

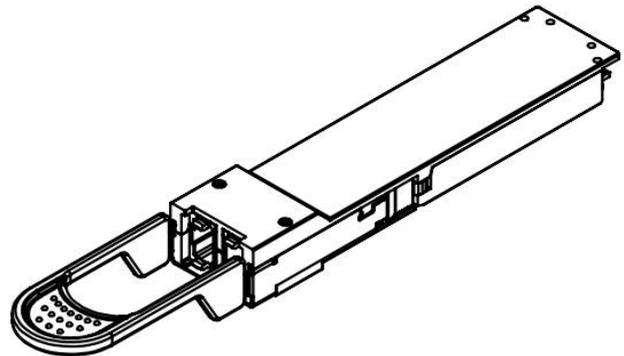
OPTICAL MODULE

400Gbps OSFP DR4, 500M

Single-Mode Fiber, 1310nm

PRODUCT FEATURES

- 400G DR4 single mode transceiver
- 4-channels of 100G-PAM4 electrical modulation
- 4-channel 100G-PAM4 optical modulation
- MPO12/APC optical connector
- OSFP RHS form factor
- Silicon photonics integration solution based on 1310nm CW laser light source
- 10W max power consumption
- 500m max reach with SMF
- 3.3V power supply
- Operating Case Temperature: 0°C~70
- Compliant to OSFP MSA Rev. 5.0
- Compliant to IEEE Std 802.3bs-2017 for Optical Interface
- Compliant to IEEE Std 802.3ck-2022 for Electrical Interface
- CMIS Rev. 4.0 Management Interface
- Compliant to Class 1 Laser Safety
- ROHS-6: Environment Safety



⚠ Images are for illustration purposes only. Product labels, colors, and lengths may

APPLICATIONS

- Ethernet for 4x100G, 2x200G, 1x400G
- IB for NDR, 2xNDR200

ORDERING INFORMATION

Part Number	Form Factor	Data Rate	Media	Distance (m)	Wavelength (nm)	Voltage (V)	Temperature (°C)
OTOSP-400GDR4	OSFP	400Gbps	SMF	500	1310	3.3	0/+70

GENERAL PRODUCT CHARACTERISTICS

Parameter	Value	Unit	Comments
Module Form Factor	OSFP RHS	-	As defined by OSFP MSA Rev. 5.0
Number of Optical Lanes	4 TX and 4 RX	-	
Maximum Aggregate Data Rate	425	Gb/s	
Protocols Supported	Ethernet	-	
Electrical Interface and Pin-out	60-pin edge connector	-	As defined by OSFP MSA Rev. 5.0
Optical Interface	Type 2 MPO12/APC	-	As defined by OSFP MSA Rev. 5.0
Maximum Power Consumption	10	W	
Management Interface	Serial, I2C-based, 400 kHz maximum frequency	-	As defined by CMIS Rev. 4.0

ABSOLUTE MAXIMUM PARAMETERS

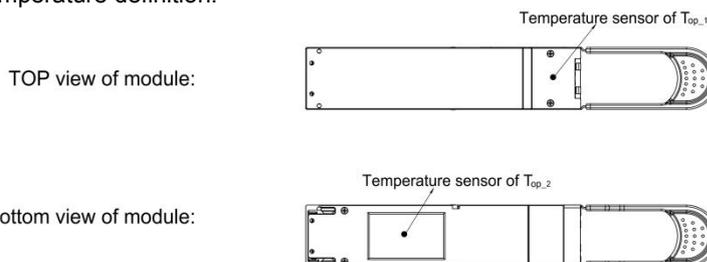
Absolute maximum ratings are those beyond which damage to the device may occur.

Prolonged operation between the operational specifications and absolute maximum ratings is not intended and may cause permanent device degradation.

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Note
Storage Temperature	T_s	-40	-	85	°C	
Case Operating Temperature	T_{op_1}	0	-	60	°C	1, 2
	T_{op_2}	0	-	70	°C	2
Supply Voltage	VCC	-0.5	-	3.6	V	
Relative Humidity	RH	5	-	95	%	
Data Input Voltage Differential	IVDIP-VDINI	-	-	1	V	
Control Input Voltage	VIN	-0.3	-	VCC+0.5	V	
Control Output Current	I_o	-20	-	20	mA	

Note:

- DDMI temperature reading is measured by the position of T_{op_1}
- Case operating temperature definition:



RECOMMENDED OPERATING PARAMETERS

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Note
Operating Case Temperature	T_{opr}	0	-	70	°C	
Power Supply Voltage	V_{cc}	3.135	-	3.465	V	
Maximum Power Consumption	P_{Con}	-	-	10	W	
Signaling Speed per Lan	BR	-	53.125	-	GBd	
Number of Lanes	-	4			-	
Pre-FEC Bit Error Ratio	-	-	-	2.4×10^{-4}	-	1
Transmit Distance	T_D	-	-	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	

