

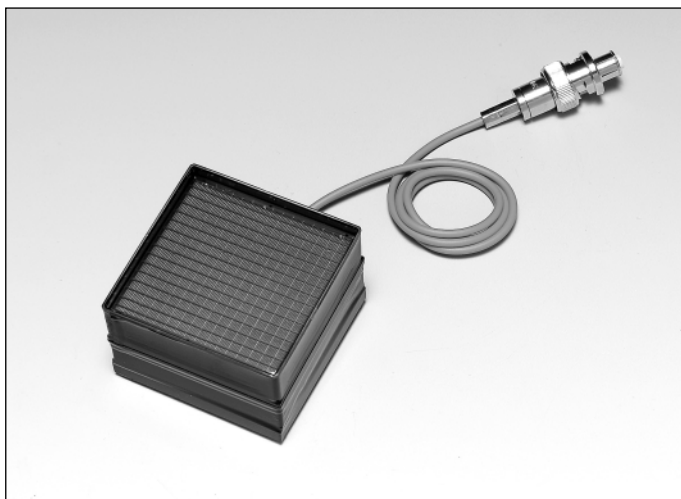
# HAMAMATSU

## FLAT PANEL TYPE MULTIANODE PHOTOMULTIPLIER TUBE ASSEMBLY H9500

52 mm Square, Bialkali Photocathode, 12-stage,  
16 × 16 Multianode, Small Dead Space, Fast Time Response

### APPLICATIONS

- Small Animal Imaging
- Compact Gamma Camera
- Scinti-mammography
- 2D Radiation Monitor



### SPECIFICATIONS

#### GENERAL

Parameter		Description / Value	Unit
Spectral Response		300 to 650	nm
Peak Wavelength		420	nm
Photocathode Material		Bialkali	—
Window	Material	Borosilicate glass	—
	Thickness	1.5	mm
Dynode	Structure	Metal channel dynode	—
	Number of Stages	12	—
Number of Anode Pixels		256 (16 × 16 matrix)	—
Pixel Size / Pitch at Center		2.8 × 2.8 / 3.04	mm
Effective Area		49 × 49	mm
Dimensional Outline (W × H × D)		52 × 52 × 33.3	mm
Packing Density (Effective Area / External Size)		89	%
Weight		177	g
Operating Ambient Temperature		0 to +50	°C
Storage Temperature		-15 to +50	°C

#### MAXIMUM RATINGS (Absolute Maximum Values)

Parameter	Value	Unit
Supply Voltage (Between Anode to Cathode)	-1100	V
Average Anode Output Current in Total	100	μA
Divider Current at -1100 V	180	μA

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## CHARACTERISTICS (at 25 °C)

Parameter		Min.	Typ.	Max.	Unit
Cathode Sensitivity	Luminous <sup>(A)</sup>	50	60	—	μA/lm
	Blue Sensitivity Index (CS 5-58) <sup>(B)</sup>	8.0	9.5	—	—
	Quantum Efficiency at 420 nm	—	24	—	%
Anode Sensitivity	Luminous <sup>(C)</sup>	—	90	—	A/lm
Gain <sup>(C)</sup>		$0.5 \times 10^6$	$1.5 \times 10^6$	—	—
Anode Dark Current per Channel <sup>(D)</sup>		—	0.05	—	nA
Anode Dark Current in Total <sup>(D)</sup>		—	13	50	nA
Time Response <sup>(E)</sup>	Rise Time <sup>(F)</sup>	—	0.8	—	ns
	Transit Time <sup>(G)</sup>	—	6	—	ns
	Transit Time Spread (FWHM) <sup>(H)</sup>	—	0.4	—	ns
Pulse Linearity per Channel (±2 % deviation)		—	0.2	—	mA
Uniformity (Condition Figure 3)		—	1:5	1:8	—
Cross-talk		—	5	—	%

## NOTES

- (A):The light source is a tungsten filament lamp operated at a distribution temperature of 2856 K. Supply voltage is 150 volts between the cathode and all other electrodes connected together as anode.
- (B):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 (A).
- (C):Measured with the same light source as Note (A) 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 (C) after 30 minutes storage in darkness.
- (E):Those are test data when a signal from a central channel of 256 anodes is used, while all photocathode are illuminated by pulsed light source.
- (F):The rise time is the time for the output pulse to rise from 10 % to 90 % of the peak amplitude when the whole photocathode is illuminated by a delta function light pulse.
- (G):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.
- (H):Also called transit time jitter. This is the fluctuation in electron transit time between individual pulses in the single photoelectron event, and defined as the FWHM of the frequency distribution of electron transit time.

