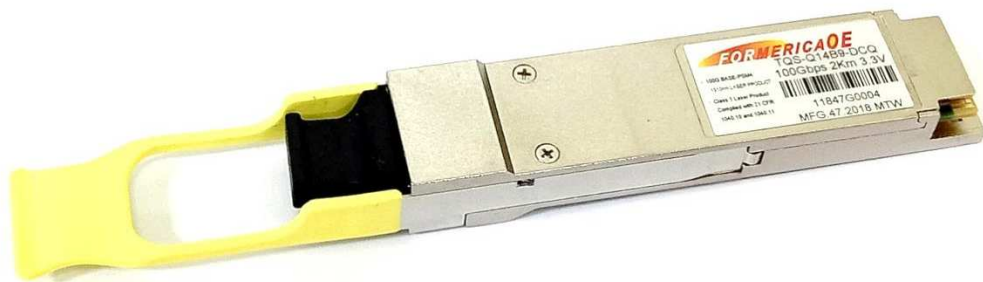


**Specification**  
**Quad Small Form-factor Pluggable**  
**Optical Transceiver Module**  
**100GBASE-PSM4**



**Ordering Information**

**TQS-Q14B9-DCQ**

| Model Name    | Voltage | Category  | Device type       | Temperature | Distance      |
|---------------|---------|-----------|-------------------|-------------|---------------|
| TQS-Q14B9-DCQ | 3.3V    | With DDMI | 1310 nm DFB / PIN | 0°C~+70°C   | 2km<br>( SMF) |

## Features

- Compliant with 100G Ethernet IEEE 802.3bm
- Compliant to SFF-8665 (QSFP28 Solution)
- Supports 103.1Gb/s aggregate bit rate
- Low power consumption of max 3.5W
- Hot pluggable electrical interface
- Using standard 12-lane optical fiber with MPO pluggable optical connector
- 0 to 70°C case temperature operating range
- RoHS compliant

## Applications

- 100GBASE Ethernet links up to 2km over SMF.
- Infiniband QDR and DDR.

## Absolute Maximum Rating

Not necessarily applied together. Exceeding these values may cause permanent damage. Functional operation under these conditions is not implied.

| Parameter                   | Symbol | Min  | Typ. | Max | Unit | Note |
|-----------------------------|--------|------|------|-----|------|------|
| Storage Temperature         | Ts     | -40  |      | 85  | °C   |      |
| 3.3V Power Supply Voltage   | Vcc    | -0.5 |      | 3.6 | V    |      |
| Relative Humidity           | RH     | 0    |      | 85  | %    |      |
| Damage Threshold, each Lane | DT     | 3    |      |     | dBm  |      |

## Recommended Operating Conditions

| Parameter                  | Min   | Typical           | Max   | Unit | Note |
|----------------------------|-------|-------------------|-------|------|------|
| Case Operating Temperature | 0     |                   | 70    | °C   |      |
| Power Supply Voltage       | 3.135 | 3.3               | 3.465 | V    |      |
| Date Rate per Channel      |       | 25.78125          |       | Gbps |      |
| Bit Error Ratio            |       | 10 <sup>-12</sup> |       |      |      |
| Control Input Voltage High | 2     |                   | Vcc   | V    |      |
| Control Input Voltage Low  | 0     |                   | 0.8   | V    |      |
| Link Reach                 |       |                   | 2000  | M    |      |

