

## SFP+ Passive Copper Cable Assembly

### CAB-10GSFP-PxM

#### Features

- SFF-8431 Compliant
- Broadband serial data rate operation:10 Mbps to 12 Gbps
- Power Level I: 15 mW per cable end
- 100 Ohm differential impedance
- Retractable pin latch
- EEPROM signature
- Pull to Release latch design
- 360° cable braid crimp
- Enhanced EMI skirt design
- Color options for strain relief and pull tab
- Linear design for use with EDCs
- AC-coupled inputs and outputs
- 30AWG to 24AWG cable available

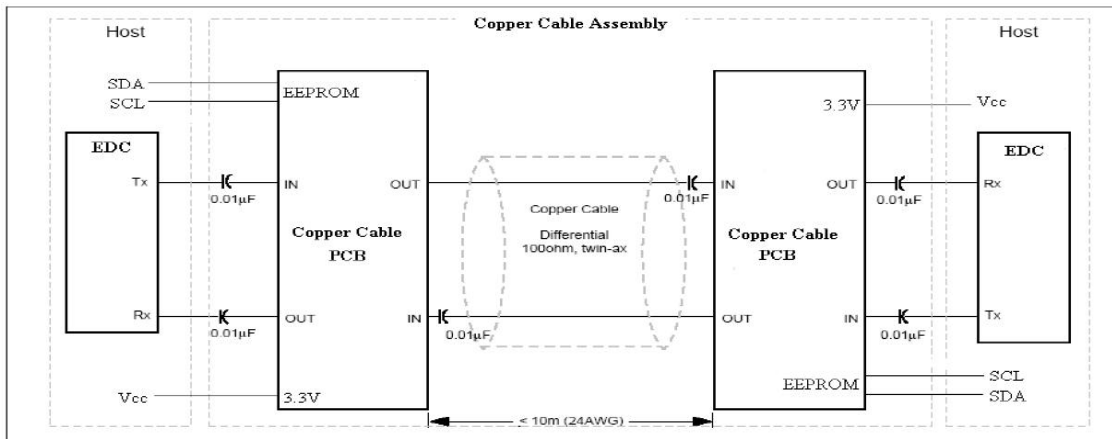


#### Applications

- 10 Gigabit Ethernet and Gigabit Ethernet (IEEE 802.3ae)
- Fiber Channel: 1, 2, 4, 8, and 10GFC
- Infiniband SDR, DDR, and QDR
- Fiber Channel over Ethernet (FCoE)
- Serial data transmission

### Product Description

The passive SFP+ Direct attach copper cable assembly is a low cost alternative for short reach applications. The design allows for a serial data transmission up to 12Gbps in each direction. The passive design has no signal amplification in the cable assembly. Electronic Dispersion Compensation (EDC) is typically used on host board designs when passive copper cable assemblies are utilized. EDC allows for an extended length of passive cable assemblies. EEPROM signature enables the host to differentiate between a passive copper cable assembly and a fiber optic module. The mechanical design of the braid crimp and EMI skirt ensure that EMI radiation is sufficiently suppressed. Additionally, the copper cable acts as a natural heat sink. The low power consumption assists in making the passive copper cable assembly an economic solution for within rack or rack to rack applications.



### Recommended Operation Condition

| Electrical              |            |         |         |         |       |
|-------------------------|------------|---------|---------|---------|-------|
| Parameter               | Symbol     | Minimum | Typical | Maximum | Unit  |
| Operating Temp.         |            | -20     |         | 85      | C     |
| Input Voltage           | VccT, VccR | 1.8     | 3.3     | 5.5     | Volts |
| Clock Frequency         |            |         |         | 400     | kHz   |
| Maximum Power           |            |         |         | 15      | mW    |
| Maximum Average Current | Icc        |         |         | 4       | mA    |
| Data Rate               |            | 0.010   |         | 10.3125 | Gbps  |

