

Common mode filter with ESD protection for MHL/USB2.0/USB3.0 interface

Datasheet - production data

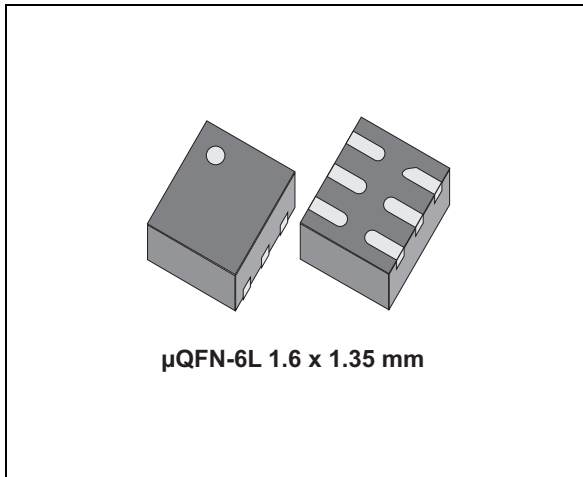
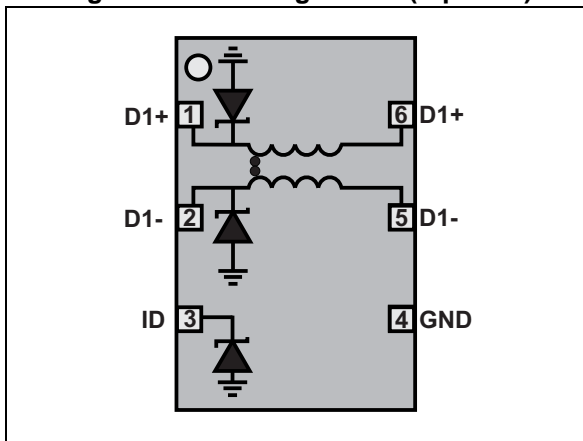


Figure 1. Pin configuration (top view)



Features

- Provides -20 dB attenuation at 700 MHz in LTE bands
- High common mode attenuation:
 - -25 dB at 800 MHz
 - -10 dB at 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

- 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 and complies with the MHL standard. The device can protect and filter a single differential lane.

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)

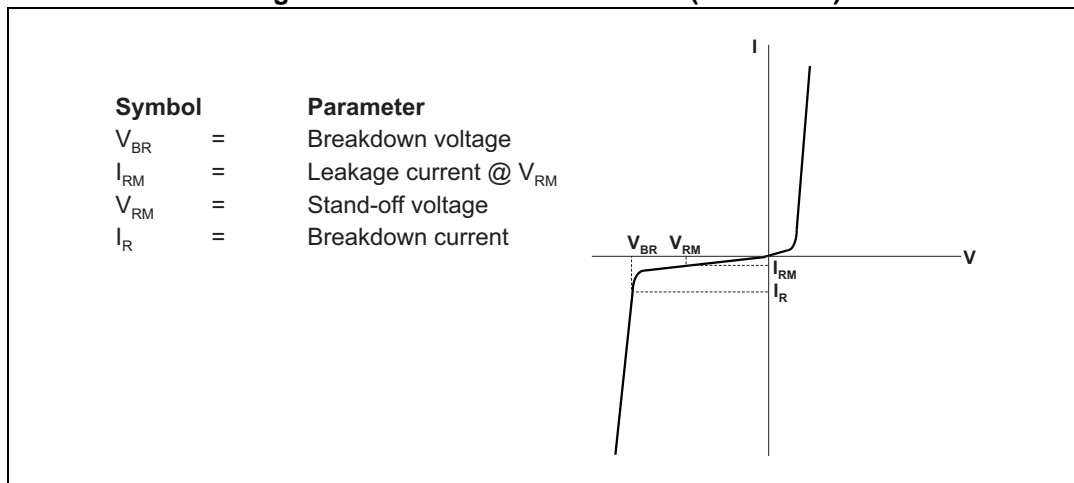


Table 2. Electrical characteristics ($T_{amb} = 25\text{ }^{\circ}\text{C}$)

