Product Specification

Customer PN	Product PN	Description
	TOFFBCWHRG04	Full-Band Tunable Filter

1. Product Description

This specification describes and defines Full-band Tunable Optical Filter.

Tunable Filter product is designed and built using proprietary micro-optics and tunable technology. It is a 2-port electrically-controlled fiber-optic device with UART (RS232) communication interface. The filter passband shape is Gaussian. As schematically shown in Figure 1-1, when multiple DWDM/CWDM channels are injected to the input port, the tunable filter selects one target channel to the output port and blocks all other channels.

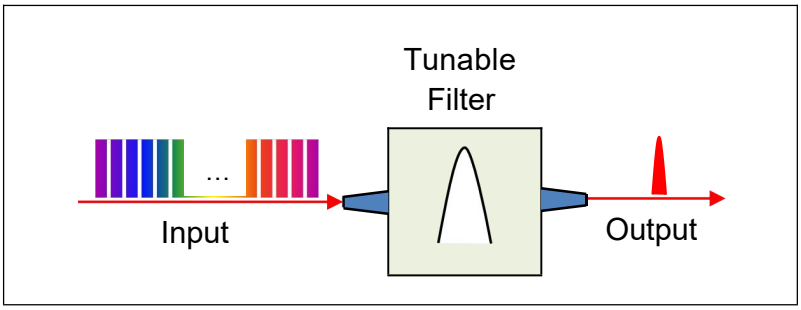

Figure 1-1: Schematic diagram of 2-port tunable filter

2. Specifications

2.1 Specifications

Parameter	Unit	Specification	Note
Wavelength Tuning Range	nm	1400 ~ 1700	
Passband Width @ -3.0 dB	nm	< 3.0	
Passband Width @ -20 dB	nm	≤ 10	
Peak Insertion Loss	dB	< 4.5	Without connectors
Polarization Dependent Loss	dB	< 0.7	At CW
Chromatic Dispersion	ps/nm	< ±10	Within CW ± 0.2nm
Polarization Mode Dispersion	ps	< 0.1	
Wavelength Tuning Resolution	nm	< 0.04	
Wavelength Setting Error	nm	< ±0.1	
Wavelength Setting Repeatability	nm	±0.04	
Wavelength Temperature Dependence	pm/。C	< ±10	
Return Loss	dB	> 40	
Maximum Input Optical Power	mW	300	
Tuning Speed	s	< 0.5	Channel to channel

Hirundo Optics Inc
Factory:2nd Floor, Building 6, #16 Xinfa Road, Southern Cable Industrial Park, Rongli Ronggui Street, Shunde District, Foshan city, Guangdong 528305 China
Tel: 0757-26619220 Email: info@hirundo-link.com Website：https://www.hirundo-link.com/

2.2 Environmental conditions

Parameters	Units	Specifications
Operating Temperature	℃	0 ~ +60
Storage Temperature	℃	-40 ~ +85
Operating Relative Humidity	%	5 ~ 85 (non-condensing)
Storage Relative Humidity	%	5 ~ 95

2.3 Fiber specifications

Parameters	Units	Specifications
Fiber Type	-	SMF-28 900 μm
Fiber Length	m	1.0 ±0.1
Optical Connector	-	None

2.4 Parameter definitions

- **Wavelength Tuning Range** specifies the spectral region over which the Tunable Filter product can operate.
- **Passband Width is** the full spectral width of transmission spectrum at a given insertion loss referenced to the peak.
- **Peak Insertion Loss** is the insertion loss ofthe tunable filter measured at the peak of the passband.
- **PDL** is the maximum power difference of power measurements between any two polarization states.
- **Chromatic Dispersion** is a parameter characterizing pulse spreading due to the fact that different wavelengths propagate with different velocities.
- **Polarization Mode Dispersion** is a parameter characterizing pulse spreading due to the fact that optical waves at different polarization states propagate with different velocities.
- **Wavelength Tuning Resolution** is the minimum step size of tuning wavelength.
- **Wavelength Setting Error** is the maximum wavelength setting deviation away from target wavelength over all channels. The wavelength setting error is calculated as the difference of the wavelength values between setting wavelength and the target wavelength.
- **Wavelength Setting Repeatability** is the maximum variation of frequency setting measurements over all channels within a given time interval at any fixed measurement condition.
- **Wavelength Temperature Dependence** describes the wavelength drift of passband as the temperature changes.
- **Optical Return Loss** is the ratio between the reflected power from the device and the input power to the device.
- **Maximum Input Power** is the maximally allowed value of total input optical power to the device.

