

10G CPRI SFP+ BiDi 60km Industrial Optical Transceivers

Features

- ◆ Operating data rate up to 10.3Gb/s data rates
- ◆ Simplex LC Connector Bi-Directional SFP+ Optical Transceiver
- ◆ Single 3.3V Supply
- ◆ Up to 60km on 9/125um SMF
- ◆ A:1270nm DFB Laser transmitter,1330nm APD receiver
- ◆ B:1330nm DFB Laser transmitter,1270nm APD receiver
- ◆ Compliant with IEEE 802.3ae 10GBASE-E6R and 10GBASE-E6W
- ◆ SFP+ MSA SFF-8431 Compliant
- ◆ Digital Diagnostic SFF-8472 Compliant
- ◆ RoHS compliant and Lead Free
- ◆ Operating case temperature:
Industrial: -40 ~85 °C

Applications

- ◆ 10GBASE-E6R at 10.3125Gbps
- ◆ 10GBASE-E6W at 9.953Gbps
- ◆ Fiber Channel
- ◆ CPRI and OBSA interface, such as 8.11008/10.1376Gbps.
- ◆ Other Optical Links

Description

The CLR-CPRI-S1060A and CLR-CPRI-S1060B series single mode transceiver is small form factor pluggable module for Bi-directional optical data communications, such as 10GBASE-E6R/E6W defined by IEEE 802.3ae, OBSAI and CPRI optical links. It is with the SFP+ 20-pin connector to allow hot plug capability.

The transceiver is designed to transmit/receive data rates from 8.5Gbps to 10.3Gbps. The transceiver consists of three sections: a BOSA, including a DFB laser transmitter and an APD photodiode integrated with a trans-impedance preamplifier (TIA); Transceiver IC, consisting of LD Driver and Post-Amplifier; and MCU control unit. All modules satisfy class I laser safety requirements.

The transceivers are compatible with SFP+ Multi-Source Agreement (MSA) and SFF-8472. For further information, please refer to SFP+ MSA.

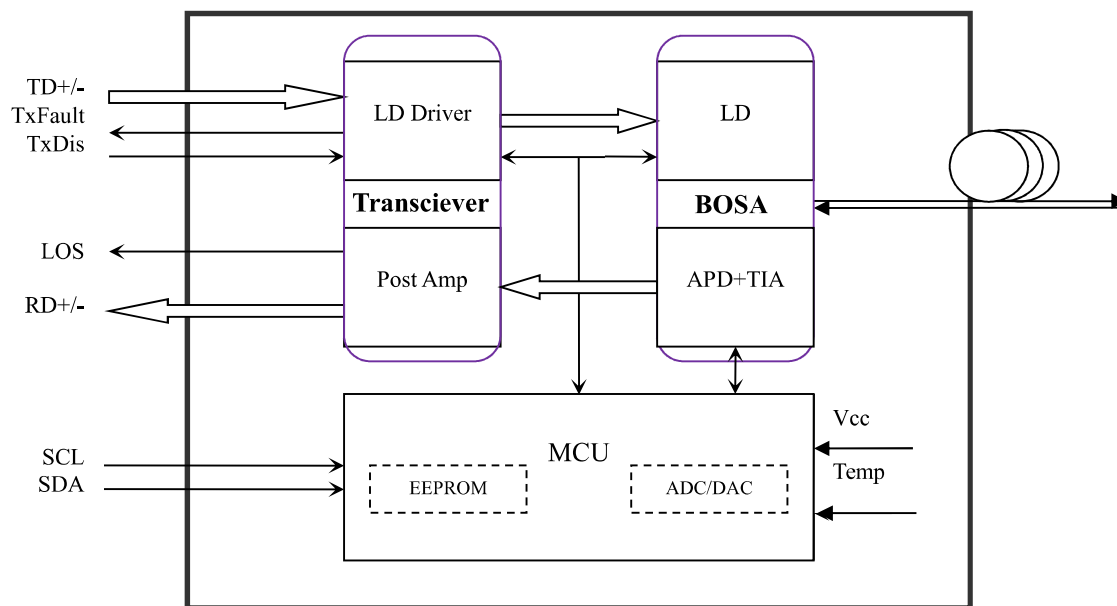


Figure1.Principle diagram of SFP+ Module

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply Voltage	Vcc	-0.5	4.5	V
Storage Temperature	Ts	-40	+85	°C
Operating Humidity	-	5	85	%

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Power Supply Voltage	Vcc	3.13	3.3	3.47	V
Power Supply Current	Icc			300	mA
Operating Case Temperature	Tc	-40		+85	°C
Data Rate				10.3	Gbps

Notes:

[1] Supply current is shared between VCCTX and VCCR. X.

