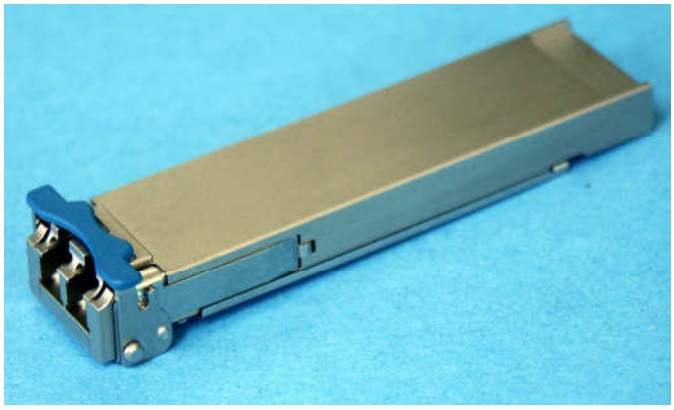
XFP Multirate Optical Transceiver
MF-10KSXA-007ZA



Features:

- Protocol Independent 10Gbps transceiver
- Hot pluggable
- Management interface compliant with I2C™ rev. 2 and XFP MSA
- Multi rate from 9.95Gbps to 11.0957Gbps (FEC)
- XFI compatible electrical interface thru 30pin connector
- Low power dissipation: < 2.5W
- Low cost

1. Description

This XFP optical transceiver is designed to provide high optical performance for SDH I-64.1 / SONET SR-1 (2km) and IEEE 802.3ae LR (10km).

Transmitter side uses 1310nm DFB with specified driving circuit and signal conditioning circuit.

Receiver side uses PD preamp-module and integrated circuits for re-shaping, re-timing and re-generating input optical signal.

Input and output signals handle NRZ format.

Digital diagnostic functions are also available via 2-wire interface according to the XFP MSA specification.

2. Block Diagram

2.1 Total Block Diagram

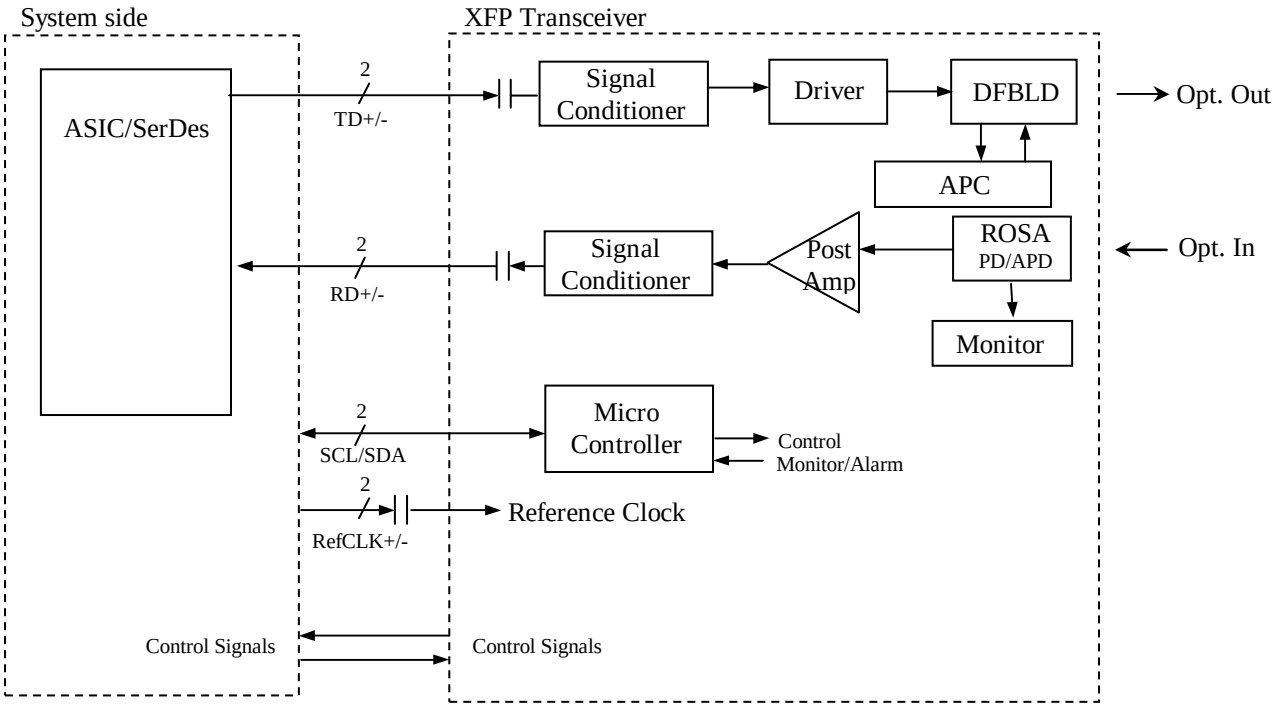


Fig. 2.1 Block Diagram

3. Absolute Maximum Ratings

Stress below listed absolute maximum rating may cause permanent damage to the module.