### WDP Specifications

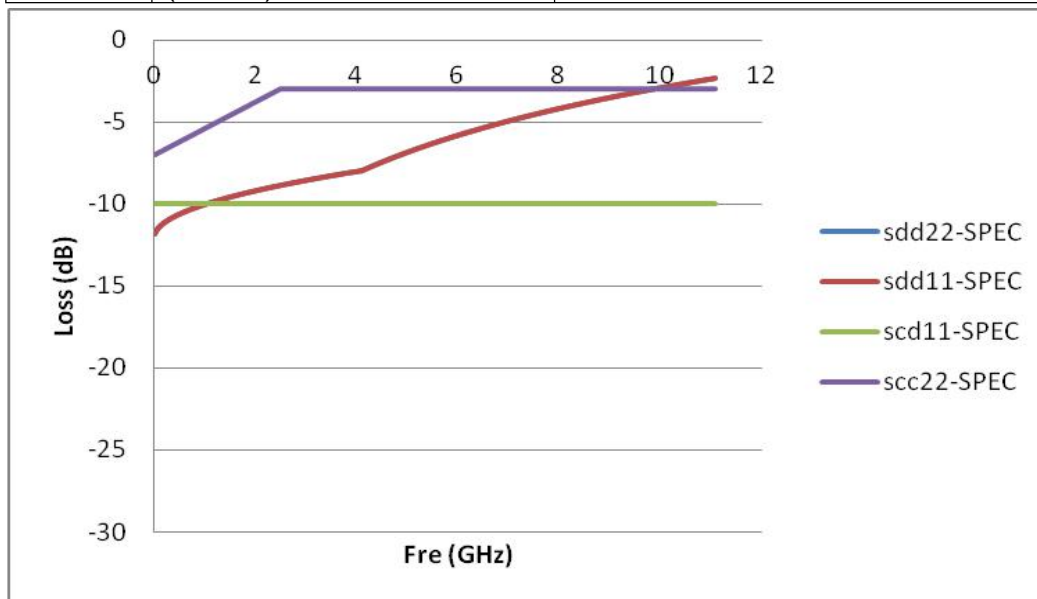
| WDP         |              |           |           |      |
|-------------|--------------|-----------|-----------|------|
| Cable Gauge | Cable Length | WDPo (dB) | WDPi (dB) | dWDP |
| Spec Limit  | --           | --        | --        | 6.75 |
| 30 AWG      | 3 meter      | 6.16      | 2.4       | 3.76 |
| 28 AWG      | 5 meter      | 7.49      | 2.4       | 5.09 |
| 24 AWG      | 7 meter      | 7.44      | 2.4       | 5.04 |

**VMA and VCR Specifications**

| VMA & VCR   |              |          |          |
|-------------|--------------|----------|----------|
| Cable Gauge | Cable Length | VMA (dB) | VCR (dB) |
| Spec Limit  | --           | 4.5      | 33       |
| 30 AWG      | 3 meter      | 3.03875  | 40.6572  |
| 28 AWG      | 5 meter      | 3.93609  | 38.53281 |
| 24 AWG      | 7 meter      | 3.86154  | 37.79826 |

**Frequency Domain**

| Item | Test Parameter                 | Specification (Proposal )   |
|------|--------------------------------|---|
| 1    | Receive Return Loss (SDD22)    | -12+2*SQRT(f) @ 0.01 to 4.1GHz<br>< -6.3 + 13 * log10(f/5.5), with f in GHz ; @4.1 to 11.1GHz |
| 2    | Transmit Return Loss (SDD11)   | -12+2*SQRT(f) @ 0.01 to 4.1GHz<br>< -6.3 + 13 * log10(f/5.5), with f in GHz ; @4.1 to 11.1GHz |
| 3    | Common Mode Reflection (SCC22) | < -7 + 1.6 × f, with f in GHz; @ 0.01 to 2.5GHz<br>-3dB @ 2.5 to 11.1GHz                      |
| 4    | Common Mode Conversion (SCD11) | -10dB @ 0.01 to 11.1GHz   |



**Time Domain**

| Item | Test Parameter          | Specification (Proposal )   |
|------|-------------------------|---|
| 1    | Intra-Skew*             | 30 ps Max   |
| 2    | Impedance               | 100 +/- 10 Ohm  |
| 3    | Insertion Loss* (SDD21) | a. 0.6GHz : -1.5 dB Max<br>b. 1.25GHz : -2.15 dB Max<br>c. 2.50GHz : -3.22 dB Max<br>d. 3.25GHz : -3.95dB Max<br>e. 5.0GHz : -5.52 dB Max |

