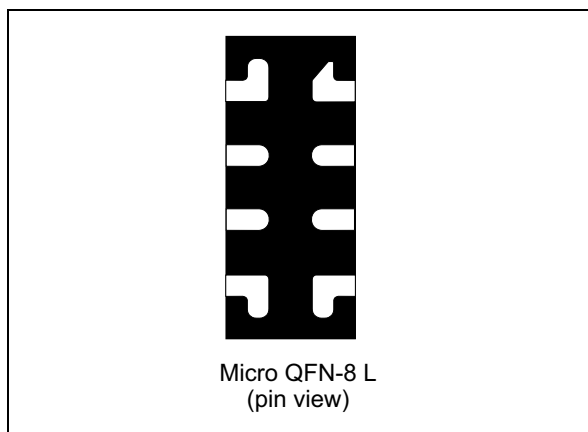


Common mode filter with ESD protection for USB 2.0 interface

Datasheet — production data



Features

- Integrated common mode filter
- Differential pair ESD protection
- 16 V V_{BUS} ESD and EOS protection
- ID pin ESD protection
- Low profile micro QFN-8L package
- High bandwidth: > 6 GHz
- Optimized for high speed USB 2.0
- High common mode attenuation at 900 MHz and 1.8 GHz
- Support for audio over USB 2.0 thanks to bidirectional ESD protection
- Ultra compact, low board space
- Low height: < 0.55 mm

Complies with the following standards:

- IEC 61000-4-2 level 4:
 - ± 15 kV (air discharge)
 - ± 8 kV (contact discharge)
- RoHS2 compliant

Applications

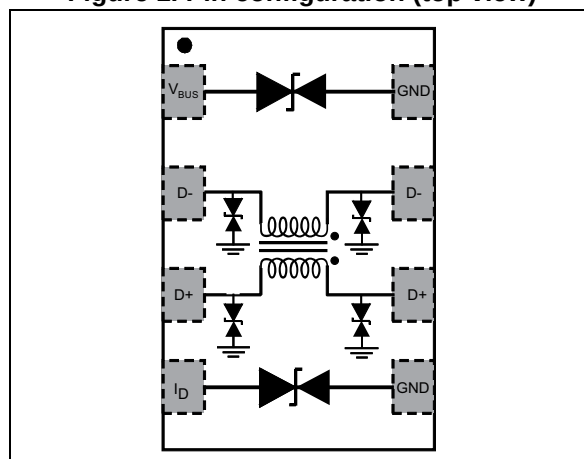
Where transient overvoltage protection in ESD sensitive equipment is required, such as:

- Computers
- Printers
- Communication systems
- Cellular phone handsets and accessories
- Video equipment

Description

The ECMF02-4CMX8 affords key component integration such as common mode filter D+ and D- lines and ESD protection on all lines. This device offers an optimized flow-through footprint for USB 2.0 applications.

Figure 1. Pin configuration (top view)



1 Characteristics

Table 1. Absolute maximum ratings (T_{amb} = 25 °C)

Symbol	Parameter		Value	Unit
V _{PP}	Peak pulse voltage ⁽¹⁾	ESD discharge IEC 61000-4-2, level 4		
		Contact discharge on D+/D- pins	10	kV
		Contact discharge on V _{BUS} and I _D pins	20	
		Air discharge on all pins	30	
P _{PP}	Peak pulse power (8/20μs) on V _{BUS}		150	W
I _{PP}	Peak pulse current (8/20μs) on V _{BUS}		4.8	A
T _j	Maximum operating junction temperature		-40 to +125	°C
T _{stg}	Storage temperature range		-55 to +150	°C

1. Measurements done on IEC 61000-4-2 test bench. For further details see Application note AN3353.

Figure 2. Electrical characteristics - definitions

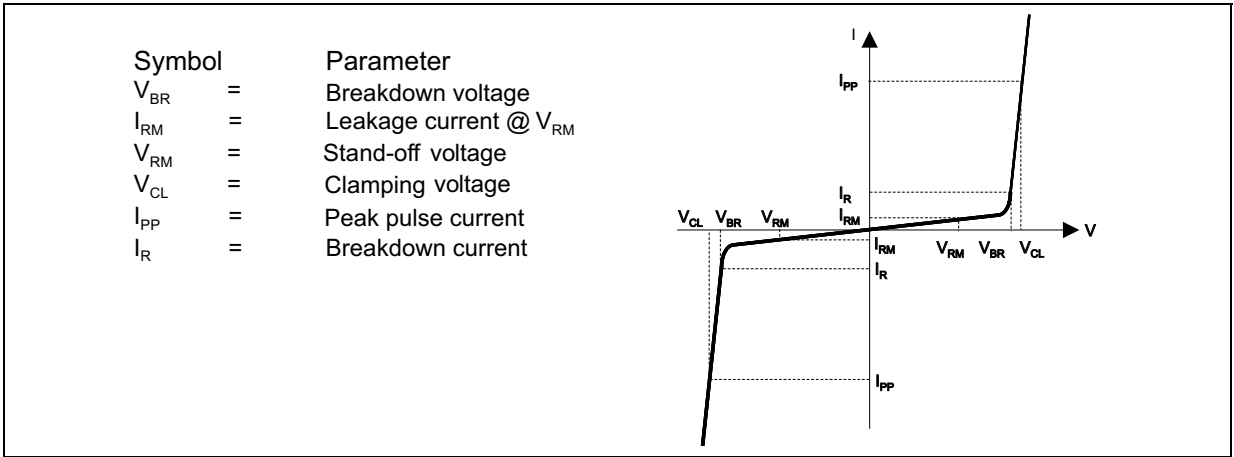


Table 2. Electrical characteristics (values, $T_{amb} = 25\text{ °C}$)

Symbol	Test conditions	Min.	Typ.	Max.	Unit
Data lines					
V_{BR}	$I_R = 1\text{ mA}$	6			V
I_{RM}	$V_{RM} = 5.5\text{ V per line}$			100	nA
R_{DC}	DC serial resistance on data line		3	4	Ω
V_{BUS}					
V_{BR}	$I_R = 1\text{ mA}$	15	16.5	18	V
I_{RM}	$V_{RM} = 12\text{ V}$			50	nA
V_{CL}	Clamping voltage. $I_{PP} = 1\text{ A}$, $t_p = 8/20\text{ }\mu\text{s}$			20	V
V_{CL}	Clamping voltage. $I_{PP} = 2.5\text{ A}$, $t_p = 8/20\text{ }\mu\text{s}$			24	V
I_D					
V_{BR}	$I_R = 1\text{ mA}$	6			V
I_{RM}	$V_{RM} = 1.5\text{ V per line}$			100	nA

Figure 3. SDD21 differential attenuation measurement ($Z_{0\text{ diff}} = 90\ \Omega$) for data lines D+ and D-

