Product Specification

1000BASE-T RoHS Compliant Copper SFP Transceiver

FCLF8520P2BTL / FCLF8521P2BTL / FCLF8522P2BTL

Product Features

- Up to 1.25Gb/s bi-directional data links
- Hot-pluggable SFP footprint
- Extended case temperature range (-40°C to +85°C)
- Fully metallic enclosure for low EMI
- RoHS compliant and Lead Free
- 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 FCLF8520P2BTL, FCLF8521P2BTL and FCLF8522P2BTL 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 transceiver is RoHS compliant and per Directive 2011/65/EU[3] and Finisar Application Note AN-2038. The 1000BASE-T physical layer IC (PHY) can be accessed via I2C, allowing access to all PHY settings and features.

The FCLF8520P2BTL uses the SFP's RX_LOS pin for link indication, and 1000BASE-X auto-negotiation should be disabled on the host system. The FCLF8521P2BTL 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. The FCLF8522 shall support both RX_LOS pin for link indication and 1000BASE-X auto-negotiation.

PRODUCT SELECTION

Part Number	Link Indicator on RX_LOS Pin	1000BASE-X auto-negotiation enabled by default
FCLF8520P2BTL	Yes	No
FCLF8521P2BTL	No	Yes

FCLF8522P2BTL	Yes	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 isolated from 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 FCLF8521P2BTL.

Table 1. SFP to host connector pin assignments and descriptions

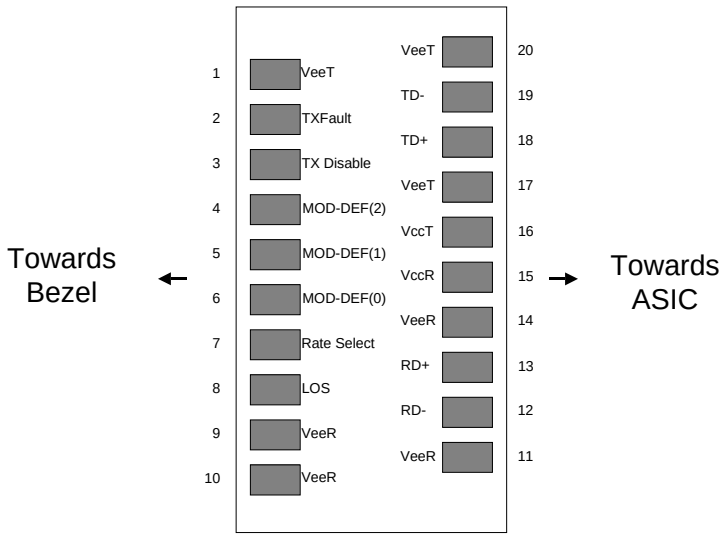


Figure 1. Diagram of host board connector block pin numbers and names

II. +3.3V Volt Electrical Power Interface

The FCLF8520P2BTL, FCLF8521P2BTL and FCLF8522P2BTL have an input voltage range of 3.3 V +/- 5%. The 4 V maximum voltage is not allowed for continuous operation.

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	
Total Maximum Current including Surge Current	I_{surge}			405	mA	Hot plug above steady state current. See caution note below

Caution: Power consumption and surge current are higher than the specific 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.

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, electrical 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	$V_{outsing}$	275		800	mV	Single ended, can be modified by writing to the PHY's internal registers. For more details, see Marvell datasheet[5]
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

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 FCLF8520P2BTL, FCLF8521P2BTL and FCLF8522P2BTL are full duplex devices 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 FCLF8520P2BTL, FCLF8521P2BTL and FCLF8522P2BTL have an industrial temperature ranges from -40°C to +85°C case temperature as specified in Table 8.

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

Table 7: Environment 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."[4]

