Dieter’s

Nixie Tube Data Archive

Document in this file	Philips datasheet – ZM1230/ZM1232
Display devices in this document	ZM1230, ZM1232

INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for side viewing.

QUICK REFERENCE DATA				
Numeral height			15.5	mm
Numerals	1 2 3 4 5 6 7 8 9 0			
Supply voltage	V_{ba}	min.	170	V
Cathode current	I_k		2.5	mA
Distance between mounting centres		min.	19	mm

GENERAL

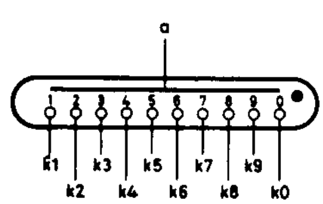
The numerals are 15.5 mm high and appear on the same base line allowing in-line read out. The ZM1230 is provided with a red contrast filter. The ZM1232 is identical to the ZM1230 but has no filter.

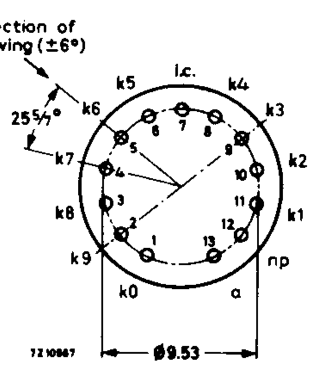
PRINCIPLE OF OPERATION

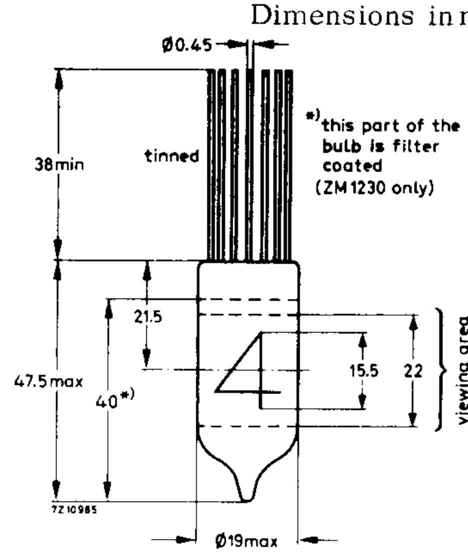
The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding figure will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







Mounting position: any

The numerals will appear upright (within ± 3°) when the tube is mounted vertically, base up.

Soldering

The tube may be soldered directly into the circuit, but heat conduction 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 for a maximum of 10 s.

Note

Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

CHARACTERISTICS AND OPERATING CONDITIONS (at 20 °C to 50 °C)

Ignition voltage	V_{ign}	min.	170	V
Ignition delay	see page 3			
Maintaining voltage	see page 4			
Cathode current, recommended	I_k		2.5	mA
Cathode current for coverage, average during any conduction period	I_k	min.	1.5	mA
D.C. operation	see pages 4 to 9			
Pulse operation	see pages 4, 10, 11 and 12			
Extinguishing voltage	V_{ext}		115	V

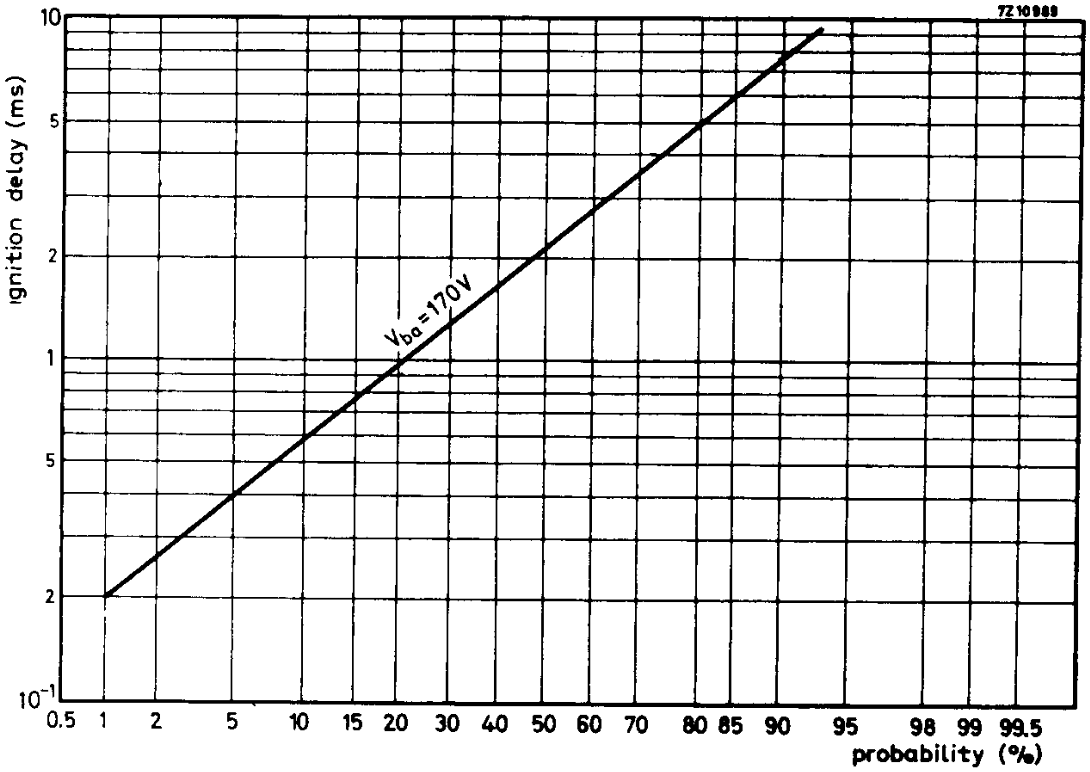
LIFE EXPECTANCY at I_k = 2.5 mA and room temperature [1])

Continuous display of one numeral	>	5 000	h
Sepuentially changing the display from one numeral to another, every 100 hrs or less	>	30 000	h

LIMITING VALUES (Absolute max. rating system)

