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PESD4V0X2UM

Extremely low capacitance unidirectional ESD protection diode array

14 September 2022 **Product data sheet**

1. General description

Extremely low capacitance bidirectional ElectroStatic Discharge (ESD) protection diode array, part of the TrEOS protection family. This device is housed in a DFN1006-3 (SOT883-3) leadless ultra small Surface-Mounted Device (SMD) plastic package designed to protect up to two signal lines from the damage caused by ESD and other transients.

2. Features and benefits

- Unidirectional ESD protection of one line pair
- V_{RWM} = 4 V device
- Extremely high surge robustness of 11.5 A for a 8/20 µs pulse
- Extremely low diode capacitance, C_d = 0.82 pF typical
- Extremely low clamping voltage to protect sensitive I/Os
- ESD protection up to ±20 kV according to IEC 61000-4-2
- Leadless ultra small SOT883-3 surface mount package
- IEC 61000-4-4 robust up to level 4 for I/O data lines (corresponds to 40 A into a 50 Ohm termination)

3. Applications

- Cellular handsets and accessories
- Portable electronics
- Communication systems
- Computers and peripherals
- USB2.0 data lines

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage			-	-	4	V
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; T_{amb} = 25 °C	[1]	-	0.82	0.98	pF

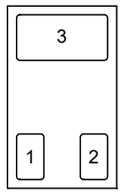
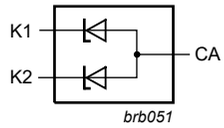
[1] Measured from pin 1 or 2 to pin 3.

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5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K1	cathode (diode 1)	 Transparent top view **DFN1006-3 (SOT883-3)**	
2	K2	cathode (diode 2)		
3	CA	common anode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PESD4V0X2UM	DFN1006-3	Leadless ultra small plastic package; 3 solder lands; body 1.0 x 0.6 x 0.46 mm	SOT883-3

7. Marking

Table 4. Marking codes

Type number	Marking code
PESD4V0X2UM	U2

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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			-	4	V
I_{PPM}	rated peak pulse current	t_p = 8/20 µs	[1] [2]	-11.5	11.5	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] [3]	-20	20	kV
		IEC 61000-4-2; air discharge	[2] [3]	-20	20	kV

[1] Non-repetitive current pulse 8/20 µs exponentially descaying waveform 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.

