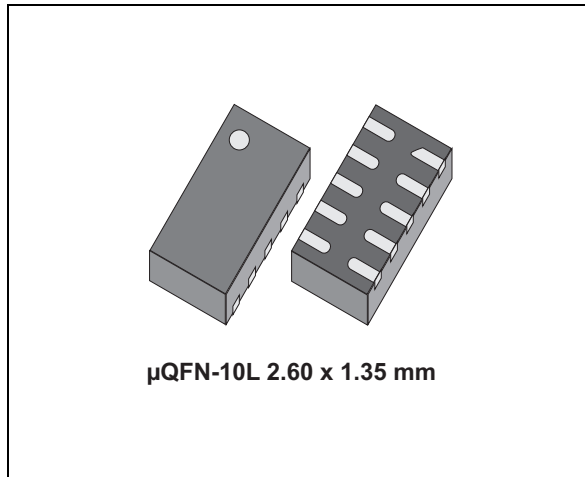
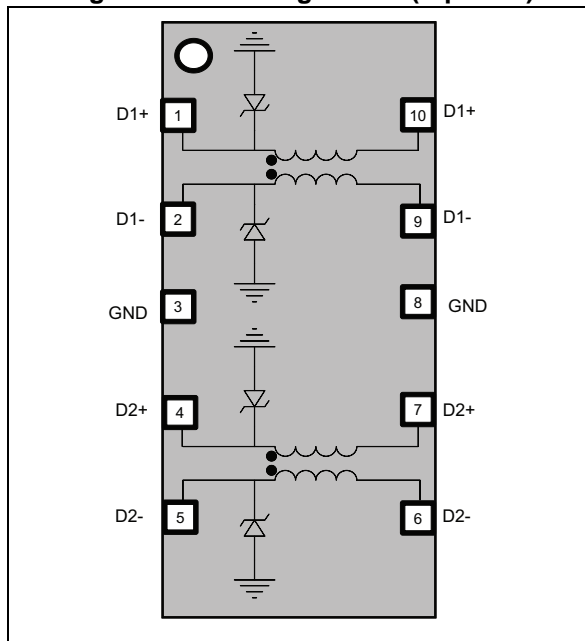


## Common-mode filter with ESD protection for high-speed serial interfaces

Datasheet - production data



**Figure 1. Pin configuration (top view)**



### Features

- Very large differential bandwidth to comply with HDMI 2.0, USB3.0, MIPI, DisplayPort and other high speed serial interfaces
- High common mode attenuation on WLAN frequencies:
  - 28 dB at 2.4 GHz and -16 dB at 5.0 GHz
- Very good attenuation at LTE, GSM and GPS frequencies
- Large bandwidth: 4.2GHz
- 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

- Set top box
- Streaming box
- Game console
- Notebook, laptop
- Portable devices

### Description

The ECMF04-4HSWM10 is a highly integrated common-mode filter designed to suppress EMI/RFI common mode noise on high-speed differential serial buses like HDMI 2.0, USB3.0, Ethernet, MIPI, DisplayPort and other high-speed serial interfaces. The device has a very large differential bandwidth to comply with these standards and can also protect and filter 2 differential lanes.

# Contents

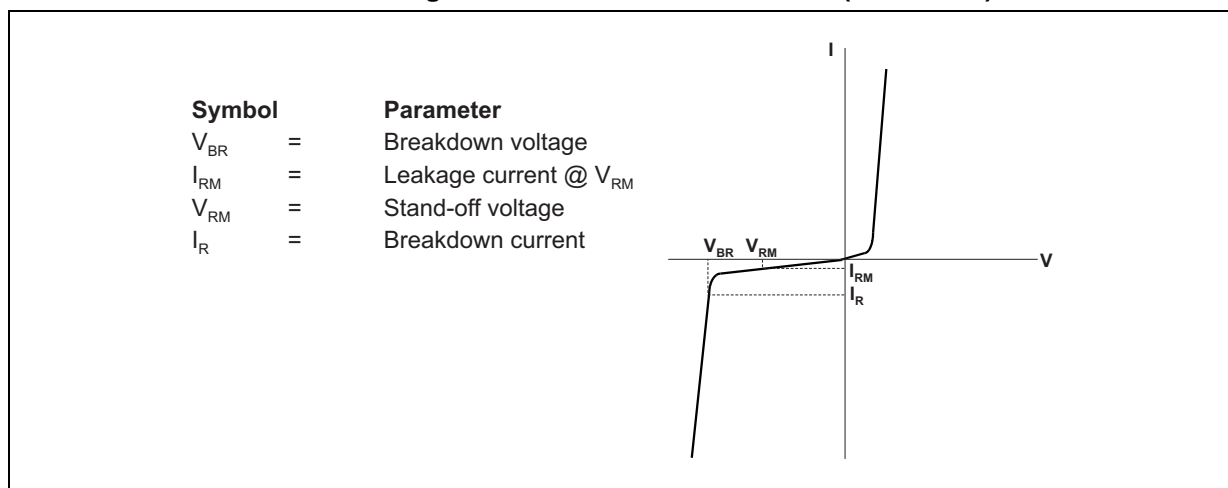
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# 1 Characteristics

