PESD2CAN

CAN bus ESD protection diode

Rev. 2 — 27 September 2012 **Product data sheet**

1. Product profile

1.1 General description

PESD2CAN in a small SOT23 Surface-Mounted Device (SMD) plastic package designed to protect two automotive Controller Area Network (CAN) bus lines from the damage caused by ElectroStatic Discharge (ESD) and other transients.

1.2 Features and benefits

- Max. peak pulse power: P_{PP} = 230 W at t_p = 8/20 μs
- Low clamping voltage: V_{CL} = 41 V at I_{PP} = 5 A
- Ultra low leakage current: I_{RM} < 1 nA
- ESD protection up to 30 kV
- IEC 61000-4-2, level 4 (ESD)
- IEC 61000-4-5 (surge); I_{PP} = 5 A at t_p = 8/20 μs
- AEC-Q101 qualified

1.3 Applications

- CAN bus protection
- Automotive applications

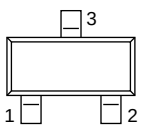
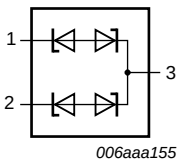
1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per diode						
V_{RWM}	reverse standoff voltage		-	-	24	V
C_d	diode capacitance	f = 1 MHz; V_R = 0 V	-	25	30	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
PESD2CAN	-	plastic surface-mounted package; 3 leads	SOT23

4. Marking

Table 4. Marking codes

Type number	Marking code[1]
PESD2CAN	6R*

[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
Per diode						
P_{PP}	peak pulse power	t_p = 8/20 μs	[1][2]	-	230	W
I_{PP}	peak pulse current	t_p = 8/20 μs	[1][2]	-	5	A
Per device						
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			−55	+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]	-	30	kV
		machine model	[2]	-	400	V
		MIL-STD-883 (human body model)	[1][2]	-	16	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 3B (human body model)	> 8 kV

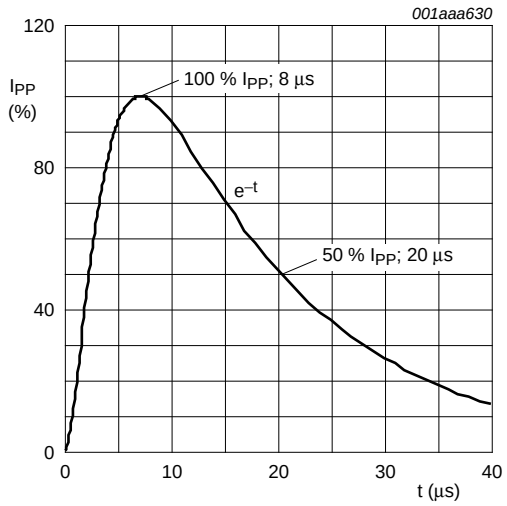


Fig 1. 8/20 µs pulse waveform according to IEC 61000-4-5

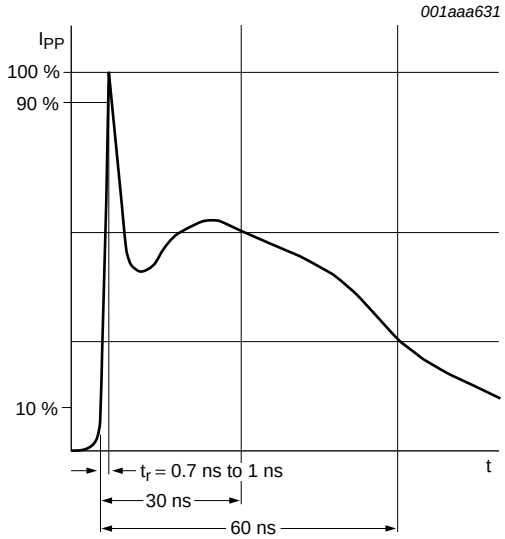


Fig 2. ESD pulse waveform according to IEC 61000-4-2

6. Characteristics

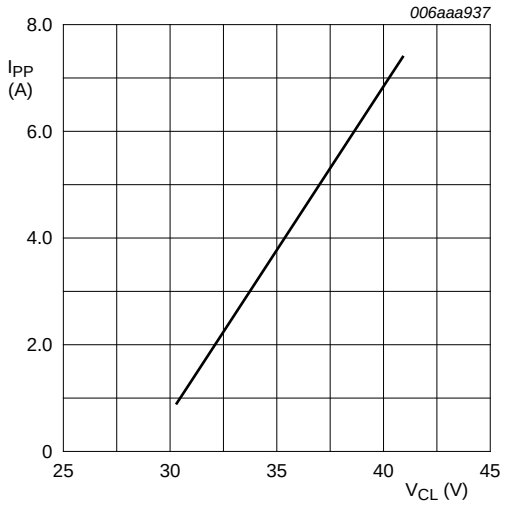
Table 8. Characteristics

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	10	nA
V_{BR}	breakdown voltage	I_R = 1 mA		26.2	28	30.3	V
C_d	diode capacitance	f = 1 MHz; V_R = 0 V		-	25	30	pF
V_{CL}	clamping voltage	I_{PP} = 1 A	[1][2]	-	-	34	V
		I_{PP} = 5 A	[1][2]	-	-	41	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 current as a function of clamping voltage; typical values

