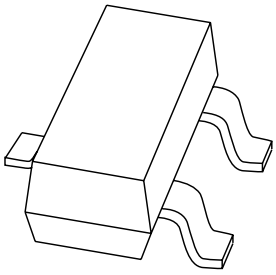
DATA SHEET



PESDxS2UAT series
Double ESD protection diodes in SOT23 package

Product specification

2004 Feb 18

Philips Semiconductors

PHILIPS

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 W at t_p = 8/20 µs
- Low clamping voltage: $V_{(CL)R}$ = 20 V at I_{pp} = 18 A
- Ultra-low reverse leakage current: I_{RM} < 700 nA
- ESD protection > 30 kV
- IEC 61000-4-2; level 4 (ESD)
- IEC 61000-4-5 (surge); I_{pp} = 18 A at t_p = 8/20 µs.

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(1)
PESD3V3S2UAT	*7A
PESD5V0S2UAT	*7B
PESD12VS2UAT	*7C
PESD15VS2UAT	*7D
PESD24VS2UAT	*7E

Note

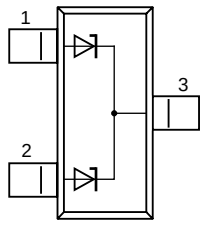
1. * = p : made in Hong Kong.
   * = t : made in Malaysia.
   * = W : made in China.

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 V_R = 0 V; f = 1 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



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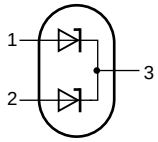


sym002

Fig.1 Simplified outline (SOT23) and symbol.

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 μs pulse; notes 1 and 2			
	PESD3V3S2UAT		–	330	W
	PESD5V0S2UAT		–	260	W
	PESD12VS2UAT		–	180	W
	PESD15VS2UAT		–	160	W
	PESD24VS2UAT		–	160	W
I_{pp}	peak pulse current	8/20 μs pulse; notes 1 and 2			
	PESD3V3S2UAT		–	18	A
	PESD5V0S2UAT		–	15	A
	PESD12VS2UAT		–	5	A
	PESD15VS2UAT		–	5	A
	PESD24VS2UAT		–	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 μs exponential decay waveform; see Fig.2.
2. Measured across either pins 1 and 3 or pins 2 and 3.

ESD maximum ratings

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
ESD	electrostatic discharge	IEC 61000-4-2 (contact discharge); 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

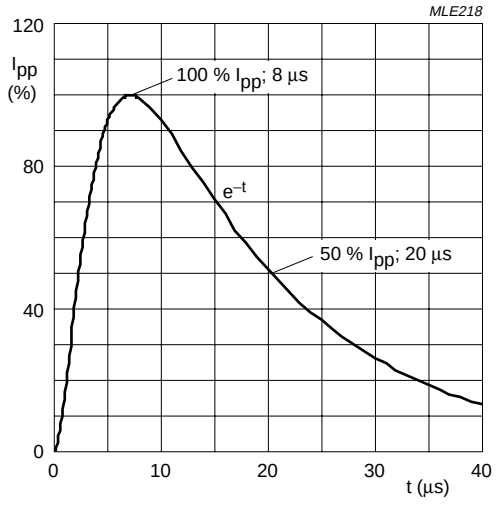


Fig.2 8/20 µs pulse waveform according to IEC 61000-4-5.

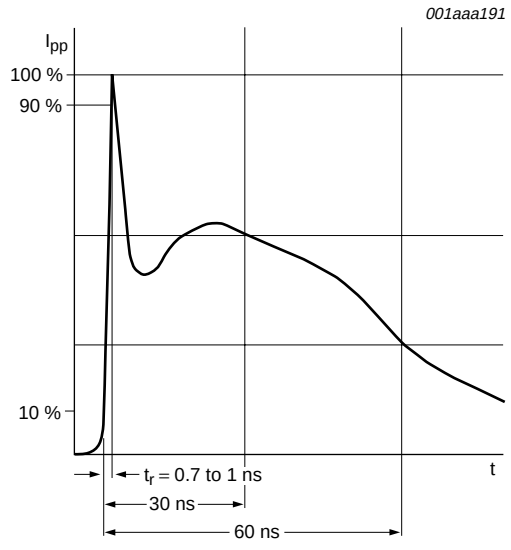


Fig.3 ElectroStatic Discharge (ESD) pulse waveform according to IEC 61000-4-2.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

