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Made and printed in England by Wightman & Co. Ltd., 1-3 Brixton Road, London. S.W.9

TECHNICAL HANDBOOK SERVICE

PREFACE

In order that you may obtain the maximum benefit from your Mullard Technical Handbook, we ask you to read carefully this short description of the Handbook Service and how it is organised.

By following the simple suggestions given you will ensure that your Handbook is always up to date, and will avoid much unnecessary correspondence and work both at your end and ours.

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The Mullard Technical Handbook is published in seven volumes plus a general index.

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In order to ensure that these sheets reach the correct individual you are earnestly requested, immediately upon receipt of your Handbook, to detach and mail to us the "Acknowledgment of Receipt Card" which you will find just inside the cover. *Please make sure that the name and full address to* which supplements should be sent are clearly given in the space provided.

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TECHNICAL HANDBOOK SERVICE

CONTENTS

Made and printed in England by Wightman & Co. Ltd., 1-3 Brixton Road, London, S.W.9

Mullard Technical Handbook

GENERAL INDEX TO VOLUME ONE

This index of Mullard receiving and amplifying valves, special quality receiving valves and television picture tubes will be reissued periodically to incorporate the latest information. It does not include data sheets for maintenance type receiving valves and cathode ray tubes which are contained in Volume 2.

Data sheets for types starred thus (*) have not yet been published but will be issued when they are available. A guarantee that these valves and tubes will become available is not implied by their inclusion in this list.

The issue number or date given against each type shows the latest information published and should correspond to that given on the data sheet at the bottom left-hand corner of each page.

Receiving and Amplifying Valves (*Current Types*)—contd.

Receiving and Amplifying Valves (*Current Types*)—contd.

GENERAL INDEX TO VOLUME ONE

VALVE TYPE NOMENCLATURE

The type nomenclature for Mullard receiving and amplifying valves generally consists of two or more letters followed by two, three or four figures. These symbols provide information concerning the principal uses of the valves, the heater or filament rating, and the type of base, according to the following code.

The first letter indicates the filament or heater voltage or current:

D—0.5 to 1.5V filament	H—150mA heater
E—6.3V filament	P—300mA heater
G—5.0V filament	U—100mA heater

Letters A(4.0V), C(200mA) and K(2.0V) have also been used.

The second and subsequent letters indicate the general class of valve:

A—single diode	H—hexode or heptode
B—double diode	K—heptode or octode
C—triode	L—output tetrode or pentode
D—output triode	M—electron beam indicator
E—tetrode	Y—half-wave rectifier
F—voltage amplifying pentode	Z—full-wave rectifier

Two or three of the above letters may be combined, e.g. BC—double-diode triode.

The first figure of the serial number indicates the type of base:

1—Miscellaneous bases (see note below)
2—B10B(10-pin) base (previously used for B8G base)
3—Octal base
4—B8A base
5—B9D(magnoval) base (previously used for miscellaneous bases)
6 and 7—Previously used for subminiature bases
8—B9A (noval) base
9—B7G base

In some earlier type numbers with three figures, if the first figure is 1 then the second figure indicates the type of base, e.g., ECC189—B9A base.

The remaining figures make up the serial number indicating a particular design or development. In future, all valves designed for 'entertainment' applications will have a serial number of three figures. Valves designed for 'professional' applications will have a serial number of four figures.

Exceptions

Some valves for 'professional' applications have a type number in which the figures follow the first letter and precede the second and subsequent letters, e.g., E88CC. Other 'professional' valves have a type number consisting of the letter 'M' followed by a four-figure serial number commencing with the figure '8', e.g. M8080.

Examples

PCF806	P 300mA heater	C triode	F voltage amplifying pentode	806 B9A base 'Entertainment' applications
EC1000	E 6.3V heater	C triode	1000 Miscellaneous (subminiature) base 'Professional' applications	

INTERPRETATION OF DATA

The principal characteristics quoted for each valve in this Handbook are normally those corresponding to a value of anode current representing typical operating conditions. The control-grid voltage given for this anode current is approximate only, the anode current being taken as the standard.

The values given are the mean values of measurements made on a large number of valves.

Where the "equivalent noise resistance" is quoted, this is the value of a resistance which, if introduced into the grid circuit of a perfectly noiseless valve, would produce noise of the same level as that of the shot and partition noise occurring in the actual valve. Curves showing the equivalent noise resistance plotted against mutual conductance or anode current are provided for certain types.

The values of input damping resistance represent the extent to which a parallel tuned circuit would be damped by the valve at the stated frequency.

The data presented graphically is that most generally required for equipment design calculations.

Curves showing cross-modulation and modulation plotted on a logarithmic scale against anode current and mutual conductance are provided for those R.F. amplifiers and frequency changers which are designed for automatic volume control.

The cross-modulation curves show the amplitude of an unwanted signal, modulated to a depth of 30 per cent. at 400 c.p.s. which will result in a cross-modulation factor of 1 per cent. The cross-modulation factor (k) is the ratio, expressed as a percentage, of the modulation depth caused by a modulated interfering carrier to the modulation depth of the wanted signal appearing on the wanted carrier frequency at the output of the valve, assuming that both carriers are modulated to the same depth. The cross-modulation factor may be considered to be independent of the amplitude of the wanted signal where this amplitude is small. The measurements plotted correspond to a wanted signal amplitude of 100 mV.

The modulation curve shows the unwanted input voltage at 400 c.p.s. which will produce 1 per cent. modulation ($m_b = 1$) of the wanted carrier at the output of the valve. For frequency changers, these values are plotted against conversion conductance instead of against mutual conductance.

Curves showing anode impedance, conversion conductance and oscillator volts plotted against oscillator-grid current are also given for frequency changers.

For diode detectors, curves showing audio frequency output voltage plotted against a 30 per cent modulated R.F. input, and D.C. output voltage against R.F. input are normally provided.

For output valves, in addition to the normal static characteristics, curves showing drive voltage, distortion and electrode currents as functions of the output power are provided. For output pentodes these parameters are also plotted against line voltage over a limited range.

Curves other than those already referred to are given for certain valve types where the additional information is necessary for design purposes for special applications.

LIMITING VALUES

The operating maxima quoted on individual data sheets should on no account be exceeded. The following general limitations should also be observed, and should be interpreted in conjunction with British Standard Specification No. 1106, " Code of Practice on the Use of Radio Valves in Equipment ", upon which these notes have, in part, been based.

Where reference is made to a particular electrode, it should also be considered as referring to an electrode performing a similar function in a more complex valve.

FILAMENT

(a) *Valves with 2-volt Filaments*

The filament voltage should be maintained between $\pm$ 7% of the rated value. If, however, some variation of the valve characteristics is acceptable, the filament voltage limits may be extended to $\pm$ 10%.

(b) *Valves with 1.4-volt Filaments*

(i) *Dry-battery Operation.* Valves with 1.4-volt filaments are designed to be operated from a dry-cell battery with a rated terminal voltage of 1.5V. In no circumstances should the voltage across any 1.4-volt section of filament exceed 1.6V. If these valves are operated with their filaments in series from dry batteries with a higher terminal voltage, shunting resistors may be required to ensure the correct voltage across individual 1.4-volt filaments.

(ii) *Accumulator or Mains Operation.* When valves with 1.4-volt filaments are operated from an accumulator or from a mains supply unit, the voltage drop across each 1.4-volt section of filament of valves with rated filament current should have a nominal value of 1.3V and should be maintained between 1.2V and 1.4V at normal line voltage, that is to say at voltages equivalent to 2-volts per cell for accumulators or to nominal line voltage for supply mains. If the filaments are operated in series, shunting resistors may be required to ensure the correct voltage across individual 1.4-volt filaments.

HEATER VOLTAGE AND CURRENT TOLERANCES (INDIRECTLY-HEATED VALVES)

(a) *Parallel Operation*

The heater voltage of individual valves must be within $\pm$ 7% of the rated value when the power supply voltage is at its nominal rated value, and valves having nominal heater characteristics are employed.

This figure is permissible only if the voltage variation is dependent upon more than one factor. In these circumstances the total tolerance may be taken as the square root of the sum of the squares of the individual deviations arising from the effect of the tolerances of the separate factors, providing no one of these deviations exceeds $\pm$ 5%. Should the voltage variation depend on one factor only, the voltage variation must not exceed $\pm$ 5%.

(b) *Series Operation*

The heater current of series-connected valves should be within $\pm$ 3.5% of the rated value when the supply voltage is at its nominal rated value, and valves having nominal heater characteristics are employed. In applications where a wider spread in the dynamic characteristics of the valve is acceptable, as for example in broadcast receivers, the heater current tolerance may be increased to $\pm$ 5%.

Both these figures are permissible only if the current variation is dependent upon more than one factor. In these circumstances the total tolerance may be taken as the square root of the sum of the squares of the individual deviations arising *from the effects of the tolerances of the separate factors, providing no one of* these deviations exceeds 2.5%, or 3.5% if the wider spread in valve characteristics is accepted. Should the total current variation depend upon one factor only, the current variation must not exceed 2.5% or 3.5% according to the spread of valve characteristics which is acceptable.

With certain combinations of valves, differences in thermal inertia may result in particular heaters being run at an excessively high temperature during the warming up period. During this period, unless otherwise stated in the published data, it is permissible for the heater voltage of indirectly heated valves to rise to a maximum value 50% in excess of the nominal rated value when using valves with nominal heater characteristics. A surge limiting device may be necessary in order to meet this requirement.

In addition to the tolerances quoted above, fluctuations in the mains supply voltage not exceeding $\pm$ 10% are permissible. These conditions are, however, the worst which are acceptable and it is better practice to maintain the heater as close to its nominal rating as is possible, particularly in television equipment where changes in valve characteristics can have an appreciable effect upon the picture Furthermore, in all types of equipment closer adjustment of heater voltage or current will react favourably upon valve life and performance.

For example, the limiting conditions listed above permit the design of an equipment using valves having parallel connected heaters for operation from the supply voltage range of 200V to 250V, employing a minimum of two tapping points arranged as follows:—

(i) 200V to 220V—Centre value 210V

(ii) 230V to 250V—Centre value 240V

Providing the equipment is not intended for use on a nominal supply voltage of between 221V and 229V, this represents a maximum voltage variation of $\pm$ 4.8% which allows : $\sqrt{7^2-4.8^2} = \pm 5.1\%$ to cover component tolerances and wiring losses.

CATHODE

Cathode voltages, with respect to earth, should be kept as low as possible. Maximum values for specific valves are indicated on the data sheets.

In order to avoid hum and instability, the heater-cathode path should not be included either in the A.F. or the R.F. circuit. This precaution is particularly important where the signal level is low.

Disintegration of the cathode coating may occur in both indirectly-heated and directly-heated rectifiers if the total resistance in series with the anode is less than that specified on the data sheet for the particular valve. The value of the resistance depends upon the effective resistance, R_t, due to the transformer

$$R_t = R_s + n^2 R_p$$

where :

R_s = Resistance of the transformer secondary in anode circuit.
R_p = Resistance of the transformer primary.
n = Primary to secondary ratio in half-wave circuits or primary to half secondary ratio in full-wave circuits.

If the resistance R_t is less than the minimum specified value for the series resistance, an additional series resistance must be included.

Unless otherwise stated, the maximum cathode-to-heater voltage specified for a particular valve is intended to be the D.C. value or the R.M.S. value, provided that the peak value does not exceed 1.4 times this figure. This point should receive particular attention in inverse feed-back circuits in which the cathode bias resistor is not decoupled.

CONTROL GRID

The resistance in series with the control grid must be kept as low as possible, and should in no circumstances exceed the maximum value quoted on the data sheet. Care should be taken when selecting valves for use as oscillators or for other circuit conditions where appreciable grid current is drawn, to ensure that the maximum grid ratings are not exceeded.

If grid bias is provided by grid rectification, precautions should be taken to ensure that the valve ratings will not be exceeded in the event of loss of drive. Normally this risk is avoided by providing a certain amount of cathode bias.

SCREEN GRID

In circuits where large anode voltage swing occurs care should be taken that the maximum screen-grid dissipation is not exceeded.

The method of feeding the screen-grid will have a considerable effect on the cross-modulation characteristics of valves designed for operation over a large A.V.C. range. Recommendations in this connection are given on individual data sheets.

SUPPRESSOR GRID

Suppressor-grids should be maintained at cathode potential except in applications for which conditions involving the application of voltage to the suppressor-grid are quoted on data sheets.

For applications where it is desired to employ the secondary emission characteristic of a valve, it should be noted that this characteristic may vary considerably as between valve and valve and the circuit design should not be critical in this respect. On account of this variability, the use of this characteristic is in general not recommended.

MOUNTING

Care should be taken when mounting indirectly-heated valves having high mutual conductance and directly-heated valves having long filaments in a horizontal position that the major axis of the first grid or the plane of the filament is vertical. The direction of this plane is indicated on the data sheets of all valves to which this recommendation applies.

Valves not falling within this category may be mounted in any position.

VENTILATION

Adequate ventilation for the dissipation of heat must be provided, particularly for power valves and rectifiers.

GENERAL

Valves should not be operated without a D.C. connection between each electrode and the cathode. Any apparent advantage to be gained by so doing may be neutralised by secondary emission from the electrode concerned.

High voltage half-wave rectifier with wired-in connections. Suitable for application in portable t.v. receivers.

HEATER ←

V_h	1.4	V
I_h	550	mA
Heater voltage tolerances $I_{out} \leq 200\mu A$	±15*	%
$I_{out} > 200\mu A$	±7*	%

*These tolerances apply when the power supply voltage is at its nominal value and when a valve having bogey heater characteristics is employed. In addition, fluctuations in the mains supply voltage not exceeding ±10% are permissible.

MOUNTING POSITION Any

NOTE - Direct soldered connections to the leads of this valve must be at least 10mm from the seal and care should be taken not to bend the leads near the seal.

CAPACITANCE

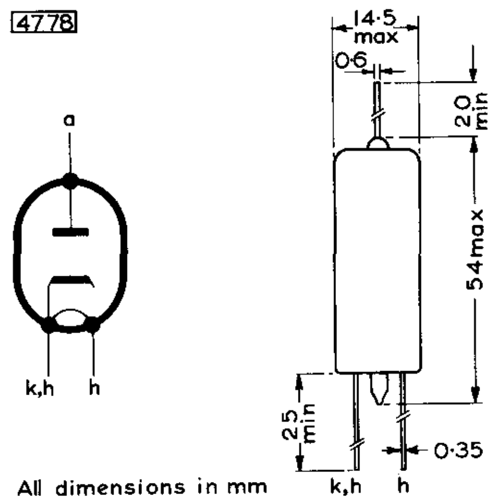
c_{a-k}	0.8	pF

LIMITING VALUES

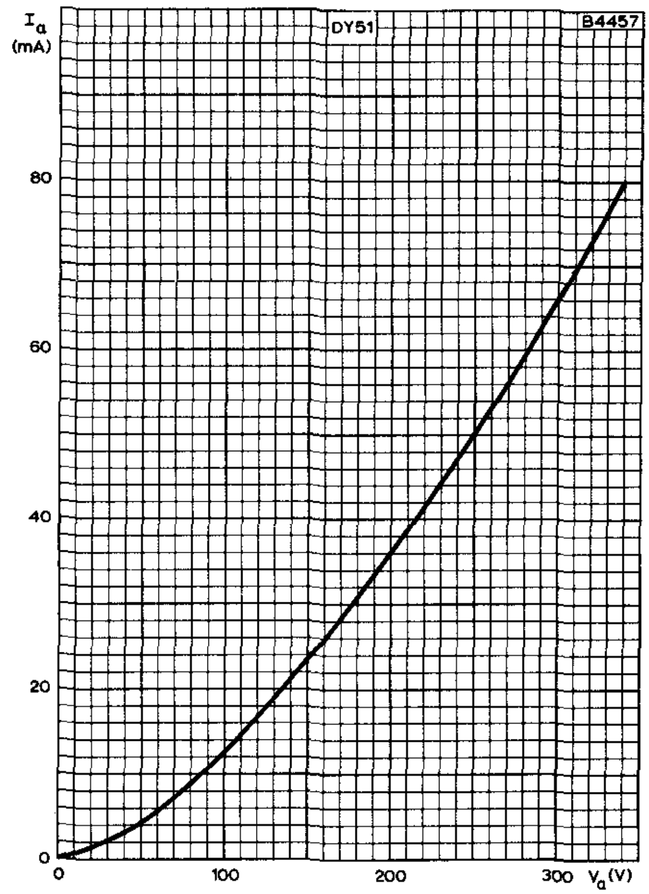
P.I.V. max.	15	kV
$I_{a\ (out)}$ max.	350	µA
*$i_{a(pk)}$ max	40	mA ←
C max.	2000	pF

*Maximum pulse duration 10% of one cycle with a maximum of 10µs ←

4778



All dimensions in mm



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

HALF-WAVE RECTIFIERS

DY86
DY87

High voltage half-wave rectifiers for television line fly-back e.h.t. supply. The DY87 is electrically identical to the DY86 but has a chemically treated bulb to prevent flash-over under conditions of high humidity.

HEATER

Vh		1.4	V
Ih		550	mA
Heater voltage tolerances	Iout < 200 μA	± 15*	%
	Iout > 200 μA	± 7*	%

* These tolerances apply when the power supply voltage is at its nominal value and when a valve having bogey heater characteristics is employed. In addition fluctuations in the mains supply voltage not exceeding ± 10 % are permissible.

CAPACITANCES

ca-(h+k+s)	1.55	pF

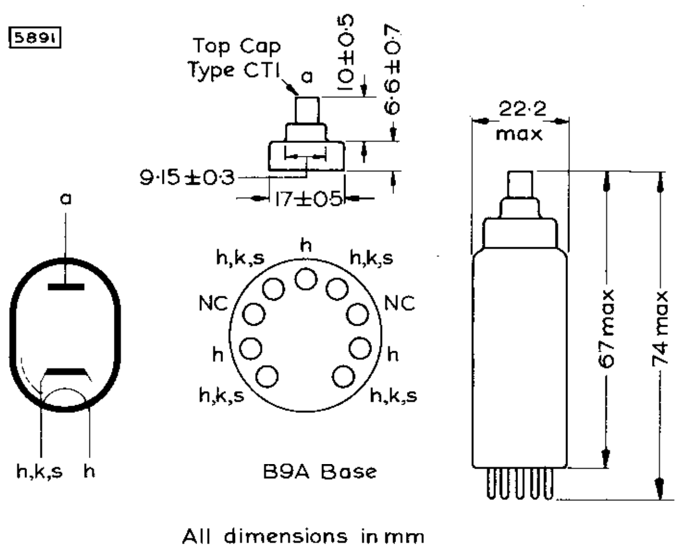
DESIGN CENTRE RATINGS

Pulsed input		
* P.I.V. max.	22	kV
‡ ia (pk) max.	40	mA
Iout max.	500	μA
C max.	2000	pF

* Maximum duration 22 % of a line scanning cycle with a maximum of 18 μs.
‡ *Maximum duration 10 % of a line scanning cycle with a maximum of 10 μs.*

WARNING

X-ray shielding is advisable to give protection against possible danger of personal injury arising from prolonged exposure at close range to this tube when operated above 16 kV. The level of X-radiation is likely to be considerably higher when the heater circuit of the tube is open.



Pins 1, 4, 6 and 9 may be used for fixing an anti-corona shield.

Pins 3 and 7 may only be connected to points in the heater circuit and must not be earthed.

HALF-WAVE RECTIFIER DY802

TENTATIVE DATA

High voltage half-wave rectifier for television line fly-back e.h.t. supply.

HEATER

V_h	1.4	V
I_h	550	mA
Heater voltage tolerances I_{out} <200μA	±15	%
I_{out} >200μA	±7	%

CAPACITANCES

$c_{a-(h+k+s)}$	1.1	pF

RATINGS (DESIGN CENTRE SYSTEM)

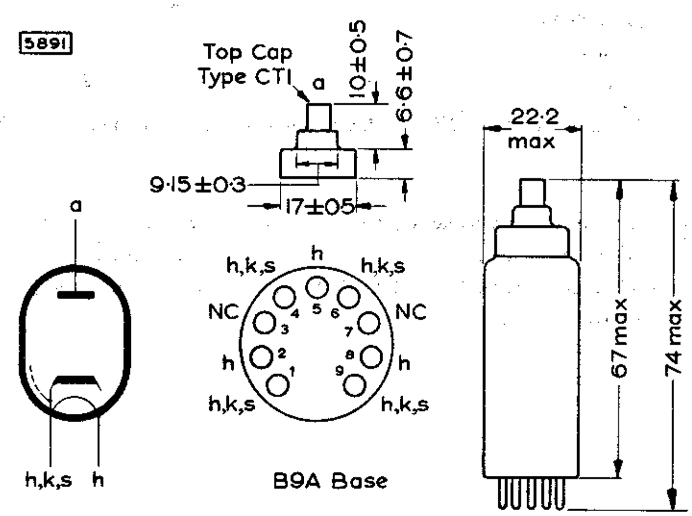
Pulsed input

*P.I.V. max.	25	kV
$i_{a(pk)}$ max.	50	mA
I_{out} max.	500	μA
C max.	2000	pF

*Maximum duration 22% of a line scanning cycle with a maximum of 22μs.

WARNING

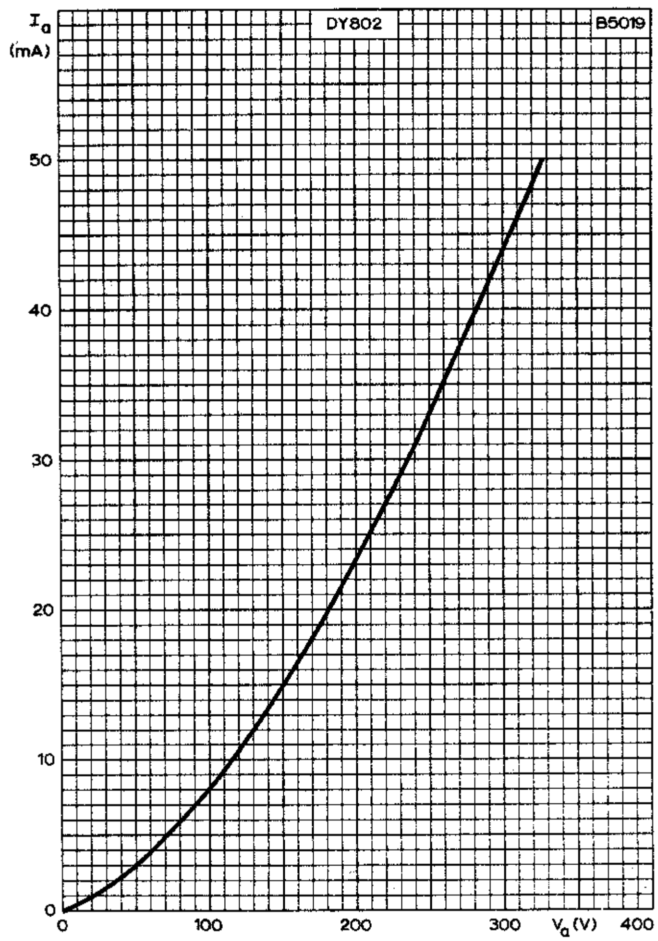
X-ray shielding is advisable to give protection against possible danger arising from prolonged exposure at close range to this valve when operated above 16kV. The level of X-ray radiation is likely to be considerably higher when the load is removed from this valve.



All dimensions in mm

Pins 1, 4, 6 and 9 may be used for fixing an anti-corona shield.

Pins 3 and 7 may only be connected to points in the heater circuit and must not be earthed.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

U.H.F. DIODE

EA52

Disc seal diode primarily intended for use as a measurements diode at frequencies up to 1000Mc/s.

HEATER

Suitable for series or parallel operation a.c. or d.c.

V_h	6.3	V
I_h	300	mA

The absolute maximum variation of heater voltage is ±0.7V

CAPACITANCE

c_{a-k}	<0.5	pF

CHARACTERISTICS

V_a (I_a = 500μA)	<3.0	V

INSULATION

Insulation between anode and cathode	>10^4	MΩ

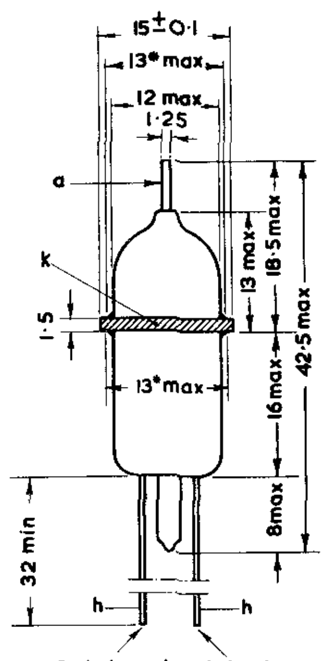
LIMITING VALUES (absolute ratings)

*P.I.V. max. (f < 100Mc/s)	1.0	kV
I_k max.	300	μA
$i_{k(pk)}$ max.	5.0	mA
V_{h-k} max.	50	V
R_{h-k} max.	20	kΩ

*At frequencies greater than 100 Mc/s, the maximum P.I.V. is $\frac{10^5}{f}$ V, where f is the frequency in Mc/s.

EA52

U.H.F. DIODE

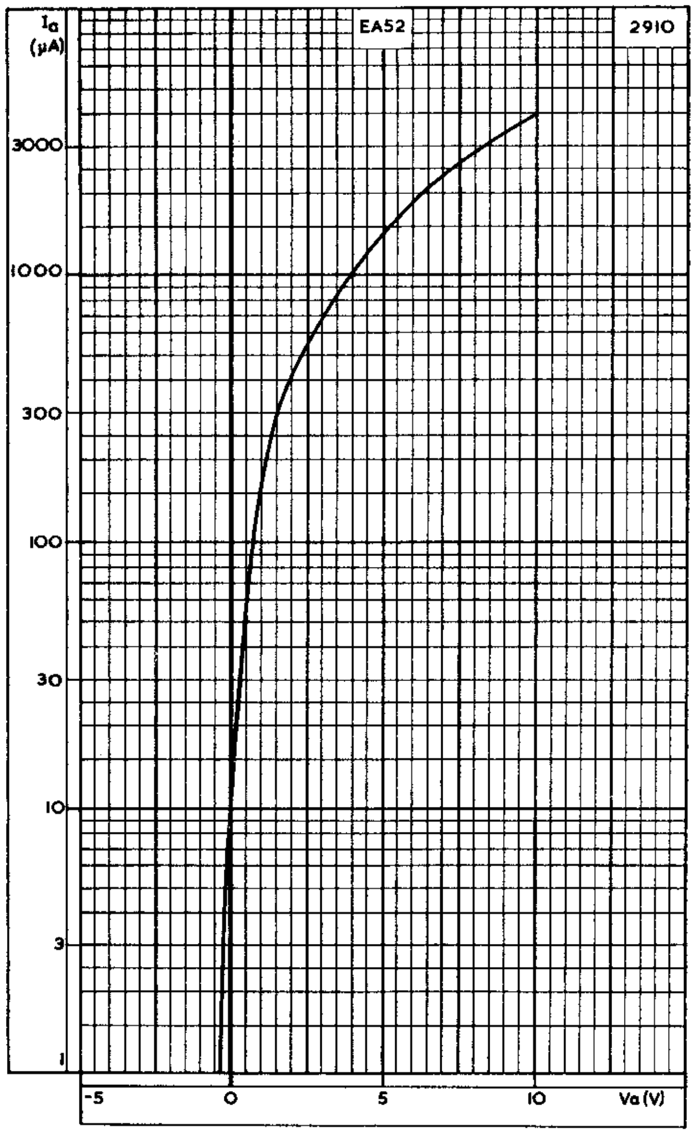


2922 All dimensions in mm

Cadmium plated leads
0·4 mm dia

* Max diameter of the glass seal

Note.—Direct soldered connections to the leads of this valve must be at least 7mm from the seal and any bending of the valve leads must be at least 1·5mm from the seal.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

TRIPLE DIODE TRIODE

EABC80

Triple diode triode, one diode having a separate cathode. Primarily designed for use in f.m./a.m. receivers.

HEATER

V_h	6.3	V
I_h	450	mA

CAPACITANCES ←

$c_{at-a'd}$	<0.12	pF
$c_{at-k''d}$	<0.01	pF
$c_{at-a'''d}$	<0.1	pF
$c_{g-a'd}$	<0.07	pF
$c_{g-k''d}$	<0.005	pF
$c_{g-a'''d}$	<0.02	pF

Triode Section

c_{in}	1.9	pF
c_{out}	1.4	pF
c_{at-g}	2.0	pF
c_{g-h}	<0.04	pF

Diode Sections

$c_{a'd-(h+kt,k'd,k'''d,s)}$	0.8	pF
$c_{a''d-(h+k''d+kt,k'd,k'''d,s)}$	4.8	pF
$c_{a'''d-(h+kt,k'd,k'''d,s)}$	4.8	pF
$c_{k''d-all}$	4.9	pF
$c_{a'd-h}$	<0.25	pF
$c_{a'''d-h}$	<0.2	pF
$c_{k''d-h}$	2.5	pF

CHARACTERISTICS ←

Triode Section

V_a	100	250	V
V_g	−1.0	−3.0	V
I_a	0.8	1.0	mA
g_m	1.45	1.4	mA/V
μ	70	70	
r_a	48	50	kΩ

Diode Sections

$r_{a'd}$ ($V_{a'd}=+10V$)	5.0	kΩ ←
$r_{a''d}$ ($V_{a''d}=+5V$)	200	Ω
$r_{a'''d}$ ($V_{a'''d}=+5V$)	200	Ω
$r_{a''d}/r_{a'''d}$	0.65 to 1.5	

EABC80

TRIPLE DIODE TRIODE

Triple diode triode, one diode having a separate cathode. Primarily designed for use in f.m./a.m. receivers.

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER* (with grid current biasing) ←

V_b (V)	R_a (k Ω)	I_a (mA)	$\frac{V_{out}}{V_{in}}$	D_{tot} (%) for $V_{out(r.m.s.)}$ =3V	=5V	=8V	R_g† (k Ω)
170	47	1.25	32	0.6	1.1	2.0	150
170	100	0.82	42	0.5	0.8	1.3	330
170	220	0.46	51	0.4	0.5	1.1	680
200	47	1.6	34	0.5	0.9	1.5	150
200	100	1.0	44	0.4	0.6	1.0	330
200	220	0.56	53	0.3	0.4	0.9	680
250	47	2.2	36	0.3	0.6	1.0	150
250	100	1.4	47	0.25	0.5	0.8	330
250	220	0.76	54	0.2	0.25	0.6	680

*Measured with a grid resistor of 10MΩ.

†R_g=grid resistor of following value.

LIMITING VALUES

Triode Section

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	1.0	W
I_k max.	5.0	mA
V_g max. (I_g=+0.3μA)	-1.3	V
*R_{g-k} max.	3.0	MΩ
R_{h-k} max.	20	kΩ
V_{h-k} max.	150	V

*With grid current biasing R_{g-k} max.=22MΩ.

Diode Sections ←

P.I.V.$_{(a'd)}$ max.	350	V
P.I.V.$_{(a''d)}$ max.	350	V
P.I.V.$_{(a'''d)}$ max.	350	V
$I_{a'd}$ max.	1.0	mA
$I_{a''d}$ max.	10	mA
$I_{a'''d}$ max.	10	mA
$i_{a'd(pk)}$ max.	6.0	mA
$i_{a''d(pk)}$ max.	75	mA
$i_{a'''d(pk)}$ max.	75	mA

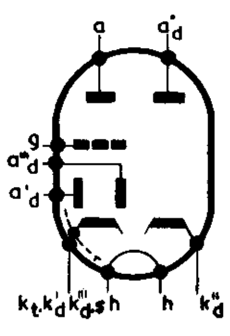
TRIPLE DIODE TRIODE

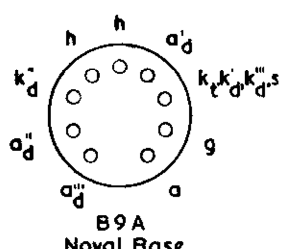
EABC80

Triple diode triode, one diode having a separate cathode. Primarily designed for use in f.m./a.m. receivers.

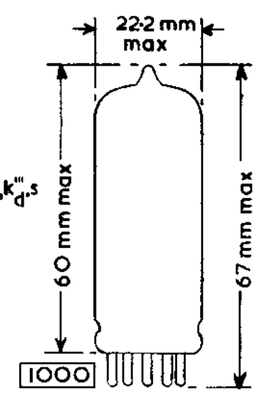
MICROPHONY

This valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 10mV for an output of 50mW from the output stage at 800c/s and higher frequencies.





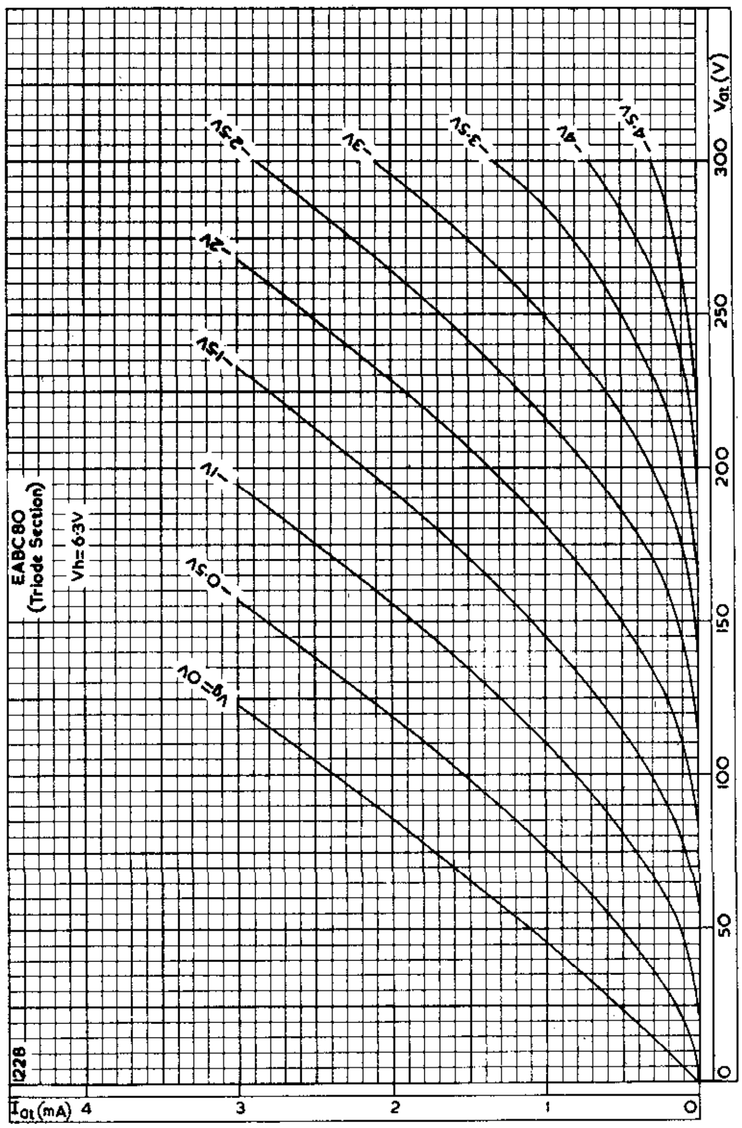
B9A
Noval Base



EABC80

TRIPLE DIODE TRIODE

Triple diode triode, one diode having a separate cathode. Primarily designed for use in f.m./a.m. receivers.

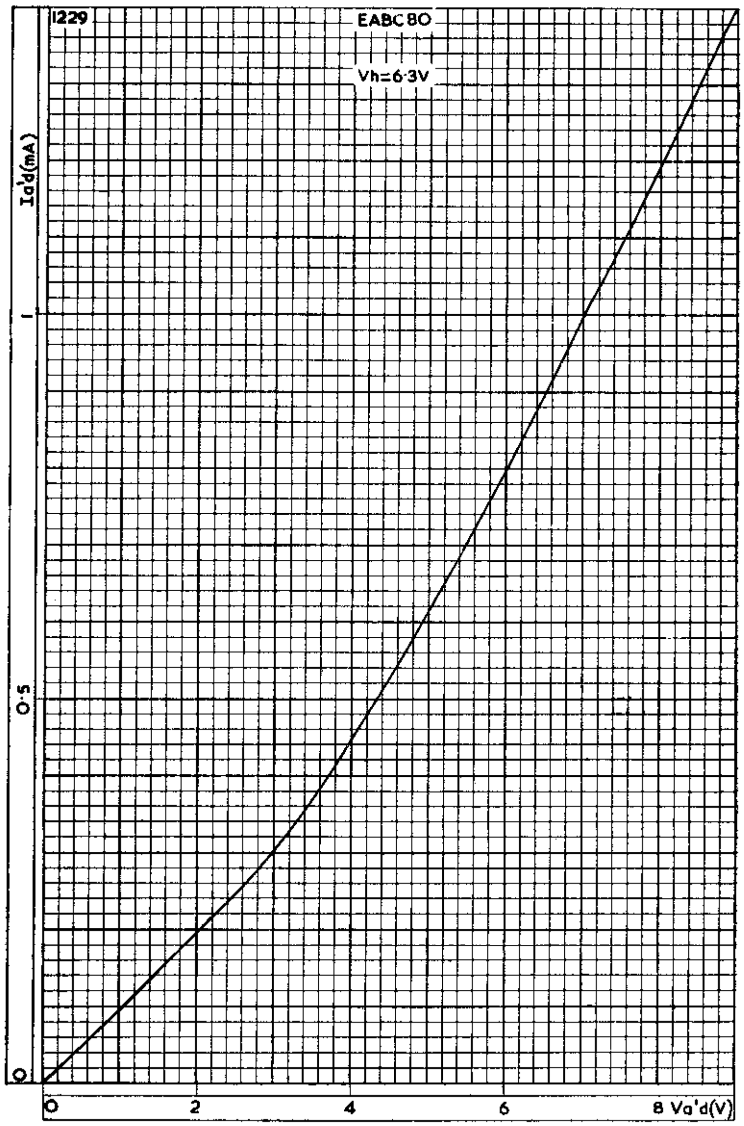


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

TRIPLE DIODE TRIODE

EABC80

Triple diode triode, one diode having a separate cathode. Primarily designed for use in f.m./a.m. receivers.

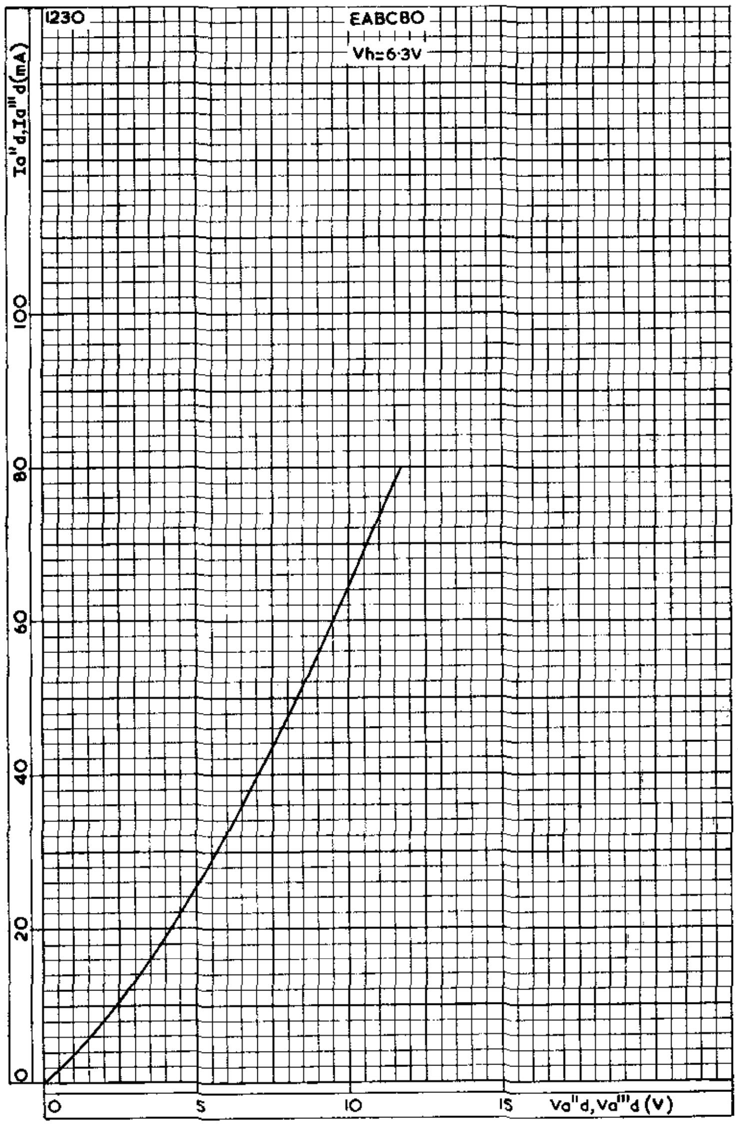


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR DIODE SECTION a′d

EABC80

TRIPLE DIODE TRIODE

Triple diode triode, one diode having a separate cathode. Primarily designed for use in f.m./a.m. receivers.

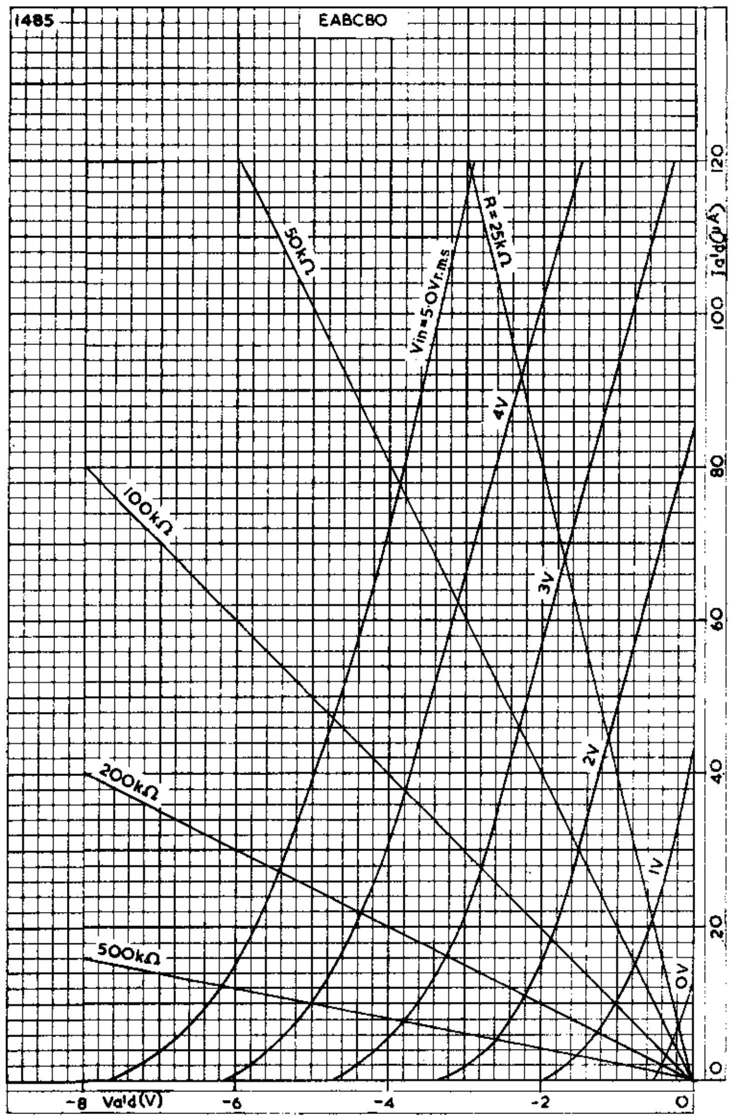


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR DIODE SECTIONS a''_d AND a'''_d

TRIPLE DIODE TRIODE

EABC80

Triple diode triode, one diode having a separate cathode. Primarily designed for use in f.m./a.m. receivers.

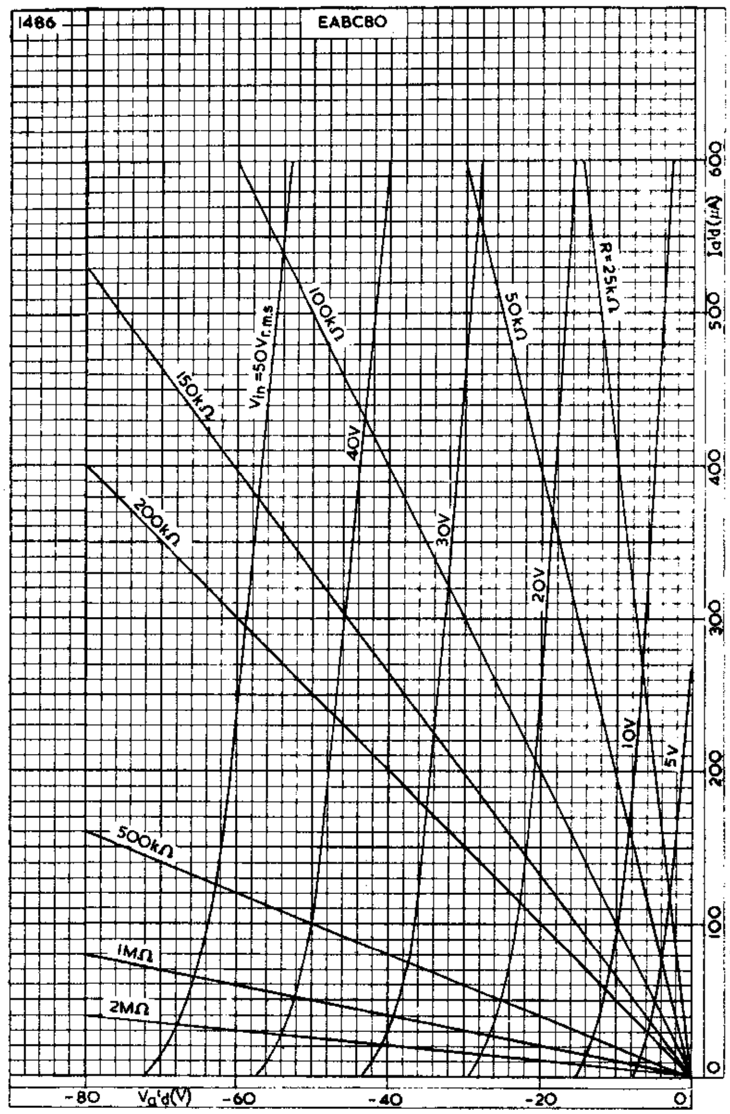


RECTIFIED CURRENT PLOTTED AGAINST OUTPUT VOLTAGE WITH INPUT VOLTAGE BETWEEN 0V AND $5V_{r.m.s.}$ AS PARAMETER FOR DIODE SECTION a'_d

EABC80

TRIPLE DIODE TRIODE

Triple diode triode, one diode having a separate cathode. Primarily designed for use in f.m./a.m. receivers.

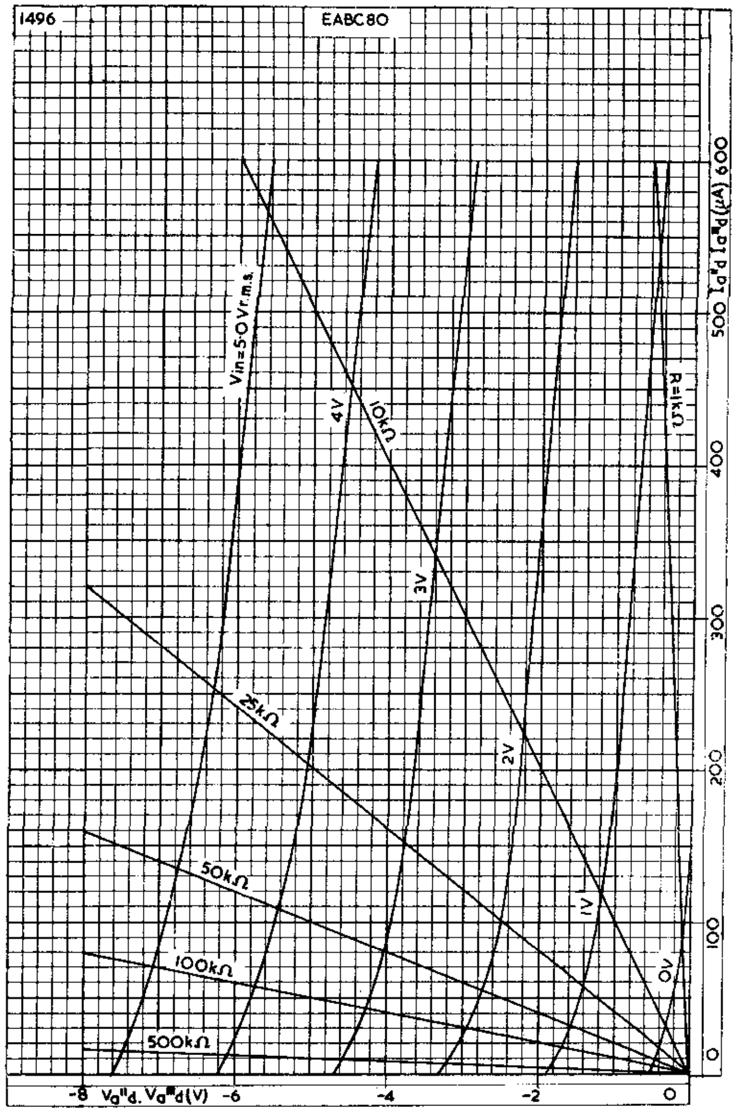


RECTIFIED CURRENT PLOTTED AGAINST OUTPUT VOLTAGE WITH INPUT VOLTAGE BETWEEN $5V_{r.m.s.}$ AND $50V_{r.m.s.}$ AS PARAMETER FOR DIODE SECTION a'_d

TRIPLE DIODE TRIODE

EABC80

Triple diode triode, one diode having a separate cathode. Primarily designed for use in f.m./a.m. receivers.

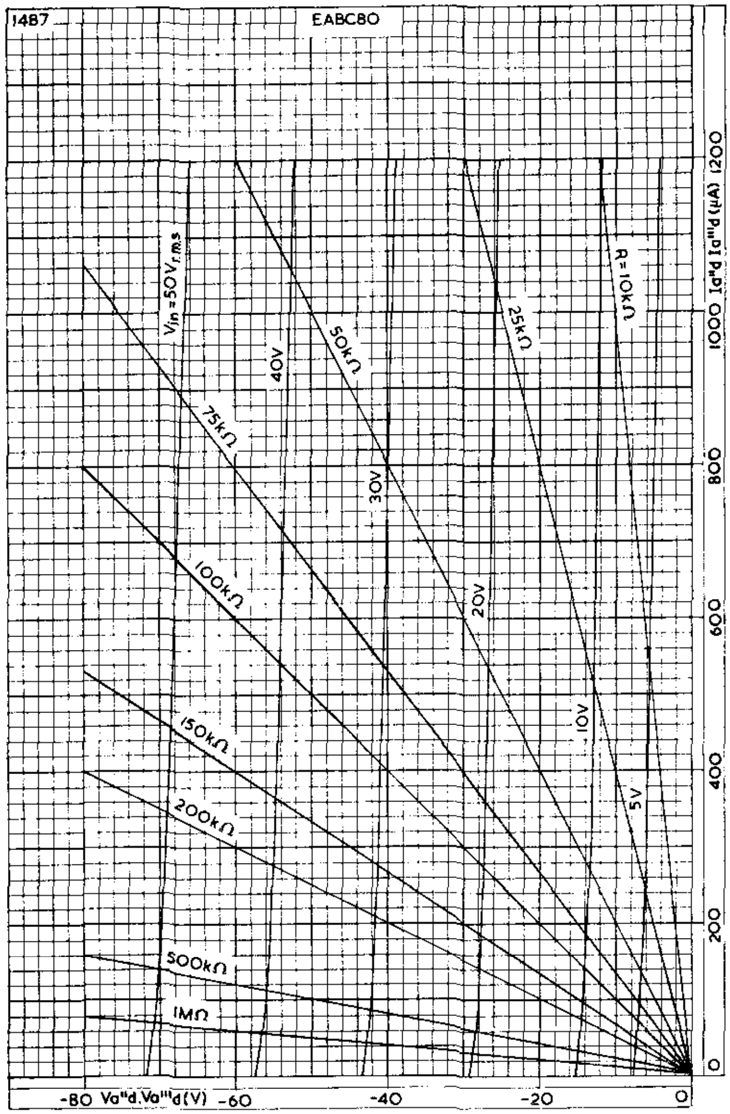


RECTIFIED CURRENT PLOTTED AGAINST OUTPUT VOLTAGE WITH INPUT VOLTAGE BETWEEN 0 AND $5V_{r.m.s.}$ AS PARAMETER FOR DIODE SECTIONS a''_d AND a'''_d

EABC80

TRIPLE DIODE TRIODE

Triple diode triode, one diode having a separate cathode. Primarily designed for use in f.m./a.m. receivers.



RECTIFIED CURRENT PLOTTED AGAINST OUTPUT VOLTAGE WITH INPUT VOLTAGE BETWEEN $5V_{r.m.s.}$ AND $50V_{r.m.s.}$ AS PARAMETER FOR DIODE SECTIONS a''_d AND a'''_d

DOUBLE DIODE

EB91

Miniature double diode with separate cathodes and internal screening between sections.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

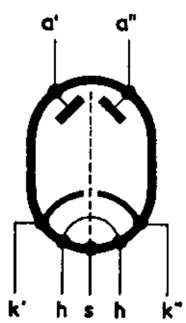
V_h	6.3	V
I_h	300	mA

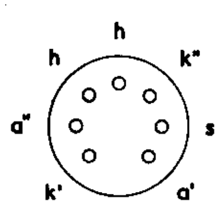
CAPACITANCES

$c_{a'-k'+h+s}$	3.0	pF
$c_{a''-k''+h+s}$	3.0	pF
$c_{k'-a'+h+s}$	3.4	pF
$c_{k''-a''+h+s}$	3.4	pF
$c_{a'-a''}$	<0.025	pF

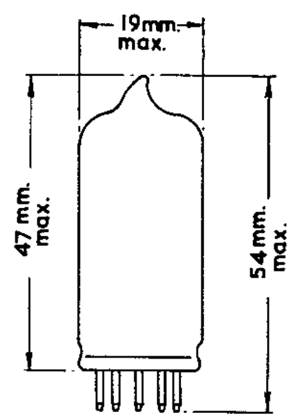
LIMITING VALUES (each section)

P.I.V. max.	420	V
I_a max.	9	mA
$i_{a(pk)}$ max.	54	mA
V_a max (I_a=0.3 μA)	−1.3	V
$v_{h-k(pk)}$ max.	330	V





B7G BASE

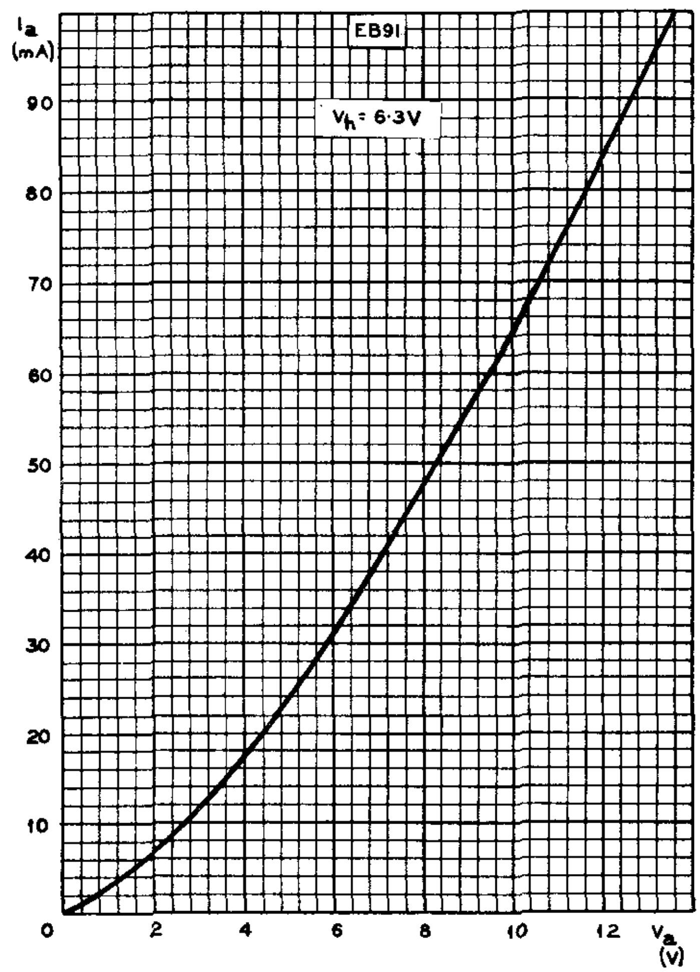


518

EB91

DOUBLE DIODE

Miniature double diode with separate cathodes and internal screening between sections.

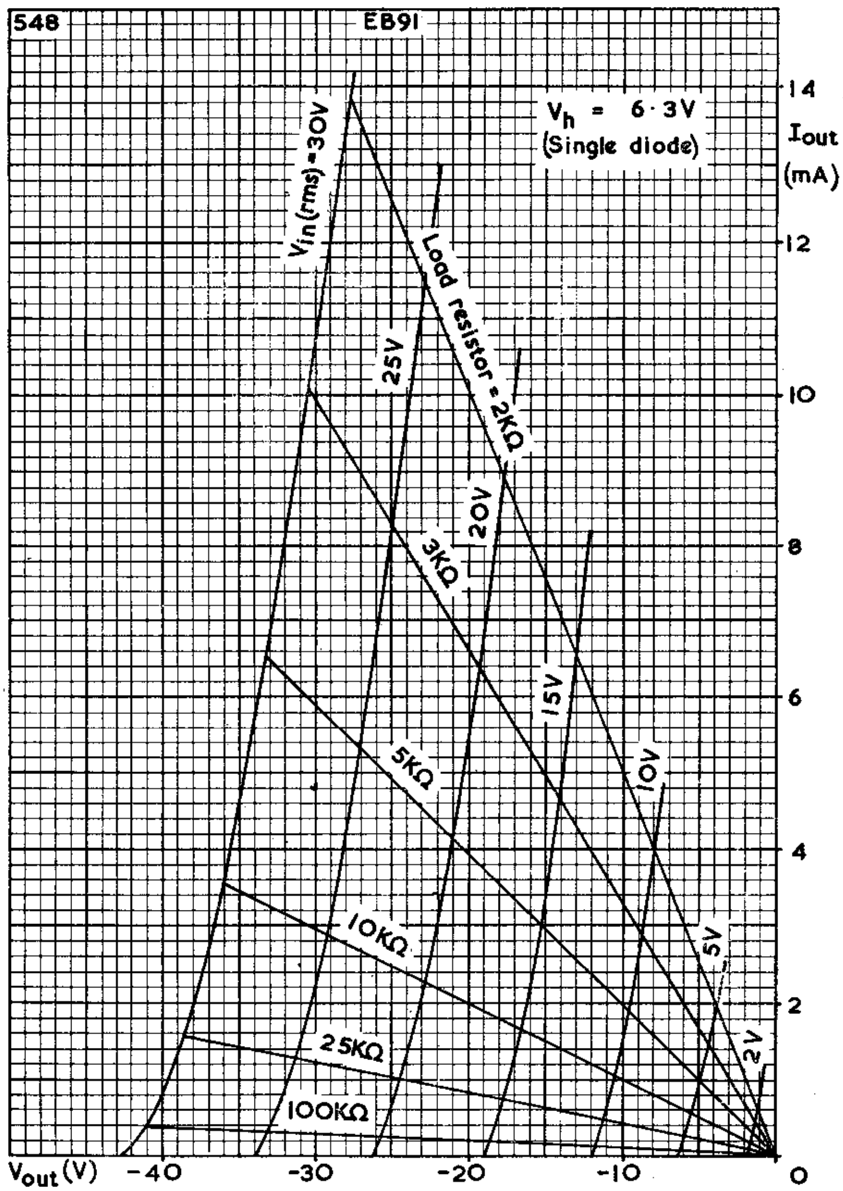


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

DOUBLE DIODE

EB91

Miniature double diode with separate cathodes and internal screening between sections.



OUTPUT CURRENT PLOTTED AGAINST OUTPUT VOLTAGE WITH INPUT VOLTAGE AS PARAMETER

DOUBLE DIODE TRIODE

EBC81

High gain triode for use as a.f. voltage amplifier combined with twin diodes.

HEATER

V_h	6.3	V
I_h	230	mA

MOUNTING POSITION

Any

CAPACITANCES

$c_{a'd-g}$	<0.007	pF
$c_{a''d-g}$	<0.007	pF
$c_{a'd-a}$	<0.005	pF
$c_{a''d-a}$	<0.01	pF

Triode section

c_{g-k}	2.3	pF
c_{a-k}	2.3	pF
c_{a-g}	1.2	pF
c_{g-h}	<0.05	pF

Diode sections

$c_{a'd-k}$	0.9	pF
$c_{a''d-k}$	0.9	pF
$c_{a'd-a''d}$	<0.2	pF
$c_{a'd-h}$	<0.25	pF
$c_{a''d-h}$	<0.05	pF

CHARACTERISTICS

V_a	250	V
V_g	−3.0	V
I_a	1.0	mA
g_m	1.2	mA/V
μ	70	
r_a	58	kΩ

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F AMPLIFIER (with cathode bias)

V_b (V)	R_a (kΩ)	I_a (mA)	R_k (kΩ)	$\frac{V_{out}}{V_{in}}$	V_{out} ($V_{r.m.s.}$) (D_{tot}=5%)	(D_{tot}=10%)	R_{g1}† (kΩ)
400	100	1.35	2.2	43.5	35.5	62.5	330
350	100	1.18	2.2	43	30.5	54	330
300	100	1.0	2.2	42.5	25.5	46	330
250	100	0.85	2.2	42	21	38	330
200	100	0.7	2.2	41	16	28.5	330
150	100	0.5	2.2	40	12	19.5	330
100	100	0.28	3.3	33.5	6.0	10.5	330
400	220	0.76	3.9	48	40	74.5	680
350	220	0.67	3.9	47.5	34.5	64	680
300	220	0.56	3.9	47	27	54	680
250	220	0.48	3.9	46.5	24.5	44.5	680
200	220	0.4	3.9	46	19	34	680
150	220	0.32	3.9	44	16.5	24	680
100	220	0.18	5.6	38	8.0	13.5	680

EBC81

DOUBLE DIODE TRIODE

High gain triode for use as a.f. voltage amplifier combined with twin diodes.

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER* (with grid current bias)

V_b (V)	R_a (kΩ)	I_a (mA)	$\frac{V_{out}}{V_{in}}$	V_{out} ($V_{r.m.s.}$) (D_{tot}=2.5%)	V_{out} ($V_{r.m.s.}$) (D_{tot}=5%)	R_{g1}† (kΩ)
400	100	2.4	56.5	33	51	330
350	100	2.0	55	27	43	330
300	100	1.95	53.5	22	35	330
250	100	1.3	51	17	27	330
200	100	0.95	48.5	12	19	330
150	100	0.6	44	7.0	11	330
100	100	0.3	35.5	3.0	5.0	330
400	220	1.3	62.5	34	55.5	680
350	220	1.1	61.5	29	47	680
300	220	0.9	59.5	23	38	680
250	220	0.7	57	17	29.5	680
200	220	0.5	54	12.5	21	680
150	220	0.33	49	8.0	14	680
100	220	0.18	40	4.0	7.0	680

*Measured with grid resistor of 22MΩ and signal source impedance Z_s=0Ω. The distortion figures quoted hold good for values of Z_s not exceeding 200kΩ. At this value of Z_s, the gain will be reduced by 10%.

