



# THE DATASHEET OF PESD4USB3U-TBSX



# PESD4USB3U-TBS

## ESD protection for high-speed interfaces

11 August 2022

Product data sheet

## 1. General description

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This unidirectional ESD protection device is designed to protect high-speed interfaces such as SuperSpeed USB 3.2 at 10 Gbps, HDMI, DisplayPort, external Serial Advanced Technology Attachment (eSATA), Low Voltage Differential Signaling (LVDS), and Gigabit Multimedia Serial Link (GMSL) Serializer/Deserializer (SerDes) against ElectroStatic Discharge (ESD).

The device is encapsulated in a leadless small DFN2510D-10 (SOT1176D) plastic package with side-wettable flanks (SWF) which allow automatic optical inspection (AOI). The device provides ESD protection up to 15 kV exceeding IEC61000-4-2 level 4 and fulfilling ISO10605.

## 2. Features and benefits

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- System-level ESD protection for USB 2.0 and SuperSpeed USB 3.2 at 10 Gbps, HDMI, DisplayPort, eSATA and LVDS
- Line capacitance of only 0.5 pF for each channel
- Outstanding system protection: extremely deep snap-back combined with dynamic resistance of 0.4  $\Omega$
- ESD protection level up to  $\pm 15$  kV (IEC 61000-4-2, level 4; ISO10605)
- Matched 0.5 mm trace spacing and side-wettable flanks (SWF) for AOI
- Design-friendly 'pass-through' signal routing
- AEC-Q101 qualified

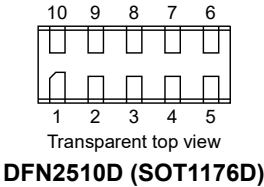
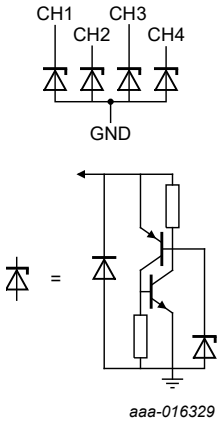
## 3. Applications

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- Infotainment applications: USB 2.0, SuperSpeed USB 3.2 at 10 Gbps, HDMI 2.0, HDBaseT
- Automotive A/V monitors, display and cameras
- SerDes: GMSL, FPD-Link, LVDS

4. Pinning information

Table 1. Pinning information

| Pin | Symbol | Description              | Simplified outline                                                                | Graphic symbol                                                                      |
|-----|--------|--------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | CH1    | channel 1 ESD protection |  |  |
| 2   | CH2    | channel 2 ESD protection |                                                                                   |                                                                                     |
| 3   | GND    | ground                   |                                                                                   |                                                                                     |
| 4   | CH3    | channel 3 ESD protection |                                                                                   |                                                                                     |
| 5   | CH4    | channel 4 ESD protection |                                                                                   |                                                                                     |
| 6   | n.c.   | not connected            |                                                                                   |                                                                                     |
| 7   | n.c.   | no connection            |                                                                                   |                                                                                     |
| 8   | GND    | ground                   |                                                                                   |                                                                                     |
| 9   | n.c.   | not connected            |                                                                                   |                                                                                     |
| 10  | n.c.   | not connected            |                                                                                   |                                                                                     |

5. Ordering information

Table 2. Ordering information

| Type number    | Package  |                                                                                                                                        |          |
|----------------|----------|----------------------------------------------------------------------------------------------------------------------------------------|----------|
|                | Name     | Description                                                                                                                            | Version  |
| PESD4USB3U-TBS | DFN2510D | plastic, leadless thin small outline package with Side-Wettable Flanks (SWF); 10 terminals; 0.5 mm pitch; 2.5 mm x 1 mm x 0.75 mm body | SOT1176D |

6. Marking

Table 3. Marking codes

| Type number    | Marking code |
|----------------|--------------|
| PESD4USB3U-TBS | 4U           |