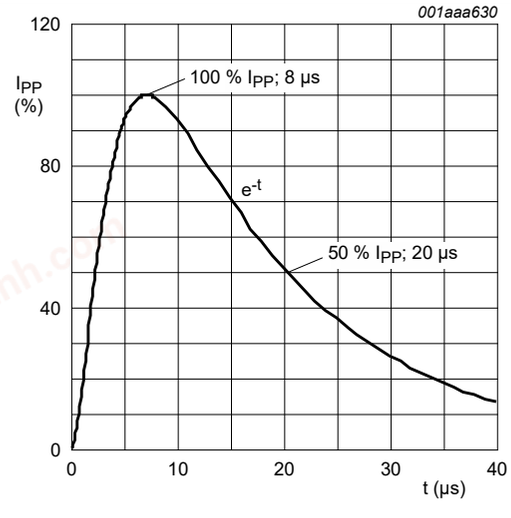


Fig. 1. 8/20 µs pulse waveform according to IEC 61000-4-5

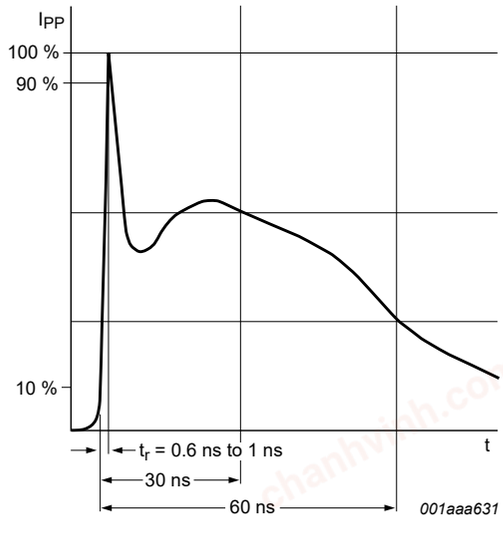


Fig. 2. ESD pulse waveform according to IEC 61000-4-2

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9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{BR}	breakdown voltage	I_R = 1 mA; T_{amb} = 25 °C	[1]	-	6.8	-	V
I_{RM}	reverse leakage current	V_{RWM} = 4 V; T_{amb} = 25 °C	[1]	-	2	100	nA
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; T_{amb} = 25 °C	[1]	-	0.82	0.98	pF
V_{CL}	clamping voltage	I_{TLP} = 8 A; t_p = TLP; T_{amb} = 25 °C	[2] [1]	-	2.7	-	V
		I_{TLP} = 16 A; t_p = TLP; T_{amb} = 25 °C	[2] [1]	-	4	-	V
		I_{PPM} = 11.5 A; T_{amb} = 25 °C	[3] [1]	-	4	-	V
R_{dyn}	dynamic resistance	I_R = 10 A; T_{amb} = 25 °C	[2] [1]	-	0.17	-	Ω
		I_R = -10 A; T_{amb} = 25 °C	[2] [1]	-	0.17	-	Ω
$f_{-3dB,dd}$	differential cut-off frequency	normalized to attenuation at 1 MHz; T_{amb} = 25 °C		-	6.6	-	GHz

[1] Measured from pin 1 or 2 to pin 3.
[2] Non-repetitive current pulse, Transmission Line Pulse (TLP); square pulse; ANSI / ESD STM5.5.1-2008
[3] Device stressed with 8/20 µs exponential decay waveform according to IEC 61000-4-5

