ECMF04-4HSM10

Common mode filter with ESD protection for high speed serial interface

Datasheet - production data
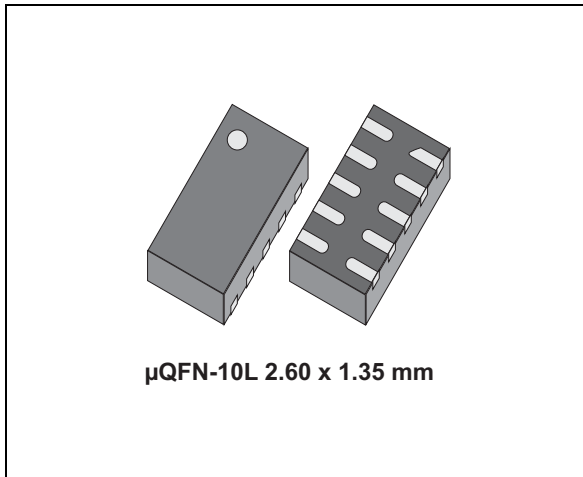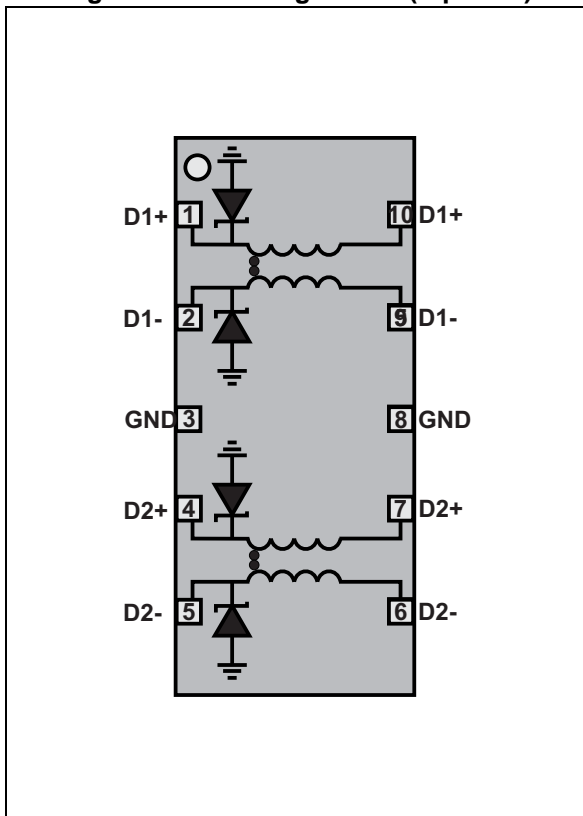

µQFN-10L 2.60 x 1.35 mm

Figure 1. Pin configuration (top view)

Features

- Very large differential bandwidth to comply with HDMI Full HD, MIPI, USB2.0, USB3.0, Display Port and other high speed serial interfaces
- Provides -20 dB attenuation at 700 MHz in LTE bands
- High common mode attenuation:- 25 dB between 800 MHz - 900 MHz
- Very low PCB space consumption
- Thin package: 0.55 mm max.
- Lead-free package
- High reduction of parasitic elements through integration.

Complies with the following standards:

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

Applications

- Mobile phones
- Notebook, laptop
- Portable devices
- PND

Description

This device is a highly integrated common mode filter designed to suppress EMI/RFI common mode noise on high speed differential serial buses like HDMI Full HD, MIPI, Display Port and other high speed serial interfaces.The device has a very large differential bandwidth to comply with these standards. The device can protect and filter 2 differential lanes.

1   Characteristics

Table 1. Absolute maximum ratings (T$_{amb}$ = 25 °C)

Symbol	Parameter		Value	Unit
V$_{PP}$	Peak pulse voltage	IEC 61000-4-2 Contact discharge (connector side) Air discharge (connector side)	8 16	kV
I$_{DC}$	Maximum DC current		100	mA
T$_{op}$	Operating temperature range		-40 to +85	°C
T$_j$	Maximum junction temperature		125	°C
T$_{stg}$	Storage temperature range		- 55 to +150	°C

Figure 2. Electrical characteristics (definitions)

Symbol   **Parameter**
V$_{BR}$ =   Breakdown voltage
I$_{RM}$ =   Leakage current @ V$_{RM}$
V$_{RM}$ =   Stand-off voltage
I$_R$ =   Breakdown current
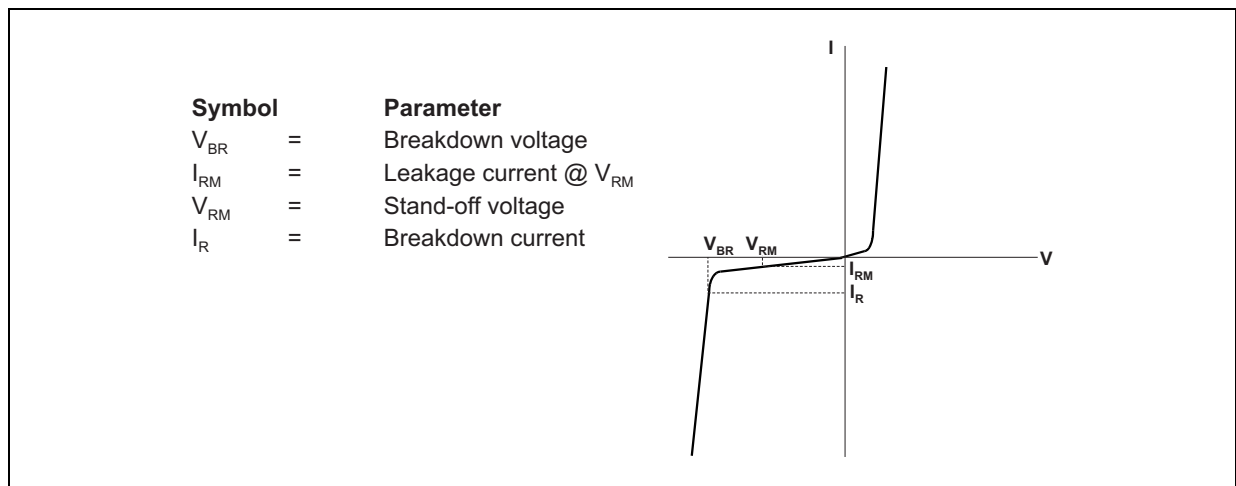
Table 2. Electrical characteristics (T$_{amb}$ = 25 °C)

