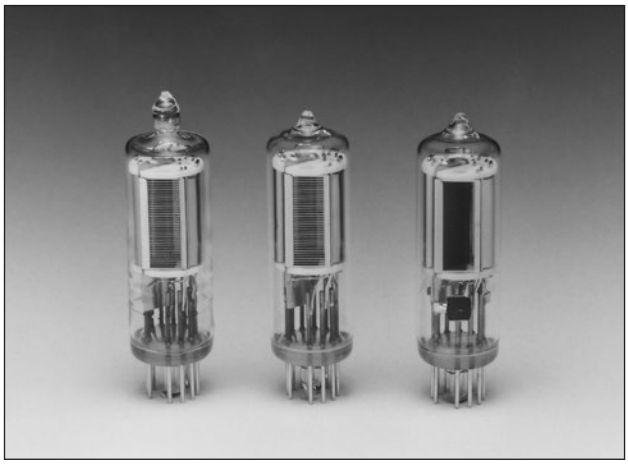
HAMAMATSU

PHOTON IS OUR BUSINESS

13 mm Dia. SIDE-ON COMPACT TYPE PHOTOMULTIPLIER TUBE SERIES

The R6350 to R6358 series are compact side-on photomultiplier tubes of a 13 mm diameter and 40 mm height. Using different photocathode and window material combinations helped to produce a full product lineup to cover a wide spectral response range from the UV to the near infrared. This allows selecting the optimal tube to match your application and wavelength to be detected, the same as when selecting the popular 28 mm (1-1/8 inch) side-on tubes.
The R6356-06 and R6357 do not use an entrance mesh which is usually installed just inside the light input window. This eliminates the light loss caused by the entrance mesh, even if the size of incident light beam is small.



▲Left: Silica glass window Center: UV glass window
Right: Meshless type (R6356-06, R6357)

APPLICATIONS

- **Emission spectroscopy (ICP, Direct reader)**
- **Environmental monitoring (NOx, SO_2, etc.)**
- **Fluorescence immunoassay**
- **Chemiluminescence immunoassay**
- **Hygiene monitors (Bio luminescence)**
- **X-ray phototimers**
- **Fluorometers**
- **Microscopes (Laser scanning microscopes)**

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13 mm Dia. SIDE-ON COMPACT TYPE PHOTOMULTIPLIER TUBE SERIES

Side-on compact type photomultiplier tubes

Type No.	Remarks	Spectral response		Ⓐ	Ⓑ	Ⓒ	Ⓓ	Socket	Maximum Ⓕ ratings		Cathode sensitivity Luminous	
		Range (nm)	Peak wave-length (nm)	Photo-cathode material	Window material	Outline No.	Dynode structure / No. of stages	Socket / Socket assembly	Anode to cathode voltage (V)	Ⓖ Average anode current (mA)	Min. (μA/lm)	Typ. (μA/lm)
R6350	For UV to visible range, general purpose.	185 to 650	340	BA	U	①	CC/9	E678-11U/Ⓔ	1250	0.01	20	40
R6351	Silica glass window type of R6350	160 to 650	340	BA	Q	②	CC/9	E678-11U/Ⓔ	1250	0.01	20	40
R6352	High sensitivity variant of R6350	185 to 750	420	BA	U	①	CC/9	E678-11U/Ⓔ	1250	0.01	80	120
R6353	Low dark current bialkali photocathode	185 to 680	400	LBA	U	①	CC/9	E678-11U/Ⓔ	1250	0.01	30	70
R6354	For UV range	160 to 320	230	Cs-Te	Q	②	CC/9	E678-11U/Ⓔ	1250	0.01	—	—
R6355	For UV to near IR range, general purpose	185 to 850	530	MA	U	①	CC/9	E678-11U/Ⓔ	1250	0.01	80	150
R6356-06 *	High sensitivity variant of R6355 Meshless type	185 to 900	400	MA	U	①	CC/9	E678-11U/Ⓔ	1250	0.01	200	300
R6357 *	High sensitivity variant of R6356-06, Meshless type	185 to 900	450	MA	U	①	CC/9	E678-11U/Ⓔ	1250	0.01	350	500
R6358	Low dark current multialkali photocathode	185 to 830	530	MA	U	①	CC/9	E678-11U/Ⓔ	1250	0.01	140	200

* Achieved the higher photocathode sensitivity by eliminating the mesh in front of the photocathode.
It also features no output variation, disturbed by the mesh, when the incident light spot to the photocathode is small.