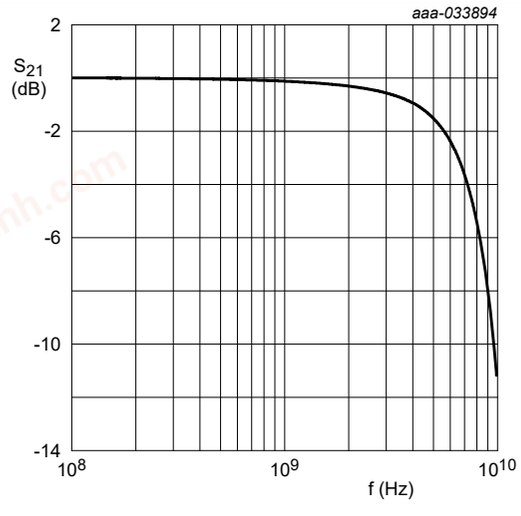


Fig. 3. Insertion loss; typical values

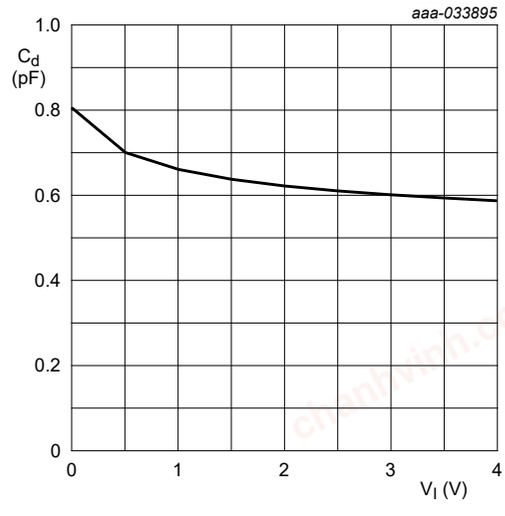
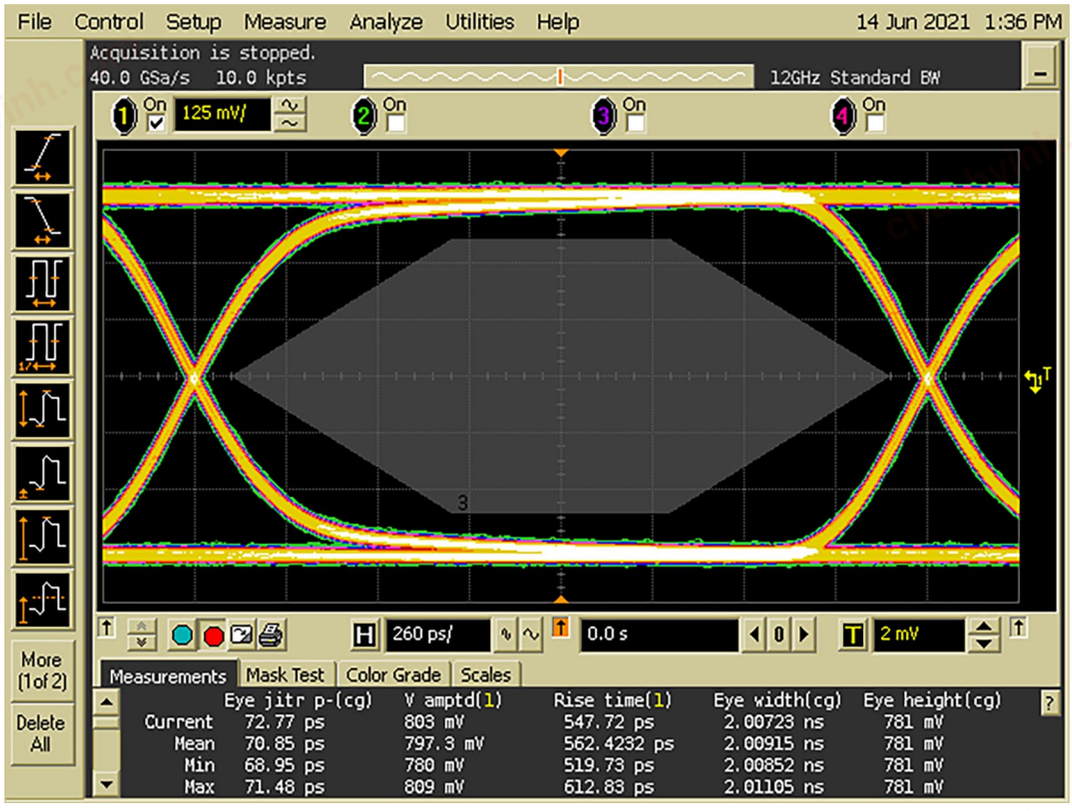


