
# PESD2USB3UX-T

## Automotive infotainment ESD protection diode

**9 September 2020** **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: $V_{RWM}$ = 3.3 V
- Low clamping voltage: $V_{CL}$= 3.3 V at $I_{PP}$ = 8 A
- ESD protection up to 8 kV (IEC 61000-4-2)
- Ultra low capacitance: $C_d$ = 0.56 pF
- ESD protection up to 8 kV (ISO 10605; C = 150 pF; R = 330 Ω)
- High temperature capability: $T_j$ = 175 °C
- Qualified according to AEC-Q101 / Automotive grade

## 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 °C | | - | - | 3.3 | V |
| $I_{PPM}$ | rated peak pulse current | $t_p$ = 8/20 µs | [1] [2] | - | - | 4 | A |
| $C_d$ | diode capacitance | f = 1 MHz; $V_R$ = 0 V; $T_{amb}$ = 25 °C | [2] | - | 0.56 | 0.7 | pF |

[1] According to IEC 61000-4-5.
[2] Measured from pin 1 or 2 to pin 3.

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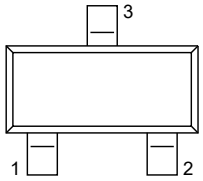
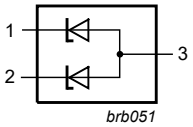
## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | K1 | cathode (diode 1) |  SOT23 |  brb051 |
| 2 | K2 | cathode (diode 2) | | |
| 3 | CA | common anode | | |

## 6. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PESD2USB3UX-T | 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[1] |
|---|---|
| PESD2USB3UX-T | Q3% |

[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 µs | [1] [2] | - | 4 | A |
| $T_j$ | junction temperature | | | - | 175 | °C |
| $T_{amb}$ | ambient temperature | | | -55 | 175 | °C |
| $T_{stg}$ | storage temperature | | | -65 | 175 | °C |
| **ESD maximum ratings** | | | | | | |
| $V_{ESD}$ | electrostatic discharge voltage | IEC 61000-4-2; contact discharge | [2] [3] | - | 8 | kV |
| | | ISO 10605; contact discharge; C = 150 pF, R = 330 Ω | [2] [3] | - | 8 | kV |
| | | ISO 10605; contact discharge; C = 330 pF, R = 330 Ω | [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.