Note:

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

ELECTRIC SPECIFICATION FOR LOW SPEED SIGNAL

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Note
Module output SCL&SDA	V_{OL}	0	-	0.4	V	
	V_{OH}	$V_{CC}-0.5$	-	$V_{CC}+0.3$	V	
Module input SCL&SDA	V_{IL}	-0.3	-	$V_{CC} \times 0.3$	V	
	V_{IH}	$V_{CC} \times 0.7$	-	$V_{CC}+0.5$	V	
IntL/RxLos	V_{OL}	0	-	0.4	V	
	V_{OH}	$V_{CC}-0.5$	-	$V_{CC}+0.3$	V	
LPMode/TxDis, ResetL, ModSelL	V_{IL}	-0.3	-	0.8	V	
	V_{IH}	2	-	$V_{CC}+0.3$	V	

ELECTRICAL CHARACTERISTICS (Compliant with IEEE 802.3ck-2022 400GAUI-4 C2M)

Parameter	Symbol	Min.	Typ.	Max.	Unit.	
Receiver at TP4 (Module output, 802.3ck Table 120G-3)						
Peak-to-peak AC common-mode voltage	$V_{CM_{LF}}$	-	-	32	mV	
	$V_{CM_{FB}}$	-	-	80		

Differential peak-to-peak output voltage	Short mode	-	-	600	mV	
	Long mode			845		
Eye height		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	-	-350	-	2850	mV	
Transmitter at TP1&TP1a (Module input, 802.3ck Table 120G-9)						
Differential pk-pk voltage tolerance	-	750	-	-	mV	
Peak-to-peak AC common-mode voltage tolerance	VCM _{LF}	32	-	-	mV	
	VCM _{FB}	80				
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	%	
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	

OPTICAL CHARACTERISTICS (Compliant with IEEE 802.3bs-2017 400GBASE-DR4)

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Note
Transmitter (Module output, 802.3bs Table 124-6)						
Signaling rate, each lane (range)	-	53.125 ± 100ppm			GBd	
Modulation format	-	PAM4			-	
Lane Wavelength	λ	1304.5		1317.5	nm	
Side-mode suppression ratio	SMSR	30			dB	
Average launch power, each lane	P _{avg}	-2.9		4	dBm	1
Outer Optical Modulation Amplitude (OMA _{outer}), each lane	OMA _{outer}	-0.8		4.2	dBm	2

Launch power in OMA_{outer} minus TDECQ, each lane	-	-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	P_{off}	-	-	-15	dBm	
Extinction ratio, each lane	ER	3.5	-	-	dB	
$RIN_{21.4OMA}$	-	-	-	-136	dB/Hz	
Optical return loss tolerance	-	-	-	21.4	dB	
Transmitter reflectance	-	-	-	-26	dB	3
Receiver (Module input, 802.3bs Table 124–7)						
Signaling rate, each lane (range)	-	53.125 ± 100ppm			GBd	
Modulation format	-	PAM4			-	
Lane Wavelength	λ	1304.5	-	1317.5	nm	
Damage threshold, each lane	-	5	-	-	dBm	4
Average receive power, each lane	-	-5.9	-	4	dBm	5
Receive Power (OMA_{outer}), each lane	-	-	-	4.2	dBm	
Receiver Reflectance	-	-	-	-26	dB	
Receiver sensitivity (OMA_{outer}), each lane (max)	-	-	-	-4.4	-	6
Stressed receiver sensitivity (OMA_{outer}), each lane (max)	-	-	-	-1.9	-	7
Conditions of stressed receiver sensitivity test:						8
Stressed eye closure for PAM4 (SECQ), lane under test	-	-	3.4	-	dB	
OMA_{outer} of each aggressor lane	-	-	4.2	-	dBm	

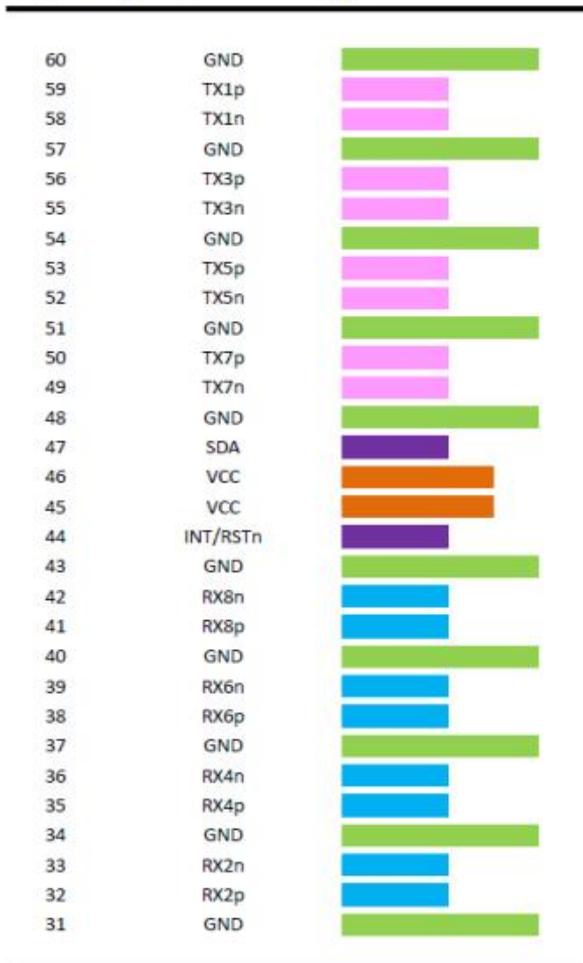
Note:

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.

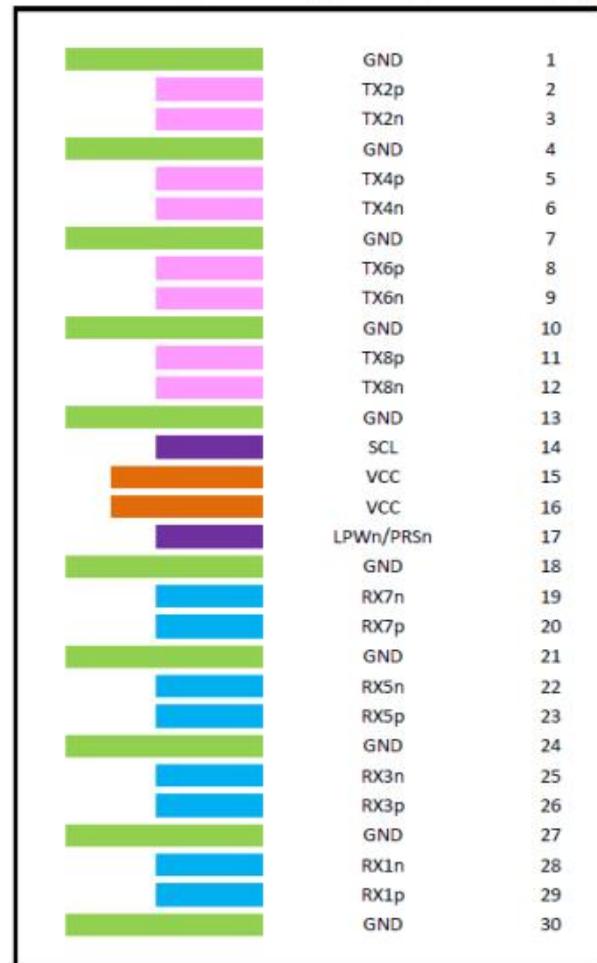
6. Receiver sensitivity (OMA_{outer}), each lane (max) is informative and is defined for a transmitter with SECQ of 0.9 dB.
7. Measured with conformance test signal at TP3 (see 124.8.9) for the BER specified 124.1.1.
8. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

MODULE PINOUT (compliant OSFP MSA Rev

Top Side (viewed from top)



Bottom Side (viewed from bottom)



----- Module Card Edge -----

5.0)

MODULE SIGNAL PIN DESCRIPTIONS (compliant OSFP MSA Rev 5.0)

