

# 8G Fiber Channel SFP+ 850nm 150m DOM LC MMF Transceiver Module

SFP-10GSR-85



## Application

- 10GBASE-SR/SW Ethernet
- SONET OC-192 / SDH STM-64
- 10G Fibre Channel

## Features

- Supports 8.5 to 11.3Gb/s bit rates
- Hot-Pluggable
- Duplex LC connector
- 850nm VCSEL transmitter, PIN photo-detector
- Maximum link length of 300m on 2000 MHZ-km MMF
- 2-wire interface for management specifications compliant with SFF 8472 digital diagnostic monitoring interface
- Power Supply :+3.3V
- Power consumption<1W
- Temperature Range: 0~ 70° C RoHS compliant

Description

The SFP+ Module is a very compact 10Gb/s optical transceiver module for serial optical communication applications at 10Gb/s. The converts a 10Gb/s serial electrical data stream to 10Gb/s optical output signal and a 10Gb/s optical input signal to 10Gb/s serial electrical data streams. The high speed 10Gb/s electrical interface is fully compliant with SFI specification.

The high performance 850nm VCSEL transmitter and high sensitivity PIN receiver provide superior performance for Ethernet applications at up to 300m links.

The SFP+ Module compliants with SFF-8431, SFF-8432 and IEEE 802.3ae 10GBASE-SR. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472.

The fully SFP compliant form factor provides hot pluggability, easy optical port upgrades and low EMI emission.

I. Absolute Maximum Ratings

| Parameter                | Symbol | Min. | Typical | Max. | Unit |
|--------------------------|--------|------|---------|------|------|
| StorageTemperature       | TS     | -40  |         | +85  | ° C  |
| CaseOperatingTemperature | TA     | 0    |         | 70   | ° C  |
| MaximumSupplyVoltage     | Vcc    | -0.5 |         | 4    | V    |
| RelativeHumidity         | RH     | 0    |         | 85   | %    |

II. Electrical Characteristics (TOP = 0 to 70 ° C, VCC = 3.0 to 3.60 Volts)

| Parameter                                     | Symbol | Min.  | Typical | Max.    | Unit | Note |
|-----------------------------------------------|--------|-------|---------|---------|------|------|
| Supply Voltage                                | Vcc    | 3.135 |         | 3.465   | V    |      |
| SupplyCurrent                                 | Icc    |       |         | 250     | mA   |      |
| PowerConsumption                              | P      |       |         | 1       | W    |      |
| Transmitter Section                           |        |       |         |         |      |      |
| Inputdifferentialimpedance                    | Rin    |       | 100     |         | Ω    | 1    |
| TxInputSingleEndedDCVoltageTolerance(RefVeeT) | V      | -0.3  |         | 4       | V    |      |
| Differentialinputvoltageswing                 | Vin,pp | 180   |         | 700     | mV   | 2    |
| TransmitDisableVoltage                        | VD     | 2     |         | Vcc     | V    | 3    |
| TransmitEnableVoltage                         | VEN    | Vee   |         | Vee+0.8 | V    |      |
| Receiver Section                              |        |       |         |         |      |      |
| SingleEndedOutputVoltageTolerance             | V      | -0.3  |         | 4       | V    |      |
| RxOutputDiffVoltage                           | Vo     | 300   |         | 850     | mV   |      |

|                                |            |       |    |         |    |   |
|--------------------------------|------------|-------|----|---------|----|---|
| <b>RxOutputRiseandFallTime</b> |            | Tr/Tf | 30 |         | ps | 4 |
| <b>LOS Fault</b>               | VLOS fault | 2     |    | VccHOST | V  | 5 |
| <b>LOSNormal</b>               | VLOSnorm   | Vee   |    | Vee+0.8 | V  | 5 |

**Note:**  
1.Connected directly to TX data input pins. AC coupling from pins into laser driver IC.  
2.Per SFF-8431 Rev 3.0  
3.Into 100 ohms differential termination.  
4.20%~80%  
5.LOS is an open collector output. Should be pulled up with 4.7k – 10kΩ on the host board. Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5V.

