

# HAMAMATSU

## METAL PACKAGE PHOTOMULTIPLIER TUBE R7400U SERIES

**Compact size (16 mm diameter, 12 mm seated length),  
Fast Time response (rise time 0.78 ns)**

The R7400U series is a subminiature photomultiplier tube with a 16 mm diameter and 12 mm seated length. A precision engineered 8-stage electron multiplier (composed of metal channel dynodes) is incorporated in the TO-8 package to produce a noise free gain of 700,000 times (R7400U). The R7400U series also features excellent response time with a rise time of 0.78 ns. Various types of the R7400U series are available with different spectral response and gain ranges, including those selected specifically for photon counting applications. Hamamatsu also provides a lens input option to the series (R7401 and R7402), effectively doubling the active area.



Left: R7400U Right: R7401/R7402

### FEATURES

- World's smallest photomultiplier tubes assembled. (1/7th of the Hamamatsu R647)  
The necessary components are built into a TO-8 package while retaining full photomultiplier tube performance to create a new generation of photosensors.
- Specially selected on account of low noise and high gain. For use in photon counting applications.
- The lens window type doubles the effective input area to 12 mm in diameter.

### SERIES

	Solar Blind	UV to Visible Range		Visible Range	Visible to Near IR Range			UV to Near IR Range
Standard	R7400U-09	R7400U-03	R7400U-06	R7400U	R7400U-01	R7400U-02	R7400U-20	R7400U-04
For Photon Counting	—	—	—	R7400P, R7401P	—	—	—	—
With Lens	—	—	—	R7401	R7402	R7402-02	R7402-20	—

### SPECIFICATIONS

#### GENERAL

Parameter		Description/Value	Unit
Minimum Effective Area		$\phi 8$	mm
Dynode	Structure	Metal Channel	—
	Number of Stages	8	—
Weight	Without Lens	Approx. 5.3	g
	With Lens	Approx. 6.3	g
Operating Ambient Temperature and Storage Temperature	Without Lens	-80 to +50	°C
	With Lens	-30 to +50	°C

#### VOLTAGE DISTRIBUTION RATIO

Electrodes	K	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	P
Ratio	1	1	1	1	1	1	1	1	1	0.5

Supply Voltage: 800 V K: Cathode Dy: Dynode P: Anode

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# METAL PACKAGE PHOTOMULTIPLIER TUBE R7400U SERIES

## CHARACTERISTICS (at 25 °C)

Type No.	Remarks	Spectral Response		Photo-cathode Material	Window Material	Out-(a) line No.	Maximum Ratings		Cathode Characteristics				
		Range (nm)	Peak Wave-length (nm)				Anode to Cathode Voltage (V)	Average Anode Current <sup>(b)</sup> (mA)	Luminous		Blue Sensitivity Index (CS 5-58) Typ.	Red/White Ratio (R-68) Typ.	Radiant Typ. (mA/W)
									Min. (μA/lm)	Typ. (μA/lm)			
R7400U-09	Solar Blind	160 to 320	240	Cs-Te	Synthetic silica	②	1000	0.01	—	—	—	—	10 <sup>(c)</sup>
R7400U	Visible	300 to 650	420	Bialkali	Borosilicate glass	①	1000	0.1	40	70	8	—	62
R7400U-03	UV to Visible	185 to 650	420	Bialkali	UV glass	①	1000	0.1	40	70	8	—	62
R7400U-06	UV to Visible	160 to 650	420	Bialkali	Synthetic silica	②	1000	0.1	40	70	8	—	62
R7400U-01	Visible to Near IR	300 to 850	400	Multialkali	Borosilicate glass	①	1000	0.1	80	150	—	0.20	60
R7400U-02	Visible to Near IR	300 to 880	500	Multialkali	Borosilicate glass	①	1000	0.1	200	250	—	0.25	58
R7400U-20	Visible to Near IR	300 to 920	630	Multialkali	Borosilicate glass	①	1000	0.1	350	500	—	0.45	78
R7400U-04	UV to Near IR	185 to 850	400	Multialkali	UV glass	①	1000	0.1	80	150	—	0.20	60
R7401	With Lens	300 to 650	420	Bialkali	Borosilicate glass	③	1000	0.1	40	70	8	—	62
R7402	With Lens	300 to 850	400	Multialkali	Borosilicate glass	③	1000	0.1	80	150	—	0.20	60
R7402-02	With Lens	300 to 880	500	Multialkali	Borosilicate glass	③	1000	0.1	200	250	—	0.25	58
R7402-20	With Lens	300 to 920	630	Multialkali	Borosilicate glass	③	1000	0.1	350	500	—	0.45	78

(a): See figure 11. (b): Averaged over any interval of 30 seconds maximum. (c): Measured at 254 nm. (d): Measured after 30 minutes storage in darkness. (e): Measured at 410 nm, at -800 V, with an input pulse width less than 30 ps. (f): Measured at a gain of 10<sup>6</sup>.

