

WFSX-1696-40XX series

DWDM XFP Single-Mode for 10GbE/10GFC/SDH/SONET
 Duplex XFP Transceiver
 RoHS6 Compliant

Features

- ◆ Supports 9.95Gb/s to 11.1Gb/s bit Rates
- ◆ Hot-Pluggable XFP Footprint
- ◆ Maximum Link Length of 40km
- ◆ Temperature-Stabilized DWDM Rated EML Transmitter
- ◆ 100GHz ITU Grid, C Band
- ◆ Duplex LC Connector
- ◆ Power Dissipation < 3.5W
- ◆ Built-in Digital Diagnostic Functions
- ◆ Operating Case Temperature:
 - Standard: 0°C to 70°C
 - Industrial: -40°C to 85°C



Applications

- ◆ 10GBASE-ER/EW Ethernet
- ◆ 1200-SM-LL-L 10G Fiber Channel
- ◆ SONET OC-192 IR-2
- ◆ SDH STM S-64.2b
- ◆ SONET OC-192 IR-3
- ◆ SDH STM S-64.3b
- ◆ ITU-T G.709

Ordering Information

Part No.	Data Rate	Laser	Distance	Temp.	Optical Interface
WFSX-1696-40X	10Gbps	EML EA	40km	Standard	LC
WFSX-1696-40XI	10Gbps	EML EA	40km	Industrial	LC

X- Channel refers to the following table:

Channel	Part NO.	Frequency (THz)	Center Wavelength (nm)
17*	WFSX-1696-4017	191.7	1563.86
18*	WFSX-1696-4018	191.8	1563.05
19*	WFSX-1696-4019	191.9	1562.23
20*	WFSX-1696-4020	192.0	1561.42
21	WFSX-1696-4021	192.1	1560.61
22	WFSX-1696-4022	192.2	1559.79

23	WFSX-1696-4023	192.3	1558.98
24	WFSX-1696-4024	192.4	1558.17
25	WFSX-1696-4025	192.5	1557.36
26	WFSX-1696-4026	192.6	1556.55
27	WFSX-1696-4027	192.7	1555.75
28	WFSX-1696-4028	192.8	1554.94
29	WFSX-1696-4029	192.9	1554.13
30	WFSX-1696-4030	193.0	1553.33
31	WFSX-1696-4031	193.1	1552.52
32	WFSX-1696-4032	193.2	1551.72
33	WFSX-1696-4033	193.3	1550.92
34	WFSX-1696-4034	193.4	1550.12
35	WFSX-1696-4035	193.5	1549.32
36	WFSX-1696-4036	193.6	1548.51
37	WFSX-1696-4037	193.7	1547.72
38	WFSX-1696-4038	193.8	1546.92
39	WFSX-1696-4039	193.9	1546.12
40	WFSX-1696-4040	194.0	1545.32
41	WFSX-1696-4041	194.1	1544.53
42	WFSX-1696-4042	194.2	1543.73
43	WFSX-1696-4043	194.3	1542.94
44	WFSX-1696-4044	194.4	1542.14
45	WFSX-1696-4045	194.5	1541.35
46	WFSX-1696-4046	194.6	1540.56
47	WFSX-1696-4047	194.7	1539.77
48	WFSX-1696-4048	194.8	1538.98
49	WFSX-1696-4049	194.9	1538.19
50	WFSX-1696-4050	195.0	1537.40
51	WFSX-1696-4051	195.1	1536.61
52	WFSX-1696-4052	195.2	1535.82
53	WFSX-1696-4053	195.3	1535.04
54	WFSX-1696-4054	195.4	1534.25
55	WFSX-1696-4055	195.5	1533.47
56	WFSX-1696-4056	195.6	1532.68
57	WFSX-1696-4057	195.7	1531.90
58	WFSX-1696-4058	195.8	1531.12
59	WFSX-1696-4059	195.9	1530.33
60*	WFSX-1696-4060	196.0	1529.55
61*	WFSX-1696-4061	196.1	1528.77

*This channel is supported with limited availability; please contact WFS for further details.

Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883G Method 3015.7	Class 1C (>1000V)
Electrostatic Discharge to the Enclosure	EN 55024:1998+A1+A2 IEC-61000-4-2 GR-1089-CORE	Compliant with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022: 2006 CISPR 22B: 2006 VCCI Class B	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	EN 55024:1998+A1+A2 IEC 61000-4-3	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits.
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1: 2007 EN (IEC) 60825-2: 2004+A1	CDRH compliant and Class I laser product. TüV Certificate No. 50135086
Component Recognition	UL and CUL EN60950-1: 2006	UL file E317337 TüV Certificate No. 50135086 (CB scheme)
RoHS6	2002/95/EC 4.1&4.2 2005/747/EC 5&7&13	Compliant with standards ^{*note3}

Note3: For update of the equipments and strict control of raw materials, WFS has the ability to supply the customized products since Jan 1st, 2007, which meet the requirements of RoHS6 (Restrictions on use of certain Hazardous Substances) of European Union.

In light of item 5 in RoHS exemption list of RoHS Directive 2002/95/EC, Item 5: Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.

In light of item 13 in RoHS exemption list of RoHS Directive 2005/747/EC, Item 13: Lead and cadmium in optical and filter glass. The three exemptions are being considered for WFS's transceivers, because WFS's transceivers use glass, which may contain Pb, for components such as lenses, isolators, and other components.

Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit
Maximum Supply Voltage 1	Vcc3	-0.5		4.0	V
Maximum Supply Voltage 2	Vcc5	-0.5		6.0	V
Storage Temperature	T _s	-40		85	°C
Case Operating Temperature	T _{OP} , WFSX-1696-X	0		70	°C
	T _{OP} , WFSX-1696-XI	-40		85	

Recommend Operating Condition

Parameter	Symbol	Min	Typ.	Max	Units	Ref.
Operating Temperature	Top	-5		70	°C	
Supply Voltage 1	Vcc3	3.13	3.3	3.45	V	
Supply Voltage 2	Vcc5	4.75	5	5.25	V	

Electrical Characteristics

(TOP = -40 to 85°C, Vcc5 = 4.75 to 5.25 Volt)

Parameter	Symbol	Min	Typ.	Max	Unit	Note	
Main Supply Voltage	Vcc5	4.75		5.25	V		
Supply Voltage #2	Vcc3	3.13		3.45	V		
Supply Current – Vcc5 supply	Icc5			300	mA		
Supply Current – Vcc3 supply	Icc3			750	mA		
Module total power	P			3.5	W		
Transmitter							
Input Differential Impedance	R _{in}		100		Ω	1	
Differential Data Input Swing	V _{in, pp}	120		820	mV		
Transmit Disable Voltage	V _D	2.0		V _{cc}	V		
Transmit Enable Voltage	V _{EN}	GND		GND+0.8	V		
Transmit Disable Assert Time				10	μs		
Receiver							
Differential Data Output Swing	V _{out, pp}	340	650	850	mV		
Data Output Rise Time	T _r			38	ps	2	
Data Output Fall Time	T _f			38	ps	2	
LOS Fault	V _{LOS Fault}	V _{cc} – 0.5		V _{ccHOST}	V	3	
LOS Normal	V _{LOS Normal}	GND		GND+0.5	V	3	
Power Supply Noise Rejection	PSNR	Compliant to Section 2.7.1 of XFP MSA					

Notes:

1. Internal AC coupling.
2. 20% – 80%
3. Loss Of Signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V.
Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics (T_{OP} = -40 to 85°C, V_{cc5} = 4.75 to 5.25 Volt)

Please note that the transmitter becomes operational within 60 seconds of power-up. This is due to the time required for the EML to reach its optimum operating temperature.

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
Output Opt. Pwr: 9/125 SMF	P _{out}	-1		+2	dBm	
Center Wavelength Spacing			100		GHz	
			0.8		nm	
Optical Wavelength-WFS	λ _c	X-100	X	X+100	pm	
Transmitter Center Wavelength –BOL	λ _c	X-25	X	X+25	pm	
Optical Extinction Ratio	ER	8.2			dB	
Transmitter and Dispersion Penalty	TDP			2	dB	
Side Mode Suppression Ratio	SMSR	30			dB	
TX Jitter Generation (peak-to-peak)	TX _j			0.1	UI	
TX Jitter Generation (RMS)	TX _{jRMS}			0.01	UI	
Receiver						
Receiver Sensitivity @ 10.5Gb/s	P _{min}			-16	dBm	
Maximum Input Power	P _{max}	+0.5			dBm	
Optical Center Wavelength	λ _c	1270		1600	nm	
Receiver Reflectance	R _{rx}			-27	dB	
LOS De-Assert	LOSD			-22	dBm	
LOS Assert	LOSA	-28			dBm	
LOS Hysteresis		1			dB	

