



# PESD2USB5UV-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:  $V_{RWM} = 5\text{ V}$
- Low clamping voltage:  $V_{CL} = 2.4\text{ V}$  at  $I_{PP} = 8\text{ A}$
- ESD protection up to 22 kV (IEC 61000-4-2)
- Ultra low capacitance:  $C_d = 0.76\text{ pF}$
- ESD protection up to 22 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 / 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

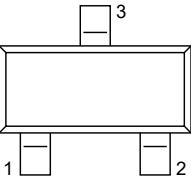
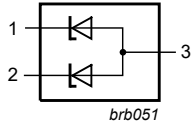
| Symbol    | Parameter                | Conditions   | Min     | Typ  | Max | Unit |
|-----------|--------------------------|--|---------|------|-----|------|
| $V_{RWM}$ | reverse standoff voltage | $T_{amb} = 25\text{ }^\circ\text{C}$   | -       | -    | 5   | V    |
| $I_{PPM}$ | rated peak pulse current | $t_p = 8/20\ \mu\text{s}$  | [1] [2] | -    | 10  | A    |
| $C_d$     | diode capacitance        | $f = 1\text{ MHz}$ ; $V_R = 0\text{ V}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ | [2]     | 0.76 | 0.9 | 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> |  <p style="text-align: center;"><i>brb051</i></p> |
| 2   | K2     | cathode (diode 2) |   |  |
| 3   | CA     | common anode      |   |  |

## 6. Ordering information

Table 3. Ordering information

| Type number   | Package |  |         |
|---------------|---------|--|---------|
|               | Name    | Description  | Version |
| PESD2USB5UV-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 <sup>[1]</sup> |
|---------------|-----------------------------|
| PESD2USB5UV-T | Q5%                         |

[1] % = placeholder for manufacturing site code

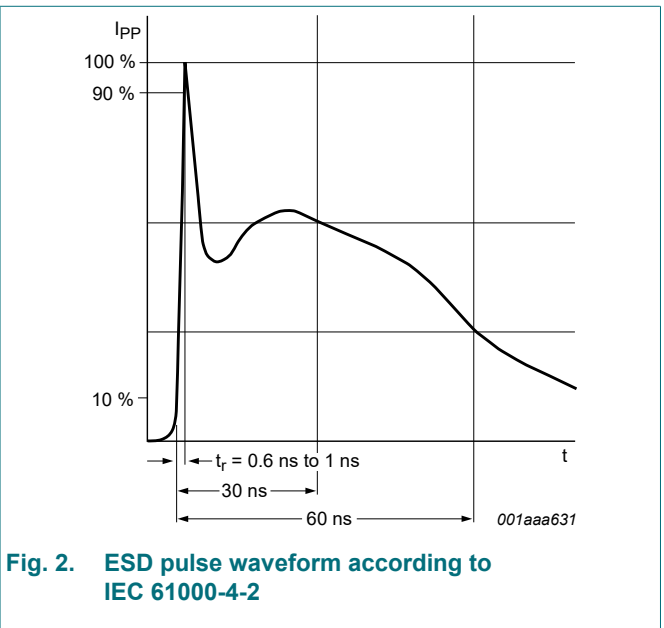
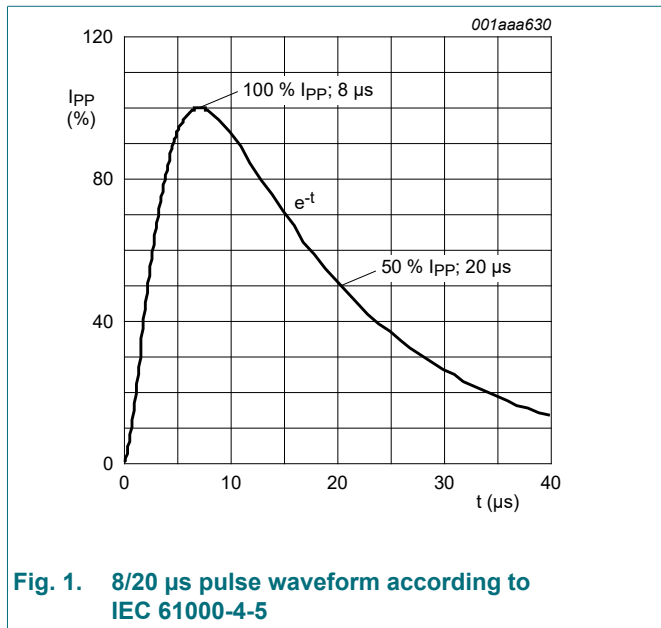
## 8. Limiting values

