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Kind regards,

Team Nexperia

PESDxS1UL series

Unidirectional ESD protection diodes

Rev. 3 — 25 October 2011 Product data sheet

1. Product profile

1.1 General description

Unidirectional ElectroStatic Discharge (ESD) protection diodes in a SOD882 leadless ultra small Surface Mounted Device (SMD) plastic package designed to protect one signal line from the damage caused by ESD and other transients.

1.2 Features and benefits

- Ultra small SMD plastic package
- ESD protection of one line
- Max. peak pulse power: P_{PP} = 150 W
- Low clamping voltage: V_{CL} = 20 V
- AEC-Q101 qualified
- Ultra low leakage current: I_{RM} < 700 nA
- ESD protection up to 30 kV
- IEC 61000-4-2; level 4 (ESD)
- IEC 61000-4-5; (surge); I_{PP} up to 15 A

1.3 Applications

- Computers and peripherals
- Audio and video equipment
- Parallel ports
- Communication systems
- High-speed data lines

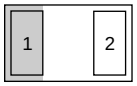
1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage					
	PESD3V3S1UL		-	-	3.3	V
	PESD5V0S1UL		-	-	5.0	V
	PESD12VS1UL		-	-	12	V
	PESD15VS1UL		-	-	15	V
	PESD24VS1UL		-	-	24	V
C_d	diode capacitance	f = 1 MHz; V_R = 0 V				
	PESD3V3S1UL		-	207	300	pF
	PESD5V0S1UL		-	152	200	pF
	PESD12VS1UL		-	38	75	pF
	PESD15VS1UL		-	32	70	pF
	PESD24VS1UL		-	23	50	pF

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	cathode [1]	 Transparent top view	 sym035
2	anode		

[1] The marking bar indicates the cathode.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PESD3V3S1UL	-	leadless ultra small plastic package; 2 terminals; body 1.0 × 0.6 × 0.5 mm	SOD882
PESD5V0S1UL			
PESD12VS1UL			
PESD15VS1UL			
PESD24VS1UL			

4. Marking

Table 4. Marking codes

Type number	Marking code
PESD3V3S1UL	G1
PESD5V0S1UL	G2
PESD12VS1UL	G3
PESD15VS1UL	G4
PESD24VS1UL	G5

5. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
P_{PP}	peak pulse power	t_p = 8/20 μs	[1]	-	150	W
I_{PP}	peak pulse current	t_p = 8/20 μs	[1]			
	PESD3V3S1UL			-	15	A
	PESD5V0S1UL			-	15	A
	PESD12VS1UL			-	5	A
	PESD15VS1UL			-	5	A
	PESD24VS1UL			-	3	A
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			−65	+150	°C
T_{stg}	storage temperature			−65	+150	°C

[1] Non-repetitive current pulse 8/20 μs exponential decay waveform according to IEC 61000-4-5.

Table 6. ESD maximum ratings

Symbol	Parameter	Conditions		Min	Max	Unit
V_{ESD}	electrostatic discharge voltage	IEC 61000-4-2 (contact discharge)	[1]			
	PESD3V3S1UL			-	30	kV
	PESD5V0S1UL			-	30	kV
	PESD12VS1UL			-	30	kV
	PESD15VS1UL			-	30	kV
	PESD24VS1UL			-	23	kV
	PESDxS1UL series	MIL-STD-883 (human body model)		-	10	kV

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

Table 7. ESD standards compliance

Standard	Conditions
IEC 61000-4-2; level 4 (ESD)	> 15 kV (air); > 8 kV (contact)
MIL-STD-883; class 3B (human body model)	> 8 kV