†R_{g1} = Grid resistor of the following valve.

LIMITING VALUES

Triode section

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	500	mW
I_k max.	5.0	mA
R_{g-k} max.	3.0	MΩ
R_{g-k} max. (grid current biasing)	22	MΩ
V_g max. (I_g = +0.3μA)	−1.3	V
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ

Diode sections (each section)

P.I.V. max.	350	V
I_{ad} max.	800	μA
$i_{ad(pk)}$ max.	5.0	mA

MICROPHONY

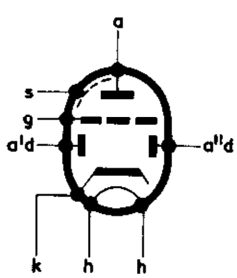
This valve can be used without special precautions against microphony in circuits in which the input voltage >10mV (r.m.s.) for an output of 50mW from the output valve.

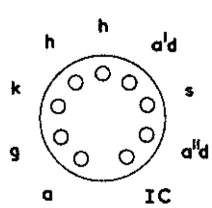
DOUBLE DIODE TRIODE

EBC81

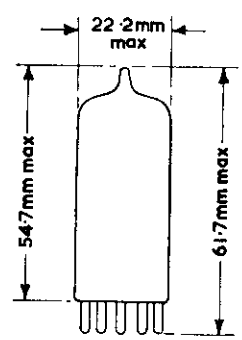
High gain triode for use as a.f. voltage amplifier combined with twin diodes.

3684





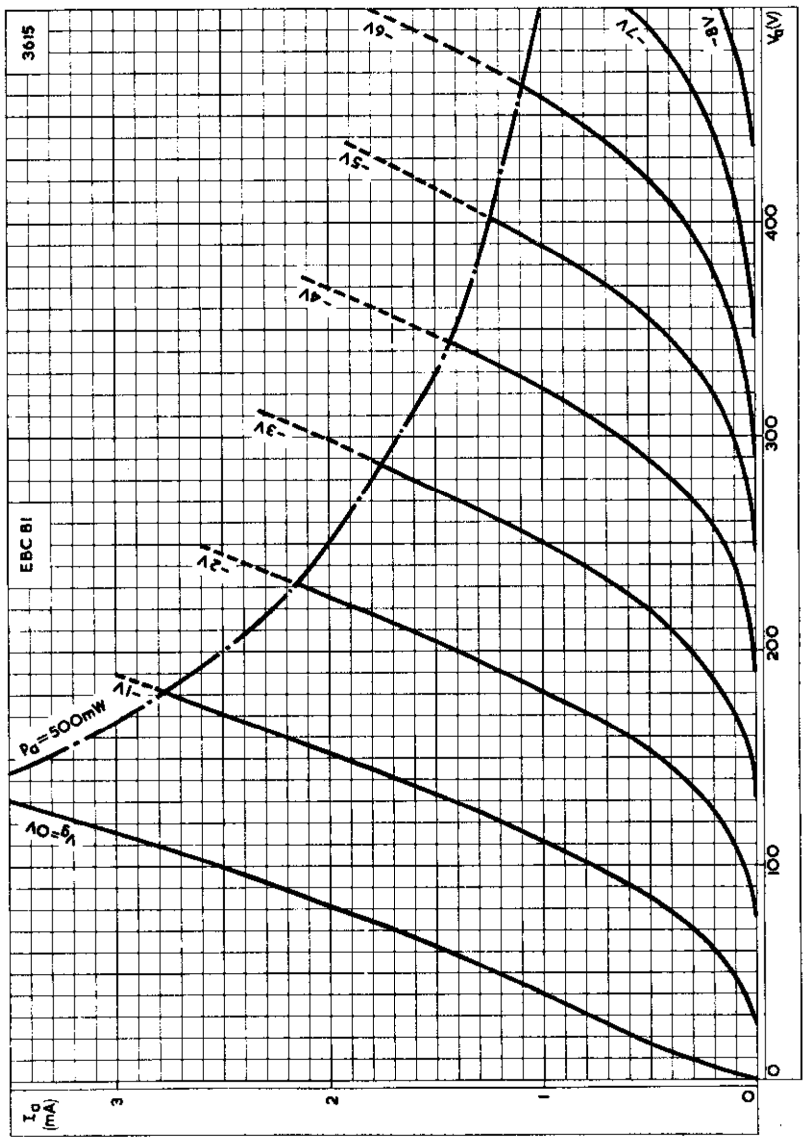
B9A Base



EBC81

DOUBLE DIODE TRIODE

High gain triode for use as a.f. voltage amplifier combined with twin diodes.

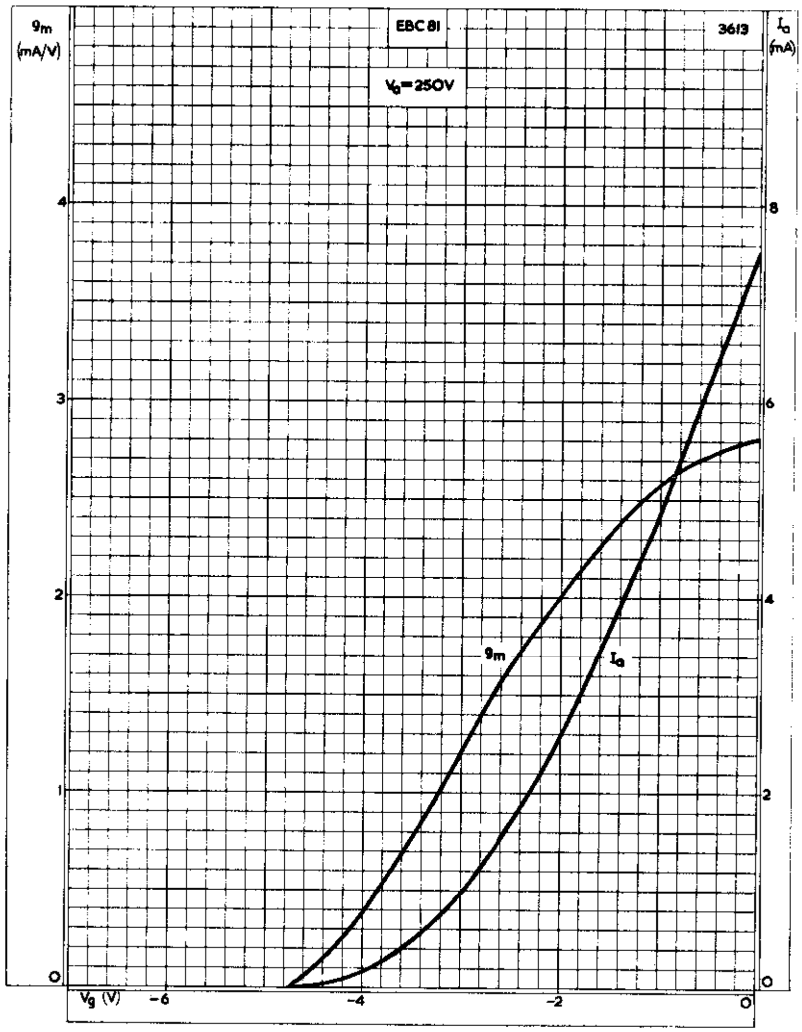


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

DOUBLE DIODE TRIODE

High gain triode for use as a.f. voltage amplifier combined with twin diodes.

EBC81



ANODE CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST GRID VOLTAGE

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

EBF83

Double diode variable-mu pentode primarily intended for use in equipment operating directly from a 6V, 12V or 24V battery, on or off charge.

HEATER

V_h	6.3	V
I_h	300	mA

CAPACITANCES

$c_{a'd-g1}$	<0.0008	pF
$c_{a''d-g1}$	<0.001	pF
$c_{a'd-a}$	<0.15	pF
$c_{a''d-a}$	<0.025	pF

Pentode section

c_{a-g1}	<0.0025	pF
c_{out}	5.2	pF
c_{in}	5.0	pF

Diode sections

$c_{a'd-k}$	2.5	pF
$c_{a''d-k}$	2.5	pF
$c_{a'd-a''d}$	<0.25	pF

CHARACTERISTICS

V_a	6.3	12.6	25	V
V_{g3}	0	0	0	V
V_{g2}	6.3	12.6	25	V
V_{g1}	†	†	†	
I_a	0.12	0.45	1.7	A
I_{g2}	40	140	500	μA
g_m	0.45	1.0	2.1	mA/V
r_a	0.65	1.0	0.2	MΩ

†Obtained by grid current biasing with $R_{g1} = 2.2\text{M}\Omega$.

LIMITING VALUES

Pentode section

V_a max.	50	V
V_{g2} max.	50	V
I_k max.	5.0	mA
R_{g1-k} max.	5.0	MΩ
V_{h-k} max.	50	V

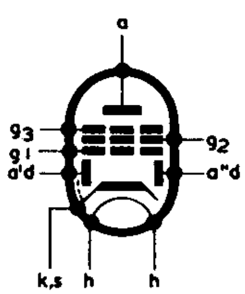
Diode sections (each section)

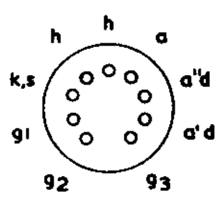
I_{ad} max.	800	μA
$i_{ad(pk)}$ max.	5.0	mA

EBF83

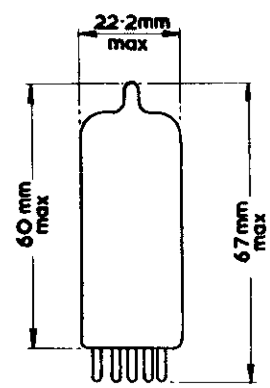
DOUBLE DIODE VARIABLE-MU R.F. PENTODE

6070





B9A Base



DOUBLE DIODE VARIABLE-MU R.F. PENTODE

EBF89

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.

HEATER

Suitable for series or parallel operation a.c. or d.c.

V_h	6.3	V
I_h	300	mA

MOUNTING POSITION

Any

CAPACITANCES

$c_{a'd-g1}$	<0.0008	pF
$c_{a''d-g1}$	<0.001	pF
$c_{a'd-a}$	<0.15	pF
$c_{a''d-a}$	<0.025	pF

Pentode section

c_{a-g1}	<0.0025	pF
c_{out}	5.2	pF
c_{in}	5.0	pF
c_{g1-h}	0.05	pF

Diode sections

$c_{a'd-k}$	2.5	pF
$c_{a''d-k}$	2.5	pF
$c_{a'd-a''d}$	<0.25	pF
$c_{a'd-h}$	<0.015	pF
$c_{a''d-h}$	<0.003	pF

CHARACTERISTICS

V_a	250	250	V
V_{g3}	0	0	V
V_{g2}	80	100	V
V_{g1}	−1.0*	−2.0	V
I_a	9.0	9.0	mA
I_{g2}	2.7	2.7	mA
g_m	4.5	3.8	mA/V
r_a	0.9	1.0	MΩ
μ_{g1-g2}	20	20	

*At this voltage grid current may occur. If this is not acceptable the negative bias voltage should be increased to −2.0V.

EBF89

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.

TYPICAL OPERATING CONDITIONS

$V_a = V_b$	200	200	250	250	V
V_{g3}	—	0	0	0	V
R_{g2}	47	30	82	56	kΩ
V_{g1}	−0.5*	−1.5	−0.5*	−2.0	V
R_k	—	105	—	170	Ω
I_a	9.5	11	8.0	9.0	mA
I_{g2}	2.8	3.3	2.2	2.7	mA
g_m	5.0	4.5	4.7	3.8	mA/V
r_a	0.6	0.6	0.8	1.0	MΩ
R_{eq}	2.5	3.5	2.3	4.0	kΩ
g_m (V_{g1} = −20V)	115	120	180	200	μA/V

*This voltage is produced by the grid current flowing through the grid resistor and the steady current of the diode. If this condition is not acceptable the negative grid bias should be increased to −1.5V at V_a = 200V and −2.0V at V_a = 250V.

LIMITING VALUES

Pentode section

$V_{a(b)}$ max.	550	V
*V_a max.	300	V
p_a max.	2.25	W
$V_{g2(b)}$ max.	550	V
*V_{g2} max. (I_a<4.0mA	300	V
V_{g2} max. (I_a>8.0mA	125	V
p_{g2} max.	450	mW
I_k max.	16.5	mA
V_{g1} max. (I_{g1} = +0.3μA)	−1.3	V
R_{g1-k} max.	3.0	MΩ
R_{g1-k} max. (grid current biasing	22	MΩ
R_{g3-k} max.	10	kΩ
R_{h-k} max.	20	kΩ
V_{h-k} max.	100	V

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

EBF89

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.

Diode sections (each section)

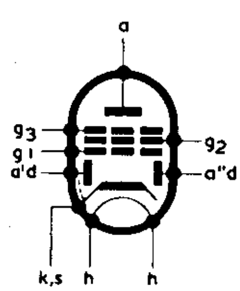
P.I.V. max.	200	V
I_{ad} max.	800	μA
$i_{ad(pk)}$ max.	5.0	mA
R_{h-k} max.	20	kΩ
V_{h-k} max.	100	V

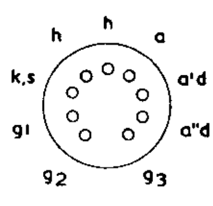
*If the heater, anode and screen-grid voltages are obtained from an accumulator by means of a vibrator, V_a max. = 250V, V_{g2} max. = 250V.

MICROPHONY

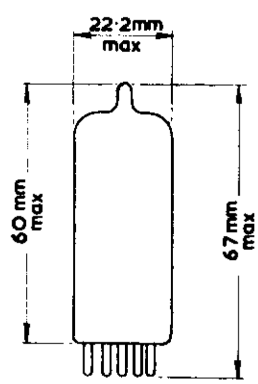
This valve can be used without special precautions against microphony in circuits in which the input voltage is >25mV (r.m.s.) for an output of 50mW from the output valve.

2845





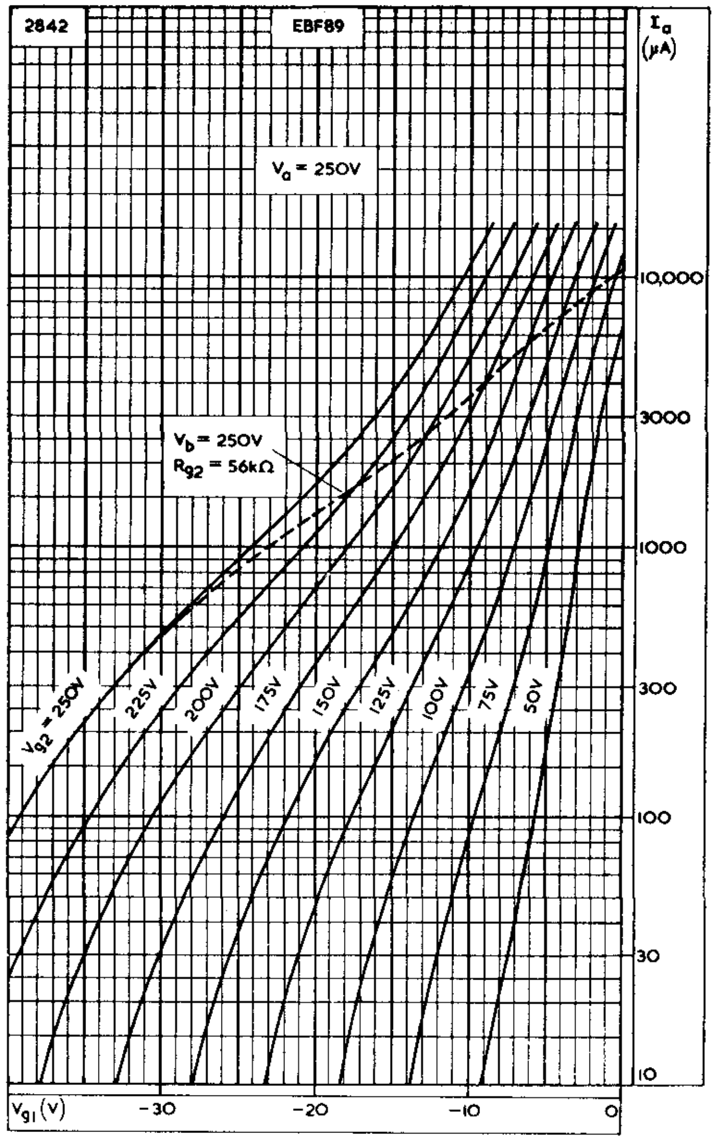
B9A Base



EBF89

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier The diode sections are only suitable for a.m. detection

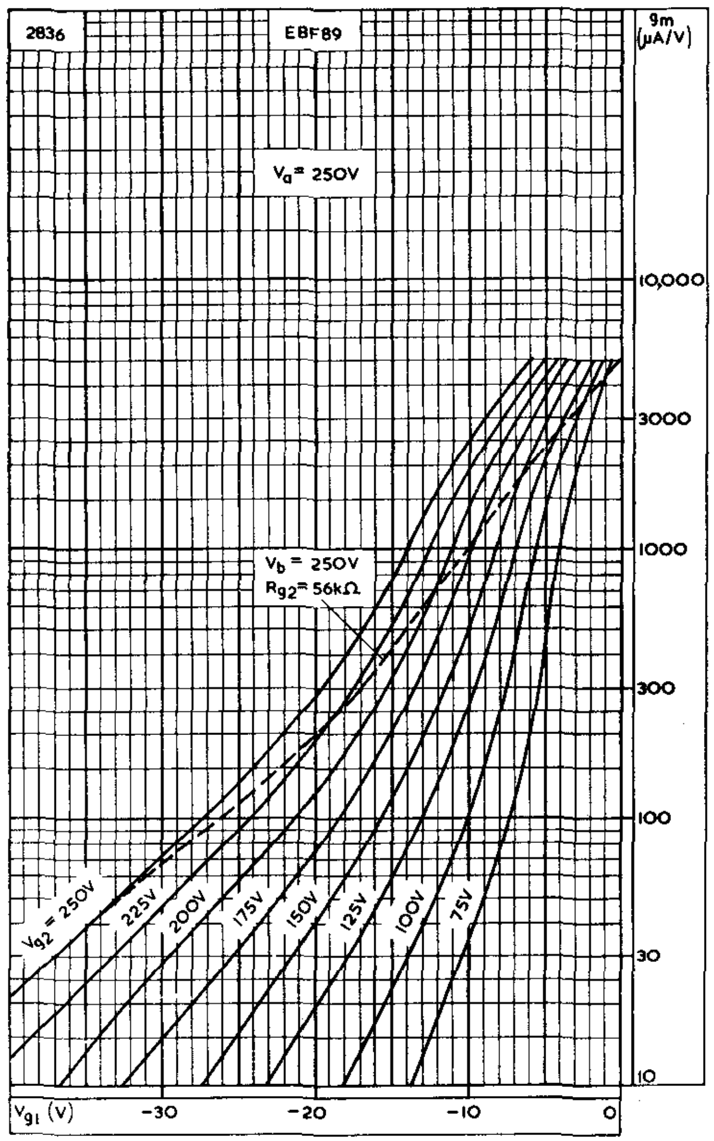


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

EBF89

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.

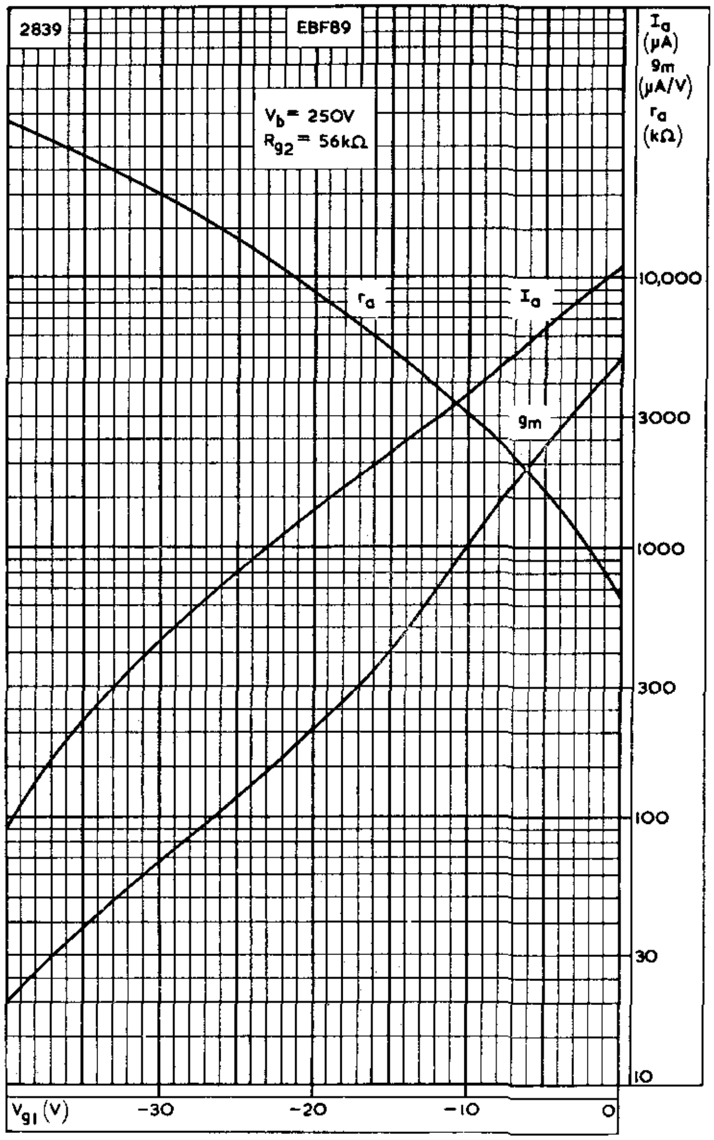


MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER

EBF89

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.

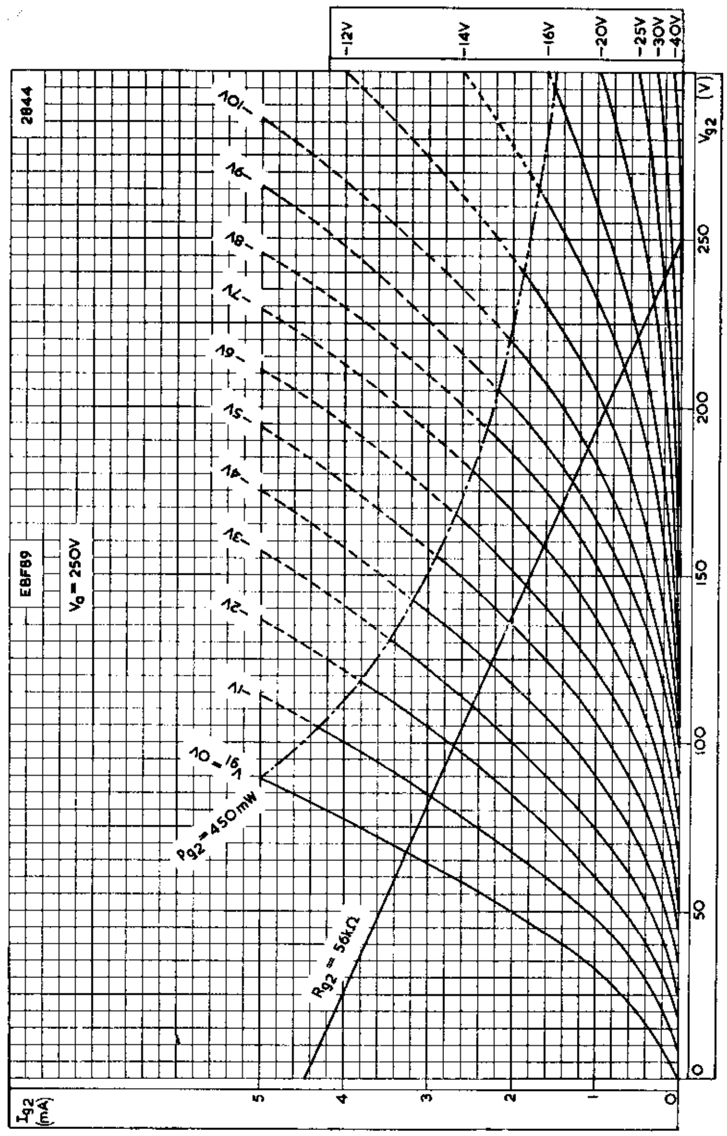


ANODE CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

EBF89

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.



SCREEN-GRID CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

U.H.F. TRIODE

EC86

Frame-grid triode for use as grounded-grid amplifier or self-oscillating mixer in Bands IV and V.

HEATER

Vh	6.3	V
Ih	175	mA

CAPACITANCES

Unshielded

ca-g	2.0	pF
ca-k	200	mpF
ca-k+h	300	mpF
ca-g+h	2.1	pF
cg-k	3.6	pF
cg-k (Ia = 12 mA)	5.6	pF
cg-k+h	3.9	pF
cg-h	300	mpF
ck-g+h	6.6	pF

Shielded

ch+k-g+s	4.2	pF
ca-g+s	3.1	pF
ca-k+h	250	mpF

CHARACTERISTICS

Va	175	V
Vg	-1.5	V
Ia	12	mA
gm	14	mA/V
ra	4.85	kΩ
μ	68	
Req	230	Ω

OPERATING CONDITIONS

As grounded-grid amplifier

Va	175	V
Ia	12	mA
Rk	125	Ω
gm	14	mA/V

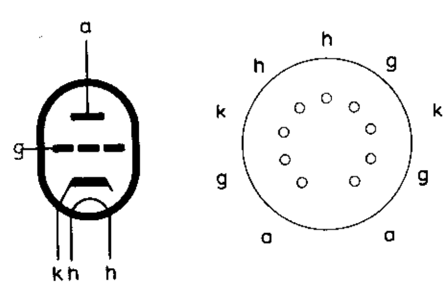
As self-oscillating mixer

Va (b)	220	V
Ra	5.6	kΩ
Rg	47	kΩ
Ia	12	mA
Ig	50	μA
vosc (r.m.s.)	2.5	V
gc	5.5	mA/V

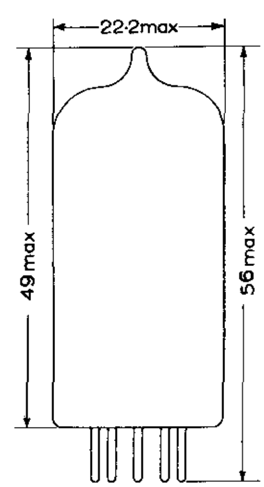
DESIGN CENTRE RATINGS

Va (b) max.	550	V
Va max.	220	V
pa max.	2.2	W
Ik max.	20	mA
-Vg max.	50	V
Rg - k max.	1.0	MΩ
Vh - k max. (cathode positive)	100	V
Vh - k max. (cathode negative)	50	V

B370



All dimensions in mm B9A Base



DOUBLE TRIODE

ECC81

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

The heater is centre-tapped and the two sections may be operated in series or in parallel with one another.

Series	V_h applied between pins 4 and 5
Parallel	V_h applied between pin 9 and pins 4 and 5 connected together

	Series	*Parallel*	
V_h	12.6	6.3	V
I_h	150	300	mA

CAPACITANCES ←

$*c_{a-g}$	1.6	pF
$*c_{in}$	2.3	pF
$c_{a'-k'+h}$	0.45	pF
$c_{a''-k''+h}$	0.35	pF
$*c_{a-k}$	0.2	pF
$*c_{h-k}$	2.5	pF
$*c_{k-g+h}$	4.7	pF
$c_{a'-g'+h}$	1.9	pF
$c_{a''-g''+h}$	1.8	pF
$c_{a'-a''}$	<0.4	pF
c_{g-h}	<0.17	pF
$c_{g'-g''}$	<0.005	pF
$c_{a'-g''}$	<0.07	pF
$c_{a''-g'}$	<0.04	pF

*Each section

CHARACTERISTICS (each section) ←

V_a	100	170	200	250	V
I_a	3.0	8.5	11.5	10	mA
V_g	−1.0	−1.0	−1.0	−2.0	V
g_m	3.75	5.9	6.7	5.5	mA/V
μ	62	66	70	60	
r_a	16.5	11	10.5	11	kΩ
$*r_{g-k}$	21	16	14	25	kΩ

*Measured at f=50Mc/s

LIMITING VALUES (each section)

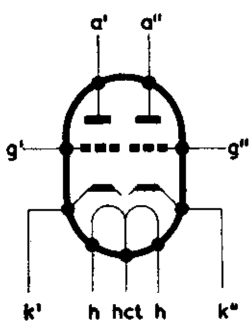
$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	2.5	W
I_k max.	15	mA
$-V_g$ max.	50	V
V_g (I_g=+0.3μA)	−1.3	V
R_{g-k} max. (self-bias)	1.0	MΩ
V_{h-k} max.	150	V
R_{h-k} max.	20	kΩ

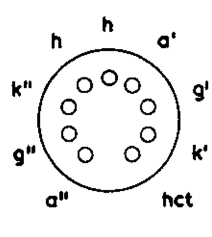
ECC81

DOUBLE TRIODE

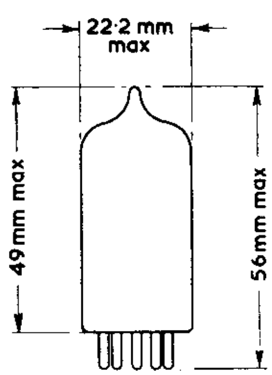
Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

2678





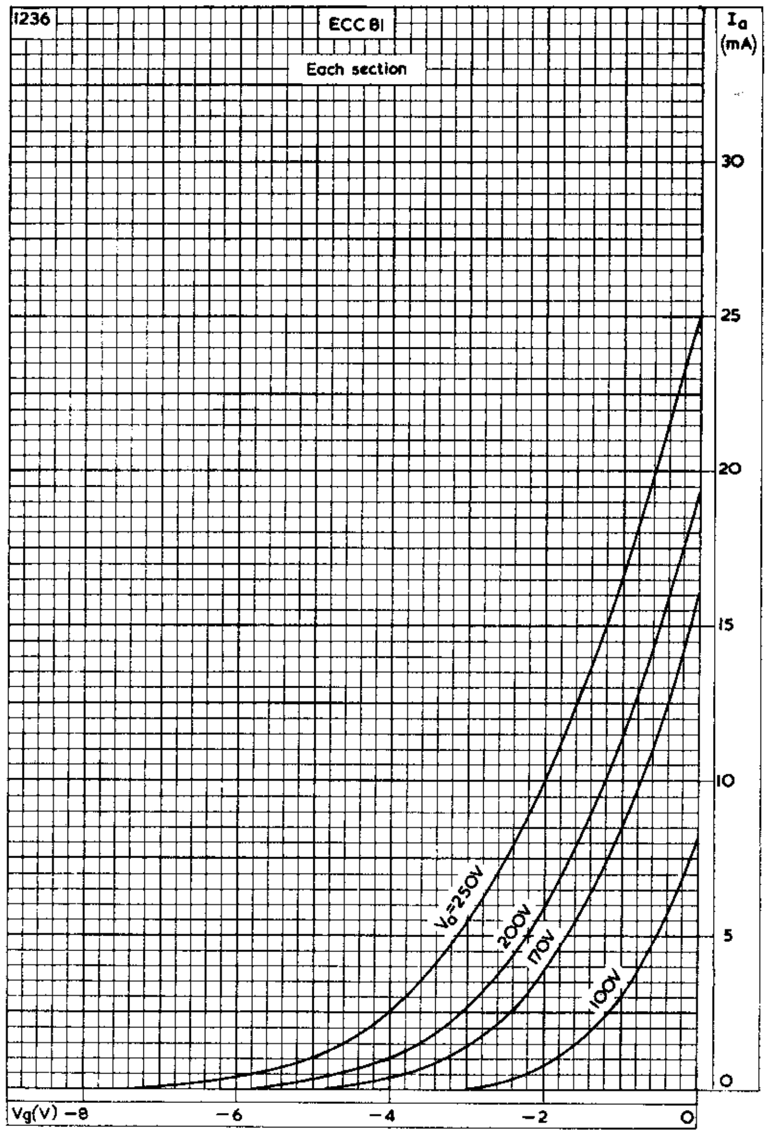
B9A Base



DOUBLE TRIODE

ECC81

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300 Mc/s.

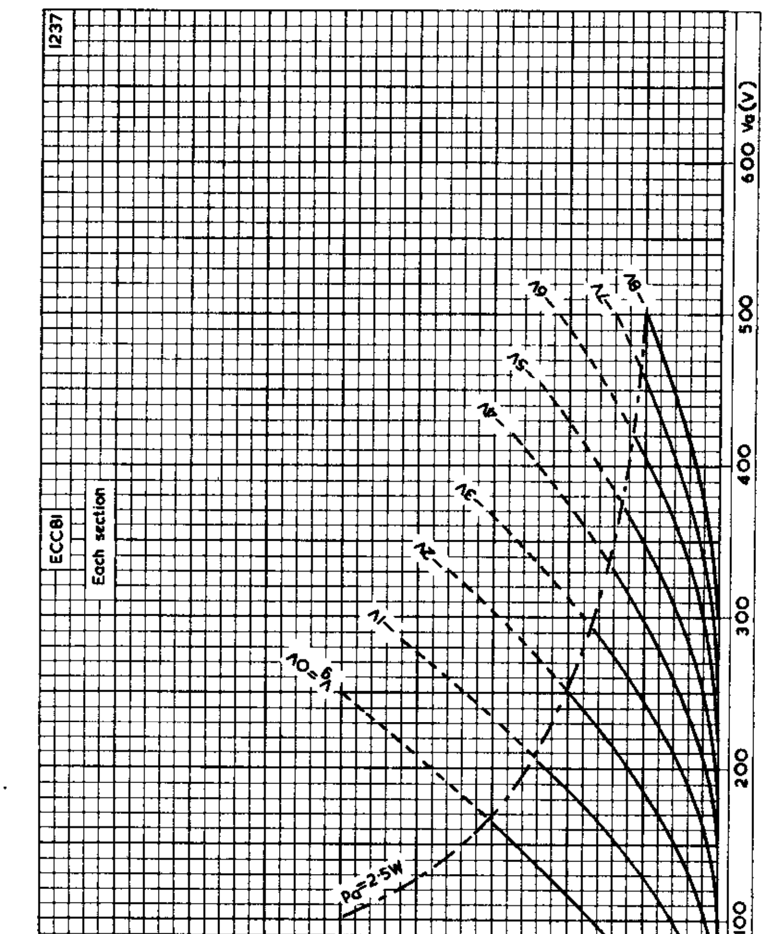


ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE, WITH ANODE VOLTAGE AS PARAMETER (EACH SECTION)

ECC81

DOUBLE TRIODE

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

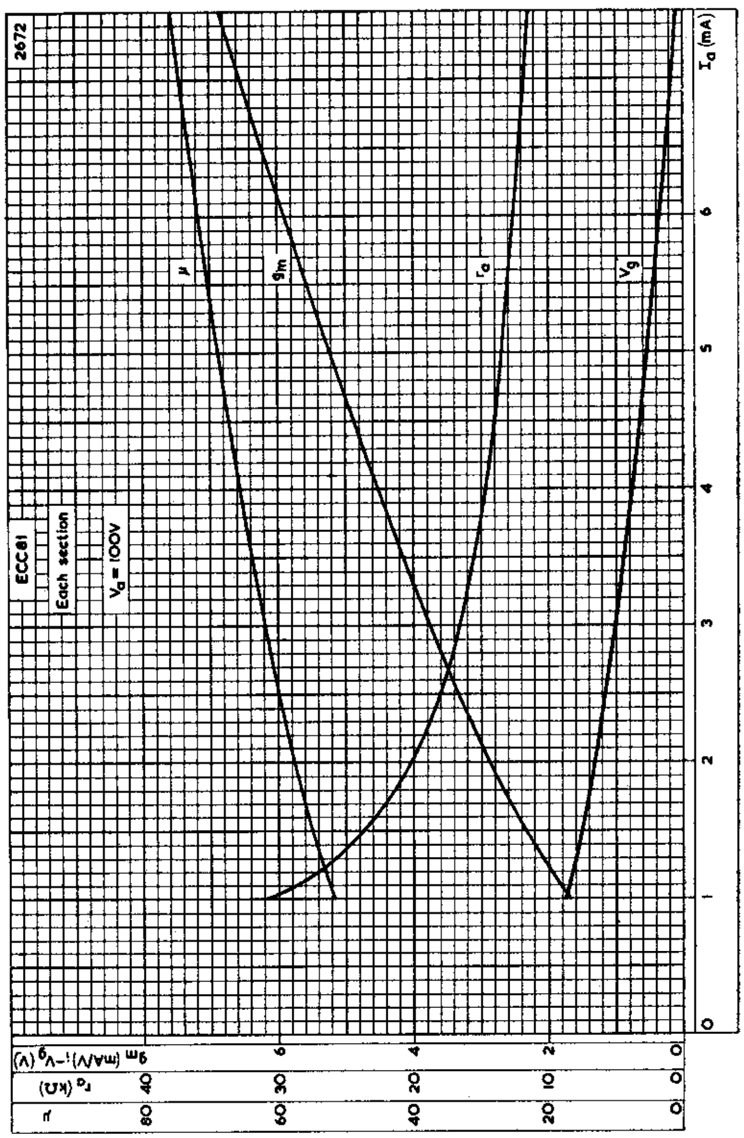


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE, WITH GRID VOLTAGE AS PARAMETER (EACH SECTION)

DOUBLE TRIODE

ECC81

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

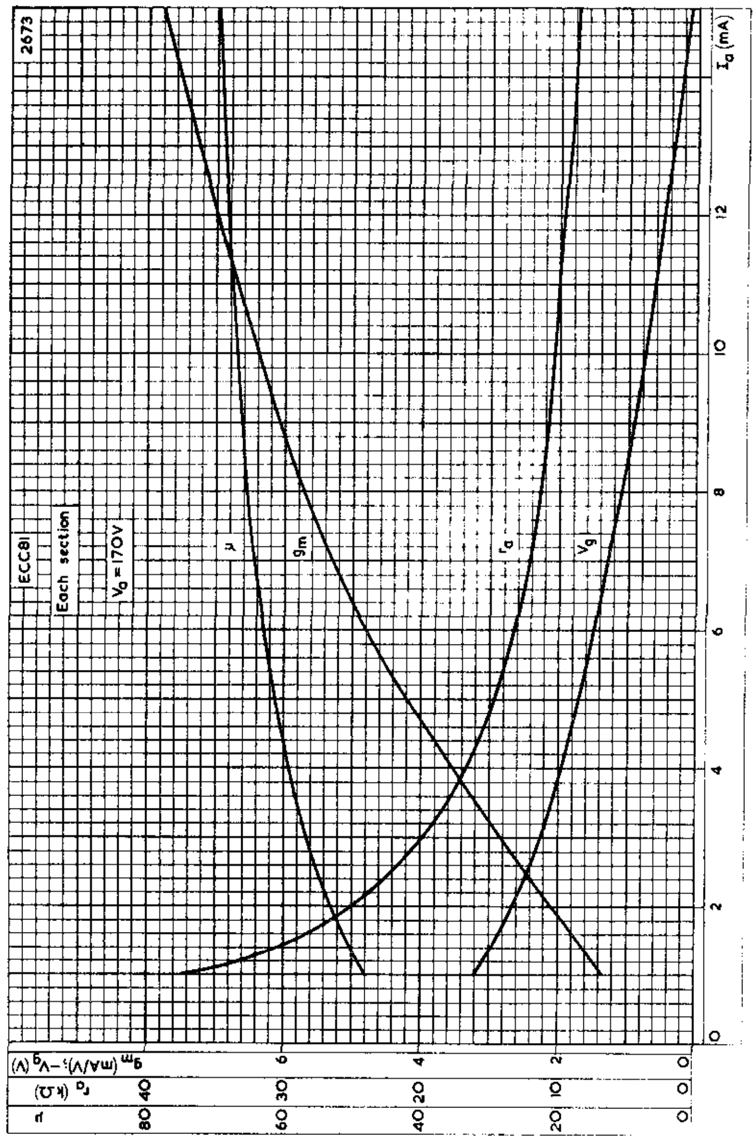


GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND INTERNAL RESISTANCE PLOTTED AGAINST ANODE CURRENT, FOR ANODE VOLTAGE OF 100V (EACH SECTION)

ECC81

DOUBLE TRIODE

Double triode primarily intended for use as a frequency changer or r.f amplifier at frequencies up to 300Mc/s.

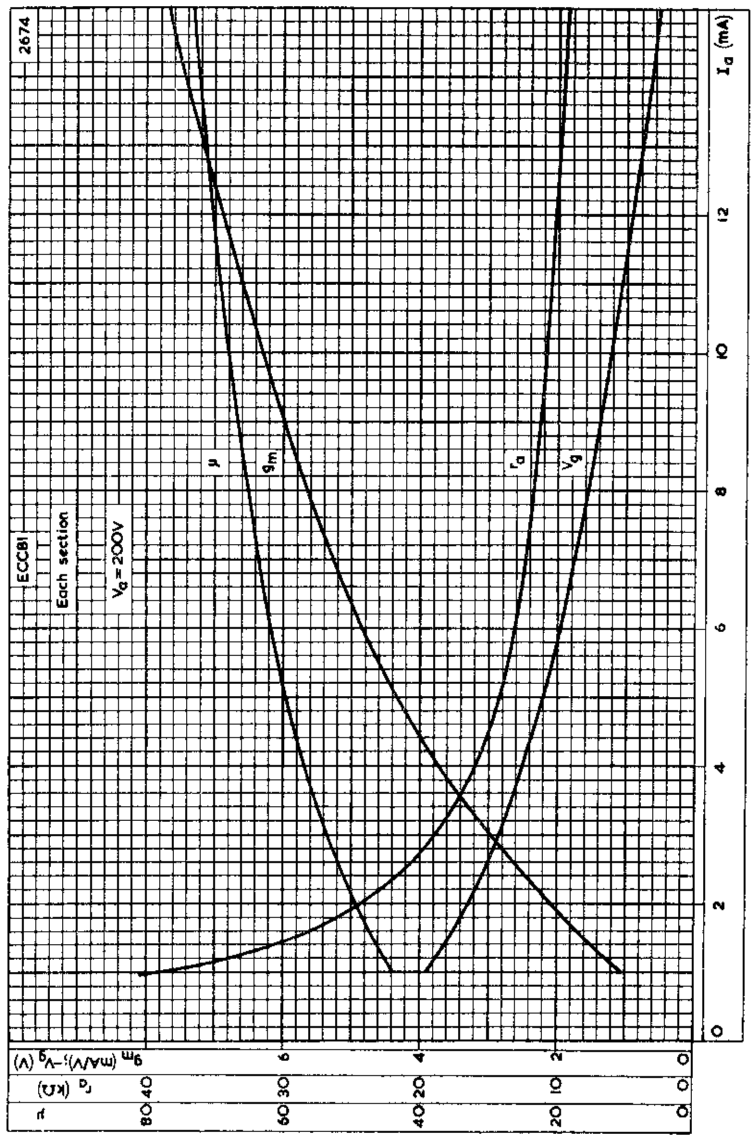


GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR, AND INTERNAL RESISTANCE PLOTTED AGAINST ANODE CURRENT, FOR ANODE VOLTAGE OF 170V (EACH SECTION)

DOUBLE TRIODE

ECC81

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

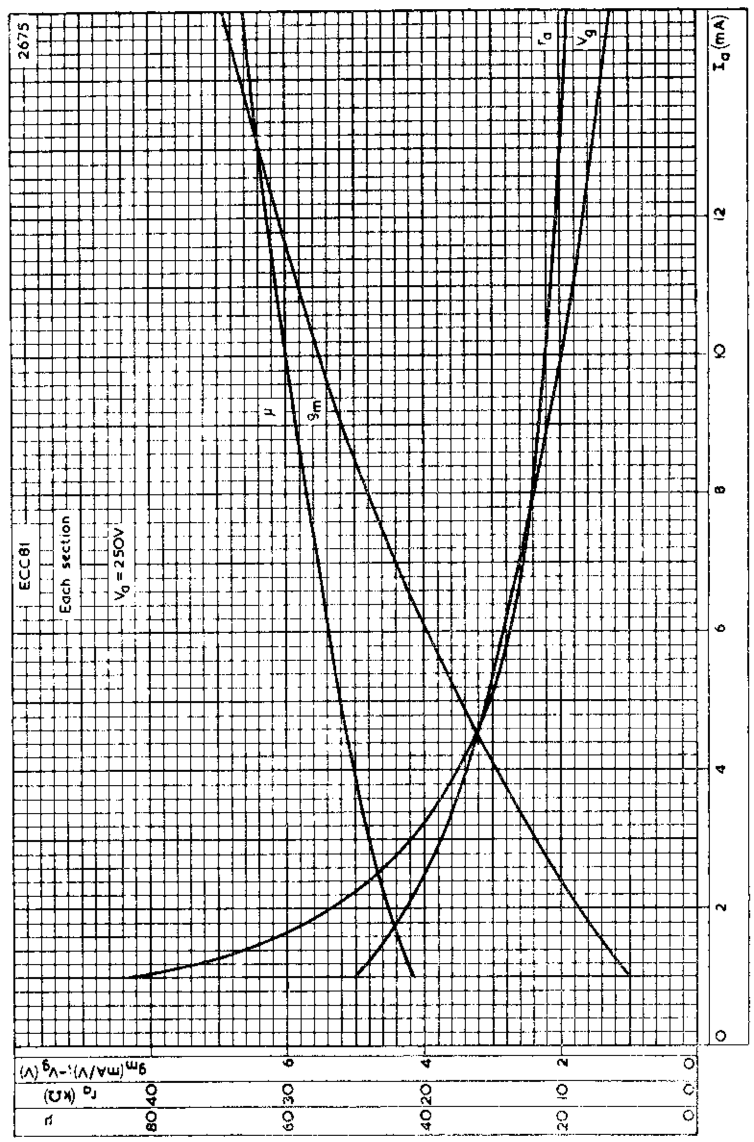


GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND INTERNAL RESISTANCE PLOTTED AGAINST ANODE CURRENT, FOR ANODE VOLTAGE OF 200V (EACH SECTION)

ECC81

DOUBLE TRIODE

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

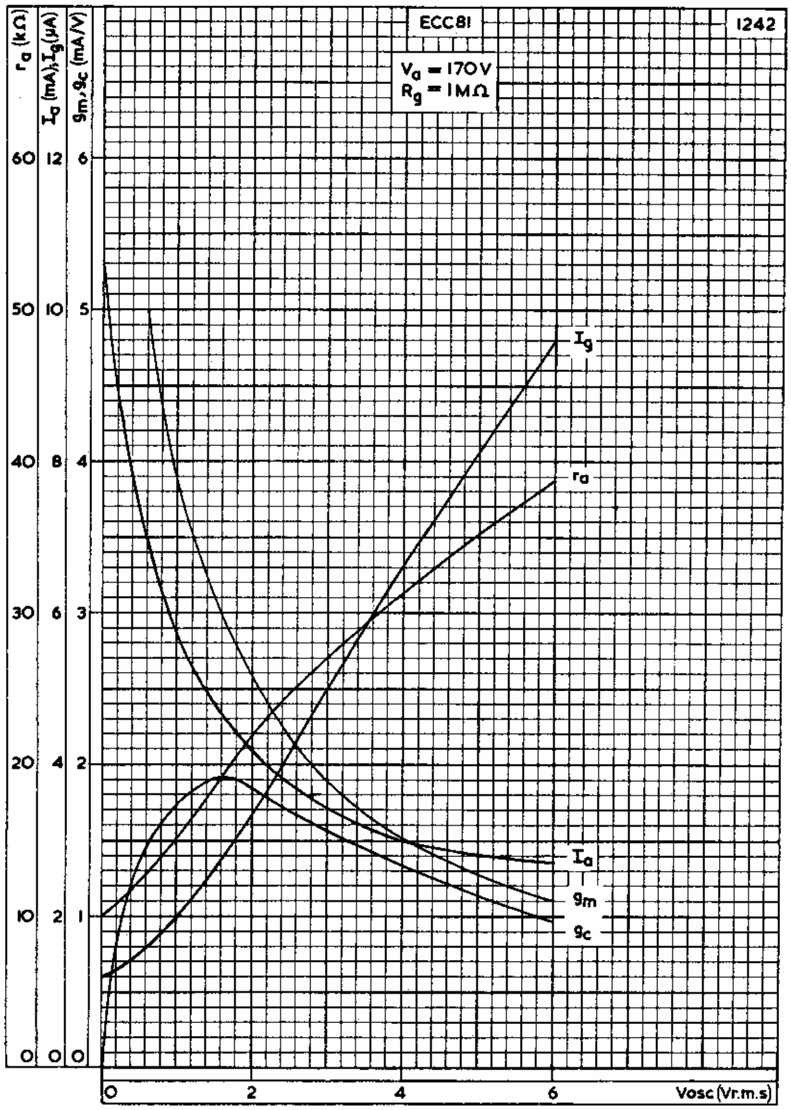


GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND INTERNAL RESISTANCE PLOTTED AGAINST ANODE CURRENT, FOR ANODE VOLTAGE OF 250V (EACH SECTION)

DOUBLE TRIODE

ECC81

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

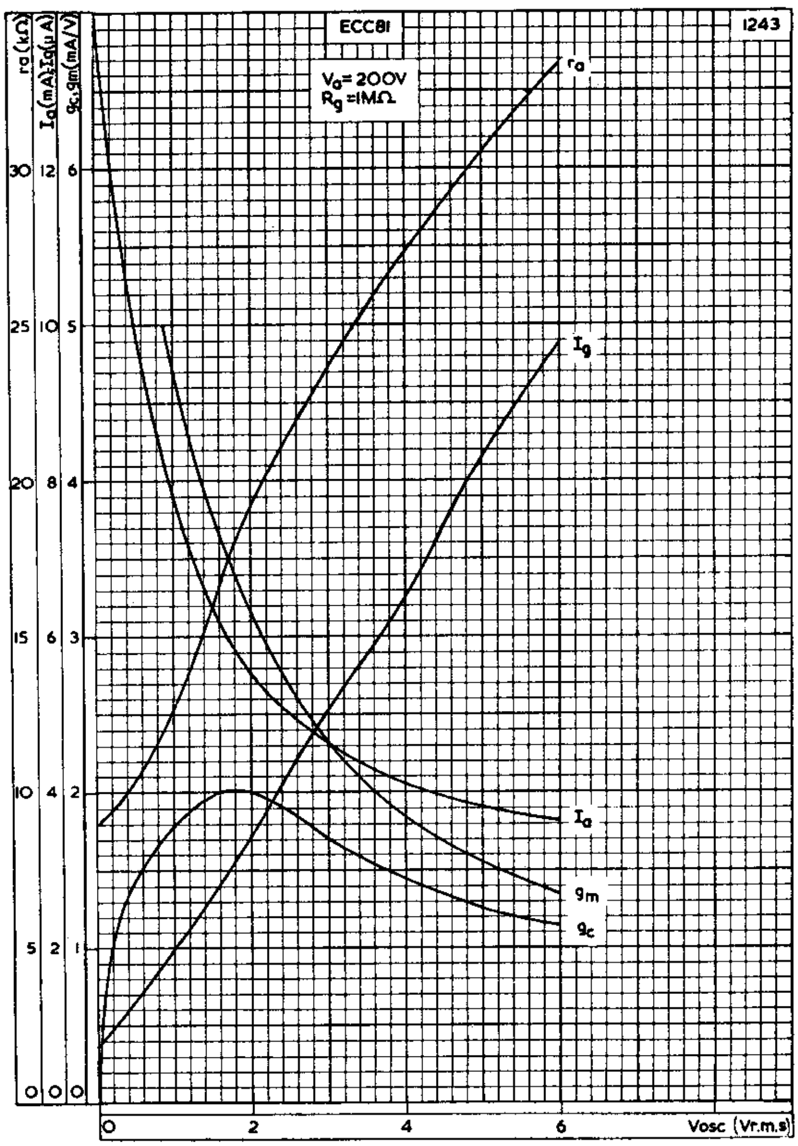


PERFORMANCE CURVES AS FREQUENCY CHANGER AT ANODE VOLTAGE OF 170V

ECC81

DOUBLE TRIODE

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

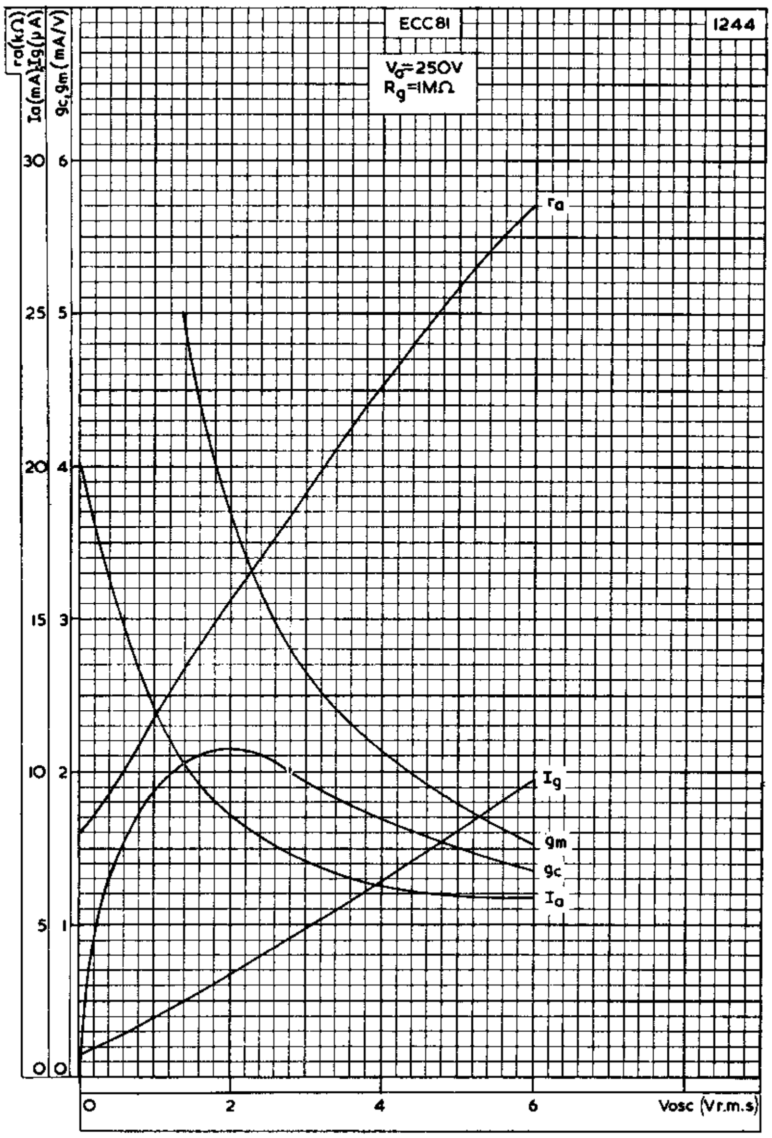


PERFORMANCE CURVES AS FREQUENCY CHANGER AT ANODE VOLTAGE OF 200V

DOUBLE TRIODE

ECC81

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.



PERFORMANCE CURVES AS FREQUENCY CHANGER AT ANODE VOLTAGE OF 250V

DOUBLE TRIODE

ECC82

Low μ double triode having separate cathodes, primarily intended for use as an amplifier or oscillator.

PRELIMINARY DATA

HEATER

Suitable for series or parallel operation, a.c. or d.c.

The heater is centre-tapped and the two sections may be operated in series or in parallel with one another.

Series	V_h applied between pins 4 and 5
Parallel	V_h applied between pin 9 and pins 4 and 5 connected together

	Series	*Parallel*	
V_h	12.6	6.3	V
I_h	0.15	0.3	A

CAPACITANCES

$^*c_{a-g}$	1.5	μμF
$^*c_{g-k}$	1.6	μμF
$c_{a'-k'}$	0.5	μμF
$c_{a''-k''}$	0.35	μμF

*Each section

CHARACTERISTICS (each section)

V_a	100	250	V
I_a	12	10.5	mA
V_g	0	-8.5	V
g_m	3.1	2.2	mA/V
μ	19	17	
r_a	6.2	7.7	kΩ

LIMITING VALUES (each section)

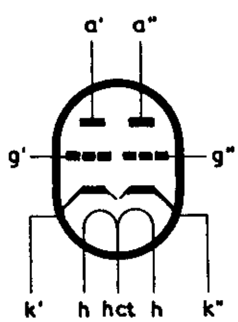
$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	2.75	W
I_k max.	20	mA
R_{g-k} max. (cathode bias)	1.0	MΩ
R_{g-k} max. (fixed bias)	250	kΩ
V_{h-k} max.	180	V
$^*R_{h-k}$ max.	20	kΩ

*When used as a phase inverter immediately preceding the output stage, R_{h-k} max. may be 120 kΩ.

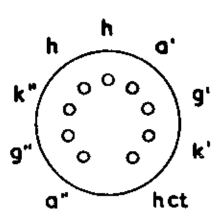
ECC82

DOUBLE TRIODE

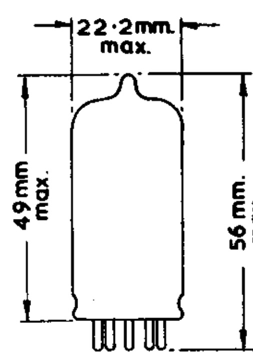
Low μ double triode having separate cathodes, primarily intended for use as an amplifier or oscillator.



504



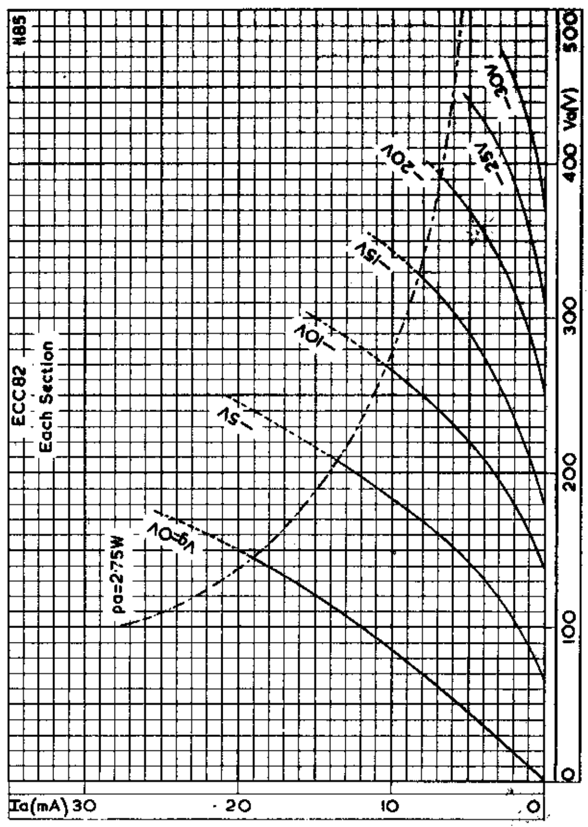
B9A
Noval Base



DOUBLE TRIODE

ECC82

Low μ double triode having separate cathodes, primarily intended for use as an amplifier or oscillator.

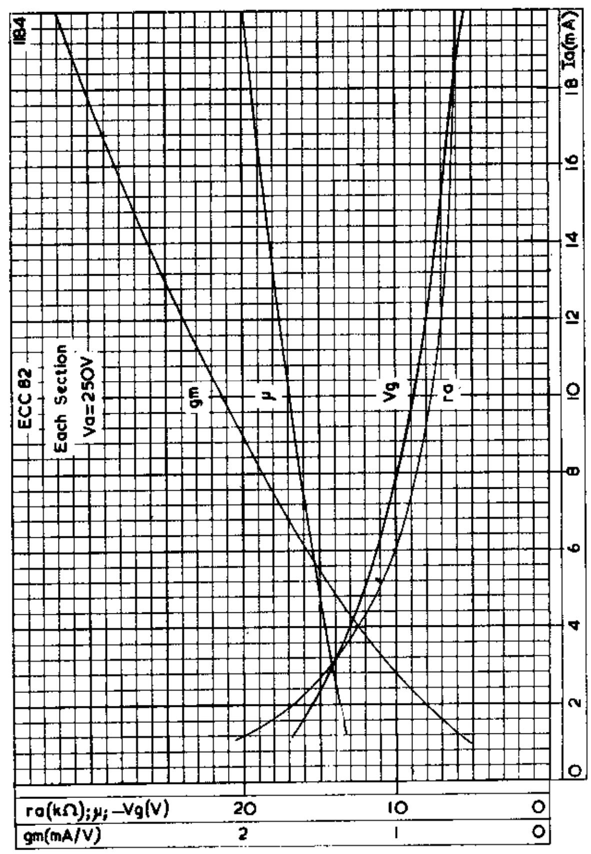


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER (EACH SECTION)

ECC82

DOUBLE TRIODE

Low μ double triode having separate cathodes, primarily intended for use as an amplifier or oscillator.



GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND INTERNAL RESISTANCE PLOTTED AGAINST ANODE CURRENT, FOR ANODE VOLTAGE OF 250 V (EACH SECTION)

DOUBLE TRIODE

ECC83

High μ double triode, having separate cathodes, primarily intended for use as a resistance-coupled amplifier or phase inverter.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

The heater is centre-tapped and the two sections may be operated in series or in parallel with one another.