Pin Descriptions

Pin	Logic	Symbol	Name/Description	Ref.
1		GND	Module Ground	1
2		VEE5	Optional –5.2 Power Supply – Not required	
3	LVTTL-I	Mod-Desel	Module De-select; When held low allows the module to respond to 2-wire serial interface commands	
4	LVTTL-O	Interrupt	Interrupt (bar); Indicates presence of an important condition which can be read over the serial 2-wire interface	2
5	LVTTL-I	TX_DIS	Transmitter Disable; Transmitter laser source turned off	
6		VCC5	+5 Power Supply	
7		GND	Module Ground	1
8		VCC3	+3.3V Power Supply	
9		VCC3	+3.3V Power Supply	

10	LVTTTL-I	SCL	Serial 2-wire interface clock	2
11	LVTTTL-I/O	SDA	Serial 2-wire interface data line	2
12	LVTTTL-O	Mod_Abs	Module Absent; Indicates module is not present. Grounded in the module.	2
13	LVTTTL-O	Mod_NR	Module Not Ready;	2
14	LVTTTL-O	RX_LOS	Receiver Loss of Signal indicator	2
15		GND	Module Ground	1
16		GND	Module Ground	1
17	CML-O	RD-	Receiver inverted data output	
18	CML-O	RD+	Receiver non-inverted data output	
19		GND	Module Ground	1
20		VCC2	+1.8V Power Supply – Not required	
21	LVTTTL-I	P_Down/RST	Power Down; When high, places the module in the low power stand-by mode and on the falling edge of P_Down initiates a module reset	
			Reset; The falling edge initiates a complete reset of the module including the 2-wire serial interface, equivalent to a power cycle.	
22		VCC2	+1.8V Power Supply – Not required	
23		GND	Module Ground	1
24	PECL-I	RefCLK+	Reference Clock non-inverted input, AC coupled on the host board – Not required	3
25	PECL-I	RefCLK-	Reference Clock inverted input, AC coupled on the host board – Not required	3
26		GND	Module Ground	1
27		GND	Module Ground	1
28	CML-I	TD-	Transmitter inverted data input	
29	CML-I	TD+	Transmitter non-inverted data input	
30		GND	Module Ground	1

Notes:

1. Module circuit ground is isolated from module chassis ground within the module.
2. Open collector; should be pulled up with 4.7k – 10k ohm on host board to a voltage between 3.15V and 3.6V.
3. A Reference Clock input is not required.

