

# HAMAMATSU

## PHOTOMULTIPLIER TUBES R7518 R7518P (For Photon Counting)

### High Sensitivity with Low Noise Photocathode

#### FEATURES

- Spectral Response ..... 185 nm to 730 nm
- High Cathode Sensitivity
  - Luminous ..... 130  $\mu$ A/lm
  - Radiant at 410 nm ..... 85 mA/W
- High Anode Sensitivity (at 1000 V)
  - Luminous ..... 1560 A/lm
  - Radiant at 410 nm .....  $10.2 \times 10^5$  A/W
- Low Dark Current ..... 0.2 nA
- Low Dark Counts (R7518P) .....  $10 \text{ s}^{-1}$

#### APPLICATIONS

- Chemiluminescence Detection
- Bioluminescence Detection
- Fluorescence Spectrometer
- SO<sub>2</sub> Monitor (UV Fluorescence)



#### SPECIFICATIONS

##### GENERAL

Parameter	Description/Value	Unit	
Spectral Response	185 to 730	nm	
Wavelength of Maximum Response	410	nm	
Photocathode	Material	Low noise bialkali	
	Minimum Effective Area	8 × 24	mm
Window Material	UV glass	—	
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 Electrode	6	pF
Base	11-pin base JEDEC No. B11-88	—	
Weight	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)	—	

# PHOTOMULTIPLIER TUBES

## R7518, R7518P (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 <sup>A</sup>	0.1	mA	

### CHARACTERISTICS (at 25 °C)

Parameter	R7518 for General Purpose			R7518P for Photon Counting			Unit
	Min.	Typ.	Max.	Min.	Typ.	Max.	
Cathode Sensitivity	Quantum Efficiency at 300 nm (Peak)	—	29	—	—	29	%
	Luminous <sup>B</sup>	120	130	—	120	130	μA/lm
	Radiant at 410 nm (Peak)	—	85	—	—	85	mA/W
	Blue Sensitivity Index (CS 5-58)	—	10	—	—	10	μA/lm-b
Anode Sensitivity	Luminous <sup>C</sup>	1200	1560	—	1200	1560	A/lm
	Radiant at 400 nm	—	10.2 × 10 <sup>5</sup>	—	—	10.2 × 10 <sup>5</sup>	A/W
Gain <sup>D</sup>	—	1.2 × 10 <sup>7</sup>	—	—	1.2 × 10 <sup>7</sup>	—	
Anode Dark Current <sup>E</sup> (After 30 min Storage in darkness)	—	0.2	2.0	—	0.2	0.5	nA
Anode Dark Counts <sup>E</sup>	—	—	—	—	10	50	s <sup>-1</sup>
ENI (Equivalent Noise Input) <sup>F</sup>	—	2.7 × 10 <sup>-17</sup>	—	—	2.7 × 10 <sup>-17</sup>	—	W
Time Response <sup>D</sup>	Anode Pulse Rise Time <sup>G</sup>	—	2.2	—	—	2.2	ns
	Electron Transit Time	—	22	—	—	22	ns
	Transit Time Spread (TTS) <sup>H</sup>	—	1.2	—	—	1.2	ns
Anode Current Stability <sup>J</sup>	Light Hysteresis	—	0.1	—	—	0.1	%
	Voltage Hysteresis	—	1.0	—	—	1.0	%

### 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 V between the cathode and all other electrodes connected together as anode.  
 C: 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.  
 D: Measured with the same supply voltage and voltage distribution ratio as Note E after removal of light.  
 E: Measured at the voltage producing the gain of 1 × 10<sup>6</sup>.  
 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.

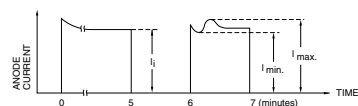
$$ENI = \frac{\sqrt{2q \cdot I_{db} \cdot G \cdot f}}{S} \quad (W)$$

- where q = Electronic charge. (1.60 × 10<sup>-19</sup> coulomb)  
 I<sub>db</sub> = Anode dark current(after 30 minute storage) in amperes.  
 G = Gain.  
 f = Bandwidth of the system in hertz. (usually 1 hertz)  
 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 entire 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: 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.

