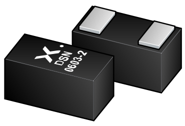


PESD5V0R1BBSF-Q

Extremely low capacitance bidirectional ESD protection diode

3 July 2025

Product data sheet

1. General description

Extremely low capacitance bidirectional ElectroStatic Discharge (ESD) protection diode, part of the TrEOS protection family. This device is housed in a DSN0603-2 (SOD962-2) leadless ultra small Surface-Mounted Device (SMD) package designed to protect one signal line from the damage caused by ESD and other transients.

2. Features and benefits

- Bidirectional ESD protection of one line
- Extremely low diode capacitance C_d = 0.08 pF
- Extremely low insertion loss α_{IL} = -0.25 dB at 10 GHz
- Extremely low return loss α_{RL} = -17 dB at 10 GHz
- Low clamping voltage to protect sensitive I/Os
- Extremely low-inductance protection path to ground
- Ultra small SMD package
- Extremely low leakage < 1 nA typical at 5 V
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- Automotive Low-Voltage Differential Signaling (LVDS)
- Automotive Multigigabit Ethernet
- SERDES lines
- Automotive A/V monitors, displays and cameras
- USB4 and Thunderbolt 4 data lines

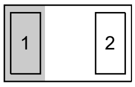
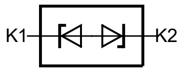
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage			-5	-	5	V
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; T_{amb} = 25 °C		-	0.08	0.095	pF

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K1	cathode	 Transparent top view **DSN0603-2 (SOD962-2)**	 *sym045*
2	K2	cathode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PESD5V0R1BBSF-Q	DSN0603-2	silicon, leadless ultra small package; 2 terminals; 0.4 mm pitch; 0.6 mm x 0.3 mm x 0.3 mm body	SOD962-2

7. Marking

Table 4. Marking codes

Type number	Marking code
PESD5V0R1BBSF-Q	E7

8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_{RWM}	reverse standoff voltage			-5	5	V
I_{PPM}	rated peak pulse current	t_p = 8/20 µs	[1]	-1	1	A
T_{amb}	ambient temperature			-40	125	°C
T_{stg}	storage temperature			-65	150	°C
ESD maximum ratings						
V_{ESD}	electrostatic discharge voltage	IEC 61000-4-2; contact discharge	[2]	-6	6	kV
		IEC 61000-4-2; air discharge	[2]	-6	6	kV

[1] Non-repetitive current pulse 8/20 µs exponentially decaying waveform according to IEC61000-4-5.
[2] Device stressed with ten non-repetitive ESD pulses.

