

M i r r o r s

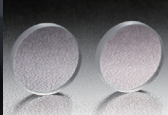




## Mirrors Selection Guide

**B009**

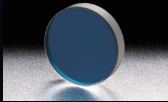
Super Mirror



Super Mirrors  
TFHSM

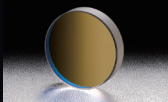
**B010**

Femtosecond Laser



Low Dispersion Mirrors for Femtosecond Laser  
Low Dispersion Mirrors for High Power Femtosecond Laser  
FLM/FLMHP

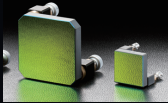
**B011**



Negative Dispersion Mirrors for Femtosecond Laser  
GFM/GCM

**B013**

Frameless Mirror Unit



Frameless Mirror Unit  
GMMUHP

**B014**



Frameless Beamsplitter Unit  
GBSMU

**B014**

Surface Accuracy Guaranteed Mirror



Surface Accuracy Guaranteed Mirror  
HTFM

**B016**



Holder Attached Surface Accuracy Guaranteed Mirrors  
HTFM-MHG

**B018**

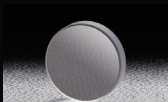
High Power



Dielectric Mirrors for High Power Laser  
TFMHP

**B020**

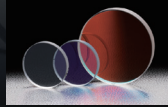
Ultra Broadband



Ultra Broadband Dielectric Mirrors  
TFMS

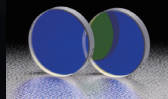
**B022**

Dielectric Multi-layer Coating



Laser Line Mirrors  
TFM

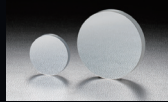
**B024**



0-45° Wide Incidence Dielectric Mirrors  
TFVM

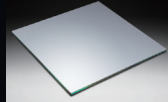
**B027**

Aluminum Coating



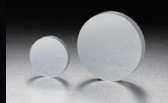
Aluminum Mirrors  
TFA/TFAN/TFAQ/TFAQN/TFAE  
OPBA/ OPSQA

**B030**



Large Aluminum Mirrors  
TFAEFL

**B034**



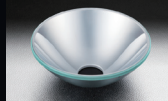
Reasonable Aluminum Flat Mirrors  
S-TFA

**B035**



Ellipsoidal mirror  
TCEA

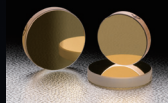
**B036**



Paraboloid mirror  
TCPA

**B037**

Gold Coating



Gold Flat Mirrors  
TFG/TFGS

**B038**



Silver Mirrors  
TFAG

**B040**

Contact sheet for Special Order for Mirror \_\_\_\_\_ **B041**

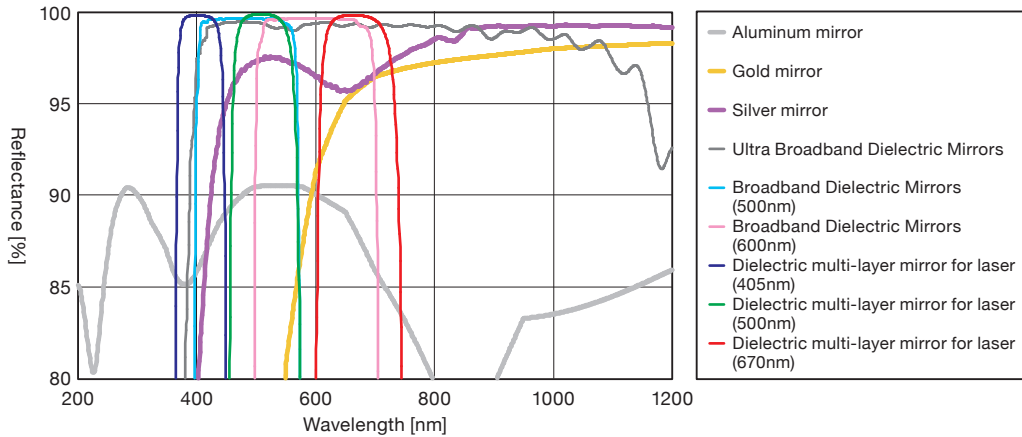
Contact sheet for laser cavity mirror \_\_\_\_\_ **B042**

# Mirrors Selection Guide



Mirrors designed for the optical laboratory are produced by metal or dielectric coating on the polished glass surface by vacuum deposition. Optical characteristics of reflectance with a variety of features are provided with the coating. Please select a mirror with the correct optical properties that matches your specifications.

## Performance Comparison of a typical reflectivity from mirror coatings



## Features of the Mirrors

Type of Coat	Affected products	Features	How to Use	
Metallic coating	<b>Aluminum (TFA)</b> <a href="#">Reference &gt; B030</a> <b>Gold (TFG/TFGS)</b> <a href="#">Reference &gt; B038</a> <b>Silver (TFAG)</b> <a href="#">Reference &gt; B040</a>		<p>Truly affordable !                      Good reflectance in a wide range of wavelength.                      Mirrors are available in gold (AU) coating and at any angle of incidence.                      Light absorption coating, reflection is slightly reduced.</p>	<p>It is designed for any simple optical system. Works well with low power lasers. Together with imaging optics that uses white light illumination system. Also highly compatible when used together with infra-red optics. (Gold mirrors)</p>
	<b>Ultra Broadband (TFMS)</b> <a href="#">Reference &gt; B022</a> <b>Broadband (TFVM)</b> <a href="#">Reference &gt; B027</a>		<p>High reflectance with low loss. Zero absorption from the coatings with high laser strength. It is resistant to hard scratches. Designed and manufactured for narrow wavelength range. To be used at 45 degrees angle of incidence</p>	<p>Designed for the following:                      Precision optical systems especially for low light and low loss optical systems. Sub-watt class laser systems. Multi-wavelength laser optical systems.</p>
	<b>For Laser (TFM)</b> <a href="#">Reference &gt; B024</a> <b>High Power (TFMHP)</b> <a href="#">Reference &gt; B020</a>		<p>High reflectance with low loss. Zero absorption from the coatings with high laser strength. It is resistant to hard scratches. Designed and manufactured for narrow wavelength range. To be used at 45 degrees angle of incidence</p>	<p>For all general and high power laser systems (TFMHP)</p>

Mirrors with a dielectric multi-layer coating can have a variety of features in addition to the characteristics of reflectance.

<b>Super Mirrors (TFSM)</b> <a href="#">Reference &gt; B010</a>		<p>It is a mirror which had low-scattering loss and high reflectivity of 99.999%.</p>
<b>Mirrors for femtosecond laser</b> Low dispersion mirrors for femtosecond laser (FLM/FLMHP) <a href="#">Reference &gt; B011</a> Negative dispersion mirrors for femtosecond laser (GFM/GCM) <a href="#">Reference &gt; B013</a>		<p>For a femtosecond laser, it uses a mirror with the combined characteristics of a dielectric multi-layer coating, wide range, low dispersion and high strength for high power lasers.</p>
<b>Dielectric Mirrors for high power laser (TFMHP)</b> <a href="#">Reference &gt; B020</a>		<p>With our propriety engineering process of the multi-layer coating, it is designed to work well with high-energy laser pulse.</p>

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Ultra Broadband

Dielectric Coating

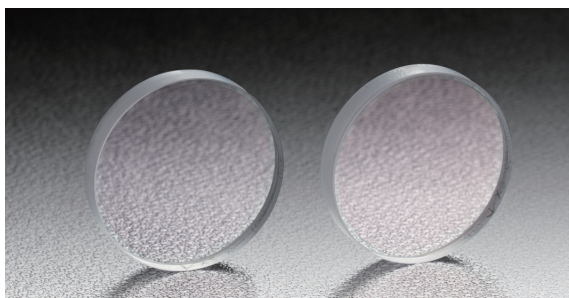
Aluminum Coating

Gold Coating

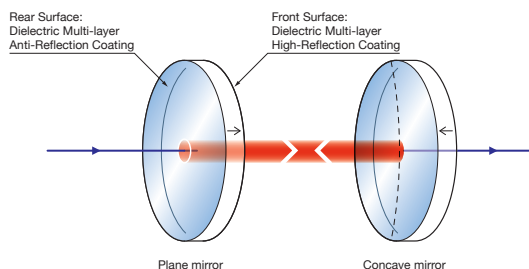


The Fabry-Perot type resonator cavity is often used for measuring extremely high accuracy time or distance with use of the light. Super mirror is an ultra-high performance mirror that surface reflectance is close to 1 (100%) as much as possible in order to increase the performance of the resonator.

- By using an ion beam sputtering (IBS), high quality and dense coating with few defects has been coated.
- With a special polishing technique, the low-scattering substrate of surface flatness  $Ra < 0.1 \text{ nm}$  is used.
- The mirror coating with reflectivity of 99.999% is achieved from the coating design technology that had been developed for many years.
- Scattering loss due to the substrate and the coating is very small, when it is incorporated into a cavity, it is to be expected a high finesse and very narrow spectral bandwidth.
- It is provided two types of wavelength 532nm and 1064nm.

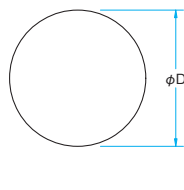


### Schematic



### Outline Drawing

(in mm)



- Tolerance Diameter  $\phi D_{-0.1}^{\circ}$
- Thickness  $t \pm 0.1$

### Specifications

Material	Synthetic Fused Silica
Dimension	Optical Flat
Parallelism	$< 5''$
Surface flatness of substrate	$\lambda/10$
Coating	Front Surface: Dielectric Multi-layer High-Reflection Coating Rear Surface: Dielectric Multi-layer Anti-Reflection Coating
Incident Angle	$0^\circ$
AR coating	$R < 0.15\%$
Clear Aperture	80% of Actual Aperture
Surface Quality (Scratch-Dig)	10-5

### Guide

- ▶ The super mirror coated on a concave substrate is available as custom. Please specify the radius of curvature.
- ▶ Product for different wavelengths, sizes, and incident angles are also provided which are not listed in the catalog. Please contact our international sales division.
- ▶ If the measurement data of such as spectral width and finesse are required, please contact our sales division.

### Attention

- ▶ When used as a single mirror, it does not transmit the light because the reflectance is high. Please use it after assembled to precise cavity in order to use transmitted light.
- ▶ Please make a measurement or handling of the mirror in the clean environment. The dirt, dust and minute amount gas contamination will cause a significant effect on the measured value.
- ▶ If a cavity is consisted of two plane mirrors, the output light may become unstable. In order to realize the stable cavity, please change the mirror of one side or both into a concave mirror, and build a cavity.
- ▶ The Super Mirror is extremely long lead time to test and manufacture. Delivery takes longer than the product of the general catalog. Please consult our sales division in advance when ordering.

### Specifications

Part Number	Wavelength Range [nm]	Diameter $\phi D$ [mm]	Thickness $t$ [mm]	Reflectance* <sup>1</sup> [%]	Loss* <sup>2</sup> [ppm]
TFHSM-12.7C06-532	532	$\phi 12.7$	6	99.995	20
TFHSM-25C06-532	532	$\phi 25$	6	99.995	20
TFHSM-25.4C06-532	532	$\phi 25.4$	6	99.995	20
TFHSM-30C06-532	532	$\phi 30$	6	99.995	20
TFHSM-50C08-532	532	$\phi 50$	8	99.995	20
TFHSM-12.7C06-1064	1064	$\phi 12.7$	6	99.999	8
TFHSM-25C06-1064	1064	$\phi 25$	6	99.999	8
TFHSM-25.4C06-1064	1064	$\phi 25.4$	6	99.999	8
TFHSM-30C06-1064	1064	$\phi 30$	6	99.999	8
TFHSM-50C08-1064	1064	$\phi 50$	8	99.999	8

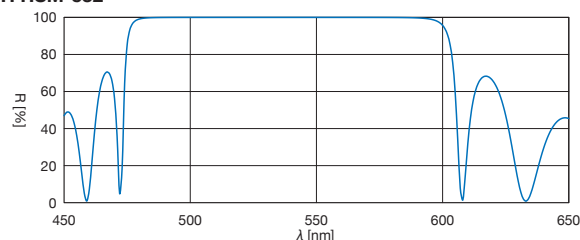
\*1 The above is the reflectance measured in the CRD method. However, there may vary depending on measurement conditions and measurement method.

\*2 The values indicated in "Loss" is only reference data. These data will not be attached with the product.

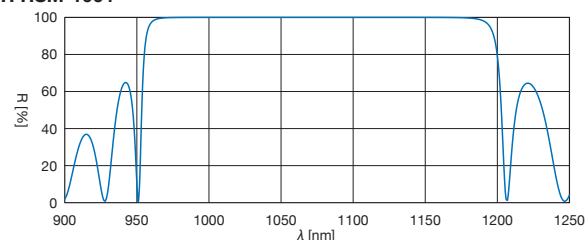
### Typical Reflectance Data

R: Reflectance

#### TFHSM-532



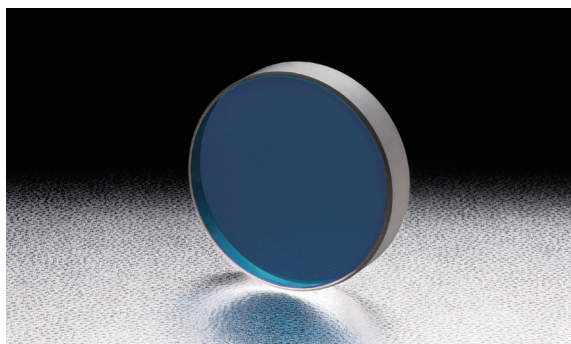
#### TFHSM-1064



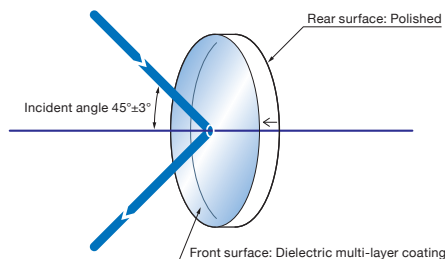


This mirror has low wavelength dispersion and can be used with ultra-short pulse laser with 100 femtosecond or less.

- We have designed a special thin film coating that optimizes wavelength dispersion, range and the strength of lasers.
- It has the effect of suppressing the spread of the pulse width produced by a plurality of reflecting mirrors.
- There are three types available, FLM1 standard, FLM2 wide wavelength band, and high strength laser FLMHP\*.
- These mirrors are designed and produced for usage within the microscopy with femtosecond laser and optical systems with femtosecond time-resolved spectroscopy.

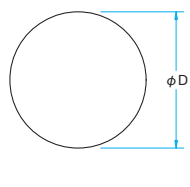


### Schematic



### Outline Drawing

(in mm)



- Tolerance  
Diameter  $\phi D \pm 0.1$   
Thickness  $t \pm 0.1$

### Specifications

Material	BK7 (FLM) Synthetic fused silica (FLMHP)
Coating	Dielectric multi-layer coating
Incident angle	$45^\circ \pm 3^\circ$
Surface Flatness	$\lambda/10$
Parallelism	$< 5''$
Surface Quality (Scratch-Dig)	10-5
Clear aperture	80% of Actual Aperture
Rear Surface	Polished

### Guide

- ▶ Fabrication is also available for low dispersion wavelength and physical dimensions other than those found in the catalogue.
- ▶ We can also produce high power negative dispersion mirror.
- ▶ Also available are our surface flatness guarantee (HTFM) mirrors with accuracy guarantee after surface coating. [Reference](#) B016

### Attention

- ▶ When used in angles other than 45 degrees (AOI), we would not be able to guarantee the wavelength dispersion.

### Low Dispersion Mirrors for Femtosecond Laser

Part Number	Wavelength Range		Diameter $\phi D$ [mm]	Thickness $t$ [mm]	Reflectance Reflectance	Laser Damage Threshold* [J/cm <sup>2</sup> ]
	S polarization [nm]	P polarization [nm]				
FLM1-12.7C05-800	720 – 900	760 – 840	$\phi 12.7$	5	>99.8	1
FLM1-25.4C05-800	720 – 900	760 – 840	$\phi 25.4$	5	>99.8	1
FLM1-30C05-800	720 – 900	760 – 840	$\phi 30$	5	>99.8	1
FLM2-12.7C05-800	700 – 940	740 – 860	$\phi 12.7$	5	>99.8	0.5
FLM2-25.4C05-800	700 – 940	740 – 860	$\phi 25.4$	5	>99.8	0.5
FLM2-30C05-800	700 – 940	740 – 860	$\phi 30$	5	>99.8	0.5

\* Laser pulse width 50fs, wavelength 800nm

### Low Dispersion Mirrors for High Power Femtosecond Laser

Part Number	Wavelength Range		Diameter $\phi D$ [mm]	Thickness $t$ [mm]	Reflectance [%]	Laser Damage Threshold* [J/cm <sup>2</sup> ]
	S polarization [nm]	P polarization [nm]				
FLMHP-12.7C05-800	745 – 855	775 – 825	$\phi 12.7$	5	>99	2
FLMHP-25.4C05-800	745 – 855	775 – 825	$\phi 25.4$	5	>99	2
FLMHP-30C05-800	745 – 855	775 – 825	$\phi 30$	5	>99	2

\* Laser pulse width 65fs, wavelength 800nm

### Compatible Optic Mounts

MHG-MP12.7-NL / MHG-MP25-NL, HS25-NL / MHG-MP30-NL, HS30-NL

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Gold Coating

# Low Dispersion Mirrors for Femtosecond Laser

FLM/FLMHP

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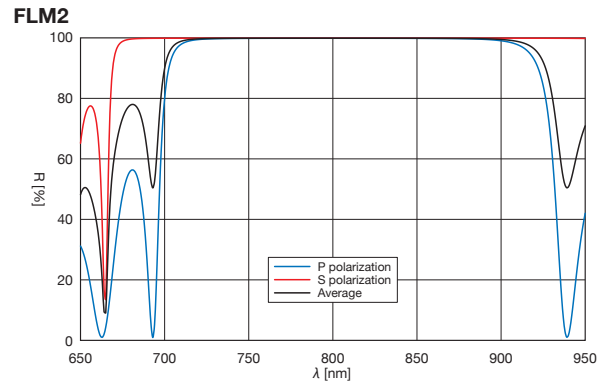
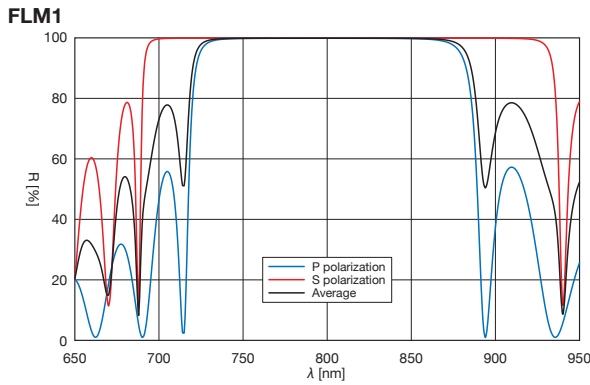
Dielectric Coating

Aluminum Coating

Gold Coating

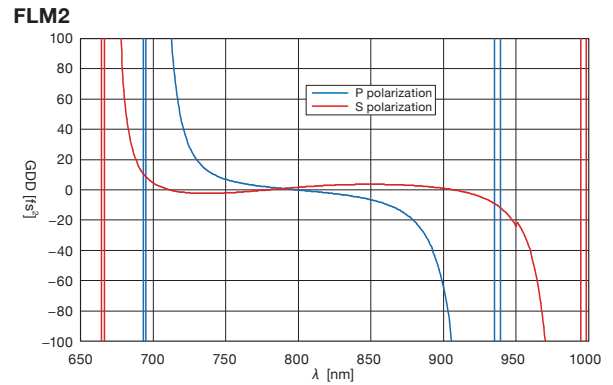
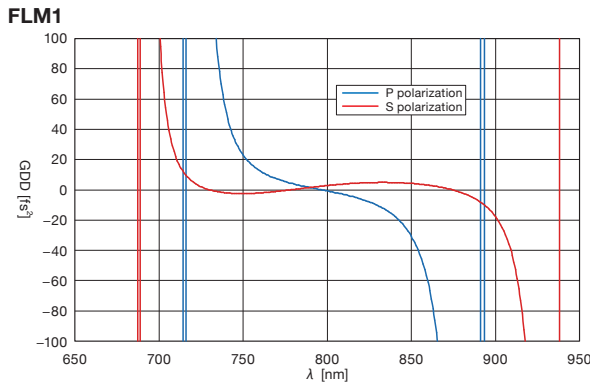
Typical Reflectance Data

R: Reflectance



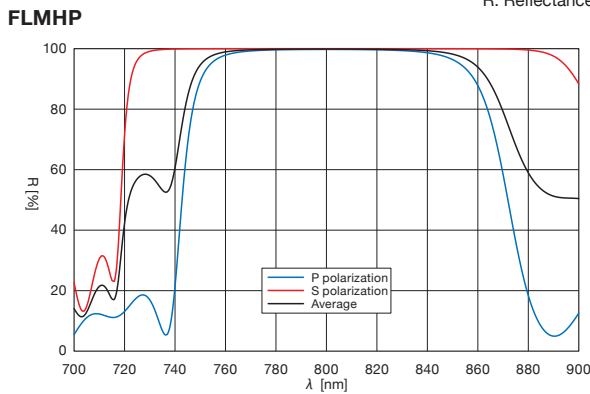
Group Delay Data (for reference only)

GDD: Group Delay Dispersion



Typical Reflectance Data

R: Reflectance

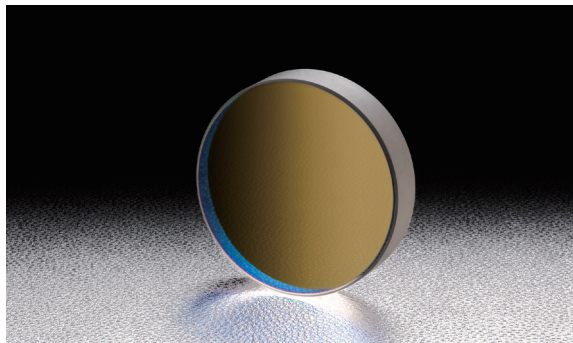






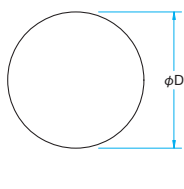
This mirror has a negative dispersion and can be used for pulse compression in a femtosecond laser system.

