



**THE DATASHEET OF
MX77S13K4F1**





PESD5V5C1UL

Extremely low clamping unidirectional ESD protection diode

6 April 2023

Product data sheet

1. General description

Ultra low capacitance unidirectional ElectroStatic Discharge (ESD) protection diode, part of the TrEOS Protection family. This device is housed in a small leadless DFN1006-2 (SOD882-2) Surface-Mounted Device (SMD) plastic package. The combination of ultra low capacitance, high ESD maximum rating and ultra small package makes the device ideal for high-speed data lines protection.

2. Features and benefits

- Unidirectional ESD protection of one line
- IEC 61000-4-5 (surge): $I_{PP} = 8.7$ A peak pulse (average measured)
- Very low diode capacitance: $C_d = 0.6$ pF typical
- Extremely low clamping voltage to protect sensitive I/Os
- ESD protection up to ± 15 kV according to IEC 61000-4-2

3. Applications

- Cellular handsets and accessories
- Portable electronics
- Communication systems
- Computers and peripherals
- USB2.0, USB3.0 data lines at 5 Gbps

4. Quick reference data

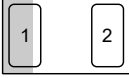

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage	$T_{amb} = 25$ °C		-	-	5.5	V
C_d	diode capacitance	$f = 1$ MHz; $V_R = 0$ V; $T_{amb} = 25$ °C	[1]	-	0.5	0.6	pF

[1] Measured from pin 1 to pin 2.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode	 <p>Transparent top view</p> <p>DFN1006-2 (SOD882-2)</p>	 <p><i>sym035</i></p>
2	A	anode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PESD5V5C1UL	DFN1006-2	Leadless ultra small plastic package; 2 terminals; body 1.0 x 0.6 x 0.47 mm	SOD882-2

7. Marking

Table 4. Marking codes

Type number	Marking code
PESD5V5C1UL	8T

8. Limiting values

Table 5. Limiting values

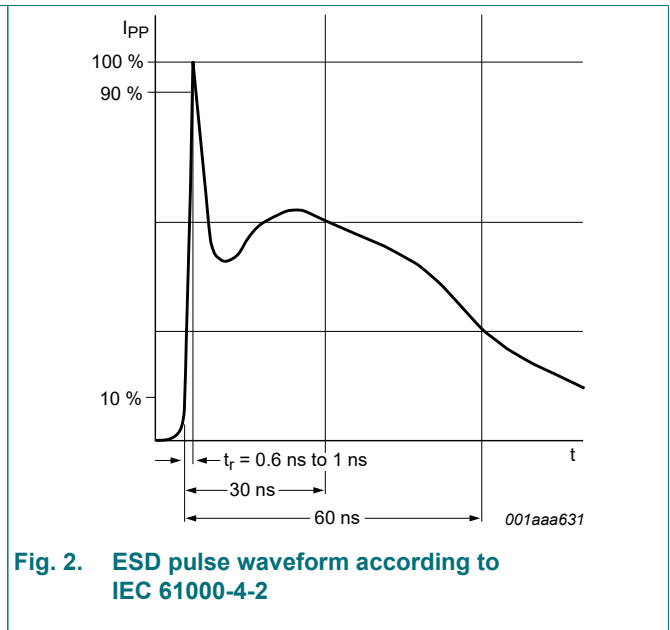
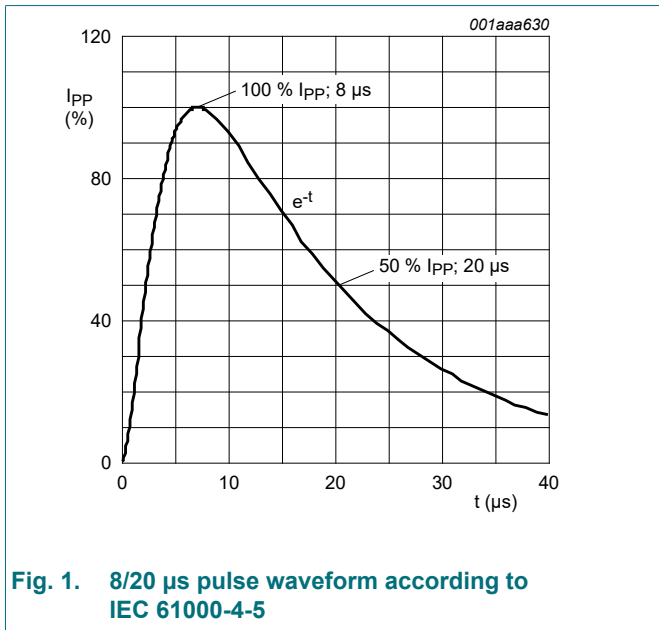
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
I_{PPM}	rated peak pulse current	$t_p = 8/20 \mu s$	[1]	-	6.5	A
T_{amb}	ambient temperature			-55	150	°C
T_{stg}	storage temperature			-65	150	°C
ESD maximum ratings						
V_{ESD}	electrostatic discharge voltage	IEC 61000-4-2; contact discharge	[2] [3]	-	15	kV
		ISO 10605: contact discharge; C = 330 pF, R = 330 Ω	[2] [3]	-	15	kV
		ISO 10605: contact discharge; C = 150 pF, R = 330 Ω	[2] [3]	-	15	kV

