Data Sheet

Cisco CWDM GBIC/SFP Solution

The Cisco® Coarse Wavelength-Division Multiplexing (CWDM) Gigabit Interface Converter (GBIC)/Small Form-Factor Pluggable (SFP) Solution allows enterprise companies and service providers to provide scalable and easy-to-deploy Gigabit Ethernet and Fibre Channel services in their networks. The product set enables the flexible design of highly available, multiservice networks.

The Cisco CWDM GBIC/SFP Solution is a convenient and cost-effective solution for the adoption of Gigabit Ethernet and Fibre Channel in campus, data center, and metropolitan-area access networks.

The Cisco CWDM GBIC/SFP Solution has two main components (Figure 1): a set of eight different pluggable transceivers (Cisco CWDM GBICs and Cisco CWDM SFPs), and a set of different Cisco CWDM optical add-drop modules (OADMs). A Cisco CWDM chassis enables rack-mounting up to two of the Cisco CWDM OADMs.

Key Features and Benefits

Scalability

The Cisco CWDM GBIC/SFP Solution enables the transport of up to eight channels (Gigabit Ethernet and/or Fibre Channel) over single-mode fiber strands.

Figure 1
Cisco CWDM GBIC/SFP Solution

Easy Deployment and Flexible Implementation

The Cisco CWDM GBIC (and Cisco CWDM SFP) fits into a standard GBIC (and SFP) port supporting the IEEE 802.3z standard on the supported Cisco platforms. The Cisco CWDM OADM is passive and requires no power. Neither the Cisco CWDM GBIC (and Cisco CWDM SFP) nor the Cisco CWDM OADM requires configuration.

The Cisco CWDM GBIC/SFP Solution allows for a variety of network configurations—from multichannel point-to-point to hub and meshed-ring configurations.

High Availability

The Cisco CWDM GBIC/SFP Solution takes advantage of a multichannel architecture and the inherent protection of ring architectures. The solution enables:

- Use of Layer 2 and Layer 3 redundancy and failover mechanisms at the channel endpoints (CWDM GBIC/SFP) to build highly available links
- Use of two-path link configurations in a ring architecture to provide protection from fiber cuts

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Investment Protection

The Cisco CWDM GBIC/SFP Solution enables enterprises and service providers to increase the bandwidth of an existing Gigabit Ethernet optical infrastructure without adding new fiber strands. The solution can be used in parallel with other Cisco GBIC and Cisco SFP devices on the same platform.

Deployment Scenarios

Point-to-Point

In a point-to-point configuration (Figure 2), two endpoints are directly connected via a fiber link. The Cisco CWDM GBIC/SFP Solution enables customers to add or drop as many as eight channels (Gigabit Ethernet and/or Fibre Channel) into a pair of single-mode fiber strands. As a result, the need for additional fiber is minimized. Redundant point-to-point links are possible by adding or dropping redundant channels into a second pair of single-mode fiber strands.

A single fiber point-to-point configuration is also possible (Figure 3). By using different wavelengths to transmit and receive signals, as many as four channels can be transported over a single fiber strand.

The main applications for the architecture are enterprise campus links and service provider point-of-presence (POP) or hub interconnects across a metro area.

Figure 2
Point-to-Point Architecture (Dual-Fiber Link)

