

Features

- OSFP MSA compliant
- Parallel 4 Optical Lanes
- IEEE802.3bs Specification compliant
- Up to 500m transmission on single mode fiber (SMF) with FEC
- Operating case temperature: 0~70°C
- 8x53.125Gb/s electrical interface (400GAUI-8)
- Data Rate 106.25Gbps (PAM4) per channel.
- Maximum power consumption 12W
- MPO-12 connector
- RoHS compliant



Applications

- 400G Ethernet
- Infiniband interconnects
- Datacenter Enterprise networking

Description

This product is a 400Gb/s Octal Small Form-factor Pluggable (OSFP) optical module designed for 500m optical communication applications. The module converts 8 channels of 50Gb/s (PAM4) electrical input data to 4 channels of parallel optical signals, each capable of 100Gb/s operation for an aggregate data rate of 400Gb/s. Reversely, on the receiver side, the module converts 4 channels of parallel optical signals of 100Gb/s each channel for an aggregate data rate of 400Gb/s into 8 channels of 50Gb/s (PAM4) electrical output data.

An optical fiber cable with an MTP/MPO-12 connector can be plugged into the OSFP DR4+ module receptacle. Proper alignment is ensured by the guide pins inside the receptacle. The cable usually cannot be twisted for proper channel to channel alignment. Electrical connection is achieved through an OSFP MSA-compliant edge type connector.

The product is designed with form factor optical/electrical connection and digital diagnostic interface according the OSFP Multi-Source Agreement (MSA). It have been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Storage Temperature	T_s	-40		85	°C	
Operating Case Temperature	T_{op}	0		70	°C	
Power Supply Voltage	V_{cc}	-0.5		3.6	V	
Relative Humidity (non-condensation)	RH	0		85	%	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Operating Case Temperature	T_{op}	0		70	°C	
Power Supply Voltage	V_{cc}	3.135	3.3	3.465	V	
Data Rate, each Lane			26.5625		Gb/s	PAM4
Data Rate Accuracy		-100		100	ppm	
Pre-FEC Bit Error Ratio				2.4×10^{-4}		
Post-FEC Bit Error Ratio				1×10^{-12}		1
Link Distance	D	0.5		500	m	2

Notes:

1. FEC provided by host system.
2. FEC required on host system to support maximum distance.

Diagnostics Monitoring

Parameter	Symbol	Accuracy	Unit	Notes
Temperature monitor absolute error	DMI_Temp	± 3	°C	Over operating Temp
Supply voltage monitor absolute error	DMI_VCC	± 0.1	V	Full operating range
RX power monitor absolute error	DMI_RX	± 2 dB	dB	1
Bias Current monitor	DMI_Ibias	± 10%	mA	
Laser power monitor absolute error	DMI_TX	± 2 dB	dB	1

Notes:

1. Due to measurement accuracy of different single mode fibers, there could be an additional +/- 1 dB fluctuation, or a +/- 3 dB total accuracy.

Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Transmitter						
Date Rate, each Lane		53.125 ± 100 ppm			Gb/s	
Modulation Format		PAM4				
Side-mode Suppression Ratio	<i>SMSR</i>	30			dB	Modulated
Center Wavelength		1304.5	1310	1317.5	nm	
Average Launch Power, each Lane	<i>P_{AVG}</i>	-2.9		4	dBm	1
Outer Optical Modulation Amplitude (OMA _{outer}), each Lane	<i>P_{OMA}</i>	-0.8		4.2	dBm	2
Launch Power in OMA _{outer} minus TDECQ, each Lane		-2.2			dB	
Transmitter and Dispersion Eye Closure for PAM4, each lane	<i>TDECQ</i>			3.4	dB	
Extinction Ratio	<i>ER</i>	3.5			dB	
RIN _{21.4} OMA	<i>RIN</i>			-136	dB/Hz	
Optical Return Loss Tolerance	<i>TOL</i>			21.4	dB	
Transmitter Reflectance	<i>T_R</i>			-26	dB	
Average Launch Power of OFF Transmitter, each Lane	<i>P_{off}</i>			-15	dBm	
Receiver						
Data Rate, each Lane		53.125 ± 100 ppm			Gb/s	
Modulation Format		PAM4				
Damage Threshold, each Lane	<i>TH₄</i>	5			dBm	3
Average Receiver Power, each Lane		-5.9		4	dBm	4
Receiver Power (OMA _{outer}), each Lane				4.2	dBm	
Receiver sensitivity (OMA _{outer}), each lane	<i>SEN</i>			-4.4	dBm	5
Stressed Receiver Sensitivity (OMA _{outer}), each Lane	<i>SRS</i>			-1.9	dBm	6
Receiver Reflectance	<i>R_R</i>			-26	dB	

