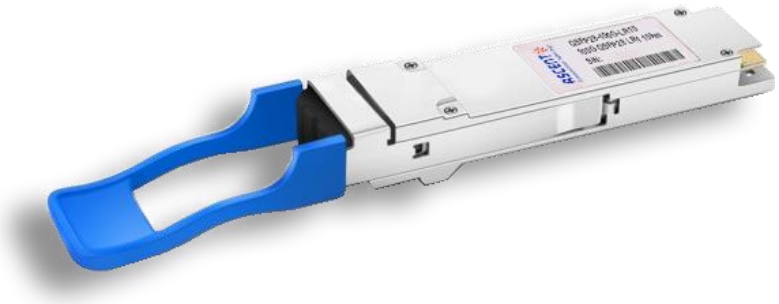
# 100G QSFP28 LR1 10 km Transceiver

## QSFP28 Series



- QSFP28 MSA compliant
- IEEE 802.3cu compliant
- Optical light source: single channel 1310nm EA-DFB LD
- Optical receiver: single channel PIN photo detector
- Max. power consumption 4 W
- Up to 10 km transmission on single-mode fiber
- Operating case temperature: 0 °C to 70 °C
- LC connector
- Single 3.3V power supply
- RoHS 2.0 compliant

Ascent's QSFP28 100G LR1 Ethernet module is a transceiver module designed for 10km optical communication applications, and it is compliant with IEEE 802.3cd and QSFP28 MSA standard.

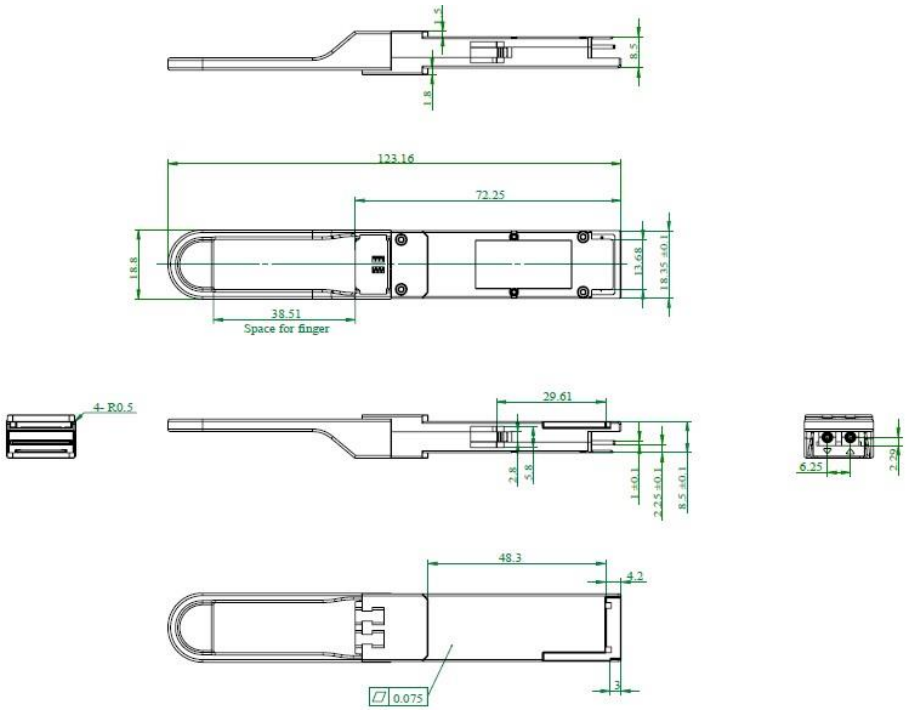
QSFP28-100G-LR10 can be used in Data Centers, High-speed interconnects within and between switches, routers and transport equipment, Server-Server Clusters, Super-computing interconnections and other network applications.

This module incorporates one channel optical signal, on 1310nm center wavelength, operating at 50G baud data rate. The transmitter path incorporates an EML Driver integrated in the DSP and a cooled EML together. On the receiver path, the input optical signal is coupled to a Pin photodiode detector. It 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.

