PESD1FLEX

FlexRay bus ESD protection diode

7 November 2021 **Product data sheet**

1. General description

PESD1FLEX in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package designed to protect two automotive FlexRay bus lines from the damage caused by ElectroStatic Discharge (ESD) and other transients.

2. Features and benefits

- Due to the integrated diode structure only one small SOT23 package is needed to protect two FlexRay bus lines
- Max. peak pulse power: P_{PPM} = 200 W at t_p = 8/20 µs
- Low clamping voltage: V_{CL} = 40 V at I_{PP} = 1 A
- Ultra low leakage current: I_{RM} = 1 nA
- Typ. diode capacitance matching: $\Delta C_d/C_d$ = 0.1 %
- ESD protection up to 23 kV
- IEC 61000-4-2, level 4 (ESD)
- IEC 61000-4-5 (surge); I_{PPM} = 3 A at t_p = 8/20 µs
- Small SMD plastic package
- AEC-Q101 qualified

3. Applications

- FlexRay bus protection
- Automotive applications

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	[1]	-	-	24	V
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; T_{amb} = 25 °C	[1]	-	11	17	pF

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

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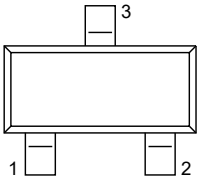
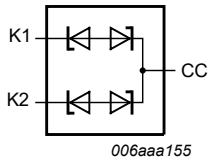
5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PESD1FLEX	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]
PESD1FLEX	ZJ%

[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
P_{PPM}	rated peak pulse power	t_p = 8/20 µs	[1] [2]	-	200	W
I_{PPM}	rated peak pulse current		[1] [2]	-	3	A
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			-65	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]	-	23	kV
		MIL-STD-883; human body model (HBM)	[2] [3]	-	10	kV

[1] Non-repetitive current pulse 8/20 µs exponential decay 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.

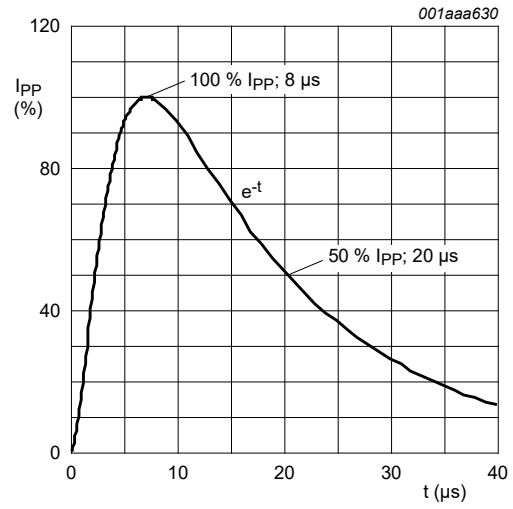


Fig. 1. 8/20 µs pulse waveform according to IEC 61000-4-5

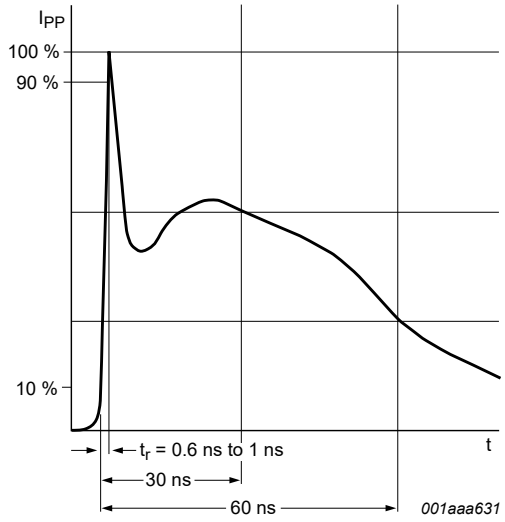


Fig. 2. ESD pulse waveform according to IEC 61000-4-2

9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage	T_{amb} = 25 °C	[1]	-	-	24	V
V_{BR}	breakdown voltage	I_R = 5 mA; T_{amb} = 25 °C	[1]	25.4	27.8	30.3	V
I_{RM}	reverse leakage current	V_{RWM} = 24 V; T_{amb} = 25 °C	[1]	-	1	50	nA
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; T_{amb} = 25 °C	[1]	-	11	17	pF
$\Delta C_d/C_d$	diode capacitance matching		[2]	-	0.1	-	%
		f = 1 MHz; V_R = 2.5 V; T_{amb} = 25 °C	[2]	-	0.1	-	%
V_{CL}	clamping voltage	I_{PP} = 1 A; t_p = 8/20 µs; T_{amb} = 25 °C	[3] [1]	-	-	40	V
		I_{PPM} = 3 A; t_p = 8/20 µs; T_{amb} = 25 °C	[3] [1]	-	-	70	V
R_{diff}	differential resistance	I_R = 1 mA; T_{amb} = 25 °C	[1]	-	-	300	Ω

[1] Measured from pin 1 or 2 to pin 3.
[2] ΔC_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 8/20 µs exponential decay waveform according to IEC 61000-4-5.