7. Limiting values

Table 4. Limiting values  
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol           | Parameter                       | Conditions                                          |         | Min | Max | Unit |
|------------------|---------------------------------|-----------------------------------------------------|---------|-----|-----|------|
| V <sub>RWM</sub> | reverse standoff voltage        | T <sub>amb</sub> = 25 °C                            |         | -   | 3.3 | V    |
| I <sub>PPM</sub> | rated peak pulse current        | t <sub>p</sub> = 8/20 µs                            | [1]     | -   | 7   | A    |
| V <sub>ESD</sub> | electrostatic discharge voltage | IEC 61000-4-2, level 4; contact discharge           | [2] [3] | -   | 15  | kV   |
|                  |                                 | ISO 10605; contact discharge; R = 330 Ω; C = 150 pF | [2] [3] | -   | 15  | kV   |
|                  |                                 | ISO 10605; contact discharge; R = 330 Ω; C = 330 pF | [2] [3] | -   | 14  | kV   |
| T <sub>stg</sub> | storage temperature             |                                                     |         | -65 | 150 | °C   |
| T <sub>amb</sub> | ambient temperature             |                                                     |         | -55 | 150 | °C   |
| T <sub>j</sub>   | junction temperature            |                                                     |         | -   | 150 | °C   |

- [1] According to IEC 61000-4-5 (8/20 µs current waveform).  
[2] All pins to ground.  
[3] Device stressed with ten non-repetitive ESD pulses.