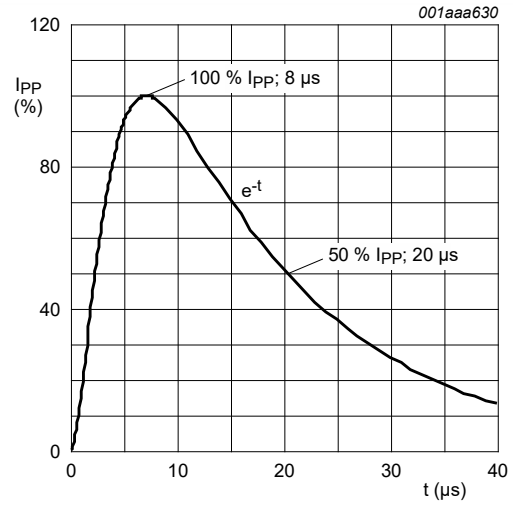



**Fig. 1. 8/20 µs pulse waveform according to IEC 61000-4-5**

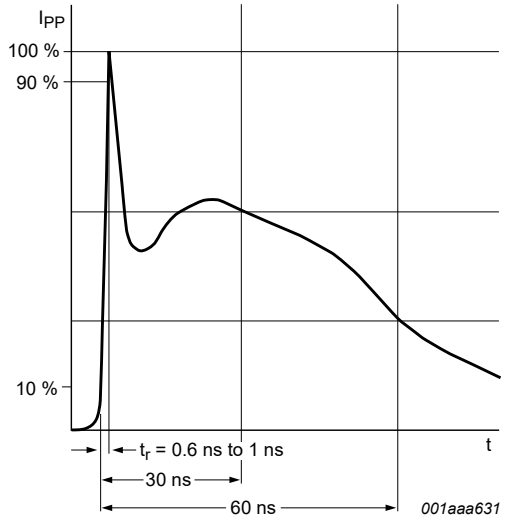



**Fig. 2. ESD pulse waveform according to IEC 61000-4-2**

# 9. Characteristics

**Table 6. Characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RWM}$ | reverse standoff voltage | $T_{amb}$ = 25 °C | | - | - | 3.3 | V |
| $V_{BR}$ | breakdown voltage | $I_R$ = 1 mA; $T_{amb}$ = 25 °C | [1] | 4.2 | 6.7 | 8 | V |
| $I_{RM}$ | reverse leakage current | $V_{RWM}$ = 3.3 V; $T_{amb}$ = 25 °C | [1] | - | 1 | 50 | nA |
| $C_d$ | diode capacitance | f = 1 MHz; $V_R$ = 0 V; $T_{amb}$ = 25 °C | [1] | - | 0.56 | 0.7 | pF |
| $\Delta C_d/C_d$ | diode capacitance matching | | [2] | - | 1 | - | % |
| $V_{CL}$ | clamping voltage | $I_{PP}$ = 8 A; $t_p$ = TLP; $T_{amb}$ = 25 °C | [3] [1] | - | 3.3 | - | V |
| $R_{dyn}$ | dynamic resistance | $I_R$ = 10 A; $T_{amb}$ = 25 °C | [3] [1] | - | 0.3 | - | Ω |

[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

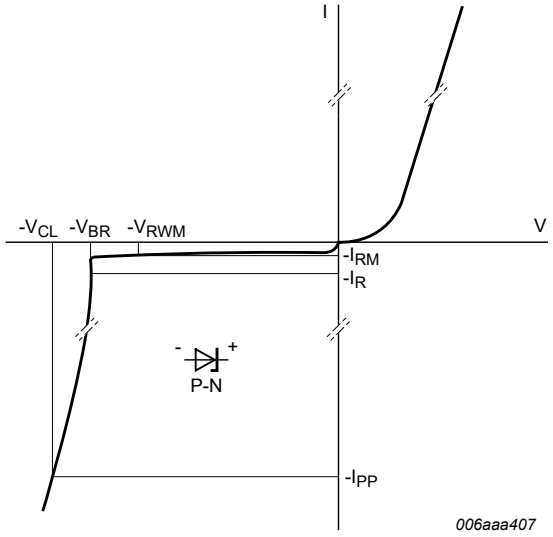



**Fig. 3. V-I characteristics for a unidirectional ESD protection diode**

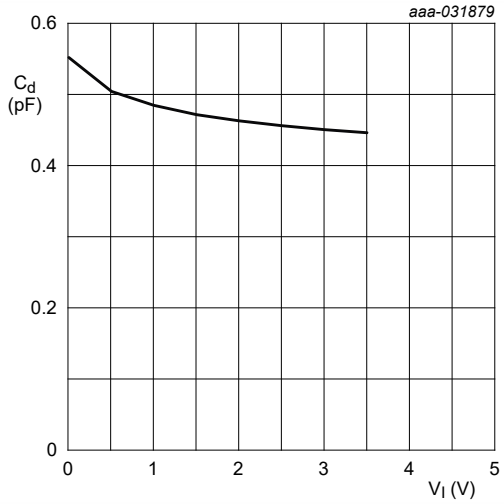
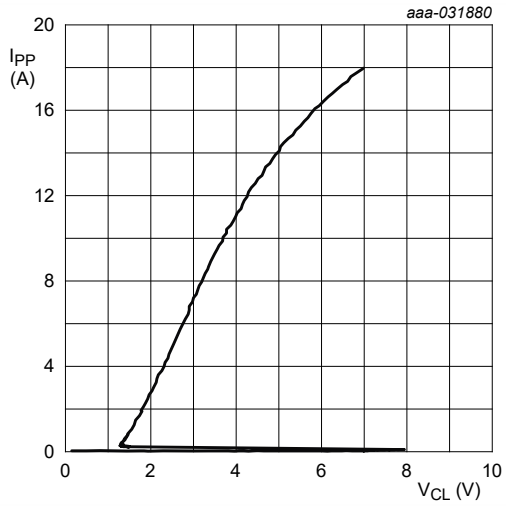
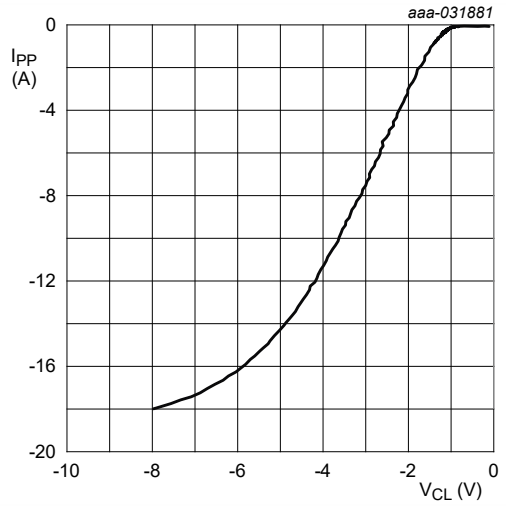



