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CORNING
Applications
Engineering Note

24-fiber MTP® Connectivity Solutions Utilizing Structured Cabling

AEN 150, Revision: 4

This Application Engineering Note will discuss the different Corning Optical Communications components that are available to provide fiber optic connectivity for transceivers with a 24-fiber MTP interface. This will include guidance for direct connections, inter-connections, and breakout applications for both OM3/OM4 Laser-Optimized 50µm multimode and OS2 single-mode fiber. This is applicable, but not limited to, transceivers like:

- Cisco CPAK based 100G Ethernet optics (100GBase-SR10, 10x10G-LR, 10x10G-ERL)
- Cisco CFP based 100G Ethernet optics (CFP-100G-SR10)
- Arista CFP2 based 100G Ethernet optics (100GBase-XSR10)
- Arista 100G MXP port using embedded optics

For Base-12 four-channel parallel to four-channel parallel transmission, please refer to AEN 151 “Four-Channel Parallel Optic Connectivity Solutions Utilizing Base-12 Structured Cabling”. For Base-12 four-channel parallel to duplex transmission, please refer to AEN152 “Four-channel Parallel to Duplex Optical Connectivity Solutions Utilizing Base-12 Structured Cabling”. For Base-8 solutions, please refer to AEN156 “Connectivity Solutions Utilizing Base-8 Structured Cabling”.

Cabling 100G CPAK and CFP/CFP2 Transceivers

The Cisco CPAK based 100G Ethernet optics (100GBase-SR10, 10x10G-LR, 10x10G-ERL), Cisco CFP based 100G Ethernet optics (CFP-100G-SR10), and Arista CFP2 based 100G Ethernet optics (100GBase-XSR10) all utilize the same 20 active fibers in the 24-fiber MTP.

Figure 1 illustrates the fiber and channel assignments of such a transceiver. All receive ports are located on the top row of the port on the key side of the connector while all the transmit ports are on the bottom row. Thus, for a given channel traffic would flow out of Tx port at the bottom and be received on the adjacent Rx port on the top row. For example, Tx0 (fiber 14) and Rx0(fiber 2) will be used to create channel 0 that will communicate with that same channel on the other end of the link. If communicating from one 100G port to another 100G port, actual organization of all the channels is not required, since the electronics can sort out the various channels. Therefore, Tx0 from

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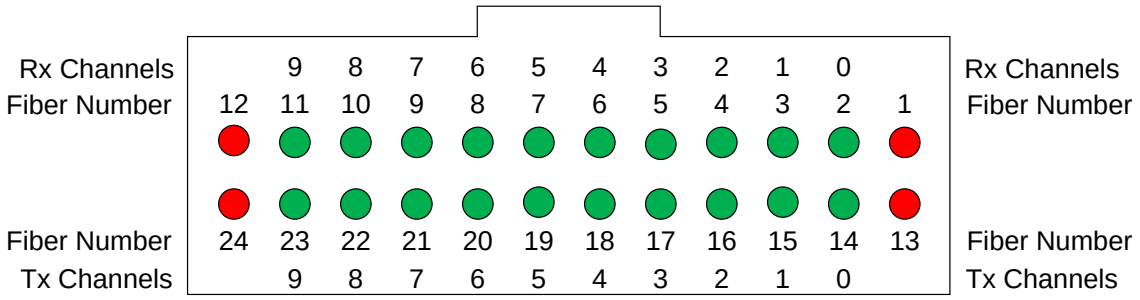
transceiver A could be received in Rx7 in transceiver B, the electronics can re-shuffle the order of the channel. However, all guidance within this document will maintain proper channel assignment.

Figure 1: Parallel Fiber (20-fiber) Optic Transmission



Fiber Numbers and Channel Assignments when looking into MTP Receptacle
NOTE: Fibers 1, 12, 13, 24 are not used.

However, when this transceiver is being used in breakout mode to 40G or 10G keeping the channels correctly ordered is required since the channel destination are in various transceivers (hence they cannot be reordered). The Cisco CPAK based 100G Ethernet optics can be configured to operate in a 40G breakout mode. This allows one 100G transceiver to be connected to two 40G QSFPs which require only 8-fibers each. The active fibers and channel assignments are shown in Figure 2, while the breakout connections to the 8-fiber optics (40G-SR4) are illustrated in Figure 3. The active fibers are not centered which requires a special polarity schemed harness (which will be discussed later in the document.)

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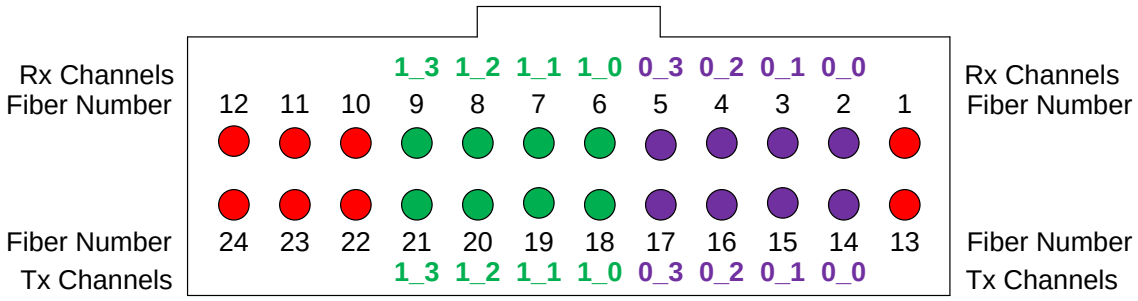
Figure 2: CPAK 100G Configured for 40G-SR4 Breakouts



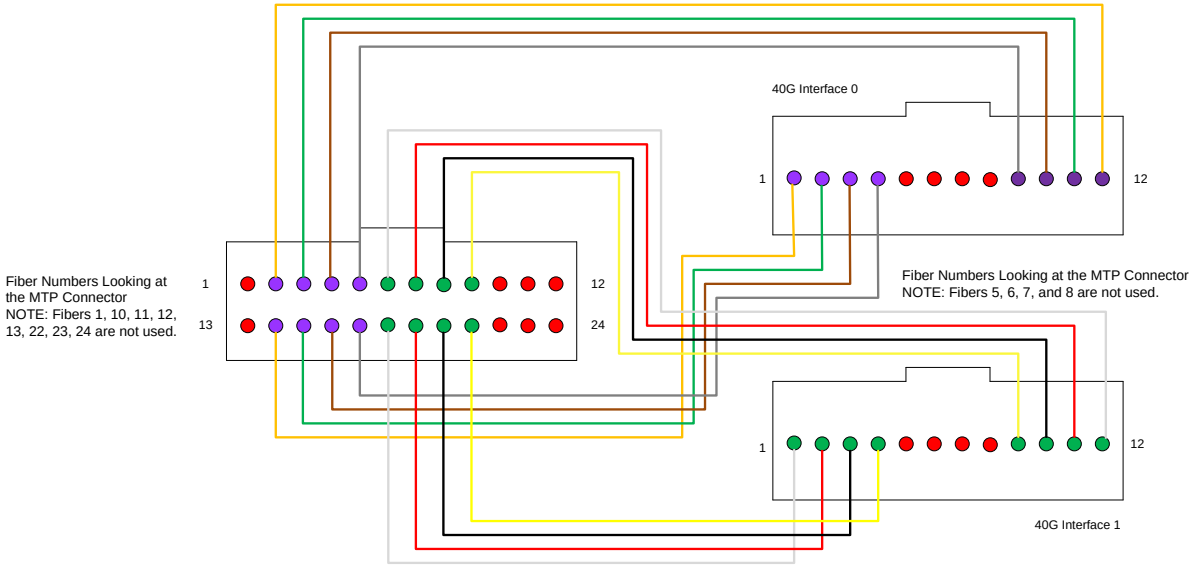
Fiber Numbers and Channel Assignments when looking into MTP Receptacle
NOTE: Fibers 1, 10, 11, 12, 13, 22, 23, 24 are not used.

40G Interface 0

40G Interface 1

Not Used

Figure 3: CPAK 80G to 40G Breakout



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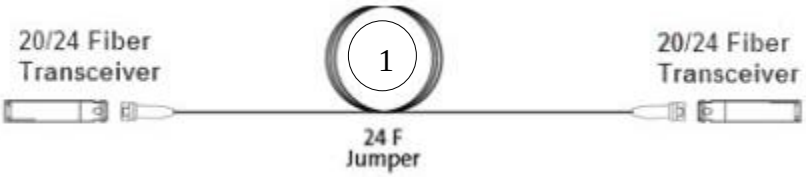
100G-to-100G Direct Connectivity

In a Direct Connect, a single 24f MTP jumper cable assembly directly connects the switch ports, as shown in Figure 4. This type of cabling would typically be deployed when the two switch ports that are being connected are within the same row of racks/cabinets, thus a very short distance.