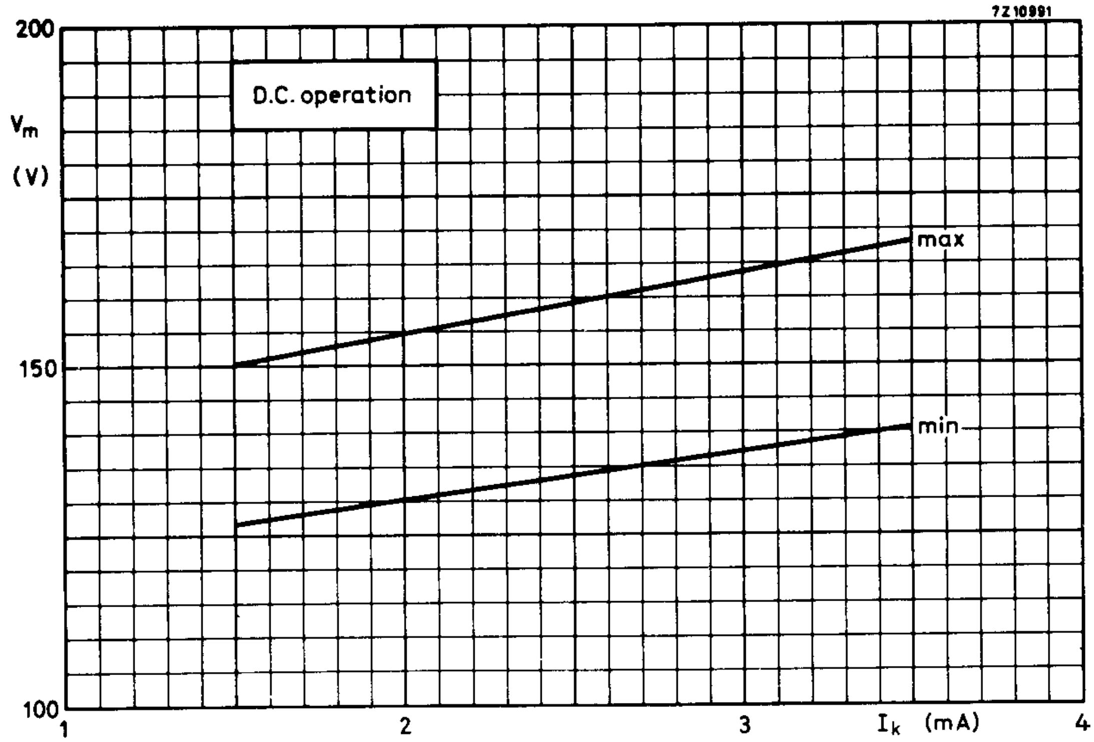
Cathode current (each digit),				
average, T_{av} = max. 10 ms	I_k	max.	3.5	mA
peak	I_{k_p}	max.	12	mA
average during any conduction period	I_k	min.	1.5	mA
Anode voltage necessary for ignition	V_a	min.	170	V
Pulse duration	T_{imp}	min.	100	µs
Bulb temperature	t_{bulb}	max.	+70	°C
	t_{bulb}	min.	-50	°C [1])

[1]) For bulb temperatures below 0 °C the life expectancy of the tube is substantially reduced.