## Electrical Characteristics

| Parameter  | Symbol                | Min                                | Typ. | Max  | Unit     | Note |
|--|-----------------------|------------------------------------|------|------|----------|------|
| <b>Transceiver Electrical Characteristics</b>      |                       |                                    |      |      |          |      |
| TRx Power Consumption                              |                       |                                    |      | 3.5  | W        |      |
| Supply Current                                     |                       |                                    |      | 1.06 | A        |      |
| <b>Transmitter Electrical Characteristics</b>      |                       |                                    |      |      |          |      |
| Data Input Differential Peak-to-Peak Voltage Swing | $\Delta V_{DI}$<br>PP | 900                                |      |      | mVp<br>p |      |
| Common Mode Voltage (Vcm)                          |                       | -350                               |      | 2850 | mV       | 1    |
| Differential Input Return Loss                     |                       | See CEI-<br>28G-VSR Equation 13-19 |      |      | dB       |      |
| Differential to Common-mode Input Return Loss      |                       | See CEI-<br>28G-VSR Equation 13-20 |      |      | dB       |      |
| <b>Receiver Electrical Characteristics</b>         |                       |                                    |      |      |          |      |
| Differential Output Return Loss                    |                       | See CEI-<br>28G-VSR Equation 13-19 |      |      | dB       |      |
| Common Mode Output Return Loss                     |                       | See CEI-<br>28G-VSR Equation 13-21 |      |      | dB       |      |
| Differential Output Voltage                        |                       |                                    |      | 900  | mV       |      |
| Eye Width  |                       | 0.57                               |      |      | UI       |      |
| Eye Height, Differential                           |                       | 228                                |      |      | mV       |      |

