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Finisar

Product Specification

1000BASE-T Copper SFP Transceiver

FCMJ-8520/8521-3

Product Features

- Up to 1.25Gb/s bi-directional data links
- Hot-pluggable SFP footprint
- Extended case temperature range (0°C to +85°C)
- Fully metallic enclosure for low EMI
- Low power dissipation (1.05 W typical)
- Compact RJ-45 connector assembly
- Access to physical layer IC via 2-wire serial bus
- 10/100/1000 BASE-T operation in host systems with SGMII interface



Applications

- 1.25 Gigabit Ethernet over Cat 5 cable

Finisar's FCMJ-8520/8521-3 1000BASE-T Copper Small Form Pluggable (SFP) transceivers are based on the SFP Multi Source Agreement (MSA)[1]. They are compatible with the Gigabit Ethernet and 1000BASE-T standards as specified in IEEE Std 802.3[2]. The 1000BASE-T physical layer IC (PHY) can be accessed via I2C, allowing access to all PHY settings and features.

The FCMJ-8520-3 uses the SFP's RX_LOS pin for link indication, and 1000BASE-X auto-negotiation should be disabled on the host system. The FCMJ-8521-3 is compatible with 1000BASE-X auto-negotiation, but does not have a link indication feature (RX_LOS is internally grounded). See AN-2036, "Frequently Asked Questions Regarding Finisar's 1000BASE-T SFPs", for a more complete explanation on the differences between the two models and details on applications issues for the products.

PRODUCT SELECTION

Part Number	Link Indicator on RX_LOS Pin	1000BASE-X auto-negotiation enabled by default
FCMJ-8520-3	Yes	No
FCMJ-8521-3	No	Yes

I. SFP to Host Connector Pin Out

Pin	Symbol	Name/Description	Note
1	V_{EET}	Transmitter ground (common with receiver ground)	1
2	T_{FAULT}	Transmitter Fault. Not supported	
3	T_{DIS}	Transmitter Disable. PHY disabled on high or open	2
4	MOD_DEF(2)	Module Definition 2. Data line for serial ID	3
5	MOD_DEF(1)	Module Definition 1. Clock line for serial ID	3
6	MOD_DEF(0)	Module Definition 0. Grounded within the module	3
7	Rate Select	No connection required	
8	LOS	Loss of Signal indication.	4
9	V_{EER}	Receiver ground (common with transmitter ground)	1
10	V_{EER}	Receiver ground (common with transmitter ground)	1
11	V_{EER}	Receiver ground (common with transmitter ground)	1
12	RD-	Receiver Inverted DATA out. AC coupled	
13	RD+	Receiver Non-inverted DATA out. AC coupled	
14	V_{EER}	Receiver ground (common with transmitter ground)	1
15	V_{CCR}	Receiver power supply	
16	V_{CCT}	Transmitter power supply	
17	V_{EET}	Transmitter ground (common with receiver ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC coupled	
19	TD-	Transmitter Inverted DATA in. AC coupled	
20	V_{EET}	Transmitter ground (common with receiver ground)	1

Notes: 1. Circuit ground is connected to chassis ground
2. PHY disabled on T_{DIS} > 2.0V or open, enabled on T_{DIS} < 0.8V
3. Should be pulled up with 4.7k – 10k Ohms on host board to a voltage between 2.0 V and 3.6 V. MOD_DEF(0) pulls line low to indicate module is plugged in.
4. LVTTL compatible with a maximum voltage of 2.5V. Not supported on FCMJ-8521-3.

