



# 40G QSFP+ Passive Cable

APCP04-QQCxxx-yy



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QSFP+ Passive Direct Attach Copper Cable assemblies were developed for high-density applications, offering a cost-effective, low-power option for high-speed data center interconnects. The QSFP+ form factor can replace up to four standard SFP+ connections, providing greater density and reduced system cost.

The direct-attach assemblies support emerging 40Gb/s applications and are available in standard lengths up to 7 meters with longer custom lengths available

## Product Features

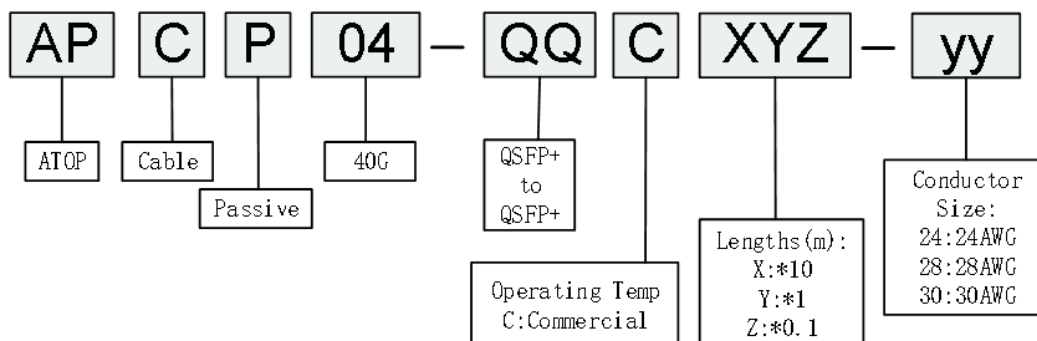
- ✓ Compliant with SFF-8436
- ✓ Fully compatible with IEEE802.3ba and InfiniBand QDR specifications
- ✓ 40 Gb/s total bandwidth
- ✓ 4 independent duplex channels operating at 10Gbps, also support for 2.5Gbps, 5Gbps data rates
- ✓ Low power, low latency analog circuitry
- ✓ Uses advanced analog signal processing technology
- ✓ All-metal housing for superior EMI performance
- ✓ BER better than 10<sup>-12</sup>
- ✓ Ultralow crosstalk for improved performance
- ✓ EEPROM for cable signature & system communications
- ✓ 30 AWG to 24AWG cable sizes available
- ✓ Tested in an end-to-end system
- ✓ RoHS compliant

## Applications

- ✓ Data Server
- ✓ Networked storage systems
- ✓ Router
- ✓ External storage system
- ✓ Data Center networking
- ✓ Communications Switches
- ✓ Routers
- ✓ 40Gigabit Ethernet (40G BASE – Cr4)



## Product Selection



| Part Number      | Lengths | Conductor Size | Note |
|------------------|---------|----------------|------|
| APCP04-QQC005-yy | 0.5m    | 26/28/30 AWG   | 1    |
| APCP04-QQC010-yy | 1m      | 26/28/30 AWG   | 1    |
| APCP04-QQC015-yy | 1.5m    | 26/28/30 AWG   | 1    |
| APCP04-QQC020-yy | 2m      | 26/28/30 AWG   | 1    |
| APCP04-QQC025-yy | 2.5m    | 26/28/30 AWG   | 1    |
| APCP04-QQC030-yy | 3m      | 26/28/30 AWG   | 1    |
| APCP04-QQC050-yy | 5m      | 26/28/30 AWG   | 1    |
| APCP04-QQC070-yy | 7m      | 26/28/30 AWG   | 1    |
| APCP04-QQC100-yy | 10m     | 26/28/30 AWG   | 1    |

