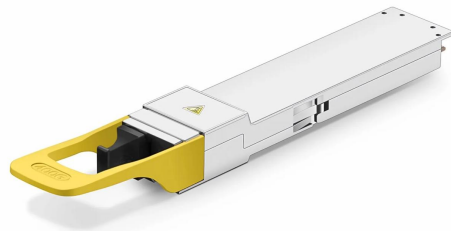


LO-M31400A-DR4C

400GBASE-DR4 OSFP PAM4 1310nm 500m MPO-12/APC DOM Flat Top Transceiver

Features

- 400G DR4 single mode transceiver
- 4-channels of 100G-PAM4 electrical modulation
- MPO12/APC optical connector
- OSFP RHS form factor
- ROHS-6: Environment Safety
- 9W max power consumption
- 500m max reach with SMF
- 3.3V power supply
- Case operating temperature 0°C to 70°C
- Compliant to CMIS Rev. 5.2
- Compliant to IEEE Std 802.3-2022:
 - 400GBASE-DR4 Optical Interface
- Compliant to IEEE Std 802.3ck-2022:
 - 400GAUI-4/200GAUI-2/100GAUI-1 C2M Electrical Interface
- CMIS Rev. 4.0 Management Interface
- Compliant to Class 1 Laser Safety



Applications

- Ethernet for 4x100G, 2x200G, 1x400G
- IB for NDR, 2x NDR200

Absolute Maximum Rating

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Storage Temperature	Ts	-40		85	°C	
Case Operating Temperature	Top_1	0		60	°C	1, 2
	Top_2	0		70	°C	2
Supply Voltage	Vcc	-0.5		3.6	V	
Relative Humidity	RH	5		95	%	
Data Input Voltage Differential	IVDIP-VDI			1	V	
Control Input Voltage	VI	-0.3			V	
Control Output Current	Io	-20		20	mA	

Notes:

- [1] DDMI temperature reading is measured by the position of Top_ 1.
- [2] Case operating temperature definition.

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Case Temperature	Top	0		70	°C	
Power Supply Voltage	Vcc	3.135	3.3	3.465	V	
Maximum Power Consumption	PCon			9	W	
Signaling Speed per Lane	DRL		53.125		GBd	
Number of Lanes			4			
Pre-FEC Bit Error Ratio				2.4x10 ⁻⁴		1
Transmit Distance	TD	2		500	m	
Two Wire Serial Interface Clock Rate				400	kHz	
Power Supply Noise Tolerance (10Hz -10MHz)				25	mV	
Rx Differential Data Output Load			100		Ohm	

Notes:

- [1] PRBS13Q test pattern is used & FEC is provided by host system.

Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Transmitter						
Data Rate, each Lane		53.125 ± 100 ppm			GBd	
Modulation Format		PAM4				
Lane Wavelength	λ	1304.5	1311	1317.5	nm	
Side-mode Suppression Ratio	SMSR	30			dB	
Average Launch Power, each lane	AOPL	-2.9		4	dBm	2

Outer Optical Modulation Amplitude (OMA _{outer}), each lane	TOMA	-0.8		4.2	dBm	
Launch Power in OMA _{outer} Minus TDECQ, each lane	TOMA-TD ECQ	-2.2			dBm	
Transmitter and Dispersion Eye Closure for PAM4 (TDECQ), each lane	TDECQ			3.4	dB	
Average Launch Power of OFF Transmitter, each lane	Toff			-15	dBm	
Extinction Ratio, each lane	ER	3.5			dB	
RIN _{21.4OMA}	RIN			-136	dB/Hz	
Optical Return Loss Tolerance	ORL			21.4	dB	
Transmitter Reflectance	TR			-26	dB	
Receiver						
Data Rate, each Lane		53.125 ± 100 ppm			GBd	
Modulation Format		PAM4				
Lane Wavelength	λ	1304.5	1311	1317.5	nm	
Damage Threshold, each lane	AOPD	5			dBm	4
Average Receive Power, each lane	AOPR	-5.9		4	dBm	5
Receive Power (OMA _{outer}), each lane	OMAR			4.2	dBm	
Receiver Reflectance	RR			-26	dB	
Receiver Sensitivity (OMA _{outer}), each lane(max)	SOMA			-3.9 SECQ – 5.3	dBm	6
Stressed Receiver Sensitivity (OMA _{outer}), each lane (max)	SRS			-1.9		7
Conditions of Stressed Receiver Sensitivity Test:						8
Stressed Eye Closure for PAM4 (SECQ), lane under test	SECQ		3.4		dB	
OMA _{outer} of each Aggressor Lane			4.2		dBm	

Notes:

[1] Average launch power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.

