

## **VC-10SFP+-DWxx-110**

10.3Gbps SFP+ DWDM Transceiver, Single Mode, 110km Reach

### **Product Features**

- ✓ Up to 11.3Gb/s data links
- ✓ DWDM EML transmitter and APD receiver
- ✓ 100 GHz ITU channel spacing with integrated wavelength locker
- ✓ Up to 110km on 9/125μm SMF
- ✓ Hot-pluggable SFP+ footprint
- ✓ Duplex LC/UPC type pluggable optical interface
- ✓ RoHS-10 compliant and lead-free
- ✓ Support Digital Diagnostic Monitoring interface
- ✓ Single +3.3V power supply
- ✓ Compliant with SFF+MSA and SFF-8472
- ✓ Metal enclosure, for lower EMI
- ✓ Meet ESD requirements, resist 8KV direct contact voltage
- ✓ Case operating temperature
  - Commercial: 0 ~ +70oC
  - Extended: -10 ~ +80°C
  - Industrial: -40 ~ +85°C

## Applications

- ✓ 1.10GBASE-ZR/ZW & 10G Ethernet
- ✓ SDH STM64
- ✓ 3.Other Optical Links

## Part Number Ordering Information

| Part Number         | Data Rate (Gb/s) | Wavelength (nm)               | Transmission Distance(km) | Temperature (°C) (Operating Case) |
|---------------------|------------------|-------------------------------|---------------------------|-----------------------------------|
| VC-10SFP+-DWxx-110C | 10.3125          | Refer to wavelength selection | 110km SMF                 | 0~70 commercial                   |
| VC-10SFP+-DWxx-110E | 10.3125          | Refer to wavelength selection | 110km SMF                 | -10~80 extended                   |
| VC-10SFP+-DWxx-110I | 10.3125          | Refer to wavelength selection | 110km SMF                 | -40~85 Industrial                 |

## Wavelength Selection: C-band $\lambda_c$ Wavelength Guide Pin Descriptions

| Channel | Wavelength (nm) | Frequency (THZ) | Channel | Wavelength (nm) | Frequency (THZ) |
|---------|-----------------|-----------------|---------|-----------------|-----------------|
| C17     | 1563.86         | 191.70          | C39     | 1546.12         | 193.90          |
| C18     | 1563.05         | 191.80          | C40     | 1545.32         | 194.00          |
| C19     | 1562.23         | 191.90          | C41     | 1544.53         | 194.10          |
| C20     | 1561.42         | 192.00          | C42     | 1543.73         | 194.20          |
| C21     | 1560.61         | 192.10          | C43     | 1542.94         | 194.30          |
| C22     | 1559.79         | 192.20          | C44     | 1542.14         | 194.40          |

|                |                                           |        |     |         |        |
|----------------|-------------------------------------------|--------|-----|---------|--------|
| C23            | 1558.98                                   | 192.30 | C45 | 1541.35 | 194.50 |
| C24            | 1558.17                                   | 192.40 | C46 | 1540.56 | 194.60 |
| C25            | 1557.36                                   | 192.50 | C47 | 1539.77 | 194.70 |
| C26            | 1556.55                                   | 192.60 | C48 | 1538.98 | 194.80 |
| C27            | 1555.75                                   | 192.70 | C49 | 1538.19 | 194.90 |
| C28            | 1554.94                                   | 192.80 | C50 | 1537.40 | 195.00 |
| C29            | 1554.13                                   | 192.90 | C51 | 1536.61 | 195.10 |
| C30            | 1553.33                                   | 193.00 | C52 | 1535.82 | 195.20 |
| C31            | 1552.52                                   | 193.10 | C53 | 1535.04 | 195.30 |
| C32            | 1551.72                                   | 193.20 | C54 | 1534.25 | 195.40 |
| C33            | 1550.92                                   | 193.30 | C55 | 1533.47 | 195.50 |
| C34            | 1550.12                                   | 193.40 | C56 | 1532.68 | 195.60 |
| C35            | 1549.32                                   | 193.50 | C57 | 1531.90 | 195.70 |
| C36            | 1548.51                                   | 193.60 | C58 | 1531.12 | 195.80 |
| C37            | 1547.72                                   | 193.70 | C59 | 1530.33 | 195.90 |
| C38            | 1546.92                                   | 193.80 | C60 | 1529.55 | 196.00 |
| <b>Non-ITU</b> | Peak wavelength between 1528.77nm-1563.86 |        | C61 | 1528.77 | 196.10 |

## I. Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

| Parameter                            | Symbol          | Min  | Max | Unit | Notes |
|--------------------------------------|-----------------|------|-----|------|-------|
| Storage Temperature                  | T <sub>s</sub>  | -40  | 85  | °C   |       |
| Power Supply Voltage                 | V <sub>CC</sub> | -0.5 | 3.6 | V    |       |
| Relative Humidity (non-condensation) | RH              | 5    | 95  | %    |       |
| Damage Threshold                     | TH <sub>d</sub> | 0    |     | dBm  |       |

