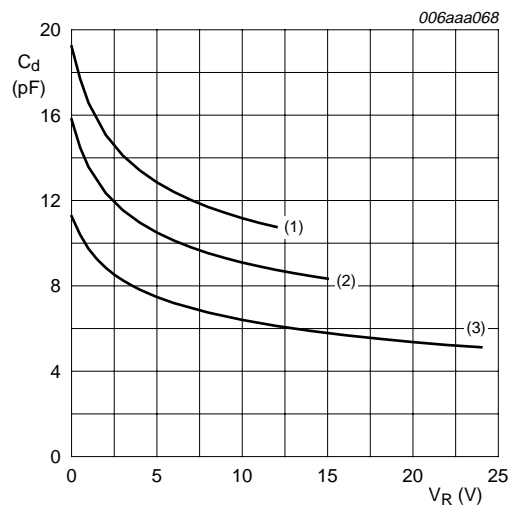
**Fig 4. Relative variation of peak pulse power as a function of junction temperature; typical values**



$T_{amb} = 25\text{ }^\circ\text{C}; f = 1\text{ MHz}$

- (1) PESD3V3L2BT
- (2) PESD5V0L2BT

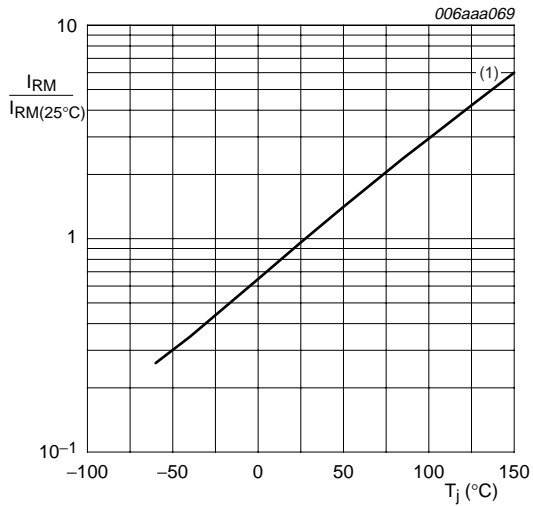
**Fig 5. Diode capacitance as a function of reverse voltage; typical values**



$T_{amb} = 25\text{ }^\circ\text{C}; f = 1\text{ MHz}$

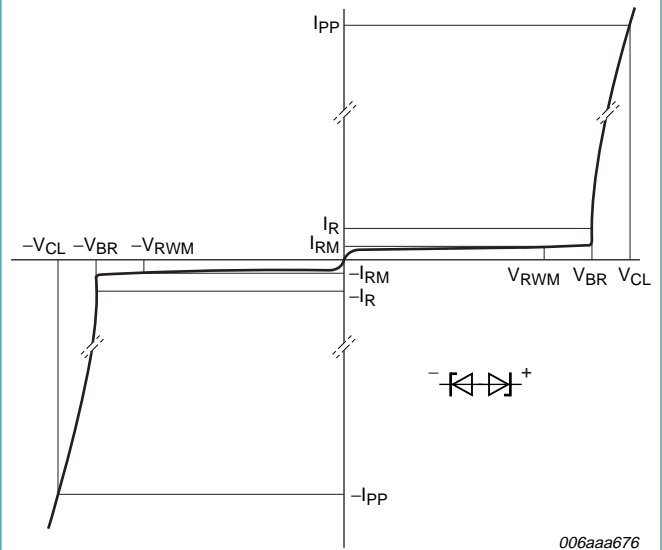
- (1) PESD12VL2BT
- (2) PESD15VL2BT
- (3) PESD24VL2BT

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



(1) PESD3V3L2BT, PESD5V0L2BT  
 PESD12VL2BT, PESD15VL2BT and  
 PESD24VL2BT:  $I_{RM} < 20 \text{ nA}$ ;  $T_j = 150 \text{ }^\circ\text{C}$