This is a stress only and functional operation of the module at these or any other conditions in excess of those given in the operational sections of this data sheet.

Exposure to Absolute Maximum Rating for extended periods may affect module reliability.

Table 3.1 Absolute Maximum Ratings (MF-10KSXA-007ZA)

Parameter	*Symbol*	*Min*	*Max*	*Unit*
Supply Voltage	VDD3	0	+3.6	V
Storage temperature	Tstg	-40	+85	degC
Operating temperature (Case)	Tcase	-5	+70	degC
Relative humidity (Non condensation)	-	5	90	%

4. Pin Descriptions

Table 4.1 shows the Pin descriptions of XFP connector and Fig.4.2 shows the Diagram of Host Board Connector Pin Numbers and Names.

Table 4.1 Pin Descriptions of XFP Connector

Pin	*Logic*	*Symbol*	*Name/Description*	*Note*
1		GND	Module Ground	1
2		VEE5	Optional –5.2V Power Supply	
3	LVTTL-I	Mod_Desel	Prevent module from communicating cia I2C	
4	LVTTL-O	/Interrupt	Indicates presence of an important conditions	2
5	LVTTL-I	Tx_Dis	Laser source turned off	
6		VDD5	+5V Power Supply	
7		GND	Module Ground	1
8		VDD3	+3.3V Power Supply	
9		VDD3	+3.3V Power Supply	
10	LVTTL-I/O	SCL	I2C Serial Interface Clock	2
11	LVTTL-I/O	SDA	I2C Serial Interface Data Line	2
12	LVTTL-O	Mod_Abs	Module-Absent indicator	2
13	LVTTL-O	Mod_Nr	Module-Not-Ready indicator	2
14	LVTTL-O	Rx_Los	Receive-Loss-Of-Signal Indicator	2
15		GND	Module Ground	1
16		GND	Module Ground	1
17	CML-O	RDN	Inverted Receiver Data Output	
18	CML-O	RDP	Receiver Data Output	
19		GND	Module Ground	1
20		VDD2	+1.8V Power Supply	
21	LVTTL-I	PDown/RST	Power down / Reset command	
22		VDD2	+1.8V Power Supply	
23		GND	Module GND	1
24	PECL-I	CRefP	Reference Clock Input	
25	PECL-I	CREfN	Inverted Reference Clock Input	
26		GND	Module GND	1
27		GND	Module GND	1
28	CML-I	TDN	Inverted Transmitter Data Input	
29	CML-I	TDP	Transmitter Data Input	
30		GND	Module GND	1

Note;
1. Module ground pins GND are isolated from the module case and chassis ground within the module.
2. Shall be pulled up with 4.7k-10kohms to a voltage between 3.15V and 3.45V on the board

