HAMAMATSU

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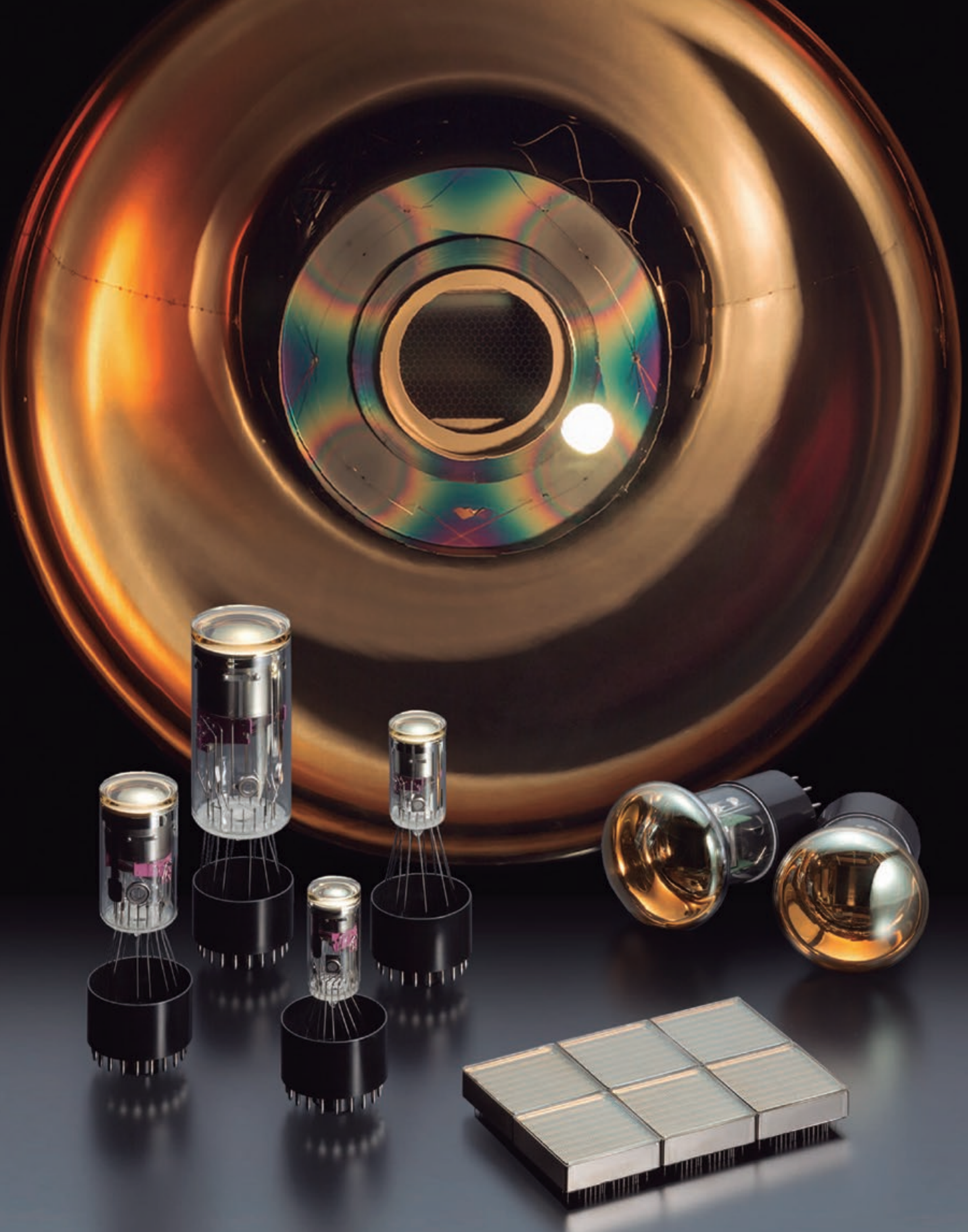
PHOTOMULTIPLIER TUBES AND ASSEMBLIES

FOR SCINTILLATION COUNTING & HIGH ENERGY PHYSICS



HAMAMATSU PHOTONICS K.K.

INTRODUCTION

In radiation measurements, scintillation counters which are combinations of scintillators and photomultiplier tubes are used as most common and useful devices in detecting X-, alpha-, beta-, gamma-rays and other high energy charged particles. A scintillator emits flashes of light in response to input radiations and a photomultiplier tube coupled to a scintillator detects these scintillation lights in a precise way.

In high energy physics experiments, one of important apparatuses is a Cherenkov counter in which photomultiplier tubes detect Cherenkov radiations emitted by high energy charged particles passing through a dielectric material.

To detect radiations accurately, photomultiplier tubes may be required to have high detecting efficiency (QE & energy resolution), wide dynamic range (pulse linearity), good time resolution (T.T.S.), high stablility & reliability, and to be operatable in high magnetic field environment or at high temperature condition. In addition, a ruggedized construction is required according to circumstances. On the other hand, several kinds of position sensitive photomultiplier tubes have been developed and are used in these measurements.

This catalog provides a quick reference for Hamamatsu photomultiplier tubes, especially designed or selected for scintillation counters and Cherenkov radiation detectors, and includes most of types currently available ranging in size from 3/8" through 20" in diameter. It should be noted that this catalog is just a starting point in describing Hamamatsu product line since new types are continuously under-development.

Please feel free to contact us with your specific requirements.

PHOTOMULTIPLIER TUBES AND ASSEMBLIES

For scintillation counting & high energy physics

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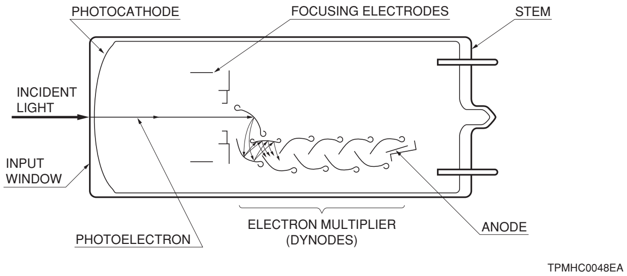
Operating characteristics

This section describes the prime features of photomultiplier tube construction and basic operating characteristics.

1. GENERAL

The photomultiplier tube (PMT) is a photosensitive device consisting of an input window, a photocathode, focusing electrodes, an electron multiplier (dynodes) and an anode in a vacuum tube, as shown in Figure 1. When light enters the photocathode, the photocathode emits photoelectrons into vacuum by the external photoelectric effect. These photoelectrons are directed by the potential of focusing electrode towards the electron multiplier where electrons are multiplied by the process of secondary electron emission.
The multiplied electrons are collected to the anode to produce output signal.

Figure 1: Cross-section of head-on type PMT



2. PHOTOCATHODE

2.1 Spectral response

The photocathode of PMT converts energy of incident light into photoelectrons by the external photoelectric effect. The conversion efficiency, that is photocathode sensitivity, varies with the wavelength of incident light. This relationship between the photocathode sensitivity and the wavelength is called the spectral response characteristics.
Typical spectral response curves of the variation of bialkali photocathodes are shown on the inside of the back cover.
The spectral response range is determined by the photocathode material on the long wavelength edge, and by the window material on the short wavelength edge.
In this catalog, the long wavelength cut-off of spectral response range is defined as the wavelength at which the cathode radiant sensitivity drops to 1 % of the maximum sensitivity.

2.2 Quantum efficiency and radiant sensitivity

Spectral response is usually expressed in term of quantum efficiency and radiant sensitivity as shown on the inside the back cover.
Quantum efficiency (QE) is defined as the ratio of the number of photoelectrons emitted from the photocathode to the number of incident photons.
It's customarily stated as a percentage.
The equation of QE is as follows:

$$\mathrm{QE} = \frac{\text{Number of photoelectrons}}{\text{Number of photons}} \times 100\ (\%)$$

Radiant sensitivity (S) is the photoelectric current from the photocathode divided by the incident radiant power at a given wavelength, expressed in A/W (ampere per watt).
The equation of S is as follows:

$$\mathrm{S} = \frac{\text{Photoelectric current}}{\text{Radiant power of light}}\ (\mathrm{A/W})$$

Quantum efficiency and radiant sensitivity have the following relationship at a given wavelength.

$$\mathrm{QE} = \frac{\mathrm{S} \times 1240}{\lambda} \times 100\ (\%)$$

where λ is the wavelength in nm (nanometer).

2.3 Window materials

The window materials commonly used in PMT are as follows:

(1) Borosilicate glass

This is the most frequently used material. It transmits light from the infrared to approximately down to 300 nm.
For some scintillation applications where radioactivity of K40 contained in the glass affects the measurement, "K-free" glass is recommended.
As "K-free" glass contains very little amount of Potassium, the background counts originated by ^{40}K is minimized.

(2) UV-transmitting glass

This glass transmits ultraviolet light well as the name implies, and it is widely used. The UV cut-off wavelength is approximately 185 nm.

(3) Silica glass

This material transmits ultraviolet light down to 160 nm. Silica is not suitable for the stem material of tubes because it has a different thermal expansion coefficient from kovar metal which is used for the tube leads. Thus, borosilicate glass is used for the stem. In order to seal these two materials having different thermal expansion ratios, a technique called graded seal is used. This is a technique to seal several glass materials having gradually different thermal expansion ratios. Another feature of silica is superiority in radiation hardness.

2.4 Photocathode materials

The photocathode is a photoemissive surface with very low work and high energy physics applications:

(1) Bialkali

This has a spectral response which fits the emission spectra of most scintillators. Thus, it is frequently used for scintillator applications.

(2) High temperature bialkali

This is particularly useful at higher operating temperatures up to 175 °C. Its major application is oil well logging. Also it can be operated with very low dark current at the room temperature.

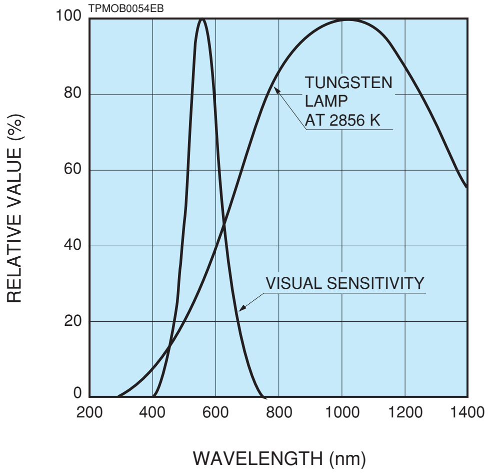
As stated above, the spectral response range is determined by the materials of the photocathode and the window as shown in Figure 34.
It is important to select appropriate materials which will suit the application.

2.5 Luminous and blue sensitivity

Since the measurement of spectral response characteristics of a PMT requires a sophisticated system and time, it isn't practical to provide spectral response data on each tube. Instead, cathode and anode luminous sensitivity data are usually attached.

The cathode luminous sensitivity is the photoelectric current from the photocathode per incident light flux (10^{-5} to 10^{-2} lumen) from a tungsten filament lamp operated at a distribution temperature of 2856 K.
The cathode luminous sensitivity is expressed in the unit of µA/lm (micro amperes per lumen).
Note that the lumen is a unit used for luminous flux in the visible region, therefore these values may be meaningless for tubes which are sensitive out of the visible region (refer to Figure 2).
The cathode blue sensitivity is the photoelectric current from the photocathode per incident light flux of a tungsten filament lamp at 2856 K passing through a blue filter. This filter is a band-pass filter and its peak wavelength of transmittance is 400 nm.
Since the light flux, once transmitted through the blue filter, can not be expressed in lumen, the blue sensitivity is usually represented by the blue sensitivity index.
The blue sensitivity is a very important parameter in the scintillation counting since most of the scintillators produce emission spectrum in the blue region, and it may dominant factor of energy resolution.
These parameters of cathode luminous and blue sensitivities are particularly useful when comparing tubes having the same or similar spectral response ranges. Hamamatsu final test sheets accompanied with tubes usually indicate these parameters.

Figure 2: Typical human eye response and spectral distribution of 2856 K tungsten lamp



3. ELECTRON MULTIPLIER (DYNODES)

The superior sensitivity (high gain and high S/N ratio) of PMT is due to a low noise electron multiplier which amplifies electrons in a vaccum with cascade secondary emission process. The electron multiplier consists of several to up to 19 stages of electrodes which are called dynodes.

3.1 Dynode types

There are several principal types of dynode structures. Features of each type are as follows:

(1) Linear focused type

Fast time response, high pulse linearity

(2) Box and grid type

Good collection efficiency, good uniformity

(3) Box and linear focused type

Good collection efficiency, good uniformity, low profile

(4) Circular and linear-focused type

Fast time response, compactness

(5) Venetian blind type

Good uniformity, large output current

(6) Metal channel type

Compact dynode construction, fast time response, position detection possible.

4. ANODE

The PMT anode output is the product of photoelectric current from the photocathode and gain. Photoelectric current is proportional to the intensity of incident light. Gain is determined by the applied voltage on a specified voltage divider.

4.1 Luminous sensitivity

The anode luminous sensitivity is the anode output current per incident light flux (10^{-10} to 10^{-5} lumen) from a tungsten filament lamp operated at a distribution temperature of 2856 K. This is expressed in the unit of A/lm (amperes per lumen) at a specified anode-to-cathode voltage with a specified voltage divider.

4.2 Gain (Current amplification)

Photoelectrons emitted from a photocathode are accelerated by an electric field so as to strike the first dynode and produce secondary electron emissions. These secondary electrons then impinge upon the next dynode to produce additional secondary electron emissions. Repeating this process over successive dynode stages (cascade process), a high gain is achieved. Therefore a very small photoelectric current from the photocathode can be observed as a large output current from the anode of the PMT.

Gain is simply the ratio of the anode output current to the photoelectric current from the photocathode. Ideally, the gain of the PMT is defined as δn, where n is the number of dynode stage and δ is an average secondary emission ratio.

While the secondary electron emission ratio δ is given by

$$\delta = A \cdot E^{\alpha}$$

where A is constant, E is an interstage voltage, and α is a coefficient determined by the dynode material and geometric structure. It usually has a value of 0.7 to 0.8.

When a voltage V is applied between the cathode and the anode of the PMT having n dynode stages, gain G becomes

$$G = \delta^n = (A \cdot E^{\alpha})^n = \left\{A \cdot \left(\frac{V}{n+1}\right)^{\alpha}\right\}^n$$

$$= \frac{A^n}{(n+1)^{\alpha n}} V^{\alpha n} = K \cdot V^{\alpha n} \qquad \text{(K: constant)}$$

Figure 3: Example of gain vs. supply voltage

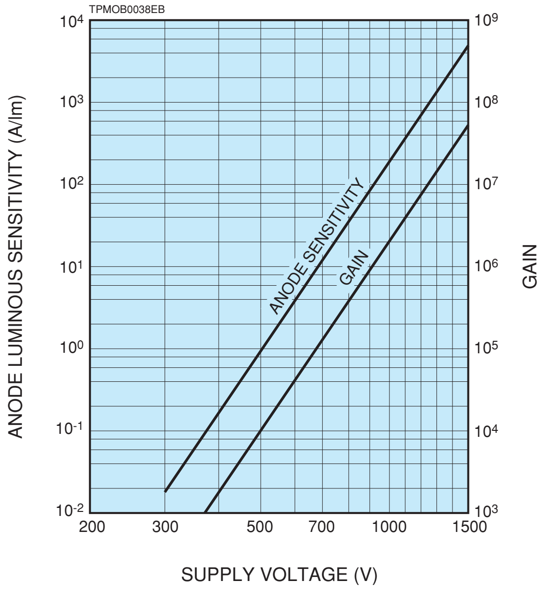


Figure 3 shows gain characteristics.

Since generally PMTs have 8 to 12 dynode stages, the anode output varies directly with the 6th to 10th power of the change in applied voltage. The output signal of the PMT is extremely susceptible to fluctuations in the power supply voltage, thus the power supply should be very stable and exhibit minimum ripple, drift and temperature coefficient. Regulated high voltage power supplies designed with this consideration are available from Hamamatsu.

5. ANODE DARK CURRENT

A small amount of output current flows in a PMT even when it is operated in complete darkness. This current is called the anode dark current. The dark current and the noise resulted from are critical factors to determine the lower limit of light detection.

The causes of dark current may be categorized as follows:

(1) Thermionic emission of electrons

Since the materials of the photocathode and dynodes have very low work functions, they emit thermionic electrons even at the room temperature. Most of the dark current originates from the thermionic emissions especially from the photocathode, and it is multiplied by the dynodes.

(2) Ionization of residual gases

Residual gases inside the PMT can be ionized by the flow of photoelectrons. When these ions strike the photocathode or earlier stages of dynodes, secondary electrons may be emitted, thus resulting in relatively large output noise pulses. These noise pulses are usually observed as afterpulses following the primary signal pulses and may be a problem in detecting short light pulses. Present PMT's are designed to minimize afterpulses.

(3) Glass scintillation

In case electrons deviating from their normal trajectories strike the glass envelope, scintillations may occur and dark pulses may result. To eliminate these pulses, PMT's may be operated with the anode at high voltage and the cathode at the ground potential. Otherwise it is useful to coat the glass bulb with a conductive paint connected to the cathode (called HA treatment: see page 13).

(4) Ohmic leakage

Ohmic leakage resulting from insufficient insulation of the glass stem base and socket may be another source of dark current. This is predominant when a PMT is operated at a low voltage or low temperature.

Contamination by dirt and humidity on the surface of the tube may cause ohmic leakage, and therefore should be avoided.

(5) Field emission

When a PMT is operated at a voltage near the maximum rating value, some electrons may be emitted from electrodes by strong electric fields causing dark pulses. It is therefore recommended that the tube be operated at 100 volts to 300 volts lower than the maximum rating.

The anode dark current decreases along time after a PMT is placed in darkness. In this catalog, anode dark currents are specified as the state after 30 minutes storage in darkness.

6. TIME RESPONSE

In applications where forms of the incident light are pulses, the anode output signal should reproduce a waveform faithful to the incident pulse waveform.
This reproducibility depends on the anode pulse time response.

(1) Rise time (refer to Figure 4)

The time for the anode output pulse to rise from 10 % to 90 % of the peak amplitude when the whole photocathode is illuminated by a delta-function light pulse.

(2) Electron transit time (refer to Figure 4)

The time interval between the arrival of a delta-function light pulse at the photocathode and the instant when the anode output pulse reaches its peak amplitude.

(3) T.T.S. (Transit Time Spread) (refer to Figure 5)

This is also called the transit time jitter. This is the fluctuation in transit time between individual pulses, and is defined as the FWHM of the frequency distribution of electron transit times. T.T.S. depends on the number of incident photons. The values in this catalog are measured in the single photoelectron state.

Figure 4: Definition of rise time and transit time

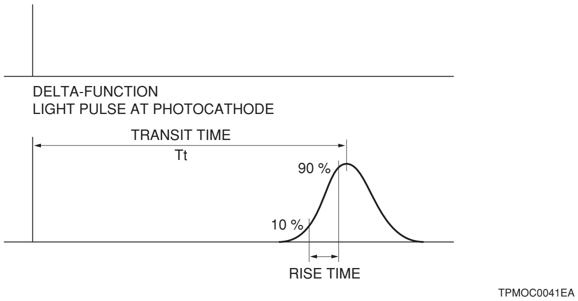
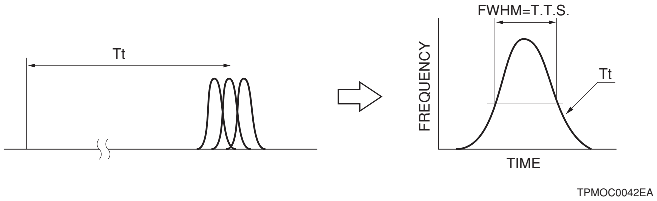


Figure 5: Definition of T.T.S.



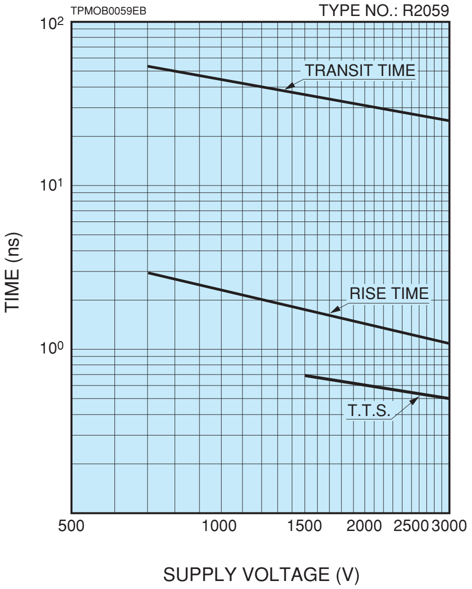
(4) C.R.T. (Coincident Resolving Time)

This is one of the important parameters in high energy physics applications and is defined as the FWHM of a coincident timing spectrum of a pair PMT's facing each other when they detect coincident gamma-ray emission due to positron annihilation of a radiation source (^{22}Na). The scintillators used are CsF, BGO or BaF_2 crystals. These PMT's can be selected for special requirements.

These parameters are affected by the dynode structure and applied voltage. In general, PMTs of the linear focused structure exhibit better time response than that of the box-and-grid or venetian blind structure.

Figure 6 shows typical time response characteristics vs. applied voltage for types R2059 (51 mm dia. head-on, 12-stage, linear-focused type).

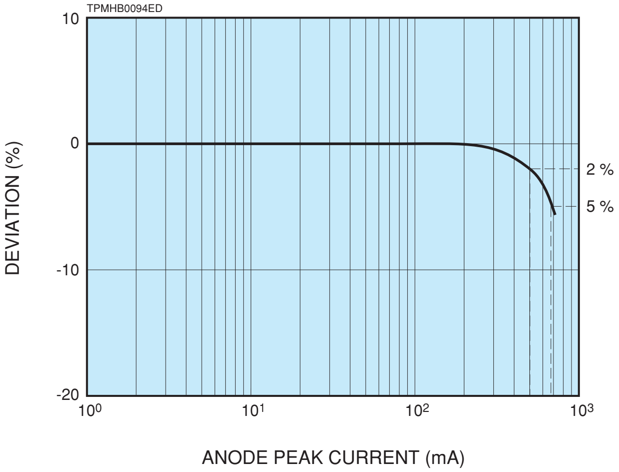
Figure 6: Time response characteristics vs. supply voltage



7. PULSE LINEARITY

The definition of the pulse linearity is proportionality between the input light amount and the output current in the pulse operation mode. When intense light pulses are to be measured, it's necessary to know the pulse linearity range of the PMT.
In this catalog, typical values of pulse linearity are specified at two points (±2 % and ±5 % deviations from linear proportionality), as shown in Figure 7.
The two-pulse technique is employed in this measurement. LED's are used for a pulsed light source. Its pulse width is 50 ns and the repetition rate is 1 kHz.
The deviation from the proportionality is called non-linearity in this catalog. The cause of non-linearity is mainly a space charge effect in the later stages of an electron multiplier. This space charge effect depends on the pulse height of the PMT output current and the strength of electric fields between electrodes.

Figure 7: Example of pulse linearity characteristic



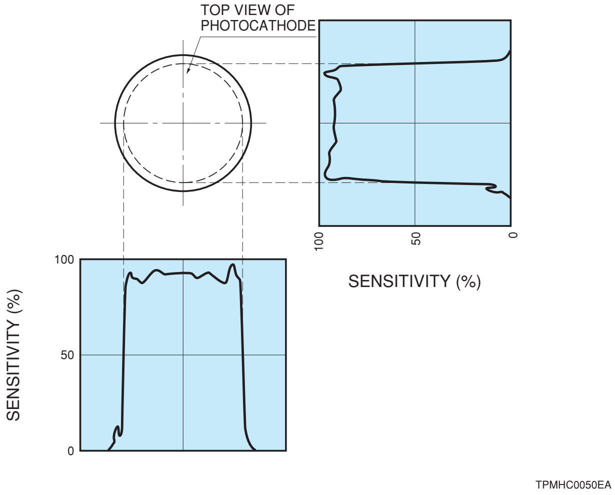
The special voltage distribution ratios are designed to achieve strong electric fields in the later stages of the electron multiplier. Some types are specified with these special voltage dividers.

8. UNIFORMITY

Although the focusing electrodes of a PMT are designed so that electrons emitted from the photocathode or dynodes are collected efficiently by the first or following dynodes, some electrons may deviate from their desired trajectories and collection efficiency is degraded. The collection efficiency varies with the position on the photocathode from which the photoelectrons are emitted, and influences the spatial uniformity of a photomultiplier tube. The spatial uniformity is also determined by the photocathode surface uniformity itself.

PMTs especially designed for gamma camera applications have excellent spatial uniformity. Example of spatial uniformity is shown in Figure 8.

Figure 8: Example of spatial uniformity



9. STABILITY

In scintillation counting, there are two relevant stability characteristics for the PMT in pulse height mode operation, the long term and the short term. In each case a ^{137}Cs source (662 keV), and an NaI(Tl) scintillator, and a multichannel pulse height analyzer are used. PMT's are warmed up for about one hour in the dark with voltage applied.

9.1 Long term stability (Mean gain deviation)

This is defined as follows when the PMT is operated for 16 hours at a constant count rate of 1000 s^{-1}:

$$Dg = \frac{\sum_{i=1}^{n} |P-Pi|}{n} \cdot \frac{100}{P} \ (\%)$$

where P is the mean pulse height averaged over n readings, Pi is the pulse height at the i-th reading, and n is the total number of readings.

9.2 Short term stability

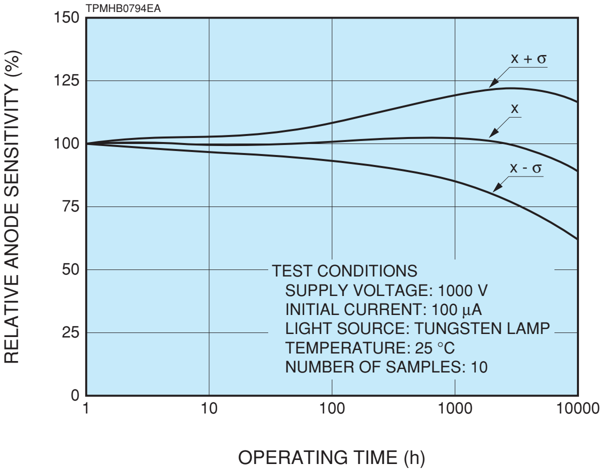
This is the gain shift against count rate change. The tube is initially operated at about 10000 s^{-1}. The photo-peak count rate is then decreased to approximately 1000 s^{-1} by increasing the distance between the ^{137}Cs source and the scintillator coupled to the PMT.

9.3 Drift and life characteristics

While operating a photomultiplier tube continuously over a long period, anode output current of the photomultiplier tube may vary slightly with time, although operating conditions have not changed. This change is reffered to as drift or in the case where the operating time is 1000 hours to 10000 hours it is called life characteristics. Figure 9 shows typical life characteristics.

Drift is primarily caused by damage to the last dynode by heavy electron bombardment. Therefore the use of lower anode current is desirable. When stability is of prime importance, the use of average anode current of 1 µA or less is recommended.

Figure 9: Examples of life characteristics

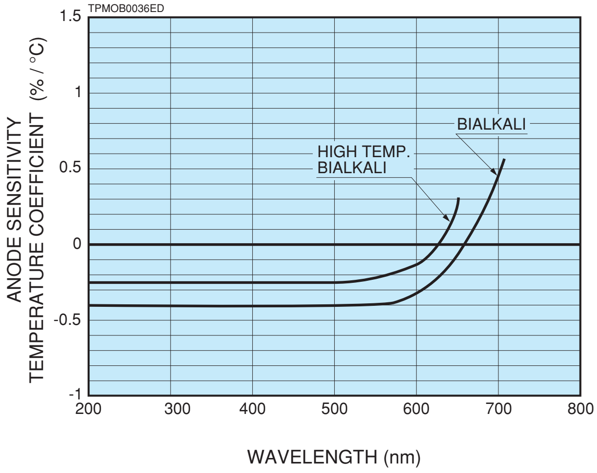


10. ENVIRONMENT

10.1 Temperature characteristics

The sensitivity of the PMT varies with the temperature. Figure 10 shows typical temperature coefficients of anode sensitivity around the room temperature for bialkali and high temp. bialkali photocathode types. In the ultraviolet to visible region, the temperature coefficient of sensitivity has a negative value, while it has a positive value near the longer wavelength cut-off. Since the temperature coefficient change is large near the longer wavelength cut-off, temperature control may be required in some applications.

Figure 10: Typical temperature coefficients of anode sensitivity



10.2 Magnetic field

Most PMTs are affected by the presence of magnetic fields. Magnetic fields may deflect electrons from their normal trajectories and cause a loss of gain. The extent of the loss of gain depends on the type of the PMT and its orientation in the magnetic field. Figure 11 shows typical effects of magnetic fields on some types of PMTs. In general, a PMT having a long path from the photocathode to the first dynode are very sensitive to magnetic fields. Therefore head-on types, especially of large diameter, tend to be more adversely influenced by magnetic fields.

When a PMT has to be operated in magnetic fields, it may be necessary to shield the PMT with a magnetic shield case. (Hamamatsu provides a variety of magnetic shield cases.)

For example, the shield case, of which inner diameter is 60 mm and the thickness is 0.8 mm, can be used in a magnetic field of around 5 mT without satulation. If a magnetic field strength is more than 10 mT, the double shielding method is necessary for a conventional PMT, otherwise proximity mesh types should be used. The magnetic shielding factor is used to express the effect of a magnetic shield case. This is the ratio of the strength of the magnetic field outside the shield case or Hout, to that inside the shield case or Hin.

The magnetic shielding factor is determined by the permeability μ, the thickness t(mm) and inner diameter r(mm) of the shield case as follows.

$$\frac{Hout}{Hin} = \frac{3\mu t}{4r}$$

It should be noted that the magnetic shielding effect decreases towards the edge of the shield case as shown in Figure 12. It is suggested to cover a PMT with a shield case longer than the PMT length by at least half the PMT diameter.

Figure 11: Typical effects by magnetic fields perpendicular to tube axis

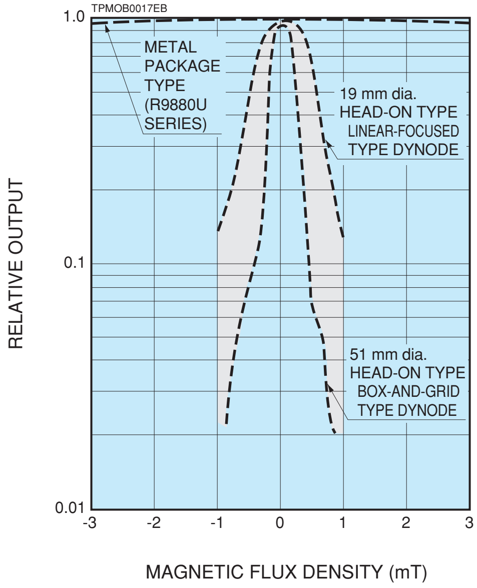
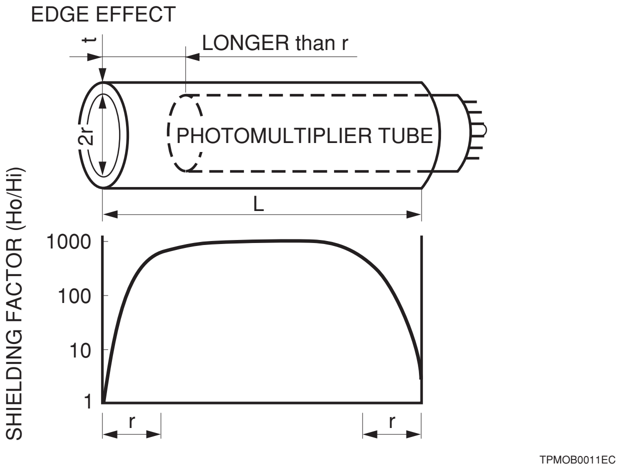


Figure 12: Edge effect of magnetic shield case



The proximity mesh made of non-magnetic material has been introduced as alternate dynodes in PMT's. These types (see page 24) exhibit much higher immunity to external magnetic fields than the conventional PMT's. Also triode and three types (see page 24) are useful for applications at high light intensities.

11. VOLTAGE DIVIDER CIRCUITS

To operate a photomultiplier tube, a high voltage of 500 volts to 2000 volts is usually supplied between the photocathode (K) and the anode (P), with a proper voltage gradient set up along the photoelectron focusing electrode (F) or grid (G), secondary electron multiplier electrodes or dynodes (Dy) and, depending on photomultiplier tube type, an accelerating electrode (Acc). Figure 13 shows a schematic representation of photomultiplier tube operation using independent multiple power supplies, but this is not a practical method. Instead, a voltage divider circuit is commonly used to divide, by means of resistors, a high voltage supplied from a single power supply.

Figure 13: Schematic representation of photomultiplier tube operation

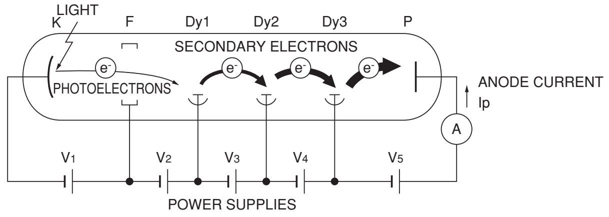


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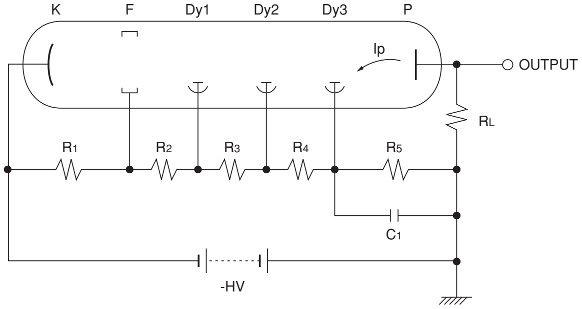
Figure 14 shows a typical voltage divider circuit using resistors, with the anode side grounded. The capacitor C_1 connected in parallel to the resistor R_5 in the circuit is called a decoupling capacitor and improves the output linearity when the photomultiplier tube is used in pulse operation, and not necessarily used in providing DC output. In some applications, transistors or Zener diodes may be used in place of these resistors.

Figure 14: Anode grounded voltage divider circuit



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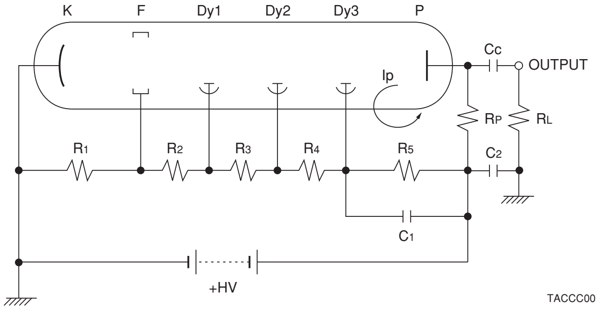
11.1 Anode grounding and photocathode grounding

In order to eliminate the potential difference between the photomultiplier tube anode and external circuits such as an ammeter, and to facilitate the connection, the generally used technique for voltage divider circuits is to ground the anode and supply a high negative voltage (-HV) to the photocathode, as shown in Figure 14. This scheme provides the signal output in both DC and pulse operations, and is therefore used in a wide range of applications.

In photon counting and scintillation counting applications, however, the photomultiplier tube is often operated with the photocathode grounded and a high positive voltage (+HV) supplied to the anode mainly for purposes of noise reduction. This photocathode grounding scheme is shown in Figure 15, along with the coupling capacitor Cc for isolating the high voltage from the output circuit. Accordingly, this setup cannot provide a DC signal output and is only used in pulse output applications. The resistor R_P is used to give a proper potential to the anode. The resistor R_L is placed as a load resistor, but the actual load resistance will be the combination of R_P and R_L.

Figure 15: Photocathode grounded voltage divider circuit



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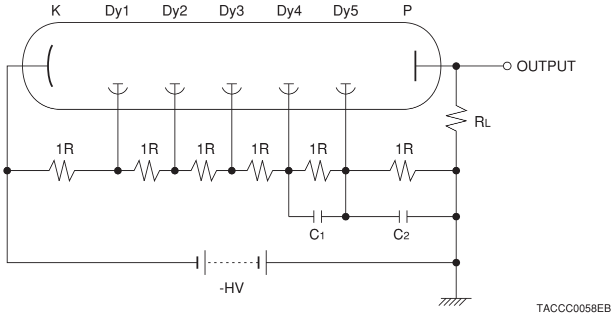
11.2 Standard voltage divider circuits

Basically, the voltage divider circuits of socket assemblies listed in this catalog are designed for standard voltage distribution ratios which are suited for constant light measurement. Socket assemblies for side-on photomultiplier tubes in particular mostly use a voltage divider circuit with equal interstage voltages allowing high gain as shown in Figure 16.

Figure 16: Equally divided voltage divider circuit



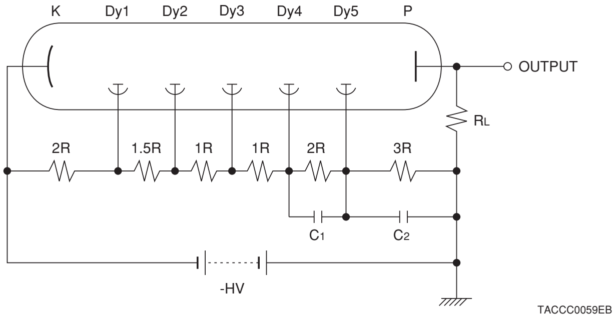
11.3 Tapered voltage divider circuits

In most pulsed light measurement applications, it is often necessary to enhance the voltage gradient at the first and/or last few stages of the voltage divider circuit, by using larger resistances as shown in Figure 17. This is called a tapered voltage divider circuit and is effective in improving various characteristics. However it should be noted that the overall gain decreases as the voltage gradient becomes greater. In addition, care is required regarding the interstage voltage tolerance of the photomultiplier tube as higher voltage is supplied. The tapered voltage circuit types and their suitable applications are listed below.

Tapered circuit at the first few stages
(resistance: large <First dynode> → small <Latter dynode>)
  Photon counting (improvement in pulse height distribution)
  Low-light-level detection (S/N ratio enhancement)
  High-speed pulsed light detection (improvement in timing properties)
  Other applications requiring better magnetic characteristics and uniformity

Tapered circuit at the last few stages
(resistance: small <First dynode> → large <Latter dynode>)
  High pulsed light detection (improvement in output linearity)
  High-speed pulsed light detection (improvement in timing properties)
  Other applications requiring high output across the load resistor

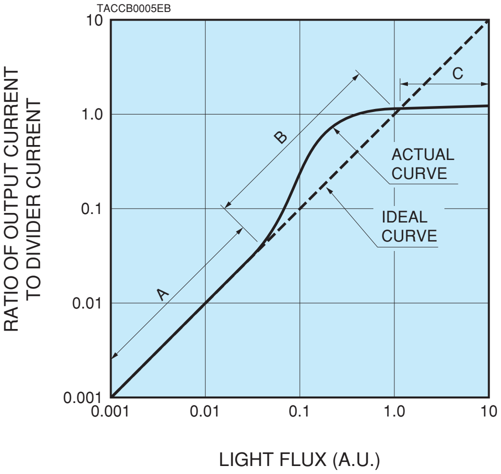
Figure 17: Tapered voltage divider circuit



11.4 Voltage divider circuit and photomultiplier tube output linearity

In both DC and pulse operations, when the light incident on the photocathode increases to a certain level, the relationship between the incident light level and the output current begins to deviate from the ideal linearity. As can be seen from Figure 18, region A maintains good linearity, and region B is the so-called overlinearity range in which the output increase is larger than the ideal level. In region C, the output goes into saturation and becomes smaller than the ideal level. When accurate measurement with good linearity is essential, the maximum output current must be within region A. In contrast, the lower limit of the output current is determined by the dark current and noise of the photomultiplier tube as well as the leakage current and noise of the external circuit.

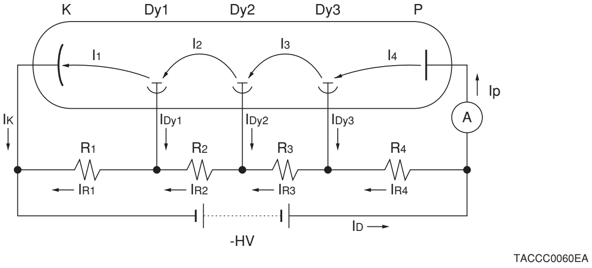
Figure 18: Output linearity of photomultiplier tube



11.5 Output linearity in DC mode

Figure 19 is a simplified representation showing photomultiplier tube operation in the DC output mode, with three stages of dynodes and four dividing resistors R_1 through R_4 having the same resistance value.

Figure 19: Basic operation of photomultiplier tube and voltage divider circuit



[When light is not incident on the tube]

In dark state operation where a high voltage is supplied to a photomultiplier tube without incident light, the current components flowing through the voltage divider circuit will be similar to those shown in Figure 20 (if we ignore the photomultiplier tube dark current). The relation of current and voltage through each component is given below

Interelectrode current of photomultiplier tube

$$I_1=I_2=I_3=I_4 \ (= 0 \text{ A})$$

Electrode current of photomultiplier tube

$$I_K=I_{Dy1}=I_{Dy2}=I_{Dy3}=I_P \ (= 0 \text{ A})$$

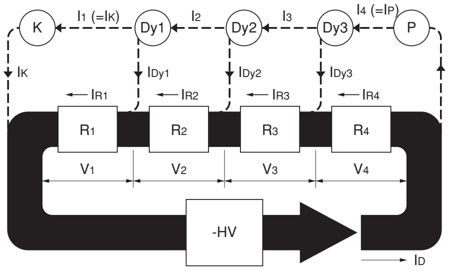
Voltage divider circuit current

$$I_{R1}=I_{R2}=I_{R3}=I_{R4}=I_D= (HV/\sum_{n=1}^{4} R_n)$$

Voltage divider circuit voltage

$$V_1=V_2=V_3=V_4=I_D \cdot R_n \ (= HV/4)$$

Figure 20: Operation without Light Input



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[When light is incident on the tube]

When light is allowed to strike the photomultiplier tube under the conditions in Figure 20, the resulting currents can be considered to flow through the photomultiplier tube and the voltage divider circuit as schematically illustrated in Figure 21. Here, all symbols used to represent the current and voltage are expressed with a prime ('), to distinguish them from those in dark state operation.

The voltage divider circuit current I_D' is the sum of the voltage divider circuit current I_D in dark state operation and the current flowing through the photomultiplier tube ΔI_D (equal to average interelectrode current). The current flowing through each dividing resistor Rn becomes as follows:

$$I_{Rn}' = I_D' - I_n'$$

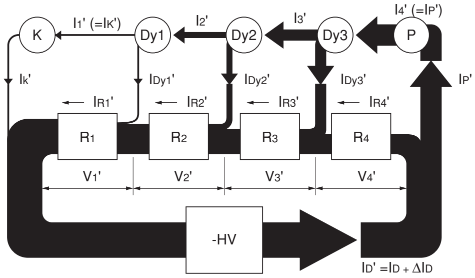
Where In' is the interelectrode current which has the following relation:

$$I_1' < I_2' < I_3' < I_4'$$

Thus, the interstage voltage V_n' ($=I_{Rn}' \cdot R_n$) becomes smaller at the latter stages, as follows:

$$V_1' > V_2' > V_3' > V_4'$$

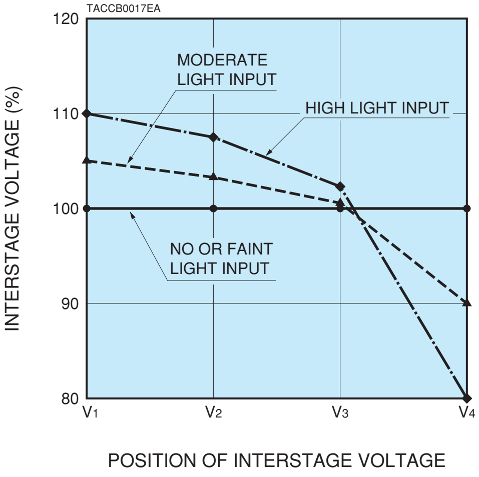
Figure 21: Operation with light input



TACCC0062EA

Figure 22 shows changes in the interstage voltages as the incident light level varies. The interstage voltage V_4' with light input drops significantly compared to V_4 in dark state operation. This voltage loss is redistributed to the other stages, resulting an increases in V_1', V_2' and V_3' which are higher than those in dark state operation. The interstage voltage V_4' is only required to collect the secondary electrons emitted from the last dynode to the anode, so it has little effect on the anode current even if dropped to 20 or 30 volts. In contrast, the increases in V_1', V_2' and V_3' directly raise the secondary emission ratios (δ_1, δ_2 and δ_3) at the dynodes Dy1, Dy2 and Dy3, and thus boost the overall gain m ($= \delta_1 \cdot \delta_2 \cdot \delta_3$). This is the cause of overlinearity in region B in Figure 10. As the incident light level further increases so that V4' approaches 0 volts, output saturation occurs in region C.

Figure 22: Changes in interstage voltages at different incident light levels



11.6 Linearity improvement in DC output mode

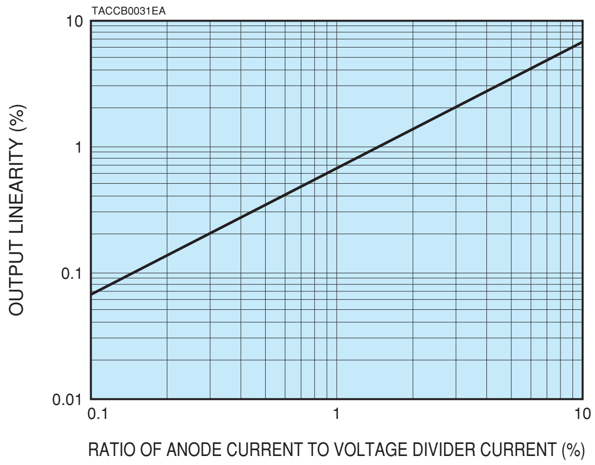
To improve the linearity in DC output mode, it is important to minimize the changes in the interstage voltage when photocurrent flows through the photomultiplier tube. There are several specific methods for improving the linearity, as discussed below.

①Increasing the voltage divider current

Figure 23 shows the relationship between the output linearity of a 28 mm (1-1/8") diameter side-on photomultiplier tube and the ratio of anode current to voltage divider current. For example, to obtain an output linearity of 1 %, it can be seen from the figure that the anode current should be set approximately 1.4 % of the divider circuit current. However, this is a calculated plot, so actual data may differ from tube to tube even for the same type of photomultiplier tube, depending on the supply voltage and individual dynode gains. To ensure high photometric accuracy, it is recommended that the voltage divider current be maintained at least twice the value obtained from this figure.

The maximum linear output in DC mode listed for the D-type socket assemblies in this catalog indicates the anode current equal to 1/20 of the voltage divider current. The output linearity at this point can be maintained within 3 % to 5 %.

Figure 23: Output linearity vs. anode current to voltage divider current ratio

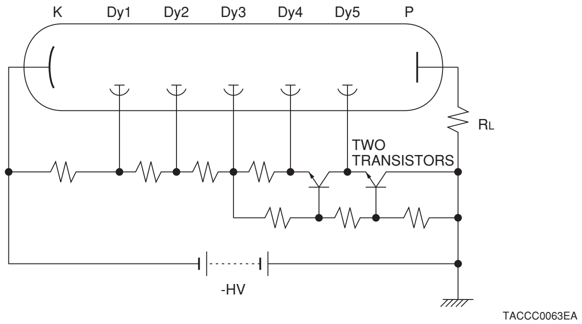


As stated above, good output linearity can be obtained simply by increasing the voltage divider current. However, this is accompanied by heat emanating from the voltage divider. If this heat is conducted to the photomultiplier tube, it may cause problems such as an increase in the dark current, and variation in the output.

②Using the active voltage divider circuit

Use of a voltage divider circuit having transistors in place of the dividing resistors in last few stages (for example, Hamamatsu E6270 series using FETs) is effective in improving the output linearity. This type of voltage divider circuit ensures good linearity up to an output current equal to 60 % to 70 % of the voltage divider current, since the interstage voltage is not affected by the interelectrode current inside the photomultiplier tube. A typical active voltage divider circuit is shown in Figure 24.

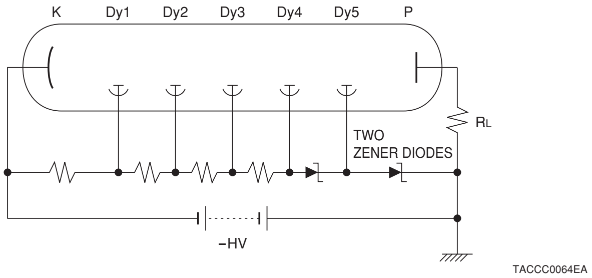
Figure 24: Active voltage divider circuit



③Using zener diodes

The output linearity can be improved by using Zener diodes in place of the dividing resistors in the last few stages, because the Zener diodes serve to maintain the interstage voltages at a constant level. However, if the supply voltage is greatly varied, the voltage distribution may be imbalanced compared to other interstage voltages, thus limiting the adjustable range of the voltage with this technique. In addition, if the supply voltage is reduced or if the current flowing through the Zener diodes becomes insufficient due to an increase in the anode current, noise may be generated from the Zener diodes. Precautions should be taken when using this type of voltage divider circuit. Figure 25 shows a typical voltage divider circuit using Zener diodes.

