

BI+10G-1213-40K-D (I)

BI+10G-1312-40K-D (I)

10Gb/s BIDI SFP+ 40km Transceiver

PRODUCT FEATURES

- Up to 11.3Gbps Data Links
- Up to 40km transmission on SMF
- Power dissipation < 1.0W
- 1270nm DFB laser and PIN receiver for BI+10G-1213-40K-D(I)
- 1330nm DFB laser and PIN receiver for BI+10G-1312-40K-D(I)
- 2-wire interface with integrated Digital Diagnostic monitoring
- EEPROM with Serial ID Functionality
- Compliant with SFP+ MSA with LC connector
- Single + 3.3V Power Supply
- Case operating temperature:
 - Commercial: 0°C to +70°C
 - Industrial: -40°C to +85°C

APPLICATIONS

- 10GBASE-BX & 10GBASE-ER/EW
- 10G SONET/SDH, OTU2/2e

STANDARD

- Compliant with SFF-8472
- Compliant to SFF-8431
- Compliant to 802.3ae 10GBASE-ER/EW
- RoHS Compliant.



PRODUCT DESCRIPTION

BI+10G-1213-40K-D(I) is hot pluggable 3.3V Small-Form-Factor transceiver module. It designed expressly for high-speed communication applications that require rates up to 11.3Gb/s, it designed to be compliant with SFF-8472 SFP+ MSA. The module data link up to 40km in 9/125um single mode fibre.

Ordering Information

Product Part Number	Data Rate (Gbps)	Media	Wavelength (nm)	Transmission Distance(km)	Temperature Range (Tcase) (°C)	
BI+10G-1213-40K-D	10.3125	Single mode fibre	1270/1330	40	0~70	Commercial
BI+10G-1312-40K-D	10.3125	Single mode fibre	1330/1270	40	0~70	Commercial
BI+10G-1213-40K-DI	10.3125	Single mode fibre	1270/1330	40	-40~85	Industrial
BI+10G-1312-40K-DI	10.3125	Single mode fibre	1330/1270	40	-40~85	Industrial

I. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Storage Temperature	Ts	-40	-	85	°C
Relative Humidity	RH	5	-	95	%
Power Supply Voltage	Vcc	-0.3	-	4	V
Signal Input Voltage		Vcc-0.3	-	Vcc+0.3	V

II. Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note	
Case Operating Temperature	Tcase	0	-	70	°C	Without air flow	
		-40	-	85		Industrial	
Power Supply Voltage	Vcc	3.14	3.3	3.47	V		
Power Supply Current	Icc			300	mA		
Data Rate	BR		10.3125	11.3	Gbps		
Transmission Distance	TD			40	km		
Coupled Fibre	Single mode fibre						9/125um SMF

III. Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Transmitter						
Average Launched Power	P _{out}	0	-	5	dBm	
Average Launched Power (Laser Off)	P _{off}	-	-	-30	dBm	Note (1)
Centre Wavelength Range	λ_C	1260	1270	1280	nm	BI+10G-1213-40K-D(I)
		1320	1330	1340	nm	BI+10G-1312-40K-D(I)
Side mode suppression ratio	SMSR	30	-	-	dB	
Spectrum Bandwidth(-20dB)	σ	-	-	1	nm	
Extinction Ratio	ER	3.5		-	dB	Note (2)
Output Eye Mask	Compliant with IEEE 802.3ae					Note (2)
Receiver						
Input Optical Wavelength	λ_{IN}	1320	1330	1340	nm	BI+10G-1213-40K-D(I)
		1260	1270	1280	nm	BI+10G-1312-40K-D(I)
Receiver Sensitivity	P _{sen}	-	-	-15	dBm	Note (3)
Input Saturation Power (Overload)	P _{SAT}	0.5	-	-	dBm	Note (3)
LOS Assert	LOSA	-30	-	-	dBm	
LOS De-assert	LOSD	-	-	-17	dBm	
LOS Hysteresis	PHys	0.5	-	5	dB	

Note:

1. The optical power is launched into SMF
2. Measured with RPBS 2[^]31-1 test pattern @10.3125Gbs
3. Measured with RPBS 2[^]31-1 test pattern @10.3125Gbs BER=<10⁻¹

