



# QBDTUMES0902– QSFP-DD Dual Fibre DWDM

## DWDM Tunable 50GHz / Coherent / 400G / OPENZR+

For your product safety, please read the following information carefully before any manipulation of the transceiver:



### ESD

This transceiver is specified as ESD threshold 1kV for SFI pins and 2kV for all others electrical input pins, tested per MIL-STD-883G, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module.



### LASER SAFETY

This is a Class1 Laser Product according to IEC 60825-1:2007. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007).

The optical ports of the module need to be terminated with an optical connector or with a dust plug in order to avoid contamination.

## 1. Overview

QBDTUMES0902 is a high performance QSFP-DD transceiver module for up to 400 Gigabit Ethernet DP-16QAM modulated data links over two single mode fibres. The maximum reach is up to 1300km without inline chromatic dispersion compensation. The narrow linewidth tunable laser is shared between the transmitter and receiver sections (LO). A tapped monitor diode is used to control the optical output power.

The receiver module is performing the coherent intradyne reception and O/E conversion of the incoming optical signal after being mixed with a local optical oscillator. Four pairs of balanced photo detectors perform quadratic detection and produce I and Q components of the two orthogonal polarizations (H and V).

This transceiver module is compliant with the QSFP-DD Multisource Agreement (MSA) and hot pluggable. Always contact Skylane Optics® commercial agents for compatibility with different equipment platforms.

## 2. Features

- QSFP-DD Multi-Source Agreement compliant
- Hot pluggable QSFP-DD footprint (Type 2A)
- Supports 400/300/200/100Gbps Payload
- 8× 26.5625GBd PAM4 Serial Electrical Interface (400GAUI-8, RS(544/514) FEC)
- 2× 26.5625GBd PAM4 Serial Electrical Interface (100GAUI-2, RS(544/514) FEC)
- 4× 25.78125GBd NRZ Serial Electrical Interface (CAUI-4, RS(528/514) FEC)
- Dual LC Optical Interface
- Tunable C-band Transmitter
- Coherent Receivers
- O-FEC (15%) with 11.6dB Net Coding Gain
- Up to 1300km Point-to-Point Transmission on Single Mode Fibre
- Operating temperature range: -5°C to 80°C
- Power Dissipation < 21.3W
- Single +3.3V Power Supply

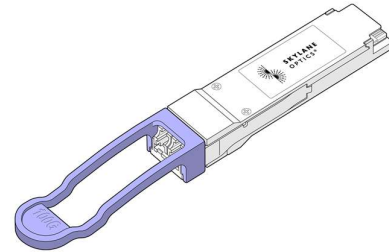


Figure 1. QSFP-DD LC  
(non-binding illustration)

## 3. Applications

- OpenZR+

## 4. Optical Interface

| P/N          | Wavelength | Protocol | Optical Output Power <sup>1</sup> [dBm] | Receiver Sensitivity <sup>2</sup> [dBm] | Optical Receiver Overload <sup>3</sup> [dBm] |
|--------------|------------|----------|---|---|--|
| QBDTUMES0902 | ITU DWDM   | OpenZR+  | -10 to -6                               | ≤ -23                                   | 1  |

1. EOL over operating temperature range

2. Minimum input power needed to achieve post-FEC BER ≤ 10<sup>-15</sup>, ZR400-OFEC-16QAM, OSNR>35dB

3. The optical input to the receiver should not exceed this value. Transmitters must never be directly connected to receivers before ensuring that proper optical attenuation is used

## 5. Technical Parameters

### 5.1. Recommended Operating Conditions

| Parameter                  | Min   | Typ  | Max   | Unit | Notes          |
|----------------------------|-------|------|-------|------|----------------|
| Storage temperature        | -40   |      | 85    | °C   |                |
| Operating Case Temperature | -5    |      | 80    | °C   |                |
| Relative Humidity          |       |      | 85    | %    | Non-Condensing |
| Power Supply Voltage       | 3.135 | 3.3  | 3.465 | V    |                |
| Power Supply Current       |       |      | 6     | A    |                |
| Power Consumption          |       | 18.4 | 21.3  | W    |                |
|                            |       |      | 1.5   |      | 4              |

