

# 10GBASE-LRM XFP 1310nm 220m DOM Duplex LC Transceiver

XFP-10GLRM-31



## Application

- 10GBASE-LRM Ethernet
- Legacy FDDI Multimode Links
- 10G Fibre Channel
- SONET OC-192/SDH STM-64
- Other Optical Links

## Standards

- XFP MSA Compliant

## Features

- Hot Pluggable 30 Pin Connector
- Support Multi Protocol from 9.95Gb/s to 11.3Gb/s
- Duplex LC Connector
- Transmission Distance of 220m over MMF
- Low Power Consumption < 1.5W
- Single 3.3V Supply Voltage
- XFP Electrical Interface with AC Coupling
- 1310nm FP Laser Transmitter
- Operating Case Temperature Range: 0 ~ 70°C
- 2-Wire Interface with Integrated Digital Diagnostic Monitoring

## Description

The 10G XFP Optical Transceiver Module supports up to 220m link lengths over OM3 MMF via an LC duplex connector. The transceiver is compliant with CPRI, eCPRI. Digital diagnostics functions are available via a 2-wire serial interface, as specified in the XFP MSA.

With these features, this 10G SFP+ transceiver is ideal for data centers, 10G fibre channel, legacy FDDI multimode links, etc.

## Product Specifications

### I. Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	$T_{ST}$	-40	85	°C
Case Operating Temperature	$T_C$	0	70	°C
Supply Voltage	$V_{CC3}$	-0.5	4.0	V

### II. Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	$T_{OPR}$	0		70	°C	
Supply Voltage	$V_{CC3}$	3.135		3.465	V	
Supply Current	$I_{CC3}$			380	mA	
Module Total Power	P			1.5	W	

### III. Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>Transmitter</b>						
<b>Operating Bit Rate</b>	BR	9.95		11.3	Gb/s	
<b>Bit Error Rate</b>	BER			10 <sup>-12</sup>		
<b>Launch Power</b>	P <sub>OUT</sub>	-7.3		-1	dBm	1
<b>Optical Wavelength</b>	$\lambda$	1260	1310	1355	nm	
<b>Optical Extinction Ratio</b>	ER	3.5			dB	
<b>RMS Spectral Width</b>	$\lambda_{RMS}$			4	nm	
<b>Rise/Fall Time (20%~80%)</b>	T <sub>r</sub> /T <sub>f</sub>			35	ps	
<b>Average Launch Power of OFF Transmitter</b>	P <sub>OFF</sub>			-30	dBm	
<b>Tx Jitter</b>	T <sub>xj</sub>	Compliant with each Standard Requirements				
<b>Optical Eye Mask</b>		IEEE802.3aq				2
<b>Receiver</b>						
<b>Operating Bit Rate</b>	BR	9.95		11.3	Gb/s	
<b>Receiver Sensitivity</b>	Sen			-11.1	dBm	2
<b>Maximum Input Power</b>	P <sub>MAX</sub>	0			dBm	2
<b>Optical Center Wavelength</b>	$\lambda_C$	1260		1355	nm	
<b>Receiver Reflectance</b>	R <sub>rx</sub>			-12	dB	
<b>LOS De-assert</b>	LOS <sub>D</sub>			-12	dBm	

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>LOS Assert</b>	LOS <sub>A</sub>	-30			dBm	
<b>LOS Hysteresis</b>	LOS <sub>H</sub>	0.5		5	dB	

**Notes:**

1. The optical power is launched into MMF.
2. Measured with a PRBS 231-1 test pattern@10.3125Gbps BER<10<sup>-12</sup>.

**IV. Electrical Characteristics**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>Transmitter</b>						
<b>Input Differential Impedance</b>	R <sub>IN</sub>		100		Ω	1
<b>Differential Data Input Swing</b>	V <sub>IN,PP</sub>	150		820	mV	
<b>Transmit Disable Voltage</b>	V <sub>D</sub>	2.0		V <sub>CC</sub>	V	
<b>Transmit Enable Voltage</b>	V <sub>EN</sub>	GND		GND+0.8	V	
<b>Transmit Disable Assert Time</b>	T <sub>off</sub>			100	ms	
<b>Tx Enable Assert Time</b>	T <sub>on</sub>			100	ms	
<b>Receiver</b>						
<b>Differential Data Output Swing</b>	V <sub>OUT,PP</sub>	300	500	850	mV	
<b>Data Output Rise Time</b>	t <sub>r</sub>			35	ps	2
<b>Data Output Fall Time</b>	t <sub>f</sub>			35	ps	2
<b>LOS Fault</b>	V <sub>LOS fault</sub>	V <sub>CC</sub> -0.5		V <sub>CCHOST</sub>	V	3

