Product Features

- OSFP MSA compliant
- Non-hermetic package design
- 4 CWDM lanes MUX/DEMUX design
- Full Duplex LC connector
- Maximum link length of 10Km G.652 SMF with KP-FEC
- Built-in digital diagnostic functions
- Operating case temperature 0℃ to +70℃
- Single 3.3 V power supply
- RoHS compliant

Applications

- Data Centers Network
- 400G Ethernet

Standards

- IEEE 802.3cu
- OSFP MSA
- CMIS4.0

Description

The 400G OSFP LR4 transceiver provides 400GBase-LR4 throughput up to 10km over single-mode fiber (SMF) via an LC connector. The module incorporates 4 independent channels on CWDM4 1271/1291/1311/ 1331nm center wavelength, operating at 100G per channel. The transmitter path incorporates 4 independent EML drivers and EML lasers together with an optical multiplexer. On the receiver path, an optical de- multiplexer is coupled to a 4-channel photodiode array.

It is a cost-effective and lower power consumption solution for 400GBASE Data Centers Network. It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference. The module offers very high functionality and feature integration, accessible via the I2C interface.

Absolute Maximum Ratings

Parameter	Unit	Min.	Typ.	Max.
Power Supply Voltage	V	-0.5	3.3	3.6
Storage Temperature	℃	-40		85
Operating Case Temperature	℃	0		70
Relative Humidity	%	5		85
Operating Relative Humidity	%			65
Power Dissipation	W			10

Notes:

1. The position of the case temperature measurement is shown further in the document. Continuous operation at the maximum temperatures should be avoided in order to maintain device reliability.

2. Exceeding the Absolute Maximum Ratings table may cause permanent damage to the device. This is just an emphasized rating and does not involve the functional operation of the device that exceeds the specifications of this technical specification under these or other conditions. Long-term operation under Absolute Maximum Ratings will affect the reliability of the device.

Electrical Characteristics

Parameter	Unit	Min.	Typ.	Max.	Notes
Power Supply Voltage	V	3.135	3.3	3.465	
Power Supply Total Current	mA			3190	
Power Supply Noise	mVp-p			50	1
Electrical Signal Rate Per Channel	GBd		53.125		2
In-Rush Instantaneous Peak Current	mA			4000	
In-Rush Current (DI/Dt)	mA/us			100	
Power Consumption	W			10	
AC Coupling Internal Capacitor	μF		0.1		
Transmitter High-Speed Electrical Characteristics					
Signaling Rate Per Lane (Range)	GBd	53.125 ± 100ppm			
Data Input Voltage – Single-Ended	V	-0.5		Vcc+0.5	
Data Input Voltage – Differential	V			0.8	3

Differential Peak-to-Peak Input Voltage Tolerance	mV	900			
Differential Return Loss (Minimum)	dB		Equation (83E-5)		4
Common-Mode to Differential Return Loss (Minimum)	dB		Equation (83E-6)		4
Differential Termination Mismatch	%			10	
Single-Ended Voltage Tolerance Range	V	-0.4		3.3	
DC Common-Mode Voltage	mV	-350		2850	5
Module Stressed Input Test			120E.3.4.1		6, 7
Eye Width	UI		0.22		
Applied Peak-to-Peak Sinusoidal Jitter			Table 120E-6		6
Eye Height	mV		32		
Receiver High-Speed Electrical Characteristics					
Signaling Rate Per Lane (Range)	GBd	53.125 ± 100ppm			
Receiver Differential Data Output Load	Ω	100			
AC Common-Mode Output Voltage (Maximum, RMS)	mV			17.5	
Differential Peak-to-Peak Output Voltage Tolerance	mV			900	
Near-End ESMW (Eye Symmetry Mask Width)	UI		0.265		
Near-End Height Differential	mV	90			
Far-End ESMW (Eye Symmetry Mask Width)	UI		0.2		
Far-End Eye Height Differential	mV	30			
Differential Output Return Loss (Minimum)	dB		Equation (83E-2)		4
Common- to Differential-Mode Conversion Return Loss (Minimum)	dB		Equation (83E-3)		4
Differential Termination Mismatch	%			10	
Transition Time (20-80%)	ps	9.5			
DC Common-Mode Voltage	V	-0.35		2.85	

Notes:

1. Power Supply Noise is defined as the peak-to-peak noise amplitude over the frequency range at the host supply side of the recommended power supply filter with the module and recommended filter in place. Voltage levels including peak-to-peak noise are limited to the recommended operating range of the associated power supply.

