

PESD4USB5BTTS-Q

ESD protection for high-speed interfaces

15 March 2024 **Product data sheet**

1. General description

This bidirectional 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 (SOT1165D) 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

- 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 0.3 pF for each channel
- Outstanding system protection: extremely deep snap-back combined with dynamic resistance of 0.5 Ω
- ESD protection level up to ±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
- Qualified according to AEC-Q101 and recommended for use in automotive applications

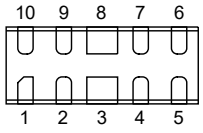
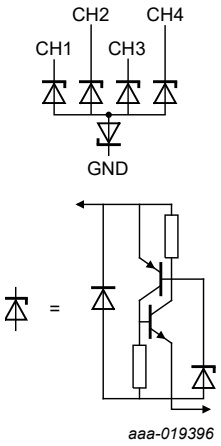
3. Applications

- 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

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4. Pinning information

Table 1. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	CH1	channel 1 ESD protection	 Transparent top view **DFN2510D-10 (SOT1165D)**	
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
PESD4USB5BTTS-Q	DFN2510D-10	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	SOT1165D

6. Marking

Table 3. Marking codes

Type number	Marking code
PESD4USB5BTTS-Q	B5B

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7. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_{RWM}	reverse standoff voltage	T_{amb} = 25 °C		-	5	V
I_{PPM}	rated peak pulse current	t_p = 8/20 µs	[1]	-	7	A
V_{ESD}	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]	-	13	kV
T_{stg}	storage temperature			-65	150	°C
T_{amb}	ambient temperature			-55	150	°C
T_j	junction temperature			-	150	°C

[1] According to IEC61000-4-5.
[2] All pins to ground.
[3] Device stressed with ten non-repetitive ESD pulses.