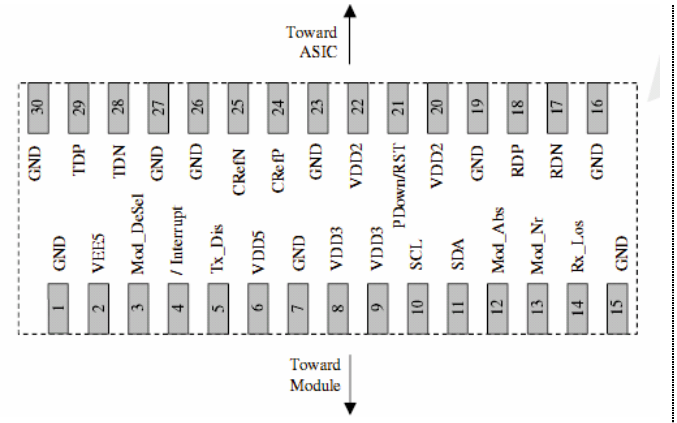


Fig. 4.2 Diagram of Host Board Connector Block Pin Numbers and Names

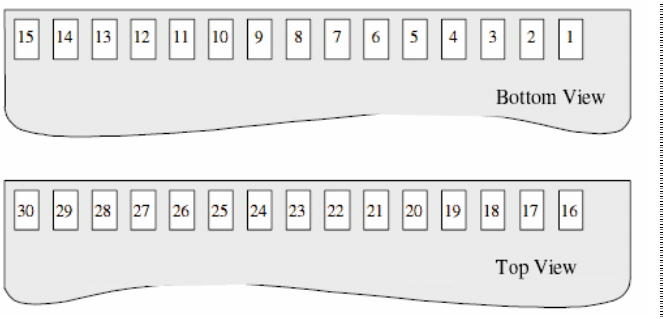


Fig. 4.3 Diagram of Transceiver card edge connector Numbers and Names (See Fig. 8.1)

5. Electrical Characteristics

All parameters are specified over the operating case temperature.

5.1 Power Supply

Table 5.1.1 Power Supply

Tc : -5 to +70degC

Parameters		*Min.*	*Typ.*	*Max.*	*Unit*
SupplyVoltage	VDD3	+3.13	+3.3	+3.47	V
SupplyCurrent	Idd3	-	-	700	mA
Power Consumption	W	-	-	2.5	W

5.2 Host Filtering and Supply Voltage Measurement Points

The example host board power supply filtering and Supply voltage measurement points are shown in Fig 5.2.1.
Host board power supply must meet XFP MSA specification.

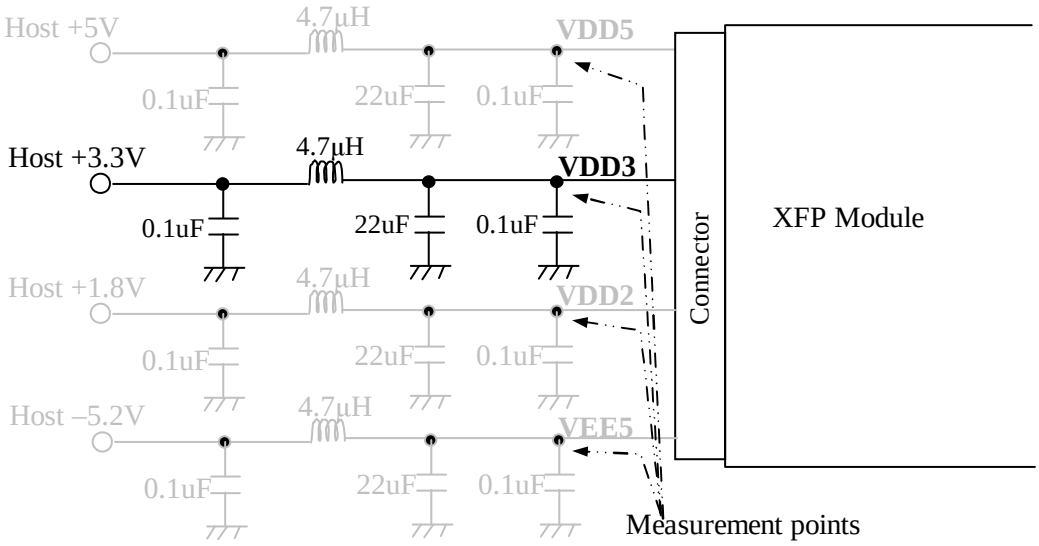


Fig. 5.2.1 Example of Host Board Supply Filtering Network and Supply Voltage measurement points

5.3 High Speed Electrical Interface

XFP Module high-speed electrical interface specification is shown in table 5.3.1 and the High Speed Electrical Interface definition point is shown in Fig. 5.3.1.

