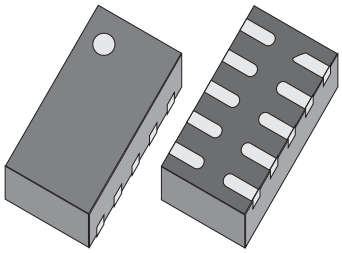
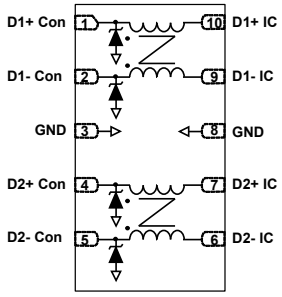
ECMF04-4HSWM10

Datasheet

Common mode filter with ESD protection for high speed serial interface



QFN-10L 2.6 x 1.35 x 0.5



Product status link
ECMF04-4HSWM10

Product summary	
Order code	ECMF04-4HSWM10

Features

- Very large differential bandwidth to comply with HDMI Full HD, MIPI, USB2.0, USB3.2 Gen 1, Display Port 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: 4.2 GHz
- Low PCB space consumption
- Thin package for compact applications: 0.55 mm max.
- High reduction of parasitic elements through integration
- RoHS package

Exceed 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

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 Full HD, MIPI, Display Port and other high speed serial interfaces.

The device has a very large differential bandwidth to comply with these standards and can protect and filter two 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 Air discharge	 8 16	kV
I_{RMS}	Maximum RMS current		100	mA
T_{op}	Operating ambient temperature range		-55 to +125	°C
T_j	Maximum junction temperature		125	
T_{stg}	Storage temperature range		-55 to +150	

Figure 1. Electrical characteristics (definitions)

V_{RM} Maximum stand-off voltage
V_{CL} Clamping voltage at peak pulse current I_{PP}
I_{RM} Leakage current at V_{RM}
I_{PP} Peak pulse current
V_{BR} Breakdown voltage
R_{DC} DC serial resistance
f_C Differential cut off frequency

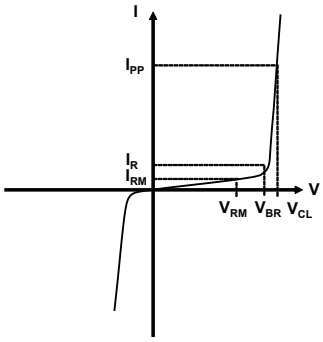


Table 2. Electrical characteristics (T_{amb} = 25 °C)

Symbol	Test conditions	Min.	Typ.	Max.	Unit
V_{BR}	I_R = 1 mA	4.5	5.5		V
I_{RM}	V_{RM} = 3 V per line			100	nA
R_{DC}	DC serial resistance		5		Ω
f_C	-3 dB 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

1.1 Characteristics (curves)

Figure 2. Differential attenuation versus frequency (Z_{0_DIFF} = 100 Ω)

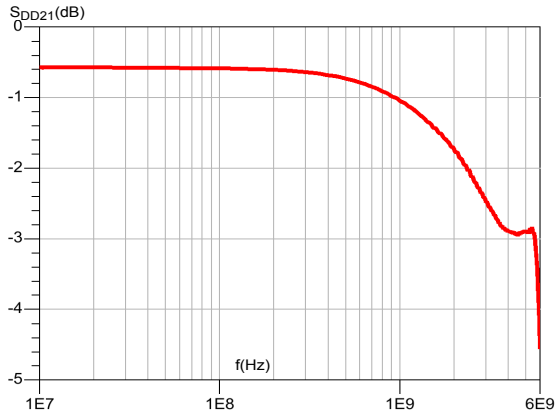


Figure 3. Common mode attenuation versus frequency (Z_{0_COM} = 50 Ω)

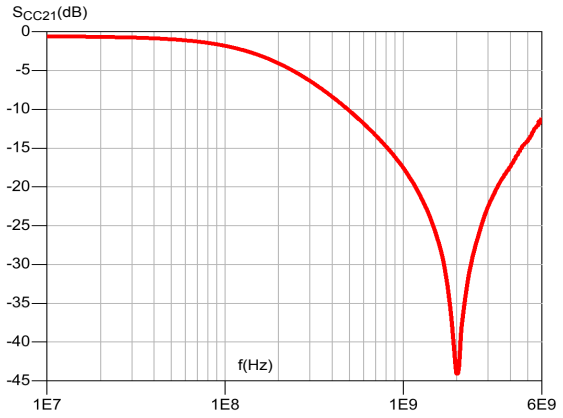


Figure 4. ESD response to IEC61000-4-2 (+8 kV contact discharge)

