

Dual-Rate 1000BASE-LX and 10GBASE-LR SFP+ 1310nm 10km DOM Transceiver

SFP-10GMLR-31



Application

- 1000BASE-LX 1G Ethernet
- 10GBASE-LR/LW 10G Ethernet

Features

- Hot-pluggable SFP+ footprint
- Supports 9.95 to 10.5 Gb/s bit rates
- Power dissipation < 1W
- RoHS-6 compliant (lead-free)
- Commercial temperature range 0° C to 70° C
- Single 3.3V power supply
- Maximum link length of 10km
- Uncooled 1310nm DFB laser
- Receiver limiting electrical interface
- Duplex LC connector
- Built-in digital diagnostic functions

Description

The 1G/10G Dual-Rate SFP+ transceivers are designed for use in 1-Gigabit and 10-Gigabit Ethernet links up to 10km over singlemode fiber. They are compliant with SFF-8431, IEEE 802.3-2005 10GBASE-LR/LW and 1000BASE-LX.

Digital diagnostics functions are available via a 2-wire serial interface. This product is for applications specifically designed for 10G SFP+ ports and 1G/10G SFP+ ports and not native 1G SFP ports. This is a “limiting module”, i.e., it employs a limiting receiver. Host board designers using an EDC PHY IC should follow the IC manufacturer’s recommended settings for interoperating the host- board EDC PHY with a limiting receiver SFP+ module. The optical transceivers are compliant per the RoHS Directive 2011/65/EU.

Product Specifications

I.General Specifications

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Bit Rate (RS0 = LOW)	BR		1.25		Gb/s	1
Bit Error Ratio (RS0 = HIGH)	BER	9.95	10.3		Gb/s	2
Max. Supported Link Length	L _{MAX}		10		km	

Notes:

- 1. 1000BASE-LX. Tested with a 27- 1 PRBS. See Section I, Note 5 for RS0 conditions for 1.25Gb/s operation.
- 2. 10GBASE-LR/LW. Tested with a 231-1 PRBS. See Section I, Note 5 for RS0 conditions for 10.3 Gb/s operation.

II. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Maximum Supply Voltage	V _{CC}	-0.5		4.0	V	
Storage Temperature	T _S	-40		85	° C	
Case Operating Temperature	T _{OP}	0		70	° C	
Relative Humidity	RH	0		85	%	1

Notes:

1. Non-condensing.

III. Electrical Characteristics (TOP= 0 to 70 ° C, VCC = 3.14 to 3.46 Volts)

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Supply Voltage	V _{CC}	3.14	3.30	3.46	V	
Supply Current	I _{CC}		200	285	mA	
Transmitter						
Input differential impedance	R _{in}		100		Ω	1
Differential data input swing	V _{in,pp}	180		700	mV	
Transmit Disable Voltage	V _D	2		V _{CC}	V	
Transmit Enable Voltage	V _{EN}	V _{EE}		V _{EE} + 0.8	V	
Receiver						
Differential data output swing	V _{out,pp}	300		850	mV	2,6
Output rise time and fall time	T _r , T _f	20			ps	3
LOS asserted	V _{LOS fault}	2		V _{CC_HOST}	V	4
LOS de-asserted	V _{LOS norm}	V _{EE}		V _{EE} +0.8	V	4
Power Supply Noise Tolerance	V _{CC_T} /V _{CC_R}		Per SFF-8431 Rev 4.1		mVpp	

Notes:

- 1.Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
- 2.Into 100Ω differential termination.
- 3.20 – 80 % . Measured with Module Compliance Test Board and OMA test pattern. Use of four 1 ’ s and four 0 ’ s in sequence in the PRBS^9 is an acceptable alternative.
- 4.LOS is an open collector output. Should be pulled up with 4.7kΩ – 10kΩ on the host board. Normal operation is logic 0; loss of signal is logic 1.
- 5.The transceiver is a “limiting module” , i.e., it employs a limiting receiver. Host board designers using an EDC PHY IC should follow the IC manufacturer’ s recommended settings for interoperating the host-board EDC PHY with a limiting receiver SFP+ module.