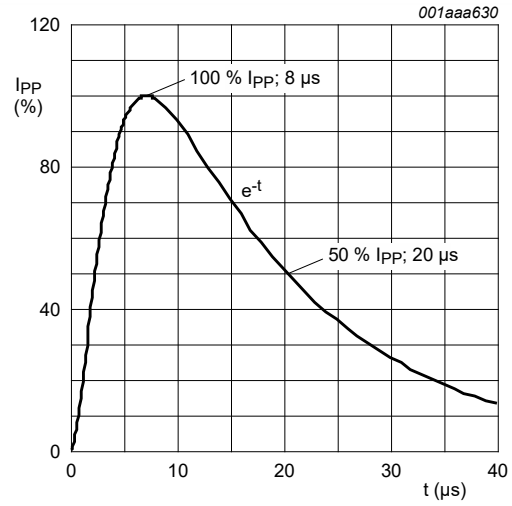


Fig. 1. 8/20 µs pulse waveform according to IEC 61000-4-5

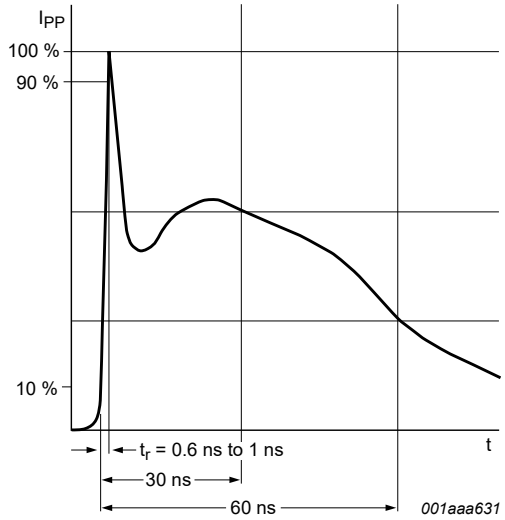


Fig. 2. ESD pulse waveform according to IEC 61000-4-2

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8. Characteristics

Table 5. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{BR}	breakdown voltage	I_I = 1 mA; T_{amb} = 25 °C		6	9	-	V
V_{CL}	clamping voltage	I_{PP} = 5 A; positive transient; T_{amb} = 25 °C	[1]	-	5.5	-	V
		I_{PP} = -5 A; negative transient; T_{amb} = 25 °C	[1]	-	-5.5	-	V
I_{RM}	reverse leakage current	per channel; V_{RWM} = 5 V; T_{amb} = 25 °C		-	1	100	nA
R_{dyn}	dynamic resistance	I_R = 10 A; t_p = 100 ns; T_{amb} = 25 °C	[2]	-	0.5	-	Ω
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; T_{amb} = 25 °C		-	0.24	0.3	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.

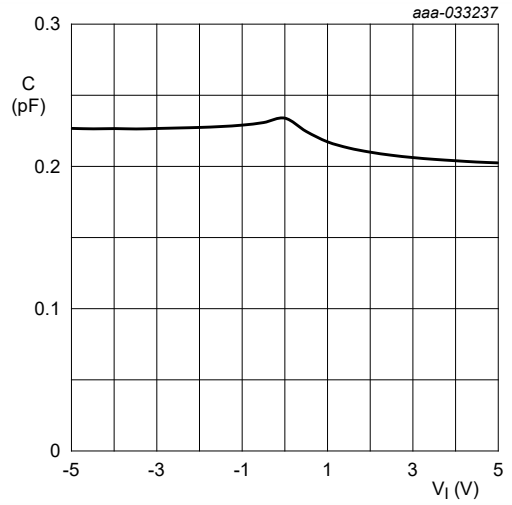


Fig. 3. Capacitance as a function of input voltage; typical values

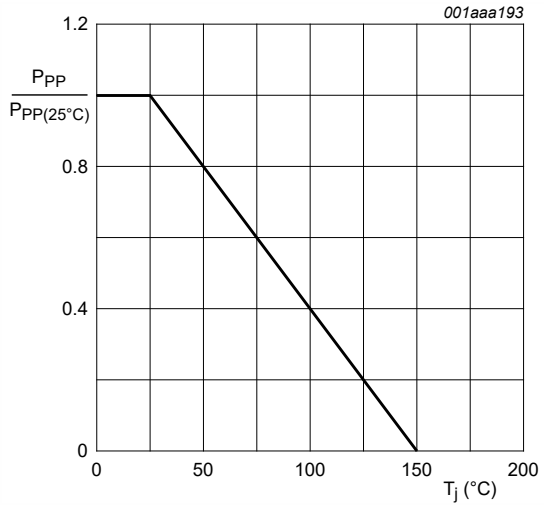
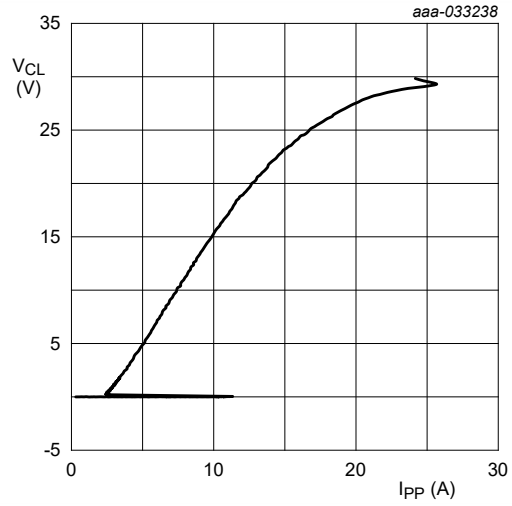
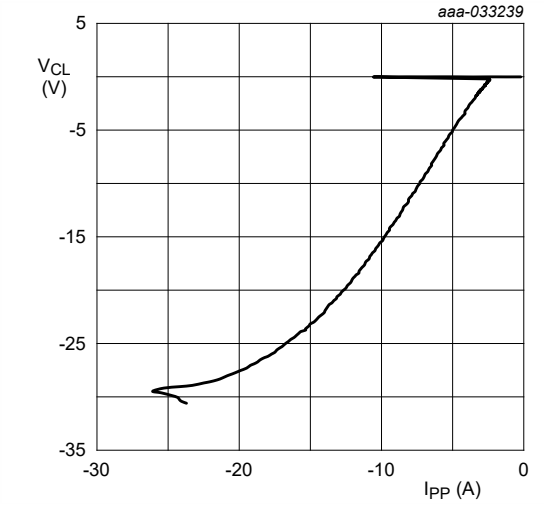


