

## Features

- ✧ Compliant with MSA SFP+ Specification SFF-8402
- ✧ Monitoring Interface Compliant with SFF-8472
- ✧ Single +3.3V Power Supply
- ✧ Hot-Pluggable
- ✧ Built-in dual CDR
- ✧ Support 25.78 Gb/s Data Links
- ✧ Up to 10Km on 9/125um SMF
- ✧ Very low EMI and excellent ESD protection
- ✧ Operating Case Temperature: 0°C~+70°C
- ✧ Power Dissipation < 1.2W
- ✧ RoHS Compliant Products



## Applications

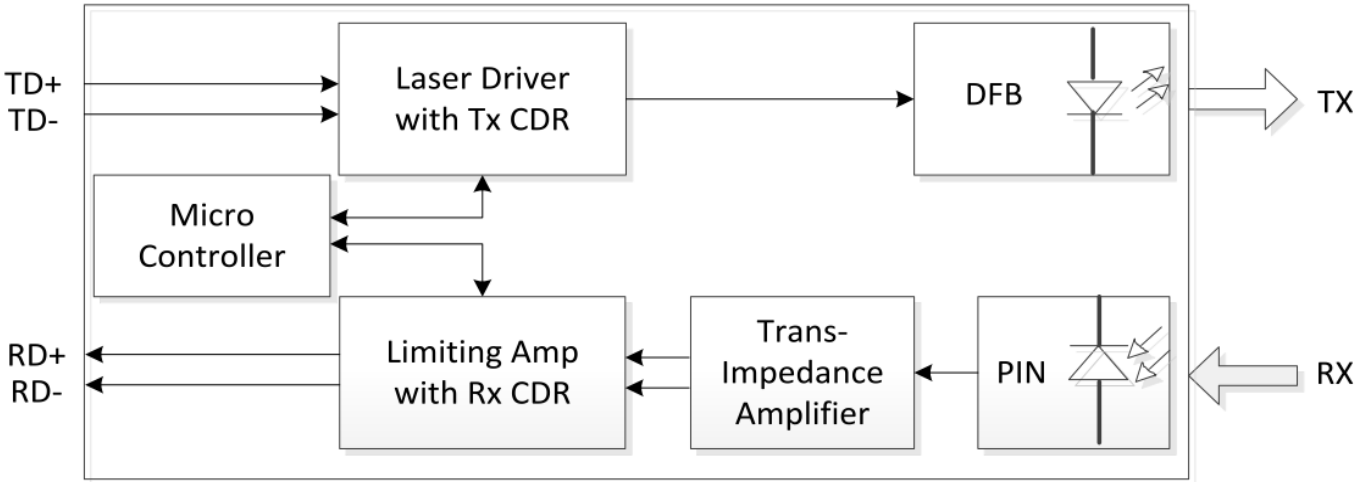
- ✧ 25GbE
- ✧ CPRI
- ✧ Other Optical Links

## Productor Selection

| Product Code  | Bail Color | Center Wavelength |
|---------------|------------|-------------------|
| HSFP28-2C2101 | Gray       | 1271nm            |
| HSFP28-2C2102 | Violet     | 1291nm            |
| HSFP28-2C2103 | Blue       | 1311nm            |
| HSFP28-2C2104 | Green      | 1331nm            |
| HSFP28-2C2105 | Yellow     | 1351nm            |
| HSFP28-2C2106 | Orange     | 1371nm            |

Description

HSFP28-2C21xx is SFP28 module for duplex optical data communications support 25.78Gb/s data links. It is with the SFP+ 20-pin connector to allow hot plug capability. Digital diagnostic functions are available via an I2C. It has built-in dual clock and data recovery (CDR).This module is designed for single-mode fiber and operates at a nominal wavelength of 1310nm.The transmitter section uses a high performance CWDM DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs detector pre-amplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.



Specification

Electrical Characteristics: (Condition: T<sub>a</sub>=T<sub>OP</sub>)

| Parameter                                             | Symbol          | Min. | Typical | Max.                 | Unit   |
|-------------------------------------------------------|-----------------|------|---------|----------------------|--------|
| Link Distance with G.652                              | -               | -    | -       | 10                   | Km     |
| Power Dissipation                                     | -               | -    | -       | 1.2                  | W      |
| <b>Transmitter:</b>                                   |                 |      |         |                      |        |
| Transmitter Differential Input Volt <sup>*Note1</sup> | +/-TX_DAT       | 180  |         | 1600                 | mV p-p |
| Input Impedance (Differential)                        | Z <sub>in</sub> |      | 100     |                      | Ω      |
| Tx_Disable Input Voltage – Low                        | V <sub>IL</sub> | -0.3 |         | 0.8                  | V      |
| Tx_Disable Input Voltage – High                       | V <sub>IH</sub> | 2.0  |         | V <sub>CC</sub> +0.3 | V      |
| Tx_Fault Output Voltage – Low                         | V <sub>OL</sub> | -0.3 |         | 0.8                  | V      |
| Tx_Fault Output Voltage – High                        | V <sub>OH</sub> | 2.0  |         | V <sub>CC</sub> +0.3 | V      |

## 25Gb/s SFP28 LR Optical Transceiver

HSFP28-2C21xx

CWDM DFB/PIN-TIA, 10Km, 0~70°C



### Receiver:

|                                         |                 |      |     |                      |          |
|-----------------------------------------|-----------------|------|-----|----------------------|----------|
| Receiver Differential Output Volt*Note1 | +/-RX_DAT       | 370  |     | 850                  | mV p-p   |
| Output Impedance (Differential)         | Zout            |      | 100 |                      | $\Omega$ |
| Rx_LOS Output Voltage- Low              | V <sub>OL</sub> | -0.3 |     | 0.8                  | V        |
| Rx_LOS Output Voltage- High             | V <sub>OH</sub> | 2.0  |     | V <sub>CC</sub> +0.3 | V        |

Note1: AC coupled.

### Optical Characteristics: (Condition: T<sub>a</sub>=T<sub>OP</sub>)

#### Transmitter:

| Parameter                        | Symbol                             | Min.              | Typical     | Max.                                    | Unit |
|----------------------------------|------------------------------------|-------------------|-------------|-----------------------------------------|------|
| Data Rate                        | B                                  | -                 | 25.78       | -                                       | Gb/s |
| Centre Wavelength                | $\lambda_c$                        | $\lambda_c - 6.5$ | $\lambda_c$ | $\lambda_c + 6.5$                       | nm   |
| Output Spectral Width            | $\Delta\lambda(-20\text{dB})$      | -                 | -           | 1                                       | nm   |
| Average Output Power*Note1       | P <sub>O</sub>                     | -7                | -           | 2                                       | dBm  |
| Extinction Ratio*Note2           | E.R.                               | 3                 | -           | -                                       | dB   |
| Transmitter Dispersion Penalty   | TDP                                | -                 |             | 3.2                                     | dB   |
| Eye Mask{X1, X2, X3, Y1, Y2, Y3} | {0.31, 0.4, 0.45, 0.34, 0.38, 0.4} |                   |             | Hit ratio 5x10 <sup>-5</sup> per sample |      |

#### Receiver:

| Parameter                         | Symbol           | Min. | Typical | Max. | Unit                               |
|-----------------------------------|------------------|------|---------|------|------------------------------------|
| Data Rate                         | B                | -    | 25.78   | -    | Gb/s                               |
| Receiver Sensitivity (OMA) *Note3 | SEN              |      |         | -12  | dBm (for BER =5x10 <sup>-5</sup> ) |
| Maximum Input Power               | P <sub>max</sub> | 2.0  | -       | -    | dBm                                |
| Signal Detect Threshold-De-Assert | S <sub>D</sub>   |      |         | -17  | dBm                                |
| Signal Detect Threshold-Assert    | S <sub>A</sub>   | -30  |         |      | dBm                                |
| Hysteresis                        | -                | 0.5  | -       |      | dB                                 |
| Optical Return Loss               | ORL              | -    | -       | -26  | dB                                 |
| Operating Wavelength              | $\lambda_c$      | 1260 | -       | 1355 | nm                                 |

Note1: Measured with 9/125 $\mu$ m single-mode fiber.

Note2: Measured with a PRBS 2<sup>31</sup>-1 test pattern @25.78Gb/s

Note3: Measured with ER=3.5dB, 2<sup>31</sup>-1 PRBS data pattern, BER less than 5E-5@25GBE and less than 1E-6@32GFC.

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### Absolute Maximum Ratings: ( $T_C=25^{\circ}\text{C}$ )

| Parameter                   | Symbol   | Min. | Max. | Unit               |
|-----------------------------|----------|------|------|--------------------|
| Storage Temperature         | $T_{ST}$ | -40  | +85  | $^{\circ}\text{C}$ |
| Operating Temperature       | $T_{IP}$ | 0    | +70  | $^{\circ}\text{C}$ |
| Input Voltage               | $T_{CC}$ | 0    | +4.0 | V                  |
| Operating Relative Humidity | RH       | 5    | 95   | %                  |

Note: Exceeding any one of these values may destroy the device permanently.

### Recommended Operating Environment:

| Parameter             | Symbol   | Min.   | Typical | Max.   | Unit               |
|-----------------------|----------|--------|---------|--------|--------------------|
| Supply Voltage        | $V_{CC}$ | +3.135 | +3.3    | +3.465 | V                  |
| Operating Temperature | $T_{OP}$ | 0      | -       | +70    | $^{\circ}\text{C}$ |

### Regulatory Compliance

| Feature                                               | Standard                                                 | Performance                           |
|-------------------------------------------------------|----------------------------------------------------------|---------------------------------------|
| Electrostatic Discharge(ESD) to the Electrical Pins   | MIL-STD-883E Method 3015.7                               | Class 1(>500 V)                       |
| Electrostatic Discharge(ESD) To the Duplex Receptacle | IEC61000-4-2                                             | Class 2(>4000V)                       |
| Electromagnetic Interference (EMI)                    | FCC Part 15 Class B                                      | Compatible with standards             |
| Immunity                                              | IEC61000-4-3                                             | Compatible with standards             |
| Laser eye safety                                      | FDA21CFR1040.10and1040.11<br>EN60950, EN (IEC) 60825-1,2 | Compatible with Class I laser product |
| Component Recognition                                 | UL and CE                                                | Compatible with standards             |
| ROHS                                                  | ROHS6                                                    | Compatible with standards             |

Note: For the latest certification information, please check with Hi-Optel.

Pin Assignment

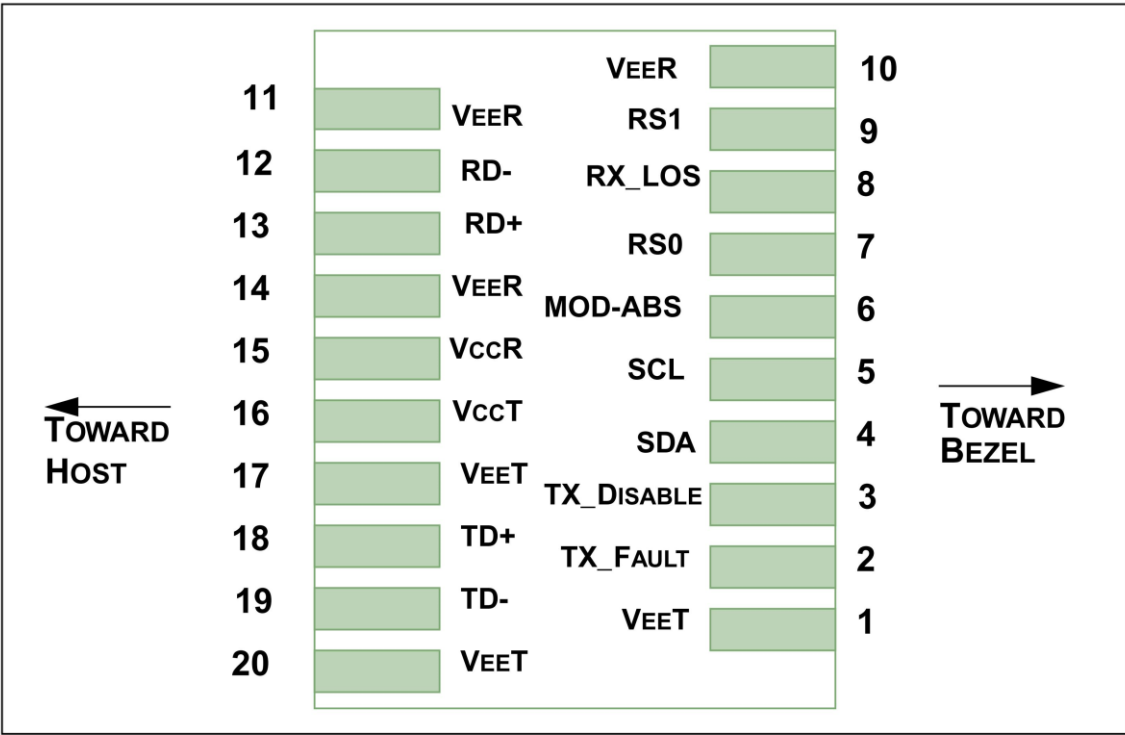


Figure 1 Host PCB SFP+ Pad Pinout Top View

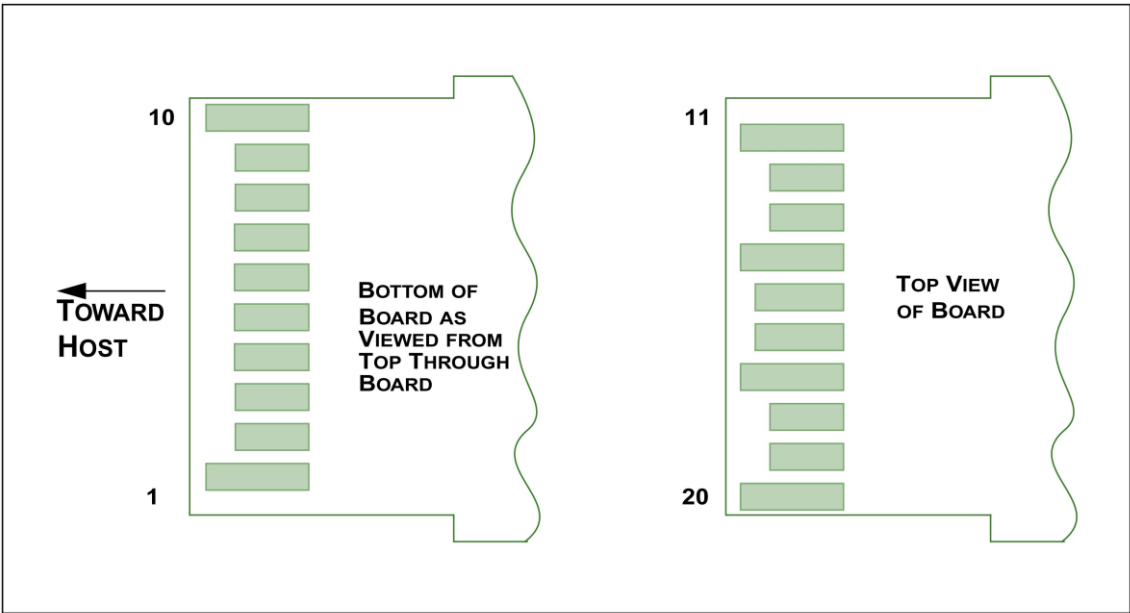


Figure 2 SFP+ Module PCB Pinout

## Pin Description

| Pin | Symbol     | Name/Description                                                           | Ref |
|-----|------------|----------------------------------------------------------------------------|-----|
| 1   | VeeT       | Transmitter Ground(Common with Receiver Ground)                            | 1   |
| 2   | Tx Fault   | Transmitter Fault. Low normal operation, High Fault indication             |     |
| 3   | Tx Disable | Transmitter Disable. Laser output disabled on high or open                 | 2   |
| 4   | SDA        | Module Definition 2.Data line for Serial ID                                | 3   |
| 5   | SCL        | Module Definition 1.Clock line for Serial ID                               | 3   |
| 6   | MOD-ABS    | Module Definition 0.Grounded within the module                             |     |
| 7   | RS0        | Rate Select 0, optionally controls SFP28 module receiver. LVTTTL Logic.    | 5   |
| 8   | LOS        | Loss of Signal indication. Logic 0 indicates normal operation.             | 4   |
| 9   | RS1        | Rate Select 1, optionally controls SFP28 module transmitter. LVTTTL Logic. | 5   |
| 10  | VeeR       | Receiver Ground(Common with Transmitter Ground)                            | 1   |
| 11  | VeeR       | 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  | VeeR       | Receiver Ground(Common with Transmitter Ground)                            | 1   |
| 15  | VccR       | Receiver Power Supply                                                      |     |
| 16  | VccT       | Transmitter Power Supply                                                   |     |
| 17  | VeeT       | 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  | VeeT       | Transmitter Ground(Common with Receiver Ground)                            | 1   |

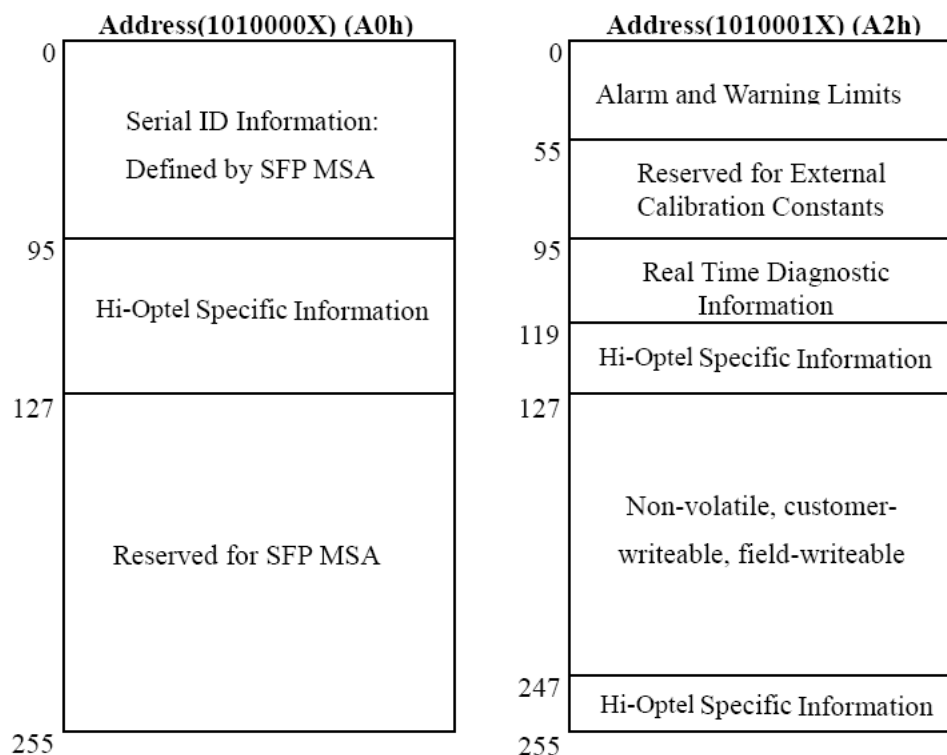
### Notes:

1. Circuit ground is internally isolated from chassis ground. VeeR and VeeT may be internally connected within the SFP28 module.
2. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
3. Should be pulled up with 4.7k – 10kohms on host board to a voltage between 2.0V and 3.6V.
4. LOS is open collector output. Should be pulled up with 4.7k – 10kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
5. Pulled low to VeeR or VeeT with a >30K resistor within the SFP28 module.

## Data Field Descriptions

The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented.

The digital diagnostic memory map specific data field define as following .For detail EEPROM information, please refer to the related document of SFF 8472 Rev 12.2.



## Digital Diagnostic Monitor Characteristics

| A2h address | Parameter   | Calibration | Accuracy | Unit |
|-------------|-------------|-------------|----------|------|
| 96-97       | Temperature | Internal    | +/- 3    | °C   |
| 98-99       | Vcc         | Internal    | +/- 3%   | V    |
| 100-101     | Tx bias     | Internal    | +/- 10%  | mA   |
| 102-103     | Tx power    | Internal    | +/- 3dB  | dB   |
| 104-105     | Rx Power    | Internal    | +/- 3dB  | dB   |

## Mechanical Dimensions:

