



## LINKX 400GB/S CABLES AND TRANSCEIVERS

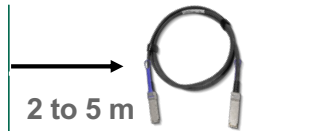
- 400G NDR INFINIBAND (4X100G)
- 400GBE ETHERNET (8X50G AND 4X100G)
- 200GBE/HDR (4X50G-PAM4)

## CONFIGURATIONS MAPS

August 22, 2023

# LOWEST COST TECHNOLOGIES FOR EACH REACH NEEDED

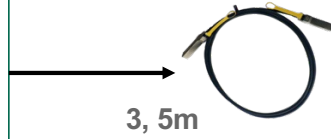
■ DAC Cables



*"DAC-In-the Rack"*

½m-to-40km  
InfiniBand & Ethernet  
10G-to-400G

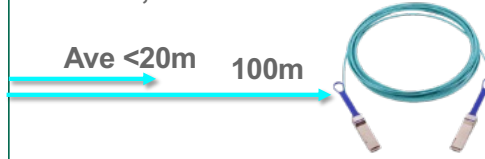
■ Active Copper Cables (ACC)



*AOCs  
"Across-the-Top"*

- Colors mean something!
- Black = DAC
  - Aqua = Multi-mode - short reach
  - Yellow = Single-mode - long reach

■ Active Optical Cables (AOC)



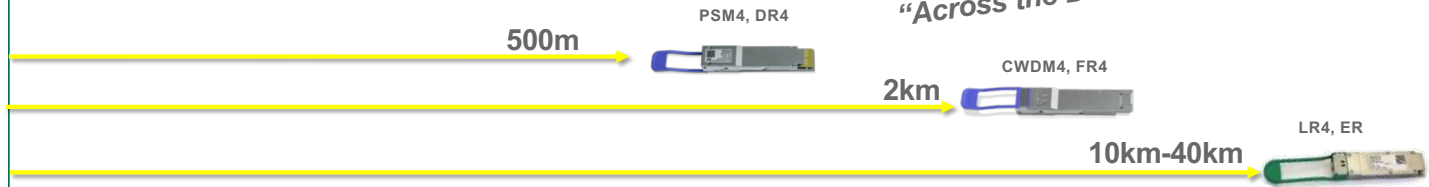
*"Multi-mode-for-Structured Cabling"*

■ Multi-Mode Transceivers



*Single-mode-for-  
"Across the Data center and Beyond"*

■ Single-Mode Transceivers



\$                    \$                    \$\$                    \$\$\$                    \$\$\$\$                    \$\$\$\$\$

**Price Increases as Reach Extends**

# LINKX 400GBE/NDR PORTFOLIO

DACs, ACCs, AOCs, Multimode + Single mode Transceivers

Based on 100G-PAM4 Modulation in OSFP + QSFP112

InfiniBand & Ethernet

**Passive Copper**  
Up to 3 meters  
800G to 2x 400G or 4x 200G  
OSFP or QSFP112



OSFP QSFP112

**Active Copper**  
Up to 5 meters  
800G to 2x 400G or 4x 200G  
OSFP or QSFP112



OSFP QSFP112

**Multimode Transceivers**  
Up to 50 meters



Twin port 2x400G SR8  
Multimode Transceiver

Multi-mode fibers:

Single Port 400G SR4 Multimode QSFP112 and  
OSFP Transceivers

QSFP112 OSFP

**Single mode Transceivers**  
Up to 100, 500 & 2K meters



Twin port 2x400G DR8  
Single mode Transceiver

Single mode fibers:

Single Port 400G DR4 Single mode  
QSFP112 and OSFP Transceivers

QSFP112 OSFP

**Backwards Compatible OSFP-to-QSFP**



# LINKX 400GBE ETHERNET PORTFOLIO

DACs, AOCs, Multimode + Single mode Transceivers

Based on 50G-PAM4 Modulation in QSFP-DD + QSFP56

## Direct Attach Copper (DAC)



400GbE

400GbE-to-2x200GbE

400GbE-to-4x100GbE

## Active Optical Cables (AOC)

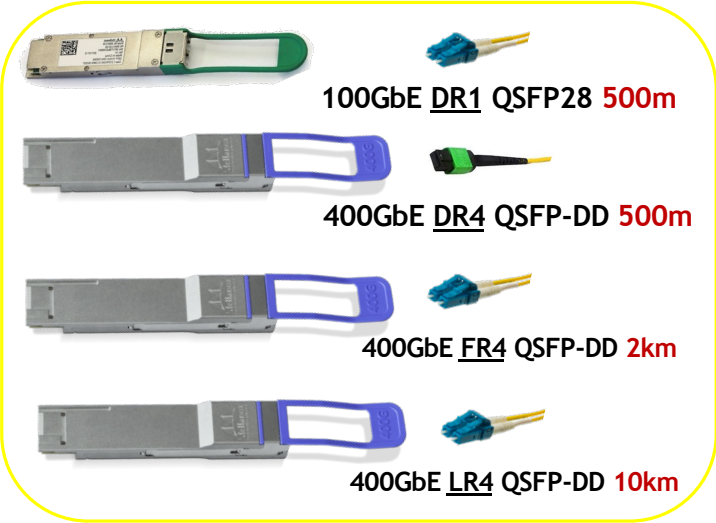


## Optical Transceivers - Multi-mode



400GbE SR8 QSFP-DD 100m

## Optical Transceivers - Single-mode



100GbE DR1 QSFP28 500m

400GbE DR4 QSFP-DD 500m

400GbE FR4 QSFP-DD 2km

400GbE LR4 QSFP-DD 10km

# LINKX 200GBE/HDR PORTFOLIO

DACs, AOCs, Multimode + Single mode Transceivers  
Based on 50G-PAM4 Modulation in QSFP56

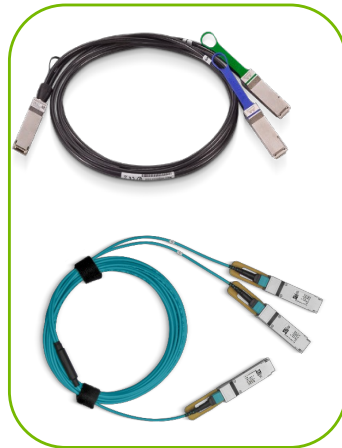
**200G QSFP56 -to- 200G QSFP56**  
InfiniBand + Ethernet



DACs

AOCs

**200G QSFP56 -to- 2x 100G QSFP56**  
InfiniBand + Ethernet



**200G QSFP56 -to- 4x50G SFP56**  
Ethernet only




*QSA28*  
SFP28-to-QSFP28 port adapter

**200GbE SR4**  
850nm Multi-mode 100-meters  
QSFP56



**200GbE FR4**  
1310nm Single-mode 2km  
QSFP56





**400G INFINIBAND QUANTUM-2 NDR & SPECTRUM-4 ETHERNET SWITCHES  
CONNECTX-7 AND BLUEFIELD-3 DPUS  
100G-PAM4, OSFP, QSFP112  
CABLES AND TRANSCEIVERS**

# LINKX 400GBE/NDR PORTFOLIO

Based on 100G-PAM4 Modulation in OSFP and QSFP112

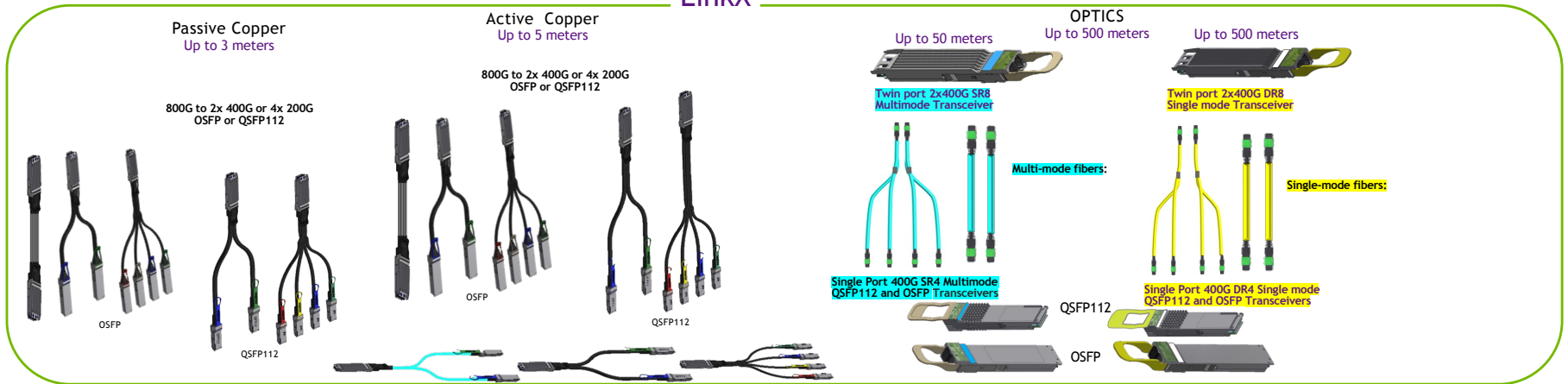
**InfiniBand**  
NDR Quantum-2 QM9700  
32-cage Twin-port-OSFP



**Ethernet**  
Spectrum-4 400GbE SN5600  
64-cage Twin-port-OSFP



## InfiniBand & Ethernet LinkX



## InfiniBand & Ethernet

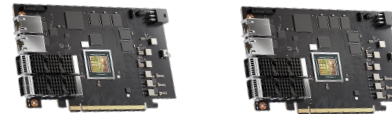
### ConnectX-7

ConnectX-7/QSFP112 or OSFP  
200G & 400G



### BlueField-3

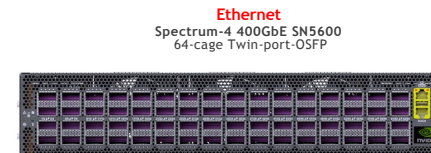
BlueField-3/QSFP112  
200G & 400G



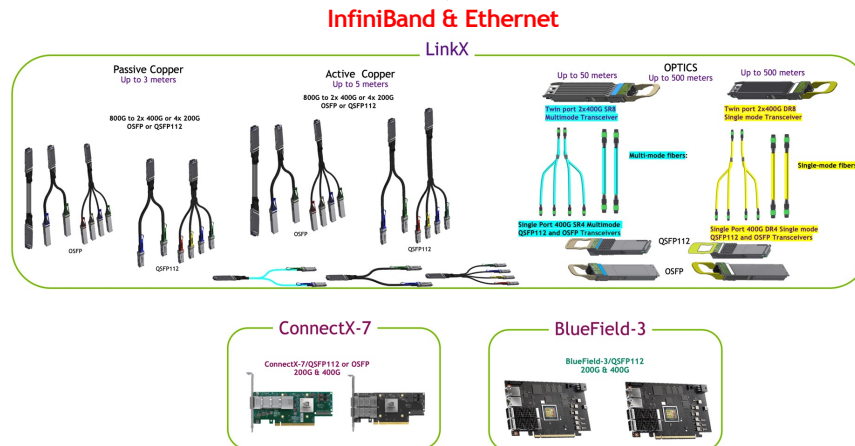
# ALL 100G-PAM4-BASED LINKX CABLES & TRANSCEIVERS, CONNECTX-7 AND BLUEFIELD-3 ADAPTERS SUPPORT BOTH INFINIBAND ETHERNET AUTOMATICALLY



Creates InfiniBand Networks



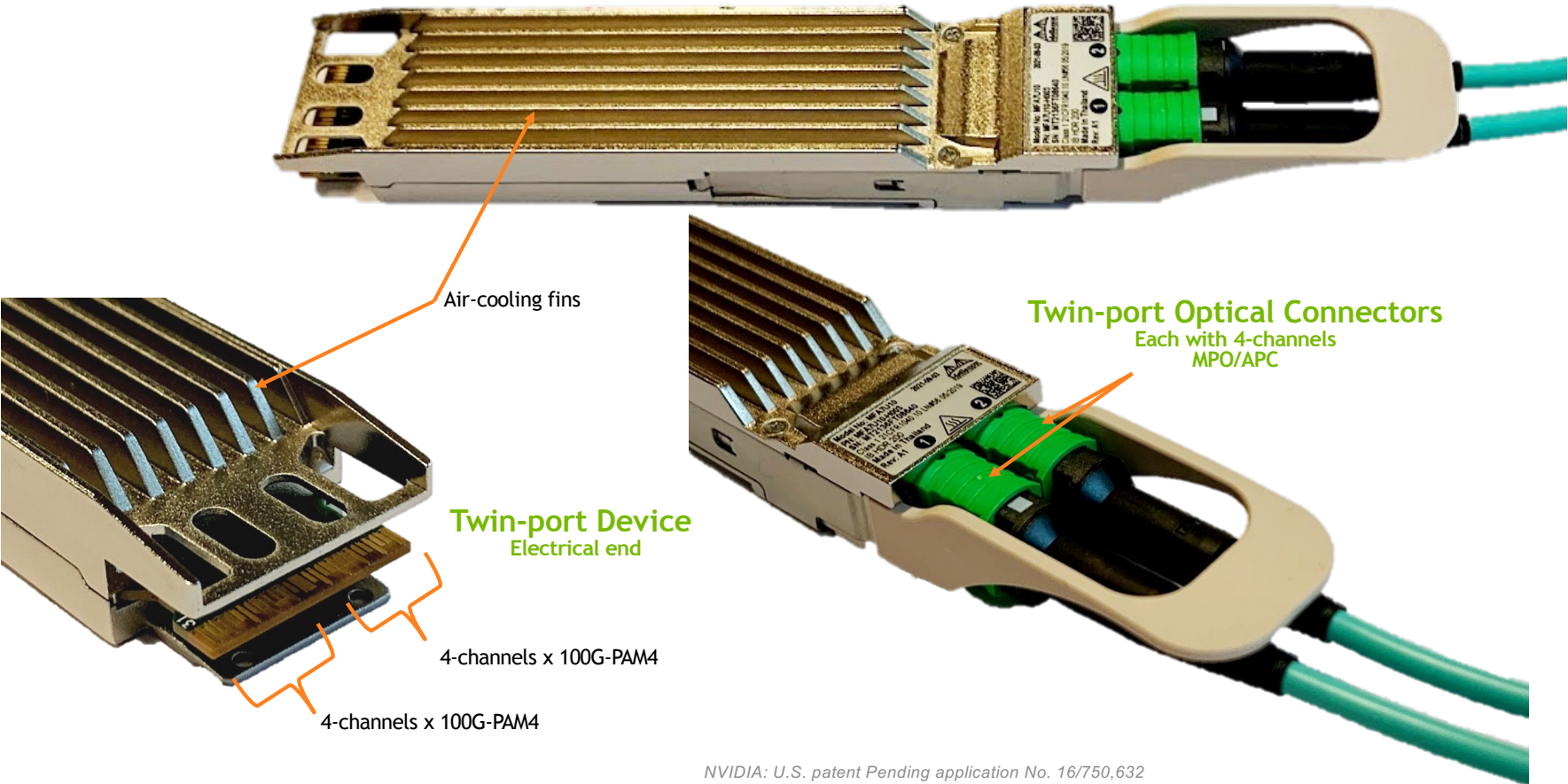
Creates Ethernet Networks





# TWIN-PORT OSFP: OCTAL SMALL FORM-FACTOR PLUG

Twin 400G (4x100G-PAM4) links



NVIDIA: U.S. patent Pending application No. 16/750,632

# QSFP + OSFP TRANSCEIVERS AND FORM-FACTORS

New Twin-Port OSFP for OSFP-Based Switches

New QSFP112 form-factor used for BlueField-3

Optical connectors

**EDR / 100GbE**  
4x25G NRZ  
4 channels



**QSFP28**



**HDR / 200GbE**  
4x50G PAM4  
4 channels



**QSFP56**



**NEW!**

**NDR / 400GbE**  
4x100G PAM4  
4 channels



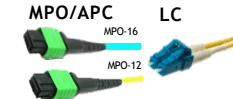
**QSFP112**



**400GbE/800GbE**  
4x100G PAM4  
8 channels



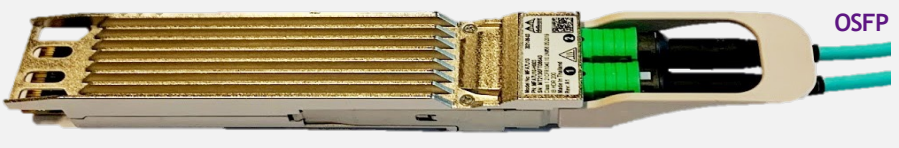
**QSFP-DD**



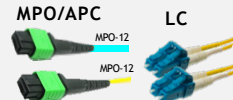
QSFP-DD is only Ethernet, not used for InfiniBand

**NEW!**

**Twin-NDR 2x400G**  
2x400GbE  
8x100G-PAM4  
8 channels

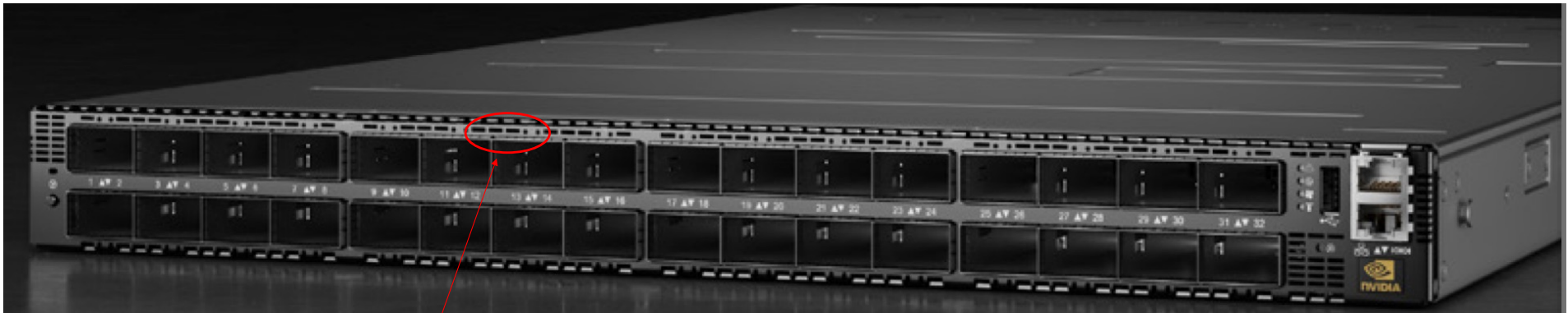


**OSFP**

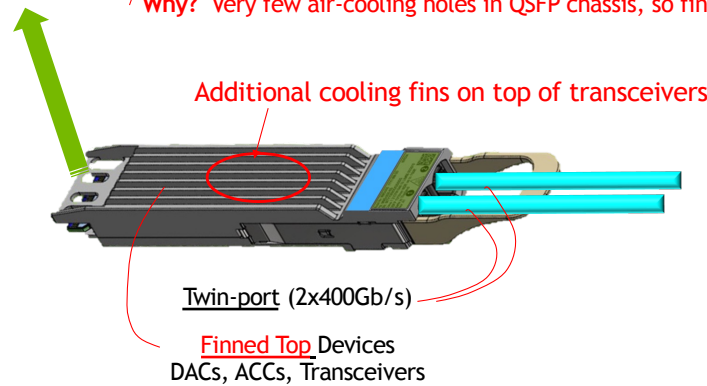


OSFP for both NDR and 2x400GbE Ethernet

# QUANTUM-2 & SN5600 ONLY ACCEPTS TWIN-PORT, FINNED-TOP DEVICES



Why? Very few air-cooling holes in QSFP chassis, so fins are added on transceivers



