

10GBASE-ER SFP+ 1310nm 40km DOM Transceiver

SFP-10GER-31



Application

- 6.144G/9.83G CPRI
- 8.5Gb/s Fibre Channel
- 10G NRZ SONET, SDH
- 10G Ethernet and Fibre Channel
- G.709 OTN FEC bit rates

Features

- Hot-pluggable SFP+ footprint
- 17dB optical link budget for up to 40km over G.652 single mode fiber
- Supports 6.144, 8.5G and from 9.83 to 11.3 Gb/s bit rates
- Un-cooled 1310nm DFB laser
- Receiver limiting electrical interface
- Power dissipation < 1.5W
- 0° C to 70° C temperature range
- RoHS-6 compliant (lead-free)
- Single 3.3V power supply
- Duplex LC connector
- Built-in digital diagnostic functions

Description

10Gb/s Pluggable SFP+ transceivers are compliant with SFF-8431 and SFF-8432, and support 10G SONET, SDH, OTN, IEEE 802.3ae, 8x/10x Fibre Channel and 6.144G/9.83 CPRI. The transceivers have higher optical transmit power and better receiver sensitivity than 1310nm 10GBASE-LR and OC-192 SR-1 transceivers, and they support an optical link budget of 17dB, to compensate for the higher fiber attenuation loss at 1310nm over 40km of G.652 single mode fiber.

Digital diagnostics functions are available via a 2-wire serial interface. The transceivers utilize internal transmitter and receiver re-timer IC's for SONET/SDH jitter compliance and to enhance host cards' signal integrity. The optical transceiver is compliant per the RoHS Directive 2011/65/EU.

Product Specifications

I. General Specifications

Data Rate Specifications	Symbol	Min	Typ.	Max	Units	Ref.
Supported Link Length	L_{MAX}	10		30	km	1,2,3
		10		40	km	1,2,3,4

Notes:

1. Tested with a $2^{31} - 1$ PRBS pattern and BER of $1E-12$, over G.652 single mode fiber.
2. Assuming that the optical link loss due to fiber attenuation is 0.38dB/km.
3. The actual min. link length may differ as it is affected by the receiver overload limit.
4. Assuming this transceivers on both side of the link. If a PIN receiver is on the other side of the link, the optical link budget may not be enough to support 40km of fiber attenuation loss.

II. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Maximum Supply Voltage	Vcc	-0.5		4.0	V	
Storage Temperature	Ts	-40		85	° C	
Case Operating Temperature	Top	0		70	° C	
Relative Humidity	RH	0		85	%	1
Receiver Optical Damage Threshold	RxDamage	5			dBm	

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

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Supply Voltage	Vcc	3.14	3.30	3.46	V	
Supply Current	Icc		300	430	mA	
Power Dissipation	Pdiss			1.5	W	
Transmitter						
Input differential impedance	Rin		100		V	1
Differential data input swing	Vin,pp	200		1800	mVpp	
Transmit Disable Voltage	VD	Vcc-0.8		Vcc	V	
Transmit Enable Voltage	VEN	Vee		Vee+0.8	v	

Receiver

Output differential impedance	Vout,pp	80	100	120	Ω	
Differential data output swing	Vout,pp	300		850	mV	2
Output rise time and fall time	Tr, Tf	28			ps	3
LOS asserted	V _{LOS A}	Vcc-0.8		Vcc	V	4
LOS de-asserted	V _{LOS D}	0		0.8	V	4
Power Supply Noise Tolerance	VccT/VccR		Per SFF-8431 Rev 3.0		mVpp	5

Notes:

1. Measured at 70° C, 3.3V and beginning of life.
2. Internally AC coupled.
3. 20 – 80%. Measured with Module Compliance Test Board and OMA test pattern. Use of four 1's and four 0's sequence in the PRBS 9 is an acceptable alternative. SFF-8431 Rev 4.1.
4. LOS is an open collector output. Should be pulled up with 4.7k Ω – 10k Ω on the host board. Normal operation is logic 0; loss of signal is logic 1.
5. See Section 2.8.3 of SFF-8431 Rev 4.1.

