



## CF2QD010C00D000

MSA Compliant 100GBase-LR4 CFP2 Transceiver (SMF, 1310nm, 10km, LC, DOM)

### Product Description

This MSA compliant CFP2 transceiver provides 100GBase-LR4 throughput up to 10km over single-mode fiber (SMF) using a wavelength of 1310nm via an LC connector. All of our transceivers are built to comply with Multi-Source Agreement (MSA) standards and are uniquely serialized and tested for data-traffic and application to ensure seamless network integration. Additional product features include Digital Optical Monitoring (DOM) support which allows access to real-time operating parameters. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

Skylane's transceivers are RoHS compliant and lead-free.

### Features:

- Compliant with 100GBase-LR4 and 4I1-9D1F
- Integrated LAN WDM EML TOSA/ROSA Up to 10km Reach Over SMF
- Up to 103.125Gbps to 111.81Gbps Transmission Lines
- Single 3.3V Power Supply
- Power Consumption: 6W
- Duplex LC Optical Receptacle
- RoHS Compliant and Lead-Free
- Operating Temperature: 0 to 70 Celsius



### Applications:

- 100GBase Ethernet
- Access and Enterprise
- OTU4 Operation

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*For your product safety, please read the following information carefully before any manipulation of the transceiver:*



#### **ESD**

This transceiver is specified as ESD threshold 1kV for SFI pins and 2kV for all others electrical input pins, tested per MIL-STD-883G, Method 3015.4 / JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module.



#### **LASER SAFETY**

This is a Class1 Laser Product according to IEC 60825-1:2007. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007).

*The optical ports of the module need to be terminated with an optical connector or with a dust plug in order to avoid contamination.*

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## Absolute Maximum Ratings

| Parameter                                      | Symbol | Min.                                 | Typ. | Max.    | Unit | Notes |
|------------------------------------------------|--------|--------------------------------------|------|---------|------|-------|
| Operating Case Temperature                     | Tc     | 0                                    |      | 70      | °C   |       |
| Storage Temperature                            | Tstg   | -40                                  |      | 85      | °C   |       |
| Power Supply Voltage                           | Vcc    | -0.3                                 |      | 4       | V    |       |
| Signal Input Voltage                           |        | Vcc-0.3                              |      | Vcc+0.3 | V    |       |
| Receive Input Optical Power (Damage Threshold) | Pdmg   |                                      |      | 5.0     | dBm  |       |
| Signaling Speed Per Lane                       |        | 25.78125 ± 100ppm<br>27.9525 ± 20ppm |      |         | Gbps |       |

## Low-Speed Electrical Characteristics

| Parameter                                         | Symbol | Min.    | Typ. | Max.      | Unit | Notes        |
|---------------------------------------------------|--------|---------|------|-----------|------|--------------|
| Power Supply Voltage                              | Vcc    | 3.13    | 3.3  | 3.47      | V    | 1            |
| Power Supply Current                              | Icc    |         |      | 450       | mA   |              |
| Power Dissipation                                 | PD     |         |      | 6.0       | W    |              |
| Power Dissipation (Low-Power Mode)                | PDLP   |         |      | 2.0       | W    |              |
| Low-Speed Control and Sense Signals (3.3V LVCMOS) |        |         |      |           |      |              |
| Output Low Voltage                                | VOL    |         |      | 0.2       | V    | IOH = 100μA  |
| Output High Voltage                               | VOH    | Vcc-0.2 |      |           | V    | IOH = -100μA |
| Input Low Voltage                                 | VIL    | -0.3    |      | 0.8       | V    |              |
| Input High Voltage                                | VIH    | 2       |      | Vcc3+ 0.3 | V    |              |
| Input Leakage Current                             | Iin    | -10     |      | 10        | μA   |              |
| Low-Speed Control and Sense Signals (1.2V LVCMOS) |        |         |      |           |      |              |
| Output Low Voltage                                | VOL    | -0.3    |      | 0.2       | V    |              |
| Output High Voltage                               | VOH    | 1.0     |      | 1.5       | V    |              |
| Output Low Current                                | Iol    | 4       |      |           | mA   |              |
| Output High Current                               | Ioh    |         |      | -4        | mA   |              |
| Input Low Voltage                                 | VIL    | -0.3    |      | 0.36      | V    |              |
| Input High Voltage                                | VIH    | 0.84    |      | 1.5       | V    |              |
| Input Leakage Current                             | Iin    | -100    |      | 100       | μA   |              |
| Input Capacitance                                 | C      |         |      | 10        | pF   |              |
| MDC Clock Rate                                    |        | 0.1     |      | 4         | MHz  |              |

