

Arista's Enhanced Performance Transceivers for Low Latency: Q&A

What are Arista's Enhanced Performance (E-Series) optical transceivers?

Arista's Enhanced Performance (or E-series) optical transceivers offer enhanced optical performance that enable 25G Ethernet and 100G Ethernet optical connectivity without requiring Forward Error Correction (FEC), reducing the latency of 25G and 100G Ethernet links by hundreds of nanoseconds.

Arista's E-Series of optics include the following devices:

E-Series Transceiver	Product Description
SFP-25G-LR-E	25GBASE-LR-Enhanced SFP, duplex LC optical connector, up to 2km over SMF without FEC (for low latency), or up to 10km over SMF with FEC.
SFP-25G-SR-E	25GBASE-SR-Enhanced SFP, duplex LC optical connector, up to 30m/50m over OM3/OM4 MMF without FEC (for low latency), or up to 70m/100m over OM3/OM4 MMF with FEC.
QSFP-100G-SR4-E	100GBASE-SR4-Enhanced QSFP, MPO-12 UPC optical connector, up to 30m/50m over OM3/OM4 MMF without FEC (for low latency), or up to 70m/100m over OM3/OM4 MMF with FEC.
QDD-8X25-MR-SR-E	8x 25GBASE-SR-Enhanced / 10GBASE-SR Dual-rate QSFP-DD, MPO-16 APC optical connector, up to 30m/50m over OM3/OM4 MMF without FEC (for low latency) at 25G, up to 70m/100m over OM3/OM4 MMF with FEC at 25G, or up to 300m/400m without FEC over OM3/OM4 MMF at 10G.

How does Arista's E-Series transceivers enable low latency 25GE and 100GE connectivity?

Arista's E-series transceivers enable low latency by eliminating FEC for 25GE and 100GE optical links.

At 25GE and 100GE speeds, all datacenter optics (except for 100GBASE-LR4) specified according to the IEEE 802.3 Ethernet standard require FEC to detect and correct bit errors incurred during optical transmission. The pre-FEC Bit Error Rate (BER) of standard Ethernet 25G and 100G optical transceivers may be as high as 5E-5. By using FEC, the post-FEC BER can be reduced to < 1E-12, the maximum BER allowed for Ethernet links. FEC is usually implemented automatically by the host system, however the addition of FEC can contribute up to 250ns of latency per link.



Arista's Enhanced Performance (E-series) transceivers have improved optical performance, ensuring a worst case BER of <1E-12 without FEC (typical BER < 1E-15) up to 30m/50m of OM3/OM4 MMF (MMF E-Series transceivers) and up to 2km SMF (SMF E-Series transceivers).

The diagram below illustrates how FEC (and corresponding FEC latency) can be eliminated by using Arista's Eseries transceivers. While the diagram below uses Arista's QSFP-100G-SR4-E optical transceiver, the same principle of low-latency operation without FEC applies to all Arista's E-Series transceivers.

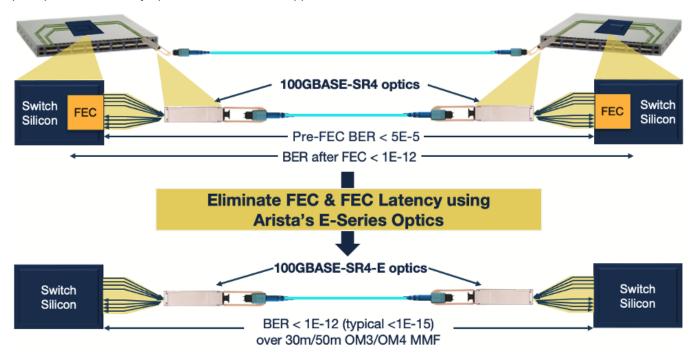


Figure 1: Eliminate FEC & FEC Latency with Arista's Enhanced Performance (E-Series) Transceivers

How much latency can be reduced by using Arista's E-Series optics and eliminating FEC?

The different FEC formats defined by IEEE 802.3 Ethernet standard for 25GE and 100GE, and their associated latency are summarized in the table below:

Data Rate	FEC Type	IEEE 803.2 Clause	Latency	Where used
25GE	RS-FEC: RS(528,514)	CL 108	250 ns	All 25G Ethernet optics and CA-L category twinax copper cables
	BASE-R FEC or "Firecode" FEC	CL 74	80 ns	CA-S or CA-N category copper twinax cables
100GE	RS-FEC: RS(528,514)	CL 91	150 ns	All 100G-4 optics, and all 100G-4 copper twinax cables

Arista's E-series optics reduce latency by eliminating the requirement for FEC, saving up to 250ns of latency.

