

## X2 DWDM 10G C-Band Single mode Optical Transceiver



### Description

The BlueOptics® BO77JXX240D X2 transceiver is a high performance, cost effective module supporting a data rate up to 10Gbps with 40 Kilometer link length on single mode fiber.

BlueOptics® transceivers are 100% compliant with X2 Multi-Source Agreement (MSA).

All BlueOptics® X2 transceivers are always equipped with digital diagnostic function compliant to MSA SFF-8472.

Using digital diagnostic, BlueOptics® X2 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 EML transmitter, a PIN photodiode, a trans-impedance preamplifier (TIA), the LD Driver and the digital diagnostic function.

### Applications

- ✓ 10G Ethernet – IEEE802.3ae
- ✓ 10G Fibre Channel – 1413-D
- ✓ SONET/ SDH – OC192/SDH-64

### Features

- ✓ XAUI Electrical Interface: 4 Lanes @ 3.125Gbit/s
- ✓ EML laser transmitter
- ✓ PIN photo-detector
- ✓ Hot-pluggable X2 footprint compliant to INF-8476
- ✓ Duplex SC/UPC type pluggable optical interface
- ✓ 2-wire interface for management
- ✓ Metal enclosure, for lower EMI
- ✓ RoHS compliant and lead-free
- ✓ Single +3.3V power supply
- ✓ Compliant with SFF-8472
- ✓ 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 only covers the first user of the equipment.

## 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® BO77JXX240D can be installed in any Small Form Factor Pluggable X2 port. You can install the BO77JXX240D regardless if the system is powered on or off, because it is hot-swappable.

Insert the transceiver into the X2 port and remove the dust cap.

You can now connect your cable.

## Order Information

Part No.	Temp.	DDM
BO77JXX240D	0°C to +70°C	✓
BO77JXX240DEX	-10°C to +80°C	✓
BO77JXX240DIN	-40°C to +80°C	✓

XX can be following Channel:

CH	λ (nm)	f (THZ)	CH	λ (nm)	f (THZ)
17	1563.86	191.70	37	1547.72	193.70
18	1563.05	191.80	38	1546.92	193.80
19	1562.23	191.90	39	1546.12	193.90
20	1561.42	192.00	40	1545.32	194.00
21	1560.61	192.10	41	1544.53	194.10
22	1559.79	192.20	42	1543.73	194.20
23	1558.98	192.30	43	1543.00	194.30
24	1558.17	192.40	44	1542.14	194.40
25	1557.36	192.50	45	1541.35	194.50
26	1556.55	192.60	46	1540.56	194.60
27	1555.75	192.70	47	1539.77	194.70
28	1554.94	192.80	48	1538.98	194.80
29	1554.13	192.90	49	1538.19	194.90
30	1554.13	193.00	50	1537.40	195.00
31	1553.33	193.10	51	1536.61	195.10
32	1552.52	193.20	52	1535.82	195.20
33	1551.72	193.30	53	1534.04	195.30
34	1550.92	193.40	54	1534.25	195.40
35	1549.32	193.50	55	1533.47	195.50
36	1548.51	193.60	56	1532.68	195.60
61	1528.77	196.10	57	1531.90	195.70
			58	1531.12	195.80
			59	1530.33	195.90
			60	1529.55	196.00
			61	1528.77	196.10

## 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)	✓
Laser Eye Safety	- FDA 21CFR 1040.10, 1040.11 - IEC/EN 60825-1, 2	Class 1 ✓
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		BO77JXX240D
		-10		80	°C	BO77JXX240DEX
		-40		85		BO77JXX240DIN
Ambient Humidity	HA	5		70	%	
Transmission Distance				40	KM	
Coupled Fiber		Single mode fiber				9/125µm MMF