### Notes:

1. With respect to GND.

## High-Speed Electrical Characteristics

| Parameter                              | Symbol | Min. | Typ. | Max. | Unit | Notes                            |
|----------------------------------------|--------|------|------|------|------|----------------------------------|
| Transmitter Electrical Input from Host |        |      |      |      |      |                                  |
| Differential Voltage Pk-Pk             |        | 100  |      | 1200 | mV   |                                  |
| Common-Mode Noise (RMS)                |        |      |      | 17.5 | mV   |                                  |
| Differential Termination Mismatch      |        |      |      | 10   | %    |                                  |
| Transition Time                        |        | 10   |      |      | ps   | 20-80%                           |
| Common-Mode Voltage                    |        | -0.3 |      | 2.8  | V    |                                  |
| Eye Width                              | EW15   | 0.46 |      |      | UI   | At 10 <sup>-15</sup> Probability |
| Eye Height                             | EH15   | 100  |      |      | mV   | At 10 <sup>-15</sup> Probability |
| Receiver Electrical Output from Host   |        |      |      |      |      |                                  |
| Differential Voltage Pk-Pk             |        | 100  |      | 1200 | mV   |                                  |
| Common-Mode Noise (RMS)                |        |      |      | 17.5 | mV   |                                  |
| Differential Termination Mismatch      |        |      |      | 10   | %    |                                  |
| Transition Time                        |        | 9.5  |      |      | ps   | 20-80%                           |
| Vertical Eye Closure                   | VEC    |      |      | 6.5  | dB   |                                  |
| Eye Width                              | EW15   | 0.57 |      |      | UI   | At 10 <sup>-15</sup> Probability |
| Eye Height                             | EH15   | 240  |      | mV   |      | At 10 <sup>-15</sup> Probability |

## Optical Characteristics for 100GBase-LR4

| Parameter                                                | Symbol                             | Min.    | Typ.    | Max.    | Unit  | Notes |
|----------------------------------------------------------|------------------------------------|---------|---------|---------|-------|-------|
| Transmitter                                              |                                    |         |         |         |       |       |
| Center Wavelength                                        | $\lambda_0$                        | 1294.53 | 1295.56 | 1296.59 | nm    |       |
|                                                          | $\lambda_1$                        | 1299.02 | 1300.05 | 1301.09 | nm    |       |
|                                                          | $\lambda_2$                        | 1303.54 | 1304.58 | 1305.63 | nm    |       |
|                                                          | $\lambda_3$                        | 1308.09 | 1309.14 | 1310.19 | nm    |       |
| Total Output Power                                       | POUT                               |         |         | 10.5    | dBm   |       |
| Transmit OMA Per Lane                                    |                                    | -1.3    |         | 4.5     | dBm   |       |
| Average Launch Power Per lane                            |                                    | -4.3    |         | 4.5     | dBm   |       |
| SMSR                                                     |                                    | 30      |         |         | dB    |       |
| Optical Extinction Ratio                                 | ER                                 | 4       |         |         | dB    |       |
| Average Launch Power Off Per Lane                        | Poff                               |         |         | -30     | dBm   |       |
| RIN                                                      | RIN                                |         |         | -130    | dB/Hz |       |
| Output Eye Mask Definitions:<br>{X1, X2, X3, Y1, Y2, Y3} | {0.25, 0.4, 0.45, 0.25, 0.28, 0.4} |         |         |         |       | 1     |
| Receiver                                                 |                                    |         |         |         |       |       |
| Center Wavelength                                        | $\lambda_0$                        | 1294.53 | 1295.56 | 1296.59 | nm    |       |
|                                                          | $\lambda_1$                        | 1299.02 | 1300.05 | 1301.09 | nm    |       |
|                                                          | $\lambda_2$                        | 1303.54 | 1304.58 | 1305.63 | nm    |       |
|                                                          | $\lambda_3$                        | 1308.09 | 1309.14 | 1310.19 | nm    |       |
| Receiver Power (OMA) Per Lane                            | RXPx                               |         |         | 4.5     | dBm   |       |
| Average Input Power Per Channel                          | RxPWR                              | -10.6   |         | 4.5     | dBm   | 2     |
| Receiver Sensitivity (OMA) Per Lane                      | RxSENS                             |         |         | -8.6    | dBm   |       |
| LOS Assert                                               | LOSA                               |         |         | -12     | dBm   |       |
| LOS De-Assert                                            | LOSD                               | -30     |         |         | dBm   |       |
| Receiver Reflectance                                     | RR                                 |         |         | -26     | dB    |       |

