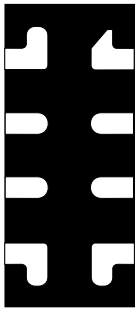
ECMF02-4CMX8

Common mode filter with ESD protection for USB 2.0 interface

Datasheet – production data



Micro QFN-8 L
(pin view)

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

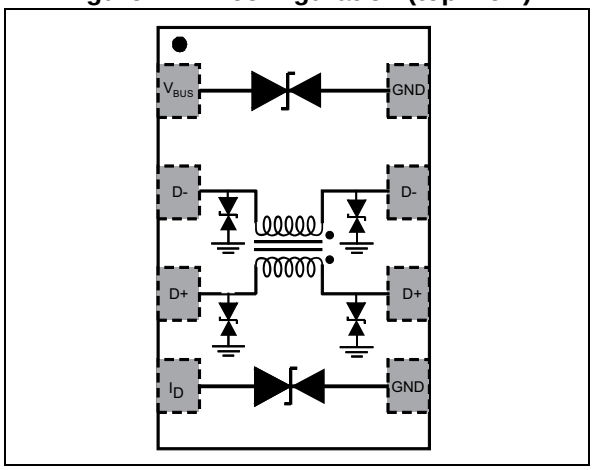
Where transient overvoltage protection in ESD sensitive equipment is required, such as:

- 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 Contact discharge on V_{BUS} and I_D pins Air discharge on all pins	 10 20 30	kV
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

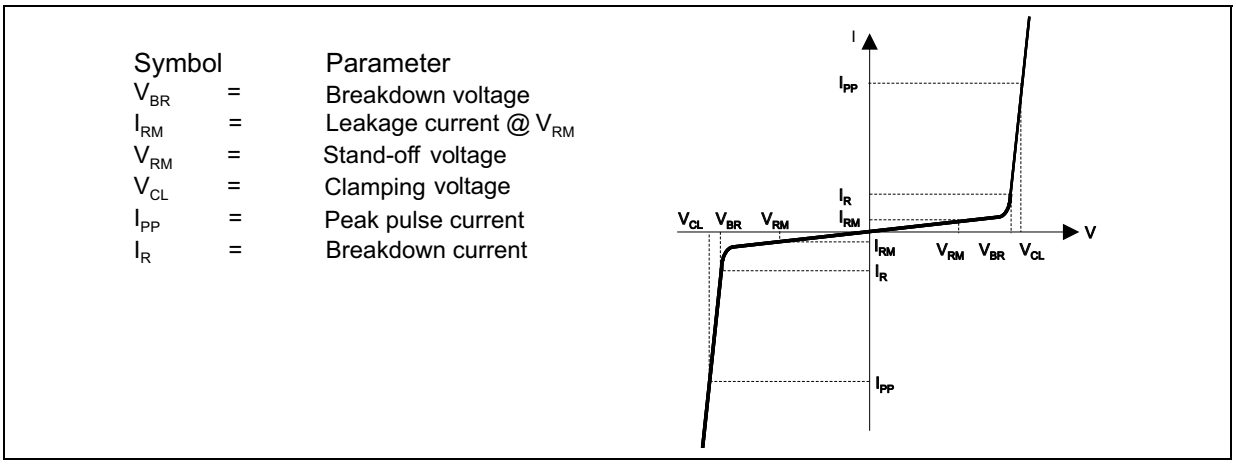


Table 2. Electrical characteristics (values, T_{amb} = 25 °C)

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

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

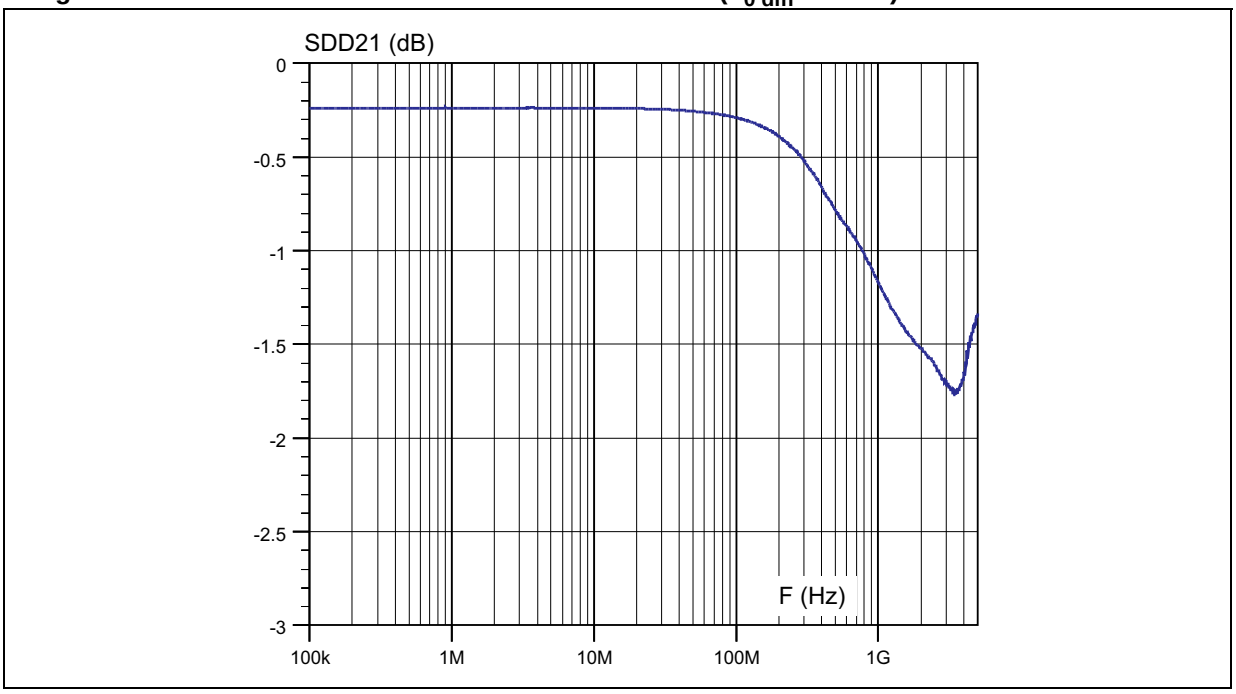


Figure 4. SCC21 common mode attenuation measurement ($Z_{0\ com}$ = 45 Ω)