Figure 25: Voltage divider circuit using zener diodes

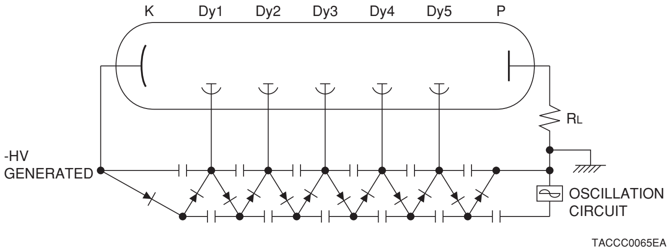


④Using Cockcroft-Walton circuit

When a Cockcroft-Walton circuit as shown in Figure 26 is used to operate a 28 mm (1-1/8") diameter side-on photomultiplier tube with a supply voltage of 1000 volts, good DC linearity can be obtained up to 200 µA and even higher. Since a high voltage is generated by supplying a low voltage to the oscillator circuit, there is no need for using a high voltage power supply.

This Cockcroft-Walton circuit achieves superior DC output linearity as well as low current consumption.

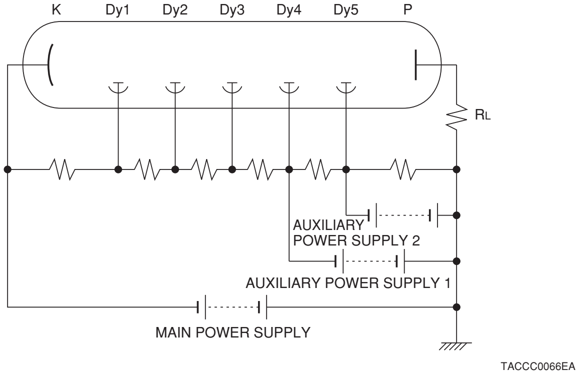
Figure 26: Cockcroft-Walton circuit



⑤Using multiple high voltage power supplies

As shown in Figure 27, this technique uses multiple power supplies to directly supply voltages to the last few stages near the anode. This is sometimes called the booster method, and is used for high pulse and high count rate applications in high energy physics experiments.

Figure 27: Voltage divider circuit using multiple power supplies (Booster method)



11.7 Output linearity in pulsed mode

In applications such as scintillation counting where the incident light is in the form of pulses, individual pulses may range from a few to over 100 milliamperes even though the average anode current is small at low count rates. In this pulsed output mode, the peak current in extreme cases may reach a level hundreds of times higher than the voltage divider current. If this happens, it is not possible to supply interelectrode currents from the voltage divider circuit to the last few stages of the photomultiplier tube, thus leading to degradation in the output linearity.

11.8 Improving linearity in pulsed output mode

①Using decoupling capacitors

Using multiple power supplies mentioned above is not popular in view of the cost. The most commonly used technique is to supply the interelectrode current by using decoupling capacitors as shown in Figure 28. There are two methods for connecting these decoupling capacitors: the serial method and the parallel method. As Figures 28 and 29 show, the serial method is more widely used since it requires lower tolerance voltages of the capacitors. The capacitance value C (farads) of the decoupling capacitor between the last dynode and the anode should be at least 100 times the output charge as follows:

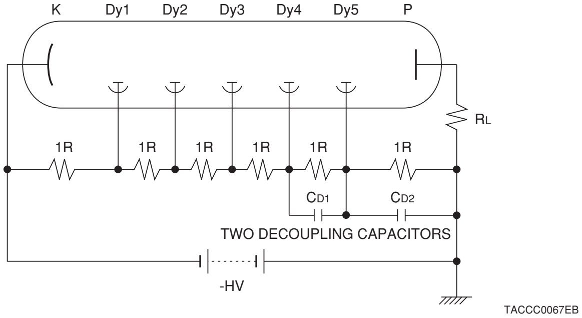
$$C > 100 \cdot Q/V$$

where Q is the charge of one output pulse (coulombs) and V is the voltage (volts) across the last dynode and the anode.

Since this method directly supplies the pulse current with electrical charges from the capacitors, if the count rate is increased and the resulting duty factor becomes larger, the electrical charge will be insufficient. Therefore, in order to maintain good linearity, the capacitance value obtained from the above equation must be increased according to the duty factor, so that the voltage divider current is kept at least 50 times larger than the average anode current just as with the DC output mode.

The active voltage divider circuit and the booster method using multiple power supplies discussed previously, provide superior pulse output linearity even at a higher duty factor.

Figure 28: Equally divided voltage divider circuit and decoupling capacitors

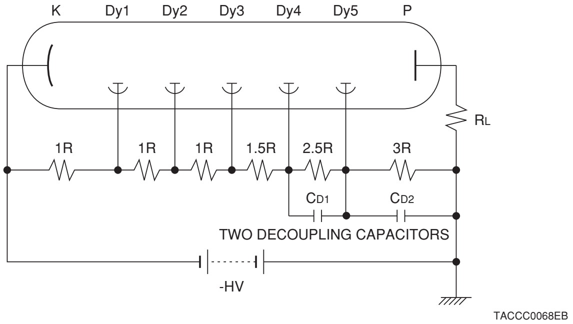


②Using tapered voltage divider circuit with decoupling capacitors

Use of the above voltage divider circuit having decoupling capacitors is effective in improving pulse linearity. However, when the pulse current increases further, the electron density also increases, particularly in last stages. This may cause a space charge effect which prevents interelectrode current from flowing adequately and leading to output saturation. A commonly used technique for extracting a higher pulse current is the tapered voltage divider circuit in which the voltage distribution ratios in the latter stages are enhanced as shown in Figure 29. Care should be taken in this case regarding loss of the gain and the breakdown voltages between electrodes.

Since use of a tapered voltage divider circuit allows an increase in the voltage between the last dynode and the anode, it is possible to raise the voltage across the load resistor when it is connected to the anode. It should be noted however, that if the output voltage becomes excessively high, the voltage between the last dynode and the anode may drop, causing a degradation in output linearity.

Figure 29: Tapered voltage divider circuit using decoupling capacitors



12. EXTERNAL POTENTIAL

If the input window or glass envelope near the photocathode is grounded, slight conductivity of glass material causes a current flow between the photocathode, which has a high negative potential, and ground.

This may cause electrolysis of photocathode, leading to significant deterioration.

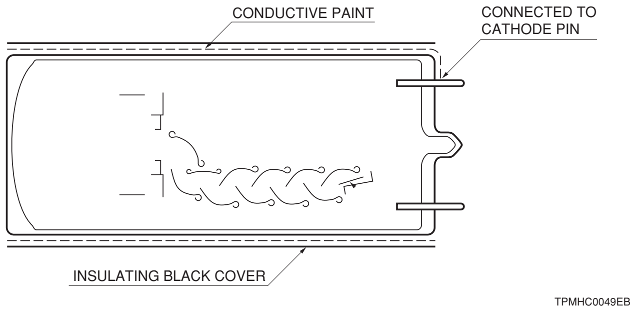
Also this may cause noise resulted from the light flashes at the above input window or glass envelope.

For those reasons, when designing a PMT housing with an electrostatic or magnetic shield case, extreme care should be required.

When the anode ground scheme is used, bringing a grounded metallic holder or magnetic shield case near the glass envelope of PMT can cause electrons to strike the inner glass wall, resulting in the noise.

This problem can be solved by applying a black conductive paint around the glass envelope and connecting it to the cathode potential. Then PMT is wrapped with an insulating black cover, as shown in Figure 30. This method is called HA treatment.

Figure 30: HA treatment



13. SCINTILLATION COUNTING

13.1 General

Scintillation counting is one of the most common and effective methods in detecting radiation particles. It uses a PMT coupled to a scintillator which produces light by incidence of radiation particles.

In radiation particle measurement, there are two parameters that should be measured. One is the energy of individual particle and the other is the amount of particles. When radiation particles enter the scintillator, they produce light flashes in response to each particle. The amount of flash is proportional to the energy of the incident particle and individual light flashes are detected by the PMT. Consequently, the output pulses obtained from the PMT contain information on both the energy and number of pulses, as shown in Figure 31.

Figure 31: Incident particles and PMT output

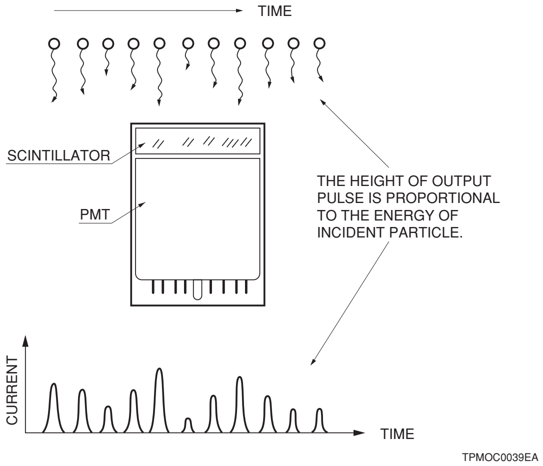
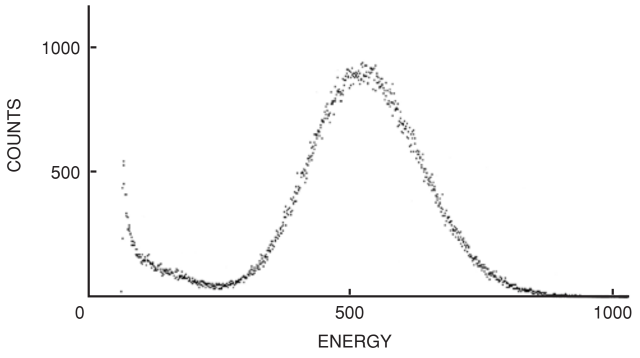
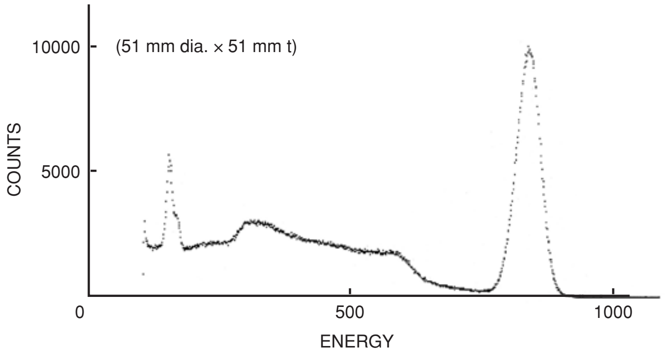

TIME
SCINTILLATOR
PMT
THE HEIGHT OF OUTPUT PULSE IS PROPORTIONAL TO THE ENERGY OF INCIDENT PARTICLE.
CURRENT
TIME
TPMOC0039EA

Figure 32: Typical pulse height distribution (Energy spectral)

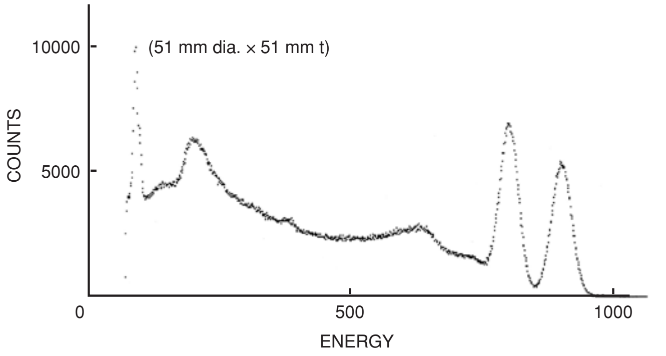
(a) ^{55}Fe+NaI(Tl)



(b) ^{137}Cs+NaI(Tl)



(c) ^{60}Co+NaI(Tl)



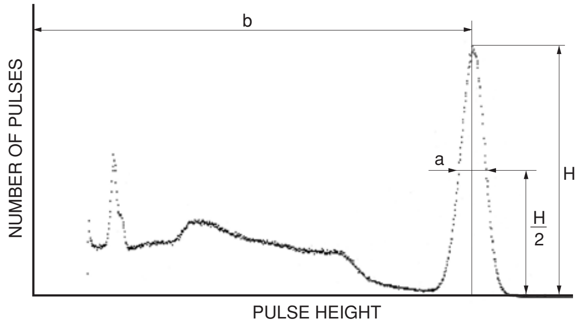
TPMOB0087EC

By analyzing these output pulses using a multichannel analyzer (MCA), pulse height distribution (PHD), or energy spectra, as shown in Figure 32, are obtained. From the PHD, the number of incident particles at various energy levels can be measured.

13.2 Energy resolution

For the energy spectrum measurement, it is very important to have a distinct peak at each energy level. This characteristic is evaluated as the pulse height resolution or the energy resolution and is most significant in the radiation particle identification.
Figure 33 shows the definition of the energy resolution using NaI(Tl) scintillator and ^{137}Cs γ-ray source. It is customarily stated as a percentage.

Figure 33: Definition of pulse height resolution



$$\text{Energy Resolution (FWHM)} = \frac{a}{b} \times 100\ \%$$

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The following factors determin the energy resolution.

(1) Energy conversion efficiency of the scintillator
(2) Intrinsic energy resolution of the scintillator
(3) Quantum efficiency of the photocathode
(4) Collection efficiency of photoelectrons at the first dynode
(5) Secondary emission yield of dynodes (especially first dynode)

The equation of the pulse height resolution is described as follows:

$$R(E)^2 = R_S(E)^2 + R_P(E)^2$$

where $R(E)$: energy resolution
$R_S(E)$: energy resolution of a scintillator
$R_P(E)$: energy resolution of a PMT

$R_P(E)^2$ is described as follows:

$$R_P(E)^2 = \frac{5.56}{N\eta\alpha} \times \frac{\delta}{\delta - 1}$$

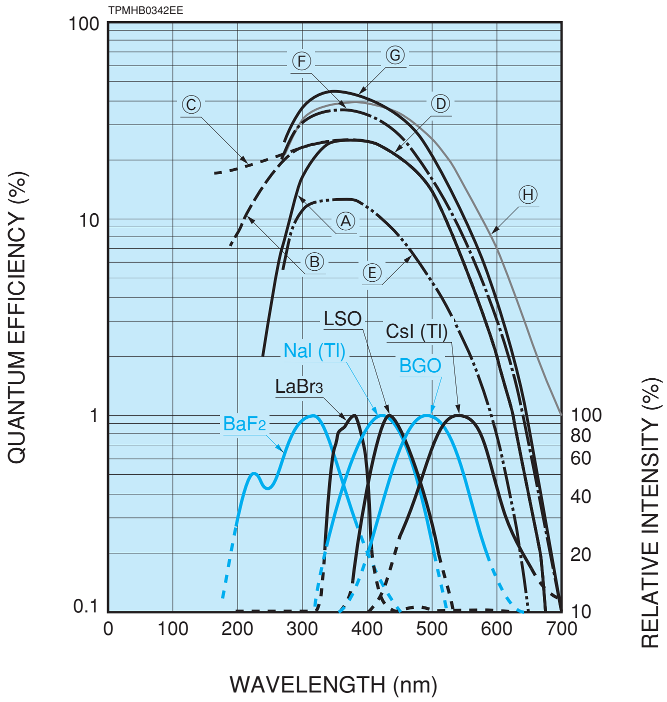
where N : mean number of incident photon
η : quantum efficiency
α : collection efficiency
δ : mean secondary emission yield of each dynode

To obtain a good energy resolution, it is important to use a good scintillator having a high efficiency and a good intrinsic energy resolution. It is also important to reduce a light loss between a PMT and a scintillator. For this purpose, it is useful to couple them with silicon oil having a refractive index close to that of the faceplate window of the PMT or scintillator material or its protective window.

13.3 Emission spectrum of scintillator

The quantum efficiency of the PMT is one of the main factors to determine its energy resolution. It is necessary to choose a PMT whose spectral response matches the scintillator emission. Figure 34 shows PMT typical spectral response vs. emission spectra of scintillators. For NaI(Tl), which is the most popular scintillator, bialkali photocathode PMTs are widely used.

Figure 34: Typical spectral response and emission spectra of scintillators



Ⓐ: Bialkali Photocathode (Borosilicate Glass)
Ⓑ: Bialkali Photocathode (UV Glass)
Ⓒ: Bialkali Photocathode (Silica Glass)
Ⓓ: Bialkali Photocathode
Ⓔ: High Temp. Bialkali Photocathode
Ⓕ: Super Bialkali
Ⓖ: Ultra Bialkali
Ⓗ: Extended Green Bialkali

13.4 Features of scintillators

Figure 35 shows typical temperature responses of various scintillators. These characteristics should be considered in the actual operation.
Table 1 shows a summary of scintillator characteristics.
These data are reported by scintillator manufactures.

Figure 35: Typical temperature response of various scintillators

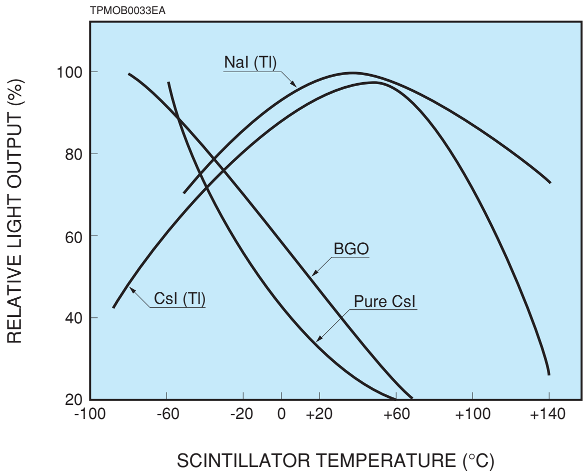


Table 1: Summary of scintillator characteristics

	NaI(Tl)	BGO	CsI(Tl)	Pure CsI	BaF2	GSO: Ce	Plastic	LaBr3: Ce	LSO: Ce	YAP: Ce
Density (g/cm³)	3.67	7.13	4.51	4.51	4.88	6.71	1.03	5.29	7.35	5.55
L_{rad} (cm)	2.59	1.12	1.85	1.85	2.10	1.38	40	2.1	0.88	2.70
Refractive index	1.85	2.15	1.80	1.80	1.58	1.85	1.58	1.9	1.82	1.97
Hygroscopic	Yes	No	Slightly	Slightly	Slightly	No	No	Yes	No	No
Luminescence (nm)	410	480	530	310	220 / 325	430	400	380	420	380
Decay time (ns)	230	300	1000	10	0.9 / 630	30	2.0	16	40	30
Relative light output	100	15	45 to 50	<10	20	20	25	165	70	40

14. METAL PACKAGE PHOTOMULTIPLIER TUBE

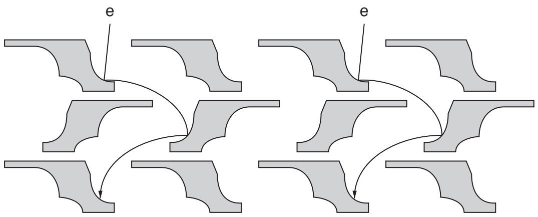
In general including, the development of more compact and portable equipment has continuously progressed. This has led to a strong demand for miniaturization of highly sensitive photodetectors like PMTs. However, it is difficult to miniaturize conventional PMTs with glass envelopes and sophisticated electrode structures.

Accordingly, PMTs have been mainly used in high-precision photometric systems, while semiconductor sensors have been used in general purpose, compact and portable equipments/applications. To meet the increasing needs for small photodetectors with high sensitivity, Hamamatsu has developed subminiature PMTs (R9880 series) using a metal package in place of the traditional glass envelope. These tubes have a size as small as semiconductor sensors, without sacrificing high sensitivity, and have the high speed response offered by conventional PMTs. The remarkable features of R9880 series are: smallest size, fast time response, ability of low light level detection and good immunity to magnetic fields.

R9880 series are a subminiature PMT that incorporates an ten stages electron multiplier constructed with stacked thin electrodes (metal channel dynode) into a TO-8 type metal can package of 15 mm in diameter and 10 mm in height. The development of this metal package and its unique thin electrodes have made the fabrication of this subminiature PMT possible. The electrode structure of the electron multiplier was designed by means of advanced computer simulation and electron trajectory analysis.

Furthermore, our long experience with micromachining technology has achieved a closed proximity assembly of these thin electrodes. Figure 36 shows a cross section of the metal channel dynode with simulated electron trajectories.

Figure 36: Cross section of metal channel dynode with electron trajectories



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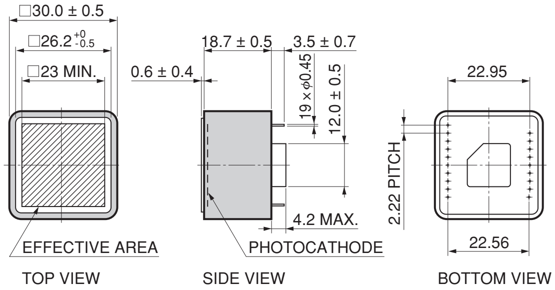
The R5900 / R7600 / R8520 / R11265 series is another version of metal package PMT. It incorporates 10 to 12 stages of metal channel dynodes into a metal package of 26 mm × 26 mm square and about 20 mm in height. The prime features are similar to those of R9880 series, but its effective area is different of R9880. The dimensional outline of R11265U is shown in Figure 37. In this figure, "U" means a tube having an insulation plastic cover. It is necessary to prevent electric shock with some insulation material, because a metal package has a cathode potential voltage.

Figure 37: Insulation plastic cover of R11265U



TPMHA0585EA

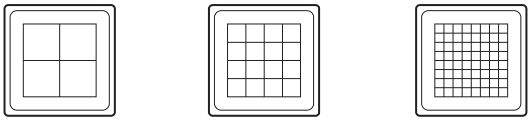
As the metal channel dynode is a sort of an array of small linear focused dynodes, secondary electrons hardly go to the adjacent dynode channel in a process of multiplication. It is possible to make multi-anode PMTs utilizing this feature. These anode shapes are categorized into 3 groups. The first group is multianode in matrix. 4 (2 × 2), 16 (4 × 4) and 64 (8 × 8) matrix channels types are available. (see Figure 38-A) Those are suitable for scintillating fiber readout as well as RICH (Ring Image CHerenkov counter).

R11265 series are wider effective area and shorter length compare with those of R7600 series. (see Figure 38-B)

Flat panel PMT assemblies use a 52 mm square photomultiplier tube having an effective area ratio of 89 % and a 64-channel or 256-channel multianode. These flat panel PMTs offer a wide photosensitive area and come in thin, compact shape (see Figure 38-C).

Figure 38: Various anode shape

(A) Matrix channel type

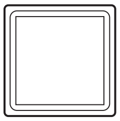


R7600U-00-M4

H8711
(R7600-00-M16)

H7546B
(R7600-00-M64)

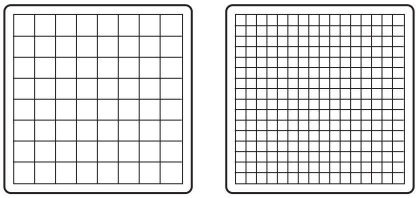
(B) R11265U series



R11265U

* R11265 series have wider effective area and low profile with those of R7600 series.

(C) Flat panel type



H12700A
(R12699-00-M64)

H13700
(R12699-00-M256)

TPMHC0204EC

List guide for photomultiplier tubes

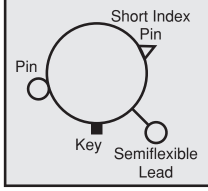
Tube diameter	Type No.	❶ Out-line No.	Spectral response ❷		Cathode characteristics				Anode characteristics								
			Spectral response range (nm)	Curve code	❸ Q.E. at peak Typ. (%)	❹ Lumi-nous Typ. (μA/lm)	❺ Blue sensitivity index Typ.	❻ Radiant Typ. (mA/W)	❼ Anode to cathode supply voltage (V)	❽ Lumi-nous Typ. (A/lm)	❻ Radiant Typ. (A/W)	❾ Gain Typ.	Dark current ❿		Time response ⓫		
													Typ. (nA)	Max. (nA)	Rise time Typ. (ns)	Transit time Typ. (ns)	T.T.S. Typ. (FWHM) (ns)

❶ Outline No.

This number corresponds to that of PMT dimensional outline drawing shown on later pages.
Basing diagram symbols are explained as follows:

BASING DIAGRAM SYMBOLS

All base diagrams show terminals viewed from the base end of the tube.



DY : Dynode
G(F) : Grid (Focusing Electrode)
ACC : Accelerating Electrode
K : Photocathode
P : Anode
SH : Shield
IC : Internal Connection (Do not use)

TPMOC0068EC

❷ Spectral response

The relationship between photocathode sensitivity and wavelength of input light.
Curve code corresponds to that of spectral response curve on the inside back cover.
(Refer to section 2 on page 2 for further details.)

❸ QE (Quantum Efficiency)

The ratio of the number of photoelectrons emitted from the photocathode to the number of incident photons.
This catalog shows quantum efficiency at the peak wavelength.
(Refer to section 2.2 on page 2 for further details.)

❹ Cathode sensitivity (Luminous)

The photoelectric current from the photocathode per incident light flux from a tungsten filament lamp operated at 2856 K.
(Refer to section 2.5 on page 3 for further details.)

❺ Cathode blue sensitivity index

The photoelectric current from the photocathode per incident light flux from a tungsten filament lamp operated at 2856 K passing through a blue filter.
(Refer to section 2.5 on page 3 for further details.)

❻ Radiant

Measured at the peak sensitivity wavelength.
(Refer to section 2.2 on page 2 for further details.)

❼ Anode to cathode supply voltage

The voltage indicates a standard applied voltage used to measure characteristics. The number in circles corresponds to that of the voltage distribution ratio on page 56 and 57.

❽ Anode sensitivity (Luminous)

The output current from the anode per incident light flux from a tungsten filament lamp operated at 2856 K.
(Refer to section 4.1 on page 3 for further details.)

❾ Gain (Current amplification)

The ratio of the anode output current to the photoelectric current from the photocathode.
(Refer to section 4.2 on page 4 for further details.)

❿ Anode dark current

The output current from the anode measured after 30 minutes storage in complete darkness.
(Refer to section 5 on page 4 for further details.)

⓫ Time response

<Rise time>
The time for the anode output pulse to rise from 10 % to 90 % of the peak amplitude.

<Electron transit time>
The time interval between the arrival of a delta function light pulse at the photocathode and the instant when the anode output pulse reaches its peak amplitude.

<T.T.S. (Transit Time Spread)>
This is the fluctuation in transit time among individual pulses, and is defined as the FWHM of the frequency distribution of transit time.
(Refer to section 6 on page 5 for further details.)

(at 25 °C)

Max. ratings ⓬		⓭ Typical pulse height resolution (%)	Stability ⓮		Pulse linearity ⓯		Remarks		Note	Type No.
Anode to cathode voltage (V)	Average anode current (mA)		Long term Typ. (%)	Short term Typ. (%)	2 % deviation Typ. (mA)	5 % deviation Typ. (mA)	⓰ Dynode structure / stage	⓱ Socket & socket assembly		

⓬ Maximum rating

<Anode to cathode voltage>

The maximum anode to cathode voltages are limited by the internal structure of the PMT.

Excessive voltage causes electrical breakdown. The voltage lower than the maximum rating should be applied to the PMT.

<Average anode current>

This indicates the maximum averaged current over any interval of 30 seconds. For practical use, operating at lower average anode current is recommended.

(Refer to section 9.3 on page 6 for further details)

★Operating ambient temperature range for the photomultiplier itself is -30 °C to +50 °C except for some types of tubes. However, when photomultiplier tubes are operated below -30 ° C at their base section, please consult us in advance.

⓭ Pulse height resolution (P.H.R.)

The P.H.R. is measured with the combination of an NaI(Tl) scintillator and a ^{137}Cs source as a standard measurement. If other scintillators or γ-ray sources are used, note is attached.

(Refer to section 13.2 on page 14 for further details.)

⓮ Stability

<Long term stability (Mean gain deviation)>

This is defined as follows under the operation for 16 hours at a constant count rate of 1000 s^{-1}:

$$Dg = \frac{\sum_{i=1}^{n} |P-Pi|}{n} \cdot \frac{100}{P} \ (\%)$$

where P is the mean pulse height averaged over n readings, Pi is the pulse height at the i-th reading, and n is the total number of readings.

<Short term stability>

This is the gain shift on count rate charge. The tube is first operated at about 10000 s^{-1}. The photo-peak count rate is then decreased to about 1000 s^{-1} by increasing the distance between the ^{137}Cs source and the tube coupled to the NaI(Tl) scintillator.

(Refer to section 9 on page 6 for further details.)

⓯ Pulse linearity

Typical values of pulse linearity are specified at two points (±2 % and ±5 % deviation points from linear proportionality).

(Refer to section 7 on page 5 and 6 for further details.)

⓰ Dynode

<Dynode structure>

Each mark means dynode structure as follows:

LINE : linear focused
BOX : box and grid
B + L : box and linear focused
C + L : circular and linear focused
VB : venetian blind
MC : metal channel

<No. of stages>

The number of dynodes used.

(Refer to section 3 on page 4 for further details.)

⓱ Socket & socket assembly

★ mark : A socket will be supplied with a PMT.
no mark : A socket will be supplied as an option.
The number in square corresponds to the outline number of the PMT socket assembly on page 58 and 59.

Photomultiplier tubes

Tube diameter	Type No.	❶ Outline No.	Spectral response ❷		Cathode characteristics				Anode characteristics								
			Spectral response range (nm)	Curve code	❸ Q.E. at peak Typ. (%)	❹ Luminous Typ. (μA/lm)	❺ Blue sensitivity index Typ.	❻ Radiant Typ. (mA/W)	❼ Anode to cathode supply voltage (V)	❽ Luminous Typ. (A/lm)	❻ Radiant Typ. (A/W)	❾ Gain Typ.	Dark current ❿ Typ. (nA)	Max. (nA)	Time response ⓫ Rise time Typ. (ns)	Transit time Typ. (ns)	T.T.S. Typ. (FWHM) (ns)
10 mm (3/8")	R1635	①	300 to 650	Ⓐ-Ⓓ	25	100	10.0	80	1250 ②	100	8.0×10^4	1.0×10^6	1	50	0.8	9	0.5
	R2496	①	160 to 650	Ⓒ-Ⓓ	25	100	10.0	80	1250 ④	100	8.0×10^4	1.0×10^6	2	50	0.7	9	0.5
13 mm (1/2")	R647-01	②	300 to 650	Ⓐ-Ⓓ	25	110	10.0	80	1000 ⑭	150	1.1×10^5	1.4×10^6	1	2	2.1	22	2.0
	R4177-06	②	300 to 650	Ⓔ	12	30	4.5	38	1500 ⑭	15	1.9×10^4	5.0×10^5	0.5	10	2.0	20	—
	R12421	③	300 to 650	Ⓐ-Ⓓ	25	110	10	80	1000 ⑲	220	1.6×10^5	2.0×10^6	0.5	2	1.2	14	1.4
	R12421-300	③	300 to 700	Ⓗ	32	160	14	105	1000 ⑲	320	2.1×10^5	2.0×10^6	1	5	1.2	14	1.4
19 mm (3/4")	R1166	④	300 to 650	Ⓐ-Ⓓ	26	110	10.5	85	1000 ⑯	110	8.5×10^4	1.0×10^6	1	5	2.5	27	2.8
	R1450	⑤	300 to 650	Ⓐ-Ⓓ	27	115	11.0	88	1500 ㉑	200	1.5×10^5	1.7×10^6	3	50	1.8	19	0.76
	R3478	⑥	300 to 650	Ⓐ-Ⓓ	27	115	11.0	88	1700 ⑦	200	1.5×10^5	1.7×10^6	10	300	1.3	14	0.36
	R3991A-04	⑦	300 to 650	Ⓔ	12	30	4.5	38	1500 ㉒	10	1.3×10^4	3.3×10^5	0.1	10	1.0	10	—
	R4125	⑤	300 to 650	Ⓐ-Ⓓ	27	115	11.0	88	1500 ⑰	100	7.7×10^4	8.7×10^5	10	50	2.5	16	0.85
	R5611A-01	⑦	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1000 ㉒	50	4.7×10^4	5.5×10^5	3	20	1.3	12	0.8
25 mm (1")	R1288A-06	⑧	300 to 650	Ⓔ	12	30	4.5	38	1500 ㉒	10	1.2×10^4	3.3×10^5	0.1	10	1.3	13	—
	R1924A	⑧	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1000 ㉒	180	1.7×10^5	2.0×10^6	3	20	1.5	17	0.9
	R1924A-100	⑧	300 to 650	Ⓕ	35	130	13.5	110	1000 ㉒	260	2.2×10^5	2.0×10^6	5	25	1.5	17	0.9
	R4998	⑨	300 to 650	Ⓐ-Ⓓ	23	80	9.5	76	2250 ㉚	400	3.8×10^5	5.0×10^6	10	200	0.7	10	0.16
	R7899-01	⑩	300 to 650	Ⓐ-Ⓓ	27	95	11.0	88	1250 ㉓	190	1.8×10^5	2.0×10^6	2	15	1.6	17	0.6
									🟦 1500 ㉔	🟦 160	🟦 1.5×10^5	🟦 1.7×10^6	🟦 2	🟦 20	🟦 1.6	🟦 16	🟦 0.7
	R8619	⑪	300 to 650	Ⓐ-Ⓓ	27	95	11.0	88	1000 ㉓	250	2.3×10^5	2.6×10^6	2	15	2.5	28	1.2
	R9800	⑫	300 to 650	Ⓐ-Ⓓ	27	95	11.0	88	1300 ⑥	100	9.3×10^4	1.1×10^6	5	50	1.0	11	0.27
	R9800-100	⑫	300 to 650	Ⓕ	35	130	13.5	110	1300 ⑥	140	1.2×10^5	1.1×10^6	10	100	1.0	11	0.27
	R13478	⑬	300 to 650	Ⓐ-Ⓓ	25	95	10.0	80	1500 ⑨	50	4.2×10^4	5.3×10^5	3	30	0.9	9.1	0.13
28 mm (1-1/8")	R3998-02	⑭	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1000 ⑫	120	1.1×10^5	1.3×10^6	2	10	4.4	32	3.5
	R3998-100-02	⑭	300 to 650	Ⓕ	35	130	13.5	110	1000 ⑫	130	1.1×10^5	1.0×10^6	5	25	4.4	32	3.5
	R6427	⑮	300 to 650	Ⓐ-Ⓓ	27	100	11.0	88	1500 ㉖	500	4.4×10^5	5.0×10^6	10	200	1.7	16	0.5
									🟦 1500 ㉗	🟦 200	🟦 1.7×10^5	🟦 2.0×10^6	🟦 4	🟦 80	🟦 1.8	🟦 17	🟦 0.5
	R7111	⑯	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1000 ㉒	180	1.7×10^5	2.0×10^6	3	20	1.6	18	0.9
	R13449	⑰	300 to 650	Ⓐ-Ⓓ	25	95	10.0	80	1500 ⑨	50	4.2×10^4	5.3×10^5	3	30	0.9	10	0.17
38 mm (1-1/2")	R580	⑱	300 to 650	Ⓐ-Ⓓ	27	95	11.0	88	1250 ⑲	100	9.7×10^4	1.1×10^6	3	20	2.7	37	4.5
									🟦 1500 ⑳	🟦 75	🟦 7.0×10^4	🟦 7.9×10^5	🟦 2	🟦 15	🟦 2.7	🟦 40	🟦 4.5
	R11102	⑲	300 to 650	Ⓐ-Ⓓ	28	110	11.5	95	1000 ⑲	110	9.5×10^4	1.0×10^6	2	20	3.2	34	4.8
	R3886A	⑳	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1000 ⑲	180	1.7×10^5	2.0×10^6	3	20	2.6	30	2.0
	R9420	㉑	300 to 650	Ⓐ-Ⓓ	27	95	11.0	88	1300 ⑥	47	4.4×10^4	5.0×10^5	10	100	1.6	17	0.55
	R9420-100	㉑	300 to 650	Ⓕ	35	130	13.5	110	1300 ⑥	65	5.5×10^4	5.0×10^5	10	100	1.6	17	0.55
	R13408	㉒	300 to 650	Ⓐ-Ⓓ	25	95	10.0	80	1500 ⑨	50	4.2×10^4	5.3×10^5	3	30	1.2	13	0.19

Note: The data shown in 🟦 is measured with tapered voltage distribution ratio.
Please refer to page 18 and 19 for each item in the above list.

(at 25 °C)

Max. ratings ⑫		⑬	Stability ⑭		Pulse linearity ⑮		Remarks			
Anode to cathode voltage (V)	Average anode current (mA)	Typical pulse height resolution (%)	Long term Typ. (%)	Short term Typ. (%)	2 % deviation Typ. (mA)	5 % deviation Typ. (mA)	⑯ Dynode structure / stage	⑰ Socket & socket assembly	Note	Type No.
1500	0.03	23 *1	1.0	2.0	3	7	LINE / 8	E678-11N*	UV type (R3878)	R1635
1500	0.03	23 *1	1.0	2.0	3	7	LINE / 8	E678-11N*		R2496
1250	0.1	7.8	1.0	2.0	3	7	LINE / 10	E678-13F* 1	SILICA (R760) and UV (R960) types	R647-01
1800	0.02	12.0	2.0	2.0	8	13	LINE / 10	E678-13E*	Flying lead type (R4177-04)	R4177-06
1250	0.1	7.8	1.0	2.0	3	12	LINE / 10	E678-13F* 2	UV type (R12421-03)	R12421
1250	0.1	—	1.0	2.0	3	12	LINE / 10	E678-13F* 2	EGBA type	R12421-300
1250	0.1	7.8	1.0	2.0	4	7	LINE / 10	E678-12L* 3	SILICA (R762) and UV (R750) types	R1166
1800	0.1	7.8	1.0	2.0	4	8	LINE / 10	E678-12L* 4		R1450
1800	0.1	7.8	1.0	2.0	4	8	LINE / 8	E678-12L* 5	SILICA (R2076) and UV (R3479) types	R3478
1800	0.02	11.0	1.0	2.0	20	40	C+L / 10	E678-12R*		R3991A-04
1800	0.1	7.8	1.0	2.0	100	170	LINE / 10	E678-12L*		R4125
1250	0.1	8.0	1.0	2.0	10	20	C+L / 10	E678-12A*	Glass base type (R5611A)	R5611A-01
1800	0.02	9.0	1.0	2.0	30	50	C+L / 10	E678-14-03*	Flying lead type (R1288A-04)	R1288A-06
1250	0.1	7.8	1.0	2.0	30	50	C+L / 10	E678-14C* 7	Flying lead type (R1924A-01)	R1924A
1250	0.1	—	—	—	30	50	C+L / 10	E678-14C 7	Flying lead type (R1924A-100-01)	R1924A-100
2500	0.1	8.0	1.0	2.0	40	70	LINE / 10	E678-12A*	SILICA type (R5320)	R4998
1800	0.1	7.8	1.0	2.0	30	50	LINE / 10	E678-12A*	Glass base type (R7899)	R7899-01
1800	0.1	7.8	1.0	2.0	100	150				
1500	0.1	8.0	1.0	2.0	5	8	LINE / 10	E678-12A*		R8619
1500	0.1	7.8	1.0	2.0	30	50	LINE / 8	E678-12A*		R9800
1500	0.1	—	—	—	30	50	LINE / 8	E678-12A*	SBA type	R9800-100
1750	0.1	8.0	—	—	10	25	LINE / 8	E678-20B*		R13478
1500	0.1	7.5	1.0	1.0	8	10	B+L / 9	E678-14C* 6		R3998-02
1500	0.1	7.0	1.0	1.0	8	10	B+L / 9	E678-14C* 6	SBA type	R3998-100-02
2000	0.1	7.8	1.0	2.0	10	30	LINE / 10	E678-14C* 8	UV type (R7056)	R6427
2000	0.1	7.8	1.0	2.0	100	150				
1250	0.1	7.8	1.0	2.0	30	50	C+L / 10	E678-14C* 7		R7111
1750	0.1	8.0	—	—	10	30	LINE / 8	E678-20B*		R13449
1750	0.1	7.7	1.0	1.0	40	60	LINE / 10	E678-12A* 9		R580
1750	0.1	7.7	1.0	1.0	150	200				
1250	0.1	6.5	0.5	0.5	10	30	C+L / 10	E678-12A 9		R11102
1250	0.1	7.5	1.0	2.0	20	30	C+L / 10	E678-12A* 9		R3886A
1500	0.1	7.8	1.0	2.0	30	50	LINE / 8	E678-12A*		R9420
1500	0.1	7.0	1.0	2.0	30	50	LINE / 8	E678-12A*	SBA type	R9420-100
1750	0.1	8.0	—	—	20	50	LINE / 8	E678-20B*		R13408

Note 1: This data is measured with ^{22}Na source and BGO scintillator.

Photomultiplier tubes

Tube diameter	Type No.	❶	Spectral response ❷		Cathode characteristics				Anode characteristics								
					❸	❹	❺	❻	❼	❽	❻	❾	Dark current ❿		Time response ⓫		
Tube diameter	Type No.	Outline No.	Spectral response range (nm)	Curve code	Q.E. at peak Typ. (%)	Luminous Typ. (µA/lm)	Blue sensitivity index Typ.	Radiant Typ. (mA/W)	Anode to cathode supply voltage (V)	Luminous Typ. (A/lm)	Radiant Typ. (A/W)	Gain Typ.	Typ. (nA)	Max. (nA)	Rise time Typ. (ns)	Transit time Typ. (ns)	T.T.S. Typ. (FWHM) (ns)
51 mm (2")	R329-02	㉓	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1500 ㊷	100	9.4×10^4	1.1×10^6	6	40	2.6	48	1.1
									2000 ㊹	270	2.6×10^5	3.0×10^6	10	100	2.7	40	1.1
	R331-05	㉔	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1500 ㊷	120	1.1×10^5	1.3×10^6	1000 s^{-1} *2	2000 s^{-1} *2	2.6	48	1.1
	R1306	㉕	300 to 650	Ⓐ-Ⓓ	28	110	11.5	95	1000 ①	30	2.6×10^4	2.7×10^5	2	20	7.0	60	—
	R1828-01	㉖	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	2500 ㊲	1800	1.7×10^6	2.0×10^7	50	400	1.3	28	0.55
									2500 ㊳	900	8.5×10^5	1.0×10^7	25	200	1.7	32	0.55
	R2083	㉗	300 to 650	Ⓐ-Ⓓ	25	80	10.0	80	3000 ⑩	200	2.0×10^5	2.5×10^6	100	800	0.8	16	0.37
	R2154-02	㉘	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1250 ⑲	90	8.5×10^4	1.0×10^6	5	20	3.4	31	3.6
									1500 ⑳	54	5.1×10^4	6.0×10^5	3	15	3.4	33	3.6
	R4607A-06	㉙	300 to 650	Ⓔ	12	30	4.5	38	1500 ⑲	10	1.2×10^4	3.3×10^5	3	50	2.6	28	—
	R6231	㉚	300 to 650	Ⓐ-Ⓓ	28	110	11.5	95	1000 ③	30	2.6×10^4	2.7×10^5	2	20	8.5	48	6.9
	R6231-100	㉚	300 to 650	Ⓕ	35	130	13.5	110	1000 ③	30	2.5×10^4	2.3×10^5	10	30	8.5	48	6.9
	R7723	㉛	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1750 ⑤	90	8.5×10^4	1.0×10^6	3	20	1.7	23	1.1
	R7724	㉛	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1750 ㉘	300	2.8×10^5	3.3×10^6	6	40	2.1	29	1.2
	R7724-100	㉛	300 to 650	Ⓕ	35	130	13.5	110	1750 ㉘	300	2.5×10^5	2.3×10^6	6	50	2.1	29	1.2
	R7725	㉛	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1750 ㊸	600	5.7×10^5	6.7×10^6	9	60	2.5	35	1.3
	R13089	㉜	300 to 650	Ⓐ-Ⓓ	25	95	10.0	80	1500 ⑨	30	2.5×10^4	3.2×10^5	10	50	2.0	20	0.23
	R13435	㉝	300 to 650	Ⓐ-Ⓓ	25	95	10.0	80	1750 ㉛	400	3.4×10^5	4.2×10^6	30	200	2.0	23	0.23
60 mm	R6232	㉞	300 to 650	Ⓐ-Ⓓ	28	110	11.5	95	1000 ③	30	2.6×10^4	2.7×10^5	2	20	9.5	52	8.5
76 mm (3")	R1307	㉟	300 to 650	Ⓐ-Ⓓ	28	110	11.5	95	1000 ①	30	2.6×10^4	2.7×10^5	2	20	8.0	64	—
	R6091	㊱	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1500 ㊷	450	4.3×10^5	5.0×10^6	10	60	2.6	48	2
									2000 ㊹	900	8.5×10^5	1.0×10^7	30	120	2.7	40	1.5
	R6233	㊲	300 to 650	Ⓐ-Ⓓ	28	110	11.5	95	1000 ③	30	2.6×10^4	2.7×10^5	2	20	9.5	52	8.5
	R6233-100	㊲	300 to 650	Ⓕ	35	130	13.5	110	1000 ③	30	2.5×10^4	2.3×10^5	10	30	9.5	52	8.5
	R15608	㊳	300 to 650	Ⓐ-Ⓓ	25	85	9.5	76	1750 ㉙	850	7.6×10^5	1.0×10^7	15	100	1.9	26.2	0.4
80 mm	R14374	㊴	300 to 650	Ⓐ-Ⓓ	27	90	11.0	90	1250 ㉑	900	9.0×10^5	1.0×10^7	50	500	2.9	35	1.3
90 mm (3.5")	R10233	㊵	300 to 650	Ⓐ-Ⓓ	28	110	11.5	95	1000 ③	30	2.6×10^4	2.7×10^5	2	20	10.0	52	9.4
	R10233-100	㊵	300 to 650	Ⓕ	35	130	13.5	110	1000 ③	30	2.5×10^4	2.3×10^5	10	30	10.0	52	9.4
	R14689	㊶	300 to 650	Ⓐ-Ⓓ	27	90	11.0	90	1250 ㉒	900	9.0×10^5	1.0×10^7	50	500	2.9	36	1.5
102 mm (4")	R10806	㊷	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1000 ③	30	2.8×10^4	3.3×10^5	5	20	9.0	55	10.5
	R10806-100	㊷	300 to 650	Ⓕ	35	105	13.5	110	1000 ③	30	3.1×10^4	2.9×10^5	10	40	9.0	55	10.5
127 mm (5")	R877	㊸	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1250 ⑮	40	3.7×10^4	4.4×10^5	10	50	20.0	115	18.5
	R877-100	㊸	300 to 650	Ⓕ	35	105	13.5	110	1250 ⑮	46	4.8×10^4	4.4×10^5	20	100	20.0	115	18.5
	R4144-100	㊹	300 to 650	Ⓕ	35	105	13.5	110	2000 ⑪	150	1.5×10^5	1.4×10^6	20	120	1.7	35	1.6
	R1250	㊺	300 to 650	Ⓐ-Ⓓ	22	70	9.0	72	2000 ㊺	1000	1.0×10^6	1.4×10^7	50	300	2.5	54	1.8
									2500 ㊻	2800	2.9×10^6	4.0×10^7	300	1800	2.2	53	1.8
	R6594	㊻	300 to 650	Ⓐ-Ⓓ	25	80	10.0	80	1500 ㉜	240	2.4×10^5	3.0×10^6	30	300	3.5	45	1.5
									1500 ㉝	160	1.6×10^5	2.0×10^6	20	200	3.5	45	1.5
	R11833-100-03	㊼	300 to 650	Ⓕ	35	105	13.5	110	1250 ⑧	50	5.5×10^4	4.8×10^5	20	100	3.3	41	4.6
202 mm (8")	R5912	㊽	300 to 650	Ⓐ-Ⓓ	25	80	10.0	80	1500 ㊼	800	8.0×10^5	1.0×10^7	100	1000	3.6	54	2.4
	R5912-20	㊽	300 to 650	Ⓐ-Ⓓ	25	80	10.0	80	1500 ㊽	80 000	8.0×10^7	1.0×10^9	5000	10000	4.4	72	3.0
	R5912-100	㊽	300 to 650	Ⓕ	35	105	13.5	110	1500 ㊼	1050	1.1×10^6	1.0×10^7	500	1000	3.6	54	2.4
	R14688	㊾	300 to 650	Ⓐ-Ⓓ	25	80	10.0	80	1750 ㉞	800	8.0×10^5	1.0×10^7	100	1000	2.2	37	1
	R14688-100	㊾	300 to 650	Ⓕ	35	105	13.5	110	1750 ㉞	1050	1.1×10^6	1.0×10^7	500	1000	2.2	37	1
253 mm (10")	R7081	㊿	300 to 650	Ⓐ-Ⓓ	25	80	10.0	80	1500 ㊼	800	8.0×10^5	1.0×10^7	100	1000	3.8	62	3.4
	R7081-20	㊿	300 to 650	Ⓐ-Ⓓ	25	80	10.0	80	1500 ㊽	80 000	8.0×10^7	1.0×10^9	5000	10000	5.0	80	3.9
	R7081-100	㊿	300 to 650	Ⓕ	35	105	13.5	110	1500 ㊼	1050	1.1×10^6	1.0×10^7	500	1000	3.8	62	3.4
508 mm (20")	R12860	(51)	300 to 650	Ⓐ-Ⓓ	30	80	12.0	90	2000 ㉟	800	9.0×10^5	1.0×10^7	500	1000	6.0	95	2.4

Note: The data shown in ▭ is measured with tapered voltage distribution ratio.
Please refer to page 18 and 19 for each item in the above list.