- These mirrors are more compact and exhibit a smaller optical loss than the conventional prisms used for pulse compression.
- Center wavelength is for Ti: Sapphire at 800nm.
- Plano and concave substrates designed for cavities are available.

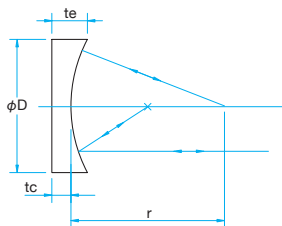


Outline Drawing

(in mm)



●Tolerance  
Diameter  $\phi D_{\pm 0.1}$   
Thickness  $t_{c \pm 0.1}$



●Tolerance  
Diameter  $\phi D_{\pm 0.1}$   
Thickness  $t_{c \pm 0.2}$

Specifications	
Material	BK7
Coating	Dielectric multi-layer coating
Incident angle	0° – 20°
Surface Flatness	$\lambda/10$
Parallelism	<5" (flat surface)
Surface Quality (Scratch-Dig)	10-5
Clear aperture	80% of Actual Aperture
Rear Surface	Polished

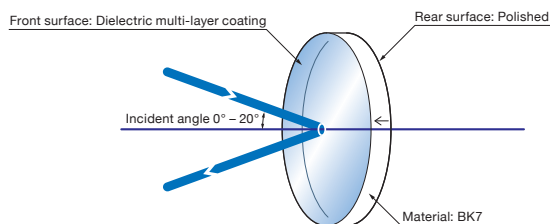
Guide

- ▶ Fabrication of negative dispersion mirror is also available.
- ▶ We can also produce high power negative dispersion mirror.
- ▶ Also available are our surface flatness guarantee (HTFM) mirrors with accuracy guarantee after surface coating. [Reference](#) ▶ B016

Attention

- ▶ The angle of incident for this series is 0 to 20 degrees and the laser dispersion may not be corrected for other angles. Please contact us for further details.

Schematic



Negative Dispersion Mirrors for Femtosecond Laser (Plano)

Part Number	Wavelength Range [nm]	Diameter $\phi D$ [mm]	Thickness $t_c$ [mm]	Reflectance [%]	Laser Damage Threshold* [J/cm <sup>2</sup> ]
GFM-12.7C05-800	700 – 900	$\phi 12.7$	5	>99.8	0.5
GFM-25.4C05-800	700 – 900	$\phi 25.4$	5	>99.8	0.5
GFM-30C05-800	700 – 900	$\phi 30$	5	>99.8	0.5

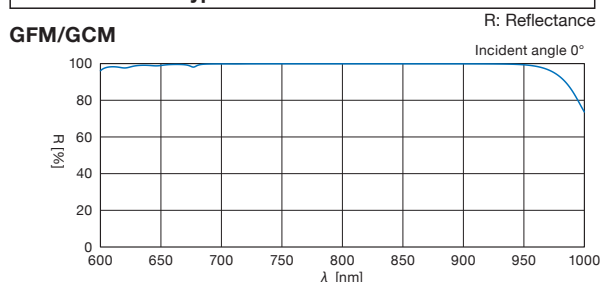
\* Laser pulse width 50fs, wavelength 800nm

Negative Dispersion Mirrors for Femtosecond Laser (Concave)

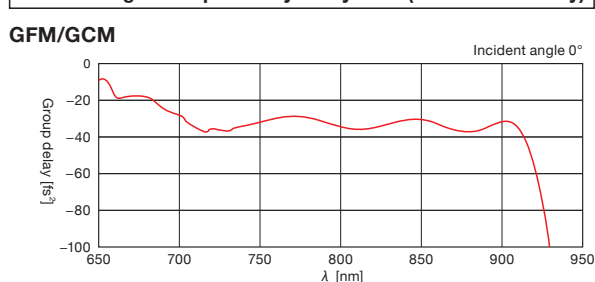
Part Number	Wavelength Range [nm]	Diameter $\phi D$ [mm]	Edge Thickness $t_e$ [mm]	Radius of curvature $r$ [mm]	Reflectance [%]	Laser Damage Threshold* [J/cm <sup>2</sup> ]
GCM-30C07-50-800	700 – 900	$\phi 30$	7	50	>99.8	0.5
GCM-30C07-100-800	700 – 900	$\phi 30$	7	100	>99.8	0.5
GCM-30C05-500-800	700 – 900	$\phi 30$	5	500	>99.8	0.5
GCM-30C05-1000-800	700 – 900	$\phi 30$	5	1000	>99.8	0.5

\* Laser pulse width 50fs, wavelength 800nm

Typical Reflectance Data



Incident angle Group Velocity Delay Data (for reference only)



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# Frameless Mirror Unit

# Frameless Beamsplitter Unit

**GMMUHP**  
**GBSMU**

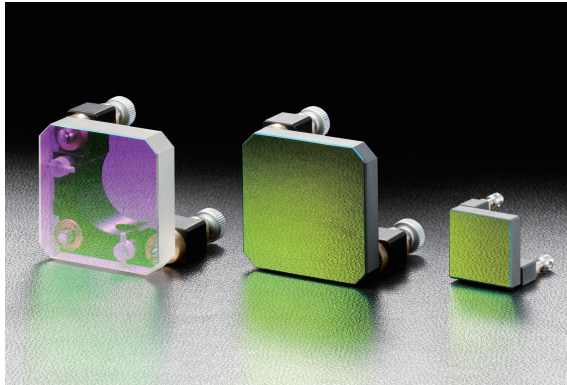
**RoHS**  
**RoHS**

Frameless mounting is designed to minimize footprint space and allows the maximum front surface area of the mirror to be coated.

Our high reflectivity mirrors are produced using a ceramic material.

Thermal expansion ratio is equivalent to Zerodur® for maximum thermal stability.

- Laser damage threshold of the mirror is equivalent to our high power dielectric laser mirrors (TFMHP).
- $\lambda/10$  surface accuracy guarantee after coating.
- The Beamsplitter coating is equivalent to our ultra broadband dielectric half mirror (PSMH).
- Fused Silica is used for our beamsplitters. It is to minimize transmitted wavefront error(s).
- The patent related to this product (Patent No. 4586110) was obtained by SIGMA KOKI CO., LTD. in November 2011.



## Specifications

### Holder

Type		GMMUHP-24.4	GMMUHP-49 GBSMU-49
Adjustable axis		3 axis	2 axis
Adjustment Range [°]	Elevation	$\pm 3$	$\pm 2$
	Rotation	$\pm 3$	$\pm 2$
Resolution [°/rotation]	Elevation	0.74	0.26
	Rotation	0.74	0.26
Main material		Brass	Aluminum
Surface finishing		Super black chrome	Black anodized
Weight [kg]		0.04	0.16

### Mirror

Type	Mirror	Beamsplitter
Material	Ceramic	Synthetic fused silica
Incident angle	$45^\circ \pm 3^\circ$	
Surface accuracy after coating	Reflective wavefront distortion $\lambda/10$	
Surface Quality (Scratch-Dig)	20-10	
Reflectance	>99%	Average 50 $\pm$ 5%

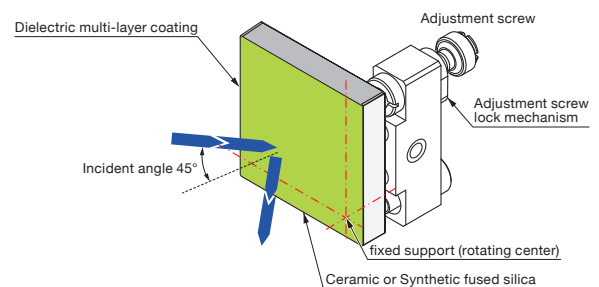
### Guide

- ▶ How to mount to the base is the same as the mirror holder MHG.  
**Reference** C010
- ▶ Able to mount on Pedestal Bases (PST-\*\*) and Post (RO-\*\*) with M6 thread (sold separately) **Reference** D040, D043

### Attention

- ▶ Surface accuracy data is not provided with product. Surface accuracy data is subjected to an additional charge.
- ▶ Reflectance of the specification are represented by the average of the reflectance of P polarized light and S polarized light.
- ▶ If the product is used without setting the angle of incidence to  $45^\circ$ , the reflection rate may decrease.
- ▶ Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.

### Schematic



Catalog Code **W3001**

### Mirror Unit

Part Number	Wavelength Range [nm]	Dimension of front plate [mm]	Coating clear aperture [mm]	Surface accuracy after coating [mm]	Laser Damage Threshold* [J/cm <sup>2</sup> ]
<b>GMMUHP-24.4-355</b>	355	24.4×24.4×7	23×23	$\phi 20$	8
<b>GMMUHP-24.4-532</b>	532	24.4×24.4×7	23×23	$\phi 20$	26.5
<b>GMMUHP-24.4-1064</b>	1064	24.4×24.4×7	23×23	$\phi 20$	28
<b>GMMUHP-49-355</b>	355	49×49×8.5	48×48	$\phi 30$	8
<b>GMMUHP-49-532</b>	532	49×49×8.5	48×48	$\phi 30$	26.5
<b>GMMUHP-49-1064</b>	1064	49×49×8.5	48×48	$\phi 30$	28

\* Laser pulse width 10ns, repetition frequency 20Hz

Catalog Code **W3406**

### Beamsplitter Unit

Part Number	Wavelength Range [nm]	Dimension of front plate [mm]	Coating clear aperture [mm]	Surface accuracy after coating [mm]	Clear aperture of transmitted beam [mm]	Laser Damage Threshold* [J/cm <sup>2</sup> ]
<b>GBSMU-49-VIS</b>	400 - 700	49×49×12	48×48	$\phi 30$	$\phi 20$	2.1

\* Laser pulse width 10ns, repetition frequency 20Hz

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Aluminum Coating

Gold Coating

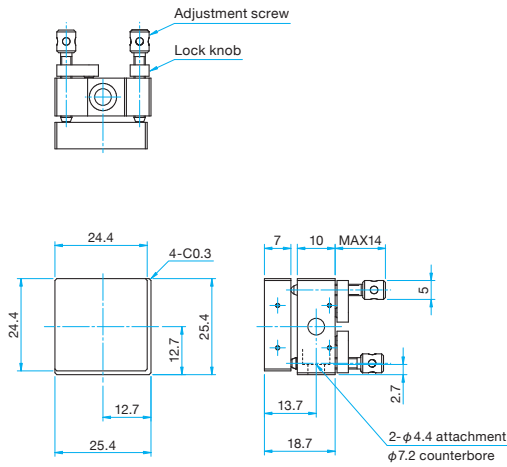




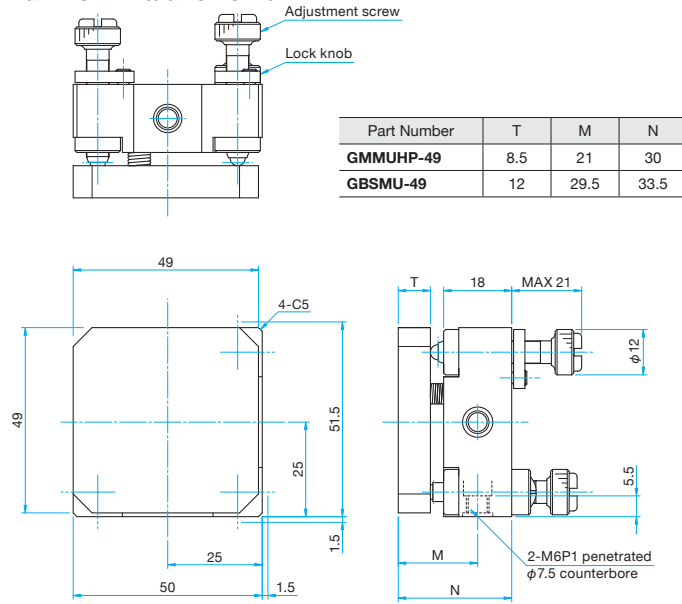
Outline Drawing

(in mm)

GMMUHP-24.4



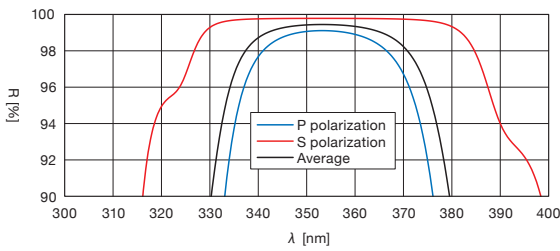
GMMUHP-49/GBSMU-49



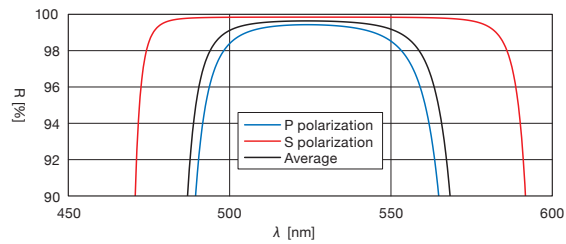
Typical Reflectance Data of Frameless Mirror

R: Reflectance

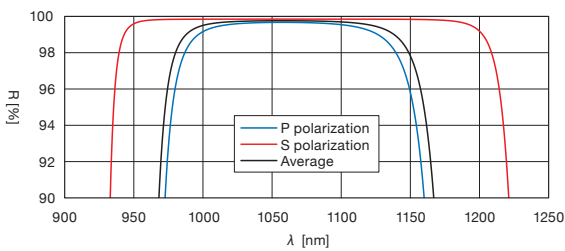
GMMUHP-355



GMMUHP-532



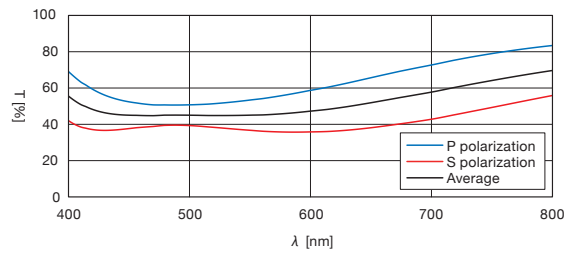
GMMUHP-1064



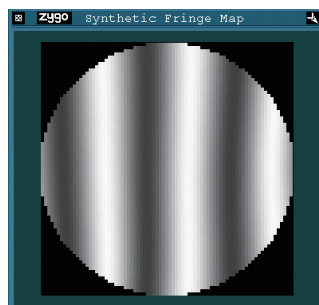
Typical Transmittance Data of Frameless Beamsplitter

T: Transmission

GBSMU-VIS



Surface Accuracy Data (reference data)



- Surface accuracy measurement method: Measured with Zygo laser interferometer
- Surface accuracy measurement wavelength: 632.8nm
- Surface accuracy guaranteed temperature: 23°C±2°C

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Dielectric Coating

Aluminum Coating

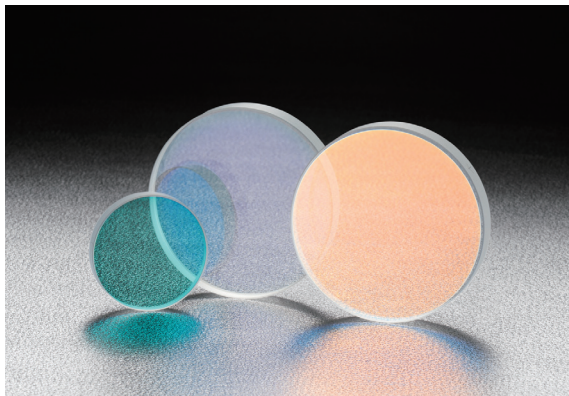
Gold Coating

# Surface Accuracy Guaranteed Mirror | HTFM

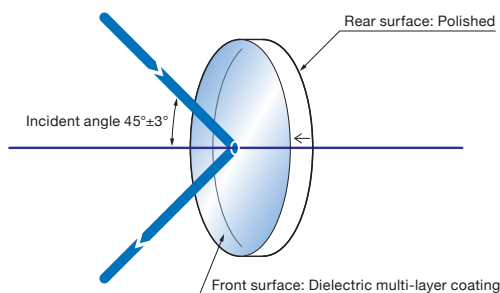
RoHS

A mirror with high surface accuracy is realized by optimizing the conditions of the substrate material, thickness and coating. A surface accuracy of  $\lambda/10$  after coating is guaranteed.

- A surface accuracy (after coating) higher than that of existing dielectric multi-layer flat mirrors (TFM) can be obtained.
- The rigidity of the product is increased by using Synthetic fused silica as the substrate and also by having it thickened.
- Our product line-up includes mirrors with high reflection that rates accordingly to each individual wavelength of ultra-violet, YAG and other lasers.

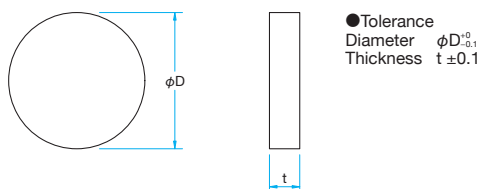


## Schematic



## Outline Drawing

(in mm)



## Specifications

Material	Synthetic fused silica
Coating	Dielectric multi-layer coating
Incident angle	$45^\circ \pm 3'$
Surface Flatness	$\lambda/10$
Parallelism	$< 3'$
Surface Quality (Scratch-Dig)	10-5
Clear aperture	80% of external diameter
Rear Surface	Polished

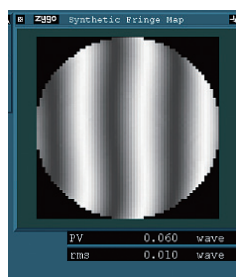
## Guide

- ▶ HTFM-MHG for which a mirror is attached to the holder and surface accuracy is guaranteed are also available. [Reference](#) B018
- ▶ Please contact our International Sales Division for customized products. (customized on outer diameter, wavelength characteristic, etc.) Please use the inquiry sheet. [Reference](#) B041

## Attention

- ▶ No surface accuracy guarantee data is attached with the product. If you need the sheet containing the surface accuracy guarantee data, an additional cost for creating the data is required. Please contact the sales representative.
- ▶ For the dielectric multi-layer film, the reflection rate wavelength characteristics vary depending on the polarization state of the incident beam. The reflection rate of P polarization is lower than that of S polarization and the reflection band is narrow.
- ▶ The reflection rate shown in the specifications represents the average value of the reflection rate of P polarization and S polarization.
- ▶ If the product is used without setting the angle of incidence to 45 degrees, the reflection rate may decrease.
- ▶ If the product is not used at an applicable wavelength, the reflection rate may decrease.

