

## For Liquid Scintillation Counting Bialkali Photocathode, 51mm (2 Inch) Diameter, 12 Stages, Head-On Type

The R331 and the R331-05 are 51mm (2 Inch) diameter series photomultiplier tubes specifically developed for the liquid scintillation counting. They feature low background noise, high tritium efficiency, good linearity and high gain. The R331 uses a synthetic silica input window and the R331-05 uses a low K content borosilicate glass input window, both with a frosted surface and convex-concave shape. They offer minimized glass scintillations and high collection efficiency.

### FEATURES

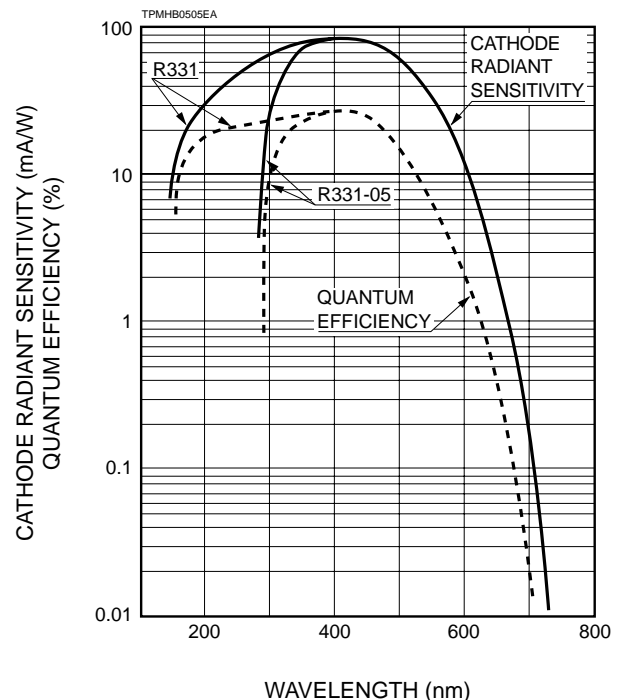
- Tritium efficiency in tritium window..... 60% Typ.
- Background noise in tritium window.....16cpm Typ. (R331)  
18cpm Typ. (R331-05)
- Tritium end point (T.E.P.) voltage..... 1700V Typ.
- Dark pulse summation at T.E.P. voltage.....  $3 \times 10^4$ cpm Max.
- Figure of merit ( $E^2/B$ )..... 200 Typ.



### GENERAL

Parameter		R331	R331-05	Unit
Spectral Response		160 to 650	300 to 650	nm
Wavelength of Maximum Response		420		nm
Photo-cathode	Material	Bialkali		—
	Minimum Useful Area	46		mm dia.
Window Material	Material	Synthetic silica (Frosted)	Low K content borosilicate glass (Frosted)	—
	Shape	Concave-Convex		—
Dynode	Structure	Linear focused		—
	Number of Stages	12		—
Direct	Anode to Last Dynode	2		pF
Interelectrode Capacitances	Anode to All Other Electrodes	2.5		pF
Base		21-pin glass base		—
Weight		151		g
Suitable Socket		E678-21A (Supplied)		—

Figure 1: Typical Spectral Response



# PHOTOMULTIPLIER TUBES R331, R331-05

## MAXIMUM RATINGS (Absolute Maximum Values)

Parameter		Value	Unit
Supply Voltage	Between Anode and Cathode	2500	Vdc
	Between Anode and Last Dynode	500	Vdc
Average Anode Current <sup>A</sup>		0.2	mA
Ambient Temperature		-80 to +50	°C

## CHARACTERISTICS (at 25°C)

Parameter		Min.	Typ.	Max.	Unit
Cathode Sensitivity	Luminous <sup>B</sup>	60	90	—	μA/lm
	Quantum Efficiency at 390nm	—	25	—	%
	Radiant at 420nm	—	85	—	mA/W
	Blue <sup>C</sup>	9.0	10.5	—	μA/lm-b
Anode Sensitivity	Luminous <sup>D</sup>	30	120	—	A/lm
	Radiant at 420nm	—	$1.1 \times 10^5$	—	A/W
Gain <sup>D</sup>		—	$1.3 \times 10^6$	—	—
Anode Dark Count <sup>E</sup>	R331	—	16	—	cpm
	R331-05	—	18	—	cpm
Time Response <sup>D</sup>	Anode Pulse Rise Time <sup>F</sup>	—	2.6	—	ns
	Electron Transit Time <sup>G</sup>	—	48	—	ns
	Transit Time Spread <sup>H</sup>	—	1.1	—	ns

## NOTES

- A: Averaged over any interval of 30 seconds maximum and the whole photocathode is illuminated.
- B: The light source is a tungsten filament lamp operated at a distribution temperature of 2856K. The light input is 0.01 lm and 150 volts are applied between the cathode and all other electrodes connected together as anode.
- C: 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 B.
- D: Measured with the same light source as Note B and the light input is 0.1 μlm. The anode-to-cathode supply voltage and voltage distribution ratio are shown in Table 1.
- E: Background noise after 30 minute storage in darkness.
- F: The rise time is the time for the output pulse to rise from 10% to 90% of the peak amplitude when the entire photocathode is illuminated by a delta function light pulse of 400nm.
- G: The electron transit time is the interval between the arrival of a delta function light pulse at the input window of the tube and the time when the output pulse reaches the peak amplitude. In measurement the entire photocathode is illuminated.
- H: Also called transit time jitter. This is the fluctuation in electron transit time between individual pulses in the single photoelectron state, and may be defined as the FWHM of the frequency distribution of the transit times.