Note 2: Dark count

(at 25 °C)

Max. ratings ⑫		⑬	Stability ⑭		Pulse linearity ⑮		Remarks		Note	Type No.
Anode to cathode voltage (V)	Average anode current (mA)	Typical pulse height resolution (%)	Long term Typ. (%)	Short term Typ. (%)	2 % deviation Typ. (mA)	5 % deviation Typ. (mA)	⑯ Dynode structure / stage	⑰ Socket & socket assembly		
2700	0.2	7.6	1.0	1.0	15	30	LINE / 12	E678-21C* 15	SILICA type (R2256-02)	R329-02
2700	0.2	7.6	1.0	1.0	100	200				
2500	0.2	—	—	—	15	30	LINE / 12	E678-21C* 15		R331-05
1500	0.1	6.3 (8.5) *3	0.5	0.5	1	5	BOX / 8	E678-14W 12 13	K-FREE type (R1306-15)	R1306
3000	0.2	7.8	1.0	1.0	100	200	LINE / 12	E678-20B* 11	SILICA type (R2059)	R1828-01
3000	0.2	7.8	1.0	1.0	250	500				
3500	0.2	7.8	1.0	2.0	100	150	LINE / 8	E678-19J*	SILICA type (R3377)	R2083
1750	0.1	7.6	1.0	1.0	50	70	LINE / 10	E678-14W 10	Glass base type (R14550-10)	R2154-02
1750	0.1	7.6	1.0	1.0	150	200				
1800	0.02	10.0	2.0	2.0	30	60	C+L / 10	E678-15C*		R4607A-06
1500	0.1	6.3 (8.5) *3	0.5	0.5	5	10	B+L / 8	E678-14W 14	Semiflexible lead type (R6231-01)	R6231
1500	0.1	6.1	0.5	0.5	5	10	B+L / 8	E678-14W 14	SBA type	R6231-100
2000	0.2	7.6	1.0	1.0	80	100	LINE / 8	E678-21C* 15		R7723
2000	0.2	7.6	1.0	1.0	60	90	LINE / 10	E678-21C* 15		R7724
2000	0.2	—	1.0	1.0	60	90	LINE / 10	E678-21C 15	SBA type	R7724-100
2000	0.2	7.6	1.0	1.0	40	80	LINE / 12	E678-21C* 15		R7725
1750	0.1	8.0	—	—	30	60	LINE / 8	E678-20B*		R13089
2000	0.1	8.0	—	—	30	60	LINE / 10	E678-20B*		R13435
1500	0.1	6.3 (8.5) *3	0.5	0.5	5	10	B+L / 8	E678-14W 14	Semiflexible lead type (R6232-01)	R6232
1500	0.1	6.3 (8.5) *3	0.5	0.5	1	5	BOX / 8	E678-14W 12 13	K-FREE type (R1307-07)	R1307
2500	0.2	7.8	1.0	1.0	40	60	LINE / 12	E678-21C* 15		R6091
2500	0.2	7.8	1.0	1.0	100	200				
1500	0.1	6.3 (8.5) *3	0.5	0.5	5	10	B+L / 8	E678-14W 14	Semiflexible lead type (R6233-01)	R6233
1500	0.1	6.1	0.5	0.5	5	10	B+L / 8	E678-14W 14	SBA type	R6233-100
2000	0.1	8.0	—	—	30	60	LINE / 10	E678-20B		R15608
1500	0.1	—	—	—	20	30	C+L / 10	E678-14W		R14374
1500	0.1	6.3 (8.5)	0.5	0.5	5	10	B+L / 8	E678-14W 14	Semiflexible lead type (R10233-01)	R10233
1500	0.1	6.1	0.5	0.5	5	10	B+L / 8	E678-14W 14	SBA type	R10233-100
1500	0.1	—	—	—	20	30	C+L / 10	E678-14W		R14689
1500	0.1	—	1.0	2.0	5	10	B+L / 8	E678-14W 14		R10806
1500	0.1	—	1.0	2.0	5	10	B+L / 8	E678-14W 14	SBA type	R10806-100
1500	0.1	8.0	1.0	1.0	10	20	BOX / 10	E678-14W 16 17	K-FREE type (R877-01)	R877
1500	0.1	7.6	1.0	1.0	10	20	BOX / 10	E678-14W 16 17	SBA type, K-FREE type (R877-100-01)	R877-100
3000	0.2	—	—	—	100	150	LINE / 8	E678-20B	SBA type	R4144-100
3000	0.2	8.3	1.0	1.0	100	150	LINE / 14	E678-20B* 18		R1250
3000	0.2	8.3	1.0	1.0	160	250				
2000	0.1	—	—	—	30	50	B+L / 10	E678-20B*		R6594
2000	0.1	—	—	—	100	150				
1500	0.1	—	1.0	1.0	10	30	B+L / 8	E678-14W	SBA type	R11833-100-03
2000	0.1	—	—	—	40	60	B+L / 10	E678-20B* 19		R5912
2000	0.1	—	—	—	30	60	B+L / 14	E678-20B*		R5912-20
2000	0.1	—	—	—	40	60	B+L / 10	E678-20B* 19	SBA type	R5912-100
2200	0.1	—	—	—	40	60	B+L / 10	E678-20B		R14688
2200	0.1	—	—	—	40	60	B+L / 10	E678-20B	SBA type	R14688-100
2000	0.1	—	—	—	40	60	B+L / 10	E678-20B* 19		R7081
2000	0.1	—	—	—	30	60	B+L / 14	E678-20B*		R7081-20
2000	0.1	—	—	—	40	60	B+L / 10	E678-20B* 19	SBA type	R7081-100
2500	0.1	—	—	—	20	40	B+L / 10	E678-20B*		R12860

Note 3: This data in parenthese is measured with ^{57}Co.

Photomultiplier tubes of special shapes

Tube diameter	Type No.	❶ Out-line No.	Spectral response ❷		Cathode characteristics				Anode characteristics								
			Spectral response range (nm)	Curve code	❸ Q.E. at peak Typ. (%)	❹ Lumi-nous Typ. (μA/lm)	❺ Blue sensitivity index Typ.	❻ Radiant Typ. (mA/W)	❼ Anode to cathode supply voltage (V)	❽ Lumi-nous Typ. (A/lm)	❻ Radiant Typ. (A/W)	❾ Gain Typ.	Dark current ❿		Time response ⓫		
													Typ. (nA)	Max. (nA)	Rise time Typ. (ns)	Transit time Typ. (ns)	T.T.S. Typ. (FWHM) (ns)
Metal package photomultipliers																	
16 mm TO-8 type	R9880U-110	(52)	230 to 700	Ⓕ	35	105	13.5	110	1000 ⑬	210	2.2×10^5	2.0×10^6	1	10	0.57	2.7	0.2
	R9880U-210	(52)	230 to 700	Ⓖ	43	135	15.5	130	1000 ⑬	270	2.6×10^5	2.0×10^6	1	10	0.57	2.7	0.2
30 mm square type	R7600U	(53)	300 to 650	Ⓐ-Ⓓ	24	80	9.5	80	800 ⑱	160	1.6×10^5	2.0×10^6	2	20	1.6	9.6	0.35
	R7600U-100	(53)	300 to 650	Ⓕ	35	105	13.5	110	800 ⑱	210	2.2×10^5	2.0×10^6	2	20	1.6	9.6	0.35
	R7600U-200	(53)	300 to 650	Ⓖ	43	135	15.5	130	800 ⑱	270	2.6×10^5	2.0×10^6	2	20	1.6	9.6	0.35
	R7600U-300	(53)	300 to 700	Ⓗ	39	160	14	125	800 ⑱	320	2.5×10^5	2.0×10^6	2	20	1.6	9.6	0.35
	R7600U-100-M4	(54)	300 to 650	Ⓕ	35	105	13.5	110	800 ⑱	140	1.4×10^5	1.3×10^6	0.5	5	1.2	9.5	0.36
	R7600U-200-M4	(54)	300 to 650	Ⓖ	43	135	15.5	130	800 ⑱	175	1.7×10^5	1.3×10^6	0.5	5	1.2	9.5	0.36
	R7600U-00-M4	(54)	300 to 650	Ⓐ-Ⓓ	24	80	9.5	80	800 ⑱	140	1.4×10^5	1.8×10^6	0.5	5	1.2	9.5	0.36
	R11265U-100	(55)	300 to 650	Ⓕ	35	105	13.5	110	900 ㊵	130	1.3×10^5	1.2×10^6	2	20	1.3	5.8	0.27
	R11265U-200	(55)	300 to 650	Ⓖ	43	135	15.5	130	900 ㊵	160	1.6×10^5	1.2×10^6	2	20	1.3	5.8	0.27
	R11265U-300	(55)	300 to 700	Ⓗ	39	160	14	125	900 ㊵	190	1.5×10^5	1.2×10^6	2	20	1.3	5.8	0.27
Square, Rectangular shape photomultipliers																	
10 mm (3/8")	R2248	(56)	300 to 650	Ⓐ-Ⓓ	25	100	10.0	80	1250 ②	100	8.0×10^4	1.0×10^6	1	50	0.9	9.0	0.6
60 mm	R6236	(57)	300 to 650	Ⓐ-Ⓓ	28	110	11.5	95	1000 ③	30	2.6×10^4	2.7×10^5	2	20	9.5	52	8.5
76 mm (3")	R6237	(58)	300 to 650	Ⓐ-Ⓓ	28	110	11.5	95	1000 ③	30	2.6×10^4	2.7×10^5	2	20	9.5	52	8.5
38 mm (1-1/2")	R8997	(59)	300 to 650	Ⓐ-Ⓓ	23	80	9.5	76	1250 ㉕	100	9.9×10^4	1.2×10^6	10	200	5.0	25	2.8
	R10550	(60)	300 to 650	Ⓐ-Ⓓ	25	80	10.0	80	1300 ⑥	100	1.0×10^5	1.3×10^6	10	100	1.3	12	0.6
2π shape photomultipliers																	
25 mm (1")	R7373A-01	(61)	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1000 ㉒	100	9.4×10^4	1.1×10^6	3	20	2	19	1.1
28 mm (1-1/8")	R8143	(62)	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	1000 ㊱	200	1.8×10^5	2.2×10^6	2	10	25	72	—

(at 25 °C)

Max. ratings ⑫		⑬	Stability ⑭		Pulse linearity ⑮		Remarks			
Anode to cathode voltage (V)	Average anode current (mA)	Typical pulse height resolution (%)	Long term Typ. (%)	Short term Typ. (%)	2 % deviation Typ. (mA)	5 % deviation Typ. (mA)	Dynode structure / stage ⑯	Socket & socket assembly ⑰	Note	Type No.
1100	0.1	—	—	—	10	30	MC / 10	E678-12-01 23	SBA type, UV (R9880U-113) and SILICA (R9880U-116) types	R9880U-110
1100	0.1	—	—	—	10	30	MC / 10	E678-12-01 23	UBA type	R9880U-210
900	0.1	—	1.0	2.0	30	60	MC / 10	E678-32B 20	UV type (R7600U-03)	R7600U
900	0.1	—	—	—	30	60	MC / 10	E678-32B 20	SBA type	R7600U-100
900	0.1	—	—	—	30	60	MC / 10	E678-32B 20	UBA type	R7600U-200
900	0.1	—	—	—	30	—	MC / 10	E678-32B 20	EGBA type	R7600U-300
900	0.1	—	—	—	10	30	MC / 10	E678-32B 21	*4, SBA type	R7600U-100-M4
900	0.1	—	—	—	10	30	MC / 10	E678-32B 21	*4, UBA type	R7600U-200-M4
900	0.1	—	—	—	10	30	MC / 10	E678-32B 21	*4	R7600U-00-M4
1000	0.1	—	—	—	20	60	MC / 12	E678-19K 22	SBA type	R11265U-100
1000	0.1	—	—	—	20	60	MC / 12	E678-19K 22	UBA type	R11265U-200
1000	0.1	—	—	—	20	60	MC / 12	E678-19K 22	EGBA type	R11265U-300
1500	0.03	23 *1	1.0	2.0	3	7	LINE / 8	E678-11N*		R2248
1500	0.1	6.3 (8.5) *3	0.5	0.5	5	10	B+L / 8	E678-14W 14	Semiflexible lead type (R6236-01) is available	R6236
1500	0.1	6.3 (8.5) *3	0.5	0.5	5	10	B+L / 8	E678-14W 14	Semiflexible lead type (R6237-01) is available	R6237
1600	0.1	16 *1	2.0	2.0	4	10	L+VB / 10	E678-20B*	*4, Quadrant (4) channel	R8997
1600	0.1	—	—	—	10	30	LINE / 8	E678-20B*	*4, Quadrant (4) channel	R10550
1250	0.1	7.8	1.0	2.0	15	30	LINE / 10	E678-12A*		R7373A-01
1250	0.1	8.0	1.0	2.0	0.2	0.5	BOX / 11	E678-14C*		R8143

Note 1: This data is measured with ^{22}Na source and BGO scintillator.
Note 3: This data in parenthese is measured with ^{57}Co.
Note 4: Dark current, time response and pulse linearity data is typical value for channel.

Photomultiplier tubes assemblies

Tube diameter	Type No.	❶ Out-line No.	Spectral response ❷		Cathode characteristics				Anode characteristics								
													Dark current ❿		Time response ⓫		
			Spectral response range (nm)	Curve code	❸ Q.E. at peak Typ. (%)	❹ Luminous Typ. (µA/lm)	❺ Blue sensitivity index Typ.	❻ Radiant Typ. (mA/W)	❼ Anode to cathode supply voltage (V)	❽ Luminous Typ. (A/lm)	❻ Radiant Typ. (A/W)	❾ Gain Typ.	Typ. (nA)	Max. (nA)	Rise time Typ. (ns)	Transit time Typ. (ns)	T.T.S. Typ. (FWHM) (ns)
30 mm square type	H8711	(63)	300 to 650	Ⓐ-Ⓓ	24	80	9.5	80	-800 ㊴	280	2.8×10^5	3.5×10^6	0.8	4	0.83	12	0.33
	H8711-100	(63)	300 to 650	Ⓕ	35	105	13.5	110	-800 ㊴	210	2.2×10^5	2.0×10^6	0.8	4	0.83	12	0.33
	H8711-200	(63)	300 to 650	Ⓖ	43	135	15.5	130	-800 ㊴	270	2.6×10^5	2.0×10^6	0.8	4	0.83	12	0.33
	H8711-300	(63)	300 to 700	Ⓗ	39	160	14	125	-800 ㊴	400	3.1×10^5	2.5×10^6	0.8	4	0.83	12	0.33
	H7546B	(64)	300 to 650	Ⓐ-Ⓓ	24	80	9.5	80	-800 ㊶	50	4.8×10^4	6.0×10^5	0.2	2	1.0	12	0.38
	H7546B-100	(64)	300 to 650	Ⓕ	35	105	13.5	110	-800 ㊶	53	5.5×10^4	5.0×10^5	0.2	2	1.0	12	0.38
	H7546B-200	(64)	300 to 650	Ⓖ	43	135	15.5	130	-800 ㊶	68	6.5×10^4	5.0×10^5	0.2	2	1.0	12	0.38
	H7546B-300	(64)	300 to 700	Ⓗ	39	160	14	125	-800 ㊶	80	6.2×10^4	5.0×10^5	0.2	2	1.0	12	0.38
	H8804-300	(65)	300 to 650	Ⓗ	39	160	14	125	-800 ㊶	80	6.2×10^4	5.0×10^5	0.2	2	1.0	12	0.38
	H11934-100	(66)	300 to 650	Ⓕ	35	105	13.5	110	-900 ㊵	130	1.3×10^5	1.2×10^6	2	20	1.3	5.8	0.27
	H11934-200	(66)	300 to 650	Ⓖ	43	135	15.5	130	-900 ㊵	160	1.6×10^5	1.2×10^6	2	20	1.3	5.8	0.27
	H11934-300	(66)	300 to 700	Ⓗ	39	160	14	130	-900 ㊵	190	1.5×10^5	1.2×10^6	2	20	1.3	5.8	0.27
51 mm square type	H12700A	(67)	300 to 650	Ⓐ-Ⓓ	32	95	12	100	-1000 ㊾	142	1.5×10^5	1.5×10^6	0.1	—	0.52	4.9	0.35
	H12700A-10	(67)	300 to 650	Ⓐ-Ⓓ	32	95	12	100	-1000 ㊾	38	4.0×10^4	4.0×10^5	0.1	—	0.52	4.9	0.35
	H12700B	(68)	300 to 650	Ⓐ-Ⓓ	32	95	12	100	-1000 ㊾	142	1.5×10^5	1.5×10^6	0.1	—	0.52	4.9	0.35
	H12700B-10	(68)	300 to 650	Ⓐ-Ⓓ	32	95	12	100	-1000 ㊾	38	4.0×10^4	4.0×10^5	0.1	—	0.52	4.9	0.35
	H13700	(69)	300 to 650	Ⓐ-Ⓓ	29	75	12	90	-1000 ㊵	110	1.4×10^5	1.5×10^6	0.02	—	0.45	5.2	0.38

(at 25 °C)

Max. ratings ⓬		⓭	Stability ⓮		Pulse linearity ⓯		Remarks		Note	Type No.
Anode to cathode voltage (V)	Average anode current (mA)	Typical pulse height resolution (%)	Long term Typ. (%)	Short term Typ. (%)	2 % deviation Typ. (mA)	5 % deviation Typ. (mA)	⓰ Dynode structure / stage	Built-in PMT (Type No. for referring)		
-1000	0.017	—	—	—	0.5	1	MC / 12	R7600-00-M16	*4	H8711
-1000	0.017	—	—	—	0.5	1	MC / 12	R7600-100-M16	*4, SBA type	H8711-100
-1000	0.017	—	—	—	0.5	1	MC / 12	R7600-200-M16	*4, UBA type	H8711-200
-1000	0.017	—	—	—	0.5	1	MC / 12	R7600-300-M16	*4, EGBA type	H8711-300
-1000	0.023	—	—	—	0.3	0.6	MC / 12	R7600-00-M64	*4	H7546B
-1000	0.023	—	—	—	0.3	0.6	MC / 12	R7600-100-M64	*4, SBA type	H7546B-100
-1000	0.023	—	—	—	0.3	0.6	MC / 12	R7600-200-M64	*4, UBA type	H7546B-200
-1000	0.023	—	—	—	0.3	0.6	MC / 12	R7600-300-M64	*4, EGBA type	H7546B-300
-1000	0.023	—	—	—	0.3	0.6	MC / 12	R7600-300-M64	*4, EGBA type	H8804-300
-1000	0.018	—	—	—	20	60	MC / 12	R11265-100	SBA type	H11934-100
-1000	0.018	7.4 / 3.1	—	—	20	60	MC / 12	R11265-200	UBA type	H11934-200
-1000	0.018	—	—	—	20	60	MC / 12	R11265-300	EGBA type	H11934-300
-1100	0.1	—	—	—	0.8	—	MC / 10	R12699-00-M64	*4, UV types (H12700A-03)	H12700A
-1100	0.1	—	—	—	3	—	MC / 10	R12699-00-M64	*4, Tapered divider type *4	H12700A-10
-1100	0.1	—	—	—	1	—	MC / 10	R12699-00-M64	*4, UV types (H12700B-03) *4	H12700B
-1100	0.1	—	—	—	3	—	MC / 10	R12699-00-M64	*4, Tapered divider type *4	H12700B-10
-1100	0.1	—	—	—	0.15	—	MC / 10	R12699-00-M256	*4, UV types (H13700-03) *4	H13700

Note 4: Dark current, time response and pulse linearity data is typical value for channel.

Photomultiplier tubes assemblies

Tube diameter	Type No.	① Outline No.	Spectral response ②		Cathode characteristics				Anode characteristics								
			Spectral response range (nm)	Curve code	③ Q.E. at peak Typ. (%)	④ Luminous Typ. (μA/lm)	⑤ Blue sensitivity index Typ.	⑥ Radiant Typ. (mA/W)	⑦ Anode to cathode supply voltage (V)	⑧ Luminous Typ. (A/lm)	⑥ Radiant Typ. (A/W)	⑨ Gain Typ.	Dark current ⑩		Time response ⑪		
													Typ. (nA)	Max. (nA)	Rise time Typ. (ns)	Transit time Typ. (ns)	T.T.S. Typ. (FWHM) (ns)
10 mm (3/8")	H3164-10	(70)	300 to 650	Ⓐ-Ⓓ	25	100	10	80	-1250	100	8.0×10^4	1.0×10^6	1	50	0.8	9.0	0.5
	H3695-10	(71)	160 to 650	Ⓒ-Ⓓ	25	100	10	80	-1250	100	8.0×10^4	1.0×10^6	2	50	0.7	9	0.5
13 mm (1/2")	H3165-10	(72)	300 to 650	Ⓐ-Ⓓ	25	110	10	80	-1000	150	1.1×10^5	1.4×10^6	1	2	2.1	22	2.0
	H12690	(73)	300 to 650	Ⓐ-Ⓓ	25	110	10	80	-1000	220	1.6×10^5	2.0×10^6	0.5	2	1.2	14	1.4
	H12690-300	(73)	300 to 700	Ⓗ	32	160	14	105	-1000	320	2.1×10^5	2.0×10^6	1	5	1.2	14	1.4
19 mm (3/4")	H6520	(74)	300 to 650	Ⓐ-Ⓓ	26	110	10.5	85	-1000	110	8.5×10^4	1.0×10^6	1	5	2.5	27	2.8
	H6524	(75)	300 to 650	Ⓐ-Ⓓ	27	115	11.0	88	-1500	200	1.5×10^5	1.7×10^6	3	50	1.8	19	0.76
	H6612	(76)	300 to 650	Ⓐ-Ⓓ	27	115	11.0	88	-1700	200	1.5×10^5	1.7×10^6	10	300	1.3	14	0.36
	H6613	(77)	160 to 650	Ⓒ-Ⓓ	27	115	11.0	88	-1700	200	1.5×10^5	1.7×10^6	10	300	1.3	14	0.36
	H8135	(78)	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	-1000	50	4.7×10^4	5.5×10^5	3	20	1.3	12	0.8
25 mm (1")	H6533	(79)	300 to 650	Ⓐ-Ⓓ	23	80	9.5	76	-2250	400	3.8×10^5	5.0×10^6	10	200	0.7	10	0.16
	H8643	(80)	300 to 650	Ⓐ-Ⓓ	27	95	11.0	88	-1500	160	1.5×10^5	1.7×10^6	2	20	1.6	16	0.7
	H10580	(81)	300 to 650	Ⓐ-Ⓓ	27	95	11.0	88	-1300	100	9.3×10^4	1.1×10^6	5	50	1.0	11	0.27
28 mm (1-1/8")	H7415	(82)	300 to 650	Ⓐ-Ⓓ	27	100	11.0	88	-1500	500	4.4×10^5	5.0×10^6	10	200	1.7	16	0.5
38 mm (1-1/2")	H3178-51	(83)	300 to 650	Ⓐ-Ⓓ	27	95	11.0	88	-1500	75	7.0×10^4	7.9×10^5	2	15	2.7	40	4.5
51 mm (2")	H6410	(84)	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	-2000	270	2.5×10^5	3.0×10^6	10	100	2.7	40	1.1
	H7195	(85)	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	-2000	270	2.5×10^5	3.0×10^6	10	100	2.7	40	1.1
	H1949-50	(86)	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	-2500	1800	1.7×10^6	2.0×10^7	50	400	1.3	28	0.55
	H1949-51	(87)	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	-2500	1800	1.7×10^6	2.0×10^7	50	400	1.3	28	0.55
	H2431-50	(88)	300 to 650	Ⓐ-Ⓓ	25	80	10.0	80	-3000	200	2.0×10^5	2.5×10^6	100	800	0.8	16	0.37
76 mm (3")	H6559	(89)	300 to 650	Ⓐ-Ⓓ	26	90	10.5	85	-2000	900	8.5×10^5	1.0×10^7	30	120	2.7	40	1.5
127 mm (5")	H6527	(90)	300 to 650	Ⓐ-Ⓓ	22	70	9.0	72	-2000	1000	1.0×10^6	1.4×10^7	50	300	2.5	54	1.8

(at 25 °C)

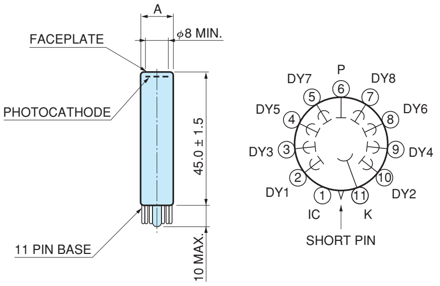
Max. ratings ⑫		⑬	Stability ⑭		Pulse linearity ⑮		Remarks		Note	Type No.
Anode to cathode voltage (V)	Average anode current (mA)	Typical pulse height resolution (%)	Long term Typ. (%)	Short term Typ. (%)	2 % deviation Typ. (mA)	5 % deviation Typ. (mA)	⑯ Dynode structure / stage	Built-in PMT (Type No. for referring)		
-1500	0.03	23 *1	1.0	2.0	3	7	LINE / 8	R1635		H3164-10
-1500	0.03	23 *1	1.0	2.0	3	7	LINE / 8	R2496		H3695-10
-1250	0.1	7.8	1.0	2.0	3	7	LINE / 10	R647-01		H3165-10
-1250	0.1	7.8	1.0	2.0	3	12	LINE / 10	R12421		H12690
-1250	0.016	—	1.0	2.0	3	12	LINE / 10	R12421-300	EGBA type	H12690-300
-1250	0.1	7.8	1.0	2.0	4	7	LINE / 10	R1166		H6520
-1800	0.1	7.8	1.0	2.0	4	8	LINE / 10	R1450		H6524
-1800	0.1	7.8	1.0	2.0	4	8	LINE / 8	R3478		H6612
-1800	0.1	7.8	1.0	2.0	4	8	LINE / 8	R2076		H6613
-1250	0.1	8.0	1.0	2.0	10	20	C+L/10	R5611A		H8135
-2500	0.1	8.0	1.0	2.0	40	70	LINE / 10	R4998	Silica type H6610 (R5320)	H6533
-1800	0.1	7.8	1.0	2.0	100	150	LINE / 10	R7899-01		H8643
-1500	0.1	7.8	1.0	2.0	30	50	LINE / 8	R9800		H10580
-2000	0.2	7.8	1.0	2.0	10	30	LINE / 10	R6427	UV type H7416 (R7056)	H7415
-1750	0.1	7.7	1.0	1.0	150	200	LINE / 10	R580		H3178-51
-2700	0.2	7.6	1.0	1.0	100	200	LINE / 12	R329-02	Silica type H6521 (R2256-02)	H6410
-2700	0.2	7.6	1.0	1.0	80	110	LINE / 12	R329-02		H7195
-3000	0.2	7.8	1.0	1.0	100	200	LINE / 12	R1828-01	Silica type H3177-50 (R2059)	H1949-50
-3000	0.2	7.8	1.0	1.0	100	200	LINE / 12	R1828-01	Silica type H3177-51 (R2059)	H1949-51
-3500	0.2	7.8	1.0	2.0	100	150	LINE / 8	R2083	Silica type H3378-50 (R3377)	H2431-50
-2500	0.2	7.8	1.0	1.0	100	200	LINE / 12	R6091		H6559
-3000	0.2	8.3	1.0	1.0	100	150	LINE / 14	R1250		H6527

Note 1: This data is measured with ^{22}Na source and BGO scintillator.

Dimensional outline and basing diagrams

For photomultiplier tubes

① R1635, R2496

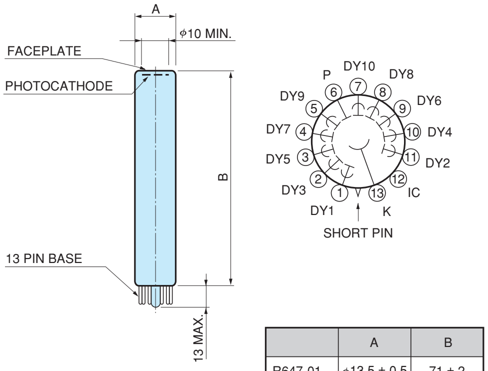

A
φ8 MIN.
FACEPLATE
PHOTOCATHODE
45.0 ± 1.5
11 PIN BASE
10 MAX.
P
DY7
DY8
DY5
DY6
DY3
DY4
DY1
DY2
IC
K
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪
SHORT PIN

	A
R1635	9.7 ± 0.4
R2496	10.5 ± 0.5

R2496 has a plano-concave faceplate.

TPMHA0343EB

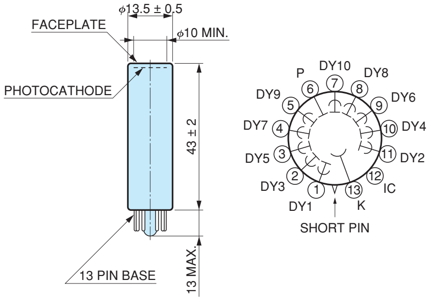
② R647-01, R4177-06


A
φ10 MIN.
FACEPLATE
PHOTOCATHODE
B
13 PIN BASE
13 MAX.
P
DY10
DY8
DY9
DY6
DY7
DY4
DY5
DY2
DY3
IC
DY1
K
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬
SHORT PIN

	A	B
R647-01	φ13.5 ± 0.5	71 ± 2
R4177-06	φ14.5 ± 0.7	61 ± 2

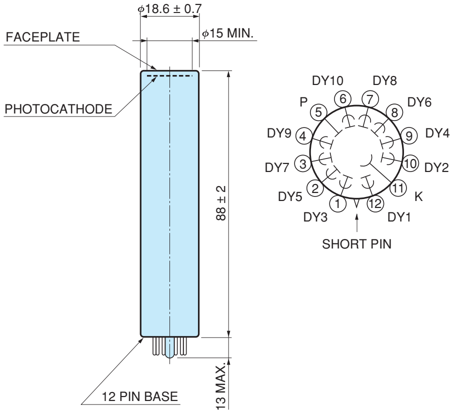
TPMHA0120EA

③ R12421, R12421-300


φ13.5 ± 0.5
φ10 MIN.
FACEPLATE
PHOTOCATHODE
43 ± 2
13 PIN BASE
13 MAX.
P
DY10
DY8
DY9
DY6
DY7
DY4
DY5
DY2
DY3
IC
DY1
K
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬
SHORT PIN

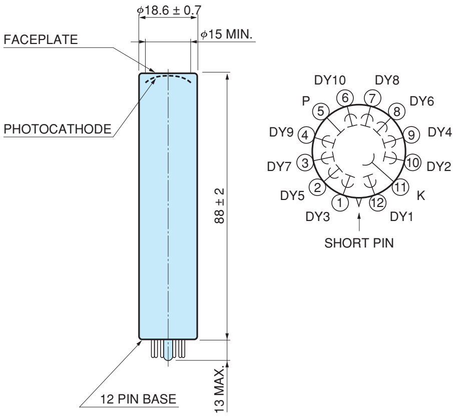
TPMHA0593EA

④ R1166


φ18.6 ± 0.7
φ15 MIN.
FACEPLATE
PHOTOCATHODE
88 ± 2
12 PIN BASE
13 MAX.
DY10
DY8
P
DY6
DY9
DY4
DY7
DY2
DY5
K
DY3
DY1
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫
SHORT PIN

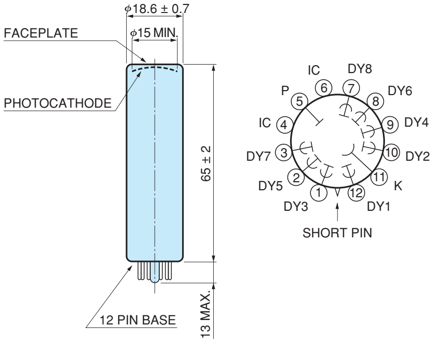
TPMHA0344EA

⑤ R1450, R4125


φ18.6 ± 0.7
φ15 MIN.
FACEPLATE
PHOTOCATHODE
88 ± 2
12 PIN BASE
13 MAX.
DY10
DY8
P
DY6
DY9
DY4
DY7
DY2
DY5
K
DY3
DY1
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫
SHORT PIN

TPMHA0307EA

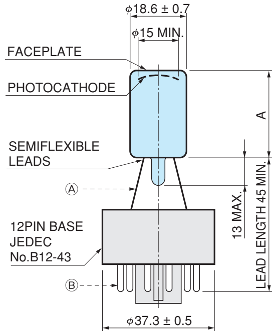
⑥ R3478


φ18.6 ± 0.7
φ15 MIN.
FACEPLATE
PHOTOCATHODE
65 ± 2
12 PIN BASE
13 MAX.
IC
DY8
P
DY6
IC
DY4
DY7
DY2
DY5
K
DY3
DY1
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫
SHORT PIN

TPMHA0431EB

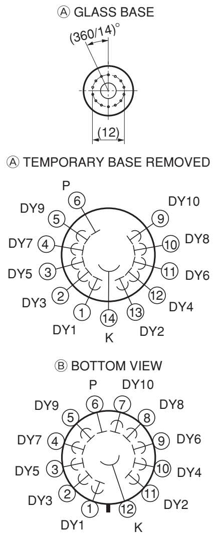
(Unit: mm)

⑦ R3991A-04, R5611A-01



φ18.6 ± 0.7
φ15 MIN.
FACEPLATE
PHOTOCATHODE
A
SEMIFLEXIBLE LEADS
Ⓐ
13 MAX.
LEAD LENGTH 45 MIN.
12PIN BASE JEDEC No.B12-43
Ⓑ
φ37.3 ± 0.5

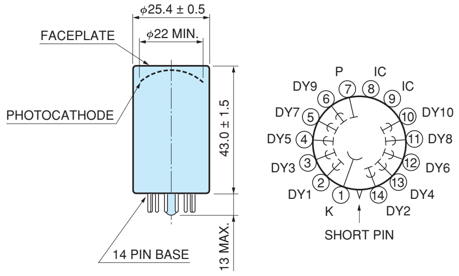
	A
R3991A-04	28 ± 1.5
R5611A-01	30 ± 1.5



Ⓐ GLASS BASE
(360/14)°
(12)
Ⓐ TEMPORARY BASE REMOVED
P
DY9
DY10
DY8
DY7
DY6
DY5
DY3
DY4
DY1
K
DY2
Ⓑ BOTTOM VIEW
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K

TPMHA0117ED

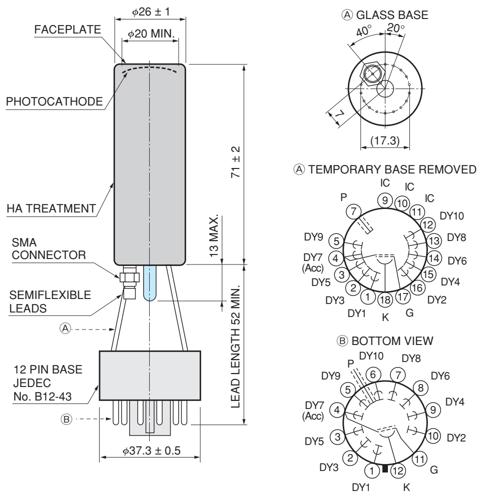
⑧ R1288A-06, R1924A



φ25.4 ± 0.5
φ22 MIN.
FACEPLATE
PHOTOCATHODE
43.0 ± 1.5
13 MAX.
14 PIN BASE
P
IC
DY9
IC
DY7
DY10
DY5
DY8
DY3
DY6
DY1
DY4
K
DY2
SHORT PIN

TPMHA0040EC

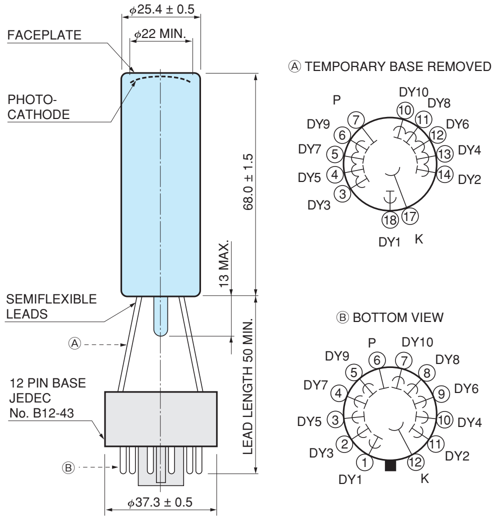
⑨ R4998



φ26 ± 1
φ20 MIN.
FACEPLATE
PHOTOCATHODE
HA TREATMENT
SMA CONNECTOR
SEMIFLEXIBLE LEADS
Ⓐ
12 PIN BASE JEDEC No. B12-43
Ⓑ
71 ± 2
13 MAX.
LEAD LENGTH 52 MIN.
φ37.3 ± 0.5
Ⓐ GLASS BASE
40°
20°
7
(17.3)
Ⓐ TEMPORARY BASE REMOVED
IC
IC
P
IC
DY10
DY9
DY8
DY7 (Acc)
DY6
DY5
DY4
DY3
DY2
DY1
K
G
Ⓑ BOTTOM VIEW
P
DY10
DY8
DY9
DY6
DY7 (Acc)
DY4
DY5
DY2
DY3
G
DY1
K

TPMHA0093EF

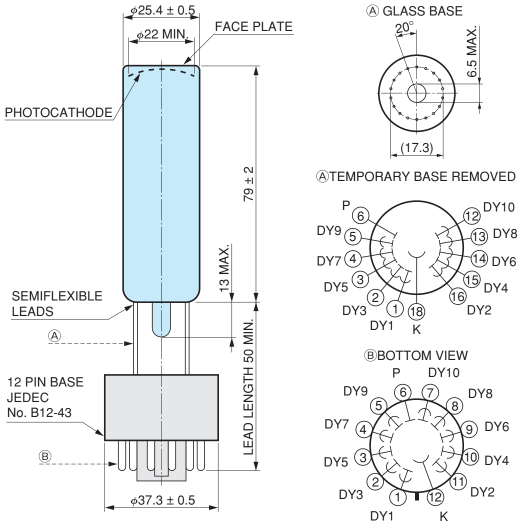
⑩ R7899-01



φ25.4 ± 0.5
φ22 MIN.
FACEPLATE
PHOTO-CATHODE
68.0 ± 1.5
13 MAX.
SEMIFLEXIBLE LEADS
Ⓐ
LEAD LENGTH 50 MIN.
12 PIN BASE JEDEC No. B12-43
Ⓑ
φ37.3 ± 0.5
Ⓐ TEMPORARY BASE REMOVED
DY10
P
DY8
DY9
DY6
DY7
DY4
DY5
DY2
DY3
DY1
K
Ⓑ BOTTOM VIEW
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K

TPMHA0474EB

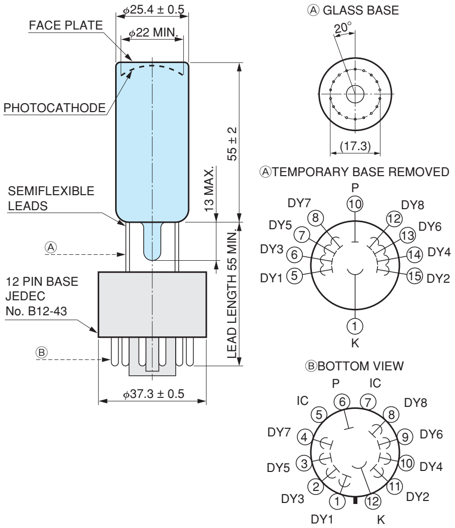
⑪ R8619



φ25.4 ± 0.5
φ22 MIN.
FACE PLATE
PHOTOCATHODE
79 ± 2
13 MAX.
SEMIFLEXIBLE LEADS
Ⓐ
LEAD LENGTH 50 MIN.
12 PIN BASE JEDEC No. B12-43
Ⓑ
φ37.3 ± 0.5
Ⓐ GLASS BASE
20°
6.5 MAX.
(17.3)
Ⓐ TEMPORARY BASE REMOVED
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
Ⓑ BOTTOM VIEW
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K

TPMHA0551ED

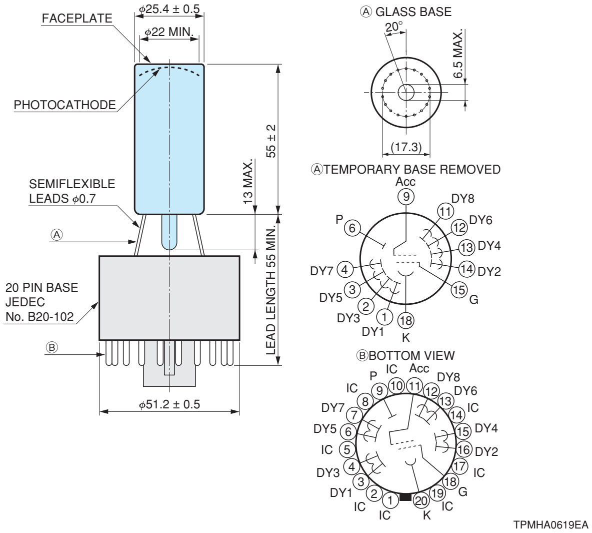
⑫ R9800, R9800-100



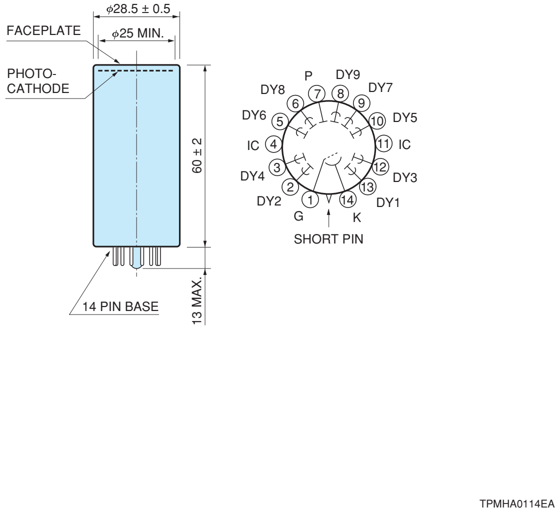
φ25.4 ± 0.5
φ22 MIN.
FACE PLATE
PHOTOCATHODE
55 ± 2
13 MAX.
SEMIFLEXIBLE LEADS
Ⓐ
LEAD LENGTH 55 MIN.
12 PIN BASE JEDEC No. B12-43
Ⓑ
φ37.3 ± 0.5
Ⓐ GLASS BASE
20°
(17.3)
Ⓐ TEMPORARY BASE REMOVED
P
DY7
DY8
DY5
DY6
DY3
DY4
DY1
DY2
K
Ⓑ BOTTOM VIEW
P
IC
IC
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K

TPMHA0521ED

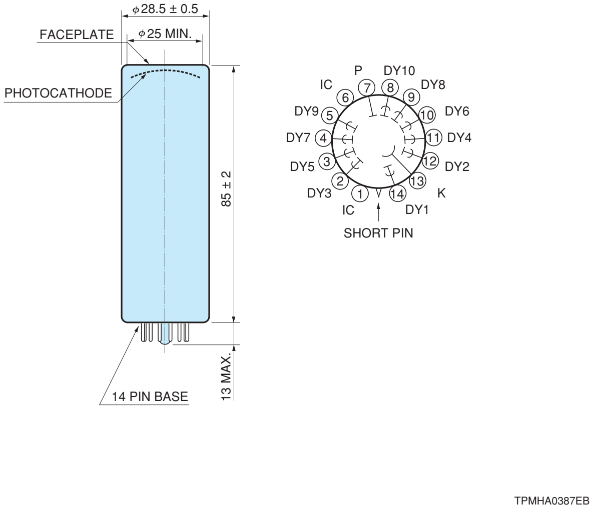
⑬ R13478


FACEPLATE
φ25.4 ± 0.5
φ22 MIN.
PHOTOCATHODE
SEMIFLEXIBLE LEADS φ0.7
Ⓐ
20 PIN BASE JEDEC No. B20-102
Ⓑ
φ51.2 ± 0.5
13 MAX.
55 ± 2
LEAD LENGTH 55 MIN.
Ⓐ GLASS BASE
20°
6.5 MAX.
(17.3)
Ⓐ TEMPORARY BASE REMOVED
Acc
DY8
DY6
DY4
DY2
G
K
DY1
DY3
DY5
DY7
P
Ⓑ BOTTOM VIEW
IC
TPMHA0619EA

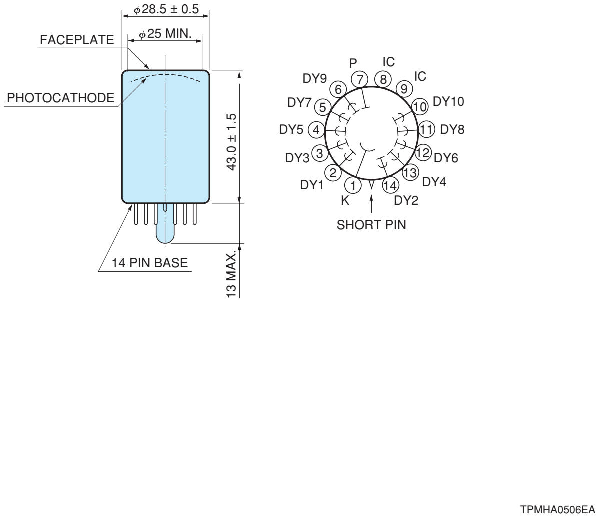
⑭ R3998-02, R3998-100-02


FACEPLATE
φ28.5 ± 0.5
φ25 MIN.
PHOTO-CATHODE
60 ± 2
14 PIN BASE
13 MAX.
P
DY9
DY7
DY8
DY6
DY5
IC
DY4
DY3
DY2
DY1
G
K
SHORT PIN
TPMHA0114EA

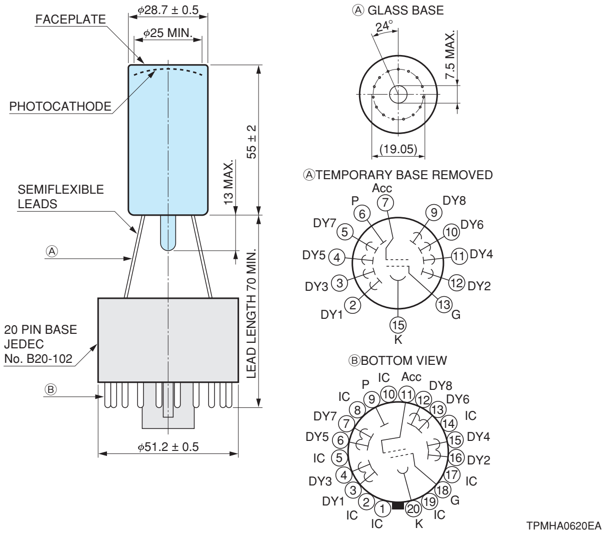
⑮ R6427


FACEPLATE
φ28.5 ± 0.5
φ25 MIN.
PHOTOCATHODE
85 ± 2
14 PIN BASE
13 MAX.
P
DY10
DY8
DY6
DY4
DY2
K
DY1
IC
DY3
DY5
DY7
DY9
SHORT PIN
TPMHA0387EB

⑯ R7111

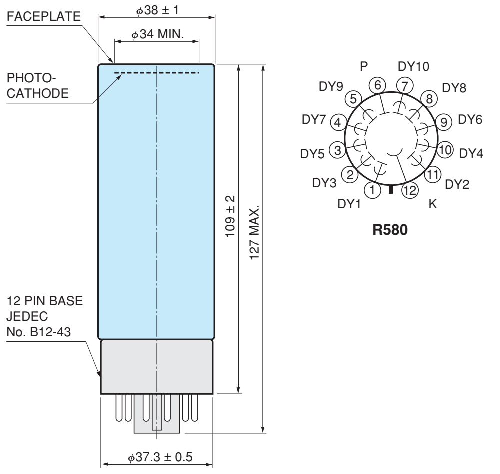

FACEPLATE
φ28.5 ± 0.5
φ25 MIN.
PHOTOCATHODE
43.0 ± 1.5
14 PIN BASE
13 MAX.
P
IC
DY9
DY10
DY7
DY8
DY5
DY6
DY3
DY4
DY1
DY2
K
SHORT PIN
TPMHA0506EA

⑰ R13449


FACEPLATE
φ28.7 ± 0.5
φ25 MIN.
PHOTOCATHODE
SEMIFLEXIBLE LEADS
Ⓐ
20 PIN BASE JEDEC No. B20-102
Ⓑ
φ51.2 ± 0.5
13 MAX.
55 ± 2
LEAD LENGTH 70 MIN.
Ⓐ GLASS BASE
24°
7.5 MAX.
(19.05)
Ⓐ TEMPORARY BASE REMOVED
Acc
P
DY8
DY6
DY4
DY2
G
K
DY1
DY3
DY5
DY7
Ⓑ BOTTOM VIEW
IC
TPMHA0620EA

(Unit: mm)

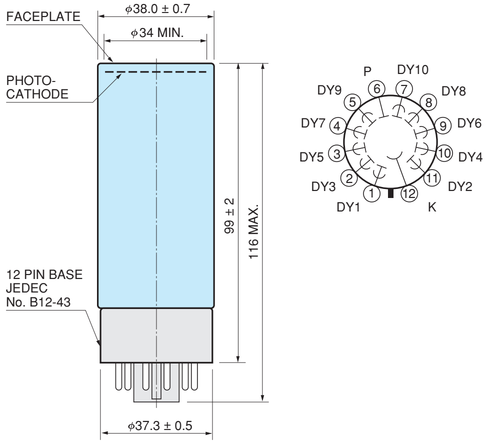
⑱ R580



FACEPLATE
φ38 ± 1
φ34 MIN.
PHOTO-CATHODE
109 ± 2
127 MAX.
12 PIN BASE JEDEC No. B12-43
φ37.3 ± 0.5
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R580

TPMHA0121EB

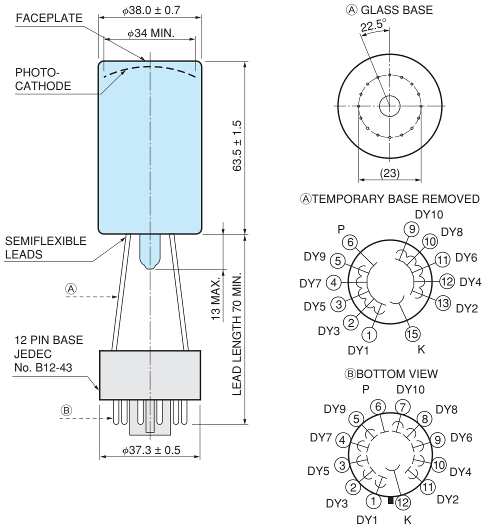
⑲ R11102



FACEPLATE
φ38.0 ± 0.7
φ34 MIN.
PHOTO-CATHODE
99 ± 2
116 MAX.
12 PIN BASE JEDEC No. B12-43
φ37.3 ± 0.5
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K