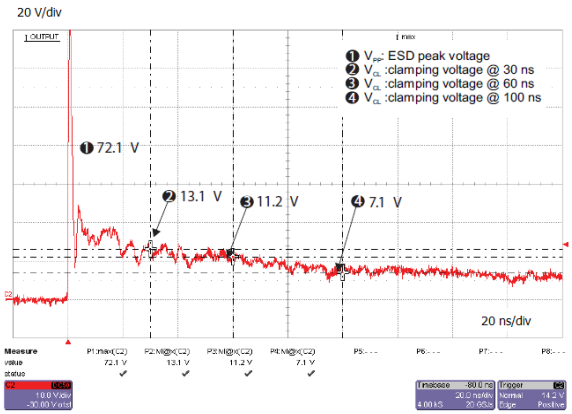


Figure 5. ESD response to IEC61000-4-2 (-8 kV contact discharge)

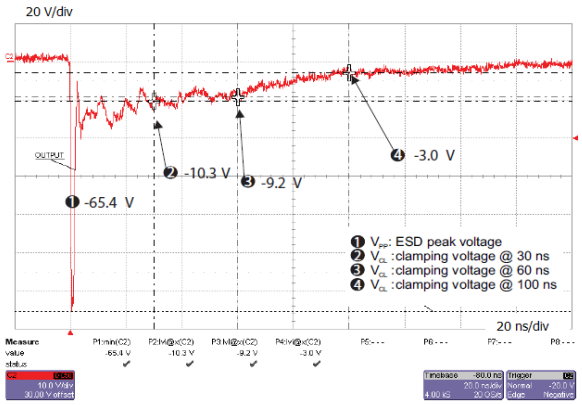


Figure 6. HDMI2.0 - 5.94 Gbps eye diagram without device (with worst cable and equalizer)

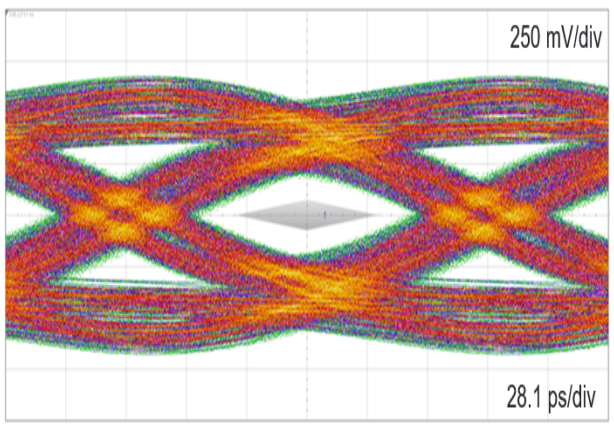


Figure 7. HDMI2.0 - 5.94 Gbps eye diagram with device (with worst cable and equalizer)

