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## Common mode filter with ESD protection for high speed serial interface

Datasheet - production data

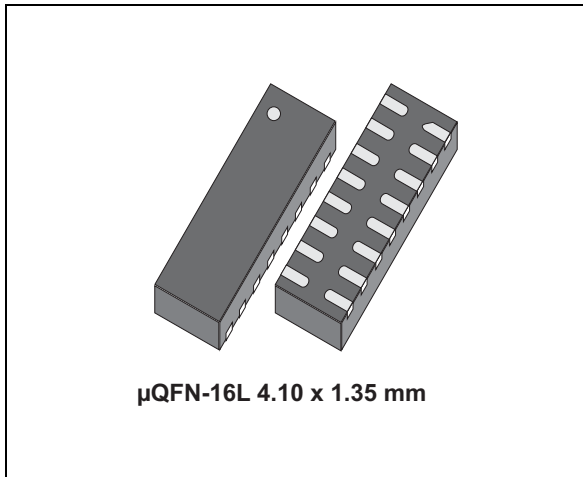
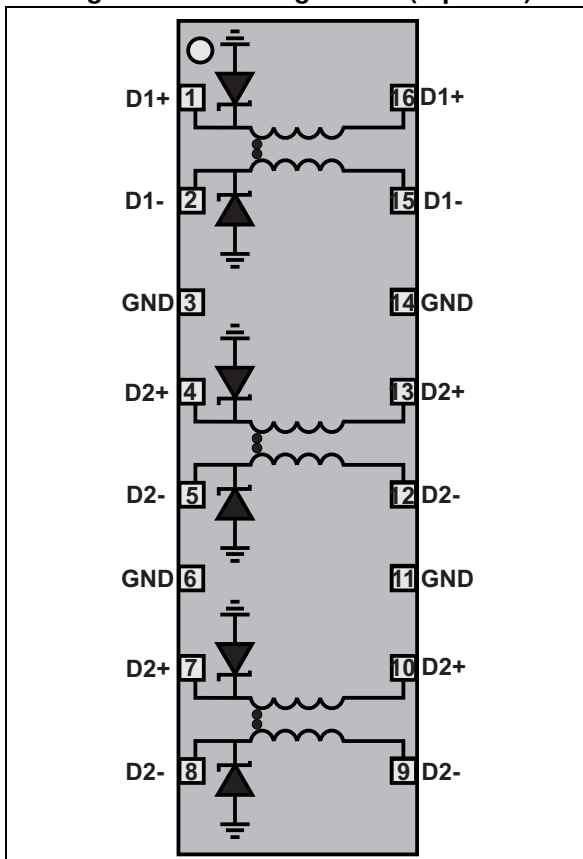


Figure 1. Pin configuration (top view)



### 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

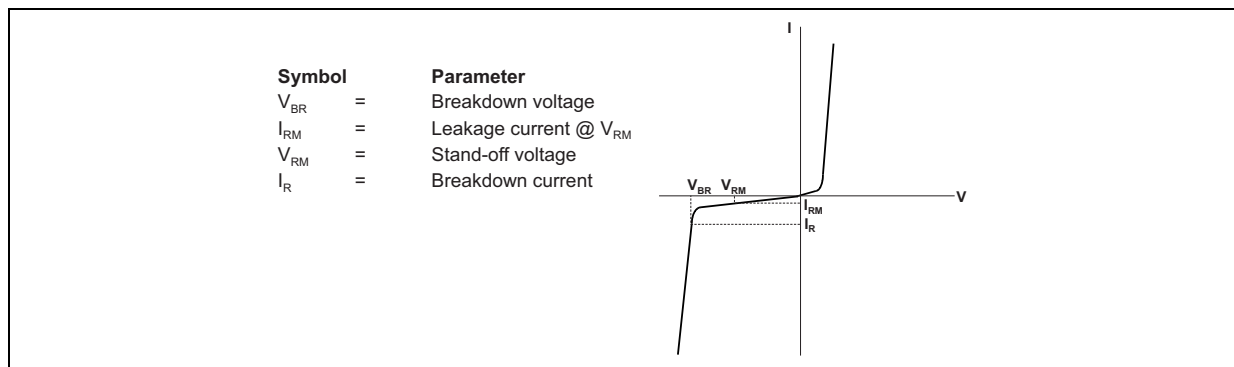
This device is a highly integrated common mode filter designed to suppress EMI/RFI common mode noise on high speed differential serial buses like HDMI Full HD, MIPI, Display Port and other high speed serial interfaces. The device has a very large differential bandwidth to comply with these standards. The device can protect and filter 3 differential lanes.

# 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)	8	kV
		Air discharge (connector side)	16	
$I_{DC}$	Maximum DC 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
$V_{BR}$	$I_R = 1\text{ mA}$	6			V
$I_{RM}$	$V_{RM} = 3\text{ V per line}$			100	nA
$R_{DC}$	DC serial resistance		5		$\Omega$

**Table 3. Pin description**

Pin number	Description	Pin number	Description	Pin number	Description	Pin number	Description
1	D1+ to connector	5	D2- to connector	9	D3- to IC	13	D2+ to IC
2	D1- to connector	6	GND	10	D3+ to IC	14	GND
3	GND	7	D3+ to connector	11	GND	15	D1- to IC
4	D2+ to connector	8	D3- to connector	12	D2- to IC	16	D1+ to IC