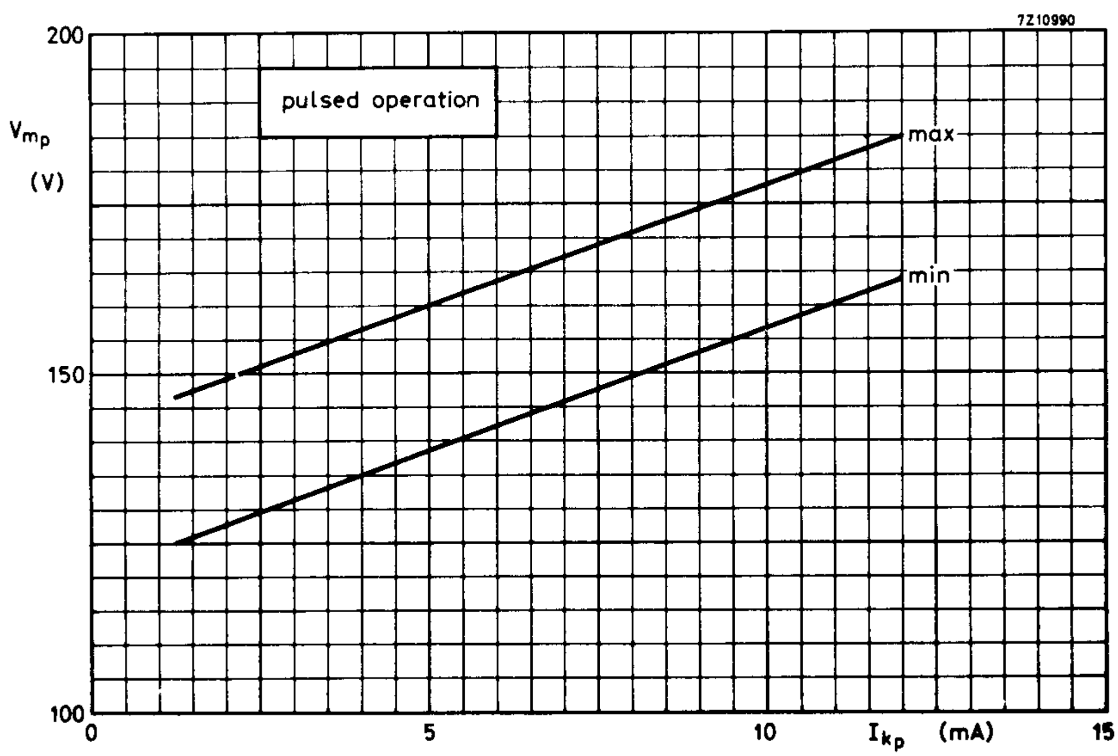


CUMULATIVE DISTRIBUTION OF IGNITION DELAY

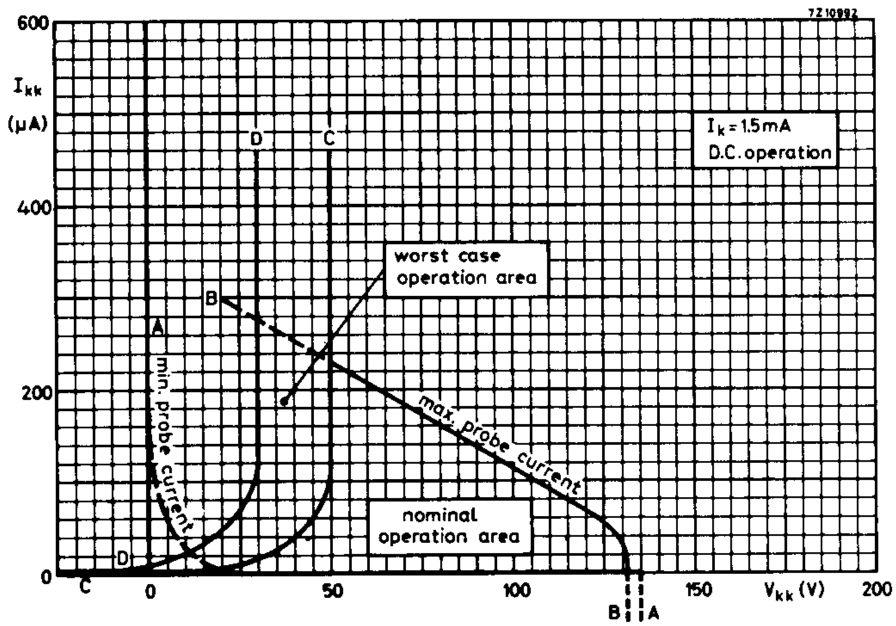
This curve shows the probability that a tube will ignite in less than the time shown after a non-conduction period of a few periods. The ignition delay will be appreciably reduced when the interval between conduction periods is less than 100 milliseconds. In general, an increase in the supply voltage will reduce the ignition delay.

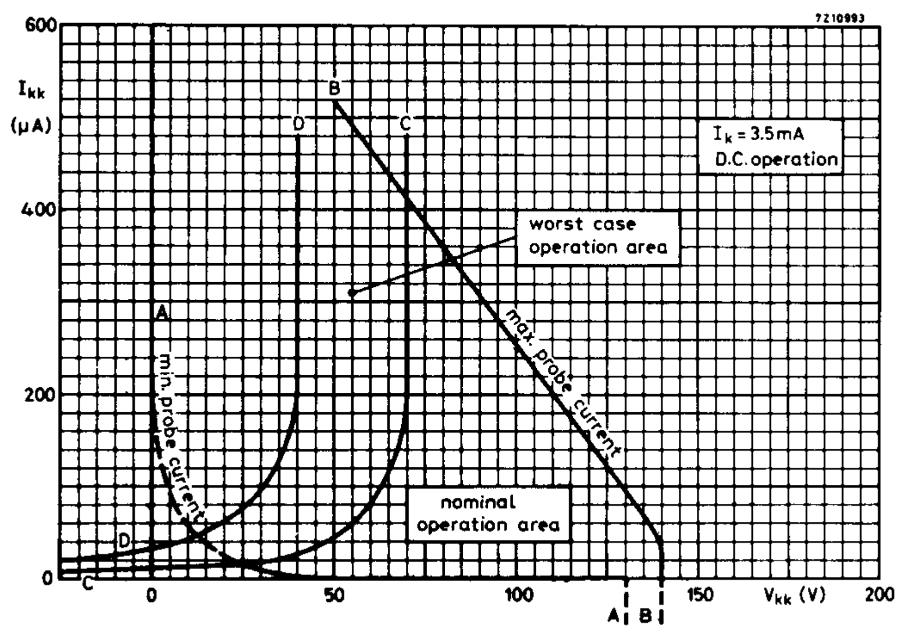


ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF CATHODE CURRENT



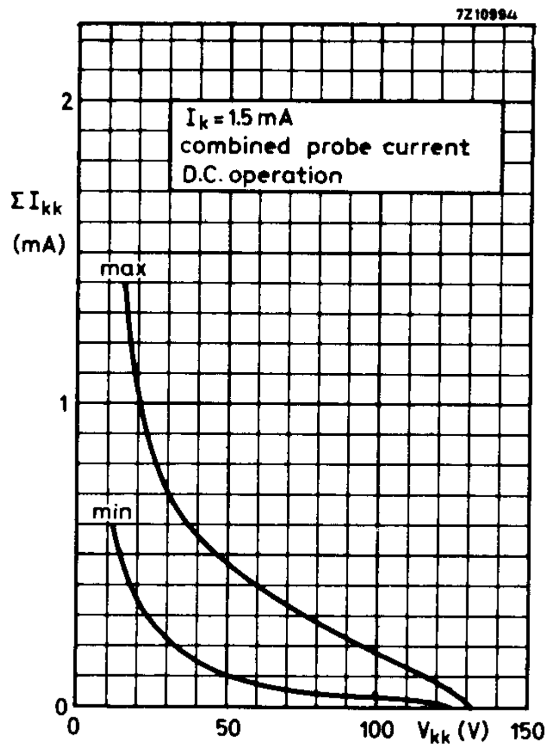
PEAK ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF PEAK CATHODE CURRENT

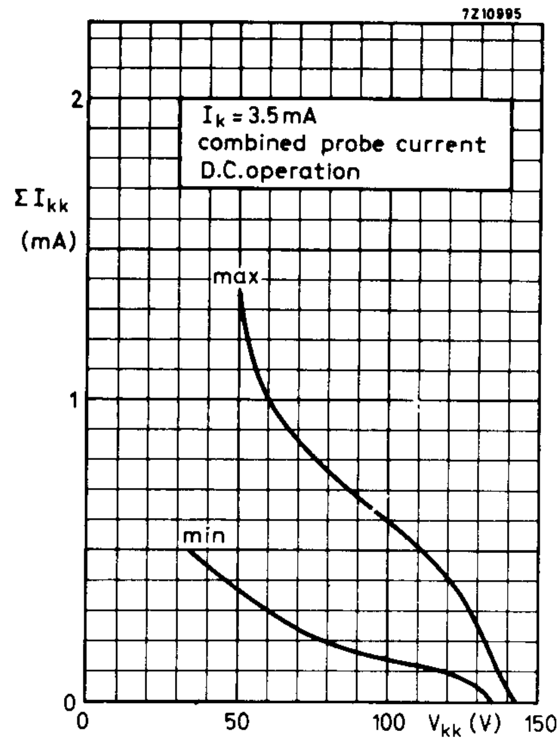




PROBE CURRENT TO INDIVIDUAL NON-CONDUCTING CATHODES

The boundaries A-A and B-B of the graphs represent, for the shown cathode current range, the range of probe current (I_{kk}) to individual non-conducting cathodes plotted against the voltage difference between the non-conducting cathodes and the conducting cathode (V_{kk}).
For low cathode selecting voltages (V_{kk}) the current I_{kk} to the non-conducting cathode will increase, and the readability conducting cathode will be affected.
It is therefore recommended to use a nominal operating point to the right of line C-C.
Under the worst operating conditions the operating point should never reach the area left of the line D-D.





