HAMAMATSU

FINE MESH PMT SERIES for HIGH MAGNETIC FIELD ENVIRONMENTS

PMT's for THE OPERATION in HIGH MAGNETIC FIELDS over 1 TESLA

In recent years, the demand for photodetectors, that can be operated in strong magnetic fields has increased, especially in the field of high energy physics. Conventional PMT's electrons trajectories are affected by magnetic fields. The gain of these PMT's is decreased under such conditions. Therefore, it is necessary for these PMT's to either use a light guide to send signal light to a region outside the magnetic field or to use a magnetic shield. The light guide and its coupling to a PMT, cause loss of light and deterioration of the timing characteristics of the signal light. The use of magnetic shield adds cost and energy loss for the next particle detector.

PMT's using fine mesh dynodes (Fine Mesh PMT's) make it possible to operate PMT's even in strong magnetic fields over 1.0 tesla. Depending on your needs, you can select from the Fine Mesh PMT series.
In addition, socket assemblies and hybrid assemblies can be supplied to avoid troublesome design and manufacturing of voltage dividers.

APPLICATION

- **TOF COUNTER**
- **CALORIMETER**
- **OTHER DETECTORS IN HIGH ENERGY PHYSICS AND NUCLEAR PHYSICS EXPERIMENTS**

FINE MESH PMT SERIES for HIGH MAGNETIC FIELD ENVIRONMENTS

Tube Diameter	Type Number	Spectral Response Range(nm) & Curve Code	ⓐ Outline No.	ⓑ Socket	No. of Stages	Cathode Sensitivity			Anode Sensitivity							
						Luminous Typ. (µA/lm)	Blue Sens. Index (CS 5-58) Typ.	Q.E at Peak Typ. (%)	Luminous Typ. (A/Lm)	Nominal Gain ⓓ (at 0 T)	Nominal Gain ⓓ (at 0.5 T)	Nominal Gain ⓓ (at 1 T)	Supply Voltage for Nominal Gain at 0 T ⓓ Typ.(V)	Supply Voltage for Nominal Gain at 0 T ⓓ Max.(V)	Dark Current at Nominal Gain at 0 T ⓓ Typ. (nA)	Dark Current at Nominal Gain at 0 T ⓓ Max. (nA)
25 mm (1")	R5505	300 to 650 400K	①	E678-17A	15	80	9.5 (7.0)	23	40	5.0×10^5	2.3×10^5	1.8×10^4	1850	2300	5	30
38 mm (1.5")	R5946	300 to 650 400K	②	E678-19D	16	80	9.5 (7.0)	23	80	1.0×10^6	4.3×10^5	2.9×10^4	1800	2300	5	30
38 mm (1.5")	R7761	300 to 650 400K	③	–	19	80	9.5 (7.0)	23	800	1.0×10^7	3.0×10^6	1.5×10^5	1800	2300	15	100
51 mm (2")	R5924	300 to 650 400K	④	–	19	70	9.0 (7.0)	22	700	1.0×10^7	4.1×10^6	2.0×10^5	1750	2300	30	200
64 mm (2.5")	R6504	300 to 650 400K	⑤	–	19	70	9.0 (7.0)	22	700	1.0×10^7	4.1×10^6	2.0×10^5	1750	2300	50	300

< NOTE >

ⓐ Basing Diagram Symbols

K : Photocathode   P : Anode   DY : Dynode

IC :Internal Connection (Don't use)

ⓑ A socket will be supplied with a PMT.

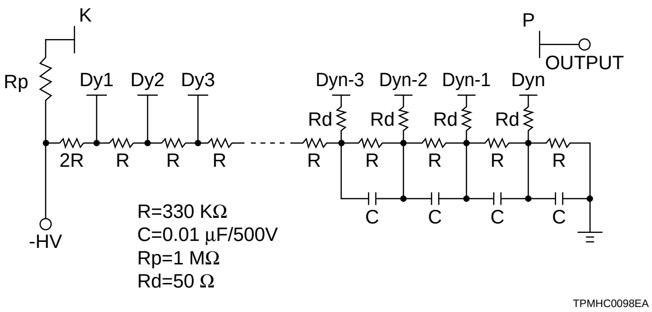
ⓒ The voltage indicates a standard applied voltage used to measure anode characteristics. The voltage distribution ratio are shown below.

The Voltage Distribution Ratio

Electrodes	K		Dy1		Dy2		Dy3		···		Dyn-1		Dyn		P
Ratio		2		1		1		1		1		1		1	

Where n corresponds to a number of dynode stages of each PMT.

