

PRODUCT SPECIFICATION

FLSF-1312-60D(I)

1.25Gb/s Duplex LC, 1310nm DFB-LD 60km SFP Transceiver

■ Features:

- ★ Up to 1.25Gb/s Data Links
- ★ Hot-Pluggable
- ★ 1310nm DFB laser transmitter
- ★ Duplex LC connector
- ★ Up to 60km on 9/125μm SMF
- ★ Single +3.3V Power Supply
- ★ Monitoring Interface Compliant with SFF-8472
- ★ Low power dissipation <1.5W typically
- ★ 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 and Lead Free



■ Applications:

- ★ Metro/Access Networks
- ★ 1.25 Gb/s 1000Base Ethernet
- ★ 1×Fiber Channel
- ★ Other Optical Link

■ Description:

Flowlink FLSF-1312-60D(I) Small Form Factor Pluggable (SFP) Transceiver is a high performance, cost effective module which has a Duplex LC optics interface, Standard AC coupled CML for high speed signal and LVTTTL control and monitor signals. The receiver section uses a PIN receiver and the transmitter uses 1310 nm DFB laser, up to 19dB link budget ensure this module 1000BASE Ethernet 60km application.

■ Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature	T _S	-40		+85	°C
Supply Voltage	V _{CC}	-0.5		4	V
Relative Humidity	RH	0		85	%

■ Recommended Operating Environment:

Parameter	Symbol	Min.	Typical	Max.	Unit
Case operating Temperature	Industrial	-40		+85	°C
	Extended				
	Commercial	0		70	

■ Electrical Characteristics (T_{OP} = T_C, V_{CC} = 3.135 to 3.465 Volts)

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Supply Voltage	V _{CC}	3.14	3.30	3.47	V	
Supply Current	I _{CC}			280	mA	
Inrush Current	I _{surge}			I _{CC} +30	mA	
Maximum Power	P _{max}			1.0	W	
Transmitter Section:						
Input differential impedance	R _{in}	90	100	110		
Single ended data input swing	V _{in PP}	200		1200	mVp-p	
Transmit Disable Voltage	V _D	V _{CC} – 1.3		V _{CC}	V	2
Transmit Enable Voltage	V _{EN}	V _{EE}		V _{EE} +0.8	V	
Transmit Disable Assert Time	T _{dessert}			10	us	
Receiver Section:						
Single ended data output swing	V _{out,pp}	300		1000	mv	3
Data output rise time	t _r			260	ps	4
Data output fall time	t _f			260	ps	4
LOS Fault	V _{losfault}	V _{CC} – 0.5		V _{CC_host}	V	5
LOS Normal	V _{los norm}	V _{EE}		V _{EE} +0.5	V	5
Power Supply Rejection	PSR	100			mVpp	6
Deterministic Jitter Contribution	RXΔDJ			51.7	ps	
Total Jitter Contribution	RXΔTJ			122.4	ps	

Note:

1. AC coupled.
2. Or open circuit.
3. Into 100 ohm differential termination.
4. LOS is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
5. All transceiver specifications are compliant with a power supply sinusoidal modulation of 20 Hz to 1.5MHz up to specified value applied through the power supply filtering network shown on page 23 of the

Small Form-factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 14, 2000.

■ Optical Parameters($T_{OP} = T_c$, $V_{CC} = 3.135$ to 3.465 Volts)

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Transmitter Section:						
Center Wavelength	λ_c	1290	1310	1330	nm	
Spectral Width(-20dB)	σ			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Optical Output Power	P _{out}	-5		0	dBm	1
Optical Rise/Fall Time	t _r / t _f			260	ps	2
Extinction Ratio	ER	9			dB	
Relative Intensity Noise	RIN			-120	dB/Hz	
Deterministic Jitter Contribution	TXΔDJ				ps	
Total Jitter Contribution	TXΔTJ				ps	
Eye Mask for Optical Output	Compliant with IEEE802.3 z (class 1 laser safety)					
Receiver Section:						
Optical Input Wavelength		1290		1330	nm	
Receiver Overload	P _{ol}	-3			dBm	4
RX Sensitivity	Sen			-24	dBm	4
RX_LOS Assert	LOS _A	-38			dBm	
RX_LOS Deassert	LOS _D			-25	dBm	
RX_LOS Hysteresis	LOS _H	0.5			dB	
General Specifications						
Data Rate	BR		1250		Mb/s	
Bit Error Rate	BER			10 ⁻¹²		
Max. Supported Link Length on 9/125μm SMF@1.25G	L _{MAX}			60	km	
Total System Budget	LB	19			dB	