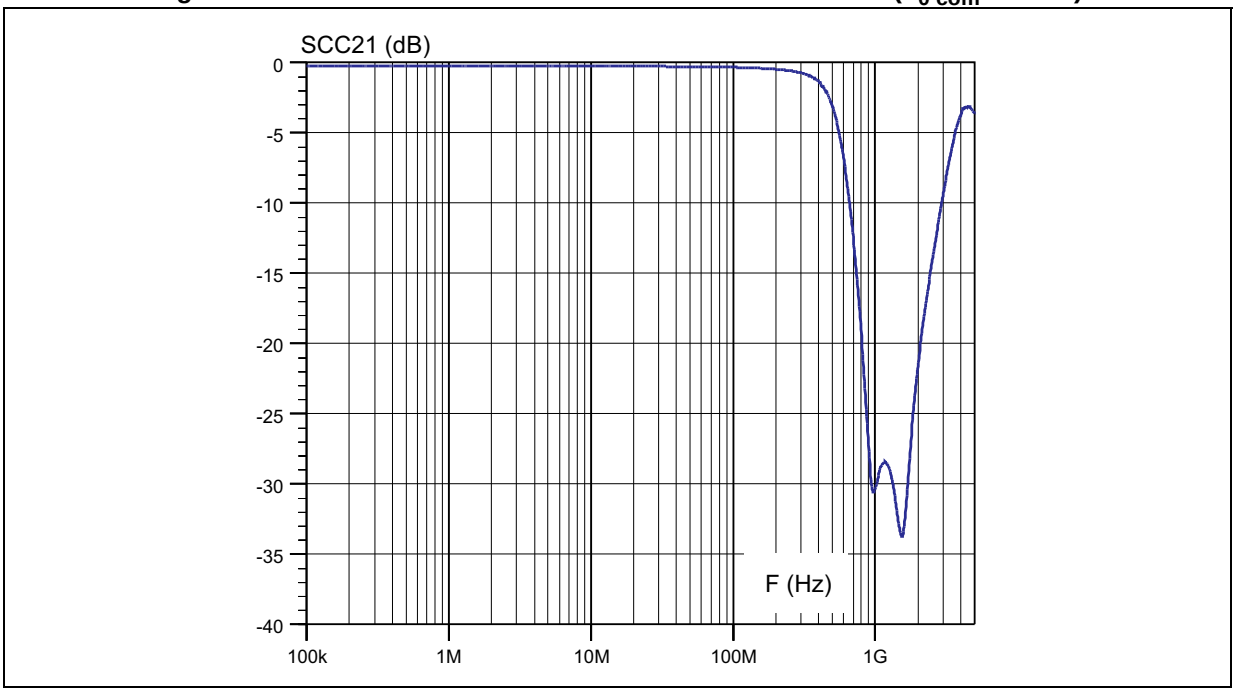


Figure 5. ID frequency response measurement (Z_0 = 75 Ω)

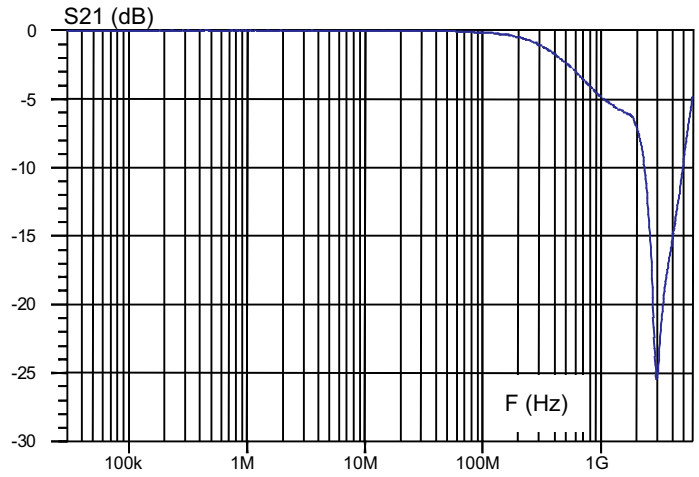


Figure 6. Differential (Z_{DD21}) and common mode (Z_{CC21}) impedance versus frequency