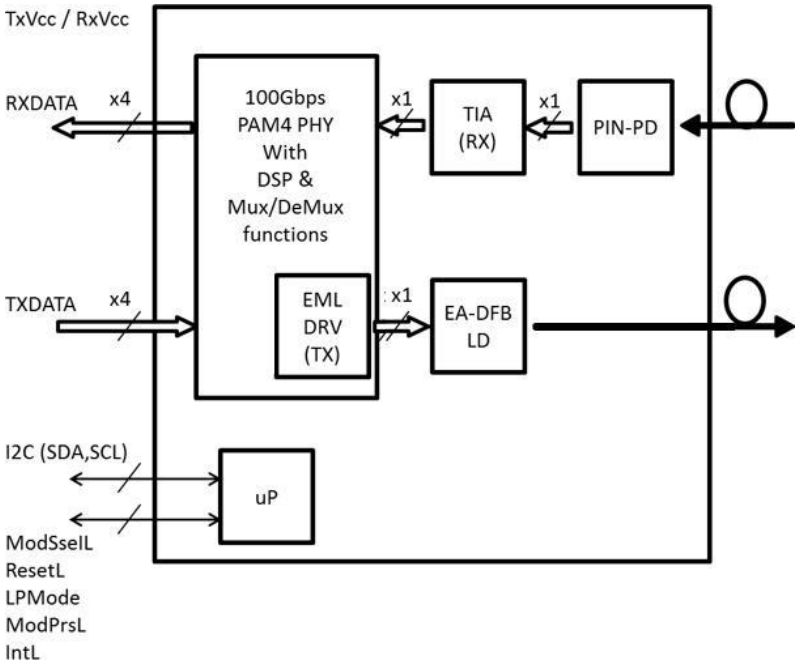
## Key Features

- Compliant with QSFP28 Standard: SFF-8636 Rev 2.10a
- Compliant with IEEE802.3cu D3.2 100GBASE-LR1
- High speed I/O electrical interface (CAUI-4)
- Single 3.3V Supply Voltage
- Maximum power consumption 4.5W
- 0-70 ºC Case Operating Temperature
- 1311nm EML laser and PIN Receiver
- Hermetically sealed TO Based design
- QSFP28 MSA package with duplex LC connector
- Two Wire Serial Interface with Digital Diagnostic Monitoring
- KP4 FEC termination inside module
- Supporting 10km reach of single mode fiber
- Complies with EU Directive 2011/65/EU (RoHS compliant)
- Class 1 Laser

