

# Technical Datasheet

## AOC-QSFP28-100G-8M-AT

### Universally Coded MSA 100GBASE-SR4 QSFP28 to QSFP28 Active Optical Cable, 8m

#### FEATURES

- Compliant with 100GBASE-SR4 and CAUI-4 specification per IEEE 802.3bm
- Compliant to SFF-8665 (QSFP28 Solution) Revision 1.8
- Supports 100 Gbps data rate links up to 70m/100 m via OM3/OM4, respectively.
- VCSEL array transmitter and PIN array receiver
- Low power consumption of max 3.5W
- Hot pluggable electrical interface
- Using standard 12/8 lane optical fiber with 3-mm round cable
- 0 to 70°C case temperature operating range
- RoHS-6 Compliant (lead-free)

#### APPLICATIONS

- Ethernet for 100GBASE-SR4
- InfiniBand EDR, FDR, & QDR
- HPC Interconnects
- Proprietary Interconnections

#### DESCRIPTION

ATGBICS Universally Coded MSA AOC-QSFP28-100G-8M-AT QSFP28 active optical cables are high-performance active optical cable with bi-directional signal transmission and aggregate 100-Gbps bandwidth for both InfiniBand EDR and Ethernet 100G-SR4 applications. Compared to conventional copper cables, longer and lighter optical cables enable the ease of complicated data-center cabling. The AOCs utilize multimode fiber with 850-nm VCSELs and PIN PDs. The certificated cables have superior signal integrity and bit- error-rate, which enables reliable operation performance.

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## Absolute Maximum Ratings

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

| Parameter                       | Min  | Max | Unit                 | Note |
|---------------------------------|------|-----|----------------------|------|
| Storage Temperature             | 0    | 70  | °C                   | 1    |
| 3.3V Power Supply Voltage       | -0.5 | 3.6 | V                    |      |
| Data Input Voltage-Single Ended | -0.5 |     | V <sub>cc</sub> +0.5 |      |
| Control Input Voltage           | -0.5 | 3.6 | V                    |      |
| Relative Humidity               | 5    | 85  | %                    | 2    |

### Note:

1. Limited by the fiber cable jacket, not the active ends
2. Non-condensing

## Recommended Operating Conditions

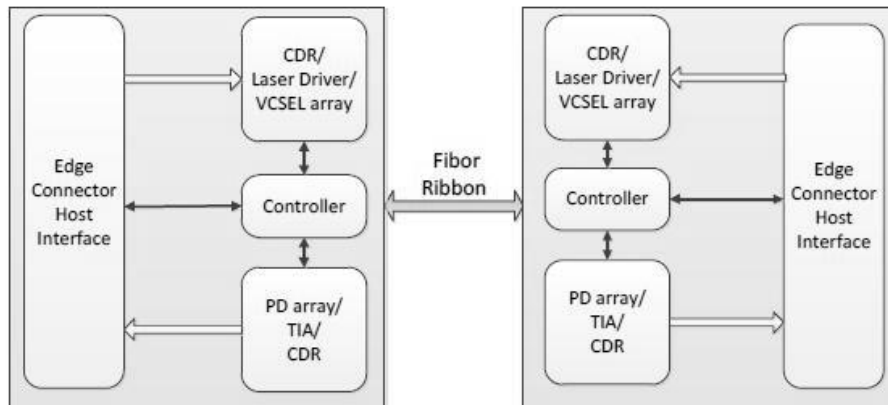
| Parameter                                  | Min   | Typical | Max                  | Unit | Note    |
|--|-------|---------|----------------------|------|---------|
| Case Operating Temperature                 | 0     |         | 70                   | °C   |         |
| Power Supply Voltage                       | 3.135 | 3.3     | 3.465                | V    |         |
| Date Rate per Channel                      |       |         | 25.78125             | Gbps |         |
| Bit Error Ratio (BER)                      |       | 10-12   |                      |      | 1, 2    |
| Control Input Voltage High                 | 2     |         | V <sub>cc</sub> +0.3 | V    |         |
| Control Input Voltage Low                  | -0.3  |         | 0.8                  | V    |         |
| Two Wire Serial (TWS) Interface Clock Rate |       |         | 400                  | kHz  |         |
| Differential Data Input / Output Load      |       | 100     |                      | Ohms | +/- 10% |
| Standard Cable Lengths                     |       |         | 100                  | m    | 3       |

### Note:

1. Bit-Error-Rate (BER) is tested with PRBS 2<sup>31</sup>-1 pattern
2. 100G QSFP28 AOC cable requires an electrical connector compliant with SFF-8662 or SFF-8672 which is used on the host board in order to guarantee its electrical interface specification.
3. Per 100GBASE-SR4 Standard, cable length supports up to 70m / 100m via OM3 / OM4, respectively. Different cable length within this range upon customization.