**Table 1: Voltage Distribution Ratio and Supply Voltage**

Electrodes	K	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	Dy11	Dy12	GR	P
Distribution Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	0.9	0.1

Supply Voltage: -1000 V, K: Cathode, Dy: Dynode, GR: Guard Ring P: Anode

Figure 1: Typical Spectral Response

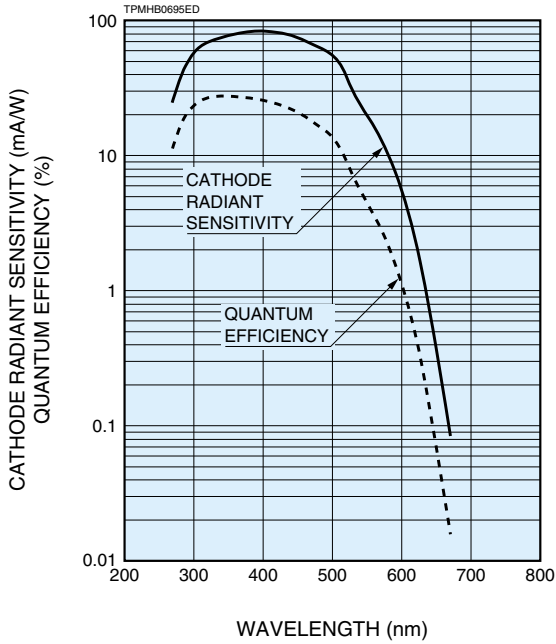


Figure 2: Typical Gain Characteristics

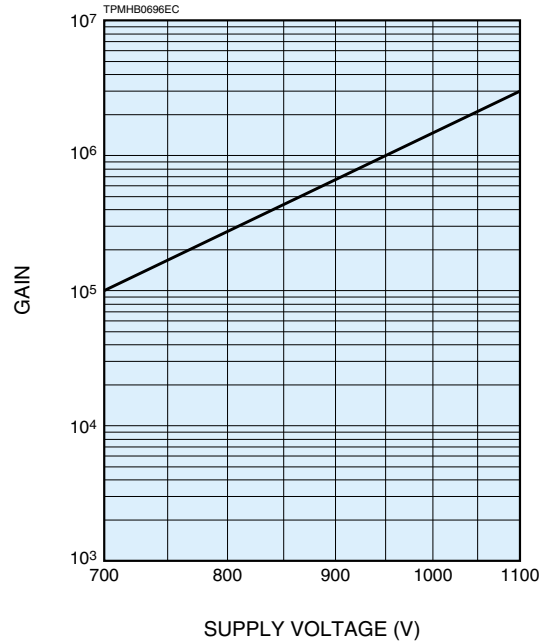


Figure 3: Anode Uniformity (Example)

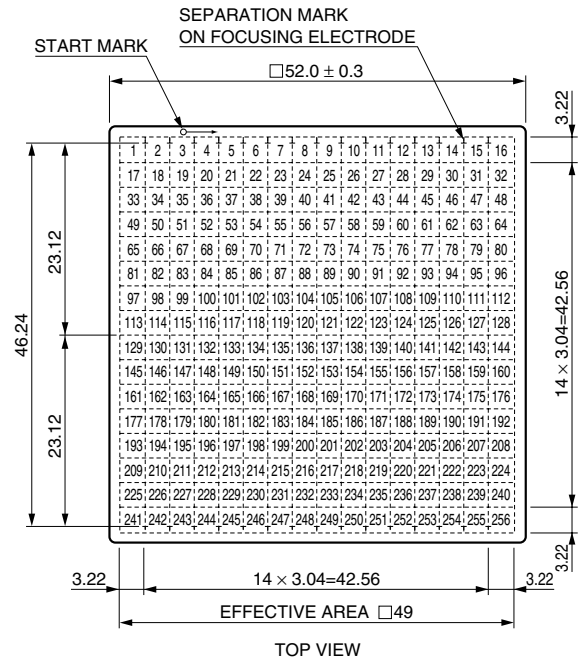
P1																					P16
23	28	34	35	37	38	35	38	38	30	28	26	29	32	34	33	P16					
38	47	54	56	57	59	60	60	58	53	50	50	50	52	62	47						
45	56	63	64	66	68	68	70	70	68	63	61	64	63	65	52						
48	59	64	68	67	70	76	78	79	71	67	63	66	63	65	48						
55	65	71	69	68	74	80	82	84	82	76	70	70	67	66	44						
54	65	68	69	74	79	85	82	85	85	81	75	72	70	63	45						
55	67	69	69	75	79	78	77	81	84	82	79	72	71	66	47						
57	67	71	75	77	78	78	78	85	87	89	84	75	70	67	46						
58	72	74	73	77	83	82	76	84	84	91	88	79	73	68	45						
61	71	75	74	78	81	82	85	87	89	96	88	84	74	65	42						
62	73	72	75	79	82	87	87	91	91	92	89	80	72	62	43						
58	72	70	72	77	77	84	91	100	93	89	84	81	70	60	40						
58	73	75	72	79	78	83	87	97	87	84	83	80	68	59	38						
61	70	70	70	76	81	82	84	87	84	82	83	76	64	55	35						
53	60	61	61	62	68	68	75	78	72	69	69	63	53	47	31						
37	41	41	40	40	44	44	46	45	46	46	44	35	25	20	P256						

