

## 14.025Gb/s SFP+ DWDM 20km Transceiver HXSD-BLxx21x

### Features

- Up to 14.025Gb/s data links
- DWDM EML transmitter and PIN receiver
- 100 GHz ITU channel spacing with integrated wavelength locker
- Up to 20km on 9/125um SMF
- Hot-pluggable SFP+ footprint
- Support Digital Monitoring interface
- Duplex LC/UPC type pluggable optical interface
- RoHS-10 compliant and lead-free
- With CDR function
- Single +3.3V power supply
- Compliant with SFF+MSA and SFF-8472
- Metal enclosure, for lower EMI
- Meet ESD requirements, resist 8KV direct contact voltage
- Case operating temperature  
Commercial: 0 ~ +70°C  
Extended: -10 ~ +80°C  
Industrial: -40 ~ +85°C



### Applications

- High-speed storage area networks
- Computer cluster cross-connect
- Custom high-speed data pipes
- Inter Rack Connection
- Other Optical Links

### Part Number Ordering Information

Part Number	Data Rate (Gb/s)	Wavelength (nm)	Transmission Distance(km)	Temperature (°C) (Operating Case)
HXSD-BLxx21C	14.025	Refer to wavelength selection	20	0~70 commercial
HXSD-BLxx21E	14.025		20	-10~80 Extended
HXSD-BLxx21I	14.025		20	-40~85 Industrial

## Wavelength Selection: C-band $\lambda_c$ Wavelength Guide Pin Descriptions

Channel (xx)	Wavelength (nm)	Frequency (THZ)	Channel (xx)	Wavelength (nm)	Frequency (THZ)
17	1563.86	191.70	39	1546.12	193.90
18	1563.05	191.80	40	1545.32	194.00
19	1562.23	191.90	41	1544.53	194.10
20	1561.42	192.00	42	1543.73	194.20
21	1560.61	192.10	43	1542.94	194.30
22	1559.79	192.20	44	1542.14	194.40
23	1558.98	192.30	45	1541.35	194.50
24	1558.17	192.40	46	1540.56	194.60
25	1557.36	192.50	47	1539.77	194.70
26	1556.55	192.60	48	1538.98	194.80
27	1555.75	192.70	49	1538.19	194.90
28	1554.94	192.80	50	1537.40	195.00
29	1554.13	192.90	51	1536.61	195.10
30	1553.33	193.00	52	1535.82	195.20
31	1552.52	193.10	53	1535.04	195.30
32	1551.72	193.20	54	1534.25	195.40
33	1550.92	193.30	55	1533.47	195.50
34	1550.12	193.40	56	1532.68	195.60
35	1549.32	193.50	57	1531.90	195.70
36	1548.51	193.60	58	1531.12	195.80
37	1547.72	193.70	59	1530.33	195.90
38	1546.92	193.80	60	1529.55	196.00
<b>Non-ITU</b>	Peak wavelength between 1528.77nm-1563.86		61	1528.77	196.10

## I. Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Max	Unit	Notes
Storage Temperature	T <sub>S</sub>	-40	85	°C	
Power Supply Voltage	V <sub>CC</sub>	-0.5	3.6	V	
Relative Humidity (non-condensation)	RH	5	95	%	
Damage Threshold	TH <sub>d</sub>	3		dBm	

## II. Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Case Temperature	T <sub>OP</sub>	0		70	°C	commercial
		-10		80		extended
		-40		85		Industrial
Power Supply Voltage	V <sub>CC</sub>	3.135	3.3	3.465	V	
Data Rate			14.025		Gb/s	
Control Input Voltage High		2		V <sub>CC</sub>	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (SMF)	D			20	km	9/125um

## III. General Description

Walsun HXSD-BLxx21x SFP+ transceiver is designed for use fiber channel up to 20km over single mode fiber. The module consists of DWDM EML Laser, PIN and Preamplifier in a high-integrated optical sub-assembly. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472. This module is designed for single mode fiber and operates at a nominal wavelength of 100GHz ITU Grid, C Band DWDM wavelength.

The module optical connection is duplex LC and shall be compatible with SFP+ 14.025Gbps and backward compatible with legacy 10G SFP+ pluggable. The SFP+ DWDM LR module is a dual directional device with a transmitter and receiver plus a control management interface (2-wire interface) in the same physical package. 2-wire interface is used for serial ID, digital diagnostics and module control function.

The transmitter converts 14.025Gbit/s serial PECL or CML electrical data into serial optical data

compliant with the 14.025GBASE-LR standard. An open collector compatible Transmit Disable (Tx\_Dis) is provided. Logic “1” or no connection on this pin will disable the laser from transmitting. Logic “0” on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (Tx\_Fault) is provided. TX\_Fault is module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX\_Fault output contact is an open drain/collector and shall be pulled up to the Vcc\_Host in the host with a resistor in the range 4.7-10 kΩ. TX\_Disable is a module input contact. When TX\_Disable is asserted high or left open, the SFP28 module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor.