COMBINED PROBE CURRENT TO ALL NON-CONDUCTING CATHODES

Sum of the probe currents to the non-conducting cathodes (I_{kk}) plotted against the voltage difference between the non-conducting cathodes and the conducting cathode (V_{kk}), showing the minimum and maximum values of probe current for a particular cathode current (I_k).

SUPPLY VOLTAGE/LOAD RESISTOR

The graphs on pages 8, 9 and 12 give the relationship between the anode supply voltage and the required anode load resistor for fixed values of V_{kk} (voltage difference between conducting cathode and non-conducting cathodes).

Each graph is plotted on log-log graph paper; therefore a given tolerance expressed as a percentage can be represented as a fixed length at any point on the x and y axes. This is shown on the first graph by taking points on each axis with a fixed tolerance.

Examples are shown on the first graph of the supply voltages and load resistors with tolerance expressed as a percentage so as to remain within the recommended operating region.

The curves are derived from:-

$$V_{ba} = I_a \cdot R_a + V_m$$

$$I_a = I_k + \Sigma I_{kk}$$

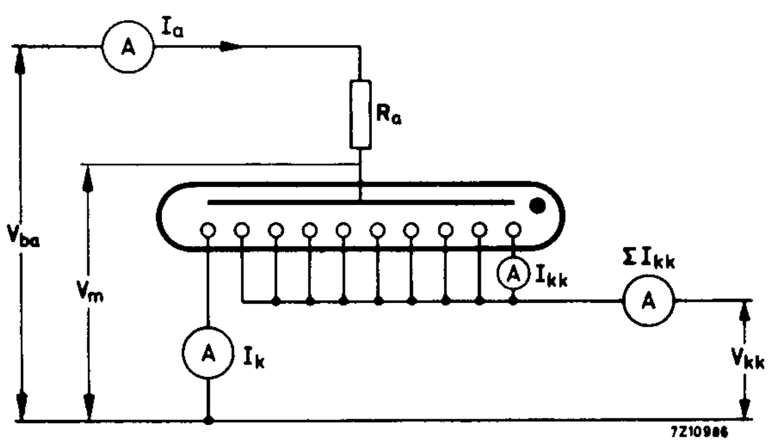
$$V_{ba} = (I_k + \Sigma I_{kk})\, R_a + V_m$$

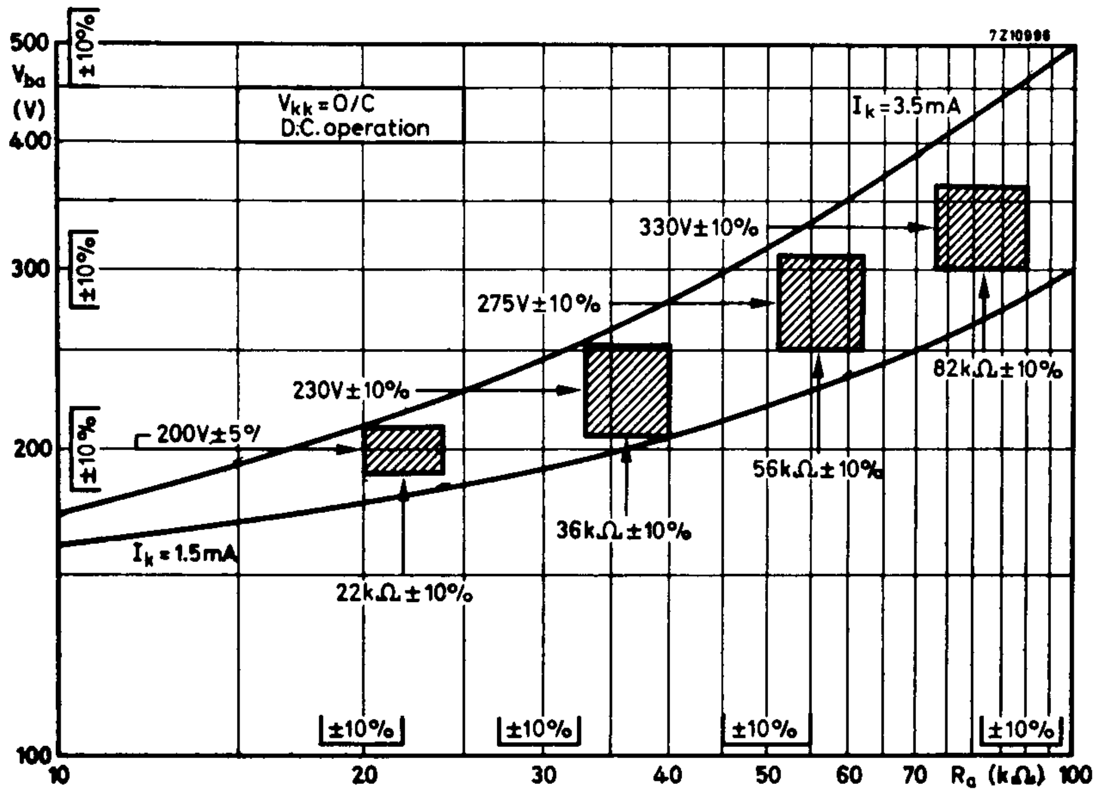
For a given value of R_a, the minimum supply voltage limit to ensure that the cathode current exceeds I_k min. is given by:

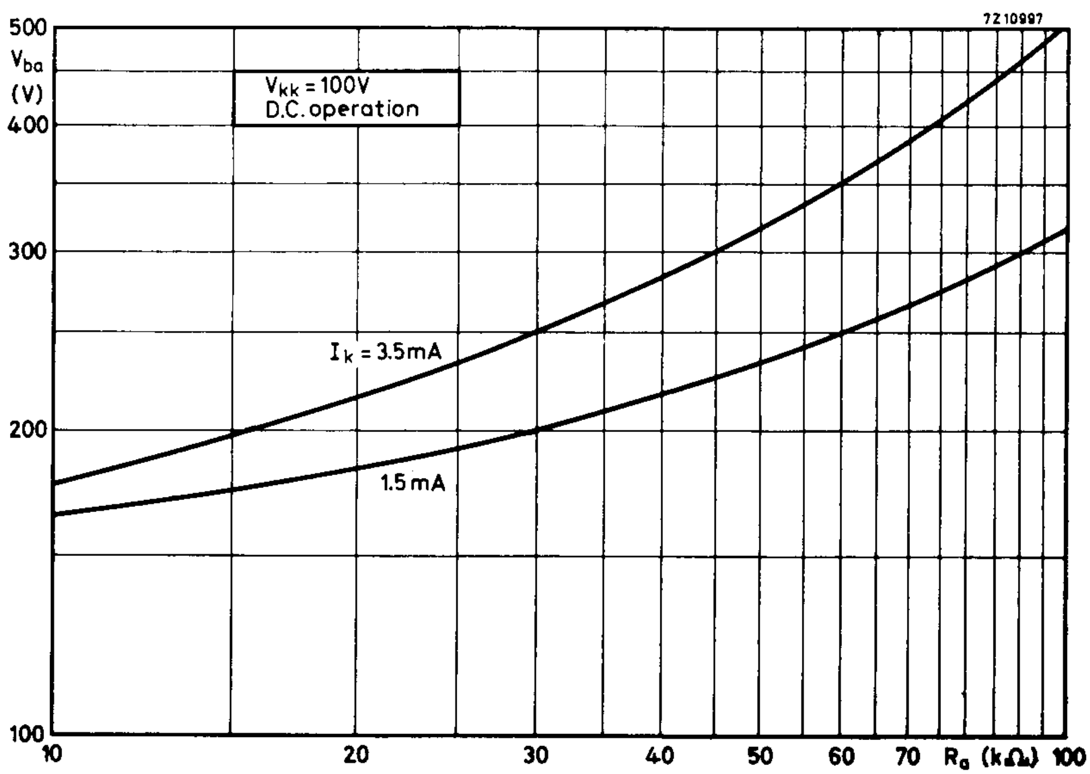
$$V_{ba}\text{ min.} = \left[I_k\text{ min.} + \Sigma I_{kk}\text{ max. (at } I_k\text{ min.)}\right] R_a + V_m\text{ max. (at } I_k\text{ min.)}$$

For the same value of R_a, the maximum supply voltage limit to ensure that the cathode current does not exceed I_k max. is given by:

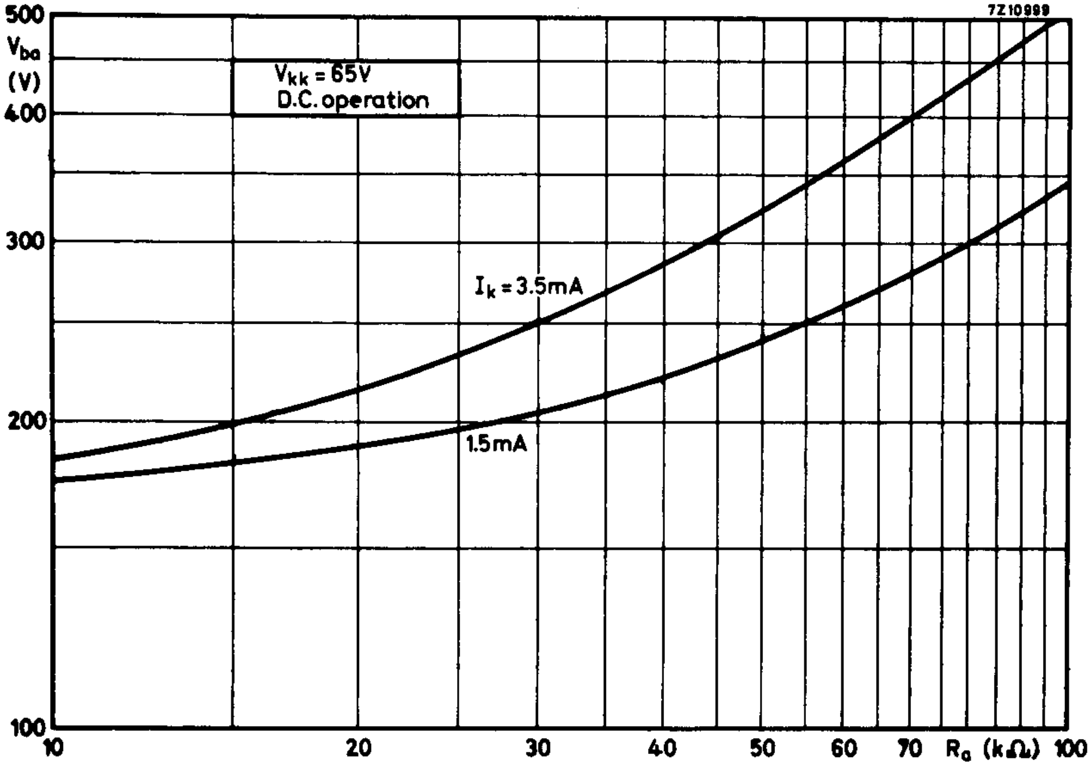
$$V_{ba}\text{ max.} = \left[I_k\text{ max.} + \Sigma I_{kk}\text{ min. (at } I_k\text{ max.)}\right] R_a + V_m\text{ min. (at } I_k\text{ max.)}$$