Finned-top devices are only on twin-port 2x400G devices (Tcvrs, DACs, ACCs) used in switches

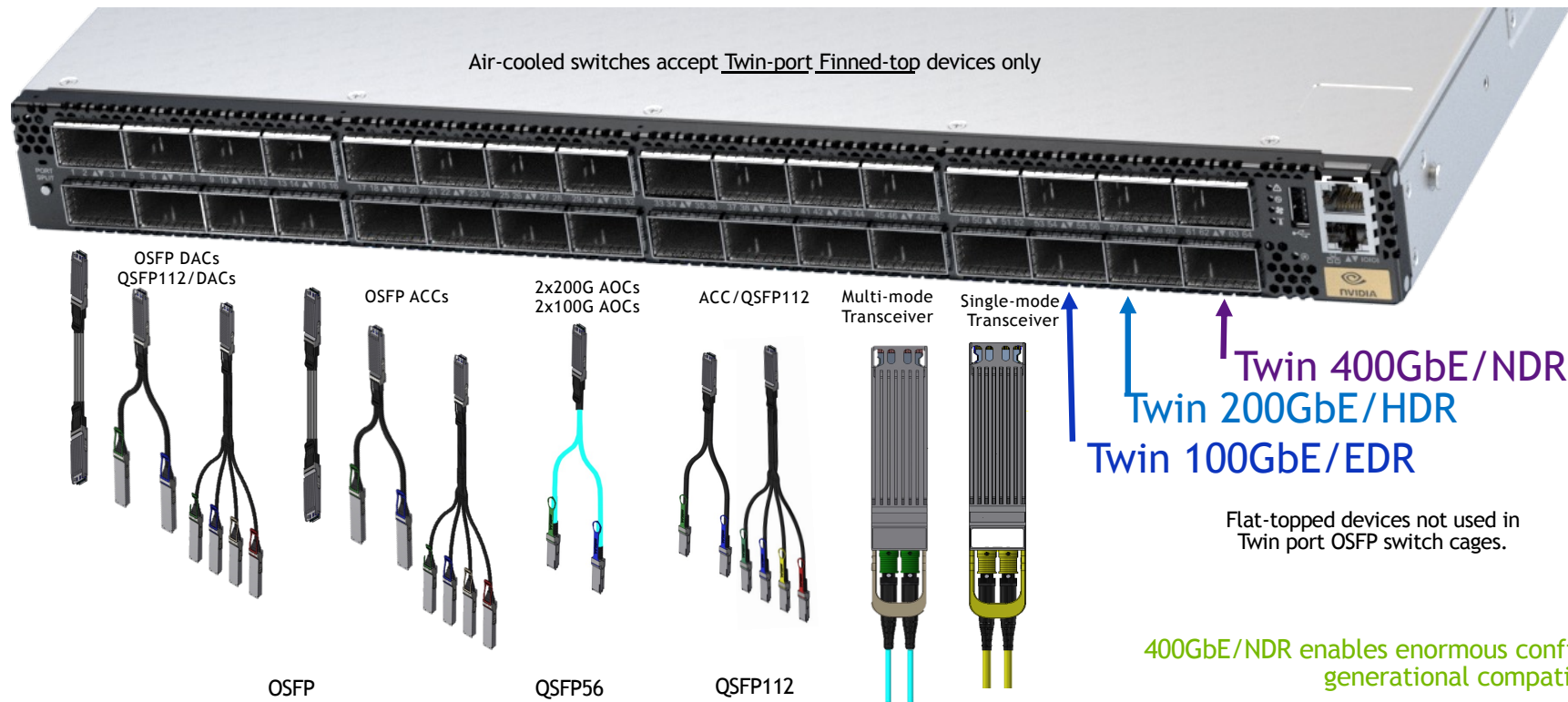
Everything else uses a flat-top devices

All Twin-port devices for air-cooled switches are **Finned-Top**

DGX H100s InfiniBand Cedarr7 cages only accepts Twin-port devices --- *with flat tops*

# 400GBE/NDR; EACH SWITCH CAGE CAN OPERATE AT DIFFERENT SPEEDS

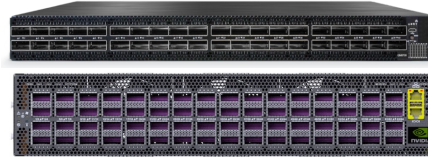
Each Twin-port can be configured individually  
DAC or ACC Cables, Multi-mode or Single-mode Transceivers  
At 400GbE/NDR, 200GbE/HDR and 100GbE/EDR speeds



# SINGLE MODE TRANSCEIVERS

50-meters to 2km

400Gb/s Quantum-2 InfiniBand  
or Spectrum-4 Ethernet  
Twin-port-OSFP Switches



InfiniBand NDR QM9700  
32-cage Twin-port-OSFP

Ethernet 400GbE SN5600  
64-cage Twin-port-OSFP



**Twin port 800G 2xDR4 Single mode Transceiver**  
MMS4X00-NS (100m)  
OSFP Finned-top  
Dual MPO-12/APC  
17 Watts

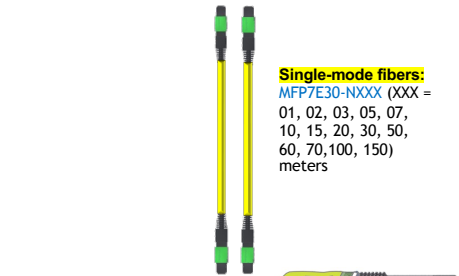
200G up to 50 meters

**Single mode Fiber Splitters**  
MFP7E40-N0XX (XX = 03, 05,  
07, 10, 15, 20, 30, 40, 50)  
meters



400G up to 100 meters

**Single-mode fibers:**  
MFP7E30-NXXX (XXX =  
01, 02, 03, 05, 07,  
10, 15, 20, 30, 50,  
60, 70, 100, 150)  
meters



**Single Port 400G DR4  
Single mode Transceiver**  
MMS4X00-NS400 (100m)  
OSFP Flat-top  
Single MPO-12/APC 8Watts

**Single Port 400G DR4  
Single mode Transceiver**  
MMS1X00-NS400 (100m)  
QSFP112 Flat-top  
Single MPO-12/APC 8 Watts

Up to 500 meters



**Twin-Port 800G 2xDR4  
Single mode Transceiver**  
MMS4X00-NM (500m)  
OSFP Finned-top  
Dual MPO/APC 17 Watts



MPO-12/APC fibers >100m  
not supplied by NVIDIA



Up to 2,000 meters



**Twin-Port 800G 2xFR4  
Single mode Transceiver**  
MMS4X50-NM (2,000m)  
OSFP Finned-top  
Dual LC Duplex 17 Watts



2-fiber LC duplex fibers  
not supplied by NVIDIA



- 100G-PAM4 based single mode and multimode transceivers can not be downshifted to 50G-PAM4.
- Use 400G OSFP & QSFP112 transceivers on 2-fiber split cables for 200G rate - automatically reduces power and activates only 2 lanes.
- 100m transceivers can be used with 500m transceivers, but only up to 100m

Mix in any combination of 400G OSFP and QSFP112 with 800G  
MMS400-NS.  
Transceiver internals are the same for both.

# 800G-TO-800G SWITCH-TO-SWITCH TWIN-PORT OSFP

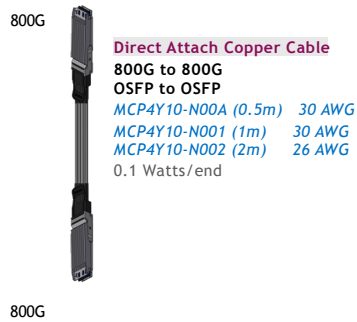
LinkX cables, transceivers, ConnectX-7 and BlueField-3 DPUs contain **both** InfiniBand and Ethernet protocols. Specific protocol is activated when inserted into the switch.

400Gb/s **Quantum-2 InfiniBand** or **Spectrum-4 Ethernet** Twin-port-OSFP Switches

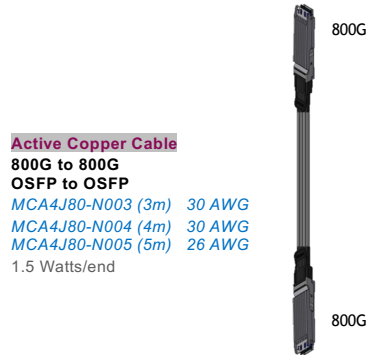


The 50-meter multimode, 100-meter, 500-meter single mode lengths are tested WITH 4 optical connectors in the link simulating using 2 optical path panels.

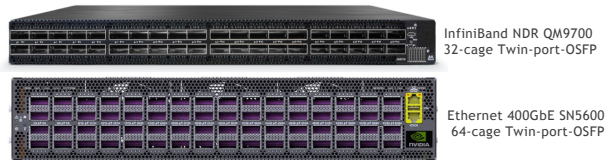
## Passive Copper 2 meters



## Active Copper (ACC) 3,4,5 meters



400Gb/s **Quantum-2 InfiniBand** or **Spectrum-4 Ethernet** Twin-port-OSFP Switches



## Up to 50 meters

**Twin port 2x400G SR8 Multimode Transceiver**  
MMA4Z00-NS (50m)  
OSFP Finned-top  
Dual MPO-12/APC  
15 Watts

**Multi-mode fibers:**  
MFP7E10-N0XX (XX = 03, 05, 07, 10, 15, 20, 25, 30, 35, 40, 50) meters

## Up to 100 & 500 meters

**Twin port 2x400G DR8 Single mode Transceiver**  
MMS4X00-NS (100m)  
MMS4X00-NM (500m)  
OSFP Finned-top  
Dual MPO-12/APC  
17 Watts

**Single-mode fibers:**  
MFP7E30-NXXX (XXX = 01, 02, 03, 05, 07, 10, 15, 20, 30, 50, 60, 70, 100, 150) meters

Also, a 500-meter version  
MMS4X00-NM (500m)

# 800G OSFP SWITCH-TO-2X 400G CONNECTX-7/OSFP

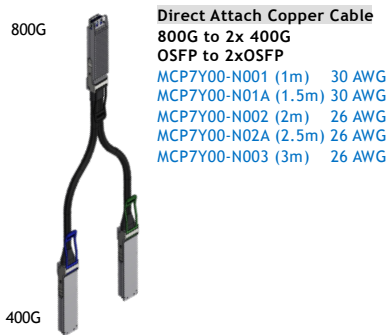
LinkX cables, transceivers, ConnectX-7 and BlueField-3 DPUs contain both InfiniBand and Ethernet protocols. Specific protocol is activated when inserted into the switch.

400Gb/s **Quantum-2 InfiniBand** or **Spectrum-4 Ethernet** Twin-port-OSFP Switches



The 50-meter multimode, 100-meter, 500-meter single mode lengths are tested WITH 4 optical connectors in the link simulating using 2 optical path panels.

## Passive Copper Up to 3 meters



**Direct Attach Copper Cable**  
800G to 2x 400G  
OSFP to 2xOSFP

- MCP7Y00-N001 (1m) 30 AWG
- MCP7Y00-N01A (1.5m) 30 AWG
- MCP7Y00-N002 (2m) 26 AWG
- MCP7Y00-N02A (2.5m) 26 AWG
- MCP7Y00-N003 (3m) 26 AWG

## Active Copper Up to 5 meters



**Active Copper Cable**  
800G to 2x 400G  
OSFP to 2xOSFP

- MCA7J60-N004 (4m) 30 AWG
- MCA7J60-N005 (5m) 26 AWG

1.5 Watts and 0.8Watts

## OPTICS

### Up to 50 meters



**Twin port 2x400G SR8 Multimode Transceiver**  
MMA4Z00-NS (50m)  
OSFP Finned-top  
Dual MPO-12/APC  
15 Watts

### Up to 100 meters

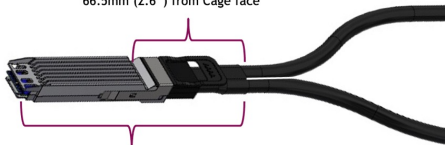


**Twin port 2x400G DR8 Single mode Transceiver**  
MMS4X00-NS (100m)  
OSFP Finned-top  
Dual MPO-12/APC  
17 Watts

**Multi-mode fibers:**  
MFP7E10-N0XX (XX = 03, 05, 07, 10, 15, 20, 25, 30, 35, 40, 50) meters

**Single-mode fibers:**  
MFP7E30-N0XX (XXX = 01, 02, 03, 05, 07, 10, 15, 20, 30, 50, 60, 70, 100, 150) meters

Cable split point  
66.5mm (2.6") from Cage face



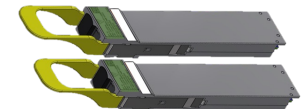
Cable split point  
155mm (6.1") from electrical end

400G NICs/HCA OSFP



ConnectX-7/OSFP  
400G

**Single port 400G Transceiver - Multimode**  
MMA4Z00-NS400 (50m)  
OSFP  
Single MPO-12/APC  
8 Watts



**Single Port 400G Transceiver**  
MMS4X00-NS400 (100m)  
OSFP  
Single MPO-12/APC  
8Watts

Rev: Aug 22, 2023

User Guides, Parts Lists, Datasheets, Product Specifications located under "Interconnects" at <https://docs.nvidia.com/networking> >> Guides

# 800G OSFP SWITCH-TO-4X 200G CONNECTX-7/OSFP

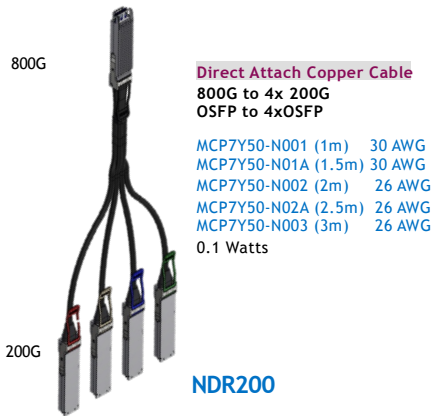
LinkX cables, transceivers, ConnectX-7 and BlueField-3 DPUs contain both InfiniBand and Ethernet protocols. Specific protocol is activated when inserted into the switch.

400Gb/s **Quantum-2 InfiniBand** or **Spectrum-4 Ethernet** Twin-port-OSFP Switches



The 50-meter multimode and single mode lengths are tested WITH 4 optical connectors in the link simulating using 2 optical path panels.

## Passive Copper Up to 3 meters



## Active Copper Up to 5 meters

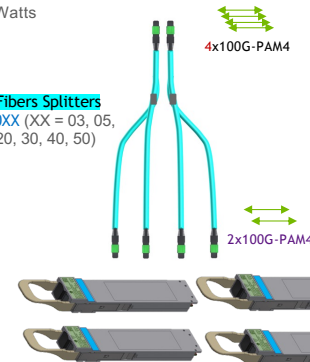


## OPTICS

### Up to 50 meters



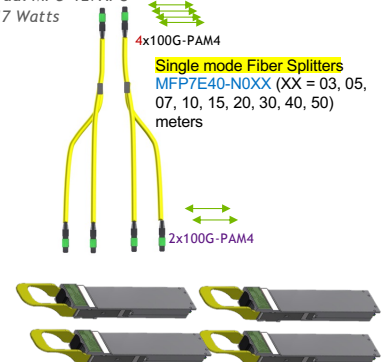
**Multimode Fibers Splitters**  
*MFP7E20-N0XX (XX = 03, 05, 07, 10, 15, 20, 30, 40, 50) meters*



### Up to 100 meters



**Single mode Fiber Splitters**  
*MFP7E40-N0XX (XX = 03, 05, 07, 10, 15, 20, 30, 40, 50) meters*

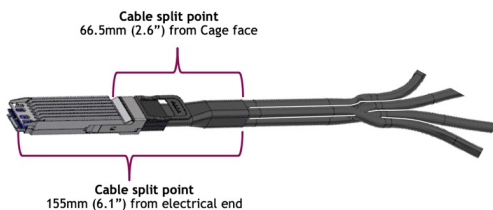


**Single port 400G Multimode Transceiver**  
*MMA4Z00-NS400 (50m)*  
OSFP  
Single MPO-12/APC  
8 Watts reduced to 5 Watts

**Single Port 400G Single mode Transceiver**  
*MMS4X00-NS400 (100m)*  
OSFP  
Single MPO-12/APC  
8 Watts reduced to 5 Watts

### NDR200

Use 400G transceivers for 200G links.  
2 fiber on split ends creates 200G and reduces power



Rev: Aug 22, 2023

User Guides, Parts Lists, Datasheets, Product Specifications located under "Interconnects" at <https://docs.nvidia.com/networking> >> Guides



# 800G OSFP SWITCH-TO-400G BLUEFIELD-3 + CONNECTX-7 WITH QSFP112

LinkX cables, transceivers, ConnectX-7 and BlueField-3 DPUs contain both InfiniBand and Ethernet protocols. Specific protocol is activated when inserted into the switch.

400Gb/s **Quantum-2 InfiniBand** or **Spectrum-4 Ethernet** Twin-port-OSFP Switches



The 50-meter multimode, 100-meter, 500-meter single mode lengths are tested WITH 4 optical connectors in the link simulating using 2 optical path panels.

