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# Technical Datasheet

# QSFP-100G-ZR4-MSA-AT

## Universally Coded MSA Compliant 100GBase-ZR4 QSFP28 Transceiver

Hot Pluggable, +3.3V, LC Duplex, 1295nm to 1309nm, 80km, Commercial Temperature

### FEATURES

- 4 lanes MUX/DEMUX design
- LAN WDM EML laser+ PIN receiver
- Built-in 4-channel Clock and Data Recovery (CDR)
- Integrated LAN WDM TOSA / ROSA for up to 80 km reach over SMF G.652
- Supports 100GBASE-ZR4 for line rate of 103.125Gbps and OTU4 for line rate of 112.2Gbps
- Aggregate bandwidth of > 100Gbps
- Duplex LC connector
- Compliant with IEEE 802.3-2012 Clause 88 standard IEEE 802.3bm CAUI-4 chip to module electrical standard ITU-T G.959.1-2012-02 standard
- Single +3.3V power supply operating
- Built-in digital diagnostic functions
- Temperature range 0°C to 70°C
- RoHS Compliant Part

### APPLICATIONS

- Local Area Network (LAN)
- Wide Area Network (WAN)
- Ethernet switches and router applications

### DESCRIPTION

ATGBICS QSFP-100G-ZR4-MSA-AT is a transceiver module designed for 80km optical communication applications. The design is compliant to 100GBASE-ZR4 of the IEEE 802.3-2012 Clause 88 standard IEEE 802.3bm CAUI-4 chip to module electrical standard ITU-T G.959.1-2012-02 standard . The module converts 4 inputs channels (ch) of 25.78 Gbps to 27.95Gbps electrical data to 4 lanes optical signals, and multiplexes them into a single channel for 100Gb/s optical transmission. Reversely, on the receiver side, the module




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optically de-multiplexes a 100Gb/s input into 4 lanes signals, and converts them to 4 lanes output electrical data.

The central wavelengths of the 4 lanes are 1296 nm, 1300 nm, 1305 nm and 1309 nm . It contains a duplex LC connector for the optical interface and a 38-pin connector for the electrical interface. To minimize the optical dispersion in the long-haul system, single-mode fiber (SMF) has to be applied in this module.

The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP28 Multi-Source Agreement (MSA). It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.

The module operates from a single +3.3V power supply and LVCMOS/LVTTL global control signals such as Module Present, Reset, Interrupt and Low Power Mode are available with the modules. A 2-wire serial interface is available to send and receive more complex control signals and to obtain digital diagnostic information. Individual channels can be addressed and unused channels can be shut down for maximum design flexibility.

This product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP28 Multi-Source Agreement (MSA). It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference. The module offers very high functionality and feature integration, accessible via a two-wire serial interface.

## ABSOLUTE MAXIMUM RATINGS

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

| Parameter | Symbol | Min | Max | Unit | Note |
|---|---|---|---|---|---|
| Storage Temperature | $T_O$ | -40 | 85 | °C | |
| Relative Humidity(non-condensing) | RH | 0 | 85 | % | |
| Operating Case Temperature | $T_O$ | 0 | 70 | degC | |
| Supply Voltage | VccT, R | -0.5 | 4 | V | |

## RECOMMENDED OPERATING CONDITIONS AND SUPPLY REQUIREMENTS

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|---|---|---|---|---|---|
| Case operating Temperature | TC | 0 | | +70 | °C |
| Supply Voltage | VCCT, R | +3.13 | 3.3 | +3.47 | V |
| Supply Current | ICC | | 1100 | 1500 | mA |
| Power Dissipation | PD | | | 5 | W |