LOS Assert	<i>LOSA</i>	-15		dBm
LOS De-assert	<i>LOSD</i>		-8.9	dBm
LOS Hysteresis	<i>LOSH</i>	0.5		dB

Stressed Conditions for Stress Receiver Sensitivity (Note 7)

Stressed Eye Closure for PAM4 (SECQ), Lane under Test		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 < 1.4dB, the OMA_{outer} (min) must exceed the minimum value specified here.
3. The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level.
4. Average receiver 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.
5. Receive sensitivity (OMA_{outer}), each lane (max) is informative and is defined for a transmitter with SECQ of 0.9dB.
6. Measured with conformance test signal for BER=2.4x10⁻⁴
7. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Electronical Characteristics

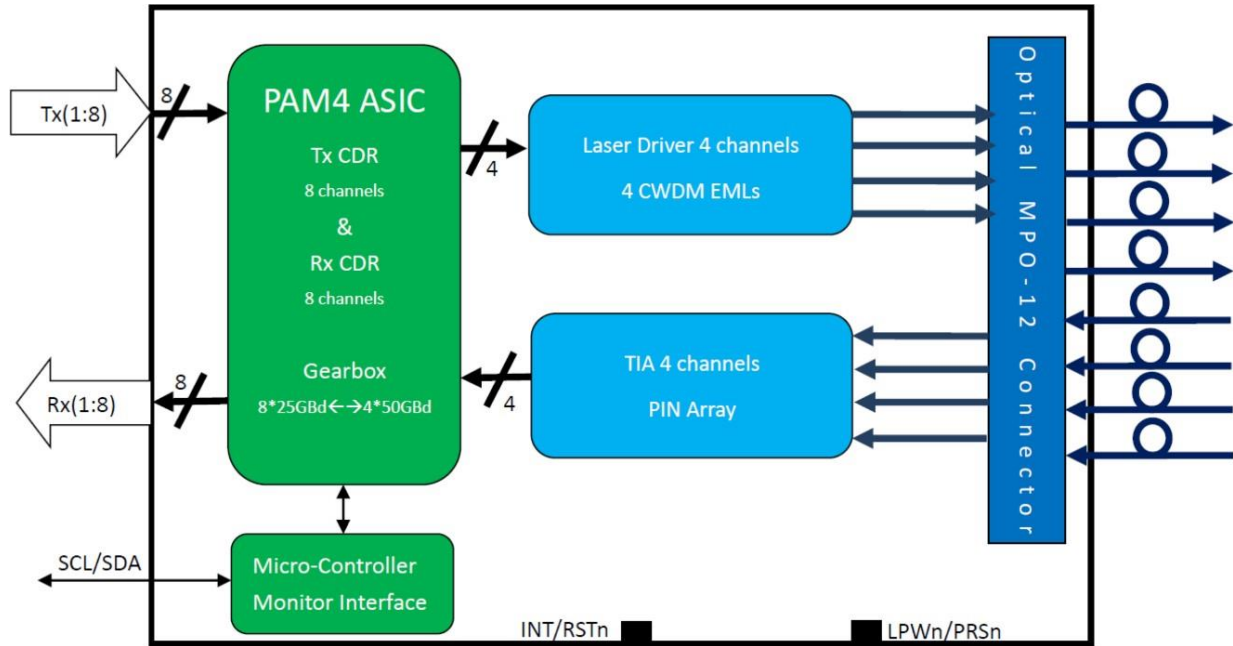
Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Power Consumption				12	W	
Supply Current	<i>I_{cc}</i>			3.64	A	
Transmitter (each Lane)						
Signaling Rate, each Lane	<i>TP1</i>	26.5625 ± 100 ppm			Gb/s	
Differential pk-pk Input Voltage Tolerance	<i>TP1a</i>	900			mVpp	1
Differential Termination Mismatch	<i>TP1</i>			10	%	
Differential Input Return Loss	<i>TP1</i>	IEEE 802.3-2015 Equation (83E-5)			dB	
Differential to Common Mode Input Return Loss	<i>TP1</i>	IEEE 802.3-2015 Equation (83E-6)			dB	
Module Stressed Input Test	<i>TP1a</i>	See IEEE 802.3bs 120E.3.4.1				2
Single-ended Voltage Tolerance Range (Min)	<i>TP1a</i>		-0.4 to 3.3			V
DC Common Mode Input Voltage	<i>TP1</i>	-350		2850	mV	3
Receiver (each Lane)						
Signaling Rate, each lane	<i>TP4</i>	26.5625 ± 100 ppm			Gb/s	
Differential Peak-to-Peak Output Voltage	<i>TP4</i>			900	mVpp	
AC Common Mode Output Voltage, RMS	<i>TP4</i>			17.5	mV	
Differential Termination Mismatch	<i>TP4</i>			10	%	
Differential Output Return Loss	<i>TP4</i>	IEEE 802.3-2015 Equation (83E-2)				

