

HTSFP-XG-1111TF

10/100/1000Base-T or 10GBase-T Copper SFP+ Transceiver

Used twisted pair category 6a/7 Cable, Link lengths at 10GBase up to 30m

Used twisted pair category 5 cable or better, Link lengths at 10/100/1000Base up to 100m

Temperature applications as 0°C to 70°C or -40°C to 85°C



HTSFP-XG-1111TF

Copper SFP Transceiver

DataSheet

Descriptions:

The Hi-Optel HTSFP-XG-11xxTF copper transceiver module is a high performance integrated duplex data link for bi-directional communication over copper cable. It is specifically designed for high speed communication links that require 10 Gigabit Ethernet over Cat 7 cable at XFI to Copper Auto-negotiation mode.

HTSFP-XG-1111TF supports SGMII to Copper Auto-negotiation mode . compliant with the Gigabit Ethernet and 1000BASE-T standards as specified in IEEE 802. 3-2012 and IEEE 802.3ab, which supports 10/100/1000Base-T Copper data-rate up to 100 meters reach over twisted-pair category 5 cable.

The HTSFP-XG-1111TF provides standard serial ID information compliant with SFP MSA, which can be accessed with address of A0h via the 2-wire serial CMOS EEPROM protocol. The physical IC can also be accessed via 2-wire serial bus at address ACh. The address of the PHY is 1010110x where x is the R/W bit.

Features:

- ✧ Supports XFI(SFI)or SGMII to Copper Auto-negotiation
- ✧ 10G BASE-T operation in Host Systems with XFI(SFI) Interface.
- ✧ 10G BASE-T supports Links up to 30m using Cat 6a/7 Cable. Power Consumption 2.5W MAX @ 30m
- ✧ 10/100/1000 BASE-T operation in Host Systems with SGMII Interface.
- ✧ 10/100/1000 BASE-T supports Links up to 100m using Cat 5 Cable or better
- ✧ Unshielded and Shielded cable support
- ✧ MDI/MDIX Crossover.
- ✧ 3.3V Single Power Supply.
- ✧ Hot-pluggable SFP Footprint. Fully Metallic Enclosure for Low EMI.
- ✧ Compact RJ-45 Connector Assembly
- ✧ Detailed Product Information in EEPROM
- ✧ Access to I²C -Wire Serial Bus Interface for Serial ID and PHY Register Access
- ✧ Compliant with SFF-8431 SFF-8432 and SFF-8472
- ✧ Compliant with SFP MSA
- ✧ Compliant with IEEE 802.3-2012, IEEE 802.3az
- ✧ Compliant with FCC 47 CFR Part 15 Class B / EN55022 Class B
- ✧ Compliant with RoHs-6.
- ✧ Operation temperature range 0°C to 70°C



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Applications:

- ✧ 10 Gigabit Ethernet over Category 6a/7 Cable
- ✧ Switch/Route to Switch/Route Link
- ✧ High Speed I/O for File Servers

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Temperature applications as 0°C to 70°C or -40°C to 85°C