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

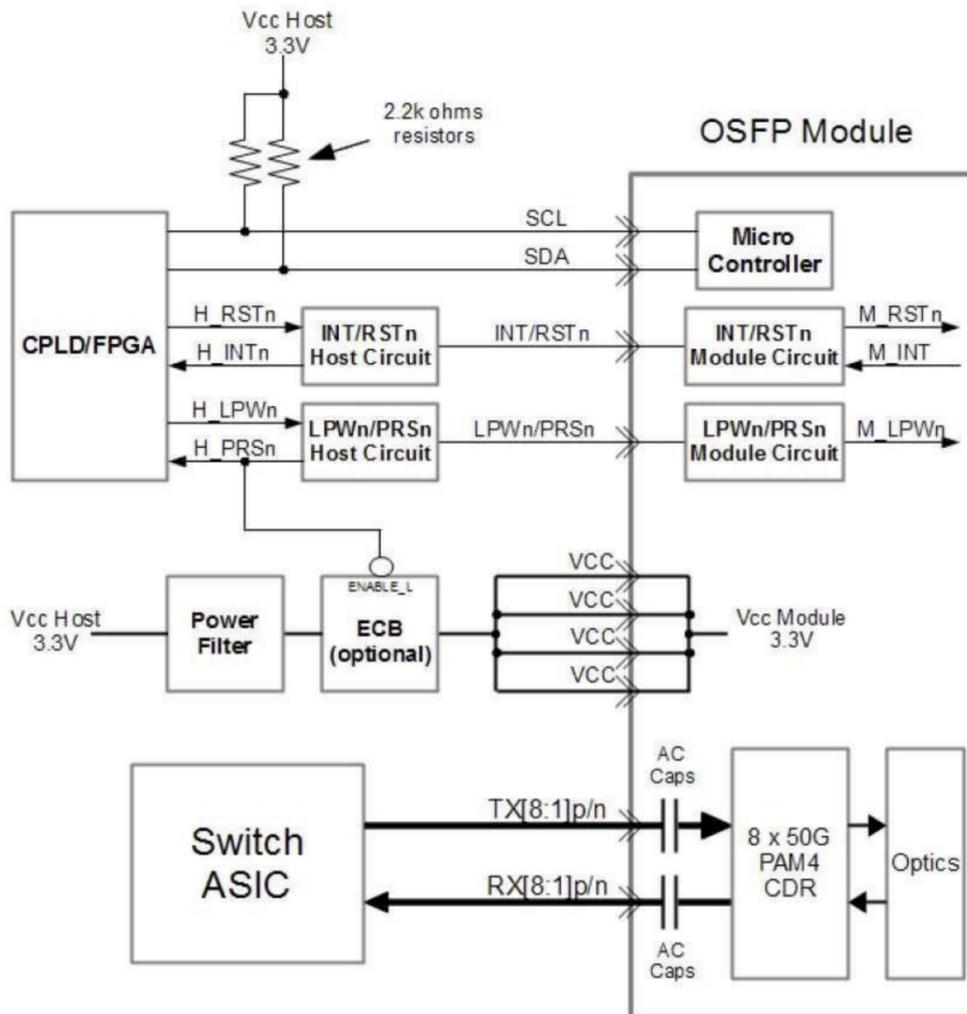
		as described in Section 10.5.3
INT/RSTn	bidir	Multi-level signal for interrupt request from module to host and reset control from host to module. This signal requires the circuit as described in Section 10.5.2
VCC	power	3.3V power for module.
GND	ground	Module Ground. Logic and power return path.

MODULE PIN LISTS (compliant OSFP MSA Rev 5.0)

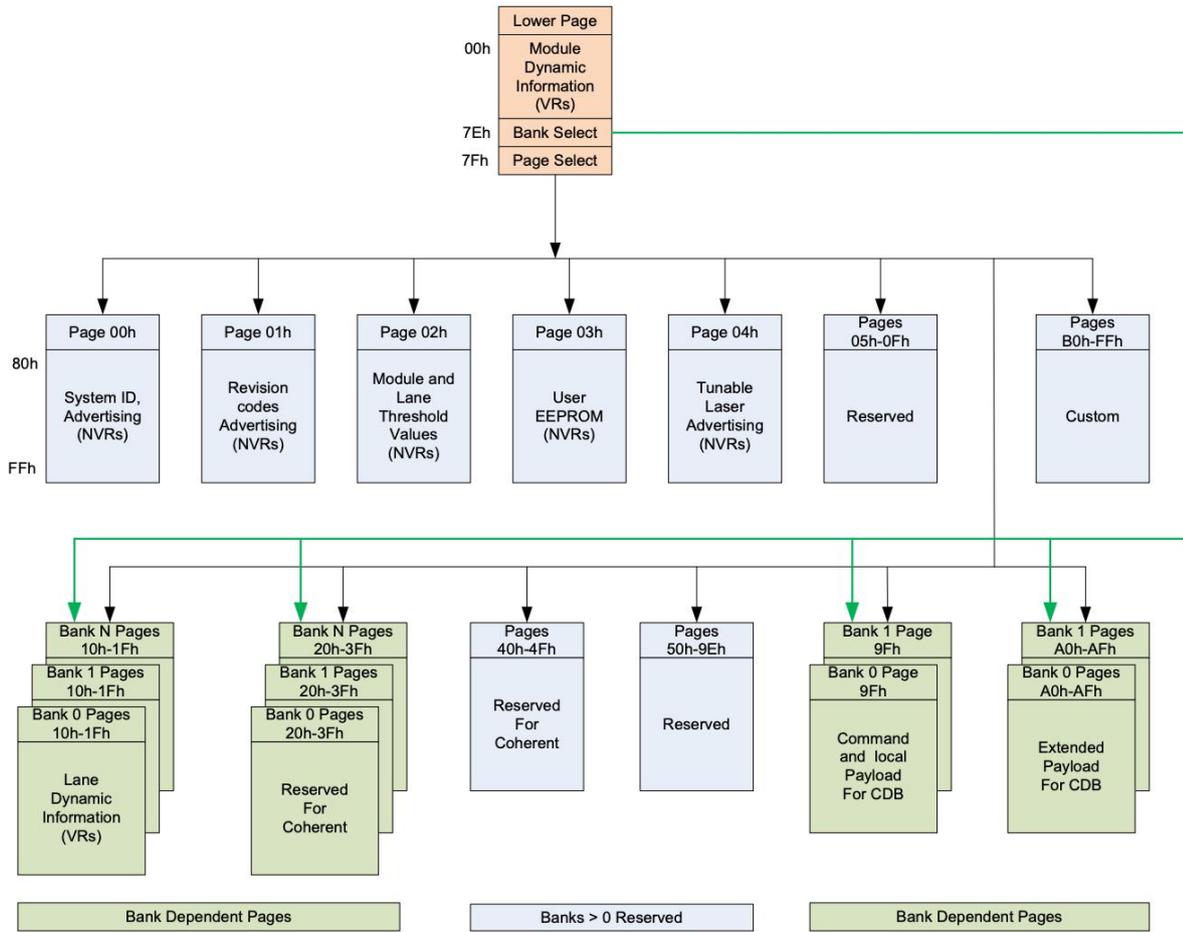
PIN	Symbol	Description	Plug Sequence
1	GND	Ground	1
2	TX2p	Transmitter Data Non-Inverted	3
3	TX2n	Transmitter Data Inverted	3
4	GND	Ground	1
5	TX4p	Transmitter Data Non-Inverted	3
6	TX4n	Transmitter Data Inverted	3
7	GND	Ground	1
8	TX6p	Transmitter Data Non-Inverted	3
9	TX6n	Transmitter Data Inverted	3
10	GND	Ground	1
11	TX8p	Transmitter Data Non-Inverted	3
12	TX8n	Transmitter Data Inverted	3
13	GND	Ground	1
14	SCL	2-wire Serial interface clock	3
15	VCC	+3.3V Power supply	2
16	VCC	+3.3V Power supply	2
17	LPWn/PRSn	Low-Power Mode / Module Present	3
18	GND	Ground	1
19	RX7n	Receiver Data Inverted	3
20	RX7p	Receiver Data Non-Inverted	3
21	GND	Ground	1
22	RX5n	Receiver Data Inverted	3
23	RX5p	Receiver Data Non-Inverted	3
24	GND	Ground	1
25	RX3n	Receiver Data Inverted	3
26	RX3p	Receiver Data Non-Inverted	3

