

## CFP4 100G 1310nm Single mode Optical Transceiver



### Description

The BlueOptics® BO94L13610D CFP4 transceiver is a high performance, cost effective module supporting a data rate up to 103.125Gbps with 10 Kilometer link length on single mode fiber.

BlueOptics® transceivers are 100% compliant with CFP4 Multi-Source Agreement (MSA).

All BlueOptics® CFP4 transceivers are always equipped with digital diagnostic function compliant to MSA SFF-8436.

Using digital diagnostic, BlueOptics® CFP4 transceivers provide the following real time information:

- Supply voltage
- Laser bias current
- Laser average output power
- Laser received input power
- Temperature

The transceiver consists of five sections: A CWDM transmitter, a PIN photodiode, a trans-impedance preamplifier (TIA), the LD Driver and the digital diagnostic function.

### Applications

- ✓ Ethernet
- ✓ Infiniband
- ✓ Fibre Channel

### Features

- ✓ 27.952 Gb/s data rate per channel compliant to IEEE 802.3bm and IEEE802.3ba
- ✓ Hot-pluggable CFP4 footprint compliant to CFP MSA
- ✓ Duplex LC/UPC type pluggable optical interface
- ✓ Link length up to 10 Kilometer on SM
- ✓ MDIO Management Interface compliant to CFP MSA
- ✓ Compliant to OIF-CEI-28G-VSR
- ✓ Metal enclosure, for lower EMI
- ✓ RoHS compliant and lead-free
- ✓ Low power dissipation: maximum 3.5W
- ✓ Single +3.3V power supply
- ✓ Case operating temperature
  - Commercial: 0°C to +70°C
  - Extended: -10°C to +80°C
  - Industrial: -40°C to +85°C

**Warnings**

**Handling Precautions:** This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended.

**Laser Safety:** Even small radiation emitted by laser devices can be dangerous to human eyes and lead to permanent eye injuries. Be sure to avoid eye contact with direct or indirect radiation.

**Warranty**

Every BlueOptics© transceiver comes with a 5 year replacement warranty and lifetime support. For a warranty inquiry, please contact your CBO sales representative.

This warranty covers the first user of the equipment only.

**Important Notice**

Performance figures, data and any illustrative material provided in this data sheet are typical and must be specifically confirmed in writing by CBO before they become applicable to any particular order or contract. In accordance with the CBO policy of continuous improvement specifications may change without notice.

The publication of information in this data sheet does not imply freedom from patent or other protective rights of CBO or others.

Further details are available from any CBO sales representative.

**Installation**

Before installation attach an ESD-preventive wrist to ensure not to damage the transceiver or hardware.

BlueOptics© BO94L13610D can be installed in any Small Form Factor Pluggable (CFP4) port. You can install the BO94L13610D regardless if the system is powered on or off, because it is hot-swappable.

Insert the transceiver into the CFP4 port and remove the dust cap.

You can now connect your cable.

**Order Information**

Part No.	Temp.	DDM
BO94L13610D	0°C to +70°C	✓
BO94L13610DEX	-10°C to +80°C	✓
BO94L13610DIN	-40°C to +80°C	✓

**Regulatory Compliance**

Feature	Standard	Co.
Electrostatic Discharge (ESD)	- IEC/EN 61000-4- 2	✓
Electromagnetic Interference (EMI)	- FCC Part 15 Class B EN 55022 - Class B (CISPR 22A)	✓
Component Recognition	- IEC/EN 60950, UL	✓
RoHS	- 2002/95/EC	✓
EMC	- EN61000-3	✓

## 1. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Storage Temperature	Ts	-40		85	°C
Storage Ambient Humidity	HA	5		95	%

## 2. Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note	
		0		70		BO94L13610D	
		-10		80	°C	BO94L13610DEX	
		-40		85		BO94L13610DIN	
Ambient Humidity	HA	5		70	%		
Transmission Distance				10	KM		
Data Rate	BR		25.78125		Gbps	per channel	
Coupled Fiber		Single mode fiber					9/125µm SMF

## 3. High Speed Electrical Interface

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
<b>Transmitter</b>						
Differential voltage pk-pk		100		1200	mV	
Differential termination mismatch				10	%	
Common mode noise (rms)				17.5	mV	
Transition time		10			ps	1
Common mode voltage		-0.3		2.8	V	
<b>Receiver</b>						
Differential voltage pk-pk		100		1200	mV	
Differential termination mismatch				10	%	
Common mode noise (rms)				17.5	mV	
Transition time		9.5			ps	

### Notes:

- 20/80%

## 4. Low Speed Electrical Interface

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
<b>Supply currents and voltages</b>						
Voltage	V <sub>cc</sub>	3.2	3.3	3.4	V	1
Supply current	I <sub>cc</sub>			1.8	A	
Power dissipation	P <sub>wr</sub>			6.0	W	
Power dissipation (low power mode)	P <sub>lp</sub>			1.0	W	
<b>Low speed control and sense signals, 3.3 V LVCMOS</b>						
Input low voltage	V <sub>OL</sub>	-0.3		0.8	V	
Input high voltage	V <sub>OH</sub>	2		V <sub>cc3</sub> +0.3	V	
Input leakage current	V <sub>IL</sub>	-10		10	µA	
Outputs low voltage	V <sub>IH</sub>	-0.3		0.2	V	
Output high voltage	I <sub>IN</sub>	V <sub>cc</sub> -0.2		V <sub>cc</sub> +0.3	V	
<b>Low speed control and sense signals, 1.2 V LVCMOS</b>						
Input low voltage	V <sub>IL</sub>			0.8	V	
Input high voltage	V <sub>IH</sub>	2		V <sub>cc3</sub> +0.3	V	
Input leakage current	V <sub>IN</sub>	-10		10	µA	
Input capacitance	C			10	pF	
MDC clock rate		0.1		4	MHz	
Output low voltage	V <sub>OL</sub>	-0.3		0.2	V	

Output high voltage	$V_{OH}$	1.0		1.5	V	
Output low current	$I_{OL}$	4			mA	
Output high current	$I_{OH}$			-4	mA	

## 4. Transmitter Specifications - Optical

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Total Average Output Power	POUT			10.5	dBm	
Lane Average Output Power		-4.3		4.5		
	$\lambda 0$	1294.53	1295.56	1296.59	nm	
	$\lambda 1$	1299.02	1300.05	1301.09	nm	
	$\lambda 2$	1303.54	1304.58	1305.63	nm	
	$\lambda 3$	1308.09	1309.14	1310.19	nm	
Extinction Ratio	ER	4			dB	
RIN	RIN			-130	dB/Hz	
SMSR		30			dB	
Optical modulation amplitude, each lane (OMA)	OMA	-1.3		4.5	dBm	
Difference in launch power between any two lanes (OMA)				5	dB	
Relative Intensity Noise	$RIN_{20}$			-130	dB/Hz	
Transmitter reflectance				-12	dB	
Transmitter eye mask {X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				

## 5. Receiver Specifications - Optical

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Receiver Sensitivity per lane	$P_{AVG}$	-10.6		4.5	dBm	1
Total Receiver Sensitivity	$R_{SENS}$			4.5	dBm	

### Notes:

1. Measured with BER =  $\leq 10^{-12}$  @PRBS=2<sup>31</sup>-1 @25.78Gb/s

## 6. CFP4 to Host Connector Pin Out

Pin	Symbol	Name / Description	Note
1	3.3V_GND		
2	3.3V_GND		
3	3.3V		
4	3.3V		
5	3.3V		
6	3.3V		
7	3.3V_GND		
8	3.3V_GND		
9	NUC		
10	NUC		
11	TX_DIS	Transmitter Disable for all lanes, "1" or NC = transmitter disabled, "0" = transmitter enabled	
12	RX_LOS	Receiver Loss of Optical Signal, "1": low optical signal, "0": normal condition	
13	GLB_ALRMn	Global Alarm. "0": alarm condition in any MDIO Alarm register, "1": no alarm condition, Open Drain, Pull Up Resistor on Host	
14	MOD_LOPWR	Module Low Power Mode. "1" or NC: module in low power (safe) mode, "0": power-on enabled	

15	MOD_ABS	Module Absent. "1" or NC: module absent, "0": module present, Pull Up Resistor on Host	
16	MOD_RSTn	Module Reset. "0" resets the module, "1" or NC = module enabled, Pull Down Resistor in Module	
17	MDC	Management Data Clock (electrical specs as per 802.3ae and ba)	
18	MDIO	Management Data I/O bi-directional data (electrical specs as per 802.3ae and ba)	
19	PRTADR0	MDIO Physical Port address bit 0	
20	PRTADR1	MDIO Physical Port address bit 1	
21	PRTADR2	MDIO Physical Port address bit 3	
22	NUC	Module Vendor I/O. Must No Connect at host board	
23	NUC		
24	NUC		
25	GND		
26	TX_MCLKn	TX Monitor Clock Output (Positive)	
27	TX_MCLKp	TX Monitor Clock Output (Positive)	
28	GND		
29	GND		
30	RX0p	Lane 0 Receiver Output (Positive)	
31	RX0n	Lane 0 Receiver Output (Negative)	
32	GND		
33	RX1p	Lane 1 Receiver Output (Positive)	
34	RX1n	Lane 1 Receiver Output (Negative)	
35	GND		
36	RX2p	Lane 2 Receiver Output (Positive)	
37	RX2n	Lane 2 Receiver Output (Negative)	
38	GND		
39	RX3p	Lane 3 Receiver Output (Positive)	
40	RX3n	Lane 3 Receiver Output (Negative)	
41	GND		
42	REFCLKp(NUC)	Reference Clock Input (Positive) (Optional)	
43	REFCLKn(NUC)	Reference Clock Input (Negative) (Optional)	
44	GND		
45	TX0p	Lane 0 Transmitter Input (Positive)	
46	TX0n	Lane 0 Transmitter Input (Negative)	
47	GND		
48	TX1p	Lane 1 Transmitter Input (Positive)	
49	TX1n	Lane 1 Transmitter Input (Negative)	
50	GND		
51	TX2p	Lane 2 Transmitter Input (Positive)	
52	TX2n	Lane 2 Transmitter Input (Negative)	
53	GND		
54	TX3p	Lane 3 Transmitter Input (Positive)	
55	TX3n	Lane 3 Transmitter Input (Negative)	
56	GND		

