

SFP with SerDes or SGMII Interface, Copper, Extended Diagnostics

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Features extended diagnostics and a wide operating temperature range.



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Federal Communications Commission and Industry Canada Radio Frequency Interference Statements

This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

Instrucciones de Seguridad (Normas Oficiales Mexicanas Electrical Safety Statement)

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc.
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico debe ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

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Chapter 1: Specifications

1. Specifications

Approvals	CE, UL®, RoHS2, TUV, FCC
Speed	LFP415: 1000-Mbps; LFP416: 10/100/1000-Mbps
Interface	LFP415: Mac Serdes; LFP416: Mac: SDMI
Power	SFP Cage; Input Voltage: 3.3 VDC (3.1 V minimum to 3.5 V maximum) 330 mA; Input Power Watts: 1 W
Environmental	Operating Temperature: -40° to +185° F (-40° to +85° C); Operating Humidity: 85% non-condensing; Altitude: 5905 ft. (1800 m)
Dimensions	0.69"H x 0.59"W x 2.75"D (1.76 x 1.5 x 7.0 cm)
Weight	0.05 lb. (0.023 kg)

2. Overview

2.1 Introduction

This Small Form-Factor Pluggable (SFP) Optical Transceiver enables you to adapt an SFP slot to a Gigabit Ethernet copper interface.

2.2 Features

- LFP415 is compatible with devices with a SerDes cage that supports 1000-Mbps.
- LFP416 is compatible with devices with a SGMII Interface that support 10/100/1000-Mbps.
- LFP415 operates at 1000-Mbps Ethernet.
- LFP416 is autosensing for 10/100/1000-Mbps operation.
- Link length up to 100 meters over CAT5 or better UTP cable.
- Throughput up to 1.25 Gbps.
- Reports basic link characteristics such as SFP type, length of fiber link, wavelength, and bit rate.
- Great for industrial use. Offers an operating temperature range of -40° to +185° F (-40° to +85° C).
- Hot-pluggable interface enables you to change SFPs on the fly when your network requirements change.
- Auto detects MDI/MDI-X.
- Complies with SFP Multi-Source Agreements standards (MSA).

2.3 Applications

- Gigabit Ethernet over CAT5 cable.
- Switch to switch SerDes interface.
- Switch to switch SGMII interface.
- Switched backplane application.

3. Technical Description

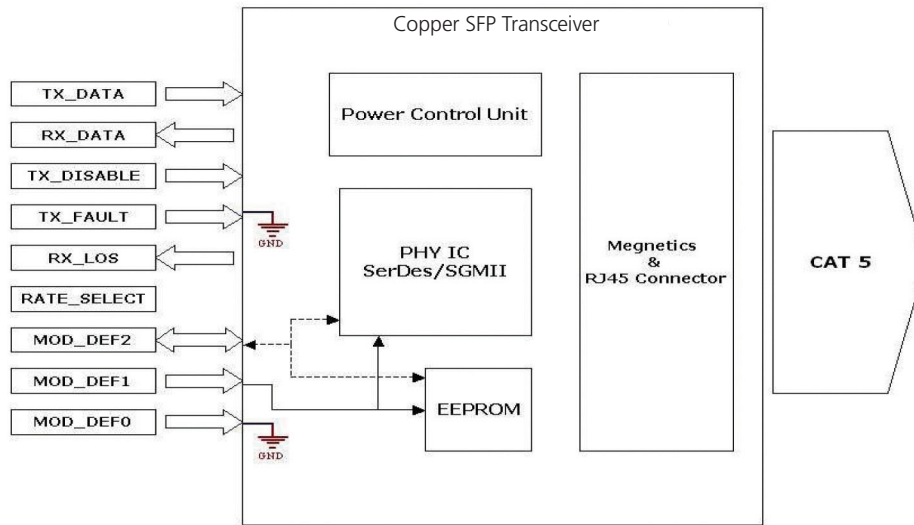


Figure 3-1. Block diagram.

The transceiver fundamentally consists of three parts: RJ45+Magnetics, PHY IC, and EEPROM. Set TX_DISABLE = LOW to turn on the transceiver module. Set TX_DISABLE =High or OPEN to reset the transceiver module. TX_FAULT is not supported—always connect it to ground. For accessing the serial identification information, an EEPROM is used to store the required data via the 2-wire serial CMOS EEPROM protocol. The detailed signal descriptions are listed in the following sections. You can also access PHY IC registers via the 2-wire serial CMOS EEPROM protocol at address ACh.

Table 3-1. Absolute maximum ratings.

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T _{st}	-40° F (-40° C)	+185° F (+85° C)	° F (° C)
Supply Voltage	V _{cc}	-0.5	4.0	V
Relative Humidity	RH	5	95	%

Table 3-2. Recommended operating conditions.

Parameter	Symbol	Min.	Typical	Max.	Unit
Case Operating Temperature	T _{OP}	0		+158° F (+70° C)	° F (° C)
		0		+185° F (+85° C)	
		-40° F (-40° C)		+185° F (+85° C)	
Supply Voltage		3.15	3.3	3.45	V
Supply Current	I _s		330	385	mA

Table 3-3. High-speed electrical interface, host to SFP.

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
TD+, TD- input voltage range	V_{in+} V_{in-}	250		1200	mV	2*
RD+, RD- output voltage range	V_{out+} V_{out-}	250		800	mV	2*
Rise time (receiver)	t_r		180	250	ps	1*
Fall time (receiver)	t_f		180	250	ps	1*
TX input impedance	Z_{in}		50		Ohm	2*
RX output impedance	Z_{out}		50		Ohm	2*

*NOTES:

1. 20 to 80% value.
2. Single-ended.