1. Ordering Information:

Part No.	DESCRIPTION	LABEL MARKING
HTSFP-XG-1111TF	10G /5G /2.5GBase-T and 10/100/1000Base-T default for all speed advertisement to XFI interface with Rate Matching, enable the auto-negotiation default, with Tx_disable function, support Rx_LOS as link indication function, 10GBase-T over Category 6a/7 Cable up to 30m, 10/100/1000Base-T over unshielded twisted-pair (UTP) Category 5 Cable up to 100m, operation temperature 0~70°C	 HTSFP-XG-1111TF Copper SFP+ 10G Base-T 30m +3.3V 0~70°C S/N: 1903032007 RoHS
HTSFP-XG-1121TF	10G /5G /2.5GBase-T and 10/100/1000Base-T default for all speed advertisement to XFI interface with Rate Matching, enable the auto-negotiation default, with Tx_disable function, support Rx_LOS as link indication function, 10GBase-T over Category 6a/7 Cable up to 30m, 10/100/1000Base-T over unshielded twisted-pair (UTP) Category 5 Cable up to 100m, operation temperature -40~85°C	 HTSFP-XG-1121TF Copper SFP+ 10G Base-T 30m +3.3V -40~85°C S/N: 1903032007 RoHS
HTSFP-XG-1112TF	10G /5G /2.5GBase-T and 10/100/1000Base-T default for all speed advertisement to XFI/5GBase-R/2.5GBase-X/SGMII interface and SGMII Auto-Negotiation Off default, with Tx_disable function, support Rx_LOS as link indication function, 10GBase-T over Category 6a/7 Cable up to 30m, 10/100/1000Base-T over unshielded twisted-pair (UTP) Category 5 Cable up to 100m, operation temperature 0~70°C	 HTSFP-XG-1112TF Copper SFP+ 10G Base-T 30m +3.3V 0~70°C S/N: 1903032007 RoHS
HTSFP-XG-1122TF	10G /5G /2.5GBase-T and 10/100/1000Base-T default for all speed advertisement to XFI/5GBase-R/2.5GBase-X/SGMII interface and SGMII Auto-Negotiation Off default, with Tx_disable function, support Rx_LOS as link indication function, 10GBase-T over Category 6a/7 Cable up to 30m, 10/100/1000Base-T over unshielded twisted-pair (UTP) Category 5 Cable up to 100m, operation temperature -40~85°C	 HTSFP-XG-1122TF Copper SFP+ 10G Base-T 30m +3.3V -40~85°C S/N: 1903032007 RoHS
HTSFP-XG-1113TF	10G /5G /2.5GBase-T and 10/100/1000Base-T default for all speed advertisement to XFI/5GBase-R/2.5GBase-X/SGMII interface and SGMII Auto-Negotiation On, enable the auto-negotiation default, with Tx_disable function, support Rx_LOS as link indication function, 10GBase-T over Category 6a/7 Cable up to 30m, 10/100/1000Base-T over unshielded twisted-pair (UTP) Category 5 Cable up to 100m, operation temperature 0~70°C	 HTSFP-XG-1113TF Copper SFP+ 10G Base-T 30m +3.3V 0~70°C S/N: 1903032007 RoHS
HTSFP-XG-1123TF	10G /5G /2.5GBase-T and 10/100/1000Base-T default for all speed advertisement to XFI/5GBase-R/2.5GBase-X/SGMII interface and SGMII Auto-Negotiation On, enable the auto-negotiation default, with Tx_disable function, support Rx_LOS as link indication function, 10GBase-T over Category 6a/7 Cable up to 30m, 10/100/1000Base-T over unshielded twisted-pair (UTP) Category 5 Cable up to 100m, operation temperature -40~85°C	 HTSFP-XG-1123TF Copper SFP+ 10G Base-T 30m +3.3V -40~85°C S/N: 1903032007 RoHS
HTSFP-XG-1114TF	10G /5G /2.5GBase-T and 10/100/1000Base-T default for all speed advertisement to USXGMII interface, enable the auto-negotiation default, with Tx_disable function, support Rx_LOS as link indication function, 10GBase-T over Category 6a/7 Cable up to 30m, 10/100/1000Base-T over unshielded twisted-pair (UTP) Category 5 Cable up to 100m, operation temperature 0~70°C	 HTSFP-XG-1114TF Copper SFP+ 10G Base-T 30m +3.3V 0~70°C S/N: 1903032007 RoHS
HTSFP-XG-1124TF	10G /5G /2.5GBase-T and 10/100/1000Base-T default for all speed advertisement to USXGMII interface, enable the auto-negotiation default, with Tx_disable function, support Rx_LOS as link indication function, 10GBase-T over Category 6a/7 Cable up to 30m, 10/100/1000Base-T over unshielded twisted-pair (UTP) Category 5 Cable up to 100m, operation temperature -40~85°C	 HTSFP-XG-1124TF Copper SFP+ 10G Base-T 30m +3.3V -40~85°C S/N: 1903032007 RoHS

HTSFP- XG - 1 1 x x T F

Data Rate:
XG: 10Gb/s

Receptacle:
1: RJ45

Package Type:

TX Disable Function:
T: Support
blank: Not support

Support MAC Type:
1: XFI with Rate Matching
2: XFI/5GBase-R/2.5GBase-X/SGMII, SGMII Auto-Negotiation Off
3: XFI/5GBase-R/2.5GBase-X/SGMII, SGMII Auto-Negotiation On
4: USXGMII

Operation Temperature:

1: 0~70°C
2: -40~85°C

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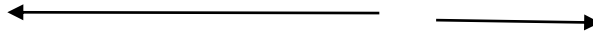
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Used twisted pair category 5 cable or better, Link lengths at 10/100/1000Base up to 100m

Temperature applications as 0°C to 70°C or -40°C to 85°C



Notes:

- 1 Adding the Capital "F" at the end of the PN for RoHs compliant product.
- 2 Automatic crossover detection is enabled. External crossover cable is not required
- 3 10GBASE-T operation requires the host system to have an SFI interface with no clocks.
- 4 10/100/1000 BASE-T operation requires the host system to have an SGMII interface with no clocks.

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2.Specification:

2.1 SFP+ to Host Connector Pin Out

Pi n	Signal Name	Description	MSA Note
1	VEET	Transmitter ground (common with receiver ground)	
2	TFAULT	Transmitter Fault. Not supported, Grounded in module	Note 1
3	TDIS	Transmitter Disable - Module disables on high or open	Note 2
4	MOD_DEF(2)	Module Definition 2. Data line for Serial ID.	Note 3
5	MOD_DEF(1)	Module Definition 1. Clock line for Serial ID.	Note 3
6	MOD_DEF(0)	Module Definition 0. Grounded in module.	Note 3
7	Rate Select	No connection	
8	LOS	Loss of Signal - High Indicates Loss of Signal	Note 4
9	VEER	Receiver Ground (common with transmitter ground)	
10	VEER	Receiver Ground (common with transmitter ground)	
11	VEER	Receiver Ground (common with transmitter ground)	
12	RD-	Receiver Inverted DATA out. AC Coupled	Note 5
13	RD+	Receiver Non-inverted DATA out. AC Coupled	Note 5
14	VEER	Receiver Ground (common with transmitter ground)	
15	VCCR	Receiver Power Supply	Note 6
16	VCCT	Transmitter Power Supply	Note 6
17	VEET	Transmitter Ground (Common with Receiver Ground)	
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	Note 7
19	TD-	Transmitter Inverted DATA in. AC Coupled.	Note 7
20	VEET	Transmitter Ground (common with receiver ground)	

