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OPTICAL SOLUTIONS & INFRASTRUCTURE

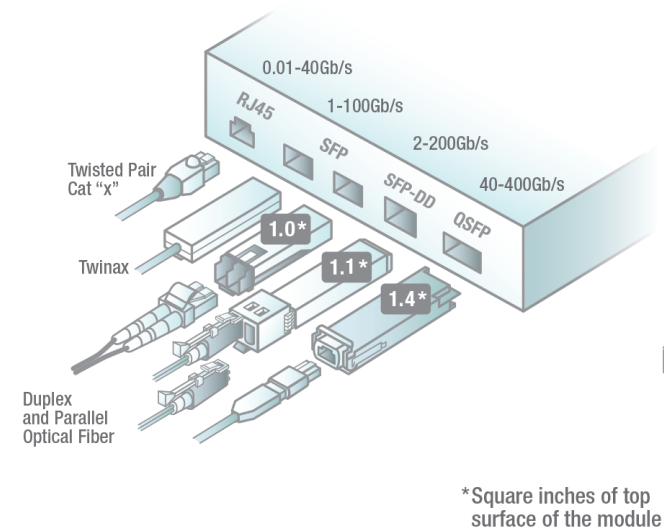
400G OM4 PreCONNECT® OCTO Scenarios

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FORM FACTORS

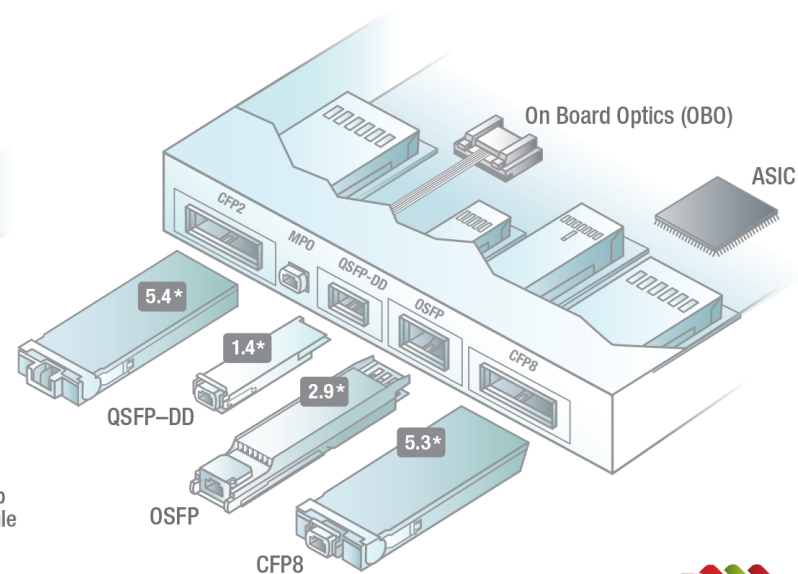
This diagram shows the most common form factors used in Ethernet ports. Hundreds of millions of RJ45 ports are sold a year while tens of millions of SFP and millions of QSFP ports ship a year.

1–4 Lane Interfaces



This diagram shows new form factors initially designed for 100GbE and 400GbE Ethernet ports. All have 4 or 8 lanes and the OBO has up to 16 lanes. The power consumption of the modules is proportional to the surface area of the module.

4–16 Lane Interfaces



■ Specifies 16x25G multimode MPO

Draft Amendment to IEEE Std 802.3-2015
IEEE P802.3bs 400 Gb/s Ethernet Task Force

IEEE Draft P802.3bs/D1.4
24th May 2016

123.11.3.1 Optical lane assignments

The 16 transmit and 16 receive optical lanes of 400GBASE-SR16 shall occupy the positions depicted in Figure 123-4 when looking into the MDI receptacle with the connector keyway feature on top. The interface contains 32 active lanes. The transmit optical lanes occupy the upper 16 positions. The receive optical lanes occupy the lower 16 positions.