TOP VIEW

SUPPLY VOLTAGE: -1000 V  
 LIGHT SOURCE: TUNGSTEN LAMP with BLUE FILTER (DC LIGHT)  
 SPOT ILLUMINATION (APERTURE SIZE): 3 mm square on each channel

TPMHB0730EA

Figure 4: Anode Matrix and Separation Mark

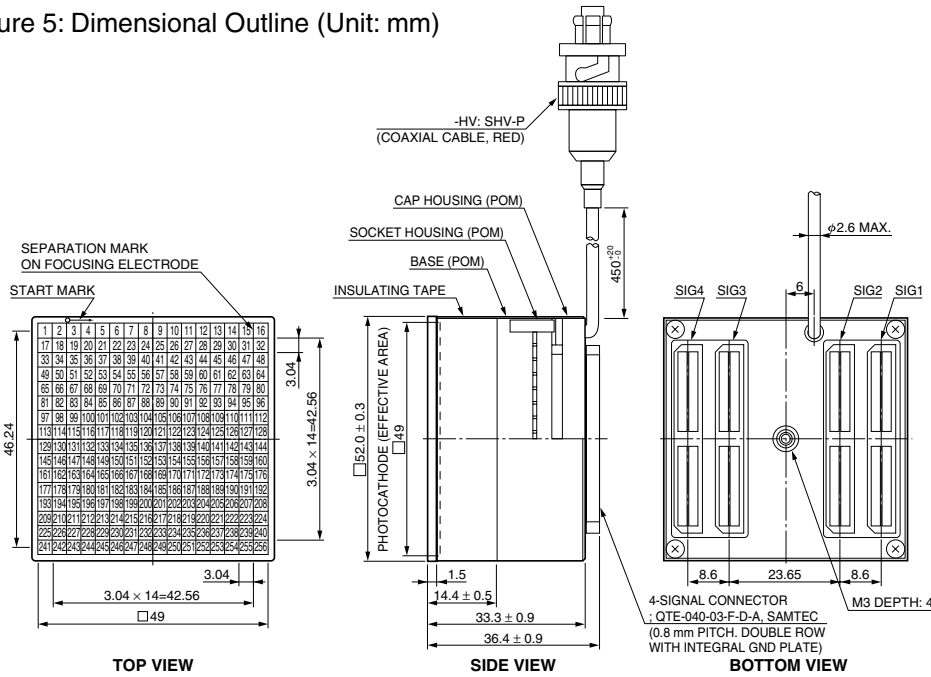


The start mark and the separation marks are put on an electrode plate inside.