NOTE: Ⓐ Photocathode materials
BA: Bialkali
LBA: Low noise bialkali
MA: Multialkali

Ⓑ Window materials
Q: Silica glass
U: UV glass

Ⓒ Outline No.
See Fig. 9

Ⓓ Dynode structure
CC: Circular-cage

Ⓔ See optional accessories

Ⓕ Operating ambient temperature and storage temperature are -30 °C to +50 °C.

Ⓖ Averaged over any interval of 30 s maximum.

Cathode sensitivity			Ⓚ Anode to cathode supply voltage	Anode sensitivity Ⓛ								Notes	Type No.
				Anode sensitivity				Anode dark current (After 30 min.)		Time response			
				Luminous		Ⓙ							
Blue sens. index Typ.	Ⓗ Red/ White ratio Typ.	Ⓙ Radiant Typ. (mA/W)	(V)	Min. (A/lm)	Typ. (A/lm)	Radiant Typ. (A/W)	Gain Typ.	Typ. (nA)	Max. (nA)	Rise time Typ. (ns)	Electron transit time Typ. (ns)		
5	—	48	1000	50	300	3.6×10^5	7.5×10^6	0.5	5	1.4	15	Photon counting type: R6350P	R6350
5	—	48	1000	50	300	3.6×10^5	7.5×10^6	0.5	5	1.4	15		R6351
10	—	90	1000	100	700	5.2×10^5	5.8×10^6	1	10	1.4	15		R6352
6.5	—	65	1000	100	400	3.7×10^5	5.7×10^6	0.1	2	1.4	15	Photon counting type: R6353P	R6353
—	—	50 Ⓜ	1000	—	—	2.0×10^5 Ⓜ	4.0×10^6	0.5	5	1.4	15		R6354
6	0.15	45	1000	100	600	1.8×10^5	4.0×10^6	1	10	1.4	15		R6355
10	0.3	77	1000	400	1200	3.1×10^5	4.0×10^6	1	10	1.4	15		R6356-06 *
13	0.4	105	1000	1000	2000	4.2×10^5	4.0×10^6	2	10	1.4	15		R6357 *
7.5	0.15	70	1000	300	700	2.5×10^5	3.5×10^6	0.1	1	1.4	15	Photon counting type: R6358-10	R6358

Ⓗ Measured using red filter.

Ⓙ Measured at the peak sensitivity wavelength.

Ⓚ Refer to note Ⓝ.

Ⓛ Anode characteristics are measured with the supply voltage and voltage distribution ratio specified by Note Ⓝ.

Ⓜ at 254 nm

Ⓝ Voltage distribution ratio and voltage.