**Notes:**

1. Vcm is generated by the host. Specification includes effects of ground offset voltage.

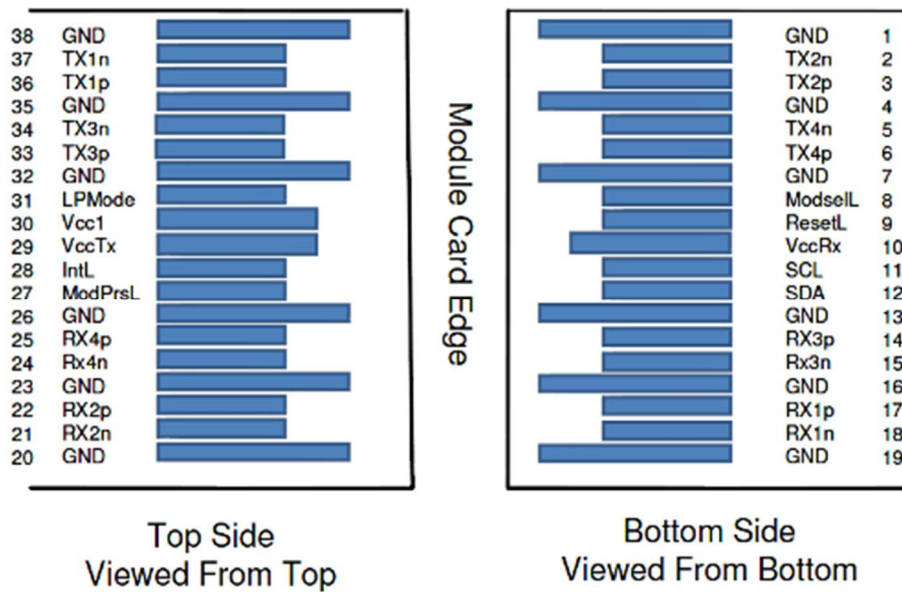
## Optical Characteristics

| Parameter  | Symbol    | Min                                | Typ. | Max    | Unit | Note                    |
|--|-----------|------------------------------------|------|--------|------|-------------------------|
| <b>Transmitter Optical Characteristics</b>       |           |                                    |      |        |      |                         |
| Center Wavelength                                | $\lambda$ | 1295                               | 1310 | 1325   | nm   |                         |
| Side-Mode Suppression Ratio                      | SMSR      | 30                                 |      |        | dB   |                         |
| Average Output Optical Power                     | PO AVE    | -5.5                               |      | 2      | dBm  |                         |
| Output Optical Modulation Amplitude, per lane    | OMA       | -3.5                               |      | 2.2    | dBm  | 1                       |
| Extinction Ratio                                 | ER        | 3.5                                |      |        | dB   |                         |
| Optical Return Loss Tolerance                    | TOL       |                                    |      | 20     | dB   |                         |
| Transmitter Reflectance                          | RT        |                                    |      | -12    | dB   |                         |
| Transmitter Eye Mask<br>{X1, X2, X3, Y1, Y2, Y3} |           | {0.31, 0.4, 0.45, 0.34, 0.38, 0.4} |      |        |      |                         |
| <b>Receiver Optical Characteristics</b>          |           |                                    |      |        |      |                         |
| Center wavelength, each lane                     | $\lambda$ | 1295                               | 1310 | 1325   | nm   |                         |
| Damage Threshold                                 |           | 3                                  |      |        | dBm  | 2                       |
| Average power at receiver input, each lane       |           | -10.2                              |      | 2      | dBm  |                         |
| Optical Modulation Amplitude (OMA)               |           |                                    |      | 2.2    | dBm  |                         |
| Receiver Sensitivity (OMA), each Lane            | SEN1      |                                    |      | -9     | dBm  | BER=1x10 <sup>-12</sup> |
| Stressed Receiver Sensitivity (OMA), each Lane   |           |                                    |      | -6.44  | dBm  | BER=1x10 <sup>-12</sup> |
| Receiver Sensitivity (OMA), each Lane            | SEN2      |                                    |      | -11.35 | dBm  | BER=5x10 <sup>-5</sup>  |
| Stressed Receiver Sensitivity (OMA), each Lane   |           |                                    |      | -8.79  | dBm  | BER=5x10 <sup>-5</sup>  |
| Receiver Reflectance                             |           |                                    |      | -26    | dBm  |                         |
| LOS Assert                                       | LOSA      | -30                                |      |        | dBm  |                         |
| LOS Deassert                                     | LOSD      |                                    |      | -15    | dBm  |                         |
| LOS Hysteresis                                   | LOSH      | 0.5                                |      |        | dB   |                         |

Notes:

1. Even if the TDP < 0.8 dB, the OMA min must exceed the minimum value specified here.
2. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
3. Measured with conformance test signal at TP3 for BER =  $5 \times 10^{-5}$

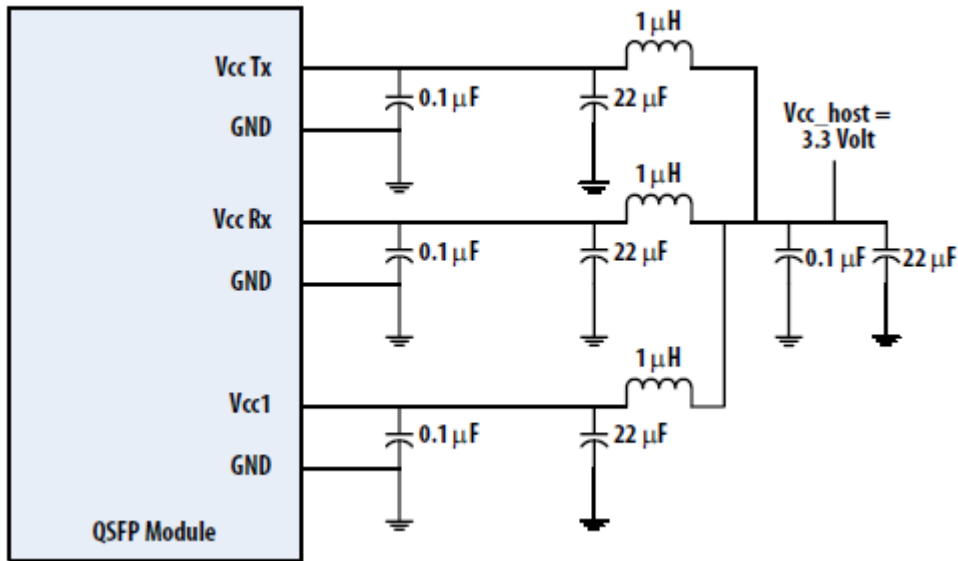
### QSFP28 Module Pad Assignments and Descriptions



