PESD1CAN-U

CAN bus ESD protection diode

Rev. 1 — 27 March 2013 Product data sheet

1. Product profile

1.1 General description

ElectroStatic Discharge (ESD) protection diode in a very small SOT323 (SC-70) Surface-Mounted Device (SMD) plastic package designed to protect two automotive Controller Area Network (CAN) bus lines from the damage caused by ESD and other transients.

1.2 Features and benefits

- One very small SOT323 package to protect two CAN bus lines
- Low clamping voltage V_{CL} = 35 V at I_{PP} = 1 A
- Typical diode capacitance matching $\Delta C_d/C_d$ = 0.1 %
- ESD protection up to 23 kV; IEC 61000-4-2, level 4
- IEC 61000-4-5 (surge); I_{PPM} = 3 A at t_p = 8/20 µs
- AEC-Q101 qualified

1.3 Applications

- CAN bus protection
- Automotive applications

1.4 Quick reference data

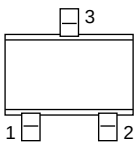
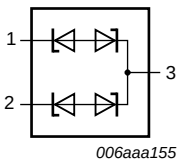
Table 1. Quick reference data

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage		-	-	24	V
C_d	diode capacitance	f = 1 MHz; V_R = 0 V	-	9.3	12	pF

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	cathode 1		
2	cathode 2		
3	common cathode		

006aaa155

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PESD1CAN-U	SC-70	plastic surface-mounted package; 3 leads	SOT323

4. Marking

Table 4. Marking codes

Type number	Marking code[1]
PESD1CAN-U	NB*

[1] * = placeholder for manufacturing site code.

5. 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		[1][2]	-	150	W
I_{PPM}	rated peak pulse current		[1][2]	-	3	A
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			−55	+150	°C
T_{stg}	storage temperature			−65	+150	°C

[1] Device stressed with ten non-repetitive current pulses (8/20 μs exponential decay waveform according to IEC 61000-4-5 and IEC 61643-321).

[2] Measured from pin 1 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
		machine model	[2]	-	400	V
		MIL-STD-883 (human body model)		-	10	kV