Common to Differential Mode Conversion Return Loss	TP4	IEEE 802.3-2015 Equation (83E-3)			
Transition Time 20% to 80%	TP4	9.5		Ps	
Near-end Eye Symmetry Mask Width (ESMW)	TP4		0.265	UI	
Near-end Eye Height, Differential	TP4	70		mV	
Far-end Eye Symmetry Mask Width (ESMW)	TP4		0.2	UI	
Far-end Eye Height, Differential	TP4	30		mV	
Far-end Pre-cursor ISI Ratio	TP4	-4.5	2.5	%	
Common Mode Output Voltage (Vcm)	TP4	-350	2850	mV	3

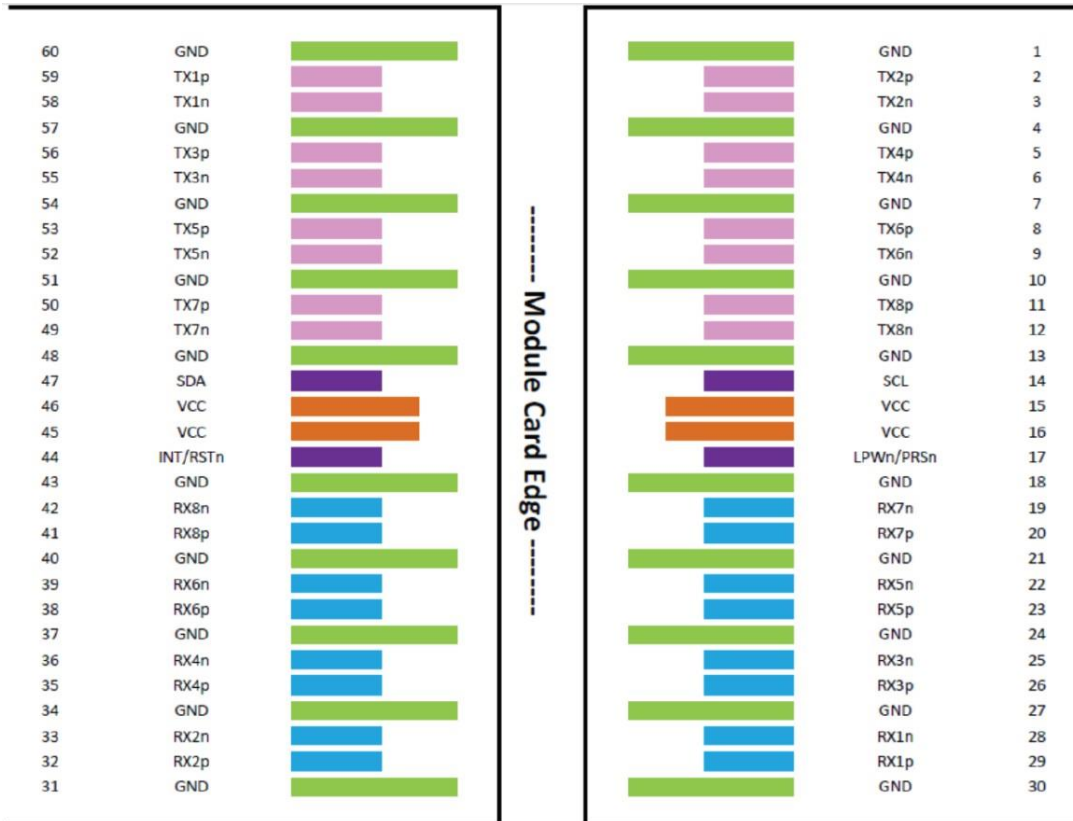
Notes:

1. With the exception to IEEE 802.3bs 120E3.1.2 that the pattern is PRBS31Q or scrambled idle.
2. Meets BER specified in IEEE 802.3bs 120E 1.1.
3. DC common mode voltage generated by the host Specification includes effects of ground offset voltage.

Transceiver Block Diagram



Pin Assignment and Description



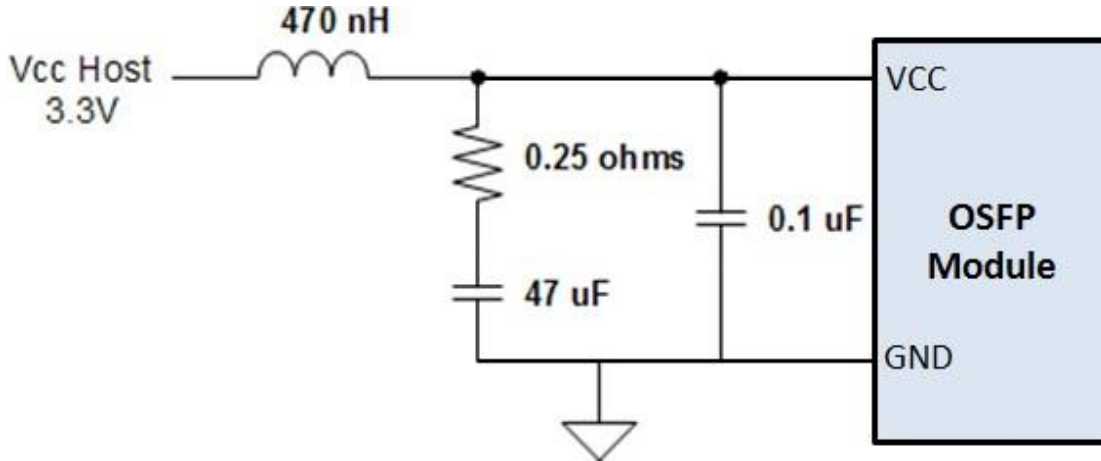
Pin Descriptions

Pin	Symbol	Description	Logic	Description	Note
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 Hos	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 Hos	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 Hos	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 Hos	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		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