III. Optical Parameters(TOP = 0 to 70° C, VCC = 3.00 to 3.60 Volts)

| Parameter                           | Symbol | Min. | Typical | Max.  | Unit  | Note |
|-------------------------------------|--------|------|---------|-------|-------|------|
| Transmitter Section                 |        |      |         |       |       |      |
| <b>CenterWavelength</b>             | λt     | 840  | 850     | 860   | nm    |      |
| <b>RMSspectralwidth</b>             | λRMS   |      |         | 4     | nm    |      |
| <b>AverageOpticalPower</b>          | Pavg   | -6   |         | -1    | dBm   | 1    |
| <b>OpticalPowerOMA</b>              | Poma   |      | -1.5    |       | dBm   |      |
| <b>LaserOffPower</b>                | Poff   |      |         | -30   | dBm   |      |
| <b>ExtinctionRatio</b>              | ER     | 3.5  |         |       | dB    |      |
| <b>TransmitterDispersionPenalty</b> | TDP    |      |         | 3.9   | dB    | 2    |
| <b>RelativeIntensityNoise</b>       | Rin    |      |         | -128  | dB/Hz | 3    |
| <b>OpticalReturnLossTolerance</b>   |        | 20   |         |       | dB    |      |
| Receiver Section                    |        |      |         |       |       |      |
| <b>CenterWavelength</b>             | λr     | 790  |         | 870   | nm    |      |
| <b>ReceiverSensitivity(OMA)</b>     | Sen    |      |         | -11.1 | dBm   | 4    |
| <b>StressedSensitivity(OMA)</b>     | SenST  |      |         | -7.5  | dBm   | 4    |
| <b>LosAssert</b>                    | LOSA   | -30  |         | -     | dBm   |      |
| <b>LosDessert</b>                   | LOSD   |      |         | -12   | dBm   |      |
| <b>LosHysteresis</b>                | LOSH   | 0.5  |         |       | dB    |      |
| <b>Overload</b>                     | Sat    | 0    |         |       | dBm   | 5    |
| <b>ReceiverReflectance</b>          | Rrx    |      |         | -12   | dB    |      |

**Note:**

- 1.Average power figures are informative only, per IEEE802.3ae.
- 2.TWDP figure requires the host board to be SFF-8431 compliant. TWDP is calculated using the Matlab code provided in clause 68.6.6.2 of IEEE802.3ae.
- 3.12dB reflection.
- 4.Conditions of stressed receiver tests per IEEE802.3ae. CSRS testing requires the host board to be SFF-8431 compliant.
- 5.Receiver overload specified in OMA and under the worst comprehensive stressed condition.

**IV. Timing Characteristics**

| Parameter                             | Symbol         | Min. | Typical | Max. | Unit |
|---------------------------------------|----------------|------|---------|------|------|
| TX_DisableAssertTime                  | t_off          |      |         | 10   | us   |
| TX_DisableNegateTime                  | t_on           |      |         | 1    | ms   |
| TimetoInitializeIncludeResetoTX_FAULT | t_int          |      |         | 300  | ms   |
| TX_FAULTfromFaulttoAssertion          | t_fault        |      |         | 100  | us   |
| TX_DisableTimetoStartReset            | t_reset        | 10   |         |      | us   |
| ReceiverLossofSignalAssertTime        | TA,RX_LOS      |      |         | 100  | us   |
| ReceiverLossofSignalDeassertTime      | Td,RX_LOS      |      |         | 100  | us   |
| Rate-SelectChageTime                  | t_ratesel      |      |         | 10   | us   |
| SerialIDClockTime                     | t_serial-clock |      |         | 100  | kHz  |

