

## SFP-25GBASE-LR20-I-C

MSA and TAA Compliant 25GBase-LR SFP28 Transceiver Capable (SMF, 1310nm, 20km, LC, DOM, -40 to 85C)

### Features:

- SFF-8402 and SFF-8472 Compliance
- Duplex LC Connector
- Single-mode Fiber
- Industrial Temperature -40 to 85 Celsius
- Hot Pluggable
- Metal with Lower EMI
- Excellent ESD Protection
- RoHS Compliant and Lead Free



### Applications:

- 25GBase Ethernet
- Access and Enterprise

### Product Description

This MSA Compliant SFP28 transceiver provides 25GBase-LR throughput up to 20km over single-mode fiber (SMF) using a wavelength of 1310nm via an LC connector. It is built to MSA standards and is uniquely serialized and data-traffic and application tested to ensure that they will integrate into your network seamlessly. Digital optical monitoring (DOM) support is also present to allow access to real-time operating parameters. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

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

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S. – made or designated country end products."



### Regulatory Compliance

- ESD to the Electrical PINs: compatible with MIL-STD-883E Method 3015.4
- ESD to the LC Receptacle: compatible with IEC 61000-4-3
- EMI/EMC compatible with FCC Part 15 Subpart B Rules, EN55022:2010
- Laser Eye Safety compatible with FDA 21CFR, EN60950-1& EN (IEC) 60825-1,2
- RoHS compliant with EU RoHS 2.0 directive 2015/863/EU

### Absolute Maximum Ratings

| Parameter                  | Symbol | Min. | Typ. | Max. | Unit | Notes   |
|----------------------------|--------|------|------|------|------|---------|
| Maximum Supply Voltage     | Vcc    | 0    |      | 3.6  | V    | +3.3V   |
| Storage Temperature        | TS     | -40  |      | 85   | °C   |         |
| Operating Case Temperature | Tc     | -40  | 25   | 85   | °C   |         |
| Optical Receiver Input     | Pmax   |      |      | +5.5 | dBm  | Average |

### Electrical Characteristics

| Parameter            | Symbol | Min.  | Typ. | Max.   | Unit   | Notes                  |
|----------------------|--------|-------|------|--------|--------|------------------------|
| Power Supply Voltage | Vcc    | 3.135 | 3.30 | 3.465  | V      |                        |
| Power Supply Noise   | Vrip   |       |      | 2<br>3 | %<br>% | DC – 1MHz<br>1 – 10MHz |
| Power Consumption    | Pw     |       |      | 1.2    | W      |                        |

## High Speed Electrical Characteristics

| Parameter  | Test Point | Min. | Typ. | Max.   | Unit | Notes/ Conditions                          |
|--|------------|------|------|--------|------|--|
| <b>High Speed Electrical Input Characteristics</b>   |            |      |      |        |      |  |
| Overload differential voltage (peak-to-peak)   | TP1a       | 900  |      |        | mV   | Calibrated at TP1a Note 3: Section 13.3.12 |
| Differential termination mismatch  | TP1        |      |      | 10     | %    | At 1 MHz Note 3: Section 13.3.6            |
| Differential return loss (SDD11)   | TP1        |      |      | Note 1 | dB   |  |
| Common mode to differential conversion and differential to common mode conversion (SDC11, SCD11) | TP1        |      |      | Note 2 | dB   |  |
| <b>High Speed Electrical Output Characteristics</b>  |            |      |      |        |      |  |
| Differential voltage, pk-pk  | TP4        |      |      | 900    | mV   |  |
| Common mode noise, RMS   | TP4        |      |      | 17.5   | mV   | Note 6: Section 13.3.5                     |
| Differential termination mismatch  | TP4        |      |      | 10     | %    | At 1 MHz                                   |
| Differential return loss (SDD22)   | TP4        |      |      | Note 4 | dB   |  |
| Common mode to differential conversion and differential to common mode conversion (SDC22, SCD22) | TP4        |      |      | Note 5 |      |  |
| Transition Time, 20 to 80%   | TP4        | 9.5  |      |        | ps   | Note 6: Section 13.3.10                    |
| Vertical Eye Closure (VEC)   |            |      |      | 5.5    | dB   | Note 6: Section 13.3.11                    |
| Eye width at 10-15 probability (EW15)  | TP4        | 0.57 |      |        | UI   | Note 6: Section 13.3.11                    |
| Eye height at 10-15 probability (EH15)   | TP4        | 228  |      |        | mV   | Note 6: Section 13.3.11                    |

### Notes:

- SDD11, SDD22 < -11dB for  $0.05 < f < f_b/7$  ( $f_b=28\text{GHz}$ )  
SDD11, SDD22 <  $-6.0+9.2*\log_{10}(2f/f_b)$  dB for  $f_b/7 < f < f_b$  ( $f_b=28\text{ GHz}$ )
- SDC11, SCD11 <  $-22+14*(f/f_b)$  dB for  $0.05 < f < f_b/2$  ( $f_b=28\text{ GHz}$ )  
SDC11, SCD11 <  $-18+6*f/f_b$  dB for  $f_b/2 < f < f_b$  ( $f_b=28\text{ GHz}$ )
- Ref OIF-CEI-28G-VSR as described in Implementation Agreement OIF-CEI-03.1
- SDD11, SDD22 < -11dB for  $0.05 < f < f_b/7$  ( $f_b=28\text{GHz}$ )  
SDD11, SDD22 <  $-6.0+9.2*\log_{10}(2f/f_b)$  dB for  $f_b/7 < f < f_b$  ( $f_b=28\text{ GHz}$ )
- SDC22, SCD22 <  $-25+20*(f/f_b)$  dB for  $0.05 < f < f_b/2$  ( $f_b=28\text{ GHz}$ )  
SDC22, SCD22 <  $-18+6*f/f_b$  dB for  $f_b/2 < f < f_b$  ( $f_b=28\text{ GHz}$ )
- Ref OIF-CEI-28G-VSR as described in Implementation Agreement OIF-CEI-03.1

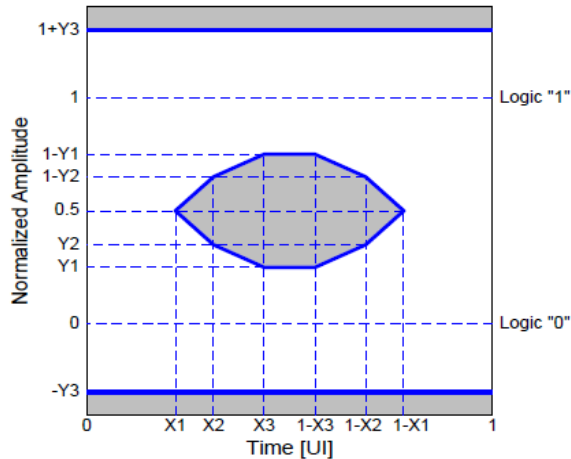
### Optical Characteristics

| Parameter                               | Symbol       | Min.         | Typ. | Max.  | Unit | Notes |
|---|--------------|--------------|------|-------|------|-------|
| <b>Transmitter</b>                      |              |              |      |       |      |       |
| Data Rate                               | fDC          | 25.78125     |      |       | Gbps | 1     |
| Signal speed variation from nominal     | $\Delta f_D$ | -100         |      | +100  | ppm  |       |
| Transmitter center wavelength           | $\lambda_C$  | 1295         | 1310 | 1325  | nm   |       |
| Average launch power                    | PTavg        | -3           |      | +4    | dBm  |       |
| Optical output power in OMA             | OMA          | -2           |      | +4    | dBm  |       |
| Launch power in OMA minus TDP           |              | -3           |      |       | dBm  |       |
| Average launch power of OFF transmitter | Poff         |              |      | -30   | dBm  |       |
| Extinction ratio                        | ER           | 3.0          |      |       | dB   |       |
| Transmitter eye mask definition         |              | Figure Below |      |       |      |       |
| <b>Receiver</b>                         |              |              |      |       |      |       |
| Receiver sensitivity in OMA             | PminOMA      |              |      | -14   | dBm  | 2, 3  |
| Stressed receiver sensitivity in OMA    | PminSOMA     |              |      | -11.5 | dBm  | 2     |
| Average received power                  | PRavg        |              |      | +4.0  | dBm  |       |

**Notes:**

1. Testing by Data Rate; NRZ at 25.78125 Gbps, Mark Ratio 50%, PRBS=2<sup>31</sup>-1
2. For BER 5x10<sup>-5</sup>
3. Receiver Sensitivity in OMA is a normative specification.

### Mask of Optical Output Eye Diagram



| X1   | X2  | X3   | Y1   | Y2   | Y3  | Max Hit Ratio (Note) |
|------|-----|------|------|------|-----|----------------------|
| 0.31 | 0.4 | 0.45 | 0.34 | 0.38 | 0.4 | 5 x 10 <sup>-5</sup> |

**Note:** The acceptable ratio of samples inside to outside the hatched area (the “hit ratio”) must be met.

## Low Speed Control Pin Logic Levels

| Parameter        | Symbol   | Min.           | Max.           | Unit | Conditions/Notes                               |
|------------------|----------|----------------|----------------|------|--|
| Host VCC Range   | Host_VCC | 3.14           | 3.47           | V    | with $\pm 5\%$ variation                       |
| TX_Fault, RX_LOS | VOL      | 0.0            | 0.40           | V    | Note 1   |
|                  | VIL      | Host_VCC - 0.5 | Host_VCC + 0.3 | V    | Note 1   |
| TX_Disable       | VIL      | -0.3           | 0.8            | V    | Pulled up with 10k ohms to VccT in the module. |
|                  | VIH      | 2.0            | VCCT + 0.3     | V    |  |

### Notes:

1. Rpullup (Rp) is the pull up resistor. Active bus termination may be used by the host in place of a pullup resistor. Pull ups can be connected to multiple power supplies, however the host board design shall ensure that no module pin has voltage exceeding module. Measured at the Host side of the connector.

**TX\_Fault** is a module output pin that when High, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX\_Fault output pin is an open drain/collector and must be pulled up to the Host\_Vcc with 4.7k-10k $\Omega$  on the host board

**TX\_Disable** is a module input pin. When TX\_Disable is asserted High or left open, the SFP+ module transmitter output must be turned off. The TX\_Disable pin is pulled up to VccT with 10k $\Omega$  in the SFP+ module. The TX\_Disable pin works for TX\_fault\_Reset as well.

**Mod\_ABS** is pulled up to Host\_Vcc with 4.7k-10k $\Omega$  on the host board and connected to VeeT or VeeR in the SFP+ module. Mod\_ABS is then asserted "High" when the SFP+ module is physically absent from a host slot. In the SFP MSA (INF8074i) this pin had the same function but is called MOD\_DEF0.

**RX\_LOS** when high indicates an optical signal level below that specified in the relevant standard. The RX\_LOS pin is an open drain/collector output and must be pulled up to host Vcc with a 4.7k-10k $\Omega$  on the host board. RX\_LOS assert min and de-assert max are defined in the relevant standard.

### CDR Control for Bypass Mode

- Default value for "Soft RSO" and "Soft RS1" is '0'
- Hard pin#7 for RSO and hard pin#9 for RS1 are terminated to Ground through 30kohm.

|     | Hard: Pin #7 | Soft: A2h, Byte 110 bit 3 | Mode of Operation |
|-----|--------------|---------------------------|-------------------|
| RSO | 0            | 0                         | CDRR bypass mode  |
|     | 0            | 1                         | CDRR engaged mode |
|     | 1            | 0                         | CDRR engaged mode |
|     | 1            | 1                         | CDRR engaged mode |

|     | Hard: Pin #9 | Soft: A2h, Byte 118 bit 3 | Mode of Operation |
|-----|--------------|---------------------------|-------------------|
| RS1 | 0            | 0                         | CDRT bypass mode  |
|     | 0            | 1                         | CDRT engaged mode |
|     | 1            | 0                         | CDRT engaged mode |
|     | 1            | 1                         | CDRT engaged mode |

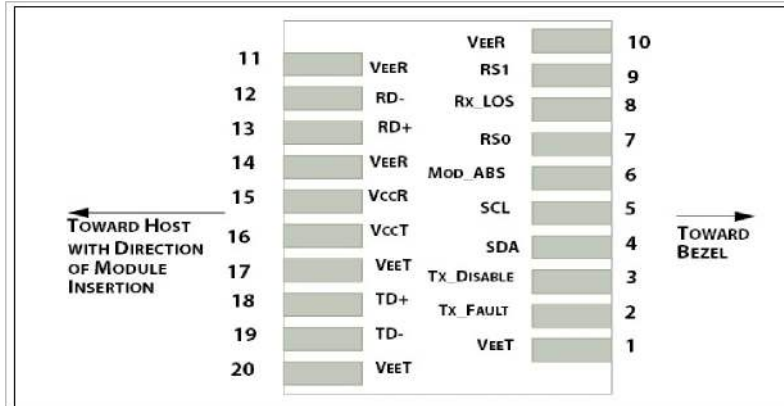
### Pin Description

| PIN | Symbol     | Name / Description   | Notes |
|-----|------------|--|-------|
| 1   | VeeT       | Transmitter Ground   | 1     |
| 2   | TX_Fault   | Transmitter Fault (LVTTTL-O) - High indicates a fault condition        | 2     |
| 3   | TX_Disable | Transmitter Disable (LVTTTL-I) – High or open disables the transmitter | 3     |
| 4   | SDA        | Two wire serial interface Data Line (LVCMOS-I/O) (MOD-DEF2)            | 4     |
| 5   | SCL        | Two wire serial interface Clock Line (LVCMOS-I/O) (MOD-DEF1)           | 4     |
| 6   | MOD_ABS    | Module Absent (Output), connected to VeeT or VeeR in the module        | 5     |
| 7   | RS0        | NA   | 6     |
| 8   | RX_LOS     | Receiver Loss of Signal (LVTTTL-O)                                     | 2     |
| 9   | RS1        | NA   | 6     |
| 10  | VeeR       | Receiver Ground  | 1     |
| 11  | VeeR       | Receiver Ground  | 1     |
| 12  | RD-        | Inverse Received Data out (CML-O)                                      |       |
| 13  | RD+        | Received Data out (CML-O)  |       |
| 14  | VeeR       | Receiver Ground  | 1     |
| 15  | VccR       | Receiver Power - +3.3V   |       |
| 16  | VccT       | Transmitter Power - +3.3 V   |       |
| 17  | VeeT       | Transmitter Ground   | 1     |
| 18  | TD+        | Transmitter Data In (CML-I)  |       |
| 19  | TD-        | Inverse Transmitter Data In (CML-I)                                    |       |
| 20  | VeeT       | Transmitter Ground   | 1     |

### Notes:

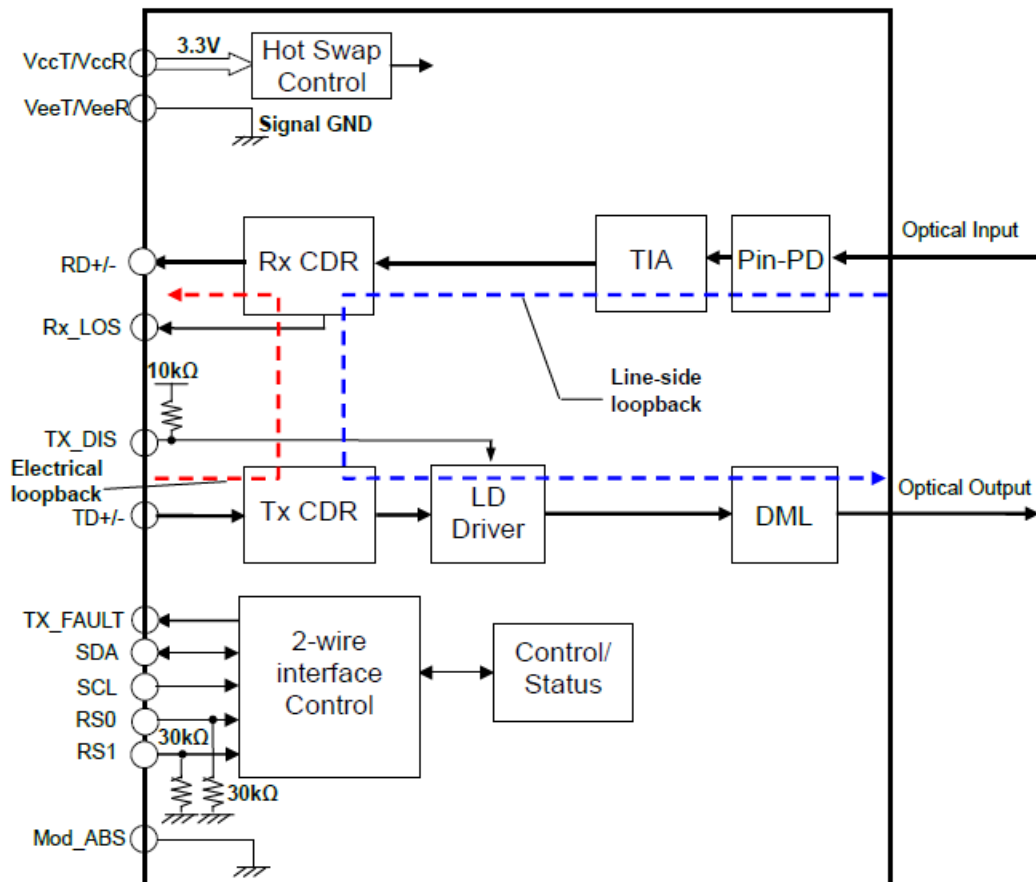
1. The module signal grounds are isolated from the module case.
2. This is an open collector/drain output that on the host board requires a 4.7K $\Omega$  to 10K $\Omega$  pull-up resistor to VccHost.
3. This input is internally biased high with a 4.7K $\Omega$  to 10K $\Omega$  pull-up resistor to VccT.
4. Two-Wire Serial interface clock and data lines require an external pull-up resistor dependent on the capacitance load.
5. This is a ground return that on the host board requires a 4.7K $\Omega$  to 10K $\Omega$  pull-up resistor to VccHost.

6. Rate select can also be set through the 2-wire bus in accordance with SFF-8472 v. 12.1, Rx Rate Select is set at Bit 3, Byte 110, Address A2h. Tx Rate Select is set at Bit 3, Byte 118, Address A2h.  
 Note: writing a "1" selects maximum bandwidth operation. Rate select is the logic OR of the input state of Rate Select Pin and 2-wire bus.



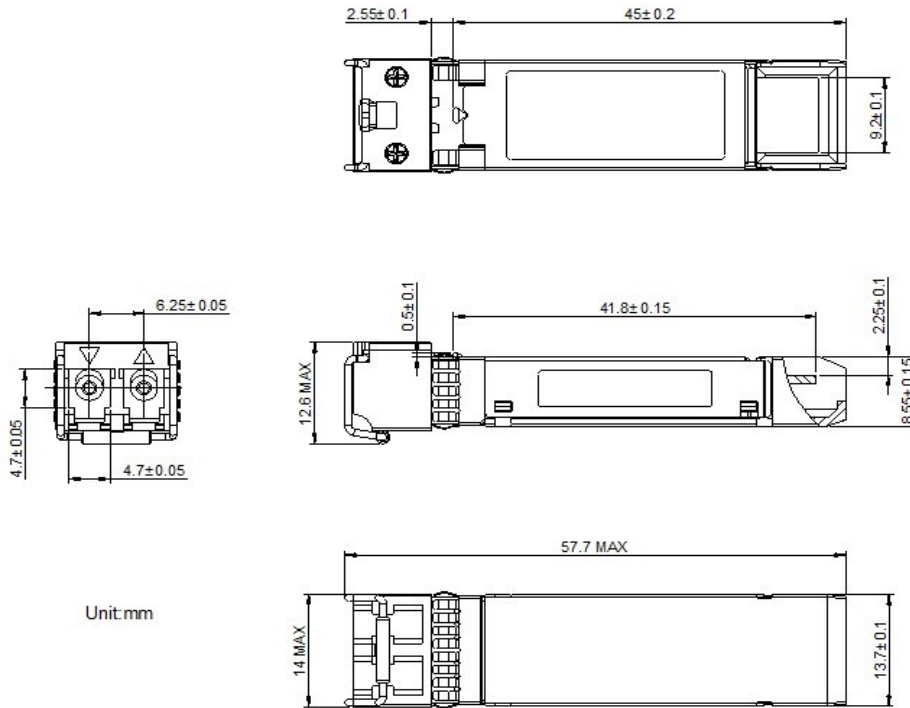
Pin-out of connector Block on Host board

