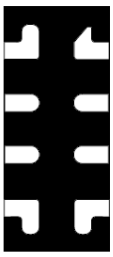
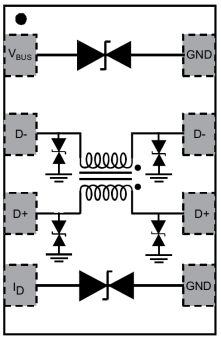
ECMF02-4CMX8

Datasheet

Common mode filter with ESD protection for USB 2.0 interface



Micro QFN-8 L
(pin view)



Product status link
ECMF02-4CMX8

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.

1 Characteristics

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

Symbol	Parameter		Value	Unit
V_{PP}	Peak pulse voltage	IEC 61000-4-2 (level 4): Contact discharge on D+/D- pins Contact discharge on V_{BUS} and ID 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_{op}	Operating ambient temperature range		-30 to +85	°C
T_j	Maximum junction temperature		-40 to +125	
T_{stg}	Storage temperature range		-55 to +150	

Figure 1. Electrical characteristics (definitions)

Symbol = Parameter
V_{BR} = Breakdown voltage
V_{CL} = Clamping voltage
I_{RM} = Leakage current @V_{RM}
V_{RM} = Stand-off voltage
I_{PP} = Peak pulse current
R_D = Dynamic resistance
I_R = Breakdown current

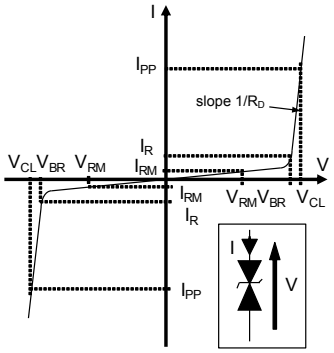


Table 2. Electrical characteristics (T_{amb} = 25 °C)

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
	Clamping voltage, I_{PP} = 2.5 A, t_p = 8/20 µs			24	
I_D					
V_{BR}	I_R = 1 mA	6			V
I_{RM}	V_{RM} = 1.5 V per line			100	nA

1.1 Characteristics (curves)

Figure 2. SDD21 differential attenuation measurement ($Z_{0\ diff}$ = 90 Ω) for data lines D+ and D-

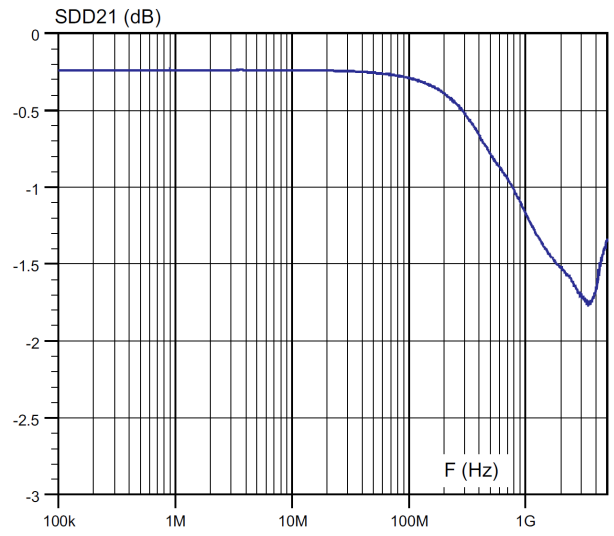


Figure 3. SCC21 common mode attenuation measurement ($Z_{0\ com}$ = 45 Ω)