Recommended voltage divider network is +HV operation but, in case you may need to operate the tube at -HV, design the circuit network as shown below.



In this drawing, Rp is a protection resistor which prevents damages to the signal readout unit when the PMT generates a large output pulse, and Rd is a damping resistor which reduces ringings of output pulses.

ⓓ Only these items are defined as a value measured with magnetic fields, and other items are defined without magnetic fields.
The direction of magnetic fields is pallarel to the tube axis.

ⓔ The maximum ambient temperature range is -80 °C to +50 °C. When a PMT is operated below -20 °C, please consult our sales office.

ⓕ The maximum anode to cathode voltage is limited by the internal structure of the PMT. Excessive voltage causes electrical breakdown.

ⓖ This indicates the maximum averaged current over any interval of 30 seconds.

ⓗ Time Response

Rise Time
The time for the anode output pulse to rise from 10 % to 90 % of the peak amplitude.

Electron Transit Time
The time interval between the arrival of a delta function light pulse at the photocathode and the instant when the anode output pulse reaches its peak amplitude.

T.T.S. (Transit Time Spread)
This is the fluctuation in transit time among individual pulses, and is defined as the FWHM of the frequency distribution of transit time. T.T.S. depends on the number of incident photons. The values in this catalog are measured in the single photoelectron state.

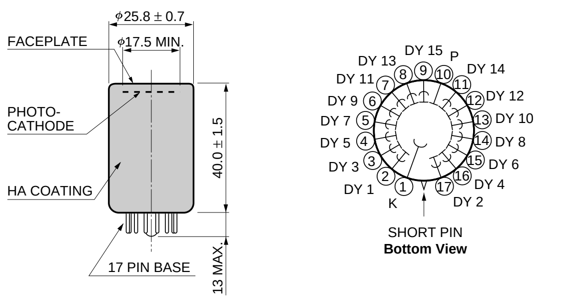
ⓘ The definition of the pulse linearity is proportionality between the input light amount and the output current in the pulse operation mode.
Typical values of pulse linearity are specified at two deviation points of ±2 % and ±5 % from linear proportionality.

(at 25 °C)

Time Response (Typ) at 0 T ⓗ			Pulse Lineaity (Typ) at 0 T ⓘ		Maximum Rating ⓔ						Notes	Type No.
Rise Time (ns)	Transit Time (ns)	T.T.S. (FWHM) (ns)	± 2% Deviation (mA)	± 5% Deviation (mA)	Anode Luminous (A/Lm)	Anode ⓕ to Cathode Voltage (V) at 0 T	Anode to Cathode Voltage (V) over 1 T	Cathode to Dy1 Voltage (V)	Dynode to Dynode Voltage (V)	Average ⓖ Anode Current (mA)		
1.5	5.6	0.35	180	250	300	2300	2500	300	200	0.01	UV Type (R5506) Synthetic Silica Type (R7494)	R5505
1.9	7.2	0.35	350	500	800	2300	2800	400	200	0.01	UV Type (R6148) Synthetic Silica Type (R6149)	R5946
2.1	7.5	0.35	350	500	4000	2300	2800	400	200	0.01		R7761
2.5	9.5	0.44	500	700	5000	2300	2800	400	200	0.1	UV type (R6608) Synthetic Silica Type (R6609)	R5924
2.7	11.0	0.47	700	1000	5000	2300	2800	400	200	0.1	UV Type (R6505)	R6504

