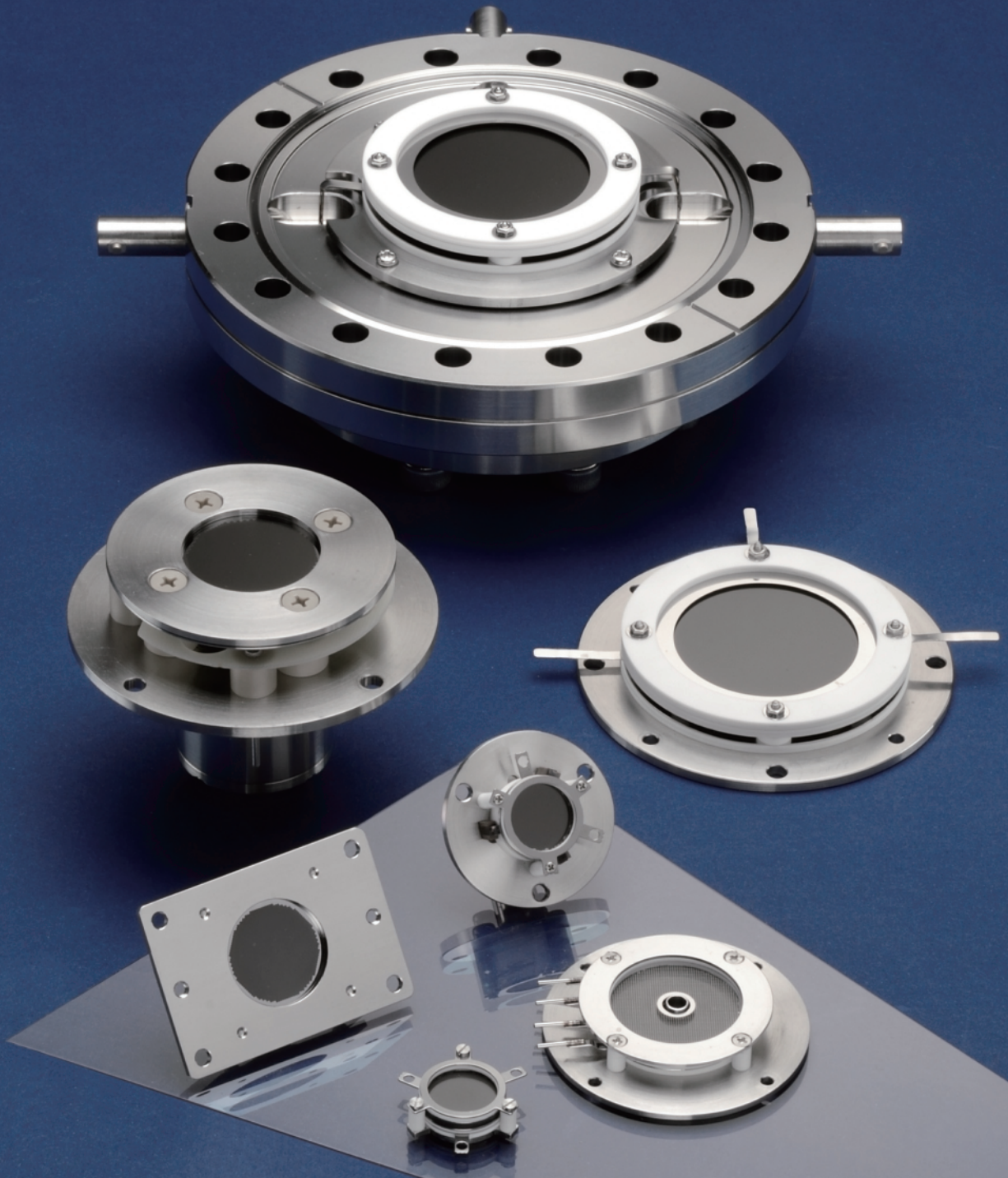


HAMAMATSU

PHOTON IS OUR BUSINESS

MCP (MICROCHANNEL PLATE) AND MCP ASSEMBLY



HAMAMATSU PHOTONICS K.K.

OVERVIEW

MCP (microchannel plate) 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. Circular and rectangular MCPs are available in various dimensions, including easy-to-use MCP assemblies with pre-mounted electrode leads and supports. 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 three different readout devices to meet application needs. The devices are of: (1) single anode (electrical output signal measurement within effective area), (2) multianode (electrical output signal measurement corresponding to signal input positions), and (3) phosphor screen (optical imaging of output signal). Select the output device that best matches 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 strikes 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 strike 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

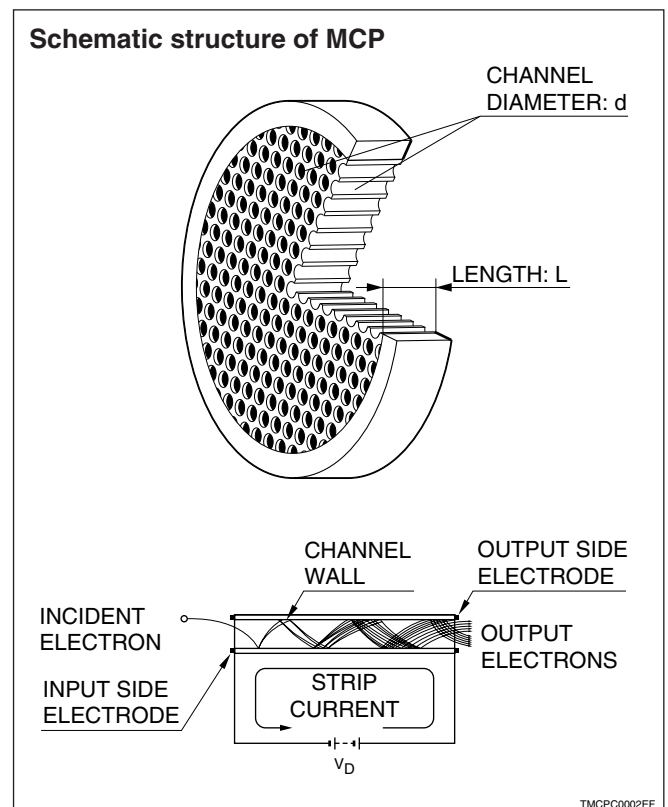
The thickness of an MCP is nearly equal to the channel length. The ratio of the channel length (L) to the channel diameter (d) is referred to as α ($\alpha=L/d$), and this α and the secondary emission factor inherent to the channel wall material determine the gain of the MCP. Standard MCPs are fabricated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

■ Open Area Ratio: OAR

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

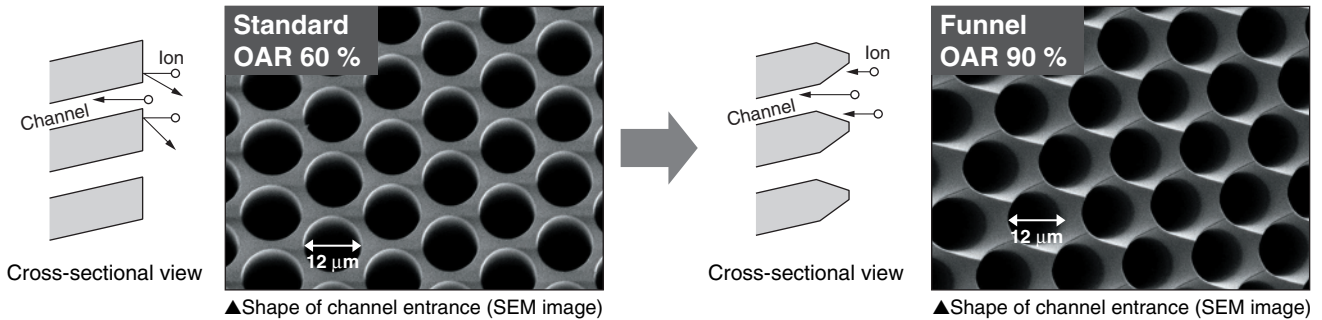
■ Bias angle

The bias angle is an angle formed by the channel axis and the axis perpendicular to the plate surface. This 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. The optimum value is usually from 5° to 15° .



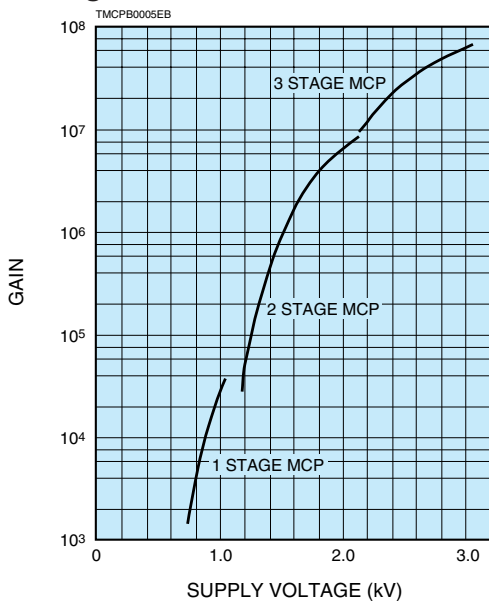
LARGE OAR: FUNNEL TYPE (OPTION)

The open area ratio (OAR) of standard MCPs is normally set to 60 %, but we also provide "funnel type" MCPs whose open area ratio is improved up to 90 % in order to guide more signals into each channel. Please contact us if you are interested in funnel type MCPs.