## Surface Accuracy Data (reference data)



- Surface accuracy measurement method: Measured with Zygo laser interferometer
- Surface accuracy measurement wavelength 632.8nm
- Surface accuracy guaranteed temperature  $23^\circ\text{C} \pm 2^\circ\text{C}$

## 248 – 308nm

Part Number	Wavelength Range [nm]	Diameter $\phi D$ [mm]	Thickness $t$ [mm]	Reflectance [%]	Laser Damage Threshold* [J/cm <sup>2</sup> ]
HTFM-12.7C08-248	248	$\phi 12.7$	8	>99.2	2
HTFM-25.4C08-248	248	$\phi 25.4$	8	>99.2	2
HTFM-30C08-248	248	$\phi 30$	8	>99.2	2
HTFM-50C11-248	248	$\phi 50$	11	>99.2	2
HTFM-50.8C11-248	248	$\phi 50.8$	11	>99.2	2
HTFM-12.7C08-266	266	$\phi 12.7$	8	>99.2	2
HTFM-25.4C08-266	266	$\phi 25.4$	8	>99.2	2
HTFM-30C08-266	266	$\phi 30$	8	>99.2	2
HTFM-50C11-266	266	$\phi 50$	11	>99.2	2
HTFM-50.8C11-266	266	$\phi 50.8$	11	>99.2	2
HTFM-12.7C08-308	308	$\phi 12.7$	8	>99.5	2
HTFM-25.4C08-308	308	$\phi 25.4$	8	>99.5	2
HTFM-30C08-308	308	$\phi 30$	8	>99.5	2
HTFM-50C11-308	308	$\phi 50$	11	>99.5	2
HTFM-50.8C11-308	308	$\phi 50.8$	11	>99.5	2

\* Laser pulse width 10ns, repetition frequency 20Hz

## Compatible Optic Mounts

MHG-MP12.7-NL / MHG-MP25-NL, HS25-NL / MHG-MP30-NL, HS30-NL / MHG-MP50-NL / MHG-MP50.8-NL



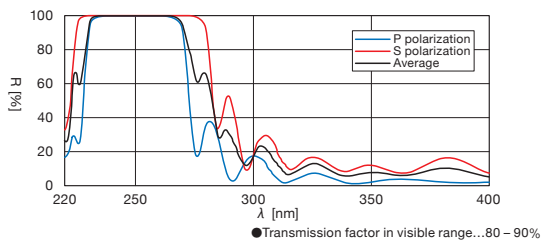


355 – 1064nm						
Part Number	Wavelength Range [nm]	Diameter $\phi$ D [mm]	Thickness t [mm]	Reflectance [%]	Laser Damage Threshold* [J/cm <sup>2</sup> ]	
HTFM-12.7C08-355	355	$\phi$ 12.7	8	>99.5	5	
HTFM-25.4C08-355	355	$\phi$ 25.4	8	>99.5	5	
HTFM-30C08-355	355	$\phi$ 30	8	>99.5	5	
HTFM-50C11-355	355	$\phi$ 50	11	>99.5	5	
HTFM-50.8C11-355	355	$\phi$ 50.8	11	>99.5	5	
HTFM-12.7C08-532	532	$\phi$ 12.7	8	>99.5	7	
HTFM-25.4C08-532	532	$\phi$ 25.4	8	>99.5	7	
HTFM-30C08-532	532	$\phi$ 30	8	>99.5	7	
HTFM-50C11-532	532	$\phi$ 50	11	>99.5	7	
HTFM-50.8C11-532	532	$\phi$ 50.8	11	>99.5	7	
HTFM-12.7C08-1064	1064	$\phi$ 12.7	8	>99.5	20	
HTFM-25.4C08-1064	1064	$\phi$ 25.4	8	>99.5	20	
HTFM-30C08-1064	1064	$\phi$ 30	8	>99.5	20	
HTFM-50C11-1064	1064	$\phi$ 50	11	>99.5	20	
HTFM-50.8C11-1064	1064	$\phi$ 50.8	11	>99.5	20	

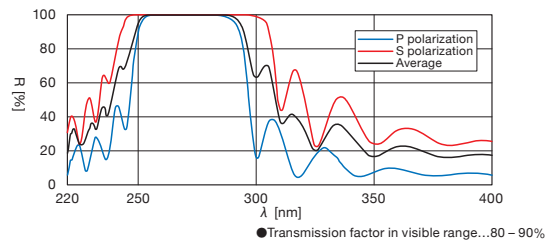
\* Laser pulse width 10ns, repetition frequency 20Hz

Typical Reflectance Data R: Reflectance

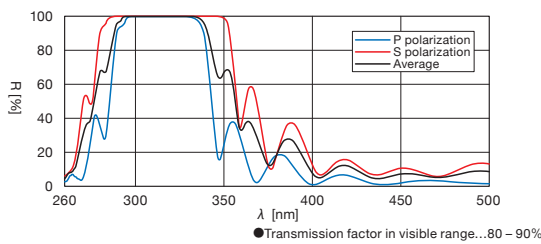
HTFM-248



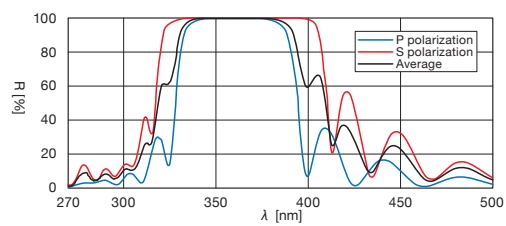
HTFM-266



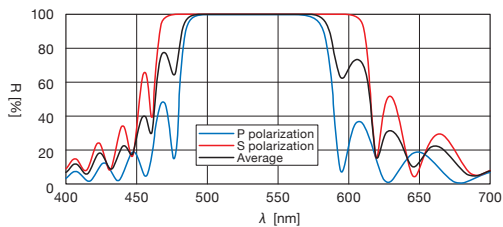
HTFM-308



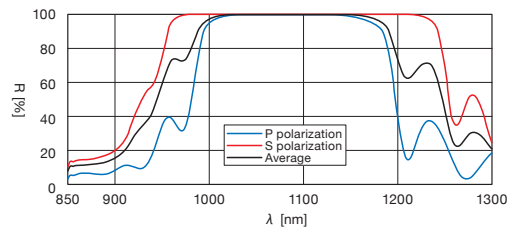
HTFM-355



HTFM-532



HTFM-1064



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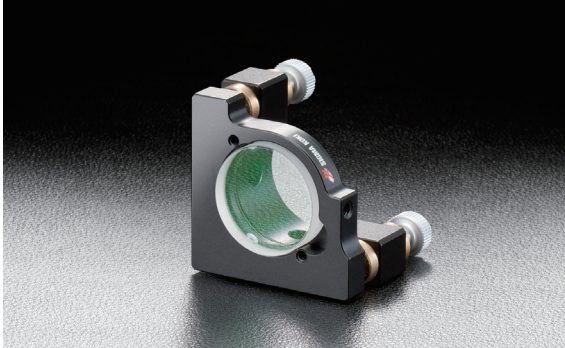
## Holder Attached Surface Accuracy Guaranteed Mirrors

HTFM-MHG

RoHS

By bonding the coated surface to our Kinematic Mirror Holders, a  $\lambda/10$  surface accuracy is guaranteed! This product can be used by composition with high accuracy wavefront optical system or interferometer requirements.

- 2 types of performance mirror holders offered: high stability mirror holder (MHG-HS) or production model (MHG-MP).



## Specifications

## Holder

Movable axis	HTFM-MHG-HS: 3 axes HTFM-MHG-MP: 2 axes (HTFM-12.7C08-MHG-MP: 3axes)
Main Material	Aluminum (Brass: MHG-MP12.7 only)
Finishing	Black anodized (Only MHG-MP12.7 is Super black chrome)

## Mirror

Material	Synthetic fused silica
Coating	Dielectric multi-layer coating
Incident angle	$45^\circ \pm 3^\circ$
Surface Accuracy	After holder is attached $\lambda/10$
Surface Quality (Scratch-Dig)	10-5
Clear aperture	80% of Actual Aperture
Rear Surface	Polished

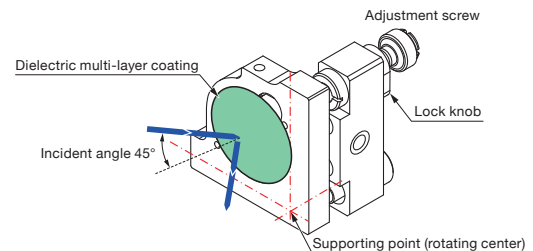
## Guide

- ▶ The Production model (MHG-MP) is equipped with lock mechanisms in the adjustment screw.
- ▶ This product can be attached to a rod (RS-\*\*-\*\*\*) separately available) or a post stand (PST-\*\*-\*\*\*) separately available).
- ▶ [Reference](#) ▶ D040 , D043
- ▶ Confirm the reflection rate wavelength characteristic with the graph of the surface accuracy guaranteed mirror (HTFM). [Reference](#) ▶ B017

## Attention

- ▶ The mirror surface will protrude by 2mm from the holder after attachment.
- ▶ Surface accuracy guarantee data is not attached. If required, a creation fee will be charged. Please contact our Sales department for more information.
- ▶ Surface accuracy will not be guaranteed when the mirror is detached.
- ▶ Any impacted shock to the holder or mirror may result in poor surface accuracy.
- ▶ For production model (MHG-MP), the rotation center is at the external side of the mirror (support point of the holder)
- ▶ When fixing the high stability model (MHG-HS) to a flat surface, please use supplied plate for attached posts
- ▶ The optical axis will be 10mm higher after using the supplied plates after attachment.

## Schematic



## 248 – 308nm

Part Number	Wavelength Range [nm]	Compatible Optics Diameter $\phi D$ [mm]	Reflectance [%]	Holder part number	Adjustment Range		Resolution		Weight [kg]
					Elevation [°]	Rotation [°]	Elevation [°/rotation]	Rotation [°/rotation]	
HTFM-12.7C08-248-MHG-MP	248	$\phi 12.7$	>99.2	MHG-MP12.7	$\pm 3$	$\pm 3$	about 0.74	about 0.74	0.04
HTFM-25.4C08-248-MHG-MP	248	$\phi 25.4$	>99.2	MHG-MP25	$\pm 3$	$\pm 3$	about 0.39	about 0.39	0.12
HTFM-25.4C08-248-MHG-HS	248	$\phi 25.4$	>99.2	MHG-HS25	$\pm 3$	$\pm 3$	about 0.39	about 0.39	0.12
HTFM-30C08-248-MHG-MP	248	$\phi 30$	>99.2	MHG-MP30	$\pm 3$	$\pm 3$	about 0.39	about 0.39	0.12
HTFM-30C08-248-MHG-HS	248	$\phi 30$	>99.2	MHG-HS30	$\pm 3$	$\pm 3$	about 0.39	about 0.39	0.12
HTFM-50C11-248-MHG-MP	248	$\phi 50$	>99.2	MHG-MP50	$\pm 2$	$\pm 2$	about 0.26	about 0.26	0.24
HTFM-50.8C11-248-MHG-MP	248	$\phi 50.8$	>99.2	MHG-MP50.8	$\pm 2$	$\pm 2$	about 0.26	about 0.26	0.24
HTFM-12.7C08-266-MHG-MP	266	$\phi 12.7$	>99.2	MHG-MP12.7	$\pm 3$	$\pm 3$	about 0.74	about 0.74	0.04
HTFM-25.4C08-266-MHG-MP	266	$\phi 25.4$	>99.2	MHG-MP25	$\pm 3$	$\pm 3$	about 0.39	about 0.39	0.12
HTFM-25.4C08-266-MHG-HS	266	$\phi 25.4$	>99.2	MHG-HS25	$\pm 3$	$\pm 3$	about 0.39	about 0.39	0.12
HTFM-30C08-266-MHG-MP	266	$\phi 30$	>99.2	MHG-MP30	$\pm 3$	$\pm 3$	about 0.39	about 0.39	0.12
HTFM-30C08-266-MHG-HS	266	$\phi 30$	>99.2	MHG-HS30	$\pm 3$	$\pm 3$	about 0.39	about 0.39	0.12
HTFM-50C11-266-MHG-MP	266	$\phi 50$	>99.2	MHG-MP50	$\pm 2$	$\pm 2$	about 0.26	about 0.26	0.24
HTFM-50.8C11-266-MHG-MP	266	$\phi 50.8$	>99.2	MHG-MP50.8	$\pm 2$	$\pm 2$	about 0.26	about 0.26	0.24
HTFM-12.7C08-308-MHG-MP	308	$\phi 12.7$	>99.5	MHG-MP12.7	$\pm 3$	$\pm 3$	about 0.74	about 0.74	0.04
HTFM-25.4C08-308-MHG-MP	308	$\phi 25.4$	>99.5	MHG-MP25	$\pm 3$	$\pm 3$	about 0.39	about 0.39	0.12
HTFM-25.4C08-308-MHG-HS	308	$\phi 25.4$	>99.5	MHG-HS25	$\pm 3$	$\pm 3$	about 0.39	about 0.39	0.12
HTFM-30C08-308-MHG-MP	308	$\phi 30$	>99.5	MHG-MP30	$\pm 3$	$\pm 3$	about 0.39	about 0.39	0.12
HTFM-30C08-308-MHG-HS	308	$\phi 30$	>99.5	MHG-HS30	$\pm 3$	$\pm 3$	about 0.39	about 0.39	0.12
HTFM-50C11-308-MHG-MP	308	$\phi 50$	>99.5	MHG-MP50	$\pm 2$	$\pm 2$	about 0.26	about 0.26	0.24
HTFM-50.8C11-308-MHG-MP	308	$\phi 50.8$	>99.5	MHG-MP50.8	$\pm 2$	$\pm 2$	about 0.26	about 0.26	0.24

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Part Number	Wavelength Range [nm]	Compatible Optics Diameter $\phi$ D [mm]	Reflectance [%]	Holder part number	Adjustment Range		Resolution		Weight [kg]
					Elevation [°]	Rotation [°]	Elevation [°/rotation]	Rotation [°/rotation]	
HTFM-12.7C08-355-MHG-MP	355	$\phi$ 12.7	>99.5	MHG-MP12.7	$\pm$ 3	$\pm$ 3	about 0.74	about 0.74	0.04
HTFM-25.4C08-355-MHG-MP	355	$\phi$ 25.4	>99.5	MHG-MP25	$\pm$ 3	$\pm$ 3	about 0.39	about 0.39	0.12
HTFM-25.4C08-355-MHG-HS	355	$\phi$ 25.4	>99.5	MHG-HS25	$\pm$ 3	$\pm$ 3	about 0.39	about 0.39	0.12
HTFM-30C08-355-MHG-MP	355	$\phi$ 30	>99.5	MHG-MP30	$\pm$ 3	$\pm$ 3	about 0.39	about 0.39	0.12
HTFM-30C08-355-MHG-HS	355	$\phi$ 30	>99.5	MHG-HS30	$\pm$ 3	$\pm$ 3	about 0.39	about 0.39	0.12
HTFM-50C11-355-MHG-MP	355	$\phi$ 50	>99.5	MHG-MP50	$\pm$ 2	$\pm$ 2	about 0.26	about 0.26	0.24
HTFM-50.8C11-355-MHG-MP	355	$\phi$ 50.8	>99.5	MHG-MP50.8	$\pm$ 2	$\pm$ 2	about 0.26	about 0.26	0.24
HTFM-12.7C08-532-MHG-MP	532	$\phi$ 12.7	>99.5	MHG-MP12.7	$\pm$ 3	$\pm$ 3	about 0.74	about 0.74	0.04
HTFM-25.4C08-532-MHG-MP	532	$\phi$ 25.4	>99.5	MHG-MP25	$\pm$ 3	$\pm$ 3	about 0.39	about 0.39	0.12
HTFM-25.4C08-532-MHG-HS	532	$\phi$ 25.4	>99.5	MHG-HS25	$\pm$ 3	$\pm$ 3	about 0.39	about 0.39	0.12
HTFM-30C08-532-MHG-MP	532	$\phi$ 30	>99.5	MHG-MP30	$\pm$ 3	$\pm$ 3	about 0.39	about 0.39	0.12
HTFM-30C08-532-MHG-HS	532	$\phi$ 30	>99.5	MHG-HS30	$\pm$ 3	$\pm$ 3	about 0.39	about 0.39	0.12
HTFM-50C11-532-MHG-MP	532	$\phi$ 50	>99.5	MHG-MP50	$\pm$ 2	$\pm$ 2	about 0.26	about 0.26	0.24
HTFM-50.8C11-532-MHG-MP	532	$\phi$ 50.8	>99.5	MHG-MP50.8	$\pm$ 2	$\pm$ 2	about 0.26	about 0.26	0.24
HTFM-12.7C08-1064-MHG-MP	1064	$\phi$ 12.7	>99.5	MHG-MP12.7	$\pm$ 3	$\pm$ 3	about 0.74	about 0.74	0.04
HTFM-25.4C08-1064-MHG-MP	1064	$\phi$ 25.4	>99.5	MHG-MP25	$\pm$ 3	$\pm$ 3	about 0.39	about 0.39	0.12
HTFM-25.4C08-1064-MHG-HS	1064	$\phi$ 25.4	>99.5	MHG-HS25	$\pm$ 3	$\pm$ 3	about 0.39	about 0.39	0.12
HTFM-30C08-1064-MHG-MP	1064	$\phi$ 30	>99.5	MHG-MP30	$\pm$ 3	$\pm$ 3	about 0.39	about 0.39	0.12
HTFM-30C08-1064-MHG-HS	1064	$\phi$ 30	>99.5	MHG-HS30	$\pm$ 3	$\pm$ 3	about 0.39	about 0.39	0.12
HTFM-50C11-1064-MHG-MP	1064	$\phi$ 50	>99.5	MHG-MP50	$\pm$ 2	$\pm$ 2	about 0.26	about 0.26	0.24
HTFM-50.8C11-1064-MHG-MP	1064	$\phi$ 50.8	>99.5	MHG-MP50.8	$\pm$ 2	$\pm$ 2	about 0.26	about 0.26	0.24

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Dielectric Coating

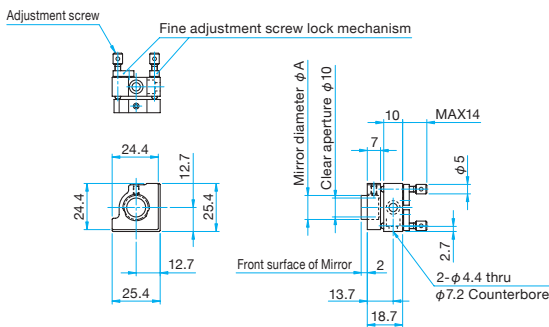
Aluminum Coating

Gold Coating

Outline Drawing (in mm)

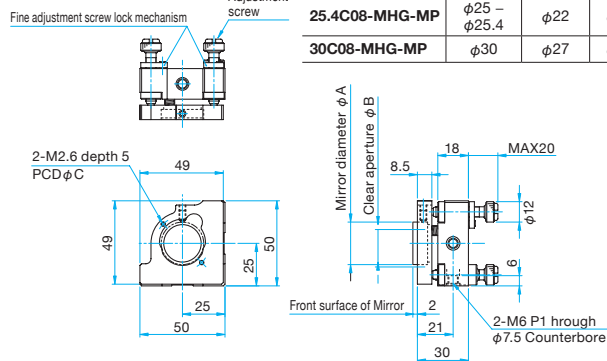
HTFM-12.7C08-MHG-MP

Hexagon socket head cap screw M4x...1 screw



HTFM-25.4C08-MHG-MP  
HTFM-30C08-MHG-MP

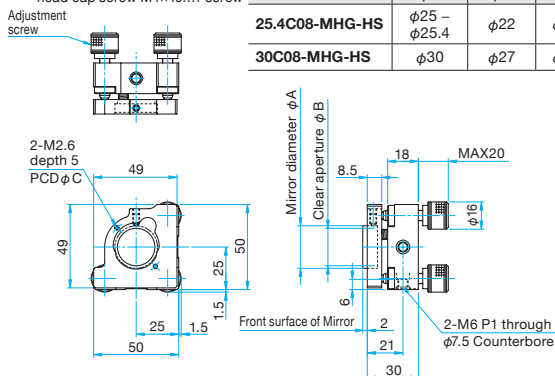
Hexagon socket head cap screw M4x10...1 screw



Part Number	Mirror diameter $\phi$ A	Clear aperture $\phi$ B	PCD $\phi$ C
25.4C08-MHG-MP	$\phi$ 25 - $\phi$ 25.4	$\phi$ 22	$\phi$ 32
30C08-MHG-MP	$\phi$ 30	$\phi$ 27	$\phi$ 35

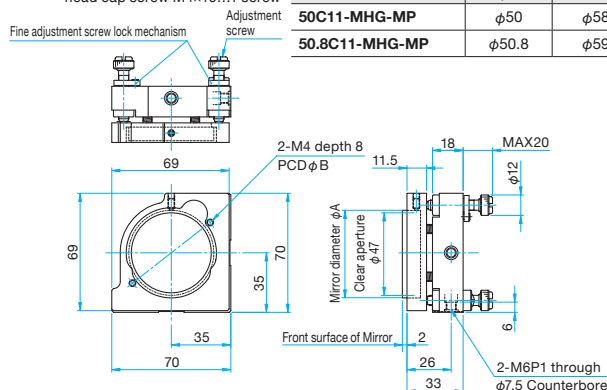
HTFM-25.4C08-MHG-HS  
HTFM-30C08-MHG-HS

Hexagon socket head cap screw M4x10...1 screw



HTFM-50C11-MHG-MP  
HTFM-50.8C11-MHG-MP

Hexagon socket head cap screw M4x10...1 screw



Part Number	Mirror diameter $\phi$ A	Clear aperture $\phi$ B	PCD $\phi$ C
50C11-MHG-MP	$\phi$ 50	$\phi$ 58	
50.8C11-MHG-MP	$\phi$ 50.8	$\phi$ 59	



## Dielectric Mirrors for High Power Laser

TFMHP

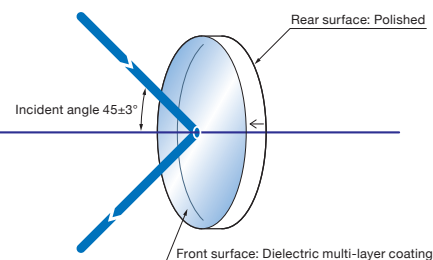
RoHS

All dielectric designs are much more resistant to laser damage than typical mirrors and are suitable for use with high power laser systems.

