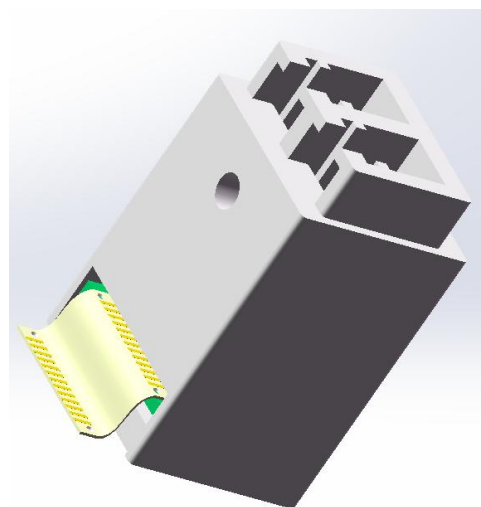


PRODUCT SPECIFICATION



10Gb/s Duplex LC, MMF, 850nm VCSEL-LD, PIN Receiver, SR 300m SFP+ Transceiver

■ Features:



- ★ Support multi-protocol from 8.5Gb/s to 11.3Gb/s
- ★ Hot-Pluggable SFP+ footprint
- ★ 850nm VCSEL laser transmitter
- ★ Duplex LC connector
- ★ Up to 300m links on MMF OM3
- ★ Single +3.3V Power Supply
- ★ Power consumption<1W
- ★ Compliant with SFF-8431 SFF-8432 and IEEE802.3ae
- ★ Industrial /Extended/ Commercial operating temperature range: -40°C to 85°C/-5°C to 85°C/0°C to 70°C Version available
- ★ RoHS compliant (lead-free)

■ Applications:

- ★ 10GBASE-SR/SW Ethernet
- ★ 10G Fiber channel
- ★ SDH/SONET Application

■ Description:

FB-LINK FBL-418-02D transceivers are Small Form Factor Pluggable SFP+ transceivers designed for use in 10-Gigabit multi-rate links. They are compliant with SFF-8431, SFF-8432 and 10GBASE LRM; support 4x, 8x and 10x Fibre Channel Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472. F B - L I N K FBL-418-02D transceivers are RoHS compliant per Directive 2011/65/EU. The high performance 850nm VCSEL transmitter and high sensitivity PIN receiver provide superior performance for Ethernet applications at up to 300m links on MMF OM3.

■ Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature	T _S	-40		+85	°C
Case Operating Temperature	T _A	0		70	°C
Supply Voltage	V _{CC}	-0.5		3.6	V
Relative Humidity	RH	0		85	%
Industrial	TC	-40		+85	°C
Commercial	TC	0		70	°C

■ General Specification

Parameter	Symbol	Min.	Typical	Max.	Unit
Bit Rate	BR	9.95	10.3125	11.3	Gb/s
Bit Error Ratio	BER	0		10 ⁻¹²	
Supply Voltage	V _{CC}	3.0		3.6	V
Maximum Supported Distances (MMF, 62.5μm 160 MHz-km)				26	m
Maximum Supported Distances (MMF, 62.5μm OM1 200 MHz-km)				33	m
Maximum Supported Distances (MMF, 50μm OM2 500 MHz-km)				82	m
Maximum Supported Distances (MMF, 50μm OM3 2000 MHz-km)				300	m
Maximum Supported Distances (MMF, 50μm OM4 4700 MHz-km)				400	m

■ Timing Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
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TX_Disable Assert Time	t _{off}			10	us
TX_Disable Negate Time	t _{on}			1	ms
Time to Initialize Include Reset of TX_FAULT	t _{int}			300	ms
TX_FAULT from Fault to Assertion	t _{fault}			100	us
TX_Disable Time to Start Reset	t _{reset}	10			us
Receiver Loss of Signal Assert Time	T _A ,RX_LOS			100	us
Receiver Loss of Signal Deassert Time	T _d ,RX_LOS			100	us
Rate-Select Chage Time	t _{ratesel}			10	us
Serial ID Clock Time	t _{serial-clock}			100	kHz