V.Optical Characteristics for RS0 = HIGH (10G Operation)
(TOP = 0 to 70 C, VCC3 = 3.14 to 3.46 Volts)

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Transmitter						
Optical Modulation Amplitude (OMA)	P _{OMA}	-5.2		+0.5	dBm	1
Average Launch Power	P _{AVE}	-8.2		+0.5	dBm	
Optical Wavelength	λ	1260		1355	nm	
Side-Mode Suppression Ratio	SMSR	30			dB	
Optical Extinction Ratio	ER	3.5			dB	
Transmitter and Dispersion Penalty	TDP			3.2	dB	
Average Launch power of OFF transmitter	P _{OFF}			-30	dBm	

IV. Optical Characteristics (TOP = 0 to 70 °C, VCC = 3.14 to 3.46 V)

Parameter	Symbol	Min	Typ.	Max	Unit	Note
Transmitter (Tx)						
Average Launch Power	P_{AVE}	-11		-3	dBm	1
Optical Wavelength	λ	1260		1355	nm	
Rise-Fall Time	T_{rise}/T_{fal}			0.26	ns	2
RMS Spectral Width	$\Delta\lambda_{rms}$			4	nm	
Optical Extinction Ratio	ER	9			dB	
Average Launch power of OFF transmitter	P_{OFF}			-30	dB	
Tx Jitter	T_{xj}	Per IEEE 802.3ae requirements				
Relative Intensity Noise	RIN			-120	dB/Hz	

Receiver (Rx)						
Receiver Sensitivity	R _{SENS}			-19	dBm	3
Stressed Receiver Sensitivity	SRS			-14.4	dBm	4
Average Receive Power	P _{AVE}			-3	dBm	
Optical Center Wavelength	λ _C	1260		1660	nm	
Return Loss	R _{Rx}	12			dB	
Receive electrical 3dB upper cutoff frequency			1500		MHz	
LOS De-AssertLOS De-Assert	LOS _D		-17		dBm	
LOS Assert	LOS _A	-30			dBm	
LOS Hysteresis		0.5			dB	

Notes:

- 1. Average power figures are informative only, per IEEE 802.3-2005.
- 2. Valid between 1260 and 1355 nm. Measured with worst ER; BER<10-12; 231 -1 PRBS.
- 3. Valid between 1260 and 1355 nm. Per IEEE 802.3-2005.

VI.Digital Diagnostic Specifications

The transceiver can be used in host systems that require either internally or externally calibrated digital diagnostics.

Parameter	Symbol	Min	Typ.	Max	Units	Ref.
Accuracy						
Internally measured transceiver temperature	ΔDD _{Temperature}			3	°C	
Internally measured transceiver supply voltage	ΔDD _{Voltage}			3	%	
Measured TX bias current	ΔDD _{Bias}			10	%	1
Measured TX output power	ΔDD _{Tx-Power}			2	dB	
Measured RX received average optical power	ΔDD _{Rx-Power}			2	dB	

Parameter	Symbol	Min	Typ.	Max	Units	Ref.
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Dynamic Range for Rated Accuracy

Internally measured transceiver temperature	DD _{Temperature}	-5		70	°C	
Internally measured transceiver supply voltage	DD _{Voltage}	3.1		3.5	V	
Measured TX bias current	DD _{Bias}	0		tbd	mA	
Measured TX output power	DD _{Tx-Power}	-8.2		+0.5	dBm	
Measured RX received average optical power	DD _{Rx-Power}	-14.2		+0.5	dBm	

Max Reporting Range

Internally measured transceiver temperature	DD _{Temperature}	-40		125	°C	
Internally measured transceiver supply voltage	DD _{Voltage}	2.8		4.0	V	
Measured TX bias current	DD _{Bias}	0		20	mA	
Measured TX output power	DD _{Tx-Power}	-10		+2	dBm	
Measured RX received average optical power	DD _{Rx-Powe}	-22		+2	dBm	

Accuracy

Internally measured transceiver temperature	DD _{Temperature}	-5		70	°C	
Internally measured transceiver supply voltage	DD _{Voltage}	2.8		4.0	V	
Measured TX bias current	DD _{Bias}	0		20	mA	
Measured TX output power	DD _{Tx-Power}	-10		+2	dBm	
Measured RX received average optical power	DD _{Rx-Powe}	-22		+2	dBm	

Note:

1.Accuracy of Measured Tx Bias Current is 10% of the actual Bias Current from the laser driver to the laser.