[2] Even if the TDECQ < 1.4 dB, the OMA_{outer} (min) must exceed these values.

[3] Transmitter reflectance is defined looking into the transmitter.

[4] The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level. The receiver does not have to operate correctly at this input power.

[5] Average receive power, each lane (min) is informative and 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.

[6] Receiver sensitivity (OMA_{outer}), each lane (max) is informative and is defined for a transmitter with SECQ of 0.9 dB.

[7] Measured with conformance test signal at TP3 (see 124.8.9) for the BER specified 124.1.1.

[8] These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Electrical Characteristics (Compliant with IEEE802.3ck C2M)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Transmitter (Module Input, TP1)						
Differential pk-pk Voltage Tolerance		750			mV	
Peak-to-peak AC Common-mode Voltage Tolerance	VCMLE VCMFB			32 80	mV	
Common-mode to Differential-mode Return Loss	RLDc	802.3ck Equation (120G-2)			dB	
Effective Return Loss	ERL	8.5			dB	
Differential Termination Mismatch				10	%	
Module Stressed Input Tolerance		See 802.3ck 120G.3.4.3				
Single-ended Voltage Tolerance Range		-0.4		3.3	V	
DC Common-mode Voltage Tolerance		-0.35		2.85	V	
Receiver (Module output, TP4)						
Peak-to-peak AC Common-mode Voltage	VCMLE VCMFB			32 80	mV	
Differential Peak-to-peak Output Voltage	Shortmode Longmode			600 845	mV	
Eye Height	EH	15			mV	
Vertical Eye Closure	VEC			12	dB	
Common-mode to Differential-mode Return Loss	RLDc	802.3ck Equation (120G-1)			dB	
Effective Return Loss	ERL	8.5			dB	
Differential Termination Mismatch				10	%	
Transition time		8.5			ps	
DC Common-mode Voltage Tolerance		-0.35		2.85	V	

Digital Diagnostic Monitor Characteristics

Parameter	Range	Accuracy	Unit
Temperature	0 to 75	±3	°C
Voltage	0 to VCC	±0.1	V
Tx Bias Current	15 to 125	±10%	mA
Tx Output Power	-4.9 to 5	±3	dB
Rx Power	-7.9 to 5	±3	dB

Pin Map and Description

The electrical interface of OSFP module consist of a 60 contacts edge connector as illustrated by the diagram in Figure 1, which defined in Clause 8.1 of OSFP MSA Specification.