Fig. 4. Capacitance as a function of reverse standoff voltage; typical values

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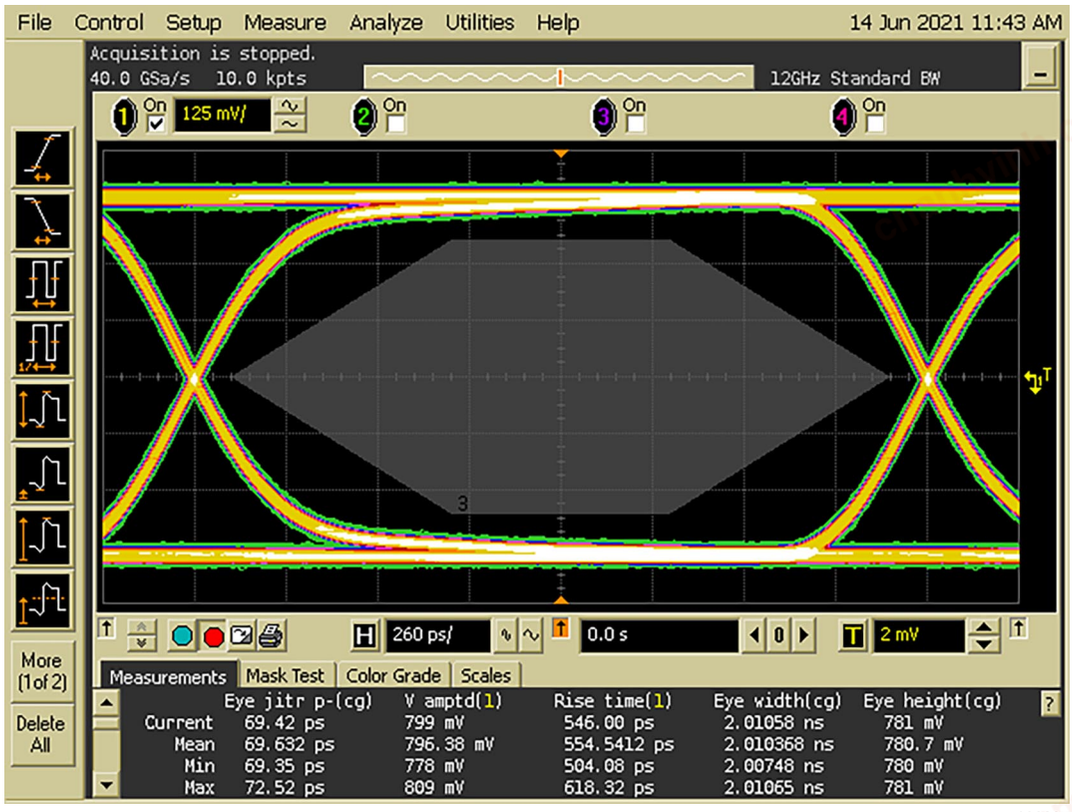
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Fig. 5. USB2.0 eye diagram, Printed-Circuit Board (PCB) with device



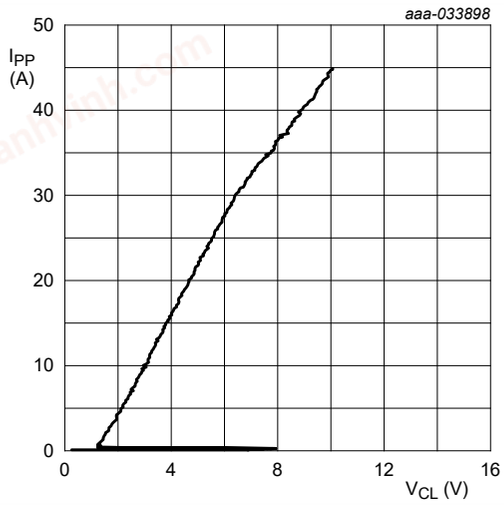
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Fig. 6. USB2.0 eye diagram, Printed-Circuit Board (PCB) without device

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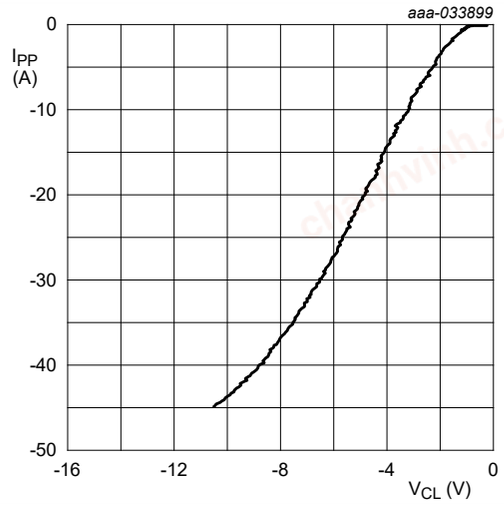
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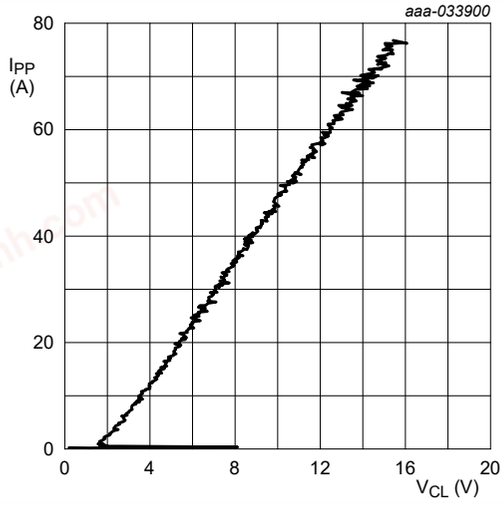
Transmission Line Pulse (TLP);
t_p = 100 ns; t_r = 1 ns