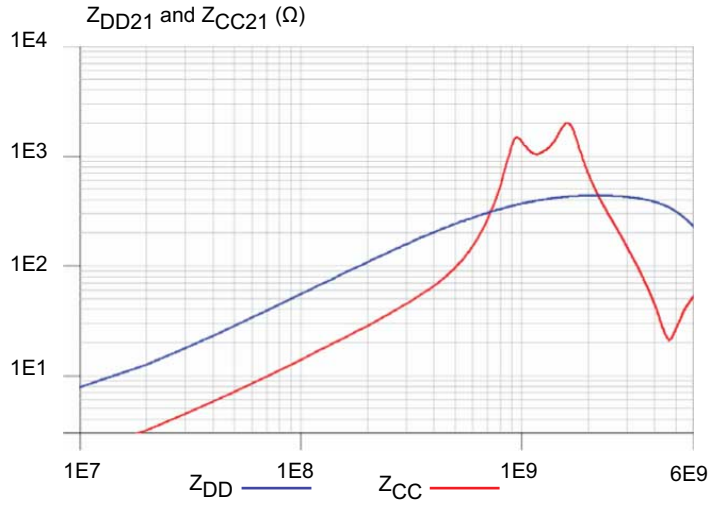


Figure 7. ESD test conditions

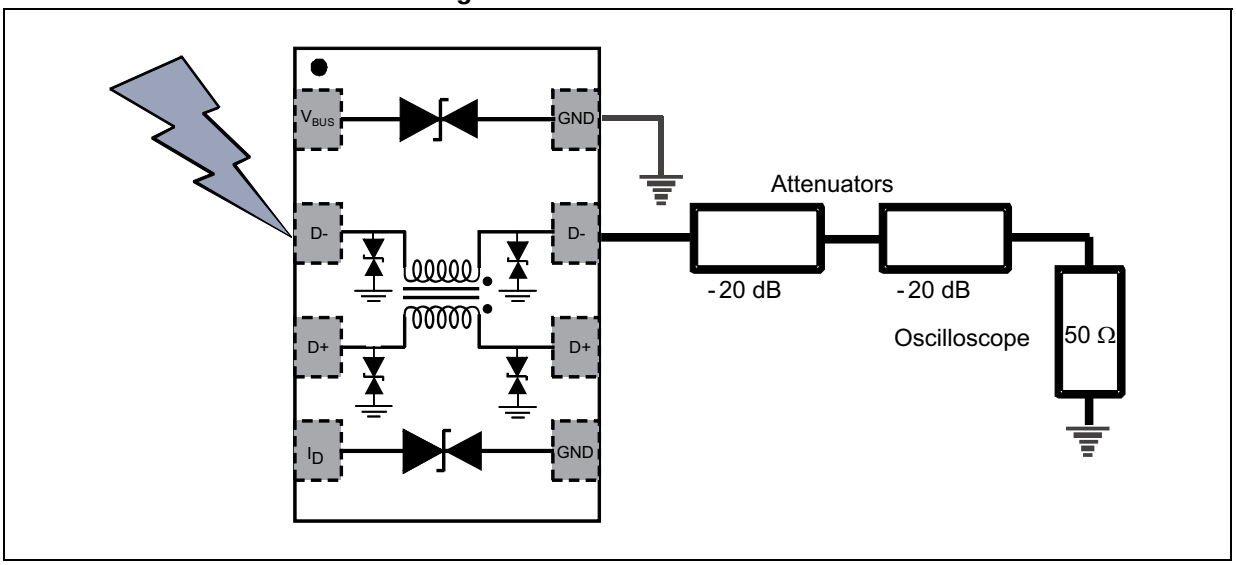


Figure 8. ESD response to IEC 61000-4-2 (+8 kV contact discharge) on V_{BUS}

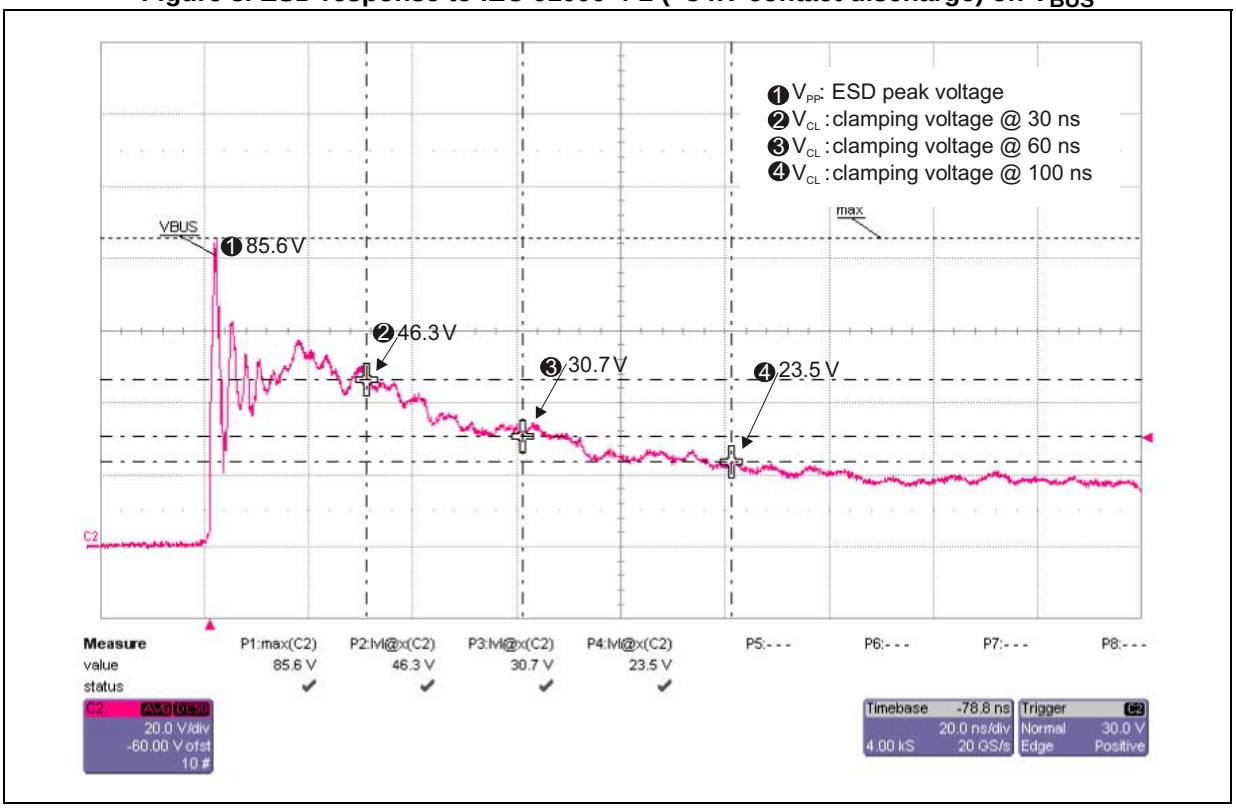


Figure 9. ESD response to IEC 61000-4-2 (-8 kV contact discharge) on V_{BUS}

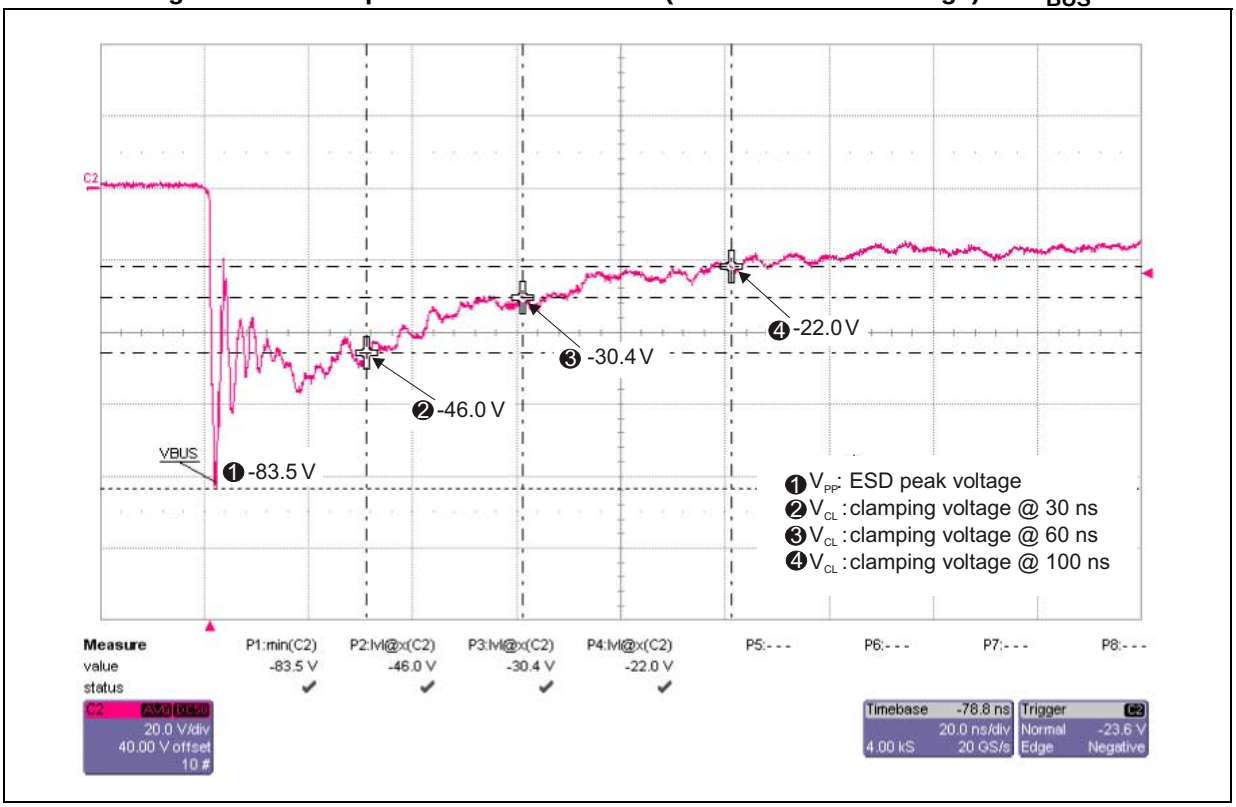