[1] Device stressed with 8/20 μs exponential decay waveform according to IEC 61000-4-5.

[2] Device stressed with ten non-repetitive ESD pulses.

[3] Measured from pin 1 to pin 2.



9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage	$T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	5.5	V
V_{BR}	breakdown voltage	$I_R = 1\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	7	9	V
I_{RM}	reverse leakage current	$V_{RWM} = 5.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	1	nA
C_d	diode capacitance	$f = 1\text{ MHz}; V_R = 0\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	0.5	pF
V_{CL}	clamping voltage	$I_{PP} = 8\text{ A}; t_p = \text{TLP}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[2] [1]	-	3.5	V
R_{dyn}	dynamic resistance	$I_R = 10\text{ A}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[2] [1]	-	0.3	Ω

[1] Measured from pin 1 to pin 2.

[2] Non-repetitive current pulse, Transmission Line Pulse (TLP) $t_p = 100\text{ ns}$; square pulse; ANSI / ESD STM5.5.1-2008.

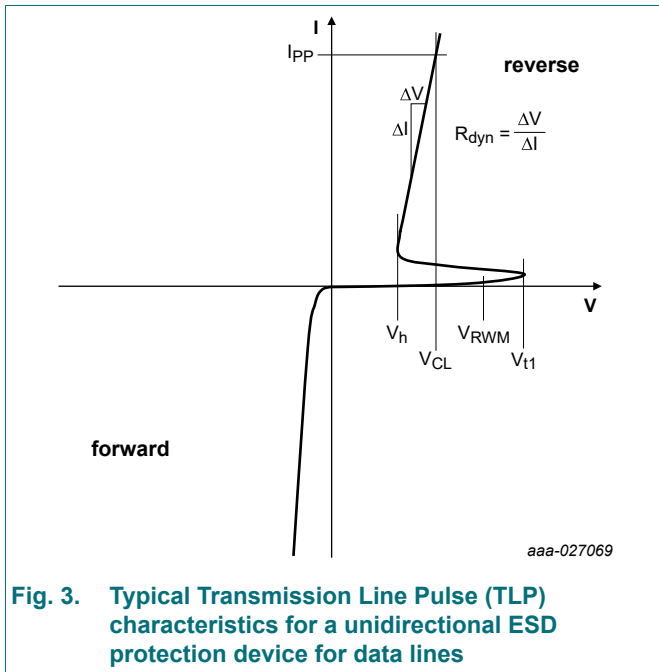


Fig. 3. Typical Transmission Line Pulse (TLP) characteristics for a unidirectional ESD protection device for data lines