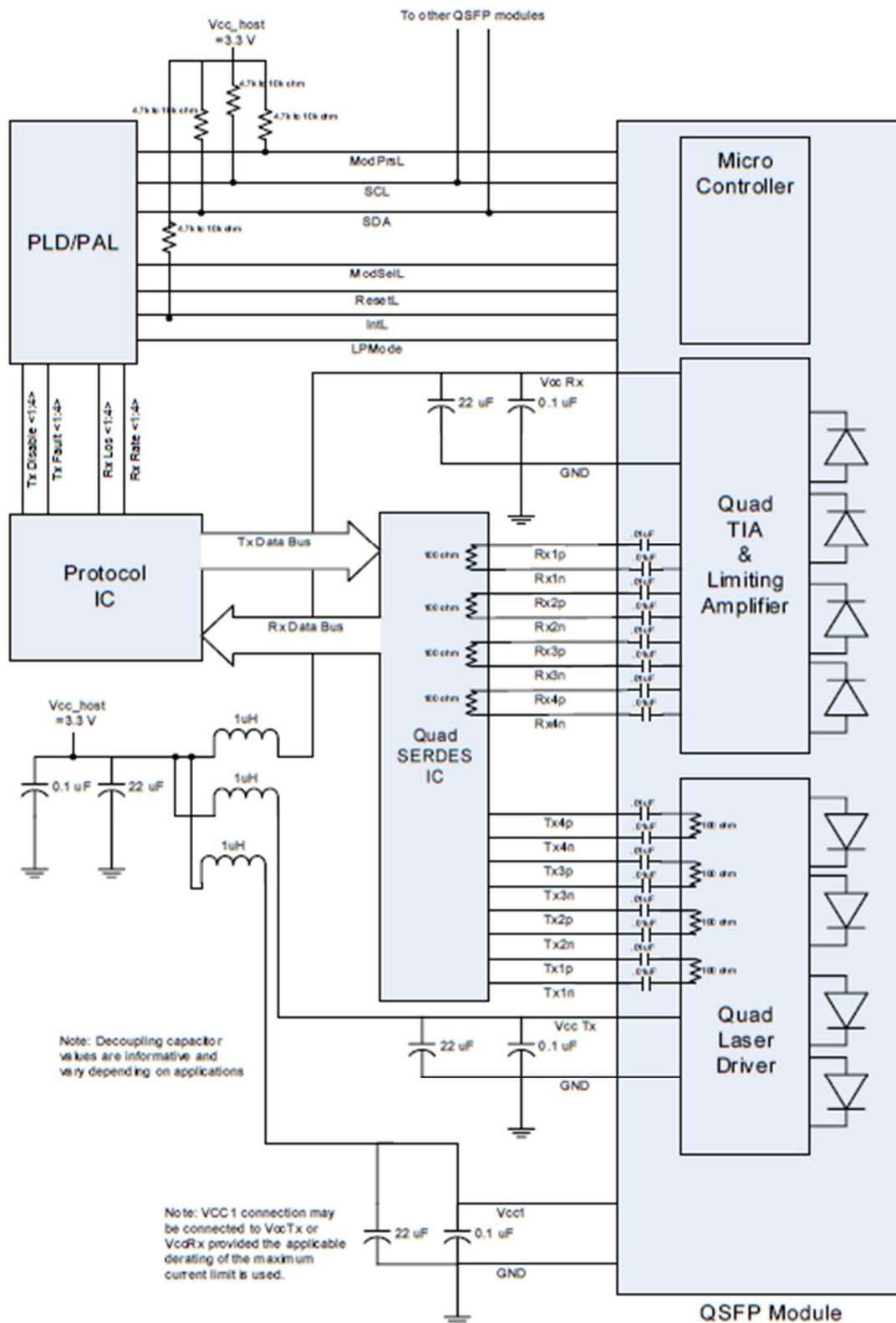
| Pin | Logic       | Symbol  | Description                         | Plug Sequence | Notes |
|-----|-------------|---------|-------------------------------------|---------------|-------|
| 1   |             | GND     | Ground                              | 1             |       |
| 2   | CML-I       | Tx2n    | Transmitter Inverted Data Input     | 3             |       |
| 3   | CML-I       | Tx2p    | Transmitter Non-Inverted Data Input | 3             |       |
| 4   |             | GND     | Ground                              | 1             |       |
| 5   | CML-I       | Tx4n    | Transmitter Inverted Data Input     | 3             |       |
| 6   | CML-I       | Tx4p    | Transmitter Non-Inverted Data Input | 3             |       |
| 7   |             | GND     | Ground                              | 1             |       |
| 8   | LVTTL-I     | ModSelL | Module Select                       | 3             |       |
| 9   | LVTTL-I     | ResetL  | Module Reset                        | 3             |       |
| 10  |             | Vcc Rx  | +3.3V Power Supply Receiver         | 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             |       |
| 17  | CML-O       | Rx1p    | Receiver Non-Inverted Data Output   | 3             |       |
| 18  | CML-O       | Rx1n    | Receiver Inverted Data Output       | 3             |       |
| 19  |             | GND     | Ground                              | 1             |       |
| 20  |             | GND     | Ground                              | 1             |       |
| 21  | CML-O       | Rx2n    | Receiver Inverted Data Output       | 3             |       |
| 22  | CML-O       | Rx2p    | Receiver Non-Inverted Data Output   | 3             |       |
| 23  |             | GND     | Ground                              | 1             |       |
| 24  | CML-O       | Rx4n    | Receiver Inverted Data Output       | 3             |       |
| 25  | CML-O       | Rx4p    | Receiver Non-Inverted Data Output   | 3             |       |
| 26  |             | GND     | Ground                              | 1             |       |
| 27  | LVTTL-O     | ModPrsL | Module Present                      | 3             |       |
| 28  | LVTTL-O     | IntL    | Interrupt                           | 3             |       |
| 29  |             | Vcc Tx  | +3.3V Power supply transmitter      | 2             |       |
| 30  |             | Vcc1    | +3.3V Power supply                  | 2             |       |
| 31  | LVTTL-I     | LPMode  | Low Power Mode                      | 3             |       |
| 32  |             | GND     | Ground                              | 1             |       |
| 33  | CML-I       | Tx3p    | Transmitter Non-Inverted Data Input | 3             |       |
| 34  | CML-I       | Tx3n    | Transmitter Inverted Data Input     | 3             |       |
| 35  |             | GND     | Ground                              | 1             |       |