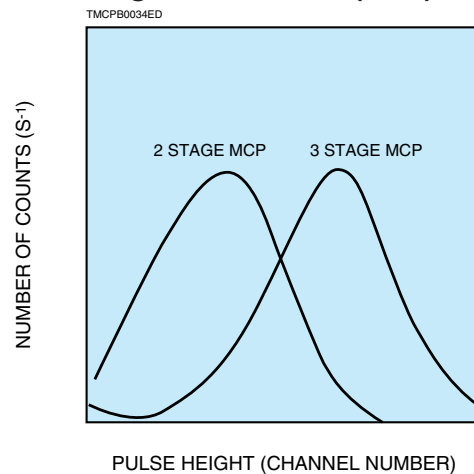


CHARACTERISTICS

MCP gain characteristics

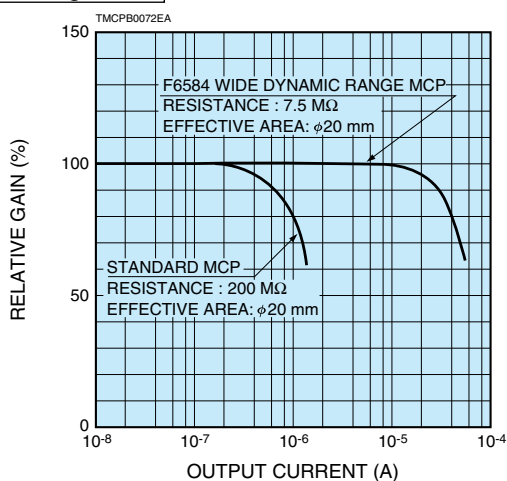


Pulse height distribution (PHD)

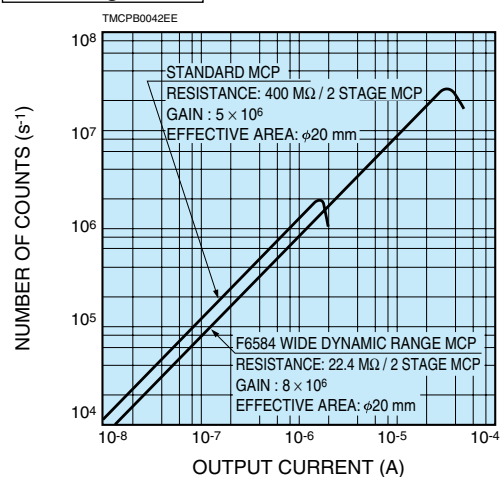


MCP saturation characteristics (output linearity)

Analog mode

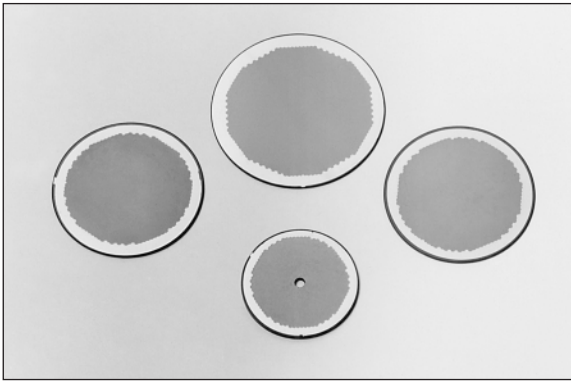


Counting mode

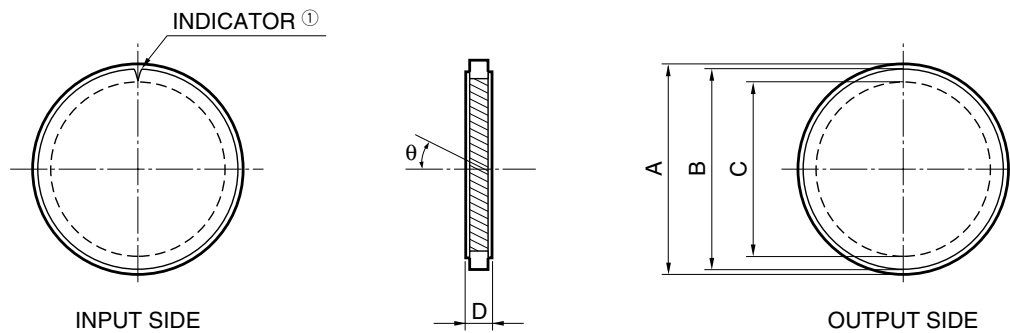


MCP SPECIFICATIONS AND DIMENSIONAL OUTLINES

Circular MCP



MCPF0006



TMCPA0056EA

| Parameter | Type | F1551 | | | | F1094 | | | F1552 | | | F1208-01 | F1217 | | F1942-04 | F2395-04 | Unit |
|--|------|-----------------------------------|-----------|-------------------|-----------|------------------|-------------------|-----------|------------------|-------------------|-----------|-----------------|------------------|---------|-----------|----------|--------------------|
| | | -01 ^⑤ | -06 | -011 | -074 | -01 ^⑤ | -011 | -074 | -01 ^⑤ | -011 | -074 | | -01 ^⑤ | -011 | | | |
| Outer size A | | φ17.9 | | | | φ24.8 | | | φ32.8 | | | φ38.4 | φ49.9 | | φ86.7 | φ113.9 | mm |
| Electrode area B | | φ17 | | | | φ23.9 | | | φ31.8 | | | φ36.5 | φ49 | | φ84.7 | φ112 | mm |
| Effective area C | | φ14.5 | | | | φ20 | | | φ27 | | | φ32 | φ42 | | φ77 | φ105 | mm |
| Thickness D | | 0.48 | 0.2 | 0.48 | 0.3 | 0.48 | 0.3 | 0.48 | 0.3 | 0.48 | 0.48 | 1 | | | | mm | |
| Channel diameter | | 12 | 4 | 12 | 6 | 12 | 6 | 12 | 6 | 12 | 12 | 25 | | | | μm | |
| Channel pitch | | 15 | 5 | 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 | | degrees |
| Open area ratio | | 60 | 55 | 60 | | | | | | | | | | | | | % |
| Electrode material | | Inconel | | | | | | | | | | | | | | | — |
| Gain (Min.) ^③ | | 10 ⁴ | | 5×10 ³ | | 10 ⁴ | 5×10 ³ | | 10 ⁴ | 5×10 ³ | | 10 ⁴ | | | | — | |
| Resistance ^③ | | 100 to 700 | 10 to 100 | 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 100 | 10 to 200 | 4 to 20 | 10 to 100 | 5 to 50 | MΩ |
| Dark current (Max.) ^③ | | 0.5 | | | | | | | | | | | | | | | pA·cm ² |
| Maximum linear output ^③ | | 7 % of strip current ^② | | | | | | | | | | | | | | | — |
| Supply voltage ^④ | | 1.0 | | | | | | | | | | | | | | | kV |
| Operating ambient temperature ^④ | | -50 to +70 | | | | | | | | | | | | | | | °C |

NOTE: ① Indicates MCP input side. Shape varies depending on product type.

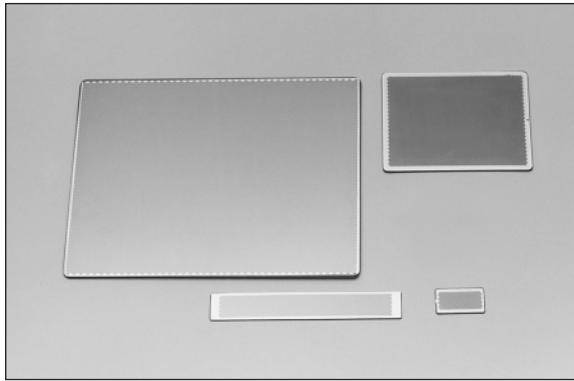
② Strip current is the current that flows through channel walls when a voltage is applied between MCP IN and OUT. It is given by dividing the applied voltage by the MCP resistance.

③ Supply voltage: 1.0 kV, vacuum: 1.3×10⁻⁴ Pa, operating ambient temperature: +25 °C

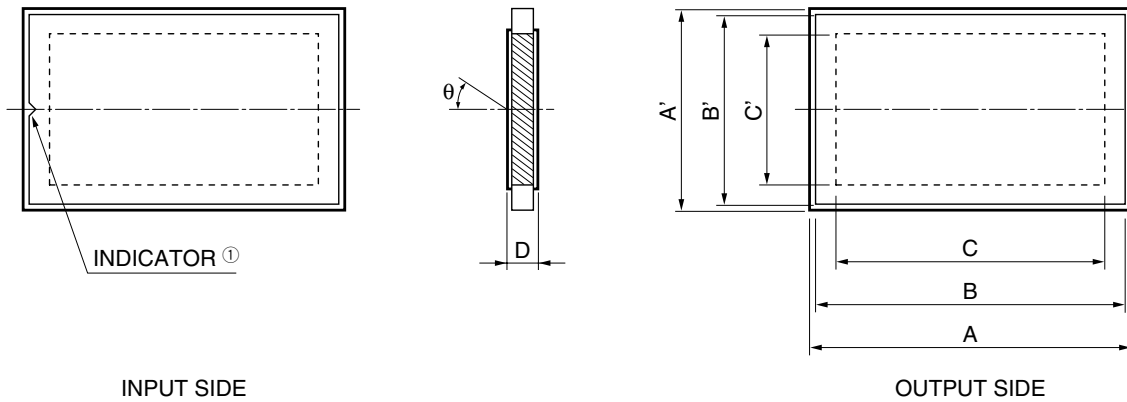
④ Vacuum: 1.3×10⁻⁴ Pa

⑤ The F1551-01, F1094-01, F1552-01, F1208-01 and F1217-01 are also available with a center through-hole (6 mm diameter).

Rectangular MCP



MCPF0011



TMCPA0057EA

| Parameter | Type | F2370-01 | F4772-01 | F2806-01 | F1943-02 | F2805-03 | F2396-04 | Unit |
|--|------|-----------------------------------|-----------|-----------|-----------|-----------|-----------|---------------------|
| Outer size A×A' | | 15.9×9.4 | 61.9×13.9 | 49.9×39.9 | 87.9×37.9 | 59.9×59.9 | 96.9×78.9 | mm |
| Electrode size B×B' | | 15×8.5 | 61×13 | 49×39 | 87×37 | 58×58 | 95.6×77.3 | mm |
| Effective area C×C' | | 13×6.5 | 55×8 | 45×35 | 81×31 | 53×53 | 90×72 | mm |
| Thickness D | | 0.48 | | | 0.60 | 0.80 | 1.00 | mm |
| Channel diameter | | 12 | | | 15 | 20 | 25 | μm |
| Channel pitch | | 15 | | | 19 | 25 | 31 | μm |
| Bias angle θ | | 8 | | | | | | degrees |
| Open area ratio | | 60 | | | | | | % |
| Electrode material | | Inconel | | | | | | — |
| Gain (Min.) ^③ | | 10 ⁴ | | | | | | — |
| Resistance ^③ | | 100 to 500 | 20 to 200 | | | 20 to 120 | 10 to 50 | MΩ |
| Dark current (Max.) ^③ | | 0.5 | | | | | | pA·cm ⁻² |
| Maximum linear output ^③ | | 7 % of strip current ^② | | | | | | — |
| Supply voltage ^④ | | 1.0 | | | | | | kV |
| Operating ambient temperature ^④ | | -50 to +70 | | | | | | °C |

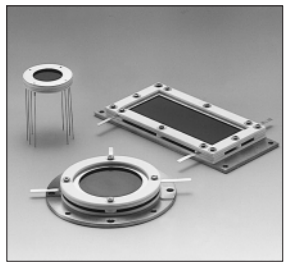
MCP ASSEMBLY SELECTION GUIDE BY PURPOSE

Target object

- Electron →
- +/- Ion →
- VUV →
- X-ray →

Signal Amount Measurement

Measures the signal amount



MCPF0081

TOF (Time of Flight) Detection

Measures the difference in the arrival time



MCPF0088

Demountable

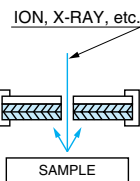
Up to 3 MCPs can be added according to level of X-rays or electrons to be detected. The screw mount allows easy replacement of the MCP and readout device.



