

## **QSFP28-100GB-ESR-OPC**

MSA and TAA 100GBase-ESR4 QSFP28 Transceiver (MMF, 850nm, 300m, MPO, DOM)

### **Features**

- SFF-8665 Compliance
- MPO Connector
- Multi-mode Fiber
- Commercial Temperature 0 to 70 Celsius
- Hot Pluggable
- Metal with Lower EMI
- Excellent ESD Protection
- RoHS Compliant and Lead Free



### **Applications:**

- 100GBase Ethernet
- Access and Enterprise

### **Product Description**

This MSA compliant QSFP28 transceiver provides 100GBase-SR4 throughput up to 300m over OM4 multi-mode fiber (MMF) using a wavelength of 850nm via an MPO connector. It is built to MSA standards and is uniquely serialized and data-traffic and application tested to ensure that they will integrate into your network seamlessly. Digital optical monitoring (DOM) support is also present to allow access to real-time operating parameters. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

## Absolute Maximum Ratings

| Parameter                     | Symbol           | Min. | Typ. | Max. | Unit                          |
|-------------------------------|------------------|------|------|------|-------------------------------|
| Storage Ambient Temperature   | T <sub>stg</sub> | -40  | +100 | °C   | Storage Ambient Temperature   |
| Relative Humidity - Storage   | RH <sub>s</sub>  | 0    | 95   | %    | Relative Humidity - Storage   |
| Relative Humidity - Operating | RH <sub>o</sub>  | 0    | 85   | %    | Relative Humidity - Operating |
| Module Supply Voltage         | V <sub>CC</sub>  | -0.5 | 3.6  | V    | Module Supply Voltage         |

### Notes:

- Exceeding the Absolute Maximum Ratings may cause irreversible damage to the device. The device is not intended to be operated under the condition of simultaneous Absolute Maximum Ratings, a condition which may cause irreversible damage to the device.

## Recommended Operating Conditions

| Parameter                   | Symbol            | Min. | Typ.  | Max. | Unit |
|-----------------------------|-------------------|------|-------|------|------|
| Case Operating Temperature  | T <sub>case</sub> | 0    | +25   | +70  | °C   |
| Module Supply Voltage       | V <sub>CC</sub>   | 3.14 | 3.3   | 3.46 | V    |
| Module Supply Current       | I <sub>IN</sub>   |      | 540   |      | mA   |
| Signaling Speed Per Channel | S                 |      | 25.78 |      | Gb/s |

### Notes:

- Temperature Range = C

## Electrical Interfaces

| Parameter                                   | Symbol           | Min.                          | Typ. | Max. | Unit | Notes |
|---------------------------------------------|------------------|-------------------------------|------|------|------|-------|
| <b>Transmitter</b>                          |                  |                               |      |      |      |       |
| Tx_Data Differential Input Voltage          | V <sub>IN</sub>  | 200                           |      | 900  | mV   |       |
| Tx_Data Differential Input Impedance        | Z <sub>IN</sub>  |                               | 100  |      | Ω    |       |
| Differential Input Return Loss              | SDD11            | Compatible with IEEE P802.3bm |      |      | dB   | 1     |
| Differential to Common Mode Conversion Loss | SCD11            | 10                            |      |      | dB   | 1     |
| <b>Receiver</b>                             |                  |                               |      |      |      |       |
| Rx_Data Differential Output Voltage         | V <sub>OUT</sub> |                               | 480  |      | mV   |       |
| Rx_Data Differential Output Impedance       | Z <sub>OUT</sub> |                               | 100  |      | Ω    |       |
| Differential Output Return Loss             |                  | Per IEEE P802.3bm             |      |      | dB   | 1     |
| Common Mode Output Return Loss              |                  | Per IEEE P802.3bm             |      |      | dB   | 1     |