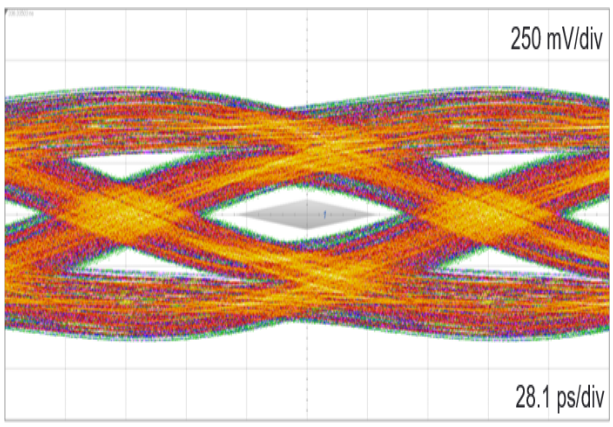


Figure 8. **HDMI1.4 3.35 Gbps eye diagram without ECMF04-4HSWM10**

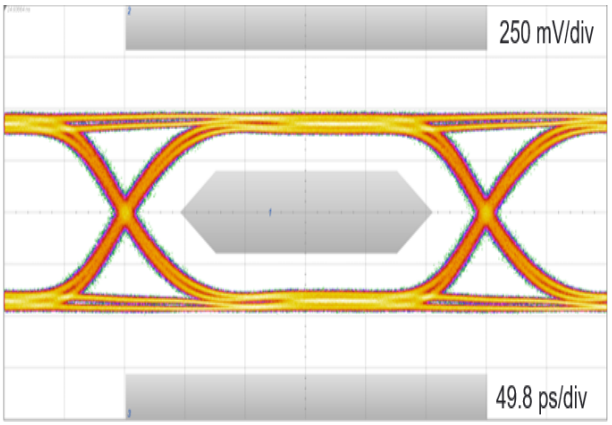


Figure 9. **HDMI1.4 3.35 Gbps eye diagram with ECMF04-4HSWM10**

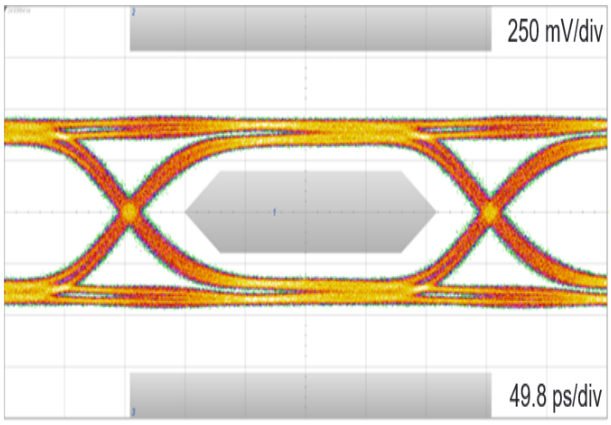


Figure 10. **USB3.2 Gen 1 5.0 Gbps eye diagram without ECMF04-4HSWM10 (with worst cable and equalizer)**

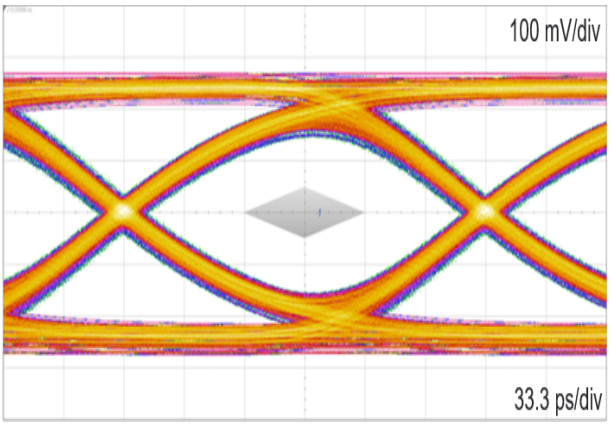


Figure 11. **USB3.2 Gen 1 5.0 Gbps eye diagram with ECMF04-4HSWM10 (with worst cable and equalizer)**

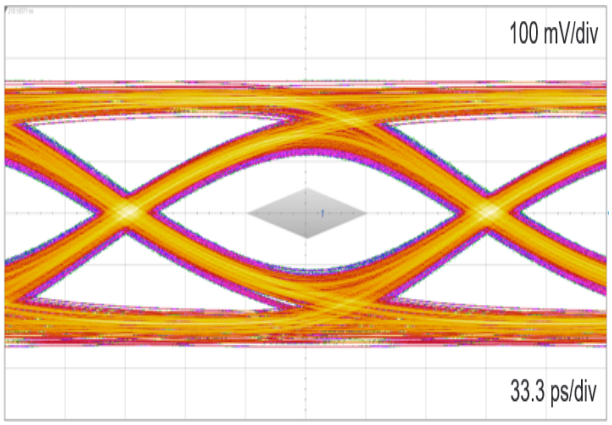


Figure 12. **MIPI D-PHY 2.5 Gbps long reference channel eye diagram without ECMF04-4HSWM10**

