

Product Highlights

Simple and Cost Effective DCI

- DWDM purpose-built for DCI using in-router pluggable modules
- Up to 3.2T per fiber pair (8x 400ZR optical waves) over 120km of SMF with no external line systems.
- Save on cost, space and power by eliminating dedicated DWDM hardware

400ZR Optical Modules

- Industry standard OIF-400ZR compliant
- 400G per lambda: DP-16QAM at 60Gbaud
- Fully tunable over the C-Band: Frequency range from 191.300 THz to 196.100 THz
- Tunable to 100GHz or 75GHz grids
- 120km reach with optical amplifiers
- Available in OSFP and QSFP-DD

Pluggable Amplifiers

- Booster and Pre-amp optical amplifiers integrated into an OSFP or QSFP module
- Amplifies 400ZR for up to 120km reach
- Automatically adjusts gain settings: No configuration required, plug and play

Optical Mux/Demux: CAB-LC8-CS

- Simple, passive, colorless, 8 channel optical power coupler - splitter, packaged as a fiber breakout patch cable

400ZR+ Optical Module

- 400ZR+ QSFP-DD module, compliant with the OpenZR+ MSA
- Long haul DWDM with open line systems
- Un-amplified links with 22dB link budget

Arista Extensible Operating System

- Native EOS configuration and telemetry of 400ZR transceivers and pluggable amplifier modules

Overview

Delivering high bandwidth for distances up to 120km, 400ZR OSFP and QSFP-DD optical transceivers, together with Arista's pluggable line system, enable simple and cost effective Dense Wavelength Division Multiplexing (DWDM) for Data Center Interconnect (DCI).

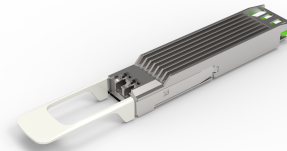
Connecting datacenters over DCI distances (40km - 120km) has traditionally required dedicated, expensive, and proprietary optical transport systems to convert client signals to DWDM optical wavelengths, multiplex multiple wavelengths onto a single fiber pair, and then amplify and transmit the optical data over long distances. Arista's 400ZR transceivers and line system modules collapse all of these DWDM functions into simple in-router pluggable modules.

For long-haul DWDM applications that require external line systems, Arista offers a high output power 400ZR+ QSFP-DD module compliant to the OpenZR+ MSA.

400ZR Optical Transceivers

Arista's 400ZR optical transceivers are software tunable, pluggable, DWDM, coherent optical modules that are compliant to the OIF-400ZR standard, ensuring industry wide interoperability. 400ZR transceivers provide 400Gb/s of optical bandwidth over a single optical wavelength using coherent, Dual Polarization-16QAM modulation.

Arista's 400ZR modules come in the same form-factor as 400G client optics modules: The OSFP and QSFP-DD. 400ZR OSFP and QSFP-DD modules can be plugged directly into a 400G switch/router port, enabling true IP over DWDM.



A 400ZR OSFP Module: Tunable DWDM, up to 120km reach with amplification

Pluggable Line Systems

While 400ZR modules integrate the DWDM optical source into the switch/router, optical amplification is required to close DCI distances, and optical multiplexers are needed to combine multiple DWDM optical waves onto a single fiber pair. Optical amplification and multiplexing have traditionally been achieved using external optical line systems. External line systems use additional rack space and power, and often require detailed optical knowledge to deploy and manage.

Arista's pluggable Line Systems are designed for point-to-point DCI, eliminating the need for external line systems. The pluggable line system consists of two key elements:

- A pluggable optical amplifier, in a choice of either OSFP or QSFP form-factors (the OSFP-AMP-ZR and QSFP-AMP-ZR)
- A simple 8-channel optical power coupler-splitter packaged as a simple fiber breakout cable (the CAB-LC8-CS).