### Notes:

- 10MHz to 19GHz

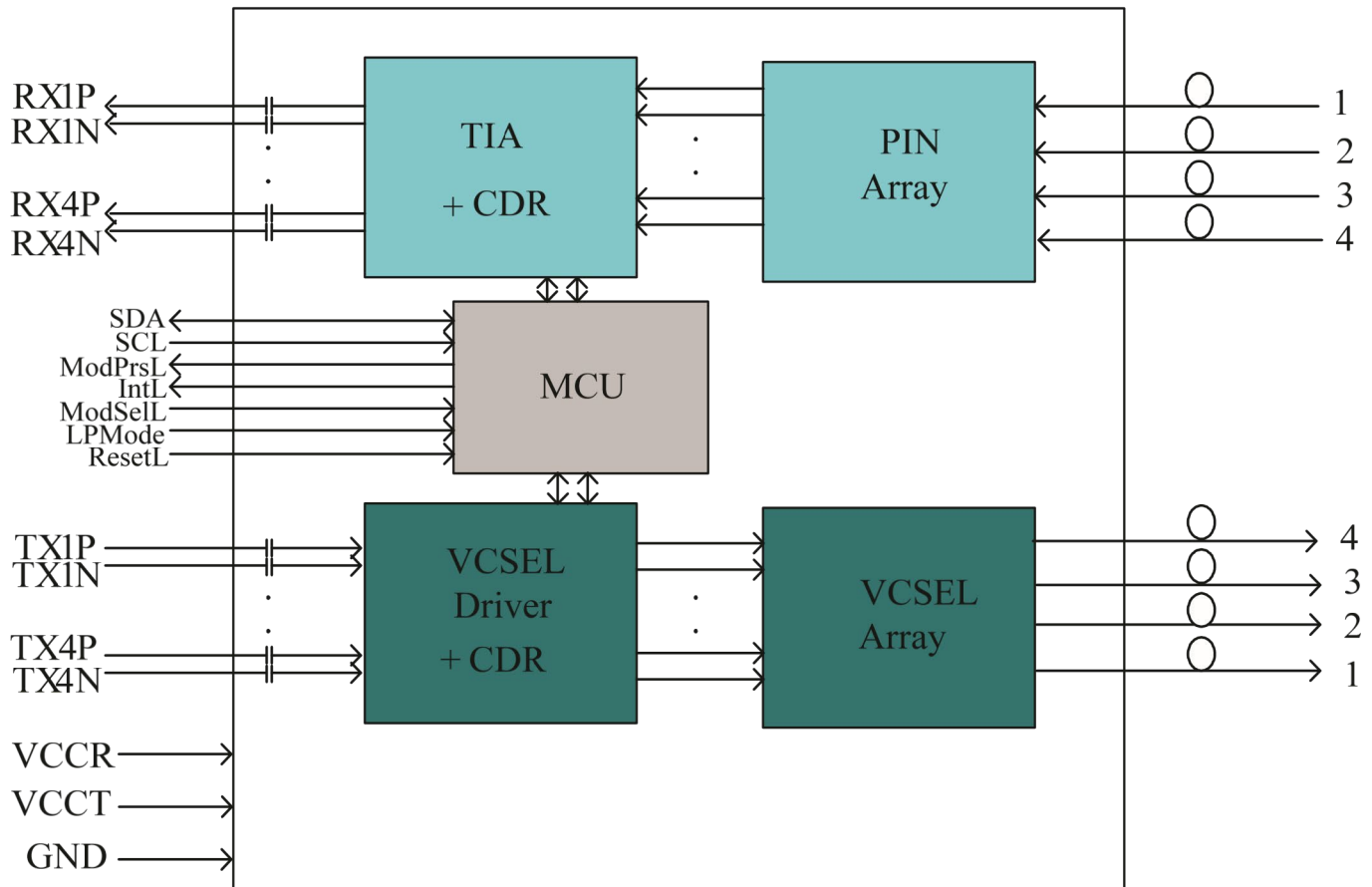
## Optical Characteristics

| Parameter                                                                       | Symbol          | Min. | Typ. | Max. | Unit | Notes |
|---------------------------------------------------------------------------------|-----------------|------|------|------|------|-------|
| <b>Transmitter</b>                                                              |                 |      |      |      |      |       |
| Average Launch Power, each lane                                                 | POUT            | -8.4 | -    | 2.4  | dBm  | 1     |
| Optical modulation Amplitude, each lane                                         | OMA             | -6.4 | -    | 3    | dBm  |       |
| Extinction Ratio                                                                | ER              | 2    | -    | -    | dB   |       |
| Optical Output with Tx OFF                                                      | POFF            | -    | -    | -30  | dBm  |       |
| Center Wavelength                                                               | $\lambda$       | 840  | 850  | 860  | nm   |       |
| RMS Spectral Width                                                              | $\Delta\lambda$ | -    | -    | 0.6  | nm   |       |
| Optical return loss tolerance                                                   | ORL             | -    | -    | 12   | dB   |       |
| Transmitter eye mask margin<br>(Hit ratio $1.5 \times 10^{-3}$ hits per sample) |                 | 5    | -    | -    | %    |       |
| <b>Receiver</b>                                                                 |                 |      |      |      |      |       |
| Average power at receive input, each lane                                       | P <sub>IN</sub> | -    | -    | 2.4  | dBm  |       |
| Unstressed receiver sensitivity, each lane (max)                                | Sen             | -    | -    | -7.2 | dBm  | 2     |
| Center Wavelength                                                               | $\lambda$       | 840  | 850  | 860  | nm   |       |
| Receiver Reflectance                                                            | RFL             | -    | -    | -12  | dB   |       |
| Rx_LOS of Signal - Assert                                                       | P <sub>A</sub>  | -30  | -    | -    | dBm  |       |
| Rx_LOS of Signal - Deassert                                                     | P <sub>D</sub>  | -    | -    | -7.5 | dBm  |       |
| Rx_LOS of Signal - Hysteresis                                                   | P <sub>Hy</sub> | 0.5  | -    | -    | dB   |       |

### Notes:

1. Average Optical Output
2. Average received power where the BER =  $5 \times 10^{-5}$ , measured with a PRBS  $2^{31}-1$  test pattern@25.78Gb/s

