

# QSFP-10100-ZR4

QSFP28 100Gb/s Single-mode 100km DDM Transceiver

## PRODUCT FEATURES

- Support line rates from 103.125 Gb/s;
- Lane bit rate 25.78 Gb/s 100GE
- Up to 100km transmission with KR4-FEC.
- LAN WDM EML laser and PIN receiver with SOA;
- Support Multi-Pin function with IntL/RxLOSL and LPMode/TxDIS;
- High speed I/O electrical interface (CAUI-4);
- I2C interface with integrated Digital Diagnostic monitoring;
- QSFP28 MSA package with duplex LC connector;
- Single +3.3V power supply;
- Maximum power consumption 6 W;
- Operating case temperature: 0 to +70 °C;
- Complies with EU Directive 2015/863/EU;



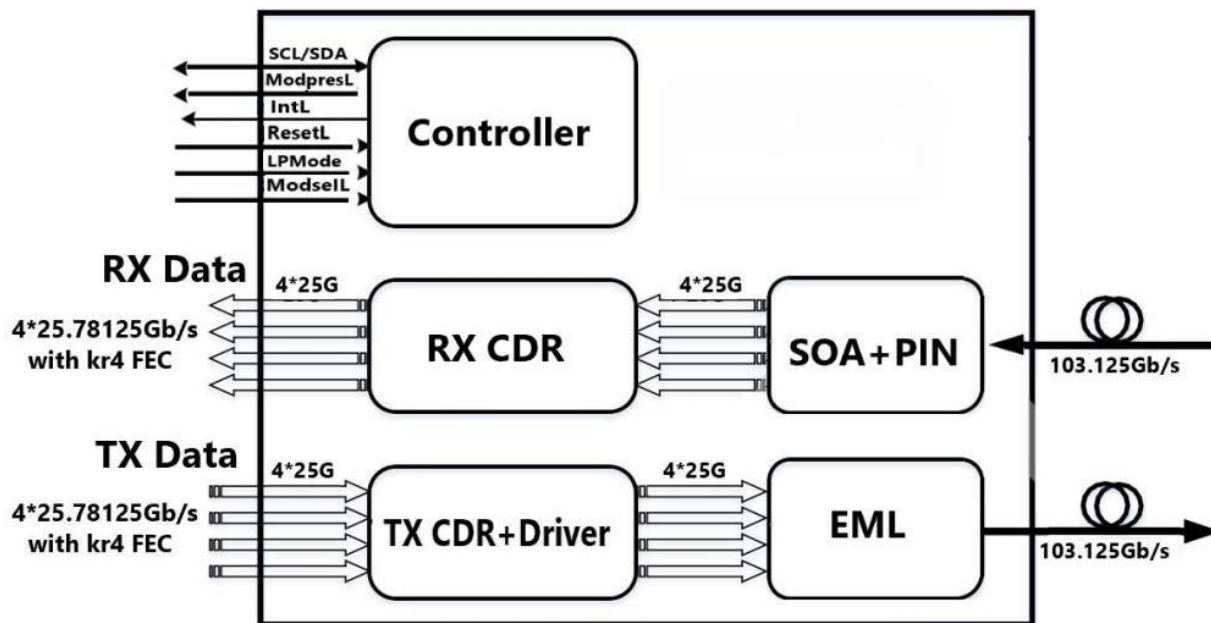
## APPLICATIONS

- 100GBASE-ZR4 Ethernet
- 100G Datacom& Telecom connections

## DESCRIPTIONS

This 100G QSFP28 eZR4 is designed for 100km optical communication applications. This module contains 4-lane optical transmitter, 4-lane optical receiver and module management block including 2 wire serial inter-face. The optical signals are multiplexed to a single-mode fiber through an industry standard LC connector. A block diagram is shown below.