OSFP-AMP-ZR



QSFP-AMP-ZR

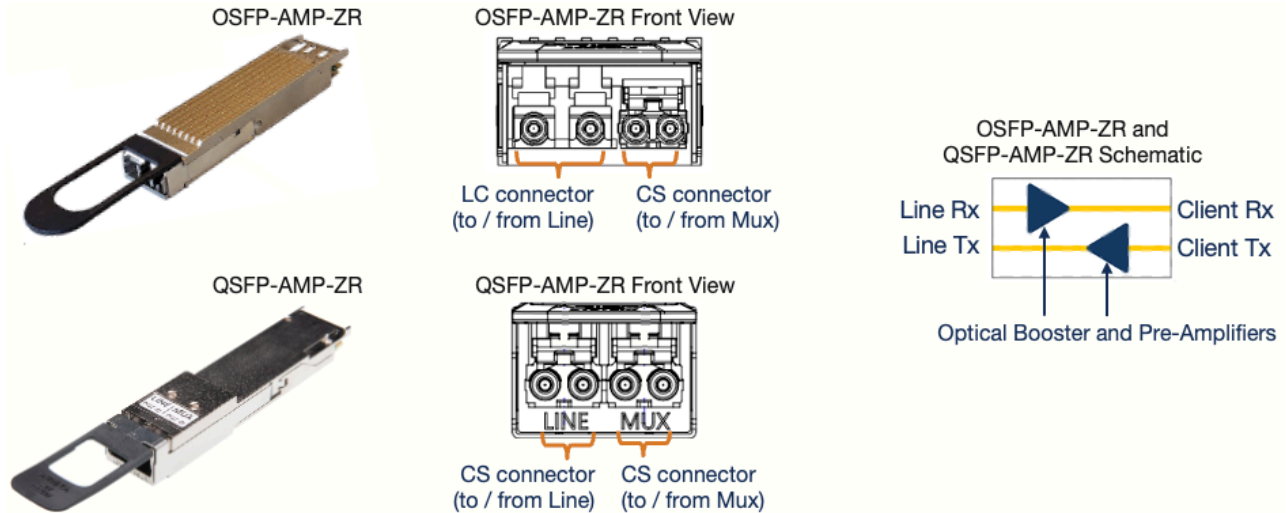


CAB-LC8-CS

The pluggable line system consists of an optical amplifier in either an OSFP or QSFP form-factor (OSFP-AMP-ZR or QSFP-AMP-ZR) and a passive optical power coupler-splitter cable (CAB-LC8-CS)

Pluggable Optical Amplifiers (OSFP-AMP-ZR and QSFP-AMP-ZR)

The OSFP-AMP-ZR and QSFP-AMP-ZR pictured below each contain two Erbium Doped Fiber Amplifiers (EDFAs): A boost amplifier to boost the optical output signal from 400ZR modules, and a pre-amplifier, which amplifies the received optical signal after transmission through up to 120km of single mode fiber. The two micro-EDFAs are integrated into a single OSFP or QSFP module, eliminating the need for external optical line systems for DCI links. The OSFP-AMP-ZR can be plugged into any Arista OSFP port, and the QFSP-AMP-ZR can be plugged into any Arista QSFP port.



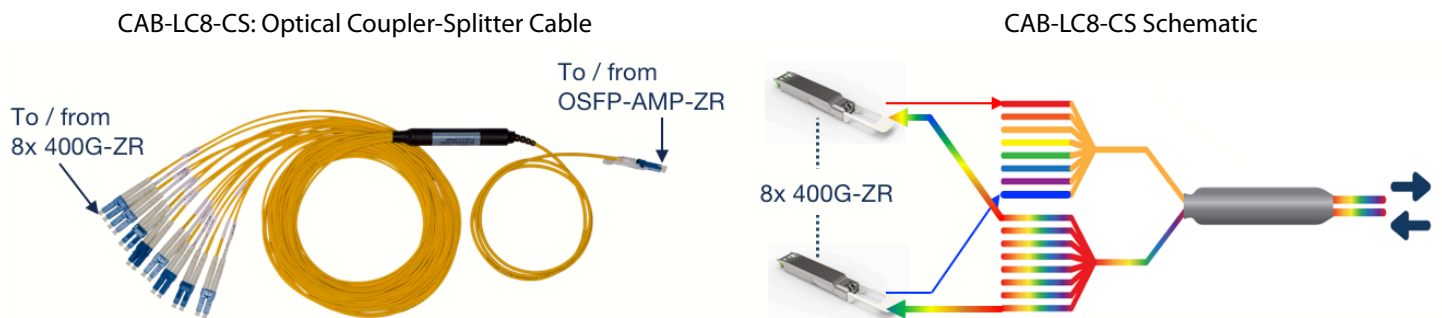
The OSFP-AMP-ZR and QSFP-AMP-ZR includes two optical amplifiers (a boost amp and a preamp) in a single OSFP or QSFP form factor

