HAMAMATSU

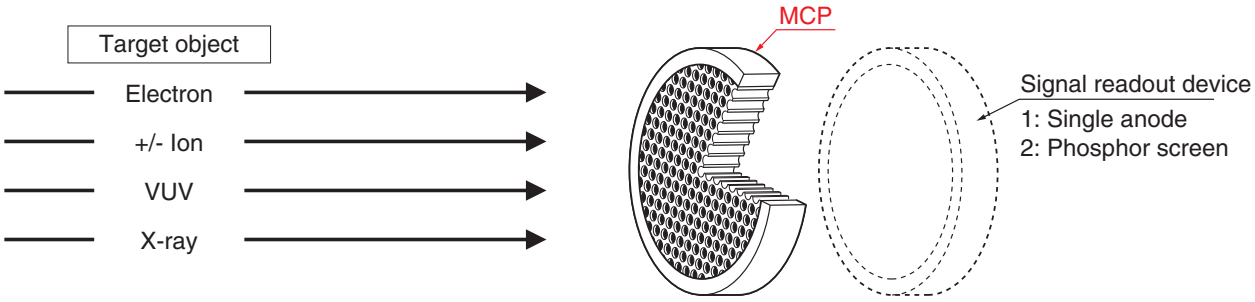
PHOTON IS OUR BUSINESS

# MCP (MICROCHANNEL PLATE) ASSEMBLY

HAMAMATSU PHOTONICS K.K.

# OVERVIEW

Microchannel plate (MCP) is a two-dimensional sensor that detects electrons, ions, vacuum UV rays, X-rays and gamma rays in a vacuum, and amplifies the detected signals. These MCPs are widely used in many types of analytical equipment such as for "mass spectroscopy", "semiconductor inspection" and "surface analysis".
The MCP assemblies are available with two different readout devices to meet application needs. The devices are of: (1) single anode (electrical signal output), and (2) phosphor screen (visible light output). Select the ideal output device for your application.
From one to three stage MCPs can be selected for the assembly to obtain necessary gain, allowing uses in the analog mode (the output signal is measured as a continuous electrical current) or the counting mode (the low level signal can be measured by a binary processing).




# OPERATING PRINCIPLE

As shown in the figure on the lower right, a potential gradient is established along the channel when the voltage $V_D$ is applied between the input and output sides of the MCP. Multiple secondary electrons are emitted when an electron enters a channel from the input side and hits its inner wall. These secondary electrons are accelerated by the potential gradient to draw parabolic trajectories that are determined by their initial velocities. They then hit the opposite wall in the channel causing further secondary electrons to be emitted. The electrons in this way travel towards the output end while striking the inner wall of the channel repeatedly. As a result, a large number of exponentially increased electrons are extracted from the output side.

## Thickness

The thickness of an MCP is nearly equal to the channel length. The ratio of the channel length (L) to the channel diameter (d) is referred to as $\alpha$ ($\alpha$=L/d), and this $\alpha$ and the secondary emission factor inherent to the channel wall material determine the gain of the MCP. Standard MCPs are fabricated so that $\alpha$ is 40 to 60. The MCP thickness is therefore determined by the required channel diameter and the design value of this $\alpha$.

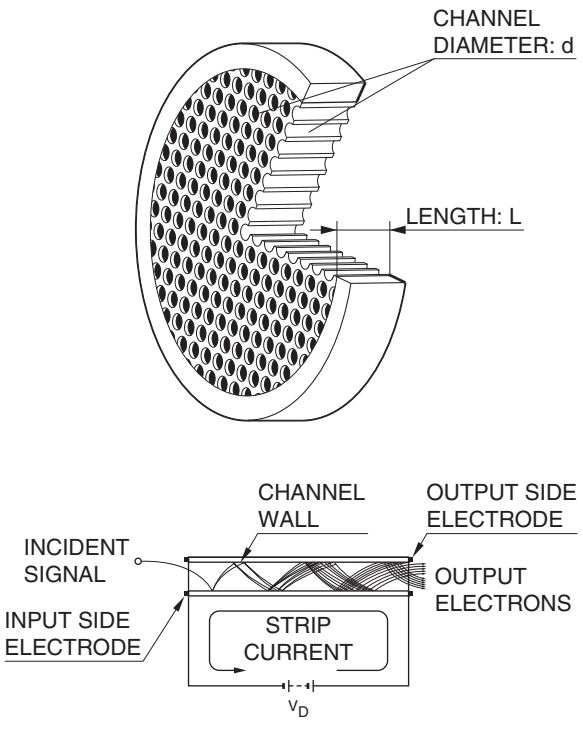
## Open Area Ratio: OAR

The OAR indicates the ratio of the channel open area to the entire effective area of MCP.

## Bias angle

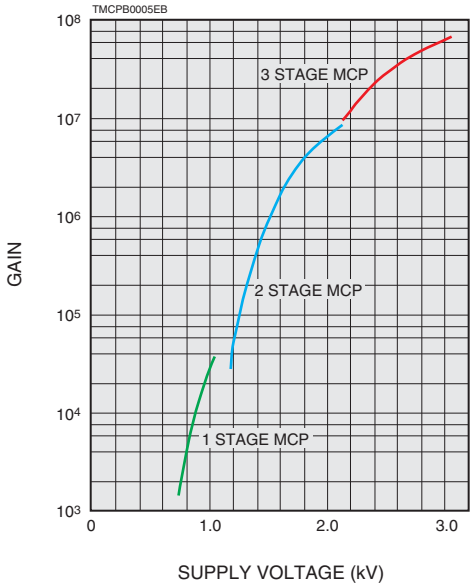
The bias angle is formed by the channel axis and the axis perpendicular to the plate surface. This bias angle is chosen by considering the detection efficiency and spatial resolution as well as the prevention of input signals from passing through the channels without colliding with the channel walls.

**Schematic structure of MCP**

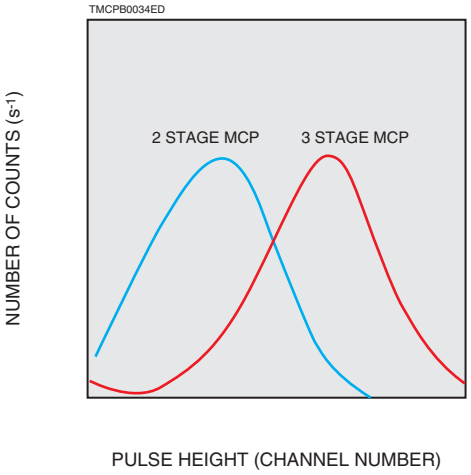


# CHARACTERISTICS

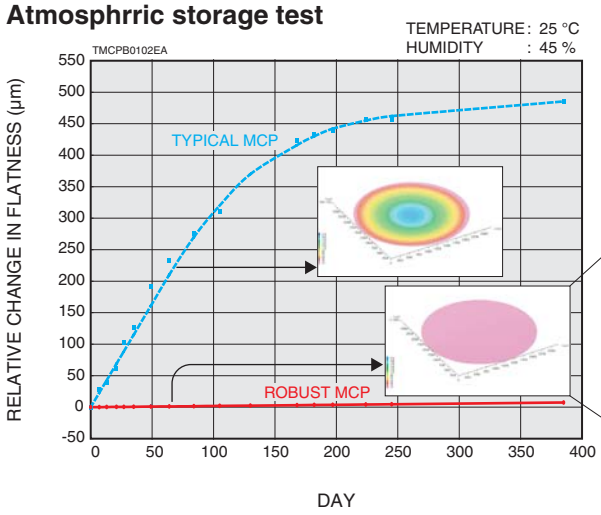
## MCP gain characteristics



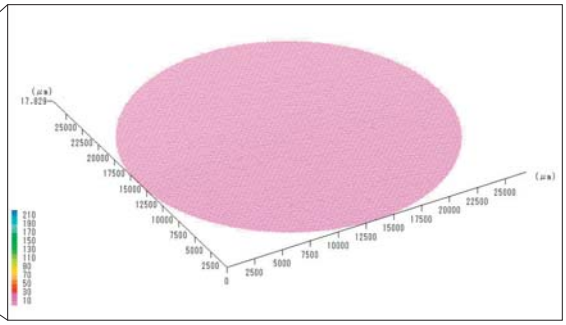

## Pulse height distribution (PHD)



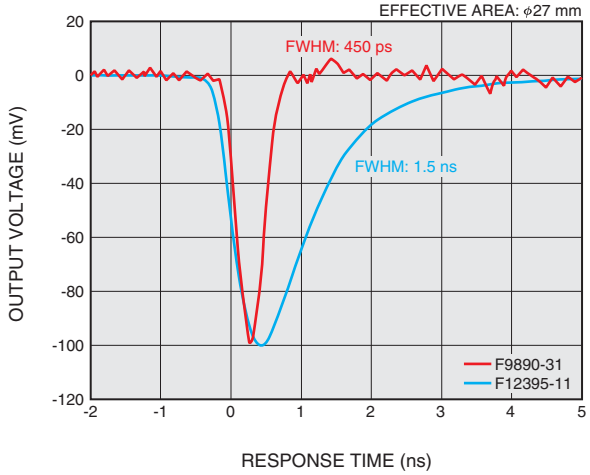

## Atmosphrric storage test




Robust MCPs have durability against various environmental conditions. They are less likely to warp or crack and are very stable in shape even when exposed to air and humidity for long time, minimizing the time jitter that affects the mass resolution of TOF-MS (Time-of-flight mass spectrometry).