Series	V_h applied between pins 4 and 5
Parallel	V_h applied between pin 9 and pins 4 and 5 connected together

	Series	*Parallel*	
V_h	12.6	6.3	V
I_h	150	300	mA

CAPACITANCES

$c_{out'}$	330	mpF
$c_{out''}$	230	mpF
$*c_{in}$	1.6	pF
$*c_{a-g}$	1.6	pF
$c_{a'-a''}$	<1.2	pF
$c_{a''-g'}$	<100	mpF
$c_{a'-g''}$	<110	mpF
$c_{g'-g''}$	<10	mpF
$*c_{g-h}$	<150	mpF

*Each section

CHARACTERISTICS (each section)

V_a	100	250	V
I_a	0.5	1.2	mA
V_g	−1.0	−2.0	V
g_m	1.25	1.6	mA/V
μ	100	100	
r_a	80	62.5	kΩ
V_g max. ($I_g = +0.3\mu A$)		−0.9	V

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER *with grid current bias* (R_g = 10MΩ)

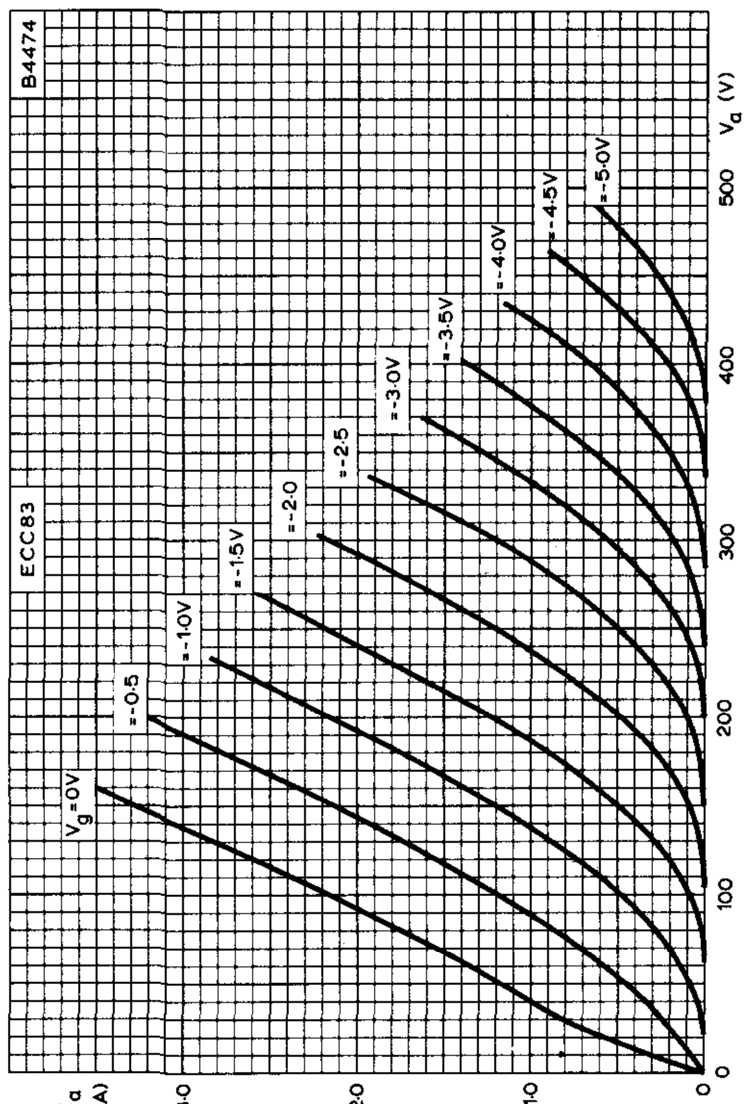
V_b (V)	R_a (kΩ)	$R_{g'}$** (kΩ)	I_a (mA)	Z_s = 0kΩ: $\frac{V_{out}}{V_{in}}$	Z_s = 0kΩ: $V_{out(r.m.s.)}$* (V)	Z_s = 220kΩ: $\frac{V_{out}}{V_{in}}$	Z_s = 220kΩ: $V_{out(r.m.s.)}$† (V)
400	47	150	3.4	47	43	38	46
350	47	150	2.8	46	36	37	38
300	47	150	2.2	44	29	36	30
250	47	150	1.7	42	22	34	24
200	47	150	1.2	39	15	32	17
400	100	330	2.1	61	59	49	62
350	100	330	1.75	60	49	48	52
300	100	330	1.4	58	39	47	42
250	100	330	1.1	56	30	46	33
200	100	330	0.8	54	21	43	23
400	220	680	1.2	73	71	58	75
350	220	680	1.0	72	59	57	63
300	220	680	0.8	70	47	56	52
250	220	680	0.6	68	36	54	40
200	220	680	0.45	65	25	52	29

*Output voltage measured at D_{tot} = 5%.

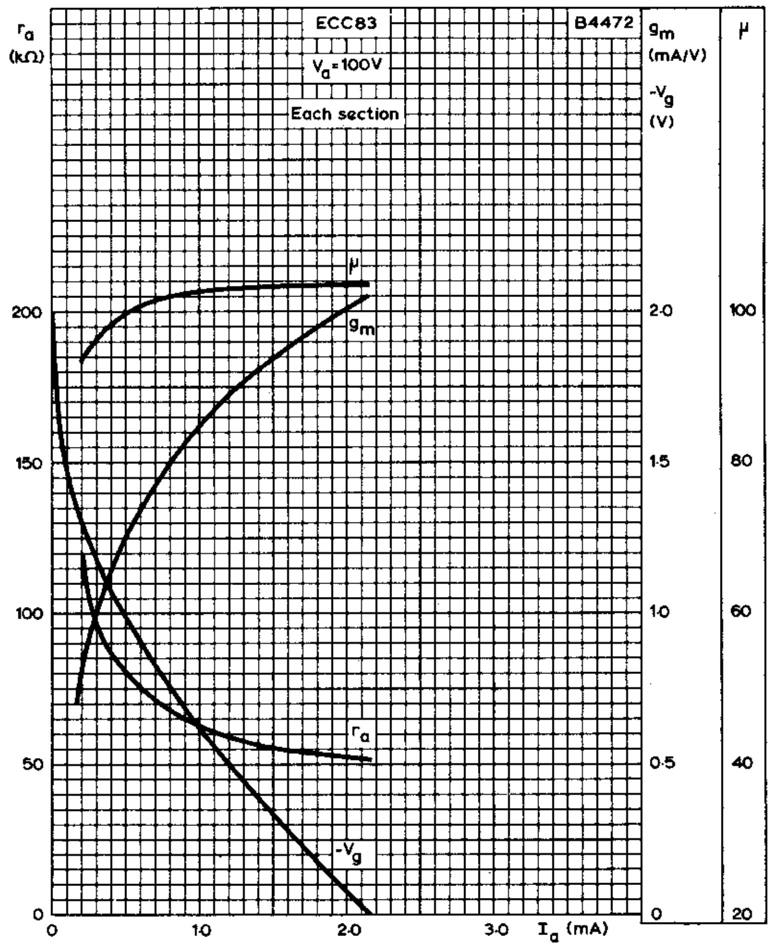
$\frac{V_{out}}{V_{in}}$ measured with $V_{in(r.m.s.)}$ = 100mV

**Grid resistor of following valve.

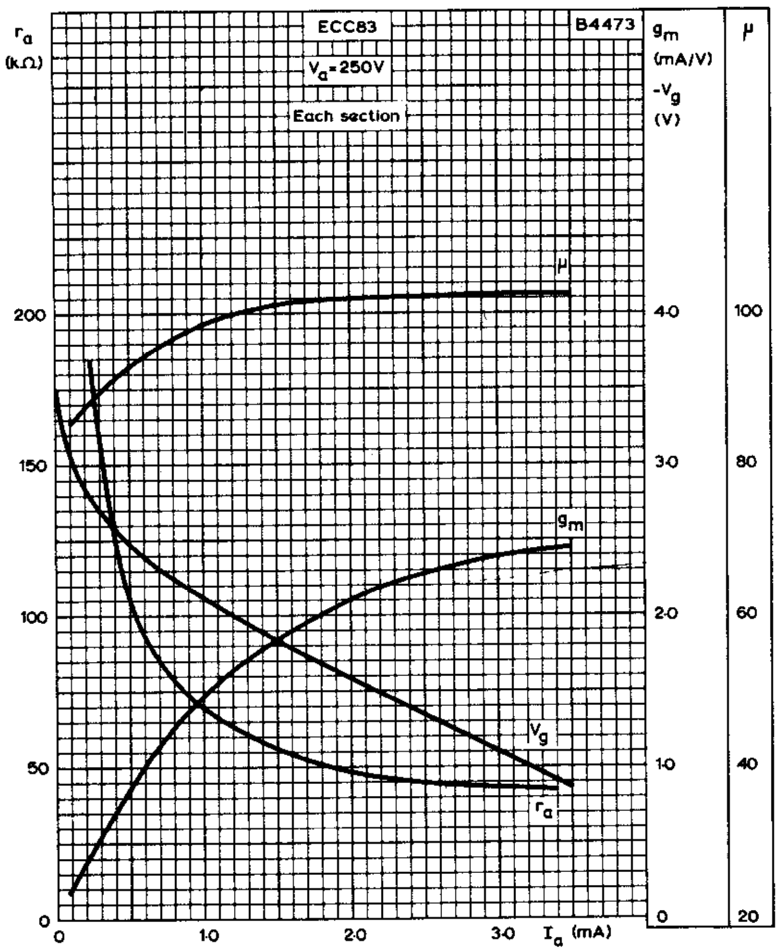
†When operating this valve with grid current bias and a high source impedance, the second harmonic distortion rises to a peak at quite low levels of output (about $10V_{r.m.s.}$) and then falls with increasing drive. The third harmonic then begins to rise, and D_{tot} finally reaches 5% at a much higher output level than with zero source impedance. The maximum value of this distortion peak varies inversely with the anode load, being about 5.5% with R_a = 47kΩ, 4.5% with R_a = 100kΩ and 4% with R_a = 220kΩ.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER (each section)



MUTUAL CONDUCTANCE, ANODE IMPEDANCE, AMPLIFICATION FACTOR AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT.
$V_a = 100V$



MUTUAL CONDUCTANCE, ANODE IMPEDANCE, AMPLIFICATION FACTOR AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT.
$V_a = 250V$

DOUBLE TRIODE

ECC83

High μ double triode, having separate cathodes, primarily intended for use as a resistance-coupled amplifier or phase inverter.

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER* (with grid current bias) ←

V_b (V)	R_a (kΩ)	I_k (mA)	$\frac{V_{out}}{V_{in}}$	D_{tot} (%) for $V_{out(r.m.s.)}$ =2V	=4V	=6V	R_{g1}† (kΩ)
400	47	3.8	41	2.1	4.2	5.4	150
350	47	3.19	40	2.2	4.2	5.5	150
300	47	2.52	38	2.2	4.5	5.5	150
250	47	1.95	36	2.3	4.6	5.6	150
200	47	1.4	34	2.4	4.7	5.6	150
150	47	0.84	33	2.5	4.6	5.2	150
100	47	0.35	25	1.7	2.1	6.0	150
400	100	2.3	52	1.7	3.5	4.8	330
350	100	1.9	51	1.8	3.6	4.9	330
300	100	1.58	50	1.8	3.6	5.0	330
250	100	1.23	48	1.8	3.8	5.1	330
200	100	0.88	46	1.9	3.8	5.1	330
150	100	0.56	43	1.9	3.0	4.7	330
100	100	0.24	34	1.6	2.3	2.5	330
400	220	1.23	60	1.6	2.7	4.2	680
350	220	1.05	59	1.6	2.8	4.3	680
300	220	0.85	58	1.6	2.9	4.4	680
250	220	0.67	57	1.6	2.9	4.4	680
200	220	0.49	54	1.7	3.0	4.4	680
150	220	0.32	51	1.7	3.0	4.4	680
100	220	0.14	42	1.6	2.5	3.2	680

*Measured with a grid resistance of 10MΩ and signal source impedance Z_s=330kΩ.

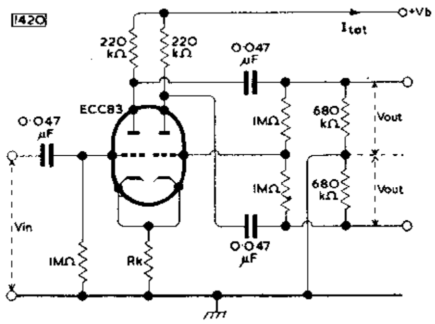
†R_{g1}=grid resistance of following valve.

ECC83

DOUBLE TRIODE

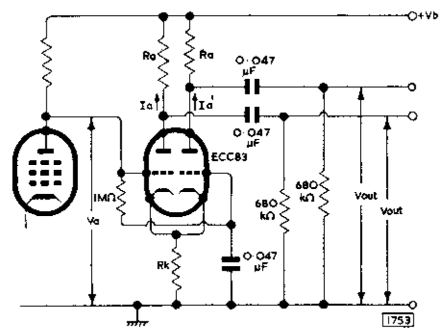
High μ double triode, having separate cathodes, primarily intended for use as a resistance-coupled amplifier or phase inverter.

TYPICAL OPERATING CONDITIONS AS A PHASE INVERTER



V_b (V)	I_{tot} (mA)	R_k (Ω)	V_{out}* ($V_{r.m.s.}$)	$\frac{V_{out}}{V_{in}}$	D_{tot}* (%)
250	1.08	1200	35	58	5.5
250	1.08	1200	7	58	1.1
350	1.7	820	45	62	3.5
350	1.7	820	9	62	0.7

*Output voltage and distortion at the start of positive grid current. At lower output voltage the distortion is approximately proportional to the voltage.



V_b (V)	†V_a (approx.) (V)	I_a+I_a' (mA)	R_k (kΩ)	R_a (kΩ)	V_{out}* ($V_{r.m.s.}$)	$\frac{V_{out}}{V_{in}}$	D_{tot}* (%)
250	65	1.0	68	100	20	25	1.8
250	65	1.0	68	100	7	25	0.6
350	90	1.2	82	150	35	27	1.8
350	90	1.2	82	150	10	27	0.5

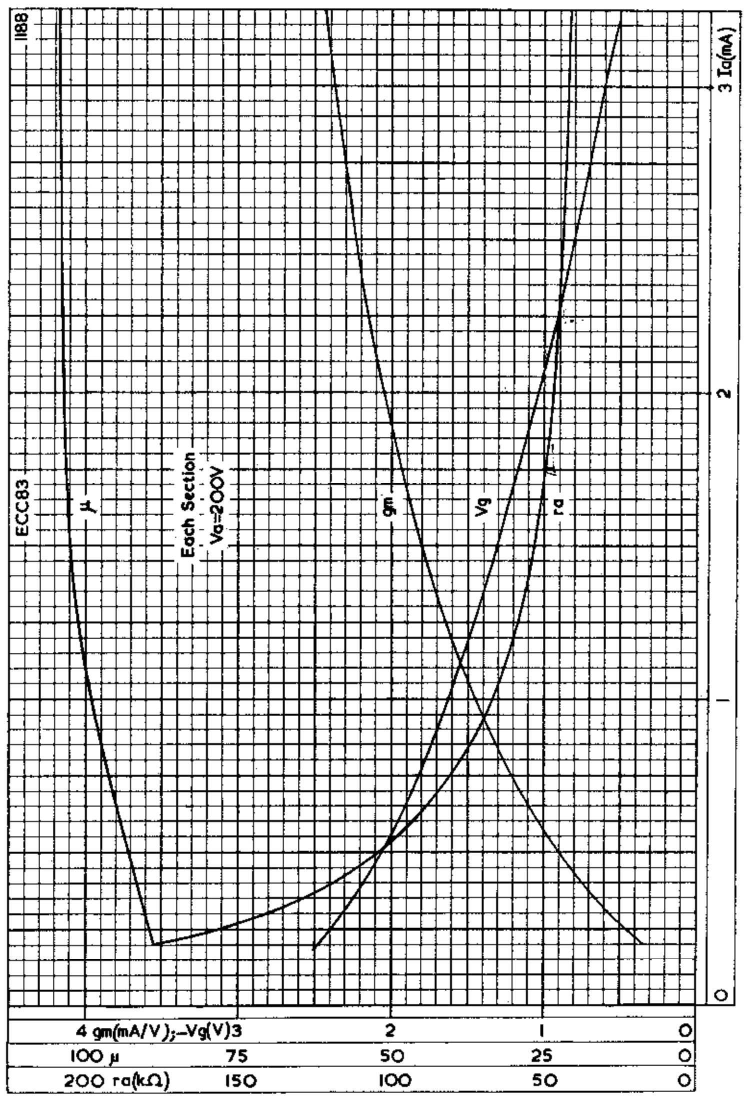
*Output voltage and distortion at the start of positive grid current. At lower output voltage the distortion is approximately proportional to the voltage.

†V_a should be adjusted so that $I_a+I_a'=1$ mA at $V_b=250$ V and 1.2 mA at $V_b=350$ V.

DOUBLE TRIODE

ECC83

High μ double triode, having separate cathodes, primarily intended for use as a resistance-coupled amplifier or phase inverter.

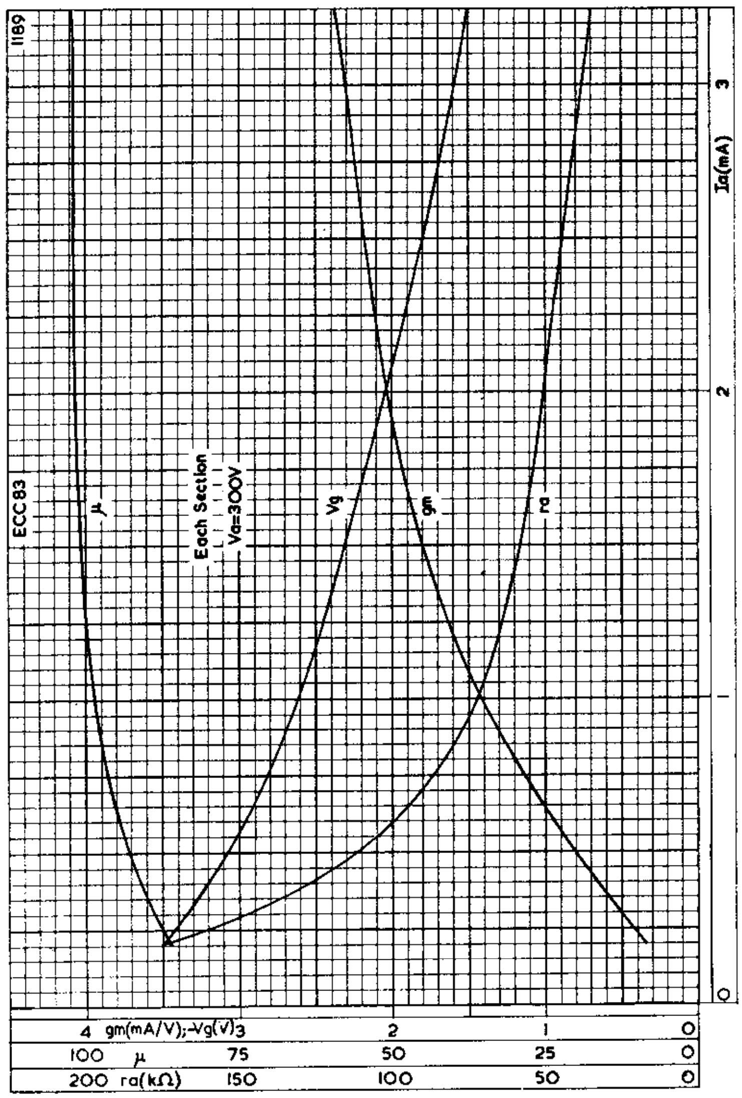


GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND INTERNAL RESISTANCE PLOTTED AGAINST ANODE CURRENT, FOR ANODE VOLTAGE OF 200 V (EACH SECTION)

ECC83

DOUBLE TRIODE

High μ double triode, having separate cathodes, primarily intended for use as a resistance-coupled amplifier or phase inverter.



GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND INTERNAL RESISTANCE PLOTTED AGAINST ANODE CURRENT, FOR ANODE VOLTAGE OF 300 V (EACH SECTION)

R.F. DOUBLE TRIODE **ECC85**

Double triode primarily intended for use in f.m. receivers as an r.f. amplifier and self-oscillating additive mixer.

HEATER

V_h	6.3	V
I_h	435	mA

CAPACITANCES ←

$c_{a'-g'}$	1.5	pF
$c_{a'-k'}$	0.17	pF
$c_{a'-k'+h+s}$	1.2	pF
$*c_{a'-k'+h+s}$	1.8	pF
$c_{g'-k'+h+s}$	3.1	pF
$c_{a''-g''}$	1.5	pF
$c_{a''-k''}$	0.18	pF
$c_{a''-k''+h+s}$	1.2	pF
$*c_{a''-k''+h+s}$	1.8	pF
$c_{g''-k''+h+s}$	3.1	pF
$c_{a'-g''}$	<8	mpF
$c_{a'-k''}$	<8	mpF
$c_{g'-k''}$	<3	mpF
$c_{a'-a''}$	<40	mpF
$*c_{a'-a''}$	<8	mpF
$c_{a''-g'}$	<8	mpF
$c_{a''-k'}$	<8	mpF
$c_{g''-k'}$	<3	mpF
$c_{g'-g''}$	<3	mpF

*Measured with an external shield

CHARACTERISTICS (each section)

V_a	250	V
I_a	10	mA
V_g	-2.7	V ←
g_m	6.1	mA/V ←
μ	55	←
r_a	9.0	kΩ ←

OPERATING CONDITIONS AS R.F. AMPLIFIER

V_b	250	V	
V_a	230	V	
R_a	1.8	kΩ	
I_a	10.8	mA	←
R_k	200	Ω	
g_m	6.8	mA/V	←
r_a	8.3	kΩ	←
r_{g1} (f = 100Mc/s)	4.7	kΩ	←
R_{eq}	580	Ω	←

OPERATING CONDITIONS AS SELF-OSCILLATING FREQUENCY CHANGER

V_b	250	V	
R_a	12	kΩ	
R_{g-k}	1.0	MΩ	
I_a	6.0	mA	←
V_{osc} (r.m.s.)	3.0	V	
g_c	3.0	mA/V	←
r_a	18	kΩ	←

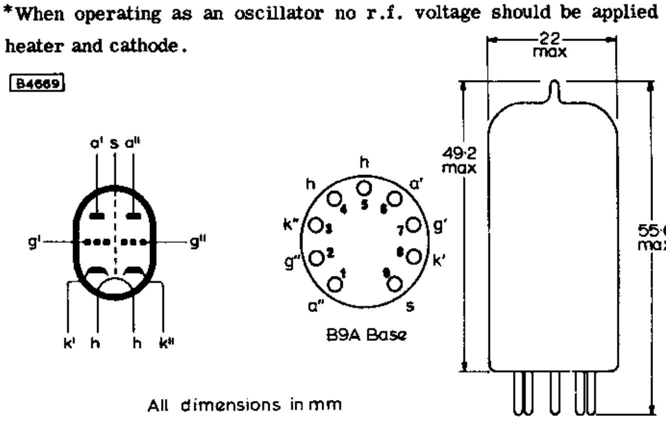
RATINGS (ABSOLUTE MAXIMUM SYSTEM)

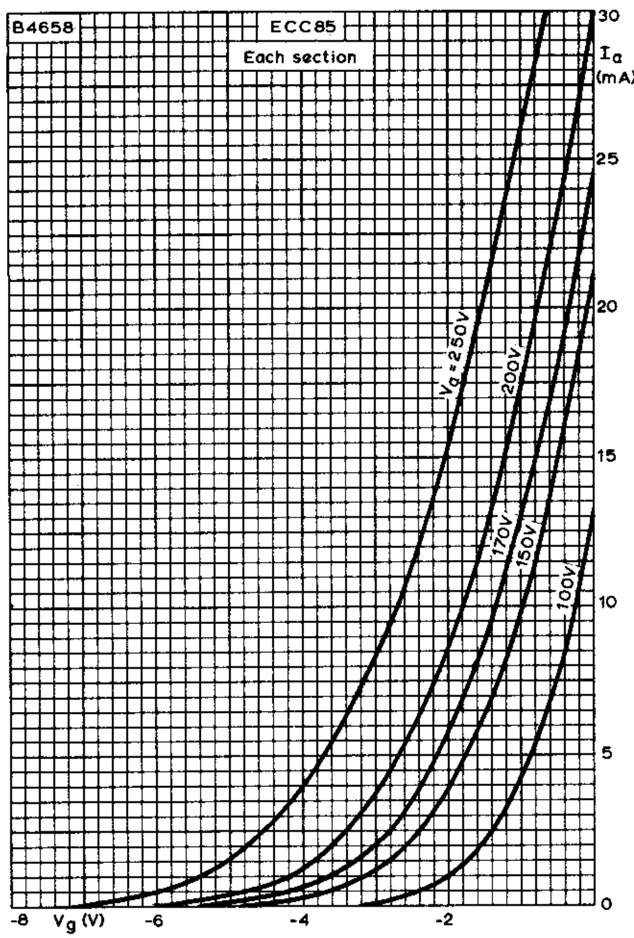
(each section unless otherwise specified)

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	2.5	W
$p_{a'}+p_{a''}$ max.	4.5	W
I_k max.	15	mA
$-V_g$ max.	100	V
R_{g-k} max.	1.0	MΩ
$*V_{h-k}$ max.	90	V
R_{h-k} max.	20	kΩ

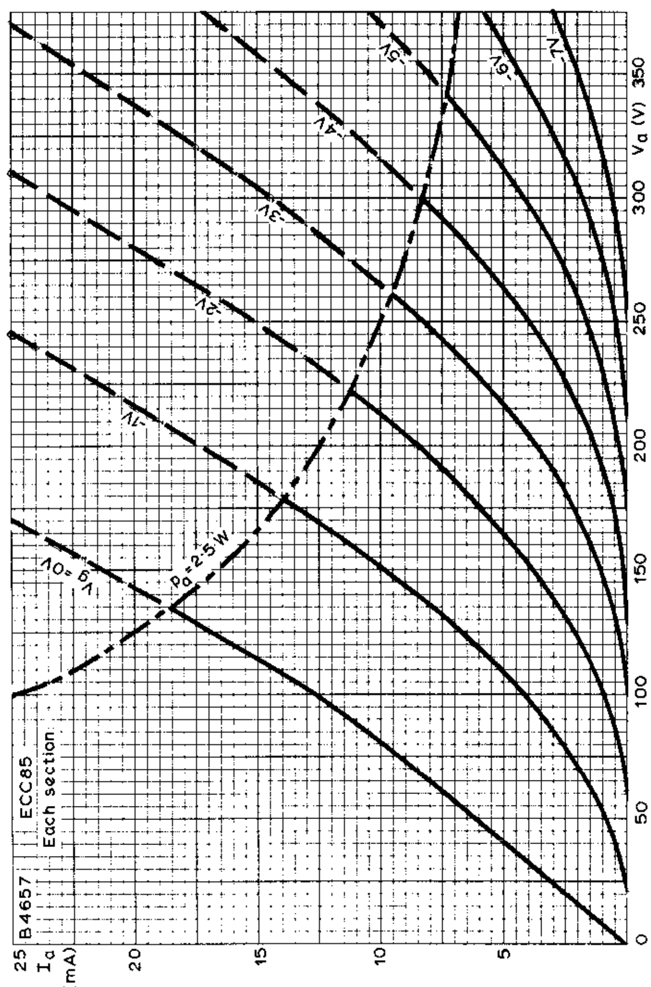
*When operating as an oscillator no r.f. voltage should be applied between heater and cathode. ←

B4669

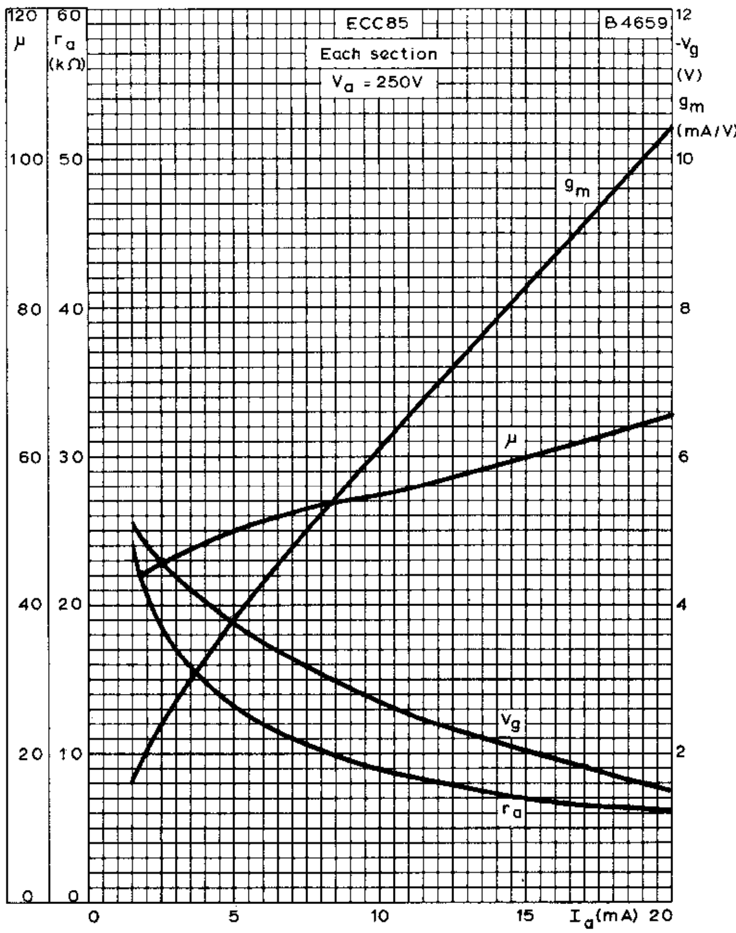




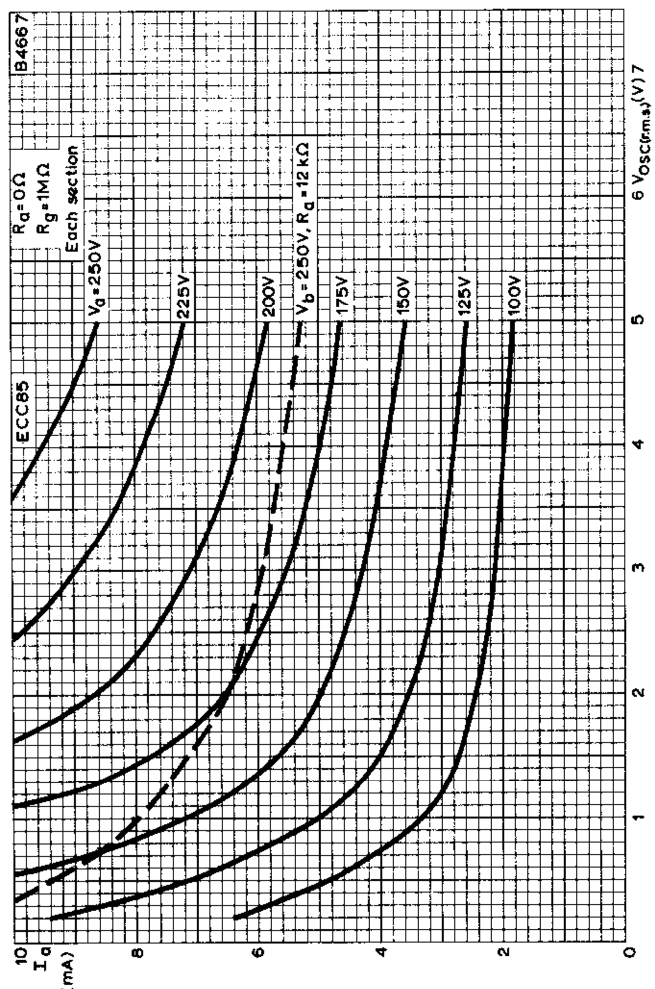
ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE
WITH ANODE VOLTAGE AS PARAMETER



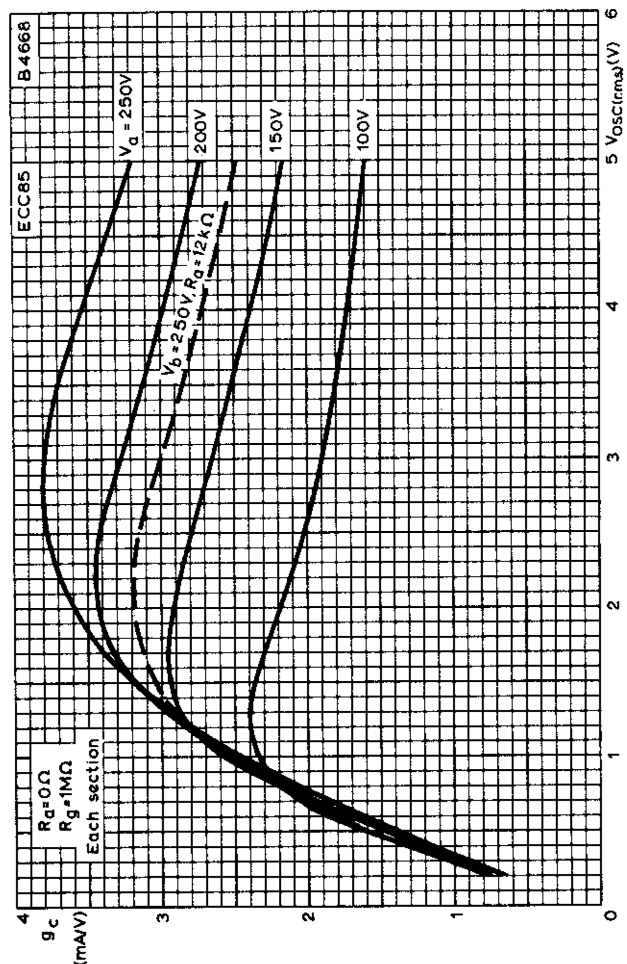
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH GRID VOLTAGE AS PARAMETER



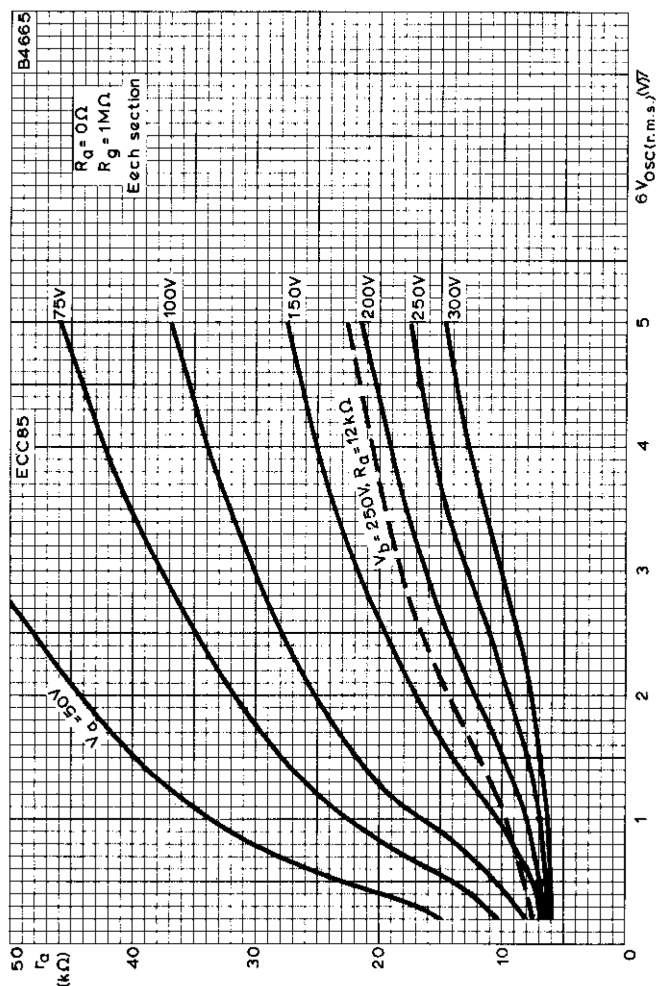
MUTUAL CONDUCTANCE, ANODE IMPEDANCE, AMPLIFICATION FACTOR AND GRID VOLTAGE PLOTTED AGAINST CURRENT. V_a = 250V



ANODE CURRENT PLOTTED AGAINST OSCILLATOR VOLTAGE WITH ANODE VOLTAGE AS PARAMETER



CONVERSION CONDUCTANCE PLOTTED AGAINST OSCILLATOR VOLTAGE
WITH ANODE VOLTAGE AS PARAMETER



ANODE IMPEDANCE PLOTTED AGAINST OSCILLATOR VOLTAGE
WITH ANODE VOLTAGE AS PARAMETER

TRIODE PENTODE

ECF80

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.

HEATER

V_h	6.3	V
I_h	430	mA

MOUNTING POSITION

Any

CAPACITANCES (measured without external shield)

c_{ap-at}	<0.06	pF
c_{ap-gt}	<0.02	pF
c_{gp-at}	<0.16	pF
c_{gp-gt}	<0.02	pF

Pentode section

*c_{a-g1}	<0.025	pF
c_{in}	5.5	pF
c_{out}	3.8	pF

*May be reduced to <0.01pF by the use of a skirted base.

Triode section

c_{a-k+h}	1.8	pF
c_{g-k+h}	2.5	pF
c_{a-g}	1.5	pF

CHARACTERISTICS

Pentode section

V_a	250	V
V_{g2}	200	V
V_{g1}	-3.2	V
I_a	7.0	mA
I_{g2}	1.8	mA
g_m	5.5	mA/V
r_a	900	kΩ
μ_{g1-g2}	47	
R_{in} (f=50Mc/s)	11	kΩ
R_{eq}	1.5	kΩ

Triode section

V_a	100	V
I_a	14	mA
V_g	-2.0	V
g_m	5.0	mA/V
μ	20	
r_a	4.0	kΩ

ECF80

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.

TYPICAL OPERATING CONDITIONS

As a frequency changer

$V_a = V_b$	250	250	V
R_{g2}	68	47	kΩ
R_{g1}	100	100	kΩ
R_k	0	820	Ω
I_a	5.6	5.7	mA
I_{g2}	1.52	1.4	mA
$V_{osc(r.m.s.)}$	4.0	3.5	V
I_{g1}	58	0	μA
g_c	1.95	2.1	mA/V
r_a	1.15	1.5	MΩ

LIMITING VALUES

Pentode section

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	1.7	W
$V_{g2(b)}$ max.	550	V
V_{g2} max. ($I_k \leq 10$mA)	200	V
V_{g2} max. ($I_k > 10$mA)	175	V
p_{g2} max. ($p_a \leq 1.2$W)	750	mW
p_{g2} max. ($p_a > 1.2$W)	500	mW
I_k max.	14	mA
V_{g1} max. ($I_{g1} = +0.3\mu$A)	-1.3	V
R_{g1-k} max. (cathode bias)	1.0	MΩ
R_{g1-k} max. (fixed bias)	500	kΩ
V_{h-k} max. (cathode positive)	150	V
V_{h-k} max. (cathode negative)	100	V

Triode section

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max	1.5	W
I_k max.	14	mA
*$i_{k(pk)}$ max.	200	mA
V_{g1} max. ($I_{g1} = +0.3\mu$A)	-1.3	V
$-v_{g1(pk)}$ max.	350	V
V_{h-k} max. (cathode positive)	150	V
V_{h-k} max. (cathode negative)	100	V

*Max. pulse duration 200μs

OPERATING NOTE

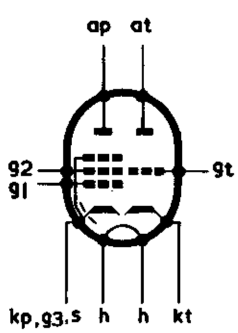
It is anticipated that variations in heater-to-cathode capacitance may render the valve unsuitable for use in Hartley oscillator circuits, particularly in f.m. receivers. For this reason it is recommended that a Colpitts type of circuit be employed.

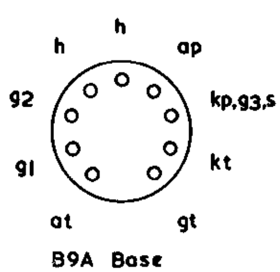
TRIODE PENTODE

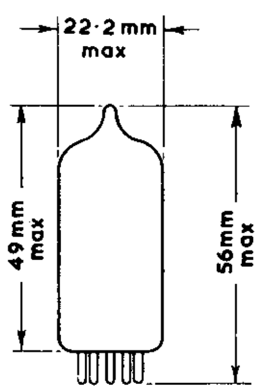
ECF80

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.

3222



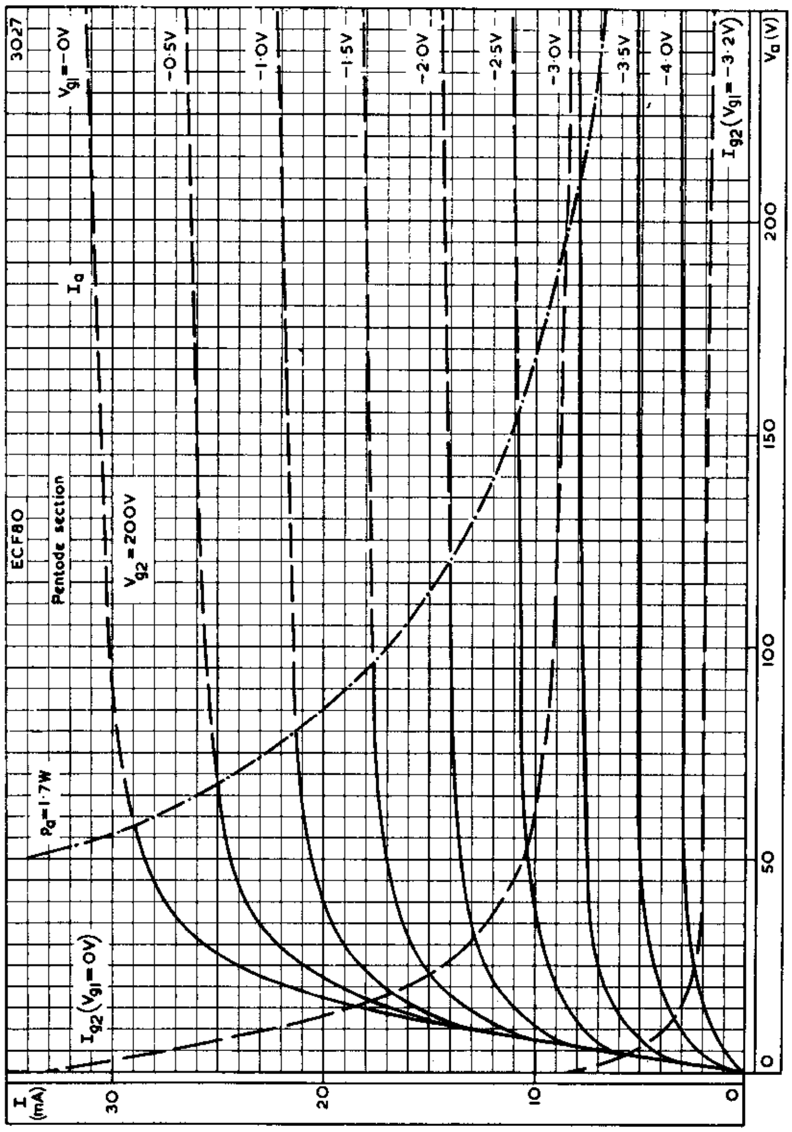




ECF80

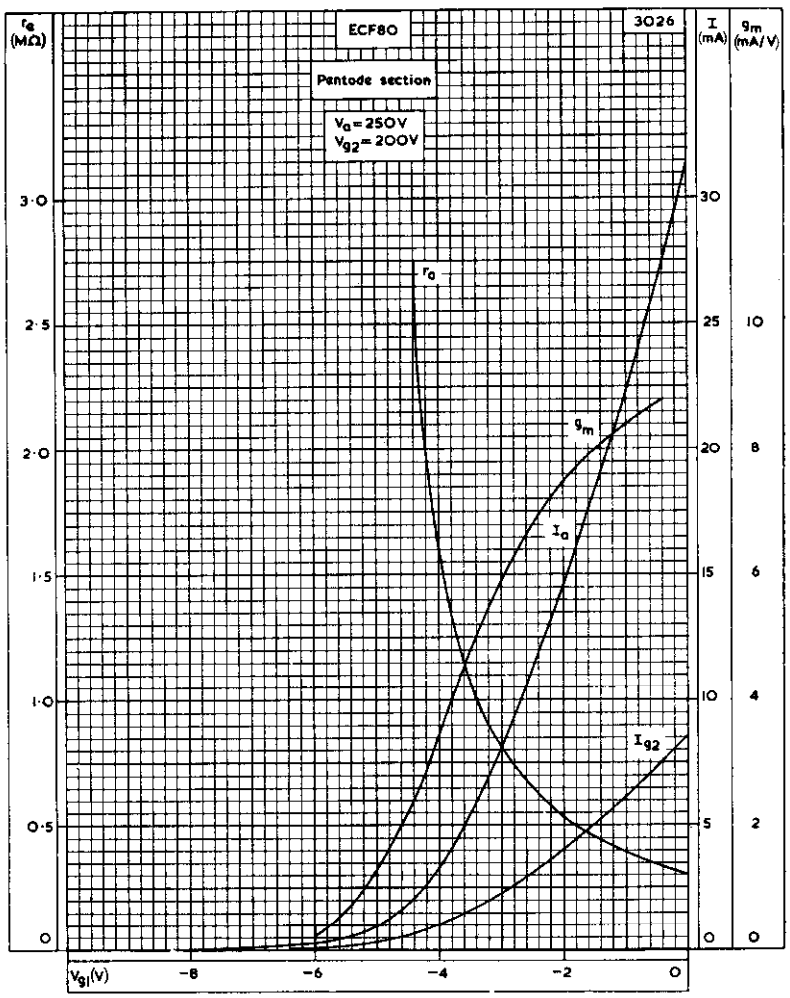
TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.



ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE FOR PENTODE SECTION WITH CONTROL-GRID VOLTAGE AS PARAMETER

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.

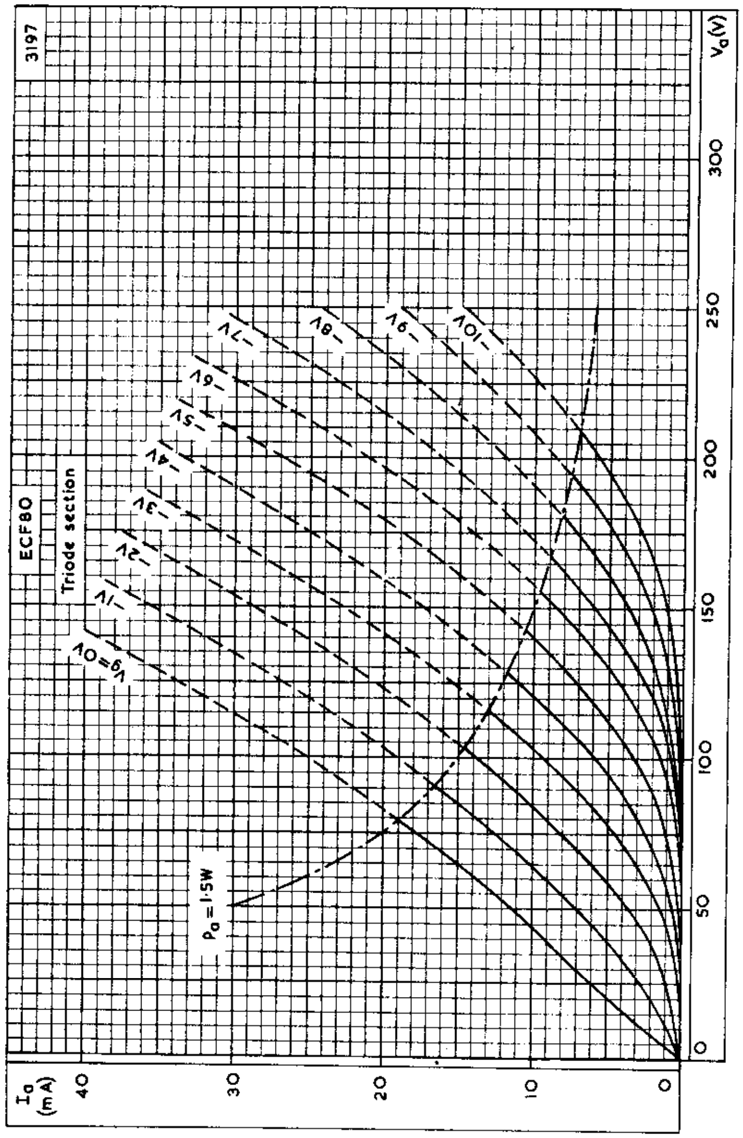


ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE OF PENTODE SECTION. V_a=250V, V_{g2}=200V

ECF80

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.

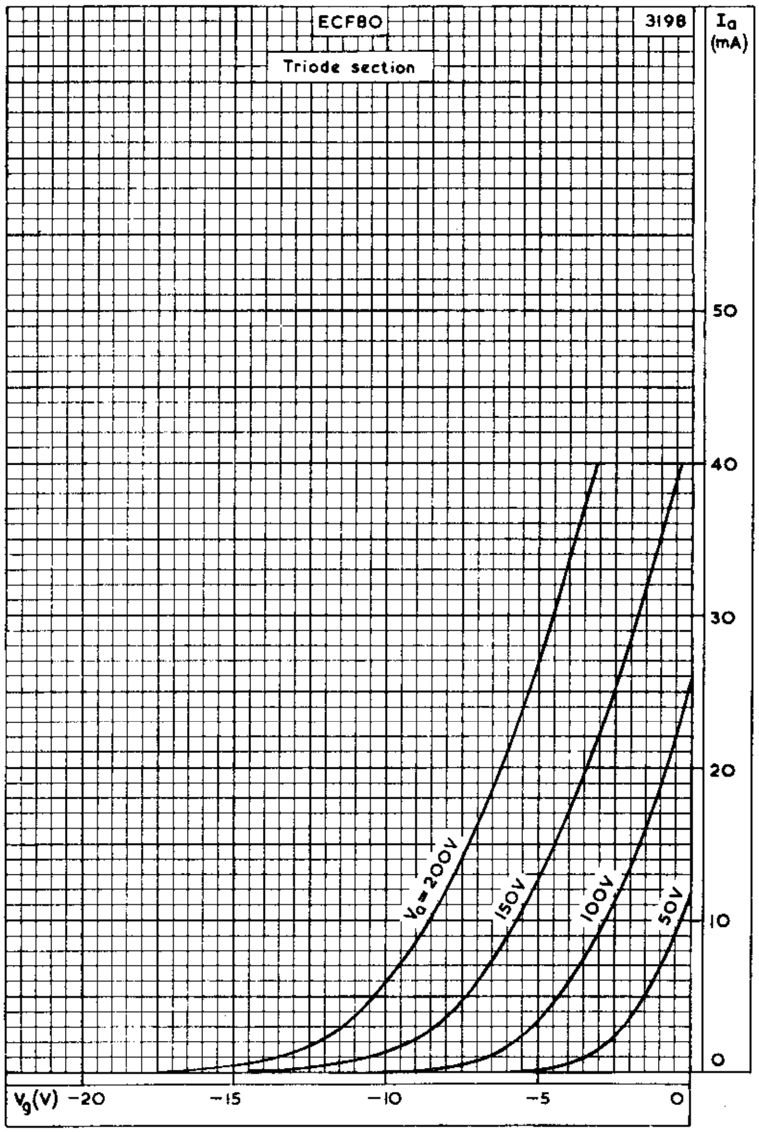


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR TRIODE SECTION WITH CONTROL-GRID VOLTAGE AS PARAMETER

TRIODE PENTODE

ECF80

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.

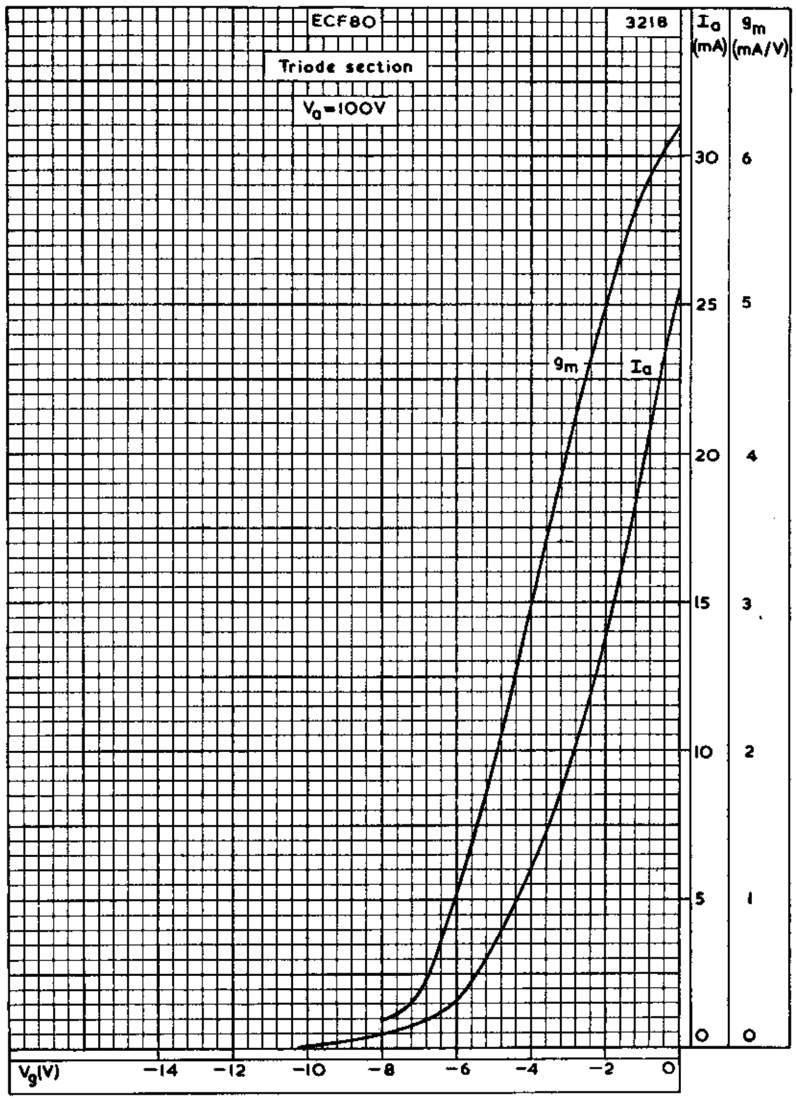


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR TRIODE SECTION FOR VARIOUS VALUES OF ANODE VOLTAGE

ECF80

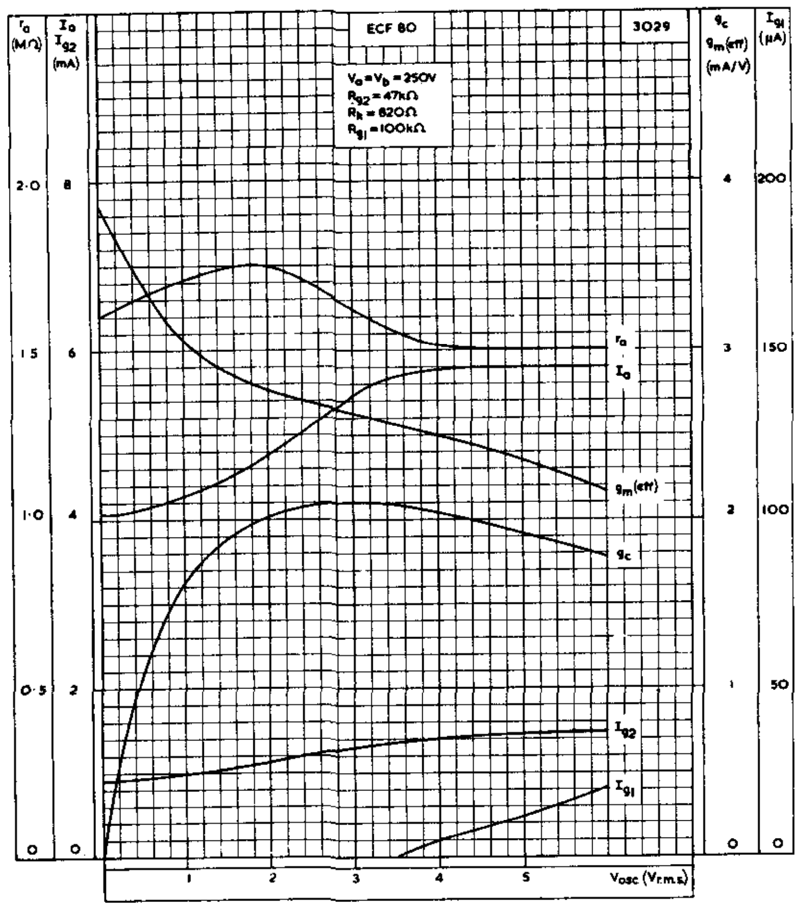
TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.



ANODE CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR TRIODE SECTION
V_a=100V

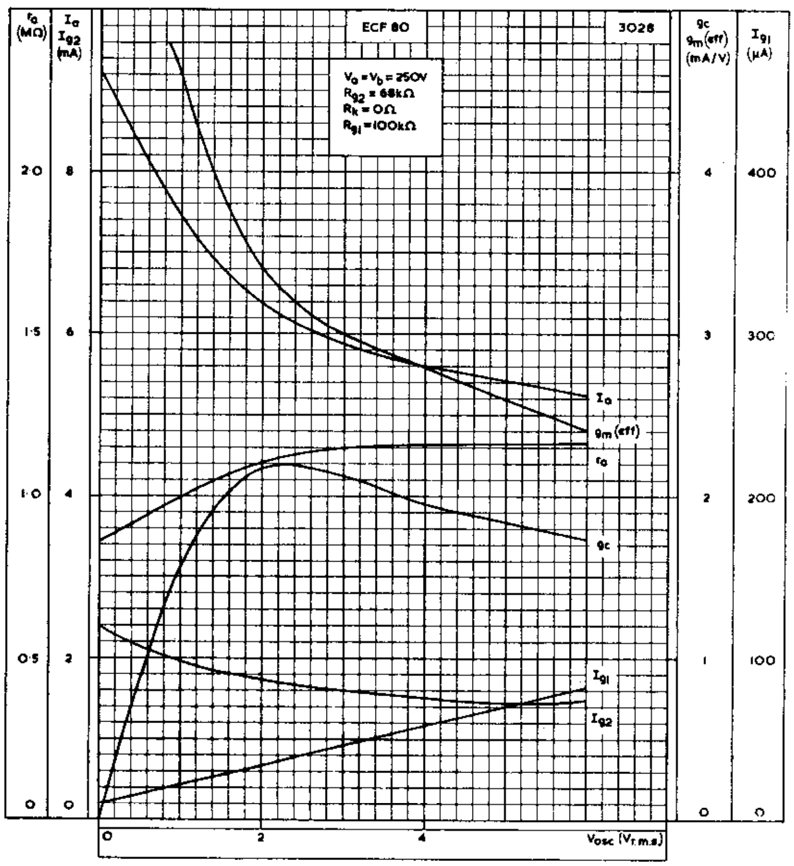
Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.



PERFORMANCE CURVES FOR USE AS FREQUENCY CHANGER WITH $R_k = 820\Omega$

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.



PERFORMANCE CURVES FOR USE AS FREQUENCY CHANGER WITH $R_k = 0\Omega$

TRIODE HEPTODE

ECH83

Triode heptode intended for use as a frequency changer or combined r.f. and a.f. amplifier in equipment operating directly from a 6V, 12V or 24V battery, on or off charge.

HEATER

V_h	6.3	V
I_h	300	mA

CAPACITANCES

c_{ah-at}	200	mpF
c_{ah-gt}	<90	mpF
$c_{ah-g3+gt}$	<350	mpF
c_{g1-at}	<60	mpF
c_{g1-gt}	<170	mpF
$c_{g1-g3+gt}$	<450	mpF

Heptode section

$c_{in(g1)}$	4.8	pF
$c_{in(g3)}$	6.0	pF
c_{out}	7.9	pF
c_{a-g1}	<12	mpF
c_{g1-g3}	<300	mpF

Triode section

c_{in}	2.6	pF
c_{out}	2.1	pF
c_{a-g}	1.0	pF

OPERATING CONDITIONS OF HEPTODE SECTION AS R.F. AMPLIFIER

$V_a = V_b$	6.3	12.6	25	V
$V_{g2+g3+g4}$	6.3	12.6	25	V
$*V_{g1(b)}$	0	0	0	V
V_{g1}	†	†	†	
R_{g1}	1.0	1.0	1.0	MΩ
I_a	0.11	0.4	1.25	mA
$I_{g2+g3+g4}$	80	250	850	µA
g_m	0.35	0.75	1.5	mA/V
r_a	600	850	200	kΩ
R_{eq}	8.5	6.5	5.0	kΩ
V_{g1} (for 100 : 1 reduction in g_m)	−2.0	−2.8	−4.4	V

$*V_{g1(b)}$ = Voltage at earthy end of grid leak.
†Obtained by grid current biasing.

OPERATING CONDITIONS AS A.M. FREQUENCY CHANGER (multiplicative mixer)

Heptode section

$V_a = V_b$	6.3	12.6	25	V
V_{g2+g4}	6.3	12.6	25	V
*$V_{g1(b)}$	0	0	0	V
V_{g1}	†	†	†	
R_{g1}	1.0	1.0	1.0	MΩ
I_a	18	100	460	μA
I_{g2+g4}	0.1	0.35	1.25	mA
I_{g3+gt}	28	32	54	μA
$V_{osc(r.m.s.)}$	0.9	1.2	2.0	V
R_{g3+gt}	47	47	47	kΩ
g_c	50	160	390	μA/V
r_a	3.75	3.8	1.1	MΩ

*$V_{g1(b)}$ = Voltage at earthy end of grid leak.
†Obtained by grid current biasing with R_{g1} = 1.0MΩ.