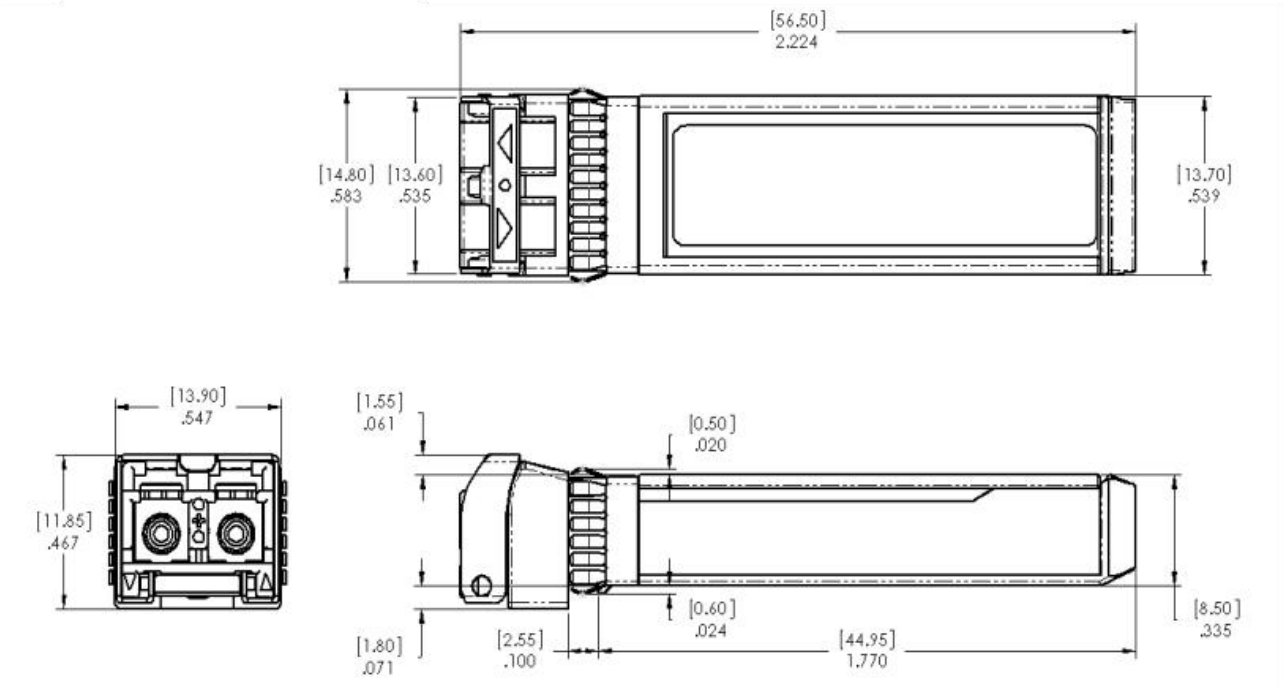
VII. Pin Description

Pin	Symbol	Name/Description	Ref.
1	V _{EET}	Transmitter Ground	1
2	T _{FAULT}	Transmitter Fault	2
3	T _{DIS}	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	2
5	SCL	2-wire Serial Interface Clock Line	2
6	MOD_ABS	Module Absent. Grounded within the module	2
7	RS0	Rate Select 0.	4
8	RX_LOS	Loss of Signal indication. Logic 0 indicates normal operation.	5
9	RS1	Rate Select 1.	4
10	V _{EER}	Receiver Ground	1
11	V _{EER}	Receiver Ground	1
12	RD-	Receiver Inverted DATA out. AC Coupled.	
13	RD+	Receiver Non-inverted DATA out. AC Coupled.	
14	V _{EER}	Receiver Ground	1
15	V _{CCR}	Receiver Power Supply	
16	V _{CCT}	Transmitter Power Supply	
17	V _{EET}	Transmitter Ground	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	V _{EET}	Transmitter Ground	1