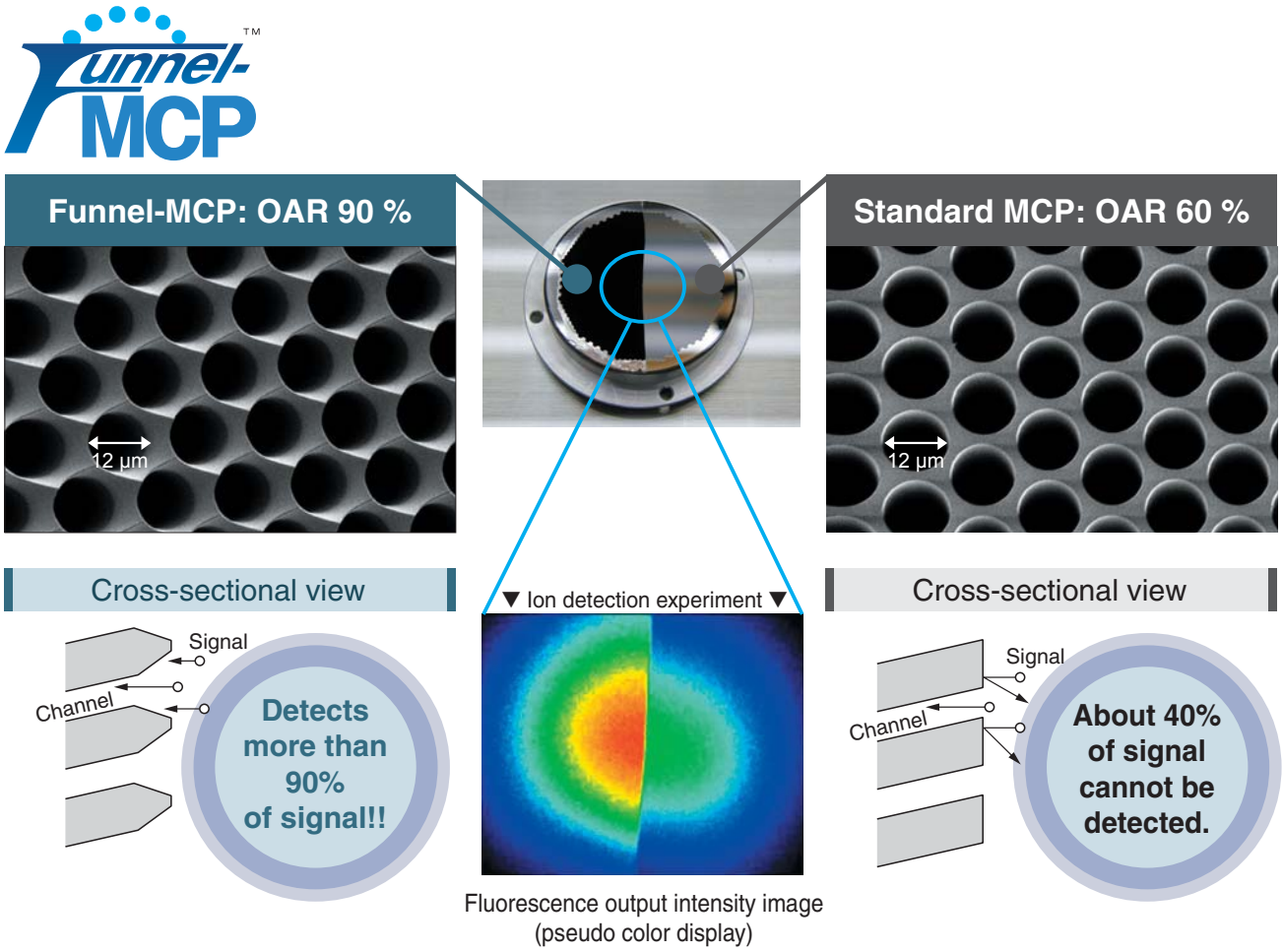
## Output waveform




MCP assemblies for TOF measurement are available with a fast response time ranging from 450 ps to 1.5 ns (FHWM). Select according to your application.

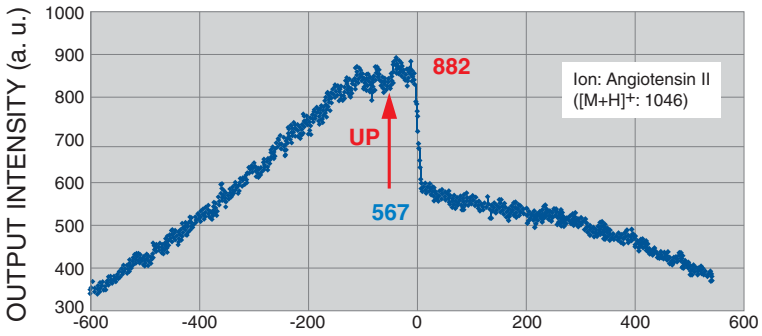
# LARGE OAR: FUNNEL TYPE

Funnel MCPs have a large open area ratio (OAR) by making the input side of each channel into the shape of a funnel. This allows more signals to enter each channel than before, enabling effective and accurate signal detection.




Fluorescence output intensity image
(pseudo color display)

**Fluorescence output intensity profile**



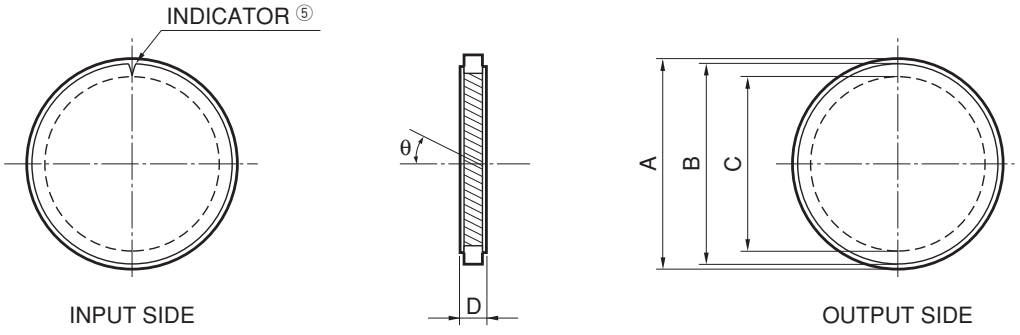

## Line-up

| Parameter / Type No. | F1551-011F | F1094-011F | F1552-011F | F1217-011F | Unit |
|---|---|---|---|---|---|
| Channel diameter | 12 | | | | µm |
| Effective area | ϕ14.5 | ϕ20 | ϕ27 | ϕ42 | mm |
| Bias angle | 12 | | | | degree |
| Thickness | 0.48 | | | | mm |