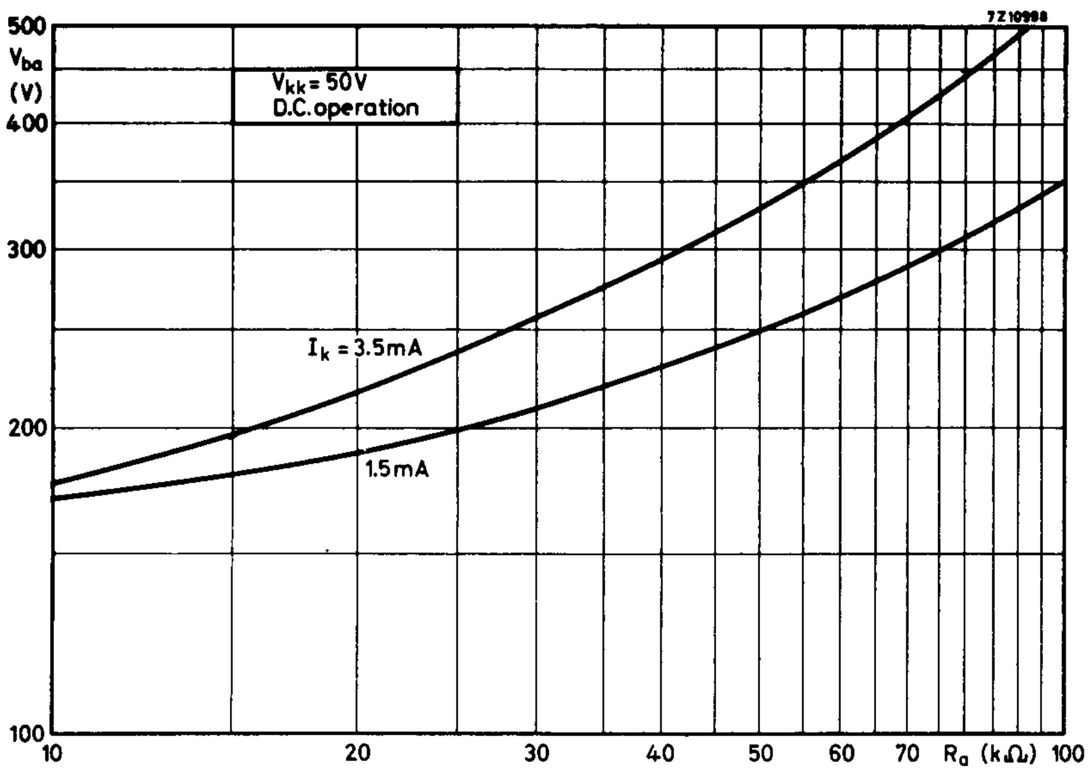




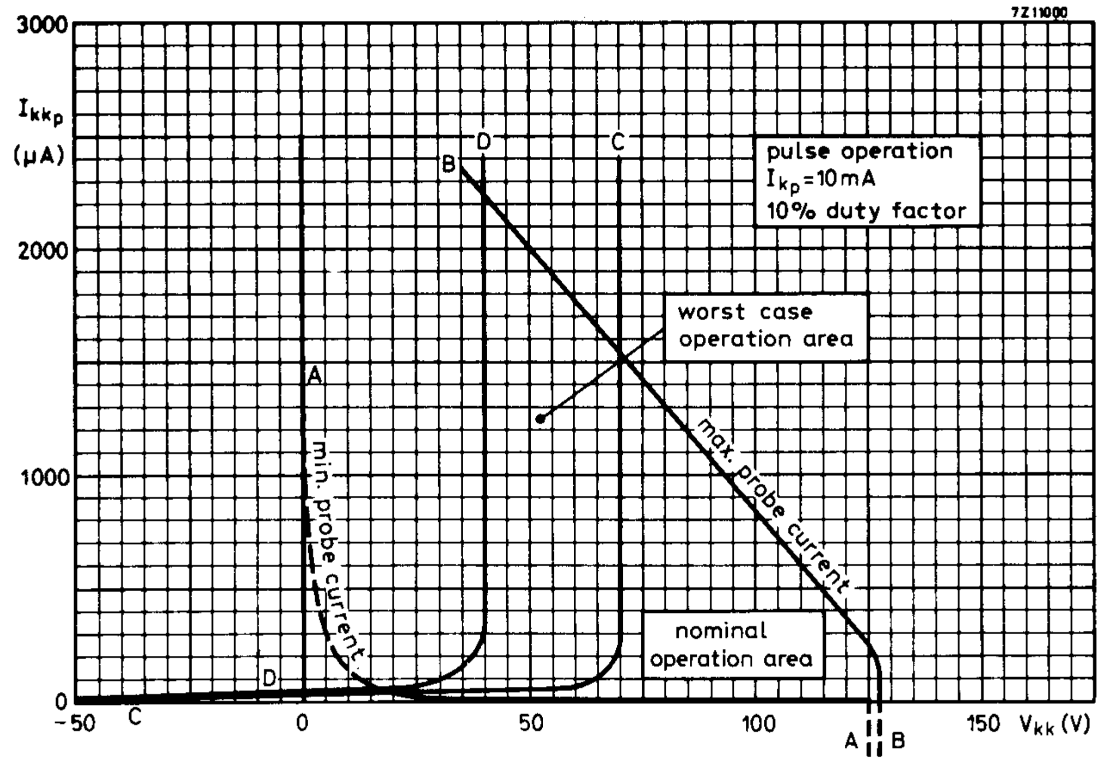


D.C. SUPPLY VOLTAGE PLOTTED AGAINST ANODE LOAD RESISTOR

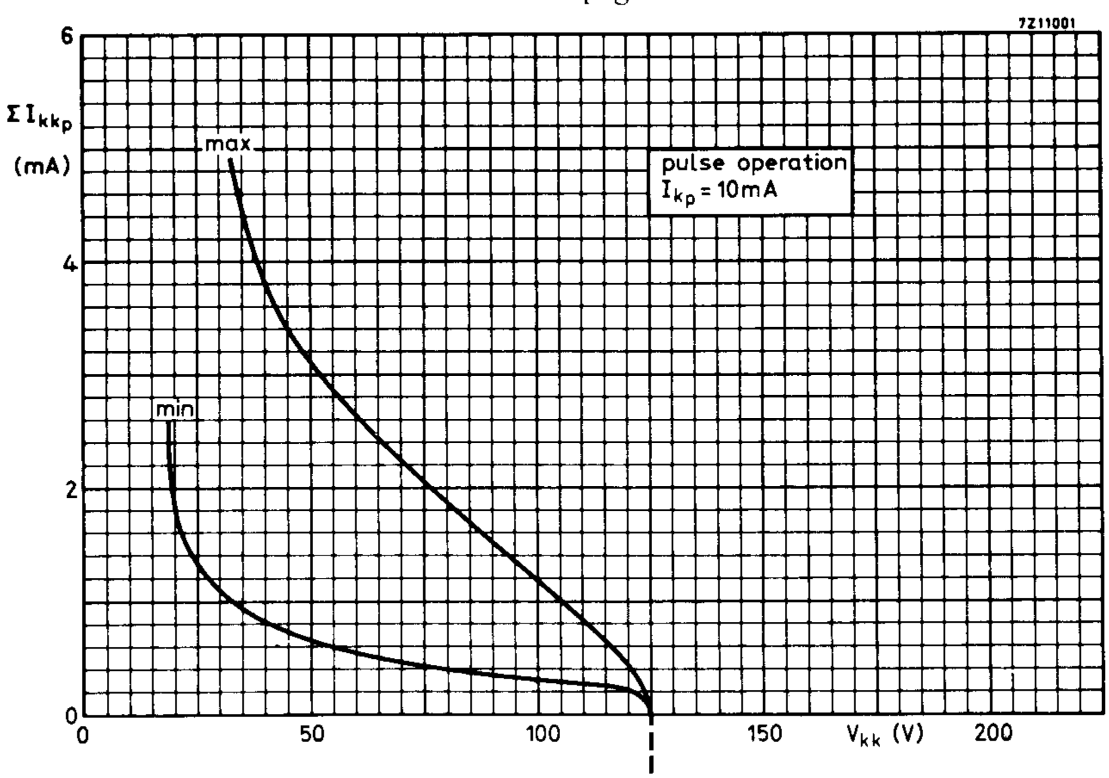




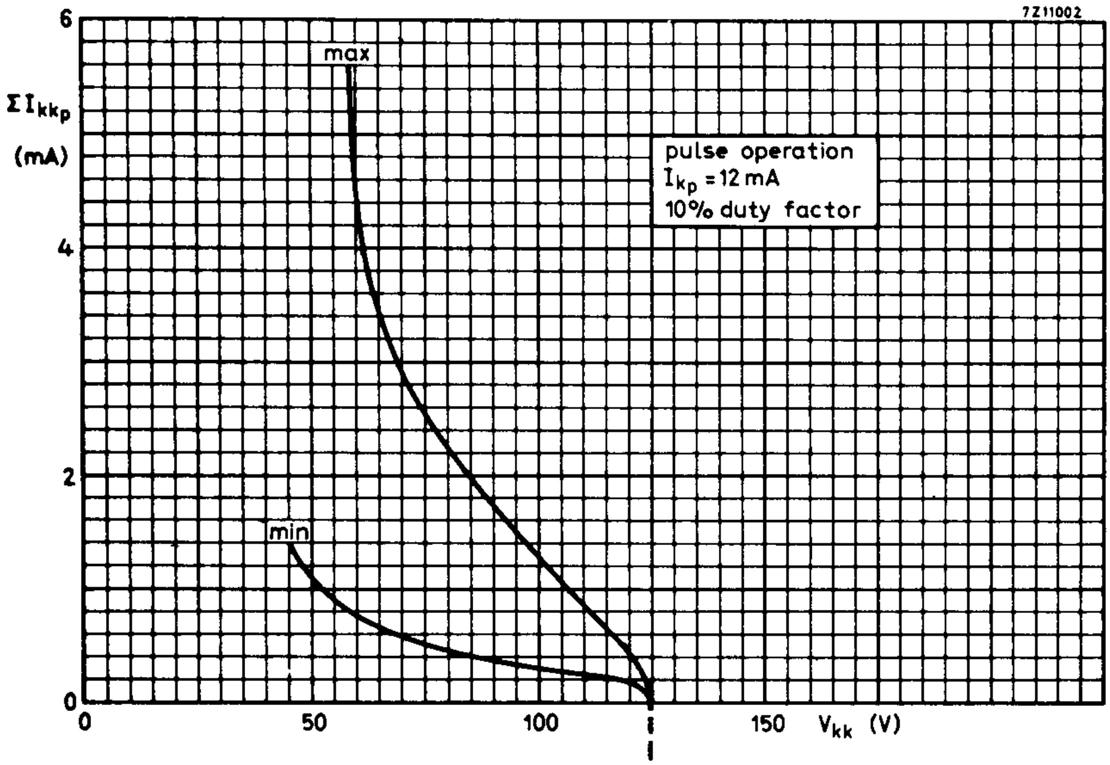