\*The item 1and 3, for different length requirements, different specification

### Host board Connector Pinout

Figure 1 : MSA compliant Connector

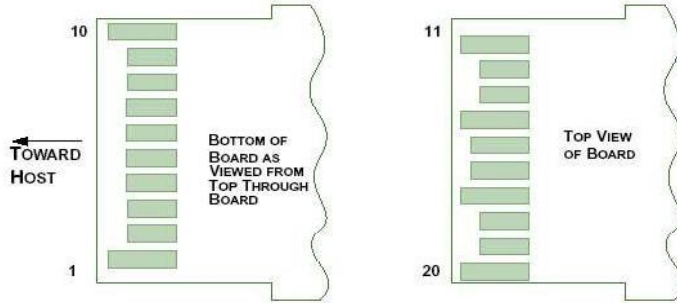


Figure 2 : Pin Definitions.

| Pin    | Logic      | Symbol         | Name  | Note |
|--------|------------|----------------|---|------|
| Pin 1  |            | VeeT           | Module Transmitter Ground                   | 1    |
| Pin 2  | LVTTTL-O   | Tx_Fault       | Transmitter Fault                           | 2    |
| Pin 3  | LVTTTL-I   | Tx_Disabl<br>e | Transmitter Disable                         | 3    |
| Pin 4  | LVTTTL-I/O | SDA            | MOD-DEF2 2-wire serial interface data line  | 4    |
| Pin 5  | LVTTTL-I/O | SCL            | MOD-DEF1 2-wire serial interface clock line | 4    |
| Pin 6  |            | Mod_Abs        | Module Absent                               | 5    |
| Pin 7  | LVTTTL-I   | RS0            | Rate Select Zero                            |      |
| Pin 8  | LVTTTL- O  | Rx_LOS         | Module Receiver Loss of Signal              | 2    |
| Pin 9  | LVTTTL-I   | RS1            | Rate Select One                             |      |
| Pin 10 |            | VeeR           | Module Receiver Ground                      | 1    |
| Pin 11 |            | VeeR           | Module Receiver Ground                      | 1    |
| Pin 12 | CML-O      | RD-            | Receiver Inverted Data Output               |      |
| Pin 13 | CML-O      | RD+            | Receiver Non-Inverted Data Output           |      |
| Pin 14 |            | VeeR           | Module Receiver Ground                      | 1    |
| Pin 15 |            | VccR           | Module Receiver 3.3V Supply                 |      |
| Pin 16 |            | VccT           | Module Transmitter 3.3V Supply              |      |
| Pin 17 |            | VeeT           | Module Transmitter Ground                   | 1    |
| Pin 18 | CML-I      | TD+            | Transmitter Non-Inverted Data Input         |      |
| Pin 19 | CML-I      | TD-            | Transmitter Inverted Data Input             |      |
| Pin 20 |            | VeeT           | Module Transmitter Ground                   | 1    |

Note 1. The module signal ground pins, VeeR and VeeT, shall be isolated from the module case.

Note 2. This pin is an open collector/drain output pin and shall be pulled up with 4.7-10k to Vcc\_Host on the host board. Pull ups can be connected to multiple power supplies, however the host board design shall ensure that no module pin has voltage exceeding module VccT/R + 0.5 V.

Note 3. This pin is an open collector/drain input pin and shall be pulled up with 4.7-10k to VccT in the module.

Note 4. See 2-wire Electrical Specifications .

Note 5. This pin shall be pulled up with 4.7-10k to Vcc\_Host on the host board

## Pin Description

- Tx\_Fault:** Tx\_Fault is an output pin to indicate a fault condition of a laser. This pin is connected to ground in the module.
- Tx\_Disable:** x\_Disable is an input pin to disable the transmitter output. This pin is pulled high in the module with a 5.11kOhm resistor.
- SDA/SCL:** SDA and SCL are the data and clock pins for the I2C interaction with the EEPROM. These pins are connected to the SDA and SCL pins of the EEPROM in the module.
- MOD\_ABS:** Mod\_Abs is an output pin to indicate that a module is present in the port. This pin is connected to ground in the module.
- RS0/RS1:** RS0 and RS1 are module rate select pins to determine the transmit data rate for lasers.
- Rx\_LOS:** Rx\_LOS is an output pin to indicate if the signal amplitude is below the receiver threshold. This pin is connected to ground in the module.
- Ground:** VeeT and VeeR are connected within the module and are used as a digital ground for signal integrity. This digital ground does not connect to the module case or the copper cable braid.
- Power:** VccT and VccR are connected within the module and are used to power the EEPROM. Typical voltage is 3.3 Volts and each pin has a maximum current capacity of 500 mA.
- Signal:** The two high speed signal pairs, TD+/TD- and RD+/RD-, are 100 Ohm differential impedance transmission lines with AC coupling on each RD trace.