The OSFP-AMP-ZR has two separate duplex optical connectors: A duplex-CS connector which connects to up to 8x 400ZR modules through the optical coupler-splitter cable, and a duplex-LC connector that connects to the line-side fiber. The QSFP-AMP-ZR uses duplex-CS connectors both for links. To connect the line side of the QSFP-AMP-ZR to duplex LC fiber connectors (commonly used for dark fiber connectivity), Arista provides a simple patch cable, the CAB-LC-CS-0.2M to convert a duplex CS connector to a duplex LC connector.

Apart from the form factor and optical connectors, the functionality of the OSFP-AMP-ZR and QSFP-AMP-ZR are identical: The amplifiers utilize automatic gain control, so that links from as short as 2m to 120km can be deployed without any user intervention enabling true plug-and-play operation. Instrumentation, monitoring and configuration of both the 400ZR and the OSFP-AMP-ZR or QSFP-AMP-ZR is provided through the Arista EOS CLI, eliminating separate dedicated optical transport management tools and systems.

Colorless 8 Channel Optical Coupler-Splitter Cable

The CAB-LC8-CS is a passive, 8 channel, colorless, optical power coupler and splitter, packaged as a simple fiber breakout cable. As shown in the image below, the cable's eight LC connectors directly connect to up to eight 400ZR transceivers. Optical signals from the 400ZR modules are power-combined / split into / from a single fiber pair which is terminated into a duplex-CS connector. The duplex-CS connector of the cable connects to the OSFP-AMP-ZR or QSFP-AMP-ZR for amplification and transmission over up to 120km of fiber.



The CAB-LC8-CS optical coupler-splitter cable combines optical signals of up to 8x 400ZR modules onto a single fiber pair

The CAB-LC8-CS is 'colorless' allowing each pair of 400ZR transceivers connected over the DWDM link to be tuned to any wavelength in a 200GHz spaced C-band grid, provided the wavelength chosen is unique. In the transmit direction, the optical output from up to eight 400ZR modules are power-combined onto the transmit fiber. In the receive direction, all of the wavelengths received from the line-side fiber are broadcast to all of the 400ZR transceivers connected to the CAB-LC8-CS. Each 400ZR transceiver selects the wavelength of interest by tuning it's coherent DWDM receiver to the desired wavelength.

The colorless coupler / splitter cable stands in contrast to traditional wavelength selective mux / demuxes, where each port of the mux / demux is locked to a specific wavelength. When deploying a traditional mux/demux, the operator must keep track of which physical mux port each 400ZR module is connected to - since each port can only accept a specific wavelength. Using a colorless optical coupler-splitter simplifies the physical deployment and management of the DWDM network.

Simple Management

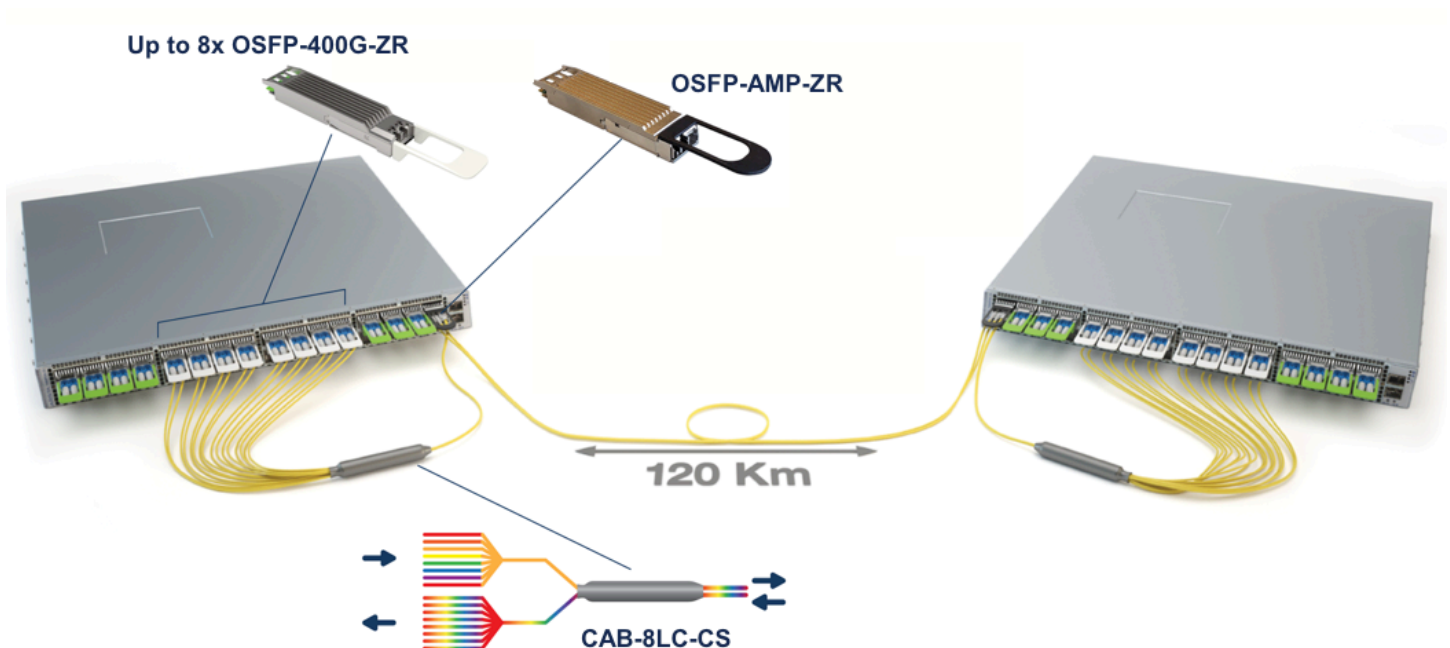
Arista EOS & CloudVision provide comprehensive configuration and real-time telemetry information allowing operators to provision, manage and monitor 400ZR and OSFP-AMP-ZR / QSFP-AMP-ZR modules.

EOS provides real-time reporting of low-speed Digital Optical Monitoring (DOM) parameters such as optical power levels, voltage and temperature, as well as high-speed line signal characteristics and statistics including Pre and Post-FEC Bit Error Rates (BER), Received Optical Signal-to-Noise Ratio (OSNR), chromatic dispersion, polarization mode dispersion and differential group delay.

In addition, for the OSFP-AMP-ZR and QSFP-AMP-ZR, EOS offers visibility into all pre-amp and booster-amp optical power inputs and outputs, allowing customers to monitor the aggregate link loss in real time.

Simple and Cost Effective DWDM, Optimized for Datacenter Interconnect

The arrival of 400ZR modules has ushered in a new era of DWDM technology marked by open, standards based, and pluggable DWDM optics, enabling true IP-over-DWDM. For point-to-point DCI applications, Arista's pluggable line system further simplifies deployment by eliminating the need for external line systems. The Arista 400ZR and pluggable line system provide a cost effective, simple, and easy to manage DWDM solution, purpose-built for DCI.



Simplify DCI with 400ZR transceivers and the pluggable amplifiers to transport up to 3.2Tb/s (8x 400ZR waves) over 120km

400ZR Specifications

Arista's OSFP and QSFP-DD 400ZR optical transceivers are Digital Coherent Optical (DCO) modules fully compliant with the OIF-400ZR industry standard. 400ZR modules enable 400Gb/s of Ethernet bandwidth over a single optical wavelength, using coherent DP-16QAM (Dual-Polarization 16 Quadrature Amplitude Modulation), at 59.84375 Gbaud/s. Arista's 400ZR transceivers offer full digital optical monitoring (DOM) and are fully tunable over the C-band (at 75GHz or 100GHz ITU-T grid spacing).