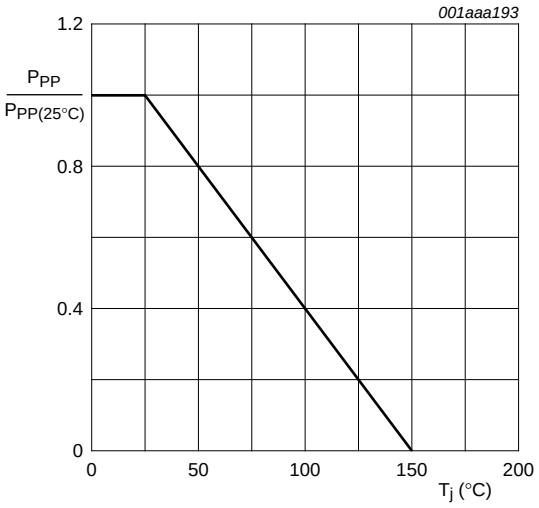
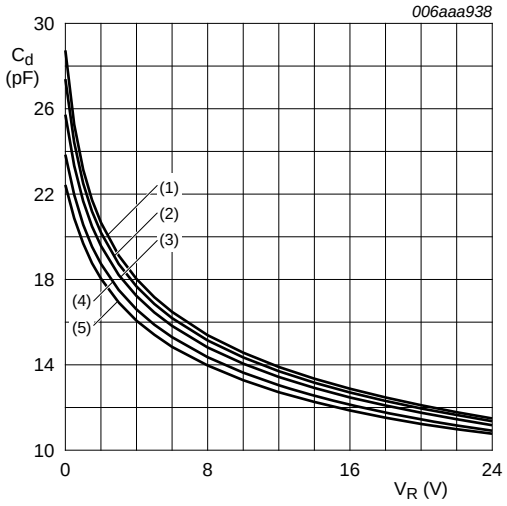


Fig 4. Relative variation of peak pulse power as a function of junction temperature; typical values



f = 1 MHz

(1) T_{amb} = 150 °C

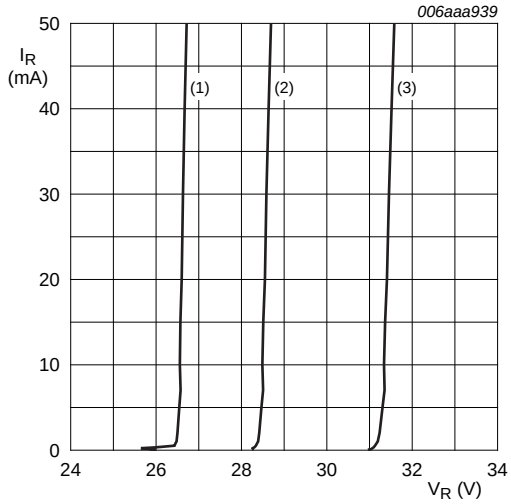
(2) T_{amb} = 125 °C

(3) T_{amb} = 85 °C

(4) T_{amb} = 25 °C

(5) T_{amb} = −40 °C

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

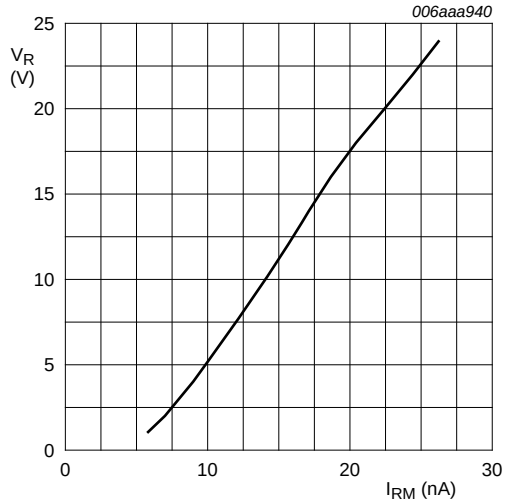


(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 150 °C

Fig 6. Reverse current as a function of reverse voltage; typical values



T_{amb} = 150 °C

I_R is less than 1 nA at −55 °C and 25 °C.