**Table 1: Voltage Distribution Ratio**

Electrodes	K	G	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	Dy11	Dy12	P
Distribution Ratio	4	0	1	1.4	1	1	1	1	1	1	1	1	1	1	1

Supply Voltage: 1500Vdc, K: Cathode, Dy: Dynode, P: Anode, G: Grid

\* Shield should be connected to Dy5.

Figure 2: Typical Anode Luminous Sensitivity and Gain

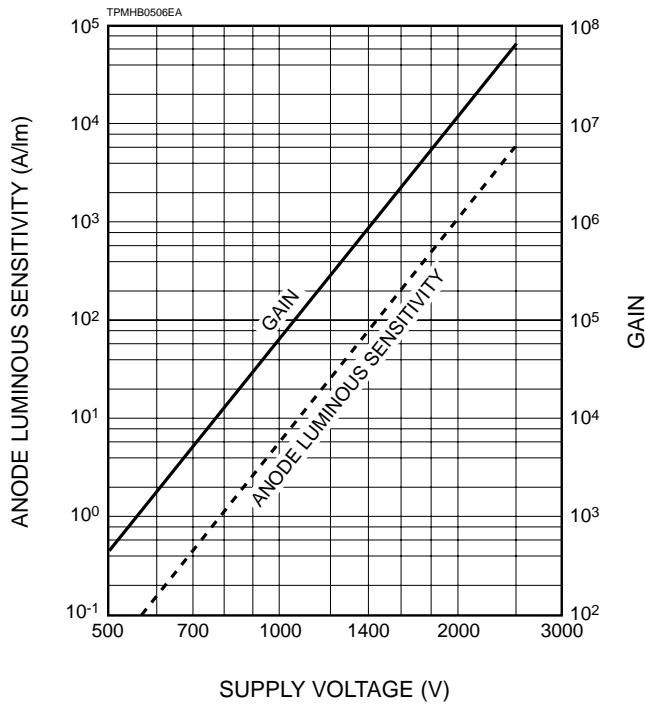


Figure 3: Typical Anode Output Wave form

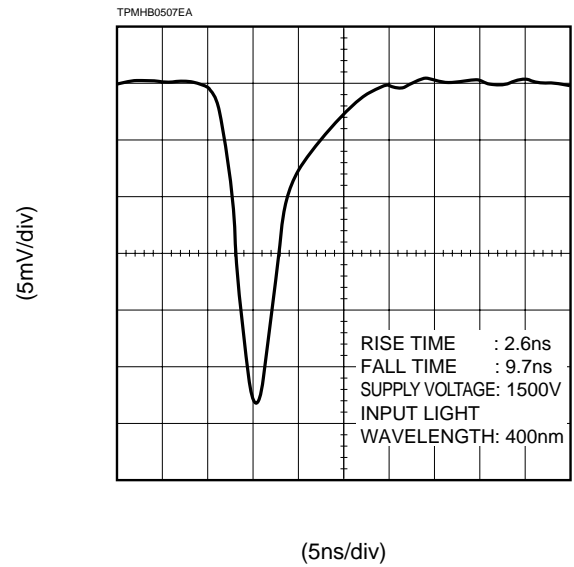


Figure 4: Typical Time Response