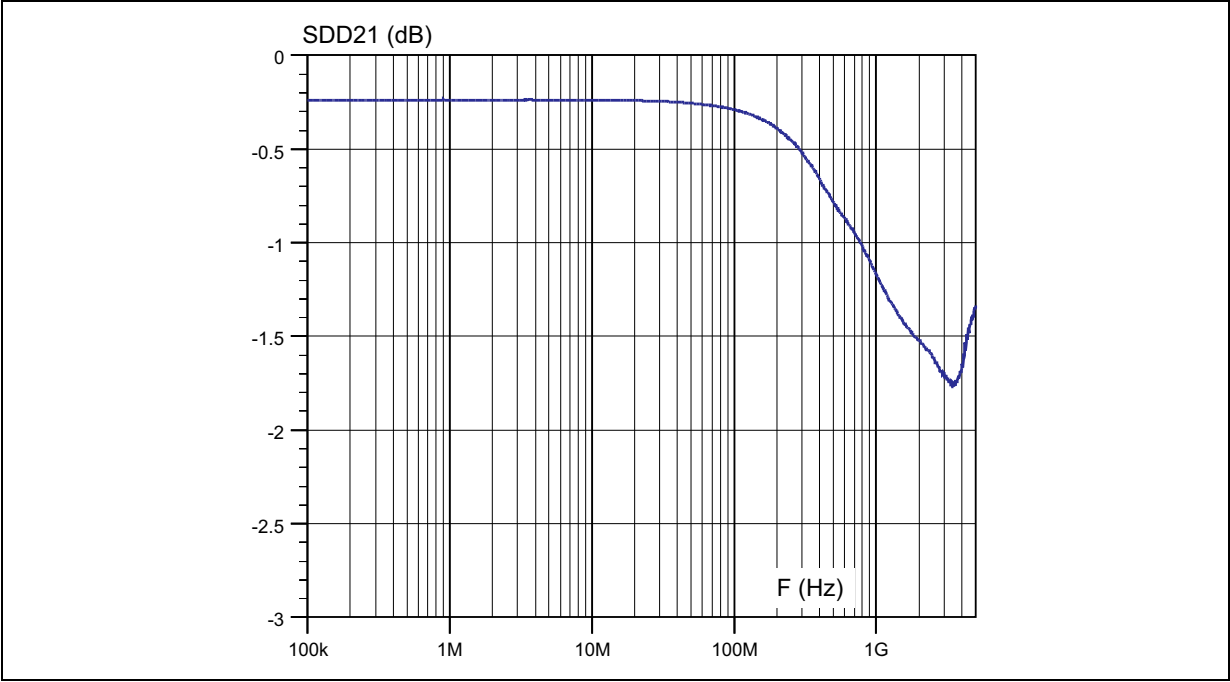


Figure 4. SCC21 common mode attenuation measurement ($Z_{0\text{ com}} = 45\ \Omega$)

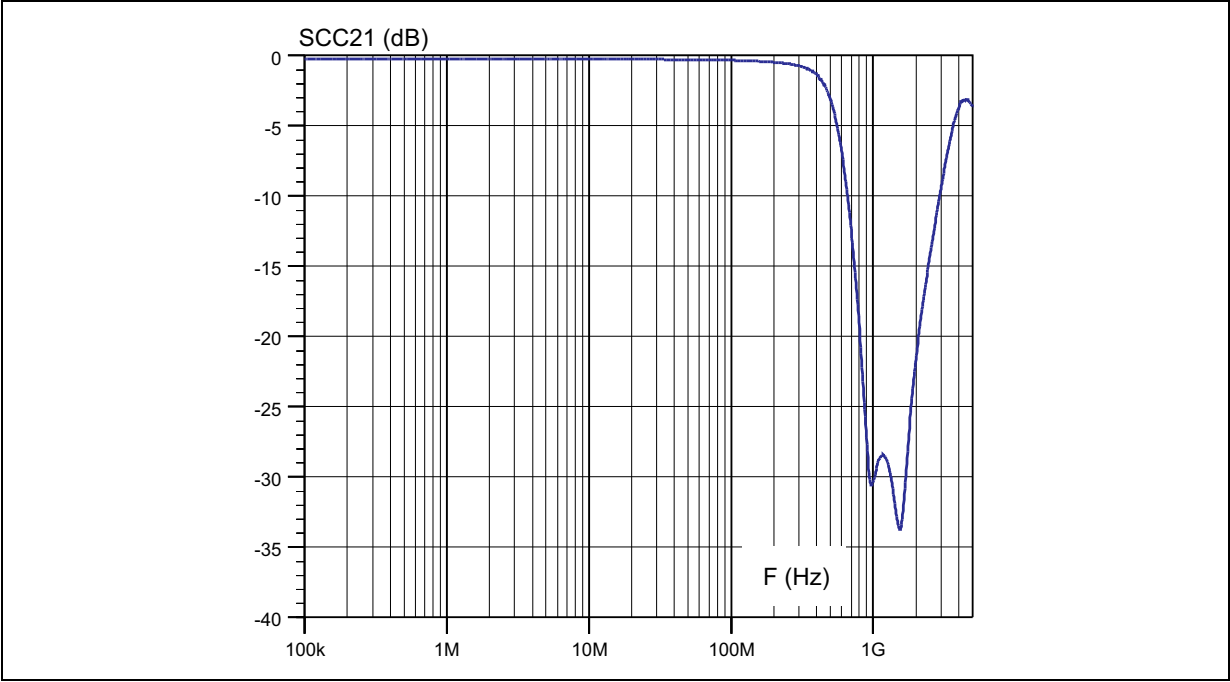


Figure 5. ID frequency response measurement ($Z_0 = 75 \Omega$)

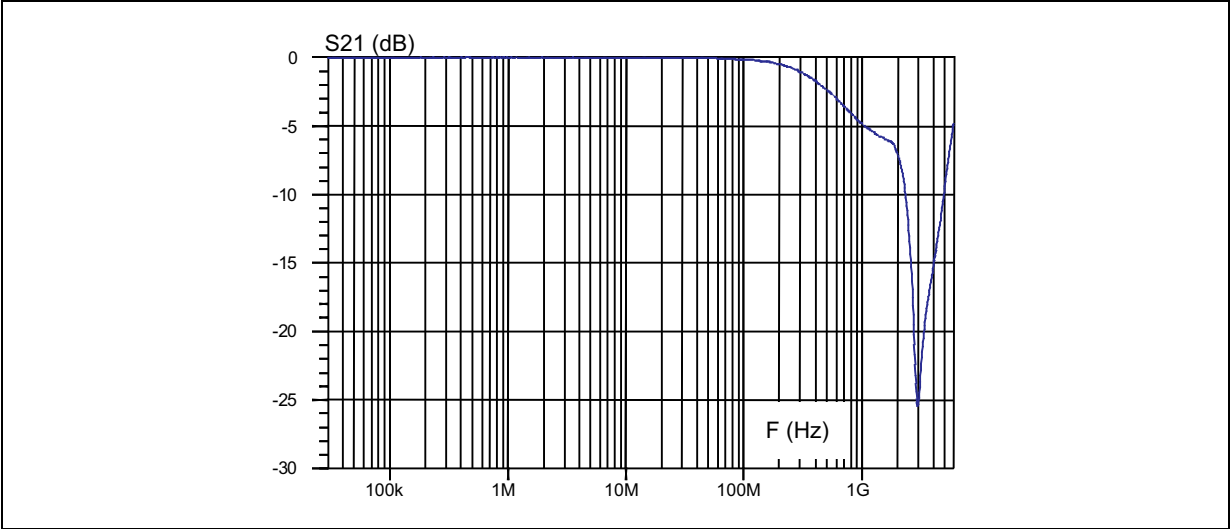


Figure 6. Differential (Z_{DD21}) and common mode (Z_{CC21}) impedance versus frequency