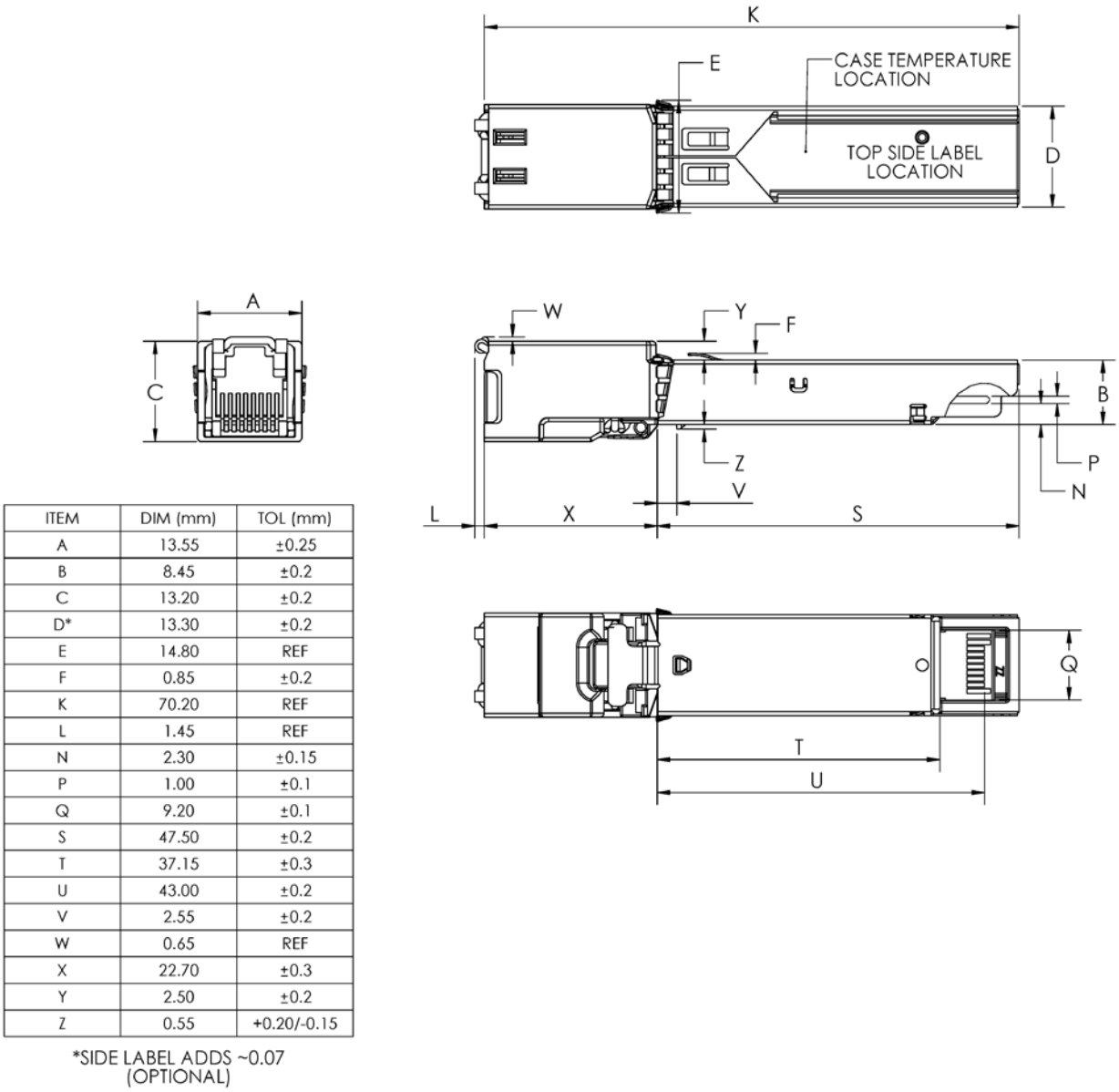
The 1000BASE-T physical layer IC can also be accessed via the 2-wire serial bus at address ACh. For details interfacing with the PHY IC, see Marvell data sheet titled "Alaska Ultra 88E1111 Integrated Gigabit Ethernet Transceiver"[5] (Marvell document number MV-S100649-00).

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 FCLF8520P2BTL, FCLF8521P2BTL and FCLF8522P2BTL 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.



ITEM	DIM (mm)	TOL (mm)
A	13.55	±0.25
B	8.45	±0.2
C	13.20	±0.2
D*	13.30	±0.2
E	14.80	REF
F	0.85	±0.2
K	70.20	REF
L	1.45	REF
N	2.30	±0.15
P	1.00	±0.1
Q	9.20	±0.1
S	47.50	±0.2
T	37.15	±0.3
U	43.00	±0.2
V	2.55	±0.2
W	0.65	REF
X	22.70	±0.3
Y	2.50	±0.2
Z	0.55	+0.20/-0.15

*SIDE LABEL ADDS ~0.07 (OPTIONAL)

Figure 2. FCLF8520P2BTL, FCLF8521P2BTL and FCLF8522P2BTL 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

3. Directive 2011/65/EU of the European Council Parliament and of the Council, "on the restriction of the use of certain hazardous substances in electrical and electronic equipment". 08-June 2011, which supercedes the previous ROHS Directive 2002/95/EC

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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