



# PESD2USB5UXT-Q

## Automotive infotainment ESD protection diode

7 March 2024

Product data sheet

## 1. General description

Automotive ESD protection device in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package, designed to protect two automotive in-vehicle network bus lines from the damage caused by ElectroStatic Discharge (ESD) and other transients. This product protects especially multimedia applications such as USB, HDMI and others.

## 2. Features and benefits

- Reverse stand-off voltage:  $V_{RWM} = 5\text{ V}$
- Low clamping voltage:  $V_{CL} = 3.3\text{ V}$  at  $I_{PP} = 8\text{ A}$
- ESD protection up to 8 kV (IEC 61000-4-2)
- Ultra low capacitance:  $C_d = 0.47\text{ pF}$
- ESD protection up to 8 kV (ISO 10605;  $C = 150\text{ pF}$ ;  $R = 330\ \Omega$ )
- High temperature capability:  $T_j = 175\text{ }^\circ\text{C}$
- Qualified according to AEC-Q101 and recommended for use in automotive applications

## 3. Applications

ESD protection for in-vehicle network lines in automotive environments

- Infotainment applications USB2.0, HDMI, DisplayPort, eSATA and LVDS
- Automotive A/V monitors, display and cameras
- SerDes: GMSL, FPD-Link, LVDS

## 4. Quick reference data

Table 1. Quick reference data

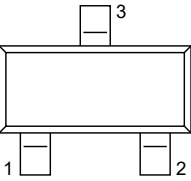
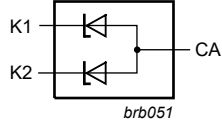
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{RWM}$	reverse standoff voltage	$T_{amb} = 25\text{ }^\circ\text{C}$	-	-	5	V
$I_{PPM}$	rated peak pulse current	$t_p = 8/20\ \mu\text{s}$	[1] [2]	-	4	A
$C_d$	diode capacitance	$f = 1\text{ MHz}$ ; $V_R = 0\text{ V}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$	[2]	0.47	0.6	pF

[1] According to IEC 61000-4-5.

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

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K1	cathode (diode 1)	 <p style="text-align: center;"><b>SOT23</b></p>	
2	K2	cathode (diode 2)		
3	CA	common anode		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PESD2USB5UXT-Q	SOT23	plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body	SOT23