## Transceiver Block Diagrams



## Ordering information

| Package | Part No.       | Data Rate(Gbps) | Laser | Fiber Type | Distance(k m) | Temp ( °C ) | Power Dissipation ( W ) |
|---------|----------------|-----------------|-------|------------|---------------|-------------|-------------------------|
| QSFP28  | QSFP-10100-ZR4 | 103.1           | LWDM  | SMF        | 100           | 0~70        | <6                      |

## I. Absolute Maximum Ratings

| Parameter                   | Symbol | Min. | Max. | Unit |
|-----------------------------|--------|------|------|------|
| Storage Temperature         | TS     | -40  | +85  | °C   |
| Maximum Supply Voltage      | VCC    | -0.5 | 3.6  | V    |
| Operating Relative Humidity | RH     |      | 85   | %    |

## II. Recommended Operating Conditions

| Parameter                  | Symbol             | Min. | Typical  | Max. | Unit | Notes       |
|----------------------------|--------------------|------|----------|------|------|-------------|
| Operating Case Temperature | T <sub>C</sub>     | 0    |          | +70  | °C   |             |
| Power Supply Voltage       | V <sub>CC</sub>    | 3.13 | 3.3      | 3.47 | V    |             |
| Power Supply Current       | I <sub>CC</sub>    |      |          | 1.82 | A    |             |
| Maximum Power Dissipation  | P <sub>D</sub>     |      |          | 6    | W    |             |
| Aggregate Bit Rate         | BR <sub>AVE</sub>  |      | 103.125  |      | Gb/s |             |
| Lane Bit Rate              | BR <sub>LANE</sub> |      | 25.78125 |      | Gb/s |             |
| Transmission Distance      | TD                 |      |          | 100  | km   |             |
| Coupled fiber              | Single mode fiber  |      |          |      |      | 9/125um SMF |

## III. Optical Characteristics

| Parameter                                                                                     | Symbol                            | Min.    | Typical  | Max.    | Unit  | Notes |
|-----------------------------------------------------------------------------------------------|-----------------------------------|---------|----------|---------|-------|-------|
| Transmitter                                                                                   |                                   |         |          |         |       |       |
| Signaling Speed per Lane                                                                      |                                   |         | 25.78125 |         | Gbps  |       |
| Lane Wavelength                                                                               | L0                                | 1294.53 | 1295.56  | 1296.59 | nm    |       |
|                                                                                               | L1                                | 1299.02 | 1300.05  | 1301.09 | nm    |       |
|                                                                                               | L2                                | 1303.54 | 1304.58  | 1305.63 | nm    |       |
|                                                                                               | L3                                | 1308.09 | 1309.14  | 1310.19 | nm    |       |
| Total Launch Power, 100GE                                                                     | P <sub>T</sub>                    | 9       |          | 12.5    | dBm   | 1     |
| Average Launch Power per Lane,                                                                | P <sub>avg</sub>                  | 3       |          | 6.5     | dBm   | 1     |
| OMA, each Lane                                                                                | P <sub>OMA</sub>                  | 4.2     |          | 7.7     | dBm   | 1     |
| Difference in launch power between any two lanes(Average and OMA) between any Two Lanes (OMA) | P <sub>tx,diff</sub>              |         |          | 3       | dB    |       |
| Average Output Power (Laser Turn off)                                                         | P <sub>off</sub>                  |         |          | -30     | dBm   |       |
| Side Mode Suppression Ratio                                                                   | SMSR                              | 30      |          |         | dB    |       |
| Extinction Ratio, 100GE                                                                       | ER                                | 7       |          |         | dB    |       |
| RIN20OMA                                                                                      | RIN                               |         |          | -130    | dB/Hz |       |
| Optical Return Loss Tolerance                                                                 | TOL                               |         |          | 20      | dB    |       |
| Transmitter Reflectance                                                                       | R <sub>T</sub>                    |         |          | -12     | dB    |       |
| Optical Eye Mask                                                                              | {0.25,0.4, 0.45, 0.25, 0.28, 0.4} |         |          |         | %     | 2     |
| Receiver                                                                                      |                                   |         |          |         |       |       |
| Signaling rate, each lane                                                                     |                                   |         | 25.78125 |         | Gbps  |       |
| Center Wavelength Lane 0                                                                      | λ0                                | 1294.53 | 1295.56  | 1296.59 | nm    |       |
| Center Wavelength Lane 1                                                                      | λ1                                | 1299.02 | 1300.05  | 1301.09 | nm    |       |

|                                         |             |         |         |         |     |   |
|-----------------------------------------|-------------|---------|---------|---------|-----|---|
| Center Wavelength Lane 2                | $\lambda_2$ | 1303.54 | 1304.58 | 1305.63 | nm  |   |
| Center Wavelength Lane 3                | $\lambda_3$ | 1308.09 | 1309.14 | 1310.19 | nm  |   |
| Damage threshold , each lane            | Pdamage     | 5.5     |         |         | dBm |   |
| Average Receive Power, each lane        |             | -31     |         | -6      | dBm | 3 |
| Receiver sensitivity Average, each lane | SEN         |         |         | -30     | dBm | 3 |
| Los Assert                              | LosA        | -40     |         |         | dBm |   |
| Los De-assert                           | LosDA       |         |         | -28     | dBm |   |

Note:

1. The optical power is launched into SMF.
2. Measured with a PRBS  $2^{31}-1$  test pattern @25.78125, Hit ratio $\leq 5E-5$ .
3. Measured with a PRBS  $2^{31}-1$  test pattern @25.78125 Gb/s, BER $\leq 5E-5$ .

