

# SNR-QSFP28-LR4

QSFP28, 100G BASE Series

## SNR-QSFP28-LR4 Series

Single-Mode 100GBASE-LR4 QSFP28 Transceiver

Single-Mode OTU4 4I1-9D1F QSFP28 Transceiver

RoHS6 Compliant

### Features

- Supports 103Gbps and 112Gbps
- Single 3.3V Power Supply and Power dissipation < 4.5W
- Up to 10km over SMF
- RoHS-6 compliant (lead-free)
- Commercial case temperature range of 0°C to 70°C
- Four 25Gbps/28Gbps EML LAN-WDM channels on transmitter side
- PIN and TIA array on the receiver side
- 4x25G/28G electrical interface
- Duplex LC receptacles
- I<sup>2</sup>C interface with integrated Digital Diagnostic Monitoring



### Applications

- 100GBASE-LR4 100G Ethernet
- OTU4 4I1-9D1F

### Ordering Information

| Part No.               | Data Rate | Fiber | Distance<br>*(note2) | Interface | Temp.      | DDMI |
|------------------------|-----------|-------|----------------------|-----------|------------|------|
| SNR-QSFP28-LR4*(note1) | 112Gbps   | SMF   | 10km                 | LC        | 0°C ~+70°C | Yes  |

Note1: also support 103Gbps

Note2: Over SMF

\*The product image only for reference purpose.

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## Regulatory Compliance\*

| Product Certificate | Certificate Number | Applicable Standard           |
|---------------------|--------------------|-------------------------------|
| TUV                 | R50135086          | EN 60950-1:2006+A11+A1+A12+A2 |
|                     |                    | EN 60825-1:2014               |
|                     |                    | EN 60825-2:2004+A1+A2         |
| UL                  | E317337            | UL 60950-1                    |
|                     |                    | CSA C22.2 No. 60950-1-07      |
| EMC CE              | AE 50285865 0001   | EN 55022:2010                 |
|                     |                    | EN 55024:2010                 |
| FCC                 | WTF14F0514417E     | 47 CFR PART 15 OCT., 2013     |
| FDA                 | /                  | CDRH 1040.10                  |
| ROHS                | /                  | 2011/65/EU                    |

\*The above certificate number updated to June 2014, because some certificate will be updated every year, such as FDA and ROHS.

## Product Description

SNR's SNR-QSFP28-LR4 transceiver module is designed for 112 Gigabit Ethernet links over 10Km single mode fiber. It is compliant with IEEE 802.3ba 100GBASE-LR4 and OTU4. Digital diagnostics functions are available via an I2C interface, as specified by the QSFP+MSA.

## Absolute Maximum Ratings

| Parameter                   | Symbol          | Min. | Max. | Unit |
|-----------------------------|-----------------|------|------|------|
| Storage Temperature         | T <sub>s</sub>  | -40  | +85  | °C   |
| Supply Voltage              | V <sub>cc</sub> | -0.5 | 3.6  | V    |
| Operating Relative Humidity | RH              | 5    | 85   | %    |

\*Exceeding any one of these values may destroy the device immediately.

## Recommended Operating Conditions

| Parameter                  | Symbol          | Min.  | Typical | Max.  | Unit |
|----------------------------|-----------------|-------|---------|-------|------|
| Operating Case Temperature | T <sub>c</sub>  | 0     |         | 70    | °C   |
| Power Supply Voltage       | V <sub>cc</sub> | 3.135 | 3.3     | 3.465 | V    |
| Power Dissipation          | P <sub>D</sub>  |       |         | 4.5   | W    |

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## Performance Specifications - Electrical

| Parameter                       | Symbol                         | Min. | Typ. | Max  | Unit              | Notes                            |
|---------------------------------|--------------------------------|------|------|------|-------------------|----------------------------------|
| <b>Transmitter</b>              |                                |      |      |      |                   |                                  |
| Differential Input amplitude    |                                | 150  |      | 1200 | mv <sub>p-p</sub> |                                  |
| Input Impedance (Differential)  | Z <sub>in</sub>                | 85   | 100  | 115  | ohms              | R <sub>in</sub> > 100 kohms @ DC |
| <b>Receiver</b>                 |                                |      |      |      |                   |                                  |
| Differential output amplitude   |                                | 200  |      | 1100 | mv <sub>p-p</sub> |                                  |
| Output Impedance (Differential) | Z <sub>out</sub>               | 85   | 100  | 115  | ohms              |                                  |
| Output Rise/Fall Time           | t <sub>r</sub> /t <sub>f</sub> |      | 12   |      | ps                | 10%~90%                          |