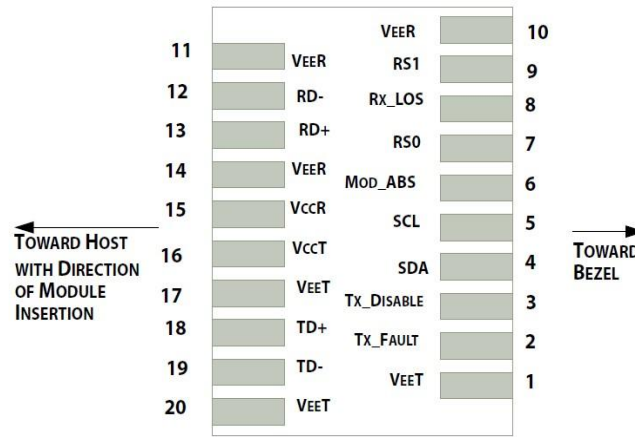
■ Electrical Characteristics (Condition: T_a=T_{op})

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Supply Voltage	V _{cc}	3.14		3.47	V	
Supply Current	I _{cc}			300	mA	
Transmitter Section:						
Input differential impedance	R _{in}		100		Ω	1
Tx Input Single Ended DC Voltage Tolerance (Ref V _{ee} T)	V _{cc}	-0.3		4	V	
Differential input voltage swing	V _{in,pp}	180		700	mV	2
Transmit Disable Voltage	V _D	2		V _{cc}	V	3
Transmit Enable Voltage	V _{EN}	V _{ee}		+0.8	V	
Receiver Section:						
Single Ended Output Voltage Tolerance	V	-0.3		4	V	
Rx Output Diff Voltage	V _o	180		850	mV	
Rx Output Rise and Fall Time	Tr/T _f	30			ps	4
LOS Fault	V _{LOS fault}	2		V _{ccHOST}	V	5
LOS Normal	V _{LOS norm}	V _{ee}		+0.8	V	5

Note:

1. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
2. Per SFF-8431 Rev 3.0
3. Into 100 ohms differential termination.
4. 20%~80%
5. LOS is an open collector output. Should be pulled up with 4.7k – 10kΩ on the host board. Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5V.

■ Pin Assignment:



Optical Characteristics (Condition: Ta=TOP)

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Transmitter Section:						
Center Wavelength	λ_t	830	850	870	nm	
RMS spectral width	$\Delta\lambda_{rms}$			0.45	nm	
Average Optical Power	P_{avg}	-7		-1	dBm	1
Optical Power OMA	P_{oma}		-1.5		dBm	
Laser Off Power	P_{off}			-30	dBm	
Extinction Ratio	ER	3.5			dB	
Transmitter Dispersion Penalty	TDP			3.9	dB	2
Relative Intensity Noise	Rin			-128	dB/Hz	3
Optical Return Loss Tolerance		20			dB	
Receiver Section:						
Center Wavelength	λ_r	830		870	nm	
Receiver Sensitivity (OMA) @ 10.3Gb/s	Sen			-10	dBm	4
Los Assert	LOS_A	-25			dBm	
Los De-assert	LOS_D			-12	dBm	
Los Hysteresis	LOS_H	0.5			dB	
Overload	Sat	-1			dBm	5

Note:

1. Average power figures are informative only, per IEEE802.3ae.
2. TWDP figure requires the host board to be SFF-8431 compliant. TWDP is calculated using the Matlab code provided in clause 68.6.6.2 of IEEE802.3ae.

3. 12dB reflection.
4. Conditions of stressed receiver tests per IEEE802.3ae. CSRS testing requires the host board to be SFF-8431 compliant.
5. Receiver overload specified in OMA and under the worst comprehensive stressed condition.

