Chirped Fiber Bragg Grating (FBG)

Product Description

Fiber Bragg Gratings (FBG) have many applications in optical communication, laser technology, and sensing systems. FBGs are widely used in fiber optical reflectors or filters with narrowband spectra. FBGs can also serve as sensitive elements for strain and temperature measurements. Chirped Fiber Bragg Gratings (CFBG) feature a linearly varying FBG period along the length of the grating. Chirped FBGs are fabricated using a non-periodic phase mask. The available chirp rate of the phase mask can range from 0.01 nm/cm to 30 nm/cm. As a result, such FBGs have a wide

spectral bandwidth and unique dispersion characteristics. Chirped FBGs are helpful for gain flattening in EDFA and ASE light sources, band-stop filters, ultrafast mode-locked fiber lasers, powerful lasers, and dispersion compensation in telecom systems. The figure shows the spectrum of a high-reflection chirped fiber Bragg grating used for high-power fiber lasers.

Product features

Wide bandwidth 、 Dispersion compensation 、 Compact structure 、 Distinguishable temperature and strain gradients

Part Number

MP-GTL-FBG-CR-840-RS

Application area

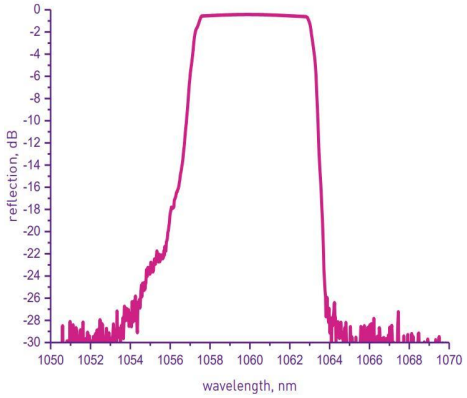
Fiber Optic Reflectors、 Narrowband Filters、 (Multi-point) Strain and Temperature Sensing、 Signal and Brillouin Scattering Filtering、 Gain Flattening EDFA、 ASE Light Sources、 Band-stop Filters、 Pulsed, Ultrafast Mode-locked, and Single-frequency Fiber Lasers、 High-power Lasers、 Dispersion Compensation in Telecom Systems、 Others

Core parameters

Wavelength Range	Bandwidth	Reflectivity
600-2300nm	2-50nm	5-99%

General Parameters

Parameters



FBG Characteristics	MP-GTL-FBG-CR-840-RS	Tolerance/Remarks
Wavelength Range (nm)	600~2300	± 0.1 ~ ± 1 Customizable
Fiber Type	SM, PM, Double-clad, LMA	Or Customizable

Quick Order Wavelength (nm)	1069 with Chirp Rate: 2.9 nm/cm, 1081 with Chirp Rate: 1.02 nm/cm, 1529 with Chirp Rate: 19.96 nm/cm, 1875 with Chirp Rate: 4.08 nm/cm	± 0.1 ~ ± 1 Customizable
Reflectivity (%)	5~99	2~5 Customizable
Chirp Rate (nm/cm)	0.01~30	Customizable
Bandwidth (FWHM, nm)	2~50	Customizable
Grating (FBG) Length (mm)	2~50	Customizable
SLSR, dB	~8	Customizable
FBG Pigtail (m)	⩾ 0.5	Customizable
FBG Coating	None, Acrylic, Polyimide	Or Customizable
Tensile Strength (kpsi)	>100	
Fiber Connector	Bare fiber, FC/APC, LC/APC	Or Customizable

The configuration can be changed according to the customer's requirements.

The parameters specified in this specification can be changed according to the reference clause.

FORC Photonics' standard fiber Bragg grating (FBG) series:

Uniform fiber Bragg grating

Apodized fiber Bragg grating

Chirped fiber Bragg grating

Apodized chirped fiber Bragg grating

Fiber laser matched fiber Bragg grating

Tilted fiber Bragg grating

π-phase shifted fiber Bragg grating

MP-GTL-FBG-UF-810 Uniform Fiber Bragg Grating

The grating lengths produced range from 0.5 mm to 10 mm. For a wavelength of 633 nm (0.1 nm and 0.17 nm at 1580 nm) and a grating length of 9 mm, the Full Width at Half Maximum (FWHM) of such gratings varies from 0.015 nm (R = 25%) to 0.03 nm (R = 90%). The standard uniform FBG has a bandwidth of 0.15 nm to 0.6 nm, with reflectivity ranging from 5% to 99%, and grating lengths from 1 mm to 3.5 mm.

Fiber Bragg Gratings (FBG) are highly sensitive to changes in strain and temperature. The uniform FBG can be provided as separated units with different wavelengths or in FBG chains. Using chained FBGs allows for multipoint monitoring of temperature, strain, or other physical parameters. Different types of single-mode fibers and fiber coatings can be used.

Acrylic-coated fibers are suitable for normal temperature ranges from -40°C to +100°C. Polyimide or metal (copper, aluminum) coated fibers are used for high-temperature applications with maximum temperatures of +300℃ and +500℃, respectively.

MP-GTL-FBG-AD-820 Apodized Fiber Bragg Grating

Shows a special distribution of induced refractive index and grating intensity along the grating length. As a result, the sidelobe level becomes smaller compared to normal gratings. There are many apodization profiles leading to optimization of various FBG parameters (intensity, FWHM, sidelobe suppression ratio (SLSR)). Apodized FBGs are useful in sensing applications, signal and Brillouin scattering filtering, etc. Possible SLSR values for different grating intensities are -10 dB to -30 dB.