Figure 10. ESD response to IEC 61000-4-2 (+8 kV contact discharge) on I_D

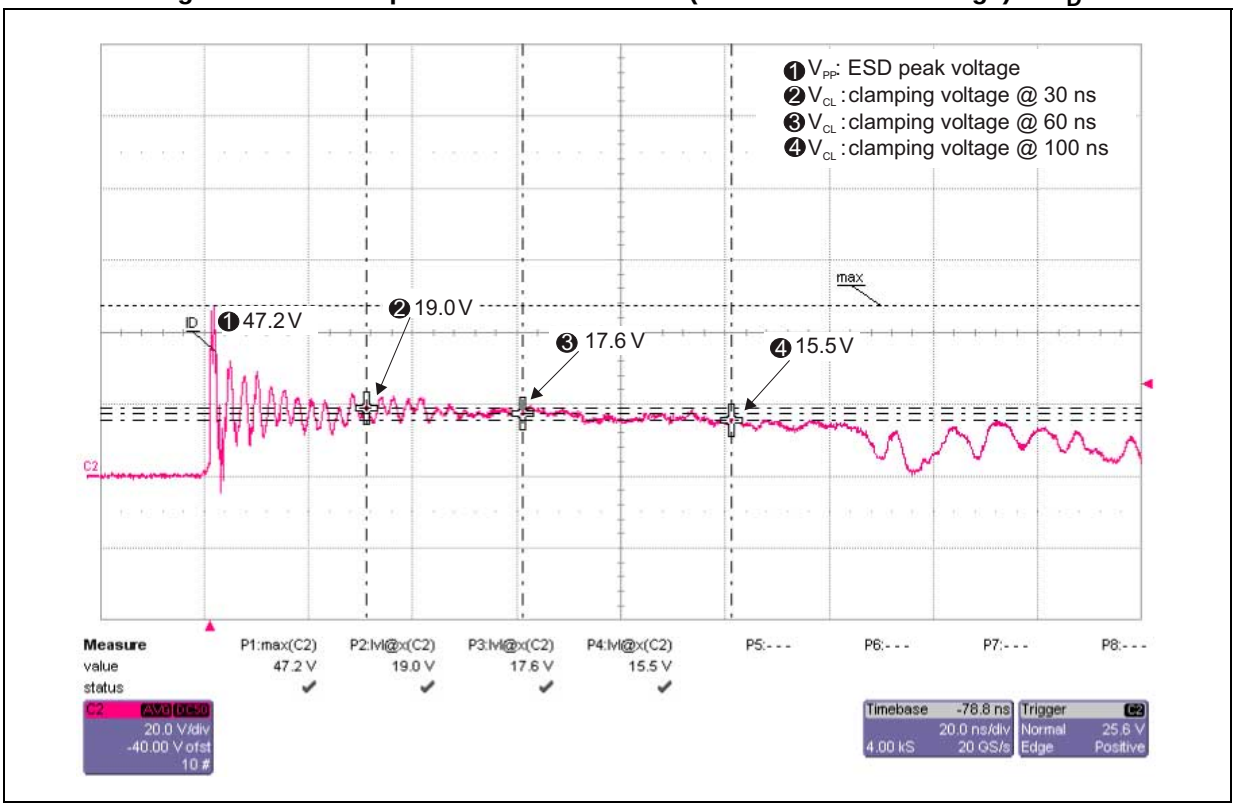


Figure 11. ESD response to IEC 61000-4-2 (-8 kV contact discharge) on I_D

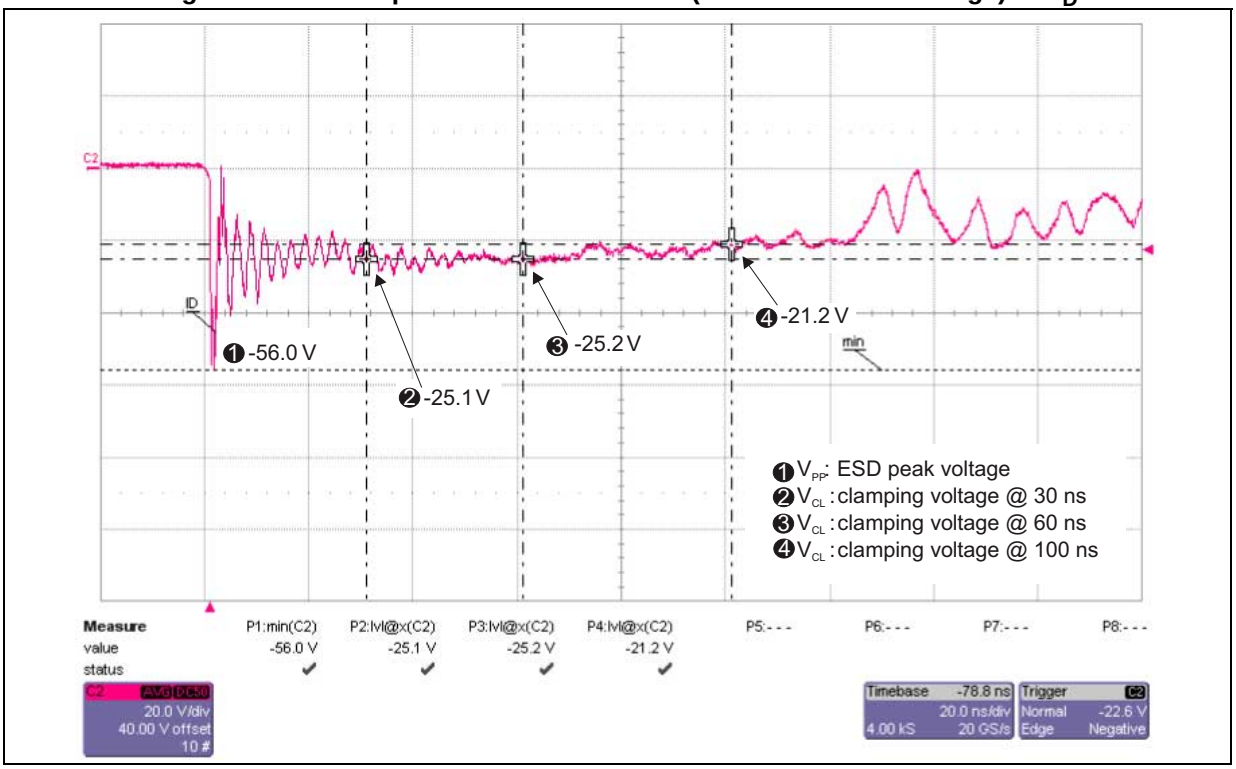


Figure 12. ESD response to IEC 61000-4-2 (+8 kV contact discharge) on differential lane

