

PUSBMxX4-TL series

High-speed USB OTG ESD protection diode arrays

Rev. 3 — 14 June 2012

Product data sheet

1. Product profile

1.1 General description

PUSBMxX4-TL is a series of four 4-channel ElectroStatic Discharge (ESD) diode arrays for USB 2.0 (On-The-Go (OTG)) interfaces. The devices provide protection to downstream components from ESD voltages up to ± 8 kV contact discharge. They offer three low capacitance ESD protection pins and one V_{BUS} protection diode. They are encapsulated in an ultra thin DFN1616-6 (SOT1189-1/XSON6) plastic package with 0.5 mm pitch. These features make the devices ideal for use in applications requiring component miniaturization, such as mobile phone handsets.

1.2 Features and benefits

- Pb-free, Restriction of Hazardous Substances (RoHS) and Dark Green compliant
- ESD protection according to IEC 61000-4-2 level 4: ± 8 kV contact discharge
- Electrical Fast Transients (EFT) protection according to IEC 61000-4-4 40A (5/50 ns)
- Three pairs of ultra low capacitance (1.1 pF typ.) rail-to-rail ESD protection diodes
- Ultra thin DFN1616-6 (SOT1189-1/XSON6) plastic package; 0.5 mm pitch

1.3 Applications

High-speed USB 2.0 and USB OTG connector ESD protection in:

- Cellular phone and Personal Communication System (PCS) mobile handsets
- Mobile internet devices
- Digital still cameras
- Portable media players

2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	low capacitance ESD protection	<p>Transparent top view</p>	<p>018aaa140</p>
2	low capacitance ESD protection		
3	low capacitance ESD protection		
4	not connected		
5	not connected		
6	V_{BUS} ESD protection		
7	ground (GND)		



3. Ordering information

Table 2. Ordering information

Type number	Package		Version
	Name	Description	
PUSBM5V5X4-TL	DFN1616-6	plastic, thermal enhanced extremely thin small outline package; no leads; 6 terminals; body 1.6 × 1.6 × 0.5 mm	SOT1189-1
PUSBM12VX4-TL			
PUSBM15VX4-TL			
PUSBM30VX4-TL			

4. Marking

Table 3. Marking codes

Type number	Marking code
PUSBM5V5X4-TL	XE
PUSBM12VX4-TL	XL
PUSBM15VX4-TL	XO
PUSBM30VX4-TL	30

5. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V _{RWM}	reverse standoff voltage	pins 1, 2, 3	-0.5	+5.5	V
		PUSBM5V5X4-TL pin 6 (V _{BUS})	-0.5	+5.5	V
		PUSBM12VX4-TL pin 6 (V _{BUS})	-0.5	+12	V
		PUSBM15VX4-TL pin 6 (V _{BUS})	-0.5	+15	V
		PUSBM30VX4-TL pin 6 (V _{BUS})	-0.5	+30	V
V _{ESD}	electrostatic discharge voltage	IEC 61000-4-2, level 4; pins 1, 2, 3, 6 to GND; [1]	-	±8	kV
P _{PP}	peak pulse power	t _p = 8/20 μs			
		pins 1, 2, 3; V _{CL} = 12 V	-	35	W
		PUSBM5V5X4-TL pin 6 (V _{BUS}); V _{CL} = 9.2 V	-	100	W
		PUSBM12VX4-TL pin 6 (V _{BUS}); V _{CL} = 16 V	-	100	W
		PUSBM15VX4-TL pin 6 (V _{BUS}); V _{CL} = 22 V	-	100	W
	PUSBM30VX4-TL pin 6 (V _{BUS}); V _{CL} = 43 V	-	100	W	
I _{PP}	peak pulse current	t _p = 8/20 μs			
		pins 1, 2, 3	-	3	A
		PUSBM5V5X4-TL pin 6 (V _{BUS})	-	12	A
		PUSBM12VX4-TL pin 6 (V _{BUS})	-	6	A
		PUSBM15VX4-TL pin 6 (V _{BUS})	-	3	A
	PUSBM30VX4-TL pin 6 (V _{BUS})	-	2	A	

Table 4. Limiting values ...continued
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
T _{reflow(peak)}	peak reflow temperature	t _p ≤ 10 s	-	+260	°C
T _{amb}	ambient temperature		-30	+85	°C
T _{stg}	storage temperature		-55	+150	°C

[1] Device is qualified with 1000 pulses of ±8 kV contact discharges each, according to IEC61000-4-2 far exceeding level 4 (±8 kV contact discharge).

