

# 10G SFP+ Passive Copper Twinax Cable (PCC)



## Application

- 1/2/4/8G Fibre Channel
- 1x InfiniBand QDR, DDR, SDR
- 10G Gigabit Ethernet & 10 GbE high performance computer clusters
- Switched fabric I/O such as ultra high bandwidth switches and routers
- High density connections between networking equipment
- End of row/Middle of row switching architectures
- Data center cabling infrastructure
- Storage Area Networks ( SAN ) & Storage Servers

## Features

- Support for multi-gigabit data rates up to 10.5Gbps
- 850nm VCSEL transmitter, PIN photo-detector receiver, up to 300m on OM3 MMF
- Wire AWG: AWG30, AWG28, AWG26, AWG24
- Cable type: Passive Copper Twinax Cable
- Available length (in meters): 1, 2, 3.....
- Improved Pluggable Form Factor (IPF) compliant for enhanced EMI/EMC performance
- Commercial temperature range (COM): 0~ 70 ° C
- Low power consumption < 0.5W
- Power supply :+3.3V
- Small diameter cable design
- Compatible to SFP+ MSA
- Electrical interface compliant to SFF-8431

## Description

The SFP+ passive cable assemblies are high performance, cost effective I/O solutions for 10G Ethernet and 10G Fiber Channel applications. SFP+ copper modules allow hardware manufactures to achieve high port density, configurability and utilization at a very low cost and reduced power budget. The high speed cable assemblies meet and exceed Gigabit Ethernet and Fiber Channel industry standard requirements for performance and reliability.

These assemblies are called “passive” copper cables because there isn’t any signal conditioning circuitry (e.g. crosstalk or echo cancellation) contained within the SFP+ connector. Sometimes these assemblies are referred to as “DAC” or “Direct Attached Copper” cables. Inside the SFP+ MSA footprint optical cables can be used that require optical transceivers or Active Optical Cables (AOC) that contain the transceiver as part of the cable.

## Products Specifications



### I. Absolute Maximum Ratings

| Parameter                         | Symbol | Min  | Typ. | Max  | Unit  |
|-----------------------------------|--------|------|------|------|-------|
| <b>Operating Case Temperature</b> | Tc     | 0    | 25   | 70   | °C    |
| <b>Relative Humidity</b>          | RH     | 5    |      | 95   | %     |
| <b>Supply Voltage</b>             |        | 3.15 | 3.3  | 3.45 | v     |
| <b>Data Rate Per Lane</b>         |        | 1    | 10.5 |      | Gbp/s |

## II. Performance Specification

### Electrical

|                                   |                            |
|-----------------------------------|----------------------------|
| Min. Dielectric Withstand Voltage | 300 VDC                    |
| Insulation Resistance             | 1000 Mohms                 |
| Current Rating                    | 0.5 Amp Min/Signal Contact |

### General

|                       |                            |
|-----------------------|----------------------------|
| Operating Temperature | 0 to 70 ° C                |
| Flammability Rating   | UL 94 V-0                  |
| Green Features        | RoHS, Lead-Free            |
| Shield                | Braid/Foil                 |
| Marking               | Mfg Name, Part#, Date Code |

### Plug

|                    |                            |
|--------------------|----------------------------|
| Backshell Material | Nickel-Plated Zinc Diecast |
| Contact Material   | PCB with Gold-Plated Pads  |
| Latch              | Positive Latching w/Pull   |
| Insertion Force    | 30N Max                    |
| Withdrawal Force   | 20N Max                    |
| Retention Force    | 90N Max                    |
| Durability         | 50 Cycles Min              |

### Cable

|             |                            |
|-------------|----------------------------|
| Conductor   | Solid                      |
| Wire Gauge  | AWG30, AWG28, AWG26, AWG24 |
| Impedance   | 100 ± 5 ohms               |
| Cable OD    | AWG 30 :4.2mm              |
|             | AWG 28 :4.7mm              |
|             | AWG 26:5.2mm               |
|             | AWG 24: 6.0mm              |
| Jacket Type | PVC                        |
| Bend Radius | 5X Cable OD                |