Standard

Circular and rectangular types are provided. The circular type also includes an even smaller device.

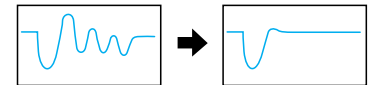
Center hole



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.

Fast response

OUTPUT WAVEFORM



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

Circular

Rectangular

Compact

Standard

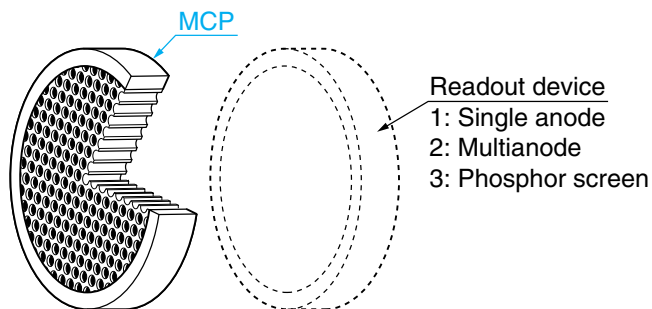
Fast time response

Anode ground

Floating

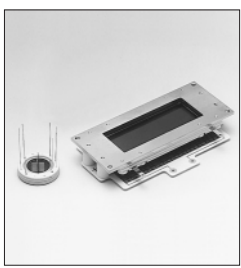
Compact

Compact and 4 μm MCP



Position Detection

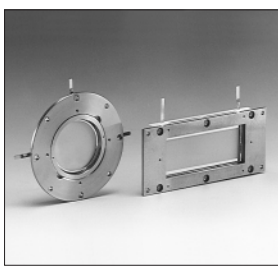
Measures the signal amount and position distribution



MCPF0077

Image Readout

Captures a signal distribution as an image



MCPF0082

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.

Non-dismountable

This type is compact, light in weight and economical. Unlike the demountable type, however, the assembled MCP cannot be replaced.

Multianode

Features

- Wide room for choice of readout patterns in one dimension (1xn) or two dimensions (axn)
- Simultaneous counting (parallel counting)
- High counting efficiency
- Anode pitch: 3 mm or more

Phosphor screen output

The phosphor screen coated on the glass plate converts the output charge distribution from the MCP into a visible image. A resolution of 40 μm to 50 μm can be obtained with a one-stage MCP, and that of 80 μm to 100 μm can be done with a two-stage MCP. Select the desired phosphor screen among three types of P43, P46 and P47. (See page 9 for detailed specifications.)

Fast response

Non-dismountable

Non-dismountable

Circular

Rectangular

Circular

Rectangular

Vacuum flange

P.15

P.8

P.8

P.9

P.10

P.9

P.10

P.16

MCP ASSEMBLY SELECTION GUIDE BY APPLICATIONS

Major applications of MCP assemblies include "mass spectroscopy", "semiconductor inspection" and "surface analysis". The table below gives you a quick reference for selecting the best MCP assembly in these major application fields. This table shows only typical applications. Feel free to contact our sales office in your area if you do not find your specific application here.

⊙: Best suited ○: Applicable

| Detection method | Field | Mass spectroscopy | | | | | | | | | | Semiconductor inspection | | | | | Surface analysis | | | | | | | | | |
|---------------------------------|---|---|---|-------------------------------------|---|--|---|--|------------------------------------|-------------------------------|---------------------------------------|----------------------------------|--------------|------------|-----------------------------------|-----------------------------------|--|--|-------------------------------|-------------------------------|---|--|----------------------------|--|-----------------------------|-------------------|
| | MCP assembly | Time-of-flight mass spectroscopy (TOF-MS) (MALDI) | Time-of-flight mass spectroscopy (TOF-MS) (LC-MS) | Quadrupole mass spectroscopy (Q-MS) | Double focusing mass spectroscopy (Sector-MS) | Gas or liquid chromatographic mass spectroscopy (GC/LC-MS) | Inductive-coupled plasma mass spectroscopy (ICP-MS) | Secondary ion mass spectroscopy (SIMS) | Scanning electron microscope (SEM) | Scanning ion microscope (SIM) | Electron beam measuring system (EBMS) | Electron or ion beam lithography | Mask aligner | FIB system | Auger electron spectroscopy (AES) | Ion scattering spectroscopy (ISS) | Electron spectroscopy for chemical analysis (ESCA) | Rutherford backscattering spectroscopy (RBS) | Vacuum UV spectroscopy (VUVS) | Soft X-ray spectroscopy (SXS) | Reflection medium energy electron diffraction (RMEED) | Low energy electron diffraction (LEED) | Field ion microscope (FIM) | Transmission electron microscope (TEM) | Soft X-ray microscope (SXM) | Positron detector |
| Total amount measurement, TOF | Demountable, circular MCP assembly (single anode) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | ○ | ○ | | | | | | | | | | | |
| | Demountable, rectangular MCP assembly (single anode) | ○ | ○ | ○ | ○ | | | | | | | | | ○ | ○ | | | | | | | | | | | |
| | Non-demountable, circular MCP assembly (single anode) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | ○ | ○ | | | | | | | | | | |
| | F2223-21SH | ○ | ○ | | | | | | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | | ○ | | | | | | | | |
| | F4294-09 | ⊙ | ⊙ | | | | | | | ⊙ | ⊙ | | | ⊙ | ⊙ | ⊙ | | | | | | | | | | |
| | F4655/-14 | | | | | | | | | | | | | | ○ | ○ | | | | | | | | | | |
| | F4655-10/-11 | ○ | ○ | ⊙ | ○ | ○ | ⊙ | ○ | | | | | | | ○ | ○ | | | | | | | | | | |
| | F4655-13 | ⊙ | ⊙ | ○ | ○ | | | ○ | | | | | | | ○ | ○ | | | | | | | | | | |
| | F9890-31/-32, F9892-31/-32 | ○ | ⊙ | ⊙ | ○ | ⊙ | ⊙ | ○ | | | | | | | ○ | ○ | | | | | | | | | | |
| | F9890-13/-14, F9892-13/-14 | ⊙ | ○ | ⊙ | ○ | ○ | ○ | ○ | | | | | | | ○ | ○ | | | | | | | | | | |
| F12334-11, F12395-11, F12396-11 | ⊙ | ○ | ⊙ | ○ | ○ | ○ | ○ | | | | | | | ○ | ○ | | | | | | | | | | | |
| Position detection | Demountable, circular MCP assembly (multi-anode) | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | | ⊙ | | ○ | ○ | | | | | | | |
| | Demountable, rectangular MCP assembly (multi-anode) | ○ | ○ | | ○ | | | ○ | | | | | | | | ⊙ | | ○ | ○ | | | | | | | |
| | Non-demountable, circular MCP assembly (multi-anode) | | | | ○ | | | ○ | | | | | | | | ⊙ | | ○ | ○ | | | | | | | |
| Image readout | Demountable, circular MCP assembly (phosphor screen) | | | | ○ | | ○ | | | | | | | | | | | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | ○ | ○ | ○ | |
| | Demountable, rectangular MCP assembly (phosphor screen) | | | | | | | | | | | | | | | | | ⊙ | ⊙ | ○ | ○ | ⊙ | ○ | ○ | ○ | |
| | F2225-21PGF | | | | | | | | | | | | | | | | | ⊙ | ⊙ | ○ | ○ | ⊙ | ○ | ○ | ○ | |
| | F6959 | | | | | | | | | | | | | | | | | ⊙ | ⊙ | ○ | ○ | ○ | ○ | ○ | ○ | |

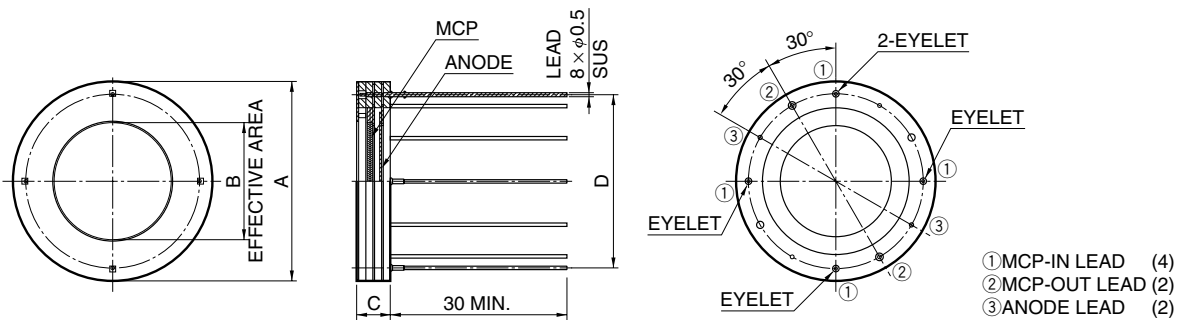
MCP ASSEMBLY SPECIFICATIONS AND DIMENSIONAL OUTLINES (Unit: mm)

| Type No. | Channel diameter (μm) | Number of MCPs | Gain (Min.) ^① | Puls height resolution (Max.) (%) ^① | Dark count (Max.) (s ⁻¹ ·cm ⁻²) ^① | MCP supply voltage (kV) ^② | MCP-OUT to anode supply voltage (kV) ^② |
|----------|-----------------------|----------------|-----------------------------------|--|---|--|---|
| F1551 | 12 | 1 to 3 | 1 stage MCP : 1 × 10 ⁴ | 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 Multianode: 0.5 |
| F1094 | | | 2 stage MCP : 1 × 10 ⁶ | | | | |
| F1552 | | | 3 stage MCP : 1 × 10 ⁷ | | | | |
| F1208 | | | | | | | |
| F1217 | | | | | | | |

NOTE: ① Supply voltage: 1.0 kV/MCP, vacuum: 1.3×10⁻⁴ Pa, operating ambient temperature: +25 °C
② Vacuum: 1.3×10⁻⁴ Pa

Circular (Non-demountable)

Perform the vacuum baking under 150 °C while keeping the exhaust system at a vacuum pressure below 1.3 × 10⁻⁴ Pa.



