# **Product Specification**

# **1000BASE-T Copper SFP Transceiver**

### FCLF-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
- RoHS compliant and Lead Free
- 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 FCLF-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 FCLF-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 FCLF-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
FCLF-8520-3	Yes	No
FCLF-8521-3	No	Yes

### I. SFP to Host Connector Pin Out

Pin	Symbol	Name/Description	Note
1	$V_{ m EET}$	Transmitter ground (common with receiver ground)	1
2	$T_{FAULT}$	Transmitter Fault. Not supported	
3	$T_{ m DIS}$	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	$V_{\rm EER}$	Receiver ground (common with transmitter ground)	1
10	$V_{\rm EER}$	Receiver ground (common with transmitter ground)	1
11	$V_{\rm EER}$	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	$V_{\rm EER}$	Receiver ground (common with transmitter ground)	1
15	$V_{CCR}$	Receiver power supply	
16	$V_{CCT}$	Transmitter power supply	
17	$V_{\mathrm{EET}}$	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	$V_{\mathrm{EET}}$	Transmitter ground (common with receiver ground)	1

Notes: 1. Circuit ground is connected to chassis ground

- 2. PHY disabled on  $T_{\text{DIS}} > 2.0 V$  or open, enabled on  $T_{\text{DIS}} < 0.8 V$
- 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 FCLF-8521-3.

Table 1. SFP to host connector pin assignments and descriptions

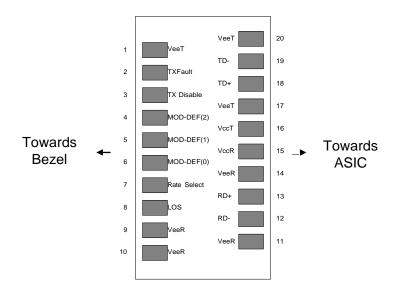


Figure 1. Diagram of host board connector block pin numbers and names

#### II. +3.3V Volt Electrical Power Interface

The FCLF-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 Interface	Power					
Parameter	Symbol	Min	Тур	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 <sub>max</sub>			4	V	
Surge Current	$I_{ m surge}$			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 <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	$V_{\rm IL}$	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-SFF	)					
Parameter	Symbol	Min	Тур	Max	Units	Notes/Conditions
Line Frequency	$f_L$		125		MHz	5-level encoding, per IEEE 802.3
Tx Output Impedance	$Z_{ ext{out,TX}}$		100		Ohm	Differential, for all frequencies between 1MHz and 125MHz
Rx Input Impedance	$Z_{\mathrm{in,RX}}$		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	Тур	Max	Units	Notes/Conditions			
Single ended data input swing	$V_{insing}$	250		1200	mV	Single ended			
Single ended data output swing	$V_{ m outsing}$	350		800	mV	Single ended			
Rise/Fall Time	$T_r, T_f$		175		psec	20%-80%			
Tx Input Impedance	$\mathbf{Z}_{\mathrm{in}}$		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	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 FCLF-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 FCLF-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	Тур	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<sup>1</sup>. These SFPs use an Atmel AT24C01A 128 byte E<sup>2</sup>PROM with an address of A0h. For details on interfacing with the E<sup>2</sup>PROM, see the Atmel data sheet titled "AT24C01A/02/04/08/16 2-Wire Serial CMOS E<sup>2</sup>PROM."<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" (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

## VIII. Mechanical Specifications

The host-side of the FCLF-8520/8521-3 conforms to the mechanical specifications outlined in the SFP MSA<sup>1</sup>. 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.

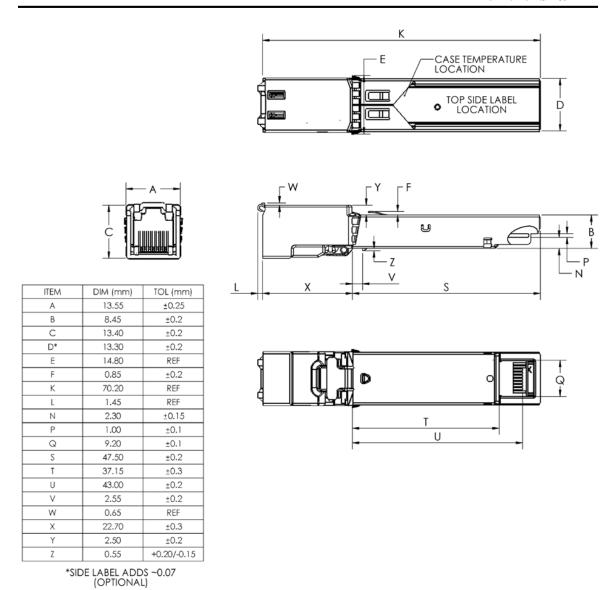


Figure 2. FCLF-8520/8521-3 mechanical dimensions

### 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. www.Atmel.com
- 5. "Alaska Ultra 88E1111 Integrated 10/100/1000 Gigabit Ethernet Transceiver", Marvell Corporation. <a href="www.marvell.com">www.marvell.com</a>

### X. For More Information

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