D.C. SUPPLY VOLTAGE AS A FUNCTION OF ANODE LOAD RESISTOR

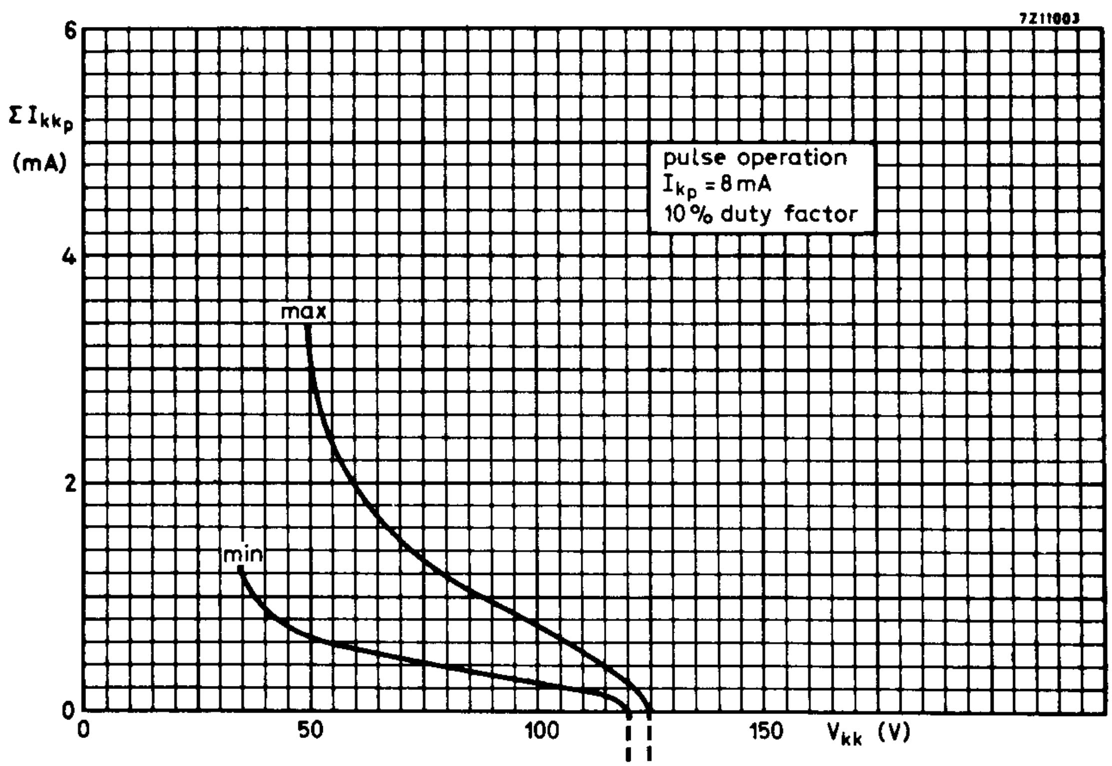


PEAK PROBE CURRENT TO INDIVIDUAL NON-CONDUCTING CATHODES
See also page 5



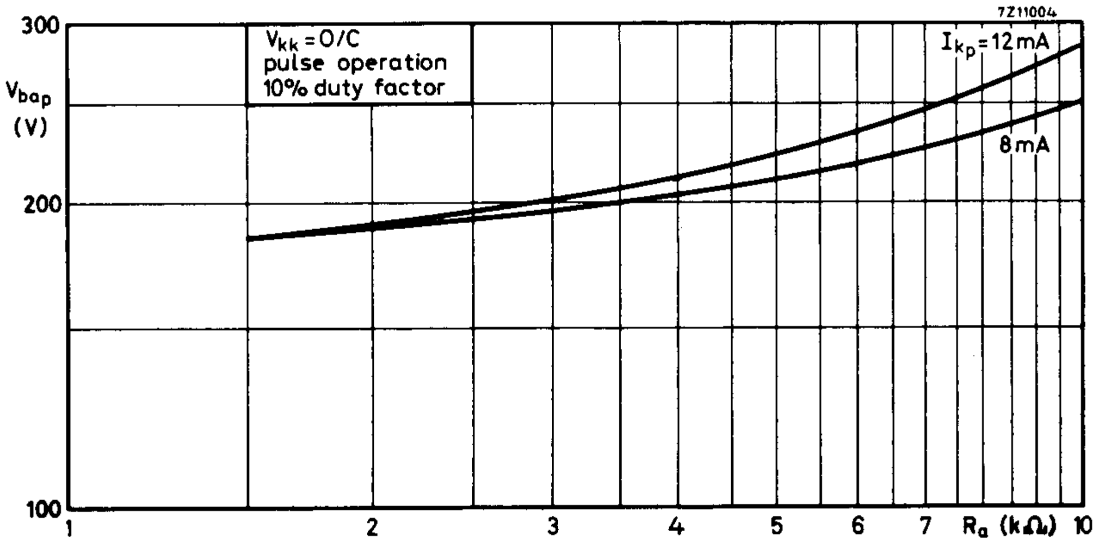
COMBINED PEAK PROBE CURRENT TO ALL NON-CONDUCTING CATHODES