**Fig. 4. Relative capacitance as a function of reverse standoff voltage; typical values**



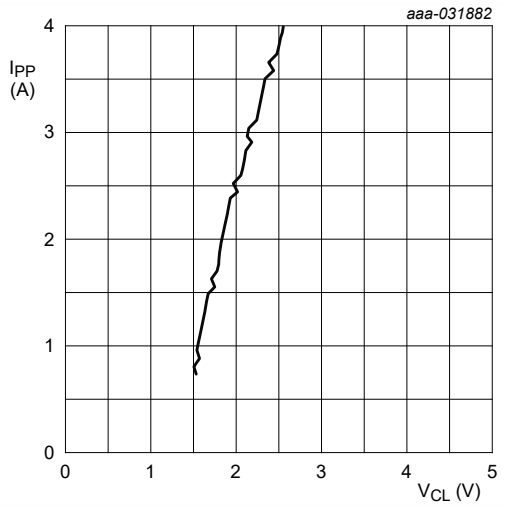

$t_p$ = 100 ns; rise time = 1 ns; Transmission Line Pulse (TLP)

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



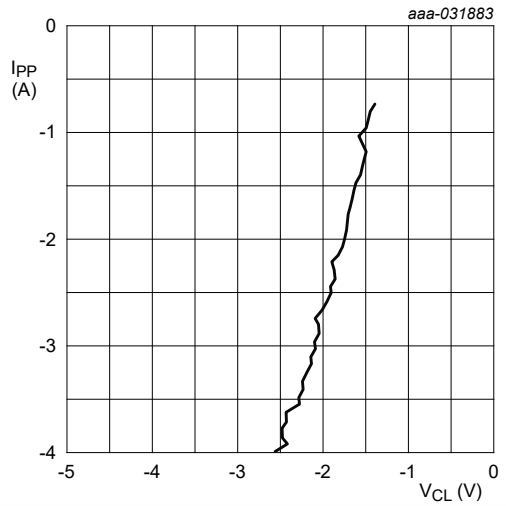

$t_p$ = 100 ns; rise time = 1 ns; Transmission Line Pulse (TLP)