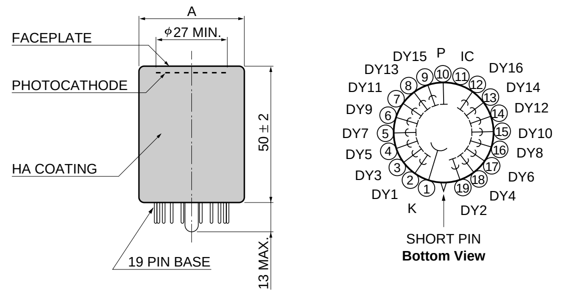
Unit: mm

① R5505, R5506, R7494



TPMHA0236EA

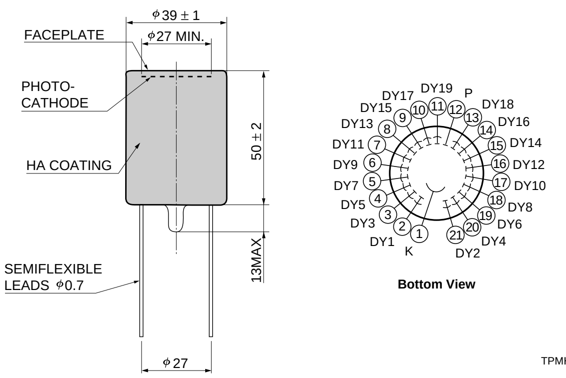
② R5946, R6148, R6149



	R5946 R6148	R6149
A	φ39 ± 1	φ40 ± 1

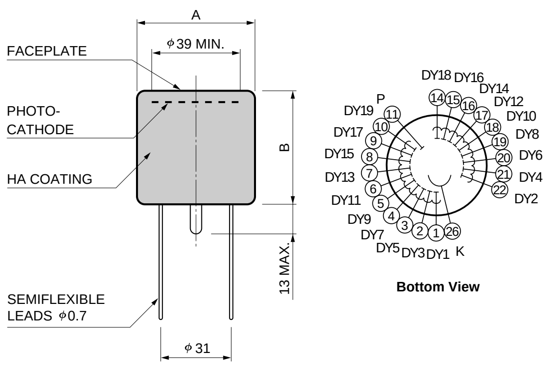
TPMHA0243EC

③ R7761



TPMHA0469EA

④ R5924, R6608, R6609



	R5924 R6608	R6609
A	φ 52 ± 1	φ 53 ± 1
B	50 ± 2	68 ± 2

TPMHA0337EA

⑤ R6504, R6505

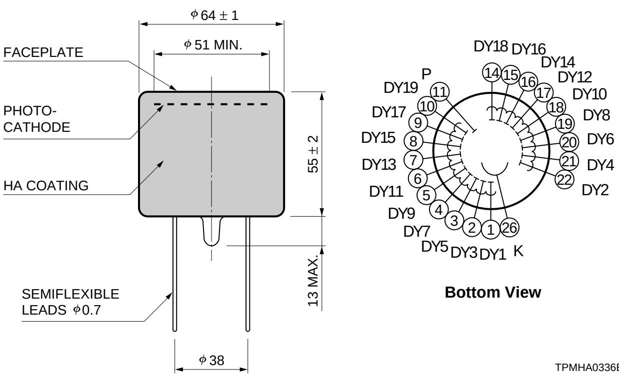


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Fig.1: Typical Spectral Response