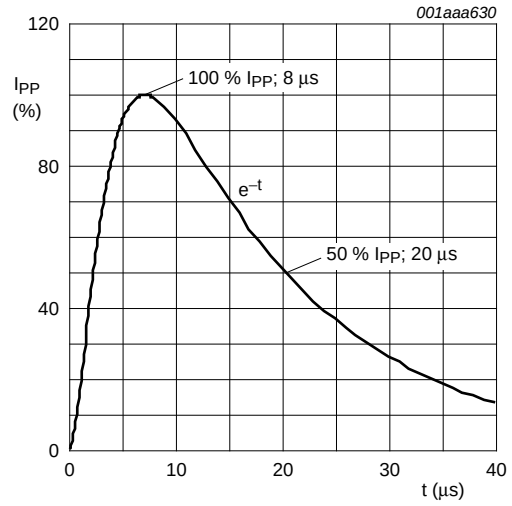


Fig 1. 8/20 µs pulse waveform according to IEC 61000-4-5

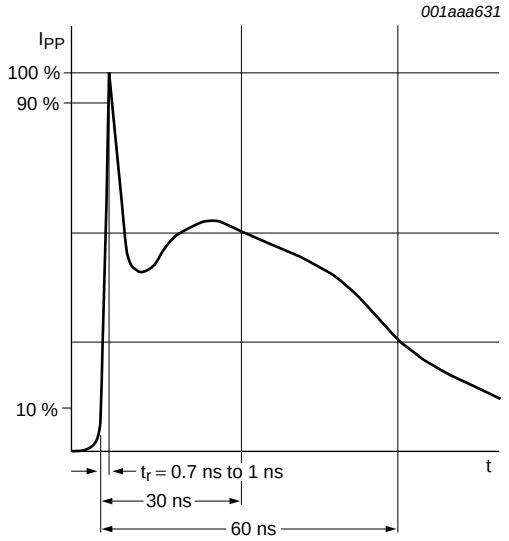


Fig 2. ESD pulse waveform according to IEC 61000-4-2

6. Characteristics

Table 8. Characteristics

T_{amb} = 25 °C unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage					
	PESD3V3S1UL		-	-	3.3	V
	PESD5V0S1UL		-	-	5.0	V
	PESD12VS1UL		-	-	12	V
	PESD15VS1UL		-	-	15	V
	PESD24VS1UL		-	-	24	V
I_{RM}	reverse leakage current					
	PESD3V3S1UL	V_{RWM} = 3.3 V	-	0.7	2	µA
	PESD5V0S1UL	V_{RWM} = 5.0 V	-	0.1	1	µA
	PESD12VS1UL	V_{RWM} = 12 V	-	< 1	50	nA
	PESD15VS1UL	V_{RWM} = 15 V	-	< 1	50	nA
	PESD24VS1UL	V_{RWM} = 24 V	-	< 1	50	nA
V_{BR}	breakdown voltage	I_R = 5 mA	[1]			
	PESD3V3S1UL		5.2	5.6	6.0	V
	PESD5V0S1UL		6.4	6.8	7.2	V
	PESD12VS1UL		14.7	15.0	15.3	V
	PESD15VS1UL		17.6	18.0	18.4	V
	PESD24VS1UL		26.5	27.0	27.5	V

