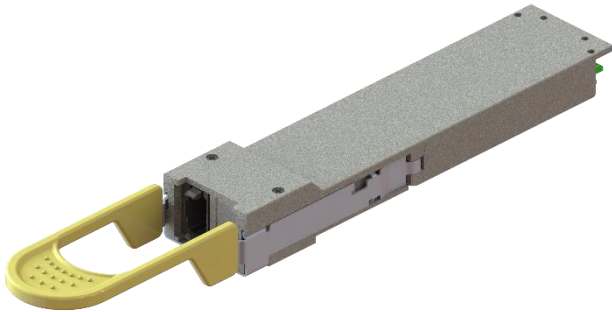


Data Sheet

400G OSFP-RHS DR4 Optical Transceiver Module

P/N: WST-OR4-DR4-C



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

Standard:

- CMIS Rev. 4.0 Management Interface
- 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
- Compliant to Class 1 Laser Safety
- ROHS-6: Environment Safety

Applications:

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

General Product Characteristic

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 Ratings

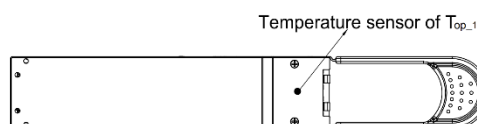
Absolute maximum ratings are those beyond which damage to the device may occur. Prolonged operation between the operational specifications and absolute maximum ratings is not intended and may cause permanent device degradation.

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	

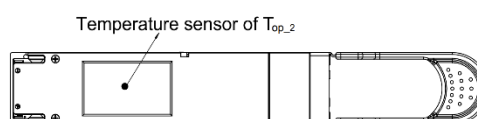
Notes:

- DDMI temperature reading is measured by the position of Top_1
- Case operating temperature definition:

TOP view of module:



Bottom view of module:



Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Note
Operating Case Temperature	T _{OP}	0		70	°C	
Power Supply Voltage	VCC	3.135	3.3	3.465	V	
Maximum Power Consumption	P _{Con}			10	Watts	
Signaling Speed per Lan	BR		53.125		GBd	
Number of Lanes		4				
Pre-FEC Bit Error Ratio				2.4x10 ⁻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	

Notes:

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}	VCC-0.5		VCC+0.3	V	
Module input SCL&SDA	V _{IL}	-0.3		VCC*0.3	V	
	V _{IH}	VCC*0.7		VCC+0.5	V	
IntL/RxLos	V _{OL}	0		0.4	V	
	V _{OH}	VCC-0.5		VCC+0.3	V	
LPMode/TxDis, ResetL, ModSelL	V _{IL}	-0.3		0.8	V	
	V _{IH}	2		VCC+0.3	V	

Electrical Characteristics (Compliant with IEEE 802.3ck-2022 400GAUI-4 C2M)

Parameter	Symbol	Min	Typical	Max	Unit	Note
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	RL _{dc}	802.3ck Equation (120G–1)			dB	
Effective return loss	ERL	8.5			dB	
Differential termination mismatch				10	%	
Module stressed input tolerance		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 at TP4 (Module output, 802.3ck Table 120G–3)						
Peak-to-peak AC common-mode voltage	VCM _{LF}			32	mV	
	VCM _{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	RL _{dc}	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	

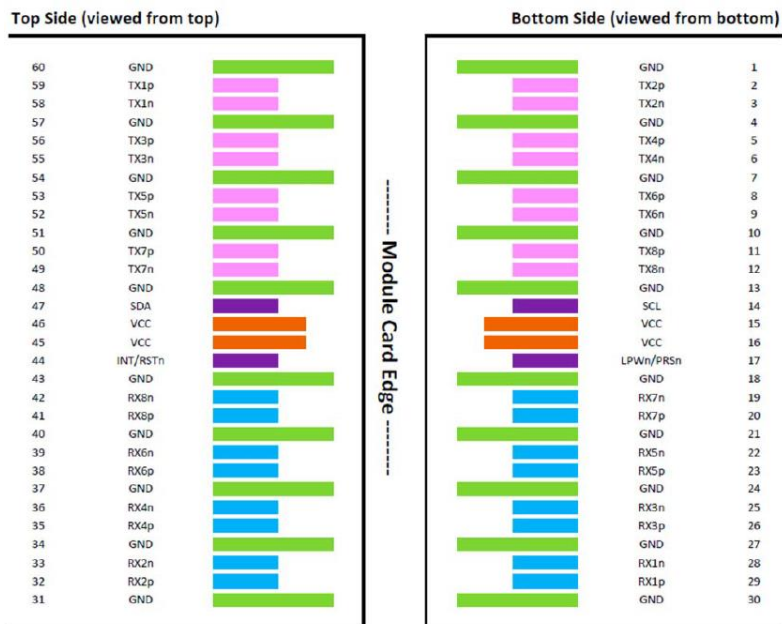
Optical Characteristics (Compliant with IEEE 802.3bs-2017 400GBASE-DR4)