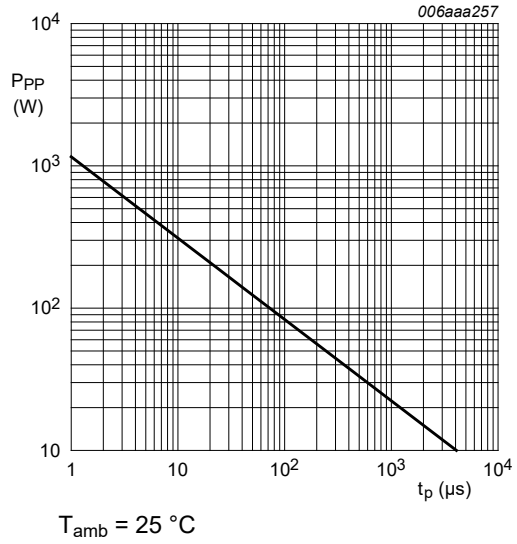


Fig. 3. Peak pulse power as a function of exponential pulse duration; typical values

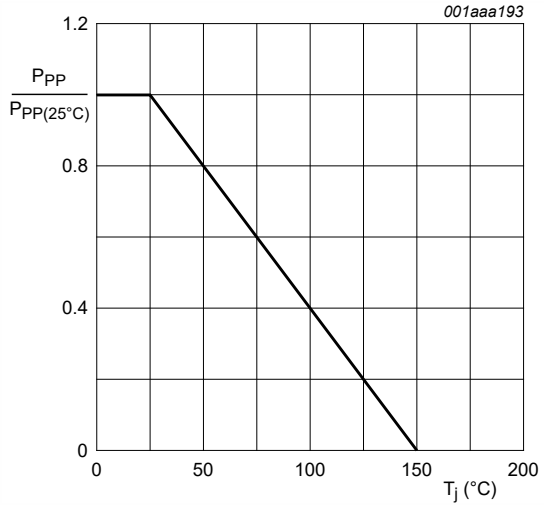
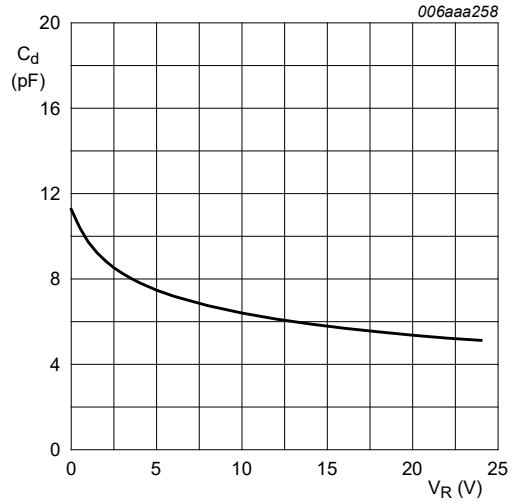


Fig. 4. Relative variation of peak pulse power as a function of junction temperature; typical values



f = 1 MHz; T_{amb} = 25 °C

Fig. 5. Diode capacitance as a function of reverse voltage; typical values

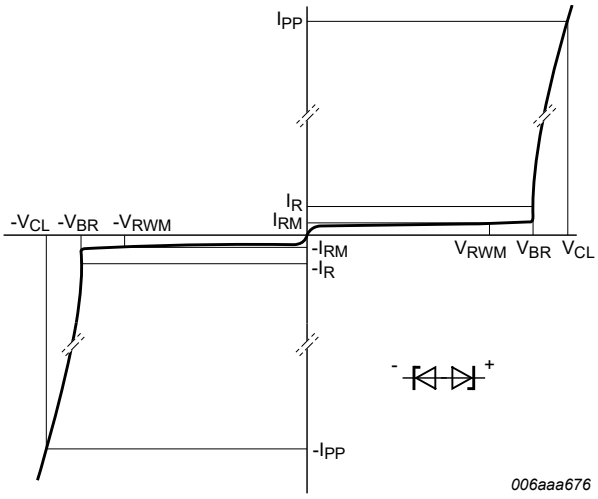


Fig. 6. V-I characteristics for a bidirectional ESD protection diode

10. Application information

The device is designed for the protection of two automotive FlexRay data lines from the damage caused by ESD and surge pulses. The device supports a FlexRay data rate of 10 Mbit/s and provides a surge capability of up to 200 W per line for an 8/20 µs waveform.

