PESDxS2UQ series

Double ESD protection diodes in SOT663 package

Rev. 04 — 26 January 2010 Product data sheet

1. Product profile

1.1 General description

Unidirectional double ElectroStatic Discharge (ESD) protection diodes in a SOT663 ultra small and flat lead Surface-Mounted Device (SMD) plastic package designed to protect up to two signal lines from the damage caused by ESD and other transients.

1.2 Features

- Unidirectional ESD protection of up to two lines
- Max. peak pulse power: P_{PP} = 150 W at t_p = 8/20 μs
- Low clamping voltage: V_{CL} = 20 V at I_{PP} = 15 A
- Low reverse leakage current: I_{RM} < 1 nA
- ESD protection up to 30 kV
- IEC 61000-4-2; level 4 (ESD)
- IEC 61000-4-5 (surge); I_{PP} = 15 A at t_p = 8/20 μs

1.3 Applications

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

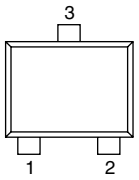
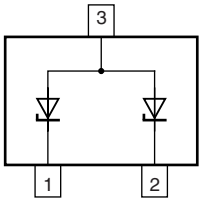
1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage					
	PESD3V3S2UQ		-	-	3.3	V
	PESD5V0S2UQ		-	-	5	V
	PESD12VS2UQ		-	-	12	V
	PESD15VS2UQ		-	-	15	V
	PESD24VS2UQ		-	-	24	V
C_d	diode capacitance	f = 1 MHz; V_R = 0 V				
	PESD3V3S2UQ		-	200	275	pF
	PESD5V0S2UQ		-	150	215	pF
	PESD12VS2UQ		-	38	100	pF
	PESD15VS2UQ		-	32	70	pF
	PESD24VS2UQ		-	23	50	pF

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	cathode 1		
2	cathode 2		
3	common anode		

006aaa154

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PESD3V3S2UQ	-	plastic surface-mounted package; 3 leads	SOT663
PESD5V0S2UQ			
PESD12VS2UQ			
PESD15VS2UQ			
PESD24VS2UQ			

4. Marking

Table 4. Marking codes

Type number	Marking code
PESD3V3S2UQ	E1
PESD5V0S2UQ	E2
PESD12VS2UQ	E3
PESD15VS2UQ	E4
PESD24VS2UQ	E5

5. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
Per diode						
P_{PP}	peak pulse power	t_p = 8/20 μs	[1][2]	-	150	W
I_{PP}	peak pulse current	t_p = 8/20 μs	[1][2]			
	PESD3V3S2UQ			-	15	A
	PESD5V0S2UQ			-	15	A
	PESD12VS2UQ			-	5	A
	PESD15VS2UQ			-	5	A
	PESD24VS2UQ			-	3	A
Per device						
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.

[2] Measured across either pins 1 and 3 or pins 2 and 3.

Table 6. ESD maximum ratings

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Max	Unit
Per diode						
V_{ESD}	electrostatic discharge voltage	IEC 61000-4-2 (contact discharge)	[1][2]			
	PESD3V3S2UQ			-	30	kV
	PESD5V0S2UQ			-	30	kV
	PESD12VS2UQ			-	30	kV
	PESD15VS2UQ			-	30	kV
	PESD24VS2UQ			-	23	kV
	PESDxS2UQ series	MIL-STD-883 (human body model)		-	10	kV

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

[2] Measured across either pins 1 and 3 or pins 2 and 3.