### III. Electrical Characteristics

| Test Type                         | Test Item                       | 24AWG  | 26AWG  | 28AWG  | 30AWG  |
|-----------------------------------|---------------------------------|--|--|--|--|
| <b>Electrical Characteristics</b> | Differential impedance          | 100 ± 5Ω @ TDR   | 100 ± 5Ω   | 100 ± 5Ω   | 100 ± 5Ω @ TDR   |
|                                   | Mutual capacitance              | 14pF/ft nominal  | 14pF/ft nominal  | 14pF/ft nominal  | 14pF/ft nominal  |
|                                   | Time delay                      | 1.31ns/ft nominal,<br>(4.3ns/m) nominal  | 1.35ns/ft nominal  | 1.35ns/ft nominal  | 1.35ns/ft nominal,<br>(4.3ns/m) nominal  |
|                                   | Time delay skew (within pairs)  | 80ps/10m maximum   | 120ps/8.5m maximum   | 120ps/7m maximum   | 50ps/5.5m maximum  |
|                                   | Time delay skew (between pairs) | 350ps/10m maximum  | 500ps/8.5m maximum   | 500ps/7m maximum   | 350ps/5.5m maximum   |
|                                   | Attenuation                     | 10dB/10m maximum @ 1.25Ghz   | 10dB/8.5m maximum @ 1.25Ghz  | 10dB/7m maximum @ 1.25Ghz  | 8.4dB/5.5m maximum @ 1.25Ghz   |
|                                   | Conductor DC Resistance         | 0.026Ω /ft maximum @ 20° C   | 0.04Ω /ft maximum @ 20° C  | 0.06Ω/ft maximum @20° C  | 0.01Ω/ft maximum @20° C  |
| <b>Physical Characteristics</b>   | Conductors (two pair)           | 24AWG Solid, Silver plated copper  | 26AWG Solid, Silver plated copper  | 28AWG Solid, Silver plated copper  | 30AWG Solid, Silver plated copper  |
|                                   | Insulation                      | Foam polyolefin  | Foam polyolefin  | Foam polyolefin  | Foam polyolefin  |
|                                   | Pair drain wire                 | 26AWG Solid, Silver plated copper  | 28AWG Solid, Silver plated copper  | 30AWG Solid, Silver plated copper  | 30AWG Solid, Silver plated copper  |
|                                   | Overall cable shield            | Aluminum/polyester tape, 125% coverage, Tin plated copper braid, 38AWG, 85% coverage | Aluminum/polyester tape, 125% coverage, Tin plated copper braid, 38AWG, 85% coverage | Aluminum/polyester tape, 125% coverage, Tin plated copper braid, 38AWG, 85% coverage | Aluminum/polyester tape, 125% coverage, Tin plated copper braid, 38AWG, 85% coverage |
|                                   | Outer diameter                  | 6.0mm  | 5.2mm  | 4.7mm  | 4.2mm  |

## IV. Pin Designation

| Pin | Logic      | Symbol   | Name/Description                | Notes |
|-----|------------|----------|---------------------------------|-------|
| 1   |            | VeeT     | Transmitter Ground              |       |
| 2   | LV-TTL-O   | TX_Fault | N/A                             | 1     |
| 3   | LV-TTL-I   | TX_DIS   | Transmitter Disable             |       |
| 4   | LV-TTL-I/O | SDA      | Tow Wire Serial Data 5 LV       |       |
| 5   | LV-TTL-I   | SCL      | Tow Wire Serial Clock           |       |
| 6   |            | MOD_DEF0 | Module present, connect to VeeT |       |
| 7   | LV-TTL-I   | RS0      | N/A                             | 1     |
| 8   | LV-TTL-O   | LOS      | LOS of Signal                   |       |
| 9   | LV-TTL-I   | RS1      | N/A                             | 1     |
| 10  |            | VeeR     | Receiver Ground                 |       |
| 11  |            | VeeR     | Receiver Ground                 |       |
| 12  | CML-O      | RD-      | Receiver Data Inverted          |       |
| 13  | CML-O      | RD+      | Receiver Data Non-Inverted      |       |
| 14  |            | VeeR     | Receiver Ground                 |       |
| 15  |            | VccR     | Receiver Supply 3.3V            |       |
| 16  |            | VccT     | Transmitter Supply 3.3V         |       |
| 17  |            | VeeT     | Transmitter Ground              |       |
| 18  | CML-I      | TD+      | Transmitter Data Non-Inverted   |       |
| 19  | CML-I      | TD-      | Transmitter Data Inverted       |       |
| 20  |            | VeeT     | Transmitter Ground              |       |

## V. Low Speed Electrical Hardware Pins

In addition to the 2-wire serial interface, the SFP+ module has the following low speed pins for control and status:



### (1) TX\_Fault

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 ohms on the host board.