Symbol	Test conditions	Min.	Typ.	Max.	Unit
V$_{BR}$	I$_R$ = 1 mA	6			V
I$_{RM}$	V$_{RM}$ = 3 V per line			100	nA
R$_{DC}$	DC serial resistance		5		Ω

Table 3. Pin description

Pin number	Description	Pin number	Description
1	D1+ to connector	6	D2- to IC
2	D1- to connector	7	D2+ to IC
3	GND	8	GND
4	D2+ to connector	9	D1- to IC
5	D2- to connector	10	D1+ to IC

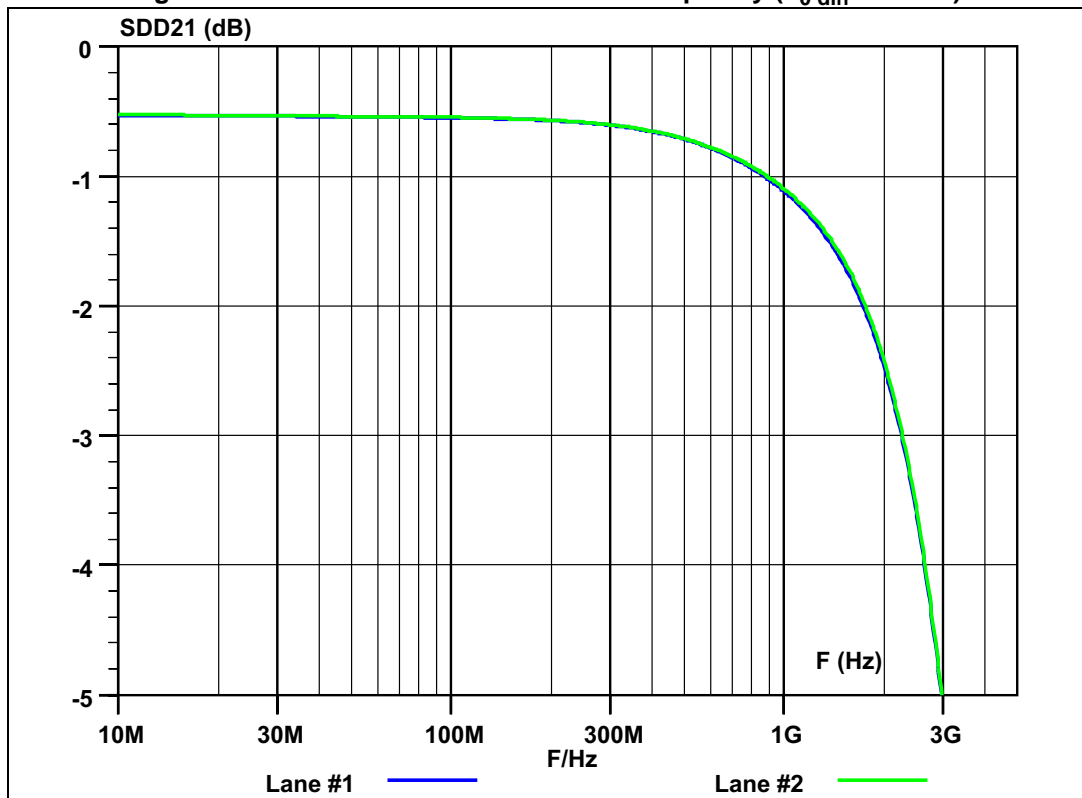**Figure 3. Differential attenuation versus frequency ($Z_{0\ diff}$ = 100 Ω)**

Lane #1 ———   Lane #2 ———

Figure 4. Common mode attenuation versus frequency ($Z_{0\ com}$ = 50 Ω)