2. 400GAUI-8 operation with host-generated FEC. The transmitter must receive pre-coded FEC signals from the host ASIC.

3. This is the maximum voltage that can be applied across the differential inputs without damaging the input circuitry. The damage threshold of the module input shall be at least 1600mV peak-to-peak differential.

4. Per IEEE 802.3bm specification.

5. DC Common-Mode Voltage is generated by the host. Specification includes the effects of ground offset voltage.

6. Per IEEE 802.3bs specification.

7. Module Stressed Input Tolerance is measured using the procedure defined in 120E-3.4.1.

Optical Characteristics

Parameter		Unit	Min.	Typ.	Max.	Notes
Optical Signal Rate Per Channel		GBd		53.125		1
Fiber Length (9μm SMF)		km		10		2
Transmitter						
Signaling Speed Per Lane		Gbps	26.5625		106.25	
Modulation Format			PAM4 or NRZ			
Center Wavelength		nm	1264.5	1271	1277.5	
		nm	1284.5	1291	1297.5	
		nm	1304.5	1311	1317.5	
		nm	1324.5	1331	1337.5	
Side-Mode Suppression Ratio		dB	30			
Extinction Ratio		dB	3.5			
Average Launch Power		dBm	-2.8		5.6	3
OMA Per Lane		dBm	0.2		4.4	
Launch Power in OMA-TDECQ	ER≥4.5dB	dBm	-1.2			
	ER<4.5dB	dBm	-1.1			
TDECQ (PAM4)		dB			3.3	
SECQ		dB			3.3	

RIN15.6OMA	dB/Hz			-136	
Average Launch Power of Off Transmitter	dBm			-15	
Optical Return Loss Tolerance	dB			15.6	
Transmitter Reflectance	dB			-26	
Transmitter Transition Time	ps			17	
Receiver					
Signaling Speed Per Lane	Gbps	26.5625		106.25	
Center Wavelength	nm	1264.5	1271	1277.5	
	nm	1284.5	1291	1297.5	
	nm	1304.5	1311	1317.5	
	nm	1324.5	1331	1337.5	
Damage Threshold	dBm	6.6			
Average Receiver Power Per Lane	dBm	-9.1		5.6	
Receive Power (OMA) Per Lane	dBm			4.4	
Receiver Sensitivity (OMA) Per Lane	dBm			Max. (-6.8, TECQ-8.2)	4
Stressed Receiver Sensitivity (OMA) Per Lane	dBm			4.1	5
LOS Assert (Average)	dBm	-30			
LOS De-Assert (Average)	dBm			-12	
LOS Hysteresis	dB				
RSSI Accuracy	dB			+2	
Receiver Reflectance	dB			-26	

Notes:

1. 400G LR4 operates with host-generated FEC. The transmitter must receive pre-coded FEC signals from the host ASIC.

2. 9μm SMF. The maximum link distance is based on an allocation of 1dB of attenuation and 3dB total connection and splice loss. The loss of a single connection shall not exceed 0.5dB.

3. Average launch power, per lane (minimum), 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.

4. Receiver sensitivity, @<4.6dBm, for Tx with TDECQ<1.4dB; @<SECQ-6, for Tx with 3.3dB≥TDECQ≥1.4dB.

5. Measured with a reference transmitter to produce SECQ greater than or equal to 2dB. The BER at the receiver must stay within the specified limit over an OMA range of (-4.9 + TDECQ)dBm to 3.7dBm.