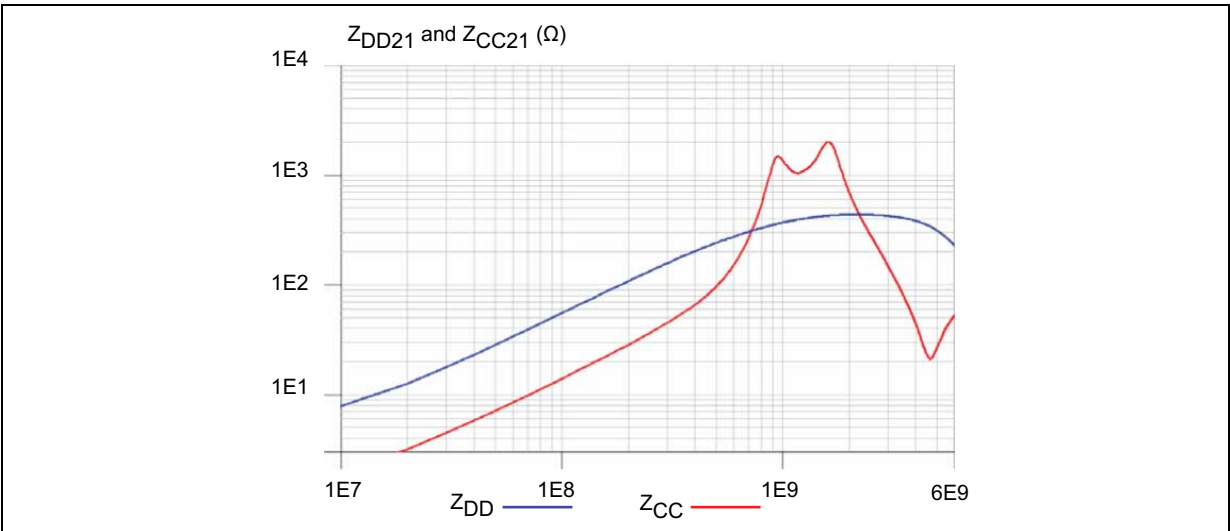


Figure 7. ESD test conditions

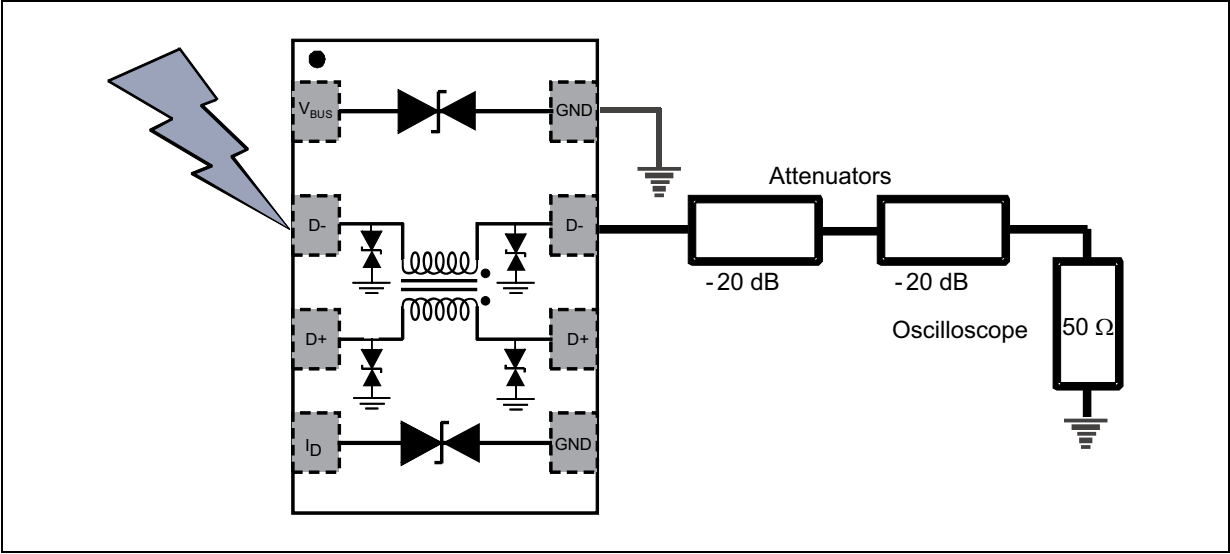


Figure 8. ESD response to IEC 61000-4-2 (+8 kV contact discharge) on V_{BUS}

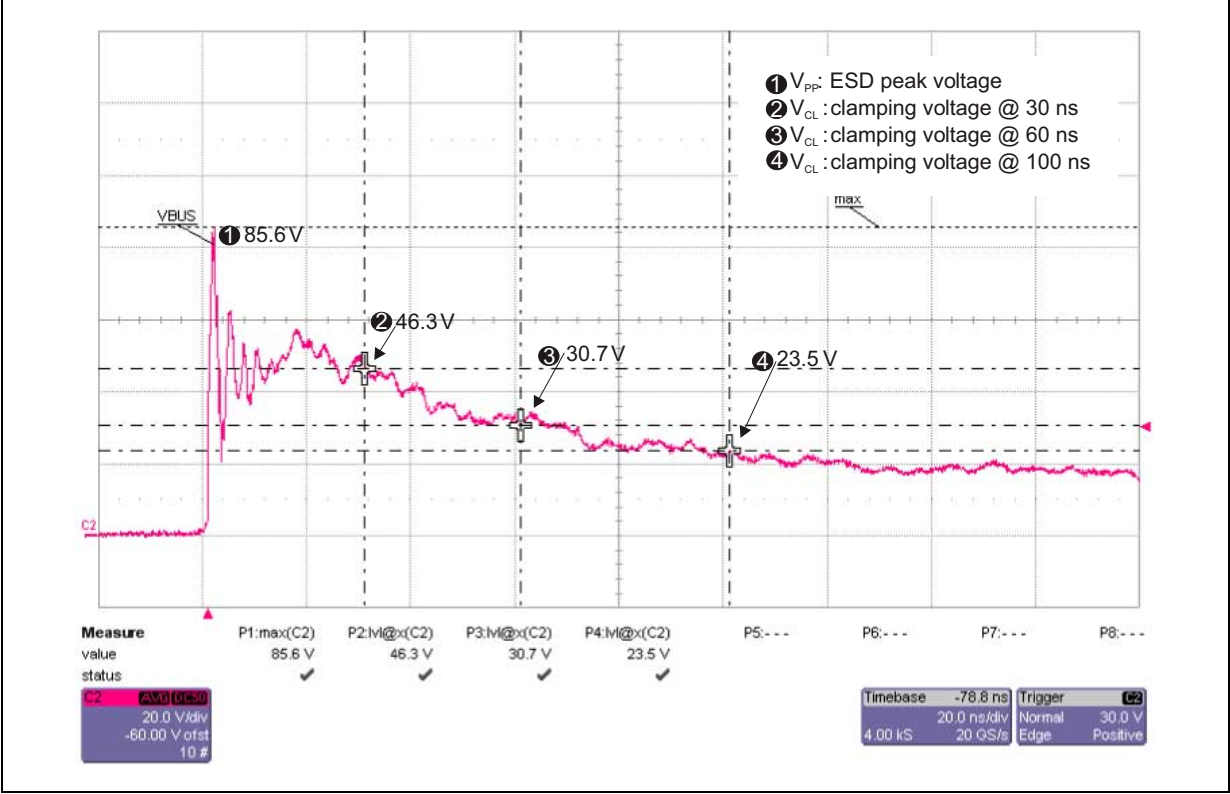


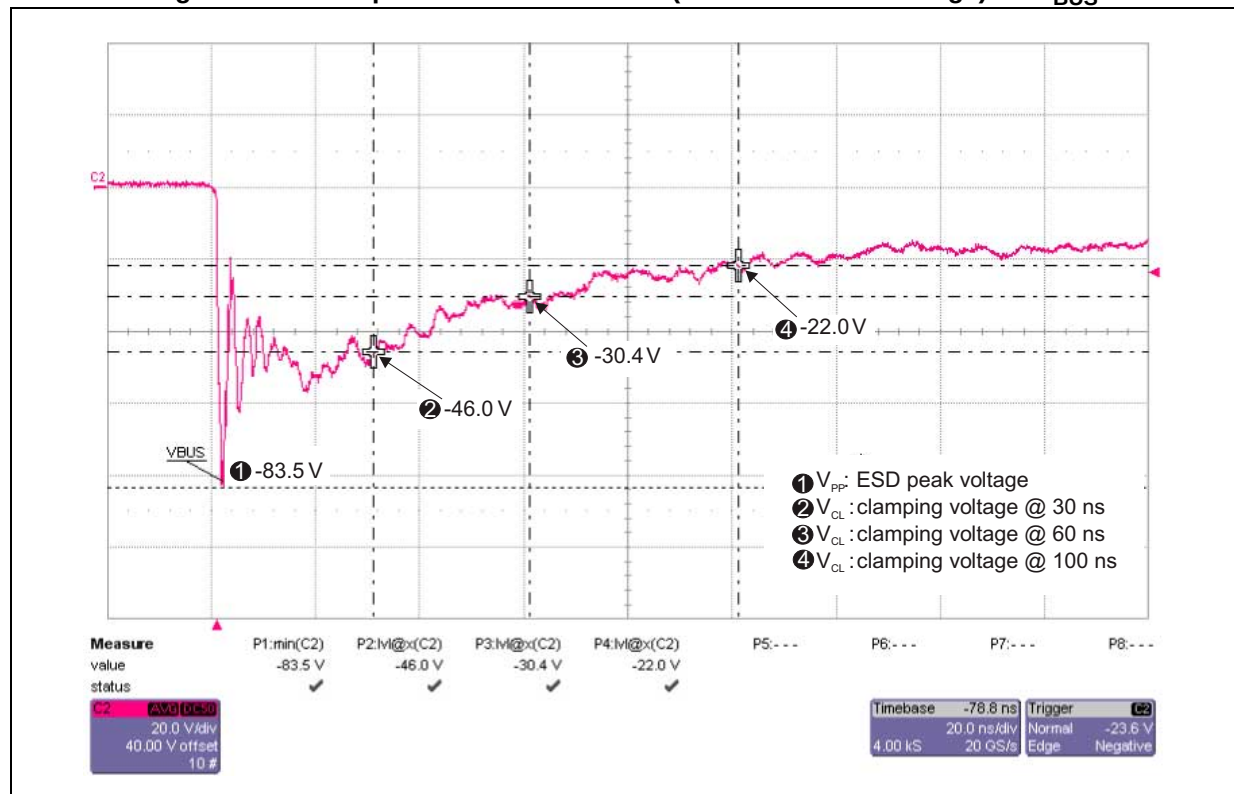
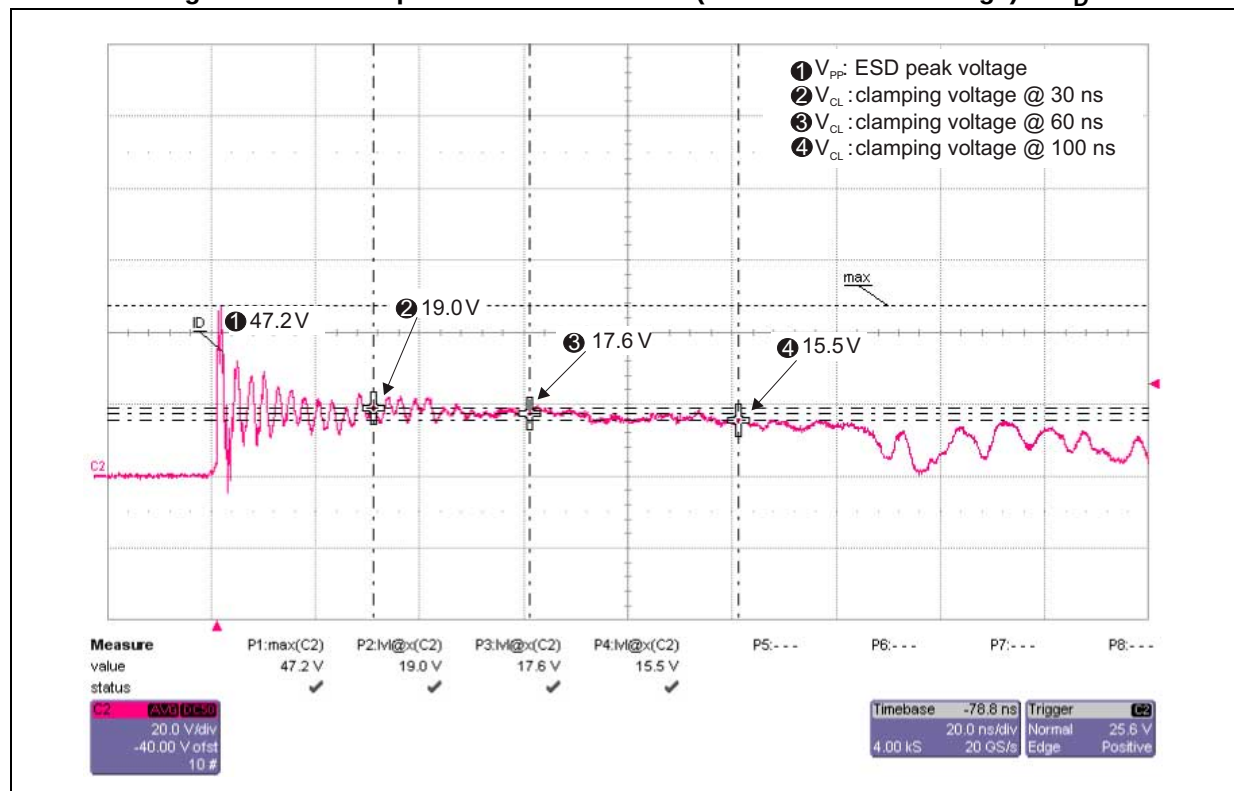
