Optics

OPTICAL FILTERS FOR COMMUNICATIONS APPLICATIONS

- Filters for Telecom
- Filters and Filter Subassemblies for Datacom

COHERENT

Applications

For telecom applications, thin-film filters may be incorporated into fiber-optic devices in several ways. One common packaging concept is to use "three-port couplers." Using this approach, light from the input port fiber is collimated by the first lens and directed onto the thin-film filter. Light reflected by the filter travels back into the lens and is focused into an output fiber, while light that passes the filter is collected by a second lens and is focused into another output fiber. A multiple-wavelength multiplexer/demultiplexer can be constructed by connecting a series of three-port couplers in cascade. Another packaging approach to yield a smaller package size is to use compact CWDM (CCWDM) modules. CCWDMs use free-space technology rather than a cascading method. Collimators and filters are bonded on a common substrate, using an appropriate epoxy and curing process. Rigorous control of manufacturing processes is demanded to manufacture CCWDM modules.

Coherent leverages the proprietary thin-film deposition process to produce the industry's best telecom filter solutions, with state-of-the-art layer thickness control.

CWDM & DWDM Filters

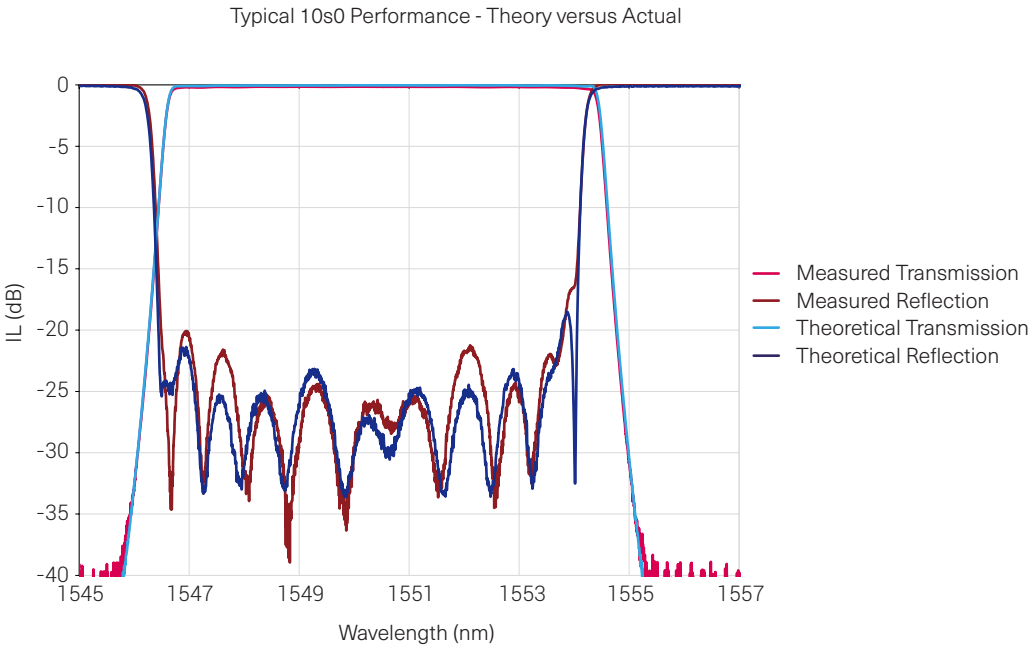
- Coarse Wavelength Division Multiplexing (CWDM) Filters
- Dense Wavelength Division Multiplexing (DWDM) Filters

Specifications for a selection of common telecom CWDM/DWDM filters. Contact II-VI with your requirements.

Parameters	CWDM Filter	DWDM Filter
Operating Wavelength Range	1250 nm to 1620 nm	1250 to 1620 nm
Typical Bandwidth	13 nm to 15 nm	< 0.5 nm
Channel Spacing	20 nm	50/100/200 GHz
Central Wavelength	1271/1291/1311 nm... to 1611 nm	1520.25/1521.02/1521.79 nm... to 1577.03 nm
Transmission / Reflection Insertion Loss	< 0.35 dB	
Transmission / Reflection Ripple	< 0.25 dB	
Transmission Isolation for Adjacent Channel	> 30 dB	
Transmission Isolation for Non-adjacent Channel	> 45 dB	
Reflection Isolation	> 13 dB	
Temperature Shift	< 2 pm/°C	
Incidence Medium	Air	
AOI	1.8 degree for 3-port coupler 13.5 degree for CCWDM	1.8 degree for 3-port coupler
Wedge	0.25 degree	
Typical Size	1.2 x 1.2 x 1.0 mm, 1.4 x 1.4 x 1.0 mm	1.4 x 1.4 x 1.0 mm