## Optical Characteristics

### 100GBASE-LR4 Operation

| Parameter  | Symbol            | Min.                                 | Typical | Max.    | Unit |
|--|-------------------|--------------------------------------|---------|---------|------|
| <b>Transmitter</b>   |                   |                                      |         |         |      |
| Signaling Speed per Lane   | BR <sub>AVE</sub> |                                      | 25.78   |         | Gbps |
| Data Rate Variation  |                   | -100                                 |         | +100    | ppm  |
| Lane_0 Center Wavelength   | λ <sub>C0</sub>   | 1294.53                              | 1295.56 | 1296.59 | nm   |
| Lane_1 Center Wavelength   | λ <sub>C1</sub>   | 1299.02                              | 1300.05 | 1301.09 | nm   |
| Lane_2 Center Wavelength   | λ <sub>C2</sub>   | 1303.54                              | 1304.58 | 1305.63 | nm   |
| Lane_3 Center Wavelength   | λ <sub>C3</sub>   | 1308.09                              | 1309.14 | 1310.19 | nm   |
| Total Average Output Power <sup>*(Note3)</sup>                               | P <sub>o</sub>    |                                      |         | 10.5    | dBm  |
| Average Launch Power per Lane  | P <sub>each</sub> | -4.3                                 |         | 4.5     | dBm  |
| Average launch power of OFF transmitter per lane                             |                   |                                      |         | -30     | dBm  |
| Optical modulation amplitude   | P <sub>oma</sub>  | -1.3                                 |         | 4.5     | dBm  |
| Optical Return Loss Tolerance  |                   |                                      |         | 20      | dB   |
| Extinction Ratio <sup>*(Note4)</sup>   | ER                | 4                                    |         |         | dB   |
| Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3} <sup>*(Note4)</sup> |                   | IEEE 802.3 Clause 88<br>100Gbase-LR4 |         |         |      |
| <b>Receiver</b>  |                   |                                      |         |         |      |
| Signaling Speed per Lane   | BR <sub>AVE</sub> |                                      | 25.78   |         | Gbps |
| Data Rate Variation  |                   | -100                                 |         | +100    | ppm  |
| Damage threshold   | R <sub>dam</sub>  | 4.5                                  |         |         | dBm  |
| Lane_0 Center Wavelength   | λ <sub>C0</sub>   | 1294.53                              | 1295.56 | 1296.59 | nm   |
| Lane_1 Center Wavelength   | λ <sub>C1</sub>   | 1299.02                              | 1300.05 | 1301.09 | nm   |
| Lane_2 Center Wavelength   | λ <sub>C2</sub>   | 1303.54                              | 1304.58 | 1305.63 | nm   |

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|   |                |         |         |         |     |
|---|----------------|---------|---------|---------|-----|
| Lane_3 Center Wavelength                                | $\lambda_{C3}$ | 1308.09 | 1309.14 | 1310.19 | nm  |
| Average Receive Power per Lane                          | Rpow           | -10.6   |         | 4.5     | dBm |
| Receive Sensitivity in OMA per Lane <sup>*(Note5)</sup> | Pmin           |         |         | -8.6    | dBm |
| Optical Return Loss                                     | ORL            |         |         | -26     | dB  |
| LOS Assert  | LOSA           | -25     |         |         | dBm |
| LOS De-Assert   | LOSD           |         |         | -11.6   | dBm |
| LOS Hysteresis  |                | 0.5     |         |         | dB  |

