PESD1FLEX

FlexRay bus ESD protection diode

Rev. 02 — 15 February 2008 Product data sheet

1. Product profile

1.1 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.

1.2 Features

- Due to the integrated diode structure only one small SOT23 package is needed to protect two FlexRay bus lines
- Max. peak pulse power: P_{PP} = 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_{PP} = 3 A at t_p = 8/20 µs
- Small SMD plastic package

1.3 Applications

- FlexRay bus protection
- Automotive applications

1.4 Quick reference data

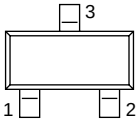
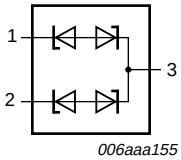
Table 1. Quick reference data

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per diode						
V_{RWM}	reverse standoff voltage		-	-	24	V
C_d	diode capacitance	f = 5 MHz; V_R = 0 V	-	11	17	pF

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Symbol
1	cathode 1		
2	cathode 2		
3	common cathode		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PESD1FLEX	-	plastic surface-mounted package; 3 leads	SOT23

4. Marking

Table 4. Marking codes

Type number	Marking code[1]
PESD1FLEX	ZJ*

[1] * = -: made in Hong Kong
* = p: made in Hong Kong
* = t: made in Malaysia
* = W: made in China

5. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
Per diode						
P_{PP}	peak pulse power	t_p = 8/20 µs	[1][2]	-	200	W
I_{PP}	peak pulse current	t_p = 8/20 µs	[1][2]	-	3	A
Per device						
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			–65	+150	°C
T_{stg}	storage temperature			–65	+150	°C

[1] Non-repetitive current pulse 8/20 µs exponential decay waveform according to IEC 61000-4-5.

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

Table 6. ESD maximum ratings

Symbol	Parameter	Conditions		Min	Max	Unit
Per diode						
V_{ESD}	electrostatic discharge voltage	IEC 61000-4-2 (contact discharge)	[1][2]	-	23	kV
		MIL-STD-883 (human body model)		-	10	kV

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

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

Table 7. ESD standards compliance

Standard	Conditions
Per diode	
IEC 61000-4-2; level 4 (ESD)	> 15 kV (air); > 8 kV (contact)
MIL-STD-883; class 3 (human body model)	> 4 kV