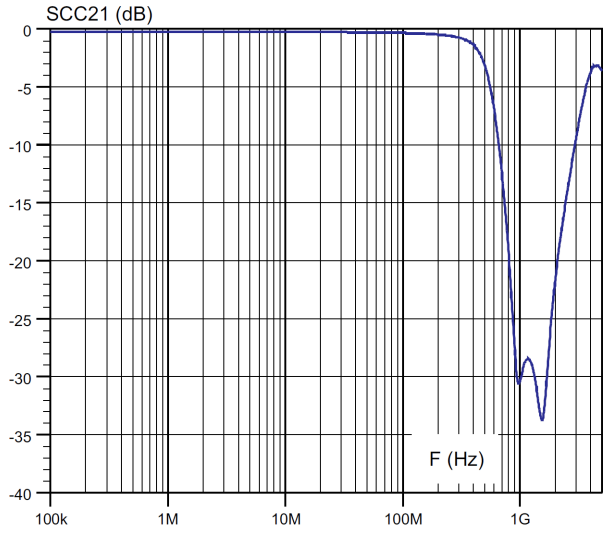


Figure 4. ID frequency response measurement (Z_0 = 75 Ω)

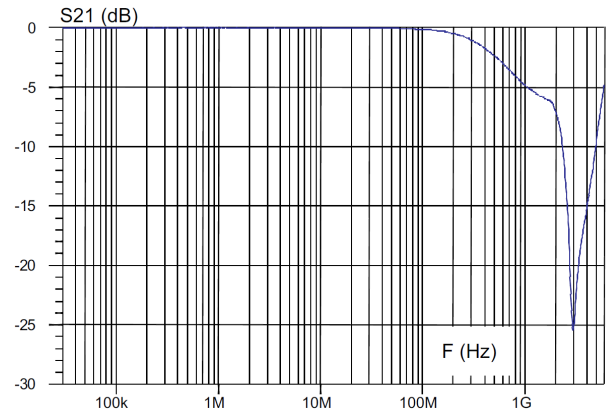


Figure 5. Differential (Z_{DD21}) and common mode (Z_{CC21}) impedance versus frequency