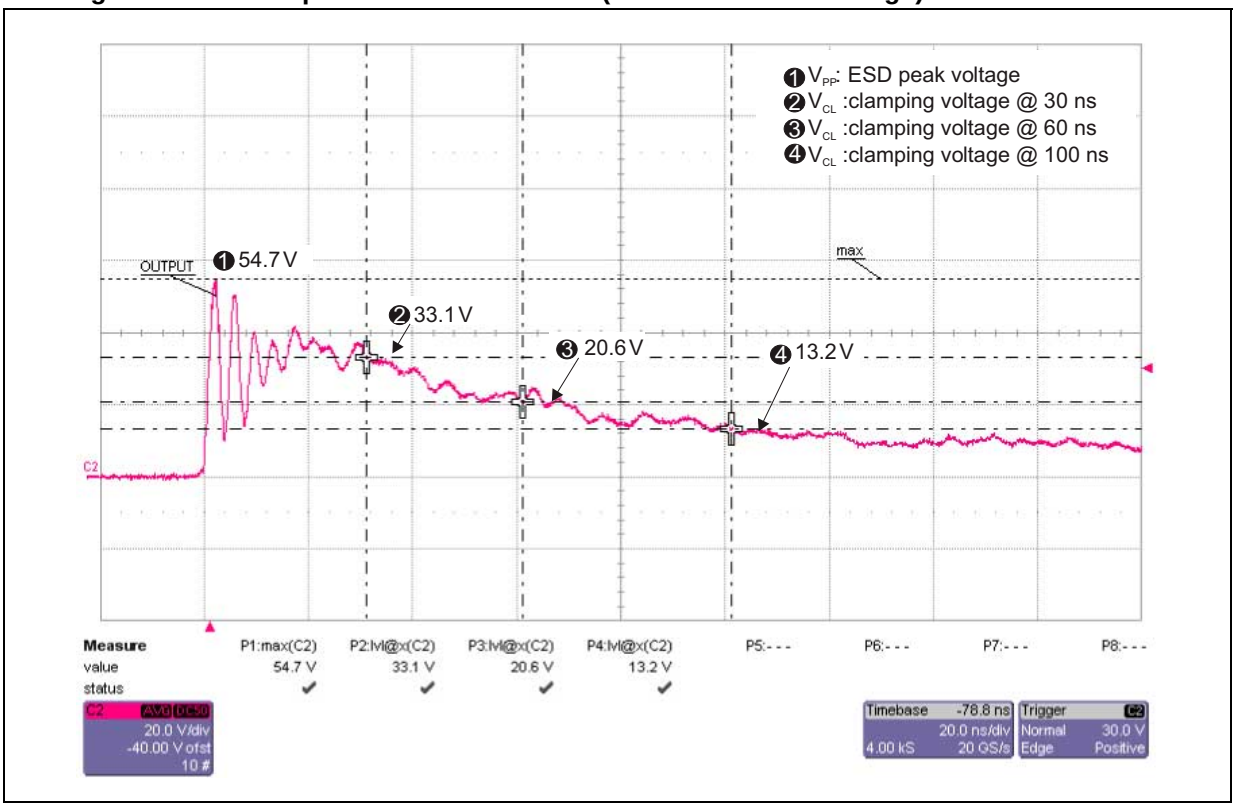


Figure 13. ESD response to IEC 61000-4-2 (-8 kV contact discharge) on differential lane

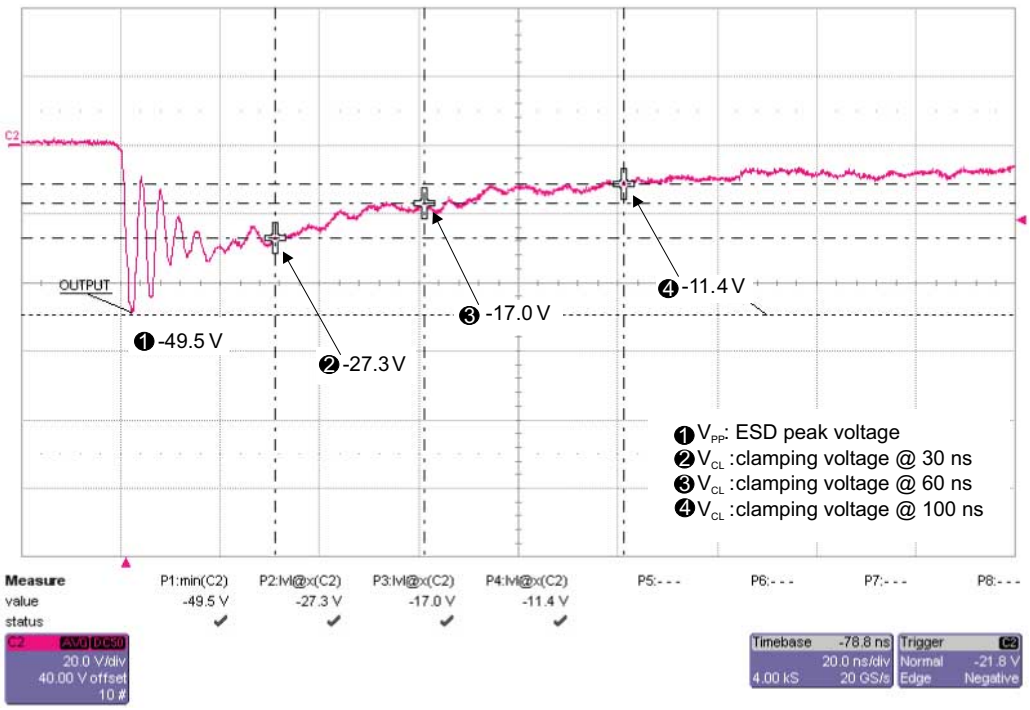
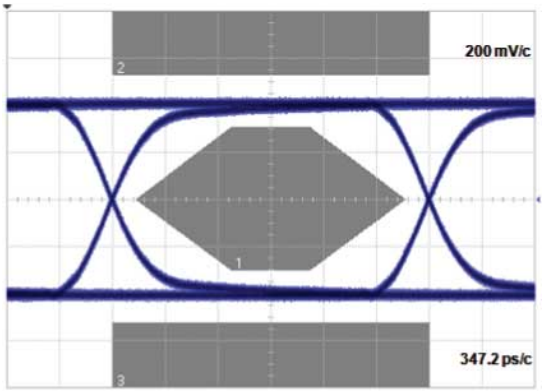
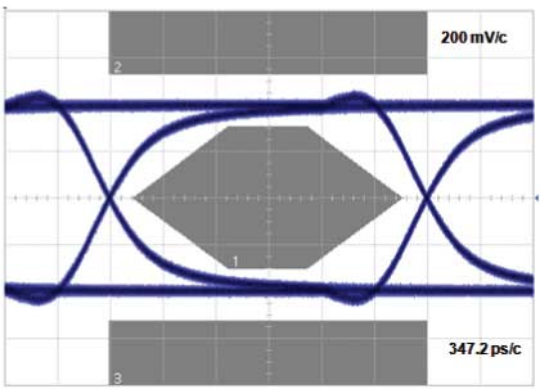