## 7. Marking

Table 4. Marking codes

Type number	Marking code <sup>[1]</sup>
PESD2USB5UXT-Q	Q4%

[1] % = placeholder for manufacturing site code

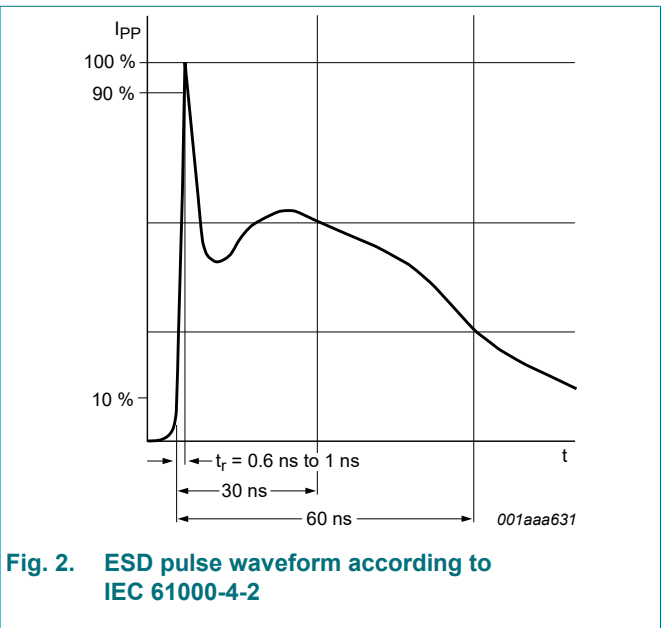
## 8. Limiting values

**Table 5. Limiting values**

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

Symbol	Parameter	Conditions		Min	Max	Unit
$I_{PPM}$	rated peak pulse current	$t_p = 8/20 \mu s$	[1] [2]	-	4	A
$T_j$	junction temperature			-	175	°C
$T_{amb}$	ambient temperature			-55	175	°C
$T_{stg}$	storage temperature			-65	175	°C
<b>ESD maximum ratings</b>						
$V_{ESD}$	electrostatic discharge voltage	IEC 61000-4-2; contact discharge	[2] [3]	-	8	kV
		ISO 10605; contact discharge; C = 150 pF, R = 330 $\Omega$	[2] [3]	-	8	kV
		ISO 10605; contact discharge; C = 330 pF, R = 330 $\Omega$	[2] [3]	-	6	kV

- [1] According to IEC 61000-4-5.
- [2] Measured from pin 1 or 2 to pin 3.
- [3] Device stressed with ten non-repetitive ESD pulses.



### 9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{RWM}$	reverse standoff voltage	$T_{amb} = 25\text{ }^{\circ}\text{C}$		-	-	5	V
$V_{BR}$	breakdown voltage	$I_R = 1\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	7.2	8.7	11	V
$I_{RM}$	reverse leakage current	$V_{RWM} = 5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	1	50	nA
$C_d$	diode capacitance	$f = 1\text{ MHz}; V_R = 0\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	0.47	0.6	pF
$\Delta C_d/C_d$	diode capacitance matching		[2]	-	1	-	%
$V_{CL}$	clamping voltage	$I_{PP} = 8\text{ A}; t_p = 100\text{ ns}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[3] [1]	-	3.3	-	V
$R_{dyn}$	dynamic resistance	$I_R = 10\text{ A}; t_p = 100\text{ ns}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[3] [1]	-	0.3	-	$\Omega$

- [1] Measured from pin 1 or 2 to pin 3.
- [2]  $\Delta C_d$  is the difference of the capacitance measured between pin 1 and pin 3 and the capacitance measured between pin 2 and pin 3.
- [3] Non-repetitive current pulse, Transmission Line Pulse (TLP); square pulse; ANSI / ESD STM5.5.1-2008