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

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

Figure 1: Typical spectral response of Cs-Te

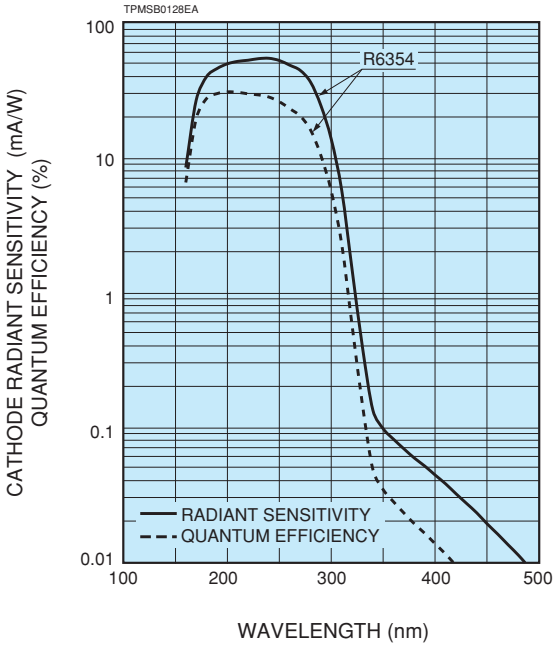


Figure 2: Typical spectral response of BA, LBA

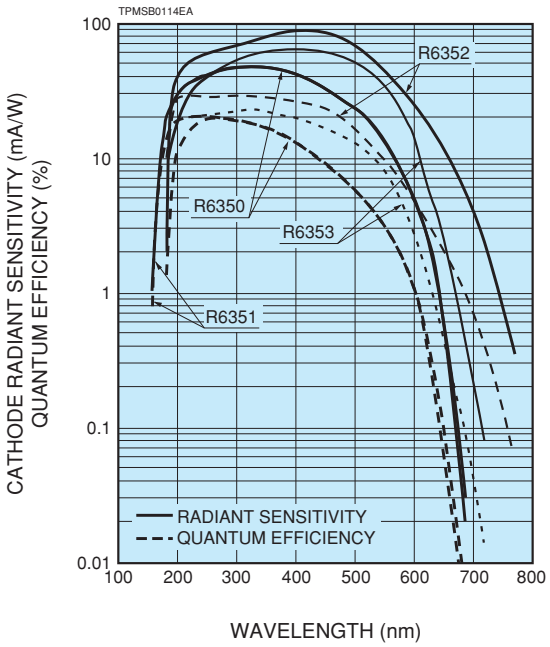