**Functional Block Diagram**



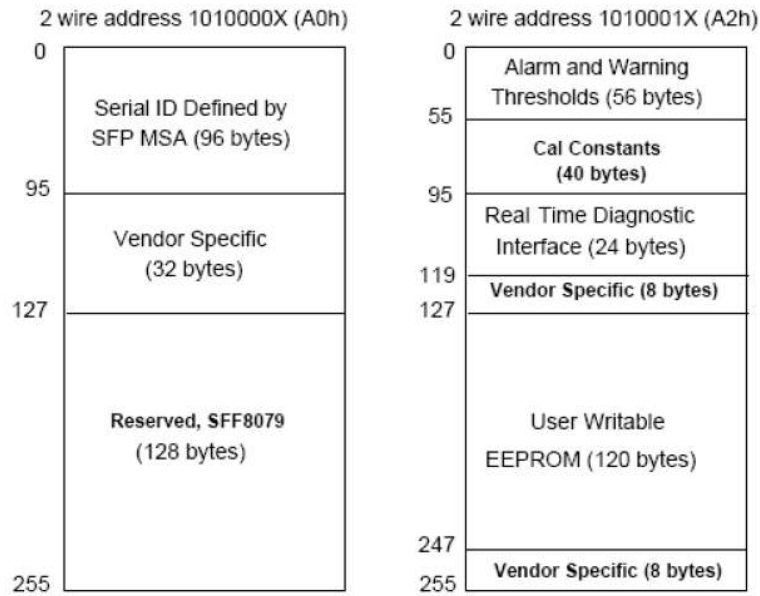
## Mechanical Specifications

Small Form Factor Pluggable (SFP) transceivers are compatible with the dimensions defined by the SFP Multi-Sourcing Agreement (MSA).



## EEPROM Information

EEPROM memory map specific data field description is as below:





## **About ProLabs**

Our experience comes as standard; for over 15 years ProLabs has delivered optical connectivity solutions that give our customers freedom and choice through our ability to provide seamless interoperability. At the heart of our company is the ability to provide state-of-the-art optical transport and connectivity solutions that are compatible with over 90 optical switching and transport platforms.

## **Complete Portfolio of Network Solutions**

ProLabs is focused on innovations in optical transport and connectivity. The combination of our knowledge of optics and networking equipment enables ProLabs to be your single source for optical transport and connectivity solutions from 100Mb to 400G while providing innovative solutions that increase network efficiency. We provide the optical connectivity expertise that is compatible with and enhances your switching and transport equipment.

## **Trusted Partner**

Customer service is our number one value. ProLabs has invested in people, labs and manufacturing capacity to ensure that you get immediate answers to your questions and compatible product when needed. With Engineering and Manufacturing offices in the U.K. and U.S. augmented by field offices throughout the U.S., U.K. and Asia, ProLabs is able to be our customers best advocate 24 hours a day.

## **Contact Information**

ProLabs US

Email: [sales@prolabs.com](mailto:sales@prolabs.com)

Telephone: 952-852-0252

ProLabs UK

Email: [salessupport@prolabs.com](mailto:salessupport@prolabs.com)

Telephone: +44 1285 719 600