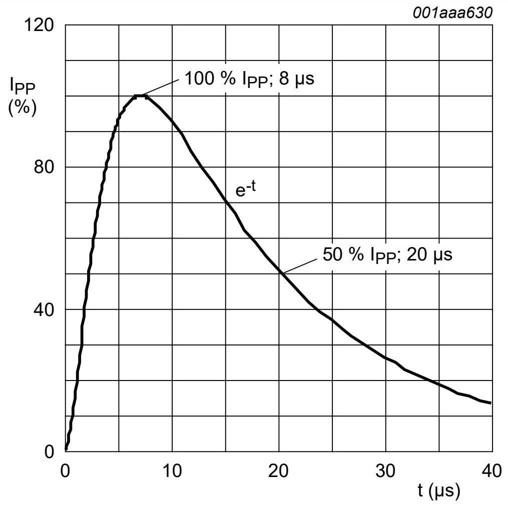


Fig. 1. 8/20 µs pulse waveform according to IEC 61000-4-5

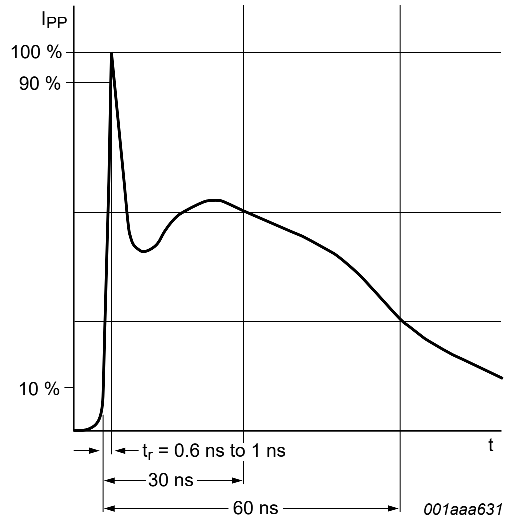


Fig. 2. ESD pulse waveform according to IEC 61000-4-2

9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{BR}	breakdown voltage	I_R = 0.1 mA; T_{amb} = 25 °C		7.5	8.7	11	V
I_{RM}	reverse leakage current	V_{RWM} = 5 V; T_{amb} = 25 °C		-	1	50	nA
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; T_{amb} = 25 °C		-	0.08	0.095	pF
		f = 1 MHz; V_R = 5 V; T_{amb} = 25 °C		-	0.07	-	pF
V_{CL}	clamping voltage	I_{PPM} = 1 A; 8/20 µs; T_{amb} = 25 °C	[1]	-	3.6	-	V
		TLP, 100 ns, 4 A; T_{amb} = 25 °C	[2]	-	5.3	-	V
		TLP, 100 ns, 8 A; T_{amb} = 25 °C	[2]	-	8.7	-	V
R_{dyn}	dynamic resistance	I_R = 5 A; T_{amb} = 25 °C	[2]	-	0.64	-	Ω
		I_R = -5 A; T_{amb} = 25 °C	[2]	-	0.64	-	Ω
$α_{IL}$	insertion loss	f = 10 GHz; T_{amb} = 25 °C	[3]	-	-0.25	-	dB
$α_{RL}$	input return loss		[3]	-	-17	-	dB
f_{-3dB}	-3 dB cut-off frequency	Normalized to attenuation at 1 MHz; T_{amb} = 25 °C	[3]	-	40	-	GHz

[1] Device stressed with 8/20 µs exponential decay waveform according to IEC 61000-4-5.
[2] Non-repetitive current pulse, Transmission Line Pulse (TLP); square pulse; ANSI / ESD.
[3] Measured on test-PCB, de-embedded.