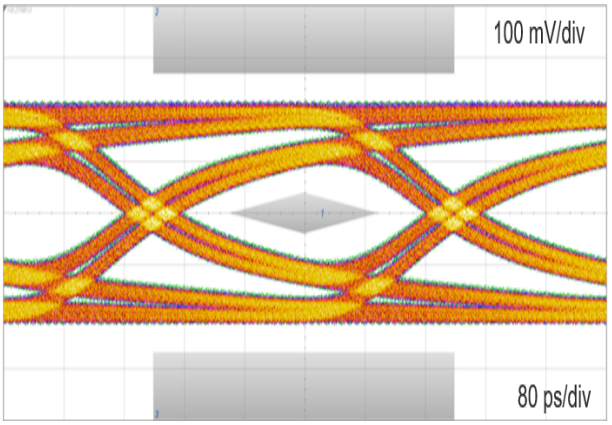


Figure 13. **MIPI D-PHY 2.5 Gbps long reference channel eye diagram with ECMF04-4HSWM10**

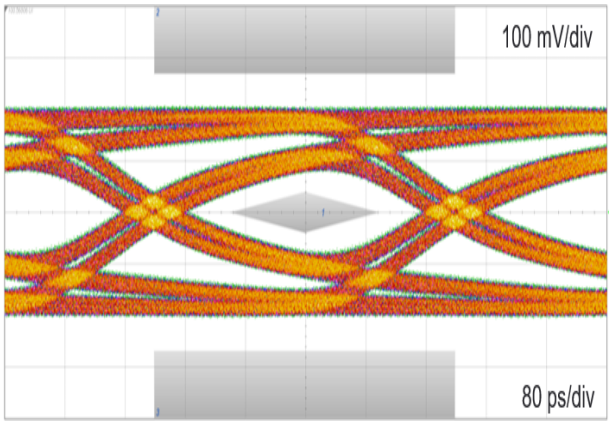


Figure 14. TDR

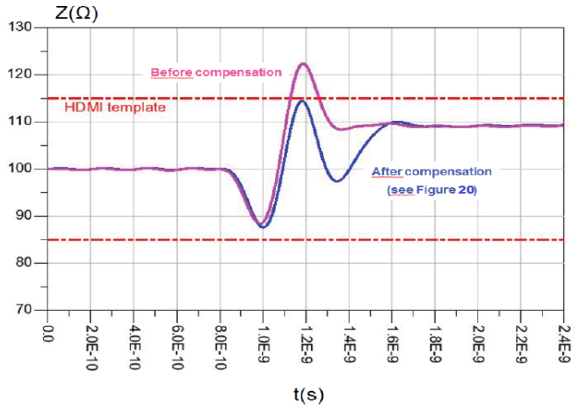
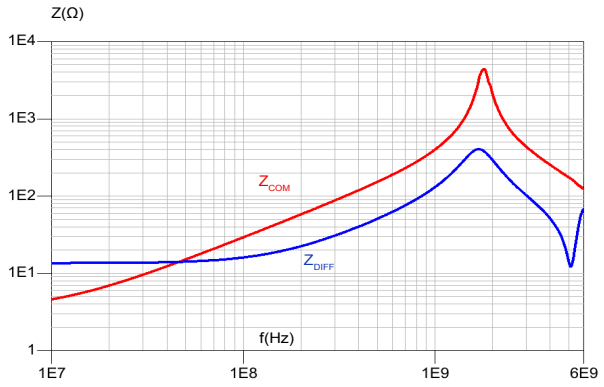
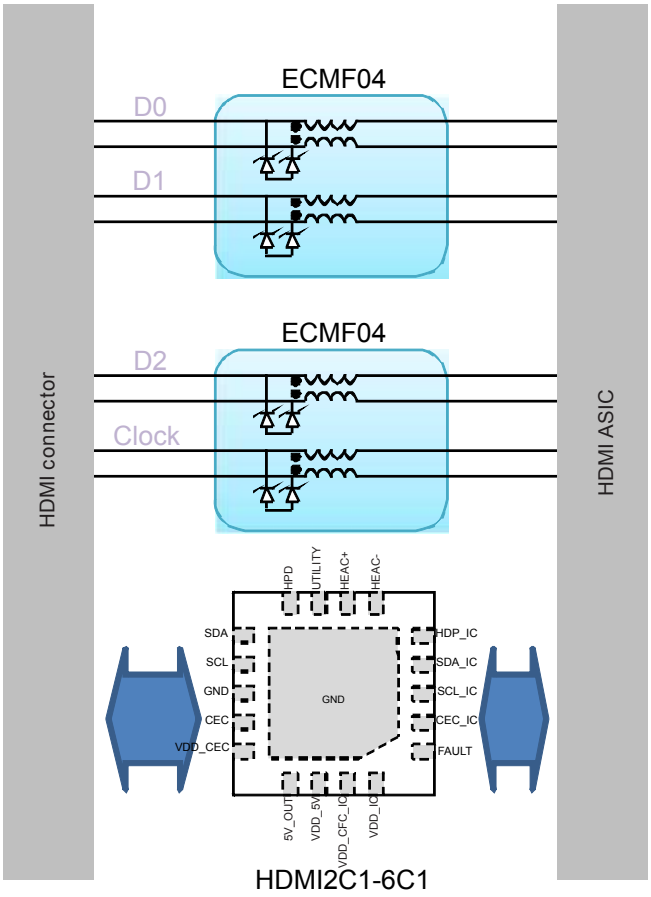