**Table 1. Absolute maximum ratings ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )**

Symbol	Parameter		Value	Unit
$V_{PP}$	Peak pulse voltage	IEC 61000-4-2 Contact discharge (connector side) Air discharge (connector side)	8 15	kV
$I_{RMS}$	Maximum RMS current		100	mA
$T_{op}$	Operating temperature range		-40 to +85	$^{\circ}\text{C}$
$T_j$	Maximum junction temperature		125	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature range		- 55 to +150	$^{\circ}\text{C}$

**Figure 2. Electrical characteristics (definitions)**



**Table 2. Electrical characteristics ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )**

Symbol	Test conditions	Min.	Typ.	Max.	Unit
$V_{BR}$	$I_R = 1\text{ mA}$	4.5	5.5		V
$I_{RM}$	$V_{RM} = 3\text{ V per line}$			100	nA
$R_{DC}$	DC serial resistance		5		$\Omega$
$F_C$	-3dB differential mode cut-off frequency		4.2		GHz

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 ( $Z_{0\text{ diff}} = 100 \Omega$ )

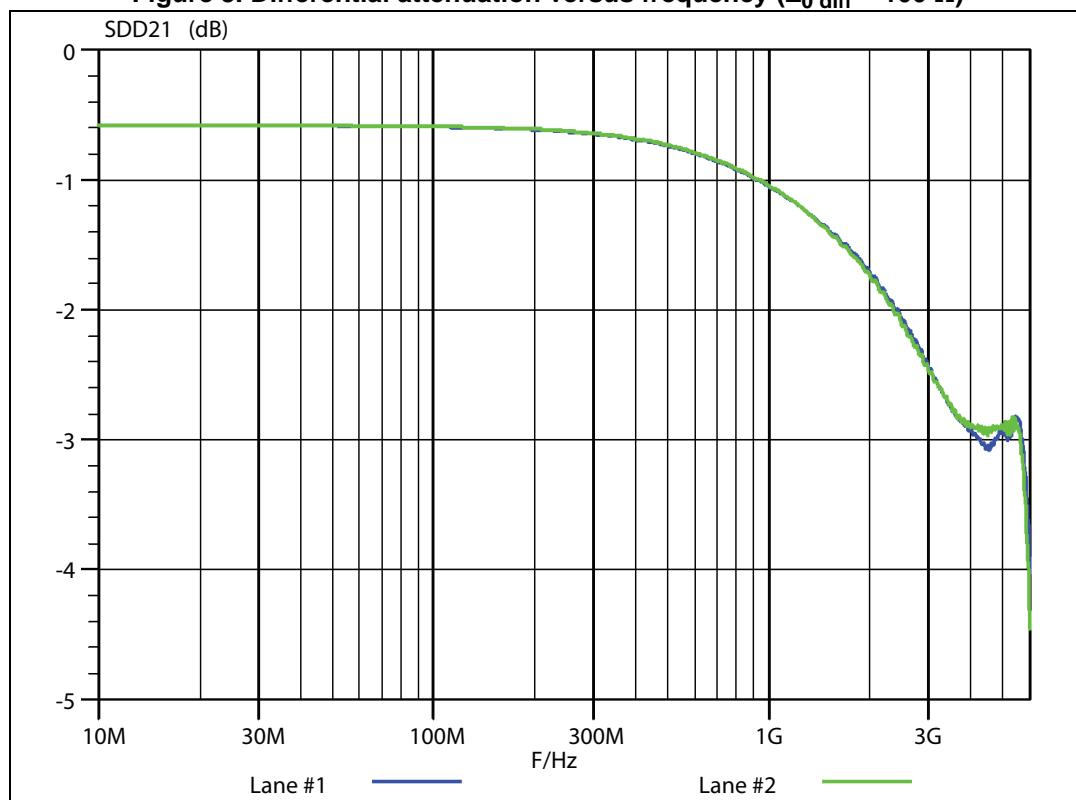


Figure 4. Common mode attenuation versus frequency ( $Z_{0\text{ com}} = 50 \Omega$ )