**V. General Specifications**

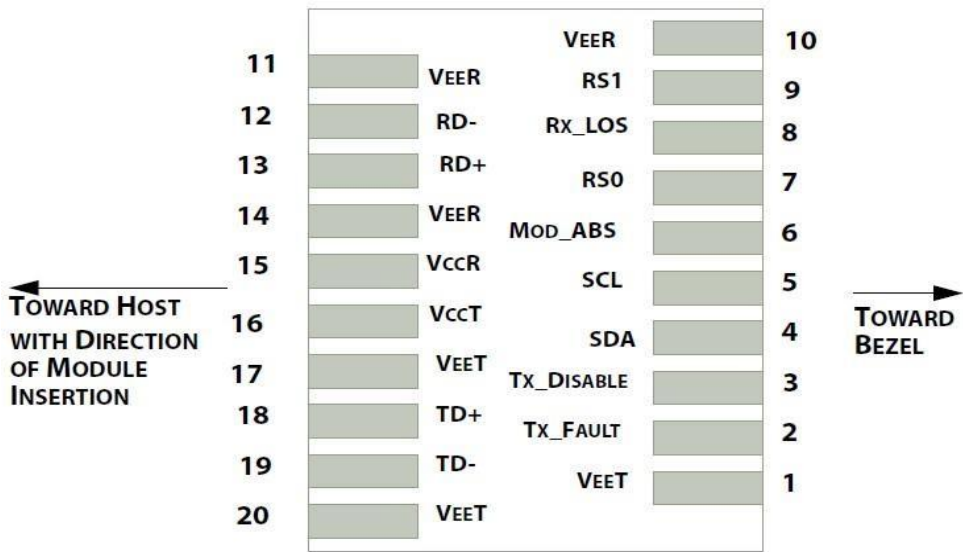
| Parameter                   | Symbol            | Min. | Typical | Max.  | Unit | Note |
|-----------------------------|-------------------|------|---------|-------|------|------|
| BitRate                     | BR                | 9.95 |         | 11.3  | Gb/s |      |
| BitErrorRatio               | BER               |      |         | 10-12 |      |      |
| Maximum Supported Distances |                   |      |         |       |      |      |
| FiberType                   | 850nmOFLBandwidth |      |         |       |      |      |
| 62.5μm                      | 160MHz-km         |      |         | 26    | m    |      |
|                             | OM1200 MHz-km     |      |         | 33    | m    |      |
|                             | 400MHz-km         |      |         | 66    | m    |      |
| 50μm                        | OM2500 MHz-km     |      |         | 82    | m    |      |
|                             | OM32000 MHz-km    |      |         | 300   | m    |      |
|                             | OM34700 MHz-km    |      |         | 500   | m    |      |

VI. Timing Characteristics

| Parameter                                   | Symbol         | Min. | Typical | Max. | Unit |
|---------------------------------------------|----------------|------|---------|------|------|
| TX_DisableAssertTime                        | t_off          |      |         | 10   | us   |
| TX_DisableNegateTime                        | t_on           |      |         | 1    | ms   |
| Time to Initialize Include Reset ofTX_FAULT | t_int          |      |         | 300  | ms   |
| TX_FAULTfromFaulttoAssertion                | t_fault        |      |         | 100  | us   |
| TX_DisableTimetoStartReset                  | t_reset        | 10   |         |      | us   |
| ReceiverLossofSignalAssertTime              | TA,RX_LOS      |      |         | 100  | us   |
| ReceiverLossofSignalDeassertTime            | Td,RX_LOS      |      |         | 100  | us   |
| Rate-SelectChageTime                        | t_ratesel      |      |         | 10   | us   |
| SerialIDClockTime                           | t_serial-clock |      |         | 100  | kHz  |

VII. Pin Assignment

Diagram of Host Board Connector Block Pin Numbers and Name



VIII. Pin Function Definitions

| PIN | Logic     | Symbol   | Name/ Description                                 | Note |
|-----|-----------|----------|---------------------------------------------------|------|
| 1   |           | VeeT     | ModuleTransmitterGround                           | 1    |
| 2   | LVTTL-O   | TX_Fault | ModuleTransmitterFault                            | 2    |
| 3   | LVTTL-I   | TX_Dis   | TransmitterDisable;Turnsofftransmitterlaseroutput | 3    |
| 4   | LVTTL-I/O | SDA      | 2-WireSerialInterfaceDataLine                     |      |
| 5   | LVTTL-I   | SCL      | 2-WireSerialInterfaceClock                        |      |
| 6   |           | MOD_DEF0 | ModuleDefinition,Groundedinth module              | 2    |

|    |          |        |                                               |   |
|----|----------|--------|-----------------------------------------------|---|
| 7  | LVTTTL-I | RS0    | ReceiverRateSelect                            |   |
| 8  | LVTTTL-O | RX_LOS | Receiver Loss of Signal Indication Active LOW | 4 |
| 9  | LVTTTL-I | RS1    | TransmitterRateSelect(notused)                |   |
| 10 |          | VeeR   | ModuleReceiver Ground                         | 1 |
| 11 |          | VeeR   | ModuleReceiver Ground                         | 1 |
| 12 | CML-O    | RD-    | ReceiverInvertedDataOutput                    |   |
| 13 | CML-O    | RD+    | ReceiverDataOutput(notused)                   |   |
| 14 |          | VeeR   | ModuleReceiver Ground                         | 1 |
| 15 |          | VccR   | ModuleReceiver 3.3VSupply                     |   |
| 16 |          | VccT   | ModuleReceiver 3.3VSupply                     |   |
| 17 |          | VeeT   | ModuleTransmitterGround                       | 1 |
| 18 | CML-I    | TD+    | TransmitterNon-InvertedDataInput              |   |
| 19 | CML-I    | TD-    | TransmitterInvertedDataInput                  |   |
| 20 |          | VeeT   | ModuleTransmitterGround                       | 1 |

Notes:

- 1.The module ground pins shall be isolated from the module case.
- 2.This pin is an open collector/drain output pin and shall be pulled up with 4.7K-10Kohms to Host\_Vcc on the host board.
- 3.This pin shall be pulled up with 4.7K-10Kohms to VccT in the module.
- 4.This pin is an open collector/drain output pin and shall be pulled up with 4.7K-10Kohms to Host\_Vcc on the host board.