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



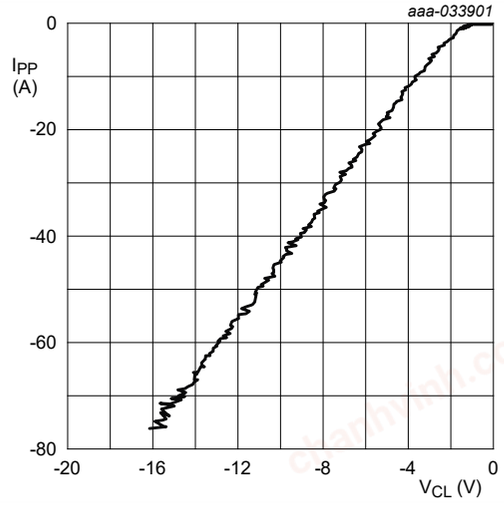
Transmission Line Pulse (TLP);
t_p = 100 ns; t_r = 1 ns

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



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

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



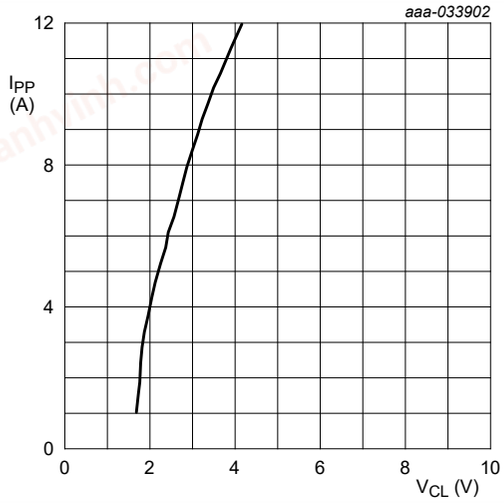
Very-Fast Transmission Line Pulse (VF-TLP);
t_p = 5 ns; t_r = 600 ps

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

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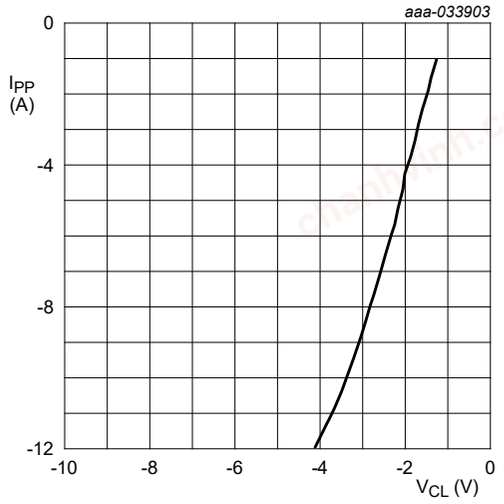
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IEC 61000-4-5; t_p = 8/20 µs; positive pulse

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



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

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

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10. Application information

The device is designed for the protection of two uni-directional or one bi-directional data or signal lines from surge pulses and ESD damage.

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).

