

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

QSFP-DD 400G-ER4 Lite Ethernet, PAM4 CMIS4.0, 1296/1300/1305/1309nm, 30km 15.5dB

## TQD023-SL4C-SO

The TQD023-SL4C-SO is a QSFP-DD form-factor transceivers for 400Gbps Ethernet applications. The intended use is data center interconnect for optical distances up to 30km 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 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  $2.4 \times 10^{-4}$ . TQD023-SL4C-SO also allows an onboard FEC, P-FEC, through application code 3 to allow better performance.

The TQD023-SL4C-SO is compliant with Common Management Interface Specification CMIS4.0.

## TECHNICAL DATA

Parameter	Value
Technology	Grey QSFP-DD
Transmission media	SM (2xLC)
Typical reach	30km
Nominal wavelength	1296/1300/1305/1309nm
Interface standards	400G ER4 Lite
Electrical interfaces	400GAUI-8 or 4x100GAUI-2
Bit rate support	425Gbps <sup>1)</sup> 53.125Gbd <sup>2)</sup>
Protocol support	400GbE, 4x100GbE
Power budget	3.8 – 15.5dB
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: +0.4dBm <sup>3)</sup> Max: +6.5dBm
Output power, OMA, per lane	Min: +3.4dBm Max: +9.0dBm
ER	Min: 6dB
Transmit wavelengths	1294.53 – 1296.59nm 1299.02 – 1301.09nm 1303.54 – 1305.63nm 1308.09 – 1310.19nm
<b>Receiver data:</b>	
Receiver sensitivity, OMA, per lane	-12.1dBm <sup>4)</sup>
Minimum input power, per lane	-15.1dBm <sup>3) 4)</sup>
Overload (max power), per lane	-3.4dBm
Receive wavelengths range	1294.53 – 1296.59nm 1299.02 – 1301.09nm 1303.54 – 1305.63nm 1308.09 – 1310.19nm
LOS Assert	Min -30dBm
LOS De-assert	Max -14dBm
LOS Hysteresis	Min 0.5dB
DDM	Yes
MSA compliance	QSFP-DD MSA, CMIS4.0

Subject to change without notice.

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## APPLICATION CODE LIST

CMIS Application Code	Host format	Electrical interface	Payload	FEC	MSA
1	400GBASE-R	1x 400GAUI-8 (8x 50G)	400G	RS-FEC	400G ER4
2	4 x 100GBASE-R	4x 100GAUI-2 (2x 50G)	400G	RS-FEC	100G ER1-30
3	400GBASE-R	1x 400GAUI-8 (8x 50G)	400G	P-FEC	400G ER4, with P-FEC

## ORDERING INFORMATION

Ordering number	Description
TQD023-SL4C-SO	QSFP-DD 400G-ER4 Lite 30km CMIS4.0

## GENERAL DEFINITIONS

Parameter	Description
Technology	Grey; Transceiver type for non-WDM applications. Electrical or optical. CWDM; Transceiver type for CWDM applications using G.694.2 channel grid. DWDM; Transceiver type for DWDM applications using G.694.1 channel grid. BiDi; Transceiver pair using two different wavelength channels operating on a single-fiber. DAC: Direct Attach Cable. Electrical cable with attached connectors. 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. Standard temperature range (C-temp): 0°C to +70°C (32°F to +158°F) Extended temperature range (E-temp): typically -20°C to +75°C (-4°F to +167°F) 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 $1E^{-12}$ . Note that some protocols require FEC to achieve sufficient BER.
Receiver max input power	Maximum average input power giving a BER, normally $1E^{-12}$ .
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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