Note

1. The optical power is launched into SMF.
2. 20-80%.
3. Jitter measurements taken using Agilent OMNIBERT 718 in accordance with GR-253.
4. Measured with PRBS 2^{7-1} at 10^{-12} BER

Pin Assignment

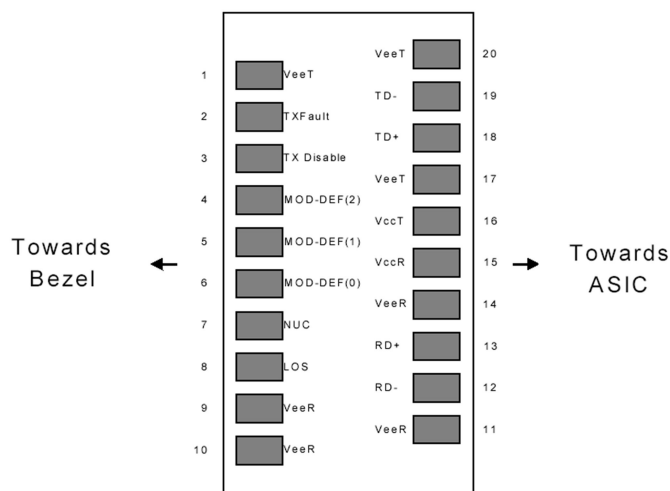


Diagram of Host Board Connector Block Pin Numbers and Names

Pin Description

Pin No	Name	Function	Plug Seq	Notes
1	VeeT	Transmitter Ground	1	1
2	TX Fault	Transmitter Fault Indication	3	
3	TX Disable	Transmitter Disable	3	2
4	MOD-DEF2	Module Definition	2	3
5	MOD-DEF1	Module Definition 1	3	3
6	MOD-DEF0	Module Definition 0	3	3
7	Rate Select	Not Connected	3	4
8	LOS	Loss of Signal	3	5
9	VeeR	Receiver Ground	1	1
10	VeeR	Receiver Ground	1	1
11	VeeR	Receiver Ground		1
12	RD-	Inv. Received Data Out	3	6
13	RD+	Received Data Out	3	6
14	VeeR	Receiver Ground	3	1
15	VccR	Receiver Power	2	1
16	VccT	Transmitter Power	2	
17	VeeT	Transmitter Ground	1	
18	TD+	Transmit Data In	3	6
19	TD-	Inv. Transmit In	3	6

20	VeeT	Transmitter Ground	1	
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Notes:

1. Circuit ground is internally isolated from chassis ground.
2. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
3. Should be pulled up with 4.7k - 10 kohms on host board to a voltage between 2.0V and 3.6V. MOD_DEF(0) pulls line low to indicate module is plugged in.
4. Rate select is not used
5. LOS is open collector output. Should be pulled up with 4.7k – 10 kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
6. AC Coupled

■ 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. And the DDM specification is at address 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 Monitor (DDM) Memory Map (A0h) and Digital Diagnostic Monitor (DDM) Memory Map (A2h)

2 wire address 1010000X (A0h)	2 wire address 1010001X (A2h)
0	0
95	55
127	95
255	247
	255
Serial ID Defined by SFP MSA (96 bytes)	Alarm and Warning Thresholds (56 bytes)
Vendor Specific (32 bytes)	Cal Constants (40 bytes)
Reserved in SFP MSA (128 bytes)	Real Time Diagnostic Interface (24 bytes)
	Vendor Specific (8 bytes)
	User Writable EEPROM (120 bytes)
	Vendor Specific (8 bytes)

