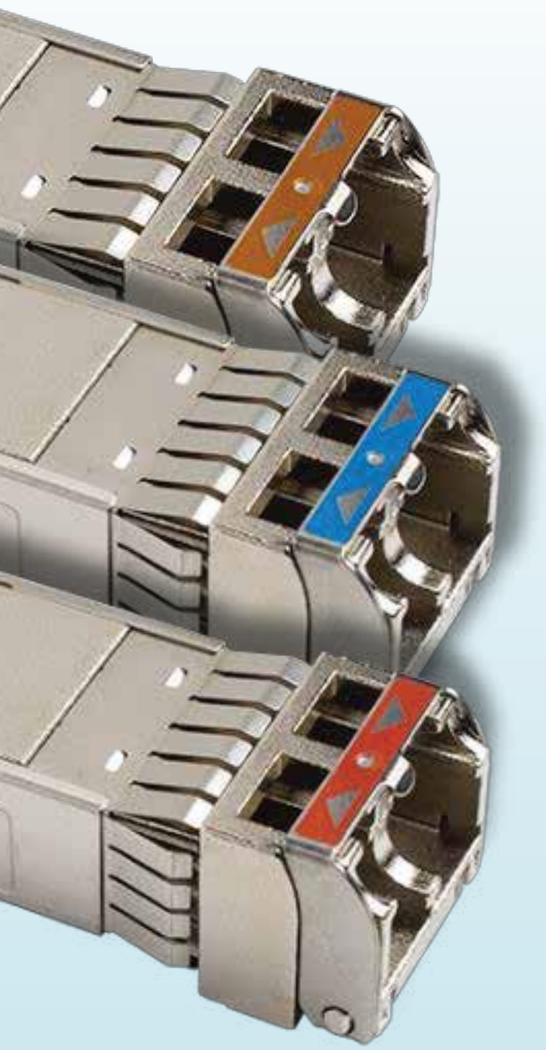

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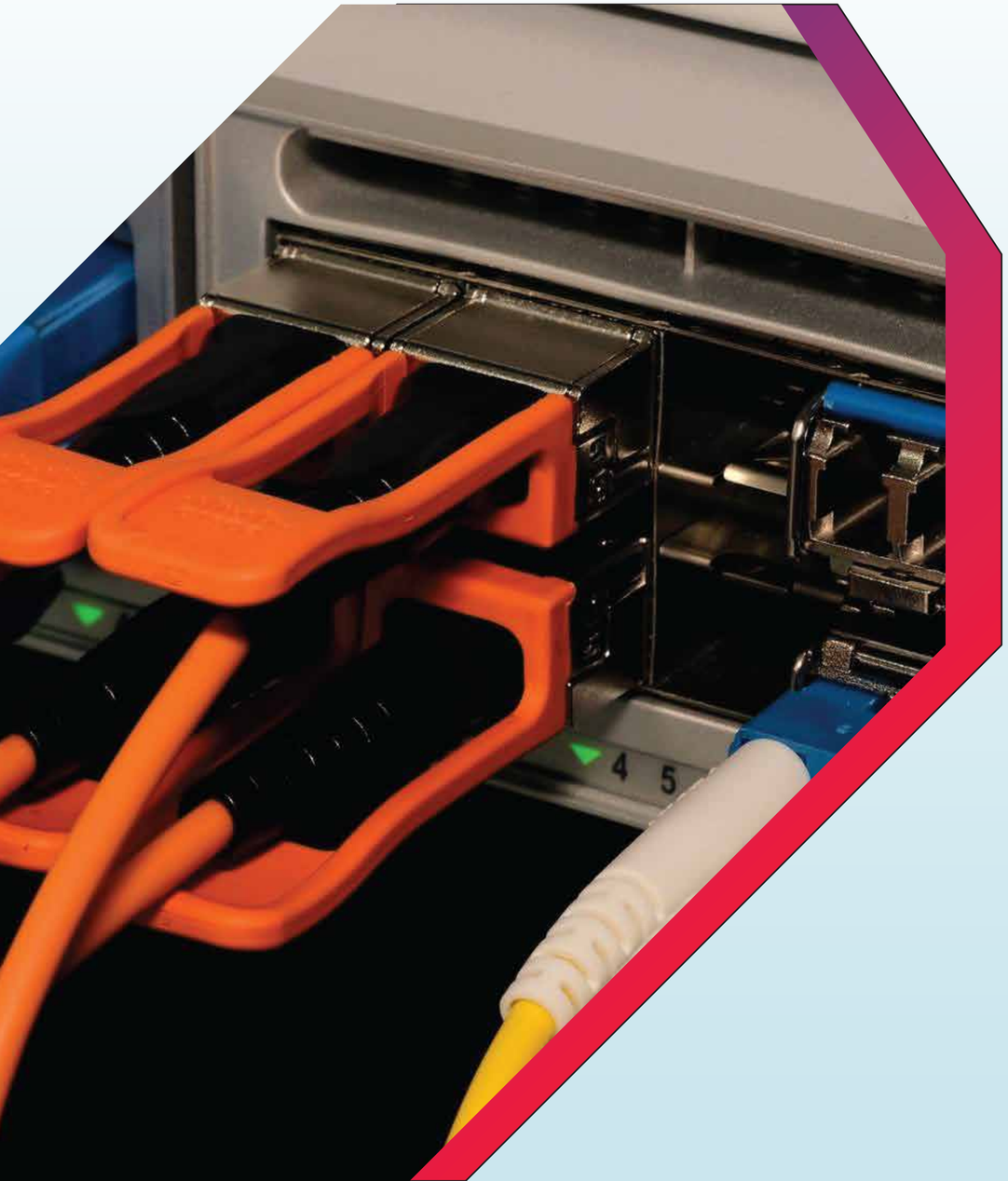
2025

829™ OPTICAL AND COPPER TRANSCEIVER PRODUCT LINE

- **Single source for quality and fast availability.**
- **On-site and lab tested for your environment.**
- **Full line of SFPs, DACs, and AOCs.**
- **TAA-compliant products.**
- **Firmware compatibility across lifecycles.**



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OPTICAL TRANSCEIVER CATEGORY

APPLICATION OF OPTICAL TRANSCEIVERS

Optical transceivers are essential in modern communication networks:

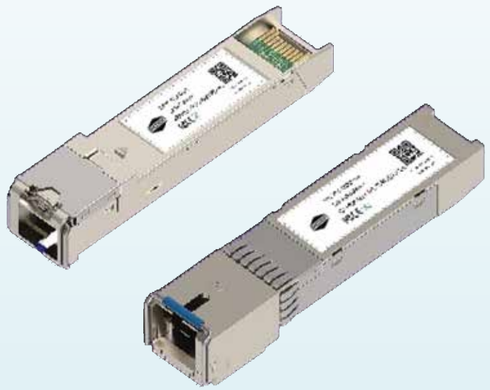
1. **High-Speed Data Transmission**: Optical transceivers enable data to be transmitted at very high speeds (up to 800 Gbps and beyond). This is critical for supporting bandwidth-intensive applications, like AI, cloud computing, streaming, and 5G networks.
2. **Long-Distance Communication**: Optical fiber carries signals over long distances (hundreds of kilometers) with minimal signal loss, unlike copper cables which degrade over distance. Optical transceivers support these long-distance transmissions.
3. **Efficient Signal Conversion**: Optical transceivers convert electrical signals (used by most devices) into optical signals for transmission over fiber optics and vice versa at the receiving end. This conversion facilitates seamless communication between signaling devices and fiber-optic infrastructure.
4. **Low Signal Interference**: Since optical signals are less susceptible to electromagnetic interference (EMI) and radio frequency interference (RFI) compared to electrical signals, using optical transceivers enhances signal integrity, particularly in environments with high EMI or RFI.
5. **Scalability and Flexibility**: Optical transceivers are modular, meaning they can be easily upgraded or replaced to support different data rates, transmission or network standards, making them highly adaptable for increasing network demands.

Overall, optical transceivers are critical for ensuring fast, reliable, and scalable communication in telecom, data centers, and networking infrastructures.

OVERVIEW | PRIMARY OPTICAL TRANSCEIVER CATEGORIES

Access Optical Transceivers

- GPON
- XGPON/XGSPON
- 10G EPON
- TWDM PON

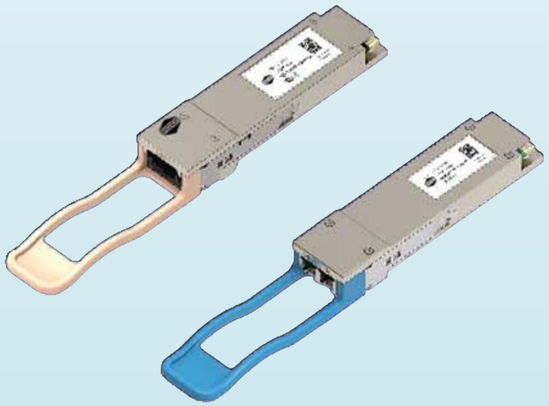


Transmission Optical Transceivers

- CFPx
- SFP+TDM/CWDM/DWDM/ Tunable
- XFP (TDM/CWDM/DWDM /Tunable)

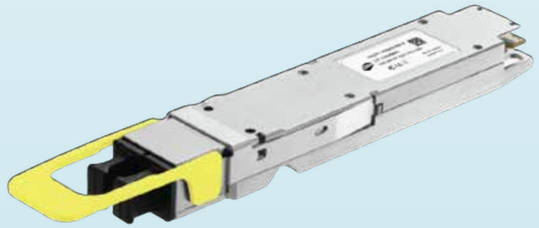
Wireless Optical Transceivers

- BIDI
- SFP+
- SFP28
- QSFP28



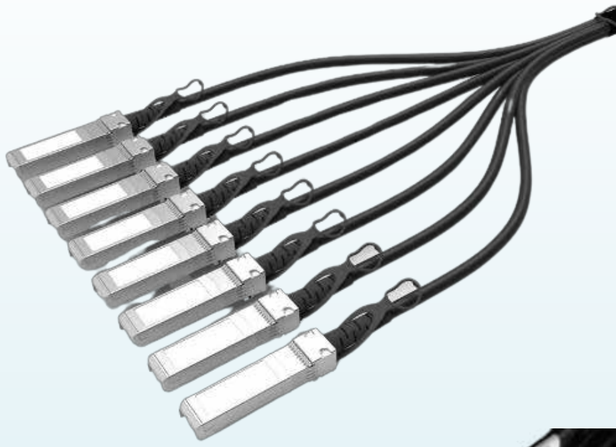
Data Center Optical Transceivers

- QSFP+ (SR4/PSM4/LR4)
- QSFP28 SR4/PSM4/CWDM4/LR4
- 10G/25G/40G/100G AOC
- SFP+/SFP28 SR/LR/ER



OVERVIEW | TRANSCEIVER CABLE CATEGORY

DAC

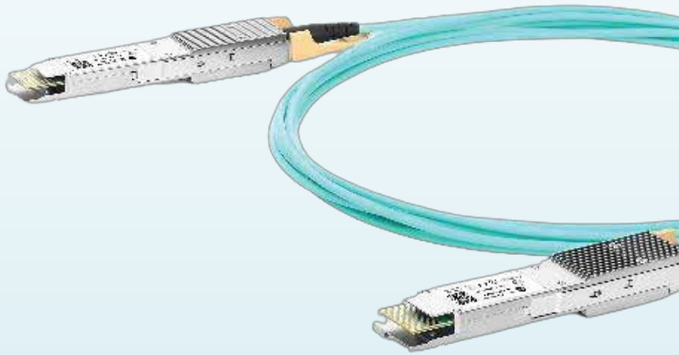


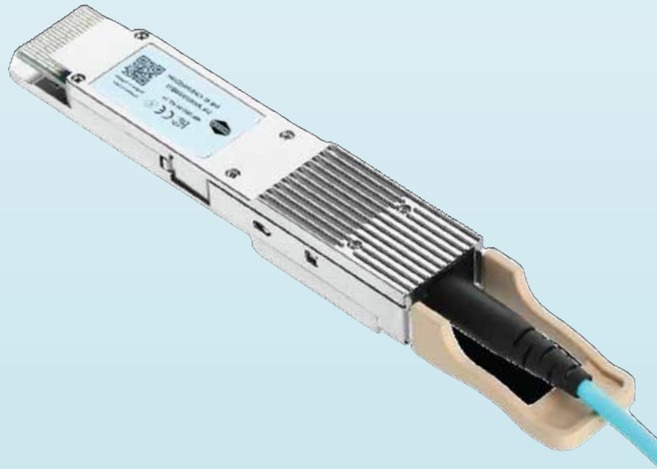
Direct Attach Copper (DAC) cables are a cost-effective solution for short-distance connections within data centers, offering low power consumption and high reliability. DAC cables come in various types, including passive and active. Passive DACs are suitable for distances up to 7 meters and do not require additional power. Active DACs, which have integrated electronics to boost signal strength, can reach up to 15 meters. In terms of form factors, DAC cables are available in several options such as SFP+, QSFP+, QSFP28, and QSFP-DD, accommodating a range of data rates. SFP+ DACs support 10Gbps, QSFP+ DACs support 40Gbps, QSFP28 DACs support 100Gbps, and QSFP-DD DACs can support up to 400Gbps. These variations ensure that DAC cables can meet the diverse requirements of modern networking environments, providing a flexible and efficient solution for high-speed data transmission over short distances.

OVERVIEW | TRANSCEIVER CABLE CATEGORY

AOC

Active Optical Cables (AOCs) are used for high-speed data transmission over longer distances than Direct Attach Copper (DAC) cables can achieve, typically ranging up to 100 meters. AOCs incorporate transceivers with active electrical components and optical fiber, offering the benefits of reduced electromagnetic interference, lower weight, and improved signal integrity. These cables are ideal for applications in data centers, high-performance computing (HPC), and AI installations where high bandwidth and long-distance connectivity are essential. AOCs come in various form factors such as SFP+, QSFP+, QSFP28, and QSFP-DD, supporting data rates from 10Gbps to 400Gbps. The integration of transceivers within AOCs ensures easy deployment and reliable performance, making them a preferred choice for connecting servers, switches, and storage devices within complex network environments.