## 3. Electrical Interface Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	Vcc	3.13	3.3	3.45	V	
Power Supply Current	Icc1			1.0	A	
Power Supply Current	Icc2			1.7	A	
Power Consumption	PDS			4.0	W	
Power supply stabilization time	TDF			500	ms	
Initialization Time	TINIT			5	S	
RESET Assert Time	TRESET	1			Ms	
Hold Time after rising edge of RESET	THOLD	500			ms	

## 4. XAUI Driver Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Baud Rate			3.125		Gbit/s	
Baud Rate Tolerance		-100		+100	ppm	
Differential Amplitude		800		1600	mVPP	

## 5. Transmitter Specifications - Optical

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Average Output Power	P <sub>OUT</sub>	-1		4	dBm	
Extinction Ratio	ER	8.2			dB	
Center Wavelength	λ <sub>C</sub>	λ-25	λ	λ+25	pm	
Average Launch power of transmitter	POFF			-30	dBm	
Output Eye Mask		Compliant with IEEE802.3ae (class 1 laser safety)				

## 6. Receiver Specifications - Optical

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Input Optical Wavelength	λ <sub>IN</sub>	1270		1610	nm	
Receiver Sensitivity	P <sub>IN</sub>			-16.5	dBm	1
Input Saturation Power (Overload)	P <sub>SAT</sub>	0.5			dBm	
LOS Assert	P <sub>A</sub>	-32			dBm	
LOS De-assert	P <sub>D</sub>			-18	dBm	
LOS Hysteresis	P <sub>A</sub> -P <sub>D</sub>	0.5			dB	

**Notes:**

1. ER=8.2dB; BER =<math>10^{-12}</math> @PRBS=2<sup>31</sup>-1 non-return-to-zero.

## 7. X2 to Host Connector Pin Out

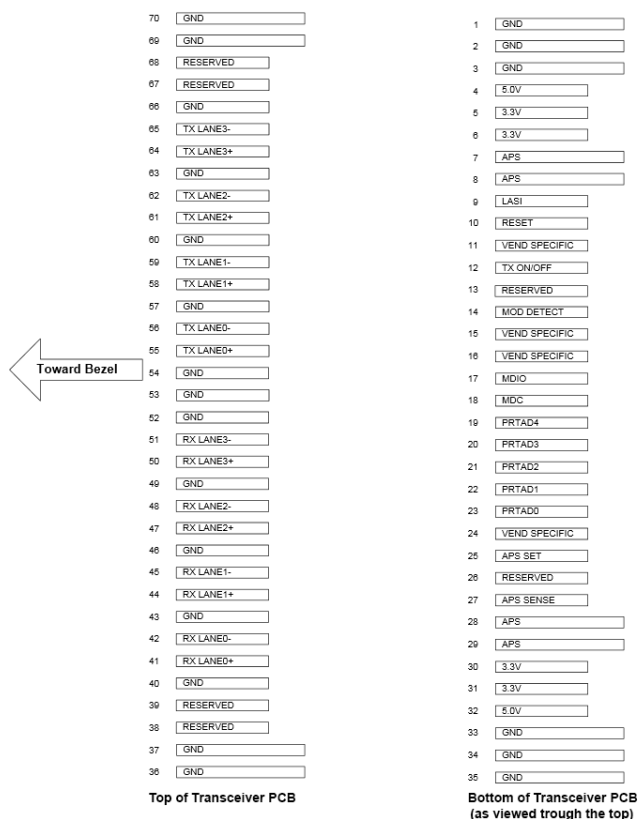
Pin	Symbol	I/O	Logic	Description
1	GND	I	Supply	Electrical ground
2	GND	I	Supply	Electrical ground
3	GND	I	Supply	Electrical ground
4	Reserved	-	-	Reserved
5	3.3 V	I	Supply	Power
6	3.3 V	I	Supply	Power
7	APS	I	Supply	Adaptive Power Supply
8	APS	I	Supply	Adaptive Power Supply
9	LASI	O	Open Drain	Link Alarm Status Interrupt. 10-22k ohm pull up on host.
10	RESET	I	1.2V CMOS	TX OFF when MDIO RESET
11	VEND SPECIFIC	-	-	Vendor Specific Pin. Leave unconnected.
12	TX ON/OFF	I	1.2V CMOS	Transmitter ON/OFF
13	Reserved	-	-	Reserved
14	MOD DETECT	O	-	Pulled low inside module through 1k ohm.
15	VEND SPECIFIC	-	-	Vendor Specific Pin. Leave unconnected.
16	VEND SPECIFIC	-	-	Vendor Specific Pin. Leave unconnected.
17	MDIO	I/O	Open Drain	Management Data IO
18	MDC	I	1.2V CMOS	Management Data Clock
19	PRTAD4	I	1.2V CMOS	Port Address bit 4 (Low=0)
20	PRTAD3	I	1.2V CMOS	Port Address bit 3 (Low=0)
21	PRTAD2	I	1.2V CMOS	Port Address bit 2 (Low=0)
22	PRTAD1	I	1.2V CMOS	Port Address bit 1 (Low=0)
23	PRTAD0	I	1.2V CMOS	Port Address bit 0 (Low=0)
24	VEND SPECIFIC	-	-	Vendor Specific Pin. Leave unconnected.
25	APS SET	O	-	Feedback output for APS
26	RESERVED	-	-	Reserved for Avalanche Photodiode use
27	APS SENSE	O	Analog	APS Sense Connection
28	APS	I	Supply	Adaptive Power Supply
29	APS	I	Supply	Adaptive Power Supply
30	3.3 V	I	Supply	Power
31	3.3 V	I	Supply	Power
32	Reserved	-	-	Reserved
33	GND	I	Supply	Electrical Ground
34	GND	I	Supply	Electrical Ground
35	GND	I	Supply	Electrical Ground
36	GND	I	Supply	Electrical Ground
37	GND	I	Supply	Electrical Ground
38	Reserved	-	-	Reserved
39	Reserved	-	-	Reserved
40	GND	I	Supply	Electrical Ground
41	RX LANE 0+	O	AC	Module XAUI Output Lane 0+