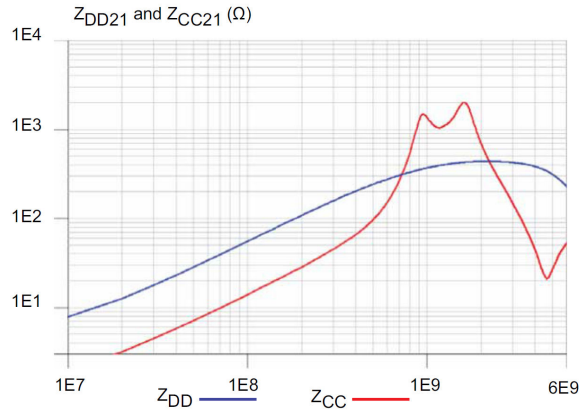


Figure 6. ESD test conditions

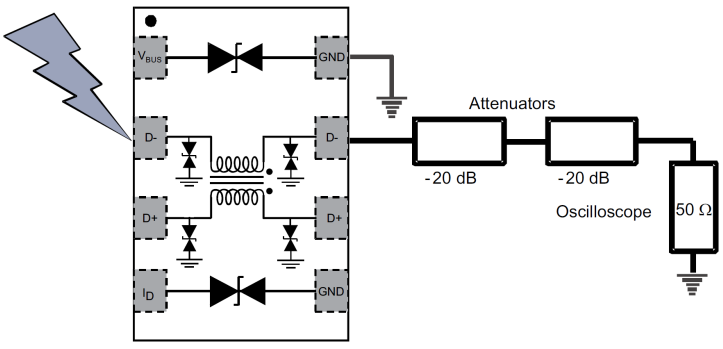


Figure 7. ESD response to IEC 61000-4-2 (+8 kV contact discharge) on V_{BUS}

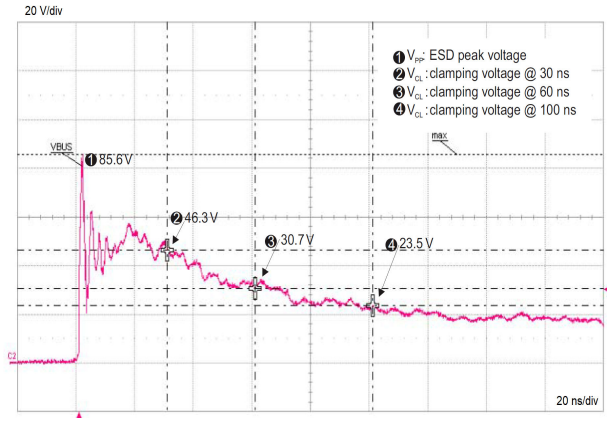


Figure 8. ESD response to IEC 61000-4-2 (-8 kV contact discharge) on V_{BUS}

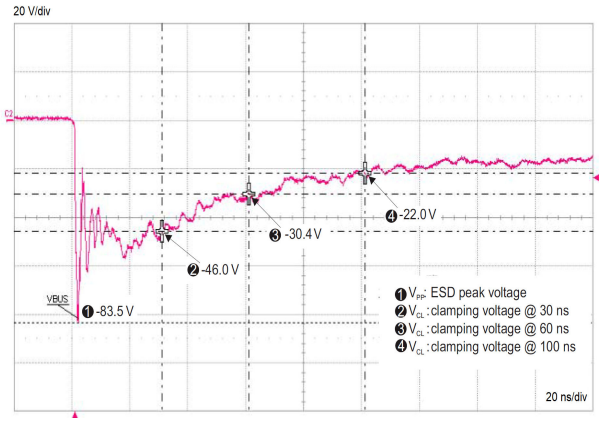


Figure 9. ESD response to IEC 61000-4-2 (+8 kV contact discharge) on I_D

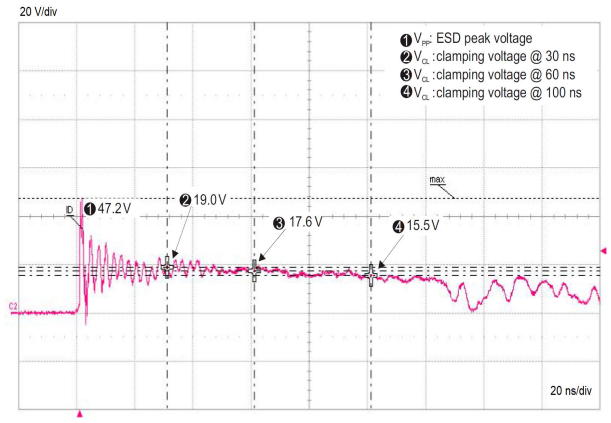


Figure 10. ESD response to IEC 61000-4-2 (-8 kV contact discharge) on I_D

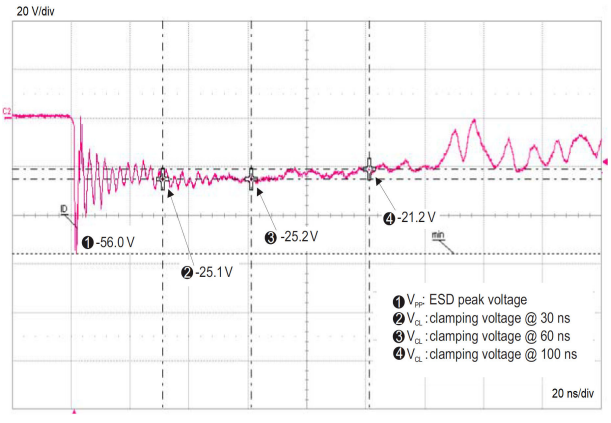


Figure 11. ESD response to IEC 61000-4-2 (+8 kV contact discharge) on differential lane

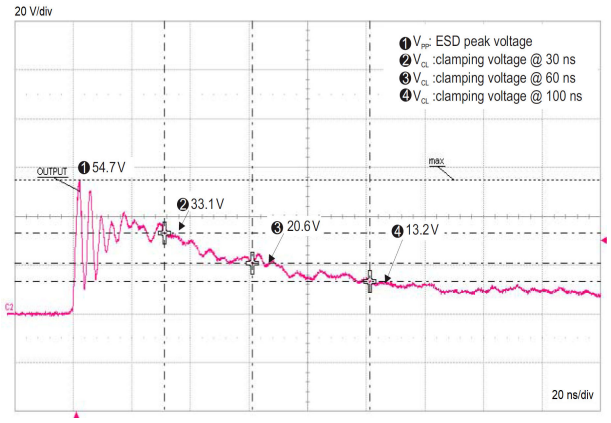


Figure 12. ESD response to IEC 61000-4-2 (-8 kV contact discharge) on differential lane