## IV. Electrical Characteristics

High-Speed Signal: Compliant to CAUI-4 (IEEE 802.3bm)

Low-Speed Signal: Compliant to SFF-8679.

| Parameter                                    | Symbol      | Min. | Typical  | Max. | Unit | Notes |
|----------------------------------------------|-------------|------|----------|------|------|-------|
| <b>Transmitter (Module Input)</b>            |             |      |          |      |      |       |
| Data Rate, each lane                         |             |      | 25.78125 |      | Gbps |       |
| Differential Voltage pk-pk                   | Vpp         |      |          | 900  | mV   | 1     |
| Common Mode Voltage                          | Vcm         | -350 |          | 2850 | mV   |       |
| Transition time                              | Trise/Tfall | 10   |          |      | ps   | 2     |
| <b>Receiver (Module Output)</b>              |             |      |          |      |      |       |
| Data Rate, each lane                         |             |      | 25.78125 |      | Gbps |       |
| Common Mode Noise, RMS                       | Vrms        |      |          | 17.5 | mV   |       |
| Differential output voltage swing            | Vout, pp    |      |          | 900  | mV   |       |
| Eye width                                    | EW15        | 0.57 |          |      | UI   |       |
| Eye height                                   | EH15        | 228  |          |      | mV   |       |
| Differential Termination Resistance Mismatch |             |      |          | 10   | %    | 1     |
| Transition time                              | Trise/Tfall | 12   |          |      | ps   |       |

Notes:

1. At 1 MHz.
2. 20%~80%.

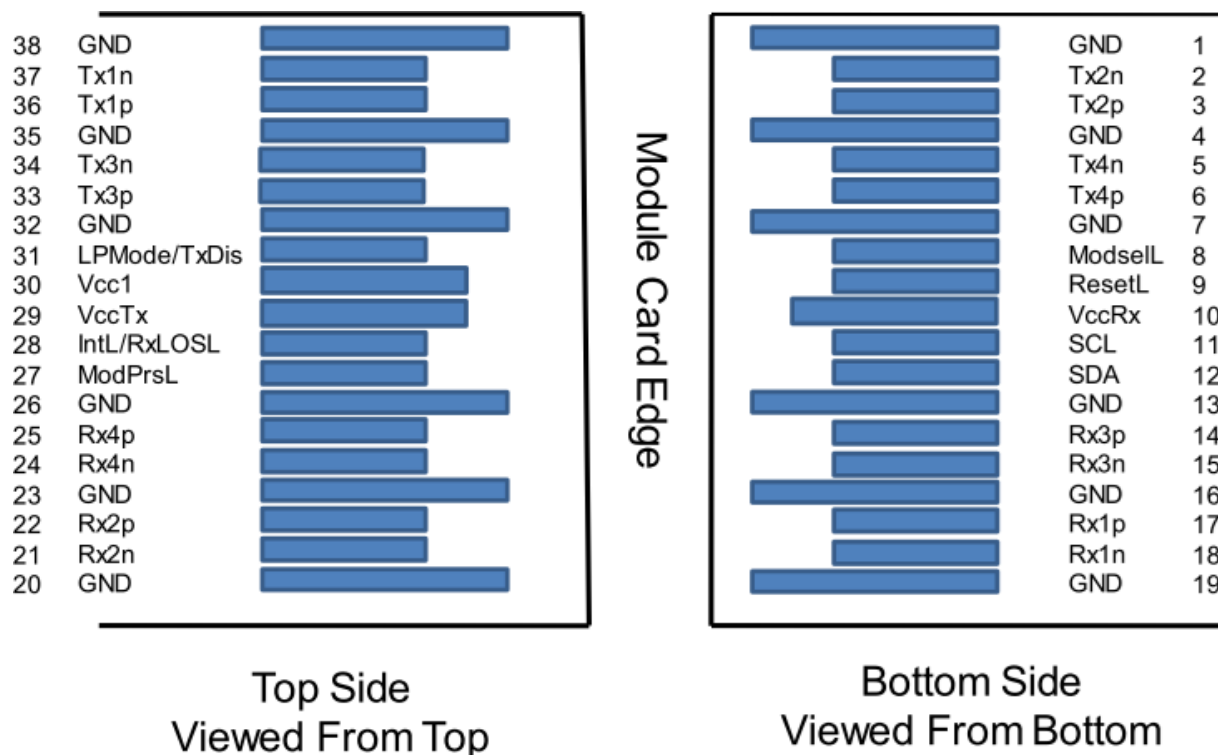
## Digital Diagnostics

| Parameter    | Range      | Unit | Accuracy | Calibration         |
|--------------|------------|------|----------|---------------------|
| Temperature  | 0 to +70   | °C   | ±3°C     | Internal / External |
| Voltage      | 3.0 to 3.6 | V    | ±3%      | Internal / External |
| Bias Current | 30 to 100  | mA   | ±10%     | Internal / External |
| TX Power     | 1 to 6.5   | dBm  | ±3dB     | Internal / External |
| RX Power     | -29 to 4.5 | dBm  | ±3dB     | Internal / External |

Note:

The transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA). The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

## V. Pin Diagram



## Pin Descriptions

| PIN | Logic       | Symbol       | Description                          | Plug Seq. | Notes |
|-----|-------------|--------------|--------------------------------------|-----------|-------|
| 1   |             | GND          | Ground                               | 1         | 1     |
| 2   | CML-I       | Tx2n         | Transmitter Inverted Data Input      | 3         |       |
| 3   | CML-I       | Tx2p         | Transmitter Non-Inverted Data output | 3         |       |
| 4   |             | GND          | Ground                               | 1         | 1     |
| 5   | CML-I       | Tx4n         | Transmitter Inverted Data Input      | 3         |       |
| 6   | CML-I       | Tx4p         | Transmitter Non-Inverted Data output | 3         |       |
| 7   |             | GND          | Ground                               | 1         | 1     |
| 8   | LVTLL-I     | ModSelL      | Module Select                        | 3         |       |
| 9   | LVTLL-I     | ResetL       | Module Reset                         | 3         |       |
| 10  |             | VccRx        | + 3.3V Power Supply Receiver         | 2         | 2     |
| 11  | LVC MOS-I/O | SCL          | 2-Wire Serial Interface Clock        | 3         |       |
| 12  | LVC MOS-I/O | SDA          | 2-Wire Serial Interface Data         | 3         |       |
| 13  |             | GND          | Ground                               | 1         |       |
| 14  | CML-O       | Rx3p         | Receiver Non-Inverted Data Output    | 3         |       |
| 15  | CML-O       | Rx3n         | Receiver Inverted Data Output        | 3         |       |
| 16  |             | GND          | Ground                               | 1         | 1     |
| 17  | CML-O       | Rx1p         | Receiver Non-Inverted Data Output    | 3         |       |
| 18  | CML-O       | Rx1n         | Receiver Inverted Data Output        | 3         |       |
| 19  |             | GND          | Ground                               | 1         | 1     |
| 20  |             | GND          | Ground                               | 1         | 1     |
| 21  | CML-O       | Rx2n         | Receiver Inverted Data Output        | 3         |       |
| 22  | CML-O       | Rx2p         | Receiver Non-Inverted Data Output    | 3         |       |
| 23  |             | GND          | Ground                               | 1         | 1     |
| 24  | CML-O       | Rx4n         | Receiver Inverted Data Output        | 3         | 1     |
| 25  | CML-O       | Rx4p         | Receiver Non-Inverted Data Output    | 3         |       |
| 26  |             | GND          | Ground                               | 1         | 1     |
| 27  | LVTTL-O     | ModPrsL      | Module Present                       | 3         |       |
| 28  | LVTTL-O     | IntL/Rx_LOS  | Interrupt/Rx_LOS                     | 3         |       |
| 29  |             | VccTx        | +3.3 V Power Supply transmitter      | 2         | 2     |
| 30  |             | Vcc1         | +3.3 V Power Supply                  | 2         | 2     |
| 31  | LVTTL-I     | LPMode/TxDIS | Low Power Mode/Tx_Disable            | 3         |       |
| 32  |             | GND          | Ground                               | 1         | 1     |
| 33  | CML-I       | Tx3p         | Transmitter Non-Inverted Data Input  | 3         |       |
| 34  | CML-I       | Tx3n         | Transmitter Inverted Data Output     | 3         |       |
| 35  |             | GND          | Ground                               | 1         | 1     |