### Block Diagram

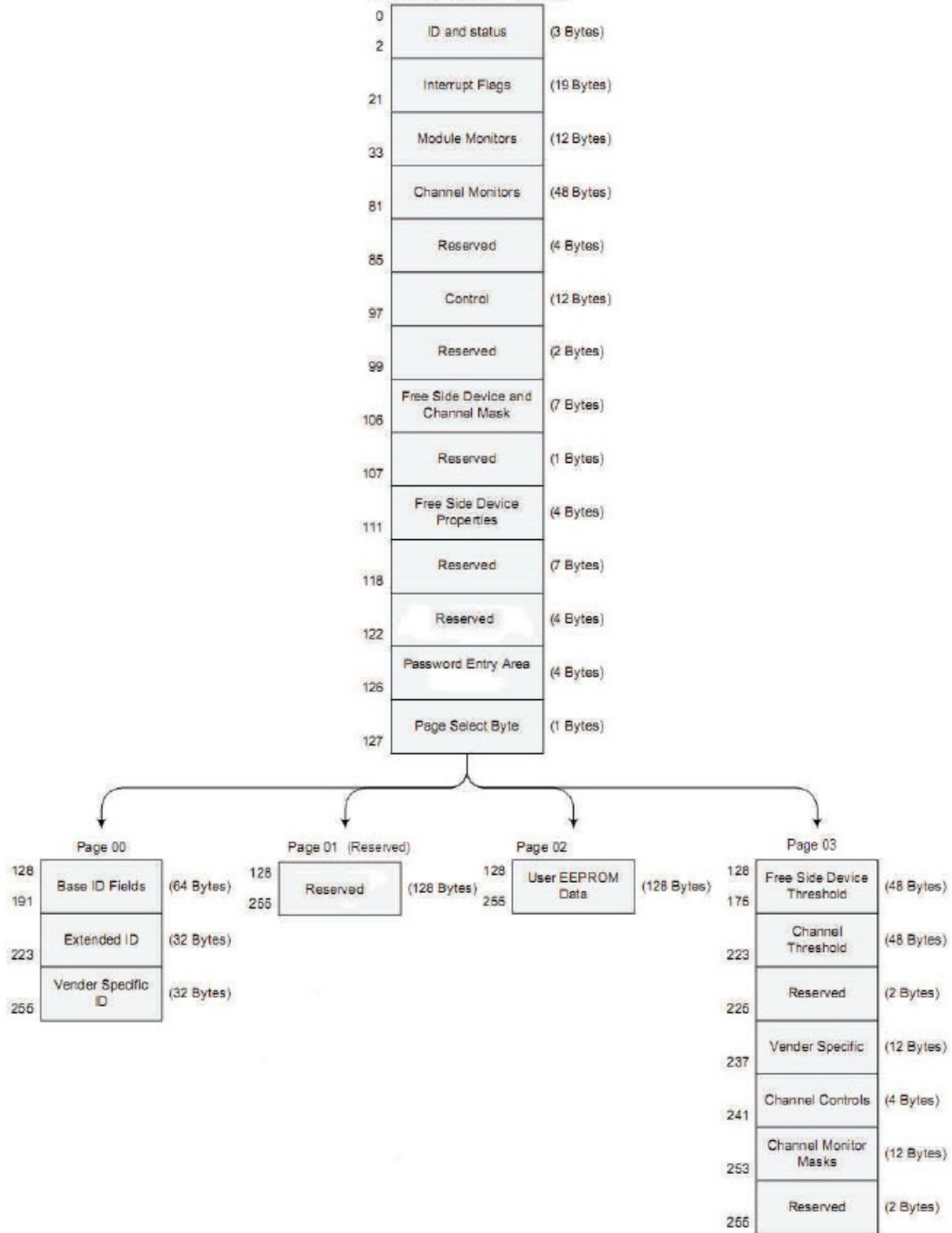


## QSFP Monitoring Interface

Monitoring is available on the QSFP28 AOC modules. A 2-wire serial interface provides user to contact with module. The module provides real-time per channel received power monitoring (optional), per channel transmitted laser bias current monitoring, supply voltage and temperature monitoring.

The memory is structured as a single address, multiple page approach. The address is given as A0h. The structure of the memory is shown in followed figure. The memory space is arranged into a lower, single page, address space of 128 bytes and multiple upper address space pages of 128 bytes each. This structure permits timely access to addresses in the lower page, e.g. Interrupt Flags and Monitors. Less time critical entries, e.g. serial ID information and threshold settings are available with the Page Select function.

2-Wire Serial Address: 1010000x



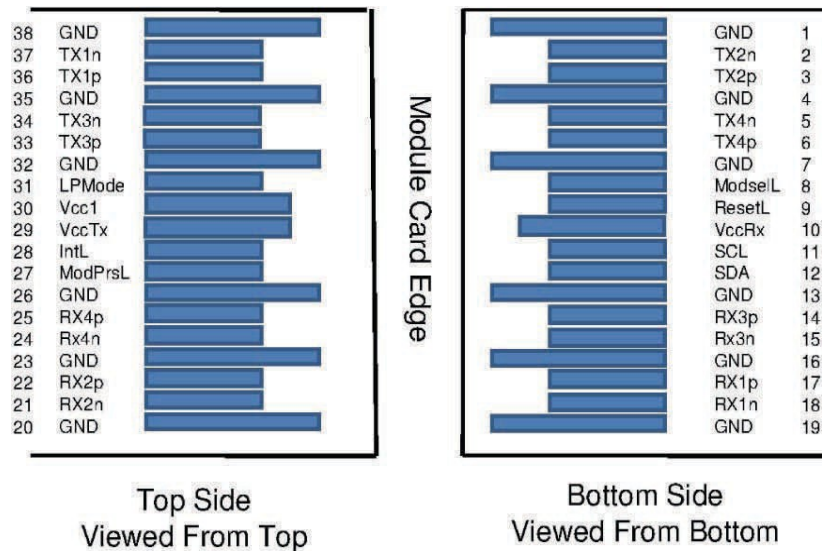
**I<sup>2</sup>C Memory Map (Upper memory map Page00-Serial ID: Data Fields, Unlisted Fields are Blank / Empty)**