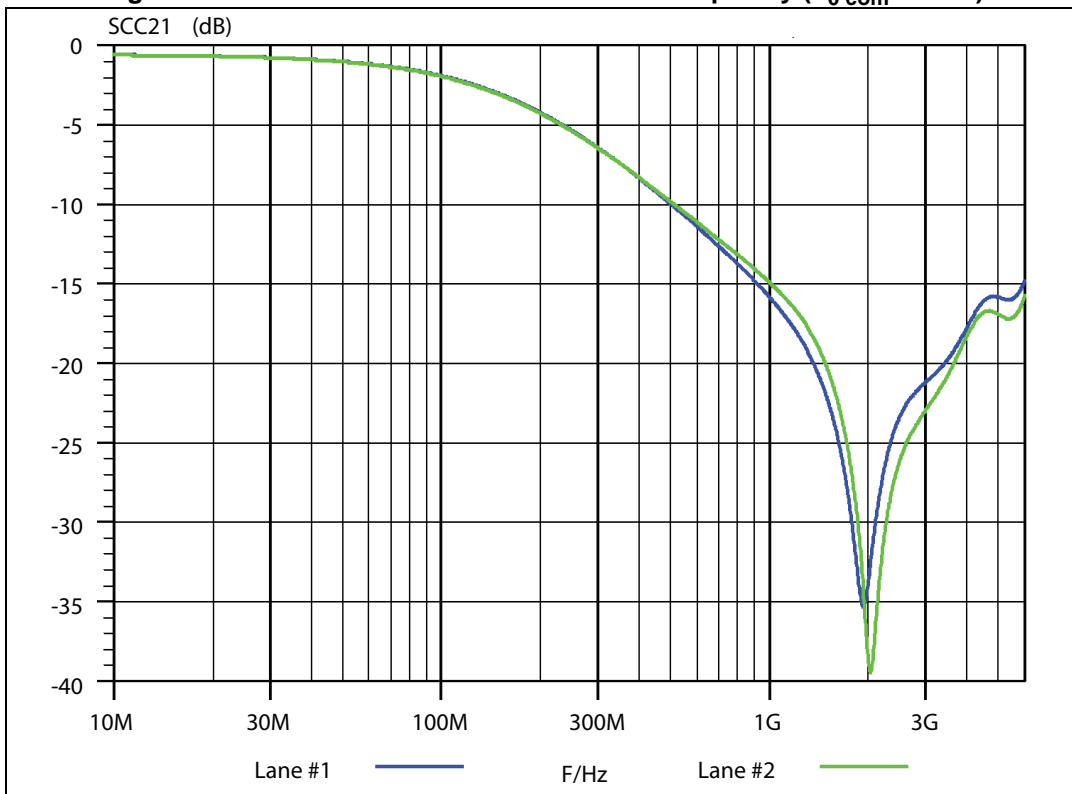


Figure 5. ESD response to IEC61000-4-2 (+8 kV contact discharge)