Fig. 4. Relative variation of peak pulse power as a function of junction temperature; typical values



Transmission Line Pulse (TLP);
t_p = 100 ns; t_r = 1 ns

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

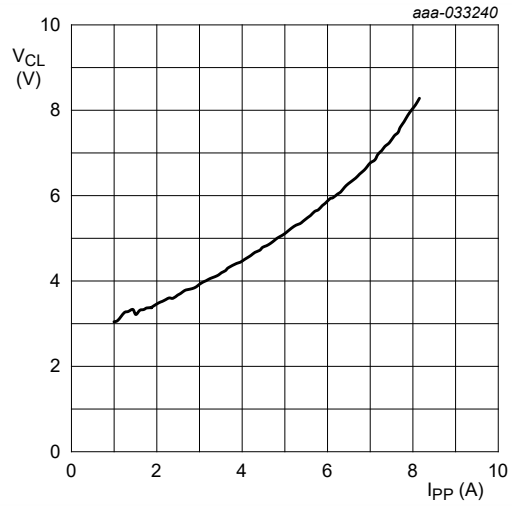


Transmission Line Pulse (TLP);
t_p = 100 ns; t_r = 1 ns

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

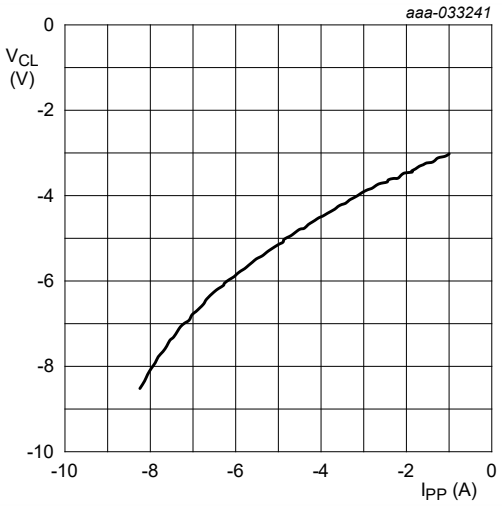
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IEC 61000-4-5; t_p = 8/20 µs; positive pulse

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



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

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

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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. Test information