| <b>IIC Addr</b> | <b>Size (byte)</b> | <b>Name</b>              | <b>Description</b>                                                                                         | <b>Values (HEX)</b>        |
|-----------------|--------------------|--------------------------|------------------------------------------------------------------------------------------------------------|----------------------------|
| <b>128</b>      | 1                  | Identifier               | Identifier Type of serial Module                                                                           | 11                         |
| <b>129</b>      | 1                  | Ext. Identifier          | Extended Identifier of Serial Module                                                                       | CC                         |
| <b>130</b>      | 1                  | Connector                | Code for connector type                                                                                    | 0C                         |
| <b>131-138</b>  | 8                  | Specification compliance | Code for electronic compatibility or optical compatibility                                                 | 80 00 00 00 40<br>40 02 08 |
| <b>139</b>      | 1                  | Encoding                 | Code for serial encoding algorithm                                                                         | 05                         |
| <b>140</b>      | 1                  | BR, nominal              | Nominal bit rate, units of 100 Mbps                                                                        | FF                         |
| <b>141</b>      | 1                  | Extended rate select     | Tags for extended rate select compliance                                                                   | 00                         |
| <b>142</b>      | 1                  | Length (SMF)             | Link length supported for SMF fiber in km (note 1)                                                         | 00                         |
| <b>143</b>      | 1                  | Length (OM3 50 um)       | Link length supported for EBW 50/125 um fiber (OM3), units of 2m (note 1)                                  | 00                         |
| <b>144</b>      | 1                  | Length (OM2 50 um)       | Link length supported for 50/125 um fiber (OM2), units of 1m (note 1)                                      | 00                         |
| <b>145</b>      | 1                  | Length (OM1 62.5 um)     | Link length supported for 62.5/125 um fiber (OM1), units of 1m (note 1)                                    | 00                         |
| <b>146</b>      | 1                  | Length (Copper/AOC)      | Link length of copper or active cable, units of 1 m                                                        | 96                         |
| <b>147</b>      | 1                  | Device tech              | Device technology                                                                                          | 00                         |
| <b>148-163</b>  | 16                 | Vendor name              | QSFP+ vendor name (ASCII)                                                                                  | “Hisense ”                 |
| <b>164</b>      | 1                  | Extended Module          | Extended Module codes for Module                                                                           | 10                         |
| <b>165-167</b>  | 3                  | Vendor OUI               | QSFP+ vendor IEEE company ID                                                                               | AC_4A_FE                   |
| <b>168-183</b>  | 16                 | Vendor PN                | Part number provided by QSFP+ vendor (ASCII)                                                               | LTA8532-PC+                |
| <b>184-185</b>  | 2                  | Vendor rev               | Revision level for part number provided by vendor (ASCII)                                                  | 01                         |
| <b>186-187</b>  | 2                  | Wave length              | Nominal laser wavelength (wavelength=value/20 in nm)                                                       | 42 68                      |
| <b>188-189</b>  | 2                  | Wavelength tolerance     | Guaranteed range of laser wavelength(+/-value) from nominal wavelength. (wavelength Tol. =value/200 in nm) | 07 D0                      |
| <b>190</b>      | 1                  | Max case temp.           | Maximum case temperature in degrees C                                                                      | 46                         |
| <b>191</b>      | 1                  | CC_BASE                  | Check code for base ID fields (addresses 128-190)                                                          | 00                         |
| <b>192-195</b>  | 4                  | Options                  | Rate Select, TX Disable, TX Fault, LOS, Warning indicators for: Temperature, VCC, RX power, TX Bias        | 02 07 C8 98                |
| <b>196-211</b>  | 16                 | Vendor SN                | Serial number provided by vendor (ASCII)                                                                   | Programmed by Factory      |
| <b>212-219</b>  | 8                  | Date Code                | Vendor’s manufacturing date code                                                                           | Programmed by Factory      |
| <b>220</b>      | 1                  | Monitoring Type          | Indicates which types of monitoring are implemented (if any) in the Module. Bit 1,0 Reserved               | 0C                         |
| <b>221</b>      | 1                  | Enhanced Options         | Indicates which optional enhanced features are implemented in the Module.                                  | 00                         |
| <b>222</b>      | 1                  | BR,nominal               | Units of 250M                                                                                              | 67                         |
| <b>223</b>      | 1                  | CC_EXT                   | Check code for the Extended ID Fields (addresses 192-222)                                                  |                            |
| <b>224-255</b>  | 32                 | Vendor Specific EEPROM   |                                                                                                            |                            |