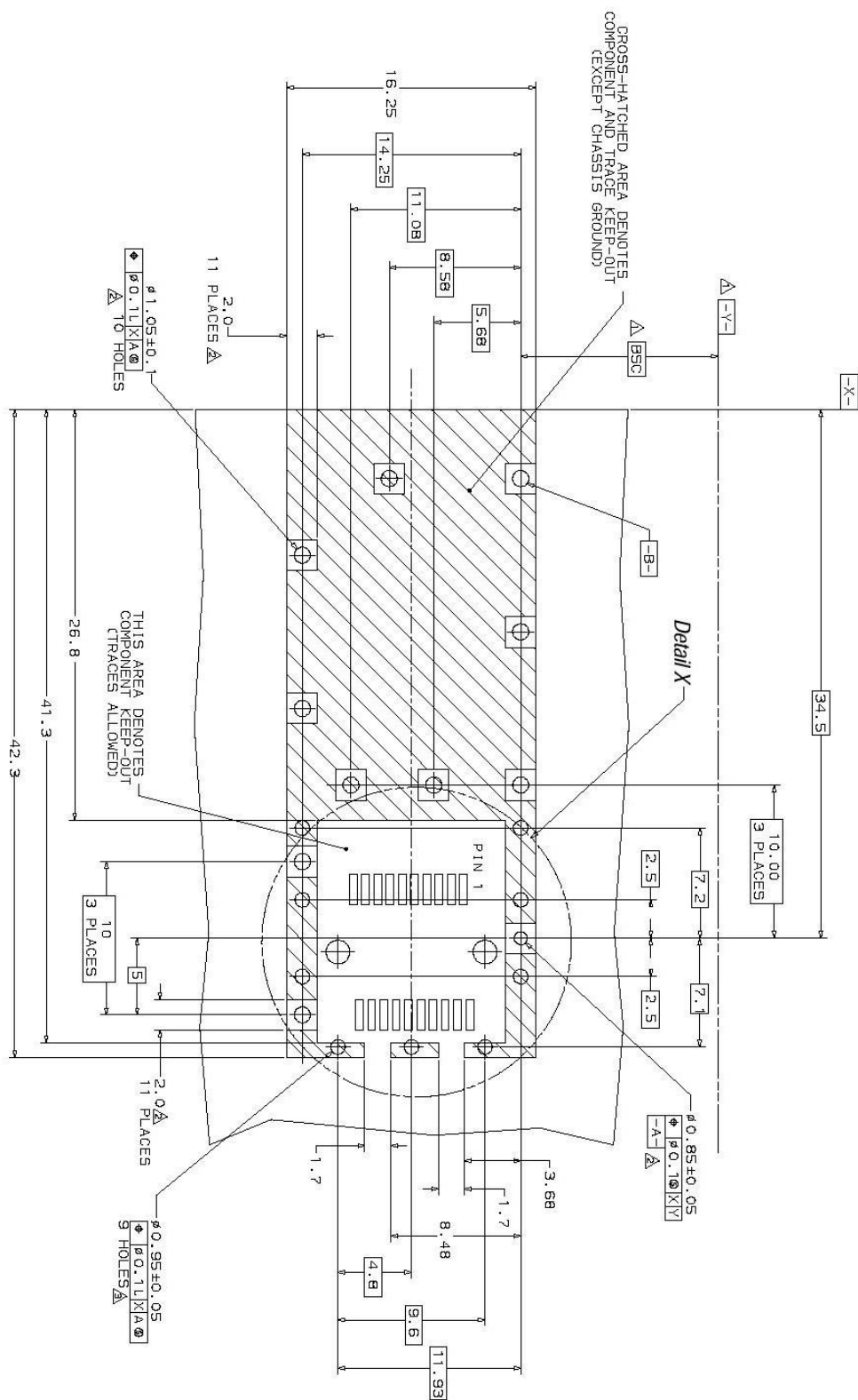
Notes:

- 1.Circuit ground is internally isolated from chassis ground.
- 2.TFAULT is an open collector/drain output, which should be pulled up with a 4.7k -10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to Vcc + 0.3V. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
- 3.Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
- 4.Internally pulled down per SFF-8431 Rev 2.0. See Sec. X for the logic table to use for the internal CDRs locking modes.
- 5.LOS is open collector output. Should be pulled up with 4.7kΩ -10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

