

JCxxxx-SFP-LC.S40 Series

CWDM SFP+ Single-Mode for 10G application
Duplex SFP+ Transceiver
0.6~10Gb/s CPRI/OBSAI
RoHS6 Compliant



Features

- ◆ Hot-Pluggable SFP+ Footprint
- ◆ 12-Wavelengths CWDM DFB Transmitter
from 1270nm to 1330nm and EML 1470nm to 1610nm, with step 20nm
- ◆ 14dB Power Budget
- ◆ Duplex LC connector
- ◆ Power Dissipation (1270nm~1330nm) < 1.2W
Power Dissipation (1470nm~1610nm) < 1.5W
- ◆ Dispersion tolerance 800ps/nm
- ◆ Case Operation Temperature:
Standard: 0°C to 70°C
- ◆ Compliant with SFF-8431 MSA
- ◆ Compliant with SFF-8432 MSA
- ◆ Compliant with SFF-8472 MSA
- ◆ Build-in digital diagnostic functions

Applications

- ◆ 10GBASE-ER/EW 10G Ethernet
- ◆ 10GBASE-ER at 10.31Gbps
- ◆ 10GBASE-EW at 9.95Gbps
- ◆ 10G FC
- ◆ OBSAI rates 6.144 Gb/s, 3.072 Gb/s, 1.536 Gb/s, 0.768Gb/s
- ◆ CPRI rates 9.830 Gb/s,7.373Gb/s, 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s
- ◆ Other optical links

Ordering information

| Part No. | Data Rate | Laser | Fiber | Power Budget | CDR | Interface | Temp. |
|---------------------------|-----------------------|----------|-------|--------------|-----|-----------|----------|
| JCxxxx-SFP-LC.S40*(note1) | 0.614Gbps to 11.1Gbps | CWDM DFB | SMF | 14dB | NO | LC | Standard |
| JCxxxx-SFP-LC.S40*(note2) | 0.6Gbps to 11.3Gbps | CWDM EML | SMF | 14dB | NO | LC | Standard |

Note1: X refers to CWDM Wavelength range 1270nm to 1330nm.

Note2: X refers to CWDM Wavelength range 1470nm to 1610nm.

CWDM* Wavelength

| Band | Nomenclature | Wavelength(nm) | | |
|-------------------------|--------------|----------------|------|--------|
| | | Min. | Typ. | Max. |
| O-band Original | 1270 | 1264 | 1270 | 1277.5 |
| | 1290 | 1284 | 1290 | 1297.5 |
| | 1310 | 1304 | 1310 | 1317.5 |
| | 1330 | 1324 | 1330 | 1337.5 |
| S-band Short Wavelength | 1470 | 1464 | 1470 | 1477.5 |
| | 1490 | 1484 | 1490 | 1497.5 |
| | 1510 | 1504 | 1510 | 1517.5 |
| | 1530 | 1524 | 1530 | 1537.5 |
| C-band Conventional | 1550 | 1544 | 1550 | 1557.5 |
| L-band Long Wavelength | 1570 | 1564 | 1570 | 1577.5 |
| | 1590 | 1584 | 1590 | 1597.5 |
| | 1610 | 1604 | 1610 | 1617.5 |

CWDM*: 12 Wavelengths from 1270nm to 1330nm and 1470nm to 1610nm, each step 20nm.

Regulatory Compliance*

| Product Certificate | Certificate Number | Applicable Standard |
|---------------------|--------------------|-------------------------------|
| TUV | R50135086 | EN 60950-1:2006+A11+A1+A12+A2 |
| | | EN 60825-1:2014 |
| | | EN 60825-2:2004+A1+A2 |
| UL | E317337 | UL 60950-1 |
| | | CSA C22.2 No. 60950-1-07 |
| EMC CE | AE 50285865 0001 | EN 55022:2010 |
| | | EN 55024:2010 |
| CB | JPTUV-049251 | IEC 60825-1 |
| | | IEC 60950-1 |
| FCC | WTF14F0514417E | 47 CFR PART 15 OCT., 2013 |
| FDA | / | CDRH 1040.10 |
| ROHS | / | 2011/65/EU |

*The above certificate number updated to June 2014, because some certificate will be updated every year, such as FDA and ROHS. For the latest certification information, please check with Data Controls Inc.