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




IEC 61000-4-5; $t_p$ = 8/20 µs; positive pulse

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




IEC 61000-4-5; $t_p$ = 8/20 µs; positive pulse

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

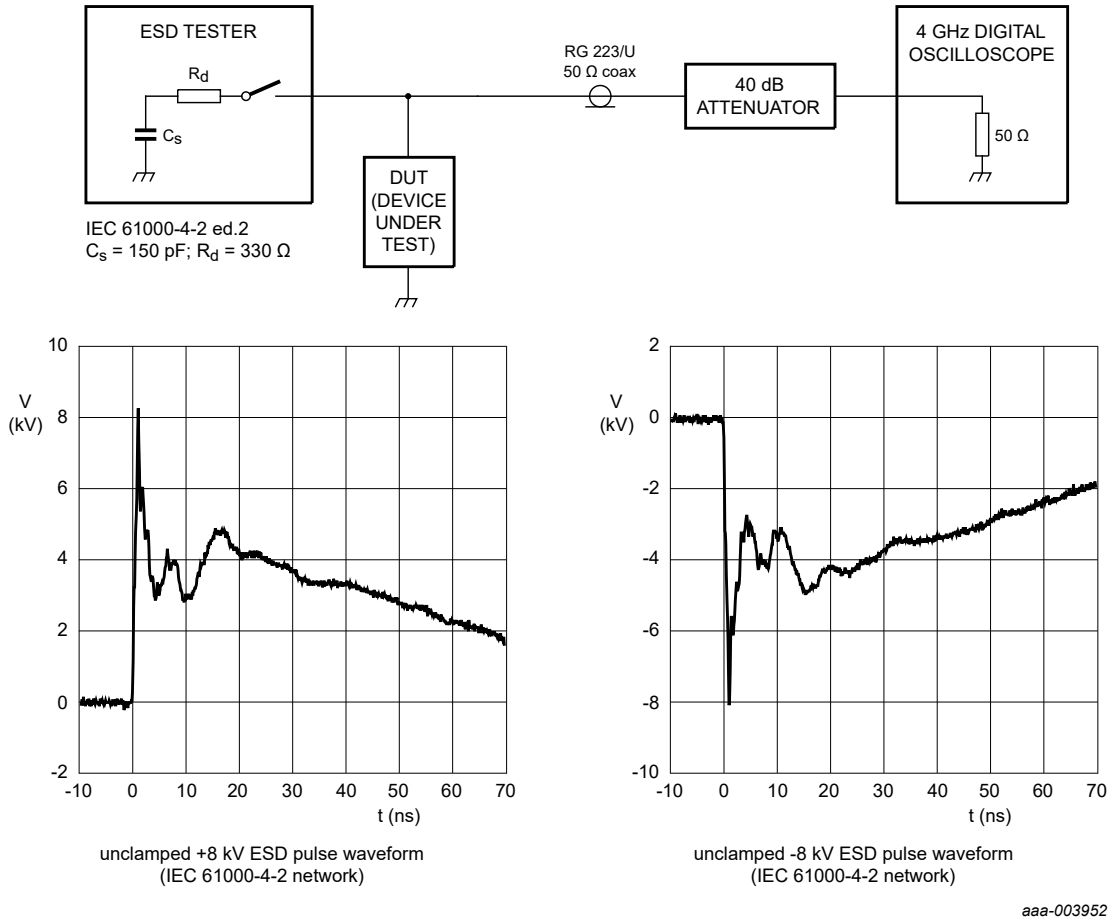



**Fig. 9. ESD clamping test setup and waveforms**

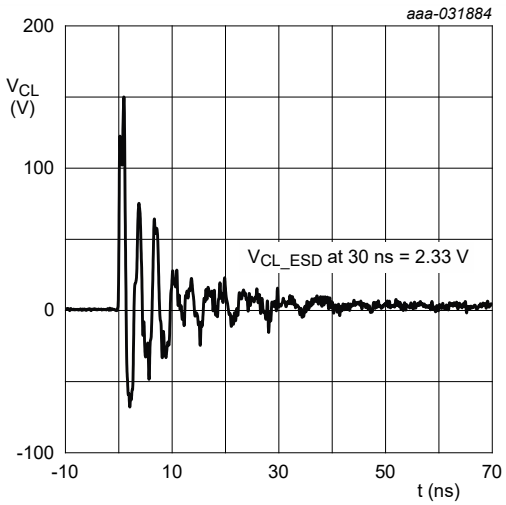



**Fig. 10. Clamped +8 kV pulse waveform (IEC 61000-4-2 network)**

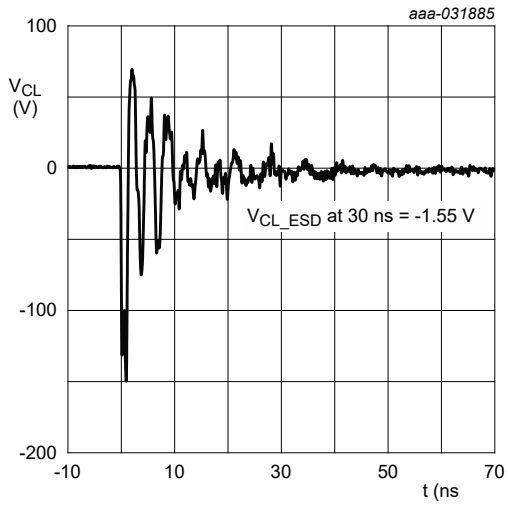



**Fig. 11. Clamped -8 kV pulse waveform (IEC 61000-4-2 network)**

# 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.

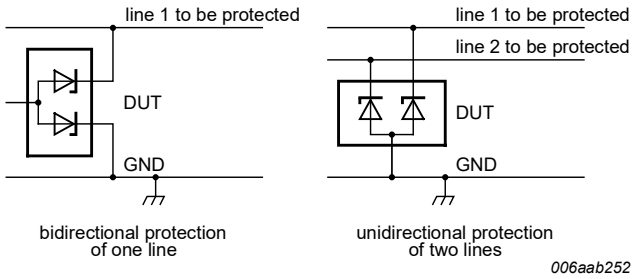



**Fig. 12. Application diagram**

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.

