



# PESD3V3X2UT

## ESD protection diode

8 February 2021

Product data sheet

## 1. General description

ESD protection device in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package designed to protect two high-speed data lines from the damage caused by ElectroStatic discharge (ESD) and other transients. This product protects especially multimedia applications such as USB, HDMI and others.

## 2. Features and benefits

- Reverse stand-off voltage:  $V_{RWM} = 3.3\text{ V}$
- Low clamping voltage:  $V_{CL} = 2.6\text{ V}$  at  $I_{TLP} = 8\text{ A}$
- ESD protection up to 18 kV (IEC 61000-4-2)
- Ultra low capacitance:  $C_d = 0.83\text{ pF}$
- ESD protection up to 18 kV (ISO 10605;  $C = 150\text{ pF}$ ;  $R = 330\text{ }\Omega$ )
- High temperature capability:  $T_j = 175\text{ }^\circ\text{C}$

## 3. Applications

ESD protection for high-speed data lines

- USB2.0, HDMI, DisplayPort, eSATA and LVDS

## 4. Quick reference data

Table 1. Quick reference data

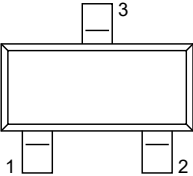
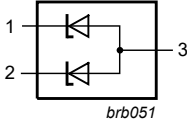
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{RWM}$	reverse standoff voltage	$T_{amb} = 25\text{ }^\circ\text{C}$		-	-	3.3	V
$I_{PPM}$	rated peak pulse current	$t_p = 8/20\text{ }\mu\text{s}$	[1] [2]	-	-	8	A
$C_d$	diode capacitance	$f = 1\text{ MHz}$ ; $V_R = 0\text{ V}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$	[2]	-	0.83	1	pF

[1] According to IEC 61000-4-5.

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

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K1	cathode (diode 1)	 SOT23	 brb051
2	K2	cathode (diode 2)		
3	CA	common anode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PESD3V3X2UT	SOT23	plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body	SOT23

7. Marking

Table 4. Marking codes

Type number	Marking code[1]
PESD3V3X2UT	Q2%

[1] % = placeholder for manufacturing site code

8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
I <sub>PPM</sub>	rated peak pulse current	t <sub>p</sub> = 8/20 μs	[1] [2]	-	8	A
T <sub>j</sub>	junction temperature			-	175	°C
T <sub>amb</sub>	ambient temperature			-55	175	°C
T <sub>stg</sub>	storage temperature			-65	175	°C
ESD maximum ratings						
V <sub>ESD</sub>	electrostatic discharge voltage	IEC 61000-4-2; contact discharge	[2] [3]	-	18	kV
		ISO 10605; contact discharge; C = 150 pF, R = 330 Ω	[2] [3]	-	18	kV
		ISO 10605; contact discharge; C = 330 pF, R = 330 Ω	[2] [3]	-	15	kV

- [1] 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.