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}	-3		+4	dBm	
Optical Wavelength	λ	1290		1330	nm	
Side-Mode Suppression Ratio	SMSR	30			dB	
Optical Extinction Ratio	ER	6			dB	
Path Penalty	TDP_S			1	dB	
Transmitter and Dispersion Penalty	TDP_F			3.2	dB	
Average Launch power when Tx is OFF	P_{OFF}			-30	dBm	
Tx Jitter 20kHz-80MHz	T_{XJ1}			0.3	UI	1,2
Tx Jitter 4MHz – 80MHz	T_{XJ2}			0.1	UI	1,2
Relative Intensity Noise	RIN			-128	dB/Hz	
Receiver (Rx)						
Sensitivity (Average Power)	8.5-10.7Gb/s	R_{SENS1}		-20	dBm	3,4
	11.1-11.3Gb/s	R_{SENS2}		-19	dBm	3,5
Sensitivity (OMA)	9.95-10.3Gb/s	R_{SENS3}		-19.2	dBm	3,4
Stressed Sensitivity (OMA)	9.95-10.3Gb/s	R_{SENS4}		-11.3	dBm	6
Overload (Average Power)	P_{AVE}	-7			dBm	
Optical Center Wavelength	λ_C	1200		1600	nm	

Receiver Reflectance	Prx			-14	dB	
LOS De-Assert	LOS _D			-22	dBm	
LOS Assert	LOS _A	-42			dBm	
LOS Hysteresis	LOS _H	0.5			dB	

Notes:

1. For SONET/SDH applications the jitter specifications are defined as per [9].
2. If the CDRs are in bypass mode, the Tx jitter is compliant to the specification defined in [4].
3. Measured with worst ER=6 dB; 2³¹ – 1 PRBS.
4. Measured for BER<10⁻¹².
5. Measured for BER>10⁻⁵.
6. As per [4].

V. Digital Diagnostic Specifications

Parameter	Symbol	Units	Min	Max	Accuracy	Ref.
Accuracy						
Transceiver temperature	ΔDD_{Temp}	°C	-10	80	± 5°C	1
Transceiver supply voltage	$\Delta DD_{Voltage}$	V	2.8	4.0	± 3%	
Transmitter bias current	ΔDD_{Bias}	mA	0	20	± 10%	2
Transmitter output power	$\Delta DD_{Tx-Power}$	dBm	-10	+2	± 2dB	
Receiver average optical input power	$\Delta DD_{Rx-Power}$	dBm	-22	+2	± 2dB	

Notes:

1. Internally measured
2. The accuracy of the Tx bias current is 10% of the actual current from the laser driver to the laser

VI. Pin Description

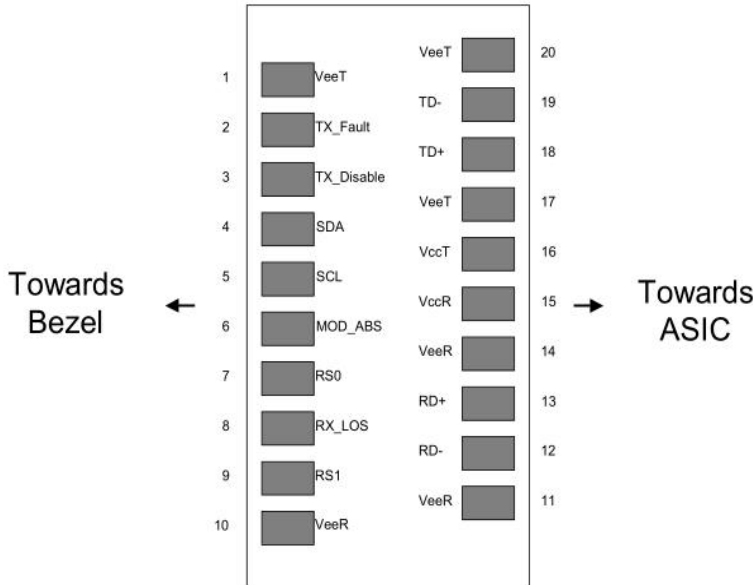


Figure 1 – Diagram of Host Board Connector Block Pin Numbers and Names.