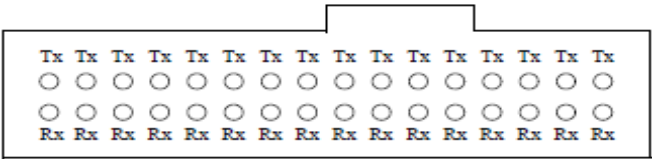


Figure 123-4—400GBASE-SR16 optical lane assignments

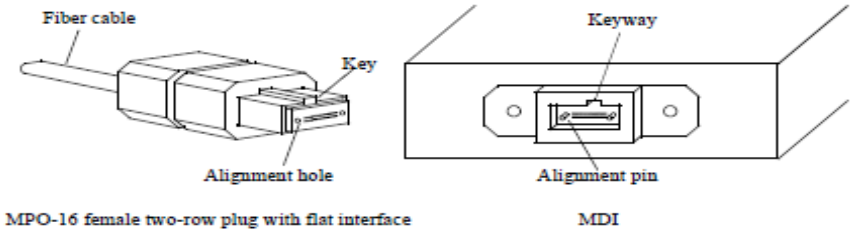
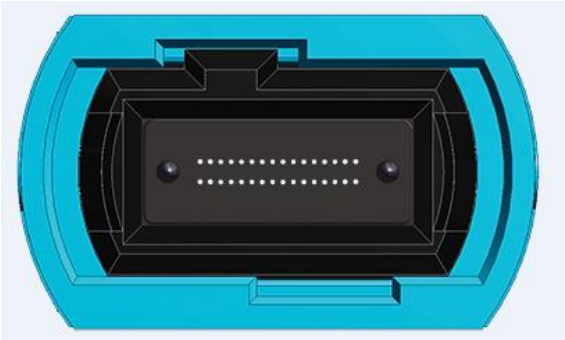


Figure 123-5—MPO-16 female two-row plug with flat interface, and an MDI

2 rows per 16 fibers with thinner Guide-Pins,
larger Pin-Pitch and offset key



MTP® 32 (2x16)

Image with courtesy of US Conec Ltd.

Table 123-6—Fiber optic cabling (channel) characteristics for 400GBASE-SR16

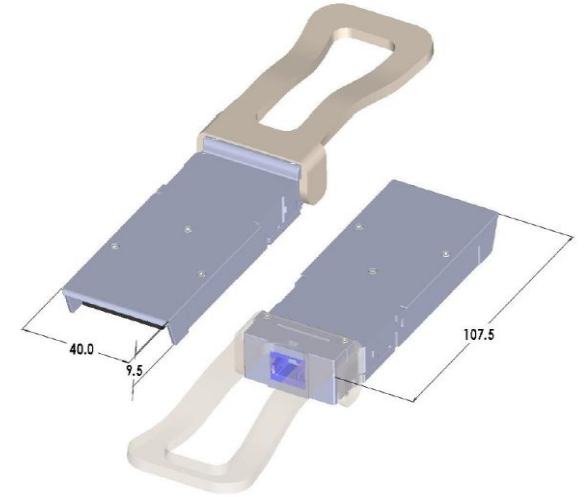
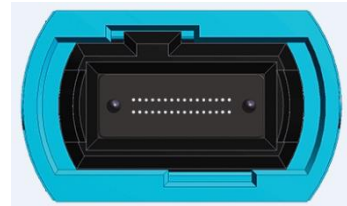
Description	OM3	OM4	Unit
Operating distance (max)	70	100	m
Channel insertion loss ^a (max)	1.8	1.9	dB
Channel insertion loss (min)	0		dB

^aThese channel insertion loss values include cable loss plus 1.5 dB allocated for connection and splice loss, over the wavelength range 840 nm to 860 nm.