## OTU4 411-9D1F Operation

| Parameter  | Symbol            | Min.              | Typical | Max.    | Unit |
|--|-------------------|-------------------|---------|---------|------|
| <b>Transmitter</b>   |                   |                   |         |         |      |
| Signaling Speed per Lane   | BR <sub>AVE</sub> |                   | 27.95   |         | Gbps |
| Data Rate Variation  |                   | -20               |         | +20     | ppm  |
| Lane_0 Center Wavelength   | $\lambda_{C0}$    | 1294.53           | 1295.56 | 1296.59 | nm   |
| Lane_1 Center Wavelength   | $\lambda_{C1}$    | 1299.02           | 1300.05 | 1301.09 | nm   |
| Lane_2 Center Wavelength   | $\lambda_{C2}$    | 1303.54           | 1304.58 | 1305.63 | nm   |
| Lane_3 Center Wavelength   | $\lambda_{C3}$    | 1308.09           | 1309.14 | 1310.19 | nm   |
| Total Average Output Power <sup>*(Note6)</sup>                               | Po                |                   |         | 10.5    | dBm  |
| Average Launch Power per Lane  | Peach             | -2.5              |         | 2.9     | dBm  |
| Maximum channel power difference   |                   |                   |         | 5       | dB   |
| Channel spacing  |                   |                   | 800     |         | GHz  |
| Maximum spectral excursion   |                   | -184              |         | 184     | GHz  |
| Side Mode Suppression Ratio  | SMSR              | 30                |         |         | dB   |
| Optical Return Loss Tolerance  |                   |                   |         | 20      | dB   |
| Extinction Ratio <sup>*(Note7)</sup>   | ER                | 7                 |         |         | dB   |
| Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3} <sup>*(Note7)</sup> |                   | G.959.1 Compliant |         |         |      |
| <b>Receiver</b>  |                   |                   |         |         |      |
| Signaling Speed per Lane   | BR <sub>AVE</sub> |                   | 27.95   |         | Gbps |
| Data Rate Variation  |                   | -20               |         | +20     | ppm  |
| Damage threshold (per lane)  | Rdam              | 4.5               |         |         | dBm  |
| Lane_0 Center Wavelength   | $\lambda_{C0}$    | 1294.53           | 1295.56 | 1296.59 | nm   |
| Lane_1 Center Wavelength   | $\lambda_{C1}$    | 1299.02           | 1300.05 | 1301.09 | nm   |
| Lane_2 Center Wavelength   | $\lambda_{C2}$    | 1303.54           | 1304.58 | 1305.63 | nm   |
| Lane_3 Center Wavelength   | $\lambda_{C3}$    | 1308.09           | 1309.14 | 1310.19 | nm   |
| Average Receive Power per Lane   | Rpow              | -8.6              |         | 2.9     | dBm  |
| Equivalent Receive Sensitivity per Lane <sup>*(Note8)</sup>                  | Pmin              |                   |         | -8.6    | dBm  |
| Maximum channel power difference   |                   |                   |         | 5.5     | dB   |
| Maximum optical path penalty   |                   |                   |         | 1.5     | dB   |
| Optical Return Loss  | ORL               |                   |         | -26     | dB   |

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|                |      |     |  |       |     |
|----------------|------|-----|--|-------|-----|
| LOS Assert     | LOSA | -25 |  |       | dBm |
| LOS De-Assert  | LOSD |     |  | -11.6 | dBm |
| LOS Hysteresis |      | 0.5 |  |       | dB  |

Note3: Output is coupled into a 9/125µm single-mode fiber.