- All Dielectric Mirrors for High Power Laser are manufactured using dielectric multi-layer coatings of alternating high and low index layers.
- These are specifically designed for use at 45 degrees (AOI).
- All dielectric designs are much more resistant to laser damage than typical mirrors and are suitable for use with high power laser systems.
- Mirrors for YAG lasers are also available.

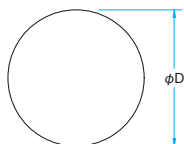


## Schematic



## Outline Drawing

(in mm)



- Tolerance  
Diameter  $\phi D_{\pm 0.1}$   
Thickness  $t \pm 0.1$

## Specifications

Material	BK7
Coating	Dielectric multi-layer coating
Incident angle	$45^\circ \pm 3^\circ$
Surface Flatness	$\lambda/10$
Parallelism	$< 3'$
Surface Quality (Scratch-Dig)	10-5
Clear aperture	90% of Actual Aperture
Rear Surface	Polished

## Guide

- ▶ Please contact our International Sales Division for customized products. (customized on outer diameter, wavelength characteristic, etc.) Please use the inquiry sheet. [Reference](#) B041
- ▶ Also available are our surface flatness guarantee (HTFM) mirrors with accuracy guarantee after surface coating. [Reference](#) B016

## Attention

- ▶ Reflectance of dielectric mirrors will vary according to the polarization of the input beams.
- ▶ The un-coated rear surface of the mirror is polished and is indicated with an arrow on the side of the substrate.
- ▶ Reflectance of laser line mirrors are different according to the polarization of input beams. S-polarization has the high reflectance and the wide reflective bandwidth compared with p-polarization. The reflectance in the specifications list is that of random polarization or  $(p\text{-polarization reflectance} + s\text{-polarization reflectance}) / 2$ .
- ▶ The reflectance curves are based on actual measurements and may be different with production lots. Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.
- ▶ The surface flatness is the reflected surface wavefront distortion before coating.

## Specifications

Part Number	Wavelength Range [nm]	Diameter $\phi D$ [mm]	Thickness $t$ [mm]	Reflectance [%]	Laser Damage Threshold* [J/cm <sup>2</sup> ]
TFMHP-25.4C05-193	193	$\phi 25.4$	5	>95	2
TFMHP-30C05-193	193	$\phi 30$	5	>95	2
TFMHP-50C08-193	193	$\phi 50$	8	>95	2
TFMHP-25.4C05-248	248	$\phi 25.4$	5	>98	4
TFMHP-30C05-248	248	$\phi 30$	5	>98	4
TFMHP-50C08-248	248	$\phi 50$	8	>98	4
TFMHP-25.4C05-266	266	$\phi 25.4$	5	>98	5
TFMHP-30C05-266	266	$\phi 30$	5	>98	5
TFMHP-50C08-266	266	$\phi 50$	8	>98	5
TFMHP-25.4C05-355	355	$\phi 25.4$	5	>99	8
TFMHP-30C05-355	355	$\phi 30$	5	>99	8
TFMHP-50C08-355	355	$\phi 50$	8	>99	8
TFMHP-25.4C05-532	532	$\phi 25.4$	5	>99	26.5
TFMHP-30C05-532	532	$\phi 30$	5	>99	26.5
TFMHP-50C08-532	532	$\phi 50$	8	>99	26.5
TFMHP-25.4C05-1064	1064	$\phi 25.4$	5	>99	28
TFMHP-30C05-1064	1064	$\phi 30$	5	>99	28
TFMHP-50C08-1064	1064	$\phi 50$	8	>99	28

\* Angle of incidence 0°, laser pulse width 10ns, repetition frequency 20Hz

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Dielectric Coating

Aluminum Coating

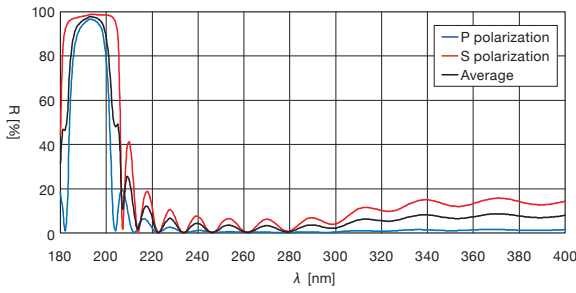
Gold Coating



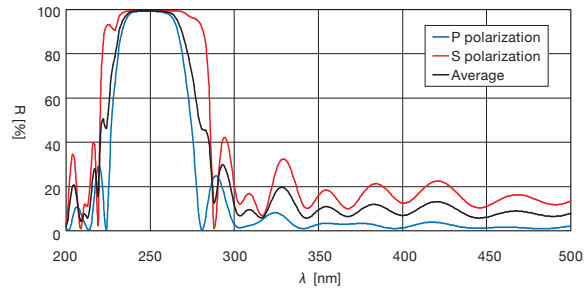
Typical Reflectance Data

R: Reflectance

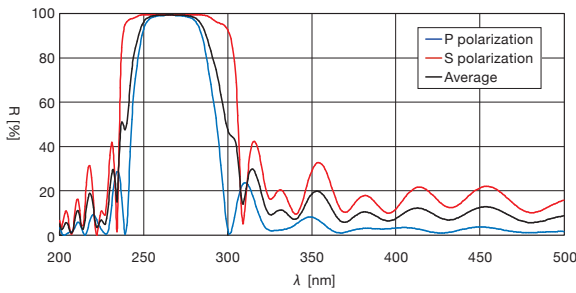
TFMHP-193



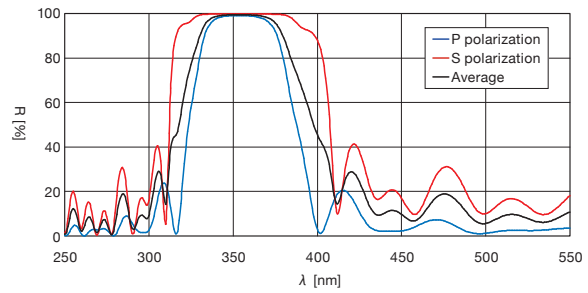
TFMHP-248



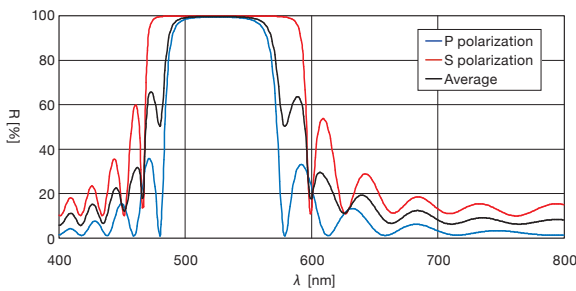
TFMHP-266



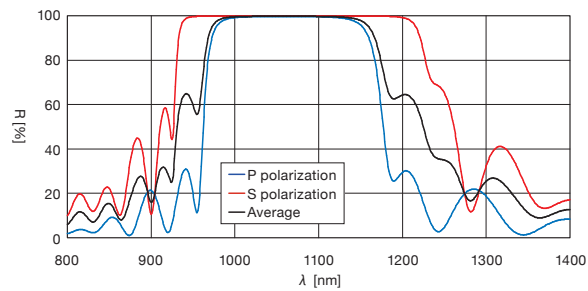
TFMHP-355



TFMHP-532



TFMHP-1064



Compatible Optic Mounts

MHG-HS25-NL, -HS30-NL / MHG-MP50-NL / MHAN-25.4S, -30S, -50S

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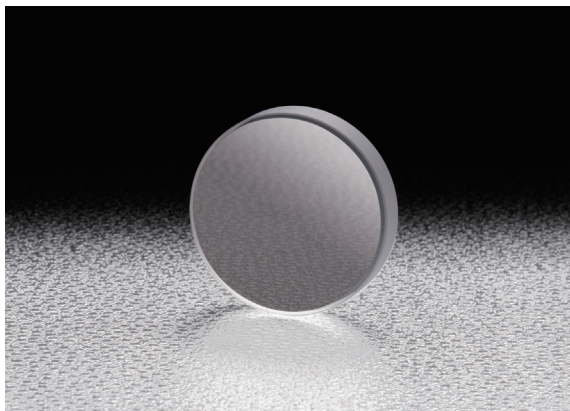
Dielectric Coating

Aluminum Coating

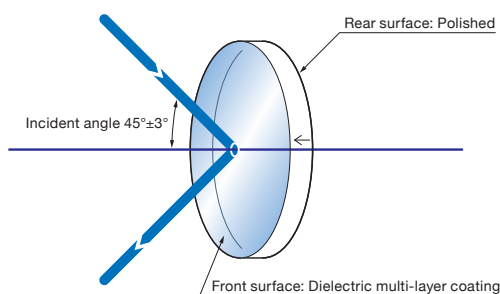
Gold Coating

Ultra Broadband Dielectric Mirrors are manufactured using all dielectric multi-layer coatings of alternating high and low index layers. These are specifically designed for use at 45 degrees angle of incidence. The mirrors are designed to achieve broad reflection like never before.

- Visible, near infrared and other multiple wavelengths are covered with a single mirror.
- These mirrors have many advantages over a metal mirror. With very little deterioration with age, it is durable and easy to clean and maintain.

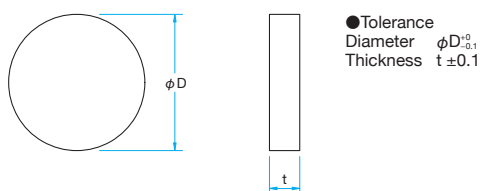


#### Schematic



#### Outline Drawing

(in mm)



#### Specifications

Material	BK7
Coating	Dielectric multi-layer coating
Incident angle	45°±3°
Surface Flatness	λ/10
Parallelism	<3'
Surface Quality (Scratch-Dig)	40-20
Clear aperture	90% of Actual Aperture
Rear Surface	Polished

#### Guide

- ▶ Please contact our International Sales Division for customized products. (customized on outer diameter, wavelength characteristic, etc.) Please use the inquiry sheet. [Reference](#) B041
- ▶ Also available are our surface flatness guarantee (HTFM) mirrors with accuracy guarantee after surface coating. [Reference](#) B016

#### Attention

- ▶ Reflectance of dielectric mirrors will vary according to the polarization of the input beams.
- ▶ The un-coated rear surface of the mirror is polished and is indicated with an arrow on the side of the substrate. Reflectance of laser line mirrors are different according to the polarization of input beams. S-Polarization has high reflectance with a wide reflective bandwidth compared with P-Polarization.
- ▶ The reflectance in the specification list is at random polarization or (P-Polarization reflectance + S-Polarization reflectance) / 2.

#### Specifications

Part Number	Wavelength Range [nm]	Diameter φD [mm]	Thickness t [mm]	Reflectance [%]	Laser Damage Threshold* [J/cm <sup>2</sup> ]
TFMS-25.4C05-2/4	245 - 400	φ25.4	5	> Average 97	0.5
TFMS-30C05-2/4	245 - 400	φ30	5	> Average 97	0.5
TFMS-25.4C05-2/7	245 - 700	φ25.4	5	> Average 97	0.5
TFMS-30C05-2/7	245 - 700	φ30	5	> Average 97	0.5
TFMS-25.4C05-4/11	400 - 1100	φ25.4	5	> Average 98	0.5
TFMS-30C05-4/11	400 - 1100	φ30	5	> Average 98	0.5
TFMS-50C08-4/11	400 - 1100	φ50	8	> Average 98	0.5
TFMS-25.4C05-4/20	400 - 2000	φ25.4	5	> Average 98	0.5
TFMS-30C05-4/20	400 - 2000	φ30	5	> Average 98	0.5
TFMS-50C08-4/20	400 - 2000	φ50	8	> Average 98	0.5
TFMS-25.4C05-3/20	300 - 2000	φ25.4	5	> Average 97	0.5
TFMS-30C05-3/20	300 - 2000	φ30	5	> Average 97	0.5
TFMS-50C08-3/20	300 - 2000	φ50	8	> Average 97	0.5

\* Laser pulse width 10ns, wavelength 532nm, repetition frequency 20Hz

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Gold Coating

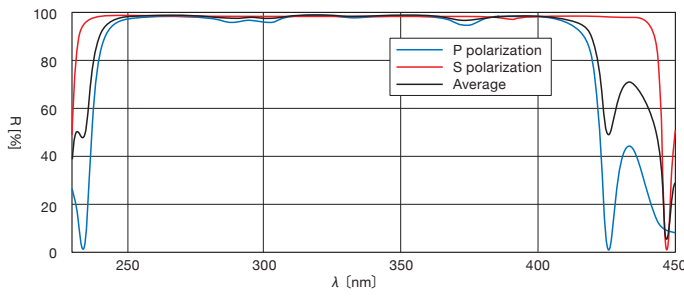




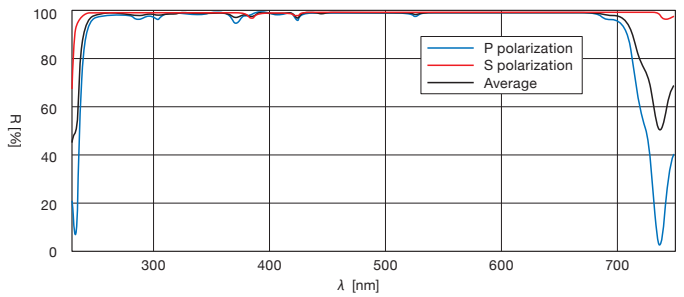
Typical Reflectance Data

R: Reflectance

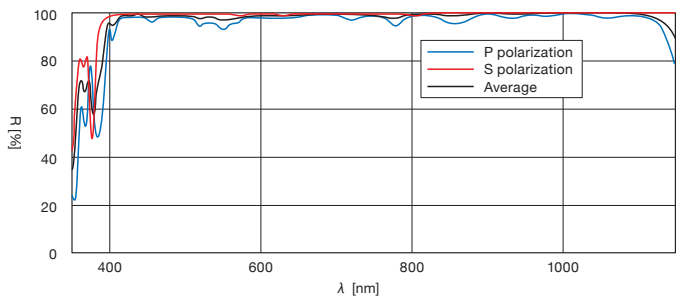
TFMS-2/4



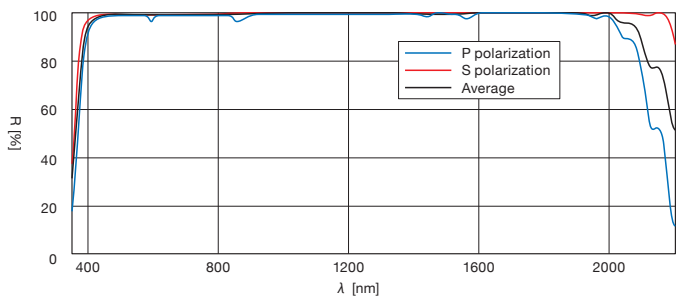
TFMS-2/7



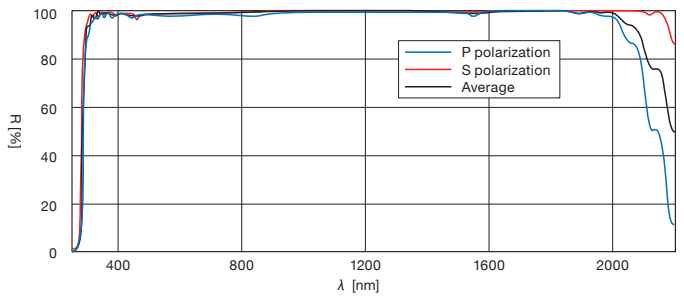
TFMS-4/11



TFMS-4/20



TFMS-3/20



Compatible Optic Mounts

MHG-HS25-NL, -HS30-NL / MHG-MP50-NL / MHAN-25.4S, -30S, -50S

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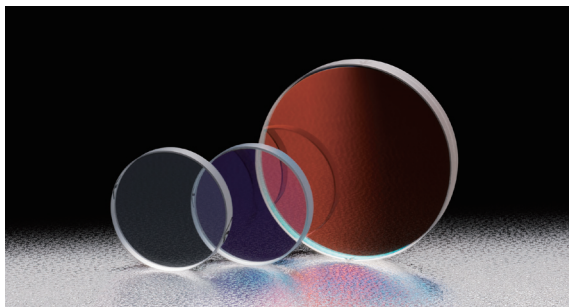
Laser Line Mirrors are total reflection mirrors, multi-layer-coated with dielectrics of different refractive index by turns on. Three types of laser line mirrors are offered.

[Narrowband] Laser line mirrors that are focused on specific wavelengths. Incident angle is 45°.

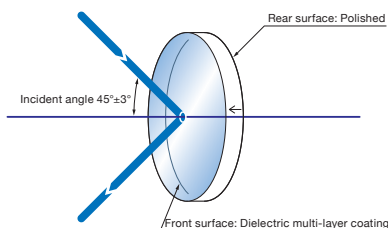
[Middleband] Multi line mirrors with middle reflection bands. Incident angle is 45°.

[Broadband] Multi line mirrors with broad reflection bands. Incident angle is 45°.

- Dielectric multi-layer coating does not have absorption like AL and the reflectance can be more than 99% except some mirrors for UV wavelength.
- These coatings are much stronger than Al+MgF<sub>2</sub> coating against high-power lasers.

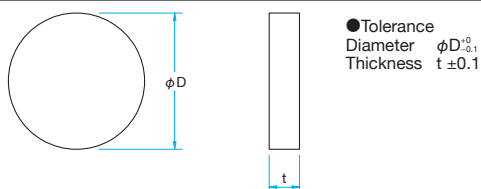


## Schematic



## Outline Drawing

(in mm)



## Specifications

Material	BK7 (CaF <sub>2</sub> crystal for TFM-157 only)
Coating	Dielectric multi-layer coating
Incident angle	45°±3°
Surface Flatness	λ/10, Polished (TFM-157)
Parallelism	<3'
Surface Quality (Scratch-Dig)	10-5 (TFM-157: 40-20)
Clear aperture	90% of Actual Aperture

## Guide

- ▶ Please contact our International Sales Division for customized products. (customized on outer diameter, wavelength characteristic, etc.) Please use the inquiry sheet. [Reference](#) B041
- ▶ Also available are our surface flatness guarantee (HTFM) mirrors with accuracy guarantee after surface coating. [Reference](#) B016

## Attention

- ▶ The un-coated rear surface of the mirror is polished and is indicated with an arrow on the side of the substrate.
- ▶ Reflectance of laser line mirrors are different according to the polarization of input beams. S-Polarization has high reflectance with a wide reflective bandwidth compared with P-Polarization. The reflectance in the specification list is at random polarization or (P-Polarization reflectance + S-Polarization reflectance) / 2.
- ▶ The reflectance curves are based on actual measurements and may be different with production lots.
- ▶ Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.
- ▶ The surface flatness is the reflected surface wavefront distortion before coating.