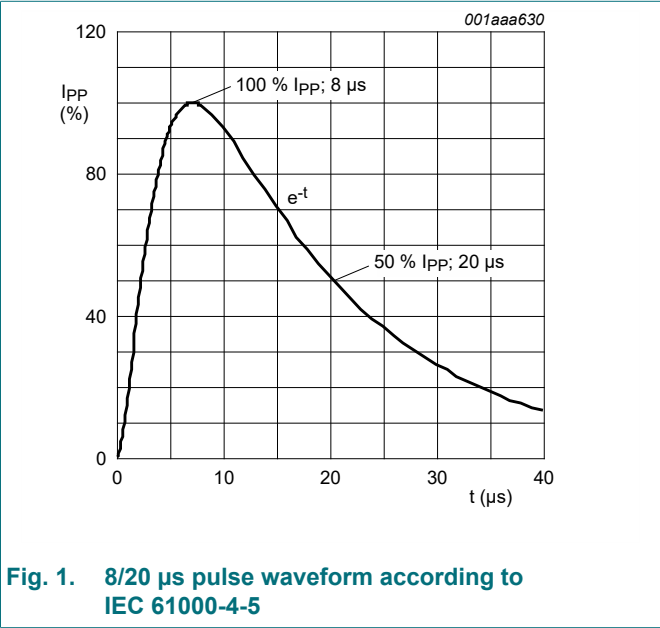


Fig. 1. 8/20 µs pulse waveform according to IEC 61000-4-5

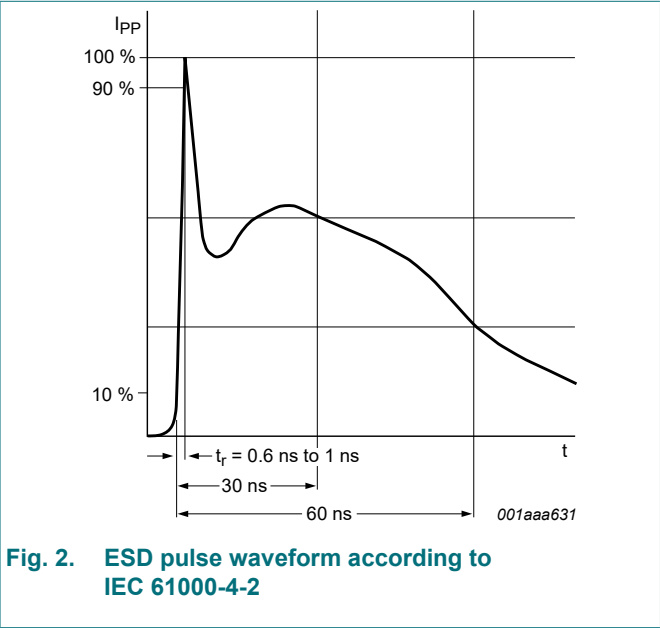


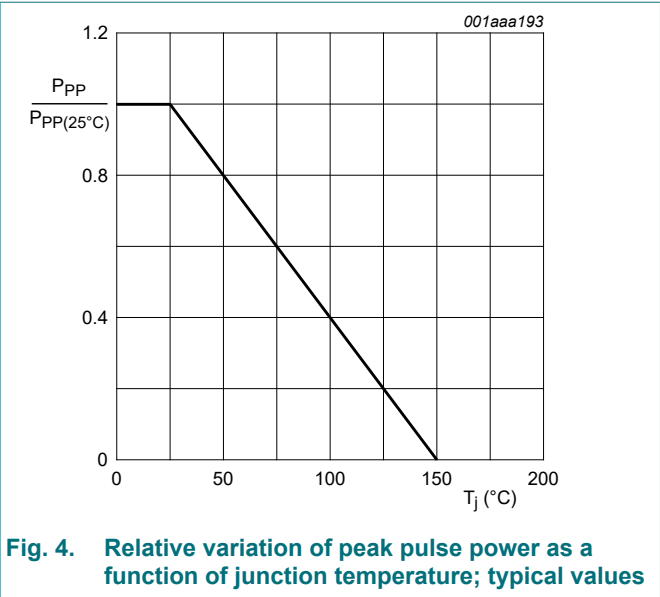
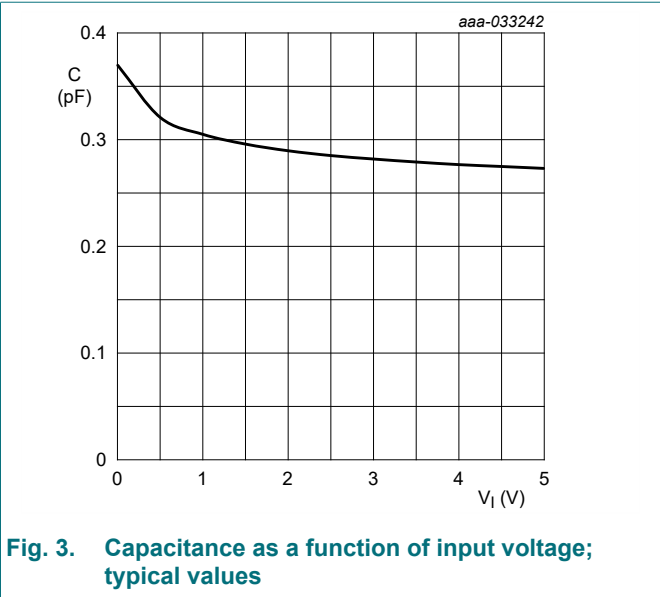
Fig. 2. ESD pulse waveform according to IEC 61000-4-2

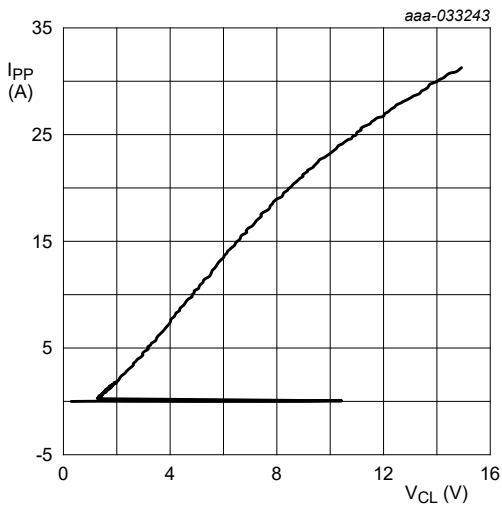
8. Characteristics

Table 5. Characteristics

| Symbol           | Parameter               | Conditions                                                               |     | Min | Typ  | Max | Unit |
|------------------|-------------------------|--------------------------------------------------------------------------|-----|-----|------|-----|------|
| V <sub>BR</sub>  | breakdown voltage       | I <sub>I</sub> = 1 mA; T <sub>amb</sub> = 25 °C                          |     | 6   | 9    | -   | V    |
| V <sub>CL</sub>  | clamping voltage        | I <sub>PP</sub> = 5 A; positive transient;<br>T <sub>amb</sub> = 25 °C   | [1] | -   | 3.5  | -   | V    |
|                  |                         | I <sub>PP</sub> = -5 A; negative transient;<br>T <sub>amb</sub> = 25 °C  | [1] | -   | -3.5 | -   | V    |
| I <sub>RM</sub>  | reverse leakage current | per channel; V <sub>RWM</sub> = 3.3 V;<br>T <sub>amb</sub> = 25 °C       |     | -   | 1    | 100 | nA   |
| R <sub>dyn</sub> | dynamic resistance      | I <sub>R</sub> = 10 A; t <sub>p</sub> = 100 ns; T <sub>amb</sub> = 25 °C | [2] | -   | 0.4  | -   | Ω    |
| C <sub>d</sub>   | diode capacitance       | f = 1 MHz; V <sub>R</sub> = 0 V; T <sub>amb</sub> = 25 °C                |     | -   | 0.4  | 0.5 | pF   |