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

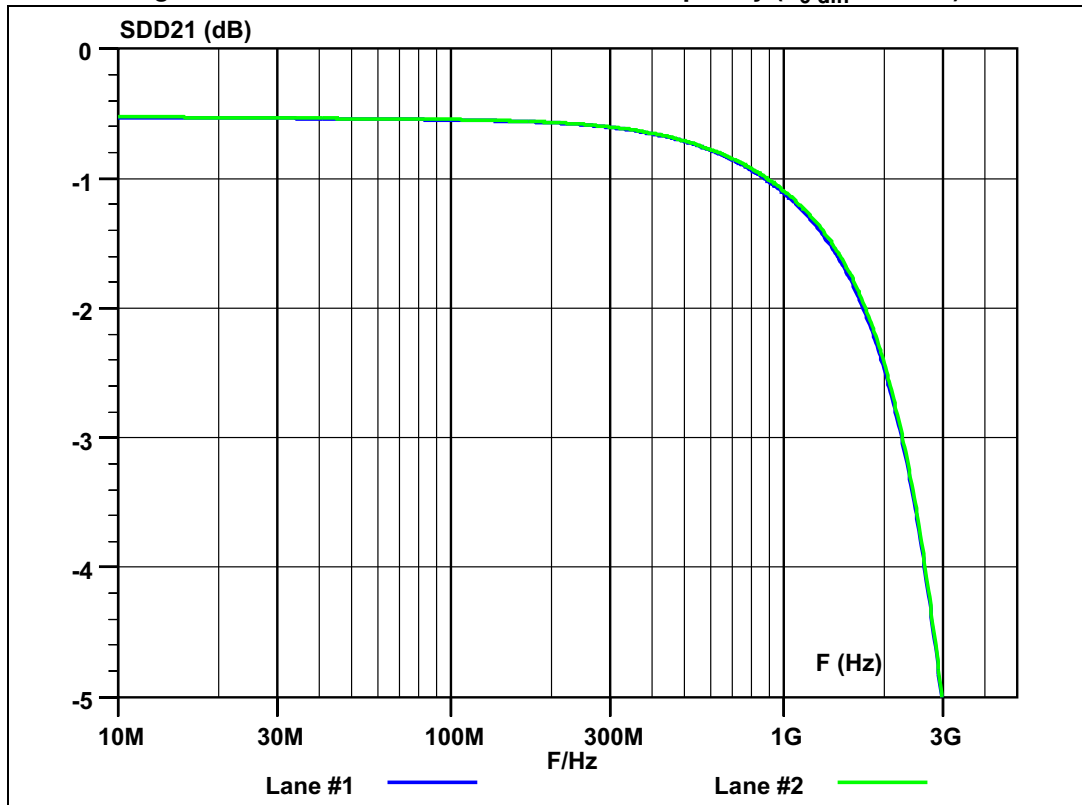


Figure 4. Common mode attenuation versus frequency ( $Z_{0\text{ com}} = 50 \Omega$ )

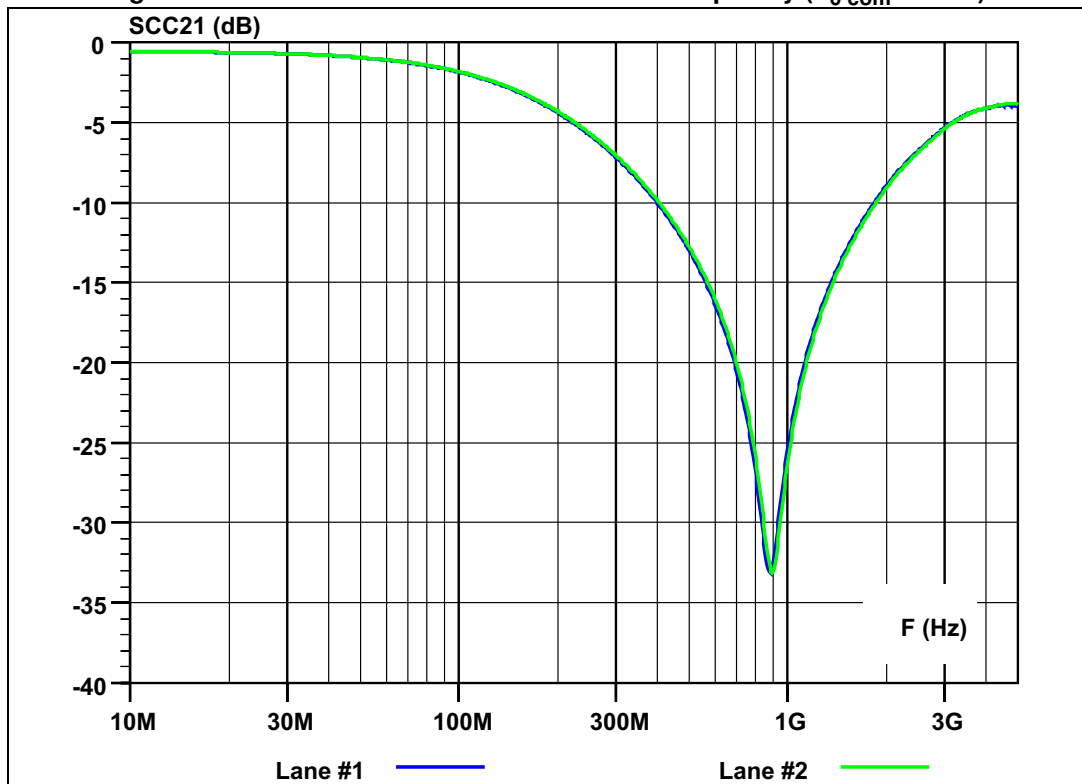


Figure 5. Differential ( $Z_{DD21}$ ) and common mode ( $Z_{CC21}$ ) impedance versus frequency