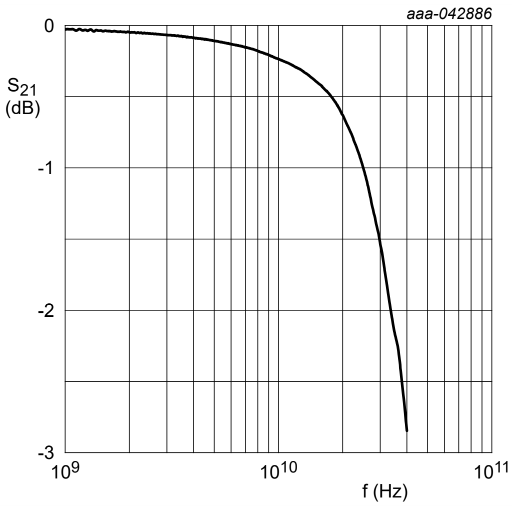


Fig. 3. Insertion loss; typical values, measured on PCB

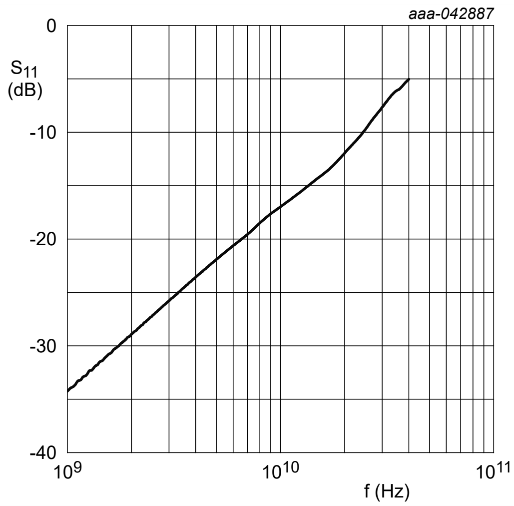


Fig. 4. Return loss; typical values, measured on PCB

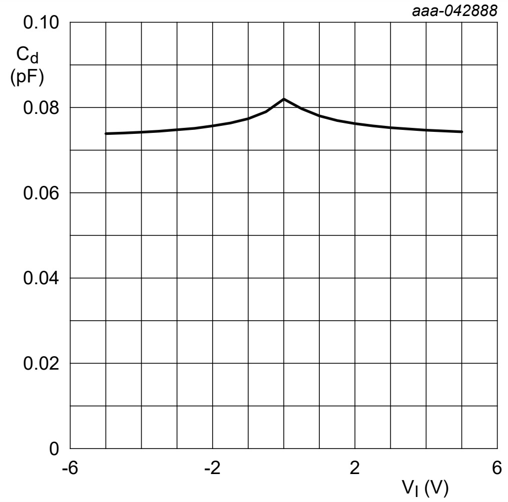
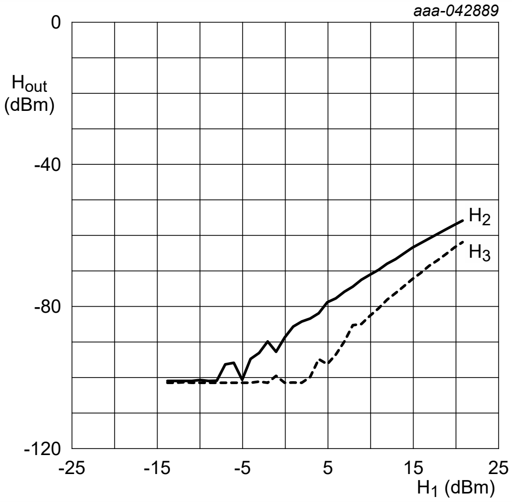
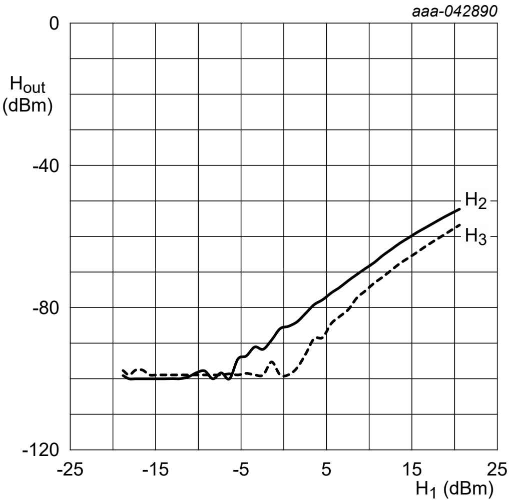


Fig. 5. Capacitance as a function of input voltage; typical values



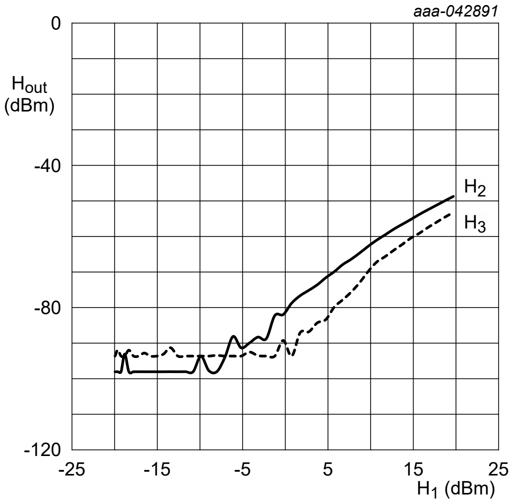
Harmonic output vs. fundamental input power at 850 MHz input

