

New Electro-Optical Design
Wide Effective Area, High Sensitivity Multialkali Photocathode
185 nm to 900 nm, 28 mm (1-1/8 Inch) Diameter, 9-stage, Side-on Type

FEATURES

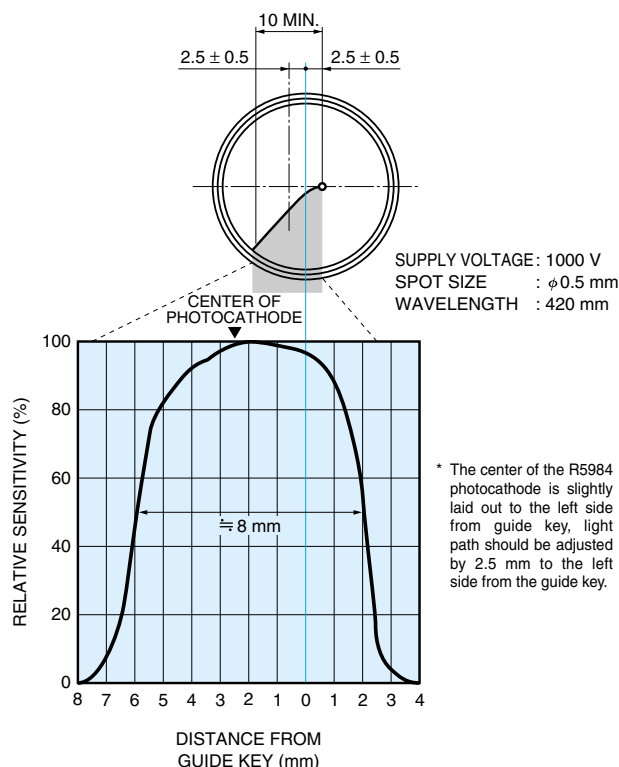
- New Electro-Optical Design Structure
- Wide Effective Area 10 mm × 24 mm
- High Cathode Sensitivity (Luminous) 300 μA/lm
- High Anode Sensitivity (Luminous) 3000 A/lm
- Basing Diagram is same as the R928

APPLICATIONS

- Spectroscopy
- Biomedical
- Environmental Monitoring



Figure 1: Typical Anode Uniformity



SPECIFICATIONS

GENERAL

Parameter	Description/Value	Unit
Spectral Response	185 to 900	nm
Wavelength of Maximum Response	400	nm
Photocathode	Material	Multialkali
	Minimum Effective Area	10 × 24
Window Material	UV glass	—
Dynode	Structure	Circular Cage
	Number of Stages	9
Direct	Anode to Last Dynode	4
Interelectrode Capacitances	Anode to All Other Electrodes	6
Base	11-pin base	—
Weight	Approx. 45	g
Operating Ambient Temperature	-30 to +50	°C
Storage Temperature	-30 to +50	°C
Suitable Socket	E678-11A (Sold Separately)	—
Suitable Socket Assembly	E717-63 (Sold Separately)	—
	E717-74 (Sold Separately)	—

TPMSB0122EB

PHOTOMULTIPLIER TUBE R5984

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	

CHARACTERISTICS (at 25 °C)

Parameter	Min.	Typ.	Max	Unit	
Cathode Sensitivity	Quantum Efficiency at 260 nm (Peak)	—	26	%	
	Luminous ^B	140	300	—	μA/lm
	Radiant at 400 nm (Peak)	—	76	—	mA/W
	Blue Sensitivity Index (CS 5-58) ^C	—	9	—	—
	Red/White Ratio ^D	—	0.32	—	—
Anode Sensitivity	Luminous ^E	400	3000	—	A/lm
	Radiant at 400 nm	—	7.6 × 10 ⁵	—	A/W
Gain ^E	—	1 × 10 ⁷	—	—	
Anode Dark Current ^F (After 30 min Storage in Darkness)	—	5	50	nA	
ENI (Equivalent Noise Input) ^G	—	1.7 × 10 ⁻¹⁶	—	W	
Time response	Anode Pulse Rise Time ^H	—	2.2	—	ns
	Electron Transit Time ^J	—	22	—	ns
Anode Current Stability ^K	Light Hysteresis	—	0.1	—	%
	Voltage Hysteresis	—	1	—	%

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 100 V 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: Red/White ratio is the quotient of the cathode current measured using a red filter (Toshiba R-68) interposed between the light source and the tube by the cathode current measured with the filter removed under the same condition as Note B.
 E: 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.
 F: Measured with the same supply voltage and voltage distribution ratio as Note E after removal of light.
 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.