Figure 1: Typical Spectral Response (Cs-Te)

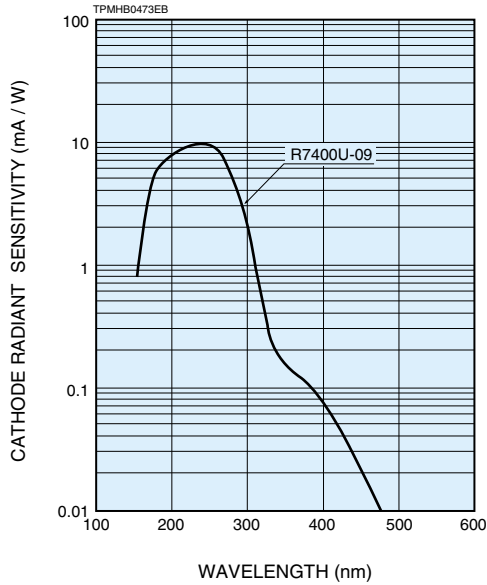


Figure 2: Typical Spectral Response (Bialkali)

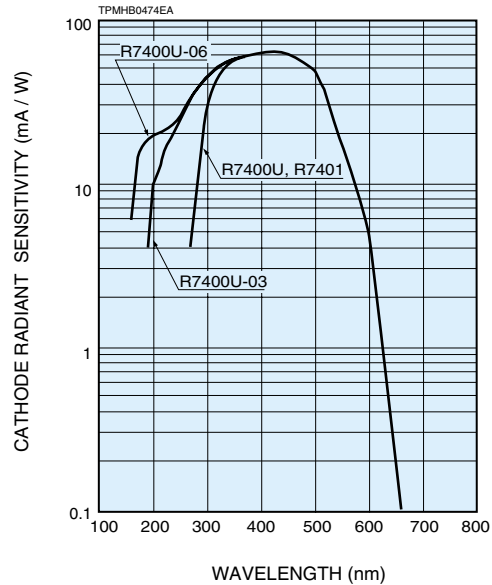
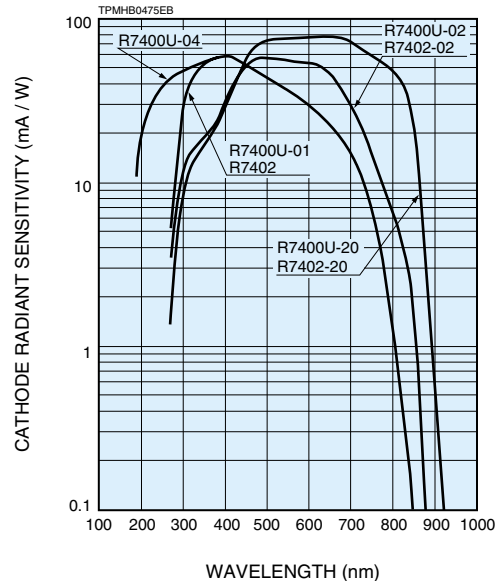


Figure 3: Typical Spectral Response (Multialkali)



Anode to Cathode Supply Voltage (V)	Anode Characteristics										Type No.
	Anode Sensitivity			Gain Typ.	Anode Dark Current (d)			Time Response			
	Luminous Min. (A/Im)	Luminous Typ. (A/Im)	Radiant Typ. (A/W)		Typ. (nA)	Max. (nA)	Rise Time Typ. (ns)	Transit Time Typ. (ns)	Transit Time Spread (T.T.S.) (ns)		
800	—	—	1100(c)	$5 \times 10^4$	0.025	0.5	0.78	5.4	0.23	R7400U-09	
800	10	50	$4.3 \times 10^4$	$7 \times 10^5$	0.2	2	0.78	5.4	0.23	R7400U	
800	10	50	$4.3 \times 10^4$	$7 \times 10^5$	0.2	2	0.78	5.4	0.23	R7400U-03	
800	10	50	$4.3 \times 10^4$	$7 \times 10^5$	0.2	2	0.78	5.4	0.23	R7400U-06	
800	15	75	$3.0 \times 10^4$	$5 \times 10^5$	0.4	4	0.78	5.4	0.23	R7400U-01	
800	25	125	$2.9 \times 10^4$	$5 \times 10^5$	2	20	0.78	5.4	0.23	R7400U-02	
800	35	250	$3.9 \times 10^4$	$5 \times 10^5$	2	20	0.78	5.4	0.23	R7400U-20	
800	15	75	$3.0 \times 10^4$	$5 \times 10^5$	0.4	4	0.78	5.4	0.23	R7400U-04	
800	10	50	$4.3 \times 10^4$	$7 \times 10^5$	0.2	2	0.78	5.4	0.23	R7401	
800	15	75	$3.0 \times 10^4$	$5 \times 10^5$	0.4	4	0.78	5.4	0.23	R7402	
800	25	125	$2.9 \times 10^4$	$5 \times 10^5$	2	20	0.78	5.4	0.23	R7402-02	
800	35	250	$3.9 \times 10^4$	$5 \times 10^5$	2	20	0.78	5.4	0.23	R7402-20	

