

FEATURES

- **High sensitivity**
Radiant at 900 nm..... 7.3 mA/W (Typ.)
Quantum efficiency at 900 nm 1 % (Typ.)
- **Wide spectral response** 185 nm to 980 nm
- **Pin compatible with conventional 1-1/8" side-on PMTs**

APPLICATIONS

- **Biomedical analysis**
Blood analyzer, Flow cytometer, DNA sequencer
- **Environmental monitoring**
NOx analyzer
- **Spectroscopy**
Fluorescence spectrometer, Raman spectrometer,
UV-VIS-NIR spectrometer
- **Microscopy**

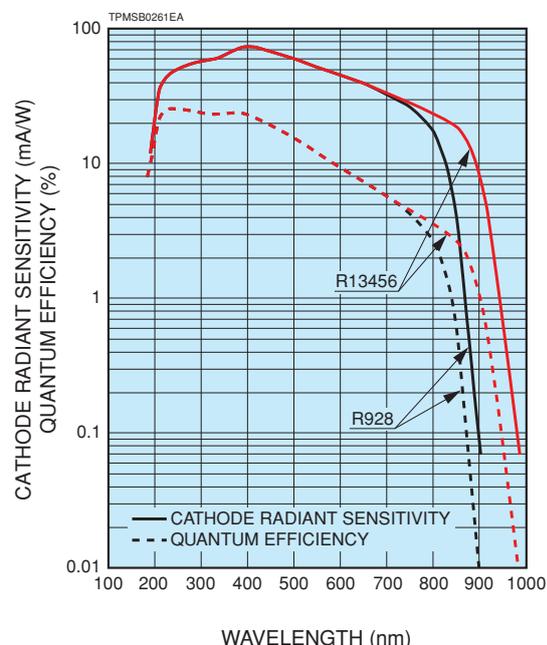


SPECIFICATIONS

GENERAL

Parameter	Description / Value	Unit	
Spectral response	185 to 980	nm	
Wavelength of maximum response	400	nm	
Photocathode	Material	Multialkali	
	Minimum effective area	8 × 24	mm
Window material	UV glass	—	
Dynode	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	
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)	—	

Figure 1: Typical spectral response



PHOTOMULTIPLIER TUBE R13456

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 900 nm	0.3	1	—	%	
	Luminous ^(B)	140	280	—	μA/lm	
	Radiant	at 194 nm	—	18	—	mA/W
		at 254 nm	—	52	—	mA/W
		at 400 nm	—	74	—	mA/W
		at 633 nm	—	41	—	mA/W
		at 852 nm	—	18	—	mA/W
Red/White ratio ^(C)	0.3	0.4	—	—		
Blue sensitivity index ^(D)	—	8	—	—		
Anode sensitivity	Luminous ^(E)	400	2800	—	A/lm	
	Radiant	at 194 nm	—	1.8 × 10 ⁵	—	A/W
		at 254 nm	—	5.2 × 10 ⁵	—	A/W
		at 400 nm	—	7.4 × 10 ⁵	—	A/W
		at 633 nm	—	4.1 × 10 ⁵	—	A/W
		at 852 nm	—	1.8 × 10 ⁵	—	A/W
Gain ^(E)	—	1.0 × 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 ^(I)	—	22	—	ns	
	Transit time spread (T.T.S.) ^(J)	—	1.2	—	ns	

NOTES

- (A): Averaged over any interval of 30 s maximum.
 (B): The light source is a tungsten filament lamp operated at a distribution temperature of 2856 kelvin. Supply voltage is 100 volts between the cathode and all other electrodes connected together as anode.
 (C): Red/White ratio is the quotient of the cathode current measured using a red filter interposed between the light source and the tube by the cathode current measured with the filter removed under the same conditions as Note (B).
 (D): The value is cathode output current when a blue filter is interposed between the light source and the tube under the same condition as Note (B).
 (E): Measured with the voltage distribution ratio shown in Table 1 below.

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

- (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 entire photocathode is illuminated by a delta function light pulse.

- (I): 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.