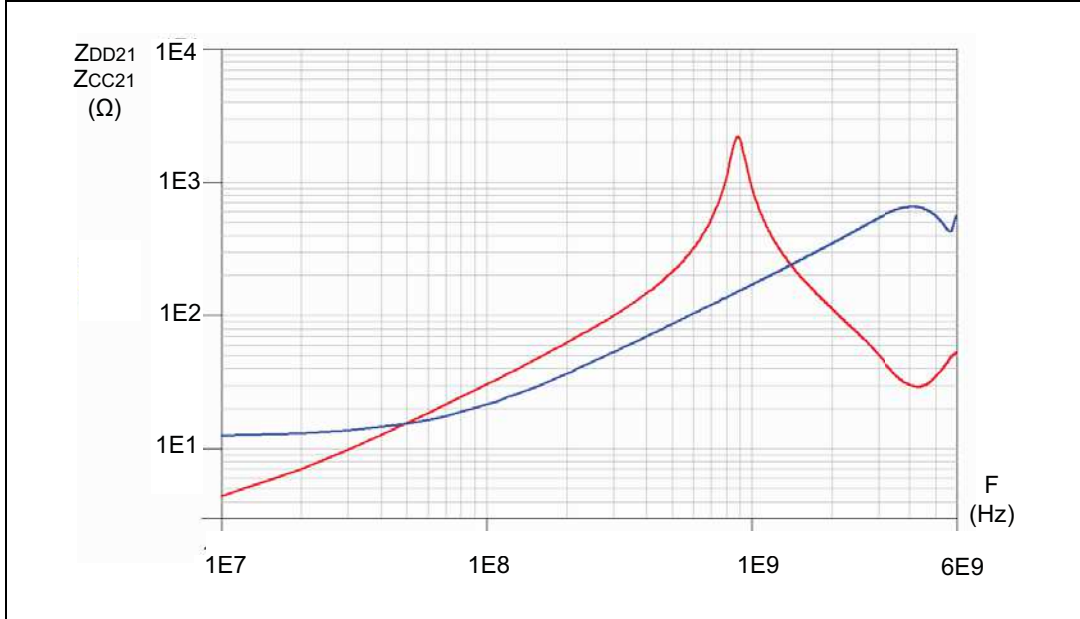


Figure 6. ESD response to IEC61000-4-2 (+8 kV contact discharge)

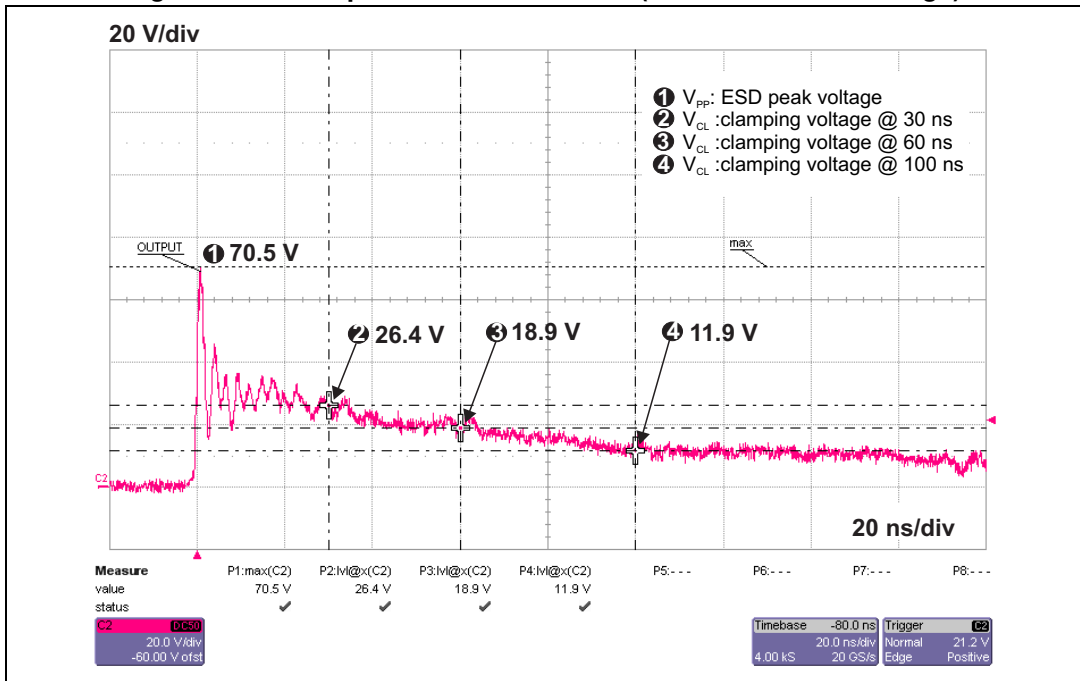


Figure 7. ESD response to IEC61000-4-2 (-8 kV contact discharge)