Figure 9. ESD response to IEC 61000-4-2 (-8 kV contact discharge) on V_{BUS} Figure 10. ESD response to IEC 61000-4-2 (+8 kV contact discharge) on I_D 

Figure 11. ESD response to IEC 61000-4-2 (-8 kV contact discharge) on I_D

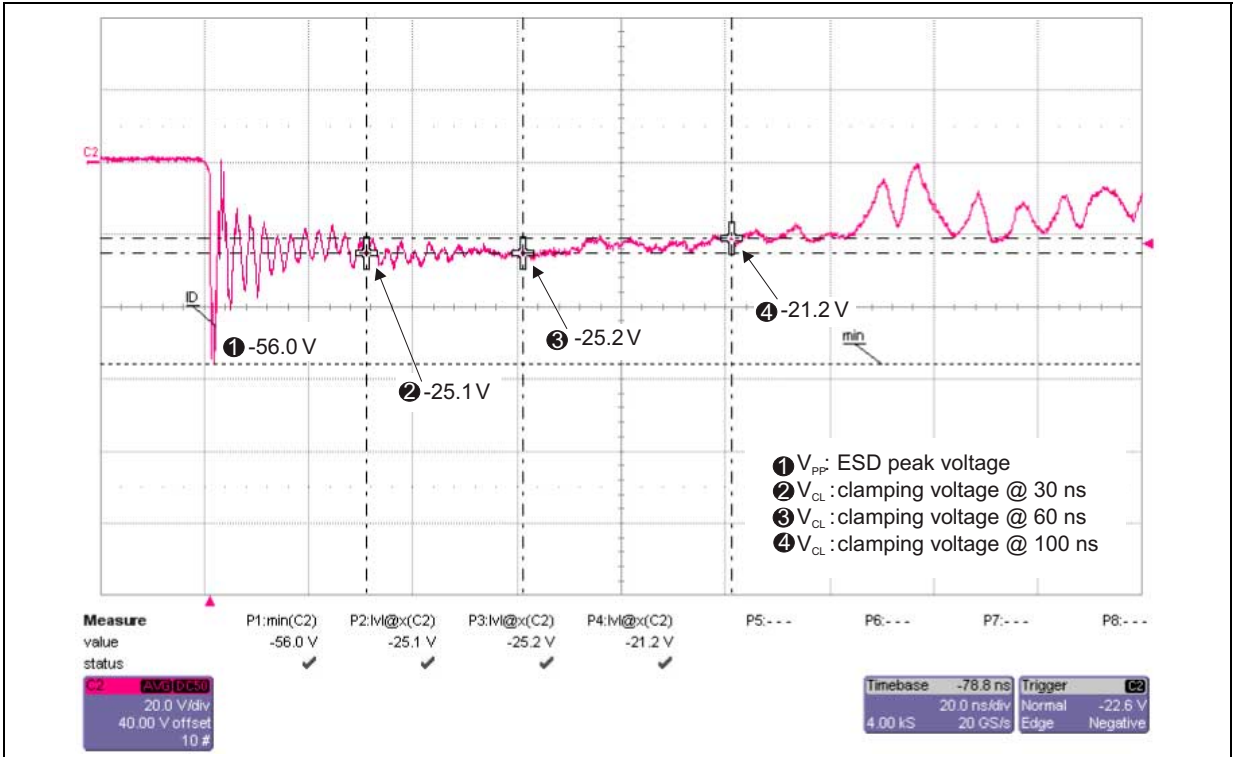


Figure 12. ESD response to IEC 61000-4-2 (+8 kV contact discharge) on differential lane