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		Ω

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

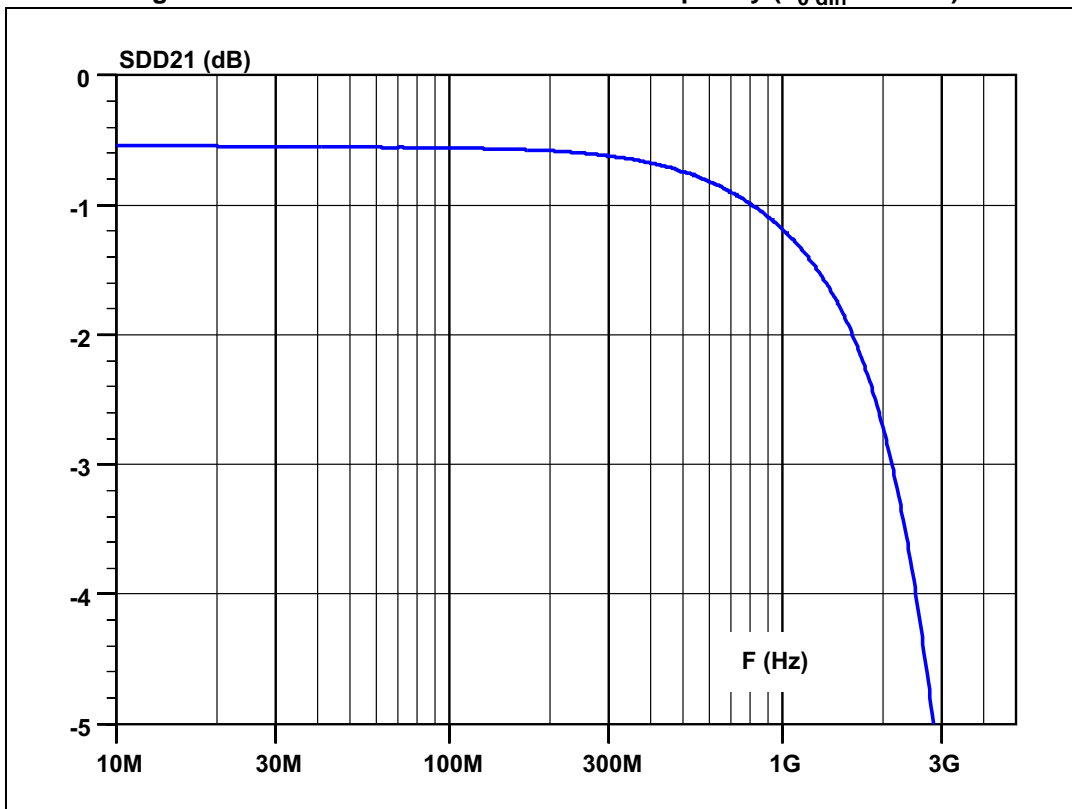


Figure 4. Common mode attenuation versus frequency ($Z_{0\text{ com}} = 50 \Omega$)

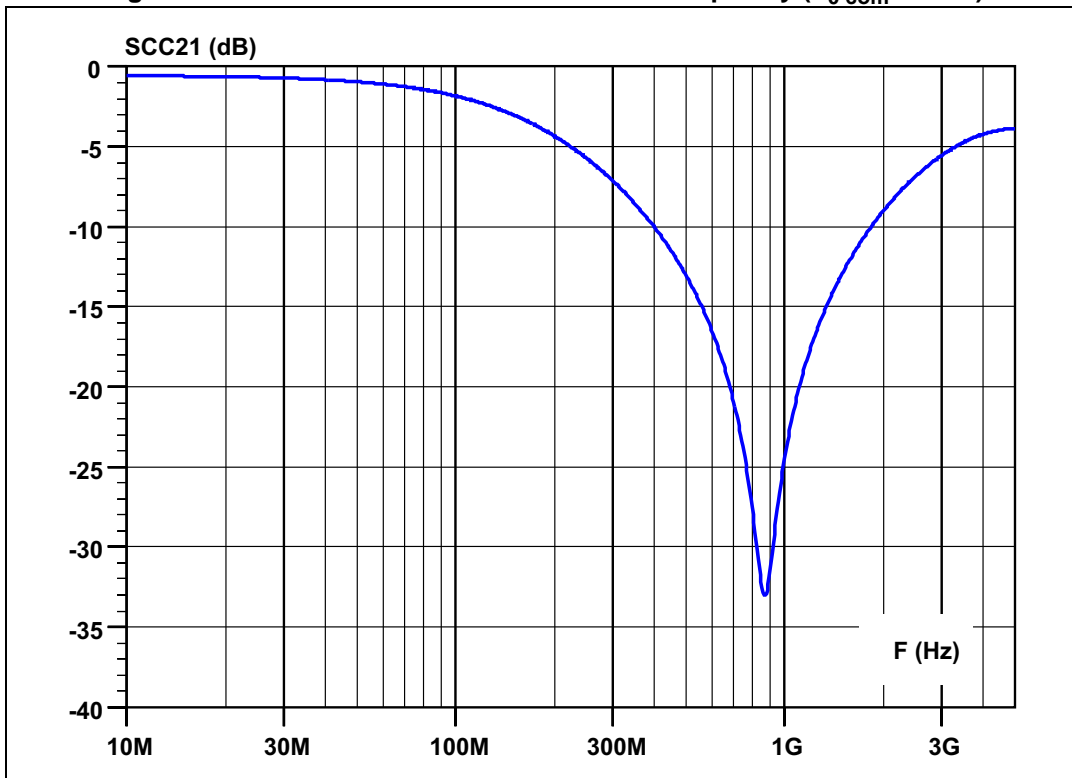


Figure 5. Return loss versus frequency ($Z_{0\text{ com}} = 50 \Omega$)

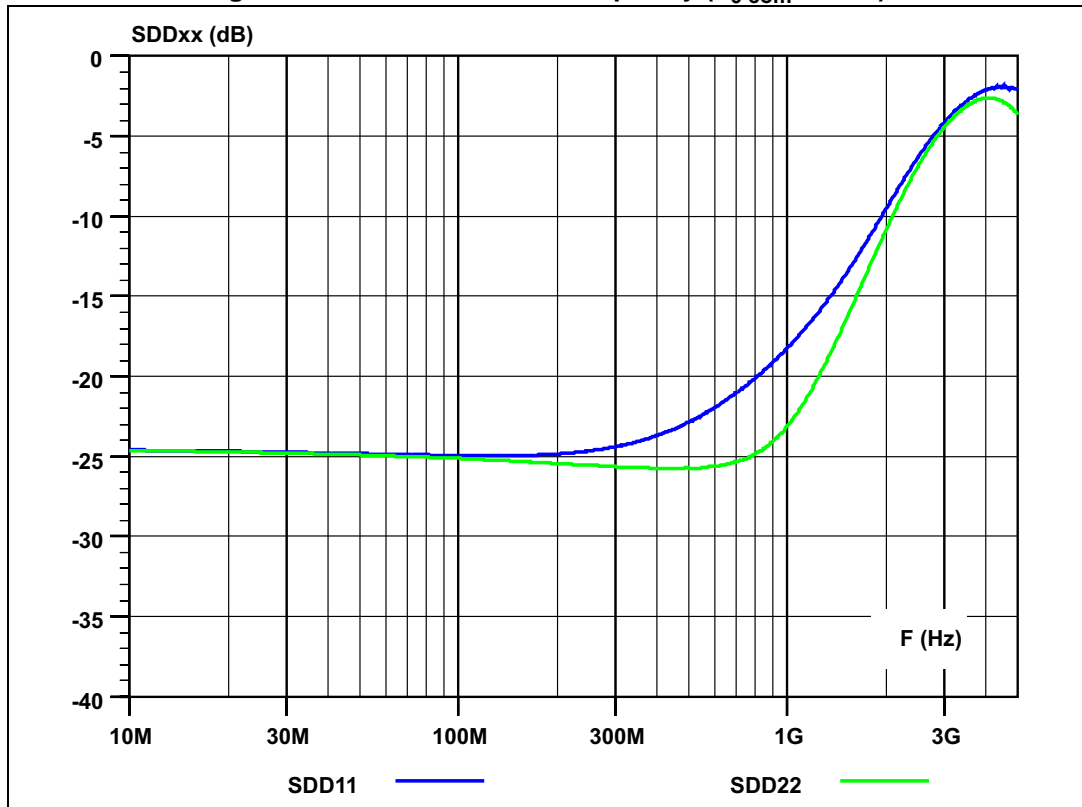


Figure 6. Differential (Z_{DD21}) and common mode (Z_{CC21}) impedance versus frequency