### Notes:

1. Hit ratio  $5 \times 10^{-5}$ .
2. Measured with a PRBS<sup>31</sup>-1 test pattern, @25.78Gbps, and BER $<10^{-12}$ .

## Optical Characteristics for OTU4 411-9D1F

| Parameter                                                | Symbol                             | Min.    | Typ.    | Max.    | Unit | Notes |
|----------------------------------------------------------|------------------------------------|---------|---------|---------|------|-------|
| Transmitter                                              |                                    |         |         |         |      |       |
| Center Wavelength                                        | λ0                                 | 1294.53 | 1295.56 | 1296.59 | nm   |       |
|                                                          | λ1                                 | 1299.02 | 1300.05 | 1301.09 | nm   |       |
|                                                          | λ2                                 | 1303.54 | 1304.58 | 1305.63 | nm   |       |
|                                                          | λ3                                 | 1308.09 | 1309.14 | 1310.19 | nm   |       |
| Total Output Power                                       | POUT                               |         |         | 8.9     | dBm  |       |
| Average Launch Power Per lane                            |                                    | -2.5    |         | 2.9     | dBm  |       |
| SMSR                                                     |                                    | 30      |         |         | dB   |       |
| Optical Extinction Ratio                                 | ER                                 | 7       |         |         | dB   |       |
| Average Launch Power Off Per Lane                        | Poff                               |         |         | -30     | dBm  |       |
| Output Eye Mask Definitions:<br>{X1, X2, X3, Y1, Y2, Y3} | {0.25, 0.4, 0.45, 0.25, 0.28, 0.4} |         |         |         |      | 3     |
| Receiver                                                 |                                    |         |         |         |      |       |
| Center Wavelength                                        | λ0                                 | 1294.53 | 1295.56 | 1296.59 | nm   |       |
|                                                          | λ1                                 | 1299.02 | 1300.05 | 1301.09 | nm   |       |
|                                                          | λ2                                 | 1303.54 | 1304.58 | 1305.63 | nm   |       |
|                                                          | λ3                                 | 1308.09 | 1309.14 | 1310.19 | nm   |       |
| Average Input Power Per Channel                          | RxPWR                              | -10.6   |         | 4.5     | dBm  |       |
| Equivalent Sensitivity Per Channel                       | RxSens                             |         |         | -10.3   | dBm  | 4     |
| LOS De-Assert                                            | LOSD                               | -30     |         |         | dBm  |       |
| LOS Assert                                               | LOSA                               |         |         | -12     | dBm  |       |
| Receiver Reflectance                                     | RR                                 |         |         | -26     | dB   |       |

### Notes:

1. Hit ratio  $5 \times 10^{-5}$ .
2. Measured with a PRBS2<sup>31</sup>-1 test pattern, @25.95Gbps, and BER <  $10^{-6}$ .