Triode section

$V_a = V_b$	12.6	V
V_g	0	V
I_a	750	μA
g_m	1.4	mA/V
I_{gt+g3}	42	μA
R_{gt+g3}	47	kΩ
$V_{gt+g3(r.m.s.)}$	1.7	V

OPERATING CONDITIONS OF TRIODE SECTION AS A.F. AMPLIFIER

V_b	12.6	V
R_a	150	kΩ
R_g	10	MΩ
R_{g1} (of following valve)	10	MΩ
V_{out}/V_{in}	8.0	
V_{out}	1.8	V
D_{tot}	5.0	%

LIMITING VALUES

Heptode section

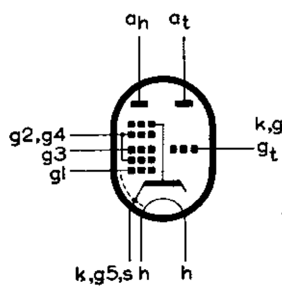
V_a max.	30	V
V_{g2+g4} max.	30	V
I_k max.	5.0	mA
R_{g1-k} max.	3.0	MΩ
R_{g3-k} max.	50	kΩ

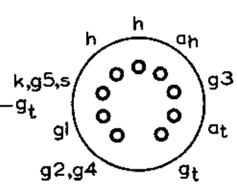
Triode section

V_a max.	30	V
I_k max.	3.0	mA

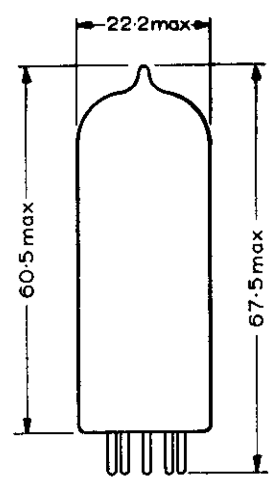
TRIODE HEPTODE

ECH83





B9A Base



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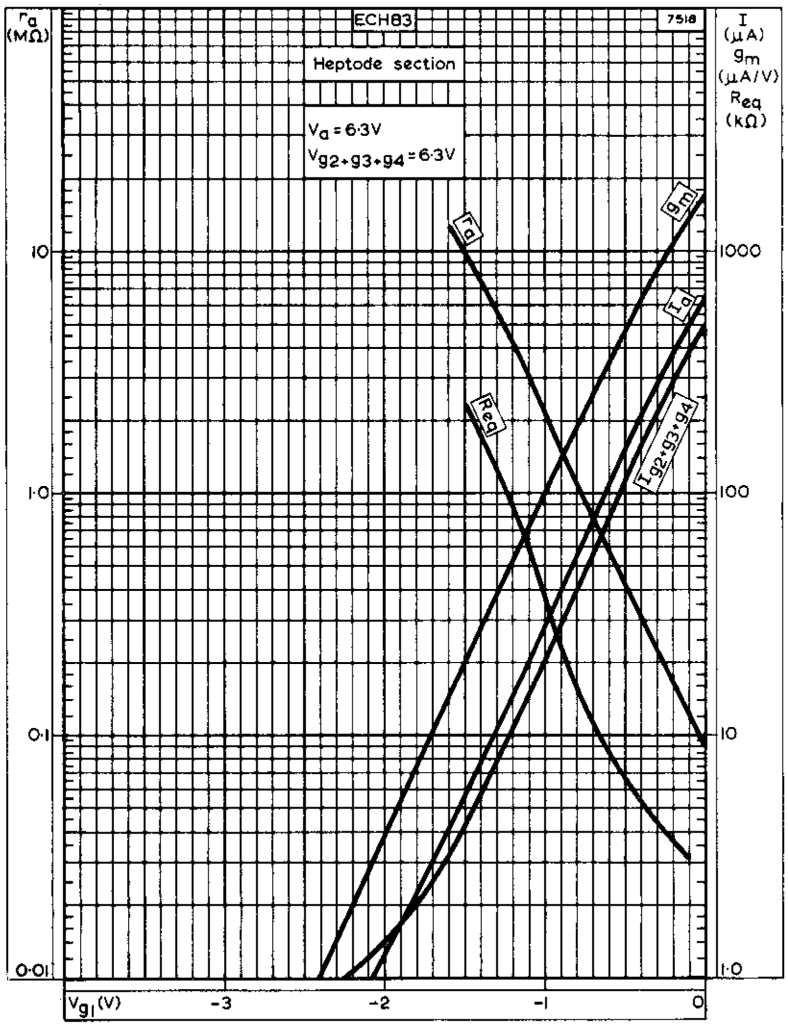
All dimensions in mm

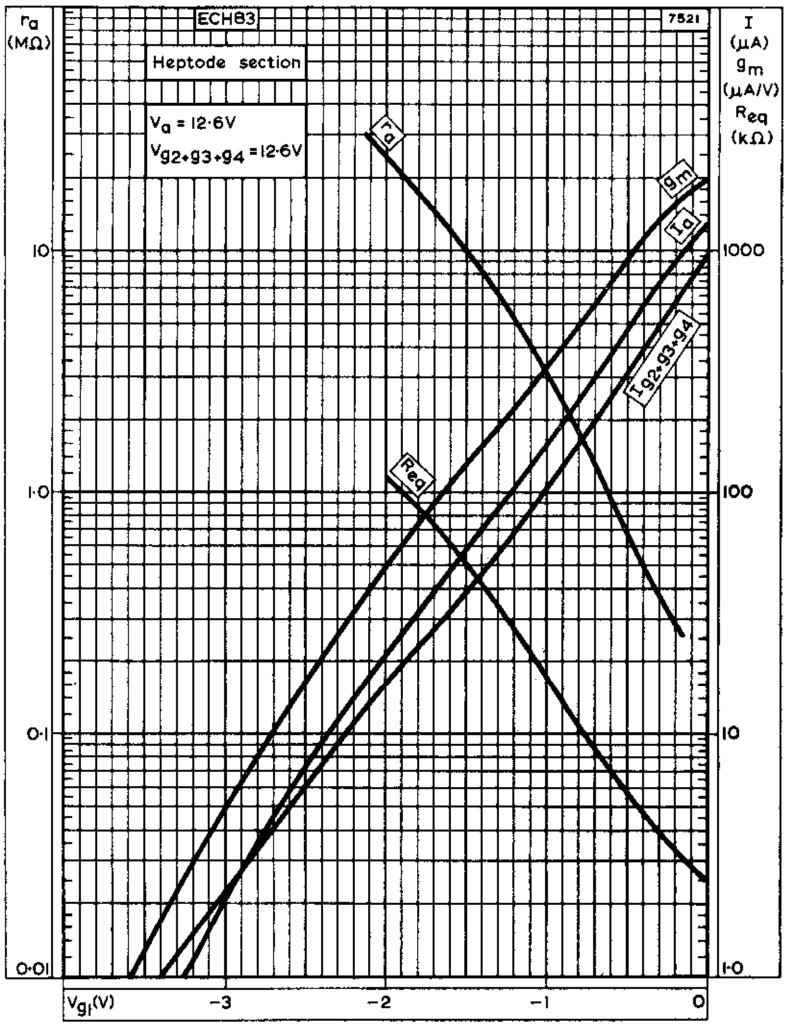


ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE, ANODE IMPEDANCE AND EQUIVALENT NOISE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR HEPTODE SECTION

$V_a = V_{g2+g3+g4} = 6.3V$

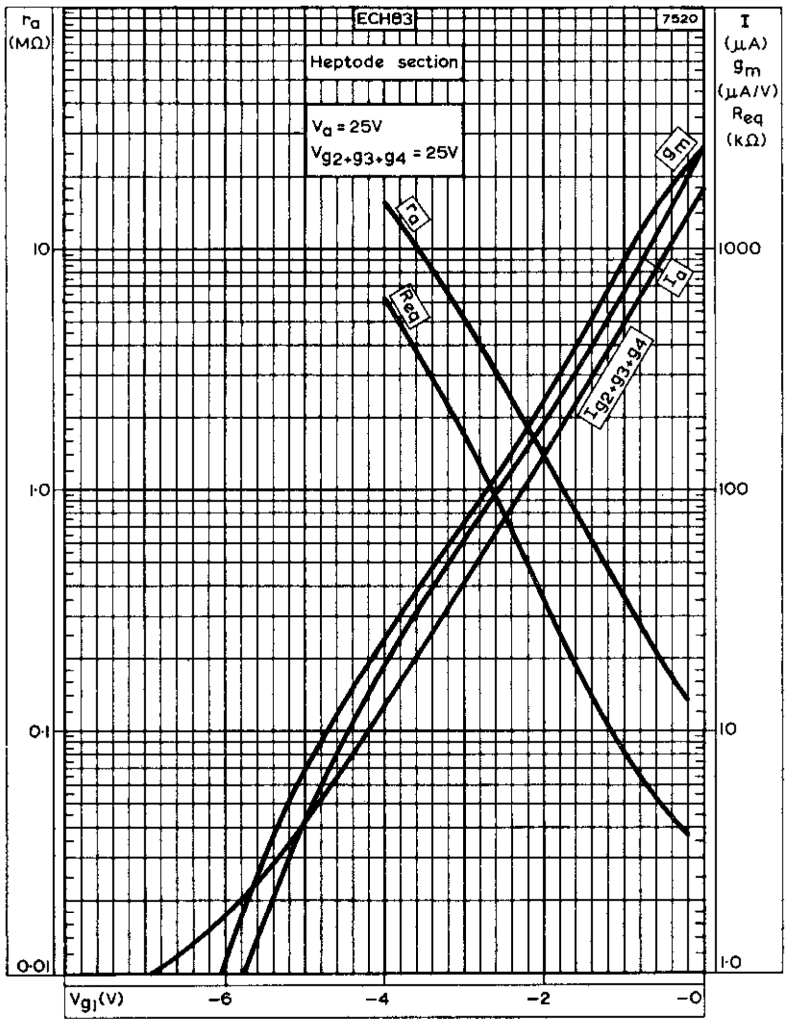
ECH83

TRIODE HEPTODE



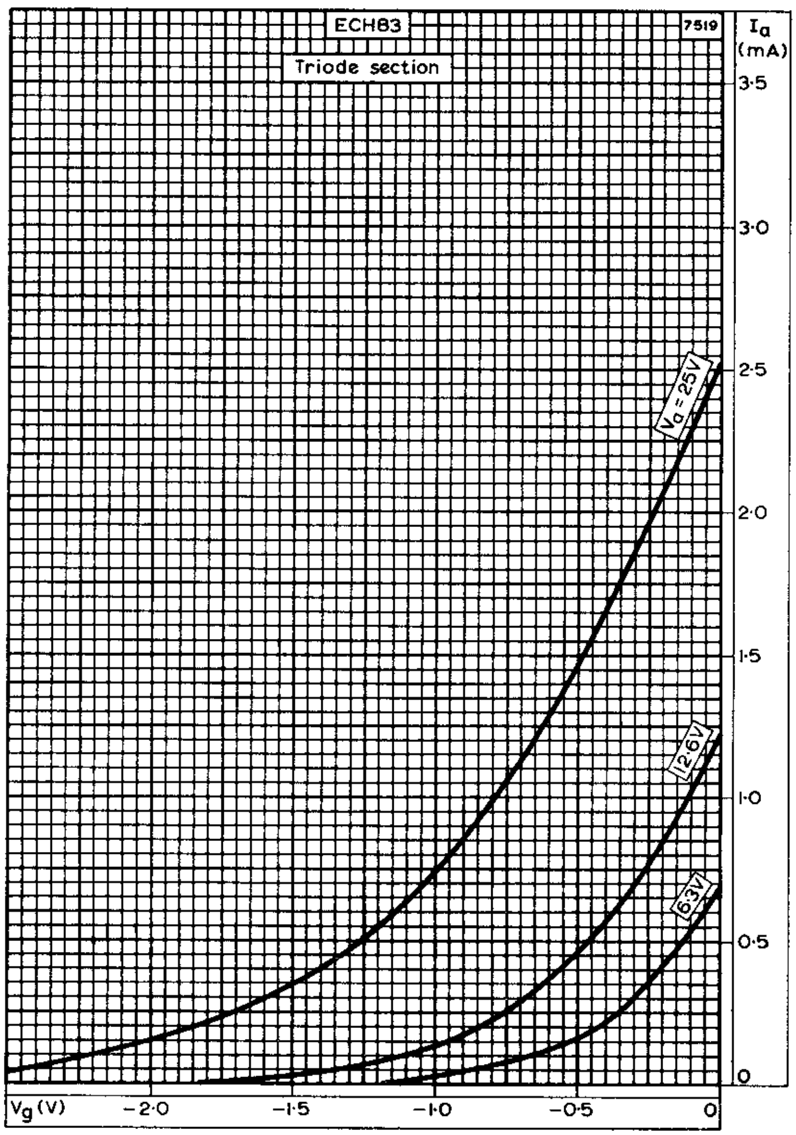
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE, ANODE IMPEDANCE AND EQUIVALENT NOISE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR HEPTODE SECTION

$V_a = V_{g2+g3+g4} = 12.6V$

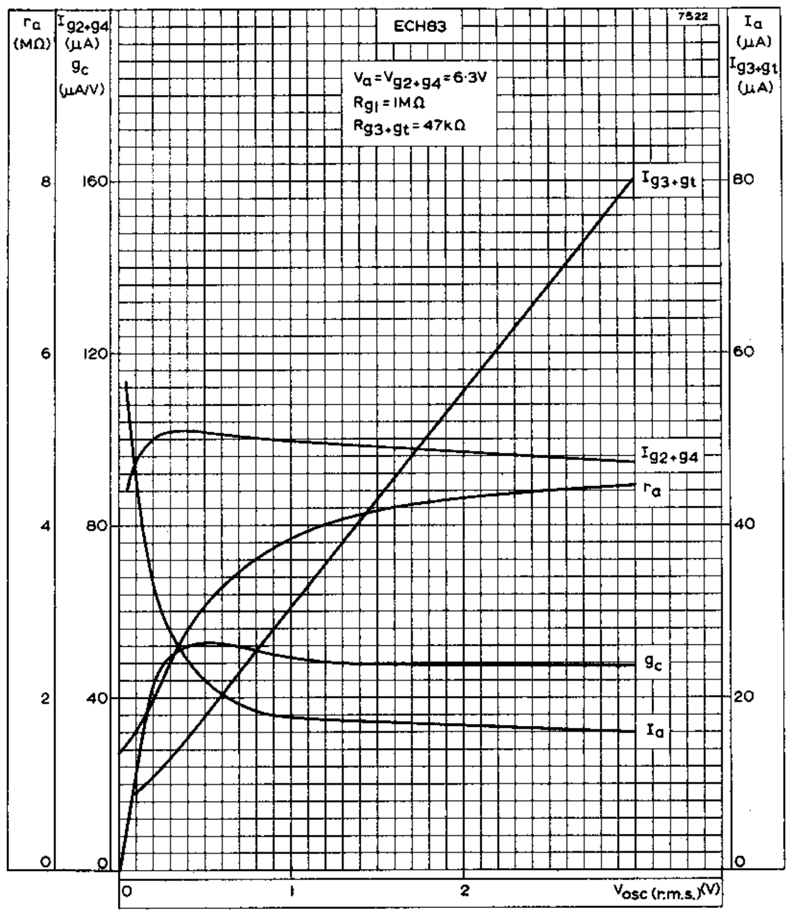


ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE, ANODE IMPEDANCE AND EQUIVALENT NOISE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR HEPTODE SECTION

$V_a = V_{g2+g3+g4} = 25V$

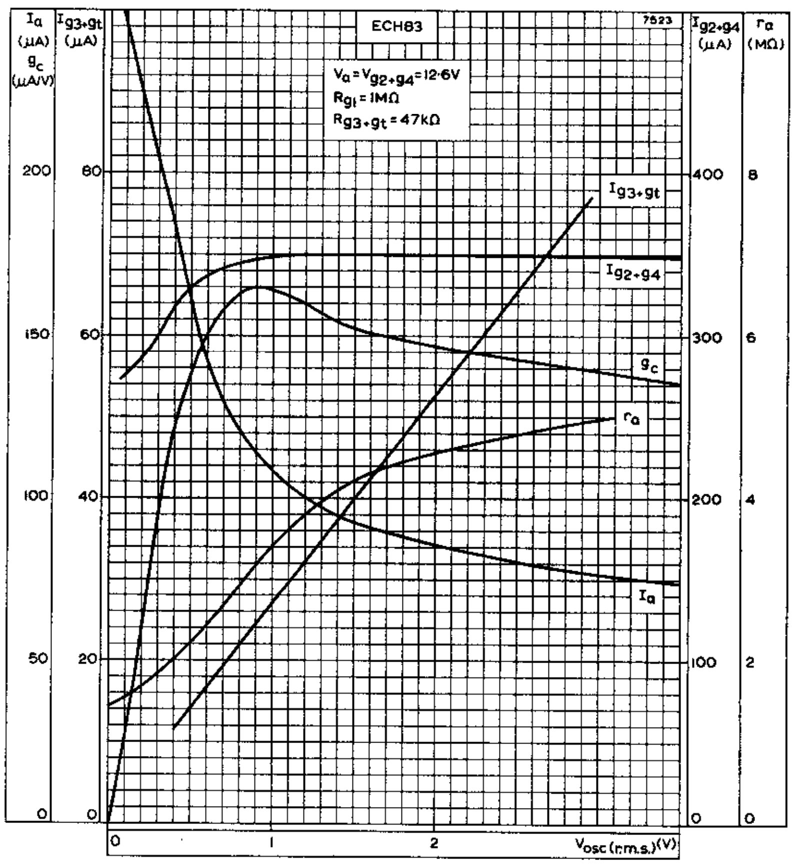


ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER. TRIODE SECTION



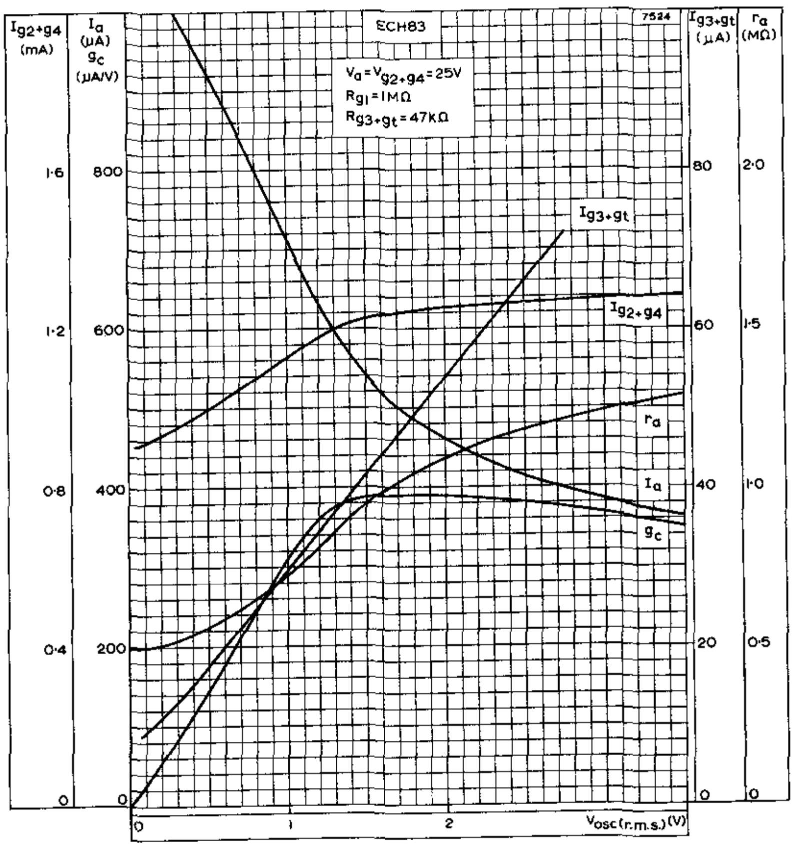
PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER

$V_a = V_{g2+g4} = 6.3V$



PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER

$V_a = V_{g2+g4} = 12.6V$



PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER
$V_a = V_{g2+g4} = 25V$

TRIODE HEPTODE

ECH84

Triode heptode intended for use as a noise cancelled synchronising pulse separator and time base oscillator.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

V_h	6.3	V
I_h	300	mA

CAPACITANCES

c_{ah-at}	<250	mpF
c_{ah-gt}	<90	mpF
c_{g1-at}	<80	mpF
c_{g1-gt}	<100	mpF
c_{g3-at}	<130	mpF
Heptode section		
c_{a-g1}	<9.0	mpF
Triode section		
c_{in}	3.0	pF
c_{a-g}	1.1	pF

CHARACTERISTICS ←

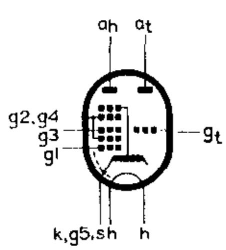
Heptode section		
V_a	135	V
V_{g3}	0	V
V_{g2+g4}	14	V
V_{g1}	0	V
I_a	1.7	mA
I_{g2+g4}	900	µA
g_m	2.2	mA/V
V_{g3} ($I_a = 20\mu A$)	–2.0	V
V_{g1} ($I_a = 20\mu A$)	–1.9	V
$-V_{g3}$ max. ($I_{g1} = +0.3\mu A$)	1.3	V
$-V_{g1}$ max. ($I_{g3} = +0.3\mu A$)	1.3	V
Triode section		
V_a	50	V
V_g	0	V
I_a	3.0	mA
g_m	3.7	mA/V
μ	50	
I_a ($V_a = 200V$, $V_g = -11V$)	<100	µA
$-V_g$ max. ($I_g = +0.3\mu A$)	1.3	V

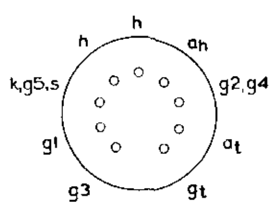
ECH84

TRIODE HEPTODE

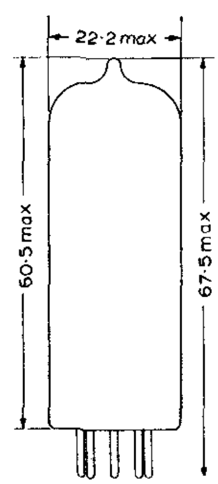
DESIGN CENTRE RATINGS

Heptode section		
$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	1.7	W
$V_{g2+g4(b)}$ max.	550	V
V_{g2+g4} max.	250	V
V_{g2+g4} min.	10	V
p_{g2+g4} max.	800	mW
$-v_{g1(pk)}$ max.	150	V
$-v_{g3(pk)}$ max.	150	V
I_k max.	12.5	mA
R_{g1-k} max.	3.0	MΩ
R_{g3-k} max.	3.0	MΩ
V_{h-k} max.	100	V
Triode section		
$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	1.3	W
$-v_{g(pk)}$ max.	200	V
I_k max.	10	mA
R_{g-k} max.	3.0	MΩ



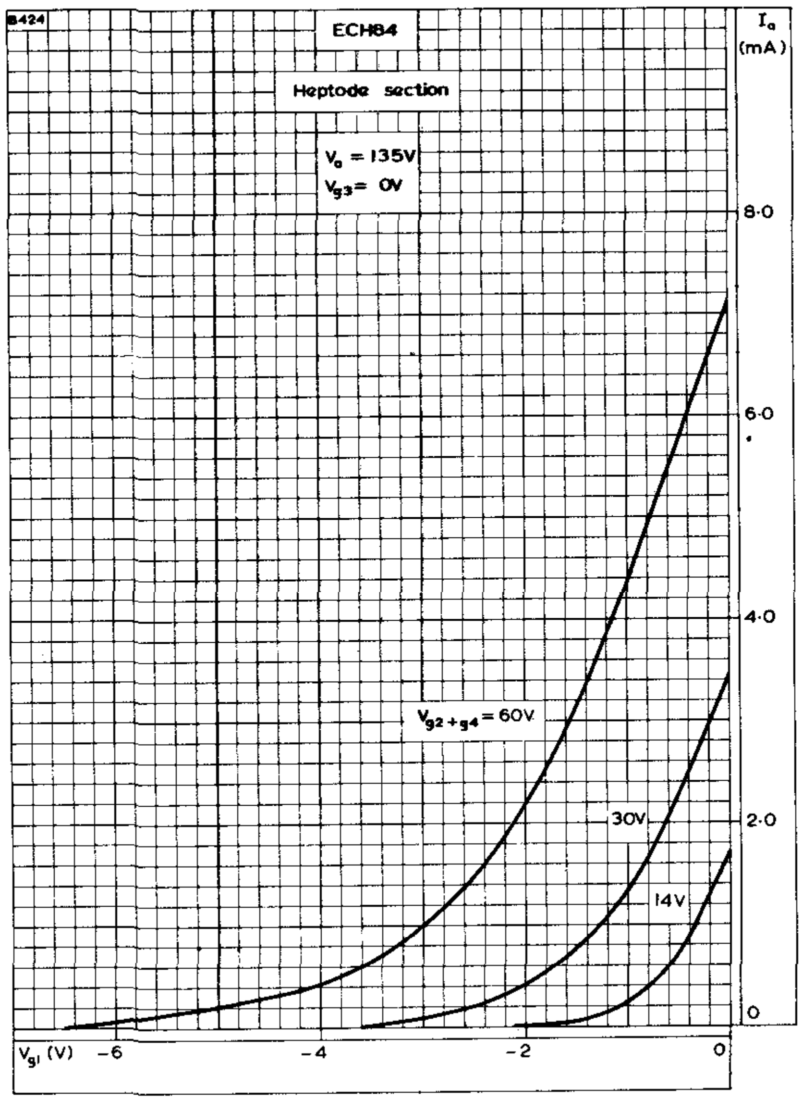


B9A Base

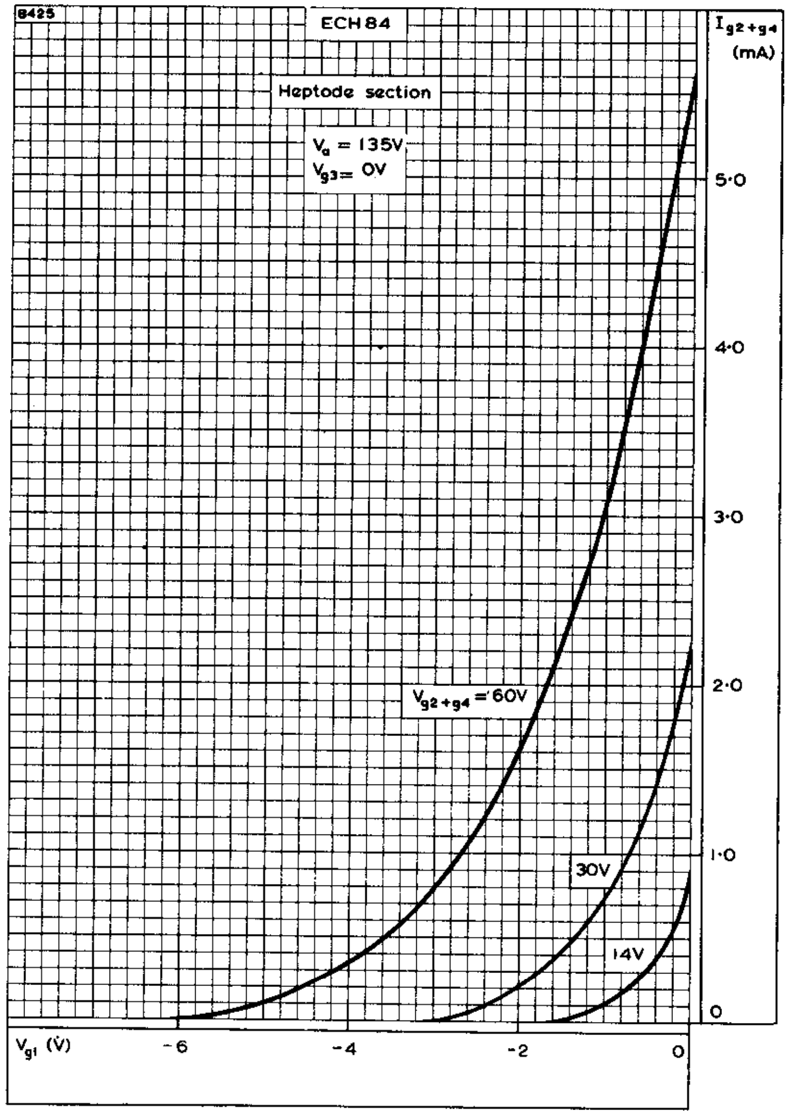


6808

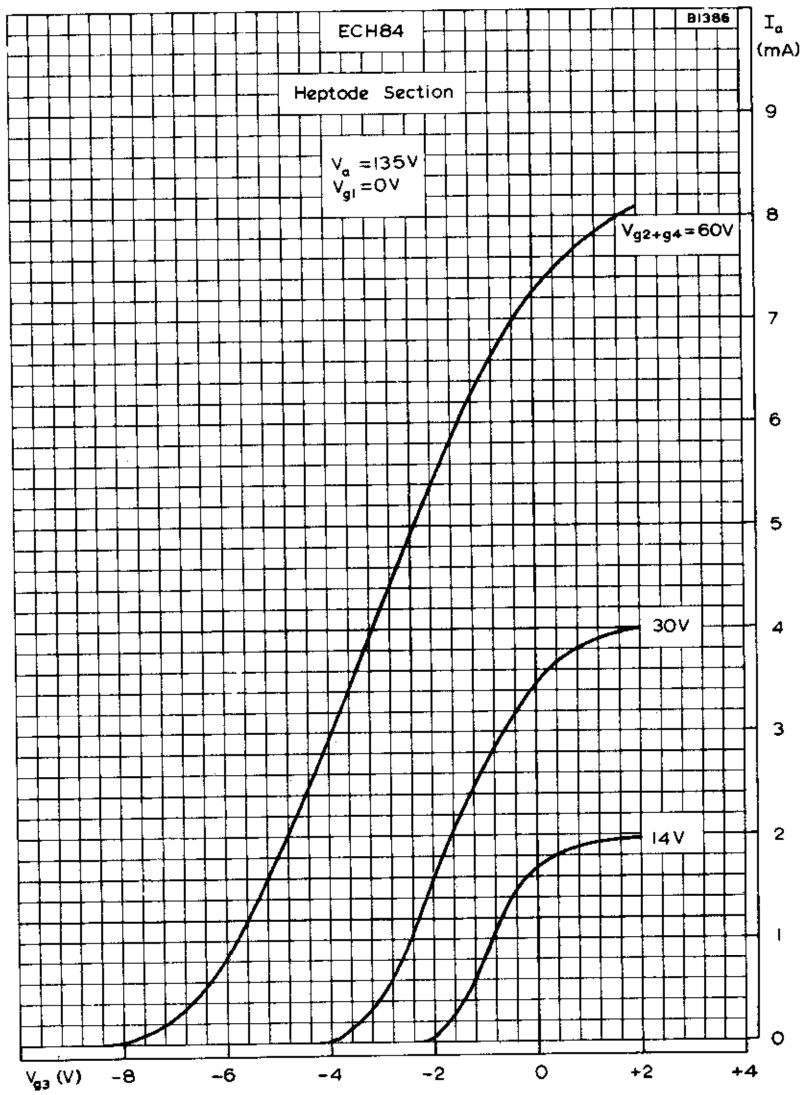
All dimensions in mm



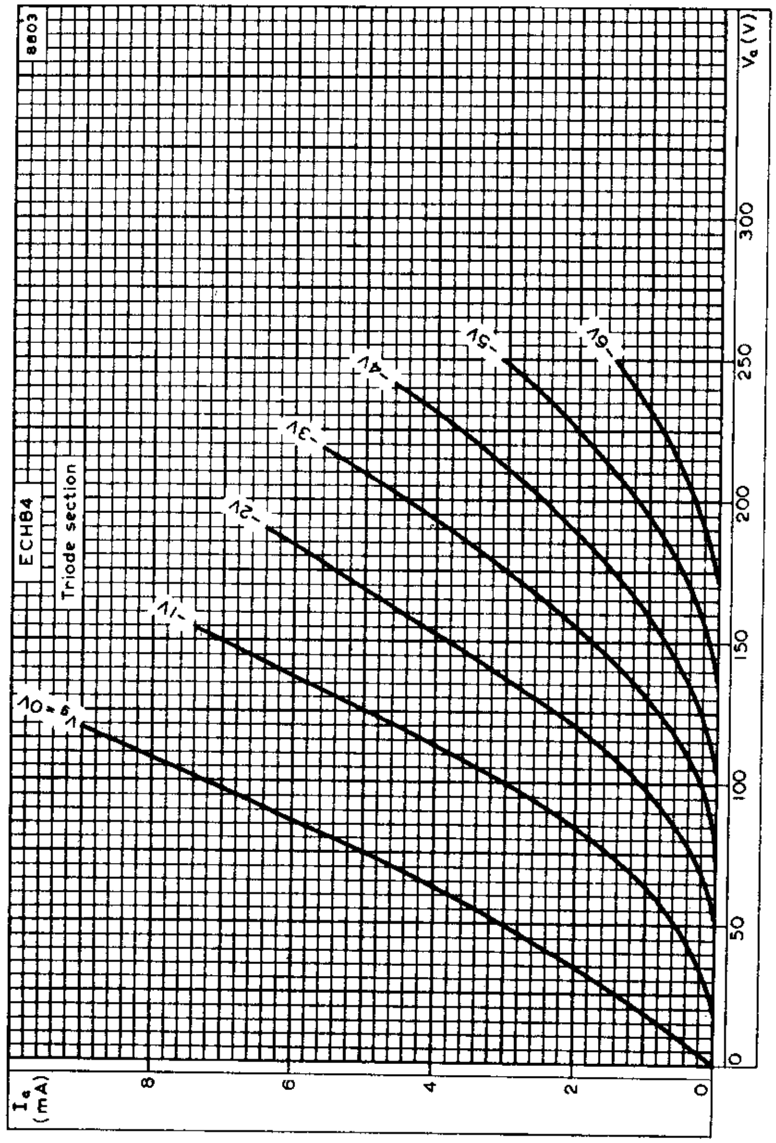
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER



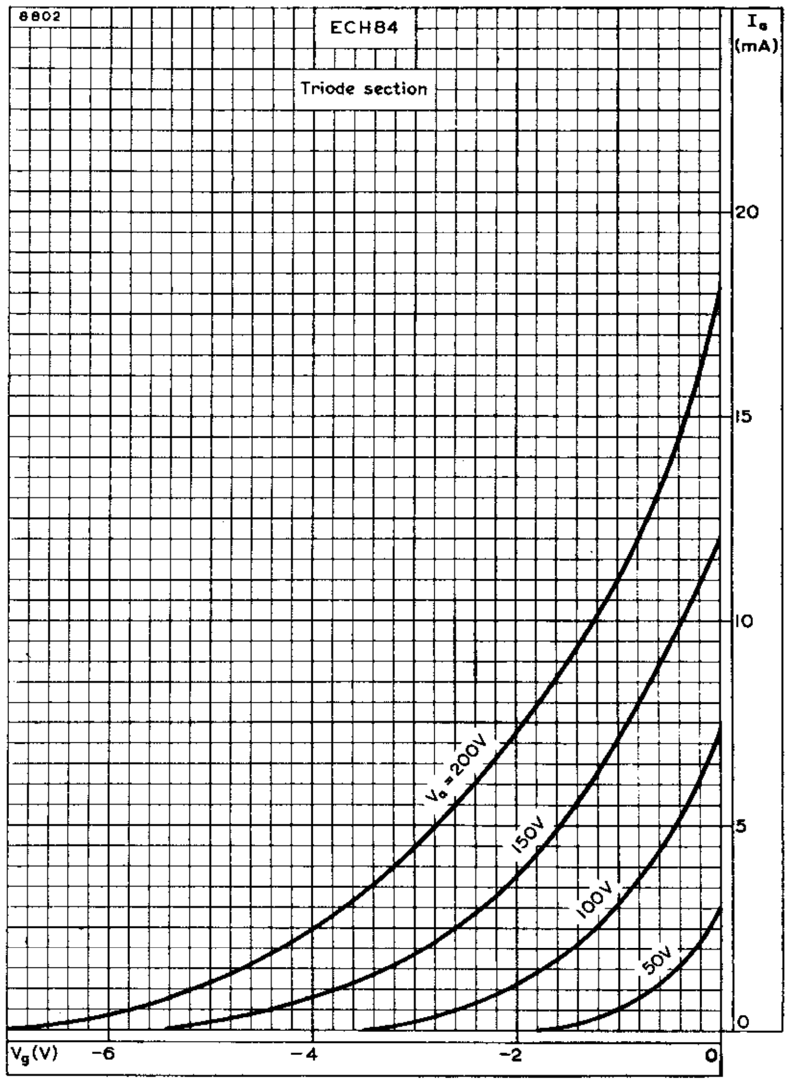
SCREEN-GRID CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER



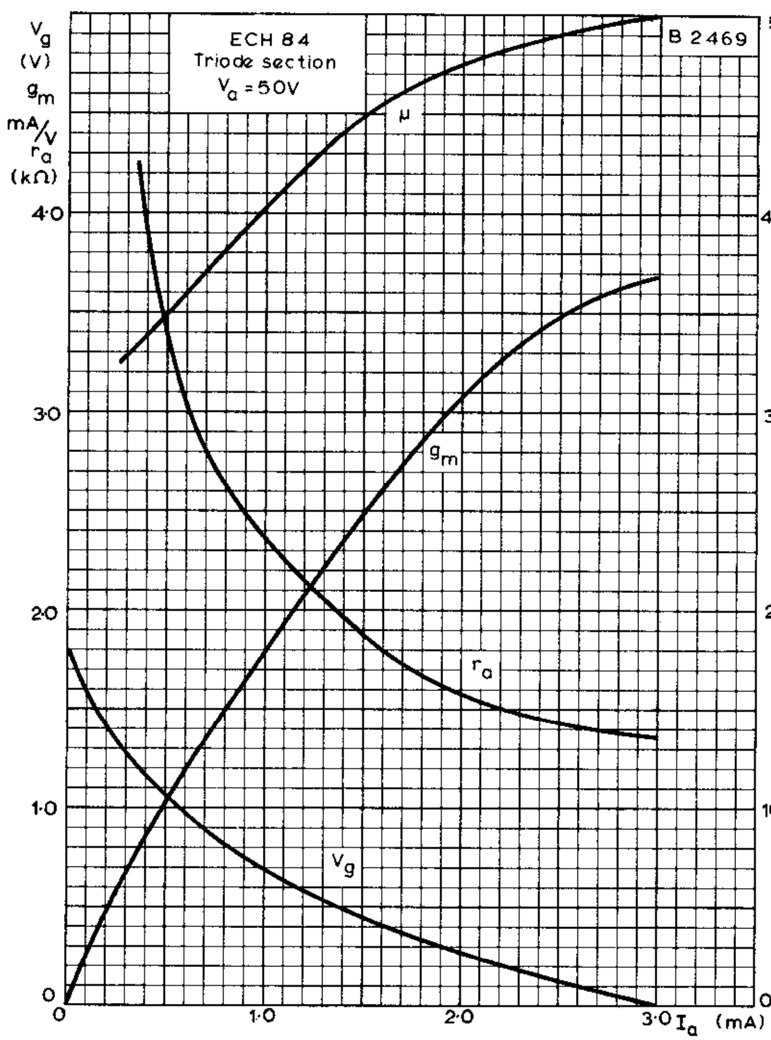
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID (g_3) VOLTAGE.
HEPTODE SECTION



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER. TRIODE SECTION



ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER. TRIODE SECTION



AMPLIFICATION FACTOR, MUTUAL CONDUCTANCE, ANODE IMPEDANCE AND CONTROL-GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT. V_a = 50V. TRIODE SECTION

TRIODE PENTODE

ECL80

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, a.f. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

HEATER

Suitable for series or parallel operation, a.c. or d.c

V_h	6.3	V
I_h	300	mA

CAPACITANCES

c_{gt-ap}	<0.12	pF
c_{at-ap}	<1.2	pF
c_{gt-g1}	<0.2	pF
c_{at-g1}	<0.2	pF
c_{h-k}	3.7	pF←

Pentode section

c_{in}	4.5	pF
c_{out}	5.0	pF
c_{a-g1}	<0.2	pF
c_{g1-h}	<0.25	pF

Triode section

c_{gt-k}	2.0	pF
c_{at-k}	0.3	pF
c_{at-gt}	0.9	pF
c_{gt-h}	<0.05	pF

CHARACTERISTICS

Pentode section

V_a	170	200	V
V_{g2}	170	200	V
V_{g3}	0	0	V
I_a	15	17.5	mA
I_{g2}	2.8	3.3	mA
V_{g1}	−6.7	−8.0	V
g_m	3.2	3.3	mA/V
r_a	150	150	kΩ
μ_{g1-g2}	14	14	

Triode section

V_{at}	100	V
I_{at}	4.0	mA
V_{gt}	−2.3	V
g_m	1.4	mA/V
r_a	12.5	kΩ
μ	17.5	

ECL80

TRIODE PENTODE

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, a.f. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

PENTODE SECTION AS FRAME OUTPUT VALVE

Typical data

V_a	170	200	V
V_{g2}	170	200	V
V_{g3}	0	0	V
V_{g1}	−9.0	−10.6	V
$I_{a(0)}$	8.5	10	mA
$I_{g2(0)}$	1.6	1.9	mA

Circuit design

To allow for valve spread and deterioration during life the frame output circuit should be designed around the following values of :—

V_a	50	60	V
V_{g2}	170	200	V
I_a	26	31	mA

PENTODE SECTION AS SYNCHRONISING PULSE SEPARATOR

Typical data

V_a	20	V
V_{g2}	15	V
V_{g3}	0	V
V_{g1} (I_a = 100μA)	−1.4	V
I_a (V_{g1}=0)	2.0	mA

PENTODE SECTION AS AUDIO OUTPUT VALVE

Operating conditions

V_a	170	200	V
V_{g2}	170	200	V
V_{g3}	0	0	V
V_{g1}	−6.7	−8.0	V
R_a	11	11	kΩ
$I_{a(0)}$	15	17.5	mA
$I_{g2(0)}$	2.8	3.3	mA
$V_{in\ (r.m.s.)}$ (P_{out}=50 mW)	0.7	0.7	V
$V_{in\ (r.m.s.)}$ (D_{tot}=10%)	3.5	4.0	V
P_{out} (D_{tot}=10%)	1.0	1.4	W
$V_{in\ (r.m.s.)}$ (up to η=50%)	4.1	4.7	V
$P_{out\ (r.m.s.)}$ (up to η=50%)	1.27	1.75	W
$D_{tot\ (r.m.s.)}$ (up to η=50%)	12	12	%

TRIODE PENTODE

ECL80

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

TRIODE SECTION AS A.F. VOLTAGE AMPLIFIER

Operating Conditions

V_b (V)	R_a (kΩ)	I_{at} (mA)	$-V_{gt}$ (V)	$\frac{V_{out}}{V_{in}}$	V_{out}* ($V_{r.m.s.}$)	D_{tot}* (%)	R_{g1}† (kΩ)
170	47	1.8	3.5	9.5	22	8.7	150
170	400	1.0	3.5	10.5	24	7.6	330
170	220	0.5	3.5	11	24.5	6.5	680
200	47	2.2	4.2	9.5	27	9.0	150
200	100	1.2	4.2	10.5	29	8.0	330
200	220	0.6	4.2	11	30	6.5	680

* Output voltage and distortion at the start of positive grid current. At lower output voltages the distortion is approximately proportional to the voltage.

† Grid resistor of the following valve.

LIMITING VALUES

Pentode Section

	$V_{a(b)}$ max.	550	V
	$v_{a(pk)}$ max.	1.2	kV
	V_a max.	400	V
	p_a max.	3.5	W
	$V_{g2(b)}$ max.	550	V
	V_{g2} max.	250	V
	p_{g2} max.	1.2	W←
	I_k max.	25	mA
*	$i_{k(pk)}$ max.	350	mA←
	V_{g1} max. (I_{g1}=+0.3μA)	−1.3	V
	R_{g1-k} max. (I_k=12 mA) (frame output valve)	2.2	MΩ
	R_{g1-k} max. (I_k=20 mA) (audio output valve)	1.0	MΩ
	R_{h-k} max.	20	kΩ
	V_{h-k} max.	150	V

* Max. pulse duration 10% of one cycle, with a maximum of 2 m secs.

ECL80

TRIODE PENTODE

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

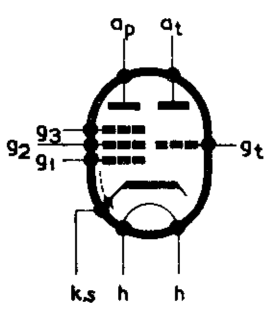
LIMITING VALUES

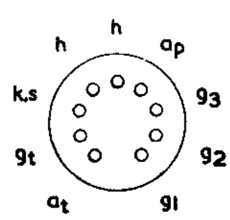
Triode Section

$V_{at(b)}$ max.	550	V
V_{at} max.	200	V
p_{at} max.	1.0	W
I_k max.	8	mA←
* $i_{k(pk)}$ max.	200	mA
V_{gt} max. ($I_{gt}=+0.3$ μA)	—1.3	V
R_{gt-k} max.	3	MΩ
R_{h-k} max.	20	kΩ
V_{h-k} max.	150	V

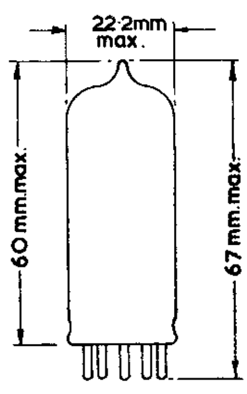
* Max pulse duration 10% of one cycle, with maximum of 2 m secs.

When the triode section is used in amplifier circuits, where the input voltage, for an output of 50 mW is less than 50 mV, no special precautions need be taken against microphonic effects.





B9A
Noval Base

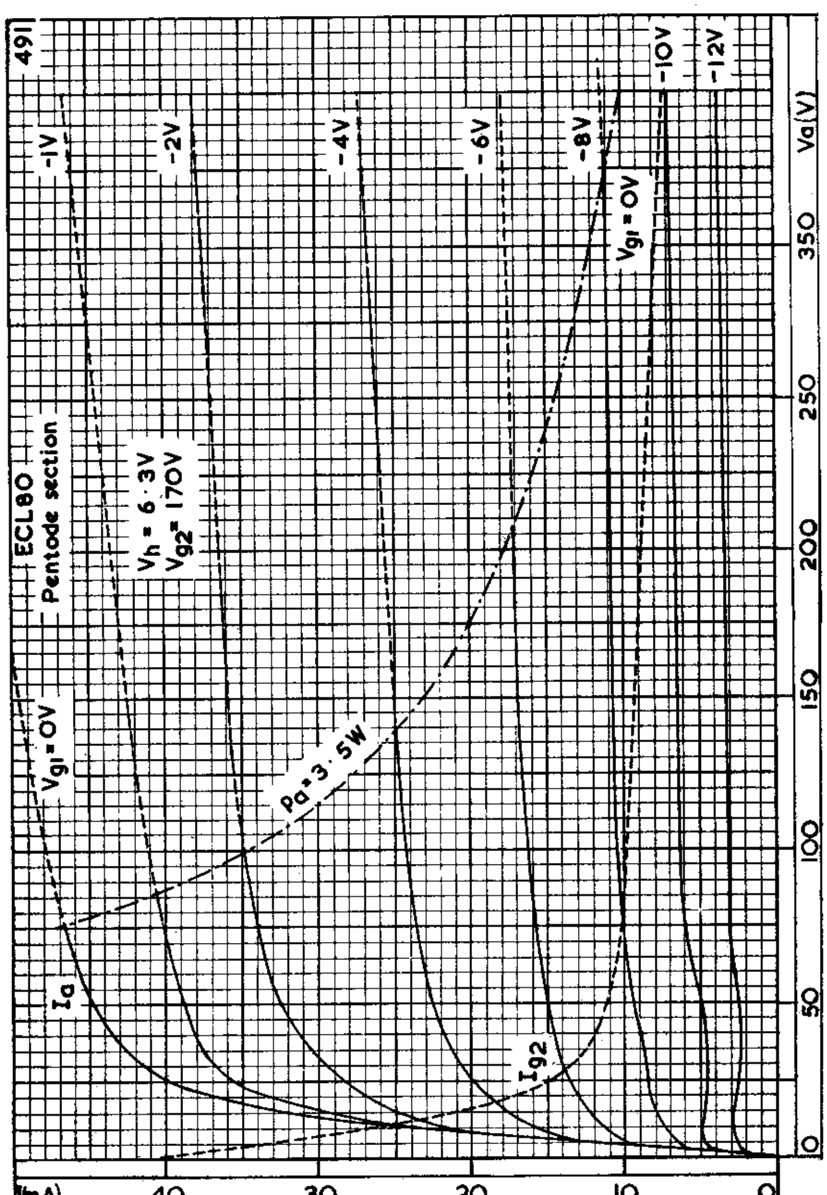


519

TRIODE PENTODE

ECL80

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

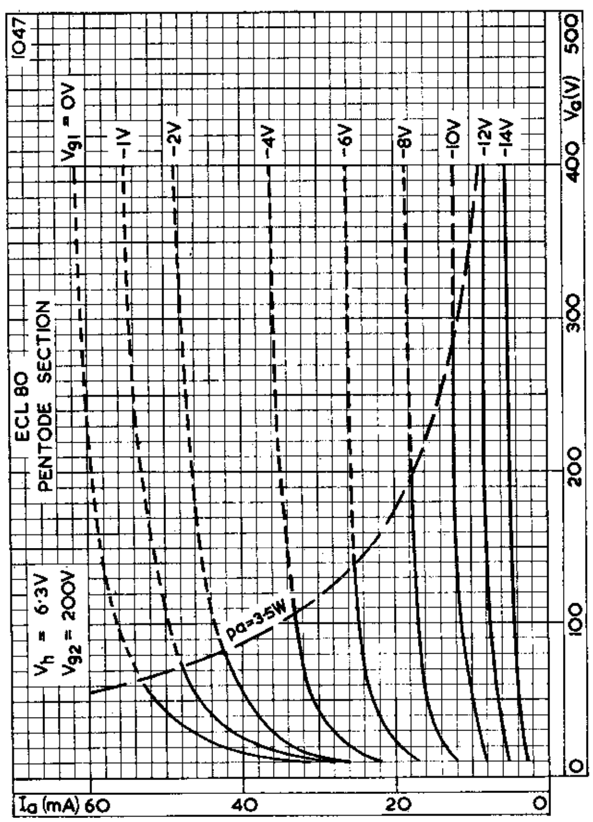


ANODE CURRENT AND SCREEN-GRID CURRENT OF PENTODE SECTION PLOTTED AGAINST ANODE VOLTAGE, FOR SCREEN-GRID VOLTAGE OF 170 V

ECL80

TRIODE PENTODE

Combined triode and output pentode designed primarily for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

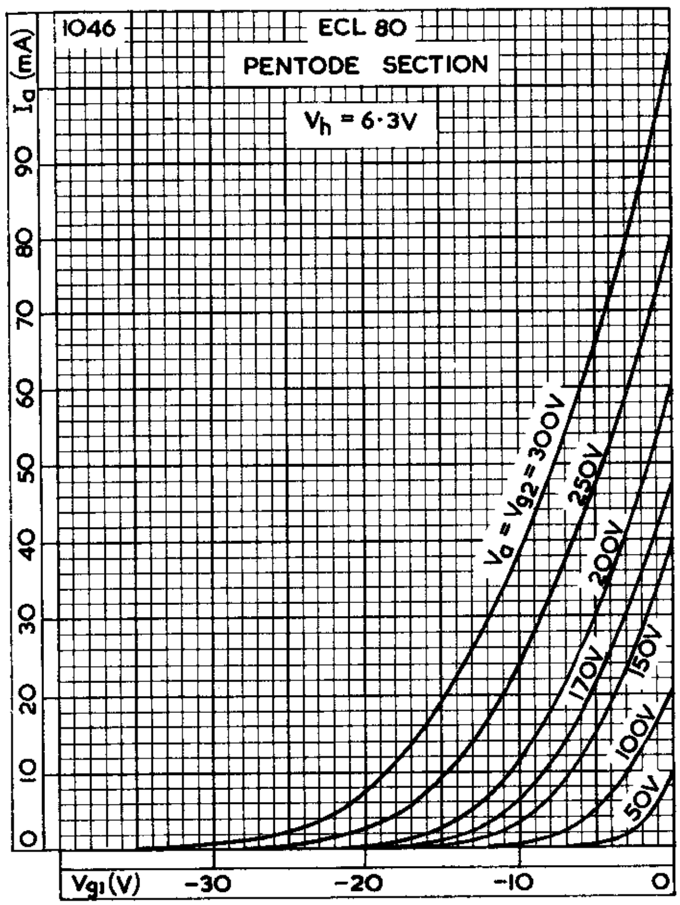


ANODE CURRENT AND SCREEN-GRID CURRENT OF PENTODE SECTION PLOTTED AGAINST ANODE VOLTAGE, FOR SCREEN-GRID VOLTAGE OF 200V

TRIODE PENTODE

ECL80

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

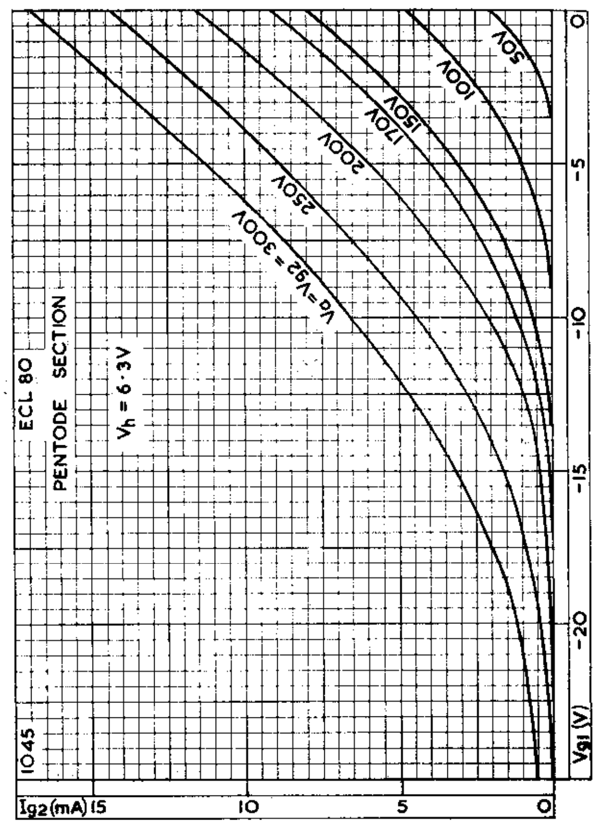


ANODE CURRENT OF PENTODE SECTION PLOTTED AGAINST CONTROL-GRID VOLTAGE, FOR ANODE AND SCREEN-GRID VOLTAGES BETWEEN 50V AND 300V

ECL80

TRIODE PENTODE

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

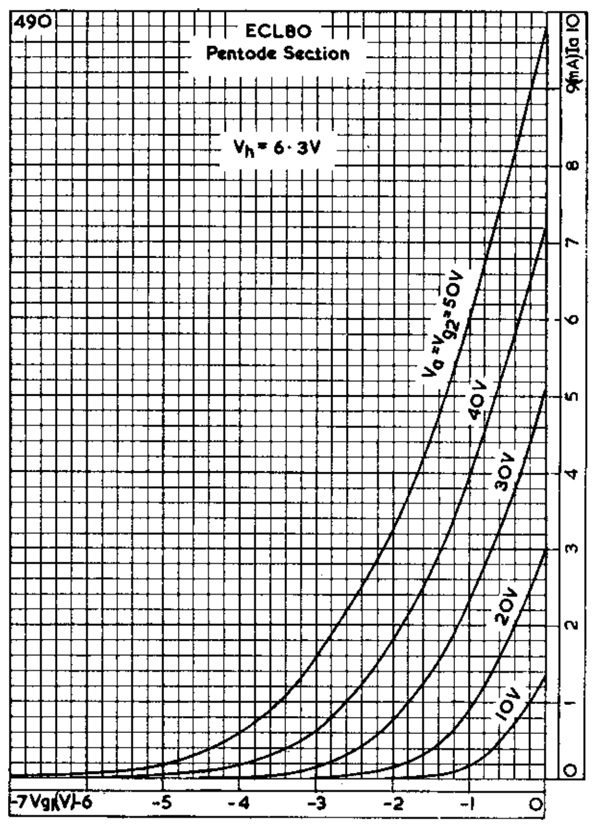


SCREEN-GRID CURRENT OF PENTODE SECTION PLOTTED AGAINST CONTROL-GRID VOLTAGE, FOR ANODE AND SCREEN-GRID VOLTAGES BETWEEN 50V AND 300V

TRIODE PENTODE

ECL80

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

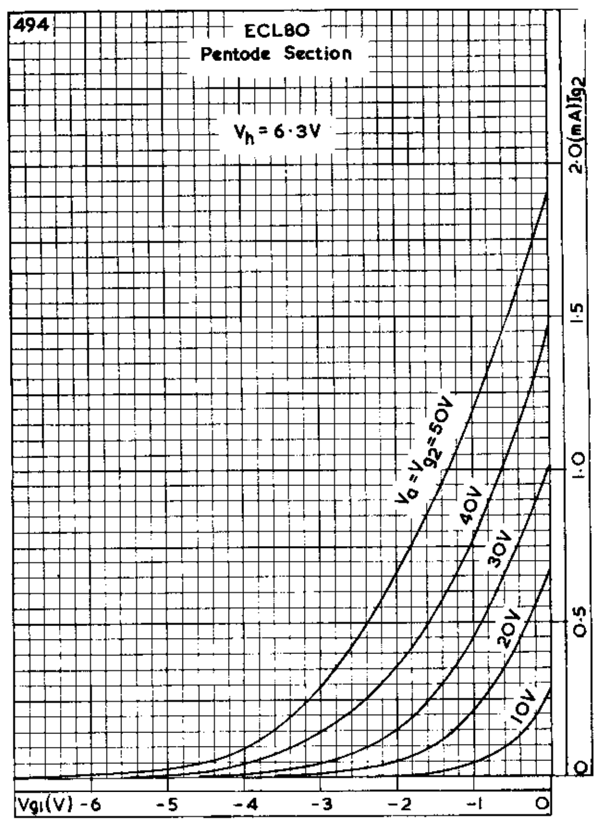


ANODE CURRENT OF PENTODE SECTION PLOTTED AGAINST CONTROL-GRID VOLTAGE, FOR ANODE AND SCREEN-GRID VOLTAGES BETWEEN 10V AND 50V

ECL80

TRIODE PENTODE

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

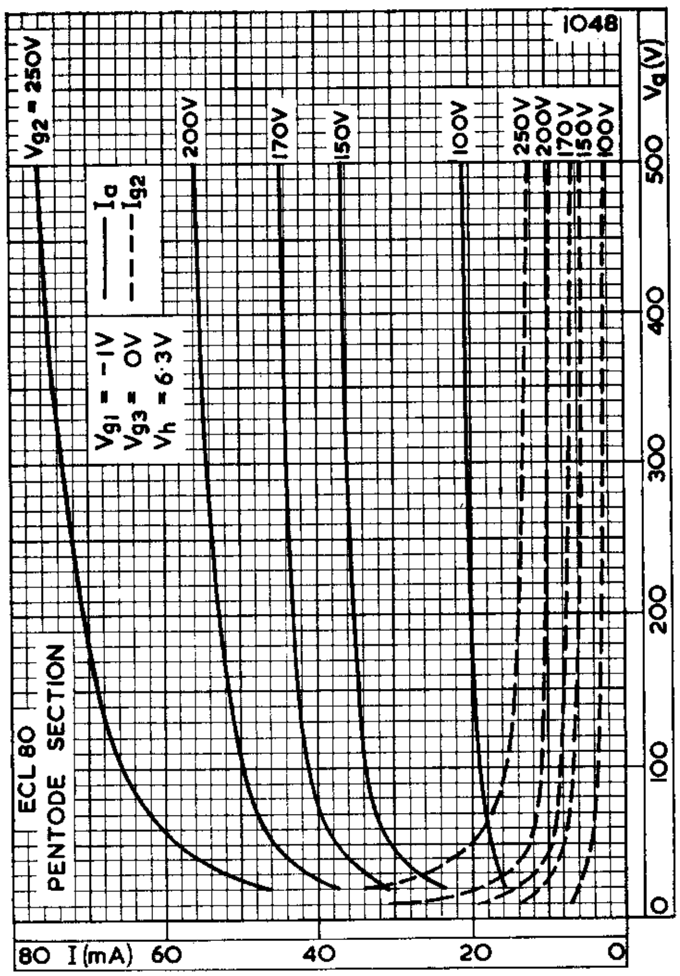


SCREEN-GRID CURRENT OF PENTODE SECTION PLOTTED AGAINST CONTROL-GRID VOLTAGE, FOR ANODE AND SCREEN-GRID VOLTAGES BETWEEN 10V AND 50V

TRIODE PENTODE

ECL80

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

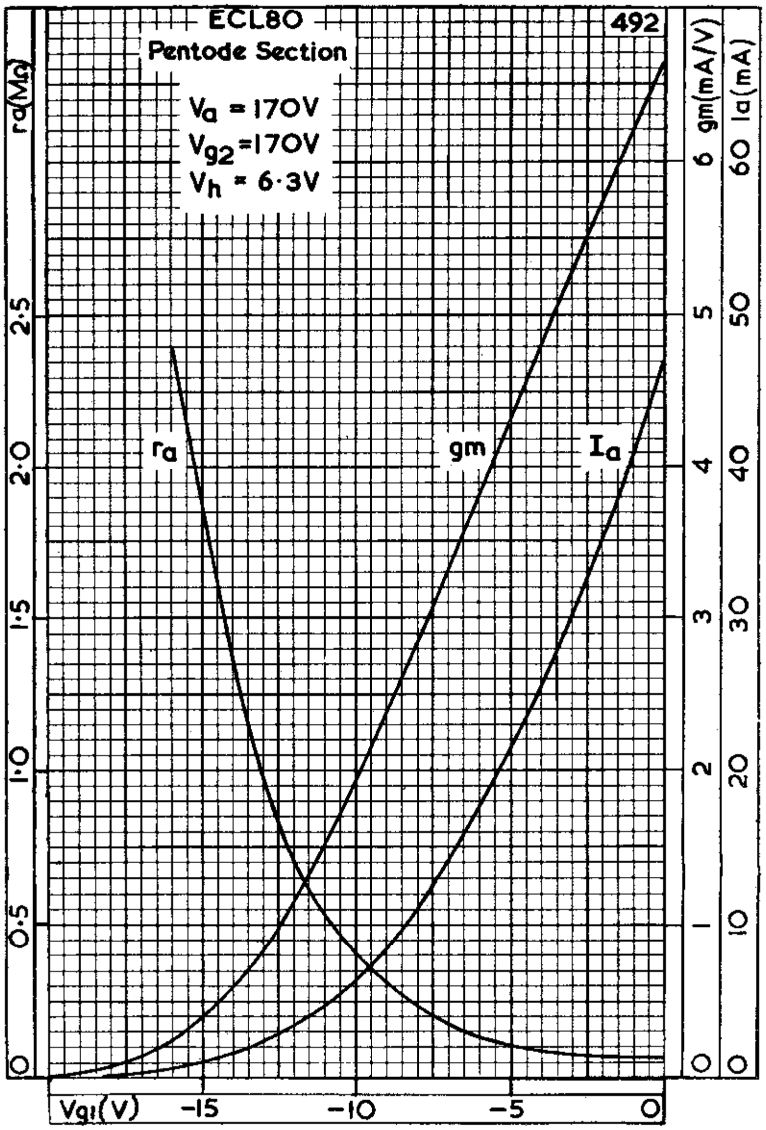


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE, WITH CONTROL-GRID VOLTAGE AT —1V

ECL80

TRIODE PENTODE

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

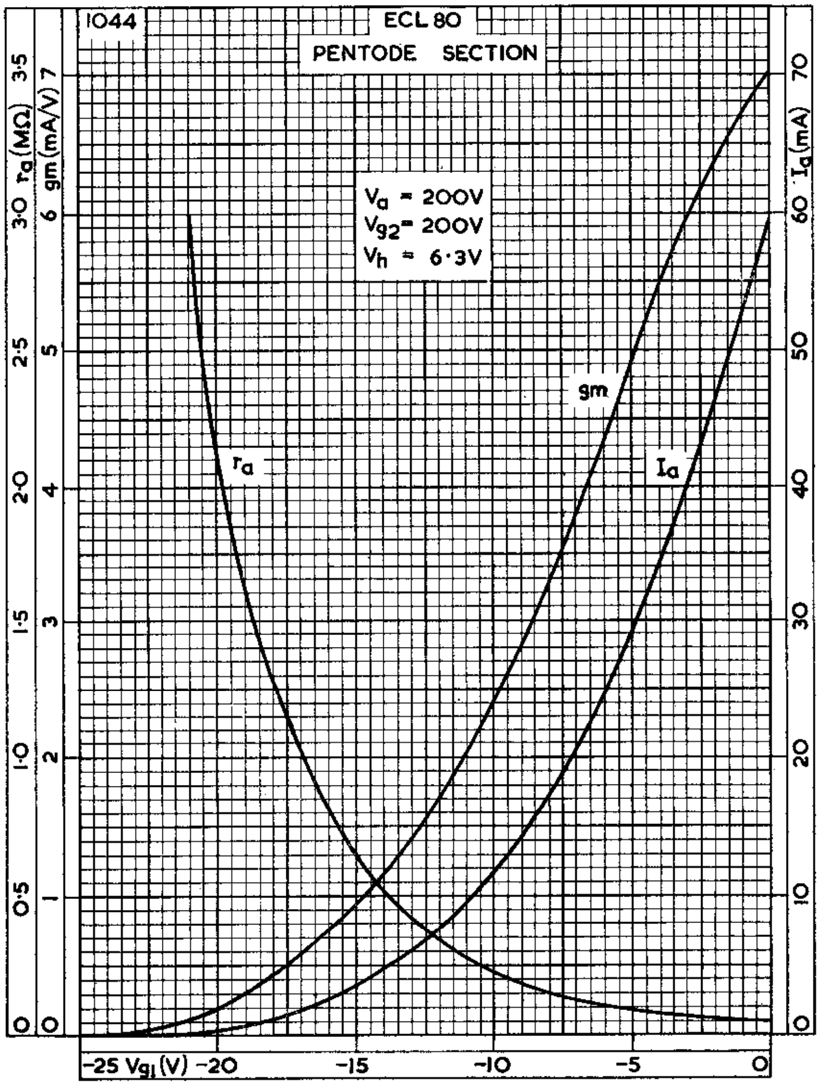


ANODE CURRENT, MUTUAL CONDUCTANCE AND INTERNAL RESISTANCE OF PENTODE SECTION PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR SCREEN-GRID VOLTAGE OF 170V

TRIODE PENTODE

ECL80

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

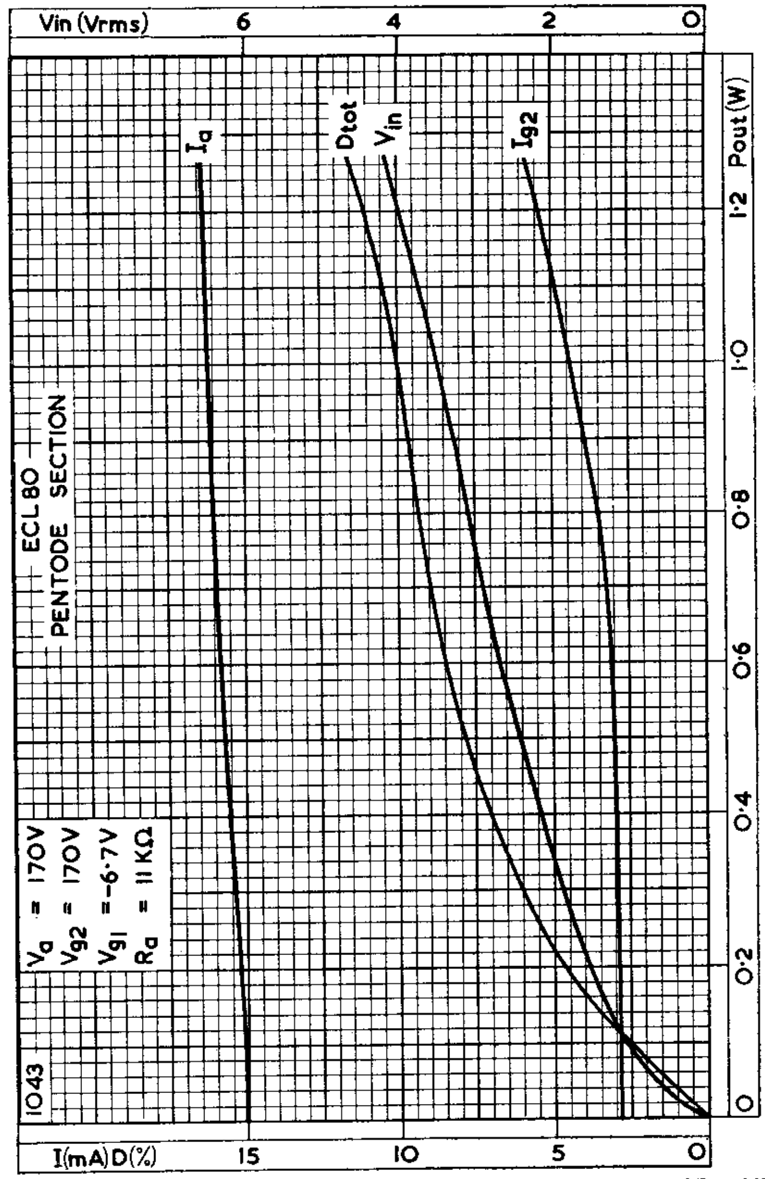


ANODE CURRENT, MUTUAL CONDUCTANCE AND INTERNAL RESISTANCE OF PENTODE SECTION PLOTTED AGAINST CONTROL-GRID VOLTAGE, FOR SCREEN-GRID VOLTAGE OF 200V

ECL80

TRIODE PENTODE

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

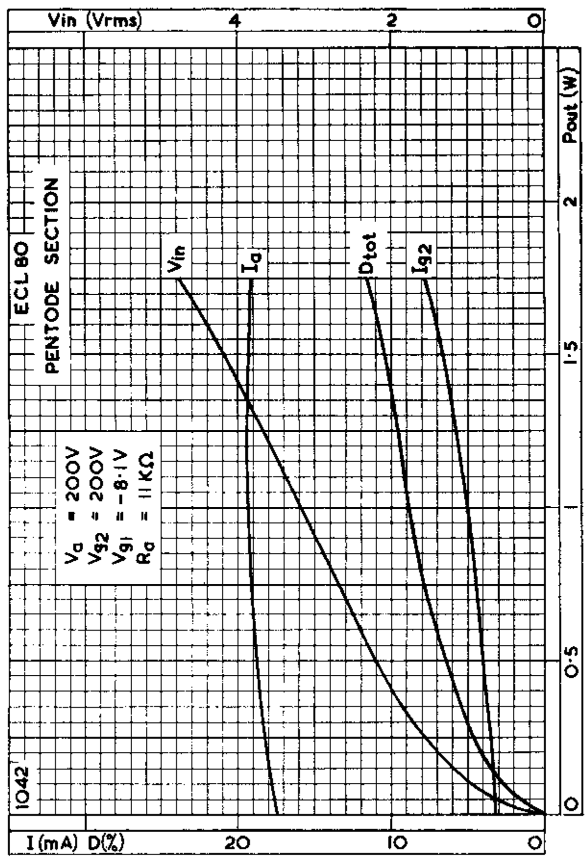


ANODE CURRENT, SCREEN-GRID CURRENT, INPUT VOLTAGE AND TOTAL DISTORTION PLOTTED AGAINST POWER OUTPUT, FOR SCREEN-GRID VOLTAGE OF 170V

TRIODE PENTODE

ECL80

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

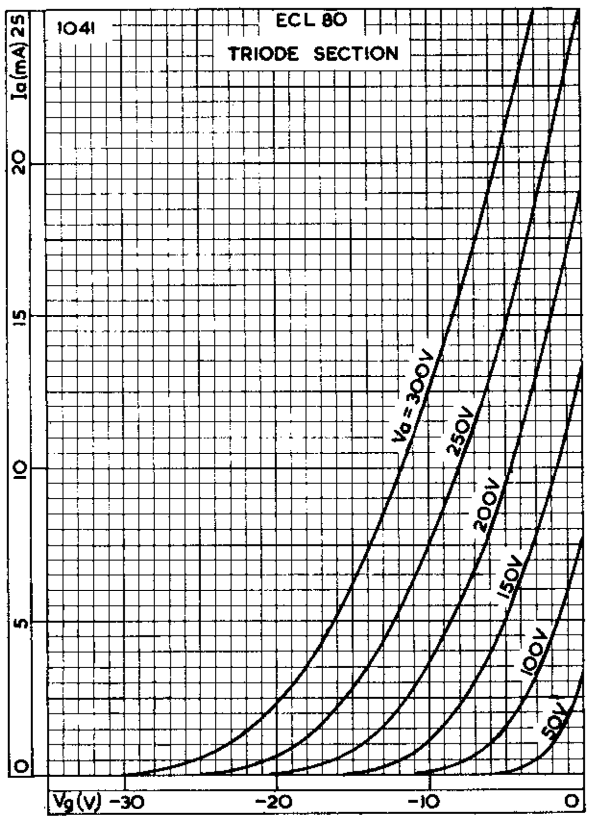


ANODE CURRENT, SCREEN-GRID CURRENT, INPUT VOLTAGE AND TOTAL DISTORTION PLOTTED AGAINST POWER OUTPUT, FOR SCREEN-GRID VOLTAGE OF 200V

ECL80

TRIODE PENTODE

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.