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 module, but is used for convenience as an input to reset the internal ASIC. This pin is pulled up within the module with a 4.7 Kohm resistor.
Low (0–0.8 V): Transceiver on
Between (0.8 V and 2.0 V): Undefined
High (2.0–3.465 V): Transceiver in reset disable state
Open: Transceiver in reset disable state
3. Mod-Def 0, 1, 2. These are the module definition pins. They should be pulled up with a 4.7-10 Kohm resistor on the host board to a supply less than VCCT + 0.3 V or VCCR + 0.3 V.
Mod Def 0 is tied to ground to indicate that the module is present.
Mod-Def 1 is clock line of two wire serial interface for optional serial ID.
Mod-Def 2 is data line of two wire serial interface for optional serial ID.
4. This pin is open drain CMOS output signals. They should be pulled up with a 4.7-10 Kohm resistor on the host board to a supply less than VCCT + 0.3 V or VCCR + 0.3 V. (see Table 3. Low-Speed Signals, Electronic Characteristics)
5. 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. The voltage swing on these lines will be between 370 and 2000 mV differential (185 – 1000 mV single ended) when properly terminated. These levels are compatible with CML and LVPECL voltage swings.
6. VCCR and VCCT are the receiver and transmitter power supplies. They are defined as 3.3 V ± 5% at the SFP connector pin. The maximum supply current is about 300mA and the associated in-rush current will typically be no more than 30 mA above steady state after 500 nanoseconds.

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7. 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. The inputs will accept differential swings of 500 – 2400 mV (250 – 1200 mV single ended), though it is recommended that values between 500 and 1200 mV differential (250 – 600 mV single ended) be used for best EMI performance. These levels are compatible with CML and LVPECL voltage swings.

2.2 SFP+ to Host Connector Pin Out and RJ45 Connector Diagram

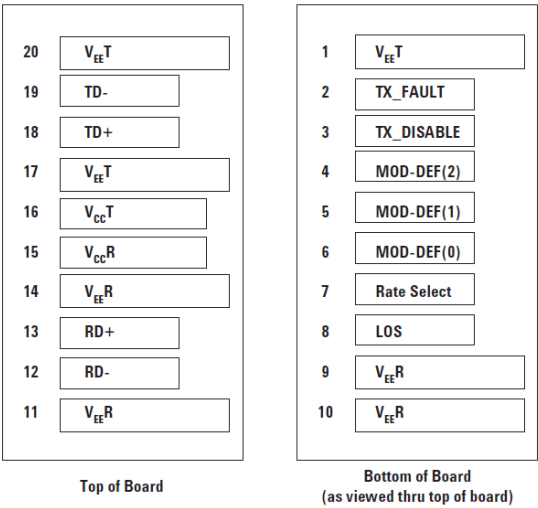


Figure 1a. Diagram of Host Board Connector Block Pin Numbers and Names

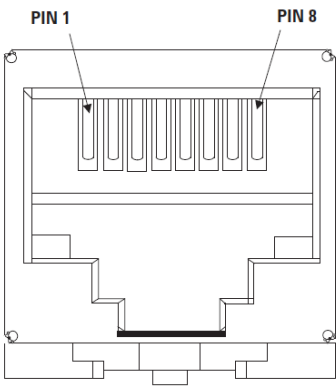


Figure1b. MDI (RJ 45 Jack) Pin Assignment

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2.3 Recommended Interface Circuit

