# 02312VSP-SKY

Huawei® 02312VSP Compatible 100GBase-DR QSFP28 Single Lambda Transceiver (SMF, 1310nm, 500m, LC, DOM, with FEC)

**Product Description**

This Huawei® 02312VSP compatible QSFP28 transceiver provides 100GBase-DR throughput up to 500m over single-mode fiber (SMF) using a wavelength of 1310nm via an LC connector. It is guaranteed to be 100% compatible with the equivalent Huawei® transceiver. This easy to install, hot swappable transceiver has been programmed, uniquely serialized and data-traffic and application tested to ensure that it will initialize and perform identically. Digital optical monitoring (DOM) support is also present to allow access to real-time operating parameters. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

Skylane's transceivers are RoHS compliant and lead-free.

**Features:**

- SFF-8665 Compliance
- Duplex LC Connector
- Commercial Temperature 0 to 70 Celsius
- Single-mode Fiber
- Hot Pluggable
- Excellent ESD Protection
- Metal with Lower EMI
- RoHS Compliant and Lead Free

**Applications:**

- 100GBase-DR Ethernet
- Access and Enterprise

*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.***

**Absolute Maximum Ratings**

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Notes |
|---|---|---|---|---|---|---|
| **Maximum Supply Voltage** | Vcc | -0.5 | | 3.6 | V | |
| **Storage Temperature** | TS | -40 | | +85 | °C | |
| **Operating Case Temperature** | Tc | 0 | | 70 | °C | |
| **Relative Humidity (non-condensing)** | RH | 0 | | 85 | % | |
| **Damage Threshold** | THd | 5 | | | dBm | |
| **Electrical Data Rate, each Lane (NRZ)** | | | 25.78125 | | Gb/s | |
| **Optical Data Rate (PAM4)** | | | 53.125 | | GBd | |
| **Data Rate Accuracy** | | -100 | | 100 | ppm | |
| **Pre-FEC Bit Error Ratio** | | | | $2.4x10^{-4}$ | | |
| **Post-FEC Bit Error Ratio** | | | | $1x10^{-12}$ | | 1 |
| **Control Input Voltage High** | | 2 | | Vcc | V | |
| **Control Input Voltage Low** | | 0 | | 0.8 | V | |
| **Link Distance with G.652** | D | 2 | | 500 | m | 2 |

**Notes:**

1. FEC feature is embedded in the module.
2. FEC required to be turned on to support maximum transmission distance.

**Electrical Characteristics**

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Notes |
|---|---|---|---|---|---|---|
| **Power Supply Voltage** | Vcc | 3.135 | 3.3 | 3.465 | V | |
| **Power Consumption** | | | | 4.5 | W | |
| **Supply Current** | Icc | | | 1.36 | A | |
| **Transmitter (Each Lane)** | | | | | | |
| **Overload Differential Voltage pk-pk** | TP1a | 900 | | | mV | |
| **Common Mode Voltage (Vcm)** | TP1 | -350 | | 2850 | mV | 1 |
| **Differential Termination Resistance Mismatch** | TP1 | | | 10 | % | At 1MHz |
| **Differential Return Loss (SDD11)** | TP1 | | | See CEI- 28G-VSR Equation 13-19 | dB | |
| **Common Mode to Differential Conversion and Differential to Common Mode Conversion (SDC11, SCD11)** | TP1 | | | See CEI- 28G-VSR Equation 13-20 | dB | |
| **Stressed Input Test** | TP1a | See CEI- 28G-VSR Section 3.3.11.2.1 | | | | |
| **Receiver (Each Lane)** | | | | | | |
| **Differential Voltage, pk-pk** | TP4 | | | 900 | mV | |
| **Common Mode Voltage (Vcm)** | TP4 | -350 | | 2850 | mV | 1 |
| **Common Mode Noise, RMS** | TP4 | | | 17.5 | mV | |
| **Differential Termination Resistance Mismatch** | TP4 | | | 10 | % | At 1MHz |
| **Differential Return Loss (SDD22)** | TP4 | | | See CEI- 28G-VSR Equation 13-19 | dB | |
| **Common Mode to Differential Conversion and Differential to Common Mode Conversion (SDC22, SCD22)** | TP4 | | | See CEI- 28G-VSR Equation 13-21 | dB | |
| **Common Mode Return Loss (SCC22)** | TP4 | | | -2 | dB | 2 |
| **Transition Time, 20 to 80%** | TP4 | 9.5 | | | ps | |
| **Vertical Eye Closure (VEC)** | TP4 | | | 5.5 | dB | |
| **Eye Width at $10^{-15}$ probability (EW15)** | TP4 | 0.57 | | | UI | |
| **Eye Height at $10^{-15}$ probability (EH15)** | TP4 | 228 | | | mV | |