## Passive Copper Up to 3 meters



**Direct Attach Copper Cable**  
800G to 2x 400G  
OSFP to 2x QSFP112

MCP7Y10-N001 (1m)	30AWG
MCP7Y10-N01A (1.5m)	30AWG
MCP7Y10-N002 (2m)	26 AWG
MCP7Y10-N02A (2.5m)	26 AWG
MCP7Y10-N003 (3m)	26 AWG

-0.1Watts

## Active Copper Up to 5 meters

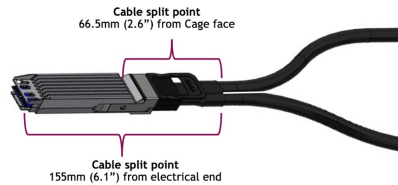


**Active Copper Cable**  
800G to 2x 400G  
OSFP to 2x QSFP112

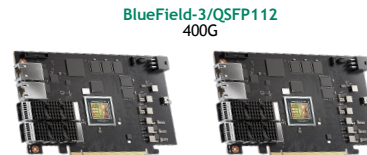
MCA7J65-N004 (4m)	30 AWG
MCA7J65-N005 (5m)	26 AWG

1.5 Watts and 0.8Watts

These cables and transceivers combinations can link to any combination of 2 QSFP112-based ConnectX-7s or BlueField-3s at the same time



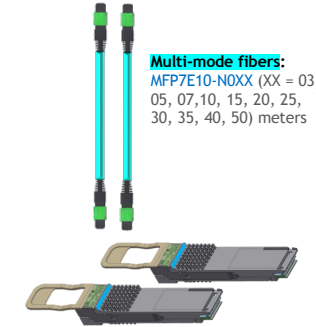
-OR-



## Up to 50 meters



**Twin port 2x400G SR8 Multimode Transceiver**  
MMA4Z00-NS (50m)  
OSFP Finned-top  
Dual MPO-12/APC  
15 Watts

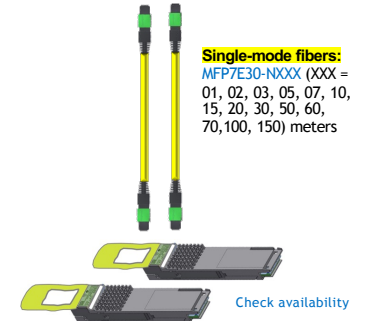


**Multi-mode fibers:**  
MFP7E10-N0XX (XX = 03, 05, 07, 10, 15, 20, 25, 30, 35, 40, 50) meters

## Up to 100 meters



**Twin port 2x400G DR8 Single mode Transceiver**  
MMS4X00-NS (100m)  
OSFP Finned-top  
Dual MPO-12/APC  
17 Watts



**Single-mode fibers:**  
MFP7E30-N0XX (XXX = 01, 02, 03, 05, 07, 10, 15, 20, 30, 50, 60, 70, 100, 150) meters

Check availability

**Single Port 400G SR4 Multimode QSFP112 Transceiver**  
MMA1Z00-NS400 (50m)  
Single MPO-12/APC  
8 Watts

**Single Port 400G DR4 Single mode QSFP112 Transceiver**  
MMS1X00-NS400 (100m)  
Single MPO-12/APC  
8 Watts

• BlueField-3 only accepts QSFP112, QSFP56 and QSFP28 devices, not OSFP

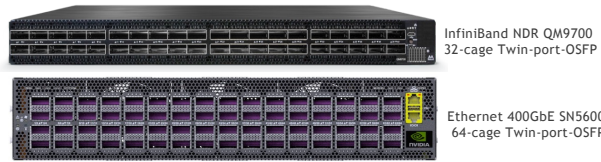
Rev: Aug 22, 2023

User Guides, Parts Lists, Datasheets, Product Specifications located under "Interconnects" at <https://docs.nvidia.com/networking> >> Guides

# 800G OSFP SWITCH-TO- 200G BLUEFIELD-3 + CONNECTX-7 WITH QSFP112

LinkX cables, transceivers, ConnectX-7 and BlueField-3 DPUs contain both InfiniBand and Ethernet protocols. Specific protocol is activated when inserted into the switch.

400Gb/s Quantum-2 InfiniBand or Spectrum-4 Ethernet Twin-port-OSFP Switches



The 50-meter multimode and single mode lengths are tested WITH 4 optical connectors in the link simulating using 2 optical path panels.

## OPTICS

### Passive Copper Up to 3 meters

2x400G  
(8x100G-PAM4)



**Direct Attach Copper Cable**  
800G to 4x 200G OSFP to 4x QSFP112

MCP7Y40-N001 (1m)	30AWG
MCP7Y40-N01A (1.5m)	30AWG
MCP7Y40-N002 (2m)	26 AWG
MCP7Y40-N02A (2.5m)	26 AWG
MCP7Y40-N003 (3m)	26 AWG

-0.1Watts

NDR200

### Active Copper Up to 5 meters

2x400G  
(8x100G-PAM4)



NDR200

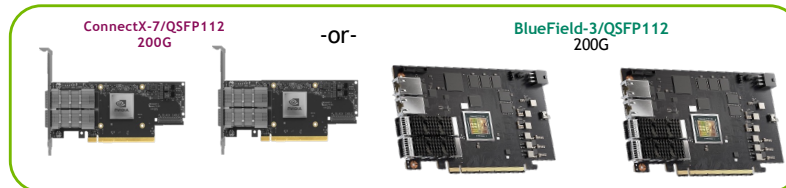
**Active Copper Cable**  
800G to 4x 200G OSFP to 4x QSFP112

MCA7J75-N004 (4m)	30 AWG
MCA7J75-N005 (5m)	26 AWG

1.5 Watts and 0.4Watts

These cables and transceivers combinations can link to any combination of 2 QSFP112-based ConnectX-7s or BlueField-3s at the same time

200G  
(2x100G-PAM4)



### Up to 50 meters

**Twin port 2x400G SR8 Multimode Transceiver**

MMA4Z00-NS (50m)  
OSFP Finned-top  
Dual MPO-12/APC  
15 Watts



4x100G-PAM4



**Multimode Fibers Splitters**  
MFP7E20-NOXX (XX = 03, 05, 07, 10, 15, 20, 30, 40, 50) meters

2x100G-PAM4



**400G SR4 Multimode QSFP112 Transceiver**  
QSFP112/Flat top  
MMA1Z00-NS400 (50m)  
Single MPO-12/APC  
8 Watts reduced to 5 Watts

### Up to 100 meters

**Twin port 2x400G DR8 Single mode Transceiver**

MMS4X00-NS (100m)  
OSFP Finned-top  
Dual MPO-12/APC  
17 Watts



**Single mode Fiber Splitters**  
MFP7E40-NOXX (XX = 03, 05, 07, 10, 15, 20, 30, 50) meters

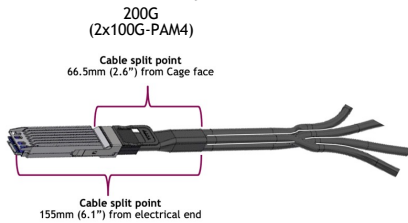


**400G DR4 Single mode Transceiver**  
MMS1X00-NS400 (100m)  
QSFP112 Flat-top  
Single MPO-12/APC  
8 Watts reduced to 5 Watts

Check availability

NDR200

Use 400G transceivers for 200G links.  
2 fiber on split ends creates 200G and reduces power



• BlueField-3 only accepts QSFP112, QSFP56 and QSFP28 devices, not OSFP

Rev: Aug 22, 2023

User Guides, Parts Lists, Datasheets, Product Specifications located under "Interconnects" at <https://docs.nvidia.com/networking> >> Guides

# TWIN PORT OSFP -TO- 200G/100G CONNECTIVITY

## Switch-to-Switch + Switch-to-ConnectX 5,6,7 & BlueField-2,3 (Backward Compatibility to 2x50G-PAM4 & 4x25G-NRZ)

400Gb/s Quantum-2 InfiniBand  
or Spectrum-4 Ethernet  
Twin-port 2x400G OSFP Switches



2x 200Gb/s  
2x 4x50G-PAM4

1, 1.5, 2-meters



### Direct Attach Cable

2x200G to 2x 200G  
OSFP to 2x QSFP56

MCP7Y60-H001	1m	980-9146K-00H001
MCP7Y60-H01A	1.5m	980-9193M-00H01A
MCP7Y60-H002	2m	980-9146L-00H002
MCP7Y60-H02A	2.5m EOL	

Thanos BC

OSFP  
Finned Top

QSFP56

OSFP  
Finned Top

QSFP56

1, 1.5, 2-meters

2x 200Gb/s  
2x 4x50G-PAM4



100GbE + HDR100  
QSFP56  
100Gb/s  
2x50G-PAM4

### Direct Attach Cable

2x 200G to 4x 100G  
OSFP to 4x QSFP56

MCP7Y70-H001	1m	
MCP7Y70-H01A	1.5m	
MCP7Y70-H002	2m	

Note: 100G is 2x50G-PAM4

This is the same part.  
Switch can downshift rate

These are the only  
AOCs in the 100G-PAM4  
line

3 to 30-meters



Multi-mode fiber

### Active Optical Cable

2x200G to 2x 200G (4x50G-PAM4)  
OSFP to 2xQSFP56 AOC

MFA7U10-H003	(3m)
MFA7U10-H005	(5m)
MFA7U10-H010	(10m)
MFA7U10-H015	(15m)
MFA7U10-H020	(20m)
MFA7U10-H030	(30m)

### Active Optical Cable

2x100G to 2x 100G (2x50G-PAM4)  
OSFP to 2xQSFP56 AOC

MFA7U40-H003	(3m)
MFA7U40-H005	(5m)
MFA7U40-H010	(10m)
MFA7U40-H015	(15m)
MFA7U40-H020	(20m)
MFA7U40-H030	(30m)

HDR100 + 100GbE end points (2x50G-PAM4)

Can not down shift to 2x100G +  
will not work at EDR 4x25G-NRZ rates  
Use MCP7Y60 DAC

Rev: Aug 22, 2023

Can not down shift to 100GbE/EDR at 4x25G-NRZ  
Use MCP7Y60 DAC

User Guides, Parts Lists, Datasheets, Product Specifications located under "Interconnects" at <https://docs.nvidia.com/networking> >> Guides

100G

OSFP  
Finned Top

1, 1.5, 2-meters

2x 100Gb/s

Direct Attach Cable  
2x100G to 2x 100G  
OSFP to 2x QSFP28

MCP7Y60-H001	1m	980-9146K-00H001
MCP7Y60-H01A	1.5m	980-9193M-00H01A
MCP7Y60-H002	2m	980-9146L-00H002
MCP7Y60-H02A	2.5m EOL	

Note: 100GbE & EDR is 4x25G-NRZ = 100G

BlueField-3/QSFP112  
200G



ConnectX-7/QSFP112  
200G



ConnectX-6  
QSFP56



SN3000 Series  
QSFP56  
4x50G-PAM4



QM87xx Series  
200G HDR QSFP56  
4x50G-PAM4



ConnectX-6  
QSFP56



Switch-IB 2 SB7800

36-port EDR QSFP28

4x25G-NRZ



SN2000 Series  
QSFP28  
4x25G-NRZ



SN2000 series switches and CX5 NICs  
do not support 50G-PAM4, only 4x25G-NRZ

- 4xHDR100 splitter AOC = EOL
- QSFP112 cages accept QSFP56 and QSFP28 devices

# DGX H100 CEDAR CX7-TO- HDR SWITCH

The 800G Twin port OSFP multimode transceiver (8x100G-PAM4) cannot down shift to 4x50G-PAM4.

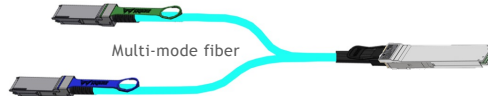
The only solution is using AOCs with Flat Top, Twin port OSFPs into the H100 + QSFP56 into HDR Switch.

Using transceivers: 800G Multimode MMA4Z00-NS-FLT -to- 200G HDR MMA1T00-HS will not work.



3 to 30-meters

HDR QSFP56  
200Gb/s  
4x50G-PAM4

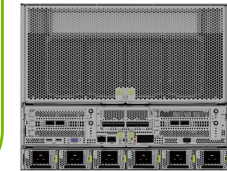


Active Optical Cable (Flat Top)  
2x200G to 2x 200G (4x50G-PAM4)  
OSFP to 2xQSFP56 AOC  
MFA7U10-H003-FLT (3m) 980-9141Y-00H003  
MFA7U10-H005-FLT (5m) 980-9110-00H005  
MFA7U10-H010-FLT (10m) 980-9112-00H010  
MFA7U10-H015-FLT (15m) 980-9114-00H015  
MFA7U10-H020-FLT (20m) 980-9116-00H020  
MFA7U10-H030-FLT (30m) 980-9118-00H030  
Akela BCH

DGX H100 Cedar7 GPU-to-switch links

4 Twin-port OSFP 800G cages

Only Flat-top 800G devices for GPU links



100GbE SR4 MPO-12/UPC	MMA1B00-C100D	980-91149-00CS00
100G EDR SR4 MPO-12/UPC	MMA1B00-E100	980-9117L-00E000
100GbE AOC	MFA1A00-C050	
100G EDR AOC	MFA1A00-Exxx	
200GbE SR4 MPO-12/UPC	MMA1T00-HS	980-9117S-00HS00
200G HDR SR4 MPO-12/UPC	MMA1T00-VS	980-9120T-00V000
200G HDR AOC	MFS1S00-VxxxE	

MPO-12/UPC

MPO-12/UPC

Use standard 100G QSFP28 200G QSFP56 DACs, AOCs, Tcvrs To link ConnectX-7/6 to Switches

Emerald CX7 card supports 1 port 400G NDR InfiniBand and 1 port 200GbE Ethernet



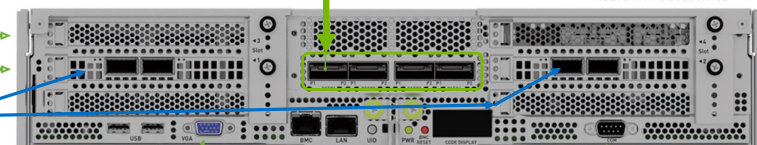
Slot 1: Dual port ConnectX-7 card Dual QSFP ports

Slot 3: Optional 50 Gb/s NIC

4 x OSFP ports, each provides connectivity to two ConnectX-7 cards for a total of 8 x 400Gb/s ports

Slot 2: Dual port ConnectX-7 card Dual QSFP ports

Slot 4: M.2 PCIe carrier for Dual 1.92TB NVMe boot drives



# 800G-TO-800G SWITCH-TO-DGX H100 TWIN-PORT OSFP GPU NETWORKING

LinkX cables, transceivers, ConnectX-7 and BlueField-3 DPUs contain **both** InfiniBand and Ethernet protocols. Specific protocol is activated when inserted into the switch.

400Gb/s **Quantum-2 InfiniBand** or **Spectrum-4 Ethernet** Twin-port-OSFP Switches



The 50-meter multimode, 100-meter, 500-meter single mode lengths are tested WITH 4 optical connectors in the link simulating using 2 optical path panels.

## OPTICS

### Active Copper (ACC)

DACs not offered

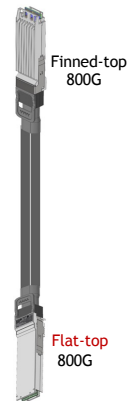
**Active Copper Cable**  
**800G to Twin 400G**  
**MCA4J80-N003-F** (3m) 30AWG  
**980-9I601-00N003**  
**OSFP/Finned -To- OSFP/FLAT**  
 1.5 Watts

*Odin*  
 Only 3m ACC cable offered

DGX H100 has additional PCIe Gen5 slots for BlueField-3 storage and ConnectX-7 adapters in both InfiniBand and Ethernet and linked with standard parts to Quantum-2 and/or Spectrum-4 switches

**DGX H100 Cedar7 GPU-to-switch links**  
 4 Twin-port OSFP 800G cages

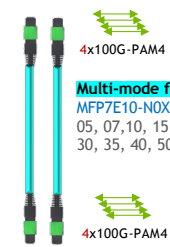
Only Flat-top 800G devices for GPU links



### Up to 50 meters



**Twin port 2x400G SR8 Multimode Transceiver**  
**MMA4Z00-NS (50m)**  
 OSFP **Finned-top**  
 Dual MPO-/APC  
 15 Watts



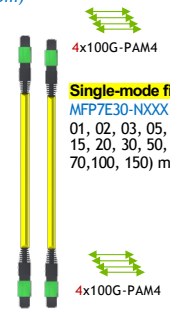
**Twin port 2x400G SR8 Multimode Transceiver**  
**MMA4Z00-NS-FLT (50m)**  
 OSFP **Flat-top**  
 Dual MPO-12/APC  
 15 Watts



### Up to 100 meters



**Twin port 2x400G DR8 Single mode Transceiver**  
**MMS4X00-NS (100m)**  
**MMS4X00-NM (500m)**  
 OSFP **Finned-top**  
 Dual MPO/APC  
 17 Watts



**Twin port 2x400G Single mode DR8 Transceiver**  
**MMS4X00-NS-FLT (100m)**  
 OSFP **Flat-top**  
 Dual MPO-12/APC  
 17 Watts



# 400G IB/EN SWITCH-TO-DGX H100/CEDAR-7 LINKS

Using Four Twin-port 800G Transceivers (Multimode) linking Eight ConnectX-7 ICs@ 400G



DGX H100

400Gb/s **Quantum-2 InfiniBand**  
or **Spectrum-4 Ethernet**  
Twin-port 2x400G OSFP Switches



800G Twin-port transceiver Flat-top  
**MMA4Z00-NS-FLT**

800G Twin-port transceiver Finned-top  
**MMA4Z00-NS**

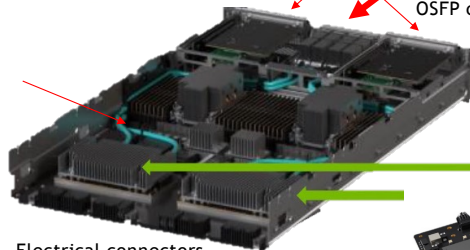
8 Hopper GPUs



Four BF3 & CX7  
PCIe cards

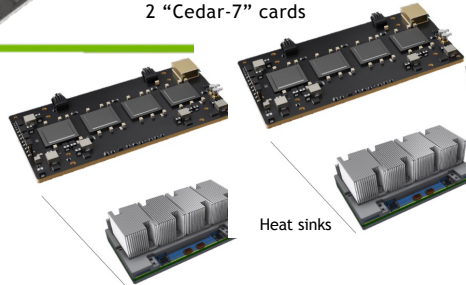
4 Twin-port  
OSFP cages

Internal DAC cabling  
Cedar-7-to-OSFP cages

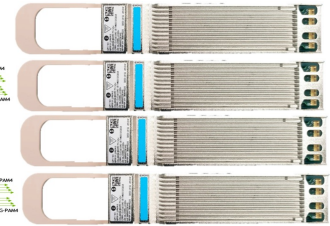
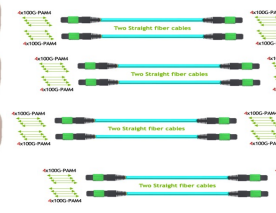
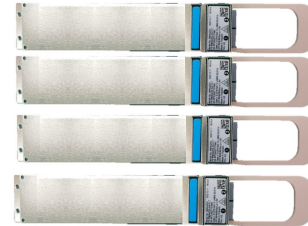