VII. Mechanical Specifications



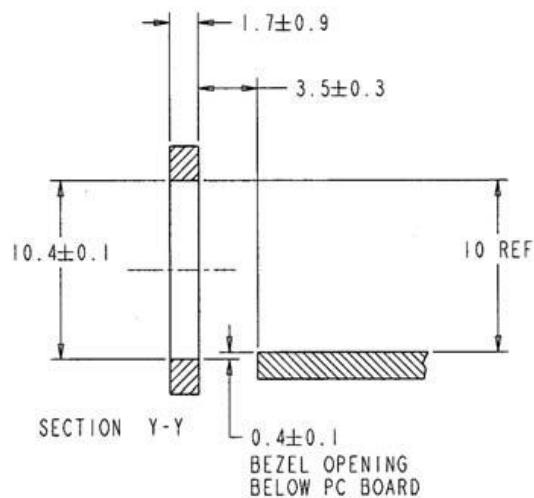
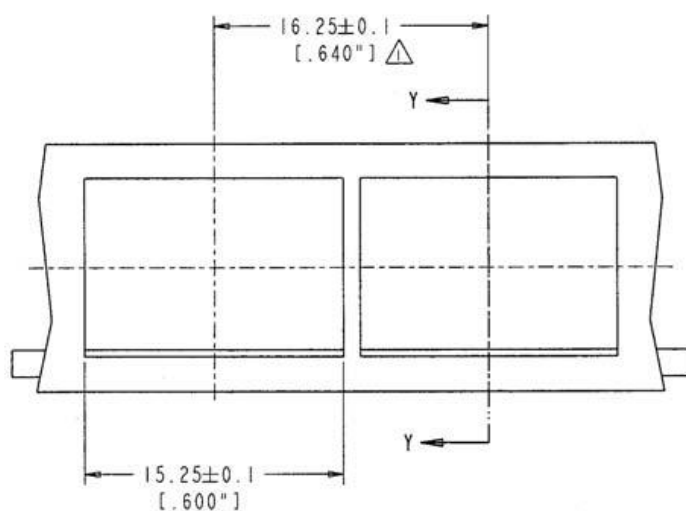
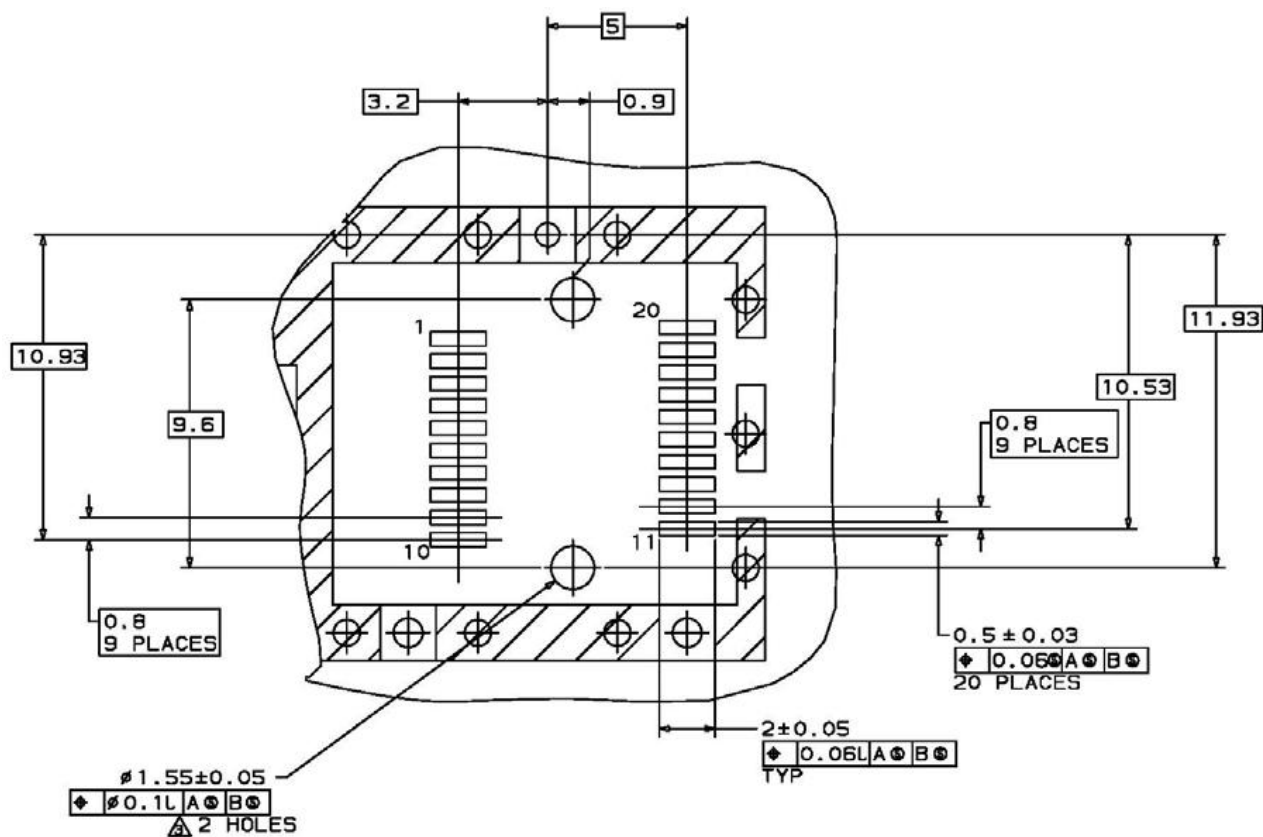
VIII. Host Board SFP+ Connector Recommendations