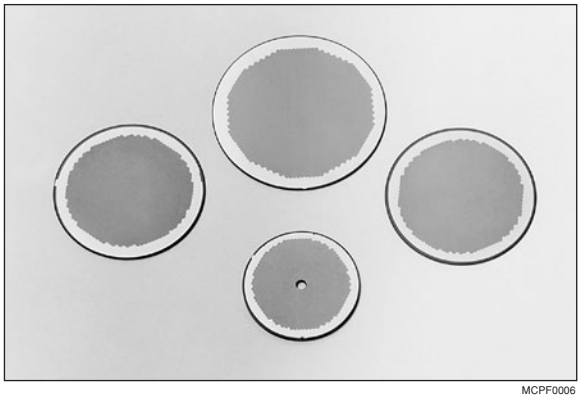
# MCP SPECIFICATIONS AND DIMENSIONAL OUTLINES

| Parameter \ Type No. | F1551 | | | F1094 | | | F1552 | | | F1208-01 | F1217 | | F1942-04 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | -01① | -011 | -074 | -01① | -011 | -074 | -01① | -011 | -074 | | -01① | -011 | | |
| Outer size A | $\phi$17.9 | | | $\phi$24.8 | | | $\phi$32.8 | | | $\phi$38.4 | $\phi$49.9 | | $\phi$86.7 | mm |
| Electrode area B | $\phi$17 | | | $\phi$23.9 | | | $\phi$31.8 | | | $\phi$36.5 | $\phi$49 | | $\phi$84.7 | mm |
| Effective area C | $\phi$14.5 | | $\phi$14 | $\phi$20 | | | $\phi$27 | | | $\phi$32 | $\phi$42 | | $\phi$77 | mm |
| Thickness D | 0.48 | 0.48 | 0.3 | 0.48 | | 0.3 | 0.48 | | 0.3 | 0.48 | 0.48 | | 1 | mm |
| Channel diameter | 12 | 12 | 6 | 12 | | 6 | 12 | | 6 | 12 | 12 | | 25 | µm |
| Channel pitch | 15 | 15 | 7.5 | 15 | | 7.5 | 15 | | 7.5 | 15 | 15 | | 31 | µm |
| Bias angle θ | 8 | 12 | | 8 | 12 | | 8 | 12 | | 8 | 8 | 12 | 8 | degree |
| Open area ratio | 60 | | | | | | | | | | | | | % |
| Electrode material | Inconel | | | | | | | | | | | | | — |
| Gain (Min.) ② | $10^4$ | | $5\times10^3$ | $10^4$ | | $5\times10^3$ | $10^4$ | | $5\times10^3$ | $10^4$ | | | | — |
| Resistance ② | 100 to 700 | 20 to 100 | 20 to 200 | 50 to 500 | 10 to 50 | 10 to 100 | 15 to 200 | 6.7 to 33.3 | 6.7 to 66 | 20 to 200 | 10 to 200 | 4 to 20 | 10 to 100 | MΩ |
| Dark current (Max.) ② | 0.5 | | | | | | | | | | | | | pA·cm$^{-2}$ |
| Maximum linear output ② | 7 % of strip current ④ | | | | | | | | | | | | | — |
| Supply voltage ③ | 1.0 | | | | | | | | | | | | | kV |
| Operating ambient temperature ③ | -50 to +70 | | | | | | | | | | | | | °C |

**NOTE:** ①The F1551-01, F1094-01, F1552-01, F1208-01 and F1217-01 are also available with a center through-hole (6 mm diameter).
②Supply voltage: 1.0 kV, vacuum: 1.3 × $10^{-4}$ Pa, operating ambient temperature: +25 °C
③Vacuum: 1.3 × $10^{-4}$ Pa
④Strip current is the current that flows through channel walls when a voltage is applied between MCP IN and OUT. It is given by dividing the applied voltage by the MCP resistance.
⑤Indicates MCP input side. Shape varies depending on product type.




TMCPA0056EA



MCPF0006

# MCP ASSEMBLY SELECTION GUIDE BY PURPOSE

## Higher pressure

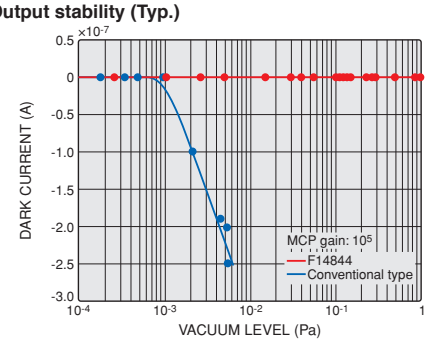
New

### Higher pressure measurement

- Miniature mass spectrometer (explosive / drug trace detection)
- Portable devices

### Ion detection at higher pressure

**Output stability (Typ.)**




This MCP assembly with triode structure supresses ion feedback noise and ensures stable operation even in a higher presuure environment of 1 Pa. This is an innovative ion detectors that can be mounted in compact desktop mass spectrometers where installing large vacuum pumping systems is difficult or impractical.

Operating principle video

**Compact F14844**

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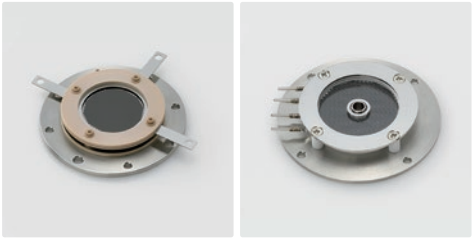
## Signal measurement

### Measures the amount of signal



- Very small amount ion detection
- Electron detection
- VUV detection
- Soft X-ray detection

### Standard

These MCP assemblies are used to detect signals in general-purpose applications where high-speed response in the order of nanoseconds is not required. Various types are provided including circular type and compact type.

**Demountable**

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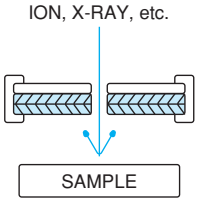
**Compact F4655-14**

Page p.8

- Scanning electron microscope (SEM)
- Mask aligner
- Surface analysis

### Center hole




This type of MCP assembly has a through-hole in the center that allows ions, X-rays and so on to pass through it to irradiate a sample. The signal from the sample can then be detected effectively.

**F2223-21SH**

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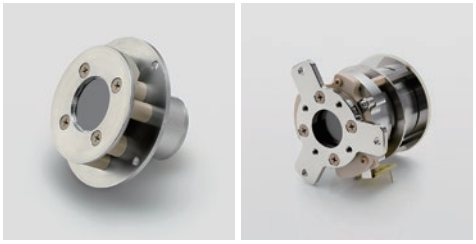
## Time-of-flight (TOF) measurement

**Measures the difference between the arrival times**



## Two-dimensional detection

**Measures two-dimensional distribution and incident position of signals**

- Mass spectrometry (TOF-MS, MALDI-TOF)
- Observation of high-speed phenomena

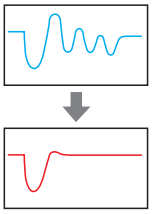
- Mass spectrometry (TOF-MS, imaging MS)

- Electron spectroscopy for chemical analysis (ESCA)
- Acceleration beam monitor
- Velocity map imaging (VMI)

less than 1 ns / 1 ns or more

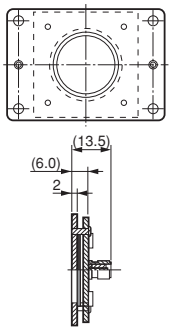
### Fast response

Output waveform



Using an anode specially designed for the high-speed signal readout, this type of MCP assembly eliminates signal oscillation called "ringing" and ensures an accurate signal output.

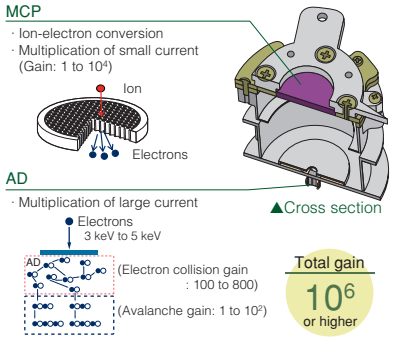
### Thin




Its thin and flat shape permits installation in minimum spaces as add on parts. Maintenance and servicing of this MCP assembly are quite easy since there are only 2 wiring connections.

### MIGHTION™

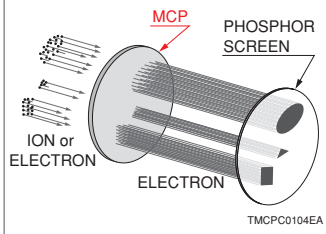
New




An ion detector consisting of a MCP (microchannel plate) and an AD (avalanche diode). It has various unique features as a hybrid type detector, such as fast time response, wide dynamic range and long life time.

Operating principle video

### Phosphor screen output




The output electrons from the MCP are converted into a visible light on the phosphor-coated glass plate. One-stage MCPs offer a spatial resolution of 40 µm to 50 µm, and two-stage MCPs a resolution of 80 µm to 100 µm. The standard phosphor is P43 (peak emission wavelength: 545 nm, decay time: 1 ms).

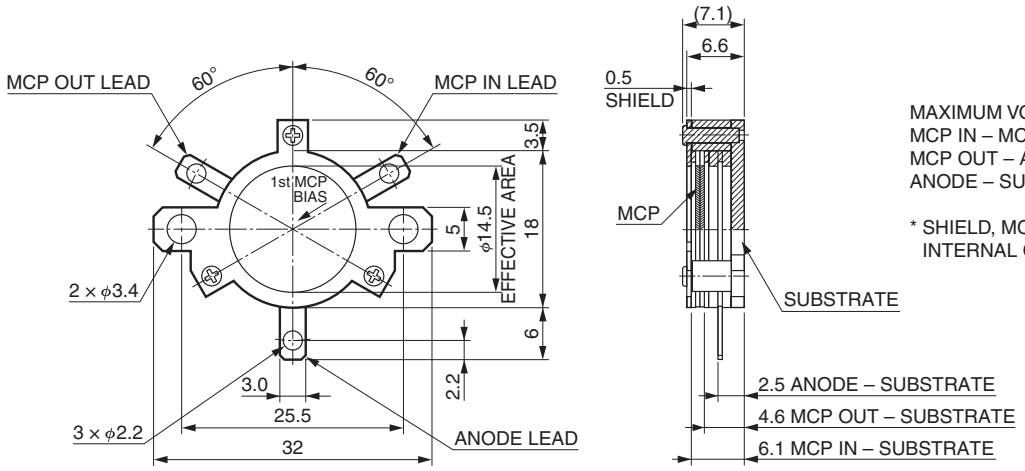
| Anode ground | Floating | Compact | Vacuum flange | Fast time response | Fast time response Hybrid type | Vacuum flange |
|---|---|---|---|---|---|---|
| F9890-13/-14<br>F9892-13/-14 | F9890-31/-32<br>F9892-31/-32 | F4655-10 | F4655-11 | F12334-11<br>F12395-11<br>F12396-11<br>F13446-11<br>F13447-11 | F14845 | F2225-21PGF<br>F6959 |
| p.10 | p.10 | p.11 | p.11 | p.12 | p.7 | p.13 |

Please consult us for product specifications not listed in this catalog.

