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CISCO
The bridge to possible

Cisco 400G QSFP-DD High-Power (Bright) Optical Module

Contents

Cisco offers a comprehensive range of pluggable optical modules in the Cisco® pluggables portfolio. The wide variety of modules gives you flexible and cost-effective options for all types of interfaces. Cisco offers a range of GBIC, SFP, XFP, SFP+, CXP, CFP, Cisco CPAK, and QSFP+ pluggable modules. These small, modular optical interface transceivers offer a convenient and cost-effective solution for an array of applications in the data center, campus, metropolitan-area access and ring network, storage area network, and long-haul network. In recent times, with longer strides of innovation, Cisco has introduced Digital Coherent 400G DWDM ZR+ as well as interfaces to the market. The latest addition to the Cisco portfolio pushes this boundary further with the introduction of the 400G QSFP-DD High-Power (Bright) Optical Module.

Figure 1.
Cisco 400G QSFP-DD High-Power (Bright) Optical module

Product overview

Cisco is now expanding the range of 400G Digital Coherent QSFP-DD transceivers, introducing High Tx Power variants (+1dBm of Tx Power). Thanks to the miniaturization of the technology with a 7-nm manufacturing procedure and innovation in silicon photonic technology, it is now possible to also squeeze an Optical Amplifier (Mini-EDFA) within a QSFP-DD form factor.

Cisco 400G QSFP-DD High-Power (Bright) Optical module's small size and low power make it an optimal choice for a wide range of DCI/Cloud, metro access/aggregation, wireless backhaul, and campus interconnect applications.

Cisco 400G QSFP-DD High-Power (Bright) Optical module is mechanically compliant to the QSFP-DD Type 2A Module Specification. The QSFP-DD module contains a PCB with a 76-contact card-edge electrical interface to external host-side logic. The media interface is a duplex LC connector coupled to a 1550-nm optical fiber carrying the DP-mQAM coherent signal. The signaling operates in the C-band.

Two product variants are available:

1. Ethernet Variant (DP04QSDD-HE0)

2. Multirate OTN/Ethernet Variant (DP04QSDD-HK9)

Cisco 400G QSFP-DD High-Power (Bright) Optical Module Ethernet Variant Overview

Cisco 400G QSFP-DD High-Power (Bright) Optical module Ethernet variant is an enhanced version of the currently available QSFP-DD ZR+ Optical Module leveraging the same operational modes but providing as a major enhancement the increase of the Tx Optical Power up to +1dBm (EoL).

Supported client interface for this pluggables is Ethernet based, making this model perfectly suitable to be hosted on a router/switch host. The module asynchronously (GMP) maps an Ethernet signal from a switch/router to an intermediate 400ZR frame structure and then adapts the frame structure to the appropriate FEC engine. The encoded signal is subsequently DSP framed and modulated for transmission as a coherent Dual-Polarity mQAM signal.

Cisco 400G QSFP-DD High-Power (Bright) Optical Module Multirate Ethernet/OTN Variant Overview

The Cisco 400G QSFP-DD High-Power (Bright) Optical module multirate Ethernet/OTN variant shares the same HW platform (and so also the high Tx power) of the Ethernet variant but also supports OTN clients. The module leverages an intermediate ODUFlex,OTUCn/FlexO-x frame structure and then adapts the frame structure with OFEC.

This variant, thanks to the OTN OH, supports Layer-1 (L1) functionality to support authentication and encryption/decryption of the OPU[Cn,4] payload. The security IP provides wire-speed Galois-Counter- Mode (GCM) AES 256-bit security in either authentication-only (GMAC) or encryption/decryption-only (CTR) modes or both (GCM). Inter-host key exchange is supported via communication over the GCC channel.

The Cisco 400G QSFP-DD High-Power (Bright) Optical module multirate Ethernet/OTN module is also offering a PAYG model with a licensed approach in which a 100G BW product is offered (DP04QSDD-LK9).

Features and benefits

In addition to the fact that this solution is providing a high-performance 400G WDM Coherent pluggable perfectly fitting 400G ports from a routing and switching host, additional benefits come from the high Tx power interface. Tx power of +1dBm allows for compatibility with a vast majority of the deployed add/drop scheme of brownfield WDM systems.

In fact, higer TX poweris allowing to be compatible with any high insertion loss add/drop structure. As consequence, differently by the standard OIF MSA optics (limited to -10dBm), the High Tx Power 400G Coherent pluggable can be deployed on the vast majority of existing WDM systems with the only caveat that a 60Gbaud signal is supported.

All network operators can now approach the Routed Optical Networking solution without any limitation driven by the legacy WDM system, as there is no substantial difference from the optical power point of view respect a legacy Coherent Transponder and a new 400G QSFP-DD High-Power (Bright) Optical Module.

The high Tx power functionality is also extremely useful in a P2P application over dark fiber: in this case, the 10dB of additional optical power translates into a much longer reach.

The availability of embedded Tuneable Filter functionality allows the Transmitted Optical Signal to provide a narrow optical spectrum, which allows it to be compatible with any add/drop structure (filtered or unfiltered based) in terms of Tx OSNR penalty.

Product sustainability

Information about Cisco's environmental, social, and governance (ESG) initiatives and performance is provided in Cisco's CSR and sustainability reporting.

