# 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)<sup>1</sup>. They are compatible with the Gigabit Ethernet and 1000BASE-T standards as specified in IEEE Std 802.3<sup>2</sup>. 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.

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

#### **PRODUCT SELECTION**

Pin	Symbol	Name/Description	Note
1	$V_{EET}$	Transmitter ground (common with receiver ground)	1
2	T <sub>FAULT</sub>	Transmitter Fault. Not supported	
3	T <sub>DIS</sub>	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 <sub>CCR</sub>	Receiver power supply	
16	V <sub>CCT</sub>	Transmitter power supply	
17	$\mathbf{V}_{\mathrm{EET}}$	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	$\mathbf{V}_{\mathrm{EET}}$	Transmitter ground (common with receiver ground)	1

#### I. SFP to Host Connector Pin Out

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

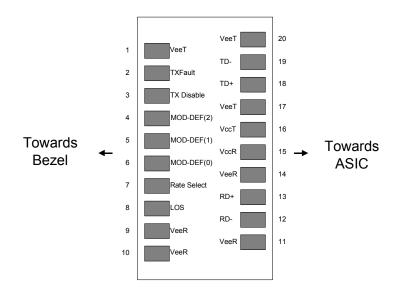


Figure 1. Diagram of host board connector block pin numbers and names

# 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	Тур	Max	Units	Notes/Conditions		
Supply Current	Is		320	375	mA	1.2W max power over full range of voltage and temperature. See caution note below		
Input Voltage	V <sub>cc</sub>	3.13	3.3	3.47	V	Referenced to GND		
Maximum Voltage	V <sub>max</sub>			4	V			
Surge Current	I <sub>surge</sub>			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 <sub>OL</sub>	0	0.5	V	4.7k to 10k pull-up to host_Vcc, measured at host side of connector				
SFP Output HIGH	V <sub>OH</sub>	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 <sub>IL</sub>	0	0.8	V	4.7k to 10k pull-up to Vcc, measured at SFP side of connector				
SFP Input HIGH	V <sub>IH</sub>	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	Тур	Max	Units	Notes/Conditions		
Line Frequency	f <sub>L</sub>		125		MHz	5-level encoding, per IEEE 802.3		
Tx Output Impedance	Z <sub>out,TX</sub>		100		Ohm	Differential, for all frequencies between 1MHz and 125MHz		
Rx Input Impedance	Z <sub>in,RX</sub>		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	Тур	Max	Units	Notes/Conditions		
Single ended data input swing	$\mathbf{V}_{\text{insing}}$	250		1200	mV	Single ended		
Single ended data output swing	Voutsing	350		800	mV	Single ended		
Rise/Fall Time	T <sub>r</sub> ,T <sub>f</sub>		175		psec	20%-80%		
Tx Input Impedance	Z <sub>in</sub>		50		Ohm	Single ended		
Rx Output Impedance	Z <sub>out</sub>		50		Ohm	Single ended		

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

# V. General Specifications

General						
Parameter	Symbol	Min	Тур	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 <sup>-12</sup>

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  $0^{\circ}$ C to +85°C case temperature as specified in Table 8.

Environmental Specifications						
Parameter	Symbol	Min	Тур	Max	Units	Notes/Conditions
Operating Temperature	T <sub>op</sub>	0		85	°C	Case temperature
Storage Temperature	T <sub>sto</sub>	-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  $E^2PROM$ ."<sup>3</sup>

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"<sup>4</sup> (Marvell document number MV-S100649-00).

Serial Bus Timing Requirements						
Parameter	Symbol	Min	Тур	Max	Units	Notes/Conditions
I <sup>2</sup> C Clock Rate		0		100,000	Hz	

Table 8.	Serial	bus	timing	requirements
1 4010 01	~~··	N CALD	******	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.

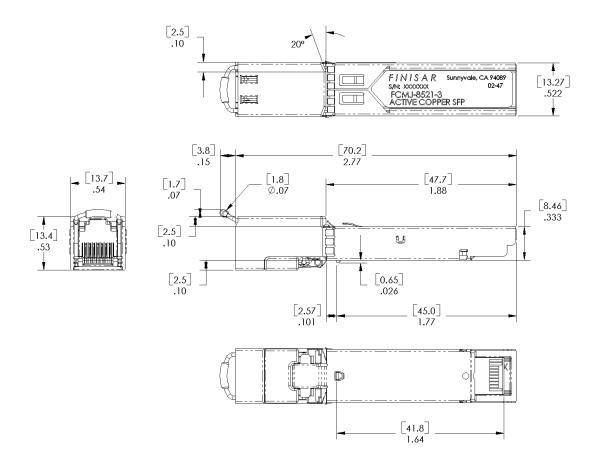


Figure 2. FCMJ-8520/8521-3 mechanical dimensions

# 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<sup>2</sup>PROM", Atmel Corporation. <u>www.Atmel.com</u>
- 5. "Alaska Ultra 88E1111 Integrated 10/100/1000 Gigabit Ethernet Transceiver", Marvell Corporation. <u>www.marvell.com</u>

# X. For More Information

Finisar Corporation 1308 Moffett Park Drive Sunnyvale, CA 94089-1133 Tel. 1-408-548-1000 Fax 1-408-541-6138 sales@finisar.com www.finisar.com