Quality information

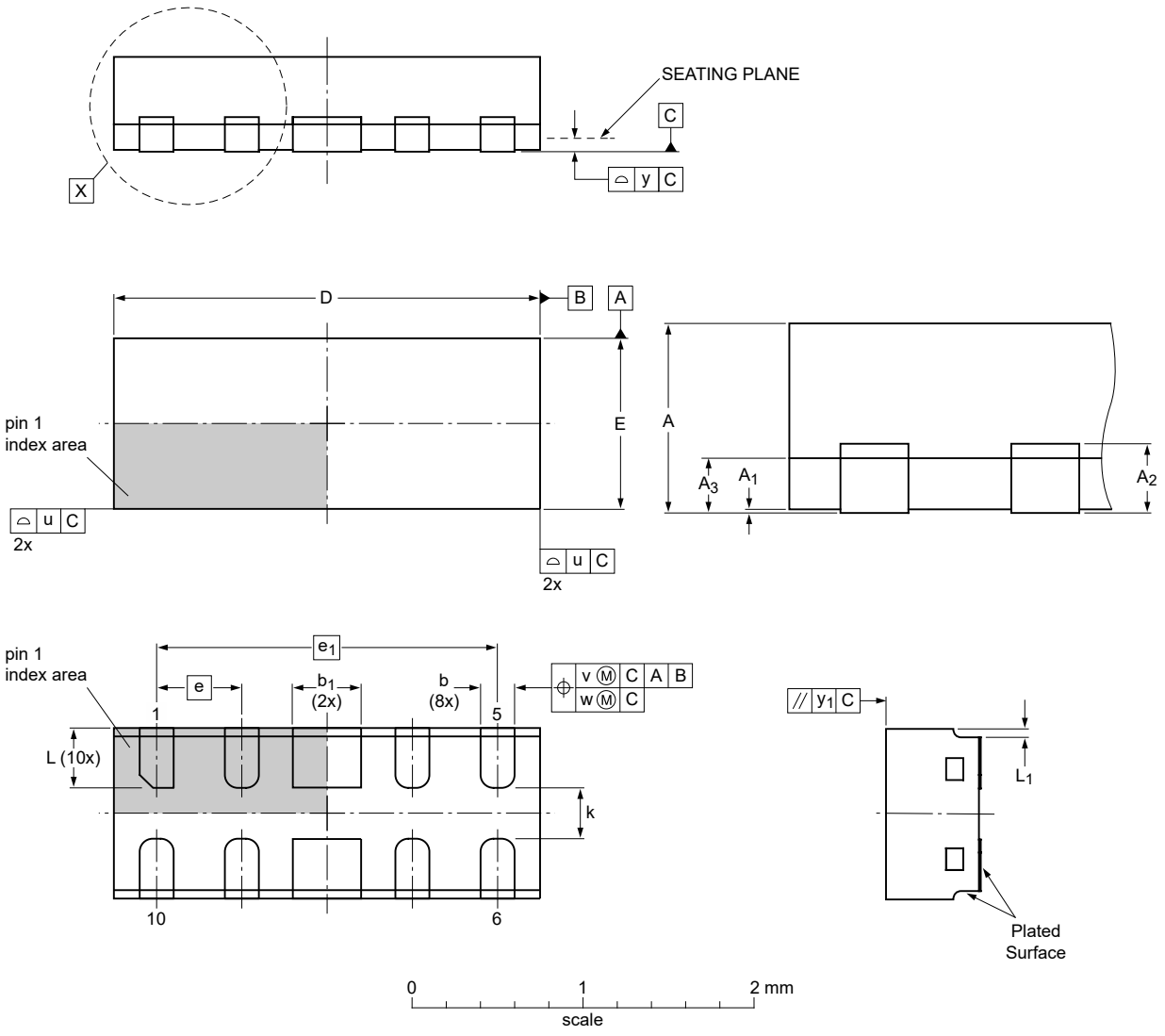
This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

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11. Package outline

DFN2510D-10: 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 **SOT1165D**



Dimensions

Unit[1]		A	A_1	A_2	A_3	b	b_1	D	E	e	e_1	k	L	L_1	u	v	w	y	y_1
	max	0.80	0.05			0.25	0.45						0.40	0.10					
mm	nom	0.75		0.2 REF		0.20	0.40	2.5	1.0	0.5	2.0		0.35	0.05	0.1	0.1	0.05	0.05	0.05
	min	0.70	0.00		0.1	0.15	0.35					0.2	0.30	- -					

sot1165d_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1165D		- - -				20-11-17

Fig. 9. Package outline DFN2510D-10 (SOT1165D)