IX. SFP Module EEPROM Information and Management

The SFP modules implement the 2-wire serial communication protocol as defined in the SFP -8472. The serial ID information of the SFP modules and Digital Diagnostic Monitor parameters can be accessed through the I2C interface at address A0h and A2h. The memory is mapped in Table 1. Detailed ID information (A0h) is listed in Table 2. And the DDM specification at address A2h. For more details of the memory map and byte definitions, please refer to the SFF-8472, “Digital Diagnostic Monitoring Interface for Optical Transceivers”. The DDM parameters have been internally calibrated.

Table 1. Digital Diagnostic Memory Map (Specific Data Field Descriptions)

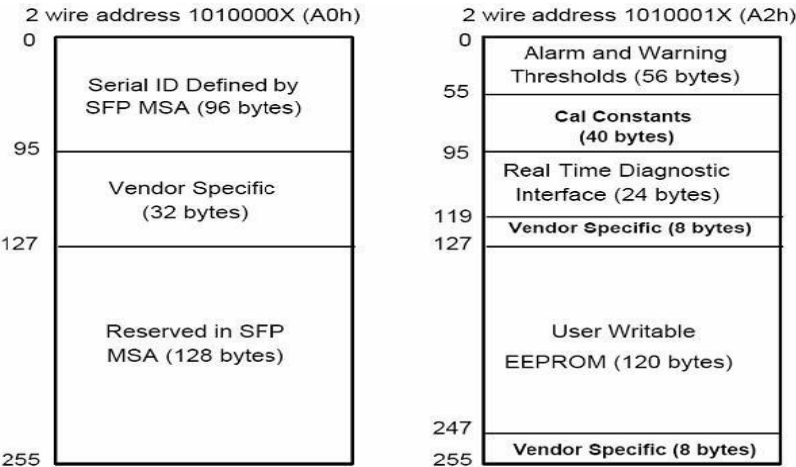


Table 2 - EEPROM Serial ID Memory Contents (A0h)

| DataAddress               | Length(Byte) | Name ofLength  | DescriptionandContents                                                                   |
|---------------------------|--------------|----------------|------------------------------------------------------------------------------------------|
| Base ID Fields            |              |                |                                                                                          |
| 0                         | 1            | Identifier     | TypeofSerialtransceiver(03h=SFP)                                                         |
| 1                         | 1            | Reserved       | Extendedidentifieroftypeserialtransceiver(04h)                                           |
| 2                         | 1            | Connector      | Codeof optical connectortype(07=LC)                                                      |
| 3-10                      | 8            | Transceiver    | 10GBase-SR                                                                               |
| 11                        | 1            | Encoding       | 64B/66B                                                                                  |
| 12                        | 1            | BR,Nominal     | Nominal baudrate, unitof100Mbps                                                          |
| 13-14                     | 2            | Reserved       | (0000h)                                                                                  |
| 15                        | 1            | Length(9um)    | Linklengthsupportedfor9/125umfiber,unitsof100m                                           |
| 16                        | 1            | Length(50um)   | Linklengthsupportedfor50/125umfiber,unitsof10m                                           |
| 17                        | 1            | Length(62.5um) | Linklengthsupportedfor62.5/125umfiber,unitsof10m                                         |
| 18                        | 1            | Length(Copper) | Linklengthsupportedforcopper,unitsofmeters                                               |
| 19                        | 1            | Reserved       |                                                                                          |
| 20-35                     | 16           | VendorName     | SFPvendorname:FS                                                                         |
| 36                        | 1            | Reserved       |                                                                                          |
| 37-39                     | 3            | VendorOUI      | SFPtransceivervendorOUIID                                                                |
| 40-55                     | 16           | VendorPN       | PartNumber:""(ASCII)                                                                     |
| 56-59                     | 4            | Vendorrev      | Revisionlevelforpartnumber                                                               |
| 60-62                     | 3            | Reserved       |                                                                                          |
| 63                        | 1            | CCID           | Leastsignificant byteof sumofdata inaddress0-62                                          |
| Extended ID Fields        |              |                |                                                                                          |
| 64-65                     | 2            | Option         | IndicateswhichopticalSFPsignalsareimplemented(001Ah=LOS,TX_FAULT,TX_DISABLEallsupported) |
| 66                        | 1            | BR,max         | Upperbitratemargin,unitsof%                                                              |
| 67                        | 1            | BR,min         | Lowerbitratemargin,unitsof%                                                              |
| 68-83                     | 16           | VendorSN       | SerialNumber(ASCII)                                                                      |
| 84-91                     | 8            | Date code      | FS'sManufacturingdatecode                                                                |
| 92-94                     | 3            | Reserved       |                                                                                          |
| 95                        | 1            | CCEX           | Checkcode forthextended IDFields (addresses64to 94)                                      |
| Vendor Specific ID Fields |              |                |                                                                                          |
| 96-127                    | 32           | Readable       | FSspecificdate,readonly                                                                  |
| 128-255                   | 128          | Reserved       | ReservedforSFF-8079                                                                      |