For Photon Counting (P Type)				
Type No.	Gain		Dark Count (f) (s <sup>-1</sup> )	
	Min.	Typ.	Typ.	Max.
R7400P	$7.5 \times 10^5$	$1 \times 10^6$	80	400
R7401P	$7.5 \times 10^5$	$1 \times 10^6$	80	400

Figure 4: Typical Gain Characteristics

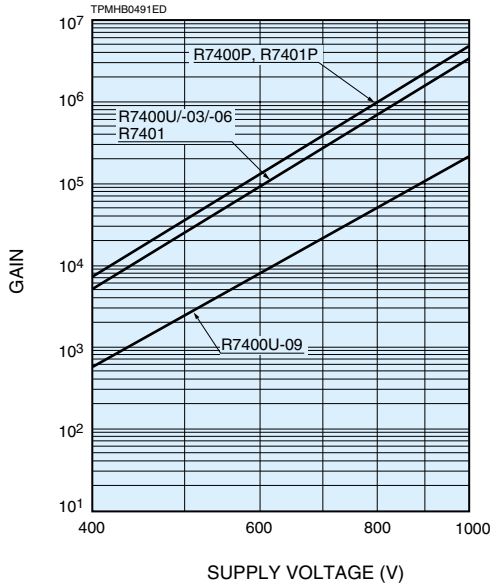


Figure 5: Typical Gain Characteristics

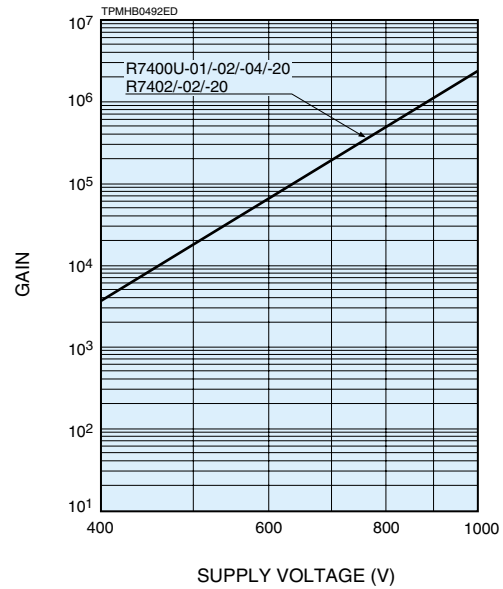


Figure 6: Anode Dark Current (v.s. Supply Voltage)

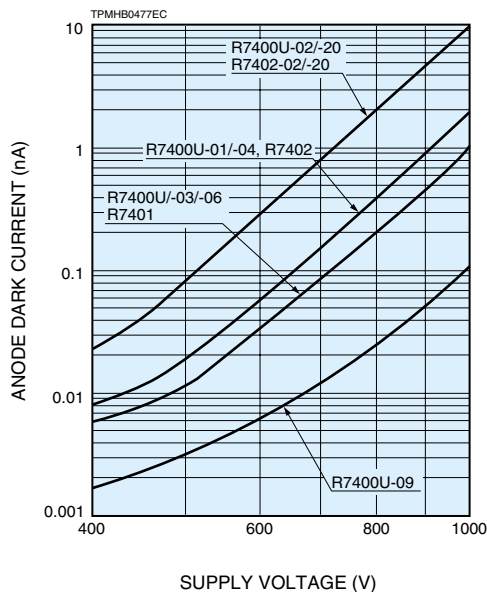
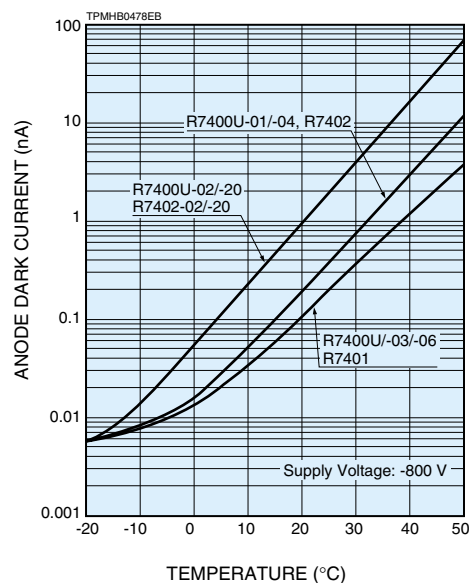