TPMHA0228EA

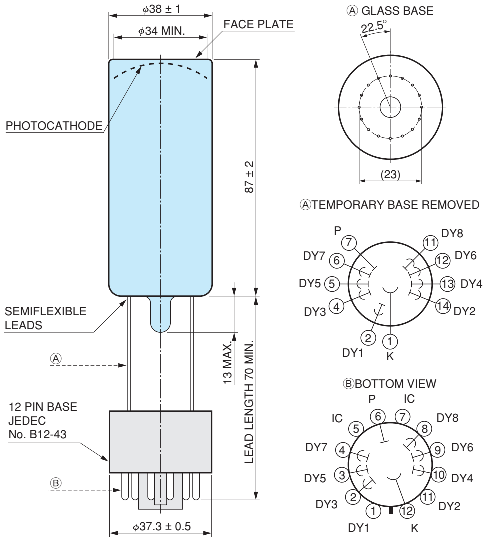
⑳ R3886A



FACEPLATE
φ38.0 ± 0.7
φ34 MIN.
PHOTO-CATHODE
63.5 ± 1.5
SEMIFLEXIBLE LEADS
Ⓐ
13 MAX.
LEAD LENGTH 70 MIN.
12 PIN BASE JEDEC No. B12-43
Ⓑ
φ37.3 ± 0.5
Ⓐ GLASS BASE
22.5°
(23)
ⒶTEMPORARY BASE REMOVED
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
ⒷBOTTOM VIEW
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K

TPMHA0104EC

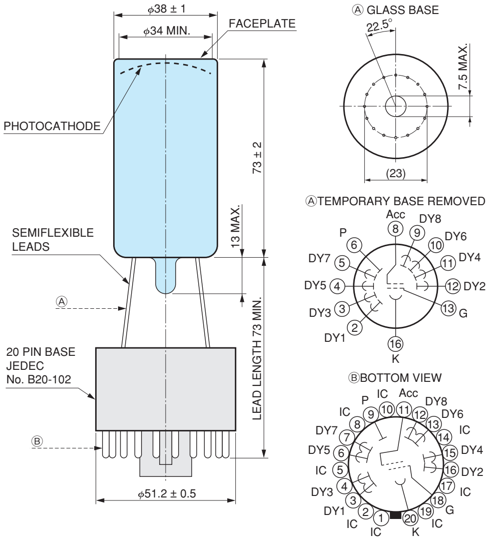
㉑ R9420, R9420-100



φ38 ± 1
φ34 MIN.
FACE PLATE
PHOTOCATHODE
87 ± 2
SEMIFLEXIBLE LEADS
Ⓐ
13 MAX.
LEAD LENGTH 70 MIN.
12 PIN BASE JEDEC No. B12-43
Ⓑ
φ37.3 ± 0.5
Ⓐ GLASS BASE
22.5°
(23)
ⒶTEMPORARY BASE REMOVED
P
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
ⒷBOTTOM VIEW
P
IC
IC
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K

TPMHA0519EE

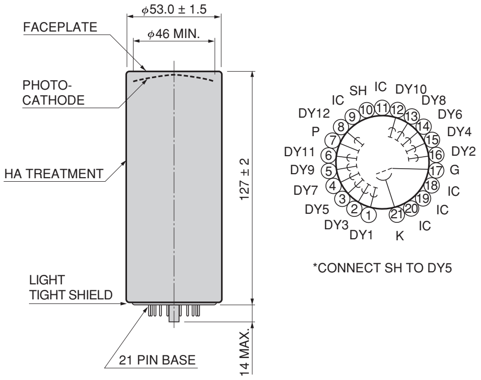
㉒ R13408



φ38 ± 1
φ34 MIN.
FACEPLATE
PHOTOCATHODE
73 ± 2
13 MAX.
SEMIFLEXIBLE LEADS
Ⓐ
LEAD LENGTH 73 MIN.
20 PIN BASE JEDEC No. B20-102
Ⓑ
φ51.2 ± 0.5
Ⓐ GLASS BASE
22.5°
7.5 MAX.
(23)
ⒶTEMPORARY BASE REMOVED
Acc
DY8
P
DY6
DY7
DY4
DY5
DY2
DY3
G
DY1
K
ⒷBOTTOM VIEW
P
IC
Acc
DY8
IC
DY6
DY7
IC
DY5
DY4
IC
DY2
DY3
IC
DY1
G
IC
IC
K
IC

TPMHA0621EE

㉓ R329-02

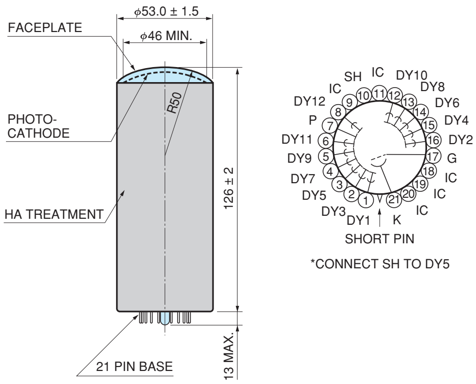


φ53.0 ± 1.5
φ46 MIN.
FACEPLATE
PHOTO-CATHODE
HA TREATMENT
127 ± 2
LIGHT TIGHT SHIELD
21 PIN BASE
14 MAX.
SH
IC
DY10
IC
DY8
DY12
DY6
P
DY4
DY11
DY2
DY9
G
DY7
IC
DY5
IC
DY3
IC
DY1
K

*CONNECT SH TO DY5

TPMHA0123EG

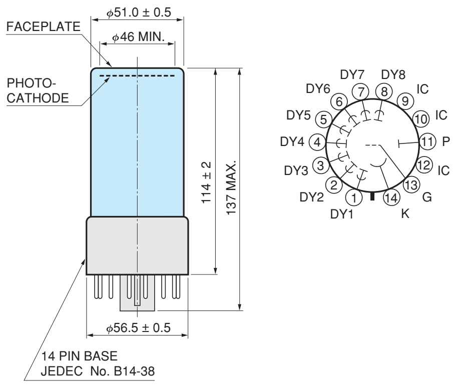
㉔ R331-05



φ53.0 ± 1.5
φ46 MIN.
FACEPLATE
PHOTO-
CATHODE
R50
HA TREATMENT
126 ± 2
13 MAX.
21 PIN BASE
SH
IC
IC
DY10
DY8
DY12
DY6
P
DY4
DY11
DY2
DY9
G
DY7
IC
DY5
IC
DY3
IC
DY1
K
SHORT PIN
*CONNECT SH TO DY5

TPMHA0072EF

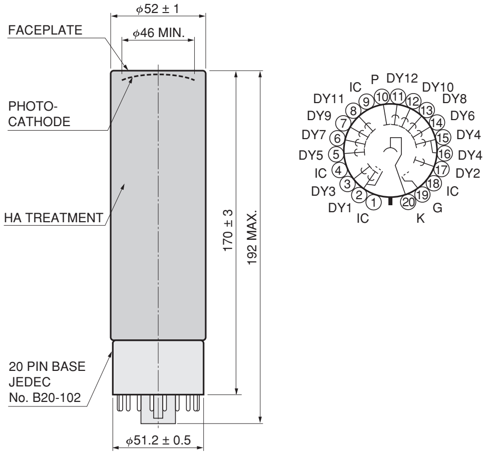
㉕ R1306



φ51.0 ± 0.5
φ46 MIN.
FACEPLATE
PHOTO-
CATHODE
114 ± 2
137 MAX.
φ56.5 ± 0.5
14 PIN BASE
JEDEC No. B14-38
DY7
DY8
DY6
IC
DY5
IC
DY4
P
DY3
IC
DY2
G
DY1
K

TPMHA0089EC

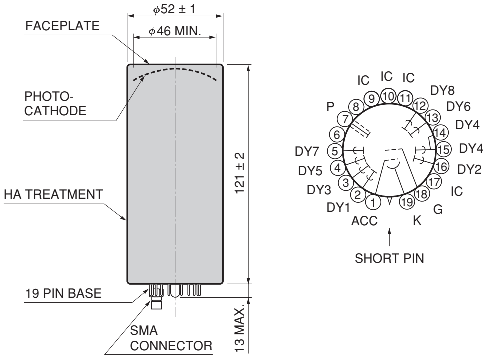
㉖ R1828-01



φ52 ± 1
φ46 MIN.
FACEPLATE
PHOTO-
CATHODE
HA TREATMENT
170 ± 3
192 MAX.
20 PIN BASE
JEDEC
No. B20-102
φ51.2 ± 0.5
IC
P
DY12
DY10
DY11
DY8
DY9
DY6
DY7
DY4
DY5
DY4
IC
DY2
DY3
IC
DY1
IC
K
G

TPMHA0064EE

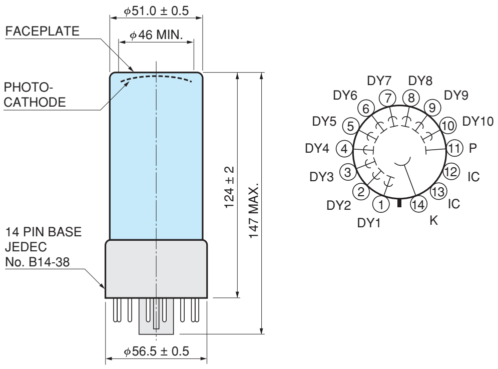
㉗ R2083



φ52 ± 1
φ46 MIN.
FACEPLATE
PHOTO-
CATHODE
HA TREATMENT
121 ± 2
19 PIN BASE
SMA
CONNECTOR
13 MAX.
IC
IC
IC
DY8
P
DY6
DY4
DY7
DY4
DY5
DY2
DY3
IC
DY1
G
ACC
K
SHORT PIN

TPMHA0185EE

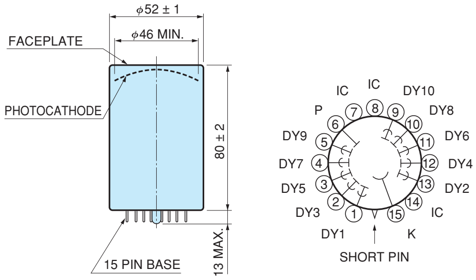
㉘ R2154-02



φ51.0 ± 0.5
φ46 MIN.
FACEPLATE
PHOTO-
CATHODE
124 ± 2
147 MAX.
14 PIN BASE
JEDEC
No. B14-38
φ56.5 ± 0.5
DY7
DY8
DY6
DY9
DY5
DY10
DY4
P
DY3
IC
DY2
IC
DY1
K

TPMHA0296EB

㉙ R4607A-06

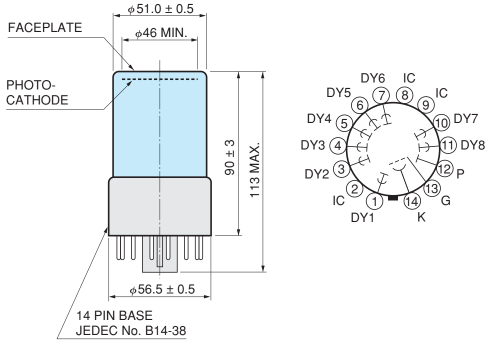


φ52 ± 1
φ46 MIN.
FACEPLATE
PHOTOCATHODE
80 ± 2
13 MAX.
15 PIN BASE
IC
IC
DY10
P
DY8
DY9
DY6
DY7
DY4
DY5
DY2
DY3
IC
DY1
K
SHORT PIN

TPMHA0003EC

(Unit: mm)

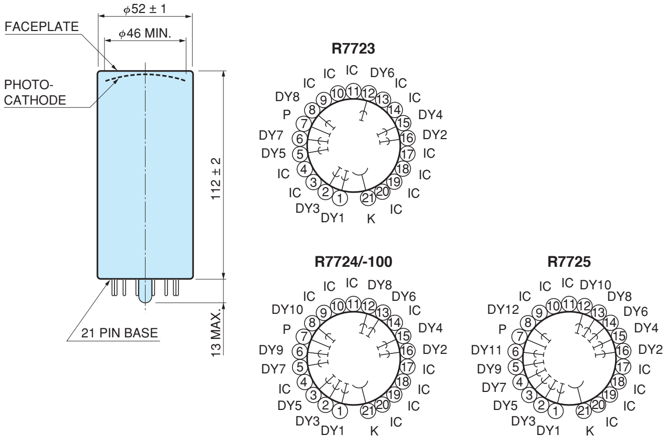
㉚ R6231, R6231-100



φ51.0 ± 0.5
φ46 MIN.
FACEPLATE
PHOTO-CATHODE
90 ± 3
113 MAX.
φ56.5 ± 0.5
14 PIN BASE
JEDEC No. B14-38
DY6 IC
DY5 ⑥ ⑦ ⑧ IC
DY4 ⑤ ⑨ ⑩ DY7
DY3 ④ ⑪ DY8
DY2 ③ ⑫ P
IC ② ① ⑭ ⑬ G
DY1 K

TPMHA0388EB

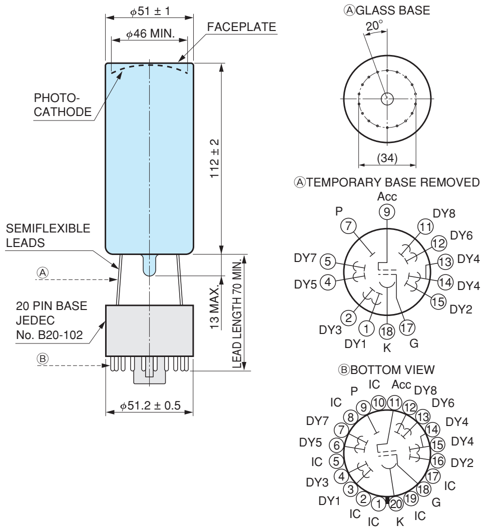
㉛ R7723, R7724, R7724-100, R7725



φ52 ± 1
φ46 MIN.
FACEPLATE
PHOTO-CATHODE
112 ± 2
13 MAX.
21 PIN BASE
R7723
IC IC DY6 IC IC DY8 P DY7 DY5 IC IC DY3 DY1 K IC IC IC IC DY2 DY4 IC
R7724/-100
IC IC DY8 DY6 IC DY10 P DY9 DY7 IC DY5 DY3 DY1 K IC IC IC IC DY2 DY4 IC
R7725
IC IC DY10 DY8 DY6 DY12 P DY11 DY9 DY7 DY5 DY3 DY1 K IC IC IC IC DY2 DY4

TPMHA0509EC

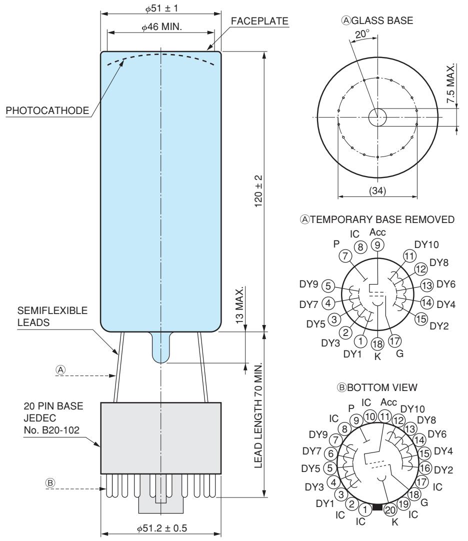
㉜ R13089



φ51 ± 1
φ46 MIN.
FACEPLATE
PHOTO-CATHODE
112 ± 2
SEMIFLEXIBLE LEADS
Ⓐ
20 PIN BASE JEDEC No. B20-102
Ⓑ
13 MAX.
LEAD LENGTH 70 MIN.
φ51.2 ± 0.5
ⒶGLASS BASE
20°
(34)
ⒶTEMPORARY BASE REMOVED
Acc P DY8 DY6 DY7 DY4 DY5 DY4 DY2 DY3 DY1 K G
ⒷBOTTOM VIEW
P IC Acc DY8 IC DY6 DY7 DY4 DY5 DY4 IC DY2 DY3 IC DY1 G IC IC K IC

TPMHA0606EA

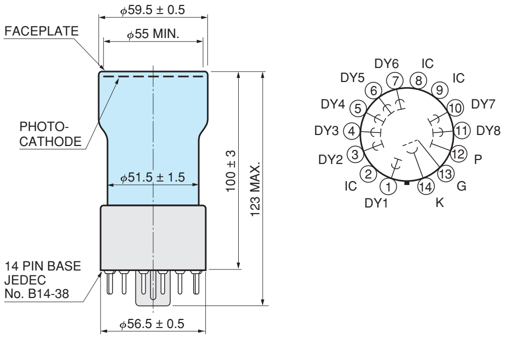
㉝ R13435



φ51 ± 1
φ46 MIN.
FACEPLATE
PHOTOCATHODE
120 ± 2
SEMIFLEXIBLE LEADS
Ⓐ
20 PIN BASE JEDEC No. B20-102
Ⓑ
13 MAX.
LEAD LENGTH 70 MIN.
φ51.2 ± 0.5
ⒶGLASS BASE
20°
7.5 MAX.
(34)
ⒶTEMPORARY BASE REMOVED
P IC Acc DY10 DY8 DY9 DY6 DY7 DY4 DY5 DY2 DY3 DY1 K G
ⒷBOTTOM VIEW
P IC Acc DY10 IC DY8 DY9 DY6 DY7 DY4 DY5 DY2 DY3 IC DY1 G IC IC IC K

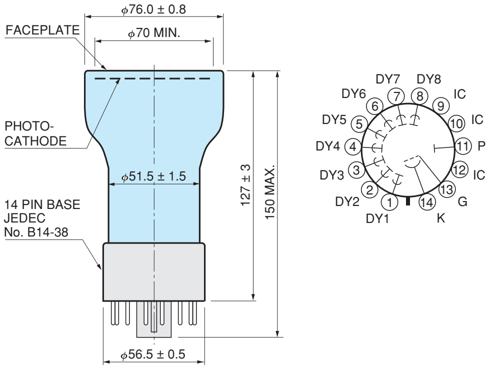
TPMHA0627EA

㉞ R6232



φ59.5 ± 0.5
φ55 MIN.
FACEPLATE
PHOTO-CATHODE
φ51.5 ± 1.5
100 ± 3
123 MAX.
14 PIN BASE
JEDEC
No. B14-38
φ56.5 ± 0.5
DY6 IC
DY5 IC
DY4 DY7
DY3 DY8
DY2 P
IC G
DY1 K

㉟ R1307

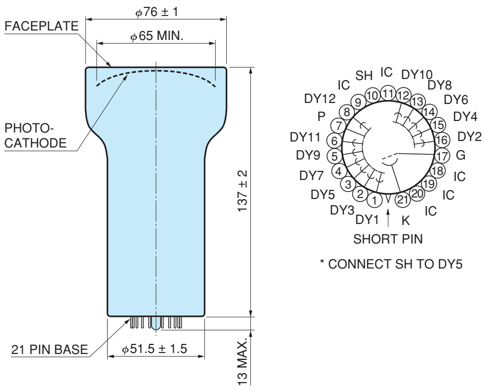


φ76.0 ± 0.8
φ70 MIN.
FACEPLATE
PHOTO-CATHODE
φ51.5 ± 1.5
127 ± 3
150 MAX.
14 PIN BASE
JEDEC
No. B14-38
φ56.5 ± 0.5
DY7 DY8
DY6 IC
DY5 IC
DY4 P
DY3 IC
DY2 G
DY1 K

TPMHA0510EA

TPMHA0078EA

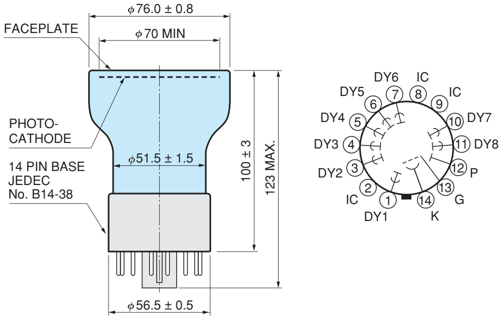
㊱ R6091



FACEPLATE
φ76 ± 1
φ65 MIN.
PHOTO-CATHODE
137 ± 2
21 PIN BASE
φ51.5 ± 1.5
13 MAX.
SH
IC
DY10
IC
DY12
DY8
DY6
P
DY4
DY2
DY11
G
DY9
DY7
IC
DY5
IC
DY3
IC
DY1
K
SHORT PIN
* CONNECT SH TO DY5

TPMHA0285EE

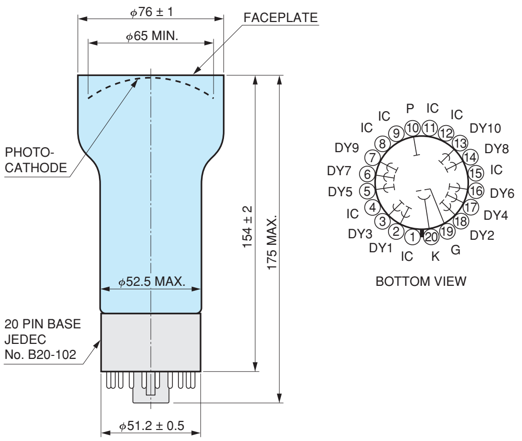
㊲ R6233, R6233-100



FACEPLATE
φ76.0 ± 0.8
φ70 MIN
PHOTO-CATHODE
φ51.5 ± 1.5
14 PIN BASE
JEDEC
No. B14-38
100 ± 3
123 MAX.
φ56.5 ± 0.5
DY6
IC
DY5
IC
DY4
DY7
DY3
DY8
DY2
P
IC
G
DY1
K

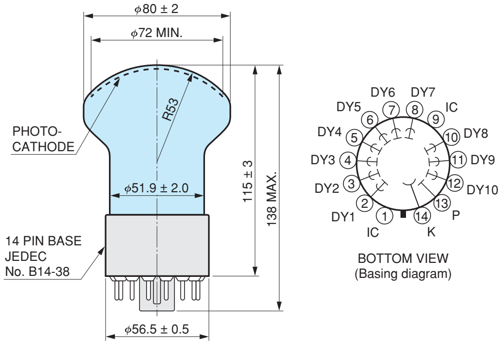
TPMHA0389EB

㊳ R15608



φ76 ± 1
FACEPLATE
φ65 MIN.
PHOTO-CATHODE
154 ± 2
175 MAX.
φ52.5 MAX.
20 PIN BASE
JEDEC
No. B20-102
φ51.2 ± 0.5
P
IC
IC
IC
IC
DY10
DY9
DY8
DY7
IC
DY5
DY6
IC
DY4
DY3
DY2
DY1
IC
K
G
BOTTOM VIEW

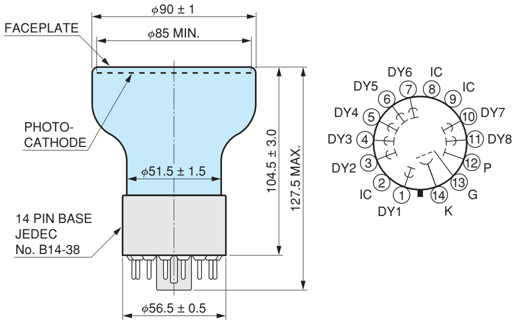
㊴ R14374



φ80 ± 2
φ72 MIN.
R53
PHOTO-CATHODE
φ51.9 ± 2.0
115 ± 3
138 MAX.
14 PIN BASE
JEDEC
No. B14-38
φ56.5 ± 0.5
DY6
DY7
DY5
IC
DY4
DY8
DY3
DY9
DY2
DY10
DY1
P
IC
K
BOTTOM VIEW
(Basing diagram)

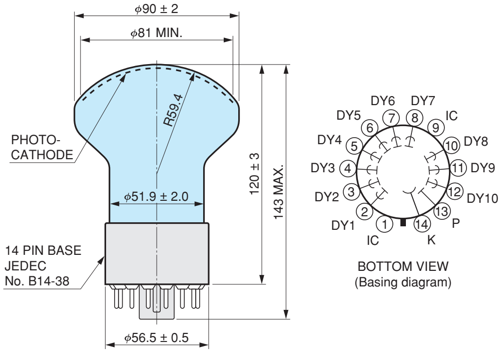
TPMHA0634EC

㊵ R10233, R10233-100



φ90 ± 1
FACEPLATE
φ85 MIN.
PHOTO-CATHODE
φ51.5 ± 1.5
104.5 ± 3.0
127.5 MAX.
14 PIN BASE
JEDEC
No. B14-38
φ56.5 ± 0.5
DY6
IC
DY5
IC
DY4
DY7
DY3
DY8
DY2
P
IC
G
DY1
K

㊶ R14689



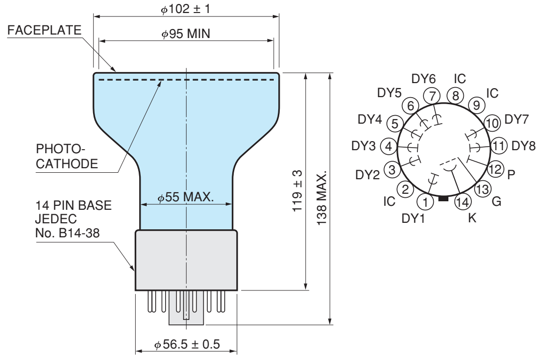
φ90 ± 2
φ81 MIN.
R59.4
PHOTO-CATHODE
φ51.9 ± 2.0
120 ± 3
143 MAX.
14 PIN BASE
JEDEC
No. B14-38
φ56.5 ± 0.5
DY6
DY7
DY5
IC
DY4
DY8
DY3
DY9
DY2
DY10
DY1
P
IC
K
BOTTOM VIEW
(Basing diagram)

TPMHA0580EB

TPMHA0635EC

(Unit: mm)

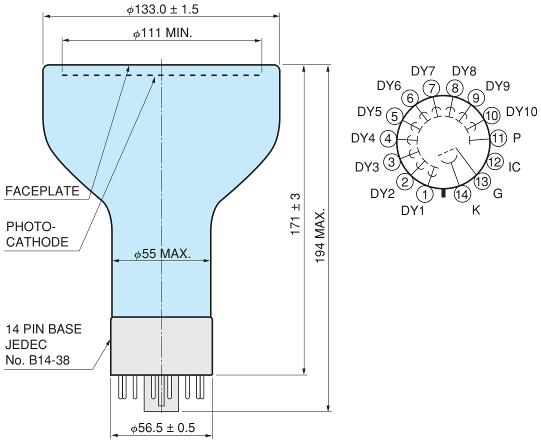
㊷ R10806, R10806-100



ϕ102 ± 1
ϕ95 MIN
FACEPLATE
PHOTO-CATHODE
ϕ55 MAX.
14 PIN BASE JEDEC No. B14-38
119 ± 3
138 MAX.
ϕ56.5 ± 0.5
DY6 IC DY5 IC DY4 DY7 DY3 DY8 DY2 P IC G DY1 K
1 2 3 4 5 6 7 8 9 10 11 12 13 14

TPMHA0628EA

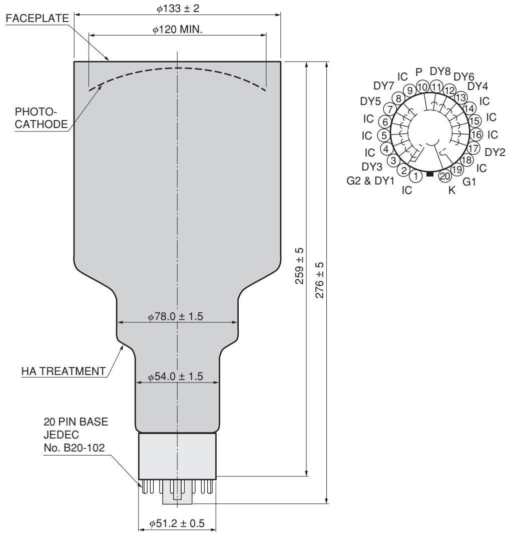
㊸ R877, R877-100



ϕ133.0 ± 1.5
ϕ111 MIN.
FACEPLATE
PHOTO-CATHODE
ϕ55 MAX.
14 PIN BASE JEDEC No. B14-38
171 ± 3
194 MAX.
ϕ56.5 ± 0.5
DY7 DY8 DY6 DY9 DY5 DY10 DY4 P DY3 IC DY2 G DY1 K
1 2 3 4 5 6 7 8 9 10 11 12 13 14

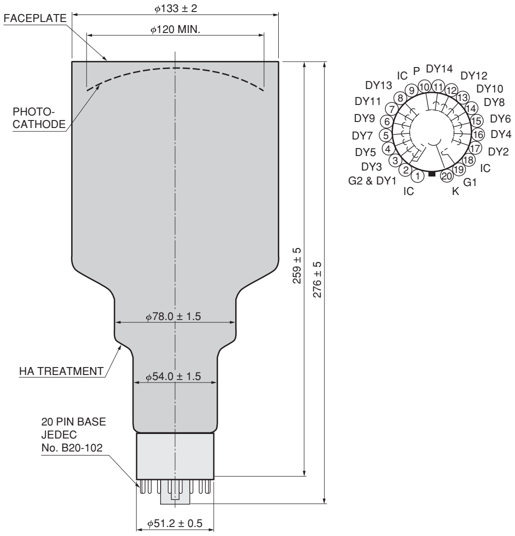
TPMHA0074EC

㊹ R4144-100



ϕ133 ± 2
ϕ120 MIN.
FACEPLATE
PHOTO-CATHODE
ϕ78.0 ± 1.5
HA TREATMENT
ϕ54.0 ± 1.5
20 PIN BASE JEDEC No. B20-102
259 ± 5
276 ± 5
ϕ51.2 ± 0.5
IC P DY8 DY7 DY6 DY5 DY4 IC IC IC IC IC IC DY2 DY3 IC G2 & DY1 G1 IC K
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

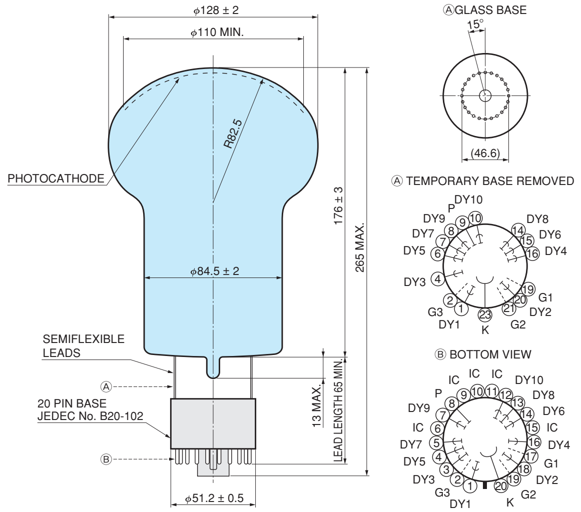
㊺ R1250



ϕ133 ± 2
ϕ120 MIN.
FACEPLATE
PHOTO-CATHODE
ϕ78.0 ± 1.5
HA TREATMENT
ϕ54.0 ± 1.5
20 PIN BASE JEDEC No. B20-102
259 ± 5
276 ± 5
ϕ51.2 ± 0.5
IC P DY14 DY13 DY12 DY11 DY10 DY9 DY8 DY7 DY6 DY5 DY4 DY3 DY2 G2 & DY1 IC G1 IC K
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

TPMHA0018EE

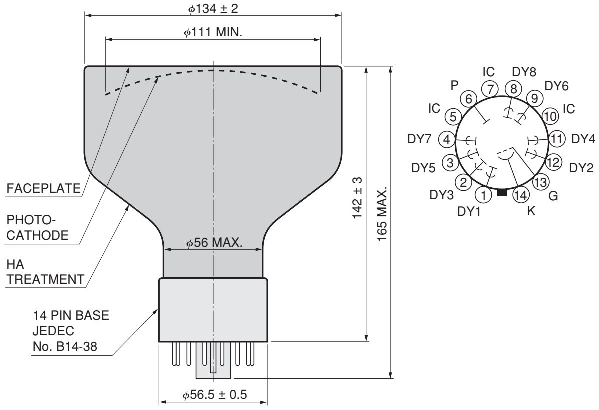
㊻ R6594



ϕ128 ± 2
ϕ110 MIN.
R82.5
PHOTOCATHODE
ϕ84.5 ± 2
176 ± 3
265 MAX.
SEMIFLEXIBLE LEADS
Ⓐ
20 PIN BASE JEDEC No. B20-102
Ⓑ
13 MAX.
LEAD LENGTH 65 MIN.
ϕ51.2 ± 0.5
ⒶGLASS BASE
15°
(46.6)
Ⓐ TEMPORARY BASE REMOVED
DY10 P DY9 DY8 DY7 DY6 DY5 DY4 DY3 G1 G3 DY2 DY1 K G2
Ⓑ BOTTOM VIEW
IC IC IC DY10 P DY8 DY9 DY6 IC IC DY7 DY4 DY5 G1 DY3 DY2 G3 G2 DY1 K

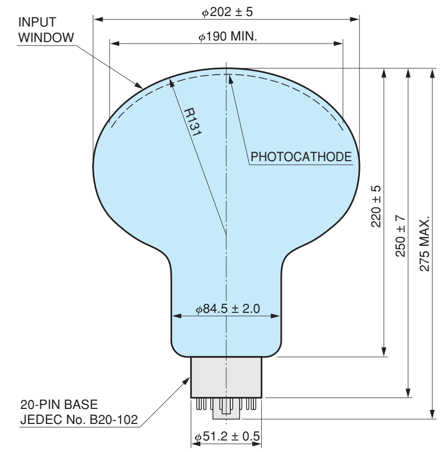
TPMHA0373EF

㊼ R11833-100-03



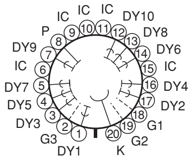
ϕ134 ± 2
ϕ111 MIN.
FACEPLATE
PHOTO-CATHODE
HA TREATMENT
ϕ56 MAX.
14 PIN BASE JEDEC No. B14-38
142 ± 3
165 MAX.
ϕ56.5 ± 0.5
IC DY8 P DY6 IC IC DY7 DY4 DY5 DY2 DY3 G DY1 K
1 2 3 4 5 6 7 8 9 10 11 12 13 14

㊽ R5912, R5912-20, R5912-100



INPUT WINDOW
φ202 ± 5
φ190 MIN.
R131
PHOTOCATHODE
220 ± 5
250 ± 7
275 MAX.
φ84.5 ± 2.0
20-PIN BASE
JEDEC No. B20-102
φ51.2 ± 0.5

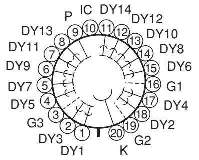
R5912/-100



IC
IC
IC
DY10
P
DY8
DY9
DY6
IC
IC
DY7
DY4
DY5
DY2
DY3
G1
G3
G2
DY1
K

(Bottom view)

R5912-20



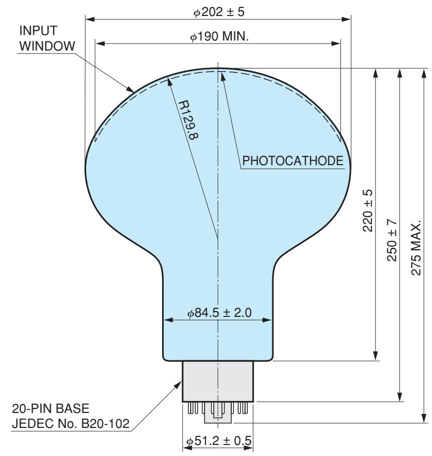
P
IC
DY14
DY12
DY13
DY10
DY11
DY8
DY9
DY6
DY7
G1
DY5
DY4
G3
DY2
DY3
G2
DY1
K

(Bottom view)

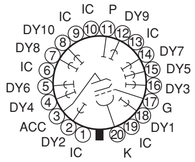
IC: Internal connection
(Do not use)

TPMHA0500EC

㊾ R14688, R14688-100



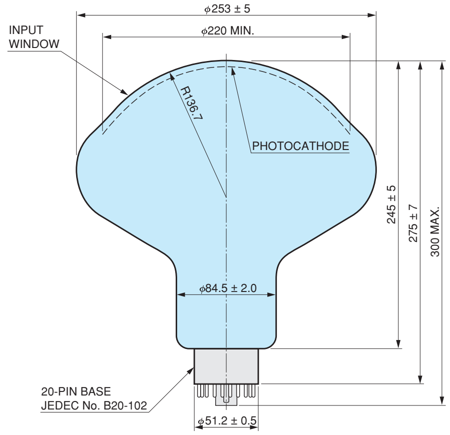
INPUT WINDOW
φ202 ± 5
φ190 MIN.
R129.8
PHOTOCATHODE
220 ± 5
250 ± 7
275 MAX.
φ84.5 ± 2.0
20-PIN BASE
JEDEC No. B20-102
φ51.2 ± 0.5



IC
IC
P
DY9
DY10
IC
DY8
DY7
IC
DY5
DY6
DY3
DY4
G
ACC
DY1
DY2
IC
IC
K

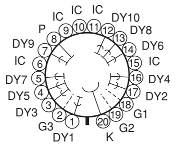
Basing diagram
(Bottom view)

㊿ R7081, R7081-20, R7081-100



INPUT WINDOW
φ253 ± 5
φ220 MIN.
R136.7
PHOTOCATHODE
245 ± 5
275 ± 7
300 MAX.
φ84.5 ± 2.0
20-PIN BASE
JEDEC No. B20-102
φ51.2 ± 0.5

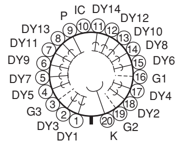
R7081/-100



IC
IC
IC
DY10
P
DY8
DY9
DY6
IC
IC
DY7
DY4
DY5
DY2
DY3
G1
G3
G2
DY1
K

(Bottom View)

R7081-20



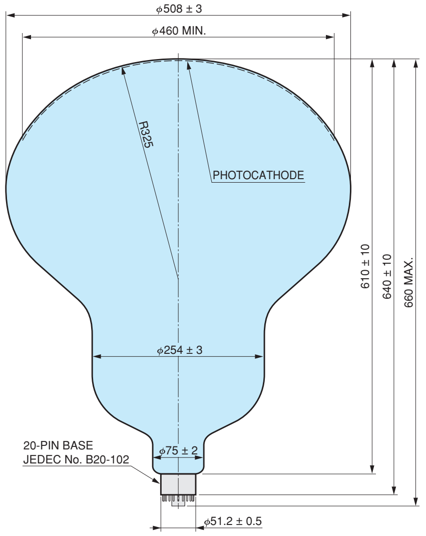
P
IC
DY14
DY12
DY13
DY10
DY11
DY8
DY9
DY6
DY7
G1
DY5
DY4
G3
DY2
DY3
G2
DY1
K

(Bottom View)

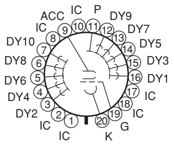
IC: Internal Connection
(Do not use)

TPMHA0501EC

(51) R12860



φ508 ± 3
φ460 MIN.
R325
PHOTOCATHODE
φ254 ± 3
610 ± 10
640 ± 10
660 MAX.
20-PIN BASE
JEDEC No. B20-102
φ75 ± 2
φ51.2 ± 0.5

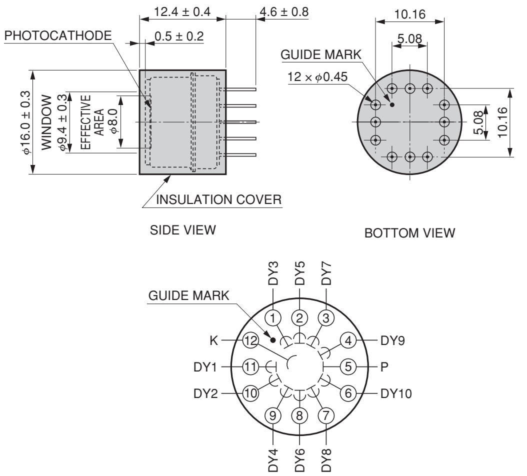


ACC
IC
P
DY9
IC
DY7
DY10
DY5
DY8
DY3
DY6
DY1
DY4
IC
DY2
IC
IC
G
IC
K

TPMHA0630EA

(Unit: mm)

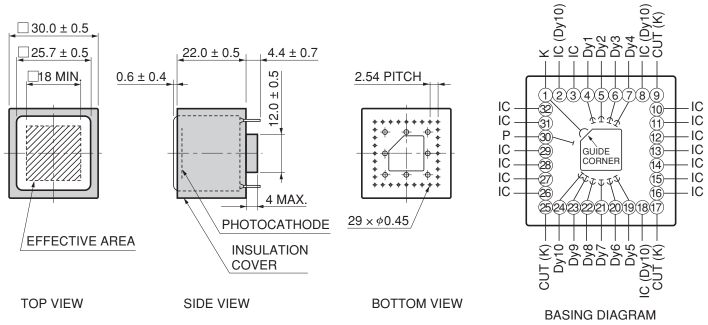
(52) R9880U-110, R9880U-210



12.4 ± 0.4
4.6 ± 0.8
PHOTOCATHODE
0.5 ± 0.2
φ16.0 ± 0.3
WINDOW φ9.4 ± 0.3
EFFECTIVE AREA φ8.0
INSULATION COVER
SIDE VIEW
10.16
5.08
GUIDE MARK
12 × φ0.45
5.08
10.16
BOTTOM VIEW
GUIDE MARK
DY3
DY5
DY7
K
DY1
DY2
DY9
P
DY10
DY4
DY6
DY8
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫

TPMHA0539EC

(53) R7600U, R7600U-100/-200/-300

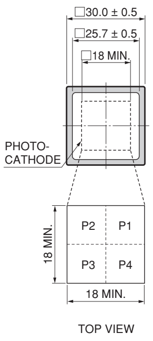


□30.0 ± 0.5
□25.7 ± 0.5
□18 MIN.
EFFECTIVE AREA
TOP VIEW
0.6 ± 0.4
22.0 ± 0.5
4.4 ± 0.7
12.0 ± 0.5
4 MAX.
PHOTOCATHODE
INSULATION COVER
SIDE VIEW
2.54 PITCH
29 × φ0.45
BOTTOM VIEW
K
IC (Dy10)
IC
Dy1
Dy2
Dy3
Dy4
IC (Dy10)
CUT (K)
IC
IC
P
IC
IC
IC
IC
GUIDE CORNER
IC
IC
IC
IC
IC
IC
IC
CUT (K)
Dy10
Dy9
Dy8
Dy7
Dy6
Dy5
IC (Dy10)
CUT (K)
BASING DIAGRAM

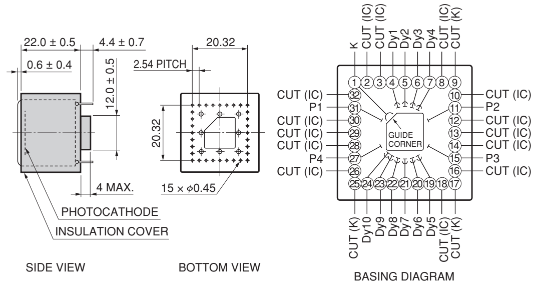
K : Photocathode
Dy : Dynode
P : Anode
CUT : Short pin
IC : Internal connection (Don't use)

TPMHA0278EJ

(54) R7600U-00-M4, R7600U-100-M4/-200-M4



□30.0 ± 0.5
□25.7 ± 0.5
□18 MIN.
PHOTO-CATHODE
P2
P1
P3
P4
18 MIN.
18 MIN.
TOP VIEW

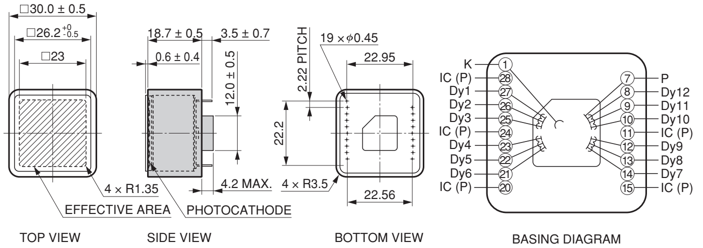


22.0 ± 0.5
4.4 ± 0.7
0.6 ± 0.4
12.0 ± 0.5
4 MAX.
PHOTOCATHODE
INSULATION COVER
SIDE VIEW
20.32
2.54 PITCH
20.32
15 × φ0.45
BOTTOM VIEW
K
CUT (IC)
CUT (IC)
Dy1
Dy2
Dy3
Dy4
CUT (IC)
CUT (K)
CUT (IC)
P1
CUT (IC)
CUT (IC)
CUT (IC)
P4
CUT (IC)
CUT (IC)
P2
CUT (IC)
CUT (IC)
CUT (IC)
P3
CUT (IC)
GUIDE CORNER
CUT (K)
Dy10
Dy9
Dy8
Dy7
Dy6
Dy5
CUT (IC)
CUT (K)
BASING DIAGRAM

K : Photocathode
Dy : Dynode
P : Anode
CUT : Short pin
IC : Internal connection (Do not Use)

TPMHA0297EJ

(55) R11265U-100, R11265U-200, R11265U-300

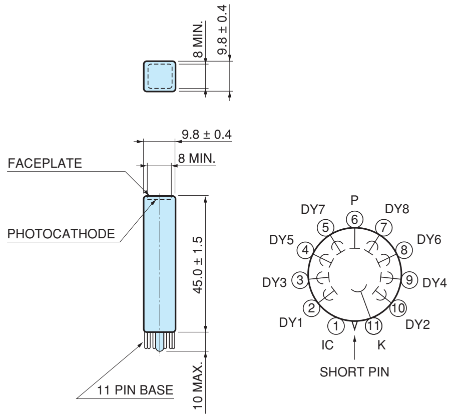


□30.0 ± 0.5
□26.2 +0 -0.5
□23
4 × R1.35
EFFECTIVE AREA
TOP VIEW
18.7 ± 0.5
3.5 ± 0.7
0.6 ± 0.4
12.0 ± 0.5
4.2 MAX.
PHOTOCATHODE
SIDE VIEW
2.22 PITCH
19 × φ0.45
22.95
22.2
4 × R3.5
22.56
BOTTOM VIEW
K
IC (P)
Dy1
Dy2
Dy3
IC (P)
Dy4
Dy5
Dy6
IC (P)
P
Dy12
Dy11
Dy10
IC (P)
Dy9
Dy8
Dy7
IC (P)
BASING DIAGRAM

K : Photocathode
Dy : Dynode
P : Anode
IC : Internal connection (Don't use)

TPMHA0577EB

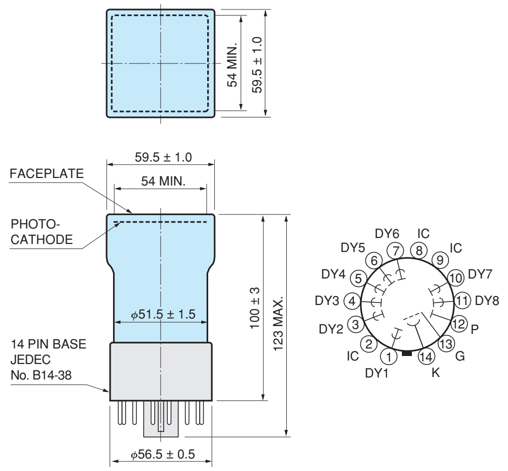
(56) R2248



8 MIN.
9.8 ± 0.4
9.8 ± 0.4
8 MIN.
FACEPLATE
PHOTOCATHODE
45.0 ± 1.5
11 PIN BASE
10 MAX.
P
DY7
DY8
DY5
DY6
DY3
DY4
DY1
DY2
IC
K
SHORT PIN
1
2
3
4
5
6
7
8
9
10
11

TPMHA0098EC

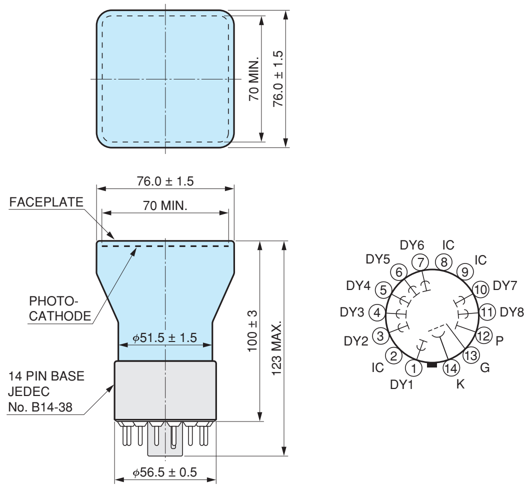
(57) R6236



54 MIN.
59.5 ± 1.0
59.5 ± 1.0
54 MIN.
FACEPLATE
PHOTO-CATHODE
φ51.5 ± 1.5
14 PIN BASE JEDEC No. B14-38
100 ± 3
123 MAX.
φ56.5 ± 0.5
DY6
IC
DY5
IC
DY4
DY7
DY3
DY8
DY2
P
IC
G
DY1
K
1
2
3
4
5
6
7
8
9
10
11
12
13
14

TPMHA0392EB

(58) R6237

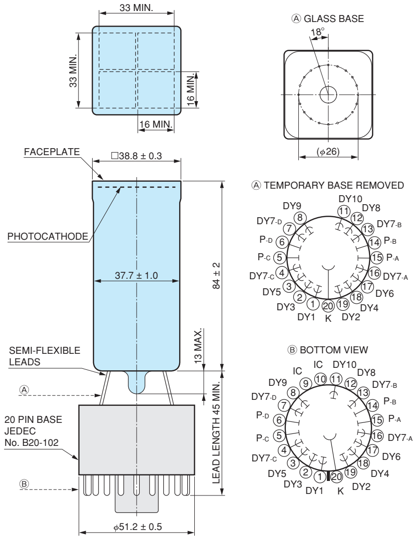


70 MIN.
76.0 ± 1.5
76.0 ± 1.5
70 MIN.
FACEPLATE
PHOTO-CATHODE
φ51.5 ± 1.5
14 PIN BASE JEDEC No. B14-38
100 ± 3
123 MAX.
φ56.5 ± 0.5
DY6
IC
DY5
IC
DY4
DY7
DY3
DY8
DY2
P
IC
G
DY1
K
1
2
3
4
5
6
7
8
9
10
11
12
13
14

