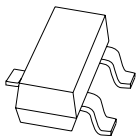


PESD1CAN

CAN bus ESD protection diode in SOT23

Rev. 02 — 17 October 2005 Product data sheet

1. Product profile

1.1 General description

PESD1CAN in a small SOT23 Surface Mounted Device (SMD) plastic package designed to protect two automotive Control Area Network (CAN) 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 CAN 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
- 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

- CAN bus protection
- Automotive applications

1.4 Quick reference data

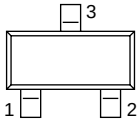
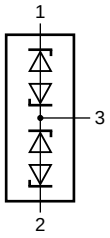
Table 1: Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage		-	-	24	V
C_d	diode capacitance	V_R = 0 V; f = 1 MHz	-	11	17	pF

PHILIPS

2. Pinning information

Table 2: Pinning

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

006aaa155

3. Ordering information

Table 3: Ordering information

Type number	Package		
	Name	Description	Version
PESD1CAN	-	plastic surface mounted package; 3 leads	SOT23

4. Marking

Table 4: Marking codes

Type number	Marking code [1]
PESD1CAN	*AN

[1] * = -: made in Hong Kong
* = p: made in Hong Kong
* = t: made in Hong Kong
* = 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
P_{PP}	peak pulse power	8/20 µs	[1] [2]	-	200	W
I_{PP}	peak pulse current	8/20 µs	[1] [2]	-	3	A
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
V_{ESD}	electrostatic discharge voltage	IEC 61000-4-2 (contact discharge)	[1] [2]	-	23	kV
		HBM MIL-STD883		-	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

ESD Standard	Conditions
IEC 61000-4-2, level 4 (ESD)	> 15 kV (air); > 8 kV (contact)
HBM MIL-STD883, class 3	> 4 kV