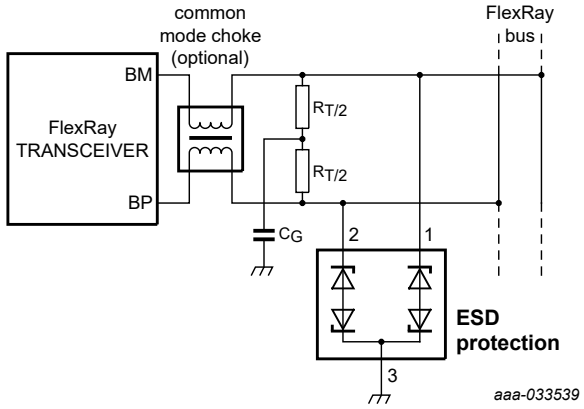


Fig. 7. Typical application: ESD protection of two automotive FlexRay data lines

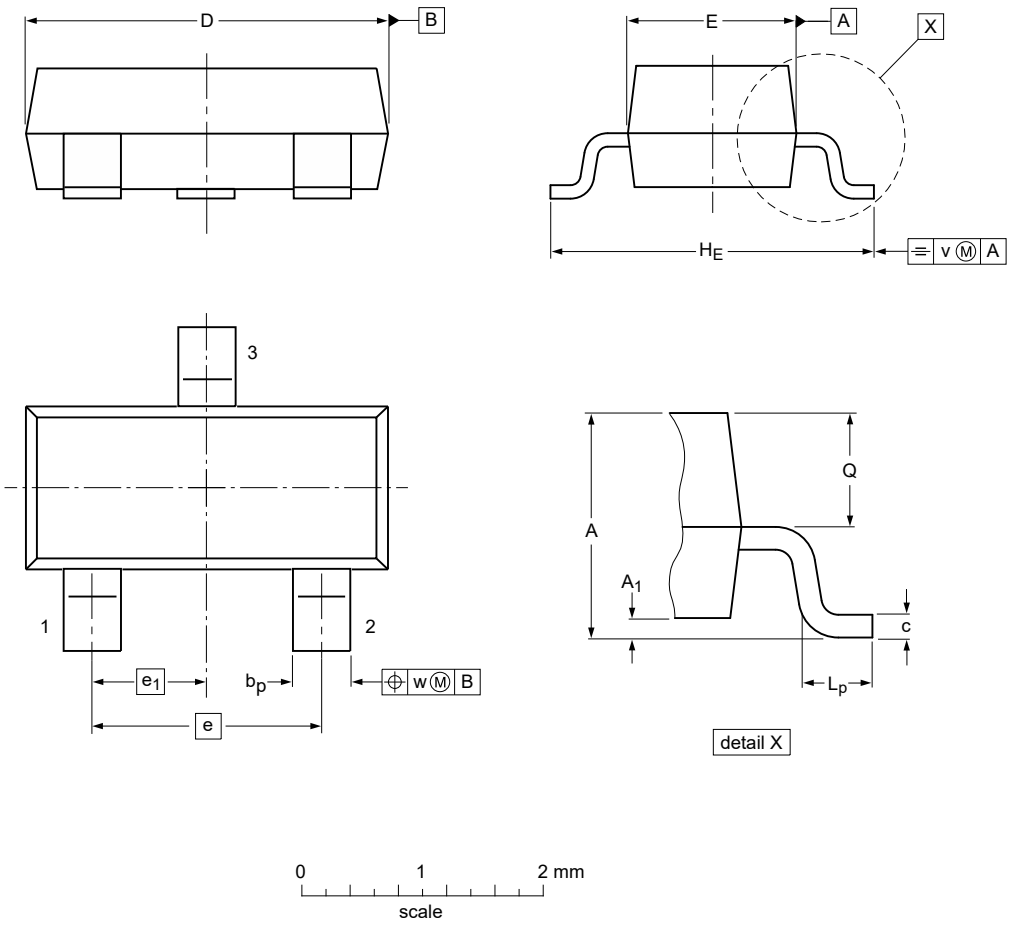
Circuit board layout and protection device placement

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

Plastic surface-mounted package; 3 leads **SOT23**



Dimensions (mm are the original dimensions)

Unit		A	A_1	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w
mm	max	1.1	0.1	0.48	0.15	3.0	1.4			2.5	0.45	0.55		
	nom							1.9	0.95				0.2	0.1
	min	0.9		0.38	0.09	2.8	1.2			2.1	0.15	0.45		

sot023_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT23		TO-236AB				~~14-06-19~~ 14-09-22