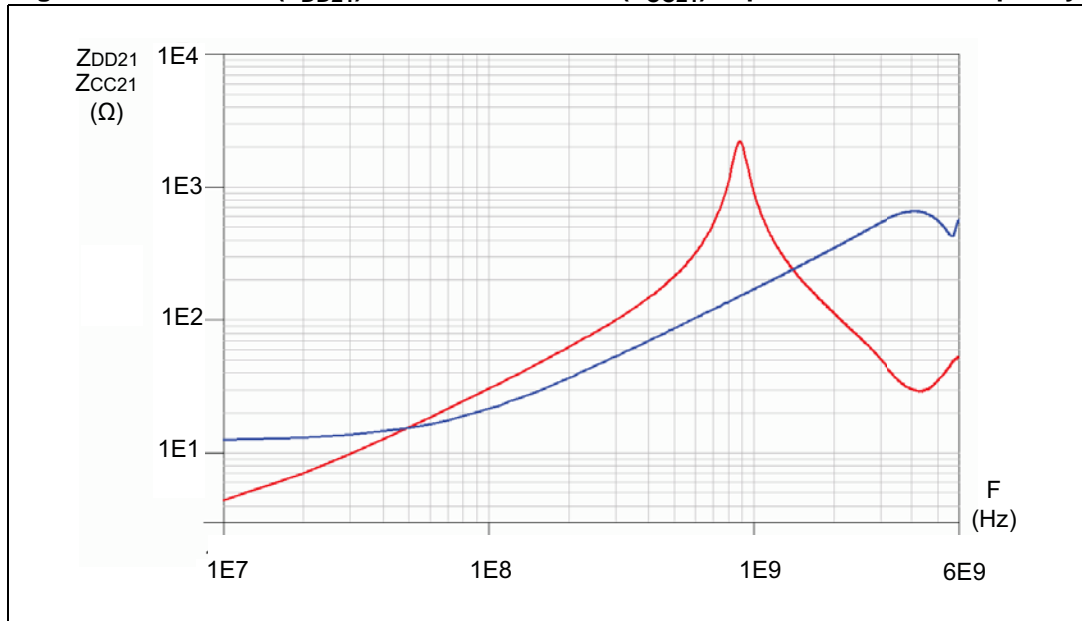


Figure 7. ESD response to IEC61000-4-2 (+8 kV contact discharge) on data lane

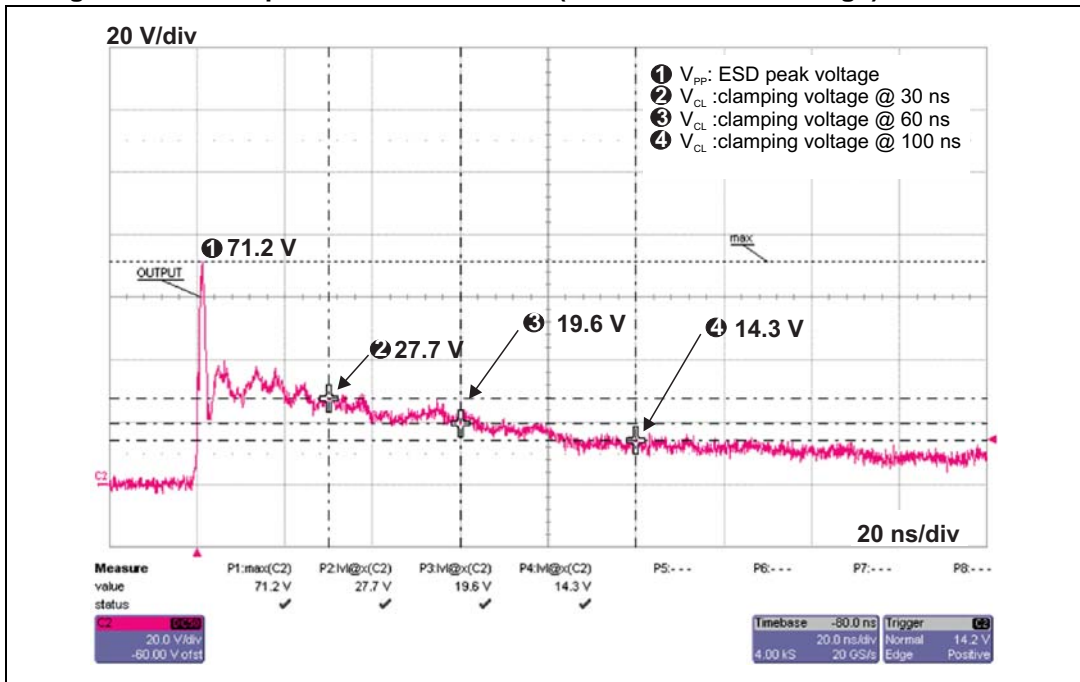


Figure 8. ESD response to IEC61000-4-2 (-8 kV contact discharge) on data lane

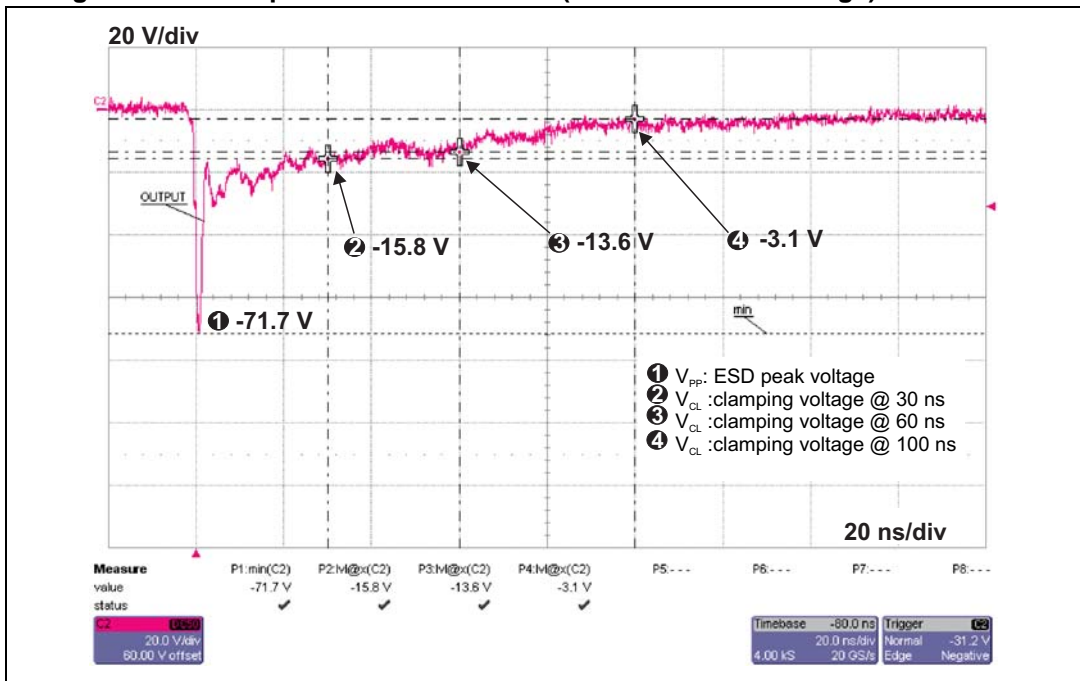


Figure 9. ESD response to IEC61000-4-2 (+8 kV contact discharge) on ID pin