Table 1. SFP to host connector pin assignments and descriptions

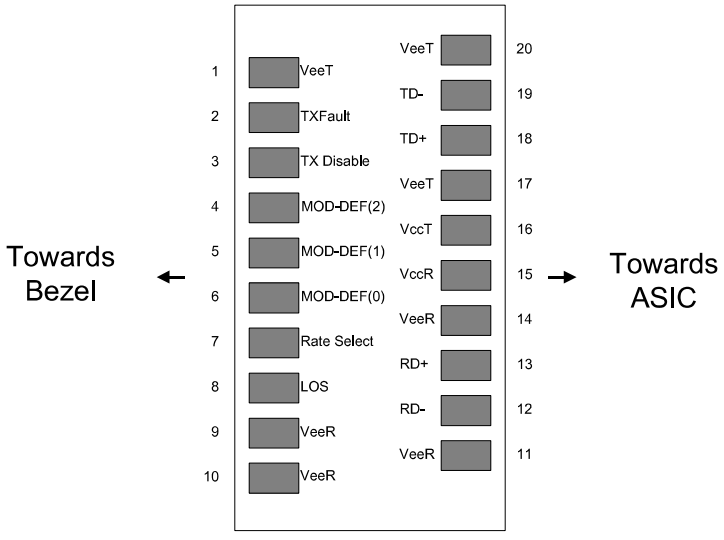


Figure 1. Diagram of host board connector block pin numbers and names

II. +3.3V Volt Electrical Power Interface

The FCMJ-8520/8521-3 has an input voltage range of 3.3 V +/- 5%. The 4 V maximum voltage is not allowed for continuous operation.

+3.3 Volt Electrical Power Interface						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Notes/Conditions**
Supply Current	I_s		320	375	mA	1.2W max power over full range of voltage and temperature. See caution note below
Input Voltage	V_{cc}	3.13	3.3	3.47	V	Referenced to GND
Maximum Voltage	V_{max}			4	V	
Surge Current	I_{surge}			30	mA	Hot plug above steady state current. See caution note below

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

Table 2. +3.3 Volt electrical power interface

III. Low-Speed Signals

MOD_DEF(1) (SCL) and MOD_DEF(2) (SDA), are open drain CMOS signals (see section VII, "Serial Communication Protocol"). Both MOD_DEF(1) and MOD_DEF(2) must be pulled up to host_Vcc.

Low-Speed Signals, Electronic Characteristics					
Parameter	**Symbol**	**Min**	**Max**	**Units**	**Notes/Conditions**
SFP Output LOW	V_{OL}	0	0.5	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector
SFP Output HIGH	V_{OH}	host_Vcc - 0.5	host_Vcc + 0.3	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector
SFP Input LOW	V_{IL}	0	0.8	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector
SFP Input HIGH	V_{IH}	2	Vcc + 0.3	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector

Table 3. Low-speed signals, electronic characteristics

IV. High-Speed Electrical Interface

All high-speed signals are AC-coupled internally.

High-Speed Electrical Interface, Transmission Line-SFP						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Notes/Conditions**
Line Frequency	f_L		125		MHz	5-level encoding, per IEEE 802.3
Tx Output Impedance	$Z_{out,TX}$		100		Ohm	Differential, for all frequencies between 1MHz and 125MHz
Rx Input Impedance	$Z_{in,RX}$		100		Ohm	Differential, for all frequencies between 1MHz and 125MHz

Table 4. High-speed electrical interface, transmission line-SFP

High-Speed Electrical Interface, Host-SFP						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Notes/Conditions**
Single ended data input swing	V_{insing}	250		1200	mV	Single ended
Single ended data output swing	$V_{outsing}$	350		800	mV	Single ended
Rise/Fall Time	T_r,T_f		175		psec	20%-80%
Tx Input Impedance	Z_{in}		50		Ohm	Single ended
Rx Output Impedance	Z_{out}		50		Ohm	Single ended

Table 5. High-speed electrical interface, host-SFP

V. General Specifications

General						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Notes/Conditions**
Data Rate	BR	10		1,000	Mb/sec	IEEE 802.3 compatible. See Notes 2 through 4 below
Cable Length	L			100	m	Category 5 UTP. BER $<10^{-12}$

Table 6. General specifications

Notes:
1. Clock tolerance is +/- 50 ppm
2. By default, the FCMJ-8520/8521-3 is a full duplex device in preferred master mode
3. Automatic crossover detection is enabled. External crossover cable is not required
4. 10/100/1000 BASE-T operation requires the host system to have an SGMII interface with no clocks, and the module PHY to be configured per Application Note AN-2036. With a SERDES that does not support SGMII, the module will operate at 1000BASE-T only.

VI. Environmental Specifications

The FCMJ-8520/8521-3 has an extended range from 0°C to +85°C case temperature as specified in Table 8.

Environmental Specifications						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Notes/Conditions**
Operating Temperature	T_{op}	0		85	°C	Case temperature
Storage Temperature	T_{sto}	-40		85	°C	Ambient temperature

Table 7. Environmental specifications

VII. Serial Communication Protocol

All Finisar SFPs support the 2-wire serial communication protocol outlined in the SFP MSA[1]. These SFPs use an Atmel AT24C01A 128 byte E^2PROM with an address of A0h. For details on interfacing with the E^2PROM, see the Atmel data sheet titled "AT24C01A/02/04/08/16 2-Wire Serial CMOS E^2PROM."[3]

The 1000BASE-T physical layer IC can also be accessed via the 2-wire serial bus at address ACh. For details interfacing with the PHY IC, see Marvell data sheet titled "Alaska Ultra 88E1111 Integrated Gigabit Ethernet Transceiver"[4] (Marvell document number MV-S100649-00).