- Proposal is the new form factor CFP8

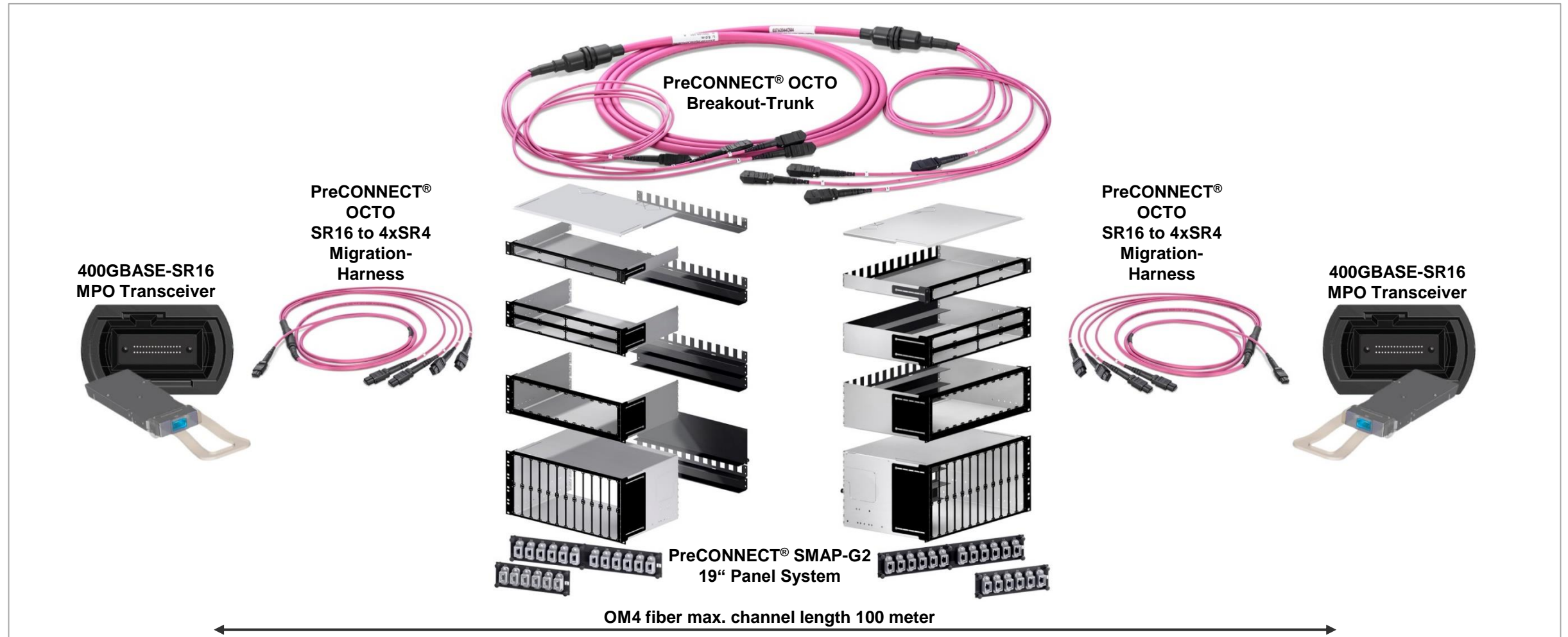
MPO based IEEE specifications supported by CFP8:

- Multimode 400GBASE-SR16 (16x25G)
MPO 32 (2x16) fiber (same as for CDFP)
- Singlemode 400GBASE-DR4 and PSM4
4x100G MPO 2x4 fiber