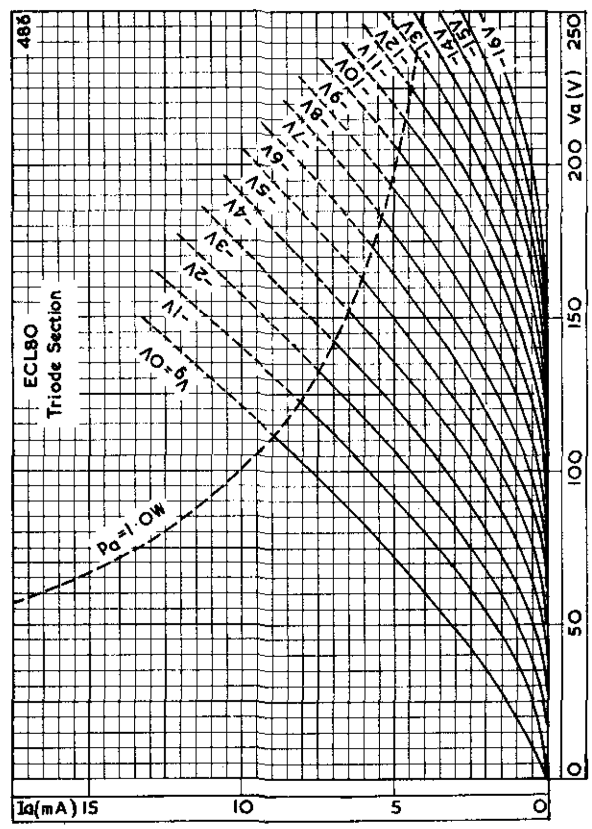


ANODE CURRENT OF TRIODE SECTION PLOTTED AGAINST GRID VOLTAGE, WITH ANODE VOLTAGE AS PARAMETER

TRIODE PENTODE

ECL80

Combined triode and output pentode primarily designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve. Other applications include the use of the triode as a line blocking oscillator, A.F. voltage amplifier or in multivibrator circuits and the operation of the pentode as an audio output valve or a synchronising pulse separator.



ANODE CURRENT OF TRIODE SECTION PLOTTED AGAINST ANODE VOLTAGE, WITH GRID VOLTAGE AS PARAMETER

TRIODE PENTODE

ECL82

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.

HEATER

V_h	6.3	V
I_h	780	mA

MOUNTING POSITION

Any

CAPACITANCES

c_{ap-at}	<0.25	pF
c_{ap-gt}	<0.02	pF
c_{g1p-at}	<0.02	pF
c_{g1p-gt}	<0.025	pF

Pentode section

c_{a-g1}	<0.3	pF
c_{in}	9.3	pF
c_{out}	8.0	pF
c_{g1-h}	<0.3	pF

Triode section

c_{a-g}	4.2	pF
c_{in}	2.7	pF
c_{out}	4.3	pF
c_{g-h}	<0.1	pF

CHARACTERISTICS

Pentode section

V_a	200	250	V
V_{g2}	200	250	V
I_a	35	28	mA
I_{g2}	7.0	5.7	mA
V_{g1}	−16	−22.5	V
g_m	6.4	5.0	mA/V
r_a	20	25	kΩ
μ_{g1-g2}	9.5	9.5	

Triode section

V_a	100	V
I_a	3.5	mA
V_g	0	V
g_m	2.5	mA/V
r_a	28	kΩ
μ	70	

ECL82

TRIODE PENTODE

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.

PENTODE SECTION AS FRAME OUTPUT VALVE

Circuit design

To allow for valve spread and deterioration during life the frame output circuit should be designed around the following values:

V_a	50	V
V_{g2}	170	V
$i_{a(pk)}$	85	mA

For an average new valve the following figures will apply

V_a	50	V
V_{g2}	170	V
$i_{a(pk)}$	135	mA

V_{g1} adjusted so that $I_{g1} = +0.3\mu A$

PENTODE SECTION AS AUDIO OUTPUT VALVE

Single valve class 'A'

V_a	200	250	V
$V_{g2(b)}$	200	250	V
*R_{g2}	0	2.2	kΩ
$I_{a(o)}$	35	28	mA
$I_{g2(o)}$	7.0	5.5	mA
I_{g2} (max. sig.)	16	10.5	mA
V_{g1}	−16	−22.5	V
R_k	390	680	Ω
$V_{in(r.m.s.)}$ (P_{out} = 50mW)	600	780	mV
R_a	5.6	9.0	kΩ
$V_{in(r.m.s.)}$	6.6	9.5	V
†P_{out}	3.5	3.4	W
D_{tot}	10	10	%

Two valves in class 'AB' push-pull

V_a	200	250	V
$V_{g2(b)}$	200	250	V
**R_{g2}	0	2.7	kΩ
$I_{a(o)}$	2×35	2×21.5	mA
I_a (max. sig.)	2×39.5	2×27.5	mA
$I_{g2(o)}$	2×7.0	2×4.2	mA
I_{g2} (max. sig.)	2×16.5	2×9.2	mA
††R_k	190	390	Ω
$V_{in(g1-g1)r.m.s.}$	25	38	V
R_{a-a}	6.0	10	kΩ
P_{out}	9.8	9.0	W
D_{tot}	4.0	5.0	%

*Undecoupled screen-grid resistor.

†P_{out} and D_{tot} are measured at fixed bias and therefore represent the power output available during the reproduction of speech and music.

**Common screen-grid resistor undecoupled.

††Common cathode bias resistor.

TRIODE PENTODE

ECL82

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.

TRIODE SECTION AS A.F. VOLTAGE AMPLIFIER

V_b (V)	R_a (kΩ)	I_a (mA)	R_k (kΩ)	R_g (MΩ)	Z_{source} (kΩ)	$\frac{V_{out}}{V_{in}}$	D_{tot} (%)	R_{g1}* (kΩ)
250	100	1.05	1.5	3.3	0	48	0.8	330
200	100	0.85	1.5	3.3	0	47	1.0	330
150	100	0.6	1.8	3.3	0	45	1.9	330
100	100	0.38	1.8	3.3	0	41	6.0	330
250	100	1.05	1.5	3.3	220	44	0.75	330
200	100	0.85	1.5	3.3	220	43	0.85	330
150	100	0.6	1.8	3.3	220	41	1.05	330
100	100	0.38	1.8	3.3	220	34	3.6	330
250	220	0.63	2.2	3.3	0	55.5	0.75	680
200	220	0.52	2.2	3.3	0	54.5	1.0	680
150	220	0.36	2.7	3.3	0	52	1.85	680
100	220	0.23	2.7	3.3	0	47	4.25	680
250	220	0.63	2.2	3.3	220	51.5	0.7	680
200	220	0.52	2.2	3.3	220	50	0.5	680
150	220	0.36	2.7	3.3	220	47	1.0	680
100	220	0.23	2.7	3.3	220	38	3.75	680
250	100	1.4	0	22	0	50	0.5	330
200	100	1.05	0	22	0	48.5	0.7	330
150	100	0.7	0	22	0	46	1.55	330
100	100	0.37	0	22	0	44	8.0	330
250	100	1.4	0	22	220	46	2.2	330
200	100	1.05	0	22	220	44	2.1	330
150	100	0.7	0	22	220	42.5	1.6	330
100	100	0.37	0	22	220	37	5.9	330
250	220	0.78	0	22	0	58	0.5	680
200	220	0.59	0	22	0	56	0.8	680
150	220	0.4	0	22	0	53	1.7	680
100	220	0.21	0	22	0	46	5.6	680
250	220	0.78	0	22	220	52.5	2.2	680
200	220	0.59	0	22	220	51	2.0	680
150	220	0.4	0	22	220	48.5	1.4	680
100	220	0.21	0	22	220	42	3.1	680

*Grid resistor of following valve

$\frac{V_{out}}{V_{in}}$ measured with an input voltage of 100mV

D_{tot} measured for $V_{out} = 10V$

MICROPHONY AND HUM

The triode section can be used without special precautions against microphony and hum in circuits in which the input voltage is >10mV(r.m.s.) for an output of 50mW from the output stage.

ECL82

TRIODE PENTODE

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.

LIMITING VALUES

Pentode section

$V_{a(b)}$ max.	550	V
V_a max.	300	V
‡$+v_{a(pk)}$ max.	2.5	kV
‡$-v_{a(pk)}$ max.	500	V
p_a max. (frame output)	5.0	W
p_a max. (audio applications)	7.0	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	300	V
p_{g2} max.	1.8	W
p_{g2} max. (speech and music)	3.2	W
I_k max.	50	mA
R_{g1-k} max. (fixed bias)	1.0	MΩ
R_{g1-k} max. (cathode bias)	2.0	MΩ
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ

Triode section

$V_{a(b)}$ max.	550	V
V_a max.	300	V
‡$+v_{a(pk)}$ max.	600	V
p_a max.	1.0	W
I_k max.	15	mA
*$i_{k(pk)}$ max.	200	mA
R_{g-k} max. (fixed bias)	1.0	MΩ
R_{g-k} max. (cathode bias)	3.0	MΩ
R_{g-k} max. (grid current biasing)	22	MΩ
Z_{g-k} max. (f = 50c/s)	500	kΩ
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ

*Maximum pulse duration 200μs

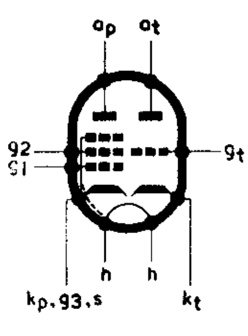
‡Maximum pulse duration 4% of one cycle with a maximum of 800μs

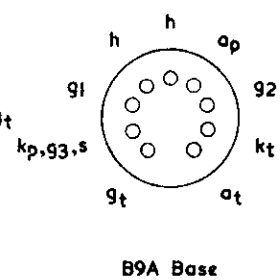
TRIODE PENTODE

ECL82

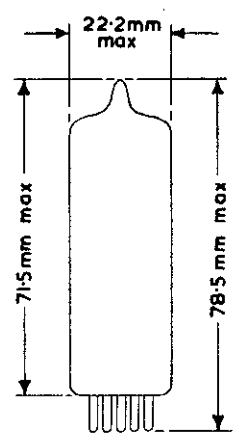
Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.

2324





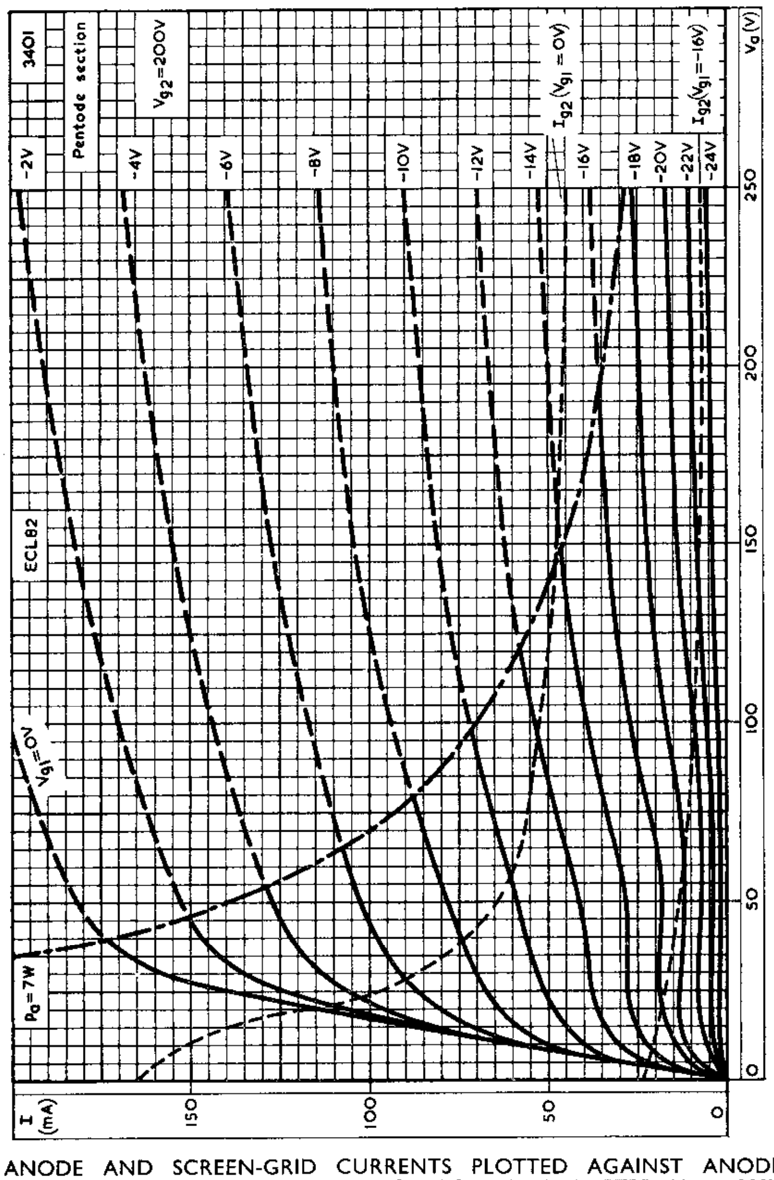
B9A Base



ECL82

TRIODE PENTODE

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.

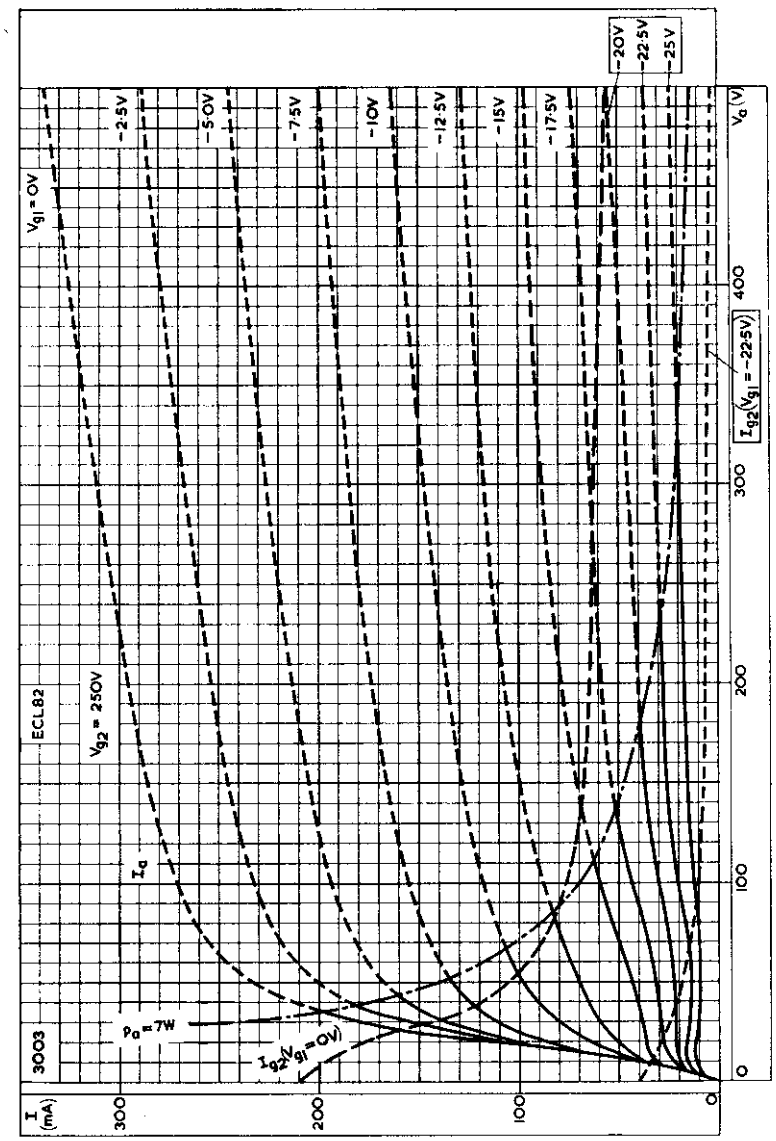


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 200V$

TRIODE PENTODE

ECL82

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.

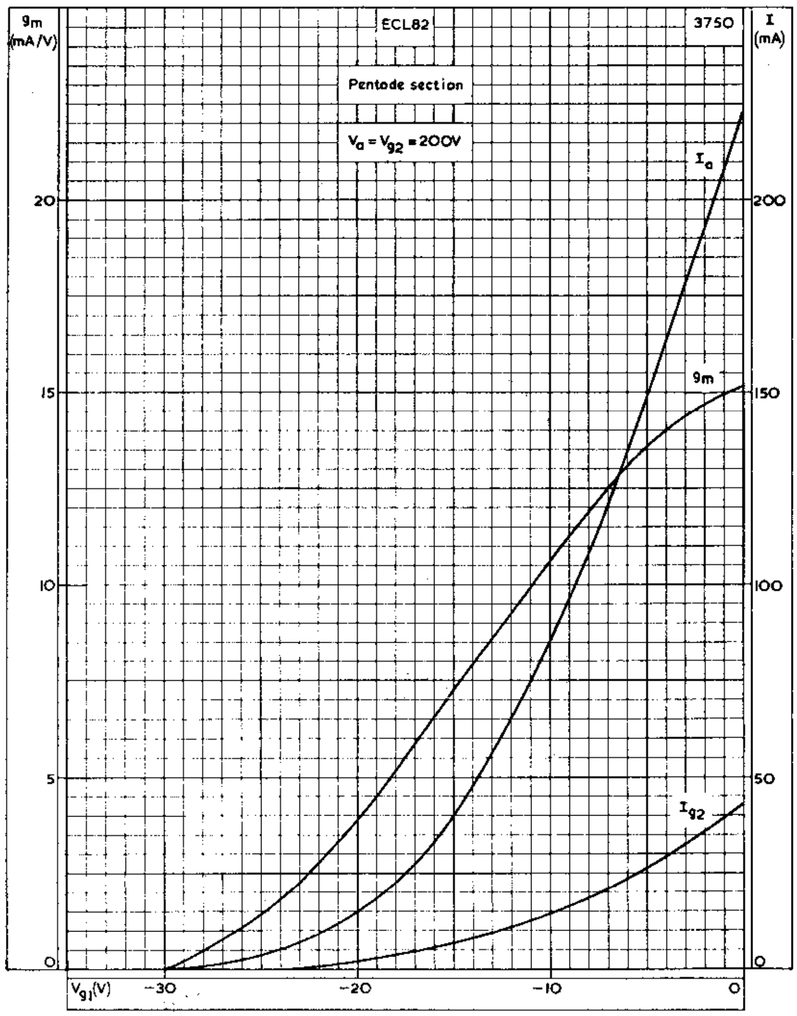


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 250V

ECL82

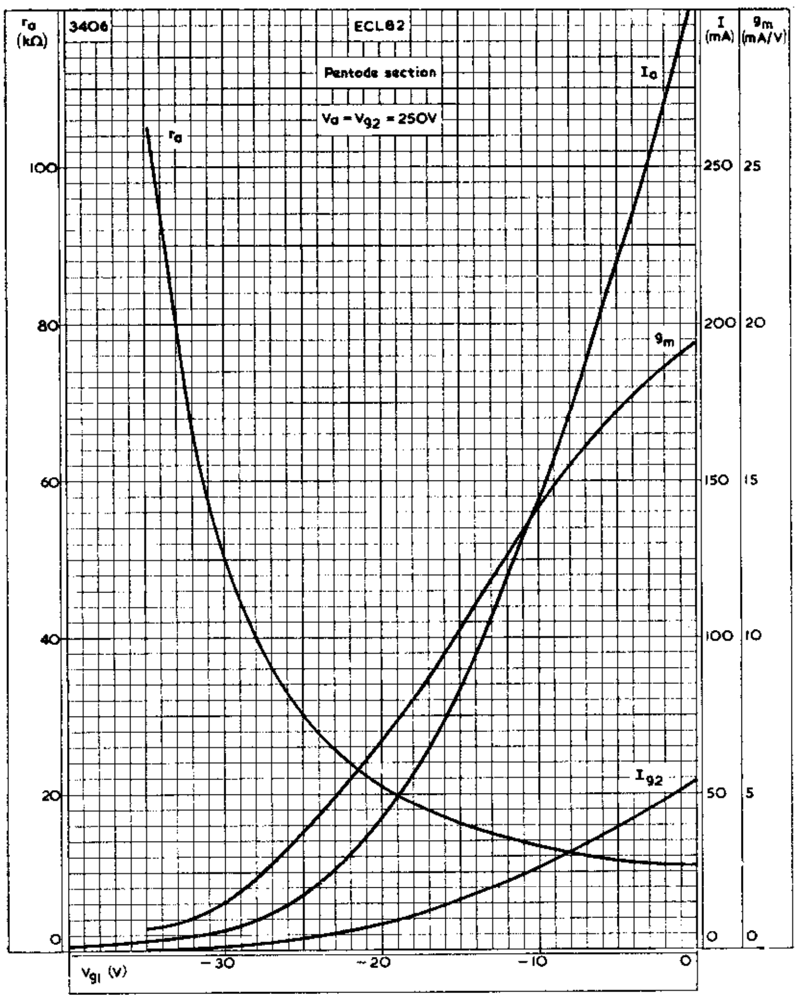
TRIODE PENTODE

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.



ANODE AND SCREEN-GRID CURRENTS AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE. $V_a = V_{g2} = 200V$

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.

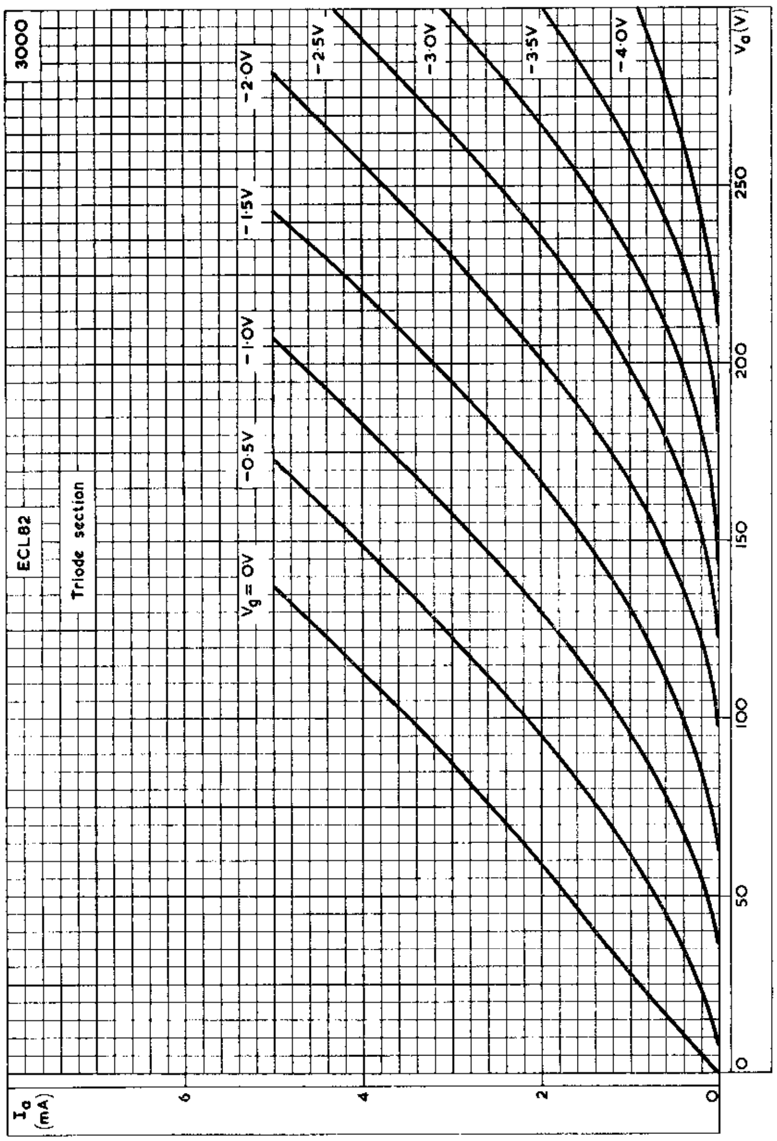


ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
$V_a = V_{g2} = 250V$

ECL82

TRIODE PENTODE

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.

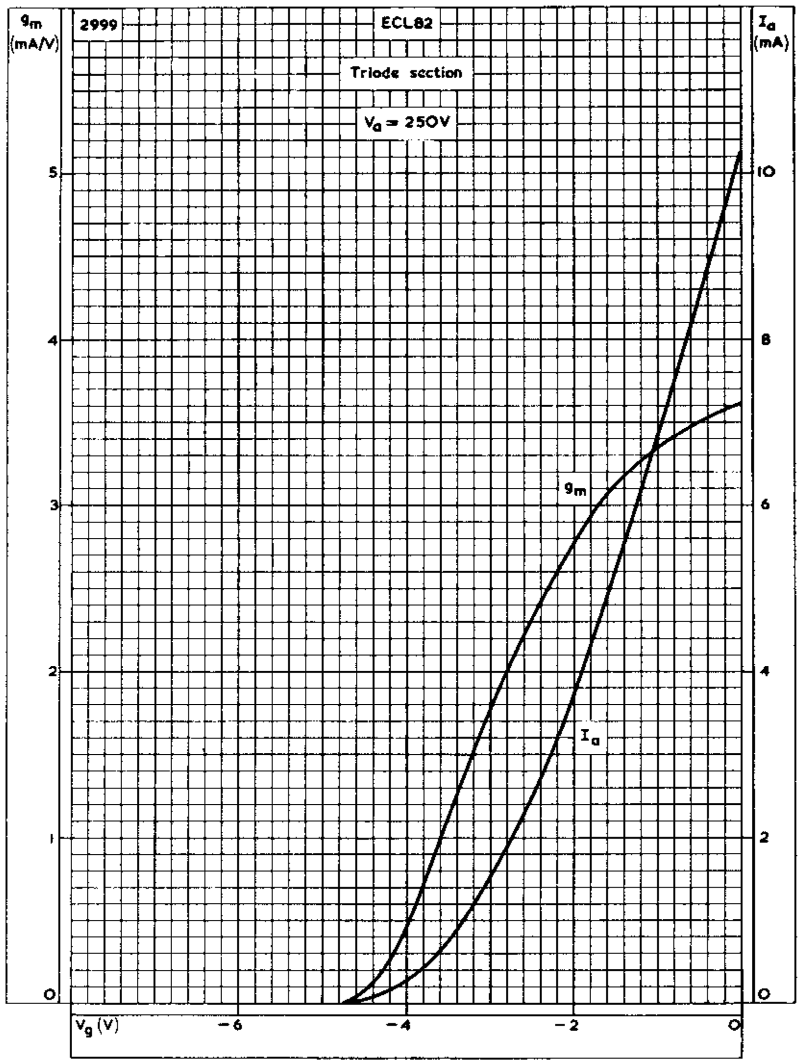


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER FOR TRIODE SECTION

TRIODE PENTODE

ECL82

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.

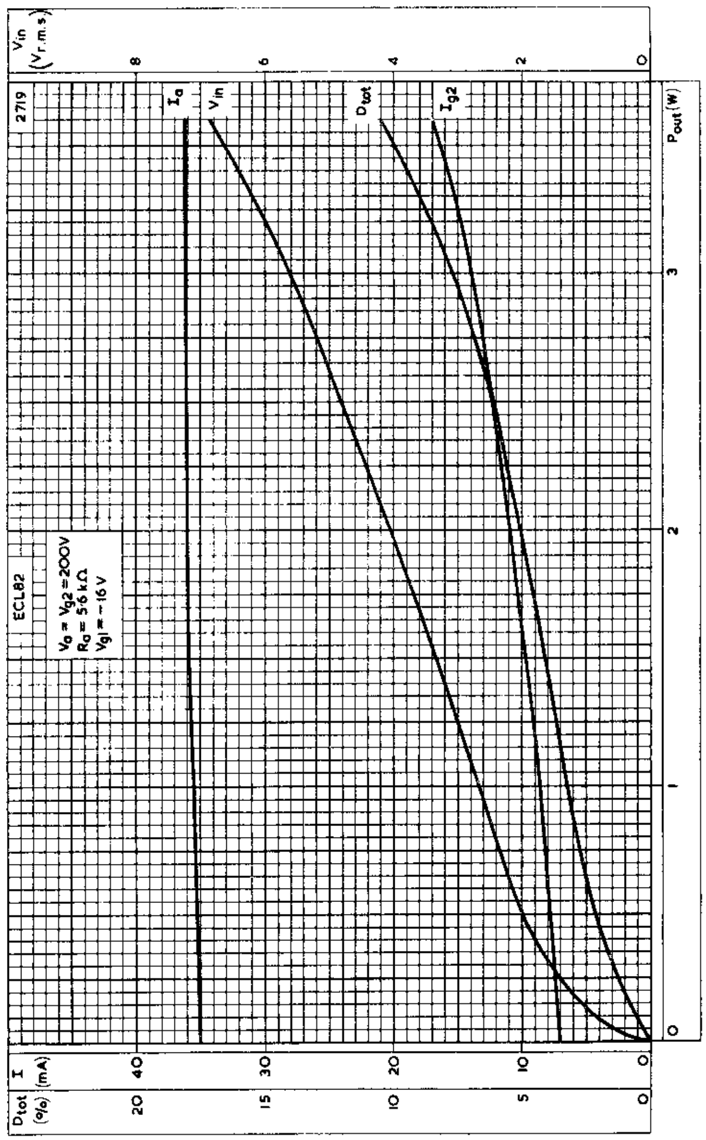


ANODE CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST GRID VOLTAGE FOR TRIODE SECTION. $V_a = 250V$

ECL82

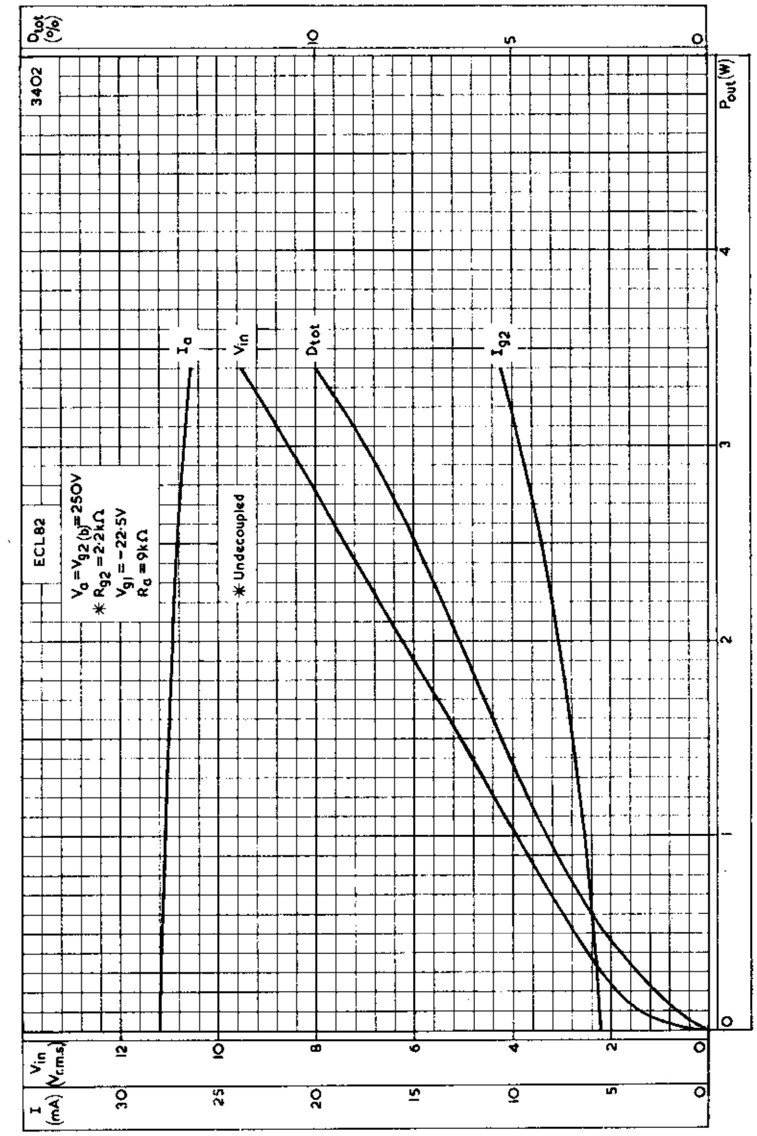
TRIODE PENTODE

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.



PERFORMANCE OF SINGLE ECL82 CLASS 'A' AMPLIFIER. $V_a = V_{g2} = 200V$

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.

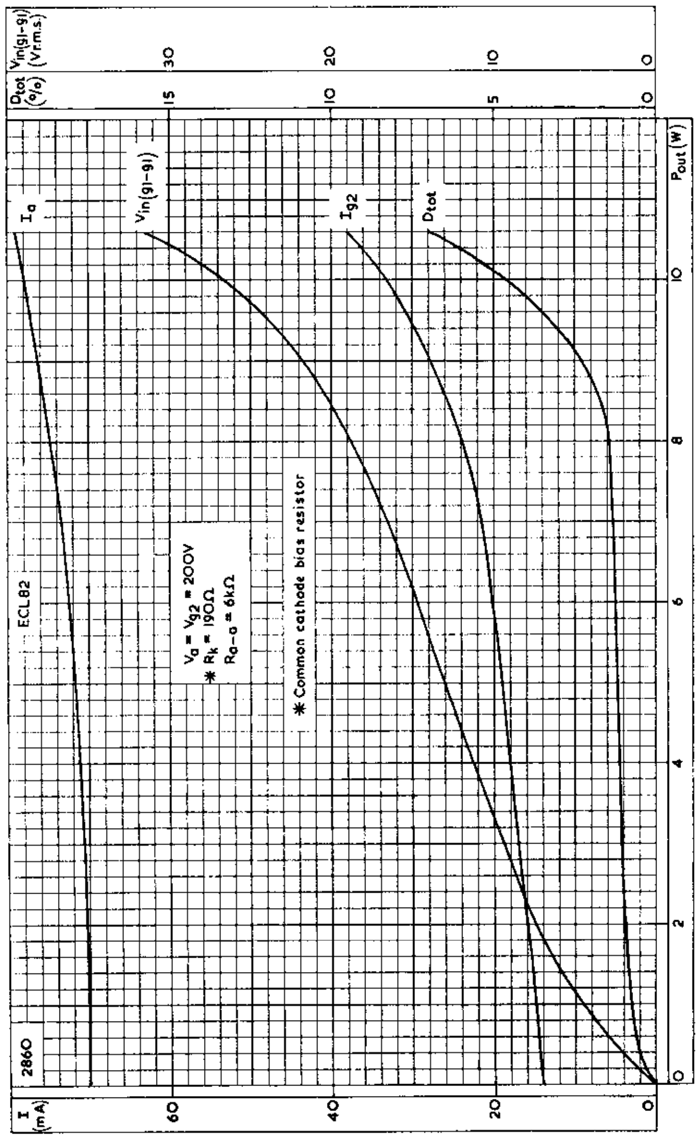


PERFORMANCE OF SINGLE ECL82 CLASS 'A' AMPLIFIER. $V_a = V_{g2(b)} = 250V$

ECL82

TRIODE PENTODE

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.

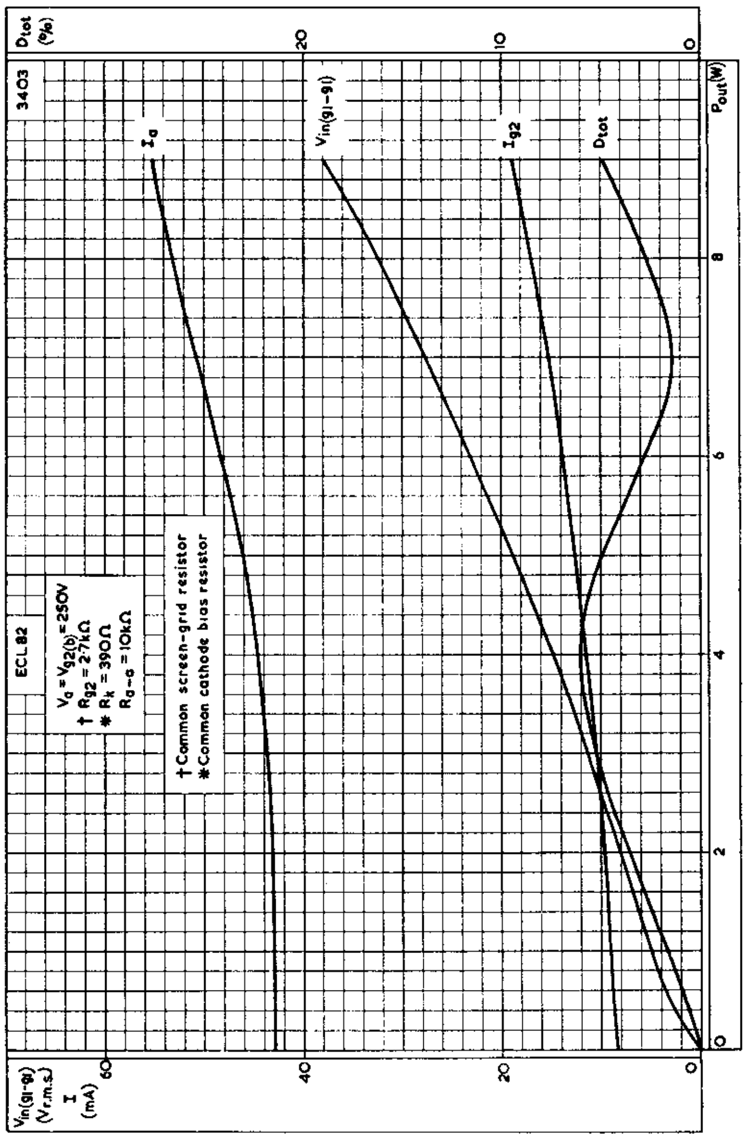


PERFORMANCE OF ECL82 IN PUSH-PULL. $V_a = V_{g2} = 200V$

TRIODE PENTODE

ECL82

Combined triode and output pentode with separate cathodes intended for use as a combined a.f. amplifier and output valve or frame oscillator and output valve.



PERFORMANCE OF ECL82 IN PUSH-PULL. $V_a = V_{g2(b)} = 250V$

Combined high-μ triode and output pentode for use in audio amplifier circuits.

HEATER

Vh	6.3	V
Ih	660	mA

CAPACITANCES

cap - gt	< 6.0	mpF
cat - g1	< 200	mpF
cgt - g1	< 20	mpF
cat - ap	< 150	mpF

Pentode section

cin	10	pF
ca - g1	< 400	mpF
cg1 - h	< 240	mpF

Triode section

cin	2.3	pF
cout	2.5	pF
ca - g	1.4	pF
cg - h	< 6.0	mpF

CHARACTERISTICS

Pentode section

Va	250	V
Vg2	250	V
Vg1	- 7.0	V
Ia	36	mA
Ig2	6.0	mA
gm	10	mA/V
ra	48	kΩ
μg1 - g2	21	
- Vg1 max. (Ig1 = + 0.3 μA)	1.3	V

Triode section

Va	250	V
Vg	- 1.9	V
Ia	1.2	mA
gm	1.6	mA/V
μ	100	
ra	62	kΩ
- Vg1 max. (Ig1 = +0.3 μA)	1.3	V

OPERATING CONDITIONS AS SINGLE VALVE AMPLIFIER

Pentode section

Va	250	250	V
Vg2	250	250	V
Rk	270	170	Ω
Ia	27	37	mA
Ig2	8.2	10	mA
Ra	10	7.0	kΩ
Pout	2.8	4.0	W
Vin (r.m.s.)	2.7	3.2	V
Dtot	10	10	%
Vin (r.m.s.) (Pout = 50 mW)	280	300	%

OPERATING CONDITIONS FOR TWO VALVES IN PUSH-PULL

Cathode bias

Va (b)	250	300	V
Vg2 (b)	250	300	V
Rk (per valve)	180	260	Ω
Ra - a	8.2	9.1	kΩ
Ia (o)	2 x 32.5	2 x 31	mA
Ia (max. sig.)	2 x 35.5	2 x 37	mA
Ig2 (o)	2 x 5.6	2 x 5.5	mA
Ig2 (max. sig.)	2 x 8.9	2 x 10.6	mA
Vin (g1 - g1) r.m.s.	11.0	16.8	V
Pout	10	13.6	W
Dtot	5.0	4.0	%
Vin (r.m.s.) (Pout = 50 mW)	480	520	mV

OPERATING CONDITIONS FOR TRIODE SECTION AS RESISTANCE COUPLED A.F. AMPLIFIER

Cathode bias

Vb	300	250	250	200	V
Ra	220	220	220	220	kΩ
Ia	0.8	0.6	0.6	0.42	mA
Rk	1.2	1.75	1.75	2.6	kΩ
$\frac{Vout}{Vin}$	80	75	70	66	
Vout (r.m.s.)	9.0	5.0	3.2	3.2	V
Dtot	0.4	0.4	0.4	0.6	%
* Rg	10	10	0.68	0.68	MΩ

* Grid resistor of following valve.

At lower values of Vb, grid current bias should be used.

Grid current bias (Rg = 10 MΩ)

Zs = 47 kΩ

Vb (V)	Ra (kΩ)	Rg* (MΩ)	Ia (mA)	Dtot (%)	$\frac{Vout}{Vin}$	Vout(r.m.s.) (V)
300	220	10	0.8	0.4	80	9
250	220	10	0.6	0.4	75	5
250	220	0.68	0.6	0.4	70	3.2
200	220	0.68	0.42	0.6	66	3.2

* Grid resistor of following valve.

LIMITING VALUES

Pentode section

Va (b) max.	550	V
Va max.	300	V
pa max.	9.0	W
Vg2 (b) max.	550	V
Vg2 max.	300	V
pg2 max.	1.8	W
Ik max.	55	mA
Rg1 - k max.	0.5	MΩ
Vh - k max.	100	V

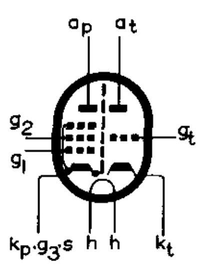
Triode section

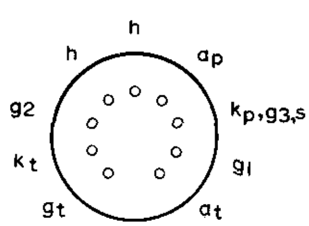
Va (b) max.	550	V
Va max.	300	V
pa max.	500	mW
Ik max.	4.0	mA
Rg - k max.	1.0	MΩ
Vh - k max.	100	V

OPERATING NOTES

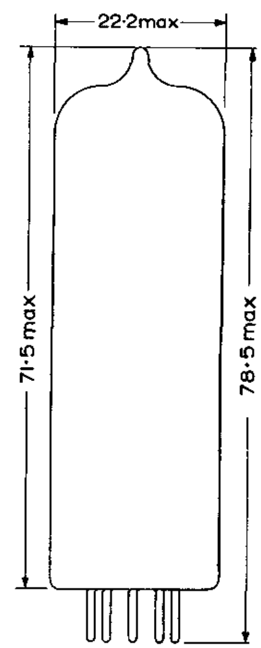
1. Microphony

This valve may be used without special precautions against microphony in equipment where the input voltage is not less than 4 mV for an output of 50 mW.



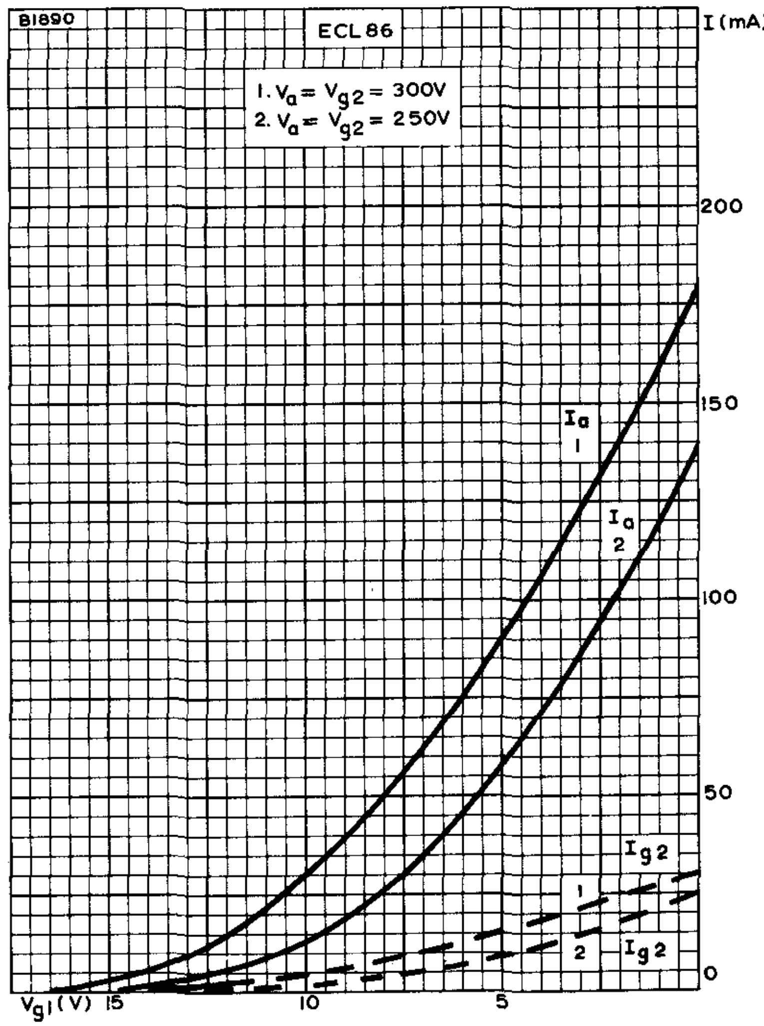


B9A Base

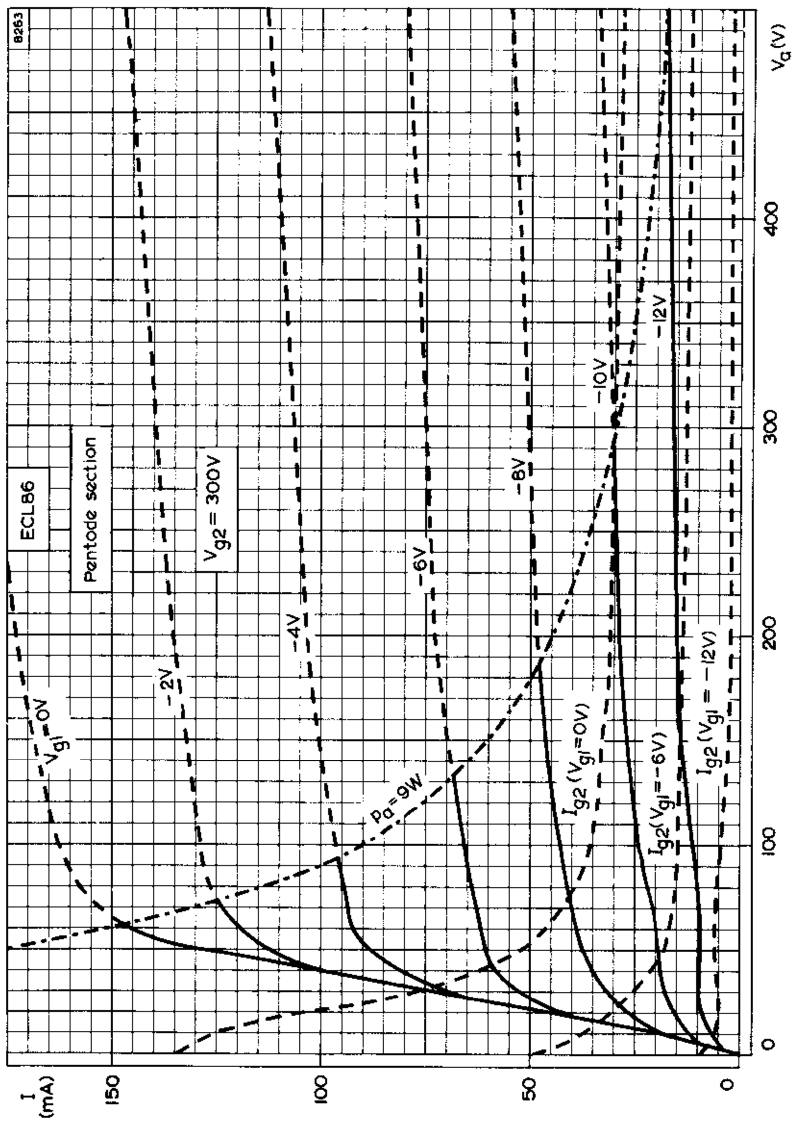


All dimensions in mm

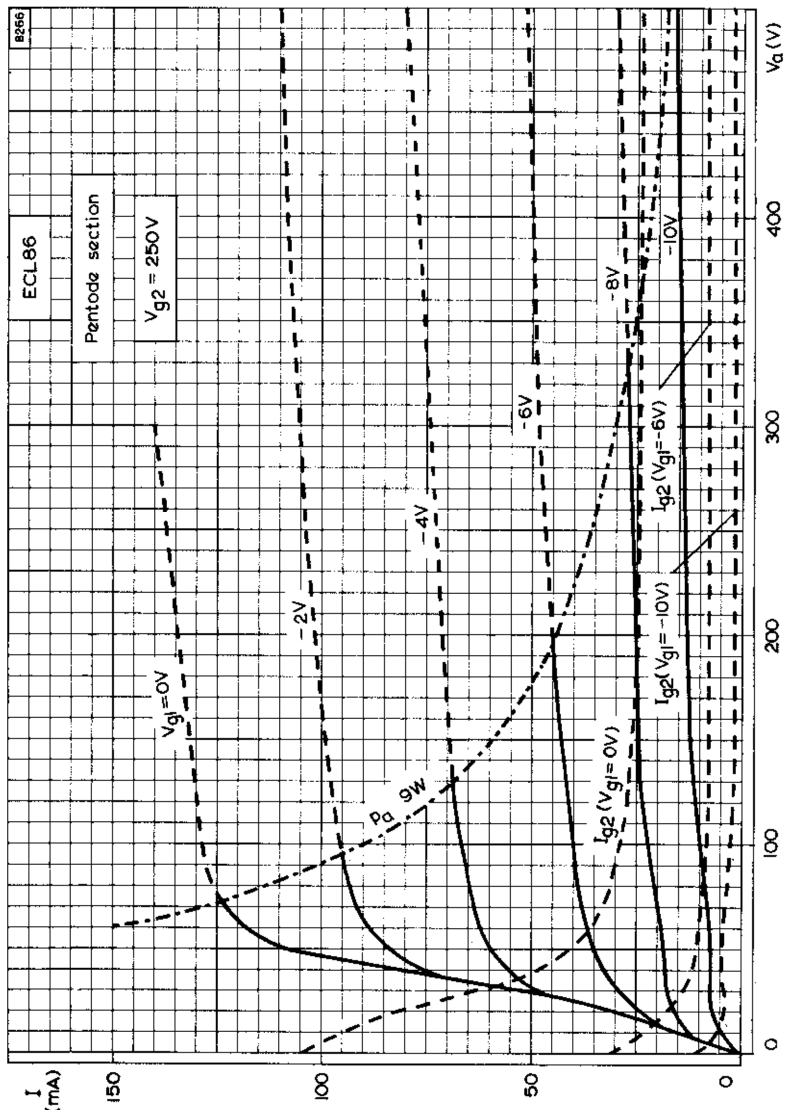
7471



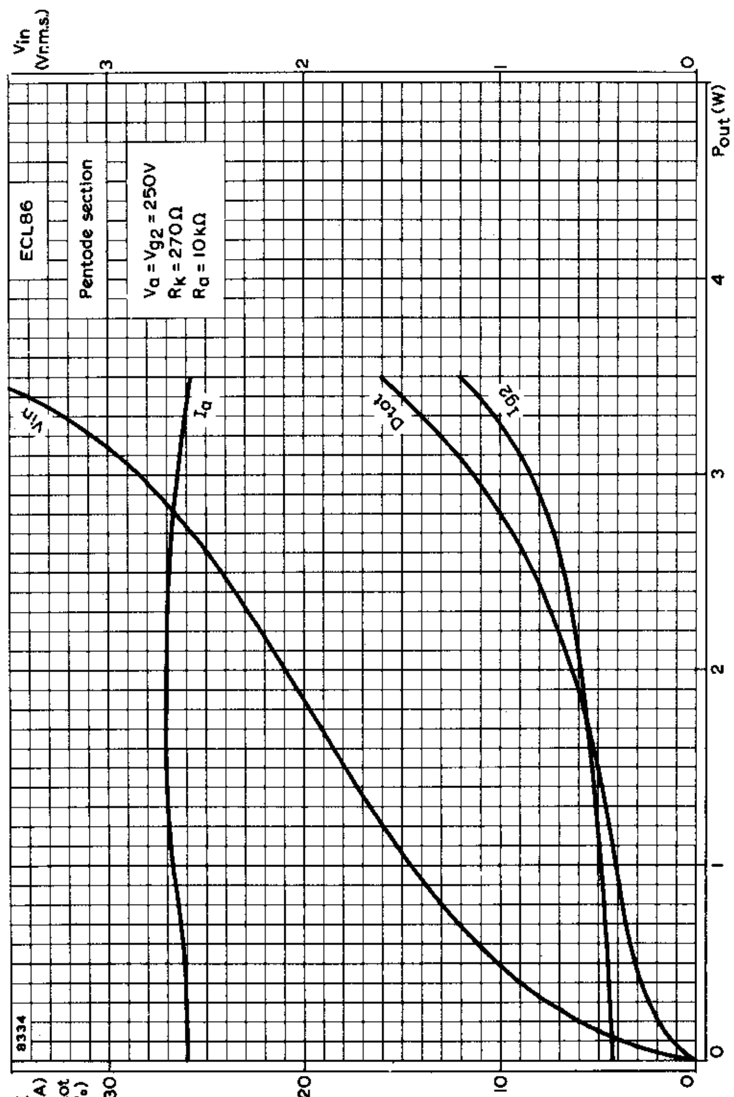
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST CONTROL-GRID VOLTAGE. PENTODE SECTION.



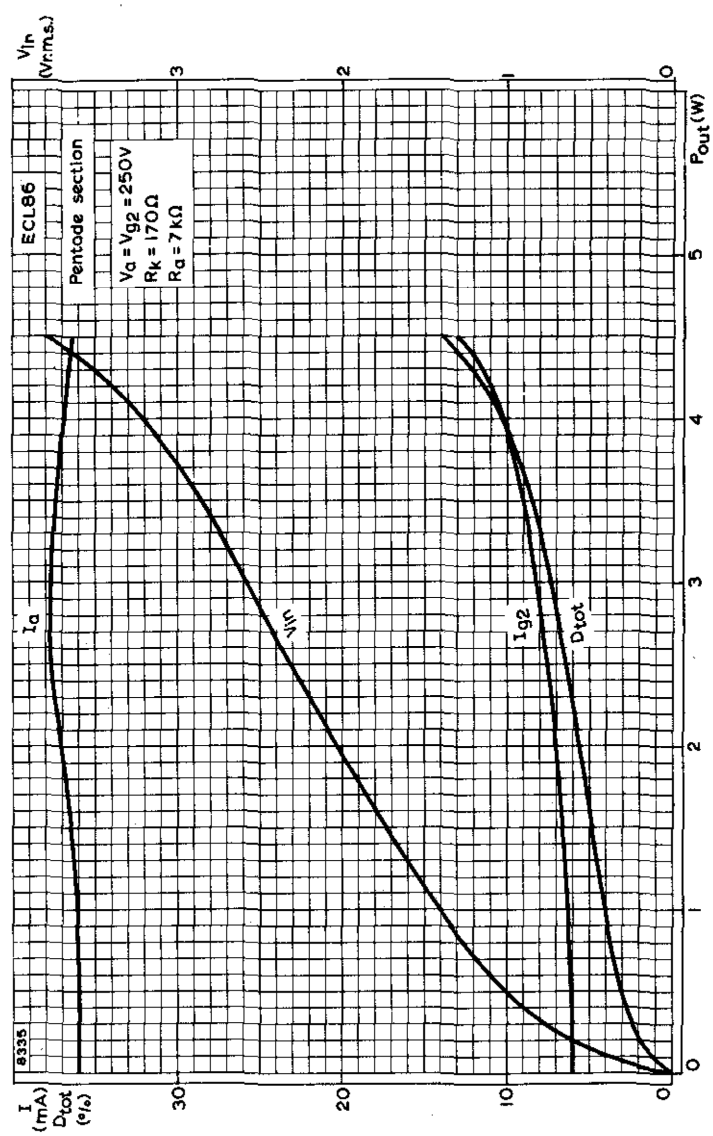
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE, WITH CONTROL-GRID VOLTAGE AS PARAMETER. PENTODE SECTION Vg2 = 300V.



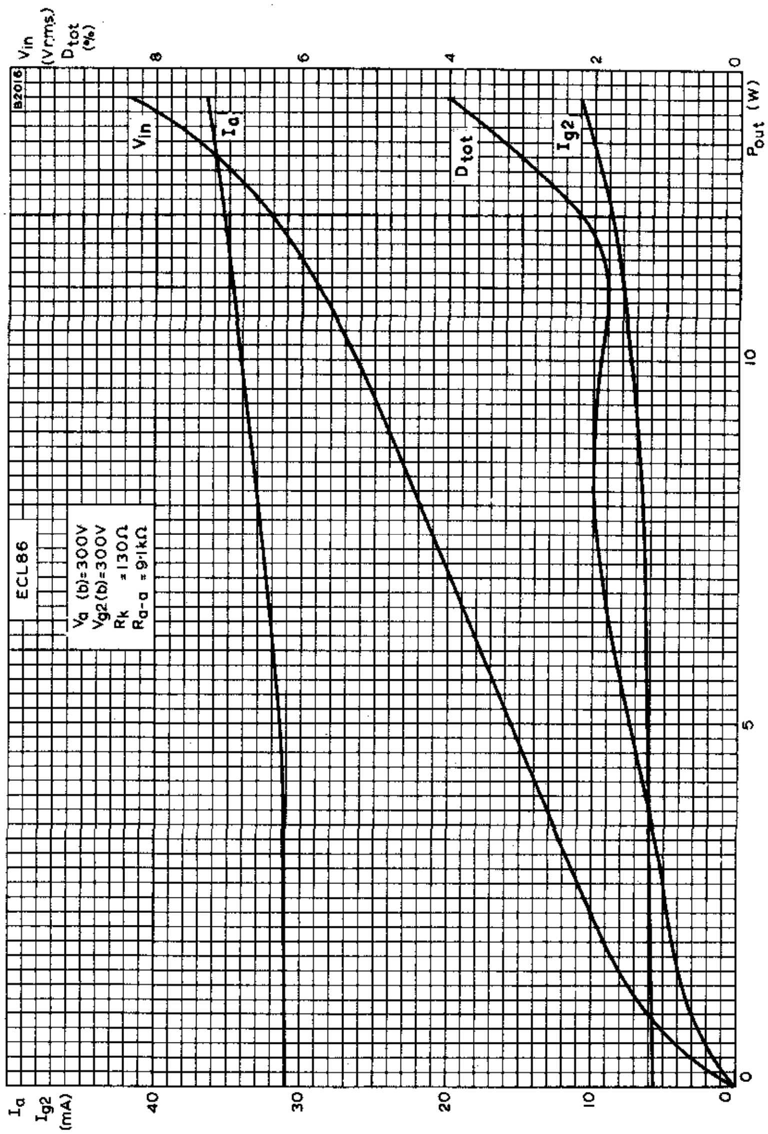
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE, WITH CONTROL-GRID VOLTAGE AS PARAMETER. PENTODE SECTION Vg2 = 250V.



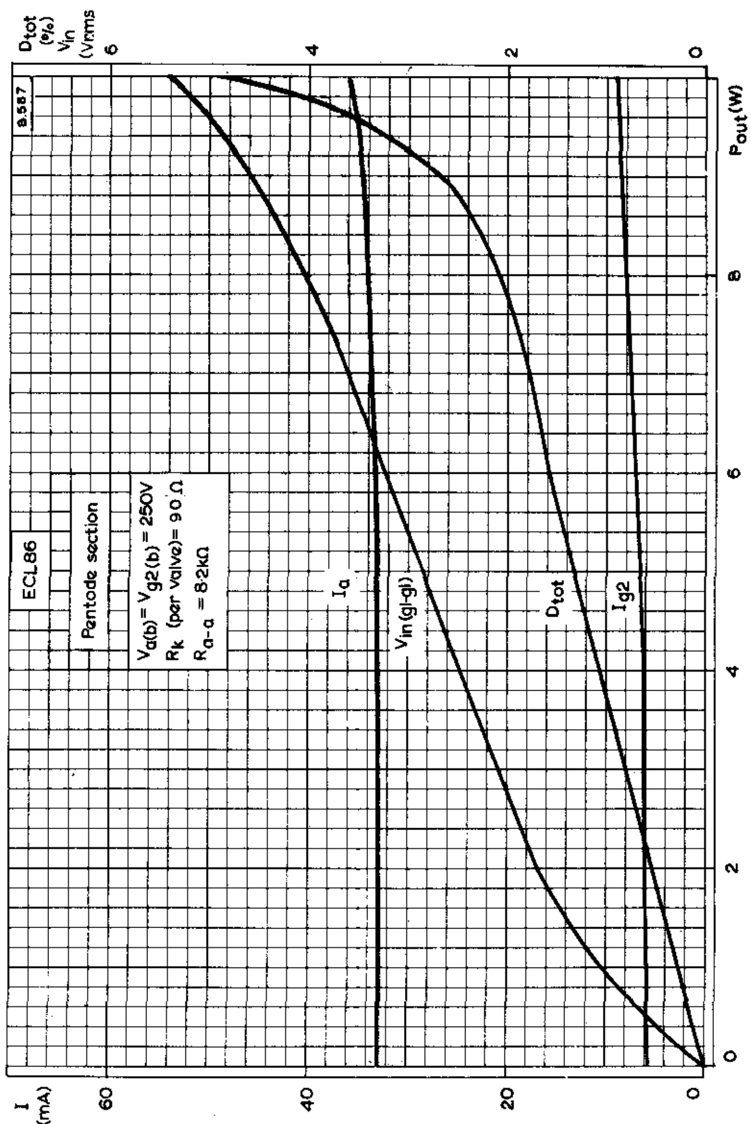
PERFORMANCE OF ECL86 AS SINGLE VALVE AMPLIFIER.
PENTODE SECTION Va = Vg2 = 250V, Rk = 270Ω.



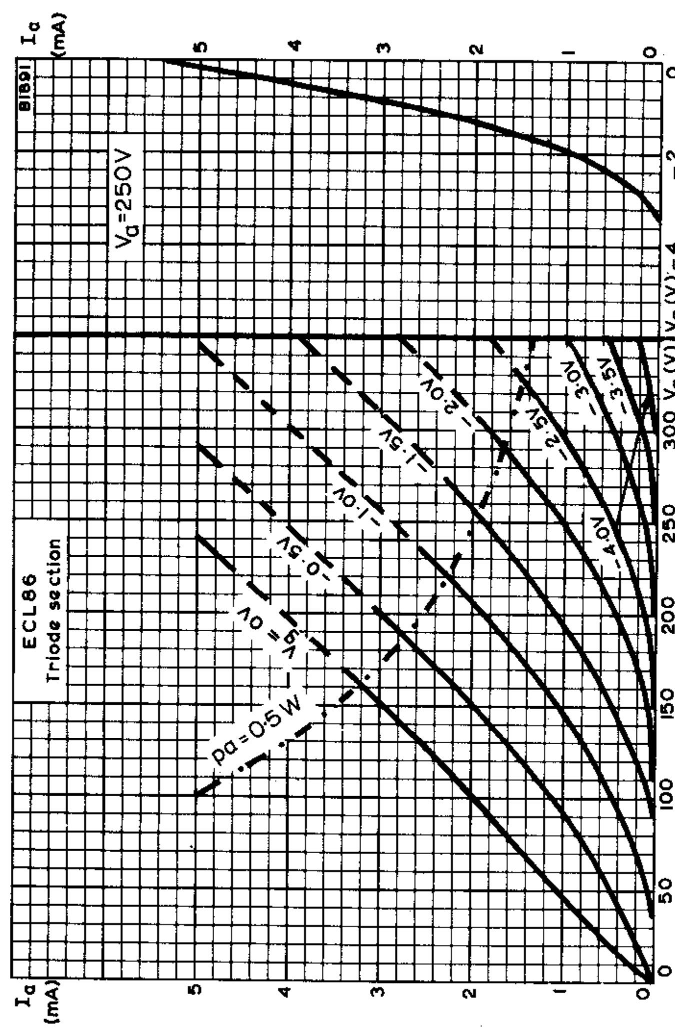
PERFORMANCE OF ECL86 AS SINGLE VALVE AMPLIFIER.
PENTODE SECTION Va = Vg2 = 250V, Rk = 170Ω.



PERFORMANCE OF ECL86 IN PUSH-PULL
PENTODE SECTION Va(b) = Vg2(b) = 300V



PERFORMANCE OF ECL86 IN PUSH-PULL
PENTODE SECTION Va(b) = Vg2(b) = 250V



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL GRID VOLTAGE AS PARAMETER.

ANODE CURRENT PLOTTED AGAINST CONTROL GRID VOLTAGE. Va = 250V

TRIODE SECTION

R.F. PENTODE

EF80

High slope r.f. pentode primarily intended for r.f. or i.f. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.

HEATER

Suitable for series or parallel operation a.c. or d.c.

V_h	6.3	V
I_h	300	mA

CAPACITANCES

$c_{in(g1)}$	7.5	pF
$c_{in(g2)}$	5.4	pF←
c_{out}	3.3	pF
c_{a-g1}	<0.007	pF
c_{g2-g1}	2.6	pF←
c_{a-k}	<0.01	pF
c_{g1-h}	<0.15	pF

CHARACTERISTICS

V_a	170	V
V_{g2}	170	V
V_{g3}	0	V
I_a	10	mA
I_{g2}	2.5	mA
V_{g1}	-2.0	V
g_m	7.4	mA/V
r_a	400	kΩ
μ_{g1-g2}	50	
R_{eq}	1.0	kΩ
Input damping (at 50 Mc/s.)	10	kΩ←

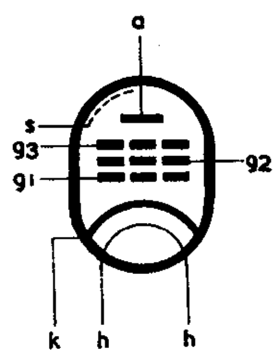
LIMITING VALUES

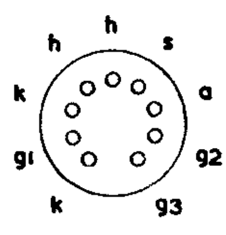
$V_{a(b)}$ max.	550	V
V_a max.	300	V←
p_a max.	2.5	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	300	V←
p_{g2} max.	0.7	W←
I_k max.	15	mA
V_{g1} max. ($I_{g1}=+0.3\ \mu A$)	-1.3	V
R_{g1-k} max. (self bias)	1.0	MΩ
R_{g1-k} max. (fixed bias)	500	kΩ
V_{h-k} max.	150	V
R_{h-k} max.	20	kΩ

EF80

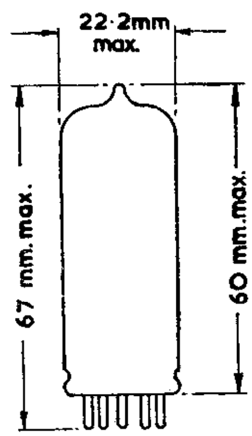
R.F. PENTODE

High slope r.f. pentode primarily intended for r.f. or i.f. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.





B9A (Noval)
BASE

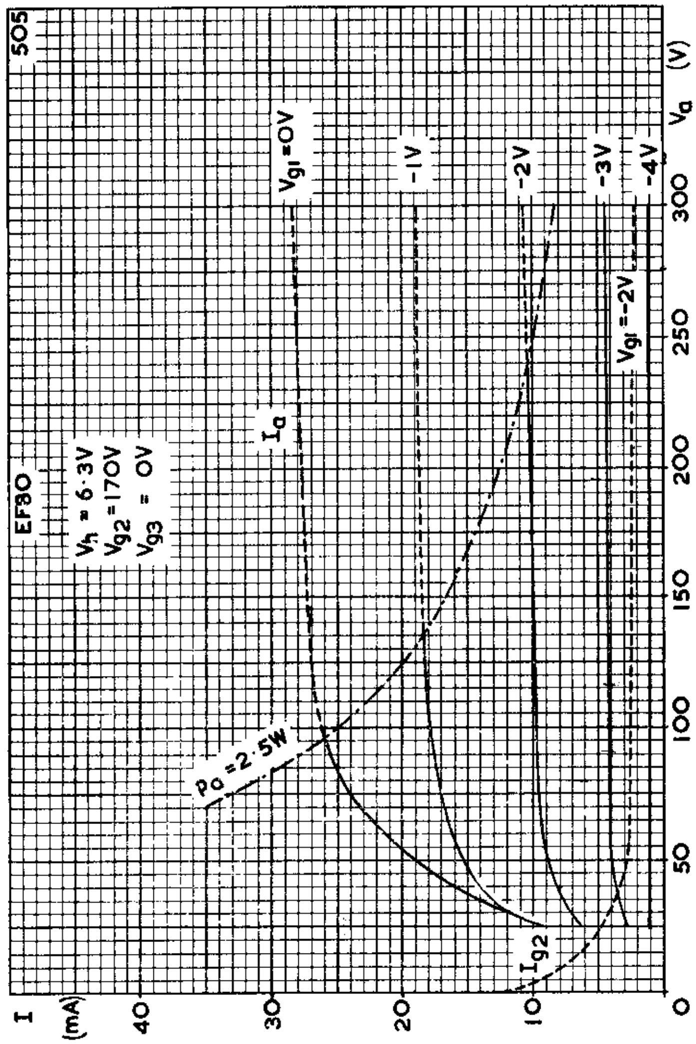


478

R.F. PENTODE

EF80

High slope r.f. pentode primarily intended for r.f. or i.f. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.

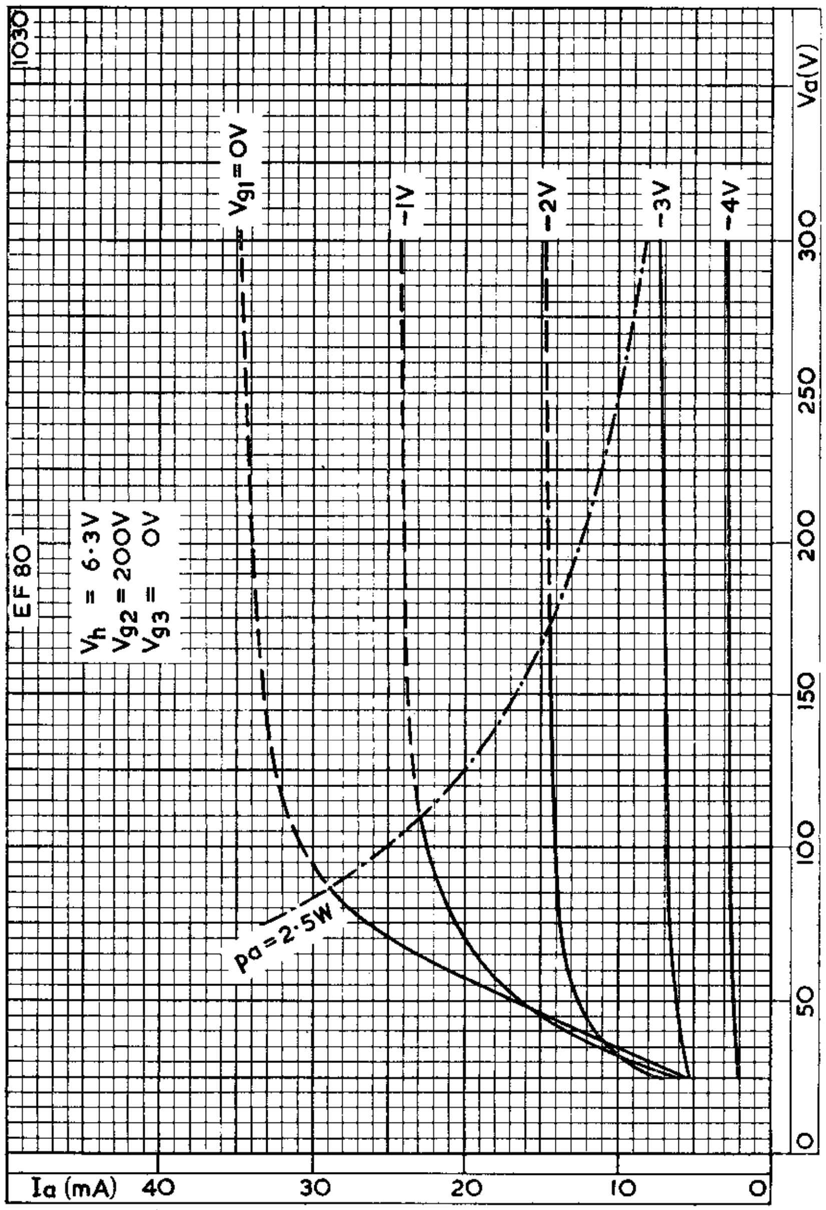


ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE, WITH SCREEN-GRID VOLTAGE AT 170V

EF80

R.F. PENTODE

High slope r.f. pentode primarily intended for r.f. or i.f. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.

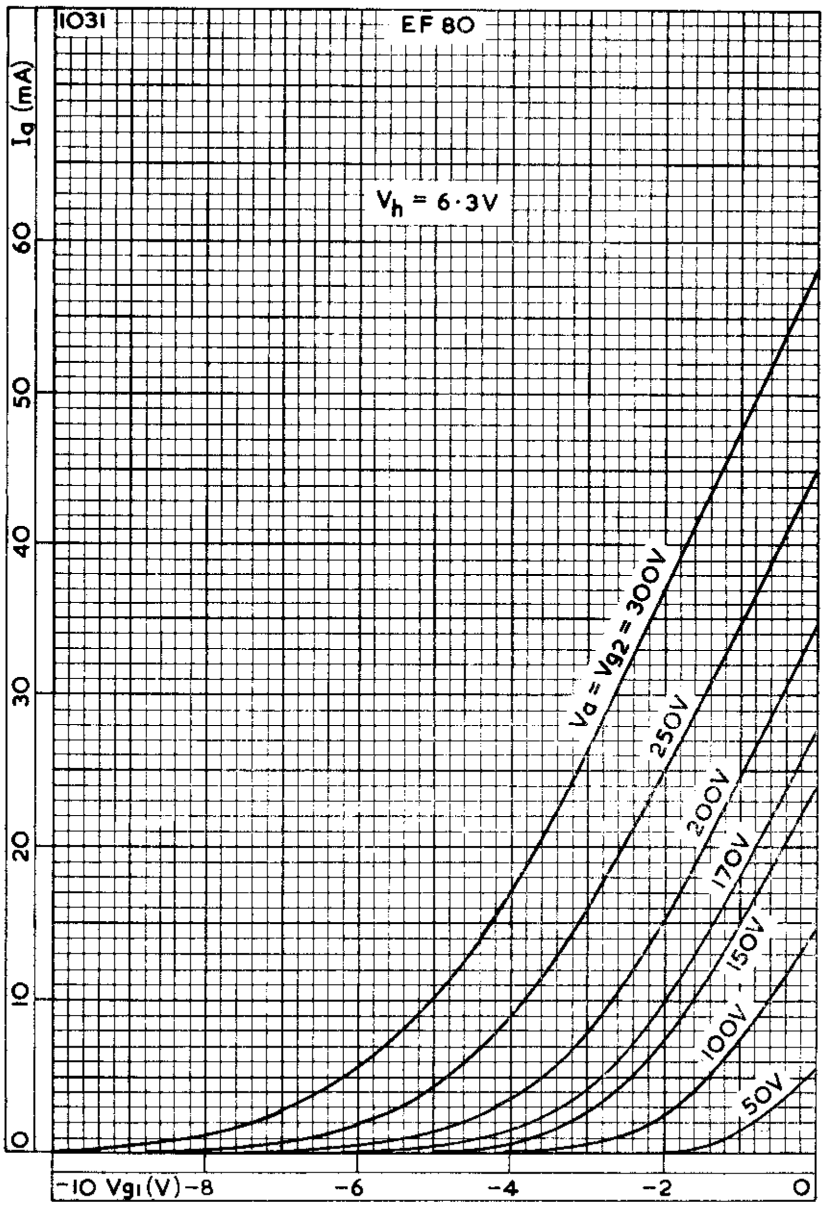


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH SCREEN-GRID VOLTAGE AT 200V

R.F. PENTODE

EF80

High slope r.f. pentode primarily intended for r.f. or i.f. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.

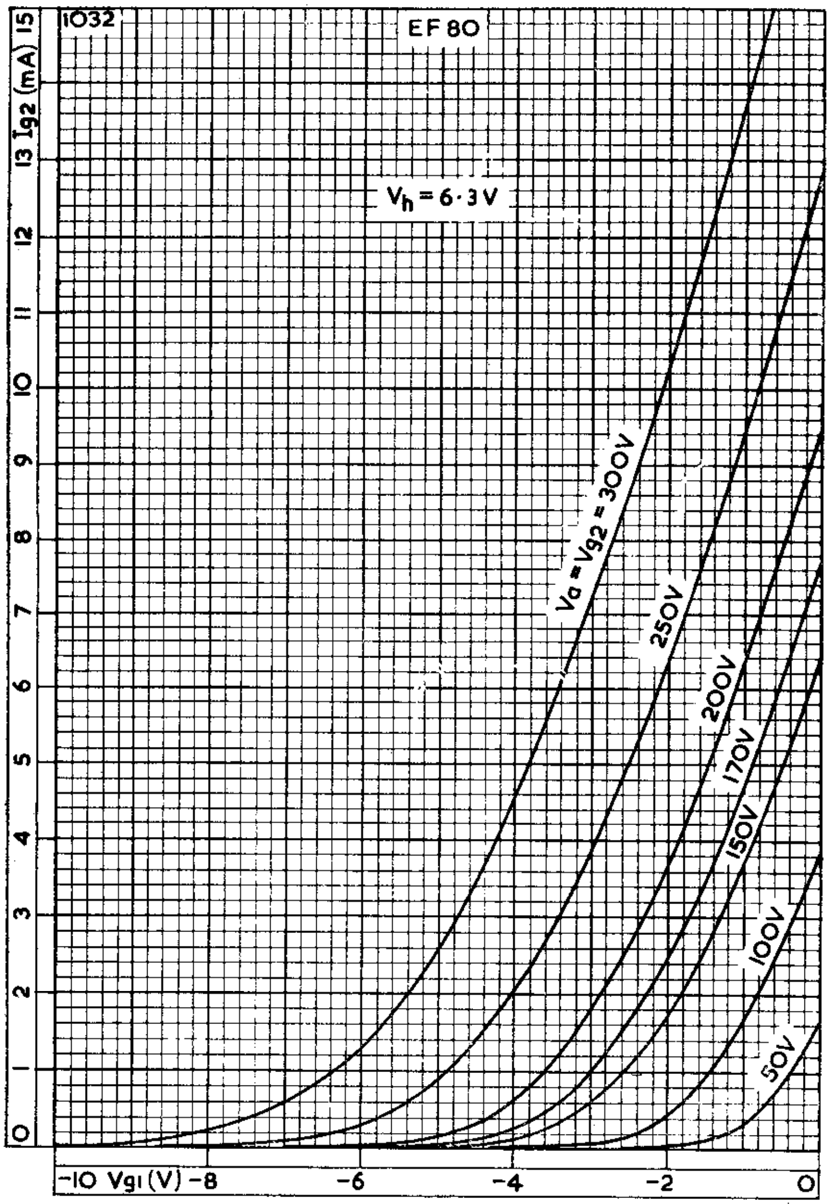


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR ANODE AND SCREEN-GRID VOLTAGES BETWEEN 50 V AND 300 V

EF80

R.F. PENTODE

High slope r.f. pentode primarily intended for r.f. or i.f. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.

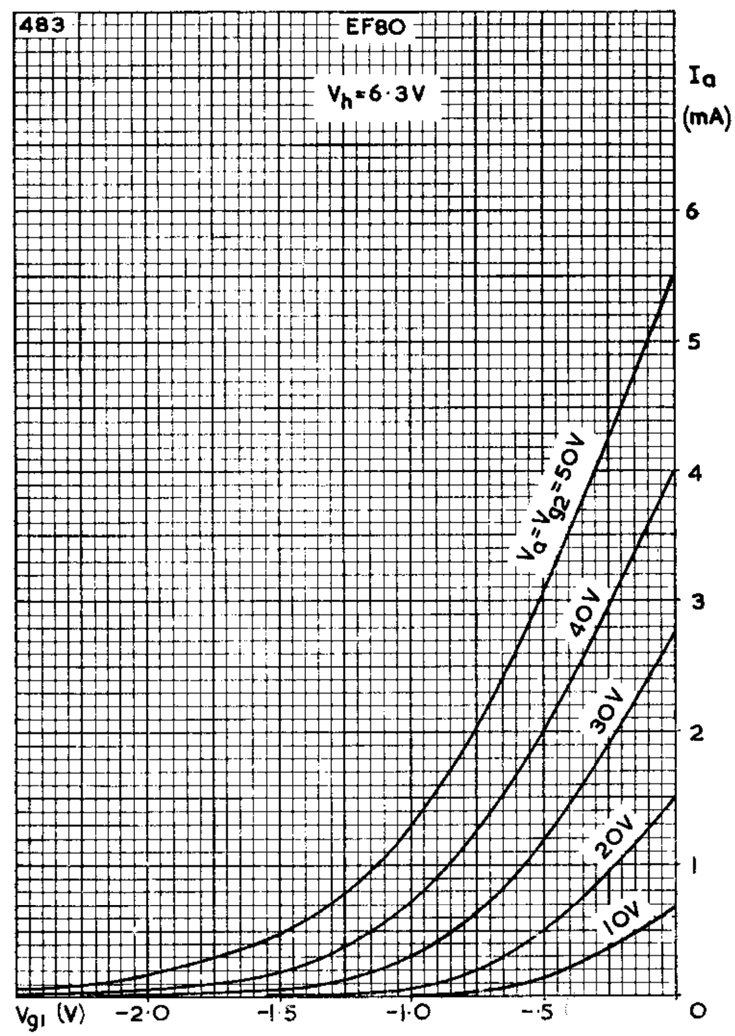


SCREEN-GRID CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR ANODE AND SCREEN-GRID VOLTAGES BETWEEN 50 V AND 300 V

R.F. PENTODE

EF80

High slope r.f. pentode primarily intended for r.f. or i.f. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.

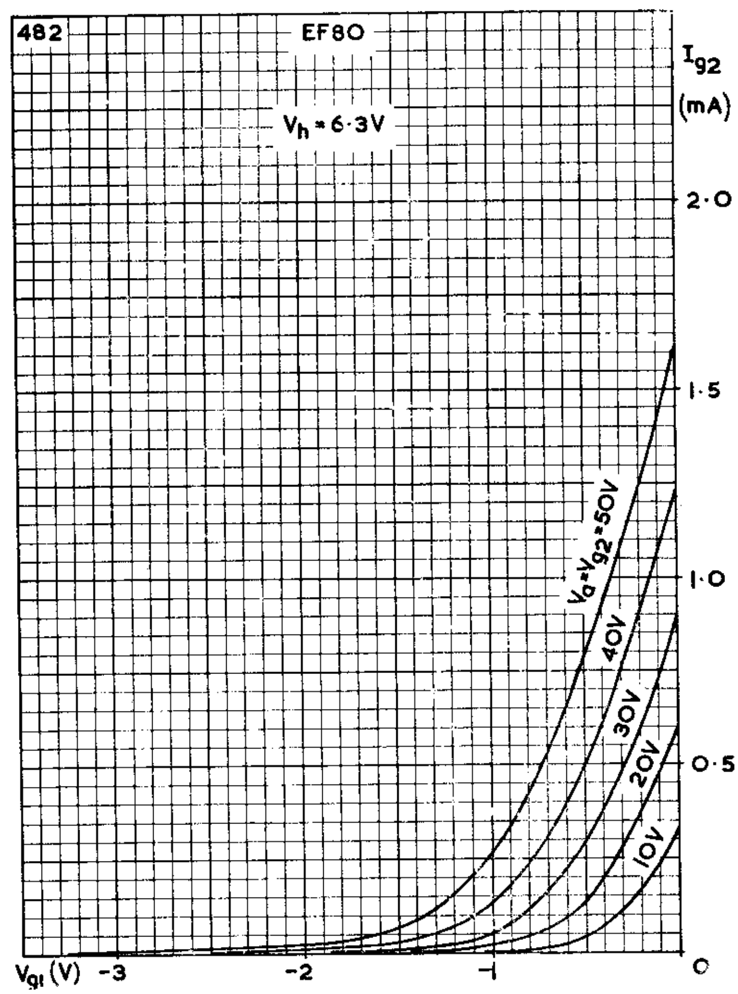


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR ANODE AND SCREEN-GRID VOLTAGES BETWEEN 10 V AND 50 V

EF80

R.F. PENTODE

High slope r.f. pentode primarily intended for r.f. or i.f. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.

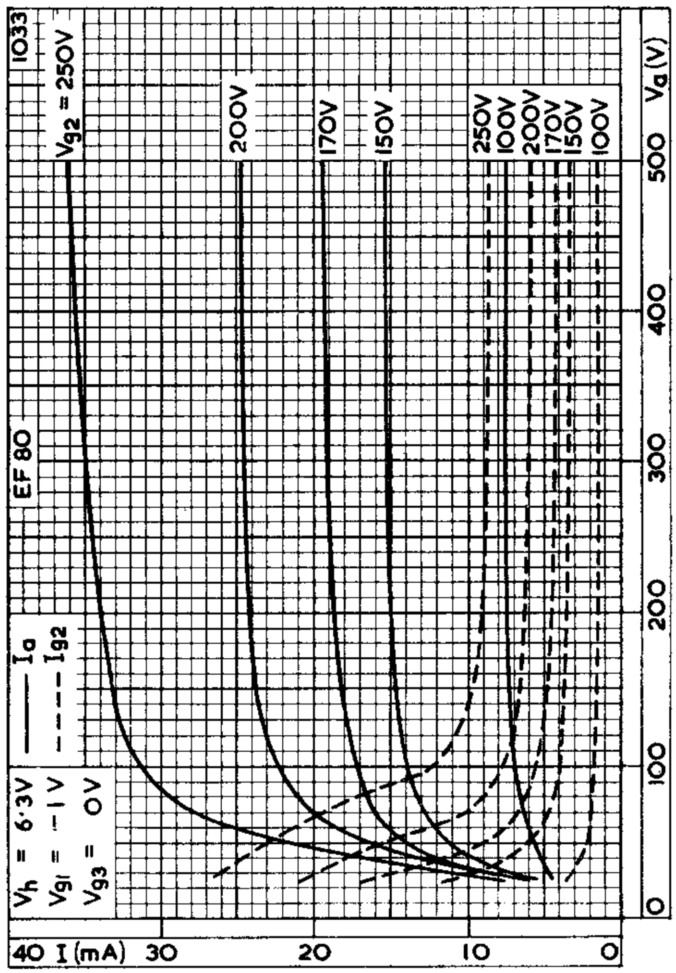


SCREEN-GRID CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR ANODE AND SCREEN-GRID VOLTAGES BETWEEN 10 V AND 50 V

R.F. PENTODE

EF80

High slope r.f. pentode primarily intended for r.f. or i.f. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.

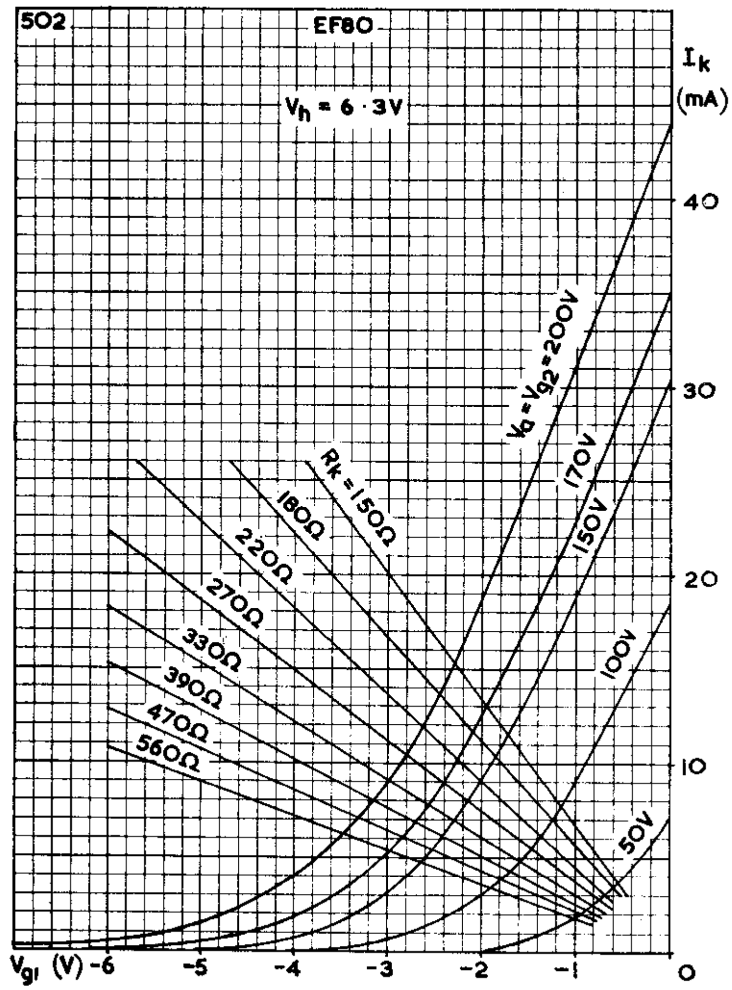


ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER

EF80

R.F. PENTODE

High slope r.f. pentode primarily intended for r.f. or i.f. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.

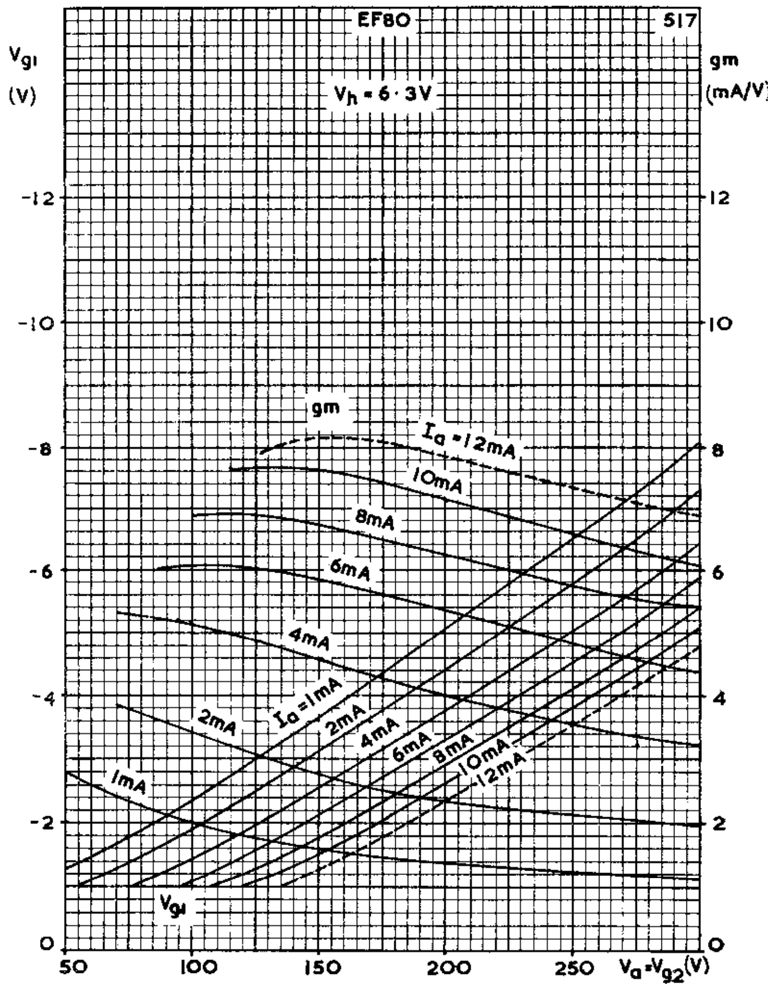


CATHODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETER

R.F. PENTODE

EF80

High slope r.f. pentode primarily intended for r.f. or i.f. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.

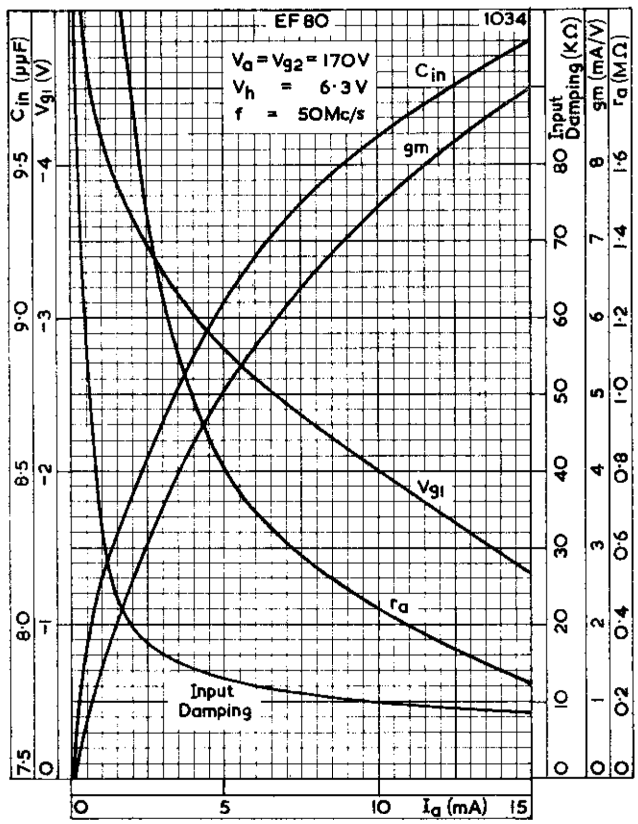


RELATION BETWEEN CONTROL-GRID VOLTAGE, MUTUAL CONDUCTANCE AND SCREEN-GRID VOLTAGE, WITH ANODE CURRENT AS PARAMETER

EF80

R.F. PENTODE

High slope r.f. pentode primarily intended for r.f. or i.f. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.

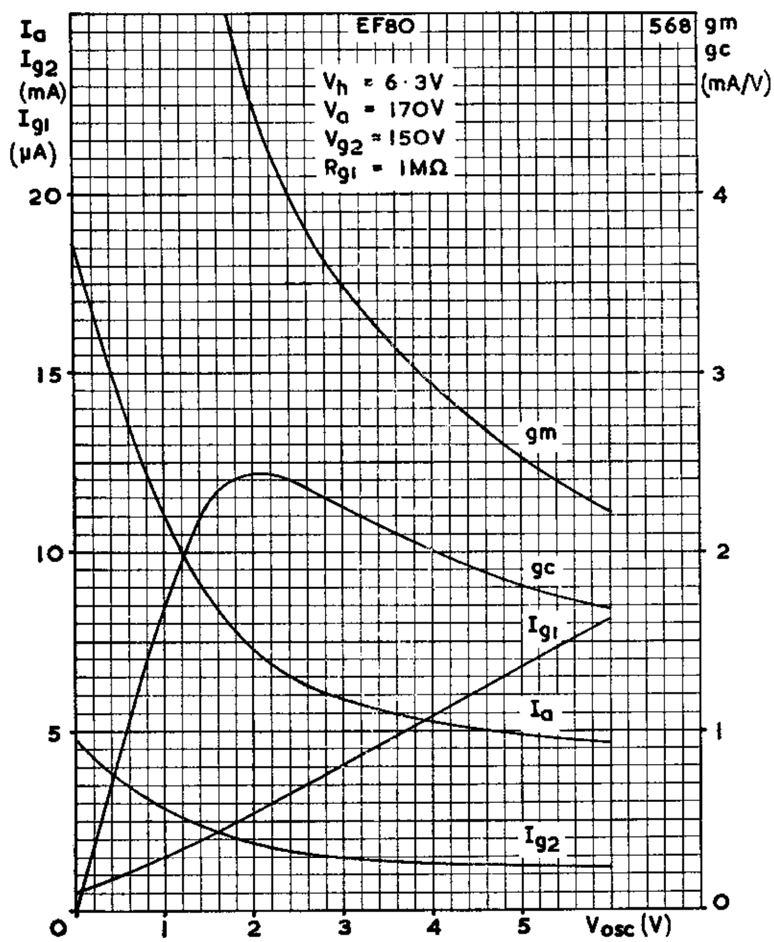


CONTROL-GRID VOLTAGE, MUTUAL CONDUCTANCE, INTERNAL RESISTANCE, INPUT CAPACITANCE AND INPUT DAMPING PLOTTED AGAINST ANODE CURRENT

R.F. PENTODE

EF80

High slope R.F. pentode primarily intended for R.F. or I.F. amplification in television receivers. It is suitable for use as a video amplifier, mixer or synchronising pulse separator.



PERFORMANCE CURVES AS FREQUENCY CHANGER AT ANODE VOLTAGE OF 170V AND SCREEN-GRID VOLTAGE OF 150V

VARIABLE-MU R.F. PENTODE

EF85

High slope variable-mu r.f. pentode, primarily intended for use in television receivers.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

V_h	6.3	V
I_h	300	mA

CAPACITANCES (measured without an external shield)

c_{in}	7.2	pF
c_{out}	3.7	pF
c_{a-g1}	< 7.0	mpF
c_{g1-h}	< 150	mpF

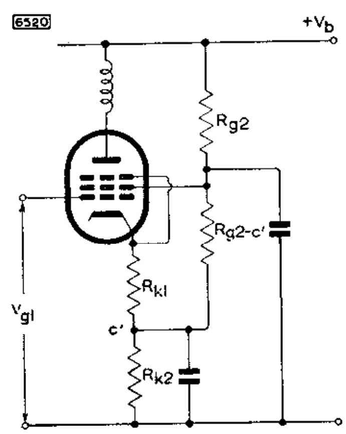
CHARACTERISTICS

$V_b = V_a$	250	V
V_{g3}	0	V
R_{g2}	60	kΩ
V_{g2}	100	V
I_a	10	mA
I_{g2}	2.5	mA
V_{g1}	–2.0	V
g_m	6.0	mA/V
r_a	500	kΩ
R_{eq}	1.5	kΩ

OPERATING CONDITIONS (See circuit on page D2)

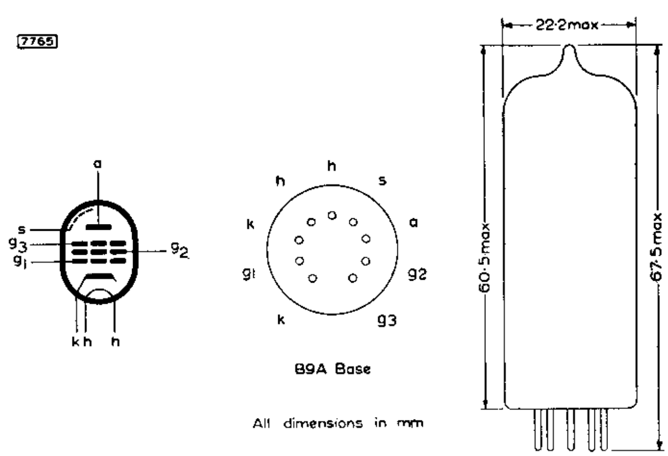
Condition	*1*	2	3	4	
V_b	190	190	190	190	V
R_{g2}	22	6.8	8.2	10	kΩ
$R_{g2-c'}$	—	8.2	12	18	kΩ
R_{k1}	47	47	47	47	Ω
R_{k2}	100	56	68	82	Ω
I_a	11.8	9.2	9.6	10	mA
I_{g2}	3.0	2.2	2.2	2.5	mA
g_m	6.0	5.7	5.8	6.0	mA/V
V_{g1} for 60 : 1 reduction in g_m	–18.5	–9.0	–10	–11	V
I_{total}	15	23.5	20.5	18.5	mA

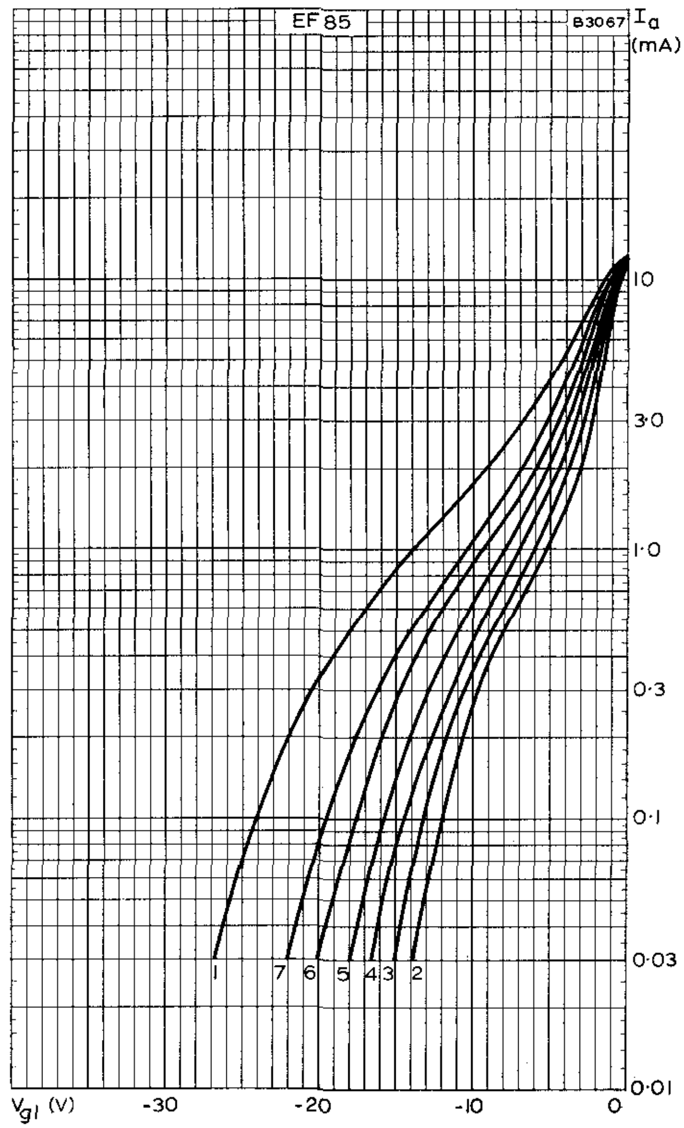
Condition	5	6	7	
V_b	190	190	190	V
R_{g2}	12	15	18	kΩ
$R_{g2-c'}$	27	47	82	kΩ
R_{k1}	47	47	47	Ω
R_{k2}	82	82	82	Ω
I_a	10.7	11.3	11.7	mA
I_{g2}	2.5	2.7	2.8	mA
g_m	6.0	6.2	6.0	mA/V
V_{g1} for 60 : 1 reduction in g_m	–12	–13.5	–15	V
I_{total}	17.5	16.5	16	mA



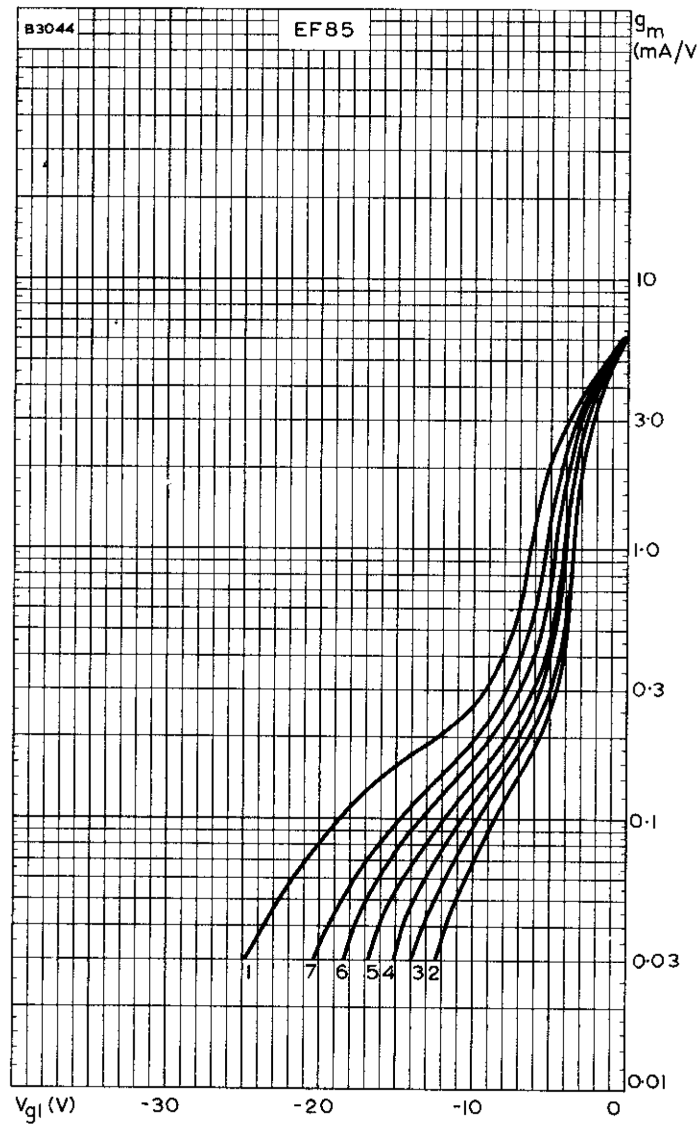
LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	2.5	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	300	V
p_{g2} max.	650	mW
I_k max.	15	mA
R_{g1-k} max.	3.0	MΩ
V_{h-k} max.	150	V
R_{h-k} max.	20	kΩ

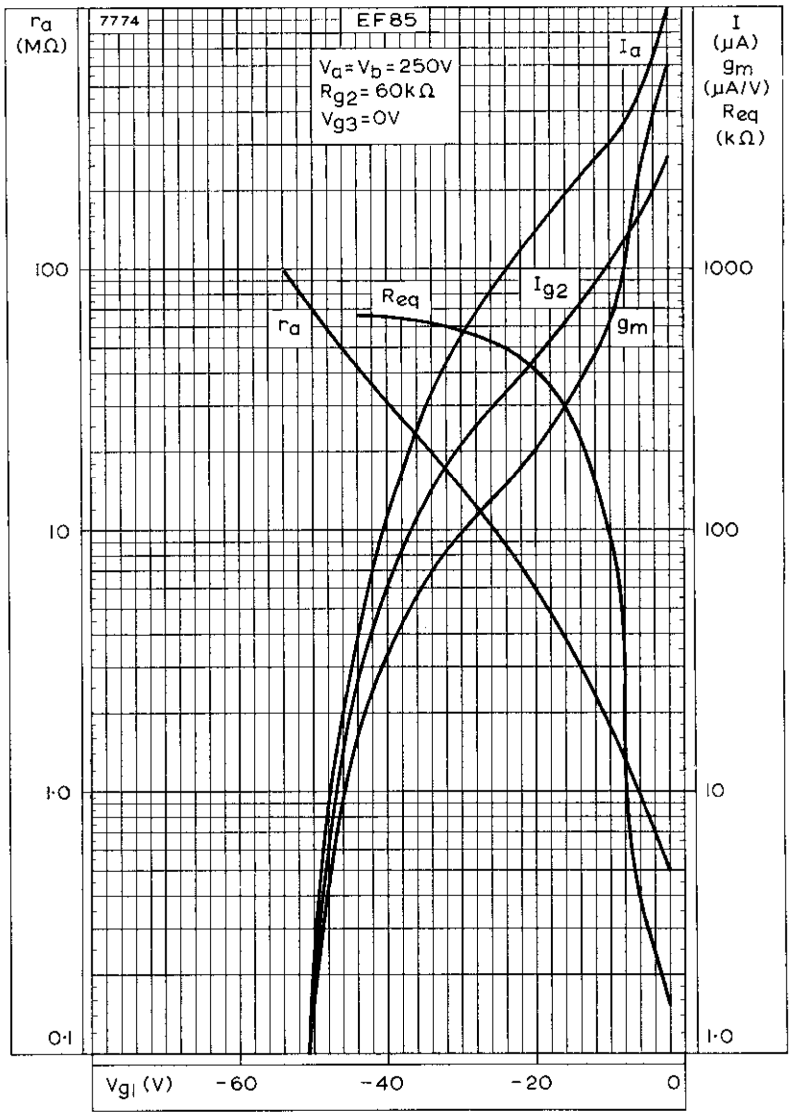




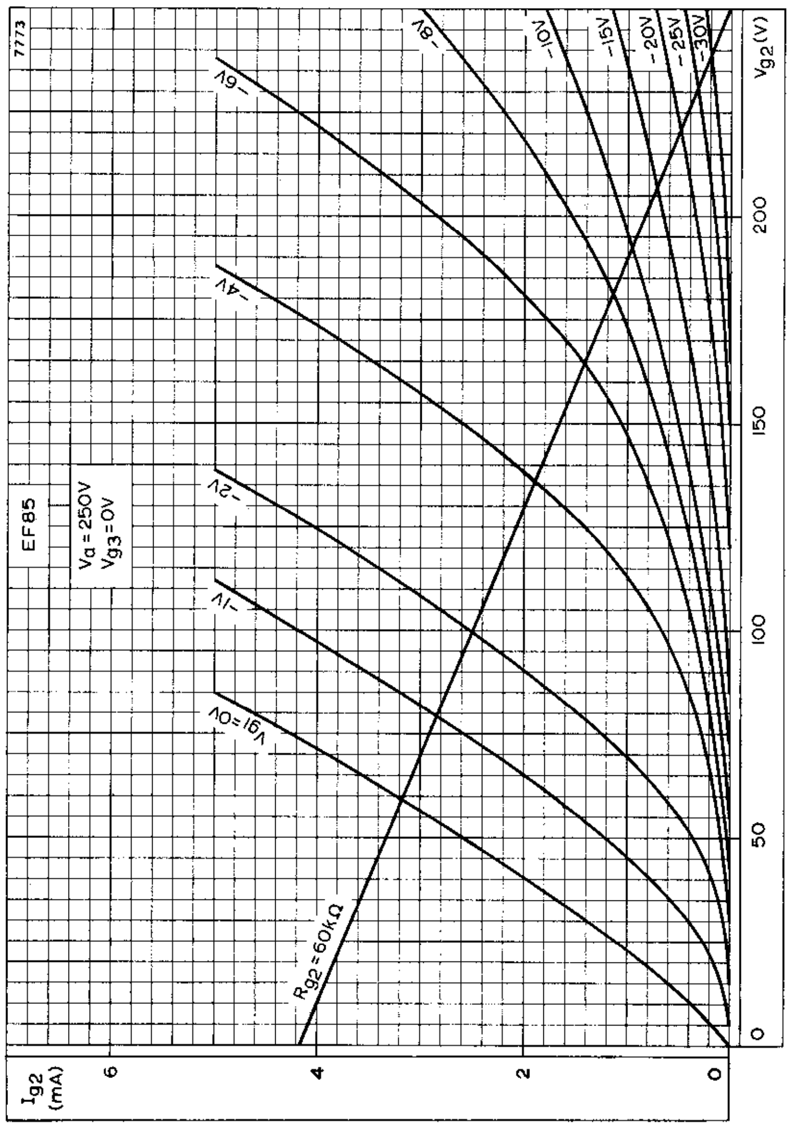
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE UNDER CONDITIONS 1 to 7 (See page D1)



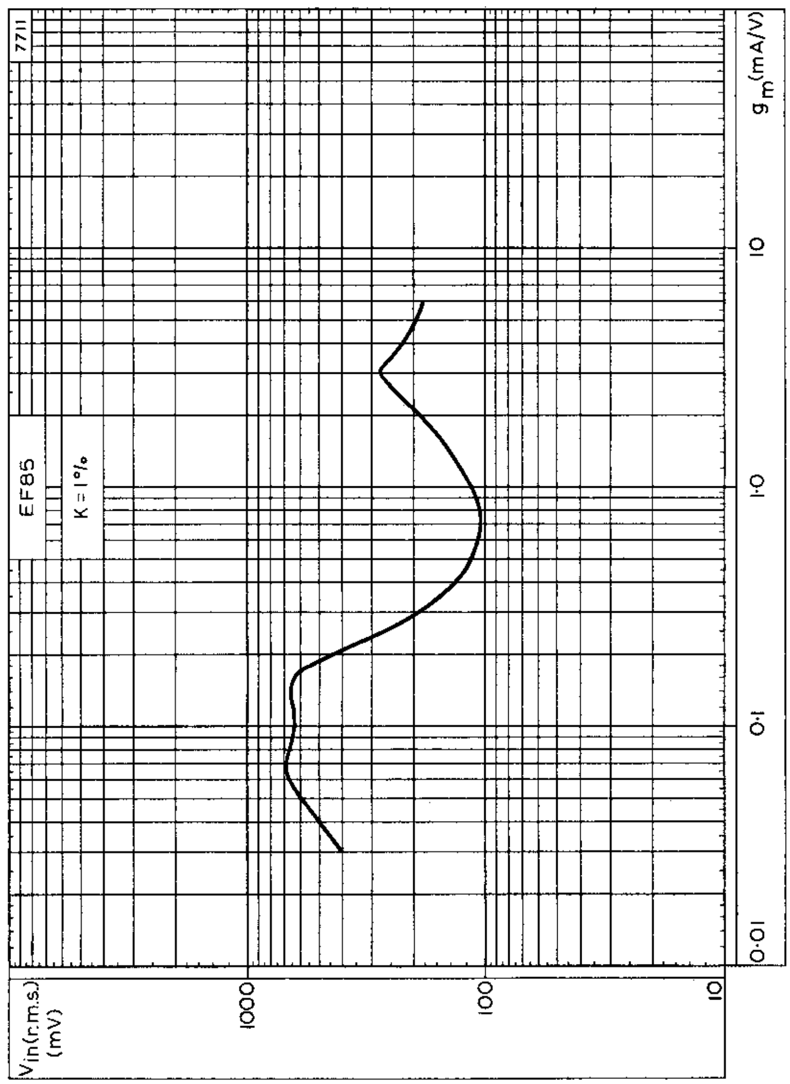
MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE UNDER CONDITIONS 1 to 7 (See page D1)



ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE ANODE IMPEDANCE, AND EQUIVALENT NOISE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE



SCREEN-GRID CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER



CROSS MODULATION CURVE

VOLTAGE AMPLIFYING PENTODE

EF86

Low-noise pentode for use as r.c. coupled a.f. voltage amplifier, particularly suitable for the early stages of high-gain audio amplifiers, microphone pre-amplifiers and tape recorders.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

V_h	6.3	V
I_h	200	mA

CAPACITANCES (measured without an external shield)

c_{out}	5.1	pF←
c_{in}	3.8	pF
c_{a-g1}	<50	mpF
c_{g1-h}	<2.5	mpF

CHARACTERISTICS

V_a	250	V
V_{g3}	0	V
V_{g2}	140	V
I_a	3.0	mA
I_{g2}	600	μA
V_{g1}	−2.2	V←
g_m	2.2	mA/V←
r_a	2.0	MΩ←
μ_{g1-g2}	38	
V_{g1} max. (I_{g1} = +0.3μA)	−1.3	V

OPERATING CONDITIONS AS R.C. COUPLED A.F. AMPLIFIER ←

Pentode connection

V_b (V)	R_a (kΩ)	R_{g2} (MΩ)	R_k (kΩ)	I_k (mA)	$\frac{V_{out}}{V_{in}}$†	V_{out}* ($V_{r.m.s.}$)	R_{g1}** (kΩ)
400	100	0.39	1.0	3.2	140	85	330
350	100	0.39	1.0	2.75	134	74	330
300	100	0.39	1.0	2.4	129	62	330
250	100	0.39	1.0	2.0	123	50	330
200	100	0.39	1.0	1.55	117	38	330
150	100	0.39	1.0	1.05	110	27	330
400	220	1.0	2.2	1.45	210	72	680
350	220	1.0	2.2	1.3	205	62	680
300	220	1.0	2.2	1.1	194	53	680
250	220	1.0	2.2	0.9	185	44	680
200	220	1.0	2.2	0.75	173	35	680
150	220	1.0	2.2	0.5	147	22	680

*Output voltage at D_{tot} = 5%.
**Grid resistor of following valve.
† $\frac{V_{out}}{V_{in}}$ measured with V_{in} = 100mV r.m.s.

EF86

VOLTAGE AMPLIFYING PENTODE

Triode connection (g_2 connected to a, g_3 to k)

V_b (V)	R_a (kΩ)	I_a (mA)	R_k (kΩ)	$\frac{V_{out}}{V_{in}}$‡	V_{out}* ($V_{r.m.s.}$)	D_{tot}* (%)	R_{g1}† (kΩ)
400	47	3.6	1.2	26	68	5.2	150
350	47	3.15	1.2	25	58	5.0	150
300	47	2.7	1.2	25	46	4.6	150
250	47	2.25	1.2	25	36	4.3	150
200	47	1.8	1.2	24	24	3.9	150
400	100	2.0	2.2	28	75	4.8	330
350	100	1.8	2.2	28	63	4.7	330
300	100	1.5	2.2	27.5	51	4.6	330
250	100	1.25	2.2	27.5	42	4.2	330
200	100	1.0	2.2	27	30	4.0	330
400	220	1.1	3.9	29	71	4.3	680
350	220	0.95	3.9	29	60	4.3	680
300	220	0.8	3.9	29	52	4.2	680
250	220	0.7	3.9	28	42	3.9	680
200	220	0.55	3.9	28	30	3.7	680

*Output voltage and distortion at the start of positive grid current. At lower output voltages the distortion is approximately proportional to the voltage.

†Grid resistor of the following valve.

‡ $\frac{V_{out}}{V_{in}}$ measured with V_{in} = 100mV r.m.s.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	1.0	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	200	V
p_{g2} max.	200	mW
I_k max.	6.0	mA
R_{g1-k} max. (p_a > 200mW)	3.0	MΩ
R_{g1-k} max. (p_a < 200mW)	10	MΩ
V_{h-k} max. (cathode positive)	100	V
V_{h-k} max. (cathode negative)	50	V
*R_{h-k} max.	20	kΩ

*When used as a phase inverter immediately preceding the output stage, R_{h-k} max. may be 120kΩ.

OPERATING NOTES

1. Hum

When used as a normal voltage amplifier with a line voltage of 250V, an anode load of 100kΩ and a grid resistor of 470kΩ the maximum hum level of the valve alone is 5μV, the average value being about 3μV when operated with one side of the heater earthed. This can be further reduced by centre-tapping the heater to earth. Under these conditions the nominal hum level is 1μV. The low level of hum attained with this valve can be completely masked by that due to an unsuitable valveholder, in which excessive leakage and capacitive coupling between pins will introduce considerable hum.

2. Noise

The low-frequency noise generated by a valve is most conveniently specified as an equivalent voltage on the control grid for a specific bandwidth. For the EF86 under normal conditions, i.e. line voltage of 250V and an anode load of 100kΩ, the equivalent noise voltage is approximately 2μV for the frequency range of 25 to 10,000c/s.