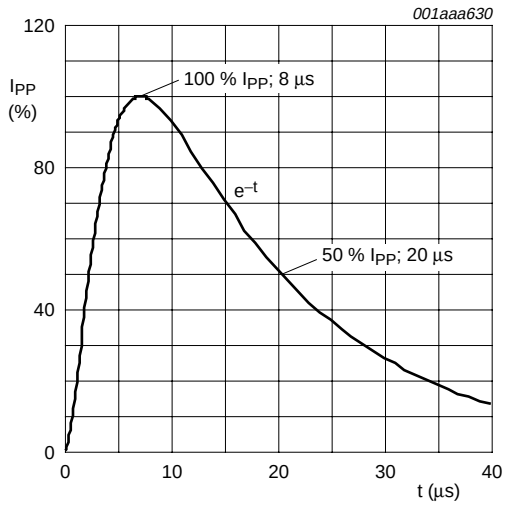


Fig 1. 8/20 µs pulse waveform according to IEC 61000-4-5

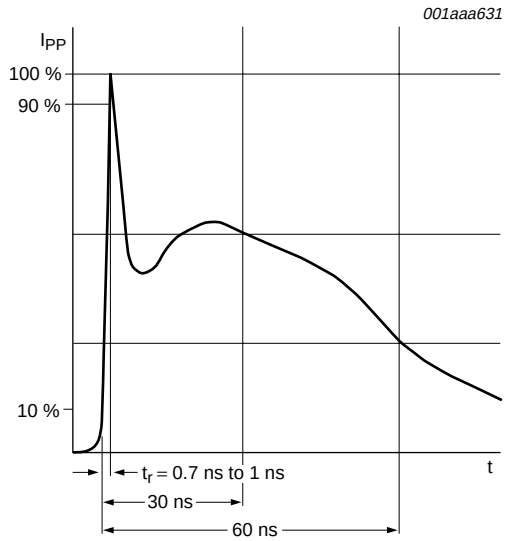


Fig 2. ESD pulse waveform according to IEC 61000-4-2

6. Characteristics

Table 8. Characteristics

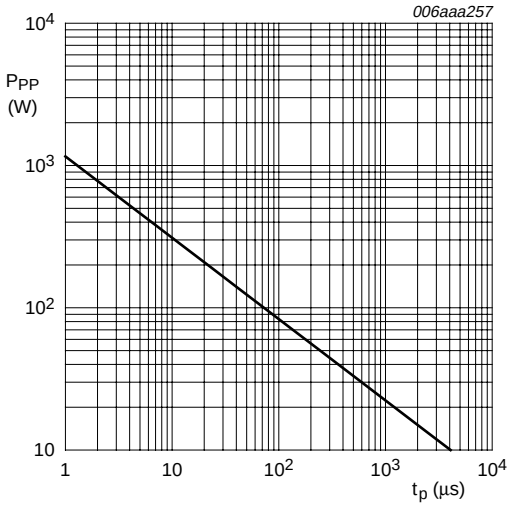
T_{amb} = 25 °C unless otherwise specified.

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

[1] 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.

[2] Non-repetitive current pulse 8/20 µs exponential decay waveform according to IEC 61000-4-5.

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



T_{amb} = 25 °C

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

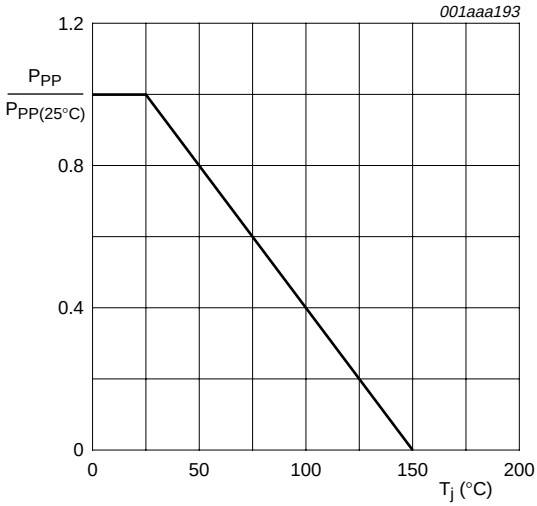
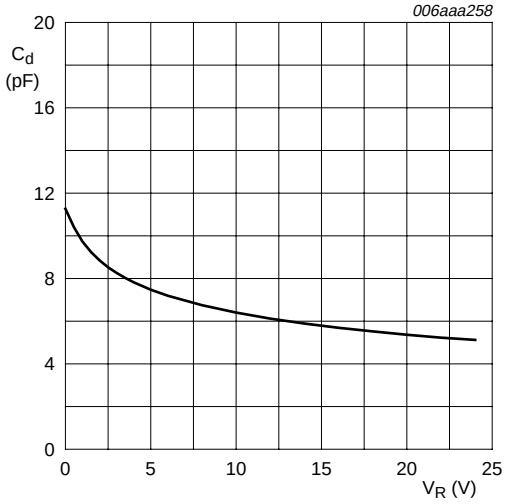


Fig 4. Relative variation of peak pulse power as a function of junction temperature; typical values



