2500BASE-T Copper Transceiver
Small Form Pluggable (SFP), 3.3V
2.5Gbps Gigabit Ethernet

Features

- Compatible with IEEE 802.3bz, IEEE 802.3, IEEE 802.3u, and IEEE 802.3ab
- Support up to 2.5G transmission rate and low power dissipation
- RJ-45 connector assembly and hot-pluggable SFP footprint
- Fully Metallic Enclosure for Low EMI
- Detailed Product Information in EEPROM via I2C
- +3.3V Single Power Supply
- Compliant with SFP MSA
- Compliant with RoHs
- Temperature range 0°C to +70°C or -40°C to +85°C

Application

- 2500 Mbps Ethernet over Category 5e Cable
- Distributed multi-processing
- High speed I/O for file server or high-end workstation
- Switch/Router to Switch/Router Link

Description

The 2500Base-T Copper SFP Transceiver names as ASFPT-T5(6)F(-I) is a small, hot-swappable RJ45 electrical port module, compliant with 2.5 Gigabit Ethernet standards and SFP Multi-Source Agreement (MSA) standards. It can operate at 2.5G only or backward compatible with 10/100/1000M transmission rate. The CAT5e class network cable transmission distance of up to 100 meters and good electromagnetic compatibility is widely used in data centers and enterprise networks.

ASFPT-T5(6)F(-I) supports the LINK status via the RX_LOS pin. It also 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.

Ordering Information

PART NUMBER	MAC INTERFACE	SPEED (Mbps)	MODE	OPERATING TEMP.	NOTE
ASFPT-T5F	SGMII/2500Base-X	10/100/1000/2500	AN on / LOS Enable	0°C to +70°C	1
ASFPT-T5F-I	SGMII/2500Base-X	10/100/1000/2500	AN on / LOS Enable	-40°C to +85°C	
ASFPT-T6F	2500Base-X	2500	AN on / LOS Enable	0°C to +70°C	1, 2
ASFPT-T6F-I	2500Base-X	2500	AN on / LOS Enable	-40°C to +85°C	

Notes:

1. AN = Auto-negotiation
2. Only used in the 2.5G SFP port and run at Ethernet network speed with 2500 Mbps

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Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNITS	NOTE
Storage Temperature	*Ts*	-45	90	°C	Ambient
Storage Humidity	*Hs*	5	95	%	

Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTE
Operating Temperature	T_C	0	-	70	°C	Ambient (Commercial)
Operating Temperature	T_I	-40	-	85	°C	Ambient (Industrial)
Operating Humidity	*Ho*	10	-	85	%	
Supply Voltage	V_{CC}	3.14	3.3	3.46	V	
Supply Current	*I*	-	250	320	mA	
Power Consumption	*P*	-	0.83	1.11	W	
Surge Current	I_{surge}	-	-	30	mA	Hot Plug
Cable Length	C_L	-	-	100	m	Category 5e UTP

Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNITS	NOTE
Transmitter						
Data Input differential Voltage	$V_{D,TX}$	0.2	-	1.6	V	1
Differential Input Impedance	Z_{TX}	80	100	120	Ohm	
Transmitter Disable Input-High	V_{DISH}	2.0	-	$V_{cc}+0.3$	V	2
Transmitter Disable Input-Low	V_{DISL}	0	-	*0.8*	V	2
Receiver						
Data Output Differential Voltage	$V_{D,RX}$	0.5	-	1.2	V	1
Differential Output Impedance	Z_{RX}	80	100	120	Ohm	
Data Output Rise/Fall Time	$T_{R,RX}/T_{F,RX}$	100	175	200	ps	3
LOS Output Voltage – High	V_{SDHL}	V_{cc}-*0.5*	-	$V_{cc}+0.3$	V	2
LOS Output Voltage – Low	V_{SDL}	0	-	0.5	V	2

Note:
1) Internally AC coupled and terminated to 100 Ohms differential load for 2500BASE-X.
2) Pull up to V_{CC} with a 4.7K – 10K Ohms resistor on host Board
3) 20% ~ 80% values