TPMHA0393EC

(Unit: mm)

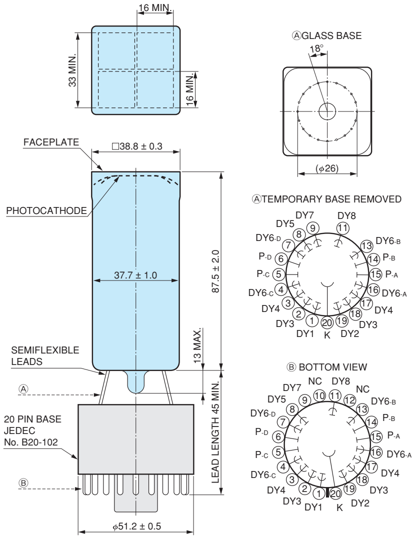
(59) R8997



33 MIN.
33 MIN.
16 MIN.
16 MIN.
Ⓐ GLASS BASE
18°
(ϕ26)
FACEPLATE
□38.8 ± 0.3
PHOTOCATHODE
37.7 ± 1.0
84 ± 2
13 MAX.
SEMI-FLEXIBLE LEADS
Ⓐ
20 PIN BASE JEDEC No. B20-102
Ⓑ
LEAD LENGTH 45 MIN.
ϕ51.2 ± 0.5
Ⓐ TEMPORARY BASE REMOVED
DY9 8
DY10 11
DY8 12
DY7-D 7
DY7-B 13
P-D 6
P-B 14
P-C 5
P-A 15
DY7-C 4
DY7-A 16
DY5 3
DY6 17
DY3 2
DY4 18
DY1 1
K 20
DY2 19
Ⓑ BOTTOM VIEW
IC 9
IC 10
DY10 11
DY8 12
DY9 8
DY7-B 13
DY7-D 7
P-B 14
P-D 6
P-A 15
P-C 5
DY7-A 16
DY7-C 4
DY6 17
DY5 3
DY4 18
DY3 2
DY1 1
K 20
DY2 19

TPMHA0552EC

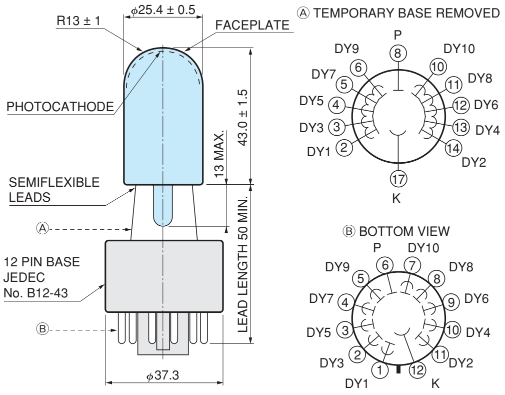
(60) R10550



16 MIN.
33 MIN.
16 MIN.
Ⓐ GLASS BASE
18°
(ϕ26)
FACEPLATE
□38.8 ± 0.3
PHOTOCATHODE
37.7 ± 1.0
87.5 ± 2.0
13 MAX.
SEMIFLEXIBLE LEADS
Ⓐ
20 PIN BASE JEDEC No. B20-102
Ⓑ
LEAD LENGTH 45 MIN.
ϕ51.2 ± 0.5
Ⓐ TEMPORARY BASE REMOVED
DY7 9
DY8 11
DY5 8
DY6-D 7
DY6-B 13
P-D 6
P-B 14
P-C 5
P-A 15
DY6-C 4
DY6-A 16
DY4 3
DY4 17
DY3 2
DY3 18
DY1 1
K 20
DY2 19
Ⓑ BOTTOM VIEW
DY7 9
NC 10
DY8 11
NC 12
DY5 8
DY6-B 13
DY6-D 7
P-B 14
P-D 6
P-A 15
P-C 5
DY6-A 16
DY6-C 4
DY4 17
DY4 3
DY3 18
DY3 2
DY1 1
K 20
DY2 19

TPMHA0576EC

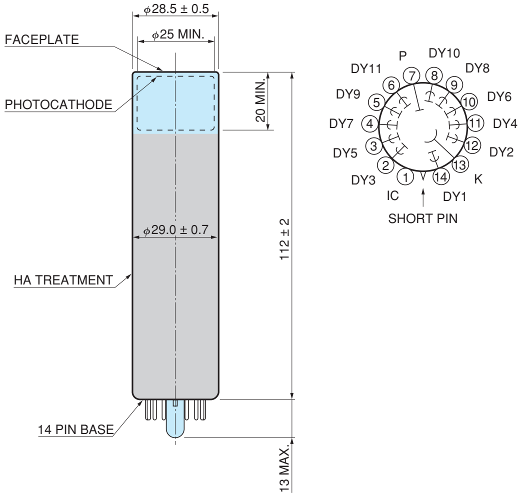
(61) R7373A-01



R13 ± 1
ϕ25.4 ± 0.5
FACEPLATE
PHOTOCATHODE
43.0 ± 1.5
13 MAX.
SEMIFLEXIBLE LEADS
Ⓐ
12 PIN BASE JEDEC No. B12-43
Ⓑ
LEAD LENGTH 50 MIN.
ϕ37.3
Ⓐ TEMPORARY BASE REMOVED
P 8
DY9 6
DY10 10
DY7 5
DY8 11
DY5 4
DY6 12
DY3 3
DY4 13
DY1 2
DY2 14
K 17
Ⓑ BOTTOM VIEW
P 6
DY10 7
DY9 5
DY8 8
DY7 4
DY6 9
DY5 3
DY4 10
DY3 2
DY2 11
DY1 1
K 12

TPMHA0460EB

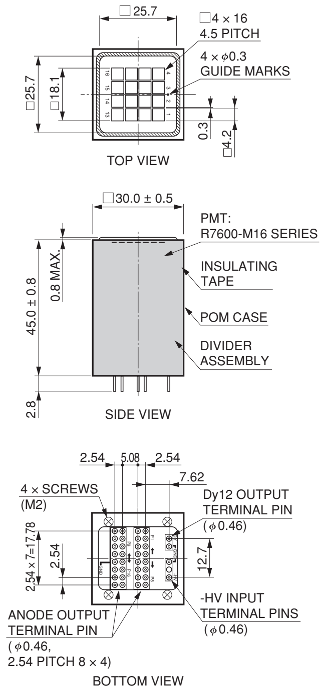
(62) R8143

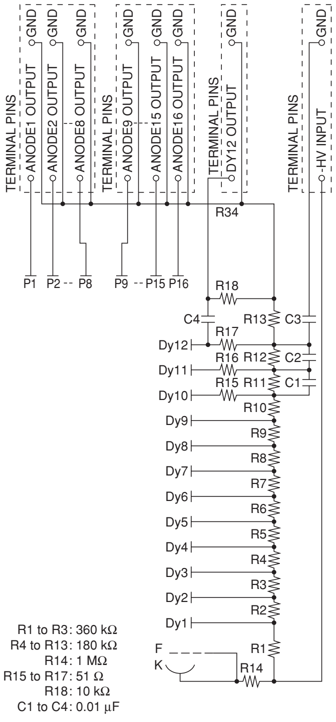


ϕ28.5 ± 0.5
ϕ25 MIN.
FACEPLATE
PHOTOCATHODE
20 MIN.
ϕ29.0 ± 0.7
112 ± 2
HA TREATMENT
14 PIN BASE
13 MAX.
P 7
DY10 8
DY11 6
DY8 9
DY9 5
DY6 10
DY7 4
DY4 11
DY5 3
DY2 12
DY3 2
K 13
IC 1
DY1 14
SHORT PIN

TPMHA0507EA

(63) H8711, H8711-100, H8711-200, H8711-300

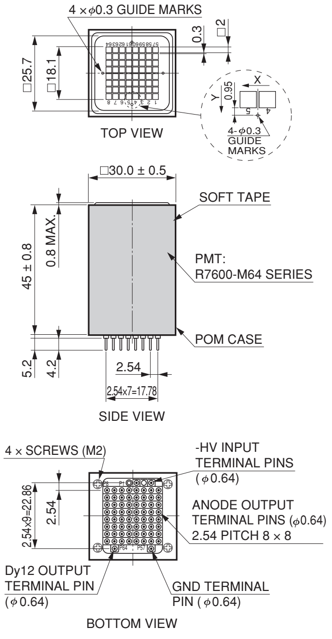

□25.7
□4 × 16
4.5 PITCH
4 × φ0.3
GUIDE MARKS
□25.7
□18.1
0.3
□4.2
TOP VIEW
□30.0 ± 0.5
PMT:
R7600-M16 SERIES
INSULATING
TAPE
POM CASE
DIVIDER
ASSEMBLY
45.0 ± 0.8
0.8 MAX.
2.8
SIDE VIEW
2.54
5.08
2.54
7.62
4 × SCREWS
(M2)
Dy12 OUTPUT
TERMINAL PIN
(φ0.46)
2.54 × 7=17.78
2.54
12.7
-HV INPUT
TERMINAL PINS
(φ0.46)
ANODE OUTPUT
TERMINAL PIN
(φ0.46,
2.54 PITCH 8 × 4)
BOTTOM VIEW

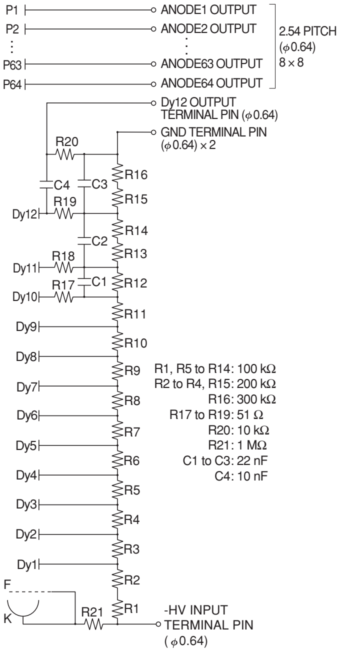

TERMINAL PINS
ANODE1 OUTPUT
ANODE2 OUTPUT
ANODE8 OUTPUT
GND
GND
GND
TERMINAL PINS
ANODE9 OUTPUT
ANODE15 OUTPUT
ANODE16 OUTPUT
GND
GND
GND
TERMINAL PINS
DY12 OUTPUT
GND
TERMINAL PINS
-HV INPUT
GND
R34
P1
P2
P8
P9
P15
P16
R18
C4
R13
C3
R17
Dy12
R16
R12
C2
Dy11
R15
R11
C1
Dy10
R10
Dy9
R9
Dy8
R8
Dy7
R7
Dy6
R6
Dy5
R5
Dy4
R4
Dy3
R3
Dy2
R2
Dy1
R1
F
K
R14

R1 to R3: 360 kΩ
R4 to R13: 180 kΩ
R14: 1 MΩ
R15 to R17: 51 Ω
R18: 10 kΩ
C1 to C4: 0.01 µF

TPMHA0487EE

(64) H7546B, H7546B-100, H7546B-200, H7546B-300

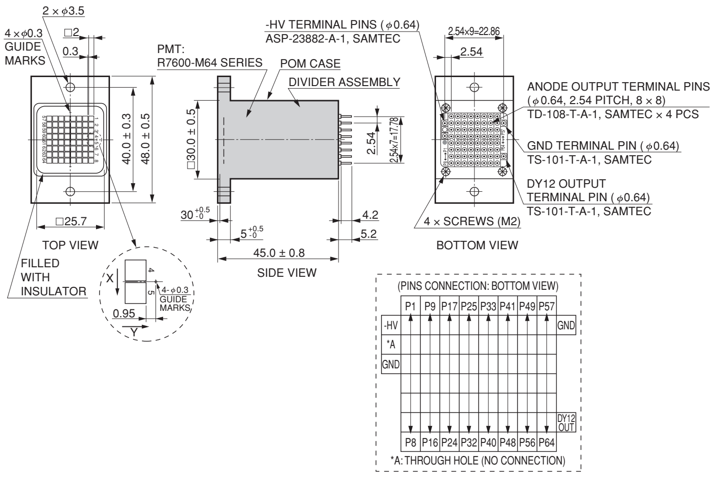

4 × φ0.3 GUIDE MARKS
□25.7
□18.1
0.3
□2
0.95
Y
X
4-φ0.3
GUIDE
MARKS
TOP VIEW
□30.0 ± 0.5
SOFT TAPE
PMT:
R7600-M64 SERIES
POM CASE
45 ± 0.8
0.8 MAX.
5.2
4.2
2.54
2.54x7=17.78
SIDE VIEW
4 × SCREWS (M2)
-HV INPUT
TERMINAL PINS
(φ0.64)
ANODE OUTPUT
TERMINAL PINS (φ0.64)
2.54 PITCH 8 × 8
2.54x9=22.86
2.54
Dy12 OUTPUT
TERMINAL PIN
(φ0.64)
GND TERMINAL
PIN (φ0.64)
BOTTOM VIEW

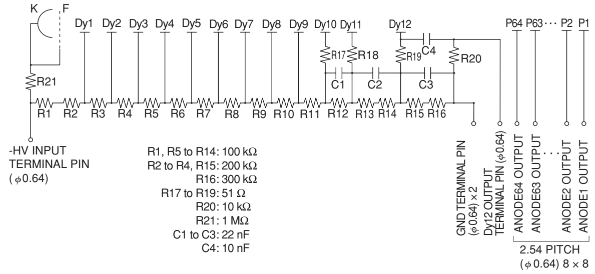

P1
P2
P63
P64
ANODE1 OUTPUT
ANODE2 OUTPUT
ANODE63 OUTPUT
ANODE64 OUTPUT
2.54 PITCH
(φ0.64)
8 × 8
Dy12 OUTPUT
TERMINAL PIN (φ0.64)
GND TERMINAL PIN
(φ0.64) × 2
R20
C4
C3
R16
R19
Dy12
R15
C2
R14
R18
Dy11
R13
R17
C1
Dy10
R12
Dy9
R11
Dy8
R10
Dy7
R9
Dy6
R8
Dy5
R7
Dy4
R6
Dy3
R5
Dy2
R4
Dy1
R3
F
R2
K
R21
R1
-HV INPUT
TERMINAL PIN
(φ0.64)

R1, R5 to R14: 100 kΩ
R2 to R4, R15: 200 kΩ
R16: 300 kΩ
R17 to R19: 51 Ω
R20: 10 kΩ
R21: 1 MΩ
C1 to C3: 22 nF
C4: 10 nF

TPMHA0223EC

(65) H8804-300

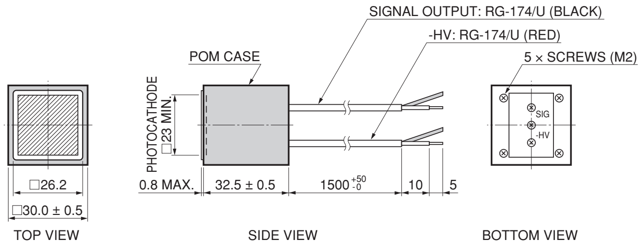

2 × φ3.5
4 × φ0.3
GUIDE
MARKS
□2
0.3
PMT:
R7600-M64 SERIES
POM CASE
DIVIDER ASSEMBLY
-HV TERMINAL PINS (φ0.64)
ASP-23882-A-1, SAMTEC
2.54x9=22.86
2.54
40.0 ± 0.3
48.0 ± 0.5
□30.0 ± 0.5
2.54
2.54x7=17.78
□25.7
TOP VIEW
FILLED
WITH
INSULATOR
X
Y
0.95
4-φ0.3
GUIDE
MARKS
30 +0.5 -0
5 +0.5 -0
4.2
5.2
45.0 ± 0.8
SIDE VIEW
ANODE OUTPUT TERMINAL PINS
(φ0.64, 2.54 PITCH, 8 × 8)
TD-108-T-A-1, SAMTEC × 4 PCS
GND TERMINAL PIN (φ0.64)
TS-101-T-A-1, SAMTEC
DY12 OUTPUT
TERMINAL PIN (φ0.64)
TS-101-T-A-1, SAMTEC
4 × SCREWS (M2)
BOTTOM VIEW
(PINS CONNECTION: BOTTOM VIEW)
P1
P9
P17
P25
P33
P41
P49
P57
-HV
*A
GND
GND
DY12 OUT
P8
P16
P24
P32
P40
P48
P56
P64
*A: THROUGH HOLE (NO CONNECTION)

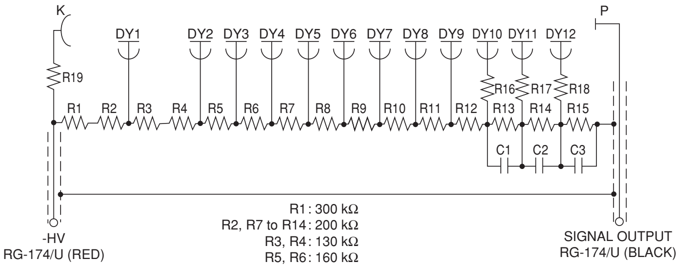

K
F
Dy1
Dy2
Dy3
Dy4
Dy5
Dy6
Dy7
Dy8
Dy9
Dy10
Dy11
Dy12
P64
P63
P2
P1
R17
R18
R19
C4
R20
R21
C1
C2
C3
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
-HV INPUT
TERMINAL PIN
(φ0.64)
GND TERMINAL PIN
(φ0.64) × 2
Dy12 OUTPUT
TERMINAL PIN (φ0.64)
ANODE64 OUTPUT
ANODE63 OUTPUT
ANODE2 OUTPUT
ANODE1 OUTPUT
2.54 PITCH
(φ0.64) 8 × 8

R1, R5 to R14: 100 kΩ
R2 to R4, R15: 200 kΩ
R16: 300 kΩ
R17 to R19: 51 Ω
R20: 10 kΩ
R21: 1 MΩ
C1 to C3: 22 nF
C4: 10 nF

TPMHA0550EB

(66) H11934-100, H11934-200, H11934-300


SIGNAL OUTPUT: RG-174/U (BLACK)
-HV: RG-174/U (RED)
POM CASE
5 × SCREWS (M2)
PHOTOCATHODE
□23 MIN.
SIG
-HV
□26.2
□30.0 ± 0.5
0.8 MAX.
32.5 ± 0.5
1500 +50 -0
10
5
TOP VIEW
SIDE VIEW
BOTTOM VIEW


K
P
DY1
DY2
DY3
DY4
DY5
DY6
DY7
DY8
DY9
DY10
DY11
DY12
R19
R16
R17
R18
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
C1
C2
C3
-HV
RG-174/U (RED)
SIGNAL OUTPUT
RG-174/U (BLACK)

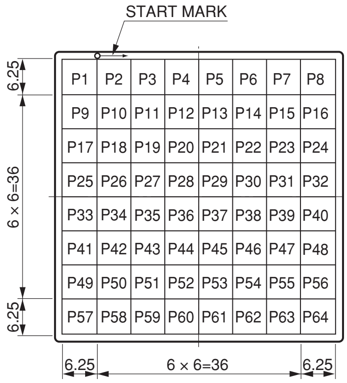
R1: 300 kΩ
R2, R7 to R14: 200 kΩ
R3, R4: 130 kΩ
R5, R6: 160 kΩ
R15: 100 kΩ
R16 to R18: 51 Ω
R19: 1 MΩ
C1 to C3: 0.01 µF

NOTE: DIVIDER RATIO=2.5: 1.3: 0.8: 0.8: 1: 1: 1: 0.5
TOTAL RESISTANCE=2.78 MΩ, DIVIDER CURRENT=359.7 µA at -1000 V (MAX.)

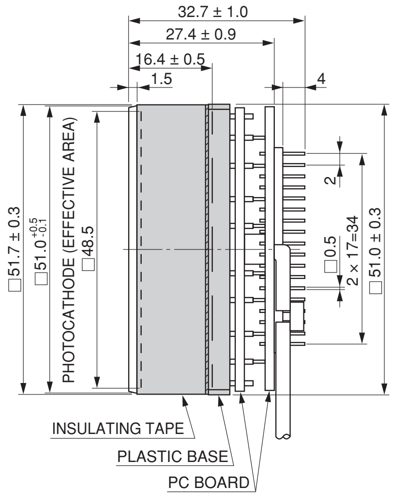
TPMHA0586EA

(Unit: mm)

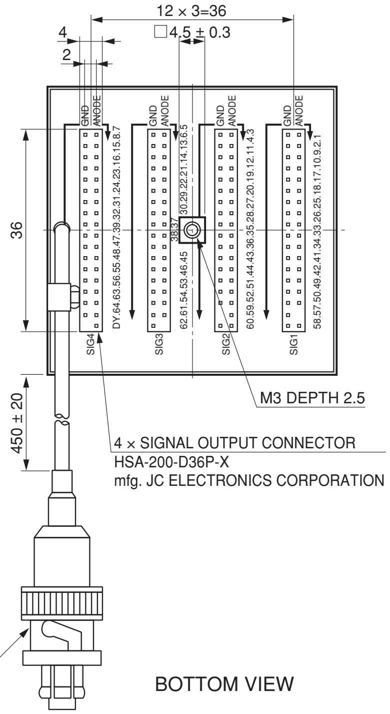
㊼ H12700A, H12700A-10


START MARK
P1 P2 P3 P4 P5 P6 P7 P8
P9 P10 P11 P12 P13 P14 P15 P16
P17 P18 P19 P20 P21 P22 P23 P24
P25 P26 P27 P28 P29 P30 P31 P32
P33 P34 P35 P36 P37 P38 P39 P40
P41 P42 P43 P44 P45 P46 P47 P48
P49 P50 P51 P52 P53 P54 P55 P56
P57 P58 P59 P60 P61 P62 P63 P64
6.25
6 × 6=36
6.25

TOP VIEW

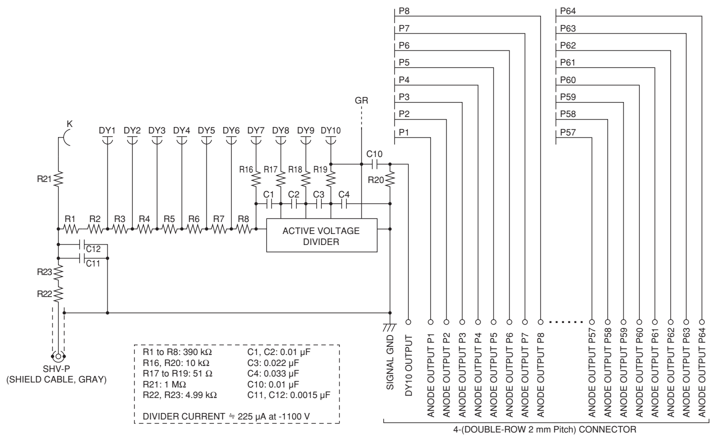

32.7 ± 1.0
27.4 ± 0.9
16.4 ± 0.5
1.5
4
□51.7 ± 0.3
□51.0 +0.5 -0.1
PHOTOCATHODE (EFFECTIVE AREA) □48.5
2
□0.5
2 × 17=34
□51.0 ± 0.3
INSULATING TAPE
PLASTIC BASE
PC BOARD

SIDE VIEW


12 × 3=36
4
2
□4.5 ± 0.3
GND ANODE
GND ANODE
GND ANODE
GND ANODE
DY.64.63.56.55.48.47.39.32.31.24.23.16.15.8.7
38.37
30.29.22.21.14.13.6.5
62.61.54.53.46.45
60.59.52.51.44.43.36.35.28.27.20.19.12.11.4.3
58.57.50.49.42.41.34.33.26.25.18.17.10.9.2.1
SIG4
SIG3
SIG2
SIG1
36
450 ± 20
M3 DEPTH 2.5
4 × SIGNAL OUTPUT CONNECTOR
HSA-200-D36P-X
mfg. JC ELECTRONICS CORPORATION
-HV: SHV-P
(SHIELD CABLE, GRAY)

BOTTOM VIEW

H12700A

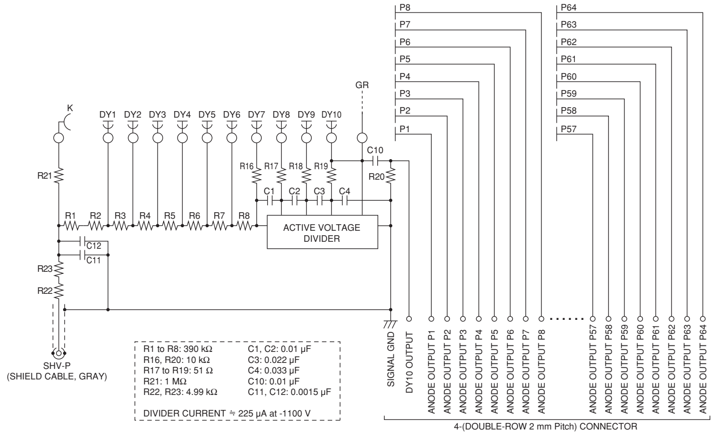

K
DY1 DY2 DY3 DY4 DY5 DY6 DY7 DY8 DY9 DY10
GR
P8 P7 P6 P5 P4 P3 P2 P1
P64 P63 P62 P61 P60 P59 P58 P57
R21
R16 R17 R18 R19
C10
R20
C1 C2 C3 C4
R1 R2 R3 R4 R5 R6 R7 R8
ACTIVE VOLTAGE DIVIDER
C12
C11
R23
R22
SHV-P
(SHIELD CABLE, GRAY)
R1 to R8: 390 kΩ
R16, R20: 10 kΩ
R17 to R19: 51 Ω
R21: 1 MΩ
R22, R23: 4.99 kΩ
C1, C2: 0.01 μF
C3: 0.022 μF
C4: 0.033 μF
C10: 0.01 μF
C11, C12: 0.0015 μF
DIVIDER CURRENT ≒ 225 μA at -1100 V
SIGNAL GND
DY10 OUTPUT
ANODE OUTPUT P1
ANODE OUTPUT P2
ANODE OUTPUT P3
ANODE OUTPUT P4
ANODE OUTPUT P5
ANODE OUTPUT P6
ANODE OUTPUT P7
ANODE OUTPUT P8
ANODE OUTPUT P57
ANODE OUTPUT P58
ANODE OUTPUT P59
ANODE OUTPUT P60
ANODE OUTPUT P61
ANODE OUTPUT P62
ANODE OUTPUT P63
ANODE OUTPUT P64
4-(DOUBLE-ROW 2 mm Pitch) CONNECTOR

CONNECTION FOR SIGNAL CONNECTORS
(BOTTOM VIEW)

GND	P7	GND	P5	GND	P3	GND	P1
GND	P8	GND	P6	GND	P4	GND	P2
GND	P15	GND	P13	GND	P11	GND	P9
GND	P16	GND	P14	GND	P12	GND	P10
GND	P23	GND	P21	GND	P19	GND	P17
GND	P24	GND	P22	GND	P20	GND	P18
GND	P31	GND	P29	GND	P27	GND	P25
GND	P32	GND	P30	GND	P28	GND	P26
GND	P39	GND	P37	GND	P35	GND	P33
GND	P40	GND	P38	GND	P36	GND	P34
GND	P47	GND	P45	GND	P43	GND	P41
GND	P48	GND	P46	GND	P44	GND	P42
GND	P55	GND	P53	GND	P51	GND	P49
GND	P56	GND	P54	GND	P52	GND	P50
GND	P63	GND	P61	GND	P59	GND	P57
GND	P64	GND	P62	GND	P60	GND	P58
GND	DY12	GND	GND	*B	GND	GND	*B
*B	GND	GND	*B	GND	GND	GND	GND
SIG4		SIG3		SIG2		SIG1	

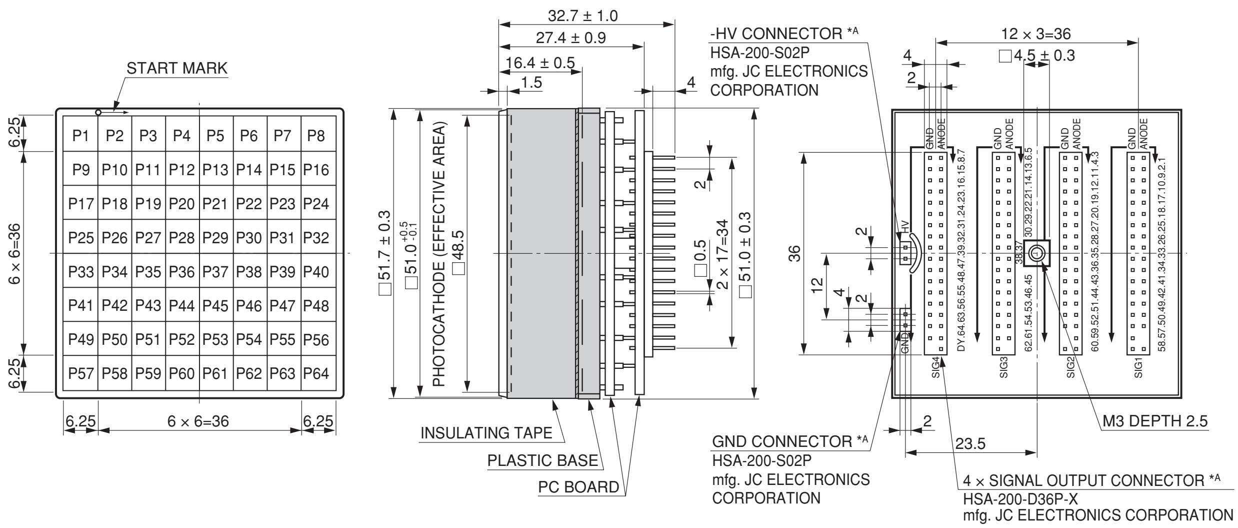
NOTE *B: No pin.

H12700A-10


K
DY1 DY2 DY3 DY4 DY5 DY6 DY7 DY8 DY9 DY10
GR
P8 P7 P6 P5 P4 P3 P2 P1
P64 P63 P62 P61 P60 P59 P58 P57
R21
R16 R17 R18 R19
C10
R20
C1 C2 C3 C4
R1 R2 R3 R4 R5 R6 R7 R8
ACTIVE VOLTAGE DIVIDER
C12
C11
R23
R22
SHV-P
(SHIELD CABLE, GRAY)
R1 to R8: 390 kΩ
R16, R20: 10 kΩ
R17 to R19: 51 Ω
R21: 1 MΩ
R22, R23: 4.99 kΩ
C1, C2: 0.01 μF
C3: 0.022 μF
C4: 0.033 μF
C10: 0.01 μF
C11, C12: 0.0015 μF
DIVIDER CURRENT ≒ 225 μA at -1100 V
SIGNAL GND
DY10 OUTPUT
ANODE OUTPUT P1
ANODE OUTPUT P2
ANODE OUTPUT P3
ANODE OUTPUT P4
ANODE OUTPUT P5
ANODE OUTPUT P6
ANODE OUTPUT P7
ANODE OUTPUT P8
ANODE OUTPUT P57
ANODE OUTPUT P58
ANODE OUTPUT P59
ANODE OUTPUT P60
ANODE OUTPUT P61
ANODE OUTPUT P62
ANODE OUTPUT P63
ANODE OUTPUT P64
4-(DOUBLE-ROW 2 mm Pitch) CONNECTOR

TPMHA0601EB

㊳ H12700B, H12700B-10


START MARK
P1 P2 P3 P4 P5 P6 P7 P8
P9 P10 P11 P12 P13 P14 P15 P16
P17 P18 P19 P20 P21 P22 P23 P24
P25 P26 P27 P28 P29 P30 P31 P32
P33 P34 P35 P36 P37 P38 P39 P40
P41 P42 P43 P44 P45 P46 P47 P48
P49 P50 P51 P52 P53 P54 P55 P56
P57 P58 P59 P60 P61 P62 P63 P64
6.25
6 × 6=36
6.25
6.25
6 × 6=36
6.25
32.7 ± 1.0
27.4 ± 0.9
16.4 ± 0.5
1.5
4
□51.7 ± 0.3
□51.0 +0.5 -0.1
PHOTOCATHODE (EFFECTIVE AREA) □48.5
2
□0.5
2 × 17=34
□51.0 ± 0.3
INSULATING TAPE
PLASTIC BASE
PC BOARD
-HV CONNECTOR *A
HSA-200-S02P
mfg. JC ELECTRONICS
CORPORATION
GND CONNECTOR *A
HSA-200-S02P
mfg. JC ELECTRONICS
CORPORATION
12 × 3=36
□4.5 ± 0.3
4
2
36
12
2
4
2
HV
GND
GND ANODE
DY.64.63.56.55.48.47.39.32.31.24.23.16.15.8.7
SIG4
62.61.54.53.46.45 38.37 30.29.22.21.14.13.6.5
SIG3
60.59.52.51.44.43.36.35.28.27.20.19.12.11.4.3
SIG2
58.57.50.49.42.41.34.33.26.25.18.17.10.9.2.1
SIG1
M3 DEPTH 2.5
2
23.5
4 × SIGNAL OUTPUT CONNECTOR *A
HSA-200-D36P-X
mfg. JC ELECTRONICS CORPORATION

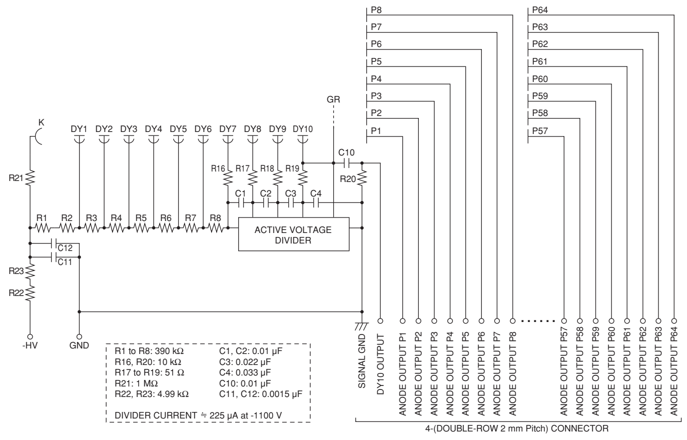
TOP VIEW

SIDE VIEW

BOTTOM VIEW

NOTE *A: Suitable sockets for the connectors will be attached.
For signal output is HSC-200-D36P-X (JC ELECTRONICS CORPORATION).
For -HV, GND is SQT-102-01-L-S (SAMTEC).

H12700B


K
DY1 DY2 DY3 DY4 DY5 DY6 DY7 DY8 DY9 DY10
GR
P8 P7 P6 P5 P4 P3 P2 P1
P64 P63 P62 P61 P60 P59 P58 P57
C10
R16 R17 R18 R19
R20
C1 C2 C3 C4
R21
R1 R2 R3 R4 R5 R6 R7 R8
ACTIVE VOLTAGE DIVIDER
C12
C11
R23
R22
-HV
GND
SIGNAL GND
DY10 OUTPUT
ANODE OUTPUT P1
ANODE OUTPUT P2
ANODE OUTPUT P3
ANODE OUTPUT P4
ANODE OUTPUT P5
ANODE OUTPUT P6
ANODE OUTPUT P7
ANODE OUTPUT P8
ANODE OUTPUT P57
ANODE OUTPUT P58
ANODE OUTPUT P59
ANODE OUTPUT P60
ANODE OUTPUT P61
ANODE OUTPUT P62
ANODE OUTPUT P63
ANODE OUTPUT P64
4-(DOUBLE-ROW 2 mm Pitch) CONNECTOR

R1 to R8: 390 kΩ
R16, R20: 10 kΩ
R17 to R19: 51 Ω
R21: 1 MΩ
R22, R23: 4.99 kΩ
C1, C2: 0.01 μF
C3: 0.022 μF
C4: 0.033 μF
C10: 0.01 μF
C11, C12: 0.0015 μF

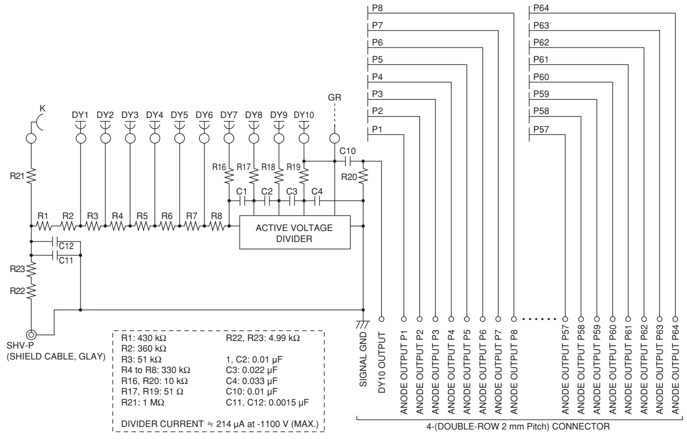
DIVIDER CURRENT ≒ 225 μA at -1100 V

CONNECTION FOR SIGNAL CONNECTORS
(BOTTOM VIEW)

	SIG4		SIG3		SIG2		SIG1	
	GND	P7	GND	P5	GND	P3	GND	P1
	GND	P8	GND	P6	GND	P4	GND	P2
	GND	P15	GND	P13	GND	P11	GND	P9
	GND	P16	GND	P14	GND	P12	GND	P10
	GND	P23	GND	P21	GND	P19	GND	P17
	GND	P24	GND	P22	GND	P20	GND	P18
	GND	P31	GND	P29	GND	P27	GND	P25
	GND	P32	GND	P30	GND	P28	GND	P26
-HV	GND	P39	GND	P37	GND	P35	GND	P33
-HV	GND	P40	GND	P38	GND	P36	GND	P34
	GND	P47	GND	P45	GND	P43	GND	P41
	GND	P48	GND	P46	GND	P44	GND	P42
	GND	P55	GND	P53	GND	P51	GND	P49
	GND	P56	GND	P54	GND	P52	GND	P50
GND	GND	P63	GND	P61	GND	P59	GND	P57
GND	GND	P64	GND	P62	GND	P60	GND	P58
	GND	DY12	GND	GND	*B	GND	GND	*B
	*B	GND	GND	*B	GND	GND	GND	GND

NOTE *B: No pin.

H12700B-10


K
DY1 DY2 DY3 DY4 DY5 DY6 DY7 DY8 DY9 DY10
GR
P8 P7 P6 P5 P4 P3 P2 P1
P64 P63 P62 P61 P60 P59 P58 P57
C10
R16 R17 R18 R19
R20
C1 C2 C3 C4
R21
R1 R2 R3 R4 R5 R6 R7 R8
ACTIVE VOLTAGE DIVIDER
C12
C11
R23
R22
SHV-P
(SHIELD CABLE, GLAY)
SIGNAL GND
DY10 OUTPUT
ANODE OUTPUT P1
ANODE OUTPUT P2
ANODE OUTPUT P3
ANODE OUTPUT P4
ANODE OUTPUT P5
ANODE OUTPUT P6
ANODE OUTPUT P7
ANODE OUTPUT P8
ANODE OUTPUT P57
ANODE OUTPUT P58
ANODE OUTPUT P59
ANODE OUTPUT P60
ANODE OUTPUT P61
ANODE OUTPUT P62
ANODE OUTPUT P63
ANODE OUTPUT P64
4-(DOUBLE-ROW 2 mm Pitch) CONNECTOR

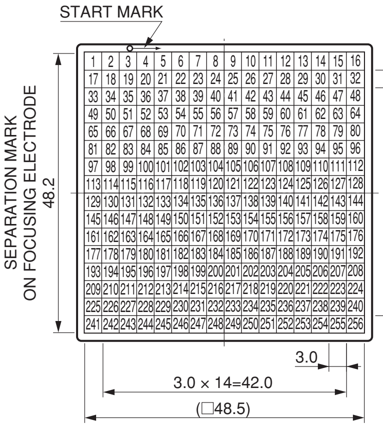
R1: 430 kΩ
R2: 360 kΩ
R3: 51 kΩ
R4 to R8: 330 kΩ
R16, R20: 10 kΩ
R17, R19: 51 Ω
R21: 1 MΩ
R22, R23: 4.99 kΩ
1, C2: 0.01 μF
C3: 0.022 μF
C4: 0.033 μF
C10: 0.01 μF
C11, C12: 0.0015 μF

DIVIDER CURRENT ≒ 214 μA at -1100 V (MAX.)

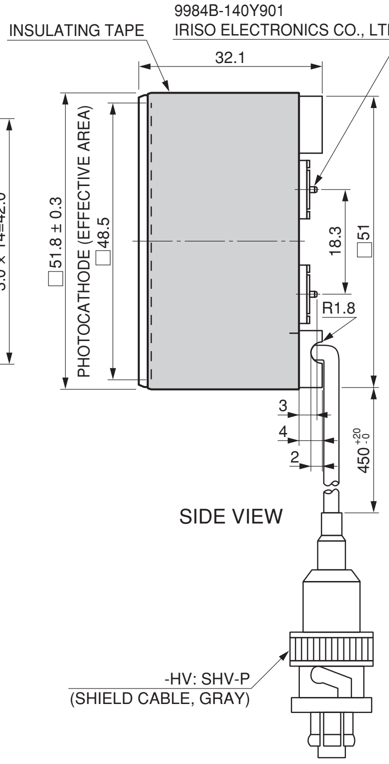
TPMHA0602EB

(Unit: mm)

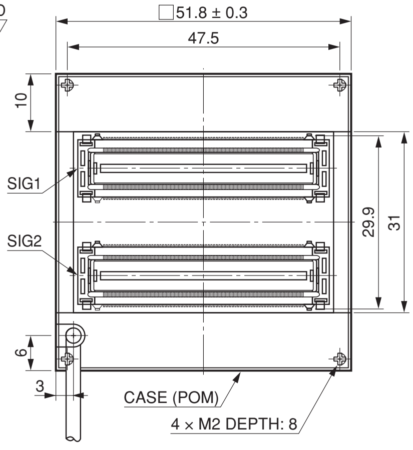
(69) H13700


START MARK
SEPARATION MARK ON FOCUSING ELECTRODE
48.2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64
65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96
97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112
113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128
129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144
145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160
161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176
177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192
193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208
209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224
225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240
241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256
3.0
3.0 × 14=42.0
3.0
3.0 × 14=42.0
(□48.5)

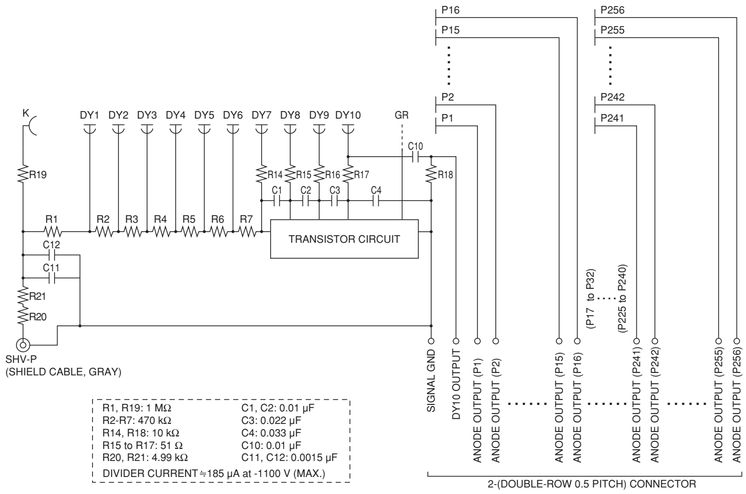
TOP VIEW


INSULATING TAPE
9984B-140Y901
IRISO ELECTRONICS CO., LTD
32.1
□51.8 ± 0.3
PHOTOCATHODE (EFFECTIVE AREA)
□48.5
18.3
□51
R1.8
3
4
2
450 +20 -0
-HV: SHV-P
(SHIELD CABLE, GRAY)

SIDE VIEW


□51.8 ± 0.3
47.5
10
SIG1
SIG2
29.9
31
6
3
CASE (POM)
4 × M2 DEPTH: 8

BOTTOM VIEW


K
DY1 DY2 DY3 DY4 DY5 DY6 DY7 DY8 DY9 DY10
GR
R19
R1
R2
R3
R4
R5
R6
R7
C12
C11
R21
R20
R14
R15
R16
R17
R18
C1
C2
C3
C4
C10
TRANSISTOR CIRCUIT
SHV-P
(SHIELD CABLE, GRAY)
P16
P15
P2
P1
P256
P255
P242
P241
(P17 to P32)
(P225 to P240)
SIGNAL GND
DY10 OUTPUT
ANODE OUTPUT (P1)
ANODE OUTPUT (P2)
ANODE OUTPUT (P15)
ANODE OUTPUT (P16)
ANODE OUTPUT (P241)
ANODE OUTPUT (P242)
ANODE OUTPUT (P255)
ANODE OUTPUT (P256)
2-(DOUBLE-ROW 0.5 PITCH) CONNECTOR

R1, R19: 1 MΩ
R2-R7: 470 kΩ
R14, R18: 10 kΩ
R15 to R17: 51 Ω
R20, R21: 4.99 kΩ
C1, C2: 0.01 μF
C3: 0.022 μF
C4: 0.033 μF
C10: 0.01 μF
C11, C12: 0.0015 μF
DIVIDER CURRENT ≒ 185 μA at -1100 V (MAX.)

CONNECTION FOR SIGNAL CONNECTORS
(BOTTOM VIEW)

SIG1

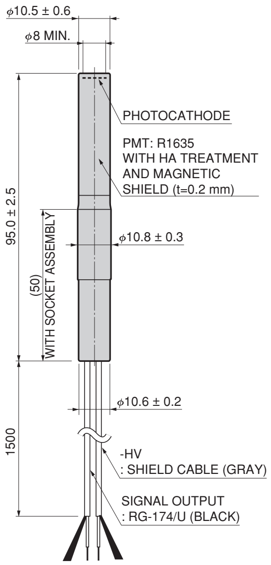
PIN ASSIGNMENT FOR PMT ANODE	PIN ASSIGNMENT FOR CONNECTOR (9984B-140Y901)	PIN ASSIGNMENT FOR CONNECTOR (9984B-140Y901)	PIN ASSIGNMENT FOR PMT ANODE
GND	1	71	GND
GND	2	72	GND
GND	3	73	GND
P49	4	74	P65
P33	5	75	P81
P17	6	76	P97
P1	7	77	P113
P50	8	78	P66
P34	9	79	P82
P18	10	80	P98
P2	11	81	P114
P51	12	82	P67
P35	13	83	P83
P19	14	84	P99
P3	15	85	P115
P52	16	86	P68
P36	17	87	P84
P20	18	88	P100
P4	19	89	P116
P53	20	90	P69
P37	21	91	P85
P21	22	92	P101
P5	23	93	P117
P54	24	94	P70
P38	25	95	P86
P22	26	96	P102
P6	27	97	P118
P55	28	98	P71
P39	29	99	P87
P23	30	100	P103
P7	31	101	P119
P56	32	102	P72
P40	33	103	P88
P24	34	104	P104
P8	35	105	P120
P9	36	106	P121
P25	37	107	P105
P41	38	108	P89
P57	39	109	P73
P10	40	110	P122
P26	41	111	P106
P42	42	112	P90
P58	43	113	P74
P11	44	114	P123
P27	45	115	P107
P43	46	116	P91
P59	47	117	P75
P12	48	118	P124
P28	49	119	P108
P44	50	120	P92
P60	51	121	P76
P13	52	122	P125
P29	53	123	P109
P45	54	124	P93
P61	55	125	P77
P14	56	126	P126
P30	57	127	P110
P46	58	128	P94
P62	59	129	P78
P15	60	130	P127
P31	61	131	P111
P47	62	132	P95
P63	63	133	P79
P16	64	134	P128
P32	65	135	P112
P48	66	136	P96
P64	67	137	P80
GND	68	138	GND
GND	69	139	GND
DY10	70	140	GND

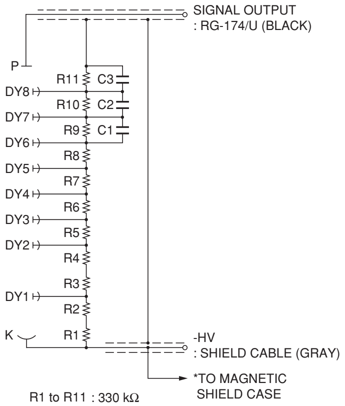
SIG2

PIN ASSIGNMENT FOR PMT ANODE	PIN ASSIGNMENT FOR CONNECTOR (9984B-140Y901)	PIN ASSIGNMENT FOR CONNECTOR (9984B-140Y901)	PIN ASSIGNMENT FOR PMT ANODE
GND	1	71	GND
GND	2	72	GND
GND	3	73	GND
P177	4	74	P193
P161	5	75	P209
P145	6	76	P225
P129	7	77	P241
P178	8	78	P194
P162	9	79	P210
P146	10	80	P226
P130	11	81	P242
P179	12	82	P195
P163	13	83	P211
P147	14	84	P227
P131	15	85	P243
P180	16	86	P196
P164	17	87	P212
P148	18	88	P228
P132	19	89	P244
P181	20	90	P197
P165	21	91	P213
P149	22	92	P229
P133	23	93	P245
P182	24	94	P198
P166	25	95	P214
P150	26	96	P230
P134	27	97	P246
P183	28	98	P199
P167	29	99	P215
P151	30	100	P231
P135	31	101	P247
P184	32	102	P200
P168	33	103	P216
P152	34	104	P232
P136	35	105	P248
P137	36	106	P249
P153	37	107	P233
P169	38	108	P217
P185	39	109	P201
P138	40	110	P250
P154	41	111	P234
P170	42	112	P218
P186	43	113	P202
P139	44	114	P251
P155	45	115	P235
P171	46	116	P219
P187	47	117	P203
P140	48	118	P252
P156	49	119	P236
P172	50	120	P220
P188	51	121	P204
P141	52	122	P253
P157	53	123	P237
P173	54	124	P221
P189	55	125	P205
P142	56	126	P254
P158	57	127	P238
P174	58	128	P222
P190	59	129	P206
P143	60	130	P255
P159	61	131	P239
P175	62	132	P223
P191	63	133	P207
P144	64	134	P256
P160	65	135	P240
P176	66	136	P224
P192	67	137	P208
GND	68	138	GND
GND	69	139	GND
GND	70	140	GND

TPMHA0618EB

⑦⓪ H3164-10


φ10.5 ± 0.6
φ8 MIN.
PHOTOCATHODE
PMT: R1635
WITH HA TREATMENT
AND MAGNETIC
SHIELD (t=0.2 mm)
95.0 ± 2.5
(50)
WITH SOCKET ASSEMBLY
φ10.8 ± 0.3
φ10.6 ± 0.2
1500
-HV
: SHIELD CABLE (GRAY)
SIGNAL OUTPUT
: RG-174/U (BLACK)

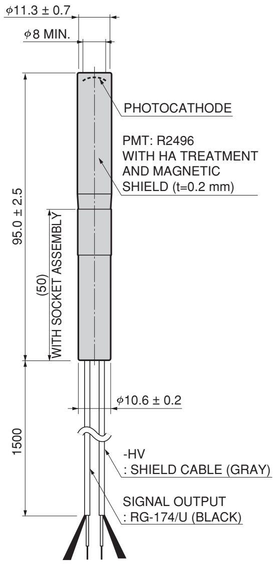

SIGNAL OUTPUT
: RG-174/U (BLACK)
P
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
-HV
: SHIELD CABLE (GRAY)
*TO MAGNETIC
SHIELD CASE

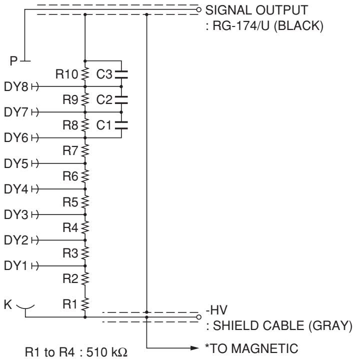
R1 to R11 : 330 kΩ
C1 to C3 : 0.01 µF

* MAGNETIC SHIELD IS CONNECTED TO -HV INSIDE OF THIS PRODUCT.
** HIGH VOLTAGE SHIELDED CABLE CAN BE CONNECTED TO A CONNECTOR FOR RG-174/U.