Serial Bus Timing Requirements						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Notes/Conditions**
I^2C Clock Rate		0		100,000	Hz	

Table 8. Serial bus timing requirements

VIII. Mechanical Specifications

The host-side of the FCMJ-8520/8521-3 conforms to the mechanical specifications outlined in the SFP MSA[1]. The front portion of the SFP (part extending beyond the face plate of the host) is larger to accommodate the RJ-45 connector. See Figure 2 below for details.

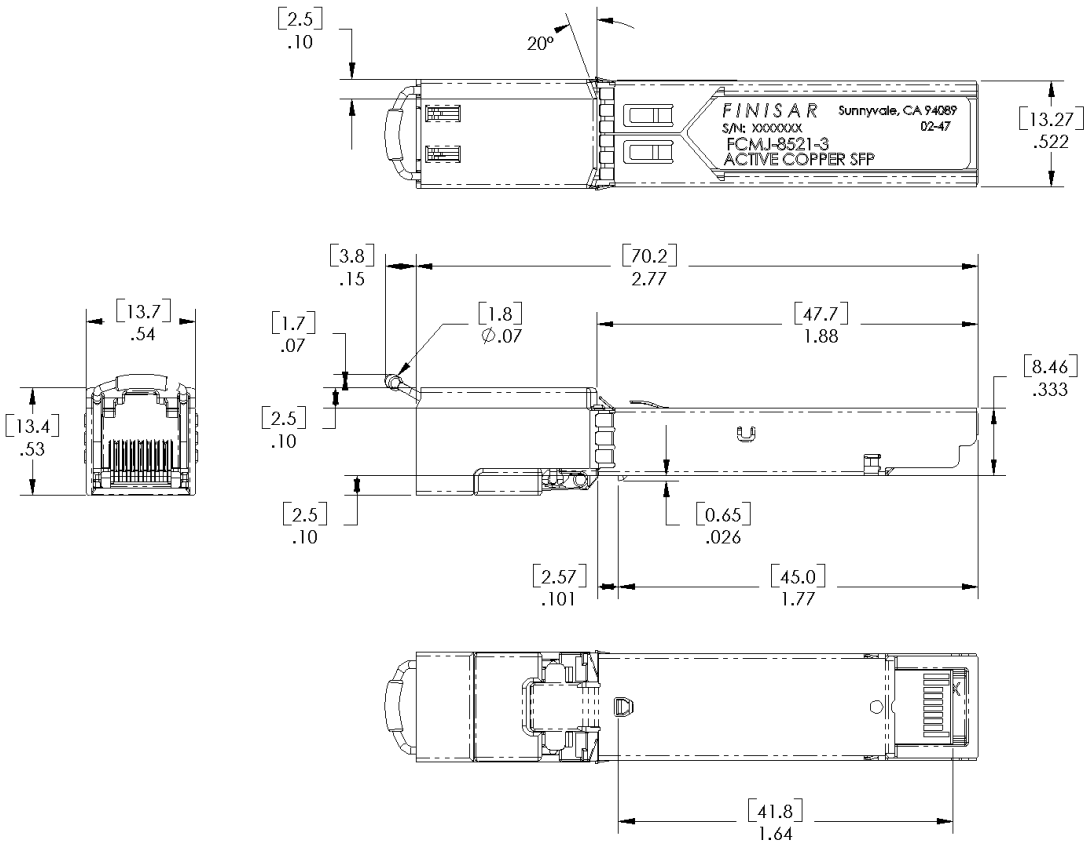


Figure 2. FCMJ-8520/8521-3 mechanical dimensions

IX. References

1. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 2000. Documentation is currently available at Finisar upon request.

2. IEEE Std 802.3, 2002 Edition. IEEE Standards Department, 2002.

4. "AT24C01A/02/04/08/16 2-Wire Serial CMOS E^2PROM", Atmel Corporation. www.Atmel.com

5. "Alaska Ultra 88E1111 Integrated 10/100/1000 Gigabit Ethernet Transceiver", Marvell Corporation. www.marvell.com

X. For More Information

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