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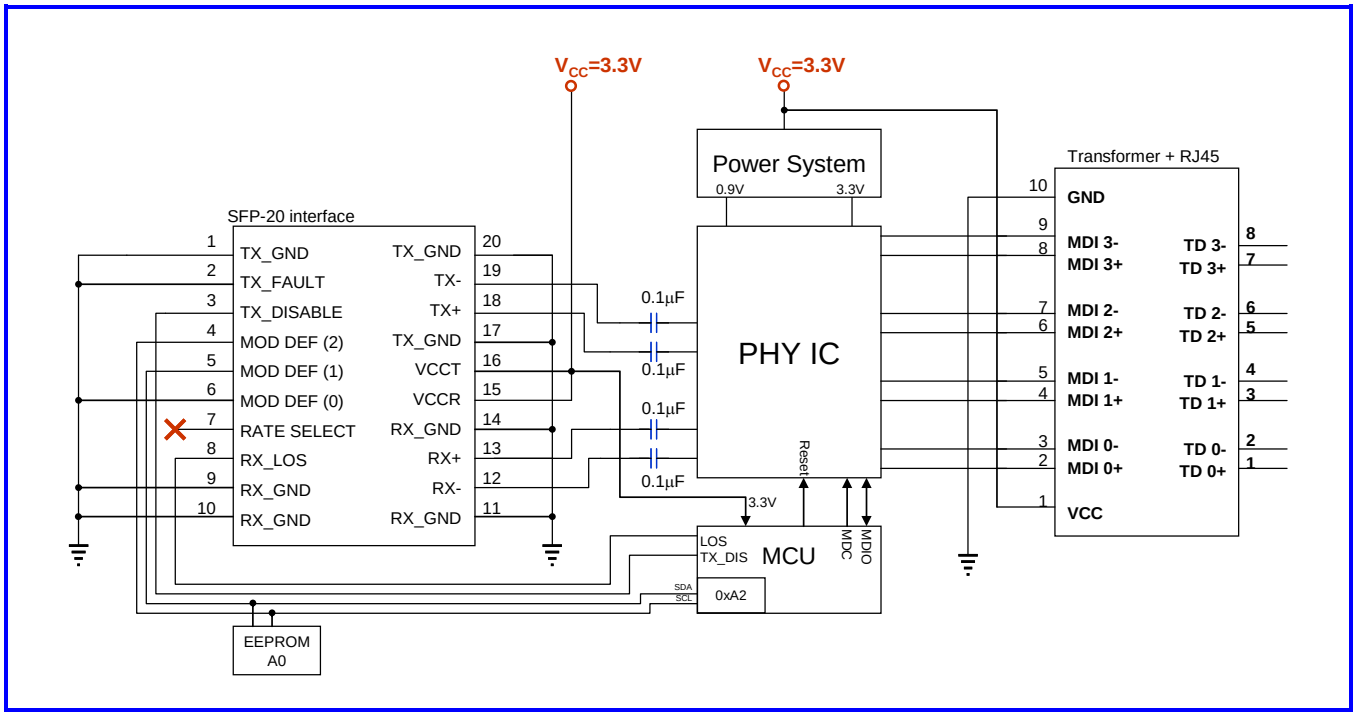
Block Diagram of Transceiver



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 <0.8V.

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.

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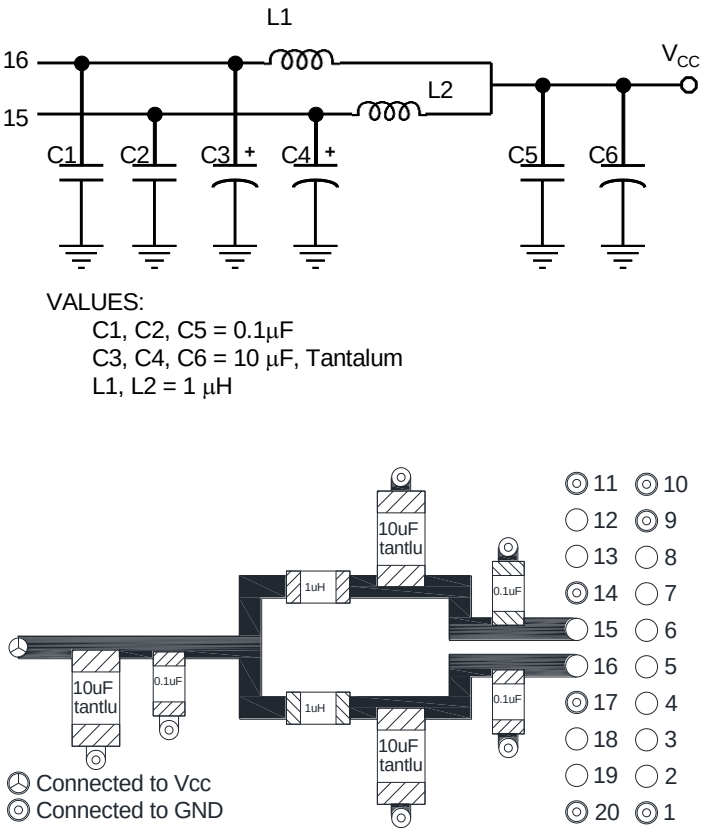

