DRIVENETS

DATASHEET

OPTICAL TRANSCEIVER · OSFP224 RIDING HEAT SINK

DriveNets 1.6T 2×FR4

OSFP224 transceiver with dual duplex LC interfaces and riding heat sink, delivering 8 × 212.5 Gbps PAM4 over four CWDM wavelengths per link, 2 km over duplex single-mode fiber.

1.6 Tbps

AGGREGATE LINE RATE

8 × 212.5G PAM4

Dual duplex LC · 2 km

26 W maximum



OVERVIEW

The DriveNets 1.6T OSFP224 2×FR4 is a small-form-factor, hot-pluggable optical transceiver designed to transmit and receive serial optical data links up to 212.5 Gbps data rate per channel using PAM4 modulation over single-mode fiber. Eight 106.25 GBd host electrical lanes drive eight optical lanes multiplexed as four CWDM wavelengths (1271, 1291, 1311 and 1331 nm) onto each of two duplex LC interfaces, giving 1.6 Tbps as two 800G-FR4 links at reaches up to 2 km. The module integrates a high-performance silicon-photonics modulator, a PAM4 DSP and a riding heat sink (RHS) in an OSFP224 form factor, and is compliant with 1600G Ethernet specifications - IEEE P802.3dj D3.0 - the OSFP MSA rev 5.2 and OIF-CMIS 5.3 management. Maximum power consumption is 26 W across a 0 °C to +70 °C case-temperature range, for AI cluster interconnection, 1600GBASE-2xFR4 Ethernet, datacenters and other 1.6T interconnect.

Optical interface

Dual duplex LC · 8 lanes at 212.5 Gbps PAM4

CWDM 1271 / 1291 / 1311 / 1331 nm · 2 km over SMF

Class 1 laser product per IEC 60825-1

Electrical & management

60-contact edge connector · 8 × 106.25 GBd host lanes

2-wire serial (SCL / SDA) · OIF-CMIS 5.3 memory map

IEEE P802.3dj D3.0 host electrical compliance

Power & environmental

26 W maximum power consumption

0 °C to +70 °C case · riding heat sink (RHS)

RoHS II 2011/65/EU · digital diagnostics monitoring

HARDWARE SPECIFICATION

Key specifications

Ordering & package

Part number	**DNOT00004**
Form factor	**OSFP224, riding heat sink (RHS)**
Optical interface	**Dual duplex LC**
Data rate	**1.6T (8 × 212.5 Gbps PAM4)**
Reach	**2 km single-mode fiber**

Electrical

Supply voltage (VCC)	**3.135 – 3.465 V**
Baud rate per lane	**106.25 GBd ±50 ppm**
Power consumption	**26 W maximum**
Output voltage, enabled	**1000 mVpp max**
Effective return loss	**8.5 dB min (TP1 / TP4)**
SNR-and-distortion (SNDR)	**Per IEEE P802.3dj D3.0**

Optical – transmitter

Modulation format	**PAM4, 4 × CWDM per link**
Lane wavelengths	**1271 / 1291 / 1311 / 1331 nm**
Output power (PAVG)	**-2.2 to 4.9 dBm**
Total average launch power	**10.9 dBm max**
OMAouter, TDECQ < 0.9 dB	**0.8 to 4.8 dBm**
TDECQ / TECQ, max	**3.4 dB**
Extinction ratio	**3.5 dB min**

Environmental

Operating case temp	**0 °C – +70 °C**
Storage temperature	**-40 °C – +85 °C**
Relative humidity	**5% – 85%**
VCC absolute maximum	**-0.3 V – +3.6 V**
Cooling	**Riding heat sink (RHS)**