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## Functional Description of Transceiver



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## Electrical Specifications

| Parameter   | Symbol | Min       | Typical | Max  | Unit | Note |
|---|--------|-----------|---------|------|------|------|
| <b>Transceiver Electrical Characteristics</b>               |        |           |         |      |      |      |
| TRx Power Consumption                                       |        |           | 2.5     | 3.5  | W    |      |
| TRx Power-on Initialization Time                            |        |           |         | 2000 | ms   |      |
| <b>CAUI-4 Module Electrical Input Characteristics (TP1)</b> |        |           |         |      |      |      |
| Single Ended Input Voltage Tolerance                        |        | -0.4      |         | 3.3  | V    |      |
| Differential pk-pk input voltage tolerance                  |        | 900       |         |      | mV   |      |
| Differential Input Return Loss                              | Sdd11  | See Eq. 1 |         |      | dB   | 1    |
| Differential to Common-mode Input Return Loss               | Sdc11  | See Eq. 2 |         |      | dB   | 2    |
| DC common mode voltage                                      |        | -350      |         | 2850 | mV   |      |

### Notes:

$$1. \quad RLd(f) \geq \begin{cases} 9.5 - 0.37f & 0.01 \leq f < 8 \\ 4.75 - 7.4 \log_{10} \left( \frac{f}{14} \right) & 8 \leq f < 19 \end{cases} \text{ (dB)} \quad \text{(Eq.1)}$$

where

$f$  is the frequency in GHz

$RLd$  is the CAUI-4 Chip-to-module input differential return loss

$$2. \quad RLdc(f) \geq \begin{cases} 22 - 20 \left( \frac{f}{25.78} \right) & 0.01 \leq f < 12.89 \\ 15 - 6 \left( \frac{f}{25.78} \right) & 12.89 \leq f < 19 \end{cases} \text{ (dB)} \quad \text{(Eq.2)}$$

where

$f$  is the frequency in GHz

$RLdc$  is the CAUI-4 Chip-to-module input differential to common mode input return loss

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| Parameter  | Symbol | Min  | Typical   | Max  | Unit | Note |
|--|--------|------|-----------|------|------|------|
| <b>CAUI-4 Module Electrical Output Characteristics (TP4)</b> |        |      |           |      |      |      |
| 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 Output Return Loss                              | Sdd22  |      | See Eq. 1 |      | dB   | 1    |
| Common to Differential Mode Conversion Return Loss           | Scd22  |      | See Eq. 2 |      | dB   | 2    |
| Transition Time (20% to 80%)                                 |        | 12   |           |      | ps   |      |
| DC Common Voltage  |        | -350 |           | 2850 | mV   |      |

**Notes:**

$$1. \quad RLd(f) \geq \begin{cases} 9.5 - 0.37f & 0.01 \leq f < 8 \\ 4.75 - 7.4 \log_{10} \left( \frac{f}{14} \right) & 8 \leq f < 19 \end{cases} \quad (\text{dB}) \quad (\text{Eq.1})$$

where

$f$  is the frequency in GHz

$RLd$  is the CAUI-4 Chip-to-module host output differential return loss

$$2. \quad RLdc(f) \geq \begin{cases} 22 - 20 \left( \frac{f}{25.78} \right) & 0.01 \leq f < 12.89 \\ 15 - 6 \left( \frac{f}{25.78} \right) & 12.89 \leq f < 19 \end{cases} \quad (\text{dB}) \quad (\text{Eq.2})$$

where

$f$  is the frequency in GHz

$RLdc$  is the CAUI-4 Chip-to-module output common to differential mode conversion return loss

**Optical Cable Specification**

| Parameter                     | Specification                     | Notes |
|-------------------------------|-----------------------------------|-------|
| Minimum Cable Bending Radius  | ~30 mm                            |       |
| Cable Cross-Section Dimension | Round Cable with 3 mm in Diameter |       |
| Cable Cover Type              | LSZH                              | 1     |
| Standard Cable Length         | 10, 20, 30, 50, 70, 100-m         | 2     |
| Cable Length Tolerance        | +100/-0 cm                        |       |