X. Digital Diagnostic Monitor Characteristics)

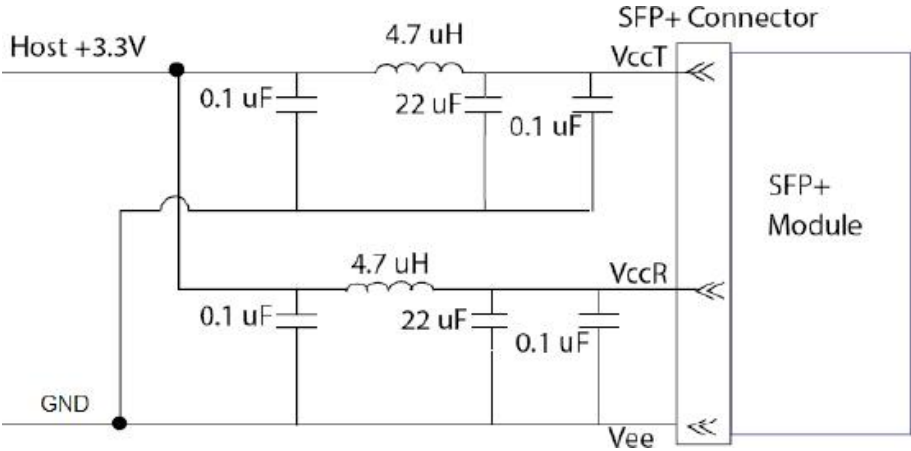
| DataAddress | Parameter                      | Accuracy | Unit |
|-------------|--------------------------------|----------|------|
| 96-97       | TransceiverInternalTemperature | ± 3.0    | ° C  |
| 98-99       | VCC3Internal SupplyVoltage     | ± 5.0    | %    |
| 100-101     | LaserBias Current              | ± 10     | %    |
| 102-103     | TxOutput Power                 | ± 3.0    | dBm  |
| 104-105     | RxInput Power                  | ± 3.0    | dBm  |