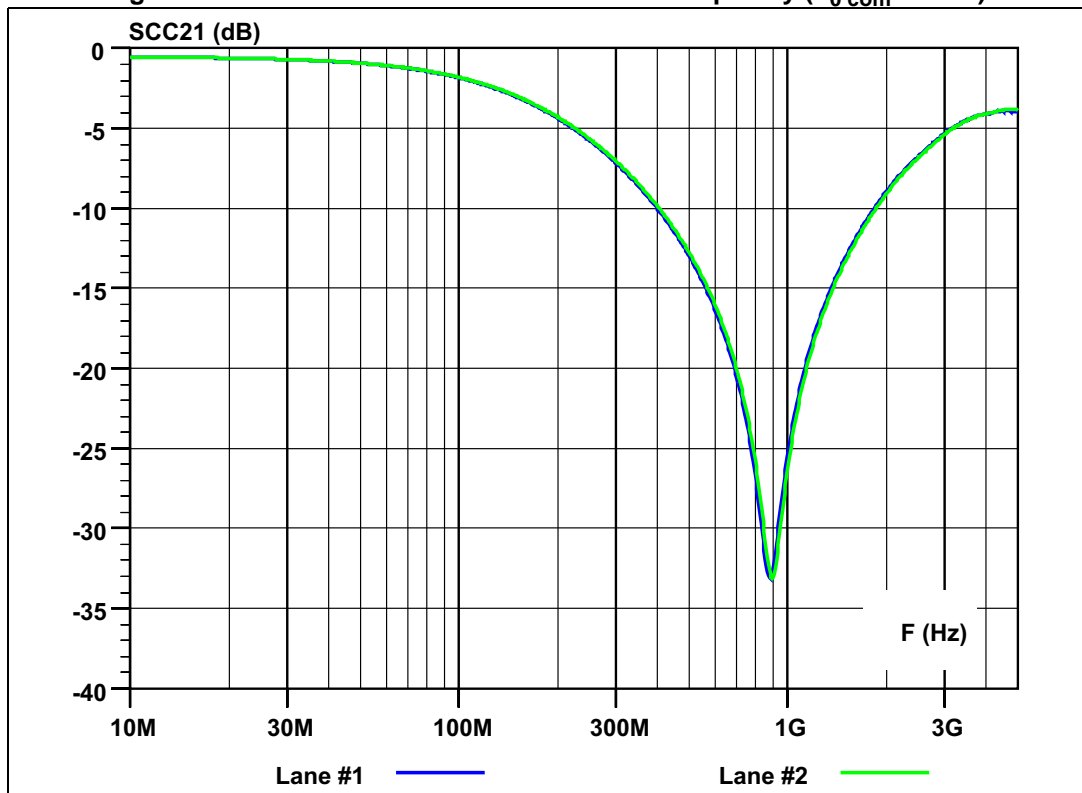Lane #1 ———   Lane #2 ———

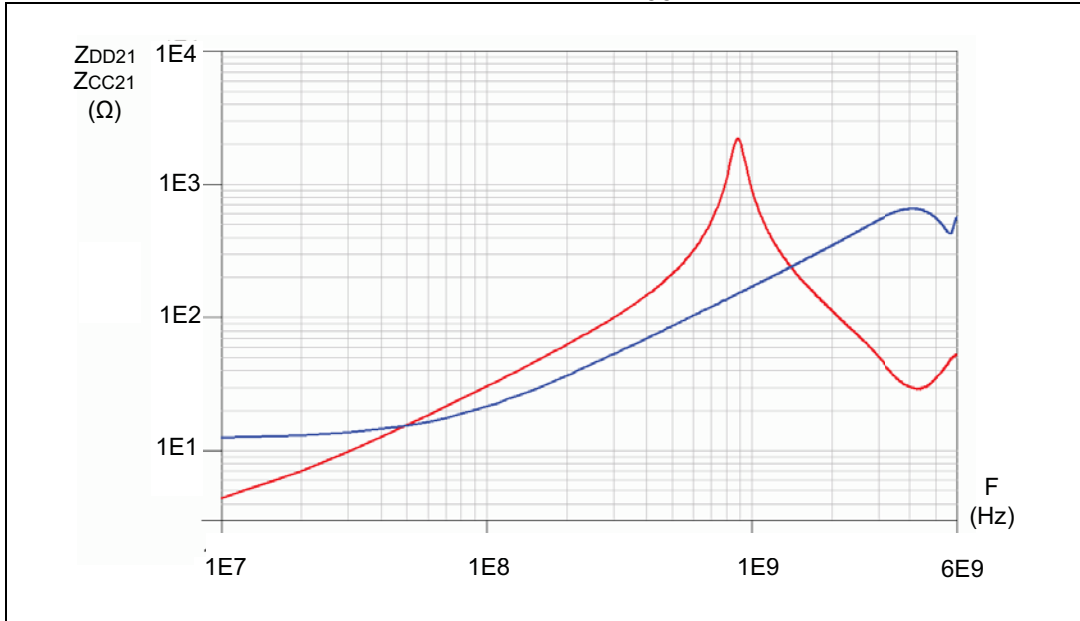**Figure 5. Differential (Z_{DD21}) and common mode (Z_{CC21}) impedance versus frequency**

