

# ECMF04-4HSWM10

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



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



#### Datasheet - production data

### 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.

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This is information on a product in full production.

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### 1 Characteristics

Symbol	Par	Value	Unit	
V <sub>PP</sub>	Peak pulse voltage	IEC 61000-4-2 Contact discharge (connector side) Air discharge (connector side)	8 15	kV
I <sub>RMS</sub>	Maximum RMS current		100	mA
T <sub>op</sub>	Operating temperature range		-40 to +85	°C
Тј	Maximum junction temperature		125	°C
T <sub>stg</sub>	Storage temperature range		- 55 to +150	°C

Table 1. Absolute I	maximum	ratings	$(T_{amb} = 25 °C)$
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### Figure 2. Electrical characteristics (definitions)



### Table 2. Electrical characteristics (T<sub>amb</sub> = 25 °C)

Symbol	Test conditions	Min.	Тур.	Max.	Unit
V <sub>BR</sub>	I <sub>R</sub> = 1 mA	4.5	5.5		V
I <sub>RM</sub>	V <sub>RM</sub> = 3 V per line			100	nA
R <sub>DC</sub>	DC serial resistance		5		Ω
F <sub>C</sub>	-3dB differential mode cut-off frequency		4.2		GHz



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		

Table 3. Pin description









Figure 4. Common mode attenuation versus frequency (Z<sub>0 com</sub> = 50  $\Omega$ )









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





## 2 Application information



#### Figure 12. HDMI schematic

#### Figure 13. USB3.0 application





### **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<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: *www.st.com.* ECOPACK<sup>®</sup> is an ST trademark.



Figure 16. µQFN-10L dimension definitions

#### Table 4. µQFN-10L dimension values

			Dime	ensions		
Ref.		Millimeters			Inches	
	Min.	Тур.	Max.	Min.	Тур.	Max.
А	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
е		0.50			0.020	
L	0.40	0.50	0.60	0.016	0.020	0.024





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. Orde	ering informa	tion schen	ie			
	ECMF	04 – 4	4 HS	5 W	/ M1	0
Function						
Common mode filter with ESD protecti	ion					
Number if lines 04 = 4 filtered lines						
Number of ESD protected lines 4 lines with ESD protection						
Version HS = High Speed						
Application WLAN 2.4 GHz						
Package M10: µQFN-10L						

### 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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