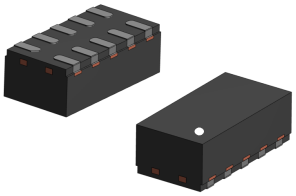
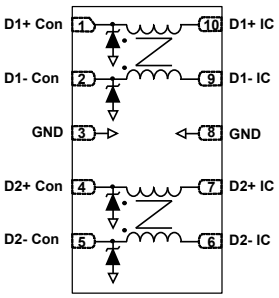
ECMF04-4HSWM10Y

Datasheet

Automotive common mode filter with ESD protection



QFN-10L 2.6 x 1.35 x 0.75



Product status link
ECMF04-4HSWM10Y

Product summary	
Order code	ECMF04-4HSWM10Y

Features

- AEC-Q101 qualified
- 3.5 GHz differential bandwidth to comply with HDMI 2.0, HDMI 1.4, USB 3.1, MIPI and LVDS
- Common mode attenuation on LTE, GSM, and GPS frequencies:
  - -13 dB at 0.7 GHz
  - -24 dB at 1.5 GHz
  - -30 dB at 2.4 GHZ
  - -26 dB at 2.7 GHZ
  - -16 dB at 5.0 GHZ
- Wettable flank for automatic optical inspection
- Low PCB space consumption: 3.5 mm²
- Thin package for compact applications: 0.75 mm
- RoHS package

Complies with the following standards

- UL94, V0
- J-STD-020 MSL level 1
- J-STD-002
- IPC7531 footprint and JEDEC registered package
- ISO 10605, IEC 61000-4-2, C = 150 pF – R = 330 Ω level 4:
  - 8 kV (contact discharge)
  - 15 kV (air discharge)
- ISO 10605, C = 330 pF – R = 330 Ω level 4:
  - 8 kV (contact discharge)
  - 15 kV (air discharge)

Description

The ECMF04-4HSWM10Y is an integrated common mode filter designed to suppress EMI/RFI common mode noise on high speed buses HDMI 1.4, USB 3.1 and MIPI. It is designed to replace discrete common mode chokes or LTCC.

The device embeds ESD protections on connector side to meets ISO 10605 requirements.

Packaged in QFN-10L with wettable flank, it is compatible with automatic visual inspection.

1 Characteristics

Table 1. Absolute maximum ratings (T_{amb} = 25 °C)

Symbol	Parameter		Value	Unit
V_{PP}	Peak pulse voltage	ISO 10605 (C = 330 pF, R = 330 Ω): Contact discharge Air discharge	 8 15	kV
		ISO10605 / IEC 61000-4-2 (C = 150 pF, R = 330 Ω): Contact discharge Air discharge	 8 15	kV
I_{RMS}	RMS current		100	mA
T_{op}	Operating ambient temperature range		-55 to +125	°C
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

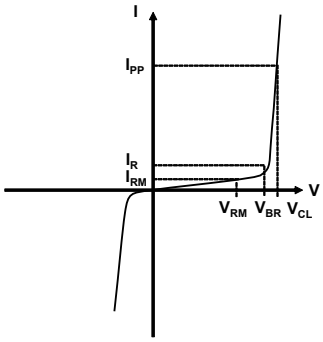


Table 2. Electrical characteristics (T_{amb} = 25 °C)

Symbol	Test conditions	Min.	Typ.	Max.	Unit
V_{BR}	I_R = 1 mA	6	7		V
I_{RM}	V_{RM} = 3 V			100	nA
R_{DC}	I_{DC} = 20 mA		5.5		Ω
f_c	S_{DD21} = -3 dB		3.5		GHz
V_{CL}	8 kV contact discharge after 30 ns, ISO 10605 (150 pF – 330 Ω)		27		V

