HAMAMATSU

PHOTON IS OUR BUSINESS

PHOTOMULTIPLIER TUBES
R7446
R7446P (For photon counting)

FEATURES

- **Spectral response ..... 160 nm to 680 nm**
- **Cathode sensitivity**
  - **Luminous ..... 60 μA/lm**
  - **Radiant at 400 nm ..... 60 mA/W**
- **Anode sensitivity (at 1000 V)**
  - **Luminous ..... 400 A/lm**
  - **Radiant at 400 nm ..... 4.0×10^5 A/W**
- **Low dark current ..... 0.1 nA**
- **Low dark counts (R7446P) ..... 10 s^{-1}**

APPLICATIONS

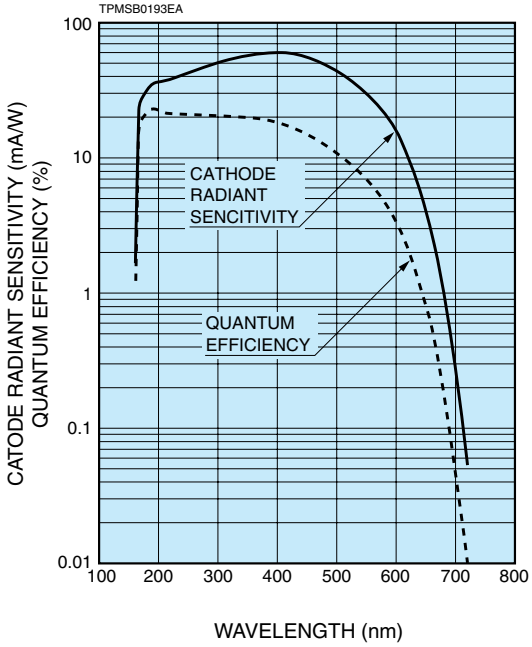
- **Environmental monitoring**
- **Atomic emission spectrometer**
- **Atomic absorption spectrometer**

SPECIFICATIONS

GENERAL

Parameter		Description / Value	Unit
Spectral response		160 to 680	nm
Wavelength of maximum response		400	nm
Photocathode	Material	Low noise bialkali	—
	Minimum effective area	8 × 24	mm
Window material		Fused sillica	—
Dynode	Secondary emitting surface	Low noise bialkali	—
	Structure	Circular-cage	—
	Number of stages	9	—
Direct interelectrode capacitances	Anode to last dynode	4	pF
	Anode to all other electrodes	6	pF
Base		11-pin base JEDEC No. B11-88	—
Weight		Approx. 45	g
Suitable socket		E678–11A (sold separately)	—
Suitable socket assembly		E717–63 (sold separately)	—

Figure 1: Typical spectral response



PHOTOMULTIPLIER TUBES
R7446, R7446P (For photon counting)

MAXIMUM RATINGS (Absolute maximum values)

Parameter		Value	Unit
Supply voltage	Between anode and cathode	1250	V
	Between anode and last dynode	250	V
Average anode current [A]		0.1	mA
Ambient temperature		-30 to +50	°C

CHARACTERISTICS (at 25 °C)

Parameter		R7446 (for general purpose)			R7446P (for photon counting)			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Cathode sensitivity	Quantum efficiency (at peak wavelength)	—	20	—	—	20	—	%
	Luminous [B]	40	60	—	40	60	—	μA/lm
	Radiant (at peak wavelength)	—	60	—	—	60	—	mA/W
	Blue sensitivity index [C]	—	6.4	—	—	6.4	—	μA/lm-b
Anode sensitivity	Luminous [D]	200	400	—	200	400	—	A/lm
	Radiant (at 400 nm)	—	4.0×10^5	—	—	4.0×10^5	—	AW
Gain [E]		—	6.7×10^6	—	—	6.7×10^6	—	—
Anode dark current [E] (After 30 min storage in the darkness)		—	0.1	2.0	—	0.1	0.5	nA
Anode dark counts [F]		—	—	—	—	10	50	s^{-1}
ENI (Equivalent noise input) [G]		—	3.7×10^{-17}	—	—	3.7×10^{-17}	—	W
Time response [D]	Anode pulse rise time [H]	—	2.2	—	—	2.2	—	ns
	Electron transit time [J]	—	22	—	—	22	—	ns
	Transit time spread (T.T.S.) [K]	—	1.2	—	—	1.2	—	ns

NOTES

A: Averaged over any interval of 30 seconds maximum.