Product Description

The JCxxx-SFP-LC.S40 series optical transceiver is designed for fiber communications application up to 10G, which fully compliant with the specification of SFP+ MSA SFF-8431.

This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are twelve center wavelengths available from 1270nm to 1330nm and 1470nm to 1610nm, with each step 20nm. A guaranteed optical link budget of 14 dB is offered.

The module is with the SFP+ connector to allow hot plug capability. Only single 3.3V power supply is needed. The optical output can be disabled by LVTTTL logic high-level input of TX_DIS. Loss of signal (RX_LOS) output is provided to indicate the loss of an input optical signal of receiver.

This module provides digital diagnostic functions via a 2-wire serial interface as defined by the SFF-8472 specification.

Absolute Maximum Ratings

| Parameter | Symbol | Min | Typical | Max | Unit | Note |
|--------------------------|----------------|------|---------|-----|------|------|
| Maximum Supply Voltage 1 | Vcc | -0.5 | | 4.0 | V | |
| Storage Temperature | T _s | -40 | | 85 | °C | |

Recommend Operating Condition

| Parameter | Symbol | | Min | Typical | Max | Units |
|----------------------------|-----------------|----------|------|---------|------|-------|
| Case Operating Temperature | T _c | Standard | 0 | | +70 | °C |
| Supply Voltage | Vcc | | 3.13 | 3.3 | 3.45 | V |
| Supply Current | I _{cc} | DFB | | | 350 | mA |
| | | EML | | 350 | 455 | |
| Data Rate | DFB | | | | 11.1 | Gbps |
| | EML | | 0.6 | | 11.3 | |

Electrical Characteristics

| Parameter | Symbol | Min. | Typ. | Max | Unit | Notes |
|---------------------------------|-----------------|------|------|---------|------|--------|
| Transmitter | | | | | | |
| CML Inputs(Differential) | V _{in} | DFB | 150 | | 1200 | mVpp 1 |
| | | EML | 180 | | 1000 | |
| Input Impedance (Differential) | Z _{in} | 85 | 100 | 115 | ohm | |
| TX_DISABLE Input Voltage - High | | 2 | | Vcc+0.3 | V | |
| TX_DISABLE Input Voltage - Low | | 0 | | 0.8 | V | |
| TX_FAULT Output Voltage - High | | 2 | | Vcc+0.3 | V | |

| | | | | | | |
|---------------------------------|------|-----|-----|---------|------|---|
| TX_FAULT Output Voltage - Low | DFB | 0 | | 0.5 | V | |
| | EML | 0 | | 0.8 | | |
| Receiver | | | | | | |
| CML Outputs (Differential) | Vout | 350 | | 700 | mVpp | 1 |
| Output Impedance (Differential) | Zout | 85 | 100 | 115 | ohm | |
| RX_LOS Output Voltage - High | | 2 | | Vcc+0.3 | V | |
| RX_LOS Output Voltage - Low | | 0 | | 0.8 | V | |
| MOD_DEF (0:2) | VoH | 2.5 | | | V | 2 |
| | VoL | 0 | | 0.5 | V | |

Notes:

1. After internal AC coupling.
2. Reference the SFF-8472 MSA.

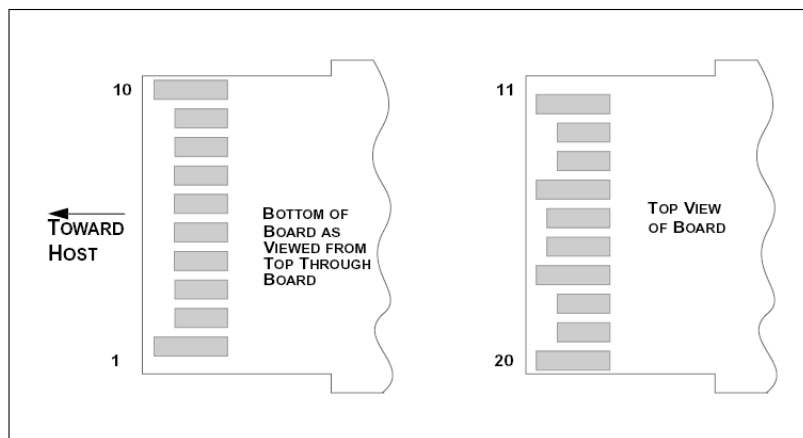
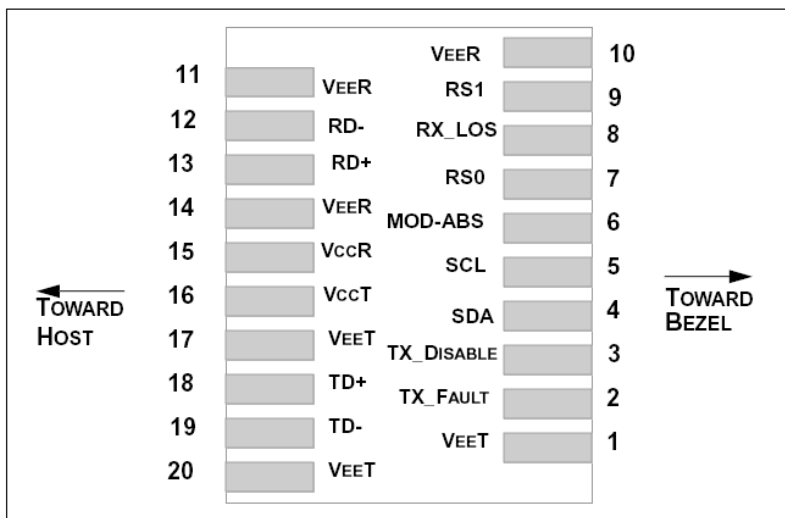
Optical Characteristics

| Parameter | Symbol | Min | Typical | Max | Unit | Note | |
|---|------------------|--------------------------|-------------|-----------------|-------|------|---|
| Transmitter | | | | | | | |
| Optical Wavelength | λ | λ_c-6 | λ_c | $\lambda_c+7.5$ | nm | 2 | |
| -20dB Spectrum Width | $\Delta\lambda$ | | | 1 | nm | | |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | | |
| Output Opt. Pwr: 9/125 SMF | Pout | DFB | -1 | | 4 | dBm | 1 |
| | | EML | -2 | | +3 | | |
| Extinction Ratio | ER | 3.5 | | | dB | | |
| Average Launch Power of OFF Transmitter | P _{OFF} | | | -30 | dBm | | |
| Transmitter Dispersion Penalty | TDP | DFB | | 2 | dB | | |
| | | EML | | 3 | | | |
| TX Jitter | TXj | Per 802.3ae requirements | | | | | |
| Relative Intensity Noise | RIN | | | -128 | dB/Hz | | |
| Receiver | | | | | | | |
| Receiver Sensitivity | Pmin | DFB | | -15 | dBm | 3 | |
| | | EML | | -16 | | | |
| Maximum Input Power | Pmax | DFB | +0.5 | | dBm | | |
| | | EML | 0 | | | | |
| Optical Center Wavelength | λ | 1260 | | 1620 | nm | | |
| Receiver Reflectance | R _{rf} | DFB | | -27 | dB | | |
| | | EML | | -12 | | | |
| LOS De-Assert | LOS _D | DFB | | -16 | dBm | | |
| | | EML | | -20 | | | |
| LOS Assert | LOS _A | -28 | | | dBm | | |
| LOS Hysteresis | | 1 | | | dB | | |

Notes:

1. Output power is coupled into a 9/125µm SMF.
2. ITU-T G.694.2 CWDM wavelength from 1270nm to 1330nm and 1470nm to 1610nm, each step 20nm.
3. Average received power; BER less than 1E-12 and PRBS 2³¹-1 test pattern.