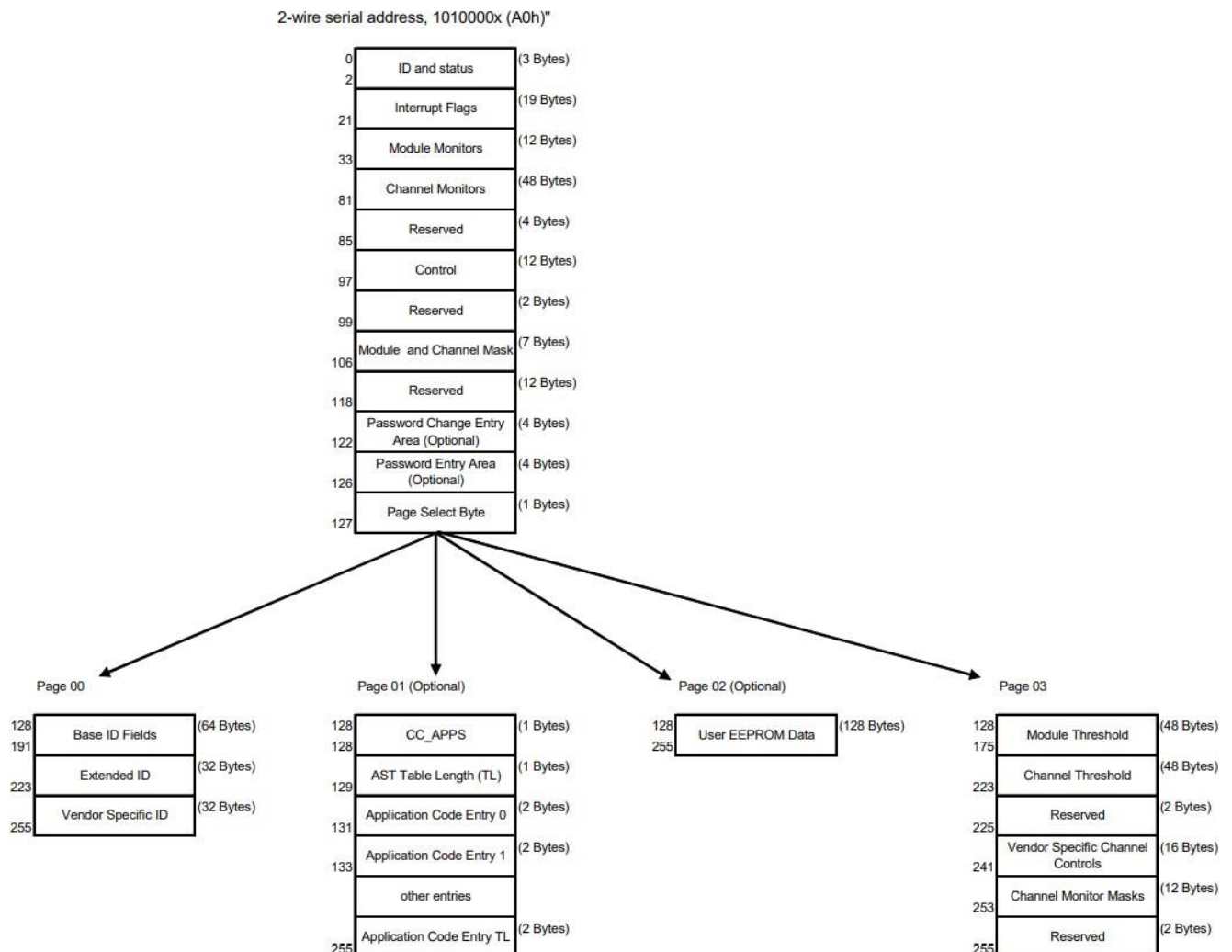
|    |       |      |                                     |   |   |
|----|-------|------|-------------------------------------|---|---|
| 36 | CML-I | Tx1p | Transmitter Non-Inverted Data Input | 3 |   |
| 37 | CML-I | Tx1n | Transmitter Inverted Data Output    | 3 |   |
| 38 |       | GND  | Ground                              | 1 | 1 |