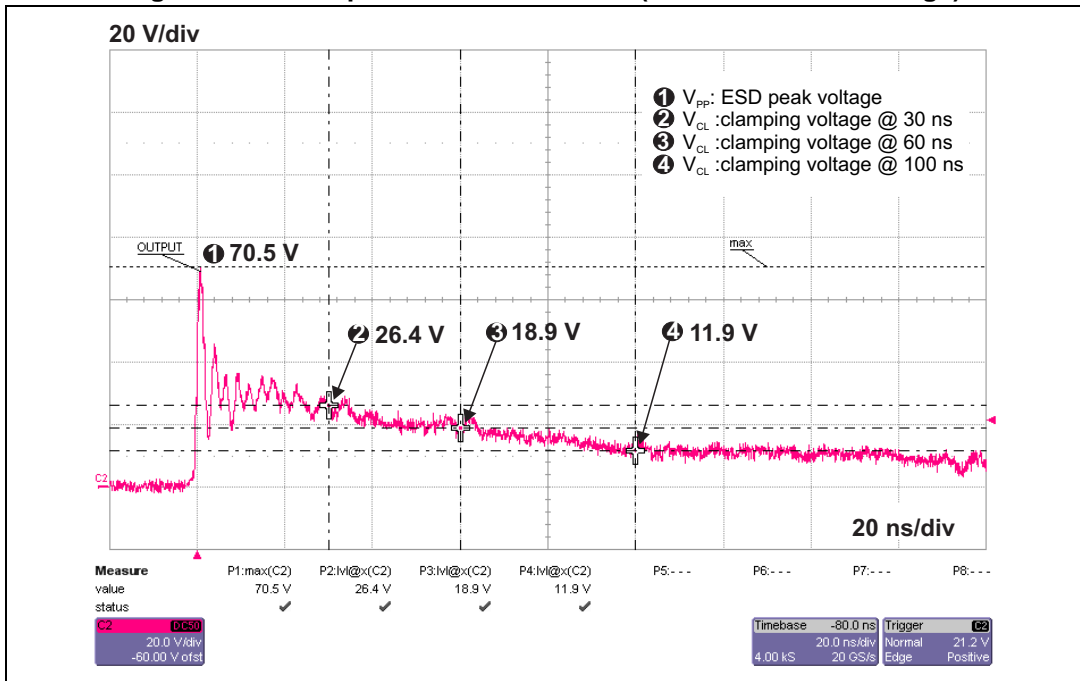**Figure 6. ESD response to IEC61000-4-2 (+8 kV contact discharge)**
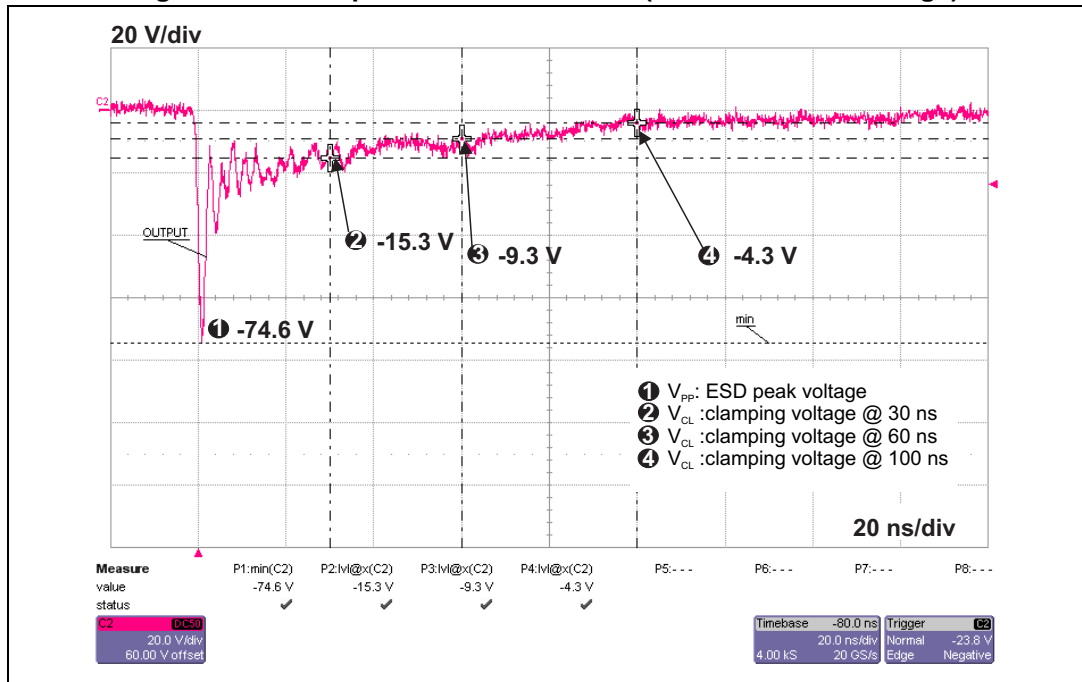
Figure 7. ESD response to IEC61000-4-2 (-8 kV contact discharge)

Figure 8. USB2.0 480 Mbps eye diagram without device
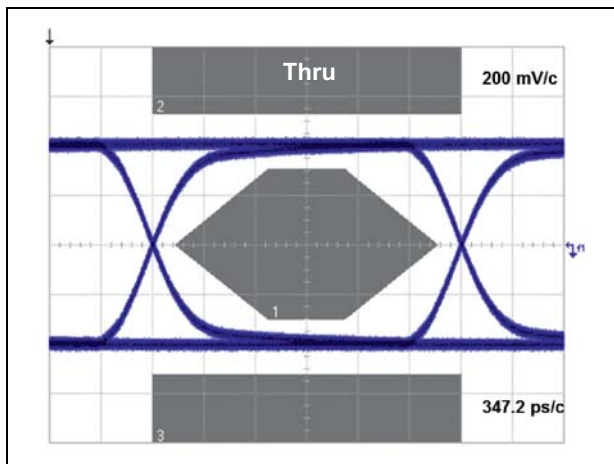
Figure 9. USB2.0 480 Mbps eye diagram with device
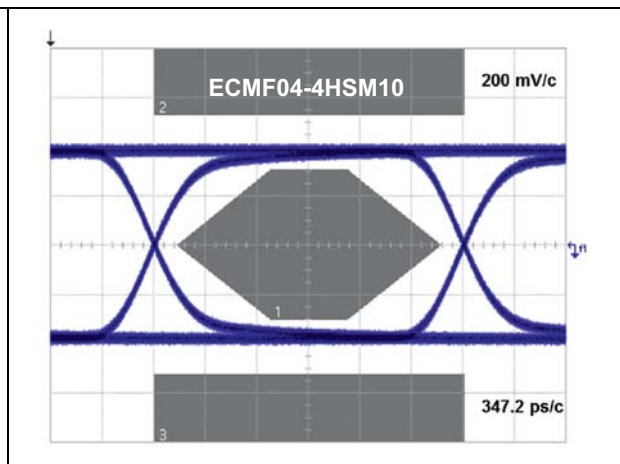
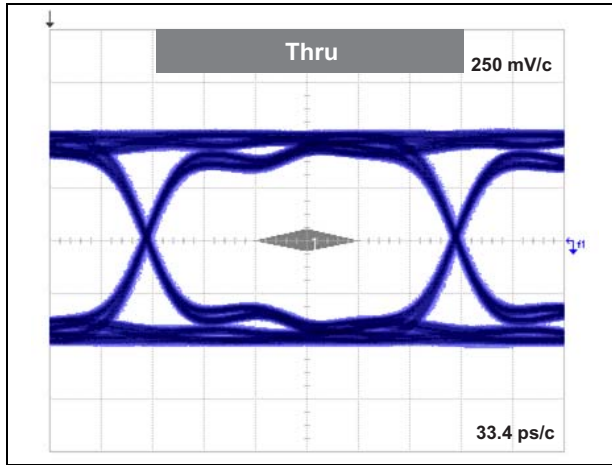**Figure 10. USB3.0 5 Gbps eye diagram without device**
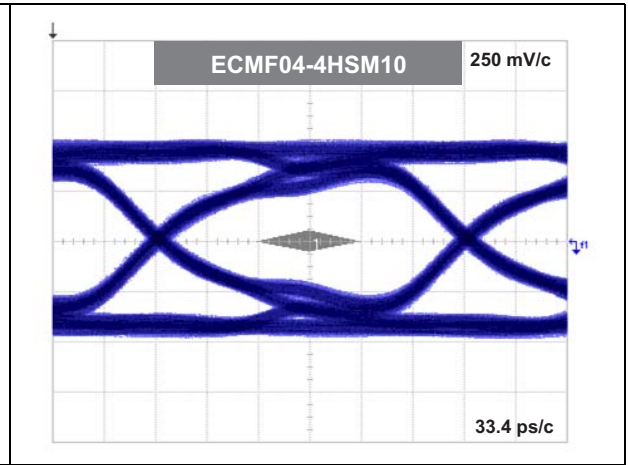