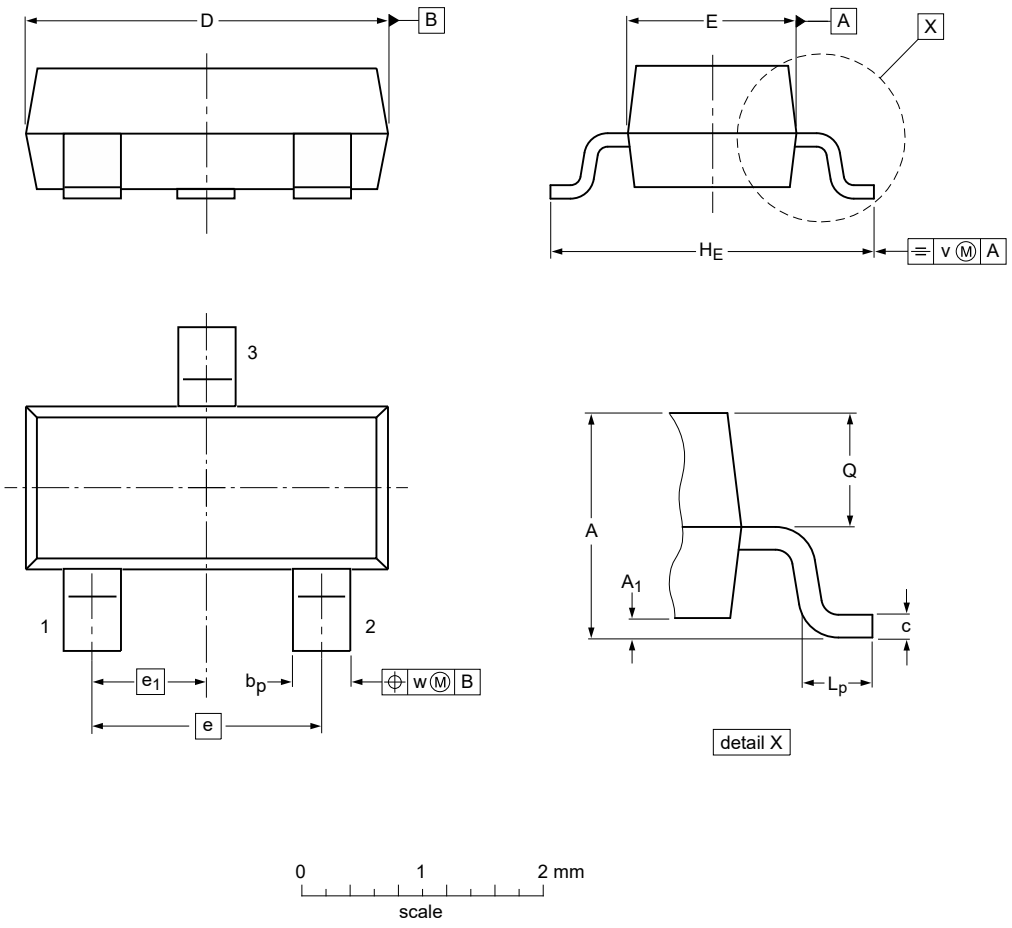
# 11. Test information

## 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

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




Dimensions (mm are the original dimensions)

| Unit | | A | $A_1$ | $b_p$ | c | D | E | e | $e_1$ | $H_E$ | $L_p$ | Q | v | w |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 1.1 | 0.1 | 0.48 | 0.15 | 3.0 | 1.4 | | | 2.5 | 0.45 | 0.55 | | |
| | nom | | | | | | | 1.9 | 0.95 | | | | 0.2 | 0.1 |
| | min | 0.9 | | 0.38 | 0.09 | 2.8 | 1.2 | | | 2.1 | 0.15 | 0.45 | | |

*sot023_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT23 | | TO-236AB | | | | ~~14-06-19~~ 14-09-22 |

