Product Specification

1.6T 2×FR4/FR8 OSFP224 Finned Top PAM4 1310nm 2km DOM Dual Dual Duplex LC/UPC SMF Optical Transceiver Module

PN: OSFP-1.6T-2FR4



Features

- Hot-pluggable OSFP224 Finned Top form factor
- Supports 1.6Tb/s nominal data rate
- 8 × 212.5Gb/s PAM4 host electrical lanes
- Two independent 4 × 226.875Gb/s PAM4 optical line interfaces
- Single +3.3V power supply
- Dual Duplex LC/UPC connectors
- Maximum power consumption ≤26.0W
- Two sets of 1271nm, 1291nm, 1311nm, and 1331nm CWDM optical channels
- Up to 2km over G.652 single-mode fiber
- 8-channel photodiode/TIA receiver
- Built-in digital diagnostic monitoring
- Host-generated FEC supported
- Commercial case temperature range of 0°C to 70°C

Compliance

- OSFP MSA
- Designed in alignment with IEEE P802.3dj raft requirements
- CMIS Rev. 5.0
- RoHS
- Class 1 Laser Product

Applications

- 1.6T OSFP224 switch interconnects
- 2×800G optical interconnects
- Data center interconnects
- AI and HPC cluster interconnects
- High-density switch-to-switch links

Description

The OSFP-1.6T-2FR4 is a hot-pluggable OSFP224 Finned Top optical transceiver designed for high-density 1.6Tb/s interconnects over single-mode fiber. The host-side electrical interface uses eight PAM4 lanes operating at 106.25 GBd per lane, corresponding to approximately 212.5 Gb/s per lane. The module incorporates two independent 800Gb/s FR4 optical engines, each connected through a dedicated Duplex LC/UPC optical interface.

Each optical engine multiplexes four PAM4 optical channels at nominal wavelengths of 1271nm, 1291nm, 1311nm, and 1331nm onto a single transmit fiber and demultiplexes the corresponding receive channels from a single receive fiber. The optical line signaling rate is 113.4375 GBd per wavelength. The two Duplex LC/UPC ports provide two independent 800Gb/s FR4 optical paths with transmission distances of up to 2 kilometers over G.652 single-mode fiber.

The module operates from a single 3.3V power supply with a maximum power consumption of 26.0W and supports a commercial case temperature range of 0°C to 70°C. Digital diagnostic monitoring and module control are provided through the two-wire management interface. The host-side interface uses eight 200G-class PAM4 electrical lanes aligned with the 1.6TAUI-8 architecture, with host-generated FEC used to achieve the specified optical link performance.

Product performance Specifications

1、Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit
Storage Temperature	TS	-40		+85	°C
Supply Voltage	VCC	-0.5		3.6	V
Relative Humidity, Non-condensing	RH	5		85	%
Single-Ended Data Input Voltage	VI	-0.3		VCC + 0.5	V
Differential Data Input Voltage	VID			0.8	V

2、Recommended Operating Conditions

Parameter	Symbol	Min	Typ.	Max	Unit
Operating Case Temperature	TC	0		70	°C
Power Supply Voltage	VCC	3.135	3.3	3.465	V
Maximum Power Consumption	PD			26.0	W
Maximum Supply Current	ICC			8.3	A
Nominal Data Rate			1.6		Tb/s
Electrical Lanes			8		lanes

Electrical Bit Rate per Lane			212.5		Gb/s
Electrical Signaling Rate per Lane			106.25 ±50ppm		GBd
Optical Wavelength Channels			8		lanes
Optical Raw Line Rate per Lane			226.875		Gb/s
Optical Signaling Rate per Lane			113.4375 ±50ppm		GBd
Modulation Format			PAM4		
Power Supply Noise				66	mVpp
Rx Differential Data Output Load			100		Ω
Operating Distance over G.652 SMF		2		2000	m

3、Host Electrical Interface

Parameter	Value
Number of Electrical Lanes	8
Bit Rate per Lane	212.5Gb/s
Signaling Rate per Lane	106.25GBd ±50ppm
Modulation Format	PAM4
Host Interface Architecture	1.6TAUI-8 C2M-class
SerDes Generation	224G-class

4、Transmitter Optical Characteristics — Per Lane

Parameter	Symbol	Min	Typ.	Max	Unit
Signaling Rate	BR		113.4375 ±50ppm		GBd
Modulation Format			PAM4		
Lane 1 / 5 Wavelength	λ1/λ5	1264.5	1271	1277.5	nm
Lane 2 / 6 Wavelength	λ2/λ6	1284.5	1291	1297.5	nm
Lane 3 / 7 Wavelength	λ3/λ7	1304.5	1311	1317.5	nm
Lane 4 / 8 Wavelength	λ4/λ8	1324.5	1331	1337.5	nm
Side-Mode Suppression Ratio	SMSR	30			dB
Total Average Launch Power				10.9	dBm
Average Launch Power, Each Lane	TxAVG	-2.2		+4.9	dBm