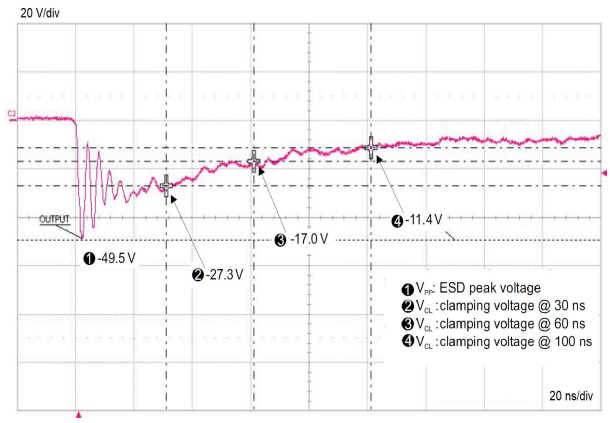
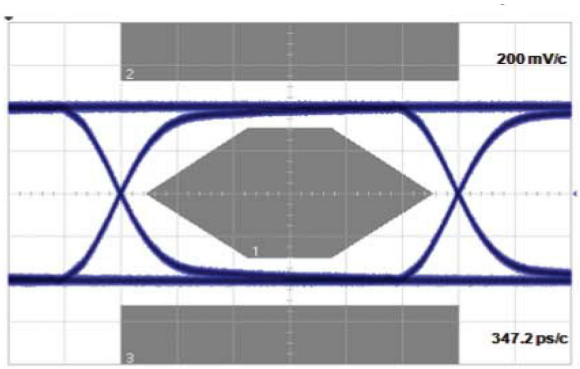
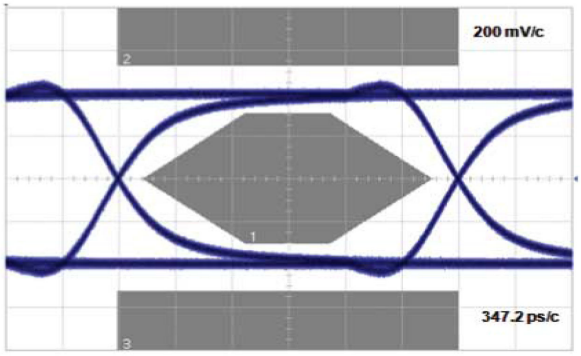


Figure 13. Eye diagram (loaded by Z_{diff} = 90 Ω) with USB2.0 [mask 1] board only



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

Figure 14. 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 15. TDR measurement (loaded by Z_{diff} = 90 Ω), rise time 400 ps