Parameter	Symbol	Min	Typical	Max	Unit	Note
Transmitter (Module output, 802.3bs Table 124–6)						
Signaling rate, each lane (range)		53.125 ±100 ppm			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)						
Data Rate, each Lane		53.125 ±100 ppm			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	
OMAouter 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 OMAouter (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 (OMAouter), 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.

PIN Descriptions (compliant with OSFP MSA Rev 5.0)

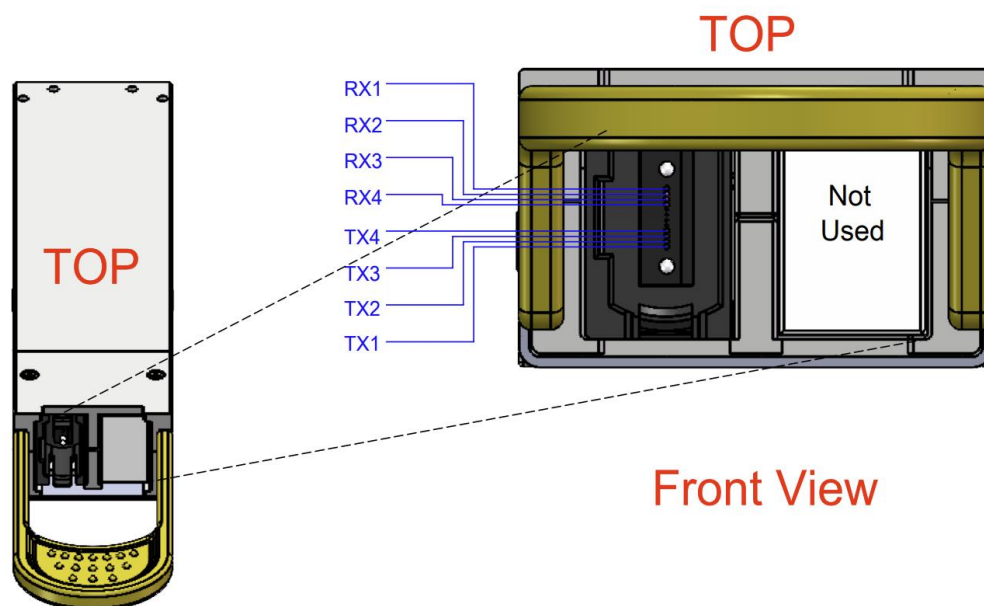
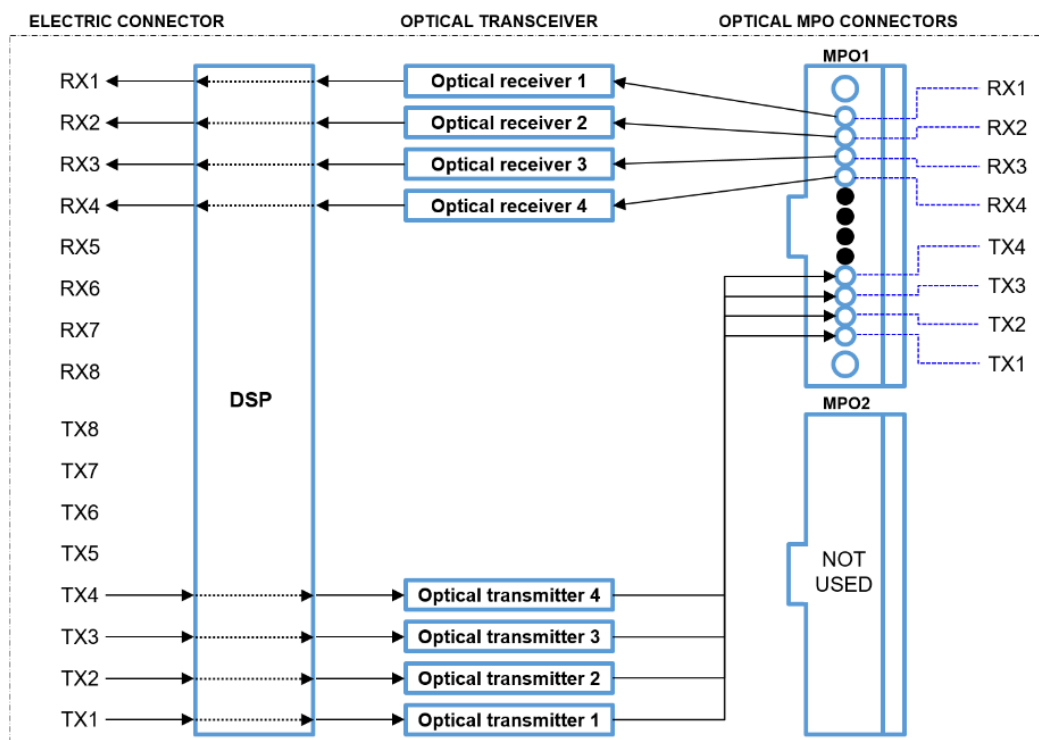
PIN	Symbol	Description	Plug Sequence
1	GND	Ground	1
2	TX2p	Transmitter Data Non-Inverted	3
3	TX2n	Transmitter Data Inverted	3
4	GND	Ground	1
5	TX4p	Transmitter Data Non-Inverted	3
6	TX4n	Transmitter Data Inverted	3
7	GND	Ground	1
8	TX6p	Transmitter Data Non-Inverted	3
9	TX6n	Transmitter Data Inverted	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