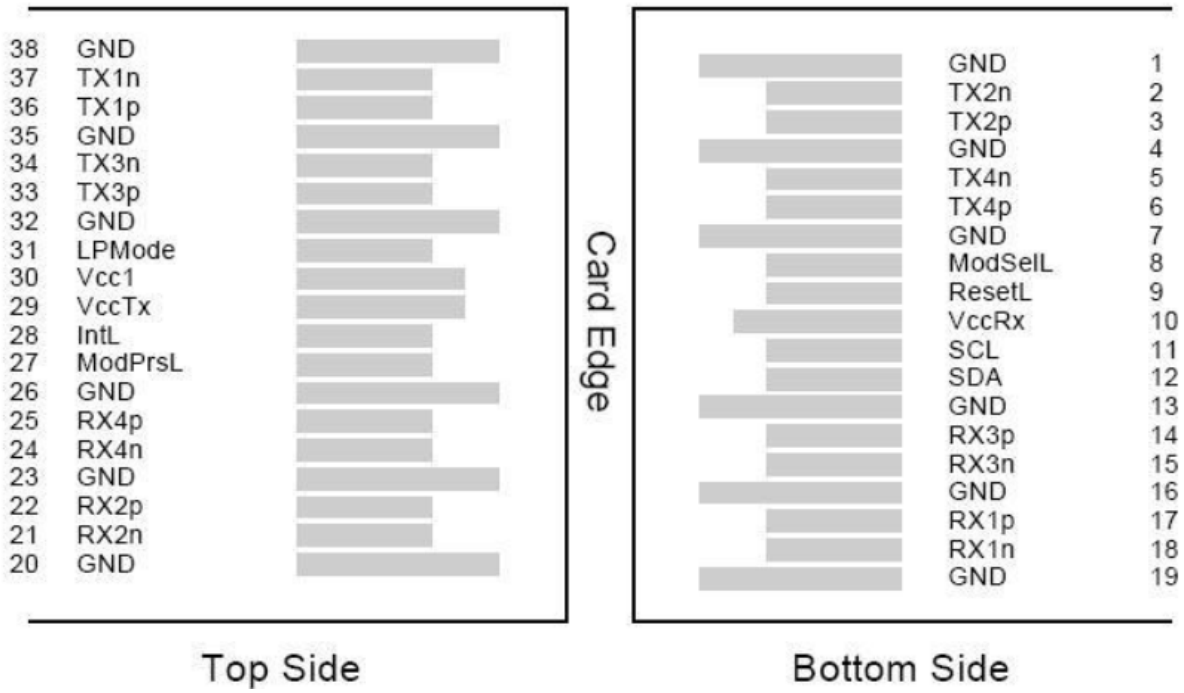
## Outline Diagram



## Host-Transceiver Block Diagram




## Pin Assignment




**Pin out of Connector Block on Host Board**

| Pin | Symbol | Name/Description | Note |
|---|---|---|---|
| 1 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 2 | Tx2n | Transmitter Inverted Data Input | |
| 3 | Tx2p | Transmitter Non-Inverted Data output | |
| 4 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 5 | Tx4n | Transmitter Inverted Data Input | |
| 6 | Tx4p | Transmitter Non-Inverted Data output | |
| 7 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 8 | ModSelL | Module Select | |
| 9 | ResetL | Module Reset | |
| 10 | VccRx | 3.3V Power Supply Receiver | 2 |
| 11 | SCL | 2-Wire serial Interface Clock | |
| 12 | SDA | 2-Wire serial Interface Data | |
| 13 | GND | Transmitter Ground (Common with Receiver Ground) | |
| 14 | Rx3p | Receiver Non-Inverted Data Output | |
| 15 | Rx3n | Receiver Inverted Data Output | |
| 16 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 17 | Rx1p | Receiver Non-Inverted Data Output | |
| 18 | Rx1n | Receiver Inverted Data Output | |
| 19 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 20 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 21 | Rx2n | Receiver Inverted Data Output | |
| 22 | Rx2p | Receiver Non-Inverted Data Output | |
| 23 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 24 | Rx4n | Receiver Inverted Data Output | 1 |
| 25 | Rx4p | Receiver Non-Inverted Data Output | |
| 26 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 27 | ModPrsl | Module Present | |
| 28 | IntL | Interrupt | |
| 29 | VccTx | 3.3V power supply transmitter | 2 |
| 30 | Vcc1 | 3.3V power supply | 2 |
| 31 | LPMode | Low Power Mode, not connect | |
| 32 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 33 | Tx3p | Transmitter Non-Inverted Data Input | |
| 34 | Tx3n | Transmitter Inverted Data Output | |
| 35 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 36 | Tx1p | Transmitter Non-Inverted Data Input | |
| 37 | Tx1n | Transmitter Inverted Data Output | |
| 38 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |

**Notes:**

1. GND is the symbol for signal and supply (power) common for QSFP+ modules. All are common within the QSFP+ 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. VccRx, Vcc1 and VccTx are the receiving and transmission power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown below. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP+ transceiver module in any combination. The connector pins are each rated for a maximum current of 500 mA.

## Specifications

### Absolute Maximum Ratings

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Notes |
|---|---|---|---|---|---|---|
| Storage Temperature | TS | -40 | - | +85 | ºC | |
| Supply Voltage | VCC | -0.3 | - | 3.6 | V | |
| Relative Humidity (Non-Condensing) | RH | 5 | - | 95 | % | |
| Data Input Voltage – Differential | $\lvert V_{DIP}-V_{DIN}\rvert$ | - | - | 1.0 | V | |
| Control Input Voltage | $V_I$ | -0.3 | - | Vcc+0.3 | V | |
| Control Output Current | $I_O$ | -20 | - | 20 | mA | |