Figure 4: 100G Connectivity with Direct Connect Cabling



Bill of Materials for Figure 4			
Item	**OM4 Part Number**	**OS2 Part Number**	**Description**
1	JA6A624QPH-NAxxxF	JA9A924GPH-NAxxxF	24f Jumper; 24f (non-pinned) to 24f (non-pinned) MTP; Plenum cable; Type-A polarity; overall length xxx feet

100G-to-100G Inter-connect Connectivity

In an Inter-Connect Structured cabling scheme larger fiber count MTP trunks (ranging from 24-576f within a single cabling sheath) are used to create more permanent cabling paths. Twelve fiber MTPs are installed into the backside of MTP patch panels that are mounted in a 19” rack-mounted enclosure. Then a 24-fiber MTP to (2) 12-fiber MTP “Y” jumper would create the connection from the patch panel to the switch port, as shown in Figure 5.

Structured cabling allows for network reconfiguration without needing to pull additional jumpers across the data center. Rather one would just add or reconfigure jumpers at the patch panel. In addition, the MTP Trunk cable construction is more robust than the jumper cable, thus can be placed in cable tray without concern of being crushed by the weight from other cabling, which can negatively affect the optical performance of the link.

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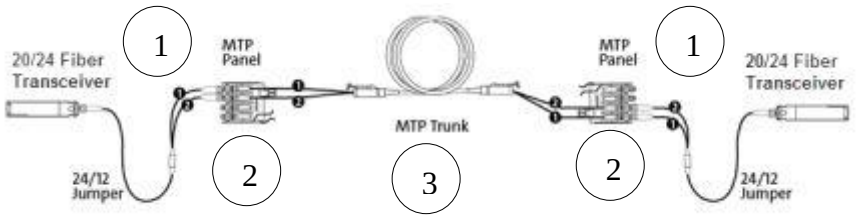
Figure 5: 100G Connectivity with Inter-Connect Structured Cabling



Bill of Materials for Figure 5			
Item	**OM4 Part Number**	**OS2 Part Number**	**Description**
1	HA69324QPH-LZxxxF	HA98924GPH-LZxxxF	24f Jumper; 24f (non-pinned) to (2) 12f (pinned) MTP; Plenum cable; Type Universal polarity; 12f leg length of 36” (L); overall length xxx meters
2	EDGE-CP48-E3	EDGE-CP48-90	48-fiber (4-port) MTP Adapter Panel; installed in 19” rack mounted EDGE housing (example, EDGE-04U)
3	G757524QPNDDUxxxF	G909024GPNDDUxxxF	24-fiber MTP(non-pinned) to MTP (non-pinned) Trunk; xxx feet
(Note: Trunks available in fiber counts up to 576f)			

80G-to-2x40G Break-out Connectivity

The Cisco CPAK 100GBase transceiver can be for the breakout to two 40G ports, by inactivating channels 8 and 9 in the transceiver. Operating this transceiver requires a breakout jumper which follows the polarity scheme as shown in figure 3.

Figure 6 shows the required Y-Jumper that is used to breakout the CPAK transceiver from one 80G port to two 40G ports. This type of direct connectivity is only suggested for short distances within a given row or in the same rack/cabinet.

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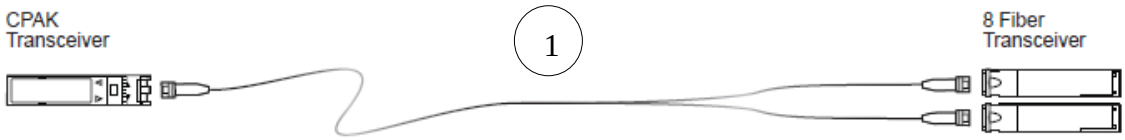
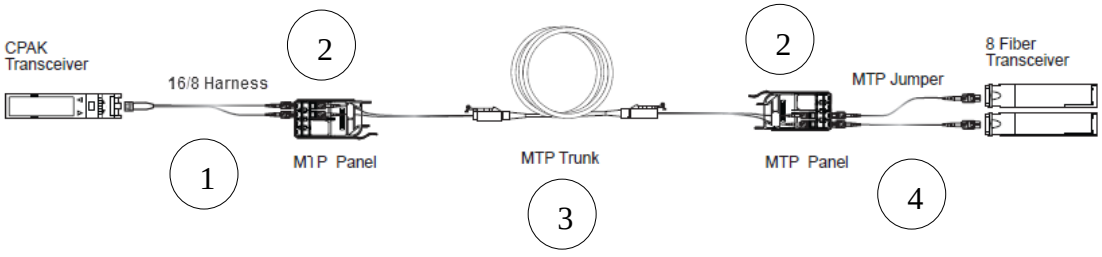
Figure 6: 80G to 2x40G Breakout Connectivity with Y-Breakout Jumper



Bill of Materials for Figure 6			
Item	**OM4 Part Number**	**OS2 Part Number**	**Description**
1	HA6E616QPH-L5xxxM	NA	EDGE™ AO Solutions 16 F "Y" Jumper, 16 F MTP® (non-pinned) to (2) 8 F MTP (non-pinned), plenum cable, Type-5 polarity, 8 F leg length of 36 in (L), length xxx m

The inter-connect structured cabling solution in Figure 7 allows for patching on both ends of the optical network. The breakout on the CPAK end of the network is accomplished by using the y-jumper mentioned in the previous scenario. The rest of the structured cabling would be accomplished by using a base-8 cabling solution utilizing 8-fiber MTP to MTP jumpers for patching on the far end.

Figure 7: 80G to 40G Breakout Connectivity with Inter-Connect Structured Cabling



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Bill of Materials for Figure 7			
Item	**OM4 Part Number**	**OS2 Part Number**	**Description**
1	HA6E616QPH-L5xxxM	NA	EDGE™ AO Solutions 16 F "Y" Jumper, 16 F MTP® (non-pinned) to (2) 8 F MTP (non-pinned), plenum, Type-5 polarity, 8 F leg length of 36 in (L), length xxx m
2	EDGE8-CP32-V3	NA	EDGE8™ 32-fiber MTP Connector Panel, aqua adapter for OM4 solutions
3	GE5E516QPNDDUxxxF	NA	EDGE8™ MTP® Trunk, 50 µm multimode (OM4), 16 Fibers, MTP 8F (Pinned) to MTP 8F(Pinned), TIA-568 Standard Universal Type-B Polarity, Pulling grip on first end only, xxx F, Non-Armored (Note: Trunks available in fiber counts up to 288f)
4	EDGE8-CP32-V3	NA	EDGE8™ 32-fiber MTP Connector Panel, aqua adapter for OM4 solutions
5	JE6E608QE8-NBxxxF	NA	8-fiber MTP® PRO Jumper, 50 µm multimode (OM4), MTP® PRO 8F (non-pinned) to MTP® PRO 8F (non-pinned), TIA-568 Type-B Polarity, xxx feet

100G-to-10x10G Break-out Connectivity

The 100G switch can also be used to create a high-density 10G fabric. The cabling solution shown in Figure 8 works best when the active equipment being connected is within the same row of racks/cabinets and the distance is short. It is also an excellent solution to port replicate and breakout a 20-fiber transceiver into a 2-fiber patching field.

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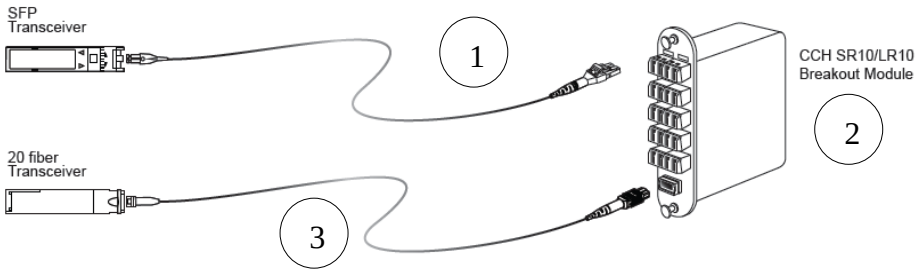
Figure 8: 10G Connectivity using SR10/LR10 Breakout Module



Bill of Materials for Figure 8			
Item	**OM4 Part Number**	**OS2 Part Number**	**Description**
1	797902QD120xxxM	787802GD120xxxF	2f LC Uniboot Jumper; xxx feet
2	CCH-BM20-05-A7Q	CCH-BM20-04-A8G	Plug & Play™ SR10 Breakout Module, LC, 20 F, Shuttered LC Duplex to 24F MTP®
3	JA6A624QPH-NAxxxF	JA9A924GPH-NAxxxF	24f Jumper; 24f (non-pinned) to 24f (non-pinned) MTP; Plenum cable; Type-A polarity; overall length xxx feet

When directly connecting a 20-fiber transceiver to the ten corresponding duplex ports, a 20-fiber LC harness can be used as shown in Figure 9. This type of direct connectivity is only suggested for short distances where the SFP ports are all in the same or adjacent cabinet. This is due to the 24” LC leg length limitation for this harness. If the SFP ports are in varying locations, a solution as described in Figure 10 should be leveraged.