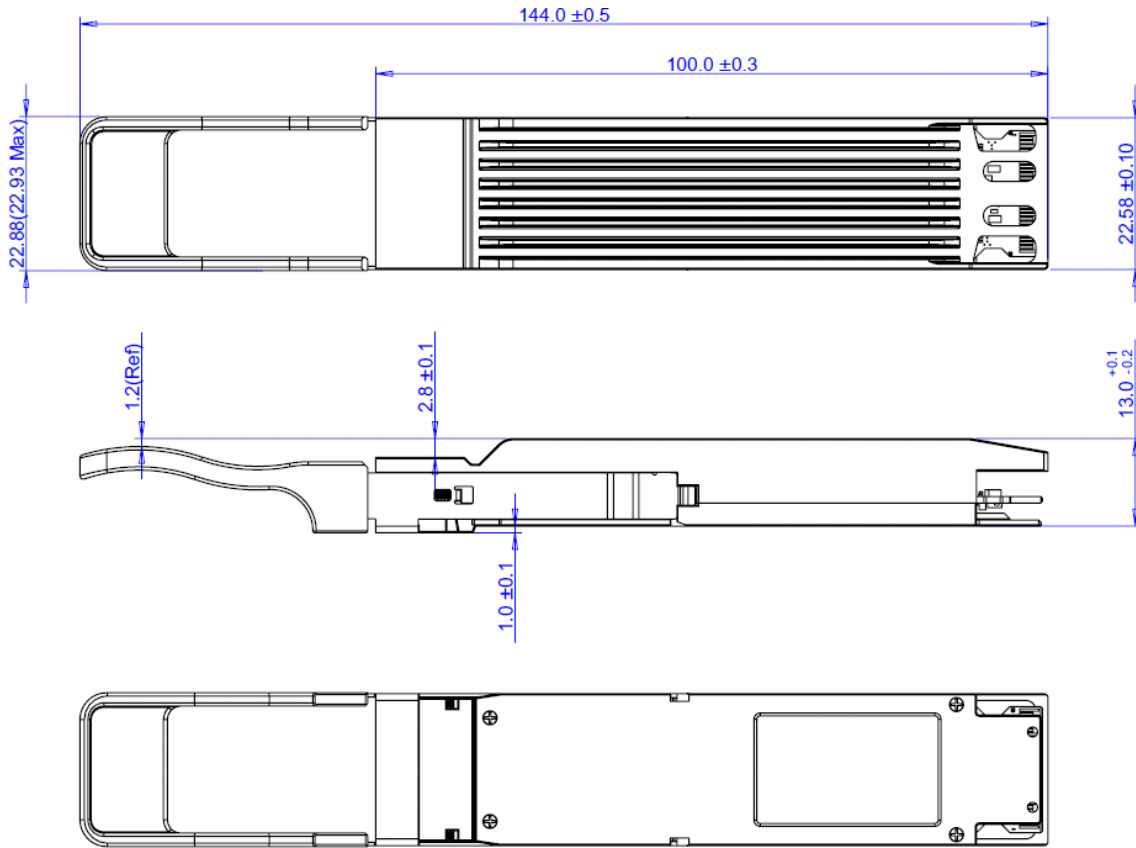
29	RX1p	Receiver Data Non-Inverted	CML-O	Output to Host	3
30	GND		Ground		1
31	GND		Ground		1
32	RX2p	Receiver Data Non-Inverted	CML-O	Output to Host	3
33	RX2n	Receiver Data Inverted	CML-O	Output to Host	3
34	GND		Ground		1
35	RX4p	Receiver Data Non-Inverted	CML-O	Output to Host	3
36	RX4n	Receiver Data 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/O	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		
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		
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		
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
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Recommended Power Supply Filter


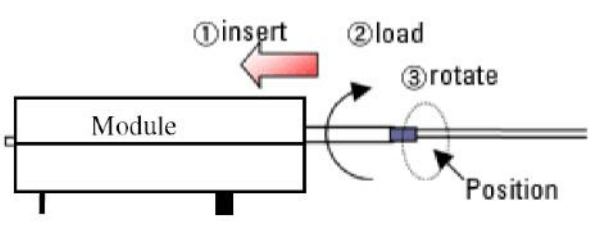


Dimensions



Optical Receptacle Cleaning Recommendations :

All fiber stubs inside the receptacle portions were cleaned before shipment. In the event of contamination of the optical ports, the recommended cleaning process is the use of forced nitrogen. If contamination is thought to have remained, the optical ports can be cleaned using a NTT international Cletop® stick type and HFE7100 cleaning fluid. Before the mating of patch-cord, the fiber end should be cleaned up by using Cletop® cleaning cassette.

Cleaning of patch-cord	Cleaning of fiber stub
	 <ol style="list-style-type: none"> 1. Insert Ensure that stick is held straight when inserting into sleeve. 2. Load Apply sufficient pressure (approx 600-700g) to ensure ferrule a little depressed in sleeve. 3. Rotate Rotate stick clockwise 4-5 times, while ensuring direct contact with ferrule end-face is maintained. <p><i>Notice: Number of possible wipes: Maintenance (repair) ~1 use / piece Equipment construction: 4 uses / piece (max.)</i></p>

Note: The pictures were extracted from NTT-ME website. And the Cletop® is a trademark registered by NTT-ME

Ordering Information

<i>Model Number</i>	<i>Part Number</i>	<i>Voltage</i>	<i>Temperature</i>
400G OSFP DR4	OPOY-SX5-13-CBS	3.3V	0°C to 70 °C

Modification History

<i>Revision</i>	<i>Date</i>	<i>Description</i>
A1	Nov. 2019	Initial Release

Note: All information contained in this document is subject to change without notice.