

10GBASE-ER SFP+ 1550nm 40km Industrial DOM Duplex LC Transceiver

SFP-10GER-55-I



Application

- 10GBASE-LR at 10.31Gbps
- 10GBASE-LW at 9.95Gbps

Standards

- SFF-8431
- SFF-8432
- SFF-8472
- 10GFC Rev 4.0
- 10GBASE-ER

Features

- High Sensitivity Receiver
- 1550nm EML Transmitter
- Power Dissipation<1.8W
- Hot-pluggable Duplex LC Connector Interface
- Single 3.3V Power Supply and TTL Logic Interface
- 2-Wire Interface with Integrated Digital Diagnostic Monitoring
- Industrial Temperature Range: -40~ 85°C

Description

The 10G ER SFP+ Optical Transceiver Module supports up to 40km link lengths over SMF. The transceiver is compliant with SFF-8431, SFF-8432, 10GFC Rev 4.0, and 10GBASE-ER. Digital diagnostics functions are available via a 2-wire serial interface, as specified in the SFF-8472.

The SFP-10GER-55-I is for industrial operating temperature range and can work in harsh industrial environments, such as telecommunication, data processing and management, the application of industrial and factory automation, outdoor applications, rail and intelligent transportation systems (ITSs), marine, oil and gas, mining etc.

Product Specifications

I. Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T_s	-40	85	°C
Operating Relative Humidity	RH		95	%
Maximum Supply Voltage	V_{CC}	-0.5	3.6	V

Note

1. Exceeding any one of these values may destroy the device immediately.

II. Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Budget		14			dB
Data Rate		0.6	9.953/10.3125		Gbps

Transmitter

Center Wavelength	λ_c	1528	1550	1565	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Average Output Power ^① (Note1)	P_{out}	-2		4	dBm

Parameter	Symbol	Min.	Typ.	Max.	Unit
Extinction Ratio	ER	7.5			dB
Average Power of OFF Transmitter	P_{off}			-30	dBm
Relative Intensity Noise	RIN			-128	dB/Hz
Side Mode Suppression Ratio	SMSR	30			dB
Transmitter Dispersion Penalty	TDP			3	dB
TX_Disable Assert Time	T_{off}			10	us
Receiver					
Center Wavelength	λ_C	1260	1550	1600	nm
Receiver Sensitivity*(Note2)	$P_{min.}$			-16	dBm
Receiver Overload	$P_{max.}$	0			dBm
LOS De-assert	LOS_D			-18	dBm
LOS Assert	LOS_A	-30			dBm
LOS-Hysteresis	Phys	0.5			dB

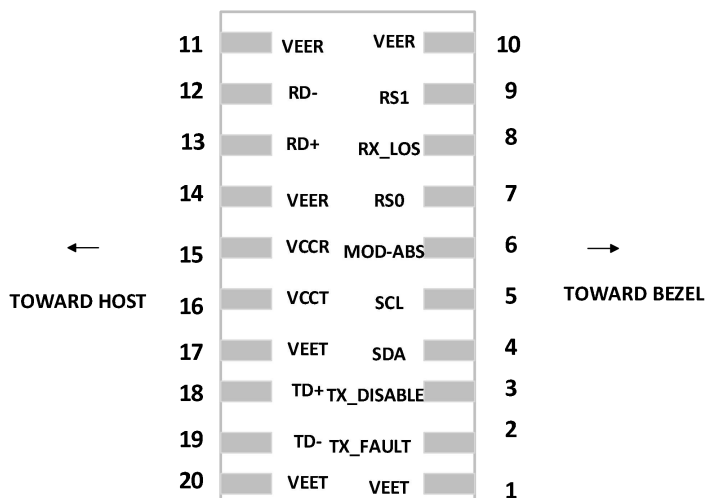
Notes

1. Output is coupled into a 9/125um SMF.
2. Measured with worst ER, BER less than 1E-12 and PRBS 2^31-1 at 10.3125Gbps.

III. Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Transmitter						
CML Inputs (Differential)	V_{in}	150		1200	mVpp	AC Coupled Inputs
Input AC Common Mode Voltage		0		25	mV	RMS
Input Impedance (Differential)	Z_{in}	85	100	115	ohms	$R_{in} > 100\text{kohms @DC}$
TX_DIS	High	2		V_{CC}	V	
	Low	0		0.8		
TX_FAULT	High	2		$V_{CC}+0.3$	V	$I_o = 400\mu\text{A}; \text{Host } V_{CC}$
	Low	0		0.5		$I_o = -4.0\text{mA}$
Receiver						
CML Outputs (Differential)	V_{out}	350		700	mVpp	AC Coupled Outputs
Output Impedance (Differential)	Z_{out}	85	100	115	ohms	
RX_LOS	High	2		$V_{CC}+0.3$		$I_o = 400\mu\text{A}; \text{Host } V_{CC}$
	Low	0		0.8		$I_o = -4.0\text{mA}$
MOD_DEF (0.2)	VoH	2.5			V	With Serial ID
	VoL	0		0.5		