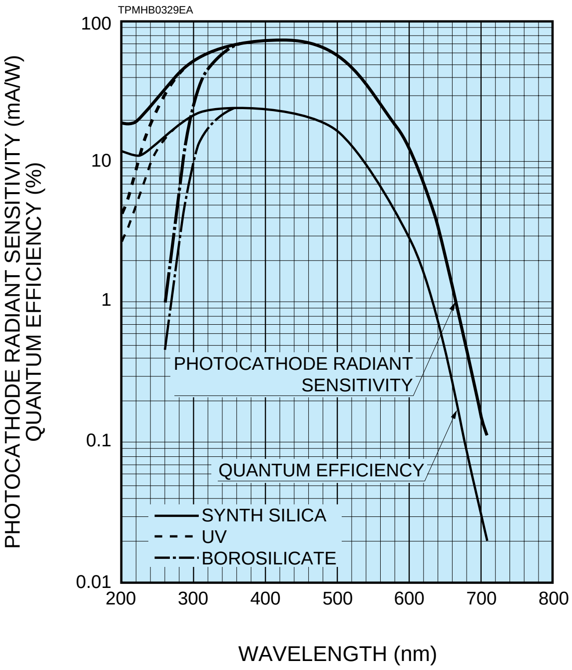


Fig.2: Typical Gain Characteristics

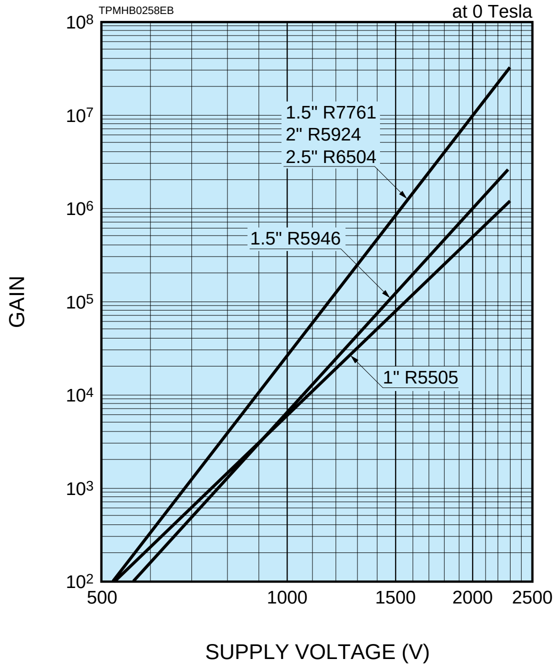


Fig.3: Typical Time Response

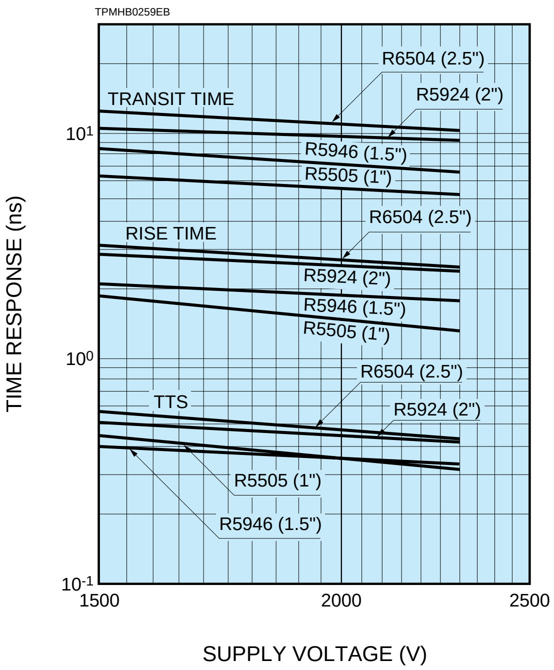


Fig.4: Typical Pulse Linearity

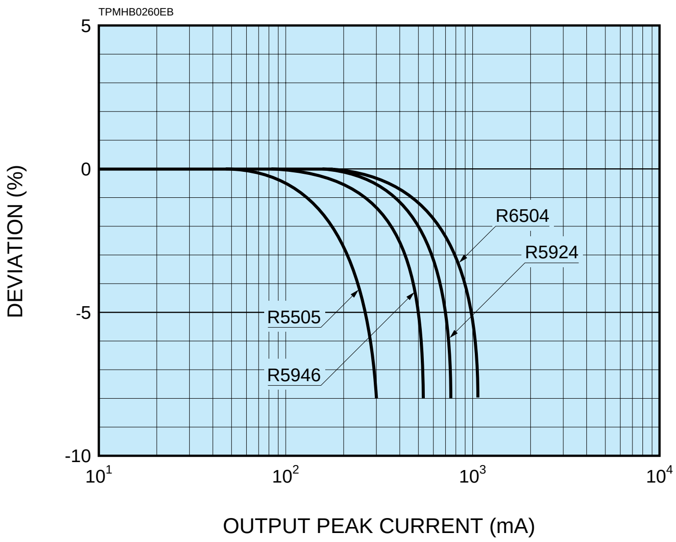


Fig.5: R5505 Typical Gain in Magnetic Fields