## Laser Line Mirrors Narrowband

157 – 337.1nm						
Part Number	Wavelength Range [nm]	Diameter φD [mm]	Thickness t [mm]	Reflectance [%]	Laser Damage Threshold* [J/cm <sup>2</sup> ]	Rear Surface
TFM-30C03-157	157	φ30	3	>95.0	0.5	Polished
TFM-50C05-157	157	φ50	5	>95.0	0.5	Polished
TFM-25.4C05-193	193	φ25.4	5	>95.0	1	Polished
TFM-30C05-193	193	φ30	5	>95.0	1	Polished
TFM-50C08-193	193	φ50	8	>95.0	1	Polished
TFM-25.4C05-248	248.4	φ25.4	5	>99.0	2	Polished
TFM-30C05-248	248.4	φ30	5	>99.0	2	Polished
TFM-50C08-248	248.4	φ50	8	>99.0	2	Polished
TFM-25.4C05-266	266	φ25.4	5	>99.2	2	Polished
TFM-30C05-266	266	φ30	5	>99.2	2	Polished
TFM-50C08-266	266	φ50	8	>99.2	2	Polished
TFM-25.4C05-282	281.8	φ25.4	5	>99.3	2	Polished
TFM-30C05-282	281.8	φ30	5	>99.3	2	Polished
TFM-50C08-282	281.8	φ50	8	>99.3	2	Polished
TFM-25.4C05-308	308	φ25.4	5	>99.5	3	Polished
TFM-30C05-308	308	φ30	5	>99.5	3	Polished
TFM-50C08-308	308	φ50	8	>99.5	3	Polished
TFM-25.4C05-325/337	325 – 337	φ25.4	5	>99.5	3	Polished
TFM-30C05-325/337	325 – 337	φ30	5	>99.5	3	Polished
TFM-50C08-325/337	325 – 337	φ50	8	>99.5	3	Polished

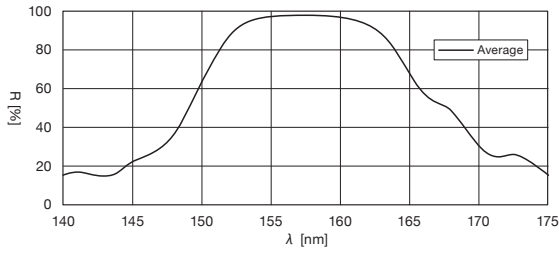
\* Laser pulse width 10ns (TFM-157: 20ns), repetition frequency 20Hz



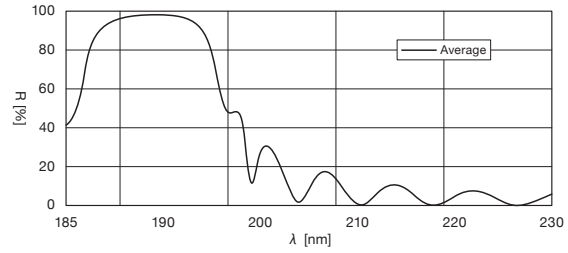
Typical Reflectance Data ... Laser Line Mirrors Narrowband

R: Reflectance

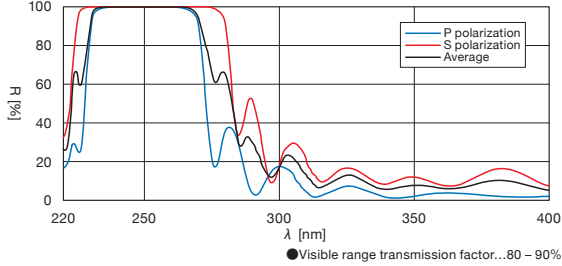
TFM-157



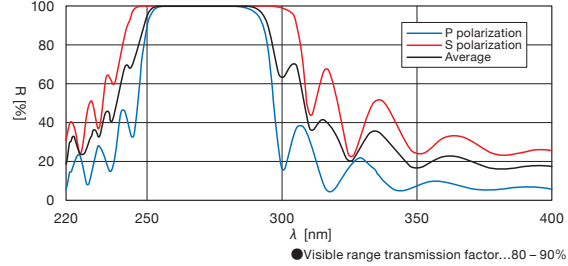
TFM-193



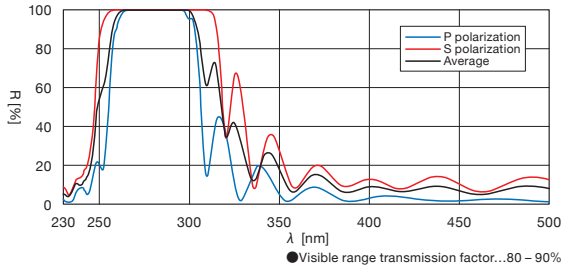
TFM-248



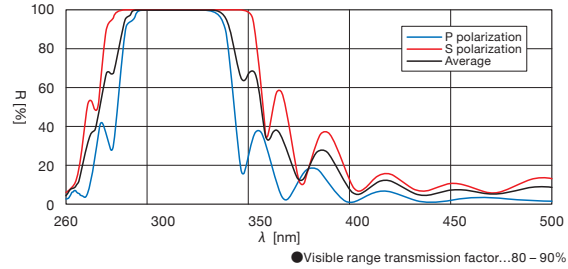
TFM-266



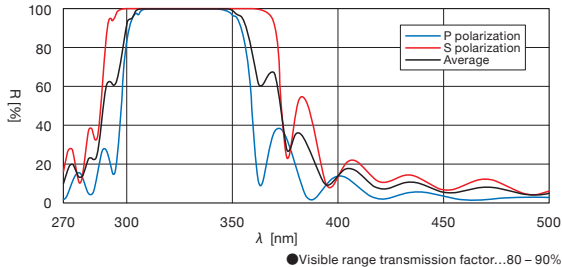
TFM-282



TFM-308



TFM-325/337



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Compatible Optic Mounts

MHG-MP12.7-NL / MHG-HS25-NL, -HS30-NL / MHG-MP50-NL, -MP50.8-NL



# Laser Line Mirrors | TFM

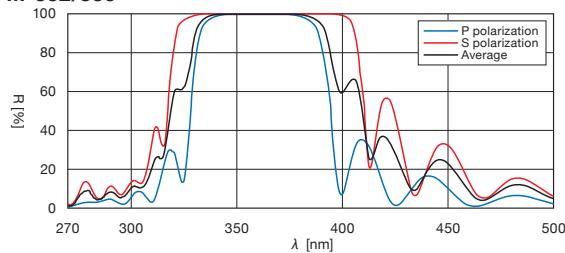
## Laser Line Mirrors Narrowband

352 – 1064nm						
Part Number	Wavelength Range [nm]	Diameter D [mm]	Thickness t [mm]	Reflectance [%]	Laser Damage Threshold* [J/cm <sup>2</sup> ]	Rear Surface
TFM-25.4C05-352/355	352 – 355	φ25.4	5	>99.5	5	Polished
TFM-30C05-352/355	352 – 355	φ30	5	>99.5	5	Polished
TFM-50C08-352/355	352 – 355	φ50	8	>99.5	5	Polished
TFM-12.7C05-532	532	φ12.7	5	>99.5	8	Ground
TFM-25C05-532	532	φ25	5	>99.5	8	Polished
TFM-25.4C05-532	532	φ25.4	5	>99.5	8	Polished
TFM-30C05-532	532	φ30	5	>99.5	8	Polished
TFM-40C06-532	532	φ40	6	>99.5	8	Polished
TFM-50C08-532	532	φ50	8	>99.5	8	Polished
TFM-50.8C08-532	532	φ50.8	8	>99.5	8	Polished
TFM-12.7C05-1064	1064	φ12.7	5	>99.5	20	Ground
TFM-25.4C05-1064	1064	φ25.4	5	>99.5	20	Polished
TFM-30C05-1064	1064	φ30	5	>99.5	20	Polished
TFM-40C06-1064	1064	φ40	6	>99.5	20	Polished
TFM-50C08-1064	1064	φ50	8	>99.5	20	Polished
TFM-50.8C08-1064	1064	φ50.8	8	>99.5	20	Polished

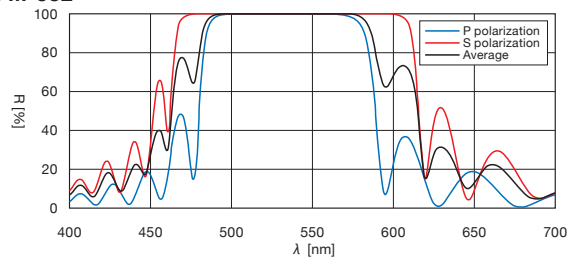
\* Laser pulse width 10ns, repetition frequency 20Hz

Typical Reflectance Data ... Laser Line Mirrors Narrowband R: Reflectance

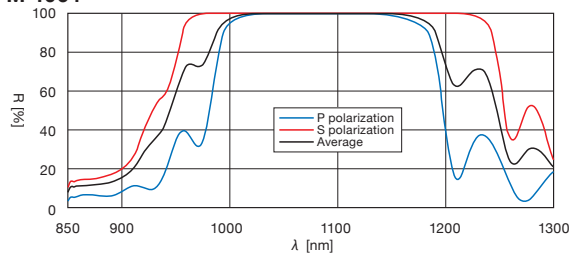
TFM-352/355



TFM-532



TFM-1064



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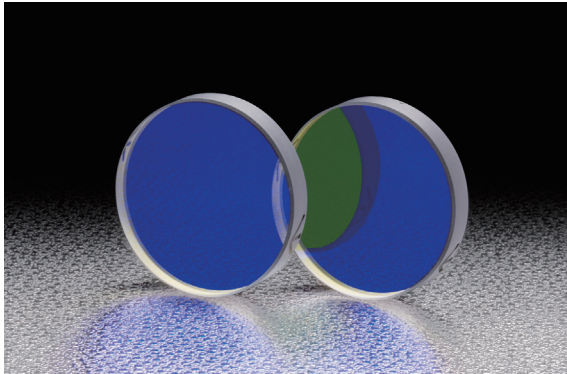
Dielectric Coating

Aluminum Coating

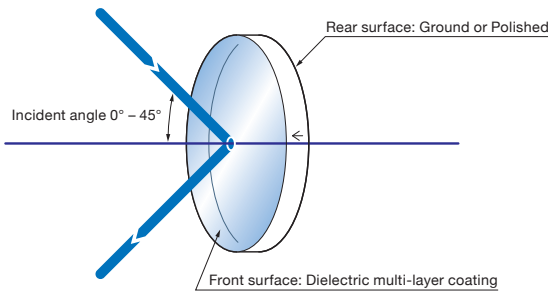
Gold Coating

You can use the 0-45° Wide Incidence Dielectric Mirrors for an optical system for reciprocating the light between two mirrors or Michelson interferometer, if you want to use a mirror at an incident angle of 45° or less. When used at 45 degree and 0 degree incidence angle, one mirror can be shared to obtain high reflectivity.

- Very high reflectivity can be obtained between from 0 degree to 45 degree angle of incidence.
- If used at a fixed angle of incidence, it can also be used as a broadband mirror. For example, if TFVM-800 is used in a 45 degree incident, reflectance of 99% or more can be obtained in the range of 730nm to 900nm.
- Since there is no absorption in the coating, little change over time, it can be durable for the continuous laser irradiation.

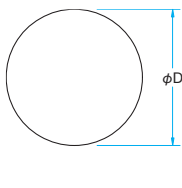


### Schematic



### Outline Drawing

(in mm)



- Tolerance  
Diameter  $\phi D_{\pm 0.1}$   
Thickness  $t \pm 0.1$

### Specifications

Material	BK7
Coating	Dielectric multi-layer coating
Incident angle	0° – 45°
Surface Flatness	$\lambda/10$
Parallelism	<3'
Surface Quality (Scratch-Dig)	10-5
Clear aperture	90% of Actual Aperture

### Guide

- ▶ It is also available for other than the products which listed in the catalog such as size and wavelength characteristic. Please use the contact sheet. [Reference](#) B041
- ▶ It is also available for "HTFM mirror" which the surface accuracy is guaranteed after coating [Reference](#) B016

### Attention

- ▶ Reflectance wavelength characteristics of dielectric multilayer coating vary depending on the polarization state of the incident beam. Reflectance of P-polarized light is lower than that of the S-polarized light, and the reflection range will also be narrower.
- ▶ When used not in adaptive wavelength, reflectance may be lower.
- ▶ If a mirror is used other than normal incidence, wavelength reflectance characteristics also vary depending on the polarization condition.
- ▶ The reflectance characteristics of the 45 degree angle of incidence, it is represented by the average value of the reflectance of P-polarized light and S-polarized light.

### 400 – 700nm

Part Number	Wavelength Range [nm]	Diameter $\phi D$ [mm]	Thickness t [mm]	Reflectance [%]	Laser Damage Threshold* [J/cm <sup>2</sup> ]	Rear Surface
TFVM-15C03-405	405	$\phi 15$	3	>99	0.5	Ground
TFVM-25.4C05-405	405	$\phi 25.4$	5	>99	0.5	Polished
TFVM-30C05-405	405	$\phi 30$	5	>99	0.5	Polished
TFVM-50C08-405	405	$\phi 50$	8	>99	0.5	Polished
TFVM-25.4C05-532	532	$\phi 25.4$	5	>99	8	Polished
TFVM-30C05-532	532	$\phi 30$	5	>99	8	Polished
TFVM-50C08-532	532	$\phi 50$	8	>99	8	Polished
TFVM-10C03-VIS	400 – 700	$\phi 10$	3	>99	0.5	Ground
TFVM-15C03-VIS	400 – 700	$\phi 15$	3	>99	0.5	Ground
TFVM-15C05-VIS	400 – 700	$\phi 15$	5	>99	0.5	Ground
TFVM-20C03-VIS	400 – 700	$\phi 20$	3	>99	0.5	Ground
TFVM-20C05-VIS	400 – 700	$\phi 20$	5	>99	0.5	Ground
TFVM-25C05-VIS	400 – 700	$\phi 25$	5	>99	0.5	Polished
TFVM-25.4C05-VIS	400 – 700	$\phi 25.4$	5	>99	0.5	Polished
TFVM-30C05-VIS	400 – 700	$\phi 30$	5	>99	0.5	Polished
TFVM-40C06-VIS	400 – 700	$\phi 40$	6	>99	0.5	Polished
TFVM-50C08-VIS	400 – 700	$\phi 50$	8	>99	0.5	Polished

\* Laser pulse width 10ns, repetition frequency 20Hz

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Gold Coating

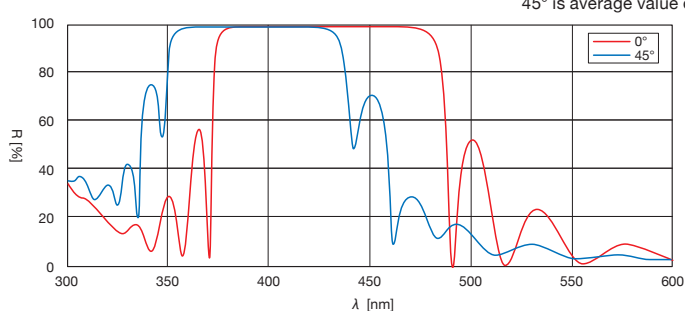
# 0-45° Wide Incidence Dielectric Mirrors | TFVM

780 – 1550nm						
Part Number	Wavelength Range [nm]	Diameter $\phi D$ [mm]	Thickness $t$ [mm]	Reflectance [%]	Laser Damage Threshold* [J/cm <sup>2</sup> ]	Rear Surface
TFVM-10C03-800	780 – 830	$\phi 10$	3	>99	0.5	Ground
TFVM-15C03-800	780 – 830	$\phi 15$	3	>99	0.5	Ground
TFVM-15C05-800	780 – 830	$\phi 15$	5	>99	0.5	Ground
TFVM-20C03-800	780 – 830	$\phi 20$	3	>99	0.5	Ground
TFVM-20C05-800	780 – 830	$\phi 20$	5	>99	0.5	Ground
TFVM-25C05-800	780 – 830	$\phi 25$	5	>99	0.5	Polished
TFVM-25.4C05-800	780 – 830	$\phi 25.4$	5	>99	0.5	Polished
TFVM-30C05-800	780 – 830	$\phi 30$	5	>99	0.5	Polished
TFVM-40C06-800	780 – 830	$\phi 40$	6	>99	0.5	Polished
TFVM-50C08-800	780 – 830	$\phi 50$	8	>99	0.5	Polished
TFVM-25.4C05-1064	1064	$\phi 25.4$	5	>99	20	Polished
TFVM-30C05-1064	1064	$\phi 30$	5	>99	20	Polished
TFVM-50C08-1064	1064	$\phi 50$	8	>99	20	Polished
TFVM-15C03-1300	1300	$\phi 15$	3	>99	1	Ground
TFVM-25.4C05-1300	1300	$\phi 25.4$	5	>99	1	Polished
TFVM-30C05-1300	1300	$\phi 30$	5	>99	1	Polished
TFVM-15C03-1550	1550	$\phi 15$	3	>99	1	Ground
TFVM-25.4C05-1550	1550	$\phi 25.4$	5	>99	1	Polished
TFVM-30C05-1550	1550	$\phi 30$	5	>99	1	Polished

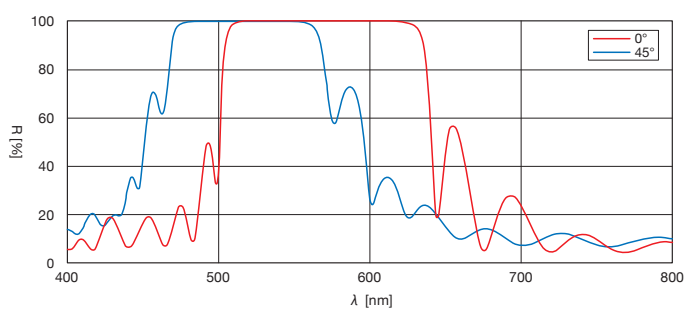
\* Laser pulse width 10ns, repetition frequency 20Hz

Typical Reflectance Data R: Reflectance

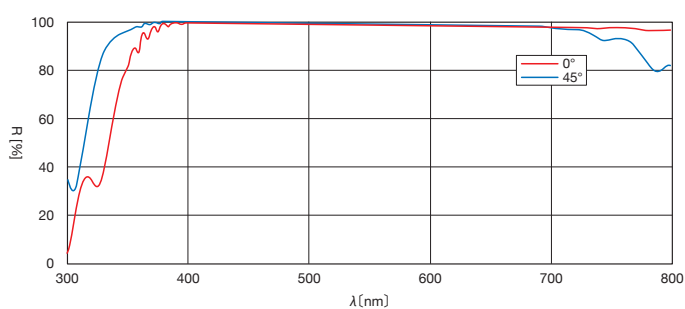
TFVM-405



TFVM-532



TFVM-VIS



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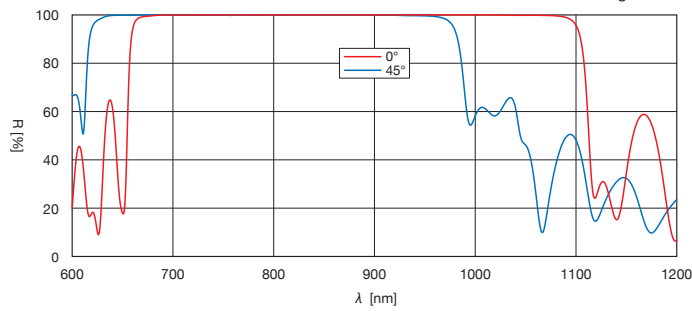