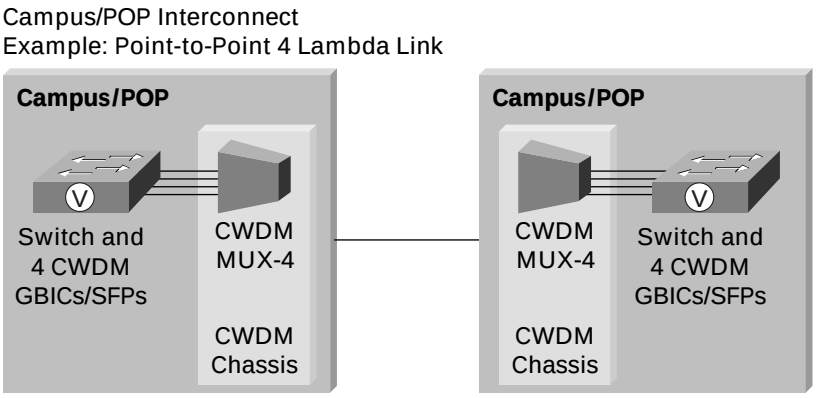

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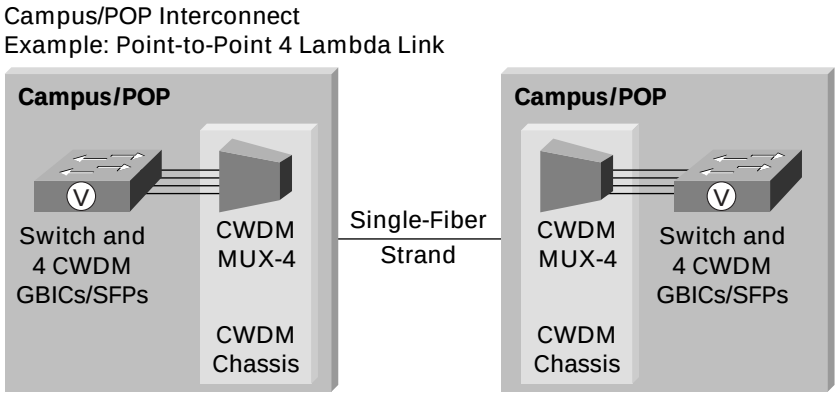
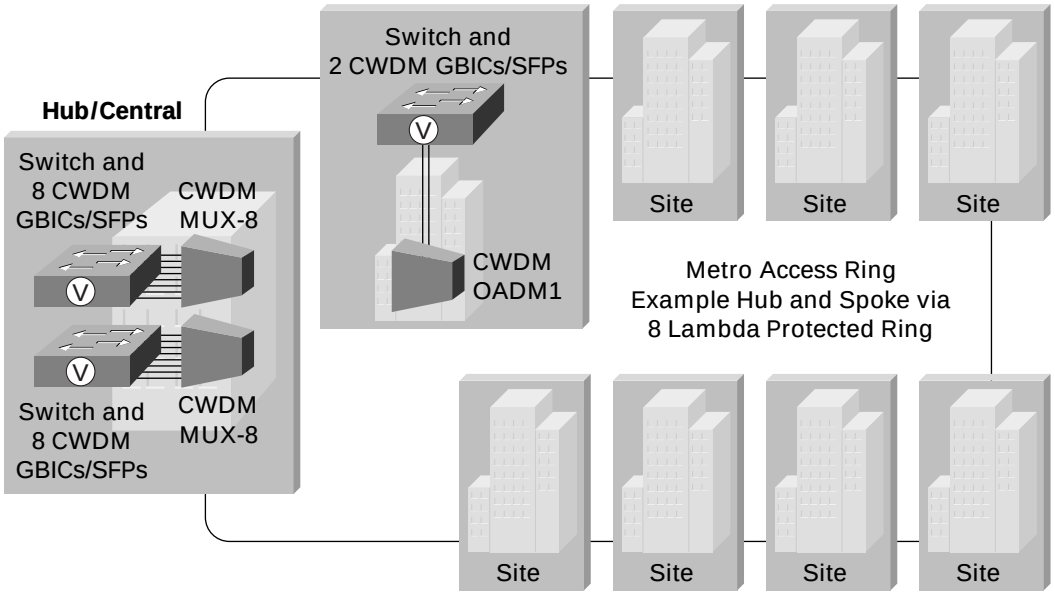
Figure 3
Point-to-Point Architecture (Single-Fiber Link)



Hub-and-Spoke (Ring)

In a hub-and-spoke configuration (Figure 4), multiple nodes (spokes) are connected with a hub location through a ring of single-mode fiber. Each hub-node connection can consist of a single or multiple channels. Protection from fiber cuts in the ring is achieved by connecting the hub and nodes through both directions of the optical ring. Service provider metro access rings are the main applications for this architecture.

Figure 4
Hub-and-Spoke (Ring) Architecture



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Mesh (Ring)

Mesh deployments are a combination of hub-and-spoke and point-to-point or even multiple point-to-point connections in parallel on the same optical link. Deployment of the maximum eight wavelengths allows for different combinations of these scenarios.

