

**FB19M70 - January 11, 2018**

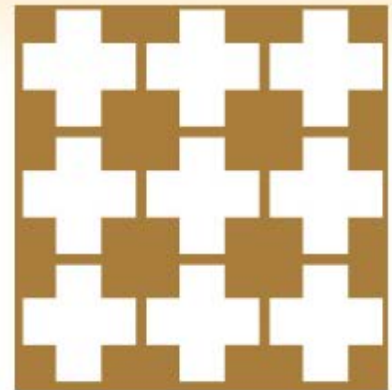
Item # FB19M70 was discontinued on January 11, 2018. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

**THZ BANDPASS FILTERS: 10 MM - 590 MM CENTER WAVELENGTH**

- ▶ **Bandpass Filters Fabricated from Gold-Mesh Frequency-Selective Surfaces**
- ▶ **Center Wavelengths Available from 10 to 590  $\mu\text{m}$  (30.0 THz to 510 GHz)**
- ▶ **Custom Filters Available**



Ø19 mm Aperture,  
25.0 mm Outer Diameter



Cross-Absent Pattern of the  
Frequency-Selective Surface

**OVERVIEW**

**Features**

- Mesh Made from Gold Film for Temperature Stability
- Designed for Use in Cryostats and Other Cooled Environments
- >70% Transmission at Center Wavelength
- Stacking Filters Reduces Out-of-Band Transmission
- 25.0 mm Outer Diameter for Compatibility with Our Ø1" Lens Tubes, Filter Mounts, and Optic Mounts
- Customizable Options Include:
  - Wavelengths from 10 to 600  $\mu\text{m}$  (30.0 THz to 500 GHz)
  - Outer Diameters up to 3" (76.2 mm)
  - Mounting Options for Single and Stacked Filters

Thorlabs' Far-Infrared and Terahertz Bandpass Filters provide high-spectral-resolution filtering with center wavelengths (CWLs) from 10 to 590  $\mu\text{m}$  (30.0 THz to 510 GHz). With more than 70% transmission at the CWL, these filters are fabricated from gold-mesh frequency-selective surfaces designed to reject out-of-band radiation primarily by reflection and destructive interference.

The cross-absent pattern of these filters (shown in detail above)

**General Specifications<sup>a</sup>**

| General Specifications <sup>a</sup>                  |                                    |
|--|------------------------------------|
| <b>Peak Transmission</b>                             | >70% at CWL <sup>b</sup>           |
| <b>Bandwidth (FWHM)<sup>a</sup></b>                  | 7% to 25% of CWL <sup>b</sup>      |
| <b>Out-of-Band Transmission, Single Filter</b>       | ≤4.6% (OD ≥ 1.3)                   |
| <b>Out-of-Band Transmission, Two Stacked Filters</b> | <1% (OD > 2)                       |
| <b>Clear Aperture</b>                                | Ø19 mm (0.75")                     |
| <b>Mounting Ring Outer Diameter</b>                  | 25.0 mm (0.98")                    |
| <b>Mounting Ring Inner Diameter</b>                  | 19.7 mm (0.78")                    |
| <b>Tolerances of Inner and Outer Diameters</b>       | ±0.2 mm (±0.008")                  |
| <b>Ring Thickness</b>                                | 1.02 mm (0.04")                    |
| <b>Ring Material</b>                                 | Nickel                             |
| <b>Gold Film Thickness</b>                           | 1 $\mu\text{m}$                    |
| <b>Temperature Range</b>                             | 4 K to 363 K<br>(-269 °C to 90 °C) |

- a. While all units will meet these specifications, the transmission of individual units will vary from production run to production run. For unit-specific information, please see the serialized item's specification sheet, found by clicking on the red

is a continuous mesh with a pattern of crosses etched away from the gold using photolithography. While a simple wire-grid mesh acts as a shortpass filter, blocking radiation with wavelengths larger than the grid size, the cross-absent mesh selects a specific band of wavelengths. For more information, please refer to *Frequency Selective Surfaces: Theory and Design* by Ben A. Munk.<sup>a</sup>