Fig. 6. 2nd and 3rd order Harmonic Distortion; typical values



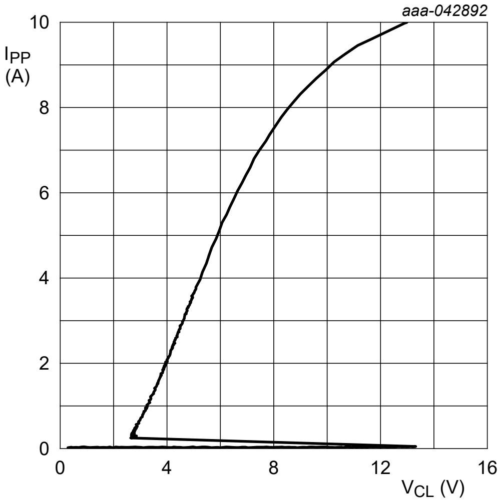
Harmonic output vs. fundamental input power at 2400 MHz input

Fig. 7. 2nd and 3rd order Harmonic Distortion; typical values



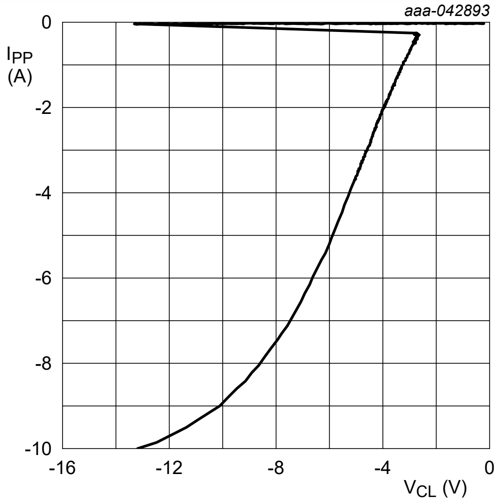
Harmonic output vs. fundamental input power at 5800 MHz input

Fig. 8. 2nd and 3rd order Harmonic Distortion; typical values



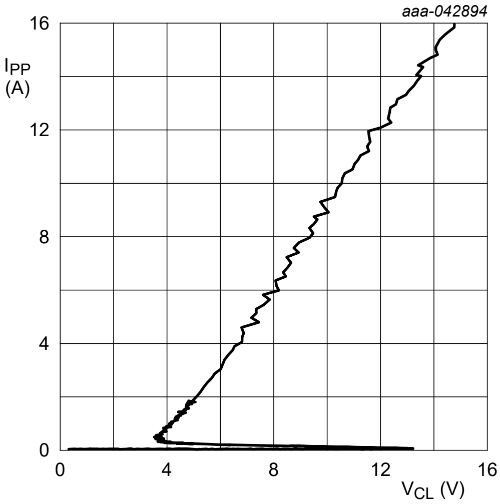
Transmission Line Pulse (TLP);
t_p = 100 ns; t_r = 1 ns

Fig. 9. Dynamic resistance with positive clamping; typical values



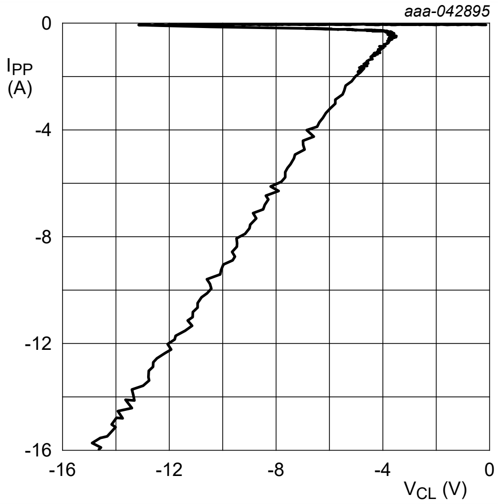
Transmission Line Pulse (TLP);
t_p = 100 ns; t_r = 1 ns

Fig. 10. Dynamic resistance with negative clamping; typical values



Very-Fast Transmission Line Pulse (VF-TLP);
t_p = 5 ns; t_r = 600 ps

Fig. 11. Dynamic resistance with positive clamping; typical values



Very-Fast Transmission Line Pulse (VF-TLP);
t_p = 5 ns; t_r = 600 ps

Fig. 12. Dynamic resistance with negative clamping; typical values

10. Application information

The device is designed for the protection of one bidirectional data 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).