OMAouter, Each Lane	OMAouter			+4.8	dBm
OMAouter, max(TECQ,TDECQ) <0.9dB	OMAouter	+0.8			dBm
OMAouter, 0.9≤max(TECQ,TDECQ)≤3.4dB	OMAouter	-0.1 + max(TECQ,TDECQ)			dBm
TDECQ	TDECQ			3.4	dB
TECQ	TECQ			3.4	dB
|TDECQ-TECQ|				2.5	dB
Average Launch Power of OFF Transmitter	TOFF			-16	dBm
Extinction Ratio	ER	3.5			dB
Transmitter Transition Time	Tt			8	ps
RIN17.1OMA	RIN			-139	dB/Hz
Optical Return Loss Tolerance	ORL			17.1	dB
Transmitter Reflectance	TR			-26	dB

5、Receiver Optical Characteristics — Per Lane

Parameter	Symbol	Min	Typ.	Max	Unit
Signaling Rate	BR		113.4375 ±50ppm		GBd
Modulation Format			PAM4		
Lane 1 / 5 Wavelength	λ1/λ5	1264.5	1271	1277.5	nm
Lane 2 / 6 Wavelength	λ2/λ6	1284.5	1291	1297.5	nm
Lane 3 / 7 Wavelength	λ3/λ7	1304.5	1311	1317.5	nm
Lane 4 / 8 Wavelength	λ4/λ8	1324.5	1331	1337.5	nm
Damage Threshold	AOPD	+5.9			dBm
Average Receive Power	RxAVG	-6.2		+4.9	dBm
Receive Power (OMAouter)	RxOMA			+4.8	dBm
Difference in Receive Power Between Any Two Lanes				4.1	dB
Receiver Reflectance	RR			-26	dB
Receiver Sensitivity, TECQ <0.9dB	SEN			-3.7	dBm
Receiver Sensitivity, 0.9≤TECQ≤SECQ	SEN			-4.6 + TECQ	dBm

6、Stressed Receiver Test Conditions

Electrical Lane	Optical Lane	Nominal Wavelength
1	1	1271nm
2	2	1291nm
3	3	1311nm
4	4	1331nm
5	5	1271nm
6	6	1291nm
7	7	1311nm
8	8	1331nm

Note 1: Average launch power, each lane (minimum), is informative and is not the principal indicator of transmitter signal strength.

Note 2: Transmitter reflectance is defined looking into the transmitter.

Note 3: Receiver sensitivity (OMAouter), each lane, is informative and is defined as -3.7 dBm for TECQ below 0.9 dB and -4.6 + TECQ dBm for TECQ from 0.9 dB up to SECQ.

Note 4: The electrical host interface operates at 106.25 GBd per lane, while the optical line interface operates at 113.4375 GBd per wavelength to accommodate the optical line coding and FEC overhead.

Note 5: Each Duplex LC/UPC port provides one independent FR4 optical path using four CWDM wavelengths at nominal centers of 1271nm, 1291nm, 1311nm, and 1331nm.

Note 6: The module contains two independent FR4 optical paths, providing eight wavelength channels in total across the two Duplex LC/UPC interfaces.