Table 1. Cisco environmental sustainability information

Sustainability Topic		Reference
General	Information on product-material-content laws and regulations	[Materials](#)
	Information on electronic waste laws and regulations, including our products, batteries, and packaging	[WEEE Compliance](#)
	Information on product takeback and reuse program	[Cisco Takeback and Reuse Program](#)
	Sustainability inquiries	Contact: csr_inquiries@cisco.com
Material	Product packaging weight and materials	Contact: environment@cisco.com

Product specifications

Transmitter specifications

Product ID	Max Transmit Power	Symbol Rate (±20 ppm)	Modulation (Payload)	FEC
DP04QSDD-HE0	+1dBm (tuneable down to -9dBm)	60,138,546,798	16-QAM (400G)	OFEC
		60,138,546,798	8-QAM (300G)	OFEC
		60,138,546,798	QPSK (200G)	OFEC
		40,092,364,532	8-QAM (200G)	OFEC
		30,069,273,399	16-QAM (200G)	OFEC
		30,069,273,399	QPSK (100G)	OFEC
DP04QSDD-HK9 **DP04QSDD-LK9**	+1dBm (tuneable down to -9dBm)	60,138,546,798 for Ethernet 63,139,467,923 for OTN	16-QAM (400G)	OFEC
		60,138,546,798 for Ethernet 63,139,467,923 for OTN	8-QAM (300G)	OFEC
		60,138,546,798 for Ethernet 63,139,467,923 for OTN	QPSK (200G)	OFEC
		40,092,364,532 for Ethernet 42,092,978,615 for OTN	8-QAM (200G)	OFEC
		30,069,273,399 for Ethernet 31,569,733,961 for OTN	16-QAM (200G)	OFEC

Product ID	Max Transmit Power	Symbol Rate (±20 ppm)	Modulation (Payload)	FEC
		30,069,273,399 for Ethernet 31,569,733,961 for OTN	QPSK (100G)	OFEC

Receiver specifications

Product ID	Modulation (Payload)	RX OSNR Sensitivity (dB)	RX Sensitivity Optimal	RX Power Sensitivity (No ASE Noise)	Max Rx Power	CD Robustness (ps/nm)
DP04QSDD-HE0	16-QAM (400G)	22.5	−12dBm	−21dBm	13dBm	Default: ±13,000 Configurable up to: ±52,000
	8-QAM (300G)	19.5	−15dBm	−23dBm		Default: ±50,000 Configurable up to: ±100,000
	QPSK (200G)	14.8	−18dBm	−29dBm		Default: ±50,000 Configurable up to: ±100,000
	8-QAM (200G)	17.2	−16dBm	−28dBm		Default: ±50,000 Configurable up to: ±100,000
	16-QAM (200G)	19.3	−15dBm	−25dBm		Default: ±30,000 Configurable up to: ±85,000
	QPSK (100G)	11.5	−20dBm	−32dBm		Default: ±80,000 Configurable up to: ±160,000
DP04QSDD-HK9 **DP04QSDD-LK9**	16-QAM (400G)	Ethernet: 22.5 OTN: 23	Ethernet: −12dBm OTN: −14dBm	Ethernet: −21dBm OTN: −20dBm		Ethernet: ±13,000 (default) Configurable up to: ±52,000 OTN: ±12,000 (default) Configurable up to: ±48,000
	8-QAM (300G)	Ethernet: 19.5 OTN: 20.5	Ethernet: −15dBm OTN: −16dBm	Ethernet: −23dBm OTN: −23dBm		Ethernet: ±50,000 (default) Configurable up to: ±100,000 OTN: ±48,000 (default) Configurable up to: ±96,000
	QPSK (200G)	Ethernet: 14.8 OTN: 15.7	Ethernet: −18dBm OTN: −18dBm	Ethernet: −29dBm OTN: −28dBm		Ethernet: ±50,000 (default) Configurable up to: ±100,000 OTN: ±48,000 (default) Configurable up to: ±96,000
	8-QAM (200G)	Ethernet: 17.2 OTN: 17.5	Ethernet: −16dBm OTN: −16dBm	Ethernet: −28dBm OTN: −28dBm		Ethernet: ±50,000 (default) Configurable up to: ±100,000 OTN: ±48,000 (default) Configurable up to: ±96,000
	16-QAM (200G)	Ethernet: 19.3 OTN: 20	Ethernet: −15dBm OTN: −15dBm	Ethernet: −25dBm OTN: −24dBm		Ethernet: ±30,000 (default) Configurable up to: ±850,000 OTN: ±25,000 (default)

Product ID	Modulation (Payload)	RX OSNR Sensitivity (dB)	RX Sensitivity Optimal	RX Power Sensitivity (No ASE Noise)	Max Rx Power	CD Robustness (ps/nm)
						Configurable up to: ±77,000
	QPSK (100G)	Ethernet: 11.5 OTN: 11.8	Ethernet: −20dBm OTN: −20dBm	Ethernet: −32dBm OTN: −32dBm		Ethernet: ±80,000 (default) Configurable up to: ±160,000 OTN: ±77,000 (default) Configurable up to: ±154,000

Ordering information

Cisco 400G QSFP-DD High-Power (Bright) Optical modules

Part #	Product Description
DP04QSDD-HE0	QSFP-DD 400G ZR+ – High Tx Power
DP04QSDD-HK9	QSFP-DD 400G ZR+ – High Tx Power – OTN
DP01QSDD-LK9	QSFP-DD 400G ZR+ – High Tx Power – OTN – 100G BW
E-100G-TRK-ZRPL	E-Deliver RTU enabling 100G BW on QDD ZR+

Warranty information

Product warranty terms and other information applicable to Cisco products are available at www.cisco.com/go/warranty.

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