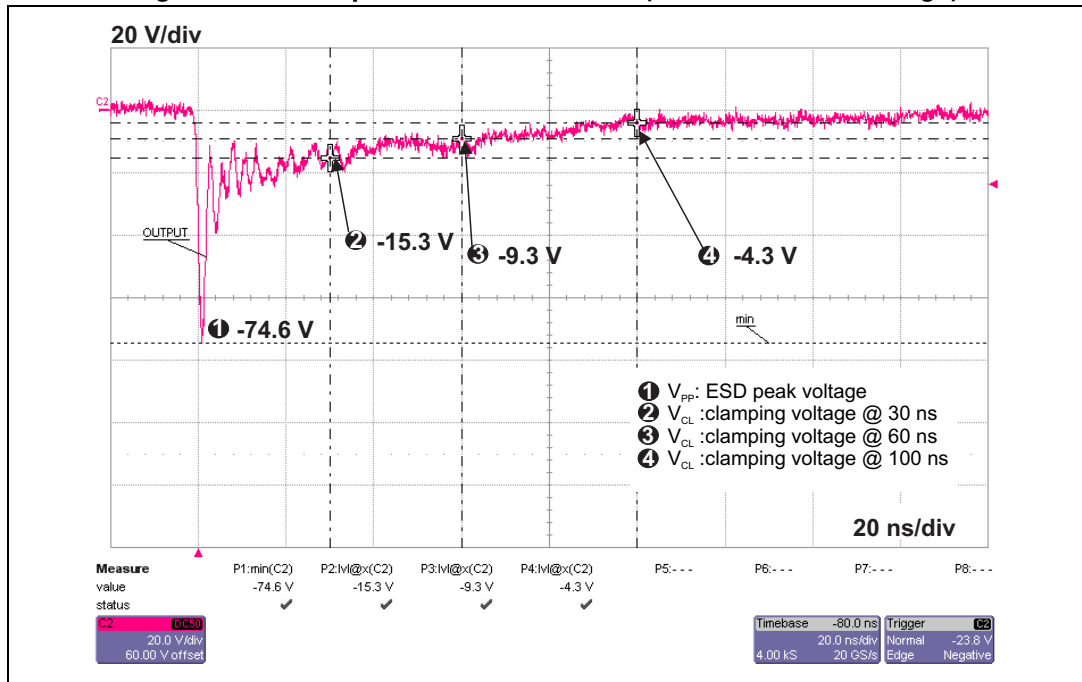


Figure 8. USB2.0 480 Mbps eye diagram without device

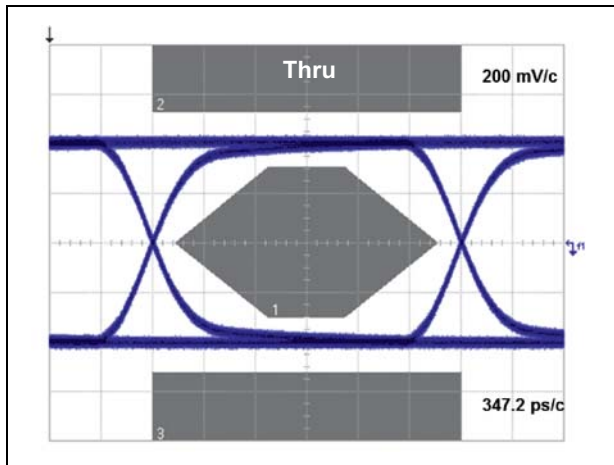


Figure 9. USB2.0 480 Mbps eye diagram with device

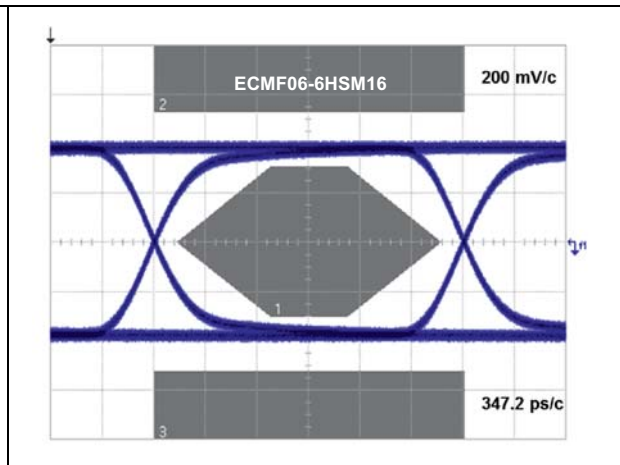


Figure 10. USB3.0 5 Gbps eye diagram without device

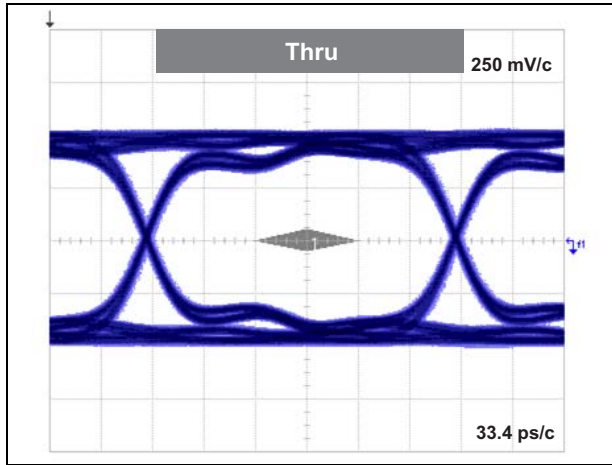