1.1 Characteristics (curves)

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

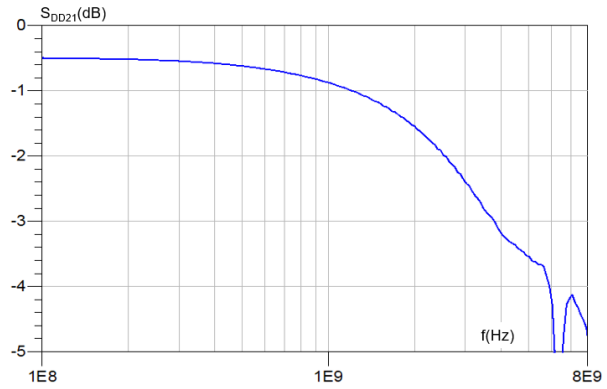


Figure 3. Common mode attenuation versus frequency (Z_{0_com} = 50 Ω)

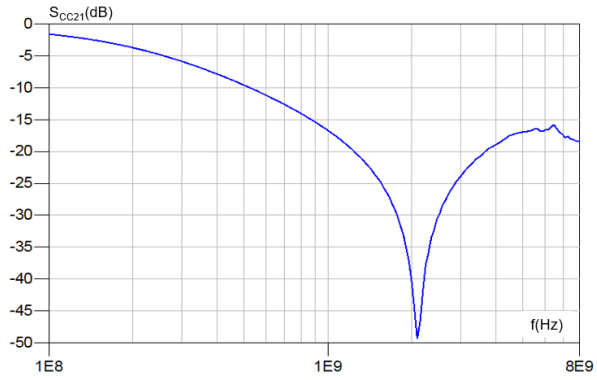


Figure 4. ISO 10605 - C = 150 pF, R = 330 Ω (+8 kV contact)

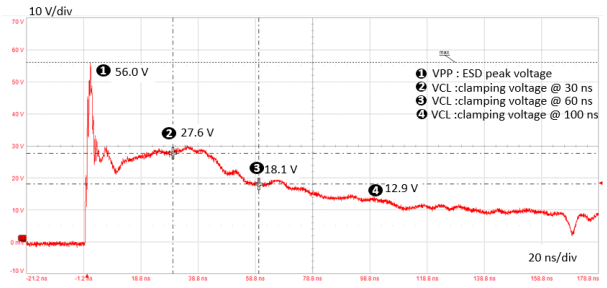


Figure 5. ISO 10605 - C = 150 pF, R = 330 Ω (-8 kV contact)