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
<b>LOS Normal</b>	$V_{LOS\ norm}$	GND		GND+0.5	V	3
<b>Power Supply Rejection</b>	PSR		See Note 4 Below			4

**Notes:**

1. After 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.
4. Per Section 2.7.1 in the XFP MSA specification.

### V. Pin Definitions

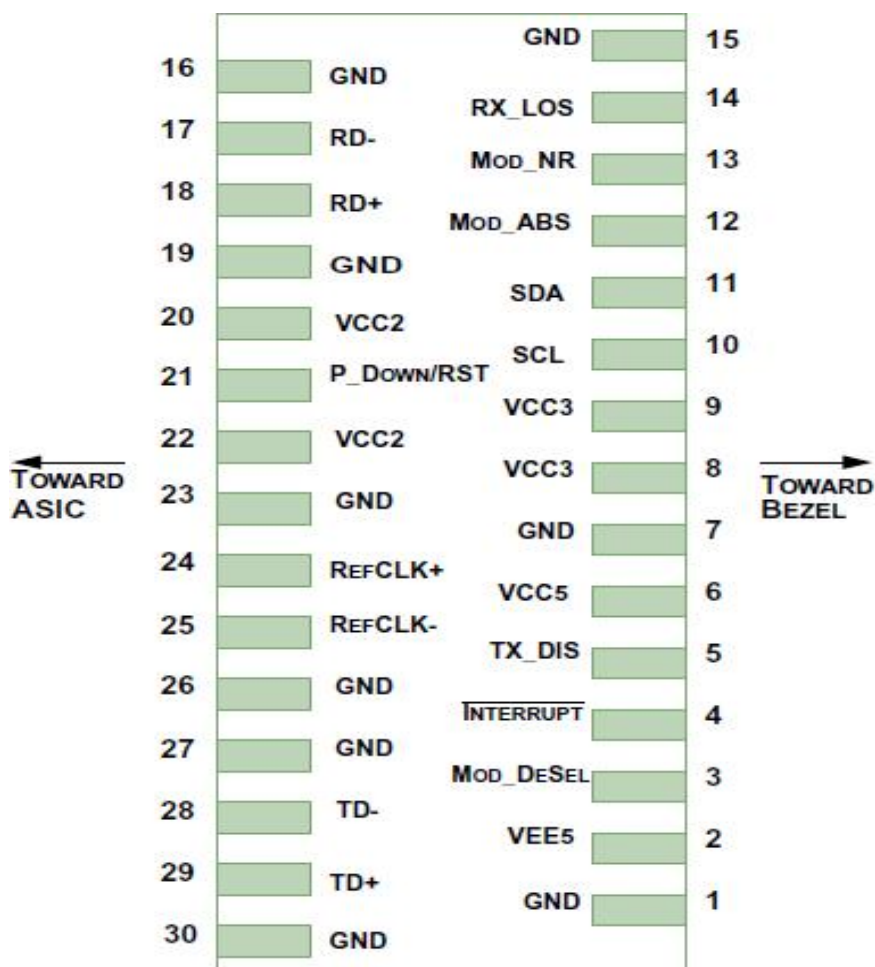


Diagram of Host Board Connector Block Pin Numbers and Name (Top View)