6. Characteristics

Table 5. Characteristics
T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _F	forward voltage		0.6	-	1.2	V
Low capacitance ESD protection						
V _{BRzd}	Zener diode breakdown voltage	I _{test} = 1 mA	6	-	10	V
C _(I/O-GND)	input/output to ground capacitance	V _{bias(DC)} = 0.5 V; f = 1 MHz; pins 1, 2, 3 to GND	[1]	-	1.1	1.3 pF
ΔC _(I/O-GND)	input/output to ground capacitance variation	V _{bias(DC)} = 0.5 V; f = 1 MHz	-	0.02	-	pF
C _(I/O-I/O)	input/output to input/output capacitance	V _{bias(DC)} = 0.5 V; f = 1 MHz; pins 1 to 2, 1 to 3, 2 to 3	-	0.5	-	pF
I _{RM}	reverse leakage current	pins 1, 2, 3 to GND; V _{RWM} = 5.5 V	-	100	1000	nA
V_{BUS} ESD protection						
V _{BR}	breakdown voltage	pin 6 (V _{BUS}) to GND; I _{test} = 1 mA				
	PUSBM5V5X4-TL		6.4	6.8	7.2	V
	PUSBM12VX4-TL		12.5	14.5	16	V
	PUSBM15VX4-TL		17	18	19	V
	PUSBM30VX4-TL		32	36	40	V
C _d	diode capacitance	V _{bias(DC)} = 0.5 V; f = 1 MHz; pin 6 (V _{BUS}) to GND				
	PUSBM5V5X4-TL		-	165	220	pF
	PUSBM12VX4-TL		-	73	100	pF
	PUSBM15VX4-TL		-	60	90	pF
	PUSBM30VX4-TL		-	50	70	pF
I _{RM}	reverse leakage current	pin 6 (V _{BUS}) to GND				
	PUSBM5V5X4-TL	V _{RWM} = 5.5 V	-	200	500	nA
	PUSBM12VX4-TL	V _{RWM} = 12 V	-	1	100	nA
	PUSBM15VX4-TL	V _{RWM} = 15 V	-	1	100	nA
	PUSBM30VX4-TL	V _{RWM} = 30 V	-	1	100	nA

[1] Guaranteed by design.

7. Application information

7.1 Typical application

The devices are designed to protect USB interfaces from downstream ESD. They offer three low capacitance ESD protection channels for D-, D+ and ID and a high-voltage ESD protection channel for V_{BUS}.

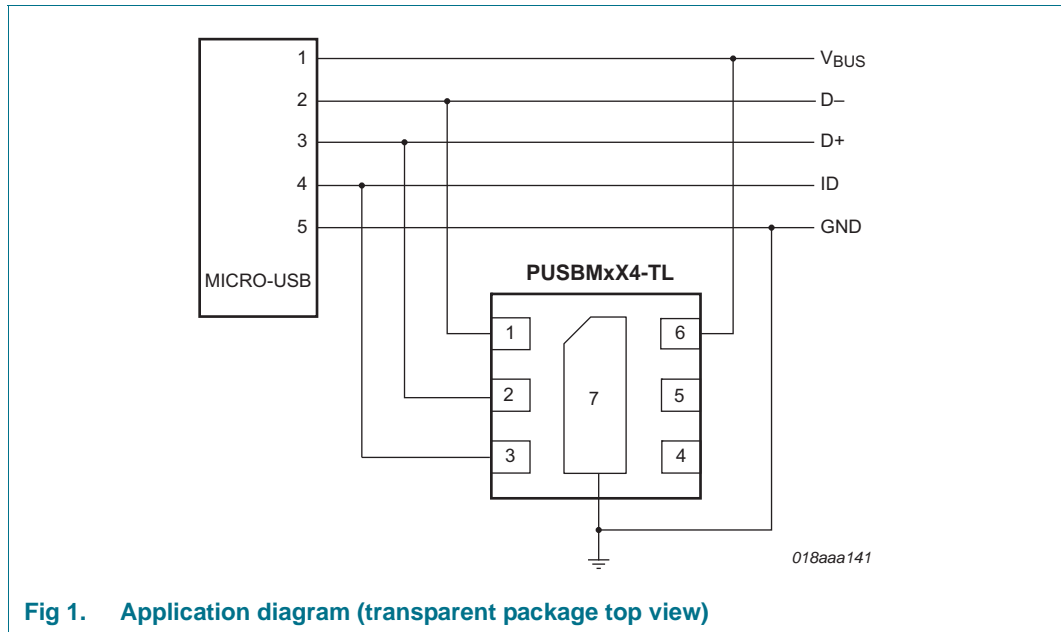


Fig 1. Application diagram (transparent package top view)

7.2 Insertion loss

The setup for measuring frequency response curves in a 50 Ω system is shown in [Figure 2](#). The frequency response curves for the low capacitance ESD protection channels (pins 1 to 3) are depicted in [Figure 3](#).