Table 7. ESD standards compliance

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

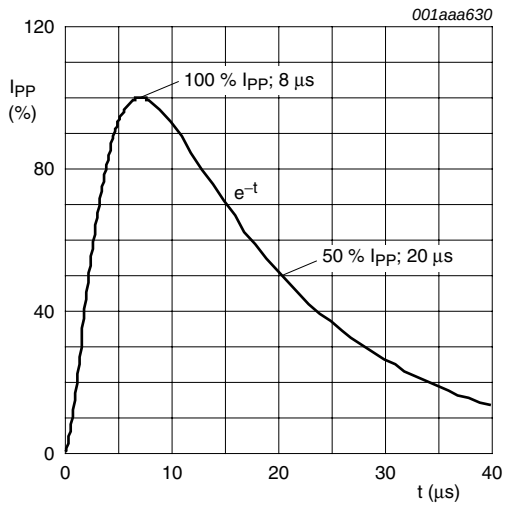


Fig 1. 8/20 µs pulse waveform according to IEC 61000-4-5

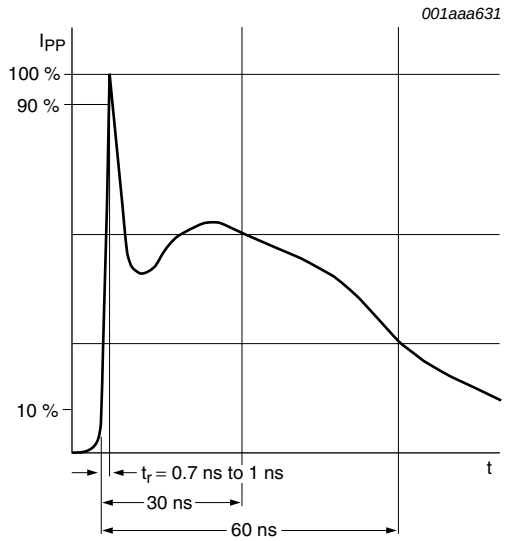


Fig 2. ESD pulse waveform according to IEC 61000-4-2

6. Characteristics

Table 8. Characteristics

T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per diode						
V_{RWM}	reverse standoff voltage					
	PESD3V3S2UQ		-	-	3.3	V
	PESD5V0S2UQ		-	-	5	V
	PESD12VS2UQ		-	-	12	V
	PESD15VS2UQ		-	-	15	V
	PESD24VS2UQ		-	-	24	V
I_{RM}	reverse leakage current					
	PESD3V3S2UQ	V_{RWM} = 3.3 V	-	0.55	3	µA
	PESD5V0S2UQ	V_{RWM} = 5 V	-	50	300	nA
	PESD12VS2UQ	V_{RWM} = 12 V	-	<1	30	nA
	PESD15VS2UQ	V_{RWM} = 15 V	-	<1	50	nA
	PESD24VS2UQ	V_{RWM} = 24 V	-	<1	50	nA
V_{BR}	breakdown voltage	I_R = 5 mA				
	PESD3V3S2UQ		5.2	5.6	6.0	V
	PESD5V0S2UQ		6.4	6.8	7.2	V
	PESD12VS2UQ		14.7	15.0	15.3	V
	PESD15VS2UQ		17.6	18.0	18.4	V
	PESD24VS2UQ		26.5	27.0	27.5	V

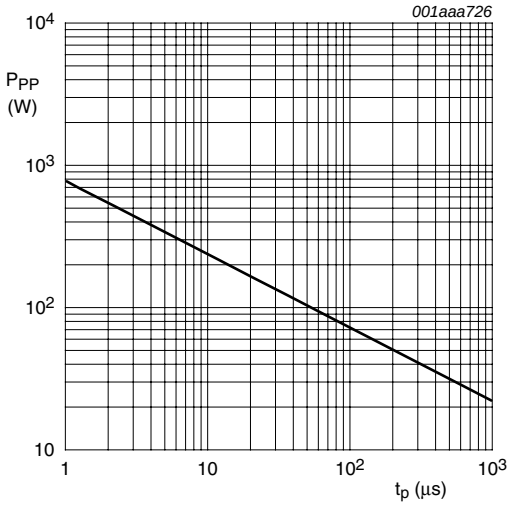
Table 8. Characteristics *...continued*

T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_d	diode capacitance	f = 1 MHz; V_R = 0 V				
	PESD3V3S2UQ		-	200	275	pF
	PESD5V0S2UQ		-	150	215	pF
	PESD12VS2UQ		-	38	100	pF
	PESD15VS2UQ		-	32	70	pF
	PESD24VS2UQ		-	23	50	pF
V_{CL}	clamping voltage	[1][2]				
	PESD3V3S2UQ	I_{PP} = 1 A	-	-	8	V
		I_{PP} = 15 A	-	-	20	V
	PESD5V0S2UQ	I_{PP} = 1 A	-	-	9	V
		I_{PP} = 15 A	-	-	20	V
	PESD12VS2UQ	I_{PP} = 1 A	-	-	19	V
		I_{PP} = 5 A	-	-	35	V
	PESD15VS2UQ	I_{PP} = 1 A	-	-	23	V
		I_{PP} = 5 A	-	-	40	V
	PESD24VS2UQ	I_{PP} = 1 A	-	-	36	V
		I_{PP} = 3 A	-	-	70	V
r_{dif}	differential resistance					
	PESD3V3S2UQ	I_R = 5 mA	-	-	40	Ω
	PESD5V0S2UQ	I_R = 5 mA	-	-	15	Ω
	PESD12VS2UQ	I_R = 5 mA	-	-	15	Ω
	PESD15VS2UQ	I_R = 1 mA	-	-	225	Ω
	PESD24VS2UQ	I_R = 0.5 mA	-	-	300	Ω

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

[2] Measured across either pins 1 and 3 or pins 2 and 3.