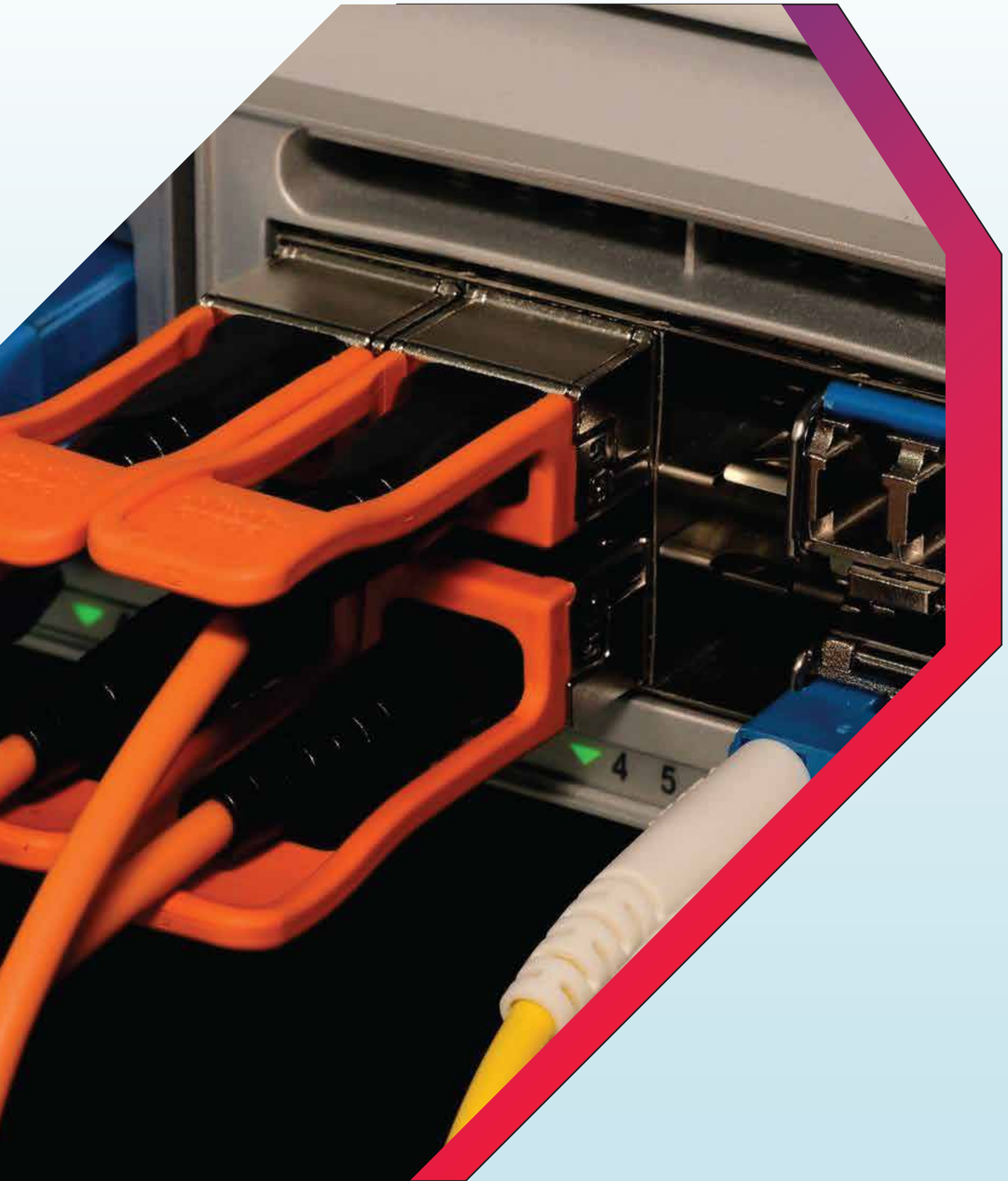




OVERVIEW | TRANSCEIVER CABLE CATEGORY

ACC/AEC

Active Electrical Cables (AECs) and Active Copper Cables (ACCs) are advanced cable solutions designed to meet the high-performance demands of AI and High Performance Computing (HPC) environments. These cables incorporate active electronic components to boost signal integrity and extend the reach of traditional copper connections, making them suitable for short to medium distances where low latency and high data rates are critical. These cables are commonly deployed in high-speed QSFPDD or OSFP based cables for platforms such as NVIDIA DGX. ACC cables are commonly used up to 3m, while AEC can reach 3-7m.



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UNDERSTANDING THE SPECIFICATIONS

UNDERSTANDING THE BASIC SPECIFICATION

There are multiple variants of pluggable transceivers, they can be identified based on 8 main parameters that define the basic technical specifications

1. Form Factor: The physical size and shape of the transceiver module
2. Data Rate: The speed at which data is transmitted, measured in Gbps or Mbps .
3. Protocol: The communication standard or language the transceiver follows, such as Ethernet or Fiber Channel
4. Transmission Type : The method used for data transmission, such as BIDI, CWDM, DWDM, Single-Lambda, or Coherent. This covers the wavelength .
5. Reach: The maximum distance over which the transceiver can transmit data reliably
6. Media Type: The type of optical fiber the transceiver uses for data transmission – it can also be copper based.
7. Temp Range: The range of operating temperature within which the transceiver functions reliably
8. Connector: The physical fiber or copper interface that connects the transceiver to the network and cabling system

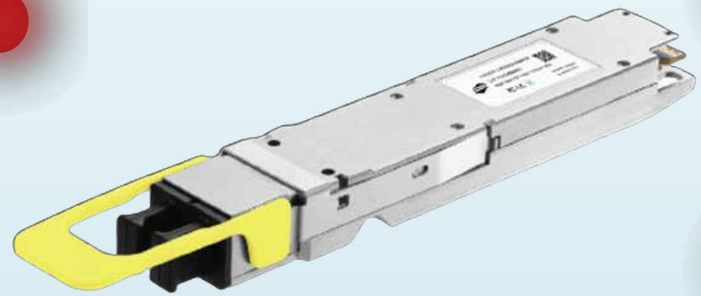
Reviewing these 8 different parameters, we can determine which specific transceiver the customer needs.
In many cases a specific standard transceiver type is requested, and these parameters can also be checked to ensure that the actual requirements do not deviate from the standard specifications.

UNDERSTANDING THE BASIC SPECIFICATION

Connector

Form Factor

Temp Range



Data Rate

Media Type

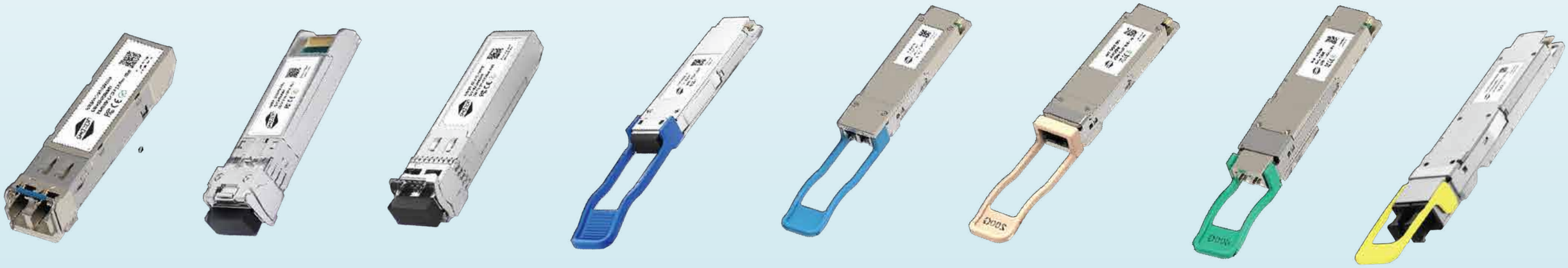
Protocol

Reach

Transmission Type

FORM FACTOR

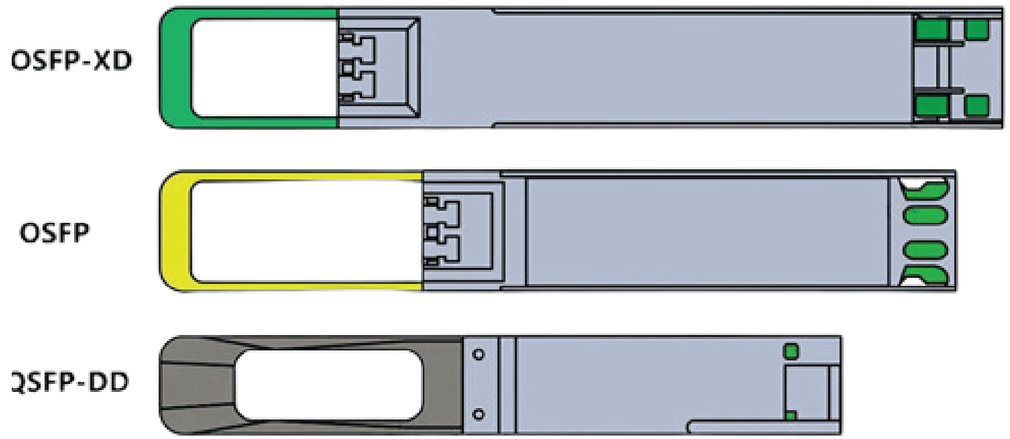
Form factors refer to the physical size, shape, and electrical interface of optical transceivers. Common form factors include SFP, SFP+, QSFP, and QSFP28, each designed to support different data rates and applications. Newer form factors include QSFP56 and SFP-DD, providing higher data throughput and increased density. Identifying the required form factor is essential in determining compatibility with networking equipment and plays a crucial role in optimizing the space and performance of data center and network infrastructures.

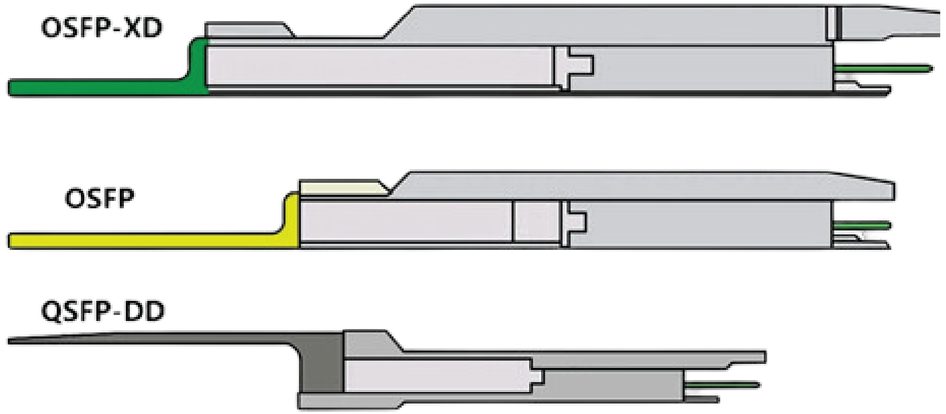


SFP **SFP+** **SFP28** **QSFP+** **QSFP28** **QSFP56** **QSFP-DD** **OSFP**

FORM FACTOR

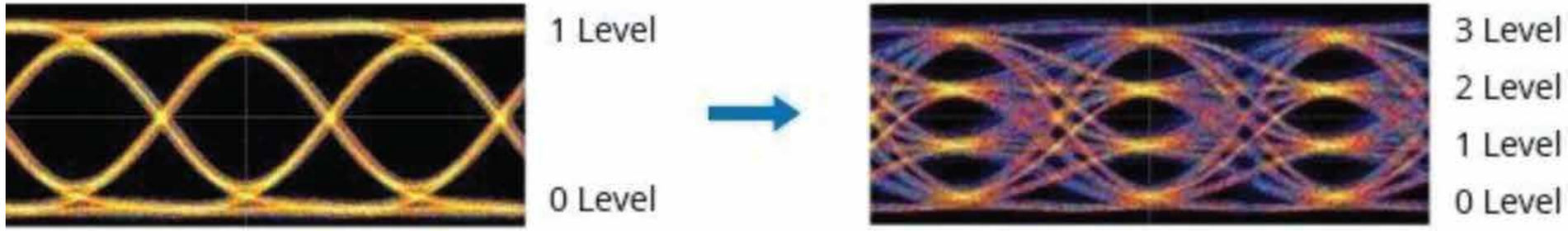
The QSFP-DD, OSFP, and OSFP-XD form factors may look quite similar, but each offers unique advantages in terms of size and electrical design. Here is a side-by-side comparison to highlight the differences between these form factors.
As we see speeds increase and technology improve, we will also see increased speeds in the SFP-size form factors with Terabit Ethernet being the next logical step. In the future, we will see new variations with CPO (Co-Packaged Optics) becoming a major topic in the industry. Different options and designs are emerging, such as Cisco's ELSFP, a pluggable variant that integrates into the CPO design.





DIFFERENCES IN THE OPTICAL TRANSCEIVERS / SFP (SMALL FORM PLUGGABLE)

Encapsulated Type	QSFP DD(Double Density)	QSFP56	QSFP28	QSFP+
Year	2017	2019	2014	2010
Electrical Channel	8	4	4	4
Single Channel Rate	25Gbps/50Gbps	50Gbps	25Gbps	10Gbps
Modulation Technique	NRZ/PAM4	PAM4	NRZ	NRZ
Compatibility	QSFP+/QSFP28/QSFP56	QSFP+/QSFP28	QSFP+	-

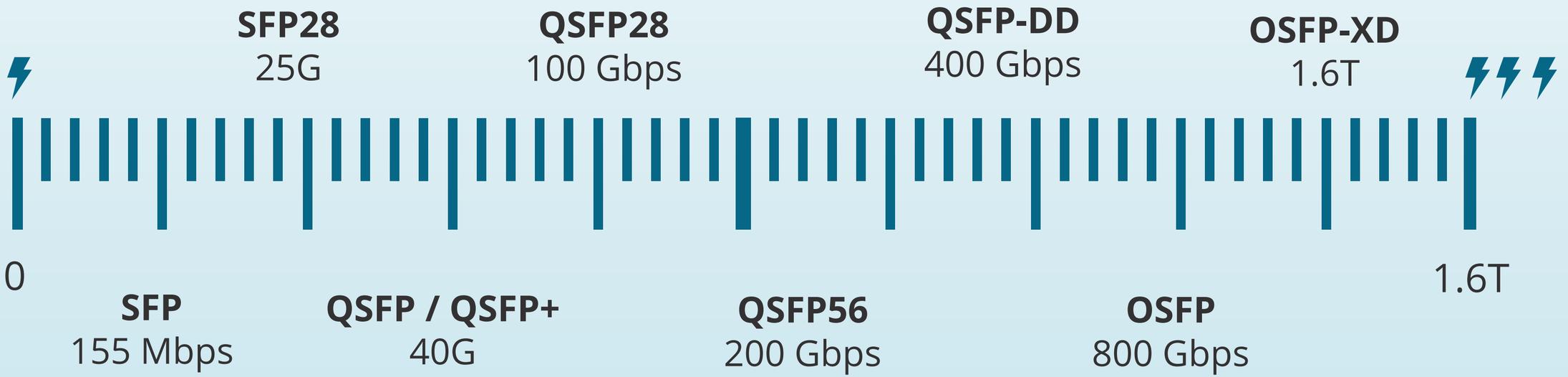


NRZ: 1 bit per clock cycle

PAM4: 2 bits per clock cycle

DATA RATE

Data rates refer to the speed at which optical transceivers can transmit and receive data. They range from 155 Mbps in older models like SFP to 400 Gbps in newer models like QSFP-DD and 800G in OSFP with even more significant speed increases in development. Higher data rates, such as those supported by QSFP28 (100 Gbps) and QSFP56 (200 Gbps), are crucial for meeting the demands of modern data centers and high-performance networks. Selecting the appropriate data rate is essential for ensuring efficient and reliable network performance.



