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UC2
User Manual
(Rel_02)

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Notice

Preface

Objectives

The document describes the UC2 optical module, including features, application scope, models, technical specifications, internal information, structure, installation, and uninstallation. Meanwhile, the document lists Frequently Asked Questions (FAQs) about the UC2 optical module and related solutions. The appendix lists terms and abbreviations involved in this document.

Conventions

Symbol conventions

The symbols that may be found in this document are defined as below.

Symbol	Description
	Indicate a hazard with a medium or low level of risk which, if not avoided, could result in minor or moderate injury.
	Indicate a potentially hazardous situation that, if not avoided, could cause equipment damage, data loss, and performance degradation, or unexpected results.
	Provide additional information to emphasize or supplement important points of the main text.
	Indicate a tip that may help you solve a problem or save time.

General conventions

Convention	Description
Times New Roman	Normal paragraphs are in Times New Roman.
Arial	Paragraphs in Warning, Caution, Notes, and Tip are in Arial.

Convention	Description
Boldface	Buttons and navigation path are in **Boldface**.
Italic	Book titles are in *italics*.
`Lucida Console`	Terminal display is in `Lucida Console`.
Book Antiqua	Heading 1, Heading 2, Heading 3, and Block are in Book Antiqua.

Change history

Updates between document versions are cumulative. Therefore, the latest document version contains all updates made to previous versions.

Issue 02 (2019-11-01)

Second commercial release

- Added the UC2-100G/DCO and UC2-200G-DCO.

Issue 01 (2019-09-01)

Initial commercial release

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1 Overview

This chapter includes the following sections:

- Introduction
- Features
- Applied scenarios
- Models

1.1 Introduction

The Raisecom UC2 module, which adopts the 100G Form-factor Pluggable 2 (CFP4) packaging, is designed for the high-speed and bidirectional communication system. It has the following features:

- Support up to 200 Gbit/s signal transmission.
- Support up to 10 km, 40 km, 1200 km, and 2400 km transmission distance.
- Provide standard Little Connector (LC) dual-fiber connector.
- Comply with ITU-T and IEEE standards and refer to the Multi Source Agreement (MSA) specifications.

1.2 Features

The Raisecom UC2 optical module has the following features:

- Comply with standards and specifications and is easy to operate.
  - Comply with IEEE802.3ba 100GBASE-LR4, 100GBASE-ER4, and CFP2 MSA Hardware Specification v1.0.
  - DDM and the management interface comply with CFP MSA Management Interface Specification.
  - High-speed electrical signals comply with CAUI-4 (IEEE 802.3bm). Low-speed electrical signals comply with CFP2 MSA Hardware Specification v1.0.
  - Comply with RoHS.
  - Comply with 21 CFR 1040.10 & 1040.11 Class 1 laser security standards.

- Low power consumption, stable performance, high efficiency, and energy conservation
  - Maximum power consumption in normal working conditions: 7.5 W (UC2-100/ER4) 6 W (UC2-100/LR4), 24 W (UC2-100G/DCO and UC2-200G/DCO)
  - Maximum power consumption in low power consumption mode: 2 W
  - Adopt a single +3.3 V power supply.
- Commercial environment standard
  - Operating temperature (altitude: 0–1800 m): -5 to 70 ℃
  - Relative humidity: 5% to 85% (non-condensing, non-freezing)
- Adopt a metallic packaging and feature outstanding EMC.
  - The ESD threshold (according to the MIL-STD-883E Method 3015.4) is greater than 50 V (for high-speed pins) or 2 kV (for non-high-speed pins).
  - The ESD immunity (according to EN 61000-4-2 level 3) of the UC2-100/ER4 and UC2-100/LR4 is greater than 8 kV for contact discharge or 15 kV for air discharge. It meets criteria B: during discharge the performance may decline, but after discharge the performance does not decline and functions are complete.
  - The ESD immunity (according to EN 61000-4-2 level 3) of the UC2-100G/DCO and UC2-200G/DCO is greater than 6 kV for contact discharge or 8 kV for air discharge. It meets criteria B: during discharge the performance may decline, but after discharge the performance does not decline and functions are complete.
  - The RF electric magnetic radiated susceptibility complies with IEC 61000-4-3.
  - The RF electric magnetic radiated emission meets requirements for FCC 47CFR Part15 class B products.
- Adopt coherent optical module technologies.
  - The modulation type of the UC2-100G/DCO is Dual Polarization Differential Quadrature Phase Shift Keying (DP-DQPSK).
  - The modulation type of the UC2-200G/DCO is Dual Polarization 8-ary Quadrature Amplitude (DP-8QAM) and Dual Polarization 16-ary Quadrature Amplitude (DP-16QAM).

Note

- When the altitude increases by 220 m between 1800 m and 5000 m, the highest operating temperature of the UC2 optical module decreases by 1 ℃.
- The Digital Coherent Optical (DCO) optical module features long transmission distance, high transmission rate, and high power consumption, so check whether it is supported by the UC2 optical module, and check its power consumption.