4. Low power mode

### 5.2. General Specifications

| Parameter      | Min | Typ      | Max | Unit | Notes      |
|----------------|-----|----------|-----|------|------------|
| Line Baud Rate |     | 60.13855 |     | GBd  | 17, 18, 19 |
|                |     | 30.06927 |     |      | 20         |

### 5.3. Transmitter Optical Specifications

| Parameter                     | Min              | Typ         | Max              | Unit     | Notes |
|-------------------------------|------------------|-------------|------------------|----------|-------|
| Average Output Power          | -10              | -8.5        | -6               | dBm      | 5, 7  |
| Laser Linewidth               |                  |             | 300              | kHz      |       |
| Transmitter VOA Dynamic Range | 10               |             |                  | dB       | 6     |
| Output Power Stability        | -1               |             | 1                | dB       |       |
| In-Band OSNR                  | 40               |             |                  | dB/0.1nm |       |
| Out-of-Band OSNR              | 35               |             |                  | dB/0.1nm |       |
| Frequency Range               | 191.275          |             | 196.125          | THz      | 8     |
| Centre Frequency              | $\nu_T - 1.5$    | $\nu_T$     | $\nu_T + 1.5$    | GHz      | 9     |
| Channel Spacing               | 6.25             |             |                  | GHz      |       |
| Centre Wavelength Range       | 1528.58          |             | 1567.34          | nm       |       |
| Centre Wavelength             | $\lambda_T - 15$ | $\lambda_T$ | $\lambda_T + 15$ | pm       |       |

5. Output power coupled into a 9/125  $\mu\text{m}$  single mode fibre

6. The output power is settable in steps of 0.1 dB within the specified wavelength range

7. With Tx VOA attenuation set to minimum

8. Per ITU-T G.694.1 DWDM grid definition

9. Applies also to LO



| 5.4. Receiver Optical Specifications |         |      |         |       |            |
|--------------------------------------|---------|------|---------|-------|------------|
| Parameter                            | Min     | Typ  | Max     | Unit  | Notes      |
| Receiver Operating Wavelength        | 1528.58 |      | 1567.34 | nm    |            |
| Receiver Input Power Range           | -12     |      | 1       | dBm   | 10, 17     |
|                                      | -15     |      | 1       |       | 10, 18     |
|                                      | -17     |      | 1       |       | 10, 19     |
|                                      | -20     |      | 1       |       | 10, 20     |
| Extended Receiver Input Power Range  | -15     |      | 1       | dBm   | 11         |
| Receiver Sensitivity                 |         |      | -23     | dBm   | 12, 13     |
|                                      |         |      | -30     |       | 14         |
|                                      |         |      | -32     |       | 15         |
| Acquisition Range                    | -3.6    |      | 3.6     | GHz   | 16         |
| Upstream Tx Linewidth                |         |      | 500     | kHz   |            |
| OSNR Tolerance                       |         | 21.7 | 22.7    | dB    | 17         |
|                                      |         | 18.3 | 19.3    |       | 18         |
|                                      |         | 14   | 15      |       | 19         |
|                                      |         | 10.5 | 11      |       | 20         |
| Crosstalk Tolerance                  |         |      | 7       | dB    | 21         |
| Chromatic Dispersion Tolerance       |         |      | 26000   | ps/nm | 17, 22     |
|                                      |         |      | 50000   |       | 18, 19, 22 |
|                                      |         |      | 80000   |       | 20, 22     |

10. An input power in this range guarantees optimum OSNR performance  
 11. With  $\pm 1$  dB OSNR tolerance degradation  
 12. Minimum input power needed to achieve post-FEC BER  $\leq 10^{-15}$ , ZR400-OFEC-16QAM, OSNR > 35 dB  
 13. Minimum input power needed to achieve post-FEC BER  $\leq 10^{-15}$ , ZR300-OFEC-8QAM, OSNR > 35 dB  
 14. Minimum input power needed to achieve post-FEC BER  $\leq 10^{-15}$ , ZR200-OFEC-QPSK, OSNR > 35 dB  
 15. 16. Minimum input power needed to achieve post-FEC BER  $\leq 10^{-15}$ , ZR100-OFEC-QPSK, OSNR > 35 dB  
 16. Frequency offset between received carrier and LO  
 17. ZR400-OFEC-16QAM  
 18. ZR300-OFEC-8QAM  
 19. ZR200-OFEC-QPSK  
 20. ZR100-OFEC-QPSK  
 21. Ratio of accumulated crosstalk channels to signal power  
 22. Less than 0.5 dB receiver sensitivity penalty compared to OSNR > 35 dB