■ Pin Function Definitions

PIN #	Name	Function	Notes
1	VeeT	Module transmitter ground	1
2	Tx Fault	Module transmitter fault	2
3	Tx Disable	Transmitter Disable; Turns off transmitter laser output	3
4	SDL	2 wire serial interface data input/output (SDA)	
5	SCL	2 wire serial interface clock input (SCL)	
6	MOD-ABS	Module Absent, connect to VeeR or VeeT in the module	2
7	RS0	Rate select0, optionally control SFP+ receiver. When high, input data rate >4.5Gb/s; when low, input data rate <=4.5Gb/s	
8	LOS	Receiver Loss of Signal Indication	4
9	RS1	Rate select0, optionally control SFP+ transmitter. When high, input data rate >4.5Gb/s; when low, input data rate <=4.5Gb/s	
10	VeeR	Module receiver ground	1
11	VeeR	Module receiver ground	1
12	RD-	Receiver inverted data out put	
13	RD+	Receiver non-inverted data out put	
14	VeeR	Module receiver ground	1
15	VccR	Module receiver 3.3V supply	
16	VccT	Module transmitter 3.3V supply	
17	VeeT	Module transmitter ground	1
18	TD+	Transmitter inverted data input	
19	TD-	Transmitter non-inverted data input	
20	VeeT	Module transmitter ground	1

Note:

1. The module ground pins shall be isolated from the module case.

2. This pin is an open collector/drain output pin and shall be pulled up with 4.7K-10Kohms to Host_Vcc on the host board.
3. This pin shall be pulled up with 4.7K-10Kohms to VccT in the module.
4. This pin is an open collector/drain output pin and shall be pulled up with 4.7K-10Kohms to Host_Vcc on the host board.

■ SFP Module EEPROM Information and Management

The SFP modules implement the 2-wire serial communication protocol as defined in the SFP -8472. The serial ID information of the SFP modules and Digital Diagnostic Monitor parameters can be accessed through the I²C interface at address A0h and A2h. The memory is mapped in Table 1. Detailed ID information (A0h) is listed in Table 2. The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), For more details of the memory map and byte definitions, please refer to the SFF-8472, “Digital Diagnostic Monitoring Interface for Optical Transceivers”. The DDM parameters have been internally calibrated.

Table 1. Digital Diagnostic Memory Map (Specific Data Field Descriptions)

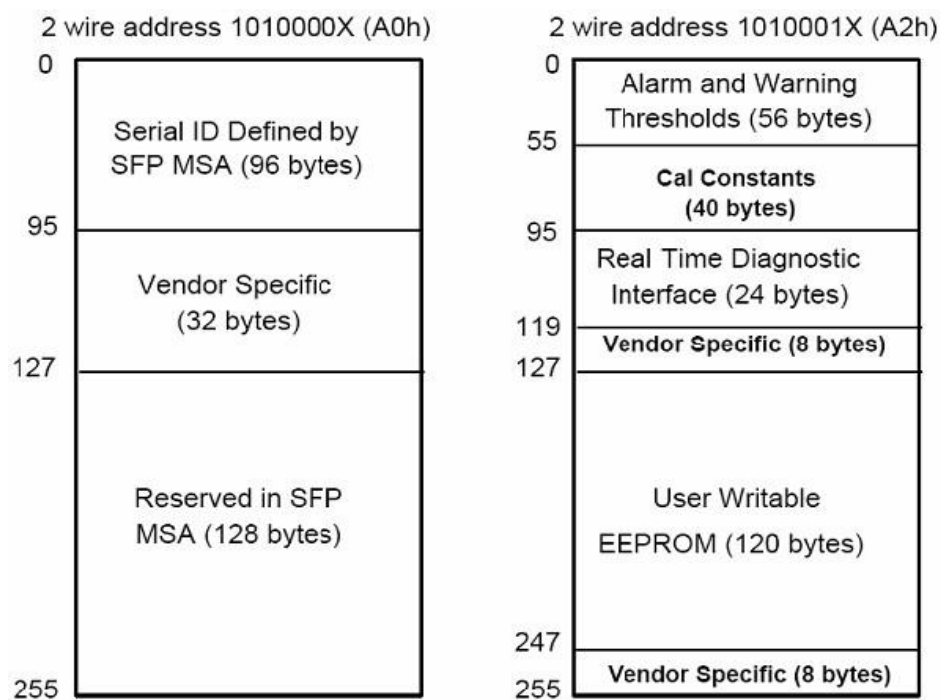


Table 2 - EEPROM Serial ID Memory Contents (A0h)