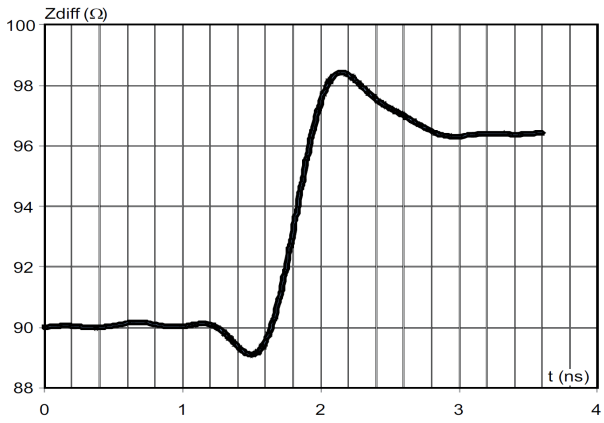


Figure 16. HS sync

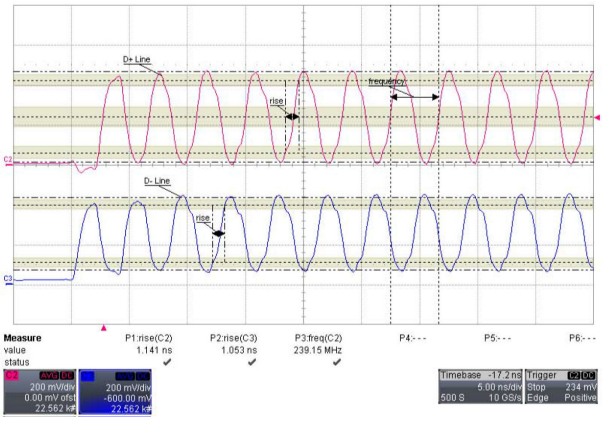


Figure 17. Total harmonic distortion on differential lanes

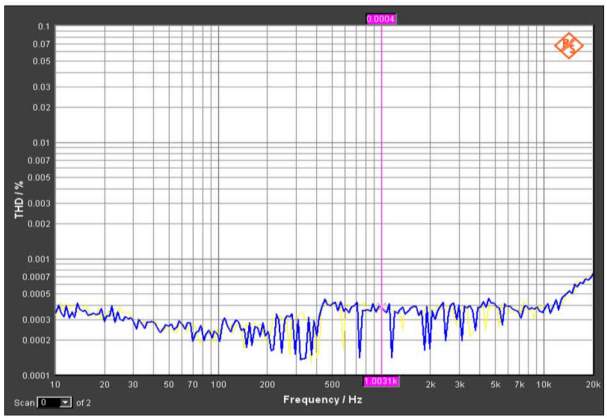
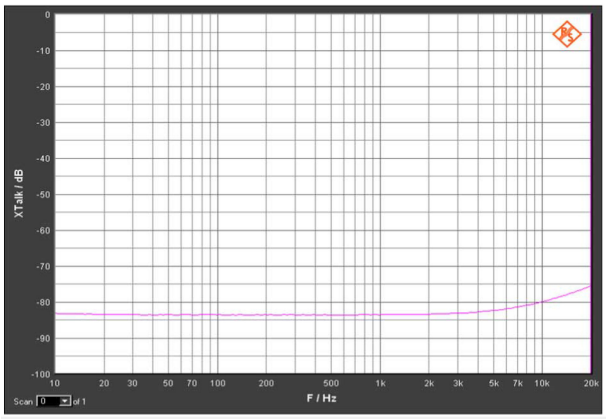
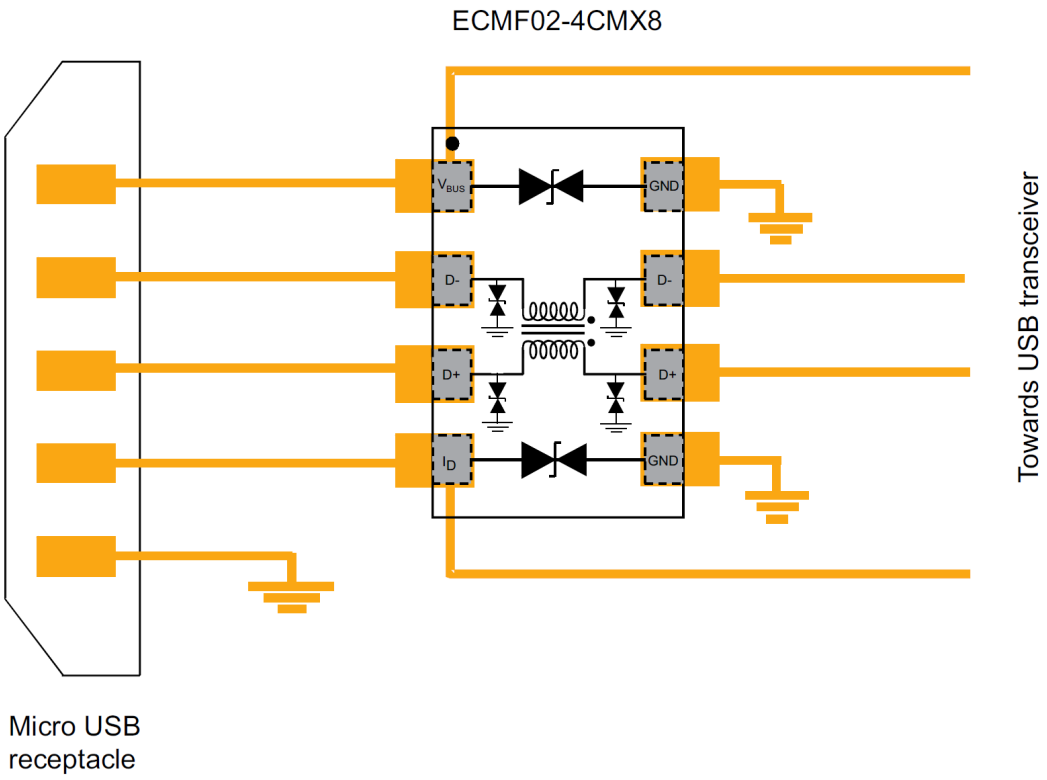