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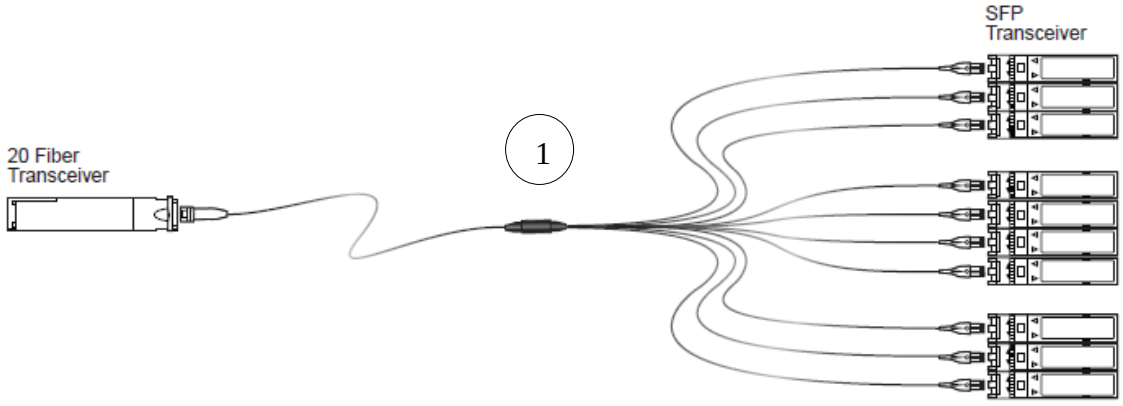
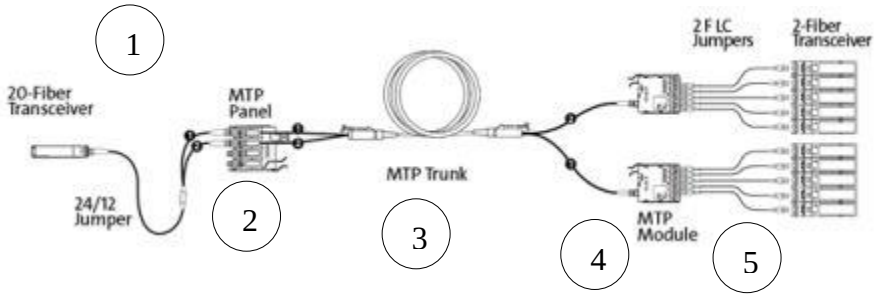
Figure 9: Harness Only – Direct Connect Structured Cabling



Bill of Materials for Figure 9			
Item	**OM4 Part Number**	**OS2 Part Number**	**Description**
1	HA60520QPH-KBxxxF	HA90420GPH-KBxxxF	24F MTP Breakout Harness; 24f (non-pinned) to 10xLC-Duplex; Plenum cable, Breakout polarity; LC-Duplex leg length of 24” (K); overall length xxx meters

A structured cabling solution is required if the desire is to carry the 100G port across the data center, then breakout the 10G ports in another location. Figure 10 shows a cabling scheme that uses MTP-LC modules to breakout each 10G circuit. The individual LC jumpers can be used to make the connection to the 10G ports. These 10G ports could be in various switches within the server row since the connection is being made with individual LC jumpers. Note that each module has an unused port as shown in the drawing.

Figure 10: 10G Connectivity with Inter-Connect Structured Cabling



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Bill of Materials for Figure 10			
Item	**OM4 Part Number**	**OS2 Part Number**	**Description**
1	HA69324QPH-L9xxxF	HA98924GPH-L9xxxF	24f Jumper; 24f (non-pinned) to (2) 12f (pinned) MTP; Plenum cable; Type-9 polarity; 12f leg length of 36” (L); overall length xxx feet
2	EDGE-CP48-E3	EDGE-CP48-90	48-fiber (4-port) MTP Adapter Panel; installed in 19” rack mounted EDGE housing (example, EDGE-04U)
3	G757524QPNDDUxxxF	G909024GPNDDUxxxF	24-fiber MTP(non-pinned) to MTP (non-pinned) Trunk; xxx feet (Note: Trunks available in fiber counts up to 576f)
4	ECM-UM12-05-93Q	ECM-UM12-04-89G	EDGE 12f MTP/LC Connector Module
5	797902QD120xxxF	787802GD120xxxF	2f LC Uniboot Jumper; xxx feet

Cabling Arista MXP Ports

The Arista MXP port utilizes all 24 fibers for data transmission. Figure11 illustrates the fiber and channel assignments of this embedded optic 24fiber-MTP port. All receive channels are located on the top row of the port on the key side of the connector while all the transmit channels are on the bottom row. When connecting two MXP ports, the same cabling guidance can be used as shown in Figure 4 and Figure 5. The cabling solutions to breakout to 10G and 40G for the MXP will be covered in the remaining section of this document. Figure 12 illustrates how the fibers breakout to connect the MXP port to three 40G transceivers. Breaking the MXP port out into 10G lanes is easily accomplished by pairing the top row receive channel with the corresponding bottom row transmit channel. For example, pairing fiber 1 to fiber 13 (Rx0 to Tx0), fiber 2 to fiber 14 (Rx1 to Tx1), and continuing this until the end of each row, which is fiber 12 to fiber 24 (Rx11 to Tx11).

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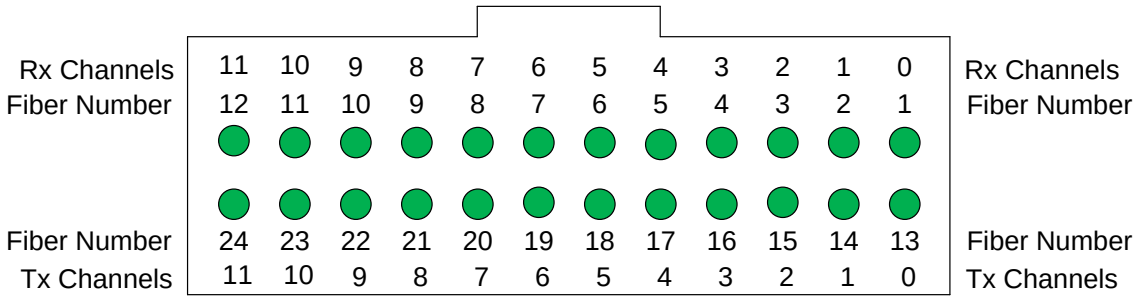
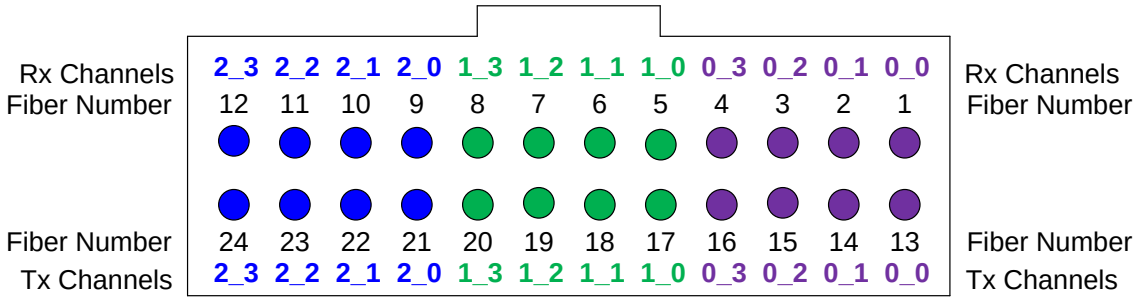
Figure 11: Parallel Fiber (24-fiber) Optic Transmission

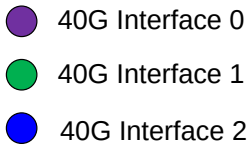


Fiber Numbers and Channel Assignments when looking into MTP Receptacle
NOTE: All fibers are utilized.

Figure 12: MXP to 40G Breakout



Fiber Numbers and Channel Assignments when looking into MTP Receptacle
NOTE: All fibers are utilized.