**Notes:**

1. Vcm is generated by the host. Specification includes effects of ground offset voltage.
2. From 250MHz to 30GHz.

**Optical Characteristics**

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Notes |
|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | |
| **Center Wavelength** | λt | 1304.5 | | 1317.5 | nm | |
| **Side Mode Suppression Ratio** | SMSR | 30 | | | dB | |
| **Average Launch Power** | $P_{AVG}$ | -2.9 | | 4 | dBm | 1 |
| **Outer Optical Modulation Amplitude ($OMA_{outer}$)** | $P_{OMA}$ | -0.8 | | 4.2 | dBm | 2 |
| **Launch Power in $OMA_{outer}$ minus TDECQ**<br>**for ER ≥ 5dB**<br>**for ER < 5dB** | | <br>-2.2<br>-1.9 | | | dBm | |
| **Transmitter and Dispersion Eye Closure for PAM4 (TDECQ)** | TDECQ | | | 3.4 | dB | |
| **TDECQ – $10*\log_{10}(C_{eq})$** | | | | 3.4 | dB | 3 |
| **Extinction Ratio** | ER | 3.5 | | | dB | |
| **RIN15.5OMA** | RIN | | | -136 | dB/Hz | |
| **Optical Return Loss Tolerance** | TOL | | | 15.5 | dB | |
| **Transmitter Reflectance** | RT | | | -26 | dB | |
| **Transmitter Transition Time** | | | | 17 | ps | |
| **Average Launch Power of OFF Transmitter** | Poff | | | -15 | dBm | |
| **Receiver** | | | | | | |
| **Center Wavelength** | λr | 1304.5 | | 1317.5 | nm | |
| **Damage Threshold** | $TH_d$ | 5 | | | dBm | 4 |
| **Average Receive Power** | | -5.9 | | 4 | dBm | 5 |
| **Receive Power ($OMA_{outer}$)** | | | | 4.2 | dBm | |
| **Receiver Sensitivity ($OMA_{outer}$)** | SEN | | | Equation (1) | dBm | 6 |
| **Stressed Receiver Sensitivity ($OMA_{outer}$)** | SRS | | | -1.9 | dBm | 7 |
| **Receiver Reflectance** | RR | | | -26 | dB | |
| **LOS Assert** | LOSA | -15 | | | dBm | |
| **LOS Deassert** | LOSD | | | -8.9 | dBm | |
| **LOS Hysteresis** | LOSH | 0.5 | | | dB | |
| **Conditions of Stress Receiver Sensitivity Test (Note 8)** | | | | | | |
| **Stressed Eye Closure for PAM4 (SECQ)** | | | 3.4 | | dB | |
| **SECQ – $10*\log_{10}(C_{eq})$** | | | | 3.4 | dB | |

**Notes:**

1. Average launch power (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
2. Even if the TDECQ < 1.4dB for an extinction ratio of ≥ 5dB or TDECQ < 1.1dB for an extinction ratio of < 5dB, the OMAouter (min) must exceed the minimum value specified here.
3. Ceq is a coefficient defined in IEEE Std 802.3-2018 clause 121.8.5.3 which accounts for reference equalizer noise enhancement.
4. 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.
5. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
6. Receiver sensitivity (OMAouter) (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4 dB. It should meet Equation (1), which is illustrated in the figure below.

$$RRRR = \max(-3.9, RRSSSSSS - 5.3)\ dddddd \quad (1)$$

Where:

RS is the receiver sensitivity, and
SECQ is the SECQ of the transmitter used to measure the receiver sensitivity.