# MCP ASSEMBLY SPECIFICATIONS AND DIMENSIONAL OUTLINES (Unit: mm)

## F14844

| Max. operating pressure (pa) | Gain (Min.) | Effective area (mm) | Resistance (MΩ) | Dark count (Max.) ($s^{-1}\cdot cm^{-2}$) |
|---|---|---|---|---|
| 1 | $1 \times 10^6$ | $\phi$14.5 | 300 ～ 600 | 3 |




MAXIMUM VOLTAGE RATING
MCP IN – MCP OUT : 2.0 kV
MCP OUT – ANODE : 0.1 kV
ANODE – SUBSTRATE: 2.1 kV

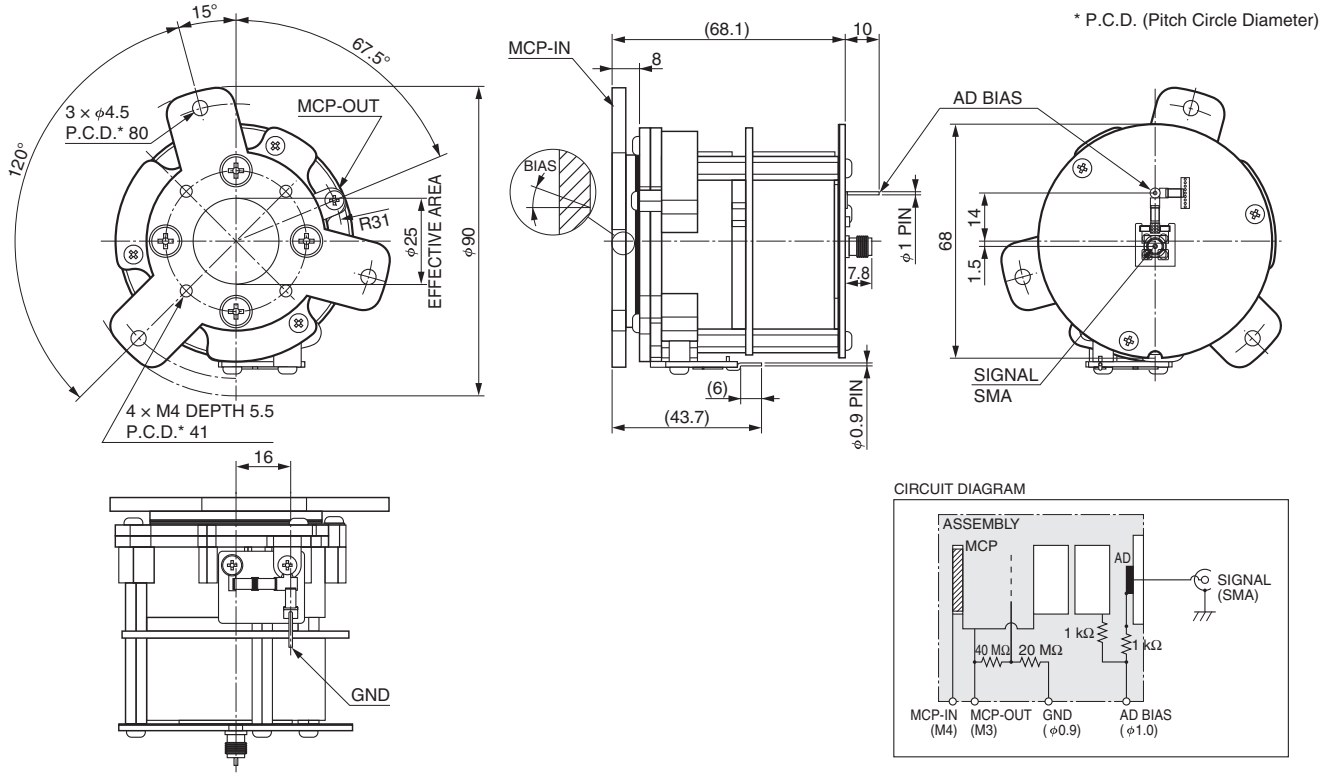
* SHIELD, MCP IN, SUBSTRATE INTERNAL CONNECTION

TMCPA0088EA

## F14845-11

| Pulse width (FWHM) (ns) | Gain ① (Min.) | Effective area (mm) | DC output ② (Max.) (μA) | Pulse linearity ③ (Max.) (V) |
|---|---|---|---|---|
| 0.6 | $1 \times 10^6$ | $\phi$25 | 200 | 3.2 |

**NOTE:** ①MCP-in: -6 kV, MCP: 600 V, AD: -350 V
②±10 %
③when connected to 50 Ω, ±10 % input




CIRCUIT DIAGRAM

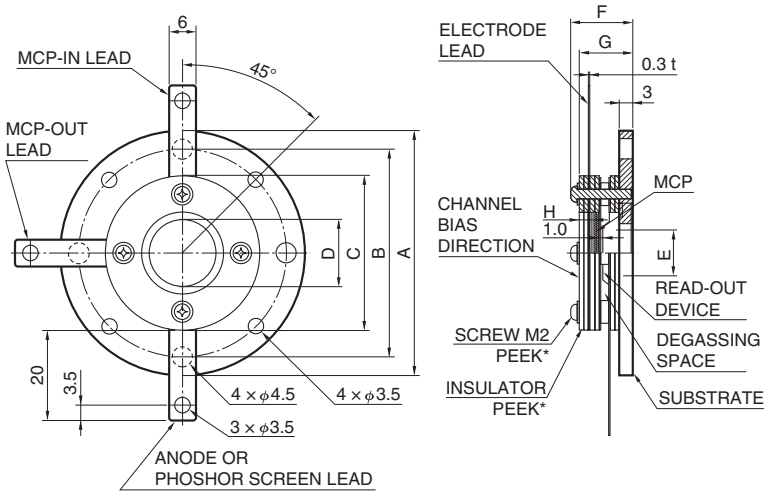



TMCPA0089EA

## Demountable

| Type No. | Channel diameter (μm) | Number of MCPs | Gain ① (Min.) | Pulse height resolution ① (Max.) (%) | Dark count ① (Max.) ($s^{-1}\cdot cm^{-2}$) | MCP ② supply voltage (kV) | MCP-OUT to anode ② supplu voltage (kV) |
|---|---|---|---|---|---|---|---|
| F2221 | 12 | Refer to "Anode type" below | 1 stage MCP : $1 \times 10^4$ 2 stage MCP : $1 \times 10^6$ 3 stage MCP : $1 \times 10^7$ | 2 stage MCP: 120 3 stage MCP: 80 | 3 (2 or 3 stage MCP) | 1 stage MCP: 1.0 2 stage MCP: 2.0 3 stage MCP: 3.0 | Single anode: 0.5 Phosphor screen : 3.0 to 4.0 |
| F2222 | | | | | | | |
| F2223 | | | | | | | |
| F2224 | | | | | | | |
| F2225 | | | | | | | |
| F2226 | 25 | | | | | | |

**NOTE:** ①Supply voltage: 1.0 kV/MCP, vacuum: $1.3 \times 10^{-4}$ Pa, operating ambient temperature: +25 °C
②Vacuum: $1.3 \times 10^{-4}$ Pa




* PEEK: Polyetheretherketone
F2226 has leads every 60 degrees.

TMCPA0026EI

| Anode type | Number of MCPs |
|---|---|
| Single anode | 1 to 3 |
| Phosphor screen | 1 to 2 |

| Symbol | Description | | F2221 | F2222 | F2223 | F2224 | F2225 | F2226 | Unit |
|---|---|---|---|---|---|---|---|---|---|
| A | Assembly outer size | | ϕ54 | ϕ61 | ϕ69 | ϕ75 | ϕ86 | ϕ123 | mm |
| B | Mounting screw hole pitch | | ϕ46 | ϕ53 | ϕ61 | ϕ67 | ϕ78 | ϕ115 | mm |
| C | Insulator outer size | | ϕ34 | ϕ41 | ϕ49 | ϕ55 | ϕ66 | ϕ103 | mm |
| D | Effective area | | ϕ14.5 | ϕ20 | ϕ27 | ϕ32 | ϕ42 | ϕ77 | mm |
| E | Effective area of readout device | | ϕ10 | ϕ17 | ϕ24 | ϕ30 | ϕ40 | ϕ75 | mm |
| F | Maximum height | | 15 | 15 | 15 | 15 | 15 | 17 | mm |
| G | Distance from bottom of substrate to insulator surface | No. of MCPs 1 | 10.9 | | | | | 12.9 | mm |
| | | No. of MCPs 2 | 11.9 | | | | | 14.4 | |
| | | No. of MCPs 3 | 11.9 | | | | | 15.9 | |
| H | Distance from MCP input surface to insulator surface | No. of MCPs 1 | 2.8 | | | | | 3.8 | mm |
| | | No. of MCPs 2 | 3.3 | | | | | 4.3 | |
| | | No. of MCPs 3 | 2.9 | | | | | 4.8 | |

Shape may differ depending on product type number.