- **Operating Temperature** specifies the minimum and maximum ambient temperatures within which the device can operate and meet its specifications.
- **Storage Temperature** specifies the minimum and maximum ambient temperatures within which the device can be stored without damage, and the device can meet its specifications when working over operating temperature range.
- **Tuning Speed** is the total time span from host command issuing to the end of reporting data to host.

3. Mechanical Drawings

The dimension ofthe tunable filter module, locations of mounting holes, locations of input and output fiber ports and electrical connector are shown in Figure 3-1. 3D picture is also shown in Figure 3-1.

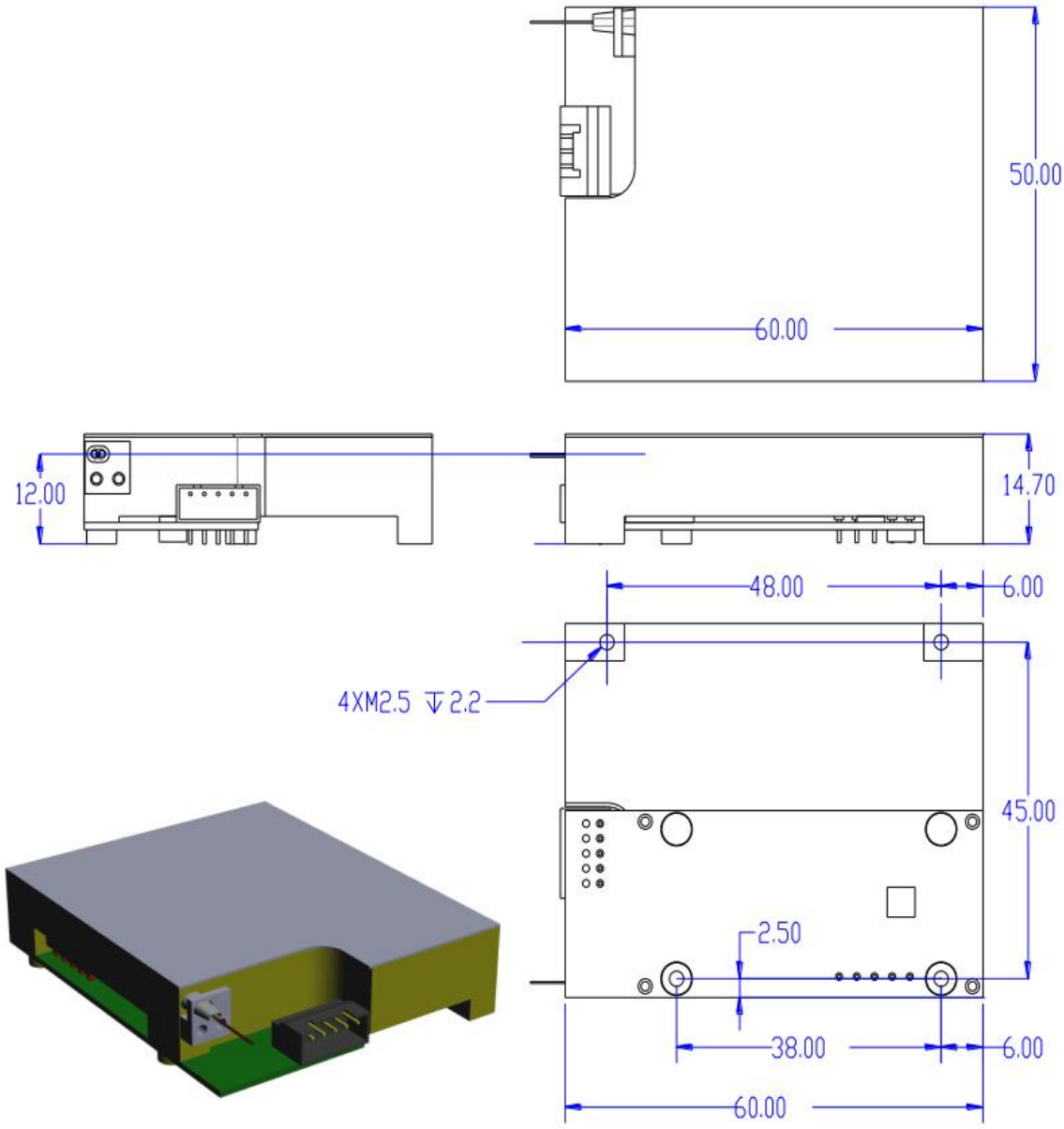

Figure 3-1: 2-port tunable filter module.

4. Electrical Specifications

4.1 Power supply

Table 4-1 lists the specification of power supply.