## II. Recommended Operating Conditions and Power Supply Requirements

| Parameter                  | Symbol          | Min   | Typical | Max             | Unit | Notes      |
|----------------------------|-----------------|-------|---------|-----------------|------|------------|
| Operating Case Temperature | T <sub>OP</sub> | 0     |         | 70              | °C   | commercial |
|                            |                 | -10   |         | 80              |      | extended   |
|                            |                 | -40   |         | 85              |      | Industrial |
| Power Supply Voltage       | V <sub>CC</sub> | 3.135 | 3.3     | 3.465           | V    |            |
| Data Rate                  |                 |       | 10.3125 |                 | Gb/s |            |
| Control Input Voltage High |                 | 2     |         | V <sub>CC</sub> | V    |            |
| Control Input Voltage Low  |                 | 0     |         | 0.8             | V    |            |
| Link Distance (SMF)        | D               |       |         | 110             | km   | 9/125um    |

## III. General Description

Vchung' VC-10SFP+-DWxx-110 SFP+ transceiver is designed for use in 10-Gigabit Ethernet links up to 110km over single mode fiber. The module consists of DWDM EML Laser, APD and Preamplifier in a high-integrated optical sub-assembly. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472. This module is designed for single mode fiber and operates at a nominal wavelength of 100GHz ITU Grid, C Band DWDM wavelength.

VC-10SFP+-DWxx-110 transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, and received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

The SFP+ MSA defines a 256-byte memory map in EEPROM that is accessible over a 2-wire serial interface at the 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged.

#### IV. Pin Assignment and Pin Description

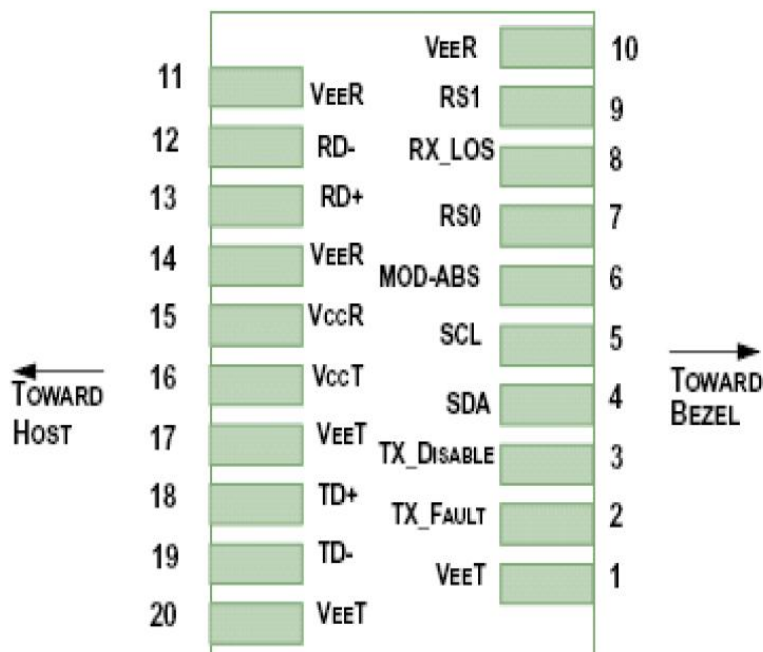


Figure1. Diagram of host board connector block pin numbers and names

| Pin | Symbol      | Name/Description                                               | Notes |
|-----|-------------|----------------------------------------------------------------|-------|
| 1   | $V_{EET}$   | Transmitter Ground (Common with Receiver Ground)               | 1     |
| 2   | $T_{FAULT}$ | Transmitter Fault.                                             | 2     |
| 3   | $T_{DIS}$   | Transmitter Disable. Laser output disabled on high or open.    | 3     |
| 4   | SDA         | 2-wire Serial Interface Data Line                              | 4     |
| 5   | SCL         | 2-wire Serial Interface Clock Line                             | 4     |
| 6   | MOD_ABS     | Module Absent. Grounded within the module                      | 4     |
| 7   | RS0         | Rate Select 0                                                  | 5     |
| 8   | LOS         | Loss of Signal indication. Logic 0 indicates normal operation. | 6     |
| 9   | RS1         | No connection required                                         |       |
| 10  | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1     |

|    |           |                                                  |   |
|----|-----------|--------------------------------------------------|---|
| 11 | $V_{EER}$ | Receiver Ground (Common with Transmitter Ground) | 1 |
| 12 | RD-       | Receiver Inverted DATA out. AC Coupled           |   |
| 13 | RD+       | Receiver Non-inverted DATA out. AC Coupled       |   |
| 14 | $V_{EER}$ | Receiver Ground (Common with Transmitter Ground) | 1 |
| 15 | $V_{CCR}$ | Receiver Power Supply                            |   |
| 16 | $V_{CCT}$ | Transmitter Power Supply                         |   |
| 17 | $V_{EET}$ | Transmitter Ground (Common with Receiver Ground) | 1 |
| 18 | TD+       | Transmitter Non-Inverted DATA in. AC Coupled.    |   |
| 19 | TD-       | Transmitter Inverted DATA in. AC Coupled.        |   |
| 20 | $V_{EET}$ | Transmitter Ground (Common with Receiver Ground) | 1 |

