HAMAMATSU

PHOTOMULTIPLIER TUBES
R5983, R5983P

New Electro-Optical Design
Wide Effective Area, Low Noise Bialkali Photocathode
185 nm to 710 nm, 28 mm (1-1/8 Inch) Diameter, 9-stage, Side-on Type

FEATURES

- **New Electro-Optical Design Structure**
- **Low Noise**
- **Wide Effective Area ..... 10 mm × 24 mm**
- **High Cathode Sensitivity (Luminous) ..... 100 μA/lm**
- **High Anode Sensitivity (Luminous) ..... 1000 A/lm**
- **R4220 Wide Effective Area Type**

APPLICATIONS

- **Spectroscopy**
- **Biomedical**
- **Environmental Monitoring**

SPECIFICATIONS

GENERAL

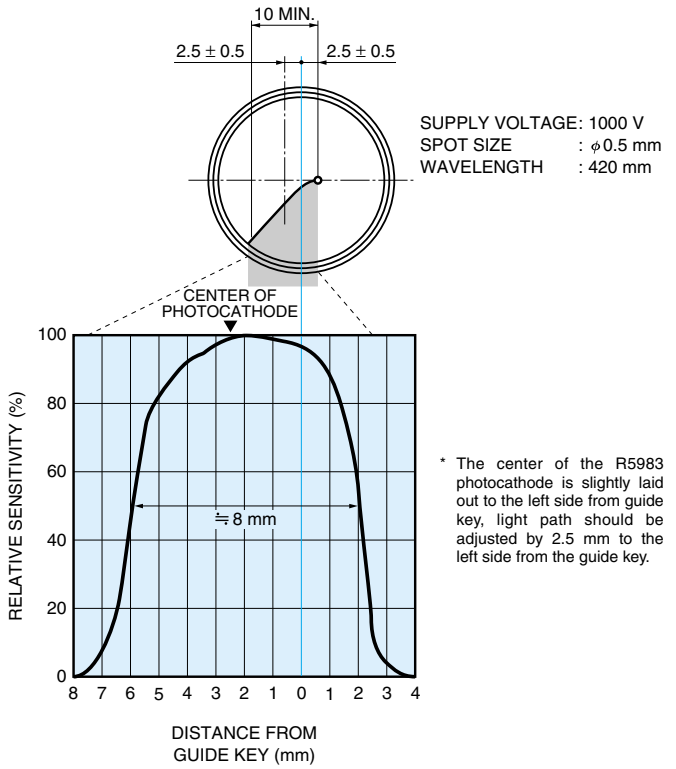
Parameter	Description/Value	Unit
Spectral Response	185 to 710	nm
Wavelength of Maximum Response	410	nm
Photocathode Material	Low Noise Bialkali	—
Minimum Effective Area	10 × 24	mm
Window Material	UV glass	—
Dynode Structure	Circular Cage	—
Number of Stages	9	—
Direct Interelectrode Capacitances		
Anode to Last Dynode	Approx. 4	pF
Anode to All Other Electrodes	Approx. 6	pF
Base	11-pin base	—
Suitable Socket	E678-11A (Sold Separately)	—
Suitable D Type Socket Assembly	E717-63 (Sold Separately)	—
Weight	Approx. 45	g
Operating Ambient Temperature	-30 to +50	°C
Storage Temperature	-30 to +50	°C

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 Ⓐ	0.1	mA

NOTE Ⓐ: Averaged over any interval of 30 seconds maximum.

Figure 1: Typical Anode Uniformity



* The center of the R5983 photocathode is slightly laid out to the left side from guide key, light path should be adjusted by 2.5 mm to the left side from the guide key.

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CHARACTERISTICS (at 25 °C)

Parameter	R5983 for General Purpose Min.	Typ.	Max.	R5983P for Photon Counting Min.	Typ.	Max.	Unit
Cathode Sensitivity							
Quantum Efficiency at 320 nm (Peak)	—	23	—	—	23	—	%
Luminous [A]	60	100	—	60	100	—	μA/lm
Radiant at 410 nm (Peak)	—	70	—	—	70	—	mA/W
Blue Sensitivity Index (CS 5-58) [B]	—	8.0	—	—	8.0	—	—
Anode Sensitivity							
Luminous [C]	500	1000	—	500	1000	—	A/lm
Radiant at 410 nm	—	7.0×10^5	—	—	7.0×10^5	—	A/W
Gain [C]	—	1×10^7	—	—	1×10^7	—	
Anode Dark Current [D]							
After 30 minute Storage in the Darkness	—	0.2	2.0	—	—	—	nA
Anode Dark Counts [E]	—	—	—	—	10	50	s^{-1}
ENI (Equivalent Noise Input) [F]	—	3.6×10^{-17}	—	—	3.6×10^{-17}	—	W
Time Response							
Anode Pulse Rise Time [G]	—	2.2	—	—	2.2	—	ns
Electron Transit Time [H]	—	22	—	—	22	—	ns
Anode Current Stability [J]							
Current Hysteresis	—	0.1	—	—	0.1	—	%
Voltage Hysteresis	—	1.0	—	—	1.0	—	%

NOTES

A: The light source is a tungsten filament lamp operated at a distribution temperature of 2856 K. Supply voltage is 100 volts between the cathode and all other electrodes connected together as anode.