Pin Definition and Description

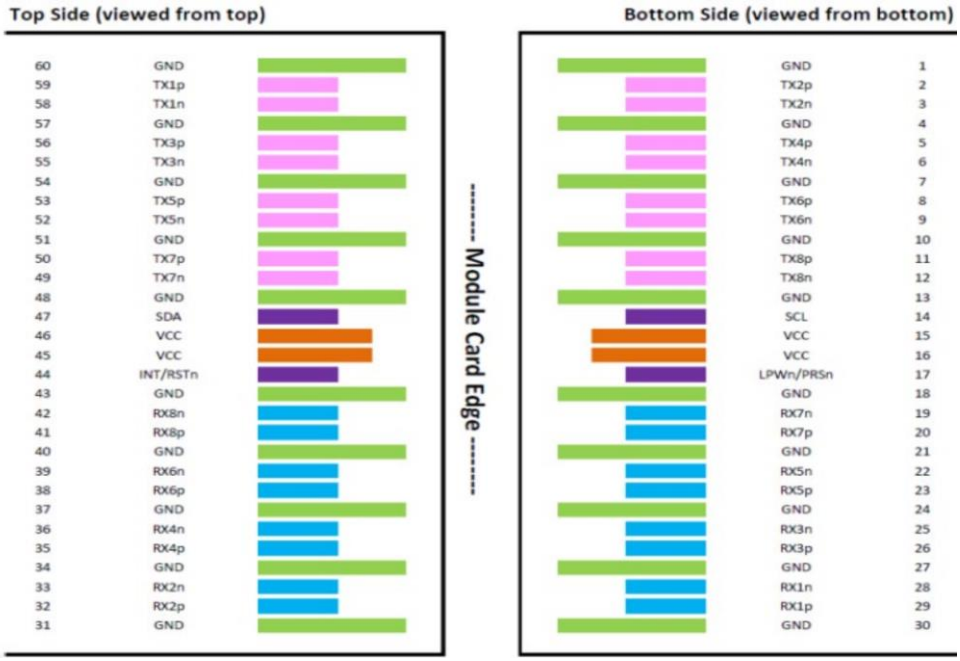


Table 1. Pin definition and descriptions

Pin	Symbol	Name/Description	Plug Sequence	Notes
1	GND	Module Ground.	1	1
2	Tx2+	Transmitter Non-Inverted Data.	3	
3	Tx2-	Transmitter Inverted Data.	3	
4	GND	Module Ground.	1	1
5	Tx4+	Transmitter Non-Inverted Data.	3	
6	Tx4-	Transmitter Inverted Data.	3	
7	GND	Module Ground.	1	1
8	Tx6+	Transmitter Non-Inverted Data.	3	
9	Tx6-	Transmitter Inverted Data.	3	
10	GND	Module Ground.	1	1
11	Tx8+	Transmitter Non-Inverted Data.	3	
12	Tx8-	Transmitter Inverted Data.	3	
13	GND	Module Ground.	1	1
14	SCL	2-Wire Serial Interface Clock.	3	2
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	Module Ground.	1	1
19	Rx7-	Receiver Inverted Data.	3	
20	Rx7+	Receiver Non-Inverted Data.	3	
21	GND	Module Ground.	1	1
22	Rx5-	Receiver Inverted Data.	3	
23	Rx5+	Receiver Non-Inverted Data.	3	
24	GND	Module Ground.	1	1
25	Rx3-	Receiver Inverted Data.	3	
26	Rx3+	Receiver Non-Inverted Data.	3	
27	GND	Module Ground.	1	1
28	Rx1-	Receiver Inverted Data.	3	
29	Rx1+	Receiver Non-Inverted Data.	3	
30	GND	Module Ground.	1	1
31	GND	Module Ground.	1	1
32	Rx2+	Receiver Non-Inverted Data.	3	
33	Rx2-	Receiver Inverted Data.	3	
34	GND	Module Ground.	1	1
35	Rx4+	Receiver Non-Inverted Data.	3	
36	Rx4-	Receiver Inverted Data.	3	
37	GND	Module Ground.	1	1
38	Rx6+	Receiver Non-Inverted Data.	3	
39	Rx6-	Receiver Inverted Data.	3	
40	GND	Module Ground.	1	1
41	Rx8+	Receiver Non-Inverted Data.	3	
42	Rx8-	Receiver Inverted Data.	3	
43	GND	Module Ground.	1	1
44	INT/RSTn	Module Input/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	2
48	GND	Module Ground.	1	1
49	Tx7-	Transmitter Inverted Data.	3	
50	Tx7+	Transmitter Non-Inverted Data.	3	
51	GND	Module Ground.	1	1
52	Tx5-	Transmitter Inverted Data.	3	
53	Tx5+	Transmitter Non-Inverted Data.	3	
54	GND	Module Ground.	1	1