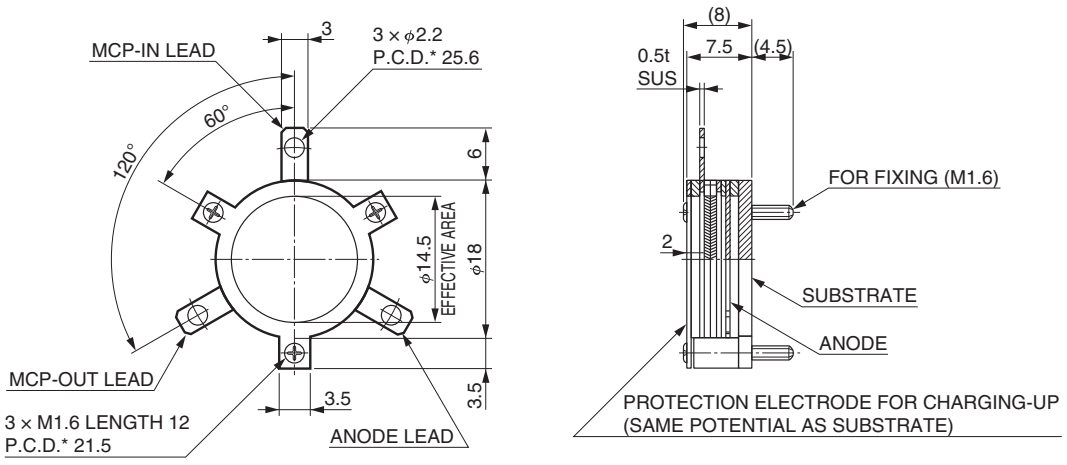
Perform the vacuum baking under 150 °C while keeping the evacuation system at a vacuum pressure below $1.3 \times 10^{-4}$ Pa.

## F4655-14

| Channel diameter (μm) | Number of MCPs | Gain ① (Min.) | Pulse height resolution ① (Max.) (%) | Dark count ① (Max.) ($s^{-1}\cdot cm^{-2}$) | MCP ② supply voltage (kV) | MCP-OUT to anode ② supplu voltage (kV) |
|---|---|---|---|---|---|---|
| 12 | 2 | $5 \times 10^7$ | 50 | 3 | 2.5 | 0.5 |

**NOTE:** ①Supply voltage: 1.0 kV/MCP, vacuum: $1.3 \times 10^{-4}$ Pa, operating ambient temperature: +25 °C
②Vacuum: $1.3 \times 10^{-4}$ Pa

* P.C.D. (Pitch Circle Diameter)




TMCPA0086EC

Perform the vacuum baking under 150 °C while keeping the evacuation system at a vacuum pressure below $1.3 \times 10^{-4}$ Pa.

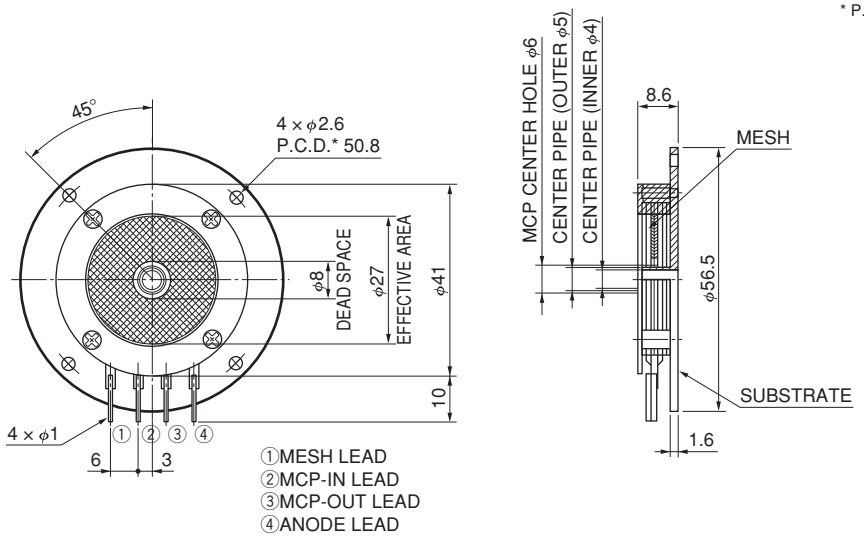
# MCP ASSEMBLY SPECIFICATIONS AND DIMENSIONAL OUTLINES (Unit: mm)

| Type No. | Channel diameter (μm) | Number of MCPs | MCP center dead area (mm) | Gain ① (Min.) | Pulse height ① resolution (Max.) (%) | Dark count ① (Max.) ($s^{-1}\cdot cm^{-2}$) | MCP ② supply voltage (kV) | MCP-OUT to anode ② supplu voltage (kV) |
|---|---|---|---|---|---|---|---|---|
| F2223-21SH | 12 | 2 | $\phi$8 | $1 \times 10^6$ | — | 3 | 2.0 | 0.5 |

**NOTE:** ①Supply voltage: 1.0 kV/MCP, vacuum: $1.3 \times 10^{-4}$ Pa, operating ambient temperature: +25 °C
②Vacuum: $1.3 \times 10^{-4}$ Pa

## F2223-21SH

* P.C.D. (Pitch Circle Diameter)



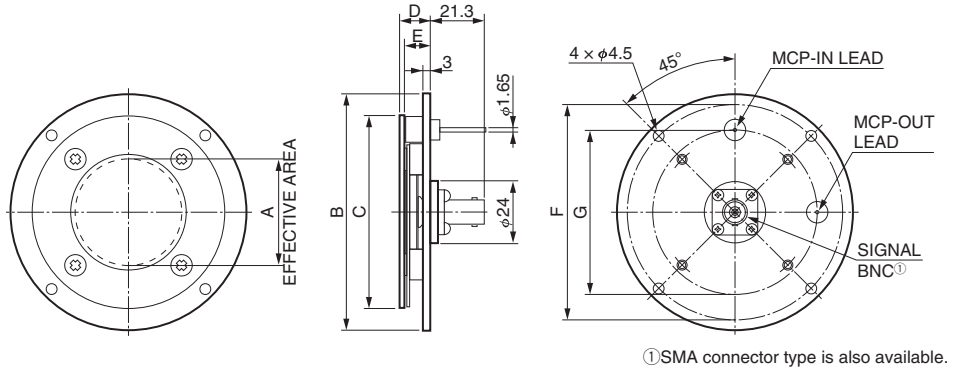

TMCPA0002EI

Perform the vacuum baking under 150 °C while keeping the evacuation system at a vacuum pressure below $1.3 \times 10^{-4}$ Pa.

| Type No. | Channel diameter (μm) | Number of MCPs | Pulse width (FWHM) (ps) | Gain ① (Min.) | Pulse height resolution ① (Max.) (%) | Dark count ① (Max.) ($s^{-1}\cdot cm^{-2}$) | MCP ② supply voltage (kV) | MCP-OUT to anode ② supplu voltage (kV) |
|---|---|---|---|---|---|---|---|---|
| F9890-13 | 12 | 2 | 900 | $1 \times 10^6$ | 150 | 3 | 2.0 | 0.5 |
| F9890-14 | 6 | | | | | | | |
| F9890-31 | 12 | | 450 | | | | | |
| F9890-32 | 6 | | | | | | | |
| F9892-13 | 12 | | 1200 | | | | | |
| F9892-14 | 6 | | | | | | | |
| F9892-31 | 12 | | 700 | | | | | |
| F9892-32 | 6 | | | | | | | |

**NOTE:** ①Supply voltage: 1.0 kV/MCP, vacuum: $1.3 \times 10^{-4}$ Pa, operating ambient temperature: +25 °C
②Vacuum: $1.3 \times 10^{-4}$ Pa

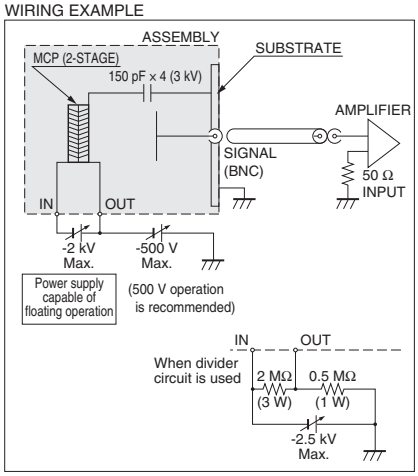
## F9890-13/-14, F9892-13/-14




①SMA connector type is also available.