PROTOCOL

PROTOCOL	PRIMARY USE	KEY CHARACTERISTICS
Ethernet	Data centers, enterprise networks, wide area networks	General-purpose, widely compatible, high-speed evolution
Fibre Channel (FC)	Data storage (SAN)	High reliability, low latency, primarily used in storage area networks
InfiniBand (IB)	High-performance computing (HPC), AI clusters	Ultra-low latency, RDMA support, high throughput for large-scale data
SONET/SDH	Telecom-grade optical transport networks	High stability, widely used by telecom operators
OTN (Optical Transport Network)	Telecom backbone networks, long-distance transmission	Strong fault tolerance, supports multiplexing of various protocols

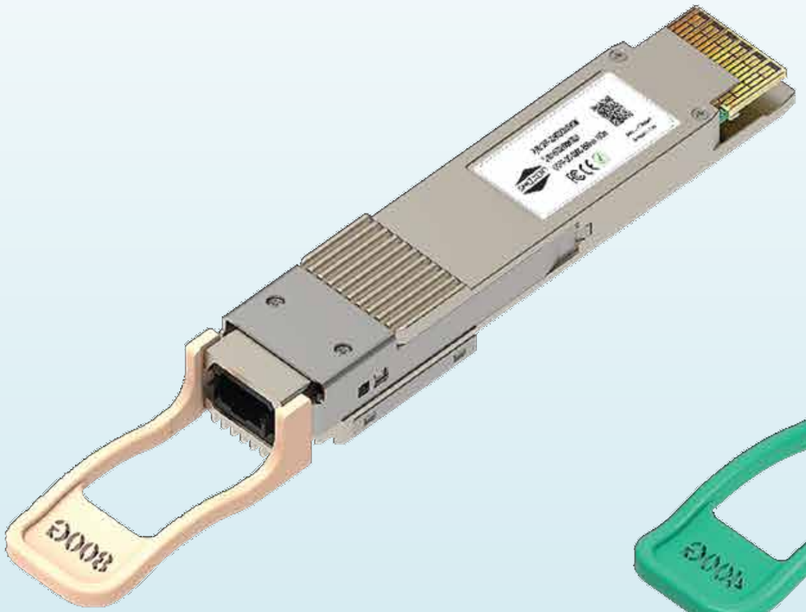
TRANSMISSION TYPE

TRANSMISSION TYPE	DESCRIPTIONS	TYPICAL USES
Single-mode Fiber (SMF)	Uses a narrow core (8-10μm) for long-distance transmission. Operates at wavelengths 1310nm, 1550nm, etc.	Long-distance, backbone networks
Multi-mode Fiber (MMF)	Uses a wider core (50μm or 62.5μm) for short-distance, high-speed transmission. Operates at 850nm.	Short-distance, data centers
Wavelength Division Multiplexing (WDM)	Multiplexes multiple optical signals with different wavelengths on a single fiber. CWDM (Coarse) and DWDM (Dense). Long-distance, high-capacity networks	Long-distance, high-capacity networks
Direct Attach Copper (DAC)	Copper cable with integrated transceiver modules on both ends, for short-distance, high-speed connections.	Server interconnects in racks
Active Optical Cable (AOC)	Optical fiber with integrated transceiver modules on both ends, for high-speed, short-distance connections.	Data centers, HPC

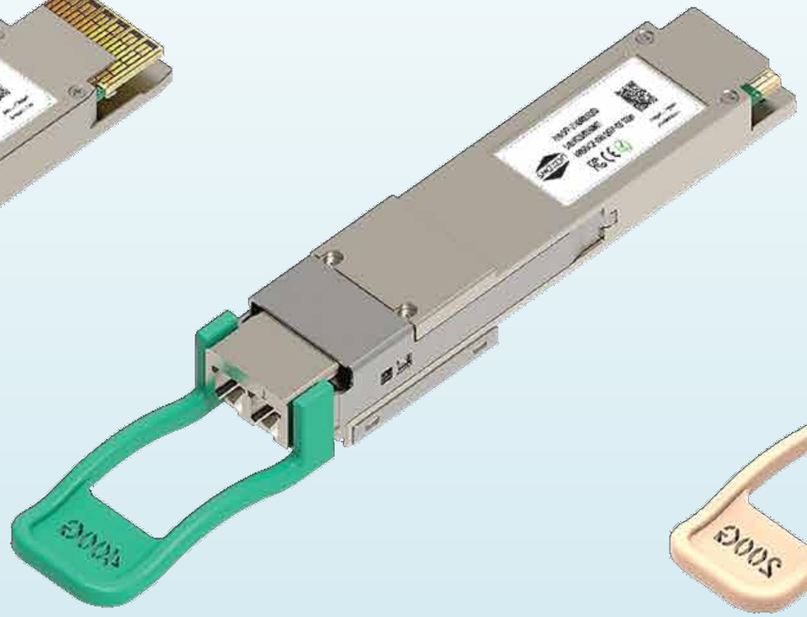
TRANSMISSION TYPE

PROTOCOL	PRIMARY USE	KEY CHARACTERISTICS
Simplex	Single fiber for one-way transmission	
Duplex	Two fibers, one for transmission (Tx) and one for reception (Rx)	
BiDi (Bidirectional)	Single fiber for both transmission and reception using different wavelengths (e.g., 1310nm Tx, 1490nm Rx)	
NRZ (Non-Return to Zero)	Simple on-off encoding, 1 bit per clock cycle	Up to 25Gbps
PAM4 (Pulse Amplitude Modulation 4-level	Uses 4 amplitude levels to encode 2 bits per clock cycle	50Gbps, 100Gbps, 400Gbps

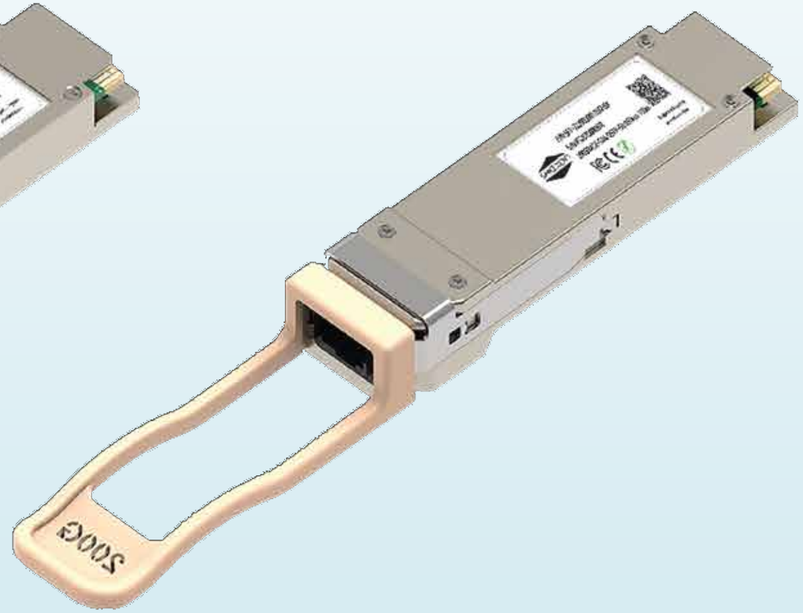
PRODUCTS: TRANSCEIVERS-SUMMARIZED BY BIT RATE



800G



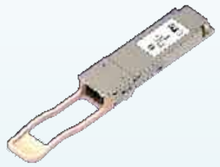
400G



200G

PRODUCTS: TRANSCEIVERS-SUMMARIZED BY BIT RATE

100G

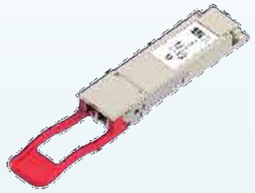


QSFP28 SR4

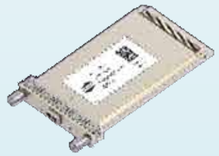
QSFP28 PSM4

QSFP28 CWDM4

QSFP28 LR4



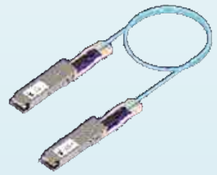
QSFP28 ER4 Lite



CFP LR4

CFP2 LR4

CFP2 ER4



QSFP28 AOC

50G

QSFP28 PAM4 LR

QSFP28 PAM4 ER

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PRODUCTS: TRANSCEIVERS-SUMMARIZED BY BIT RATE

40G

QSFP+ SR4 AOC

QSFP+ PSM4

QSFP+ CWDM4

QSFP+ LR4

QSFP+

25G

SFP28 SR AOC

SFP28 LR(C/I)

SFP28 ER (C/I)

SFP28 BIDI (C/I)

SFP28

SFP28 CWDM (C/I)

SFP28 DWDM (C/I)

SFP28 LWDM (C/I)

PRODUCTS: TRANSCEIVERS-SUMMARIZED BY BIT RATE

10G-1G

10G SFP+ CWDM/DWDM

10G SFP+ BIDI

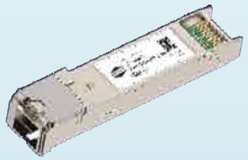
10G XFP

10G XFP BIDI

10G SFP+

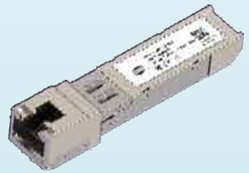
SFP28 SR AOC

6G SFP+ BIDI



2.5G SFP

1.25G SFP



1.25G

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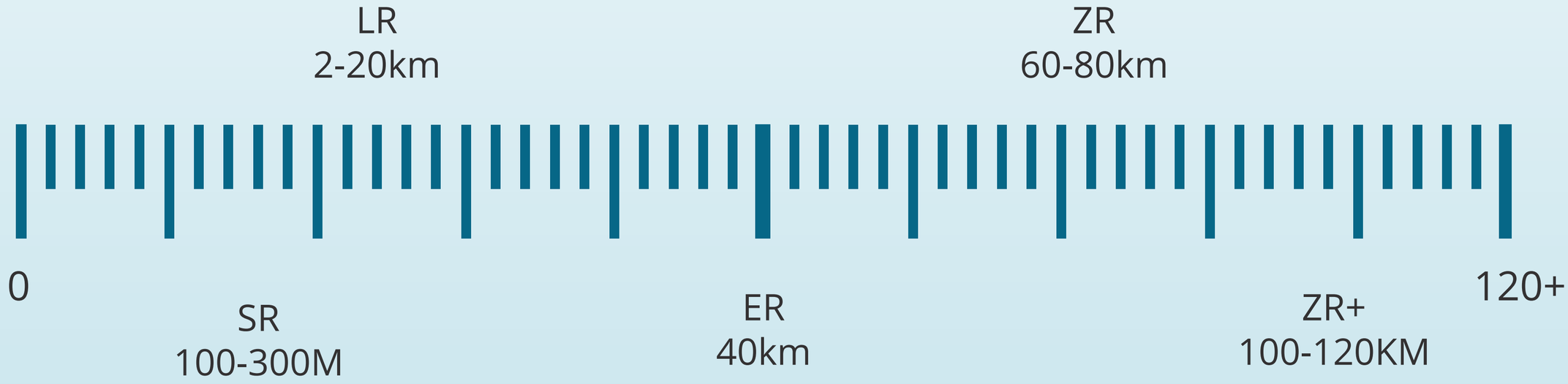
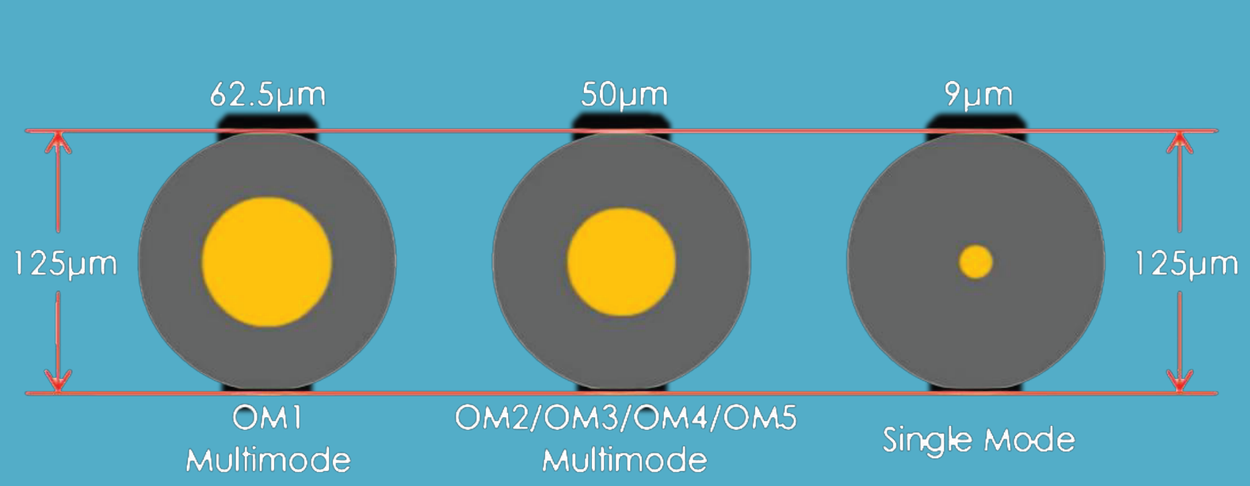
REACH

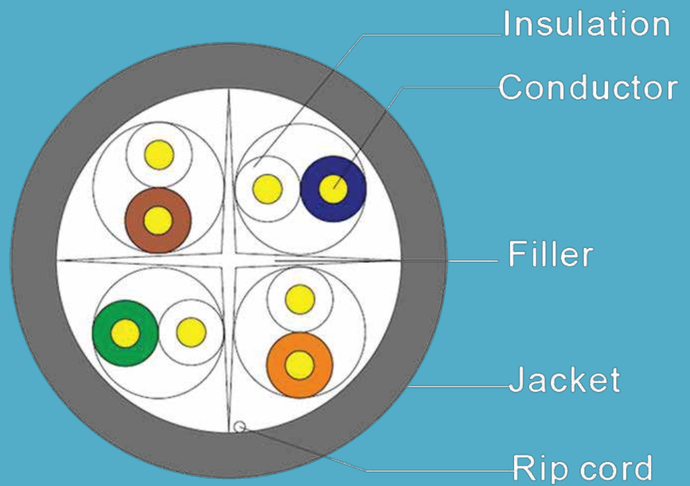
The reach of an optical transceiver refers to the maximum distance over which it can reliably transmit data signals through fiber optic cables. It varies depending on factors such as the type of fiber used, the transmission power of the transceiver, and the specific transmission type (e.g., BIDI, CWDM, DWDM). Optical transceivers are categorized into various reach classifications, such as short reach (SR), intermediate reach (IR), long reach (LR), and extended reach (ER), ZE best range (ZR).each designed to meet different distance requirements in networking applications. Choosing the appropriate reach is crucial for meeting network design requirements and efficient data transmission across networks.



MEDIA TYPE

Different media types play crucial roles in network infrastructure, each offering distinct advantages depending on the application's specific requirements. Traditionally, multimode fiber was favored for short distances, while singlemode fiber was preferred for longer distances. However, increasing data rates have raised the demands on fiber optics, leading to the introduction of the original OM1 and later new multimode fiber variants such as OM3, OM4, and OM5. This evolution has also prompted the introduction of short-distance singlemode optics to meet modern networking needs. In environments such as servers with fixed ports, copper cables continue to be widely used due to their reliability and cost-effectiveness.