Electrical connectors  
up to GPU complex

8 ConnectX-7 ICs on  
2 "Cedar-7" cards



Heat sinks



**Multi-mode fibers:**  
MFP7E10-NOXX (XX = 03,  
05, 07, 10, 15, 20, 25,  
30, 35, 40, 50) meters

# 400G IB/EN SWITCH-TO-DGX H100/CEDAR-7 LINKS

Using Four Twin-port 800G Transceivers (Single mode) linking Eight ConnectX-7 ICs@ 400G

400Gb/s **Quantum-2 InfiniBand**  
or **Spectrum-4 Ethernet**  
Twin-port 2x400G OSFP Switches



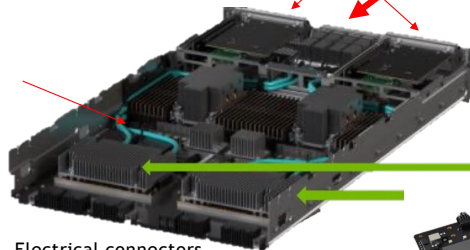
DGX H100

8 Hopper GPUs



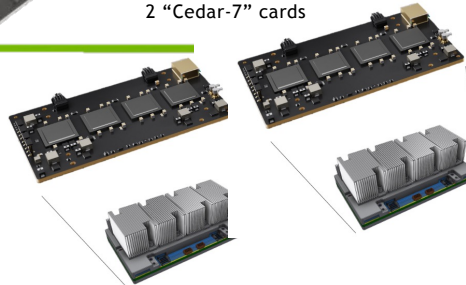
Four BF3 & CX7  
PCIe cards  
4 Twin-port  
OSFP cages

Internal DAC cabling  
Cedar-7-to-OSFP cages

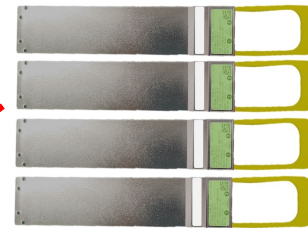


Electrical connectors  
up to GPU complex

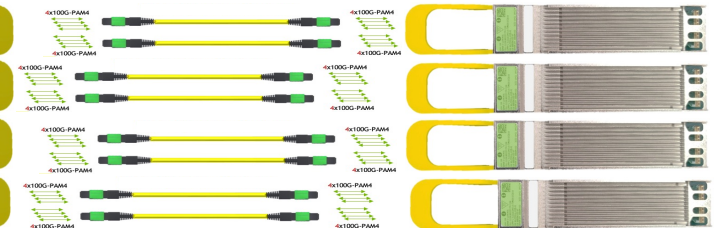
8 ConnectX-7 ICs on  
2 "Cedar-7" cards



2x400G Twin-port transceiver **Flat-top**  
**MMS4X00-NS-FLT**

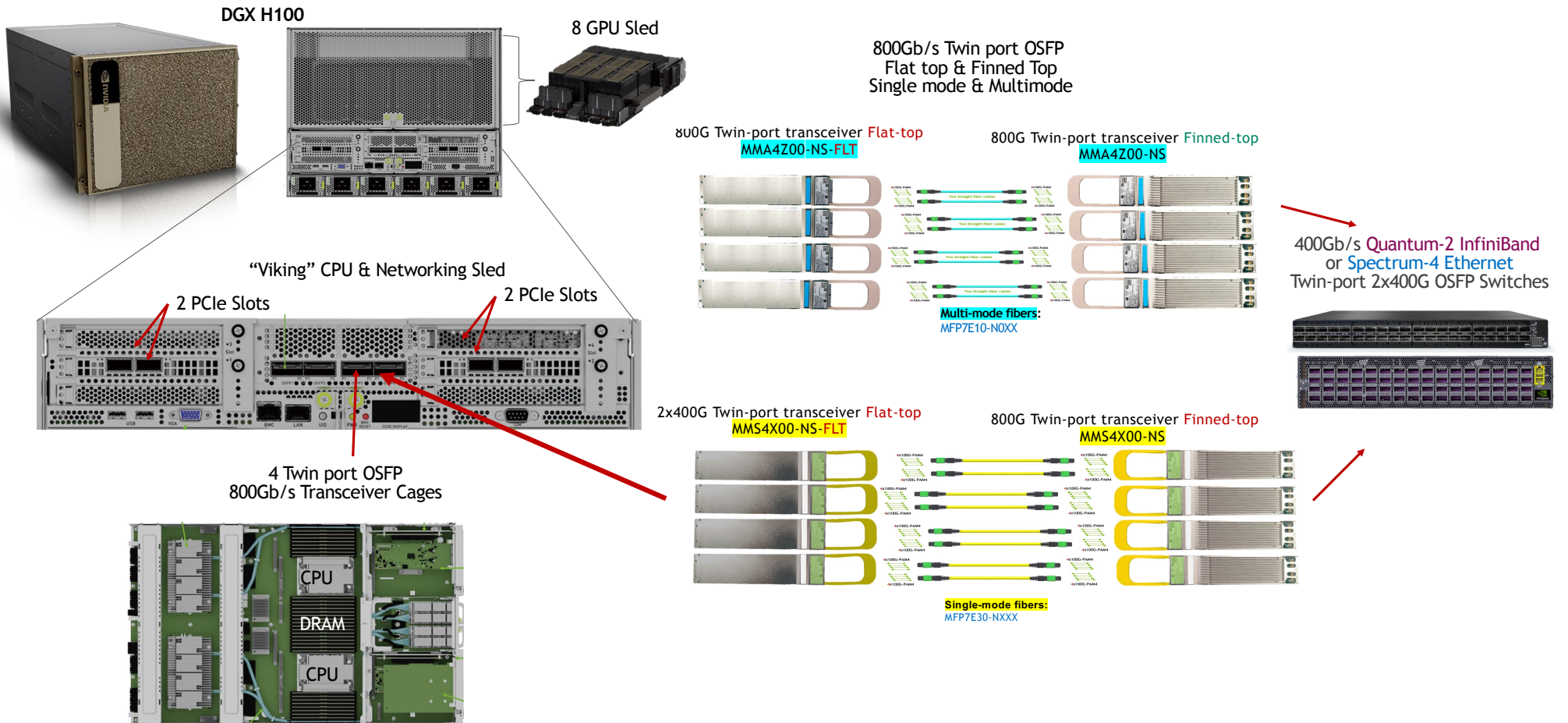


800G Twin-port transceiver **Finned-top**  
**MMS4X00-NS**



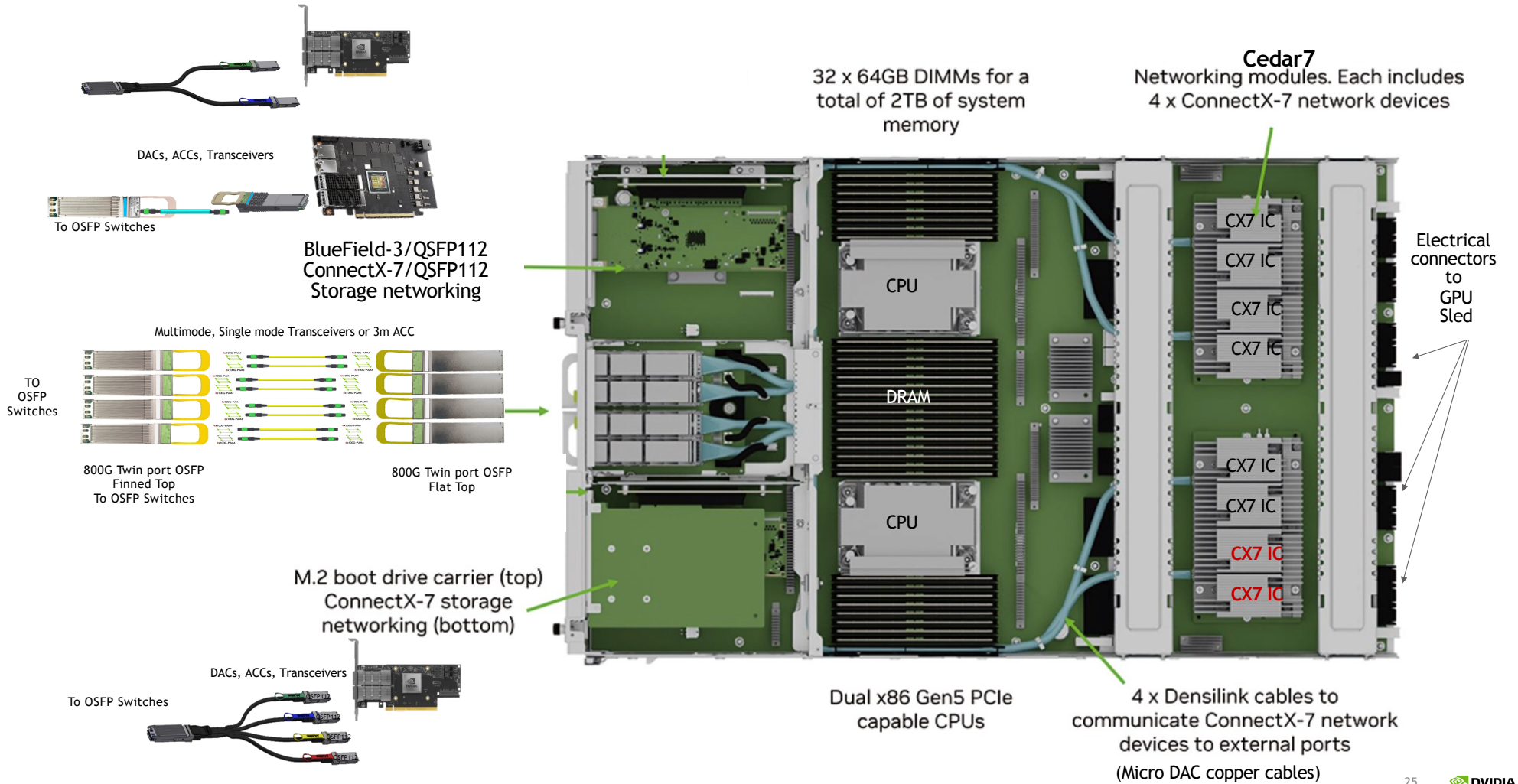
**Single-mode fibers:**  
**MFP7E30-NXXX** (XXX =  
01, 02, 03, 05, 07, 10,  
15, 20, 30, 50, 60,  
70, 100, 150) meters

# 400G IB/EN SWITCH-TO-DGX H100/CEDAR-7 GPU LINKS





# 400G IB/EN SWITCH-TO-DGX H100/CEDAR-7 GPU LINKS



# MULTIMODE AND SINGLE MODE CROSSOVER FIBER CABLES

## Multimode

## Single mode

## Crossover straight fiber arrangement

### Straight Cable

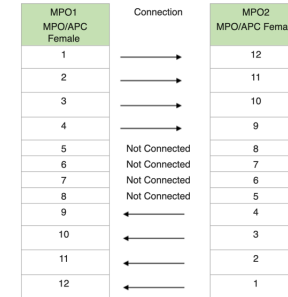
### 1:2 Splitter Cable

Part Number	Length	Part Number	Length
MFP7E10-N003	3m	MFP7E20-N003	3m
MFP7E10-N005	5m	MFP7E20-N005	5m
MFP7E10-N007	7m	MFP7E20-N007	7m
MFP7E10-N010	10m	MFP7E20-N010	10m
MFP7E10-N015	15m	MFP7E20-N015	15m
MFP7E10-N020	20m	MFP7E20-N020	20m
MFP7E10-N025	25m	MFP7E20-N030	30m
MFP7E10-N030	30m	MFP7E20-N050	50m
MFP7E10-N035	35m		
MFP7E10-N040	40m		
MFP7E10-N050	50m		

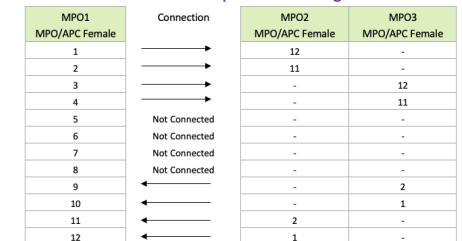
### Straight Cable

### 1:2 Splitter Cable

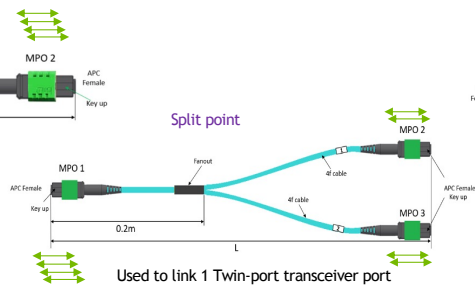
Part Number	Length	Part Number	Length
MFP7E30-N001	1m	MFP7E40-N003	3m
MFP7E30-N002	2m	MFP7E40-N005	5m
MFP7E30-N003	3m	MFP7E40-N007	7m
MFP7E30-N005	5m	MFP7E40-N010	10m
MFP7E30-N007	7m	MFP7E40-N015	15m
MFP7E30-N010	10m	MFP7E40-N020	20m
MFP7E30-N015	15m	MFP7E40-N030	30m
MFP7E30-N020	20m	MFP7E40-N050	50m
MFP7E30-N030	30m		
MFP7E30-N050	50m		
MFP7E30-N060	60m		
MFP7E30-N070	70m		
MFP7E30-N100	100m		
MFP7E30-N150	150m		



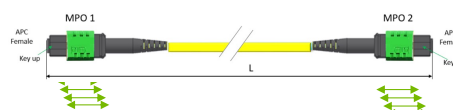
## Crossover fiber splitter arrangement



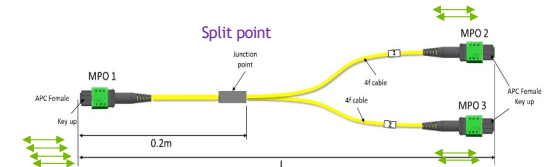
Used to link 1 Twin-port transceiver port to 1 400G transceiver or another Twin port OSFP transceiver



Used to link 1 Twin-port transceiver port to 2 400G transceivers for 200G speed



Used to link 1 Twin-port transceiver port to 1 400G transceiver or another Twin port OSFP transceiver



Used to link 1 Twin-port transceiver port to 2 400G transceivers for 200G speed

- Use 2 cables per Twin port 2x400G OSFP Transceiver
- Both fiber types must be the same kind and not mixed (both straight or both split)
- Fibers beyond listed reaches are not offered
- LC duplex fiber cables not offered



**400GBE SPECTRUM-3 & SPECTRUM-4 ETHERNET  
50G-PAM4, QSFP-DD  
CABLES AND TRANSCEIVERS**

# 400GBE LINKX CABLES AND TRANSCEIVER PRODUCTS

Based on 50G-PAM4 in QSFP56 + QSFP-DD

## Direct Attach Copper (DAC)



400GbE



400GbE-to-2x200GbE



400GbE-to-4x100GbE

QSFP28 and QSFP56 use 4-channels  
 QSFP-DD has "2 rows" of 4-channels = "double density"  
 8-channels x 50G-PAM4 = 400Gb/s

BlueField-3 & ConnectX-7/QSFP-DD version are not offered - BF3+CX7 only have 4-pins  
 To link a QSFP-DD switch -to- ConnectX-7/200G: Only DAC cables + Multimode transceiver/splitter are available.

Single mode transceivers are offered to link a QSFP-DD switch -to- ConnectX-7/400G in OSFP and QSFP112 slide 43  
 There is no other solution for a 400G-to-400G link; No DACs, ACCs, AOCs, or multimode transceivers

## Active Optical Cables (AOC)



## Optical Transceiver - Multi-mode



400GbE **SR8** QSFP-DD **100m**  
 Optical: 8 x 50G-PAM4 Parallel

## Optical Transceivers - Single-mode



Electrical: 4x25G NRZ  
**100GbE DR1** QSFP28 **500m**  
 Optical: 1 x 100G-PAM4



**MMS1V00-WM**  
 Electrical: 8x50G PAM4  
**400GbE DR4** QSFP-DD **500m**  
 Optical: 4 x 100G-PAM4 Parallel

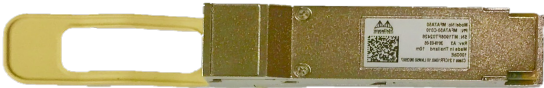
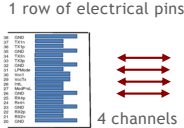

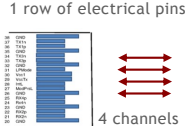

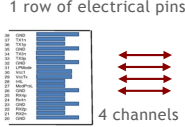

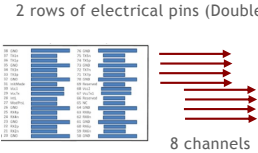


**MMS1V50-WM**  
 Electrical: 8x50G PAM4  
**400GbE FR4** QSFP-DD **2km**  
 Optical: 4 x 100G-PAM4 Multiplexed



Electrical: 8x50G PAM4  
**400GbE LR4** QSFP-DD **10km**  
 Optical: 4 x 100G-PAM4 Multiplexed


# QSFP-DD EXTENDS QSFP BACKWARDS COMPATIBILITY

		<p>QSFP28</p>  <p>1 row of electrical pins 4 channels</p>	<p>EDR / 100GbE 4x25G NRZ</p>	<p>Used in: ConnectX-6/QSFP28 BlueField-2/QSFP28</p>
4-channels 50G-PAM4 Optical		<p>QSFP56</p>  <p>1 row of electrical pins 4 channels</p>	<p>HDR + 200GbE 4x50G-PAM4</p>	<p>Used in: ConnectX-6/QSFP56 BlueField-2/QSFP56</p>
4-channels 100G-PAM4 Optical		<p>QSFP112</p>  <p>1 row of electrical pins 4 channels</p>	<p>NDR + 400GbE 4x100G PAM4</p>	<p>Used in: ConnectX-7/QSFP112 BlueField-3/QSFP112</p>
4-channels 100G-PAM4 Optical		<p>QSFP-DD</p>  <p>2 rows of electrical pins (Double Density) 8 channels</p>	<p>400GbE 8x50G-PAM4</p>	<p>Used in: SN4700 switches 32-cage QSFP-DD Spectrum-3 SN5400 switches 64-cage QSFP-DD Spectrum-4</p> <p>Ethernet ONLY</p>


# SWITCH-TO-SWITCH: 400G -TO- 400G

Spectrum-3 +4 QSFP-DD Switch -to- Spectrum-4/OSFP Switches  
 DAC Copper Cables  
 50G-PAM4 modulation

**SN5400**  
 400GbE Spine/Super Spine Ethernet Switch  
 64 400GbE QSFP-DD cages  
 Spectrum-4




**SN4700**  
 400GbE Spine/ToR Ethernet Switch  
 32 QSFP-DD cages  
 Spectrum-3



8x50G-PAM4

Also supports QSFP56 & QSFP28 devices and QSFP112 @50G-PAM4

QSFP-DD                      400G-to-400G                      Twin-port OSFP



8x50G-PAM4                      8x50G-PAM4

**Direct Attach Copper Cable**  
 400G (8x50G) to 400G (8x50G)  
 QSFP-DD to OSFP

MCP7670-W001 (1m)	30 AWG
MCP7670-W002 (2m)	26 AWG
MCP7670-W02A (2.5m)	26 AWG

0.1 Watts/end

In development.  
 Check availability dates

Note: in this cable the part number ending -FLT is not used here.