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

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

Table 7. ESD standards compliance

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

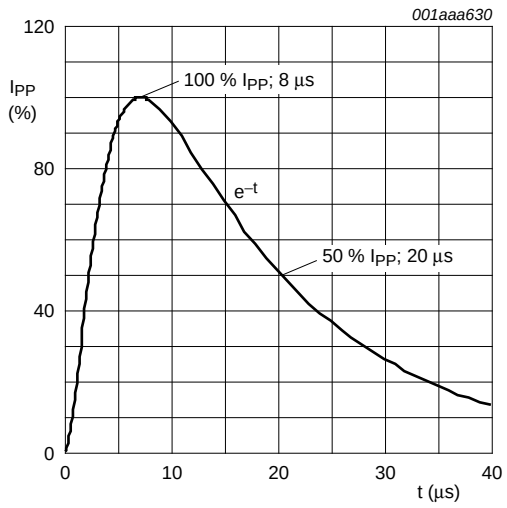


Fig 1. 8/20 µs pulse waveform according to IEC 61000-4-5 and IEC 61643-321

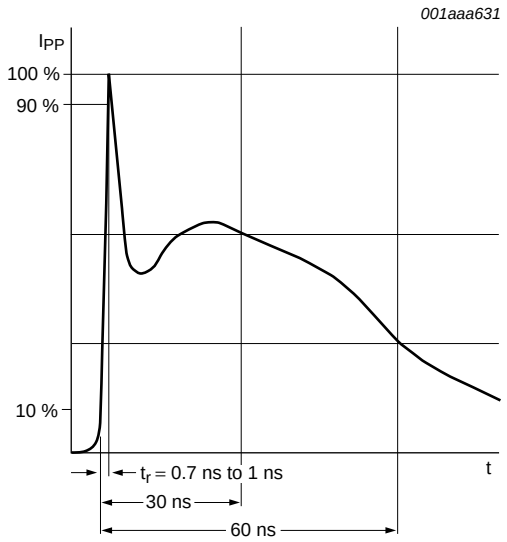


Fig 2. ESD pulse waveform according to IEC 61000-4-2

6. Characteristics

Table 8. Characteristics

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

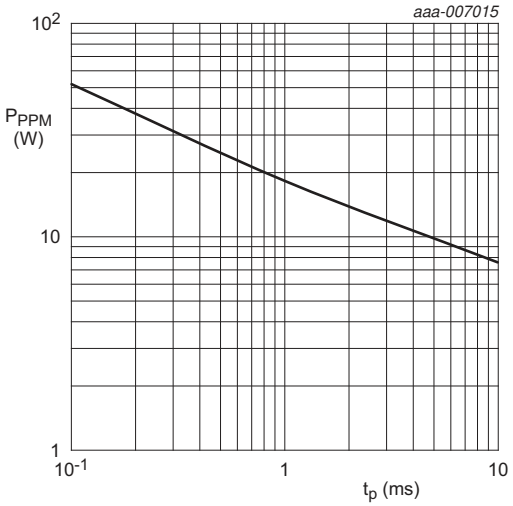
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage			-	-	24	V
I_{RM}	reverse leakage current	V_{RWM} = 24 V		-	1	50	nA
V_{BR}	breakdown voltage	I_R = 5 mA		25.4	27.8	30.3	V
V_{CL}	clamping voltage	I_{PP} = 1 A	[1][2]	-	-	35	V
		I_{PPM} = 3 A		-	-	50	V
C_d	diode capacitance	f = 1 MHz; V_R = 0 V		-	9.3	12	pF
		f = 1 MHz; V_R = 2.5 V		-	7.2	-	pF
$\Delta C_d/C_d$	capacitance matching	f = 1 MHz; V_R = 0 V	[3]	-	0.1	-	%
		f = 1 MHz; V_R = 2.5 V		-	0.1	-	%
r_{dyn}	dynamic resistance	I_R = 10 A	[2][4]	-	1.5	-	Ω

[1] Device stressed with 8/20 µs exponential decay waveform according to IEC 61000-4-5 and IEC 61643-321.

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

[3] 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.

[4] Non-repetitive current pulse, Transmission Line Pulse (TLP) t_p = 100 ns; square pulse; ANS/IESD STM5.1-2008.



T_{amb} = 25 °C

Fig 3. Rated peak pulse power as a function of square pulse duration; typical values

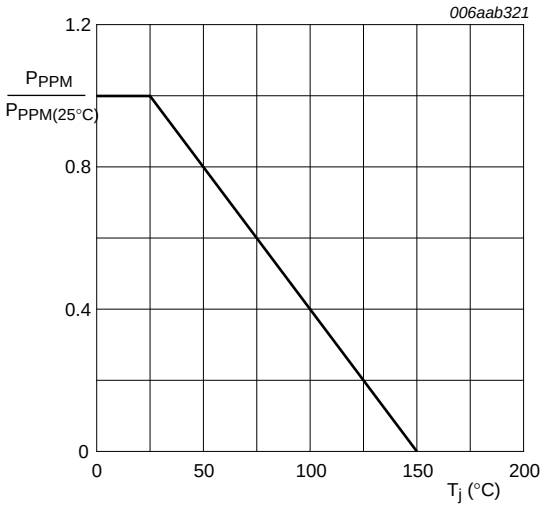
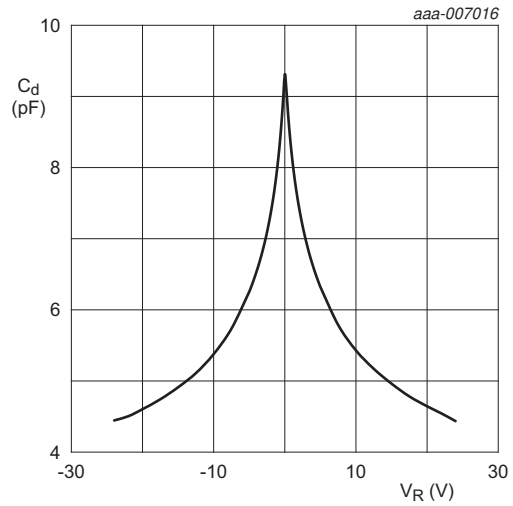