B: The light source is a tungsten filament lamp operated at a distribution temperature of 2856 K. Supply voltage is 150 volts between the cathode and all other electrodes connected together as anode.

C: The value is cathode output current when a blue filter(Corning CS-5-58 polished to 1/2 stock thickness) is interposed between the light source and the tube under the same condition as Note B.

D: Measured with the same light source as Note B and with the anode-to-cathode supply voltage and voltage distribution ratio shown in Table 1 below.

E: Measured with the same supply voltage and voltage distribution ratio as Note D after removal of light.

F: Measured at the voltage producing the gain of 1×10^6.

G: ENI is an indication of the photon-limited signal-to-noise ratio. It refers to the amount of light in watts to produce a signal-to-noise ratio of unity in the output of a photomultiplier tube.

$$ENI = \frac{\sqrt{2q \cdot Idb \cdot G \cdot f}}{S}$$

where q = Electronic charge (1.60×10^{-19} coulomb).
Idb = Anode dark current(after 30 minute storage) in amperes.
G = Gain.
f = Bandwidth of the system in hertz. 1 hertz is used.
S = Anode radiant sensitivity in amperes per watt at the wavelength of peak response.

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

J: The electron transit time is the interval between the arrival of delta function light pulse at the entrance window of the tube and the time when the anode output reaches the peak amplitube. In measurement, the whole photocathode is illuminated.

K: Also called transit time jitter. This is the fluctuation in electron transit time between individual pulses in the signal photoelectron mode, and may be defined as the FWHM of the frequency distribution of electron transit times.

Table 1:Voltage distribution ratio

Electrode	K	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	P
Distribution ratio	1	1	1	1	1	1	1	1	1	1	