Table 5.3.1 High Speed Electrical Interface

Tc : -5 to +70degC

Parameter	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Note*
Transmitter Input						
Input Differential Impedance	Zd	80	100	120	ohm	
Termination Mismatch	ΔZ_M			5	%	
Source to Sink DC Potential Difference	Vcm	0		3.6	V	
Input AC Common mode Voltage				25	mV(RMS)	
Differential Input Return Loss	SDD11	8			dB	Up to 8GHz
Common Mode Input Return Loss	SCC11	3			dB	0.1-15GHz
Differential to Common Mode Conversion	SCD11	10			dB	0.1-15GHz
Total Non-DDJ Jitter				0.41	UIpp	
Total Jitter	TJ			0.61	UIpp	
Sinusoidal Jitter Tolerance	SJ			See 2		
Eye Mask	X1			0.305	UI	See 3, Fig. 5.3.2
	Y1	60			mV	Fig. 5.3.2
	Y2			410	mV	See 4, Fig. 5.3.2
Receiver Output						
Reference Differential Output Impedance	Zd	80	100	120	ohm	
Termination Mismatch	ΔZ_M			5	%	
DC Common Mode Potential	Vcm	0		3.6	V	
Output AC Common Mode Voltage				15	mV(RMS)	
Output Rise and Fall time	t_{RH}/t_{FH}	24			ps	20-80%
Differential Output Return Loss	SDD22	8			dB	Up to 8GHz
Common Mode Output Return Loss	SCC22	3			dB	0.1-15GHz
Deterministic Jitter	DJ			0.18	UIpp	
Total Jitter	TJ			0.34	UIpp	
Eye Mask	X1			0.17	UI	Fig. 5.3.3
	X2			0.42	UI	Fig. 5.3.3
	Y1	170			mV	Fig. 5.3.3
	Y2			425	mV	Fig. 5.3.3
Reference Clock						
Clock Differential Input Impedance	Zd	80	100	120	ohm	
Differential Input Clock Amplitude		640		1600	mVpp	AC Coupled PECL
Reference Clock Duty Cycle		40	50	60	%	
Reference Clock Rise/Fall time	Tr/Tf	200		1250	ps	20-80%
Reference Clock Frequency	f0		Baud/64			
RMS Jitter Random Jitter	σ			10	ps	Up to 100MHz
Reference Clock Frequency Tolerance	Δf	-100		100	ppm	V.S. Baud/64

1. Sinusoidal jitter tolerance for Telecom and Datacom respectively given by XFP MSA specification.
2. Mask coordinate X1=0.205 if total non-DDJ is measured.
3. Out of 410mV,50mV is allocated for multiple reflection.
4. Differential Return Loss given be equation SDD22(dB)=8-22.66 log10(f/5.5), f=frequency(GHz)