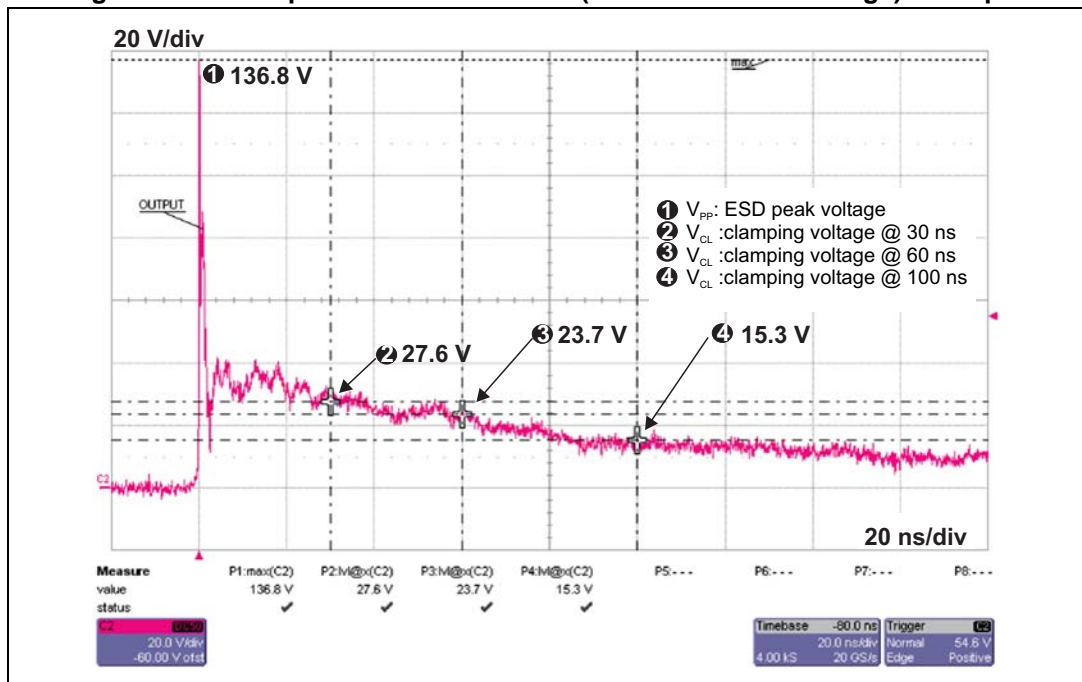


Figure 10. ESD response to IEC61000-4-2 (-8 kV contact discharge) on ID pin

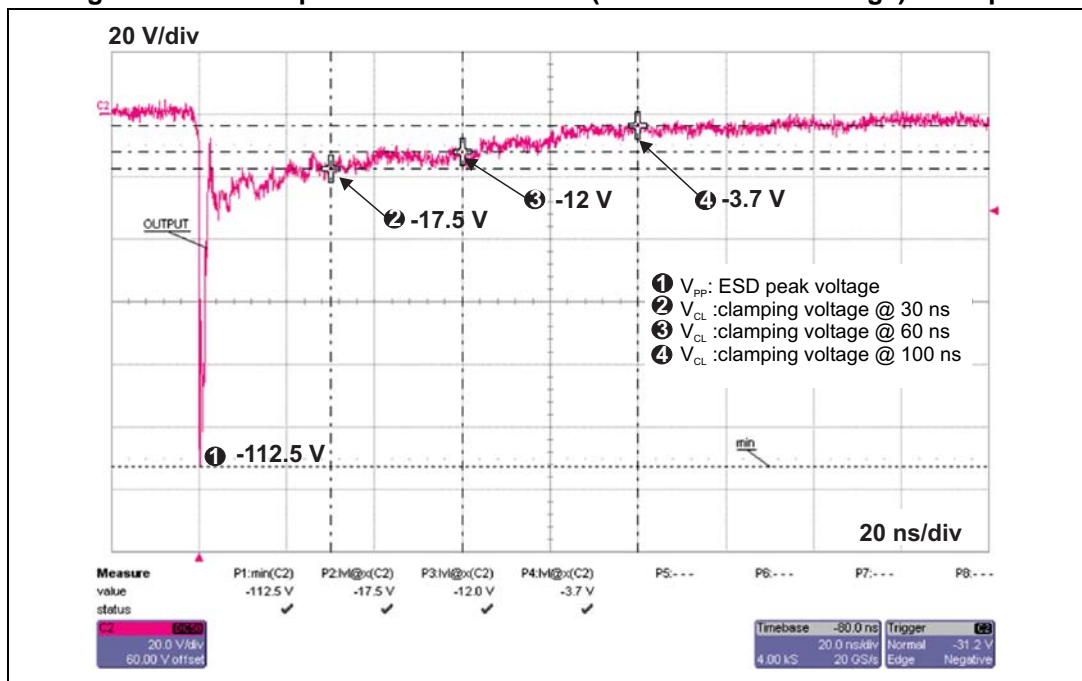


Figure 11. USB2.0 480 Mbps eye diagram without device

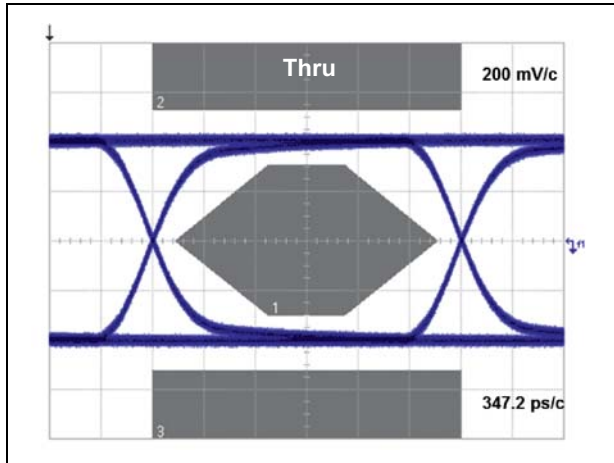


Figure 12. USB2.0 480 Mbps eye diagram with device