No Flat top OSFP available to CX7

**SN5600**  
 2x400GbE Spine/Super Spine Ethernet Switch  
 64 OSFP cages  
 Two 400GbE ports per cage  
 Total of 128 400GbE ports  
 Spectrum-4



Twin-port 800G switch cages  
 down shifted to 400G (8x50G-PAM4)

ACCs, and Multimode optics are not offered as they do not have an internal gearbox to convert 8x50G-to-4x100G

# 400GBE ETHERNET QSFP-DD (50G-PAM4)



## Direct Attach Copper (DAC)



## Active Optical Cables (AOCs)



Switch-to-Switch or  
ConnectX-6 and/or  
BlueField-2 DPUs

## 400GbE SR8 QSFP-DD 100m

T-DQ8FNS-N00-M



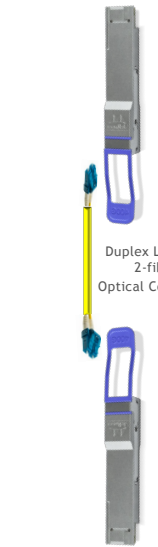
## 400GbE DR4 QSFP-DD 500m

MMS1V00-WM



## 400GbE ER4 QSFP-DD 2km

MMS1V50-WM



## 400GbE LR4 QSFP-DD 10km

MMS1V90-WR

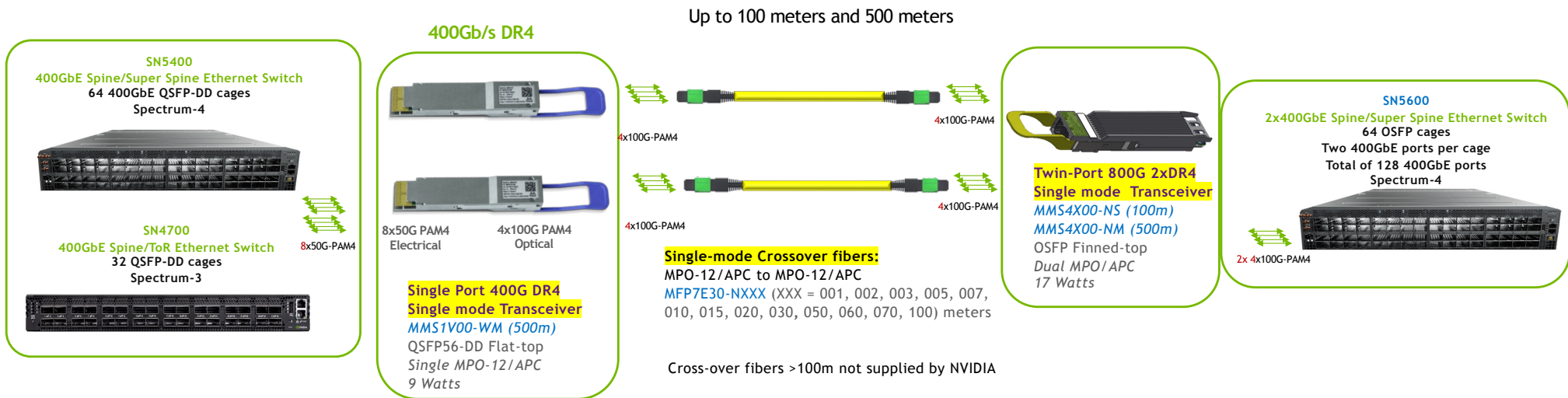


# SWITCH-TO-SWITCH: 400G QSFP-DD -TO- 2X 400G OSFP

Spectrum-3 + 4 QSFP-DD -to- Spectrum-4 OSFP

DR4 to -2xDR4 Single mode Transceivers

50G-PAM4 & 100G-PAM4 modulation



Also supports QSFP56 & QSFP28 devices and QSFP112 @50G-PAM4




No multimode transceiver, DAC or ACC equivalent




# 400G SWITCH-TO-SWITCH

400GbE QSFP-DD -to- 400GbE QSFP-DD

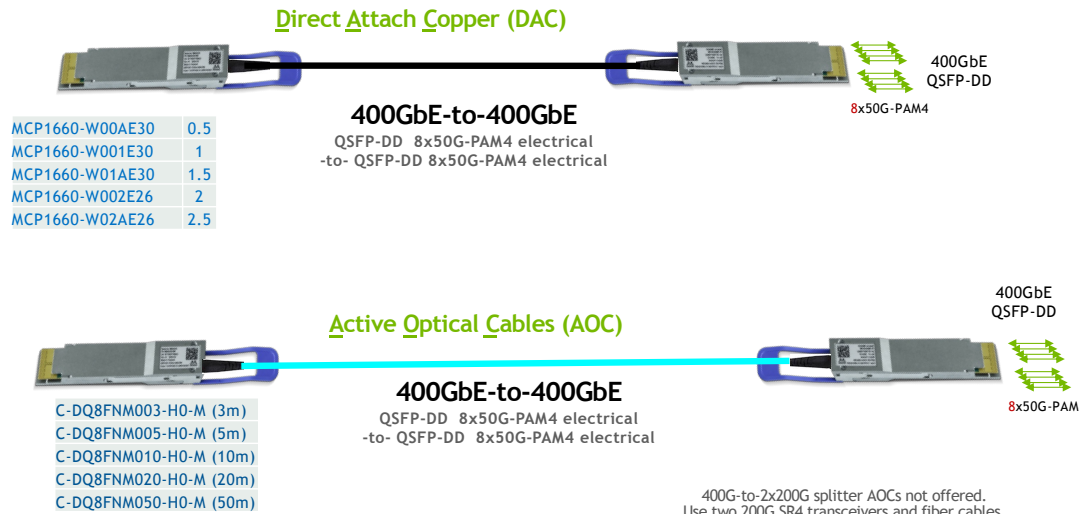
**SN5400**  
400GbE Spine/Super Spine Ethernet Switch  
64 400GbE QSFP-DD cages  
Spectrum-4



**SN4700**  
400GbE Spine/ToR Ethernet Switch  
32 QSFP-DD cages  
Spectrum-3



8x50G-PAM4



**SN5400**  
400GbE Spine/Super Spine Ethernet Switch  
64 400GbE QSFP-DD cages  
Spectrum-4



**SN4700**  
400GbE Spine/ToR Ethernet Switch  
32 QSFP-DD cages  
Spectrum-3



8x50G-PAM4

Also supports QSFP56 & QSFP28 devices and QSFP112 @50G-PAM4

400G-to-2x200G splitter AOCs not offered.  
Use two 200G SR4 transceivers and fiber cables.  
4x100G split configurations not supported by SN4000 firmware

# 400G SWITCH-TO-SWITCH

Spectrum-3 + 4 QSFP-DD

Multimode & Single mode Transceivers

50G-PAM4 & 100G-PAM4 modulation

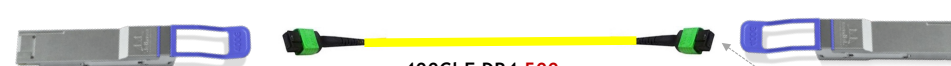
Check FW status for use in CX7, BF3



**100GbE DR1 500m**  
**QSFP28 LC Single mode**  
 4x25G-NRZ electrical -to- 1x100G-PAM4 optical  
 MMS1V70-CM



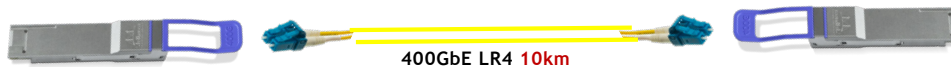
**400GbE SR8 100m**  
**QSFP-DD MPO-16/APC Multimode**  
 8x50G-PAM4 electrical to 8x50G optical, parallel  
 T-DQ8FNS-N00-M



**400GbE DR4 500m**  
**QSFP-DD MPO-12/APC Single mode**  
 8x50G-PAM4 electrical to 4x100G optical, Parallel  
 MMS1V00-WM




**400GbE FR4 2km**  
**QSFP-DD LC Single mode**  
 50G-PAM4 electrical to 4x100G optical, Multiplexed  
 MMS1V50-WM




**400GbE LR4 10km**  
**QSFP-DD LC Single mode**  
 50G-PAM4 electrical to 4x100G optical, Multiplexed  
 MMS1V90-WR

**SN5400**  
 400GbE Spine/Super Spine Ethernet Switch  
 64 400GbE QSFP-DD cages  
 Spectrum-4



**SN4700**  
 400GbE Spine/ToR Ethernet Switch  
 32 QSFP-DD cages  
 Spectrum-3



8x50G-PAM4

**SN5400**  
 400GbE Spine/Super Spine Ethernet Switch  
 64 400GbE QSFP-DD cages  
 Spectrum-4



**SN4700**  
 400GbE Spine/ToR Ethernet Switch  
 32 QSFP-DD cages  
 Spectrum-3



8x50G-PAM4

Fiber cables shown here are *not* supplied by NVIDIA except for 100-meter for 400G DR4. References are available. Contact LinkX-Marketing.


Also supports QSFP56 & QSFP28 devices and QSFP112 @50G-PAM4

**Single-mode Crossover fibers:**  
 MPO-12/APC to MPO-12/APC  
 MFP7E30-NXXX (XXX = 001, 002, 003, 005, 007, 010, 015, 020, 030, 050, 060, 070, 100) meters


# 400G SWITCH-TO-SWITCH, BLUEFIELD-3, CONNECTX

## 400GbE QSFP-DD -to- 2x 200GbE QSFP56 or 4x 100GbE QSFP28

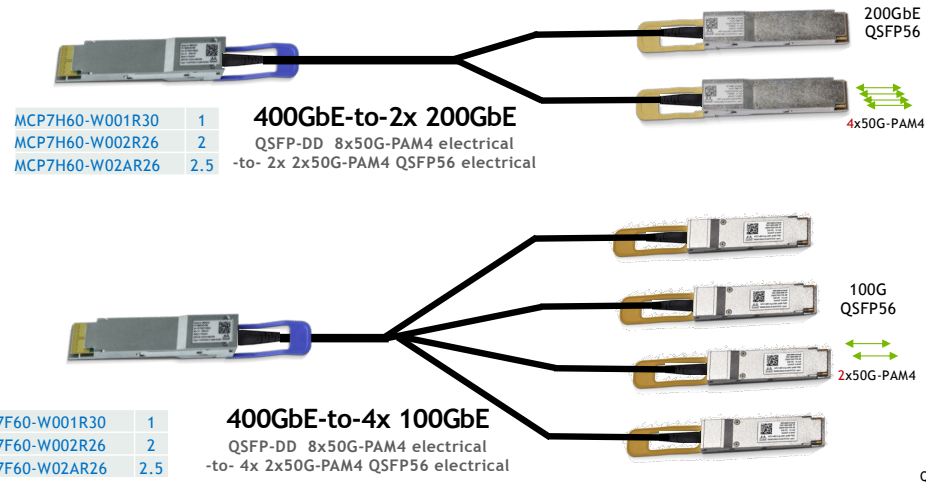
**SN5400**  
400GbE Spine/Super Spine Ethernet Switch  
64 400GbE QSFP-DD cages  
Spectrum-4



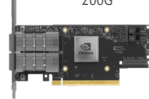
**SN4700**  
400GbE Spine/ToR Ethernet Switch  
32 QSFP-DD cages  
Spectrum-3




8x50G-PAM4




**ConnectX-7/QSFP112**  
200G




**BlueField-3/QSFP112**  
200G




**SN3000 Series**  
32-port 200GbE QSFP56



**ConnectX-6**  
QSFP56



**SN4000 Series**  
32-port 400GbE QSFP-DD



QSFP28 devices can also be inserted into QSFP-DD and QSFP56 cages.  
QSFP56 and QSFP28 devices can be inserted into QSFP112 & QSFP-DD cages.

Also supports QSFP56 & QSFP28 devices  
and QSFP112 @50G-PAM4

# SWITCH-TO-SWITCH, BLUEFIELD-3, CONNECTX

## QSFP-DD 50G-PAM4 -to- 50G-PAM4 QSFP56 or 25G-NRZ QSFP28

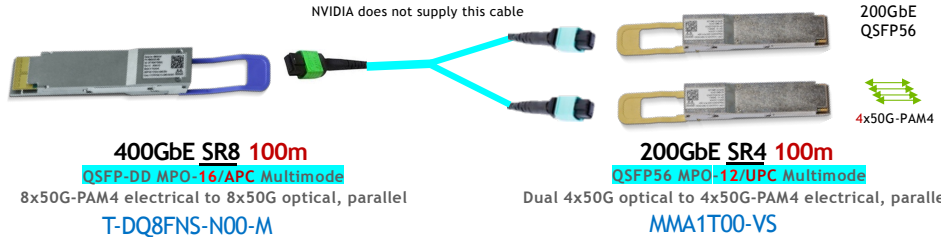
**SN5400**  
400GbE Spine/Super Spine Ethernet Switch  
64 400GbE QSFP-DD cages  
Spectrum-4



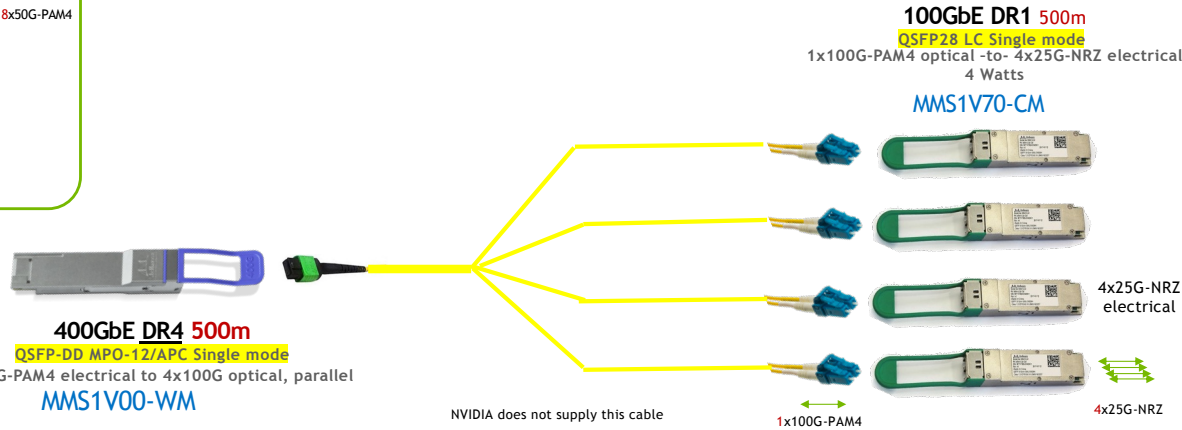
**SN4700**  
400GbE Spine/ToR Ethernet Switch  
32 QSFP-DD cages  
Spectrum-3



Also supports QSFP56 & QSFP28 devices and QSFP112 @50G-PAM4



This set up can downshift to 200G-to-2x 100G (4x25G-NRZ)



NVIDIA does not supply this cable

1x100G-PAM4

4x25G-NRZ electrical

4x25G-NRZ

**BlueField-3/QSFP112**  
200G



**ConnectX-7/QSFP112**  
200G



**SN3000 Series**  
32-port 200GbE QSFP56



**ConnectX-6**  
QSFP56



**SN4000 Series**  
32-port 400GbE QSFP-DD



QSFP28 transceivers can also be inserted into QSFP-DD and QSFP56 cages

DR1 transceiver is 4 Watts power dissipation and supported in ONLY SN2700 and SN3420 left & right outer 5W 2 ports.

**SN2000 Series**  
32-port 100GbE QSFP28



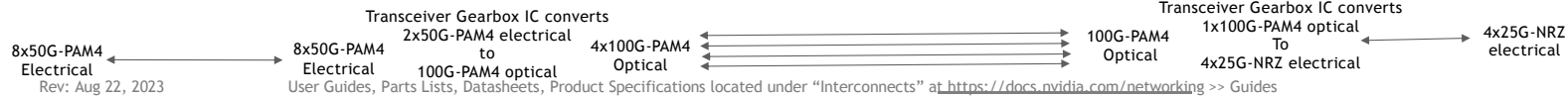
**SN3000 Series**  
32-port 200GbE QSFP56



**SN4000 Series**  
32-port 400GbE QSFP-DD



QSFP28 transceivers can also be inserted into QSFP-DD SN4000 and QSFP56 cages




User Guides, Parts Lists, Datasheets, Product Specifications located under "Interconnects" at <https://docs.nvidia.com/networking> >> Guides


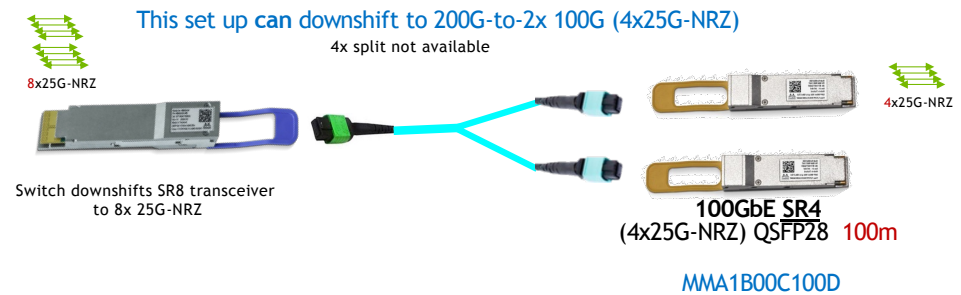
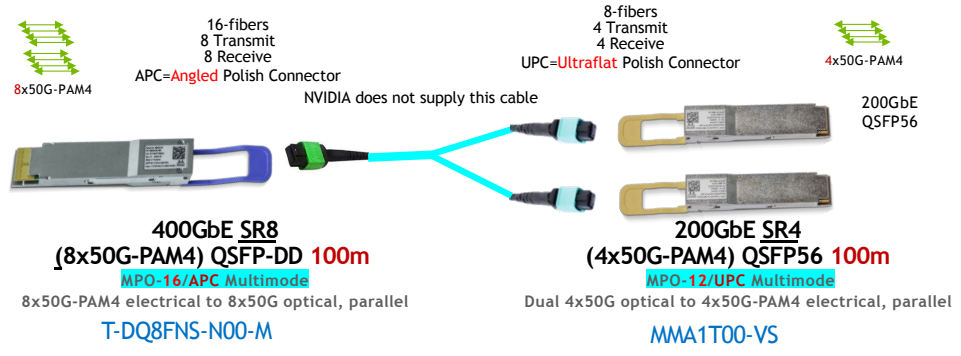
# SWITCH-TO-SWITCH, BLUEFIELD-3, CONNECTX

## QSFP-DD 50G-PAM4 -to- 50G-PAM4 QSFP56 or 25G-NRZ QSFP28


**SN5400**  
400GbE Spine/Super Spine Ethernet Switch  
64 400GbE QSFP-DD cages  
Spectrum-4




**SN4700**  
400GbE Spine/ToR Ethernet Switch  
32 QSFP-DD cages  
Spectrum-3

**BlueField-3/QSFP112**  
200G




**ConnectX-7/QSFP112**  
200G




**SN3000 Series**  
32-port 200GbE QSFP56



**ConnectX-6**  
QSFP56




**SN4000 Series**  
32-port 400GbE QSFP-DD




QSFP28 transceivers can also be inserted into QSFP-DD and QSFP56 cages

DR1 transceiver is 4 Watts power dissipation and supported in ONLY SN2700 and SN3420 left & right outer 5W 2 ports.