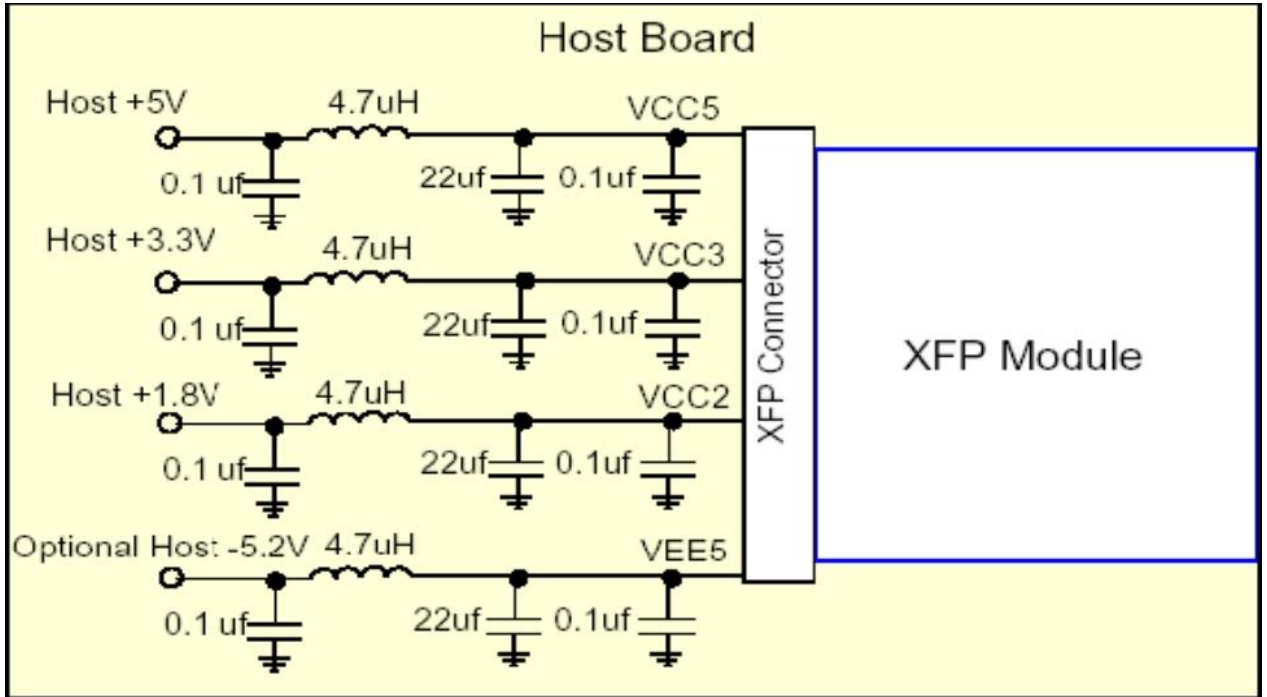
Pin	Logic	Symbol	Name/Description	Ref.
1		GND	Module Ground	1
2		V <sub>EE</sub> 5	Optional-5.2V Power Supply- Not Required	
3	LVTTTL-I	Mod-Desel	Module De-select; When Held Low Allows the Module to, Respond to 2-wire Serial Interface Commands	
4	LVTTTL-O	Interrupt	Interrupt (Bar); Indicates Presence of an Important Condition Which can Be read over the Serial 2-Wire Interface	2
5	LVTTTL-I	Tx_DIS	Transmitter Disable; Transmitter Laser Source Turned off	
6		V <sub>CC</sub> 5	5V Power Supply	
7		GND	Module Ground	1
8		V <sub>CC</sub> 3	3.3V Power Supply	
9		V <sub>CC</sub> 3	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	

Pin	Logic	Symbol	Name/Description	Ref.
18	CML-O	RD+	Receiver Non-Inverted Data Output	
19		GND	Module Ground	1
20		V <sub>CC2</sub>	1.8V Power Supply–Not Required	
21	LVTTL-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		V <sub>CC2</sub>	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