Mechanical Specifications	OSFP-400G-ZR	QDD-400G-ZR
Form Factor	OSFP	QSFP-DD, Type 2A
Module dimensions (H x W x D)	13.0 x 22.6 x 100.4mm	13.5 x 19 x 93.3mm
Pull tab color	White	White

Optical and Electrical Specifications	OSFP-400G-ZR & QDD-400G-ZR
Channel Range (Tunable)	191.300 to 196.100 THz
Channel Grid	100GHz & 75GHz
Optical Connector Type	Duplex LC
Tx output power	> -10 dBm*
Min Tx OSNR	45 dB
Rx input power	-16 dBm to 0 dBm
Min Rx OSNR	> 26 dB
Pre-FEC BER threshold	1.0E-02
Forward Error Correction (FEC)	C-FEC
Max amplified reach **	120km
Max span loss **	25 dB
Min span loss	2 dB
Max chromatic dispersion	2400 ps/nm
Power consumption	16 W Typ, 20 W max
Max case temperature	75C

* DOM reporting accuracy of +/- 1dB

** Reach and span loss are specified for a 3.2T DCI link with 8x 400ZR waves, amplified and managed through Arista's pluggable line system

OSFP-AMP-ZR and QSFP-AMP-ZR Specifications

The OSFP-AMP-ZR and QSFP-AMP-ZR modules integrate two micro-EDFAs: A boost amplifier, used to boost the optical output signals of the 400ZR transceivers, and a pre-amplifier, used to amplify the signal received after transmission over up to 120km of fiber.

Mechanical Specifications	OSFP-AMP-ZR	QSFP-AMP-ZR
Form Factor	OSFP	QSFP
Module dimensions (H x W x D)	13.0 x 22.6 x 100.4mm	13.36 x 18.35 x 82.7
Pull tab color	Black	Black
Line side optical connector (to / from up to 120km dark fiber)	LC duplex	CS duplex
Client side optical connector (to / from CAB-LC8-CS)	CS duplex	CS duplex

Electrical Specifications

OSFP-AMP-ZR & QSFP-AMP-ZR

Max power consumption	4 W
Max case temperature	70 C

Optical Specifications: OSFP-AMP-ZR & QSFP-AMP-ZR

Booster amplifier

Pre-amplifier

Number of 400ZR channels	1 to 8	1 to 8
Channel spacing	200 GHz	200 GHz
Frequency range	192.900 THz to 194.500 THz	192.900 THz to 194.500 THz
Input power per channel	-21dBm to -19 dBm *	-21dBm to 4dBm
Total input power	-21dBm to -10dBm *	-21dBm to 13dBm
Gain	25dB	2dB to 21dB
Gain tilt	-0.5 to 0 dB	-0.5 to 0 dB
Gain ripple (max, pk-to-pk)	0.5 dB	0.5 dB
Output power per channel	4 to 6 dBm *	0 to 6 dBm**
Total output power	4 to 15 dBm *	0 to 15 dBm **
Noise figure (max)	5.5dB	5.5dB @ 21dB gain 11.5dB @ 2dB gain
Polarization dependent gain (max)	0.5dB	0.5dB

* Assumes a -10dBm nominal 400ZR Tx Power and a 9dB to 11dB power combiner/splitter loss

** Power levels are reported before 1x8 splitter at the pre-amp CS local output. After the 1x8 splitter, each 400ZR receiver will see a total power between -11 dBm and +6 dBm and a channel power between -11 dBm (min) and -3 dBm (max) depending on the span loss and the number of 400G ZR waves.

CAB-LC8-CS, Colorless Mux / Demux, Specifications

The CAB-LC8-CS is a completely passive, optical power coupler-splitter, which combines the optical signals of up to eight 400ZR modules, onto a single fiber pair, enabling a total of 3.2Tb/s of bandwidth per fiber pair. The LC connectors of the OSFP-LC8-CS connect to 400ZR optical transceivers, while the CS connector of the cable, which contains the multiplexed optical signals, connects to the OSFP-AMP-ZR or QSFP-AMP-ZR for optical amplification.

Mechanical & Optical Specifications: CAB-LC8-CS

Total cable length	2 m
Host side optical connectors	Eight duplex-LC connectors (connects to 400ZR modules)
Line side optical connector	Duplex-CS (connects to OSFP-AMP-ZR)
Length from CS connector to fiber breakout	1 m
Optical insertion loss	9 to 11dB

400ZR+ QSFP-DD Module specifications

Arista's QDD-400G-ZRP is a high output power (>1dBm) OpenZR+ MSA compliant transceiver, optimized for two applications:

- I. Long-haul DWDM applications when used with external line systems.
- II. Un-amplified point to point links, with a total link loss budget of up to 22dB at 400G.