**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] | -   | 10  | 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] | -   | 22  | kV   |
|                            |                                 | ISO 10605; contact discharge; C = 150 pF, R = 330 $\Omega$ | [2] [3] | -   | 22  | kV   |
|                            |                                 | ISO 10605; contact discharge; C = 330 pF, R = 330 $\Omega$ | [2] [3] | -   | 18  | 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   | $T_{amb} = 25\text{ °C}$   |         | -   | -    | 5   | V        |
| $V_{BR}$         | breakdown voltage          | $I_R = 1\text{ mA}; T_{amb} = 25\text{ °C}$                      | [1]     | 7.2 | 8.7  | 11  | V        |
| $I_{RM}$         | reverse leakage current    | $V_{RWM} = 5\text{ V}; T_{amb} = 25\text{ °C}$                   | [1]     | -   | 1    | 50  | nA       |
| $C_d$            | diode capacitance          | $f = 1\text{ MHz}; V_R = 0\text{ V}; T_{amb} = 25\text{ °C}$     | [1]     | -   | 0.76 | 0.9 | pF       |
| $\Delta C_d/C_d$ | diode capacitance matching |  | [2]     | -   | 0.5  | -   | %        |
| $V_{CL}$         | clamping voltage           | $I_{PP} = 8\text{ A}; t_p = \text{TLP}; T_{amb} = 25\text{ °C}$  | [3] [1] | -   | 2.4  | -   | V        |
|                  |                            | $I_{PP} = 16\text{ A}; t_p = \text{TLP}; T_{amb} = 25\text{ °C}$ | [3] [1] | -   | 3.4  | -   | V        |
| $R_{dyn}$        | dynamic resistance         | $I_R = 10\text{ A}; T_{amb} = 25\text{ °C}$                      | [3] [1] | -   | 0.12 | -   | $\Omega$ |