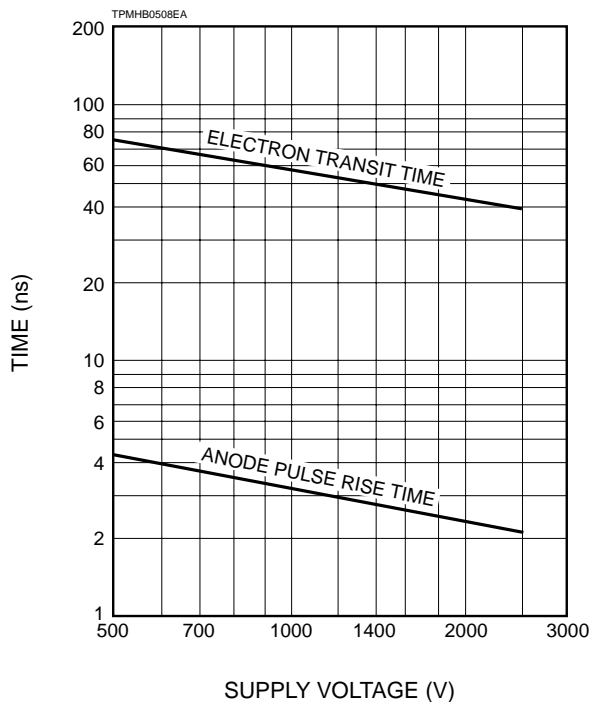
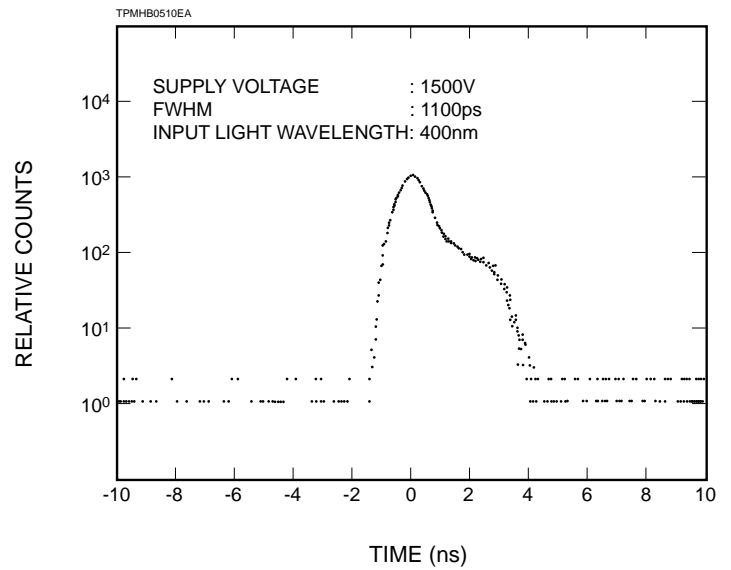
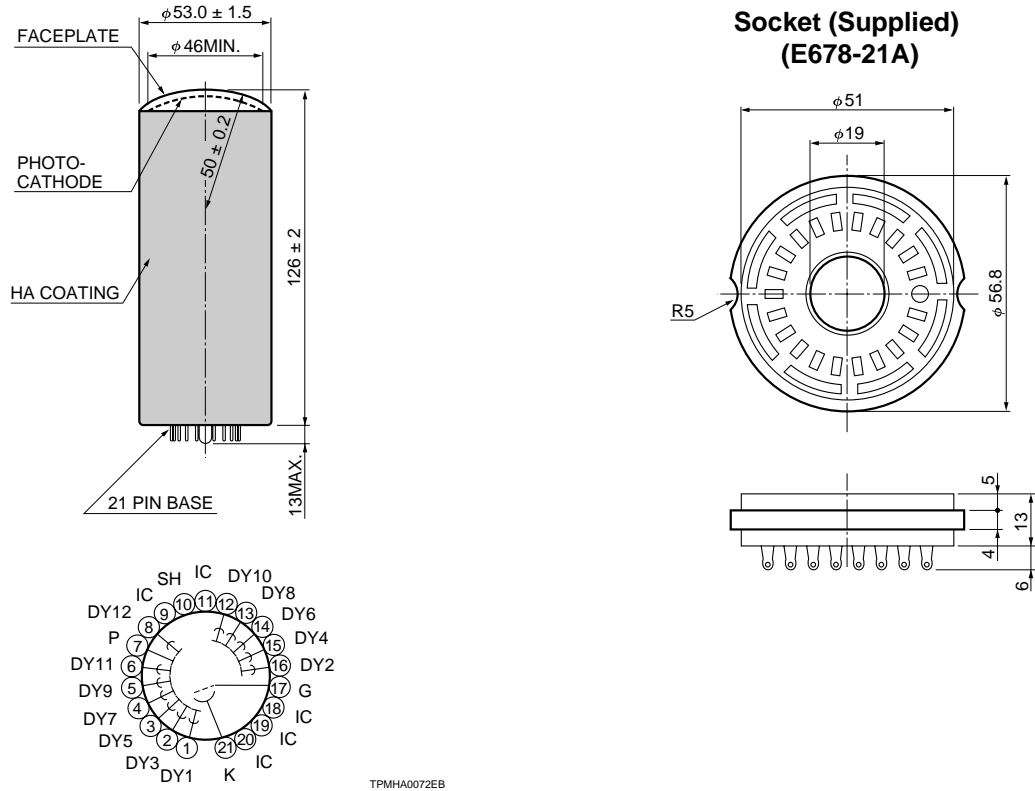


Figure 5: Typical Transit Time Spread



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Figure 6: Dimensional Outline and Basing Diagram (Unit: mm)



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TPMHA0072EB

\* Shield (SH) should be connected to Dy5.

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TPMH1209E01  
JUL. 1998