Optical – receiver

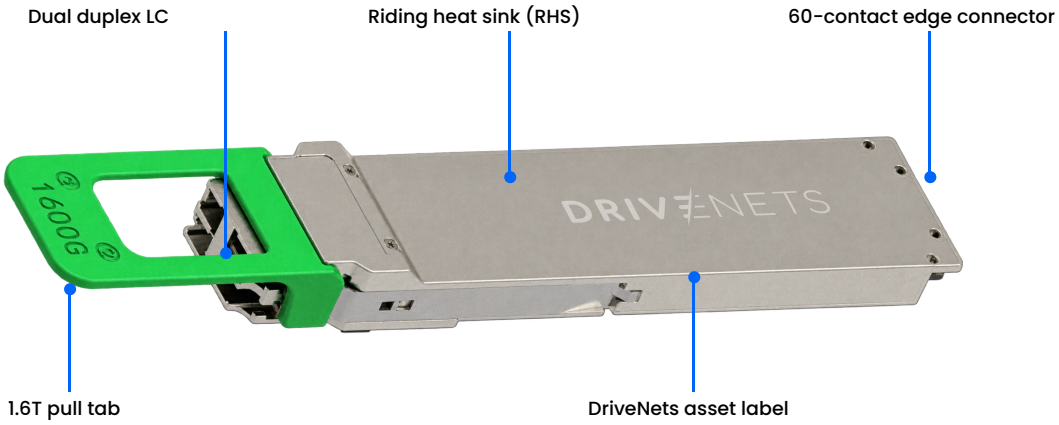
Average receive power	**-6.2 to 4.9 dBm**
Sensitivity (OMAouter)	**-3.7 dBm @ 2.4E-4**
Stressed sensitivity	**-1.2 dBm**
Damage threshold	**5.9 dBm per lane**
Receiver reflectance	**-26 dB max**

Management & DDM

Host interface	**60-contact edge connector**
Memory map	**OIF-CMIS 5.3**
Temperature / voltage	**±3 °C / ±0.1 V**
Tx bias current, per lane	**10%**
Tx / Rx power, per lane	**±3 dB**

INTERFACE OVERVIEW

Module layout



REGULATORY COMPLIANCE

Certifications

EMC

FCC 47 CFR Part 15, Class B

EN 55032:2015+A11:2020+A1:2020

EN 55035:2017+A11:2020

IEC 61000-4-3:2020

IEC EN 61000-4-2:2008

Product safety

CB: IEC 62368-1:2018

TÜV Mark: EN IEC 62368-1:2020+A11

UL Recognized Component: UL 62368-1:2019 R10.21, CSA C22.2 No. 62368-1:19

Optical & environmental

Class 1 laser product

FDA/CDRH

IEC 60825-1:2014

IEC 60825-2:2021

EN 60825-1:2014+A11

Complies with RoHS II Directive 2011/65/EU

1.6 Tbps
AGGREGATE LINE RATE

8 × 212G
PAM4 OPTICAL LANES

2 km
REACH OVER SMF

26 W
MAXIMUM POWER

APPLICATIONS & STANDARDS

Applications

- AI cluster interconnection
- 1600GBASE-2xFR4 Ethernet
- Datacenters
- Other 1.6T interconnect

Reference documents

- OIF-CMIS-05.3 - common management interface specification (CMIS) rev 5.3
- OSFP MSA specification for OSFP octal small form factor pluggable module rev 5.2
- IEEE P802.3dj™-D3.0

RATINGS

Absolute maximum ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Storage temperature range	T_S	**-40**	**+85**	°C
Relative humidity	RH	**5**	**85**	%
Power supply voltage	V_{CC}	**-0.3**	**+3.6**	V
Rx damage threshold, per lane			**5.9**	dBm

1. Absolute maximum ratings: modules operated outside this range may be permanently damaged.

OPERATING CONDITIONS

Recommended operating conditions

PARAMETER	SYMBOL	MIN	TYPICAL	MAX	UNIT
Operating case temperature	T_C	**0**	**-**	**70**	°C
Power supply voltage	V_{CC}	**3.135**	**3.3**	**3.465**	V
Baud rate, per channel		**106.25 -50 ppm**	**106.25**	**106.25 +50 ppm**	GBd

1. Recommended operating conditions: performance is not guaranteed outside this range.

MONITORING

DDM accuracy

PARAMETER	ACCURACY	UNIT	CALIBRATION
Temperature	**±3**	°C	Internal
Voltage	**±0.1**	V	Internal
Tx bias current, each lane	**10**	%	Internal
Tx output power, each lane	**±3**	dB	Internal
Rx receive power, each lane	**±3**	dB	Internal

MANAGEMENT

Memory map

Refer to OIF-CMIS - common management interface specification (CMIS), rev 5.3.