IV. Electrical Interface Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Total power supply current	I _{cc}	-		300	mA
Transmitter					
Differential Data Input Voltage	V _{DT}	180	-	700	mVp-p
Differential line input Impedance	R _{IN}	85	100	115	Ohm
Transmitter Fault Output-High	V _{FaultH}	2.4	-	V _{cc}	V
Transmitter Fault Output-Low	V _{FaultL}	-0.3	-	0.8	V
Transmitter Disable Voltage- High	V _{DisH}	2	-	V _{cc} +0.3	V
Transmitter Disable Voltage- low	V _{DisL}	-0.3	-	0.8	V
Receiver					
Differential Data Output Voltage	V _{DR}	300	-	850	mVp-p
Differential line Output Impedance	R _{OUT}	80	100	120	Ohm
Receiver LOS Pull up Resistor	R _{LOS}	4.7	-	10	KOhm
Data Output Rise/Fall time	tr/tf		-	38	ps
LOS Fault	V _{LOS fault}	V _{cc} -1.3		V _{cc} HOST	V
LOS Normal	V _{LOS norm}	V _{ee}		V _{ee} +0.8	V

V. Pin Descriptions

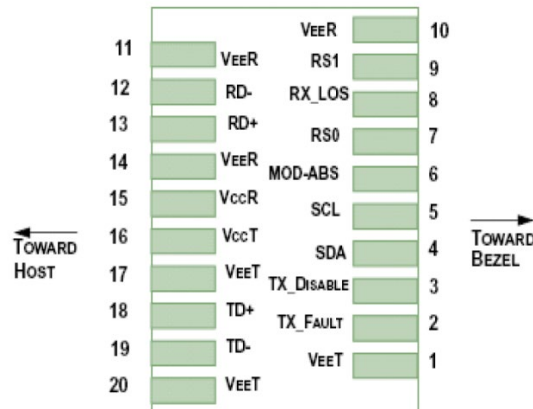


Diagram of Host Board Connector Block Pin Numbers and Name

Pin	Symbol	Name/Description	Note
1	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1
2	T_{FAULT}	Transmitter Fault.	2
3	T_{DIS}	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	4
5	SCL	2-wire Serial Interface Clock Line	4
6	MOD_ABS	Module Absent. Grounded within the module	4
7	RS0	Rate Select 0	5
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	6
9	RS1	No connection required	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:

- Circuit ground is internally isolated from chassis ground.
- T_{FAULT} is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to $V_{CC} + 0.3V$. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
- Laser output disabled on $T_{DIS} > 2.0V$ or open, enabled on $T_{DIS} < 0.8V$.
- Should be pulled up with 4.7k Ω - 10k Ω host board to a voltage between 2.0V and 3.6V. MOD_ABS pull line low to indicate module is plugged in.
- Internally pulled down per SFF-8431 Rev 4.1.
- LOS is open collector output. It should be pulled up with 4.7k Ω – 10k Ω on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

VI. Digital Diagnostic Functions

BI+10G-1213-40K-D(I) transceivers support the 2-wire serial communication protocol as defined in the SFP+MSA.

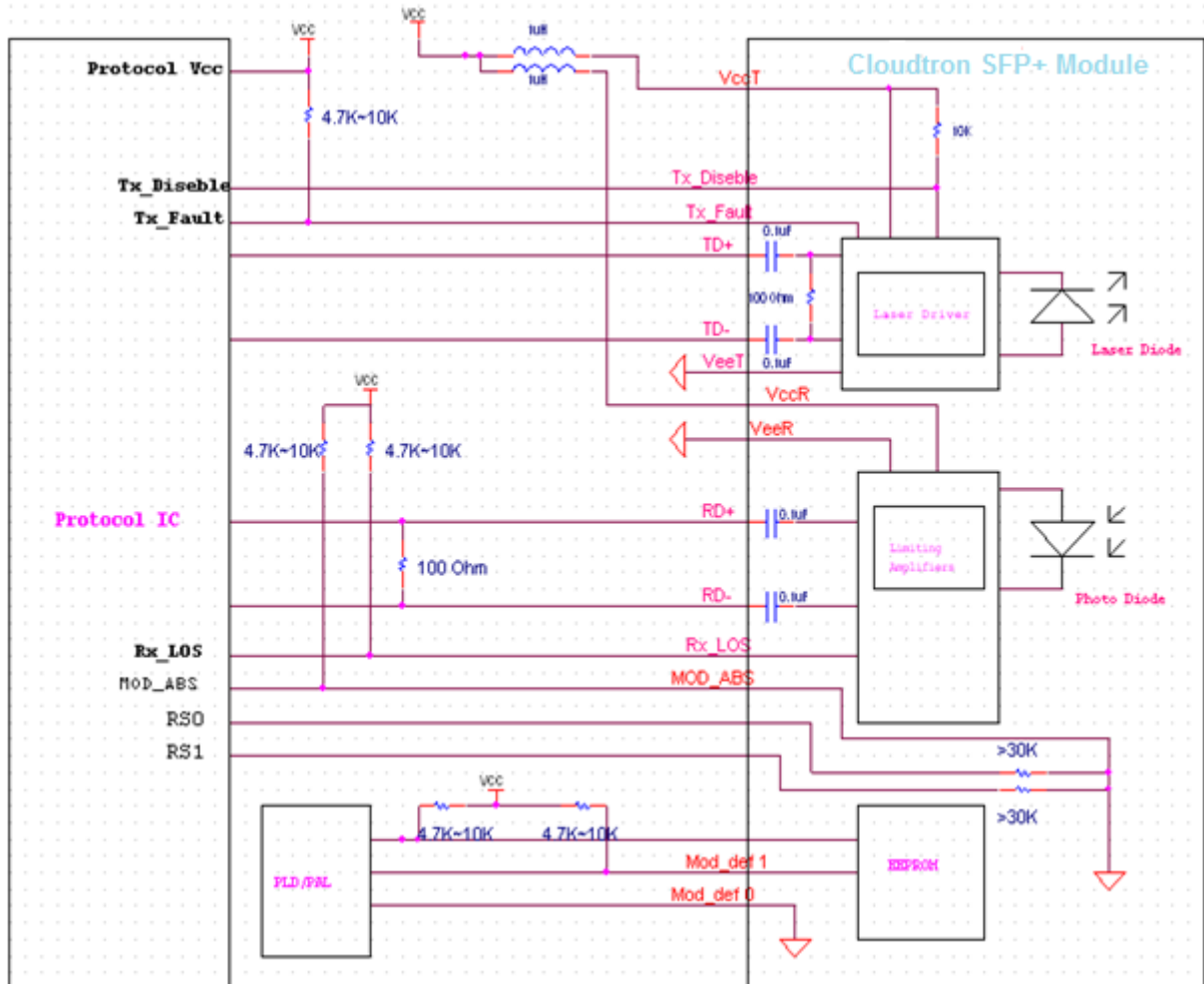
The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