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12. Soldering

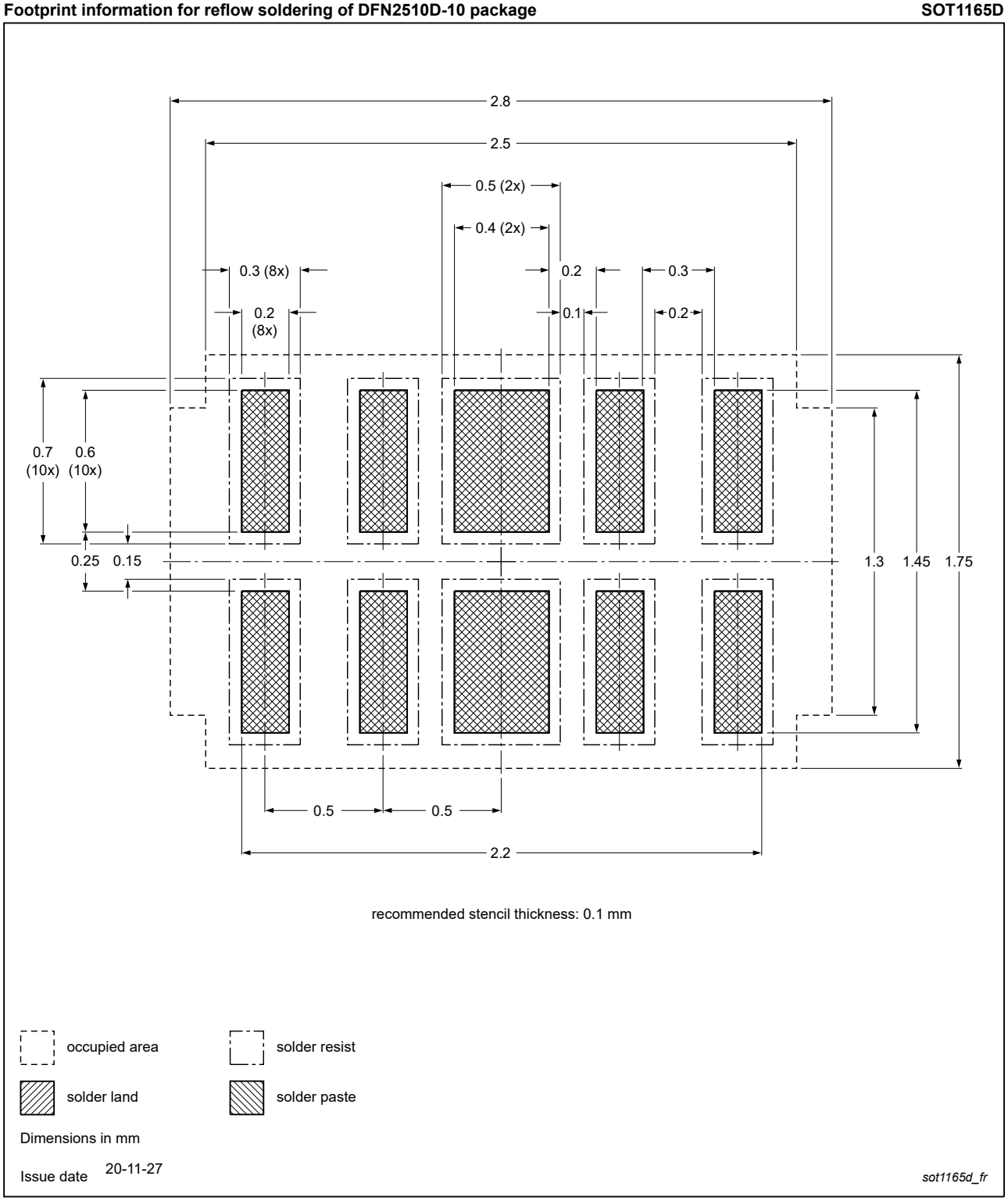


Fig. 10. Reflow soldering footprint for DFN2510D-10 (SOT1165D)

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13. Revision history

Table 6. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PESD4USB5BTTS-Q v.1	20240315	Product data sheet	-	-

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14. 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.

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Contents

1. General description....1
2. Features and benefits....1
3. Applications....1
4. Pinning information....2
5. Ordering information....2
6. Marking....2
7. Limiting values....3
8. Characteristics....4
9. Application information....6
10. Test information....6
11. Package outline....7
12. Soldering....8
13. Revision history....9
14. Legal information....10

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