TPMHA0309EE

⑦① H3695-10


φ11.3 ± 0.7
φ8 MIN.
PHOTOCATHODE
PMT: R2496
WITH HA TREATMENT
AND MAGNETIC
SHIELD (t=0.2 mm)
95.0 ± 2.5
(50)
WITH SOCKET ASSEMBLY
φ10.6 ± 0.2
1500
-HV
: SHIELD CABLE (GRAY)
SIGNAL OUTPUT
: RG-174/U (BLACK)

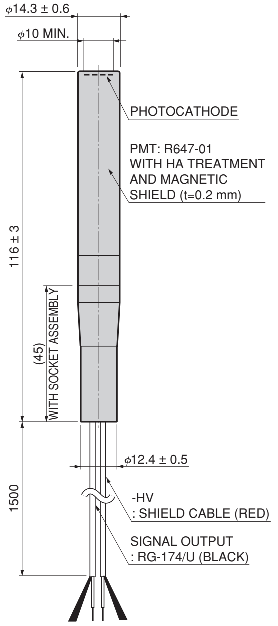

SIGNAL OUTPUT
: RG-174/U (BLACK)
P
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
-HV
: SHIELD CABLE (GRAY)
*TO MAGNETIC
SHIELD CASE

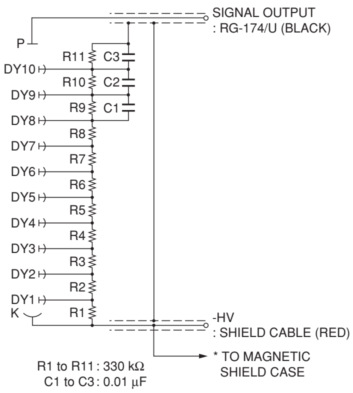
R1 to R4 : 510 kΩ
R5 to R10 : 330 kΩ
C1 to C3 : 0.01 µF

* MAGNETIC SHIELD IS CONNECTED TO -HV INSIDE OF THIS PRODUCT.
** HIGH VOLTAGE SHIELDED CABLE CAN BE CONNECTED TO A CONNECTOR FOR RG-174/U.

TPMHA0310EE

⑦② H3165-10


φ14.3 ± 0.6
φ10 MIN.
PHOTOCATHODE
PMT: R647-01
WITH HA TREATMENT
AND MAGNETIC
SHIELD (t=0.2 mm)
116 ± 3
(45)
WITH SOCKET ASSEMBLY
φ12.4 ± 0.5
1500
-HV
: SHIELD CABLE (RED)
SIGNAL OUTPUT
: RG-174/U (BLACK)

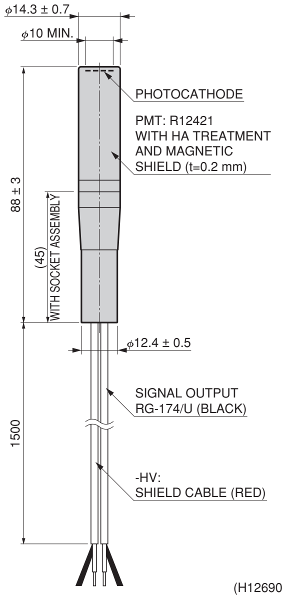

SIGNAL OUTPUT
: RG-174/U (BLACK)
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
-HV
: SHIELD CABLE (RED)
* TO MAGNETIC
SHIELD CASE

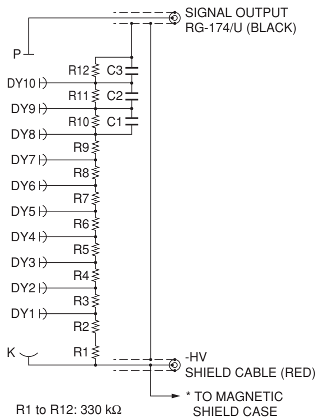
R1 to R11 : 330 kΩ
C1 to C3 : 0.01 µF

* MAGNETIC SHIELD IS CONNECTED TO -HV INSIDE OF THIS PRODUCT.
** HIGH VOLTAGE SHIELDED CABLE CAN BE CONNECTED TO A CONNECTOR FOR RG-174/U.

TPMHA0311EE

⑦③ H12690, H12690-300


φ14.3 ± 0.7
φ10 MIN.
PHOTOCATHODE
PMT: R12421
WITH HA TREATMENT
AND MAGNETIC
SHIELD (t=0.2 mm)
88 ± 3
(45)
WITH SOCKET ASSEMBLY
φ12.4 ± 0.5
SIGNAL OUTPUT
RG-174/U (BLACK)
1500
-HV:
SHIELD CABLE (RED)


SIGNAL OUTPUT
RG-174/U (BLACK)
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
-HV
SHIELD CABLE (RED)
* TO MAGNETIC
SHIELD CASE

R1 to R12: 330 kΩ
C1 to C3: 0.01 µF

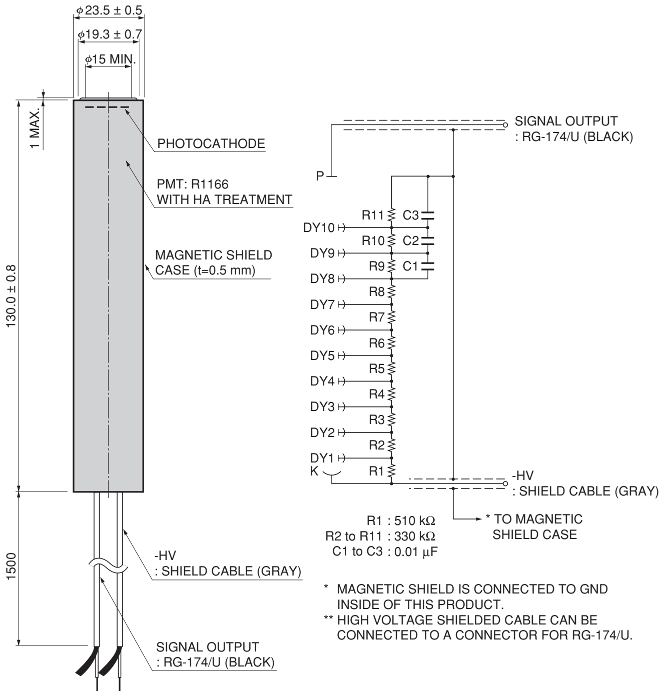
* MAGNETIC SHIELD IS CONNECTED TO -HV INSIDE OF THIS PRODUCT.
** HIGH VOLTAGE SHIELDED CABLE CAN BE CONNECTED TO A CONNECTOR FOR RG-174/U.

(H12690-300: PMT: R12421-300)

TPMHA0596EA

(Unit: mm)

74 H6520



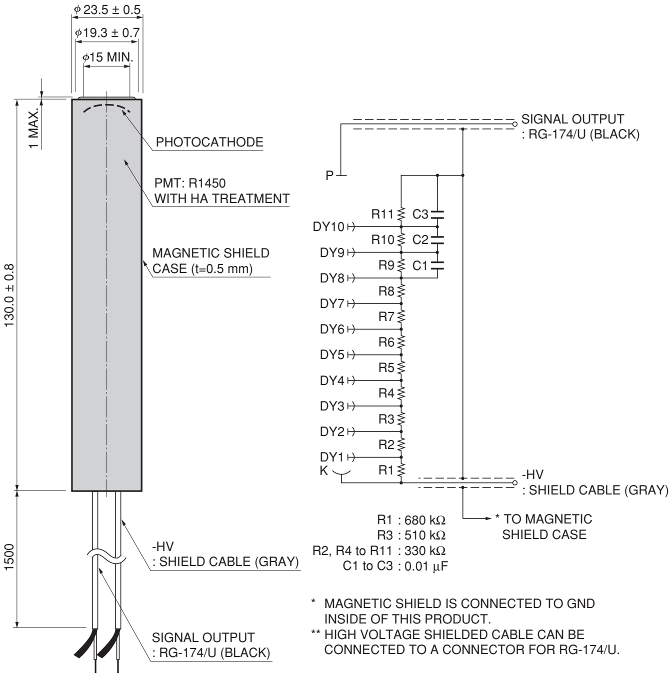
φ23.5 ± 0.5
φ19.3 ± 0.7
φ15 MIN.
1 MAX.
130.0 ± 0.8
1500
PHOTOCATHODE
PMT: R1166
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.5 mm)
-HV
: SHIELD CABLE (GRAY)
SIGNAL OUTPUT
: RG-174/U (BLACK)
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
SIGNAL OUTPUT
: RG-174/U (BLACK)
-HV
: SHIELD CABLE (GRAY)
* TO MAGNETIC
SHIELD CASE

R1 : 510 kΩ
R2 to R11 : 330 kΩ
C1 to C3 : 0.01 μF

* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.
** HIGH VOLTAGE SHIELDED CABLE CAN BE CONNECTED TO A CONNECTOR FOR RG-174/U.

TPMHA0312ED

75 H6524



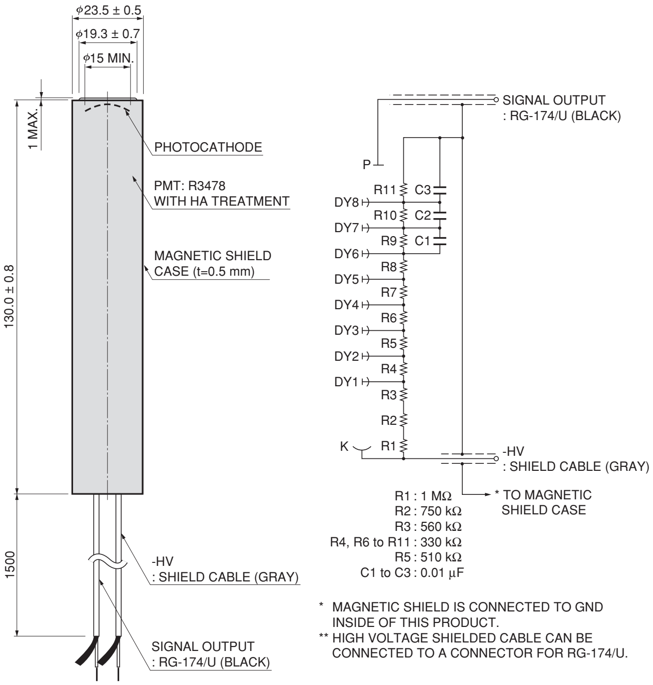
φ23.5 ± 0.5
φ19.3 ± 0.7
φ15 MIN.
1 MAX.
130.0 ± 0.8
1500
PHOTOCATHODE
PMT: R1450
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.5 mm)
-HV
: SHIELD CABLE (GRAY)
SIGNAL OUTPUT
: RG-174/U (BLACK)
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
SIGNAL OUTPUT
: RG-174/U (BLACK)
-HV
: SHIELD CABLE (GRAY)
* TO MAGNETIC
SHIELD CASE

R1 : 680 kΩ
R3 : 510 kΩ
R2, R4 to R11 : 330 kΩ
C1 to C3 : 0.01 μF

* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.
** HIGH VOLTAGE SHIELDED CABLE CAN BE CONNECTED TO A CONNECTOR FOR RG-174/U.

TPMHA0313EC

76 H6612



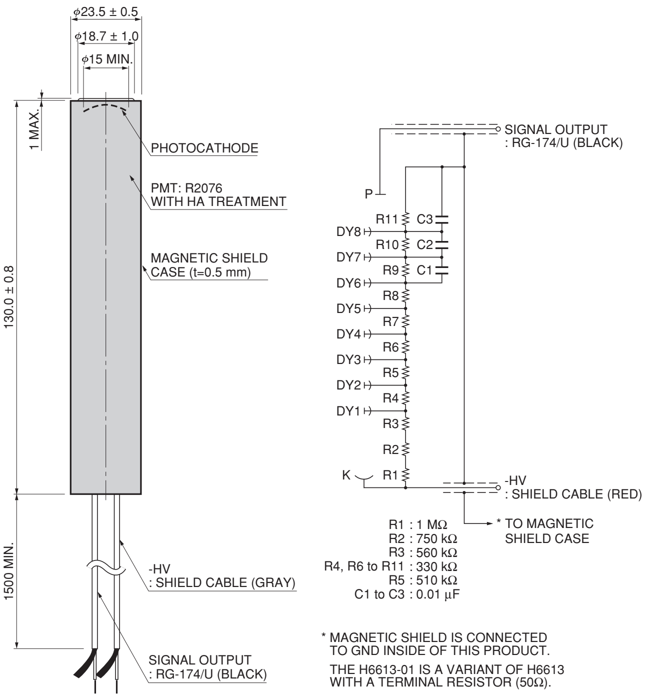
φ23.5 ± 0.5
φ19.3 ± 0.7
φ15 MIN.
1 MAX.
130.0 ± 0.8
1500
PHOTOCATHODE
PMT: R3478
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.5 mm)
-HV
: SHIELD CABLE (GRAY)
SIGNAL OUTPUT
: RG-174/U (BLACK)
P
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
SIGNAL OUTPUT
: RG-174/U (BLACK)
-HV
: SHIELD CABLE (GRAY)
* TO MAGNETIC
SHIELD CASE

R1 : 1 MΩ
R2 : 750 kΩ
R3 : 560 kΩ
R4, R6 to R11 : 330 kΩ
R5 : 510 kΩ
C1 to C3 : 0.01 μF

* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.
** HIGH VOLTAGE SHIELDED CABLE CAN BE CONNECTED TO A CONNECTOR FOR RG-174/U.

TPMHA0315EC

77 H6613



φ23.5 ± 0.5
φ18.7 ± 1.0
φ15 MIN.
1 MAX.
130.0 ± 0.8
1500 MIN.
PHOTOCATHODE
PMT: R2076
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.5 mm)
-HV
: SHIELD CABLE (GRAY)
SIGNAL OUTPUT
: RG-174/U (BLACK)
P
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
SIGNAL OUTPUT
: RG-174/U (BLACK)
-HV
: SHIELD CABLE (RED)
* TO MAGNETIC
SHIELD CASE

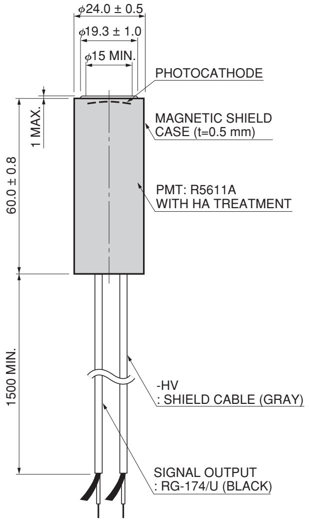
R1 : 1 MΩ
R2 : 750 kΩ
R3 : 560 kΩ
R4, R6 to R11 : 330 kΩ
R5 : 510 kΩ
C1 to C3 : 0.01 μF

* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

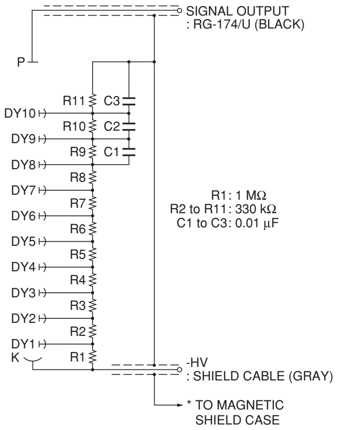
THE H6613-01 IS A VARIANT OF H6613 WITH A TERMINAL RESISTOR (50Ω).

TPMHA0314EC

⑱ H8135



φ24.0 ± 0.5
φ19.3 ± 1.0
φ15 MIN.
PHOTOCATHODE
1 MAX.
MAGNETIC SHIELD CASE (t=0.5 mm)
60.0 ± 0.8
PMT: R5611A WITH HA TREATMENT
1500 MIN.
-HV : SHIELD CABLE (GRAY)
SIGNAL OUTPUT : RG-174/U (BLACK)



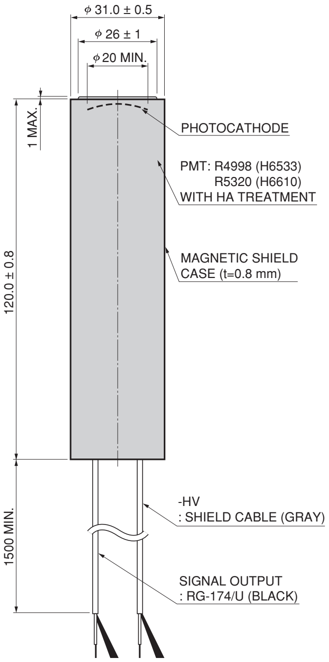
SIGNAL OUTPUT : RG-174/U (BLACK)
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
-HV : SHIELD CABLE (GRAY)
* TO MAGNETIC SHIELD CASE

R1: 1 MΩ
R2 to R11: 330 kΩ
C1 to C3: 0.01 μF

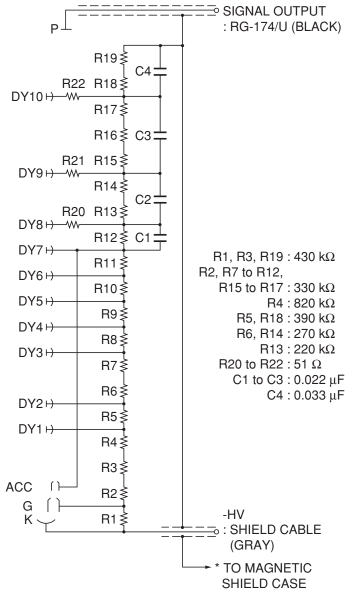
* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

TPMHA0513EC

⑲ H6533



φ 31.0 ± 0.5
φ 26 ± 1
φ 20 MIN.
1 MAX.
PHOTOCATHODE
PMT: R4998 (H6533) R5320 (H6610) WITH HA TREATMENT
120.0 ± 0.8
MAGNETIC SHIELD CASE (t=0.8 mm)
1500 MIN.
-HV : SHIELD CABLE (GRAY)
SIGNAL OUTPUT : RG-174/U (BLACK)



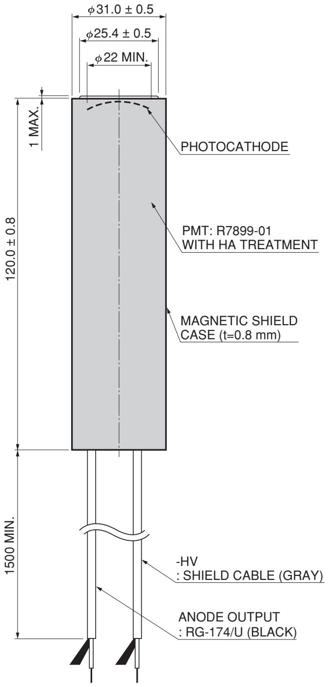
SIGNAL OUTPUT : RG-174/U (BLACK)
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
ACC
G
K
R22
R21
R20
R19
R18
R17
R16
R15
R14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C4
C3
C2
C1
-HV : SHIELD CABLE (GRAY)
* TO MAGNETIC SHIELD CASE

R1, R3, R19 : 430 kΩ
R2, R7 to R12,
R15 to R17 : 330 kΩ
R4 : 820 kΩ
R5, R18 : 390 kΩ
R6, R14 : 270 kΩ
R13 : 220 kΩ
R20 to R22 : 51 Ω
C1 to C3 : 0.022 μF
C4 : 0.033 μF

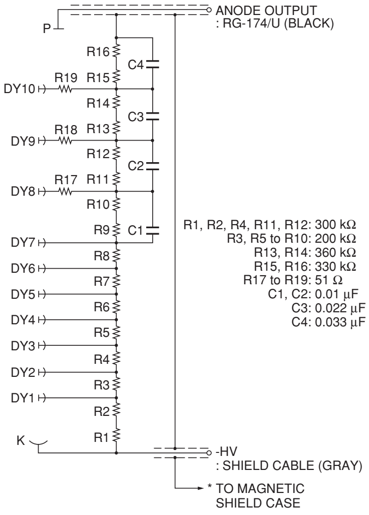
* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.
** HIGH VOLTAGE SHIELDED CABLE CAN BE CONNECTED TO A CONNECTOR FOR RG-174/U.

TPMHA0317ED

⑳ H8643



φ31.0 ± 0.5
φ25.4 ± 0.5
φ22 MIN.
1 MAX.
PHOTOCATHODE
120.0 ± 0.8
PMT: R7899-01 WITH HA TREATMENT
MAGNETIC SHIELD CASE (t=0.8 mm)
1500 MIN.
-HV : SHIELD CABLE (GRAY)
ANODE OUTPUT : RG-174/U (BLACK)



ANODE OUTPUT : RG-174/U (BLACK)
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R19
R18
R17
R16
R15
R14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C4
C3
C2
C1
-HV : SHIELD CABLE (GRAY)
* TO MAGNETIC SHIELD CASE

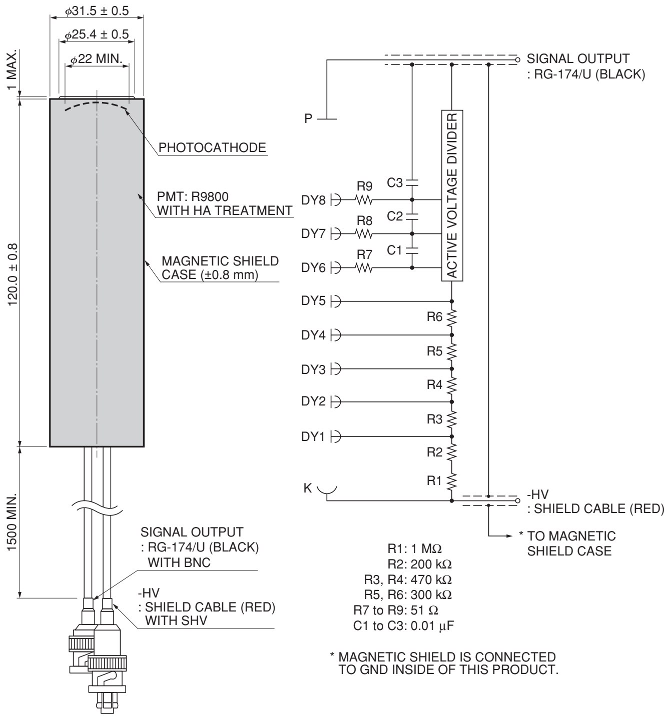
R1, R2, R4, R11, R12: 300 kΩ
R3, R5 to R10: 200 kΩ
R13, R14: 360 kΩ
R15, R16: 330 kΩ
R17 to R19: 51 Ω
C1, C2: 0.01 μF
C3: 0.022 μF
C4: 0.033 μF

* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

TPMHA0514EB

(Unit: mm)

(81) H10580



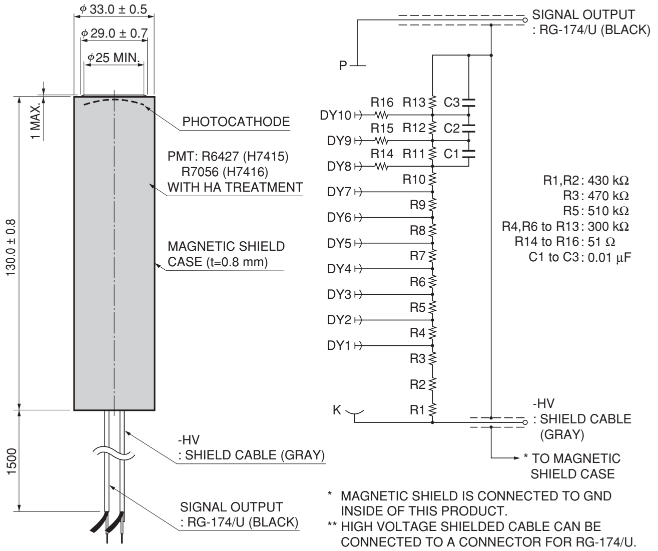
φ31.5 ± 0.5
φ25.4 ± 0.5
φ22 MIN.
1 MAX.
120.0 ± 0.8
1500 MIN.
PHOTOCATHODE
PMT: R9800
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (±0.8 mm)
SIGNAL OUTPUT
: RG-174/U (BLACK)
WITH BNC
-HV
: SHIELD CABLE (RED)
WITH SHV
SIGNAL OUTPUT
: RG-174/U (BLACK)
P
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R9
R8
R7
C3
C2
C1
ACTIVE VOLTAGE DIVIDER
R6
R5
R4
R3
R2
R1
-HV
: SHIELD CABLE (RED)
* TO MAGNETIC
SHIELD CASE

R1: 1 MΩ
R2: 200 kΩ
R3, R4: 470 kΩ
R5, R6: 300 kΩ
R7 to R9: 51 Ω
C1 to C3: 0.01 µF

* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

TPMHA0554EA

(82) H7415



φ 33.0 ± 0.5
φ 29.0 ± 0.7
φ25 MIN.
1 MAX.
130.0 ± 0.8
1500
PHOTOCATHODE
PMT: R6427 (H7415)
R7056 (H7416)
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.8 mm)
-HV
: SHIELD CABLE (GRAY)
SIGNAL OUTPUT
: RG-174/U (BLACK)
SIGNAL OUTPUT
: RG-174/U (BLACK)
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R16
R15
R14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
-HV
: SHIELD CABLE
(GRAY)
* TO MAGNETIC
SHIELD CASE

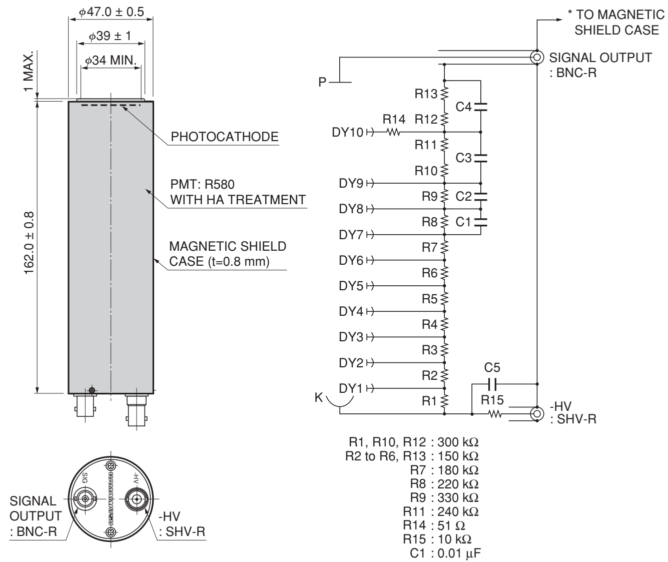
R1,R2: 430 kΩ
R3: 470 kΩ
R5: 510 kΩ
R4,R6 to R13: 300 kΩ
R14 to R16: 51 Ω
C1 to C3: 0.01 µF

* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

** HIGH VOLTAGE SHIELDED CABLE CAN BE CONNECTED TO A CONNECTOR FOR RG-174/U.

TPMHA0318ED

(83) H3178-51



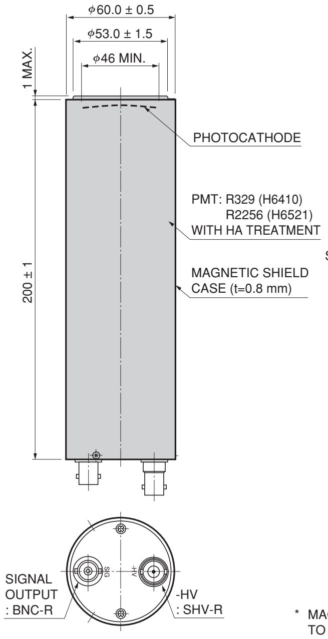
φ47.0 ± 0.5
φ39 ± 1
φ34 MIN.
1 MAX.
162.0 ± 0.8
PHOTOCATHODE
PMT: R580
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.8 mm)
SIGNAL
OUTPUT
: BNC-R
-HV
: SHV-R
SIG
HV
* TO MAGNETIC
SHIELD CASE
SIGNAL OUTPUT
: BNC-R
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C4
C3
C2
C1
C5
R15
-HV
: SHV-R

R1, R10, R12 : 300 kΩ
R2 to R6, R13 : 150 kΩ
R7 : 180 kΩ
R8 : 220 kΩ
R9 : 330 kΩ
R11 : 240 kΩ
R14 : 51 Ω
R15 : 10 kΩ
C1 : 0.01 µF
C2 : 0.022 µF
C3 : 0.047 µF
C4 : 0.1 µF
C5 : 4700 pF

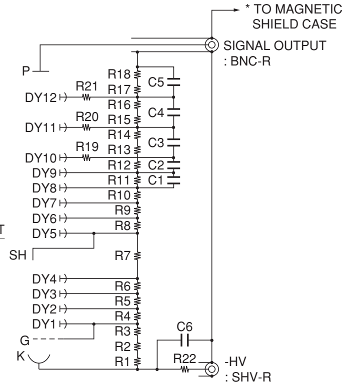
* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

TPMHA0320EC

㉞ H6410



φ60.0 ± 0.5
φ53.0 ± 1.5
φ46 MIN.
1 MAX.
PHOTOCATHODE
PMT: R329 (H6410)
R2256 (H6521)
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.8 mm)
200 ± 1
SIGNAL
OUTPUT
: BNC-R
-HV
: SHV-R



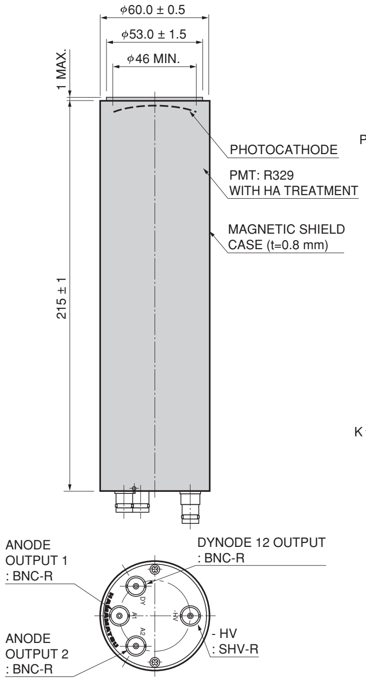
* TO MAGNETIC
SHIELD CASE
SIGNAL OUTPUT
: BNC-R
P
DY12
DY11
DY10
DY9
DY8
DY7
DY6
DY5
SH
DY4
DY3
DY2
DY1
G
K
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
C1
C2
C3
C4
C5
C6
-HV
: SHV-R

R1, R5 : 240 kΩ
R2, R10, R16 : 220 kΩ
R3, R9 : 180 kΩ
R4, R6 to R8, R14, R18 : 150 kΩ
R11, R13, R17 : 300 kΩ
R12, R15 : 360 kΩ
R19 : 51 Ω
R20, R21 : 100 Ω
R22 : 10 kΩ
C1 : 0.022 μF
C2 : 0.047 μF
C3 : 0.1 μF
C4 : 0.22 μF
C5 : 0.47 μF
C6 : 470 pF

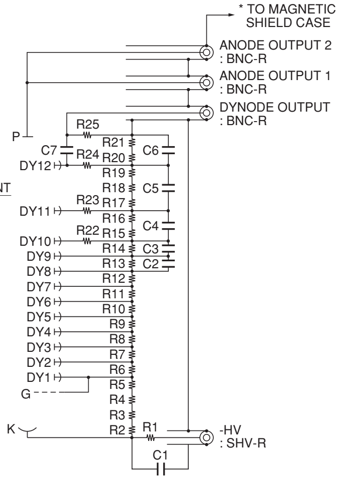
* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

TPMHA0324ED

㉟ H7195



φ60.0 ± 0.5
φ53.0 ± 1.5
φ46 MIN.
1 MAX.
PHOTOCATHODE
PMT: R329
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.8 mm)
215 ± 1
ANODE
OUTPUT 1
: BNC-R
DYNODE 12 OUTPUT
: BNC-R
ANODE
OUTPUT 2
: BNC-R
- HV
: SHV-R



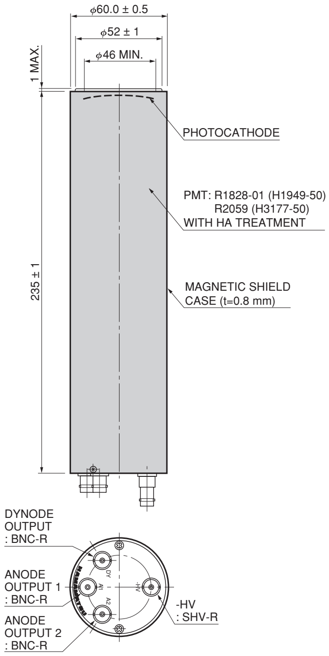
* TO MAGNETIC
SHIELD CASE
ANODE OUTPUT 2
: BNC-R
ANODE OUTPUT 1
: BNC-R
DYNODE OUTPUT
: BNC-R
P
DY12
DY11
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
G
K
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
C1
C2
C3
C4
C5
C6
C7
-HV
: SHV-R

R1, R25 : 10 kΩ
R2 to R4, R17 to R19 : 110 kΩ
R5, R6, R8 to R13, R15
R16, R20, R21 : 100 kΩ
R7, R14 : 160 kΩ
R22 : 51 Ω
R23, R24 : 100 Ω
C1 : 470 pF
C2 : 0.022 μF
C3 : 0.047 μF
C4 : 0.1 μF
C5 : 0.22 μF
C6 : 0.47 μF
C7 : 0.01 μF

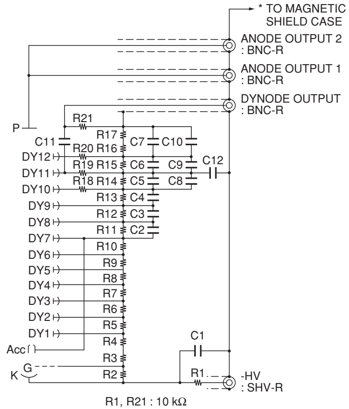
* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

TPMHA0323ED

㊱ H1949-50



φ60.0 ± 0.5
φ52 ± 1
φ46 MIN.
1 MAX.
PHOTOCATHODE
PMT: R1828-01 (H1949-50)
R2059 (H3177-50)
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.8 mm)
235 ± 1
DYNODE
OUTPUT
: BNC-R
ANODE
OUTPUT 1
: BNC-R
ANODE
OUTPUT 2
: BNC-R
-HV
: SHV-R



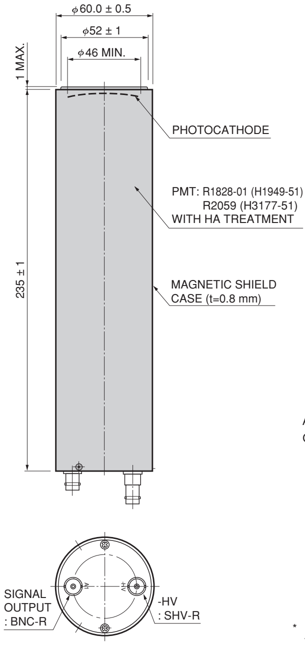
* TO MAGNETIC
SHIELD CASE
ANODE OUTPUT 2
: BNC-R
ANODE OUTPUT 1
: BNC-R
DYNODE OUTPUT
: BNC-R
P
DY12
DY11
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
Acc
G
K
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
-HV
: SHV-R

R1, R21 : 10 kΩ
R2, R5 : 120 kΩ
R3, R7 to R12, R16 : 100 kΩ
R4, R6 : 180 kΩ
R13, R14, R17 : 150 kΩ
R15 : 300 kΩ
R18 to R20 : 51 Ω
C1 : 470 pF
C2 to C4, C10 to C12 : 0.01 μF
C5, C6 : 0.022 μF
C7 : 0.033 μF
C8, C9 : 4700 pF

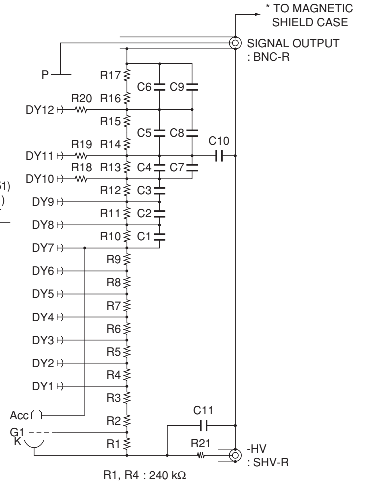
* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

TPMHA0325ED

㊲ H1949-51



φ60.0 ± 0.5
φ52 ± 1
φ46 MIN.
1 MAX.
PHOTOCATHODE
PMT: R1828-01 (H1949-51)
R2059 (H3177-51)
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.8 mm)
235 ± 1
SIGNAL
OUTPUT
: BNC-R
-HV
: SHV-R



* TO MAGNETIC
SHIELD CASE
SIGNAL OUTPUT
: BNC-R
P
DY12
DY11
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
Acc
G1
K
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
-HV
: SHV-R

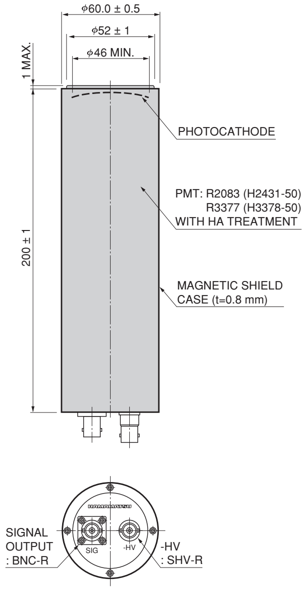
R1, R4 : 240 kΩ
R2, R5 : 360 kΩ
R3, R6 to R11, R17 : 200 kΩ
R12 to R16 : 300 kΩ
R18 to R20 : 51 Ω
R21 : 10 kΩ
C1 to C7 : 0.01 μF
C8 : 0.022 μF
C9 : 0.033 μF
C10 : 0.01 μF
C11 : 470 pF

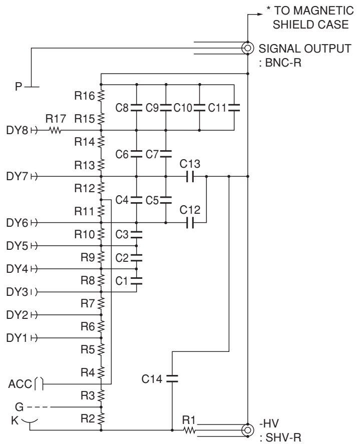
* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

TPMHA0326ED

(Unit: mm)

(88) H2431-50


φ60.0 ± 0.5
φ52 ± 1
φ46 MIN.
1 MAX.
200 ± 1
PHOTOCATHODE
PMT: R2083 (H2431-50)
R3377 (H3378-50)
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.8 mm)
SIGNAL
OUTPUT
: BNC-R
SIG
-HV
-HV
: SHV-R

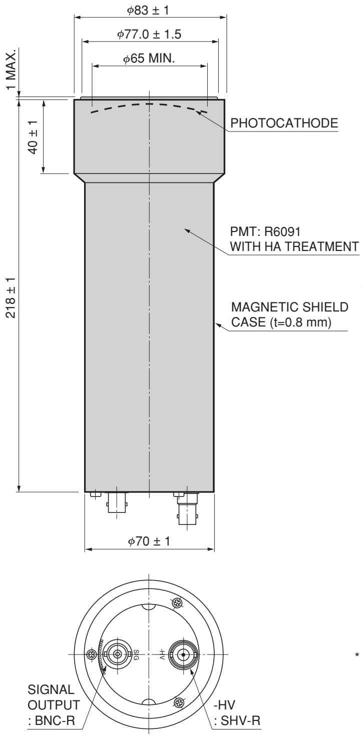

* TO MAGNETIC
SHIELD CASE
SIGNAL OUTPUT
: BNC-R
P
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
ACC
G
K
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
-HV
: SHV-R

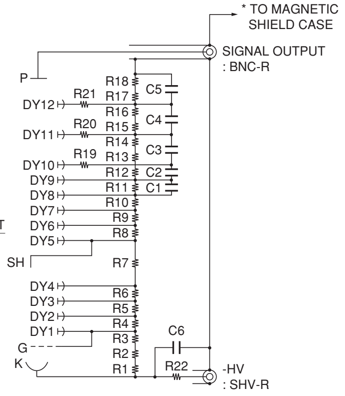
R1 : 33 kΩ
R2, R15 : 390 kΩ
R3, R4, R13 : 470 kΩ
R5 : 499 kΩ
R6, R16 : 360 kΩ
R7 : 536 kΩ
R8 to R11 : 300 kΩ
R12 : 150 kΩ
R14 : 430 kΩ
R17 : 51 Ω
C1, C2 : 4700 pF
C3 to C11 : 0.01 μF
C12, C13 : 1000 pF
C14 : 2200 pF

* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

TPMHA0327EC

(89) H6559


φ83 ± 1
φ77.0 ± 1.5
φ65 MIN.
1 MAX.
40 ± 1
218 ± 1
PHOTOCATHODE
PMT: R6091
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.8 mm)
φ70 ± 1
SIG
-HV
SIGNAL
OUTPUT
: BNC-R
-HV
: SHV-R

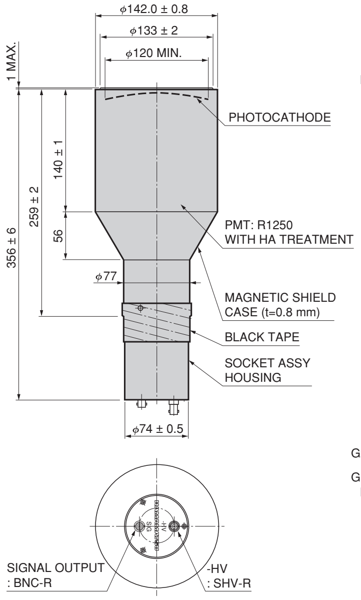

* TO MAGNETIC
SHIELD CASE
SIGNAL OUTPUT
: BNC-R
P
DY12
DY11
DY10
DY9
DY8
DY7
DY6
DY5
SH
DY4
DY3
DY2
DY1
G
K
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
C1
C2
C3
C4
C5
C6
-HV
: SHV-R

R1, R5 : 240 kΩ
R2, R10, R16 : 220 kΩ
R3, R9 : 180 kΩ
R4, R6 to R8, R14, R18 : 150 kΩ
R11, R13, R17 : 300 kΩ
R12, R15 : 360 kΩ
R19 : 51 Ω
R20, R21 : 100 Ω
R22 : 10 kΩ
C1 : 0.022 μF
C2 : 0.047 μF
C3 : 0.1 μF
C4 : 0.22 μF
C5 : 0.47 μF
C6 : 470 pF

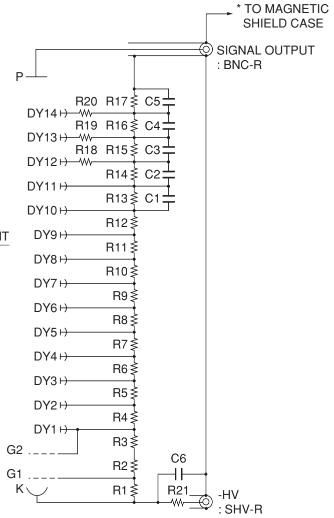
* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

TPMHA0331EC

(90) H6527


φ142.0 ± 0.8
φ133 ± 2
φ120 MIN.
1 MAX.
140 ± 1
259 ± 2
356 ± 6
56
φ77
PHOTOCATHODE
PMT: R1250
WITH HA TREATMENT
MAGNETIC SHIELD
CASE (t=0.8 mm)
BLACK TAPE
SOCKET ASSY
HOUSING
φ74 ± 0.5
SIG
-HV
SIGNAL OUTPUT
: BNC-R
-HV
: SHV-R

H6527=Flat window, Borosilicate


* TO MAGNETIC
SHIELD CASE
SIGNAL OUTPUT
: BNC-R
P
DY14
DY13
DY12
DY11
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
G2
G1
K
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
C1
C2
C3
C4
C5
C6
-HV
: SHV-R

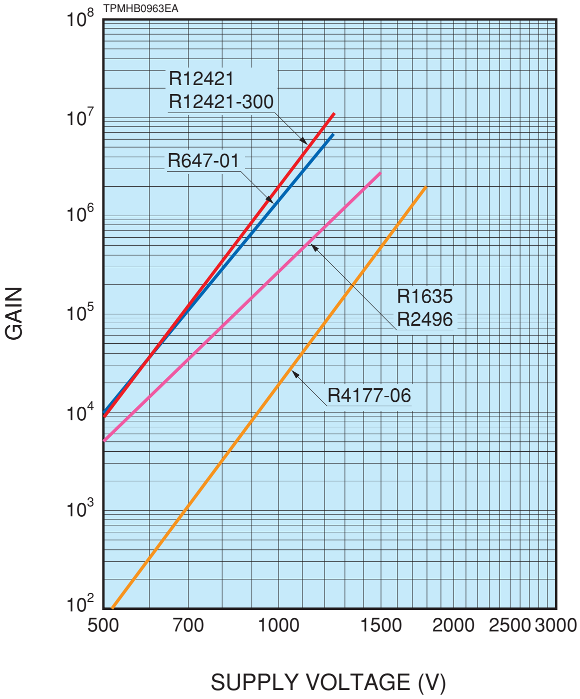
R1, R17 : 240 kΩ
R2 : 360 kΩ
R3 : 390 kΩ
R4 : 120 kΩ
R5 : 180 kΩ
R6 to R13 : 100 kΩ
R14, R15 : 150 kΩ
R16 : 300 kΩ
R18 : 51 Ω
R19, R20 : 100 Ω
R21 : 10 kΩ
C1 : 0.022 μF
C2 : 0.047 μF
C3 : 0.1 μF
C4 : 0.22 μF
C5 : 0.47 μF
C6 : 470 pF

* MAGNETIC SHIELD IS CONNECTED TO GND INSIDE OF THIS PRODUCT.

