25Gb/s SFP28 1310nm 80km Transceiver

HC-FL381x

Features

Up to 25.78Gb/s data links

1310nm DFB laser and PIN+SOA receiver

Up to 80km on 9/125um SMF

Hot-pluggable SFP footprint

Support Digital Monitoring interface

Class 1 laser safety certified

Cost effective SFP28 solution, enables higher port densities and greater bandwidth

RoHS-10 compliant and lead-free

Single +3.3V power supply

2-wire interface for management specifications compliant with SFF-8472 digital diagnostic monitoring interface for optical transceivers

All-metal housing for superior EMI performance

Case operating temperature

Commercial: 0 ~ +70ºC Extended: -10 ~ +80ºC Industrial: -40 ~ +85ºC

Applications

High-speed storage area networks

25GBASE 80KM

Other Optical Links

Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Max	Unit	Notes
Storage Temperature	T_S	-40	85	°C	
Power Supply Voltage	V_{CC}	-0.5	3.6	V	
Relative Humidity (non-condensation)	RH	5	95	%	
Damage Threshold	TH_d	3		dBm	

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Case Temperature	T_{OP}	0		70	°C	commercial
		-40		85	°C	Industrial
Power Supply Voltage	V_{CC}	3.135	3.3	3.465	V	
Data Rate			25.78		Gb/s	
Control Input Voltage High		2		Vcc	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (SMF)	D			80	km	9/125um

General Description

HC-FL381x 25Gb/s SFP28 transceiver consists of five sections: the LD driver, the limiting amplifier, the digital diagnostic monitor, the DFB laser and the PIN+SOA receiver .The module data link up to 80km in 9/125um single mode fiber.

The module optical connection is duplex LC and shall be compatible with SFP+ 28Gbps and backward compatible with legacy 10G SFP+ pluggable. The SFP28 ZR module is a dual directional device with a transmitter and receiver plus a control management interface (2-wire interface) in the same physical package. 2-wire interface is used for serial ID, digital diagnostics and module control

function.

The transmitter converts 25Gbit/s serial PECL or CML electrical data into serial optical data compliant with the 25GBASE-LR standard. An open collector compatible Transmit Disable (Tx_Dis) is provided. Logic “1” or no connection on this pin will disable the laser from transmitting. Logic “0” on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (Tx_Fault) is provided. TX_Fault is module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX_Fault output contact is an open drain/collector and shall be pulled up to the Vcc_Host in the host with a resistor in the range 4.7-10 kΩ. TX_Disable is a module input contact. When TX_Disable is asserted high or left open, the SFP28 module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor

The receiver converts 25Gbit/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx_LOS contact is an open drain/collector output and shall be pulled up to Vcc_Host in the host with a resistor in the range 4.7-10 kΩ, or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx_LOS signal is intended as a preliminary indication to the system in which the SFP28 is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