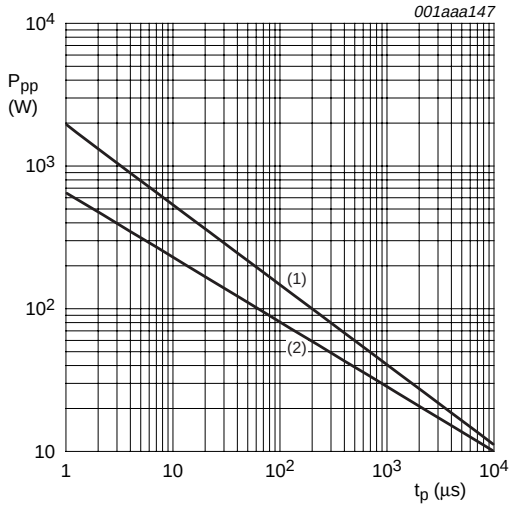
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{RWM}	reverse stand-off voltage					
	PESD3V3S2UAT		–	–	3.3	V
	PESD5V0S2UAT		–	–	5	V
	PESD12VS2UAT		–	–	12	V
	PESD15VS2UAT		–	–	15	V
	PESD24VS2UAT		–	–	24	V
I_{RM}	reverse leakage current					
	PESD3V3S2UAT	V_{RWM} = 3.3 V	–	0.7	2	μA
	PESD5V0S2UAT	V_{RWM} = 5 V	–	0.1	1	μA
	PESD12VS2UAT	V_{RWM} = 12 V	–	<1	50	nA
	PESD15VS2UAT	V_{RWM} = 15 V	–	<1	50	nA
	PESD24VS2UAT	V_{RWM} = 24 V	–	<1	50	nA
V_{BR}	breakdown voltage	I_Z = 5 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 MHz; V_R = 0 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 A	–	–	7	V
		I_{pp} = 18 A	–	–	20	V
	PESD5V0S2UAT	I_{pp} = 1 A	–	–	9	V
		I_{pp} = 15 A	–	–	20	V
	PESD12VS2UAT	I_{pp} = 1 A	–	–	19	V
		I_{pp} = 5 A	–	–	35	V
	PESD15VS2UAT	I_{pp} = 1 A	–	–	23	V
		I_{pp} = 5 A	–	–	40	V
	PESD24VS2UAT	I_{pp} = 1 A	–	–	36	V
		I_{pp} = 3 A	–	–	70	V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
R_{diff}	differential resistance					
	PESD3V3S2UAT	I_R = 1 mA	–	–	400	Ω
	PESD5V0S2UAT	I_R = 1 mA	–	–	80	Ω
	PESD12VS2UAT	I_R = 1 mA	–	–	200	Ω
	PESD15VS2UAT	I_R = 1 mA	–	–	225	Ω
	PESD24VS2UAT	I_R = 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



(1) PESD3V3S2UAT and PESD5V0S2UAT.
(2) PESD12VS2UAT, PESD15VS2UAT, PESD24VS2UAT

T_{amb} = 25 °C.
t_p = 8/20 μs exponential decay waveform; see Fig.2.

Fig.4 Peak pulse power dissipation as a function of pulse time; typical values.