Figure 2: Anode luminous sensitivity and gain characteristics

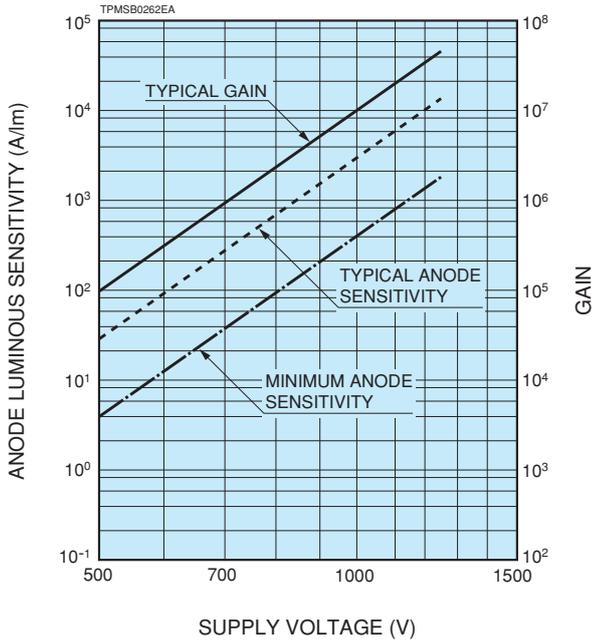


Figure 3: Typical time response

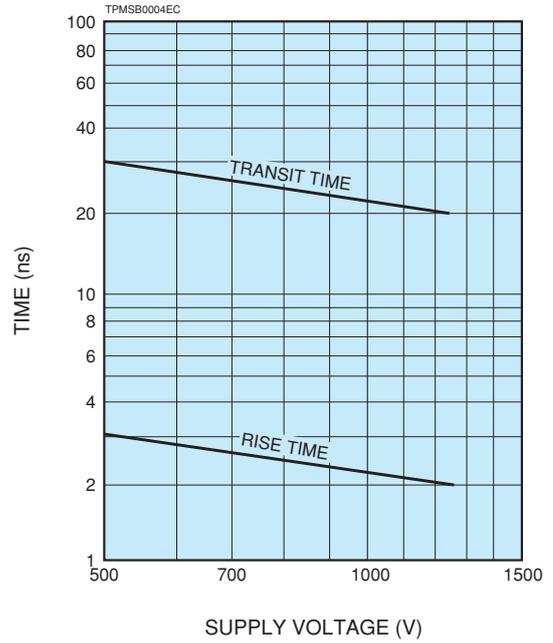


Figure 4: Typical temperature coefficient of anode sensitivity

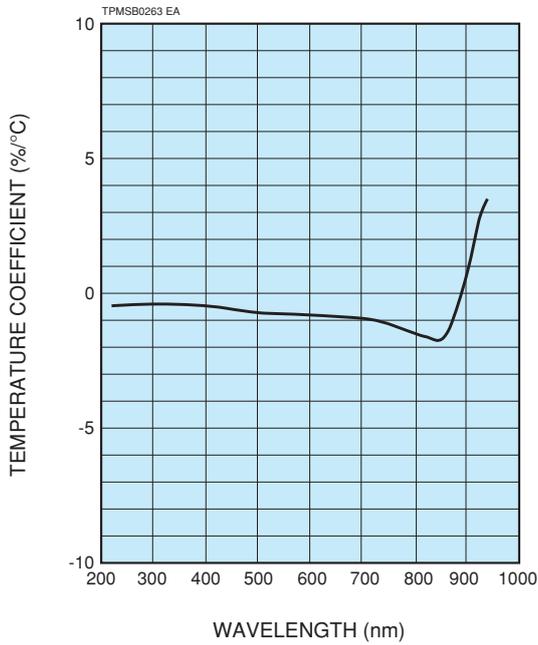
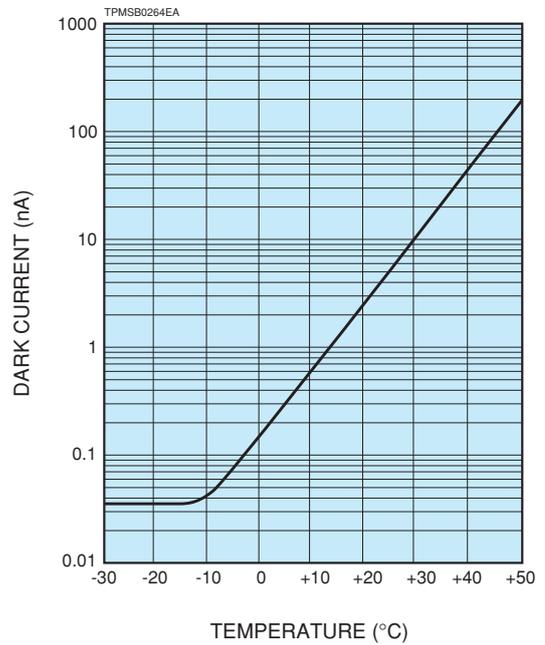
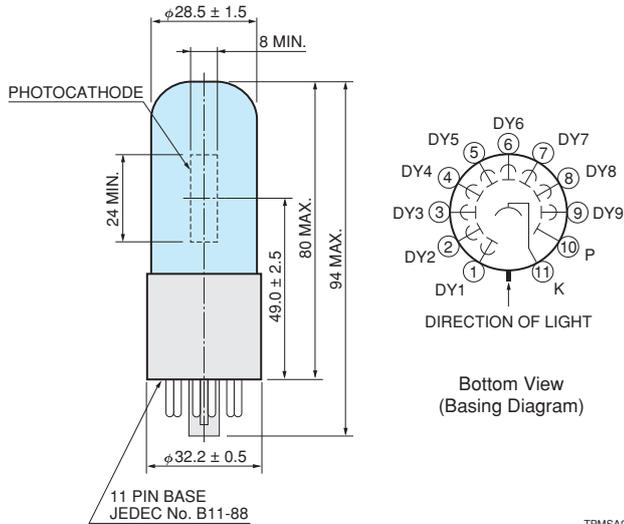