7. Measured with conformance test signal at TP3 for the BER equal to 2.4x10-4.
8. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

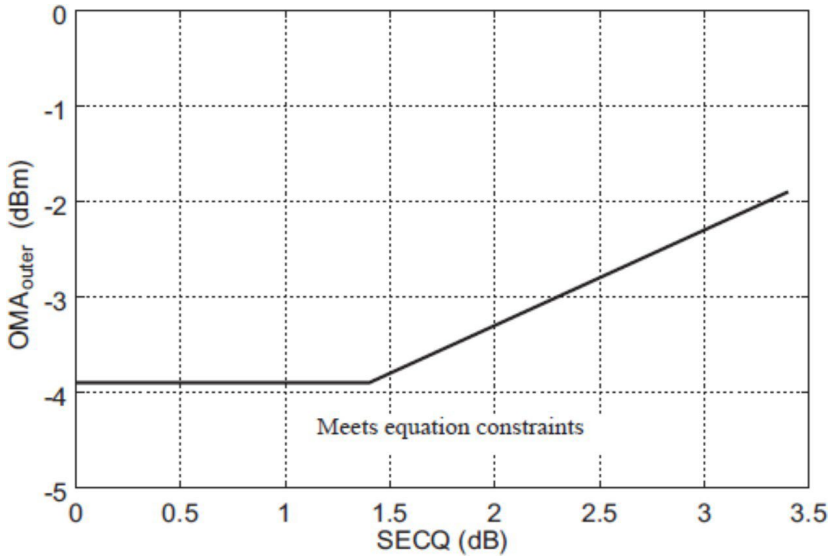



**Illustration of Receiver Sensitivity Mask for 100G-DR**

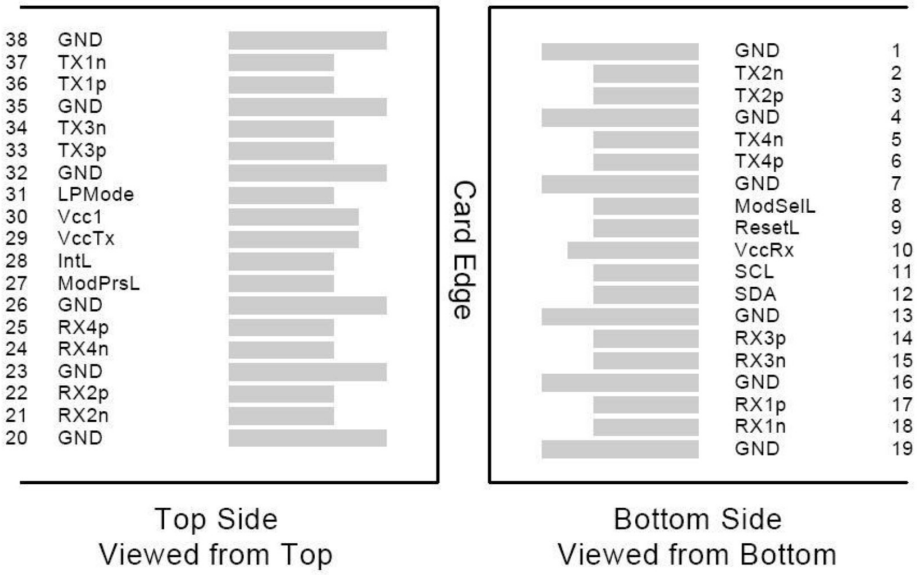
**Pin Descriptions**

| Pin | Logic | Symbol | Name/Descriptions | Ref. |
|---|---|---|---|---|
| **1** | | GND | Module Ground | 1 |
| **2** | CML-I | Tx2- | Transmitter inverted data input | |
| **3** | CML-I | Tx2+ | Transmitter non-inverted data input | |
| **4** | | GND | Module Ground | 1 |
| **5** | CML-I | Tx4- | Transmitter inverted data input | |
| **6** | CML-I | Tx4+ | Transmitter non-inverted data input | |
| **7** | | GND | Module Ground | 1 |
| **8** | LVTTL-I | MODSEIL | Module Select | |
| **9** | LVTTL-I | ResetL | Module Reset | |
| **10** | | VCCRx | +3.3v Receiver Power Supply | 2 |
| **11** | LVCMOS-I | SCL | 2-wire Serial interface clock | |
| **12** | LVCMOS-I/O | SDA | 2-wire Serial interface data | |
| **13** | | GND | Module Ground | 1 |
| **14** | CML-O | RX3+ | Receiver non-inverted data output | |
| **15** | CML-O | RX3- | Receiver inverted data output | |
| **16** | | GND | Module Ground | 1 |
| **17** | CML-O | RX1+ | Receiver non-inverted data output | |
| **18** | CML-O | RX1- | Receiver inverted data output | |
| **19** | | GND | Module Ground | 1 |
