

## CFP2 100G 1310nm Single mode Optical Transceiver



### Description

The BlueOptics® BO92L13610D CFP2 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 CFP2 Multi-Source Agreement (MSA).

All BlueOptics® CFP2 transceivers are always equipped with digital diagnostic function compliant to MSA SFF-8436.

Using digital diagnostic, BlueOptics® CFP2 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 CFP2 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© BO92L13610D can be installed in any Small Form Factor Pluggable (CFP2) port. You can install the BO92L13610D regardless if the system is powered on or off, because it is hot-swappable.

Insert the transceiver into the CFP2 port and remove the dust cap.

You can now connect your cable.

## Order Information

Part No.	Temp.	DDM
BO92L13610D	0°C to +70°C	✓
BO92L13610DEX	-10°C to +80°C	✓
BO92L13610DIN	-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	
Case Operating Temperature	Tcase	0		70		BO92L13610D	
		-10		80	°C	BO92L13610DEX	
		-40		85		BO92L13610DIN	
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>			0.2	V	
Output high voltage	I <sub>IN</sub>	V <sub>cc</sub> -0.2			V	
<b>Low speed control and sense signals, 1.2 V LVCMOS</b>						
Input low voltage	V <sub>IL</sub>	-0.3		0.36	V	
Input high voltage	V <sub>IH</sub>	0.84		1.5	V	
Input leakage current	V <sub>IN</sub>	-100		100	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		
Wavelength Assignment	$\lambda_0$	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 =  $<10^{-12}$  @PRBS= $2^{31}-1$  @25.78Gb/s

#### 6. CFP2 to Host Connector Pin Out

Pin	Symbol	Name / Description	Note
1	GND	Module ground	
2	(TX_MCLKn)	No Connect	
3	(TX_MCLKp)	No Connect	
4	GND	Module ground	
5	NC	No Connect	
6	NC	No Connect	
7	3.3V_GND	3.3V ground; tied with module ground	
8	3.3V_GND	3.3V ground; tied with module ground	
9	3.3V	3.3V module supply voltage	
10	3.3V	3.3V module supply voltage	
11	3.3V	3.3V module supply voltage	
12	3.3V	3.3V module supply voltage	
13	3.3V_GND	3.3V ground; tied with module ground	
14	3.3V_GND	3.3V ground; tied with module ground	
15	VND_IO_A	Module vendor IO A; do not connect	
16	VND_IO_B	Module vendor IO B; do not connect	
17	PRG_CNTL1	Programmable control 1; MSA default: TRXIC_RSTn; "0": reset; "1" or NC: not used	

18	PRG_CNTL2	Programmable control 2; MSA default: Hardware interlock LSB; Default "0": ≤ 9 W	
19	PRG_CNTL3	Programmable control 3; MSA default: Hardware interlock MSB; Default "1": ≤ 9 W	
20	PRG_ALARM1	Programmable alarm 1; MSA default: HIPWR_ON; "1": module power up completed, "0": module not high powered up	
21	PRG_ALARM2	Programmable alarm 2; MSA default: MOD_READY; "1": Ready, "0": not Ready	
22	PRG_ALARM3	Programmable alarm 3; MSA default:: MOD_FAULT; "1": Fault, "0": no Fault	
23	GND	Module ground	
24	TX_DIS	Transmitter disable for all lanes; "1" or NC: transmitter disabled; "0": transmitter enabled	
25	RS_LOS	Receiver loss of optical signal; "1": low optical signal, "0": normal condition	
26	MOD_LOPWR	Module low power mode; "1" or NC: module in low power mode, "0": power on enabled	
27	MOD_ABS	Module absent; "1" or NC: module absent; "0": module present. Pull up resistor on host.	
28	MOD_RSTn	Module reset; "0": reset the module; "1" or NC: module enabled	
29	GLB_ALRMn	Global alarm; "0": alarm in any MDIO alarm register; "1": no alarm condition. Pull up resistor on host.	
30	GND	Module ground	
31	MDC	Management interface clock input	
32	MDIO	Management interface bi-directional data	
33	PRTADR0	MDIO physical port address bit 0	
34	PRTADR1	MDIO physical port address bit 1	
35	PRTADR2	MDIO physical port address bit 2	
36	VND_IO_C	Module vendor IO C; do not connect	
37	VND_IO_D	Module vendor IO D; do not connect	
38	VND_IO_E	Module vendor IO E; do not connect	
39	3.3V_GND	3.3V ground; tied with module ground	
40	3.3V_GND	3.3V ground; tied with module ground	
41	3.3V	3.3V module supply voltage	
42	3.3V	3.3V module supply voltage	
43	3.3V	3.3V module supply voltage	
44	3.3V	3.3V module supply voltage	
45	3.3V_GND	3.3V ground; tied with module ground	
46	3.3V_GND	3.3V ground; tied with module ground	
47	NC	No Connect	
48	NC	No Connect	
49	GND	Module ground	
50	(RX_MCLKn)	No Connect	
51	(RX_MCLKp)	No Connect	
52	GND	Module ground	
53	GND	Module ground	
54	NC	No Connect	
55	NC	No Connect	
56	GND	Module ground	
57	RX0P	25 Gbps receiver data; Lane 0	
58	RX0n	25 Gbps receiver data bar; Lane 0	
59	GND	Module ground	
60	RX1P	25 Gbps receiver data; Lane 1	
61	RX1n	25 Gbps receiver data bar; Lane 1	
62	GND	Module ground	
63	NC	No Connect	
64	NC	No Connect	
65	GND	Module ground	
66	NC	No Connect	
67	NC	No Connect	