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



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



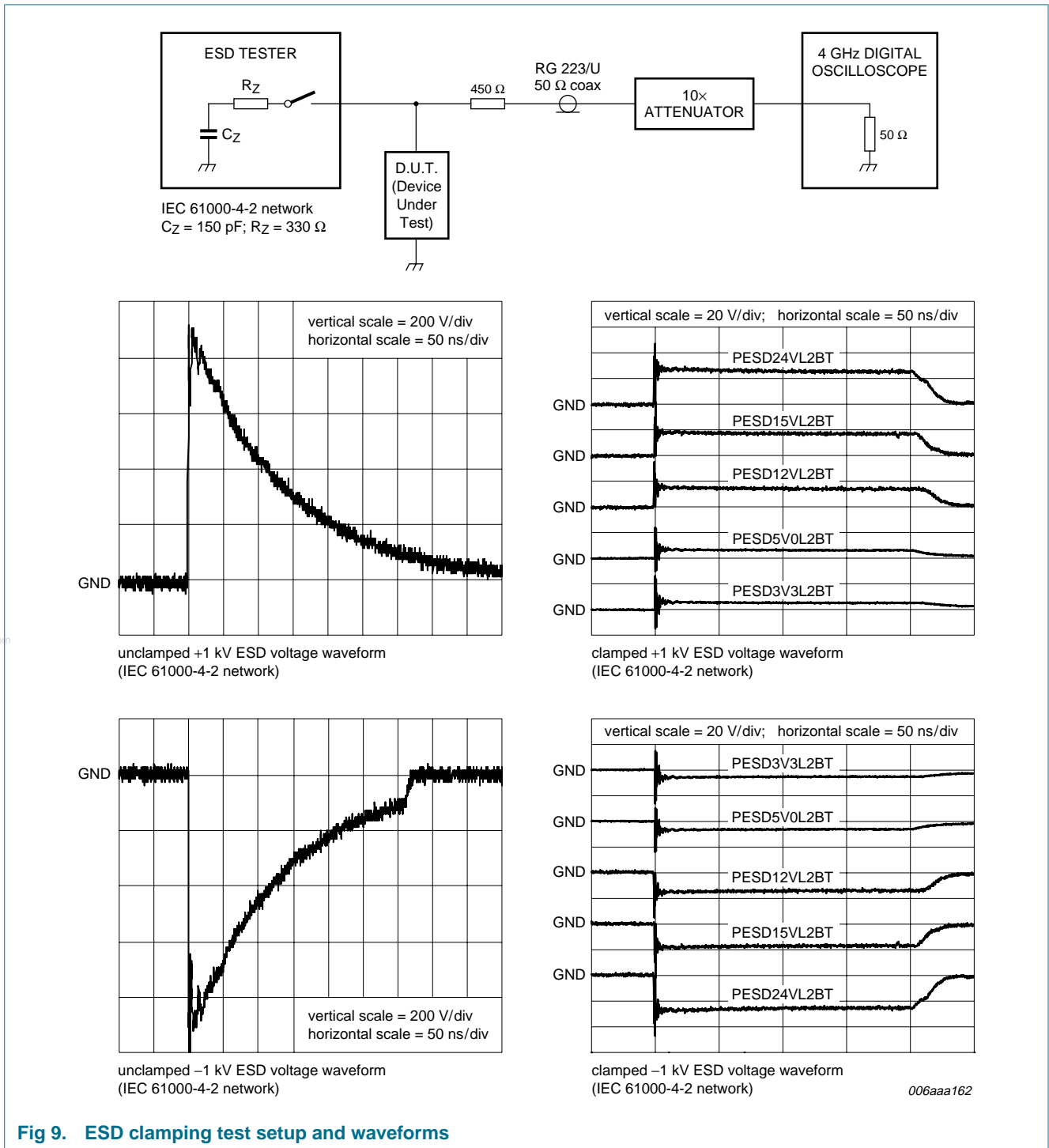


Fig 9. ESD clamping test setup and waveforms

## 7. Application information

The PESDxL2BT series is designed for the protection of two bidirectional signal lines from the damage caused by ESD and surge pulses. The PESDxL2BT series may be used on lines where the signal polarities are above and below ground. The PESDxL2BT series provides a surge capability of up to 350 W per line for an 8/20  $\mu$ s waveform.