Technical Specifications

Cisco CWDM GBICs

The Cisco CWDM GBIC (Figure 5) is a hot-swappable input and output device that plugs into an 802.3z standard-compliant GBIC port or slot of a Cisco switch or router, linking the port with the fiber-optic network.

Figure 5
Cisco CWDM GBICs

Performance

- 1.25-Gbps full-duplex links
- Optical link budget of 30 decibels (dB)

Platform Support

The Cisco CWDM GBICs are supported across a variety of Cisco switches, routers, and optical transport devices. For more details, see the document *Cisco CWDM GBIC Compatibility Matrix*.

Connectors and Cabling

Equipment: Standard GBIC interface

Network: Dual SC connector

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Environmental Conditions and Power Requirements

The operating temperature range is between 32 and 122 F (0 and 50 C); storage temperature range is between –40 and 185 F (–40 and 85 C). Table 1 provides the electrical power interface details, and Table 2 describes optical parameters.

Table 1 Electrical Power Interface Data

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply current	I_s		280	350	mA
Maximum voltage	V_{max}			6	V
Surge current	I_{Surge}			400	mA
Input voltage	V_{cc}	4.75	5	5.25	V

Optical Specifications

Table 2 Optical Parameters

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes/Conditions
Transmitter center wavelength	λ_c	(x-4)		(x+7)	nm	Available center wavelengths are 1470, 1490, 1510, 1530, 1550, 1570, 1590, and 1610 nm
Side-mode suppression ratio	SMSR	30			dB	
Transmitter optical output power	P_{out}	+1.0	+3.0	+5.0	dBm	Average power coupled into single-mode fiber
Receiver optical input power (BER <10^{-12} with PRBS 2^{-7}–1)	P_{in}	–29.0	–33.0	–7.0	dBm	@ 1.25 Gbps, 140 F (60 C) case temperature
Optical input wavelength	λ_{in}	1450		1620	nm	
Transmitter extinction ratio	OMI	9			dB	
Dispersion penalty at 100 km				3	dB	@ 1.25 Gbps

Note: Parameters are specified over temperature and at end of life unless otherwise noted.

Note: When shorter distances of single-mode fiber are used, it may be necessary to insert an in-line optical attenuator in the link to avoid overloading the receiver.

Warranty

• Standard warranty: 90 days

• Extended warranty (option): Cisco CWDM GBICs may be covered via a Cisco SMARTnet® support contract for the Cisco switch or router chassis

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Ordering Information

Refer to Table 3 for details on ordering Cisco CWDM GBICs.

Table 3 Cisco CWDM GBIC Product Information

Product Number	Description	Color
CWDM-GBIC-1470=	Cisco 1000BASE-CWDM GBIC 1470 nm	Gray
CWDM-GBIC-1490=	Cisco 1000BASE-CWDM GBIC 1490 nm	Violet
CWDM-GBIC-1510=	Cisco 1000BASE-CWDM GBIC 1510 nm	Blue
CWDM-GBIC-1530=	Cisco 1000BASE-CWDM GBIC 1530 nm	Green
CWDM-GBIC-1550=	Cisco 1000BASE-CWDM GBIC 1550 nm	Yellow
CWDM-GBIC-1570=	Cisco 1000BASE-CWDM GBIC 1570 nm	Orange
CWDM-GBIC-1590=	Cisco 1000BASE-CWDM GBIC 1590 nm	Red
CWDM-GBIC-1610=	Cisco 1000BASE-CWDM GBIC 1610 nm	Brown
CWDM-8GBIC-SET1=	Set of 4 pairs of Cisco 1000BASE-CWDM GBICs	2x Gray, Blue, Yellow, Red
CWDM-8GBIC-SET2=	Set of 4 pairs of Cisco 1000BASE-CWDM GBICs	2x Violet, Green, Orange, Brown

Regulatory and Standards Compliance

Compatible with 1000BASE-X standard as specified in IEEE 802.3z

Safety

- Laser Class I 21CFR1040

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Cisco CWDM SFPs

A Cisco CWDM SFP (Figure 6) is a hot-swappable input and output device that plugs into an SFP port or slot of a Cisco switch or router, linking the port with the fiber-optic network.

The Cisco CWDM SFPs are multirate parts that support both Gigabit Ethernet and Fibre Channel (1 Gigabit and 2 Gigabit).