Figure 5: Typical temperature characteristic of dark current (at 1000 V, after 30 min storage in darkness)



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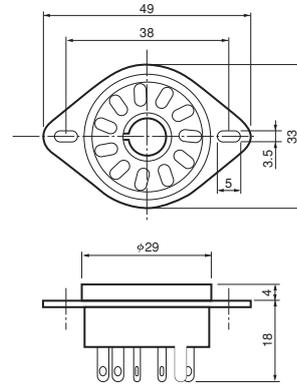
Figure 6: Dimensional outline and basing diagram (Unit: mm)



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Figure 7: Socket (Unit: mm) Sold separately

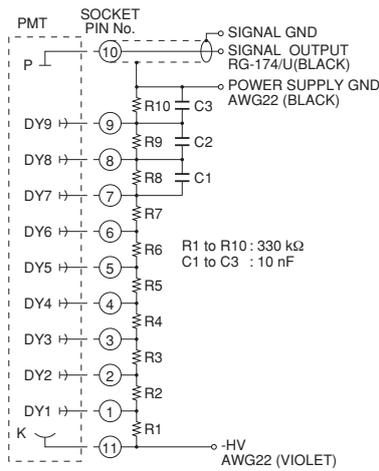
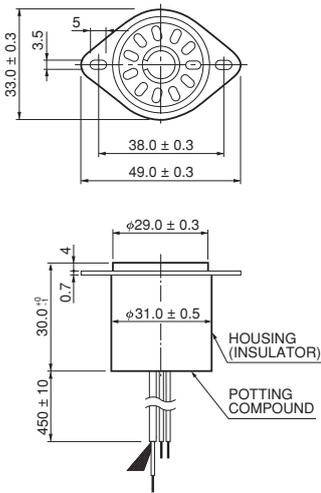
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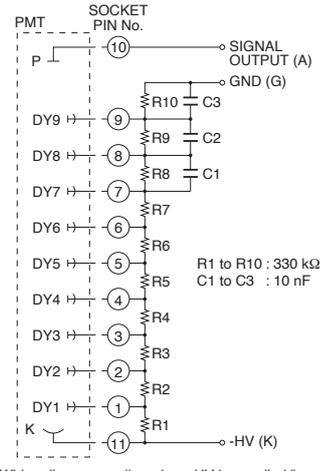
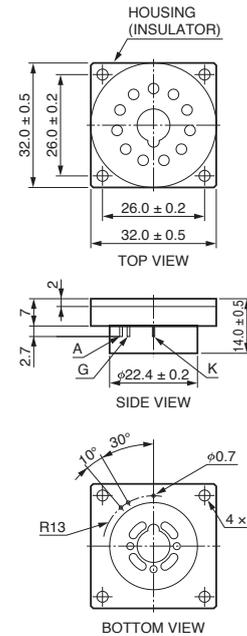
Figure 8: D type socket assembly (Unit: mm) Sold separately

E717-63



TACCA0022EH

E717-74



* "Wiring diagram applies when -HV is supplied." To supply +HV, connect the pin "G" to +HV, and the pin "K" to the GND.

TACCA0277EA

* Hamamatsu also provides C13890 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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