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 μA/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 $s^{-1}$**

## APPLICATIONS

- **Chemiluminescence Detection**
- **Bioluminescence Detection**
- **Fluorescence Spectrometer**
- **$SO_2$ 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 | $8 \times 24$ | 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 [A] | | 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 [B] | 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 [C] | 1200 | 1560 | — | 1200 | 1560 | — | A/lm |
| | Radiant at 400 nm | — | $10.2 \times 10^5$ | — | — | $10.2 \times 10^5$ | — | A/W |
| Gain [D] | | — | $1.2 \times 10^7$ | — | — | $1.2 \times 10^7$ | — | — |
| Anode Dark Current [E] (After 30 min Storage in darkness) | | — | 0.2 | 2.0 | — | 0.2 | 0.5 | nA |
| Anode Dark Counts [E] | | — | — | — | — | 10 | 50 | $s^{-1}$ |
| ENI (Equivalent Noise Input) [F] | | — | $2.7 \times 10^{-17}$ | — | — | $2.7 \times 10^{-17}$ | — | W |
| Time Response [D] | Anode Pulse Rise Time [G] | — | 2.2 | — | — | 2.2 | — | ns |
| | Electron Transit Time | — | 22 | — | — | 22 | — | ns |
| | Transit Time Spread (TTS) [H] | — | 1.2 | — | — | 1.2 | — | ns |
| Anode Current Stability [J] | 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 $1 \times 10^6$.

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.

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

where q = Electronic charge. ($1.60 \times 10^{-19}$ coulomb)
Idb = 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

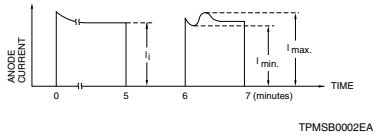
G: The rise time is the time for the output pulse to rise from 10% to 90% of the peak amplitude when the entire photocathode is illuminated by a delta function light pulse.

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.

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

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(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 | |