Figure 6
Cisco CWDM SFPs

Performance

- Gigabit Ethernet 1.25-Gbps full-duplex links with an optical link budget of 29 dB)
- Fibre Channel 1.06-Gbps and 2.12-Gbps full-duplex links with an optical link budget of 28 dB

Platform Support

The Cisco CWDM SFPs are supported across a variety of Cisco switches, routers, and optical transport devices. For more details, see the document *Cisco CWDM SFP Compatibility Matrix*.

Connectors and Cabling

Equipment: Standard SFP interface

Network: Dual LC connector

Environmental Conditions and Power Requirements

Operating temperature range: 32 to 122 F (0 and 50 C)

Storage temperature range: –40 to 185 F (–40 to 85 C)

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Table 4 describes the electrical power interface details, and Table 5 describes optical parameters.

Table 4 Electrical Power Interface Data

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply current	I_s		220	300	mA
Surge current	I_{Surge}			+30	mA
Input voltage	V_{max}	3.1	3.3	3.6	V

Table 5 Optical Parameters

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes/Conditions
Transmitter center wavelength	λ_c	(x-4)		(x+7)	nm	Available center wavelengths are 1470, 1490, 1510, 1530, 1550, 1570, 1590, and 1610 nm
Side-mode suppression ratio	SMSR	30			dB	
Transmitter optical output power	P_{out}	0.0		5.0	dBm	Average power coupled into single-mode fiber
Receiver optical input power (BER <10^{-12} with PRBS 2^{-7}–1)	P_{in}	–28.0		–7.0	dBm	@ 2.12 Gbps, 140 F (60 C) case temperature
Receiver optical input power (BER <10^{-12} with PRBS 2^{-7}–1)	P_{in}	–29.0		–7.0	dBm	@ 1.25 Gbps, 140 F (60 C) case temperature
Receiver optical input wavelength	λ_{in}	1450		1620	nm	
Transmitter extinction ratio	OMI	9			dB	
Dispersion penalty at 100 km				3	dB	@ 2.12 Gbps
Dispersion penalty at 100 km				2	dB	@ 1.25 Gbps

Note: Parameters are specified over temperature and at end of life unless otherwise noted.

Note: When shorter distances of single-mode fiber are used, it may be necessary to insert an in-line optical attenuator in the link to avoid overloading the receiver.

Warranty

• Standard warranty: 90 days

• Extended warranty (option): Available under a Cisco SMARTnet support contract for the Cisco switch or router chassis

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Ordering Information

Refer to Table 6 for details on ordering Cisco CWDM SFPs.

Table 6 Cisco CWDM SFP Product Information

Product Number	Description	Color
CWDM-SFP-1470=	Cisco CWDM SFP 1470 nm; Gigabit Ethernet and 1G/2G FC	Gray
CWDM-SFP-1490=	Cisco CWDM SFP 1490 nm; Gigabit Ethernet and 1G/2G FC	Violet
CWDM-SFP-1510=	Cisco CWDM SFP 1510 nm; Gigabit Ethernet and 1G/2G FC	Blue
CWDM-SFP-1530=	Cisco CWDM SFP 1530 nm; Gigabit Ethernet and 1G/2G FC	Green
CWDM-SFP-1550=	Cisco CWDM SFP 1550 nm; Gigabit Ethernet and 1G/2G FC	Yellow
CWDM-SFP-1570=	Cisco CWDM SFP 1570 nm; Gigabit Ethernet and 1G/2G FC	Orange
CWDM-SFP-1590=	Cisco CWDM SFP 1590 nm; Gigabit Ethernet and 1G/2G FC	Red
CWDM-SFP-1610=	Cisco CWDM SFP 1610 nm; Gigabit Ethernet and 1G/2G FC	Brown

Regulatory and Standards Compliance

Compatible with 1000BASE-X standard as specified in IEEE 802.3z

Compatible with Fibre Channel Draft Physical Interface Specification (FC-PI 10.0)

Safety

- Laser Class I 21CFR1040

Cisco CWDM OADMs and Cisco CWDM Chassis

The Cisco CWDM OADMs are passive devices that provide the ability to multiplex and demultiplex, or add and drop wavelengths from multiple fibers onto one fiber. The OADM connectors are interfaced to the color-matching Cisco CWDM GBICs or Cisco CWDM SFPs on the equipment side. All modules are the same size. The Cisco CWDM chassis enables rack mounting for up to two Cisco CWDM OADMs in a single rack unit.

