

# GNQ2M0C31

## 100Gb/s QSFP28 PSM4 2km Optical Transceiver

### Features

- Four-channel full-duplex transceiver modules
- Transmission data rate up to 26Gbit/s per channel
- Up to 2km transmission of single mode fiber
- Low power consumption <3.5W
- Operating case temperature 0°C to 70°C
- 3.3V power supply voltage
- RoHS 6 compliant
- Hot Pluggable QSFP28 form factor
- Single MPO connector receptacle
- Built-in digital diagnostic function

### Application

- 100G Ethernet
- Proprietary High Speed
- Interconnections
- Data centre

The GNQ2M0C31 is a Four-Channel, Pluggable, Parallel, Fiber-Optic QSFP28 Transceiver for 100G Ethernet Applications. The QSFP28 full-duplex optical module offers 4 independent transmit and receive channels, each capable of 26Gbps operation for an aggregate data rate of 104Gbps 2km using single mode fiber. These modules are designed to operate over single mode fiber systems using DFB laser array. An optical fiber ribbon cable with an MPO/MTPTM connector can be plugged into the QSFP28 module receptacle. QSFP28 PSM4 is one kind of parallel transceiver which provides increased port density and total system cost savings.

### Ordering Information

| Part Number | Description  |
|-------------|--|
| GNQ2M0C31   | 4X25.78125G QSFP28 PSM4, MPO connector, 2km over single mode fiber |

### Regulatory Compliance

| Feature                              | Standard   | Performance                           |
|--------------------------------------|--|---------------------------------------|
| Electromagnetic Interference (EMI)   | FCC Part 15 Class B<br>EN 55022:2010, Class B                | Compatible with standards             |
| Electromagnetic susceptibility (EMS) | EN 55024:2010  | Compatible with standards             |
| Laser Eye Safety                     | FDA 21CFR 1040.10 and 1040.11<br>EN60950, EN (IEC) 60825-1,2 | Compatible with Class I laser product |

### Absolute Maximum Ratings

The operation in excess of any absolute maximum ratings might cause permanent damage to this module.

| Parameter                            | Symbol | Min  | Max     | Max  | Notes |
|--------------------------------------|--------|------|---------|------|-------|
| Storage Temperature                  | TS     | -40  | 85      | degC |       |
| Operating Case Temperature           | TOP    | 0    | 70      | degC |       |
| Power Supply Voltage                 | VCC    | -0.3 | 3.6     | V    |       |
| Relative Humidity (non-condensation) | RH     | 0    | 85      | %    |       |
| Input Voltage                        | Vin    | -0.3 | Vcc+0.3 | V    |       |

### Recommended Operating Conditions and Power Supply Requirements

| Parameter                  | Symbol | Min   | Typical  | Max   | Unit | Notes                      |
|----------------------------|--------|-------|----------|-------|------|----------------------------|
| Operating Case Temperature | TOP    | 0     |          | 70    | degC | Operating Case Temperature |
| Power Supply Voltage       | VCC    | 3.135 | 3.3      | 3.465 | V    | Power Supply Voltage       |
| Power Consumption          |        | -     |          | 3.5   | W    | Power Consumption          |
| Data Rate                  | DR     |       | 25.78125 |       | Gbps | Data Rate                  |
| Data Speed Tolerance       | ΔDR    | -100  |          | +100  | ppm  | Data Speed Tolerance       |
| Link Distance with G.652   | D      | 0     |          | 2     | km   | Link Distance with G.652   |

### Electrical Characteristics

| Parameter                             | Test Point | Min     | Typical | Max  | Unit  | Notes |
|---------------------------------------|------------|---------|---------|------|-------|-------|
| Differential input impedance          | Zin        | 90      | 100     | 110  | ohm   |       |
| Differential Output impedance         | Zout       | 90      | 100     | 110  | ohm   |       |
| Differential input voltage amplitude  | ΔVin       | 300     |         | 1100 | mVp-p |       |
| Differential output voltage amplitude | ΔVout      | 300     |         | 800  | mVp-p |       |
| Input Logic Level High                | VIH        | 2.0     |         | VCC  | V     |       |
| Input Logic Level Low                 | VIL        | 0       |         | 0.8  | V     |       |
| Output Logic Level High               | VOH        | VCC-0.5 |         | VCC  | V     |       |
| Output Logic Level Low                | VOL        | 0       |         | 0.4  | V     |       |