SFP+ Transceiver Electrical Pad Layout



Pin Function Definitions

| Pin Num. | Name | Function | Plug Seq. | Notes |
|----------|----------|------------------------------|-----------|--------|
| 1 | VeeT | Transmitter Ground | 1 | Note 5 |
| 2 | TX Fault | Transmitter Fault Indication | 3 | Note 1 |

| | | | | |
|----|------------|--------------------------|---|--|
| 3 | TX Disable | Transmitter Disable | 3 | Note 2, Module disables on high or open |
| 4 | SDA | Module Definition 2 | 3 | 2-wire Serial Interface Data Line. |
| 5 | SCL | Module Definition 1 | 3 | 2-wire Serial Interface Clock. |
| 6 | MOD-ABS | Module Definition 0 | 3 | Note 3 |
| 7 | RS0 | RX Rate Select (LVTTTL). | 3 | Rate Select 0, optionally controls SFP+ module receiver. This pin is pulled low to VeeT with a >30K resistor.. |
| 8 | LOS | Loss of Signal | 3 | Note 4 |
| 9 | RS1 | TX Rate Select (LVTTTL). | 1 | Rate Select 1, optionally controls SFP+ module transmitter. This pin is pulled low to VeeT with a >30K resistor. |
| 10 | VeeR | Receiver Ground | 1 | Note 5 |
| 11 | VeeR | Receiver Ground | 1 | Note 5 |
| 12 | RD- | Inv. Received Data Out | 3 | Note 6 |
| 13 | RD+ | Received Data Out | 3 | Note 6 |
| 14 | VeeR | Receiver Ground | 1 | Note 5 |
| 15 | VccR | Receiver Power | 2 | 3.3V ± 5%, Note 7 |
| 16 | VccT | Transmitter Power | 2 | 3.3V ± 5%, Note 7 |
| 17 | VeeT | Transmitter Ground | 1 | Note 5 |
| 18 | TD+ | Transmit Data In | 3 | Note 8 |
| 19 | TD- | Inv. Transmit Data In | 3 | Note 8 |
| 20 | VeeT | Transmitter Ground | 1 | Note 5 |

Notes:

1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor on the host board. Pull up voltage between 2.0V and VccT/R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

2) 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~10 K Ω resistor. Its states are:

Low (0 – 0.8V): Transmitter on

(>0.8, < 2.0V): Undefined

High (2.0 – 3.465V): Transmitter Disabled

Open: Transmitter Disabled

3) Module Absent, connected to VeeT or VeeR in the module.

4) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor on host board. Pull up voltage between 2.0V and VccT/R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will

be pulled to $< 0.8V$.

5) The module signal ground contacts, VeeR and VeeT, should be isolated from the module case.

6) RD-/+ : These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 370 and 700 mV differential (185 –350mV single ended) when properly terminated.

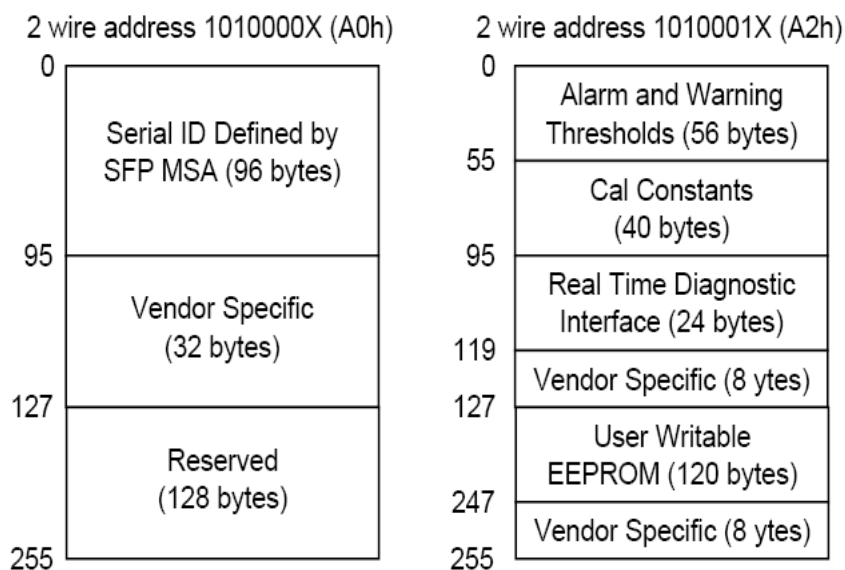
7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V $\pm 5\%$ at the SFP+ connector pin. Maximum supply current is 430mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 ohm should be used in order to maintain the required voltage at the SFP+ input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP+ transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP+ transceiver module.

8) TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

EEPROM

The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL). The serial data signal (SDA) 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.

The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. If the module is defined as external calibrated, the diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at wire serial bus address A2H. The digital diagnostic memory map specific data field define as following .For detail EEPROM information, please refer to the related document of SFF 8472 Rev 10.3.



EEPROM Serial ID Memory Contents

Accessing Serial ID Memory uses the 2 wire address 1010000X (A0h). Memory Contents of Serial ID are shown in Table 1.

Table 1 Serial ID Memory Contents

| Addr. | Size (Bytes) | Name of Field | Hex | Description |
|-----------------------|--------------|-------------------|--------------------------------|---|
| BASE ID FIELDS | | | | |
| 0 | 1 | Identifier | 03 | SFP |
| 1 | 1 | Ext. Identifier | 04 | SFP function is defined by serial ID only |
| 2 | 1 | Connector | 07 | LC Connector |
| 3-10 | 8 | Transceiver | 20 00 00 00 00 00 00 00 | Transmitter Code |
| 11 | 1 | Encoding | 01 | 8B10B |
| 12 | 1 | BR, Nominal | 6B | 10.7Gbps |
| 13 | 1 | Reserved | 00 | |
| 14 | 1 | Length (9µm)km | 1E | Transceiver transmit distance |
| 15 | 1 | Length(9µm)100m | FF | |
| 16 | 1 | Length (50µm) 10m | 00 | |
| 17 | 1 | Length(62.5µm)10m | 00 | |
| 18 | 1 | Length (Copper) | 00 | Not compliant |
| 19 | 1 | Reserved | 00 | |
| 20-35 | 16 | Vendor name | Data Controls | (ASCII) |
| 36 | 1 | Reserved | 00 | |
| 37-39 | 3 | Vendor OUI | 68F125 | 00 83 79(DEC) |
| 40-55 | 16 | Vendor PN | JCxxxxSFPLCS40 | PN |
| 56-59 | 4 | Vendor rev | XX XX XX XX ^(Note2) | ASCII |

| | | | | |
|----------------------------------|-----|----------------------------|---|--|
| | | | | (31 2E 30 20means 1.0 revision) |
| 60-61 | 2 | Wavelength | XX XX ^(Note2) | XX |
| 62 | 1 | Reserved | 00 | |
| 63 | 1 | CC_BASE | Check Sum (Variable) | Check code for Base ID Fields |
| EXTENDED ID FIELDS | | | | |
| 64-65 | 2 | Options | 00 1A | TX_DISABLE, TX_FAULT and Rx_LOS implemented. |
| 66 | 1 | BR,max | 00 | |
| 67 | 1 | BR,min | 00 | |
| 68-83 | 16 | Vendor SN | XX XX XX XX XX XX XX XX XX 20 20 20 20 20 20 20 20 ^(Note2) | Serial Number of transceiver (ASCII). For example "B000822". |
| 84-91 | 8 | Date code | XX XX XX XX XX XX XX XX ^(Note2) | Manufactory date code. For example "080405". |
| 92 | 1 | Diagnostic Monitoring Type | 68 | Digital diagnostic monitoring implemented; Internally calibrated; average power |
| 93 | 1 | Enhanced Options | B2 | Optional Alarm/warning flags implemented; Optional soft TX_FAULT and RX_LOS monitoring implemented. Optional Rate Select control implemented per SFF-8431. |
| 94 | 1 | SFF-8472 Compliance | 03 | 03 for Rev10.2 SFF-8472. |
| 95 | 1 | CC_EXT | Check Sum (Variable) | Check sum for Extended ID Field. |
| VENDOR SPECIFIC ID FIELDS | | | | |
| 96-127 | 32 | Vendor Specific | Read only | Depends on customer information |
| 128-255 | 128 | Reserved | Read only | |

Note2: "XX" is referred to be variable.