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## Electrical Characteristics (TOP = 0 to 70 °C, VCC = 3.13 to 3.47 Volts

| Parameter | Symbol | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|
| Data Rate per Channel | | - | 25.78125 | | Gbps | |
| | | | 27.9525 | | | |
| Power Consumption | | - | 3.6 | 5.5 | W | |
| Supply Current | Icc | | 1.1 | 1.5 | A | |
| Control I/O Voltage-High | VIH | 2.0 | | Vcc | V | |
| Control I/O Voltage-Low | VIL | 0 | | 0.7 | V | |
| Inter-Channel Skew | TSK | | | 35 | Ps | |
| RESETL Duration | | | 10 | | Us | |
| RESETL De-assert time | | | | 100 | ms | |
| Power On Time | | | | 100 | ms | |
| Transmitter | | | | | | |
| Single Ended Output Voltage Tolerance | | 0.3 | | Vcc | V | 1 |
| Common mode Voltage Tolerance | | 15 | | | mV | |
| Transmit Input Diff Voltage | VI | 150 | | 1200 | mV | |
| Transmit Input Diff Impedance | ZIN | 85 | 100 | 115 | | |
| Data Dependent Input Jitter | DDJ | | 0.3 | | UI | |
| Receiver | | | | | | |
| Single Ended Output Voltage Tolerance | | 0.3 | | 4 | V | |
| Rx Output Diff Voltage | Vo | 370 | 600 | 950 | mV | |
| Rx Output Rise and Fall Voltage | Tr/Tf | | | 35 | ps | 1 |
| Total Jitter | TJ | | 0.3 | | UI | |

Note:

20 ~ 80%




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## Optical Parameters(TOP = 0 to 70 °C, VCC = 3.0 to 3.6 Volts)

| Parameter | Symbol | Min | Typ | Max | Unit | Ref. |
|---|---|---|---|---|---|---|
| Transmitter | | | | | | |
| Wavelength Assignment | 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 | |
| Side-mode Suppression Ratio | SMSR | 30 | - | - | dB | |
| Total Average Launch Power | PT | 8.0 | - | 10.5 | dBm | |
| Average Launch Power, each Lane | | 2.0 | - | 4.5 | dBm | |
| Difference in Launch Power between any two Lanes (OMA) | | - | - | 6.5 | dB | |
| Optical Modulation Amplitude, each Lane | OMA | | | 3.5 | dBm | |
| Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane | | -4.8 | - | | dBm | |
| TDP, each Lane | TDP | | | 2.2 | dB | |
| Extinction Ratio | ER | 6.0 | - | - | dB | |
| Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3} | | {0.25, 0.4, 0.45, 0.25, 0.28, 0.4} | | | | |
| Optical Return Loss Tolerance | | - | - | 20 | dB | |
| Average Launch Power OFF Transmitter, each Lane | Poff | | | -30 | dBm | |
| Relative Intensity Noise | Rin | | | -128 | dB/HZ | 1 |
| Optical Return Loss Tolerance | | - | - | 12 | dB | |
| Receiver | | | | | | |
| Damage Threshold | THd | 3.3 | | | dBm | 1 |
| Average Power at Receiver Input, each Lane | R | -10.6 | | 0 | dBm | |
| RSSI Accuracy | | -2 | | 2 | dB | |
| Receiver Reflectance | Rrx | | | -26 | dB | |
| Receiver Power (OMA), each Lane | | - | - | 7 | dBm | |
| LOS De-Assert | LOSD | | | -15 | dBm | |
| LOS Assert | LOSA | -25 | | | dBm | |
| LOS Hysteresis | LOSH | 0.5 | | | dB | |