Figure 15. Differential an common mode impedance versus frequency



2 Application information

Figure 16. **HDMI schematic**



More application information available in following AN:

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

3 Package information

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.

3.1 QFN-10L package information

Figure 17. QFN10L package outline

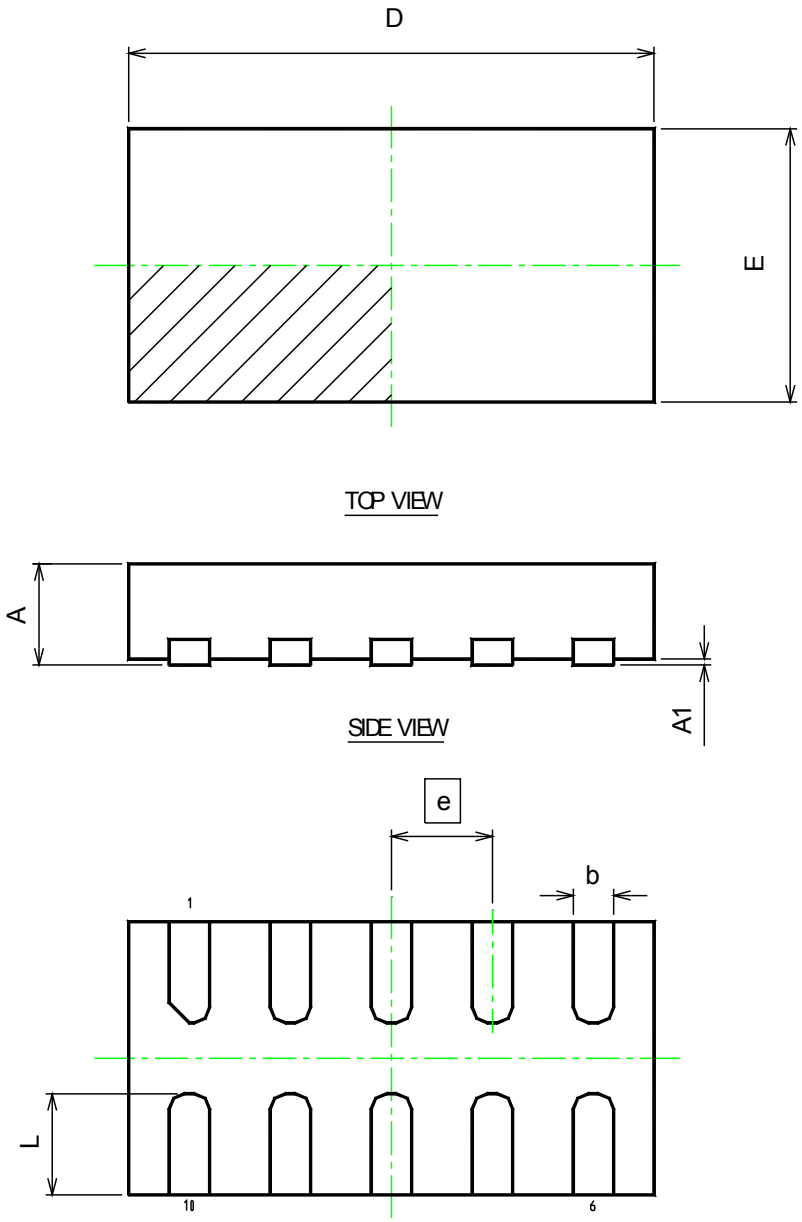
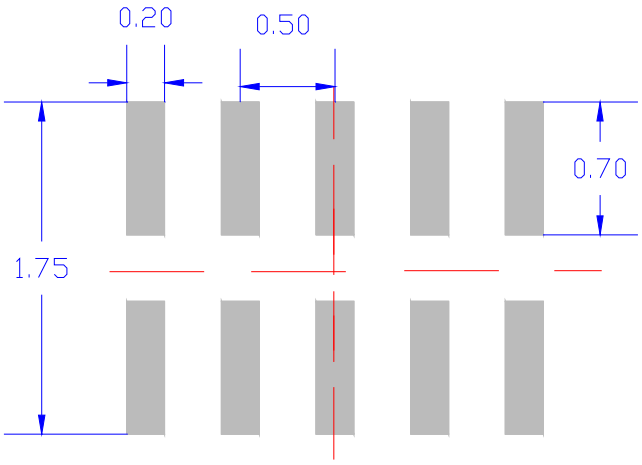