**SN2000 Series**  
32-port 100GbE QSFP28



**SN3000 Series**  
32-port 200GbE QSFP56



**SN4000 Series**  
32-port 400GbE QSFP-DD




QSFP28 transceivers can also be inserted into QSFP-DD SN4000 and QSFP56 cages

# 400G SWITCH-TO-400G CONNECTX-7/OSFP + CONNECTX-7/BLUEFIELD-3/QSFP112

400GbE QSFP-DD (8x50G-PAM4) -to- 400G OSFO (4x100G-PAM4) Single mode


ConnectX-7/OSFP

**SN5400**  
400GbE Spine/Super Spine Ethernet Switch  
64 400GbE QSFP-DD cages  
Spectrum-4




8x50G-PAM4

**SN4700**  
400GbE Spine/ToR Ethernet Switch  
32 QSFP-DD cages  
Spectrum-3



Also supports QSFP56 & QSFP28 devices and QSFP112 @50G-PAM4

**400Gb/s DR4**




8x50G PAM4 Electrical      4x 100G PAM4 Optical

**Single Port 400G DR4 Single mode Transceiver**  
*MMS1V00-WM (500m)*  
QSFP56-DD Flat-top  
Single MPO-12/APC  
9 Watts



**Single-mode Crossover fibers:**  
MPO-12/APC to MPO-12/APC  
MFP7E30-NXXX (XXX = 001, 002, 003, 005, 007, 010, 015, 020, 030, 050, 060, 070, 100) meters

**400Gb/s**




**ConnectX-7/OSFP 400G**

**Single Port 400G Single mode Transceiver**  
*MMS4X00-NS400 (100m)*  
OSFP Flat-top  
Single MPO/APC  
9 Watts


ConnectX-7 + BlueField-3/QSFP112

**BlueField-3/QSFP112 400G**



**Single Port 400G DR4 Single mode Transceiver**  
*MMS1X00-NS400 (100m)*  
QSFP112 Flat-top  
Single MPO-12/APC  
9 Watts

**ConnectX-7/QSFP112 400G**



Check availability of 400G DR4 Single mode part

Check FW status for use in CX7 + BF3 Supporting 400G

**THIS IS THE ONLY SOLUTION TO LINK 400G QSFP-DD Switch -to- ConnectX-7/400G**



- No Multimode ACC, or DAC equivalent offered
- No OSFP 400G BlueField-3 offered - only QSFP112
- 400G ConnectX-7 QSFP112 in development (MCX715105AS-WEAT)

# SWITCH-TO-CONNECTX-7/OSFP DGX-H100 “CEDAR7” MODULE

Spectrum-3 Switch-to-ConnectX-7 /Cedar

8x50G-PAM4 -to- 4x100G-PAM4 **Single mode**

8 ConnectX-7 ICs on  
2 Cedar Modules



To 4 Cedar  
Twin-port OSFP Cages

**SN5400**  
400GbE Spine/Super Spine Ethernet Switch  
64 400GbE QSFP-DD cages  
Spectrum-4





8x50G-PAM4

**SN4700**  
400GbE Spine/ToR Ethernet Switch  
32 QSFP-DD cages  
Spectrum-3



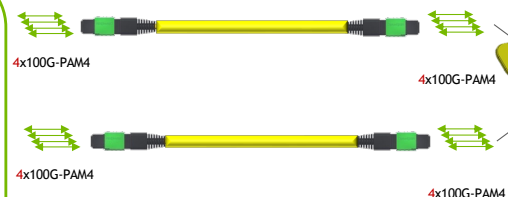
Also supports QSFP56 & QSFP28 devices  
and QSFP112 @50G-PAM4

**400Gb/s DR4**

8x50G PAM4 Electrical    4x100G PAM4 Optical

**Single Port 400G DR4**  
**Single mode Transceiver**  
*MMS1V00-WM (500m)*  
QSFP56-DD Flat-top  
Single MPO-12/APC  
9 Watts



**Single-mode Crossover fibers:**  
MPO-12/APC to MPO-12/APC  
*MFP7E30-NXXX* (XXX = 001, 002, 003, 005, 007, 010, 015, 020, 030, 050, 060, 070, 100) meters

**Twin-Port 800G**  
**Single mode Transceiver**  
*MMS4X00-NS-FLT (100m)*  
OSFP Flat-top  
Dual MPO-12/APC  
17 Watts  
DGX-H100 Cedar links

4 Additional PCIe slots use standard CX7 and BF3 networking





**200GBE ETHERNET & HDR INFINIBAND  
50G-PAM4 QSFP56  
CABLES AND TRANSCEIVERS**



# 200GBE ETHERNET (50G-PAM4) QSFP56

InfiniBand cables and transceivers are tested to lower BER than Ethernet.  
InfiniBand can be used for Ethernet systems - but not the reverse.



## 200G QSFP56 -to- 200G QSFP56

MCP1650-V00AE30 (0.5m)	EN only
MCP1650-V001E30 (1m)	
MCP1650-V01AE26 (1.5m)	
MCP1650-V002E26 (2m)	
MCP1650-V02AE26 (2.5m)	



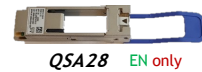
## 200G QSFP56 -to- 2x 100G QSFP56

MCP7H50-H001R30	1	IB+ EN
MCP7H50-H002R26	2	



## 200G QSFP56 -to- 4x 50G SFP56

MCP7H70-V001R30	1	EN only
MCP7H70-V002R26	2	
MCP7H70-V02AR26	2.5	



No 50G-PAM4 version offered.

## 200GbE SR4

850nm Multi-mode 100-meters  
QSFP56  
MMA1T00-VS EN only

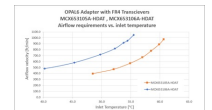


## 200GbE FR4

1310nm Single-mode 2km  
QSFP56  
MMS1W50-HM IB+ EN



200G FR4 can only be used in CX6s versions supporting hi power tcvrs. MCX653106A-HDAT MCX653105A-HDAT Server airflow requirements also must be met. Some 200GbE Ethernet switches can only operate with certain ports.



Fibers not supplied by NVIDIA

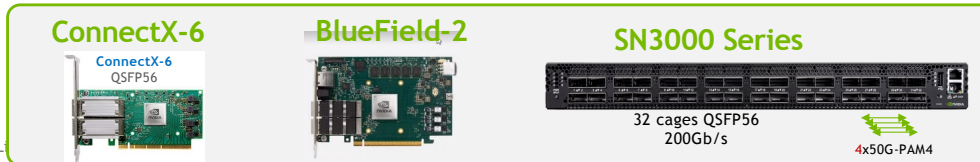
- ACCs EOL'd  
Active Copper Cables  
MCA1J00-H003E (3m)  
MCA1J00-H004E (4m)  
MCA7J50-H003R (3m)  
MCA7J50-H004R (4m)



MFS1S00-H003V	3	IB+ EN
MFS1S00-H005V	5	
MFS1S00-H010V	10	
MFS1S00-H015V	15	
MFS1S00-H020V	20	
MFS1S00-H030V	30	
MFS1S00-H050V	50	
MFS1S00-H100V	100	

MFS1S50-H003V	3	IB+ EN
MFS1S50-H005V	5	
MFS1S50-H010V	10	
MFS1S50-H015V	15	
MFS1S50-H020V	20	
MFS1S50-H030V	30	
MFS1S50-H040V	40	
MFS1S50-H050V	50	

Titan 2x AOC: 40+50-m likely EOL soon



100GbE (2x50G-PAM4) is not compatible with 100GbE (4x25-NRZ)

# 200GBE (50G-PAM4) HDR INFINIBAND QSFP56

AOCs and FR4 transceivers support both IB + EN  
 DACs & SR4 transceiver are separate and protocol specific.  
 InfiniBand DACs tested to lower (better) BER than Ethernet.  
 InfiniBand DACs can be used for Ethernet systems - but not the reverse.



## 200G QSFP56 -to- 200G QSFP56

- MCP1650-H00AE30 (0.5m)
- MCP1650-H001E30 (1m)
- MCP1650-H01AE30 (1.5m)
- MCP1650-H002E26 (2m)

IB only



## 200G QSFP56 -to- 2x 100G QSFP56

- MCP7H50-H001R30 (1m)
- MCP7H50-H01AR30 (2m)
- MCP7H50-H002R26 (2m)

IB + EN



- |               |    |
|---------------|----|
| MFS1S50-H003V | 3  |
| MFS1S50-H005V | 5  |
| MFS1S50-H010V | 10 |
| MFS1S50-H015V | 15 |
| MFS1S50-H020V | 20 |
| MFS1S50-H030V | 30 |
| MFS1S50-H040V | 40 |
| MFS1S50-H050V | 50 |

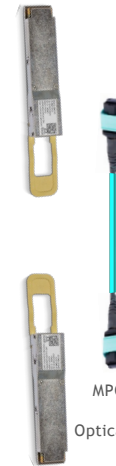
Titan  
 IB + EN

5W & 3.5Watts

Titan 2x AOC: 40+50-m likely EOL soon

## 200GbE SR4 HDR 850nm Multi-mode 100-meters QSFP56

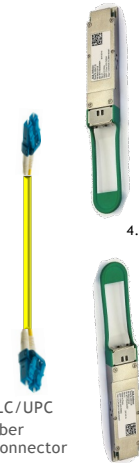
MMA1T00-HS IB-only



MPO-12/UPC  
 8-fiber  
 Optical Connector

## 200GbE FR4 HDR 1310nm Single-mode 2km QSFP56

MMS1W50-HM IB+ EN

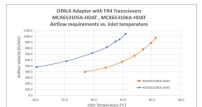


4.4Watts

Duplex LC/UPC  
 2-fiber  
 Optical Connector

Fibers not supplied by NVIDIA

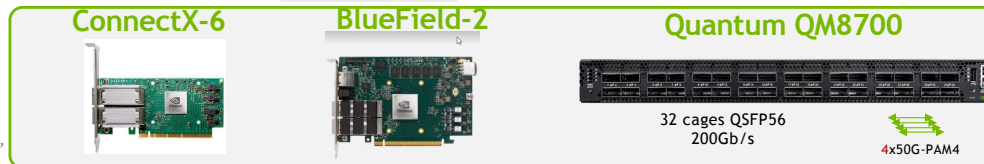
200G FR4 can only be used in CX66 supporting hi power tcvrs.  
 MCX653106A-HDAT  
 MCX653105A-HDAT  
 Server airflow requirements also must be met.



- ACCs EOL'd  
 Active Copper Cables  
 MCA1J00-H003E (3m)  
 MCA1J00-H004E (4m)  
 MCA7J50-H003R (3m)  
 MCA7J50-H004R (4m)



- |               |     |         |
|---------------|-----|---------|
| MFS1S00-H003V | 3   | IB + EN |
| MFS1S00-H005V | 5   |         |
| MFS1S00-H010V | 10  |         |
| MFS1S00-H015V | 15  |         |
| MFS1S00-H020V | 20  |         |
| MFS1S00-H030V | 30  |         |
| MFS1S00-H050V | 50  |         |
| MFS1S00-H100V | 100 |         |



HDR100 = 2x50G PAM4 = 100G  
 (Not compatible with EDR 4x25G-NRZ)  
 HDR = 4x50G PAM4 = 200G



**COMMON QUESTIONS  
& TECHNICAL TRAINING**

# MULTI-MODE & SINGLE-MODE FIBERS

Yellow and aqua colors are important

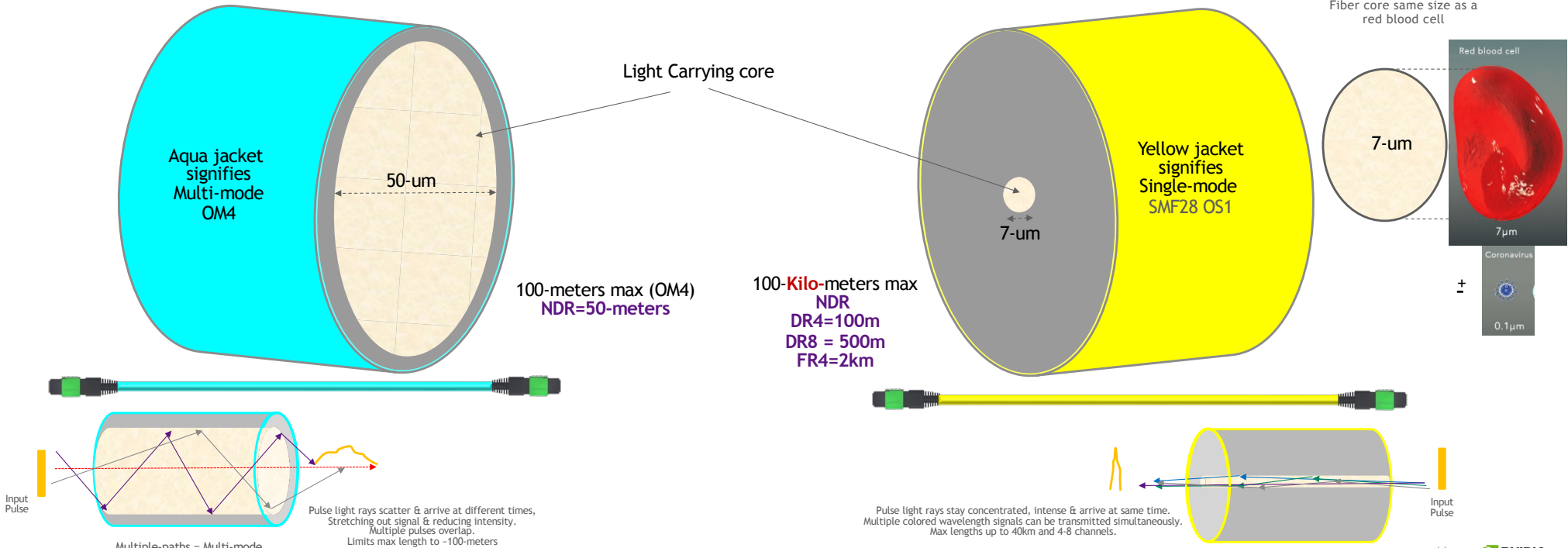
Two types of optical fibers are used in InfiniBand

## Multi-mode

- Large light carrying core
- + Easy and low-cost to interface with lasers and detectors
- Signal bounces down fiber and degrades; limiting lengths to 50-100-meters
- o Used with SR, SR4, SR8 transceivers “SR=Short Reach”
- o Used with only one signal direction at 850nm wavelength

## Single-mode

- Tiny light carrying core
- Difficult and higher-cost to interface with lasers and detectors
- + Signal stays together over hundreds of kilometers - used in to 40km InfiniBand
- o Can multiplex 4 or 8 signals simultaneously into 1 fiber at 1310nm wavelength
- o Used with DR1, DR4, DR8, FR4, LR4 transceivers



Rev: Aug 22, 2023

User Guides, Parts Lists, Datasheets, Product Specifications located under “Interconnects” at <https://docs.nvidia.com/networking> >> Guides