## Pin Descriptions

| Pin | Symbol     | Type      | Name/Description                                                                                             | Notes |
|-----|------------|-----------|--------------------------------------------------------------------------------------------------------------|-------|
| 1   | GND        |           | Module Ground.                                                                                               |       |
| 2   | (TX_MCLK-) | CML       | Not Connected.                                                                                               |       |
| 3   | (TX_MCLK+) | CML       | Not Connected.                                                                                               |       |
| 4   | GND        |           | Module Ground.                                                                                               |       |
| 5   | N.C.       |           | Not Connected.                                                                                               |       |
| 6   | N.C.       |           | Not Connected.                                                                                               |       |
| 7   | 3.3V_GND   |           | 3.3V Ground. Tied w/Module Ground.                                                                           |       |
| 8   | 3.3V_GND   |           | 3.3V Ground. Tied w/Module Ground.                                                                           |       |
| 9   | 3.3V       |           | 3.3V Module Supply Voltage.                                                                                  |       |
| 10  | 3.3V       |           | 3.3V Module Supply Voltage.                                                                                  |       |
| 11  | 3.3V       |           | 3.3V Module Supply Voltage.                                                                                  |       |
| 12  | 3.3V       |           | 3.3V Module Supply Voltage.                                                                                  |       |
| 13  | 3.3V_GND   |           | 3.3V Ground. Tied w/Module Ground.                                                                           |       |
| 14  | 3.3V_GND   |           | 3.3V Ground. Tied w/Module Ground.                                                                           |       |
| 15  | VND_IO_A   |           | Module Vendor IO A. Do Not Connect.                                                                          |       |
| 16  | VND_IO_B   |           | Module Vendor IO B. Do Not Connect.                                                                          |       |
| 17  | PRG_CNTL1  | LVC MOS1  | Programmable Control 1. MSA default: TRXIC_RSTn. "0": reset; "1" or NC: not used.                            |       |
| 18  | PRG_CNTL2  | LVC MOS1  | Programmable Control 2. MSA default: hardware interlock LSB; default "0": ≤9W.                               |       |
| 19  | PRG_CNTL3  | LVC MOS1  | Programmable Control 3. MSA default: hardware interlock MSB; default "1": ≤9W.                               |       |
| 20  | PRG_ALARM1 | LVC MOS   | Programmable Alarm 1. MSA default: HIPWR_ON; "1" module power-up completed; "0": module not high powered up. |       |
| 21  | PRG_ALARM2 | LVC MOS   | Programmable Alarm 2. MSA default: MOD_Ready; "1" Ready; "0": Not Ready.                                     |       |
| 22  |            | LVC MOS   |                                                                                                              |       |
| 23  | GND        |           | Module Ground.                                                                                               |       |
| 24  | Tx_DIS     | LVC MOS1  | Transmitter disables for all lanes; "1" or NC: transmitter disables; "0": transmitter enabled.               |       |
| 25  | Rx_LOS     | LVC MOS   | Receiver loss of optical signal; "1": Low optical signal, "0": normal condition.                             |       |
| 26  | MOD_LOPWR  | LVC MOS1  | Module low-power mode; "1" or NC: module in low-power mode, "0": power enabled.                              |       |
| 27  | MOD_ABS    | GND       | Module Absent; "1" or NC: module absent, "0": module present. Pull-up resistor on host.                      |       |
| 28  | MOD_RST-   | LVC MOS2  | Module Reset, "0": reset the module; "1" or NC: module enabled.                                              |       |
| 29  | GLB_ALARM- | LVC MOS   | Global Alarm. "0": alarm in any MDIO alarm register; "1": no alarm condition. Pull-up resistor on host.      |       |
| 30  | GND        |           | Module Ground.                                                                                               |       |
| 31  | MDC        | 1.2V CMOS | Management Interface Clock Input.                                                                            |       |
| 32  | MDIO       | 1.2V CMOS | Management Interface Bi-Directional Data.                                                                    |       |
| 33  | PRTADR0    | 1.2V CMOS | MDIO Physical Port Address Bit 0.                                                                            |       |
| 34  | PRTADR1    | 1.2V CMOS | MDIO Physical Port Address Bit 1.                                                                            |       |
| 35  | PRTADR2    | 1.2V CMOS | MDIO Physical Port Address Bit 2.                                                                            |       |