Table 4. **QFN10L package mechanical data**

Ref.	Dimensions		
	Millimeters		
	Min.	Typ.	Max.
A	0.45	0.50	0.55
A1	0.00	0.02	0.05
b	0.15	0.20	0.25
D	2.55	2.60	2.65
E	1.30	1.35	1.40
e		0.50	
L	0.40	0.50	0.60

Figure 18. **Footprint recommendations (mm)**



4 PCB assembly recommendation

Figure 19. **Recommended PCB layout**

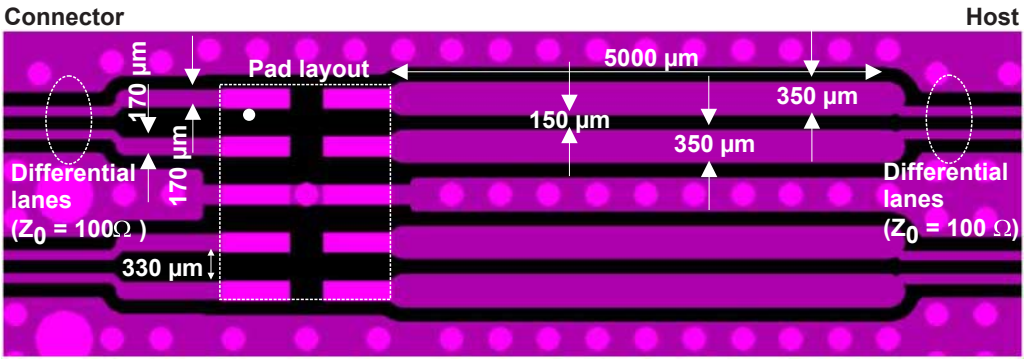
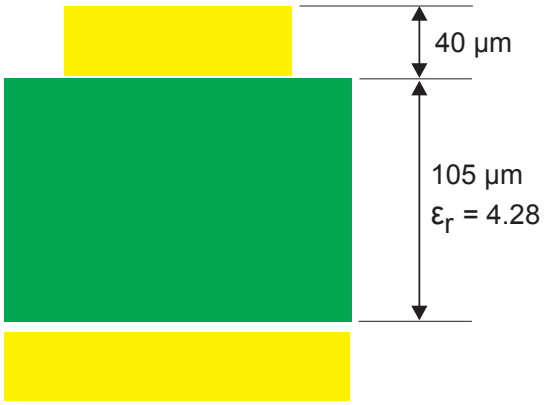


Figure 20. **PCB stack dimensions**



4.1 Solder paste

1. Halide-free flux qualification ROL0 according to ANSI/J-STD-004.
2. “No clean” solder paste is recommended.
3. Offers a high tack force to resist component movement during high speed.
4. Use solder paste with fine particles: powder particle size is 20-38 µm.