**Fig. 13. Package outline SOT23**

## 13. Soldering

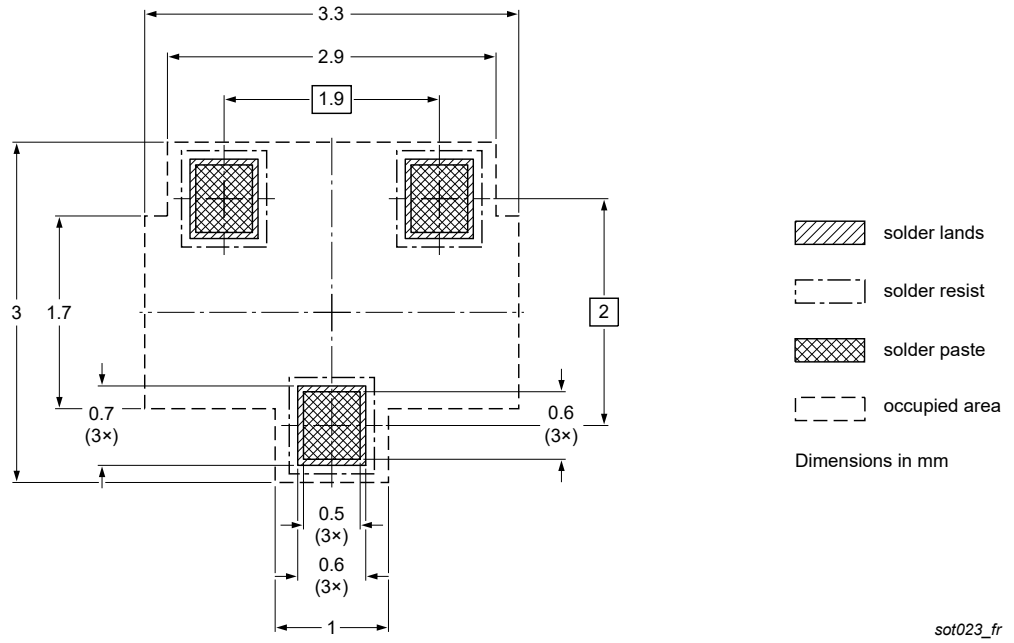



**Fig. 14. Reflow soldering footprint for SOT23**

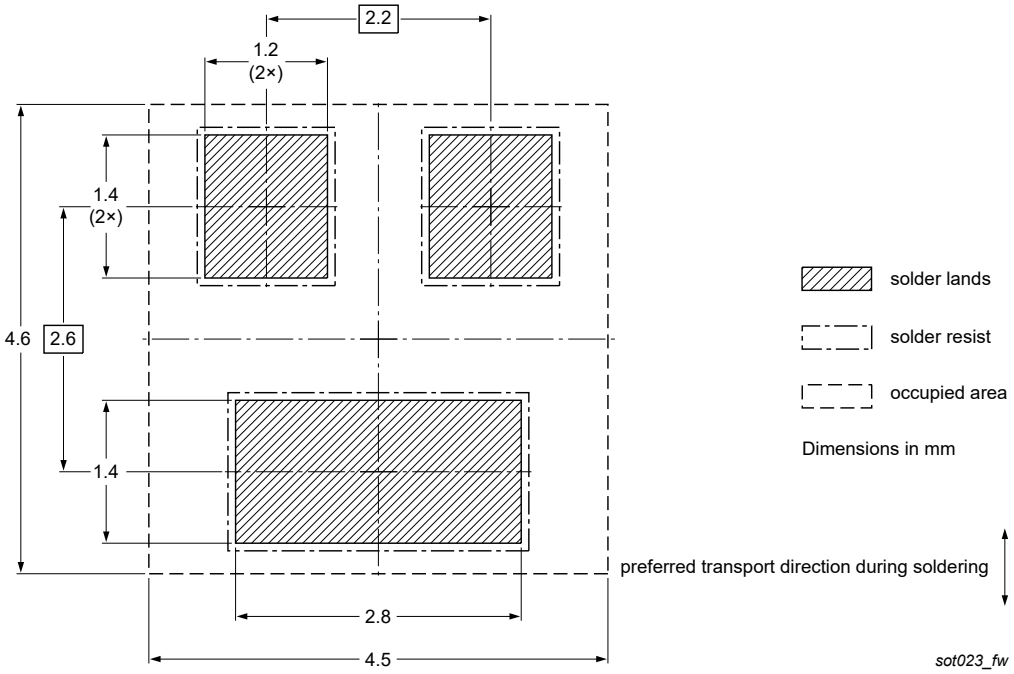



**Fig. 15. Wave soldering footprint for SOT23**

# 14. Revision history

**Table 7. Revision history**

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PESD2USB3UX-T v.1 | 20200909 | 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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