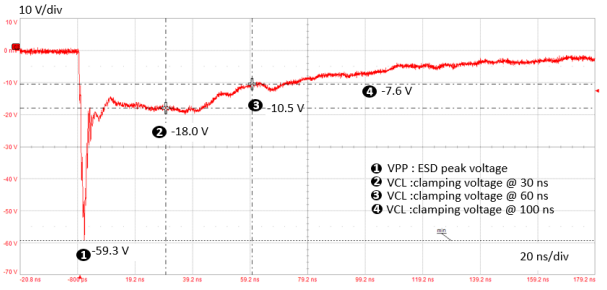


Figure 6. TLP characteristic

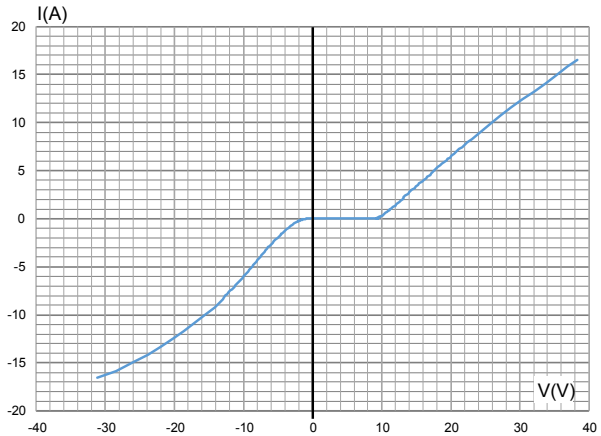


Figure 7. HDMI1.4 – 1.485 Gbps eye diagram without device

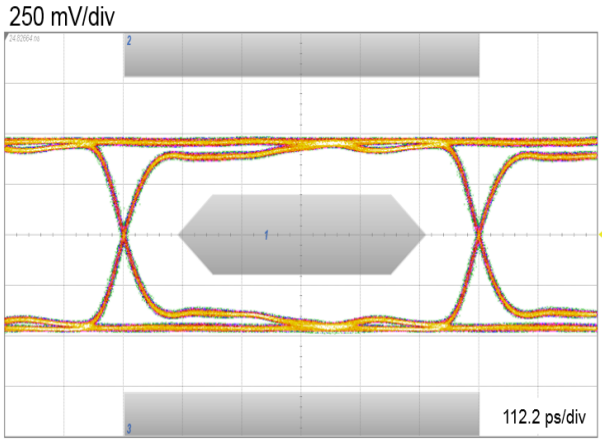


Figure 8. HDMI1.4 – 1.485 Gbps eye diagram with device

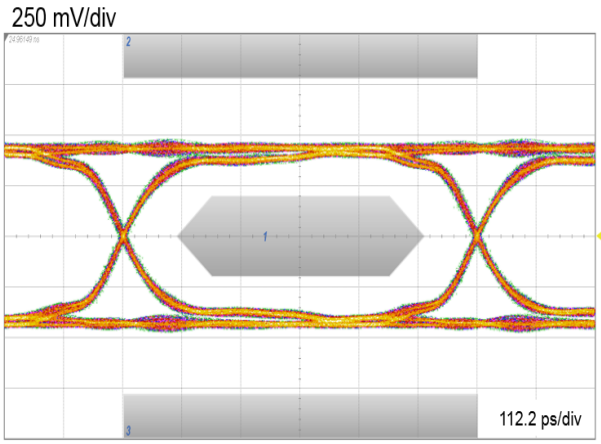


Figure 9. HDMI2.0 – 5.94 Gbps eye diagram without device (with worst cable and equalizer)

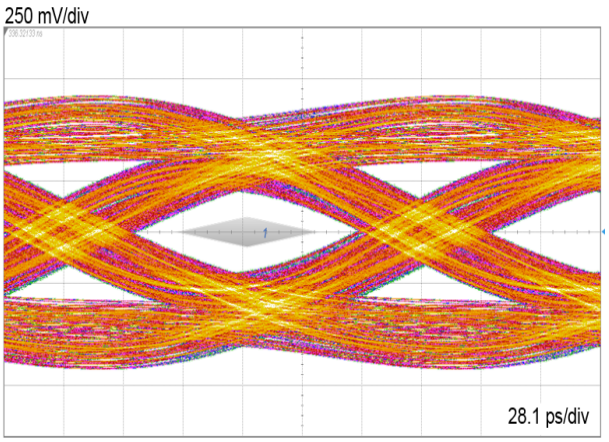


Figure 10. HDMI2.0 – 5.94 Gbps eye diagram with device (with worst cable and equalizer)