[2] In-rush is defined as current level above steady state current requirements.

Electrical Characteristics(T_{OP}=25℃，V_{CC}=3.3 Volts)

Parameter		Symbol	Min	Typical	Max	Unit	Notes
Supply Voltage		V _{CC}	3.00	3.30	3.60	V	1
Supply Current		I _{CC}		200	300	mA	1
Transmitter							
Input Differential Impedance		R _{in}	90	100	110	Ω	3
Single-ended Data Input Swing		V _{in,pp}	150		1200	mV _{pp}	2
Transmit Disable Voltage		V _D	2		V _{CC} +0.3	V	
Transmit Enable Voltage		V _{EN}	V _{ee}		V _{ee} +0.8	V	
TX Fault	Fault	V _{Fault}	2.0		V _{cc}	V	
	Normal	V _{Normal,Fault}	V _{ee}		V _{ee} +0.4	V	
Receiver							
Output Differential Impedance		R _{out}	90	100	110	Ω	3
Single-ended Data Output Swing		V _{out,pp}	300		700	mV _{pp}	2
LOS Fault		V _{LOS,fault}	2		V _{CC}	V	4
LOS Normal		V _{LOS,norm}	V _{ee}		V _{ee} +0.8	V	4

- Notes:
- 1. Module power consumption never exceeds 1.0W.
 - 2. AC coupled.
 - 3. 100ohm differential termination.
 - 4. LOS is LVTTTL. Logic 0 indicates normal operation; logic1 indicates no signal detected.

Optical Characteristics(TOP=25℃，VCC=3.3 Volts)

CLR-CPRI-S1060A

Parameter		Symbol	Min	Typical	Max	Unit	Notes
Transmitter							
Centre Wavelength		λ _c	1260	1270	1280	nm	
Side Mode Suppression Ratio		SMSR	30			dB	
Spectral Width (-20dB)		σ			1	nm	
Average Output Power		P _{out}	0		6	dBm	1
Extinction Ratio		ER	3.5			dB	
Transmitter and Dispersion Penalty		TDP			2	dB	
Average Power of OFF Transmitter		P _{Disable}			-30	dBm	
Relative Intensity Noise		RIN			-128	dB/Hz	

Receiver						
Centre Wavelength	λ_c	1320		1340	nm	
Average Receiver Power	$P_{\text{sensitivity}}$			-20	dBm	1,2
Receiver Overload	P_{MAX}			+0.5	dBm	
LOS De-Assert	LOS_D			-20	dBm	
LOS Assert	LOS_A	-32			dBm	
LOS Hysteresis		0.5			dB	

- Notes:
1. Average Receiver Power (Min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant.
 2. Measured with a PRBS2³¹-1 test pattern @10.3125Gbps, BER ≤ 10⁻¹².
 3. Rise and fall times, 20% to 80%, are measured following a fourth-order Bessel-Thompson filter with a bandwidth of 0.75 x clock frequency corresponding to the serial data rate.

CLR-CPRI-S1060B

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
Centre Wavelength	λ_c	1320	1330	1340	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Spectral Width (-20dB)	σ			1	nm	
Average Output Power	P_{out}	0		6	dBm	1,2
Extinction Ratio	ER	3.5			dB	
Eye Mask	Compliant with IEEE 802.3					
Rise/Fall Time (20%~80%)	tr/tf			40	ps	4
Transmitter and Dispersion Penalty	TDP			2	dB	
Average Power of OFF Transmitter	P_{Disable}			-30	dBm	
Relative Intensity Noise	RIN			-128	dB/Hz	
Receiver						
Centre Wavelength	λ_c	1260		1280	nm	
Average Receiver Power	$P_{\text{sensitivity}}$			-20	dBm	2,3
Receiver Overload	P_{MAX}			+0.5	dBm	
LOS De-Assert	LOS_D			-20	dBm	
LOS Assert	LOS_A	-32			dBm	
LOS Hysteresis		0.5			dB	

- Notes:
1. Output is coupled into a 9/125um SMF.
 2. Average Receiver Power (Min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant.
 3. Measured with a PRBS2³¹-1 test pattern @10.3125Gbps, BER ≤ 10⁻¹².
 4. Rise and fall times, 20% to 80%, are measured following a fourth-order Bessel-Thompson filter with a bandwidth of 0.75 x clock frequency corresponding to the serial data rate.