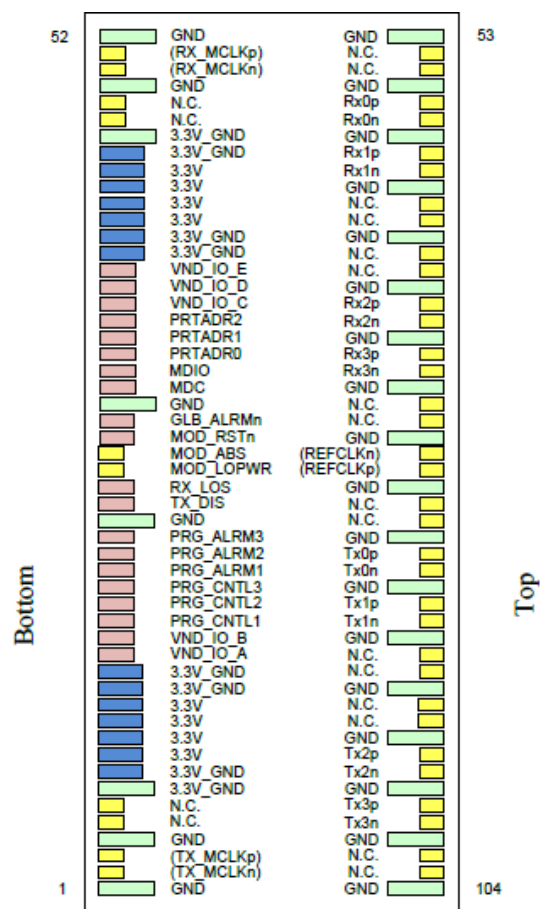
|    |            |     |                                     |  |
|----|------------|-----|-------------------------------------|--|
| 36 | VND_IO_C   |     | Module Vendor IO C. Do Not Connect. |  |
| 37 | VND_IO_D   |     | Module Vendor IO D. Do Not Connect. |  |
| 38 | VND_IO_E   |     | Module Vendor IO E. Do Not Connect. |  |
| 39 | 3.3V_GND   |     | 3.3V Ground. Tied w/Module Ground.  |  |
| 40 | 3.3V_GND   |     | 3.3V Ground. Tied w/Module Ground.  |  |
| 41 | 3.3V       |     | 3.3V Module Supply Voltage.         |  |
| 42 | 3.3V       |     | 3.3V Module Supply Voltage.         |  |
| 43 | 3.3V       |     | 3.3V Module Supply Voltage.         |  |
| 44 | 3.3V       |     | 3.3V Module Supply Voltage.         |  |
| 45 | 3.3V_GND   |     | 3.3V Ground. Tied w/Module Ground.  |  |
| 46 | 3.3V_GND   |     | 3.3V Ground. Tied w/Module Ground.  |  |
| 47 | N.C.       |     | Not Connected.                      |  |
| 48 | N.C.       |     | Not Connected.                      |  |
| 49 | GND        |     | Module Ground.                      |  |
| 50 | (RX_MCLK-) | CML | Not Connected.                      |  |
| 51 | (RX_MCLK+) | CML | Not Connected.                      |  |
| 52 | GND        |     | Module Ground.                      |  |
| 53 | GND        |     | Module Ground.                      |  |
| 54 | N.C.       |     | Not Connected.                      |  |
| 55 | N.C.       |     | Not Connected.                      |  |
| 56 | GND        |     | Module Ground.                      |  |
| 57 | Rx0+       |     | 25Gbps Receiver Data; Lane 0.       |  |
| 58 | Rx0-       |     | 25Gbps Receiver Data Bar; Lane 0.   |  |
| 59 | GND        |     | Module Ground.                      |  |
| 60 | Rx1+       |     | 25Gbps Receiver Data; Lane 1.       |  |
| 61 | Rx1-       |     | 25Gbps Receiver Data Bar; Lane 1.   |  |
| 62 | GND        |     | Module Ground.                      |  |
| 63 | N.C.       |     | Not Connected.                      |  |
| 64 | N.C.       |     | Not Connected.                      |  |
| 65 | GND        |     | Module Ground.                      |  |
| 66 | N.C.       |     | Not Connected.                      |  |
| 67 | N.C.       |     | Not Connected.                      |  |
| 68 | GND        |     | Module Ground.                      |  |
| 69 | Rx2+       |     | 25Gbps Receiver Data; Lane 2.       |  |
| 70 | Rx2-       |     | 25Gbps Receiver Data Bar; Lane 2.   |  |
| 71 | GND        |     | Module Ground.                      |  |
| 72 | Rx3+       |     | 25Gbps Receiver Data; Lane 3.       |  |
| 73 | Rx3-       |     | 25Gbps Receiver Data Bar; Lane 3.   |  |
| 74 | GND        |     | Module Ground.                      |  |
| 75 | N.C.       |     | Not Connected.                      |  |
| 76 | N.C.       |     | Not Connected.                      |  |
| 77 | GND        |     | Module Ground.                      |  |