Figure 11. USB3.0 5 Gbps eye diagram with device

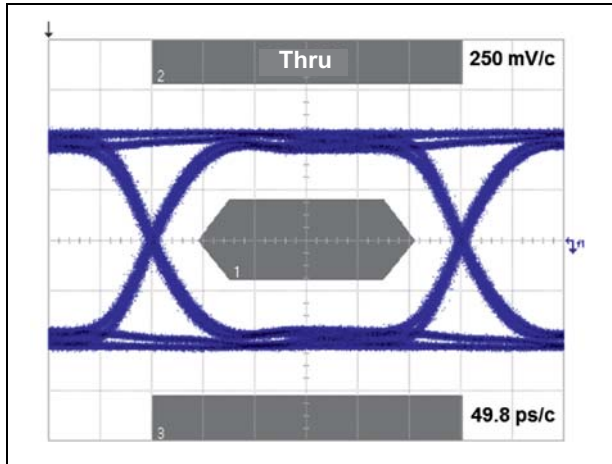**Figure 12. HDMI 3.35 Gbps eye diagram without device**
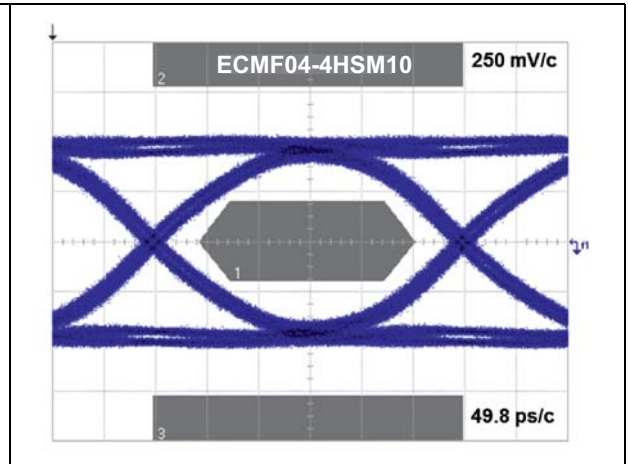