4.2 QFN-10L packing information

Figure 21. **Marking**

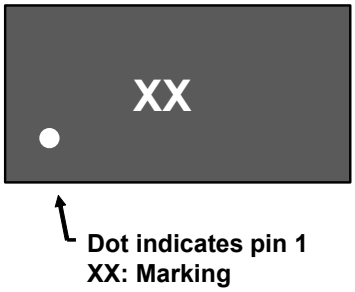
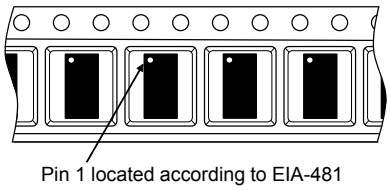


Figure 22. **Package orientation in reel**



Note: Pocket dimensions are not on scale
Pocket shape may vary depending on package

Figure 23. **Tape and reel orientation**

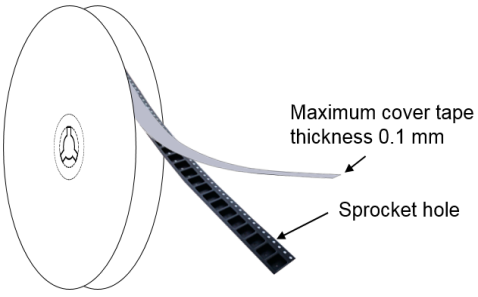


Figure 24. **Reel dimensions (mm)**

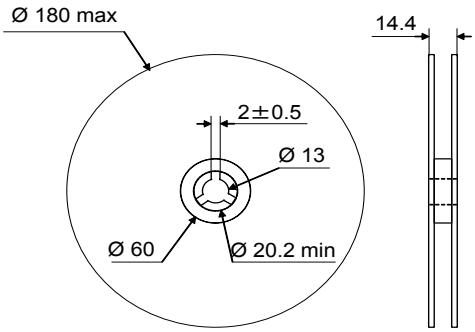


Figure 25. **Inner box dimensions (mm)**

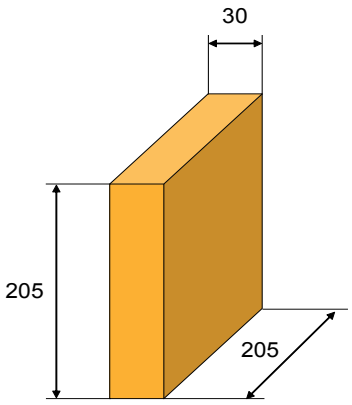
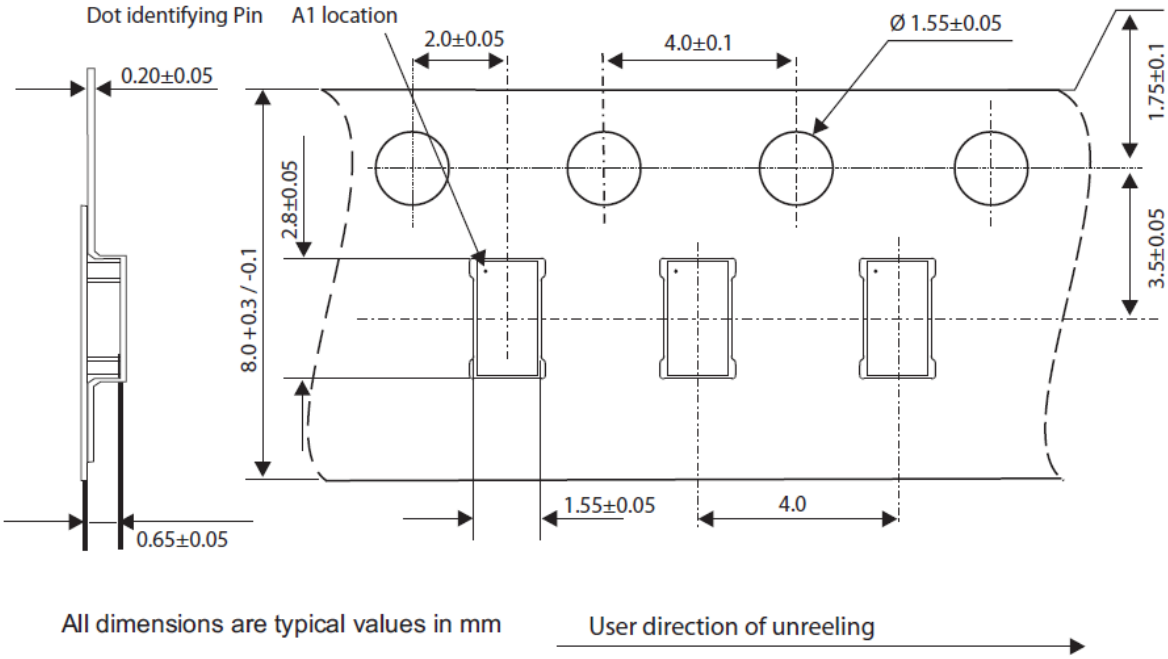
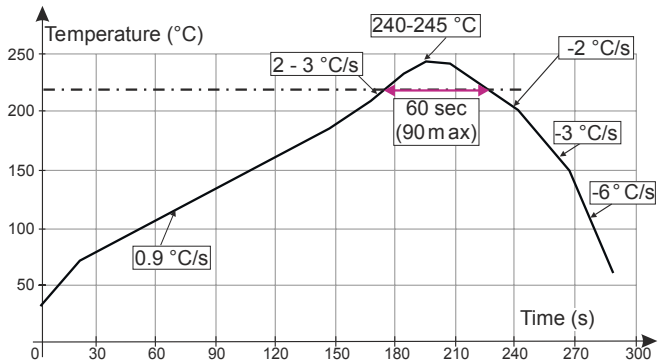