The receiver converts 14.025Gbit/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx\_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx\_LOS contact is an open drain/collector output and shall be pulled up to Vcc\_Host in the host with a resistor in the range 4.7-10 kΩ, or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx\_LOS signal is intended as a preliminary indication to the system in which the SFP+ is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

#### IV. Pin Assignment and Pin Description

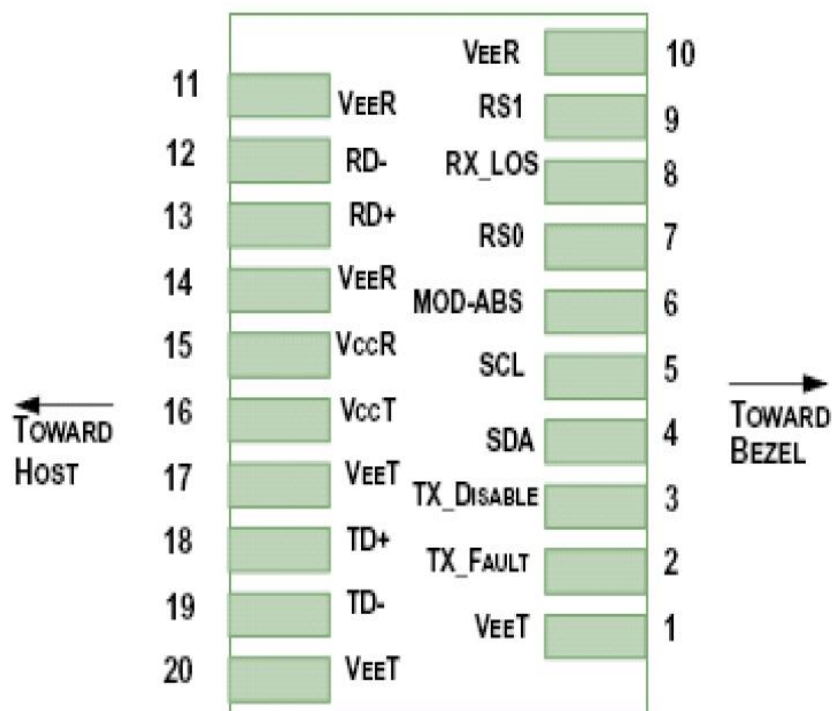


Figure1. Diagram of host board connector block pin numbers and names

PIN	Name	Name/Description	Notes
1	VeeT	Transmitter Ground	1
2	TX_Fault	Transmitter Fault	
3	TX_Disable	Transmitter Disable; Turns off transmitter laser output	
4	SDA	Two wire serial interface Data Line (LVCMOS-I/O) (MOD-DEF2)	2
5	SCL	Two wire serial interface Clock Line (LVCMOS-I/O) (MOD-DEF1)	2
6	MOD_ABS	Module Definition, Grounded in the module	
7	RS0	Rx Rate Select:	
8	RX_LOS	Receiver Loss of Signal Indication Active LOW	
9	RS1	Transmitter Rate Select (not used)	
10	VeeR	Receiver Ground	1
11	VeeR	Receiver Ground	1
12	RD-	Receiver Inverted Data Output	
13	RD+	Receiver Data Output	
14	VeeR	Receiver Ground	1
15	VccR	Receiver Power - +3.3V	
16	VccT	Transmitter Power - +3.3 V	
17	VeeT	Transmitter Ground	1
18	TD+	Transmitter Non-Inverted Data Input	
19	TD-	Transmitter Inverted Data Input	
20	VeeT	Transmitter Ground	1

Notes:

1. Module ground pins GND are isolated from the module case.
2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.47V on the host board.

## V. Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Power Consumption	p			1.75	W	
Supply Current	I <sub>cc</sub>			520	mA	
<b>Transmitter</b>						
Single-ended Input Voltage Tolerance	V <sub>cc</sub>	-0.3		4.0	V	
Common mode voltage tolerance		15			mV	
Differential Input Voltage Swing	V <sub>in,pp</sub>	180		700	mV <sub>pp</sub>	
Differential Input Impedance	Z <sub>in</sub>	90	100	110	Ohm	1
Transmit Disable Assert Time				10	us	
Transmit Disable Voltage	V <sub>dis</sub>	V <sub>cc</sub> -1.3		V <sub>cc</sub>	V	
Transmit Enable Voltage	V <sub>en</sub>	V <sub>ee</sub>		V <sub>ee</sub> +0.8	V	2
<b>Receiver</b>						
Single-ended Input Voltage Tolerance	V <sub>cc</sub>	-0.3		4.0	V	
Differential Output Voltage Swing	V <sub>out,pp</sub>	300		900	mV <sub>pp</sub>	
Differential Output Impedance	Z <sub>out</sub>	90	100	110	Ohm	3
Data output rise/fall time	Tr/Tf	9.5			ps	4
LOS Assert Voltage	V <sub>losH</sub>	V <sub>cc</sub> -1.3		V <sub>cc</sub>	V	5
LOS De-assert Voltage	V <sub>losL</sub>	V <sub>ee</sub>		V <sub>ee</sub> +0.8	V	5