Pin Assignment and Pin Description

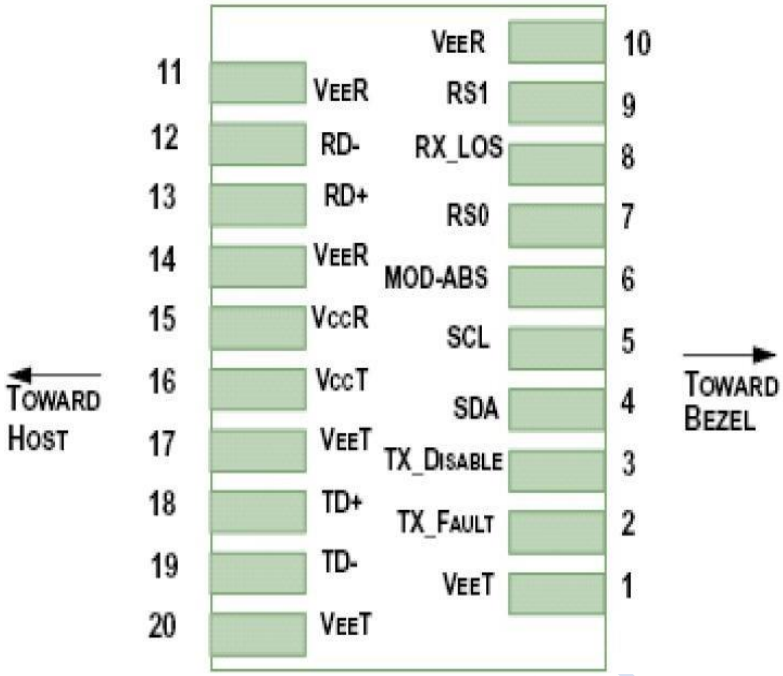

Figure1. Diagram of host board connector block pin numbers and names

PIN	Name	Name/Description	Notes
1	VeeT	Transmitter Ground	1
2	TX_Fault	Transmitter Fault	
3	TX_Disable	Transmitter Disable; Turns off transmitter laser output	
4	SDA	Two wire serial interface Data Line (LVCMOS-I/O) (MOD-DEF2)	2
5	SCL	Two wire serial interface Clock Line (LVCMOS-I/O) (MOD-DEF1)	2
6	MOD_ABS	Module Definition, Grounded in the module	
7	RS0	Rate Select 0 – Not used	
8	RX_LOS	Receiver Loss of Signal Indication Active LOW	
9	RS1	Rate Select 1 – Not used	
10	VeeR	Receiver Ground	1
11	VeeR	Receiver Ground	1

12	RD-	Receiver Inverted Data Output	
13	RD+	Receiver Data Output	
14	VeeR	Receiver Ground	1
15	VccR	Receiver Power - +3.3V	
16	VccT	Transmitter Power - +3.3 V	
17	VeeT	Transmitter Ground	1
18	TD+	Transmitter Non-Inverted Data Input	
19	TD-	Transmitter Inverted Data Input	
20	VeeT	Transmitter Ground	1

Notes:

1. Module ground pins GND are isolated from the module case.

2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.47V on the host board.

Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Power Consumption	p			3	W	
Supply Current	Icc			865	mA	
Transmitter						
Single-ended Input Voltage Tolerance	Vcc	-0.3		4.0	V	
Common mode voltage tolerance		15			mV	
Differential Input Voltage Swing	Vin,pp	180		700	mVpp	
Differential Input Impedance	Zin	90	100	110	Ohm	1

Transmit Disable Assert Time				100	us	
Transmit Disable Voltage	Vdis	Vcc-1.3		Vcc	V	
Transmit Enable Voltage	Ven	Vee		Vee +0.8	V	2
Receiver						
Single-ended Input Voltage Tolerance	Vcc	-0.3		4.0	V	
Differential Output Voltage Swing	Vout,pp	300		900	mVpp	
Differential Output Impedance	Zout	90	100	110	Ohm	3
Data output rise/fall time	Tr/Tf	12			ps	4
LOS Assert Voltage	VlosH	Vcc-1.3		Vcc	V	5
LOS De-assert Voltage	VlosL	Vee		Vee +0.8	V	5

Notes:

3. Connected directly to TX data input pins. AC coupled thereafter.

4. Or open circuit.

5. Input 100 ohms differential termination.

6. These are unfiltered 20-80% values.

Loss of Signal is LVTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics

The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
Transmitter						
Center Wavelength	λ_C	1295	1310	1325	nm	
Optical Spectral Width	$\Delta\lambda$			1	nm	
Average Optical Power	P_{AVG}	1		6	dBm	1
Side Mode Suppression Ratio	SMSR	30			dB	
Optical Extinction Ratio	ER	6			dB	

Transmitter OFF Output Power	Poff			-30	dBm	
Optical Return Loss Tolerance	ORLT			20	dB	
Transmitter reflectance	Tref			-26	dB	
Transmitter Eye Mask	Compliant with IEEE802.3ae					
Receiver						
Center Wavelength	λ_C	1295	1310	1325	nm	
Average Receive Power		-30		-7	dBm	
Receiver Sensitivity (Average, each lane)	Sen1			-23	dBm	2
	Sen2			-29	dBm	3
Input Saturation Power (overload)	Psat	-7			dBm	
LOS Assert	LOSA	-40			dBm	
LOS De-assert	LOSD			-29	dBm	
Damage Threshold	TH_d	-3			dBm	
LOS Hysteresis	LOSH	0.5			dB	

Notes:

1. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
2. Measured @25.78125Gbps, ER=6.2dB, BER=<1E-12, PRBS=2^31-1
3. Measured @25.78125Gbps, ER=6.2dB, BER=<5E-5, PRBS=2^31-1

Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8472 Rev10.2 with internal calibration mode. For external calibration mode please contact our sales staff.