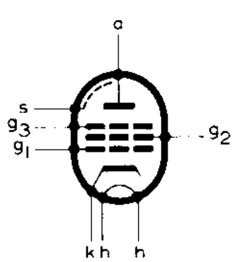
3. Microphony

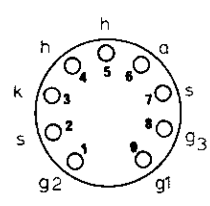
Care in the design of the valve to ensure that the electrode structure and its mounting are as rigid as possible has reduced the microphony of the EF86 to a very low level. There are no appreciable internal resonances at frequencies below 1,000c/s. At higher frequencies the effect of vibration is usually negligible on account of the damping provided by the chassis and the valveholder. In high-gain applications such as tape recording care should be taken in siting the valve, particularly when a loudspeaker is present in the same cabinet or when a motor is mounted on the same chassis. In such cases a flexible mounting for the valveholder or a separate weighted sub-chassis is advisable.

EF86

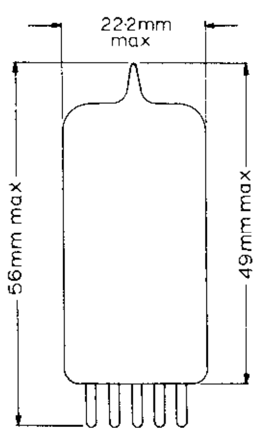
VOLTAGE AMPLIFYING PENTODE

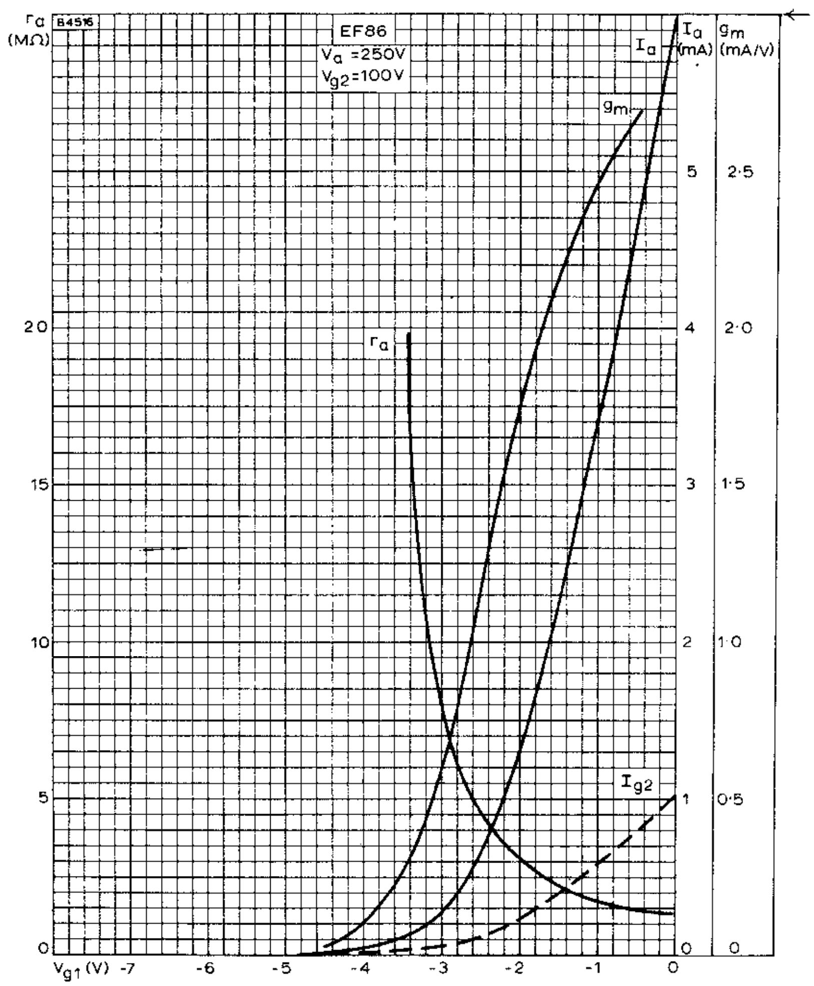
B4522



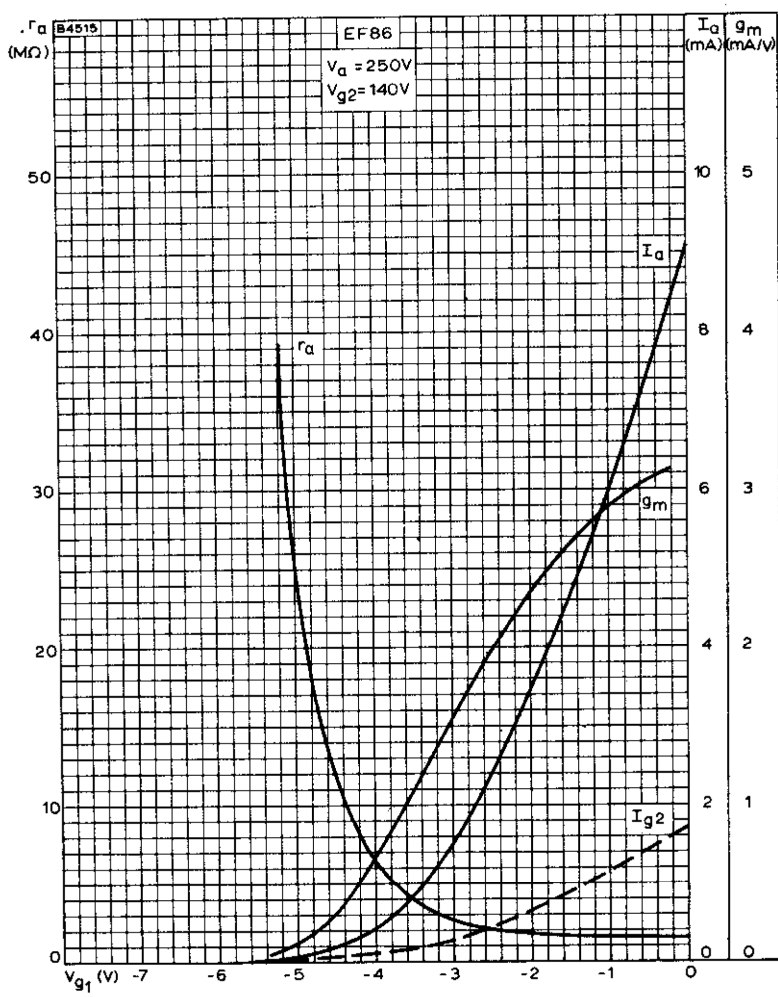


B9A Base

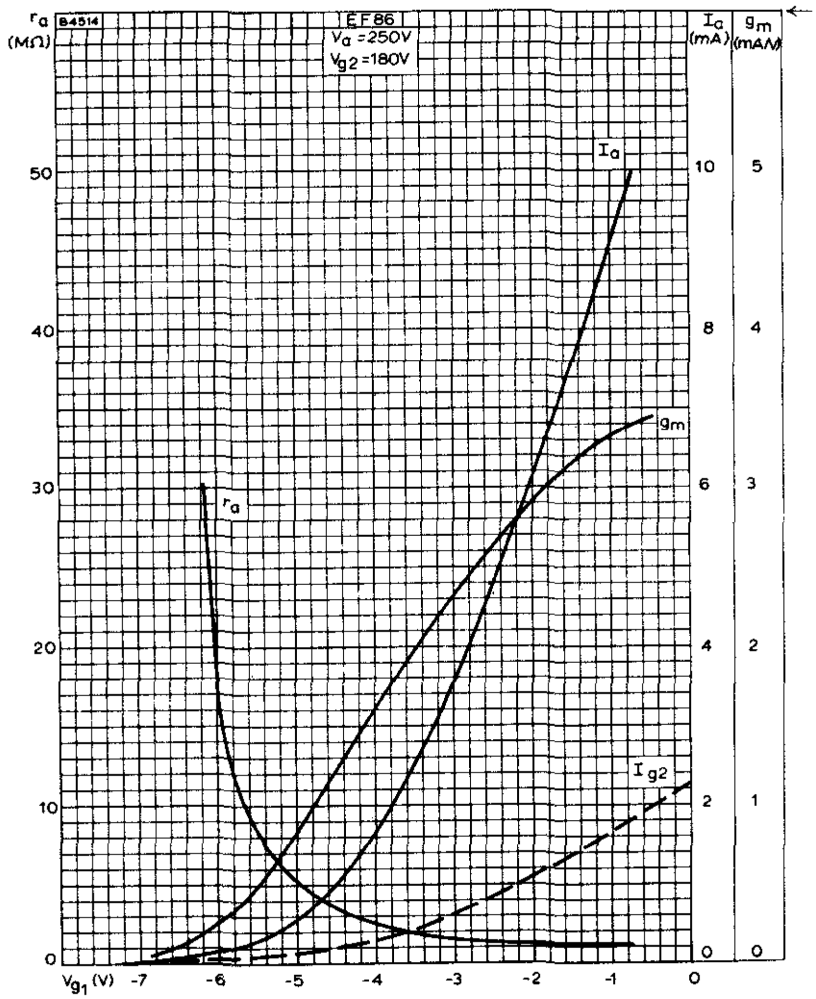




ANODE AND SCREEN-GRID CURRENTS, ANODE IMPEDANCE AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
V_{g2} = 100V



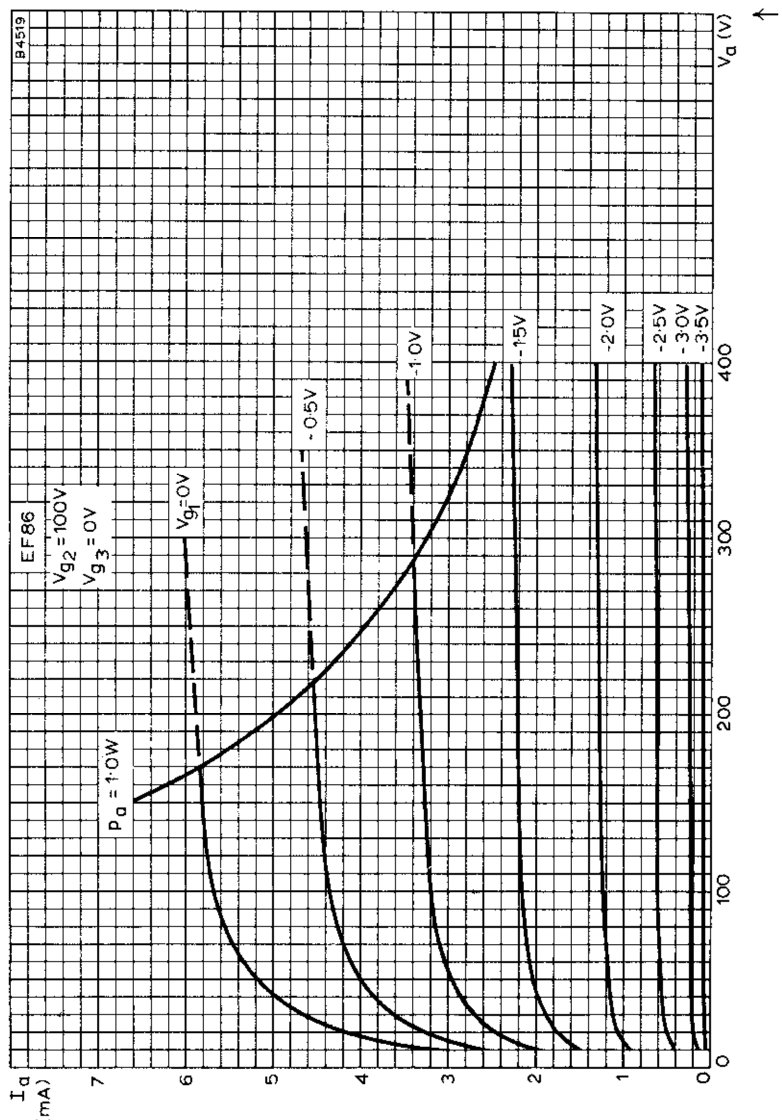
ANODE AND SCREEN-GRID CURRENTS, ANODE IMPEDANCE AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE. V_{g2} = 140V



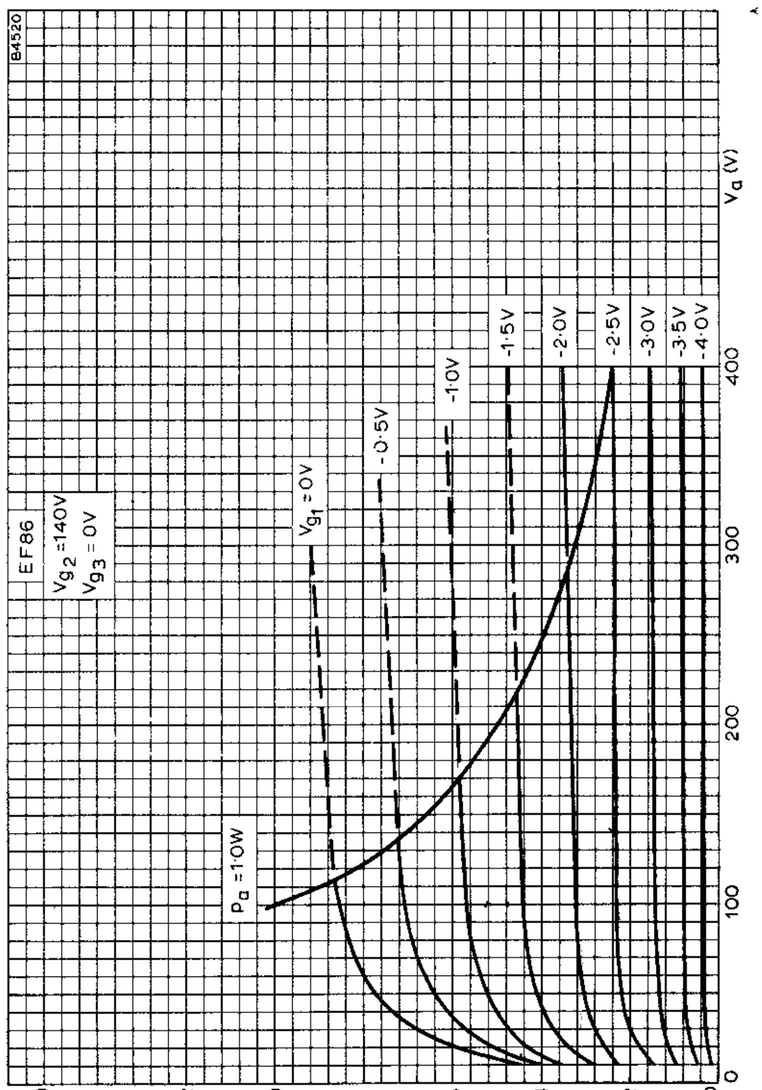
ANODE AND SCREEN-GRID CURRENTS, ANODE IMPEDANCE AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
$V_{g2} = 180V$

EF86

VOLTAGE AMPLIFYING
VOLTAGE



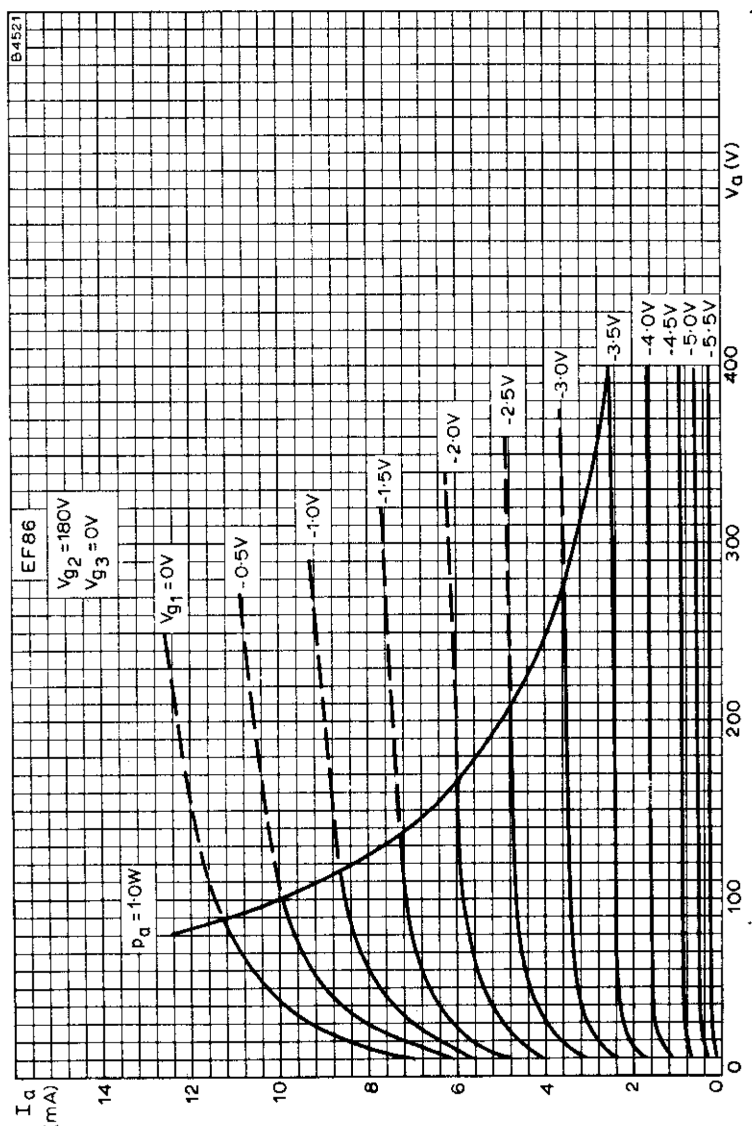
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 100V



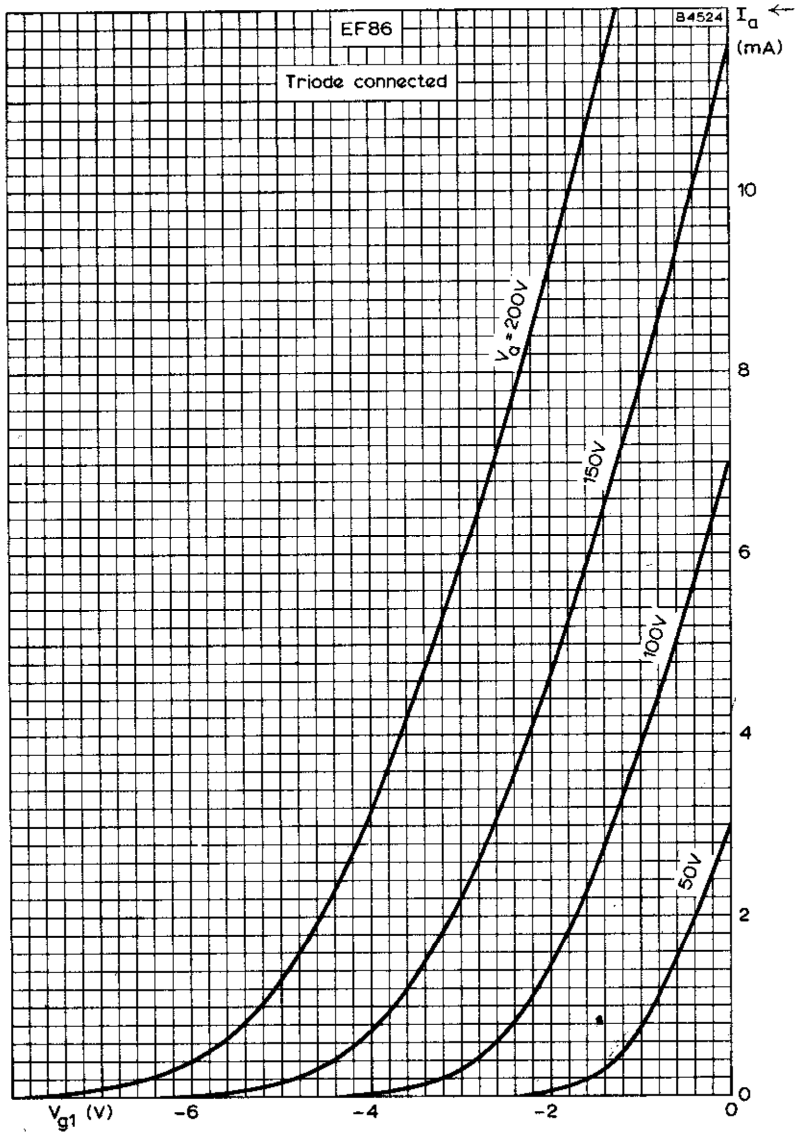
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 140V$

EF86

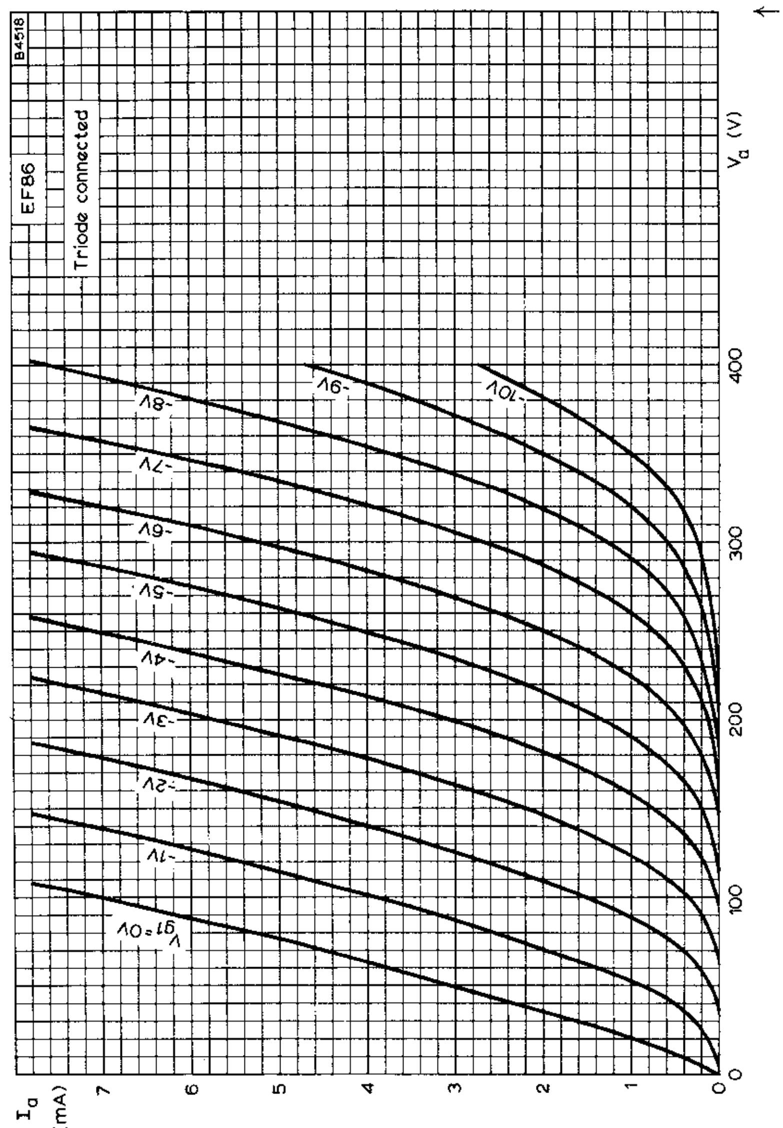
VOLTAGE AMPLIFYING PENTODE



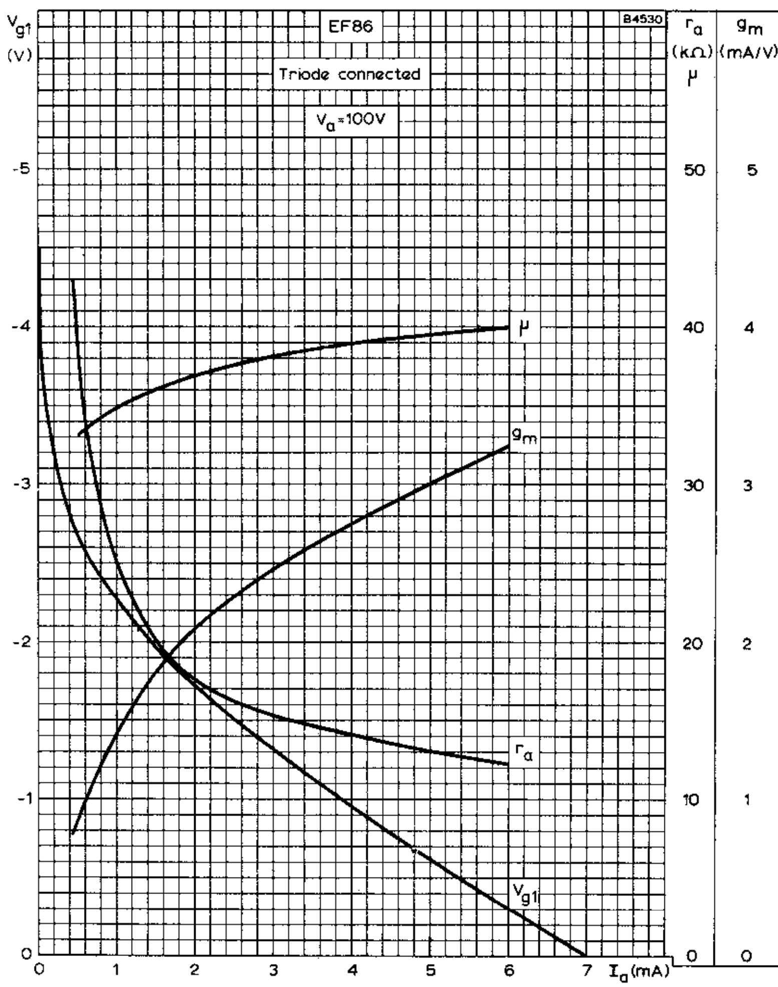
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 180V



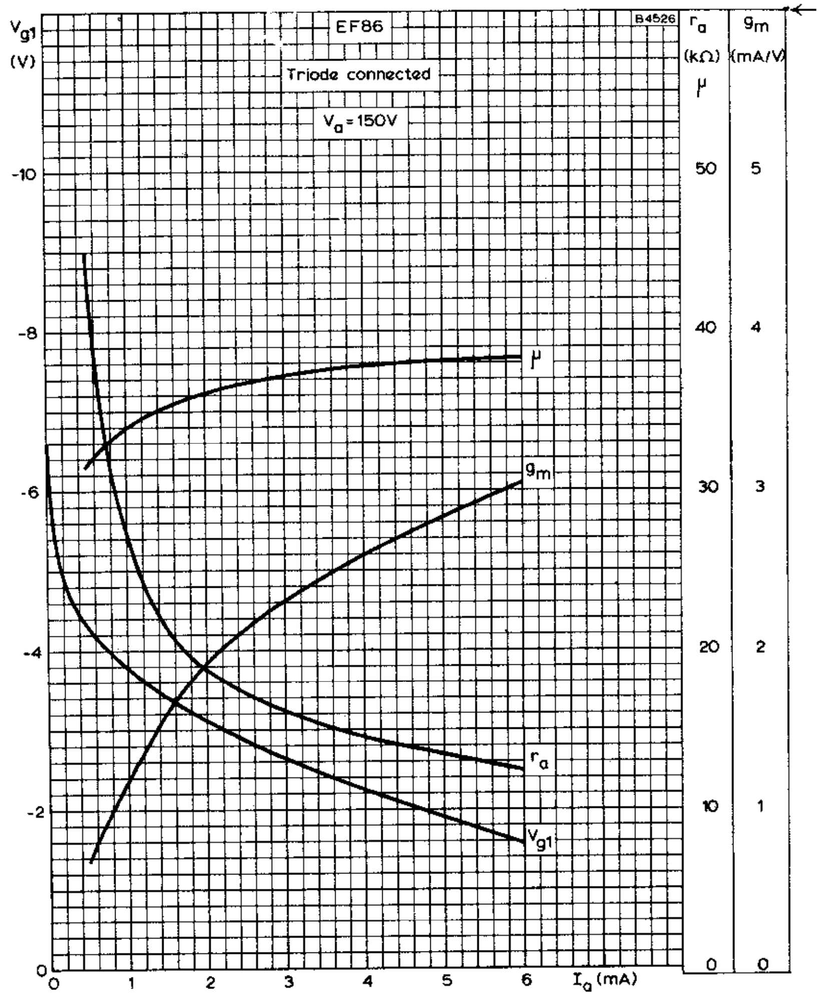
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER WHEN TRIODE CONNECTED



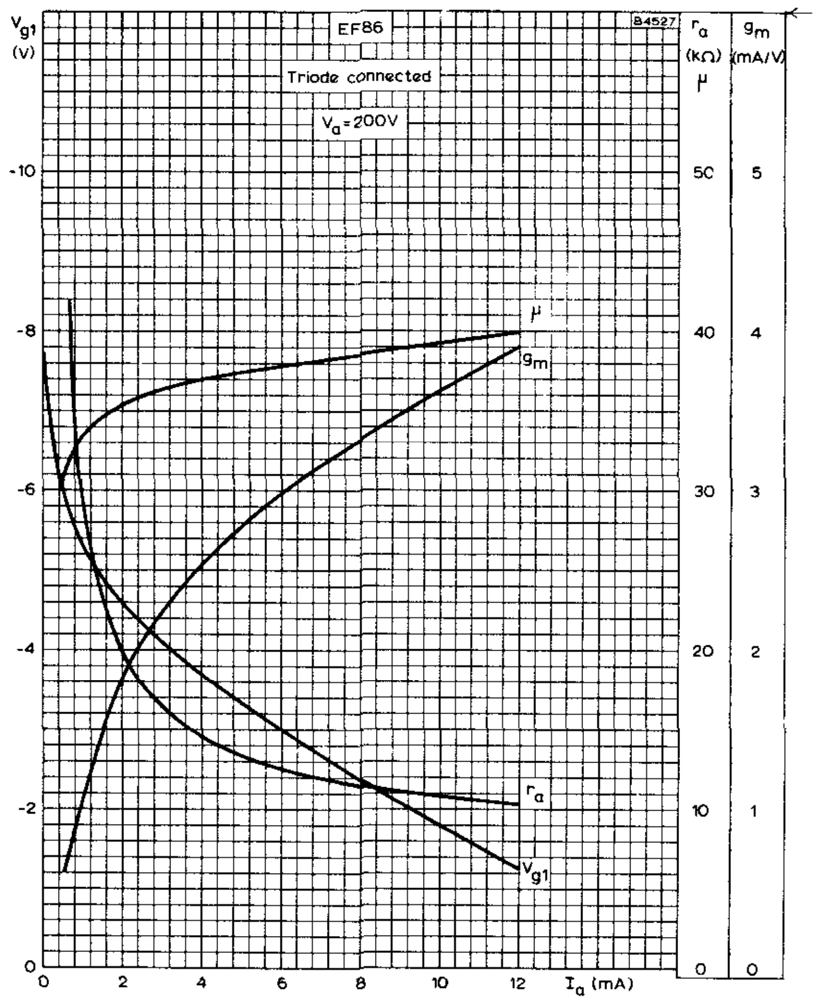
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER WHEN TRIODE CONNECTED



CONTROL-GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND ANODE IMPEDANCE PLOTTED AGAINST ANODE CURRENT WHEN TRIODE CONNECTED. $V_a = 100V$



CONTROL-GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND ANODE IMPEDANCE PLOTTED AGAINST ANODE CURRENT WHEN TRIODE CONNECTED. V_a = 150V



CONTROL-GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND ANODE IMPEDANCE PLOTTED AGAINST ANODE CURRENT WHEN TRIODE CONNECTED. V_a = 200V

VARIABLE-MU R.F. PENTODE

EF92

Variable-mu r.f. pentode for use as a controlled r.f. or i.f. amplifier.

HEATER

V_h	6.3	V
I_h	200	mA

CAPACITANCES

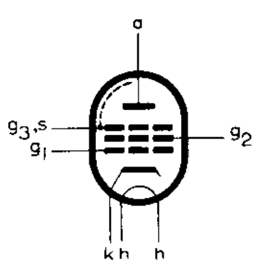
	Unshielded	*Shielded*	←
c_{in}	4.8	5.0	pF
c_{out}	6.3	6.5	pF
c_{a-g1}	$<$ 15	$<$ 10	mpF
c_{h-k}	2.3	2.3	pF

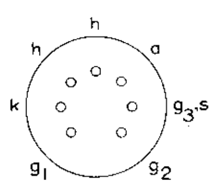
CHARACTERISTICS ←

V_a	200	V
V_{g2}	200	V
V_{g3}	0	V
I_a	8.25	mA
I_{g2}	2.1	mA
V_{g1}	–2.5	V
g_m	2.45	mA/V
r_a	900	kΩ
μ_{g1-g2}	30	
V_{g1} (for 100 : 1 reduction in g_m)	–27	V

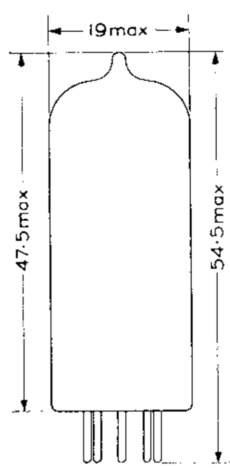
LIMITING VALUES

$V_{a(b)}$ max.	500	V ←
V_a max.	250	V
p_a max.	2.5	W
$V_{g2(b)}$ max.	500	V ←
V_{g2} max.	250	V
p_{g2} max.	600	mW
$-V_{g1}$ max.	50	V ←
I_k max.	12	mA
R_{g1-k} max.	100	kΩ ←
V_{h-k} max.	100	V
T_{bulb} max.	170	°C ←



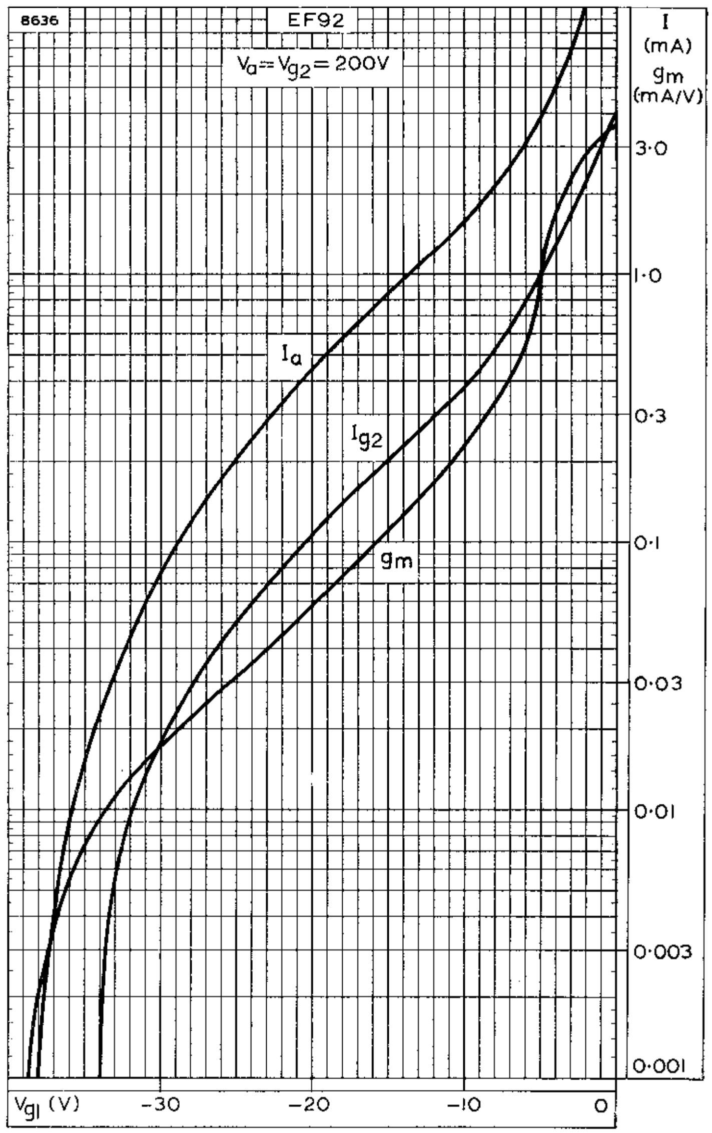


B7G Base

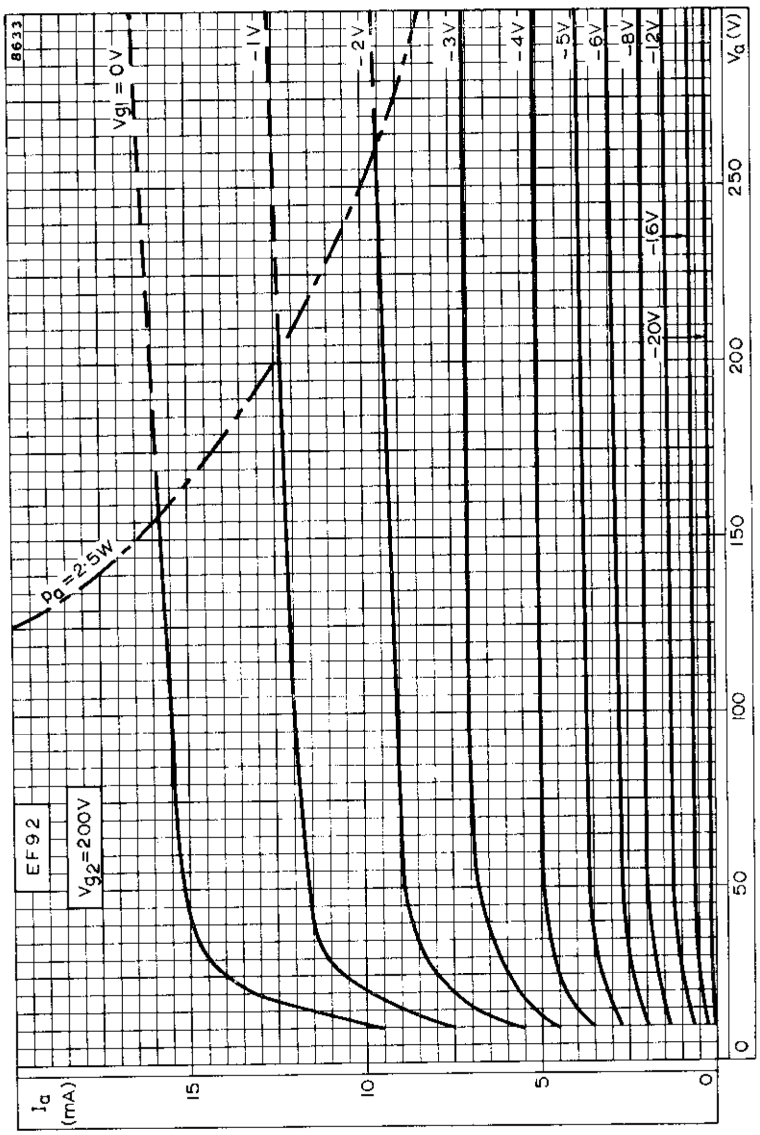


All dimensions in mm

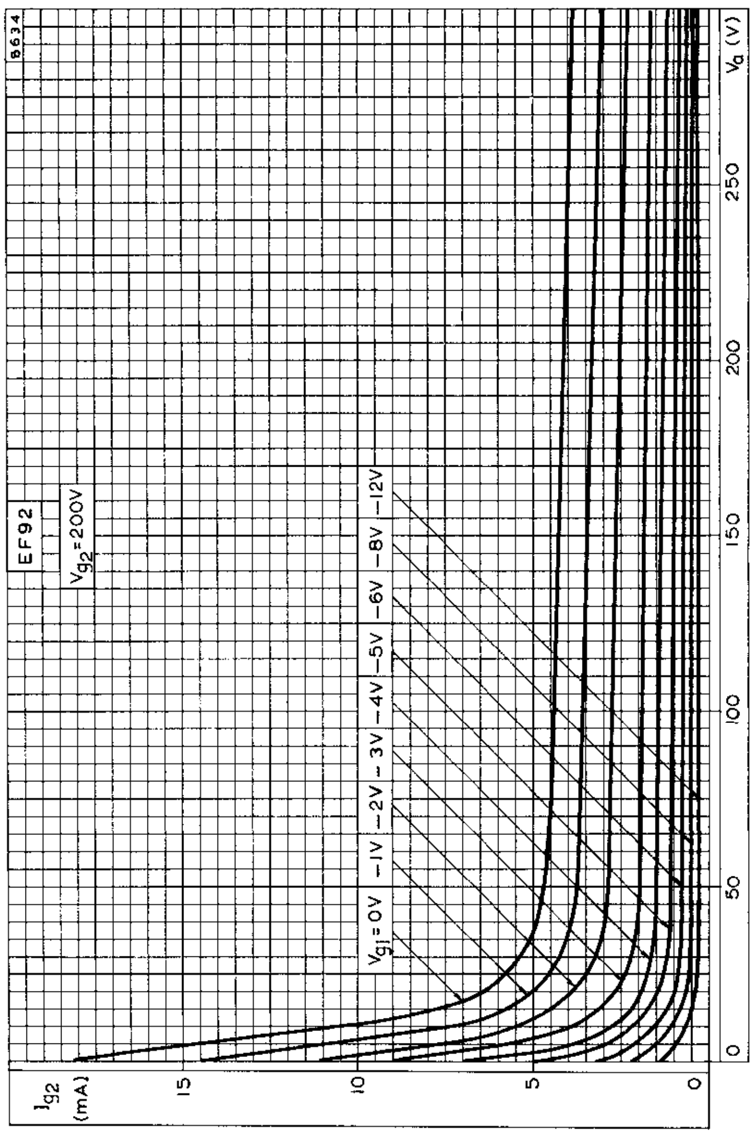
B723



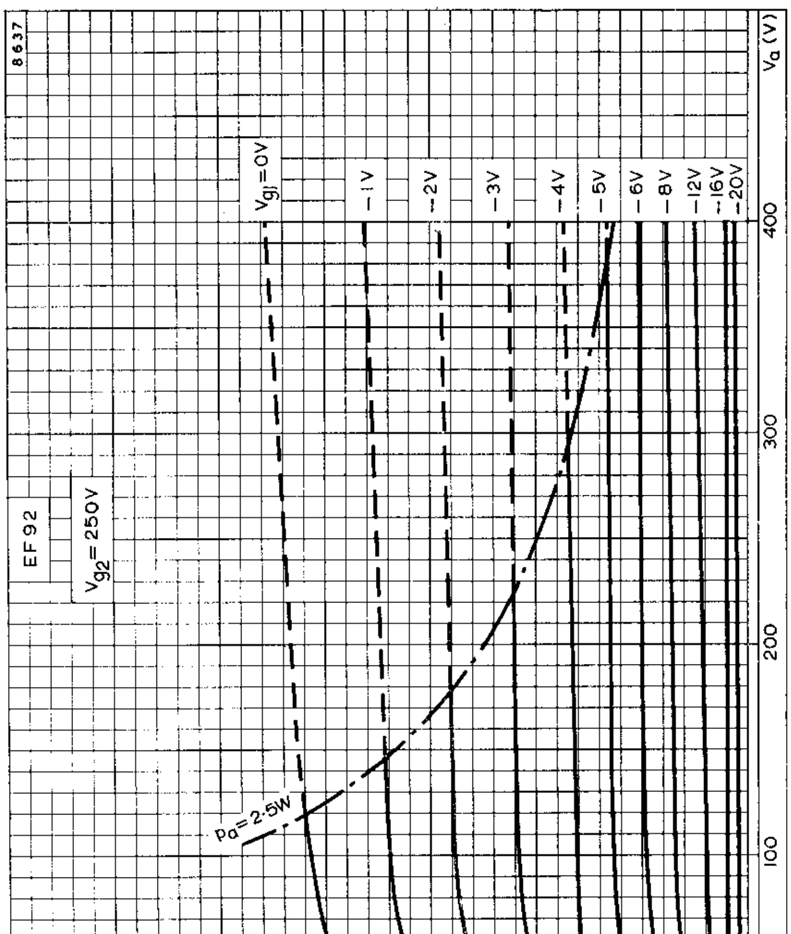
ANODE CURRENT, SCREEN-GRID CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
$V_a = V_{g2} = 200V$



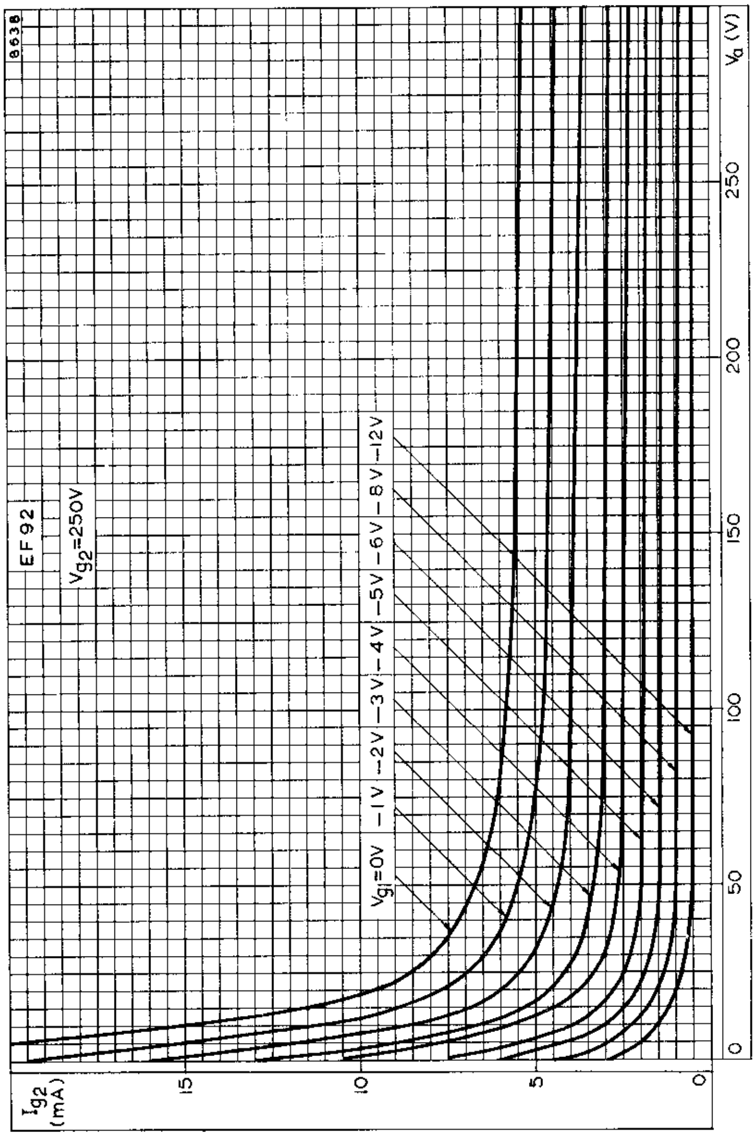
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER.
$V_{g2} = 200V$



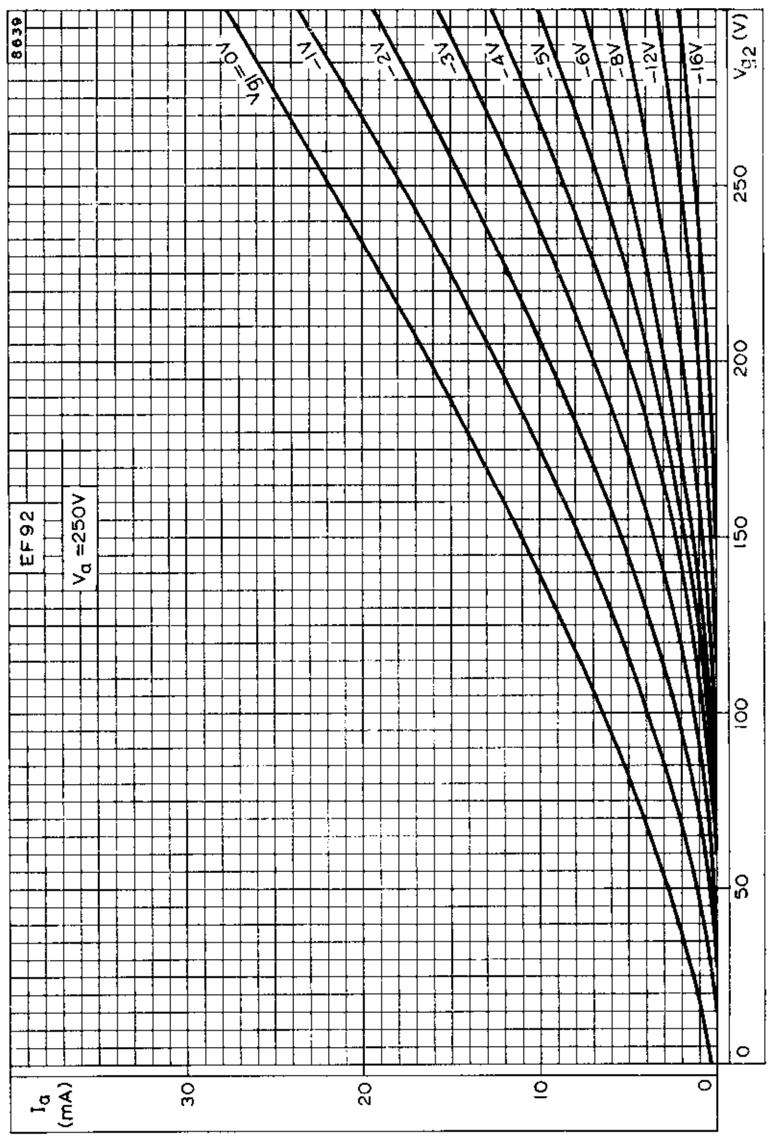
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER.
$V_{g2} = 200V$



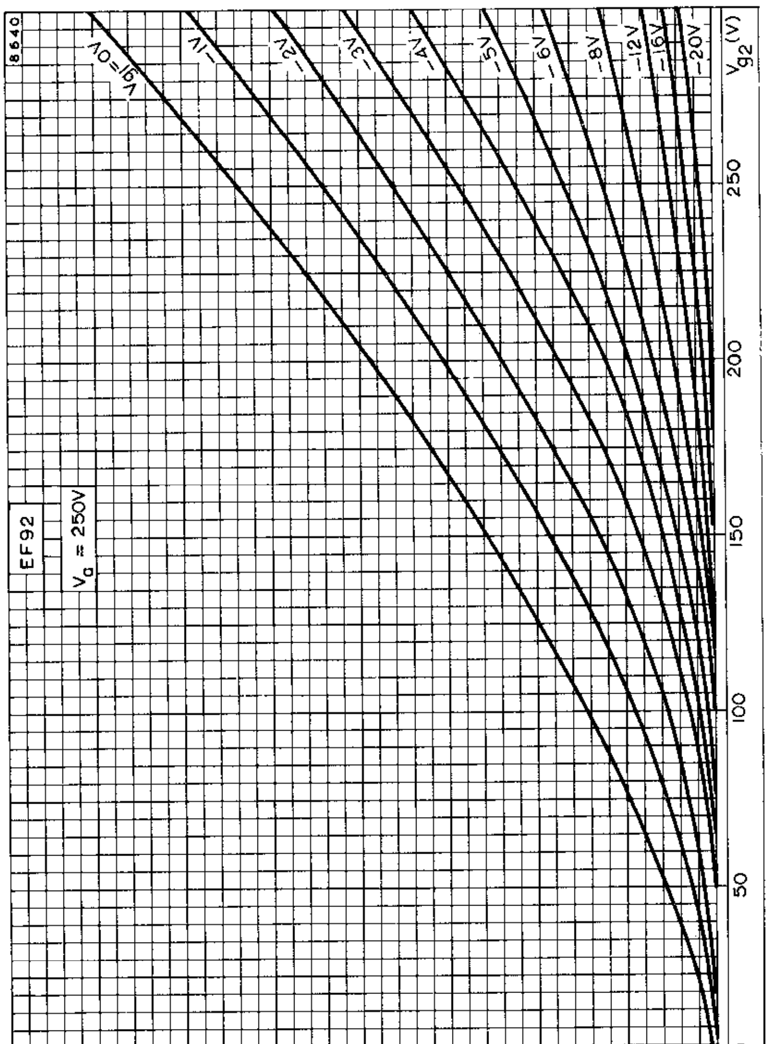
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER.
$V_{g2} = 250V$



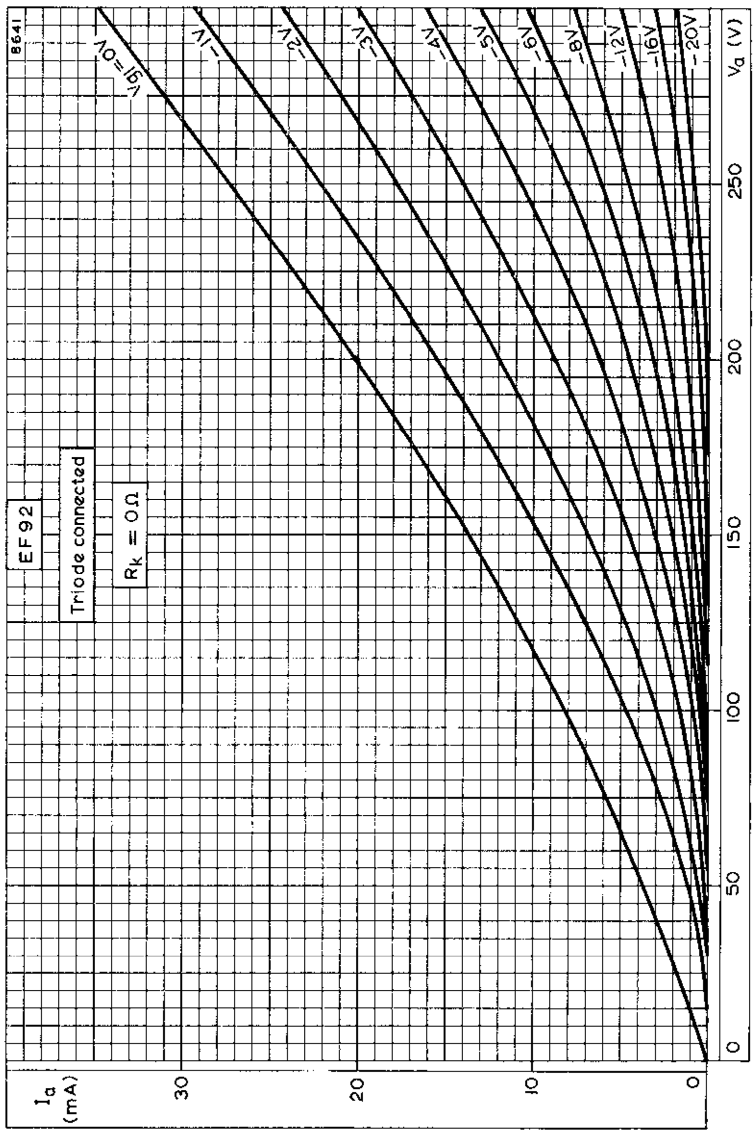
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER.
$V_{g2} = 250V$



ANODE CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER.
$V_a = 250V$



SCREEN-GRID CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER.
$V_a = 250V$



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER,
WHEN TRIODE CONNECTED

V.H.F. PENTODE

EF95

Low noise, high slope pentode primarily intended for use as an r.f. and i.f. amplifier.