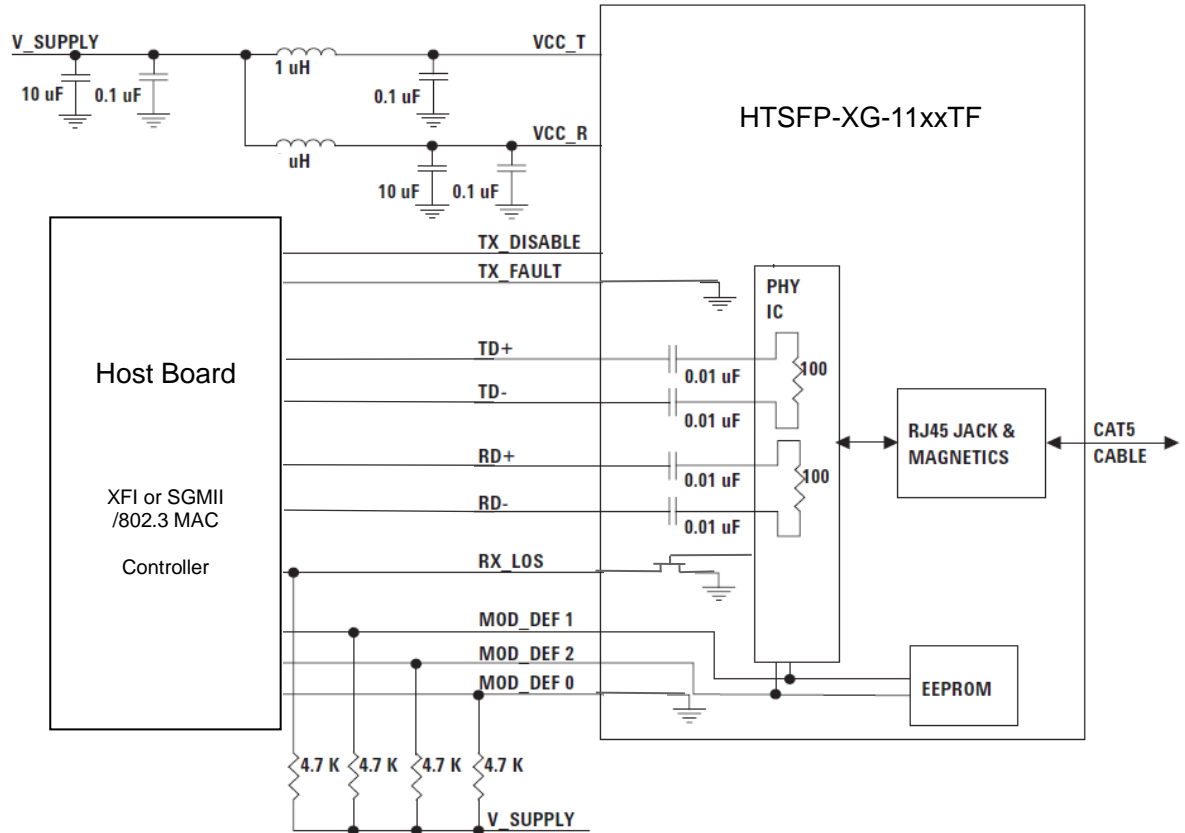


Figure 2 Recommended Interface Circuit

2.4 Recommended Host Board Power Supply Circuit

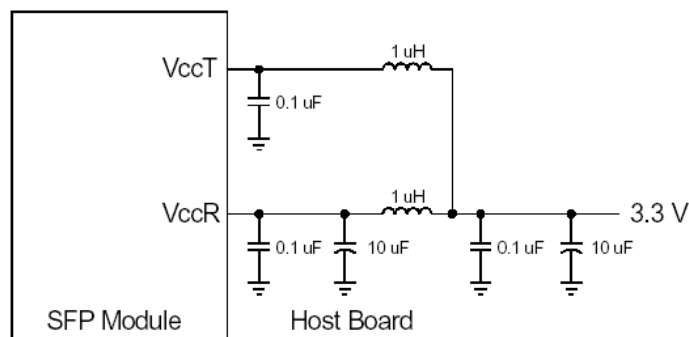


Figure 3, Recommended Host Board Power Supply Circuit

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2.5 Power Supply Interface Electronic Characteristics

The SFP+ Copper Transceiver has an input voltage range of $3.3\text{ V} \pm 5\%$. The 4 V maximum voltage is not allowed for continuous operation.

Power Supply Interface Electronic Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Note/Conditions
Supply Current	I _s		650	700	mA	At 10GBase-t Cat 6a/7 30m 2.5W max power over full range of voltage and temperature. See caution note below
			430	470	mA	At 1000Base-t Cat 5 100m over full range of voltage and temperature
			290	320	mA	At 100Base-t Cat 5 100m over full range of voltage and temperature
			330	360	mA	At 10Base-t Cat 5 100m over full range of voltage and temperature
Input Voltage	V _{cc}	3.135	3.3	3.465	V	Referenced to GND

Caution: Power consumption and surge current are higher than the specified values in the SFP MSA

Table 2. Power Supply Interface Electronic Characteristics

2.6 Low-Speed Signals

MOD_DEF (1) (SCL) and MOD_DEF (2) (SDA) are open drain CMOS signals. Both MOD_DEF (1) and MOD_DEF (2) must be pulled up to host_Vcc.

Low-Speed Signals, Electronic Characteristics

Parameter	Symbol	Min.	Max.	Unit	Note/Conditions
SFP Output LOW	V _{OL}	0	0.5	V	4.7k to 10k pull-up to host_Vcc.
SFP Output HIGH	V _{OH}	host_Vcc - 0.5	host_Vcc + 0.3	V	4.7k to 10k pull-up to host_Vcc.
SFP Input LOW	V _{IL}	0	0.8	V	4.7k to 10k pull-up to Vcc.
SFP Input HIGH	V _{IH}	2	Vcc + 0.3 V	V	4.7k to 10k pull-up to Vcc.

Table 3. Low-Speed Signals, Electronic Characteristics

2.7 High-Speed Electrical Interface

All high-speed signals are AC-coupled internally.