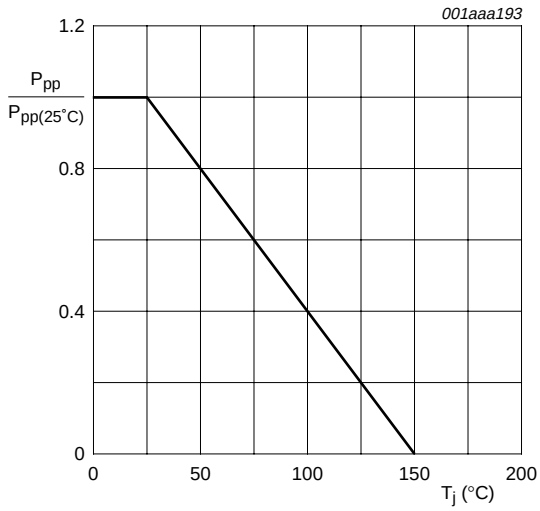
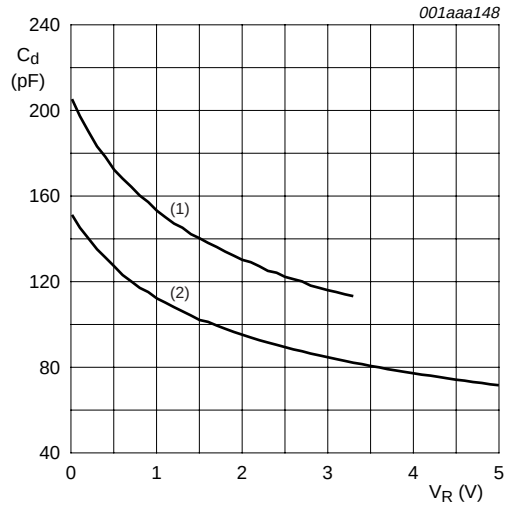


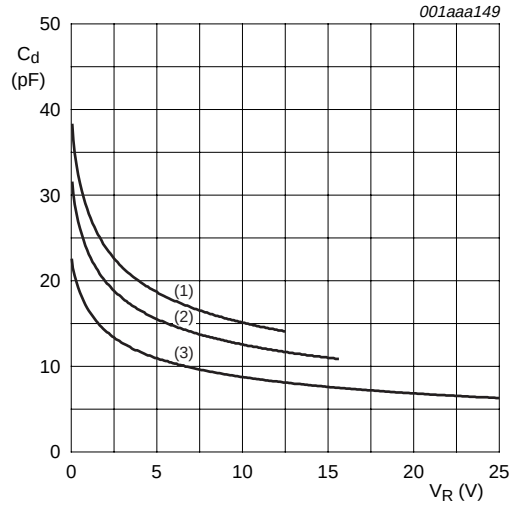
Fig.5 Relative variation of peak pulse power as a function of junction temperature; typical values.



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

T_{amb} = 25 °C; f = 1 MHz.

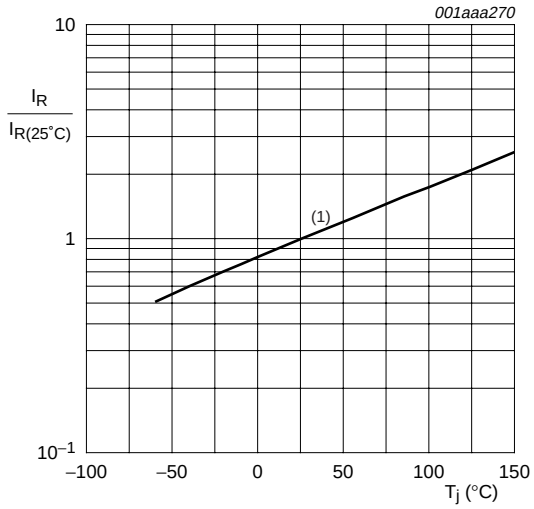
Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) PESD12VS2UAT; V_{RWM} = 12 V.
(2) PESD15VS2UAT; V_{RWM} = 15 V.
(3) PESD24VS2UAT; V_{RWM} = 24 V.

T_{amb} = 25 °C; f = 1 MHz.

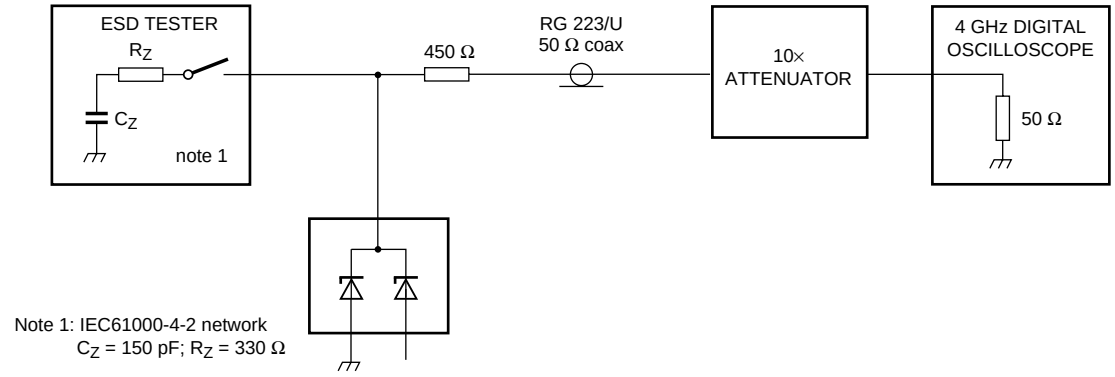
Fig.7 Diode capacitance as a function of reverse voltage; typical values.