Recommended Host Board Power Supply Circuit

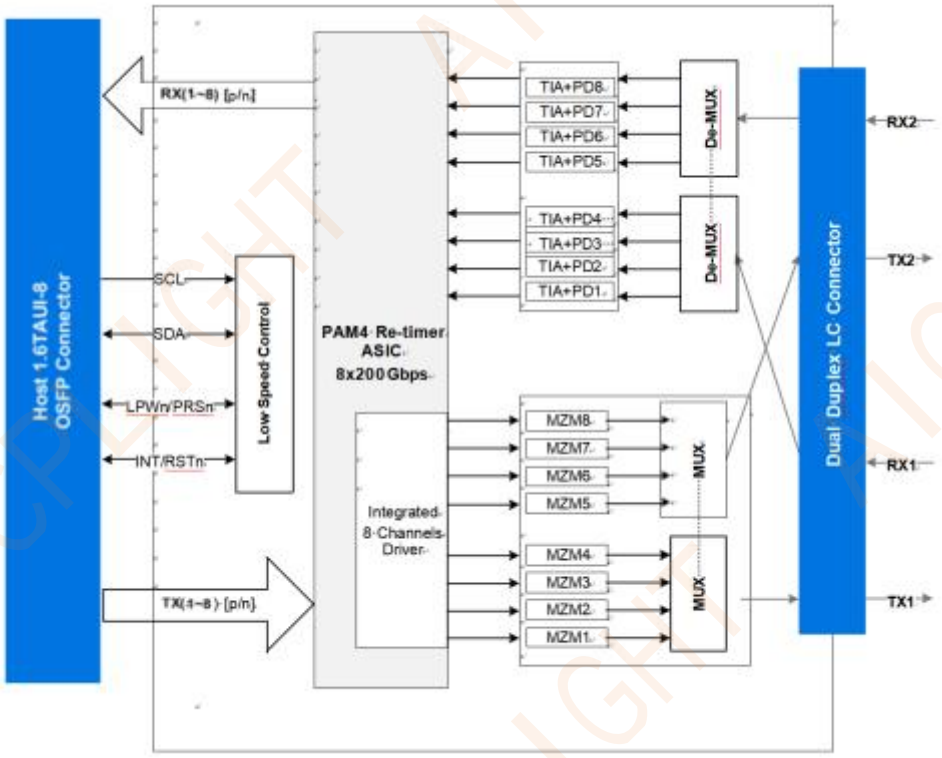


Figure 1:Module Block Diagram

Optical Interface

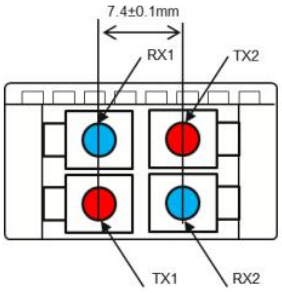


Figure3:Optical Lane Sequence

Pin-out Definition



Figure4:Pin view(OSFP)

Pin Function Definitions

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

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

58	CML-I	TX1n	Transmitter Data Inverted	
59	CML-I	TX1p	Transmitter Data Non-Inverted	
60		GND	Ground	

Note1: Open-Drain with pull up resistor on Host.

Note2: See pin description for required circuit.