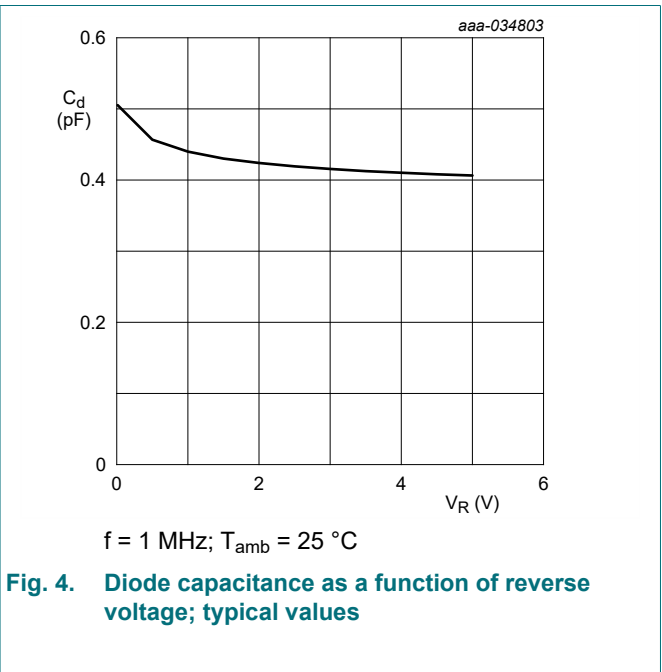
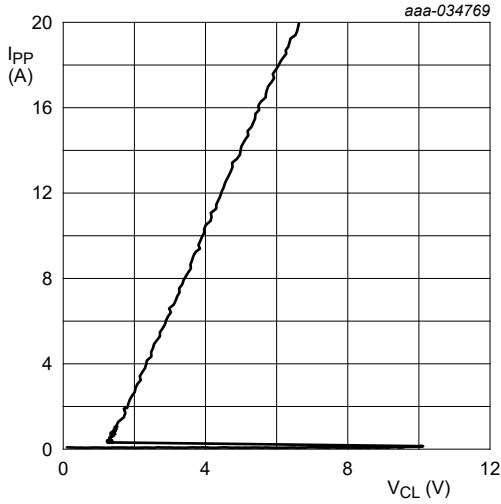
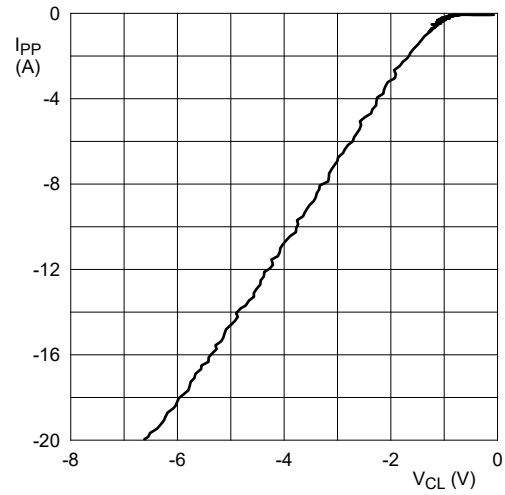


Fig. 4. Diode capacitance as a function of reverse voltage; typical values



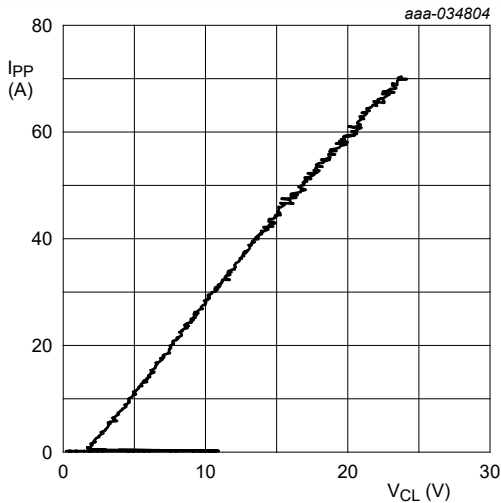
Transmission Line Pulse (TLP);
 $t_p = 100 \text{ ns}$; $t_r = 1 \text{ ns}$