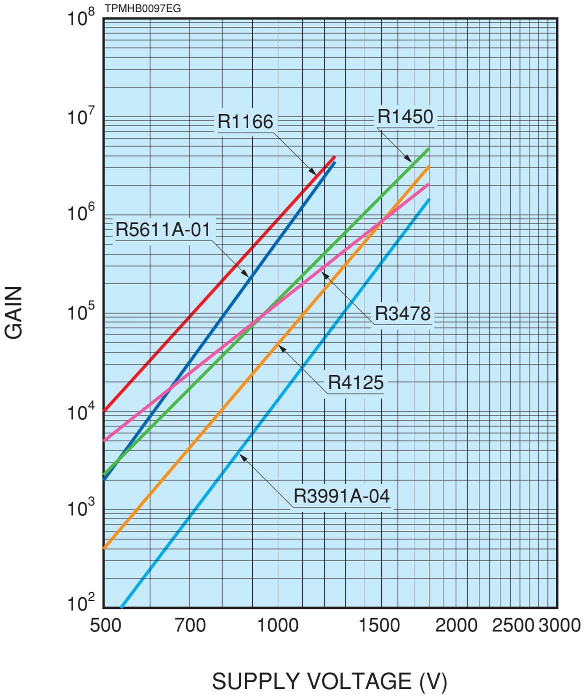
TPMHA0332EF

Typical gain characteristics

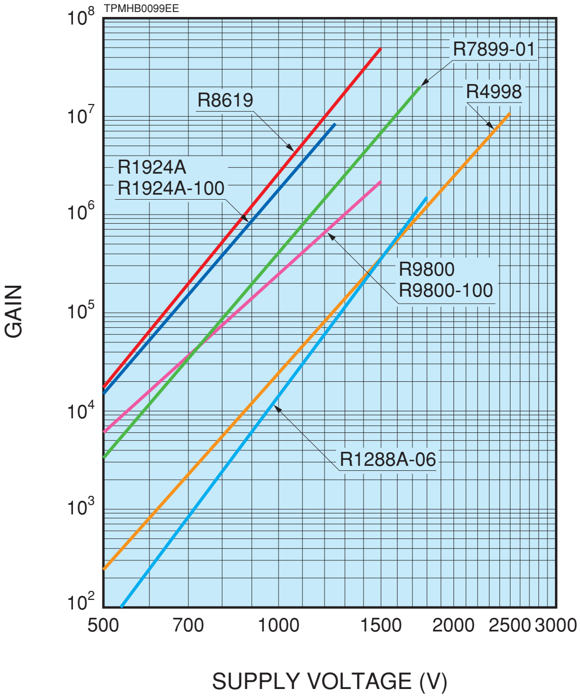
● 10 mm (3/8") Dia. and TO-8 types
● 13 mm (1/2") Dia. types



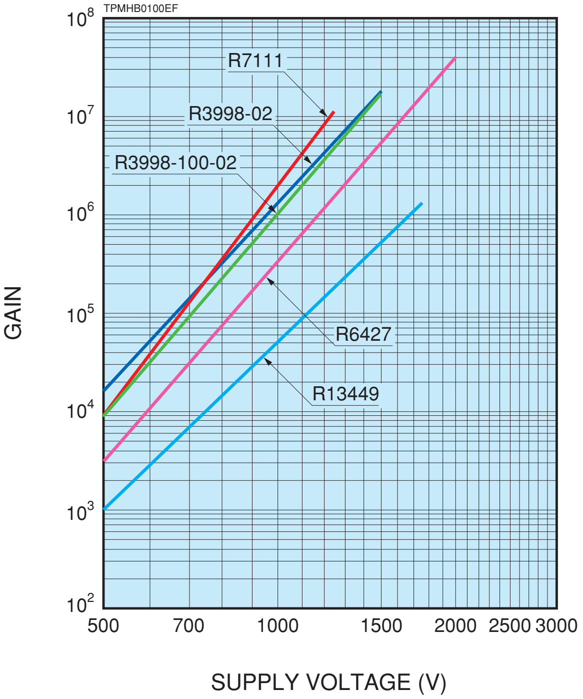
● 19 mm (3/4") Dia. types



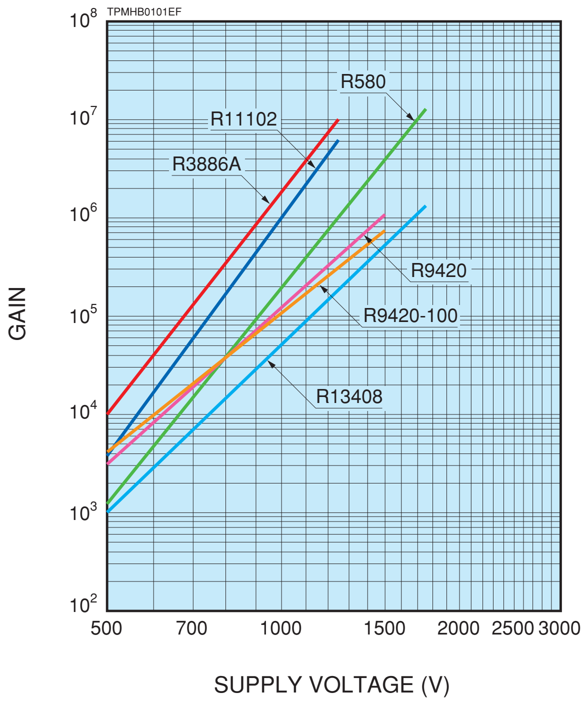
● 25 mm (1") Dia. types



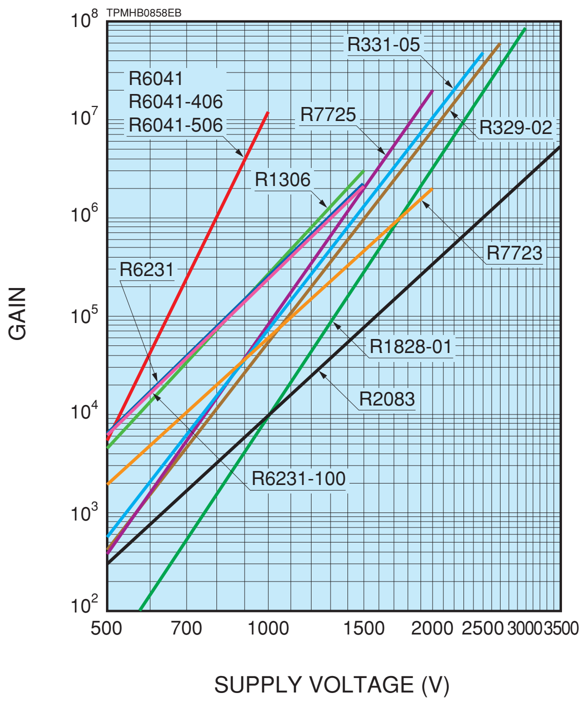
● 28 mm (1-1/8") Dia. types



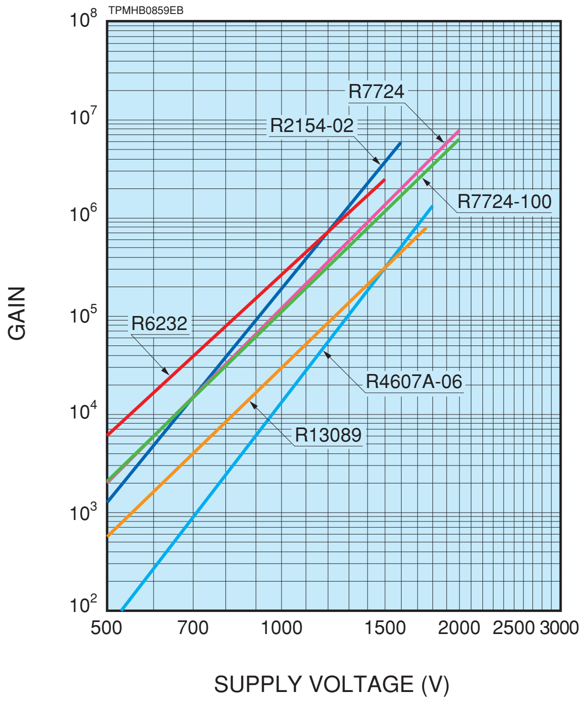
● 38 mm (1-1/2") Dia. types



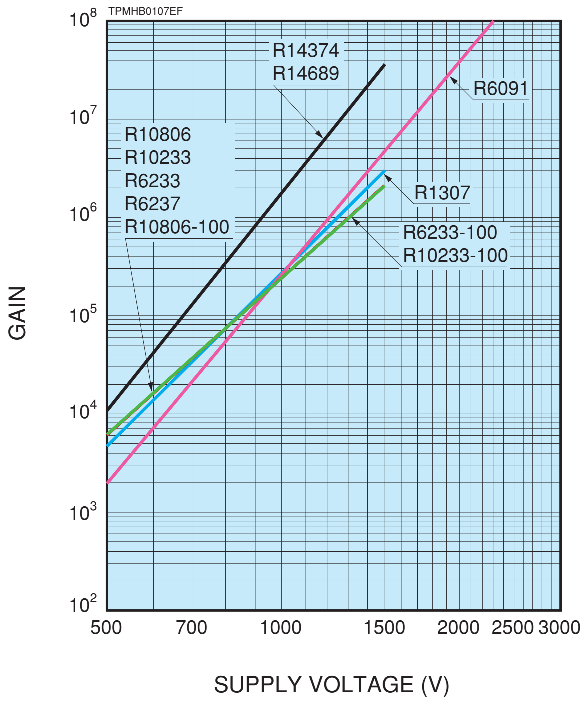
● 51 mm (2") Dia. types



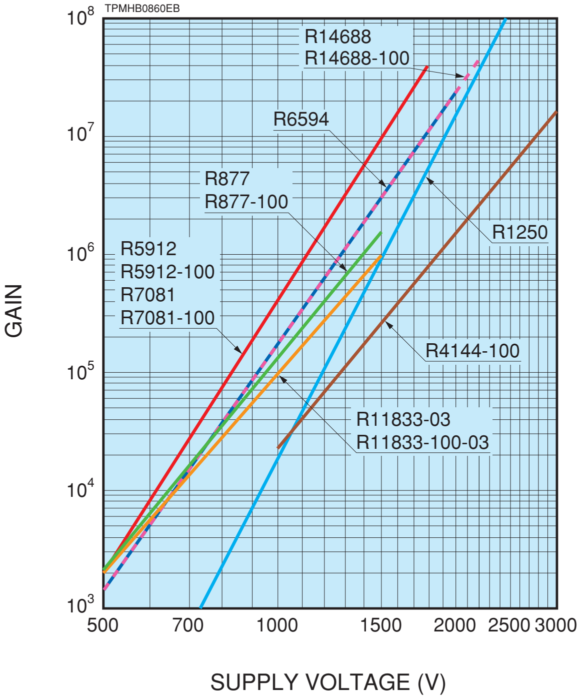
● 51 mm (2") Dia. types
● 60 mm (2.5") Dia. types

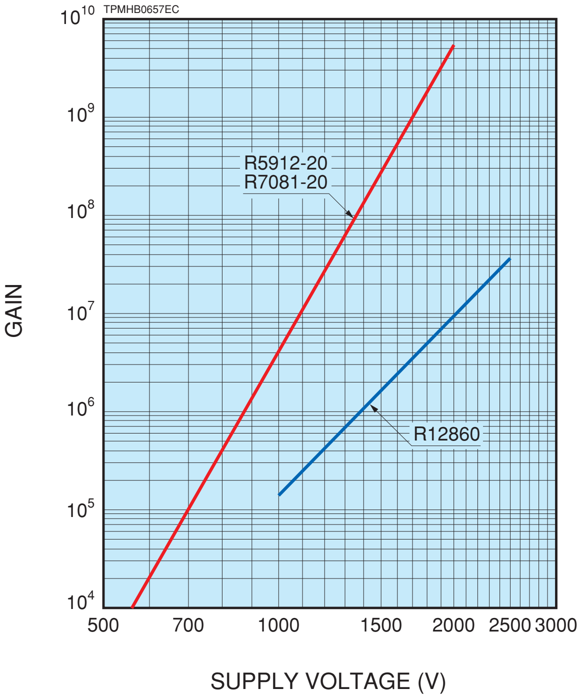


● 76 mm (3") Dia. types
● 80 mm (3-1/8") Dia. types
● 90 mm (3.5") Dia. types
● 102 mm (4") Dia. types

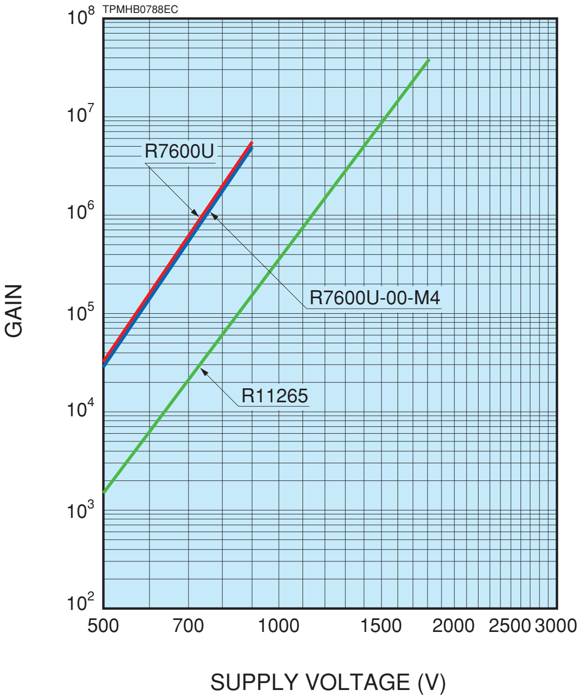


● 127 mm (5"), 202 mm (8"), 253 mm (10") and 508 mm (20") Dia. types

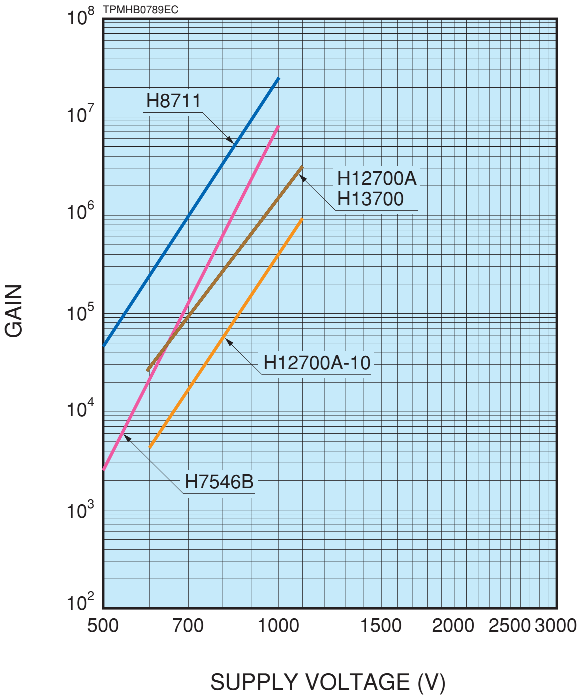




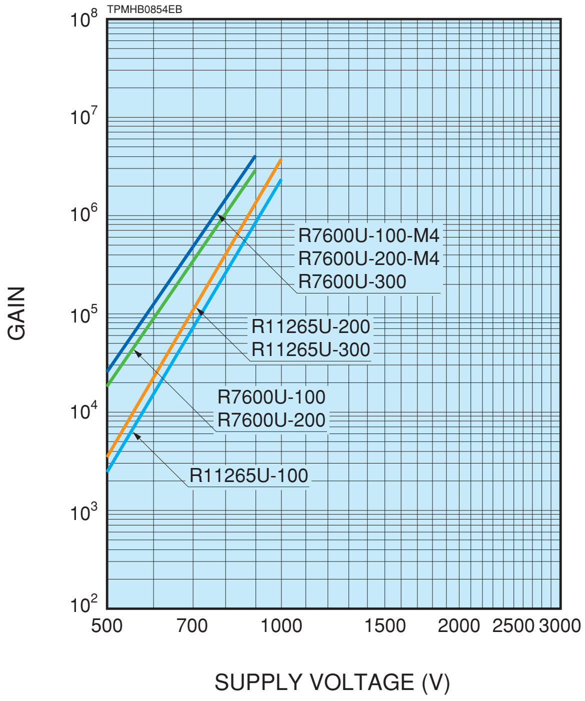
● Metal package types



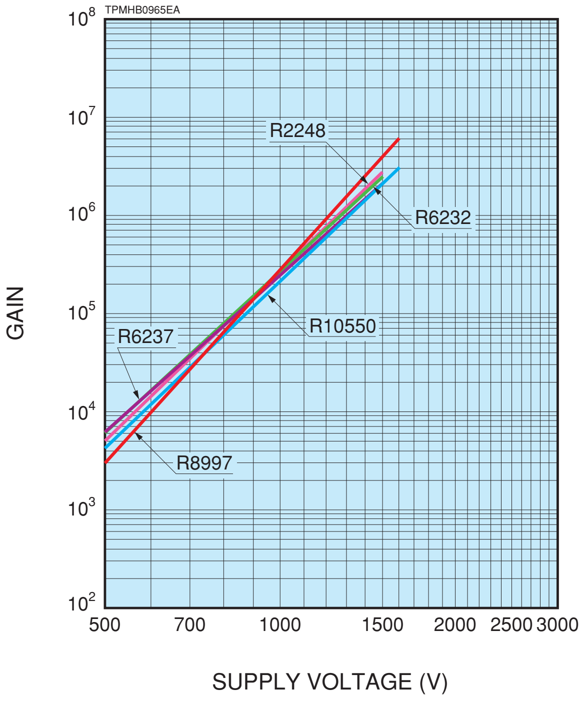
● Metal package types and assembly type



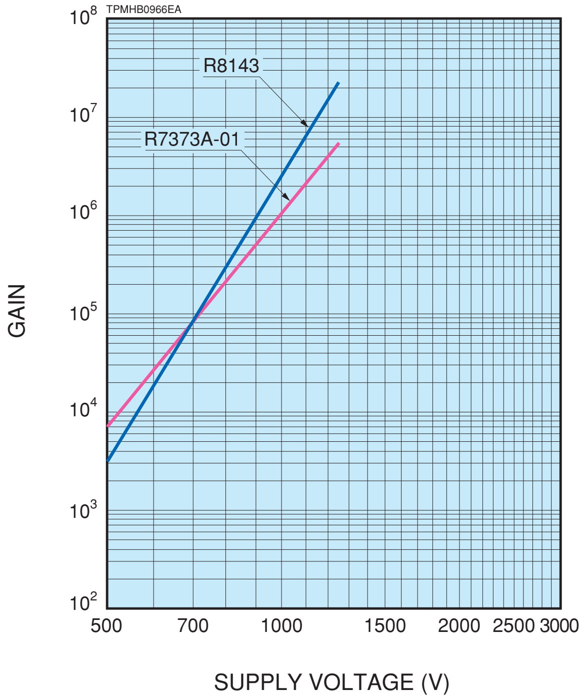
● SBA / UBA / EGBA metal package types



● Square, Rectangular shape photomultipliers



● 2π shape photomultipliers



Voltage distribution ratios

Interstages for the dynodes of a PMT are supplied by a voltage divider network consisting of series resistors, as shown on the right page. The cathode ground scheme (1) is usually used in scintillation counting because it reduces noise resulting from glass scintillation. In fast-pulse light applications, use of the anode ground scheme (2) is suggested. Either scheme requires decoupling (charge-storage) capacitors connected to the last few stages of dynodes in order to maintain the dynode voltage at a constant value during pulse duration. refer to section 11 and 12 on page 8 to 13 for further details.

To free the user from the necessity of designing voltage divider and performing troublesome parts selection, Hamamatsu provides a variety of socket assemblies which enable sufficient performance to be derived from PMT's by making simple connections only.

Voltage distribution ratio

<Symbols>
K: Photocathode G: Grid F: Focusing electrode
Dy: Dynode GR: Guard ring P: Anode
Acc: Accelerating electrode

Voltage distribution No.	Number of stages	Voltage distribution ratios											
		K	G	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	P	ΣR
①	8	1	1	1	1	1	1	1	1	1	1		10
②		2	—	2	1	1	1	1	1	1	1		11
③		2	2	1	1	1	1	1	1	1	1		12
④		3	—	1.5	1.5	1	1	1	1	1	1		12
⑤		4	—	1	2	1	1	1	1	2	1		14
⑥		4	—	1.5	1.5	1	1	1	1	1	1		13
⑦		7	—	1	1.5	1	1	1	1	1	1		15.5
⑧		4	0	1.2	1.5	1	1	1	1	1	1		12.7

No.	stages	K	G	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8(Acc)	P	ΣR
⑨	8	1.3	4.8	1.5	1.5	1	1	1	1	1	1		15.1

(Note 1)

No.	stages	K	G	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Acc	Dy7	Dy8	P	ΣR
⑩	8	1.3	4.8	1.2	1.8	1	1	1	1	0.5	3	2.5		19.1

Acc: Grid (Accelerating electrode)

No.	stages	K	G1	G2	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	P	ΣR
⑪	8	2.5	7.5	0	1.2	1.8	1	1	1.5	1.5	3	2.5		23.5

No.	stages	K	G	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	P	ΣR
⑫	9	3	1	1	1	1	1	1.5	1	1	1	1		13.5

No.	stages	K	G	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	P	ΣR
⑬	10	1	—	1	1	1	1	1	1	1	1	1	0.5		10.5
⑭		1	—	1	1	1	1	1	1	1	1	1	1		11
⑮		1	1	1	1	1	1	1	1	1	1	1	1		12
⑯		1.5	—	1	1	1	1	1	1	1	1	1	1		11.5
⑰		1.5	—	1	1	1	1	1	1	1.2	1.8	3.6	3.3		17.4
⑱		1.5	—	1.5	1.5	1	1	1	1	1	1	1	1		12.5
⑲		2	—	1	1	1	1	1	1	1	1	1	1		12
⑳		2	—	1	1	1	1	1	1.2	1.5	2.2	3.6	3		18.5
㉑		2	—	1	1.5	1	1	1	1	1	1	1	0.75		12.25
㉒		3	—	1	1	1	1	1	1	1	1	1	1		13
㉓		3	—	1	1.5	1	1	1	1	1	1	1	1		13.5
㉔		3	—	1	1.5	1	1	1	1	2	3	3.6	3.3		21.4
㉕		3	—	1.5	1	1	1	1	1	1	1	1	1		13.5
㉖		4	—	1	1.5	1	1	1	1	1	1	1	1		14.5
㉗		4	—	1	1.5	1	1	1	1.2	1.5	2	3.3	3		20.5
㉘		4	—	1	2	1	1	1	1	1	1	2	1		16
㉙		4.3	1.8	1.5	1.5	1	1	1	1	1	1	1	1		17.1

No.	stages	K	G	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7(Acc)	Dy8	Dy9	Dy10	P	ΣR
㉚	10	1.3	4.8	1.2	1.8	1	1	1	1	1	1.5	3	2.5		21.1

(Note 2)

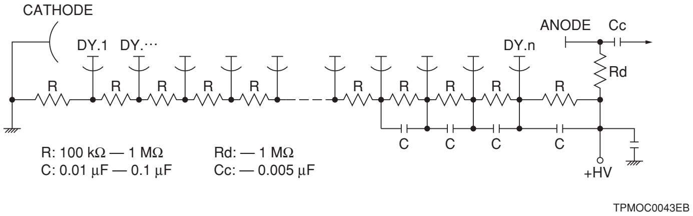
No.	stages	K	G	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8(Acc)	Dy9	Dy10	P	ΣR
㉛	10	1.3	4.8	1.5	1.5	1	1	1	1	1	1	1	1		17.1

(Note 1)

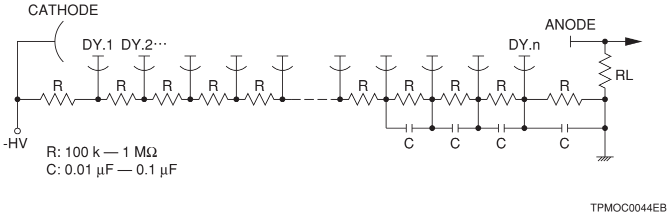
Note 1: Acc to be connected to Dy8 with a protection resistor in series. (recommended resistance: 10 MΩ)
Note 2: Acc should be connected to Dy7 except R4998.

Schematic diagram of voltage divider networks

(1) Cathode ground scheme (+HV)


CATHODE
DY.1
DY.···
ANODE
Cc
DY.n
Rd
R
C
+HV
R: 100 kΩ — 1 MΩ
C: 0.01 µF — 0.1 µF
Rd: — 1 MΩ
Cc: — 0.005 µF
TPMOC0043EB

(2) Anode ground scheme (-HV)


CATHODE
DY.1
DY.2···
ANODE
DY.n
RL
R
C
-HV
R: 100 k — 1 MΩ
C: 0.01 µF — 0.1 µF
TPMOC0044EB

Voltage distribution ratio

Voltage distribution No.	Number of stages	K	Dy1	G1	G3	G2	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	P	ΣR
㉜	10	8	0.18	0	0.17	0.85	1.5	1	1	1	1	1	1	1	1		18.7
㉝		8	0.18	0	0.17	0.85	1.5	1	1	1	1.2	1.5	2.1	3	2.4		23.9

No.	stages	K	Dy1	G	Dy2	Dy3	Dy4	Dy5	Dy6(Acc)	Dy7	Dy8	Dy9	Dy10	P	ΣR
㉞	10	11	1.5	4	4.5	1.5	1.5	1	1.2	2	2.2	3	1.7		35.1

No.	stages	K	Dy1	G	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7(Acc)	Dy8	Dy9	Dy10	P	ΣR
㉟	10	11.5	1	3.5	4	2	2	1	1	1	1	1	1		30

No.	stages	K	G	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	Dy11	P	ΣR
㊱	11	2	—	1	1	1	1	1	1	1	1	1	1	1		13

No.	stages	K	G	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	Dy11	Dy12	P	ΣR	
㊲	12	1.2	2.8	1.2	1.8	1	1	1	1	1	1	1.5	1.5	3	2.5		21.5	
㊳		1.2	2.8	1.2	1.8	1	1	1.2	1.5	2	2.8	4	5.7	8	5		40.2	
㊴		2	—	2	2	1	1	1	1	1	1	1	1	1	1		16	
㊵		2.5	—	1.3	0.8	0.8	1	1	1	1	1	1	1	1	0.5		13.9	
㊶		3	—	2	2	1	1	1	1	1	1	1	1	2	5		22	
㊷		4	0	1	1.4	1	1	1	1	1	1	1	1	1	1		16.4	(Note 3)
㊸		4	—	1	2	1	1	1	1	1	1	1	1	2	1		18	
㊹		4.3	0	1	1.6	1	1	1	1.2	1.5	2	2.4	3	3.9	3		26.9	(Note 3)

No.	stages	K	G	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	Dy11	Dy12	Dy13	Dy14	P	ΣR
㊺	14	2.5	7.5	1.2	1.8	1	1	1	1	1	1	1	1	1.5	1.5	3	2.5		29.5
㊻		2.5	7.5	1.2	1.8	1	1	1	1	1.2	1.5	2	2.8	4	5.7	8	5		47.2

No.	stages	K	Dy1	G2	G1	G3	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	Dy11	Dy12	Dy13	Dy14	P	ΣR
㊼	10	16.8	0	0.6	0	3.4	5	3.33	1.67	1	1.2	1.5	2.2	3	—	—	—	—	2.4		42.1
㊽	14	11.3	0	0.6	0	3.4	5	3.33	1.67	1	1	1	1	1	1.2	1.5	2.2	3	2.4		40.6

No.	stages	K	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	Dy11	Dy12	GR	P	ΣR
㊾	10	2	1	1	1	1	1	1	1	1	1	—	—	1	0.5		12.5

Note 3: Shield should be connected to Dy5.

Quick reference for PMT socket assemblies

Assembly type No.	PMT characteristics				Assembly characteristics						Notes
	Tube diameter	Tube type No. / Voltage distribution ratio		Reference page for PMT feature	Outline No.	H.V input terminal	Signal output terminal	Standard rating		Maximum rating	
								Overall① voltage (V)	Divider② current (mA)	Overall voltage (V)	
E849-90	13 mm (1/2")	R647-01	⑭	20	1	SHV	BNC	-1000	0.28	-1250	
E849-99		R12421	⑲	20	2	AWG22	RG-174/U	-1000	0.32	-1250	
E974-17	19 mm (3/4")	R1166	⑯	20	3	SHV	BNC	-1000	0.27	-1250	
E974-22		R1450	㉑	20	4	SHV	BNC	-1500	0.37	-1800	
E2253-05		R3478	⑦	20	5	SHV	BNC	-1700	0.34	-1800	
E990-29	25 mm (1")	R3998-02 R3998-100-02	⑫	20 26	6	AWG22	RG-174/U	-1000	0.23	-1500	
E2924-500	28 mm (1-1/8")	R1924A R7111	㉒	20 20	7	SHV	BNC	-1000	0.24	-1250	
E2624-14	28 mm (1-1/8")	R6427	㉖	20	8	SHV	BNC	-1500	0.32	-2000	
E2183-500	38 mm (1-1/2")	R580 R11102 R3886A	⑲	20 20 20	9	SHV	BNC	-1250 -1000 -1000	0.32 0.26 0.26	-1750 -1250 -1250	
E1198-07	51 mm (2")	R2154-02	⑲	22	10	AWG22	RG-174/U	-1250	0.32	-1750	
E2979-500		R1828-01 R2059	㊲	22	11	SHV	BNC	-2500	0.58	-3000	with shield case
E1198-05	51 mm (2") 60 mm (2.4") 76 mm (3") 90 mm (3.5") 102 mm (4")	R1306 R1307	①	22 22	12	AWG22	RG-174/U	-1000	0.31	-1500	-HV type
E1198-20			①	22 22	13	SHIELD CABLE	RG-174/U	+1000	0.31	+1500	+HV type
E1198-26		R6231 R6231-100 R6232 R6233 R6233-100 R6236 R6237 R10233 R10233-100 R10806 R10806-100	③	22 22 22 22 22 24 24 22 22 22 22	14	SHIELD CABLE	RG-174/U	-1000	0.25	-1500	-HV type
E1198-27					14	SHIELD CABLE	RG-174/U	+1000	0.25	+1500	+HV type

Note:
①: When overall voltage is negative (-HV), DC and pulse signals are obtained. When it's positive (+HV), pulse signal is obtained.
②: The maximum average anode current is defined as 5 % of divider current.

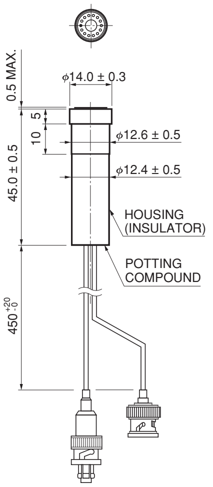
Assembly type No.	PMT characteristics				Assembly characteristics						Notes
	Tube diameter	Tube type No. / Voltage distribution ratio		Reference page for PMT feature	Outline No.	H.V input terminal	Signal output terminal	Standard rating		Maximum rating	
								Overall① voltage (V)	Divider② current (mA)	Overall voltage (V)	
E5859	51 mm (2") 76 mm (3")	R329-02 R6091	㊹	22 22	15	SHV	BNC	-2000	0.5	-2700 -2500	shield case is available. +HV type (E5859-02) is available.
E5859-01		R329-02 R331-05 R6091	㊷	22 22 22	15	SHV	BNC	-1500	0.42	-2700 -2500 -2500	shield case is available. +HV type (E5859-03) is available.
E5859-11		R7725	㊸	22	15	SHV	BNC	-1750	0.45	-2000	
E5859-15		R7723	⑤	22	15	SHV	BNC	-1750	0.38	-2000	
E5859-19		R7724 R7724-100	㉘	22	15	SHV	BNC	-1750	0.5	-2000	
E1198-22	127 mm (5")	R877 R877-100	⑮	22	16	SHIELD CABLE	RG-174/U	-1250	0.32	-1500	shield case is available. -HV type
E1198-23					16	SHIELD CABLE	RG-174/U	-1250	0.32	-1500	shield case is available. +HV type
E6316-01					17	SHV	BNC	-1250	0.32	-1500	shield case is available. -HV type with rear panel connector
E7693		R1250	㊺	22	18	SHV	BNC	-2000	0.68	-3000	
E7694-02	204 mm (8") 254 mm (10")	R5912 R7081	㊼	22 22	19	SHV	BNC	-1500	0.36	-2000	+HV type, (E7694-03) is available
E5996	30 mm square type	R7600U R7600U-03 R7600U-100 R7600U-200 R7600U-300	⑱	24	20	SHIELD CABLE	RG-174/U	-800	0.3	-900	
E7083		R7600U-00-M4 R7600U-100-M4 R7600U-200-M4	⑱	24	21	SHIELD CABLE	0.8D-QEV	-800	0.3	-900	Active base type (E6572) is available.
E11807		R11265U R11265U-100 R11265U-200	㊵	24	22	SHIELD CABLE	RG-174/U	-900	0.33	-1000	
E11807-01		R11265U R11265U-100 R11265U-200	㊵	24	22	SHIELD CABLE	RG-174/U	-900	0.34	-1000	E11807 with tapered voltage driver circuit.
E10679-02	16 mm TO-8	R9880U-110 R9800U-210	⑬	24	23	AWG22	RG-174/U	-1000	0.29	-1100	SHV / BNC connector type E10679-03 is available

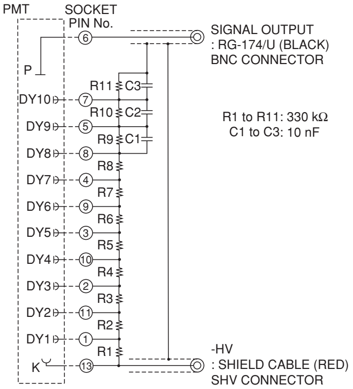
Note:
①: When overall voltage is negative (-HV), DC and pulse signals are obtained. When it's positive (+HV), pulse signal is obtained.
②: The maximum average anode current is defined as 5 % of divider current.

Dimensional outline and circuit diagrams

For PMT socket assemblies

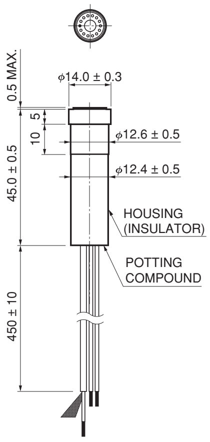
1 E849-90


0.5 MAX.
φ14.0 ± 0.3
5
10
φ12.6 ± 0.5
φ12.4 ± 0.5
45.0 ± 0.5
HOUSING (INSULATOR)
POTTING COMPOUND
450 +20 -0

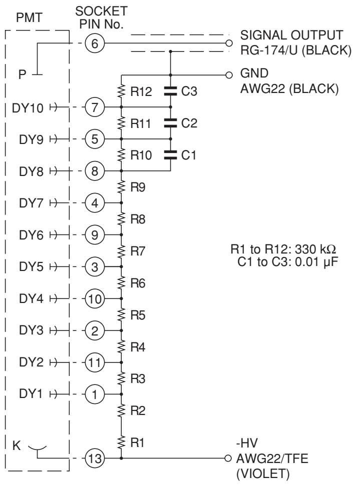

PMT
SOCKET PIN No.
SIGNAL OUTPUT : RG-174/U (BLACK) BNC CONNECTOR
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
6
7
5
8
4
9
3
10
2
11
1
13
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
R1 to R11: 330 kΩ
C1 to C3: 10 nF
-HV : SHIELD CABLE (RED) SHV CONNECTOR

TACCA0077ED

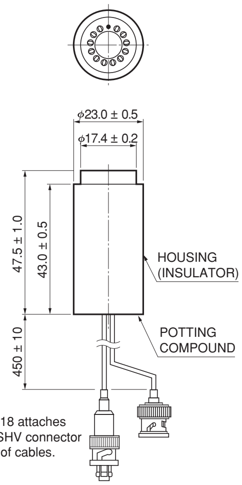
2 E849-99


0.5 MAX.
φ14.0 ± 0.3
5
10
φ12.6 ± 0.5
φ12.4 ± 0.5
45.0 ± 0.5
HOUSING (INSULATOR)
POTTING COMPOUND
450 ± 10

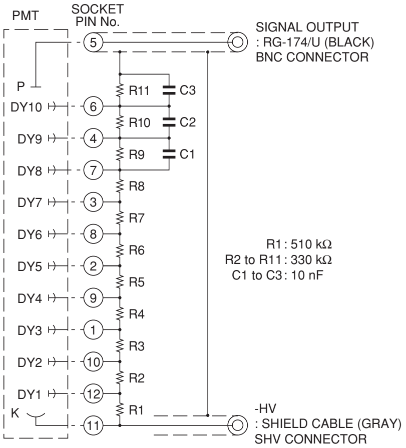
E849-99


PMT
SOCKET PIN No.
SIGNAL OUTPUT RG-174/U (BLACK)
GND AWG22 (BLACK)
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
6
7
5
8
4
9
3
10
2
11
1
13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
R1 to R12: 330 kΩ
C1 to C3: 0.01 μF
-HV AWG22/TFE (VIOLET)

3 E974-17

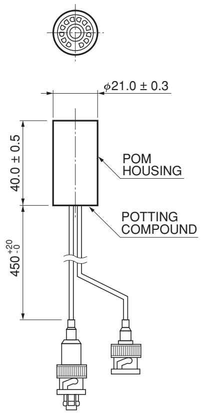

φ23.0 ± 0.5
φ17.4 ± 0.2
47.5 ± 1.0
43.0 ± 0.5
HOUSING (INSULATOR)
POTTING COMPOUND
450 ± 10

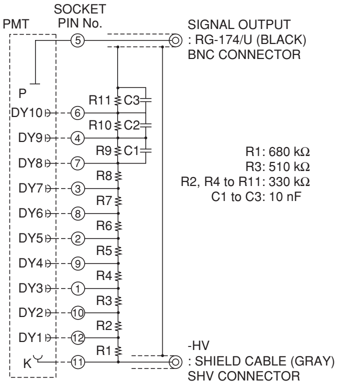
E974-17, -18 attaches BNC and SHV connector at the end of cables.


PMT
SOCKET PIN No.
SIGNAL OUTPUT : RG-174/U (BLACK) BNC CONNECTOR
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
5
6
4
7
3
8
2
9
1
10
12
11
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
R1 : 510 kΩ
R2 to R11 : 330 kΩ
C1 to C3 : 10 nF
-HV : SHIELD CABLE (GRAY) SHV CONNECTOR

TACCA0212EB

4 E974-22

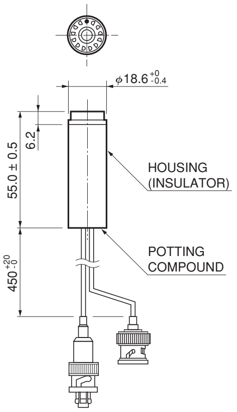

φ21.0 ± 0.3
40.0 ± 0.5
POM HOUSING
POTTING COMPOUND
450 +20 -0

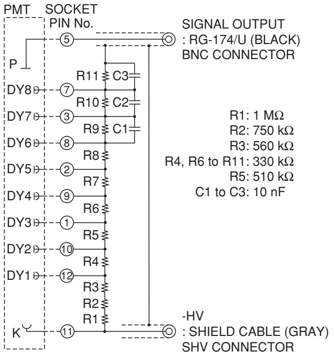

PMT
SOCKET PIN No.
SIGNAL OUTPUT : RG-174/U (BLACK) BNC CONNECTOR
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
5
6
4
7
3
8
2
9
1
10
12
11
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
R1: 680 kΩ
R3: 510 kΩ
R2, R4 to R11: 330 kΩ
C1 to C3: 10 nF
-HV : SHIELD CABLE (GRAY) SHV CONNECTOR

TACCA0078EC

(Unit: mm)

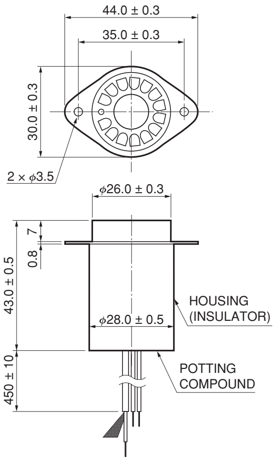
5 E2253-05

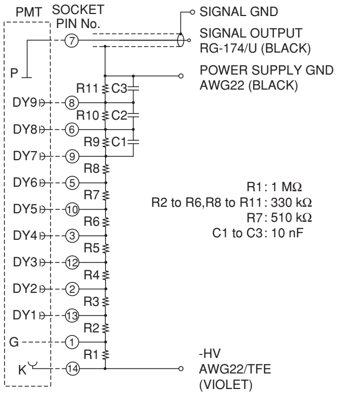

φ18.6 +0 -0.4
6.2
55.0 ± 0.5
450 +20 -0
HOUSING (INSULATOR)
POTTING COMPOUND


PMT
SOCKET PIN No.
SIGNAL OUTPUT
: RG-174/U (BLACK)
BNC CONNECTOR
P
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
R1: 1 MΩ
R2: 750 kΩ
R3: 560 kΩ
R4, R6 to R11: 330 kΩ
R5: 510 kΩ
C1 to C3: 10 nF
-HV
: SHIELD CABLE (GRAY)
SHV CONNECTOR

TACCA0079EB

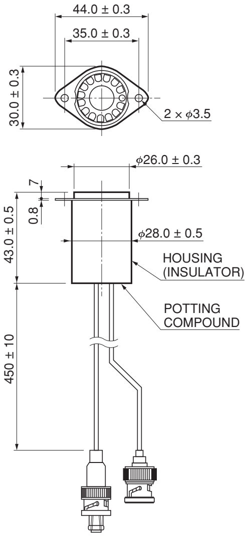
6 E990-29

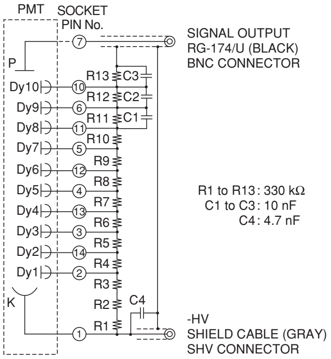

44.0 ± 0.3
35.0 ± 0.3
30.0 ± 0.3
2 × φ3.5
φ26.0 ± 0.3
7
0.8
43.0 ± 0.5
φ28.0 ± 0.5
450 ± 10
HOUSING (INSULATOR)
POTTING COMPOUND


PMT
SOCKET PIN No.
SIGNAL GND
SIGNAL OUTPUT
RG-174/U (BLACK)
POWER SUPPLY GND
AWG22 (BLACK)
P
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
G
K
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
R1: 1 MΩ
R2 to R6,R8 to R11: 330 kΩ
R7: 510 kΩ
C1 to C3: 10 nF
-HV
AWG22/TFE
(VIOLET)

TACCA0215EC

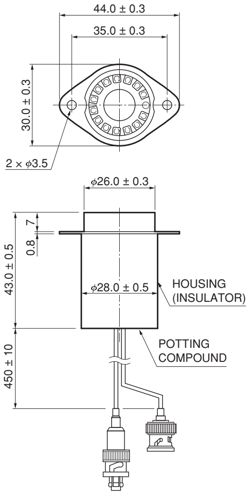
7 E2924-500

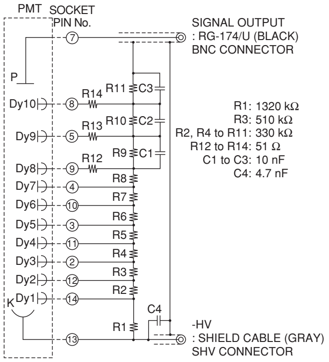

44.0 ± 0.3
35.0 ± 0.3
30.0 ± 0.3
2 × φ3.5
φ26.0 ± 0.3
7
0.8
43.0 ± 0.5
φ28.0 ± 0.5
450 ± 10
HOUSING (INSULATOR)
POTTING COMPOUND


PMT
SOCKET PIN No.
SIGNAL OUTPUT
RG-174/U (BLACK)
BNC CONNECTOR
P
Dy10
Dy9
Dy8
Dy7
Dy6
Dy5
Dy4
Dy3
Dy2
Dy1
K
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
C4
R1 to R13: 330 kΩ
C1 to C3: 10 nF
C4: 4.7 nF
-HV
SHIELD CABLE (GRAY)
SHV CONNECTOR

TACCA0081EC

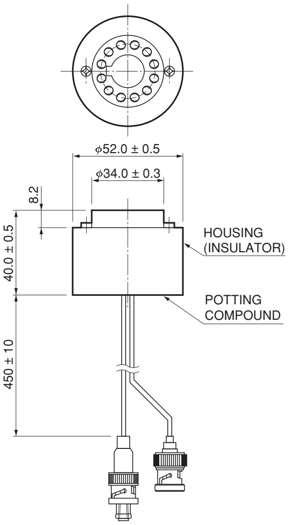
8 E2624-14


44.0 ± 0.3
35.0 ± 0.3
30.0 ± 0.3
2 × φ3.5
φ26.0 ± 0.3
7
0.8
43.0 ± 0.5
φ28.0 ± 0.5
450 ± 10
HOUSING (INSULATOR)
POTTING COMPOUND


PMT
SOCKET PIN No.
SIGNAL OUTPUT
: RG-174/U (BLACK)
BNC CONNECTOR
P
Dy10
Dy9
Dy8
Dy7
Dy6
Dy5
Dy4
Dy3
Dy2
Dy1
K
R14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
C4
R1: 1320 kΩ
R3: 510 kΩ
R2, R4 to R11: 330 kΩ
R12 to R14: 51 Ω
C1 to C3: 10 nF
C4: 4.7 nF
-HV
: SHIELD CABLE (GRAY)
SHV CONNECTOR

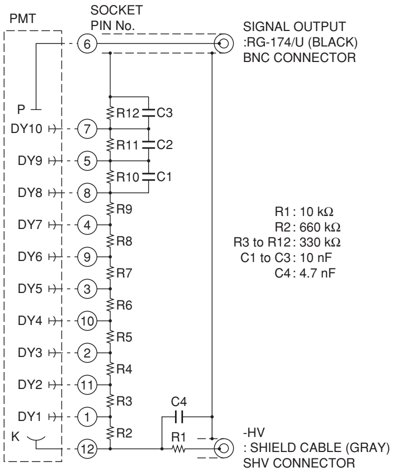
TACCA0082EC

9 E2183-500



φ52.0 ± 0.5
φ34.0 ± 0.3
8.2
40.0 ± 0.5
450 ± 10
HOUSING (INSULATOR)
POTTING COMPOUND

E2183-500

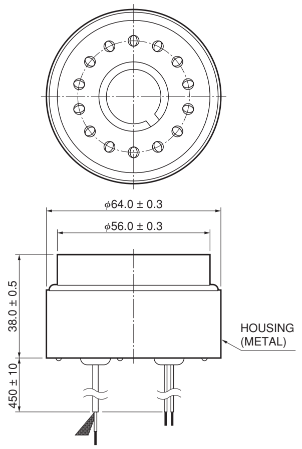


PMT
SOCKET PIN No.
SIGNAL OUTPUT :RG-174/U (BLACK) BNC CONNECTOR
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
6
7
5
8
4
9
3
10
2
11
1
12
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
C4
-HV : SHIELD CABLE (GRAY) SHV CONNECTOR

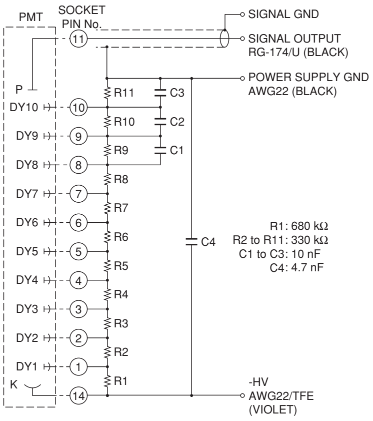
R1 : 10 kΩ
R2 : 660 kΩ
R3 to R12 : 330 kΩ
C1 to C3 : 10 nF
C4 : 4.7 nF

TACCA0166EC

10 E1198-07



φ64.0 ± 0.3
φ56.0 ± 0.3
38.0 ± 0.5
450 ± 10
HOUSING (METAL)



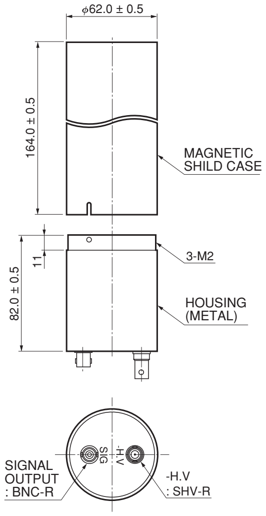
PMT
SOCKET PIN No.
SIGNAL GND
SIGNAL OUTPUT RG-174/U (BLACK)
POWER SUPPLY GND AWG22 (BLACK)
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
11
10
9
8
7
6
5
4
3
2
1
14
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
C4
-HV AWG22/TFE (VIOLET)

R1: 680 kΩ
R2 to R11: 330 kΩ
C1 to C3: 10 nF
C4: 4.7 nF

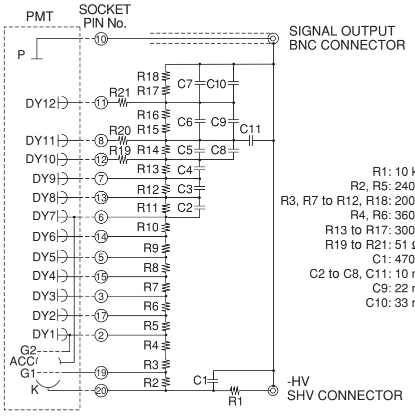
The housing is internally connected to the GND.

TACCA0220EB

11 E2979-500



φ62.0 ± 0.5
164.0 ± 0.5
MAGNETIC SHILD CASE
11
82.0 ± 0.5
3-M2
HOUSING (METAL)
SIG
H.V
SIGNAL OUTPUT : BNC-R
-H.V : SHV-R



PMT
SOCKET PIN No.
SIGNAL OUTPUT BNC CONNECTOR
P
DY12
DY11
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
G2
ACC
G1
K
10
11
8
12
7
13
6
14
5
15
3
17
2
19
20
R21
R20
R19
R18
R17
R16
R15
R14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C7
C10
C6
C9
C11
C5
C8
C4
C3
C2
C1
-HV SHV CONNECTOR

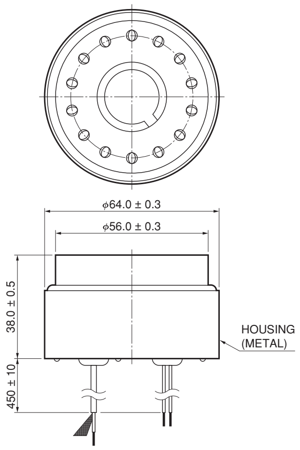
R1: 10 kΩ
R2, R5: 240 kΩ
R3, R7 to R12, R18: 200 kΩ
R4, R6: 360 kΩ
R13 to R17: 300 kΩ
R19 to R21: 51 Ω
C1: 470 pF
C2 to C8, C11: 10 nF
C9: 22 nF
C10: 33 nF

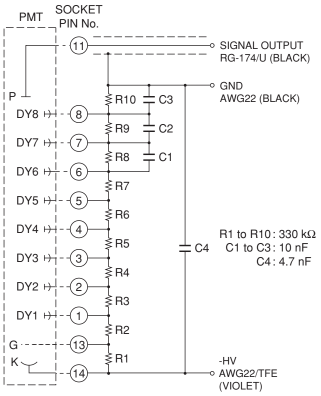
The housing is internally connected to the GND.