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

**Recommended Host Board Power Supply Circuit**



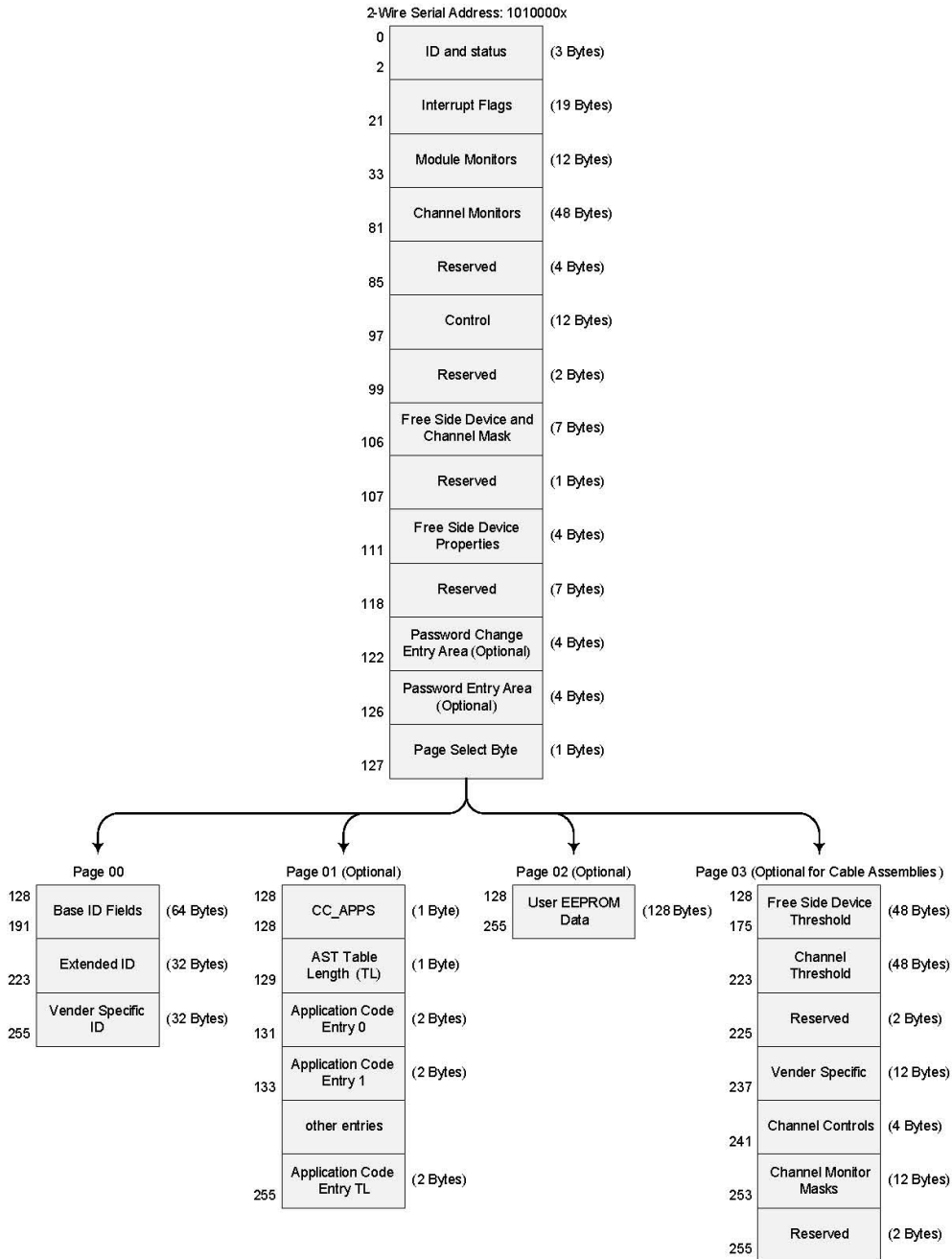
### Recommended Interface Circuit





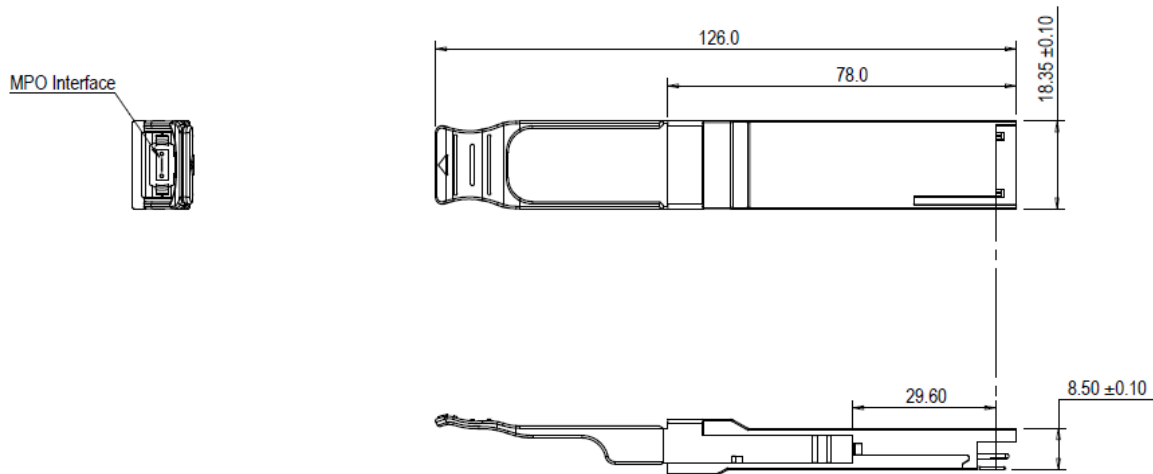
## Memory Map

The memory map is structured as a single address and multiple page approaches, according to the QSFP28 SFF-8636 MSA specification as shown in the below. For more detailed description of this memory map or lower pages, please see our Memory Map document with flexible customization settings.



## Mechanical Design Diagram

Unit: mm



## ESD

Normal ESD precautions are required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

## Laser Safety

This is a Class 1 Laser Product according to IEC / EN 60825-1: 2014 (Third Edition). This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007).

## Contact Information

### Formerica OptoElectronics Inc.

5F-11, No.38, Taiyuan St., Zhubei City,

Hsinchu County 30265, Taiwan

Tel: +886-3-5600286

Fax: +886-3-5600239

### San Diego, CA

Tel: 1-949-466-8069

[inquiry@formericaoe.com](mailto:inquiry@formericaoe.com)

[www.formericaoe.com](http://www.formericaoe.com)

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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

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