Figure 3: Typical spectral response of MA

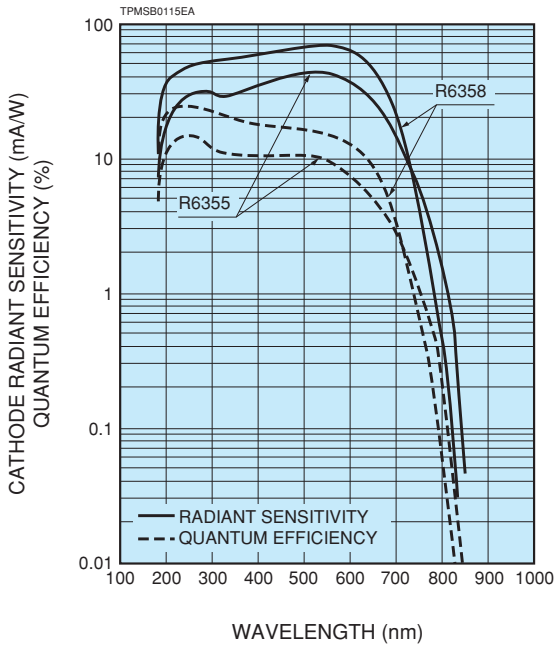


Figure 4: Typical spectral response of high sensitivity MA

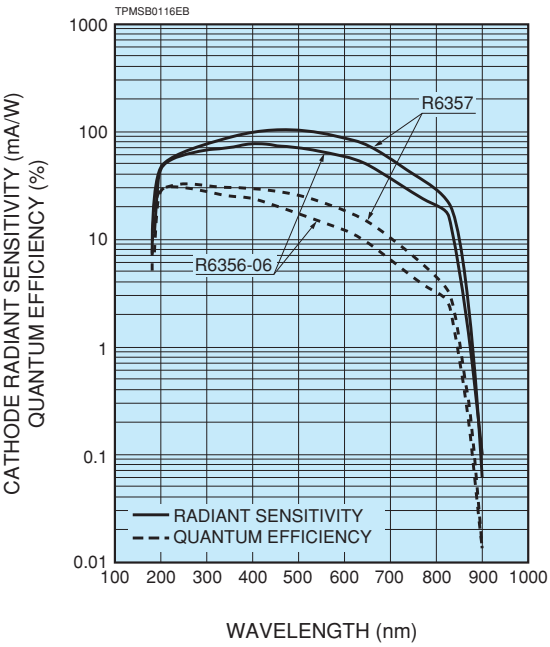


Figure 5: Typical gain

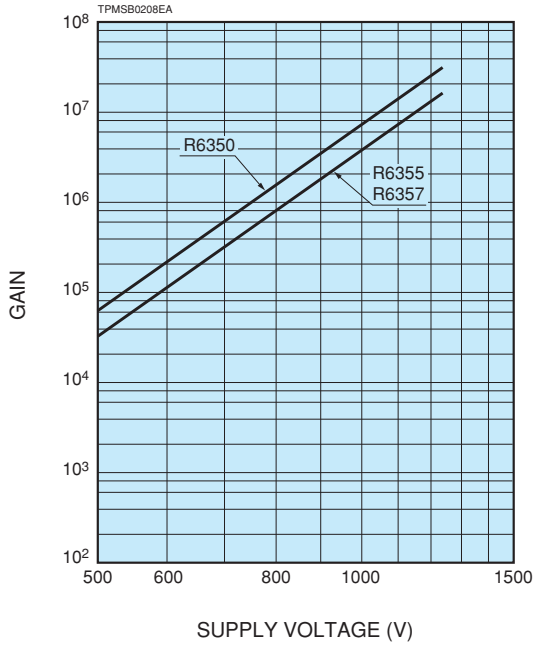


Figure 6: Typical time response

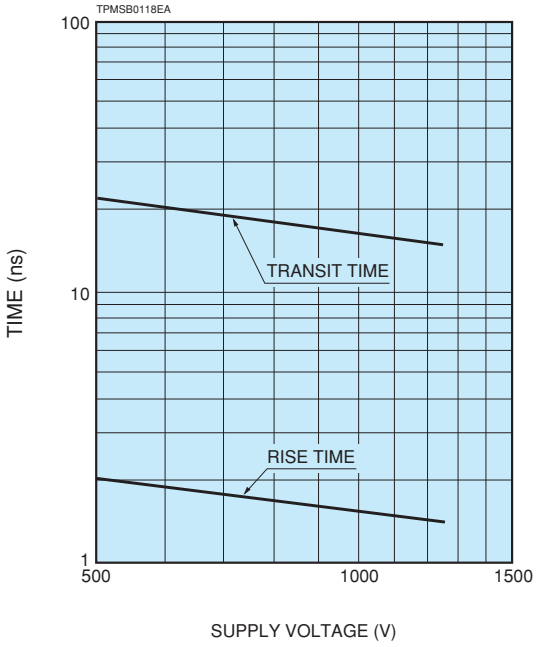