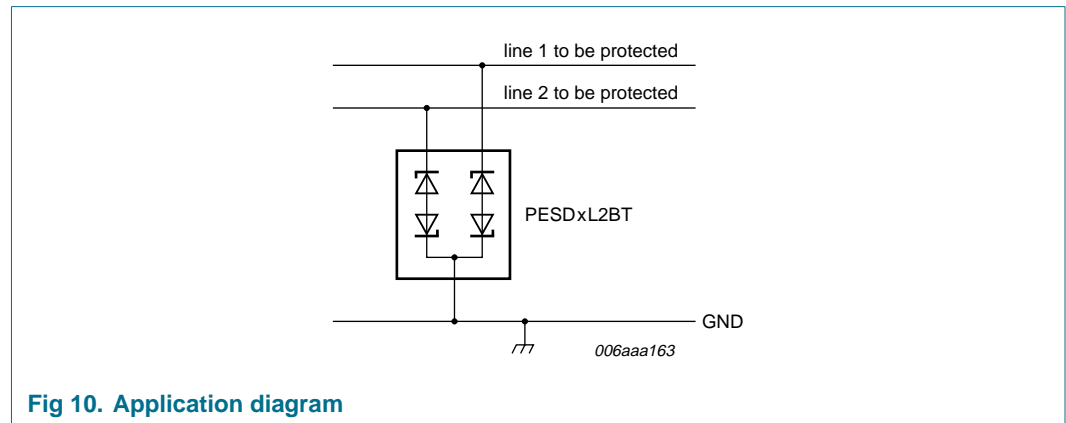


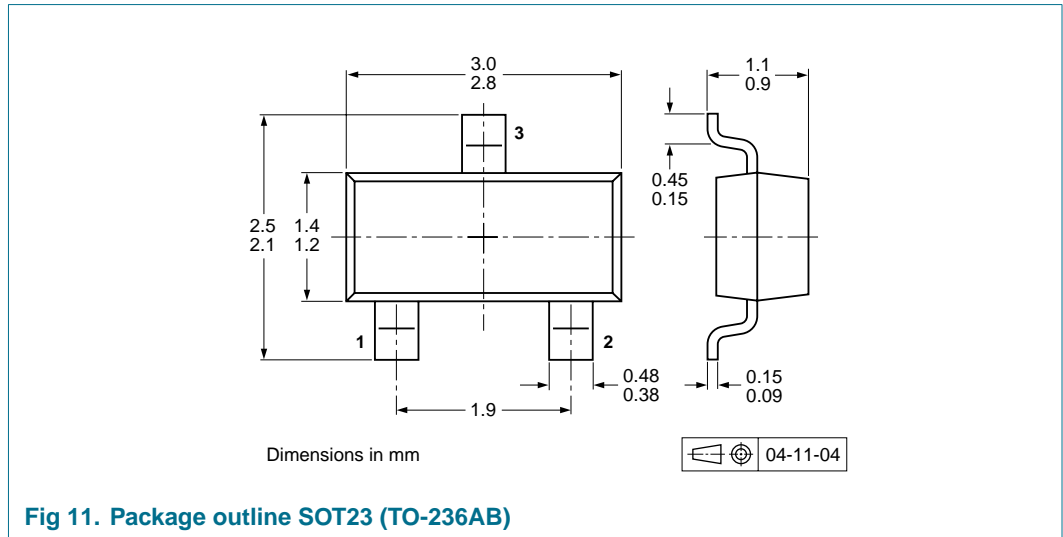
Fig 10. Application diagram

### 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 PESDxL2BT as close to the input terminal or connector as possible.
2. The path length between the PESDxL2BT 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.

## 8. Package outline



## 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
PESD3V3L2BT	SOT23	4 mm pitch, 8 mm tape and reel	-215	-235
PESD5V0L2BT				
PESD12VL2BT				
PESD15VL2BT				
PESD24VL2BT				

[1] For further information and the availability of packing methods, see [Section 15](#).

## 10. Revision history

**Table 10: Revision history**

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
PESDXL2BT_SER_1	20051101	Product data sheet	-	9397 750 14034	-

## 11. 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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