High-Speed Electrical Interface, Transmission Line-SFP+

Parameter	Symbol	Min.	Typical	Max.	Unit	Note/Conditions
Line Frequency	f _L		10.3125		GHz	SFI to Copper
			1.25		GHz	SGMII to Copper
Tx Output Impedance	Z _{out,TX}		100		Ohm	Differential
Rx Input Impedance	Z _{in,RX}		100		Ohm	Differential

Table 4. High-Speed Electrical Interface, Transmission Line-SFP+

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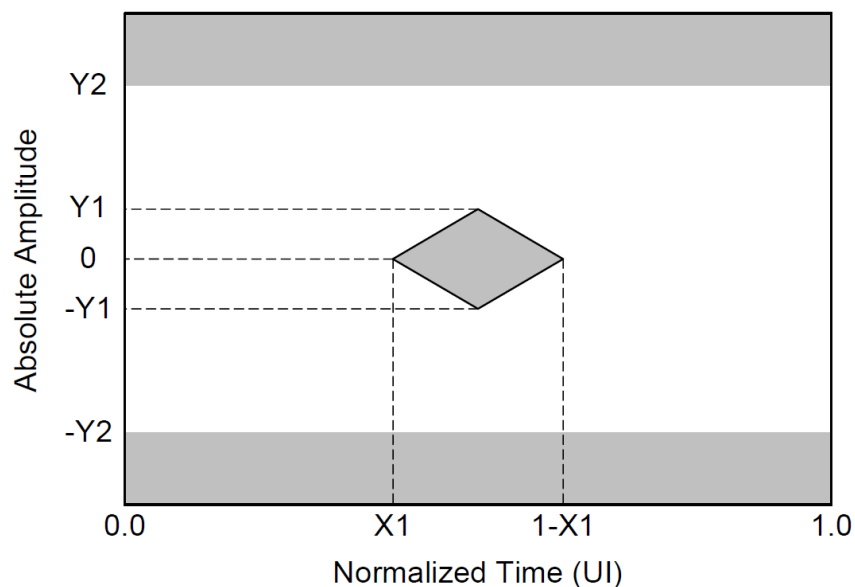


High-Speed Electrical Interface, Host-SFP+

SERDES Receiver Input

Symbol	Parameter	Condition	Min	Typ	Max	Units
SDD11	Input Return Loss	Differential, 100 Ω				dB
		$f < 2.5$ GHz			-9	
		2.5 - 7.5 GHz			$-9 + 12 \log(f/2.5G)$	
Adiff	Amplitude	Differential pk-pk	0.5	0.8	1.1	V
Acm	CM ripple				20	mv, pk-pk
SCD11	Input Return Loss	Reference 25 Ω				dB
		$f < 2.5$ GHz			-6	
		2.5 - 7.5 GHz			$-6 + 12 \log(f/2.5G)$	
X1	Tx Eye Mask				0.325	UI
Y1	Tx Eye Mask		0.055			V pk, diff
Y2	Tx Eye Mask				0.5	V pk, diff
Vicm	Input CM	Rx can be DC coupled	0.1		1.4	V
RC2	Receiver interference tolerance at 10 Gbps	As per IEEE 802.3, section 72				

Receiver Eye Mask



Symbol	Parameter	Condition	Min	Typ	Max	Units
SDD11	Input Return Loss	Differential, 100 Ω				dB
		f < 2.5 GHz			-9	
		2.5 - 7.5 GHz			-9+12log(f/2.5G)	
Adiff	Amplitude	Differential pk-pk	0.5	0.8	1.1	V
tr, tf	Rise, Fall Time	20 - 80% of swing	25		47	ps
Acm	CM ripple				20	mv, pk-pk
SCD11	Input Return Loss	Reference 25 Ω				dB
		f < 2.5 GHz			-6	
		2.5 - 7.5 GHz			-6+12log(f/2.5G)	
X1	Tx Eye Mask				0.15	UI
X2	Tx Eye Mask				0.4	UI
Y1	Tx Eye Mask		0.185			V pk, diff
Y2	Tx Eye Mask				0.4	V pk, diff
TJ	Total Jitter				0.3	UI

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Parameter	Symbol	Min.	Typical	Max.	Unit	Note/Conditions
Data Input: Transmitter Differential Input Voltage (TD +/-)	Vinsing	500	800	1100	mV	
Data Output: Receiver Differential Output Voltage (RD +/-)	Voutsing	500	800	1100	mV	
Rise/Fall Time	Tr, Tf	25		47	psec	20%-80%
Tx Input Impedance	Zin		50		Ohm	Single ended
Rx Output Impedance	Zout		50		Ohm	Single ended

Table 5. High-Speed Electrical Interface, Host-SFP+

General Specifications

Parameter	Symbol	Min.	Typical	Max.	Unit	Note/Conditions
Data Rate	BR		10.3125 or 1.25		Gb/s	IEEE 802.3 compatible.
Cable Length	L			30	m	@10GBase-T .Category 6a/7 BER <10 ⁻¹²
				100	m	@10/100/1000Base-T .C ategory 5 UTP. BER <10 ⁻¹²

Table 6. General Specifications

Notes:

1. Automatic crossover detection is enabled. External crossover cable is not required.
2. 10GBASE-T operation requires the host system to have an SFI interface with no clocks.
3. 10/100/1000 BASE-T operation requires the host system to have an SGMII interface with no clocks.

2.8 Environmental Specifications

The HTSFP-XG-11xxTF case temperature as specified in Table 7.