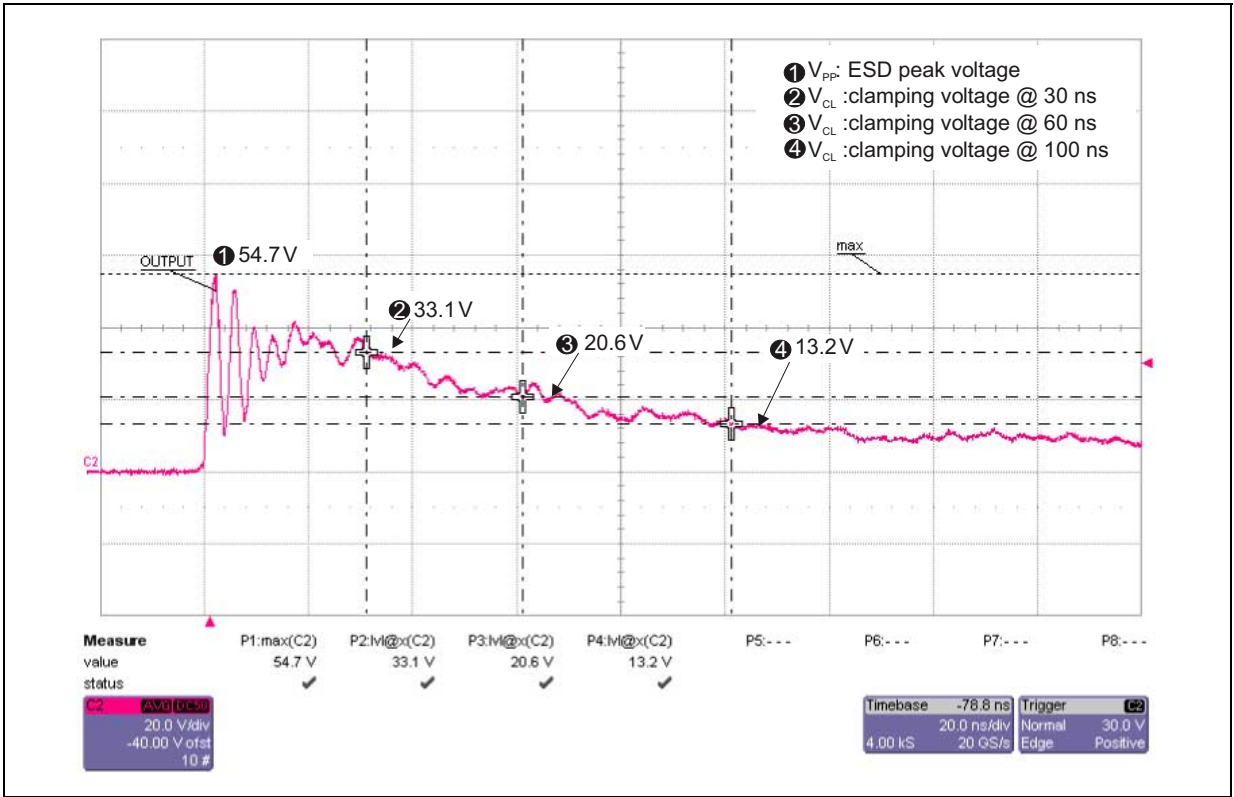


Figure 13. ESD response to IEC 61000-4-2 (-8 kV contact discharge) on differential lane

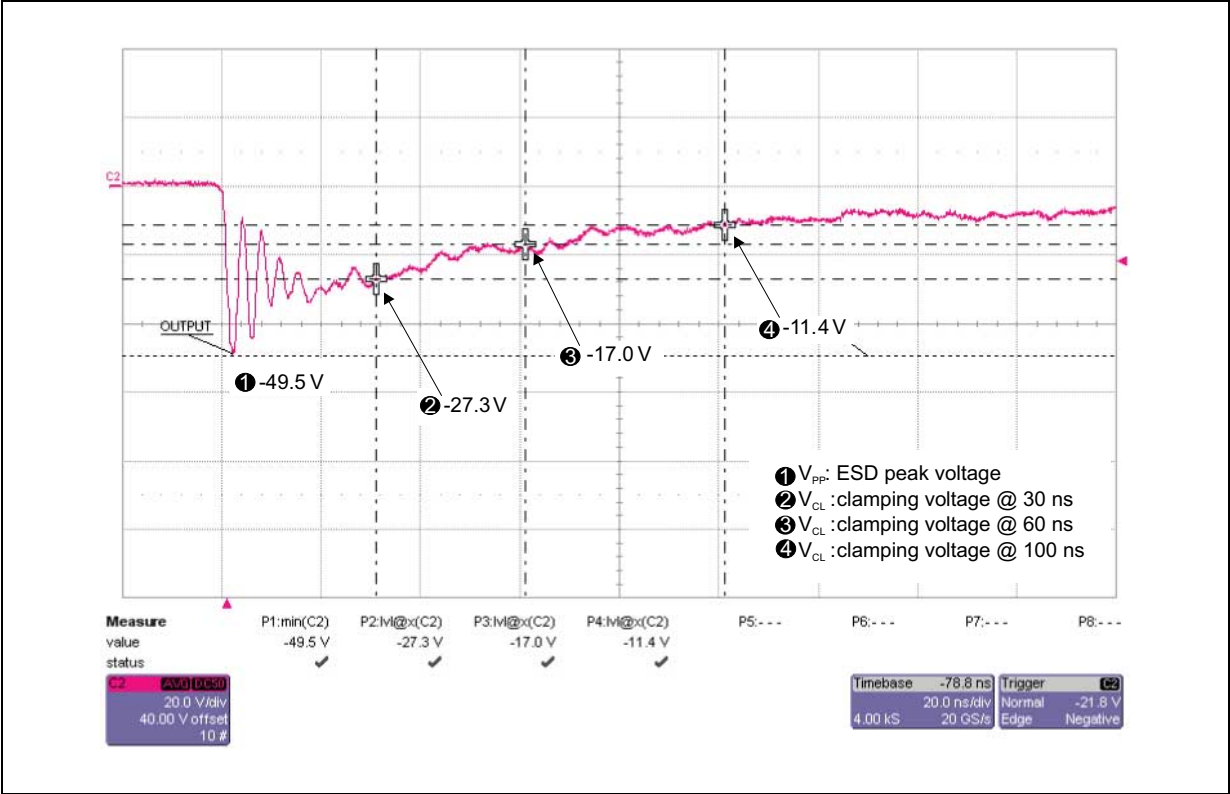


Figure 14. Eye diagram (loaded by $Z_{diff} = 90 \Omega$) with USB2.0 [mask 1] board only

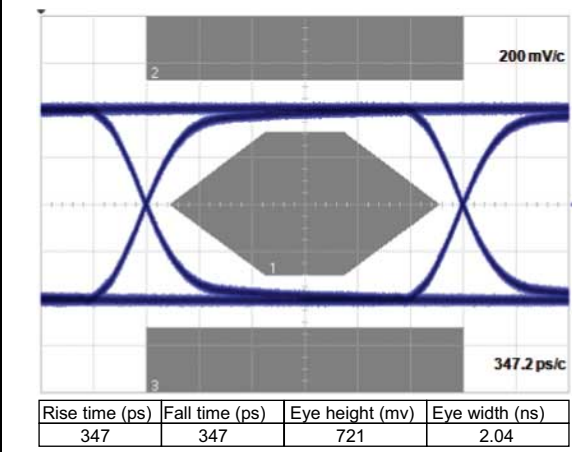


Figure 15. Eye diagram (loaded by $Z_{diff} = 90 \Omega$) with USB2.0 [mask 1] board with ECM02-4CMX8