TMCPA0027EF

| Anode type | Number of MCPs |
|------------------------|----------------|
| Without readout device | 1 to 3 |
| Single anode | |
| Multianode | |

Phosphor output type are not available.

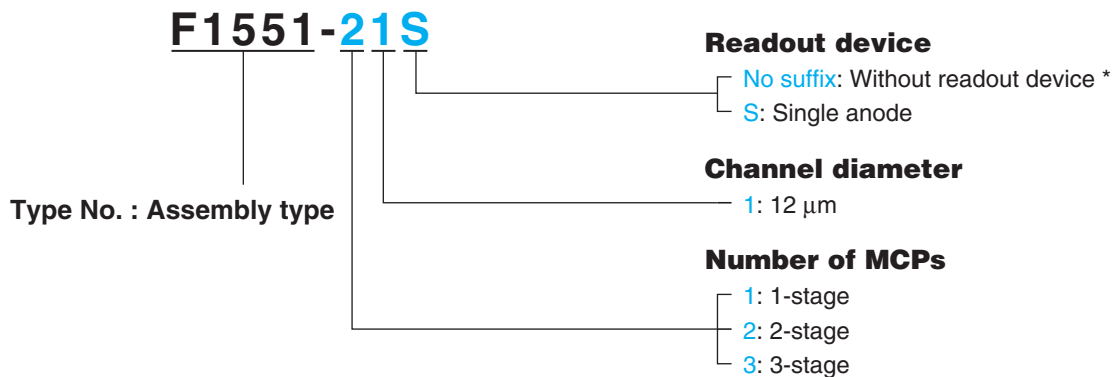
| Symbol | Description | F1551 | F1094 | F1552 | F1208 | F1217 | Unit |
|--------|---------------------|-------------|-------|-------|-------|-------|------|
| A | Assembly outer size | φ27 | φ34 | φ42 | φ49 | φ62 | mm |
| B | Effective area | φ14.5 | φ20 | φ27 | φ32 | φ42 | mm |
| C | Assembly height | No. of MCPs | 1 | 4.5 | | | mm |
| | | | 2 | 5.7 | | | |
| | | | 3 | 5.7 | | | |
| D | Lead pin circle | φ22.5 | φ29.5 | φ37.5 | φ44 | φ56 | mm |

* Multianode types have different dimensions.
Types with no anode are also available.

TYPE NUMBER DESIGNATION FOR NON-DEMOUNTABLE TYPE

The following ordering information applies only to circular MCP assemblies (non-demountable type). When ordering other MCPs (non-assembled MCPs) and MCP assemblies, use their type numbers as listed.

* When the customer prepares a read-out device, we supply MCP assemblies without readout devices.



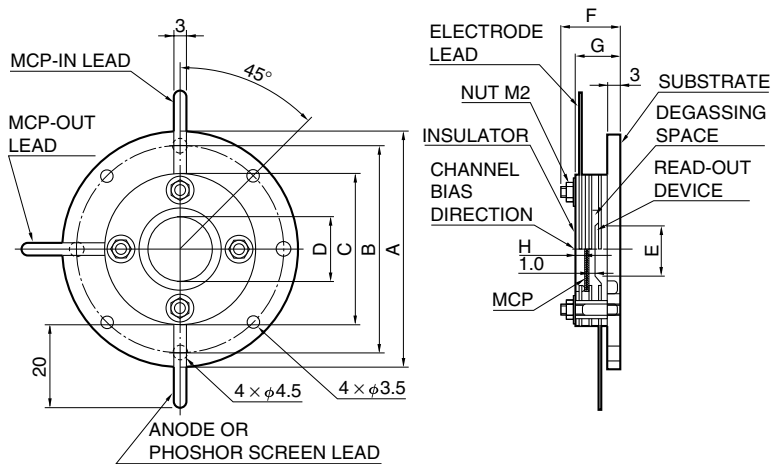
MCP ASSEMBLY SPECIFICATIONS AND DIMENSIONAL OUTLINES (Unit: mm)

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

NOTE: ① Supply voltage: 1.0 kV/MCP, vacuum: 1.3×10⁻⁴ Pa, operating ambient temperature: +25 °C
② Vacuum: 1.3×10⁻⁴ Pa

Circular (Demountable)

Perform the vacuum baking under 150 °C while keeping the exhaust system at a vacuum pressure below 1.3 × 10⁻⁴ Pa.



| Anode type | Number of MCPs |
|------------------------|----------------|
| Without readout device | 1 to 3 |
| Single anode | |
| Multianode | |
| 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. 1 | 10.9 | | | | 12.9 | mm |
| | | No. 2 | 11.9 | | | | 14.4 | |
| H | Distance from MCP input surface to insulator surface | MCPs 3 | 11.9 | | | | 15.9 | mm |
| | | No. 1 | 2.8 | | | | 3.8 | |
| | | No. 2 | 3.3 | | | | 4.3 | |
| MCPs 3 | | No. 1 | 2.9 | | | | 4.8 | mm |
| | | No. 2 | | | | | | |

Shape may differ depending on product type number.

PHOSPHOR SCREEN

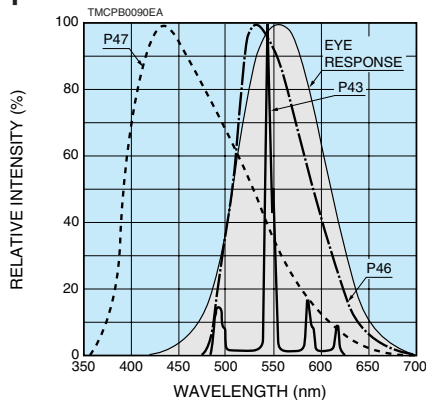
Select the desired phosphor screen by taking into account the decay time according to the readout method and application, and the emission wavelength according to the readout device sensitivity.

| Phosphor screen type | Peak emission wavelength (nm) | Emission color | Relative energy efficiency ^① | 10 % decay time | Remarks |
|----------------------|-------------------------------|-----------------|---|-------------------------------|------------------|
| P43 | 545 | Yellowish green | 1 | 1 ms | Standard type |
| P46 | 510 | Yellowish green | 0.3 | 0.2 μs to 0.4 μs ^② | Short decay |
| P47 | 430 | Purplish blue | 0.3 | 0.11 μs | Very short decay |

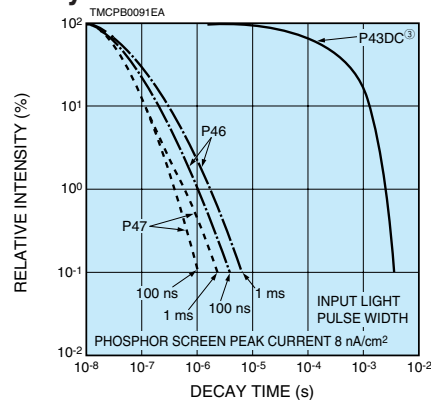
NOTE: ① Supply voltage: 6 kV. Value relative to P43 which is specified as 1.

② Varies depending on the input pulse width.

■ Spectral emission characteristics



■ Decay characteristics



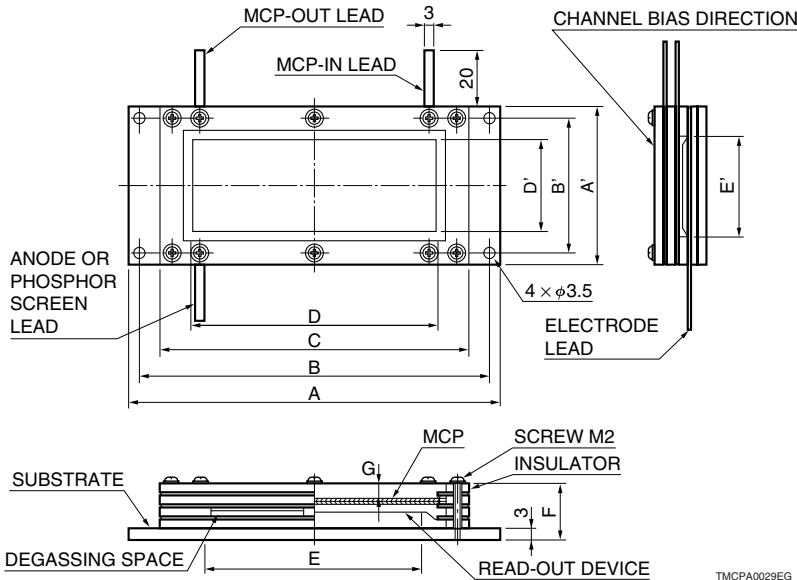
③ Decay characteristics after removal of continuous light input

| Type No. | Channel diameter (μm) | Number of MCPs | Gain (Min.) ^① | Puls height resolution (Max.) (%) ^① | Dark count (Max.) (s ⁻¹ ·cm ⁻²) ^① | MCP supply voltage (kV) ^② | MCP-OUT to anode Supply voltage (kV) ^② |
|----------|-----------------------|-----------------------------|-----------------------------------|--|---|--|--|
| F2813 | 15 | Refer to "Anode type" below | 1 stage MCP : 1 × 10 ⁴ | 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 Multianode: 0.5 Phosphor screen : 3.0 to 4.0 |
| F2814 | 20 | | 2 stage MCP : 1 × 10 ⁶ | | | | |
| F3490 | 12 | | 3 stage MCP : 1 × 10 ⁷ | | | | |