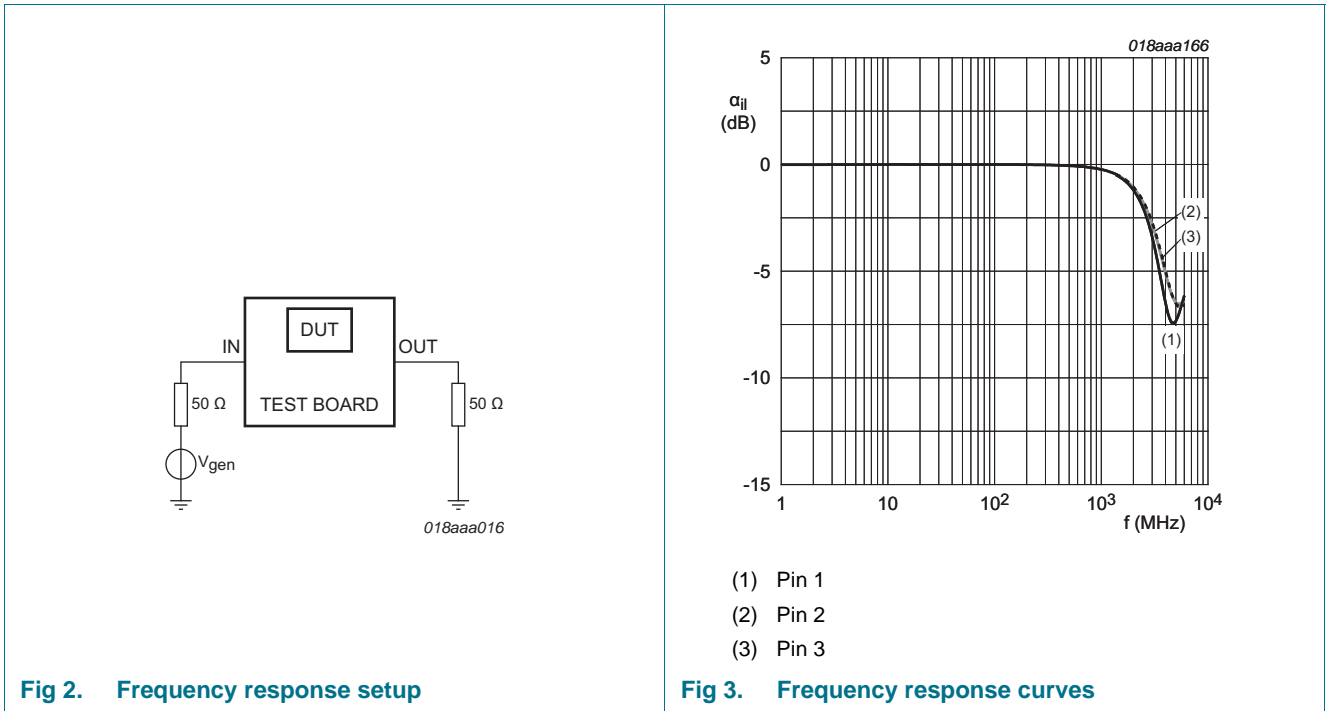


Fig 2. Frequency response setup

Fig 3. Frequency response curves

8. Package outline

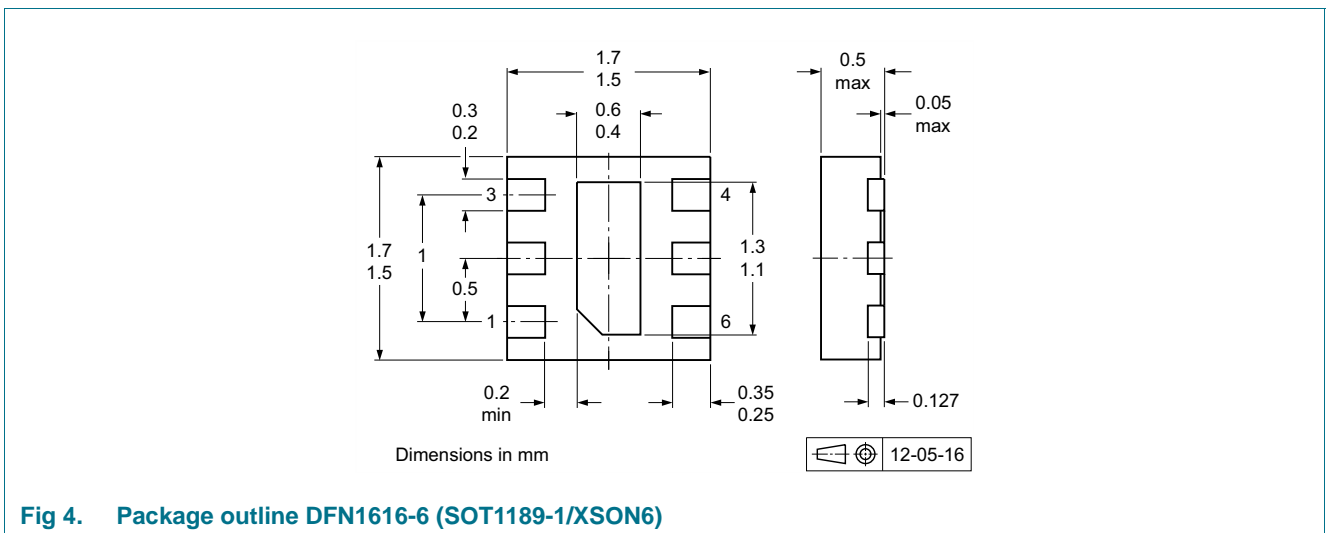
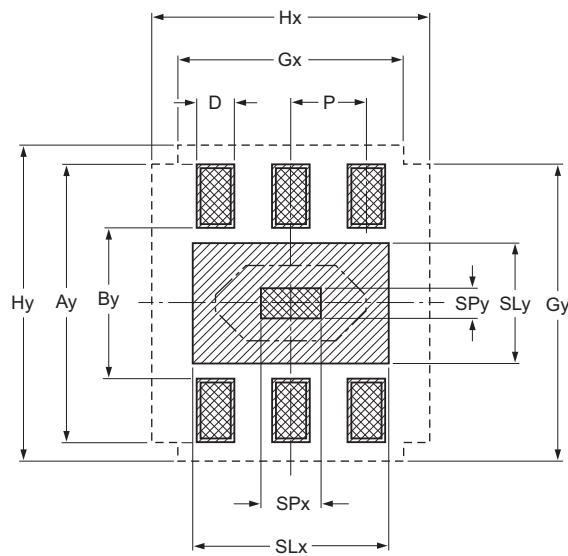




Fig 4. Package outline DFN1616-6 (SOT1189-1/XSON6)

9. Soldering

Footprint information for reflow soldering of HXSON6 package

SOT1189-1



-  solder land
-  solder land plus solder paste
- occupied area
- solder resist

DIMENSIONS in mm

P	Ay	By	D	SLx	SLy	SPx	SPy	Gx	Gy	Hx	Hy
0.50	1.85	1.05	0.25	1.3	0.8	0.4	0.2	1.5	1.85	1.85	2.1

Issue date 11-06-27
11-07-06

sot1189-1_fr

Fig 5. Reflow soldering footprint DFN1616-6 (SOT1189-1/XSON6)

10. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PUSBMXX4-TL_SER v.3	20120614	Product data sheet	-	PUSBMXX4-TL_SER v.2
Modifications:				
			<ul style="list-style-type: none">• Section 2 "Pinning information": simplified outline graph updated• Figure 1 updated• Figure 4 replaced by minimized package outline	
PUSBMXX4-TL_SER v.2	20120416	Preliminary data sheet	-	PUSBMXX4-TL_SER v.1
PUSBMXX4-TL_SER v.1	20111209	Preliminary data sheet	-	-

11. Legal information

11.1 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.nxp.com>.

11.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

11.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

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

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nxp.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Non-automotive qualified products — Unless this data sheet expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

11.4 Trademarks

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

12. Contact information

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: salesaddresses@nxp.com

13. Contents

1 Product profile 1

1.1 General description 1

1.2 Features and benefits 1

1.3 Applications 1

2 Pinning information 1

3 Ordering information 2

4 Marking 2

5 Limiting values 2

6 Characteristics 3

7 Application information 4

7.1 Typical application 4

7.2 Insertion loss 5

8 Package outline 5

9 Soldering 6

10 Revision history 7

11 Legal information 8

11.1 Data sheet status 8

11.2 Definitions 8

11.3 Disclaimers 8

11.4 Trademarks 9

12 Contact information 9

13 Contents 10

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© NXP B.V. 2012.

All rights reserved.

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 14 June 2012

Document identifier: PUSBMXX4-TL_SER