Monitoring Specification

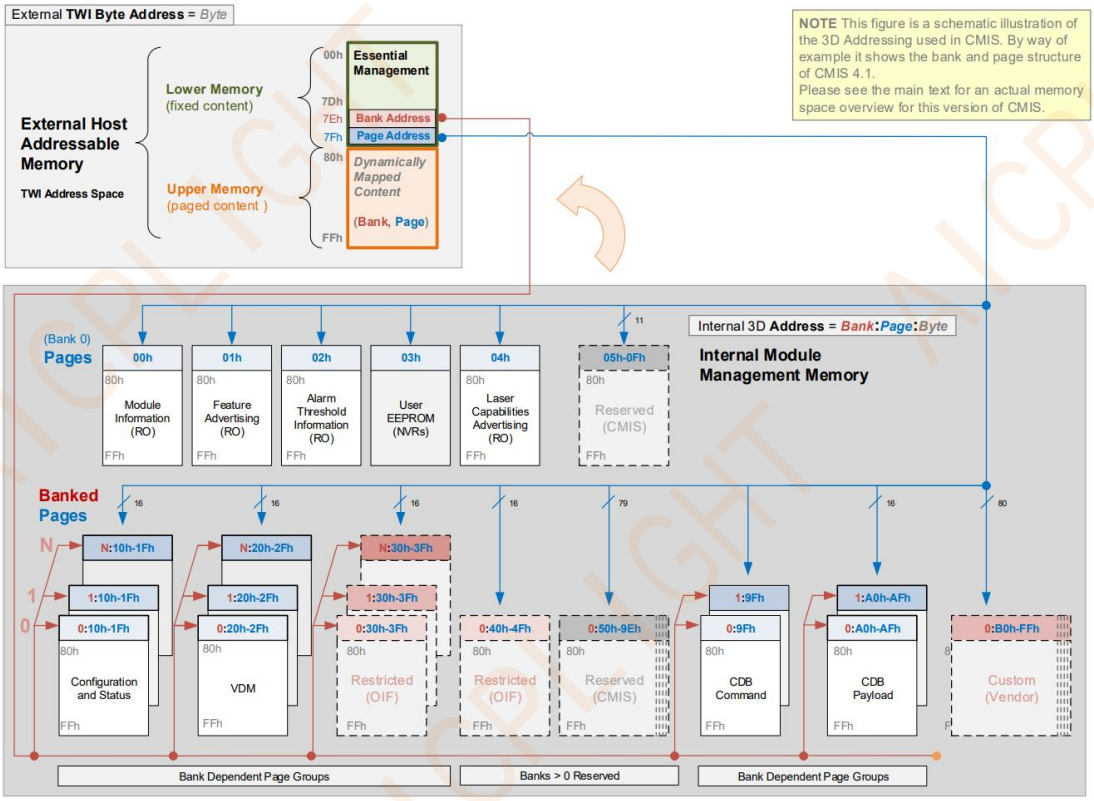


Figure5: Memory map

Memory map Table

Byte	Unit	Name	Description
Lower Page 00h			
0-2	3	Management Characteristics	Basic Information about how this module is managed
3	1	Global Status Information	Current state of Module, Interrupt signal status
4-7	4	Flag Summary	Summary of Flags set on specific Pages (and Banks)
8-13	6	Module-Level Flags	Flags that are not lane or Data Path specific
14-25	12	Module-Level Monitors	Monitors that are not lane or Data Path specific
26-30	5	Module-Level Controls	Controls applicable to the module as a whole
31-36	6	Module-Level Masks	Mask bits for the Module-Level Flags
37-38	2	CDB Command Status	Status of current CDB command
39-40	2	Module Active Firmware Version	Module Active Firmware Version number

41	1	Fault Information	Fault cause for entering ModuleFault state
42-63	22		Reserved
64-84	21		Custom
85-117	33	Supported Applications Advertising	Applications supported by module Data Path(s)
118-125	8	Password Facilities	Password Entry and Change (mechanism only)
126-127	2	Page Mapping	Page mapping into host addressable Upper Memory
Upper Page 00h			
128	1	SFF8024IdentifierCopy	Copy of Byte 00h:0
129-144	16	VendorName	Vendor name (ASCII)
145-147	3	Vendor OUI	Vendor IEEE company ID
148-163	16	Vendor PN	Part number provided by vendor (ASCII)
164-165	2	Vendor Rev	Revision level for part number provided by vendor (ASCII)
166-181	16	Vendor SN	Vendor Serial Number (ASCII)
182-189	8	DateCode	Manufacturing Date Code (ASCII)
190-199	10	CLEICode	Common Language Equipment Identification Code (ASCII)
200-201	2	ModulePowerCharacteristics	Module power characteristics
202	1	CableAssemblyLinkLength	Cable length (for cable assembly modules only)
203	1	ConnectorType	Connector type of the media interface
204-209	6	Copper Cable Attenuation	Attenuation characteristics (passive copper cables only)
210	1	MediaLaneInformation	Supported near end media lanes (all modules)
211	1	Cable Assembly Information	Far end modules information (cable assemblies only)
212	1	MediaInterfaceTechnology	Information on media side device or cable technology
213-220	8		Reserved
221	1		Custom
222	1	PageChecksum	Page Checksum over bytes 128-221
223-255	33		Custom

Mechanical Dimension

Handling and Safety Precautions:

- **ESD Protection:** Use proper electrostatic discharge (ESD) protection when handling, installing, or removing the module.
- **Installation and Removal:** Insert or remove the OSFP module using the pull tab or release mechanism. Do not force the module into the cage or pull on the fiber cable.
- **Form Factor Compatibility:** OSFP Flat Top and OSFP Finned Top modules are designed for different thermal and cage configurations and are not interchangeable. Always use the module type specified for the host system.
- **Thermal Management:** Ensure sufficient airflow and proper heatsink contact. Do not obstruct the module or system cooling path, as the module may become hot during operation.
- **Connector Cleaning:** Keep MTP/MPO or LC optical interfaces clean and protected with dust caps when not in use. Clean connector end faces before connection.

- **Fiber Handling:** Avoid excessive bending, pulling, twisting, or crushing of fiber cables. Follow the specified minimum bend radius.
- **Laser Safety:** Do not look directly into the optical port or connected fiber while the module is powered. Do not disassemble or modify the module.

Ordering Information

PN	Description
OSFP-1.6T-2DR4	1.6T 2×DR4/DR8 OSFP224 Finned Top PAM4 1310nm 500m DOM Dual MTP/MPO-12 APC SMF Optical Transceiver Module
OSFP-1.6T-2FR4	1.6T 2×FR4/FR8 OSFP224 Finned Top PAM4 1310nm 2km DOM Dual Dual Duplex LC/UPC SMF Optical Transceiver Module
OSFP-800G-DR4	800G DR4 OSFP224 Flat Top PAM4 1310nm 500m DOM MTP/MPO-12 APC Optical Transceiver Module