Figure 7: Typical ENI characteristics

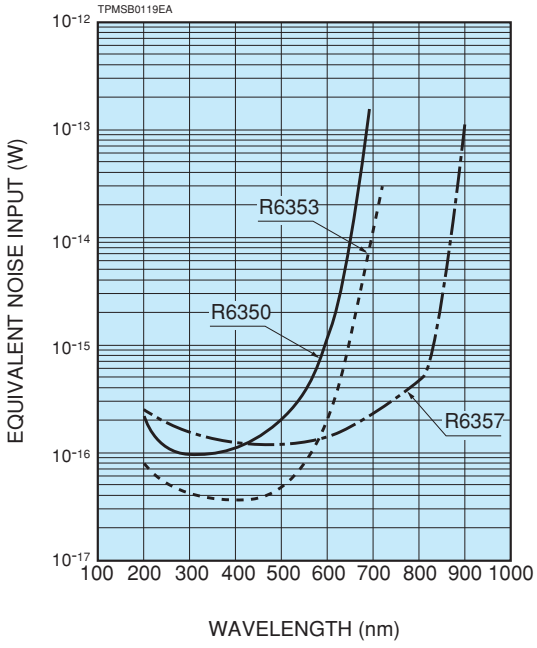


Figure 8: Typical anode uniformity

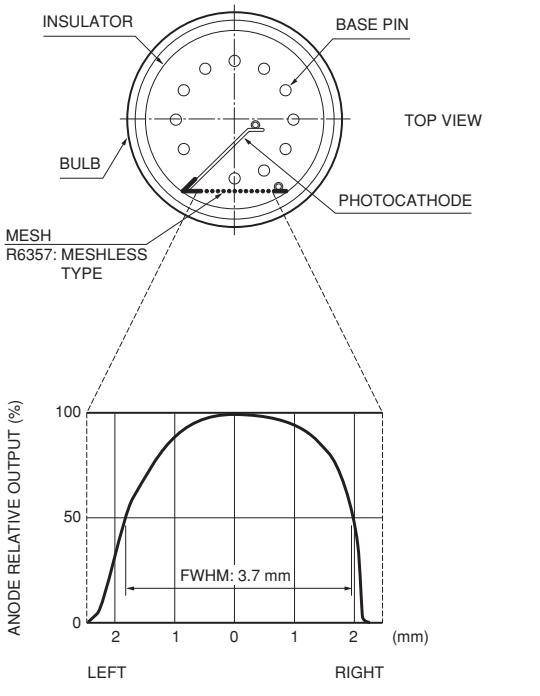
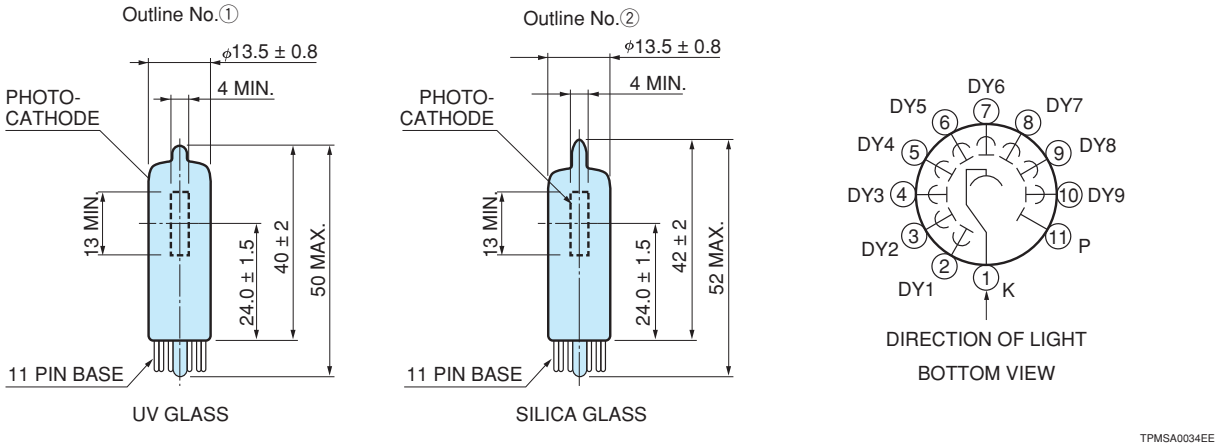
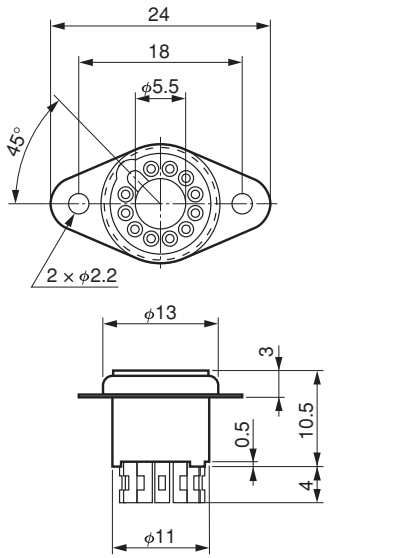


Figure 9: Dimensional outline and basing diagram (Unit: mm)