**Notes:**

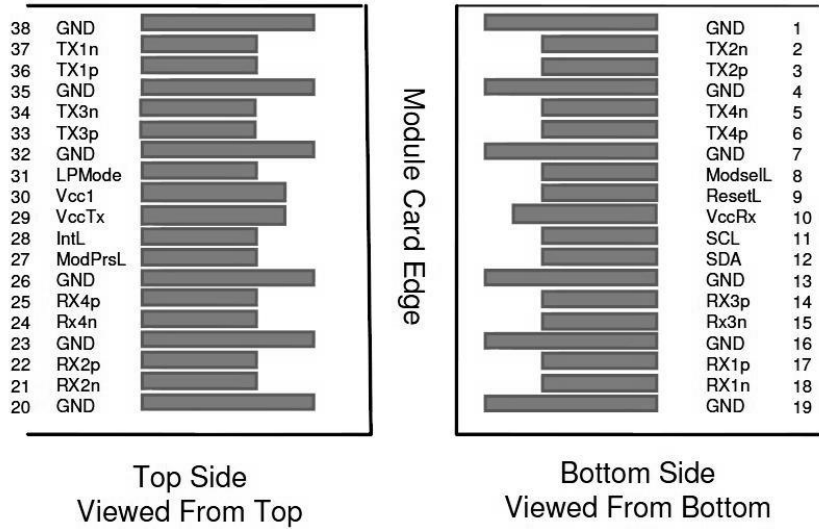
1. Cable cover type standard is LSZH. Other types can be available upon request.
2. Different cable length within this range upon customization.

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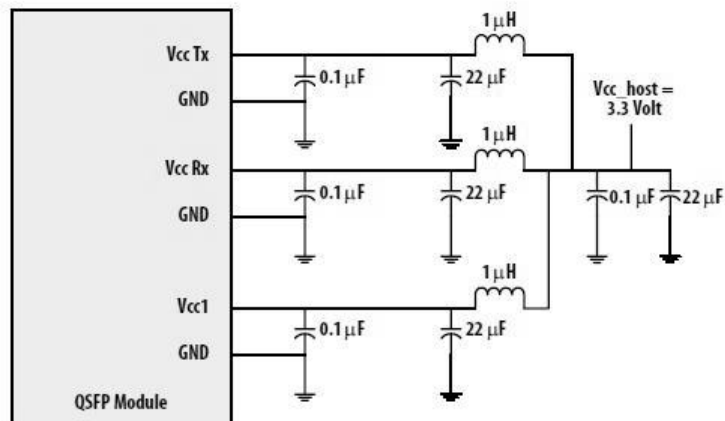
## QSFP28 Module Pad Assignments and Descriptions

| Pin | Logic     | Symbol  | Description                         | Plug Sequence |
|-----|-----------|---------|-------------------------------------|---------------|
| 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  | LVCMS-I/O | SCL     | 2-wire serial interface clock       | 3             |
| 12  | LVCMS-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             |