Table 4-1: Voltage and current specifications

Electrical Parameters	Specification
Voltage Supply	+5.0 V DC
Voltage Tolerance	± 10%
Typical Current	0.3 A
Maximum Current	0.4 A

4.2 Electrical connector and pin assignment

5-Pin UART connector on OSA module is:

Pin header on OSA module: HRS DF3-5P-2DS(01)

Mating connector: HRS DF3-5S-2C

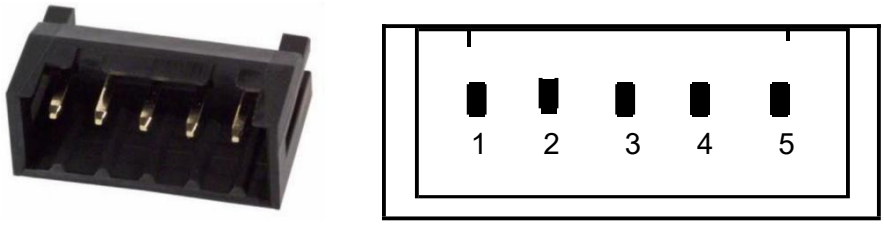

Figure 4-1: UART connector and Pin locations

Table 4-2: Pin assignment

Pin Number	Pin Definition	Purpose
1	/Reset	UART (LVTTL)
2	+5V DC	UART
3	Rx (Tunable filter)	UART (LVTTL)
4	Tx (Tunable filter)	UART (LVTTL)
5	Ground	UART

Table 4-3: LVTTL Logic Voltage Level

Symbol	Parameter	Condition	Minimum	Maximum
V(IH)	High-level input voltage		2.0 V	3.6 V
V(IL)	Low-level input voltage		-0.3 V	0.8 V
V(OH)	High-level output voltage	Max I(OH) = 8 mA	2.4 V	
V(OL)	Low-level output voltage	Max I(OL) = -8 mA[1)]		0.4 V

Note: 1) Absolute value is 8 mA and the “-” sign stands for current direction.

5. Communication Protocol/Command

The tunable optical filter (TOF) provides UART Serial port communication. Communication commands are compatible to RS232.

5.1 UART serial port setting

UART serial port setting is shown in Table 5-1-1.

Table 5-1-1: UART serial port setting

Item	Setting
Baud Rate	115200
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

5.2 Host set target wavelength command

Table 5-2-1: Set target wavelength command

Field	Parameter	Command
0	Head byte	0xAA (0ne byte head)
1	Command Word_ 1	0x474F
2	Command Word_2	0x574C
3	Length word	0x0002 (Words in Field 4 ~5)
4	Wavelength (pm) high 16-bit	High 16-bits of 32-bit integer
5	Wavelength (pm) low 16-bit	Low 16-bits of 32-bit integer
6	Checksum word	Unsigned 16-bit integer

Table 5-2-2: TOF's response to "Set target wavelength" command

Field	Parameter	TOF's response
0	Head byte	0xAA (One byte head)
1	Command Word_ 1	0x474F
2	Command Word_2	0x574C
3	Length word	0x0003 (Words in Field 4~6)
4	Error word	16-bit Error Code (00 for No error)
5	Wavelength (pm) high 16-bit	High 16-bits of 32-bit integer.
6	Wavelength (pm) low 16-bit	Low 16-bits of 32-bit integer.
7	Checksum word	Unsigned 16-bit integer

Note:

- Target wavelength is 32-bit integer in pm.
- "Checksum" is an unsigned 16-bits number of the summation of all bytes from Field 1 to the byte before "checksum" word. "Checksum" does not include "Head" byte "0xAA".

- Error code = 0x0000: “No error”.
- Error code = 0x0001: TOF received “Unknown command”.
- Error code = 0x0002: TOF received target wavelength “Out of range”.
- Error code = 0x0009: TOF received data “Checksum Error”.

5.3 Host read TOF target wavelength command

Table 5-3-1: Read target wavelength command

Field	Parameter	Command
0	Head byte	0xAA (0ne byte head)
1	Command Word_ 1	0x4754
2	Command Word_2	0x574C
3	Length word	0x0000 (No data field)
4	Checksum word	0x013E (Unsigned 16-bit integer)

Table 5-3-2: TOF’s response to “Read target wavelength” command

Field	Parameter	TOF’s response
0	Head byte	0xAA (One byte head)
1	Command Word_ 1	0x4754
2	Command Word_2	0x574C
3	Length word	0x0003 (Words in Field 4~6)
4	Error word	16-bit Error Code (00 for No error)
5	Wavelength (pm) high 16-bit	High 16-bits of 32-bit integer.
6	Wavelength (pm) low 16-bit	Low 16-bits of 32-bit integer.
7	Checksum word	Unsigned 16-bit integer

Note: TOF returns current position of target wavelength as a 32-bit integer in pm.