**Typical Reflectance Data**

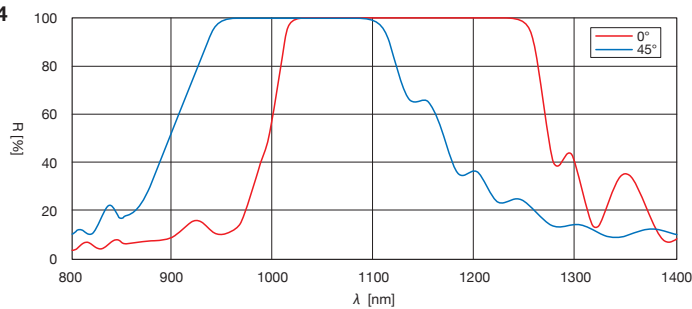
R: Reflectance

45° is average value of P polarization and S polarization

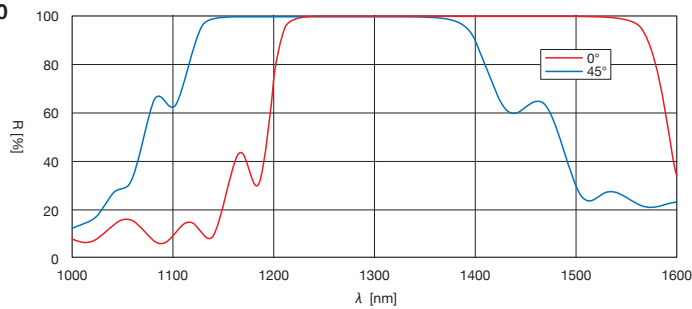
**TFVM-800**



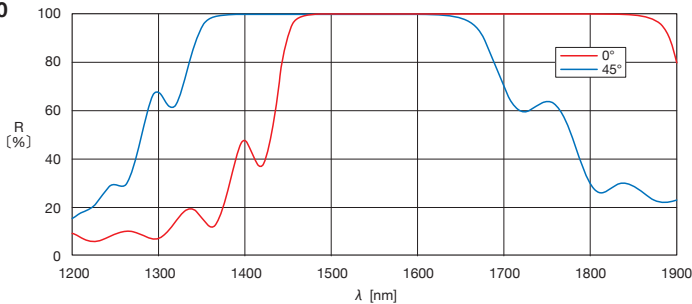
**TFVM-1064**



**TFVM-1300**



**TFVM-1550**



**Compatible Optic Mounts**

MHG-MP30-NL / MHG-MP50-NL / BSHL-15-2

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**Dielectric Coating**

Aluminum Coating

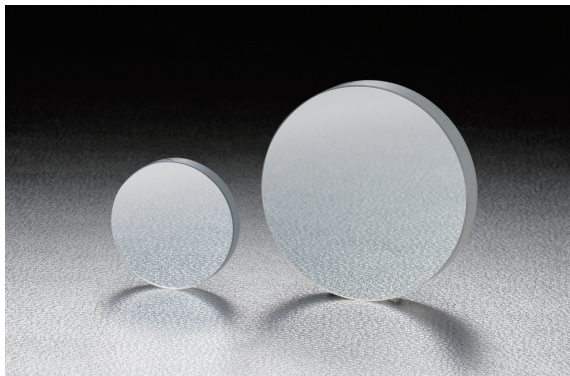
Gold Coating

# Aluminum Mirrors | TFA/TFAN/TFAQ/TFAQN/TFAE/OPBA/OPSQA

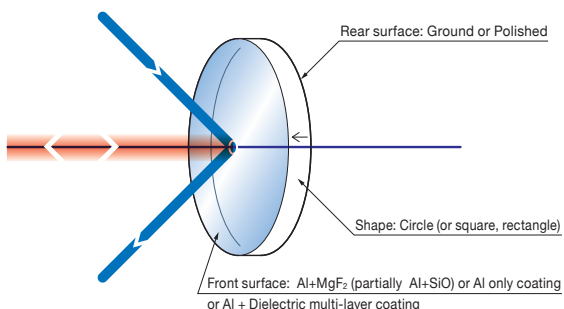
RoHS

This is a vapour-deposited aluminium mirror plane and the substrate is polished with high accuracy. Designed for high reflectivity at any incident angle.

- With four types to choose from; (TFAN/TFAQN) which is coated with only aluminium, (TFA/TFAQ) which is coated with a protective coating against accidental hard scratches, (TFAE) which is coated with a protective coating and aluminium to increase the reflectance of ultraviolet and lastly, (OPBA/OPSQA) which provides a protective coat on the optical parallel substrate.
- For ultraviolet, visible and near-infrared light applications.
- For low thermal expansion mirrors, we have (TFAQ/TFAQN) which is made of Synthetic fused silica that provides high rigidity and high precision surface quality.



### Schematic



### Specifications

Material	BK7 Synthetic fused silica Hard glass (Pyrex <sup>®</sup> etc.)
Coating	TFAN/TFAQN: Al (without protection coating) TFA/TFAQ/OPBA/OPSQA: Al+MgF <sub>2</sub> (surface flatness λ/20 is Al+SiO <sub>2</sub> ) TFAE: Al + Dielectric multi-layer coating
parallelism	TFA/TFAN/TFAQ/TFAQN/TFAE: <3' OPBA/OPSQA: <2"
Incident angle	TFA/TFAQ/TFAE: 45° OPBA/OPSQA: 0°
Laser Damage Threshold	0.25J/cm <sup>2</sup> (pulse width 10ns, repetition frequency 20Hz)
Surface Quality (Scratch-Dig)	40-20
Clear aperture	90% of actual aperture or circle or ellipse that contacts 90% square of dimension

### Guide

- ▶ If you need a much higher reflectance aluminium mirror, please kindly contact us.
- ▶ Should you require a surface accuracy analysis/data, please kindly contact our sales group.
- ▶ For non-standard sizes other than those found in our catalogue, please kindly contact us.
- ▶ Pyrex<sup>®</sup> is a registered trademark of Corning Inc.

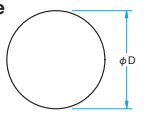
### Attention

- ▶ For aluminium mirrors without a protective film, (TFAN/TFAQN) can be easily scratched and oxidation builds up in the membrane. Do not rub the surface with paper or cloth. For long term storage, use any de-oxidizer to prevent the oxidation.
- ▶ When a laser is transmitted with multiple mirrors installed, there will be a large amount of light loss and this is due to the absorption of the aluminium coating. Please switch to dielectric multi-layer mirrors (TFM) for improved performance.
- ▶ Reflectance of the specification are represented by the average of the reflectance of P polarized light and S polarized light. Reflectance may vary depending on the polarization state of the incident beam.

### Outline Drawing

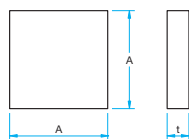
(in mm)

#### ●Circle



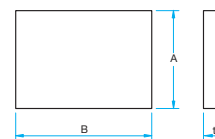
- Tolerance
- φD ≤ φ50 Diameter φD<sup>+0.1</sup>  
Thickness t ± 0.1
- φ60 ≤ φD Diameter φD<sup>+0.2</sup>  
Thickness t ± 0.2

#### ●Square



- Tolerance
- A ≤ 50 Length A<sup>+0.1</sup>  
Thickness t ± 0.1
- 60 ≤ A Length A<sup>+0.2</sup>  
Thickness t ± 0.2

#### ●Rectangle

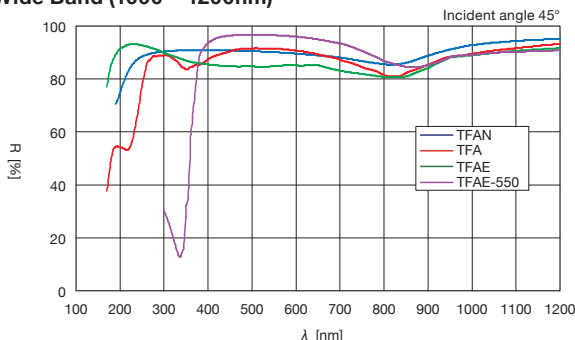


- Tolerance
- A × B ≤ 40 × 50 Length A · B<sup>+0.1</sup>  
Thickness t ± 0.1
- 50 × 60 ≤ A × B Length A · B<sup>+0.2</sup>  
Thickness t ± 0.2

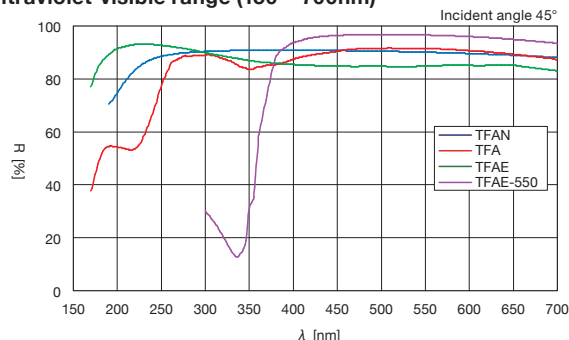
### Typical Reflectance Data

R: Reflectance

#### Wide Band (1000 – 1200nm)



#### Ultraviolet-visible range (150 – 700nm)





Circle		Diameter $\phi$ D [mm]	Thickness t [mm]	Material	Surface Flatness	Rear Surface
Al+MgF <sub>2</sub> (partially Al+SiO)	Al only					
Part Number	Part Number					
TFA-10C03-4	—	$\phi$ 10	3	BK7	$\lambda/4$	Ground
TFA-10C03-10	TFAN-10C03-10	$\phi$ 10	3	BK7	$\lambda/10$	Ground
TFA-10C05-10	TFAN-10C05-10	$\phi$ 10	5	BK7	$\lambda/10$	Ground
TFA-10C05-20	TFAN-10C05-20	$\phi$ 10	5	BK7	$\lambda/20$	Ground
TFAQ-10C06-20	TFAQN-10C06-20	$\phi$ 10	6	Synthetic Fused Silica	$\lambda/20$	Ground
TFA-12.7C05-4	—	$\phi$ 12.7	5	BK7	$\lambda/4$	Ground
TFA-12.7C05-10	—	$\phi$ 12.7	5	BK7	$\lambda/10$	Ground
TFAQ-12.7C06-20	—	$\phi$ 12.7	6	Synthetic Fused Silica	$\lambda/20$	Ground
TFA-15C03-10	TFAN-15C03-10	$\phi$ 15	3	BK7	$\lambda/10$	Ground
TFA-15C05-10	TFAN-15C05-10	$\phi$ 15	5	BK7	$\lambda/10$	Ground
TFA-15C05-20	TFAN-15C05-20	$\phi$ 15	5	BK7	$\lambda/20$	Ground
TFAQ-15C06-20	TFAQN-15C06-20	$\phi$ 15	6	Synthetic Fused Silica	$\lambda/20$	Ground
TFA-20C03-10	TFAN-20C03-10	$\phi$ 20	3	BK7	$\lambda/10$	Ground
TFA-20C05-4	TFAN-20C05-4	$\phi$ 20	5	BK7	$\lambda/4$	Ground
TFA-20C05-10	TFAN-20C05-10	$\phi$ 20	5	BK7	$\lambda/10$	Ground
TFA-20C05-20	TFAN-20C05-20	$\phi$ 20	5	BK7	$\lambda/20$	Ground
TFAQ-20C06-20	TFAQN-20C06-20	$\phi$ 20	6	Synthetic Fused Silica	$\lambda/20$	Ground
TFA-25C05-1	TFAN-25C05-1	$\phi$ 25	5	BK7	$\lambda$	Polished
TFA-25C05-4	TFAN-25C05-4	$\phi$ 25	5	BK7	$\lambda/4$	Polished
TFA-25C05-10	TFAN-25C05-10	$\phi$ 25	5	BK7	$\lambda/10$	Polished
TFA-25C05-20	TFAN-25C05-20	$\phi$ 25	5	BK7	$\lambda/20$	Polished
TFAQ-25C06-20	TFAQN-25C06-20	$\phi$ 25	6	Synthetic Fused Silica	$\lambda/20$	Polished
TFA-25.4C05-4	—	$\phi$ 25.4	5	BK7	$\lambda/4$	Polished
TFA-25.4C05-10	TFAN-25.4C05-10	$\phi$ 25.4	5	BK7	$\lambda/10$	Polished
TFAQ-25.4C06-20	—	$\phi$ 25.4	6	Synthetic Fused Silica	$\lambda/20$	Polished
TFA-30C05-1	TFAN-30C05-1	$\phi$ 30	5	BK7	$\lambda$	Polished
TFA-30C05-4	TFAN-30C05-4	$\phi$ 30	5	BK7	$\lambda/4$	Polished
TFA-30C05-10	TFAN-30C05-10	$\phi$ 30	5	BK7	$\lambda/10$	Polished
TFA-30C05-20	TFAN-30C05-20	$\phi$ 30	5	BK7	$\lambda/20$	Polished
TFAQ-30C06-20	TFAQN-30C06-20	$\phi$ 30	6	Synthetic Fused Silica	$\lambda/20$	Polished
TFA-40C06-1	TFAN-40C06-1	$\phi$ 40	6	BK7	$\lambda$	Polished
TFA-40C06-4	TFAN-40C06-4	$\phi$ 40	6	BK7	$\lambda/4$	Polished
TFA-40C06-10	TFAN-40C06-10	$\phi$ 40	6	BK7	$\lambda/10$	Polished
TFA-40C06-20	TFAN-40C06-20	$\phi$ 40	6	BK7	$\lambda/20$	Polished
TFAQ-40C08-20	TFAQN-40C08-20	$\phi$ 40	8	Synthetic Fused Silica	$\lambda/20$	Polished
TFA-50C08-1	TFAN-50C08-1	$\phi$ 50	8	BK7	$\lambda$	Polished
TFA-50C08-4	TFAN-50C08-4	$\phi$ 50	8	BK7	$\lambda/4$	Polished
TFA-50C08-10	TFAN-50C08-10	$\phi$ 50	8	BK7	$\lambda/10$	Polished
TFA-50C08-20	TFAN-50C08-20	$\phi$ 50	8	BK7	$\lambda/20$	Polished
TFAQ-50C10-20	TFAQN-50C10-20	$\phi$ 50	10	Synthetic Fused Silica	$\lambda/20$	Polished
TFA-50.8C08-10	—	$\phi$ 50.8	8	BK7	$\lambda/10$	Polished
TFA-60C10-1	TFAN-60C10-1	$\phi$ 60	10	Hard glass	$\lambda$	Polished
TFA-60C10-4	TFAN-60C10-4	$\phi$ 60	10	Hard glass	$\lambda/4$	Polished
TFA-60C10-10	TFAN-60C10-10	$\phi$ 60	10	Hard glass	$\lambda/10$	Polished
TFA-60C10-20	TFAN-60C10-20	$\phi$ 60	10	Hard glass	$\lambda/20$	Polished
TFA-80C12-1	TFAN-80C12-1	$\phi$ 80	12	Hard glass	$\lambda$	Polished
TFA-80C12-4	TFAN-80C12-4	$\phi$ 80	12	Hard glass	$\lambda/4$	Polished
TFA-80C12-10	TFAN-80C12-10	$\phi$ 80	12	Hard glass	$\lambda/10$	Polished
TFA-80C12-20	TFAN-80C12-20	$\phi$ 80	12	Hard glass	$\lambda/20$	Polished
TFA-100C15-1	TFAN-100C15-1	$\phi$ 100	15	Hard glass	$\lambda$	Polished
TFA-100C15-4	TFAN-100C15-4	$\phi$ 100	15	Hard glass	$\lambda/4$	Polished
TFA-100C15-10	TFAN-100C15-10	$\phi$ 100	15	Hard glass	$\lambda/10$	Polished
TFA-130C18-1	TFAN-130C18-1	$\phi$ 130	18	Hard glass	$\lambda$	Polished
TFA-130C18-4	TFAN-130C18-4	$\phi$ 130	18	Hard glass	$\lambda/4$	Polished
TFA-130C18-10	TFAN-130C18-10	$\phi$ 130	18	Hard glass	$\lambda/10$	Polished
TFA-150C20-1	TFAN-150C20-1	$\phi$ 150	20	Hard glass	$\lambda$	Polished
TFA-150C20-4	TFAN-150C20-4	$\phi$ 150	20	Hard glass	$\lambda/4$	Polished
TFA-150C20-10	TFAN-150C20-10	$\phi$ 150	20	Hard glass	$\lambda/10$	Polished

**Compatible Optic Mounts**

MHG-MP12.7-NL / MHG-HS25-NL, -HS30-NL / MHG-MP50-NL, -MP50.8-NL / MAD-30-10 + MHB-30M / BSHL-15-2 / MHF-20  
 MHAN-40S, -60S / MHA-80S, -100S, -130S, -150S

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- Gold Coating

Catalog Code W3405

## UV Enhanced Aluminum Flat Mirrors

Part Number	Wavelength Range [nm]	Reflectance [%]	Diameter $\phi$ D [mm]	Thickness t [mm]	Material	Surface Flatness	Rear Surface
TFAE-12.7C05-10	170 – 400	> average 85	$\phi$ 12.7	5	BK7	$\lambda/10$	Ground
TFAE-25.4C05-10	170 – 400	> average 85	$\phi$ 25.4	5	BK7	$\lambda/10$	Polished
TFAE-30C05-10	170 – 400	> average 85	$\phi$ 30	5	BK7	$\lambda/10$	Polished
TFAE-50C08-10	170 – 400	> average 85	$\phi$ 50	8	BK7	$\lambda/10$	Polished
TFAE-12.7C05-10-550	400 – 700	> average 85	$\phi$ 12.7	5	BK7	$\lambda/10$	Polished
TFAE-25.4C05-10-550	400 – 700	> average 85	$\phi$ 25.4	5	BK7	$\lambda/10$	Polished
TFAE-30C05-10-550	400 – 700	> average 85	$\phi$ 30	5	BK7	$\lambda/10$	Polished

Catalog Code W3403

## Square

Al+MgF <sub>2</sub> (partially Al+SiO) Part Number	Al only Part Number	Length A [mm]	Thickness t [mm]	Material	Surface Flatness	Rear Surface
TFA-10S03-10	TFAN-10S03-10	$\square$ 10	3	BK7	$\lambda/10$	Ground
TFA-10S05-10	TFAN-10S05-10	$\square$ 10	5	BK7	$\lambda/10$	Ground
TFA-10S05-20	TFAN-10S05-20	$\square$ 10	5	BK7	$\lambda/20$	Ground
TFQA-10S06-20	TFANQ-10S06-20	$\square$ 10	6	Synthetic fused silica	$\lambda/20$	Ground
TFA-12.7S03-4	—	$\square$ 12.7	3	BK7	$\lambda/4$	Ground
TFA-12.7S03-10	—	$\square$ 12.7	3	BK7	$\lambda/10$	Ground
TFA-15S03-4	TFAN-15S03-4	$\square$ 15	3	BK7	$\lambda/4$	Ground
TFA-15S03-10	TFAN-15S03-10	$\square$ 15	3	BK7	$\lambda/10$	Ground
TFA-15S05-4	TFAN-15S05-4	$\square$ 15	5	BK7	$\lambda/4$	Ground
TFA-15S05-10	TFAN-15S05-10	$\square$ 15	5	BK7	$\lambda/10$	Ground
TFA-15S05-20	TFAN-15S05-20	$\square$ 15	5	BK7	$\lambda/20$	Ground
TFQA-15S06-20	TFANQ-15S06-20	$\square$ 15	6	Synthetic fused silica	$\lambda/20$	Ground
TFA-20S03-4	TFAN-20S03-4	$\square$ 20	3	BK7	$\lambda/4$	Ground
TFA-20S03-10	TFAN-20S03-10	$\square$ 20	3	BK7	$\lambda/10$	Ground
TFA-20S05-4	TFAN-20S05-4	$\square$ 20	5	BK7	$\lambda/4$	Ground
TFA-20S05-10	TFAN-20S05-10	$\square$ 20	5	BK7	$\lambda/10$	Ground
TFA-20S05-20	TFAN-20S05-20	$\square$ 20	5	BK7	$\lambda/20$	Ground
TFQA-20S06-20	TFANQ-20S06-20	$\square$ 20	6	Synthetic fused silica	$\lambda/20$	Ground
TFA-25S05-1	TFAN-25S05-1	$\square$ 25	5	BK7	$\lambda$	Ground
TFA-25S05-4	TFAN-25S05-4	$\square$ 25	5	BK7	$\lambda/4$	Ground
TFA-25S05-10	TFAN-25S05-10	$\square$ 25	5	BK7	$\lambda/10$	Ground
TFA-25S05-20	TFAN-25S05-20	$\square$ 25	5	BK7	$\lambda/20$	Ground
TFQA-25S06-20	TFANQ-25S06-20	$\square$ 25	6	Synthetic fused silica	$\lambda/20$	Ground
TFA-30S05-1	TFAN-30S05-1	$\square$ 30	5	BK7	$\lambda$	Ground
TFA-30S05-4	TFAN-30S05-4	$\square$ 30	5	BK7	$\lambda/4$	Ground
TFA-30S05-10	TFAN-30S05-10	$\square$ 30	5	BK7	$\lambda/10$	Ground
TFA-30S05-20	TFAN-30S05-20	$\square$ 30	5	BK7	$\lambda/20$	Ground
TFQA-30S06-20	TFANQ-30S06-20	$\square$ 30	6	Synthetic fused silica	$\lambda/20$	Ground
TFA-40S06-1	TFAN-40S06-1	$\square$ 40	6	Hard glass	$\lambda$	Polished
TFA-40S06-4	TFAN-40S06-4	$\square$ 40	6	Hard glass	$\lambda/4$	Polished
TFA-40S06-10	TFAN-40S06-10	$\square$ 40	6	Hard glass	$\lambda/10$	Polished
TFA-40S06-20	TFAN-40S06-20	$\square$ 40	6	Hard glass	$\lambda/20$	Polished
TFA-50S08-1	TFAN-50S08-1	$\square$ 50	8	Hard glass	$\lambda$	Polished
TFA-50S08-4	TFAN-50S08-4	$\square$ 50	8	Hard glass	$\lambda/4$	Polished
TFA-50S08-10	TFAN-50S08-10	$\square$ 50	8	Hard glass	$\lambda/10$	Polished
TFA-50S08-20	TFAN-50S08-20	$\square$ 50	8	Hard glass	$\lambda/20$	Polished
TFA-60S10-1	TFAN-60S10-1	$\square$ 60	10	Hard glass	$\lambda$	Polished
TFA-60S10-4	TFAN-60S10-4	$\square$ 60	10	Hard glass	$\lambda/4$	Polished
TFA-60S10-10	TFAN-60S10-10	$\square$ 60	10	Hard glass	$\lambda/10$	Polished
TFA-60S10-20	TFAN-60S10-20	$\square$ 60	10	Hard glass	$\lambda/20$	Polished
TFA-80S12-1	TFAN-80S12-1	$\square$ 80	12	Hard glass	$\lambda$	Polished
TFA-80S12-4	TFAN-80S12-4	$\square$ 80	12	Hard glass	$\lambda/4$	Polished
TFA-80S12-10	TFAN-80S12-10	$\square$ 80	12	Hard glass	$\lambda/10$	Polished
TFA-80S12-20	TFAN-80S12-20	$\square$ 80	12	Hard glass	$\lambda/20$	Polished
TFA-100S15-1	TFAN-100S15-1	$\square$ 100	15	Hard glass	$\lambda$	Polished
TFA-100S15-4	TFAN-100S15-4	$\square$ 100	15	Hard glass	$\lambda/4$	Polished
TFA-100S15-10	TFAN-100S15-10	$\square$ 100	15	Hard glass	$\lambda/10$	Polished
TFA-130S18-1	TFAN-130S18-1	$\square$ 130	18	Hard glass	$\lambda$	Polished
TFA-130S18-4	TFAN-130S18-4	$\square$ 130	18	Hard glass	$\lambda/4$	Polished
TFA-130S18-10	TFAN-130S18-10	$\square$ 130	18	Hard glass	$\lambda/10$	Polished
TFA-150S20-1	TFAN-150S20-1	$\square$ 150	20	Hard glass	$\lambda$	Polished
TFA-150S20-4	TFAN-150S20-4	$\square$ 150	20	Hard glass	$\lambda/4$	Polished
TFA-150S20-10	TFAN-150S20-10	$\square$ 150	20	Hard glass	$\lambda/10$	Polished