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

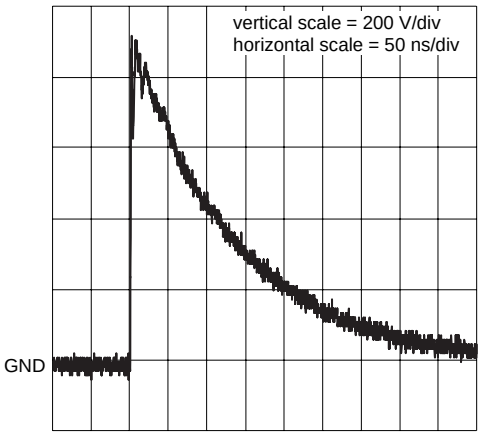
I_R is less than 10 nA at 150 °C for:
PESD12V52UAT; V_{RWM} = 12 V.
PESD15VS2UAT; V_{RWM} = 15 V.
PESD24VS2UAT; V_{RWM} = 24 V.

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

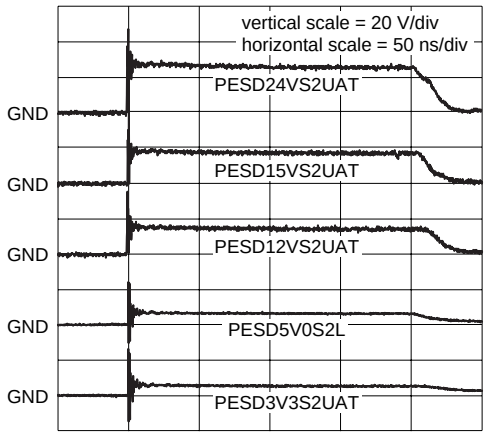


Note 1: IEC61000-4-2 network
C_Z = 150 pF; R_Z = 330 Ω

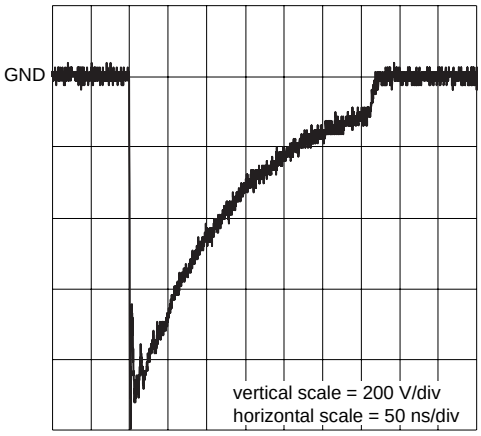
D.U.T.: PESDxS2UAT



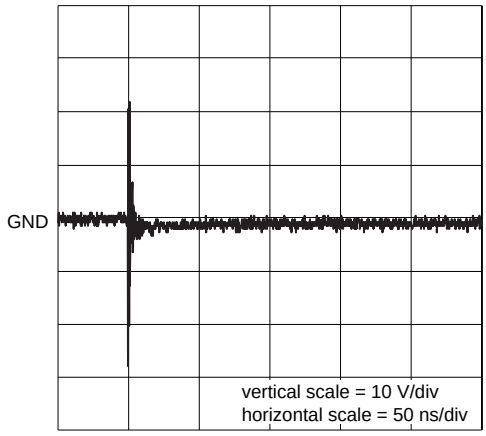
unclamped +1 kV ESD voltage waveform
(IEC61000-4-2 network)



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)

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

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 μs waveform.