|            |           |     |                                        |  |
|------------|-----------|-----|----------------------------------------|--|
| <b>78</b>  | (REFCLK+) | CML | Module Reference Clock. Not Connected. |  |
| <b>79</b>  | (REFCLK-) | CML | Module Reference Clock. Not Connected. |  |
| <b>80</b>  | GND       |     | Module Ground.                         |  |
| <b>81</b>  | N.C.      |     | Not Connected.                         |  |
| <b>82</b>  | N.C.      |     | Not Connected.                         |  |
| <b>83</b>  | GND       |     | Module Ground.                         |  |
| <b>84</b>  | Tx0+      |     | 25Gbps Transmitter Data; Lane 0.       |  |
| <b>85</b>  | Tx0-      |     | 25Gbps Transmitter Data Bar; Lane 0.   |  |
| <b>86</b>  | GND       |     | Module Ground.                         |  |
| <b>87</b>  | Tx1+      |     | 25Gbps Transmitter Data; Lane 1.       |  |
| <b>88</b>  | Tx1-      |     | 25Gbps Transmitter Data Bar; Lane 1.   |  |
| <b>89</b>  | GND       |     | Module Ground.                         |  |
| <b>90</b>  | N.C.      |     | Not Connected.                         |  |
| <b>91</b>  | N.C.      |     | Not Connected.                         |  |
| <b>92</b>  | GND       |     | Module Ground.                         |  |
| <b>93</b>  | N.C.      |     | Not Connected.                         |  |
| <b>94</b>  | N.C.      |     | Not Connected.                         |  |
| <b>95</b>  | GND       |     | Module Ground.                         |  |
| <b>96</b>  | Tx2+      |     | 25Gbps Transmitter Data; Lane 2.       |  |
| <b>97</b>  | Tx2-      |     | 25Gbps Transmitter Data Bar; Lane 2.   |  |
| <b>98</b>  | GND       |     | Module Ground.                         |  |
| <b>99</b>  | Tx3+      |     | 25Gbps Transmitter Data; Lane 3.       |  |
| <b>100</b> | Tx3-      |     | 25Gbps Transmitter Data Bar; Lane 3.   |  |
| <b>101</b> | GND       |     | Module Ground.                         |  |
| <b>102</b> | N.C.      |     | Not Connected.                         |  |
| <b>103</b> | N.C.      |     | Not Connected.                         |  |
| <b>104</b> | GND       |     | Module Ground.                         |  |

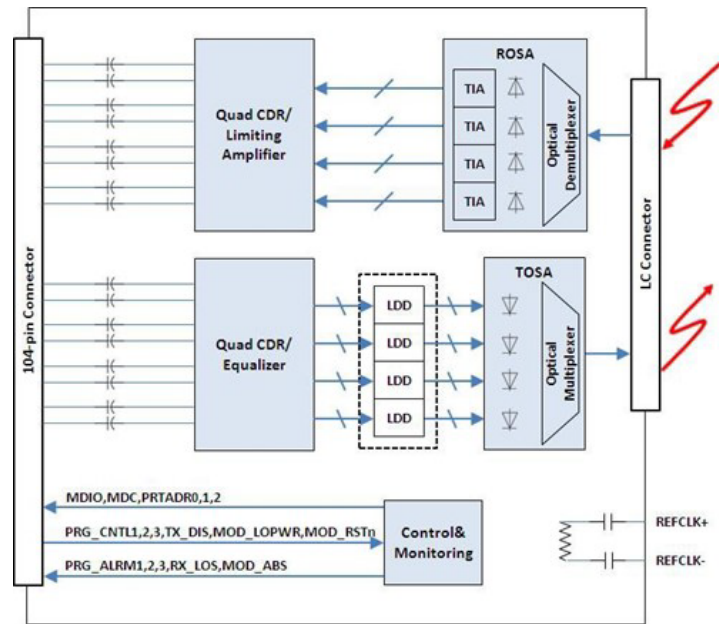
**Notes:**

1. Pulled up with 4.7k $\Omega$ -10k $\Omega$  to 3.3V inside the module.
2. Pulled up with 4.7k $\Omega$ -10k $\Omega$  to GND inside the module.