NOTE: ①Supply voltage: 1.0 kV/MCP, vacuum: 1.3×10⁻⁴ Pa, operating ambient temperature: +25 °C
②Vacuum: 1.3×10⁻⁴ Pa

Rectangular (Demountable)

Perform the vacuum baking under 150 °C while keeping the exhaust system at a vacuum pressure below 1.3 × 10⁻⁴ Pa.



| Anode type | Number of MCPs |
|------------------------|----------------|
| Without readout device | 1 to 3 |
| Single anode | |
| Multianode | |
| Phosphor screen | 1 to 2 |

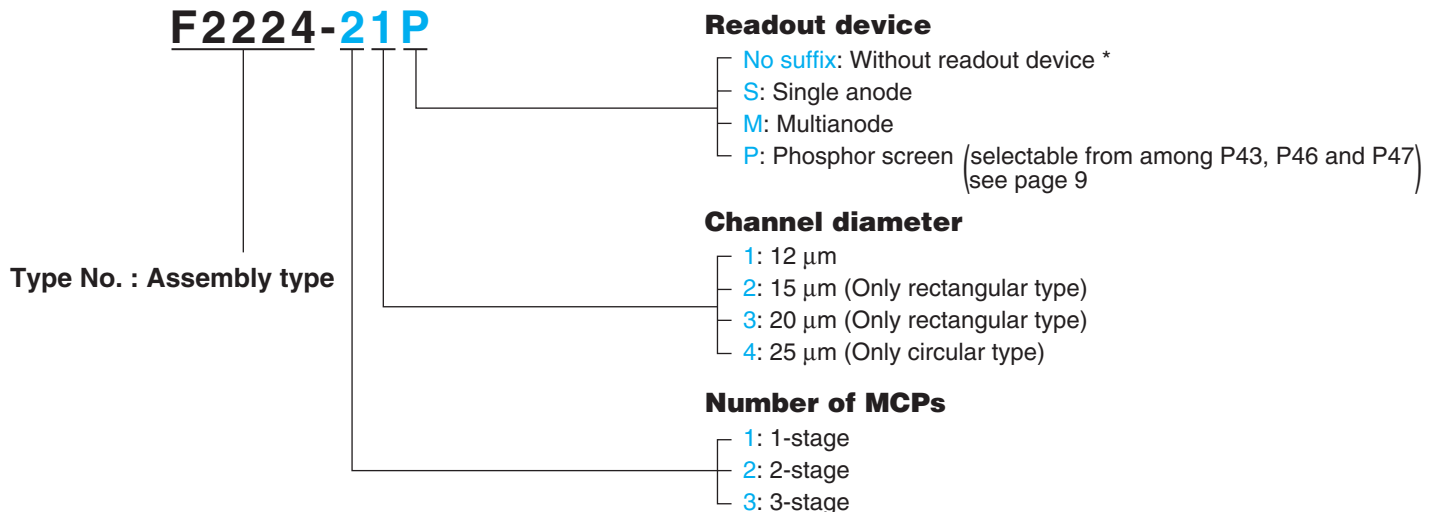
| Symbol | Description | F2813 | F2814 | F3490 | Unit | |
|--------|--|--------|-------|---------|------|----|
| A×A' | Assembly outer size | 128×54 | 96×76 | 78×29.5 | mm | |
| B×B' | Mounting screw hole pitch | 120×46 | 86×68 | 72×18 | mm | |
| C×A' | Insulator outer size | 104×54 | 76×76 | 66×29.5 | mm | |
| D×D' | Effective area | 81×31 | 53×53 | 55×8 | mm | |
| E×E' | Effective area of readout device | 80×30 | 50×50 | 52×7 | mm | |
| F | Distance from bottom of substrate to insulator surface | No. 1 | 10.9 | 10.9 | 11.9 | mm |
| | | of 2 | 11.9 | 11.9 | | |
| | | MCPs 3 | 11.9 | 12.9 | | |
| G | Distance from MCP input surface to insulator surface | No. 1 | 2.7 | 2.5 | 3.8 | mm |
| | | of 2 | 3.1 | 2.7 | 3.3 | |
| | | MCPs 3 | 2.5 | 2.9 | 2.9 | |

Shape may differ depending on product type number.

TYPE NUMBER DESIGNATION FOR DEMOUNTABLE TYPE

The following ordering information applies only to circular/rectangular MCP assemblies (demountable type). When ordering other MCPs (non-assembled MCPs) and MCP assemblies, use their type numbers as listed.

* When the customer prepares a read-out device, we supply MCP assemblies without readout devices. If using a phosphor screen as the readout device, there is a need to change some points, so please consult us in advance.



MCP ASSEMBLY SPECIFICATIONS AND DIMENSIONAL OUTLINES (Unit: mm)

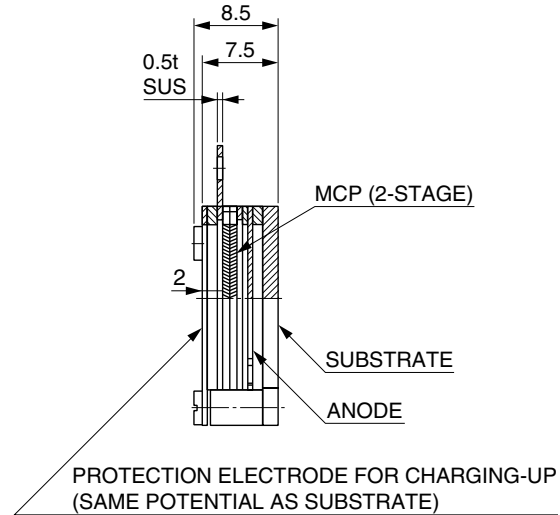
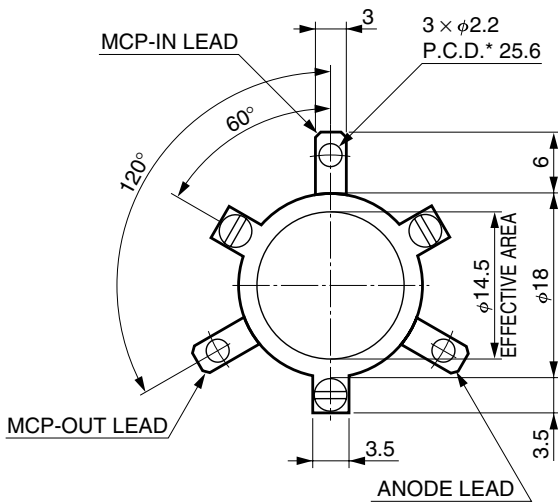
| Type No. | Channel diameter (μm) | Number of MCPs | Gain (Min.) ^① | Puls height resolution (Max.) (%) ^① | Dark count (Max.) (s ⁻¹ ·cm ⁻²) ^① | MCP supply voltage (kV) ^② | MCP-OUT to anode supply voltage (kV) ^② |
|----------|-----------------------|----------------|--------------------------|--|---|--------------------------------------|---|
| F4655 | 12 | 2 | 5 × 10 ⁷ | 50 | 3 | 2.5 | 0.5 |
| F4655-14 | | | | | | | |

NOTE: ①Supply voltage: 1.0 kV/MCP, vacuum: 1.3×10⁻⁴ Pa, operating ambient temperature: +25 °C
 ②Vacuum: 1.3×10⁻⁴ Pa

F4655

Perform the vacuum baking under 150 °C while keeping the exhaust system at a vacuum pressure below 1.3 × 10⁻⁴ Pa.

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

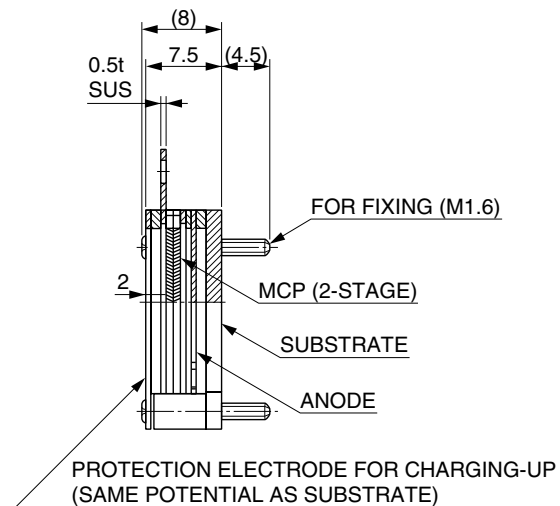
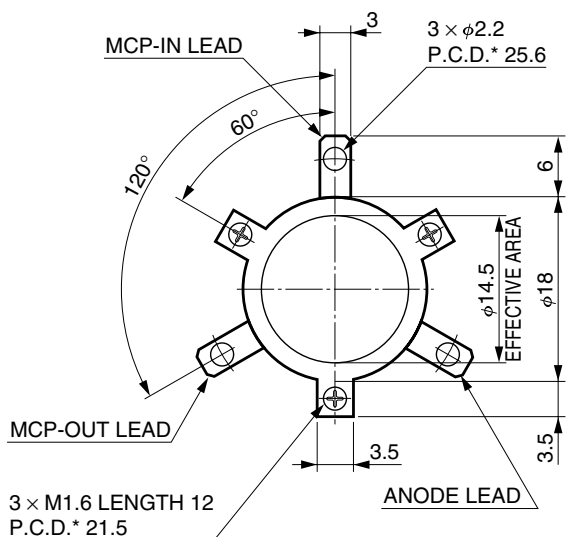


TMCPA0001EJ

F4655-14

Perform the vacuum baking under 150 °C while keeping the exhaust system at a vacuum pressure below 1.3 × 10⁻⁴ Pa.