| | F9890-13 | F9890-14 | F9892-13 | F9892-14 |
|---|---|---|---|---|
| A | φ27 | | φ42 | |
| B | φ81 | | φ92 | |
| C | φ63 | | φ75 | |
| D | 12 | 11.6 | 12 | 11.6 |
| E | 10 | 9.6 | 10 | 9.6 |
| F | φ72 | | φ84 | |
| G | φ52 | | φ64 | |

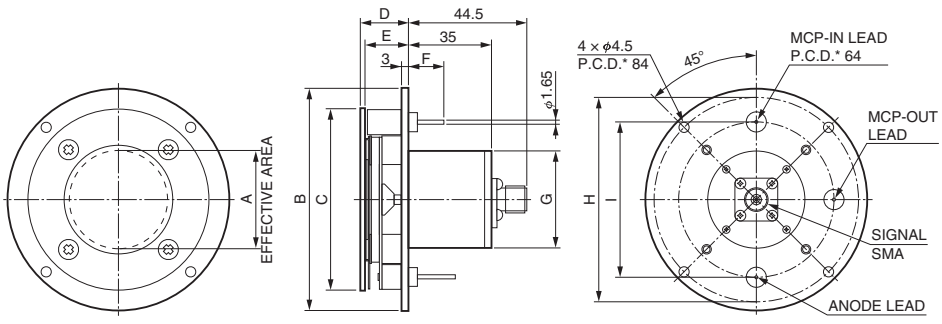
WIRING EXAMPLE




TMCPA0075EC

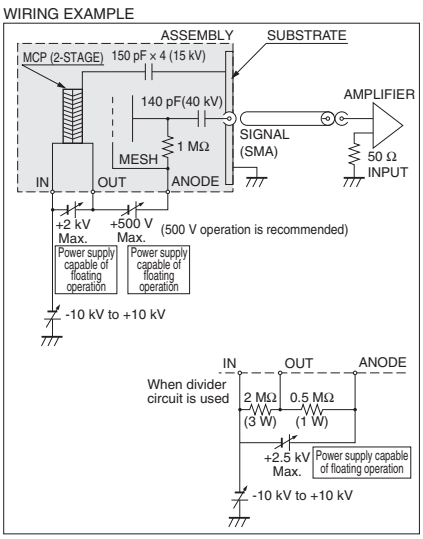
## F9890-31/-32, F9892-31/-32

* P.C.D. (Pitch Circle Diameter)




| | | F9890-31 | F9890-32 | F9892-31 | F9892-32 |
|---|---|---|---|---|---|
| A | | φ27 | | φ42 | |
| B | | φ81 | | φ92 | |
| C | | φ63 | | φ75 | |
| D | | 20.2 | 19.9 | 20.2 | 19.9 |
| E | | 18.2 | 17.9 | 18.2 | 17.9 |
| F | MCP-IN LEAD | 13.5 | 13.9 | 13.5 | 13.9 |
| | MCP-OUT LEAD | 15.2 | | 15.2 | |
| | ANODE LEAD | 19.4 | | 19.4 | |
| G | | φ35 | | φ40 | |
| H | | φ72 | | φ84 | |
| I | | φ52 | | φ64 | |

WIRING EXAMPLE




TMCPA0082EE

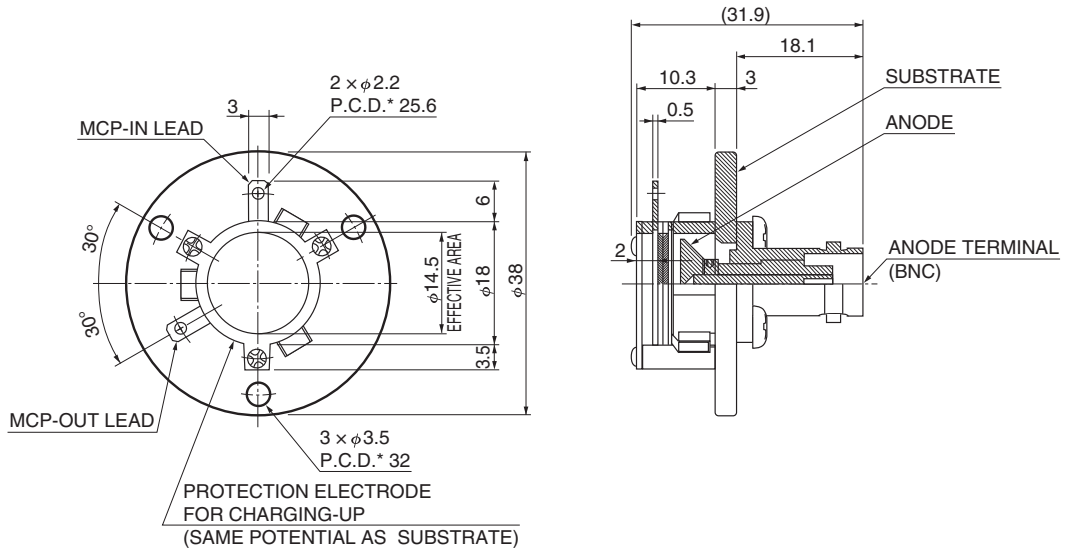
# MCP ASSEMBLY SPECIFICATIONS AND DIMENSIONAL OUTLINES (Unit: mm)

| Type No. | Channel diameter (μm) | Number of MCPs | Pulse width (FWHM) (ps) | Gain ① (Min.) | Pulse height resolution ① (Max.) (%) | Dark count ① (Max.) ($s^{-1}\cdot cm^{-2}$) | MCP ② supply voltage (kV) | MCP-OUT to anode ② supplu voltage (kV) |
|---|---|---|---|---|---|---|---|---|
| F4655-10 | 12 | 2 | 600 | $5 \times 10^7$ | 50 | 3 | 2.5 | 0.5 |
| F4655-11 | | | | | | | | |

**NOTE:** ①Supply voltage: 1.0 kV/MCP, vacuum: $1.3 \pm 10^{-4}$ Pa, operating ambient temperature: +25 °C
②Vacuum: $1.3 \times 10^{-4}$ Pa

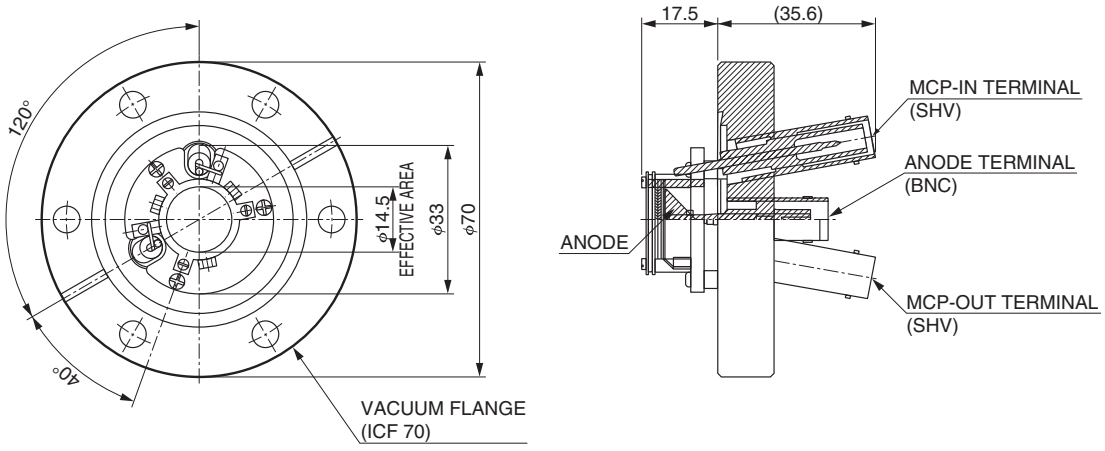
## F4655-10

* P.C.D. (Pitch Circle Diameter)




TMCPA0021EH

## F4655-11

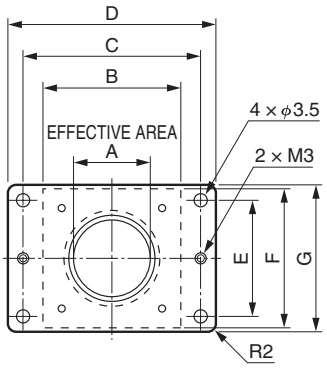


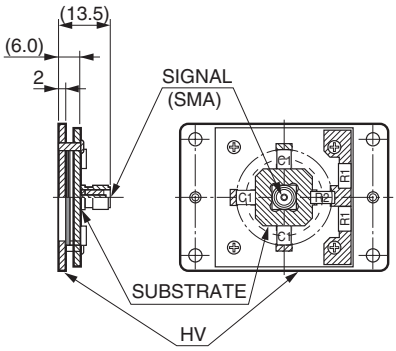

TMCPA0085EC

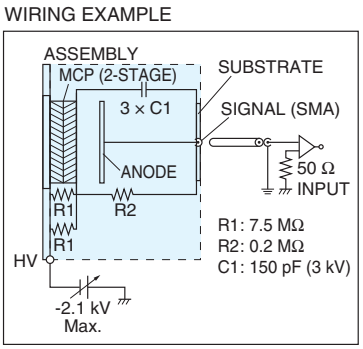
| Type No. | Channel diameter (μm) | Number of MCPs | Pulse width (FWHM) (ps) | Gain (Min.) ① | Pulse height resolution (Max.) (%) ① | Dark count (Max.) ($s^{-1}\cdot cm^{-2}$) ① | MCP supply voltage (kV) ② | MCP-OUT to anode supplu voltage (kV) ② |
|---|---|---|---|---|---|---|---|---|
| F12334-11 | 12 | 2 | 1.5 | $1 \times 10^6$ | — | 3 ③ | — ③ | 0.5 |
| F12395-11 | | | | | | | | |
| F12396-11 | | | | | | | | |
| F13446-11 | | | 1.3 | | | | | |
| F13447-11 | | | | | | | | |

**NOTE:** ①Supply voltage: 1.0 kV/MCP, vacuum: $1.3 \times 10^{-4}$ Pa, operating ambient temperature: +25 °C
②Vacuum: $1.3 \times 10^{-4}$ Pa
③A maximum of -2.1 kV is supplied to the HV electrode, depending on the built-in bleeder resistors.