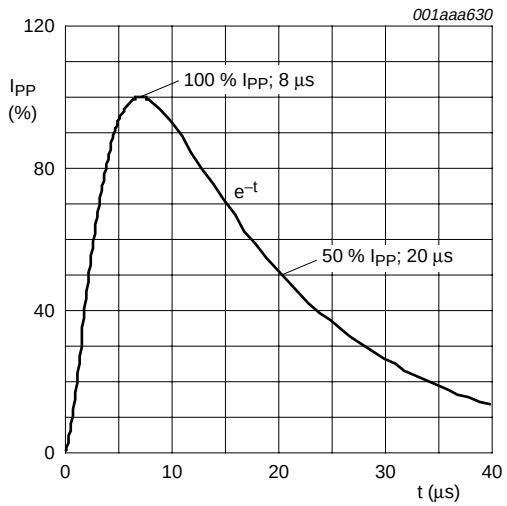


Fig 1. 8/20 µs pulse waveform according to IEC 61000-4-5

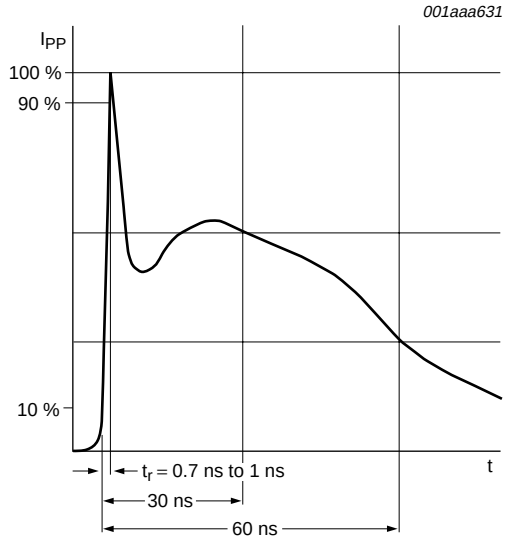


Fig 2. ESD pulse waveform according to IEC 61000-4-2

6. Characteristics

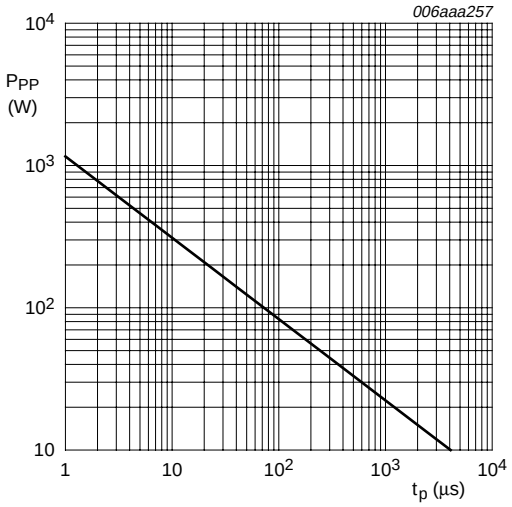
Table 8: Characteristics

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
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	V_R = 0 V; f = 1 MHz		-	11	17	pF
V_{CL}	clamping voltage	I_{PP} = 1 A	[1] [2]	-	-	40	V
		I_{PP} = 3 A	[1] [2]	-	-	70	V
r_{dif}	differential resistance	I_R = 1 mA		-	-	300	Ω

[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.



T_{amb} = 25 °C

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

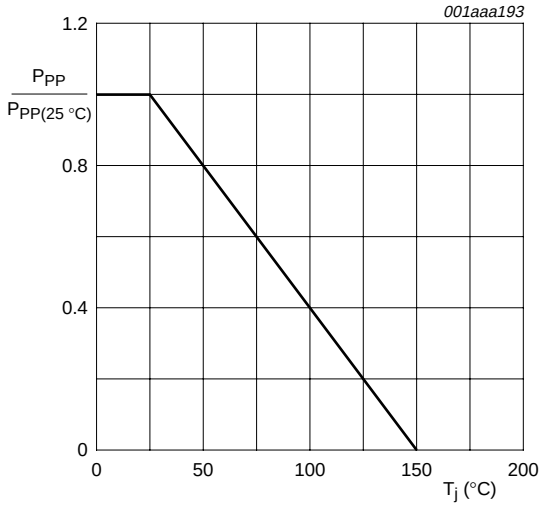
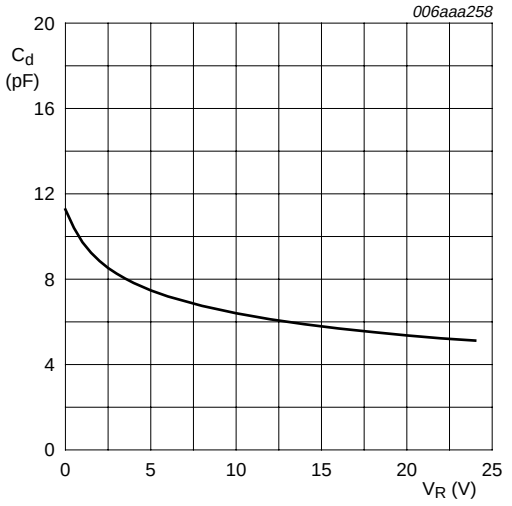


Fig 4. Relative variation of peak pulse power as a function of junction temperature; typical values