Fig 7. Reverse voltage as a function of reverse leakage current; typical values

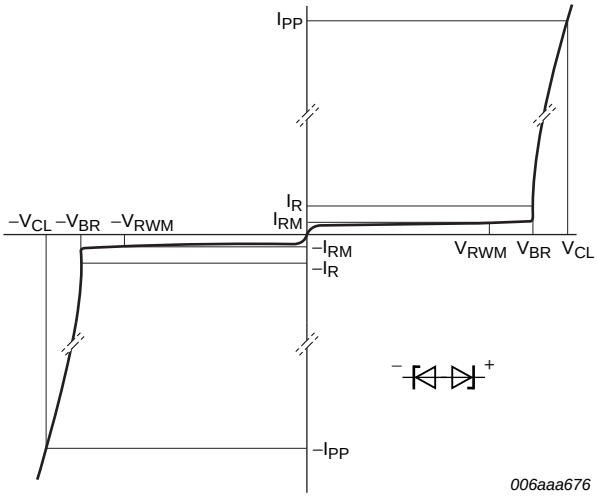
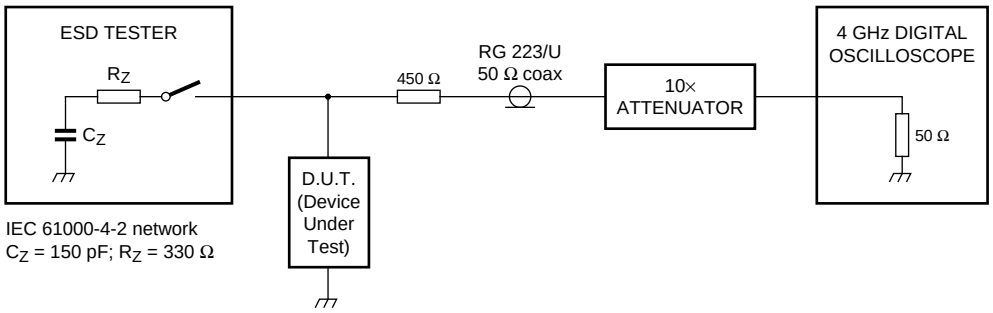
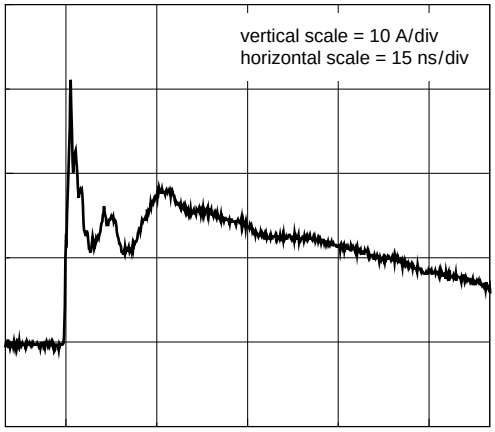
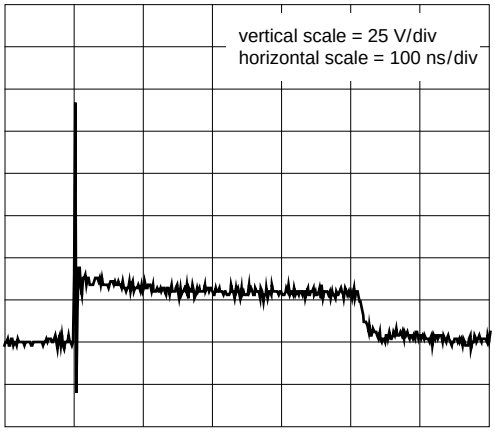