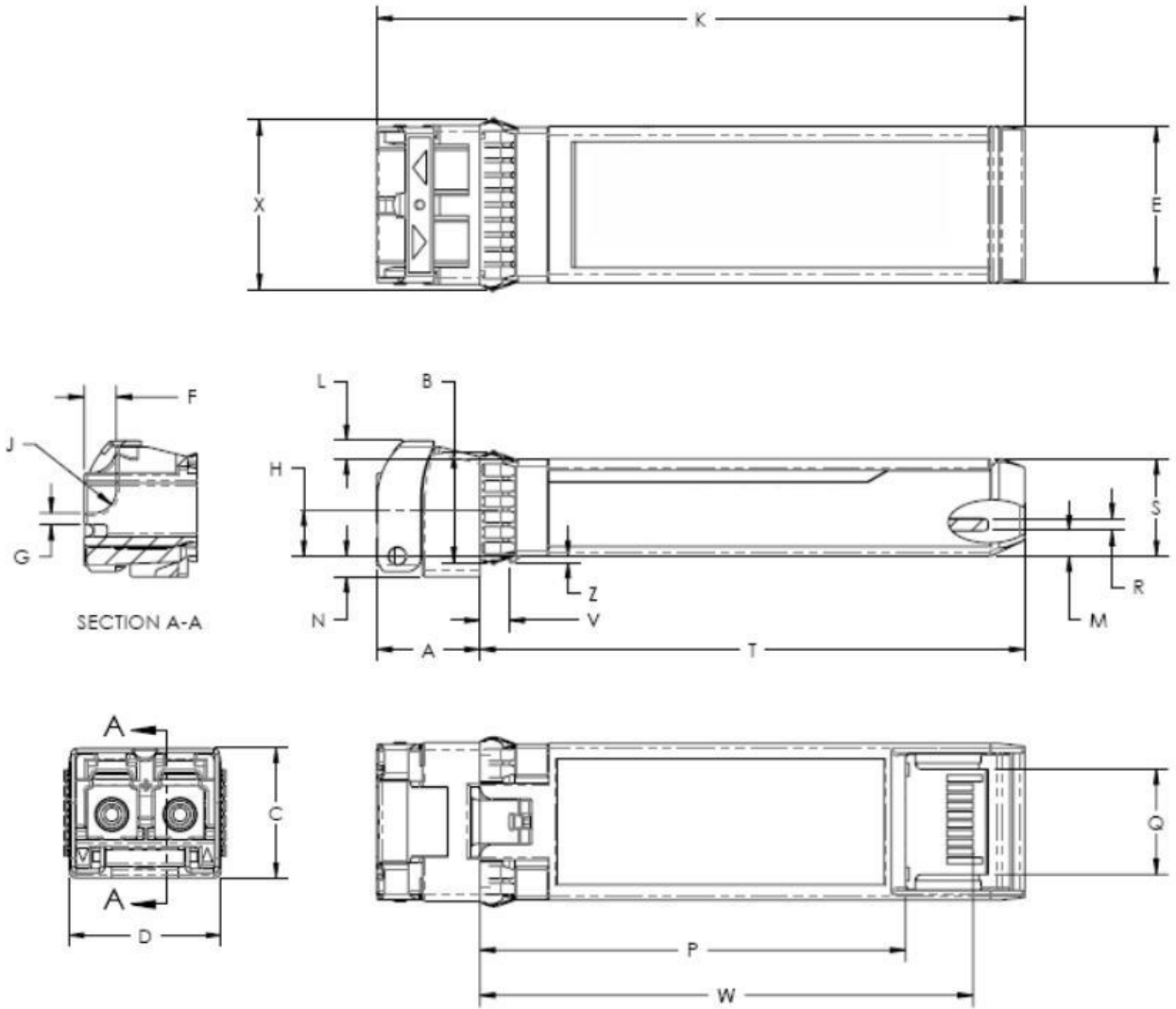
Pin	Symbol	Name/Description	Notes
1	VEET	Transmitter Ground	1
2	TFault	Transmitter Fault	2
3	TDIS	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	2
5	SCL	2-wire Serial Interface Clock Line	2
6	MOD_ABS	Module Absent. Grounded within the module	2
7	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	VEER	Receiver Ground	1
11	VEER	Receiver Ground	1
12	RD-	Receiver Inverted DATA out. AC Coupled.	
13	RD+	Receiver Non-inverted DATA out. AC Coupled.	
14	VEER	Receiver Ground	1
15	VCCR	Receiver Power Supply	
16	VCCT	Transmitter Power Supply	
17	VEET	Transmitter Ground	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	VEET	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 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.