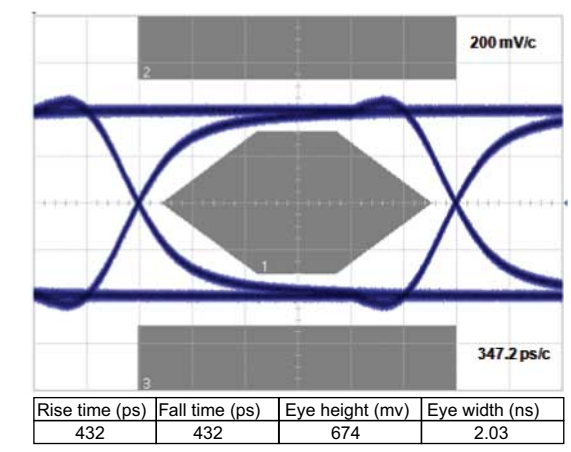


Figure 16. TDR measurement (loaded by $Z_{diff} = 90 \Omega$), rise time 400 ps

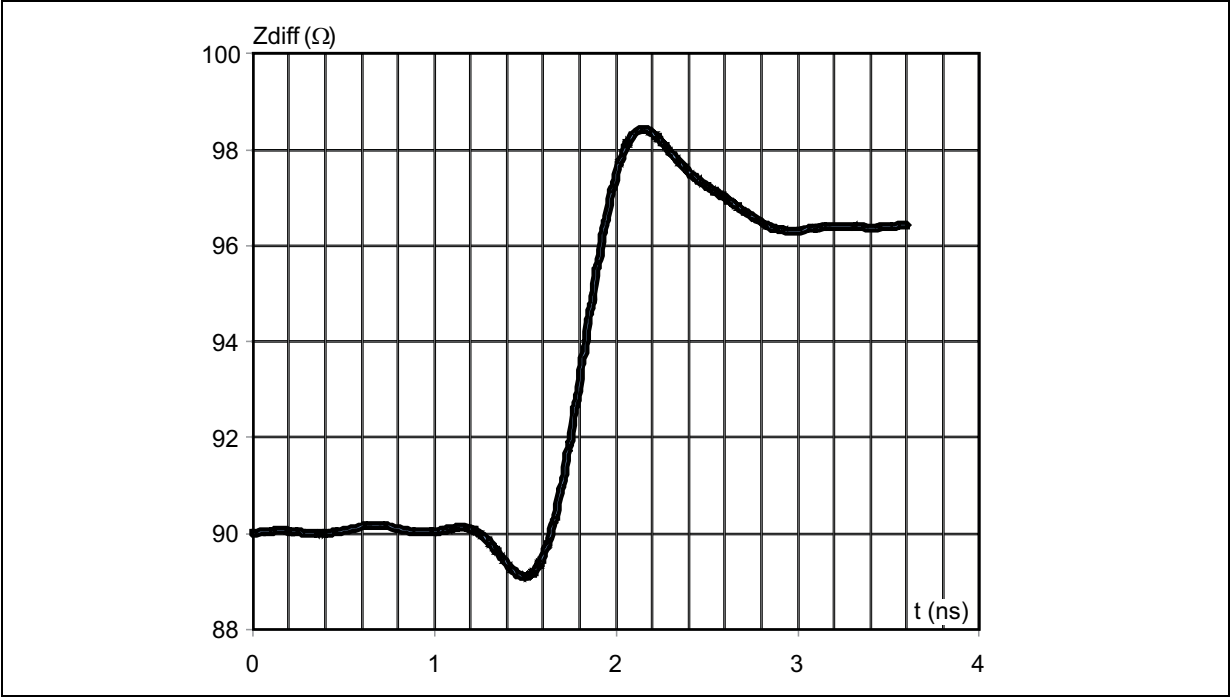


Figure 17. HS sync

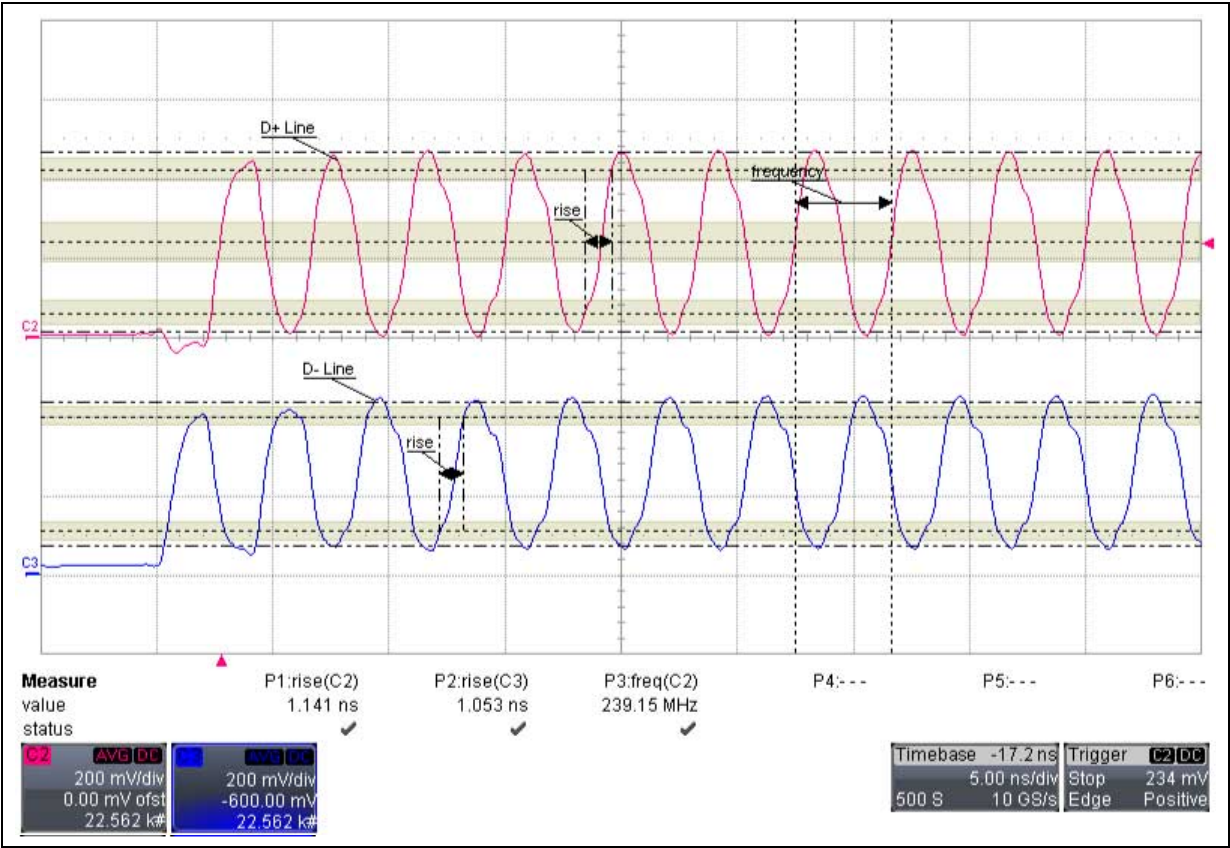


Figure 18. Total harmonic distortion on differential lanes

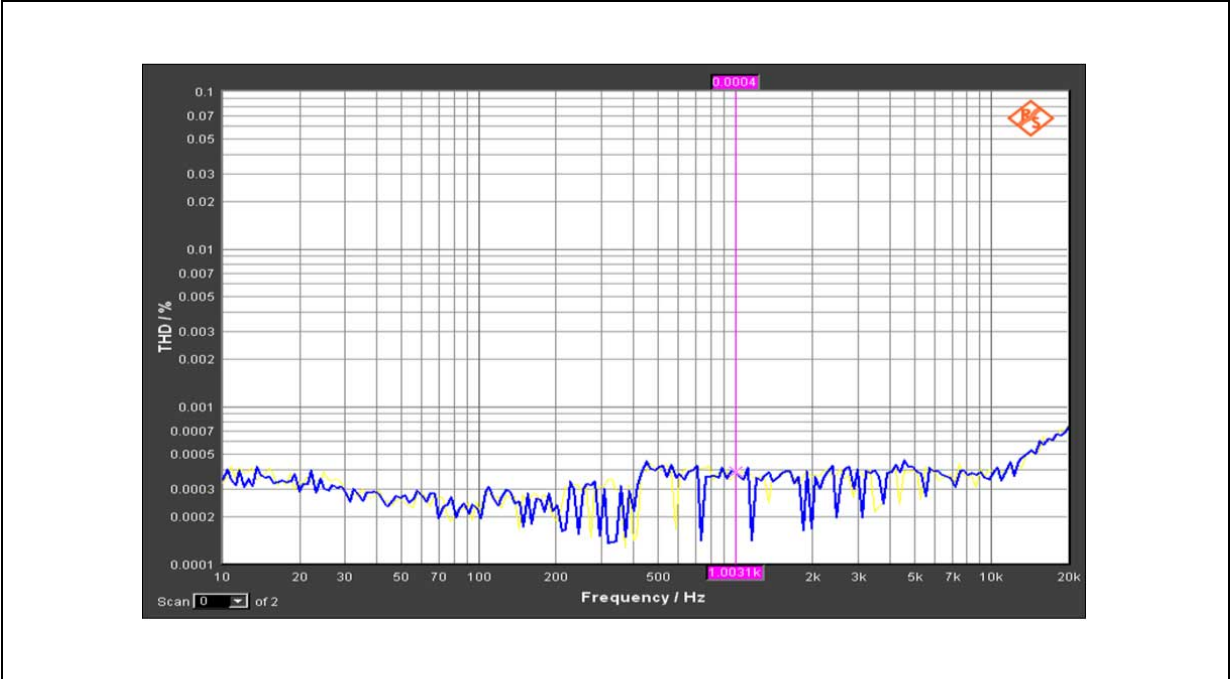
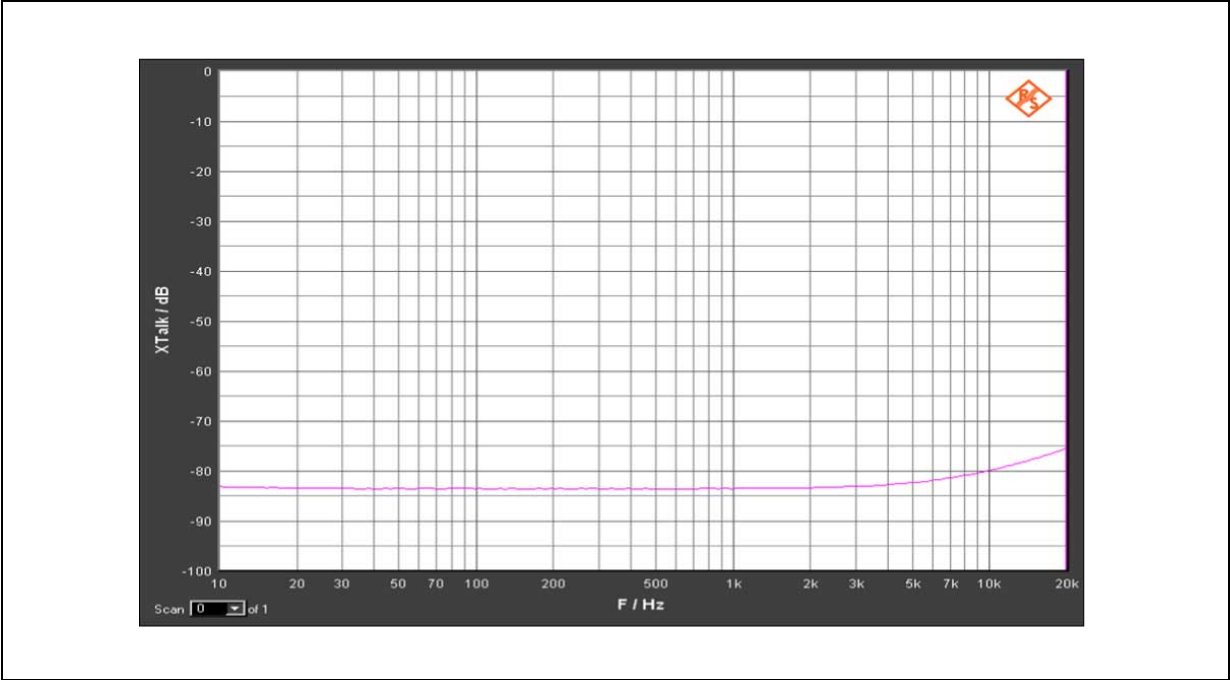
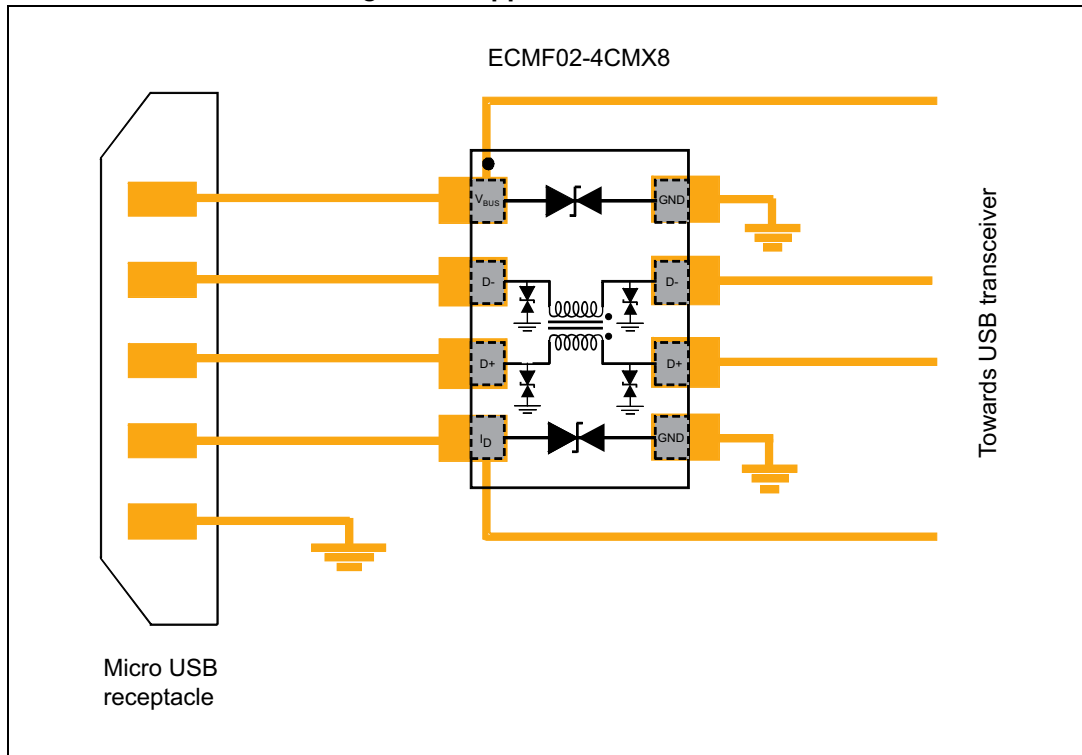


Figure 19. Crosstalk on differential lanes



2 Application schematic

Figure 20. Application schematic



3 Package information