Note4: Filtered, measured with a PRBS 2<sup>31</sup>-1 test pattern @25.78Gbps

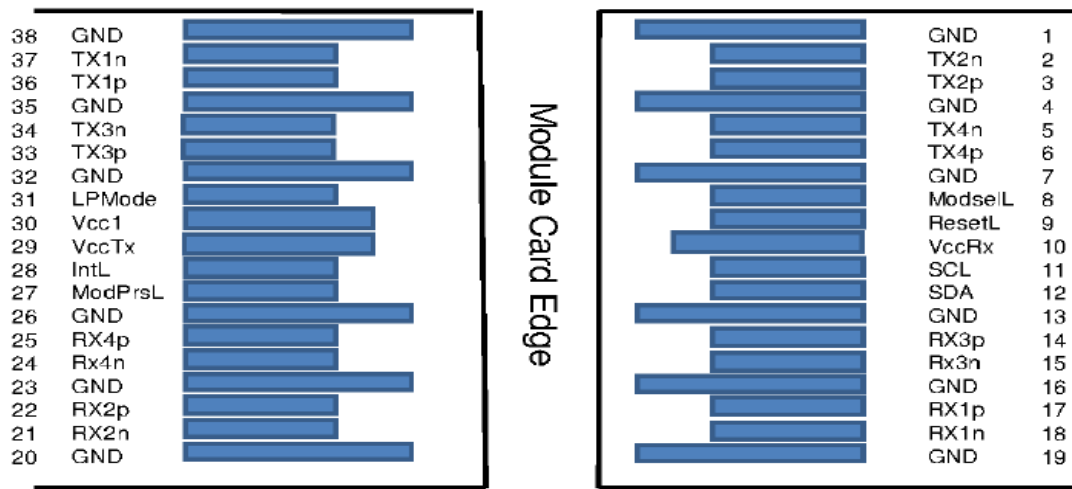
Note5: Minimum average optical power measured at BER less than 1E-12, with a 2<sup>31</sup>-1 PRBS.

Note6: Output is coupled into a 9/125µm single-mode fiber.

Note7: Filtered, measured with a PRBS 2<sup>31</sup>-1 test pattern @27.95Gbps

Note8: Minimum average optical power measured at BER less than 1E-12, with a 2<sup>31</sup>-1 PRBS.

## QSFP28 Transceiver Electrical Pad Layout



Top Side  
Viewed From Top

Bottom Side  
Viewed From Bottom

## Pin Arrangement and Definition

| Pin | Logic        | Symbol  | Description                         | Plug Sequence | Notes |
|-----|--------------|---------|-------------------------------------|---------------|-------|
| 1   |              | GND     | Ground                              | 1             | 1     |
| 2   | CML-I        | Tx2n    | Transmitter Inverted Data Input     | 3             |       |
| 3   | CML-I        | Tx2p    | Transmitter Non-Inverted Data Input | 3             |       |
| 4   |              | GND     | Ground                              | 1             | 1     |
| 5   | CML-I        | Tx4n    | Transmitter Inverted Data Input     | 3             |       |
| 6   | CML-I        | Tx4p    | Transmitter Non-Inverted Data Input | 3             |       |
| 7   |              | GND     | Ground                              | 1             | 1     |
| 8   | LVTTL-I      | ModSelL | Module Select                       | 3             |       |
| 9   | LVTTL-I      | ResetL  | Module Reset                        | 3             |       |
| 10  |              | VccRx   | +3.3V Power Supply Receiver         | 2             | 2     |
| 11  | LVC MOS- I/O | SCL     | 2-wire serial interface clock       | 3             |       |
| 12  | LVC MOS- I/O | SDA     | 2-wire serial interface data        | 3             |       |

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|    |          |         |                                     |   |   |
|----|----------|---------|-------------------------------------|---|---|
| 13 |          | GND     | Ground                              | 1 | 1 |
| 14 | CML-O    | Rx3p    | Receiver Non-Inverted Data Output   | 3 |   |
| 15 | CML-O    | Rx3n    | Receiver Inverted Data Output       | 3 |   |
| 16 |          | GND     | Ground                              | 1 | 1 |
| 17 | CML-O    | Rx1p    | Receiver Non-Inverted Data Output   | 3 |   |
| 18 | CML-O    | Rx1n    | Receiver Inverted Data Output       | 3 |   |
| 19 |          | GND     | Ground                              | 1 | 1 |
| 20 |          | GND     | Ground                              | 1 | 1 |
| 21 | CML-O    | Rx2n    | Receiver Inverted Data Output       | 3 |   |
| 22 | CML-O    | Rx2p    | Receiver Non-Inverted Data Output   | 3 |   |
| 23 |          | GND     | Ground                              | 1 | 1 |
| 24 | CML-O    | Rx4n    | Receiver Inverted Data Output       | 3 |   |
| 25 | CML-O    | Rx4p    | Receiver Non-Inverted Data Output   | 3 |   |
| 26 |          | GND     | Ground                              | 1 | 1 |
| 27 | LVTTTL-O | ModPrsL | Module Present                      | 3 |   |
| 28 | LVTTTL-O | IntL    | Interrupt                           | 3 |   |
| 29 |          | VccTx   | +3.3V Power supply transmitter      | 2 | 2 |
| 30 |          | Vcc1    | +3.3V Power supply                  | 2 | 2 |
| 31 | LVTTTL-I | LPMode  | Low Power Mode                      | 3 |   |
| 32 |          | GND     | Ground                              | 1 | 1 |
| 33 | CML-I    | Tx3p    | Transmitter Non-Inverted Data Input | 3 |   |
| 34 | CML-I    | Tx3n    | Transmitter Inverted Data Input     | 3 |   |
| 35 |          | GND     | Ground                              | 1 | 1 |
| 36 | CML-I    | Tx1p    | Transmitter Non-Inverted Data Input | 3 |   |
| 37 | CML-I    | Tx1n    | Transmitter Inverted Data Input     | 3 |   |
| 38 |          | GND     | Ground                              | 1 | 1 |