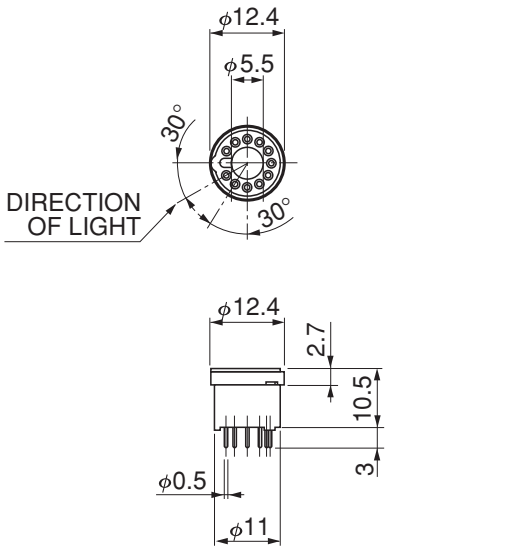


Socket

E678-11U



E678-11T (Sold separately):
For direct soldering to PC board



OPTIONAL ACCESSORIES

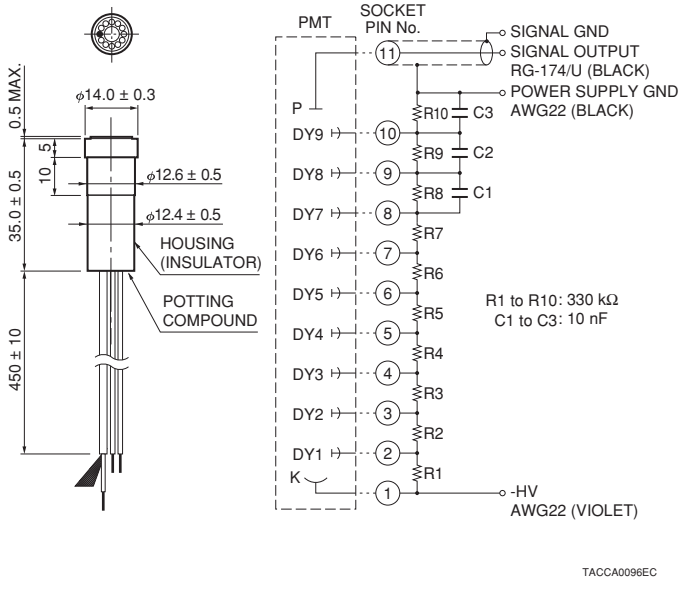
D-type socket assembly

Type No.	Grounded electrode / supply voltage polarity	Maximum ratings Ⓓ Insulation voltage between case and pins (V)	Maximum ratings Ⓓ Supply voltage (V)	Maximum ratings Ⓓ Voltage divider current Ⓐ (mA)	Leakage current in signal Ⓑ Max. (A)	Total voltage divider resistance (MΩ)	Maximum linear output in DC mode Ⓒ (μA)	Signal output
E850-13 Ⓔ, E850-22	Anode / –	1500	1250	0.38	1×10^{-10}	3.3	18 (at 1250 V)	DC/Pulse

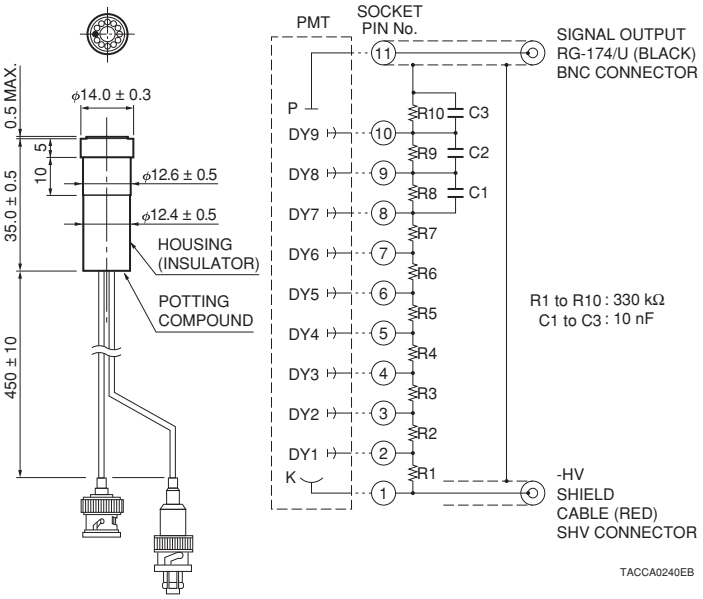
NOTE: Ⓐ Measured with the maximum supply voltage.
Ⓑ Measured with a supply voltage of 1000 V.
Ⓒ The current at which the output linearity is kept within 5 %.
Ⓓ Operating temperature range is 0 °C to +50 °C.
Ⓔ Supplied with a separate mounting flange (E5038).

Dimensional outline and circuit diagram (Unit: mm)

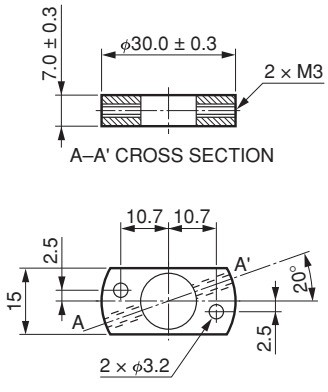
E850-13



E850-22



Mounting flange E5038
(For E850-13, E850-22)



LENS FOR 1/2 INCH DIAMETER SIDE-ON TYPE PHOTOMULTIPLIER TUBES

The optimized cylindrical lens which can be attached at the entrance window of 1/2 inch side-on photomultiplier tube. This lens helps the incident light reaches the photocathode efficiently.
With this lens, the effective area widens by the factor of two in case of 1/2" PMT (7.5 mm width). The lens transmits above 300 nm light only.