Figure 14. Eye diagram (loaded by Z_{diff} = 90 Ω) with USB2.0 [mask 1] board only



Rise time (ps)	Fall time (ps)	Eye height (mv)	Eye width (ns)
347	347	721	2.04

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



Rise time (ps)	Fall time (ps)	Eye height (mv)	Eye width (ns)
432	432	674	2.03

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

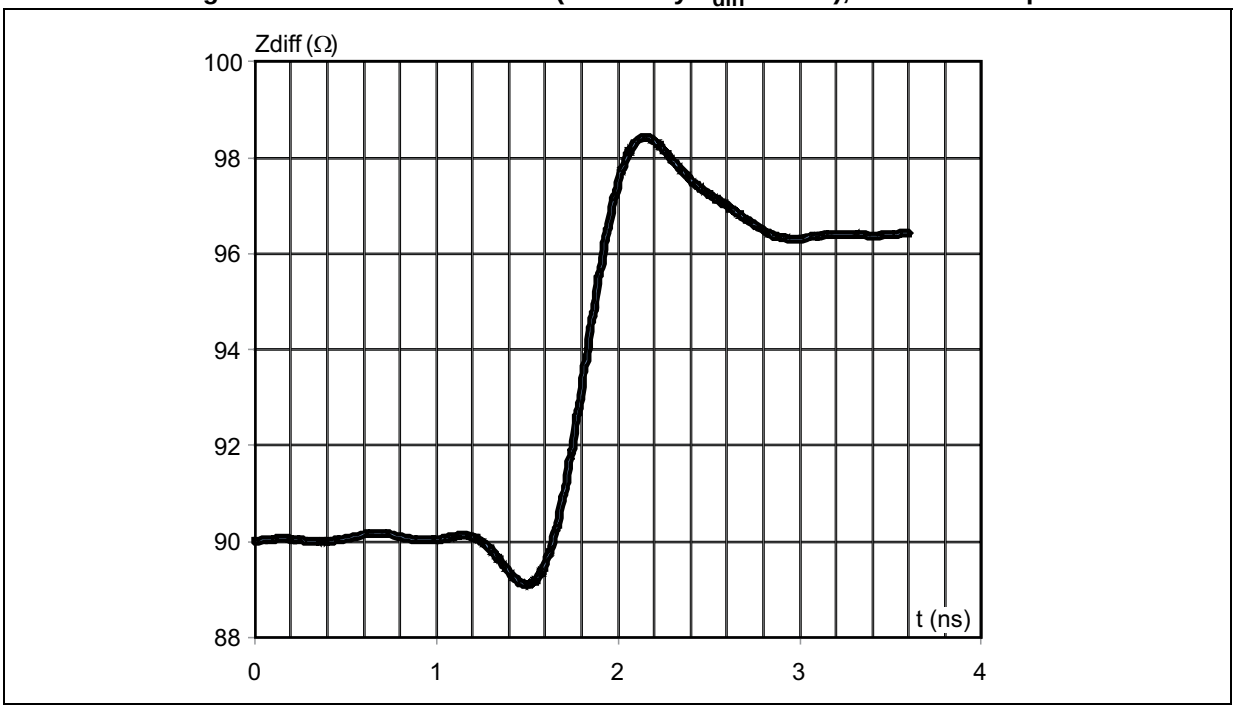


Figure 17. HS sync

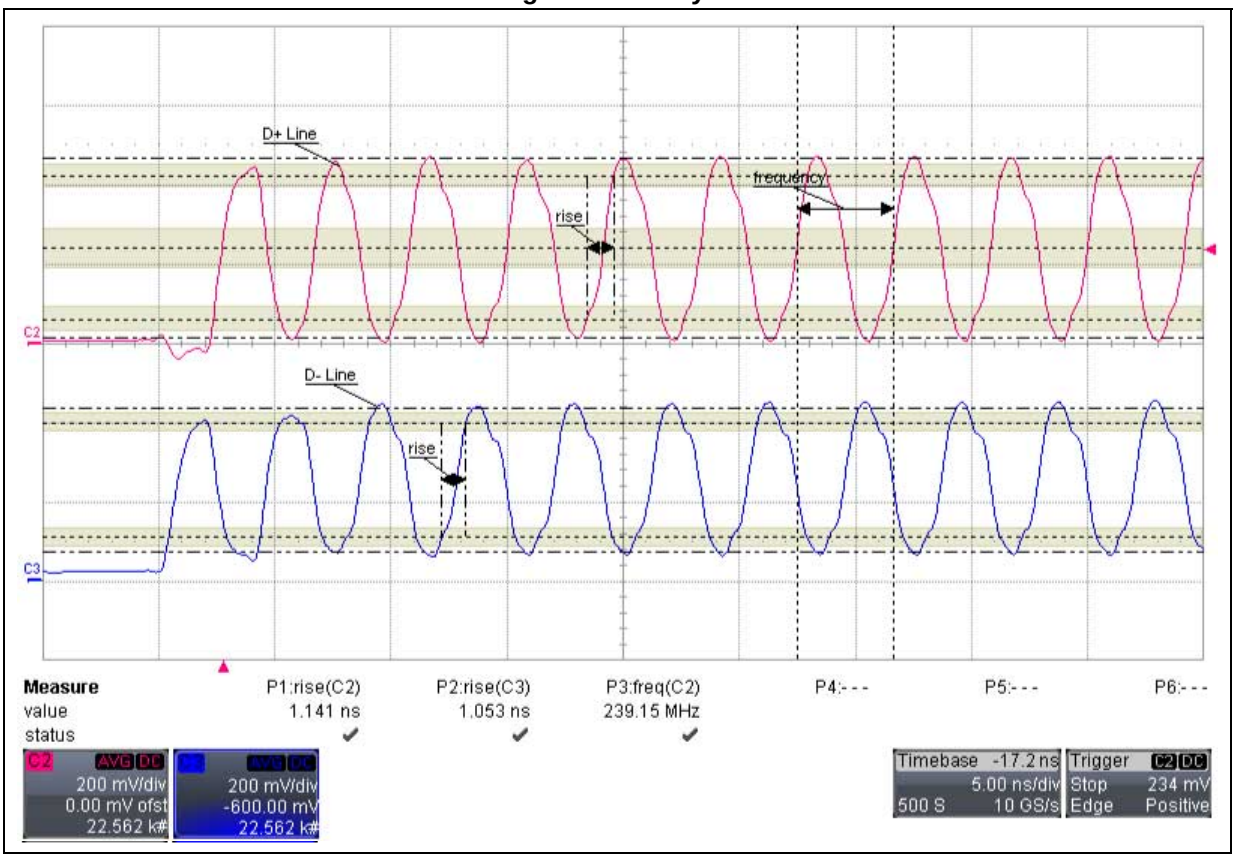


Figure 18. Total harmonic distortion on differential lanes

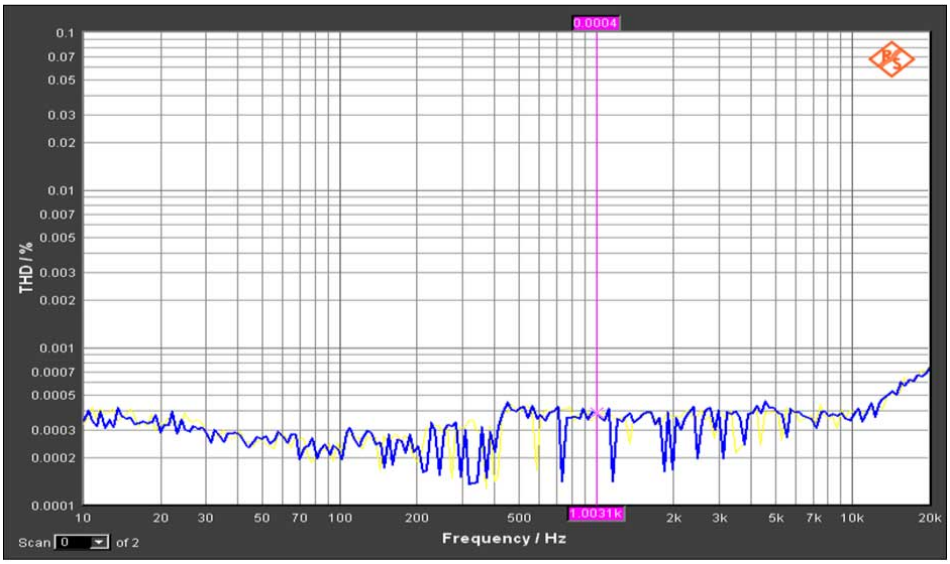
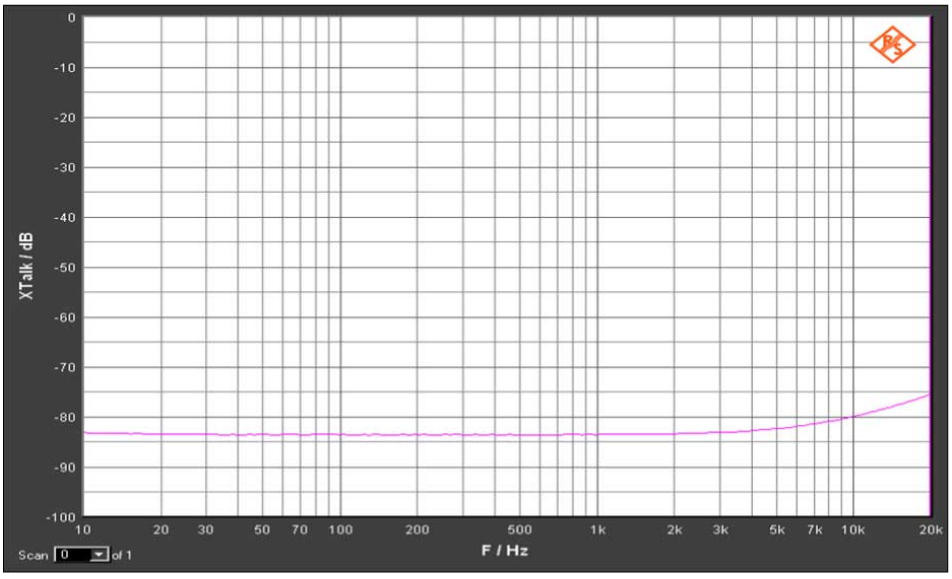
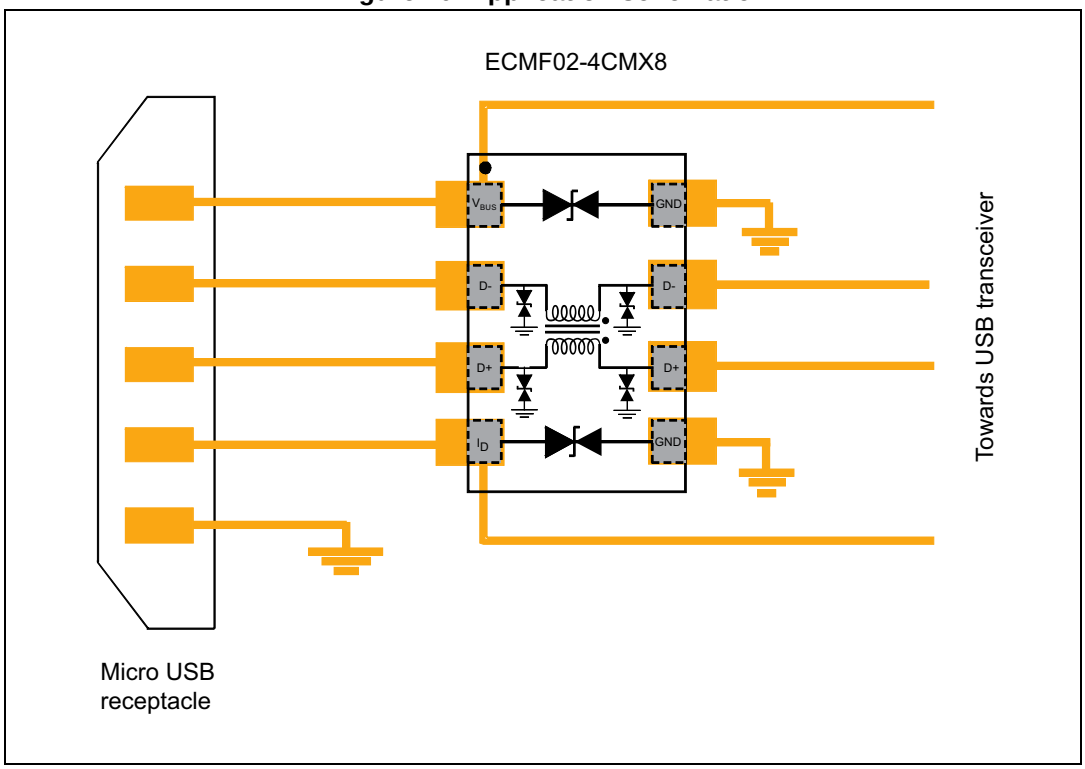