[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

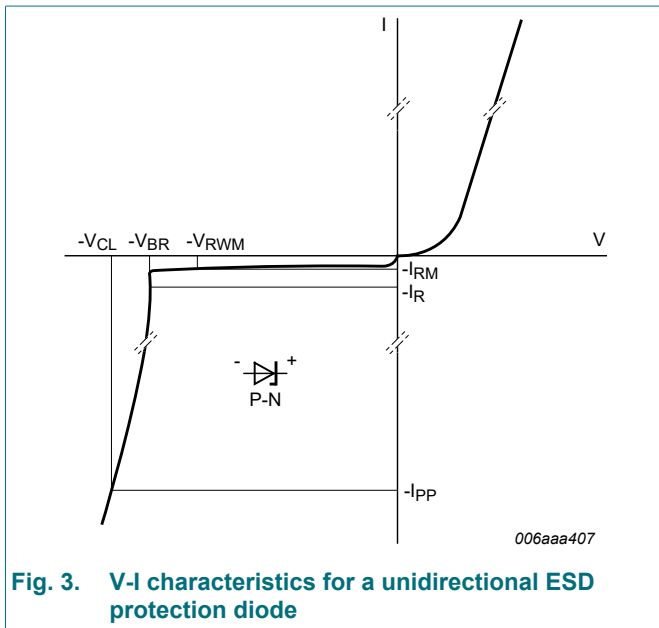


Fig. 3. V-I characteristics for a unidirectional ESD protection diode

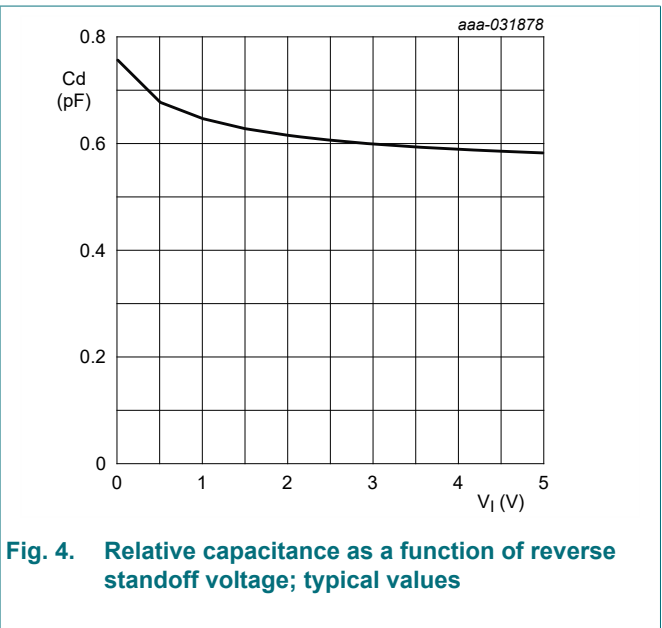
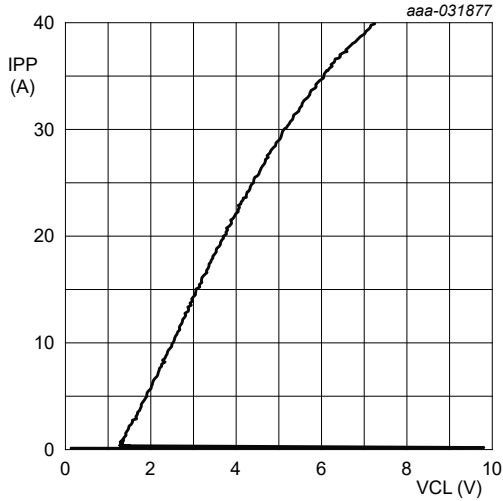
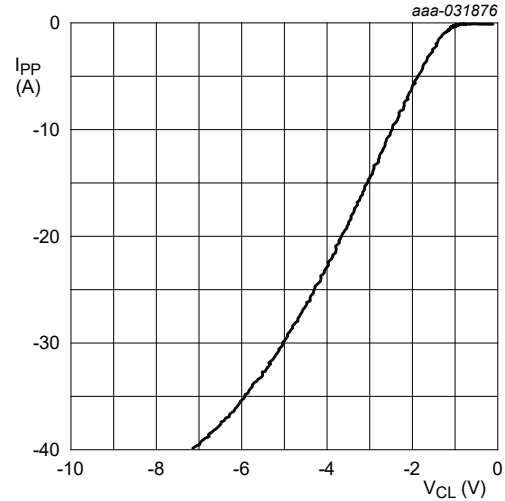


Fig. 4. Relative capacitance as a function of reverse standoff voltage; typical values



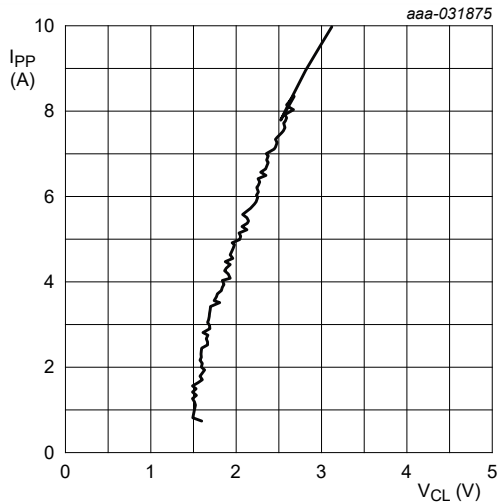
$t_p = 100 \text{ ns}$ ; rise time = 1 ns; Transmission Line Pulse (TLP)