5.4 Host increase TOF target wavelength command

Table 5-4-1: Increase TOF target wavelength command

Field	Parameter	Command
0	Head byte	0xAA (0ne byte head)
1	Command Word_ 1	0x5550
2	Command Word_2	0x574C
3	Length word	0x0001 (Words in Field 4)
4	Wavelength increment (pm)	16-bit integer for WL increment (pm)
5	Checksum word	Unsigned 16-bit integer

Note: In command, target wavelength increment is a 16-bit integer in pm.

Table 5-4-2: TOF’s response to “Increase target wavelength” command

Field	Parameter	TOF’s response
0	Head byte	0xAA (One byte head)
1	Command Word_ 1	0x5550

2	Command Word_2	0x574C
3	Length word	0x0003 (Words in Field 4~6)
4	Error word	16-bit Error Code (00 for No error)
5	Wavelength (pm) high 16-bit	High 16-bits of 32-bit integer.
6	Wavelength (pm) low 16-bit	Low 16-bits of 32-bit integer.
7	Checksum word	Unsigned 16-bit integer

Note: In TOF's response, returned wavelength is 32-bit integer in pm.

5.5 Host decrease TOF target wavelength command

Table 5-5-1: Decrease TOF target wavelength command

Field	Parameter	Command
0	Head byte	0xAA (0ne byte head)
1	Command Word_ 1	0x444E
2	Command Word_2	0x574C
3	Length word	0x0001 (Words in Field 4)
4	Wavelength decrement (pm)	16-bit integer for WL decrement (pm)
5	Checksum word	Unsigned 16-bit integer

Note: In command, target wavelength decrement is a 16-bit integer in pm.

Table 5-5-2: TOF's response to "Decrease target wavelength" command

Field	Parameter	TOF's response
0	Head byte	0xAA (One byte head)
1	Command Word_ 1	0x444E
2	Command Word_2	0x574C
3	Length word	0x0003 (Words in Field 4~6)
4	Error word	16-bit Error Code (00 for No error)
5	Wavelength (pm) high 16-bit	High 16-bits of 32-bit integer.
6	Wavelength (pm) low 16-bit	Low 16-bits of 32-bit integer.
7	Checksum word	Unsigned 16-bit integer

Note: In TOF's response, returned wavelength is 32-bit integer in pm.

5.6 Host read TOF information command

Table 5-6-1: Read TOF Info

Field	Parameter	Command
0	Head byte	0xAA (0ne byte head)
1	Command Word_ 1	0x534E
2	Command Word_2	0x4656
3	Length word	0x0001 (Word in Field 4)
4	Reserved word	0x0000
5	Checksum word	0x013E (Unsigned 16-bit integer)

Table 5-6-2: TOF's response to Read Info command

Field	Parameter	TOF's Response
0	Head byte	0xAA (One byte head)
1	Command Word_1	0x534E
2	Command Word_2	0x4656
3	Length word	16-bit integer (Words in Field 4~10)
4	Error word	16-bit Error Code (00 for No error)
5	TOF PN words (10 word)	PN max. length 20 bytes ASCII codes
6	TOF SN words (10 word)	SN max. length 20 bytes ASCII codes
7	Manufacture date words (5 words)	10 bytes ASCII codes
8	TOF FW version (4 words)	8 bytes ASCII codes
9	TOF HW version (6 words)	12 bytes ASCII codes
10	TOF temperature (1 word)	16 bits signed integer as 10xT degree.
11	Checksum word	Unsigned 16-bit integer

Notes:

(1) PN, SN and version numbers are in ASCII format.

(2) PN/SN field has maximum length 20 bytes. If PN/SN length is less than 20 bytes, 0 is appended.

(3) Manufacturing date has 10 bytes ASCII codes as MM-DD-YYYY.

(4) TOF temperature is a signed 16 bits integer as 10xT. For example, number 342 = 34.2。C, and number -21 = -2.1。C.

6. Labelling

Product label is defined as follows:

1) Supplier name:
2) Product description: Full-Band Tunable Filter
3) Part number: TOFFBCWHRG04
4) Serial number: TOFyywwnnn
5) Manufacturing date: mm/dd/yyyy

7. RoHS Compliance

The product is RoHS10 compliant.

Revision History

Rev.	Date	Revision History	Originated by	Signed by
1.0	10/11/2025	Initial release	Virgil	