Figure 7: Anode Dark Current (v.s. Temperature)



# METAL PACKAGE PHOTOMULTIPLIER TUBE R7400U SERIES

Figure 8: Transmittance of Lens

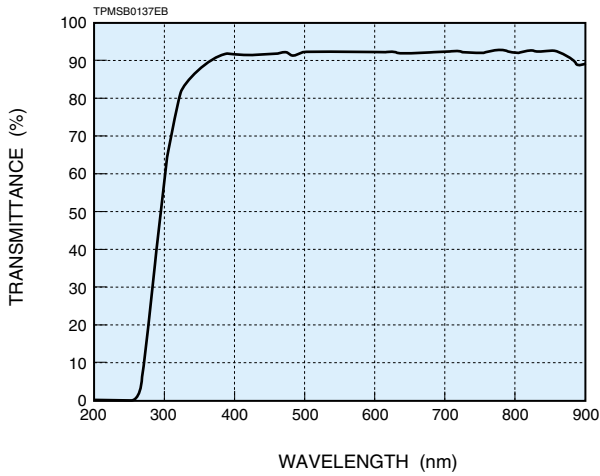
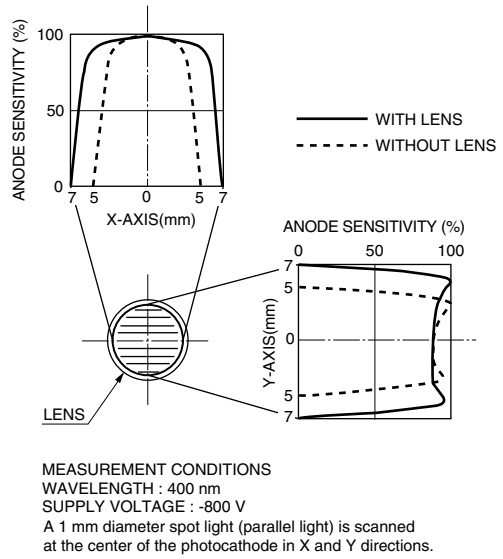