1.3 Applied scenarios

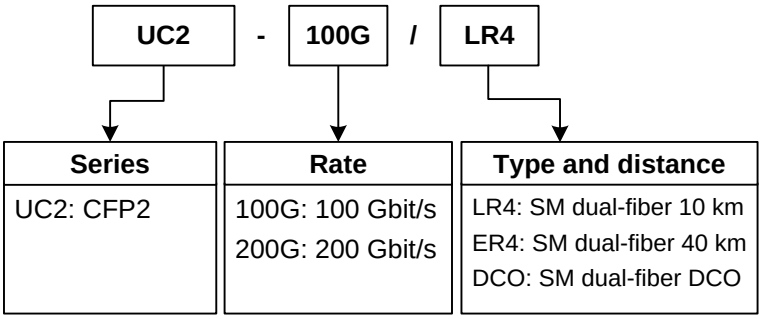
The UC2 optical module is applicable to the Metropolitan Area Network (MAN), access network, and high-speed data communication devices, and is mainly applied to the 10 GE Ethernet and OTN OTU4.

1.4 Models

Naming convention

Figure 1-1 shows the naming convention of the UC2 optical module.

Figure 1-1 Naming convention of the UC2 optical module



Model list

Table 1-1 lists models of the UC2 optical module.

Table 1-1 Models of the UC2 optical module

Model	Rate (Gbit/s)	Wavelength (nm)	Maximum transmission distance (km)	DDM	RoHS
UC2-100G/LR4	• 103.1 • 111.8	• 1295.56 • 1300.05 • 1304.58 • 1309.14	10	Supported	Compliant
UC2-100G/ER4	• 103.1 • 111.8	• 1295.56 • 1300.05 • 1304.58 • 1309.14	40	Supported	Compliant
UC2-100G/DCO	• 103.1 • 111.8	1528.77 (196.10 THz) to 1567.54 (191.25 THz)	2400	Supported	Compliant
UC2-200G/DCO	• 103.1×2 • 111.8×2	1528.77 (196.10 THz) to 1567.54 (191.25 THz)	1200	Supported	Compliant

2 Technical specifications

This chapter includes the following sections:

- Absolute maximum parameters
- Recommended operating parameters
- Maximum power consumption
- Performance index
- Appearance and dimension

2.1 Absolute maximum parameters

Table 2-1 lists the absolute maximum parameters of the UC2-100/ER4 and UC2-100/LR4.

Table 2-1 Absolute maximum parameters of the UC2-100/ER4 and UC2-100/LR4

Parameter	Minimum value	Maximum value
Storage temperature (℃)	-40	85
Relative humidity (non-condensing)	5%	85%
Supply voltage (℃)	-0.5	3.6

Table 2-2 lists the absolute maximum parameters of the UC2-100G/DCO and UC2-200G/DCO.

Table 2-2 Absolute maximum parameters of the UC2-100G/DCO and UC2-200G/DCO

Parameter	Minimum value	Maximum value
Storage temperature (℃)	-40	85
Relative humidity (non-condensing)	5%	85%
Operating case temperature (℃)	-10	80

Parameter	Minimum value	Maximum value
Supply voltage (V)	3.2	3.4
Single channel Rx input power (dBm)	–	13
Total Rx input power (dBm)	–	20

2.2 Recommended operating parameters

Table 2-3 lists the recommended operating parameters of the UC2 optical modules.

Table 2-3 Recommended operating parameters of the UC2 optical modules

Parameter	Minimum value	Maximum value
Operating case temperature (℃) (altitude: 0–1800 m)	-5	70
Power supply voltage (V)	3.2	3.4

2.3 Maximum power consumption

Table 2-4 Maximum power consumption

Model	Maximum power consumption in normal conditions (W)	Maximum power consumption in low power consumption mode (W)
UC2-100G/LR4	6	2
UC2-100G/ER4	7.5	
UC2-100G/DCO	24	
UC2-200G/DCO	24	

2.4 Performance index

Caution

Transmission errors may occur when the Rx optical power is greater than the overload optical power. The optical receiver of the modules may be damaged if the

optical power exceeds the threshold. Therefore, when using the optical module, you should use the optical power meter to measure the actual value of the optical power and confirm that the value is within the range before accessing optical signals.

Note

- In this chapter, performance indexes listed in the tables are End of Life (EOL) value (except parameters marked with BOL), namely, values that are available even in the allowed worst operating environment (temperature and humidity) until the end of life.
- In this chapter, all listed power values are average ones, except marked with OMA.

2.4.1 Optical features

UC2-100G/LR4

Table 2-5 lists the optical features of the UC2-100G/LR4.