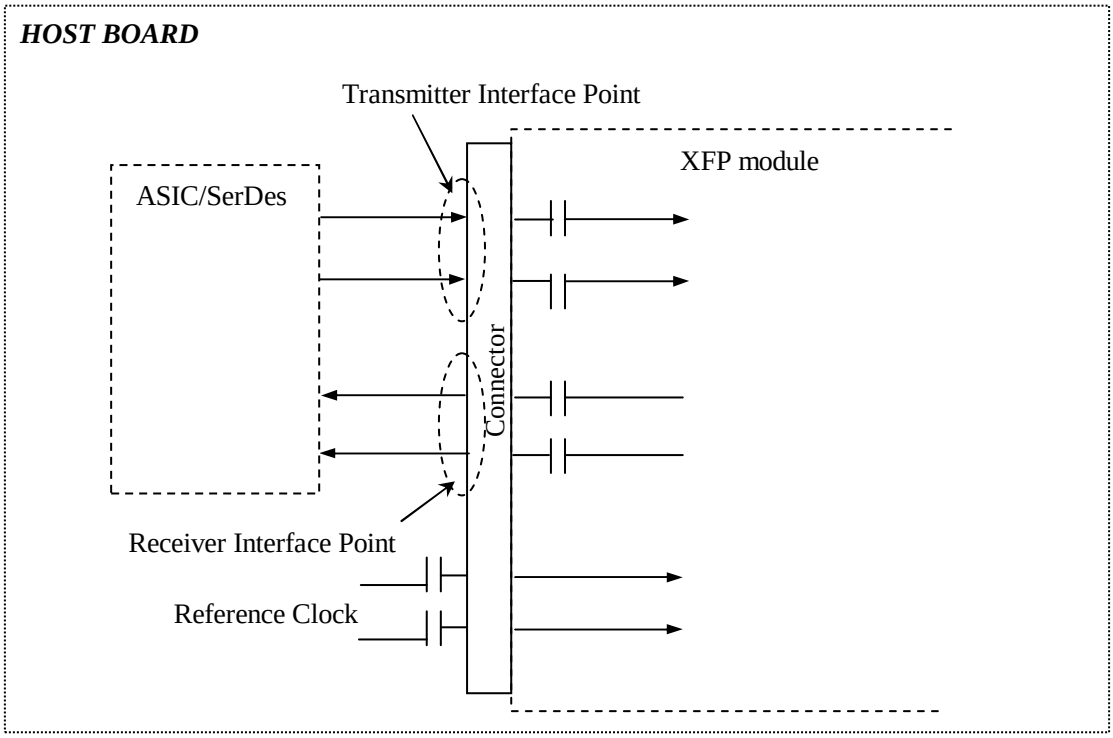


Fig. 5.3.1 XFP Module Electrical Interface Point

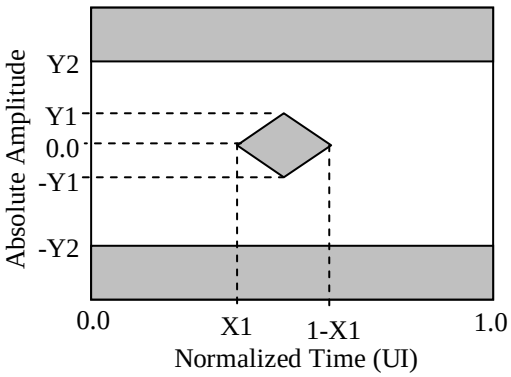


Fig. 5.3.2 Transmitter Differential Input Compliance Mask

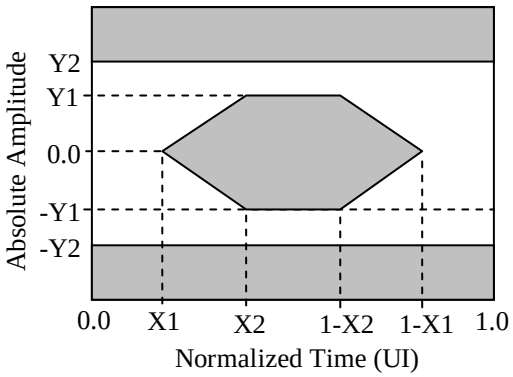


Fig. 5.3.3 Receiver Differential Output Compliance Mask

5.4 Low Speed Electrical Interface

XFP Module low speed electrical interface specification is shown in Table 5.4.1.

Table 5.4.1 Low Speed Electrical Interface Tc : -5 to +70degC

Parameter	*Symbol*	*Min.*	*Max.*	*Unit*	*Note*
LVTTL-I (Tx_Dis, P_Down/RST)	V_{IH}	2.0	VDD3+0.3	V	VDD3 as same as Pull-up Vcc
	V_{IL}	-0.3	0.8	V	
LVTTL-O (Interrupt, Mod_Nr, Rx_Los)	V_{OH}	VDD3-0.5	VDD3+0.3	V	VDD3 as same as Pull-up Vcc
	V_{OL}	0.0	0.4	V	
LVTTL-I (SCL, SDA)	V_{IH}	VDD3*0.7	VDD3+0.5	V	VDD3 as same as Pull-up Vcc
	V_{IL}	-0.3	VDD3*0.3	V	VDD3 as same as Pull-up Vcc
LVTTL-O (SCL, SDA)	V_{OH}	VDD3-0.5	VDD3+0.3	V	VDD3 as same as Pull-up Vcc
	V_{OL}	0.0	0.4	V	
Leakage Current	I_l	-10	10	uA	
Capacitance for XFP SCL and SDA I/O Pin	C_i		14	pF	
Total bus capacitance load for SCL and for SDA	C_b		100	pF	At 400kHz, 3.0kohm Rp, max At 100kHz, 8.0kohm Rp, max
			400	pF	At 400kHz, 0.80kohm Rp, max At 100kHz, 2.0kohm Rp, max

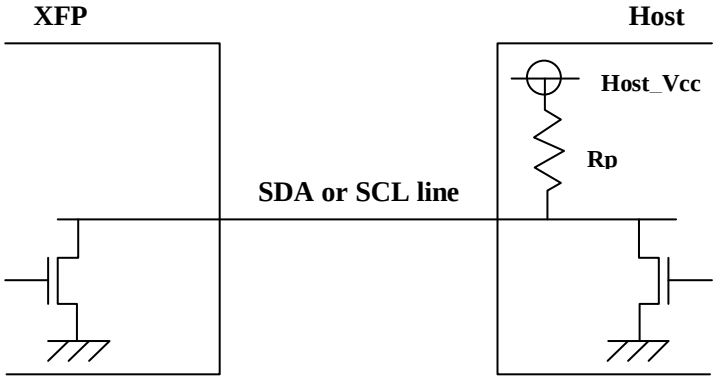


Fig. 5.4.1 An Example Open Drain Type Connection for I2C

6. Optical Characteristics

All parameters are specified over the operating case temperature.