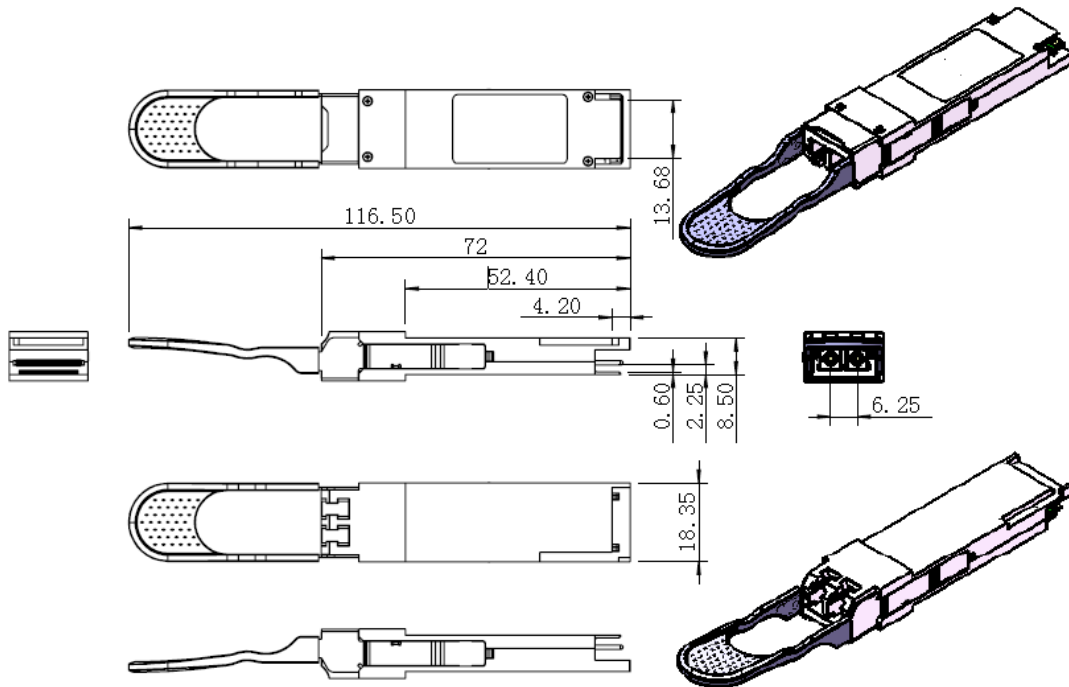
1: GND is the symbol for signal and supply (power) common for the QSFP28 module. All are common within the QSFP28 module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.

2: Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. Requirements defined for the host side of the Host Edge Card Connector are listed in Table 6. Recommended host board power supply filtering is shown in Figures 3 and 4. Vcc Rx Vcc1 and Vcc Tx may be internally connected within the QSFP28 Module in any combination. The connector pins are each rated for a maximum current of 500mA.

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## Mechanical Specifications



### GUARANTEE:



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