TEMPERATURE RANGE

Temperature ranges are critical considerations in the deployment of optical transceivers, ensuring optimal performance and longevity. These modules are designed to operate within specific temperature ranges, typically ranging from commercial (0°C to 70°C) to industrial (-40°C to 85°C) temperatures. Choosing the appropriate temperature range ensures reliability and stability in diverse environmental conditions across various applications.

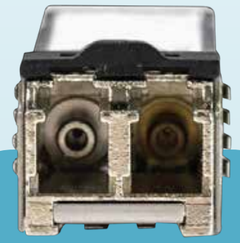
Commercial Grade
0°~70°C

Extended Grade
-20° ~ 70°C

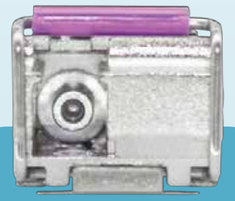
Industrial Grade
-40°~85°C

CONNECTOR TYPES

The LC Duplex connector is the most common connector type found in transceivers, although other variants like SC Duplex are still used in legacy devices such as X2 and XENPAK, and also as Simplex in 1G BIDI SFP modules. With the increasing demand for high speed optics, connectors like MPO/MTP are becoming more prominent, along with newer options such as the CS connector and the dual application of MPO and CS connectors. Selecting the appropriate transceiver often hinges on compatibility with existing cabling infrastructure or specific application requirements. Cost considerations also play a crucial role, as specialized connectors like CS typically come at a premium price point due to their patented design and more recent deployment.



LC Duplex



LC Simplex

SC Simplex

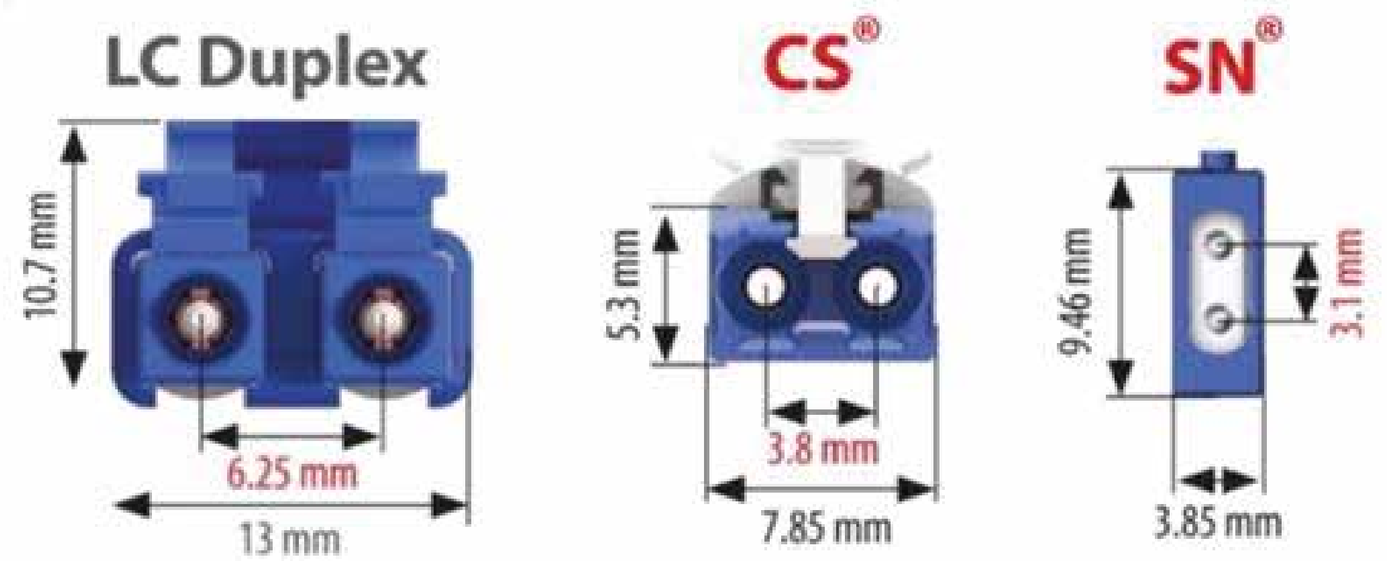
SC Duplex

RJ45

MPO MTP

VSFF CONNECTOR TYPES

VSFF (Very Small Form Factor) connectors are the latest innovation in the field of pluggable transceivers, designed to address the growing need for higher port density and increased data transmission rates. These connectors, including types like CS, SN, and MDC, are significantly smaller than traditional connectors, allowing for more connections within the same physical space. This advancement is particularly beneficial for high-density data center environments and next-generation network infrastructure, where maximizing space and performance is critical. The introduction of VSFF connectors enables more efficient and scalable network solutions, meeting the demands of modern high-speed data applications.



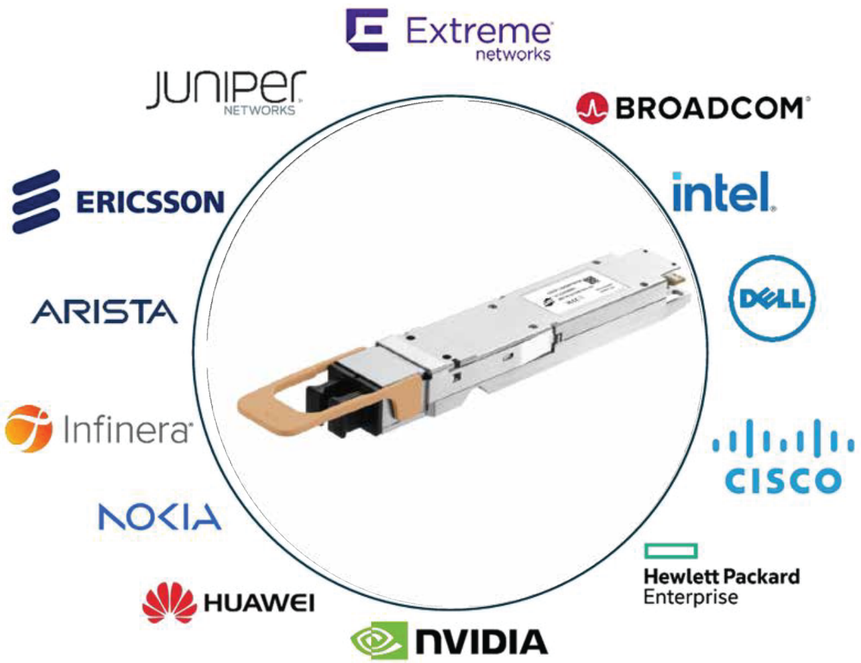
COMPATIBILITY

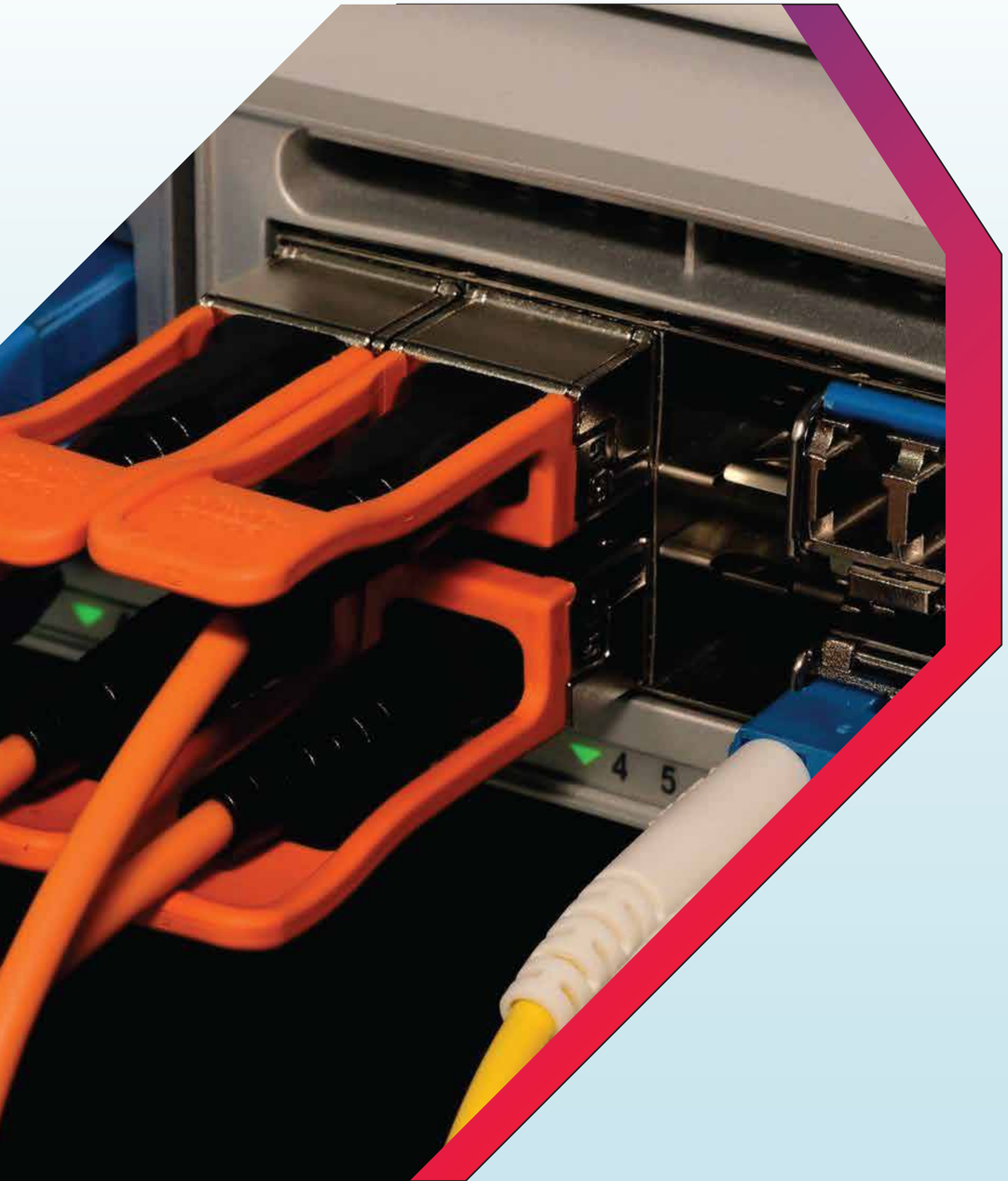
Transceiver compatibility is a crucial aspect of network infrastructure, ensuring that different components within a system can effectively communicate and function together. Compatibility in transceivers involves matching the optical module with the equipment's specifications, including its form factor, data rate, protocol, and connector type. To ensure seamless operation, transceivers must align with the equipment vendor's requirements. This means that the transceiver's firmware, electrical design, and optical characteristics must be compatible with the host device, such as switches, routers, or servers. Many vendors adhere to industry standards to guarantee that their transceivers work universally across various platforms, but proprietary designs can also come into play, adding an extra layer of consideration.

To ensure compatibility, we need to clarify the following:

- Are the hardware specifications of the transceiver compatible with the equipment vendor's requirements, and is the requested type supported by the equipment?

- Does the equipment vendor require specific EEPROM or coding for the transceiver to be accepted?





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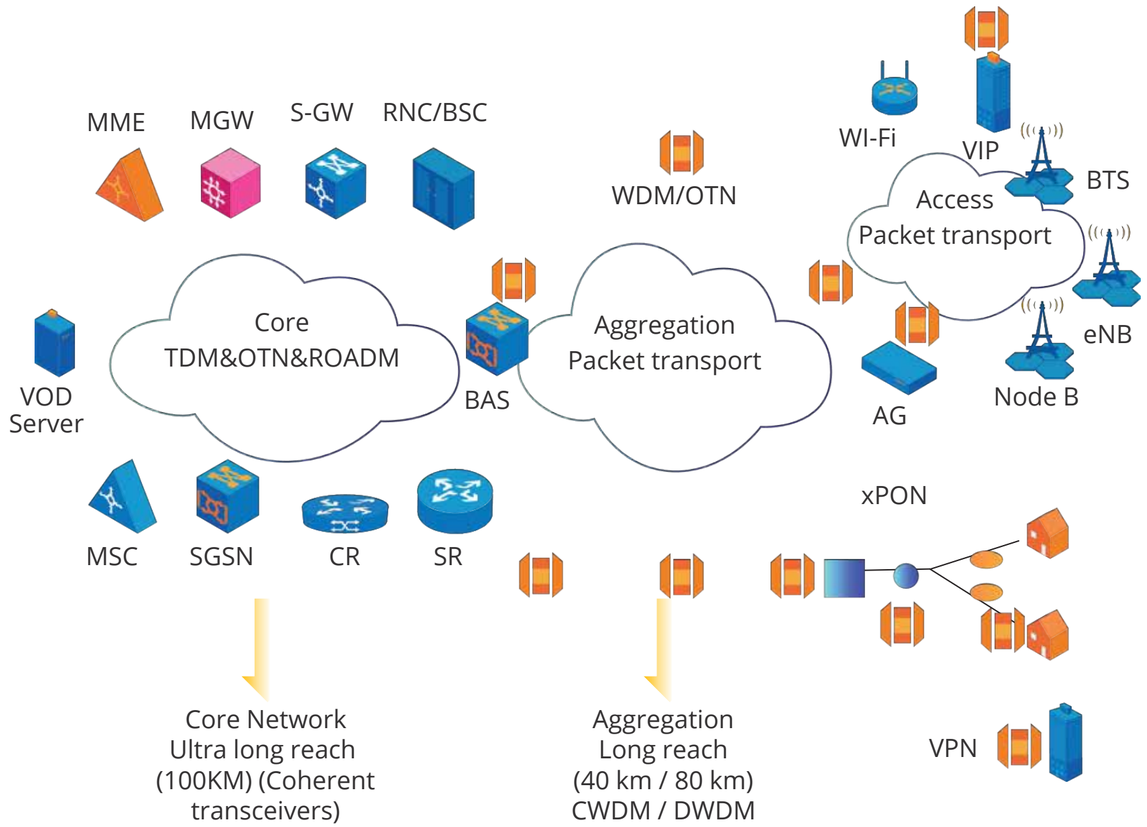
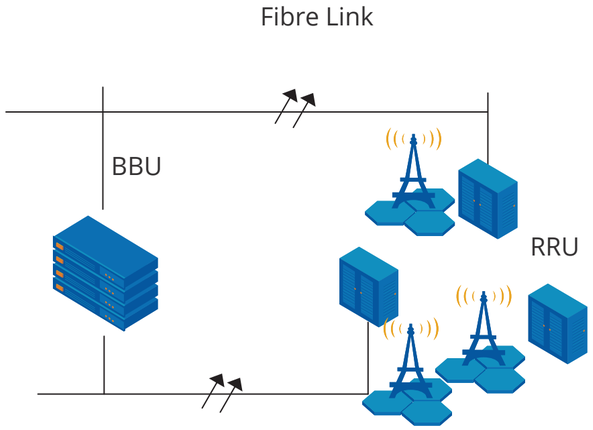
UNDERSTANDING THE APPLICATION SCENARIO