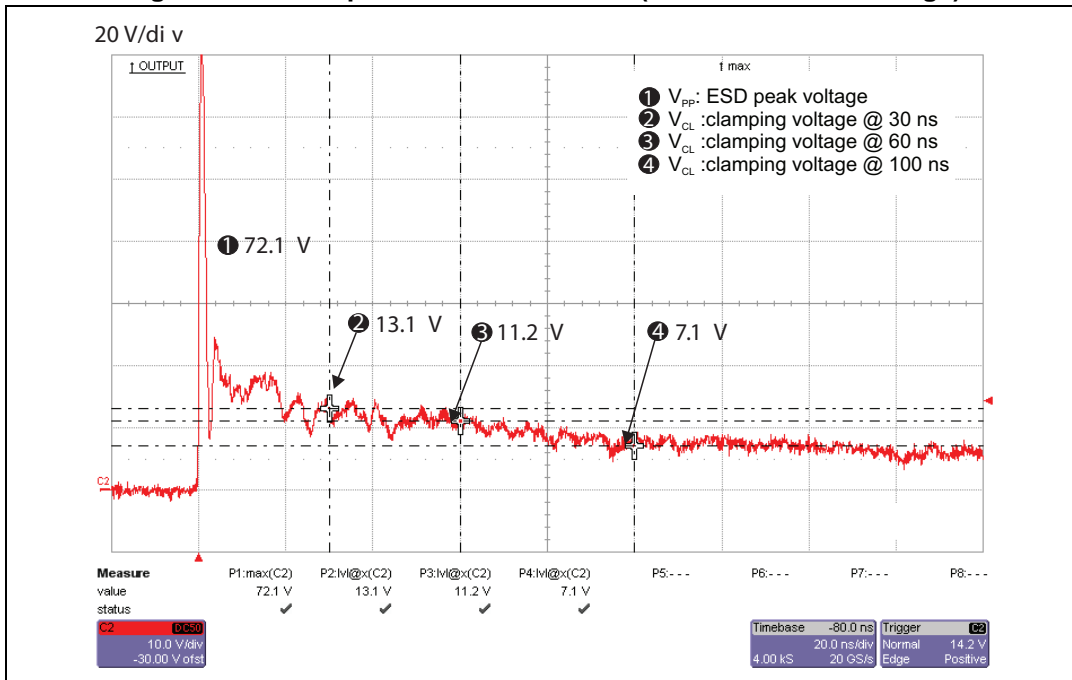


Figure 6. ESD response to IEC61000-4-2 (-8 kV contact discharge)

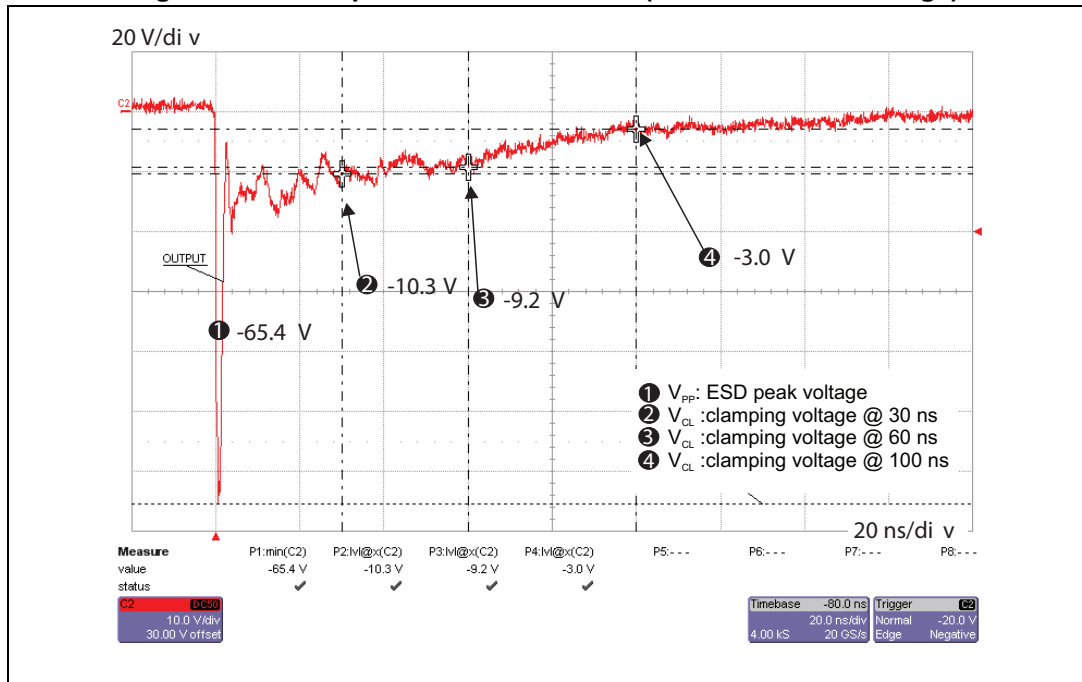


Figure 7. HDMI2.0 5.94 Gbps eye diagram without ECMF04-4HSWM10 (evaluation board with SMA connector)

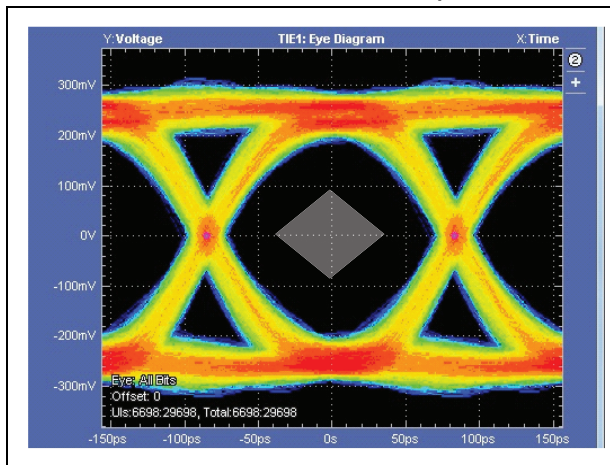


Figure 8. HDMI2.0 5.94 Gbps eye diagram with ECMF04-4HSWM10 (evaluation board with SMA connector)