Table 2-5 Optical features of the UC2-100G/LR4

Parameter		Minimum value	Typical value	Maximum value	Remarks
Rate, each lane (Gbit/s)	100GE	–	25.78125	–	Compatible with data services and telecom services
	OTU4	–	27.9525	–	
Transmission distance (km)		–	–	10	The transmission distance is used to classify modules. The real transmission distance also depends on other factors, such as the line loss and SNR.
Laser type: LAN-WDM Laser					
Central wavelength (nm)		1294.53	1295.56	1296.59	–
		1299.02	1300.05	1301.09	–
		1303.54	1304.58	1305.63	–
		1308.09	1309.14	1310.19	–
SMSR(dB)		30	–	–	–
Total launch average power (dBm)	100GE	–	–	10.5	–
	OTU4	–	–	10.0	–
Launch power, each lane (dBm)	100GE	-4.3	–	4.5	–
	OTU4	-0.6	–	4.0	–
OMA, each lane (100GE) (dBm)		-1.3	–	4.5	–

Parameter		Minimum value	Typical value	Maximum value	Remarks
Difference in launch power between any two lanes (OMA) (dB)		–	–	5	–
Extinction ratio (dB)	100GE	4	–	–	–
	OTU4	4	–	7	–
Average launch power off transmitter, each lane (dBm)		–	–	-30	–
Optical return loss tolerance (dB)		–	–	20	–
TDP, each lane (dB)		–	–	2.2	–
Launch power in OMA-TDP, each lane (dBm)		-2.3	–	–	–
Tx reflection RFL (dB)		–	–	-12	–
$RIN_{20}OMA$(dB/Hz)		–	–	-130	–
Eye mask {X1,X2,X3,Y1,Y2,Y3}		{0.25,0.4,0.45,0.25,0.28,0.4} ITU-T 959.1&IEEE802.3ba, Hit ratio=5E-5			
Receiver type: PIN					
Range of Rx wavelength (nm)		1294.53	1295.56	1296.59	–
		1299.02	1300.05	1301.09	–
		1303.54	1304.58	1305.63	–
		1308.09	1309.14	1310.19	–
Damage threshold, each lane (dBm)		5.5	–	–	–
Total average launch power (OTU4) (dBm)		–	–	10/8.9	The data on the left is tested when the extinction ratio is 4–7 dB. The data on the right is tested when the extinction ratio is greater than 7 dB.
Average launch power, each lane (dBm)	100GE	-10.6	–	4.5	–
	OTU4	-6.9/-8.8	–	4/2.9	The data on the left is tested when the extinction ratio is 4–7 dB. The data on the right is tested when the extinction ratio is greater than 7 dB.
Rx optical power, each lane (OMA) (dBm)		–	–	4.5	–

Parameter		Minimum value	Typical value	Maximum value	Remarks
Rx power difference between any two lanes (OMA) (dB)		–	–	5.5	–
Rx sensitivity, each lane (OMA) (dBm)	100GE	–	–	-8.6	–
Equivalent Rx sensitivity, each lane (OTU4)(dBm)		–	–	-8.4/-10.3	The data on the left is tested when the extinction ratio is 4–7 dB. The data on the right is tested when the extinction ratio is greater than 7 dB.
Optical path cost (dB)		–	–	1.5	–
Stressed Rx sensitivity (OMA), each lane (100GE) (dBm)		–	–	-6.8	–
VECP, each lane (dB)		–	1.8	–	Conditions for the stressed Rx sensitivity test
Stressed system J2 jitter (UI)		–	0.3	–	
Stressed system J9 jitter (UI)		–	0.47	–	
Rx reflection RFL (dB)		–	–	-26	
LOS assert (dBm)		-25	–	-17	–
LOS de-assert (dBm)		–	–	-15	–
LOS hysteresis (dB)		0.5	–	5	–

Note

- Test code pattern of 100GE: PRBS 2^{31}-1 @ 25.78Gb/s, BER = 1×10^{-12}
- Test code pattern of OTU4: PRBS 2^{31}-1 @ 27.95Gb/s, BER is 1×10^{-12} when FEC is used or it is 1.8×10^{-4} when FEC is not used.

UC2-100G/ER4

Table 2-6 lists the optical features of the UC2-100G/ER4.

Table 2-6 Optical features of the UC2-100G/ER4

Parameter		Minimum value	Typical value	Maximum value	Remarks
Rate, each lane (Gbit/s)	100GE	–	25.78125	–	Compatible with data services and telecom services
	OTU4	–	27.9525	–	

Parameter		Minimum value	Typical value	Maximum value	Remarks
Transmission distance (km)		–	–	40	The transmission distance is used to classify modules. The real transmission distance also depends on other factors, such as the line loss and SNR.
Laser type: LAN-WDM Laser					
Central wavelength (nm)		1294.53	1295.56	1296.59	–
		1299.02	1300.05	1301.09	–
		1303.54	1304.58	1305.63	–
		1308.09	1309.14	1310.19	–
SMSR(dB)		30	–	–	–
Average total launch power (dBm)	100GE	–	–	8.9	–
	OTU4	–	–	8.9	–
Launch power, each lane (dBm)	100GE	2.9	–	2.9	–
	OTU4	2.7	–	2.9	–
OMA, each lane (100GE) (dBm)		0.1	–	4.5	–
Difference in launch power between any two lanes (OMA) (dB)		–	–	3.6	–
Extinction ratio (dB)	100GE	7	–	–	–
	OTU4	7	–	7	–
Average launch power off transmitter, each lane (dBm)		–	–	-30	–
Eye mask {X1,X2,X3,Y1,Y2,Y3}		{0.25,0.4,0.45,0.25,0.28,0.4} ITU-T 959.1&IEEE802.3ba, Hit ratio=5E-5			
Receiver type: PIN/SOA					
Range of Rx wavelength (nm)		1294.53	1295.56	1296.59	–
		1299.02	1300.05	1301.09	–
		1303.54	1304.58	1305.63	–
		1308.09	1309.14	1310.19	–
Damage threshold, each lane (dBm)		5.5	–	–	–
Total average launch power (OTU4) (dBm)		–	–	10.5	–