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes/Conditions
Operating Temperature	Top	0		70	°C	Commercial Case temperature
		-40		85	°C	Industrial Case temperature
Storage Temperature	Tsto	-55		105	°C	Ambient temperature

Table 7. Environmental Specifications

2.9 Serial Communication Protocol



Parameter	Symbol	Min.	Typical	Max.	Unit	Note/Conditions
I ² C Clock Rate			100	200	KHz	

Table 8. I²C Specifications

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2.10 Serial ID Memory Contents:

The HTSFP- XG – 11xxTF provides standard serial ID information compliant with SFP MSA, which can be accessed with address of A0h via the 2-wire serial CMOS EEPROM protocol.

Address	Field Size (Byte)	Name of Field	Description and Contents	Hex
Base ID Fields				
0	1	Identifier	Type of Serial transceiver (SFP)	03
1	1	Ext. Identifier	Extended identifier of type serial transceiver (MOD4)	04
2	1	Connector	Code of optical connector type (Copper)	22
3-10	8	Transceiver	SFI to 10G Base-T Copper	10 00 00 00 00 00 00 00
11	1	Encoding	64B/66B	06
12	1	BR,Nominal	Nominal baud rate, unit of 100 MBd 10.3125 GBd For 10GBase-T	67
13	1	Rate Identifier	Type of rate select functionality ,(Unspecified)	00
14	1	Length (SMF9um)-km	Link length supported for single mode fiber, units of km	00
15	1	Length (SMF9um)	Link length supported for 9/125um fiber, units of 100m	00
16	1	Length (50um)	Link length supported for 50/125um OM2 fiber, units of 10m	00
17	1	Length (62.5um)	Link length supported for 62.5/125um OM1 fiber, units of 10m	00
18	1	Length (OM4 or copper cable)	Link length supported for 50um OM4 fiber, units of 10m. Alternatively copper or direct attach cable, units of m. For copper links, this value specifies minimum link length (30m) supported by the transceiver while operating in compliance with applicable standards using copper cable.	1E
19	1	Length (OM3)	Link length supported for 50 um OM3 fiber, units of 10 m	00
20-35	16	Vendor Name	SFP vendor name (ASCII), "Hi-OPTTEL"	48 69 2D 4F 50 54 45 4C 20 20 20 20 20 20 20 20
36	1	Transceiver	Code for electronic or optical compatibility(SFF-8024 Table 4-4) 10GBASE-T with SFI electrical interface	16
37-39	3	Vendor OUI	SFP vendor IEEE company ID, A value of all zero in the 3-byte field indicates that the Vendor OUI is unspecified.	00 00 00
40-55	16	Vendor PN	Part number provided by SFP vendor (ASCII) "HTSFP-XG-1111TF"	48 54 53 46 50 2D 58 47 2D 31 31 31 31 54 46 20
56-59	4	Vendor rev	Part number provided by SFP vendor (ASCII) , A value of all zero in the 4-byte field indicates that the vendor revision is unspecified.(1.0 revision)	31 2E 30 20
60-61	2	Wavelength	Laser wavelength (Passive/Active Cable Specification Compliance). A value of 00h for both A0h Byte 60 and Byte 61 denotes laser wavelength or cable specification compliance is unspecified.	00 00
62	1	Unallocated		00
63	1	CC_BASE	Check code for Base ID Fields	xx
63	1	CCID	Least significant byte of Check sum of data in address 0 to 62	xx
Extended ID Fields				
64-65	2	Option	Indicates which optional transceiver signals are implemented TX_DISABLE and RX_LOS are implemented	00 12
66	1	BR, max	Upper bit rate margin, units of %. A value of 00h indicates that this field is not specified	00
67	1	BR, min	Lower bit rate margin, units of % A value of 00h indicates that this field is not specified.	00
68-83	16	Vendor SN	Serial number provided by vendor (ASCII)	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx
84-91	8	Date code	Manufacturing date code Year (2 bytes), Month (2 bytes), Day (2 bytes) vendor specific lot code, may be blank (2 bytes)	xx xx xx xx xx xx xx xx
92	1	Diagnostic Monitoring Type	Indicates which type of diagnostic monitoring is implemented (if any) in the transceiver	00
93	1	Enhanced Options	Indicates which optional enhanced features are implemented (if any) in the transceiver	00
94	1	SFF-8472 Compliance	Indicates which revision of SFF-8472 the transceiver complies with. A value of 00h indicates Digital diagnostic functionality not	00

HTSFP-XG-1111TF

10/100/1000Base-T or 10GBase-T Copper SFP+ Transceiver

Used twisted pair category 6a/7 Cable, Link lengths at 10GBase up to 30m

Used twisted pair category 5 cable or better, Link lengths at 10/100/1000Base up to 100m

Temperature applications as 0°C to 70°C or -40°C to 85°C



included or undefined.				
95	1	CC_EX	Check code for the extended ID Fields (addresses 64 to 94)	xx
Vendor Specific ID Fields				
96-127	32	Vendor specific	Vendor Specific EEPROM,	all 00
128-255	128	Reserved	Reserved for SFF-8079	all 00

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10/100/1000Base-T or 10GBase-T Copper SFP+ Transceiver