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42	RX LANE 0-	O	AC	Module XAUI Output Lane 0-
43	GND	I	Supply	Electrical Ground
44	RX LANE 1+	O	AC	Module XAUI Output Lane 1+
45	RX LANE 1-	O	AC	Module XAUI Output Lane 1-
46	GND	I	Supply	Electrical Ground
47	RX LANE 2+	O	AC	Module XAUI Output Lane 2+
48	RX LANE 2-	O	AC	Module XAUI Output Lane 2-
49	GND	I	Supply	Electrical Ground
50	RX LANE 3+	O	AC	Module XAUI Output Lane 3+
51	RX LANE 3-	O	AC	Module XAUI Output Lane 3-
52	GND	I	Supply	Electrical Ground
53	GND	I	Supply	Electrical Ground
54	GND	I	Supply	Electrical Ground
55	TX LANE 0+	I	AC	Module XAUI Input Lane 0+
56	TX LANE 0-	I	AC	Module XAUI Input Lane 0-
57	GND	I	Supply	Electrical Ground
58	TX LANE 1+	I	AC	Module XAUI Input Lane 1+
59	TX LANE 1-	I	AC	Module XAUI Input Lane 1-
60	GND	I	Supply	Electrical Ground
61	TX LANE 2+	I	AC	Module XAUI Input Lane 2+
62	TX LANE 2-	I	AC	Module XAUI Input Lane 2-
63	GND	I	Supply	Electrical Ground
64	TX LANE 3+	I	AC	Module XAUI Input Lane 3+
65	TX LANE 3-	I	AC	Module XAUI Input Lane 3-
66	GND	I	Supply	Electrical Ground
67	Reserved	-	AC	Reserved
68	Reserved	-	AC	Reserved
69	GND	I	Supply	Electrical Ground
70	GND	I	Supply	Electrical Ground