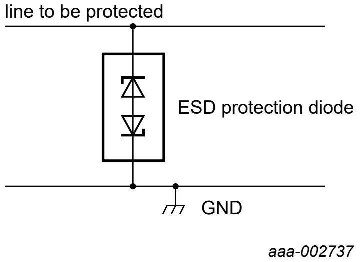


Fig. 13. Application diagram

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.

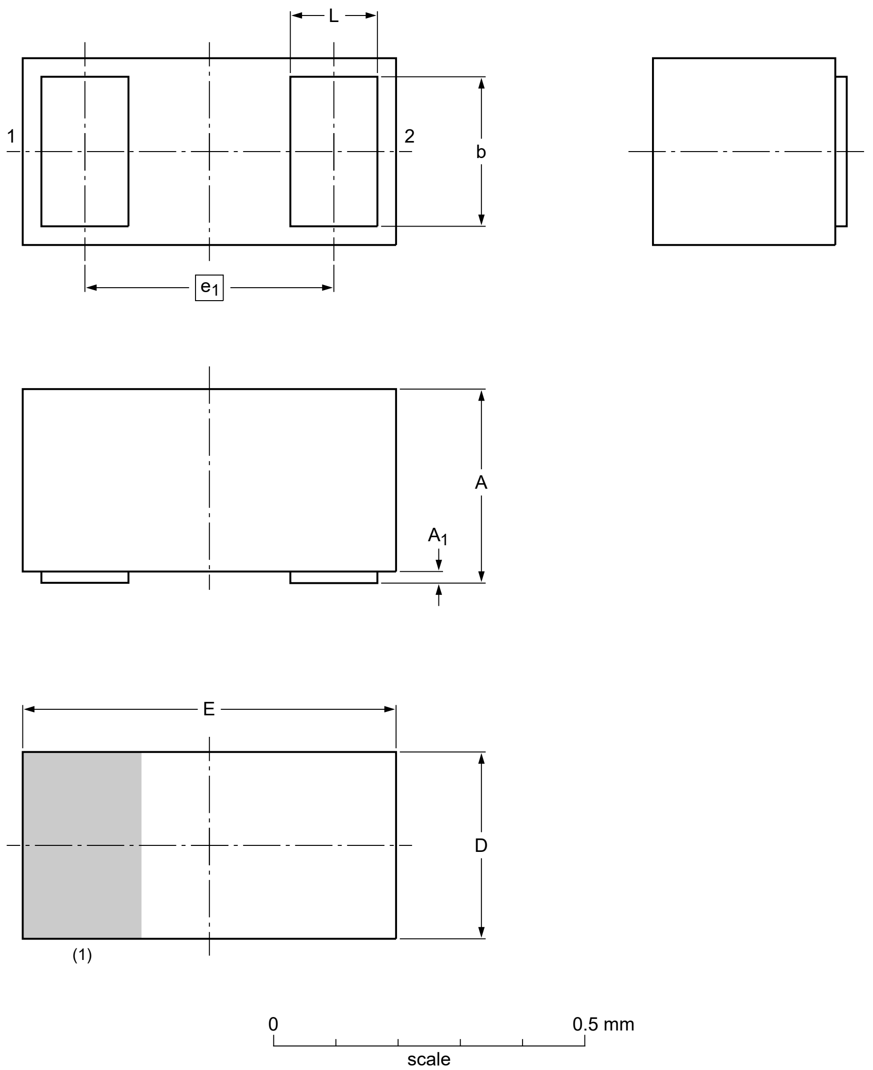
11. Test information

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

Leadless ultra small package; 2 terminals; body 0.6 x 0.3 x 0.3 mm **SOD962-2**



Dimensions (mm are the original dimensions)

Unit		A	A_1	b	D	E	e_1	L
mm	max	0.32	0.03	0.25	0.325	0.625		0.15
	nom						0.4	
	min	0.28		0.23	0.275	0.575		0.13

Note
1. The marking bar indicates the cathode.

sod962-2_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOD962-2						~~13-07-12~~ 13-07-17

Fig. 14. Package outline DSN0603-2 (SOD962-2)

13. Soldering

Footprint information for reflow soldering of leadless ultra small package; 2 terminals **SOD962-2**