### Recommended Operating Conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Operating Case Temperature | $T_{OPR}$ | 0 | - | 70 | °C | |
| Power Supply Voltage | $V_{CC}$ | 3.135 | 3.3 | 3.465 | V | |
| Instantaneous Peak Current at Hot Plug | $I_{CC\_IP}$ | - | - | 1800 | mA | |
| Sustained Peak Current at Hot Plug | $I_{CC\_SP}$ | - | - | 1485 | mA | |
| Maximum Power Dissipation | $P_D$ | - | - | 4.5 | W | 1 |
| Maximum Power Dissipation, Low Power Mode | $P_{DLP}$ | - | - | 1.5 | W | |
| Signaling Rate | SR | - | 53.125 | - | GBd | |
| Control Input Voltage High | $V_{IH}$ | $V_{CC}$*0.7 | - | $V_{CC}$+0.3 | V | |
| Control Input Voltage Low | $V_{IL}$ | -0.3 | - | $V_{CC}$*0.3 | V | |
| Two Wire Serial Interface Clock Rate | - | - | - | 400 | kHz | |
| Power Supply Noise | - | - | - | 66 | mVpp | 2 |
| Rx Differential Data Output Load | - | - | 100 | - | ohms | |
| Operating Distance | - | 2 | - | 10000 | m | |

**Notes:**

1. With power supply voltage 3.3 V.

2. 10Hz -10MHz

**Optical and Electrical Characteristics**

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | |
| Wavelength | $\lambda_C$ | 1304.5 | 1311 | 1317.5 | nm | |
| Side Mode Suppression Ratio | SMSR | 30 | - | - | dB | |
| Average Optical Launch Power | $P_{OUT}$ | -1.9 | - | 4.8 | dBm | 1 |
| Average Launch Power of OFF Transmitter | $P_{OUT\_OFF}$ | - | - | -15 | dBm | |
| Extinction Ratio | ER | 3.5 | - | - | dB | |
| Outer Optical Modulation Amplitude | $OMA_{outer}$ | - | - | 5 | dBm | |
| Outer Optical Modulation Amplitude | $OMA_{outer}$ | | | | | |
| for TDECQ <1.4 dB | | 1.1 | - | - | dBm | |
| for 1.4 dB ≤TDECQ ≤3.4 dB | | -0.3+ TDECQ | - | - | dBm | |
| Transmitter and Dispersion Eye Closure | TDECQ | - | - | 3.4 | dB | |
| Transmitter eye closure for PAM4 | TECQ | | | | | |
| (TECQ) | | - | - | 3.4 | dB | |
| \|TDECQ - TECQ\| | - | - | - | 2.5 | dB | |
| Over/Under-Shoot | - | - | - | 22 | % | |
| Transmitter Power Excursion | - | - | - | 2.8 | dBm | |
| RIN15.6OMA | RIN | - | - | -136 | dB/Hz | |
| Optical return loss tolerance | ORLT | - | - | 15.6 | dB | |
| Transmitter transition time | | - | - | 17 | ps | |
| Transmitter reflectance | TR | - | - | -26 | dB | |
| **Receiver** | | | | | | |
| Wavelength | λC | 1304.5 | 1311 | 1317.5 | nm | |
| Damage Threshold | | 5.8 | - | - | dBm | |
| Average Receive Power | | -8.2 | - | 4.8 | dBm | 2 |
| Receive Power ($OMA_{outer}$) | RP | - | - | 5 | dBm | |
| Receiver Reflectance | RR | - | - | -26 | dB | |
| Receiver Sensitivity ($OMA_{outer}$) | RS | | | | | |
| for TECQ < 1.4 dB | | - | - | -6.1 | dBm | |
| for 1.4 dB≤ TECQ ≤3.4 dB | | - | - | -7.5+ TECQ | dBm | |
| Stressed Receiver Sensitivity | SRS | - | - | -4.1 | dBm | 3 |
| **Stressed Receiver Sensitivity Test Conditions** | | | | | | |
| Stressed eye closure for PAM4 (SECQ) | SECQ | - | - | 3.4 | dB | |

**Notes:**

1. Average launch power is informative and not the principal indicator of signal strength.
2. Average receive power (min) is informative and not the principal indicator of signal strength.
3. Measured with conformance test signal at TP3 for the BER = $2.4 \times 10^{-4}$.