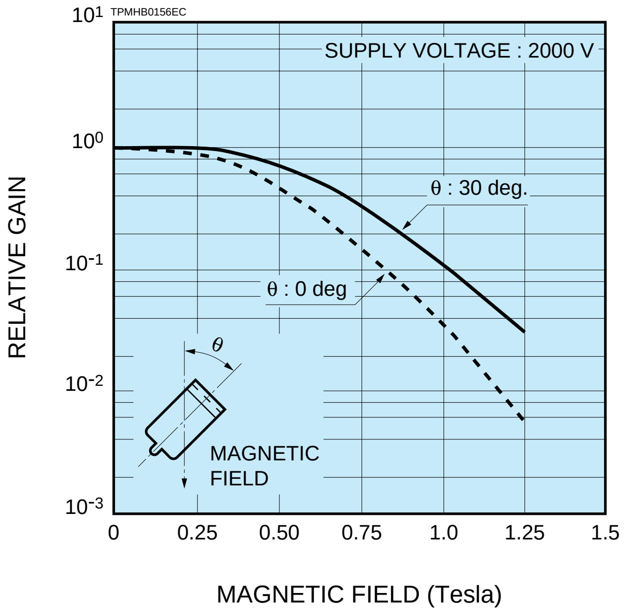


Fig.6: R5946 Typical Gain in Magnetic Fields

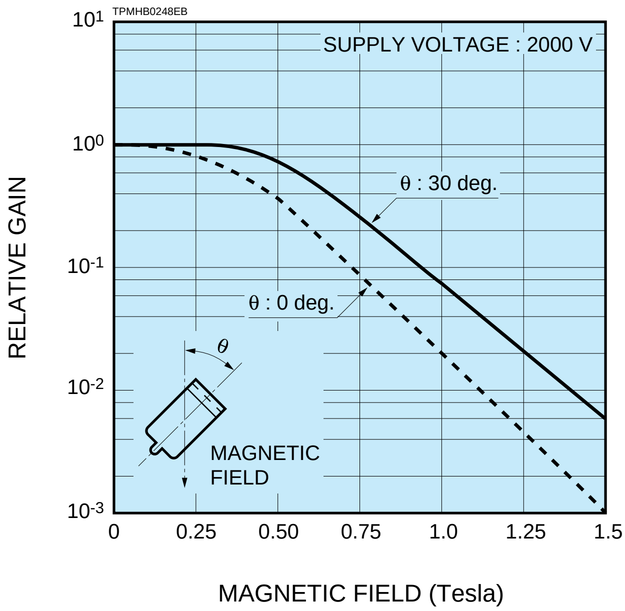


Fig.7: R5924 & R6504 Typical Gain in Magnetic Fields

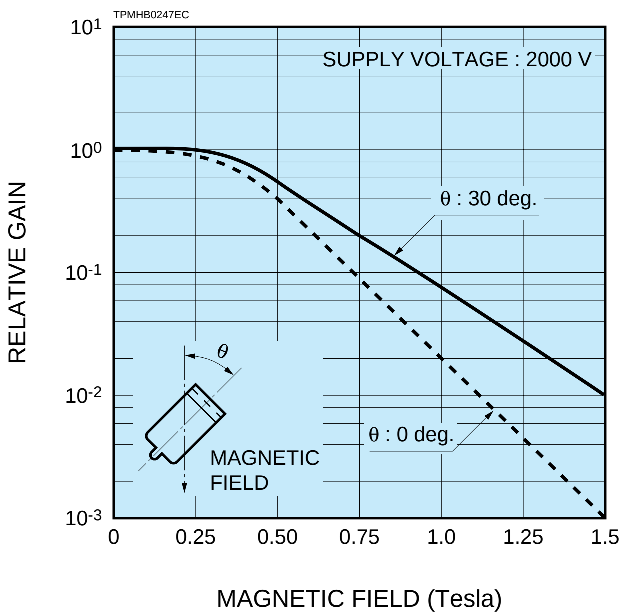
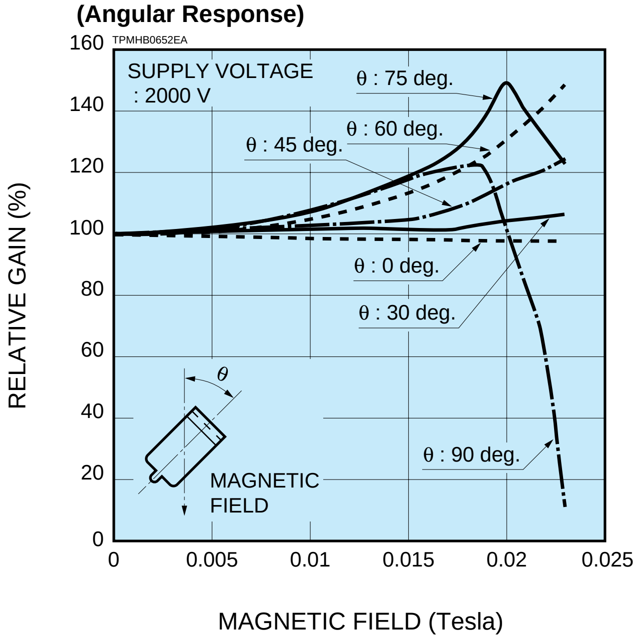


Fig.8: R5946 Typical Gain in Magnetic Fields (Angular Response)