B: 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 A.

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

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

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

F: 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.

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

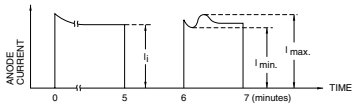
where q = Electronic charge (1.60×10^{-19} coulomb).
Idb = Anode dark current (after 30 minute storage) in amperes.
G = Gain.
Δf = Bandwidth of the system in hertz. 1 hertz is used.
S = Anode radiant sensitivity in amperes per watt at the wavelength of peak response.

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

H: 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 amplitude. In measurement, the whole photocathode is illuminated.

J: Hysteresis is temporary instability in anode current after light and voltage are applied.

$$\text{Hysteresis} = \frac{I_{max.} - I_{min.}}{I_i} \times 100\ (\%)$$



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(1)Current Hysteresis
The tube is operated at 750 volts with an anode current of 1 micro-ampere for 5 minutes. The light is then removed from the tube for a minute. The tube is then re-illuminated by the previous light level for a minute to measure the variation.
(2)Voltage Hysteresis
The tube is operated at 300 volts with an anode current of 0.1 micro-ampere for 5 minutes. The light is then removed from the tube and the supply voltage is quickly increased to 800 volts. After a minute, the supply voltage is then reduced to the previous value and the tube is re-illuminated for a minute to measure the variation.

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 dc
K : Cathode, Dy : Dynode, P : Anode