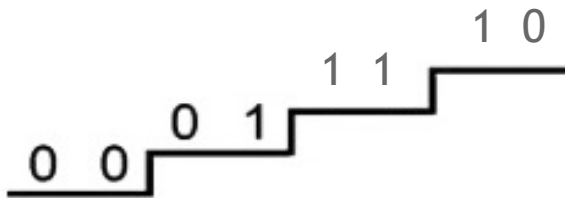
# 100G-PAM4 MODULATION

## PULSE AMPLITUDE MODULATION 4-LEVELS

### *PAM4 vs NRZ Signaling*

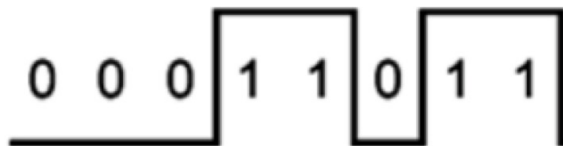
#### PAM4

Pulse Amplitude Modulation 4-levels  
2 bits per clock



#### NRZ

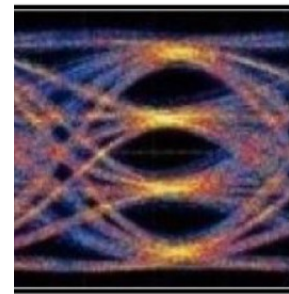
Non-Return to Zero  
1 bit per clock



#### 50G-PAM4

2-bits/clock

HDR



"10" level

"11" level

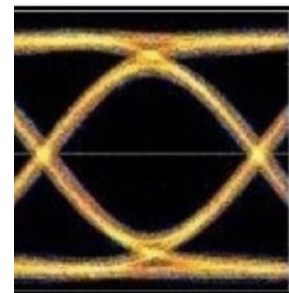
"01" level

"00" level

#### 25G-NRZ

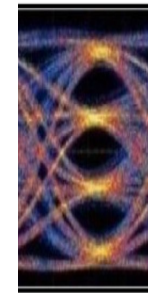
1-bit/clock

EDR



"1" level

"0" level

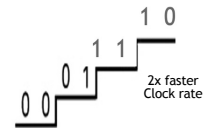


#### 100G-PAM4

2-bits/clock

NDR

~50GHz clock



~25GHz clock

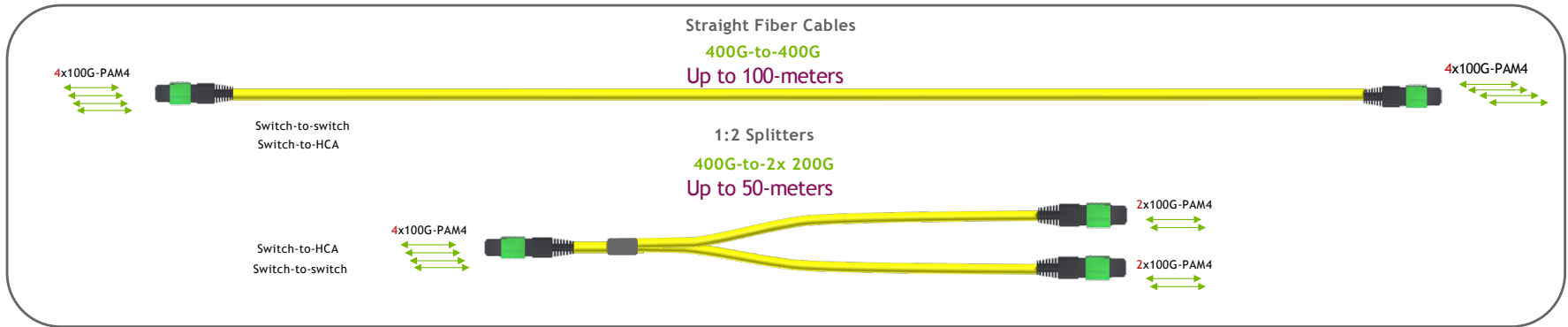
**Bottom line: Twice as fast**

Switch & HCA ICs can downshift to slower speeds supporting HDR and EDR. This occurs in the switch or HCA – not in the cables or transceivers

# SUMMARY: PASSIVE FIBER CABLING

## Four Cross-over Fiber Cable Types in Straight and 1:2 Splitters

### Single-Mode Fibers



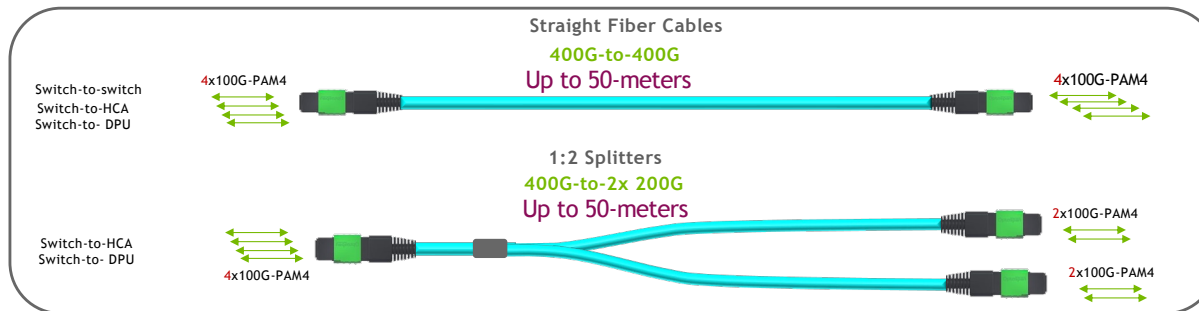
Twin-port Transceivers use 2 fibers/transceiver. Both must be the same type (straight or splitter)



### IMPORTANT NOTE:

These are “cross-over” fibers and can directly connect 2 transceivers together properly aligning the transmitters with receivers

### Multi-Mode Fibers



# NEW OPTICAL CONNECTORS

## Angled Polish Connectors (APC) to reduce internal back reflections in 100G-PAM4 links

- NDR uses MPO/APC optical connector Angled Polish Connector (Green shell)
- APC is used for both single mode and multimode fibers
- EDR + HDR use MPO/UPC: Ultra-flat Polished Connector (Blue shell)
- MPO/APC is not compatible with MPO/UPC

Used for 100GbE/EDR, 200GbE/HDR

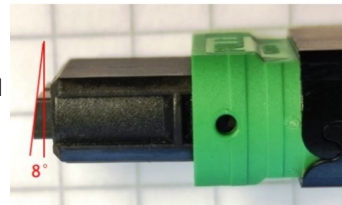
MPO-12/UPC  
Ultra-flat Polished Connector



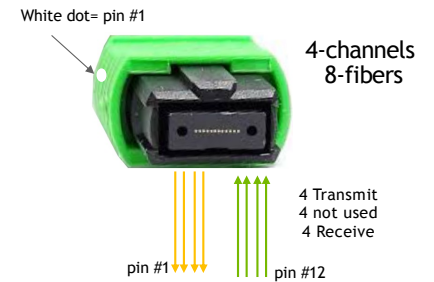
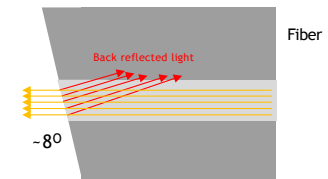
Flat ~~Angled~~

Used for: 400GbE/NDR

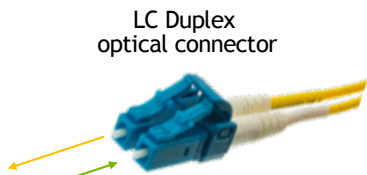
MPO-12/APC  
Angled Polished Connector



The Angled Polish reduces the optical back reflections between the two fiber ends that distorts the data signals



MPO-12/APC  
"-12" means 12 optical fibers in the cable but only 8 are used.  
2 fibers for 1-channel (1 transmit & 1 receive fiber)



LC Duplex optical connector

2-fiber optical connector for FR4 2km transceivers.

4 different laser wavelengths multiplexed into a single fiber for long length transmission.



Transceivers have pins  
Optical connector has holes



Pinned connectors for joining cables  
Holes Pins

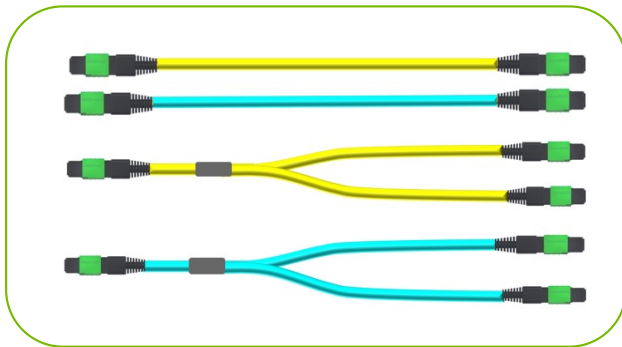
- 1) Flat and Angled Optical connectors are not compatible
- 2) Although both HDR & NDR200 have 200Gb/s rates, they are not interoperable

# LINKING 2 TRANSCEIVERS DIRECTLY REQUIRES USING **CROSS-OVER** FIBERS

NDR fiber cables offered by NVIDIA are all Cross-over types

## Cross-over Optical Fibers

Multi-mode & Single-mode  
Straight and 1:2 Splitters



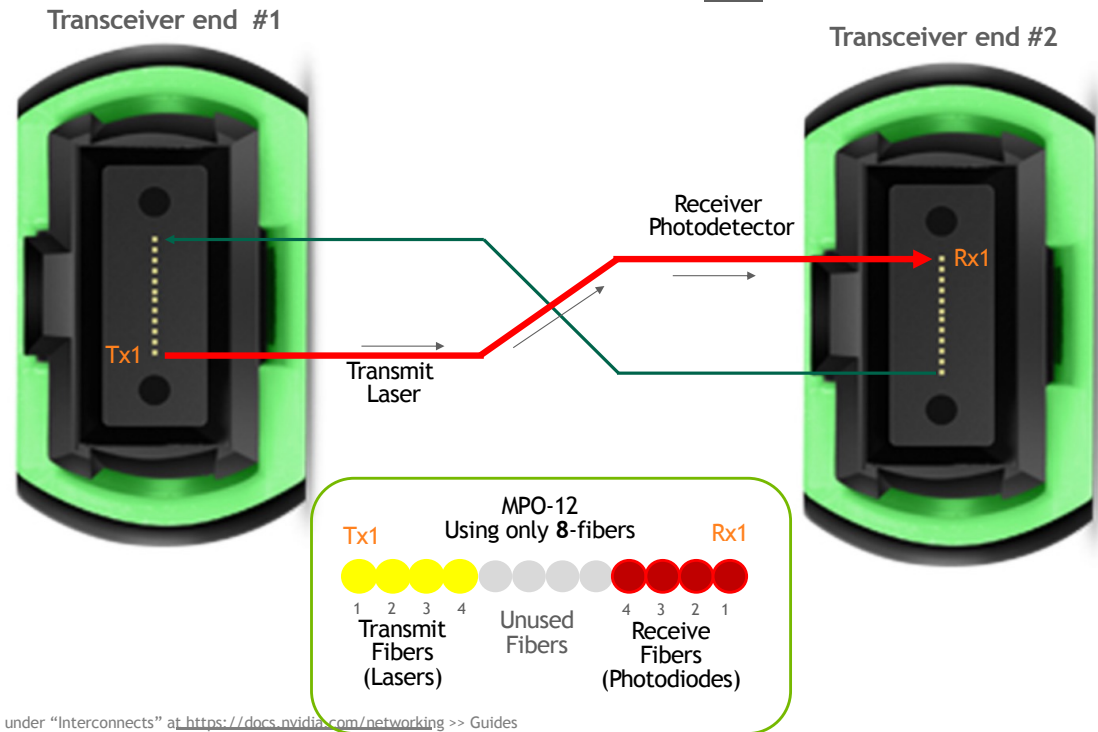
AOCs are constructed with cross-over fibers.

Transceivers have to use specific cross-over fiber cables somewhere in the link to directly connect 2 transceivers together.

**Type-A** cables have a straight parallel fiber arrangement and are often used as trunk cables between optical patch panels.

## Type-B “Crossover” cable

Transmitter lasers 1,2,3,4 have to align with receiver photodetectors 1,2,3,4  
Transmit and receive fibers are switched inside the cable





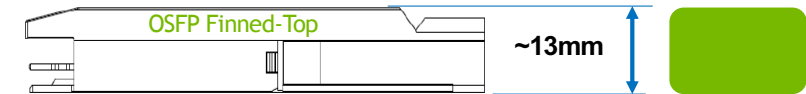
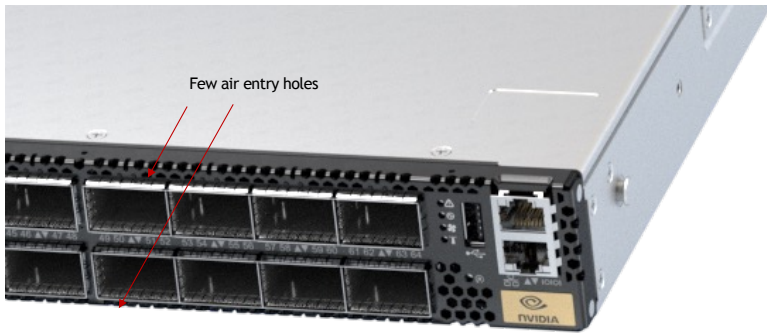
# WHY NO NDR AOCS?

Heavy transceiver ends are almost certain to break the glass fiber during installation



# WHY FINNED & FLAT CABLES AND TRANSCEIVERS?

Switches and Adapters are cooled differently



Same width  
Different heights



Air-cooled switch cages are cooled by an array of fans in the back but few front panel holes for cooling air.  
Twin-port transceivers run hot at 17 Watts and 15 Watts.  
Finned top for each transceiver aids in consistent cooling.



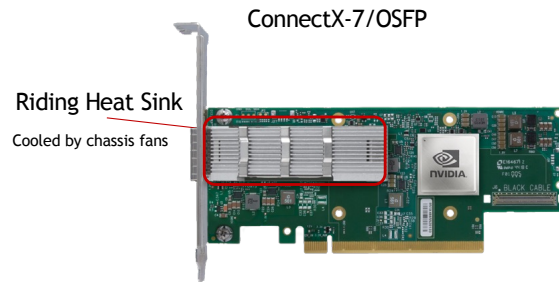
-FLT

Liquid-cooled Modular switches use a liquid-cooling riding heat sink and only accept Flat-top Twin-port devices

A mechanical stop prevents inserting Flat-top devices into the Air-cooled switch cages

Rev: Aug 22, 2023

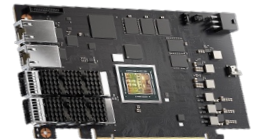
User Guides, Parts Lists, Datasheets, Product Specifications located under "Interconnects" at <https://docs.nvidia.com/networking> >> Guides



ConnectX-6,5/QSFP56/28



BlueField 3



BlueField-2



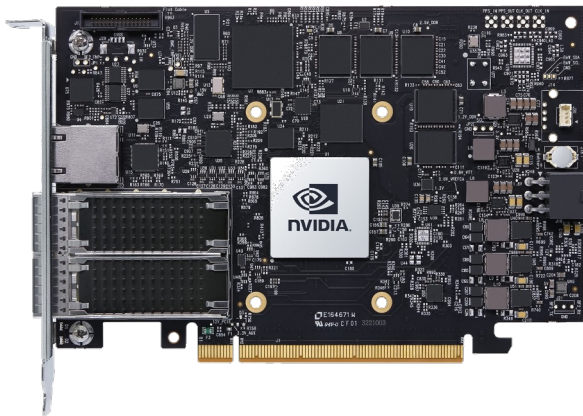
HCA and DPUs use flat-top cables and transceivers.  
Single-port transceivers are rated lower power at 9,8, and 5 Watts.

The HCA and DPUs use a "riding heat sink" on top of the card cage for OSFP and QSFP112, QSFP56, QSFP28.  
Cooled by a server or storage chassis fans.



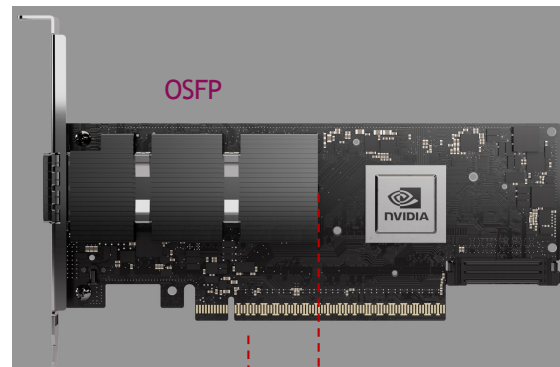
# CONNECTX-7 & BLUEFIELD-3 QSFP112 CAGE WITH RIDING HEAT SINK

BlueField-3/QSFP112



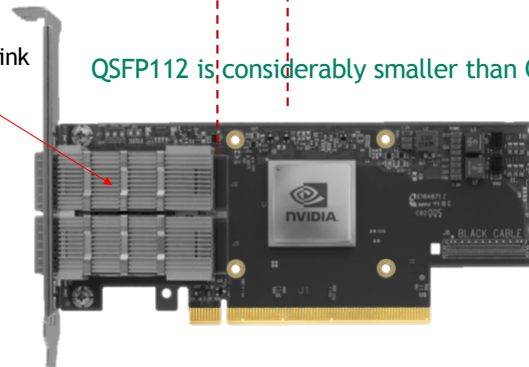
No OSFP devices for BlueField-3

ConnectX-7/OSFP



Riding Heat Sink

QSFP112 is considerably smaller than OSFP

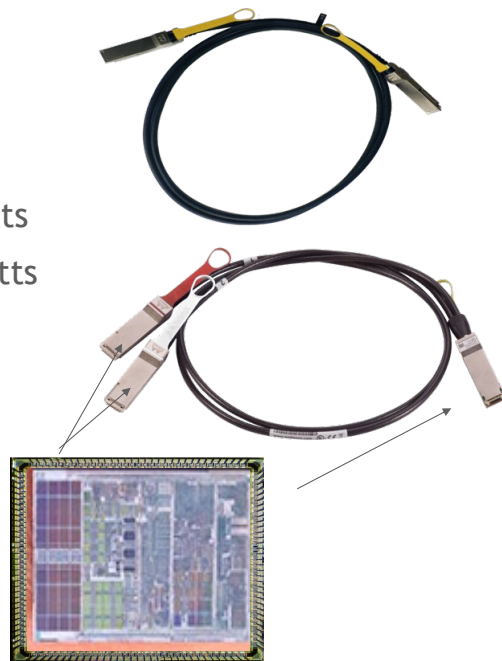


# NEW 400GBE/NDR ACTIVE COPPER CABLES

Adding signal boosting ICs to DAC cables to extend lengths, reduce latency

## 200G HDR ACC

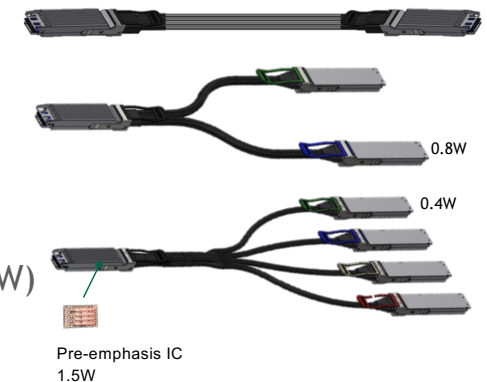
- QSFP56 form-factor
- Based on DSP ICs
- 200G end = 3.5 Watts
- 100G ends = 2.5 Watts
- 3 & 4-meters
- 26 & 30 AWG



Digital Signal Processor (DSP)

## 400G 400GbE/NDR ACC

- OSFP form-factor
- Based on pre-emphasis ICs
- Non-retimed interface
- <1.5 Watts /end (.8W and .4W)
- 3, 4+5-meters
- 30 + 26AWG wire thicknesses