FINE MESH PMT SERIES for HIGH MAGNETIC FIELD ENVIRONMENTS

ASSEMBLIES for FINE MESH PMT SERIES

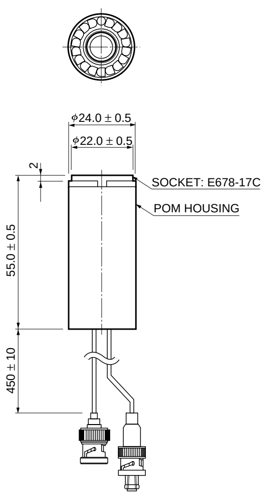
Type Number	PMT Tube Diameter	PMT Type Number	Outline Number	Ground Potential	H.V Input Terminal	Signal Output Terminal	ⓐ Material of Case	Total Resistance (MΩ)	Maximum Rating: Overall Voltage (V)	Maximum Rating: Divider Current (μA)
SOCKET ASSEMBLIES										
E6133-04	25 mm (1")	R5505	①	CATHODE	COAXIAL CABLE (with SHV)	RG-174/U (with BNC)	POM	5.61	+2500	446
E6113-03	38 mm (1.5")	R5946	②	CATHODE	COAXIAL CABLE (with SHV)	RG-174/U (with BNC)	POM	5.94	+2800	472
HYBRID ASSEMBLIES (PMT INCLUDED)										
H6152-70	25 mm (1")	R5505	③	CATHODE	COAXIAL CABLE	RG-174/U	POM	5.61	+2500	446
H6153-70	38 mm (1.5")	R5946	④	CATHODE	COAXIAL CABLE	RG-174/U	POM	5.94	+2800	472
H8409-70	38 mm (1.5")	R7761	⑤	CATHODE	COAXIAL CABLE	RG-174/U	POM	6.93	+2800	404
H6614-70	51 mm (2")	R5924	⑥	CATHODE	COAXIAL CABLE	RG-174/U	POM	6.93	+2800	404
H8318-70	64 mm (2.5")	R6504	⑦	CATHODE	COAXIAL CABLE	RG-174/U	POM	6.93	+2800	404

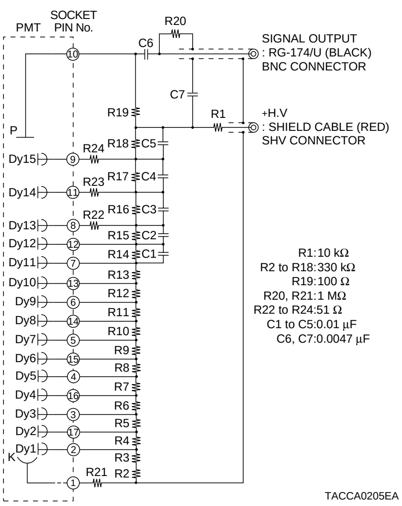
ⓐ POM : Poly Oxy Methylene

Dimensional Outlines and Circuit Diagrams for Socket Assemblies and Hybrid Assemblies