Parameter		Minimum value	Typical value	Maximum value	Remarks
Average launch power, each lane (dBm)	100GE	-20.9	–	4.5	–
	OTU4	-23.2	–	4.5	–
Rx optical power, each lane (OMA) (dBm)		–	–	4.5	–
Rx power difference between any two lanes (OMA) (dB)		–	–	4.5	–
Rx sensitivity, each lane (OMA) (dBm)	100GE	–	–	21.4	–
	OTU4	–	–	-23.2	–
Optical path cost (dB)		–	–	2.5	–
Stressed Rx sensitivity (OMA), each lane (100GE) (dBm)		–	–	-17.9	–
VECP, each lane (dB)		–	3.5	–	Conditions for the stressed Rx sensitivity test
Stressed system J2 jitter (UI)		–	0.3	–	
Stressed system J9 jitter (UI)		–	0.47	–	
Rx reflection RFL (dB)		–	–	-26	
LOS assert (dBm)		-40	–	–	–
LOS de-assert (dBm)		–	–	-26	–
LOS hysteresis (dB)		0.5	–	5	–

Note

- Test code pattern of 100GE: PRBS 2^{31}-1 @ 25.78Gb/s, BER = 1×10^{-12}
- Test code pattern of OTU4: PRBS 2^{31}-1 @ 27.95Gb/s, BER is 1×10^{-12} when FEC is used or it is 1.8×10^{-4} when FEC is not used.

UC2-100G/DCO

Table 2-7 lists the optical features of the UC2-100G/DCO.

Table 2-7 Optical features of the UC2-100G/DCO

Parameter	Minimum value	Typical value	Maximum value	Remarks
Optical interface performance indexes (Tx)				
Laser central frequency (THz)	191.25	–	196.10	–
Laser Tx frequency interval (GHz)	6.25	–	50	–

Parameter	Minimum value	Typical value	Maximum value	Remarks
Laser Tx frequency stability (GHz)	-1.5	–	+1.5	–
SMSR (dB)	30	40	–	–
Launch optical power (dBm)	-5	–	–	–
Launch power stability (dB)	-0.5	–	0.5	–
Tx wavelength switching time (s)	–	–	60	–
Tx laser shutdown time (ms)	–	–	10	–
Tx OSNR (dB/0.1nm)	40	–	–	–
Tx optical return loss (dB)	20	–	–	–
Launch optical power off laser (dBm)	–	–	-35	–
Polarization-related launch optical power (dB)	–	–	1.0	–
Laser line width (kHz)	–	–	300	–
Laser average relative strength noise (dB/Hz)	–	-140	-135	–
I/Q time offset (ps)	–	–	2	–
X/Y time offset (ps)	–	–	5	–
QPSK modulation -20dB spectrum width (GHz)	40	–	–	–
Optical interface performance indexes (Rx)				
Rx central frequency (THz)	191.25	–	196.10	–
Optimal input optical power range (dBm)	-18	–	0	–
Rx sensitivity (dBm)	-30	–	–	–
Overloading optical power, each lane (dBm)	0	–	–	–
OSNR tolerance (dB/0.1nm)	11.4	–	18.5	–
CD tolerance (ps/nm)	–	–	40000	–
PMD tolerance (ps)	–	–	30	–
LOS Hysteresis power (dB)	0.3	1.0	1.7	–

Note

- Test code pattern of 100GE: PRBS 2^{31}-1 @ 25.78Gb/s, BER = 1×10^{-12}

- Test code pattern of OTU4: PRBS 2^{31}-1 @ 27.95Gb/s, BER is 1×10^{-12} when FEC is used or it is 1.8×10^{-4} when FEC is not used.
- The eye mask and jitter of high-speed electrical signals comply with CEI-28G-MR, SR, and VSR.

UC2-200G/DCO

Table 2-8 lists the optical features of the UC2-200G/DCO.