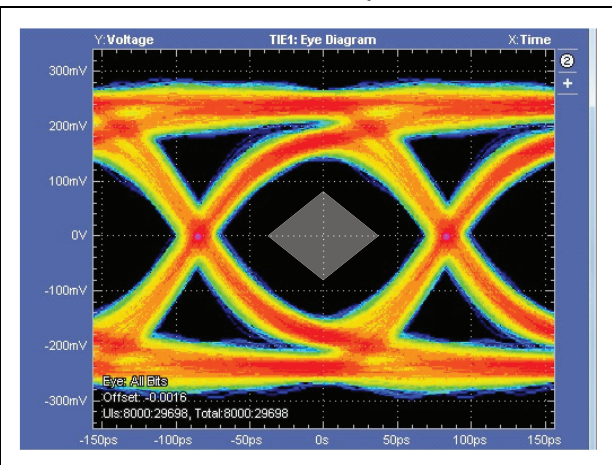


Figure 9. HDMI1.4 3.35 Gbps eye diagram without ECMF04-4HSWM10

Figure 10. HDMI1.4 3.35 Gbps eye diagram with ECMF04-4HSWM10

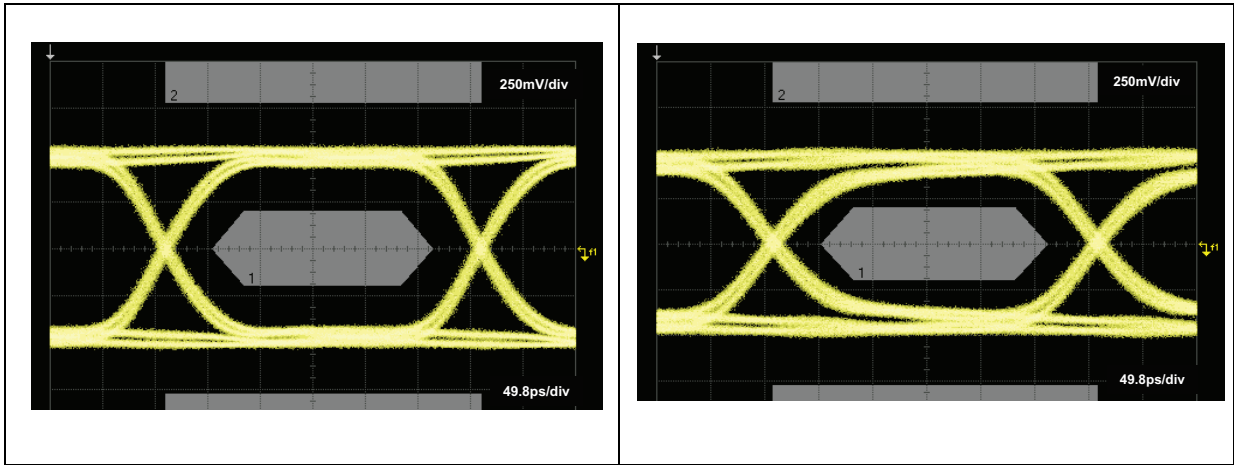
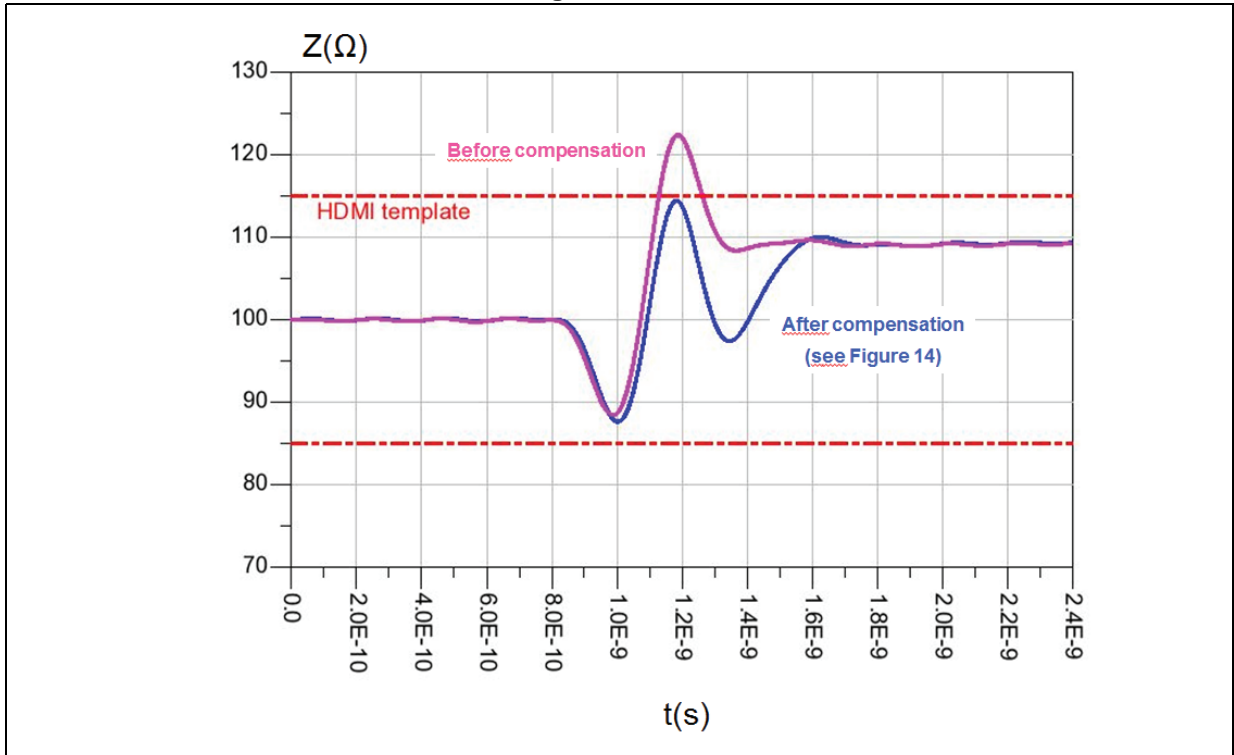