Timing and Electrical

Parameter	Symbol	Min	Typical	Max	Unit
Tx Disable Negate Time	t_on			1	ms
Tx Disable Assert Time	t_off			10	µs
Time To Initialize, including Reset of Tx Fault	t_init			300	ms
Tx Fault Assert Time	t_fault			100	µs
Tx Disable To Reset	t_reset	10			µs
LOS Assert Time	t_loss_on			100	µs
LOS De-assert Time	t_loss_off			100	µs
Serial ID Clock Rate	f_serial_clock			400	KHz
MOD_DEF (0:2)-High	V _H	2		V _{cc}	V
MOD_DEF (0:2)-Low	V _L			0.8	V

Diagnostics Specification

Parameter	Range	Unit	Accuracy	Calibration
Temperature	0 to +70	°C	±3°C	Internal / External
	-40 to +85			
Voltage	3.0 to 3.6	V	±3%	Internal / External
Bias Current	0 to 100	mA	±10%	Internal / External
TX Power	2 to6	dBm	±3dB	Internal / External
RX Power	-20 to -6	dBm	±3dB	Internal / External

Pin Definitions

Pin Diagram

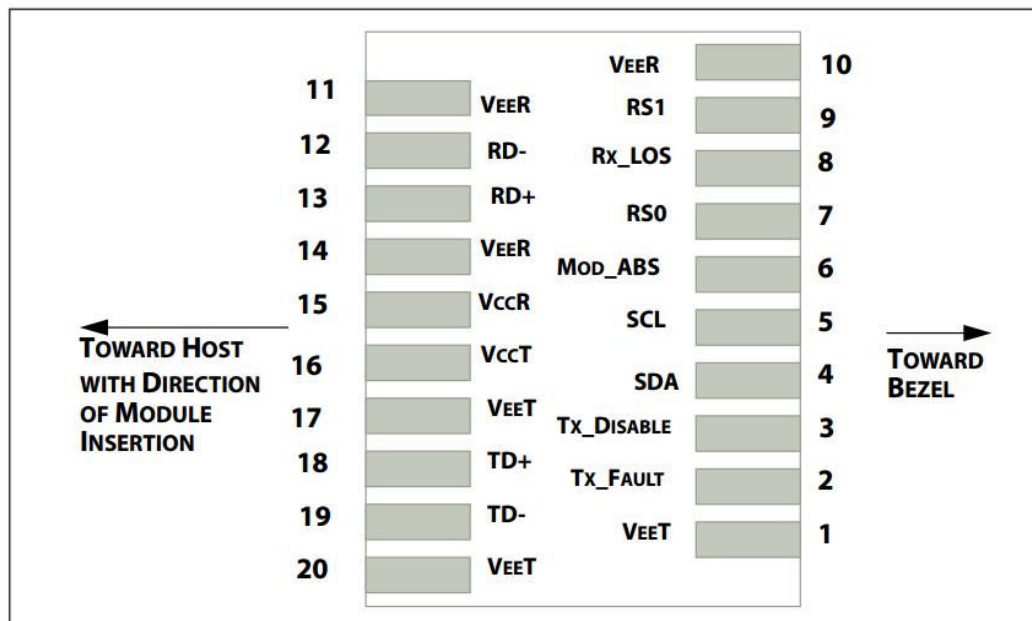


Figure2. Host PCB SFP+ pad assignment top view

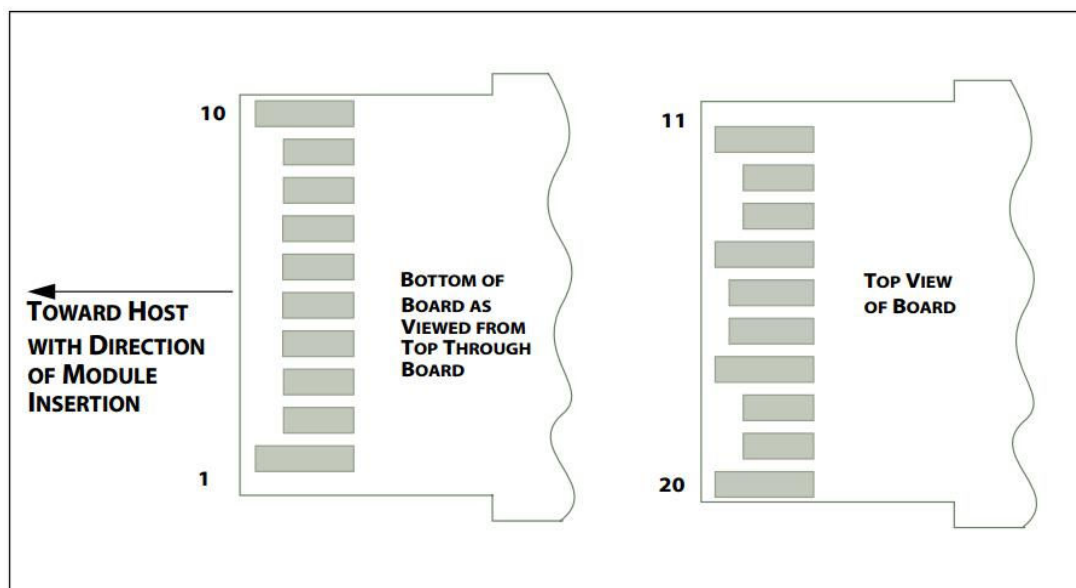


Figure3. SFP+ module contact assignment

Pin Descriptions

Pin	Signal Name	Description	Plug Seq.	Notes
1	VEET	Transmitter Ground	1	Note 1
2	TX_FAULT	Transmitter Fault Indication	3	Note 2
3	TX_DISABLE	Transmitter Disable, Laser output disabled on high or open	3	Note 3
4	SDA	2-wire Serial Interface Data Line, SDA Serial Data Signal	3	Note 2
5	SCL	2-wire Serial Interface Data Line, SCL Serial Clock Signal	3	Note 2
6	MOD_ABS	Module Absent. Grounded within the module	3	Note 4
7	RS0	RS0 for Rate Select: Open or Low = Module supports ≤ 4.25 Gbps High = Module supports 9.95 Gb/s to 10.3125 Gb/s	3	Note 5
8	RX_LOS	Loss of Signal indication. Logic 0 indicates normal operation	3	Note 2
9	RS1	No connection required	1	Note 5