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	Gigabit Ethernet 1000Base-EX
11	1	Encoding	NRZ (03h)
12	1	BR,Nominal	Nominal baud rate, unit of 100Mbps
13	1	Reserved	(0000h)
14	1	Length(9um,km)	Link length supported for 9/125um fiber, units of km
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: "GL-xxxxx" (ASCII)
56-59	4	Vendor rev	Revision level for part number
60-61	2	Wavelength	Laser wavelength
62	1	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	1	Diagnostic Type	Diagnostics
93	1	Enhanced Options	Diagnostics
94	1	SFF-8472	Diagnostics
95	1	CCEX	Check code for the extended ID Fields (addresses 64 to 94)
Vendor Specific ID Fields			

96-127	32	Readable	Vendor specific date, read only
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

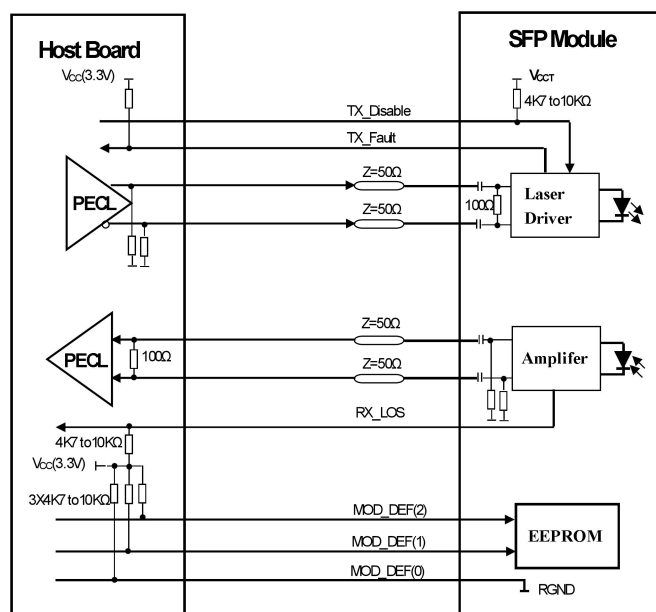
The transceiver complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

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.

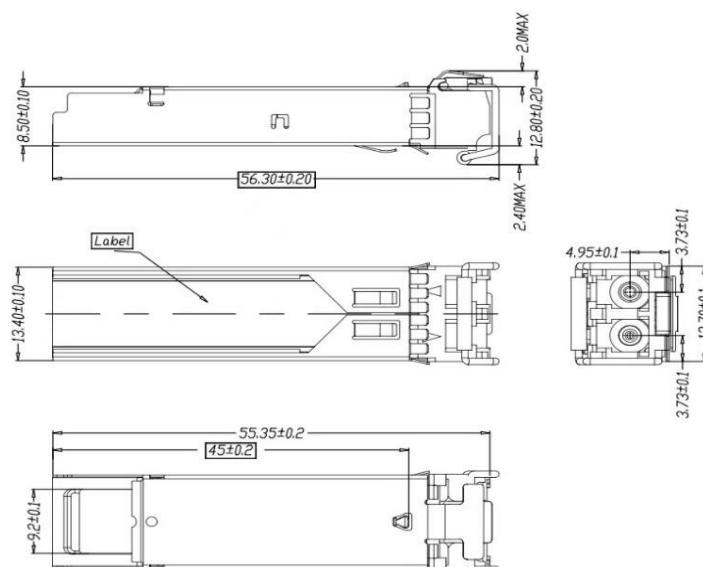
■ Reference

1. IEEE Std 802.3, 2002 Edition, Clause 38, PMD Type 1000BASE-LX. IEEE Standards Department, 2002.
2. “Fibre Channel Physical and Signaling Interface (FC-PH, FC-PH2, FC-PH3)”. American National Standard for Information Systems.
3. “Fibre Channel Draft Physical Interface Specification (FC-PI 13.0)”. American National Standard for Information Systems.
4. Small Form-factor Pluggable (SFP) Transceiver Multi-source Agreement (MSA) September 14, 2000.

■ Recommended circuit & Mechanical Dimensions



SFP Host Recommended Circuit



Mechanical Drawing

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