**8. EEPROM Information**

Device Address (Dec) Register Address (Hex)	PMA/PMD 1	PCS 3	PHY XS 4
0x0000	PMA/PMD Control1	PCS Control1	PHY XS Control1
0x0001	PMA/PMD Status1	PCS Status1	PHY XS Status1
0x0002	PMA/PMD Device Identifier0	PCS Device Identifier0	PHY XS Device Identifier0
0x0003	PMA/PMD Device Identifier1	PCS Device Identifier1	PHY XS Device Identifier1
0x0004	PMA/PMD Speed Ability	PCS Speed Ability	PHY XS Speed Ability
0x0005	PMA/PMD Device in Package1	PCS Device in Package1	PHY XS Device in Package1
0x0006	PMA/PMD Device in Package2	PCS Device in Package2	PHY XS Device in Package2
0x0007	10G PMA/PMD Control2	PCS Control2	Reserved
0x0008	10G PMA/PMD Status2	PCS Status2	PHY XS Status2
0x0009	Reserved	Reserved	Reserved
0x000A	Reserved	Reserved	Reserved
0x000E	Reserved	Reserved	Reserved
0x000F	Reserved	Reserved	Reserved
0x0018	Reserved	Reserved	10G PHY XGXS Lane Status
0x0019	Reserved	Reserved	10G PHY XGXS Test Control
0x0020	Reserved	10GBASE-R PCS Status1	Reserved
0x0021	Reserved	10GBASE-R PCS Status2	Reserved
0x0022	Reserved	10GBASE-R PCS Test pattern Seed A0	Reserved
0x0023	Reserved	10GBASE-R PCS Test pattern Seed A1	Reserved
0x0024	Reserved	10GBASE-R PCS Test pattern Seed A2	Reserved
0x0025	Reserved	10GBASE-R PCS Test pattern Seed A3	Reserved
0x0026	Reserved	10GBASE-R PCS Test pattern Seed B0	Reserved
0x0027	Reserved	10GBASE-R PCS Test pattern Seed B1	Reserved
0x0028	Reserved	10GBASE-R PCS Test pattern Seed B2	Reserved
0x0029	Reserved	10GBASE-R PCS Test pattern Seed B3	Reserved
0x002A	Reserved	10GBASE-R PCS	Reserved

		Test pattern Control	
0x002B	Reserved	10GBASE-R PCS Test pattern Error counter	Reserved
0x8000	NVR Control/Status (X2 Register)		Reserved
0x8007 - 0x807D	NVR (X2 Register)		Reserved
0x807E- 0x80AD	Customer AREA		Reserved
0x80AE - 0x8106	Vendor Specific		Reserved
0x9000	RX_ALARM Control (X2 Register)		Reserved
0x9001	TX_ALARM Control (X2 Register)		Reserved
0x9002	LASI Control (X2 Register)		Reserved
0x9003	RX_ALARM Status (X2 Register)		Reserved
0x9004	TX_ALARM Status (X2 Register)		Reserved
0x9005	LASI Status (X2 Register)		Reserved
0x9006	TX_FLAG Control Bits		Reserved
0x9007	RX_FLAG Control Bits		Reserved
0xA000 - 0xA027	Alarm and Warning Thresholds		Reserved
0xA060 - 0xA069	Digital Optical Monitoring Interface		Reserved
0xA06F	DOM Capability - Extended		Reserved
0xA070	TX_ALARM_FLAG Bits		Reserved
0xA071	RX_ALARM_FLAG Bits		Reserved
0xA074	TX_WARNING_FLAG Bits		Reserved
0xA075	RX_WARNING_FLAG Bits		Reserved
0xA100	Optional Digital Optical Monitoring (DOM) Control/Status		Reserved

## 9. 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.

## 10. Mechanical Specifications (Unit: mm)