Table 3-4. High-speed electrical interface, cable to SFP.

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Transmission frequency	ft.		125		Mhz	1*
TX output impedance	$Z_{out\ TX}$		100		Ohm	2*
RX output impedance	$Z_{in\ RX}$		100		ps	2*

*NOTES:

1. 4D-PAM-5 encoding per IEEE 802.3: 2002.
2. Differential for frequencies ranging from 1 MHz to 125 MHz.

Chapter 3: Technical Description

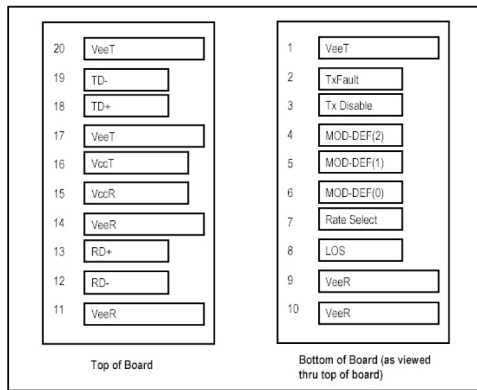


Figure 3-2. SFP transceiver electric pad layout.

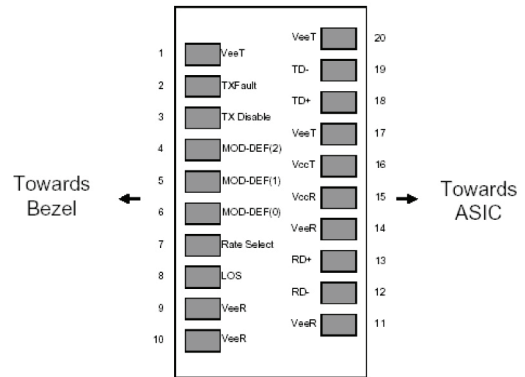


Figure 3-3. Host board connector block pins.

Table 3-5. Pinning.

Pin Number	Pin Name	Function	Plug Sequence	Notes
1	VeeT	Transmitter ground	1	—
2	TX fault	Transmitter fault indication	3	1
3	TX disable	Transmitter disable	3	2
4	MOD_DEF 2	Module definition 2	3	3
5	MOD_DEF 1	Module definition 1	3	3
6	MOD_DEF 0	Module definition 0	3	3
7	Rate select	Full or reduced receiver bandwidth	3	4
8	RX_LOS	Receiver loss of signal	3	5
9	VeeR	Receiver ground	1	6
10	VeeR	Receiver ground	1	6
11	VeeR	Receiver ground	1	6
12	RD-	Inv. Received Data out	3	7
13	RD+	Received Data out	3	7
14	VeeR	Receiver ground	1	6
15	VccR	Receiver power	2	8
16	VccT	Transmitter power	2	8
17	VeeT	Transmitter ground	1	6
18	TD+	Transmit Data in	3	9
19	TD-	Inv. Transmit Data in	3	9
20	VeeT	Transmitter Ground	1	6

NOTES:

Plug Seq.: Pin engagement sequence during hot plugging.

- 1. TX Fault is not supported.*
- 2. TX disable, an input used to reset the transceiver module, is pulled up within the module with a 4.7 to 10 K resistor. Its states are:
Low (0 – 0.8V): transceiver module on.
(>0.8, < 2.0V): Undefined.
High (2.0 – 3.465V): transceiver module disabled.
Open: transceiver module disabled.*
- 3. Mod-Def 0,1,2, are the module definition pins, which should be pulled up with a 4.7 K to 10 K resistor on the host board. The pull-up voltage shall be VccT or VccR.
Mod-Def 0 is grounded in the module to indicate that the module is present.
Mod-Def 1 is the clock line of two-wire serial interface for serial ID.
Mod-Def 2 is the data line of two-wire serial interface for serial ID.*
- 4. Rate select is not required for connection.*
- 5. RX_LOS (Loss of Signal): LVTTTL compatible with a maximum voltage of 2.5 V. Being Activated on AXGT-R154-05Ix, AXGT-R1T4 05Ix, AXGT-R154-05Jx. For those modules without LOS function, the LOS pin is internally attached to signal ground.*
- 6. VeeR and VeeT may be internally connected within the SFP module.*
- 7. RD-/+, the differential receiver outputs, are AC coupled 100-ohm differential lines that should be terminated with 100 L differential at the user SerDes. The AC coupling is done inside the module, thus not required on the host board. The voltage swing on these lines will be between 370 and 2000 mV differential (185 mV to 1000 mV single ended) when properly terminated.*
- 8. VccR and VccT are the receiver and transmitter power supplies defined as 3.3V \pm 5% at the SFP connector pin. Maximum supply current is 385 mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1-ohm should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging the SFP transceiver module will result in an inrush current of no more than 30 mA greater than the steady state value. VccR and VccT may be internally connected within the SFP transceiver module.*
- 9. TD-/+, the differential transmitter inputs, are AC-coupled differential lines with 100-ohm differential termination inside the module. The AC coupling is done inside the module, thus not required on the host board. The inputs will accept differential swings of 500 to 2400 mV (250 mV to 1200 mV single-ended), though it is recommended that values between 500 and 1200 mV differential (250 to 600 mV single-ended) be used for best EMI performance.*

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