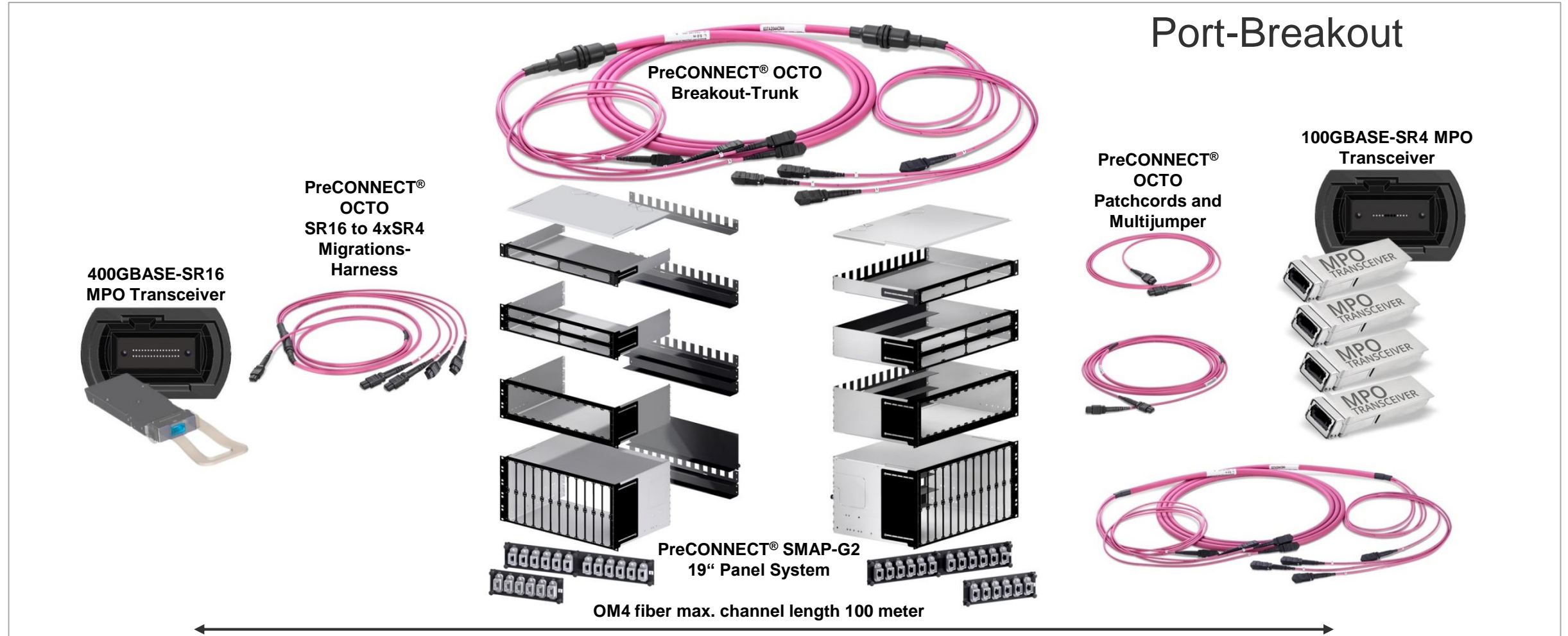
PreCONNECT® OCTO migration to 400GBASE-SR16

400GBASE-SR16 MPO-MPO point-to-point



PreCONNECT® OCTO migration to 400GBASE-SR16

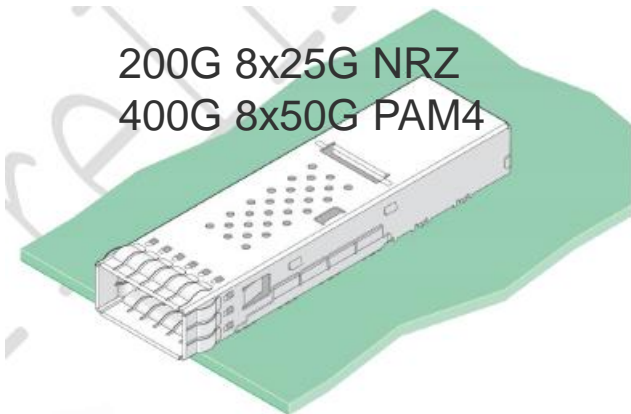
400GBASE-SR16 MPO to 4x100GBASE-SR4 MPO



- Will employ eight lanes that operate up to 25G NRZ modulation or 50G PAM4 modulation, providing solutions up to 200G or 400G aggregate.

QSFP-DD MSA
QSFP-DD Specification
for
QSFP DOUBLE DENSITY 8X PLUGGABLE TRANSCEIVER

200G 8x25G NRZ
400G 8x50G PAM4



QSFP-DD 8X Pluggable Transceiver

1. Scope

The scope of this specification is the definition of a high density 8-lane (8x) module, cage and connector system. QSFP-DD supports up to 400 Gb/s in aggregate over an 8 x 50 Gb/s electrical interface. The cage and connector design provides backwards compatibility to QSFP28 modules which can be inserted into 4 of the 8 electrical lanes.