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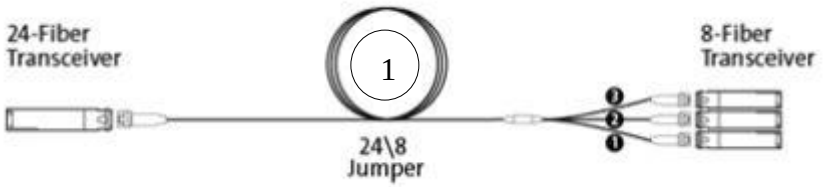
MXP-to-3x40G Break-out Connectivity

The MXP port can also support a 40G breakout utilizing all 24-fibers. Typically, this would be the deployment method when the Leaf switch has 40G connection ports to interface with the MXP port on the Spine switch. Figure 13 shows Direct Connect cabling where the transceiver port is directly connected via a single cable assembly to three 40G ports.

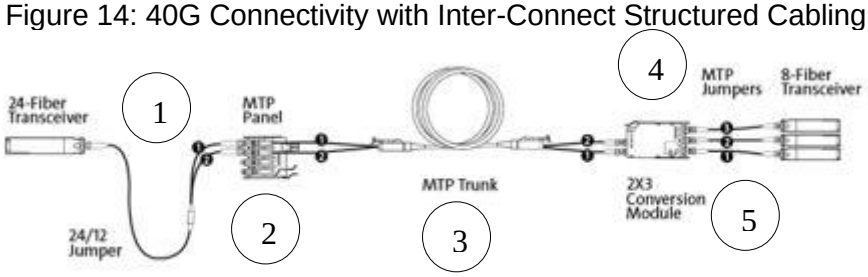
Figure 13: 40G Connectivity with Direct Connect Cabling



Bill of Materials for Figure 13			
Item	**OM4 Part Number**	**OS2 Part Number**	**Description**
1	HA67524QPH-KAxxxF	HA99024GPH-KAxxxF	24f Jumper; 24f (non-pinned) to (3) 8f (non-pinned) MTP; Plenum cable; Type-A polarity; 8f leg length of 24” (K); overall length xxx feet

The more typical deployment would be an Inter-Connect cabling infrastructure, as shown in Figure 14. Each MXP port in the spine switch is cabled to the server rows where the Leaf switch would reside. By deploying the 2x3 conversion module, each 8F MTP jumper could be connected to 40G ports in the same or various Leaf switches within that server area. This allows for diversity of port connectivity to a given Leaf switch uplink.

Figure 14: 40G Connectivity with Inter-Connect Structured Cabling



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Bill of Materials for Figure 14			
Item	**OM4 Part Number**	**OS2 Part Number**	**Description**
1	HA69324QPH-L8xxxF	NA	24f Jumper; 24f (non-pinned) to (2) 12f (pinned) MTP; Plenum cable; Type-8 polarity; 12f leg length of 36” (L); overall length xxx meters
2	EDGE-CP48-E3	NA	48-fiber (4-port) MTP Adapter Panel; installed in 19” rack mounted EDGE housing (example, EDGE-04U)
3	G757548QPNDDUxxxF	NA	48-fiber MTP(non-pinned) to MTP (non-pinned) Trunk; xxx feet (Note: Trunks available in fiber counts up to 576f)
4	ECM-UM24-93-93Q	NA	EDGE 2x3 Conversion Module
5	J757512QE8-NBxxxF	NA	12f MTP Jumper; MTP PRO (non-pinned) to MTP PRO (non-pinned); Type-B polarity; xxx feet

Another way to accomplish an Inter-Connect deployment would be by using a 2 x 3 conversion module to break out each 24f port to three 40G ports. Figure 15 illustrates how a 2x3 conversion module would be deployed with the connectivity to the Leaf switches using three MTP (non-pinned) to MTP (non-pinned) Type-B polarity jumpers. This configuration allows the port to be broken out in three 40G 8-fiber ports near the switch, with MTP jumpers extending out to the Leaf switches. This application uses MTP jumpers as structured cabling, which is not ideal for larger deployments, but could be used in a smaller data center footprint.

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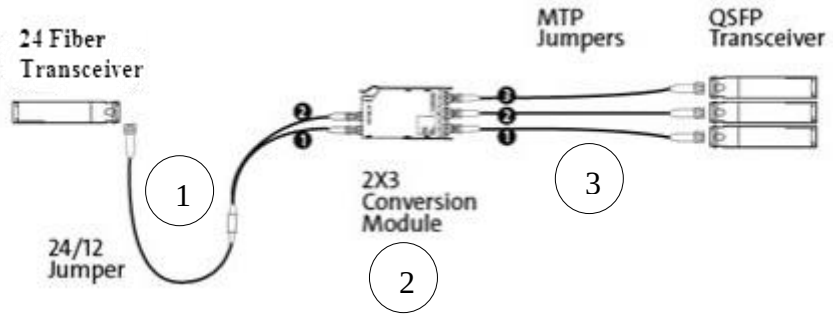
Figure 15: 40G Connectivity with Inter-Connect Port Replication



Bill of Materials for Figure 15			
Item	**OM4 Part Number**	**OS2 Part Number**	**Description**
1	HA67524QPH-L6xxxF	NA	24f Jumper; 24f (non-pinned) to (2) 12f (non-pinned) MTP; Plenum cable; Type-6 polarity; 12f leg length of 36” (L); overall length xxx meters
2	ECM-UM24-93-93Q	NA	EDGE 2x3 Conversion Module
3	J757512QE8-NBxxxF	NA	12f MTP Jumper; MTP PRO (non-pinned) to MTP PRO (non-pinned); Type-B polarity; xxx feet

MXP-to-12x10G Break-out Connectivity

MXP can breakout to support a 10G connection as well. Figure 16 shows a cabling scheme that uses MTP-LC modules to breakout each MXP port. Then individual LC jumpers can be used to make the connection to the 10G ports.

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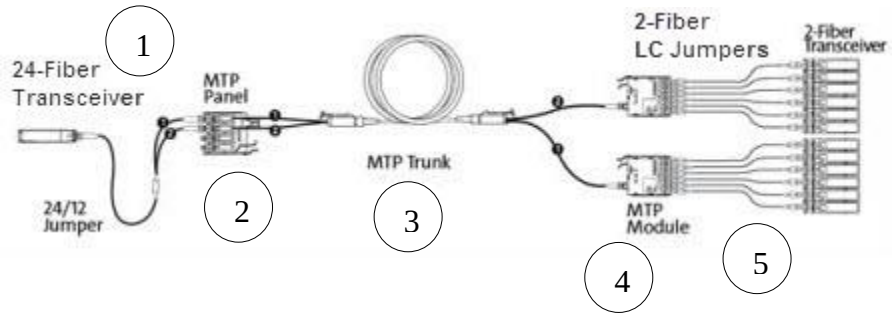
Figure 16: 10G Connectivity with Inter-Connect Structured Cabling



Bill of Materials for Figure 16			
Item	**OM4 Part Number**	**OS2 Part Number**	**Description**
1	HA69324QPH-L9xxxF	HA98924GPH-L9xxxF	24f Jumper; 24f (non-pinned) to (2) 12f (pinned) MTP; Plenum cable; Type-9 polarity; 12f leg length of 36” (L); overall length xxx feet
2	EDGE-CP48-E3	EDGE-CP48-90	48-fiber (4-port) MTP Adapter Panel; installed in 19” rack mounted EDGE housing (example, EDGE-04U)
3	G757548QPNDDUxxxF	G909048GPNDDUxxxF	48-fiber MTP(non-pinned) to MTP (non-pinned) Trunk; xxx feet (Note: Trunks available in fiber counts up to 576f)
4	ECM-UM12-05-93Q	ECM-UM12-04-89G	EDGE 12f MTP/LC Connector Module
5	797902QD120xxxF	787802GD120xxxF	2f LC Uniboot Jumper; xxx feet

If the 10G connections are in the same row as the MXP port, then using a trunk is not needed. Figure 17 illustrates how EDGE8 MTP-LC modules along with a harness assembly can be leveraged for this application. This configuration provides the added advantage to be able to use various lengths of LC jumpers to connect to the 10G ports.

