

**High Sensitivity Multialkali Photocathode
28 mm (1-1/8 Inch) Diameter, 9-Stage, Side-On Type**

FEATURES

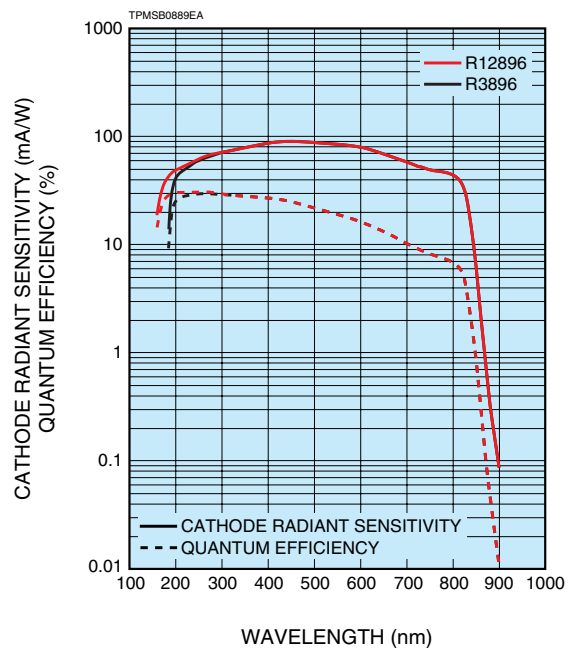
- **Wide Spectral Response**
 R3896 185 nm to 900 nm
 R12896 160 nm to 900 nm
- **High Sensitivity**
 Luminous 525 $\mu\text{A/lm}$ (Typ.)
 Radiant
 at 450 nm (peak wavelength) 90 mA/W (Typ.)
 at 633 nm 73 mA/W (Typ.)
 Quantum Efficiency
 at 260 nm (peak wavelength) 30 % (Typ.)
 at 633 nm 14 % (Typ.)
- **High Signal to Noise Ratio**



APPLICATIONS

- **Biomedical Analysis**
 Fluorescence Immuno Assy, Flow Cytometer, MTP Reader
- **Environmental Monitoring**
 NOx Analyzer
- **Spectroscopy**
 UV-VIS Spectrometer, Fluorescence Spectrometer,
 Atomic Absorption, Raman Spectrometer
- **Semiconductor Industry**
 Wafer Inspection, Particle Counter

Figure 1: Typical Spectral Response



PHOTOMULTIPLIER TUBE R3896, R12896

SPECIFICATIONS

GENERAL

Parameter		R3896	R12896	Unit
Spectral Response		185 to 900	160 to 900	nm
Wavelength of Maximum Response		450		nm
Photocathode	Material	Multialkali		—
	Minimum Effective Area	8 × 24		mm
Window Material		UV glass	Fused silica	—
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)		—

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

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: 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 conditions as Note B.
 D: 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.
 E: Measured with the same light source as Note B and with the voltage distribution ratio shown in Table 1 below.

Table 1: Voltage Distribution Ratio

Electrodes	K	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	P
Ratio	1	1	1	1	1	1	1	1	1	1	1

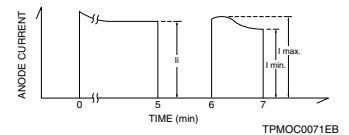
Supply Voltage: 1000 V, K: Cathode, Dy: Dynode, P: Anode

- F: Measured with the same supply voltage and voltage distribution ratio as Note E after removal of light.
 G: 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.

I: 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.

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

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



(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.

CHARACTERISTICS (at 25 °C)

Parameter			R3896			R12896			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Cathode Sensitivity	Quantum Efficiency	at 194 nm	—	21	—	—	30	—	%
		at 254 nm	—	29	—	—	31	—	%
		at 450 nm	—	25	—	—	25	—	%
		at 633 nm	—	14	—	—	14	—	%
		at 852 nm	—	0.73	—	—	0.73	—	%
	Luminous ^B		475	525	—	475	525	—	μA/lm
		Radiant	at 194 nm	—	33	—	—	47	—
	at 254 nm		—	60	—	—	63	—	mA/W
	at 450 nm		—	90	—	—	90	—	mA/W
	at 633 nm		—	73	—	—	73	—	mA/W
at 852 nm	—		5.0	—	—	5.0	—	mA/W	
	Red/White Ratio ^C	—	0.4	—	—	0.4	—	—	
	Blue Sensitivity Index ^D	—	15	—	—	15	—	—	
Anode Sensitivity	Luminous ^E	3000	5000	—	3000	5000	—	A/lm	
Gain ^E		—	9.5 × 10 ⁶	—	—	9.5 × 10 ⁶	—	—	
Anode Dark Current ^F (After 30 min Storage in Darkness)		—	10	50	—	10	50	nA	
Time Response	Anode Pulse Rise Time ^G	—	2.2	—	—	2.2	—	ns	
	Electron Transit Time ^H	—	22	—	—	22	—	ns	
	Transit Time Spread (TTS) ^I	—	1.2	—	—	1.2	—	ns	
Anode Current Stability ^J	Light Hysteresis	—	0.1	—	—	0.1	—	%	
	Voltage Hysteresis	—	1.0	—	—	1.0	—	%	