Optical characteristics

The following optical characteristics are defined over the recommended operating conditions unless otherwise specified.

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	NOTES
Transmitter (per lane)						
Signaling speed		**106.25 -50 ppm**	**106.25**	**106.25 +50 ppm**	GBd	
Modulation format			**PAM4**			
Lane wavelength		**1264.5** **1284.5** **1304.5** **1324.5**	**1271** **1291** **1311** **1331**	**1277.5** **1297.5** **1317.5** **1337.5**	nm	
Side-mode suppression ratio	SMSR	**30**			dB	
Total average launch power				**10.9**	dBm	
Average launch power	P_{AVG}	**-2.2**		**4.9**		1
Outer optical modulation amplitude, for TDECQ < 0.9 dB	OMA_{outer}	**0.8**		**4.8**	dBm	
Outer optical modulation amplitude, for 0.9 dB < TDECQ < 3.4 dB	OMA_{outer}	**-0.1 + Max (TECQ, TDECQ)**		**4.8**	dBm	
Difference in launch power between any two lanes (OMA_{outer})				**4**	dB	
Transmitter and dispersion eye closure for PAM4	TDECQ			**3.4**	dB	
Transmitter eye closure for PAM4	TECQ			**3.4**	dB	
| TDECQ - TECQ |				**2.5**	dB	
$TDECQ_{CER}$, each lane				**3.4**	dB	
Transmitter functional symbol error histogram, each lane (max)		See IEEE Std 802.3dj™ D3.0, Table 180-18			-	
Transmitter overshoot and undershoot				**22**	%	
Transmitter power excursion				**2.9**	dB	
Extinction ratio	ER	**3.5**			dB	
Transmitter transition time				**8**	ps	
Average launch power of OFF transmitter				**-16**	dBm	
$RIN_{17.1}OMA$				**-139**	dB/Hz	
Optical return loss tolerance				**17.1**	dB	
Transmitter reflectance				**-26**	dB	2

Optical characteristics (continued)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	NOTES
Receiver (per lane)						
Signaling speed per lane		**106.25 -50 ppm**	**106.25**	**106.25 +50 ppm**	GBd	
Modulation format			**PAM4**			
Lane wavelength		**1264.5** **1284.5** **1304.5** **1324.5**	**1271** **1291** **1311** **1331**	**1277.5** **1297.5** **1317.5** **1337.5**	nm	
Damage threshold, each lane		**5.9**			dBm	
Average receive power, each lane		**-6.2**		**4.9**	dBm	3
Receive power (OMA_{outer}), each lane				**4.8**	dBm	
Difference in receive power between any two lanes (OMA_{outer})				**4.1**	dB	
Receiver sensitivity (OMA_{outer}), for TECQ < 0.9 dB				**-3.7**	dBm	
Receiver sensitivity (OMA_{outer}), for 0.9 dB ≤ TECQ ≤ 3.4 dB				**-4.6 + TECQ**	dBm	
Receiver reflectance				**-26**	dB	
Stressed receiver sensitivity (OMA_{outer})				**-1.2**	dBm	
Conditions of the stressed receiver sensitivity test (note 4)						
Stressed eye closure for PAM4 (SECQ), lane under test			**3.4**		dB	
OMA_{outer} of each aggressor lane			**0.8**		dBm	

1. An average launch power of -2.2 dBm corresponds to an OMA of 0.8 dBm with an infinite extinction ratio.
2. Transmitter reflectance is defined by looking into the transmitter.
3. Average receive power, each lane (min) is not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
4. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Electrical characteristics

The following electrical characteristics are defined over the recommended operating conditions unless otherwise specified.