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



TMCPA0006EB

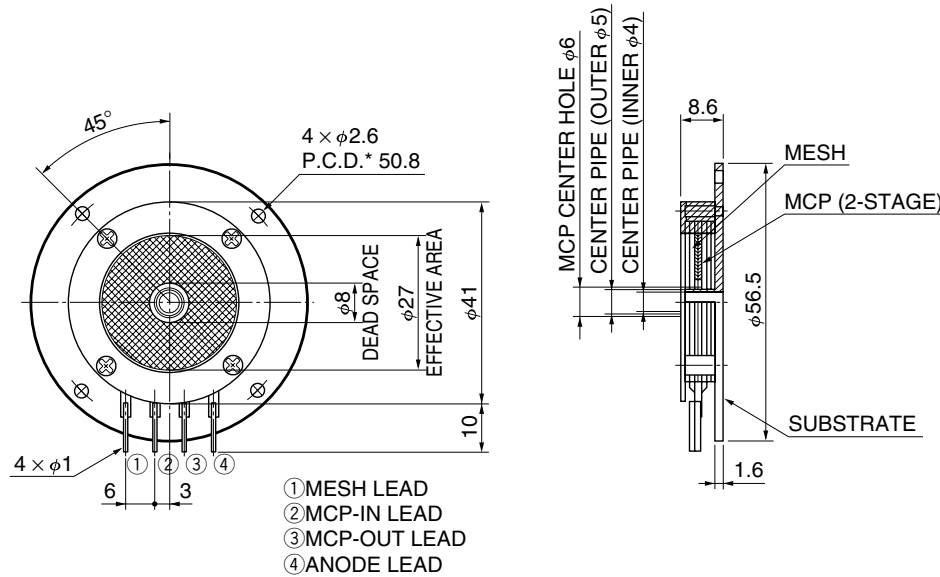
| Type No. | Channel diameter (μm) | Number of MCPs | MCP center dead area (mm) | Gain (Min.) ^① | Puls height resolution (Max.) (%) ^① | Dark count (Max.) (s ⁻¹ ·cm ⁻²) ^① | MCP supply voltage (kV) ^② | MCP-OUT to anode supply voltage (kV) ^② |
|------------|-----------------------|----------------|---------------------------|--------------------------|--|---|--------------------------------------|---|
| F2223-21SH | 12 | 2 | φ8 | 1 × 10 ⁶ | — | 3 | 2.0 | 0.5 |
| F4294-09 | | | φ12 | | | | | |

NOTE: ① Supply voltage: 1.0 kV/MCP, vacuum: 1.3×10⁻⁴ Pa, operating ambient temperature: +25 °C
 ② Vacuum: 1.3×10⁻⁴ Pa

F2223-21SH

Perform the vacuum baking under 150 °C while keeping the exhaust system at a vacuum pressure below 1.3 × 10⁻⁴ Pa.

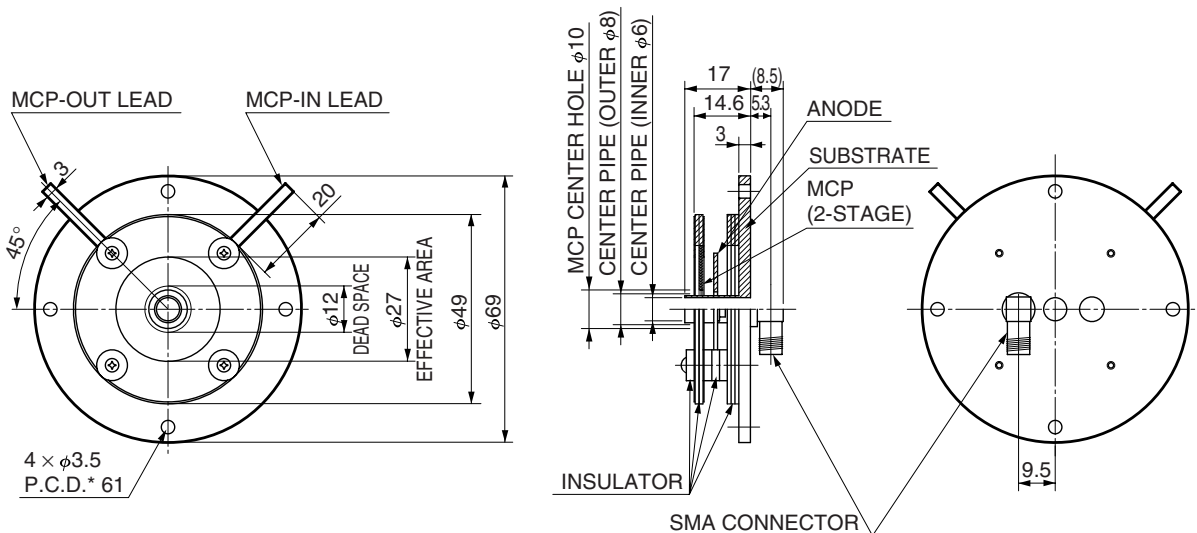
* P.C.D. (Pitch Circle Diameter)



TMCPA0002EH

F4294-09

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



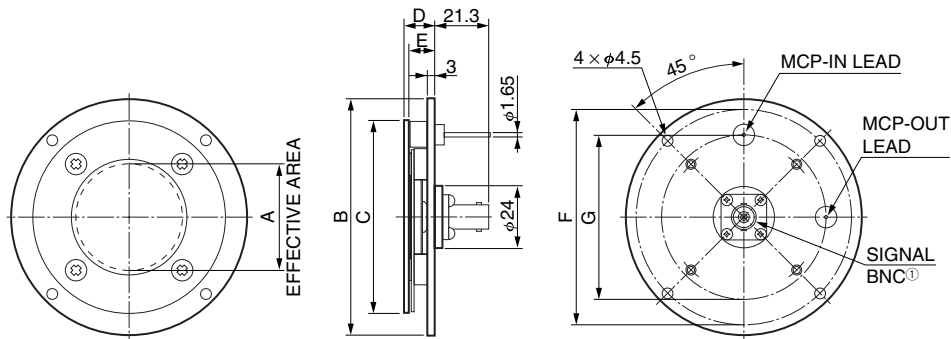
TMCPA0042EF

MCP ASSEMBLY SPECIFICATIONS AND DIMENSIONAL OUTLINES (Unit: mm)

| Type No. | Channel diameter (μm) | Number of MCPs | Pulse width (FWHM) (ps) | Gain (Min.) ^① | Puls height resolution (Max.) (%) ^① | Dark count (Max.) (s ⁻¹ ·cm ⁻²) ^① | MCP supply voltage (kV) ^② | MCP-OUT to anode supply voltage (kV) ^② |
|----------|-----------------------|----------------|-------------------------|--------------------------|--|---|--------------------------------------|---|
| F9890-13 | 12 | 2 | 900 | 1 × 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: ① Supply voltage: 1.0 kV/MCP, vacuum: 1.3×10⁻⁴ Pa, operating ambient temperature: +25 °C
 ② Vacuum: 1.3×10⁻⁴ Pa

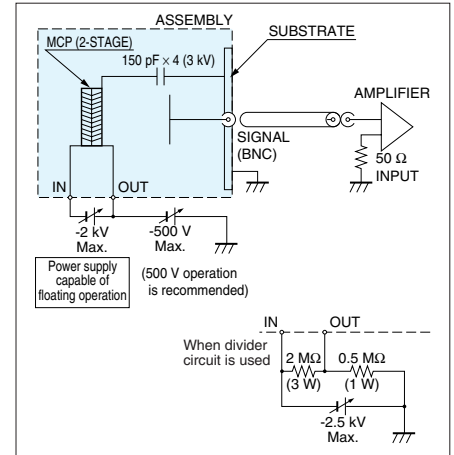
F9890-13/14, F9892-13/14



① SMA connector type is also available.

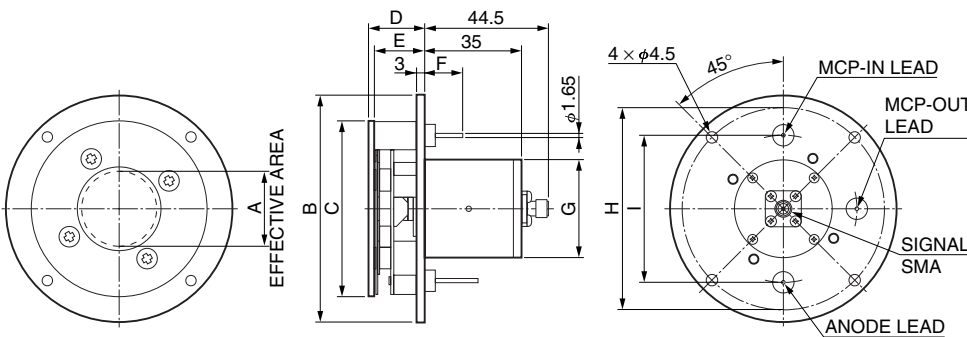
| | F9890-13 | F9890-14 | F9892-13 | F9892-14 |
|---|----------|----------|----------|----------|
| A | φ27 | | φ42 | |
| B | φ81 | | φ92 | |
| C | φ63 | | φ75 | |
| D | 12 | 11.6 | 12 | 11.6 |
| E | 10 | 9.6 | 10 | 9.6 |
| F | φ72 | | φ84 | |
| G | φ52 | | φ64 | |

WIRING EXAMPLE



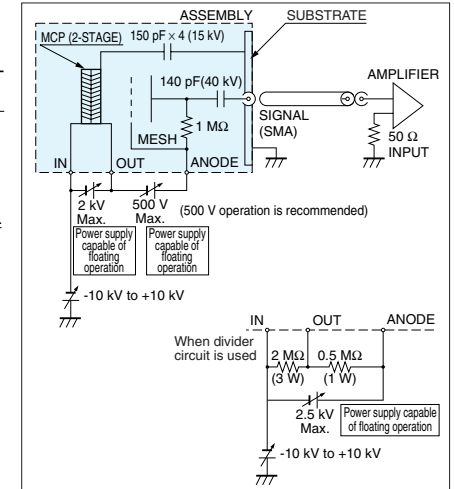
TMCPA0075EC

F9890-31/32, F9892-31/32



| | 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 |
| F | MCP-OUT LEAD | 15.2 | | 15.2 |
| F | ANODE LEAD | 19.4 | | 19.4 |
| G | φ35 | | φ40 | |
| H | φ72 | | φ84 | |
| I | φ52 | | φ64 | |

WIRING EXAMPLE



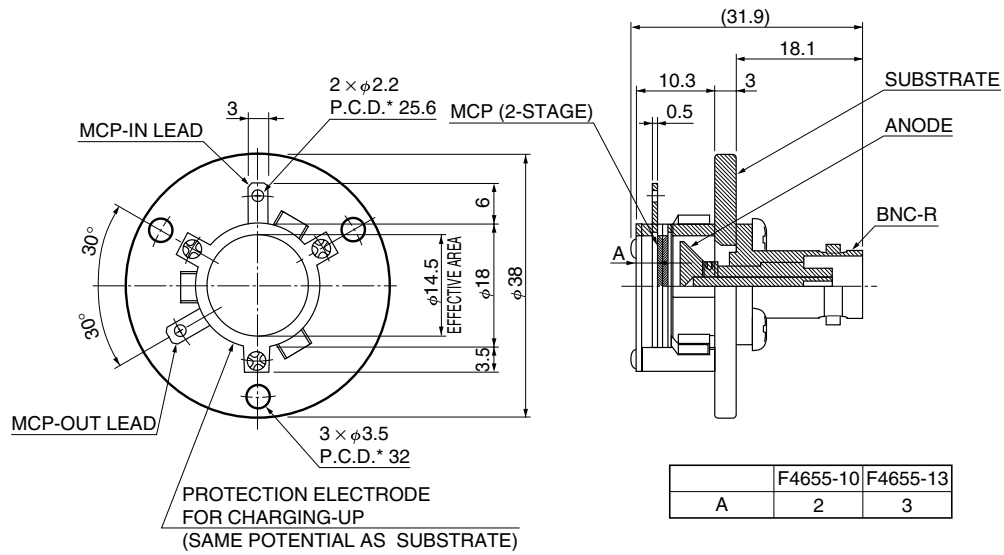
TMCPA0082EC

| Type No. | Channel diameter (μm) | Number of MCPs | Pulse width (FWHM) (ps) | Gain (Min.) ^① | Puls height resolution (Max.) (%) ^① | Dark count (Max.) (s ⁻¹ ·cm ⁻²) ^① | MCP supply voltage (kV) ^② | MCP-OUT to anode supply voltage (kV) ^② |
|----------|-----------------------|----------------|-------------------------|--------------------------|--|---|--------------------------------------|---|
| F4655-10 | 12 | 2 | 600 | 5 × 10 ⁷ | 50 | 3 | 2.5 | 0.5 |
| F4655-11 | | | | 1 × 10 ⁶ | 120 | 5 | 2.0 | |
| F4655-13 | 4 | | | | | | | |

NOTE: ① Supply voltage: 1.0 kV/MCP, vacuum: 1.3×10⁻⁴ Pa, operating ambient temperature: +25 °C
 ② Vacuum: 1.3×10⁻⁴ Pa

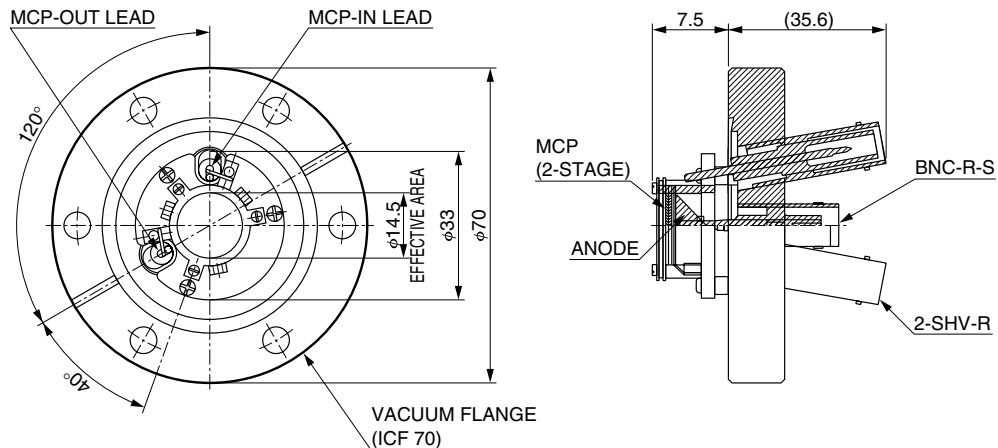
F4655-10/-13

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



TMCPA0021EG

F4655-11



TMCPA0085EB

MCP ASSEMBLY SPECIFICATIONS AND DIMENSIONAL OUTLINES (Unit: mm)

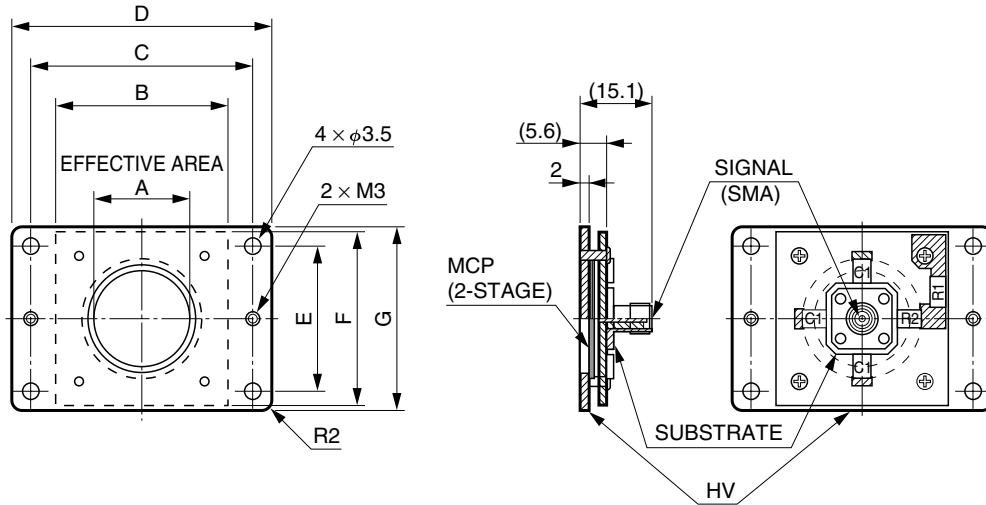
| Type No. | Channel diameter (μm) | Number of MCPs | Pulse width (FWHM) (ns) | Gain (Min.) ^① | Puls height resolution (Max.) (%) ^① | Dark count (Max.) (s ⁻¹ ·cm ⁻²) ^① | MCP supply voltage (kV) ^② | MCP-OUT to anode supply voltage (kV) ^② |
|-----------|-----------------------|----------------|-------------------------|--------------------------|--|---|--------------------------------------|---|
| F12334-11 | 12 | 2 | 1.5 | 1 × 10 ⁶ | — | 3 ^③ | — ^③ | 0.5 |
| F12395-11 | | | | | | | | |
| F12396-11 | | | | | | | | |

NOTE: ①Supply voltage: 1.0 kV/MCP, vacuum: 1.3×10⁻⁴ Pa, operating ambient temperature: +25 °C

②Vacuum: 1.3×10⁻⁴ Pa

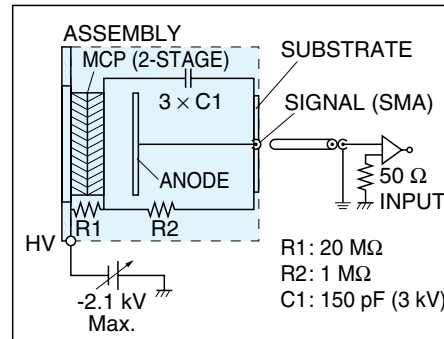
③A maximum of -2.1 kV is supplied to the HV electrode, depending on the built-in bleeder resistors.

F12334-11, F12395-11, F12396-11



| | F12334-11 | F12395-11 | F12396-11 |
|---|-----------|-----------|-----------|
| A | 20 | 27 | 42 |
| B | 36 | 40 | 51 |
| C | 46 | 51 | 62 |
| D | 54 | 61 | 72 |
| E | 30 | 30 | 40 |
| F | 36 | 40 | 51 |
| G | 38 | 41 | 52 |

WIRING EXAMPLE



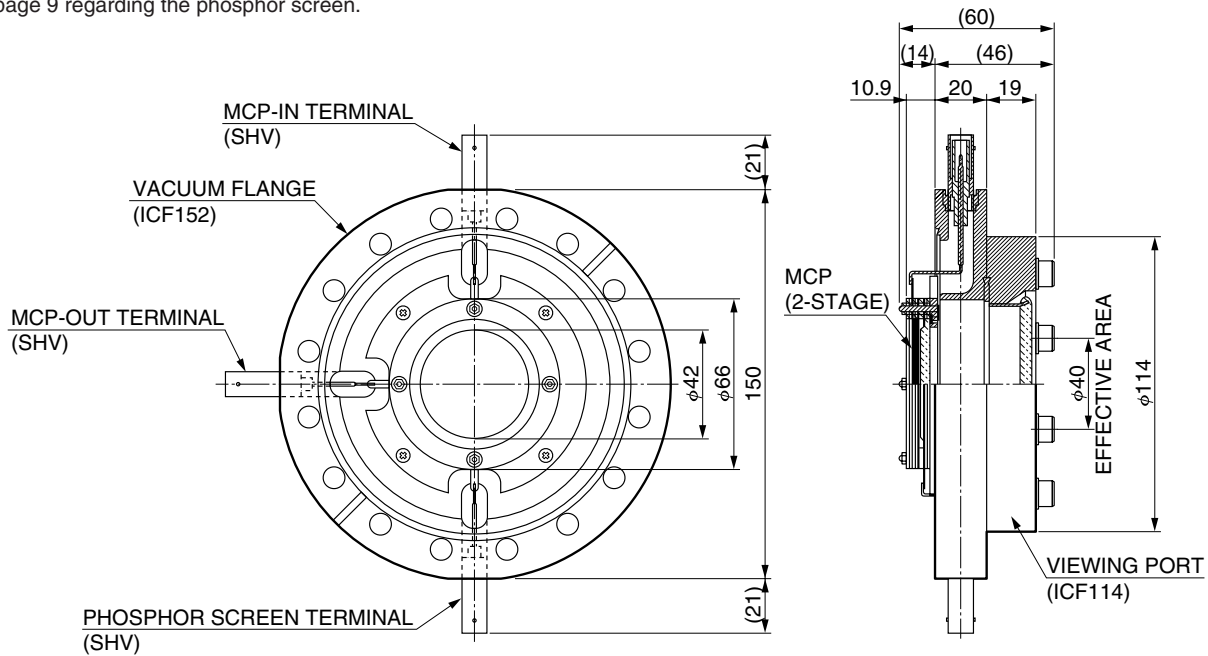
TMCPA0084EC

| Type No. | Channel diameter (μm) | Number of MCPs | Gain (Min.) ^① | Puls height resolution (Max.) (%) ^① | Dark count (Max.) (s ⁻¹ ·cm ⁻²) ^① | MCP supply voltage (kV) ^② | MCP-OUT to anode supply voltage (kV) ^② |
|-------------|-----------------------|----------------|--------------------------|--|---|--------------------------------------|---|
| F2225-21PGF | 12 | 2 | 1 × 10 ⁶ | — | 3 | 2.0 | 4.0 |
| F6959 | | | | | | | 3.0 |

