

# QSFP-DD 400GBASE-ER4, CMIS4.0

QSFP-DD 400GBASE-ER4, CMIS4.0, nLWDM - 1304/1306/1309/1311nm, 40km 18.5dB

## TQD031-SN4C-SO

The TQD031-SN4C-SO is a QSFP-DD form-factor transceivers for 400Gbps Ethernet applications. The intended use is data center interconnect for optical distances up to 40km over a SingleMode (SM) fiber cable.

The electrical interface consists of eight 53.125G signals (400GAUI-8) that are converted to four PAM4-modulated channels/lanes to transport the Ethernet signal. The optical lanes range from 228.6THz to 229.8THz with 400GHz spacing. The transceiver can also be set in 4x100GAUI-2 mode to enable 400G to 4x 100G break-out configurations. Digital diagnostics functions are available via an I2C interface, as specified by the QSFP-DD MSA.

Forward Error Correction (FEC) is required to be implemented by the host in order to ensure reliable system operation. The FEC type shall be as defined in IEEE802.3bj, i.e. Reed Solomon RS(528,514). The optical parameters will provide a bit error ratio (BER) of  $2.4 \times 10^{-4}$ .

The TQD031-SN4C-SO is compliant with Common Management Interface Specification CMIS4.0.

## TECHNICAL DATA

| Parameter             | Value  |
|-----------------------|--|
| Technology            | Grey QSFP-DD                                     |
| Transmission media    | SM (2xLC)  |
| Typical reach         | 40km   |
| Nominal wavelength    | 1304.58/1306.85/1309.14/1311.43nm                |
| Interface standards   | 400G ER4   |
| Electrical interfaces | 400GAUI-8 or 4x100GAUI-2                         |
| Bit rate support      | 425Gbps <sup>1)</sup><br>53.125Gbd <sup>2)</sup> |
| Protocol support      | 400GbE, 4x100GbE                                 |
| Power budget          | 10.5 – 18.5dB                                    |
| Power consumption     | < 12W  |
| Operating temperature | 0°C to +70°C                                     |
| Storage temperature   | -40°C to +85°C                                   |

<sup>1)</sup> Aggregated line rate 400GbE

<sup>2)</sup> Line baud rate

<sup>3)</sup> Average receive power, (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.

<sup>4)</sup> Specified at BER  $2.4 \times 10^{-4}$

<sup>5)</sup> Typical value, specified as an indicator of strength. Varies between individual components.

### Safety/regulatory compliance:

TUV/UL/FDA (contact Smartoptics for latest certification information)

RoHS compliance

| Parameter                           | Value  |
|-------------------------------------|--|
| <b>Transmitter data:</b>            |  |
| Output power, per lane              | Min: +1.5dBm <sup>3)</sup><br>Max: +7.1dBm   |
| Output power, OMA, per lane         | Min: +4.5dBm<br>Max: +7.9dBm   |
| ER                                  | Min: 6dB   |
| Transmit wavelengths                | 1304.06 – 1305.10nm<br>1306.33 – 1307.38nm<br>1308.61 – 1309.66nm<br>1310.90 – 1311.96nm |
| <b>Receiver data:</b>               |  |
| Receiver sensitivity, OMA, per lane | -14.0dBm <sup>4)</sup>   |
| Minimum input power, per lane       | -16.2dBm <sup>3) 4)</sup>  |
| Overload (max power), per lane      | -3.4dBm  |
| Receive wavelengths range           | 1304.06 – 1305.10nm<br>1306.33 – 1307.38nm<br>1308.61 – 1309.66nm<br>1310.90 – 1311.96nm |
| LOS Assert                          | Min -17dBm   |
| LOS De-assert                       | Max -20dBm   |
| LOS Hysteresis                      | Min 0.5dB  |
| DDM                                 | Yes  |
| MSA compliance                      | QSFP-DD MSA, CMIS4.0   |

## APPLICATION CODE LIST

| CMIS Application Code | Host format    | Electrical interface  | Host Electrical ID | Payload | FEC    | MSA         | Media ID |
|-----------------------|----------------|-----------------------|--------------------|---------|--------|-------------|----------|
| 1                     | 400GBASE-R     | 1x 400GAUI-8 (8x 50G) | 0x11               | 400G    | RS-FEC | -           | 0xC0     |
| 2                     | 4 x 100GBASE-R | 4x 100GAUI-2 (2x 50G) | 0x0D               | 400G    | RS-FEC | 100G ER1-40 | 0x4C     |

## ORDERING INFORMATION

| Ordering number | Description                   |
|-----------------|-------------------------------|
| TQD031-SN4C-SO  | QSFP-DD 400G-ER4 40km CMIS4.0 |

## GENERAL DEFINITIONS

| Parameter                         | Description  |
|-----------------------------------|--|
| Technology                        | Grey; Transceiver type for non-WDM applications. Electrical or optical.<br>CWDM; Transceiver type for CWDM applications using G.694.2 channel grid.<br>DWDM; Transceiver type for DWDM applications using G.694.1 channel grid.<br>BiDi; Transceiver pair using two different wavelength channels operating on a single-fiber.<br>DAC: Direct Attach Cable. Electrical cable with attached connectors.<br>AOC: Active Optical Cable. Optical cable with attached connectors. |
| Transmission Media                | Type of fiber, e.g. Multimode (MM) or Singlemode (SM). Number of and connector type within brackets (e.g. 2x LC, 1x MPO).  |
| Typical reach                     | Nominal distance performance based on typical fiber dispersion, fiber loss and power budget properties, i.e. w/o dispersion compensation and optical amplification. Actual distance is dependent on actual optical path loss and dispersion properties.  |
| Bit rate range                    | Supported bit rate range in Gigabit or Megabit per second (Gbps or Mbps).  |
| Protocols                         | Protocols within supported bit rate range.   |
| Nominal wavelength                | Typical wavelength(s) from transmitter.  |
| Interface standards               | Referenced interface standards or MSA's, e.g. IEEE 802.3 standard for 10GbE services or 100G 4WDM-10 etc.  |
| Power budget                      | Min and max power budget between Transmitter and Receiver w/o optical path penalties.  |
| Dispersion tolerance/penalty      | Maximum amount of tolerated dispersion and required reduction of power budget to maintain stipulated Bit Error Rate (BER) and at a given bit rate.   |
| Temperature range                 | Max operating case temperature range.<br>Standard temperature range (C-temp): 0°C to +70°C (32°F to +158°F)<br>Extended temperature range (E-temp): typically -20°C to +75°C (-4°F to +167°F)<br>Industrial temperature range (I-temp): -40°C to +85°C (-40°F to +185°F)   |
| Power consumption                 | Worst case power consumption. Will vary over temperature.  |
| Transmitter Output power          | Average output power. Provided in min and max values.  |
| Receiver minimum input power      | Minimum average input power at specified BER, normally $1\text{E}^{-12}$ . Note that some protocols require FEC to achieve sufficient BER.   |
| Receiver max input power          | Maximum average input power giving a BER, normally $1\text{E}^{-12}$ .   |
| Optical modulation Amplitude, OMA | Optical Modulation Amplitude is a parameter that, in certain standards, specifies the output power and receiver sensitivity. To measure the OMA, a oscilloscope with a baud rate corresponding to the transceiver is required. Thus, this parameter cannot be measured using an ordinary optical power meter.  |
| DDM                               | Digital Diagnostic Monitoring functionality as defined in e.g. SFF-8472 MSA.   |

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