## I<sup>2</sup>C Memory Map (Module and Channel Thresholds)

| IIC Addr | Byte | Name                        | Description        | Values |
|----------|------|-----------------------------|--------------------|--------|
| 128-129  | 2    | Case temp High Alarm (°C)   | MSB at low address | 80     |
| 130-131  | 2    | Case temp Low Alarm (°C)    | MSB at low address | -10    |
| 132-133  | 2    | Case temp High Warning (°C) | MSB at low address | 75     |
| 134-135  | 2    | Case temp Low Warning (°C)  | MSB at low address | -5     |
| 136-143  | 8    | Reserved                    | MSB at low address |        |
| 144-145  | 2    | Vcc High Alarm (V)          | MSB at low address | 3.63   |
| 146-147  | 2    | Vcc Low Alarm (V)           | MSB at low address | 2.97   |
| 148-149  | 2    | Vcc High Warning (V)        | MSB at low address | 3.465  |
| 150-151  | 2    | Vcc Low Warning (V)         | MSB at low address | 3.135  |
| 152-159  | 8    | Reserved                    |                    |        |
| 160-175  | 16   | Reserved                    |                    |        |
| 176-177  | 2    | RX Power High Alarm (dBm)   | MSB at low address | 5.4    |
| 178-179  | 2    | RX Power Low Alarm (dBm)    | MSB at low address | -13.3  |
| 180-181  | 2    | RX Power High Warning (dBm) | MSB at low address | 2.4    |
| 182-183  | 2    | RX Power Low Warning (dBm)  | MSB at low address | -10.3  |
| 184-185  | 2    | Tx Bias High Alarm (mA)     | MSB at low address | 12     |
| 186-187  | 2    | Tx Bias Low Alarm (mA)      | MSB at low address | 0      |
| 188-189  | 2    | Tx Bias High Warning (mA)   | MSB at low address | 10     |
| 190-191  | 2    | Tx Bias Low Warning (mA)    | MSB at low address | 0      |
| 192-193  | 2    | TX Power High Alarm (dBm)   | MSB at low address | 5.4    |
| 194-195  | 2    | TX Power Low Alarm (dBm)    | MSB at low address | -11.4  |
| 196-197  | 2    | TX Power High Warning (dBm) | MSB at low address | 2.4    |
| 198-199  | 2    | TX Power Low Warning (dBm)  | MSB at low address | -8.4   |