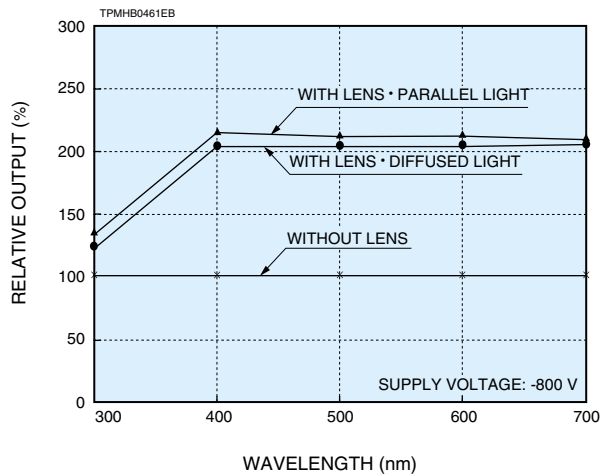
Figure 9: Lens Effect



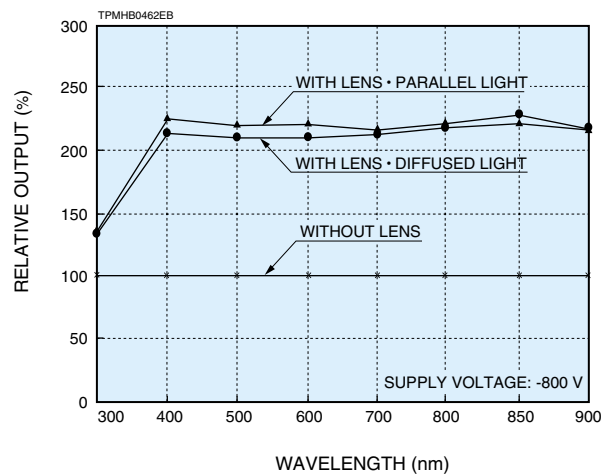
TPMHC0153EB

Figure 10: Lens Effect

● R7401



● R7402

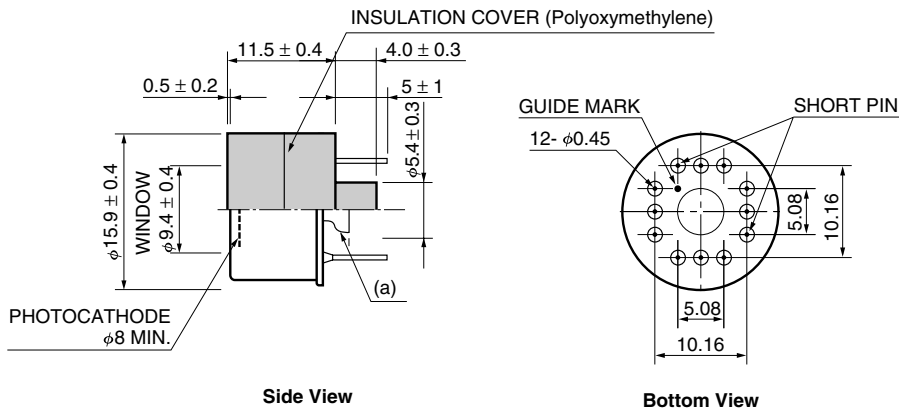


Parallel light : Parallel light from a 40 mm diameter parallel light source insuring uniform intensity over the entire active area of the photomultiplier tube.

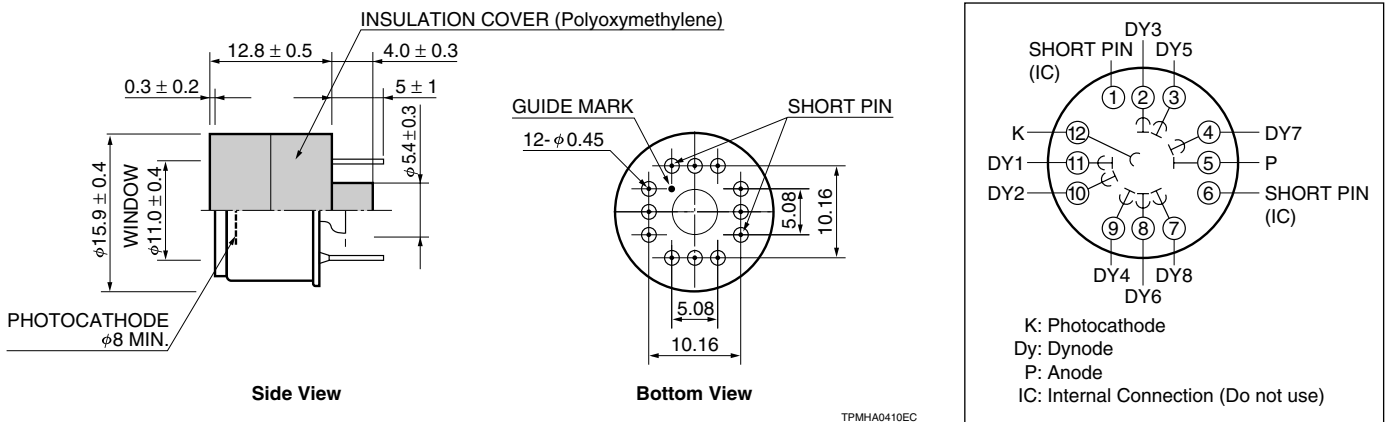
Diffused light: Diffused light from a 40 mm diameter parallel light source and a diffuser placed 10cm from the detector. The entire active area of the PMT is exposed.

Figure 11: Dimensional Outline and Basing Diagram (Unit: mm)

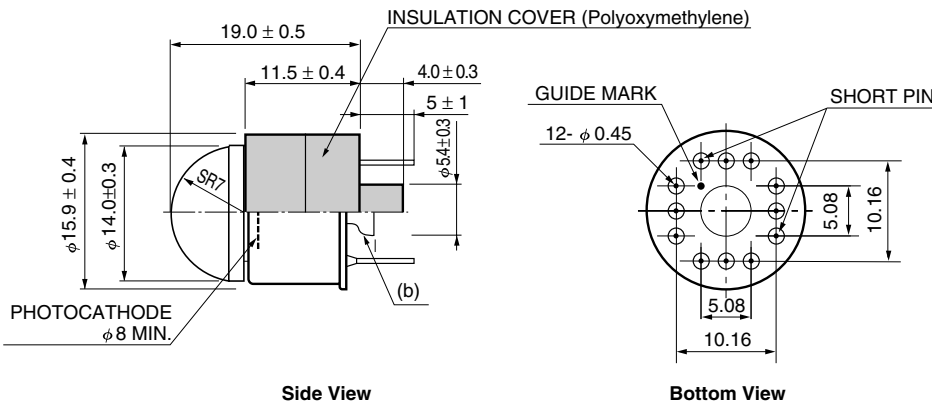
① R7400U/ -01/ -02/ -03/ -04/ -20, R7400P