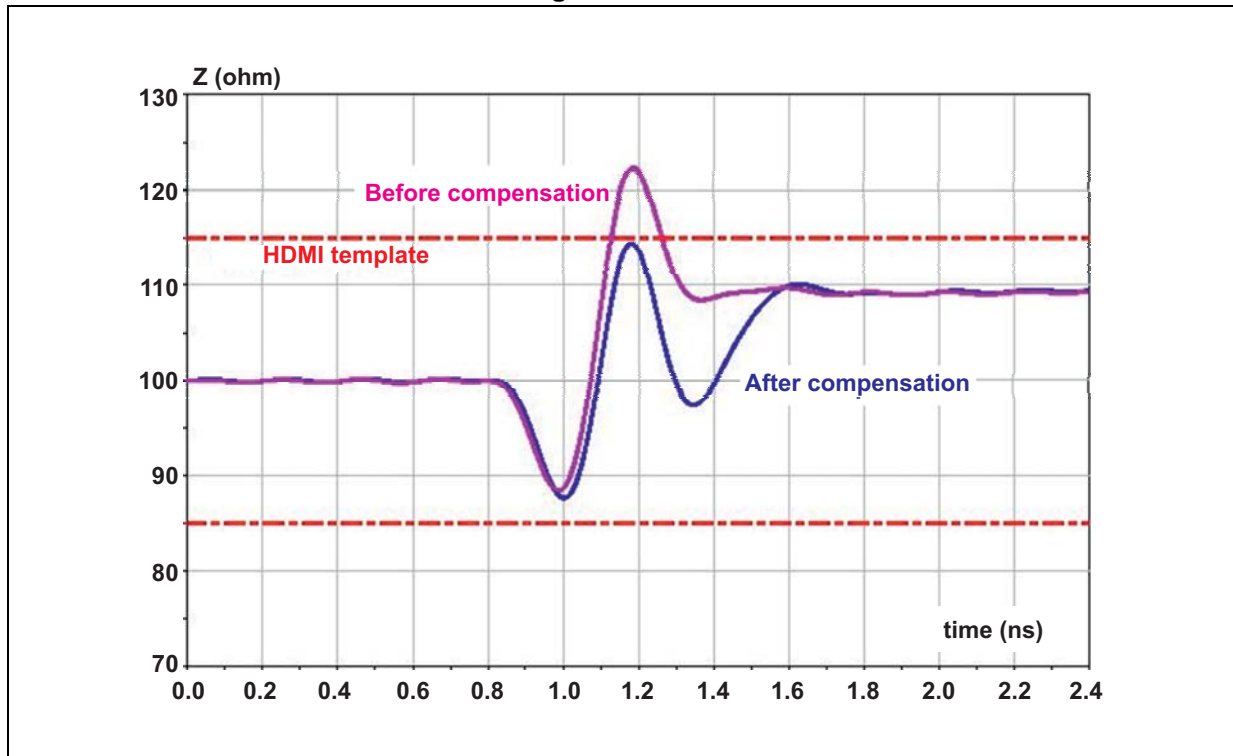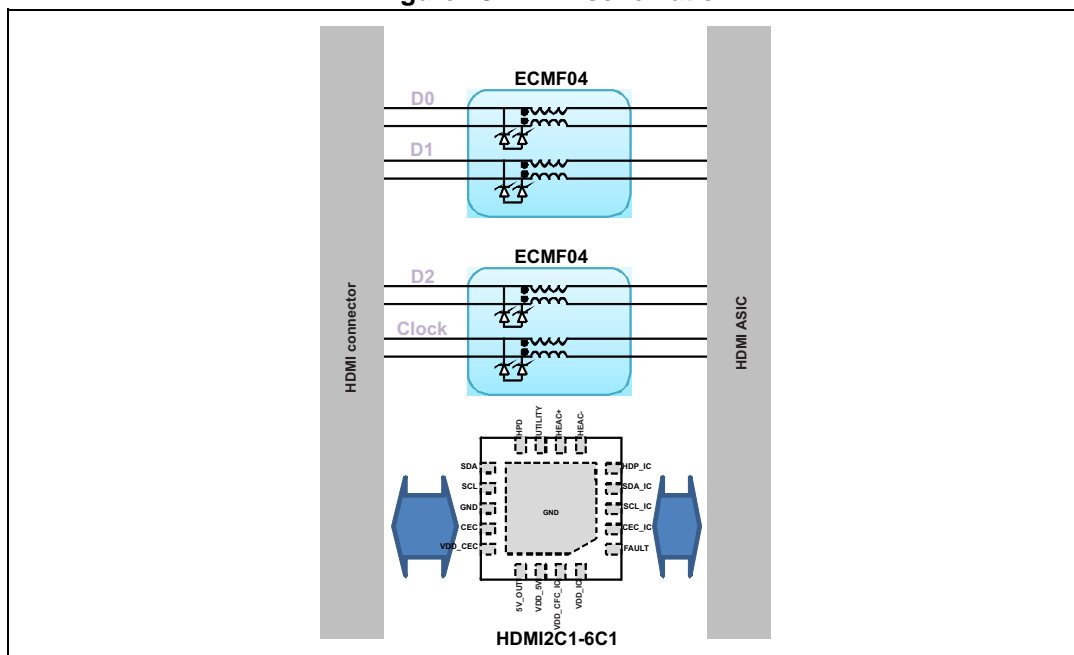**Figure 13. HDMI 3.35 Gbps eye diagram with device**

Figure 14. TDR

2 Application information

Figure 15. HDMI schematic

More application information available in following AN:

- Application Note AN4356: "Antenna desense on handheld equipment"
- Application Note AN4511: "Common Mode filters"
- Application Note AN4540: "MHL link filtering and protection"

3   PCB layout recommendations

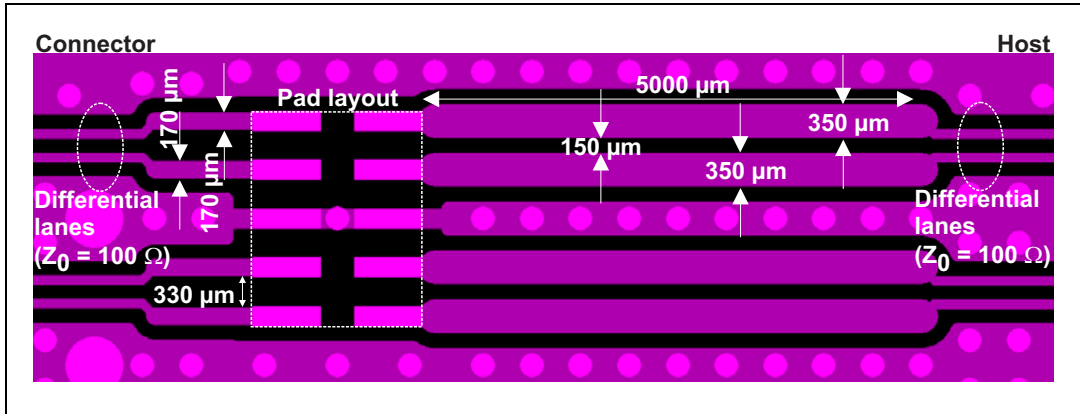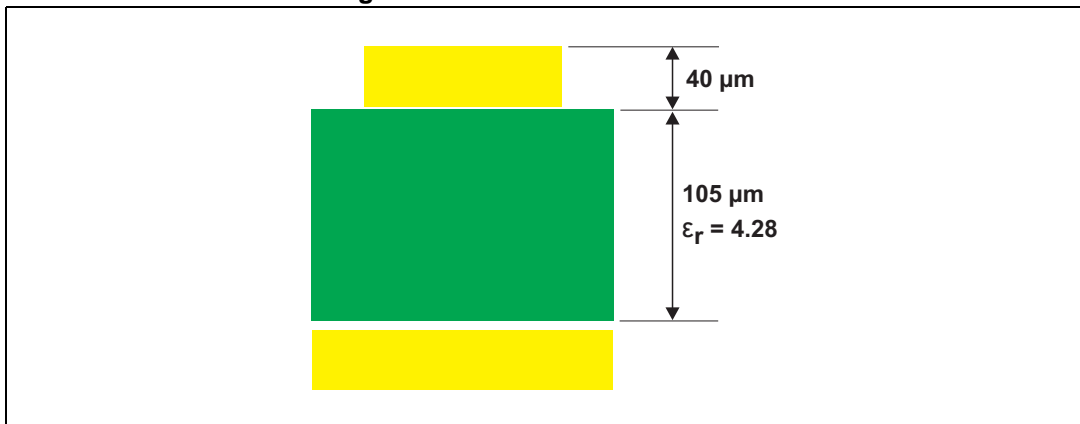**Figure 16. PCB layout recommendations**