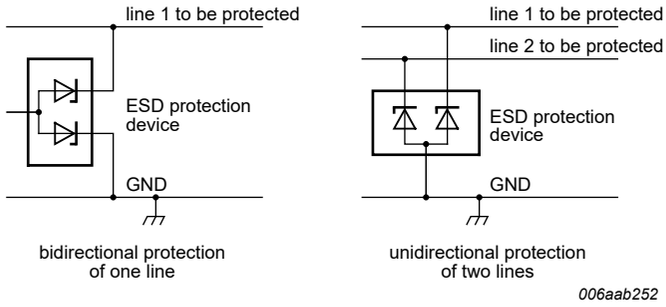


Fig. 13. Application diagram

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.

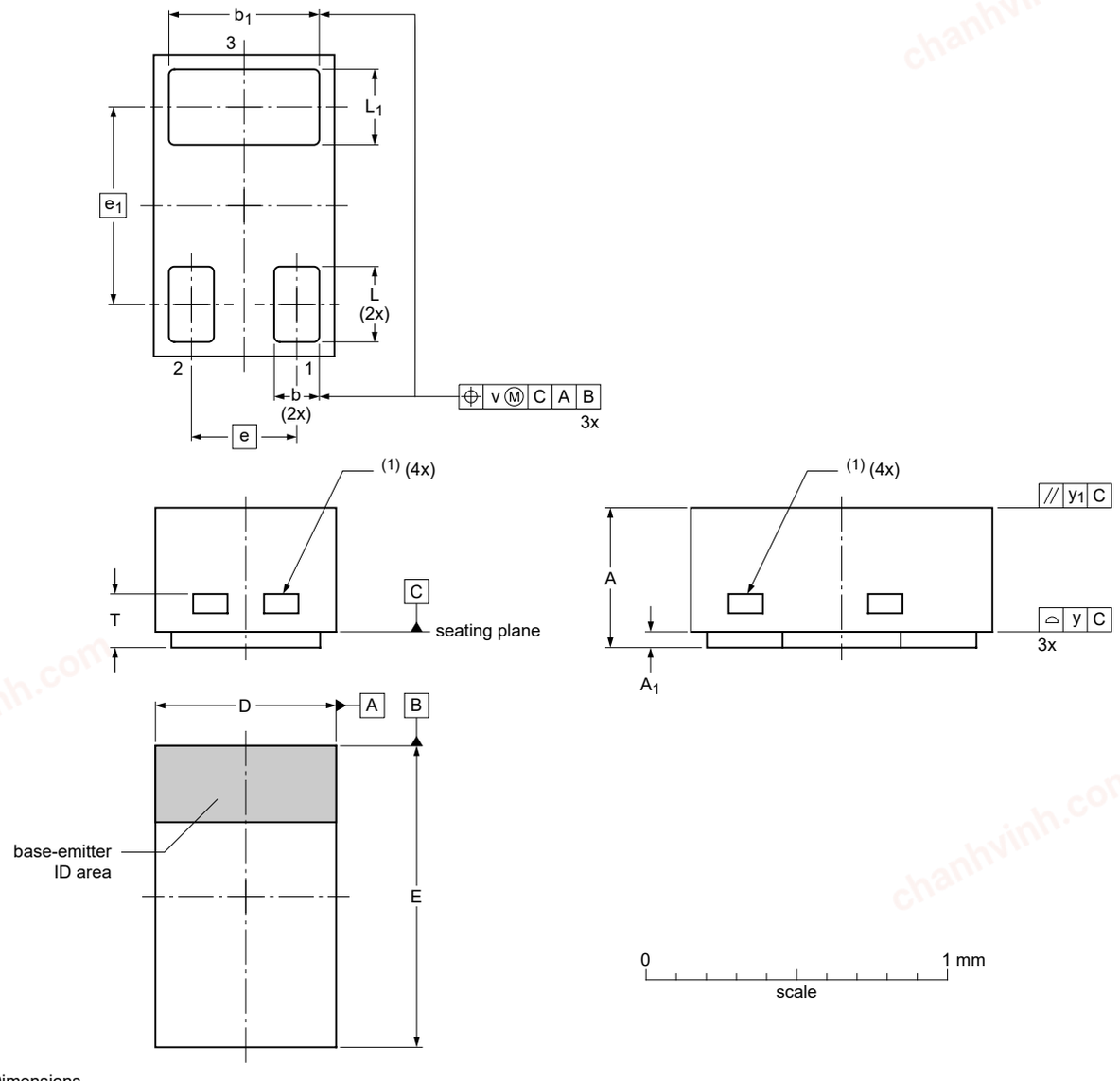
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11. Package outline

