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HAMAMATSU

2060

TECHNICAL DATA SHEET

PHOTOMULTIPLIER TUBE

For Scintillation Counting
Sb-Cs Photocathode, 1-1/2" Diameter, 10 Stage
Head-on Type Photomultiplier Tube
Direct Replacement with RCA 2060



FEATURES :

	Typical
• Quantum Efficiency at 420 nm	22%
• Pulse Height Resolution	
with ^{137}Cs Source (Note 1,2)	7.5%
with ^{55}Fe Source (Note 1,3)	48%
• Stability	
Anode Current Drift (DC Output) (Note 1,4)	3%
Long Term (MGD) (For 16 hours at 1,000 cps) (Note 1,5a)	0.5%
Short Term (From 10,000 cps to 1,000 cps) (Note 1,5b)	1.0%
• Background in the Middle of Plateau	5 cps
• Plateau Length (Note 1,6)	150V
• Anode Pulse Rise Time (Note 1,7)	2.8 ns
• Electron Transit Time (Note 1,8)	40 ns

GENERAL :

Spectral Response	300~ 650 nm (see Figure 1)
Wavelength of Maximum Response	440±30 nm
Photocathode Material	Sb - Cs
Window	
Material	Borosilicate glass
Shape	Plano - Plano
Dynode	
Structure	Circular - cage
Number of Stages	10
Direct Interelectrode Capacitances (approx.)	
Anode to Last Dynode	3 pF
Anode to All Other Electrodes	4 pF
Weight	85 g
Suitable Socket	Hamamatsu E678 - 12A or equivalent

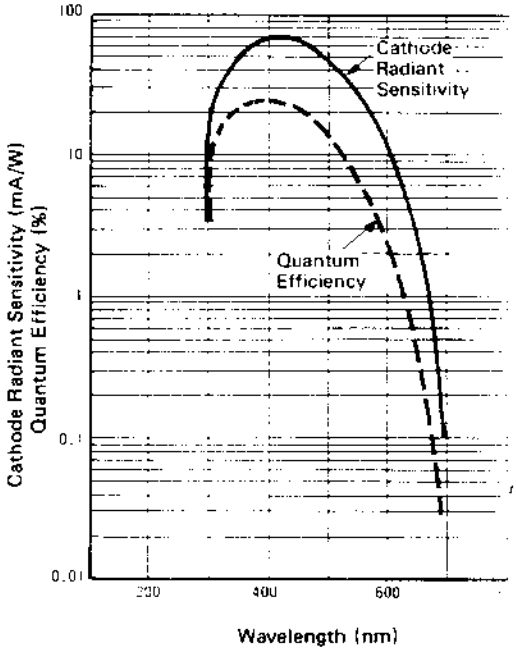
MAXIMUM RATINGS (Absolute Maximum Values) :

Supply Voltage	
Between Anode and Cathode	1250 Vdc
Between Anode and Last Dynode	250 Vdc
Average Anode Current (Note 9)	0.1 mA
Ambient Temperature	−80~+50°C

CHARACTERISTICS (at 25°C) :

	Min.	Typ.	Max.	Units
Anode Sensitivity				
Luminous (Note 1, 10)	10	35	—	A/lm
Cathode Sensitivity				
Luminous (Note 11)	40	80	—	μA/lm
Blue (Note 12)	6	10.5	—	μA/lm-blue
Current Amplification (Note 1)	—	4.4×10^5	--	
Anode Dark Current (Note 1)	—	1	3	nA

FIGURE 1
Typical Spectral Response



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2060 PHOTOMULTIPLIER TUBE

FIGURE 2
Anode Sensitivity and Amplification Characteristics

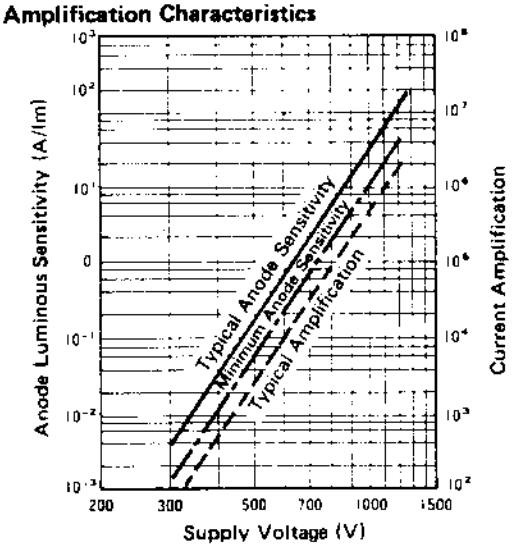


FIGURE 3
Example of Pulse Height Characteritic (Note 13)