68	GND	Module ground	
69	RX2P	25 Gbps receiver data; Lane 2	
70	RX2n	25 Gbps receiver data bar; Lane 2	
71	GND	Module ground	
72	RX3p	25 Gbps receiver data; Lane 3	
73	RX3n	25 Gbps receiver data bar; Lane 3	
74	GND	Module ground	
75	NC	No Connect	
76	NC	No Connect	
77	GND	Module ground	
78	(REFCLKp)	Module reference clock. No connect.	
79	(REFCLKn)	Module reference clock. No connect.	
80	GND	Module ground	
81	NC	No Connect	
82	NC	No Connect	
83	GND	Module ground	
84	TX0P	25 Gbps transmitter data; Lane 0	
85	TX0n	25 Gbps transmitter data bar; Lane 0	
86	GND	Module ground	
87	TX1P	25 Gbps transmitter data; Lane 1	
88	TX1n	25 Gbps transmitter data bar; Lane 1	
89	GND	Module ground	
90	NC	No Connect	
91	NC	No Connect	
92	GND	Module ground	
93	NC	No Connect	
94	NC	No Connect	
95	GND	Module ground	
96	TX2P	25 Gbps transmitter data; Lane 2	
97	TX2n	25 Gbps transmitter data bar; Lane 2	
98	GND	Module ground	
99	TX3p	25 Gbps transmitter data; Lane 3	
100	TX3n	25 Gbps transmitter data bar; Lane 3	
101	GND	Module ground	
102	NC	No Connect	
103	NC	No Connect	
104	GND	Module ground	

## 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	Transmitter 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

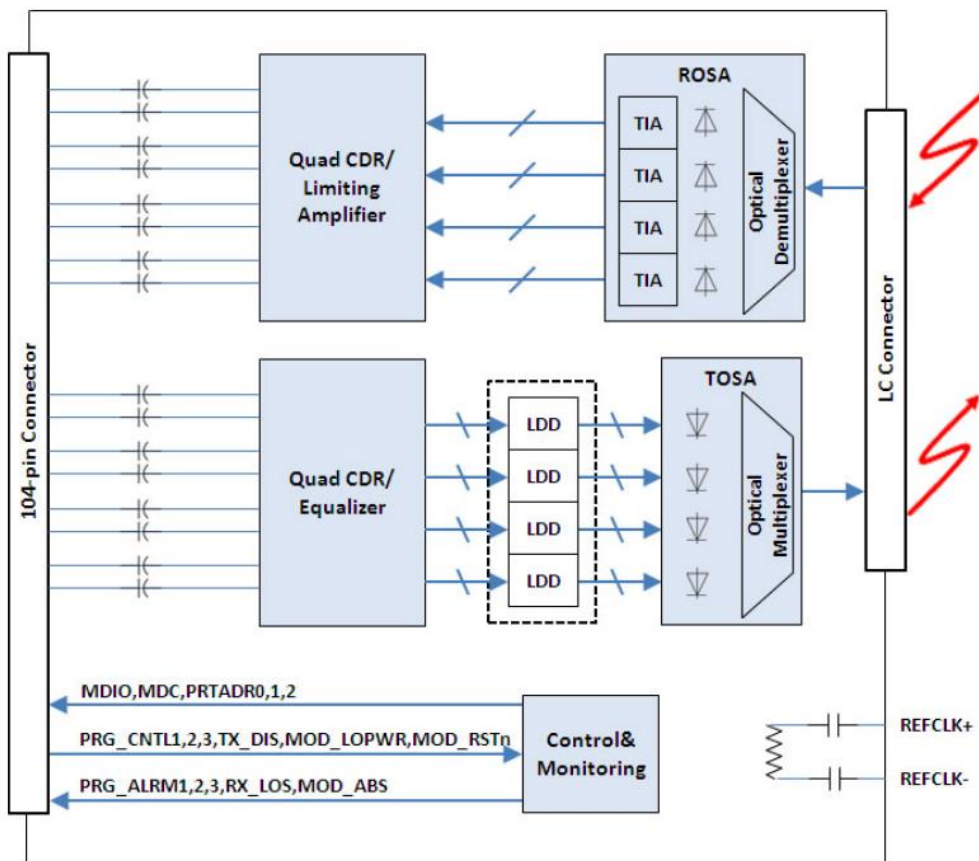
147	1	Device Tech	Device technology
148-163	16	Vendor name	Vendor name - OEM
164	1	Extended Transceiver	Extended Transceiver Codes for InfiniBand
165-167	3	Vendor OUI	
168-183	16	Vendor PN	Product Number - depending on Part
184-185	2	Vendor rev	Vendor revision
186-187	2	Wavelength	Transceiver Wavelength
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





## 10. Mechanical Specifications (Unit: mm)