Host board Connector Pinout

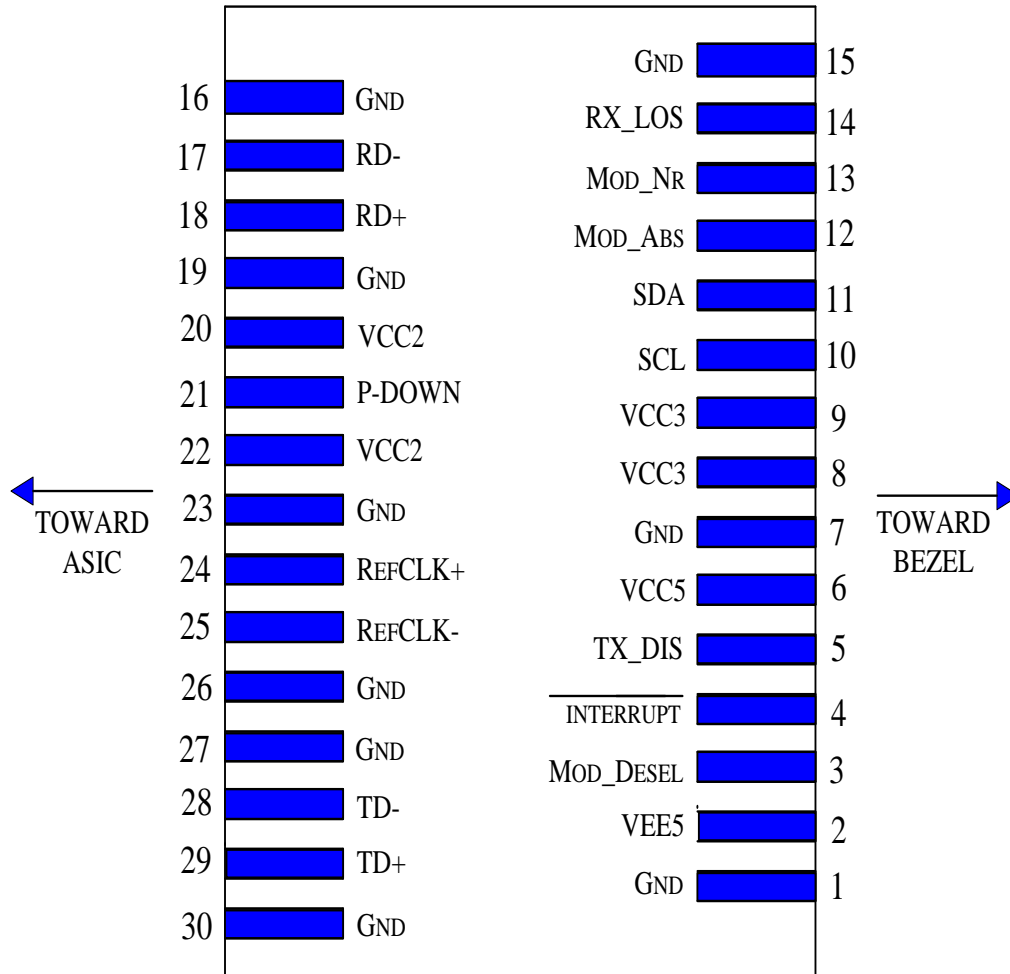


Diagram of Host Board Connector Block Pin Numbers and Name

General Specifications

Parameter	Symbol	Min	Typ.	Max	Units	Ref.
Bit Rate	BR	9.95		11.1	Gbps	1
Bit Error Ratio	BER			10^{-12}		2
Max. Supported Link Length	LMAX		40		km	1

Notes:

1. SONET OC-192 IR-2, OC-192 IR-3, ITU-T G.709, 10GBASE-ER/EW with FEC, 10G Fiber Channel
2. Tested with a $2^{31} - 1$ PRBS

Digital Diagnostic Functions

WFS's WFSX-1696-40X Small Form Factor 10Gbps (XFP) transceivers are compliant with the current XFP Multi-Source Agreement (MSA) Specification Rev 4.5.

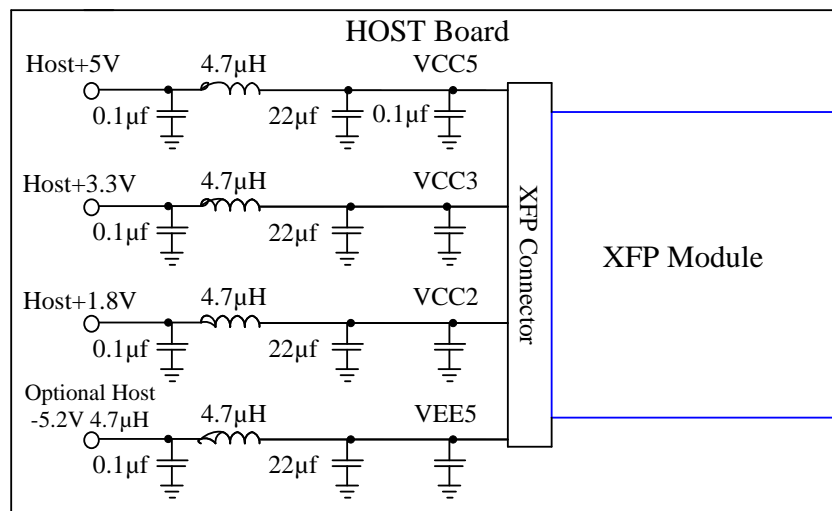
As defined by the XFP MSA, WFS XFP transceivers provide digital diagnostic functions via a 2-wire serial interface, which allows real-time access to the following operating parameters:

- ◆ Transceiver temperature
- ◆ Laser bias current
- ◆ Transmitted optical power
- ◆ Received optical power
- ◆ Transceiver supply voltage