Table 2-8 Optical features of the UC2-200G/DCO

Parameter	Minimum value	Typical value	Maximum value	Remarks
Optical interface performance indexes (Tx)				
Laser central frequency (THz)	191.25	–	196.10	–
Laser Tx frequency interval (GHz)	6.25	–	50	–
Laser Tx frequency stability (GHz)	-1.5	–	+1.5	–
SMSR (dB)	30	40	–	–
Launch optical power (dBm)	-10	–	–	–
Launch power stability (dB)	-0.5	–	0.5	–
Tx wavelength switching time (s)	–	–	60	–
Tx laser shutdown time (ms)	–	–	10	–
Tx OSNR (dB/0.1nm)	40	–	–	–
Tx optical return loss (dB)	20	–	–	–
Launch optical power off laser (dBm)	–	–	-35	–
Polarization-related launch optical power (dB)	–	–	1.0	–
Laser line width (kHz)	–	–	300	–
Laser average relative strength noise (dB/Hz)	–	-140	-135	–
I/Q time offset (ps)	–	–	2	–
X/Y time offset (ps)	–	–	5	–
QPSK modulation -20dB spectrum width (GHz)	40	–	–	–
Optical interface performance indexes (Rx)				
Rx central frequency (THz)	191.25	–	196.10	–
Optimal input optical power range (dBm)	-18	–	0	–
Rx sensitivity (dBm)	-24	–	–	–

Parameter	Minimum value	Typical value	Maximum value	Remarks
Overloading optical power, each lane (dBm)	0	–	–	–
OSNR tolerance (dB/0.1nm)	18.1	–	21.5	–
CD tolerance (ps/nm)	–	–	20000	–
PMD tolerance (ps)	–	–	15	–
LOS Hysteresis power (dB)	0.3	1.0	1.7	–

Note

- Test code pattern of 100GE: PRBS 2^{31}-1 @ 25.78Gb/s, BER = 1×10^{-12}
- Test code pattern of OTU4: PRBS 2^{31}-1 @ 27.95Gb/s, BER is 1×10^{-12} when FEC is used or it is 1.8×10^{-4} when FEC is not used.
- The eye mask and jitter of high-speed electrical signals comply with CEI-28G-MR, SR, and VSR.

2.4.2 Electical features

Electrical interfaces include Tx (1, 2, 3, 4, 5, 6, 7, and 8) n/p PINs and Rx (1, 2, 3, 4, 5, 6, 7, and 8) n/p PINs. The letter n indicates the negative direction while the letter p indicates the positive direction.

UC2-100G/LR4

Table 2-9 Electrical features of the UC2-100G/LR4

Parameter	Minimum value	Typical value	Maximum value	Remarks
Tx (1, 2, 3, and 4) n/p input PINs				
Differential peak-to-peak voltage (mV)	–	–	900	–
AC common mode output noise (mV)	–	–	17.5	RMS
Common mode input voltage Vcm (V)	-0.3	–	2.8	–
Stressed input test	CEI-28G-VSR, IEEE 802.3bm			–
Rx (1, 2, 3, and 4) n/p output PINs				
Differential peak-to-peak voltage (mV)	–	–	900	–
AC common mode output noise (mV)	–	–	17.5	RMS
Transient time (20%–80%) (ps)	9.5	–	–	Tr, Tf
Eye width (UI)	0.57	–	–	10^{-15} probability condition

Parameter	Minimum value	Typical value	Maximum value	Remarks
Eye height (mV)	228	–	–	10^{-15} probability condition
Output electric eye mask	CEI-28G-VSR, IEEE802.3bm			–

UC2-100G/ER4

Table 2-10 Electrical features of the UC2-100G/ER4

Parameter	Minimum value	Typical value	Maximum value	Remarks
Tx (1, 2, 3, and 4) n/p input PINs				
Differential peak-to-peak voltage (mV)	–	–	1050	–
AC common mode output noise (mV)	–	–	17.5	RMS
Common mode input voltage Vcm (V)	-0.3	–	2.8	–
Stressed input test	CEI-28G-VSR, IEEE 802.3bm			–
Rx (1, 2, 3, and 4) n/p output PINs				
Differential peak-to-peak voltage (mV)	–	–	1000	–
AC common mode output noise (mV)	–	–	17.5	RMS
Transient time (20%–80%) (ps)	9.5	–	–	Tr, Tf
Eye width (UI)	0.57	–	–	10^{-15} probability condition
Eye height (mV)	228	–	–	10^{-15} probability condition
Output electric eye mask	CEI-28G-VSR, IEEE802.3bm			–

UC2-100G/DCO

Table 2-11 Electrical features of the UC2-100G/DCO

Parameter	Minimum value	Typical value	Maximum value	Remarks
Tx (1, 2, 3, and 4) n/p input PINs				
Rate, each lane (Gbit/s)	25.78	–	28.3	• ±20 ppm, OTU4 • ±100 ppm, 100GE

