

product specification

**Four-channel, square, 54.5 mm tube  
With 4 structures**

<b>Applications :</b> This four-channel tube behaves like four separate photomultipliers. It will be used in cases where a number of tubes have to be stacked together in order to more efficiently cover a large surface of detection.			
<b>Description :</b>	Window :	Material :	borosilicate glass
		Photocathode :	bi-alkali
		Refr. index at 420 nm :	1.48
	Multiplier :	Structure :	foil multiplier
		Nb of stages :	11
	Mass :		80 g

**Photocathode characteristics**

Spectral range :				270-650	nm
	Maximum sensitivity at :			420	nm
<input checked="" type="checkbox"/> Sensitivity ① :	Luminous :	min.: 70	typ.: 90		μA/lm
	Blue :	min.: 10	typ.: 11		μA/lmF
	Radiant, at 420 nm :		typ.: 100		mA/W

**Characteristics with voltage divider A**

Gain slope (vs supp. volt., log/log) :				8	
For an anode blue sensitivity of :				16	A/lmF
<input checked="" type="checkbox"/> Supply voltage :		max.: 1450	typ.: 1150		V
		min.: 900			
Gain :			typ.: 1.5x10 <sup>6</sup>		
<input checked="" type="checkbox"/> Anode dark current ② :		max.: 100	typ.: 30		nA
Individual channel gain adjustment ③ :					
Cross talk between channels ④ :		max.: 10	typ.: 5		%
<input checked="" type="checkbox"/> Pulse height resolution per channel for 511 keV Gamma Ray with BGO ⑤ :		max.: 21	typ.: 19		%
Mean anode sensitivity deviation ⑥ :					
	long term (16 h) :			1	%
	after change of count rate :			1	%
Anode sensitivity change for magnetic field of 0.3 mT :					
	perpendicular to axis "n" :			15	%
	parallel to axis "n" :			2	%
	parallel to tube axis :			1	%
For a supply voltage of :				1500	V
	Anode pulse rise time ⑦ :			4.5	ns
	Anode pulse duration at half height :			6	ns
	Signal transit time :			29	ns
Capacitance	anode to all :			20	pF

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Recommended voltage divider

Type A for maximum gain

K	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	A1 to A4	
3	2	1	1	1	1	1	1	1	1	1	1		(total : 15)
K: photocathode		Dn: dynode			A1 to A4: anodes								

Individual channel gain adjustment

D6	G1	D6	G2	D6	G3	D6	G4
0 to 0.3		0 to 0.3		0 to 0.3		0 to 0.3	
G1 to G4 : individual channel gain control electrodes (Gi for Ai)							

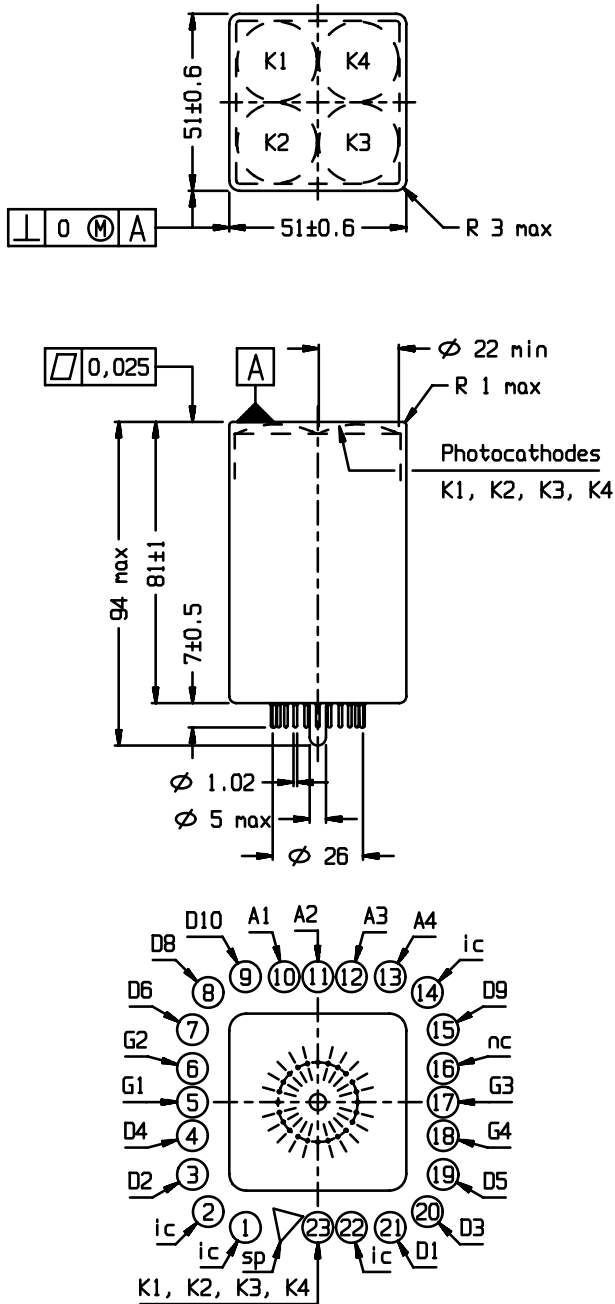
Limiting values

Anode blue sensitivity :		max.:	200	A/lmF		
Supply voltage :		max.:	1550	V		
Continuous anode current :		max.:	100	mA		
Voltage between :	D1 and photocathode :	min.:	150	max.:	350	V
	consecutive dynodes :			max.:	250	V
	anode and last dynode :	min.:	50	max.:	150	V
Ambient temperature :	short operation (< 30 mn) :	min.:	-30	max.:	+80	°C
	continuous operation :	min.:	-20	max.:	+50	°C
	continuous storage :	min.:	-35	max.:	+50	°C

Notes :  Characteristic measured and mentioned on the test ticket of each tube.