400G 2x200G NRZ
800G 2x400G PAM4

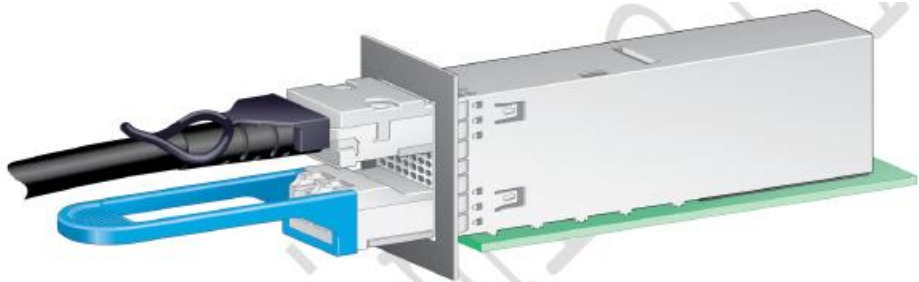
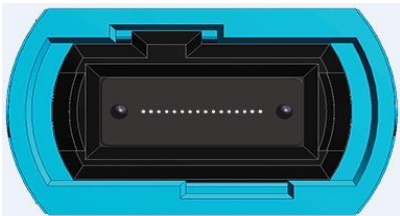
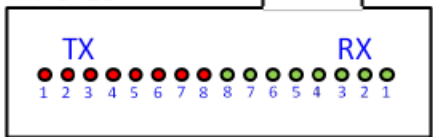


Figure 6a: QSFP-DD 2x1 stacked cage pluggable and direct attach module rendering

QSFP-DD press fit cage for surface mount (SMT) connector



View into Transceiver MDI
MPO-16



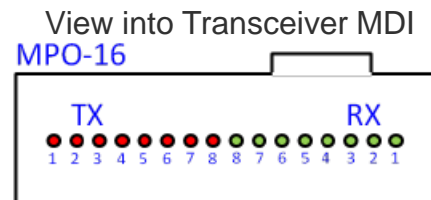
MTP® 16

Image with courtesy of US Conec Ltd.

- Original text: The OSFP is a new pluggable form factor with eight high speed electrical lanes that will initially support 400 Gbps (8x50G). It is slightly wider and deeper than the QSFP but it still supports 32 OSFP ports per 1U front panel, enabling 12.8 Tbps per 1U.
- We are a member of the OSFP MSA