## Pin Assignment

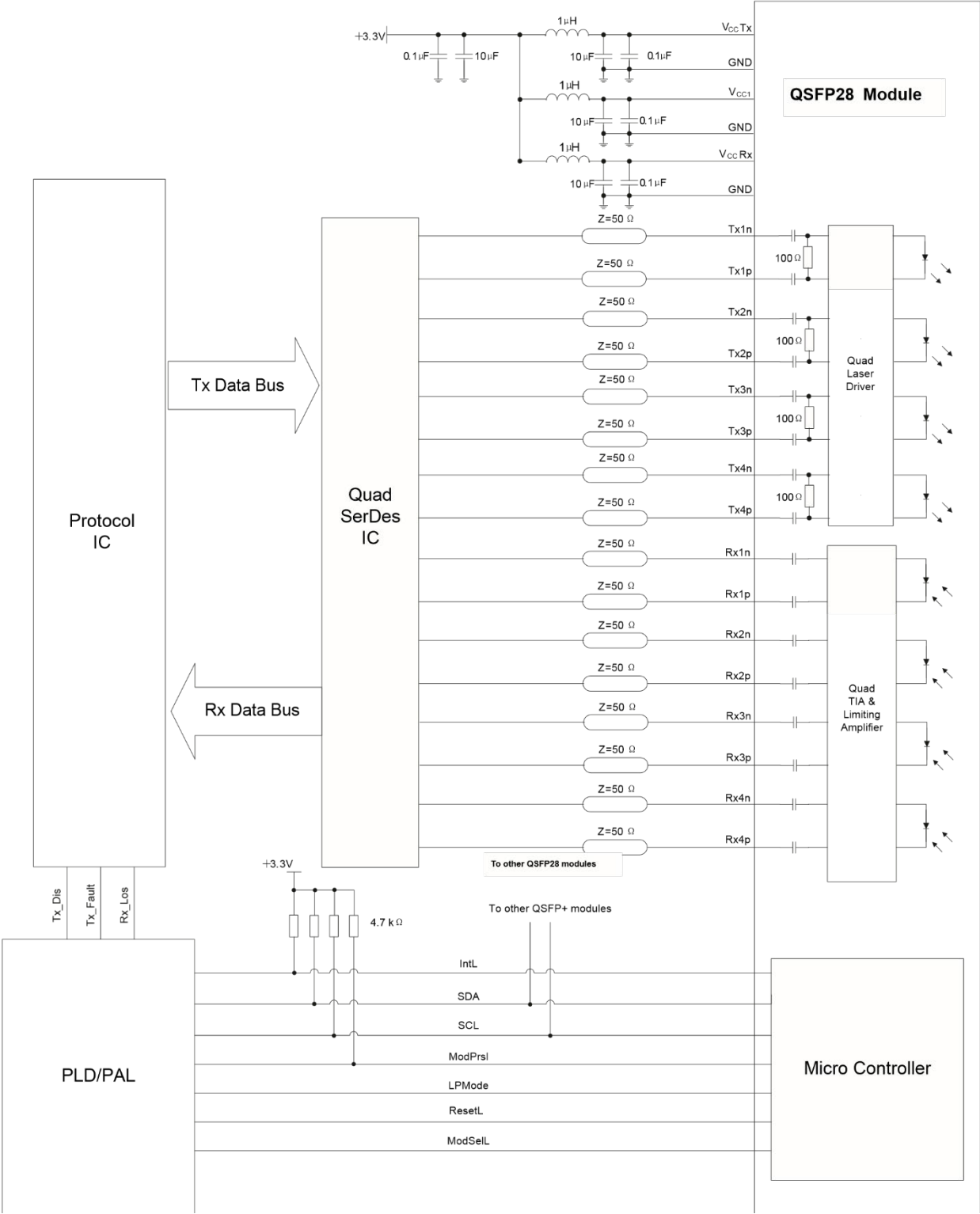


## Pin Descriptions

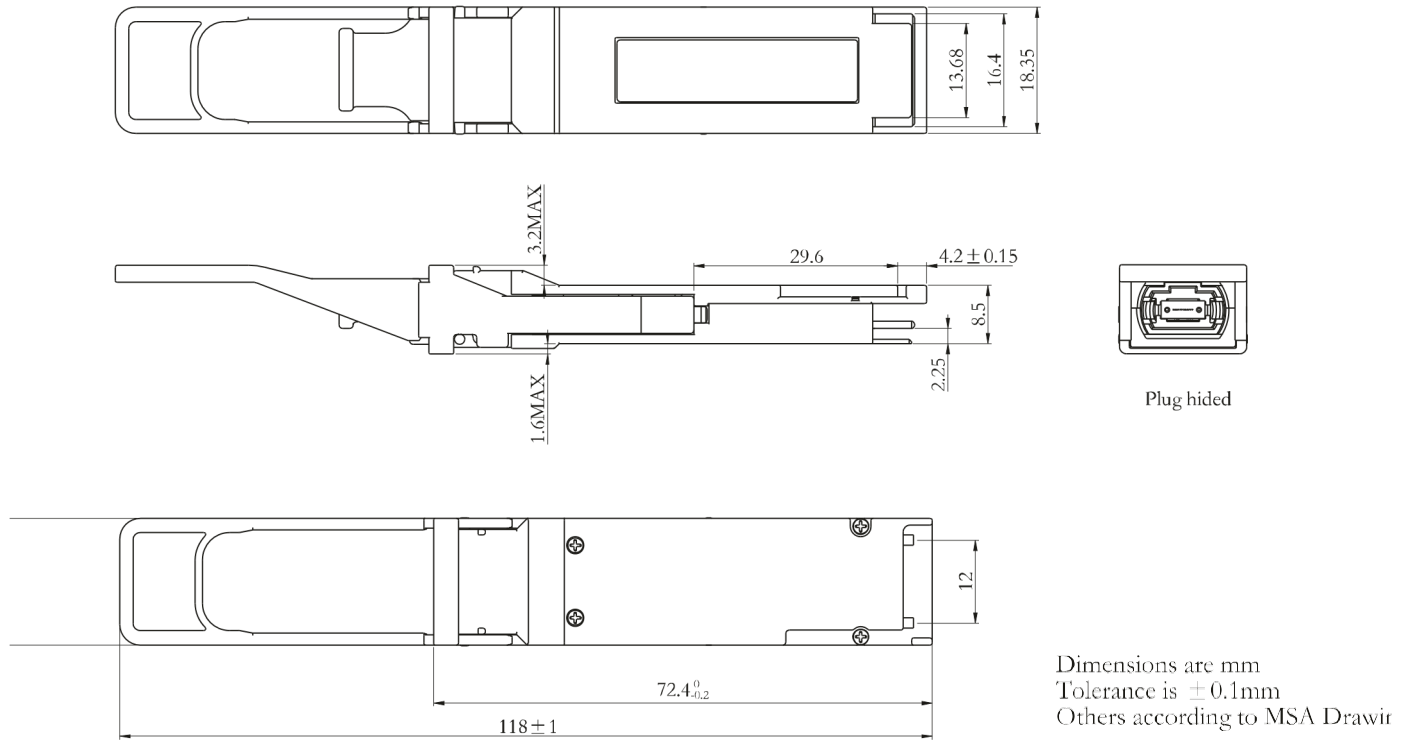
| Pin | Symbol             | Name/Descriptions                         | Ref. |
|-----|--------------------|-------------------------------------------|------|
| 1   | GND                | Ground                                    |      |
| 2   | Tx2n               | Transmitter Inverted Data Input           |      |
| 3   | Tx2p               | Transmitter Non Inverted Data Input       |      |
| 4   | GND                | Ground                                    |      |
| 5   | Tx4n               | Transmitter Inverted Data Input           |      |
| 6   | Tx4p               | Transmitter Non Inverted Data Input       |      |
| 7   | GND                | Ground                                    |      |
| 8   | ModselL            | Module Select                             |      |
| 9   | ResetL             | Module Reset                              |      |
| 10  | V <sub>CC</sub> Rx | Receiver +3.3V DC Power Supply            |      |
| 11  | SCL                | I <sup>2</sup> C Serial Clock             |      |
| 12  | SDA                | I <sup>2</sup> C Serial Data              |      |
| 13  | GND                | Ground                                    |      |
| 14  | Rx3p               | Receiver Non Inverted Differential Output |      |
| 15  | Rx3n               | Receiver Inverted Differential Output     |      |
| 16  | GND                | Ground                                    |      |
| 17  | Rx1p               | Receiver Non Inverted Differential Output |      |
| 18  | Rx1n               | Receiver Inverted Differential Output     |      |
| 19  | GND                | Ground                                    |      |