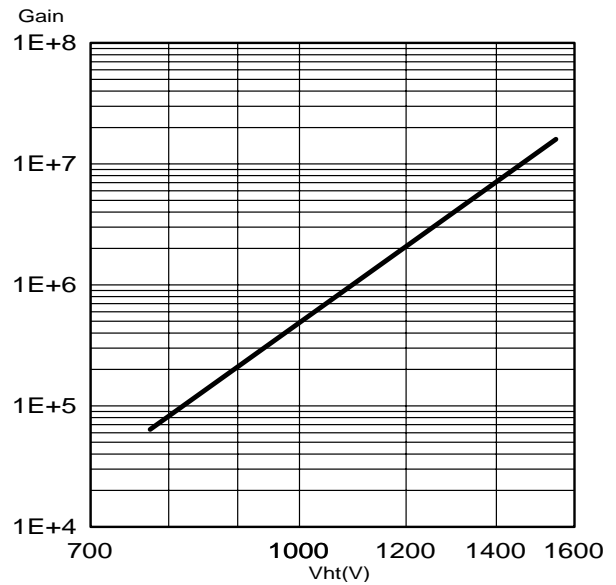
- ① Luminous sensitivity is measured with a tungsten filament lamp with a colour temperature of  $2856 \pm 5$  K. The blue sensitivity, expressed in A/lmF ("F" as in Filtered) is measured with a tungsten filament lamp with a colour temperature of  $2856 \pm 5$  K. Light is transmitted through a blue filter Corning CS no.5-58, polished to half stock thickness. The radiant sensitivity is measured with a tungsten filament lamp with a colour temperature of  $2856 \pm 5$  K. Light is transmitted through an interference filter. Radiant sensitivity at 420 nm, expressed in mA/W, can be estimated by multiplying the blue sensitivity, expressed in  $\mu$ A/lmF, by 7.5 for this type of tube.
- ② Dark current is measured with the four anodes tied together, at ambient temperature, after the tube has been in darkness for approximately 30 minutes.
- ③ The channel gain adjustment is operated as follows. The G1, G2, G3 and G4 electrodes voltages are set to D6 dynode voltage. A parallel light beam illuminates the whole photocathode area, resulting in 4 different anode currents flowing through the 4 anodes. The lowest anode current is taken as a reference. The 3 other gain electrode voltages are adjusted so that the 4 anode currents are equal.
- ④ The cross talk is measured as follows :  
A parallel light beam illuminates fully one of the 4 photocathode elements. The currents at the corresponding anode and the other elements are recorded. The cross-talk is calculated as the ratio for each adjacent anode between the current at this anode and the current to the illuminated anode. This is made by illuminating each of the 4 photocathode elements.
- ⑤ The pulse height resolution is measured with a QUAD BGO CRYSTAL ASSEMBLY (the size of each crystal is 20x20x30) and a  $^{22}$ Na Gamma Ray source (511 keV) centred on the QUAD BGO.
- ⑥ The mean pulse amplitude deviation is measured by coupling a NaI(Tl) scintillator to the window of the tube. Long term (16h) deviation is measured by placing a  $^{137}$ Cs source at a distance from the scintillator such that the count rate is  $\sim 10^4$  c/s, corresponding to an anode current of  $\sim 300$  nA. The mean pulse amplitude deviation after change of count rate is measured with a  $^{137}$ Cs source at a distance from the scintillator such that the count rate can be changed from  $10^4$  to  $10^3$  c/s, corresponding to an anode current of  $\sim 1 \mu$ A and  $0.1 \mu$ A respectively. Both tests are carried out according to ANSI-N42-9-1972 of IEEE recommendations.
- ⑦ Measured with a pulse light source, with a pulse duration (FWHM) of approximately 1 ns., the cathode being completely illuminated. The rise time is determined between 10 % and 90 % of the anode pulse amplitude. The signal transit time is measured between the instant at which the illuminating pulse of the cathode becomes maximum, and the instant at which the anode pulse reaches its maximum. Rise time, pulse duration and transit time vary with respect to high tension supply voltage Vht as  $(Vht)^{-1/2}$ .

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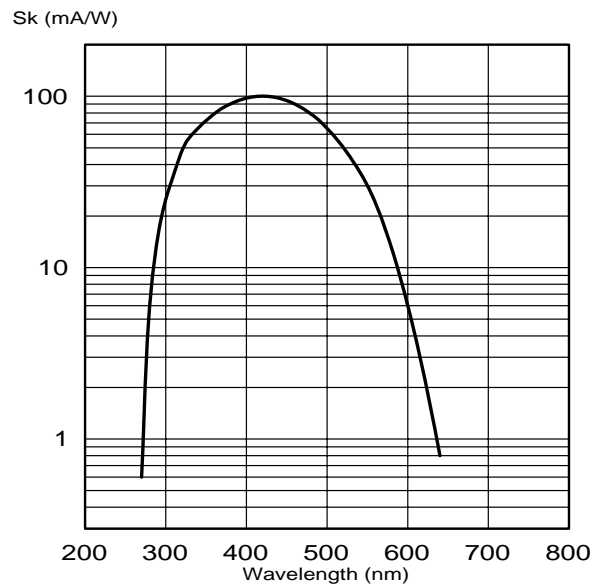


ref.: 99902699  
 ic: internal connection  
 n: plane of symmetry of the multiplier  
 Kn: cathode      Dn: dynode  
 A1 to A4: anodes  
 G1 to G4: channel gain control electrodes

Typical gain curve



Typical spectral characteristics



Accessories

Socket : FE3123