## 9. Characteristics

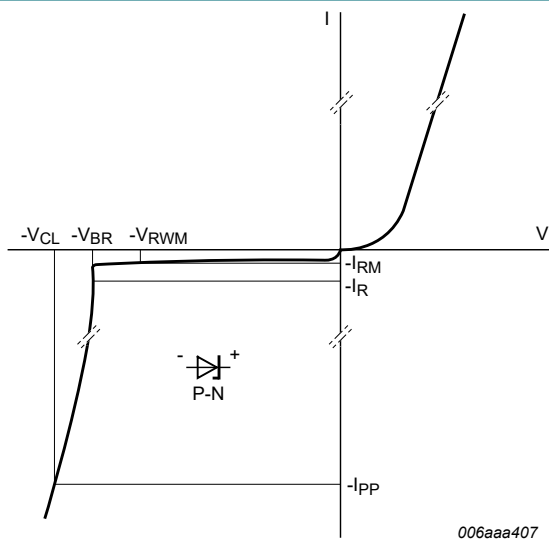
**Table 6. Characteristics**

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{RWM}$	reverse standoff voltage	$T_{amb} = 25\text{ }^{\circ}\text{C}$		-	-	3.3	V
$V_{BR}$	breakdown voltage	$I_R = 1\text{ mA}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	4.2	6.7	8	V
$I_{RM}$	reverse leakage current	$V_{RWM} = 3.3\text{ V}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	1	50	nA
$C_d$	diode capacitance	$f = 1\text{ MHz}$ ; $V_R = 0\text{ V}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	0.83	1	pF
$\Delta C_d/C_d$	diode capacitance matching		[2]	-	0.5	-	%
$V_{CL}$	clamping voltage	$I_{PP} = 8\text{ A}$ ; $t_p = \text{TLP}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	[3] [1]	-	2.6	-	V
		$I_{PP} = 16\text{ A}$ ; $t_p = \text{TLP}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	[3] [1]	-	3.7	-	V
$R_{dyn}$	dynamic resistance	$I_R = 10\text{ A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	[3] [1]	-	0.14	-	$\Omega$

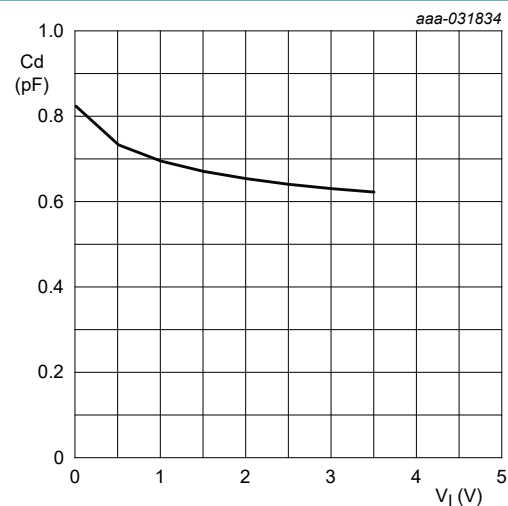
[1] Measured from pin 1 or 2 to pin 3.

[2]  $\Delta C_d$  is the difference of the capacitance measured between pin 1 and pin 3 and the capacitance measured between pin 2 and pin 3.

[3] Non-repetitive current pulse, Transmission Line Pulse (TLP); square pulse; ANSI / ESD STM5.5.1-2008



