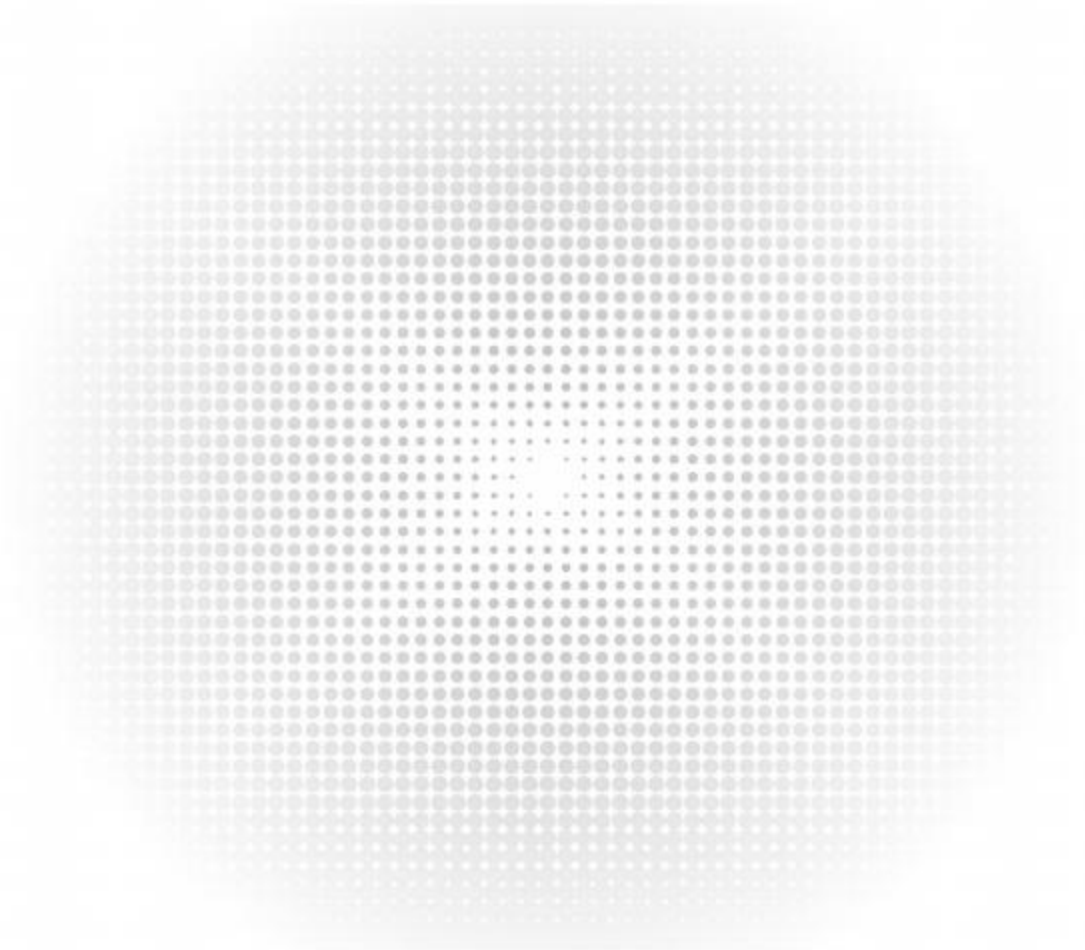
100G QSFP28 / SFP-DD FAQ

Models: 100G QSFP28 & SFP-DD Modules and Cables FAQ



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Chapter 1 General FAQ

1.1 What 100G Transceivers and Cables are available from FS?

FS supports a full range of 100G copper cables and optical transceivers that comply with IEEE standards and industry MSA. FS's 100G connectivity solutions include copper cables and Active Optical Cables (AOC) for cost-effective short-distance options, along with a variety of QSFP28 optical transceivers to meet different fiber types, distances, and interoperability requirements. For more information, please check https://resource.fs.com/mall/resource/100g-qsfp28-cable-and-transceiver-modules-data-sheet.pdf.