6.1 SONET SDH 2km/ IEEE 10km Optical Characteristics

Table 6.1.1 Optical Characteristics Tc : -5 to +70degC

Parameter	*Symbol*	*Min*	*Typ.*	*Max*	*Unit*	*Note*
Bit Rate	B	9.953	-	11.0957	Gbps	
Transmitter Part						
Center Wavelength	-	1290	-	1330	nm	
Optical Source	-	DFB			-	
Optical Output Power	S_{nom}	-6	-	-1	dBm	
Shutdown Optical Power	Sidle	-	-	-30	dBm	
Extinction Ratio with Filter	ER	6	-	-	dB	
Optical Modulation Amplitude	OMA	-5.2	-	-	dBm	10.3Gbps
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Eye Mask *1	-	GR-253-CORE / ITU-T G.691			-	Fig.6.1.1
		IEEE802.3ae			-	10.3Gbps, Fig.6.1.2
Receiver Part						
Center Wavelength	-	1290	-	1330	nm	
Sensitivity	-	-		-11	dBm	@BER=10^{-12}
Overload	OL	0			dBm	
Stressed Sensitivity in OMA	-	-	-	-10.3	dBm	10.3Gbps, @BER=10^{-12}
Maximum Reflectance	-	-	-	-14	dB	

*1 : Eye mask compliance is shown in Fig.6.1.1 and Fig.6.1.2.

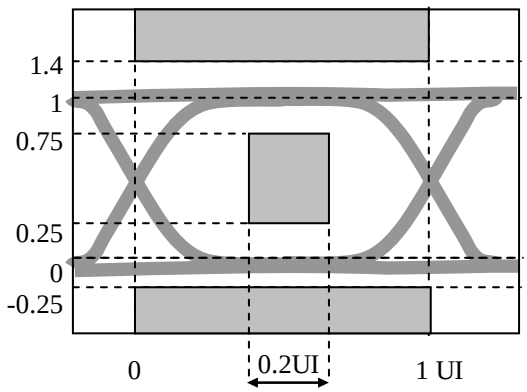


Fig. 6.1.1 MASK for GR-253/G.691

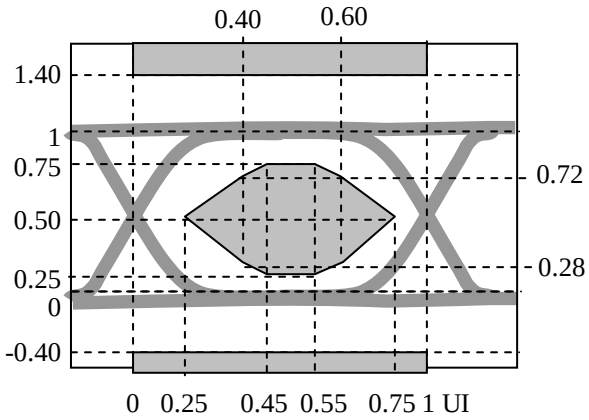


Fig. 6.1.2 MASK for IEEE802.3ae

7. 2-Wire Serial Interface

XFP module has 2-Wire Serial Interface (SDA, SCL), which allows host to monitor some operating parameters and to set some parameters to control the XFP module. As for the detail information of 2-Wire Interface, please see the XFP MSA specification document.

7.1 Digital Diagnostic Functions

Digital Diagnostic Functions are provided using 2-Wire Interface. It provides the following operating monitoring function to Host.

1) Internally Measured Transceiver Temperature

Represented as a 16 bit signed twos compliment value in increments of 1/256 degrees Celsius valid.
The accuracy is better than +/-3 degrees Celsius over specified operating case temperature and voltage.

2) Measured TX Bias Current in uA

Represented as a 16 bit unsigned integer with the current defined as the full 16 bit value with LSB equal to 2uA, yielding a total measurement range of 0 to 131uA.
The accuracy is better than +/-10% over specified operating case temperature and voltage.

3) Measured Tx Output Power in mW

Represented as a 16 bit unsigned integer with the power defined as the full 16 bit value with LSB equal to 0.1uW, yielding a total measurement range of 0 to 6.5535mW (8.2dBm). Data is based on measurement of laser monitor photodiode current.
The accuracy is better than +/-2dB over specified operating case temperature and voltage.