Figure 19. Crosstalk on differential lanes



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

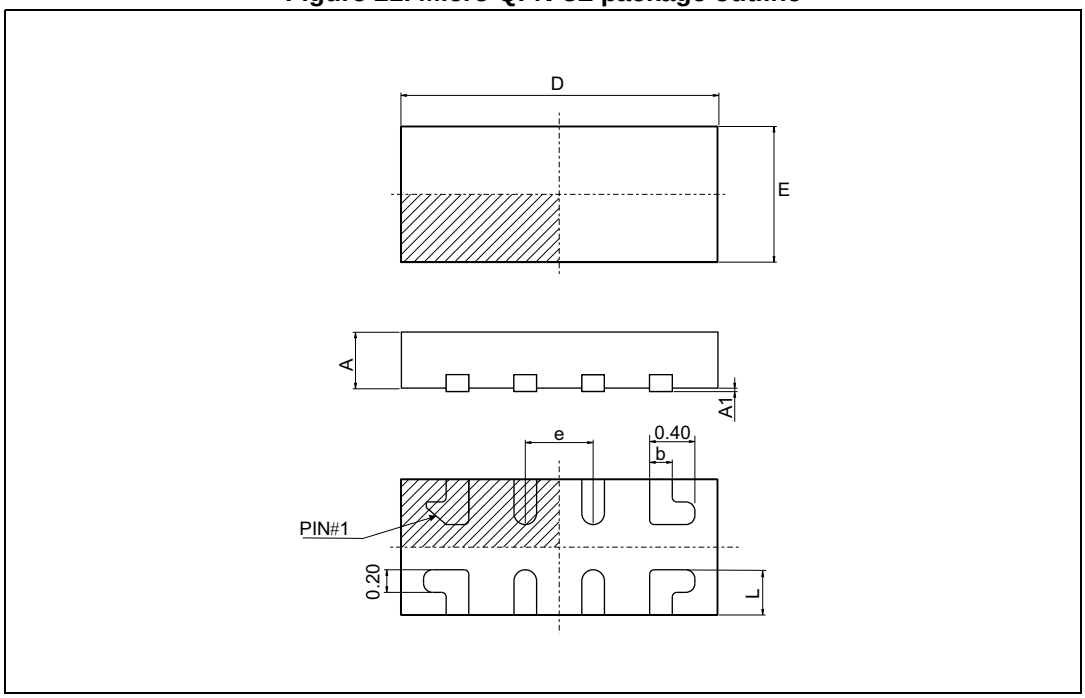


Table 3. Micro QFN-8L package mechanical data

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 22. Footprint

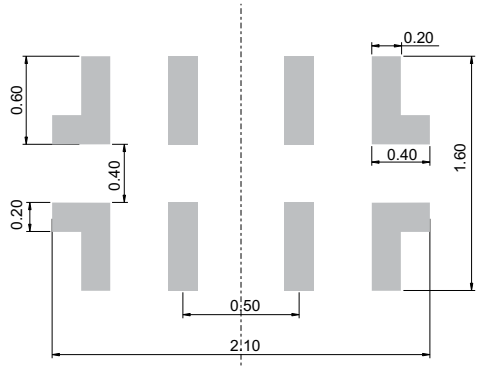


Figure 23. Marking

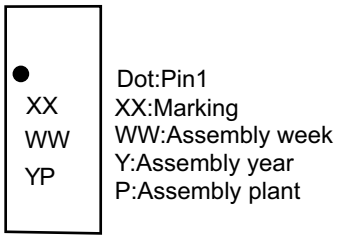
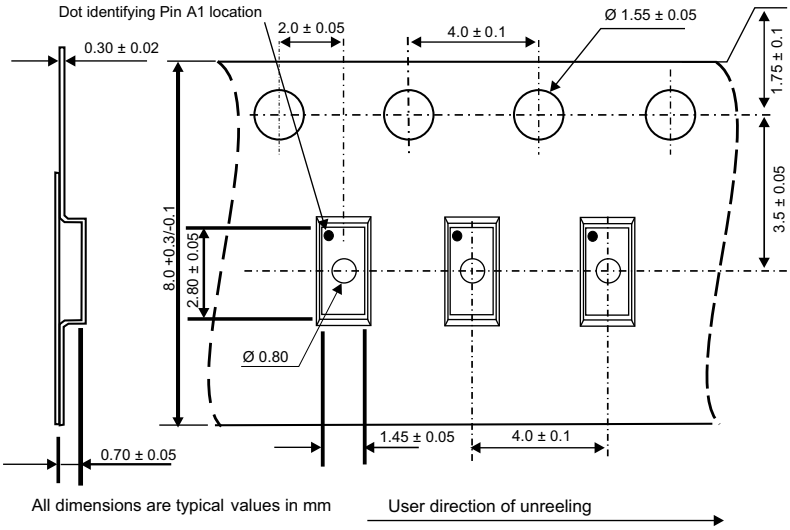


Figure 24. Tape and reel specifications



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

4 Ordering information

Figure 25. Ordering information scheme

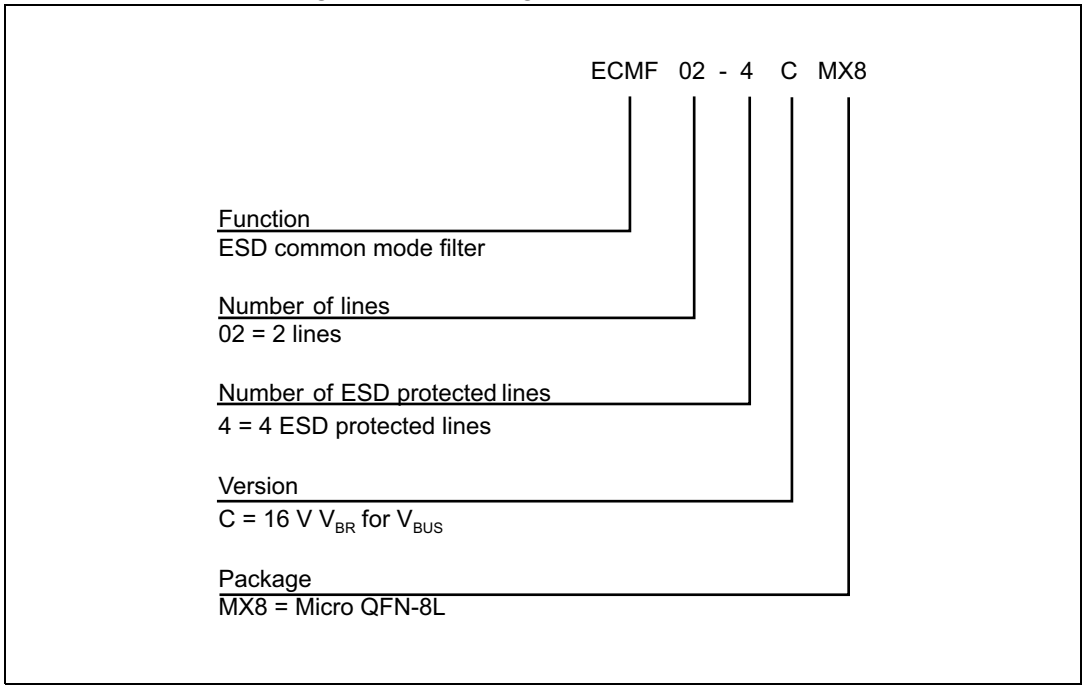


Table 4. Ordering information

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.