1.2 What are the features and benefits that FS 100G QSFP28 transceivers can offer?

FS 100G QSFP28 transceivers offer several features and benefits:

1. Superior Quality and Leading Performance

FS collaborates with a high-quality supply chain of globally recognized brands, utilizing premium components from mainstream manufacturers. Our low-power design reduces electricity and cooling costs while ensuring product stability and longevity through rigorous testing and certification, keeping networks running smoothly.

2. Extensive Compatibility

FS products undergo strict testing with equipment from brands like Cisco, Arista, and Juniper to ensure compatibility. Our hot-swappable 100G QSFP28 Ethernet device ports are designed for seamless integration. Additionally, the FS BOX provided by FS can be flexibly adapted for compatibility with Cisco, Dell, Juniper, and Mellanox, meeting diverse customer requirements.

3. Excellent Interoperability

Our products can interoperate with IEEE-standard 100GBASE interfaces (where applicable) and connect with multi-vendor products.

4. Rich Product Ecosystem

FS offers not only high-frequency general products but also a variety of specialized products (such as different temperatures, BIDI, dual-rate, etc.), providing equivalent products for well-known brands like Cisco, Juniper, and Arista.

5. Regulatory and Standards Compliance

Our 100G optical modules comply with internationally recognized protocols such as IEEE 802.3, MSA, SFF-8636, SFF-8665, and RoHS 6, as well as safety compliance certifications like UL E116441 and IEC 60825-1, IEC 60825-2 Class 1 laser safety.

6. Comprehensive Services

FS provides an integrated service for solutions and products, supported by thorough compatibility testing to simplify customer selection. Our products can also be customized based on customer requirements for software, performance, functionality, labeling, and more.

1.3 What is the 100G SWDM4 transceiver?

The 100G SWDM4 module provides 100Gbps bandwidth over standard duplex multimode fiber, eliminating the need for expensive parallel multimode fiber infrastructure and offering a seamless migration path from duplex 10G to 100G. It is supported on all FS QSFP28 100G ports and can be used over distances of up to 75m with OM3 fiber, 100m with OM4 fiber, or 150m with OM5 fiber. The SWDM4 Tx port transmits 100G data via 4 x 25Gbps wavelengths, and the Rx port receives data through 4 x 25Gbps wavelengths. The wavelengths are in the shortwave range (850nm – 940nm).

1.4 What is the QSFP-SR1.2-100G module?

Similar to the QSFP28-BIDI-100G transceiver, the FS QSFP-SR1.2-100G transceiver also provides 100Gbps bandwidth over standard duplex multimode fiber. However, unlike the SWDM4 transceiver (which transmits 4 x 25Gbps wavelengths from the Tx port and receives 4 x 25Gbps wavelengths at the Rx port), each fiber port on the SRBD contains both a transmitter and receiver, operating at full-duplex 50Gbps on a single fiber. The two ports of the QSFP-100G-SRBD provide a total bandwidth of 100Gbps. All FS QSFP 100G ports support QSFP-100G-SRBD and can be used for OM3 links up to 70m, OM4 links up to 100m, or OM5 links up to 150m of multimode fiber.

1.5 What are 100G Lambda optics?

100G Lambda or single-lambda optics refer to transceivers with an optical output composed of a single 100G PAM-4 optical signal. FS 100G single-lambda SKUs include:

1. QSFP-DR-100G: 100GBASE-DR single-lambda QSFP, supports transmission over duplex SMF for distances up to 500m.
2. QSFP-FR-100G: 100GBASE-FR single-lambda QSFP, supports transmission over duplex SMF for distances up to 2km.
3. QSFP-LR-100G: 100GBASE-LR single-lambda QSFP, supports transmission over duplex SMF for distances up to 10km.

The 100G-DR/FR/LR transceivers can be inserted into any FS 100G QSFP port. The electrical connector interface is 4 x 25G NRZ, the same as all existing traditional 100G QSFP modules. The optical output is a single wavelength (or lambda) 100Gbps PAM-4 optical signal. The 100G-DR/FR/LR modules include a gearbox chip that converts 4 x 25G NRZ electrical signals into a 1 x 100G PAM-4 optical signal. This contrasts with traditional QSFP100 modules (e.g., CWDM4 or LR4 100G modules), which multiplex 4 x 25G NRZ optical wavelengths onto a single fiber.

Due to differences in optical modulation schemes, 100G-DR/FR/LR modules do not interoperate with traditional 100G modules (e.g., CWDM4, LR4, etc.), but they do interoperate with 400G-DR4 and 400G-XDR4 modules using breakout cables. For more details on 400G to 4x 100G breakout options, refer to the 400G FAQ. The differences in optical modulation schemes between traditional 100G QSFP modules and 100G-DR/FR/LR modules are shown below.

1.6 What is 100G BiDi transceiver?

The 100G BiDi transceiver refers to the QSFP28 single-mode fiber bidirectional optical module applied to 100G Ethernet. Each optical port on the QSFP28 BiDi contains both a transmitter and receiver, transmitting and receiving data to/from interconnected network devices (like network switches or routers) at full-duplex 50GBd via a single optical fiber. QSFP28 BiDi modules are highquality solutions for data communication and interconnect applications with the lowest cost in i nfrastructure.

1.7 What is the difference between QSFP28 and 100G QSFP?

They are the same. The QSFP form factor was originally defined for <10G speeds. When it was adopted for 40G, the name became QSFP+ to denote the higher aggregate performance. The same QSFP form factor was later adopted for 100G but the electrical interface had to be upgraded to handle 25Gbps/lane. The electrical interface for 100G can handle up to 28Gbps, hence the engineering and industry name is QSFP28. Arista refers to the 100G form factor as 100G QSFP to avoid any confusion.

1.8 Which 100G QSFP28 transceivers can support link distances over 10km?

Please refer to the table below.

Part Number	Distance	Part Number	Distance
QSFP-ZR4-100G	80km	QSFP-ELR4-100GM	20km
QSFP-ZR4-100G-I	80km	QSFP28-100G-BX20	20km
Q28-100G-BX40	40km	Q28-100G-BX10	10km
QSFP-4W40-100G-E	40km	QSFP-4W10-100G	10km
QSFP-4W40-100G-I	40km	QSFP-LR-100G	10km
QSFP-ER-100G	40km	QSFP-LR-100G-27	10km
QSFP-ER4-100GM	40km	QSFP-LR-100G-29	10km
QSFP-ER4L-100G	40km	QSFP-LR-100G-33	10km
Q28-100G-BX30	30km	QSFP-LR4-100G	10km
QSFP-ER4L-100GM	30km	QSFP-LR4-100G-I	10km
QSFP-4W20-100G-I	20km	QSFP-LR4-100GM	10km
QSFP-PLR4-100G	10km		

1.9 Is there a 100G transceiver that allows the use of standard duplex multimode fiber?

Yes. FS offers four 100G transceivers that operate over duplex multimode fiber: Q28-40/100G-SM4, QSFP-LX4-100G, QSFP-SR1.2-100G, and QSFP28-BIDI-100G.

1.10 Which FS 100G transceivers and cables support breakout mode?

Breakout mode refers to operating a 100G port as four independent 25GE channels. Transceivers or copper cables that support optical or electrical breakout allow a 100G QSFP100 port to connect to four physically independent 25G links. When splitting a single 100G port into 4x25G links, it's essential to use the same forward error correction (FEC) mode at both ends of the link to ensure proper connectivity. The FS transceivers and copper cables that support 100G to 4x25G breakout are listed below.