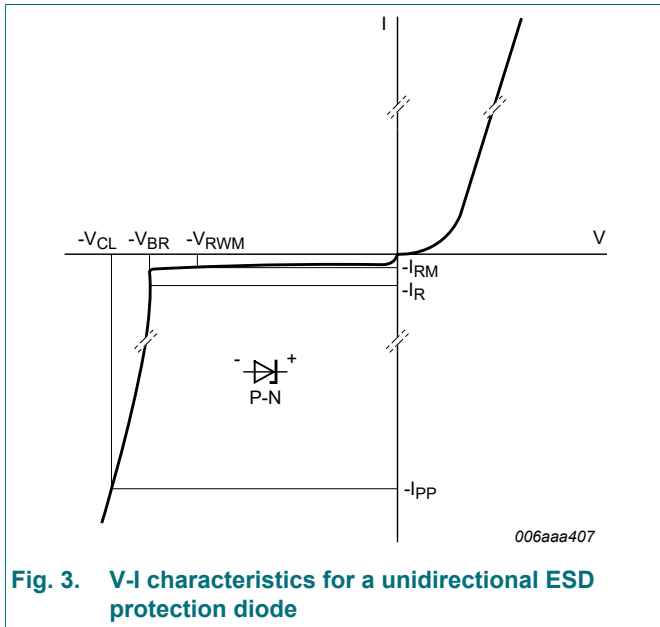


Fig. 3. V-I characteristics for a unidirectional ESD protection diode

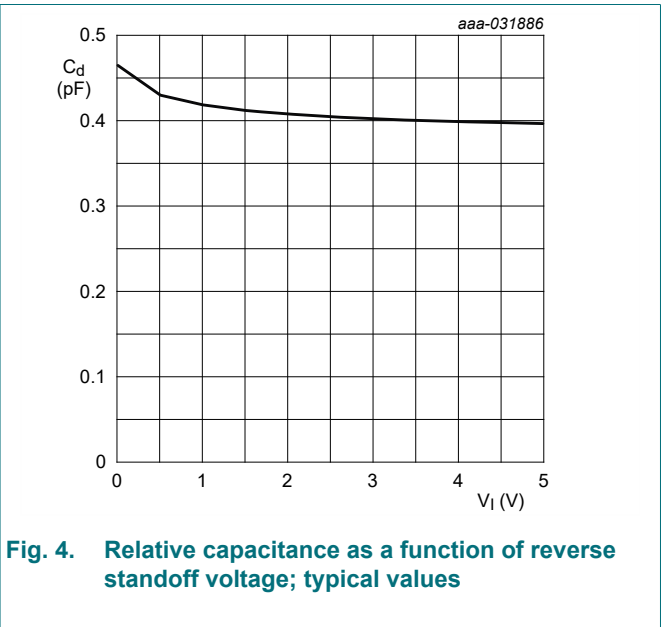
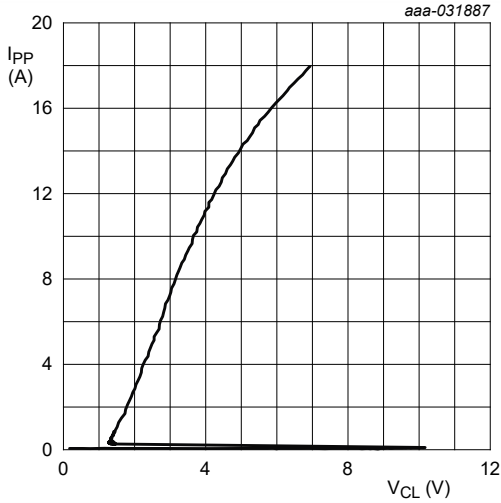
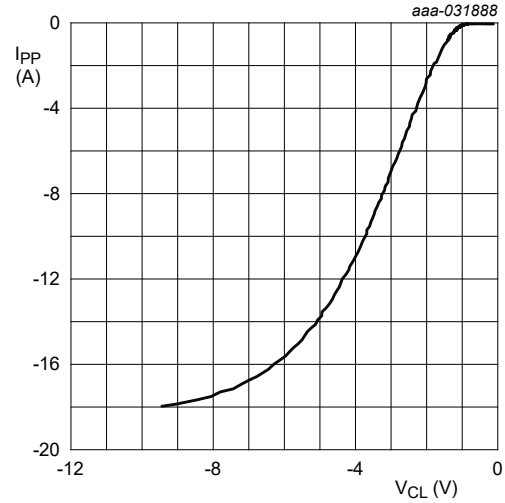


Fig. 4. Relative capacitance as a function of reverse standoff voltage; typical values



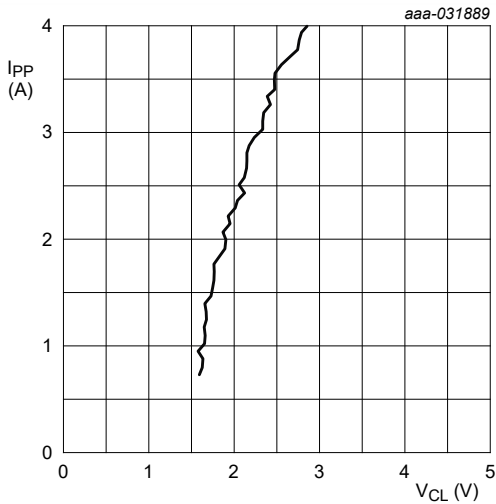
Transmission Line Pulse (TLP);  
 $t_p = 100 \text{ ns}$ ; rise time = 1 ns