**Optical Characteristics**

| Parameter   | Symbol          | Min                          | Typical | Max    | Unit  | Notes |
|---|-----------------|------------------------------|---------|--------|-------|-------|
| <b>Transmitter</b>  |                 |                              |         |        |       |       |
| Center Wavelength   | $\lambda_C$     | 1295                         |         | 1325   | nm    | 1     |
| RMS Spectral Width  | $\lambda_{rms}$ | -                            |         | 3.5    | nm    | 1     |
| Average Launch Power, each lane                           | PAVG            | -6                           | -0.5    | +2.0   | dBm   |       |
| Optical Modulation Amplitude (OMA)                        | POMA            | -5                           | -0.5    | +2.2   | dBm   | 1     |
| Difference in Launch Power between any two lanes          | Ptx,diff        |                              |         | 5.0    | dB    |       |
| Transmitter and dispersion penalty (TDP), each lane (max) | TDP             |                              |         | 2.9    | dBm   | 1     |
| Rise/Fall Time  | Tr/Tf           |                              |         | 30     | ps    |       |
| Extinction Ratio  | ER              | 3.5                          |         |        | dB    |       |
| Relative Intensity Noise                                  | Rin             |                              |         | -128   | dB/Hz |       |
| Optical Return Loss Tolerance                             | TOL             |                              |         | 20     | dB    |       |
| Transmitter Reflectance                                   | RT              |                              |         | -12    | dB    |       |
| Transmitter Eye Mask Margin                               | EMM             | 10                           |         |        | %     | 2     |
| Average Launch Power OFF Transmitter, each Lane           | Poff            |                              |         | -30    | dBm   |       |
| Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}  |                 | {0.31,0.4,0.450.34,0.38,0.4} |         |        |       |       |
| <b>Receiver</b>   |                 |                              |         |        |       |       |
| Center Wavelength   | $\lambda_C$     | 1295                         |         | 1325   | nm    |       |
| Damage Threshold  | THd             | +3                           |         |        | dBm   |       |
| Overload, each lane                                       | OVL             | +2.5                         |         |        | dBm   |       |
| Receiver Sensitivity in OMA, each Lane                    | SEN             |                              |         | -11.35 | dBm   | 3     |
| Signal Loss Assert Threshold                              | LOSA            | -30                          |         |        | dBm   |       |
| Signal Loss Deassert Threshold                            | LOSD            |                              |         | -12    | dBm   |       |
| LOS Hysteresis  | LOSH            | 0.5                          |         |        | dB    |       |
| Optical Return Loss                                       | ORL             |                              |         | -12    | dBm   |       |