Figure 11. USB3.0 5 Gbps eye diagram with device

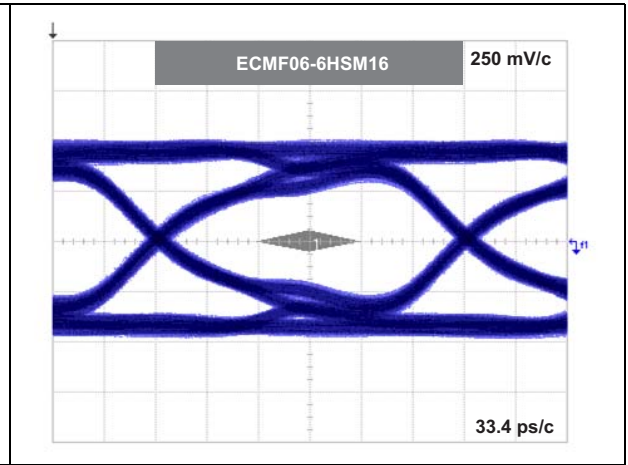


Figure 12. HDMI 3.35 Gbps eye diagram without device

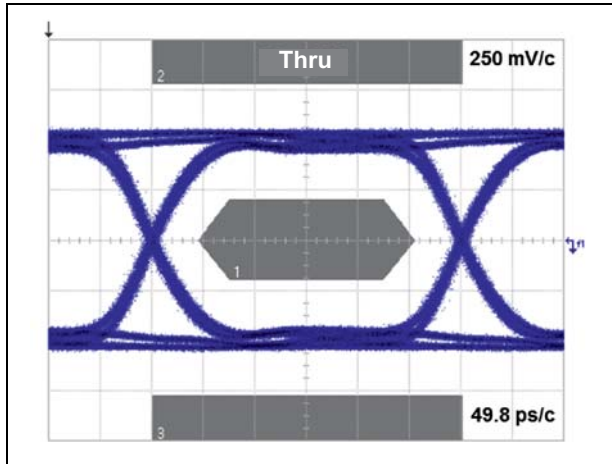


Figure 13. HDMI 3.35 Gbps eye diagram with device

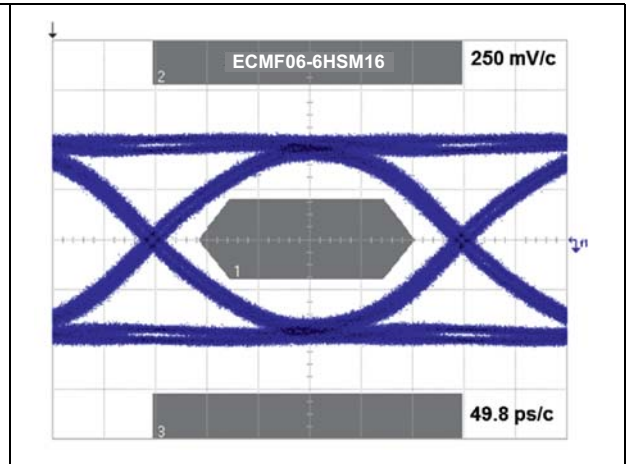
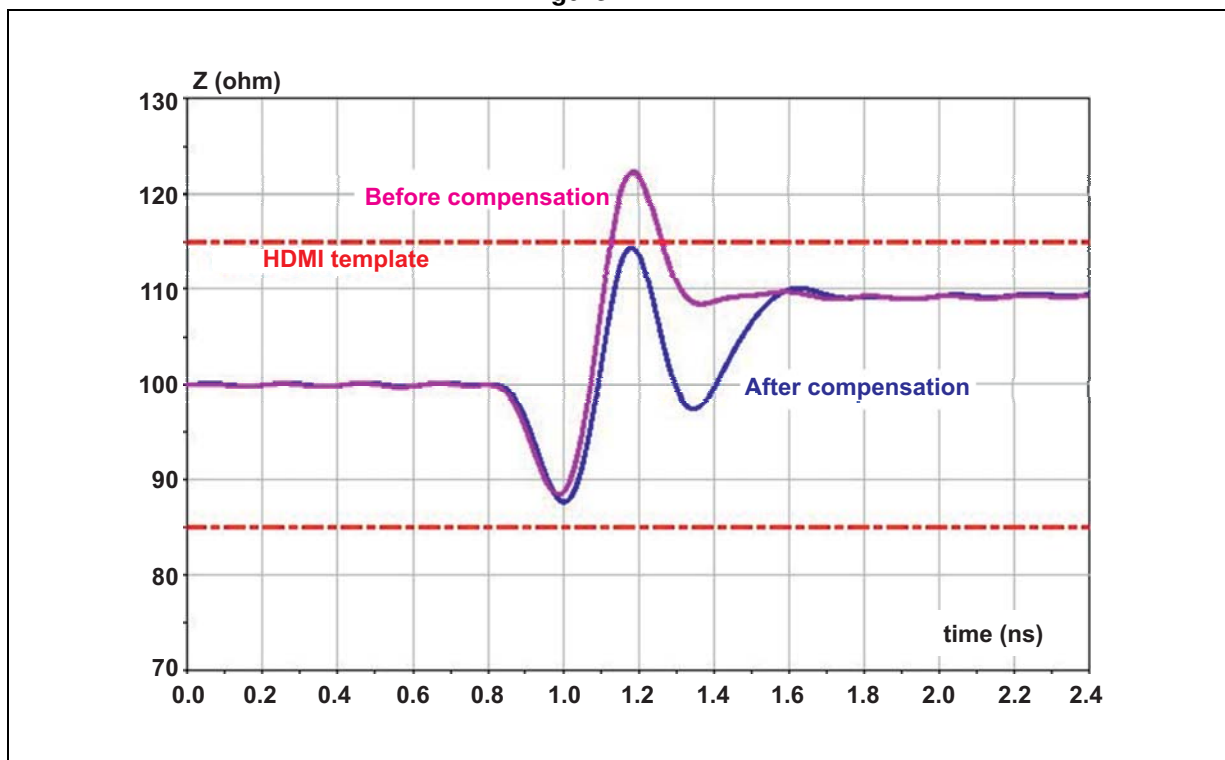