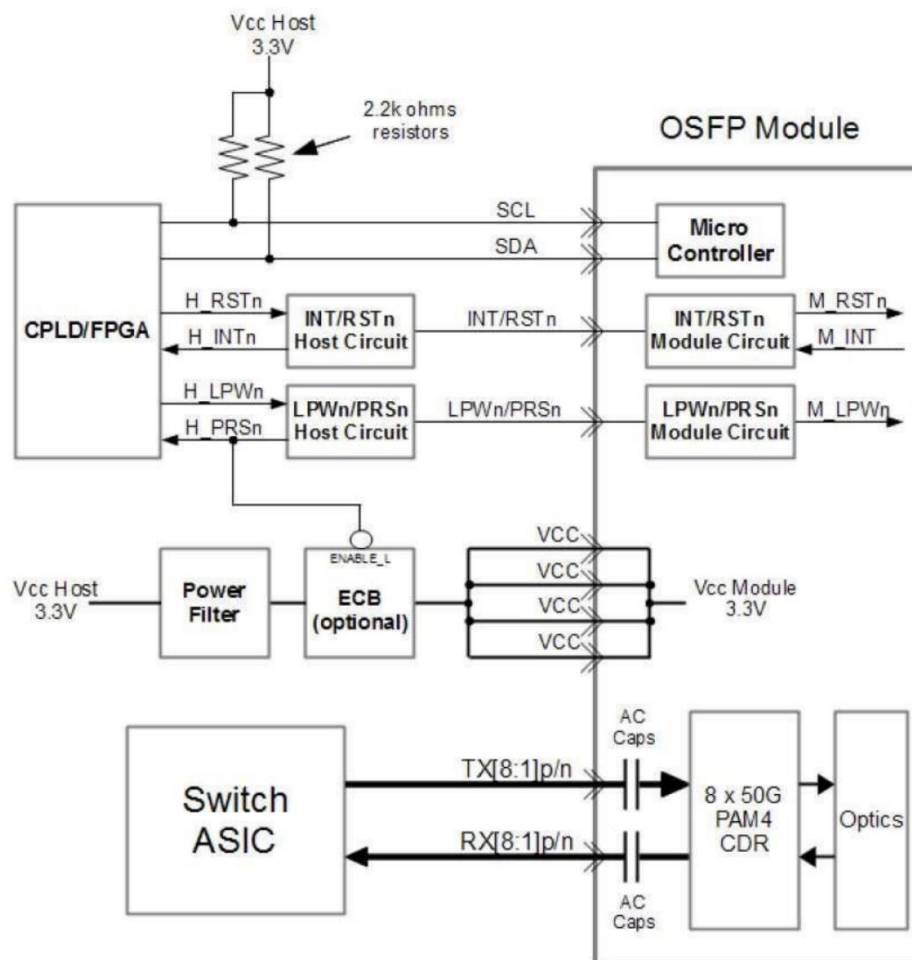
26	RX3p	Receiver Data Non-Inverted	3
27	GND	Ground	1
28	RX1n	Receiver Data Inverted	3
29	RX1p	Receiver Data Non-Inverted	3
30	GND	Ground	1
31	GND	Ground	1
32	RX2n	Receiver Data Inverted	3
33	RX2p	Receiver Data Non-Inverted	3
34	GND	Ground	1
35	RX4n	Receiver Data Inverted	3
36	RX4p	Receiver Data Non-Inverted	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