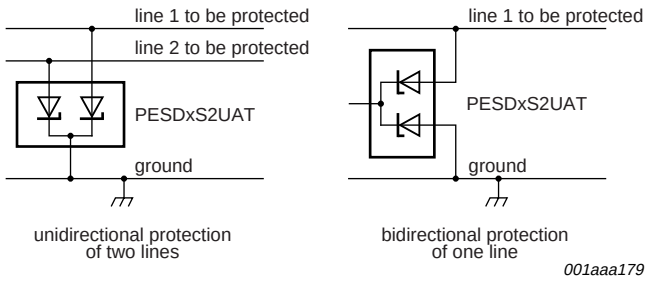


Fig.10 Typical application: ESD protection of data lines.

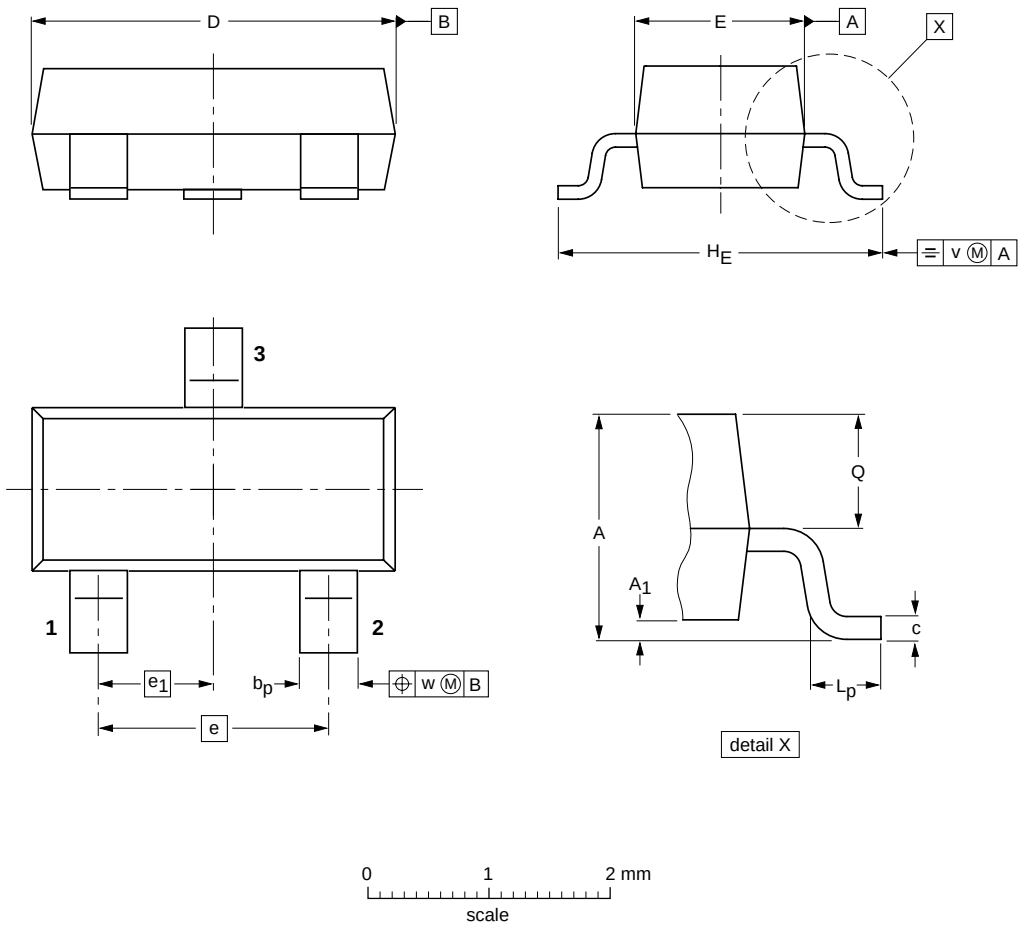
Circuit board layout and protection device placement

Circuit board layout is critical for the suppression of ESD, Electrical Fast Transient (EFT) and surge transients. The following guidelines are recommended:

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.

PACKAGE OUTLINE

Plastic surface mounted package; 3 leads **SOT23**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max.	b_p	c	D	E	e	e_1	H_E	L_p	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	EIAJ			
SOT23		TO-236AB				~~97-02-28~~ 99-09-13

DATA SHEET STATUS

LEVEL	DATA SHEET STATUS(1)	PRODUCT STATUS(2)(3)	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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1. Please consult the most recently issued data sheet before initiating or completing a design.
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3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

DEFINITIONS

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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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