Figure 2: Typical Spectral Response

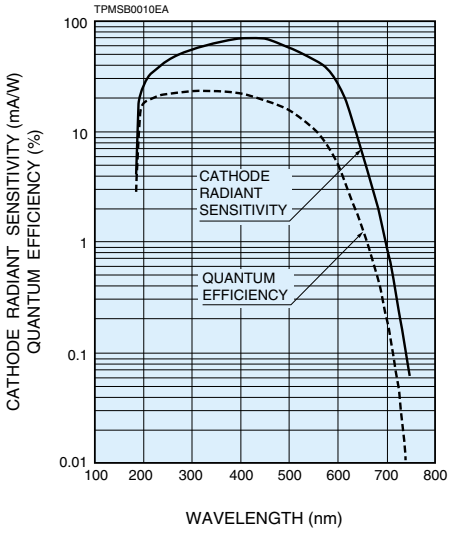


Figure 3: Typical Gain and Anode Dark Current

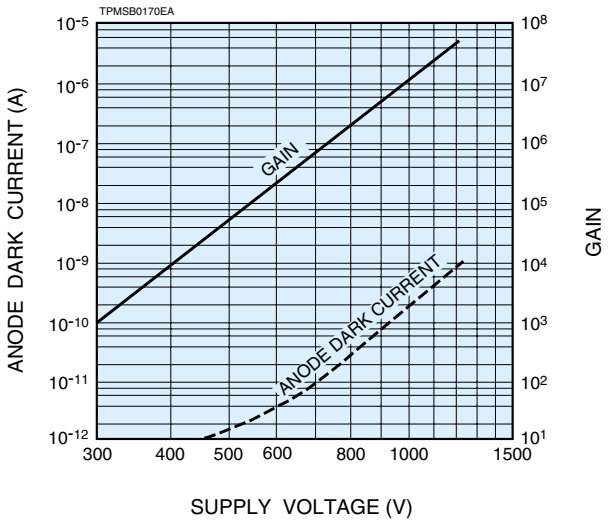


Figure 4: Typical ENI vs. Wavelength

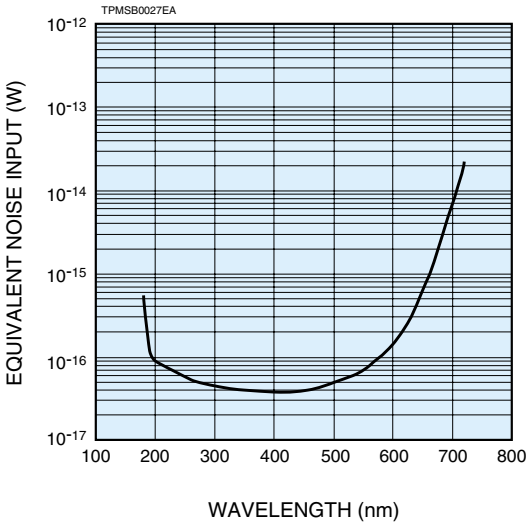


Figure 5: Typical Single Photon Pulse Height Distribution for R5983P

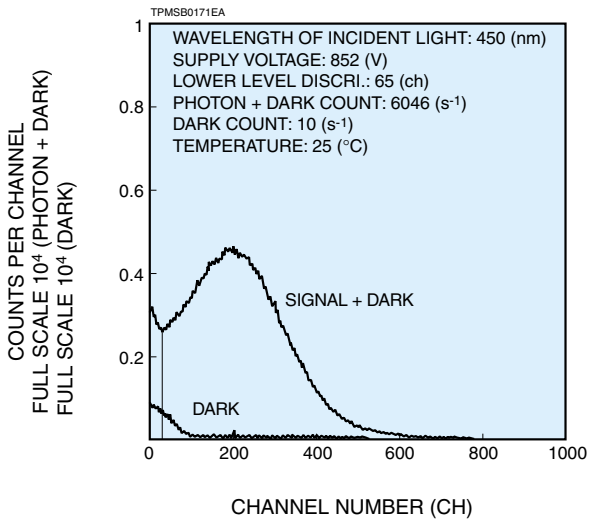


Figure 6: Typical Temperature Characteristics of Dark Count for R5983P

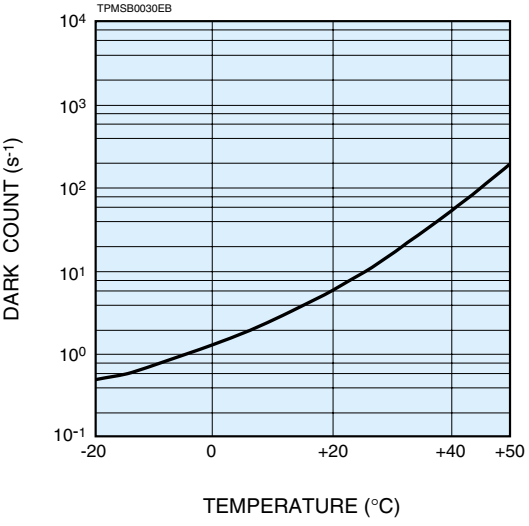
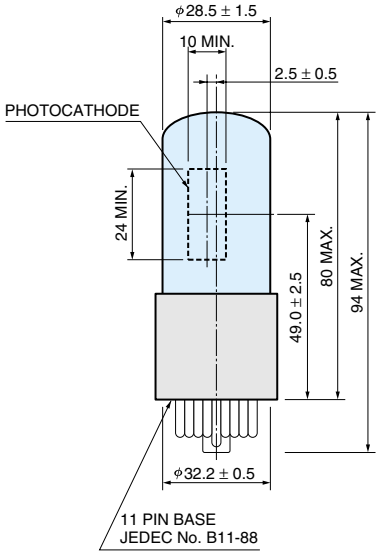


Figure 7: Dimensional Outline and Basing Diagram (Unit: mm)



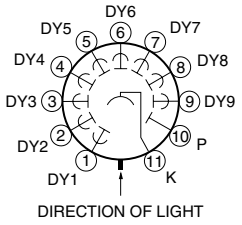


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Figure 8: Socket E678-11A (Sold Separately)

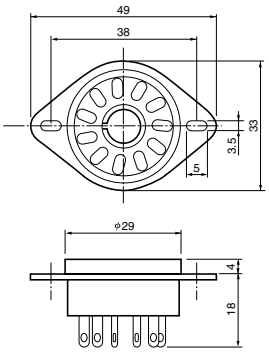

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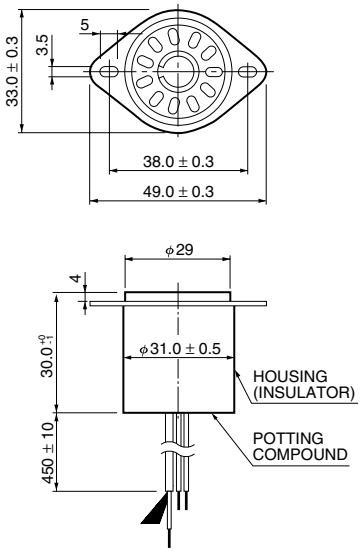
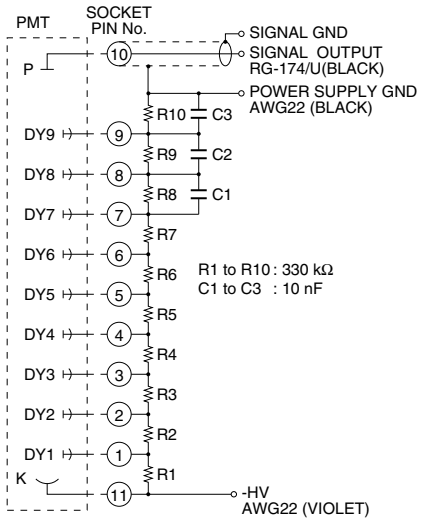
Figure 9: D Type Socket Assembly E717-63 (Sold Separately)





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∗ Hamamatsu also provides C4900 series compact high voltage power supplies and C6270 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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