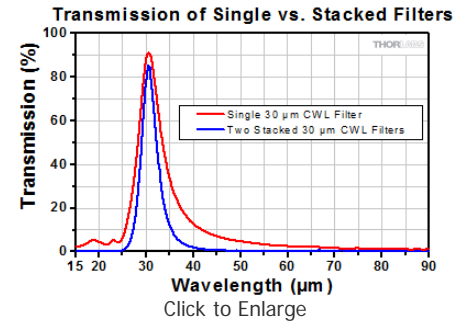
- documents icon next to the serialized Item #.
- b. Center Wavelength

Unlike similar bandpass filters, these gold filters do not require a polymer support layer, which eliminates issues of darkening due to gamma radiation, delamination due to thermal cycling, and unwanted vibronic bands associated with polymers. Due to the construction from gold mesh and a nickel ring, these filters are compatible with temperatures down to 4 K (-269 °C). The filter also maintains performance over wide temperature cycles, making it ideal for use in astronomy and materials research.

To further decrease out-of-band transmission, two or more filters of similar center wavelength can be stacked together. With only two filters in series, the out-of-band transmission will fall from 4.6% or less to below 1%, as shown by the graph to the right for the 30 μm CWL filter.

### Handling Precautions and Mounting


The 1 μm thick gold mesh on these filters is exceptionally fragile and will break easily if bumped or touched. We do not recommend using canned air on these filters or otherwise attempting to clean them. Quick changes in pressure should be avoided. For more reliable handling outside of a cryogenic environment, we strongly recommend mounting these filters in our Ø1" Lens Tubes, non-motorized Filter Mounts, or Optic Mounts. If the mount requires a retaining ring to be threaded against the optic, the SPW602 Spanner Wrench and SM1LTRR Stress-Free Retaining Ring should be used, and care should be taken to avoid overtightening the ring against the filter. Excessive pressure from the retaining ring may cause rippling in the mesh. Pre-mounted versions are available as a custom option.



### Custom Options







While we offer a selection of filters from stock, Thorlabs is also able to provide custom filters with alternative center wavelengths, diameters, and mounts. Filters with center wavelengths between 10 and 600 μm can be produced. Options for outer diameters include, but are not limited to, 19.1 mm and 33.1 mm. Custom outer diameters can be made as large as 3" (76.2 mm). We can also provide single or stacked filters pre-mounted in our Ø1" Lens Tubes or other mounts; up to four filters can be stacked together in one lens tube. Please contact Tech Support for more information.

a. Munk, Ben A., *Frequency Selective Surfaces: Theory and Design*, John Wiley & Sons, Inc. (2000).

| Webpage Features  |  |
|---|--|
|  | Clicking this icon allows you to download our standard support documentation.  |
| <a href="#">Choose Item</a>   | Clicking the words "Choose Item" opens a drop-down list containing all of the in-stock filters around the desired center wavelength. The red icon next to the serial number then allows you to download spectral measurements for that serial-numbered filter. |

| Additional Bandpass Filters   |  |   |  |  |                      |
|---|--|---|--|--|----------------------|
| UV/Visible Bandpass Filters<br>340 - 694.3 nm CWLs  | NIR Bandpass Filters<br>700 - 1650 nm CWLs | MIR Bandpass Filters<br>1750 - 8500 nm CWLs | LWIR, FIR, and THz Filters<br>10 - 590 μm CWLs | Premium Bandpass Filters<br>355 - 1550 nm CWLs | Bandpass Filter Kits |
| We also offer custom bandpass filters with other central wavelengths or FWHM. To request a quote, contact Tech Support. |  |   |  |  |                      |