T_{amb} = 25 °C

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

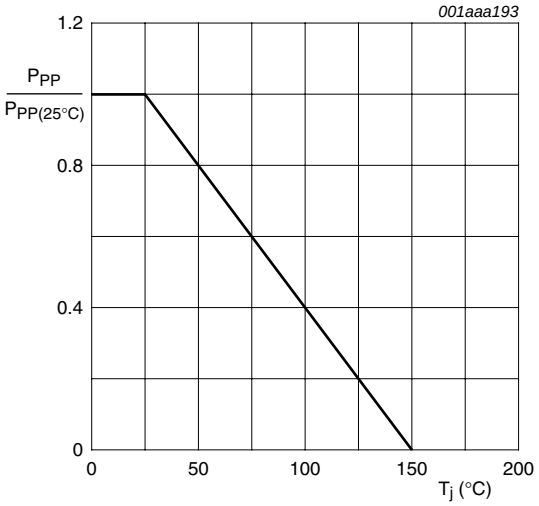
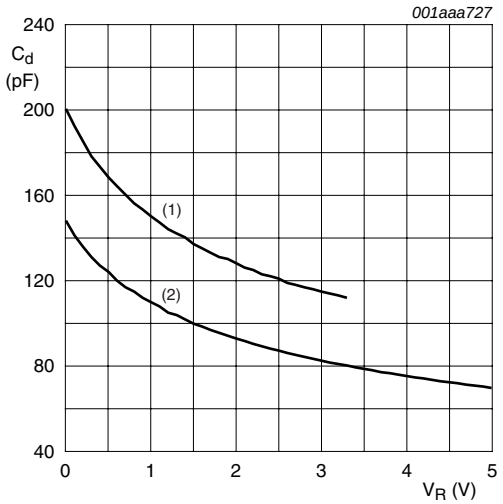


Fig 4. Relative variation of peak pulse power as a function of junction temperature; typical values