Supply Voltage : 1000 V
K : Cathode, Dy : Dynode, P : Anode

Figure 2: Typical gain and anode dark current

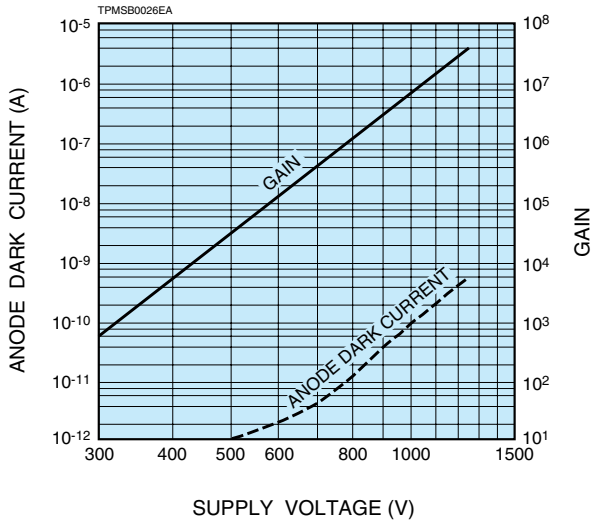


Figure 3: Typical time response

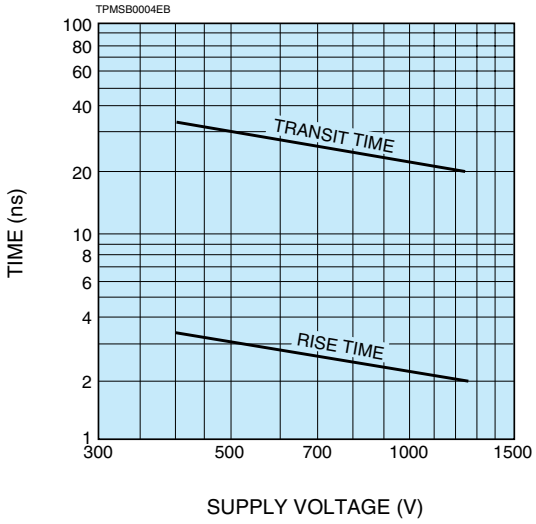


Figure 4: Typical ENI vs. wavelength

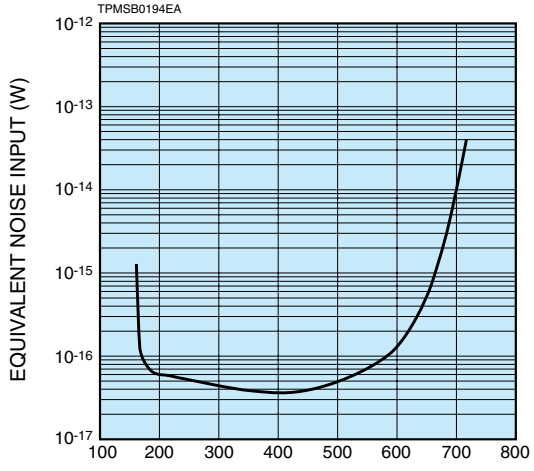
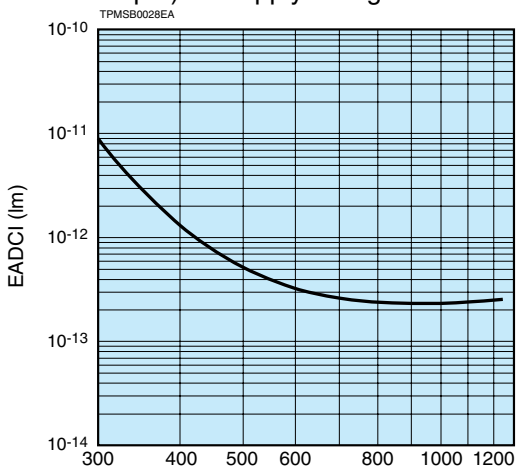


Figure 5: Typical EADCI (Equivalent Anode Dark Current Input) vs. supply voltage



Data shown here, which is given from a relation among supply voltage, anode sensitivity and dark current, serves as a good reference in order to determine the most suitable supply voltage or its range.