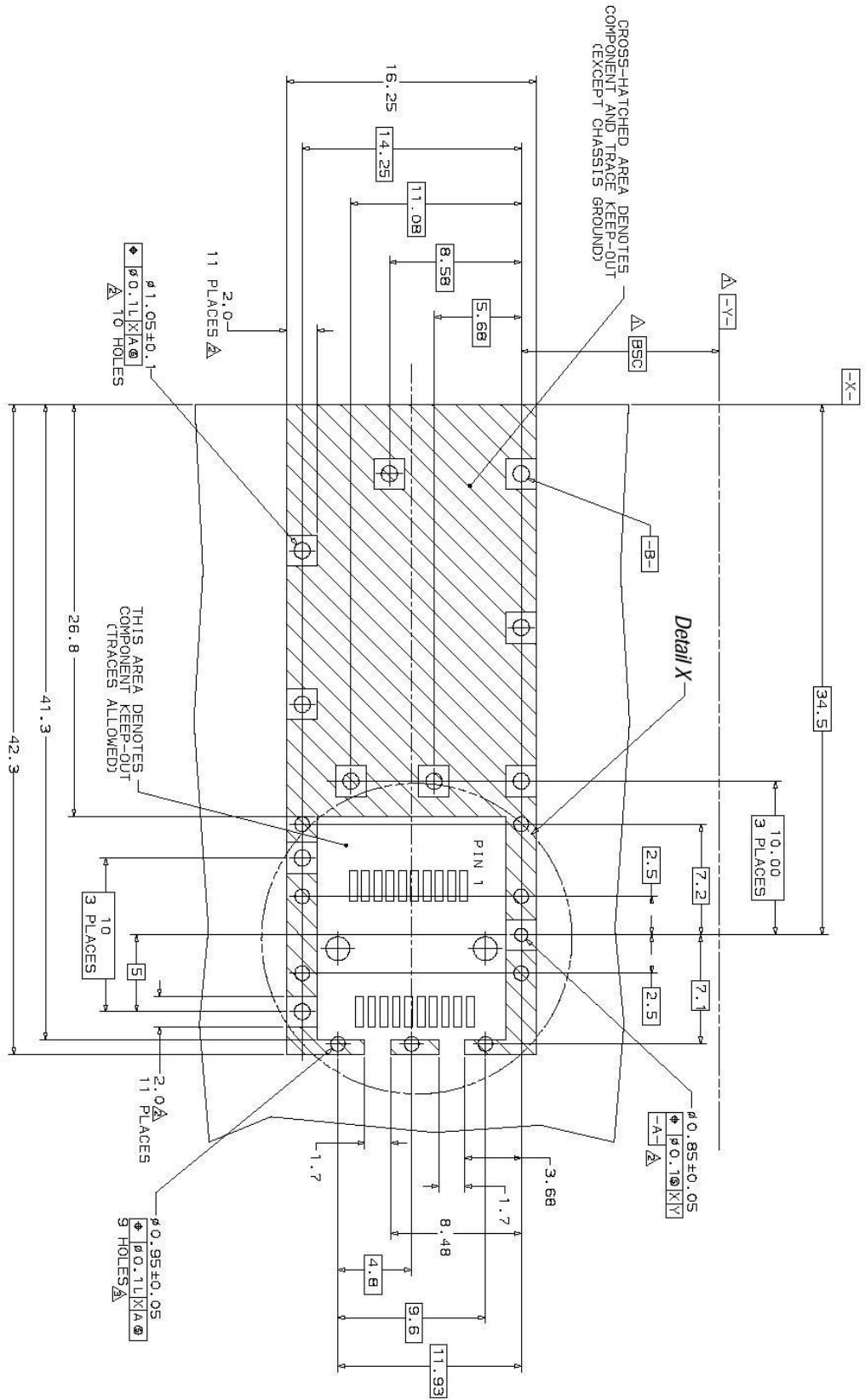
VII. Mechanical Specifications



Note:

The option of the label on the top side of the transceiver is not recommended.