Parameter	Minimum value	Typical value	Maximum value	Remarks
Differential peak-to-peak voltage (mV)	85	1000	1600	–
DC common mode input voltage (mV)	–	450	–	–
Input impedance (Ω)	80	100	120	–
Common mode return loss (dB)	–	–	-6	<10GHz
	–	–	-4	10GHz-Baud Rate
Sinusoidal Jitter, Max (UIpp)	–	–	5	
Sinusoidal Jitter, High Frequency (UIpp)	–	–	0.05	
Rx (1, 2, 3, and 4) n/p output PINs				
Rate, each lane (Gbit/s)	25.78	–	28.3	• ±20ppm, OTU4 • ±100ppm, 100GE
Differential peak-to-peak voltage (mV)	0	1000	1200	–
DC common mode output voltage (mV)	–	450	–	–
Output impedance (Ω)	80	100	120	–
Transient time (20%–80%) (ps)	–	9	–	Tr, Tf
Common mode return loss (dB)	–	–	-6	< 10GHz
	–	–	-4	10GHz-Baud Rate
Total jitter	–	–	0.28	–

UC2-200G/DCO

Table 2-12 Electrical features of the UC2-200G/DCO

Parameter	Minimum value	Typical value	Maximum value	Remarks
Tx (1, 2, 3, 4, 5, 6, 7, and 8) n/p input PINs				
Rate, each lane (Gbit/s)	25.78	–	28.3	• ±20 ppm, OTU4 • ±100 ppm, 100GE
Differential peak-to-peak voltage (mV)	85	1000	1600	–
DC common mode input voltage (mV)	–	450	–	–
Input impedance (Ω)	80	100	120	–
Common mode return loss (dB)	–	–	-6	<10GHz

Parameter	Minimum value	Typical value	Maximum value	Remarks
	–	–	-4	10GHz-Baud Rate
Sinusoidal Jitter, Max (UIpp)	–	–	5	
Sinusoidal Jitter, High Frequency (UIpp)	–	–	0.05	
Rx (1, 2, 3, 4, 5, 6, 7, and 8) n/p output PINs				
Rate, each lane (Gbit/s)	25.78	–	28.3	• ±20ppm, OTU4 • ±100ppm, 100GE
Differential peak-to-peak voltage (mV)	0	1000	1200	–
DC common mode output voltage (mV)	–	450	–	–
Output impedance (Ω)	80	100	120	–
Transient time (20%–80%) (ps)	–	9	–	Tr, Tf
Common mode return loss (dB)	–	–	-6	< 10GHz
	–	–	-4	10GHz-Baud Rate
Total jitter	–	–	0.28	–