Used twisted pair category 6a/7 Cable, Link lengths at 10GBase up to 30m

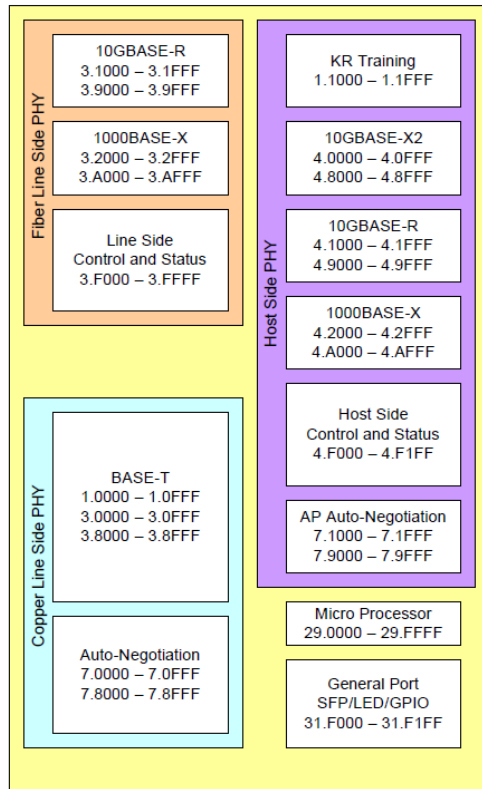
Used twisted pair category 5 cable or better, Link lengths at 10/100/1000Base up to 100m

Temperature applications as 0°C to 70°C or -40°C to 85°C



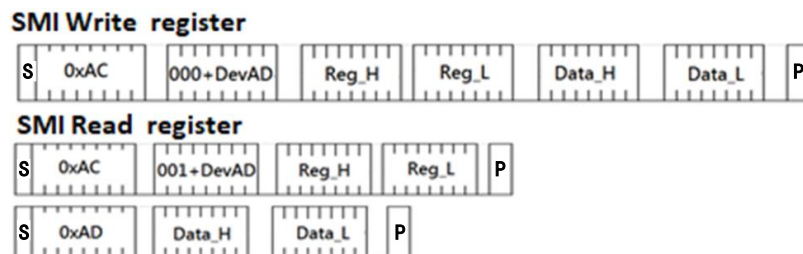
2.11 I²C Serial Management Interface (SMI) Communication Protocol for SFP's PHY

PHY Device Register Map Summary



Unit	Sub Block	Device Address	Base Register Address	Actual Register Address
T Unit	IEEE PMD/PMA	1	0x0000 to 0x0FFF	Same as Base Address
T Unit	IEEE PCS	3	0x0000 to 0x0FFF	Same as Base Address
T Unit	Proprietary Copper	3	0x8000 to 0x8FFF	Same as Base Address
T Unit	IEEE Auto-Negotiations	7	0x0000 to 0x0FFF	Same as Base Address
T Unit	Proprietary Auto-Negotiations	7	0x8000 to 0x8FFF	Same as Base Address
T Unit	Proprietary Copper	3	0xDC8C to 0xDCA9	Same as Base Address
X Unit	IEEE PMD/PMA	1	0x0000 to 0x0FFF	0x1000 to 0x1FFF
X Unit	IEEE 10GBASE-R	3	0x0000 to 0x01FF	0x1000 to 0x11FF
X Unit	IEEE 1000BASE-X/SGMII	3	0x0000 to 0x01FF	0x2000 to 0x21FF
X Unit	Proprietary 10GBASE-R	3	0x8000 to 0x81FF	0x9000 to 0x91FF
X Unit	Proprietary 1000BASE-X/SGMII	3	0x8000 to 0x81FF	0xA000 to 0xA1FF
X Unit	Control and Status	3	0x8000 to 0x81FF	0xF000 to 0xF1FF
H Unit	IEEE 10GBASE-R	4	0x0000 to 0x01FF	Same as Base Address
H Unit	IEEE 10GBASE-X2	4	0x0000 to 0x01FF	0x1000 to 0x11FF
H Unit	IEEE 1000BASE-X/SGMII	4	0x0000 to 0x01FF	0x2000 to 0x21FF
H Unit	Proprietary 10GBASE-R	4	0x8000 to 0x81FF	Same as Base Address
H Unit	Proprietary 10GBASE-X2	4	0x8000 to 0x81FF	0x9000 to 0x91FF
H Unit	Proprietary 1000BASE-X/SGMII	4	0x8000 to 0x81FF	0xA000 to 0xA1FF
H Unit	Control and Status	4	0x8000 to 0x81FF	0xF000 to 0xF1FF
P Unit	Micro Processor	1, 3	0xC050, 0xD0F0 to 0xD0F2	Same as Base Address
M Unit	MACsec	31	0x0000 to 0xEFFF	Same as Base Address
C Unit	General Controls	31	0x8000 to 0x81FF	0xF000 to 0xF1FF
F Unit	Frame To Register, Rate Match FIFO	31	0x0000 to 0x07FF	0xF800 to 0xFFFF

I²C Serial Management Interface (SMI) reading and writing time sequence:



I²C Serial Management Interface (SMI) for PHY write sequence : 6 bytes I²C frame are required.