## 6. Transceiver Electrical Pad Layout

| Top side           |         |  |                         |          |  | Bottom side             |  |          |                    |  |         |    |
|--------------------|---------|--|-------------------------|----------|--|-------------------------|--|----------|--------------------|--|---------|----|
| 38                 | GND     |  | 76                      | GND      |  | Module Card Edge        |  | GND      | 39                 |  | GND     | 1  |
| 37                 | TX1n    |  | 75                      | TX5n     |  |                         |  | TX6n     | 40                 |  | TX2n    | 2  |
| 36                 | TX1p    |  | 74                      | TX5p     |  |                         |  | TX6p     | 41                 |  | TX2p    | 3  |
| 35                 | GND     |  | 73                      | GND      |  |                         |  | GND      | 42                 |  | GND     | 4  |
| 34                 | TX3n    |  | 72                      | TX7n     |  |                         |  | TX8n     | 43                 |  | TX4n    | 5  |
| 33                 | TX3p    |  | 71                      | TX7p     |  |                         |  | TX8p     | 44                 |  | TX4p    | 6  |
| 32                 | GND     |  | 70                      | GND      |  |                         |  | GND      | 45                 |  | GND     | 7  |
| 31                 | LPMode  |  | 69                      | Reserved |  |                         |  | Reserved | 46                 |  | ModSelL | 8  |
| 30                 | Vcc1    |  | 68                      | Vcc2     |  |                         |  | VS1      | 47                 |  | ResetL  | 9  |
| 29                 | VccTx   |  | 67                      | VccTx1   |  |                         |  | VccRx1   | 48                 |  | VccRx   | 10 |
| 28                 | IntL    |  | 66                      | Reserved |  |                         |  | VS2      | 49                 |  | SCL     | 11 |
| 27                 | ModPrsL |  | 65                      | NC       |  |                         |  | VS3      | 50                 |  | SDA     | 12 |
| 26                 | GND     |  | 64                      | GND      |  |                         |  | GND      | 51                 |  | GND     | 13 |
| 25                 | RX4p    |  | 63                      | RX8p     |  |                         |  | RX7p     | 52                 |  | RX3p    | 14 |
| 24                 | RX4n    |  | 62                      | RX8n     |  |                         |  | RX7n     | 53                 |  | RX3n    | 15 |
| 23                 | GND     |  | 61                      | GND      |  |                         |  | GND      | 54                 |  | GND     | 16 |
| 22                 | RX2p    |  | 60                      | RX6p     |  |                         |  | RX5p     | 55                 |  | RX1p    | 17 |
| 21                 | RX2n    |  | 59                      | RX6n     |  |                         |  | RX5n     | 56                 |  | RX1n    | 18 |
| 20                 | GND     |  | 58                      | GND      |  |                         |  | GND      | 57                 |  | GND     | 19 |
| Legacy QSFP28 pads |         |  | Additional QSFP-DD pads |          |  | Additional QSFP-DD pads |  |          | Legacy QSFP28 pads |  |         |    |