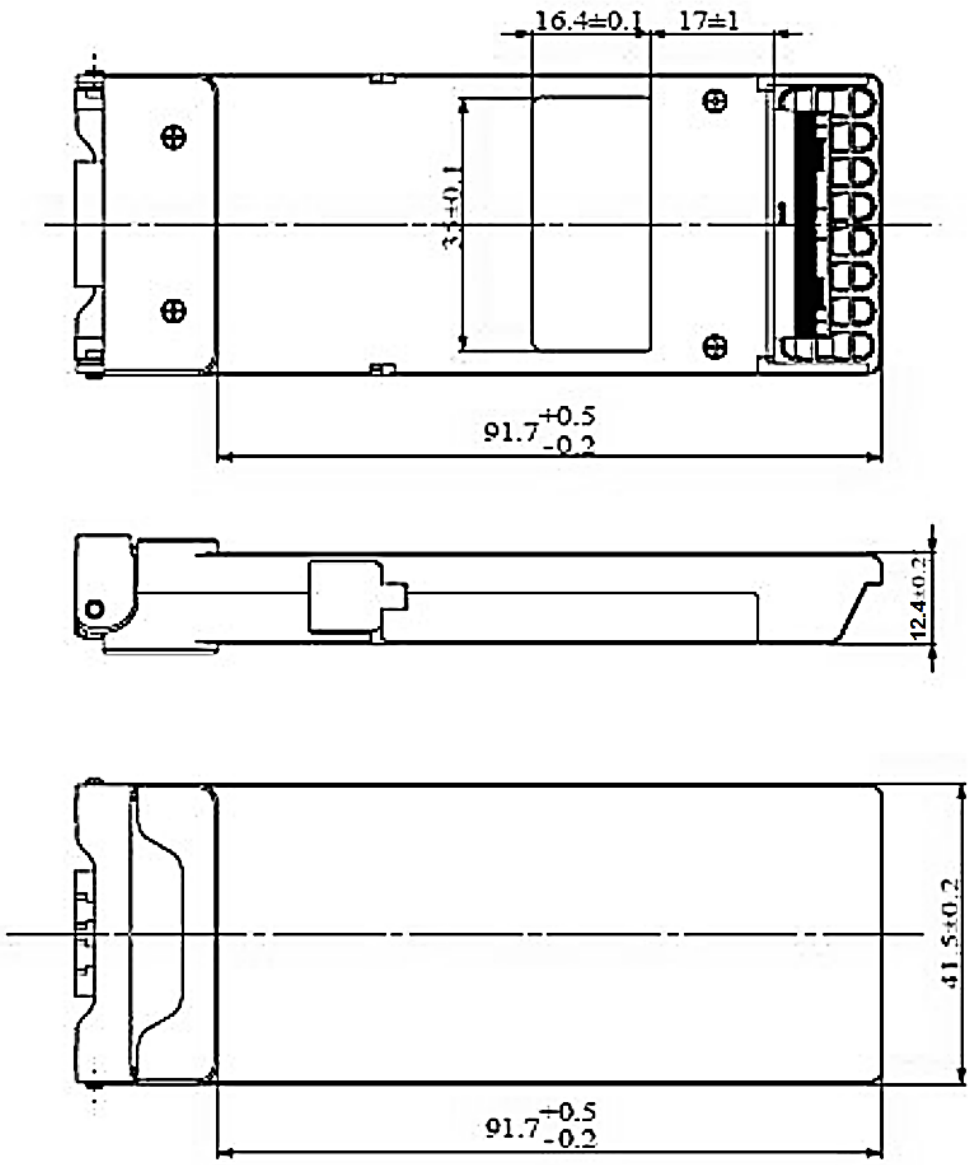
2.5 Appearance and dimension

2.5.1 Optical module

Figure 2-1 shows the top view of the UC2 optical module and Figure 2-2 shows the dimensions.

Figure 2-1 Appearance of the UC2 (the pull tab of the UC2-100G/LR4 is blue while that of the UC2-100G/ER4 is red)

Figure 2-2 Dimensions (mm) of the UC2 optical module

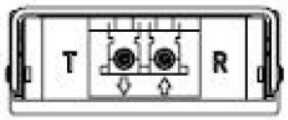


2.5.2 Optical interface

The UC2 module adopts the standard LC dual-fiber connector which needs to be inserted with LC fiber.

- The wavelength of the 4 or 8 channels is added/dropped by the module.
- The definition of the channels is shown in Figure 2-3. The position of the 2 channels in sequential order is: Tx channel (T) and Rx channel (R)

Figure 2-3 Appearance of the LC connector



3 Installation and uninstallation

Warning

- During any operation or maintenance process, pay attention to laser safety. Do not stare into the optical interface or fiber connector with eyes directly or through an instrument, to prevent laser from damaging eyes.
- Before connecting the fiber, use an optical power meter to measure the current optical power of the fiber. When the current optical power is smaller than the overload point of the optical module, you can connect the fiber. When the current optical power is greater than the overload point of the optical module, bit error or device damage may occur. When the current optical power is lower than the sensitivity, services will be blocked.
- When using the UC2 optical module, do not use the optical fiber jumper to performance hardware loopback (in other words, use a fiber to connect the Tx interface of the UC2 optical module to the Rx interface directly), otherwise the device will be damaged. Before using the optical fiber jumper to performance hardware loopback, add a 10-dB fiber attenuator to the UC2 optical module so that the optical power is smaller than the overload point but greater than the Rx sensitivity.

Caution

- While transporting and using the optical module, avoid violent vibration and crash. Otherwise, the precise photoelectric components inside the optical module may be damaged.
- While installing the optical module, take ESD measures to prevent the optical module from being damaged. The module interface and optical fiber are highly precise, do not insert them and pull them out frequently.
- If the Rx optical power at the Rx end of the optical module exceeds the threshold, the optical module may be damaged.
- Clean the fiber end face before inserting the fiber jumper to the optical module interface so as to keep the optical module interface clean. Otherwise, the performance of the optical module may be affected.
- While removing the optical module, unlock it from the device. Otherwise, the optical module or the connector may be permanently damaged.
- When you do not use the UC2 optical module, put the dustproof plug over the interface of the module and the fiber and put the optical module in an anti-static bag. Therefore, keep the dustproof plug for future use while installing the optical module. In addition, keep the slots on the UC2 away from dust.
- Do not fix the optical module by yourself.

The installation and uninstallation of the UC2 optical module are simple.

For installation, install the UC2 module, and then insert the fiber.

Step 1 Insert it to the slot.

Step 2 Push it to the end of the slot until it is locked with the device.

For uninstallation, remove the fiber from the UC2 optical module, and then remove the UC2 optical module.

Step 1 Bend the pull tab to a degree of 90° to unlock the UC2 optical module from the guide rail.

Step 2 Pull out the optical module from the guide rail at this angle of the pull tag.

4 Appendix

This chapter includes the following sections:

- FAQs
- Terms
- Abbreviations

4.1 FAQs

This chapter mainly describes the FAQs and the corresponding solutions, as listed in Table 4-1.

Table 4-1 FAQs and solutions

No.	Fault	Solution
1	The LOS LED is lit up (or the LNK LED is off) when the UC2 optical module accesses optical signals.	• Check the cleanness of the optical interface of the UC2 optical module. • Confirm that the speed of accessed optical signals matches with the UC2 optical module. • Confirm that the configured rate of the optical interface of the UC2 optical module matches with the UC2 optical module. • Check whether the Rx optical power of the related optical interface is greater than the minimum overload or is smaller than the Rx sensitivity. If the Rx optical power is greater than the minimum overload, it may damage the UC2 optical module. • If the Rx optical power is smaller than the Rx sensitivity, it may cause the device to fail to be registered. If it is a SM UC2 optical module, check whether the wavelength and rate of the UC2 optical modules on both ends are matched.
2	No optical power is output when the UC2 optical module is powered on.	• Check the cleanness of the optical interface of the UC2 optical module. • Check whether the end-face of the jumper is contaminated or damaged. • Check whether the UC2 optical module is damaged. • Check whether the device is enabled with functions that may cause the laser to be shut down, such as link-state tracking or ALS. • Check whether the Tx-side laser of the optical interface is shut down. • If there is a Tx_fault alarm, perhaps the operating condition is bad or the UC2 optical module fails.