Figure 2: Typical Temperature Characteristics of Dark Current (at 1000 V, after 30 min storage in darkness)

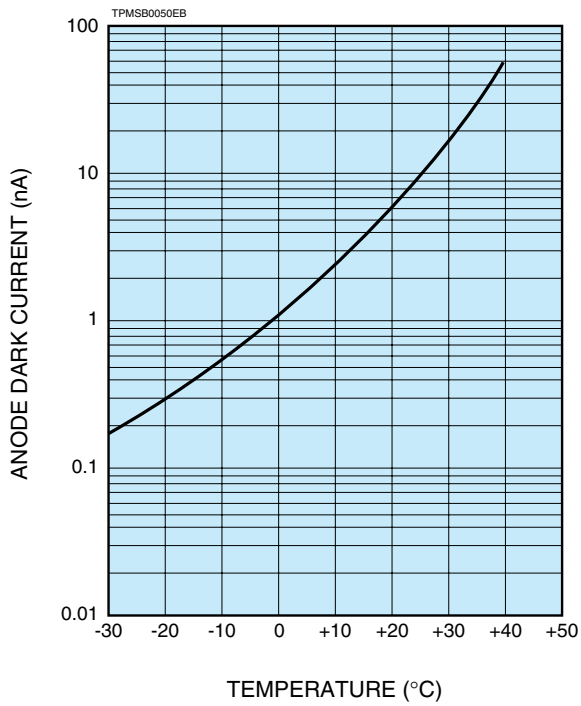


Figure 3: Anode Luminous Sensitivity and Gain Characteristics

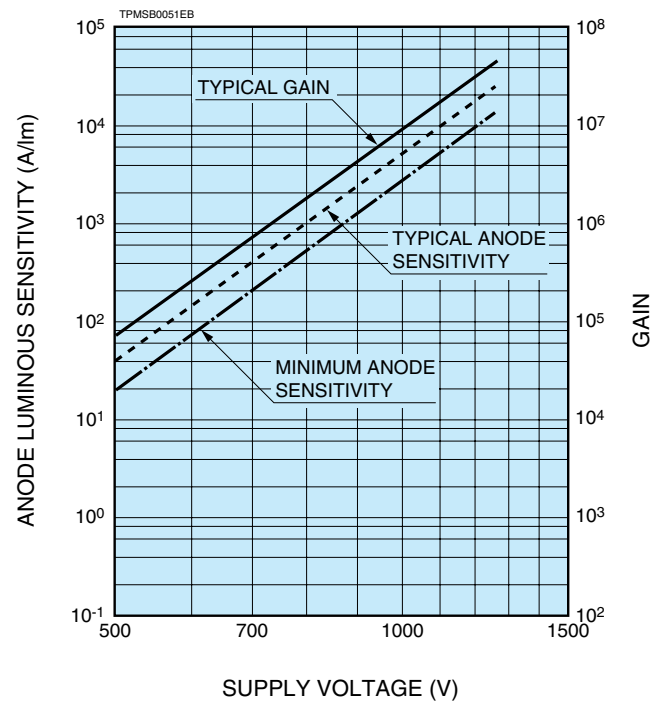


Figure 4: Typical Time Response

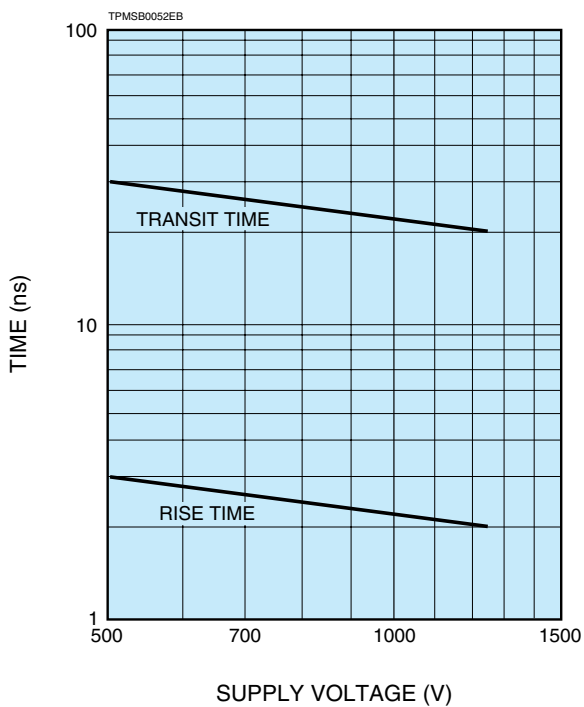
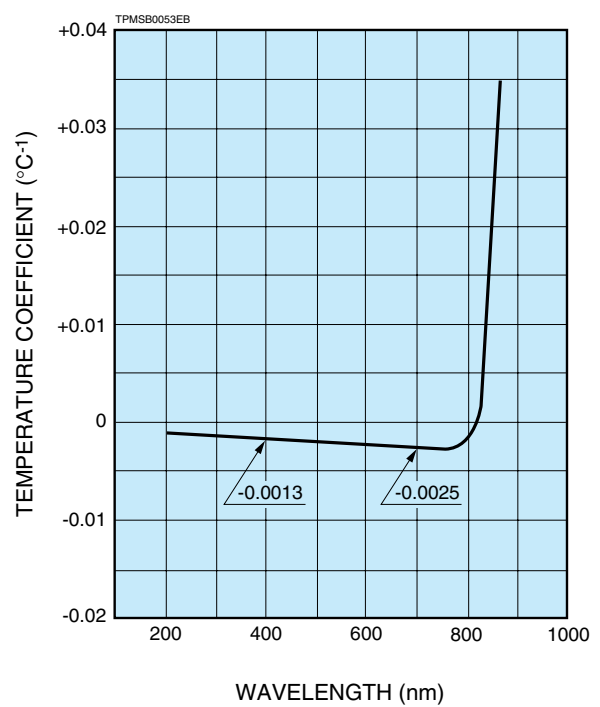


Figure 5: Typical Temperature Coefficient of Anode Sensitivity