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



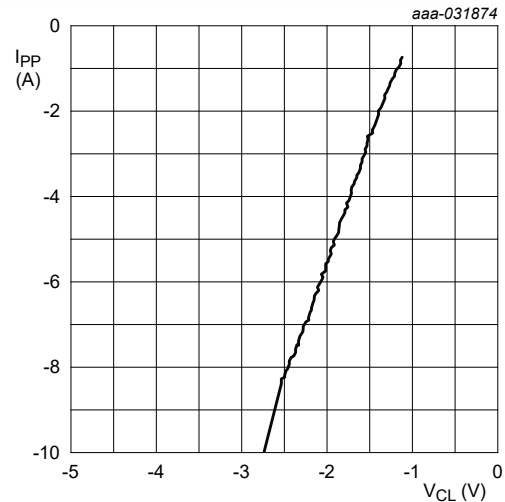
$t_p = 100 \text{ ns}$ ; rise time = 1 ns; Transmission Line Pulse (TLP)

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



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

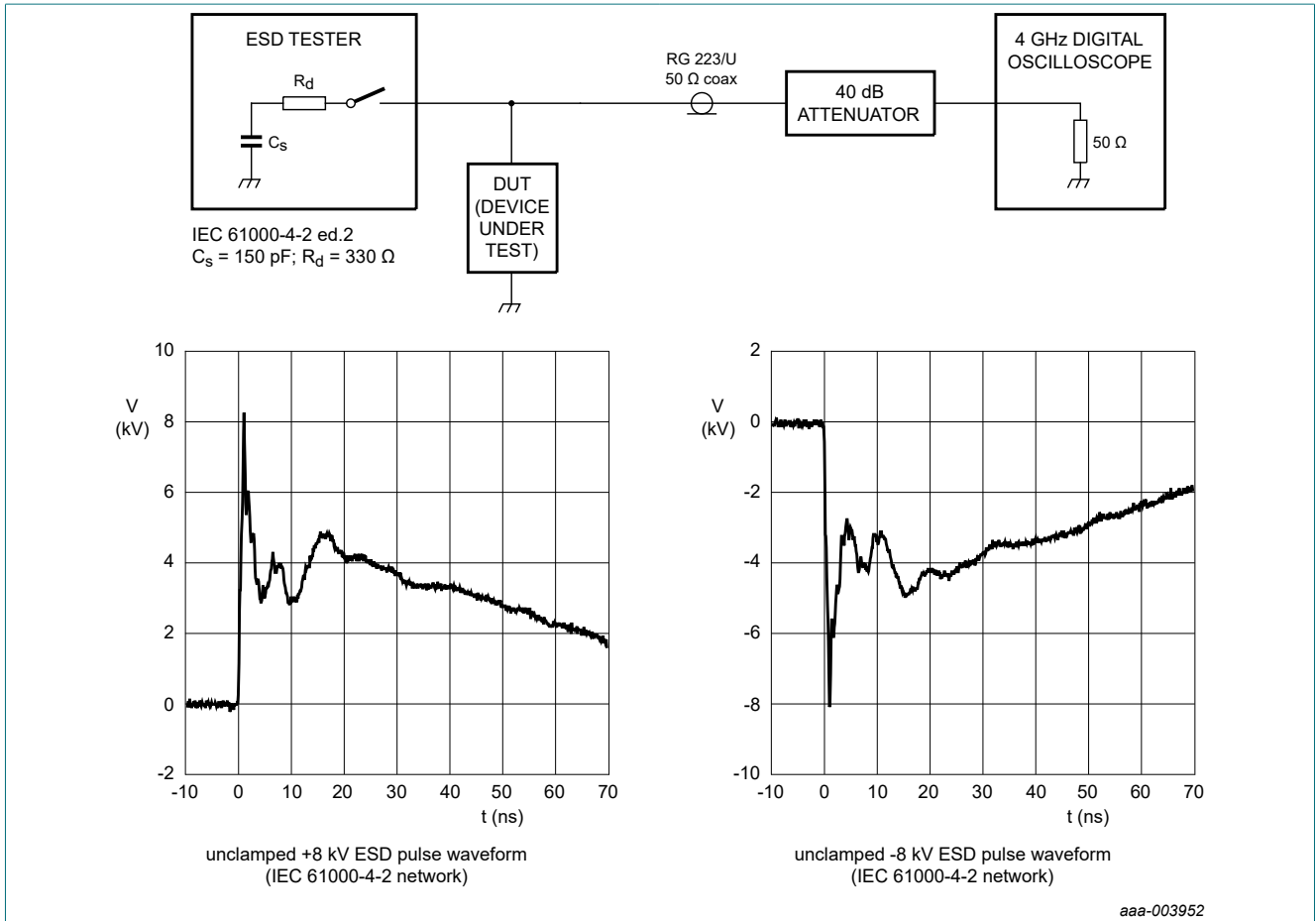


Fig. 9. ESD clamping test setup and waveforms

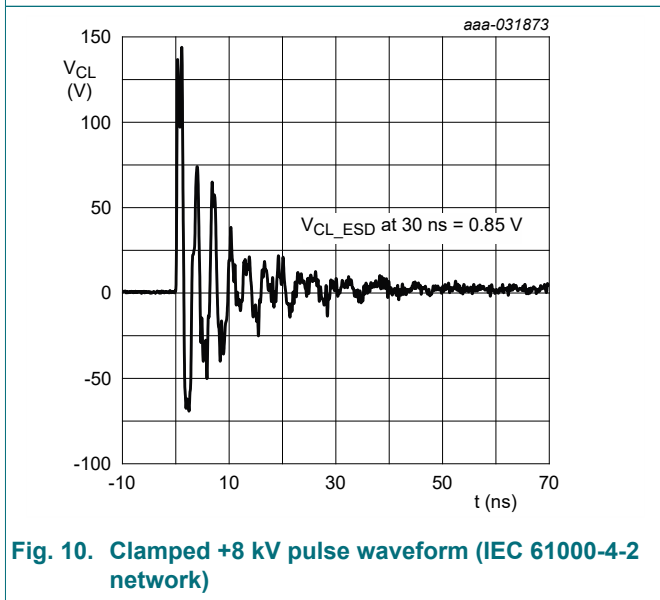


Fig. 10. Clamped +8 kV pulse waveform (IEC 61000-4-2 network)

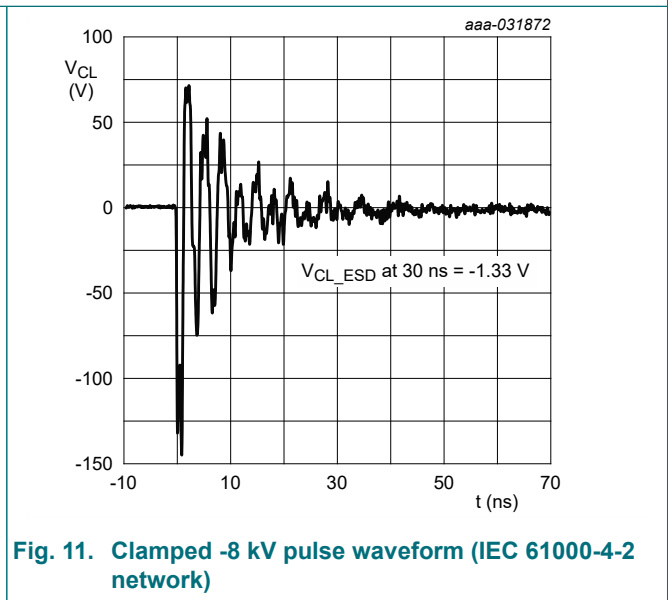


Fig. 11. Clamped -8 kV pulse waveform (IEC 61000-4-2 network)