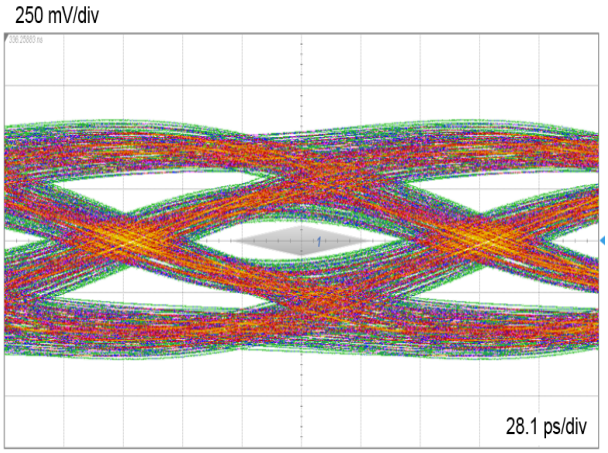


Figure 11. MIPI - 5.83 Gbps eye diagram without device

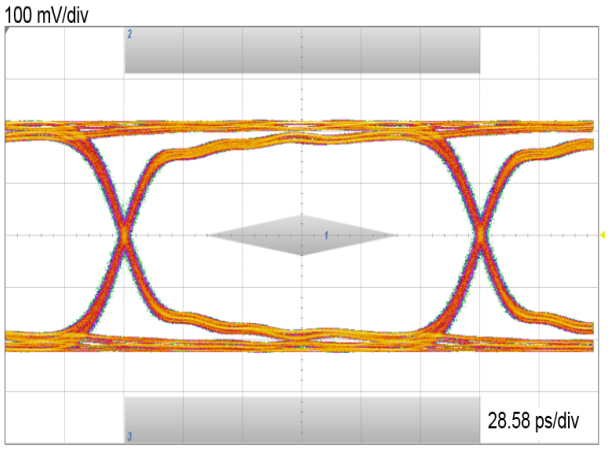


Figure 12. MIPI - 5.83 Gbps eye diagram with device

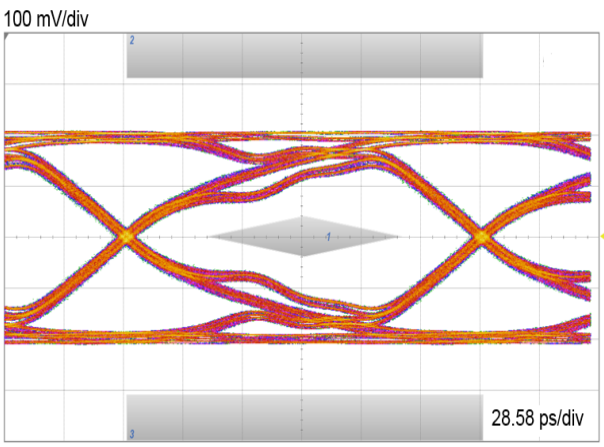


Figure 13. USB3.1 – 5 Gbps eye diagram without device (with worst cable and equalizer)

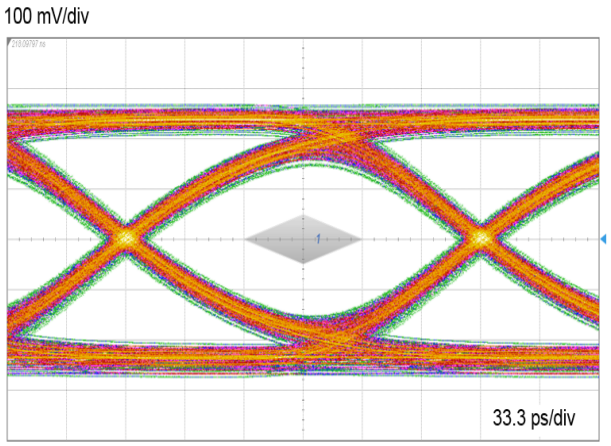
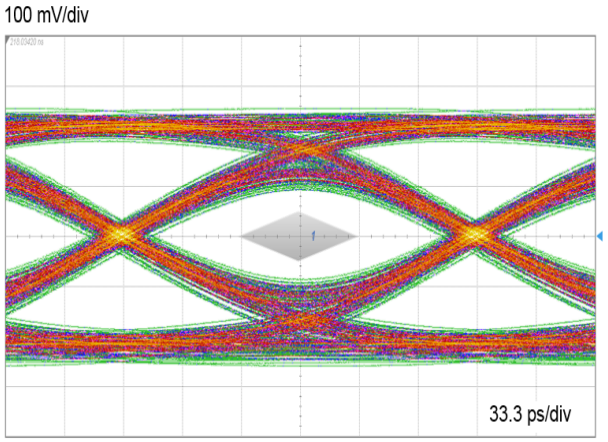


Figure 14. USB3.1 – 5 Gbps eye diagram with device (with worst cable and equalizer)



2 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.