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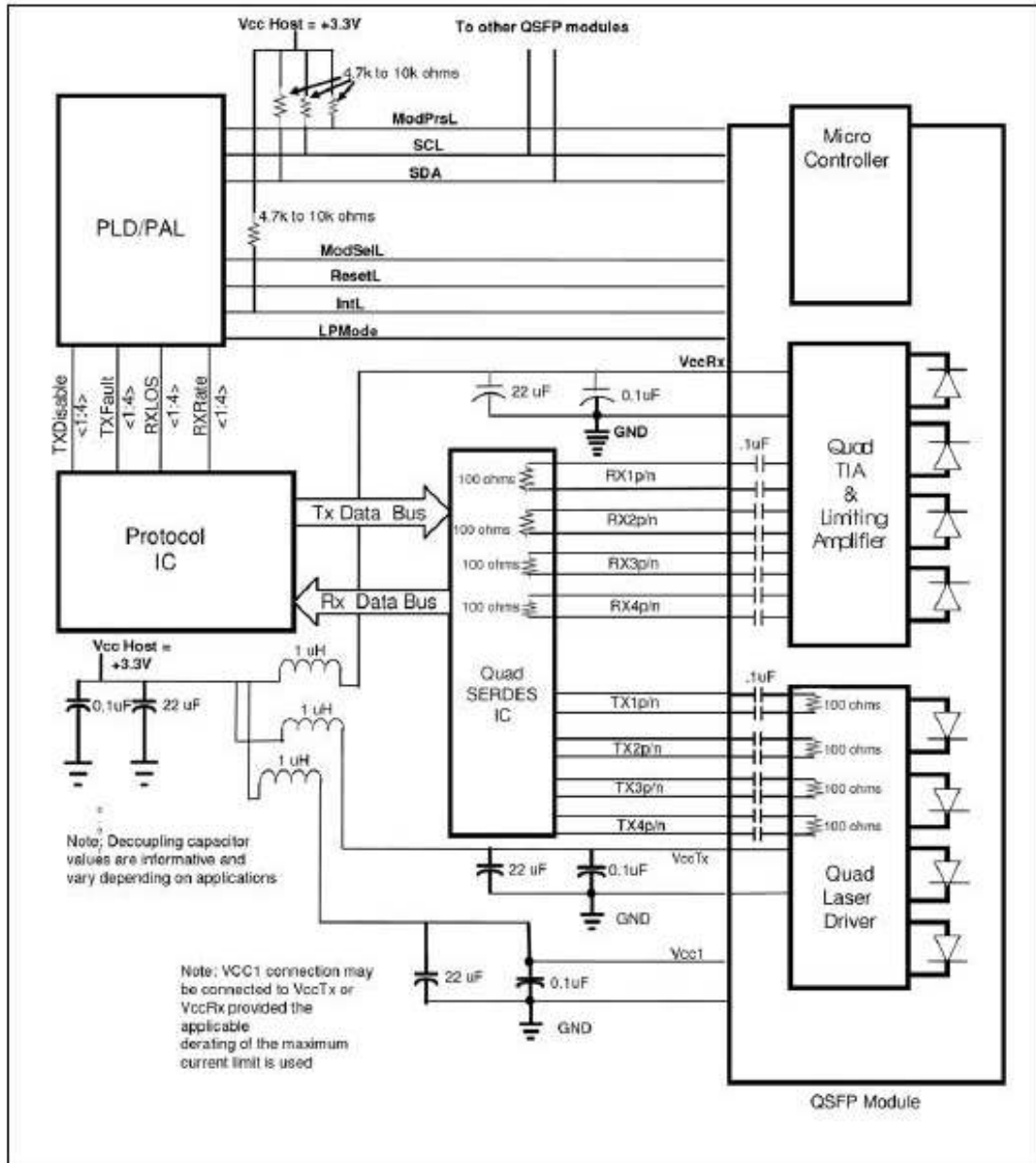


## RECOMMENDED HOST BOARD POWER SUPPLY CIRCUIT



## RECOMMENDED INTERFACE CIRCUIT

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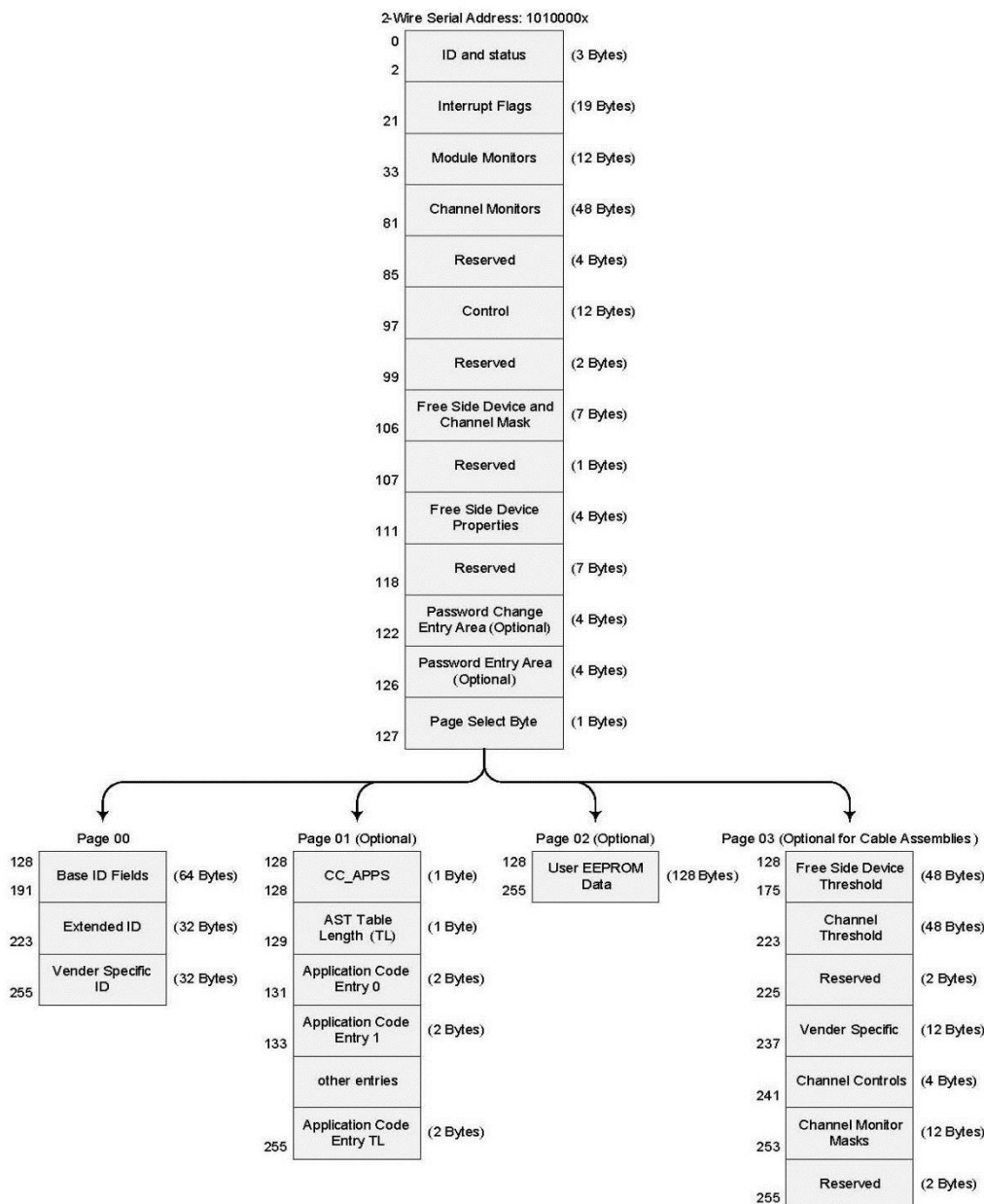