Figure 17. PCB stack dimensions

4 Package information

- Epoxy meets UL94, V0
- Lead-free package

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.
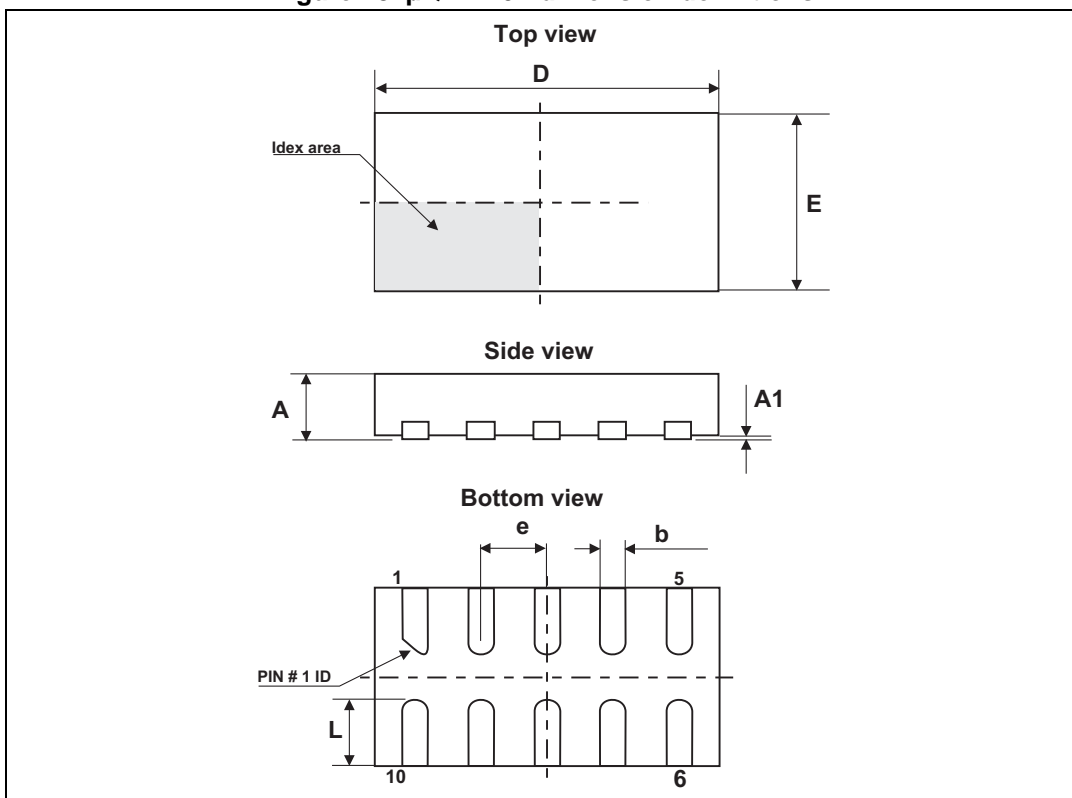
Figure 18. µQFN-10L dimension definitions