Legacy QSFP28 pads

Additional QSFP-DD pads

Additional QSFP-DD pads

Legacy QSFP28 pads

Figure 2. QSFP-DD Electrical Pad Layout

## 7. Module Electrical Pin Definition

| Pin Number | Name    | Function                            | Pin Number | Name     | Function                            |
|------------|---------|-------------------------------------|------------|----------|-------------------------------------|
| 1          | GND     | Ground                              | 39         | GND      | Ground                              |
| 2          | TX2n    | Transmitter Inverted Data Input     | 40         | TX6n     | Transmitter Inverted Data Input     |
| 3          | TX2p    | Transmitter Non-Inverted Data Input | 41         | TX6p     | Transmitter Non-Inverted Data Input |
| 4          | GND     | Ground                              | 42         | GND      | Ground                              |
| 5          | TX4n    | Transmitter Inverted Data Input     | 43         | TX8n     | Transmitter Inverted Data Input     |
| 6          | TX4p    | Transmitter Non-Inverted Data Input | 44         | TX8p     | Transmitter Non-Inverted Data Input |
| 7          | GND     | Ground                              | 45         | GND      | Ground                              |
| 8          | ModSelL | Module Select                       | 46         | Reserved | For future use                      |
| 9          | ResetL  | Module Reset                        | 47         | VS1      | Module Vendor Specific 1            |
| 10         | VccRx   | +3.3V Power Supply Receiver         | 48         | VccRx1   | 3.3V Power Supply                   |
| 11         | SCL     | 2-wire serial interface clock       | 49         | VS2      | Module Vendor Specific 2            |
| 12         | SDA     | 2-wire serial interface data        | 50         | VS3      | Module Vendor Specific 3            |
| 13         | GND     | Ground                              | 51         | GND      | Ground                              |
| 14         | RX3p    | Receiver Non-Inverted Data Output   | 52         | RX7p     | Receiver Non-Inverted Data Output   |
| 15         | RX3n    | Receiver Inverted Data Output       | 53         | RX7n     | Receiver Inverted Data Output       |
| 16         | GND     | Ground                              | 54         | GND      | Ground                              |
| 17         | RX1p    | Receiver Non-Inverted Data Output   | 55         | RX5p     | Receiver Non-Inverted Data Output   |
| 18         | RX1n    | Receiver Inverted Data Output       | 56         | RX5n     | Receiver Inverted Data Output       |
| 19         | GND     | Ground                              | 57         | GND      | Ground                              |
| 20         | GND     | Ground                              | 58         | GND      | Ground                              |
| 21         | RX2n    | Receiver Inverted Data Output       | 59         | RX6n     | Receiver Inverted Data Output       |
| 22         | RX2p    | Receiver Non-Inverted Data Output   | 60         | RX6p     | Receiver Non-Inverted Data Output   |
| 23         | GND     | Ground                              | 61         | GND      | Ground                              |
| 24         | RX4n    | Receiver Inverted Data Output       | 62         | RX8n     | Receiver Inverted Data Output       |
| 25         | RX4p    | Receiver Non-Inverted Data Output   | 63         | RX8p     | Receiver Non-Inverted Data Output   |
| 26         | GND     | Ground                              | 64         | GND      | Ground                              |
| 27         | ModPrsL | Module Present                      | 65         | NC       | No Connect                          |
| 28         | IntL    | Interrupt                           | 66         | Reserved | For future use                      |
| 29         | VccTx   | +3.3V Power supply transmitter      | 67         | VccTx1   | 3.3V Power Supply                   |
| 30         | Vcc1    | +3.3V Power supply                  | 68         | Vcc2     | 3.3V Power Supply                   |
| 31         | LPMode  | Low Power Mode                      | 69         | Reserved | For future use                      |
| 32         | GND     | Ground                              | 70         | GND      | Ground                              |
| 33         | TX3p    | Transmitter Non-Inverted Data Input | 71         | TX7p     | Transmitter Non-Inverted Data Input |
| 34         | TX3n    | Transmitter Inverted Data Input     | 72         | TX7n     | Transmitter Inverted Data Input     |
| 35         | GND     | Ground                              | 73         | GND      | Ground                              |
| 36         | TX1p    | Transmitter Non-Inverted Data Input | 74         | TX5p     | Transmitter Non-Inverted Data Input |
| 37         | TX1n    | Transmitter Inverted Data Input     | 75         | TX5n     | Transmitter Inverted Data Input     |
| 38         | GND     | Ground                              | 76         | GND      | Ground                              |