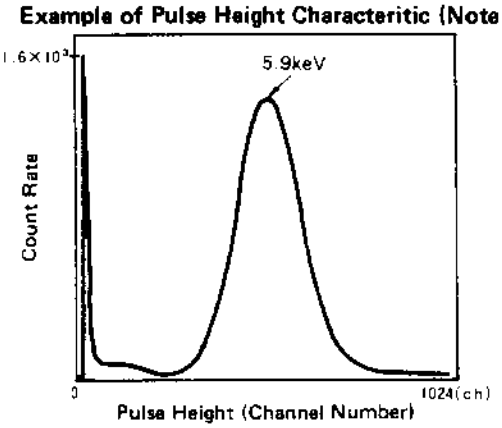
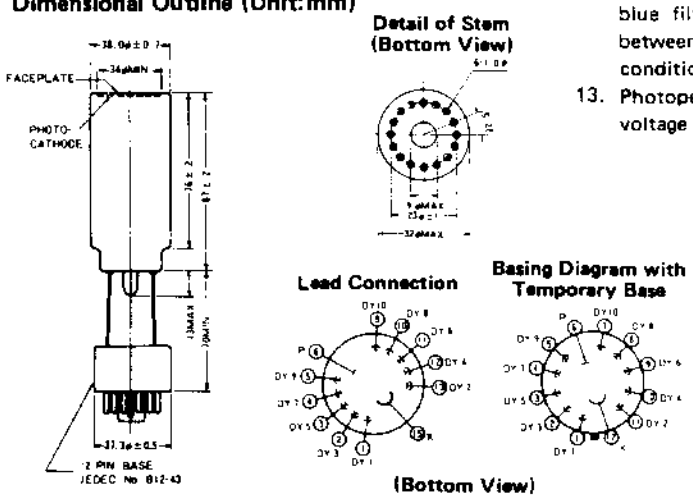


FIGURE 4
Dimensional Outline (Unit: mm)



NOTES:

1. Voltage distribution ratio
   Supply voltage (E) = 1000 Vdc
   K :Cathode Dy : Dynode P : Anode

Electrode	K	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	P
Distribution ratio	2	1	1	1	1	1	1	1	1	1	1	1

2. Scintillator is manufactured by BICRON (Type 1,125R1, NaI(Tl), 1-1/8" diameter 1" thickness). Photopeak count rate of 1000 cps.
3. Scintillator is manufactured by BICRON (Type 1R040B, NaI(Tl), 1" diameter, 1mm thickness). Photopeak count rate of 1000 cps.
4. The value is a period of 1 hour after 10 minutes of warm up with 10 microampere anode current.
5. A ^{137}Cs source and an NaI(Tl) crystal (1-1/8" diameter, 1" thickness) are employed to measure the pulse height. Warming-up time is about 1 hour.
   a) Long term (Mean Gain Deviation) is defined as follows:

$$Dg = \frac{\sum_{i=1}^{n} |P - Pi|}{n} \cdot \frac{100}{P} \quad (\%)$$

   where P is the mean pulse height averaged over n readings, Pi is the pulse height at the i-th reading, and n is the total number of readings.
   b) Short term
   The photomultiplier tube is first operated at about 10,000 cps. The photopeak counting is then decreased to approximately 1,000 cps by increasing the distance between the source and the crystal on the tube.
6. Voltage in the middle of plateau is 920 volts, plateau slope is 0.08%/V, and source is ^{55}Fe.
7. The rise time is the time for the output pulse to rise from 10% to 90% of the peak output when the tube is illuminated by a flash of light of very short duration. In measurements, the entire photocathode is illuminated.
8. The electron transit time is the interval between the arrival of a delta function light pulse at the entrance window of the tube and the time when the output pulse at the anode terminal reaches the peak amplitude.
9. Averaged over any interval of 30 seconds maximum.
10. The light source is a tungsten filament lamp operated at a distribution temperature of 2856K. The light input of 1×10^{-7} lumen is used. The load resistor has a value of 10 kilo-ohms.
11. The condition is the same as shown in Note 10 except that the value of light input is 1×10^{-4} lumen and 150 volts are applied between cathode and all other electrodes connected together as anode.
12. These values are cathode output current divided by light flux on the filter when the blue filter (Corning CS No. 5-58 polished to ⅛ stock thickness) is interposed between the light source (providing 1×10^{-4} lumen) and the tube under the same condition as Note 11.
13. Photopeak count : 1500cps, Scintillator : 1" dia.x 1 mm thick (BICRON), Supply voltage : 1000 V, Resolution : 48%, Source : ^{55}Fe, P/V : 40, Live time : 200 sec.

Warning – Personal Safety Hazards
Electrical Shock – Operating voltages applied to this device present a shock hazard.

HAMAMATSU

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