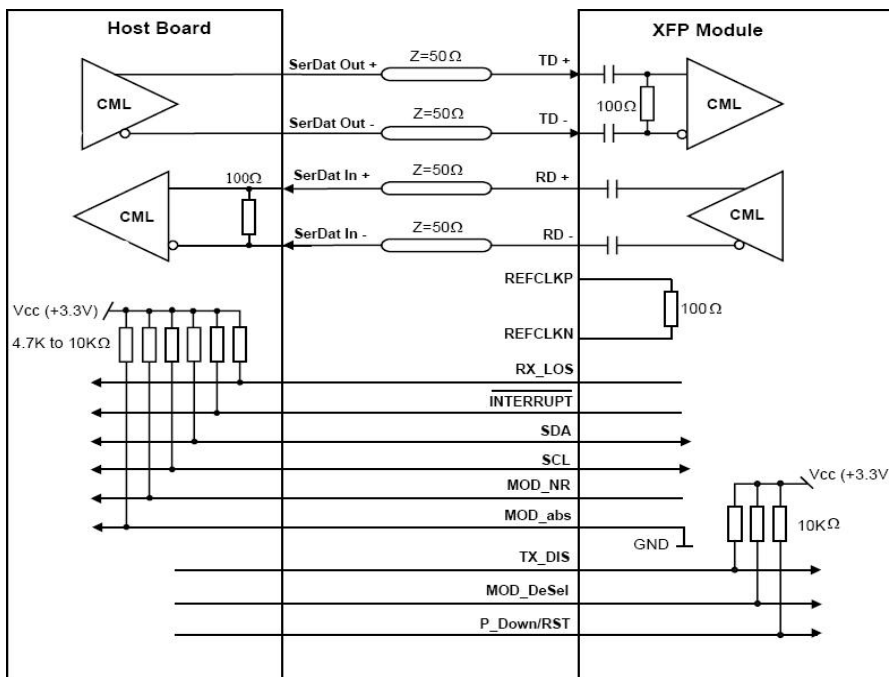
**Notes:**

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

### VI. Recommended Circuit:

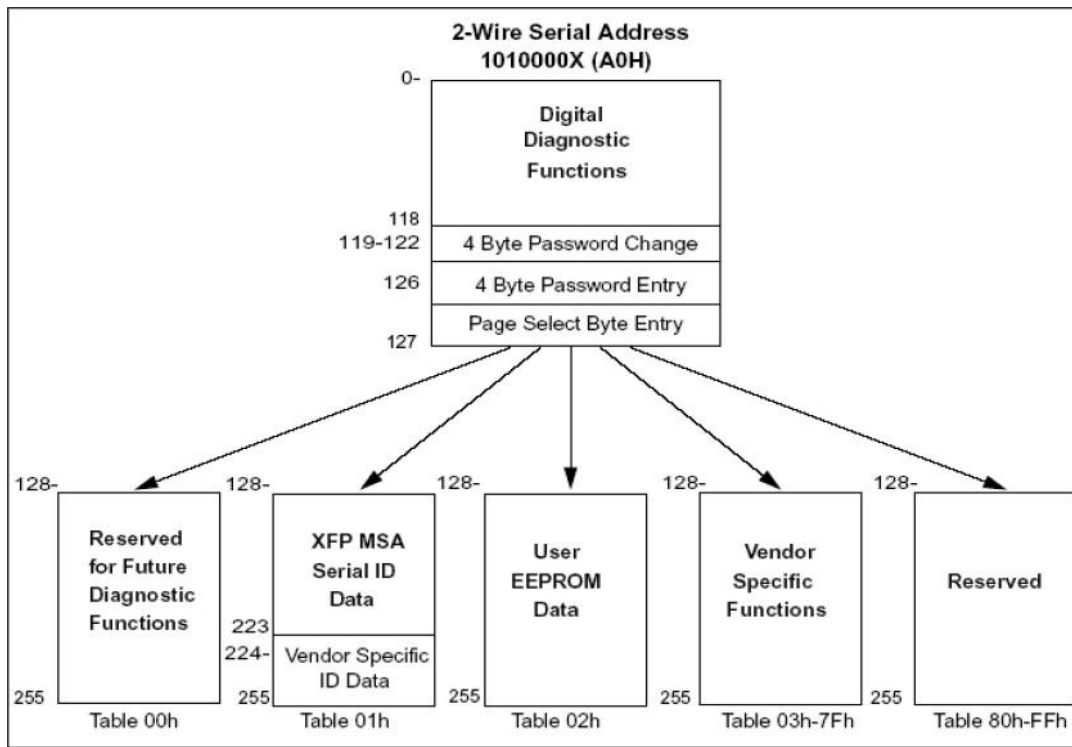


### VII. Recommended Host Board Power Supply Circuit





## VIII. Digital Diagnostic Functions:



As defined by the XFP MSA 1, FS's XFP transceivers provide digital diagnostic functions via a 2-wire serial interface, which allows real-time access to the following operating parameters:

1. Transceiver temperature
2. Laser bias current
3. Transmitted optical power
4. Received optical power
5. Transceiver supply voltage