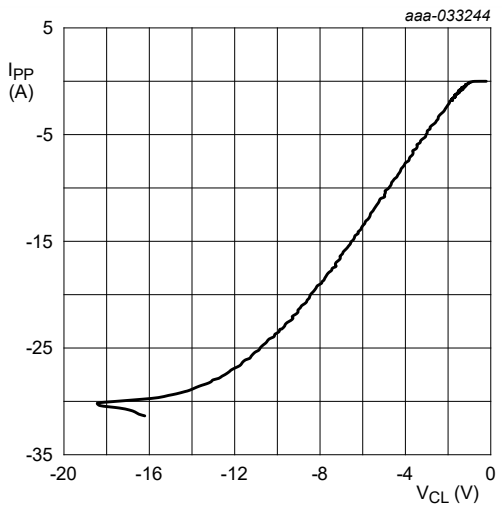
[1] According to IEC 61000-4-5 (8/20 μs current waveform).  
[2] Non-repetitive current pulse, Transmission Line Pulse (TLP); square pulse; ANSI / ESD STM5.5.1-2008.





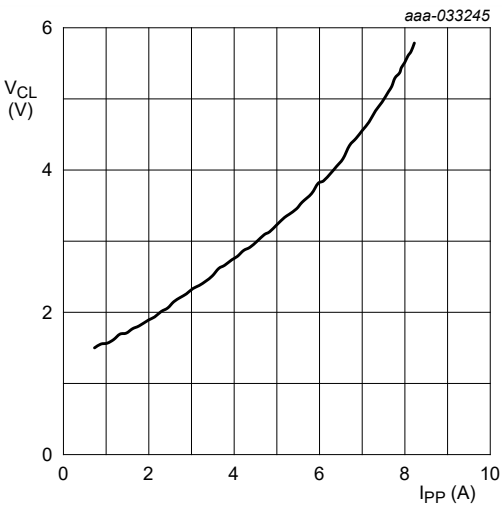
Transmission Line Pulse (TLP);  
 $t_p = 100\text{ ns}$ ;  $t_r = 1\text{ ns}$

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



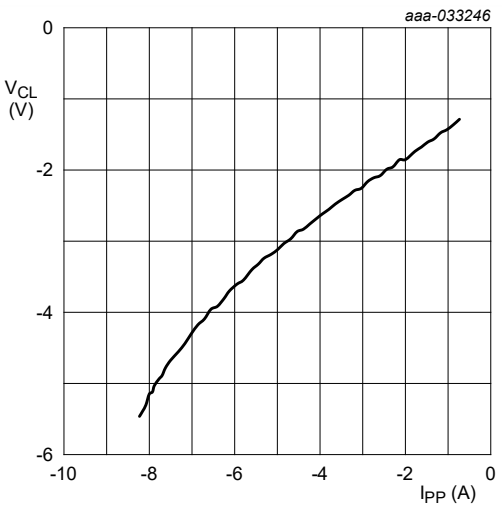
Transmission Line Pulse (TLP);  
 $t_p = 100\text{ ns}$ ;  $t_r = 1\text{ ns}$

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;  $t_p = 8/20\text{ }\mu\text{s}$ ; negative pulse

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

## 9. Application information

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

**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.

### Dynamic resistance

The device uses an advanced clamping structure showing a negative dynamic resistance.

This snap-back behavior strongly reduces the clamping voltage to the system behind the ESD protection during an ESD event. Do not connect unlimited DC current sources to the data lines to avoid keeping the ESD protection device in snap-back state after exceeding breakdown voltage (due to an ESD pulse for instance).