OSFP
400GBASE-SR8
InnoLight



MTP® 16

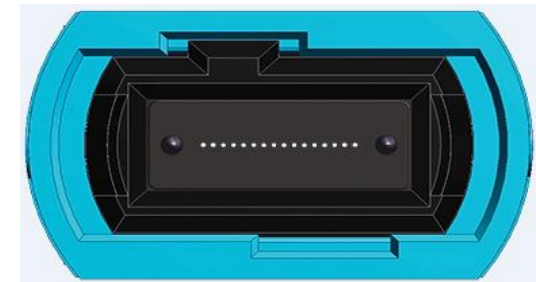
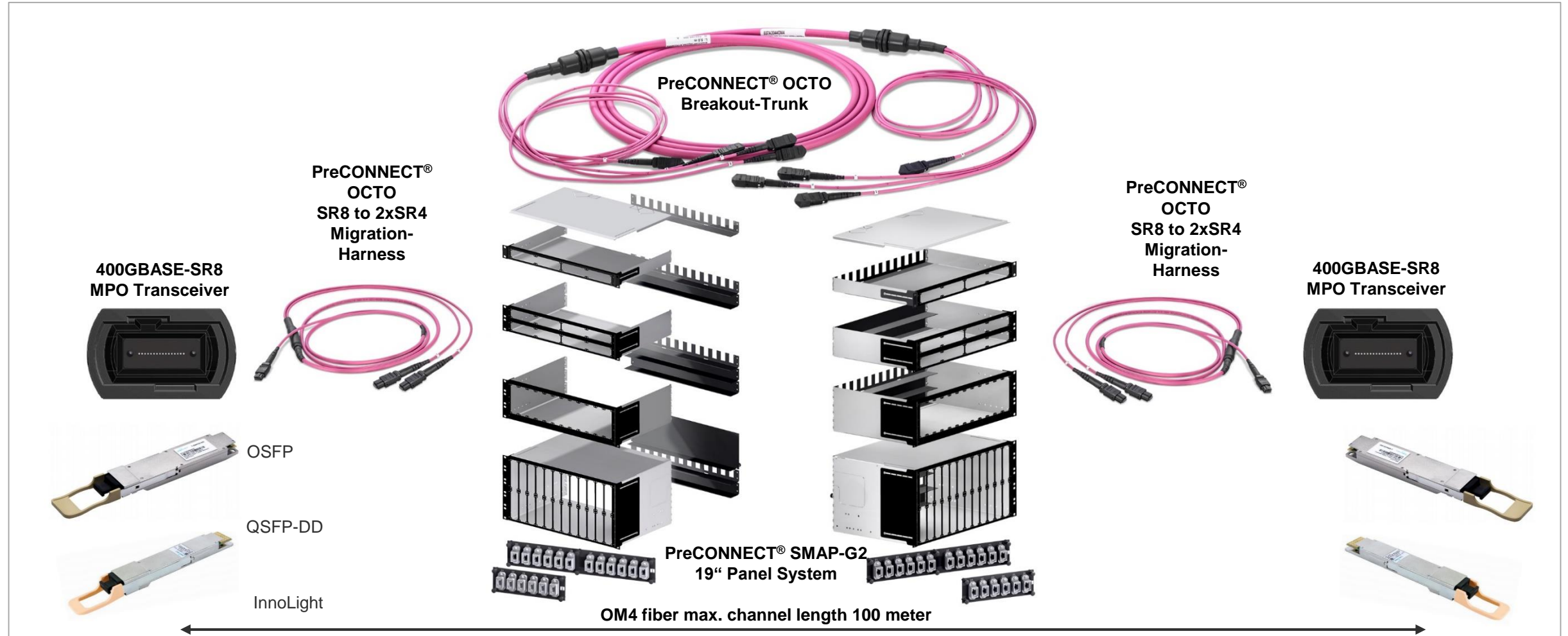


Image with courtesy of US Conec Ltd.

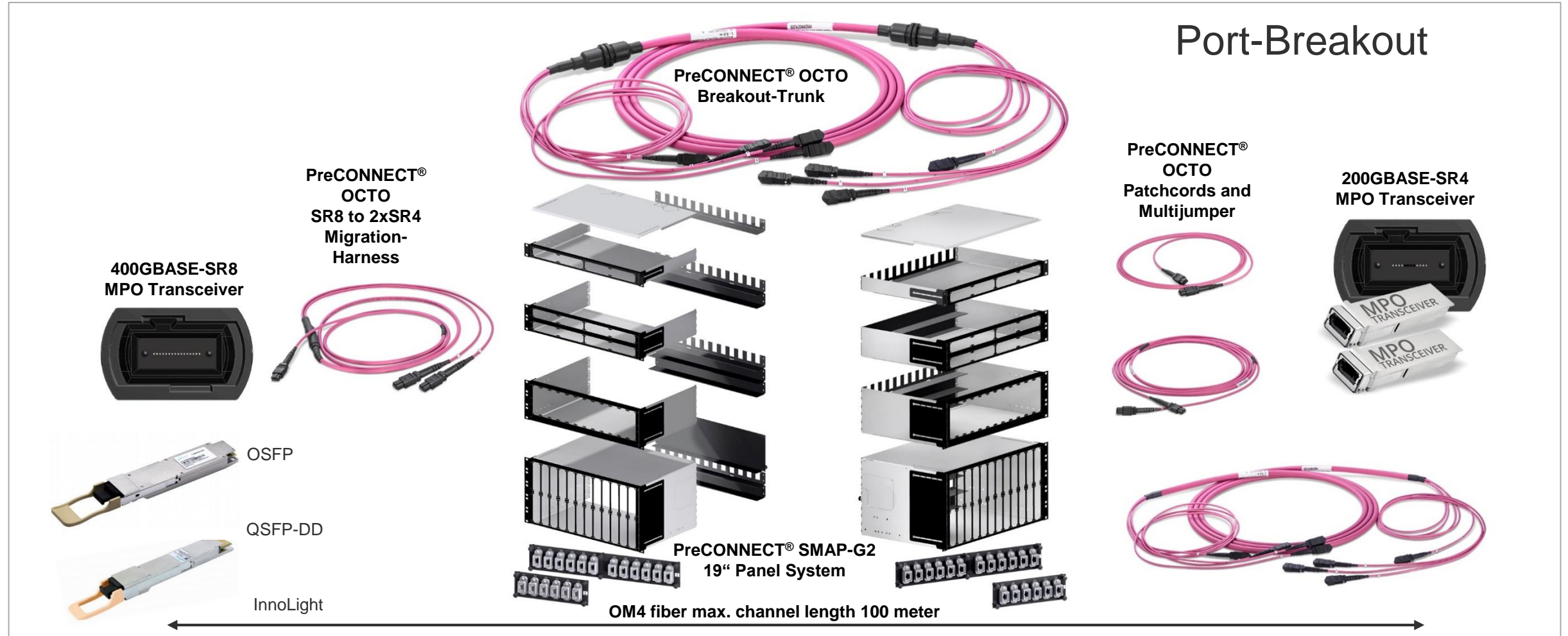
PreCONNECT® OCTO migration to 400GBASE-SR8