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	NOTES
Supply voltage	V_{CC}	**3.135**		**3.465**	V	
Power consumption	PC			**26**	W	
Module input						
DC common-mode voltage tolerance		**0.15**		**1.05**	V	TP1
Peak-to-peak AC common-mode voltage tolerance, low-frequency	V_{CMLF}	**32**			mV	TP1
Peak-to-peak AC common-mode voltage tolerance, full-band	V_{CMFB}	**85**			mV	TP1
Differential-mode to common-mode return loss	RL_{cd}	See IEEE Std 802.3dj™ D3.0, Equation (179-23)			dB	TP1
Effective return loss	ERL	**8.5**			dB	TP1
Amplitude tolerance				**0.5**	V	TP1
Interference tolerance		See IEEE Std 802.3dj™ D3.0, Table 176D-11				TP1
Jitter tolerance		See IEEE Std 802.3dj™ D3.0, Table 176D-12				TP1
Module output						
Differential peak-to-peak output voltage, output disabled				**30**	mV	TP4
Differential peak-to-peak output voltage, output enabled				**1000**	mV	TP4
Peak-to-peak AC common-mode voltage, low-frequency	V_{CMLF}			**15**	mV	TP4
Peak-to-peak AC common-mode voltage, full-band	V_{CMFB}			**60**	mV	TP4
DC common-mode voltage		**0.15**		**1.05**	V	TP4
Common-mode to common-mode return loss		See IEEE Std 802.3dj™ D3.0, Equation (179-15)			dB	TP4
Common-mode to differential-mode return loss		See IEEE Std 802.3dj™ D3.0, Equation (179-16)			dB	TP4
Effective return loss	ERL	**8.5**			dB	TP4
Transmitter steady-state voltage		**0.389**		**0.5**	V	TP4
Linear fit pulse peak ratio		**0.46**			-	TP4
Level separation mismatch ratio		**0.95**			-	TP4

Electrical characteristics (continued) - module output

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	NOTES
Transmitter output waveform: absolute value of step size for all taps		**0.005**		**0.025**	-	
Transmitter output waveform: value at minimum state for c(-3)				**-0.06**	-	
Transmitter output waveform: value at maximum state for c(-2)		**0.12**			-	
Transmitter output waveform: value at minimum state for c(-1)				**-0.34**	-	
Transmitter output waveform: value at minimum state for c(0)				**0.5**	-	
Transmitter output waveform: value at minimum state for c(1)				**-0.2**	-	
Signal-to-noise-and-distortion ratio (SNDR)		See IEEE Std 802.3dj™ D3.0, Table 179-9			dB	TP4
Signal-to-residual-intersymbol-interference ratio		**28**			dB	TP4
Output jitter (J_{RMS03})				**0.023**	UI	TP4
Output jitter (EOJ_{03})				**0.025**	UI	TP4
Output jitter (J_{4u03})				**0.118**	UI	TP4
Low-speed signals - SCL and SDA (I_{OLmax} = 3 mA)						
Output low voltage	V_{OL}	**0**		**0.4**	V	
Output high voltage	V_{OH}	**V_{CC} - 0.5**		**V_{CC} + 0.3**	V	
Input low voltage	V_{IL}	**-0.3**		**V_{CC} × 0.3**	V	
Input high voltage	V_{IH}	**V_{CC} × 0.7**		**V_{CC} + 0.5**	V	

Pin assignment

The electrical interface of the OSFP module consists of a 60-contact edge connector, as illustrated in the figure below, which is defined in Clause 8.1 of the OSFP MSA Specification.