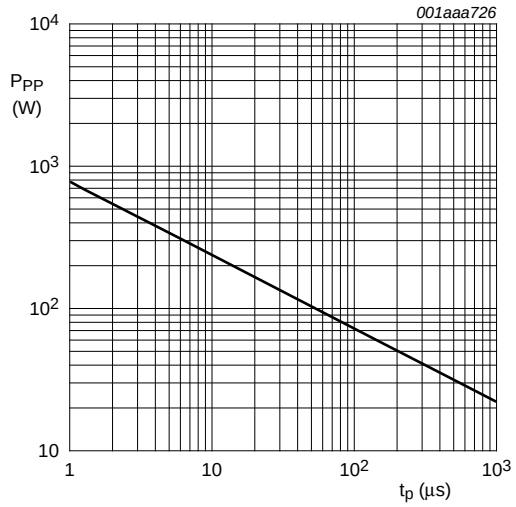
Table 8. Characteristics *...continued*

T_{amb} = 25 °C unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_d	diode capacitance	f = 1 MHz; V_R = 0 V				
	PESD3V3S1UL		-	207	300	pF
	PESD5V0S1UL		-	152	200	pF
	PESD12VS1UL		-	38	75	pF
	PESD15VS1UL		-	32	70	pF
	PESD24VS1UL		-	23	50	pF
V_{CL}	clamping voltage		[2]			
	PESD3V3S1UL	I_{PP} = 1 A	-	-	8	V
		I_{PP} = 15 A	-	-	20	V
	PESD5V0S1UL	I_{PP} = 1 A	-	-	9	V
		I_{PP} = 15 A	-	-	20	V
	PESD12VS1UL	I_{PP} = 1 A	-	-	19	V
		I_{PP} = 5 A	-	-	35	V
	PESD15VS1UL	I_{PP} = 1 A	-	-	23	V
		I_{PP} = 5 A	-	-	40	V
	PESD24VS1UL	I_{PP} = 1 A	-	-	36	V
		I_{PP} = 3 A	-	-	70	V
r_{dif}	differential resistance					
	PESD3V3S1UL	I_R = 1 mA	-	-	400	Ω
	PESD5V0S1UL	I_R = 1 mA	-	-	80	Ω
	PESD12VS1UL	I_R = 1 mA	-	-	200	Ω
	PESD15VS1UL	I_R = 1 mA	-	-	225	Ω
	PESD24VS1UL	I_R = 0.5 mA	-	-	300	Ω

[1] Pulse test: $t_p \leq 300$ μs; duty cycle ≤ 0.02.

[2] Non-repetitive current pulse 8/20 μs exponential decay waveform according to IEC 61000-4-5.



T_{amb} = 25 °C

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

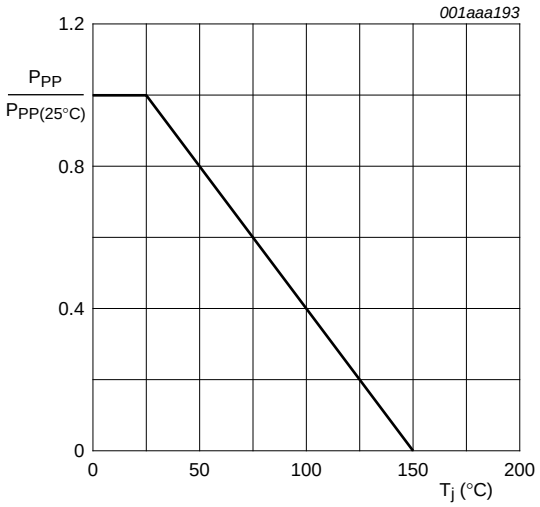
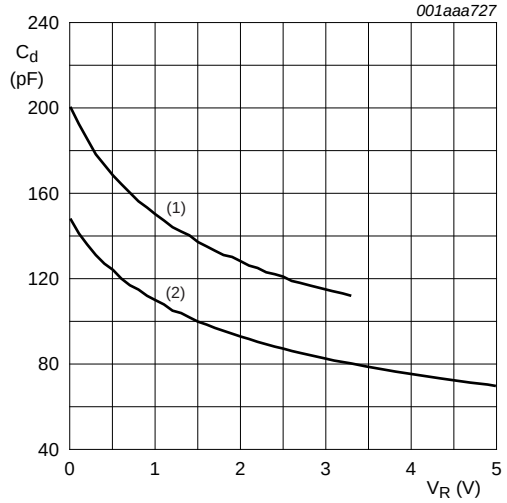


Fig 4. Relative variation of peak pulse power as a function of junction temperature; typical values