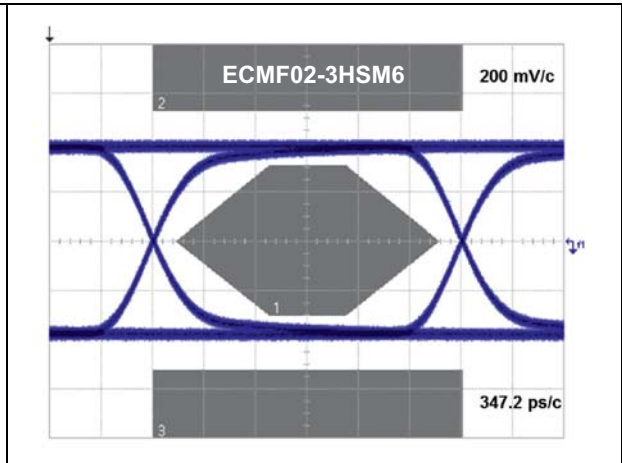


Figure 13. USB3.0 5 Gbps eye diagram without device

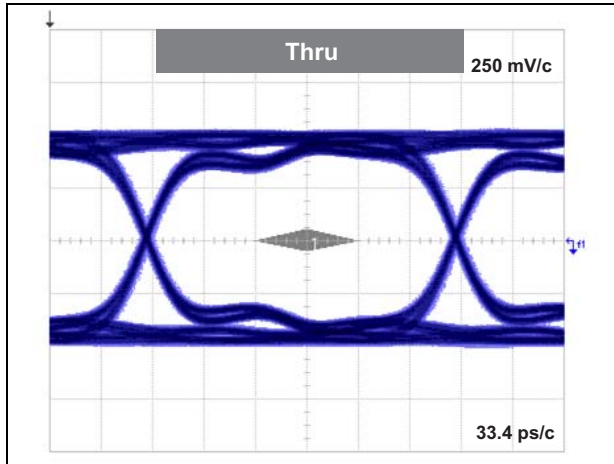


Figure 14. USB3.0 5 Gbps eye diagram with device

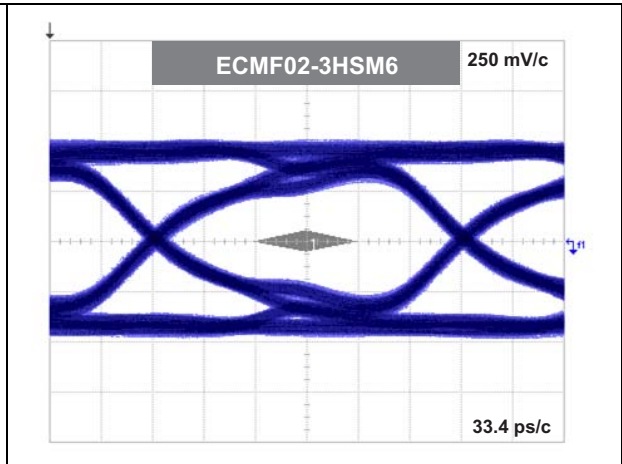


Figure 15. MHL 2.25 Mbps eye diagram without device

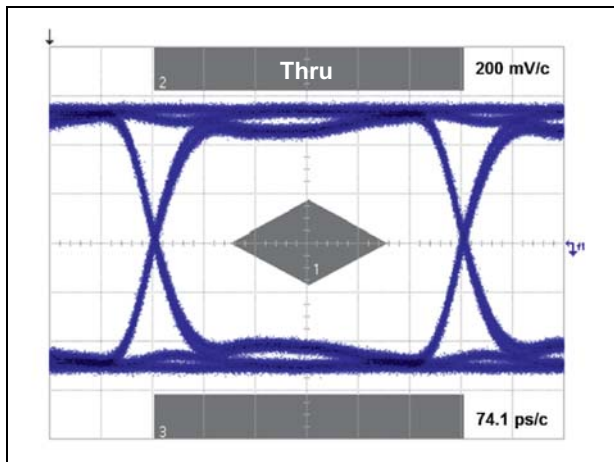