XI. Regulatory Compliance

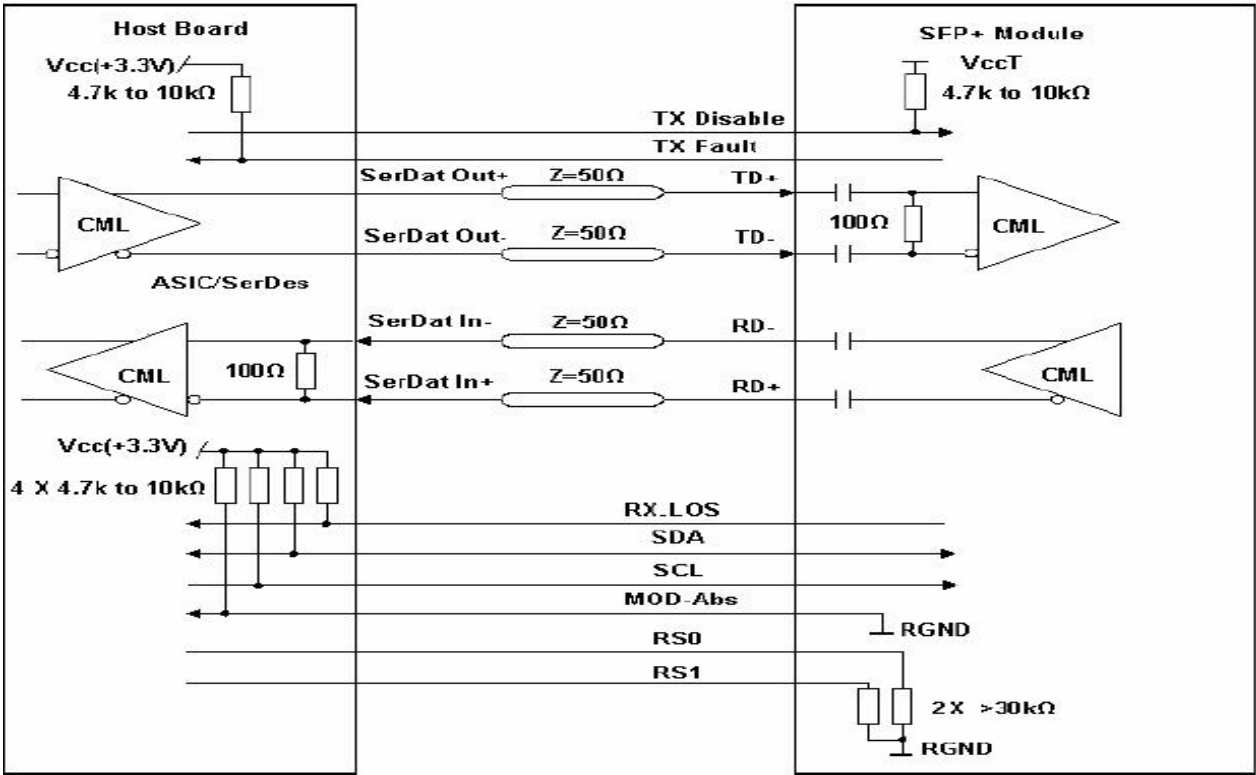
The complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

|                                                        |                                                       |                                   |
|--------------------------------------------------------|-------------------------------------------------------|-----------------------------------|
| ElectrostaticDischarge(ESD)totheElectricalPin<br>s     | MIL-STD-883EMethod3015.7                              | Class1(>1000V)                    |
| ElectrostaticDischarge(ESD)totheDuplexLCRe<br>ceptacle | IEC61000-4-2GR-1089-CORE                              | Compatiblewithstandards           |
| ElectromagneticInterference(EMI)                       | FCCPart15ClassBEN55022Class B(CISPR<br>22B)VCCIClassB | Compatiblewithstandards           |
| LaserEye Safety                                        | FDA21CFR1040.10and<br>1040.11EN60950,EN(IEC)60825-1,2 | CompatiblewithClass1laserproduct. |