#### Notes:

1. Circuit ground is internally isolated from chassis ground.
2. TFAULT is an open collector/drain output, which should be pulled up with a 4.7k $\Omega$ -10k $\Omega$  resistor on the host board if intended for use. Pull up voltage should be between 2.0V to  $V_{cc} + 0.3V$ . A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
3. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
4. Should be pulled up with 4.7k $\Omega$ -10k $\Omega$  on host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.
5. Internally pulled down per SFF-8431 Rev 4.1.
6. LOS is open collector output. It should be pulled up with 4.7k $\Omega$ -10k $\Omega$  on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

#### V. Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

| Parameter                            | Symbol          | Min. | Typ. | Max | Unit | Notes |
|--------------------------------------|-----------------|------|------|-----|------|-------|
| Power Consumption                    | p               |      |      | 1.6 | W    |       |
| Supply Current                       | I <sub>cc</sub> |      |      | 480 | mA   |       |
| <b>Transmitter</b>                   |                 |      |      |     |      |       |
| Single-ended Input Voltage Tolerance | V <sub>cc</sub> | -0.3 |      | 4.0 | V    |       |

|                                              |                     |                      |     |                      |                  |   |
|----------------------------------------------|---------------------|----------------------|-----|----------------------|------------------|---|
| AC Common Mode Input Voltage Tolerance (RMS) |                     | 15                   |     |                      | mV               |   |
| Differential Input Voltage Swing             | V <sub>in,pp</sub>  | 120                  |     | 820                  | mV <sub>pp</sub> |   |
| Differential Input Impedance                 | Z <sub>in</sub>     | 90                   | 100 | 110                  | Ohm              | 1 |
| Transmit Disable Assert Time                 |                     |                      |     | 10                   | us               |   |
| Transmit Disable Voltage                     | V <sub>dis</sub>    | V <sub>cc</sub> -1.3 |     | V <sub>cc</sub>      | V                |   |
| Transmit Enable Voltage                      | V <sub>en</sub>     | V <sub>ee</sub>      |     | V <sub>ee</sub> +0.8 | V                | 2 |
| <b>Receiver</b>                              |                     |                      |     |                      |                  |   |
| Differential Output Voltage Swing            | V <sub>out,pp</sub> | 350                  |     | 850                  | mV <sub>pp</sub> |   |
| Differential Output Impedance                | Z <sub>out</sub>    | 90                   | 100 | 110                  | Ohm              | 3 |
| Data output rise/fall time                   | Tr/Tf               | 28                   |     |                      | ps               | 4 |
| LOS Assert Voltage                           | V <sub>losH</sub>   | V <sub>cc</sub> -1.3 |     | V <sub>cc</sub>      | V                | 5 |
| LOS De-assert Voltage                        | V <sub>losL</sub>   | V <sub>ee</sub>      |     | V <sub>ee</sub> +0.8 | V                | 5 |
| Power Supply Rejection                       | PSR                 | 100                  |     |                      | mV <sub>pp</sub> | 6 |

Notes:

1. Connected directly to TX data input pins. AC coupled thereafter.
2. Or open circuit.
3. Input 100 ohms differential termination.
4. These are unfiltered 20-80% values.
5. Loss of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

## VI. Optical Characteristics

| Parameter          | Symbol      | Min.              | Typical | Max               | Unit | Notes |
|--------------------|-------------|-------------------|---------|-------------------|------|-------|
| <b>Transmitter</b> |             |                   |         |                   |      |       |
| Optical Wavelength | $\lambda_c$ | $\lambda_c - 0.1$ |         | $\lambda_c + 0.1$ | nm   | 1     |
| Center Wavelength  |             |                   | 100     |                   | GHz  |       |