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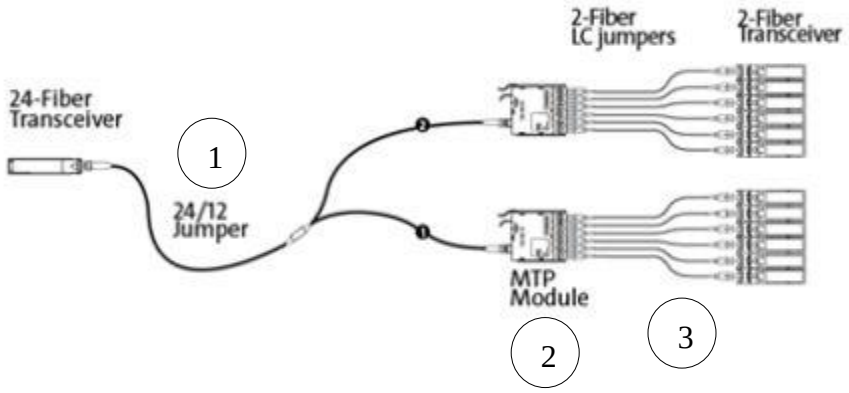
Figure 17: 10G Connectivity with Inter-Connect Port Replication



Bill of Materials for Figure 17			
Item	**OM4 Part Number**	**OS2 Part Number**	**Description**
1	HA67524QPH-L7xxxF	HA99024GPH-L7xxxF	24f Jumper; 24f (non-pinned) to (2) 12f (non-pinned) MTP; Plenum cable; Type-7 polarity; 12f, leg length of 36” (L); overall length xxx meters
2	ECM-UM12-05-93Q	ECM-UM12-04-89G	EDGE 12f MTP/LC Connector Module
3	797902QD120xxxM	787802GD120xxxF	2f LC Uniboot Jumper; xxx feet

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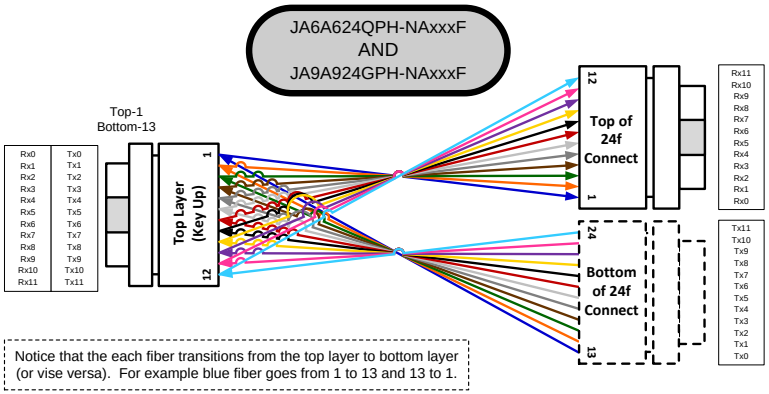
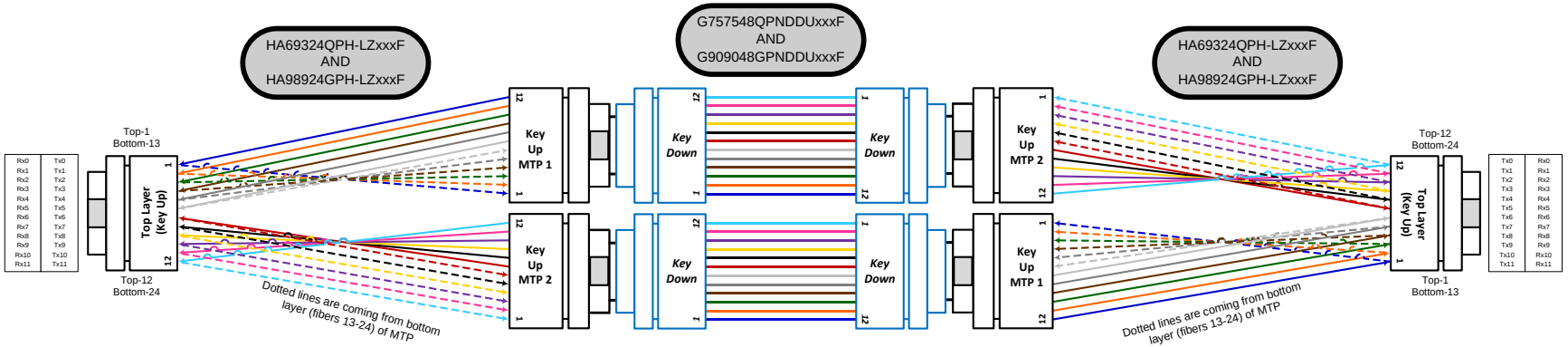
Appendix A:

Polarity of Figure 4



Polarity of Figure 5



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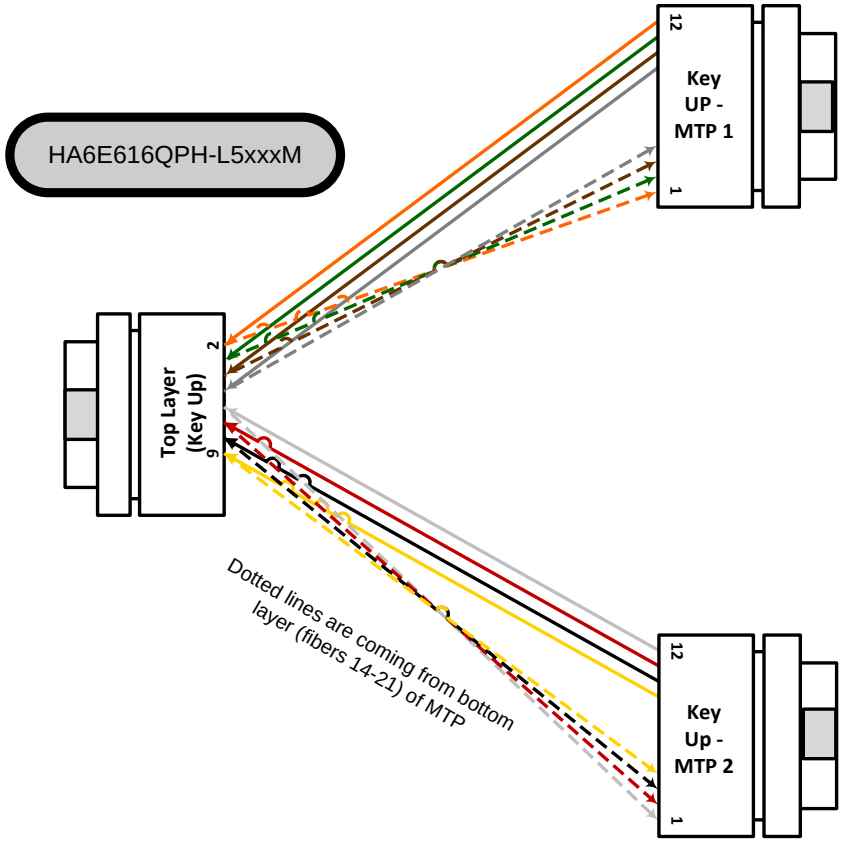
Polarity of Figure 6



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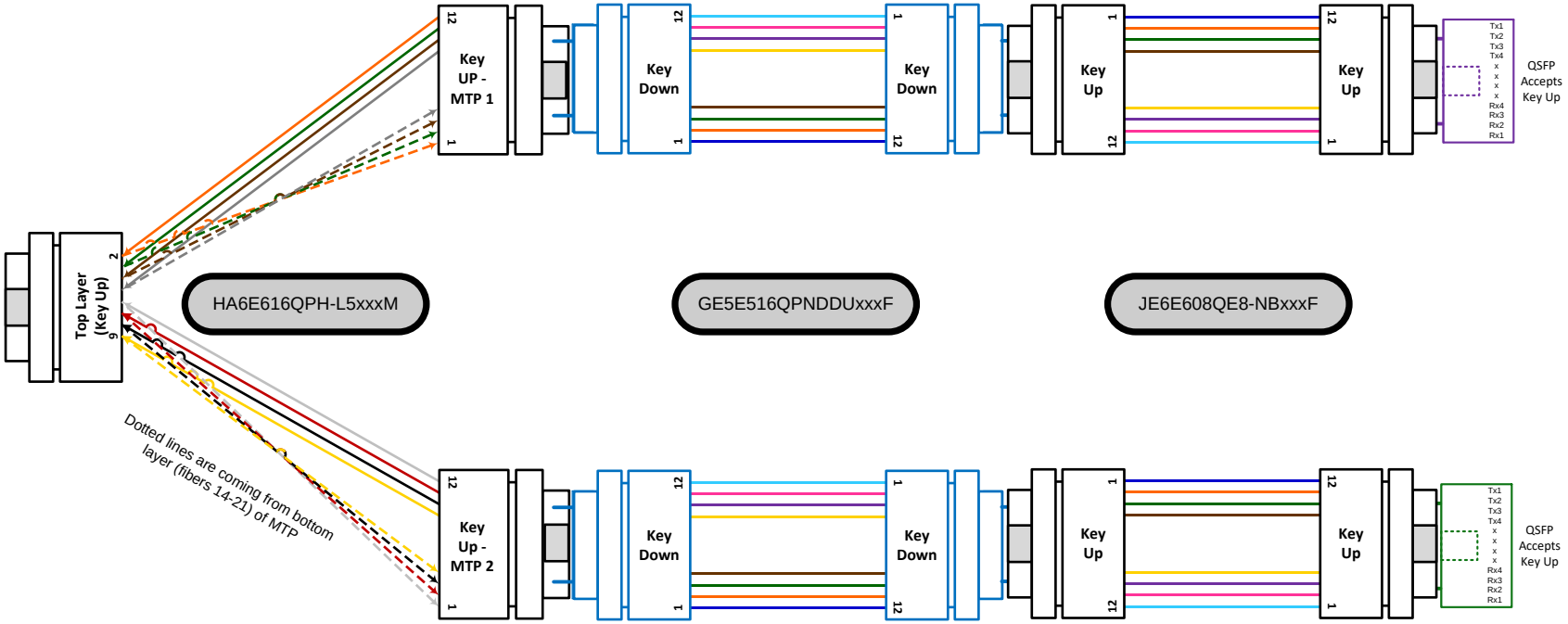
Polarity of Figure 7