Mechanical Specifications

QDD-400G-ZRP

Form Factor	QSFP-DD, Type 2A
Module dimensions (H x W x D)	13.5 x 19 x 93.3mm
Pull tab color	White

Optical and Electrical Specifications

QDD-400G-ZRP

Channel Range (Tunable)	191.300 to 196.100 THz
Channel Grid	100GHz & 75GHz
Optical Connector Type	Duplex LC
Tx output power	-9dBm to 1dBm
Min OOB Tx OSNR	40 dB
Max total Rx input Power	13 dBm
Rx input power	Refer to tables below
Min Rx OSNR	Refer to tables below
Pre-FEC BER threshold	2E-02
Forward Error Correction (FEC)	O-FEC
Max amplified reach	Refer to tables below
Max chromatic dispersion	Refer to tables below
Power consumption	23 W max
Max case temperature	75C

Amplified DWDM Applications: OSNR, Rx Power and Chromatic Dispersion Compensation (CDC) Range

Mode	Min OSNR Sensitivity	@ Min Rx Power	CDC Range [default]
400G 16QAM	22.5 dB	-12 dBm	13,000 ps/nm
300G 8QAM	19.5 dB	-15 dBm	50,000 ps/nm
200G QPSK	14.8 dB	-18 dBm	50,000 ps/nm
100G QPSK	11.5 dB	-20 dBm	80,000 ps/nm

Un-amplified Point to Point Applications : TX Power, Min Rx Power and Link Loss Budget

Mode	Max Tx Power	Min Rx Power	Loss Budget
400G 16QAM	> 1dBm	-21 dBm	22 dB
300G 8QAM	> 1dBm	-23 dBm	24 dB
200G QPSK	> 1dBm	-29 dBm	30 dB
100G QPSK	> 1dBm	-32 dBm	33 dB

Standards Compliance & Certifications

EMC Emissions & Immunity	Subpart B, Part 15 FCC Class A, ICES-003 Issue 7 EN 55032:2015, BS EN 55032:2015, EN 55035:2017, EN 300 386 V2.1.1
Safety	EN 62368-1:2014 + A11:2017, IEC 62368-1:2014 21CFR-1040.10 LN#50, Laser Class 1 or 1M IEC 60825-1, Laser Class 1 or 1M EN 60825-1,
Certifications	CE South Korea KCC Australia RCM UKCA
European Union Directives	2014/35/EU Low Voltage Directive 2014/30/EU EMC Directive 2012/19/EU WEEE Directive 2011/65/EU RoHS 2015/863/EU Commission Delegated Directive

Environmental Characteristics

Operating Temperature	0 to 40°C (32 to 104°F)
Storage Temperature	-40 to 70°C (-40 to 158°F)
Relative Humidity	5 to 85%
Operating Altitude	0 to 10,000 ft, (0-3,000m)

Product Number	Product Description
OSFP-400G-ZR	400GBASE-ZR OSFP Digital Coherent Tunable Transceiver, up to 120km over duplex SMF with amplification
QDD-400G-ZR	400GBASE-ZR QSFP-DD Digital Coherent Tunable Transceiver, up to 120km over duplex SMF with amplification
OSFP-AMP-ZR	OSFP Optical amplifier line system for coherent ZR
QSFP-AMP-ZR	QSFP Optical amplifier line system for coherent ZR
CAB-LC8-CS	8 Channel Passive Optical Power Combiner / Splitter
CAB-LC-CS-0.2M	CS to LC Single Mode Fiber patch cable, 215mm length.
QDD-400G-ZRP	400GBASE-ZR+, OpenZR+ Compliant, Digital Coherent Tunable Transceiver

Warranty

Arista pluggable modules and cables include a one-year limited hardware warranty, which covers parts, repair or replacement with a 10 business day turn-around after the unit is received

Service and Support

Support services including next business day and 4-hour advance hardware replacement are available. For service depot locations, please see: <http://www.arista.com/en/service>

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