**Fig. 5. Dynamic resistance with positive clamping; typical values**



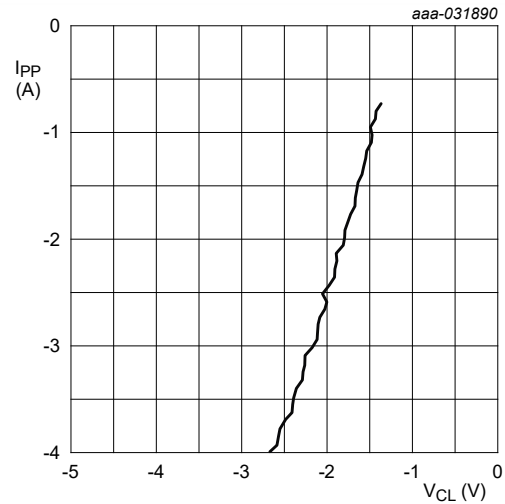
Transmission Line Pulse (TLP);  
 $t_p = 100 \text{ ns}$ ; rise time = 1 ns

**Fig. 6. Dynamic resistance with negative clamping; typical values**



IEC 61000-4-5;  $t_p = 8/20 \text{ }\mu\text{s}$ ; positive pulse

**Fig. 7. Dynamic resistance with positive clamping; typical values**

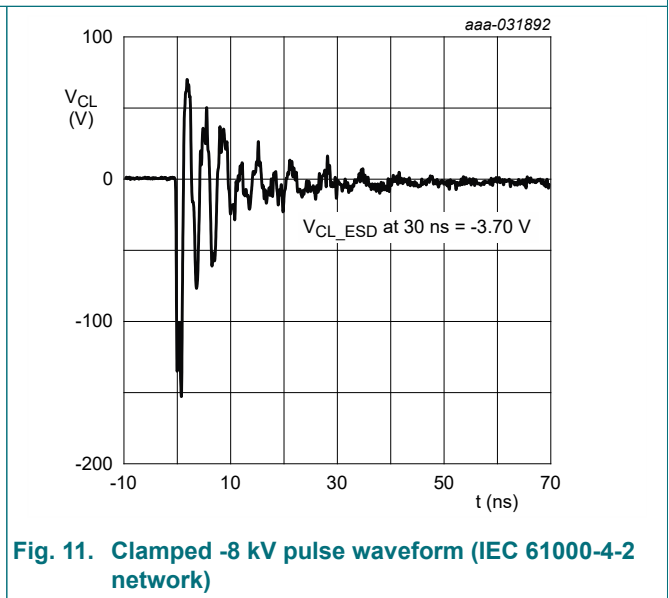
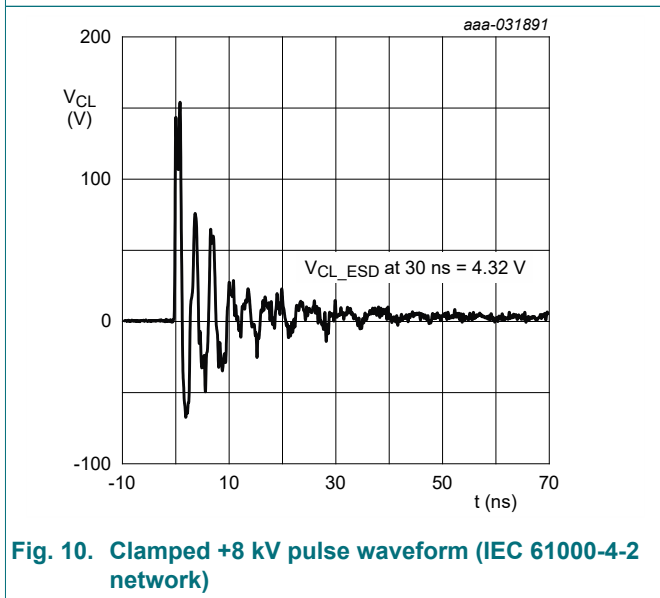


IEC 61000-4-5;  $t_p = 8/20 \text{ }\mu\text{s}$ ; positive pulse

**Fig. 8. Dynamic resistance with negative clamping; typical values**



Fig. 9. ESD clamping test setup and waveforms



## 10. Application information

The device is designed to provide high-level ESD protection for high-speed serial data buses such as USB, HDMI, DisplayPort, eSATA and LVDS data lines.