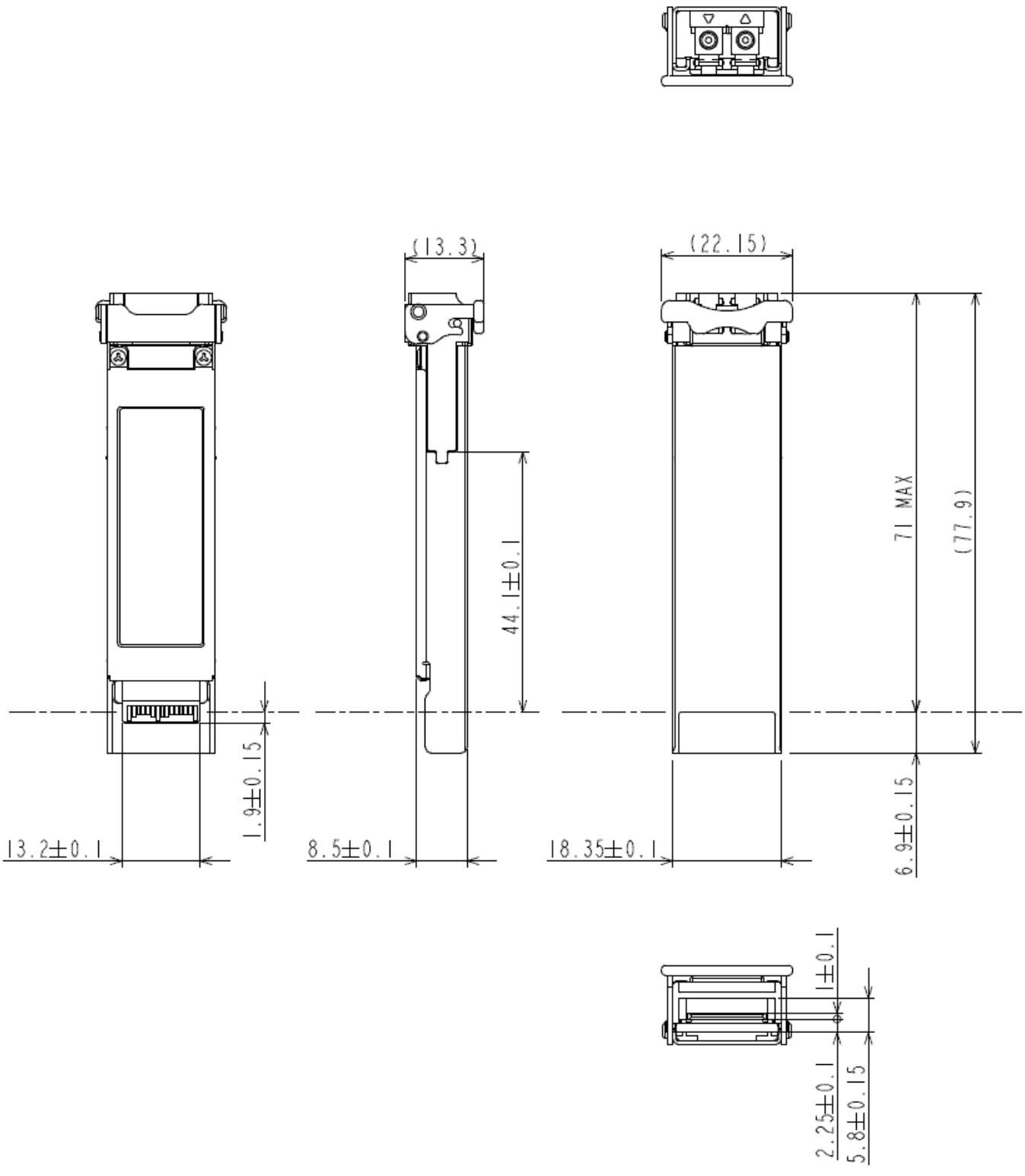
4) Measured RX Received Optical Power in mW

Value can represent either the average received power. Represented as a 16 bit unsigned integer with the power defined as the full 16 bit value with LSB equal to 0.1uW, yielding a total measurement range of 0 to 6.5535mW (+8.2dBm).
The accuracy is better than +/-2dB over specified operating case temperature and voltage.