## 7. EEPROM Information

The SFP MSA defines a 256-byte memory map in EEPROM describing the transceivers capabilities, standard interfaces, manufacturer, and other information, which-h is accessible over a 2 wire serial interface at the 8-bit address 1010000X (A0h).

Data Address	Field Size (Bytes)	Name of Field	Description
128	1	Identifier	Formfactor
129	1	Ext. Identifier	
130	1	Connector	
131-138	8	Transceiver	Transmittter Code

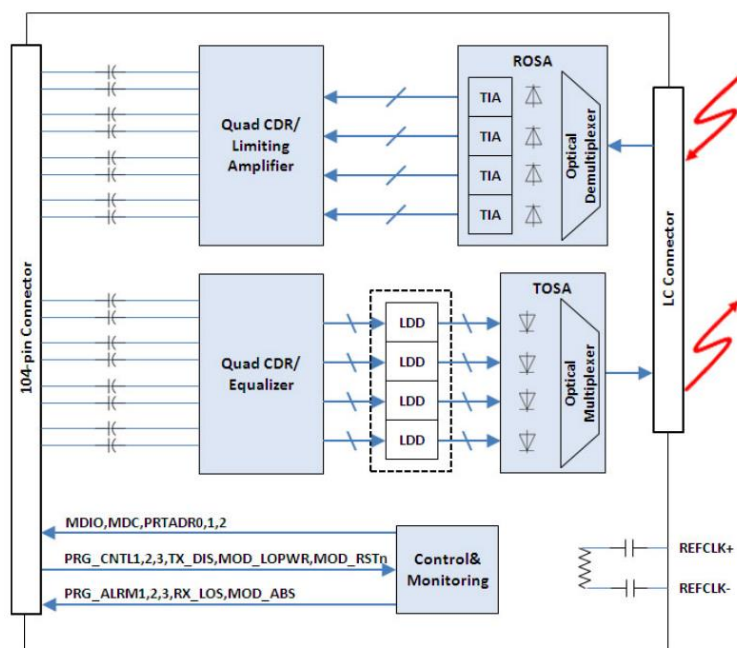
139	1	Encoding	
140	1	BR, Nominal	Transceiver Speed
141	1	Extended RateSelect Compliance	Tags for Extended RateSelect compliance
142	1	Length (9µm) km	Max. link length in KM
143	1	Length (9µm) 100m	Max. link length in M
144	1	Length (50µm) 10m	Max. link length in M
145	1	Length(62.5µm)10m	Max. link length in M
146	1	Length (Copper)	Max. link length in M
147	1	Device Tech	Device technology
148-163	16	Vendor name	Vendor name - OEM
164	1	Extended Transceiver	Extended Transceiver Codes for InfiniBand
165-167	3	Vendor OUI	
168-183	16	Vendor PN	Product Number - depending on Part
184-185	2	Vendor rev	Vendor revision
186-187	2	Wavelength	Transceiver Wavelength
188-189	2	Wavelength tolerance	Guaranteed range of laser wavelength (+/- value) from Nominal wavelength (Wavelength Tol. = value/200 in nm)
190	1	Max Case Temp	Maximum Case Temperature in Degrees C
191	1	CC_BASE	Check code for Base ID Fields (addresses 128-190)
192-195	4	Options	Rate Select, TX Disable, TX Fault, LOS
196-211	16	Vendor SN	Part serial number
212-219	8	Vendor date code	Year, Month, Day
220	1	Diagnostic type	Diagnostics
221	1	Enhanced option	Indicates which optional enhanced features are implemented in the transceiver.
222	1	Reserved	Reserved
223	1	CC_EXT	Check code for the Extended ID Fields (addresses 192-222)
224-255	32	Vendor Specific	Vendor Specific EEPROM

## 8. Digital Diagnostics / Digital Optical Monitoring

The transceiver provides serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA).

The diagnostic information with internal calibration or external calibration are all implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

## 9. Recommended Interface Circuit



# BO94L13610D

Optical Transceiver  
CFP4 100GBase-LR4 103.125GB/s 10KM  
Datasheet - Rev. 1.1

## 10. Mechanical Specifications (Unit: mm)