## 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.

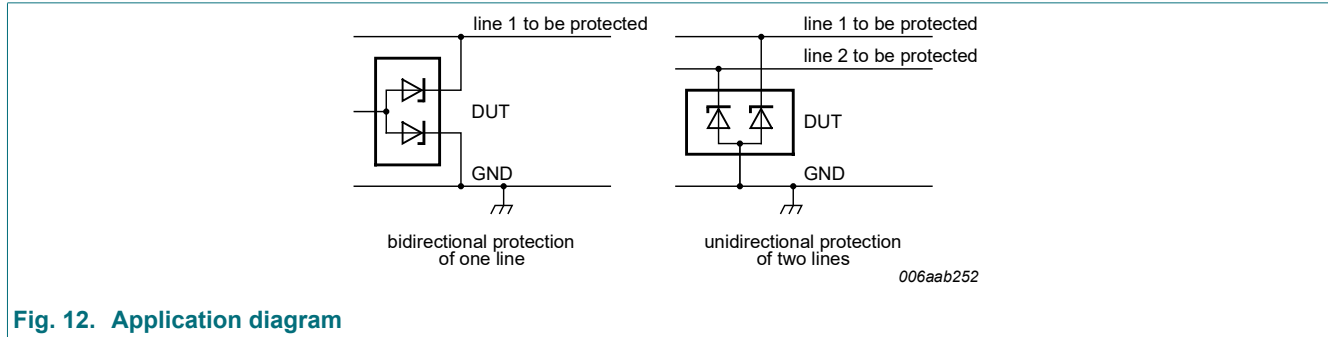


Fig. 12. Application diagram

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

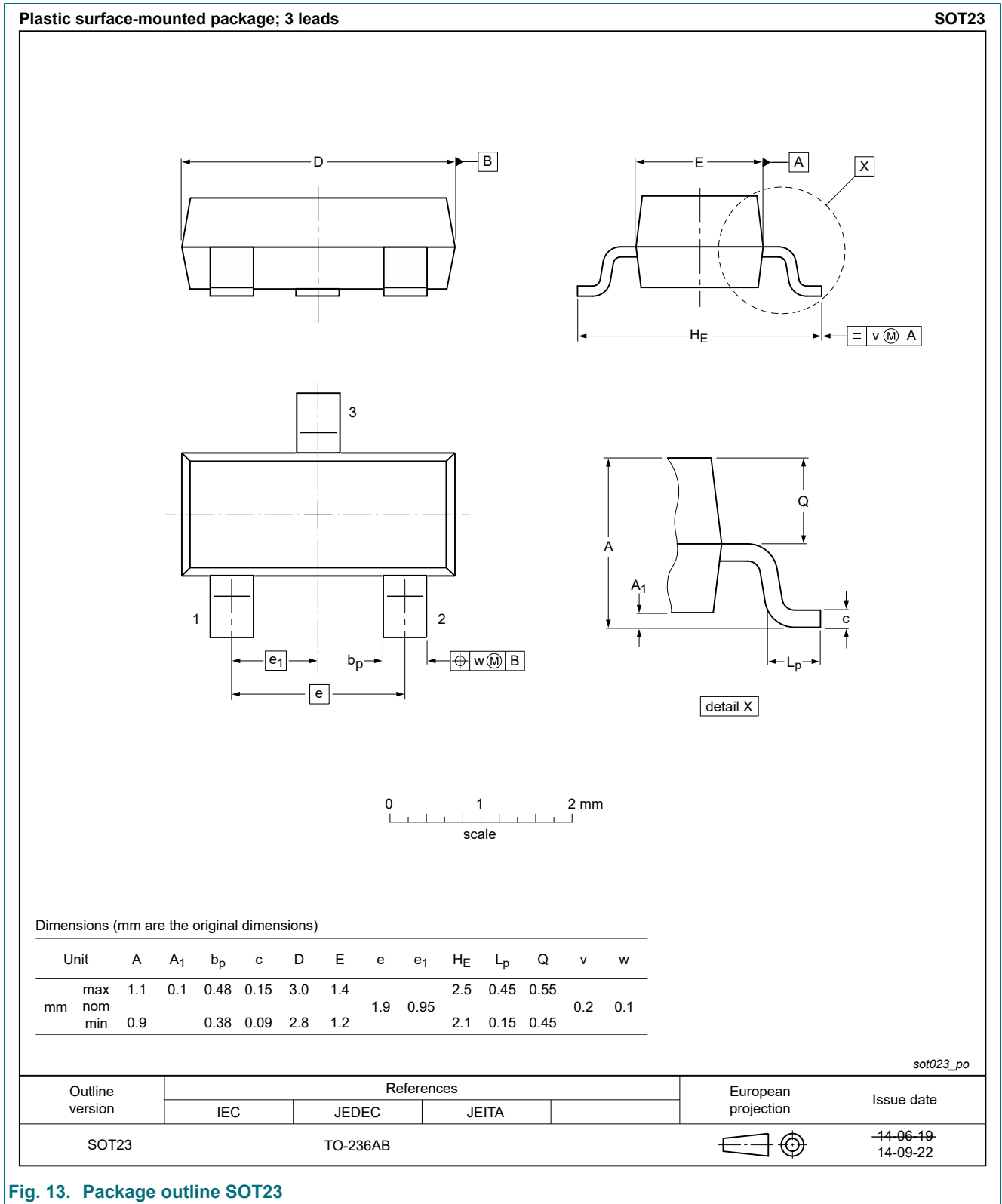


Fig. 13. Package outline SOT23