**Note:**

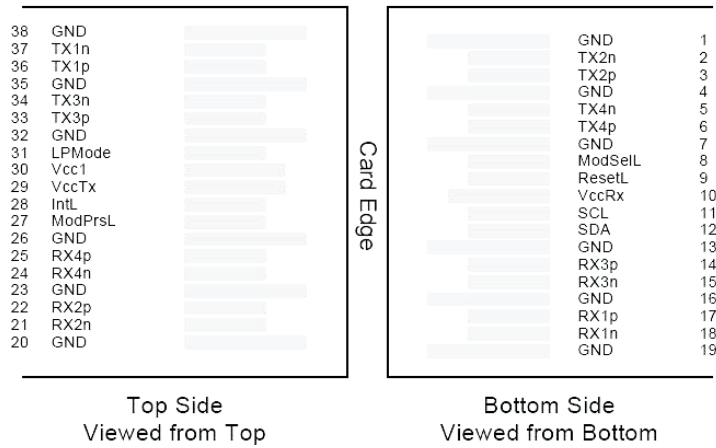
1, yy=30,28,26, present wire size AWG

## Pin Descriptions

### QSFP+ End

| Pin | Symbol  | Name   | Ref. |
|-----|---------|--|------|
| 1   | GND     | Ground   |      |
| 2   | Tx2n    | Transmitter Inverted Data Input, CML-I   |      |
| 3   | Tx2p    | Transmitter Non-Inverted Data output, CML-I  |      |
| 4   | GND     | Ground   |      |
| 5   | Tx4n    | Transmitter Inverted Data Input, CML-I   |      |
| 6   | Tx4p    | Transmitter Non-Inverted Data output, CML-I  |      |
| 7   | GND     | GND  |      |
| 8   | ModSelL | <p>The ModSelL is an input pin. When held low by the host, the module responds to 2-wire serial communication commands. The ModSelL allows the use of multiple QSFP+ modules on a single 2-wire interface bus. When the ModSelL is "High", the module shall not respond to or acknowledge any 2-wire interface communication from the host. ModSelL signal input node must be biased to the "High" state in the module</p> |      |
| 9   | ResetL  | <p>The ResetL pin must be pulled to Vcc in the QSFP+ module. A low level on the ResetL pin for longer than the minimum pulse length (t_Reset_init) initiates a complete module reset, returning all user module settings to their default state. Module Reset Assert Time (t_init) starts on the rising edge after the low level on the ResetL pin is released.</p>  |      |
| 10  | VccRx   | + 3.3V Power Supply Receiver   |      |
| 11  | SCL     | 2-Wire Serial Interface Clock  |      |

|    |         |  |
|----|---------|--|
| 12 | SDA     | 2-Wire Serial Interface Data   |
| 13 | GND     | GND  |
| 14 | Rx3p    | Receiver Non-Inverted Data Output, CML-O   |
| 15 | Rx3n    | Receiver Inverted Data Output, CML-O   |
| 16 | GND     | GND  |
| 17 | Rx1p    | Receiver Non-Inverted Data Output, CML-O   |
| 18 | Rx1n    | Receiver Inverted Data Output, CML-O   |
| 19 | GND     | Ground   |
| 20 | GND     | Ground   |
| 21 | Rx2n    | Receiver Inverted Data Output, CML-O   |
| 22 | Rx2p    | Receiver Non-Inverted Data Output, CML-O   |
| 23 | GND     | Ground   |
| 24 | Rx4n    | Receiver Inverted Data Output, CML-O   |
| 25 | Rx4p    | Receiver Non-Inverted Data Output, CML-O   |
| 26 | GND     | Ground   |
| 27 | ModPrsL | Module Present, connect to GND   |
| 28 | IntL    | The IntL pin is an open collector output and must be pulled to host supply voltage on the host board. The INTL pin is de-asserted "High" after completion of reset, when byte 2 bit 0 (Data Not Ready) is read with a value of '0' and the flag field is read. |
| 29 | VccTx   | +3.3 V Power Supply transmitter  |
| 30 | Vcc1    | +3.3 V Power Supply  |
| 31 | LPMode  | The LPMode pin shall be pulled up to Vcc in the QSFP+ module. This function is affected by the LPMode pin and the combination of the Power_over-ride and Power_set softwarecontrol bits (Address A0h, byte 93 bits 0,1).                                       |
| 32 | GND     | Ground   |
| 33 | Tx3p    | Transmitter Non-Inverted Data Input, CML-I   |
| 34 | Tx3n    | Transmitter Inverted Data Output, CML-I  |
| 35 | GND     | Ground   |
| 36 | Tx1p    | Transmitter Non-Inverted Data Input, CML-I   |
| 37 | Tx1n    | Transmitter Inverted Data Output, CML-I  |
| 38 | GND     | Ground   |