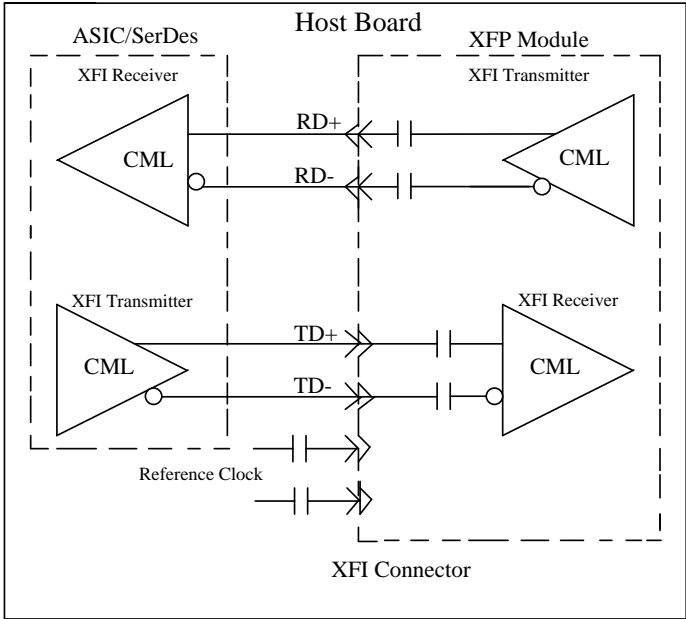
It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller inside the transceiver, which is accessed through the 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL pin) is generated by the host. The positive edge clocks data into the XFP transceiver into those segments of its memory map that are not write-protected. The negative edge clocks data from the XFP transceiver. The serial data signal (SDA pin) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially. The 2-wire serial interface provides sequential or random access to the 8 bit parameters, addressed from 000h to the maximum address of the memory.

Recommended Host Board Power Supply Circuit

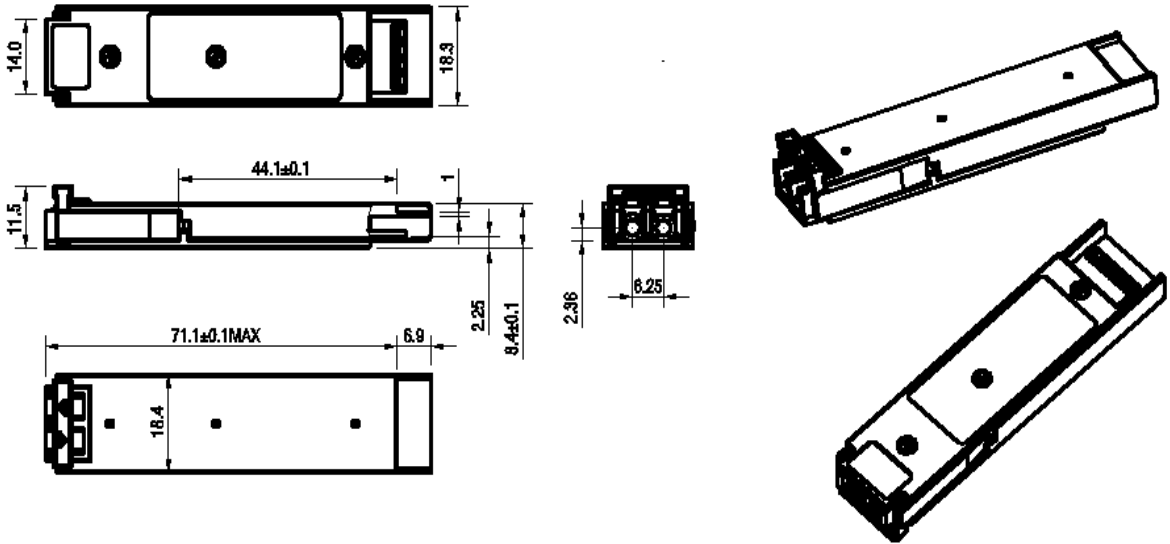


Recommended High-Speed Interface Circuit



Mechanical Specifications

WFS's XFP transceivers are compliant with the dimensions defined by the XFP Multi-Sourcing Agreement (MSA).



Eye Safety

This single-mode transceiver is a Class 1 laser product. It complies with IEC-60825 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug.

Obtaining Document

You can visit our website:

<http://www.wfsnetworks.com>

Or contact WFS listed at the end of the documentation to get the latest documents.

Revision History

Revision	Initiated	Reviewed	Approved	DCN	Release Date
V2.a	Tim.Liang	Kelly.Cao Florence.Dai		Released.	Nov 24, 2008
V2.b	Kelly.Cao			Add the industrial product.	Nov 24, 2009
V2.c	Kelly.Cao			Revise sensitivity description.	Dec 31, 2009
V2.d	Kelly.Cao			Change the logo.	Jan 4, 2010

Notice:

WFS reserves the right to make changes to or discontinue any optical link product or service identified in this publication, without notice, in order to improve design and/or performance. Applications that are described herein for any of the optical link products are for illustrative purposes only. WFS makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

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