Datum and Basic Dimension Established by Customer

⚠️ Pads and Vias are Chassis Ground, 11 Places

△ Through Holes are Unplated



NOTES:

△ MINIMUM PITCH ILLUSTRATED, ENGLISH DIMENSIONS ARE FOR REFERENCE ONLY

2. NOT RECOMMENDED FOR PCI EXPANSION CARD APPLICATIONS

Test Center

FS.COM transceivers are tested to ensure connectivity and compatibility in our test center before shipped out. FS.COM test center is supported by a variety of mainstream original brand switches and groups of professional staff, helping our customers make the most efficient use of our products in their systems, network designs and deployments.

The original switches could be found nowhere but at FS.COM test center, eg: Juniper MX960 & EX 4300 series, Cisco Nexus 9396PX & Cisco ASR 9000 Series, HP 5900 Series & HP 5406R ZL2 V3(J9996A), Arista 7050S-64, Brocade ICX7750-26Q & ICX6610-48, Avaya VSP 7000 MDA 2, etc.



Cisco ASR 9000 Series(A9K-MPA-1X40GE)



ARISTA 7050S-64(DCS-7050S-64)



Juniper MX960



Brocade ICX 7750-26Q



Extreme Networks X670V VIM-40G4X



Mellanox M3601Q



Dell N4032F



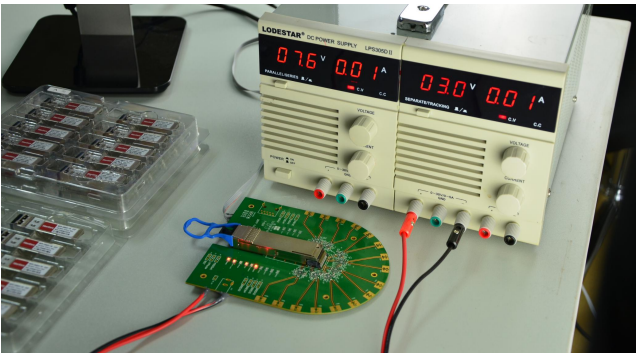
HP 5406R ZL2 V3(J9996A)



AVAYA 7024XLS(7002QQ-MDA)

Test Assured Program

FS.COM truly understands the value of compatibility and interoperability to each optics. Every module FS.COM provides must run through programming and an extensive series of platform diagnostic tests to prove its performance and compatibility. In our test center, we care of every detail from staff to facilities—professionally trained staff, advanced test facilities and comprehensive original-brand switches, to ensure our customers to receive the optics with superior quality.



Our smart data system allows effective product management and quality control according to the unique serial number, properly tracking the order, shipment and every part.

Our in-house coding facility programs all of our parts to standard OEM specs for compatibility on all major vendors and systems such as Cisco, Juniper, Brocade, HP, Dell, Arista and so on.



With a comprehensive line of original-brand switches, we can recreate an environment and test each optics in practical application to ensure quality and distance.

The last test assured step to ensure our products to be shipped with perfect package.

Order Information

Part Number	Description
SFP-10GSR-85	10GBASE-SR SFP+ 850nm 300m DOM Transceiver
SFP-10GLRM-31	10GBASE-LRM SFP+ 1310nm 220m DOM Transceiver
SFP-10GLR-31	10GBASE-LR SFP+ 1310nm 10km DOM Transceiver
SFP-10GER-55	10GBASE-ER SFP+ 1550nm 40km DOM Transceiver
SFP-10GZR-55	10GBASE-ZR SFP+ 1550nm 80km DOM Transceiver
SFP-10GZR100-55	10GBASE-ZR SFP+ 1550nm 100km DOM Transceiver
SFP-10GMSR-85	Dual-Rate 1000BASE-SX and 10GBASE-SR SFP+ 850nm 300m DOM Transceiver
SFP-10GMLR-31	Dual-Rate 1000BASE-LX and 10GBASE-LR SFP+ 1310nm 10km DOM Transceiver

Note:

1. 10G SFP+ transceiver module is individually tested on corresponding equipment such as Cisco, Arista, Juniper, Dell, Brocade and other brands, and passes the monitoring of FS.COM intelligent quality control system.