**Notes:**

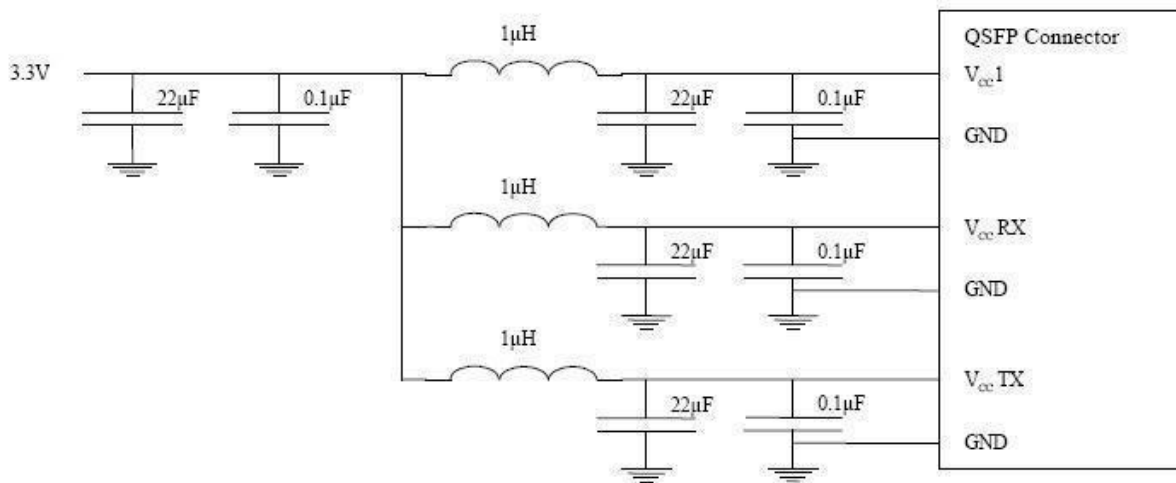
1. Transmitter wavelength, RMS spectral width and power need to meet the OMA minus TDP specs to guarantee link performance.
2. The eye diagram is tested with 1000 waveform.
3. Measured with a PRBS 2<sup>31</sup> -1 test pattern, @25.78Gb/s, BER<5\*10<sup>-5</sup>

**Digital Diagnostic Functions**

The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise specified.

| Parameter                               | Symbol    | Min  | Max | Unit | Notes                |
|---|-----------|------|-----|------|----------------------|
| Temperature monitor absolute error      | DMI_Temp  | -3   | 3   | degC | Over operating temp  |
| Supply voltage monitor absolute error   | DMI_VCC   | -0.1 | 0.1 | V    | Full operating range |
| Channel RX power monitor absolute error | DMI_RX    | -3   | 3   | dB   | Per channel          |
| Channel Bias current monitor            | DMI_Ibias | -10% | 10% | mA   | Per channel          |
| Temperature monitor absolute error      | DMI_Temp  | -3   | 3   | degC | Over operating temp  |