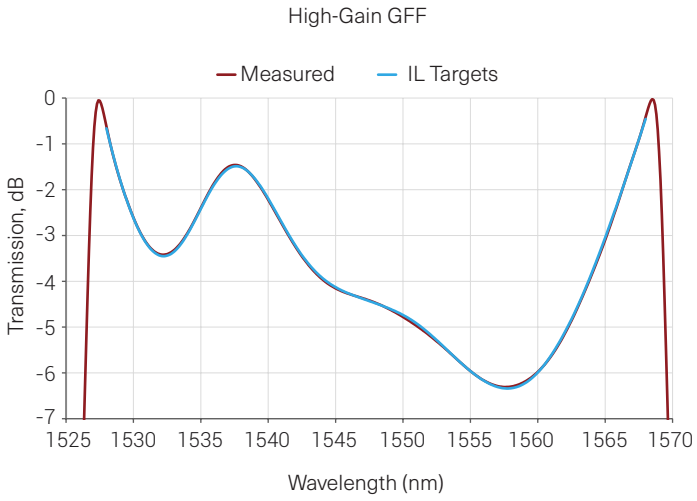
In addition to high-volume production of standard 200 GHz/100 GHz/50 GHz DWDM filters and high-angle/low-angle CWDM filters, Coherent also makes high-performance skip filters, gain-flattening filters, and dual-band filters.

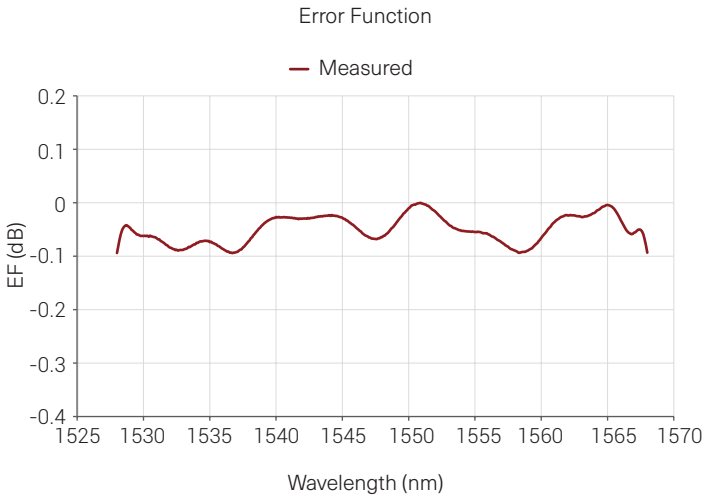
Skip Zero Filters



Coherent makes every option of skip zero 100 GHz filters, 2s0, 4s0, 5s0, 8s0, and 10s0. Many options of CWDM skip zero filters are also available.

Gain-Flattening Filter (GFF)





Coherent's proprietary tools have an outstanding capability of producing GFFs. Error functions of <0.1 dB can be achieved.

Applications

The bandwidth of optical transceivers for datacenters has been upgraded from 40G to 100G and even higher. To work at long distance and high speed, WDM multiplexers and WDM demultiplexers are integrated into the transceiver to save the fiber cost in long-distance and high-speed connections. Typically, optical multiplexers combine light from four transmitters, while optical demultiplexers select and transmit beams to each lane depending on the corresponding wavelength. Optical interfaces are often based on the 4-channel coarse wavelength division multiplexing (CWDM4) grid, or the local area network wavelength division multiplexing (LAN-WDM) grid.

Coherent's WDM and beam splitter filters are widely integrated into high-speed transceivers. Filters operate at four CWDM4 wavelengths, four LAN-WDM wavelengths, or the 850 nm wavelength range. In addition to the conventional CWDM4 or LAN-WDM filter at low angles of incidence (AOIs), II-VI leverages its coating capabilities to make WDM filters working at high AOIs, and beam splitters with low P/S polarization splitting, to make the module more compact.