XII. Recommended Circuit

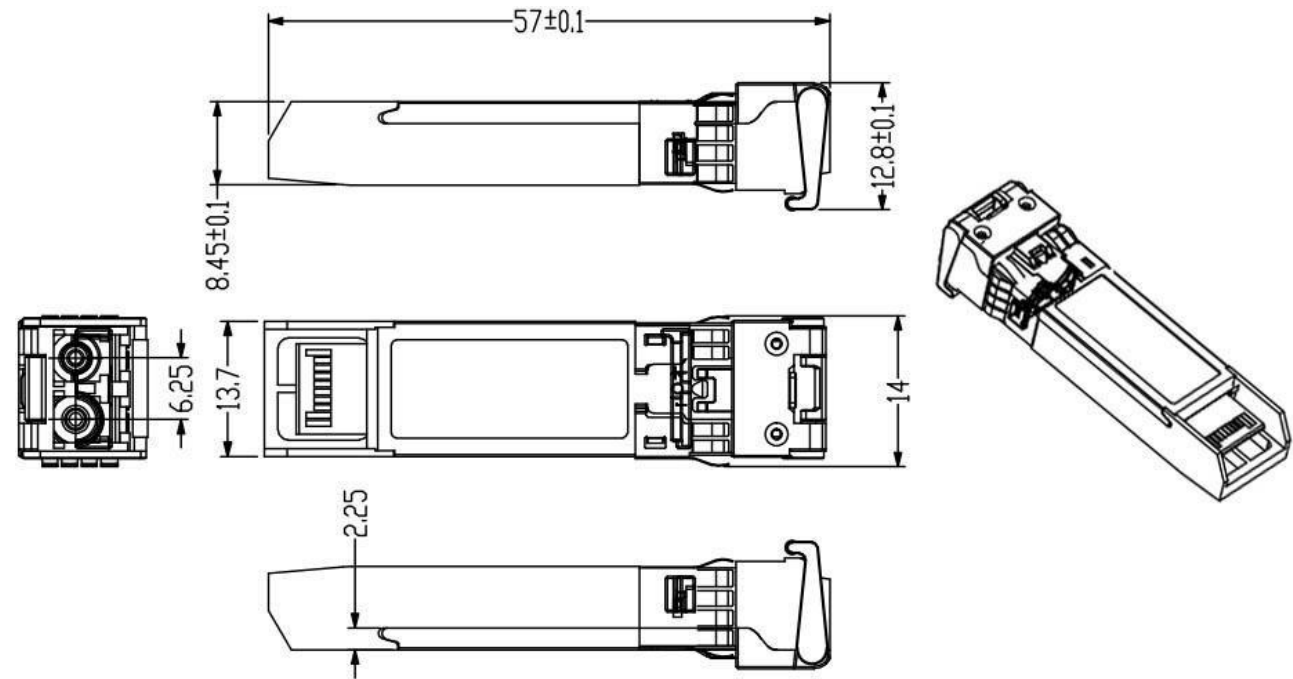






Recommended High-speed Interface Circuit

XIII. Mechanical Dimensions



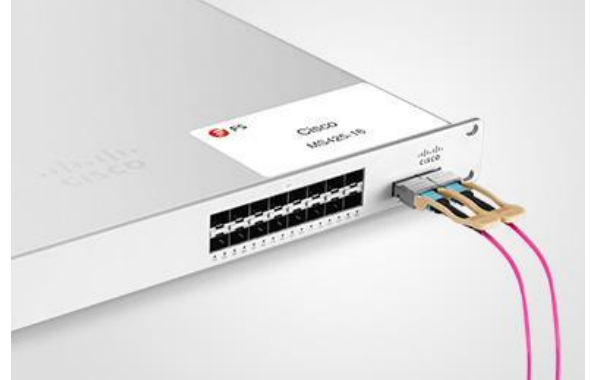
## Test Center

### I. Compatibility Testing

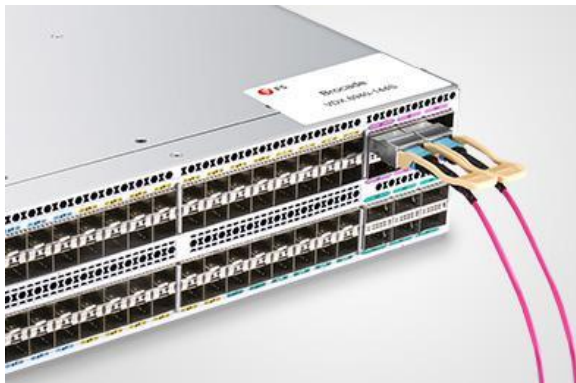
Each fiber optical transceiver has been tested in host device on site in FS Assured Program to ensure full compatibility with over 200 vendors.



Cisco Catalyst C9500-24Y4C



Cisco MS425-16



Brocade VDX 6940-144S



Dell EMC Networking Z9100-ON



Force10 S60-44T

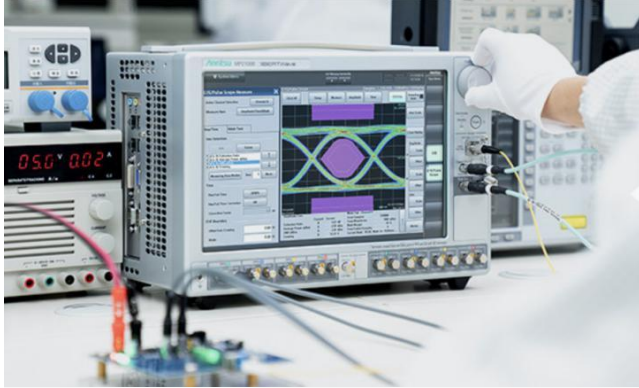


HUAWEI S6720-30L-HI-24S

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.