## Compatible Optic Mounts

CHA-25, -60, -130 / LHA-150



Rectangle						
Al+MgF <sub>2</sub> (partially Al+SiO) Part Number	Al only Part Number	Length AxB [mm]	Thickness t [mm]	Material	Surface Flatness	Rear Surface
TFA-1015R03-4	TFAN-1015R03-4	10×15	3	BK7	λ/4	Ground
TFA-1015R03-10	TFAN-1015R03-10	10×15	3	BK7	λ/10	Ground
TFA-1015R05-4	TFAN-1015R05-4	10×15	5	BK7	λ/4	Ground
TFA-1015R05-10	TFAN-1015R05-10	10×15	5	BK7	λ/10	Ground
TFA-1015R05-20	TFAN-1015R05-20	10×15	5	BK7	λ/20	Ground
TFAQ-1015R06-20	TFAQN-1015R06-20	10×15	6	Synthetic fused silica	λ/20	Ground
TFA-1525R03-4	TFAN-1525R03-4	15×25	3	BK7	λ/4	Ground
TFA-1525R03-10	TFAN-1525R03-10	15×25	3	BK7	λ/10	Ground
TFA-1525R05-4	TFAN-1525R05-4	15×25	5	BK7	λ/4	Ground
TFA-1525R05-10	TFAN-1525R05-10	15×25	5	BK7	λ/10	Ground
TFA-1525R05-20	TFAN-1525R05-20	15×25	5	BK7	λ/20	Ground
TFAQ-1525R06-20	TFAQN-1525R06-20	15×25	6	Synthetic fused silica	λ/20	Ground
TFA-2030R05-1	TFAN-2030R05-1	20×30	5	BK7	λ	Ground
TFA-2030R05-4	TFAN-2030R05-4	20×30	5	BK7	λ/4	Ground
TFA-2030R05-10	TFAN-2030R05-10	20×30	5	BK7	λ/10	Ground
TFA-2030R05-20	TFAN-2030R05-20	20×30	5	BK7	λ/20	Ground
TFAQ-2030R06-20	TFAQN-2030R06-20	20×30	6	Synthetic fused silica	λ/20	Ground
TFA-2535R05-1	TFAN-2535R05-1	25×35	5	BK7	λ	Ground
TFA-2535R05-4	TFAN-2535R05-4	25×35	5	BK7	λ/4	Ground
TFA-2535R05-10	TFAN-2535R05-10	25×35	5	BK7	λ/10	Ground
TFA-2535R05-20	TFAN-2535R05-20	25×35	5	BK7	λ/20	Ground
TFAQ-2535R06-20	TFAQN-2535R06-20	25×35	6	Synthetic fused silica	λ/20	Ground
TFA-3040R06-1	TFAN-3040R06-1	30×40	6	Hard glass	λ	Polished
TFA-3040R06-4	TFAN-3040R06-4	30×40	6	Hard glass	λ/4	Polished
TFA-3040R06-10	TFAN-3040R06-10	30×40	6	Hard glass	λ/10	Polished
TFA-3040R06-20	TFAN-3040R06-20	30×40	6	Hard glass	λ/20	Polished
TFAQ-3040R08-20	TFAQN-3040R08-20	30×40	8	Hard glass	λ/20	Polished
TFA-4050R08-1	TFAN-4050R08-1	40×50	8	Hard glass	λ	Polished
TFA-4050R08-4	TFAN-4050R08-4	40×50	8	Hard glass	λ/4	Polished
TFA-4050R08-10	TFAN-4050R08-10	40×50	8	Hard glass	λ/10	Polished
TFA-4050R08-20	TFAN-4050R08-20	40×50	8	Hard glass	λ/20	Polished
TFA-5060R10-1	TFAN-5060R10-1	50×60	10	Hard glass	λ	Polished
TFA-5060R10-4	TFAN-5060R10-4	50×60	10	Hard glass	λ/4	Polished
TFA-5060R10-10	TFAN-5060R10-10	50×60	10	Hard glass	λ/10	Polished
TFA-5060R10-20	TFAN-5060R10-20	50×60	10	Hard glass	λ/20	Polished
TFA-6080R12-1	TFAN-6080R12-1	60×80	12	Hard glass	λ	Polished
TFA-6080R12-4	TFAN-6080R12-4	60×80	12	Hard glass	λ/4	Polished
TFA-6080R12-10	TFAN-6080R12-10	60×80	12	Hard glass	λ/10	Polished
TFA-6080R12-20	TFAN-6080R12-20	60×80	12	Hard glass	λ/20	Polished
TFA-80100R15-1	TFAN-80100R15-1	80×100	15	Hard glass	λ	Polished
TFA-80100R15-4	TFAN-80100R15-4	80×100	15	Hard glass	λ/4	Polished
TFA-80100R15-10	TFAN-80100R15-10	80×100	15	Hard glass	λ/10	Polished

High Parallelism				
Part Number	Diameter φD [mm]	Thickness t [mm]	Material	Surface Flatness
OPBA-10C05-10	φ10	5	BK7	λ/10
OPBA-15C05-10	φ15	5	BK7	λ/10
OPBA-20C05-10	φ20	5	BK7	λ/10
OPBA-25C05-10	φ25	5	BK7	λ/10
OPBA-30C05-10	φ30	5	BK7	λ/10
OPBA-40C06-10	φ40	6	BK7	λ/10
OPBA-50C08-10	φ50	8	BK7	λ/10
OPBA-60C10-10	φ60	10	BK7	λ/10
OPSQA-10C05-10	φ10	5	Synthetic fused silica	λ/10
OPSQA-15C05-10	φ15	5	Synthetic fused silica	λ/10
OPSQA-20C05-10	φ20	5	Synthetic fused silica	λ/10
OPSQA-25C05-10	φ25	5	Synthetic fused silica	λ/10
OPSQA-30C05-10	φ30	5	Synthetic fused silica	λ/10

# Large Aluminum Mirrors | TFAEFL

RoHS

Catalog Code

W3177

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Femtosecond Laser

Frameless

Accuracy Guarantee

High Power

Ultra Broadband

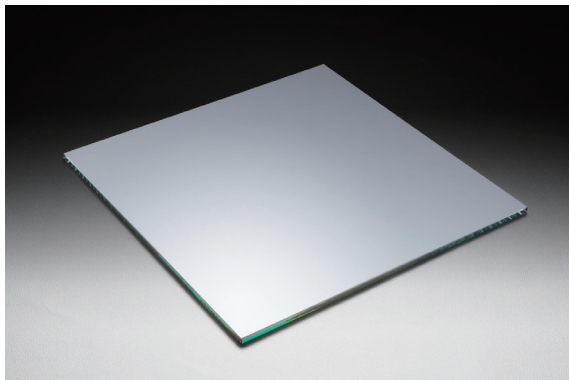
Dielectric Coating

Aluminum Coating

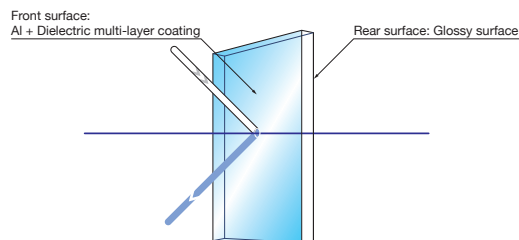
Gold Coating

It is a mirror of aluminum coating on one side of the substrate. As a line up, there are mirrors of large size of 200mm or more.

- For visible and near-infrared light applications.
- For large aperture optical system.

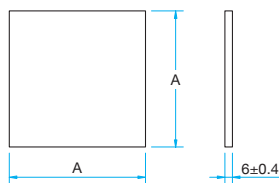


## Schematic



## Outline Drawing

(in mm)



- Tolerance
- Length A  $\pm 0.3$
- Chamfer C0.6 – C1

## Specifications

Part Number	Wavelength Range [nm]	Reflectance	Length A [mm]	Surface Flatness
TFAEFL-200S06-P	400 – 700	> average 90	200	4 – 6 $\lambda$ (Within $\phi 25.4$ )
TFAEFL-250S06-P	400 – 700	> average 90	250	4 – 6 $\lambda$ (Within $\phi 25.4$ )
TFAEFL-300S06-P	400 – 700	> average 90	300	4 – 6 $\lambda$ (Within $\phi 25.4$ )

## Specifications

Material	Float glass (Soda-Lime glass)
Coating	Al + Dielectric multi-layer coating
Clear aperture	90% of Actual Aperture
Rear surface	Glossy surface
Surface Quality (Scratch-Dig)	60–40

## Guide

- ▶ Please contact our International Sales Division for customized products.
- ▶ For the holder to fix the mirror, please contact our International Sales Division.

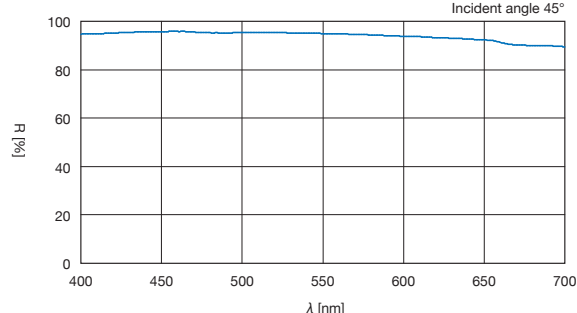
## Attention

- ▶ It is delivered in a state of protective film attached to the coated surface. Before use, please use it after removal of the protective film.
- ▶ When a laser is transmitted with multiple mirrors installed, there will be a loss large amount of light caused by the absorption of the aluminium coating. Please use dielectric multi-layer mirrors (TFM) for improved performance.

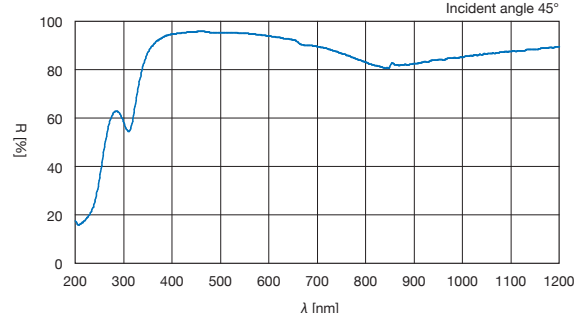
## Typical Reflectance Data

R: Reflectance

400 – 700nm

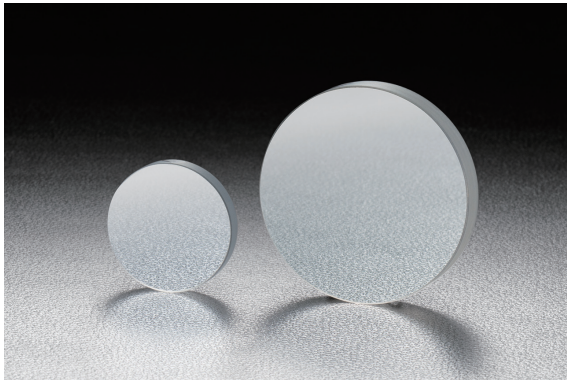


200 – 1200nm

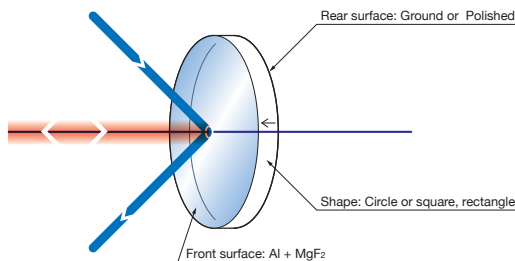


For an illumination optical system and a simple experiment, it is not requested the low-scratch polishing for a laser. Reflectance and surface flatness is the same as aluminum mirrors (TFA) for a laser.

- The dirt on the surface of the mirror can be wiped because the scratch-resistant protection is coated on the aluminum coating.
- Reflectance of less variation can be obtained in a wide wavelength range from visible to near-infrared.



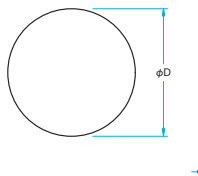
### Schematic



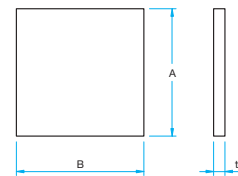
### Outline Drawing

(in mm)

#### ● Circle



#### ● Square / Rectangle



- Tolerance  
Diameter  $\phi D_{-0.1}^{+0}$   
Length  $A_{-0.1}^{+0}, B_{-0.1}^{+0}$   
Thickness  $t \pm 0.1$

Circle				
Part Number	Diameter $\phi D$ [mm]	Thickness $t$ [mm]	Surface flatness	Rear surface
S-TFA-10C03-10	$\phi 10$	3	$\lambda/10$	Ground
S-TFA-10C05-10	$\phi 10$	5	$\lambda/10$	Ground
S-TFA-15C03-10	$\phi 15$	3	$\lambda/10$	Ground
S-TFA-15C05-10	$\phi 15$	5	$\lambda/10$	Ground
S-TFA-20C03-10	$\phi 20$	3	$\lambda/10$	Ground
S-TFA-20C05-10	$\phi 20$	5	$\lambda/10$	Ground
S-TFA-25C05-1	$\phi 25$	5	$\lambda$	Polished
S-TFA-25C05-10	$\phi 25$	5	$\lambda/10$	Polished
S-TFA-30C05-1	$\phi 30$	5	$\lambda$	Polished
S-TFA-30C05-10	$\phi 30$	5	$\lambda/10$	Polished
S-TFA-40C06-1	$\phi 40$	6	$\lambda$	Polished
S-TFA-40C06-10	$\phi 40$	6	$\lambda/10$	Polished
S-TFA-50C08-1	$\phi 50$	8	$\lambda$	Polished
S-TFA-50C08-10	$\phi 50$	8	$\lambda/10$	Polished

### Specifications

Material	BK7
Coating	Al + MgF <sub>2</sub>
Parallelism	<3'
Incident angle	45°
Laser Damage Threshold	0.25J/cm <sup>2</sup> (pulse width 10ns, repetition frequency 20Hz)
Surface Quality (Scratch-Dig)	60-40
Clear aperture	90% of actual aperture or circle or ellipse that contacts 90% square of dimension

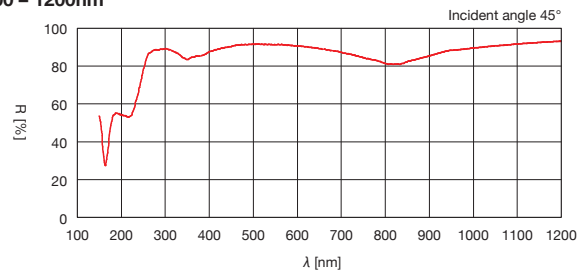
### Attention

- ▶ When a laser is transmitted with multiple mirrors installed, there will be a loss of a large amount of light caused by the absorption of the aluminum coating. Please switch to dielectric multi-layer mirrors (TFM) for improved performance.
- ▶ Reflectance of the specification is represented by the average of the reflectance of P polarized light and S polarized light. Reflectance may vary depending on the polarization state of the incident beam.

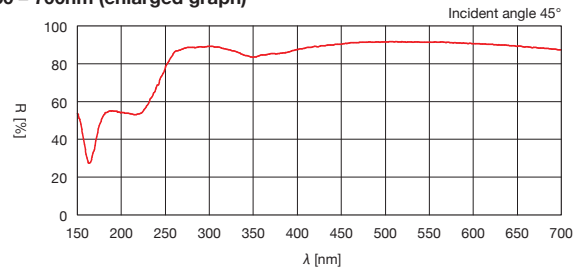
### Typical Reflectance Data

R: Reflectance

#### 100 - 1200nm



#### 150 - 700nm (enlarged graph)



### Square / Rectangle

Part Number	Length A x B [mm]	Thickness $t$ [mm]	Surface flatness	Rear surface
S-TFA-10S03-10	10x10	3	$\lambda/10$	Ground
S-TFA-15S03-10	15x15	3	$\lambda/10$	Ground
S-TFA-20S03-10	20x20	3	$\lambda/10$	Ground
S-TFA-20S05-4	20x20	5	$\lambda/4$	Ground
S-TFA-20S05-10	20x20	5	$\lambda/10$	Ground
S-TFA-25S05-10	25x25	5	$\lambda/10$	Ground
S-TFA-30S05-1	30x30	5	$\lambda$	Ground
S-TFA-30S05-10	30x30	5	$\lambda/10$	Ground
S-TFA-1015R03-10	10x15	3	$\lambda/10$	Ground
S-TFA-1015R05-10	10x15	5	$\lambda/10$	Ground
S-TFA-1525R03-10	15x25	3	$\lambda/10$	Ground
S-TFA-1525R05-10	15x25	5	$\lambda/10$	Ground
S-TFA-2030R05-10	20x30	5	$\lambda/10$	Ground
S-TFA-2535R05-10	25x35	5	$\lambda/10$	Ground

### Compatible Optic Mounts

MHG-HS25-NL, -HS30-NL / MHG-MP50-NL / MAD-30-10 + MHB-30M / BSHL-15-2 / MHF-20 / MHAN-40S

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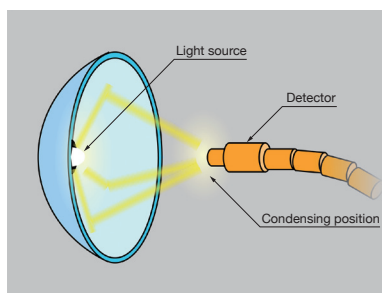
Gold Coating

In general, ellipsoid has two focal points and the light passes through one focal point also passes through the other focal point after being reflected by the elliptical surface. By using this principle, if one light source is put on one focal point, it is possible to collect light at the other focal point. It is used to incident a light of lamp into optical fiber or light guide.