## 2 Wire Interface EEPROM

The EEPROM on the SFP+ passive cable assembly is designed for 256 addresses. The information for addresses 0 to 127 is listed below. This information can be tailored to any customer request. Any address can be altered to display customer specific information and more memory can be added if more addresses are needed. Addresses 128 to 255 can be reserved for customer specific information that is in addition to the SFF 8431 specification.

SFP+ Passive Cable EEPROM Map

| Device 0xA0 |            |             |   |                                  |
|-------------|------------|-------------|---|----------------------------------|
| Addr (dec)  | Addr (hex) | Value (hex) | Name of Field                                     | Description                      |
| 0           | 0          | 3           | Identifier  | 03h=SFP                          |
| 1           | 1          | 4           | Extended identifier                               | 04h=GBIC/SFP function is defined |
| 2           | 2          | 21          | Connector type                                    | 21h=Copper pigtail               |
| 3           | 3          | 0           | Transceiver application supported                 |                                  |
| 4           | 4          | 0           |   |                                  |
| 5           | 5          | 0           |   |                                  |
| 6           | 6          | 0           |   |                                  |
| 7           | 7          | 0           |   |                                  |
| 8           | 8          | 4           | SFP+ Cable Technology                             | 04h=Passive Cable                |
| 9           | 9          | 0           | Transceiver application supported                 |                                  |
| 10          | A          | 0           |   |                                  |
| 11          | B          | 0           | Encoding  |                                  |
| 12          | C          | 67          | Nominal bit rate (unit: 100M bps)                 | 67h=10.3G/bps                    |
| 13          | D          | 0           | Reserved  |                                  |
| 14          | E          | 0           | Link length supported for 9/125um fiber in Km     |                                  |
| 15          | F          | 0           | Link length supported for 9/125um fiber in 100m   |                                  |
| 16          | 10         | 0           | Link length supported for 50/125um fiber in 10m   |                                  |
| 17          | 11         | 0           | Link length supported for 62.5/125um fiber in 10m |                                  |
| 18          | 12         | 1           | Link length supported for copper in meters        | 01h=1M                           |
| 19          | 13         | 0           | Length(OM3)                                       |                                  |
| 20          | 14         | 31          | Vendor name                                       | 10Gtek                           |
| 21          | 15         | 30          |   |                                  |
| 22          | 16         | 47          |   |                                  |
| 23          | 17         | 74          |   |                                  |
| 24          | 18         | 65          |   |                                  |
| 25          | 19         | 6B          |   |                                  |
| 26          | 1A         | 20          |   |                                  |
| 27          | 1B         | 20          |   |                                  |
| 28          | 1C         | 20          |   |                                  |
| 29          | 1D         | 20          |   |                                  |
| 30          | 1E         | 20          |   |                                  |
| 31          | 1F         | 20          |   |                                  |
| 32          | 20         | 20          |   |                                  |
| 33          | 21         | 20          |   |                                  |
| 34          | 22         | 20          |   |                                  |
| 35          | 23         | 20          |   |                                  |
| 36          | 24         | 0           | Reserved  |                                  |
| 37          | 25         | 0           | Vendor OUI  |                                  |
| 38          | 26         | 0           |   |                                  |
| 39          | 27         | 0           |   |                                  |
| 40          | 28         | 53          | Vendor PN   | SFP-10G-CU1M                     |
| 41          | 29         | 46          |   |                                  |
| 42          | 2A         | 50          |   |                                  |