Figure 11. TDR







### 3 PCB layout recommendations

Figure 14. PCB layout recommendations

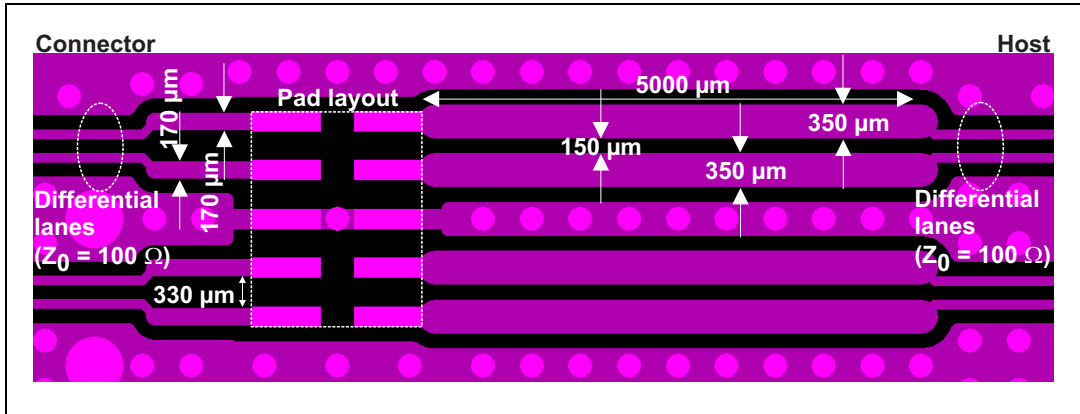
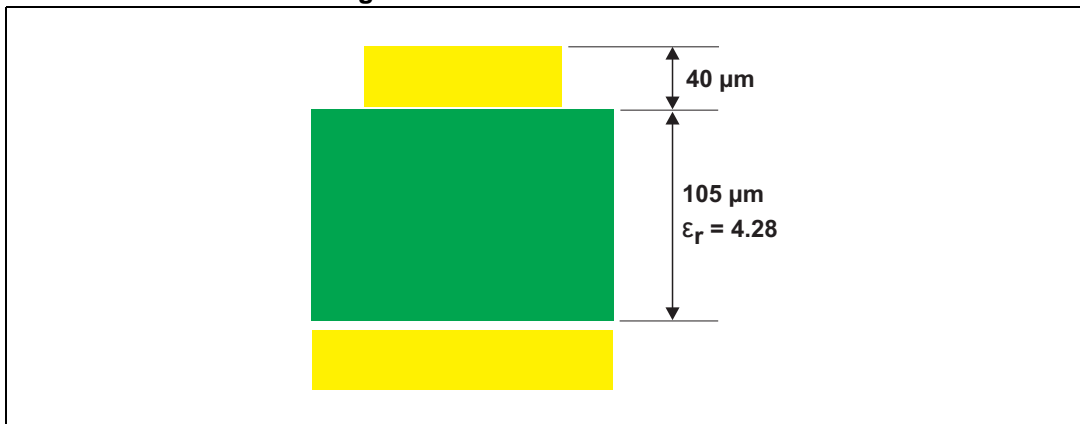