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



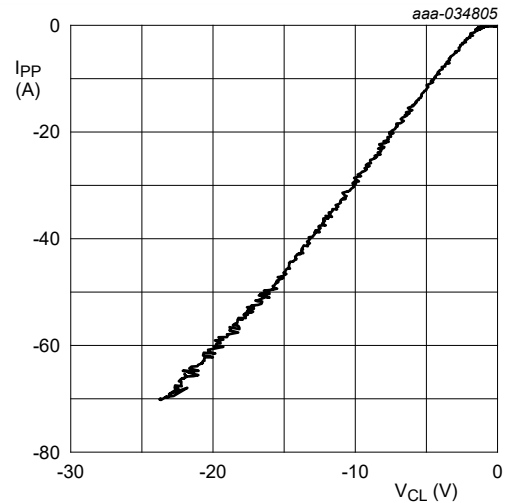
Transmission Line Pulse (TLP);
 $t_p = 100 \text{ ns}$; $t_r = 1 \text{ ns}$

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



Very-Fast Transmission Line Pulse (VF-TLP);
 $t_p = 5 \text{ ns}$; $t_r = 600 \text{ ps}$

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



Very-Fast Transmission Line Pulse (VF-TLP);
 $t_p = 5 \text{ ns}$; $t_r = 600 \text{ ps}$

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

10. Application information

The device is designed for the protection of one data or signal line from surge pulses and ESD damage. The device is suitable on lines where the signal polarities are both, positive and negative with respect to ground.

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).

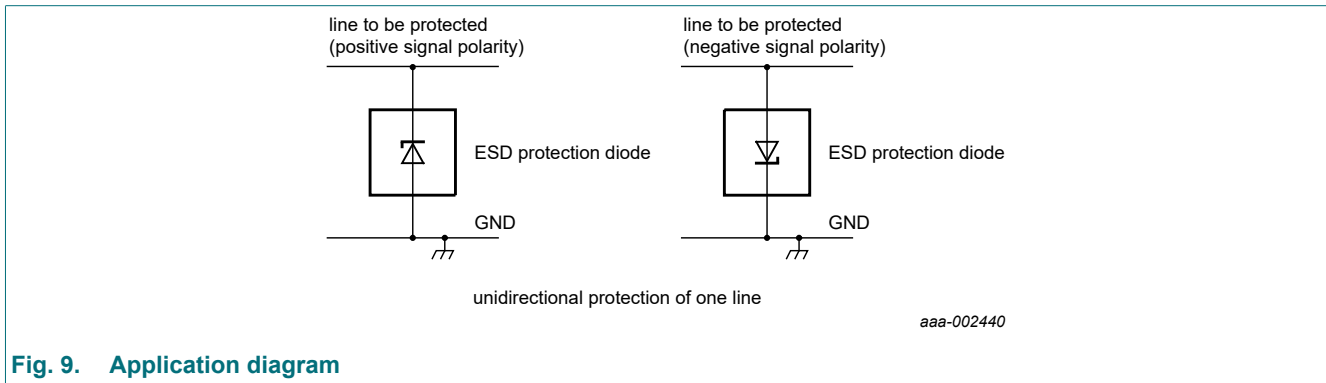


Fig. 9. Application diagram

Circuit board layout and protection device placement

Circuit board layout is critical for the suppression of ESD, Electrical Fast Transient (EFT) and surge transients. The following guidelines are recommended:

1. Place the device as close to the input terminal or connector as possible.
2. Minimize the path length between the device and the protected line.
3. Keep parallel signal paths to a minimum.
4. Avoid running protected conductors in parallel with unprotected conductors.
5. Minimize all Printed-Circuit Board (PCB) conductive loops including power and ground loops.
6. Minimize the length of the transient return path to ground.
7. Avoid using shared transient return paths to a common ground point.
8. Use ground planes whenever possible. For multilayer PCBs, use ground vias.