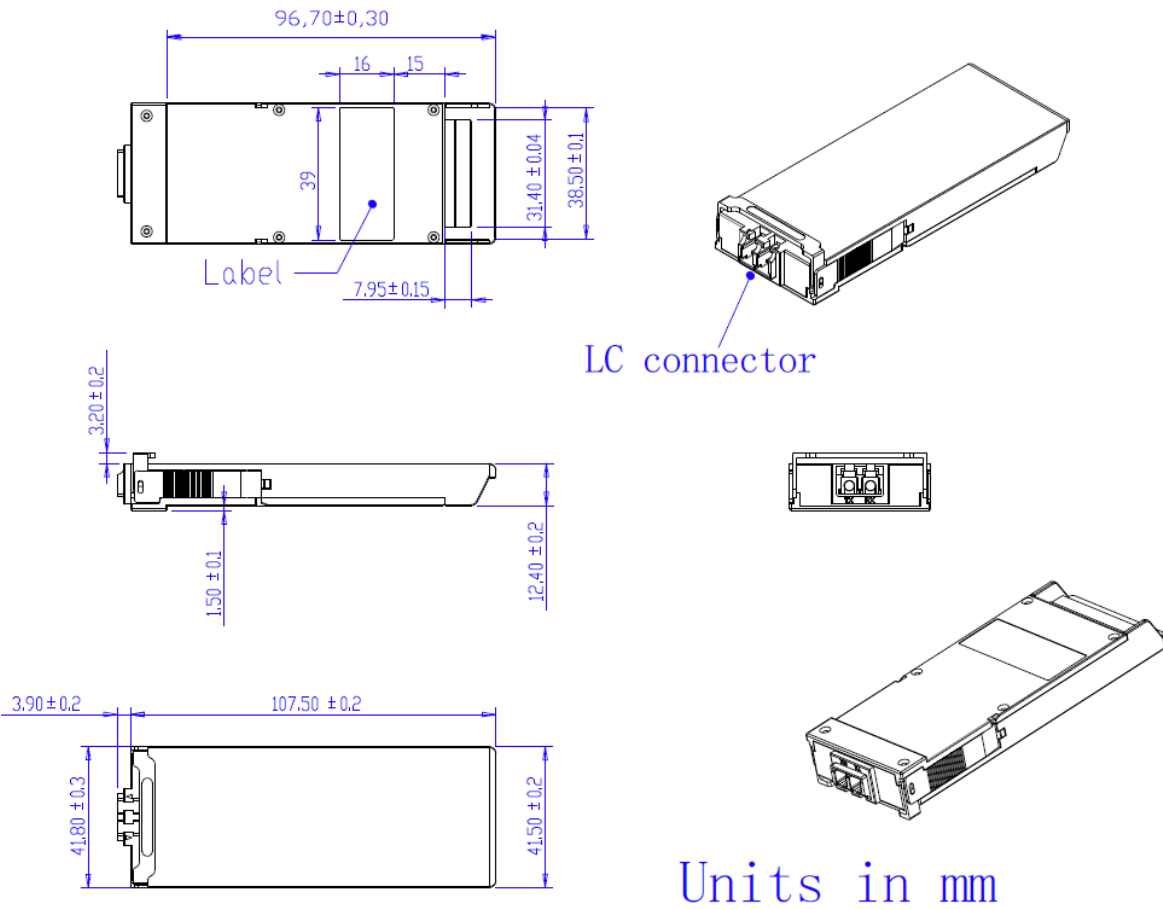
Electrical Pad Layout



Block Diagram



Mechanical Specifications



Units in mm

# About Skylane Optics

Skylane is a leading provider of transceivers for optical communication.

We offer an extensive portfolio for the enterprise, access, datacenter and metropolitan fiber optical market as well as for smart home applications and home networks.

We cover the European, South American and North American market with a strong partner network and have offices in Belgium, Brazil, Sweden and USA.

Our offerings are characterized by high quality and performance. In combination with our strong technical support, we enable our customers to build cost optimized network solutions.

We offer an extensive range of high-quality products including transceivers (Optical and copper), Active Optical Cable (AOC), Direct Attach Cable (DAC), Mux/Demux, Coding Box.