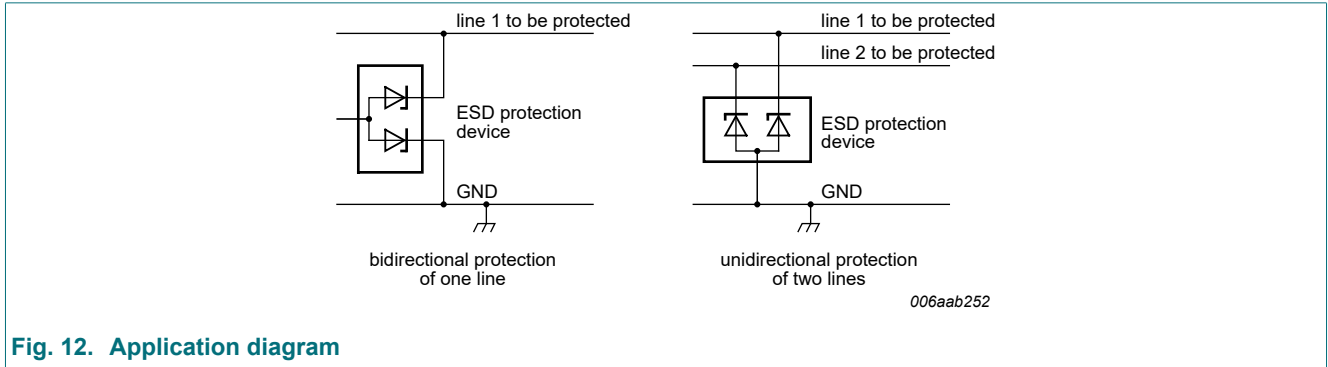


Fig. 12. Application diagram

Note: When designing the PCB, give careful consideration to impedance matching and signal coupling. Do not connect the signal lines to unlimited current sources like, for example, a battery.