② R7400U-06/ -09



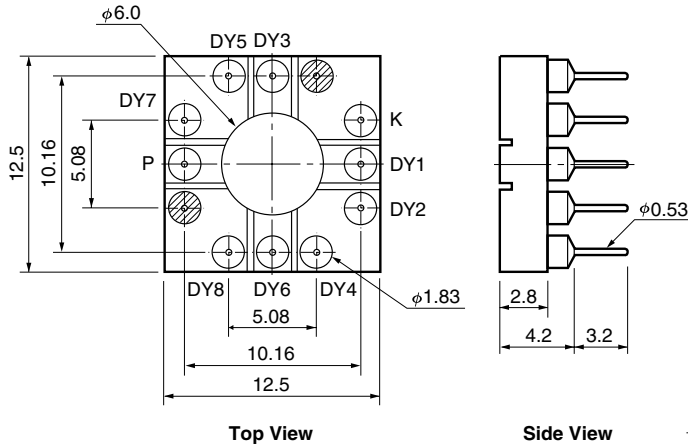
③ R7401, R7401P, R7402/ -02/ -20



# METAL PACKAGE PHOTOMULTIPLIER TUBE R7400U SERIES

ACCESSORIES (Unit: mm) **SOLD SEPARATELY**

## ● Socket E678-12M



TACCA0059ED

## ● D Type Socket Assemblies E5770/E5780

These are current-output type, small socket assemblies with an internal voltage divider circuit, specifically designed for use with the R7400U series.

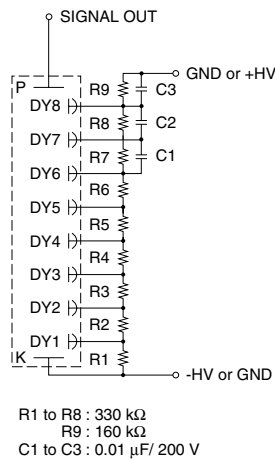
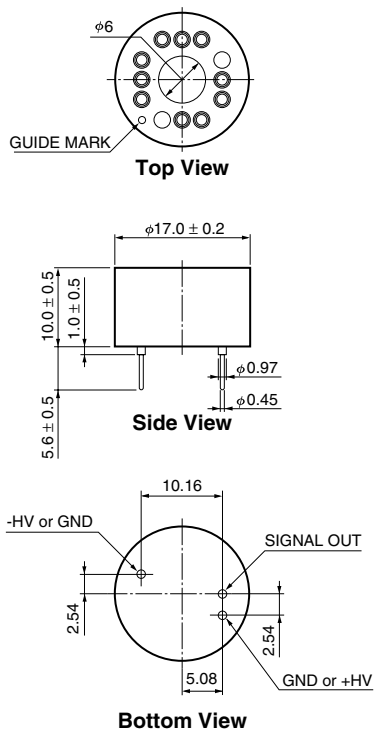
Type No.	Grounded Electrode	Divider Resistance (Total)	Maximum Linear Output of Photomultiplier Tube (DC Mode)	Operating Ambient Temperature <sup>(c)</sup>	Storage Temperature <sup>(c)</sup>	Output Signal	
						Cathode Grounded	Anode Grounded
E5770 <sup>(a)</sup>	Anode/Cathode	2.8 MΩ	13 μA	0 °C to +50 °C	-15 °C to +60 °C	Pulse	DC/Pulse
E5780 <sup>(b)</sup>	Anode					—	DC/Pulse

(a): When operating the E5770 with the cathode grounded (positive high voltage applied to the anode), use a high-voltage resistant capacitor to isolate the signal from the positive high voltage.

(b): The E5780 must be operated with the anode grounded (negative high voltage applied to the cathode). If you need a variant type operating with the cathode grounded (positive high voltage applied to the anode), then consult with our sales office.