Digital Diagnostic Specifications

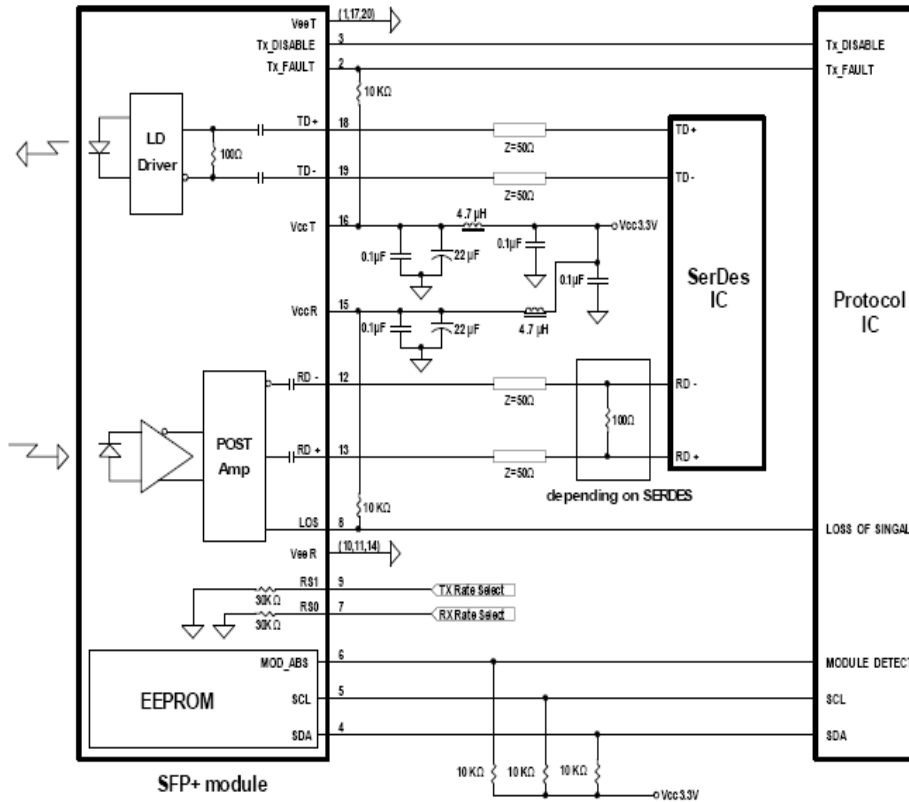
JCxxx-SFP-LC.S40 transceivers can be used in host systems that require either internally or externally calibrated digital diagnostics.

| Parameter | Symbol | Accuracy | Units | Ref. |
|--|----------------|----------|-------|-------|
| Internally measured transceiver temperature | DD Temperature | ±3 | °C | |
| Internally measured transceiver supply voltage | DD Voltage | ±3 | % | |
| Measured TX bias current | DD Bias | ±10 | % | Note3 |
| Measured TX output power | DD Tx-Power | ±2 | dB | |

| | | | | |
|--|-------------|----|----|--|
| Measured RX received average optical power | DD Rx-Power | ±2 | dB | |
|--|-------------|----|----|--|

