XA-ST02 Copper SFP
Small Form Factor Pluggable, 3.3V
1G/2.5G/5G/10Gbps Ethernet

Features

- 10Gbps Links up to 30m using Cat 6a/7 Cable
- 1G/2.5G Links up to 100m using Cat 5e Cable
- 5Gbps Links up to 100m using Cat 6a Cable
- Low Power Consumption
  - 4.0W Max, 35m @ 10Gbps, 75°C
  - 3.0W Max, 200m @ 2.5Gbps, 75°C
  - 3.0W Max, 100m @ 100M, 1Gbps and 5Gbps, 75°C
- IEEE 802.3az/bz Compliant
- SFF-8431 and SFF-8432 MSA Compliant
- Access EEPROM/PHY IC via 2-wire Serial Bus
- I2C to MDIO Bridge (Support IEEE 802.3 Clause 45)
- Fast Retrain and EMI Cancellation Algorithm
- Compliant with RoHS.
- +3.3V Single Power Supply
- Temperature Range 0°C to +75°C

Application

- XA-ST02 testing to NuStreams XM-RM882 Module and NuDOG-802
- 10Gbps Ethernet over Category 6a/7 Cable
- Distributed multi-processing
- High speed I/O for file server or high-end workstation Switch/Router to Switch/Router Link

Ordering Information

PART NUMBER	Product Name
XA-ST02	Multi-G Copper SFP

Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNITS	NOTE
Storage Temperature	*Ts*	-45	90	°C	
Storage Humidity	*Hs*	5	90	%	

Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	MAX	UNITS	NOTE
Operating Temperature	*T*	0	75	°C	Case Temperature
Operating Humidity	*Ho*	10	85	%	
Supply Voltage	*Vcc*	3.135	3.465	V	Typ. 3.3V
Surge Current	*Isurge*		30	mA	Hot Plug

Cable Length Operating Conditions

PARAMETER	SYMBOL	MAX	UNITS	NOTE
10Gbps @30M Cat7	*I*	1200	mA	(1), (2), (5)
5Gbps @100M Cat6a	*I*	900	mA	(1), (3), (5)
2.5Gbps @100M Cat5e	*I*	900	mA	(1) , (4)
1Gbps @100M Cat5e	*I*	900	mA	(1) , (3)

Note:

(1) Chamber = 60°C, measurement after traffic 30 minutes without packet loss.
(2) Single Cat7 30m cable without series.
(3) Single Cat5e 100m cable without series.
(4) Two Cat5e 100m cable with series.
(5) Case temperature measurement is around chamber temperature + 22~23°C.
Thus, ambient temperature should be controlled under 50°C for proper operation.
Network switch with good air flow/temperature control at 25°C, case temperature should be less than 50°C.

Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNITS	NOTE
Transmitter						
Data Input differential Voltage	$V_{D,TX}$	110		1000	mV	(1)
Differential Input Impedance	Z_{TX}		100		Ohm	
Transmitter Disable Input-High	V_{Dish}		N/A		V	Not implement
Transmitter Disable Input-Low	V_{DISL}		N/A		V	Not implement
Receiver						
Data Output Differential Voltage	$V_{D,RX}$	370		800	mV	(3)
Differential Output Impedance	Z_{RX}		100		Ohm	
LOS Output Voltage – High	V_{SDHL}	2.4		V_{cc}	V	(2)
LOS Output Voltage – Low	V_{SDL}	0		0.5	V	(2)

Note:
(1) Internally AC coupled to PHY chip.
(2) Pull up to VCC with a 4.7K – 10K Ohm resistor on host Board
(3) Internally AC coupled, but requires a 100 Ohm differential termination at MAC side.

LOS Function

The SFP MSA specification defines a pin called LOS to indicate loss of signal to the motherboard. This should be pulled up with a 4.7K to 10K resistor. Pull up voltage between 2.0V and Vcc-T/R+0.3V. When high, this output indicates link fail. Low indicates normal operation. In the low state, the output will be pulled to <0.5V.

Termination Circuits

Inputs to the transceiver are AC coupled and internally terminated through 50 ohms. The input signal must have at least an 110mV differential peak-to-peak signal swing. Output from the receiver section of the module is also AC coupled and is expected to drive a 50 ohm load. Different termination strategies may be required depending on the particular Serializer/Deserializer chip set used. The transceiver is designed with AC coupled data inputs and outputs to provide the following advantages:

Close positioning of SERDES with respect to transceiver; allows for shorter line lengths and at high speeds reduces EMI. Minimize number of external components. Internal termination reduces the potential for un-terminated stubs which would otherwise increase jitter and reduce transmission margin.

Subsequently, this affords the customer capability to optimally locate the SERDES as close to the transceiver as possible and save valuable real estate. At 10Gbps rates this can provide a significant advantage resulting in better transmission performance and accordingly better signal integrity.