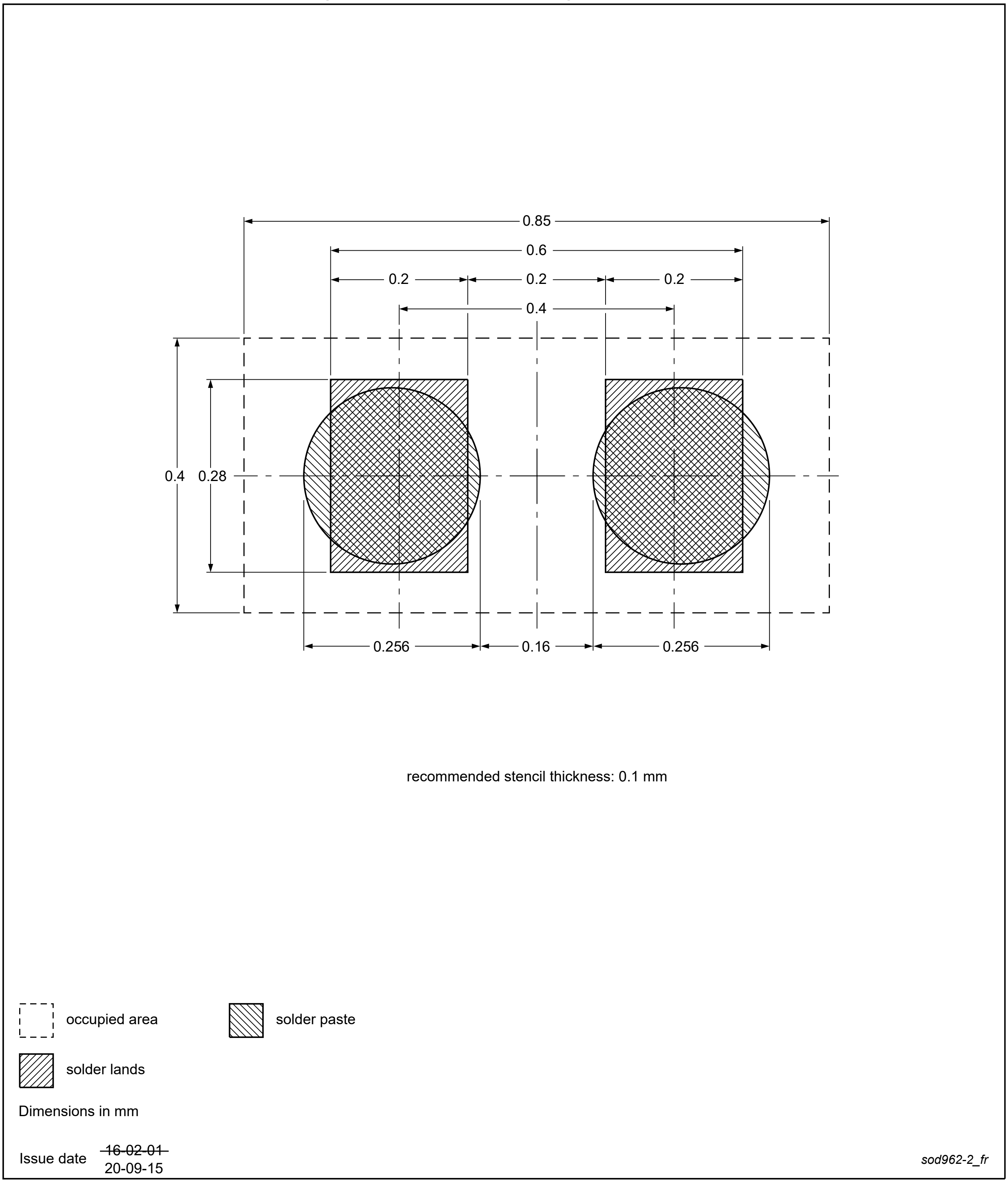


Fig. 15. Reflow soldering footprint for DSN0603-2 (SOD962-2)

14. Revision history

Table 7. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PESD5V0R1BBSF-Q v.1	20250703	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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Date of release: 3 July 2025