Notes:

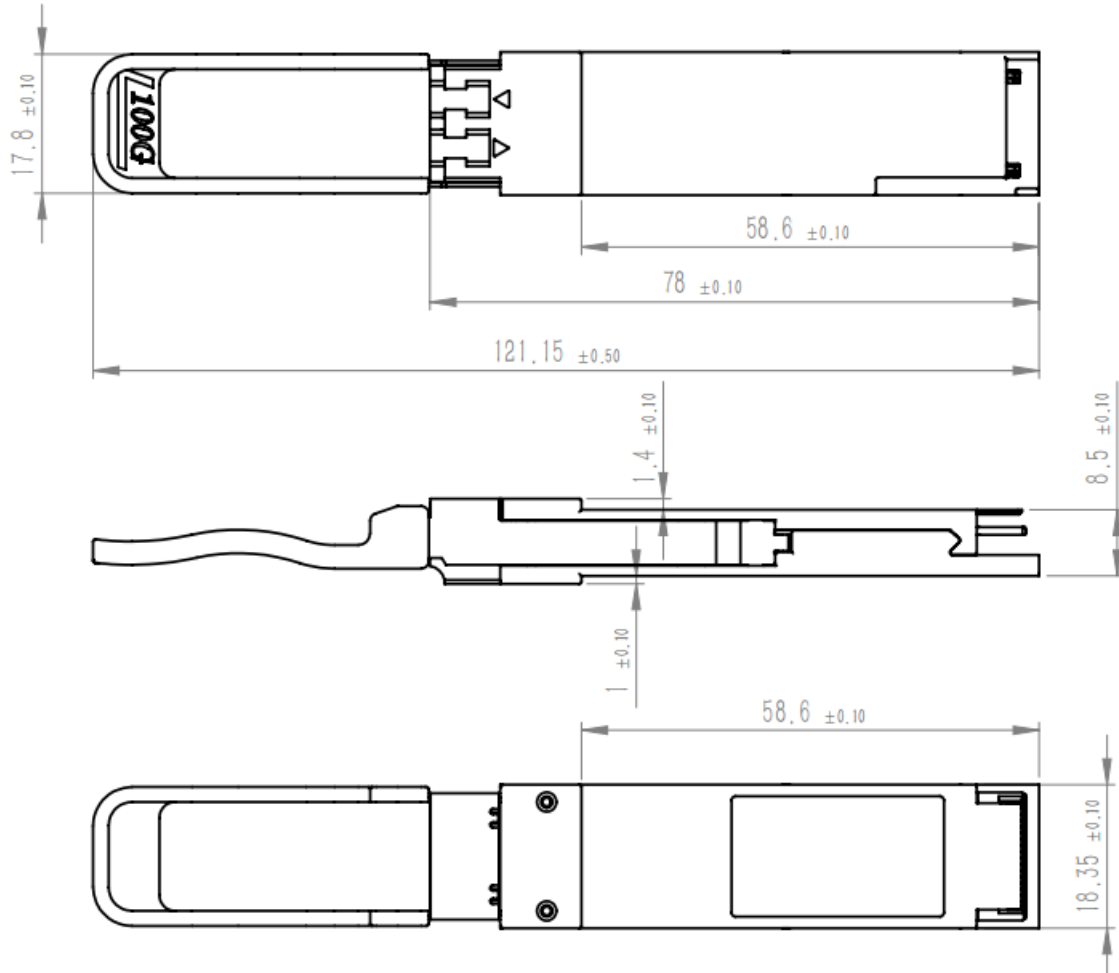
1. GND is the symbol for signal and supply (power) common for the QSFP28 module. All are common within the QSFP28 module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.
2. Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. Requirements defined for the host side of the Host Edge Card Connector are listed in MSA. The connector pins are each rated for a maximum current of 500 mA.

## VI. EEPROM Information

EEPROM memory map specific data field description is as below



## VII. Mechanical Specifications (Unit: mm)



## Ordering information

| Package | Part No.       | Data Rate(Gbps) | Laser | Fiber Type | Distance(km) | Temp (°C) | Power Dissipation(W) |
|---------|----------------|-----------------|-------|------------|--------------|-----------|----------------------|
| QSFP28  | QSFP-10100-ZR4 | 103.1           | LWDM  | SMF        | 100          | 0~70      | <6                   |