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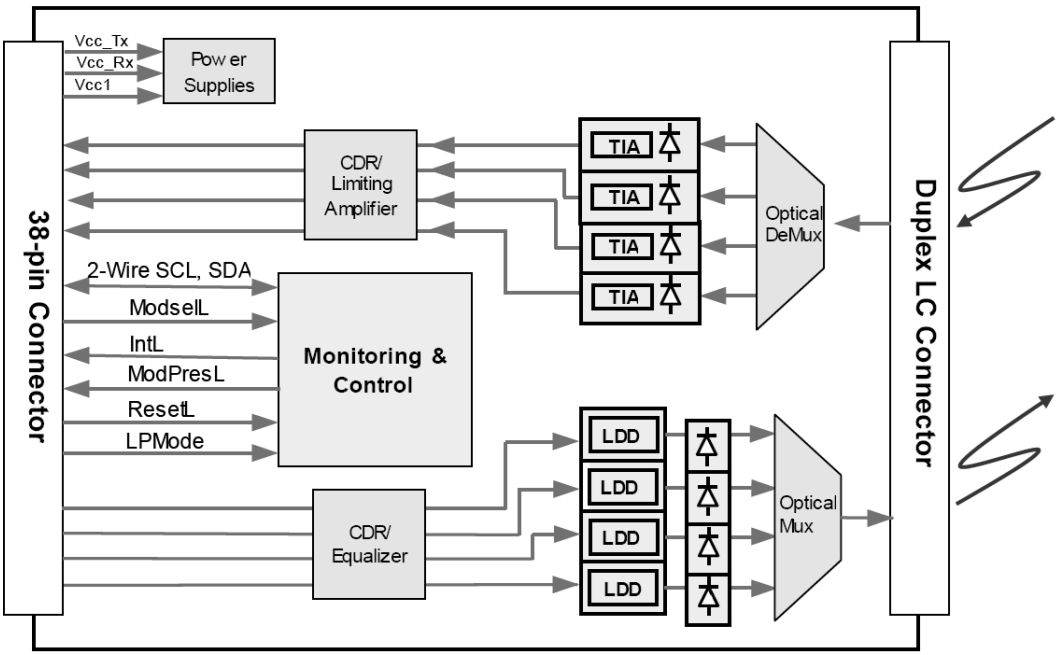
Note

12dB Reflection

## Transceiver Block Diagram



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## PIN ASSIGNMENT

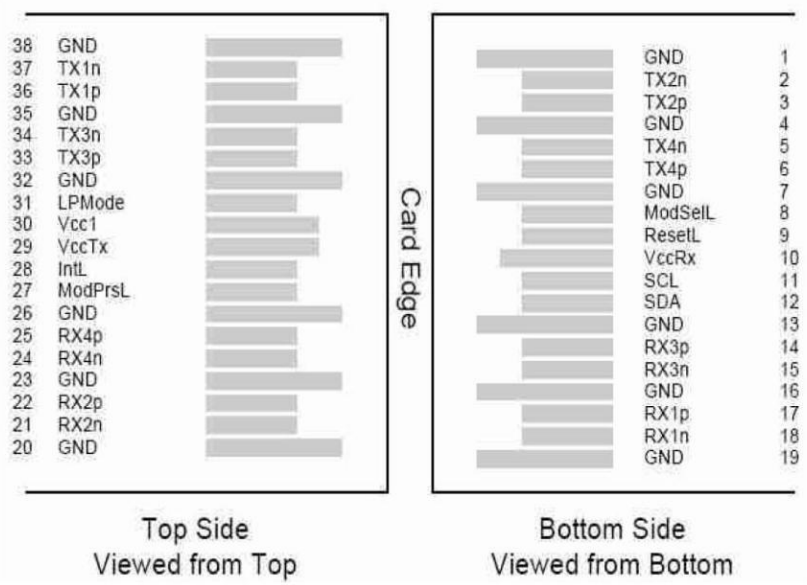


Diagram of Host Board Connector Block Pin Numbers and Name

## Pin Description

| Pin | Logic | Symbol | Name/Description | Ref. |
|---|---|---|---|---|
| 1 | | GND | Ground | 1 |
| 2 | CML-I | Tx2n | Transmitter Inverted Data Input | |
| 3 | CML-I | Tx2p | Transmitter Non-Inverted Data output | |
| 4 | | GND | Ground | 1 |
| 5 | CML-I | Tx4n | Transmitter Inverted Data Output | |
| 6 | CML-I | Tx4p | Transmitter Non-Inverted Data Output | |
| 7 | | GND | Ground | 1 |
| 8 | LVTTL-I | ModSelL | Module Select | |
| 9 | LVTTL-I | ResetL | Module Reset | |
| 10 | | VccRx | +3.3V Power Supply Receiver | 2 |
| 11 | LVCMOS-I/O | SCL | 2-Wire Serial Interface Clock | |
| 12 | LVCMOS-I/O | SDA | 2-Wire Serial Interface Data | |
| 13 | | GND | Ground | 1 |
| 14 | CML-O | Rx3p | Receiver Inverted Data Output | |