Table 4. µQFN-10L dimension values

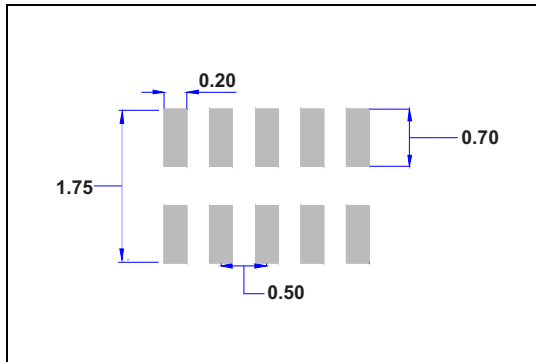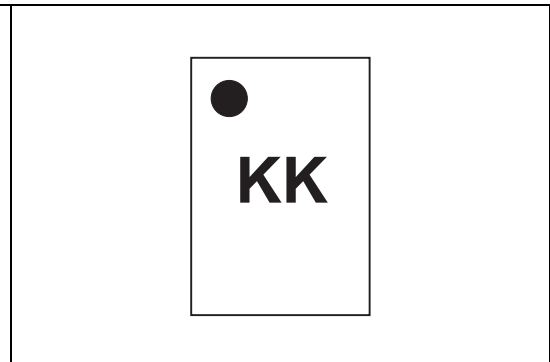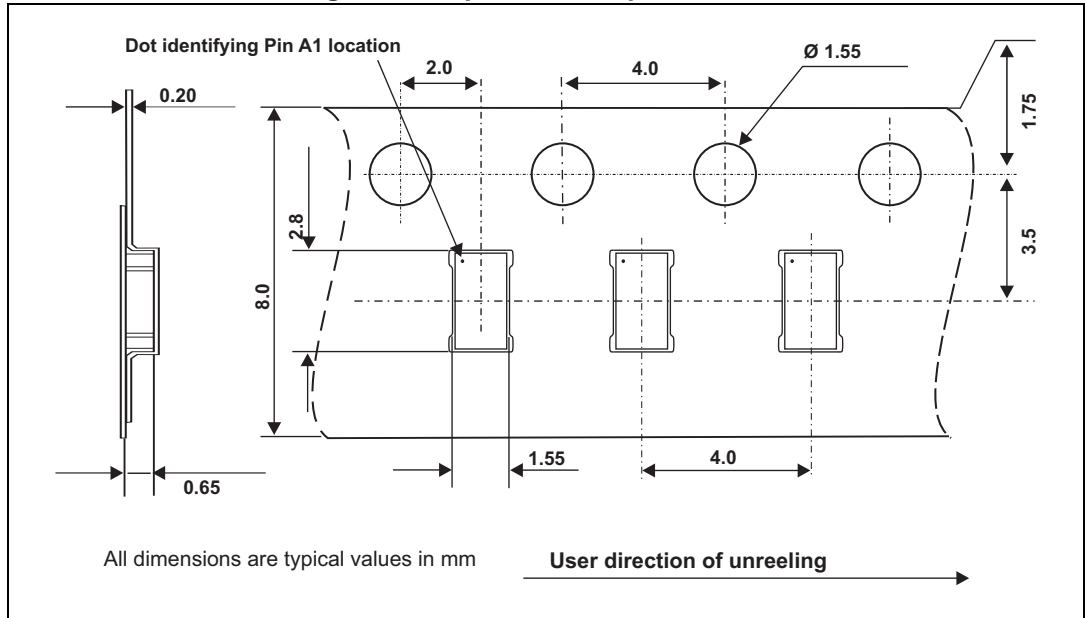| Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.45	0.50	0.55	0.018	0.020	0.022
A1	0.00	0.02	0.05	0.00	0.0008	0.002
b	0.15	0.20	0.25	0.006	0.008	0.010
D	2.55	2.60	2.65	0.1	0.102	0.104
E	1.30	1.35	1.40	0.051	0.053	0.055
e		0.50			0.020	
L	0.40	0.50	0.60	0.016	0.020	0.024

Figure 19. Footprint

Figure 20. Marking

Note: *Product marking may be rotated by multiples of 90° for assembly plant differentiation. In no case should this product marking be used to orient the component for its placement on a PCB. Only pin 1 mark is to be used for this purpose.*

Figure 21. Tape and reel specifications

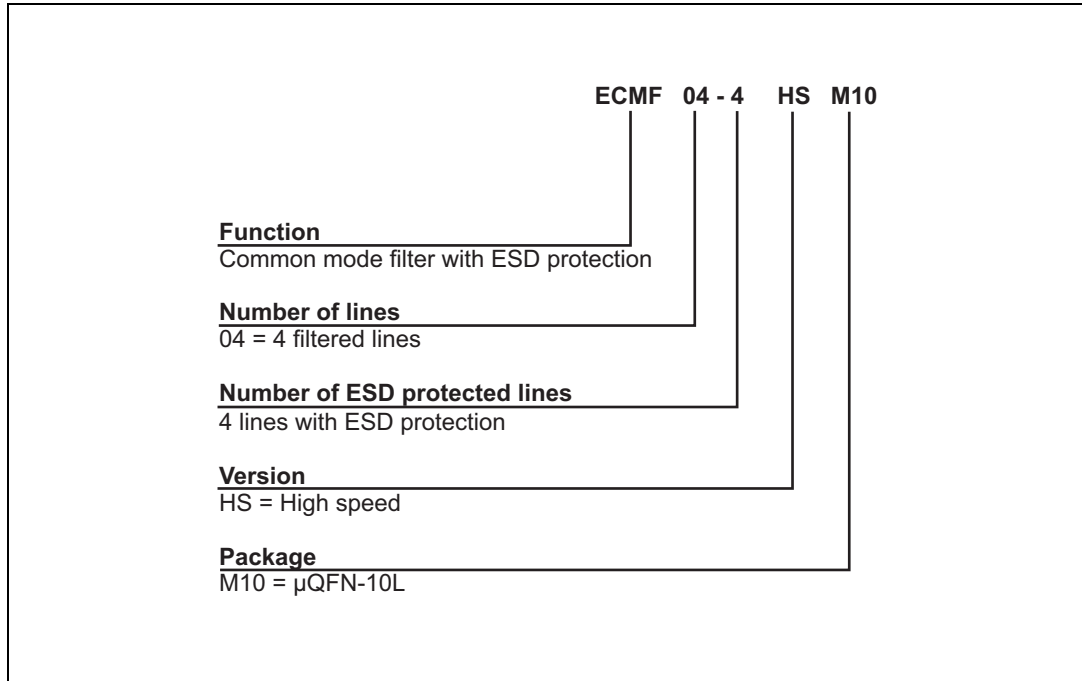# 5   Ordering information

Figure 22. Ordering information scheme

ECMF 04 - 4   HS M10

Function
Common mode filter with ESD protection

Number of lines
04 = 4 filtered lines

Number of ESD protected lines
4 lines with ESD protection

Version
HS = High speed

Package
M10 = µQFN-10L

Table 5. Ordering information

Order code	Marking[1]	Package	Weight	Base qty	Delivery mode
ECMF04-4HSM10	KK	µQFN-10L	5.00 mg	3000	Tape and reel

1.   The marking can be rotated by multiples of 90° to differentiate assembly location

6   Revision history

Table 6. Document revision history

Date	Revision	Changes
03-Oct-2013	1	Initial release.
25-Aug-2014	2	Added *Figure 5: Differential (ZDD21) and common mode (ZCC21) impedance versus frequency*.

IMPORTANT NOTICE – PLEASE READ CAREFULLY