- Epoxy meets UL94, V0
- Lead-free packages

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

3.1 Micro QFN-8L package information

Figure 21. Micro QFN-8L package outline

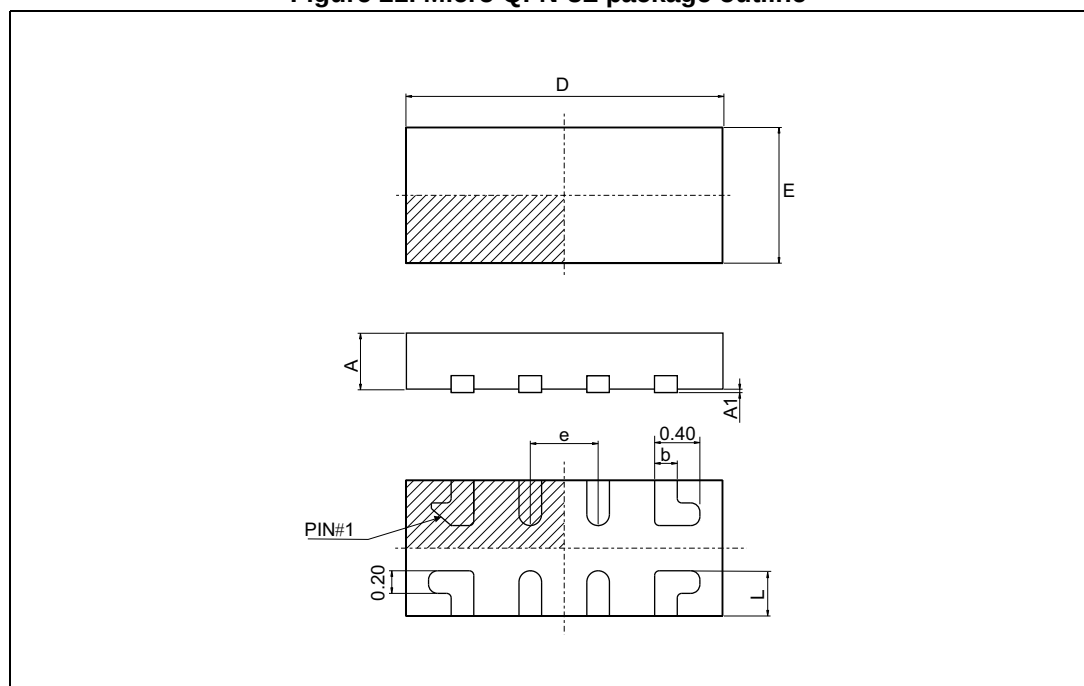


Table 3. Micro QFN-8L package mechanical data

Ref.	Dimensions					
	Millimeters			Inches ⁽¹⁾		
	Typ.	Min.	Max.	Typ.	Min.	Max.
A	0.50	0.45	0.55	0.020	0.018	0.022
A1	0.02	0.00	0.05	0.0008	0.00	0.002
b	0.20	0.15	0.25	0.008	0.006	0.010
D	2.50	2.45	2.55	0.098	0.096	0.100
E	1.20	1.15	1.25	0.047	0.045	0.049