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

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



TPMSB0002EA

- (1) Current 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

Electrodes	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 1: Typical Spectral Response

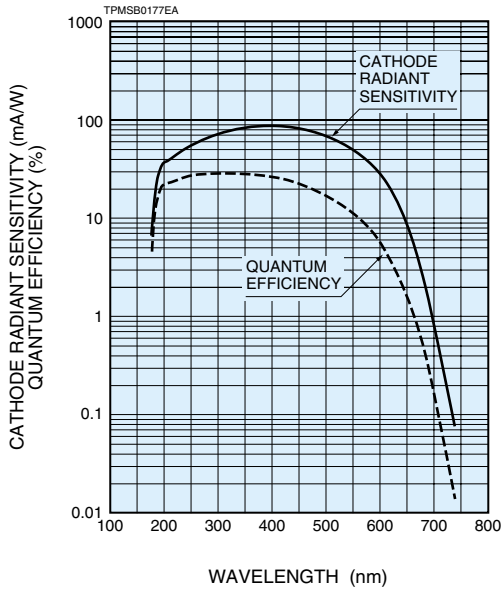


Figure 2: Typical Gain and Anode Dark Current

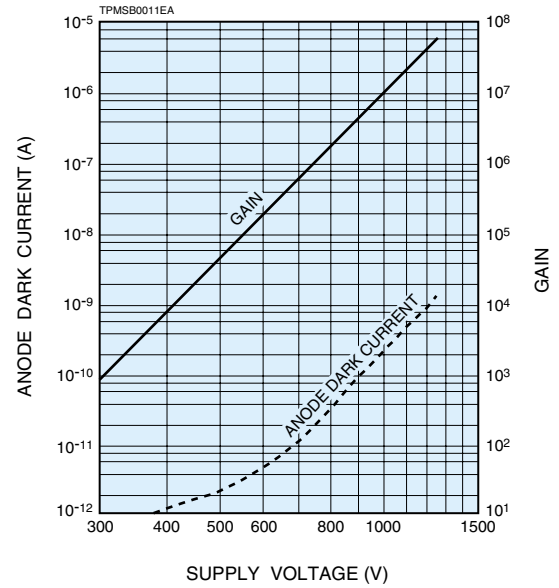


Figure 3: Typical Time Response

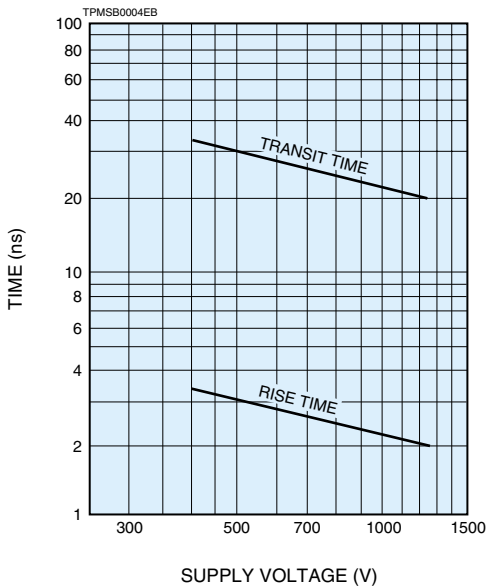


Figure 4: Typical ENI vs. Wavelength

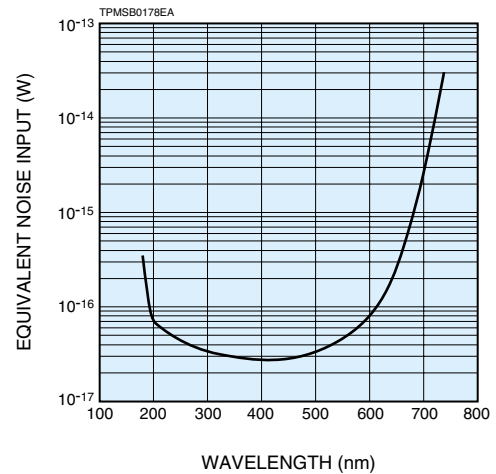


Figure 5: Typical Single Photon Pulse Height Distribution for R7518P

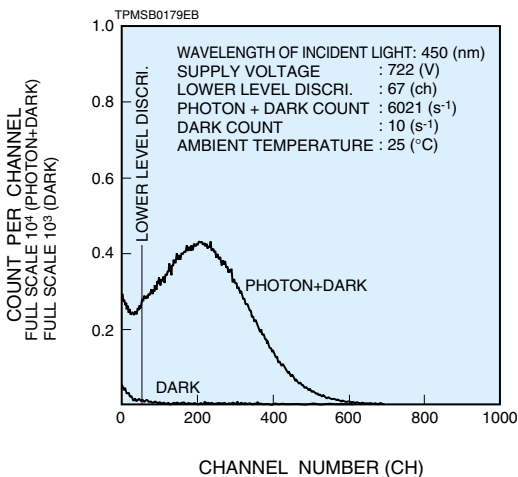
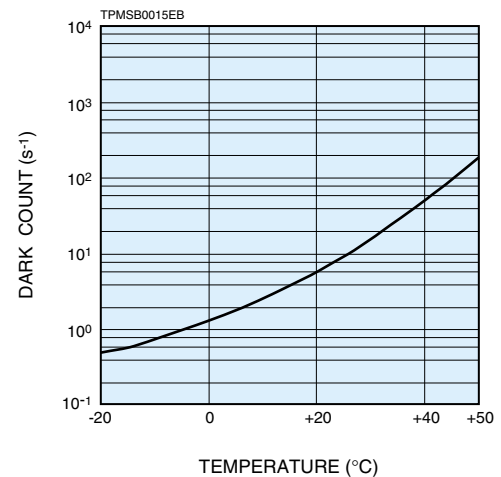


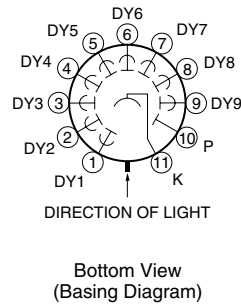
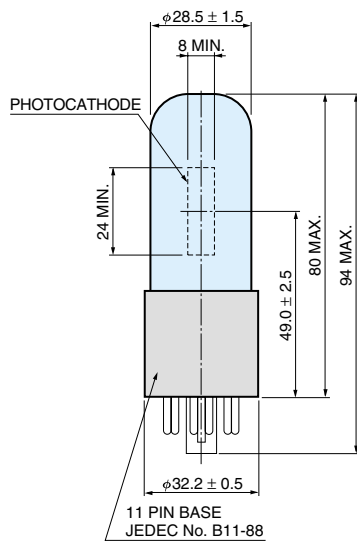
Figure 6: Typical Temperature Characteristics of Dark Count for R7518P



# PHOTOMULTIPLIER TUBES

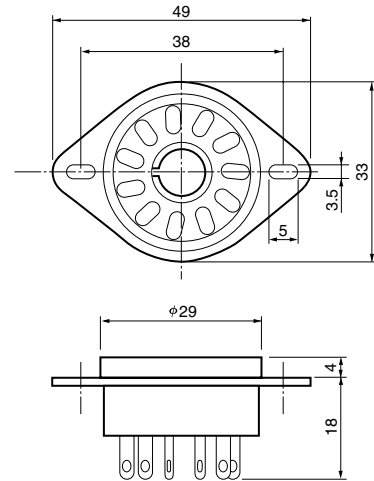