APPLICATION SCENARIO

Operator Network Topology



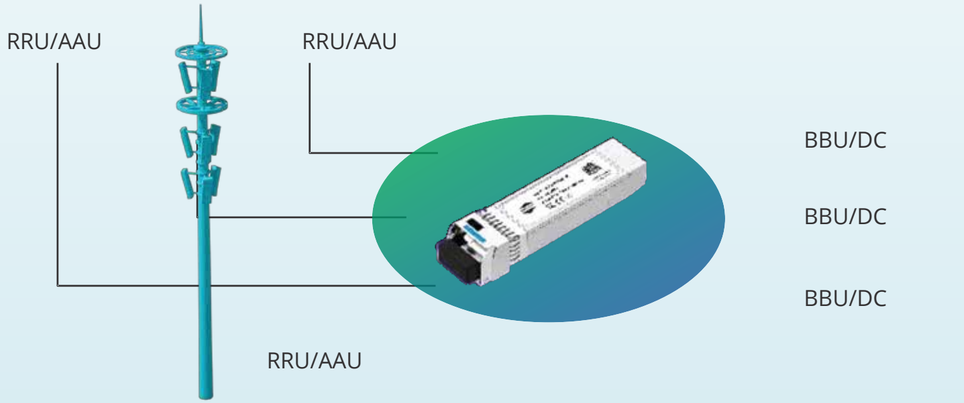
Wireless (fronthaul, backhaul)

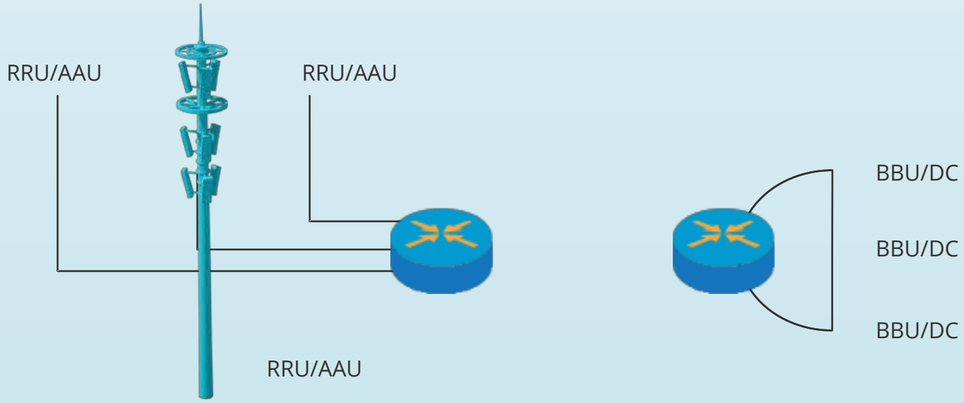


APPLICATION SCENARIO & REQUIREMENTS
5G fronthaul optical transceivers (for wireless base stations)

Fibre direct connection scenario

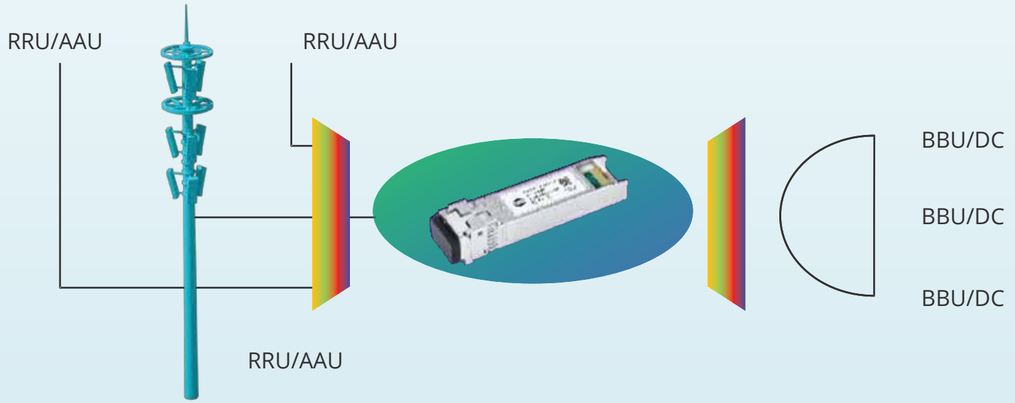
- 25Gb/s TDM transceiver, Duplex or BIDI up to 300m or 10km





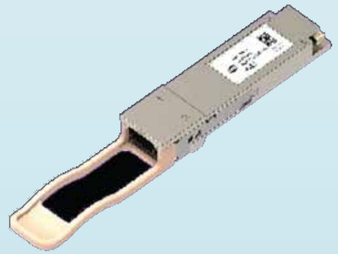
Passive (point-to-point) WDM scenario

- 10Gb/s or 25Gb/s WDM transceivers



Active WDM/OTN/SPN scenario

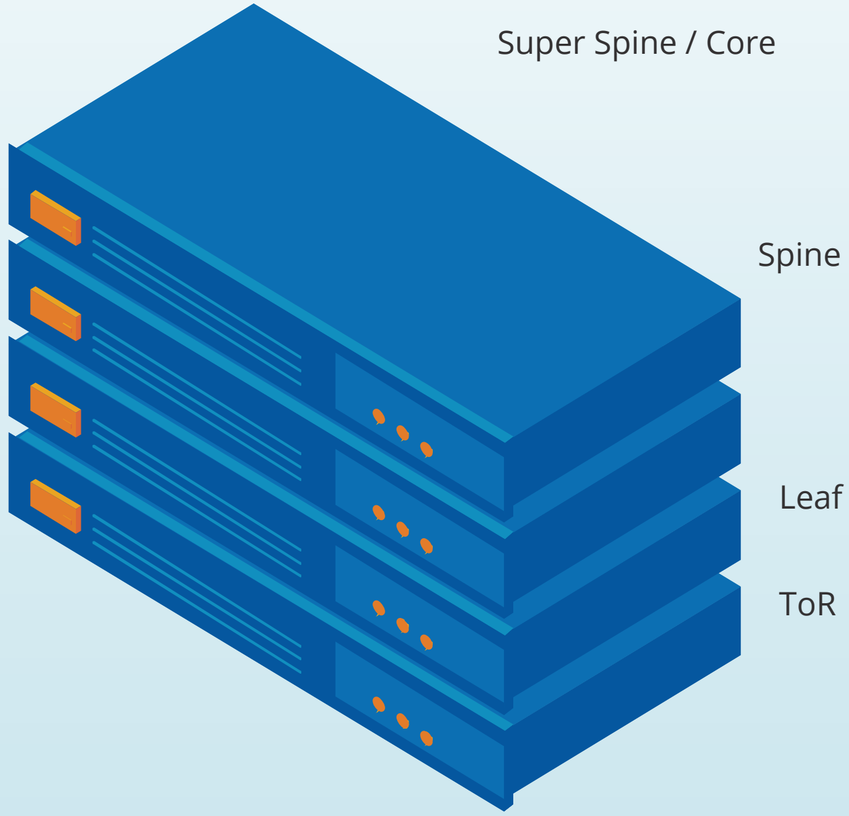
- Requires 10Gb/s or 25Gb/s short distance TDM transceiver
- To link WDM/OTN/SPN equipment, 25/100Gb/s dual fibre or bidi WDM transceiver is needed



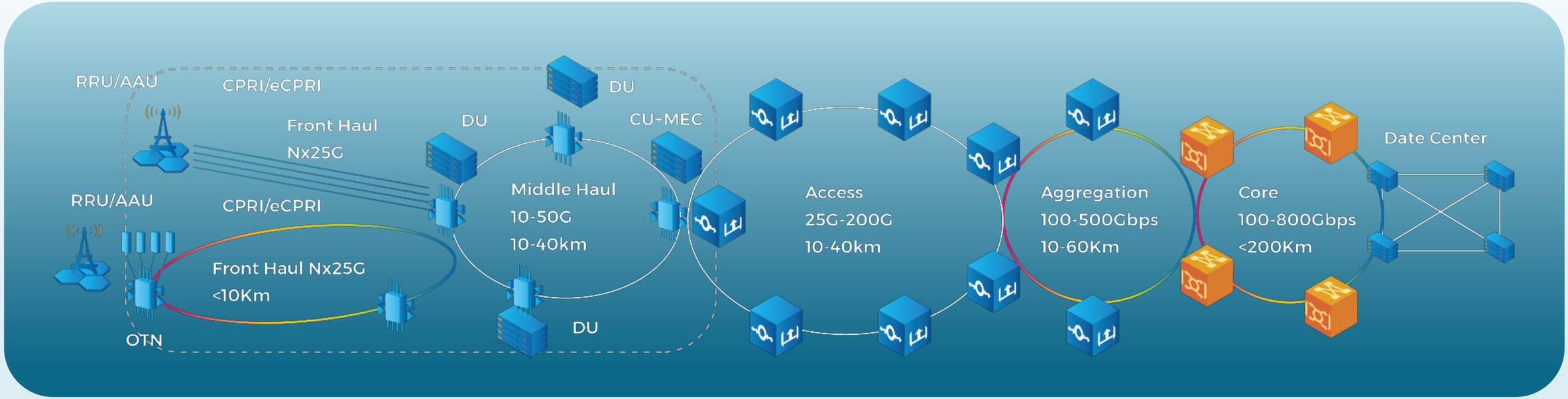
APPLICATIONS OF OPTICAL MODULES IN VARIOUS DATA CENTER SCENARIOS

	Small	Medium	Large
Inter DC 20km-metro	10G/40G SMF	100G/200G SMF	200G/400G SMF
Spine-core 500-2km	40G SMF	100G SMF	200G/400G SMF
Leaf-spine 300-2km	40G MMF or SMF	100G SMF	200G/400G SMF
Tor-Leaf 100m-500m	40G MMF or SM	100G MMF or SMF	200G/400G SMF
Server-Top of Rack 1m-30m	10G/25G DAC or AOC	25G DAC or AOC	50G DAC or AOC

Core Network / Inter Data Center



SOLUTIONS & PRODUCTS: TRANSCEIVERS FOR 5G FRONTHAUL WIRELESS



25G LR/ER

- 1310nm
- I-temp
- Up to 10km/40km
- PIN & DML (uncooled)

25G CWDM

- 6/12 wavelengths
- I-temp
- Up to 10km
- PIN & DML (uncooled)

25G LAN-WDM

- 9 wavelengths 1287nm/1291nm/1296nm/ 1300nm/1305nm/1310nm
- I-temp
- 25km, with APD & EML
- 20km, with APD & DML

25G DWDM

- C-band DWDM
- E-temp (-20 to 85 □)
- Up to 15km
- APD & EML (cooled)

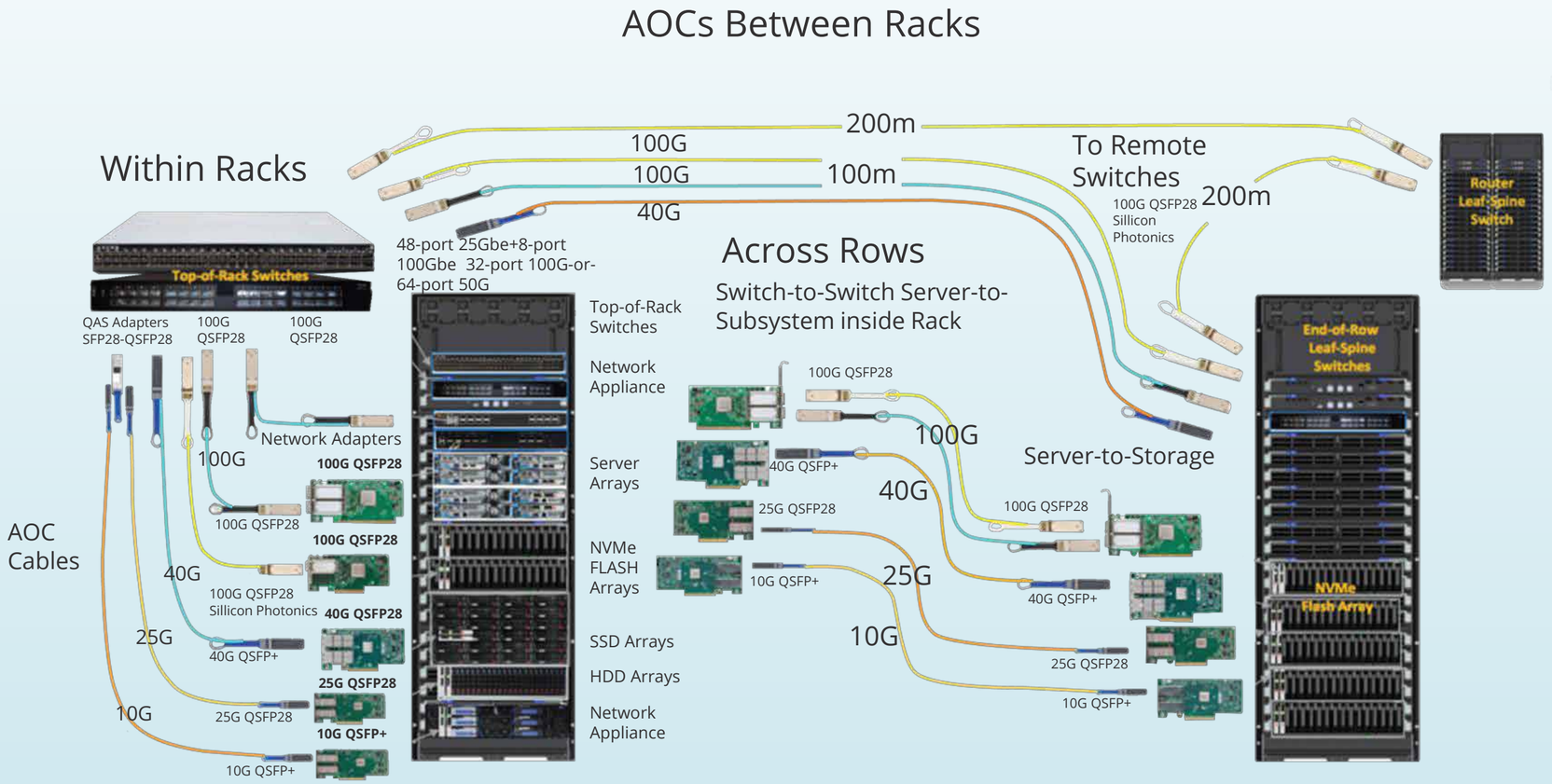
25G BiDi

- I-temp
- Targets 10km/30km
- DML & PIN
- DDM support
- 1270nm/1330nm
- 1270nm/1310nm

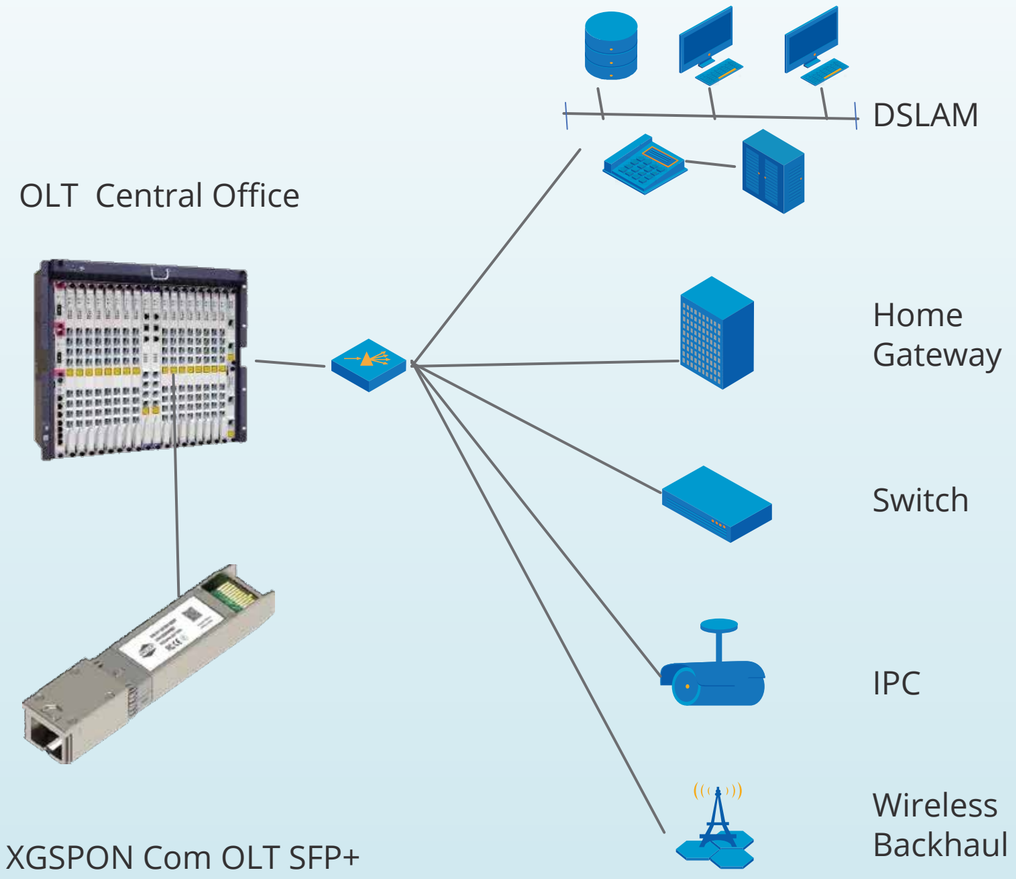
DATA CENTER AOC PRODUCTS

Shaxon AOCs available:

- 10G SFP+ AOC
- 25G SFP28 AOC
- 40G QSFP+ AOC
- 100G QSFP28 AOC
- 40G Breakout AOC
- 100G Breakout AOC
- 200G Breakout AOC
- 400G Breakout AOC
- 800G Breakout AOC



SOLUTIONS & PRODUCTS: TRANSCEIVERS FOR 10G PON



XGSPON Combo OLT SFP+

Key Features

- XGSPON Combo PON OLT SFP+
- 5-8dBm @ 1577nm. High power
- -29dBm Sensitivity @1270nm
- E-temp (-20 to 85 □)
- Saves space and deployment cost

Enablers

- Mitsubishi EML
- In-house 1490/1270/1310 TO
- In-house OSA
- In-house SMT

ACCESS OPTICAL MODULE

Passive Optical Network (PON) is a fiber-optic telecommunication technology used to provide broadband network access to end customers. It employs passive splitters to divide the optical signal from a single optical fiber into multiple outputs, serving multiple premises. The main PON technologies are: GPON (Gigabit PON): Supports downstream speeds up to 2.5Gbps and upstream speeds up to 1.25Gbps. XGS-PON (10 Gigabit Symmetric PON): Provides symmetrical speeds of 10Gbps for both downstream and upstream. PONs are cost-effective because they use passive components and require less fiber and hardware than traditional point-to-point architectures. They are widely used in FTTH (Fiber to the Home) and FTTB (Fiber to the Building) deployments.

XGSPON OLT

- TX:1577nm/ RX:1270nm ;
- Transmission rate :10Gbps;
- The Class B+/C+ standard ;
- 10G Burst mode burst-mode ;
- Transmission distance: 20KM;
- SFP+ Hot-plug;

XGSPON OLT

- TX:1577nm/ RX:1270nm ; RX:1310nm/1270nm;
- Transmission rate :10Gbps/2.5Gbps;
- The Class D1/D2 standard ;
- 10G/2.5G Burst mode burst-mode ;
- Transmission distance: 20KM;
- SFP+ Hot-plug;

PON PRODUCT DEVELOPMENT ROADMAP

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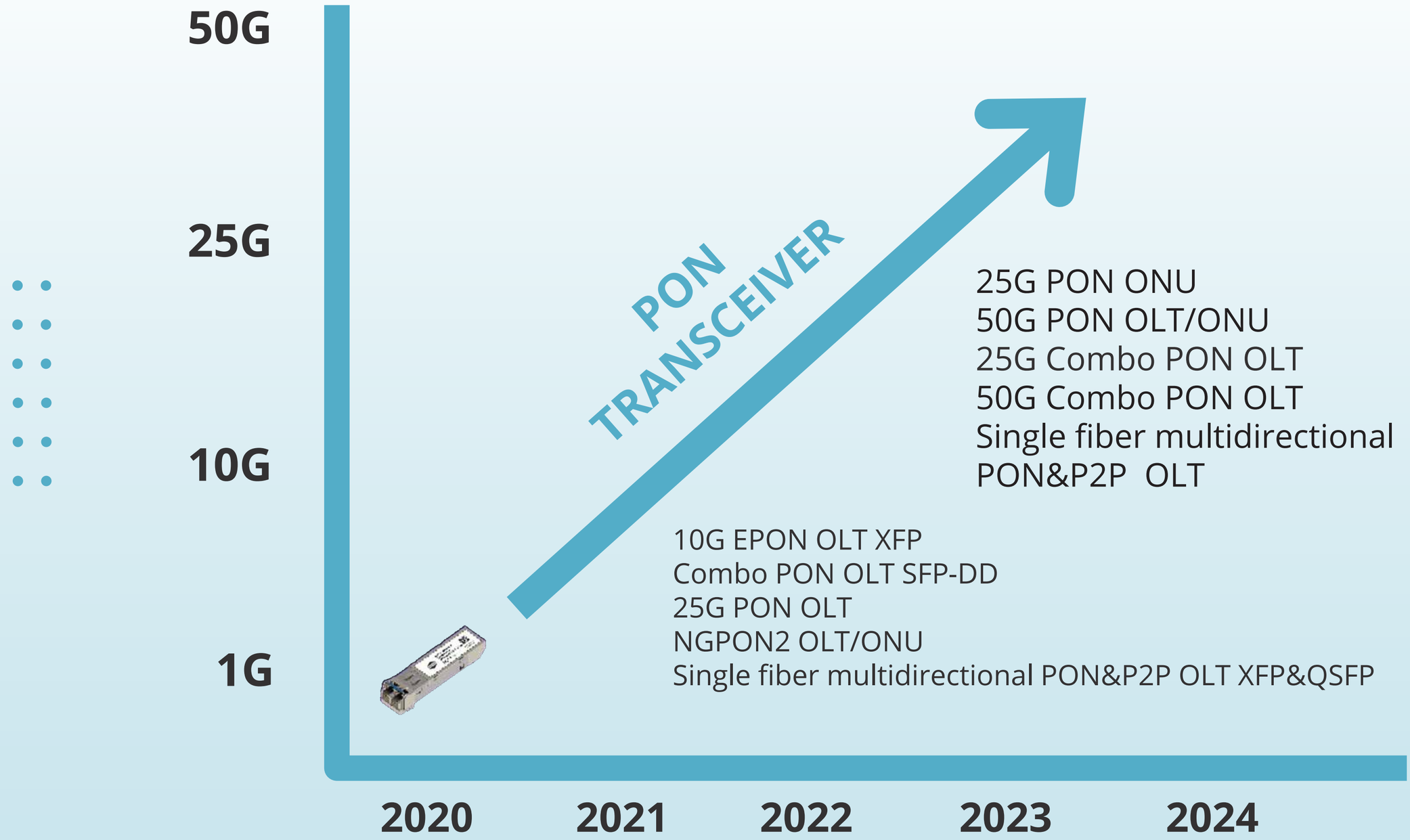

5G PRODUCT DEVELOPMENT ROADMAP

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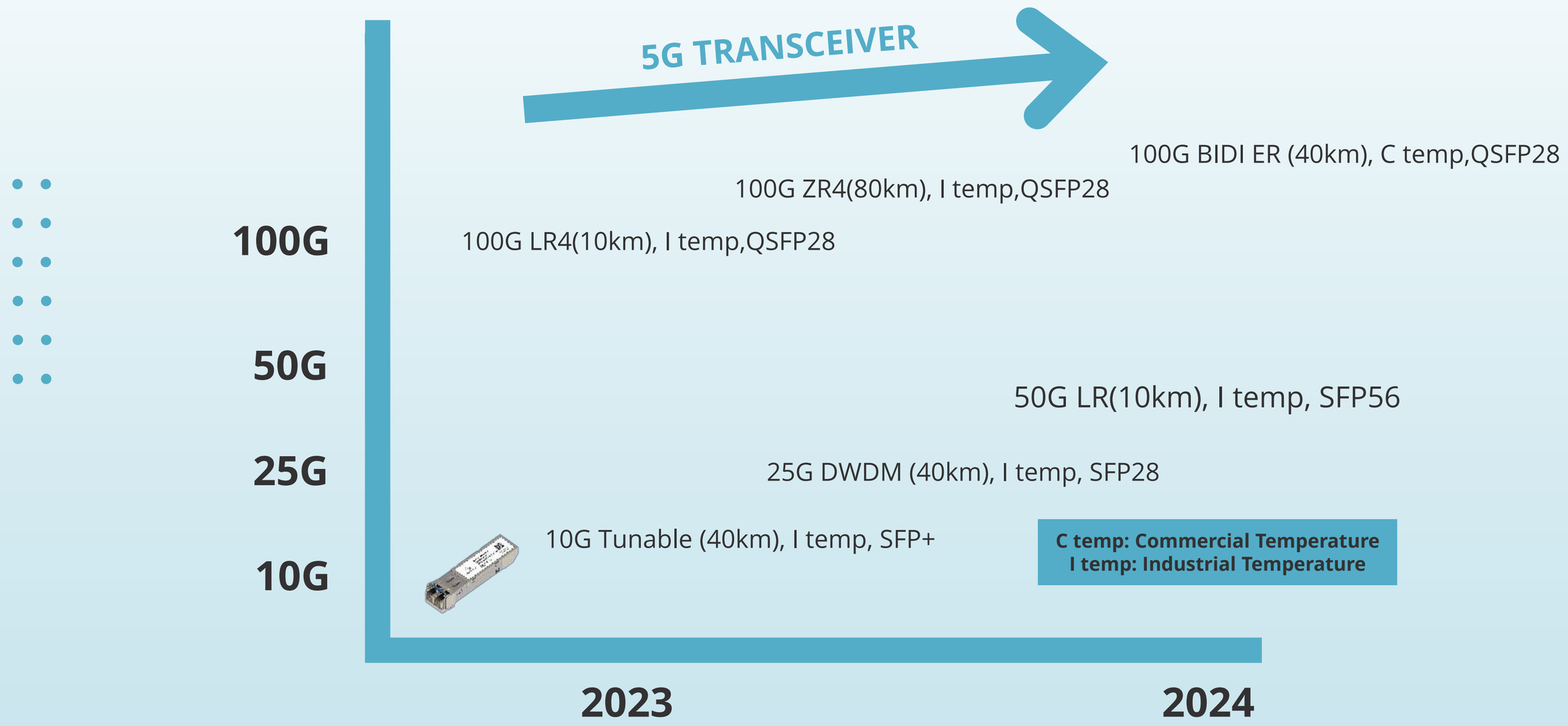

DATACENTER PRODUCT DEVELOPMENT ROADMAP

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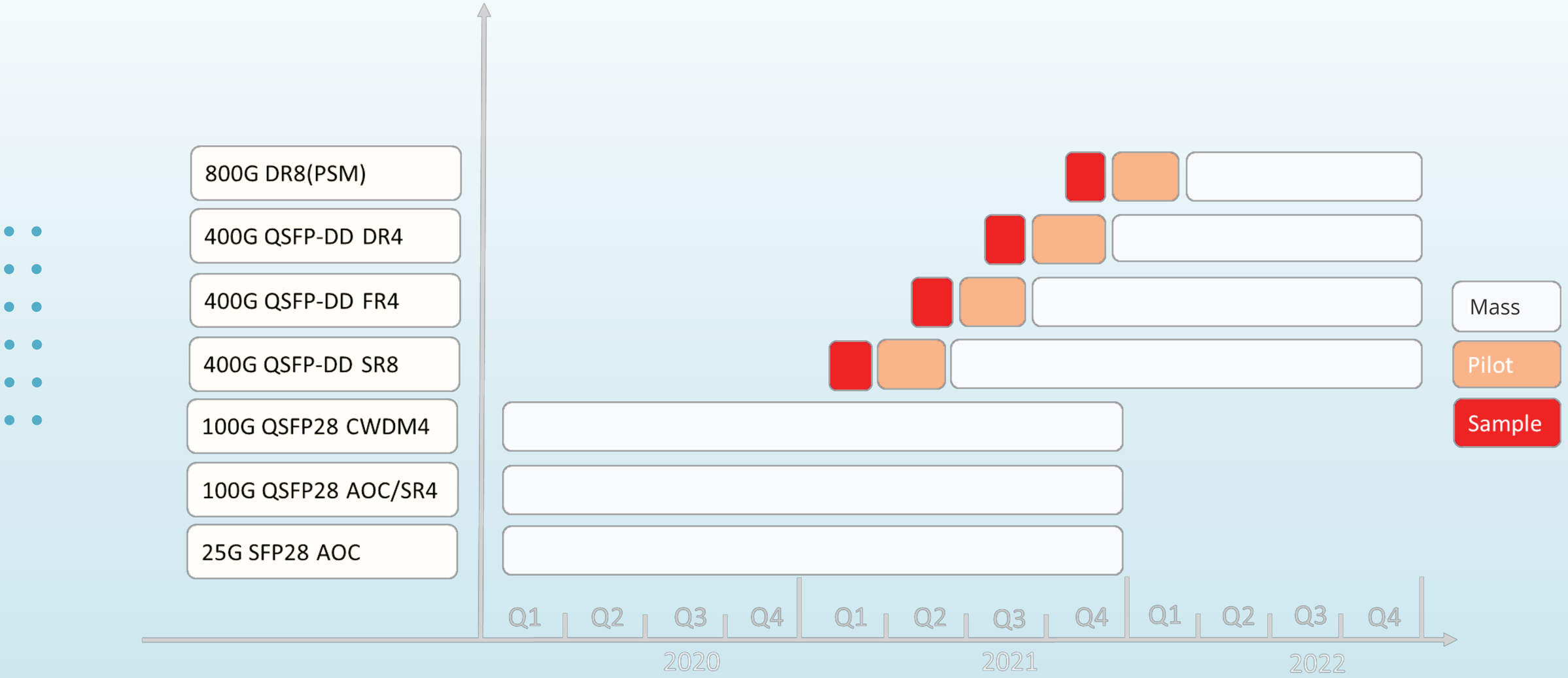

DATACENTER PRODUCT DEVELOPMENT ROADMAP 2023~2024

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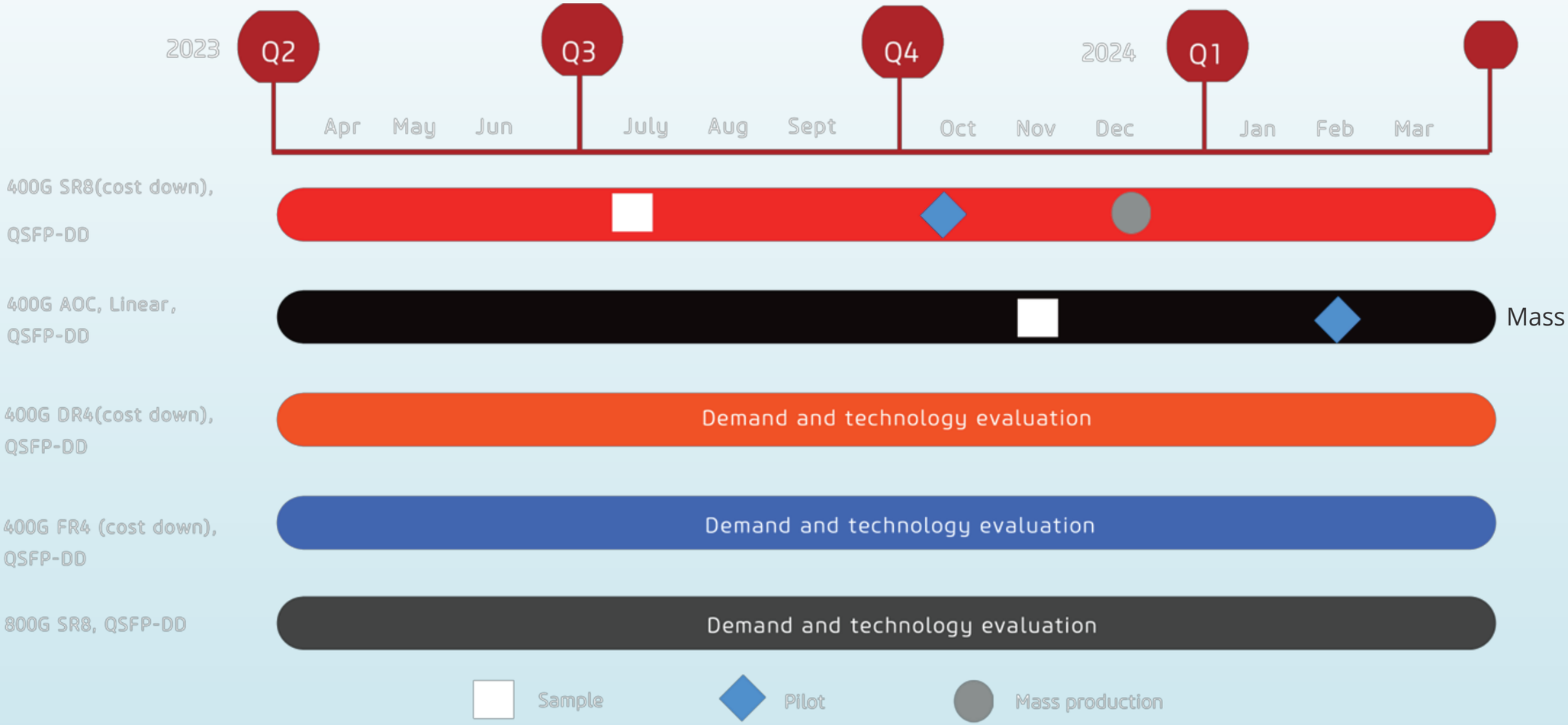

DATACENTER PRODUCT DEVELOPMENT ROADMAP 2024~2026

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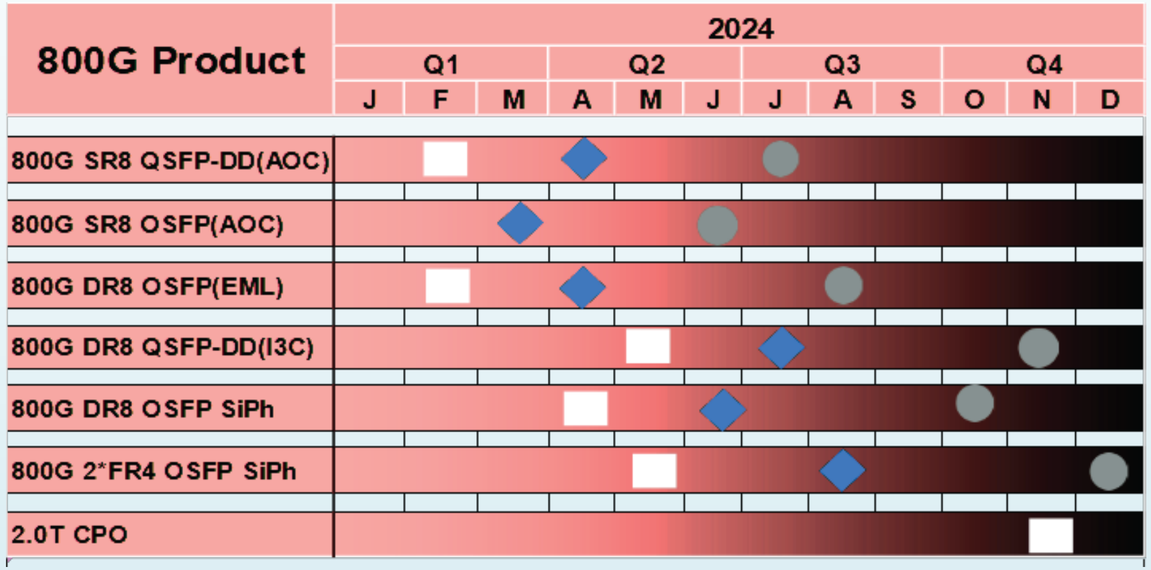
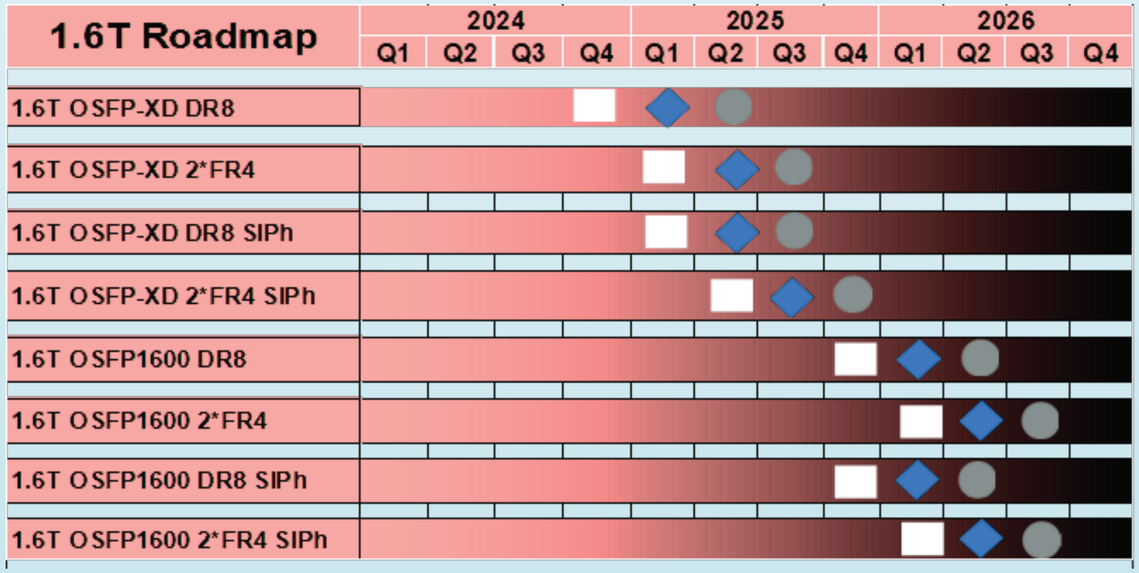
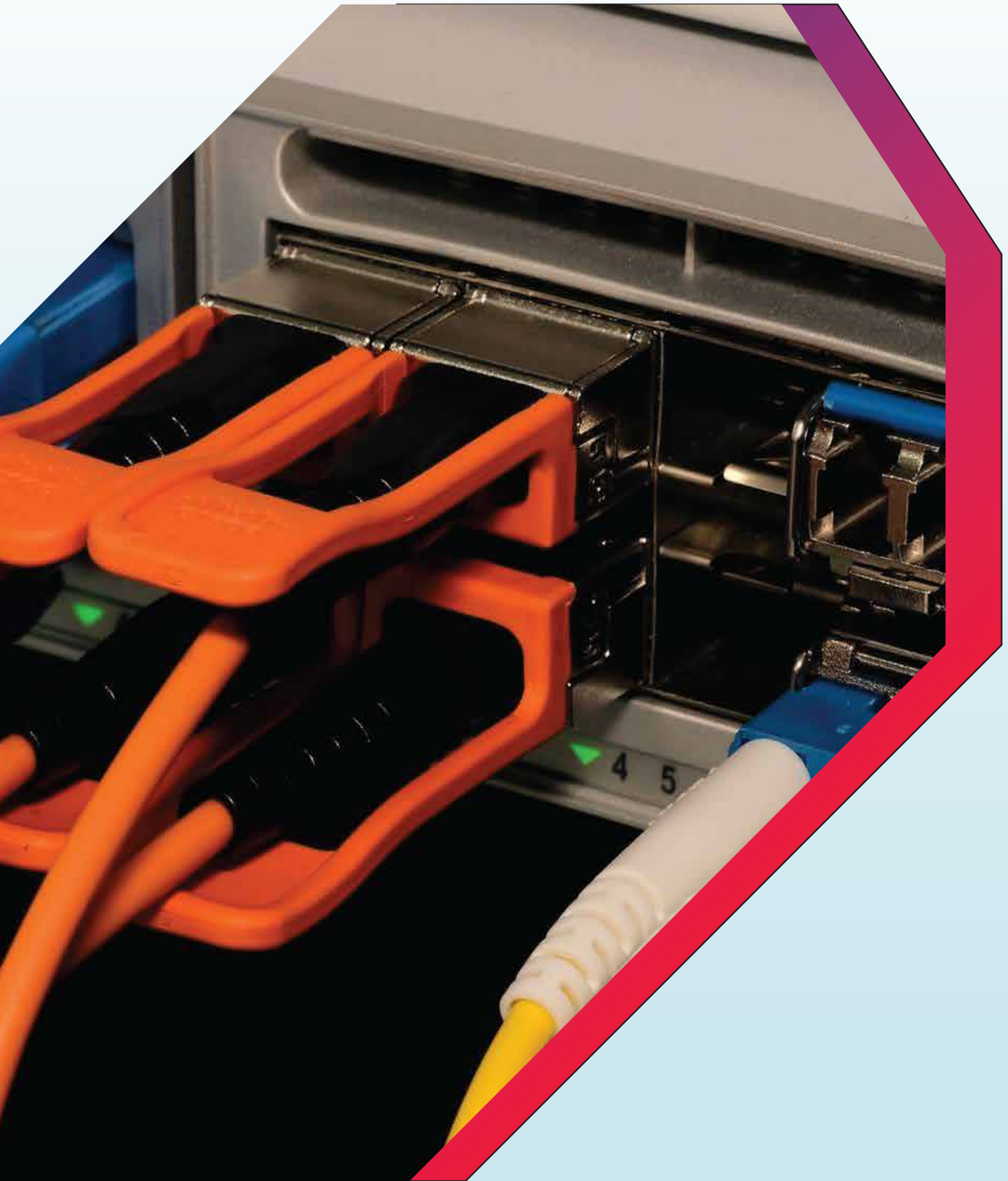




Sample Pilot Mass production



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QUALITY & TESTING PROCEDURE

QUALIFICATION AND TESTING

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To ensure the optimal performance and reliability of pluggable transceivers, thorough testing and qualification are essential. This process guarantees that the transceivers meet the specific requirements of the customer's network infrastructure, providing seamless integration and operation. The following sections outline the importance of qualification, the procedures for on-site and in-lab testing, and the steps to ensure compatibility and performance. In many cases, this is mainly a matter of verification on the customer side that they can trust that the products are compatible with the systems as intended. This is a crucial step in engaging with new customers.

Importance of Qualification

Qualification of pluggable transceivers is critical to ensuring that they function correctly within the customer's specific network environment. This involves verifying that the transceivers meet all necessary technical specifications and performance criteria. Proper qualification helps prevent potential issues such as signal degradation, data loss, and network downtime, which can arise from incompatibilities or suboptimal performance. By thoroughly qualifying transceivers, customers can achieve reliable and efficient network operations, minimizing disruptions and maximizing the return on their investment.

On-Site and In-Lab Testing Procedures

Testing pluggable transceivers can be conducted both on-site at the customer's facilities and in specialized labs. On-site testing allows for real-time assessment within the actual network environment, providing immediate feedback and adjustments. This involves bringing the required optics and testing equipment to the customer's location, where our experts work directly with the customer's team to verify performance and compatibility.

QUALIFICATION AND TESTING

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In-lab testing, on the other hand, provides a controlled environment where transceivers are subjected to rigorous testing protocols. This includes simulations of various network conditions and stress tests to ensure the transceivers can handle peak loads and challenging scenarios. Both on-site and in-lab testing procedures are essential to identify any potential issues early and to fine-tune the transceivers for optimal performance. Often a customer will have a lab on their side, where they can test with equipment matching their live network.

At Shaxon factory we have three options for testing and qualification procedure:
• Customer can test product in their lab or network by themselves.
• Shaxon will conduct or assist on on-site testing at customer site.
• Shaxon conducts lab testing on customers own equipment at the Shaxon facility – results are verified by customer afterwards. All testing are documented to ensure continuity and stability for ongoing collaboration.

Ensuring Compatibility and Performance
Ensuring compatibility and performance involves more than just matching the transceivers to the equipment vendor's specifications. It requires a detailed analysis of the customer's network setup, including factors such as data rate, protocol, reach, and operating conditions. The transceivers must be coded to meet the equipment vendor's requirements and may need custom adjustments to the EEPROM settings to facilitate easier daily operations, such as customized part numbers or adjusted DDMI thresholds.

Through comprehensive testing and qualification, we can confirm that the transceivers not only meet but exceed the customer's expectations, providing reliable and efficient network performance. This meticulous approach ensures that customers receive transceivers that are fully compatible with their network, delivering consistent and high-quality performance

QUALIFICATION AND TESTING

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Ensuring regulatory compliance and obtaining necessary certifications are fundamental to maintaining the highest standards of quality and reliability in our pluggable transceivers. Our commitment to compliance and quality is reflected in our adherence to industry standards, our range of certifications and memberships, and our rigorous quality assurance practices.