5) Internally Measured Transceiver Supply Voltage

Represented as a 16 bit unsigned integer with the voltage defined as the full 16 bit value with LSB equal to 100uV, yielding a total measurement range of 0 to +6.55V.
The accuracy is better than +/- 3% over specified operating case temperature and voltage.

8. General Outline Drawing



9. Environment Considerations

9.1 Mechanical Shock
MIL-STD-883 Method 2002

9.2 Mechanical Vibration
MIL-STD-883 Method 2004

9.3 Thermal Shock
MIL-STD-883 Method 1011

9.4 Laser Class
Class 1 Laser Products

9.5 ESD
IEC 610004-2, 500V, HBM

10. Reference Document

1) 10 Gigabit Small Form Factor Pluggable Module (XFP) Multi-Source Agreement (MSA), Rev 4.0 – April 2003. http://www.xfpmsa.org/XFP_SFF_INF_8077i_Rev4_0.pdf

11. Ordering Information

11.1 Transceiver Type Number

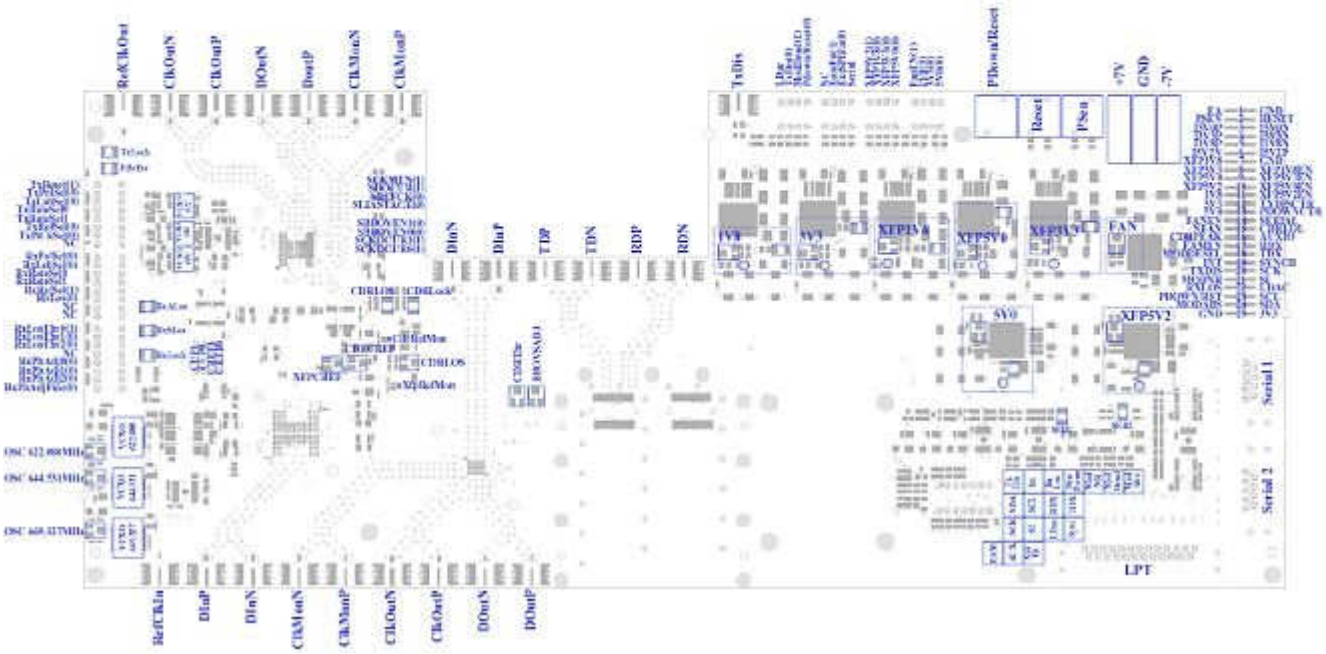
Type Number	*Features*	*Optical Connector*
MF-10KSXA-007ZA	MITSUBISHI Standard type (1310nm 2km/10km version)	LC Receptacle

11.2 Optional Test Board

Type Number	*Features*
	XFP Test Board

Please refer following figure.

	9.953280	10.312500	10.709225	Ext ClkRef
CUP1	0	0	1	
CUP0	0	1	0	
CREF1	0	0	1	1
CREF0	0	1	0	1
TxRateSel0	0	1	1	
TxRateSel1	0	1	0	
RxRateSel0	0	1	1	
RxRateSel1	0	1	0	



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