(c): No condensation

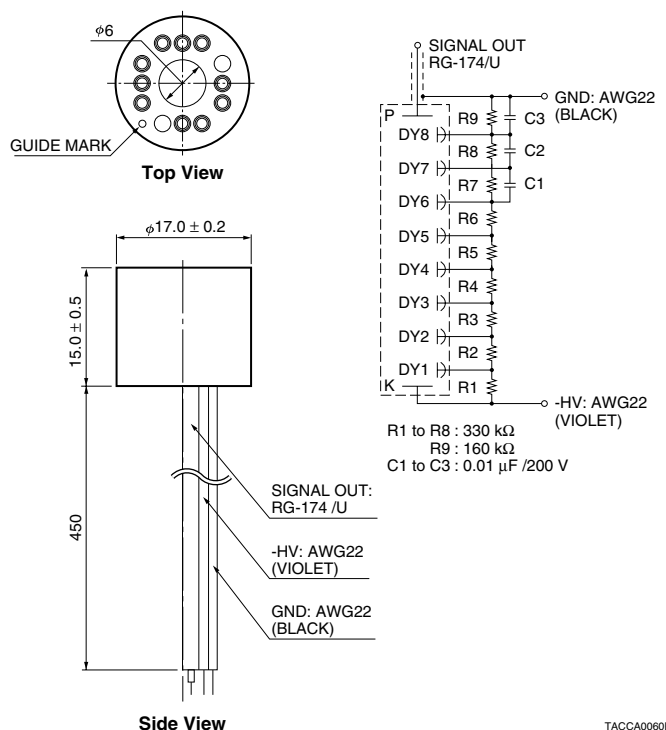
### PC-board Mounting Type E5770



For +HV, it will be necessary to use a coupling capacitor between the output and the customer's signal processing circuit.

TACCA0057EG

### Cable Output Type E5780



TACCA0060EF

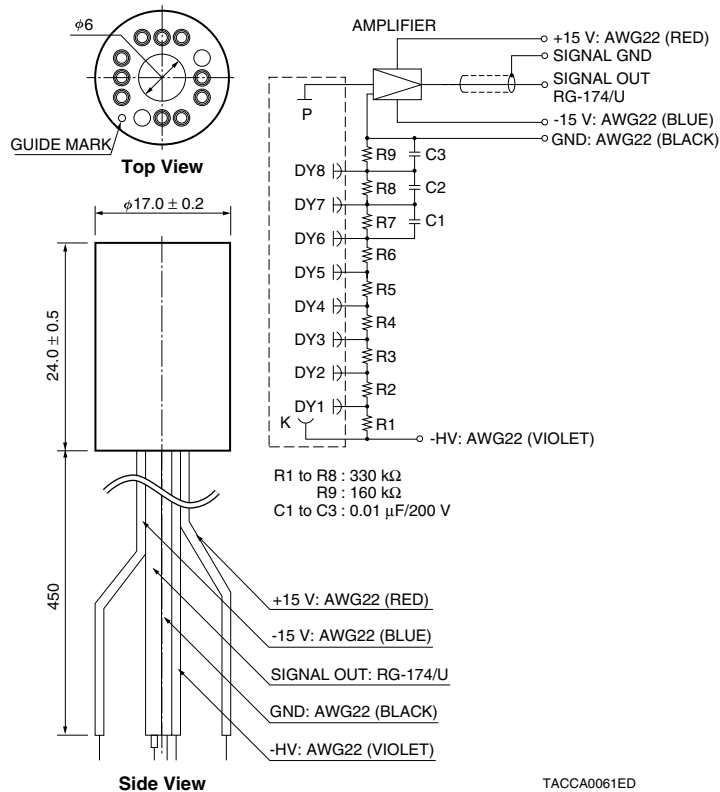
## ● DA Type Socket Assembly C5781

The C5781 is a subminiature socket assembly that incorporates a voltage divider circuit and a low-noise amplifier.

### SPECIFICATIONS of Built-in Amplifier

Parameter	Value	Unit
Input Voltage for Amplifier	±15	V
Current to Voltage Conversion Factor	1	V/μA
Maximum Output Voltage (with no load resistor)	10	V
Bandwidth (-3 db)	Typ. DC to 20	kHz
Operating Ambient Temperature (a)	0 to +40	°C
Storage Temperature (a)	-15 to +60	°C

(a): No condensation

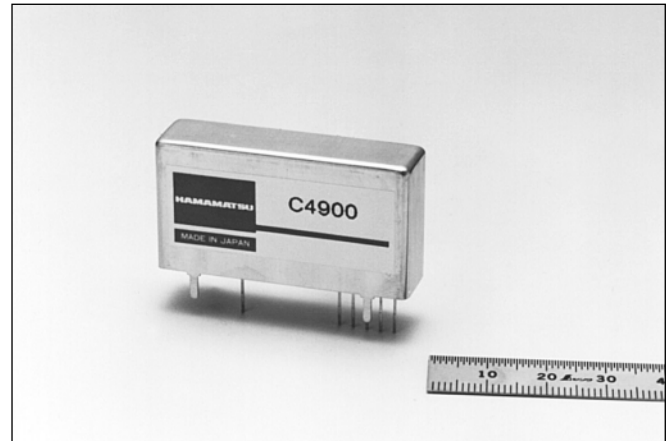


TACCA0061ED

## ● Compact High Voltage Power Supply Units C4900 Series

The C4900 series is an on-board type high voltage power supply unit, with a design that aims at providing both "compactness and high performance".

The newly developed circuit achieves high performance and low power consumption. The C4900 series in addition provides enhanced protective functions yet is offered at lower costs.