10	VEER	Receiver ground	1	Note 1
11	VEER	Receiver ground	1	Note 1
12	RD-	Receiver Inverted Data out. AC Coupled	3	Note 6
13	RD+	Receiver Data out. AC Coupled	3	Note 6
14	VEER	Receiver ground	1	Note 1
15	VCCR	Receiver Power Supply	2	
16	VCCT	Transmitter Power Supply	2	
17	VEET	Transmitter Ground	1	Note 1
18	TD+	Transmit Data In.AC Coupled	3	Note 7
19	TD-	Transmit Inverted Data In. AC Coupled	3	Note 7
20	VEET	Transmitter Ground	1	Note 1

Notes:

Plug Seq.: Pin engagement sequence during hot plugging.

1) Module circuit ground is isolated from module chassis ground within the module.

2) TX Fault/RX_LOS is an open collector output, which should be pulled up with a 4.7k~10k Ω resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind or loss of signal. In the low state, the output will be pulled to less than 0.8V. SDA/SCL should be pulled up with 4.7k – 10k ohms on host board to a voltage between 3.15V and 3.6V.

3) TX Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7k~10k Ω resistor. Its states are:

Low (0 to 0.8V):	Transmitter on
(>0.8V, < 2.0V):	Undefined
High (2.0 to 3.465V):	Transmitter Disabled
Open:	Transmitter Disabled

4) Mod_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull this contact up to Vcc_Host with a resistor in the range 4.7 k Ω to 10 k Ω . Mod_ABS is asserted “High” when the SFP+ module is physically absent from a host slot.

5) RS0 and RS1 are module inputs and are pulled low to VeeT with > 30 k Ω resistors in the module.

6) RD-/+ : These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100 Ω (differential).

7) TD-/+ : These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100 Ω differential termination inside the module.