### (2) TX\_Disable

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\_DIS pin must be pulled up to VccT in the SFP+ module.

### (3) RS0/RS1

RS0 and RS1 are module input rate select pins and are pulled low to VeeT with a  $> 30k\Omega$  resistor in the module. RS0 is an input hardware pin which optionally selects the optical receive data path rate coverage for an SFP+ module. RS1 is an input hardware pin which optionally selects the optical transmit path data rate coverage for an SFP+ module.

### (4) MOD\_ABS

Mod\_ABS is pulled up to Host\_Vcc with 4.7k-10k ohms 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.

### (5) SCL/SDA

SCL is the 2-wire interface clock and SDA is the 2-wire interface data line. SCL and SDA are pulled up to a voltage in the range of 3.14V to 3.46V on the host.

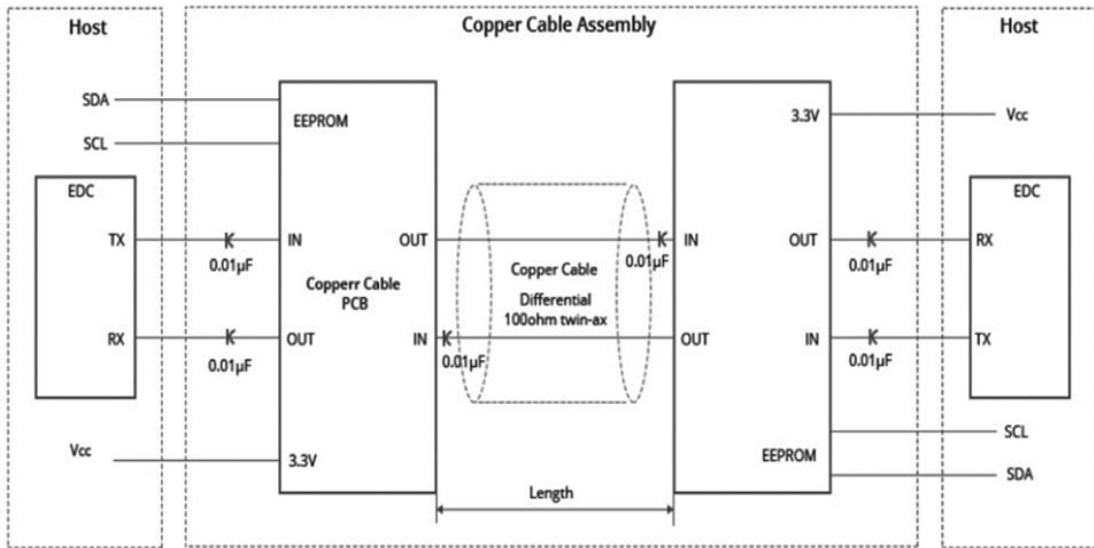
### (6) RX\_LOS

RX\_LOS when High indicated 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 ohms on the host board. RX\_LOS assert min and de-assert max are defined in the relevant standard.