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

Figure 1: Typical Spectral Response

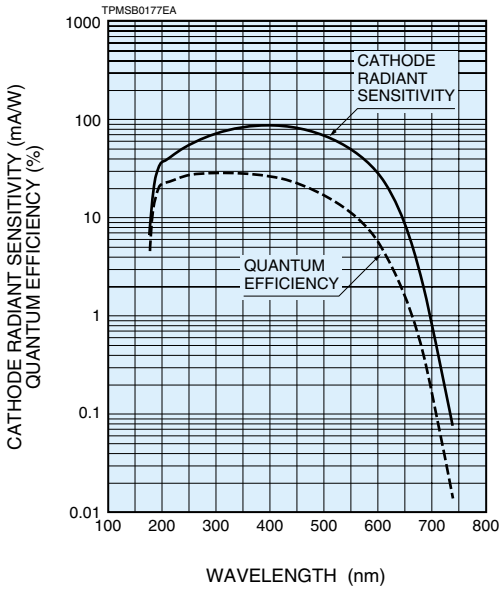


Figure 2: Typical Gain and Anode Dark Current

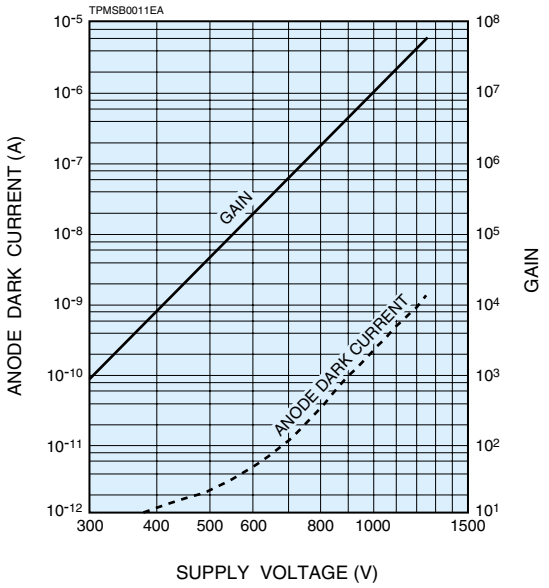


Figure 3: Typical Time Response

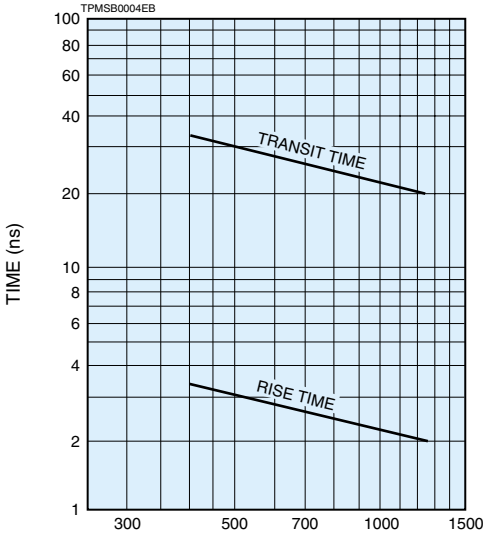


Figure 4: Typical ENI vs. Wavelength

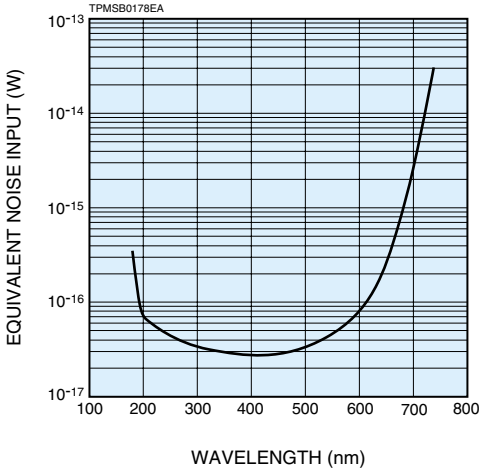


Figure 5: Typical Single Photon Pulse Height Distribution for R7518P

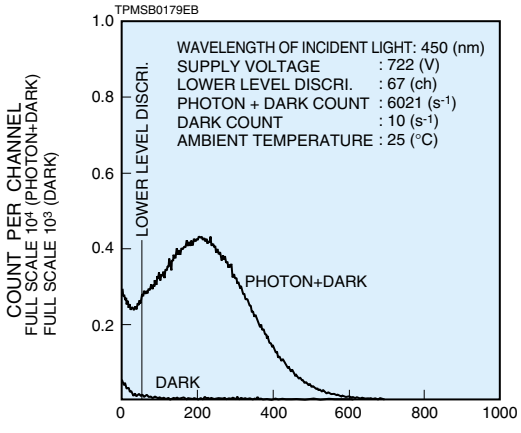


Figure 6: Typical Temperature Characteristics of Dark Count for R7518P

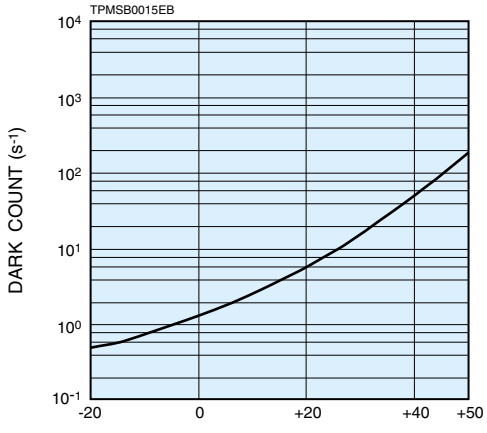

Figure 7: Dimensional Outline and Basing Diagram (Unit: mm)

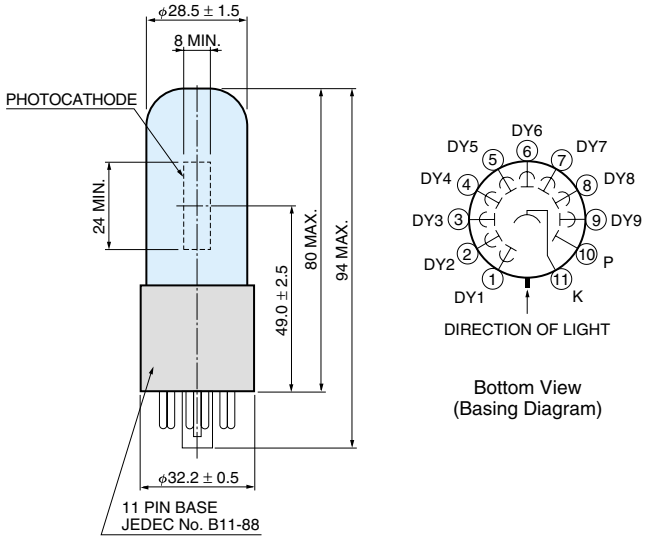


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Figure 8: Socket E678-11A (Sold Separately)

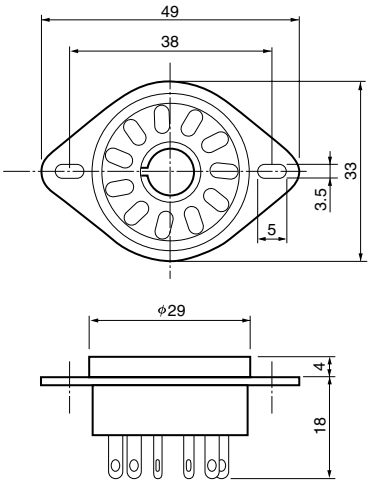


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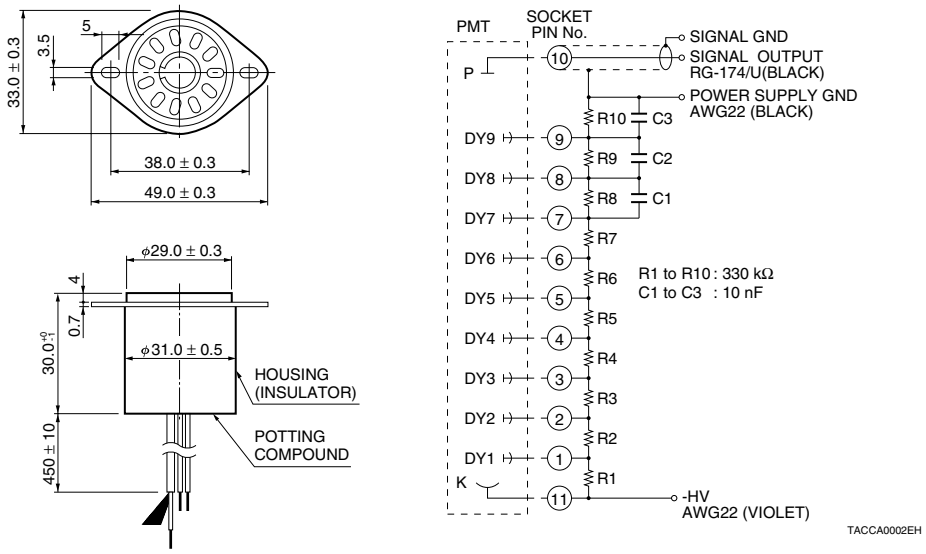
Figure 9: D Type Socket Assembly E717-63 (Sold Separately)

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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.

HAMAMATSU WEB SITE http://www.hamamatsu.com

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TPMS1060E02
APR. 2005. IP