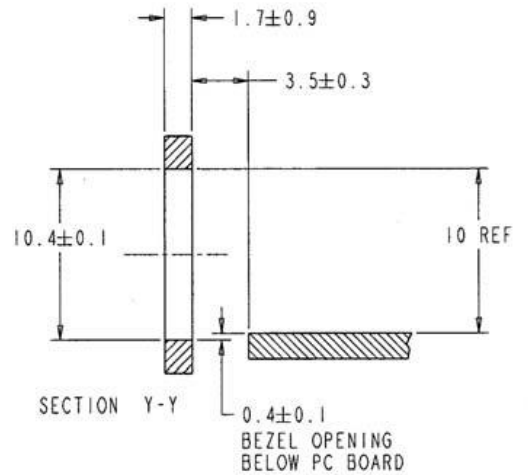
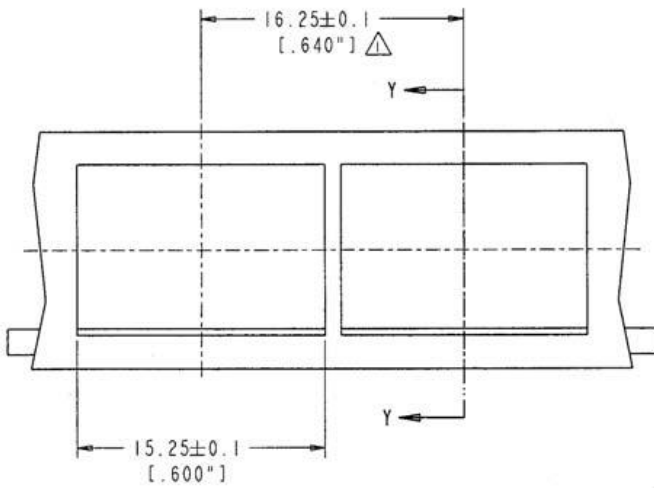
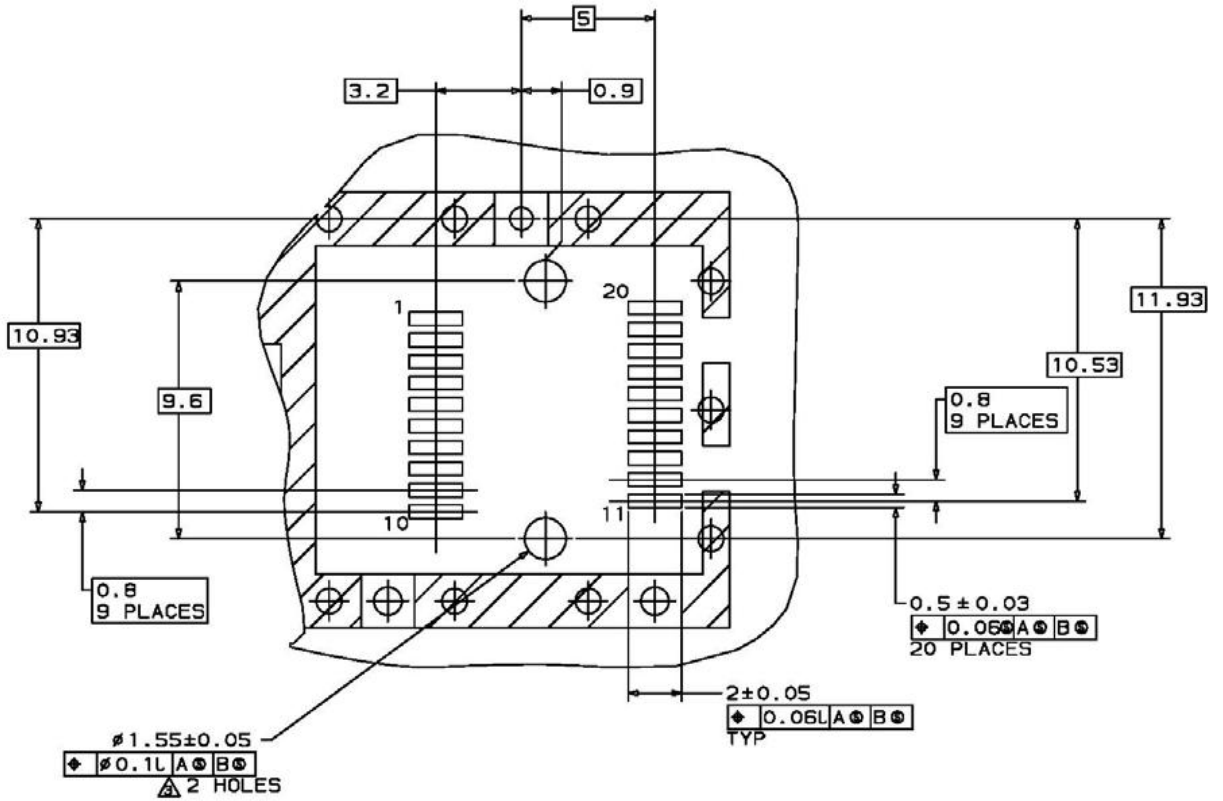
VIII. Host Board SFP+ Connector Recommendations



△ Datum and Basic Dimension Established by Customer

△ Pads and Vias are Chassis Ground, 11 Places

△ Through Holes are Unplated



NOTES:

\triangle 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)



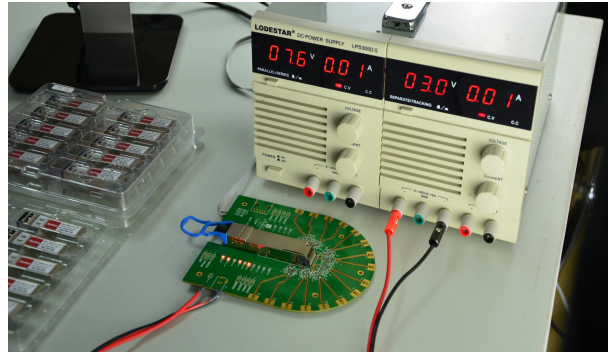
AVAYA 7024XLS(7002QQ-MDA)

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	10G SFP+ 1310nm 2km 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-10GZRC-55	10G 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

Note:

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.



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