|    |    |    |                           |                   |
|----|----|----|---------------------------|-------------------|
| 43 | 2B | 2D |                           |                   |
| 44 | 2C | 31 |                           |                   |
| 45 | 2D | 30 |                           |                   |
| 46 | 2E | 47 |                           |                   |
| 47 | 2F | 2D |                           |                   |
| 48 | 30 | 43 |                           |                   |
| 49 | 31 | 55 |                           |                   |
| 50 | 32 | 31 |                           |                   |
| 51 | 33 | 4D |                           |                   |
| 52 | 34 | 20 |                           |                   |
| 53 | 35 | 20 |                           |                   |
| 54 | 36 | 20 |                           |                   |
| 55 | 37 | 20 |                           |                   |
| 56 | 38 | 30 | Vendor rev                | 01                |
| 57 | 39 | 31 |                           |                   |
| 58 | 3A | 20 |                           |                   |
| 59 | 3B | 20 |                           |                   |
| 60 | 3C | 1  | Wavelength                | 01=Passive Cable  |
| 61 | 3D | 0  |                           |                   |
| 62 | 3E | 0  | Reserved                  |                   |
| 63 | 3F | 0  | Checksum                  | addresses 0 to 62 |
| 64 | 40 | 0  | Implemented options       |                   |
| 65 | 41 | 0  |                           |                   |
| 66 | 42 | 0  | Maximum bit rate margin   |                   |
| 67 | 43 | 0  | Minimum bit rate margin   |                   |
| 68 | 44 | 41 | Vendor serial number      | A1234560001       |
| 69 | 45 | 31 |                           |                   |
| 70 | 46 | 32 |                           |                   |
| 71 | 47 | 33 |                           |                   |
| 72 | 48 | 34 |                           |                   |
| 73 | 49 | 35 |                           |                   |
| 74 | 4A | 36 |                           |                   |
| 75 | 4B | 30 |                           |                   |
| 76 | 4C | 30 |                           |                   |
| 77 | 4D | 30 |                           |                   |
| 78 | 4E | 31 |                           |                   |
| 79 | 4F | 20 |                           |                   |
| 80 | 50 | 20 |                           |                   |
| 81 | 51 | 20 |                           |                   |
| 82 | 52 | 20 |                           |                   |
| 83 | 53 | 20 |                           |                   |
| 84 | 54 | 31 | Date code                 | YYMMDD(160501)    |
| 85 | 55 | 36 |                           |                   |
| 86 | 56 | 30 |                           |                   |
| 87 | 57 | 35 |                           |                   |
| 88 | 58 | 30 |                           |                   |
| 89 | 59 | 31 |                           |                   |
| 90 | 5A | 20 | Lot number                |                   |
| 91 | 5B | 20 |                           |                   |
| 92 | 5C | 0  | DD monitoring type        |                   |
| 93 | 5D | 0  | Enhanced software options |                   |
| 94 | 5E | 0  | SFF-8472 compliance       |                   |
| 95 | 5F | 43 | Checksum                  | addresses 64 to94 |
| 96 | 60 | 0  | Vendor Specific ID Fields | 0                 |
| 97 | 61 | 0  |                           |                   |

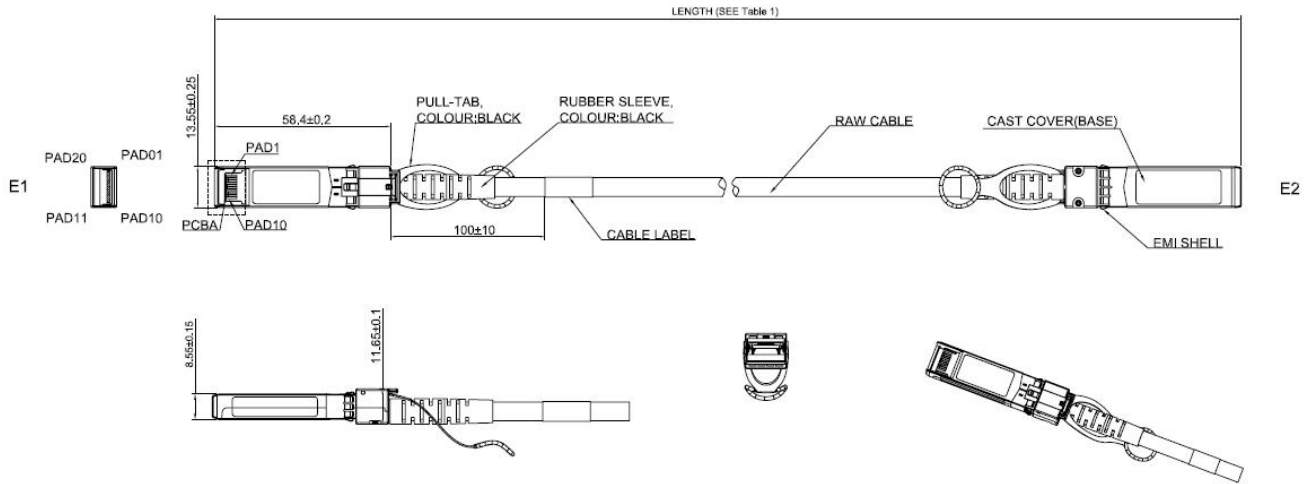
|     |    |   |  |  |
|-----|----|---|--|--|
| 98  | 62 | 0 |  |  |
| 99  | 63 | 0 |  |  |
| 100 | 64 | 0 |  |  |
| 101 | 65 | 0 |  |  |
| 102 | 66 | 0 |  |  |
| 103 | 67 | 0 |  |  |
| 104 | 68 | 0 |  |  |
| 105 | 69 | 0 |  |  |
| 106 | 6A | 0 |  |  |
| 107 | 6B | 0 |  |  |
| 108 | 6C | 0 |  |  |
| 109 | 6D | 0 |  |  |
| 110 | 6E | 0 |  |  |
| 111 | 6F | 0 |  |  |
| 112 | 70 | 0 |  |  |
| 113 | 71 | 0 |  |  |
| 114 | 72 | 0 |  |  |
| 115 | 73 | 0 |  |  |
| 116 | 74 | 0 |  |  |
| 117 | 75 | 0 |  |  |
| 118 | 76 | 0 |  |  |
| 119 | 77 | 0 |  |  |
| 120 | 78 | 0 |  |  |
| 121 | 79 | 0 |  |  |
| 122 | 7A | 0 |  |  |
| 123 | 7B | 0 |  |  |
| 124 | 7C | 0 |  |  |
| 125 | 7D | 0 |  |  |
| 126 | 7E | 0 |  |  |
| 127 | 7F | 0 |  |  |