10. Package outline

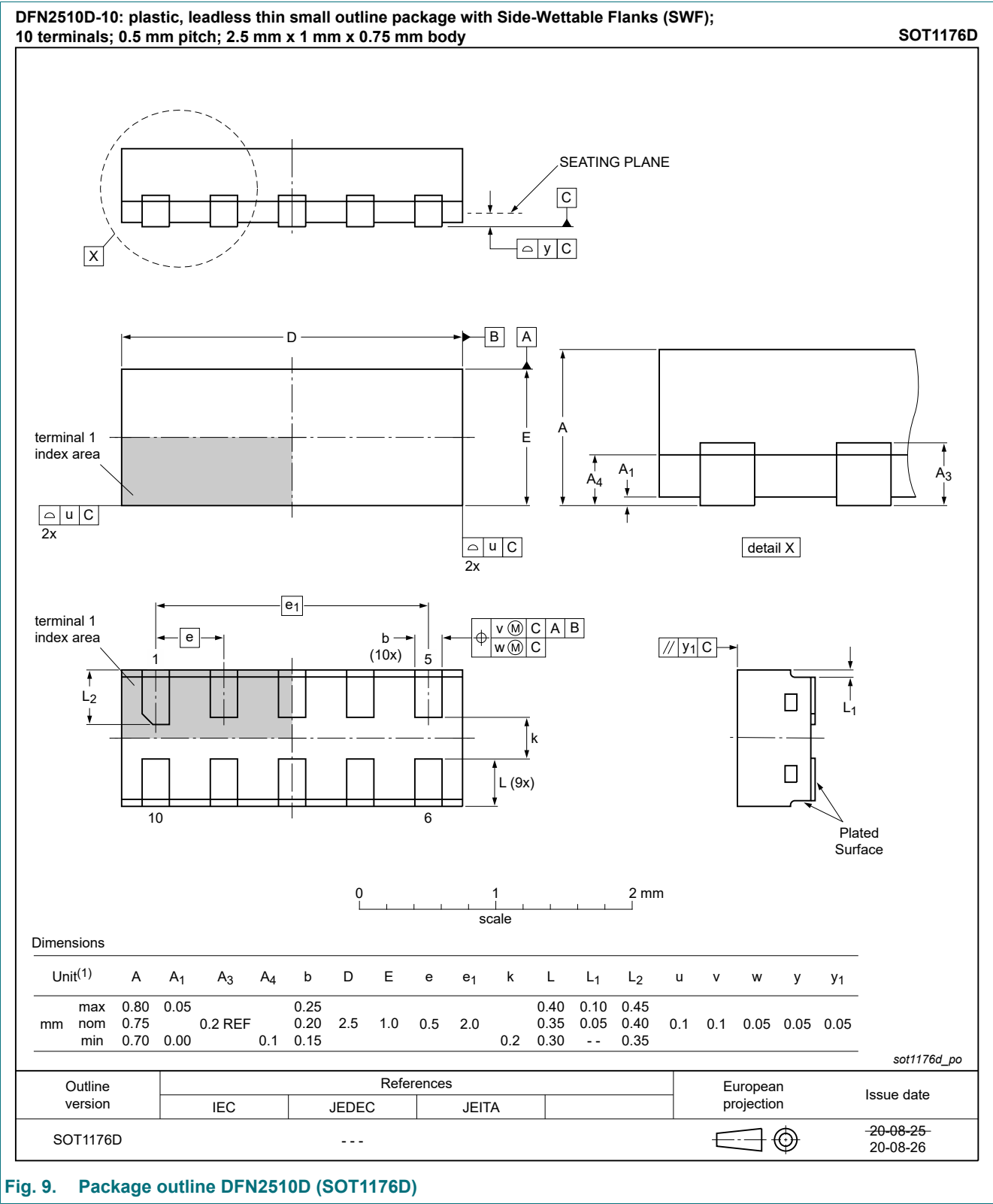


Fig. 9. Package outline DFN2510D (SOT1176D)