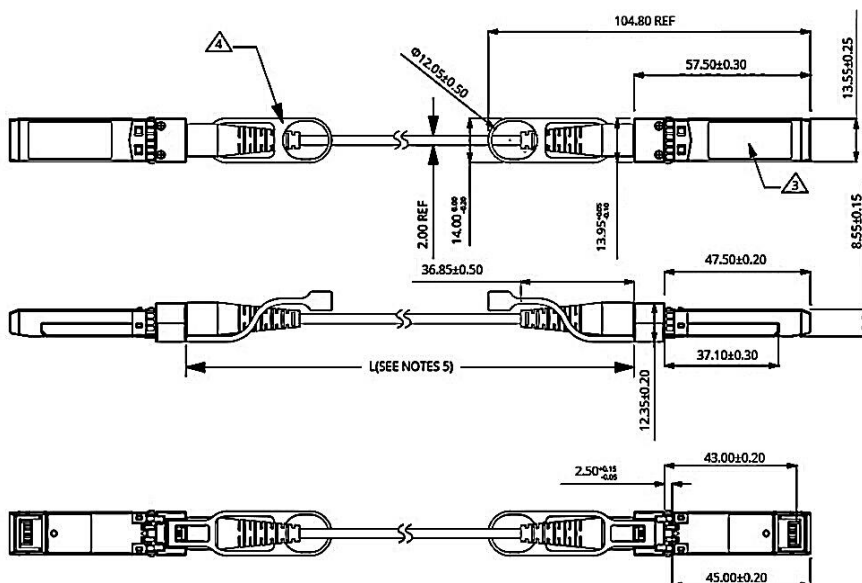
## VI. Electrical Design

The electrical design of the passive SFP+ direct attach copper cable assembly is fully compliant to the SFF-8431 SFP+ MSA. The electrical design incorporates a PCB and wire management design to minimize crosstalk, insertion loss, and return loss.

Reducing these frequency domain characteristics result in improved WDP measurements. Because of the common use of EDC(Electronic Dispersion Compensation) with passive SFP+ cable assemblies WDP measurements are a requirement instead of time domain measurements such as eye patterns.



## VII. Mechanical Dimensions



**Notes:**

- Unit: mm
- Tolerance: φ0.1mm if not shown
- Label specification
- Latch color: black
- Tolerance of cable length

| L      | TOLERANCE |
|--------|-----------|
| L ≤ 5M | ±5CM      |
| L > 5M | ±1%       |

## VIII. Installation

### Caution:

Follow accepted ESD practices when handling SFP+ connectors to prevent damage to the internal components within the connector. ESD (electrostatic discharge) is the sudden flow of electricity between two objects at different voltage potentials caused by contact. The basis of any ESD protection strategy is to ground or bring all elements in the ESD protected area to the same potential. An ESD wrist strap should be used for everything in the ESD protected area including personnel, tools, cabinets and components.

### A. Installing SFP+ Modules

Follow these steps to install a FS.COM SFP+ cable assembly:

- Step 1.** Remove the protective ESD cap from the connector.
- Step 2.** Slide the SFP+ cable end into the slot until it locks into position (see figure 1).

There is an audible click when the connector is properly seated.



Figure 1. Installing an SFP+ Module



Figure 2. Disconnecting Latch Mechanism



Figure 3. Removing Modules

### Caution :

The latching mechanism locks the SFP+ connector into place when cables are connected. Do not pull on the cable in an attempt to remove the SFP+ connector.

### B. Removing SFP+ Modules

Follow these steps to remove a FS.COM SFP+ cable assembly:

- Step 1.** Pull on the SFP+ latch pull lanyard. See figure 2.
- Step 2.** Grasp the SFP+ connector on both sides and remove it from the system. See figure 3.
- Step 3.** If possible, replace the ESD protective cap or put the SFP+ into an ESD protected bag.



## Test Center

FS.COM transceivers are tested to ensure connectivity and compatibility in our test center before shipped out. FS.COM test center is supported by a variety of mainstream original brand switches and groups of professional staff, helping our customers make the most efficient use of our products in their systems, network designs and deployments.

The original switches could be found nowhere but at FS.COM test center, eg: Juniper MX960 & EX 4300 series, Cisco Nexus 9396PX & Cisco ASR 9000 Series, HP 5900 Series & HP 5406R ZL2 V3(J9996A), Arista 7050S-64, Brocade ICX7750-26Q & ICX6610-48, Avaya VSP 7000 MDA 2, etc.



Cisco ASR 9000 Series(A9K-MPA-1X40GE)



ARISTA 7050S-64(DCS-7050S-64)



Juniper MX960



Brocade ICX 7750-26Q



Extreme Networks X670V VIM-40G4X



Mellanox M3601Q



Dell N4032F



HP 5406R ZL2 V3(J9996A)



AVAYA 7024XLS(7002QQ-MDA)