400GBASE-SR8 MPO-MPO point-to-point



PreCONNECT® OCTO migration to 400GBASE-SR8

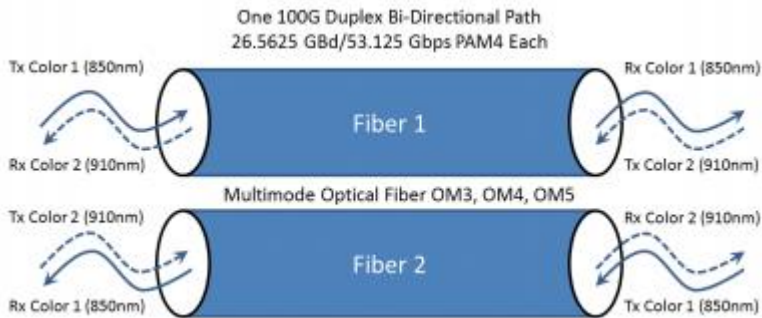
400GBASE-SR8 MPO to 2x200GBASE-SR4 MPO



400G BiDi MSA <https://www.400gbidi-msa.org/>

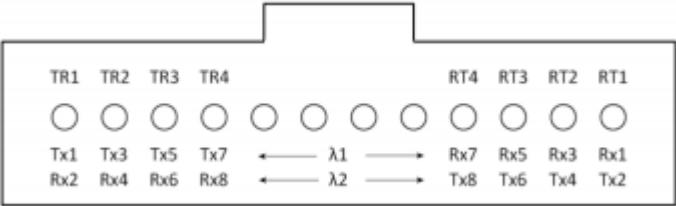
400GBASE-SR4.2

- The youngest MSA for 400G Multimode Transceivers
- Optical bidirectional technology allows each single fiber to carry signals in both directions, thereby improving fiber utilization relative to existing 400G MMF standards. For a 100G BiDi link, one fiber pair is required running 53.125 Gbps on each fiber in both directions for an aggregate of 106.25 Gbps. The 400G BiDi specification is a quad version of the 100G BiDi approach utilizing four fiber pairs, consistent with commonly installed infrastructure such as a 4+4 fiber MPO. For all BiDi implementations, only one laser is launched into each fiber end, simplifying optical design and keeping costs low.
- The optical interface defined by the 400G BiDi MSA is expected to be implementable in common industry form factor MSAs such as QSFP-DD and OSFP.
- *PreCONNECT® OCTO OM4 cabling system fits perfectly !*



Parameter	OM3 Value	OM4 Value	OM5 Value	Unit
Effective Modal Bandwidth at 850nm ^a	2000	4700	4700	MHz km
Effective Modal Bandwidth at 918nm	1210 ^b	1850 ^b	2890 ^a	MHz km
Power Budget (for max TDECQ)	6.6			dB
Operating Distance	70	100	150	m
Channel Insertion Loss ^c	1.8	1.9	2.0	dB

View into Transceiver MDI





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FOR MORE INFORMATION

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