See also page 6

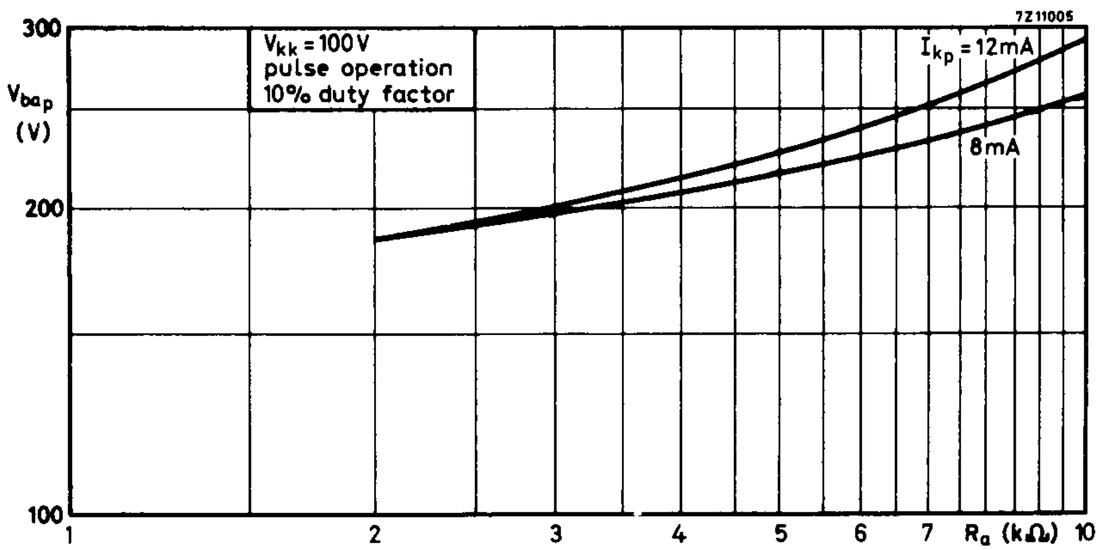


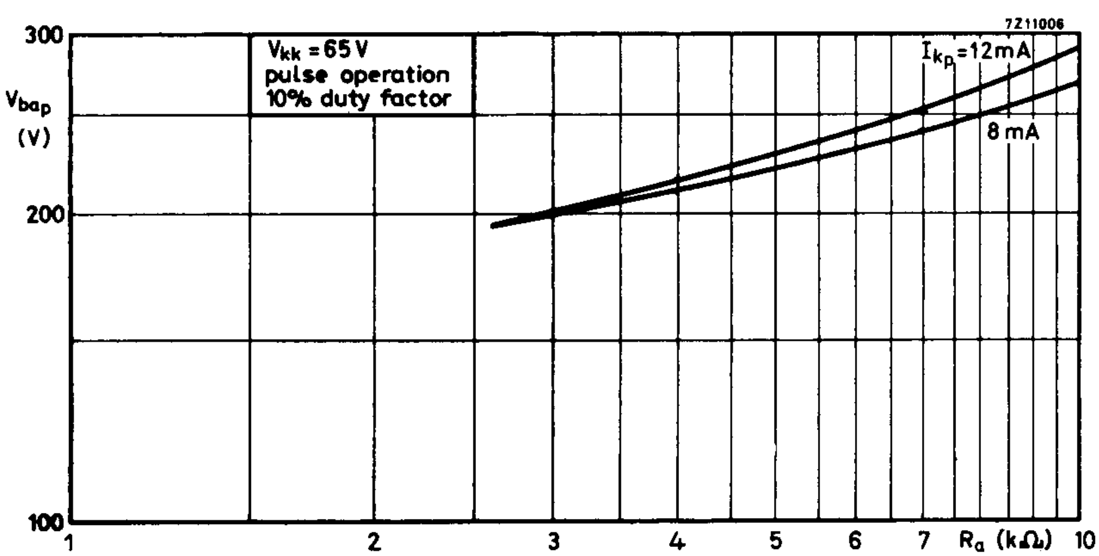


COMBINED PEAK PROBE CURRENT TO ALL NON-CONDUCTING CATHODES

See also page 6







PEAK SUPPLY VOLTAGE AS A FUNCTION OF ANODE LOAD RESISTOR