Table 3. Micro QFN-8L package mechanical data (continued)

Ref.	Dimensions					
	Millimeters			Inches ⁽¹⁾		
	Typ.	Min.	Max.	Typ.	Min.	Max.
e	0.50	0.45	0.55	0.020	0.018	0.022
L	0.40	0.30	0.50	0.016	0.012	0.020

1. Values in inches are converted from mm and rounded to 4 decimal digits.

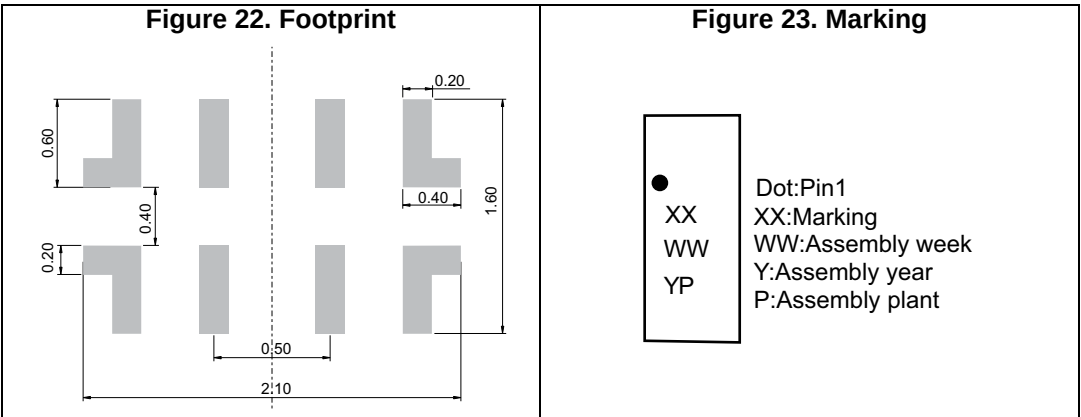
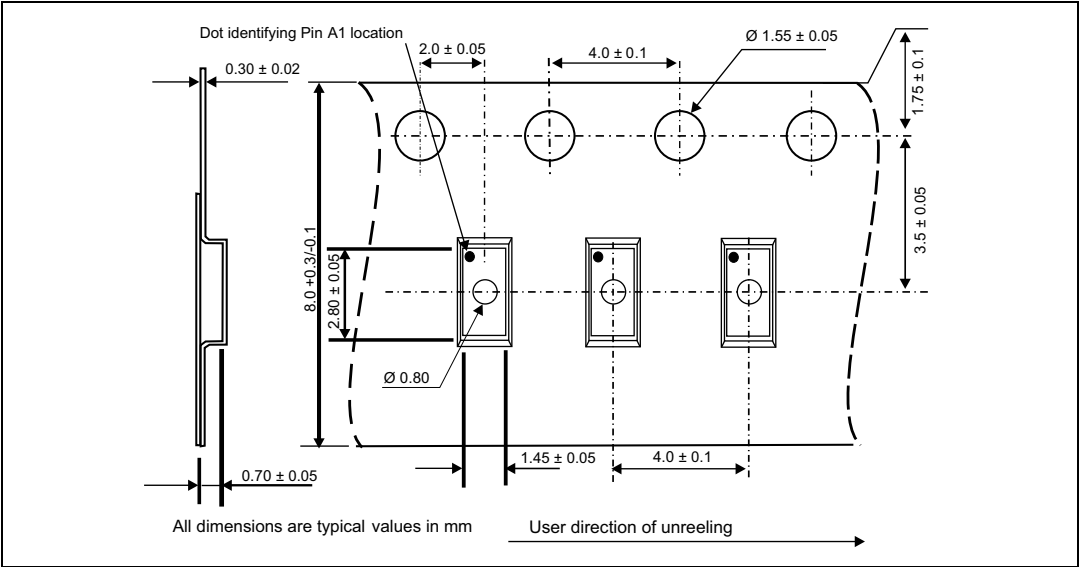


Figure 24. Tape and reel specifications



Note: More packing information is available in the application notes: AN1751: "EMI Filters: Recommendations and measurements"

4 Ordering information

Figure 25. Ordering information scheme

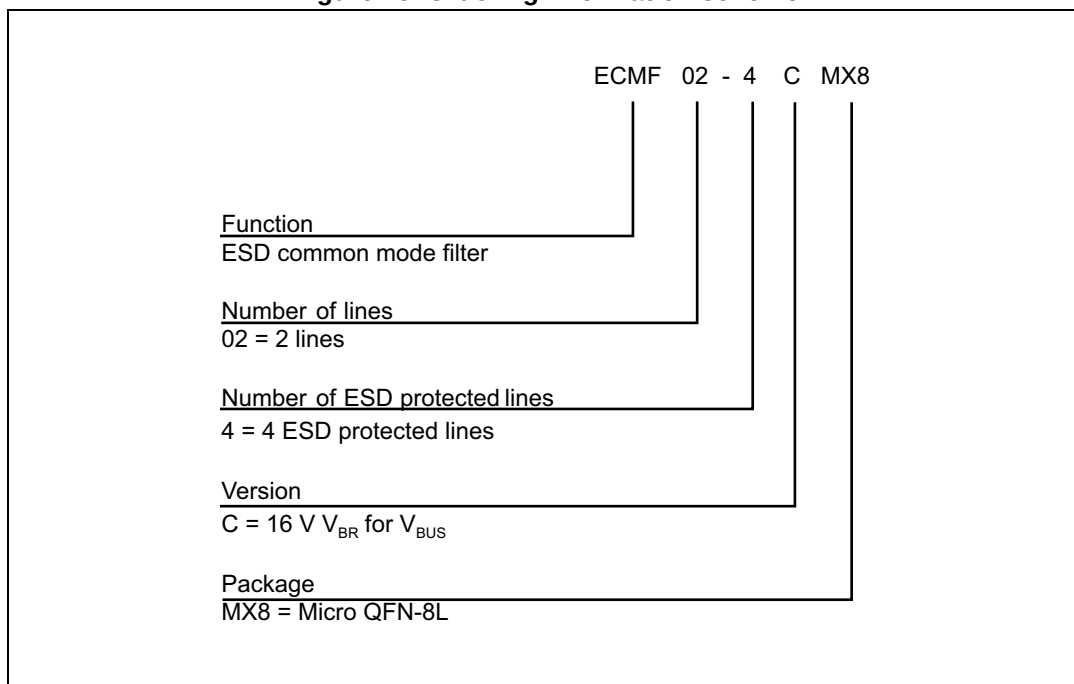


Table 4. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
ECMF02-4CMX8	KG	Micro QFN-8L	3.7 mg	3000	Tape and reel

For the latest information on available order codes see the product pages on: www.st.com.

5 Revision history

Table 5. Document revision history

Date	Revision	Changes
19-Sep-2012	1	Initial release.
27-May-2014	2	Updated Figure 24 , Figure 25 and reformatted the document.
05-May-2015	3	Added Figure 6 . Updated Table 1 . Format updated to current standard.

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2015 STMicroelectronics – All rights reserved

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[STMicroelectronics:](#)

[ECMF02-4CMX8](#)