No.	Fault	Solution
3	DDM data exceeds the normal range and alarms are generated.	• If the temperature alarm is generated frequently, we recommend improving the heat-dissipation environment. • The generation of current/voltage alarms concerns the operating status of the device. • The Tx optical power alarm may cause Tx_fault. Therefore, we recommend changing the UC2 optical module. • If the alarm is generated because the Rx optical power is low, maybe the Rx-side optical power is too low or the UC2 optical module is damaged, we recommend changing the UC2 optical module. If the alarm is generated because the Rx optical power exceeds the threshold, we recommend adding an optical attenuator.
4	DDM Tx/Rx optical power is normal but the measured optical power is abnormal.	• Check the cleanness of the optical interface of the UC2 optical module. • Check whether the end-face of the jumper is contaminated or damaged. • Check whether the precision of the optical power meter is normal.
5	The LOL LED is lit up after the UC2 optical module is powered on.	• Check whether the Rx side of the UC2 optical module has accessed optical signals. If not, the LOS alarm threshold of the UC2 optical module is configured too small. Therefore, you should change the UC2 optical module. • If the problem still exists after services are accessed at the UC2 optical module side, check rate configurations of the optical interface. • Pull out and then insert the UC2 optical module again or restart the device.
6	After the UC2 optical module is powered on, the Tx optical power is normal. However, the device fails to communicate with the remote device.	• Check whether the Rx side of the UC2 optical interface can work properly. • Check whether the remote device is configured properly. • Check whether the vendor has specific customized requirements on the UC2 optical module. • Check LEDs of the device.

Note

Usually, when the Rx optical power of the UC2 optical module exceeds the normal range, it may cause link fault. Therefore, when solving the link fault problem, you can first check whether the Rx optical power of the UC2 optical module is normal. For optical performance indexes of optical modules, see Chapter 2 Technical specifications.

4.2 Terms

A

ALS	The technology that is used for automatically shutting down the laser to avoid the maintenance and operation risks when the fiber is pulled out or the output power is over great.

E

Extinction ratio	The extinction ratio refers to the smallest ratio of A and B in complete modulation under the worst reflection conditions, that is ER=10lg (A/B). Wherein, A refers to the average Tx optical power at high voltage level and B refers to that at low voltage level.
Eye mask	After being binary or N-nary signals are transmitted, they are displayed as a continuous overlapping waveforms on the oscilloscope, which are similar to human eyes. Therefore, it is named as the eye pattern. With eye pattern, you can learn the degree of the intersymbol interference. An open eye pattern corresponds to minimal signal distortion. A close eye pattern corresponds to maximal signal distortion.

F

Fiber	It refers to the filamentous optical waveguide made of dielectric substance, which is used to guide electromagnetic energy in a form of optical wave.

I

I^2C	The I^2C is a two-cable serial bus consisting of the serial data line SDA and serial clock SCL. It is used to connect the micro-controller and peripheral devices. It is a bus standard widely used in the micro-electronics communication control area. It is a specific mode of synchronous communication with features of few connected cables, simple control mode, small part encapsulation mode, and high communication speed.

L

Laser	A laser is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation.

O

Optical power	The work done by light within a time unit Units of optical power include mW and dBm, of which the former is a linear unit and the latter is a logarithmic unit. The relationship between the two units is: P(dBm)=10Log(P(mW)/1mW)

R

Rx sensitivity	The minimum average input optical power received by the optical receiver when the frame loss rate of the fiber transceiver is zero in full-load data traffic conditions

4.3 Abbreviations

A	
APD	Avalanche Photo Diode
B	
BER	Bit Error Rate
BOL	Beginning of Life
C	
CFP4	C form-factor pluggable 4
D	
DDMI	Digital Diagnostic Monitor Interface
DFB	Distributed Feedback
E	
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMI	Electromagnetic Interference
EOL	End of Life
I	
IEEE	Institute of Electrical and Electronics Engineers
ITU-T	International Telecommunications Union-Telecommunication Standardization Sector
L	
LC	Little Connector
LOS	Loss of Signal
M	
MM	Multi-Mode
MSA	Multi Source Agreement

P

PIN	P type-intrinsic-n type

R

RMS	Root Mean Square
RoHS	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

S

SCL	Serial Clock
SDA	Serial Data Line
SDH	Synchronous Digital Hierarchy
SFP	Small Form-factor Pluggable
SM	Single-Mode

T

TTL	Transistor-Transistor Logic

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