27	GND	Ground	1
28	RX1n	Receiver Data Inverted	3
29	RX1p	Receiver Data Non-Inverted	3
30	GND	Ground	1
31	GND	Ground	1
32	RX2n	Receiver Data Inverted	3
33	RX2p	Receiver Data Non-Inverted	3
34	GND	Ground	1
35	RX4n	Receiver Data Inverted	3
36	RX4p	Receiver Data Non-Inverted	3
37	GND	Ground	1
38	RX6n	Receiver Data Inverted	3
39	RX6p	Receiver Data Non-Inverted	3
40	GND	Ground	1
41	RX8n	Receiver Data Inverted	3
42	RX8p	Receiver Data Non-Inverted	3
43	GND	Ground	1
44	INT/RSTn	Module Interrupt / Module Reset	3
45	VCC	+3.3V Power supply	2
46	VCC	+3.3V Power supply	2
47	SDA	2-wire Serial interface data	3
48	GND	Ground	1
49	TX7p	Transmitter Data Non-Inverted	3
50	TX7n	Transmitter Data Inverted	3
51	GND	Ground	1
52	TX5p	Transmitter Data Non-Inverted	3
53	TX5n	Transmitter Data Inverted	3
54	GND	Ground	1
55	TX3p	Transmitter Data Non-Inverted	3
56	TX3n	Transmitter Data Inverted	3
57	GND	Ground	1
58	TX1p	Transmitter Data Non-Inverted	3
59	TX1n	Transmitter Data Inverted	3
60	GND	Ground	1