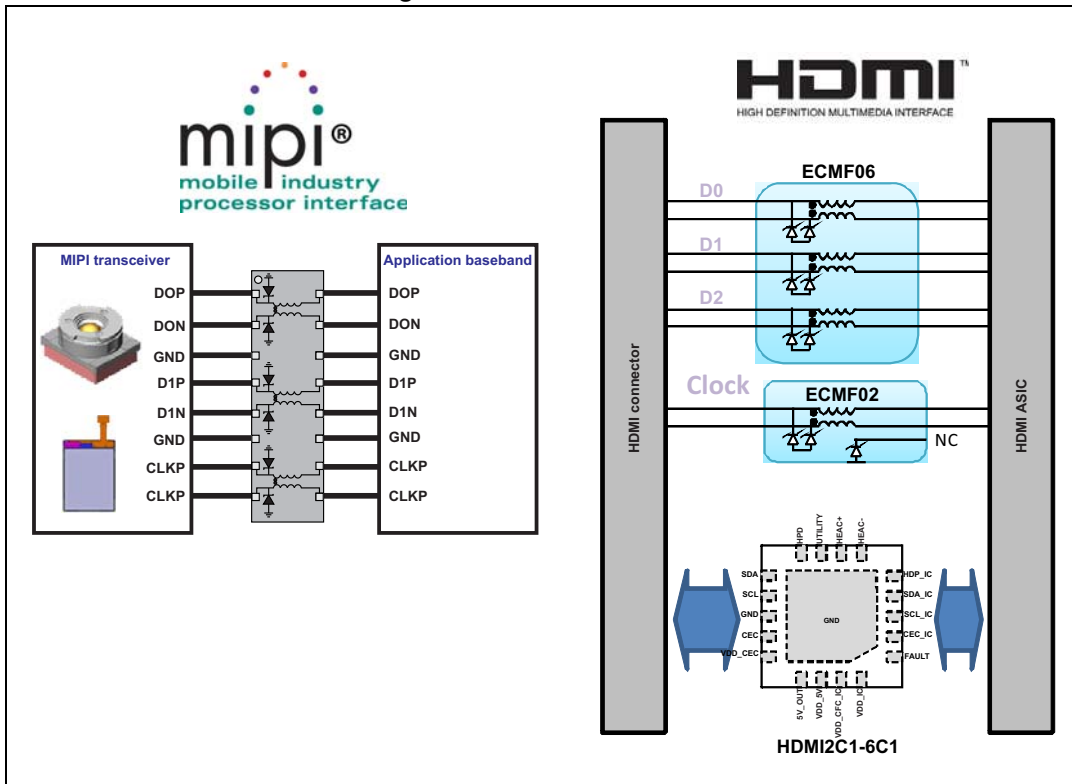
Figure 14. TDR





## 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

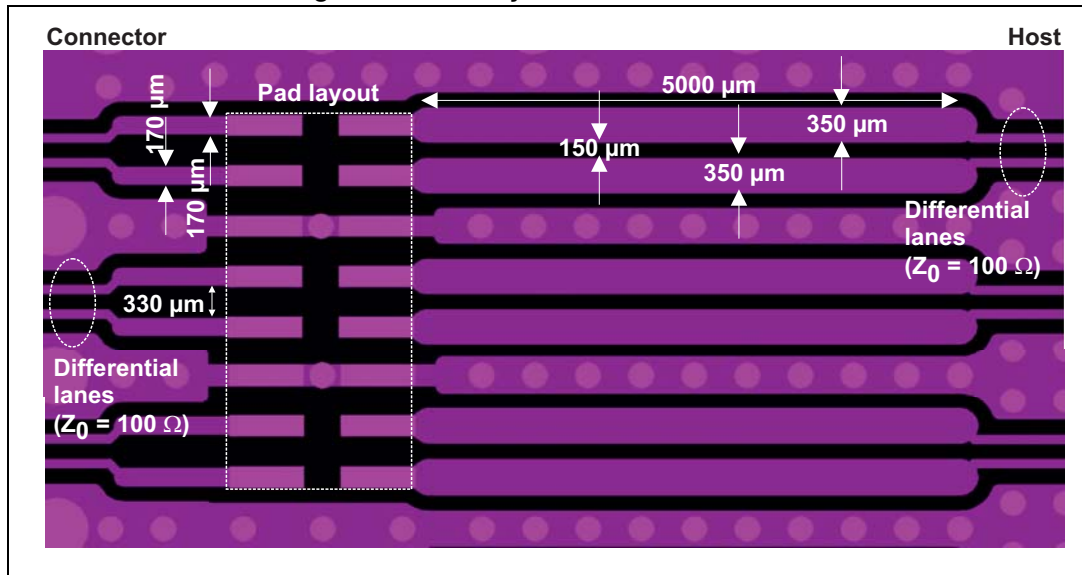
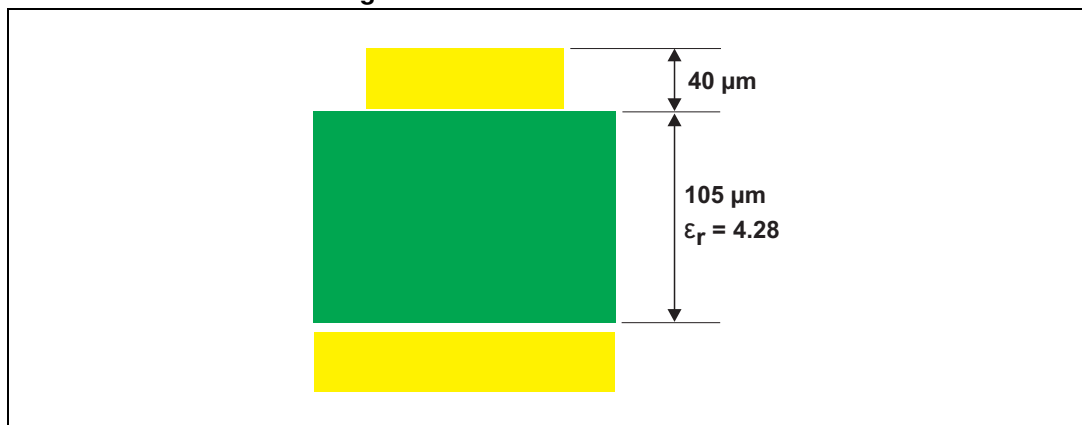