IV. Pin Definitions



Pin	Name	Function	Plug Seq.	Notes
1	V _{EE} T	Transmitter Ground	1	5)
2	TX Fault	Transmitter Fault Indication	3	1)
3	TX Disable	Transmitter Disable	3	2) Module Disables on High or Open
4	SDA	Transmitter Disable	3	3) 2 Wire Serial ID Interface.
5	SCL	Module Definition 2	3	3) 2 Wire Serial ID Interface.
6	MOD-ABS	Module Definition 1	3	3)
7	RS0	RX Rate Select (LVTTTL)	3	Rate Select 0, optionally controls SFP+ module receiver. This pin is pulled low to V _{EE} T with a >30K resistor.
8	LOS	Loss of Signal	3	4)
9	RS1	TX Rate Select (LVTTTL).	1	Rate Select1, optionally controls SFP+ Module transmitter. This pin is pulled low to V _{EE} T with a >30K resistor.
10	V _{EE} R	Receiver Ground	1	5)
11	V _{EE} R	Receiver Ground	1	5)
12	RD-	Inv. Received Data Out	3	6)

Pin	Name	Function	Plug Seq.	Notes
13	RD+	Received Data Out	3	6)
14	V _{EE} R	Receiver Ground	1	5)
15	V _{CC} R	Receiver Power	2	7) 3.3V ± 5%
16	V _{CC} T	Transmitter Power	2	7) 3.3V ± 5%
17	V _{EE} T	Transmitter Ground	1	5)
18	TD+	Transmit Data In	3	8)
19	TD-	Inv. Transmit Data In	3	8)
20	V _{EE} T	Transmitter Ground	1	5)

Notes

- 1). TX Fault is an open collector/drain output, which should be pulled up with a 4.7K-10K resistor on the host board. Pull up voltage between 2.0V and V_{CC}T, R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.
- 2). TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7-10 K resistor. It states are Low(0-0.8V): Transmitter on.(>0.8, < 2.0V): Undefined High (2.0 – 3.465V): Transmitter Disabled Open: Transmitter Disabled.
- 3). Modulation Absent, connected to VEET or VEER in the module.
- 4). LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K 10K resistor. Pull up voltage between 2.0V and VCCT, R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver Sensitivity (as defined by the Standard in use).Low indicates normal operation .
- 5). VEER and VEET may be internally connected within the SFP module.
- 6). RD-/+ : These are the differential receiver outputs. They are AC coupled 100 differential Lines which should be terminated with 100 (differential) at the user SERDES.The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 400 and 2000 mV differential (200 –1000 mV single ended) when properly terminated.
- 7). VCCR and VCCT are the receiver and transmitter power supplies. They are defined as 3.3V ± 5% at the SFP connector pin. Maximum supply current is 300mA. Reco-mmended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 ohm should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage When the recommended supply-filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. VCCR and VCCT may be internally connected within the SFP transceiver module.
- 8). TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 differential termination inside the module.

V. Digital Diagnostic Specifications

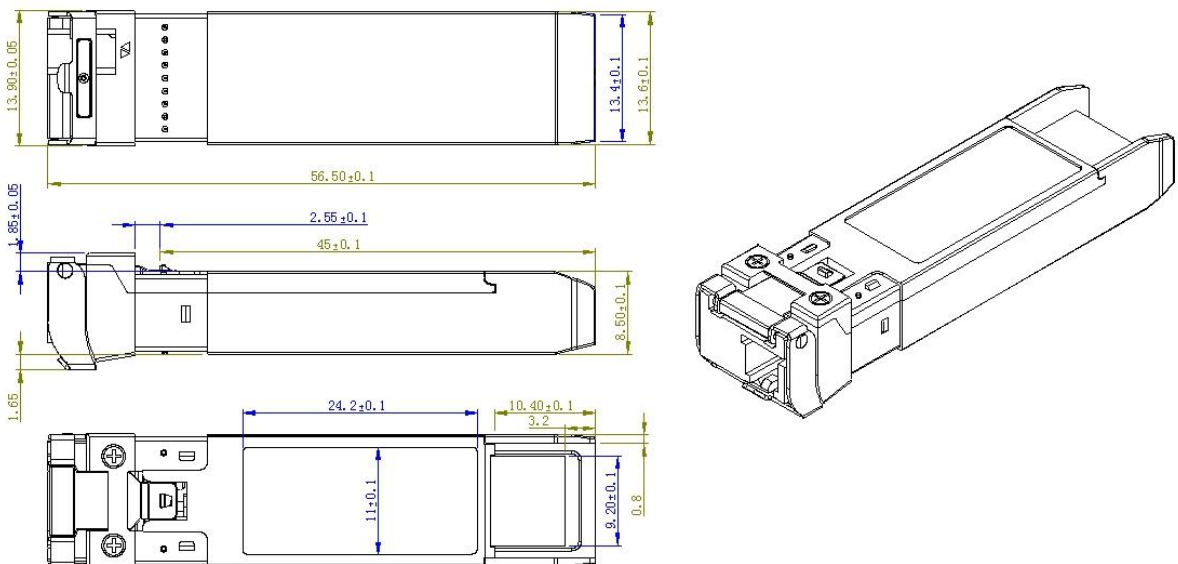
DDM	HAalarm	HWarm	LAalarm	LWarm
Temperature (°C)	95	85	-50	-40
V_{CC} (V)	3.6	3.5	3.0	3.1
I_{bias} (mA)	120	100	20	30
Tx Power (dBm)	6	4	-4	-2
Rx Power (dBm)	2	0	-18	-16