NOTE: ① Supply voltage: 1.0 kV/MCP, vacuum: 1.3×10⁻⁴ Pa, operating ambient temperature: +25 °C
 ② Vacuum: 1.3×10⁻⁴ Pa

F2225-21PGF

Perform the vacuum baking under 150 °C while keeping the exhaust system at a vacuum pressure below 1.3 × 10⁻⁴ Pa. See page 9 regarding the phosphor screen.

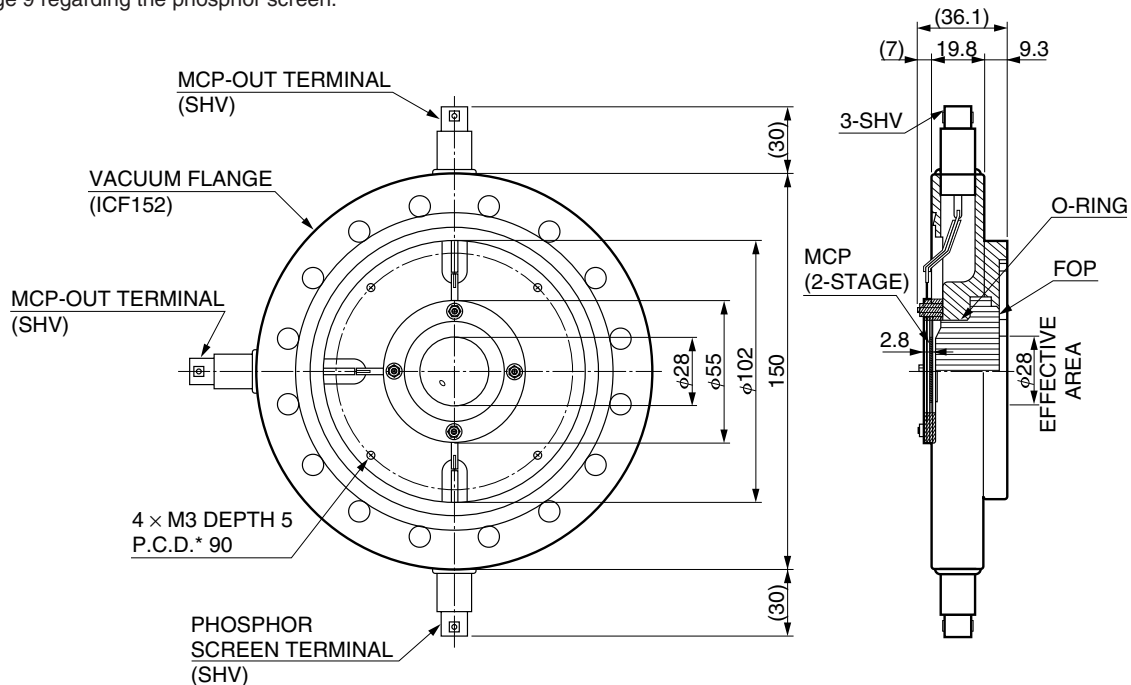


TMCPA0081ED

F6959

See page 9 regarding the phosphor screen.

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

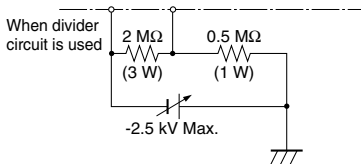
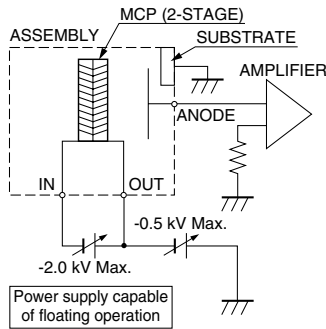


TMCPA0038EF

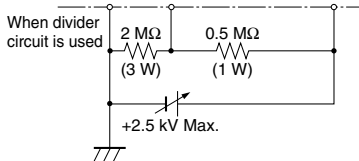
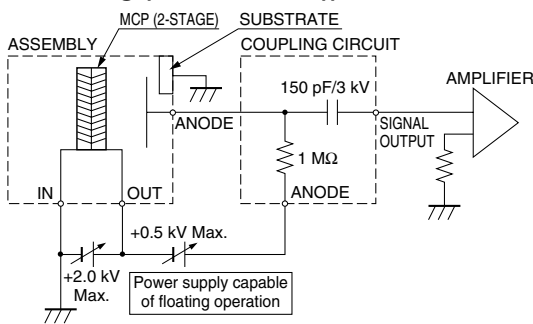
MCP ASSEMBLY WIRING EXAMPLES

Signal detection

● Positive ion detection (Anode ground)



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



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

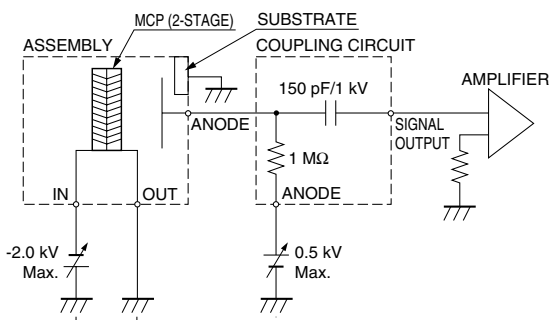
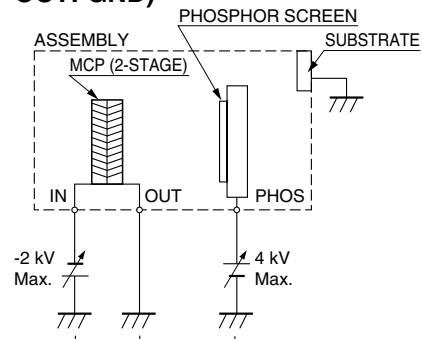
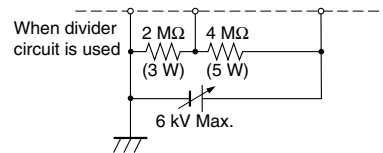
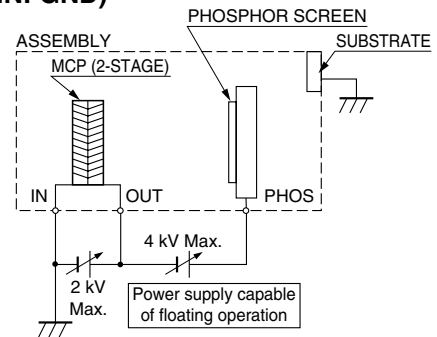


Image detection

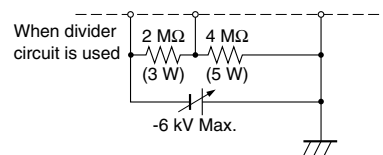
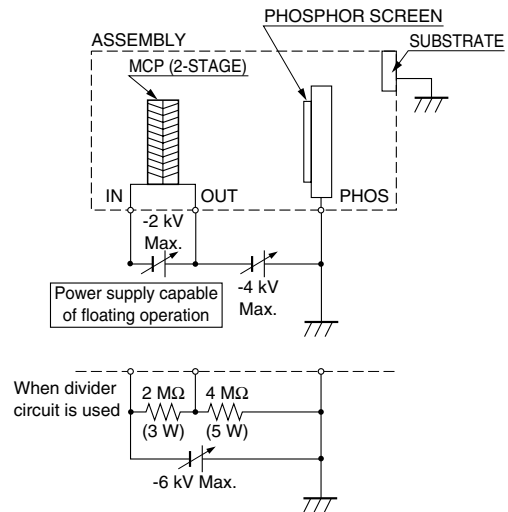
● Positive ion detection (MCP-OUT: GND)



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



● Positive ion detection (Phosphor screen: GND)



TMCP0005EH

TMCP0007EE

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.

CUSTOMIZATION

- We also manufacture custom-designed MCPs and MCP assemblies not included in the standard product lineup. Please consult us with your specific requirements for outside dimensions, effective dimensions, thickness, etc.
- Feel free to consult us on MCPs with a special aperture or through-hole (for use with reflection electron microscopes), CsI deposition (for higher quantum efficiency in the VUV to X-ray range), aluminum film coating (as a barrier to ions and radiation), MgO coating (for higher gain), electrodes made of Au (gold) and special-purpose MCPs.
- For multianodes, consult us on the desired anode pattern.
- Assemblies with a phosphor-coated fiber optic plate (FOP) are available to enable fiber-coupling to solid state imaging devices (CCD, MOS linear image sensors), etc.
- Assemblies with an MCP, readout device and lead terminals mounted on a special vacuum flange or printed circuit board are also available.
- Please consult us regarding funnel type MCPs with an OAR of 90 %.

HOW TO HANDLE

1. STORAGE

The MCP and the 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 1.3×10^{-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 exhaust system at a vacuum pressure below 1.3×10^{-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 1.3×10^{-4} Pa in operation.

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. 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.

WARRANTY PERIOD AND COVERAGE

This product is warranted for a period of one year from the date of shipment. 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.

Subject to local technical requirements and regulations, availability of products included in this promotional material may vary. Please consult with our sales office.

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