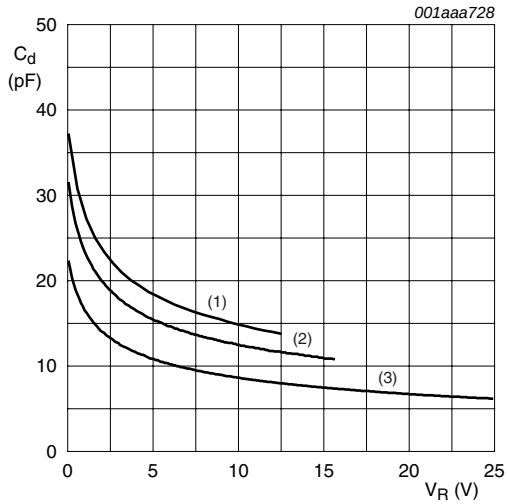


f = 1 MHz; T_{amb} = 25 °C

(1) PESD3V3S2UQ; V_{RWM} = 3.3 V

(2) PESD5V0S2UQ; V_{RWM} = 5 V

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



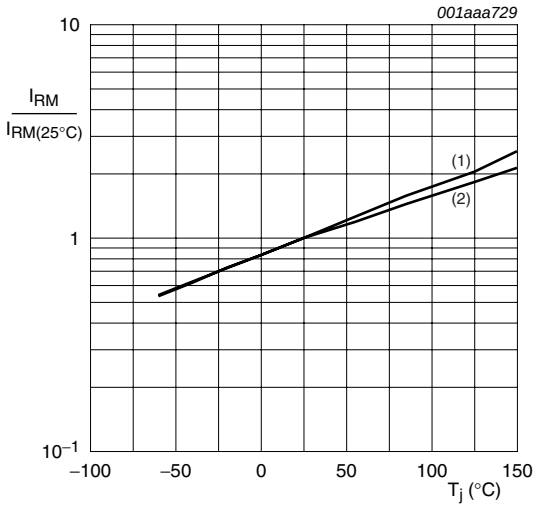
f = 1 MHz; T_{amb} = 25 °C

(1) PESD12VS2UQ; V_{RWM} = 12 V

(2) PESD15VS2UQ; V_{RWM} = 15 V

(3) PESD24VS2UQ; V_{RWM} = 24 V

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



(1) PESD3V3S2UQ; V_{RWM} = 3.3 V

(2) PESD5V0S2UQ; V_{RWM} = 5 V

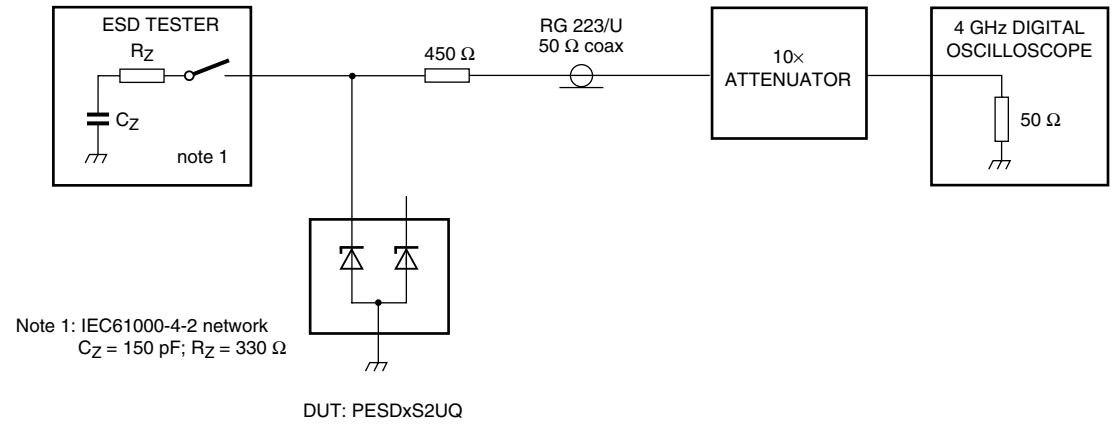
I_R is less than 15 nA at 150 °C for:

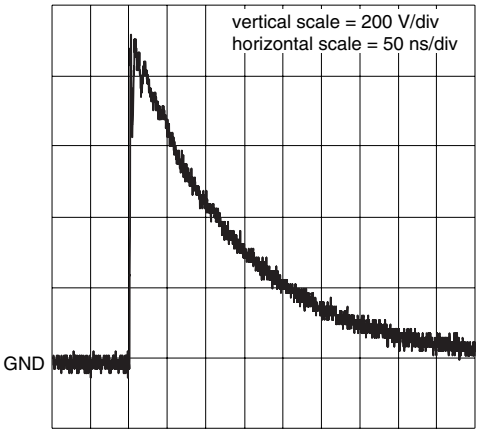
PESD12VS2UQ; V_{RWM} = 12 V

PESD15VS2UQ; V_{RWM} = 15 V

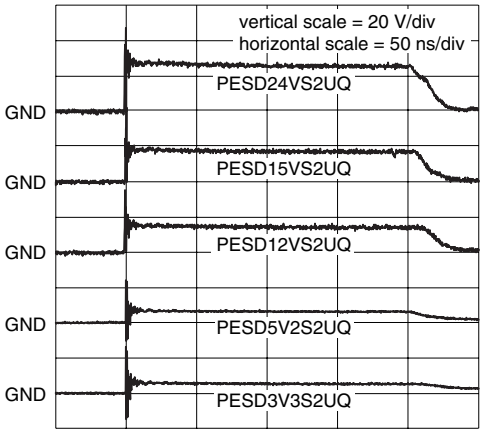
PESD24VS2UQ; V_{RWM} = 24 V

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

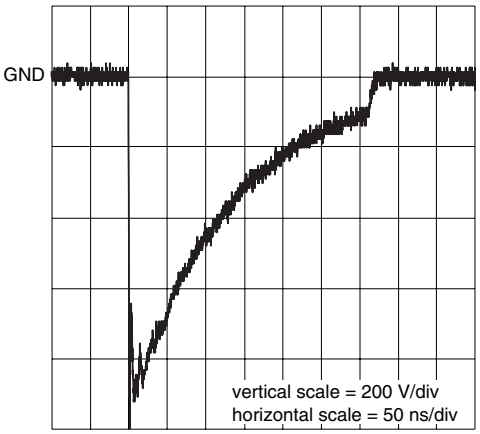




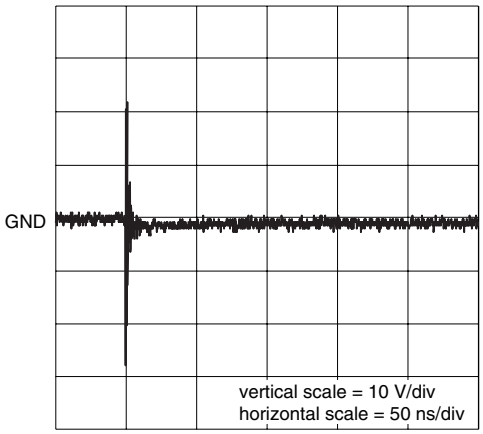
unclamped +1 kV ESD voltage waveform
(IEC61000-4-2 network)



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)

001aaa731

Fig 8. ESD clamping test setup and waveforms

7. Application information

The PESDxS2UQ series is designed for the protection of up to two unidirectional data lines from the damage caused by ESD and surge pulses. The devices may be used on lines where the signal polarities are below ground. The PESDxS2UQ series provides a surge capability of up to 150 W (P_{PP}) per line for an 8/20 μs waveform.

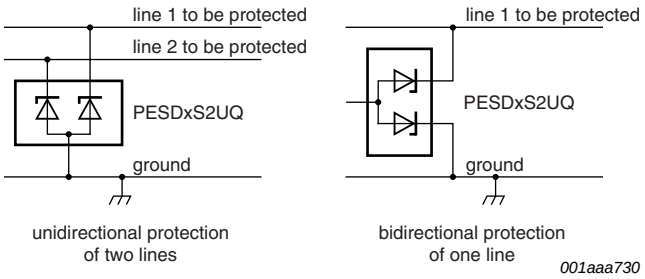


Fig 9. Typical application: ESD protection of data lines

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

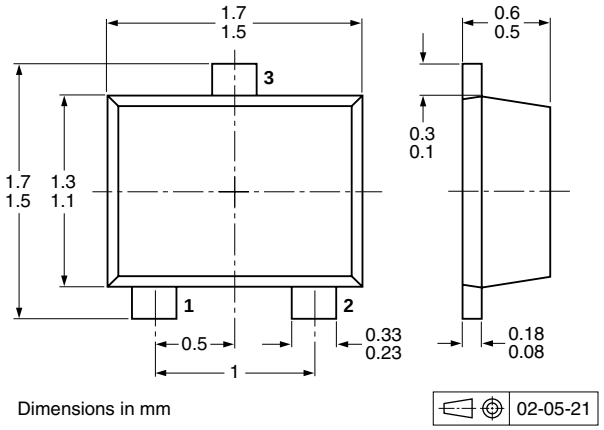


Fig 10. Package outline PESDxS2UQ series (SOT663)

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	
			4000	8000
PESD3V3S2UQ PESD5V0S2UQ PESD12VS2UQ PESD15VS2UQ PESD24VS2UQ	SOT663	2 mm pitch, 8 mm tape and reel	-	-315
PESD3V3S2UQ PESD5V0S2UQ PESD12VS2UQ PESD15VS2UQ PESD24VS2UQ	SOT663	4 mm pitch, 8 mm tape and reel	-115	-

[1] For further information and the availability of packing methods, see Section 12.

10. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PESDXS2UQ_SER_4	20100126	Product data sheet	-	PESDXS2UQ_SER_N_3
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Section 1.1 “General description”: amended • Section 1.4 “Quick reference data”: amended • Table 2 “Pinning”: updated • Section 7 “Application information”: amended • Figure 10: superseded by minimized package outline drawing • Section 9 “Packing information”: added • Section 11 “Legal information”: updated			
PESDXS2UQ_SER_N_3	20080911	Product data sheet	-	PESDXS2UQ_SERIES_2
PESDXS2UQ_SERIES_2	20040427	Product specification	-	PESDXS2UQ_SERIES_1
PESDXS2UQ_SERIES_1	20031215	Product specification	-	-

11. Legal information

11.1 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.nexperia.com.

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13. Contents

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