Figure 26. **Tape and reel outline**



4.3 Solder reflow

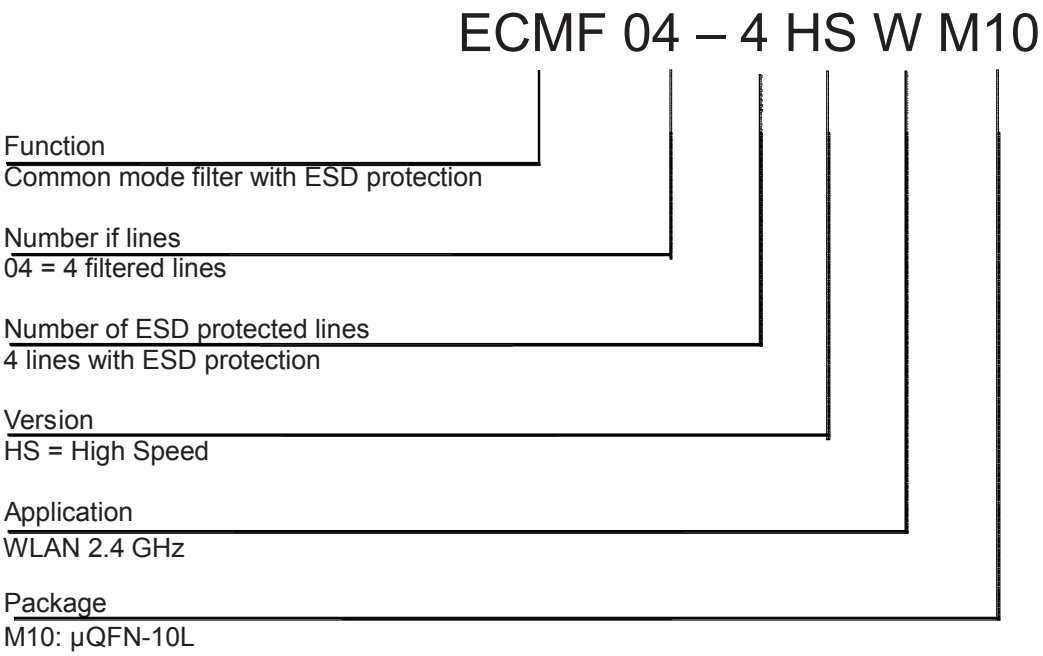
Figure 27. **ST ECOPACK® recommended soldering reflow profile for PCB mounting**



Note: Minimize air convection currents in the reflow oven to avoid component movement. Maximum soldering profile corresponds to the latest IPC/JEDEC J-STD-020.

5 Ordering information

Figure 28. **Ordering information scheme**



Order code	Marking	Package	Weight	Base qty.	Delivery mode
ECMF04-4HSWM10	KW(1)	µQFN-10L	5 mg	3000	Tape and reel

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

Revision history

Table 5. **Document revision history**

Date	Version	Changes
10-Jun-2014	1	Initial release.
08-Jan-2018	2	Updated Table 1.
16-Mar-2021	3	Updated Figure 8 and Figure 9. Added Figure 10, Figure 11 and Figure 15.

Mouser Electronics

Authorized Distributor

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ECMF04-4HSWM10