## F12334-11, F12395-11, F12396-11



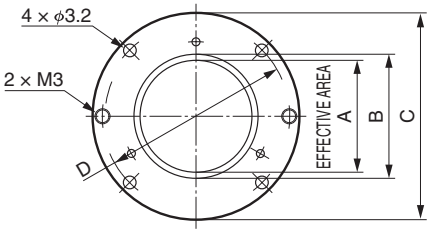



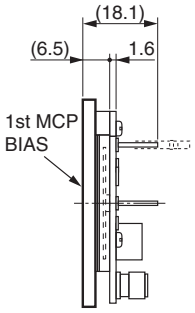



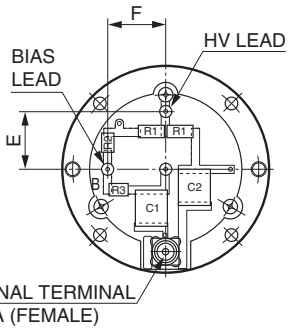

| | F12334-11 | F12395-11 | F12396-11 |
|---|---|---|---|
| A | ϕ20 | ϕ27 | ϕ42 |
| B | 36 | 40 | 51 |
| C | 46 | 51 | 62 |
| D | 54 | 61 | 72 |
| E | 30 | 30 | 40 |
| F | 36 | 40 | 51 |
| G | 38 | 41 | 52 |

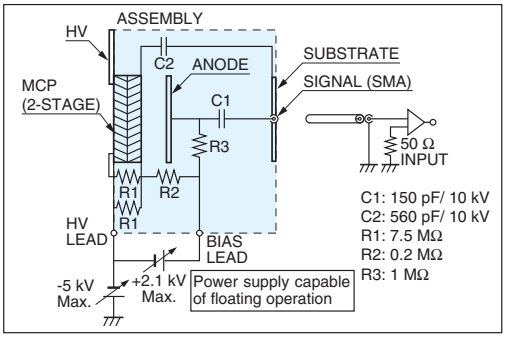
TMCPA0084EE

## F13446-11, F13447-11




| | F13446-11 | F13447-11 |
|---|---|---|
| A | ϕ27 | ϕ42 |
| B | ϕ30 | ϕ46 |
| C | ϕ50 | ϕ70 |
| D | ϕ45 | ϕ65 |
| E | 14 | 16 |
| F | 14 | 18 |

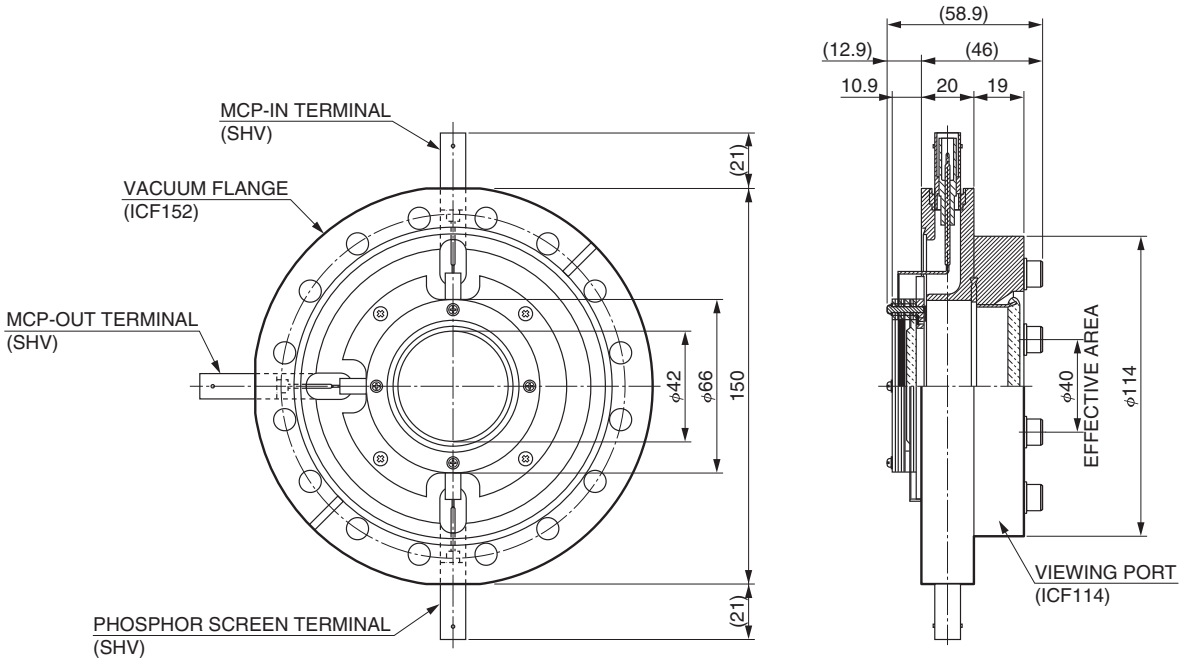
TMCPA0087ED

# MCP ASSEMBLY SPECIFICATIONS AND DIMENSIONAL OUTLINES (Unit: mm)

| Type No. | Channel diameter (μm) | Number of MCPs | Gain ① (Min.) | Pulse height resolution ① (Max.) (%) | Dark count ① (Max.) ($s^{-1} \cdot cm^{-2}$) | MCP ② supply voltage (kV) | MCP-OUT to anode ② supplu voltage (kV) |
|---|---|---|---|---|---|---|---|
| F2225-21PGF | 12 | 2 | $1 \times 10^6$ | — | 3 | 2.0 | 4.0 |
| F6959 | | | | | | | 3.0 |

**NOTE:** ①Supply voltage: 1.0 kV/MCP, vacuum: $1.3 \times 10^{-4}$ Pa, operating ambient temperature: +25 °C
②Vacuum: $1.3 \times 10^{-4}$ Pa

## F2225-21PGF

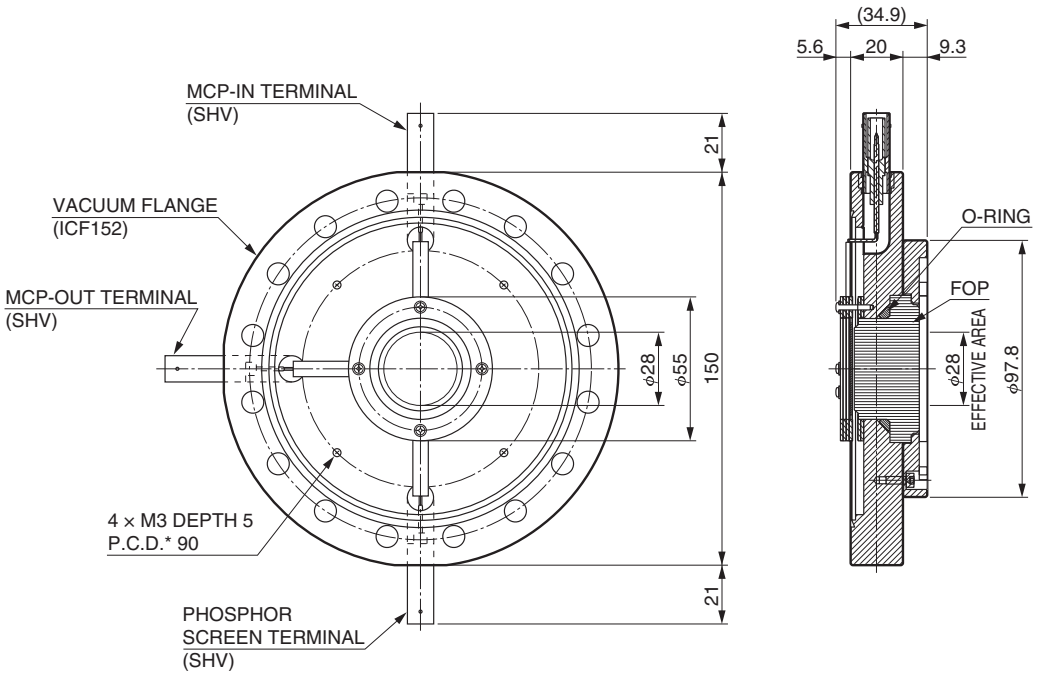



TMCPA0081EE

Perform the vacuum baking under 150 °C while keeping the evacuation system at a vacuum pressure below $1.3 \times 10^{-4}$ Pa.