Pin-out of Connector Block on Host Board

### Signal Integrity

| ITEM   | REQUIREMENT   | TEST CONDITION                            |           |           |                     |           |
|--|---|---|-----------|-----------|---------------------|-----------|
| Cable Impedance  | 105+5/-5Ω   |   |           |           |                     |           |
| Differential Impedance                                 | Paddle Card Impedance<br>100±10Ω  | Rise time of 35ps<br>(20% - 80%).         |           |           |                     |           |
| Cable Termination Impedance                            | 100±15Ω   |   |           |           |                     |           |
| [ Differential (Input/Output) Return loss SDD11/SDD22] | $\text{Return loss}(f) \geq \begin{cases} 10 & 0.01 \leq f < 4.1 \\ 6.3 - 13 \log_{10}(f/5.5) & 4.1 \leq f \leq 11.1 \end{cases}$ <p>Where<br/>f is the frequency in GHz<br/>Return loss(f) is the return loss at frequency f</p> | 0.01GHz ≤ f ≤ 11.1GHz<br>SFF-8431 Rev.4.1 |           |           |                     |           |
| Differential Insertion Loss (SDD21 Max.)               | (Differential Insertion Loss Max.)  |   |           |           | 10MHz ≤ f ≤ 11.1GHz |           |
|  | AWG \ F   | 600MHz                                    | 1.25GHz   | 2.5GHz    |                     | 5.0GHz    |
|  | 30(1m)Max   | ≥ -3.0dB                                  | ≥ -4.0dB  | ≥ -5.5dB  |                     | ≥ -8.0dB  |
|  | 30(2m)Max   | ≥ -5.0dB                                  | ≥ -6.5dB  | ≥ -9.5dB  |                     | ≥ -14.0dB |
|  | 30(3m)Max   | ≥ -6.0dB                                  | ≥ -8.0dB  | ≥ -11.0dB |                     | ≥ -16.0dB |
| 26(5m)Max  | ≥ -8.0dB  | ≥ -11.5dB                                 | ≥ -17.0dB | ≥ -26.5dB |                     |           |
| 24(10m)Max   | ≥ -3.0dB  | ≥ -4.0dB                                  | ≥ -5.5dB  | ≥ -8.0dB  |                     |           |
| MDNEXT(multiple disturber near-end crosstalk)          | ≥ 26dB @ 5GHz   |   |           |           | 10MHz ≤ f ≤ 5GHz    |           |
| Insertion Loss Deviation                               | -0.7 - 0.2 * 10 <sup>-3</sup> f ≤ ILD ≤ 0.7 + 0.2 * 10 <sup>-3</sup> f<br>(f is the frequency in MHz)   |   |           |           | 10MHz ≤ f ≤ 5GHz    |           |

## Other Electrical Performance

| ITEM                            | REQUIREMENT                    | TEST CONDITION   |
|---------------------------------|--------------------------------|--|
| Low Level Contact Resistance    | 80milliohms Max. From initial. | EIA-364-23:Apply a maximum voltage of 20mV<br>And a current of 100 mA.   |
| Insulation Resistance           | 10Mohm(Min.)                   | EIA364-21:AC 300V 1 minute   |
| Dielectric Withstanding Voltage | NO disruptive discharge.       | EIA-364-20:Apply a voltageof 300VDC for<br>1 minute between adjacent terminals<br>And between adjacent terminals and ground. |

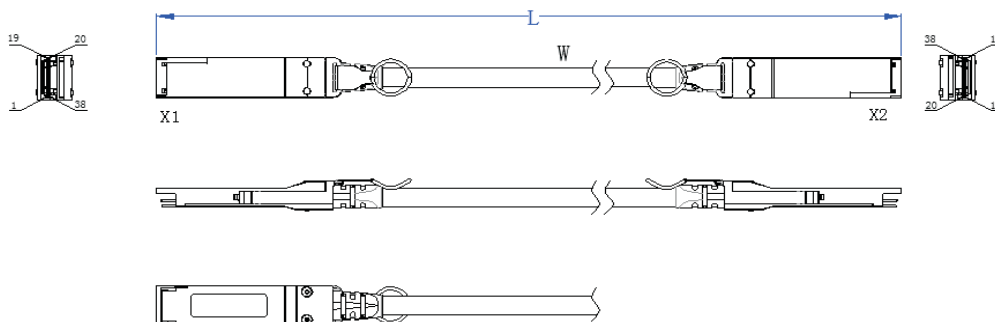
## Environment Performance

| ITEM   | REQUIREMENT  | TEST CONDITION  |
|--|--|---|
| Operating Temp. Range                        | 0°C to +70°C   | Cable operating temperature range.  |
| Storage Temp. Range<br>(in packed condition) | -40°C to +80°C   | Cable storage temperature range<br>in packed condition.                             |
| Thermal Cycling Non-Powered                  | No evidence of physical damage   | EIA-364-32D, Method A, -25 to 90C,<br>100 cycles, 15 min. dwells                    |
| Salt Spraying                                | 48 hours salt spraying after shell<br>corrosive area less than 5%.     | EIA-364-26  |
| Mixed Flowing Gas                            | Pass electrical tests per 3.1 after<br>stressing. (For connector only) | EIA-364-35 Class II, 14 days.   |
| Temp. Life                                   | No evidence of physical damage   | EIA-364-17C w/ RH, Damp heat 90°C at 85%<br>RH for 500 hours then return to ambient |
| Cable Cold Bend                              | 4H, No evidence of physical damage                                     | Condition: -20°C ±2°C , mandrel diameter<br>is 6 times the cable diameter.          |