|                                      |                  |                            |  |       |     |   |
|--------------------------------------|------------------|----------------------------|--|-------|-----|---|
| Spacing                              |                  |                            |  |       |     |   |
| Optical Spectral Width               | $\Delta\lambda$  |                            |  | 1     | nm  |   |
| Side Mode Suppression Ratio          | SMSR             | 30                         |  |       | dB  |   |
| Average Optical Power                | P <sub>AVG</sub> | 1                          |  | 6     | dBm | 2 |
| Optical Extinction Ratio             | ER               | 8.2                        |  |       | dB  |   |
| Transmitter and Dispersion Penalty   | TDP              |                            |  | 3     | dB  |   |
| Transmitter OFF Output Power         | POff             |                            |  | -30   | dBm |   |
| Transmitter Eye Mask                 |                  | Compliant with IEEE802.3ae |  |       |     |   |
| Receiver                             |                  |                            |  |       |     |   |
| Center Wavelength                    | $\lambda_c$      | 1270                       |  | 1610  | nm  |   |
| Receiver Sensitivity (Average Power) | Sen.             |                            |  | -25.5 | dBm | 3 |
| Input Saturation Power (overload)    | Psat             | -8                         |  |       | dBm |   |
| LOS Assert                           | LOSA             | -35                        |  |       | dB  |   |
| LOS De-assert                        | LOSD             |                            |  | -27   | dBm |   |
| LOS Hysteresis                       | LOSH             | 0.5                        |  |       | dBm |   |

following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Notes:

1.  $\lambda_c$  refer to wavelength selection, and corresponds to approximately 0.8 nm.
2. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
3. Measured with Light source 1528.77~1563.86nm, ER=8.2dB; BER =<10<sup>-12</sup> @10.3125Gbps, PRBS=2<sup>31</sup>-1 NRZ.

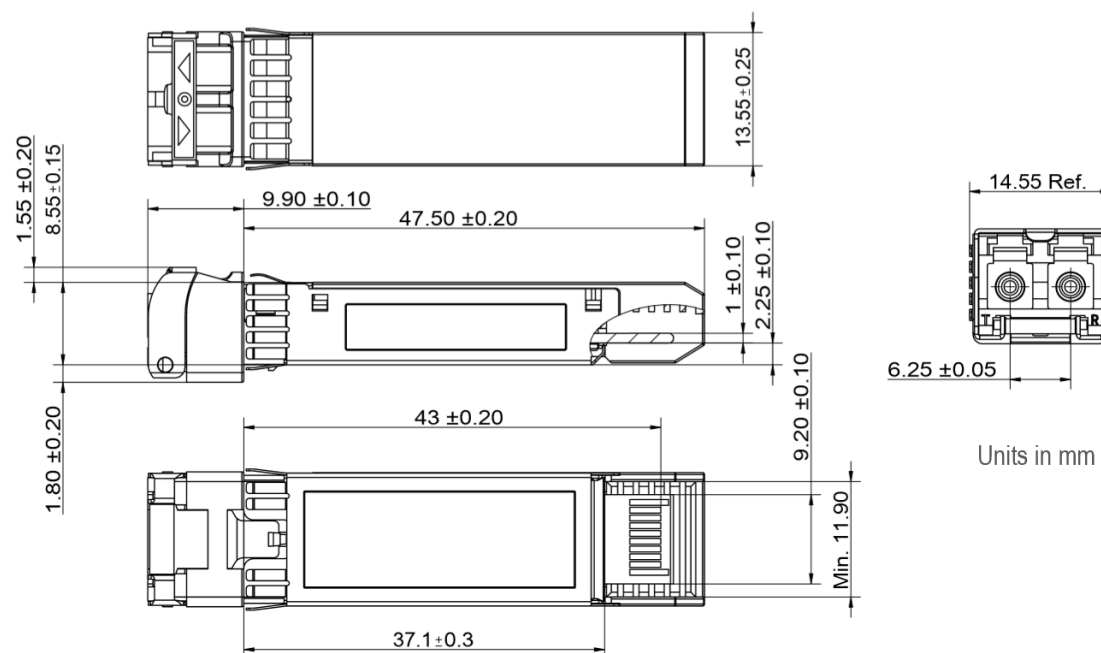
## VII. Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8472 Rev10.2 with internal calibration mode. For external calibration mode please contact our sales staff.

| Parameter                          | Symbol   | Min | Max | Unit | Notes               |
|------------------------------------|----------|-----|-----|------|---------------------|
| Temperature monitor absolute error | DMI_Temp | -3  | 3   | degC | Over operating temp |

|                                       |          |       |      |    |                      |
|---------------------------------------|----------|-------|------|----|----------------------|
| Supply voltage monitor absolute error | DMI_VCC  | -0.15 | 0.15 | V  | Full operating range |
| RX power monitor absolute error       | DMI_RX   | -3    | 3    | dB |                      |
| Bias current monitor                  | DMI_bias | -10%  | 10%  | mA |                      |
| TX power monitor absolute error       | DMI_TX   | -3    | 3    | dB |                      |

## VIII. Mechanical Dimensions



**Figure2. Mechanical Outline**

## IX. Precautions

- This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.
- Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.