**Mechanical Specifications**

| <b>Mechanical</b>              |         |         |         |        |
|--------------------------------|---------|---------|---------|--------|
| Parameter                      | Minimum | Typical | Maximum | Unit   |
| Cable Diameter (24 AWG)        |         | 0.255   |         | Inches |
| Bend Radius (24 AWG)           | 1.25    |         |         | Inches |
| Cable Diameter (28 AWG)        |         | 0.185   |         | Inches |
| Bend Radius (28AWG)            | 0.8     |         |         | Inches |
| Cable Diameter (30 AWG)        |         | 0.175   |         | Inches |
| Bend Radius (30 AWG)           | 0.7     |         |         | Inches |
| Within Pair Skew               |         |         | 120     | ps/10m |
| Cable Insertion Loss           |         | 10      |         | dB/10m |
| Bulk Cable Crosstalk           |         |         | 1       | %      |
| Bulk Cable Time Delay          |         |         | 4.3     | ns/m   |
| Cable Capacitance (intra-pair) |         |         | 43      | pF/m   |
| Bulk Cable Impedance           | 95      | 100     | 105     | Ohms   |



**Mechanical Dimensions**



**Part Numbers**

**Passive SFP+ Cable Assemblies**

| Length    | 24AWG P/N               | 28AWG P/N               | 30AWG P/N               |
|-----------|-------------------------|-------------------------|-------------------------|
| 0.5 meter | CAB-10GSFP-P50CM-00-3-2 | CAB-10GSFP-P50CM-00-2-2 | CAB-10GSFP-P50CM-00-1-2 |
| 1 meter   | CAB-10GSFP-P1M-00-3-2   | CAB-10GSFP-P1M-00-2-2   | CAB-10GSFP-P1M-00-1-2   |
| 2 meter   | CAB-10GSFP-P2M-00-3-2   | CAB-10GSFP-P2M-00-2-2   | CAB-10GSFP-P2M-00-1-2   |
| 3 meter   | CAB-10GSFP-P3M-00-3-2   | CAB-10GSFP-P3M-00-2-2   | CAB-10GSFP-P3M-00-1-2   |
| 5 meter   | CAB-10GSFP-P5M-00-3-2   | CAB-10GSFP-P5M-00-2-2   |                         |
| 7 meter   | CAB-10GSFP-P7M-00-3-2   |                         |                         |
| 10 meter  | CAB-10GSFP-P10M-00-3-2  |                         |                         |

**Revision History**

| Revision | Initiated | Review | Approved | Revision History | Release Date |
|----------|-----------|--------|----------|------------------|--------------|
| V1.3     | Vinson    | Steven | Nicky    | Released.        | Jul,23, 2016 |

**Further Information**

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