

# 400G QSFP-DD ZR+ HP Coherent

400G, DWDM, QSFP-DD, ZR+, HP, Coherent, LC, SM

## CDD-4S-ZP-CCH22

### OVERVIEW

The CDD-4S-ZP-CCH22 is a high-power QSFP-DD (Type 2a) coherent DWDM transceiver designed for flexible optical transport using both OIF 400ZR and OpenZR+ profiles for 100G to 400G Ethernet services. It integrates a tunable coherent optical engine, advanced DSP, and CMIS 5.0 management interface to support multi-rate, multi-reach coherent links.

With up to +1 dBm transmit output power (provisionable) and high OSNR performance, the module enables 400G transport over existing 100 GHz ROADM architectures, extending deployment options in brownfield DWDM networks. It supports multiple host interface mappings (400GAUI-8, 200GAUI-4, 100GAUI-2, CAUI-4) and automatically configures operating modes via CMIS application codes.

The module performs GMP mapping of Ethernet client signals into a 400ZR frame structure, applies CFEC or oFEC, and transmits a dual-polarization coherent signal using DP-16QAM, DP-8QAM, or DP-QPSK depending on the selected mode. It is compatible for use in routers, switches, and muxponder platforms and aligns with specifications from OIF and OpenZR+ MSA.

### KEY SPECIFICATIONS

- QSFP-DD form factor for high-density deployments
- Up to 400G Ethernet using 4x106.25G PAM4 electrical lanes
- Supports OpenZR+ protocol and CMIS 5.0 management
- Tunable C-band DWDM, 75 GHz spacing
- Coherent transmission with integrated DSP
- Software-tunable output power and wavelength
- Power consumption below 16 W
- I2C interface for digital diagnostics

## TECHNICAL DATA

| Parameter             | Value                                                                                                     | Parameter                                                               | Value                                                         |
|-----------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|---------------------------------------------------------------|
| Form Factor           | QSFP-DD                                                                                                   | Tx Power                                                                | Min 1dBm <sup>2)</sup>                                        |
| Transmission Media    | SM (2x LC)                                                                                                | Tx In-band OSNR                                                         | Min 38dB/0.1nm                                                |
| Nominal Wavelengths   | 191.3 – 196.1THz (tunable)<br>6.25GHz Grid                                                                | Tx Out-Of-Band OSNR                                                     | Min 42dB/0.1nm                                                |
| Interface standards   | OIF 400ZR / OpenZR+                                                                                       | Rx LOS Assert                                                           | -28dBm <sup>3)</sup>                                          |
| Operating Temperature | +15°C to 75°C <sup>1)</sup>                                                                               | Receiver turn-up                                                        | Max 30ms from warm start<br>Max 120s from cold start          |
| Storage Temperature   | -40°C to 85°C                                                                                             |                                                                         |                                                               |
| DDM                   | Total received power<br>Coherent channel power<br>OSNR, eSNR, PDL, dispersion,<br>DGD<br>Case Temperature | Absolute max conditions                                                 | Rx signal input power: +13dBm<br>Rx total input power: +15dBm |
| MSA                   | QSFP-DD MSA's, CMIS5.0                                                                                    | Power consumption, 23.1W @ 400G<br>EOL @ Default CD Range <sup>4)</sup> | 23.4W @ 300G<br>21.9W @ 200G<br>18.0W @ 100G                  |
| MISC                  | Sync-E support, LLDP, RMON                                                                                |                                                                         |                                                               |

<sup>1)</sup> The module will turn up from cold start at ambient temperature as low as -5C and will reach specifications after self-heating up to min temperature.

<sup>2)</sup> The module transmit power can be provisioned up to the maximum available TX power.

<sup>3)</sup> Set to comply with 400G modes. Can be changed on individual modules to fully support other modes.

<sup>4)</sup> Increasing the CD range with 2x of default range will increase the power consumption by 0.6W.