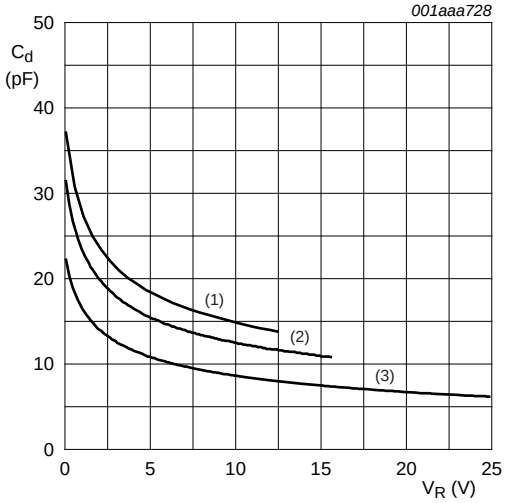


f = 1 MHz; T_{amb} = 25 °C

(1) PESD3V3S1UL; V_{RWM} = 3.3 V

(2) PESD5V0S1UL; V_{RWM} = 5.0 V

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



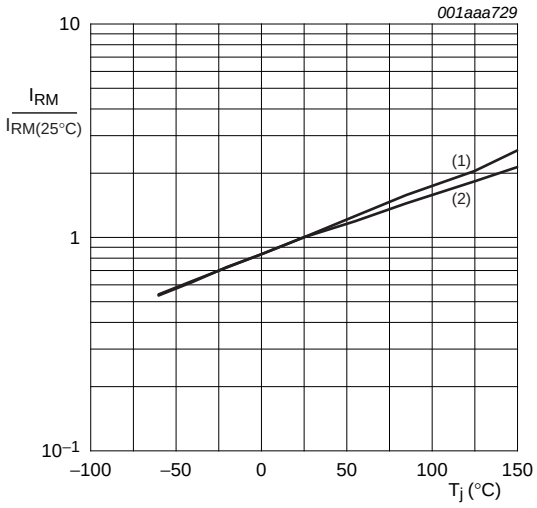
f = 1 MHz; T_{amb} = 25 °C

(1) PESD12VS1UL; V_{RWM} = 12 V

(2) PESD15VS1UL; V_{RWM} = 15 V

(3) PESD24VS1UL; V_{RWM} = 24 V

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



(1) PESD3V3S1UL; V_{RWM} = 3.3 V

(2) PESD5V0S1UL; V_{RWM} = 5.0 V

I_R is less than 15 nA at 150 °C for:

PESD12VS1UL; V_{RWM} = 12 V

PESD15VS1UL; V_{RWM} = 15 V

PESD24VS1UL; V_{RWM} = 24 V

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

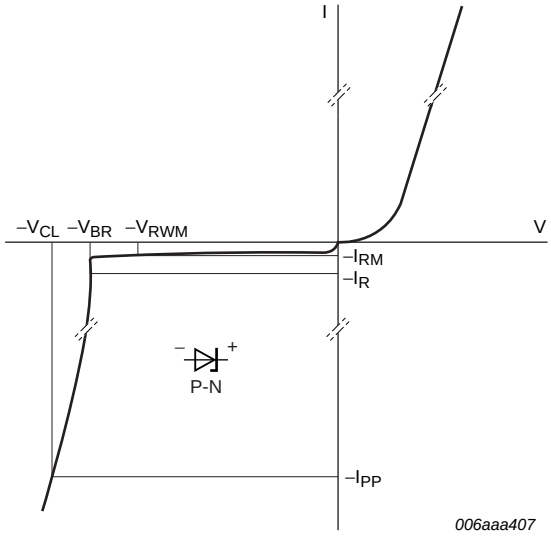
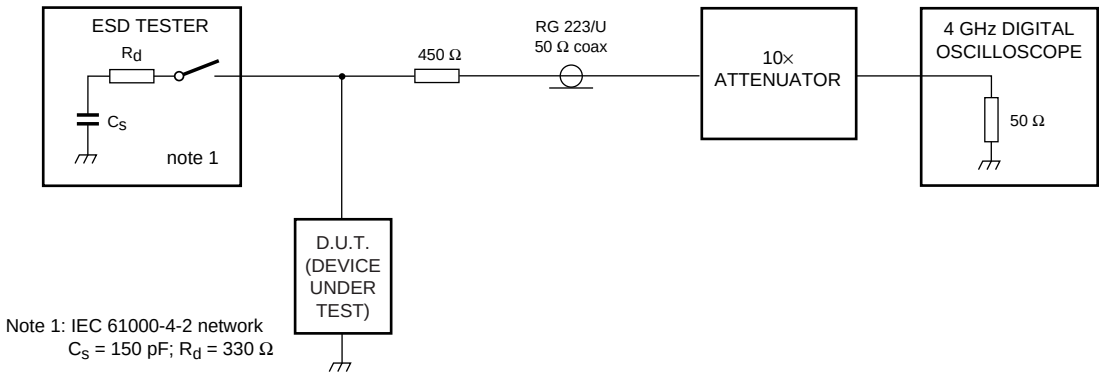
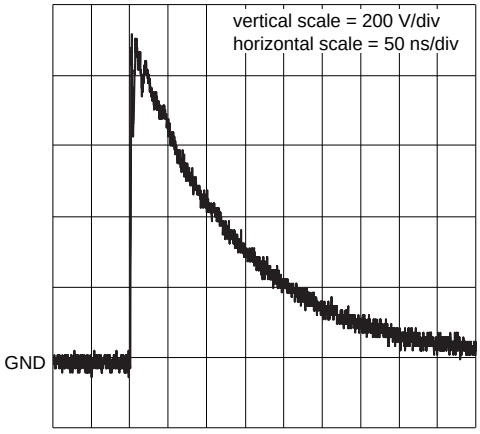
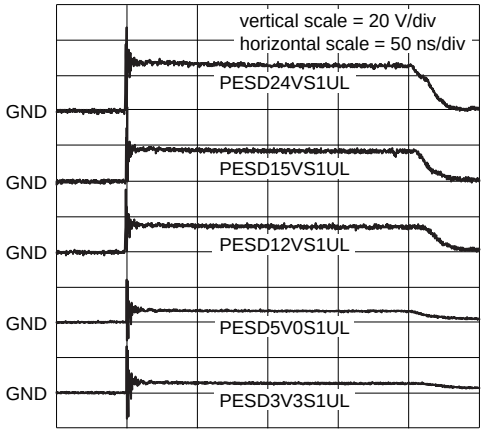


Fig 8. V-I characteristics for a unidirectional ESD protection diode

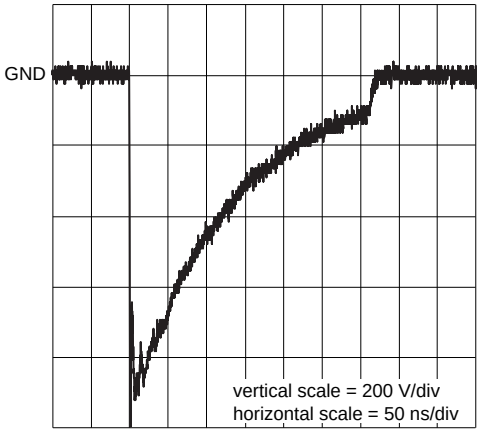




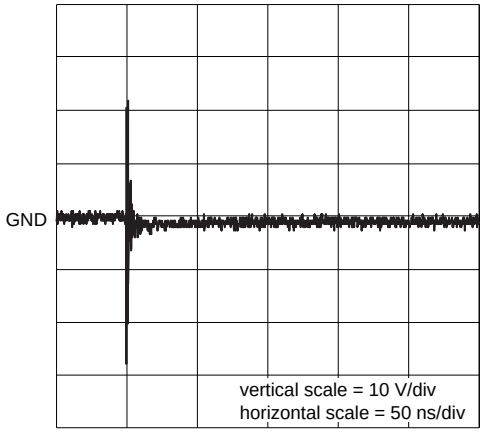
unclamped +1 kV ESD voltage waveform
(IEC 61000-4-2 network)



clamped +1 kV ESD voltage waveform
(IEC 61000-4-2 network)



unclamped −1 kV ESD voltage waveform
(IEC 61000-4-2 network)



clamped −1 kV ESD voltage waveform
(IEC 61000-4-2 network)

006aaa682

Fig 9. ESD clamping test setup and waveforms

7. Application information

The PESDxS1UL series is designed for protection of one unidirectional data line from the damage caused by ESD and surge pulses. The PESDxS1UL series may be used on lines where the signal polarities are either positive or negative with respect to ground. The PESDxS1UL series provides a surge capability of 150 W for an 8/20 μs waveform.