Product Number	Supported Breakout Modes
QSFP-SR4-100G	4x25G to interoperate with 25GBASE-SR
QSFP-ESR4-100G	4x25G to interoperate with 25GBASE-ESR
QSFP-PSM4-100G	4x25G to interoperate with 25GBASE-LR up to 500m
QSFP-PLR4L-100G	4x25G to interoperate with 25GBASE-LR up to 2km
QSFP-PLR4-100G	4x25G to interoperate with 25GBASE-LR up to 10km
QSFP-100G-4SPCxxx	100G QSFP28 to 4 x 25G SFP28 Passive Direct Attach Copper Breakout Cable
QSFP-100G-4SACxxx	100G QSFP28 to 4 x 25G SFP28 Active Direct Attach Copper Breakout Cable
QSFP-100G-4SAOxxx	100G QSFP28 to 4x25G SFP28 Active Optical Breakout Cable
QSFP-PSM4-100G	4x25G to interoperate with 25GBASE-LR up to 500m
QSFP-SL4-100G	4x25G to interoperate with 25GBASE-SR up to 30m
QSFP-SR4-100G-I	4x25G to interoperate with 25GBASE-SR up to 100m

1.11 Does the 100G QSFP28 need to use the FEC function?

Not all QSFP28 transceivers need FEC function, as the process of correcting error code will inevitably cause some data packet delay. FEC (Forward Error Correction) is a method to increase the credibility of data communication by correcting errors during signal transmission. When an error occurs in the transmission, the receiver is allowed to reconstruct the data. In the design of transceivers, the cost of FEC function is relatively high and is generally rarely used.

The table below summarizes the FEC support for FS products.

Part Number	FEC
QSFP-100G-PCxxx	Supported

Part Number	FEC
QSFP-100G-4SPCxxx	Supported
QSFP-100G-AOxxx	Supported
QSFP-SR4-100G	Supported
QSFP-BIDI-100G	Supported
QSFP-DR-100G	Supported
QSFP-CWDM4-100G	Supported
QSFP-FR-100G	Supported
QSFP-LR4-100G	Unsupported
QSFP-ER4L-100G	FEC enabled: 40km; FEC disabled: 30km.

1.12 What is the operating temperature range of 100G QSFP28 transceivers?

The standard operating temperature range of QSFP28 100G module commercial version is 0°C to 70°C and that of the industrial version is -40 to 85°C. Commercial version transceivers are generally applied. There are also some data centers that use 100G transceivers with operating temperatures ranging from 20°C to 50°C to reduce costs.

1.13 QSFP28 vs QSFP+ vs 100G CFP vs QSFP-DD: What are the differences?

The main differences between the four types of transceivers are shown below:

Form Factor	QSFP28	QSFP+	100G CFP	QSFP-DD
Number of Electrical Interface Lanes	4	4	4	4
Single Channel Rate	25Gbps	10Gbps	25Gbps	25Gbps/50Gbps
Modulation Technology	NRZ	NRZ	NRZ	NRZ/PAM4
Applications	100G Ethernet	40G Ethernet	40G/100G Ethernet	400G Etnernet

For more information: 100G CFP vs QSFP28: When to Use Each?

1.14 Can Q28-40/100G-SM4 interoperate with QSFP-BIDI-100G?

Yes, both products use SWDM4 technology and are interoperable. MBIDI supports both 40G and 100G dual rates.

1.15 Can QSFP-BIDI-100G interoperate with QSFP-SR1.2-100G?

No, BIDI is SWDM4 and uses four SWDM4 wavelengths with 25G NRZ modulation, while SR1.2 uses two SWDM4 wavelengths with 50G PAM4 modulation.

1.16 Is there a dual-speed 100G/40G transceiver to avoid costly upgrades?

Yes, the Q28-40/100G-SM4 can operate in both 40G and 100G modes.

1.17 What are the applications of QSFP28 100G transceivers?

Based on different transmission distances, 100G QSFP28 can be applied in various scenarios such as interconnections between racks, switches, long-distance telecommunications, etc. To learn more: How to Choose the Right 100G QSFP28 Optical Transceivers?

1.18 How to achieve 100G to 4x 25G breakout application?

A simple 100G to 4x 25G breakout connection can be made between one QSFP28 SR4 transceiver and four SFP28 transceivers with breakout cables. In addition to 100G transceivers, breakouts can also be implemented with AOCs or DACs.