Fig 4. Relative variation of peak pulse power as a function of junction temperature; typical values



f = 1 MHz; T_{amb} = 25 °C

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

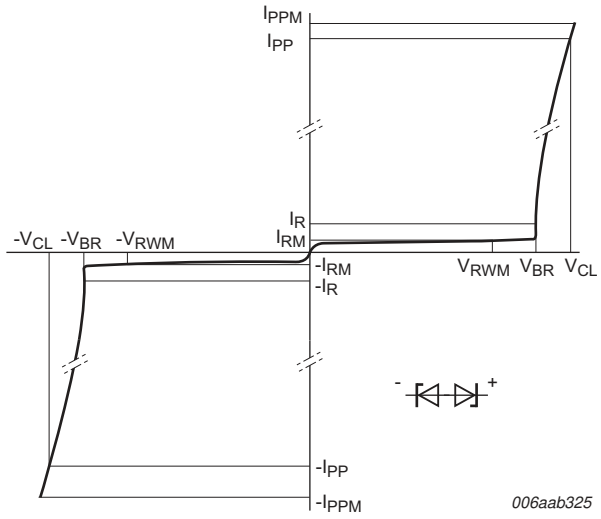


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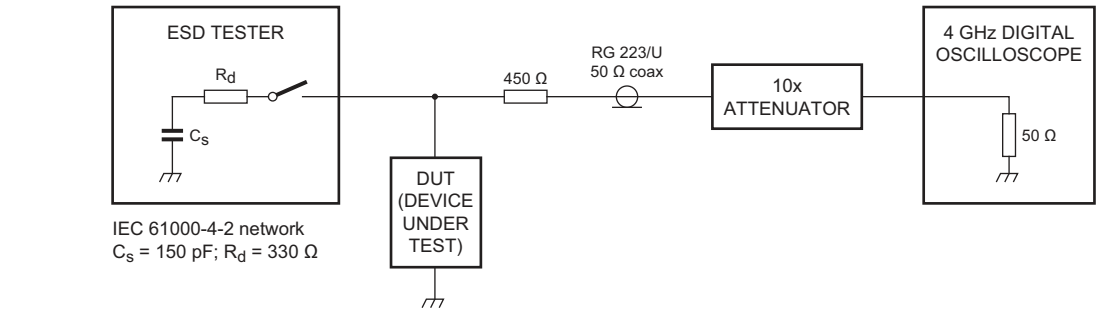
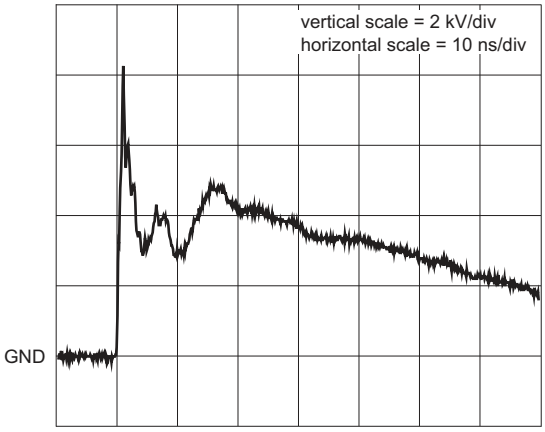
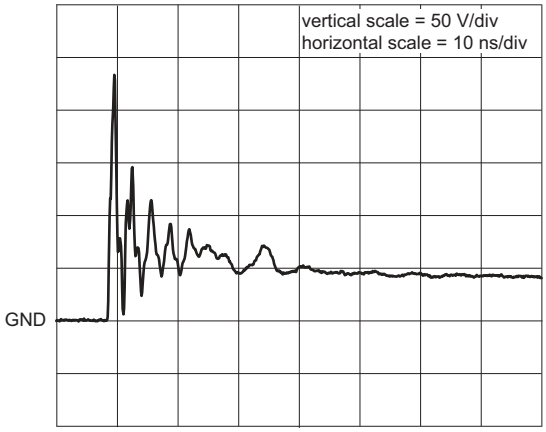
Fig 6. V-I characteristics for a bidirectional ESD protection diode