## THz Bandpass Filters: 10 - 590 μm Center Wavelength

| Item #    | Center Wavelength <sup>a</sup> | CWL Tolerance | Transr | Item #   | Center Wavelength <sup>a</sup> | CWL Tolerance | Transmission  |
|-----------|--------------------------------|---------------|--------|----------|--------------------------------|---------------|---|
| FB19M10   | 10 μm (30.0 THz)               | ±1 μm         |        | FB19M80  | 80 μm (3.8 THz)                |               |  |
| FB19M12.5 | 12.5 μm (24.0 THz)             |               |        | FB19M90  | 90 μm (3.3 THz)                |               |  |
| FB19M15   | 15 μm (20.0 THz)               |               |        | FB19M100 | 100 μm (3.0 THz)               |               |  |
| FB19M20   | 20 μm (15.0 THz)               | ±1.2 μm       |        | FB19M120 | 120 μm (2.5 THz)               |               |  |
| FB19M23   | 22.5 μm (13.3 THz)             |               |        | FB19M135 | 135 μm (2.2 THz)               |               |  |
| FB19M25   | 25 μm (12.0 THz)               |               |        | FB19M150 | 150 μm (2.0 THz)               |               |  |

|         |                             |     |          |                             |     |  |
|---------|-----------------------------|-----|----------|-----------------------------|-----|--|
| FB19M27 | 27 $\mu\text{m}$ (11.0 THz) | ±5% | FB19M200 | 200 $\mu\text{m}$ (1.5 THz) | ±5% |  |
| FB19M30 | 30 $\mu\text{m}$ (10.0 THz) |     | FB19M250 | 250 $\mu\text{m}$ (1.2 THz) |     |  |
| FB19M35 | 35 $\mu\text{m}$ (8.6 THz)  |     | FB19M300 | 300 $\mu\text{m}$ (1.0 THz) |     |  |
| FB19M40 | 40 $\mu\text{m}$ (7.5 THz)  |     | FB19M325 | 325 $\mu\text{m}$ (920 GHz) |     |  |
| FB19M45 | 45 $\mu\text{m}$ (6.7 THz)  |     | FB19M350 | 350 $\mu\text{m}$ (860 GHz) |     |  |
| FB19M50 | 50 $\mu\text{m}$ (6.0 THz)  |     | FB19M400 | 400 $\mu\text{m}$ (750 GHz) |     |  |
| FB19M60 | 60 $\mu\text{m}$ (5.0 THz)  |     | FB19M500 | 500 $\mu\text{m}$ (600 GHz) |     |  |
| FB19M70 | 70 $\mu\text{m}$ (4.3 THz)  |     | FB19M590 | 590 $\mu\text{m}$ (510 GHz) |     |  |

- a. Nominal center wavelength. Click "Choose Item" below, followed by the red Docs icon next to a serial number to view a document with the unit-specific center wavelength, as well as the bandwidth based on the unit-specific center wavelength.