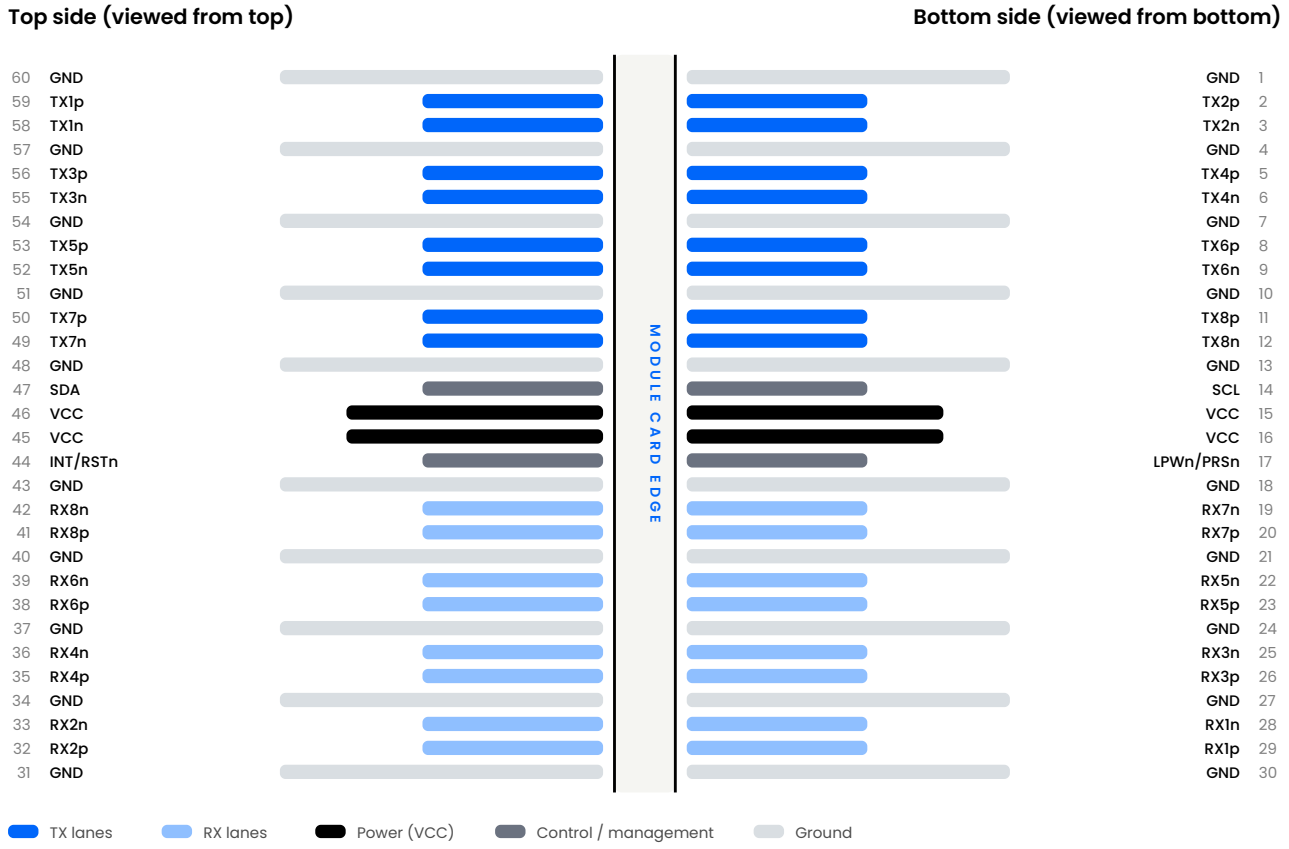


Figure 1. OSFP module pinout

SIGNALS

Pin description

NAME	PIN	DIRECTION	DESCRIPTION
TX[8:1]p / TX[8:1]n		Input	Transmit differential pairs from host to module.
RX[8:1]p / RX[8:1]n		Output	Receive differential pairs from module to host.
SCL	14	Bidirectional	2-wire serial clock signal. Requires pull-up resistor to 3.3 V on host.
SDA	47	Bidirectional	2-wire serial data signal. Requires pull-up resistor to 3.3 V on host.
LPWn/PRSn	17	Bidirectional	Multi-level signal for low-power control from host to module and module-presence indication from module to host.
INT/RSTn	44	Bidirectional	Multi-level signal for interrupt request from module to host and reset control from host to module.
VCC	15, 16, 45, 46	Power	3.3 V power for module.
GND		Ground	Module ground. Logic and power return path.