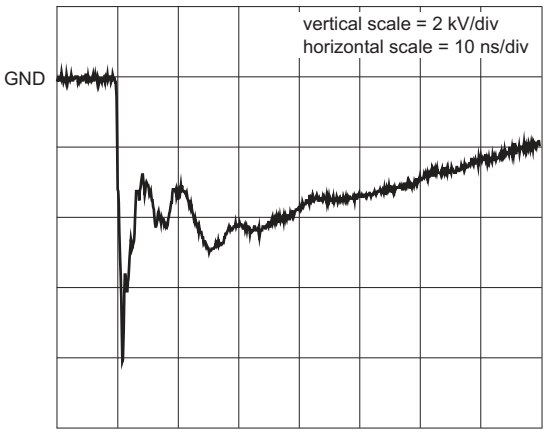




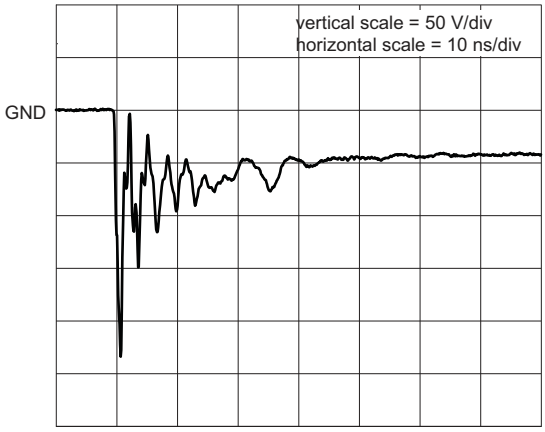
unclamped +8 kV ESD pulse waveform
(IEC 61000-4-2 network)



clamped +8 kV ESD pulse waveform
(IEC 61000-4-2 network)



unclamped -8 kV ESD pulse waveform
(IEC 61000-4-2 network)



clamped -8 kV ESD pulse waveform
(IEC 61000-4-2 network)

aaa-007017

Fig 7. ESD clamping test setup and waveforms

7. Application information

The device is designed for the protection of two automotive CAN bus lines from surge pulses and ESD damage. The device is suitable on lines where the signal polarities are both, positive and negative with respect to ground.

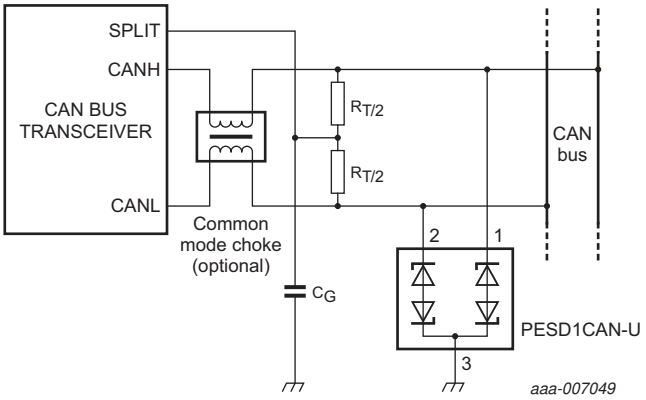


Fig 8. Application diagram

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.