Leadless ultra small plastic package; 3 solder lands; body 1.0 x 0.6 x 0.46 mm **SOT883-3**



Dimensions

Unit		A	A_1	b	b_1	D	E	e	e_1	L	L_1	T	v	y	y_1
mm	max	0.50	0.05	0.20	0.55	0.65	1.05	0.35	0.65	0.30	0.30	0.127 (ref)	0.1	0.05	0.05
	nom	0.46		0.15	0.50	0.60	1.00			0.25	0.25				
	min	0.42	0.00	0.10	0.45	0.55	0.95			0.20	0.20				

Note
1. Visible depend upon used manufacturing technology.

sot883-3_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT883-3						21-08-23

Fig. 14. Package outline DFN1006-3 (SOT883-3)

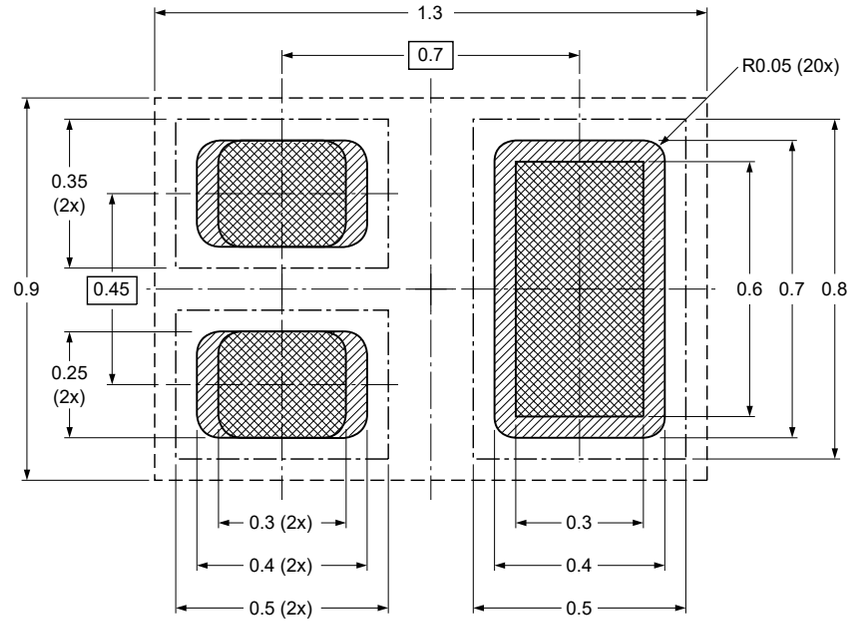
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12. Soldering

Footprint information for reflow soldering of DFN1006-3 (SOT883-3) package **SOT883-3**



occupied area

solder resist

solder lands

solder paste

Dimensions in mm

Issue date 21-08-23

sot883-3_fr

Fig. 15. Reflow soldering footprint for DFN1006-3 (SOT883-3)

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13. Revision history

Table 7. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PESD4V0X2UM v.3	20220914	Product data sheet	-	PESD4V0X2UM v.2
Modifications:	• Update of chapter "Features and benefits"			
PESD4V0X2UM v.2	20220214	Product data sheet	-	PESD4V0X2UM v.1
PESD4V0X2UM v.1	20210826	Preliminary 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.

[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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