Notes:

1. Connected directly to TX data input pins. AC coupled thereafter.
2. Or open circuit.
3. Input 100 ohms differential termination.
4. These are unfiltered 20-80% values.
5. Loss of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

## VI. Optical Characteristics

The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typ	Max	Unit	Notes
<b>Transmitter</b>						
Optical Wavelength	$\lambda_c$	$\lambda_c - 0.1$		$\lambda_c + 0.1$	nm	1
Center Wavelength Spacing			100		GHz	
Optical Spectral Width	$\Delta\lambda$			1	nm	
Average Optical Power	$P_{AVG}$	-1		4	dBm	2
Side Mode Suppression Ratio	SMSR	30			dB	
Optical Extinction Ratio	ER	4			dB	
Transmitter OFF Output Power	$P_{off}$			-30	dBm	
Transmitter and Dispersion Penalty	TDP			2.7	dB	
Optical Return Loss Tolerance	ORLT			20	dB	
Transmitter Eye Mask	Compliant with IEEE802.3ae					
<b>Receiver</b>						
Center Wavelength	$\lambda_c$	1270		1610	nm	
Receiver Sensitivity	Sen.			-14	dBm	3
Average Receive Power		-17		2	dBm	
Input Saturation Power (overload)	$P_{sat}$	0.5			dBm	
LOS Assert	LOSA	-30			dBm	
LOS De-assert	LOSD			-17	dBm	
LOS Hysteresis	LOSH	0.5			dB	
Damage Threshold	$TH_d$	3			dBm	

Notes:

1.  $\lambda_c$  refer to wavelength selection, and corresponds to approximately 0.8 nm.
2. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
3. Measured with Light source 1528.77~1563.86nm, ER=4dB; BER≤1E-12 @10.3125Gbps, PRBS=2<sup>31</sup>-1 NRZ.

## VII. Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8472 Rev10.2 with internal calibration mode. For external calibration mode please contact our sales staff.

Parameter	Symbol	Min.	Max	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	°C	Over operating temp
Supply voltage monitor absolute error	DMI_VCC	-0.15	0.15	V	Full operating range
RX power monitor absolute error	DMI_RX	-3	3	dB	
Bias current monitor	DMI_bias	-10%	10%	mA	
TX power monitor absolute error	DMI_TX	-3	3	dB	

## VIII. Mechanical Dimensions

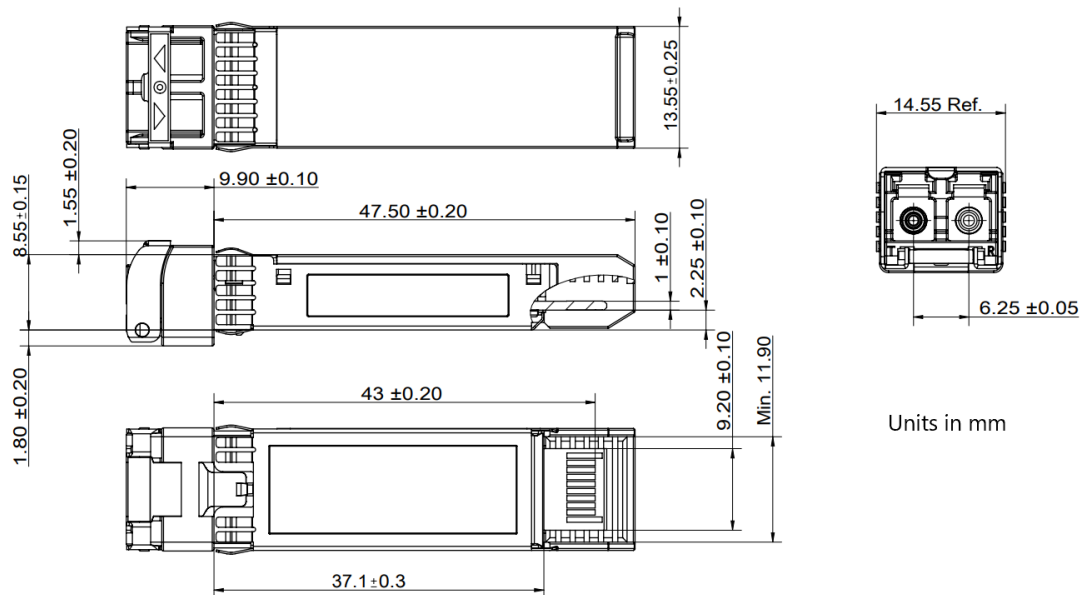


Figure2. Mechanical Outline

## IX. Revision History

Version No.	Initiated	Revised contents	Release Date
1.0	Andy Zhang	Preliminary datasheet	2018-05-22



## **X. Contact us**

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