TACCA0093EB

(Unit: mm)

12 E1198-05

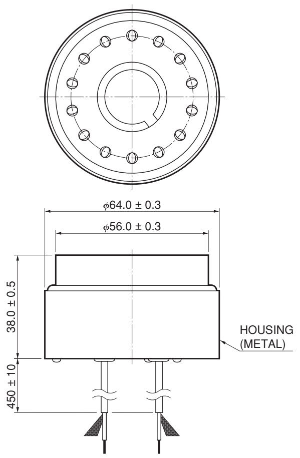

φ64.0 ± 0.3
φ56.0 ± 0.3
38.0 ± 0.5
450 ± 10
HOUSING (METAL)

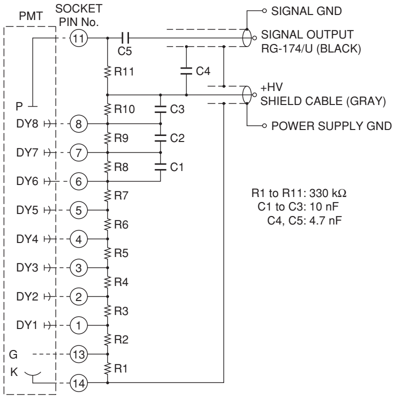

PMT
SOCKET PIN No.
SIGNAL OUTPUT RG-174/U (BLACK)
GND AWG22 (BLACK)
P
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
G
K
11
8
7
6
5
4
3
2
1
13
14
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
C4
R1 to R10 : 330 kΩ
C1 to C3 : 10 nF
C4 : 4.7 nF
-HV AWG22/TFE (VIOLET)

The housing is internally connected to the GND.

TACCA0221EB

13 E1198-20

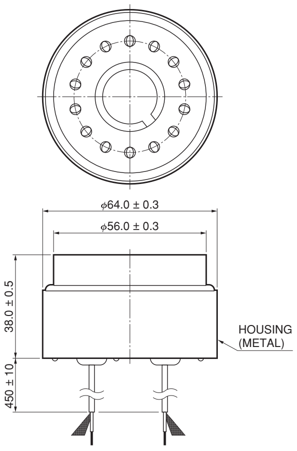

φ64.0 ± 0.3
φ56.0 ± 0.3
38.0 ± 0.5
450 ± 10
HOUSING (METAL)


PMT
SOCKET PIN No.
SIGNAL GND
SIGNAL OUTPUT RG-174/U (BLACK)
+HV SHIELD CABLE (GRAY)
POWER SUPPLY GND
P
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
G
K
11
8
7
6
5
4
3
2
1
13
14
C5
R11
C4
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
R1 to R11: 330 kΩ
C1 to C3: 10 nF
C4, C5: 4.7 nF

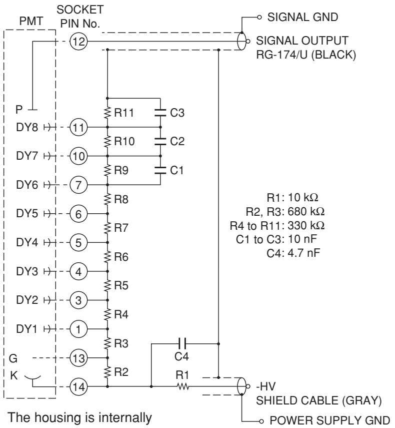
The housing is internally connected to the GND.

TACCA0223EC

14 E1198-26, E1198-27


φ64.0 ± 0.3
φ56.0 ± 0.3
38.0 ± 0.5
450 ± 10
HOUSING (METAL)

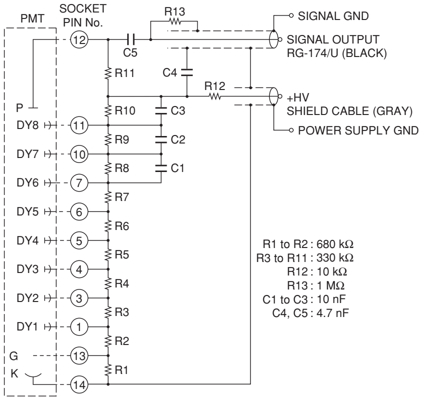
E1198-26


PMT
SOCKET PIN No.
SIGNAL GND
SIGNAL OUTPUT RG-174/U (BLACK)
P
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
G
K
12
11
10
7
6
5
4
3
1
13
14
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
C4
R1: 10 kΩ
R2, R3: 680 kΩ
R4 to R11: 330 kΩ
C1 to C3: 10 nF
C4: 4.7 nF
-HV SHIELD CABLE (GRAY)
POWER SUPPLY GND

The housing is internally connected to the GND.

TACCA0224EB

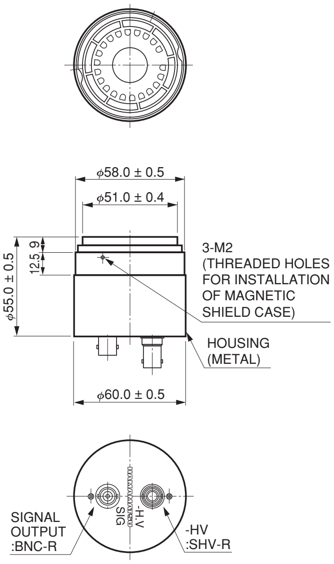
E1198-27


PMT
SOCKET PIN No.
R13
SIGNAL GND
SIGNAL OUTPUT RG-174/U (BLACK)
C5
R11
C4
R12
+HV SHIELD CABLE (GRAY)
POWER SUPPLY GND
P
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
G
K
12
11
10
7
6
5
4
3
1
13
14
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
R1 to R2 : 680 kΩ
R3 to R11 : 330 kΩ
R12 : 10 kΩ
R13 : 1 MΩ
C1 to C3 : 10 nF
C4, C5 : 4.7 nF

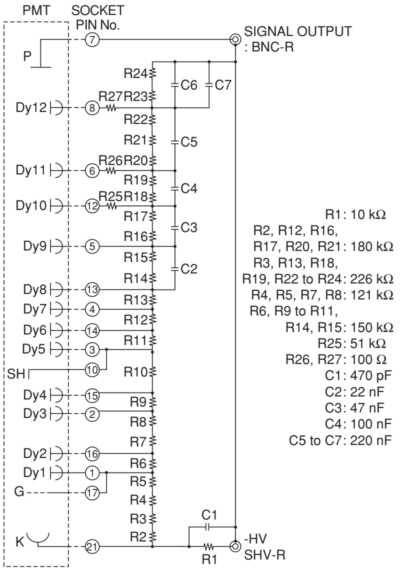
The housing is internally connected to the GND.

TACCA0225EB

15 E5859, E5859-01, E5859-11, E5859-15, E5859-19


φ58.0 ± 0.5
φ51.0 ± 0.4
φ55.0 ± 0.5
12.5
9
3-M2
(THREADED HOLES
FOR INSTALLATION
OF MAGNETIC
SHIELD CASE)
HOUSING
(METAL)
φ60.0 ± 0.5
SIGNAL
OUTPUT
:BNC-R
SIG
-HV
-HV
:SHV-R

E5859 taper bleeder circuit
(For R329-02/R6091)

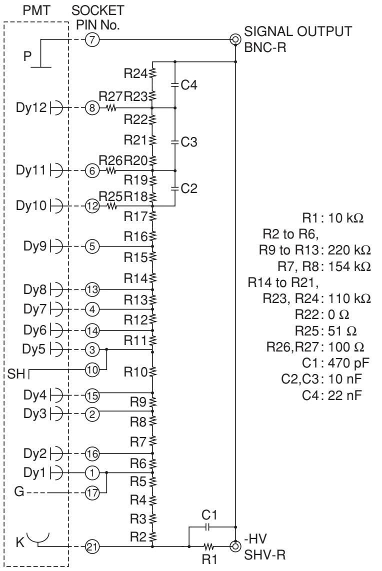

PMT
SOCKET
PIN No.
SIGNAL OUTPUT
: BNC-R
P
Dy12
Dy11
Dy10
Dy9
Dy8
Dy7
Dy6
Dy5
SH
Dy4
Dy3
Dy2
Dy1
G
K
R1
C1
C2
C3
C4
C5
C6
C7
-HV
SHV-R

R1 : 10 kΩ
R2, R12, R16,
R17, R20, R21 : 180 kΩ
R3, R13, R18,
R19, R22 to R24 : 226 kΩ
R4, R5, R7, R8 : 121 kΩ
R6, R9 to R11,
R14, R15 : 150 kΩ
R25 : 51 kΩ
R26, R27 : 100 Ω
C1 : 470 pF
C2 : 22 nF
C3 : 47 nF
C4 : 100 nF
C5 to C7 : 220 nF

The housing is internally connected to the GND.

TACCA0176EC

E5859-01 standard bleeder circuit
(For R329-02/R331-05/R6091)

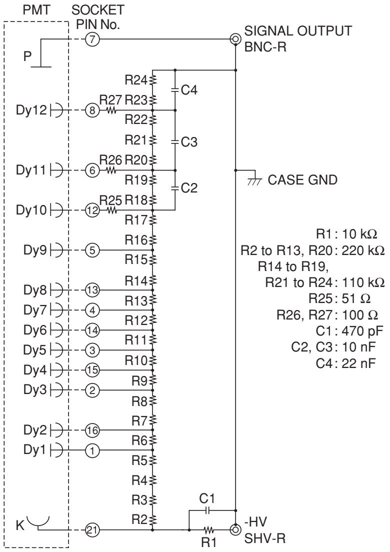

PMT
SOCKET
PIN No.
SIGNAL OUTPUT
BNC-R
P
Dy12
Dy11
Dy10
Dy9
Dy8
Dy7
Dy6
Dy5
SH
Dy4
Dy3
Dy2
Dy1
G
K
R1
C1
C2
C3
C4
-HV
SHV-R

R1 : 10 kΩ
R2 to R6,
R9 to R13 : 220 kΩ
R7, R8 : 154 kΩ
R14 to R21,
R23, R24 : 110 kΩ
R22 : 0 Ω
R25 : 51 Ω
R26,R27 : 100 Ω
C1 : 470 pF
C2,C3 : 10 nF
C4 : 22 nF

The housing is internally connected to the GND.

TACCA0178EC

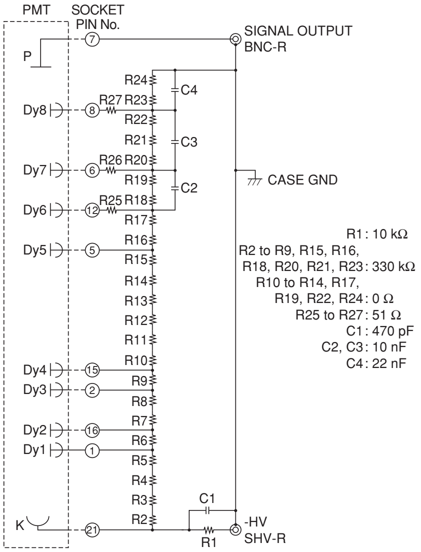
E5859-11
(For R7725)


PMT
SOCKET
PIN No.
SIGNAL OUTPUT
BNC-R
P
Dy12
Dy11
Dy10
Dy9
Dy8
Dy7
Dy6
Dy5
Dy4
Dy3
Dy2
Dy1
K
CASE GND
R1
C1
C2
C3
C4
-HV
SHV-R

R1 : 10 kΩ
R2 to R13, R20 : 220 kΩ
R14 to R19,
R21 to R24 : 110 kΩ
R25 : 51 Ω
R26, R27 : 100 Ω
C1 : 470 pF
C2, C3 : 10 nF
C4 : 22 nF

TACCA0359EA

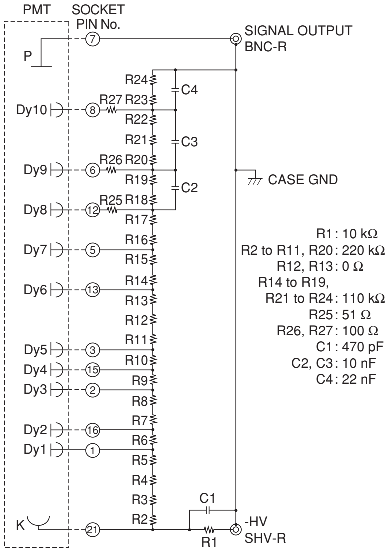
E5859-15
(For R7723)


PMT
SOCKET
PIN No.
SIGNAL OUTPUT
BNC-R
P
Dy8
Dy7
Dy6
Dy5
Dy4
Dy3
Dy2
Dy1
K
CASE GND
R1
C1
C2
C3
C4
-HV
SHV-R

R1 : 10 kΩ
R2 to R9, R15, R16,
R18, R20, R21, R23 : 330 kΩ
R10 to R14, R17,
R19, R22, R24 : 0 Ω
R25 to R27 : 51 Ω
C1 : 470 pF
C2, C3 : 10 nF
C4 : 22 nF

TACCA0360EA

E5859-19
(For R7724)

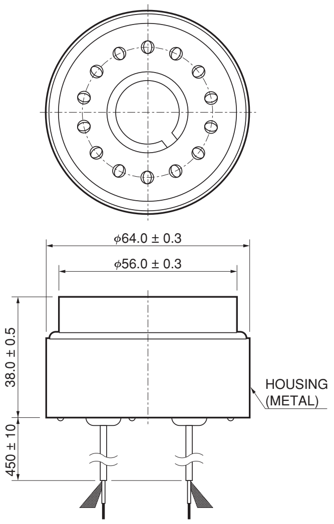

PMT
SOCKET
PIN No.
SIGNAL OUTPUT
BNC-R
P
Dy10
Dy9
Dy8
Dy7
Dy6
Dy5
Dy4
Dy3
Dy2
Dy1
K
CASE GND
R1
C1
C2
C3
C4
-HV
SHV-R

R1 : 10 kΩ
R2 to R11, R20 : 220 kΩ
R12, R13 : 0 Ω
R14 to R19,
R21 to R24 : 110 kΩ
R25 : 51 Ω
R26, R27 : 100 Ω
C1 : 470 pF
C2, C3 : 10 nF
C4 : 22 nF

TACCA0361EA

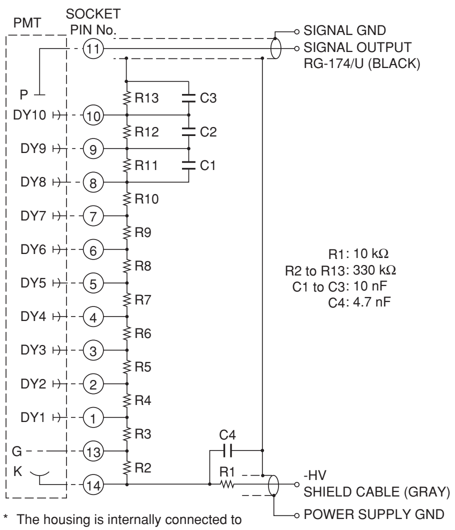
(Unit: mm)

16 E1198-22, E1198-23



φ64.0 ± 0.3
φ56.0 ± 0.3
38.0 ± 0.5
450 ± 10
HOUSING
(METAL)

E1198-22



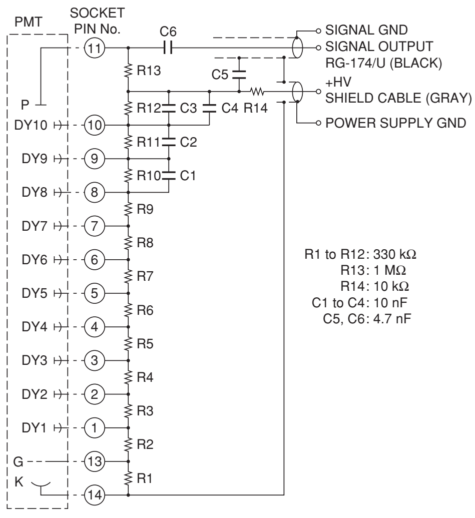
PMT
SOCKET
PIN No.
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
G
K
11
10
9
8
7
6
5
4
3
2
1
13
14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
C4
SIGNAL GND
SIGNAL OUTPUT
RG-174/U (BLACK)
-HV
SHIELD CABLE (GRAY)
POWER SUPPLY GND

R1: 10 kΩ
R2 to R13: 330 kΩ
C1 to C3: 10 nF
C4: 4.7 nF

* The housing is internally connected to the GND.
** High voltage shielded cable can be connected to a connector for RG-174/U.

TACCA0168EB

E1198-23



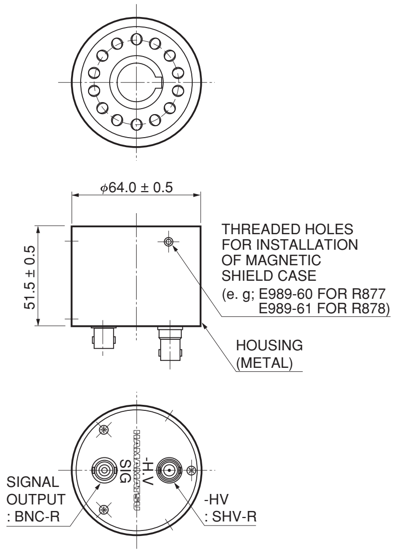
PMT
SOCKET
PIN No.
C6
C5
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
G
K
11
10
9
8
7
6
5
4
3
2
1
13
14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C4
R14
C2
C1
SIGNAL GND
SIGNAL OUTPUT
RG-174/U (BLACK)
+HV
SHIELD CABLE (GRAY)
POWER SUPPLY GND

R1 to R12: 330 kΩ
R13: 1 MΩ
R14: 10 kΩ
C1 to C4: 10 nF
C5, C6: 4.7 nF

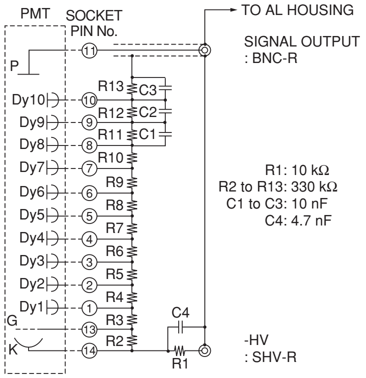
* The housing is internally connected to the GND.
** High voltage shielded cable can be connected to a connector for RG-174/U.

TACCA0169EC

17 E6316-01



φ64.0 ± 0.5
51.5 ± 0.5
THREADED HOLES
FOR INSTALLATION
OF MAGNETIC
SHIELD CASE
(e. g; E989-60 FOR R877
E989-61 FOR R878)
HOUSING
(METAL)
SIG
-H.V
SIGNAL
OUTPUT
: BNC-R
-HV
: SHV-R



PMT
SOCKET
PIN No.
TO AL HOUSING
SIGNAL OUTPUT
: BNC-R
P
Dy10
Dy9
Dy8
Dy7
Dy6
Dy5
Dy4
Dy3
Dy2
Dy1
G
K
11
10
9
8
7
6
5
4
3
2
1
13
14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C3
C2
C1
C4
-HV
: SHV-R

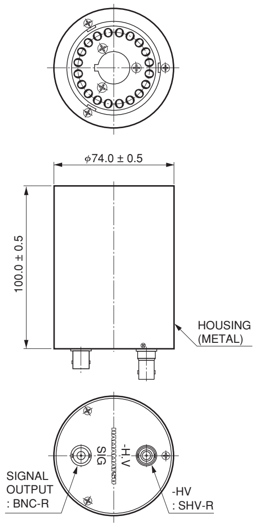
R1: 10 kΩ
R2 to R13: 330 kΩ
C1 to C3: 10 nF
C4: 4.7 nF

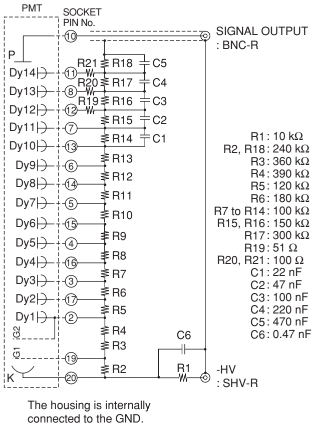
The housing is internally connected to the GND.

Note: Magnetic shield case is available to order separately.

TACCA0089EB

18 E7693


φ74.0 ± 0.5
100.0 ± 0.5
HOUSING
(METAL)
SIG
-HV
SIGNAL
OUTPUT
: BNC-R
-HV
: SHV-R

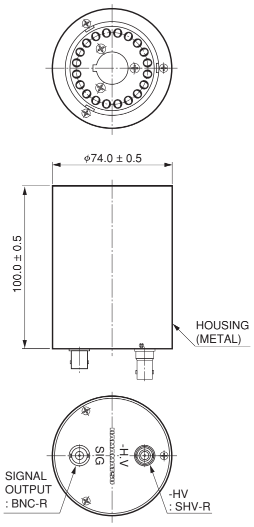

PMT
SOCKET
PIN No.
SIGNAL OUTPUT
: BNC-R
P
Dy14
Dy13
Dy12
Dy11
Dy10
Dy9
Dy8
Dy7
Dy6
Dy5
Dy4
Dy3
Dy2
Dy1
G2
G1
K
R21
R20
R19
R18
R17
R16
R15
R14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
C5
C4
C3
C2
C1
C6
R1
-HV
: SHV-R

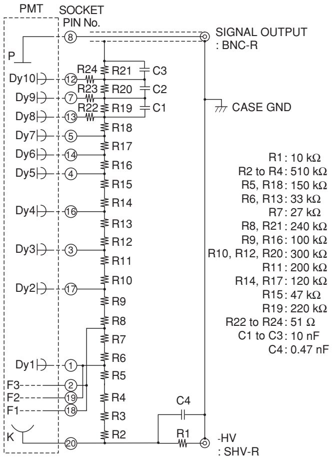
R1 : 10 kΩ
R2, R18 : 240 kΩ
R3 : 360 kΩ
R4 : 390 kΩ
R5 : 120 kΩ
R6 : 180 kΩ
R7 to R14 : 100 kΩ
R15, R16 : 150 kΩ
R17 : 300 kΩ
R19 : 51 Ω
R20, R21 : 100 Ω
C1 : 22 nF
C2 : 47 nF
C3 : 100 nF
C4 : 220 nF
C5 : 470 nF
C6 : 0.47 nF

The housing is internally connected to the GND.

TACCA0227EC

19 E7694-02

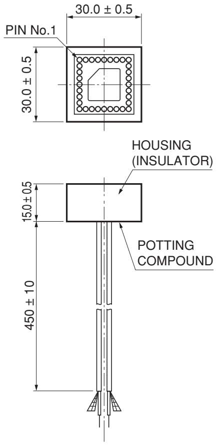

φ74.0 ± 0.5
100.0 ± 0.5
HOUSING
(METAL)
SIG
-HV
SIGNAL
OUTPUT
: BNC-R
-HV
: SHV-R

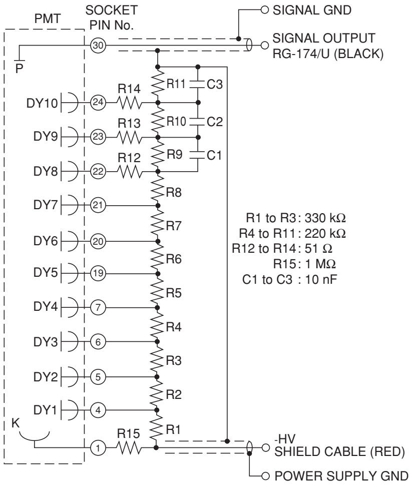

PMT
SOCKET
PIN No.
SIGNAL OUTPUT
: BNC-R
CASE GND
P
Dy10
Dy9
Dy8
Dy7
Dy6
Dy5
Dy4
Dy3
Dy2
Dy1
F3
F2
F1
K
R24
R23
R22
R21
R20
R19
R18
R17
R16
R15
R14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
C3
C2
C1
C4
R1
-HV
: SHV-R

R1 : 10 kΩ
R2 to R4 : 510 kΩ
R5, R18 : 150 kΩ
R6, R13 : 33 kΩ
R7 : 27 kΩ
R8, R21 : 240 kΩ
R9, R16 : 100 kΩ
R10, R12, R20 : 300 kΩ
R11 : 200 kΩ
R14, R17 : 120 kΩ
R15 : 47 kΩ
R19 : 220 kΩ
R22 to R24 : 51 Ω
C1 to C3 : 10 nF
C4 : 0.47 nF

TACCA0229EB

20 E5996

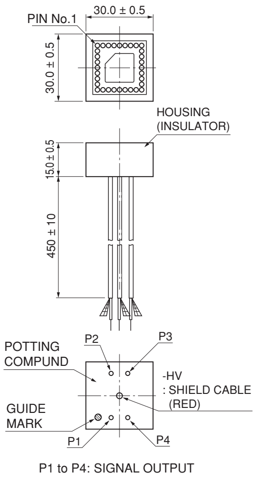

30.0 ± 0.5
PIN No.1
30.0 ± 0.5
HOUSING
(INSULATOR)
15.0 ± 0.5
POTTING
COMPOUND
450 ± 10


PMT
SOCKET
PIN No.
SIGNAL GND
SIGNAL OUTPUT
RG-174/U (BLACK)
P
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
R15
C3
C2
C1
-HV
SHIELD CABLE (RED)
POWER SUPPLY GND

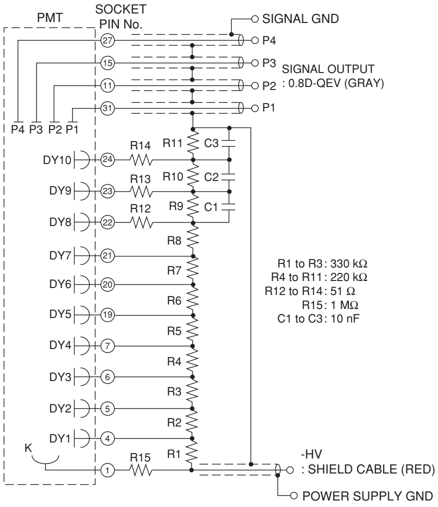
R1 to R3 : 330 kΩ
R4 to R11 : 220 kΩ
R12 to R14 : 51 Ω
R15 : 1 MΩ
C1 to C3 : 10 nF

TACCA0234ED

21 E7083


PIN No.1
30.0 ± 0.5
30.0 ± 0.5
HOUSING
(INSULATOR)
15.0 ± 0.5
450 ± 10
POTTING
COMPUND
P2
P3
-HV
: SHIELD CABLE
(RED)
GUIDE
MARK
P1
P4

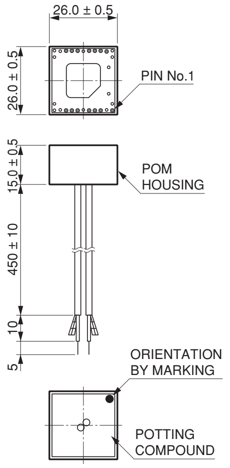
P1 to P4: SIGNAL OUTPUT
0.8D-QEV (GRAY)


PMT
SOCKET
PIN No.
SIGNAL GND
P4
P3
P2
P1
SIGNAL OUTPUT
: 0.8D-QEV (GRAY)
P4 P3 P2 P1
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R14
R13
R12
R11
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
R15
C3
C2
C1
-HV
: SHIELD CABLE (RED)
POWER SUPPLY GND

R1 to R3 : 330 kΩ
R4 to R11 : 220 kΩ
R12 to R14 : 51 Ω
R15 : 1 MΩ
C1 to C3 : 10 nF

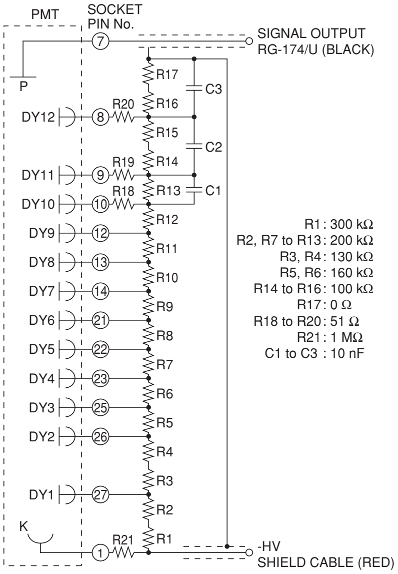
TACCA0162ED

22 E11807, E11807-01


26.0 ± 0.5
26.0 ± 0.5
PIN No.1
15.0 ± 0.5
POM HOUSING
450 ± 10
10
5
ORIENTATION BY MARKING
POTTING COMPOUND

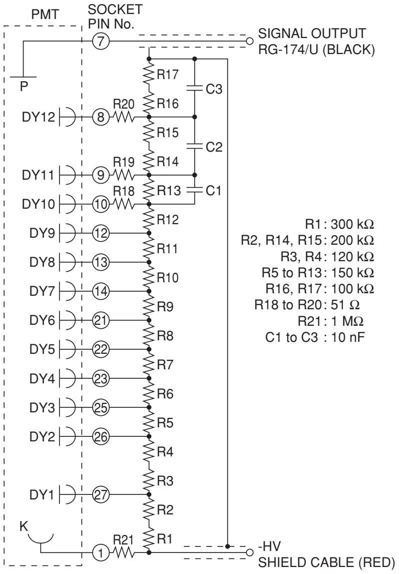
NOTE: Don't touch socket holes while high voltage is supplied in circuit.

E11807


PMT
SOCKET PIN No.
SIGNAL OUTPUT RG-174/U (BLACK)
P
DY12
DY11
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
C1
C2
C3
-HV SHIELD CABLE (RED)

R1 : 300 kΩ
R2, R7 to R13 : 200 kΩ
R3, R4 : 130 kΩ
R5, R6 : 160 kΩ
R14 to R16 : 100 kΩ
R17 : 0 Ω
R18 to R20 : 51 Ω
R21 : 1 MΩ
C1 to C3 : 10 nF

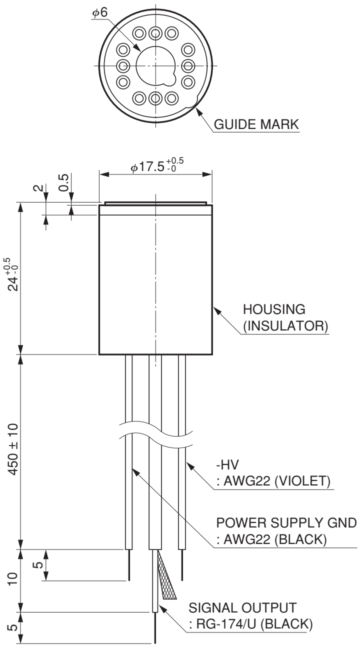
E11807-01


PMT
SOCKET PIN No.
SIGNAL OUTPUT RG-174/U (BLACK)
P
DY12
DY11
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
C1
C2
C3
-HV SHIELD CABLE (RED)

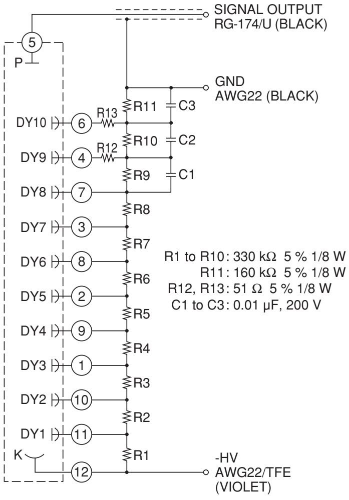
R1 : 300 kΩ
R2, R14, R15 : 200 kΩ
R3, R4 : 120 kΩ
R5 to R13 : 150 kΩ
R16, R17 : 100 kΩ
R18 to R20 : 51 Ω
R21 : 1 MΩ
C1 to C3 : 10 nF

TACCA0314EA

23 E10679-02


φ6
GUIDE MARK
φ17.5 +0.5 -0
2
0.5
24 +0.5 -0
HOUSING (INSULATOR)
450 ± 10
-HV : AWG22 (VIOLET)
POWER SUPPLY GND : AWG22 (BLACK)
10
5
5
SIGNAL OUTPUT : RG-174/U (BLACK)

* E10679-02 with SHV / BNC connector type (E10679-03) is also available.


SIGNAL OUTPUT RG-174/U (BLACK)
P
GND AWG22 (BLACK)
DY10
DY9
DY8
DY7
DY6
DY5
DY4
DY3
DY2
DY1
K
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
C1
C2
C3
-HV AWG22/TFE (VIOLET)

R1 to R10 : 330 kΩ 5 % 1/8 W
R11 : 160 kΩ 5 % 1/8 W
R12, R13 : 51 Ω 5 % 1/8 W
C1 to C3 : 0.01 μF, 200 V

MAXIMUM HIGH VOLTAGE = -1100 V
DIVIDER CURRENT = 318 μA

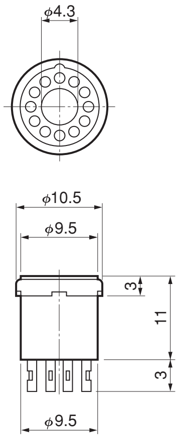
TACCA0299EA

TACCC0165EA

Dimensional outlines

For E678 series sockets

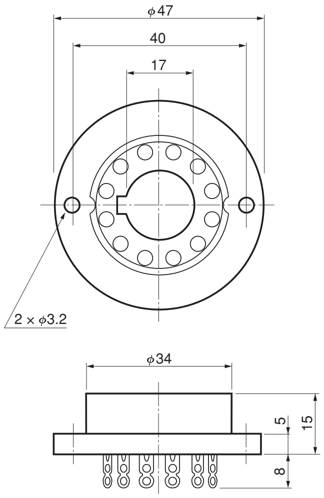
E678-11N



φ4.3
φ10.5
φ9.5
3
11
3
φ9.5

TACCA0043EA

E678-12A, E678-12R*

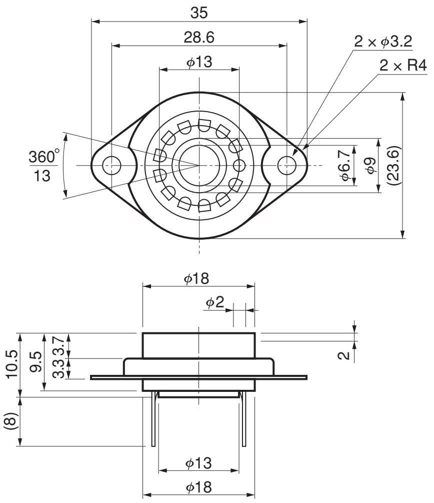


φ47
40
17
2 × φ3.2
φ34
5
15
8

* Gold plating type

TACCA0009EB

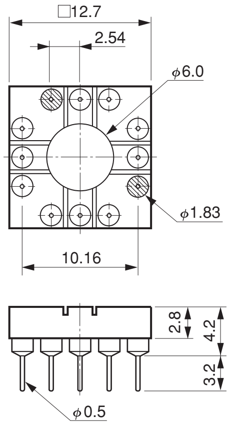
E678-12L



35
28.6
φ13
2 × φ3.2
2 × R4
360°
13
φ6.7
φ9
(23.6)
φ18
φ2
10.5
9.5
3.3
3.7
2
(8)
φ13
φ18

TACCA0047EA

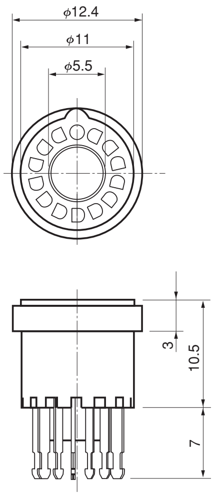
E678-12V



□12.7
2.54
φ6.0
φ1.83
10.16
2.8
4.2
3.2
φ0.5

TACCA0164EC

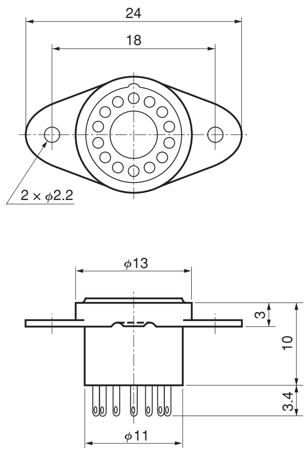
E678-13E



φ12.4
φ11
φ5.5
3
10.5
7

TACCA0013EB

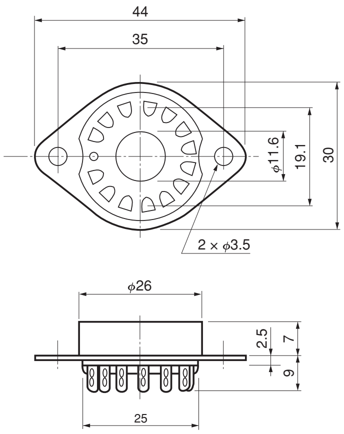
E678-13F



24
18
2 × φ2.2
φ13
3
10
3.4
φ11

TACCA0005EA

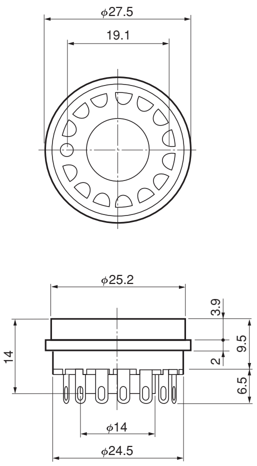
E678-14C



44
35
φ11.6
19.1
30
2 × φ3.5
φ26
2.5
7
9
25

TACCA0004EA

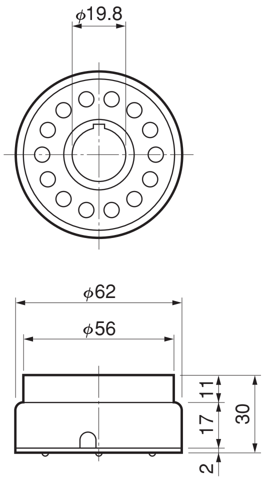
E678-14-03



φ27.5
19.1
φ25.2
3.9
14
9.5
2
6.5
φ14
φ24.5

TACCA0184EA

E678-14W

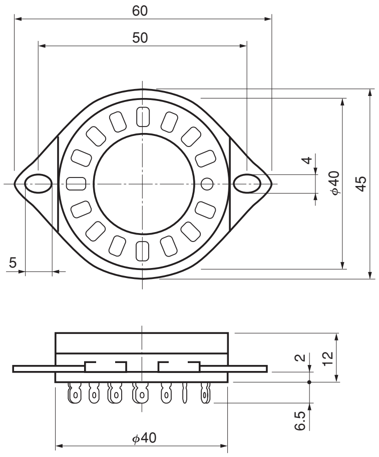


φ19.8
φ62
φ56
11
17
30
2

TACCA0200EA

(Unit: mm)

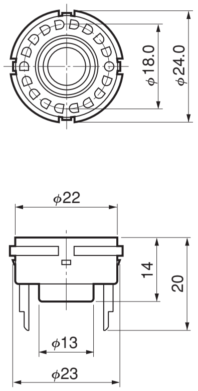
E678-15C



60
50
4
φ40
45
5
2
12
6.5
φ40

TACCA0201EA

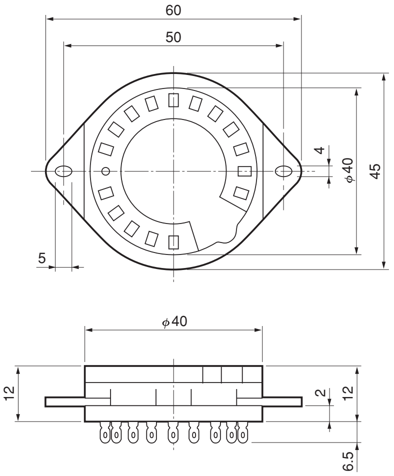
E678-17D



φ18.0
φ24.0
φ22
14
20
φ13
φ23

TACCA0046EC

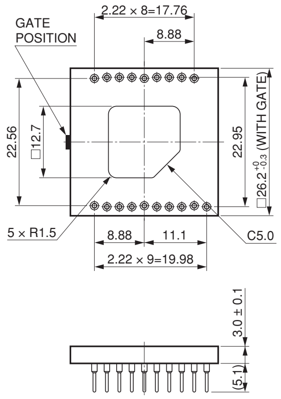
E678-19J



60
50
4
φ40
45
5
φ40
12
2
12
6.5

TACCA0203EA

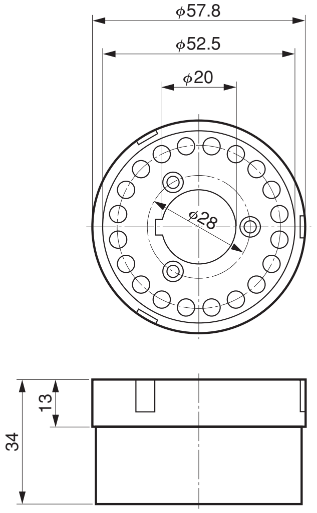
E678-19K



GATE POSITION
2.22 × 8=17.76
8.88
22.56
□12.7
22.95
□26.2 +0 -0.3 (WITH GATE)
5 × R1.5
8.88
11.1
C5.0
2.22 × 9=19.98
3.0 ± 0.1
(5.1)

TACCA0313EA

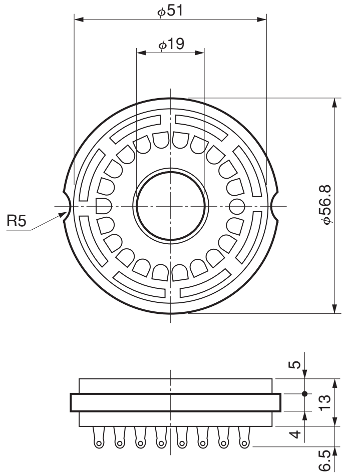
E678-20B



φ57.8
φ52.5
φ20
φ28
13
34

TACCA0309EA

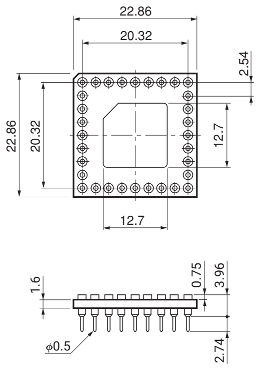
E678-21C



φ51
φ19
R5
φ56.8
5
13
4
6.5

TACCA0066EC

E678-32B



22.86
20.32
2.54
22.86
20.32
12.7
12.7
1.6
0.75
3.96
φ0.5
2.74

MATERIAL: Glass Epoxy

TACCA0094ED

Index by type No.

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R329-02	51 mm (2") dia. PMT	22
R331-05	51 mm (2") dia. PMT	22
R580	38 mm (1-1/2") dia. PMT	20
R647-01	13 mm (1/2") dia. PMT	20
E678 SERIES	Socket	68, 69
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R762	19 mm (3/4") dia. PMT	21
E849-90	Socket assembly	58
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R877	127 mm (5") dia. PMT	22
R877-01	127 mm (5") dia. PMT	23
R877-100	127 mm (5") dia. PMT (SBA type)	22
R960	13 mm (1/2") dia. PMT	21
E974-17	Socket assembly	58
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E990-29	Socket assembly	58
R1166	19 mm (3/4") dia. PMT	20
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R1288A-04	25 mm (1") dia. PMT	21
R1288A-06	25 mm (1") dia. PMT	20
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R1306-15	51 mm (2") dia. PMT	23
R1307	76 mm (3") dia. PMT	22
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R1635	10 mm (3/8") dia. PMT	20
R1828-01	51 mm (2") dia. PMT	22
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R1924A-01	25 mm (1") dia. PMT	21
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H6527	Hybrid assembly	28
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R7600U-300	Hybrid assembly (EGBA type)	24
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R7600U-200-M4	Metal package PMT (UBA type)	24
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E7694-03	Socket assembly	59
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R13089	51 mm (2") dia. PMT	22
R13408	38 mm (1-1/2") dia. PMT	20
R13435	51 mm (2") dia. PMT	22
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CAUTIONS AND WARRANTY

⚠ WARNING

HIGH
VOLTAGE

Take sufficient care to avoid an electric shock hazard

A high voltage used in photomultiplier tube operation may present a shock hazard. Photomultiplier tubes should be installed and handled only by qualified personnel that have been instructed in handling of high voltages. Designs of equipment utilizing these devices should incorporate appropriate interlocks to protect the operator and service personnel. The metal housing of the Metal Package PMT R8520-406 and R8520-506 and R11065 series and R11410 series are connected to the photocathode (potential) so that it becomes a high voltage potential when the product is operated at a negative high voltage (anode grounded).

PRECAUTIONS FOR USE

● Maximum ratings

Do not operate over maximum anode to cathode voltage. Excessive voltage causes electrical breakdown. The voltage lower than the maximum rating should be applied to the PMT.

● Handle tubes with extreme care

Photomultiplier tubes have evacuated glass envelopes. Allowing the glass to be scratched or to be subjected to shock can cause cracks. Extreme care should be taken in handling, especially for tubes with graded sealing of synthetic silica.

● Keep faceplate and base clean

Do not touch the faceplate and base with bare hands. Dirt and fingerprints on the faceplate cause loss of transmittance and dirt the base may cause ohmic leakage. Should they become soiled, wipe it clean using alcohol.

● Do not expose to strong light

Direct sunlight and other strong illumination may cause damage the Photocathode. They must not be allowed to strike the photocathode, even when the tube is not operated.

● Handling of tubes with a glass base

A glass base (also called button stem) is less rugged than a plastic base, so care should be taken in handling this type of tube. For example, when fabricating the voltage-divider circuit, solder the divider resistors to socket lugs while the tube is inserted in the socket.

● Cooling of tubes

When cooling a photomultiplier tube, the photocathode section is usually cooled. However, if you suppose that the base is also cooled down to -30 °C or below, please consult our sales office in advance.

● Helium permeation

helium will permeate through the glass bulb, leading to an increase in noise. avoid operating or storing tubes in an environment where helium is present. Helium permeation through silica glass is especially large.

Data and specifications listed in this catalog are subject to change due to product improvement and other factors. before specifying any of the types in your production equipment, please consult our sales office.

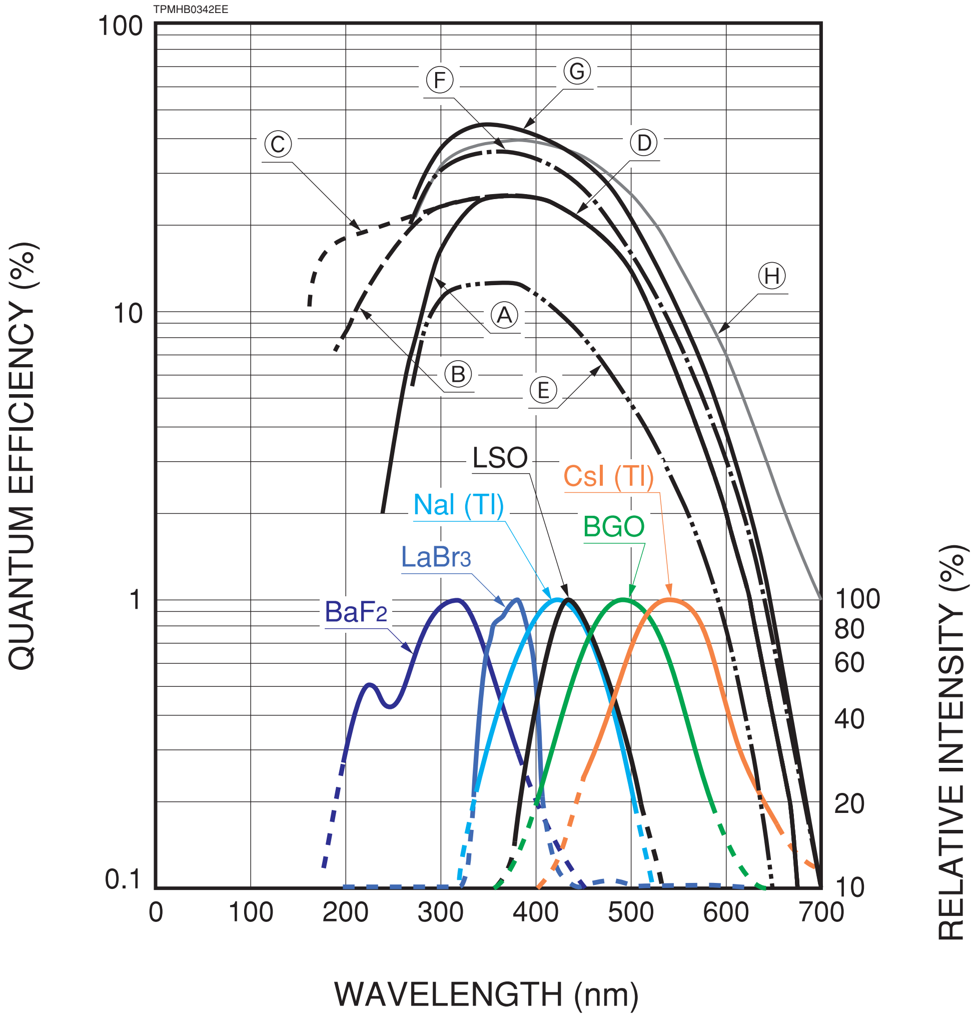
WARRANTY

Hamamatsu photomultiplier tubes and related products are warranted to the original purchaser for a period of 12 months after delivery. The warranty is limited to repair or replacement of a defective product due to defects in workmanship or materials used in its manufacture.

However, even if within the warranty period the warranty shall not apply to failures or damages caused by misoperation, mishandling, modification or accidents such as natural or man-made disasters.

The customer should inspect and test all products as soon as they are delivered.

Typical photocathode spectral response and emission spectrum of scintillators



Ⓐ: Bialkali photocathode (Borosilicate glass)
Ⓑ: Bialkali photocathode (UV glass)
Ⓒ: Bialkali photocathode (Silica glass)
Ⓓ: Bialkali photocathode
Ⓔ: High temp. bialkali photocathode
Ⓕ: Super bialkali
Ⓖ: Ultra bialkali
Ⓗ: Extended green bialkali

HAMAMATSU
PHOTON IS OUR BUSINESS

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- Si photodiodes
- APD
- MPPC®
- Photo IC
- Image sensors
- PSD
- Infrared detectors
- LED
- Optical communication devices
- Automotive devices
- X-ray flat panel sensors
- MEMS devices
- Mini-spectrometers
- Opto-semiconductor modules

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- Photomultiplier tube modules
- Microchannel plates
- Image intensifiers
- Xenon lamps / Mercury-xenon lamps
- Deuterium lamps
- Light source applied products
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- X-ray imaging devices

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- Scientific cameras
- Spectroscopic and optical measurement systems
- Ultrafast photometry systems
- Life science systems
- Medical systems
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- Semiconductor manufacturing support systems
- Material research systems

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- Laser diode bar modules
- Quantum cascade lasers
- Applied products of semiconductor lasers
- Solid state lasers
- Laser related products

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- Please thoroughly read the precautions and the prohibited uses included in the user manual before installation and use.

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