## 8. EEPROM

QSFP-DD CMIS Rev 4.0

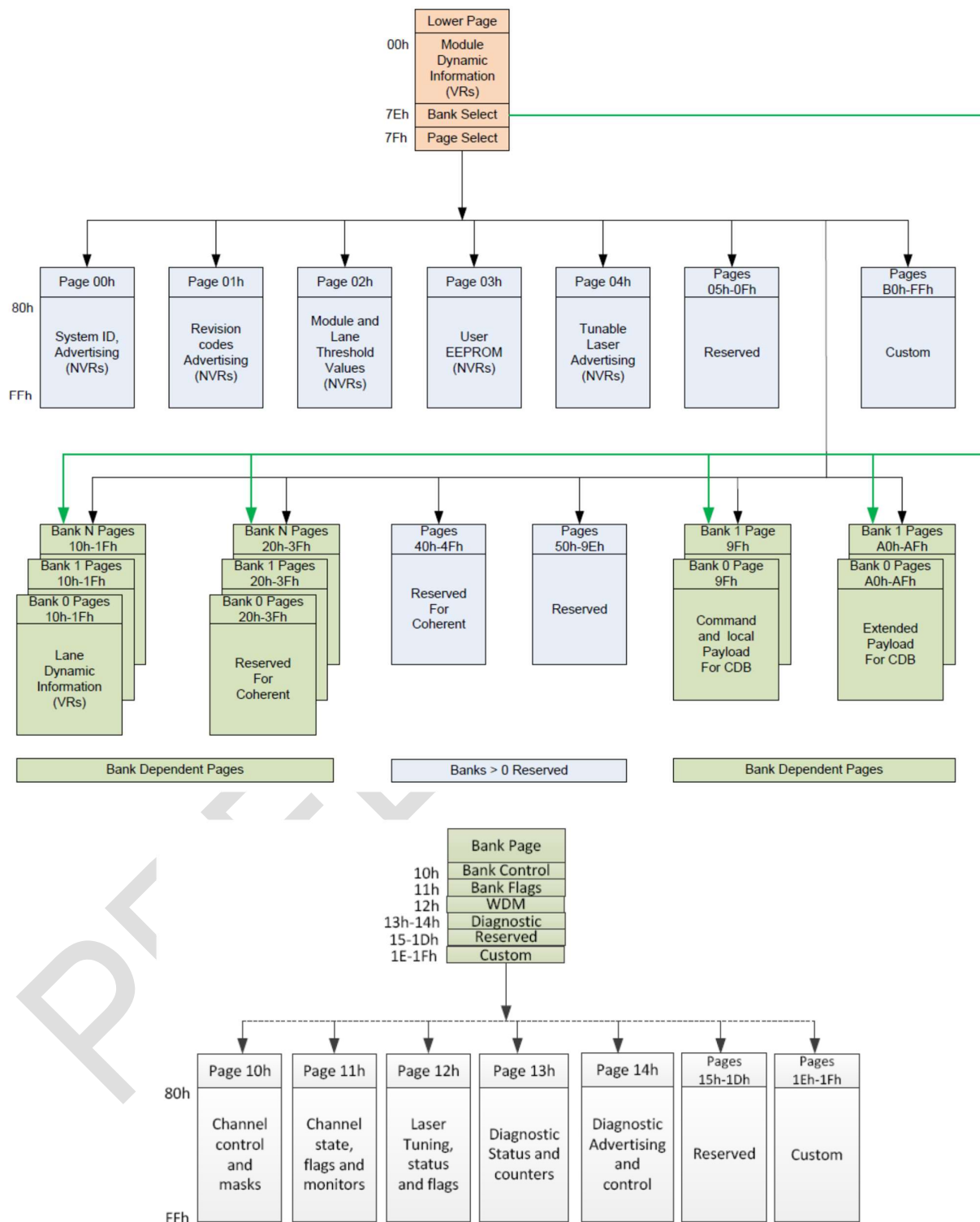


Figure 3. QSFP-DD Memory Map

## 9. Ordering Information

| Part Number  | Description  |
|--------------|--|
| QBDTUMES0902 | QSFP-DD DCO, DWDM, Tx (tunable), Rx (coherent), 1300km reach on SMF, 400G OPENZR+, dual LC connector, 0°C to 70°C, DDM |

## 10. Document Revision Information

| Revision | Description     |
|----------|-----------------|
| A        | Initial release |

SkyLane Optics® supplies a broad range of optical transceivers. Our engineers work closely with our customers to find the best solutions for every application. We are committed to provide high quality products and services to our customers.

For questions on this product please contact:  
**[support@skylaneoptics.com](mailto:support@skylaneoptics.com)**

**Beyond  
Quality**

**Reliable  
Alliance**

**Performing  
Smartly**

PRELIMINARY