## Safety/Regulatory Compliance

- Class 1 laser safe
- RoHS Compliance

The below table lists the OIF 400ZR and OpenZR+ modes supported by CDD-4S-ZP-CCH22.

| CMIS Appl. Code | Host format    | Electrical Interface   | Payload | FEC  | Modulation | Line Symbol Baud Rate | Operating Reach | MSA Format               | Media ID (hex) |
|-----------------|----------------|------------------------|---------|------|------------|-----------------------|-----------------|--------------------------|----------------|
| 1               | 400GBASE-R     | 1x 400GAUI-8 (8x 50G)  | 400G    | CFEC | DP-16QAM   | 59.8GBd               | 80km            | OIF 400ZR, app code 0x01 | 0x3E           |
| 2               | 400GBASE-R     | 1x 400GAUI-8 (8x 50G)  | 400G    | CFEC | DP-16QAM   | 59.8GBd               | 25km            | OIF 400ZR, app code 0x02 | 0x3F           |
| 3               | 400GBASE-R     | 1x 400GAUI-8 (8x 50G)  | 400G    | oFEC | DP-16QAM   | 60.1GBd               | 120km           | OpenZR+ MSA              | 0x46           |
| 4               | 2 × 200GBASE-R | 2x 200GAUI-4 (2x 200G) | 400G    | oFEC | DP-16QAM   | 60.1GBd               | 450km           | OpenZR+ MSA              | 0x46           |
| 5               | 4 × 100GBASE-R | 4x 100GAUI-2 (2x 50G)  | 400G    | oFEC | DP-16QAM   | 60.1GBd               | 450km           | OpenZR+ MSA              | 0x46           |
| 6               | 400GBASE-R     | 1x 400GAUI-8 (8x 50G)  | 400G    | oFEC | DP-16QAM   | 60.1GBd               | 450km           | OpenZR+ MSA, Enhanced    | 0xCE           |
| 7               | 2 × 200GBASE-R | 2x 200GAUI-4 (2x 200G) | 400G    | oFEC | DP-16QAM   | 60.1GBd               | 450km           | OpenZR+ MSA, Enhanced    | 0xCE           |
| 8               | 4 × 100GBASE-R | 4x 100GAUI-2 (2x 50G)  | 400G    | oFEC | DP-16QAM   | 60.1GBd               | 450km           | OpenZR+ MSA, Enhanced    | 0xCE           |
| 9               | 2 × 100GBASE-R | 2x 100GAUI-2 (2x 50G)  | 200G    | oFEC | DP-QPSK    | 60.1GBd               | 1000km          | OpenZR+ MSA              | 0x48           |
| 10              | 1 × 100GBASE-R | 1x 100GAUI-2 (2x 50G)  | 100G    | oFEC | DP-QPSK    | 30.1GBd               | 1000km          | OpenZR+ MSA              | 0x49           |
| 11              | 3 × 100GBASE-R | 3x 100GAUI-2 (2x 50G)  | 300G    | oFEC | DP-8QAM    | 60.1GBd               | 1000km          | OpenZR+ MSA              | 0x47           |
| 13              | 4 × 100GBASE-R | 4x 100GAUI-2 (2x 50G)  | 400G    | CFEC | DP-16QAM   | 59.8GBd               | 80km            | OIF400ZR app code 0x01   | 0x3E           |
| 14              | 2 × 100GBASE-R | 2x 100GAUI-2 (2x50G)   | 200G    | oFEC | DP-16QAM   | 30.1GBd               | 2000km          | OpenZR+ MSA, Enhanced    | 0xF3           |
| 15              | 100GBASE-R     | 1x CAUI-4 w/o FEC      | 100G    | oFEC | DP-QPSK    | 30.1GBd               | 2000km          | OpenZR+ MSA              | 0x49           |

CDD-4S-ZP-CCH22 will automatically configure the above via the Application modes. For 400G applications, the CDD-4S-ZP-CCH22 asynchronously (GMP) maps an Ethernet signal from a switch/router to an intermediate 400ZR frame structure, then adapts the frame structure to the selected FEC engine. The encoded signal is subsequently DSP framed and modulated for transmission as a coherent Dual Polarity signal.

## OPTICAL SPECIFICATION – APPLICATION CODES

The table below lists the primary optical specifications for each supported application code