Recommend Circuits

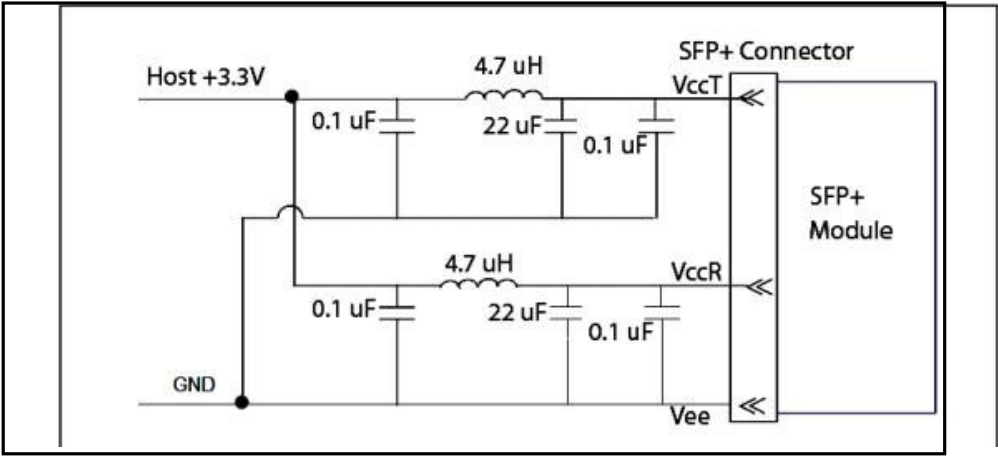


Figure4. Host Board Power Supply Filters Circuit

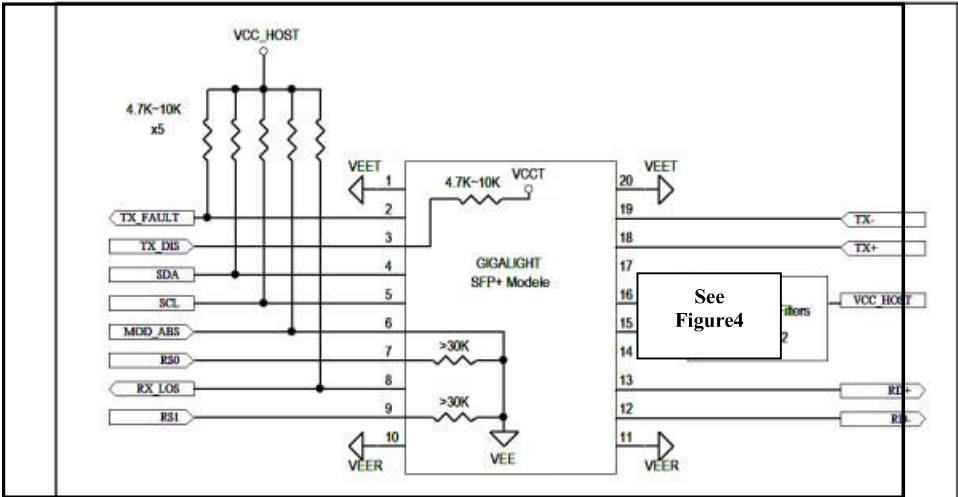


Figure5.Host-Module Interface

Mechanical Dimensions

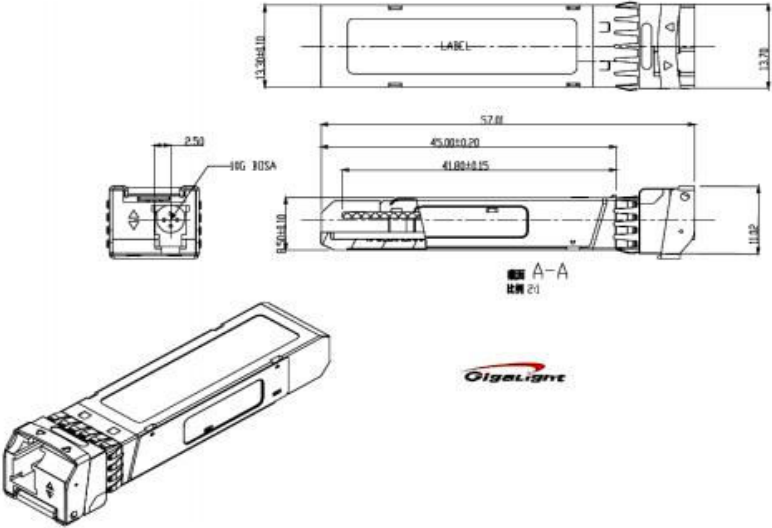


Figure5.Key Mechanical Dimensions