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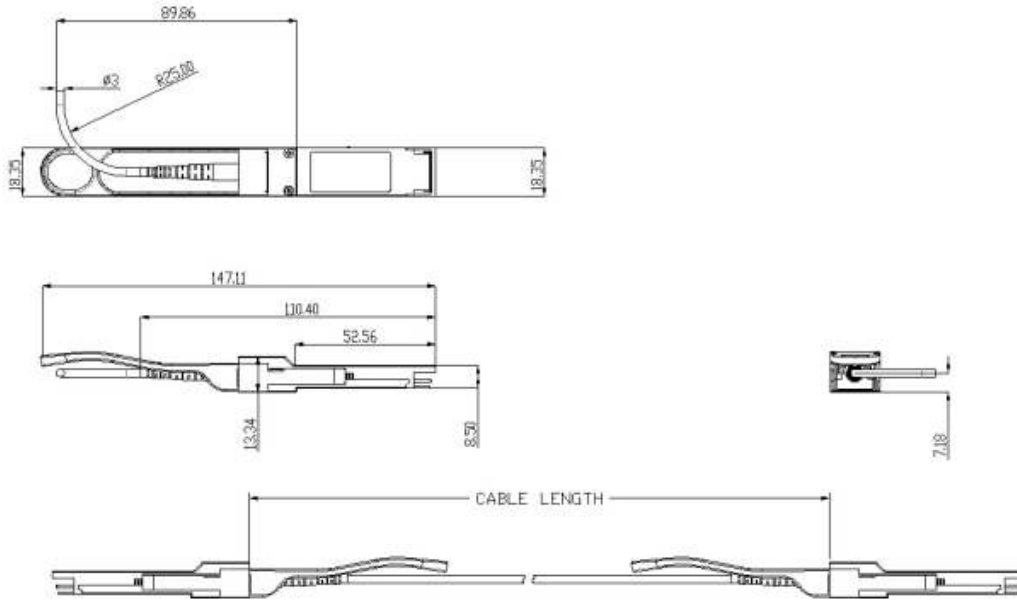
## Memory Map

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 a more detailed description of this memory map or lower pages, please see our memory map document with flexible customization settings.



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## MECHANICAL DIMENSIONS



| Length      | Note            |
|-------------|-----------------|
| <b>3m</b>   | OM3 Round Cable |
| <b>5m</b>   | OM3 Round Cable |
| <b>10m</b>  | OM3 Round Cable |
| <b>20m</b>  | OM3 Round Cable |
| <b>30m</b>  | OM3 Round Cable |
| <b>50m</b>  | OM3 Round Cable |
| <b>70m</b>  | OM3 Round Cable |
| <b>100m</b> | OM4 Round Cable |