**Fig. 3. V-I characteristics for a unidirectional ESD protection diode**



**Fig. 4. Relative capacitance as a function of reverse standoff voltage; typical values**

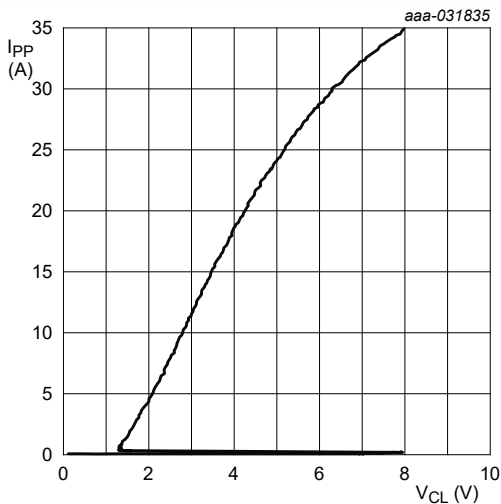


Fig. 5. Dynamic resistance with positive clamping; typical values

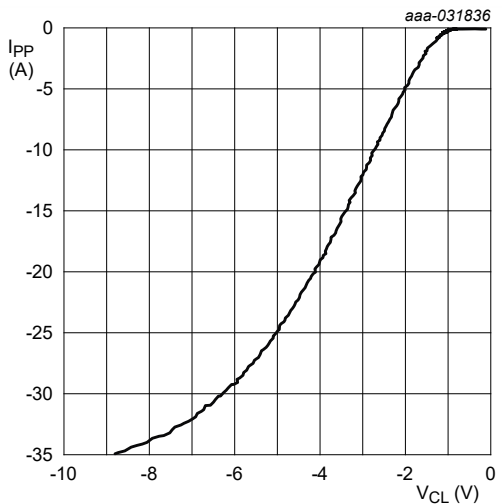


Fig. 6. Dynamic resistance with negative clamping; typical values

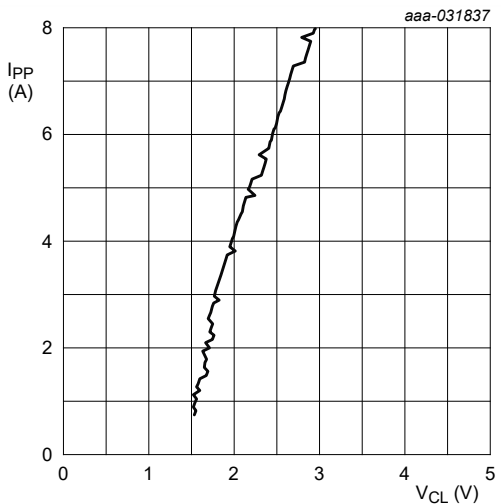


Fig. 7. Dynamic resistance with positive clamping; typical values

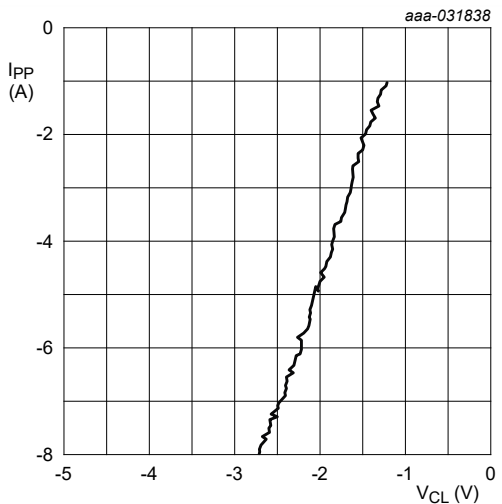
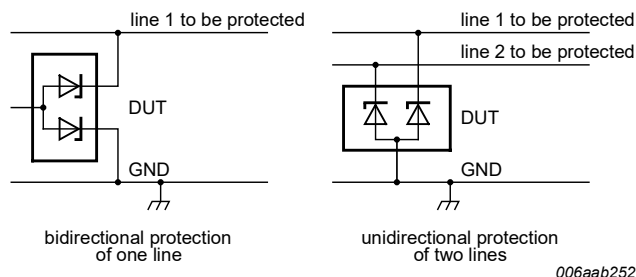


