

16G Fiber Channel SFP+ 1310nm 10km DOM LC SMF Transceiver

SFP-16GLR-31



Application

- High-Speed Storage Area Networks
- Computer Cluster Cross-Connect
- Custom High-Speed Data Pipes
- Inter Rack Connection

Features

- Up to 14.025Gb/s Data Links
- 1310nm DFB Laser and PIN Receiver
- Up to 10km on 9/125um SMF
- Hot-Pluggable SFP Footprint
- Support Digital Monitoring Interface
- Class 1 Laser Safety Certified
- Cost Effective SFP+ Solution, Enables Higher Port Densities and Greater Bandwidth
- RoHS-10 compliant and Lead-Free
- Single +3.3V Power Supply
- 2-Wire Interface for Management Specifications
- Compliant with SFF-8472
- Digital Diagnostic Monitoring Interface for Optical Transceivers
- All-Metal Housing for Superior EMI Performance
- Case Operating Temperature: Commercial: 0 ~ 70°C

Description

16G fiber channel SFP+ transceiver consists of five sections: the LD driver, the limiting amplifier, the digital diagnostic monitor, the DFB laser and the PIN photo-detector. The module data link up to 10km in 9/125um single mode fiber.

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+ 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 16GBASE-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 16GFC 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.

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
Storage Temperature	T _c	-40	85	°C
Power Supply Voltage	V _{cc}	-0.5	3.6	V
Relative Humidity (Non-Condensation)	RH	5	95	%
Damage Threshold	TH _d	3		dBm

II. Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Case Temperature	Top	0		70	°C	commercial
		-40		85	°C	Industrial
Power Supply Voltage	V _{CC}	3.135	3.3	3.465	V	
Data Rate			14.025		Gb/s	
Control Input Voltage High		2		V _{CC}	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (SMF)	D			10	km	9/125um

III. Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Power Consumption	p			1.75	W	
Supply Current	I _{CC}			520	mA	
Transmitter						
Single-Ended Input Voltage Tolerance	V _{CC}	-0.3		4.0	V	
Common Mode Voltage Tolerance		15			mV	
Differential Input Voltage Swing	V _{in,pp}	180		700	mV	
Differential Input Impedance	Z _{in}	90	100	110	Ohm	1
Transmit Disable Assert Time				100	us	
Transmit Disable Voltage	V _{dis}	V _{CC} -1.3		V _{CC}	V	

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Transmit Enable Voltage	Ven	Vee		Vee +0.8	V	2
Receiver						
Single-Ended Input Voltage Tolerance	V _{CC}	-0.3		4.0	V	
Differential Output Voltage Swing	Vout,pp	300		900	mV	
Differential Output Impedance	Zout	90	100	110	Ohm	3
Data Output Rise/Fall time	Tr/Tf	9.5			ps	4
LOS Assert Voltage	VlosH	V _{CC} -1.3		V _{CC}	V	5
LOS De-Assert Voltage	VlosL	Vee		Vee +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.

IV. Optical Characteristics

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Transmitter						
Center Wavelength	λC	1295	1310	1325	nm	
Optical Spectral Width	Δλ			1	nm	
Average Optical Power	P _{AVG}	-7		2	dBm	1
Side Mode Suppression Ratio	SMSR	30			dB	
Optical Extinction Ratio	ER	3.5			dB	

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Transmitter Off Output Power	Poff			-30	dBm	
Transmitter and Dispersion Penalty	TDP			4.4	dB	
Optical Return Loss Tolerance	ORLT			20	dB	
Transmitter Eye Mask	Compliant with IEEE802.3ae					
Receiver						
Center Wavelength	λC	1295	1310	1325	nm	
Receiver Sensitivity (OMA)	Sen.			-12	dBm	2
Average Receive Power		-18		2	dBm	
Input Saturation Power (overload)	Psat	0.5			dBm	
LOS Assert	LOSA	-30			dBm	
LOS De-assert	LOSD			-17	dBm	
Damage Threshold	THd	3			dBm	
LOS Hysteresis	LOSH	0.5			dB	

- Notes:
- 1. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
 - 2. Measured with Light source 1310nm, ER=3.5dB; BER =<10⁻¹² @ PRBS=2³¹-1 NRZ.