## Mechanical and Physical Characteristics

| ITEM                         | REQUIREMENT                                    | TEST CONDITION  |
|------------------------------|--|---|
| Vibration                    | Pass electrical tests per 3.1 after stressing. | Clamp & vibrate per EIA-364-28E,TC-VII, test condition letter – D, 15 minutes in X, Y & Z axis.   |
| Cable Flex                   | No evidence of physical damage                 | Flex cable 180° for 20 cycles ( $\pm 90^\circ$ from nominal position) at 12 cycles per minute with a 1.0kg load applied to the cable jacket. Flex in the boot area 90° in each direction from vertical. Per EIA-364-41C |
| Cable Plug Retention in Cage | 90N Min.<br>No evidence of physical damage     | Pull on cable jacket approximately 1 ft behind cable plug. No functional damage to cable plug below 90N. Per SFF-8432 Rev 5.0   |
| Cable Retention in Plug      | 90N Min.<br>No evidence of physical damage     | Cable plug is fixtured with the bulk cable hanging vertically. A 90N axial load is applied (gradually) to the cable jacket and held for 1 minute. Per EIA-364-38B   |
| Mechanical Shock             | Pass electrical tests Per 3.1 after stressing. | Clamp and shock per EIA-364-27B, TC-G,3 times in 6 directions, 100g, 6ms.   |
| Cable Plug Insertion         | 40N Max.                                       | Per SFF-8436 Rev 5.4.1.   |
| Cable plug Extraction        | 30N Max.                                       | Place axial load on de-latch to de-latch plug. Per SFF-8436 Rev 5.4.1.  |
| Durability                   | 50 cycles, No evidence of physical damage      | EIA-364-09, perform plug & unplug cycles: Plug and receptacle mate rate: 250times/hour. 50times for module (CONNECTOR TO PCB)   |

## Mechanical Specifications



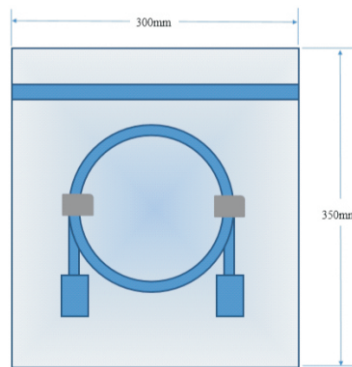
## Wiring Diagram

| X1   | X2   | REMARKS | X1  | X2  | REMARKS                         |
|--|--|---------|---|---|---------------------------------|
| 18(RX1-)   | 37(TX1-)   | pair    | 37(TX1-)                                      | 18(RX1-)                                      | pair                            |
| 17(RX1+)   | 36(TX1+)   |         | 36(TX1+)                                      | 17(RX1+)                                      |                                 |
| 15(RX3-)   | 34(TX3-)   | pair    | 34(TX3-)                                      | 15(RX3-)                                      | pair                            |
| 14(RX3+)   | 33(TX3+)   |         | 33(TX3+)                                      | 14(RX3+)                                      |                                 |
| 6 (TX4+)   | 25(RX4+)   | pair    | 25(RX4+)                                      | 6 (TX4+)                                      | pair                            |
| 5 (TX4-)   | 24(RX4-)   |         | 24(RX4-)                                      | 5 (TX4-)                                      |                                 |
| 3 (TX2+)   | 22(RX2+)   | pair    | 22(RX2+)                                      | 3 (TX2+)                                      | pair                            |
| 2 (TX2-)   | 21 (RX2-)  |         | 21 (RX2-)                                     | 2 (TX2-)                                      |                                 |
| 1, 4, 7, 13,<br>16, 19, 20,<br>23, 26, 32,<br>35, 38 | 1, 4, 7, 13,<br>16, 19, 20,<br>23, 26, 32,<br>35, 38 | GND     | 8, 9, 10,<br>11, 12, 27,<br>28, 29, 30,<br>31 | 8, 9, 10,<br>11, 12, 27,<br>28, 29, 30,<br>31 | EEPROM<br>point at<br>both ends |

## Package diagram

<=2m: 200mm\*300mm

>2m: 300mm\*350mm



## Revision History

| Revision   | Initiated    | Reviewed | Approved   | DCN           | Release Date |
|------------|--------------|----------|------------|---------------|--------------|
| Version1.0 | Tangzhiqiang | Li Tao   | Ding zheng | New Released. | Nov 19, 2019 |





let's make it personal

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