Figure 15. PCB stack dimensions



## 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](http://www.st.com). ECOPACK® is an ST trademark.

Figure 16. μQFN-10L dimension definitions

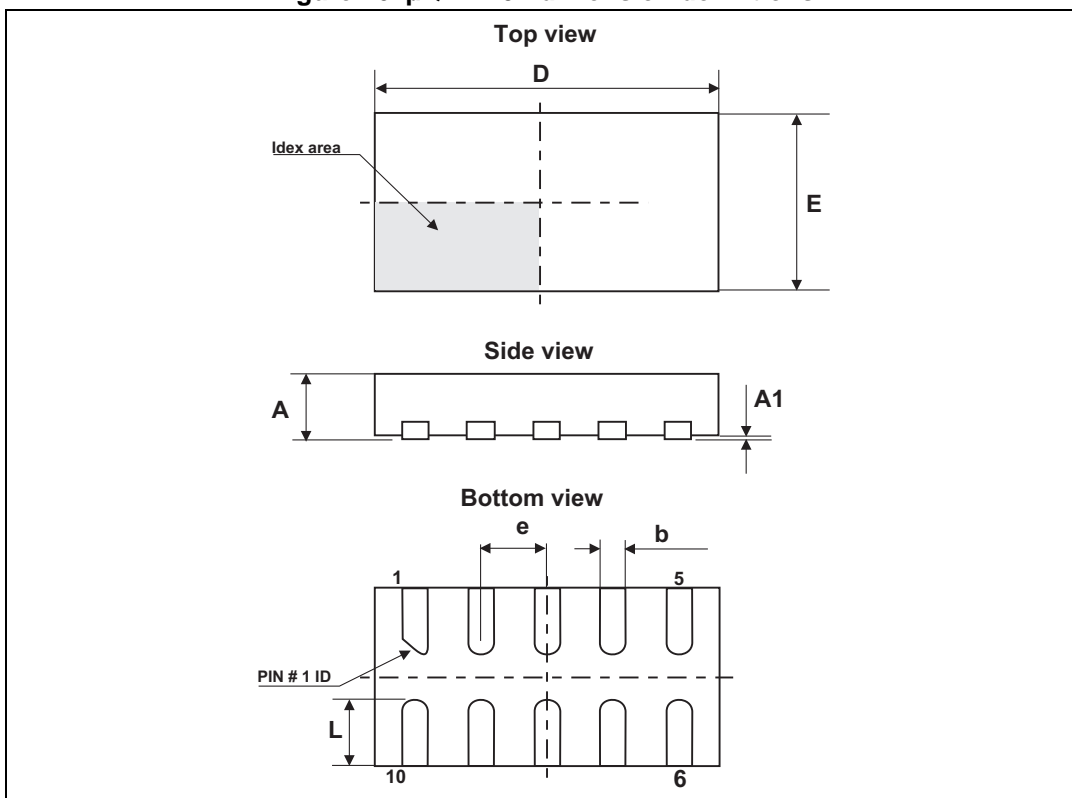


Table 4. μQFN-10L dimension values

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 17. Footprint

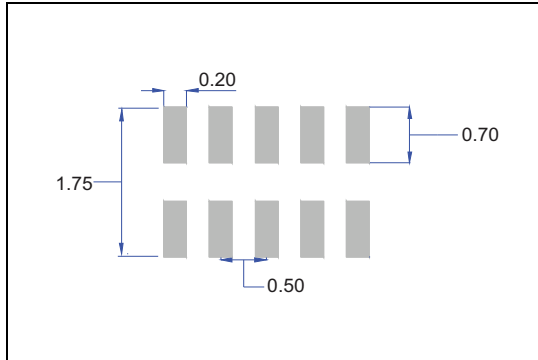
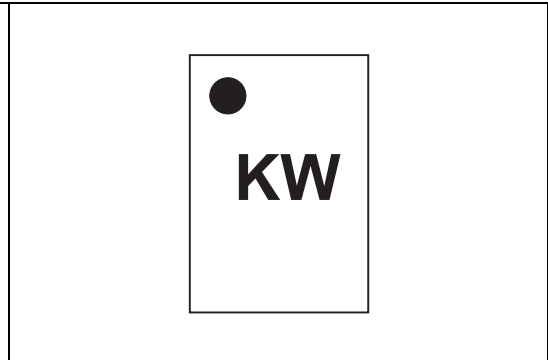
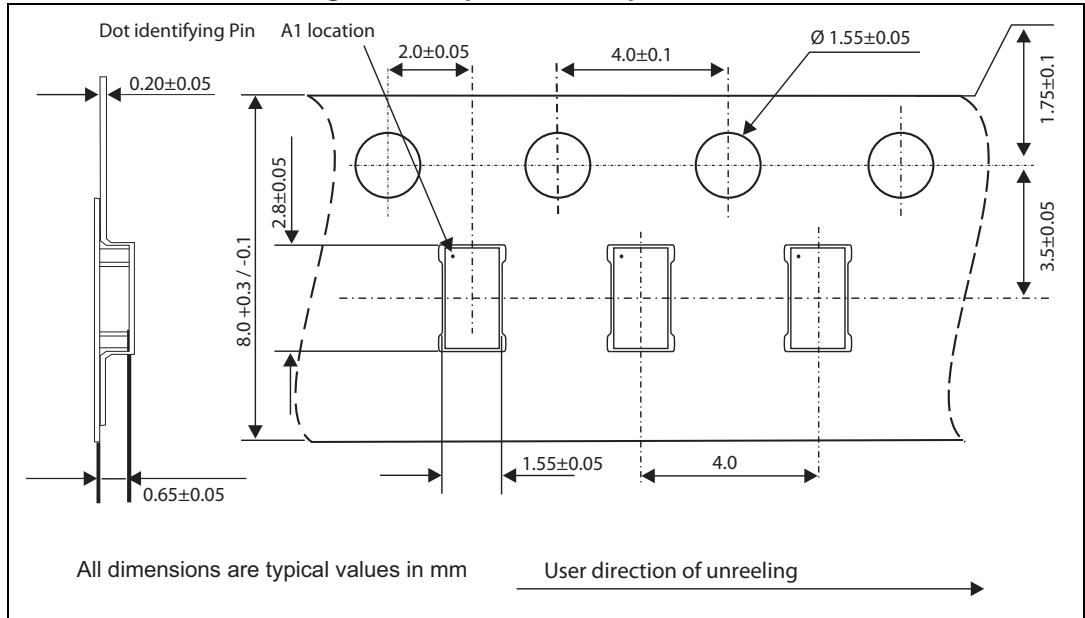


Figure 18. Marking