| **20** | | GND | Module Ground | 1 |
| **21** | CML-O | RX2- | Receiver inverted data output | |
| **22** | CML-O | RX2+ | Receiver non-inverted data output | |
| **23** | | GND | Module Ground | 1 |
| **24** | CML-O | RX4- | Receiver inverted data output | |
| **25** | CML-O | RX4+ | Receiver non-inverted data output | |
| **26** | | GND | Module Ground | 1 |
| **27** | LVTTL-O | ModPrsL | Module Present, internal pulled down to GND | |
| **28** | LVTTL-O | IntL | Interrupt output, should be pulled up on host board | |
| **29** | | VCCTx | +3.3v Transmitter Power Supply | 2 |
| **30** | | VCC1 | +3.3v Power Supply | 2 |
| **31** | LVTTL-I | LPMode | Low Power Mode | |
| **32** | | GND | Module Ground | 1 |
| **33** | CML-I | Tx3+ | Transmitter non-inverted data input | |
| **34** | CML-I | Tx3- | Transmitter inverted data input | |
| **35** | | GND | Module Ground | 1 |
| **36** | CML-I | Tx1+ | Transmitter non-inverted data input | |
| **37** | CML-I | Tx1- | Transmitter inverted data input | |
| **38** | | GND | Module Ground | 1 |

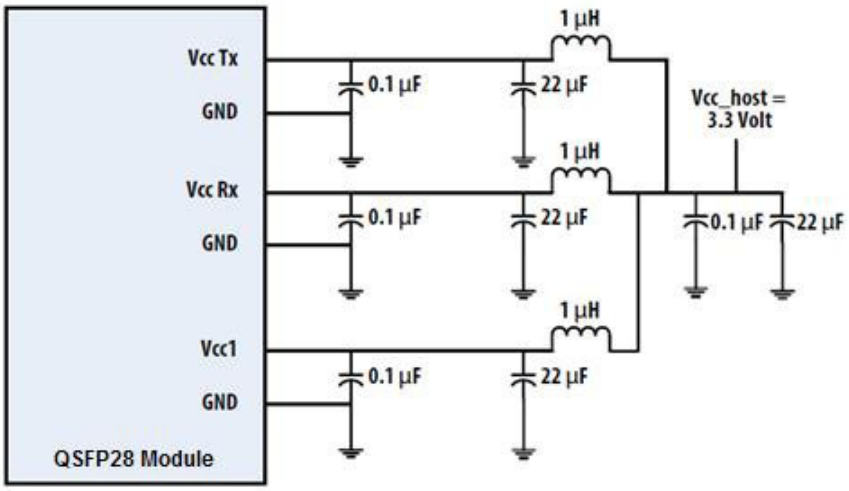
**Notes:**

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. Open collector; should be pulled up with 4.7k-10k ohms on host board to a voltage between 3.15V and 3.6V.
2. Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. 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 1000mA.