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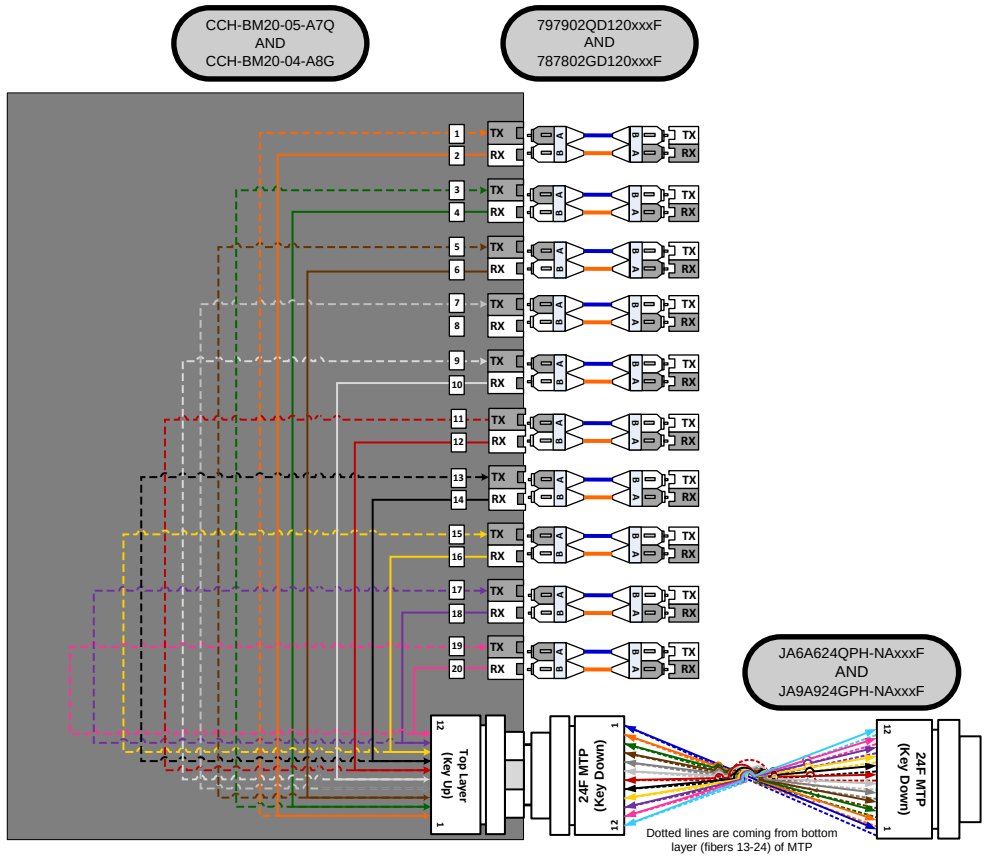
Polarity of Figure 8



Polarity of Figure 9

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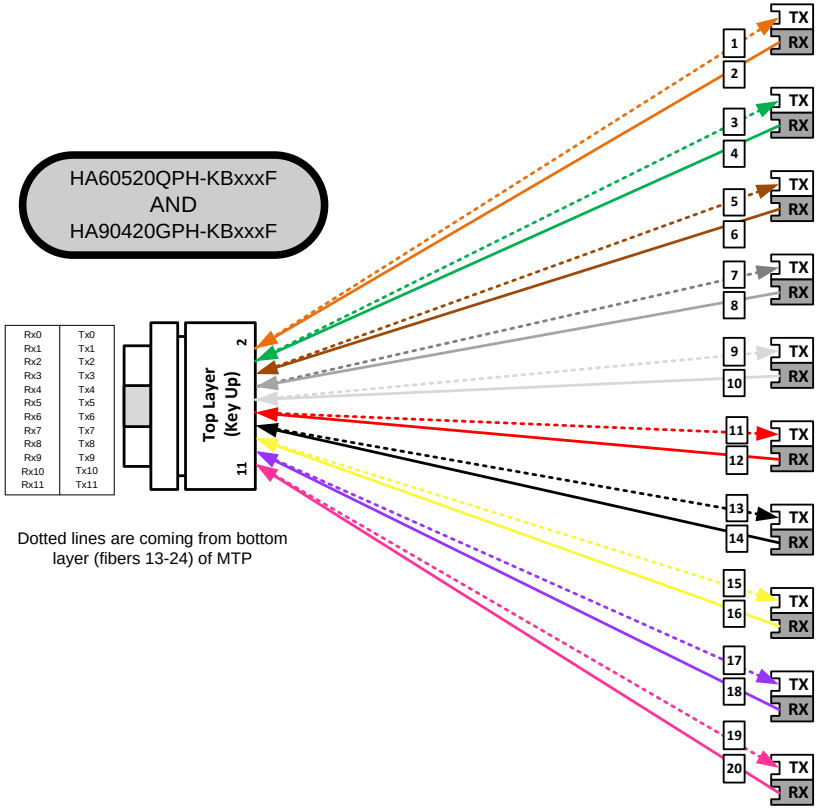

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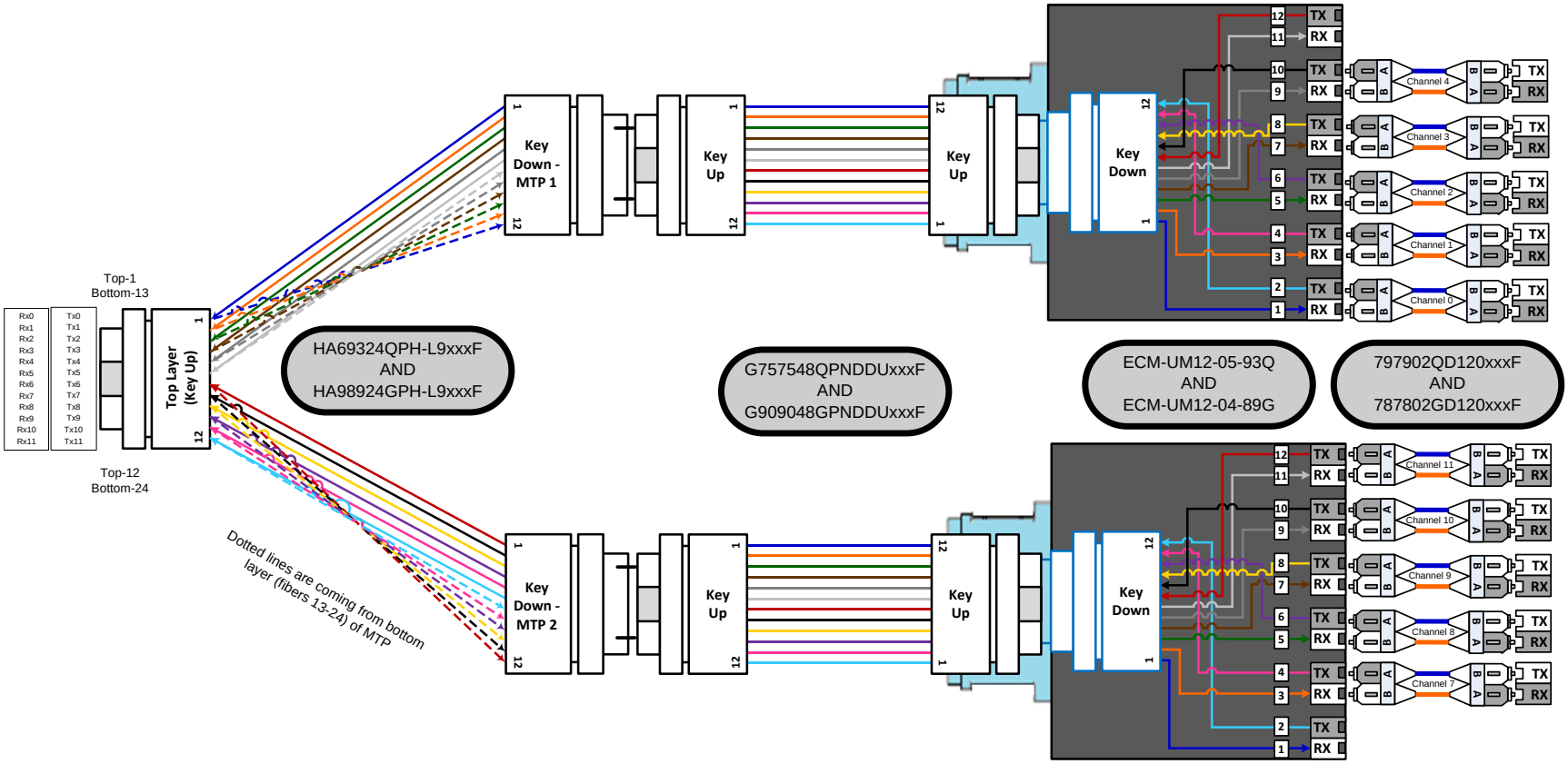
Polarity of Figure 10