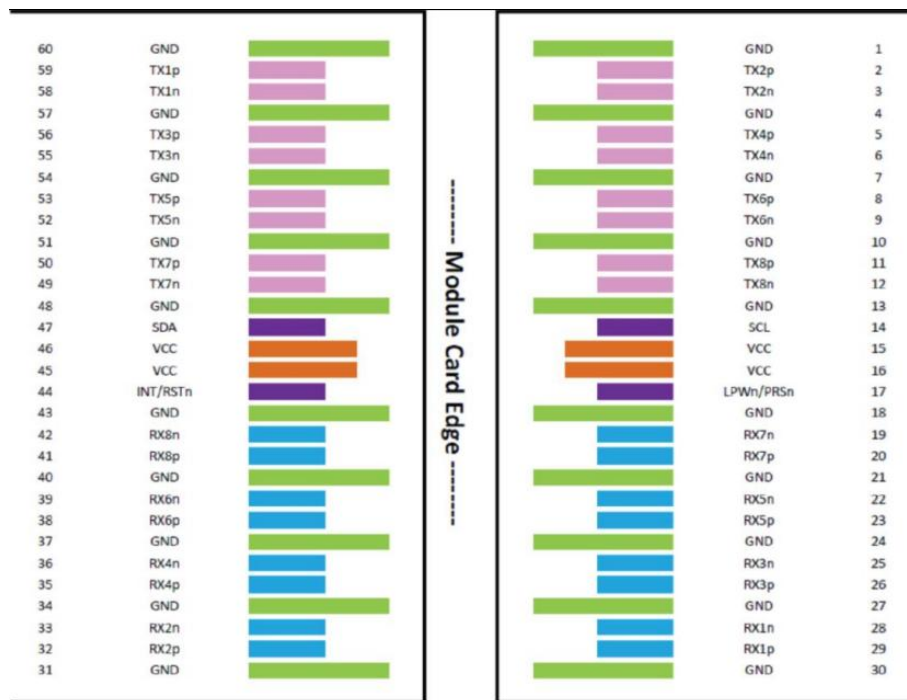


Figure 1. MSA Compliant Connector

Pin#	Symbol	Description	Logic	Direction	Plug
1	GND		Ground		1
2	TX2p	Transmitter Data Non-Inverted	CML-I	Input from Host	3
3	TX2n	Transmitter Data Inverted	CML-I	Input from Host	3
4	GND		Ground		1
5	TX4p	Transmitter Data Non-Inverted	CML-I	Input from Host	3
6	TX4n	Transmitter Data Inverted	CML-I	Input from Host	3
7	GND		Ground		1
8	TX6p	Transmitter Data Non-Inverted	CML-I	Input from Host	3
9	TX6n	Transmitter Data Inverted	CML-I	Input from Host	3
10	GND		Ground		1
11	TX8p	Transmitter Data Non-Inverted	CML-I	Input from Host	3
12	TX8n	Transmitter Data Inverted	CML-I	Input from Host	3
13	GND		Ground		1
14	SCL	2-wire Serial interface clock	LVC MOS-I/O	Bi-directional	3
15	VCC	+3.3V Power		Power from Host	2
16	VCC	+3.3V Power		Power from Host	2
17	LPWn/PRSn	Low-Power Mode / Module Present	Multi-Level	Bi-directional	3

18	GND		Ground		1
19	RX7n	Receiver Data Inverted	CML-O	Output to Host	3
20	RX7p	Receiver Data Non-Inverted	CML-O	Output to Host	3
21	GND		Ground		1
22	RX5n	Receiver Data Inverted	CML-O	Output to Host	3
23	RX5p	Receiver Data Non-Inverted	CML-O	Output to Host	3
24	GND		Ground		1
25	RX3n	Receiver Data Inverted	CML-O	Output to Host	3
26	RX3p	Receiver Data Non-Inverted	CML-O	Output to Host	3
27	GND		Ground		1
28	RX1n	Receiver Data Inverted	CML-O	Output to Host	3
29	RX1p	Receiver Data Non-Inverted	CML-O	Output to Host	3
30	GND		Ground		1
31	GND		Ground		1
32	RX2p	Receiver Data Non-Inverted	CML-O	Output to Host	3
33	RX2n	Receiver Data Inverted	CML-O	Output to Host	3
34	GND		Ground		1
35	RX4p	Receiver Data Non-Inverted	CML-O	Output to Host	3
36	RX4n	Receiver Data Inverted	CML-O	Output to Host	3
37	GND		Ground		1
38	RX6p	Receiver Data Non-Inverted	CML-O	Output to Host	3
39	RX6n	Receiver Data Inverted	CML-O	Output to Host	3
40	GND		Ground		1
41	RX8p	Receiver Data Non-Inverted	CML-O	Output to Host	3
42	RX8n	Receiver Data Inverted	CML-O	Output to Host	3
43	GND		Ground		1
44	INT/RSTn	Module Interrupt / Module Reset	Multi-Level	Bi-directional	3
45	VCC	+3.3V Power		Power from Host	2
46	VCC	+3.3V Power		Power from Host	2
47	SDA	2-wire Serial interface data	LVC MOS-I/	Bi-directional	3
48	GND		Ground		1
49	TX7n	Transmitter Data Inverted	CML-I	Input from Host	3
50	TX7p	Transmitter Data Non-Inverted	CML-I	Input from Host	3
51	GND		Ground		1
52	TX5n	Transmitter Data Inverted	CML-I	Input from Host	3
53	TX5p	Transmitter Data Non-Inverted	CML-I	Input from Host	3
54	GND		Ground		1
55	TX3n	Transmitter Data Inverted	CML-I	Input from Host	3
56	TX3p	Transmitter Data Non-Inverted	CML-I	Input from Host	3
57	GND		Ground		1
58	TX1n	Transmitter Data Inverted	CML-I	Input from Host	3
59	TX1p	Transmitter Data Non-Inverted	CML-I	Input from Host	3
60	GND		Ground		1

OSFP Module Signal Pin Descriptions

Name	Direction	Description
TX[8:1]p	input	Transmit differential pairs from host to module.
TX[8:1]n	input	
RX[8:1]p	output	Receiver differential pairs from module to host
RX[8:1]n	output	
SCL	bidir	2-wire serial clock signal. Requires pull-up resistor to 3.3V on host.
SDA	bidir	2-wire serial data signal. Requires pull-up resistor to 3.3V on host.
LPWn/PRSn	bidir	Multi-level signal for low power control from host to module and module presence indication from module to host. This signal requires the circuit as described in Section 10.5.3
INT/RSTn	bidir	Multi-level signal for interrupt request from module to host and reset control from host to module. This signal requires the circuit as described in Section 10.5.2
VCC	power	3.3V power for module.
GND	ground	Module Ground. Logic and power return path.