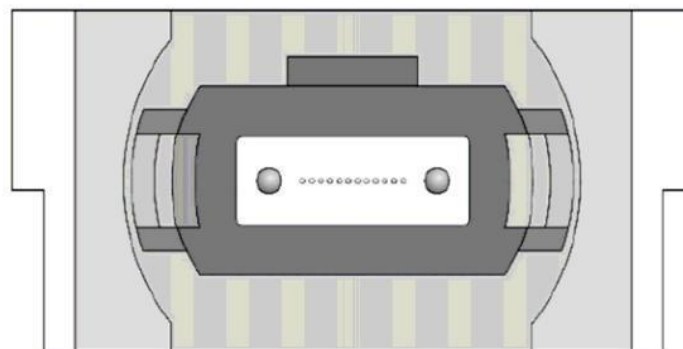
**Power Supply Filtering**



**Figure1. Host Board Power Supply Filtering**

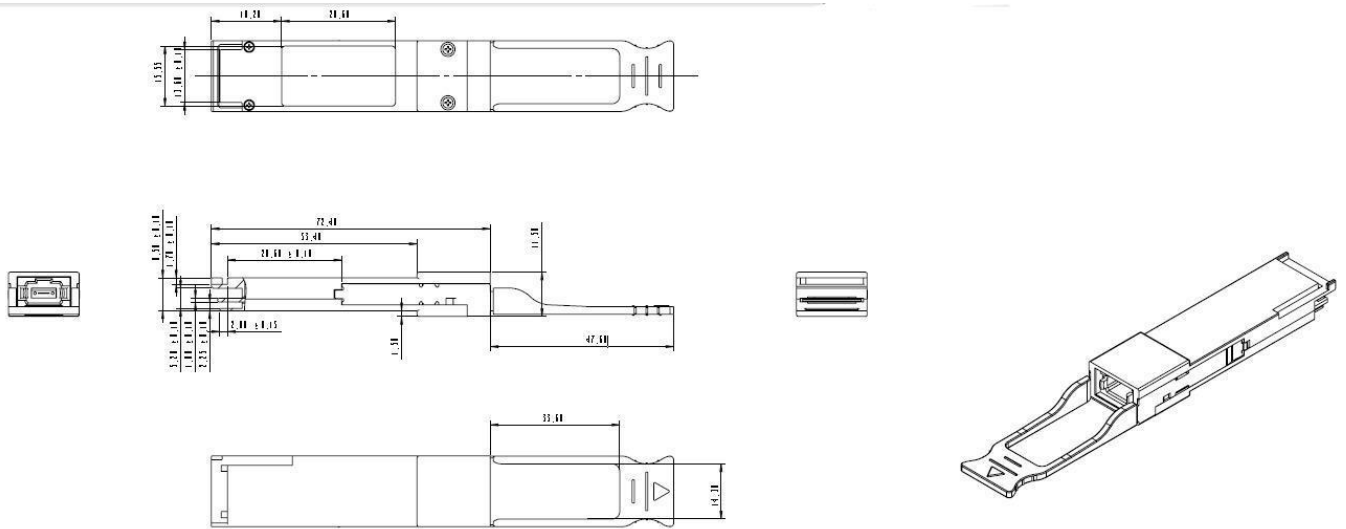
**Optical Interface Lanes and Assignment**

The optical interface port is a male MPO connector. The four fiber positions on the left as shown in Figure 2, with the key up, are used for the optical transmit signals (Channel 1 through4). The fiber positions on the right are used for the optical receive signals (Channel 4 through 1). The central four fibers are physically present.

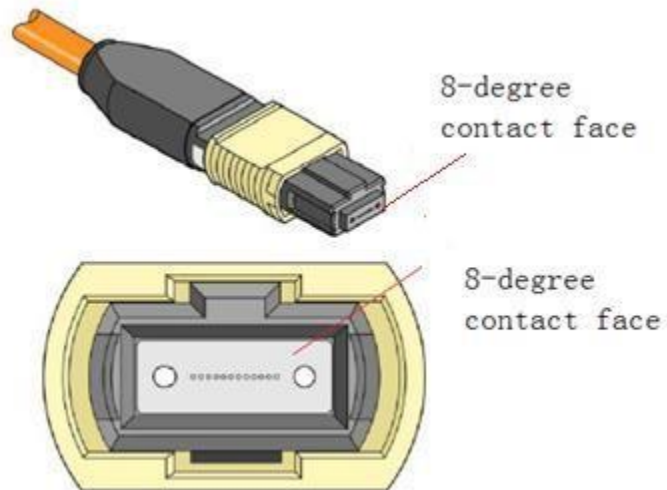


Transmit Channels: 1 2 3 4  
 Unused positions: x x x x  
 Receive Channels: 4 3 2 1

**Figure 2. Optical Receptacle and hannel Orientation**

**Mechanical Dimensions**

Attention: To minimize MPO connection induced reflections, an MPO receptacle with 8-degree angled end-face is utilized for this product. A male MPO connector with 8-degree end-face should be used with this product as illustrated in Figure 5.