Fig 8. V-I characteristics for a bidirectional ESD protection diode

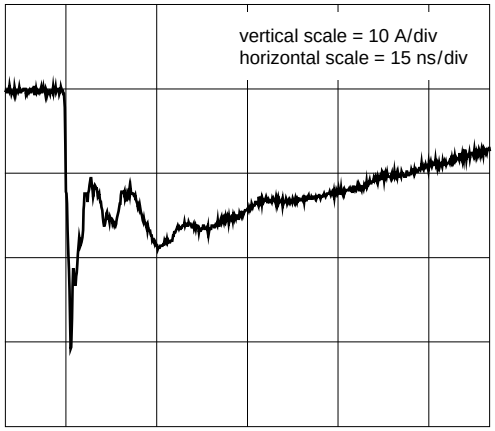




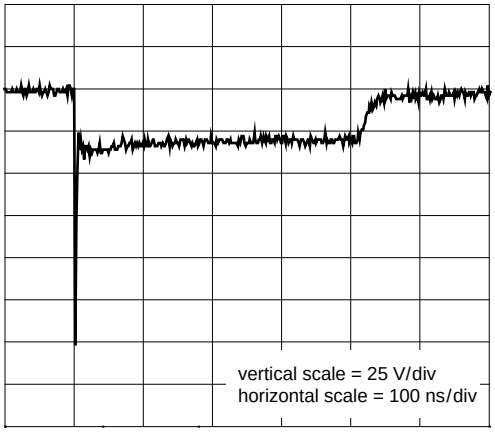
unclamped +8 kV ESD pulse waveform
(IEC 61000-4-2 network)



clamped +8 kV ESD pulse waveform
(IEC 61000-4-2 network), Pin 1 to 3



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



clamped −8 kV ESD voltage waveform
(IEC 61000-4-2 network), Pin 1 to 3

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Fig 9. ESD clamping test setup and waveforms

7. Application information

The PESD2CAN is designed for the protection of two automotive CAN bus lines from the damage caused by ESD and surge pulses. The PESD2CAN can be used for both, high-speed CAN bus and fault-tolerant CAN bus protection. The PESD2CAN provides a surge capability of up to 230 W per line for an 8/20 μs waveform.

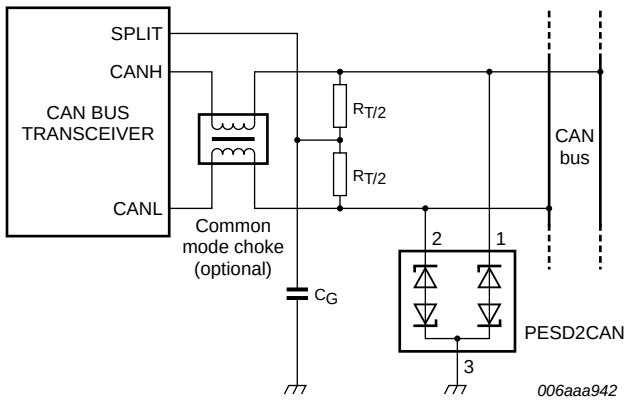

Fig 10. Typical application: ESD protection of two automotive CAN bus lines

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 PESD2CAN as close to the input terminal or connector as possible.
2. Minimize the path length between the PESD2CAN and the protected line.
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. 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

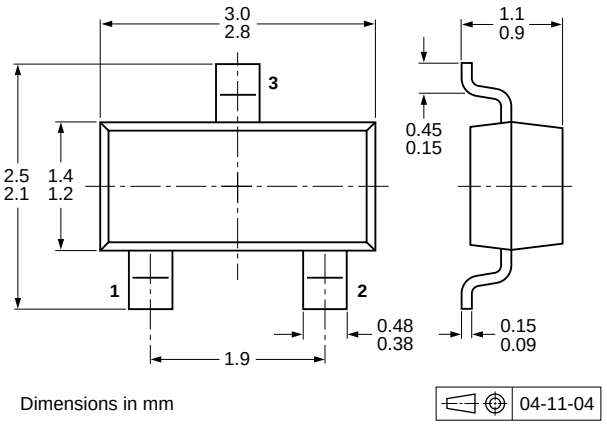

Fig 11. Package outline SOT23 (TO-236AB)

10. 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
PESD2CAN	SOT23	4 mm pitch, 8 mm tape and reel	-215	-235

[1] For further information and the availability of packing methods, see Section 14.