Figure 1: Suggested Power Coupling

Serial Communication Protocol

APAC ASFPT-T5(6)F(-I) supports the 2-wire serial communication protocol defined in the SFP MSA. These SFP use a 128 byte EEPROM with an address of A0h. If necessary, the PHY registers can also be accessed via the 2-wire serial bus at address A2h and assigned special register 0xFF. User can refer to RTL8221B(I) datasheet for the MMD and PHY registers in details. For example,

Read: 0xA2 0xFF <8-bit MMD> <16-bit PHY_REG ADDR>

Write: 0xA2 0xFF <8-bit MMD> <16-bit PHY_REG ADDR> <16-bit Data>

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EEPROM Serial ID Memory Contents

Accessing Serial ID Memory uses the 2 wire address 10100000 (A0H). Memory Contents of Serial ID are shown in Table 1.

Table 1 Serial ID Memory Contents

Addr.	Size (Bytes)	Name of Field	Hex	Description
0	1	Identifier	03	SFP or SFP+
1	1	Ext.Identifier	04	GBIC/SFP function is defined by two-wire interface ID only
2	1	Connector	22	RJ45
3-10	8	Transceiver	00 00 00 00 00 00 40 00	Transceiver Code
11	1	Encoding	01	8B/10B
12	1	BR(Nominal)	19	2500M bps
13	1	Rate Identifier	00	Unspecified
14	1	Length(SMFm)-km	00	N/A
15	1	Length(SMF)	00	N/A
16	1	Length(50μm)	00	N/A
17	1	Length(62.5μm)	00	N/A
18	1	Length(cable)	64	100(units of meters)
19	1	Length(OM3)	00	N/A
20-35	16	Vendor name	XX XX XX XX XX XX XX 20 20 20 20 20 20 20 20 20	Vendor name (ASCII)
36	1	Transceiver	00	Unallocated
37-39	3	Vendor OUI	XX XX XX	Vendor OUI
40-55	16	Vendor PN	XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX	Transceiver part number
56-59	4	Vendor rev	XX XX XX XX	Vendor rev
60-61	2	Wavelength	00	0nm
62	1	Unallocated	00	Unallocated
63	1	CC_BASE	Check Sum (Variable)	Check code for Base ID Fields
64-65	2	Options	00 12	TX_DIS and RX_LOS is implemented
66	1	BR	00	max
67	1	BR	00	min
68-83	16	Vendor SN	41 34 32 30 33 30 30 34 20 20 20 20 20 20 20 20	Serial Number of transceiver (ASCII). For example“A4203004”.
84-91	8	Date code	XX XX XX XX XX XX XX XX	Manufacture date code
92	1	Diagnostic Monitoring Type	00	N/A
93	1	Enhanced Options	00	N/A
94	1	SFF-8472 Compliance	00	Digital diagnostic function not included or undefined
95	1	CC_EXT	Check Sum (Variable)	Check sum for Extended ID Field.
96-127	32	Vendor Specific	Read only	Depends on customer information

Note: The “XX” byte should be filled in according to practical case. For more information, please refer to the related document of SFP Multi-Source Agreement (MSA).