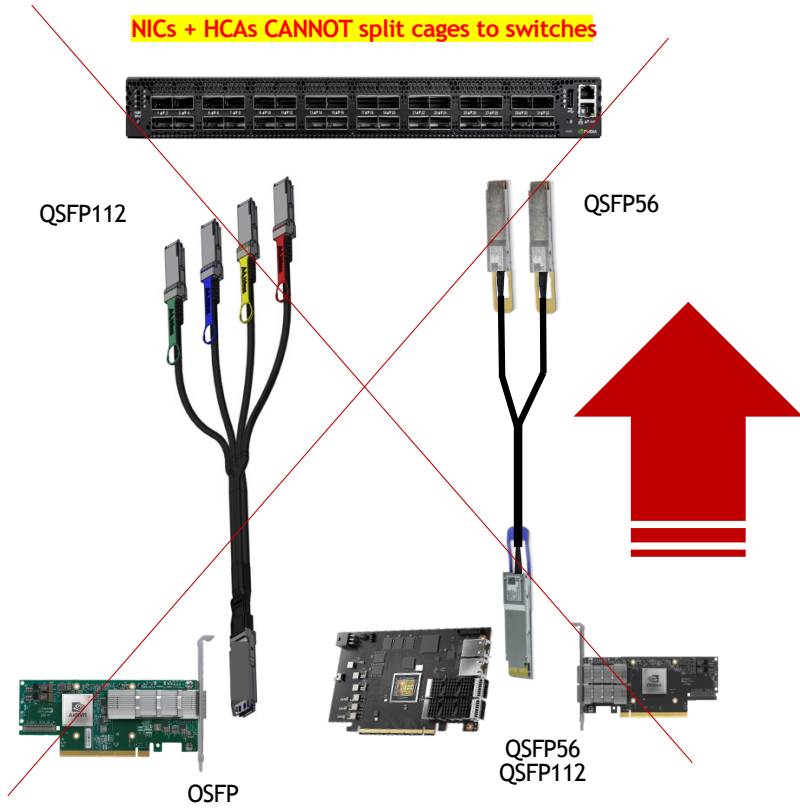


+ Significantly lower-latency, power, size and cost than 200G HDR ACCs and 3+5m AOCs

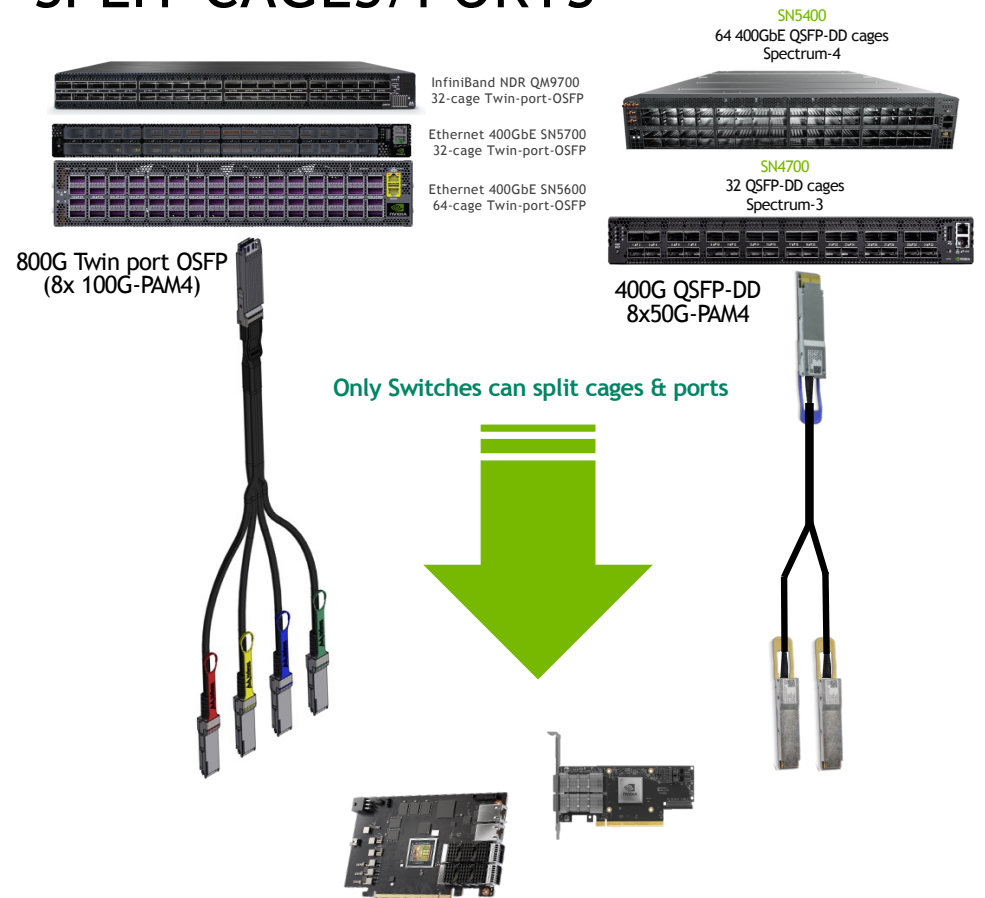
Pre-emphasis pre-determines the noise in the fixed cable length.  
The IC inverts the noise test signal (-noise) which combines with the noise (+ noise) which cancels out

# CONNECTX-7S CANNOT SPLIT CAGES/PORTS

**NICs + HCAs CANNOT split cages to switches**



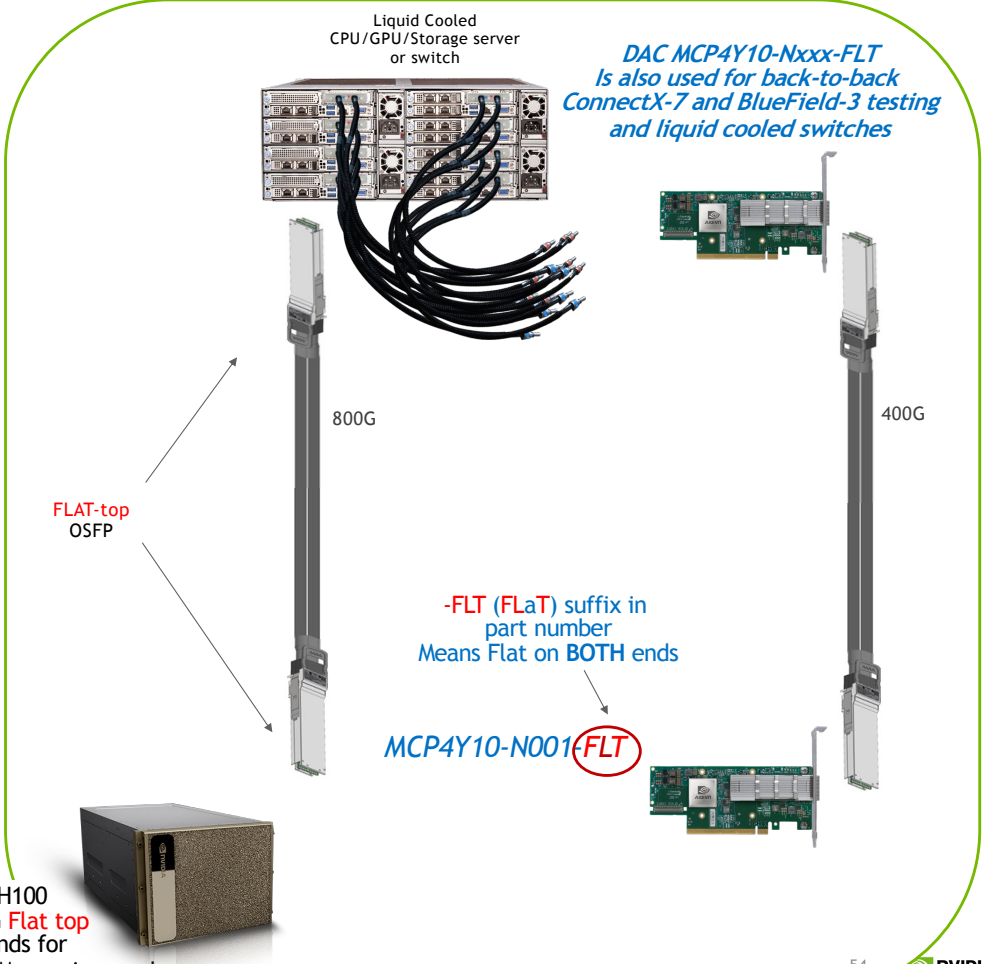
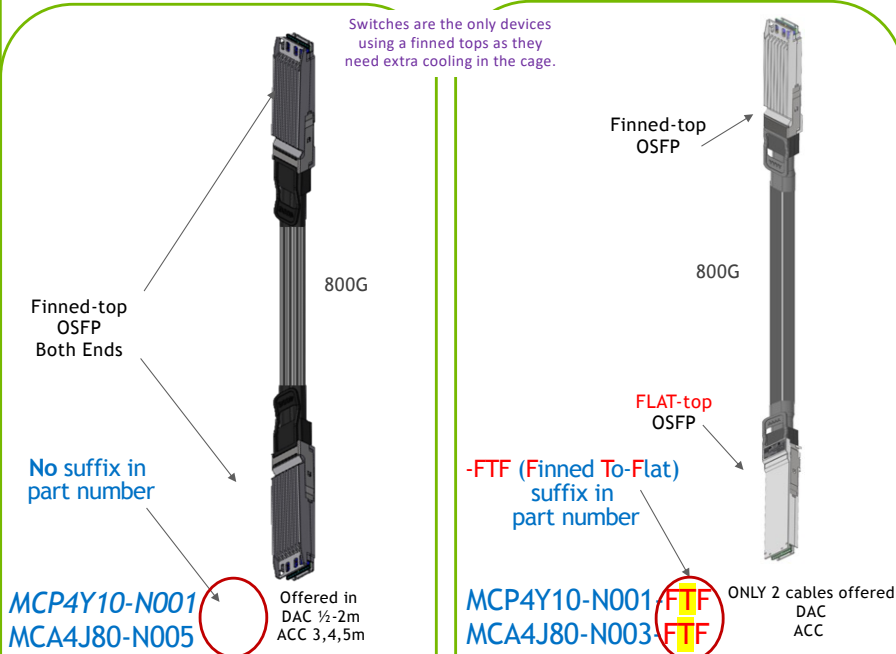
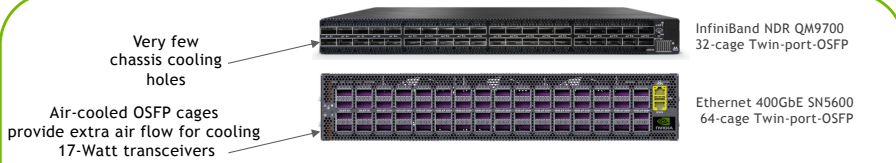
Currently not supported but firmware planned release in 2024.



Applies to both InfiniBand and Ethernet

# PART NUMBER SUFFIX: “ “, FLT, FTF

**Finned top-to-Finned top OSFP** for OSFP air-cooled switches ONLY.  
**Finned-to-Flat top** for DGX H100 Cedar links to switches.  
**Flat top-to-Flat top** for liquid cooled OEM systems + back-to-back adapter testing.



# -FLT AND -FTF CABLES AND TRANSCEIVERS

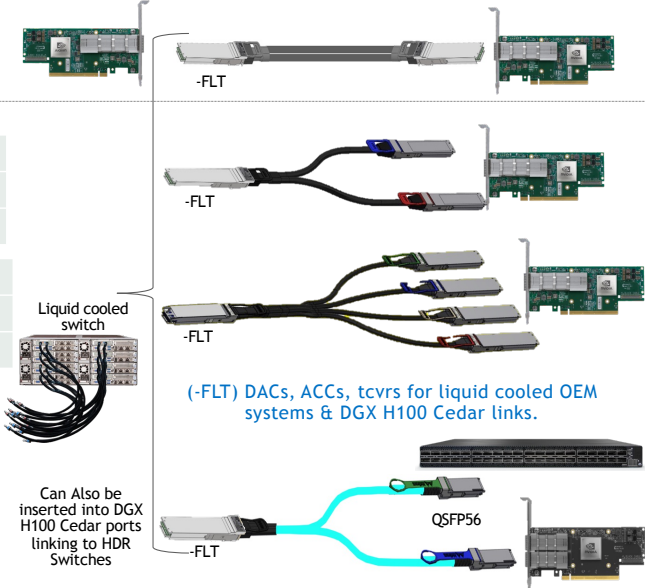
Twin port OSFP devices are assumed to be FINNED and ONLY for Quantum-2 and SN5600 switches.

Everything else assumed to be FLAT topped - mainly for CX and BF and 200G/100G switches

-FLT Exceptions below:

Interlink DAC - OSFP to OSFP	MCP4Y10-N00A-FLT	980-9IA0L-00N00A	DAC	ULTRON	NVIDIA Passive Copper cable, IB twin port NDR, up to 800Gb/s, OSFP, 0.5m , flat top
Interlink DAC - OSFP to OSFP	MCP4Y10-N001-FLT	980-9IA0G-00N001	DAC	ULTRON	NVIDIA Passive Copper cable, IB twin port NDR, up to 800Gb/s, OSFP, 1m, flat top
Interlink DAC - OSFP to OSFP	MCP4Y10-N01A-FLT	980-9IA0R-00N01A	DAC	ULTRON	NVIDIA passive Copper cable, IB twin port NDR, up to 800Gb/s, OSFP, 1.5m , flat top
Interlink DAC - OSFP to OSFP	MCP4Y10-N002-FLT	980-9IA0J-00N002	DAC	ULTRON	NVIDIA passive Copper cable, IB twin port NDR, up to 800Gb/s, OSFP, 2m, flat top

(-FLT) DAC cable for back-to-back adapter testing & liquid switches



(-FLT) DACs, ACCs, tcvrs for liquid cooled OEM systems & DGX H100 Cedar links.

Splitter DAC NDR Twin PORT to 2 NDR ports	MCP7Y00-N001-FLT	980-9I433-00N001	DAC	THANOS	NVIDIA passive copper splitter cable, IB twin port NDR 800Gb/s to 2x400G b/s, OSFP to 2xOSFP, 1m, flat top
Splitter DAC NDR Twin PORT to 2 NDR ports	MCP7Y00-N01A-FLT	980-9I927-00N01A	DAC	THANOS	NVIDIA passive copper splitter cable, IB twin port NDR 800Gb/s to 2x400G b/s, OSFP to 2xOSFP, 1.5m, flat top
Splitter DAC NDR Twin PORT to 2 NDR ports	MCP7Y00-N002-FLT	980-9I925-00N002	DAC	THANOS	NVIDIA passive copper splitter cable, IB twin port NDR 800Gb/s to 2x400G b/s, OSFP to 2xOSFP, 2m, flat top
Splitter DAC NDR Twin PORT to 4 NDR200 ports	MCP7Y50-N001-FLT	980-9I75F-00N001	DAC	HULK	NVIDIA passive copper splitter cable, IB twin port NDR 800Gb/s to 4x200G b/s, OSFP to 4xOSFP, 1m, flat top
Splitter DAC NDR Twin PORT to 4 NDR200 ports	MCP7Y50-N01A-FLT	980-9I46J-00N01A	DAC	HULK	NVIDIA passive copper splitter cable, IB twin port NDR 800Gb/s to 4x200G b/s, OSFP to 4xOSFP, 1.5m, flat top
Splitter DAC NDR Twin PORT to 4 NDR200 ports	MCP7Y50-N002-FLT	980-9I46H-00N002	DAC	HULK	NVIDIA passive copper splitter cable, IB twin port NDR 800Gb/s to 4x200G b/s, OSFP to 4xOSFP, 2m, flat top

<a href="#">NDR backward compatibility AOC splitters</a>	MFA7U10-H003-FLT	980-9I41Y-00H003	AOC	AKELA BCH	NVIDIA AOC splitter, IB twin port HDR, 400Gb/s to 2x200Gb/s, OSFP to 2xQSFP56, 3m, flat top
<a href="#">NDR backward compatibility AOC splitters</a>	MFA7U10-H005-FLT	980-9I110-00H005	AOC	AKELA BCH	NVIDIA AOC splitter, IB twin port HDR, 400Gb/s to 2x200Gb/s, OSFP to 2xQSFP56, 20m, flat top
<a href="#">NDR backward compatibility AOC splitters</a>	MFA7U10-H010-FLT	980-9I112-00H010	AOC	AKELA BCH	NVIDIA AOC splitter, IB twin port HDR, 400Gb/s to 2x200Gb/s, OSFP to 2xQSFP56, 10m, flat top
<a href="#">NDR backward compatibility AOC splitters</a>	MFA7U10-H015-FLT	980-9I114-00H015	AOC	AKELA BCH	NVIDIA AOC splitter, IB twin port HDR, 400Gb/s to 2x200Gb/s, OSFP to 2xQSFP56, 15m, flat top
<a href="#">NDR backward compatibility AOC splitters</a>	MFA7U10-H020-FLT	980-9I116-00H020	AOC	AKELA BCH	NVIDIA AOC splitter, IB twin port HDR, 400Gb/s to 2x200Gb/s, OSFP to 2xQSFP56, 20m, flat top
<a href="#">NDR backward compatibility AOC splitters</a>	MFA7U10-H030-FLT	980-9I118-00H030	AOC	AKELA BCH	NVIDIA AOC splitter, IB twin port HDR, 400Gb/s to 2x200Gb/s, OSFP to 2xQSFP56, 30m, flat top

<a href="#">NDR Transceivers</a>	MMS4X00-NM-FLT	980-9I301-00NM00	Transceivers / Modules	BAGHEERA	NVIDIA twin port transceiver, 800Gbps,2xNDR, OSFP, 2xMPO12 APC, 1310nm S MF, up to <b>500m</b> , flat top
<a href="#">NDR Transceivers</a>	MMS4X00-NS-FLT	980-9I301-00NS00	Transceivers / Modules	BAGHEERA	NVIDIA twin port transceiver, 800Gbps,2xNDR, OSFP, 2xMPO12 APC, 1310nm S MF, up to <b>100m</b> , flat top
<a href="#">NDR Transceivers</a>	MMA4Z00-NS-FLT	980-9I51A-00NS00	Transceivers / Modules	LOUIE	NVIDIA twin port transceiver, 800Gbps,2xNDR, OSFP, 2xMPO12 APC, 850nm MM F, up to <b>50m</b> , flat top

(-FLT) Flat for DGX-H100 800G Cedar



Interlink ACC - OSFP to OSFP	MCA4J80-N003-FTF	980-9I601-00N003	ACC ODIN		NVIDIA Active copper cable, IB twin port NDR, up to 800Gb/s, OSFP, <b>3m</b> , flat to finned
Interlink DAC - OSFP to OSFP	MCP4Y10-N001-FTF	980-9IA0H-00N001	DAC	ULTRON	NVIDIA Passive Copper cable, IB twin port NDR, up to 800Gb/s, OSFP, <b>1m</b> , flat to finned

(-FTF) Finned-to-Flat for DGX-H100 Cedar links