| Part Number | Description   | Price    | Availability |
|-------------|---|----------|--------------|
| FB19M10     | THz Bandpass Filter, Ø25.0 mm, 10 $\mu\text{m}$ Center Wavelength   | \$728.28 | Lead Time    |
| FB19M12.5   | THz Bandpass Filter, Ø25.0 mm, 12.5 $\mu\text{m}$ Center Wavelength | \$728.28 | Lead Time    |
| FB19M15     | THz Bandpass Filter, Ø25.0 mm, 15 $\mu\text{m}$ Center Wavelength   | \$728.28 | Today        |
| FB19M15     |   | \$728.28 | Today        |
| FB19M20     | THz Bandpass Filter, Ø25.0 mm, 20 $\mu\text{m}$ Center Wavelength   | \$728.28 | Today        |
| FB19M20     |   | \$728.28 | Today        |
| FB19M23     | THz Bandpass Filter, Ø25.0 mm, 22.5 $\mu\text{m}$ Center Wavelength | \$728.28 | Lead Time    |
| FB19M25     | THz Bandpass Filter, Ø25.0 mm, 25 $\mu\text{m}$ Center Wavelength   | \$728.28 | Lead Time    |
| FB19M27     | THz Bandpass Filter, Ø25.0 mm, 27 $\mu\text{m}$ Center Wavelength   | \$728.28 | Lead Time    |
| FB19M30     | THz Bandpass Filter, Ø25.0 mm, 30 $\mu\text{m}$ Center Wavelength   | \$728.28 | Lead Time    |
| FB19M35     | THz Bandpass Filter, Ø25.0 mm, 35 $\mu\text{m}$ Center Wavelength   | \$728.28 | Lead Time    |
| FB19M40     | THz Bandpass Filter, Ø25.0 mm, 40 $\mu\text{m}$ Center Wavelength   | \$728.28 | Lead Time    |
| FB19M45     | THz Bandpass Filter, Ø25.0 mm, 45 $\mu\text{m}$ Center Wavelength   | \$728.28 | Lead Time    |
| FB19M50     | THz Bandpass Filter, Ø25.0 mm, 50 $\mu\text{m}$ Center Wavelength   | \$728.28 | Lead Time    |
| FB19M60     | THz Bandpass Filter, Ø25.0 mm, 60 $\mu\text{m}$ Center Wavelength   | \$728.28 | Lead Time    |
| FB19M70     | THz Bandpass Filter, Ø25.0 mm, 70 $\mu\text{m}$ Center Wavelength   | \$728.28 | Lead Time    |
| FB19M80     | THz Bandpass Filter, Ø25.0 mm, 80 $\mu\text{m}$ Center Wavelength   | \$728.28 | Lead Time    |
| FB19M90     | THz Bandpass Filter, Ø25.0 mm, 90 $\mu\text{m}$ Center Wavelength   | \$728.28 | Lead Time    |
| FB19M100    | THz Bandpass Filter, Ø25.0 mm, 100 $\mu\text{m}$ Center Wavelength  | \$728.28 | Today        |
| FB19M100    |   | \$728.28 | Today        |
| FB19M100    |   | \$728.28 | Today        |
| FB19M100    |   | \$728.28 | Today        |
| FB19M120    | THz Bandpass Filter, Ø25.0 mm, 120 $\mu\text{m}$ Center Wavelength  | \$728.28 | Lead Time    |
| FB19M135    | THz Bandpass Filter, Ø25.0 mm, 135 $\mu\text{m}$ Center Wavelength  | \$728.28 | Lead Time    |
| FB19M150    | THz Bandpass Filter, Ø25.0 mm, 150 $\mu\text{m}$ Center Wavelength  | \$728.28 | Today        |
| FB19M150    |   | \$728.28 | Today        |
| FB19M200    | THz Bandpass Filter, Ø25.0 mm, 200 $\mu\text{m}$ Center Wavelength  | \$728.28 | Lead Time    |
| FB19M250    | THz Bandpass Filter, Ø25.0 mm, 250 $\mu\text{m}$ Center Wavelength  | \$728.28 | Lead Time    |
| FB19M300    | THz Bandpass Filter, Ø25.0 mm, 300 $\mu\text{m}$ Center Wavelength  | \$728.28 | Today        |
| FB19M300    |   | \$728.28 | 3-5 Days     |
| FB19M300    | CWL: 299.19 $\mu\text{m}$ , FWHM: 19.42%, Max Transmission: 69.09%  | \$728.28 | Today        |
| FB19M300    | CWL: 299.34 $\mu\text{m}$ , FWHM: 17.35%, Max Transmission: 81.94%  | \$728.28 | Today        |
| FB19M325    | THz Bandpass Filter, Ø25.0 mm, 325 $\mu\text{m}$ Center Wavelength  | \$728.28 | Lead Time    |
| FB19M350    | THz Bandpass Filter, Ø25.0 mm, 350 $\mu\text{m}$ Center Wavelength  | \$728.28 | Lead Time    |
| FB19M400    | THz Bandpass Filter, Ø25.0 mm, 400 $\mu\text{m}$ Center Wavelength  | \$728.28 | Lead Time    |

|          |   |          |           |
|----------|---|----------|-----------|
| FB19M500 | THz Bandpass Filter, Ø25.0 mm, 500 µm Center Wavelength | \$728.28 | Lead Time |
| FB19M590 | THz Bandpass Filter, Ø25.0 mm, 590 µm Center Wavelength | \$728.28 | Lead Time |

# 70 µm CWL Filter Sample Transmission