Figure 18. Crosstalk on differential lane



2 Application schematic

Figure 19. **Application schematic**



3 Package information

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 QFN-8L package information

Figure 20. QFN-8L package outline

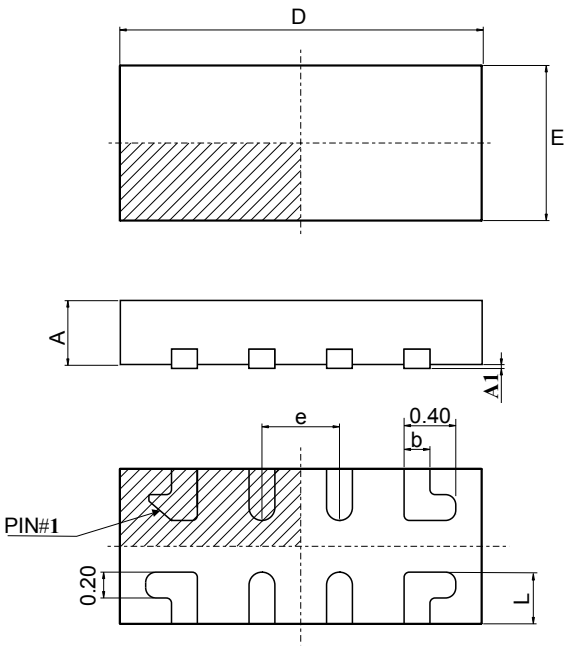


Table 3. QFN-8L mechanical data

Symbol	Dimesions					
	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.45	0.50	0.55	0.018	0.020	0.022
A1	0.00	0.02	0.05	0.000	0.0008	0.002
b	0.15	0.20	0.25	0.006	0.008	0.10
D	2.45	2.50	2.55	0.096	0.098	0.100
E	1.15	1.20	1.25	0.045	0.047	0.049
e	0.45	0.50	0.55	0.018	0.020	0.022
L	0.30	0.40	0.50	0.012	0.016	0.020