11. Package outline

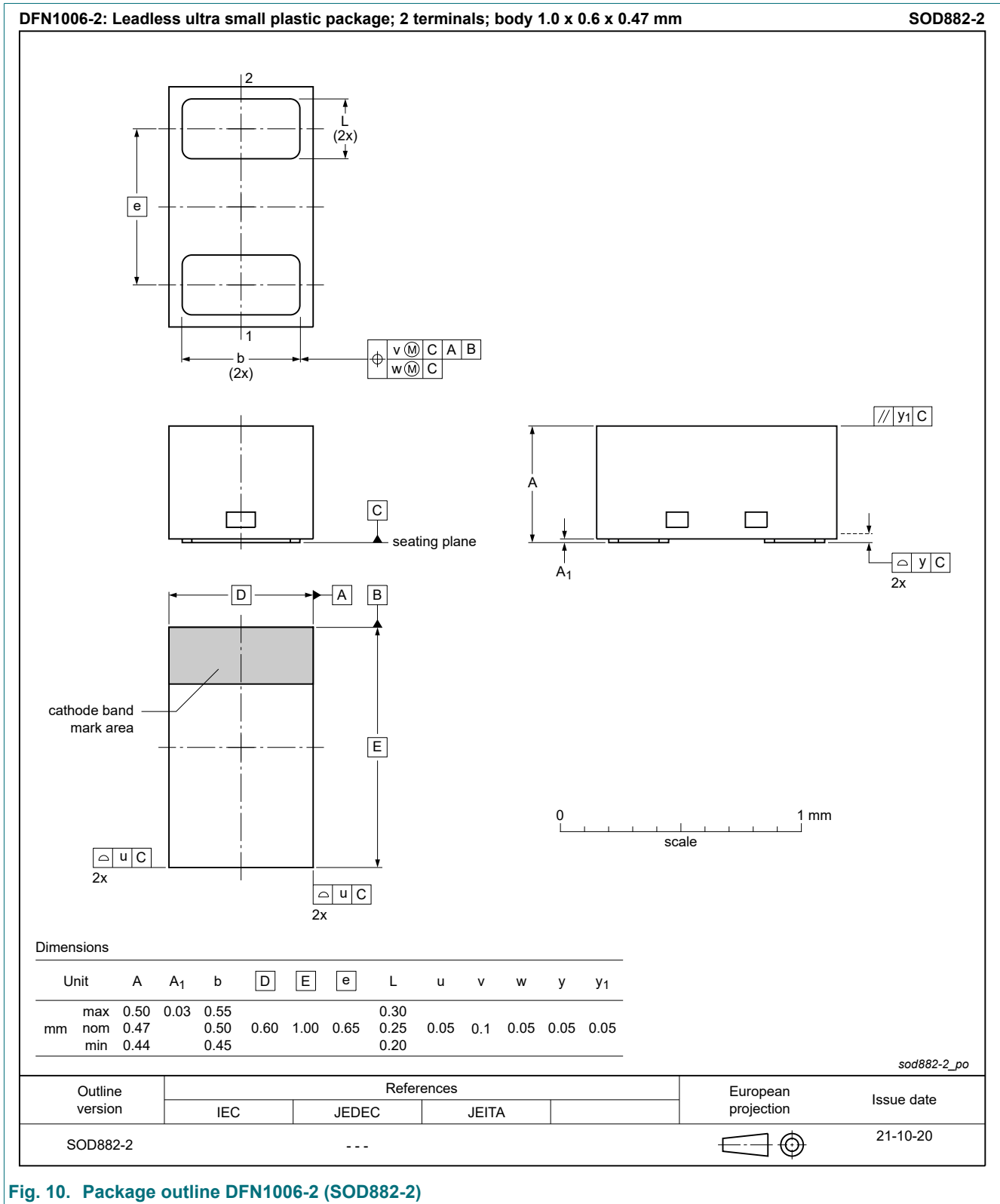


Fig. 10. Package outline DFN1006-2 (SOD882-2)