MP-GTL-FBG-CR-840 Chirped Fiber Bragg Grating

Features a linear variation of the FBG period along the grating length. Chirped FBGs are fabricated by using a non-periodic phase mask. The available chirp rate range for the phase mask period is from 0.01 nm/cm to 30 nm/cm. As a result, this type of fiber gratings has a wide spectral bandwidth and special dispersion characteristics. Chirped FBGs can be used in gain-flattened EDFA and ASE sources, bandstop filters, ultrafast mode-locked fiber lasers, powerful lasers and dispersion compensated telecommunication systems.

Apodization of the chirped FBG is necessary to obtain a FBG with a smooth reflection spectrum. There are several apodization profiles that optimize various parameters of the FBG, such as reflection coefficient, FWDM, sidelobe suppression ratio (SLSR) or dispersion parameters. In a chirped fiber grating, the dispersion is determined by the rate of change of the period along the length of the fiber grating. In the GTL-FBG-ADG-820 series of apodized-chirped fiber Bragg gratings, FORC Photonics has implemented several types of apodization profiles: sinusoidal, Gaussian, semi-Gaussian and super-Gaussian.

The simplest type of apodization is "sinusoidal", which "saves" the length of the FBG and provides (SLSR) values of about 20 dB. The "Gaussian" apodization function provides good SLSR values of the order of 30 dB. For many applications, such as pulsed fiber lasers, there are special requirements on the dispersion values and the shape of the reflection profile. The "Gaussian" apodization of chirped FBGs allows to obtain excellent results in these applications. Apodization of the "SuperGauss" type is intended to obtain a flat-top reflection spectrum. Apodized FBGs are useful in sensing applications, signal and Brillouin scattering filtering, etc.

MP-GTL-FBG-LP-830 Fiber Laser Matched

FBGs are an ideal solution for fiber laser manufacturing. Min insertion loss and other

parameters are good for lasers with output powers of tens of watts. High and low reflection gratings are available, the high reflection gratings show -20 dB levels of about 0.5 nm to 0.7 nm. Low reflection output gratings with 5% to 40% reflectivity have FWHM values of 0.15 nm to 0.35nm. Mismatch of LR with respect to HR gratings is up to ±0.15 nm. For narrow-line fiber lasers, we offer FBG pairs with FWHM values around or below 0.1 nm, which are ideally matched without adjustment.

MP-GTL-FBG-TL-860 tilted fiber Bragg gratings

This type of grating has an angle between the wave vector of the grating and the fiber axis. As a result, the cladding mode resonance peaks become more intense compared to ordinary gratings. The wavelength of the cladding mode resonance of a tilted fiber Bragg grating is highly sensitive to the refractive index of the medium outside the fiber cladding. TFBGs are useful in sensing applications. Possible values for the tilt angle are from 1^{o} to 45^{o}.

MP-GTL-FBG-PS-870 π-phase-shifted fiber Bragg gratings

This type of grating has very narrow peaks in their transmission/reflection spectra. A phase-shifted FBG is a grating with a phase defect in the center. While the grating length determines its bandwidth, the spectral width of this peak depends on the strength of the two parts of the FBG. Typical FWHM values of our π-phase-shifted fiber Bragg gratings

are 0.1 nm to 0.005 nm. Typical applications for phase-shifted FBGs are narrow bandwidth optical filters for single frequency fiber laser.

The following configurations can be changed according to customer requirements.

Parameters/ Classification	MP-GTL-FBG-UF-810 Uniform FBGs	MP-GTL-FBG-AD-820 Apodized FBGs	MP-GTL-FBG-CR-840 Chirped FBGs	MP-GTL-FBG-ADG-820 Apodized-chirped FBGs	MP-GTL-FBG-LP-830 Fiber Laser Matched FBG Pairs	MP-GTL-FBG-TL-86 Tilted FBGs	MP-GTL-FBG-PS-870 π-phase-shifted FBGs
Wavelength Range (nm)	600 ~ 2300						
Quick Order Wavelength [nm]	-	-	1069, 1081, 1529, 1875	30 values between 633 and 2300 Wavelength [nm] for quick order			

Fiber type	SM、PM、Double cladding、LMA、Custom			SM、PM、Double cladding、Custom	SM、PM、Double cladding、LMA、Custom		
Reflective [%]	0.2 - 99.9	0.5 - 99.9	5 - 99		5 - >99	5 - 99	
Tilt Angle	-	-	-	-	-	1° - 45°	-
Chirp rate [nm/cm]	-	-	0.01 - 30	0.01 - 25	-	-	-
Bandwidth (WFHM) [nm]	0.05 - 1.2	0.1 - 1.2	2 - 50	0.5 - 50	0.1 - 1.2	0.1 - 0.8	
Grating (FBG) Length [mm]	-	-	2 - 50	-	-	-	-
SLSR [dB]	~8	>10，>15	~8	>15	-	~8	
FBG Pigtail length [m]	⩾0.5，custom			-	⩾0.5，custom		

FBG Recoating	None, Acrylate, Polyimide, Aluminum, Copper, Customized		None, Acrylate, Polyimide, Customize		None, low or high refractive index polymer , acrylate, polyimide, custom	None, Acrylate, Polyimide, Aluminum, Copper, Customized	
Tensile strength [kpsi]	>100	-	>100				
Optical connector	Bare fiber、FC/APC、LC/APC、custom			-	Bare fiber, custom	Bare fiber、FC/APC、LC/APC、custom	
Packing dimensions LxWxH [mm]	-	-	-	-	25 x 10 x 6.0	-	-