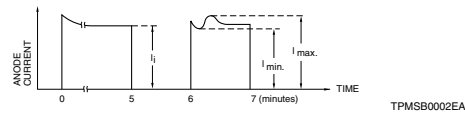
$$ENI = \frac{\sqrt{2q \cdot I_{db} \cdot G \cdot \Delta f}}{S}$$

- where q = Electronic charge (1.60 × 10⁻¹⁹ coulomb).
 I_{db} = 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.

- H: 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.

- 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 amplitude. In measurement, the whole photocathode is illuminated.
 K: Hysteresis is temporary instability in anode current after light and voltage are applied.

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



(1) Light Hysteresis

The tube is operated at 750 V with an anode current of 1 μA 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 V with an anode current of 0.1 μA for 5 minutes. The light is then removed from the tube and the supply voltage is quickly increased to 800 V. 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	1

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

Figure 2: Typical Spectral Response

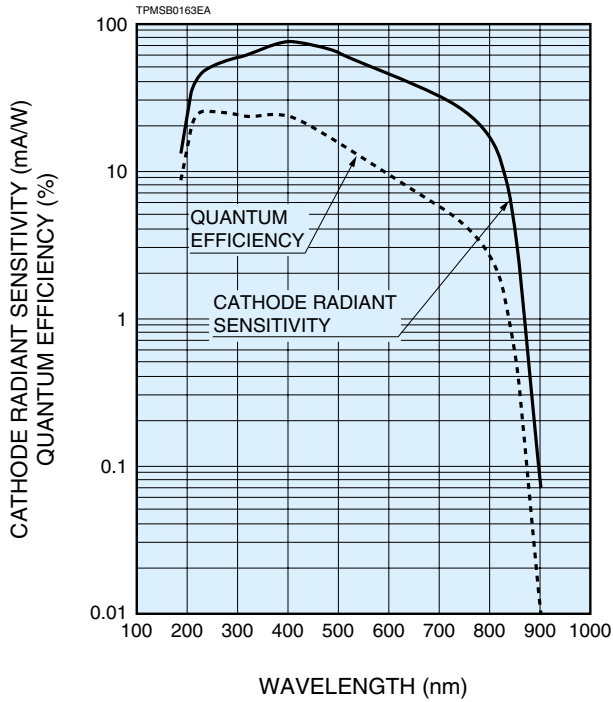


Figure 3: Anode Luminous Sensitivity and Gain Characteristics

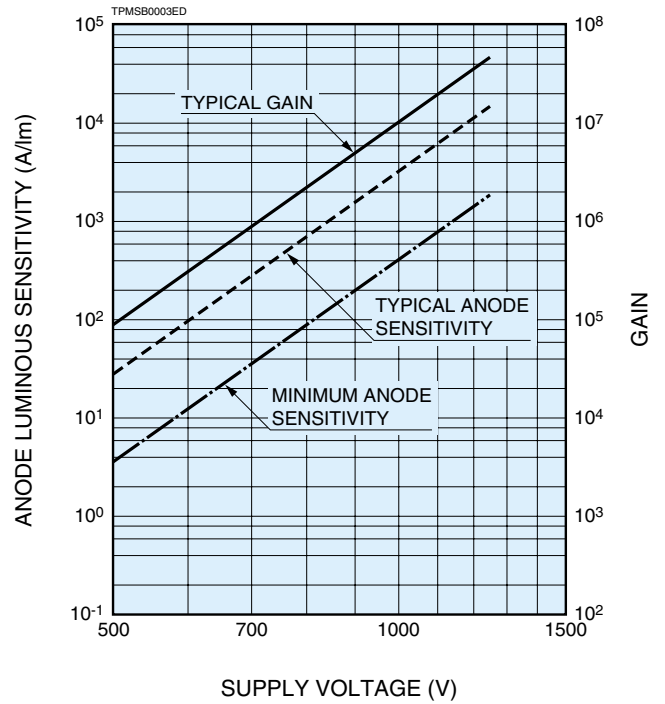
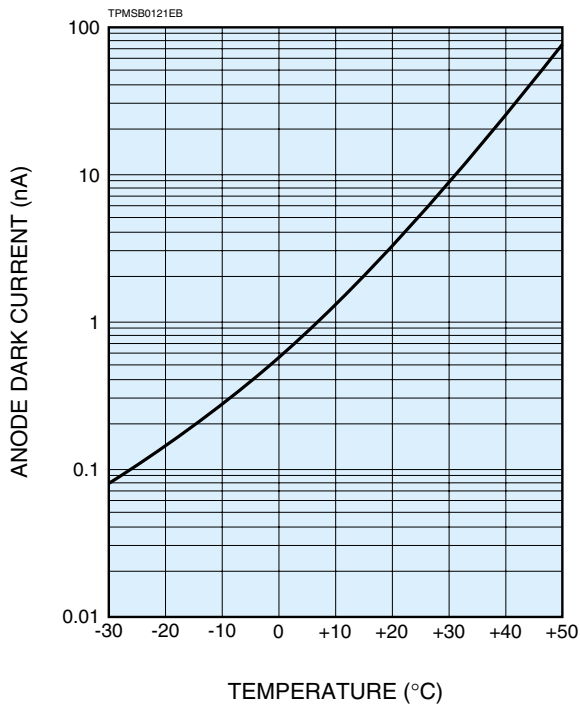


Figure 4: Typical Temperature Characteristics of Dark Current (at 1000 V, after 30 min storage in darkness)



PHOTOMULTIPLIER TUBE R5984

Figure 5: Dimensional Outline and Basing Diagram (Unit: mm)