2.1 QFN-10L package information

Figure 15. QFN-10L package outline

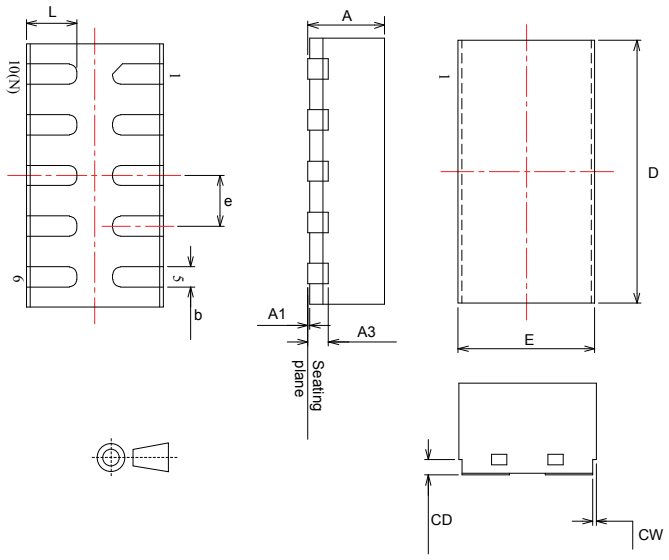


Table 3. QFN-10L mechanical data

Ref.	Dimensions					
	Millimeters			Inches[1]		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.70	0.75	0.80	0.0275	0.0295	0.0315
A1	0.00	0.02	0.05	0.0000	0.0008	0.0020
A3		0.20			0.0079	
b	0.15	0.20	0.25	0.0059	0.0079	0.0099
D	2.55	2.60	2.65	0.1003	0.1024	0.1044
E	1.30	1.35	1.40	0.0511	0.0531	0.0552
e		0.50			0.0197	
L	0.45	0.50	0.55	0.0177	0.0197	0.0217
CW	0.01	0.05	0.09	0.0003	0.0020	0.0032
CD	0.10			0.0039		

1. *Value in inches are converted from mm and rounded to 4 decimal digits*

3 PCB assembly recommendations

Figure 16. **Recommended PCB layout**

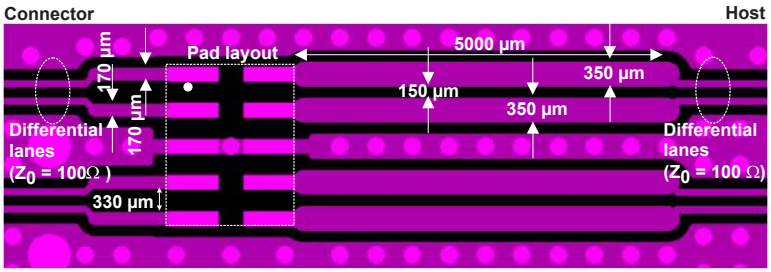
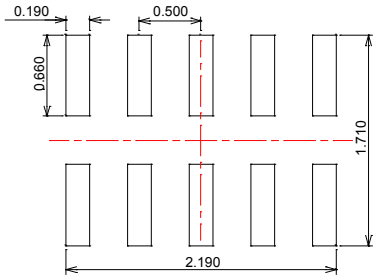


Figure 17. **Recommended PCB stack-up**

Top layer	Cu = 35 µm	774 µm
FR4 = 105 µm	(Er 4.3)	
GND layer	Cu = 17 µm	
FR4 = 460 µm	(Er 4.3)	
	Cu = 17 µm	
FR4 = 105 µm	(Er 4.3)	
Bottom layer	Cu = 35 µm	

Figure 18. **Recommended stencil opening (mm)**



Stencil opening thickness: 100 µm

Figure 19. **Wettable flank profile**

3.1 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.

3.2 QFN-10L packing information

Figure 20. Footprint recommendations (mm)

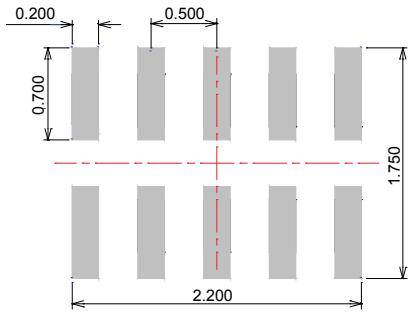
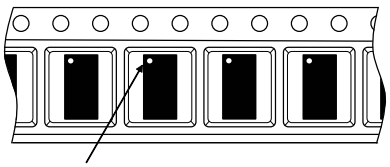