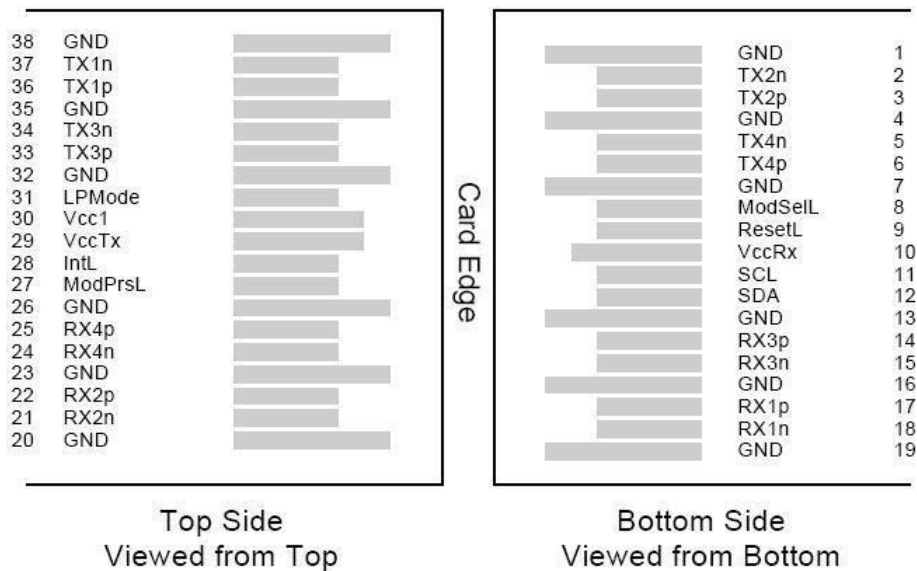
**ESD**

This transceiver is specified as ESD threshold 1kV for SFI pins and 2kV for all other electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still 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 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)

**Pin Assignment and Description**



**Pin Assignment**

| PIN# | Logic       | Symbol  | Description                          | Notes |
|------|-------------|---------|--------------------------------------|-------|
| 1    |             | GND     | Ground                               |       |
| 2    | CML-I       | Tx2n    | Transmitter Inverted Data Input      |       |
| 3    | CML-I       | Tx2p    | Transmitter Non-Inverted Data output |       |
| 4    |             | GND     | Ground                               |       |
| 5    | CML-I       | Tx4n    | Transmitter Inverted Data Input      |       |
| 6    | CML-I       | Tx4p    | Transmitter Non-Inverted Data output |       |
| 7    |             | GND     | Ground                               |       |
| 8    | LVTLL-I     | ModSelL | Module Select                        |       |
| 9    | LVTLL-I     | ResetL  | Module Reset                         |       |
| 10   |             | VccRx   | +3.3V Power Supply Receiver          |       |
| 11   | LVC MOS-I/O | SCL     | 2-Wire Serial Interface Clock        |       |
| 12   | LVC MOS-I/O | SDA     | 2-Wire Serial Interface Data         |       |
| 13   |             | GND     | Ground                               |       |
| 14   | CML-O       | Rx3p    | Receiver Non-Inverted Data Output    |       |
| 15   | CML-O       | Rx3n    | Receiver Inverted Data Output        |       |
| 16   |             | GND     | Ground                               |       |
| 17   | CML-O       | Rx1p    | Receiver Non-Inverted Data Output    |       |
| 18   | CML-O       | Rx1n    | Receiver Inverted Data Output        |       |
| 19   |             | GND     | Ground                               |       |
| 20   |             | GND     | Ground                               |       |
| 21   | CML-O       | Rx2n    | Receiver Inverted Data Output        |       |
| 22   | CML-O       | Rx2p    | Receiver Non-Inverted Data Output    |       |
| 23   |             | GND     | Ground                               |       |
| 24   | CML-O       | Rx4n    | Receiver Inverted Data Output        |       |
| 25   | CML-O       | Rx4p    | Receiver Non-Inverted Data Output    |       |
| 26   |             | GND     | Ground                               |       |
| 27   | LVTTL-O     | ModPrsL | Module Present                       |       |
| 28   | LVTTL-O     | IntL    | Interrupt                            |       |
| 29   |             | VccTx   | +3.3 V Power Supply transmitter      |       |
| 30   |             | Vcc1    | +3.3 V Power Supply                  |       |
| 31   | LVTTL-I     | LPMODE  | Low Power Mode                       |       |
| 32   |             | GND     | Ground                               |       |
| 33   | CML-I       | Tx3p    | Transmitter Non-Inverted Data Input  |       |
| 34   | CML-I       | Tx3n    | Transmitter Inverted Data Output     |       |
| 35   |             | GND     | Ground                               |       |
| 36   | CML-I       | Tx1p    | Transmitter Non-Inverted Data Input  |       |
| 37   | CML-I       | Tx1n    | Transmitter Inverted Data Output     |       |
| 38   |             | GND     | Ground                               |       |