Data Address	Length (Byte)	Name of Length	Description and Contents
Base ID Fields			
0	1	Identifier	Type of Serial transceiver (03h=SFP)
1	1	Reserved	Extended identifier of type serial transceiver (04h)
2	1	Connector	Code of optical connector type (07=LC)
3-10	8	Transceiver	10G Base-SR
11	1	Encoding	64B/66B
12	1	BR, Nominal	Nominal baud rate, unit of 100Mbps
13-14	2	Reserved	(0000h)
15	1	Length(9um)	Link length supported for 9/125um fiber, units of 100m
16	1	Length(50um)	Link length supported for 50/125um fiber, units of 10m
17	1	Length(62.5um)	Link length supported for 62.5/125um fiber, units of 10m
18	1	Length(Copper)	Link length supported for copper, units of meters
19	1	Reserved	
20-35	16	Vendor Name	SFP vendor name:
36	1	Reserved	
37-39	3	Vendor OUI	SFP transceiver vendor OUI ID
40-55	16	Vendor PN	Part Number: "FBL-XXXXXX" (ASCII)
56-59	4	Vendor rev	Revision level for part number
60-62	3	Reserved	
63	1	CCID	Least significant byte of sum of data in address 0-62
Extended ID Fields			
64-65	2	Option	Indicates which optical SFP signals are implemented (001Ah = LOS, TX_FAULT, TX_DISABLE all supported)
66	1	BR, max	Upper bit rate margin, units of %
67	1	BR, min	Lower bit rate margin, units of %
68-83	16	Vendor SN	Serial number (ASCII)

84-91	8	Date code	Manufacturing date code
92-94	3	Reserved	
95	1	CCEX	Check code for the extended ID Fields (addresses 64 to 94)
Vendor Specific ID Fields			
96-127	32	Readable	
128-255	128	Reserved	Reserved for SFF-8079

Digital Diagnostic Monitor Characteristics

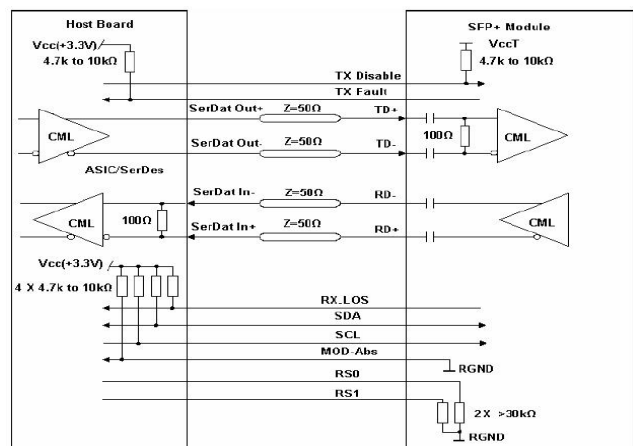
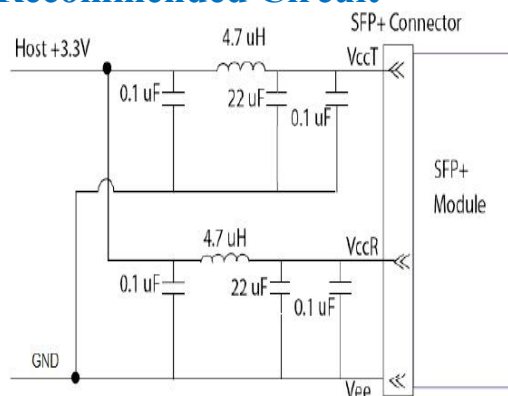
Data Address	Parameter	Accuracy	Unit	Calibration
96-97	Transceiver Internal Temperature	±3.0	°C	internal
98-99	VCC3 Internal Supply Voltage	±5.0	%	internal
100-101	Laser Bias Current	±10	%	internal
102-103	Tx Output Power	±3.0	dBm	internal
104-105	Rx Input Power	±3.0	dBm	internal

Regulatory Compliance

The transceiver complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1(>1000 V)
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	IEC 61000-4-2 GR-1089-CORE	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compatible with Class 1 laser product.

Recommended Circuit



Recommended Host Board Power Supply Circuit

Recommended High-speed Interface Circuit

■ Mechanical Dimensions