Figure 16. MHL 2.25 Mbps eye diagram with device

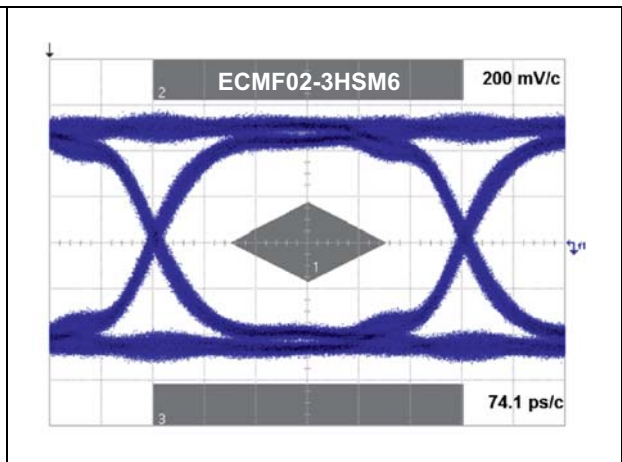
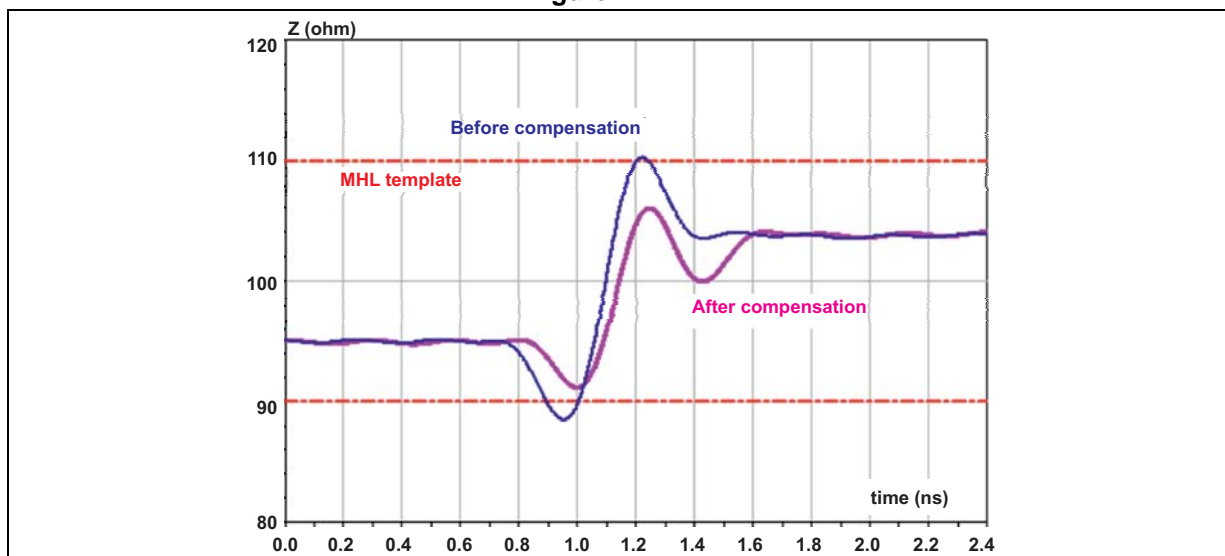
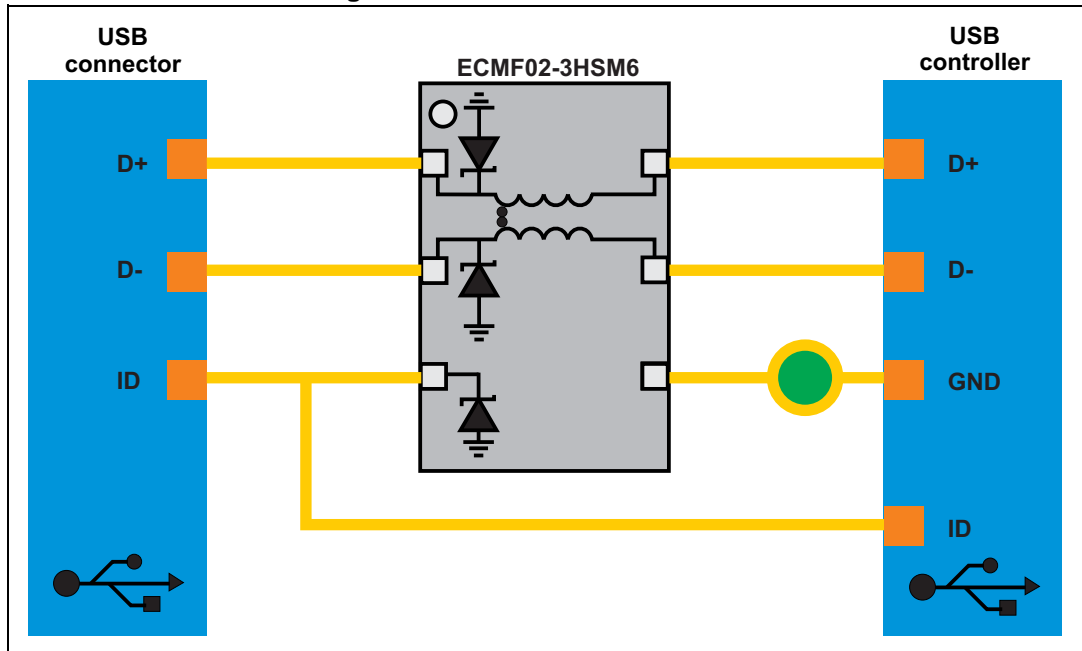


Figure 17. TDR



2 Application information

Figure 18. USB and MHL 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 19. PCB layout recommendations