12. Soldering

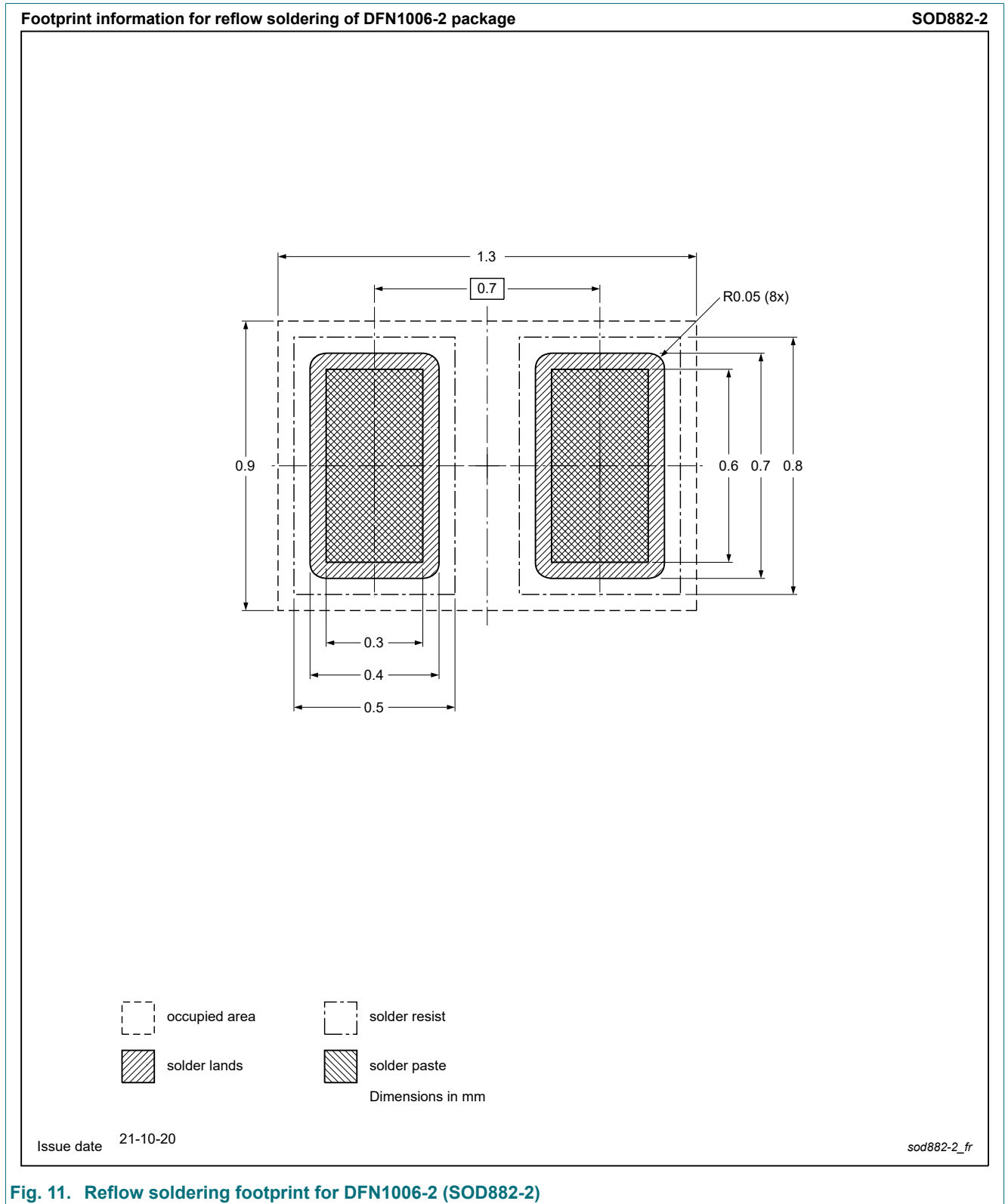


Fig. 11. Reflow soldering footprint for DFN1006-2 (SOD882-2)

13. Revision history

Table 7. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PESD5V5C1UL v.2	20230406	Product data sheet	-	PESD5V5C1UL v.1
Modifications:	• Chapter "General description": typo correction			
PESD5V5C1UL v.1	20230315	Product data sheet	-	-

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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- [2] The term 'short data sheet' is explained in section "Definitions".
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