Figure 17. PCB stack dimensions



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

Figure 18. μQFN-16L dimension definitions

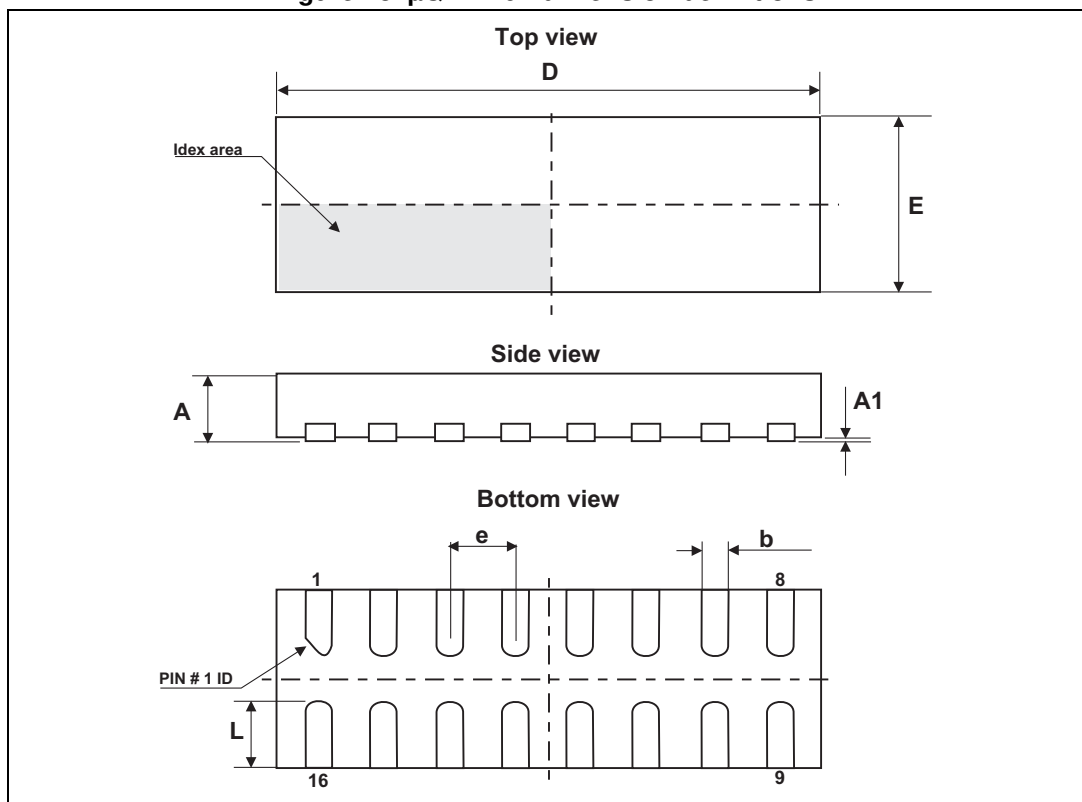


Table 4. μQFN-16L dimension values

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		4.10			0.161	
E		1.35			0.053	
e		0.50			0.020	
L	0.40	0.50	0.60	0.016	0.020	0.024

Figure 19. Footprint

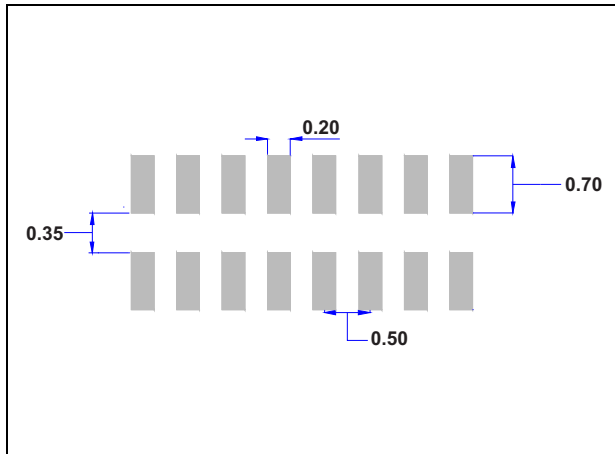


Figure 20. Marking

Dot : Pin 1 Identification  
 X X= Marking  
 WW= DataCode (week)  
 Y=Data code(Year)  
 P=Assembly plant