V. 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

Parameter	Symbol	Min.	Max.	Unit	Notes
Supply Voltage Monitor Absolute Error	DMI_V _{CC}	-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	

VI. Pin Assignment

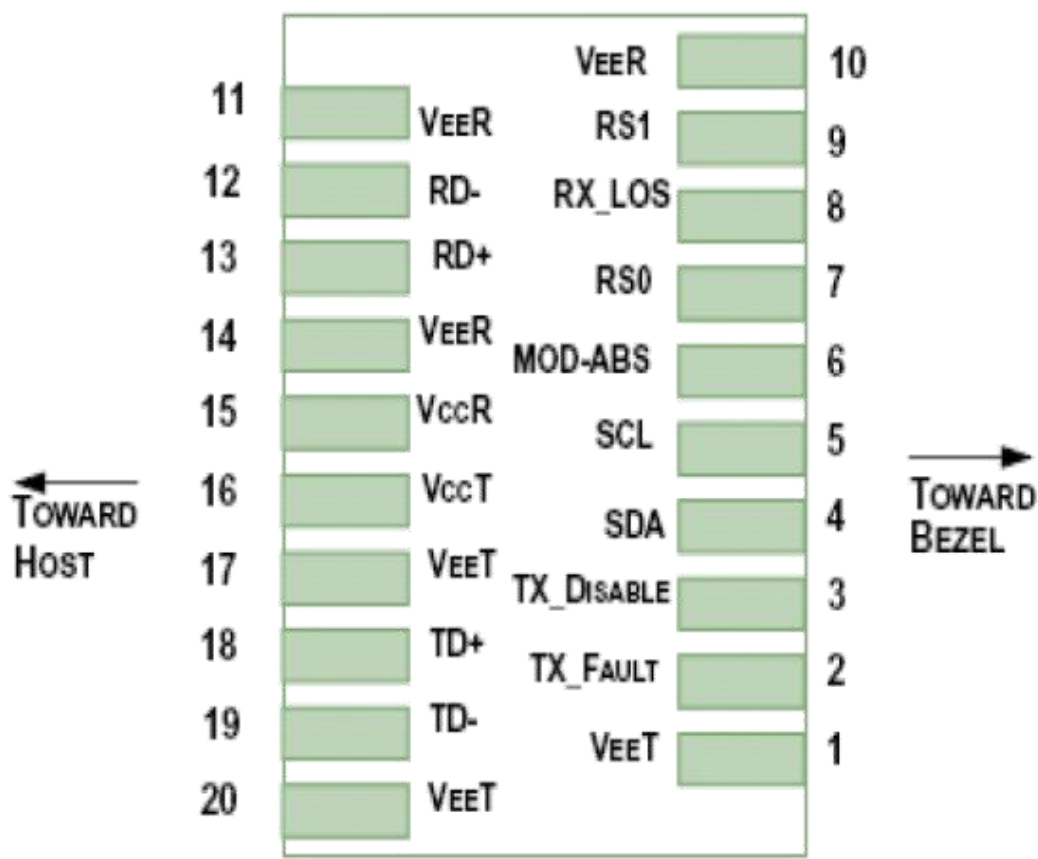


Figure1. Diagram of host board connector block pin numbers and names

VII. Pin Description

PIN	Name	Name/Description	Notes
1	V _{ee} T	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	V _{ee} R	Receiver Ground	1
11	V _{ee} R	Receiver Ground	1
12	RD-	Receiver Inverted Data Output	
13	RD+	Receiver Data Output	
14	V _{ee} R	Receiver Ground	1
15	V _{cc} R	Receiver Power - +3.3V	
16	V _{cc} T	Transmitter Power - +3.3 V	
17	V _{ee} T	Transmitter Ground	1
18	TD+	Transmitter Non-Inverted Data Input	

PIN	Name	Name/Description	Notes
19	TD-	Transmitter Inverted Data Input	
20	V _{ee} T	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.