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 19. Tape and reel specifications



## 5 Ordering information

Figure 20. Ordering information scheme

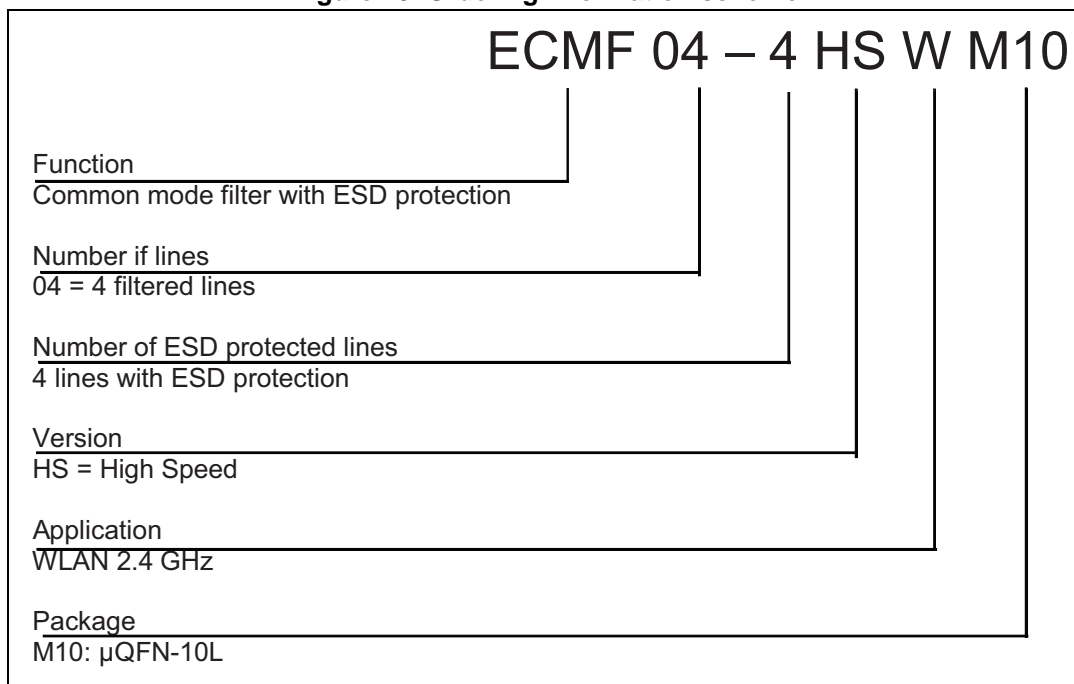


Table 5. Ordering information

Order code	Marking <sup>(1)</sup>	Package	Weight	Base qty	Delivery mode
ECMF04-4HSWM10	KW	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
10-Jun-2014	1	Initial release.

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