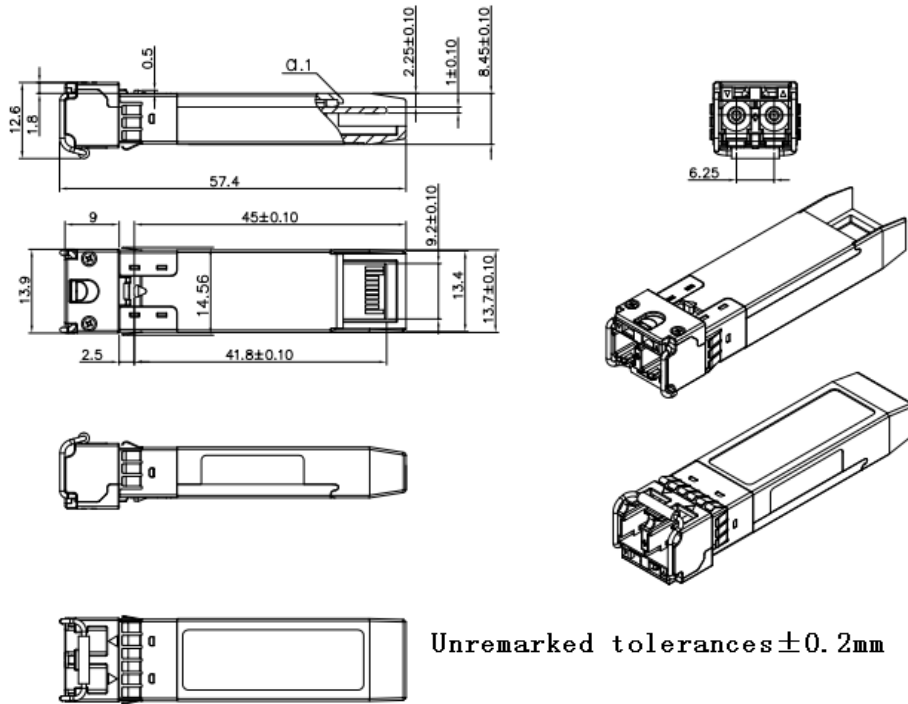
Note3. Accuracy of Measured Tx Bias Current is 10% of the actual Bias Current from the laser driver to the laser.

Recommend Circuit Schematic

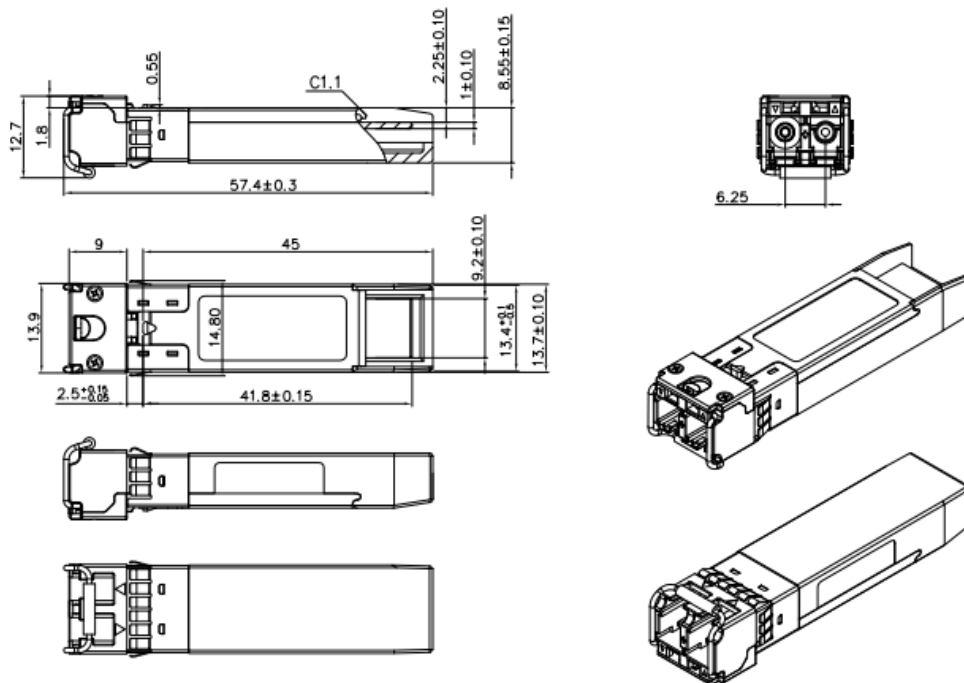


Mechanical Specifications

DFB (1270nm~1330nm)



EML(1470nm~1610nm)



*This 2D drawing only for reference, please check with Data Controls Inc before ordering.

Eye Safety

This single-mode transceiver is a Class 1 laser product. It complies with IEC-60825 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug.