



# DATASHEET

## 10GB-ER-SFPP-C

Product specifications



## 10GB-ER-SFPP-C

10 Gb/s 40km SFP+ Optical Transceiver

### Product Features

- ✓ Duplex LC Connector
- ✓ Support hot-pluggable
- ✓ Metal with lower EMI
- ✓ Excellent ESD protection
- ✓ RoHS Compliant and Lead-Free
- ✓ Compliant with IEEE 802.3ae
- ✓ Temperature-stabilized EML transmitter and PIN ROSA
- ✓ Up to 40KM for single mode fiber
- ✓ GR-253-CORE compliant
- ✓ Compliant with SFP+ MSA: SFF-8431 Rev4.1
- ✓ Digital diagnostic compatible with SFF-8472 Rev11.0
- ✓ Single 3.3V power supply and Low power dissipation <2.5W

### Applications

- ✓ 10GBASE-ER/EW 10G Ethernet
- ✓ 10G Fibre Channel
- ✓ SONET OC-192 /SDH STM-64

## Regulatory Compliance

- ✓ ESD to the Electrical PINs: compatible with MIL-STD-883E Method 3015.4
- ✓ ESD to the LC Receptacle: compatible with IEC 61000-4-2
- ✓ 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 Directive 2011/65/EU

## Pin Descriptions

| Pin | Symbol     | Name/Description   | Ref. |
|-----|------------|--|------|
| 1   | VeeT       | Transmitter Ground (Common with Receiver Ground)                             | 1    |
| 2   | TX Fault   | Transmitter Fault. LVTTTL-O  | 2    |
| 3   | TX Disable | Transmitter Disable. Laser output disabled on high or open. LVTTTL-I         | 3    |
| 4   | SDA        | 2-Wire Serial Interface Data Line(Same as MOD-DEF2 in INF-8074i). LVTTTL-I/O |      |
| 5   | SCL        | 2-Wire Serial Interface Data Line(Same as MOD-DEF2 in INF-8074i). LVTTTL-I   |      |
| 6   | Mod_ABS    | Module Absent, Connect to VeeT or VeeR in Module.                            | 4    |
| 7   | RS0        | Rate Select 0, optionally controls SFP+ module receiver LVTTTL-I             | 5    |
| 8   | LOS        | Loss of Signal indication. Logic 0 indicates normal operation. LVTTTL-O      | 2    |
| 9   | RS1        | Rate Select 1, optionally controls SFP+ module transmitter. LVTTTL-I         | 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. CML-O                                |      |
| 13  | RD+        | Receiver Non-inverted DATA out. AC Coupled. CML-O                            |      |
| 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. CML- I                         |      |
| 19  | TD-        | Transmitter Inverted DATA in. AC Coupled. CML- I                             |      |
| 20  | VeeT       | Transmitter Ground (Common with Receiver Ground)                             | 1    |

**Notes:**

1. The module signal ground contacts, VeeR and VeeT, should be isolated from the module case.
2. This contact is an open collector/drain output and should be pulled up to the Vcc\_Host with resistor in the range 4.7K $\Omega$  to 10K $\Omega$ . Pull ups can be connected to one or several power supplies, however the host board design shall ensure that no module contact has voltage exceeding module VccT/R +0.5V.
3. Tx\_Disable is an input contact with a 4.7K $\Omega$  to 10K $\Omega$  pull-up resistor to VccT inside module.
4. Mod\_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull the contact up to Vcc\_Host with a resistor in the range from 4.7K $\Omega$  to 10K $\Omega$ . Mod\_ABS is asserted “High” when the SFP+ module is physically absent from a host slot.
5. RS0 and RS1 are module inputs and are pulled low to VeeT with > 30 k $\Omega$  resistors in the module. RS0 optionally selects the optical receive signaling rate coverage. RS1 optionally selects the optical transmit signaling rate coverage.

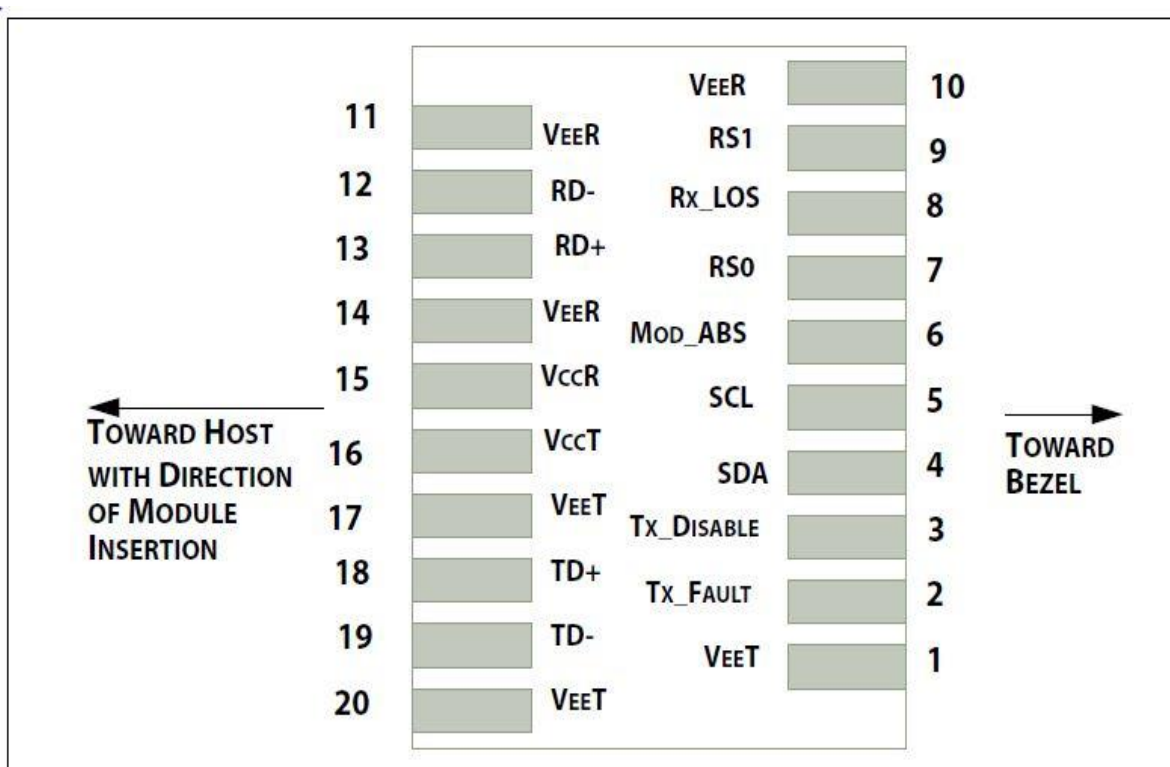
These contacts can also be used for RS0 and RS1 if implementing SFF8079. See SFF8079 for details. RS1 is commonly connected to VeeT or VeeR in the classic SFP modules. The host needs to ensure that it will not be damaged if this contact is connected to VeeT or VeeR in the module.

The SFP+ module provides two inputs RS0 and RS1 that can optionally be used for rate selection. RS0 controls the receive path signalling rate capability, and RS1 controls the transmit path signaling rate capability. The host and module may choose to use either, both, or none of these functions. Because contact 9 in the classic SFP INF-8074i is connected to VeeR, an SFP+ host utilizing RS1 must provide short circuit protection.

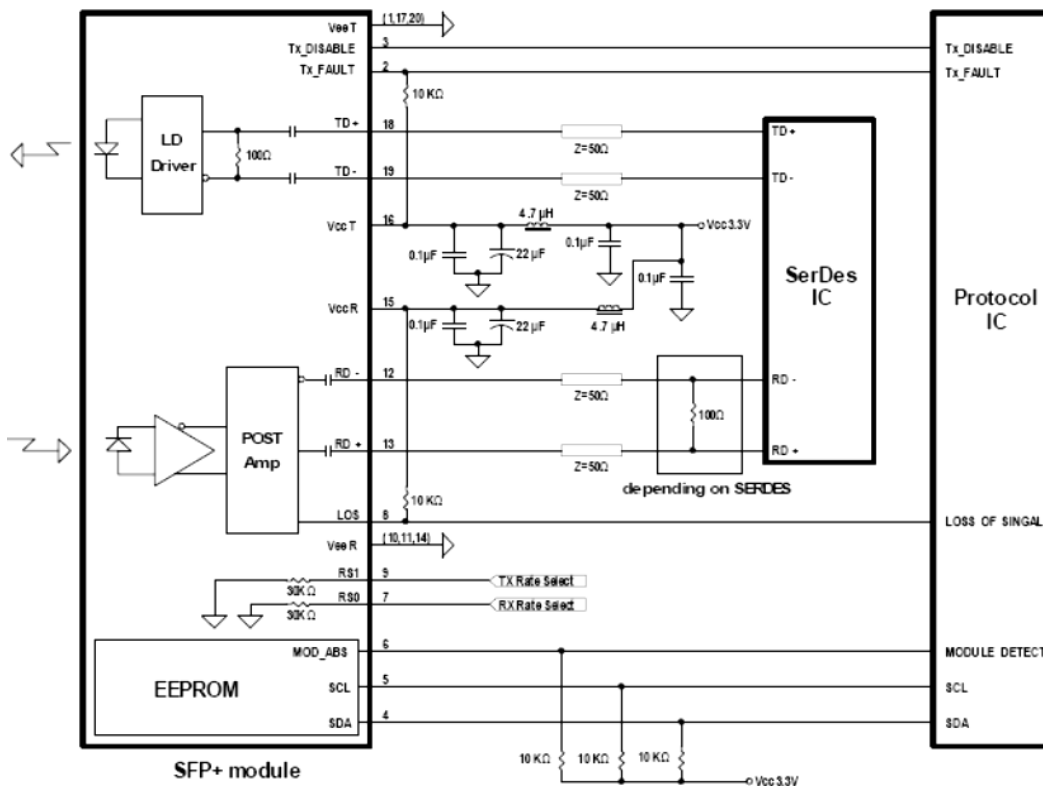
This rate select functionality can also be controlled by software as defined by SFF-8472. Optionally the rate select methods of Part 2 of SFF-8079 may be used instead of the method described here by setting the management declaration bit (A0h byte 93 bit 2) to 1, see SFF-8472.

| Parameter | State | Conditions                                      |
|-----------|-------|---|
| RS0       | Low   | Rx signally rate less than or equal to 4.25GBd. |
|           | High  | Rx signally rate great than 4.25GBd.            |
| RS1       | Low   | Tx signally rate less than or equal to 4.25GBd. |
|           | High  | Tx signally rate great than 4.25GBd.            |

**Pin-out of Connector Block on Host Board**



## Recommend Circuit Schematic



## Absolute Maximum Ratings

| Parameter              | Symbol | Min  | Typ | Max  | Unit | Ref. |
|------------------------|--------|------|-----|------|------|------|
| Maximum Supply Voltage | Vcc    | -0.5 |     | +4.0 | V    |      |
| Storage Temperature    | TS     | -40  |     | +85  | °C   |      |
| Operating Humidity     | RH     | 5    |     | 95   | %    |      |

## Recommended Operating Conditions

| Parameter                  | Symbol | Min  | Typ  | Max  | Unit | Ref. |
|----------------------------|--------|------|------|------|------|------|
| Power Supply Voltage       | Vcc    | 3.13 | 3.30 | 3.47 | V    |      |
| Power Supply Current       | Icc    | -    | -    | 750  | mA   |      |
| Case Operating Temperature | Tc     | -5   | -    | +70  | °C   |      |
| 9/125um G.652 SMF          | Lmax   | -    | -    | 40   | km   |      |
| Operating Data Rate        |        | 9.95 |      | 11.3 | Gbps |      |

## Electrical Characteristics

| Parameter                      | Symbol               | Min             | Typ | Max                   | Unit | Ref. |
|--------------------------------|----------------------|-----------------|-----|-----------------------|------|------|
| <b>Transmitter</b>             |                      |                 |     |                       |      |      |
| Input differential impedance   | R <sub>in</sub>      | 85              | 100 | 115                   | Ω    | 1    |
| Differential data input swing  | V <sub>in,pp</sub>   | 120             | 600 | 850                   | mV   |      |
| TX Disable-High                | -                    | 2               | -   | V <sub>cc</sub> +0.3  | V    |      |
| TX Disable-Low                 | -                    | V <sub>ee</sub> | -   | V <sub>ee</sub> + 0.8 | V    |      |
| TX Fault-High                  | -                    | 2               | -   | V <sub>cc</sub> +0.3  | V    |      |
| TX Fault-Low                   | -                    | V <sub>ee</sub> | -   | V <sub>ee</sub> +0.8  | V    |      |
| <b>Receiver</b>                |                      |                 |     |                       |      |      |
| Single ended data output swing | V <sub>out, pp</sub> | 350             | 400 | 700                   | mV   |      |
| LOS-High                       | -                    | 2               |     | V <sub>cc</sub> +0.3  | V    |      |
| LOS-Low                        | -                    | V <sub>ee</sub> |     | V <sub>ee</sub> +0.8  | V    |      |

### **Notes:**

1. AC coupled.

## Optical Characteristics

| Parameter                                     | Symbol           | Min         | Typ  | Max   | Unit      | Ref. |
|---|------------------|-------------|------|-------|-----------|------|
| <b>Transmitter</b>                            |                  |             |      |       |           |      |
| Output Opt. Power                             | PO               | -1          | -    | 2     | dBm       |      |
| Optical Extinction Ratio                      | ER               | 8.2         | -    | -     | dB        |      |
| Optical Wavelength                            | $\lambda$        | 1528        | 1550 | 1565  | nm        |      |
| Average Launch power of OFF TX                | Poff             | -           | -    | -45   | dBm       |      |
| Spectral Width(-20dB)                         | $\Delta \lambda$ | -           | -    | 1     | nm        |      |
| Side mode Suppression Ratio                   | SMSR             | 30          |      |       | dB        |      |
| Optical Return Loss Tolerance                 | ORLT             |             |      | 12    | dB        |      |
| Relative Intensity Noise                      | RIN              | -           | -    | -128  | dB/H<br>z |      |
| Transmitter and Dispersion Penalty(@800ps/nm) | TDP              | -           | -    | 2     | dB        |      |
| Optical Eye Mask 1                            |                  | ITU-T G.691 |      |       |           | 1    |
| Optical Eye Mask 2                            |                  | IEEE802.3ae |      |       |           | 2    |
| <b>Receiver</b>                               |                  |             |      |       |           |      |
| Overload                                      | Po               | -1          | -    | -     | dBm       |      |
| Optical Center Wavelength                     | $\lambda_C$      | 1270        | -    | 1600  | nm        |      |
| Receiver Reflectance                          | -                | -           | -    | -27   | dB        |      |
| LOS De-Assert                                 | LOSD             | -           | -    | -20   | dBm       |      |
| LOS Assert                                    | LOSA             | -34         | -    | -     | dBm       |      |
| LOS Hysteresis                                | -                | 0.5         | -    | 5     | dB        |      |
| Receiver Sensitivity @non-FEC rate            | Pmin1            |             |      | -15.8 | dBm       | 3    |
| Receiver Sensitivity @ FEC rate               | Pmin2            |             |      | -19   | dBm       | 3    |