Fig. 8. Dynamic resistance with negative clamping; typical values

## 10. Application information

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

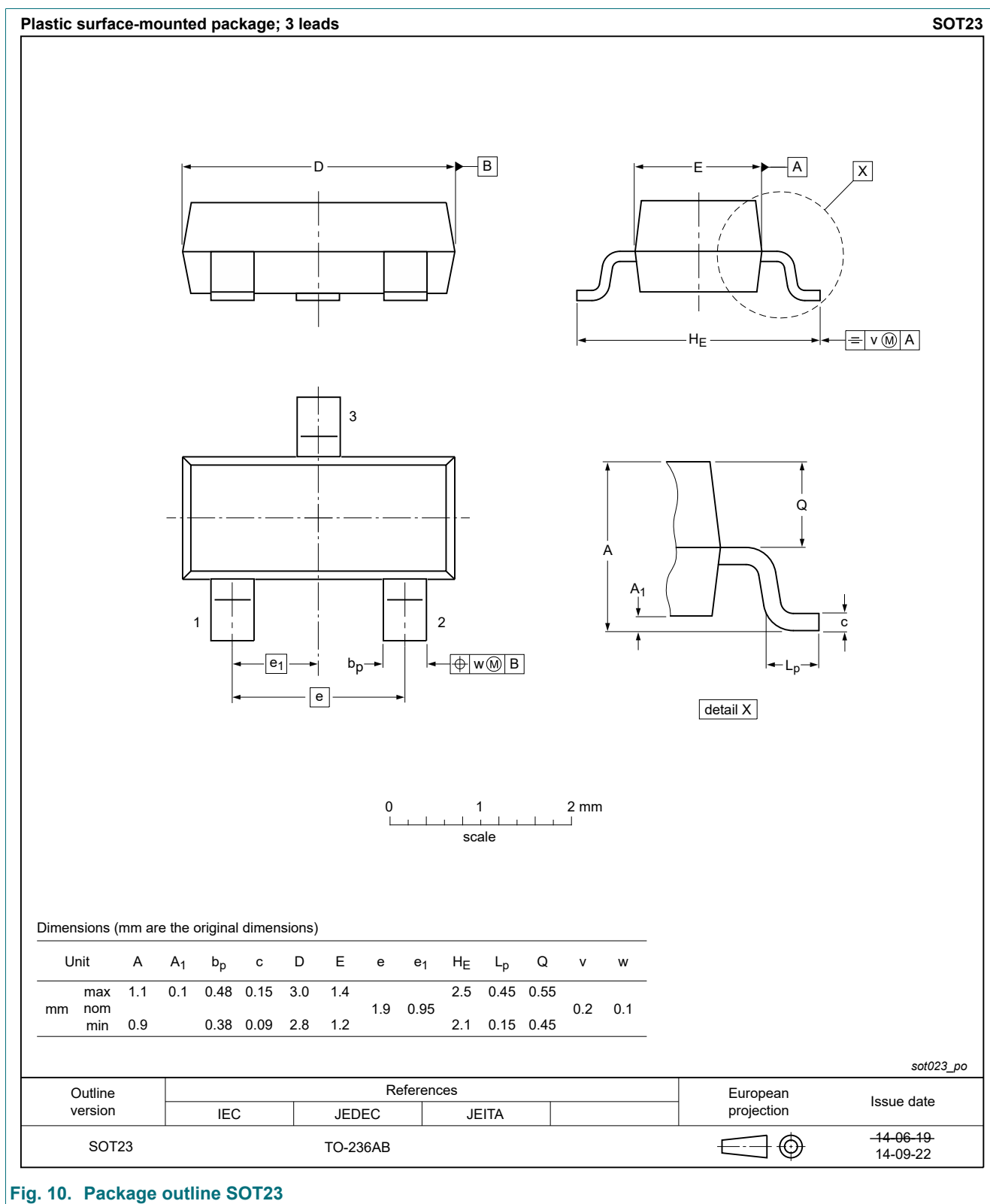


**Fig. 9. Application diagram**

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).

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.