ARCHITECTURE

Functional block diagram

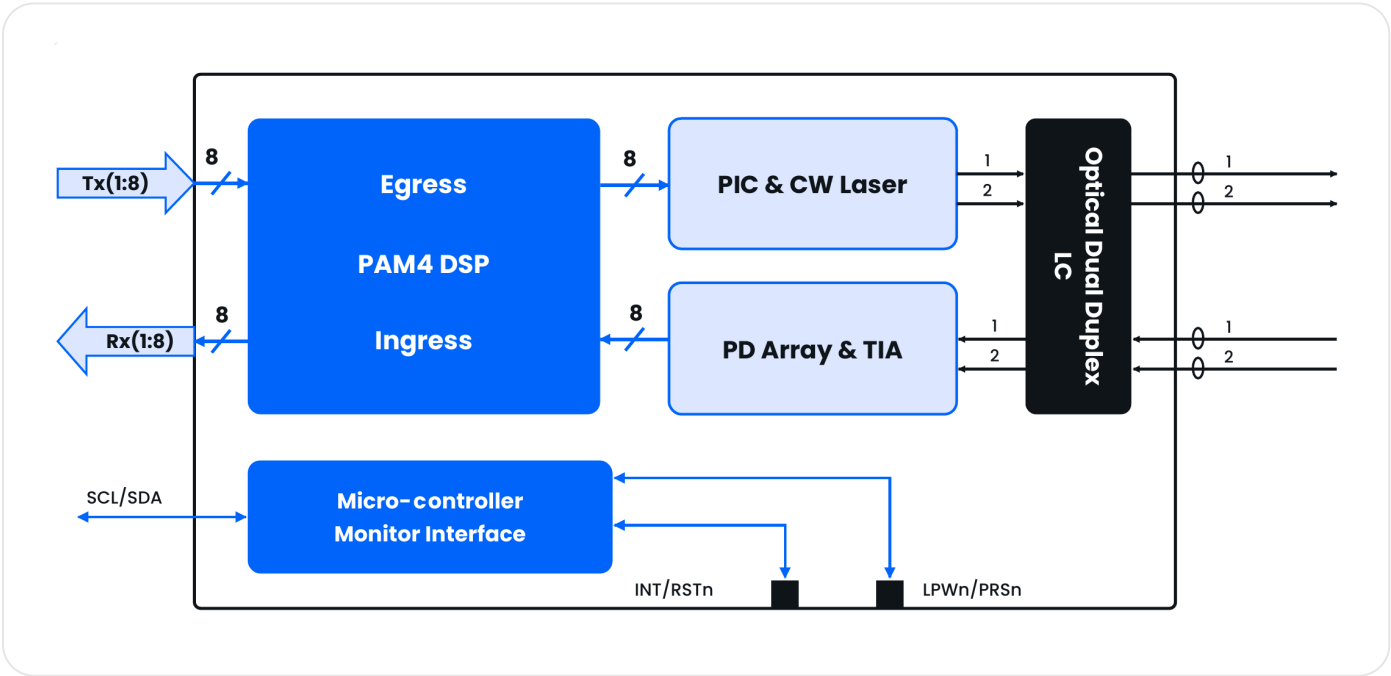


Figure 2. 1600G OSFP 2xFR4 functional block diagram

COMPLIANCE

Regulatory and compliance

CATEGORY	STANDARD
EMC - immunity	EN 55035:2017+A11:2020 IEC 61000-4-3:2020
EMC - emission	FCC 47 CFR Part 15, Class B EN 55032:2015+A11:2020+A1:2020
ESD threshold	IEC EN 61000-4-2:2008
Product safety	CB: IEC 62368-1:2018 TÜV Mark: EN IEC 62368-1:2020+A11 UL Recognized Component: UL 62368-1:2019 R10.21, CSA C22.2 No. 62368-1:19
Optical safety	Class 1 laser product FDA/CDRH IEC 60825-1:2014 IEC 60825-2:2021 EN 60825-1:2014+A11
RoHS	Complies with RoHS II Directive 2011/65/EU