T_{amb} = 25 °C; f = 1 MHz

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

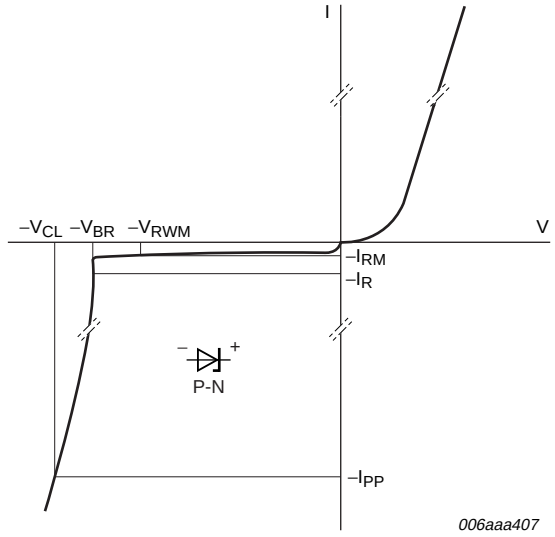
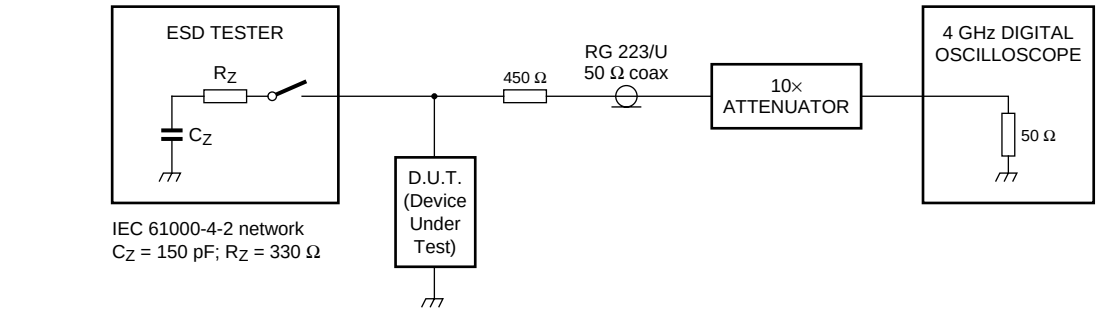
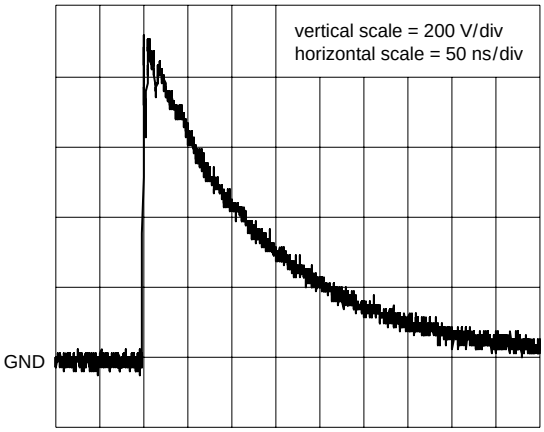
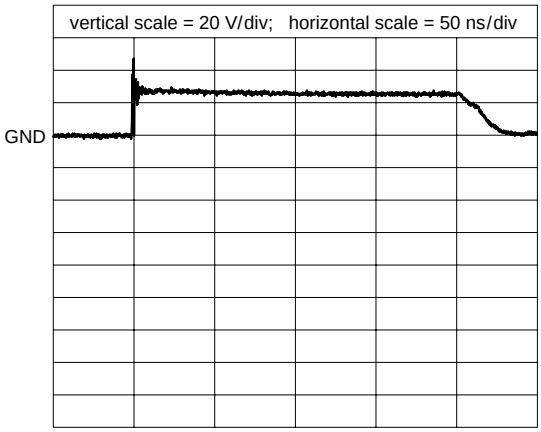


Fig 6. V-I characteristics

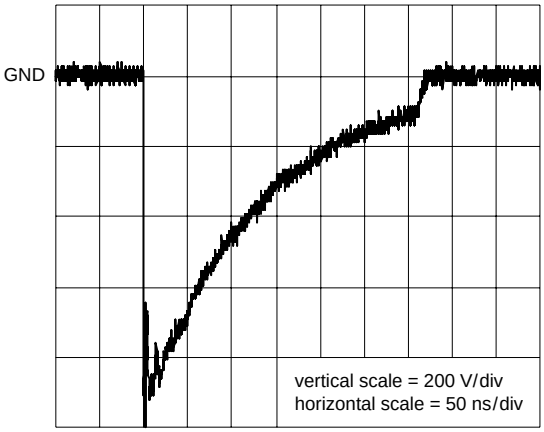




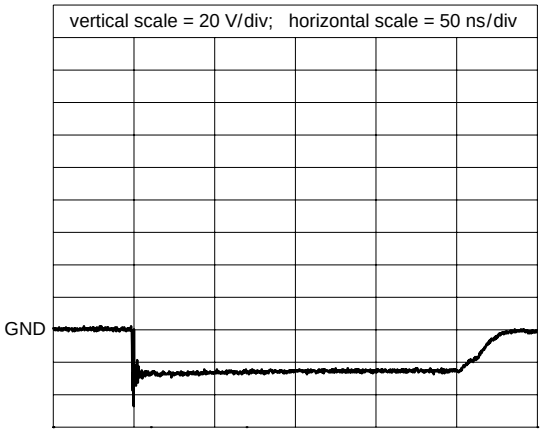
unclamped +1 kV ESD voltage waveform
(IEC 61000-4-2 network)



clamped +1 kV ESD voltage waveform
(IEC 61000-4-2 network)



unclamped −1 kV ESD voltage waveform
(IEC 61000-4-2 network)



clamped −1 kV ESD voltage waveform
(IEC 61000-4-2 network)