## 11. Package outline



12. Soldering

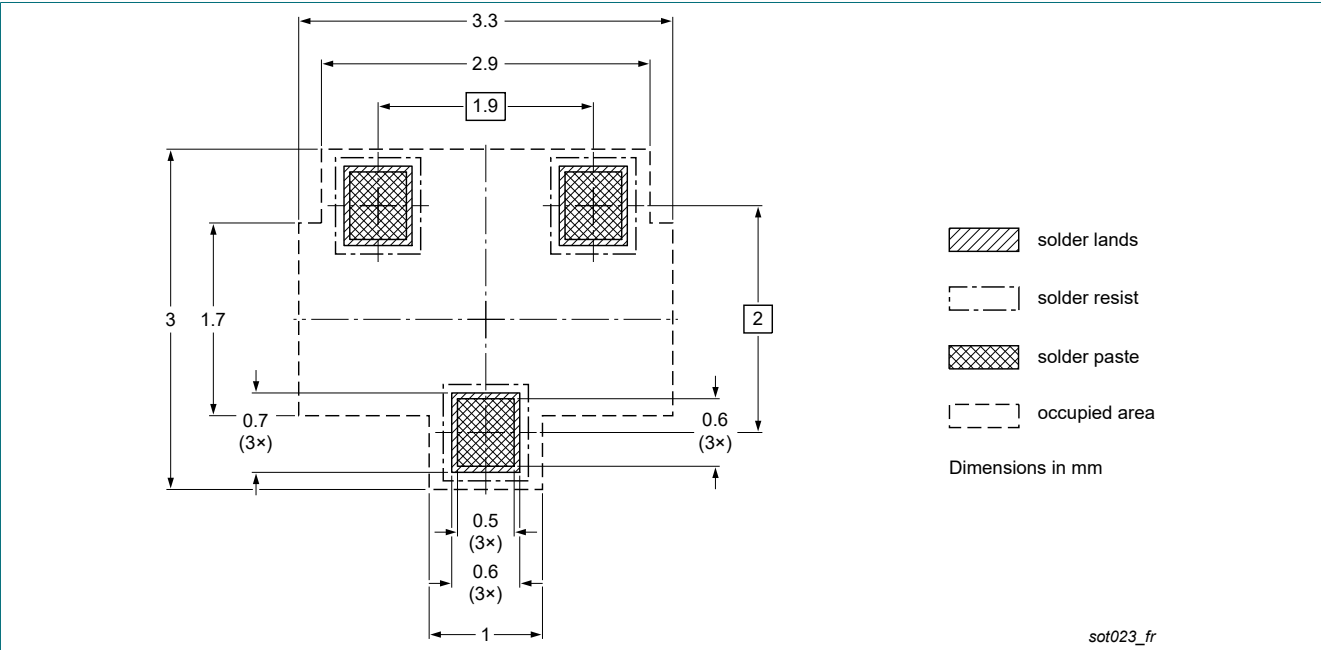


Fig. 11. Reflow soldering footprint for SOT23

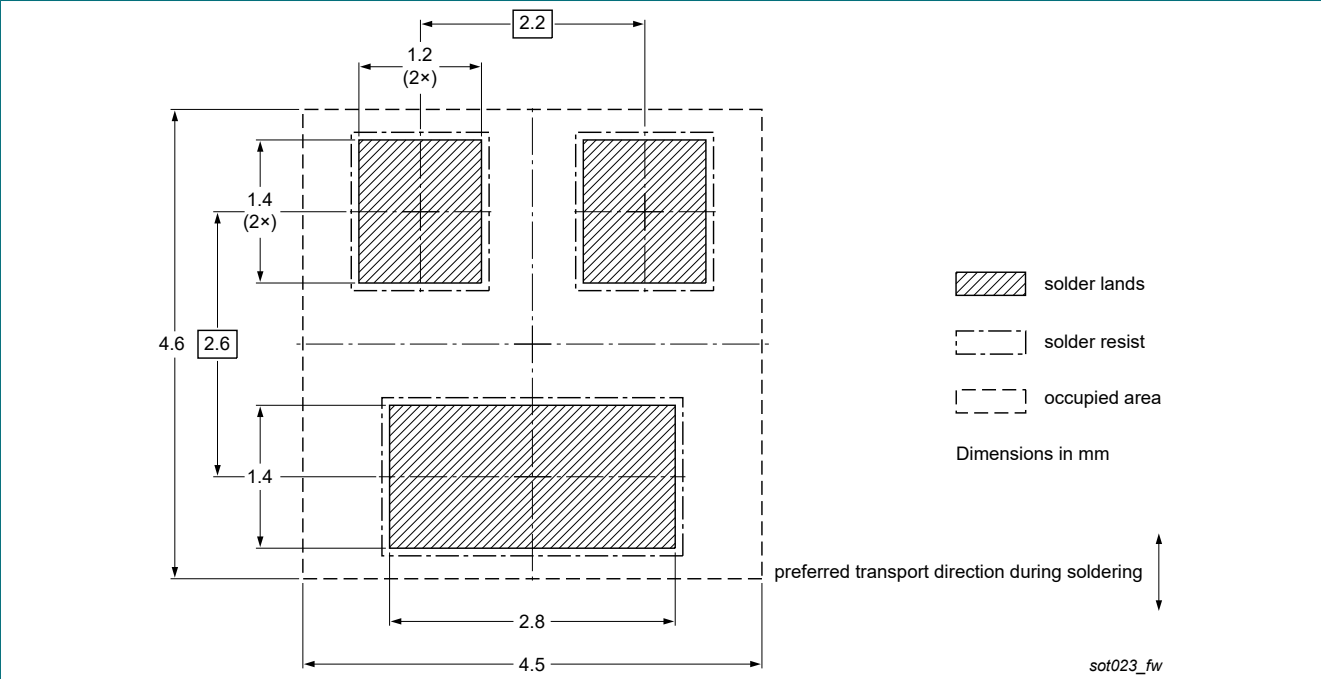


Fig. 12. Wave soldering footprint for SOT23



### 13. Revision history

Table 7. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PESD3V3X2UT v.1	20210208	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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Contents

1. General description..... 1

2. Features and benefits..... 1

3. Applications..... 1

4. Quick reference data..... 1

5. Pinning information.....2

6. Ordering information.....2

7. Marking.....2

8. Limiting values..... 3

9. Characteristics.....4

10. Application information..... 6

11. Package outline..... 7

12. Soldering..... 8

13. Revision history.....9

14. Legal information.....10

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