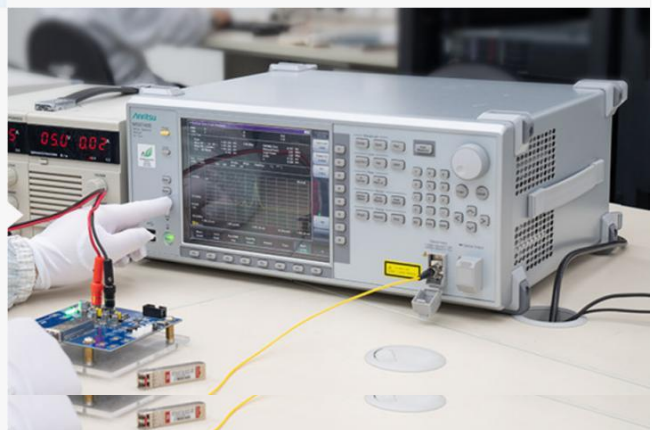
- Ethernet
- Fibre Channel
- SDH/SONET
- CPRI

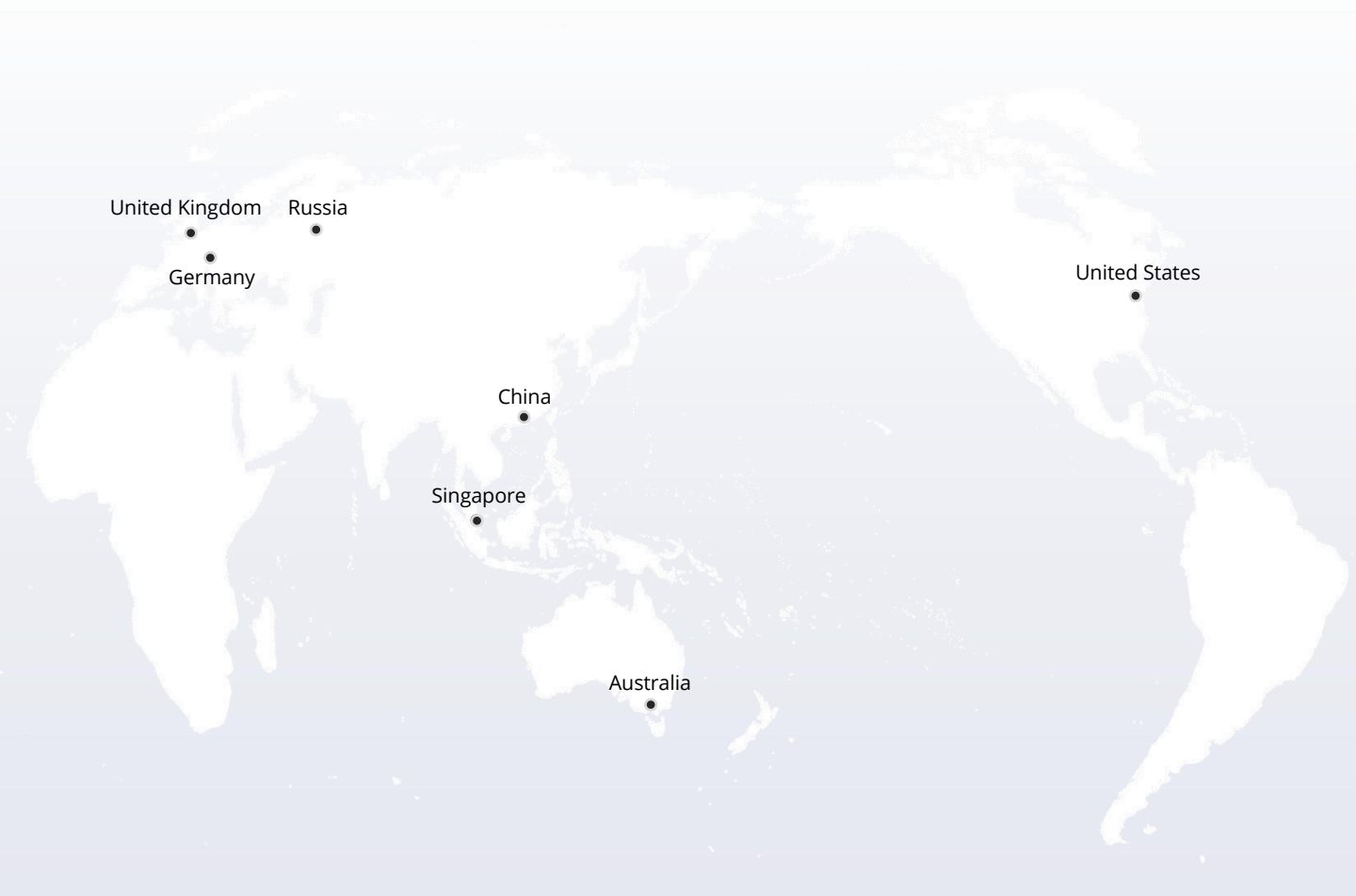


### 4. Optical Spectrum Evaluation

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

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





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