Polarity of Figure 13

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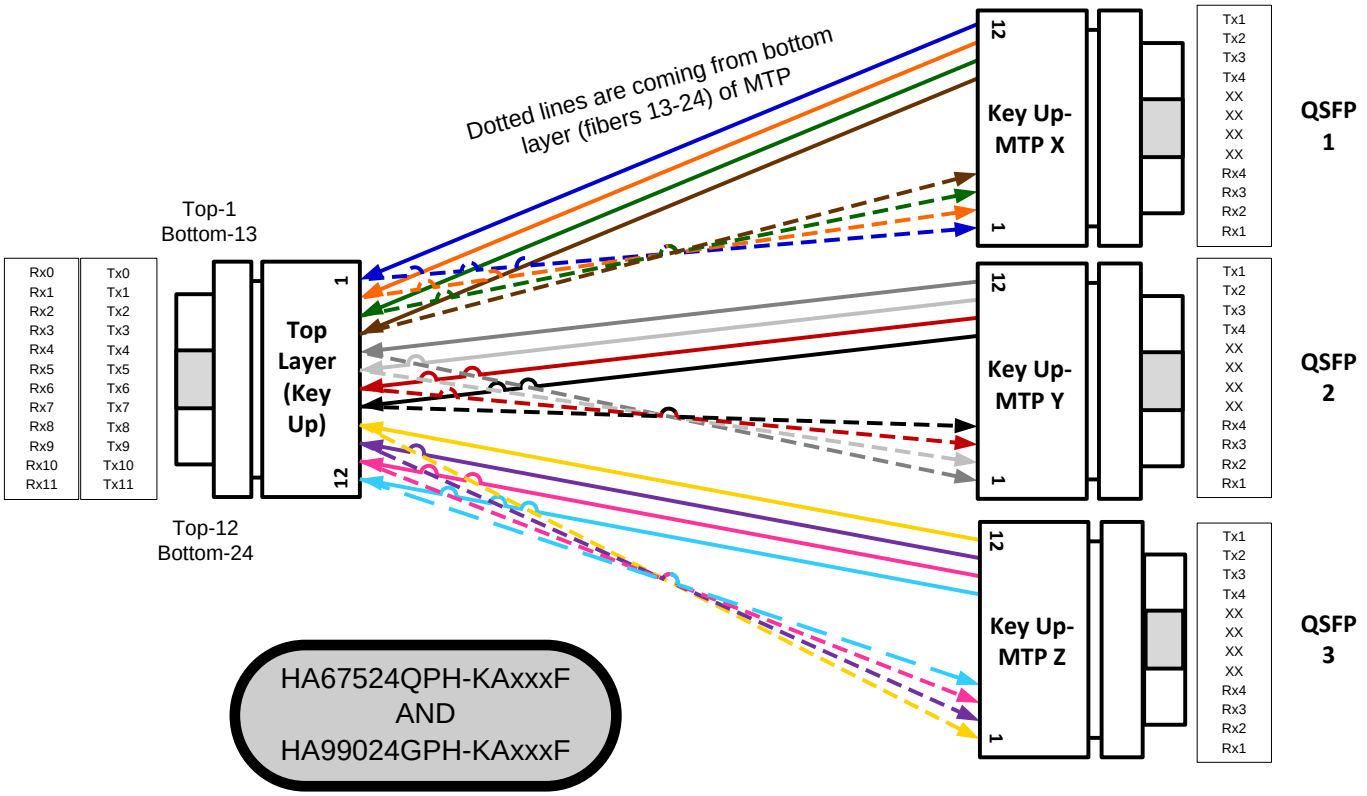

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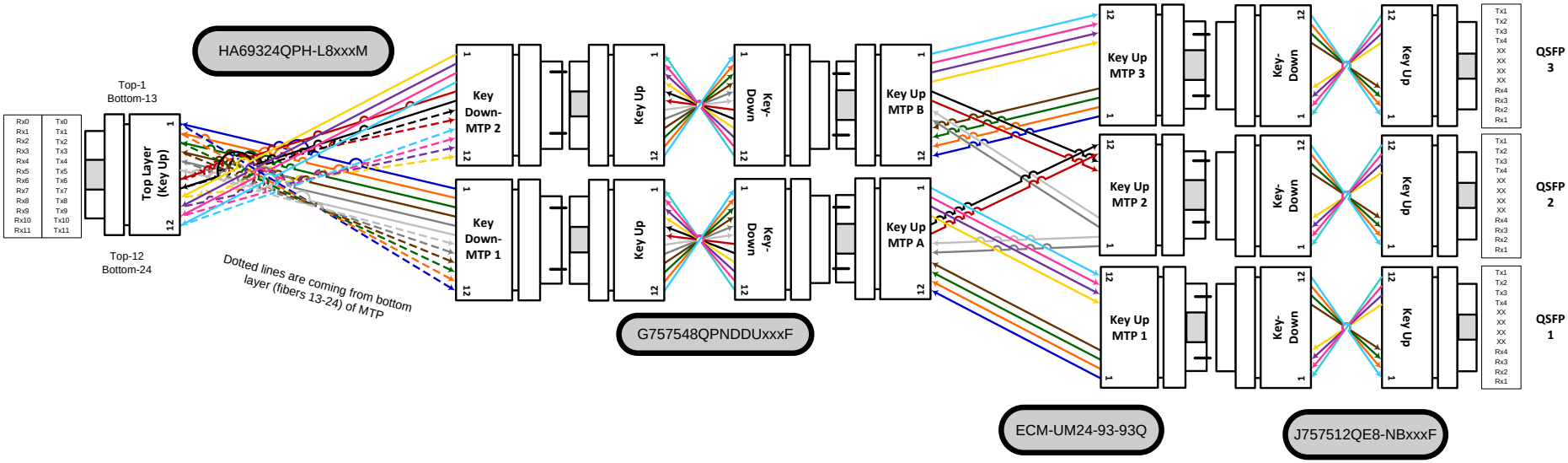
Polarity of Figure 14



Polarity of Figure 15

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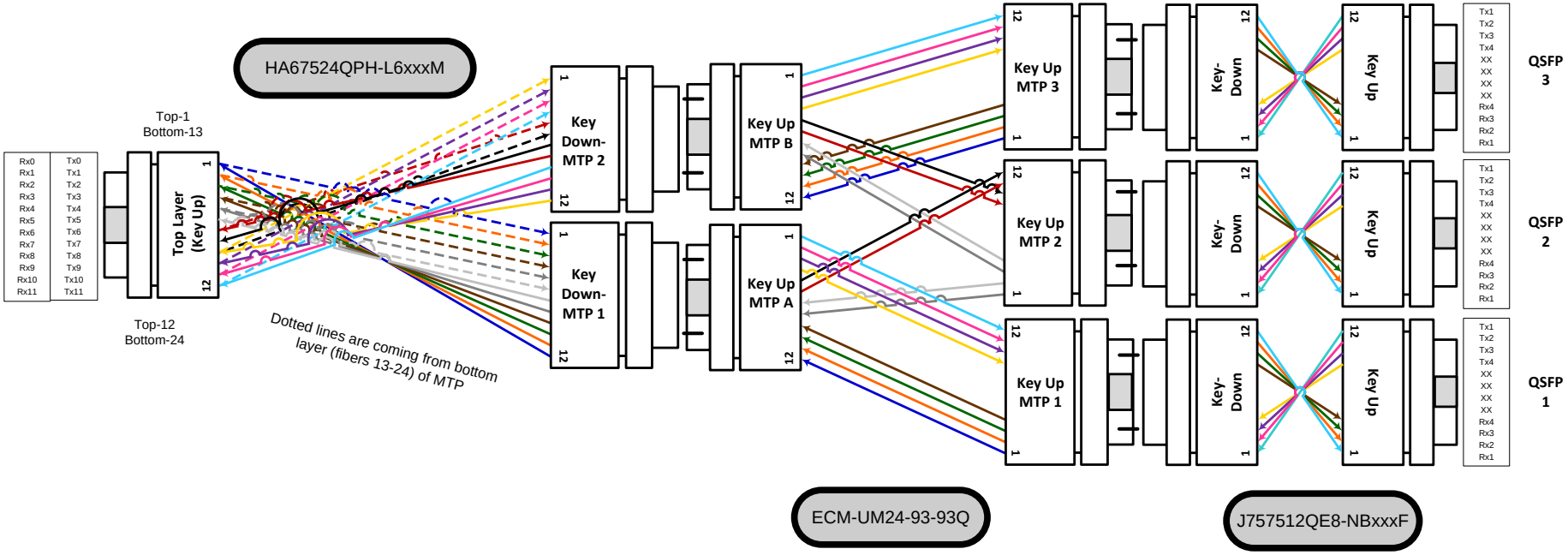

