

SWITCHING AND LIGHT DIODE

Cold cathode neon filled subminiature switching and light diode with a large and stable difference between ignition and maintaining voltage intended for low speed switching and counting e.g. in combination with CdS photo sensitive devices. The tube is shock and vibration resistant.

QUICK REFERENCE DATA

Ignition voltage	V_{ign}	170 V
Maintaining voltage	V_m	109 V
Cathode current	I_k	3.5 mA

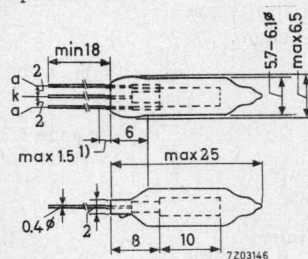
OPERATING PRINCIPLE

The diode contains a rod shaped molybdenum cathode and a concentric gauze anode. By applying a suitable voltage between the electrodes, a glow discharge occurs and its red light is available outside the tube.

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Colour type indication on pinch: red dot.



MOUNTING

The tube may be soldered directly into the circuit but heat conducted to the glass to metal seals should be kept to a minimum by the use of a thermal shunt. The leads may be dip-soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C during max. 10 s. Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

1) This part of the leads is not tinned.

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

(Valid over the first 15000 hours operation within the preferred current range and at t_{amb} = room. The electrical characteristics are independent of ambient illumination).

Non conduction

Anode voltage below which ignition
will not occur in any tube

$$V_{ign \min} \quad 163 \text{ V}$$

Insulation resistance

$$r_{isol} \quad > 300 \text{ M}\Omega$$

Ignition

Anode voltage to ensure ignition

$$V_{ign \max} \quad 178 \text{ V}$$

Ignition delay

See pages C7 and C8

Typical max. individual variation
of ignition voltage during life

$$\Delta V_{ign} \quad < 5 \text{ V}$$

Typical temperature coefficient of
ignition voltage, averaged over
the range -55°C to $+70^\circ\text{C}$

$$\frac{\Delta V_{ign}}{\Delta t_{bulb}} \quad < \pm 15 \text{ mV}/^\circ\text{C}$$

Conduction

Cathode current, average during any
conduction period

$$I_k \quad > 2.2 \text{ mA}$$

average ($T_{av} = \max. 1 \text{ s}$)

$$I_k \quad < 4.5 \text{ mA}$$

peak (See "Reliability and
life expectancy")

$$I_{kp} \quad < 50 \text{ mA}$$

Typical rise in bulb temperature

$$\frac{\Delta t_{bulb}}{\Delta I_k} \quad 10 \text{ }^\circ\text{C}/\text{mA}$$

Maintaining voltage

See page C7

Typical max. individual variation
of maintaining voltage during life

$$\Delta V_m \quad < \begin{matrix} +2 \\ -4 \end{matrix} \text{ V}$$

Typical max. temperature coefficient
of maintaining voltage, averaged over
the range -55°C to $+70^\circ\text{C}$

$$\frac{\Delta V_m}{\Delta t_{bulb}} \quad < \pm 15 \text{ mV}/^\circ\text{C}$$

Light intensity ¹⁾²⁾

$$E \quad > 20 \text{ lux}/\text{mA}$$

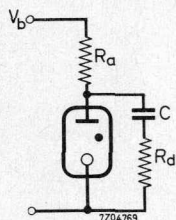
Typical variation of light intensity

$$\Delta E \quad < -3 \text{ } \%/1000 \text{ h}$$

¹⁾²⁾ See page C5

Extinction

Typical min. RC components to ensure self extinction at $V_b = 250$ V for different values of current limiting resistance R_d .



R_d	0	1	10	47	100	$k\Omega$
R_a	1	1	1.5	2	3	$M\Omega$
C	5	22	22	22	22	nF

RELIABILITY AND LIFE EXPECTANCY

Reliability has been assessed in a life test programme totalling $5 \cdot 10^6$ tube hours on 400 tubes. The longest test period being 15000 hours on 100 tubes. A total of 7 failures result in a failure rate of better than 0.15% per 1000 h. This failure rate is not expected to increase over the next period of 15000 h. Life expectancy: 30000 operating hours within the preferred current range or

2.4×10^6 ignitions discharging a capacitor of max. $16 \mu F$ with suitable series impedance to limit the peak current to max. 50 mA.

- 1) Light intensity measured over an angle of 70° at a distance of 3.6 mm from the tube axis opposite the anode cylinder.
- 2) Measured with a Standard Weston Cell adopted to eye sensitivity. Because the light emission of the neon discharge is mainly contained in the red region, the illumination resistance of a CdS cell will be 1.5 to 2 times lower than in case of irradiation by a $2700^\circ K$ incandescent light source. The exact conversion factor depends on the type of CdS cell used.

LIMITING VALUES (Absolute max. rating system)

Cathode current, average for continuous conduction	I_k	min. 2.2 mA ¹⁾
average ($T_{av} = \text{max. } 1 \text{ s}$)	I_k	max. 4.5 mA ¹⁾
peak	I_{kp}	max. 50 mA
Anode voltage, negative peak	$-V_{ap}$	max. 200 V
Bulb temperature	t_{bulb}	min. -55 °C max. +70 °C
Altitude	h	max. 24 km

SHOCK AND VIBRATION RESISTANCE

These conditions are solely used to assess the mechanical quality of the tube. The tube must not be continuously operated under these conditions.

Shock resistance 500 g

Forces as applied by the NRL impact machine for electronic devices caused by 5 blows of the hammer lifted over an angle of 30° in each of 4 positions of the tube.

Vibration resistance 2.5 g(peak)

Vibrational forces for a period of 32 hours at a frequency of 50 Hz in each of 3 directions.

¹⁾ Current excursions down to 1 mA and up to 5 mA are permitted under conditions of e.g. extreme supply voltage variations. The excursion times should preferably be as short as possible but never exceed 24 hours.