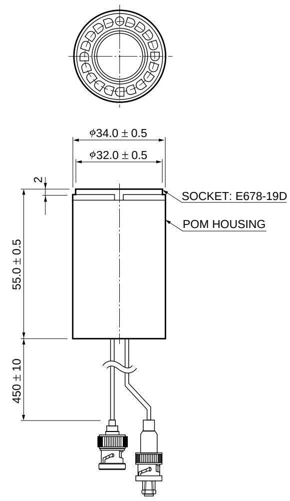
Unit: mm

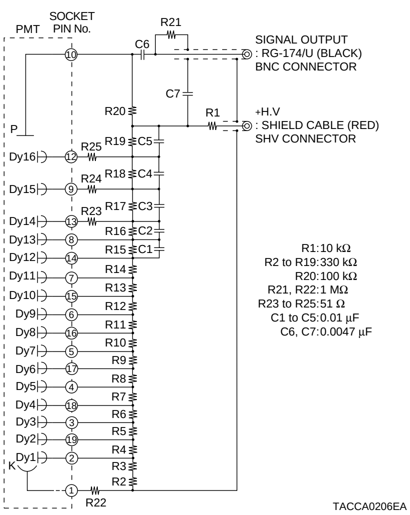
① E6133-04



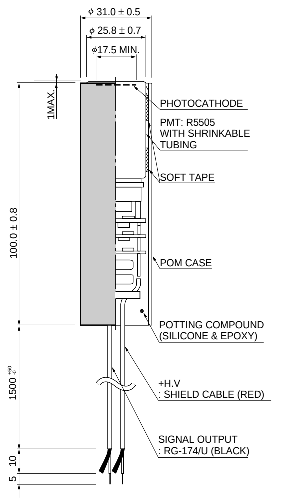


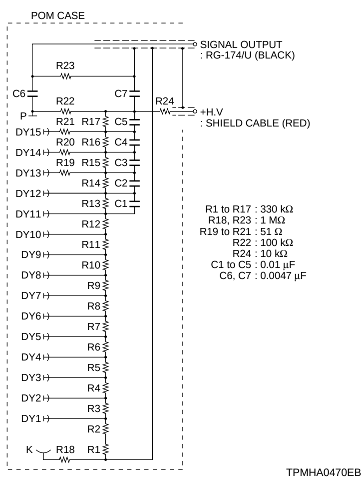
② E6113-03





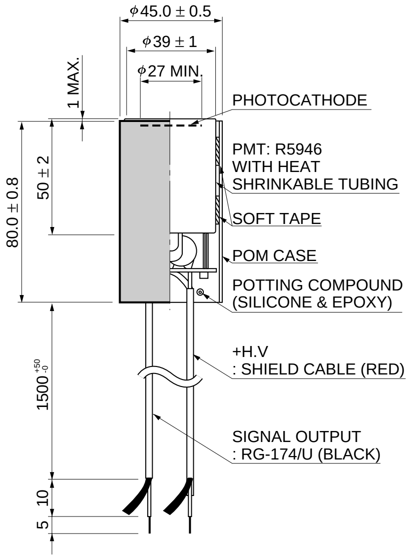
③ H6152-70

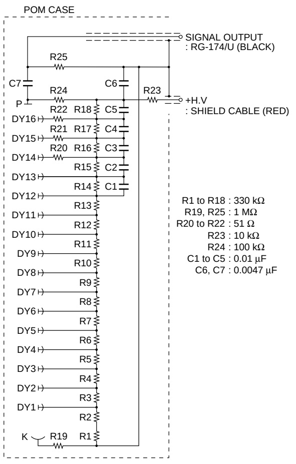




Unit: mm

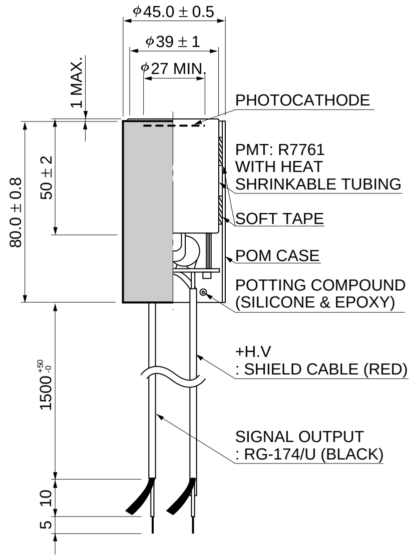
④ H6153-70

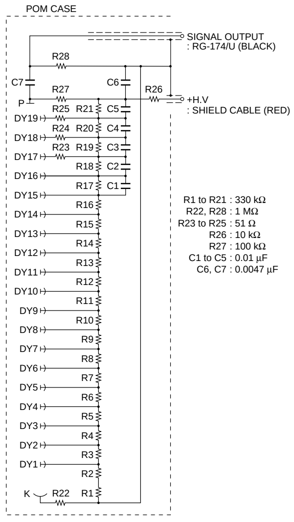




TPMHA0470EB

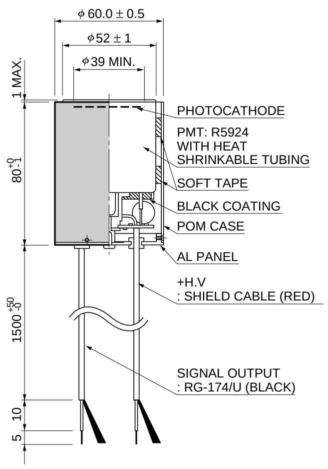
⑤ H8409-70

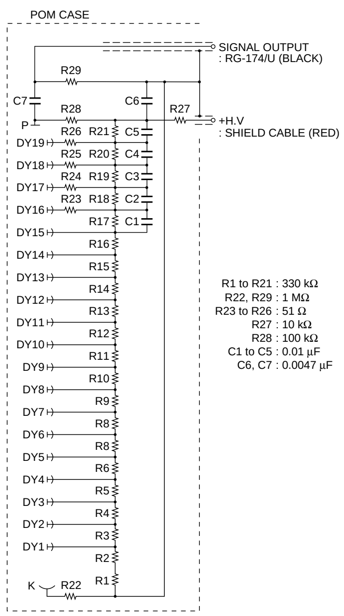




TPMHA0476EA

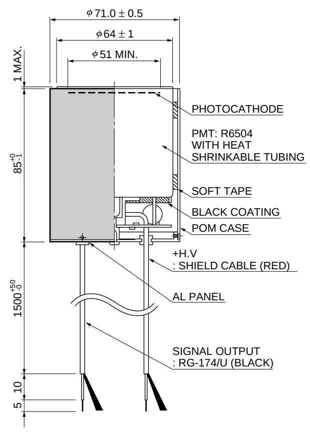
⑥ H6614-70

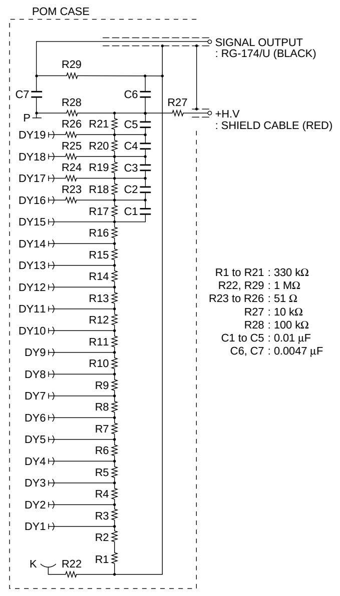




TPMHA0472EA

⑦ H8318-70





TPMHA0473EA

Socket Assembly	The maximum operating temperature range : -10 °C to +50 °C The maximum storage temperature range : -15 °C to +60 °C
Hybrid Assembly	The maximum operating temperature range : -10 °C to +50 °C The maximum storage temperature range : -15 °C to +50 °C

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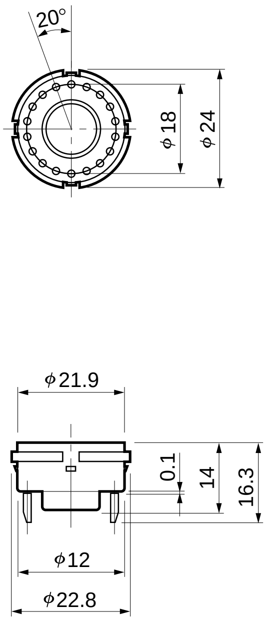
Socket Dimensional Outlines

Unit: mm

E678-17A



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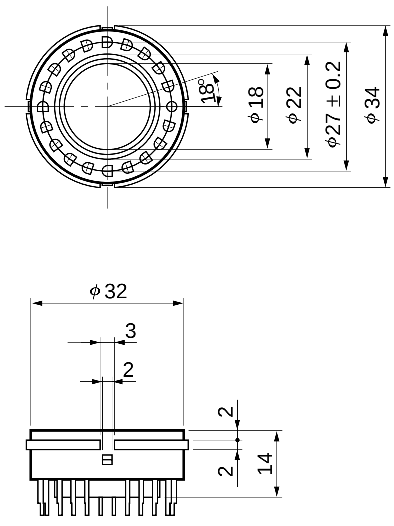
E678-19D



TACCA0067EB

Warranty

All Hamamatsu photomultiplier tubes are warranted to the original purchaser for a period of 12 months following the date of shipment. The warranty is limited to repair or replacement of any defective material due to defects in workmanship or materials used in manufacture.

A: Any claim for damage of shipment must be made directly to the delivering carrier within five days.

B: Customers must inspect and test all photomultiplier tubes within 30 days after shipment. Failure to accomplish said incoming inspection shall limit all claims to 75 % of invoice value.

C: No credit will be issued for broken detectors unless in the opinion of Hamamatsu the damege is due to a bulb crack traceable to a manufacturing defect.

D: No credit will be issued for any photomultiplier tubes which in the judgement of Hamamatsu has been dameged, abused, modified or whose serial number or type number have been obliterated or defaced.

E: No photomultiplier tubes will be accepted for return unless permission has been obtained from Hamamatsu in writing, the shipment has been returned prepaid and insured, the photomultiplier tubes are packed in their original box and accompanied by the original datasheet furnished to the customer with the tube, and a full written explanation of the reason for rejection of each photomultiplier tubes.

F: When photomultiplier tubes are used at the condition which exceeds the specified maximum ratings or which could hardly be grasped, Hamamatsu will not be responsible to the guarantee of photomultiplier tubes.

HAMAMATSU is always in pursuit of improvements and new developments in the field of photodetectors. We can provide various kinds of detectors, emitters and assemblies for use in high energy physics as well as other fields of physics. Please feel free to contact us at any time.

HOMEPAGE URL http://www.hamamatsu.com

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