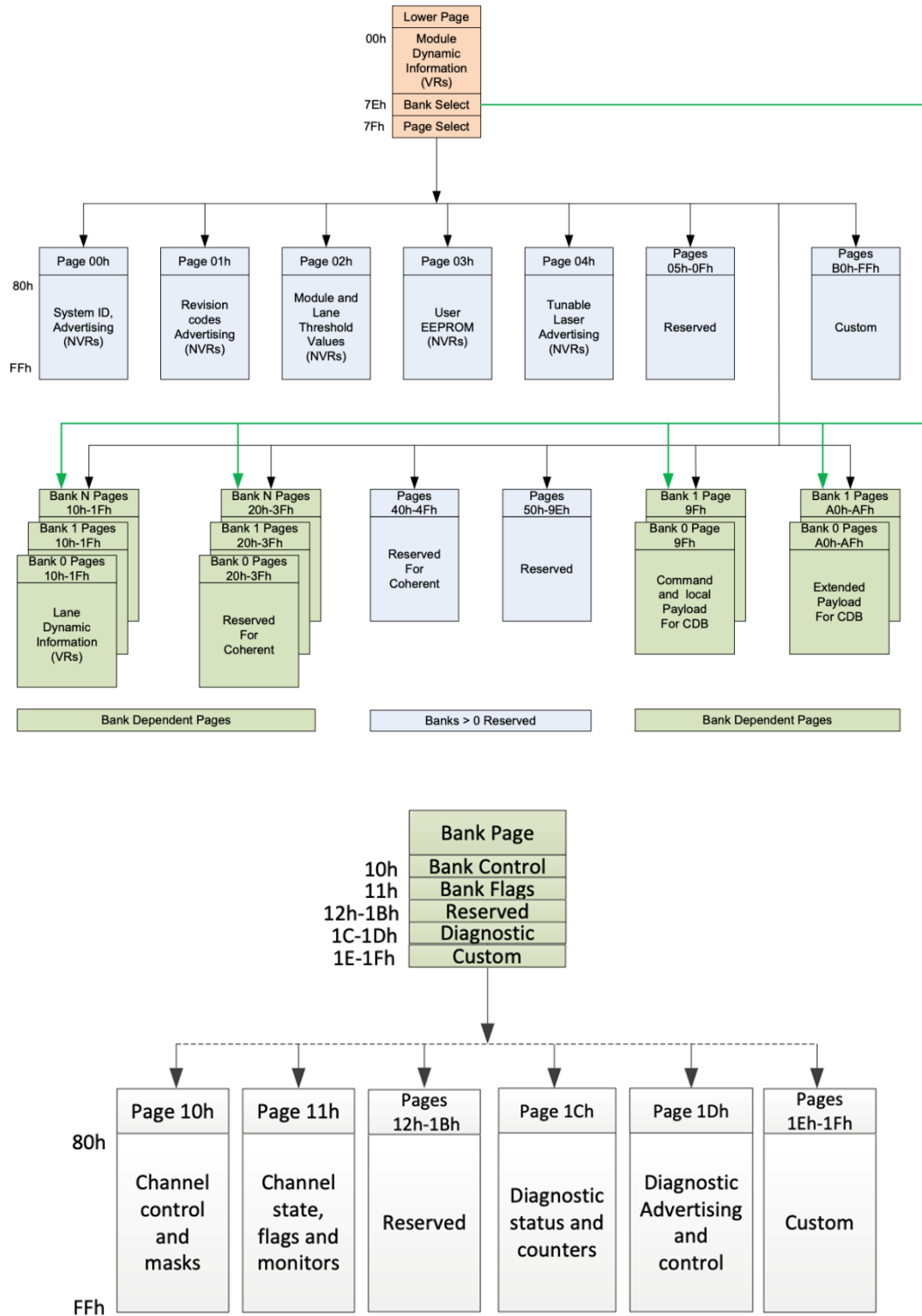
53	TX5n	Transmitter Data Inverted	3
54	GND	Ground	1
55	TX3p	Transmitter Data Non-Inverted	3
56	TX3n	Transmitter Data Inverted	3
57	GND	Ground	1
58	TX1p	Transmitter Data Non-Inverted	3
59	TX1n	Transmitter Data Inverted	3
60	GND	Ground	1