Fig. 8. Package outline SOT23

12. Soldering

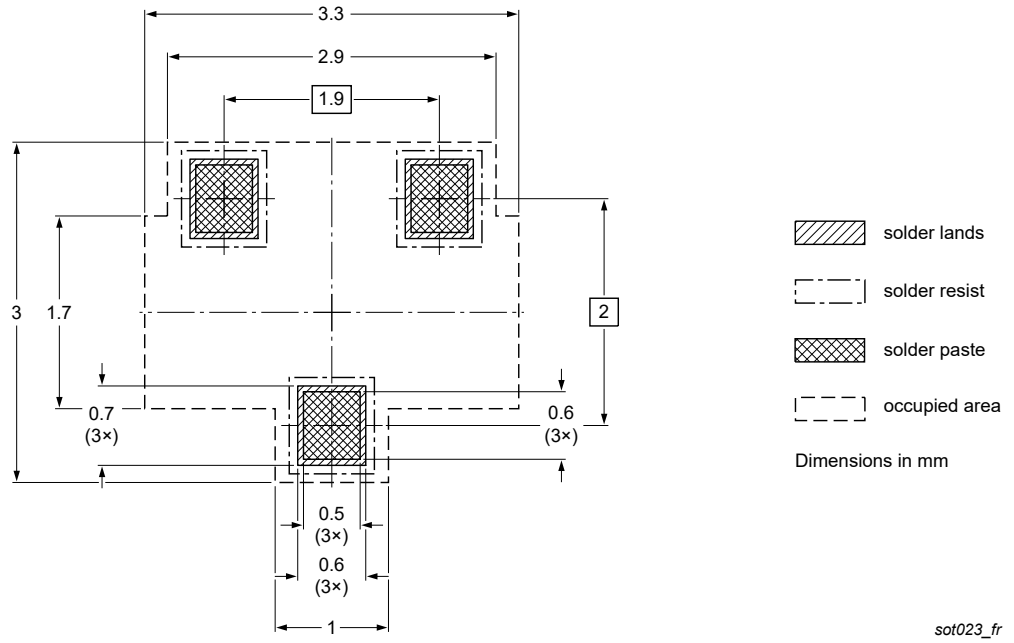


Fig. 9. Reflow soldering footprint for SOT23

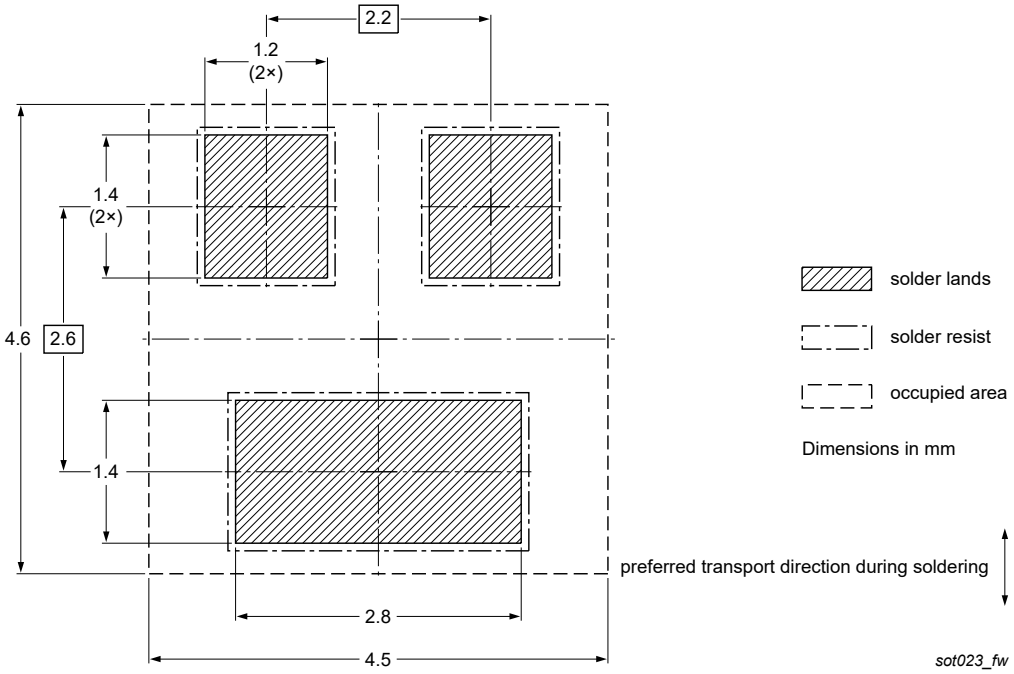


Fig. 10. Wave soldering footprint for SOT23

13. Revision history

Table 7. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PESD1FLEX v.3	20211107	Product data sheet	-	PESD1FLEX v.2
Modifications:	• Chapter "Limiting values": removed the table for ESD standards compliance • Chapter "Quick reference data": typo correction at parameter C_d • Chapter "Characteristics": typo correction at parameter C_d • Chapter "Characteristics": removed the figure "ESD clamping test setup and waveforms" • Chapter "Packing information" removed			
PESD1FLEX v.2	20080215	Product data sheet	-	PESD1FLEX v.1
PESD1FLEX v.1	20070521	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.

[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".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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