Coherent also provides Z-block, which is a micro-optical precision assembly that combines or separates four wavelengths at the transmitter or receiver, respectively, in an extremely small size. II-VI's Z-block optics fits in a standard CFP4 or QSFP28 package.

Specifications for a selection of common datacom filters and filter subassemblies. Contact Coherent with your requirements.

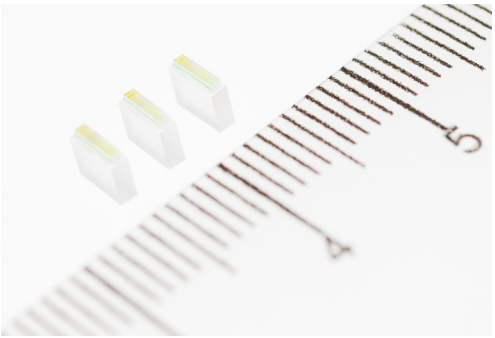
CWDM4 and LAN-WDM Filters at Low AOIs

Parameters	CWDM4 Filter	LAN-WDM Filter
Center Wavelength	1271/1291/1311/1331 nm 1511/1531/1551/1571 nm	1273.54/1277.89/1282.26/1286.66 nm 1295.56/1300.06/1304.58/1309.14 nm
Typical Bandwidth	>13.5 nm	>2.1 nm
Channel Spacing	20 nm	800 GHz
Transmission/Reflection Insertion Loss	<0.4 dB	
Transmission/Reflection Ripple	<0.3 dB	
Transmission Isolation for Adjacent Channel	>25 dB	
Transmission Isolation for Non-adjacent Channel	>30 dB	
Polarization-Dependent Loss	<0.1 dB	
Reflection Isolation	>13 dB	
Incidence Medium	Epoxy	
AOI (in air)	8/13/13.5 degree	
Wedge	No wedge	
Typical Size	0.8 x 0.8 x 0.8 mm	
Edge Chipping	<0.1 mm	

CWDM4, LAN-WDM, and 850 nm Filters at High AOIs

Parameters	CWDM4 Type A	CWDM4 Type B	LAN-WDM Type A	LAN-WDM Type B	850nm Filter
AOI (in air)	26/45 degree	26/45 degree	26/45 degree	26/45 degree	45 degree
Thickness	0.55 mm	0.55 mm	0.55 mm	0.55 mm	0.3 mm
Dimension	Customized	Customized	Customized	Customized	Customized
Passband	1261-1281 nm	1281-1301 nm	1294.53-1296.59 nm	1299.02-1301.09 nm	840-865 nm
Reflection Band	1301-1321 nm	1321-1341 nm	1303.54-1305.63 nm	1308.09-1310.09 nm	840-865 nm
Transmission at Pass-band	>90%	>90%	>90%	>90%	T:R = 1:3/1:2 etc.
Reflection at Reflection Band	>95.5%	>95.5%	>95.5%	>95.5%	T:R = 1:3/1:2 etc.
Backside AR	<1%	<1%	<1%	<1%	<1%
Polarization	P	P	P	P	Both S & P
Edge Chipping	<0.1 mm	<0.1 mm	<0.1 mm	<0.1 mm	<0.1 mm
Surface Quality	40/20	40/20	40/20	40/20	40/20

CWDM4 and LAN-WDM Z-Block



Parameters	Unit	CWDM4	LAN-WDM
Operation Wavelength	nm	1250-1350	1280-1330
Center Wavelength (λc)	nm	1271/1291/1311/1331	1295.56/1300.05/1304.56/1309.14
Passband (PB)	nm	>λc ± 6.5	>λc ± 1.05
Max. Insertion Loss @ PB	dB	<1.0	<1.0
IL Uniformity @ PB	dB	<0.4	<0.5
PDL @ Passband	dB	<0.25	<0.25
Adjacent CH Isolation	dB	>25	>25
Non-Adj. CH Isolation	dB	>30	>30
Typical AOI (in air)	degree	8/13.5	8/13
Pitch	μm	500/750/900/1000/1100/1500	
Beam Parallelism	degree	<0.2	<0.2
Operating Temperature	℃	-20 ~ +85	-5 ~ +75
Storage Temperature	℃	-40 ~ +85	-40 ~ +85

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