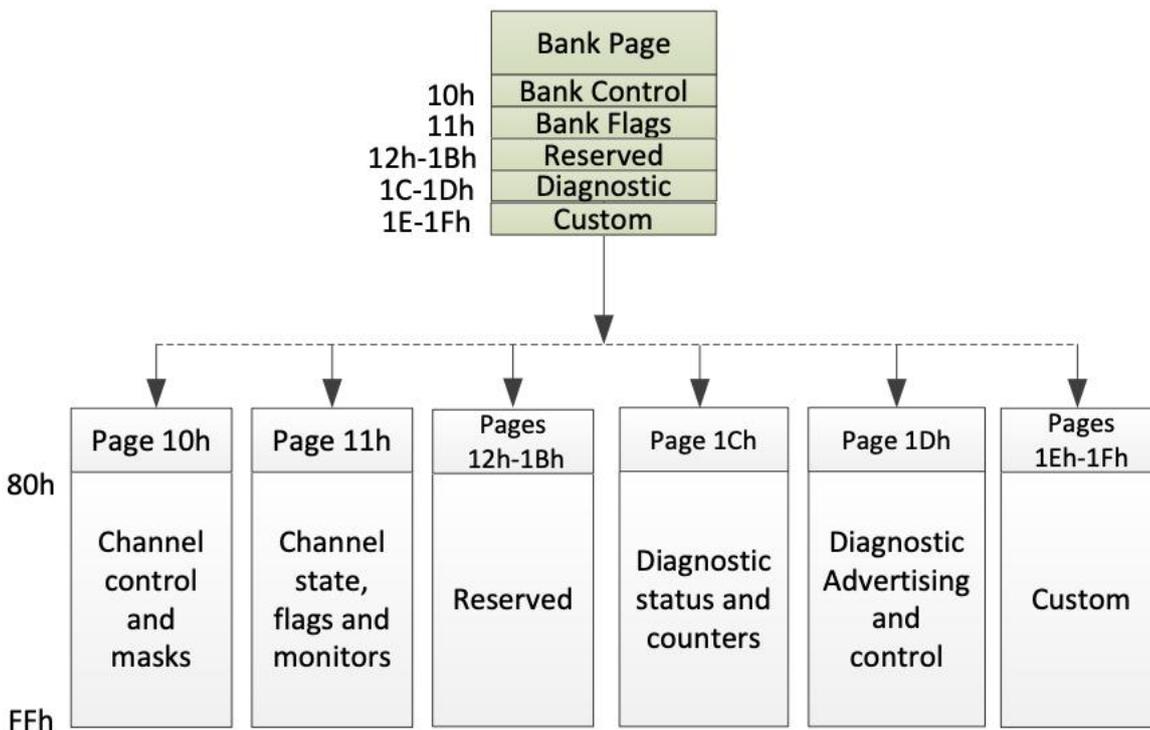
RECOMMENDED HOST BOARD SCHEMATIC



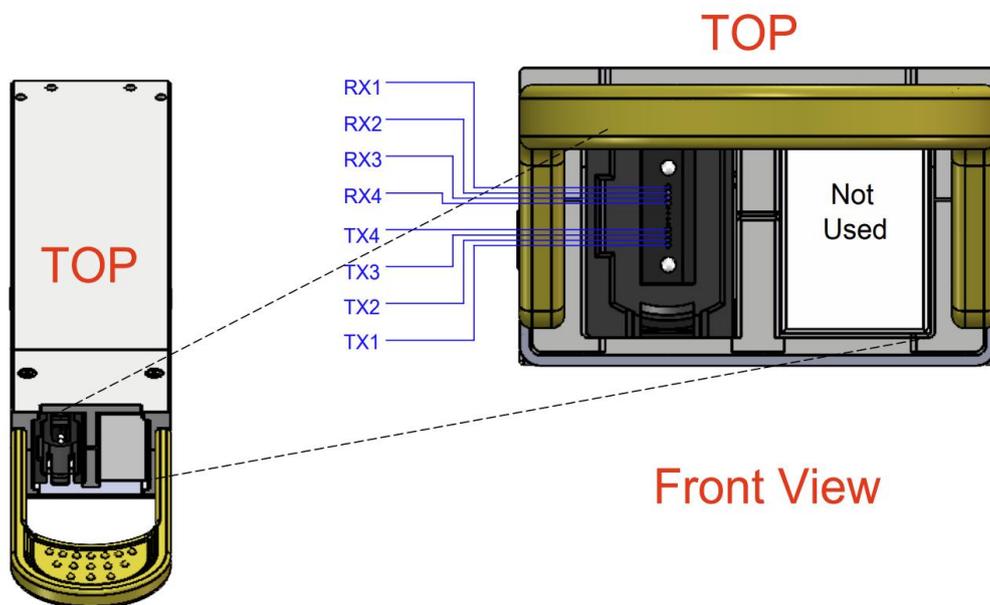