006aaa259

Fig 7. ESD clamping test set-up and waveforms

7. Application information

The PESD1CAN is designed for the protection of two automotive CAN bus lines from the damage caused by ESD and surge pulses. PESD1CAN can be used for both, high-speed CAN bus and fault-tolerant CAN bus protection. The PESD1CAN provides a surge capability of up to 200 W per line for an 8/20 μs waveform.

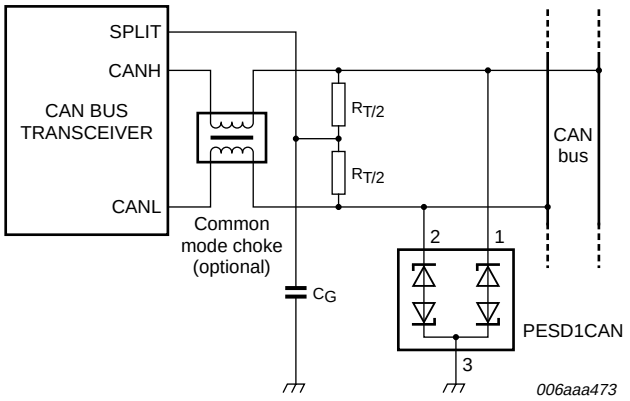


Fig 8. Typical application: ESD protection of two automotive CAN bus lines

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 PESD1CAN as close to the input terminal or connector as possible.
2. The path length between the PESD1CAN and the protected line should be minimized.
3. Keep parallel signal paths to a minimum.
4. Avoid running protection conductors in parallel with unprotected conductor.
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

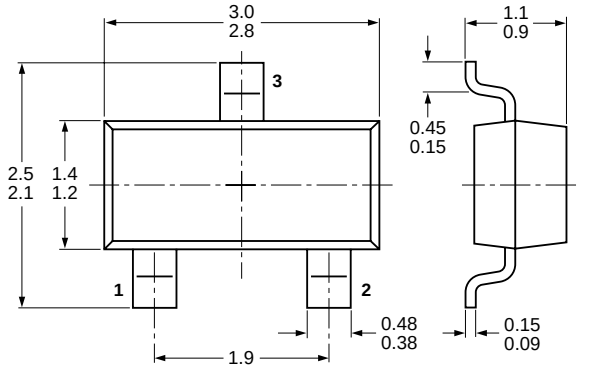


Fig 9. Package outline SOT23 (TO-236AB)

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
PESD1CAN	SOT23	4 mm pitch, 8 mm tape and reel	-215	-235

[1] For further information and the availability of packing methods, see Section 15.

10. Revision history

Table 10: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
PESD1CAN_2	20051017	Product data sheet	-	9397 750 15087	PESD1CAN_1
Modifications:	• Product status changed • Table 1 “Quick reference data”: added maximum value for C_d diode capacitance • Table 4 “Marking codes”: amended • Figure 6: added • Figure 8: superseded by enhanced version • Figure 9: superseded by minimized package outline • Section 14 “Trademarks”: added				
PESD1CAN_1	20050125	Objective data sheet	-	9397 750 14197	-

11. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

12. Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

13. Disclaimers

Life support — These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

Right to make changes — Philips Semiconductors reserves the right to make changes in the products - including circuits, standard cells, and/or software - described or contained herein in order to improve design and/or performance. When the product is in full production (status 'Production'), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

14. Trademarks

Notice — All referenced brands, product names, service names and trademarks are the property of their respective owners.

15. Contact information

For additional information, please visit: **http://www.semiconductors.philips.com**

For sales office addresses, send an email to: **sales.addresses@www.semiconductors.philips.com**

16. Contents

Date of release: 17 October 2005
Document number: 9397 750 15087

Published in The Netherlands