TPMHB0731EA

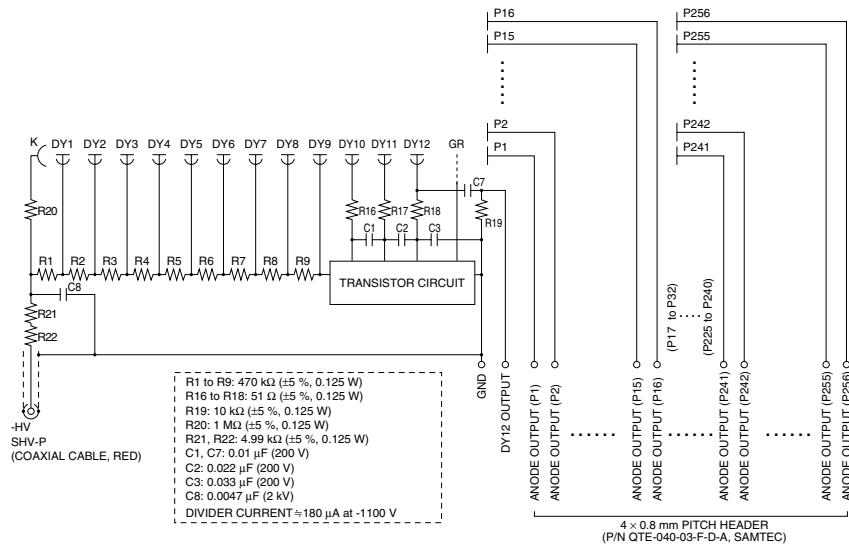
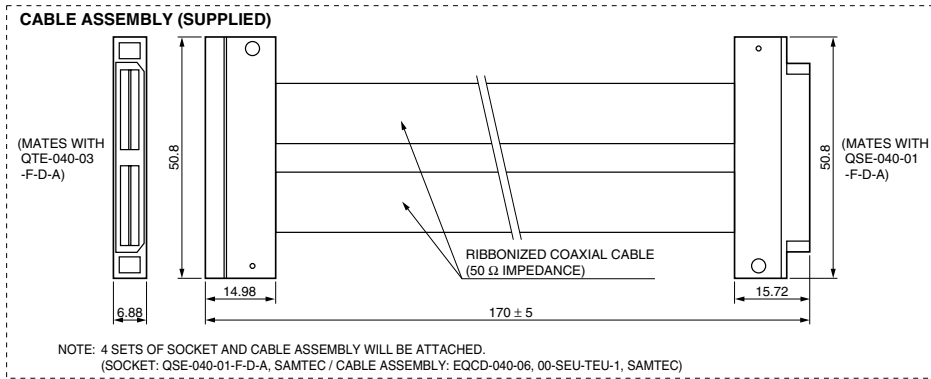
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Figure 5: Dimensional Outline (Unit: mm)



CONNECTION FOR SIGNAL CONNECTORS (BOTTOM VIEW)

SIG4		SIG3		SIG2		SIG1	
GND	GND	GND	GND	GND	GND	GND	GND
GND	GND	GND	GND	GND	GND	GND	GND
GND	GND	GND	GND	GND	GND	GND	GND
GND	GND	GND	GND	GND	GND	GND	GND
P15	P13	P11	P9	P7	P5	P3	P1
P16	P14	P12	P10	P8	P6	P4	P2
P31	P29	P27	P25	P23	P21	P19	P17
P32	P30	P28	P26	P24	P22	P20	P18
P47	P45	P43	P41	P39	P37	P35	P33
P48	P46	P44	P42	P40	P38	P36	P34
P63	P61	P59	P57	P55	P53	P51	P49
P64	P62	P60	P58	P56	P54	P52	P50
P79	P77	P75	P73	P71	P69	P67	P65
P80	P78	P76	P74	P72	P70	P68	P66
P95	P93	P91	P89	P87	P85	P83	P81
P96	P94	P92	P90	P88	P86	P84	P82
P111	P109	P107	P105	P103	P101	P99	P97
P112	P110	P108	P106	P104	P102	P100	P98
P127	P125	P123	P121	P119	P117	P115	P113
P128	P126	P124	P122	P120	P118	P116	P114
P143	P141	P139	P137	P135	P133	P131	P129
P144	P142	P140	P138	P136	P134	P132	P130
P159	P157	P155	P153	P151	P149	P147	P145
P160	P158	P156	P154	P152	P150	P148	P146
P175	P173	P171	P169	P167	P165	P163	P161
P176	P174	P172	P170	P168	P166	P164	P162
P191	P189	P187	P185	P183	P181	P179	P177
P192	P190	P188	P186	P184	P182	P180	P178
P207	P205	P203	P201	P199	P197	P195	P193
P208	P206	P204	P202	P200	P198	P196	P194
P223	P221	P219	P217	P215	P213	P211	P209
P224	P222	P220	P218	P216	P214	P212	P210
P239	P237	P235	P233	P231	P229	P227	P225
P240	P238	P236	P234	P232	P230	P228	P226
P255	P253	P251	P249	P247	P245	P243	P241
P256	P254	P252	P250	P248	P246	P244	P242
GND	GND	GND	GND	GND	GND	GND	GND
GND	GND	GND	GND	GND	GND	GND	GND
GND	GND	GND	GND	GND	GND	GND	GND
DY12 OUTPUT	GND	GND	GND	GND	GND	GND	GND
METAL PLATE (GND)							



- R1 to R9: 470 kΩ (±5%, 0.125 W)
- R16 to R18: 51 Ω (±5%, 0.125 W)
- R19: 10 kΩ (±5%, 0.125 W)
- R20: 1 MΩ (±5%, 0.125 W)
- R21, R22: 4.99 kΩ (±5%, 0.125 W)
- C1, C7: 0.01 μF (200 V)
- C2: 0.022 μF (200 V)
- C3: 0.033 μF (200 V)
- C8: 0.0047 μF (2 kV)
- DIVIDER CURRENT = 180 μA at -1100 V

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