3.2 Packing information

Figure 21. Footprint

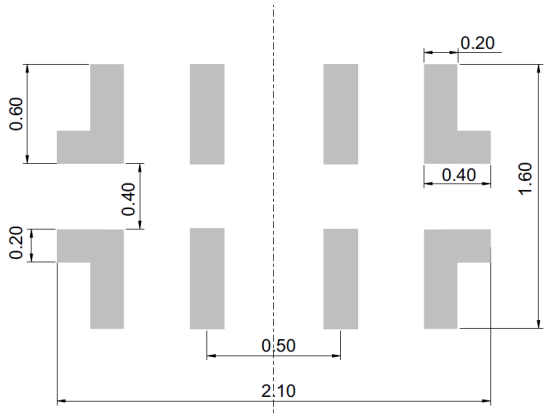


Figure 22. Marking

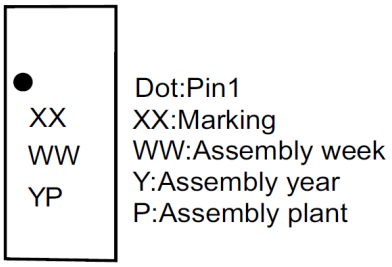
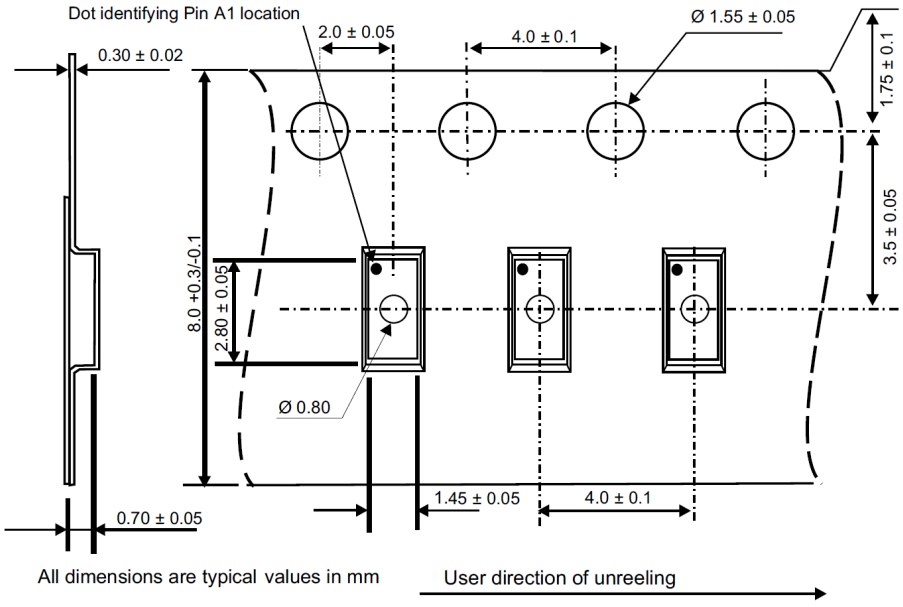


Figure 23. Tape outline



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

4 Ordering information

Figure 24. **Ordering information scheme**

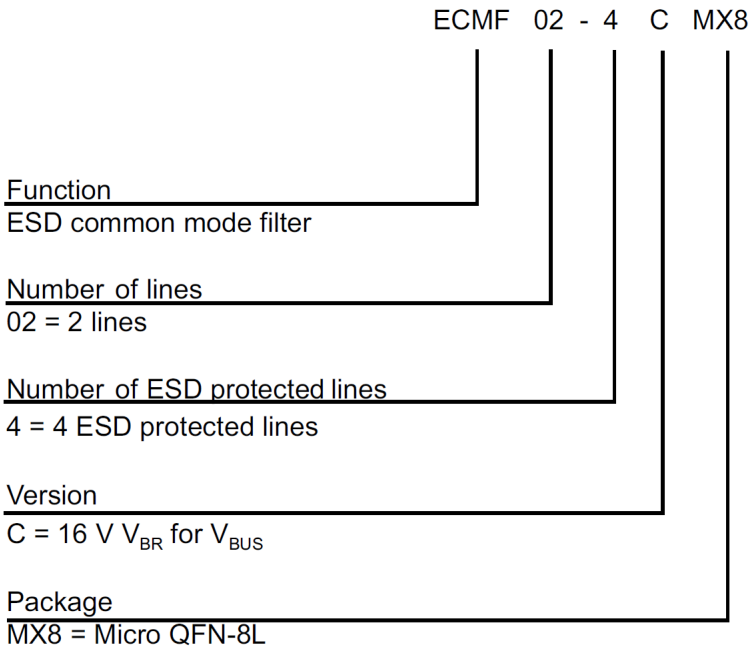


Table 4. **Ordering information**

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

Revision history

Table 5. **Document revision history**

Date	Version	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.
03-Mar-2025	4	Updated Table 1. Minor text changes.

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