Additionally, Cloudtron SFP+ transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

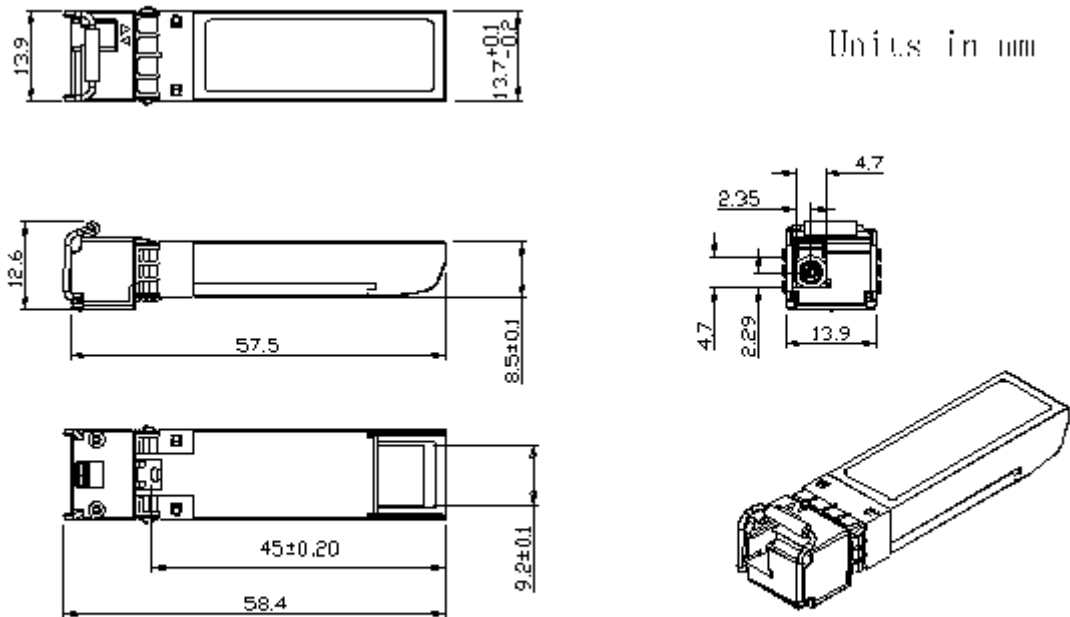
The SFP+ MSA defines a 256-byte memory map in EEPROM that is accessible over a 2-wire serial interface at the 8bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the E2PROM that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

VII. Recommended Interface Circuit



VIII. Outline Dimensions



IX. Regulatory Compliance

Feature	Reference	Performance
Electrostatic discharge (ESD)	IEC/EN 61000-4-2	Compatible with standards
Electromagnetic Interference(EMI)	FCC Part 15 Class B EN 55022 Class B (CISPR 22A)	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, 2	Class 1 laser product
Component Recognition	IEC/EN 60950, UL	Compatible with standards
ROHS	2002/95/EC	Compatible with standards
EMC	EN61000-3	Compatible with standards