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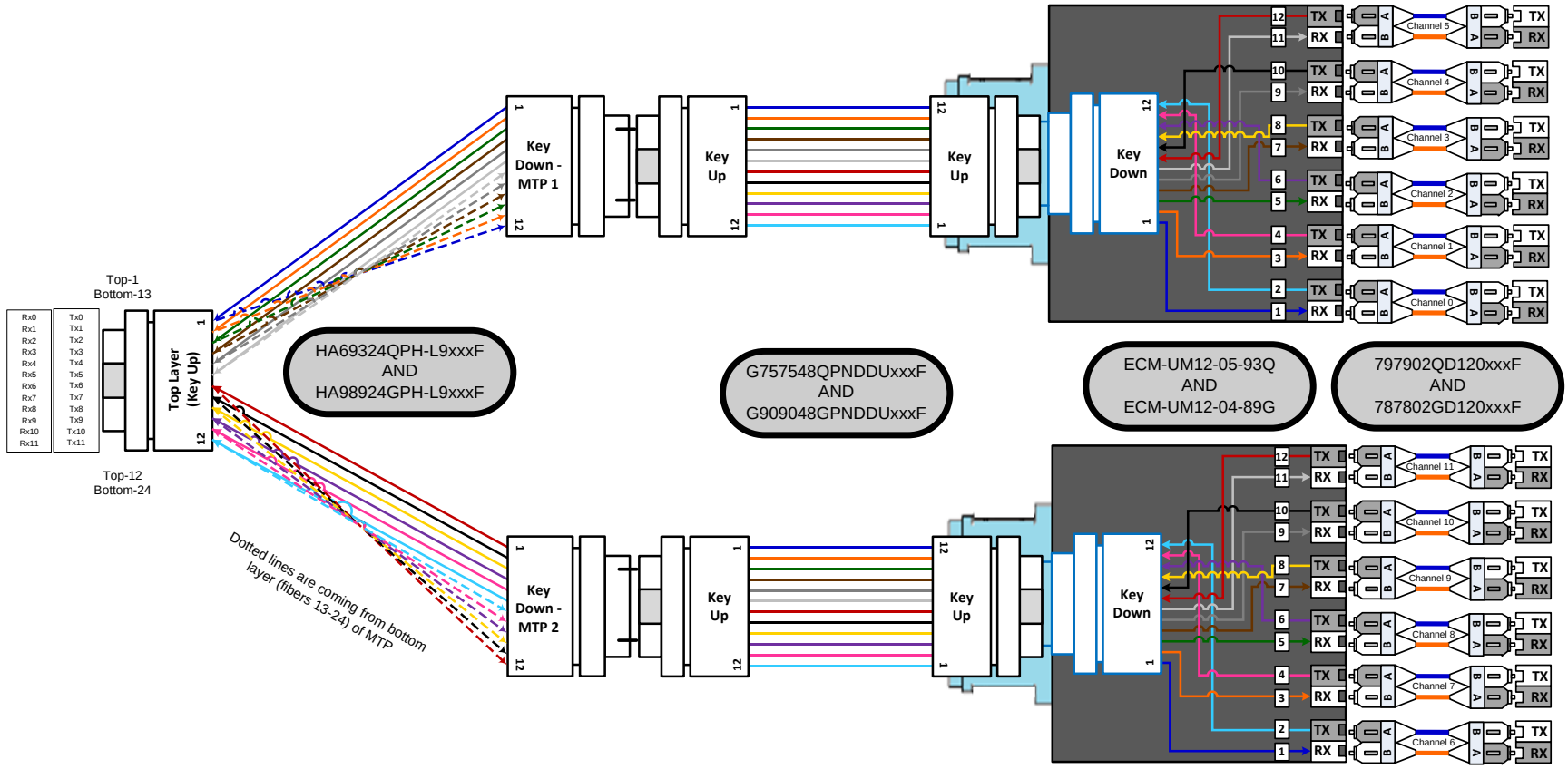
Polarity of Figure 16



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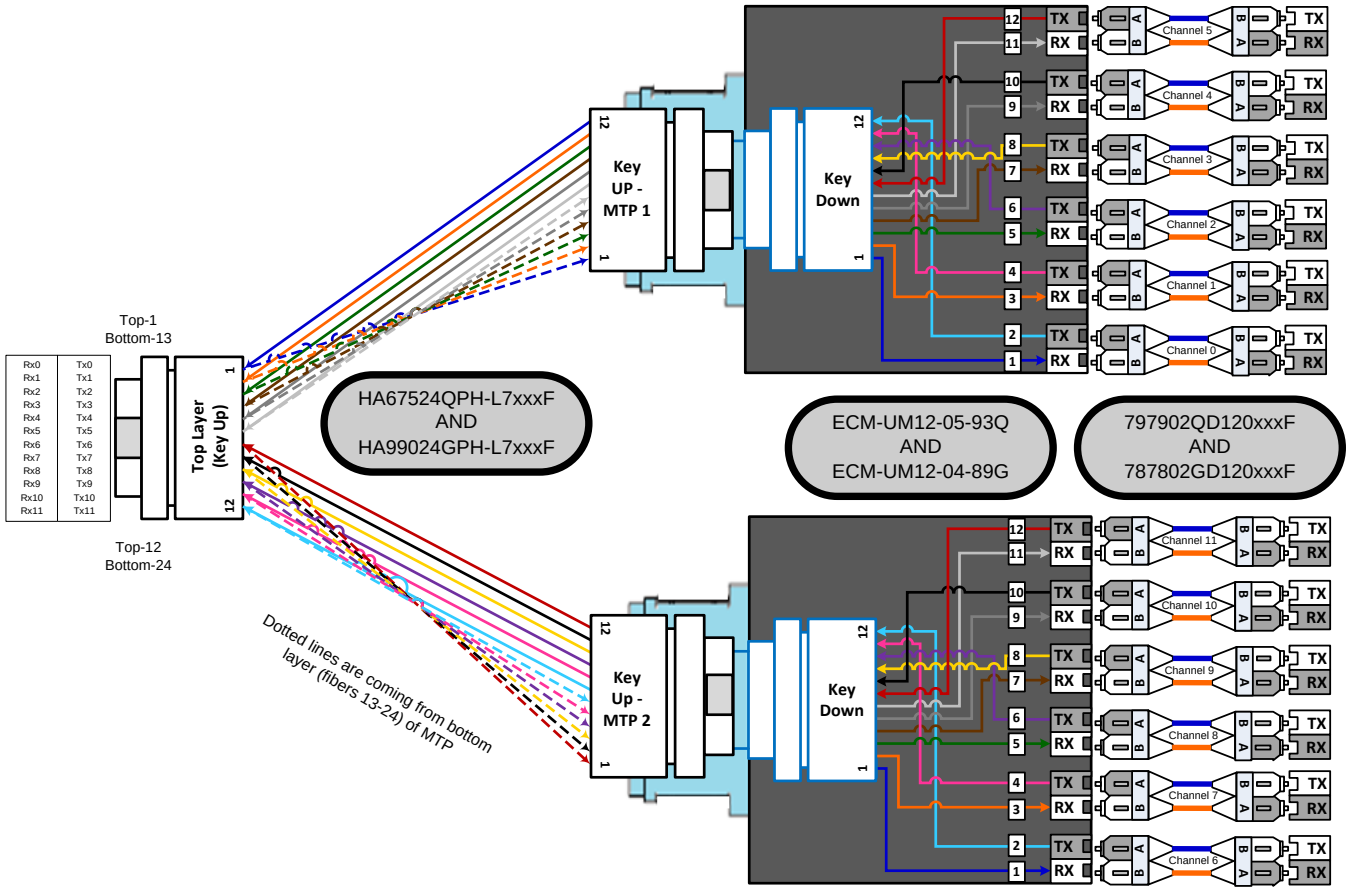
Polarity of Figure 17



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