Cisco provides four different types of CWDM OADMs:

• *Dual Single-Channel OADM (CWDM-MUX-AD-xxxx=)*—This device allows you to add and drop two channels of the same wavelength into two directions of an optical ring (Figure 7). The other wavelengths are passed through the OADM. Dual fiber is used for both network and GBIC (and SFP) connections. Eight options of this OADM are available, one for each wavelength: 1470, 1490, 1510, 1530, 1550, 1570, 1590, and 1610 nanometers (nm).

• *4-Channel OADM: (CWDM-MUX-4=)*—This device allows you to add and drop four channels (with different wavelengths) into one direction of an optical ring (Figure 8). The other wavelengths are passed through the OADM. Dual fiber is used for both network and GBIC (and SFP) connections. The four wavelengths are set to 1470, 1510, 1550, and 1590 nm.

• *8-Channel Multiplexer/Demultiplexer (CWDM-MUX-8=)*—This device allows you to multiplex and demultiplex eight separate channels into one pair of fiber (Figure 9). Dual fiber is used for both network and GBIC (and SFP) connections. The eight wavelengths are set to 1470, 1490, 1510, 1530, 1550, 1570, 1590, and 1610 nm.

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• *Single Fiber 4-Channel Multiplexer/Demultiplexer (CWDM-MUX-4-SFx=)*—This device allows you to multiplex and demultiplex up to four separate channels into one strand of fiber (Figure 10). Dual fiber is used for the GBIC (and SFP) connections; single fiber is used for the network connections. The two existing models (CWDM-MUX-4-SF1= and CWDM-MUX-4-SF2=) have to be used to create a four-channel single fiber point-to-point link.

Table 7 OADM Type Comparison

OADM Type	No. of Fiber Strands/Network	Maximum No. of Gigabit Links	OADM vs. Multiplexer/ Demultiplexer	Architecture Options
CWDM-MUX-AD-xxxx=	2	8	OADM (dual add/drop)	Ring (point-to-point possible)
CWDM-MUX-4=	2	8	OADM	Ring, point-to-point
CWDM-MUX-8=	2	8	Multiplexer/demultiplexer	Ring, point-to-point
CWDM-MUX-4-SFx=	1	4	Multiplexer/demultiplexer	Point-to-point only

Figure 7
Dual Single-Channel Cisco CWDM OADM (CWDM-MUX-AD-1470= Pictured)

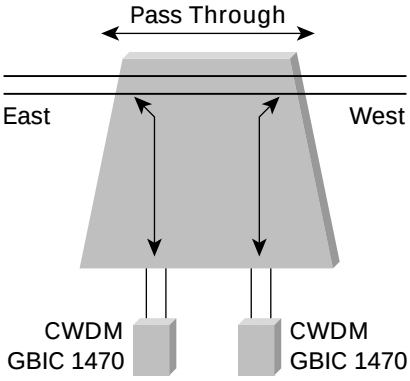

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Figure 8
4-Channel Cisco CWDM OADM