Industry Standards

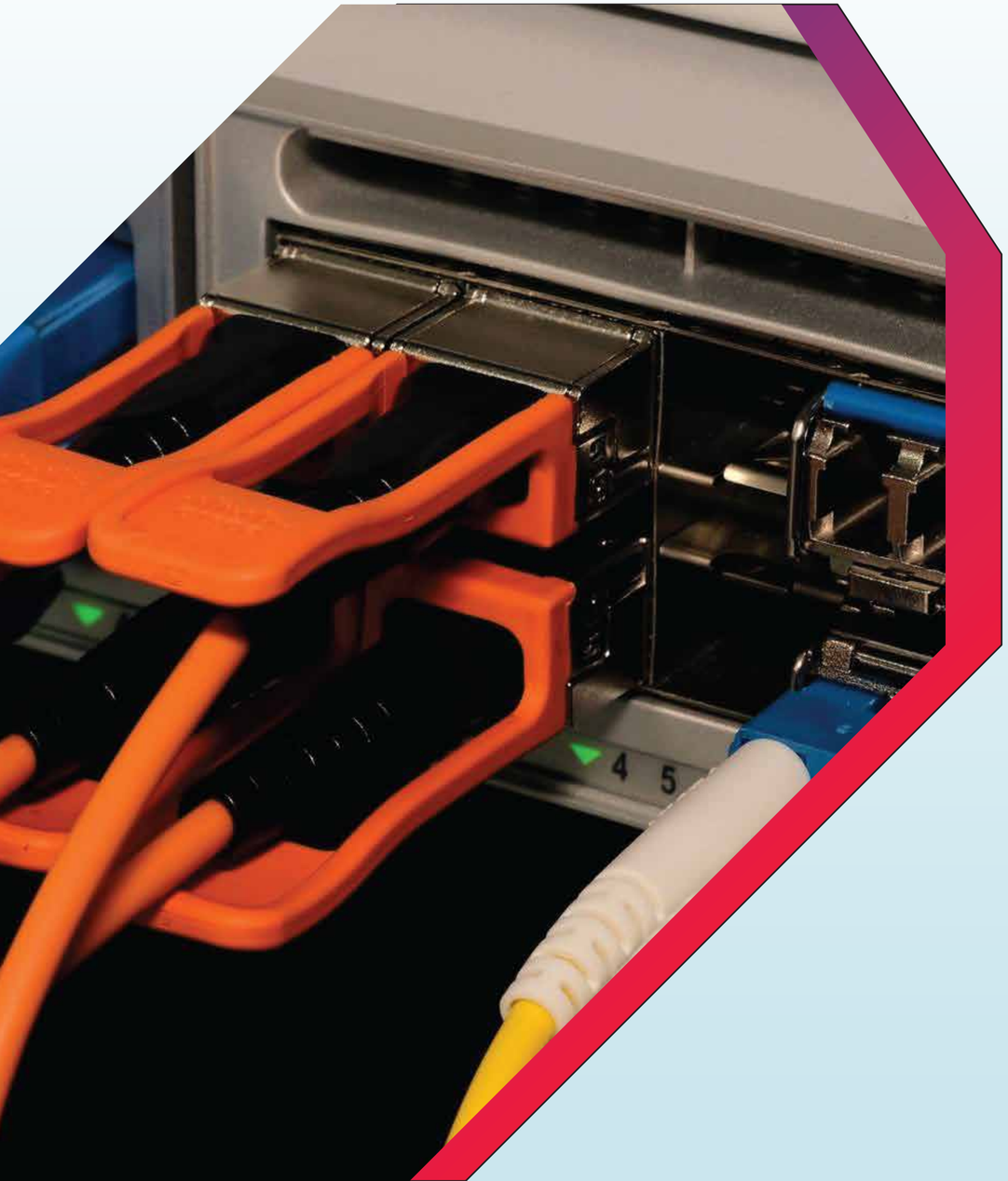
Our pluggable transceivers are designed and manufactured in accordance with the latest industry standards. This includes compliance with standards such as IEEE, ITUT, and ANSI, which govern the performance, interoperability, and safety of optical communication devices. By adhering to these standards, we ensure that our products are compatible with a wide range of network equipment and meet the expectations for performance and reliability

Certifications and Memberships

We hold numerous certifications that attest to the quality and safety of our products. These include ISO 9001 for quality management systems, ISO 14001 for environmental management, and various certifications specific to our products, such as CE, RoHS, and FCC. Additionally, we are active members of several industry organizations, such as the Optica and OIF (Optical Internetworking Forum). These memberships keep us at the forefront of technological advancements and industry best practices, ensuring that our products remain cutting-edge and compliant with the latest standards

Quality Assurance Practices

Our quality assurance practices are designed to guarantee the highest levels of product reliability and customer satisfaction. From the initial design phase through to production and final testing, we implement stringent quality control measures. These include comprehensive testing of each transceiver for performance, compatibility, and durability under various conditions. Our state-of-the-art manufacturing facilities are equipped with advanced testing equipment and staffed by highly trained personnel dedicated to maintaining our rigorous quality standards. By prioritizing quality at every stage, we ensure that our products not only meet but exceed the expectations of our customers



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SUMMARY OF TERMS

GLOSSARY

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ACC	Active Copper Cable which as Active DAC that can compensate the for loss of signal in the copper cable
AEC	Active Electrical Cable is similar with ACC, but contains a silicon chip that can compensate for signal noise.
AOC	Active Optical Cable. Optical fiber cable with fixed transceiver connectors at each end of the cable
APC	Angled Physical Contact. Ends of the fiber in a fiber connector that is angled at 8° and can be identified by green connector color
APD (Avalanche Photodiode)	A highly sensitive photodiode used to detect light in fiber optic communications. This are sometimes used in the receiver side of a transceiver.
AWG	Arrayed Waveguide Grating: A device used in DWDM systems to separate different wavelengths of light.
BER	Bit Error Rate: The number of bit errors per unit time.
BIDI	Bidirectional: Transceivers that use a single fiber for both transmitting and receiving data
BOM	Bill of Materials: A comprehensive list of materials required to manufacture a product.
C Band	The wavelength range from 1530nm to 1565nm.
CFP	A multi-source agreement to produce a common form factor for the transmission of high-speed digital signals
CLI	The text-based interface used when one connects to a switch (Console, telnet or SSH).
CPO	Co-Packaged Optics are transceiver type, where the aim is the integrate the optics into the equipment instead of being pluggable.

GLOSSARY

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DAC	Direct Attach Copper. A copper cable assembled with pluggable transceivers at each end. Can be Active or Passive version.
DDM/DOM	Digital Diagnostic Monitoring or Digital Optical Monitoring. A functionality where it is possible to monitor the optical performance of a transceiver. .
Duplex	Means that two fibers are used for a single connection.
DWDM	Dense Wavelength Division Multiplexing: Combines multiple signals on different wavelengths for transmission over a single fiber.
EEPROM	Electrically Erasable Programmable Read-Only Memory: Used in transceivers to store configuration information.
EMI	Electromagnetic Interference: Disturbance generated by external sources that affect electrical circuits.
FEC	Forward Error Correction: A method to control errors in data transmission.
FTTB	Fiber to the Building: A fiber optic installation that reaches the boundary of the building.
FTTH	Fiber to the Home: A fiber optic installation that reaches the home
GPON	Gigabit Passive Optical Network: A telecommunications technology for fiber optic access.
Infini-band	A high-speed communications protocol used in HPC and AI environments.
ITU	International Telecommunication Union: An international organization that standardizes global telecoms.
LAN	Local Area Network: A network that connects computers within a limited area.

GLOSSARY

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LWDM	Lan Wavelength Division Multiplexing: An extension of WDM technology for LAN environments.
MMF	Multimode Fiber. Usually used for short distances.
MSA	Multi-Source Agreement which is a definition of an industry standard which defines a standardized product.
MTBF	Mean-Time-Between-Failure which is a theoretical calculated number that indicates failure rate of a product.
MWDM	Metro Wavelength Division Multiplexing: An extension of WDM for metro networks.
NRZ	Non-Return-to-Zero: A binary code where ones are represented by one significant condition and zeros by another.
P2P	Point-to-Point: A type of network connection where a direct link exists between two endpoints
PLC	Planar Lightwave Circuit: Used in splitters for PON networks.
PON	Passive Optical Network: A telecommunications technology that uses point-to-multipoint fiber to the end-points.
Rx	Receive: Refers to the receiver side of the transceiver.
SFP	Small Form-Factor Pluggable: A compact, hot-pluggable transceiver.
SFP+	An enhanced version of the SFP transceiver, supporting higher data rates.
SFP28	A type of SFP that supports 25G data rates

GLOSSARY

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SFP56	A type of SFP supporting 50G data rates. .
Simplex	Means that a single fiber is used, such as Bidirectional transceivers.
SiPh	Silicon Photonics: Technology integrating photonics and electronics on a silicon chip.
SWDM	Short-Wavelength Division Multiplexing: Uses multiple wavelengths on multimode fiber to increase capacity.
Tx	Transmit: Refers to the transmitter side of the transceiver.
VSFF	Stands for Very Small Form Factor, which is a category of fiber connector types that are smaller than LC connector size.
WDM	Wavelength Division Multiplexing: A technology that combines multiple optical signals on a single fiber by using different wavelengths.
QSFP	Quad Small Form-Factor Pluggable: A transceiver designed for four lanes of data.
QSFP-DD	Quad Small Form-Factor Pluggable Double Density: An advanced QSFP with double the data lanes.
XGS-PON	A standard for passive optical networks that supports higher speeds than GPON.

APPENDIXES

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SFP (Small Form-factor Pluggable)
SFP SX: Short-range transceiver using multimode fiber (up to 550m).
SFP LX: Long-range transceiver using single-mode fiber (up to 10km).
SFP ZX: Extended-range transceiver using single-mode fiber (up to 80km).
SFP BX: Bi-directional transceiver using single-mode fiber (up to 10km).
SFP CWDM: Coarse Wavelength Division Multiplexing transceiver.
SFP DWDM: Dense Wavelength Division Multiplexing transceiver.

SFP+ (Enhanced Small Form-factor Pluggable)
SFP+ SR: Short-range transceiver using multimode fiber (up to 300m).
SFP+ LR: Long-range transceiver using single-mode fiber (up to 10km).
SFP+ ER: Extended-range transceiver using single-mode fiber (up to 40km).
SFP+ ZR: Ultra-extended-range transceiver using single-mode fiber (up to 80km).
SFP+ BX: Bi-directional transceiver using single-mode fiber (up to 10km).
SFP+ CWDM: Coarse Wavelength Division Multiplexing transceiver.
SFP+ DWDM: Dense Wavelength Division Multiplexing transceiver.

SFP28 (25Gbps Small Form-factor Pluggable)
SFP28 SR: Short-range transceiver using multimode fiber (up to 100m).
SFP28 LR: Long-range transceiver using single-mode fiber (up to 10km).
SFP28 ER: Extended-range transceiver using single-mode fiber (up to 40km).

APPENDIXES

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SFP56 (56Gbps Small Form-factor Pluggable)
SFP56 SR: Short-range transceiver using multimode fiber.
SFP56 LR: Long-range transceiver using single-mode fiber.
SFP56 ER: Extended-range transceiver using single-mode fiber.

XFP (10Gbps Small Form-factor Pluggable)
XFP SR: Short-range transceiver using multimode fiber (up to 300m).
XFP LR: Long-range transceiver using single-mode fiber (up to 10km).
XFP ER: Extended-range transceiver using single-mode fiber (up to 40km).
XFP ZR: Ultra-extended-range transceiver using single-mode fiber (up to 80km).
XFP CWDM: Coarse Wavelength Division Multiplexing transceiver.
XFP DWDM: Dense Wavelength Division Multiplexing transceiver.

QSFP (Quad Small Form-factor Pluggable)
QSFP SR4: Short-range transceiver using multimode fiber (up to 100m).
QSFP LR4: Long-range transceiver using single-mode fiber (up to 10km).
QSFP ER4: Extended-range transceiver using single-mode fiber (up to 40km).

SFP-DD (Double Density Small Form-factor Pluggable)
SFP-DD: Double density SFP transceiver for higher data rates, supporting up to 100Gbps.

APPENDIXES

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QSFP+ (Enhanced Quad Small Form-factor Pluggable)
QSFP+ SR4: Short-range transceiver using multimode fiber (up to 100m).
QSFP+ LR4: Long-range transceiver using single-mode fiber (up to 10km).
QSFP+ ER4: Extended-range transceiver using single-mode fiber (up to 40km).

QSFP28 (100Gbps Quad Small Form-factor Pluggable)
QSFP28 SR4: Short-range transceiver using multimode fiber (up to 100m).
QSFP28 LR4: Long-range transceiver using single-mode fiber (up to 10km).
QSFP28 CWDM4: Coarse Wavelength Division Multiplexing transceiver (up to 2km).
QSFP28 PSM4: Parallel Single-Mode 4 transceiver (up to 500m).
QSFP28 ER4: Extended-range transceiver using single-mode fiber (up to 40km).
QSFP28 ZR4: Ultra-extended-range transceiver using single-mode fiber (up to 80km).

QSFP56 (200Gbps Quad Small Form-factor Pluggable)
QSFP56 SR4: Short-range transceiver using multimode fiber (up to 100m).
QSFP56 LR4: Long-range transceiver using single-mode fiber (up to 10km).
QSFP56 ER4: Extended-range transceiver using single-mode fiber (up to 40km).

QSFP-DD (Double Density Quad Small Form-factor Pluggable)
QSFP-DD SR8: Short-range transceiver using multimode fiber.
QSFP-DD LR8: Long-range transceiver using single-mode fiber.
QSFP-DD LR4: Long-range transceiver using single-mode.
QSFP-DD ER8: Extended-range transceiver using single-mode fiber.

APPENDIXES

OSFP (Octal Small Form-factor Pluggable)
OSFP SR8: Short-range transceiver using multimode fiber.
OSFP LR8: Long-range transceiver using single-mode fiber.
OSFP FR8: Extended-range transceiver using single-mode fiber.

CFP (C Form-factor Pluggable)
CFP SR10: Short-range transceiver using multimode fiber.
CFP LR4: Long-range transceiver using single-mode fiber.
CFP ER4: Extended-range transceiver using single-mode fiber.

CFP2 (2nd Generation C Form-factor Pluggable)
CFP2 SR10: Short-range transceiver using multimode fiber.
CFP2 LR4: Long-range transceiver using single-mode fiber.
CFP2 ER4: Extended-range transceiver using single-mode fiber.

CFP4 (4th Generation C Form-factor Pluggable)
CFP4 SR4: Short-range transceiver using multimode fiber.
CFP4 LR4: Long-range transceiver using single-mode fiber.
CFP4 ER4: Extended-range transceiver using single-mode fiber.

APPENDIXES

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Others

XENPAK SR: Short-range transceiver.
XENPAK LR: Long-range transceiver.
X2 SR: Short-range transceiver.
X2 LR: Long-range transceiver.
GBIC SX: Short-range transceiver using multimode fiber.
GBIC LX: Long-range transceiver using single-mode fiber.

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