VIII. Mechanical Dimensions

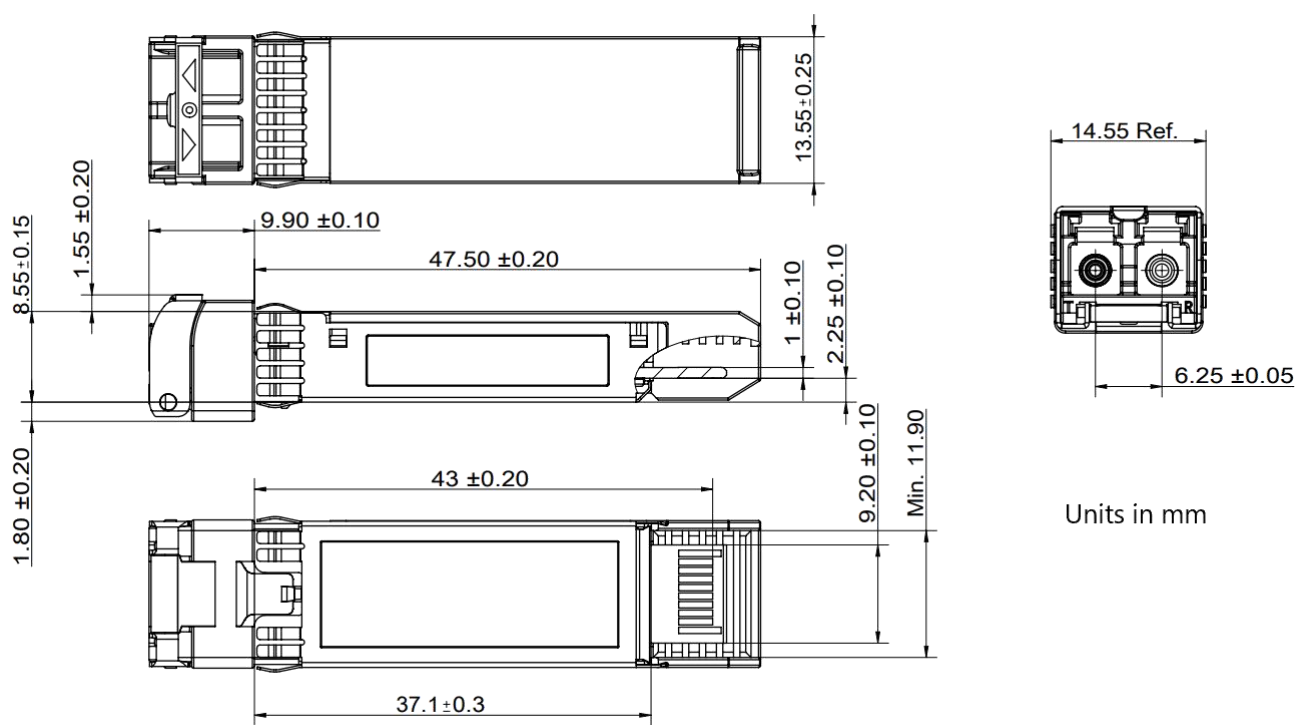


Figure 2. Mechanical Outline

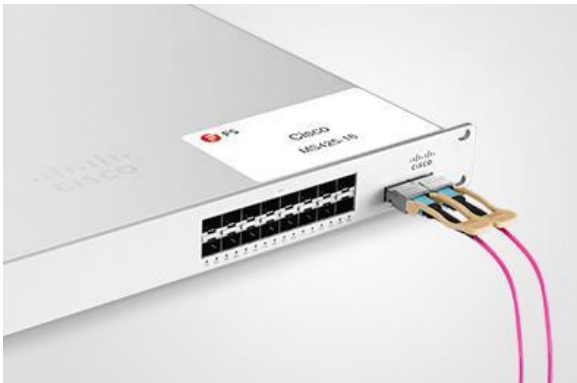
Test Center

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



Force@tm S60-44T

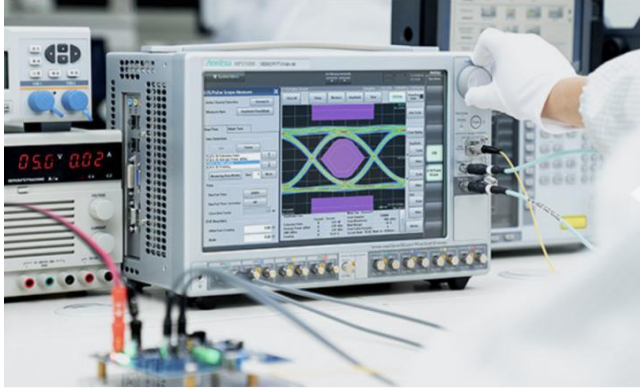


HUAWEI S6720-30L-HI-24S

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.

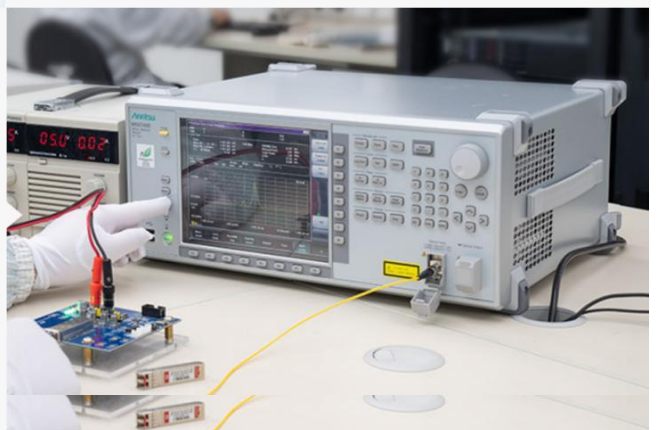
- Ethernet
- Fibre Channel
- SDH/SONET
- CPRI



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



Ordering Information

Part Number	Description
SFP-16GSR-85	16G Fiber Channel SFP+ 850nm 100m DOM LC Transceiver for MMF
SFP-16GLR-31	16G Fiber Channel SFP+ 1310nm 10km DOM LC Transceiver for SMF
SFP-16GER-55	16G Fiber Channel SFP+ 1550nm 40km DOM LC Transceiver for SMF



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