f = 5 MHz; T_{amb} = 25 °C

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

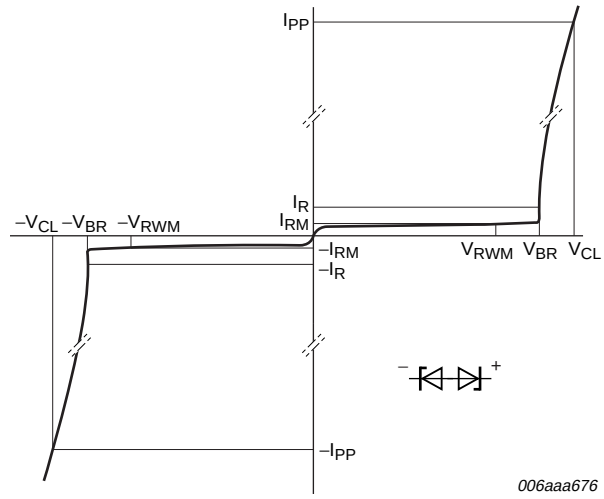


Fig 6. V-I characteristics for a bidirectional ESD protection diode

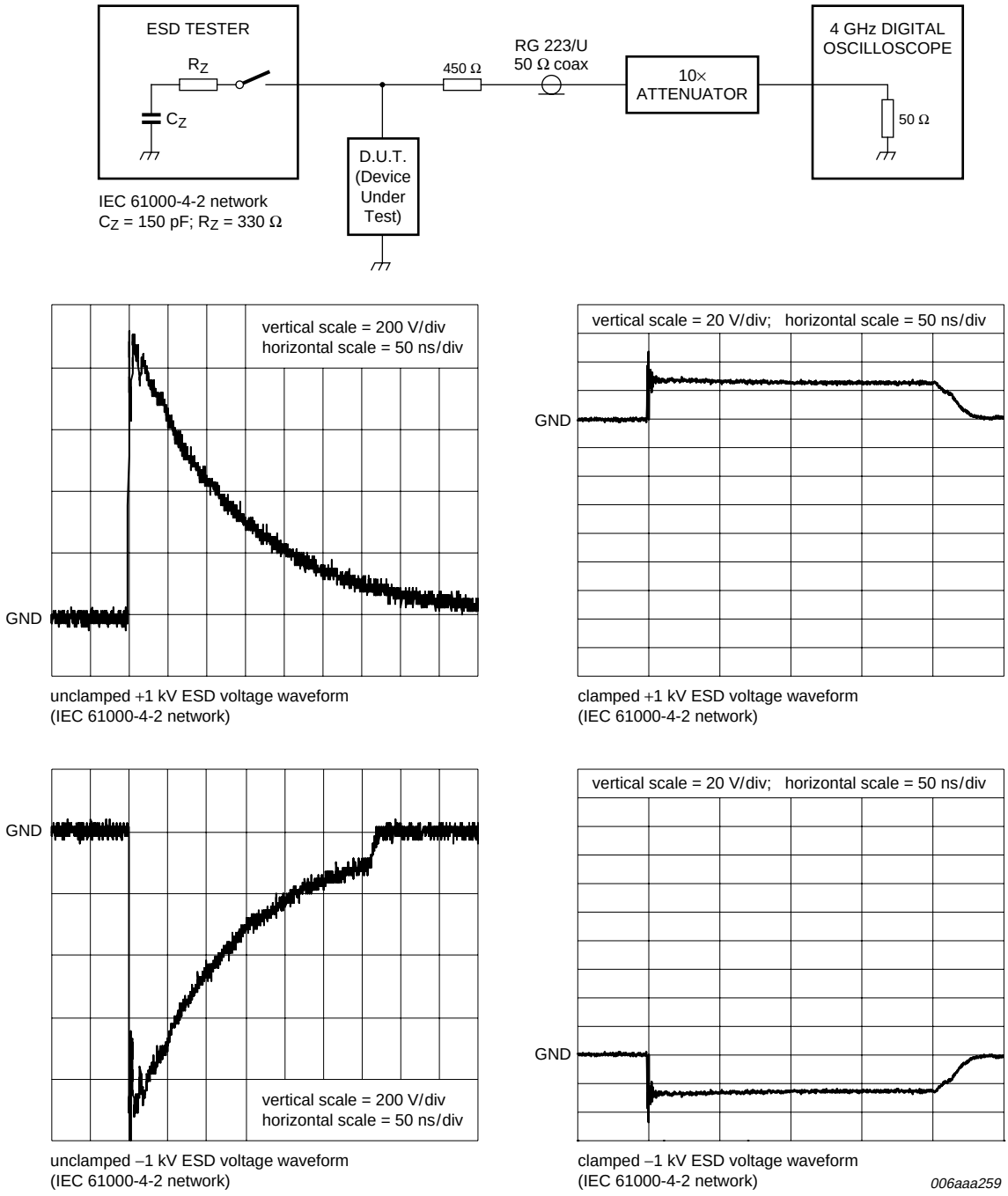


Fig 7. ESD clamping test setup and waveforms

7. Application information

The PESD1FLEX 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. The PESD1FLEX provides a surge capability of up to 200 W per line for an 8/20 µs waveform.

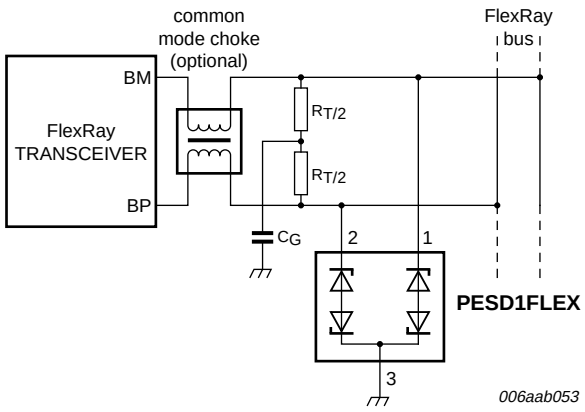


Fig 8. Typical application: ESD protection of two automotive FlexRay bus lines

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 PESD1FLEX as close to the input terminal or connector as possible.
2. The path length between the PESD1FLEX and the protected line should be minimized.
3. Keep parallel signal paths to a minimum.
4. Avoid running protection 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. Ground planes should be used whenever possible. For multilayer PCBs, use ground vias.