**Electrical Pin-out Details**




**Recommended Power Supply Filter**



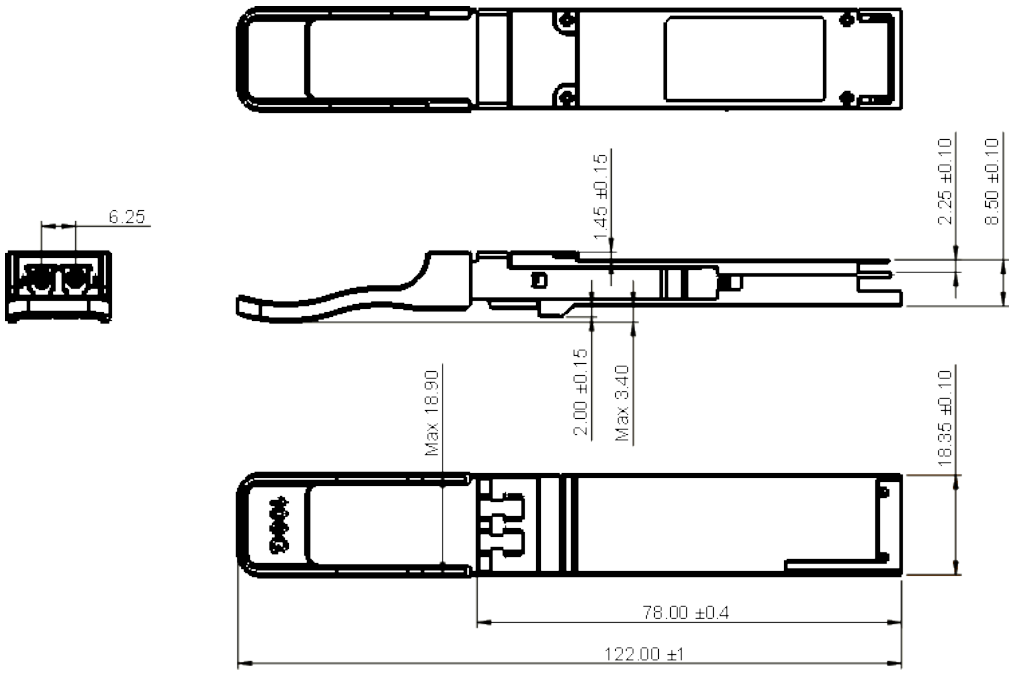
**Digital Diagnostic Functions**

| Parameter | Symbol | Min | Max | Units | Notes |
|---|---|---|---|---|---|
| **Temperature Monitor Absolute Error** | DMI_Temp | -3 | 3 | degC | Over operating temperature range |
| **Supply Voltage Monitor Absolute Error** | DMI _VCC | -0.1 | 0.1 | V | Over full operating range |
| **RX Power Monitor Absolute Error** | DMI_RX | -2 | 2 | dB | 1 |
| **Bias Current Monitor** | DMI_Ibias | -10% | 10% | mA | |
| **TX Power Monitor Absolute Error** | DMI_TX | -2 | 2 | dB | 1 |

**Notes:**

1. Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

**Mechanical Specifications**



# About Skylane Optics

Skylane is a leading provider of transceivers for optical communication.

We offer an extensive portfolio for the enterprise, access, datacenter and metropolitan fiber optical market as well as for smart home applications and home networks.

We cover the European, South American and North American market with a strong partner network and have offices in Belgium, Brazil, Sweden and USA.

Our offerings are characterized by high quality and performance. In combination with our strong technical support, we enable our customers to build cost optimized network solutions.

We offer an extensive range of high-quality products including transceivers (Optical and copper), Active Optical Cable (AOC), Direct Attach Cable (DAC), Mux/Demux, Coding Box.