Migrating network speeds from 10GE to 25GE also reduces the serialization delay by a factor of 2.5x. The table below compares the serialization delays incurred by an Ethernet packet of various packet lengths at 10GE and 25GE data rates.



Packet Length	Serialization Delay at 1	0GE and 25GE	Reduction in serialization	
	10GE	25GE	delay from 10GE to 25GE	
64	51.2 ns	20.48 ns	30.7 ns	
256	204.8ns	81.92 ns	122.88 ns	
512	409.6ns	163.84ns	245.76 ns	

Arista's E-Series optics enable 10GE to 25GE network upgrades that **cut serialization delay by a factor of 2.5x**, **without incurring any additional latency due to FEC**.

Are any E-series optics 10G / 25G dual-rate?

Yes - the QDD-8X25G-MR-SR-E is dual-rate and can operate at 8x 25GE (or 2x 100G-4) and 8x10GE. The remaining E-series optics are single rate and are specified for 25G / lane speeds only.

Which E-Series optics can be used for optical breakout?

The QDD-8X25-MR-SR-E and the QSFP-100G-SR4-E can be used for optical breakout as shown below.

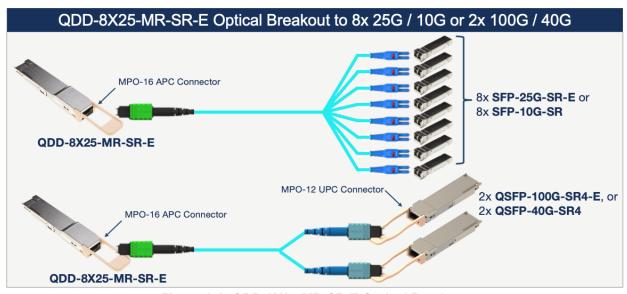


Figure 2.1: QDD-8X25-MR-SR-E Optical Breakout

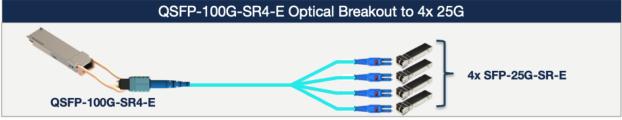


Figure 2.2: QSFP-100G-SR4-E Optical Breakout



Will Arista's E-Series optical transceivers interop with IEEE standards-based optics?

Yes. While Arista's Enhanced Performance optical transceivers exceed the optical specifications of standards-based IEEE optics, the E-series transceivers will interoperate with all equivalent standards-based Ethernet optics.

Note that when connecting to IEEE standard optics, FEC should be used to guarantee reliable operation over any link distance. For operation without FEC, Arista's E-Series optical transceivers should be used at both ends of the link. The tables below summarize the interop capabilities of Arista's E-Series optics.

Interoperability of MMF E-Series Optics at 25G / lane			
	SFP-25G-SR-E, QSFP-100G-SR4-E, QDD-8X25-MR-SR-E @ 8x 25G	SFP-25G-SR, SFP-25G-MR-SR, SFP- 25G-MR-XSR, QSFP-100G-SR4, and QSFP-100G-XSR4	
SFP-25G-SR-E, QSFP-100G-SR4-E, QDD-8X25-MR-SR-E @ 8x 25G	30m/50m OM3/OM4 without FEC 70m/100m OM3/OM4 with FEC	70m / 100m OM3 / OM4 with FEC	

Interoperability of MMF E-Series Optics at 10G / lane		
	QDD-8X25-MR-SR-E @ 8x 10G	
	SFP-25G-MR-SR, SFP-25G-MR-XSR @ 10G	
	SFP-10G-SR, QSFP-40G-SR4, QSFP-40G-XSR4	
QDD-8X25-MR-SR-E @ 8x 10G	300m / 400m OM3 / OM4 without FEC	

Interoperability	of SMF E-Series Optics			
	SFP-25G-LR-E	SFP-25G-LR and SFP-25G-MR-LR	QSFP-100G-PSM4	QSFP-100G-PLRL4
SFP-25G-LR-E	2km over SMF without FEC 10km over SMF with FEC	10km over SMF with FEC	500m over SMF with FEC	2km over SMF with FEC

Which Arista platforms support E-Series optical transceivers?

The QDD-8X25G-MR-SR-E is supported on all Arista QSFP-DD ports, including the ultra-low latency 7130B Series, and QSFP-DD ports on 7050X and 7060X platforms.

The QSFP-100G-SR4-E is supported on all Arista QSFP-DD and 100G QSFP ports, including the ultra-low latency 7130B, 7135LB and 7132LB Series, and 7050X and 7060X platforms.

The SFP-25G-SR-E and SFP-25G-LR-E are supported on all Arista 25G SFP ports, including the ultra-low latency 7135LB and 7132LB Series, and 25G SFP ports on 7050X and 7060X platforms.

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