8. Package outline

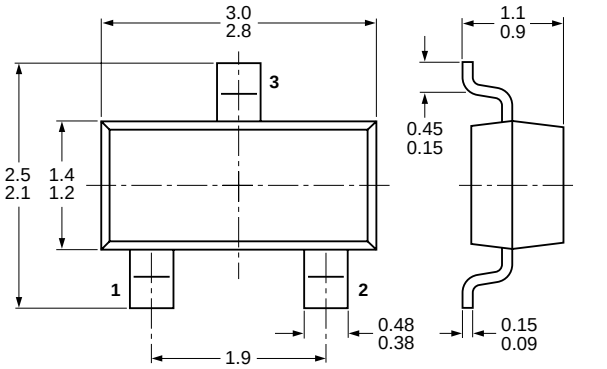


Fig 9. Package outline SOT23 (TO-236AB)

9. Packing information

Table 9. Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code.[1]

Type number	Package	Description	Packing quantity	
			3000	10000
PESD1FLEX	SOT23	4 mm pitch, 8 mm tape and reel	-215	-235

[1] For further information and the availability of packing methods, see Section 13.

10. Soldering

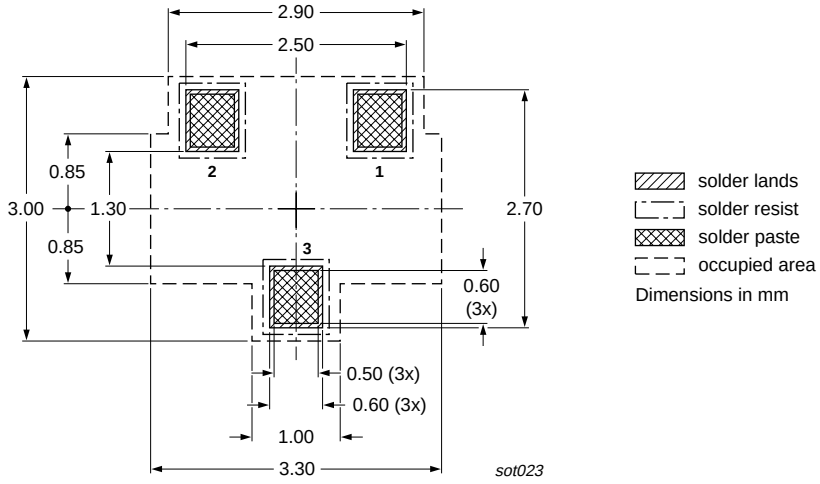


Fig 10. Reflow soldering footprint SOT23 (TO-236AB)

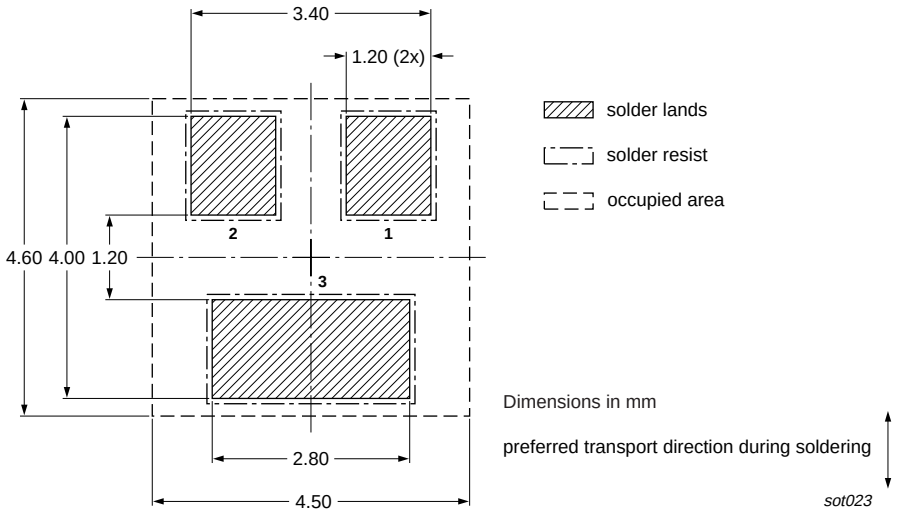


Fig 11. Wave soldering footprint SOT23 (TO-236AB)

11. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PESD1FLEX_2	20080215	Product data sheet	-	PESD1FLEX_1
Modifications:	• Section 1.2 “Features”: list item for diode capacitance matching added • Table 8 “Characteristics”: $\Delta C_d/C_d$ diode capacitance matching added			
PESD1FLEX_1	20070521	Product data sheet	-	-

12. Legal information

12.1 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 URL http://www.nexperia.com.

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