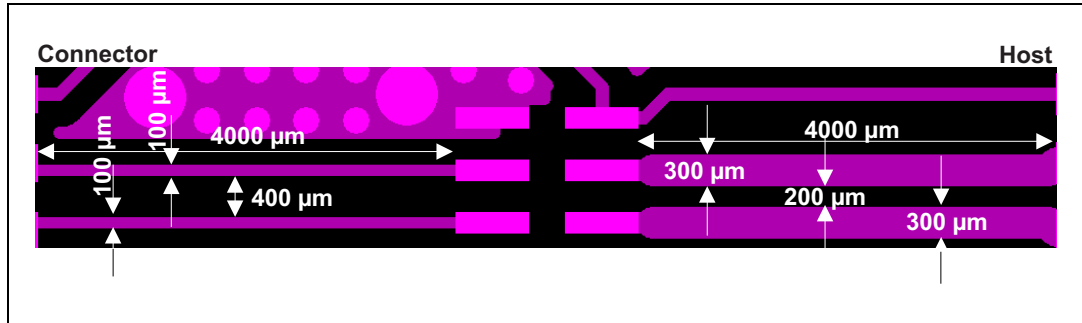
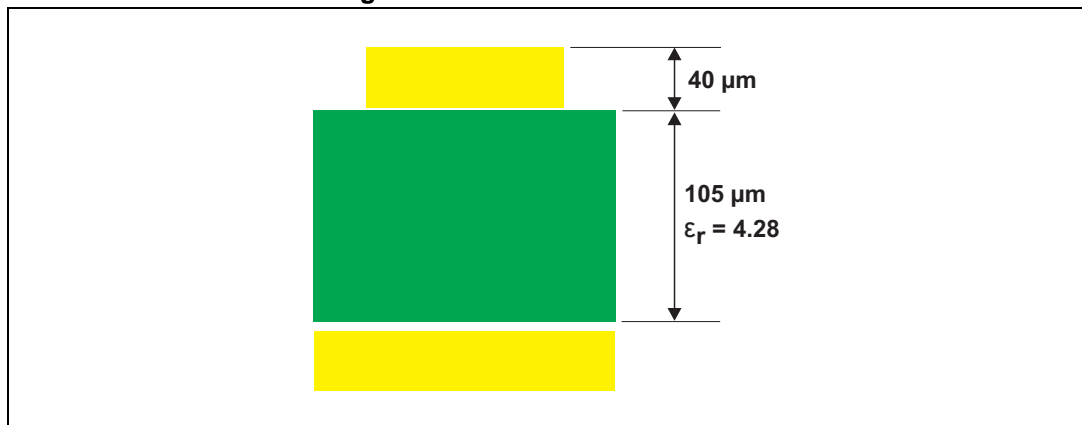


Figure 20. PCB stack dimensions



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 21. μQFN-6L dimension definitions

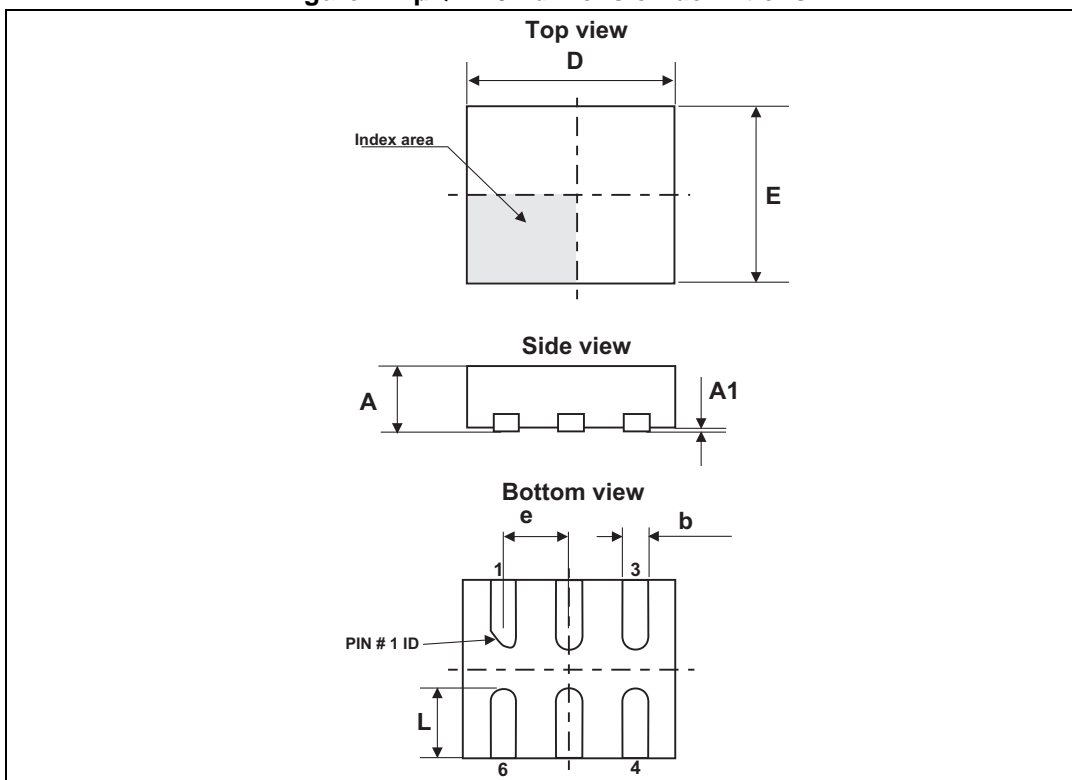


Table 3. μQFN-6L dimension values

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	1.55	1.60	1.65	0.061	0.063	0.065
E	1.30	1.35	1.40	0.051	0.053	0.055
e	0.45	0.50	0.55	0.018	0.020	0.022
L	0.40	0.50	0.60	0.016	0.020	0.024