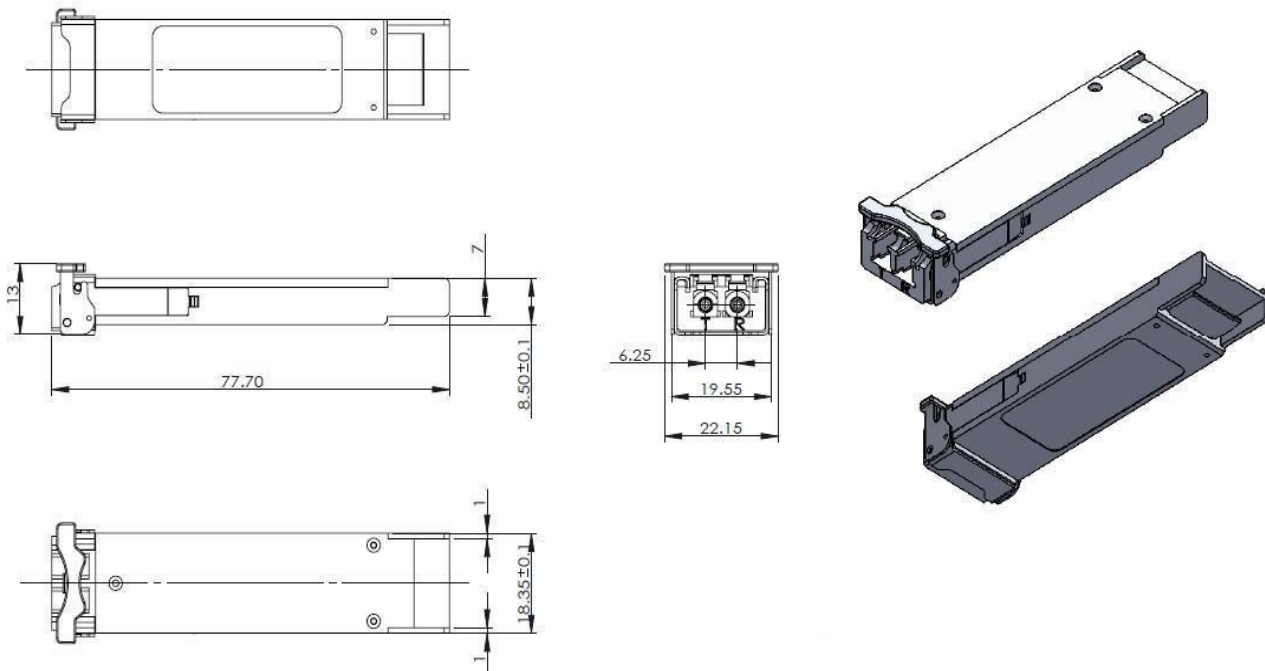
It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) 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.

For more detailed information including memory map definitions, please see the XFP MSA specification.

### IX. Mechanical Specifications

Unit: mm



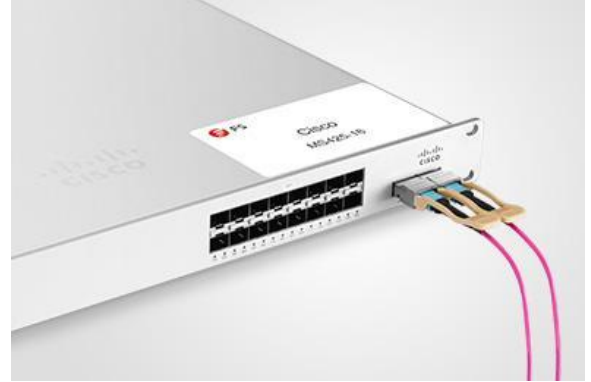
## Test Center

### I. Compatibility Testing

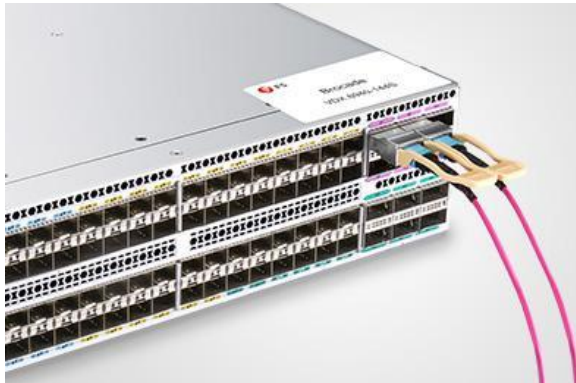
Each fiber optical transceiver has been tested in host device on site in FS Assured Program to ensure full compatibility with over 200 vendors.