## 11. Test information

### 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.

## 12. Package outline

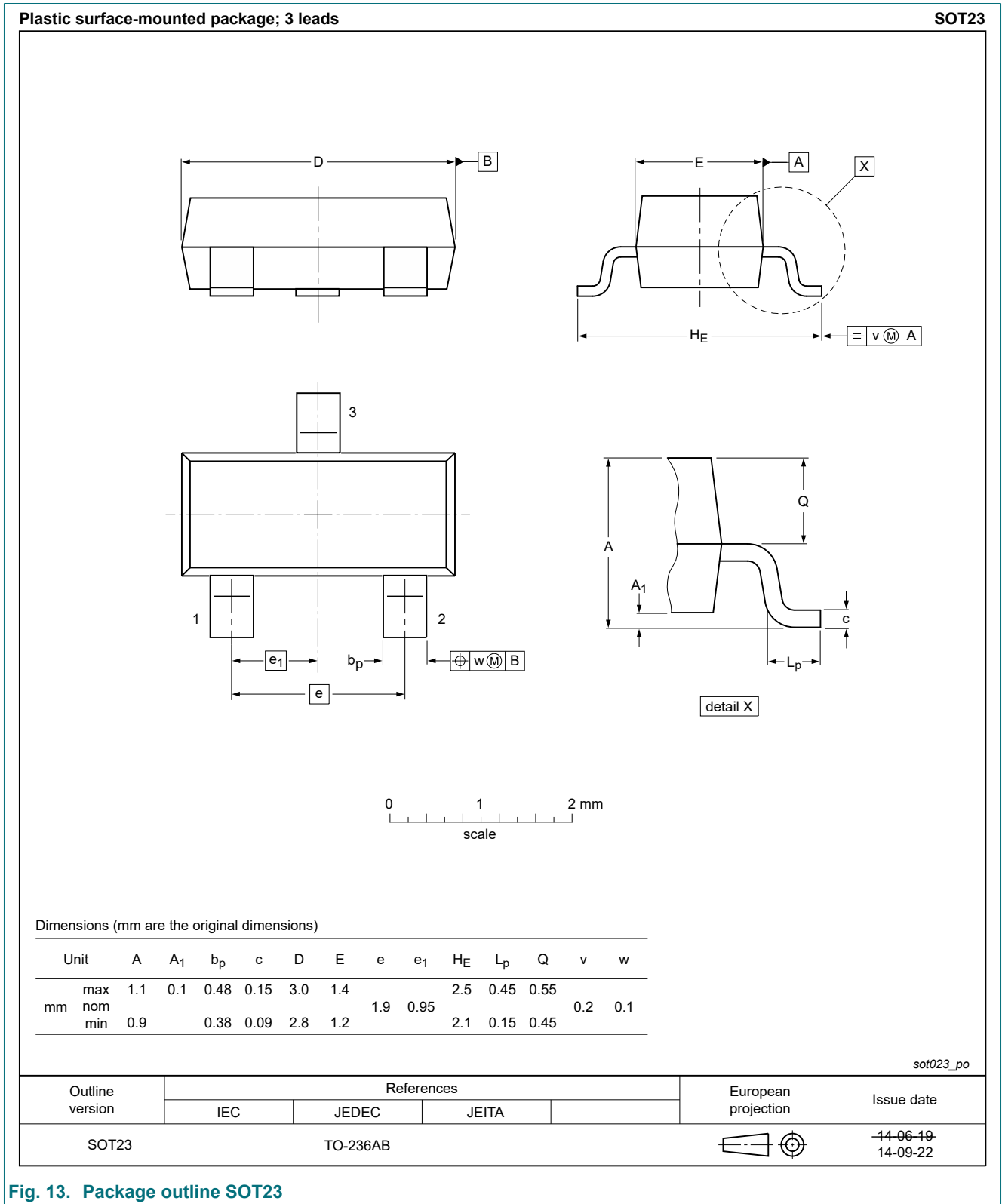


Fig. 13. Package outline SOT23



### 13. Soldering

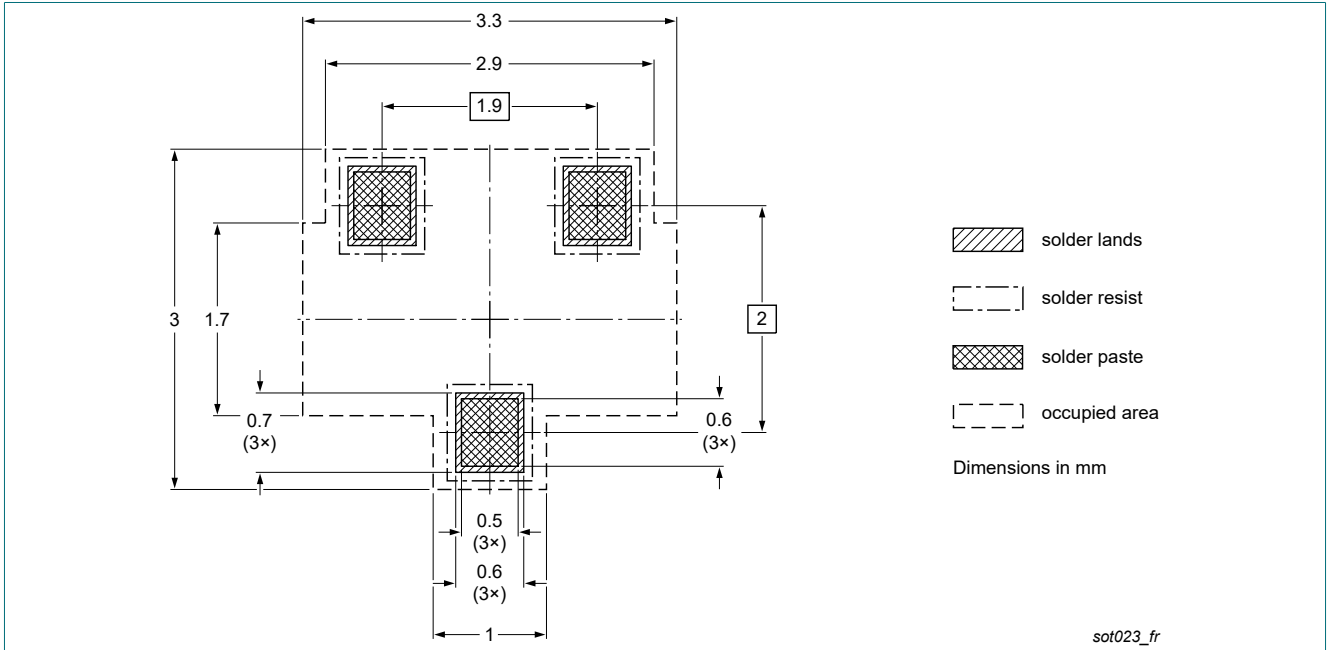


Fig. 14. Reflow soldering footprint for SOT23

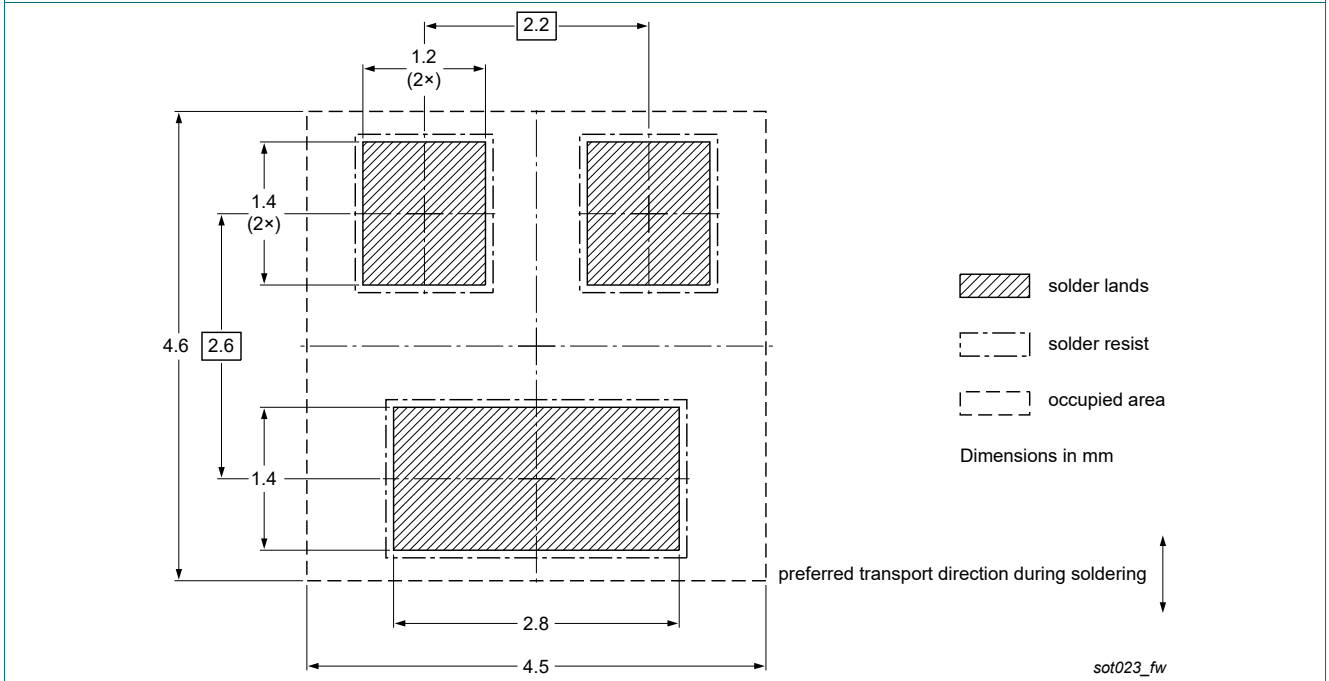


Fig. 15. Wave soldering footprint for SOT23

### 14. Revision history

Table 7. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PESD2USB5UXT-Q v.1	20240307	Product data sheet	-	-

## 15. Legal information

### 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".
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