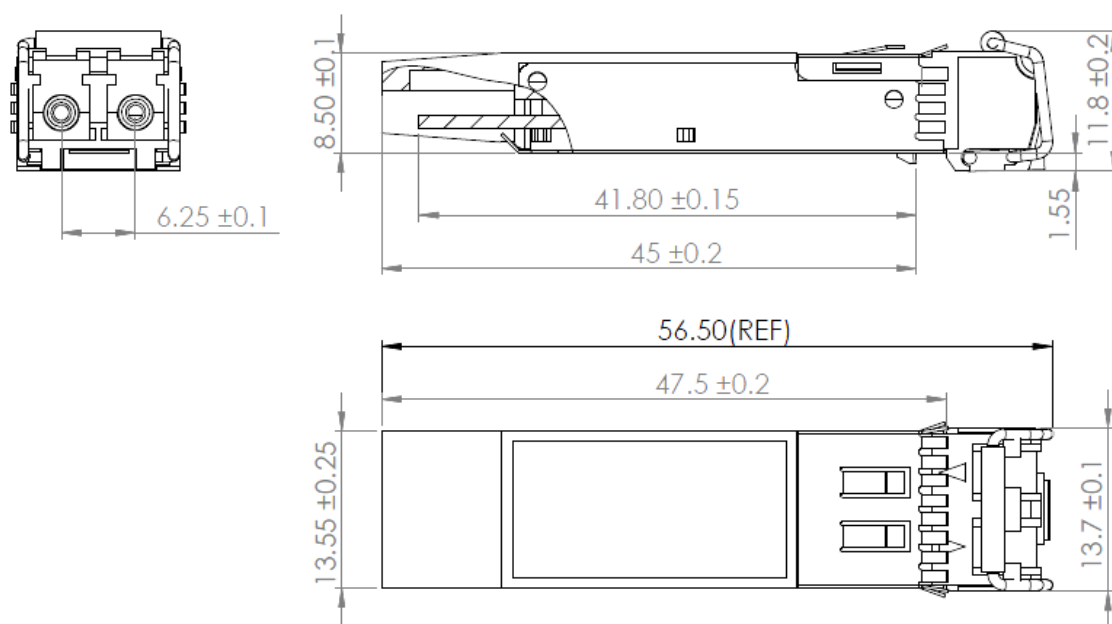
### Notes:

1. Measured at 9.95328Gb/s , PRBS2<sup>31</sup>-1,NRZ,
2. Measured at 10.3125Gb/s,Non-framed PRBS2<sup>31</sup>-1,NRZ.
3. non-FEC rate refers 9.9/10.3/10.5Gbps, and FEC rate refers 10.7/11.1/11.3Gbps, BER of 1E-12 for non-FEC rate, and 1E-4 for FEC rate



## Mechanical Specifications

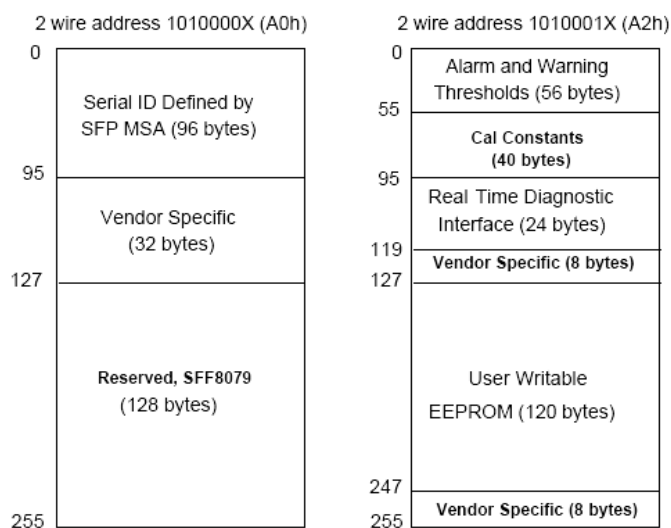
RAPIDCON's Small Form Factor Pluggable (SFP+) transceivers are compatible with the dimensions defined by the SFP Multi-Sourcing Agreement (MSA).



**10GB-ER-SFPP-C**

## EEPROM Information

EEPROM memory map specific data field description is as below:



## Digital Diagnostic Monitoring Interface

Five transceiver parameter values are monitored. The following table defines the monitored parameter's accuracy.

| Parameter    | Range          | Accuracy | Calibration |
|--------------|----------------|----------|-------------|
| Temperature  | 0 to +70°C (C) | ±3°C     | Internal    |
| Voltage      | 2.97 to 3.63V  | ±3%      | Internal    |
| Bias Current | 0 to 100mA     | ±10%     | Internal    |
| TX Power     | -1 to +2dBm    | ±2dB     | Internal    |
| RX Power     | -19to -1dBm    | ±3dB     | Internal    |