Cisco Catalyst C9500-24Y4C



Cisco MS425-16



Brocade VDX 6940-144S



Dell EMC Networking Z9100-ON



Force10 S60-44T

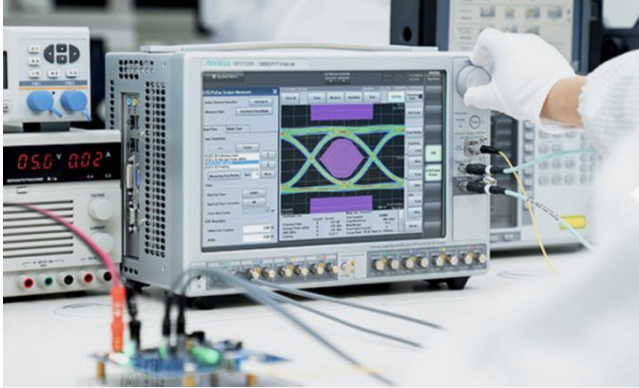


HUAWEI S6720-30L-HI-24S

Above is part of our test bed network equipment. For more information, please click the Test Bed PDF. It will be updated in real time as we expand our portfolio.

## II. Performance Testing

Each fiber optical transceiver has been fully tested in FS Assured Program equipped with world's most advanced analytical equipment to ensure that our transceivers work perfectly on your device.



### 1. TX/RX Signal Quality Testing

Equipped with the all-in-one tester integrated 4ch BERT & sampling oscilloscope, and variable optical attenuator to ensure the input and output signal quality.

- Eye Pattern Measurements: jitter, Mask Margin, etc
- Average Output Power
- OMA
- Extinction Ratio
- Receiver Sensitivity
- BER Curve

### 2. Reliability and Stability Testing

Subject the transceivers to dramatic changes in temperature on the thermal shock chamber to ensure reliability and stability of the transceivers.

- Commercial: 0 °C to 70 °C
- Extended: -5 °C to 85 °C
- Industrial: -40 °C to 85 °C



### 3. Transfer Rate and Protocol Testing

Test the actual transfer data rate and the transmission ability under different protocols with Network Master Pro.

- Ethernet
- Fibre Channel
- SDH/SONET
- CPRI



### 4. Optical Spectrum Evaluation

Evaluate various important parameters with the Optical Spectrum Analyzer to meet the industry standards.

- Center Wavelength, Level
- OSNR
- SMSR
- Spectrum Width



## Order Information

Part Number	Description
SFP-10G-T	10GBASE-T SFP+ Copper RJ-45 30m Transceiver
SFP-10GLRM-31	10GBASE-LRM SFP+ 1310nm 220m DOM Duplex LC Transceiver
XFP-10GLRM-31	10GBASE-LRM XFP 1310nm 220m DOM Duplex LC Transceiver
SFP-10GSR-85	10GBASE-SR SFP+ 850nm 300m DOM Duplex LC Transceiver
SFP-10GLR-31	10GBASE-LR SFP+ 1310nm 10km DOM Duplex LC Transceiver
SFP-10GER-55	10GBASE-ER SFP+ 1550nm 40km DOM Duplex LC Transceiver
SFP-10GZR-55	10GBASE-ZR SFP+ 1550nm 80km DOM Duplex LC Transceiver
XFP-10GZR-55	10GBASE-ZR XFP 1550nm 80km DOM Duplex LC Transceiver
SFP-10GZRC-55	10GBASE-ZR SFP+ 1550nm 100km DOM Transceiver
SFP-10GSR-85	Dual-Rate 1000BASE-SX and 10GBASE-SR SFP+ 850nm 300m DOM Transceiver
SFP-10GLR-31	Dual-Rate 1000BASE-LX and 10GBASE-LR SFP+ 1310nm 10km DOM Transceiver
SFP-10G-T-I	10GBASE-T SFP+ Copper RJ-45 30m Industrial Transceiver
SFP-10GSR-85-I	10GBASE-SR SFP+ 850nm 300m Industrial DOM Transceiver
SFP-10GLR-31-I	10GBASE-LR SFP+ 1310nm 10km Industrial DOM Transceiver
SFP-10GER-31-I	10GBASE-ER SFP+ 1550nm 40km Industrial DOM Transceiver
SFP-10GZR-55-I	10GBASE-ZR SFP+ 1550nm 80km Industrial DOM Transceiver



 <https://www.fs.com>



The information in this document is subject to change without notice. FS has made all efforts to ensure the accuracy of the information, but all information in this document does not constitute any kind of warranty.