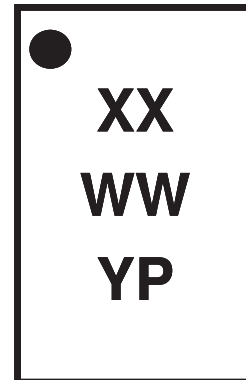
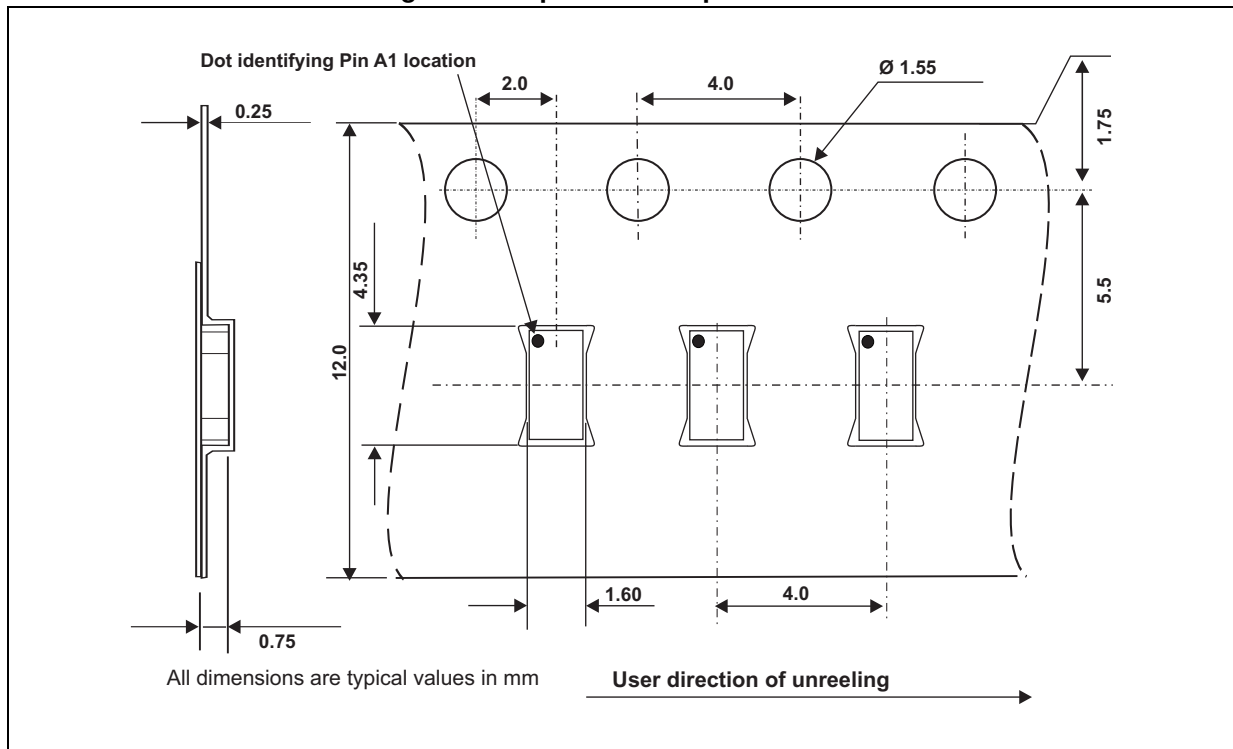


Figure 21. Tape and reel specifications



## 5 Ordering information

Figure 22. Ordering information scheme

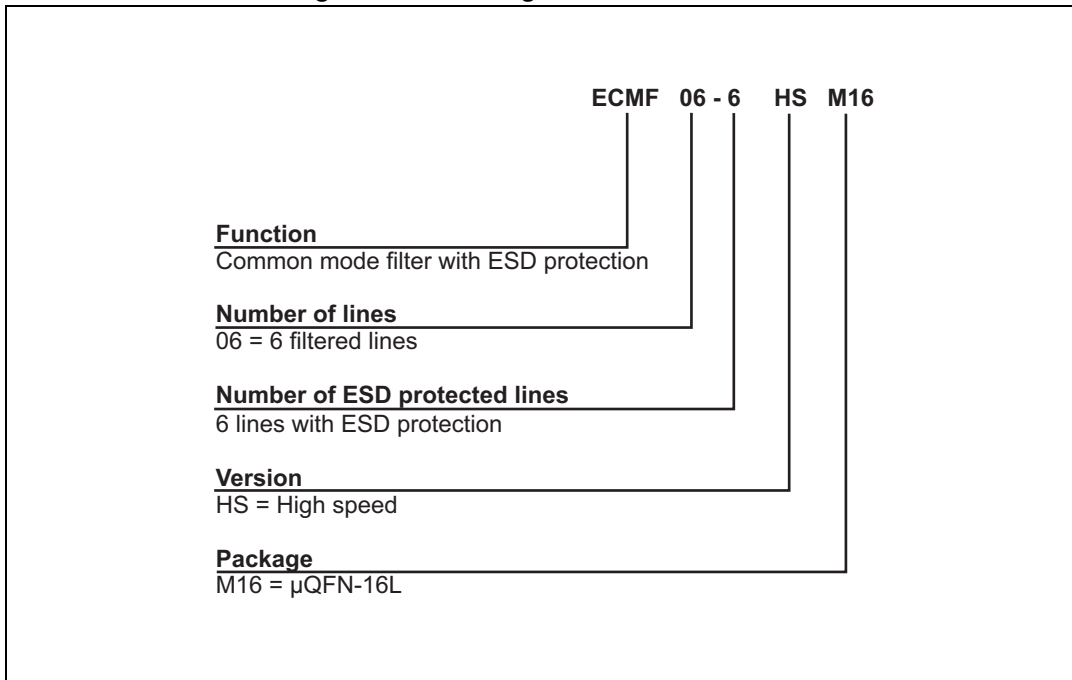


Table 5. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
ECMF06-6HSM16	KL	$\mu$ QFN-16L	7.76 mg	3000	Tape and reel

## 6 Revision history

Table 6. Document revision history

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

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