**Electrical Specifications High Speed Signal**

Compliant with IEEE 802.3 CAUI-4

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| **Receiver (Module Output)** | | | | | | |
| AC Common-Mode Output Voltage (RMS) | | - | - | 17.5 | mV | |
| Differential Output Voltage | | - | - | 900 | mV | |
| Eye Width | | 0.57 | - | - | UI | |
| Eye Height Differential | | 228 | - | - | mV | |
| Vertical Eye Closure | | - | - | 5.5 | dB | |
| Differential Termination Mismatch | | - | - | 10 | % | |
| Transition Time (20% to 80%) | | 12 | - | - | ps | |
| DC Common Mode Voltage | | -350 | - | 2850 | mV | |
| **Transmitter (Module Input)** | | | | | | |
| Differential pk-pk Input Voltage Tolerance | | 900 | - | - | mV | |
| Differential Termination Mismatch | | - | - | 10 | % | |
| Single-Ended Voltage Tolerance Range | | -0.4 | - | 3.3 | V | |
| DC Common Mode Voltage | | -350 | - | 2850 | mV | |

**Electrical Specification Low Speed Signal**

Compliant with SFF-8679 Rev 1.8

| Parameter | Symbol | Min. | Max. | Unit | Condition |
|---|---|---|---|---|---|
| Module Output SCL and SDA | VOL | 0 | 0.4 | V | |
| | VOH | Vcc-0.5 | Vcc+0.3 | V | |
| Module Input SCL and SDA | VIL | -0.3 | Vcc*0.3 | V | |
| | VIH | Vcc*0.7 | Vcc+0.5 | V | |
| LPMode/TxDis, ResetL, and ModSelL | VIL | -0.3 | 0.8 | V | |
| | VIH | 2 | Vcc+0.3 | V | |
| ModPrsL and IntL/RxLOSL | VOL | 0 | 0.4 | V | |
| | VOH | Vcc-0.5 | Vcc+0.3 | V | |

**Digital Diagnostics**

| Parameter | Range | Accuracy | Unit | Calibration |
|---|---|---|---|---|
| Temperature | 0 to 70 | ±3 | °C | Internal |
| Voltage | 0 to VCC | ±3% | V | Internal |
| Tx Bias Current | 0 to 100 | ±10% | mA | Internal |
| Tx Output Power | -1.9 to +4.8 | ±3 | dB | Internal |
| Rx Receive Power | -8.2 to +4.8 | ±3 | dB | Internal |

## Ordering Information

| Product Name | Product Description |
|---|---|
| QSFP28-100G-LR10 | QSFP28 Plug-in, 100GBASE-LR1, Single Channel 1310nm, 10km Optical Transceiver, LC, DOM |

## Contact Information

**Ascent Communication Technology Ltd**

**AUSTRALIA**
140 William Street, Melbourne
Victoria 3000, AUSTRALIA
Phone: +61-3-8691 2902

**CHINA**
Unit 1933, 600 Luban Road
200023, Shanghai CHINA
Phone: +86-21-60232616

**EUROPE**
Pfarrer-Bensheimer-Strasse 7a
55129 Mainz, GERMANY
Phone: +49 (0) 6136 926 3246

**HONG KONG SAR**
Unit 9, 12th Floor, Wing Tuck Commercial Centre
177 Wing Lok Street, Sheung Wan, HONG KONG
Phone: +852-2851 4722

**USA**
2710 Thomes Ave
Cheyenne, WY 82001, USA
Phone: +1-203 816 5188

**VIETNAM**
15 /F TTC Building, Duy Tan Street
Cau Giay Dist., Hanoi, VIETNAM
Phone: +84 243 795 5917

**WEB:** www.ascentcomtec.com

**EMAIL:** sales@ascentcomtec.com


Ver. ACT_QSFP28-100G-LR10_Datasheet_V1b_Nov_2020