11. Soldering

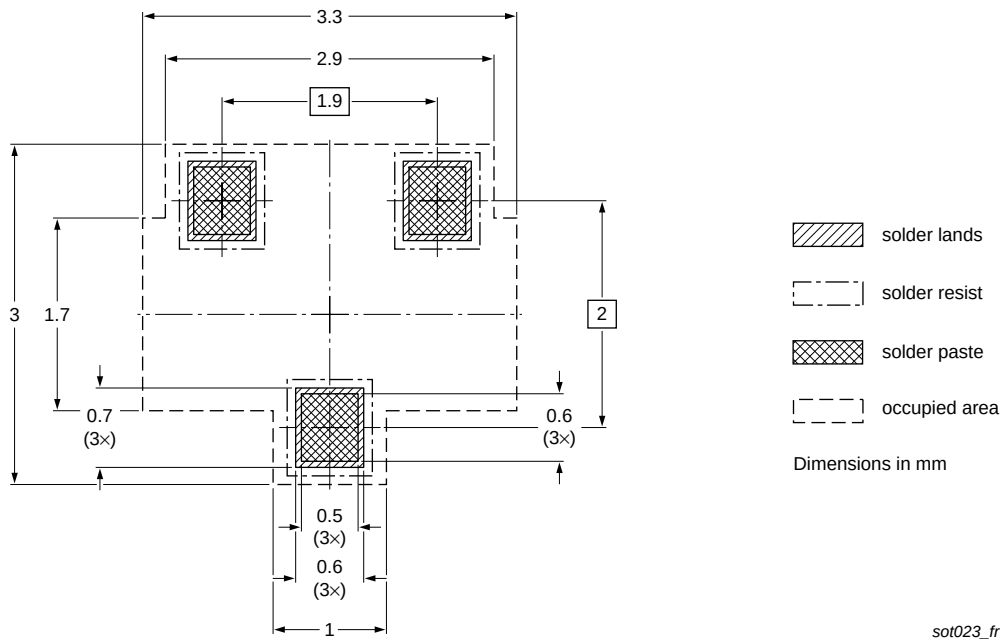

Fig 12. Reflow soldering footprint SOT23 (TO-236AB)

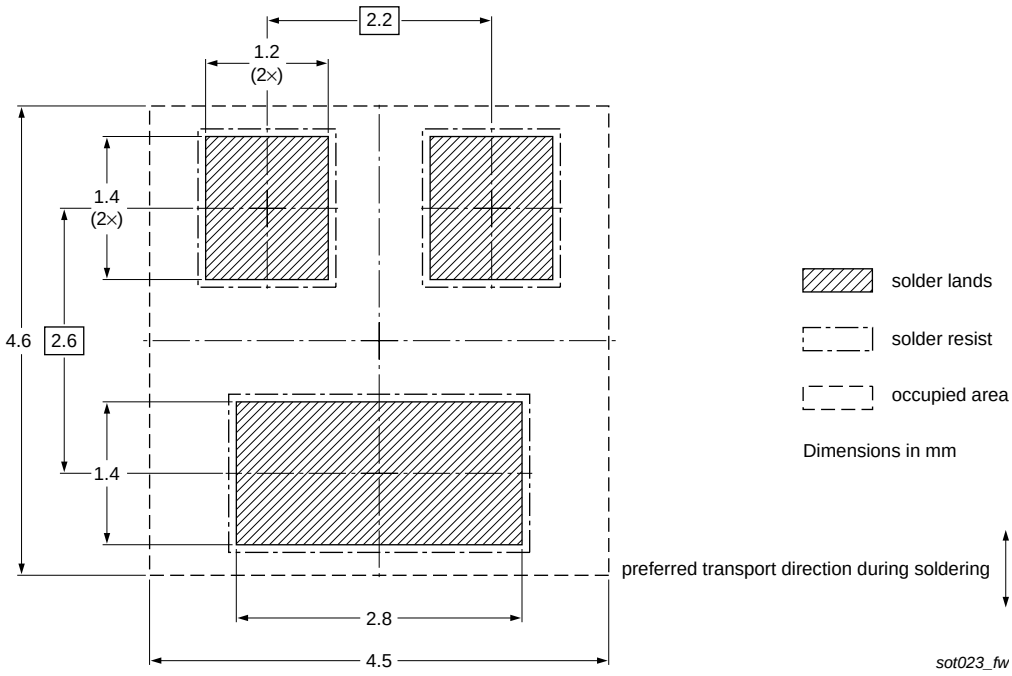

Fig 13. Wave soldering footprint SOT23 (TO-236AB)

12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PESD2CAN v.2	20120927	Product data sheet	-	PESD2CAN v.1
Modifications:	• Section 1.2 “Features and benefits”: updated • Table 6 “ESD maximum ratings”: corrected T_{amb} minimum value • Table 7 “ESD standards compliance”: updated • Section 8 “Test information”: added • Section 11 “Soldering”: added • Section 13 “Legal information”: updated			
PESD2CAN v.1	20061222	Product data sheet	-	-

13. Legal information

13.1 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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15. Contents

1 Product profile 1
1.1 General description 1
1.2 Features and benefits 1
1.3 Applications 1
1.4 Quick reference data 1
2 Pinning information 1
3 Ordering information 2
4 Marking 2
5 Limiting values 2
6 Characteristics 4
7 Application information 7
8 Test information 7
8.1 Quality information 7
9 Package outline 8
10 Packing information 8
11 Soldering 9
12 Revision history 10
13 Legal information 11
13.1 Data sheet status 11
13.2 Definitions 11
13.3 Disclaimers 11
13.4 Trademarks 12
14 Contact information 12
15 Contents 13

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