1.19 Can FS 100G transceivers interoperate with other 100G transceivers in the industry?

Yes, as long as non-FS 100G transceivers comply with relevant industry standards, FS 100G transceivers can fully interoperate with them.

1.20 Can 100G QSFP interfaces interoperate with SR10-based 100GbE?

No, the 100G QSFP form factor only has four electrical lanes, which is insufficient to support 10 x 10G electrical lanes. The 100G QSFP can only support 4x10G or 4x25G electrical lanes and can be used as 4x10GbE or 4x25GbE, but not as 10x 10GbE. Therefore, 100G QSFP SR4 cannot interoperate with SR10-based 100GbE transceivers. A complex design with reverse gearbox (4x25G to 10x10G) could achieve this, but it would result in expensive and power-hungry optics.

1.21 Can a 40G QSFP be used in an FS 100G QSFP switch port?

Yes, as long as the 100G QSFP port supports 40G speeds, it can be used.

1.22 Can customers use third-party copper cables?

FS does not restrict the use of third-party passive copper cables; however, all cables must comply with relevant IEEE specifications and the SFF-8636 management interface/EEPROM specifications to ensure that FS switches/routers can correctly identify and recognize them. Cable interfaces that are not properly recognized will be disabled.

1.23 Can I use QSFP+ optics on QSFP28 ports?

Yes, 100G QSFP28 ports can generally take either QSFP+ or QSFP28 optics. QSFP28 transceivers have the same form factor as the QSFP+ optical modules, and a QSFP28 module can break out into either 4x 25G or 4x 10G lanes, which depends on the transceiver used. It means that QSFP+ optics can be used on the QSFP28 ports at a lower 40G speed. However, QSFP28 modules can not be used on QSFP+ ports as the speed of the ports is lower than that of the optics used.

1.24 Can 100G QSFP28 interfaces interoperate with SR10-based 100GbE?

No. The QSFP28 form factor has just 4 electrical lanes, which is not enough to support 10 lanes of 10G electrical interface. A QSFP 100G can only support a 4x 10G or 4x 25G electrical interface, which can be used as 4x 10GbE or 4x 25GbE, but not 10x 10GbE. As a result, the 100G QSFP28 interfaces cannot interoperate with SR10-based 100GbE transceivers.

1.25 Can QSFP28 transceiver work with the CFP transceiver?

Yes, both are products of the Ethernet protocol and can interoperate with each other.

Chapter 2 Service and Warranty

2.1 Can FS provide technical support and maintenance services?

Of course, we have a professional engineering team ready to provide prompt technical support and maintenance services. You can purchase them on-demand through the FS website: https://www.fs.com/c/100g-qsfp28-sfp-dd-1159. If you already own an FS 100G optical transceiver module, it comes with the same 5-year warranty as top brands, along with a 30-day return and exchange policy, ensuring you the most reliable after-sales service. For more details on our support and maintenance services, please review the following agreements: https://www.fs.com/policies/warranty.html.

2.2 What customization services does FS offer for optical transceivers?

1. BOX V4 can be flexibly adjusted for compatibility with Cisco, Dell, Juniper, and Mellanox, meeting customers' needs for flexible device adaptation.
2. Customization services are available for hardware, software, appearance, performance, and functionality based on customer requirements.
3. Ample stock and stable lead times ensure timely delivery to meet customer demands.

Chapter 3 Resource

3.1 What other resources are available for transceivers and cables?

Here is a list of additional resources available on the transceivers and cables page at https://www.fs.com/

1. 100GBASE Optical Transceivers and Cables Portfolio
2. 100G QSFP28 Cable and Transceiver Modules Data Sheet
3. FS 100G Optics-to-Optics Interoperability Matrix
4. Compatible OEM Switches Models
5. 100G Transceiver Modules and Cables Part Number Notice
6. Optical Transceiver Modules Quick Start Guide V3.0