### 13. Soldering

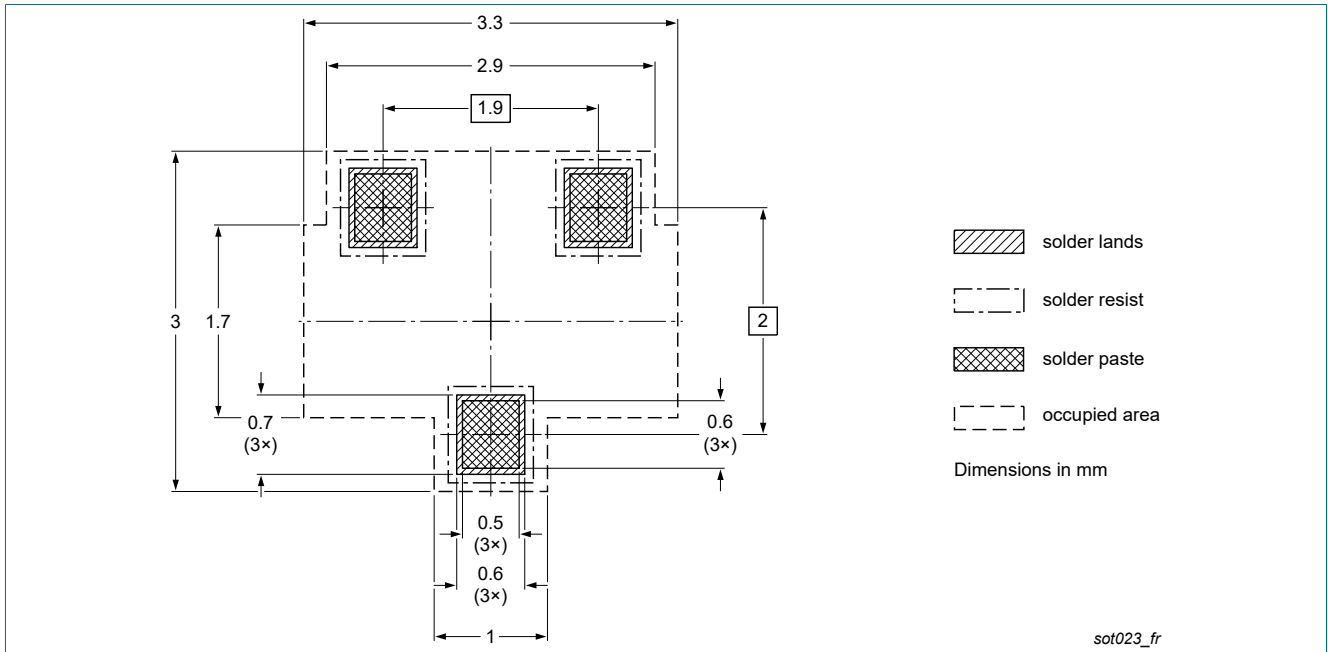


Fig. 14. Reflow soldering footprint for SOT23

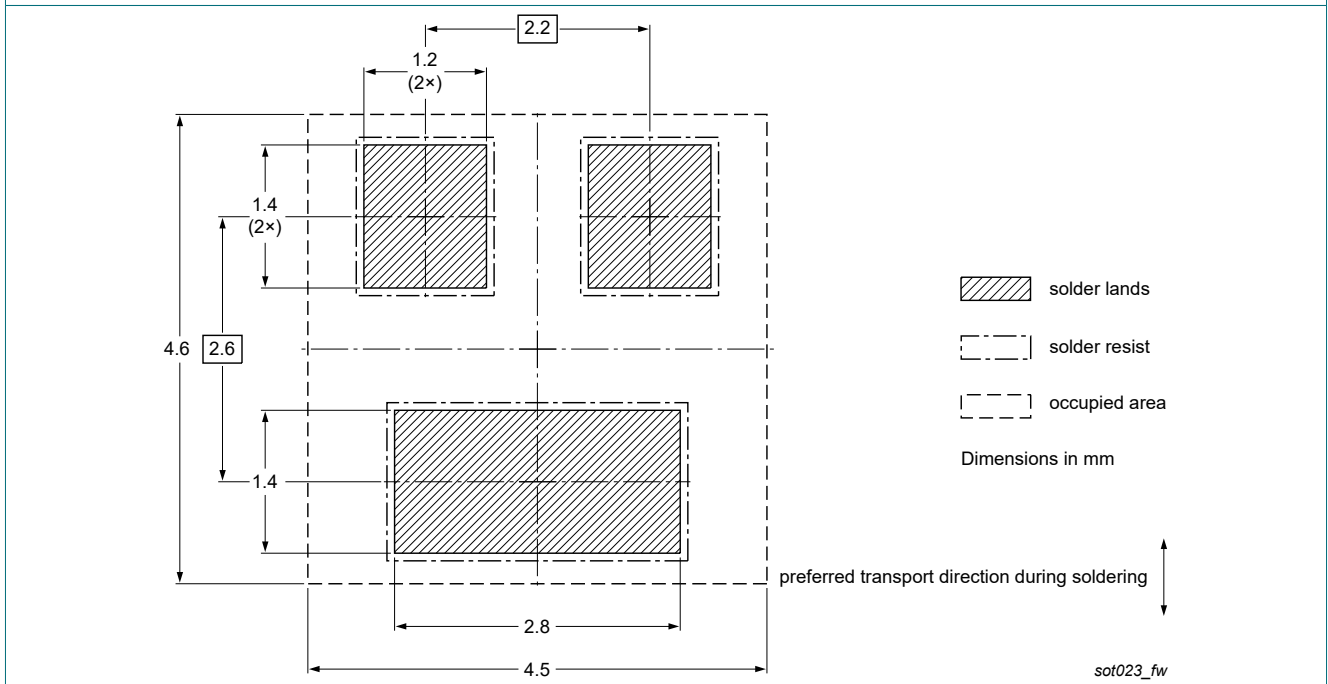


Fig. 15. Wave soldering footprint for SOT23

## 14. Revision history

Table 7. Revision history

| Data sheet ID     | Release date | Data sheet status  | Change notice | Supersedes |
|-------------------|--------------|--------------------|---------------|------------|
| PESD2USB5UV-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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