Figure 22. Footprint

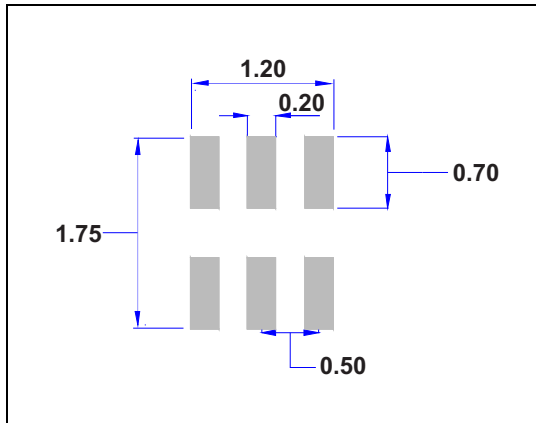
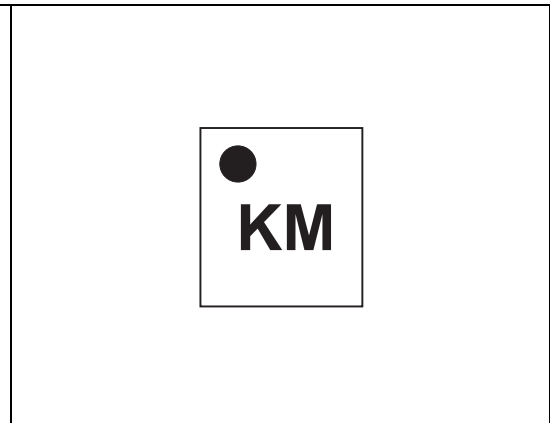
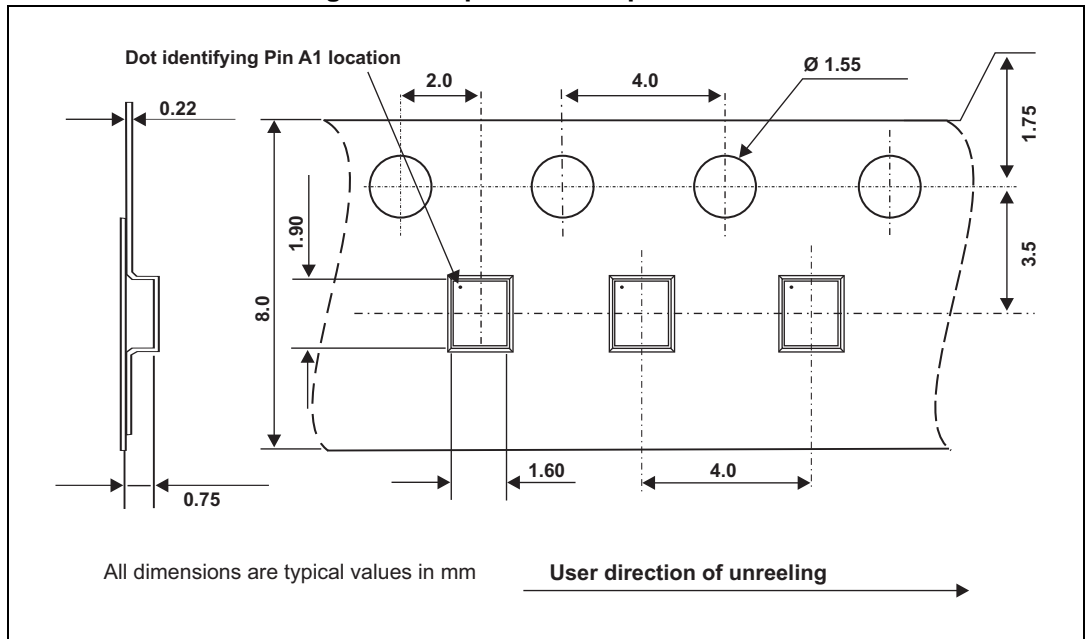


Figure 23. Marking



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 24. Tape and reel specifications



5 Ordering information

Figure 25. Ordering information scheme

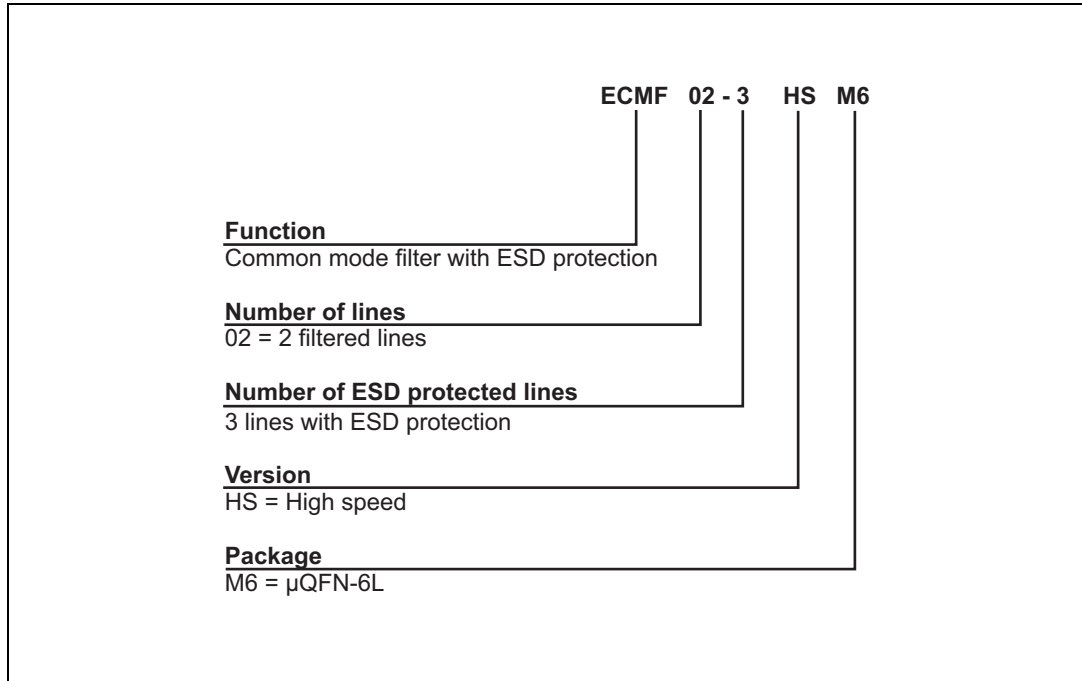


Table 4. Ordering information

Order code	Marking ⁽¹⁾	Package	Weight	Base qty	Delivery mode
ECMF02-3HSM6	KM	μ QFN-6L	3.03 mg	3000	Tape and reel

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

6 Revision history

Table 5. Document revision history

Date	Revision	Changes
02-Oct-2013	1	Initial release.
25-Aug-2014	2	Added Figure 6: Differential (ZDD21) and common mode (ZCC21) impedance versus frequency.

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2014 STMicroelectronics – All rights reserved