8. Test information

8.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

9. Package outline

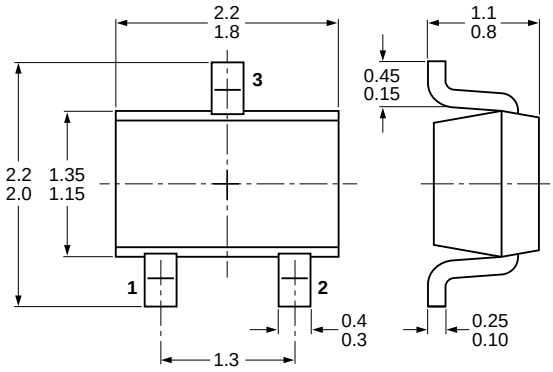


Fig 9. Package outline SOT323 (SC-70)

10. Soldering

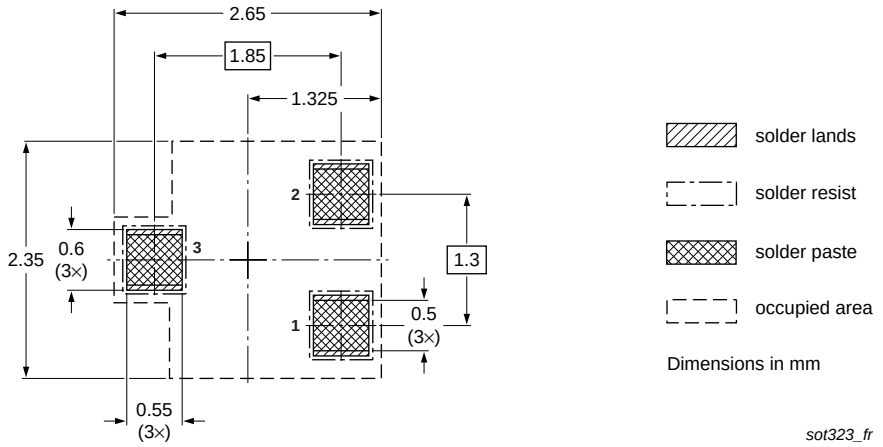


Fig 10. Reflow soldering footprint SOT323 (SC-70)

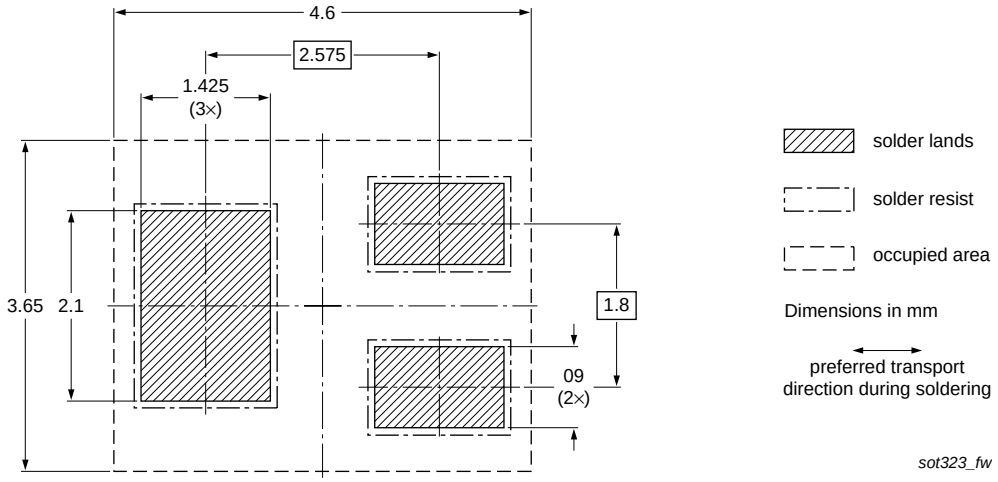


Fig 11. Wave soldering footprint SOT323 (SC-70)

11. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PESD1CAN-U v.1	20130327	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".

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14. Contents

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