### SPECIFICATIONS

Parameter	C4900	C4900-01	C4900-50	C4900-51
Input Voltage	+15 V	+12 V	+15 V	+12 V
Input Current (a)	① 14 mA	15 mA	14 mA	15 mA
	② 90 mA	95 mA	90 mA	95 mA
Variable Output Range	0 V to -1250 V		0 V to +1250 V	
Maximum Output Current	0.6 mA	0.5 mA	0.6 mA	0.5 mA
Ripple Noise (p-p)	0.007 % Typ.			
Line Regulation (b)	±0.01 % Typ.			
Load Regulation (c)	±0.01 % Typ.			
Operating Ambient Temperature (d)	0 °C to +50 °C			
Storage Temperature	-20 °C to +70 °C			
Dimension (e) (W×H×D)	46 mm × 24 mm × 12 mm			

① With No Load

② With Full Load

(a): At Maximum Output Voltage.

(b): Against ±1 V Change.

(c): Against 0 to 100 % Load Change.

(d): At Maximum Output Voltage and Current.

(e): Excluding Projecting Parts

# METAL PACKAGE PHOTOMULTIPLIER TUBE R7400U SERIES

## WARNING: HIGH VOLTAGE



The metal package photomultiplier tubes are operated by applying a high voltage. Use extreme caution to avoid electrical shock and damage to the peripheral equipment and be sure to provide adequate safety measures as needed. As safety measures, an insulation cover is fitted to the metal package which is electrically connected to the photocathode. When operated with the cathode at a high voltage (anode ground scheme), the metal package will be at this same high voltage level. Removing the insulation cover is extremely dangerous, so never attempt to remove it from the package.

## RELATED PRODUCTS

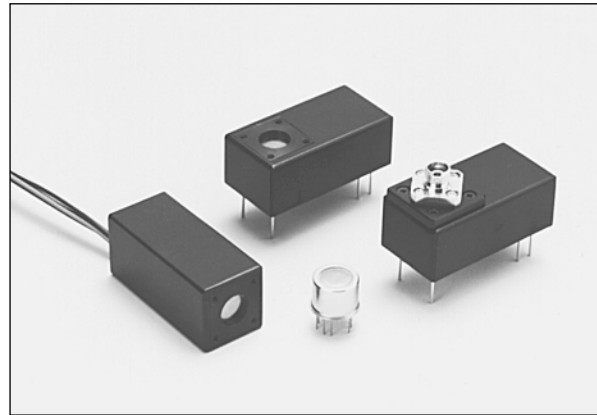
### PHOTOSENSOR MODULES H5773/H5783/H6779/H6780/H5784 SERIES

The H5773/H5783/H6779/H6780 series are photo-sensor modules that incorporate a metal package PMT along with a high-voltage power supply. These photosensor modules operate from a low-voltage supply (+15 V: H5773/H5783/H6779/H6780 series, -15 V: H5784 series) and feature higher sensitivity, wider dynamic range and faster time response compared to conventional photosensors.

The H5773 and H6779 series photosensor modules are a lead pin output type that can be directly mounted on a PC board. The H5783 and H6780 series photosensor modules are a flexible cable output type. The H5784 series is also a cable output type that further contains a low-noise amplifier circuit (DC to 20 kHz). When used with an optional optical fiber adapter (E5776), light can be directly guided to the photosensitive surface through an optical fiber.

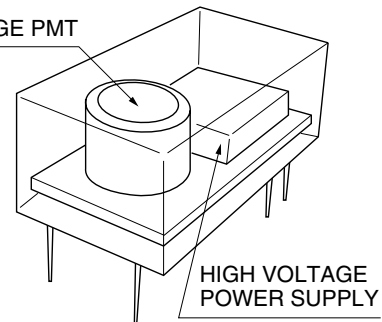
#### FEATURES

- Low Power Consumption
- Low Voltage Drive
- Easy to Use
- High Sensitivity
- Wide Dynamic Range
- Fast Time Response



Left: H6780 Center: H6779 Right: H6779 with E5776  
Front: METAL PACKAGE PMT

METAL PACKAGE PMT



H6779

TPMHC0093EB

H5773, H6779 Series: SIZE 25(W) × 18(H) × 50(D) mm WEIGHT: 60 g  
H5783, H6780 Series: SIZE 22(W) × 22(H) × 50(D) mm WEIGHT: 80 g  
H5784 Series : SIZE 22(W) × 22(H) × 60(D) mm WEIGHT: 100 g

\*PATENT: USA: 5410211 and other(9), GBR: 551767 and other(9), DEU: 69209809 and other(9), FRA: 551767 and other(9), JPN: 3078905 and other(9)

# HAMAMATSU

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