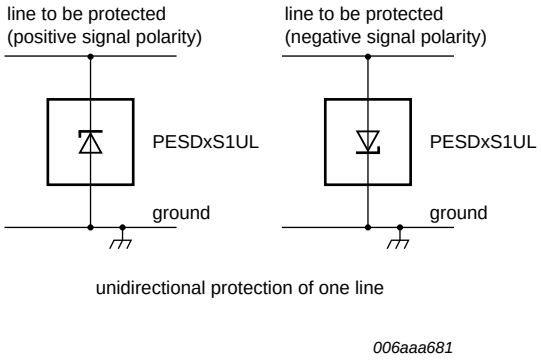


Fig 10. Application diagram

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 PESDxS1UL as close to the input terminal or connector as possible.
2. The path length between the PESDxS1UL 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. Test information

8.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

9. Package outline

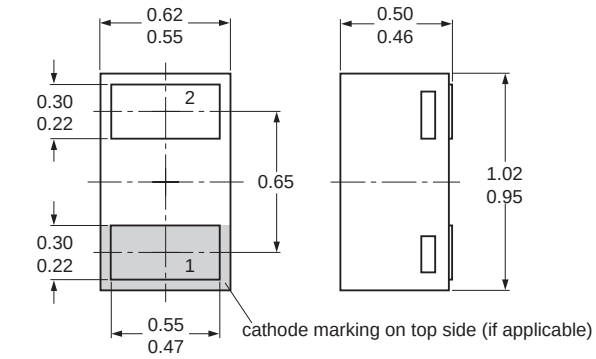


Fig 11. Package outline SOD882

10. Packing information

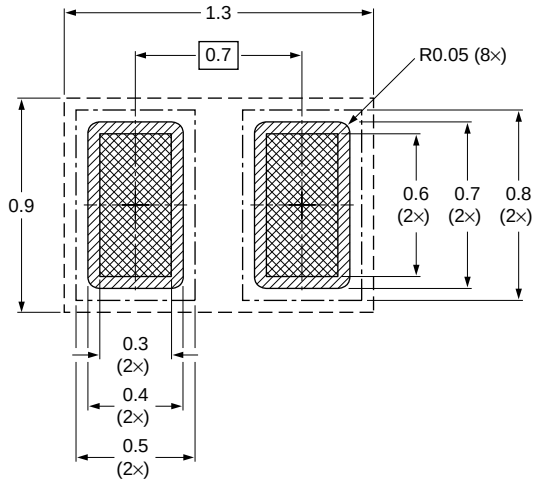
Table 9. Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code.[1]

Type number	Package	Description	Packing quantity
			10000
PESD3V3S1UL	SOD882	4 mm pitch, 8 mm tape and reel	-315
PESD5V0S1UL			
PESD12VS1UL			
PESD15VS1UL			
PESD24VS1UL			

[1] For further information and the availability of packing methods, see Section 14.

11. Soldering



Reflow soldering is the only recommended soldering method.

Fig 12. Reflow soldering footprint SOD882

12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PESDXS1UL_SER v.3	20111025	Product data sheet	-	PESDXS1UL_SER v.2
Modifications:	• Section 1.2 “Features and benefits”: updated • Table 7: updated • Table 8: added pulse conditions for breakdown voltage V_{BR} • Section 8 “Test information”: added • Section 11 “Soldering”: added • Section 13 “Legal information”: updated			
PESDXS1UL_SER v.2	20090820	Product data sheet	-	PESDXS1UL_SER v.1
PESDXS1UL_SER v.1	20060331	Product data sheet	-	-

13. Legal information

13.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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15. Contents

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