| 20  | GND                | Ground                                    |      |
| 21  | Rx2n               | Receiver Inverted Differential Output     |      |
| 22  | Rx2p               | Receiver Non Inverted Differential Output |      |
| 23  | GND                | Ground                                    |      |
| 24  | Rx4n               | Receiver Inverted Differential Output     |      |
| 25  | Rx4p               | Receiver Non Inverted Differential Output |      |
| 26  | GND                | Ground                                    |      |
| 27  | ModPrsL            | Module Present                            |      |
| 28  | IntL               | Interrupt                                 |      |
| 29  | V <sub>CC</sub> Tx | Transmitter +3.3V DC Power Supply         |      |
| 30  | V <sub>CC1</sub>   | +3.3V DC Power Supply                     |      |
| 31  | LPMoD              | Low Power Mode                            |      |
| 32  | GND                | Ground                                    |      |
| 33  | Tx3p               | Transmitter Non Inverted Data Input       |      |
| 34  | Tx3n               | Transmitter Inverted Data Input           |      |
| 35  | GND                | Ground                                    |      |
| 36  | Tx1p               | Transmitter Non Inverted Data Input       |      |
| 37  | Tx1n               | Transmitter Inverted Data Input           |      |
| 38  | GND                | Ground                                    |      |



Electrical Interface



## Mechanical Dimensions



## Warnings

### Handling Precautions:

This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

### Laser Safety:

Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.