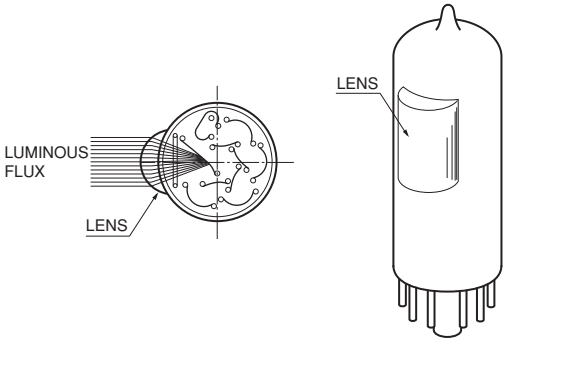
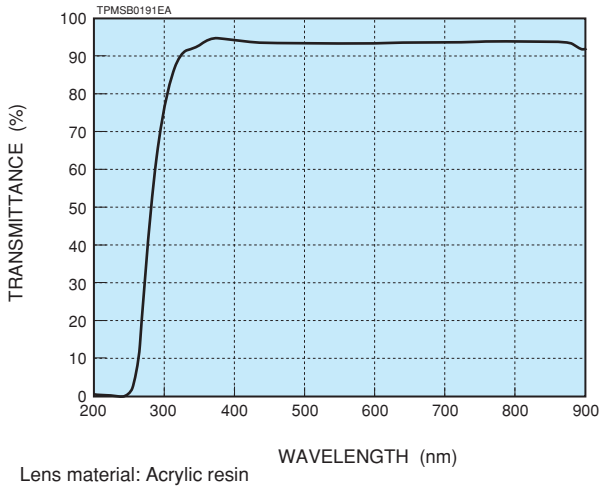
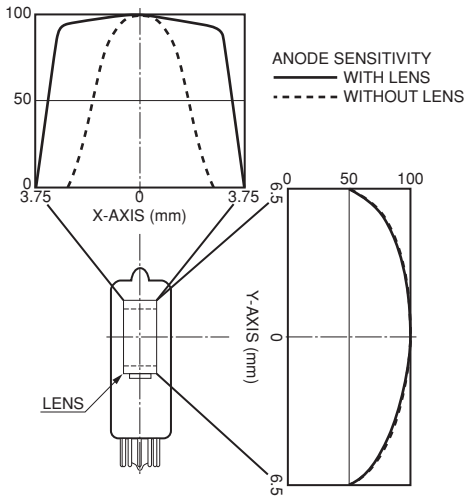


Figure 10: Transmittance of lens



Lens material: Acrylic resin

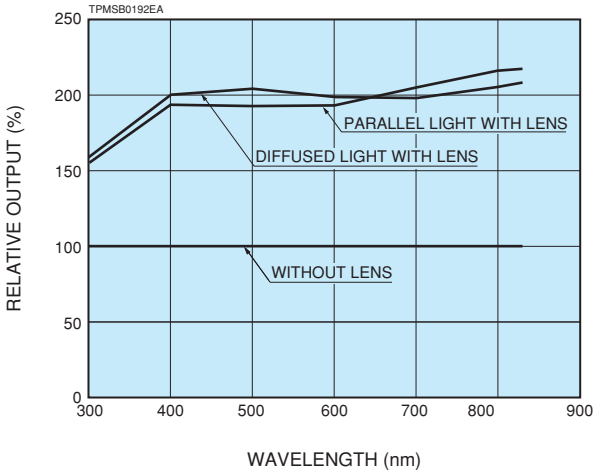
Figure 11: Uniformity



MEASUREMENT CONDITIONS
WAVELENGTH: 400 nm
SUPPLY VOLTAGE: -1000 V
A 1 mm diameter spot light (parallel light) is scanned at the center of the photocathode in X and Y directions.

NOTE: The lens only (without photomultiplier tube) is not available.

Figure 12: Lens effect (Ex.: R6358)



Parallel light:
Uniform and sufficiently large area, than the sensitive area size, of the parallel incident light (40 mm dia.) shall be given to the photomultiplier tube.

Diffused light:
Parallel light (40 mm dia.) is given to the photomultiplier tube through the diffuser, which locates 100 mm from the tube.

⚠ WARNING ~High voltage~

The product is operated at high voltage potential. Further, the metal housing of the product is connected to the photocathode (potential) so that it becomes a high voltage potential when the product is operated at a negative high voltage (anode grounded).
Accordingly, extreme safety care must be taken for the electrical shock hazard to the operator or the damage to the other instruments.

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