## R7518, R7518P (For Photon Counting)

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



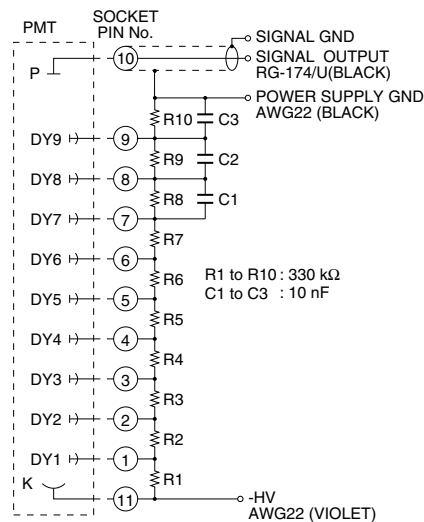
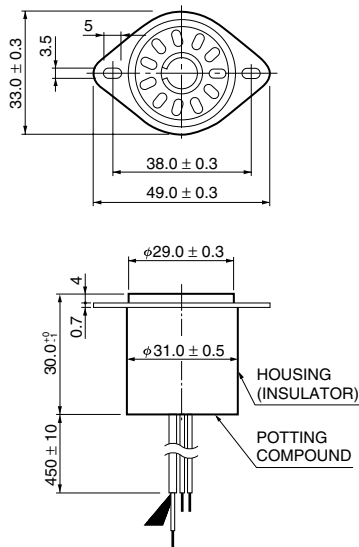
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Figure 8: Socket E678-11A (Sold Separately)



TACCA0064EA

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



TACCA0002EH

\* 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 <http://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](mailto: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](mailto:info@hamamatsu.de)

France: Hamamatsu Photonics France S.A.R.L.: 8, 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](mailto: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](mailto: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](mailto: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](mailto:info@hamamatsu.it)

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