Figure 21. Marking

Dot indicates pin 1
XX: Marking
Y: Year
M: Month

Figure 22. Package orientation in reel



Pin 1 located according to EIA-481

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

Figure 23. Tape and reel orientation

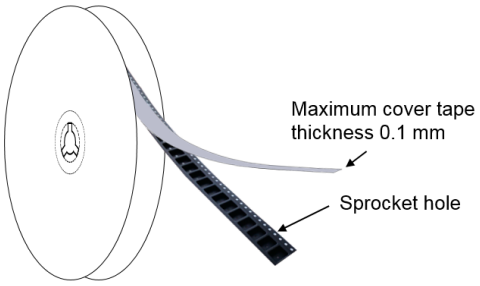


Figure 24. Reel dimensions (mm)

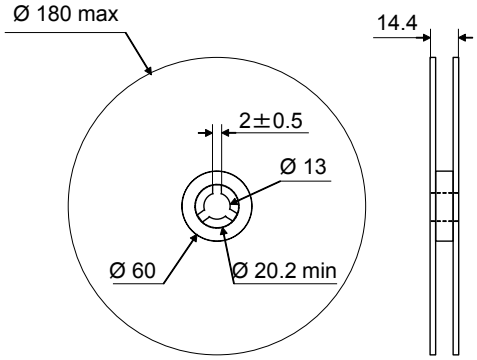


Figure 25. Inner box dimensions (mm)

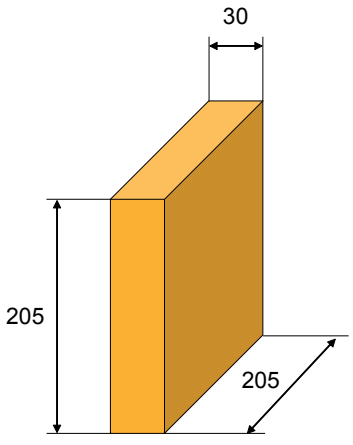
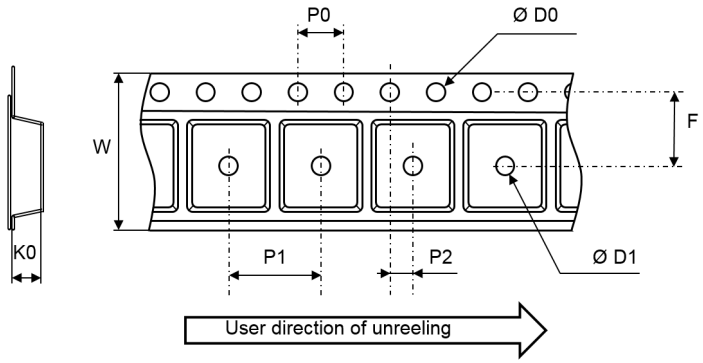


Figure 26. **Tape and reel outline**



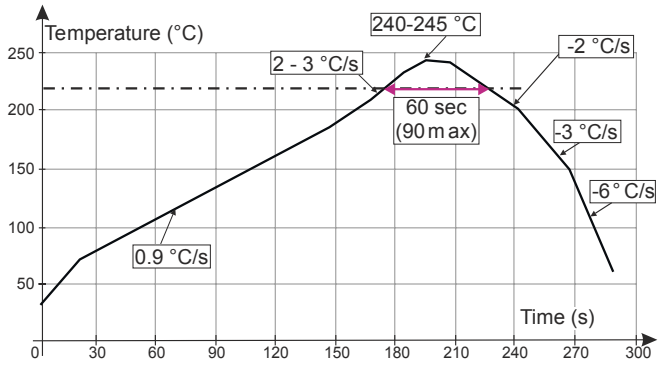
Note: Pocket dimensions are not on scale
Pocket shape may vary depending on package

Table 4. **Tape and reel mechanical data**

Ref.	Dimensions		
	Millimeters		
	Min.	Typ.	Max.
ØD0	1.40	1.50	1.50
ØD1	0.80		
F	1.65	1.75	1.85
K0	0.85	0.95	1.05
P0	3.9	4.0	4.1
P1	3.9	4.0	4.1
P2	1.95	2.00	2.05
W	7.9	8.0	8.3

3.3 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.

4 Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
ECMF04-4HSWM10Y	BY[1]	QFN-10L	7 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
17-Dec-2019	1	Initial release.