Module Signal PIN Descriptions (compliant OSFP MSA Rev 5.0)

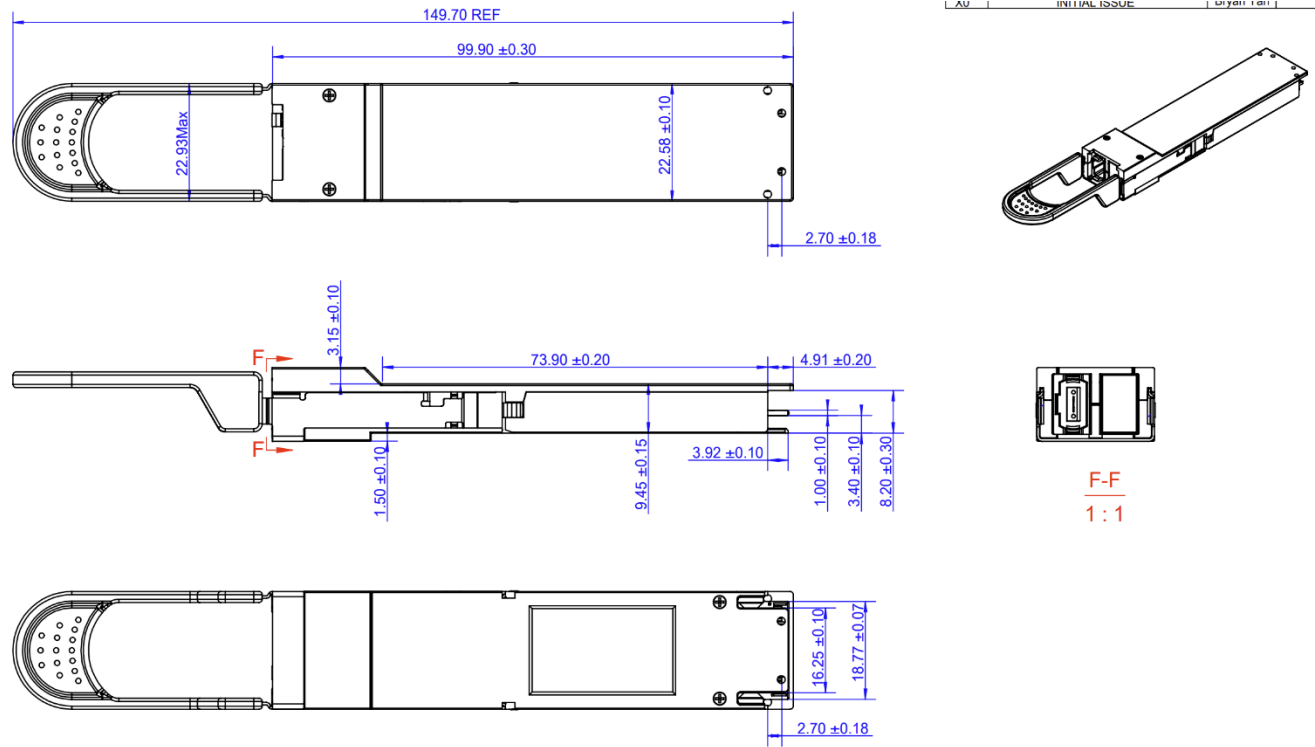
Name	Direction	Description
TX[8:1]p	input	Transmit differential pairs from host to module.
TX[8:1]n	input	
RX[8:1]p	output	Receiver differential pairs from module to host.
RX[8:1]n	output	
SCL	bidir	2-wire serial clock signal. Requires pull-up resistor to 3.3V on host.
SDA	bidir	2-wire serial data signal. 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.

Transceiver block diagram

Recommended Host Board Schematic

Memory Map ((compliant with CMIS Rev. 4.0))

Mechanical Drawing



Ordering Information

Part No	Specification									
	Package	Data rate per Lane	Laser	Optical Power (OMAouter)	Detector	Max. Receive Sensitivity (OMA)	Temp	Reach	Other	Application code
WST-OR4-DR4-C	OSFP RHS	53.125Gbd (PAM4) each Channel	1310nm EML	-2.9~ +4 dBm each Channel	PIN	-4.4 dBm each Channel	0~70°C	500m	DDM RoHS	400G Ethernet

Modification History

Revision	Date	Description	Originator	Review	Approved
V1.0	20-July-2024	New Release	Joanne Ni	Ken Cheng	Wayne Liao

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