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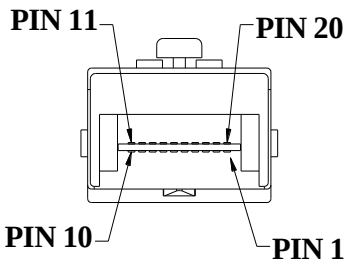
Connection Diagram

Pin-Out



Pin	Signal Name	Function	Descript	Notes
1	VeeT	Transmitter Ground	VeeT and VeeR are connected in SFP.	1
2	TX_FAULT	Transmitter Fault Indication	Tied to ground.	2
3	TX_DISABLE	Transmitter Disable	Transmitter Disable. PHY disabled on high or open	3
4	MOD DEF (2)	Module Definition 2	Data Line (SDA) for Serial ID.	4
5	MOD DEF (1)	Module Definition 1	Clock Line (SCL) for Serial ID.	4
6	MOD DEF (0)	Module Definition 0	Connected to MCU and control SFP ready status	4
7	RATE SELECT	Not Implemented	No connection required.	
8	LOS	Loss of Signal	PHY Link status. See LOS option.	
9	VeeR	Receiver Ground	VeeT and VeeR are connected in SFP.	1
10	VeeR	Receiver Ground	VeeT and VeeR are connected in SFP.	1
11	VeeR	Receiver Ground	VeeT and VeeR are connected in SFP.	1
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.	1
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.	1
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	1

Notes:

1. Circuit ground is connected to Host board ground
2. TX Fault is not used and is always tied to ground.
3. Disabled: TDIS > 2V or open, Enabled: TDIS < 0.8V.
4. Should be pulled up with 4.7k - 10k ohms on host board to a voltage between 2V and 3.6V.

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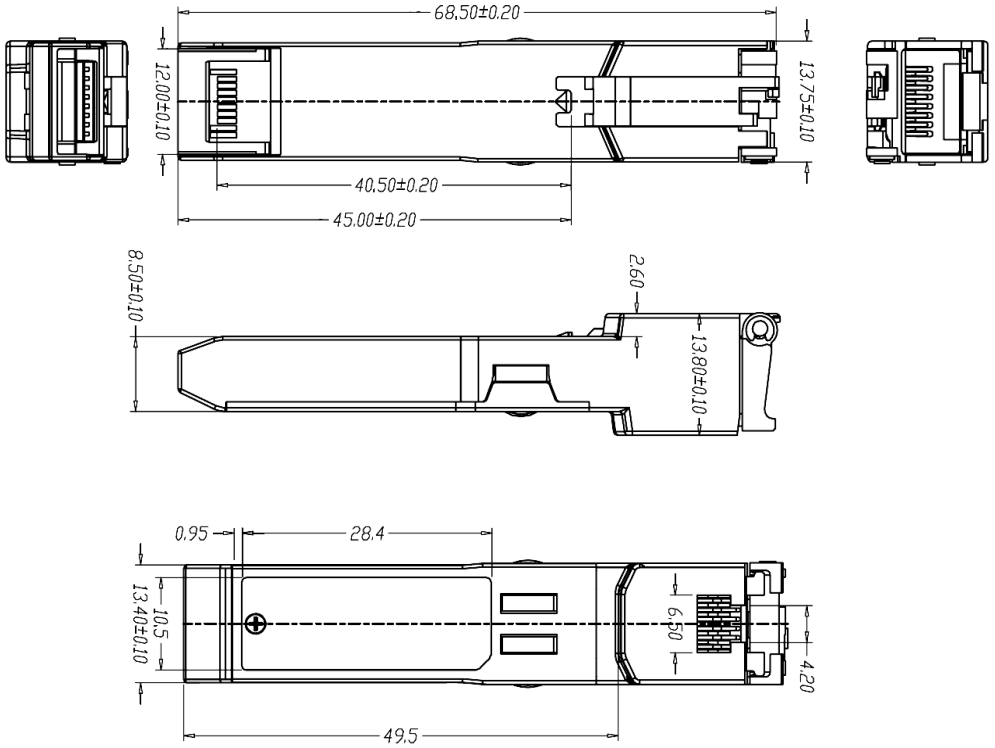
Drawing Dimensions



ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED

UNIT: mm

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.

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