## F6959

* P.C.D. (Pitch Circle Diameter)

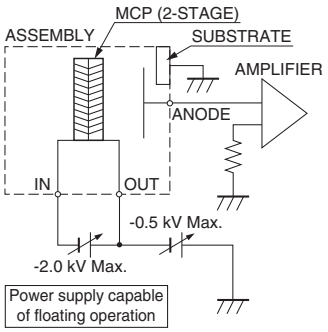


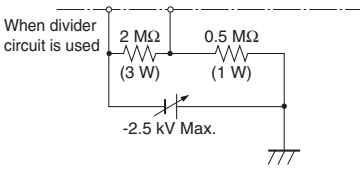

TMCPA0038EH

# MCP ASSEMBLY WIRING EXAMPLE

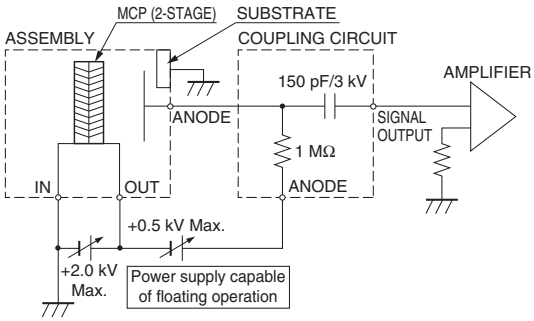
## Signal measurement (electrical signal output)

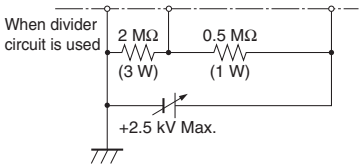
### Positive ion detection: Anode grounded



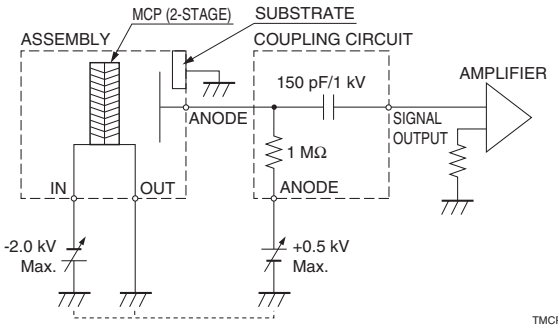




### Electron or negative ion detection: Anode floating (MCP-IN: GND)



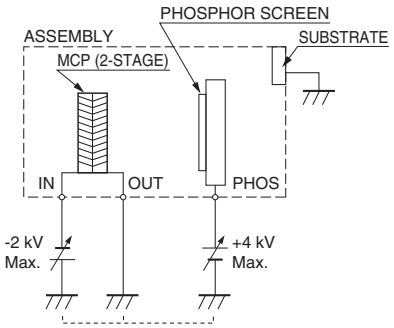

### Positive ion detection: Anode floating (MCP-OUT: GND)



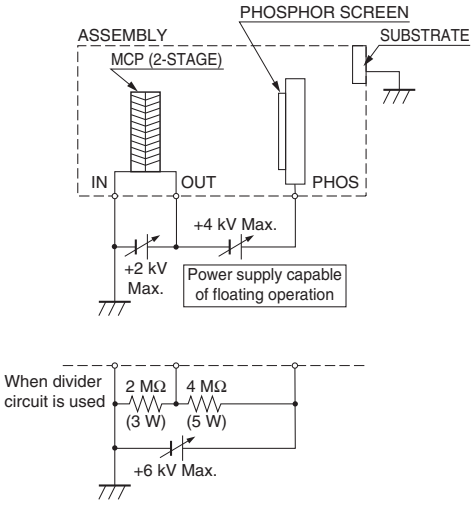

TMCPC0005JI

## Two-dimensional detection (visible light output)

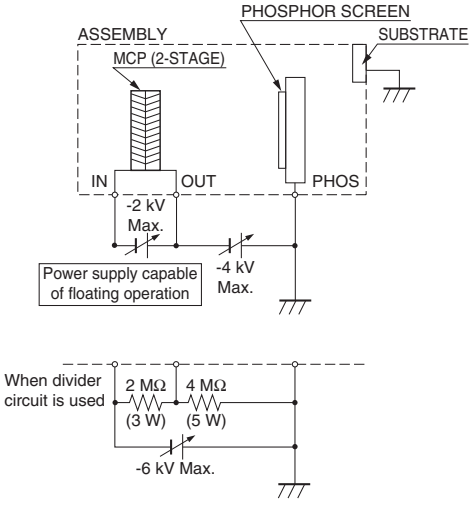
### Positive ion detection (MCP-OUT: GND)




### Electron or positive ion detection (MCP-IN: GND)




### Positive ion detection (Phosphor screen: GND)




TMCPC0007JF

Using multiple high-voltage power supplies has an advantage that the MCP gain can be independently adjusted.
Using the divider circuit with a single high-voltage power supply offers low cost, but there is a disadvantage that the MCP gain varies as the power supply voltage varies.
There can be some exceptions.

## HOW TO HANDLE

**1. STORAGE**

MCP and MCP assembly are shipped in packages that are evacuated to a vacuum or filled with dry nitrogen. These packages are intended for use during shipping and not suited for long-term storage. When storing the MCP and MCP assemblies, take them out of their packages and keep them in a clean case under either a) or b) of the following conditions.

a) At vacuum pressure below 13 Pa and no oil diffusion.

b) Under gentle constant flow of dry nitrogen passed through a 0.45 µm or smaller filter (humidity: 20 % or less).

**2. HANDLING**

Avoid touching the MCP and the MCP assembly with bare hand. If handled with bare hand, these might be contaminated by oil and salt from it causing an increase in dark current, a loss of gain and an electrical discharge.

When handling them, always wear clean vinyl or polyethylene gloves. Even when you wear gloves, never touch the effective area of the MCP and the MCP assembly.

**3. ENVIRONMENTS**

The MCP surface is processed to be electrically active and the components used for the assembly are also processed for high vacuum use. So as much as possible, handle them in an environment conforming to clean-room (dust-proof room) specifications where oily vapor, moisture and dust are minimized.

If dusts or debris get on the MCP surface, blow them off with dry clean air or nitrogen gas. When doing this, check the pressure and surrounding area so as not to blow other dust into the air. Never use your own breath to blow off the dust from the MCP surface.

**4. DEGASSING BEFORE USE**

Gas adsorption usually occurs on the surface of an MCP which has not yet been used after delivery or has been stored after use. The MCP must be evacuated in a high vacuum below $1.3 \times 10^{-4}$ Pa for more than 24 hours to perform degassing before using it (before supplying a voltage).

**5. VACUUM BAKING**

Vacuum baking is effective in degassing when the MCP or the MCP assembly is to be used in a high vacuum.

Perform the vacuum baking under 150 °C while keeping the vacuum pressure below $1.3 \times 10^{-4}$ Pa.

Vacuum baking cannot be performed on some types of MCP assembly. Please consult us for details.

**6. SUPPLY VOLTAGE**

Always maintain the MCP and the MCP assembly high vacuum condition below $1.3 \times 10^{-4}$ Pa in operation. (1 Pa or less for the F14844 series)

When supplying a voltage to the MCP or MCP assembly and to the output signal readout device (anode, phosphor screen), slowly increase it at every 100 V step (approx. 5 seconds per 100 V).

**7. MEASUREMENT OF MCP RESISTANCE**

Because MCP is made of lead glass, the resistance of MCP cannot be measured correctly if placed in the atmosphere due to the humidity. The resistance can be measured correctly only when the MCP is placed in a vacuum and its electrodes are securely in contact with the measuring device. The MCP resistance has a negative temperature characteristics (resistance deceases as temperature increases), so it may take several minutes for the resistance value to become stable.

## WARRANTY

This product is warranted for one year after delivery. If you find any failure or defect in the workmanship and notify us within this warranty period, we will repair or replace it free of charge. The warranty is limited to replacement of the defective product.

Even if within the warranty period, this warranty shall not apply to failures or damages that were caused by the product reaching the end of its service life, incorrect operation, or accidents such as natural or man-made disasters.

## DISPOSAL METHOD

The materials in these products contain lead and its compound. Please follow the applicable regulations regarding disposal of hazardous materials and industrial wastes in your country, state, region or province.



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