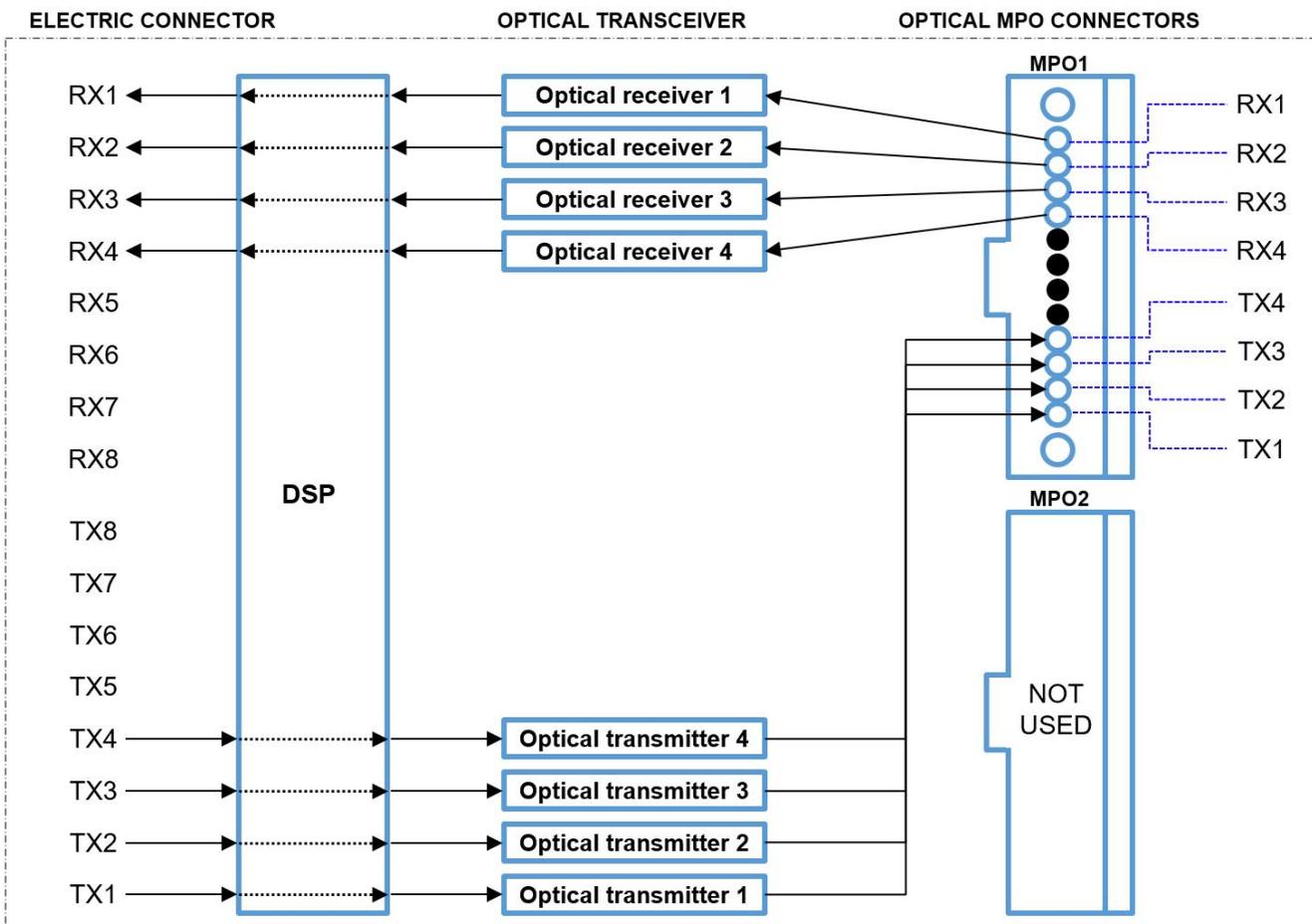
MEMORY MAP (compliant CMIS Rev.



4.0)