- High condensing performance is obtained by precision aspheric surface processing.
- It can be used in a long-term stability because it is given a protective scratch-resistant coating over aluminum.
- Customer can select a mirror to suit specification from among the wide variety of products which are classified in the focal position and outer diameter.

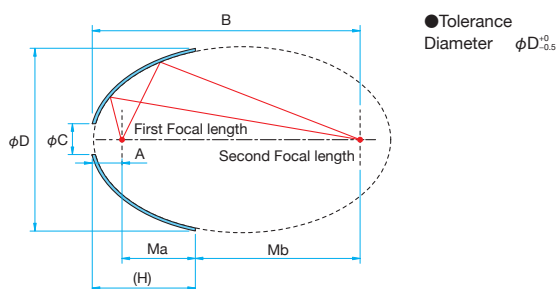


## Schematic



## Outline Drawing

(in mm)



## Specifications

Material	Tempax®
Coating	Al + SiO <sub>2</sub>

Tempax® is a registered trademark of SCHOTT AG company.

## Guide

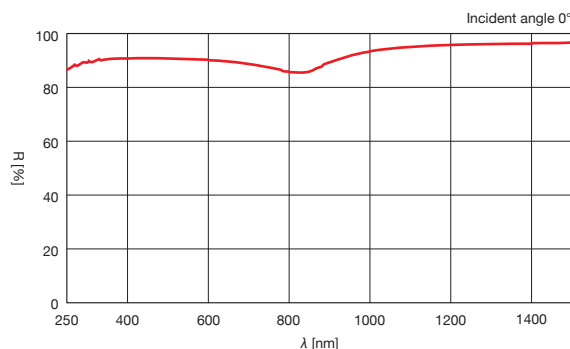
- ▶ It is also available for product which is not listed in the catalog such as focal length, outer diameter, hole size, and so on.
- ▶ It is also available for parabolic TCPA mirror, to project the light from the first focal point to infinity. [Reference](#) B037

## Attention

- ▶ The focus is not available on the second focal point when using a light source with directivity, because the light is not reflected by the mirror surface.
- ▶ Brightness distribution if away from the second focal point, may result in the distribution of ring-shaped.

## Typical Reflectance Data

R: Reflectance



## Specifications

Part Number	Dimension φD [mm]	Thickness* H [mm]	Hole dimension φC [mm]	Ma [mm]	Mb [mm]	First Focal length A [mm]	Second Focal length B [mm]
TCEA-64C-11/78-SH18	φ64	44	φ18	31	36	11	78
TCEA-76C-13.5/120-SH18	φ76	42	φ18	25	81.5	13.5	120
TCEA-86C-14/134-SH20	φ86	46	φ20	32	88	14	134
TCEA-105C-22/145-SH27	φ105	44	φ27	20	103	22	145
TCEA-113C-17/272-SH27	φ113	54	φ27	36	219	17	272
TCEA-124C-23/195-SH25	φ124	56.5	φ25	32.6	139.4	23	195
TCEA-128C-18/288-SH31	φ128	67	φ31	50	220	18	288
TCEA-148C-28/252-SH30	φ148	63	φ30	34.6	189.4	28	252

\* The thickness "H" is design value and there is a possibility of individual variability in the actual product. It is Not guaranteed value.





TCPA is curved mirror that converts diverging light from a point of light source into parallel light. By making the paraboloid a curved surface, it is possible to retrieve parallel light more efficiently than spherical concave mirror. It is used as a lamp reflector of the lamp house of the microscope as an example.

- It is obtained high performance condensing by precision aspheric surface processing.
- It can be used in a long-term stability because it is given a protective scratch-resistant coating over aluminum.
- It is easy to position the light source at the focusing point because there is a hole on the axis of the paraboloid.
- By entering the thick parallel light, it is available to collect the light on one point.



Specifications	
Material	Tempax®
Coating	Al + SiO <sub>2</sub>

Tempax® is a registered trademark of SCHOTT AG company.

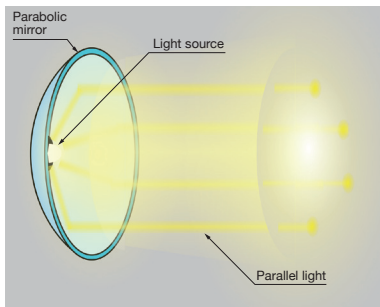
**Guide**

- ▶ It is also available for product which is not listed in the catalog such as focal length, outer diameter, hole size, and so on.
- ▶ It is also available for ellipsoidal TCEA mirror for focusing light of the lamp at one point.

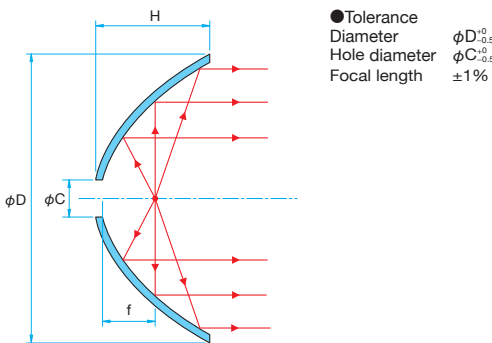
**Attention**

- ▶ Light does not reach to the mirror surface when high directivity source is placed at focal point, so it is not available to get the effect of paraboloid mirror.
- ▶ Light near the optical axis center is not reflected by the hole in the mirror, there is a case that intensity distribution of the parallel light becomes ring-shaped.
- ▶ When focusing the light emitted from a paraboloid mirror by the lens, it is not focused at one point by the influence of light incident on the lens directly from the lamp.

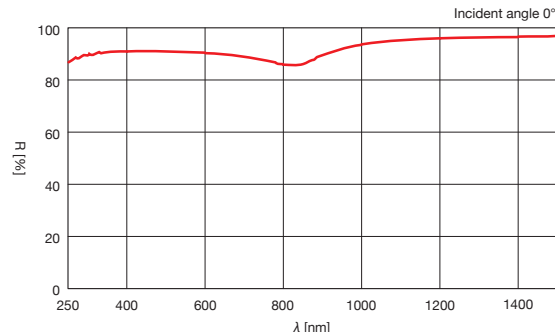
**Schematic**



**Outline Drawing** (in mm)



**Typical Reflectance Data** R: Reflectance



Specifications				
Part Number	Dimension $\phi D$ [mm]	Focal length $f$ [mm]	Thickness* $H$ [mm]	Hole dimension $\phi C$ [mm]
TCPA-100C-12.5-SH18	$\phi 100$	12.5	46	$\phi 18$
TCPA-105C-15-SH23	$\phi 105$	15	42	$\phi 23$
TCPA-152C-17-SH30	$\phi 152$	17	76.5	$\phi 30$
TCPA-152C-30-SH35	$\phi 152$	30	44.5	$\phi 35$

\* The thickness "H" is design value and there is a possibility of individual variability in the actual product. It is Not guaranteed value.

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# Gold Flat Mirrors | TFG/TFGS



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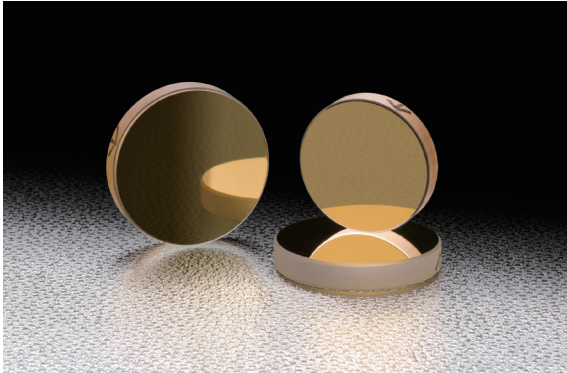
Dielectric Coating

Aluminum Coating

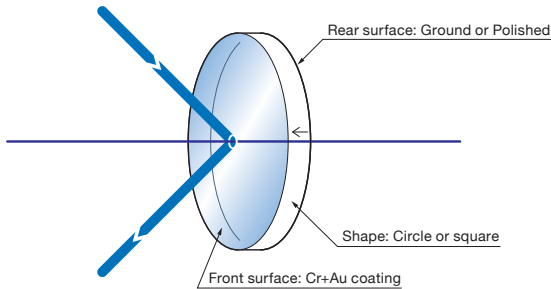
**Gold Coating**

Gold (AU) coated reflection mirrors have high reflectance in a wide infrared range.

- Chromium (Cr) is deliberately undercoated to better reinforce the adhesion of gold to the substrate.
- Gold mirrors with silicon substrates have higher durability than glass because gold coating adheres much stronger to silicon and has a higher thermal conductivity. (thermal conductivity of silicon is 111 times better compared to glass)



### Schematic



### Specifications

Material	BK7 Hard glass (Pyrex® etc.) Silicon crystal
Coating	Cr (chrome) + Au (Gold)
Parallelism	<3'
Surface Quality (Scratch-Dig)	40-20
Clear aperture	90% of diameter or circle that internally contacts 90% square of dimension
Laser Damage Threshold	1.2kW/cm <sup>2</sup> (CW laser)

### Guide

- ▶ Please contact our International Sales Division for customized products. (customized on outer diameter, etc.)
- ▶ Pyrex® is a registered trademark of Corning Inc.

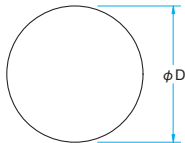
### Attention

- ▶ When silicon mirrors are water-cooled, heat dissipates more quickly and they have higher durability.
- ▶ Since gold coating has an extremely low mechanical strength, it can only be blown by air to clean its coating surface. It must be handled carefully.
- ▶ Reflectance of the specification are represented by the average of the reflectance of P polarized light and S polarized light.

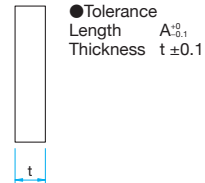
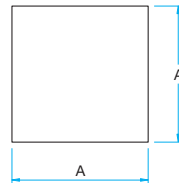
### Outline Drawing

(in mm)

#### ● Circle

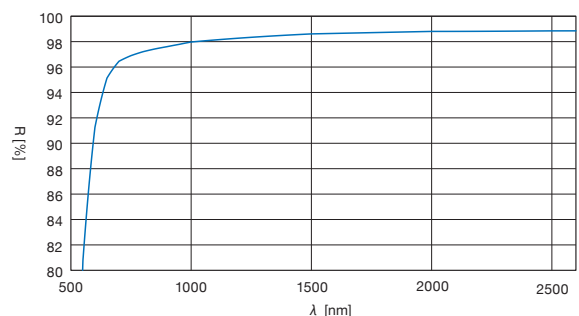


#### ● Square



### Typical Reflectance Data

R: Reflectance





## Gold Flat Mirrors

Circle						
Part Number	Dimension $\phi D$ [mm]	Thickness t [mm]	Surface Flatness		Material	Rear Surface
			(at 632.8nm)	(at 10.6 $\mu m$ )		
TFG-20C05-10	$\phi 20$	5	$\lambda/10$	$\lambda/160$	BK7	Ground
TFG-25C05-10	$\phi 25$	5	$\lambda/10$	$\lambda/160$	BK7	Polished
TFG-30C05-10	$\phi 30$	5	$\lambda/10$	$\lambda/160$	BK7	Polished
TFG-40C06-10	$\phi 40$	6	$\lambda/10$	$\lambda/160$	BK7	Polished
TFG-50C08-10	$\phi 50$	8	$\lambda/10$	$\lambda/160$	BK7	Polished

Square						
Part Number	Length A [mm]	Thickness t [mm]	Surface Flatness		Material	Rear Surface
			(at 632.8nm)	(at 10.6 $\mu m$ )		
TFG-20S05-10	$\square 20$	5	$\lambda/10$	$\lambda/160$	BK7	Ground
TFG-25S05-10	$\square 25$	5	$\lambda/10$	$\lambda/160$	BK7	Ground
TFG-30S05-10	$\square 30$	5	$\lambda/10$	$\lambda/160$	BK7	Ground
TFG-50S08-10	$\square 50$	8	$\lambda/10$	$\lambda/160$	Hard glass	Polished

## Gold Silicon Mirrors

Circle						
Part Number	Dimension $\phi D$ [mm]	Thickness t [mm]	Surface Flatness		Material	Rear Surface
			(at 632.8nm)	(at 10.6 $\mu m$ )		
TFGS-30C03-2	$\phi 30$	3	$\lambda$	$\lambda/16$	Silicon crystal	Ground
TFGS-40C04-2	$\phi 40$	4	$\lambda$	$\lambda/16$	Silicon crystal	Ground
TFGS-50C05-2	$\phi 50$	5	$\lambda$	$\lambda/16$	Silicon crystal	Ground

### Compatible Optic Mounts

MHG-HS25, -HS30 / MHG-MP50 / MHF-20 / MHAN-40M

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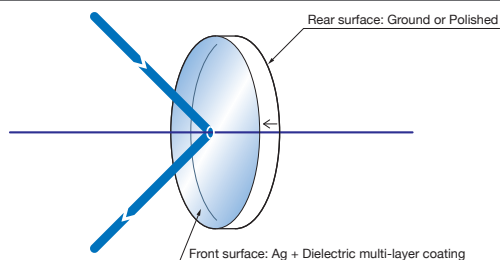
Silver (Ag) coated reflection mirrors have high reflectance in a wide range from visible to infrared wavelength.

Since it is coated with a protective layer on the silver, it can be used for a long term without oxidation.

- For the wavelength range from the visible to infrared, higher reflectance than aluminum mirror can be obtained.
- Incident dependence is smaller than the dielectric multilayer coating, it can use for the placement of various incident angles.
- Since it is coated by protective layer, a scratch hardly occurs even if it is rubbed with a cloth.

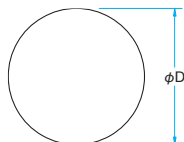


### Schematic



### Outline Drawing

(in mm)



- Tolerance  
Diameter  $\phi D_{\pm 0.05}$   
Thickness  $t \pm 0.1$

### Specifications

Part Number	Diameter $\phi D$ [mm]	Thickness $t$ [mm]	Rear Surface
TFAG-12.7C05-10	$\phi 12.7$	5	Ground
TFAG-25.4C05-10	$\phi 25.4$	5	Polished
TFAG-30C05-10	$\phi 30$	5	Polished
TFAG-50C08-10	$\phi 50$	8	Polished
TFAG-50.8C08-10	$\phi 50.8$	8	Polished

### Specifications

Material	BK7
Coating	Ag + Dielectric multi-layer coating
Wavelength Range	450 – 2000nm
Reflectance	> average 97.5%
Surface Flatness	$\lambda/10$
Parallelism	<3'
Surface Quality (Scratch-Dig)	40–20
Clear aperture	90% of Actual Aperture

### Guide

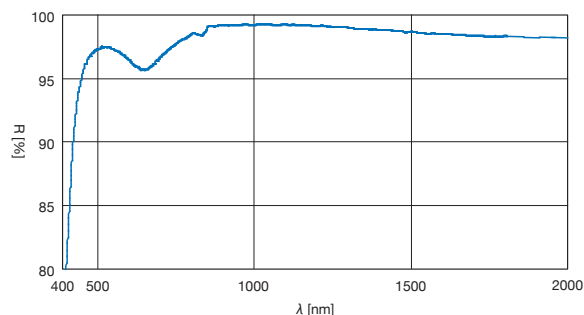
- ▶ Please contact our International Sales Division for customized products.

### Attention

- ▶ For a long term storage, please use a de-oxidizer to prevent the oxidation of the silver.
- ▶ When a laser is transmitted with multiple mirrors installed, there will be a loss of the amount of light caused by the absorption of the silver coating. Please use 0-45° Wide incidence dielectric mirrors (TFVM) for improved performance. [Reference](#) B027
- ▶ Reflectance of the specification is represented by the average of the reflectance of P polarized light and S polarized light. Reflectance may vary depending on the polarization state of the incident beam.

### Typical Reflectance Data

R: Reflectance



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# Contact sheet



Contact sheet for Special Order for Mirror

Estimation  Order

Date

To: Sigma Koki Co., Ltd. **FAX +81-3-5638-6550**

Affiliation (Organization Name)							
Department			Name				
TEL		FAX		E-mail			
Country/Address							
Name & Designation		(Tentative name is okay)					
Drawing Number			Estimate		<input type="checkbox"/> Yes: by Date <input type="checkbox"/> No		
Desired Delivery Date			Budget		JP Yen		
Substrates				If you are using a substrate of standard product, please fill in the product number. * If you specify a standard product of the substrate, it is not necessary to fill in fields marked with ▲.			
Material <sup>▲</sup>		<input type="checkbox"/> BK7 <input type="checkbox"/> Synthetic fused silica <input type="checkbox"/> Hard Glass <input type="checkbox"/> Other ( )					
Quantity			Laser Damage Threshold <sup>▲</sup> (at $\lambda = 632.8\text{nm}$ )				
Rear Surface <sup>▲</sup>		<input type="checkbox"/> Ground <input type="checkbox"/> Polished <input type="checkbox"/> No object		Parallelism <sup>▲</sup> (enter only when it is necessary)			
Dimensions <sup>▲</sup> If you do not specify a dimension tolerance is outside the standard tolerance.						$\phi A$ mm	
						a mm	
						b mm	
						t mm	
Specifications of Total Reflection Coat Select metallic coating or dielectric multi-layer coating.		<input type="checkbox"/> Metallic Coating		<input type="checkbox"/> Al only <input type="checkbox"/> Al + MgF <sub>2</sub> <input type="checkbox"/> Al + SiO <input type="checkbox"/> Al + Dielectric coating <input type="checkbox"/> Ag + Dielectric coating <input type="checkbox"/> Cr + Au <input type="checkbox"/> Pt <input type="checkbox"/> Other ( )			
		<input type="checkbox"/> Dielectric multi-layer coating		Wavelength Range $\lambda =$ nm		Incident angle $\theta =$ ° ± °	
Specifications of Light Source Used		Wavelength Used $\lambda =$ nm		Type			
		Output or Energy W		Beam size		mm	
		Incident angle $\theta =$ °		J Pulse width s		Repetition frequency Hz	
		Polarization Conditions (If nothing is specified, circular polarized light or 45° direction of linearly polarization are set.)					
Other		* Write more detailed specifications here. (Rough illustration is acceptable.)					

Sigma Koki Co., Ltd.

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Gold Coating

Contact sheet for laser cavity mirror

Estimation  Order

Date

To: Sigma Koki Co., Ltd. **FAX +81-3-5638-6550**

Affiliation (Organization Name)								
Department			Name					
TEL		FAX		E-mail				
Country/Address								
Name & Designation <small>(Tentative name is okay)</small>								
Drawing Number				Estimate		<input type="checkbox"/> Yes: by Date <input type="checkbox"/> No		
Desired Delivery Date				Budget		JP Yen		
Substrates				If you are using a substrate of standard product, please fill in the product number. * If you specify a standard product of the substrate, it is not necessary to fill in fields marked with ▲.				
Material▲ <input type="checkbox"/> BK7 <input type="checkbox"/> Synthetic fused silica <input type="checkbox"/> Other ( )								
Quantity								
Dimensions▲ <small>If you do not specify a dimension tolerance is outside the standard tolerance.</small>	Flat Mirror Type		* The back is basically a polished surface.			$\phi A$	mm	
					t	mm		
					Laser Damage Threshold▲ (at $\lambda = 632.8\text{nm}$ )			
	Concave Mirror Type			* The back is basically a polished surface.			$\phi A$	mm
						te	mm	
						tc	mm	
					r	mm		
		Standard Curvature Radius [mm]	10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100, 120, 150, 200, 250, 300, 400, 500, 600, 700, 800, 1000, 1500, 2000, 2500, 3000, 4000, 5000, 10000, 20000, 30000			(Caution) In other than the above curvature radius, tooling costs may be required.		
Specifications of Coating	Dielectric multi-layer coating	Wavelength Used	$\lambda =$	nm	Incident angle	$\theta =$	$^{\circ}\pm$	
		Reflective Coating	$\lambda =$	for	nm	Reflectance	R = % or more	

Sigma Koki Co., Ltd.

Concave Mirror  
(rear mirror)

Flat Mirror  
(output mirror)

Laser cavity mirrors for the laser oscillator used in coating technology and high-quality high-precision polishing technology are required. In accordance with the specifications received from customers, we manufacture high quality mirror cavity with a high degree of accuracy. We will propose to use a substrate such as a mirror that has been standardized, the method that best meets your budget. To confirm the specifications for the quotation, we may contact to the customer.