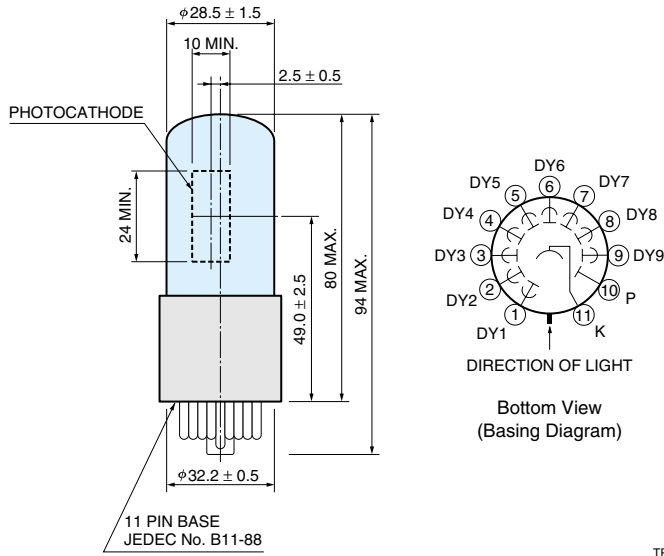


Figure 6: Socket (Unit: mm) **Sold Separately**

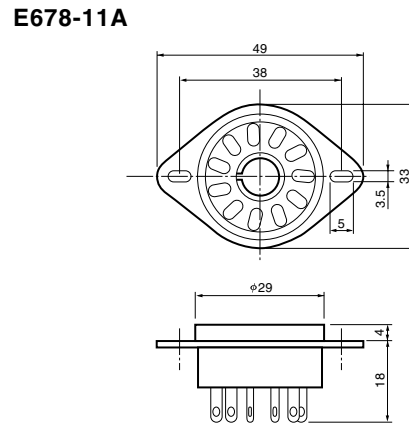
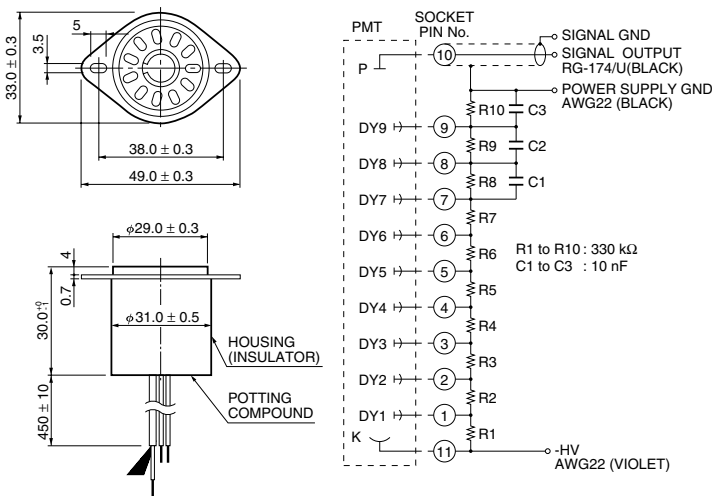
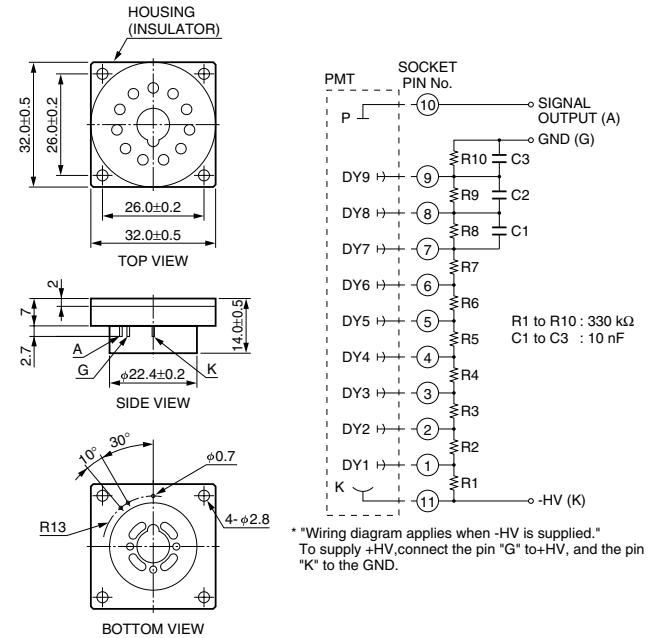


Figure 7: D Type Socket Assembly (Unit: mm) **Sold Separately**

E717-63



E717-74



* 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.

HAMAMATSU

WEB SITE www.hamamatsu.com

HAMAMATSU PHOTONICS K.K., Electron Tube Division

314-5, Shimokanzo, Iwata City, Shizuoka Pref., 438-0193, Japan, Telephone: (81)539/62-5248, Fax: (81)539/62-2205

U.S.A.: Hamamatsu Corporation, 360 Foothill Road, P. O. Box 6910, Bridgewater, N.J. 08807-0910, U.S.A., Telephone: (1)908-231-0960, Fax: (1)908-231-1218 E-mail: usa@hamamatsu.com

Germany: Hamamatsu Photonics Deutschland GmbH: Arzbergerstr. 10, D-82211 Herrsching am Ammersee, Germany, Telephone: (49)8152-375-0, Fax: (49)8152-2658 E-mail: info@hamamatsu.de

France: Hamamatsu Photonics France S.A.R.L.: 19, Rue du Saule Trapu, Parc du Moulin de Massy, 91882 Massy Cedex, France, Telephone: (33)1 69 53 71 00, Fax: (33)1 69 53 71 10 E-mail: infos@hamamatsu.fr

United Kingdom: Hamamatsu Photonics UK Limited: 2 Howard Court, 10 Tewin Road Welwyn Garden City Hertfordshire AL7 1BW, United Kingdom, Telephone: 44-(0)1707-294888, Fax: 44-(0)1707-325777 E-mail: info@hamamatsu.co.uk

North Europe: Hamamatsu Photonics Norden AB: Smidesvägen 12, SE-171-41 SOLNA, Sweden, Telephone: (46)8-509-031-00, Fax: (46)8-509-031-01 E-mail: info@hamamatsu.se

Italy: Hamamatsu Photonics Italia: S.R.L.: Strada della Moia, 1/E, 20020 Arese, (Milano), Italy, Telephone: (39)02-935 81 733, Fax: (39)02-935 81 741 E-mail: info@hamamatsu.it

TPMS1033E03
JUL. 2006 IP