Parameter	Symbol	Min.	Max	Unit	Notes
Temperature monitor absolute error	DMI_ Temp	-3	3	°C	0~85C
Supply voltage monitor absolute error	DMI _VCC	-3	3	%	0~Vcc

RX power monitor absolute error	DMI_RX	-3	3	dB	-7~-30dBm
Bias current monitor error	DMI_ bias	-10	10	%	0~100mA
TX power monitor absolute error	DMI_TX	-3	3	dB	1~6dBm

Mechanical Dimensions

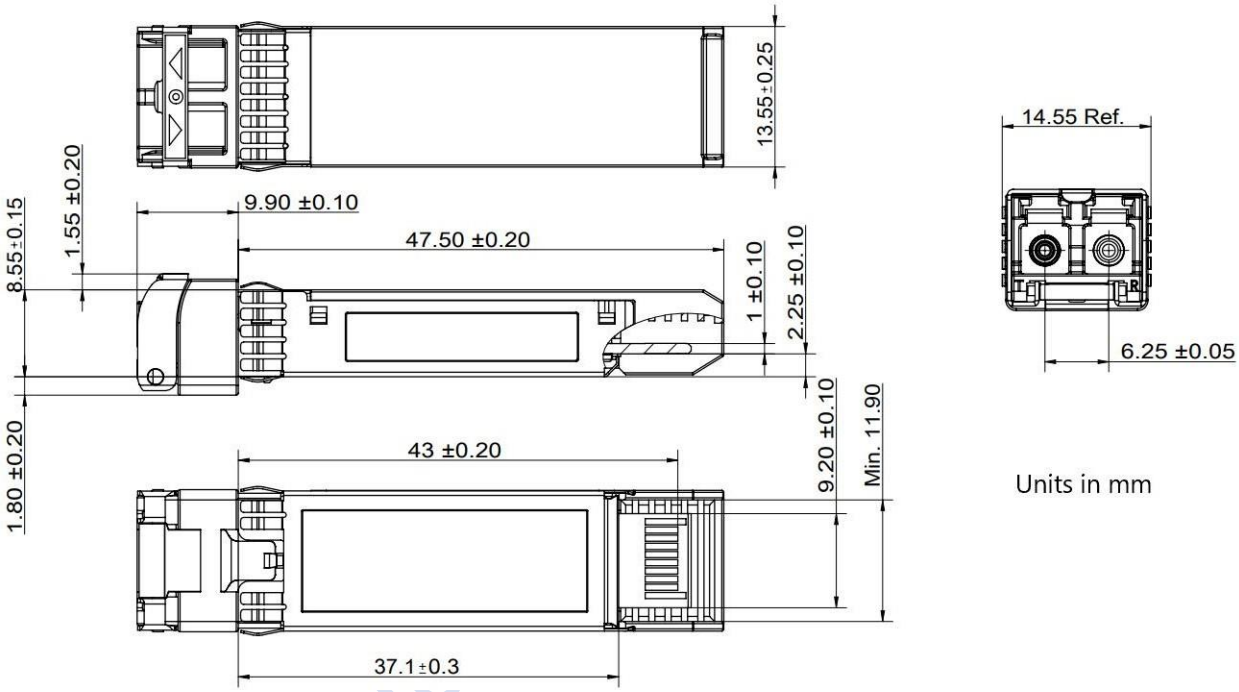

Figure2. Mechanical Outline

Ordering Information

Part Number	Data Rate (Gb/s)	Wavelength (nm)	Transmission Distance(km)	Temperature (°C) (Operating Case)
HC -FL381C	25.78	1310	80	0~70 Commercial
HC -FL381E	25.78	1310	80	-10~80 Extended
HC -FL381I	25.78	1310	80	-40~85 Industrial