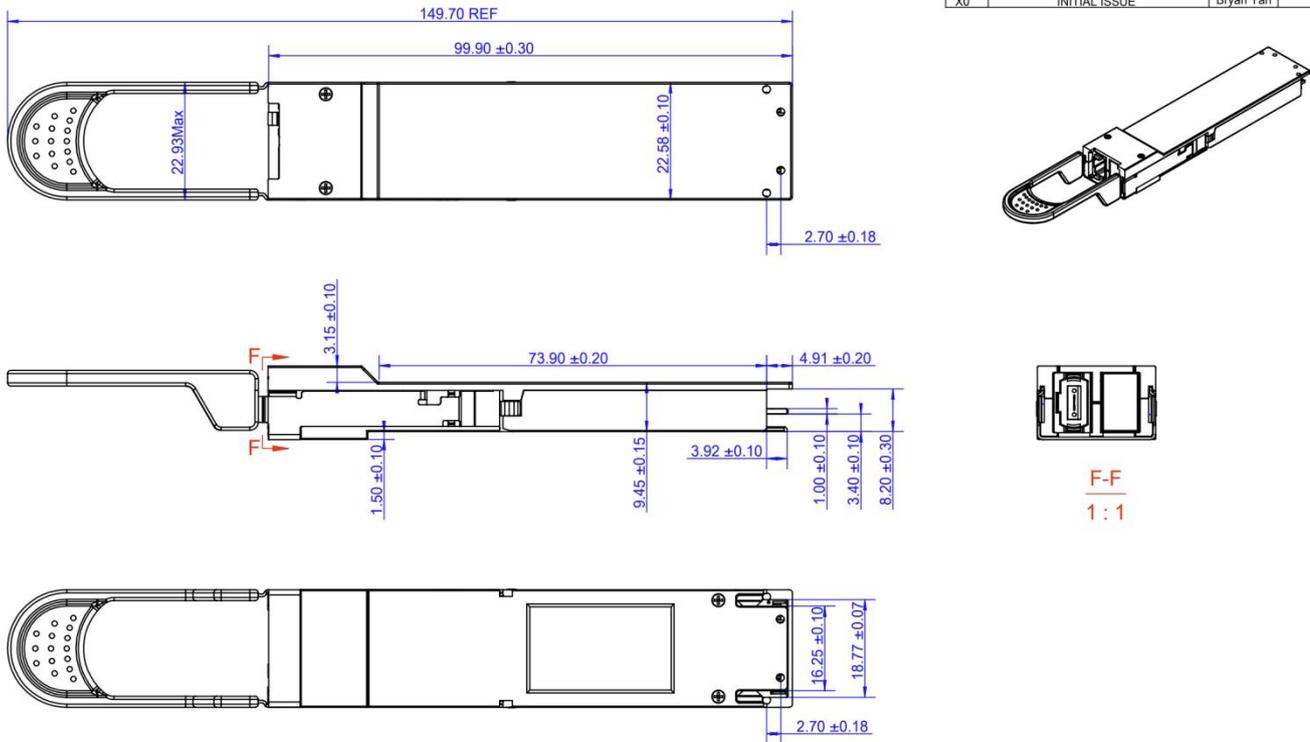
TRANSCEIVER PMD BLOCK DIAGRAM AND LANES ROUTING



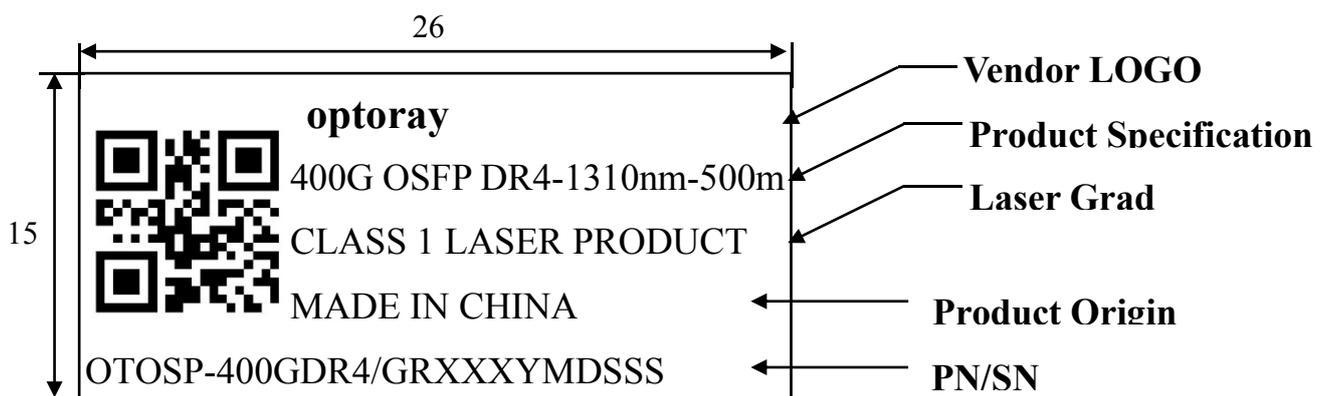
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MECHANICAL SPECIFICATION

Product shall be of design, construction and physical dimensions specified on applicable product drawing.



MODULE LABEL (Illustration)



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MODULE LABEL PART NUMBER AND SERIAL NUMBER LEGEND

Type	Symbol	Meaning	Notes
PN	P	A fixed character represents the optical module product	A fixed character: P
	CC	Customer-specific fields	Variable, 2 digits
	RR	Rate and Form-Factor	Variable, 2 digits
	F	Fiber type code	Variable, 1 digit
	T	Transmission reach	Variable, 1 digit
	XX	Product ID Code	Variable, 2 digits
	-	A dash with no practical meaning	A fixed symbol: -
	NN	Product special marking characters	Variable, 2 digits
	-	A dash with no practical meaning	A fixed symbol: -
	H	Environmental characteristics of the product	Variable, 1 digit
	/	Demarcation symbol "/"	A fixed symbol: /
SN	G	Photoelectric product Code	A fixed symbol: G
	RR	Same as above	Same as above
	F	Same as above	Same as above
	T	Same as above	Same as above
	XX	Same as above	Same as above
	Y	Year of manufacturing	Variable, 1 digit(numeric). Last digit of the year
	M	Month of manufacturing	Variable, 1 digit of 1-9 and A-C
	D	Day of manufacturing	Variable, 1 digit of 1-9 and A-Y(except I、O)
	SSS	Serial number	Variable, 3 digits: 001-ZZZ(except I、O、X)
Quick response code	PN/SN		OTSP-400GDR4/GRXXYMDSSS