| Appl code | Line rate | Host format       | Tx power <sup>1)</sup> | Rx sens @ OSNR > 36dB | Rx @ OSNR <sup>2)</sup> | Rx OSNR @ 0.5dB penalty <sup>2)</sup> | Rx OSNR @ 1dB penalty <sup>2)</sup> | Default CDC range <sup>3)</sup> | Maximum CDC search range <sup>3)</sup> |
|-----------|-----------|-------------------|------------------------|-----------------------|-------------------------|---------------------------------------|-------------------------------------|---------------------------------|----------------------------------------|
| 1         | 400G      | 1x 400GAUI-8      | 1dBm                   | -20dBm                | 26dB@-12dBm             | 26.5dB@-14dBm                         | 27.0dB@-15dBm                       | 4,000 ps/nm                     | 4,000 ps/nm                            |
| 2         | 400G      | 1x 400GAUI-8      | 1dBm                   | -20dBm                | 26dB@-12dBm             | 26.5dB@-14dBm                         | 27.0dB@-15dBm                       | 4,000 ps/nm                     | 4,000 ps/nm                            |
| 3         | 400G      | 1x 400GAUI-8      | 1dBm                   | -21dBm                | 23.0dB@-12dBm           | 23.5dB@-14dBm                         | 24.0dB@-16dBm                       | 13,000 ps/nm                    | 52,000 ps/nm                           |
| 4         | 400G      | 2x 200GAUI-4      | 1dBm                   | -21dBm                | 23.0dB@-12dBm           | 23.5dB@-14dBm                         | 24.0dB@-16dBm                       | 13,000 ps/nm                    | 52,000 ps/nm                           |
| 5         | 400G      | 4x 100GAUI-2      | 1dBm                   | -21dBm                | 23.0dB@-12dBm           | 23.5dB@-14dBm                         | 24.0dB@-16dBm                       | 13,000 ps/nm                    | 52,000 ps/nm                           |
| 6         | 400G      | 1x 400GAUI-8      | 1dBm                   | -21dBm                | 22.5dB@-12dBm           | 23.0dB@-14dBm                         | 23.5dB@-16dBm                       | 13,000 ps/nm                    | 52,000 ps/nm                           |
| 7         | 400G      | 2x 200GAUI-4      | 1dBm                   | -21dBm                | 22.5dB@-12dBm           | 23.0dB@-14dBm                         | 23.5dB@-16dBm                       | 13,000 ps/nm                    | 52,000 ps/nm                           |
| 8         | 400G      | 4x 100GAUI-2      | 1dBm                   | -21dBm                | 22.5dB@-12dBm           | 23.0dB@-14dBm                         | 23.5dB@-16dBm                       | 13,000 ps/nm                    | 52,000 ps/nm                           |
| 9         | 200G      | 2x 100GAUI-2      | 1dBm                   | -29dBm                | 14.8dB@-18dBm           | 15.3dB@-20dBm                         | 15.8dB@-22dBm                       | 50,000 ps/nm                    | 100,000 ps/nm                          |
| 10        | 100G      | 1x 100GAUI-2      | 1dBm                   | -32dBm                | 11.5dB@-20dBm           | 12.0dB@-23dBm                         | 12.5dB@-25dBm                       | 80,000 ps/nm                    | 100,000 ps/nm                          |
| 11        | 300G      | 3x 100GAUI-2      | 1dBm                   | -22dBm                | 20.3dB@-15dBm           | 20.8dB@-17dBm                         | 20.5dB@-19dBm                       | 50,000 ps/nm                    | 100,000 ps/nm                          |
| 13        | 400G      | 4x 100GAUI-2      | 1dBm                   | -20dBm                | 26dB@-12dBm             | 26.5dB@-14dBm                         | 27.0dB@-15dBm                       | 4,000 ps/nm                     | 4,000 ps/nm                            |
| 14        | 200G      | 2x 100GAUI-2      | 1dBm                   | -24dBm                | 19.3dB@-15dBm           | 19.8dB@-18dBm                         | 20.3dB@-20dBm                       | 21,000 ps/nm                    | 85,000 ps/nm                           |
| 15        | 100G      | 1x CAUI-4 w/o FEC | 1dBm                   | -32dBm                | 11.5dB@-20dBm           | 12.0dB@-23dBm                         | 12.5dB@-25dBm                       | 80,000 ps/nm                    | 160,000 ps/nm                          |

<sup>1)</sup> Minimum Tx power without attenuation. The module Tx power can be attenuated with 10dB from the maximum available Tx power. If the Tx power is not provisioned by the host, the module Tx power will default to the maximum available power.

<sup>2)</sup> Specified as [Min OSNR Value @ Min Rx power for the OSNR value].

<sup>3)</sup> Maximum provisionable CD search range. Increasing the search range will increase the power consumption of the transceiver.

## ABSOLUTE MAX RATING

Exceeding these limits can cause permanent damage to the transceiver

| Parameter      | Value         | Parameter            | Value  |
|----------------|---------------|----------------------|--------|
| Supply Voltage | 3.3V±5%V      | Max Rx Optical Power | +15dBm |
| Storage Temp   | -40°C to 85°C |                      |        |

## ORDERING INFORMATION

| Ordering Code   | Description                                     |
|-----------------|-------------------------------------------------|
| CDD-4S-ZP-CCH22 | 400G QSFP-DD, DWDM, ZR+, HP, LC, SM, 15C to 75C |

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