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| | | | | |
|---|---|---|---|---|
| 15 | CML-O | Rx3n | Receiver Non-Inverted Data Output | |
| 16 | | GND | Ground | 1 |
| 17 | CML-O | Rx1p | Receiver Inverted Data Output | |
| 18 | CML-O | Rx1n | Receiver Non-Inverted Data Output | |
| 19 | | GND | Ground | 1 |
| 20 | | GND | Ground | 1 |
| 21 | CML-O | Rx2n | Receiver Inverted Data Output | |
| 22 | CML-O | Rx2p | Receiver Non-Inverted Data Output | |
| 23 | | GND | Ground | 1 |
| 24 | CML-O | Rx4n | Receiver Inverted Data Output | |
| 25 | CML-O | Rx4p | Receiver Non-Inverted Data Output | |
| 26 | | GND | Ground | 1 |
| 27 | LVTTL-O | ModPrsL | Module Present | |
| 28 | LVTTL-O | IntL | Interrupt | |
| 29 | | VccTx | +3.3V Power Supply Transmitter | 2 |
| 30 | | Vcc1 | +3.3V Power Supply | 2 |
| 31 | LVTTL-I | LPMode | Low Power Mode | |
| 32 | | GND | Ground | 1 |
| 33 | CML-I | Tx3p | Transmitter Inverted Data Output | |
| 34 | CML-I | Tx3n | Transmitter Non-Inverted Data Output | |
| 35 | | GND | Ground | 1 |
| 36 | CML-I | Tx1p | Transmitter Inverted Data Output | |
| 37 | CML-I | Tx1n | Transmitter Non-Inverted Data Output | |
| 38 | | GND | Ground | 1 |

Notes:

GND is the symbol for single and supply(power) common for QSFP28 modules, All are common within the QSFP28 module and all module voltages are referenced to this potential otherwise noted. Connect these directly to the host board signal common ground plane. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.

VccRx, Vcc1 and VccTx are the receiver and transmitter power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown below. VccRx, Vcc1 and VccTx may be internally connected within the QSFP28 transceiver module in any combination. The connector pins are each rated for maximum current of 500mA.




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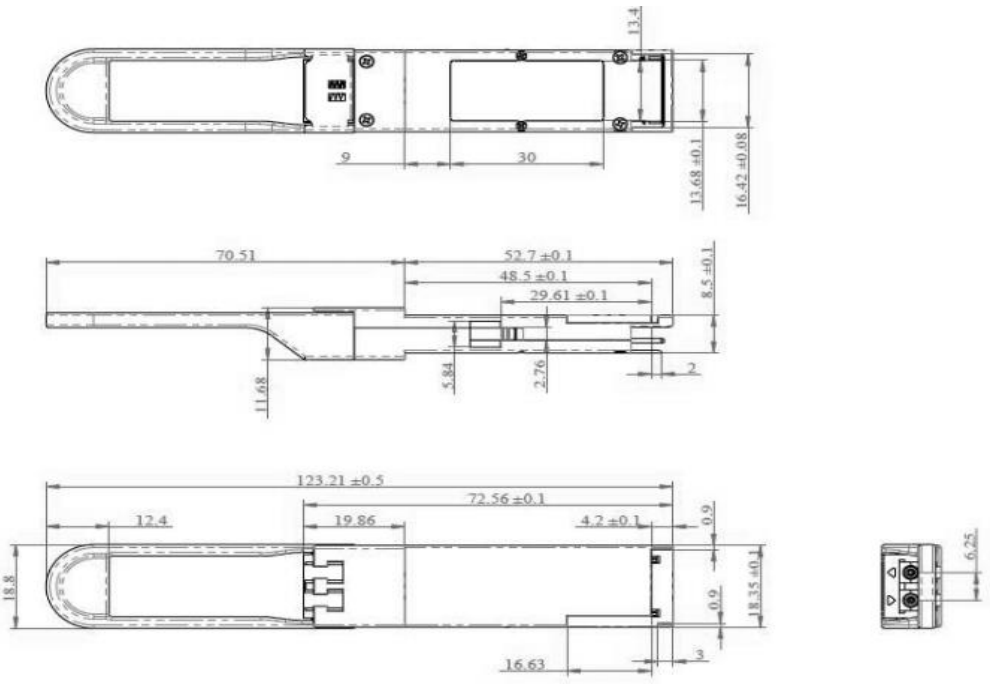
## Mechanical Dimensions







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