Power Coupling

A suggested layout for power and ground connections is given in Figure 1 below. Connections are made via separate voltage and ground planes. The mounting posts are at case ground and should not be connected to circuit ground. The ferrite bead should provide a real impedance of 50 to 100 ohms at 100 to 1000 MHz. Bypass capacitors should be placed as close to the 20 pin connector as possible.

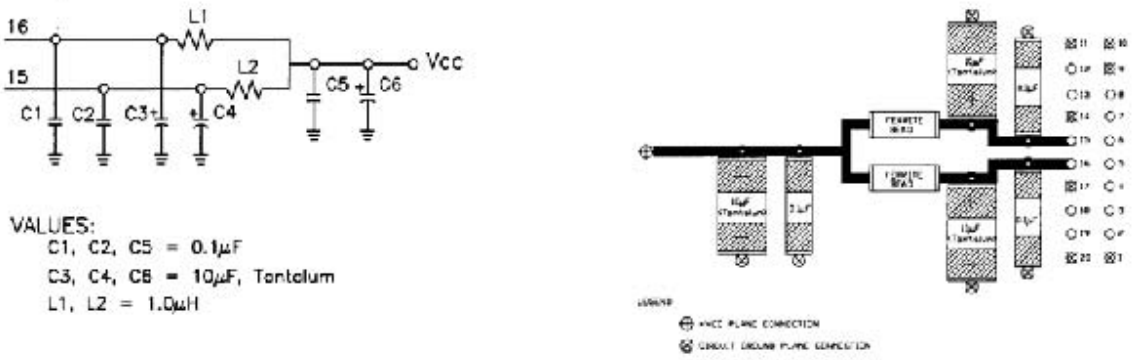
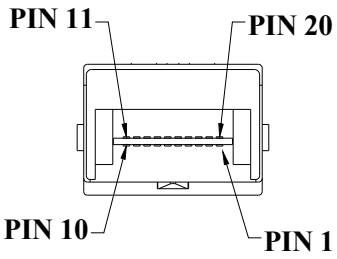


Figure 1: Suggested Power Coupling

Connection Diagram

Pin-Out



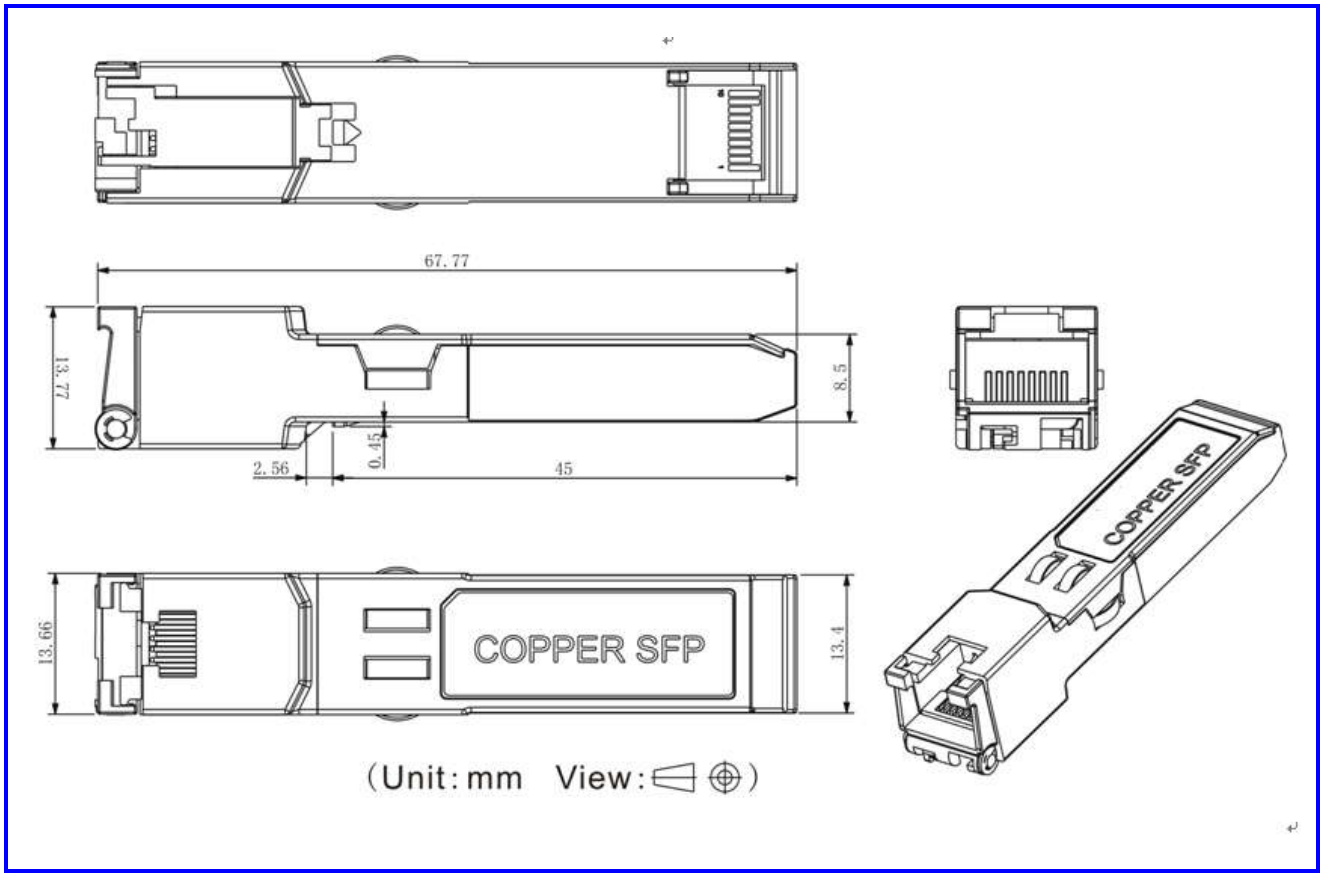
Pin	Signal Name	Function	NOTES
1	VeeT	Transmitter Ground	VeeT and VeeR are connected in SFP.
2	TX_FAULT	Transmitter Fault Indication	Not Implemented. Tied to VeeT in SFP.
3	TX_DISABLE	Transmitter Disable	Not Implemented. Floating in host.
4	MOD DEF (2)	Module Definition 2	Data Line for Serial ID.
5	MOD DEF (1)	Module Definition 1	Clock Line for Serial ID.
6	MOD DEF (0)	Module Definition 0	Tied to Vee in SFP.
7	RATE SELECT	Not Implemented	Not implemented.
8	LOS	Loss of Signal	See LOS option.
9	VeeR	Receiver Ground	VeeT and VeeR are connected in SFP.
10	VeeR	Receiver Ground	VeeT and VeeR are connected in SFP.
11	VeeR	Receiver Ground	VeeT and VeeR are connected in SFP.
12	RD-	Inverted Received Data out	AC coupled 100 ohm differential high speed data lines.
13	RD+	Non-Inverted Received Data out	AC coupled 100 ohm differential high speed data lines.
14	VeeR	Receiver Ground	VeeT and VeeR are connected in SFP.

15	VccR	Receiver Power	VccR and VccT are connected in SFP.
16	VccT	Transmitter Power	VccR and VccT are connected in SFP.
17	VeeT	Transmitter Ground	VeeT and VeeR are connected in SFP.
18	TD+	Non-inverted Data In	AC coupled 100 ohm differential high speed data lines.
19	TD-	Inverted Data In	AC coupled 100ohm differential high speed data lines
20	VeeT	Transmitter Ground	Veet and VeeR are connected in SFP

Notes:

1. TX Fault is not used and is always tied to ground.
2. TX Disable as described in the MSA is not applicable to the copper SFP module.
3. Mod-Def 0,1, 2. These are the module definition pins. They should be pulled up with a 4.7-10 K resistor on the host board to a supply less than VCCT + 0.3 V or VCCR + 0.3 V.
4. RD-/+: These are the differential receiver outputs. They are AC coupled 100 Ohm differential lines which should be terminated with 100 ohm differential at the user SerDes. The AC coupling is done inside the module and is thus not required on the host board.
5. VCCR and VCCT are the receiver and transmitter power supplies. They are defined as 3.3 V ± 5% at the SFP connector pin.
6. TD-/+: These are the differential transmitter inputs. They are AC coupled differential lines with 100 Ohm differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

Drawing Dimensions



Mating of SFP Transceiver to SFP Host Board Connector

The pads on the PCB of the SFP transceiver shall be designed for a sequenced mating as follows: First mate: Ground contacts. Second mate: Power contacts. Third mate: Signal contacts The SFP MSA specification for a typical contact pad plating for the PCB is 0.38 micrometers minimum hard gold over 1.27 micrometers minimum thick nickel. To ensure the long term reliability performance after a minimum of 50 insertion removal cycles, the contact plating of the transceiver is 0.762 micron (30 micro-inches) over 3.81 micron (150 micro-inches) of Ni on Cu contact pads.

RJ45 Connector

RJ45 connector shall support shielded and unshielded cables. Also, the connector is mechanically robust enough and designed to prevent loss of link, when the cable is positioned or moves in different angles. The connector shall pass the “wiggle” RJ45 connector operational stress test. During the test, after the cable is plugged in, the cable is moved in circle to cover all 360 deg in the vertical plane, while the data traffic is on. There shall be no link or data loss.