11. Soldering

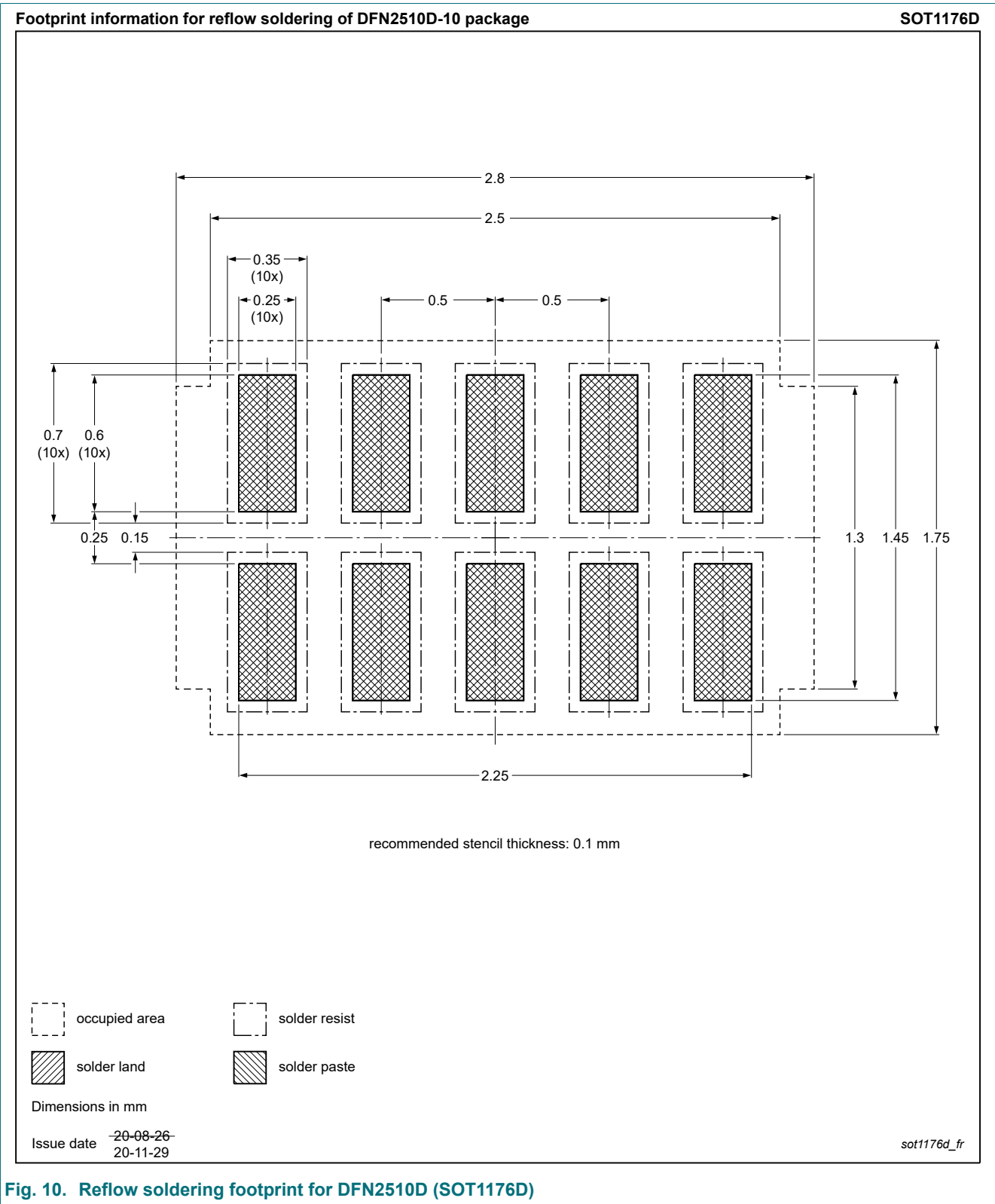


Fig. 10. Reflow soldering footprint for DFN2510D (SOT1176D)

## 12. Revision history

**Table 6. Revision history**

| Data sheet ID      | Release date                                                                       | Data sheet status  | Change notice | Supersedes         |
|--------------------|------------------------------------------------------------------------------------|--------------------|---------------|--------------------|
| PESD4USB3U-TBS v.2 | 20220811                                                                           | Product data sheet | -             | PESD4USB3U-TBS v.1 |
| Modifications:     | • Chapter "Characteristics": Typo correction in conditions for parameter $R_{dyn}$ |                    |               |                    |
| PESD4USB3U-TBS v.1 | 20210315                                                                           | Product data sheet | -             | -                  |

## 13. Legal information

### Data sheet status

| Document status<br>[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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