MECHANICAL

Mechanical package outline

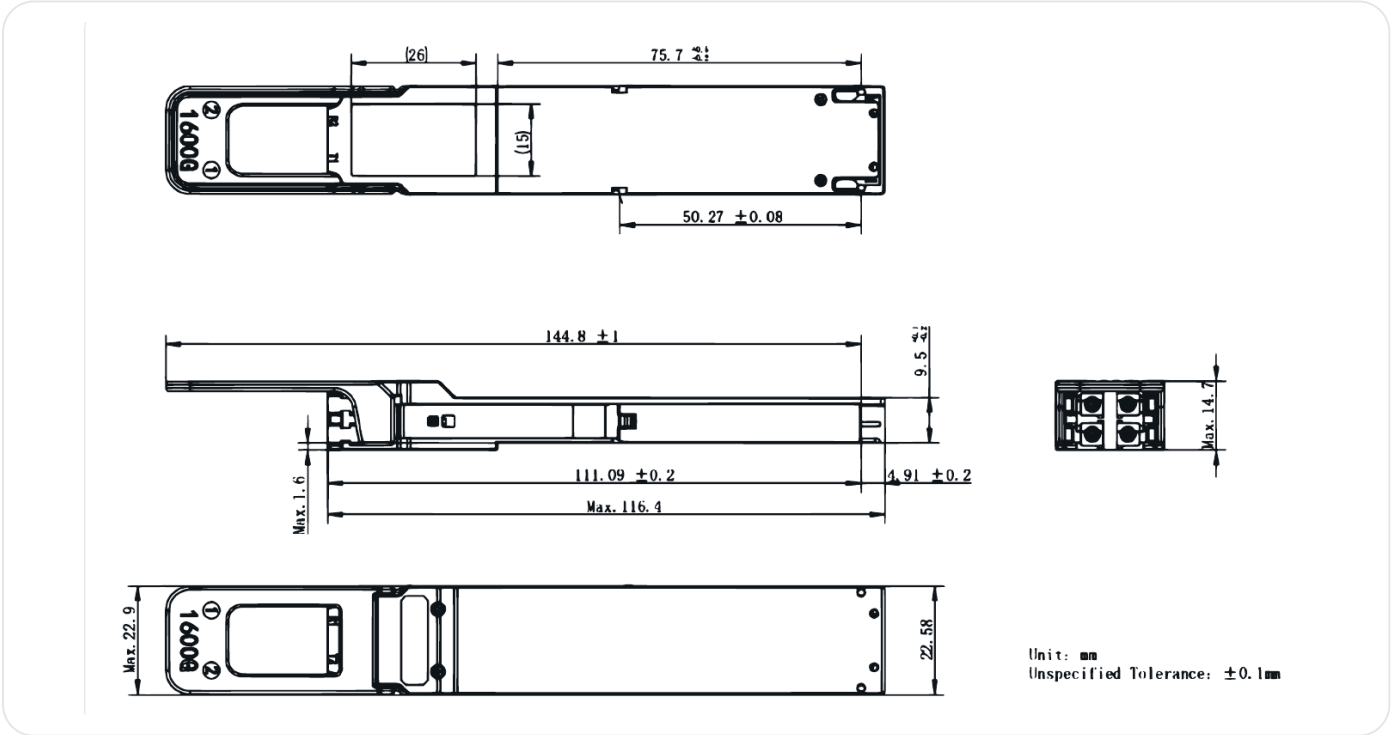


Figure 3. Mechanical package outline (all dimensions are in mm) · Unit: mm. Unspecified tolerance: ±0.1 mm.

Optical interface

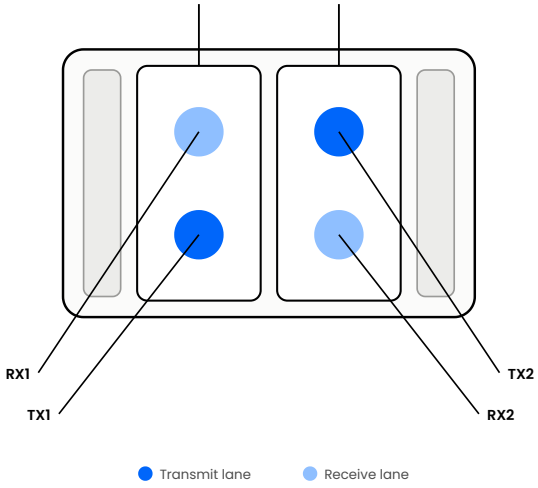


Figure 4. Optical receptacle and channel orientation for dual duplex LC.