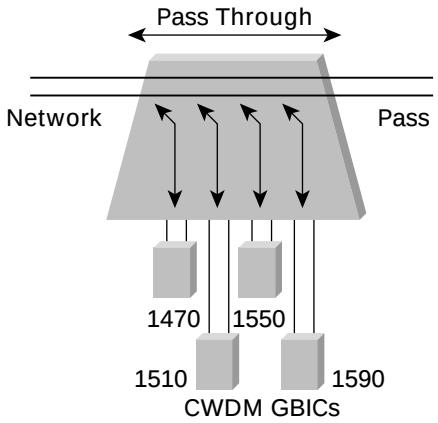


Figure 9
8-Channel Cisco CWDM Multiplexer/Demultiplexer

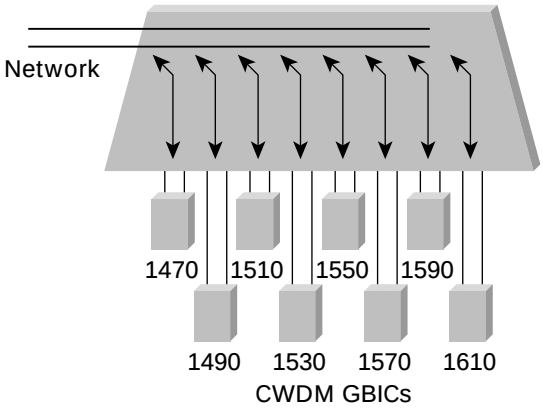
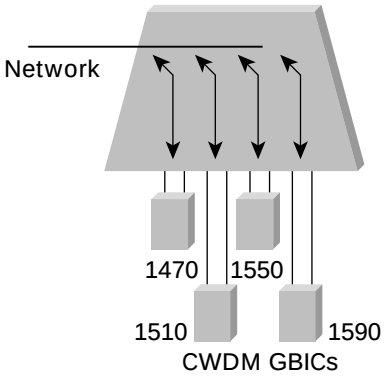


Figure 10
Single Fiber 4-Channel Cisco CWDM Multiplexer/Demultiplexer (CWDM-MUX-4-SF1= Pictured)



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Connectors and Cabling

Equipment: Dual SC connector per channel

Network:

Dual SC connector—CWDM-MUX-AD-xxxx=, CWDM-MUX-4=, CWDM-MUX-8=

Single SC connector—CWDM-MUX-4-SF1=, CWDM-MUX-4-SF2=

Environmental Conditions and Power Requirements

The operating temperature range is between 0 and 60 C(32 to 140 F),storage temperature range is –40 to 85 C(–40 to 185 F).

The Cisco CWDM OADMs and the Cisco CWDM chassis are passive components that do not require power.

Dimensions and Weight

All the different Cisco CWDM OADMs have the same dimensions—WxDxH: 8.3″ x 1.17″ x 10.4″ (21.15 cm x 43.35 cm x 26.52 cm). Two of these modules fit into one Cisco CWDM chassis. The Cisco CWDM chassis is 1-RU in height and fits in a standard 19″ rack.

Warranty

- Standard warranty: 90 days (10-day warranty from return to manufacturer authorization)
- Extended warranty (option): Cisco SMARTnet support contract available

Optical Specifications

Table 8 shows the optical parameters of the Cisco CWDM OADMs.

Table 8 Optical Parameters for Cisco CWDM OADMs

	Max Insertion Loss (dB)			Typical Insertion Loss (dB)		
	Add	**Drop**	**Pass**	**Add**	**Drop**	**Pass**
CWDM-MUX-AD-xxxx=	1.9	2.3	2.0	1.2	1.6	1.5
CWDM-MUX-4=	4.0	5.0	2.6	3.0	4.0	2.0
CWDM-MUX-8=	4.0	5.0	–	3.0	4.0	–
CWDM-MUX-4-SF1=	3.0	3.0	–	3.0	3.0	–
CWDM-MUX-4-SF1=	3.0	3.0	–	3.0	3.0	–

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Ordering Information

Table 9 shows ordering information for the Cisco CWDM OADMs and chassis.

Table 9 Cisco CWDM OADM and Cisco CWDM Chassis Ordering Information

Product Number	Description
CWDM-MUX-AD-1470=	1470 nm OADM
CWDM-MUX-AD-1490=	1490 nm OADM
CWDM-MUX-AD-1510=	1510 nm OADM
CWDM-MUX-AD-1530=	1530 nm OADM
CWDM-MUX-AD-1550=	1550 nm OADM
CWDM-MUX-AD-1570=	1570 nm OADM
CWDM-MUX-AD-1590=	1590 nm OADM
CWDM-MUX-AD-1610=	1610 nm OADM
CWDM-MUX-4=	4-channel OADM
CWDM-MUX-8=	8-channel multiplexer/demultiplexer
CWDM-CHASSIS-2=	2-slot chassis for Cisco OADM and Multiplexer/demultiplexer
CWDM-MUX-4-SF1=	Single Fiber 4-channel Multiplexer/demultiplexer
CWDM-MUX-4-SF2=	Single Fiber 4-channel Multiplexer/demultiplexer

Regulatory and Standards Compliance

Safety

- Network Equipment Building Standards (NEBS) Level 3

For More Information

For additional information about the Cisco CWDM GBIC Solution, contact:

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