Figure 6: Typical single photon height distribution for R7446P

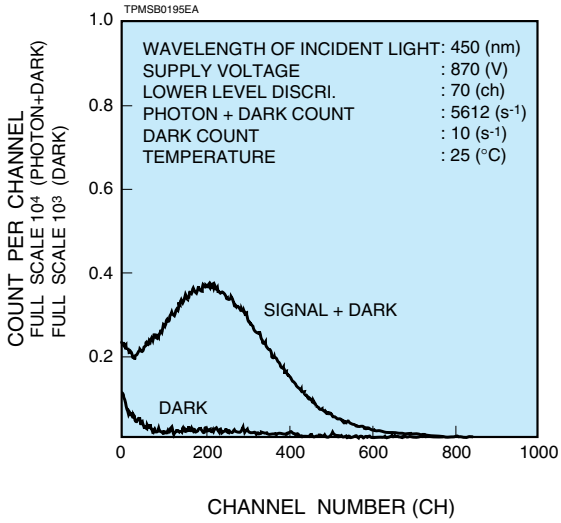


Figure 7: Typical temperature characteristics of dark count for R7446P

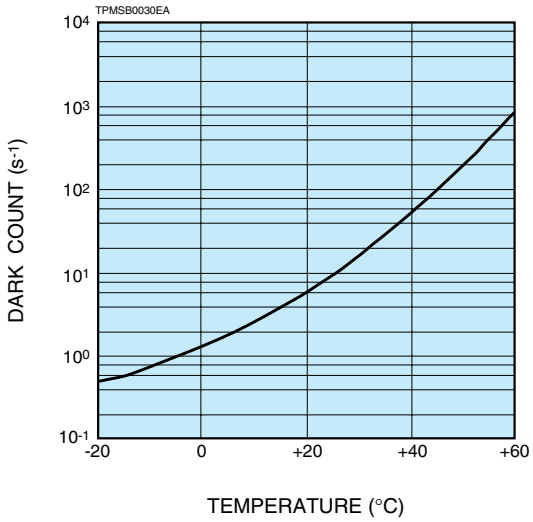
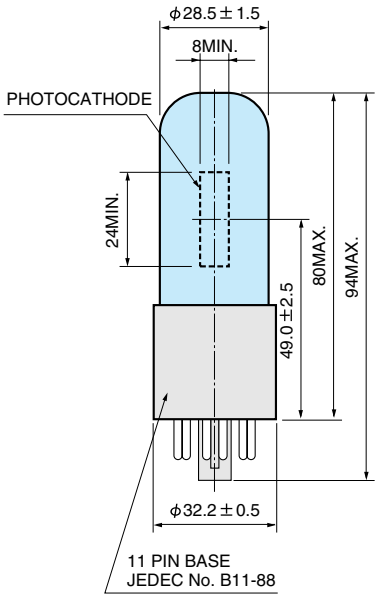
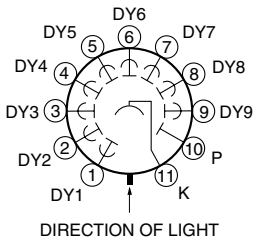


Figure 8: Dimensional outline and basing diagram(Unit: mm)



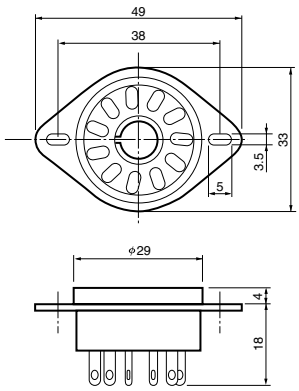


BOTTOM VIEW
(BASING DIAGRAM)

TPMSA0001EA

Figure 9: Accessories (Unit: mm) Sold separately

Socket E678-11A



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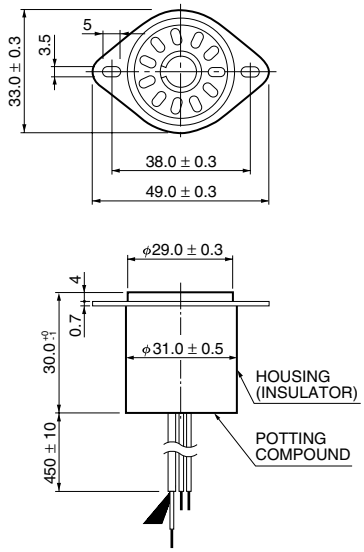
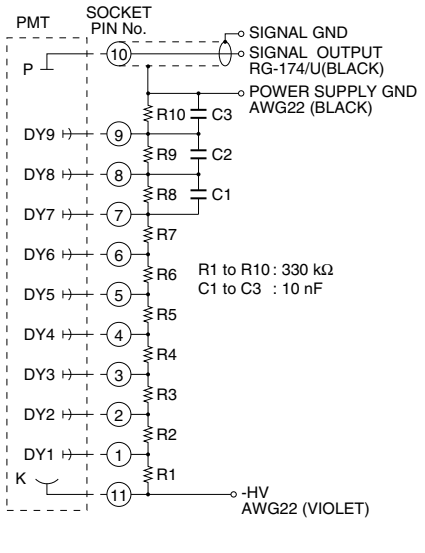
D type socket assembly E717-63





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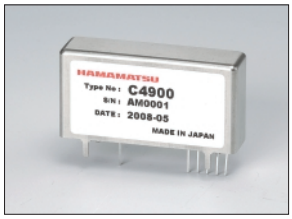
* Hamamatsu also provides C4900 series compact high voltage power supplies and C12597-01 series DP type socket assemblies which incorporate a DC to DC converter type high voltage power supply.



Warning–personal safety hazards

Electrical shock–operating voltages applied to this device present a shock hazard.

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