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Figure 6: Dimensional Outline and Basing Diagram (Unit: mm)

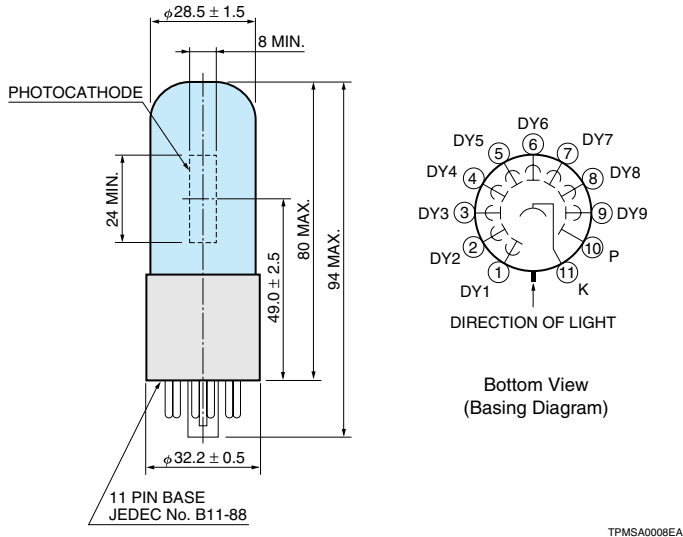
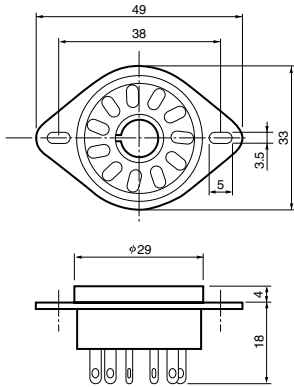
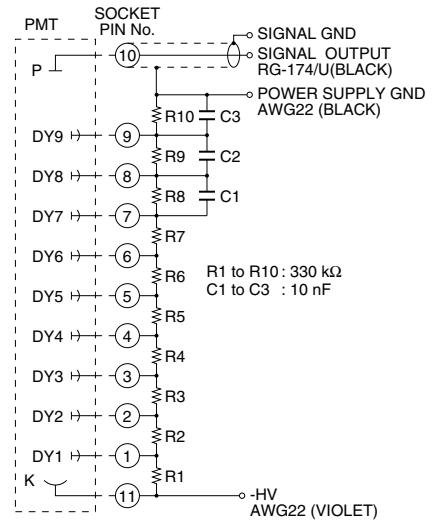
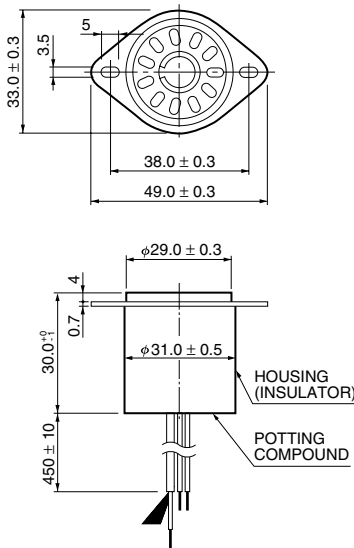


Figure 7: Accessories (Unit: mm) Sold Separately

Socket E678-11A



D Type Socket Assembly E717-63



* Hamamatsu also provides C4900 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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