55	Tx3-	Transmitter Inverted Data.	3	
56	Tx3+	Transmitter Non-Inverted Data.	3	
57	GND	Module Ground.	1	1
58	Tx1-	Transmitter Inverted Data.	3	
59	Tx1+	Transmitter Non-Inverted Data.	3	
60	GND	Module Ground.	1	1

Notes:

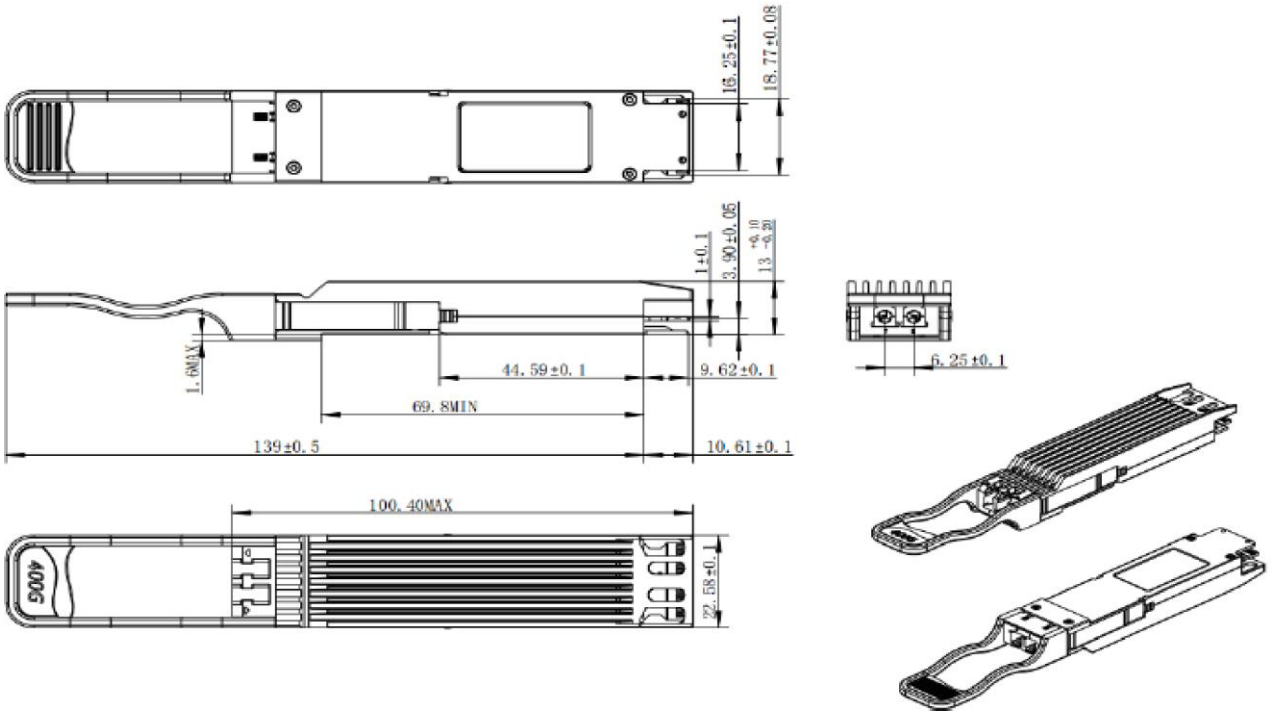
1. OSFP uses common ground (GND) for all signals and supply (power). All are common within the OSFP module, and all module voltages are referenced to this potential unless otherwise noted.

2. Open-drain with pull-up resistor on the host.

Digital Diagnostic Monitoring Functions

Parameter	Units	Error	Notes
Temperature Monitor	℃	±3	1LSB=1/256℃
Supply Voltage Monitor	V	±0.1	1LSB=100uV
Bias Current Monitor	mA	±10%	1LSB=2uA
TX Power Monitor	dBm	±3	1LSB=0.1uW
RX Power Monitor	dBm	±3	1LSB=0.1uW

Mechanical Specifications



Notes:

1. All dimensions are in mm.

2. For safety and protection of the host system, the power to each OSFP module may be protected by an electronic circuit breaker on the host board which is enabled with the H_PRSn signal such that power is only enabled when the module is fully engaged into the OSFP connector.