## Test Assured Program

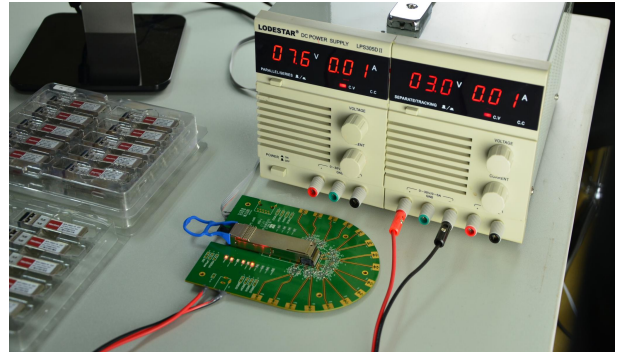
FS.COM truly understands the value of compatibility and interoperability to each optics. Every module FS.COM provides must run through programming and an extensive series of platform diagnostic tests to prove its performance and compatibility. In our test center, we care of every detail from staff to facilities—professionally trained staff, advanced test facilities and comprehensive original-brand switches, to ensure our customers to receive the optics with superior quality.



Our smart data system allows effective product management and quality control according to the unique serial number, properly tracking the order, shipment and every part.



With a comprehensive line of original-brand switches, we can recreate an environment and test each optics in practical application to ensure quality and distance.



Our in-house coding facility programs all of our parts to standard OEM specs for compatibility on all major vendors and systems such as Cisco, Juniper, Brocade, HP, Dell, Arista and so on.



The last test assured step to ensure our products to be shipped with perfect package.

## Excellent Quality Control System

FS innovated a self-developed automated and integrated test system, and also equipped with complete sets of advanced testing equipment to ensure modules quality and high performance.



### Performance Testing

One-Click operation, including centre-wavelength, extinction ratio, optical eye diagram, TX power, receiver sensitivity, DDM etc.

### Environmental Testing

Low temp test, storage in 85° C and -40° C for 12 hours. ESD test,  $\pm 8$  and  $\pm 15$  kV discharges as per GR-78-CORE. Connector durability - pull test, min of 10 connections, no more than 30% pullouts.



### Compatibility and Connectivity Testing

Equipped with a variety of mainstream original brand switches, like Cisco, Juniper, Arista, HPE etc. Each transceiver will be tested before delivery.

## Order Information

| Part Number     | Data Rate   | Length | Wire Gauge | Connector Type | Temp. Range | Cable Jacket |
|-----------------|-------------|--------|------------|----------------|-------------|--------------|
| SFP-10G-DAC-0.5 | Up to 10.5G | 0.5m   | AWG30      | Passive Copper | 0-70°C      | PVC          |
| SFP-10G-DAC-1   | Up to 10.5G | 1m     | AWG30      | Passive Copper | 0-70°C      | PVC          |
| SFP-10G-DAC-1.5 | Up to 10.5G | 1.5m   | AWG30      | Passive Copper | 0-70°C      | PVC          |
| SFP-10G-DAC-2   | Up to 10.5G | 2m     | AWG24      | Passive Copper | 0-70°C      | PVC          |
| SFP-10G-DAC-2.5 | Up to 10.5G | 2.5m   | AWG24      | Passive Copper | 0-70°C      | PVC          |
| SFP-10G-DAC-3   | Up to 10.5G | 3m     | AWG24      | Passive Copper | 0-70°C      | PVC          |
| SFP-10G-DAC-4   | Up to 10.5G | 4m     | AWG24      | Passive Copper | 0-70°C      | PVC          |
| SFP-10G-DAC-5   | Up to 10.5G | 5m     | AWG24      | Passive Copper | 0-70°C      | PVC          |
| SFP-10G-DAC-6   | Up to 10.5G | 6m     | AWG24      | Passive Copper | 0-70°C      | PVC          |
| SFP-10G-DAC-7   | Up to 10.5G | 7m     | AWG24      | Passive Copper | 0-70°C      | PVC          |
| SFP-10G-DAC-10  | Up to 10.5G | 10m    | AWG24      | Passive Copper | 0-70°C      | PVC          |

### Notes:

1. 10G SFP+ Passive Copper Twinax Cable is individually tested on corresponding equipment such as Cisco, Arista, Juniper, Dell, Brocade and other brands, and passes the monitoring of FS.COM intelligent quality control system.
2. Customized 10GBASE SFP+ PCC are available in various lengths.
3. The Wire Gauge can be customized if it is required, like AWG24, AWG26, AWG28 and AWG30.



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