- 1st byte : 0xAC (8bits)
- 2nd byte : 0b'000 + DEVAD (5 bits)
- 3~4 bytes : Register Address (16 bits)
- 5~6 bytes : Write Data (16 bits)

I²C Serial Management Interface (SMI) for PHY read sequence : 7 bytes I²C frame are required.

- 1st byte : 0xAC (8bits)
- 2nd byte : 0b'001 + DEVAD (5 bits)
- 3~4 bytes : Register Address (16 bits)
- Delay >1 mS (Important: for Host access Copper SFP PHY through I²C)
- 5th byte : 0xAD (8bits)

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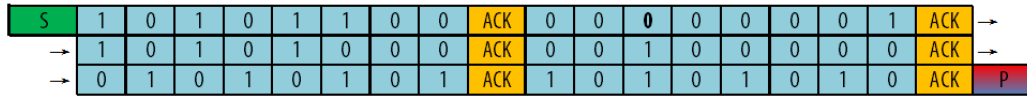
Temperature applications as 0°C to 70°C or -40°C to 85°C



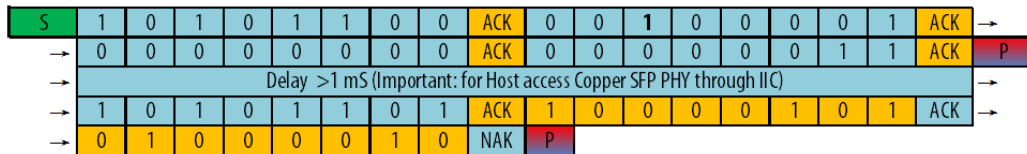
6~7 bytes : Read Data (16 bits)

Example:

Write 0x55AA to DEVAD 1 Register 0xA820



Read 0x8542 from DEVAD 1 Register 0x0003



Notes:

1. PHY Register uses one frame to perform write operation. After the start bit of I²C, send 0XAC as the address of PHY, and 000+DevAD as the device address of PHY. Then send Reg_H and Reg_L which are the register address of PHY. Then send Data_H and Data_L, the write-in data of register before the stop bit of I²C.
2. PHY Register uses two frames to finish read operation. The first frame is to sent the address of register which needs to read by sending 0XAC as the address of PHY and 001+DevAD with Reg_H and Reg_L before the stop bit of I²C. The second frame is to read data by sending 0XAD after the start bit of I²C and then reading Data_H, Data_L before the stop bit of I²C.
3. References PHY-Datasheet- Register Description for detailed

2.10 Mechanical Drawing:

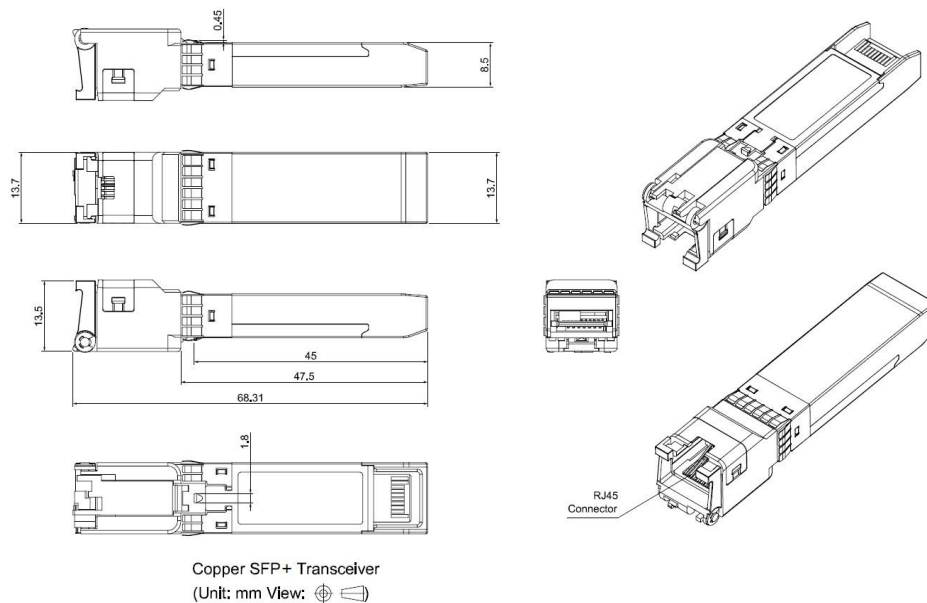


Figure 4, Mechanical Diagram of Copper SFP+

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10/100/1000Base-T or 10GBase-T Copper SFP+ Transceiver

Used twisted pair category 6a/7 Cable, Link lengths at 10GBase up to 30m

Used twisted pair category 5 cable or better, Link lengths at 10/100/1000Base up to 100m

Temperature applications as 0°C to 70°C or -40°C to 85°C



References

1. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 2000.
2. IEEE Std 802.3, 2012 Edition. IEEE Standards Department, 2012.
4. "AT24C01A/02/04/08/16 2-Wire Serial CMOS E²PROM", Atmel Corporation. www.Atmel.com