Note

The transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA). The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

VI. Mechanical Specifications

Unit: mm



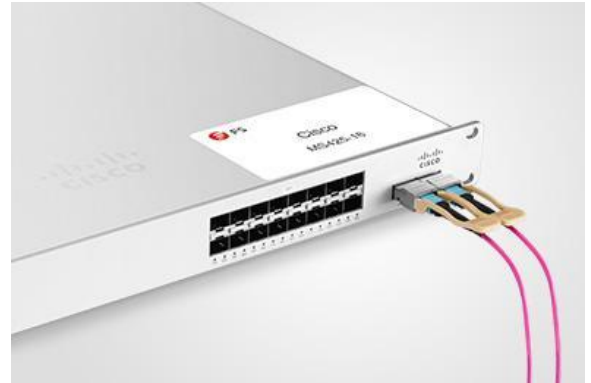
Test Center

I. Compatibility Testing

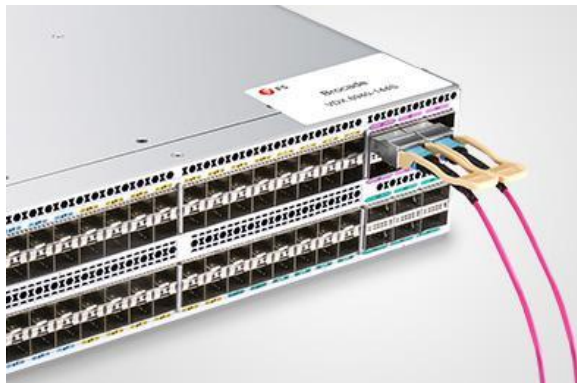
Each fiber optical transceiver has been tested in host device on site in FS Assured Program to ensure full compatibility with over 200 vendors.



Cisco Catalyst C9500-24Y4C



Cisco MS425-16



Brocade VDX 6940-144S



Dell EMC Networking Z9100-ON



Force@tm S60-44T

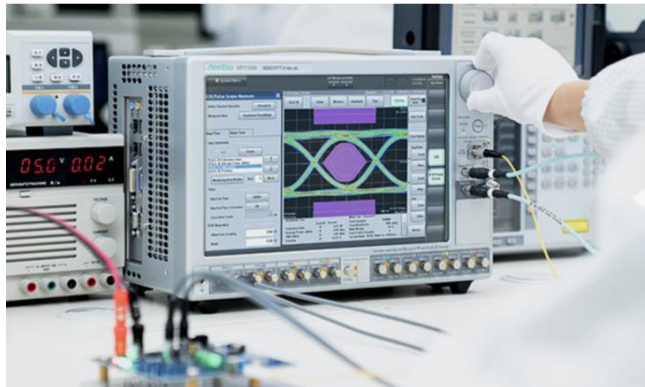


HUAWEI S6720-30L-HI-24S

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

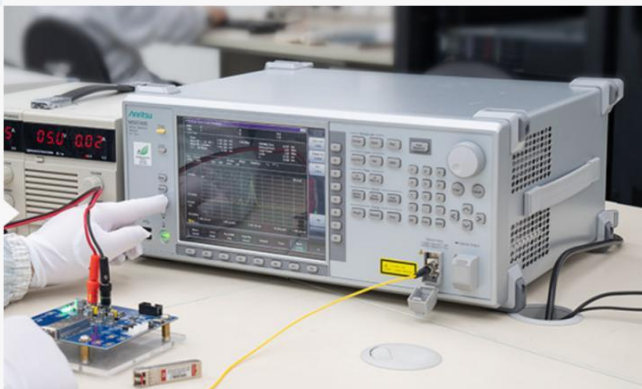
Test the actual transfer data rate and the transmission ability under different protocols with Network Master Pro.

- 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



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-ER SFP+ 1550NM 40KM INDUSTRIAL 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



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