Optical Interface

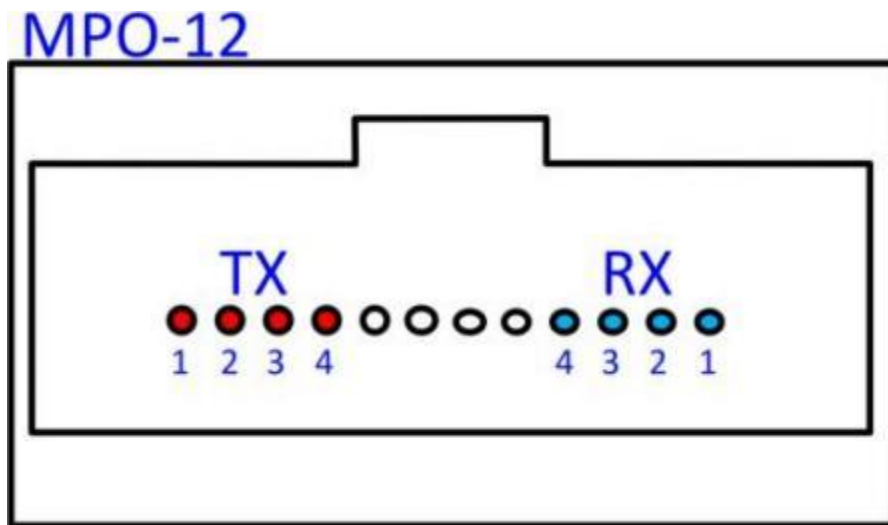


Figure 2. Optical Media Dependent Interface port assignments

Mechanical Drawing

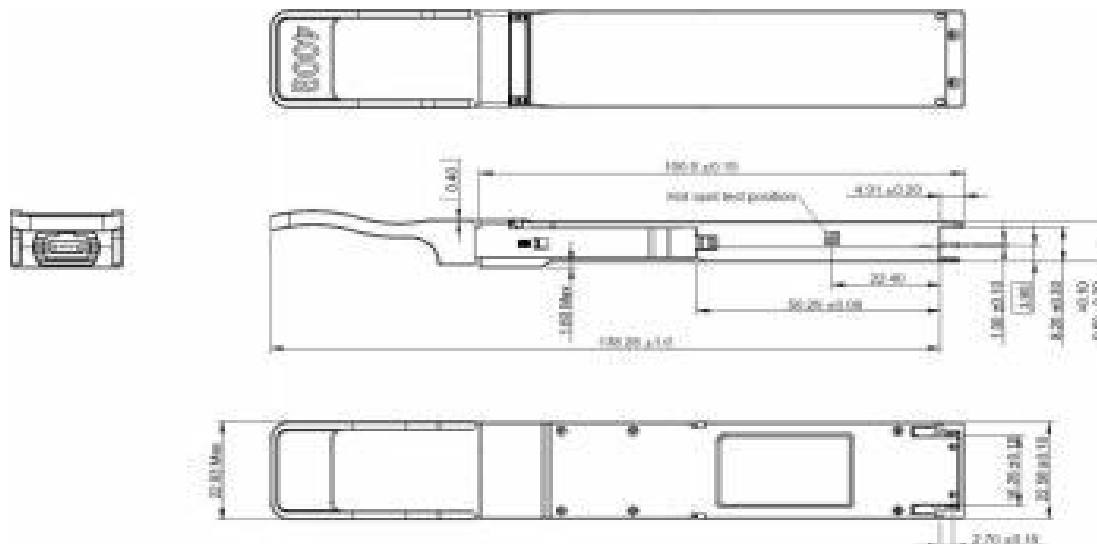


Figure 5. Mechanical Outline

ESD

This transceiver is specified as ESD threshold 1kV for high speed data pins and 2kV for all other electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

Laser safety

This is a Class I Laser Product, or Class 1 Laser Product according to IEC/EN 60825-1:2014.

This product complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.

Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Ordering information

Part Number	Product Description
LO-M31400A-DR4C	OSFP 400G, DR4, Flat Top, MPO-12 APC interface, 1310nm, up to 500m, 0° C~+70° C