HEATER

V_h	6.3	V
I_h	175	mA

CAPACITANCES

Pentode connection

	Unshielded	Shielded	
c_{in}	4.0	4.0	pF
c_{out}	2.2	3.1	pF
c_{a-g1}	23	< 20	mpF
c_{h-k}	2	2	pF

Triode connection

	Unshielded	Shielded	
c_{in}	2.7	2.8	pF
c_{out}	4.2	5.1	pF
c_{a-g}	1.4	1.4	pF

CHARACTERISTICS

Pentode connection

V_a	120	180	V
V_{g2}	120	120	V
I_a	7.5	7.7	mA
I_{g2}	2.5	2.4	mA
V_{g1}	−2.0	−2.0	V
g_m	5.0	5.1	mA/V
r_a	250	400	kΩ
μ_{g1-g2}	35	35	
R_{eq}	2	2	kΩ
r_{g1} (f = 50Mc/s)	25	25	kΩ

Triode connection

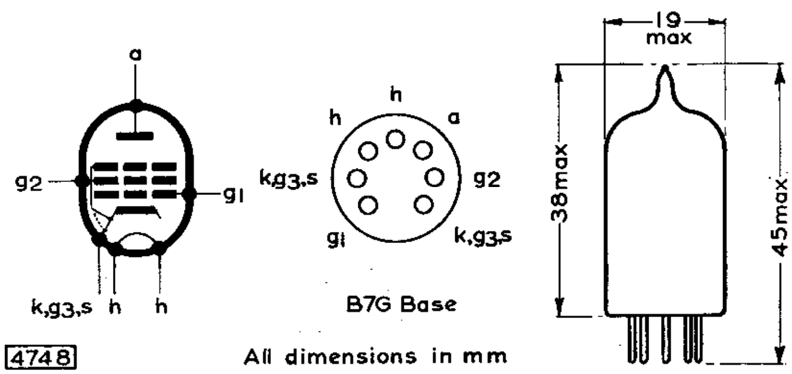
V_a	120	V
I_a	10	mA
V_g	−2	V
g_m	6.8	mA/V
r_a	5.2	kΩ
μ	35	
R_{eq}	900	Ω

DESIGN CENTRE RATINGS

$V_{a(b)}$ max.	300	V
V_a max.	180	V
p_a max.	1.7	W
$V_{g2(b)}$ max.	300	V
V_{g2} max.	140	V
p_{g2} max.	500	mW
$-V_{g1}$ max.	50	V
R_{g1-k} max.	3.0	MΩ←
I_k max.	18	mA
V_{h-k} max.	120	V
T_{bulb} max.	170	°C

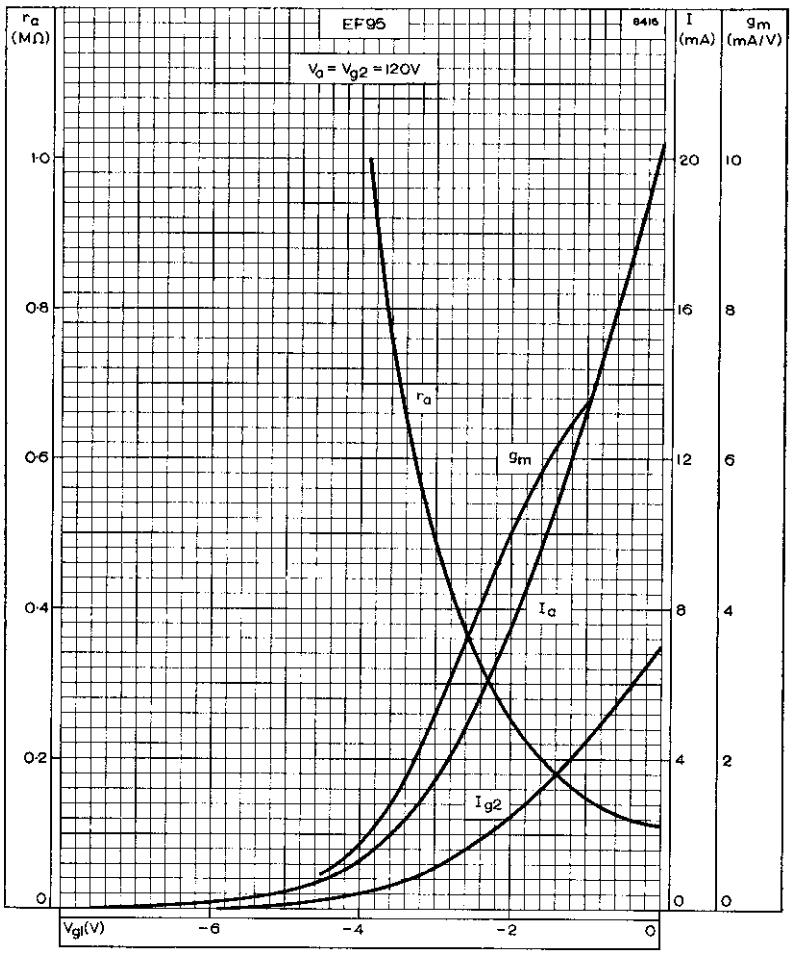
EF95

V.H.F. PENTODE

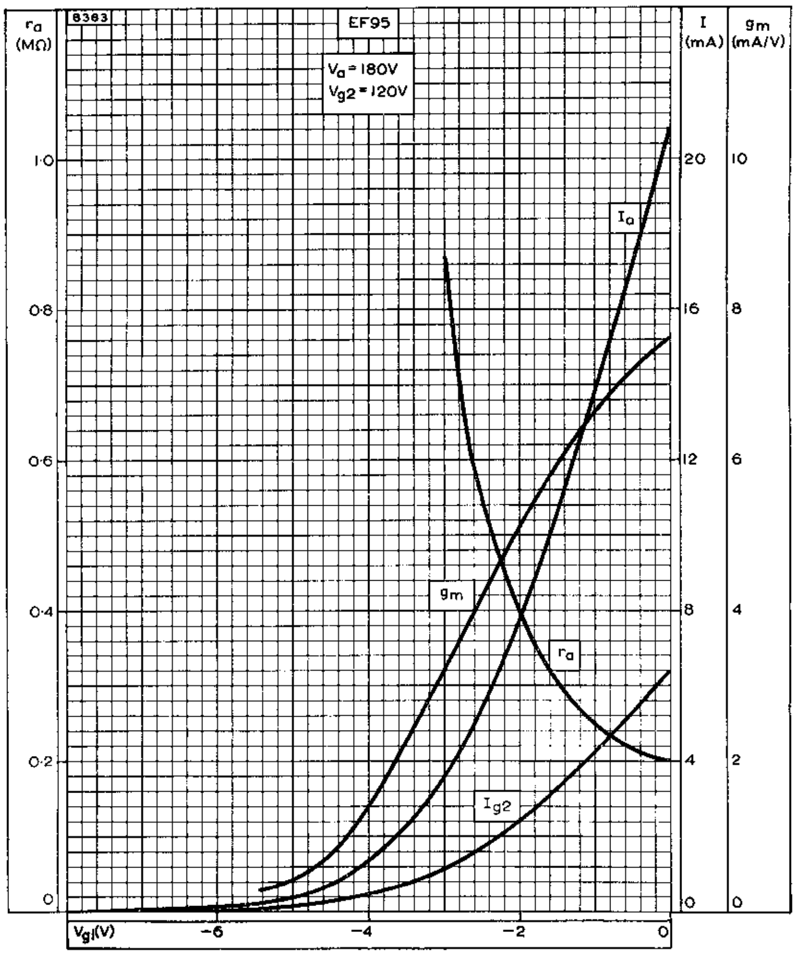


4748

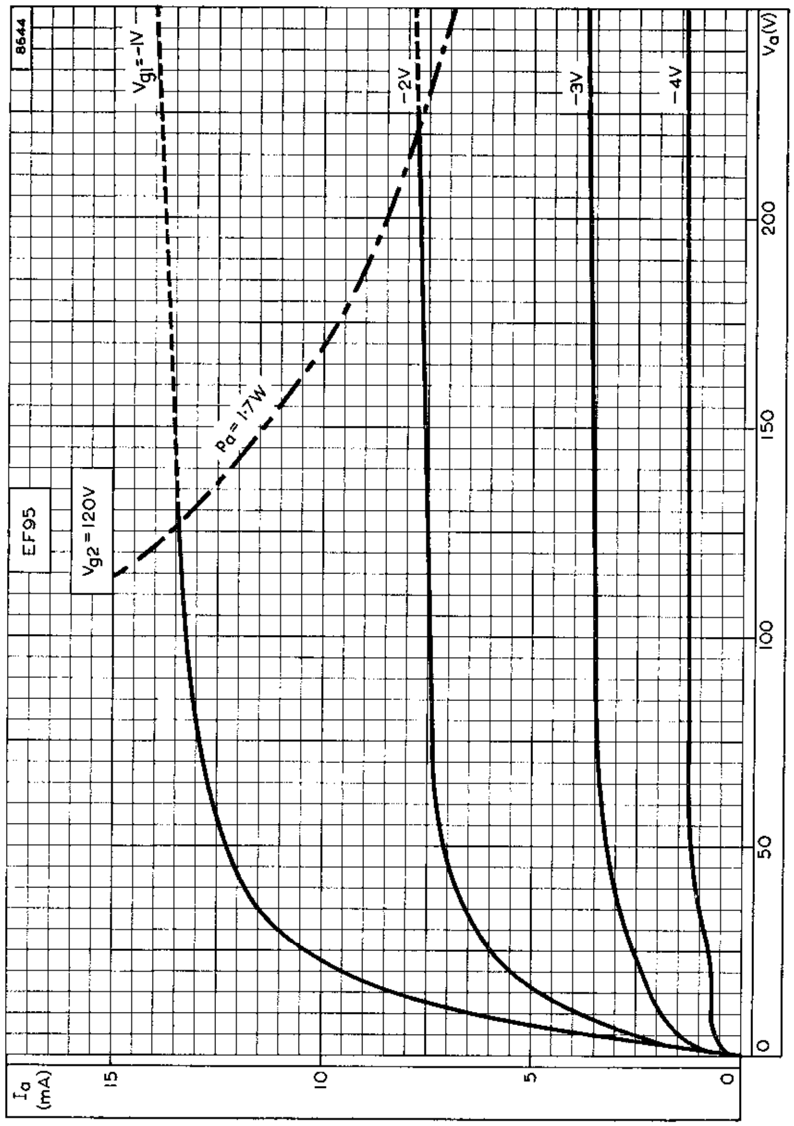
All dimensions in mm



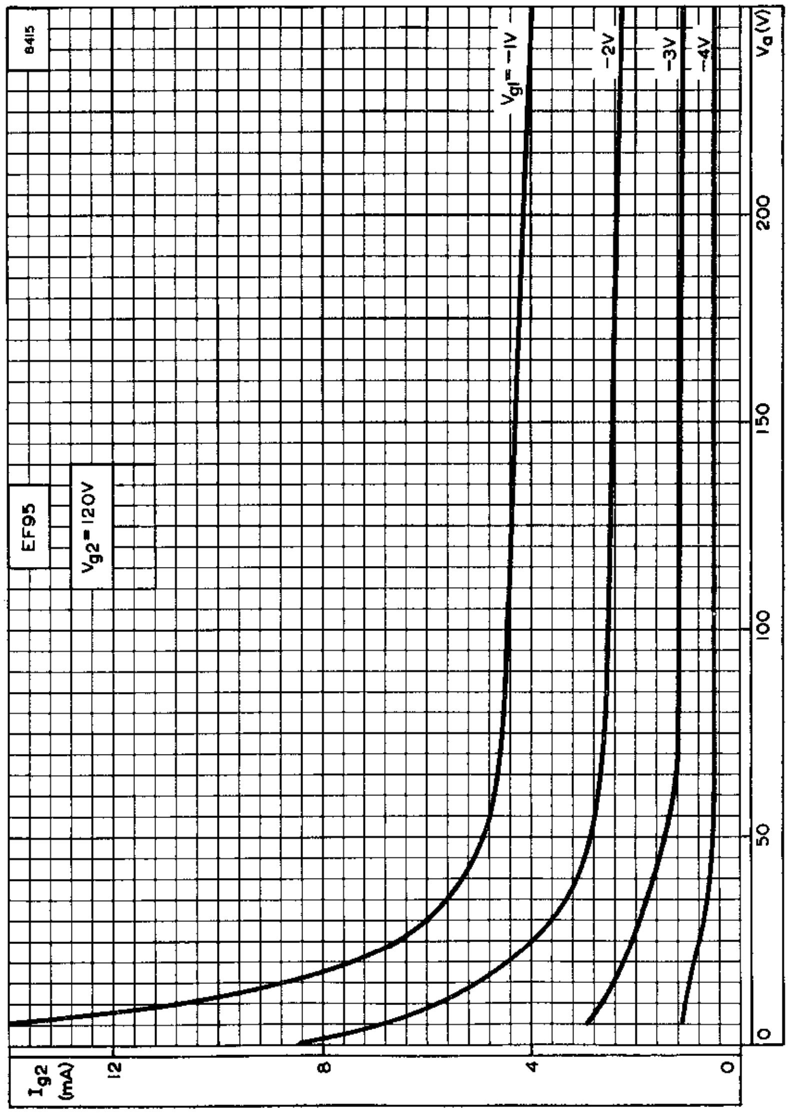
ANODE CURRENT, SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
$V_a = 120V$



ANODE CURRENT, SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE. Va = 180V

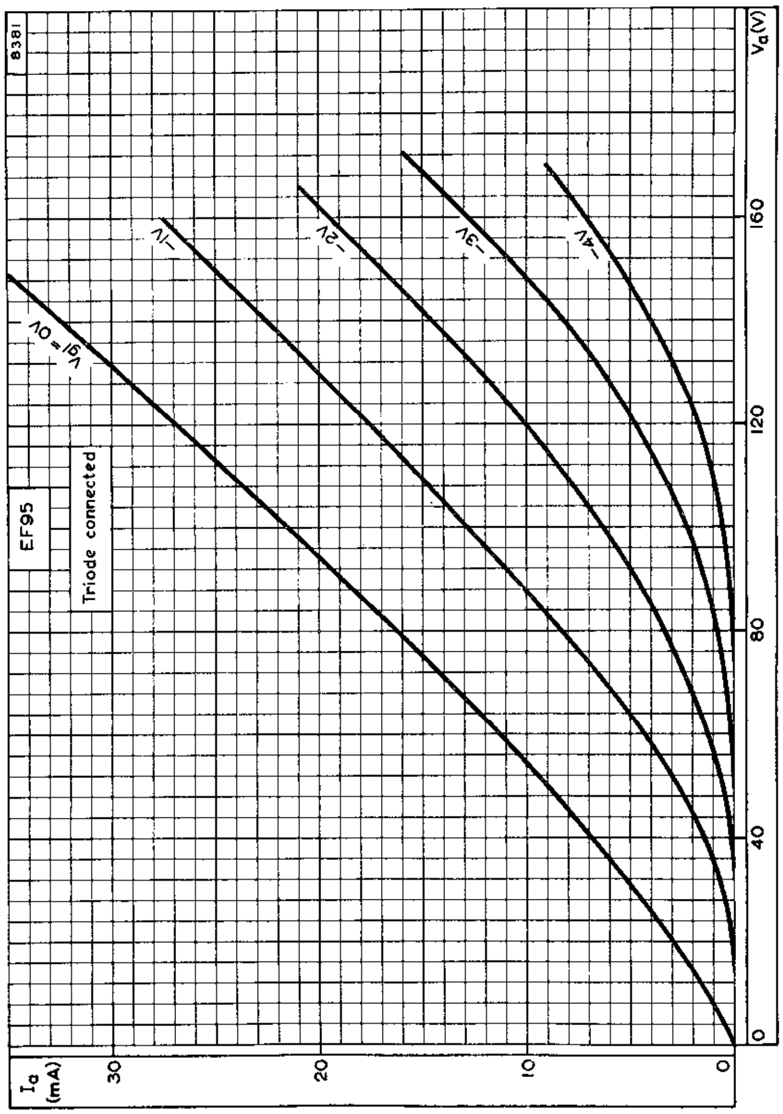


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER



SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER

ANODE CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE, WHEN TRIODE CONNECTED



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER,
WHEN TRIODE CONNECTED

VARIABLE-MU R.F. PENTODE

EF183

Frame-grid variable-mu r.f. pentode for use as an automatic gain controlled i.f. amplifier in television receivers.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

V_h	6.3	V
I_h	300	mA

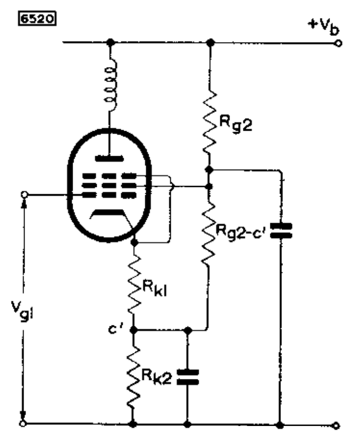
CAPACITANCES

c_{in}	9.5	pF
c_{out}	3.0	pF
c_{a-g1}	5.5	mpF←
c_{g1-g2}	2.8	pF

CHARACTERISTICS

V_a	170	200	230	V
V_{g2}	90	90	90	V
V_{g3}	0	0	0	V
I_a	14	12	10.5	mA
I_{g2}	5.3	4.5	3.6	mA
V_{g1}	−1.8	−2.0	−2.1	V
g_m	14	12.5	10.6	mA/V
r_a	350	500	650	kΩ
r_{g1} (f = 40Mc/s)	11.6	13	15.3	kΩ
R_{eq} (f = 40Mc/s)	—	490	—	Ω←

OPERATING CONDITIONS

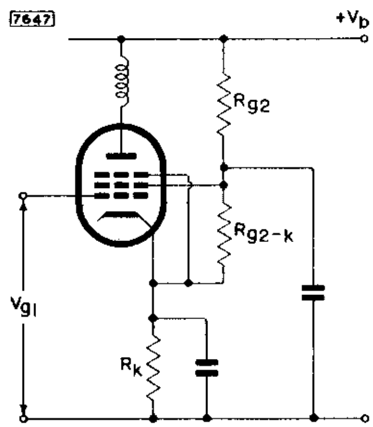


With compensating resistor R_{k1} (e.g. vision i.f. amplifier)

Condition	*1*	2	*3*	*4*	
*V_b	190	190	190	190	V
R_{g2}	22	6.8	8.2	10	kΩ
$R_{g2-c'}$	—	8.2	12	18	kΩ
R_{k1}	22	22	22	22	Ω
R_{k2}	100	56	68	82	Ω
R_{g1}	—	—	—	—	kΩ
I_a	11.6	11.8	11.7	11.4	mA
I_{g2}	4.3	4.4	4.4	4.3	mA
g_m	12.3	12.4	12.2	12	mA/V
V_{g1} for 100 : 1 reduction in g_m	−18.5	−9.0	−10	−11	V
I_{total}	16	27	24	21	mA

Condition	5	6	7	*8*	
*V_b	190	190	190	190	V
R_{g2}	12	15	18	33	kΩ
$R_{g2-c'}$	27	47	82	—	kΩ
R_{k1}	22	22	22	22	Ω
R_{k2}	82	82	82	0	Ω
R_{g1}	—	—	—	470	kΩ
I_a	11.8	11.9	12	11.6	mA
I_{g2}	4.4	4.5	4.5	4.4	mA
g_m	12.3	12.5	12.5	15.5	mA/V
V_{g1} for 100 : 1 reduction in g_m	−12	−13.5	−14.5	−17	V
I_{total}	19.7	18.5	14.7	16	mA

*For other values of V_b up to 210V, the above conditions can be used providing the values of R_{g2} are changed to keep V_{g2} at approx. 90V.



Without compensating resistor (e.g. sound i.f. amplifier)

Condition	*1*	*2*	*3*	*4*	
*V_b	190	190	190	190	V
R_{g2}	22	6.8	8.2	10	kΩ
R_{g2-k}	—	8.2	12	18	kΩ
R_k	120	68	82	100	Ω
I_a	11.7	12	11.8	11.4	mA
I_{g2}	4.3	4.5	4.4	4.3	mA
g_m	12.4	13	12.3	12	mA/V
V_{g1} for 10 : 1 reduction in g_m	−5.0	−3.0	−3.25	−3.5	V
V_{g1} for 100 : 1 reduction in g_m	−18.5	−9.0	−10	−11	V
I_{total}	16	27	24	21	mA

Condition	5	6	7	
*V_b	190	190	190	V
R_{g2}	12	15	18	kΩ
R_{g2-k}	27	47	82	kΩ
R_k	100	100	100	Ω
I_a	11.8	12	12	mA
I_{g2}	4.4	4.5	4.5	mA
g_m	12.4	12.5	12.5	mA/V
V_{g1} for 10 : 1 reduction in g_m	−4.0	−4.4	−4.6	V
V_{g1} for 100 : 1 reduction in g_m	−12	−13.5	−14.5	V
I_{total}	19.7	18.5	17.5	mA

*For other values of V_b up to 210V, the above conditions can be used providing the values of R_{g2} are changed to keep V_{g2} at approx. 90V.

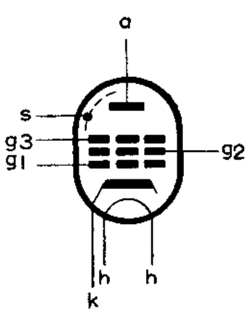
EF183

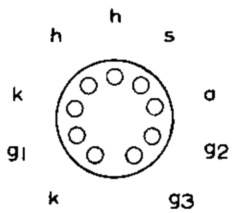
VARIABLE-MU R.F. PENTODE

DESIGN CENTRE RATINGS

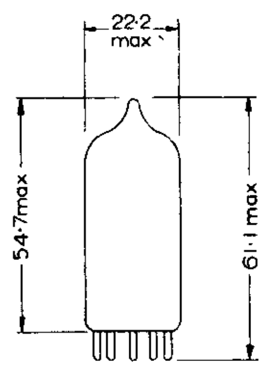
$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	2.5	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
p_{g2} max.	650	mW
$-v_{g1(pk)}$ max.	50	V
I_k max.	20	mA
R_{g1-k} max.	1.0	MΩ
R_{g3-k} max.	50	kΩ
V_{h-k} max.	150	V
R_{h-k} max.	20	kΩ
T_{bulb} max.	180	°C

6688

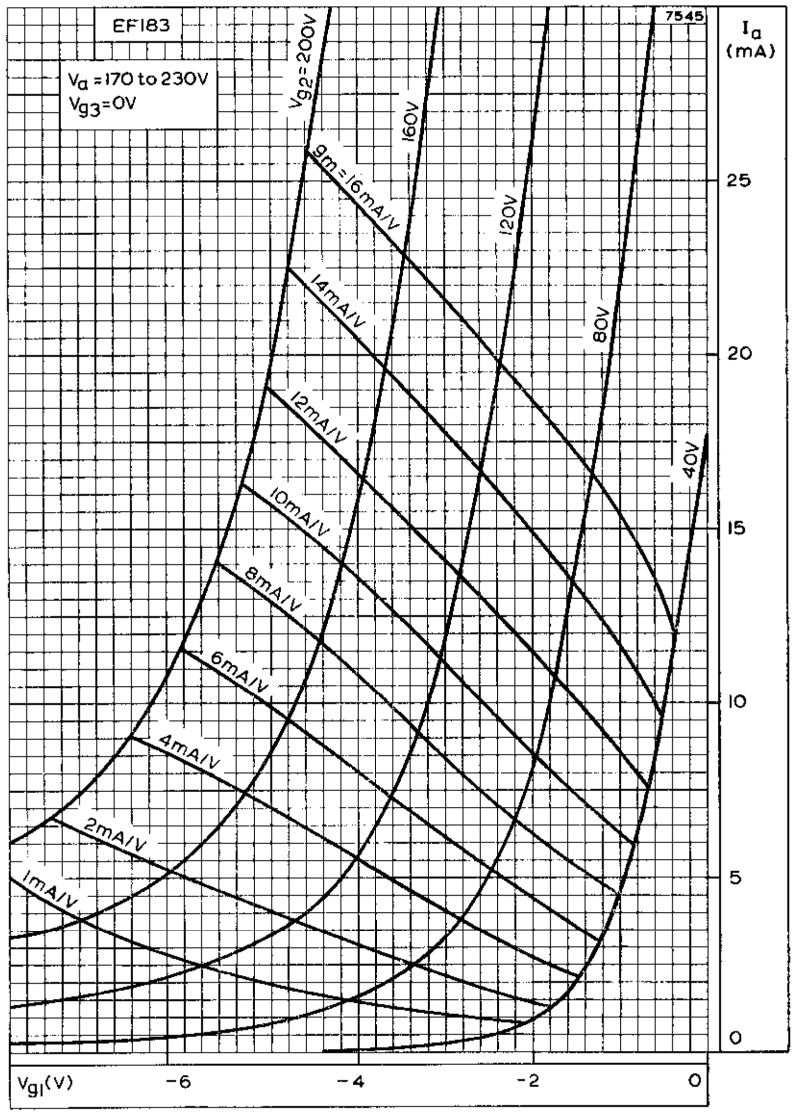




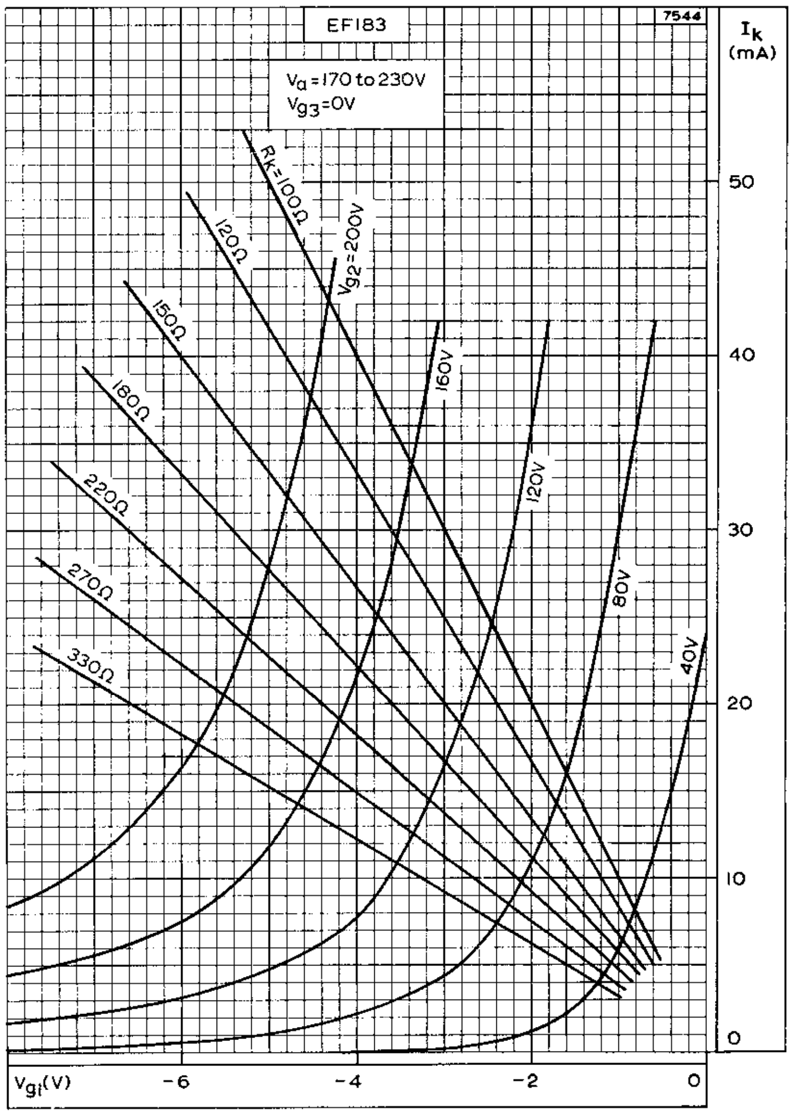
B9A Base



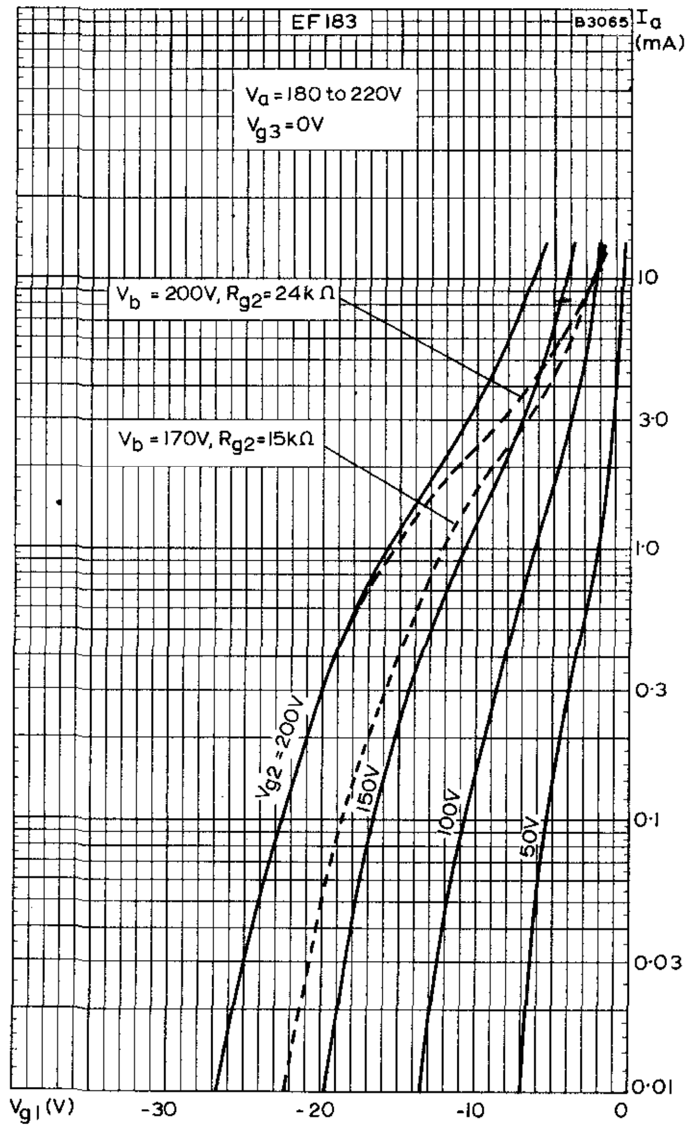
All dimensions in mm



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER AND WITH MUTUAL CONDUCTANCE CONTOURS



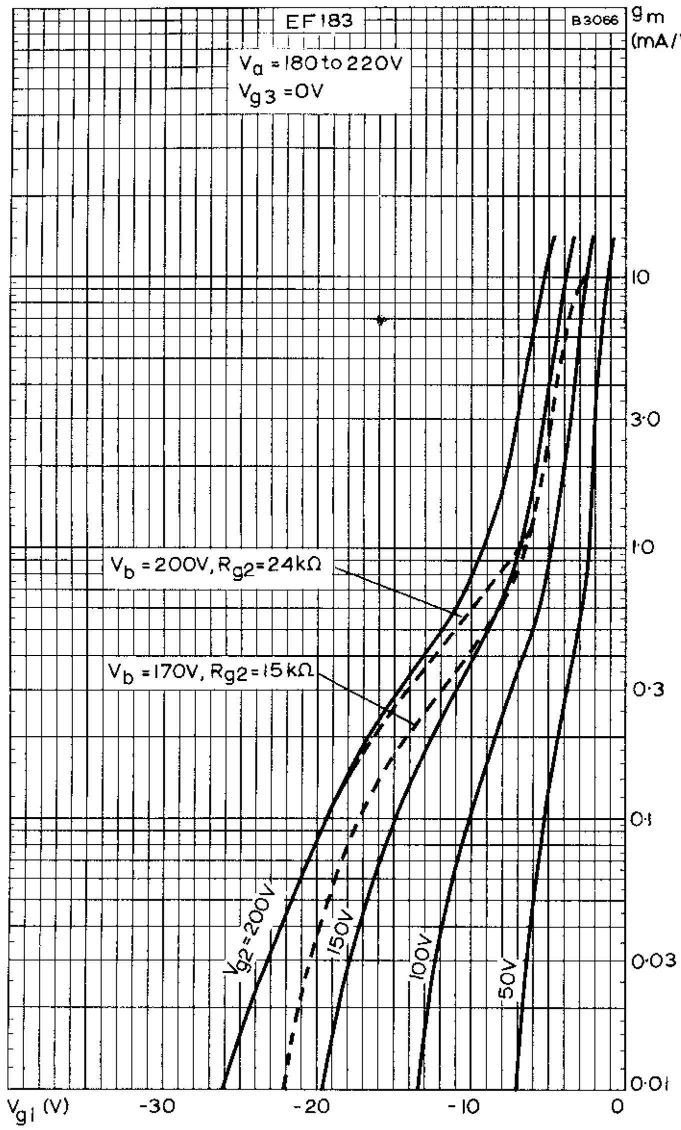
CATHODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER



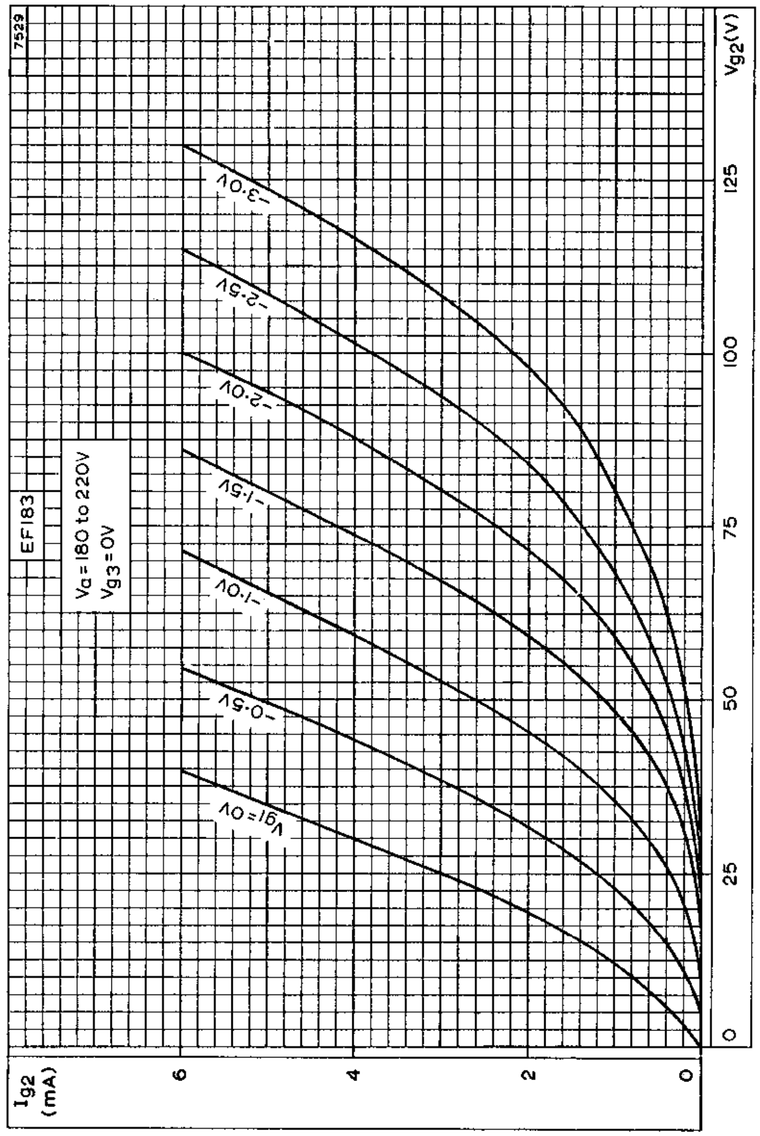
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER

EF183

VARIABLE-MU R.F. PENTODE



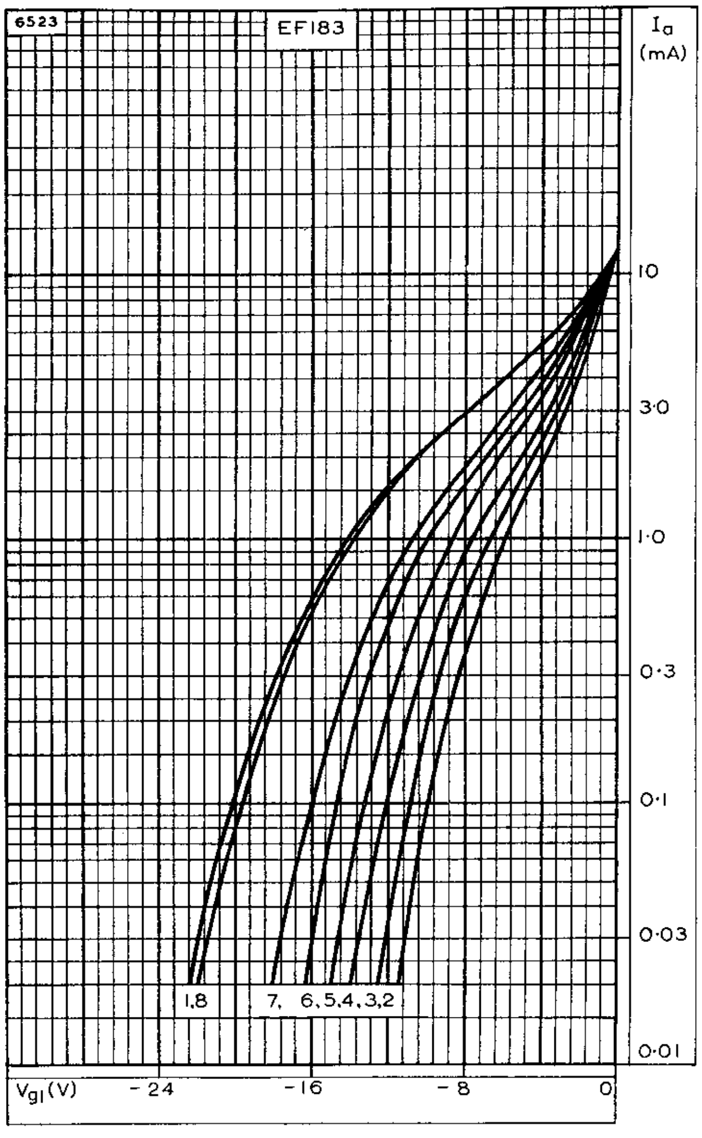
MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER



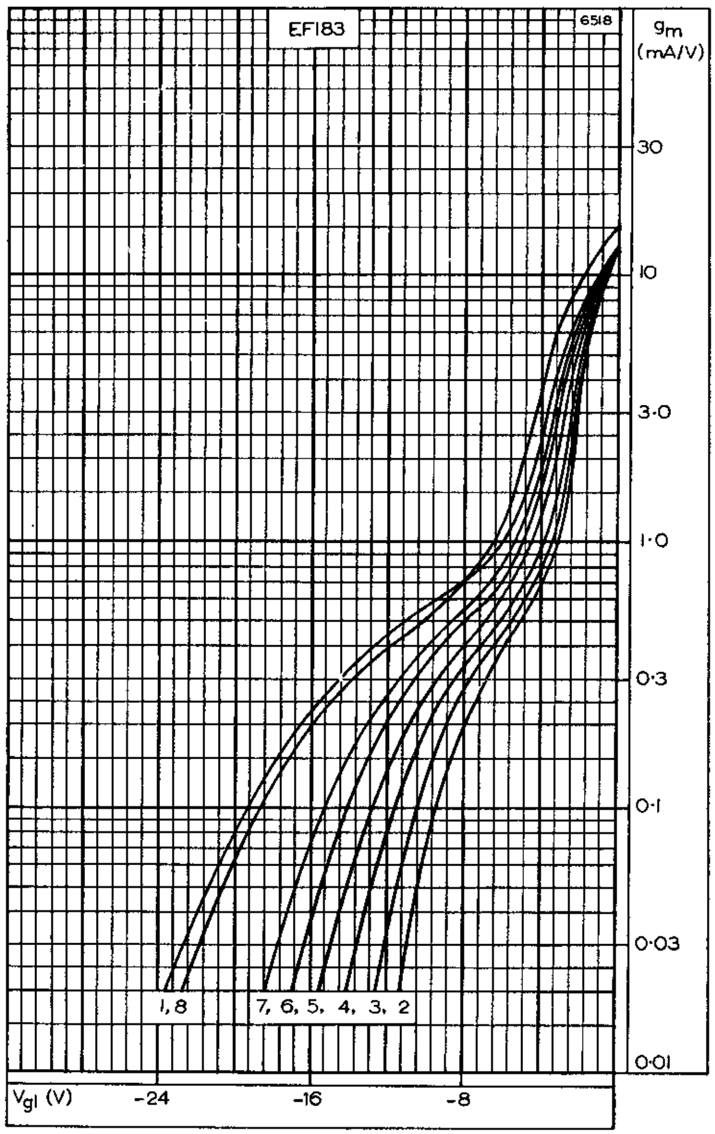
SCREEN-GRID CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

EF183

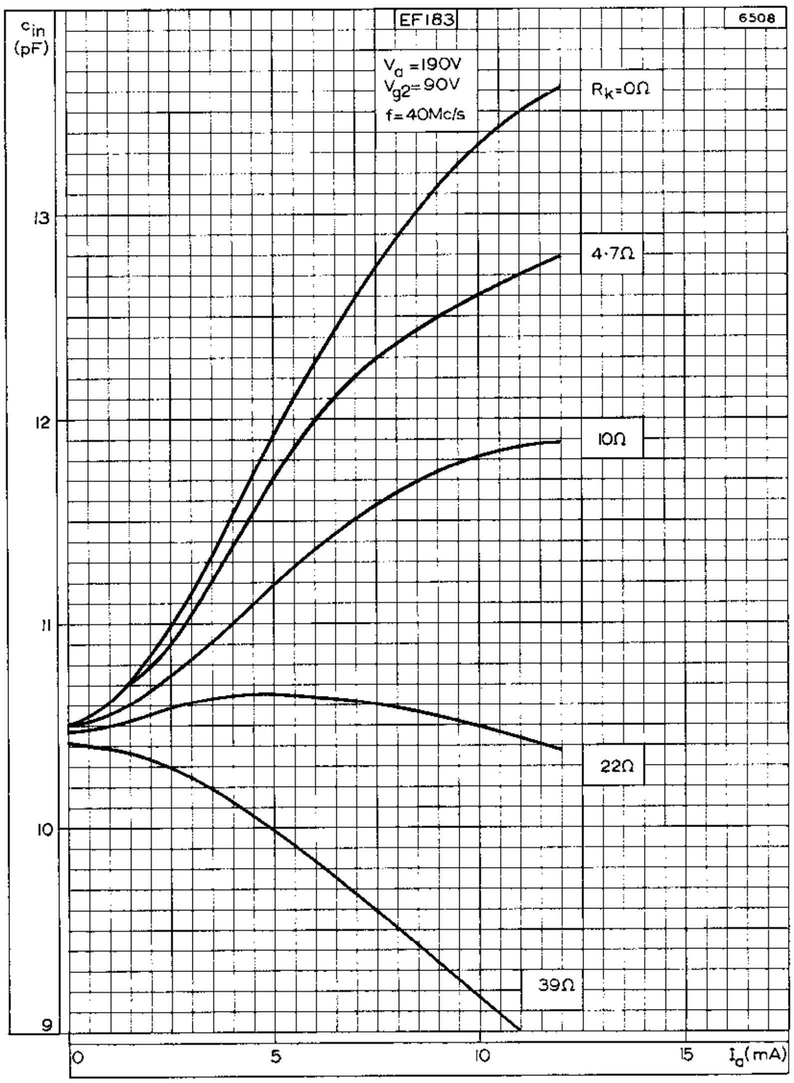
VARIABLE-MU R.F. PENTODE



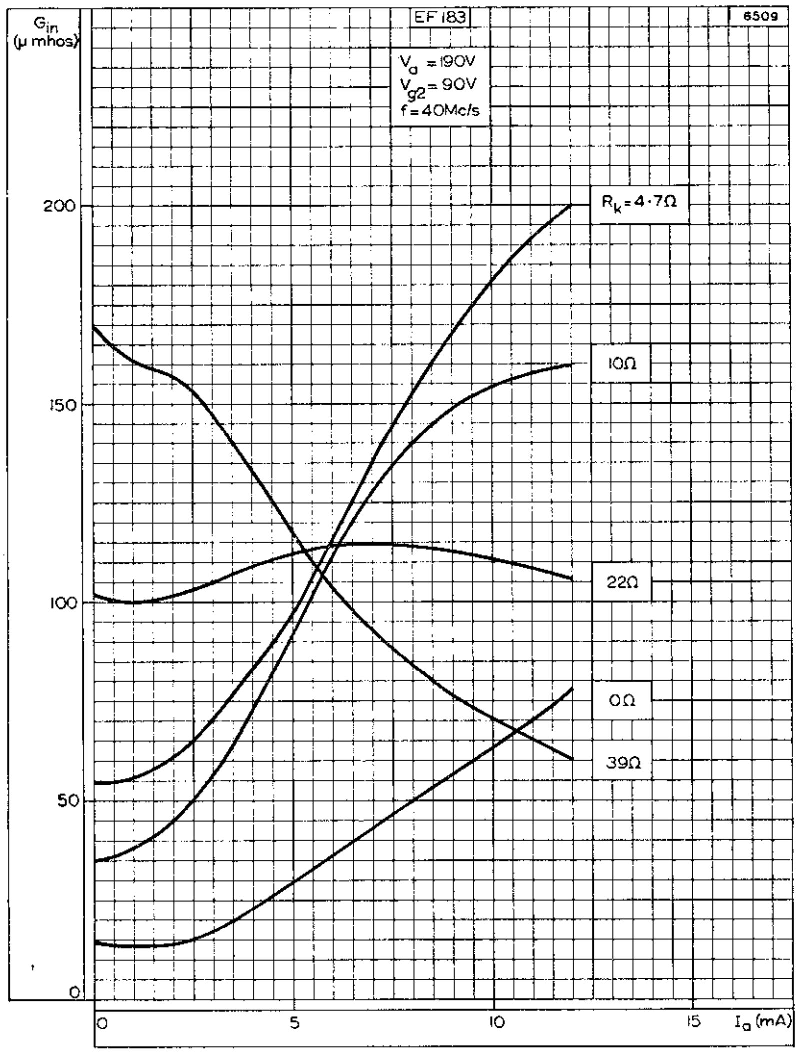
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE.
Curve numbers refer to operating conditions on pages D2, D3



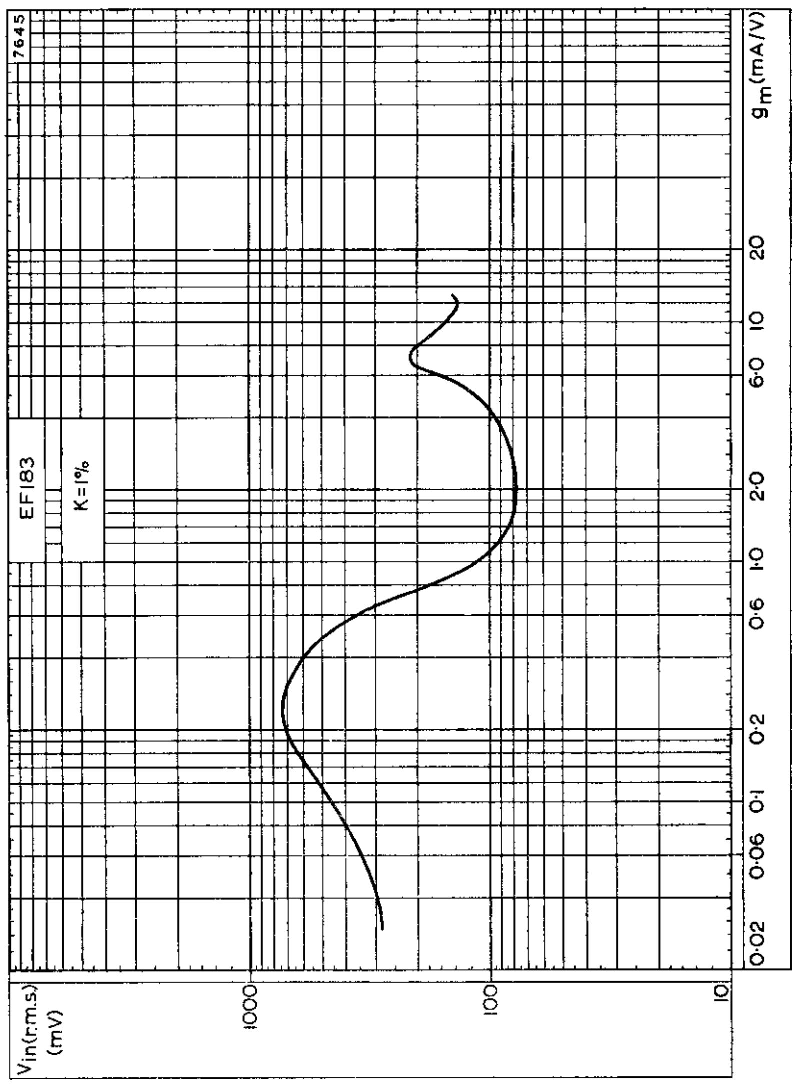
MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
Curve numbers refer to operating conditions on pages D2, D3



INPUT CAPACITANCE PLOTTED AGAINST ANODE CURRENT FOR VARIOUS VALUES OF CATHODE RESISTOR



INPUT CONDUCTANCE PLOTTED AGAINST ANODE CURRENT FOR VARIOUS VALUES OF CATHODE RESISTOR



CROSS-MODULATION CURVE

R.F. PENTODE

EF184

Frame-grid sharp cut-off pentode for use as an i.f. amplifier in television receivers.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

V_h	6.3	V
I_h	300	mA

CAPACITANCES

c_{in}	10	pF
c_{out}	3.0	pF
c_{a-g1}	5.5	mpF←
c_{g1-g2}	2.8	pF

CHARACTERISTICS

V_a	170	200	V
V_{g2}	170	200	V
V_{g3}	0	0	V
I_a	10	10	mA
I_{g2}	4.1	4.1	mA
V_{g1}	−2.0	−2.5	V
g_m	15.6	15	mA/V
r_a	330	380	kΩ
μ_{g1-g2}	60	60	
r_{g1} (f = 40Mc/s)	9.5	11	kΩ
R_{eq} (f = 40Mc/s)	—	330	Ω←

OPERATING CONDITIONS ←

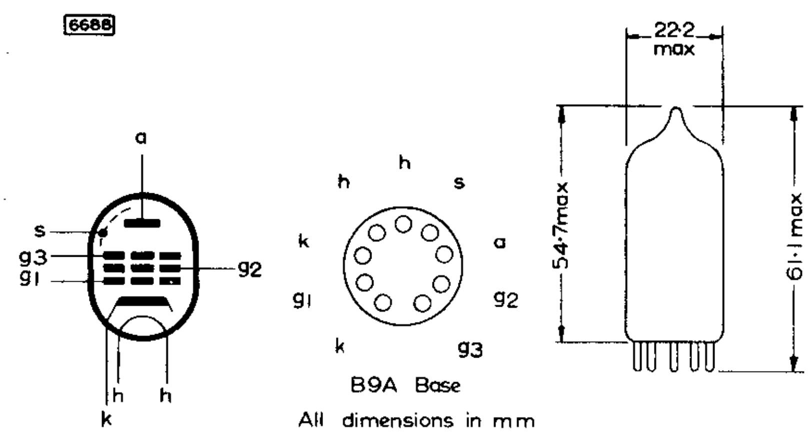
$V_{a(b)}$	170	200	230	V
$V_{g3(b)}$	0	0	0	V
$V_{g2(b)}$	170	200	230	V
R_k	140	140	140	Ω
R_{g2}	0	7.5	15	kΩ
I_a	10	10	10	mA
I_{g2}	4.1	4.1	4·1	mA
g_m	15.6	15.6	15.6	mA/V
r_a	330	510	680	kΩ
r_{g1} (f = 40Mc/s)	10	10	10	kΩ
R_{eq} (f = 40Mc/s)	300	300	300	Ω

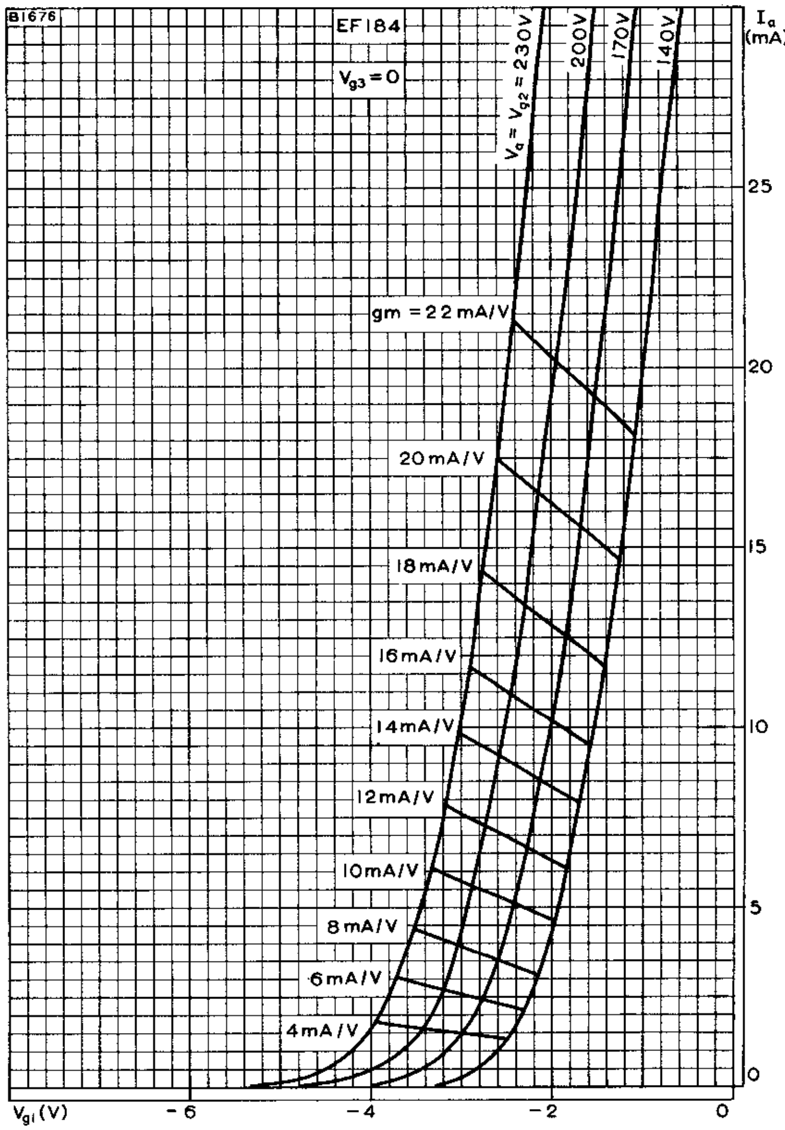
EF184

R.F. PENTODE

DESIGN CENTRE RATINGS

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	2.5	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
p_{g2} max.	900	mW
$-v_{g1(pk)}$ max.	50	V
I_k max.	25	mA
R_{g1-k} max.	1.0	MΩ
V_{h-k} max.	150	V
R_{h-k} max.	20	kΩ
T_{bulb} max.	180	°C





ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETER AND WITH MUTUAL CONDUCTANCE CONTOURS

EF184

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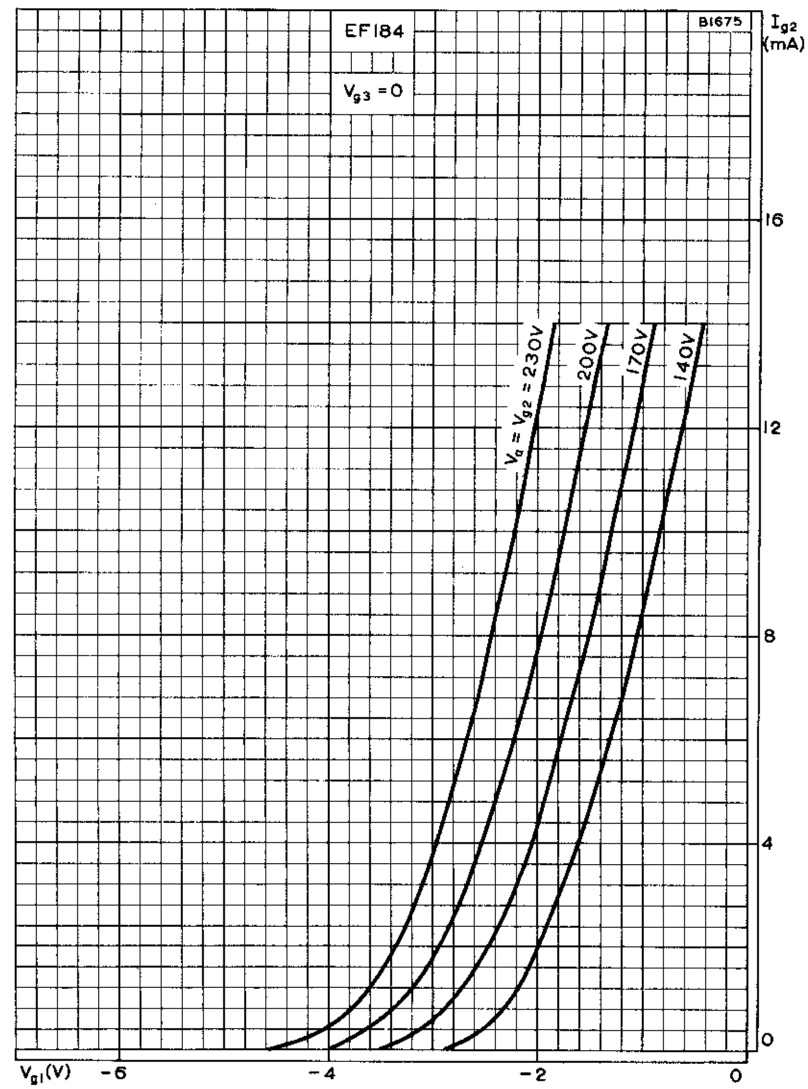
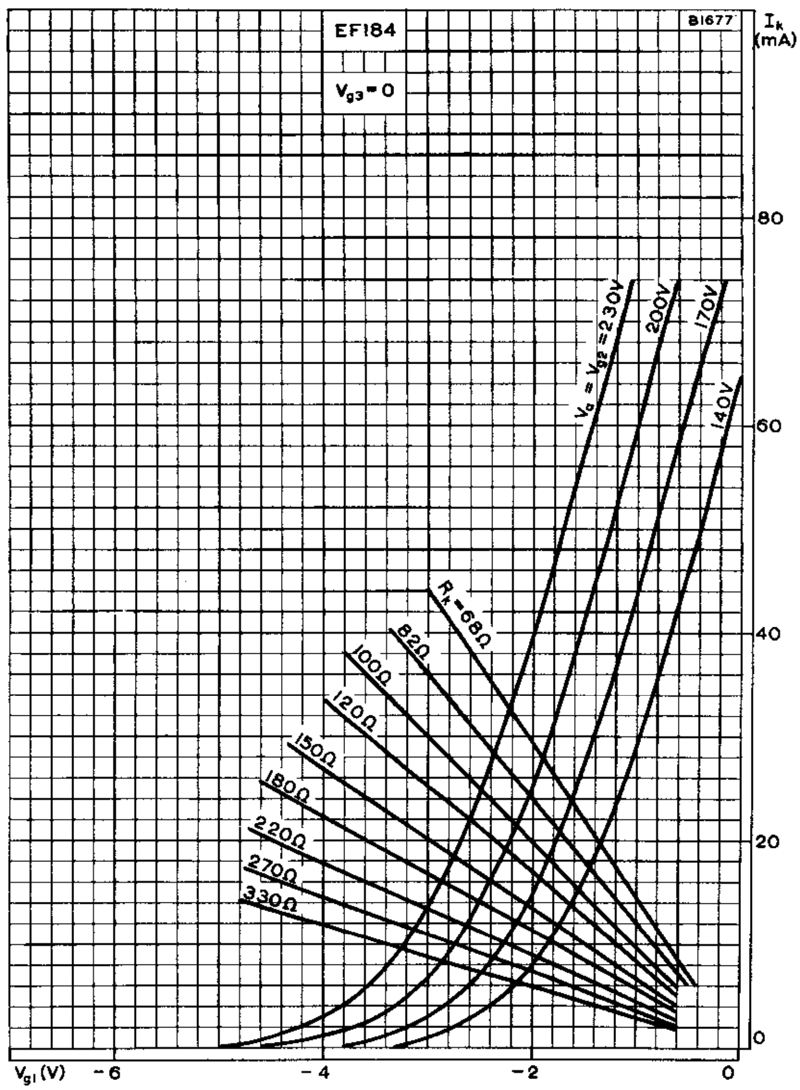
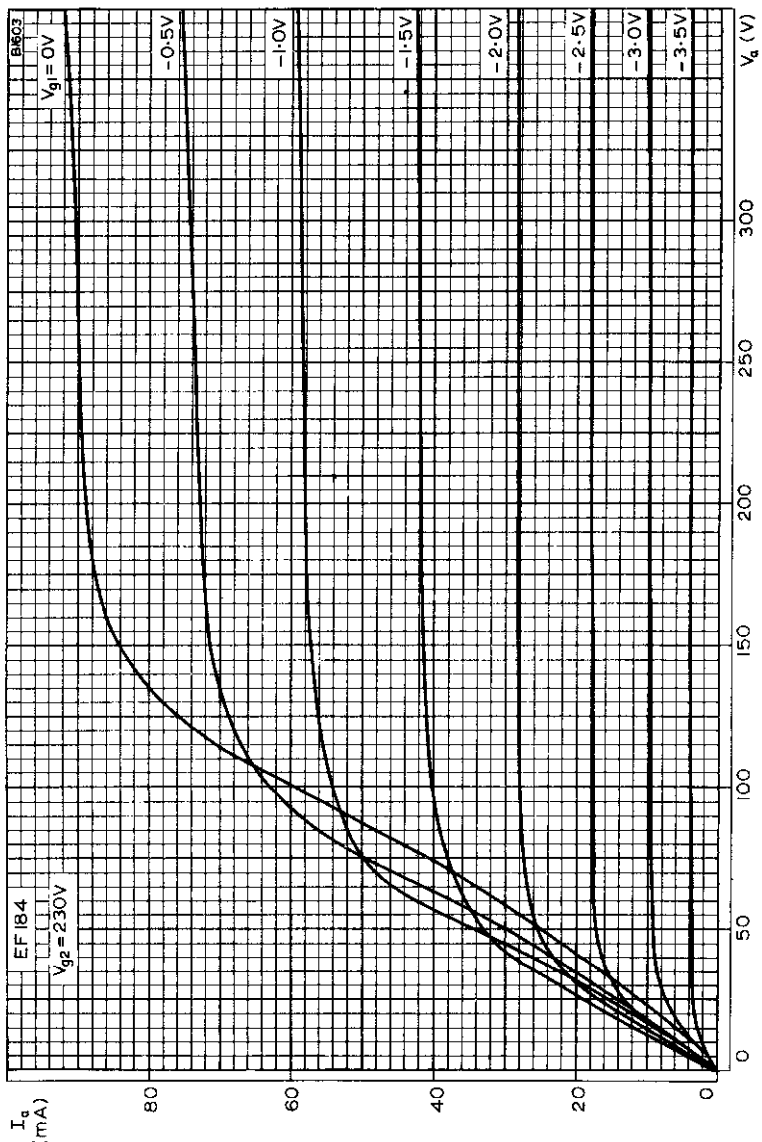


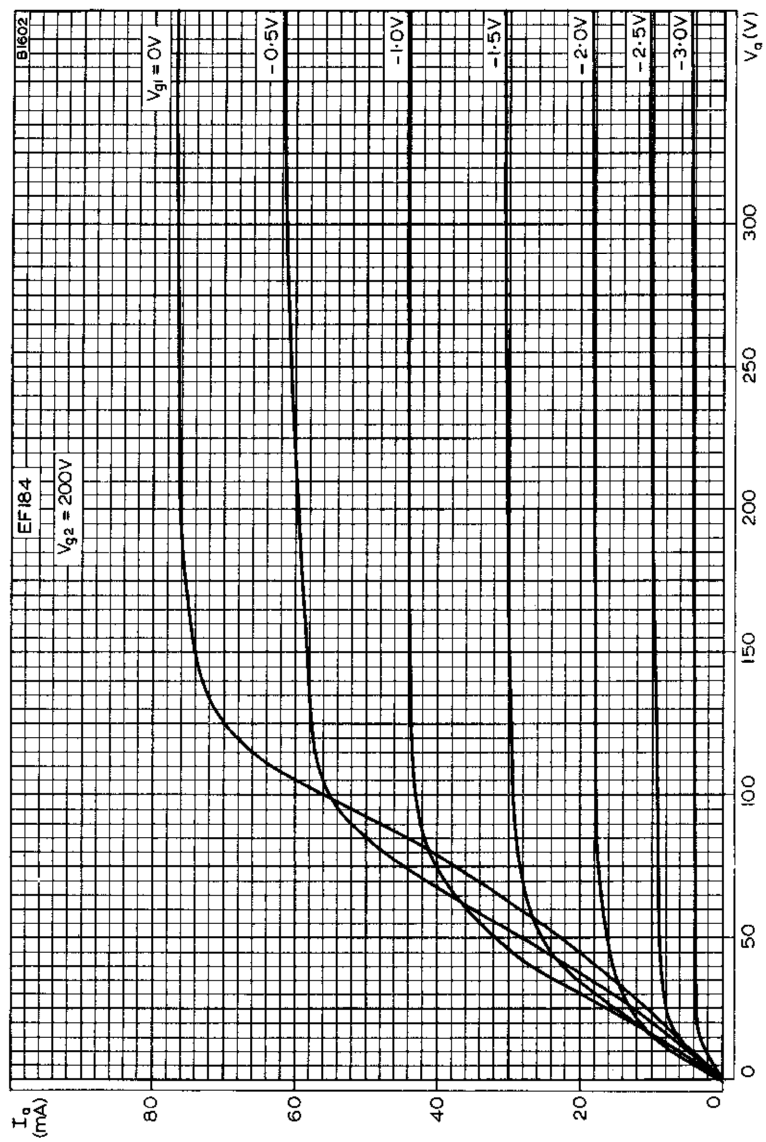
SCREEN-GRID CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETER



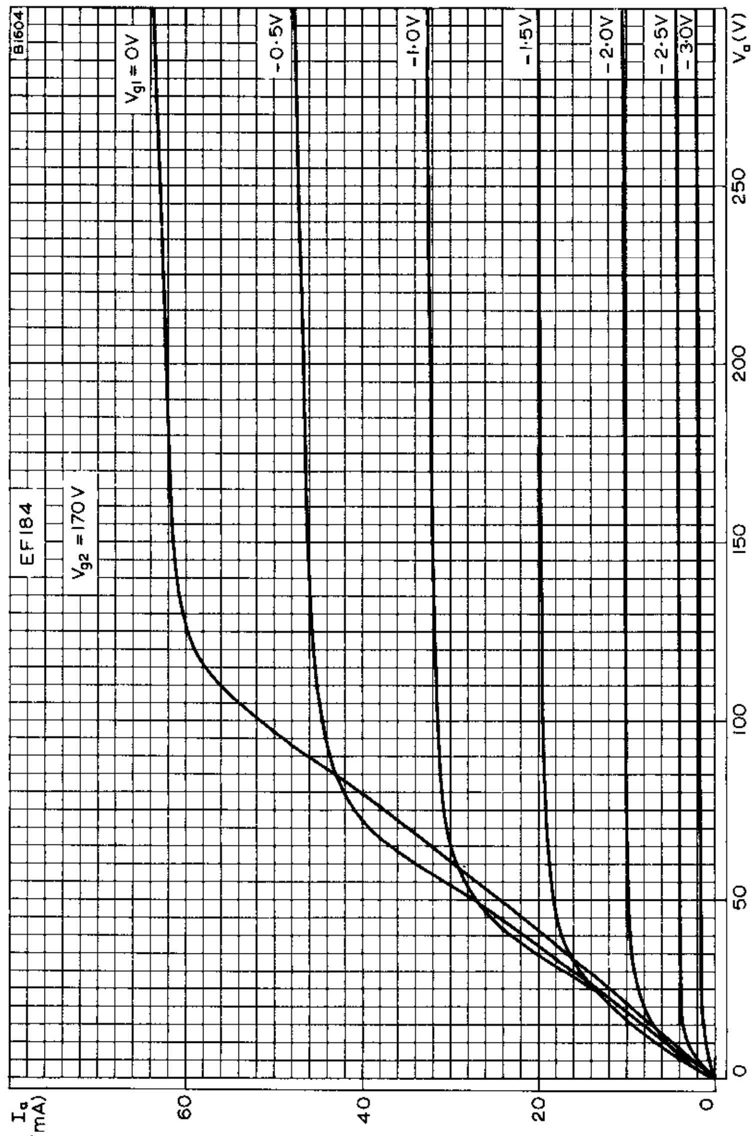
CATHODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETER



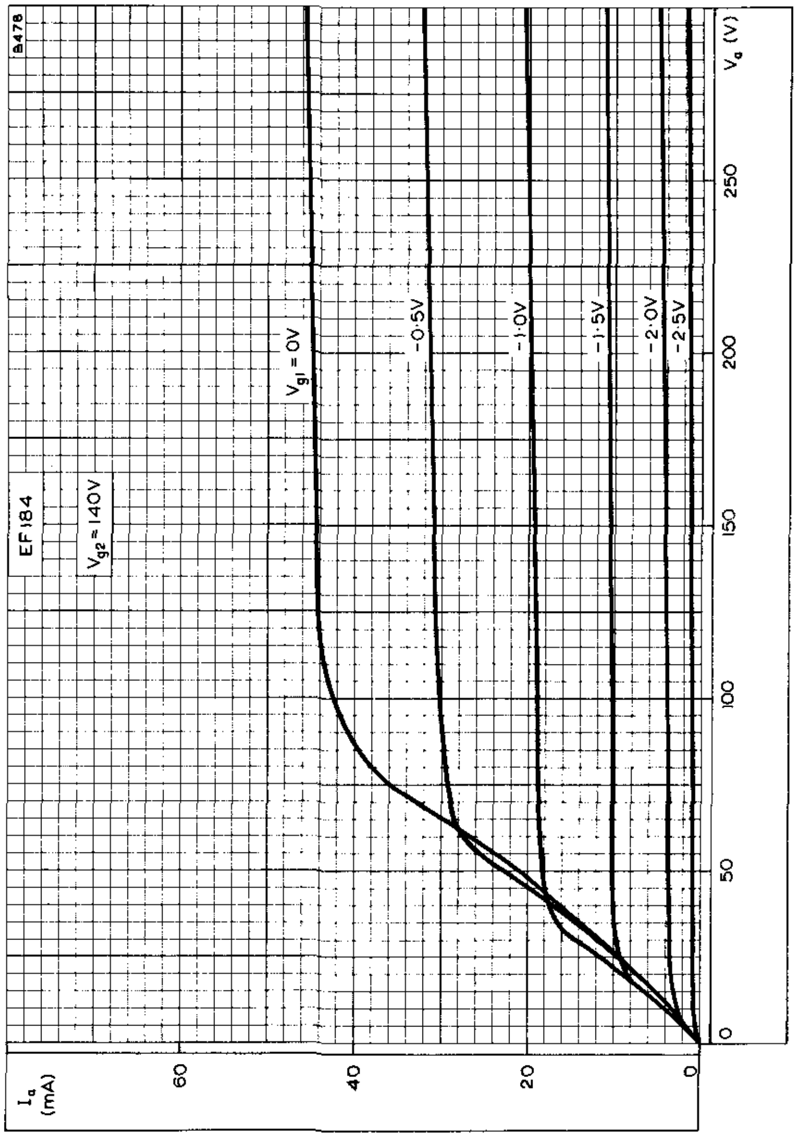
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 230V$



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 200V$



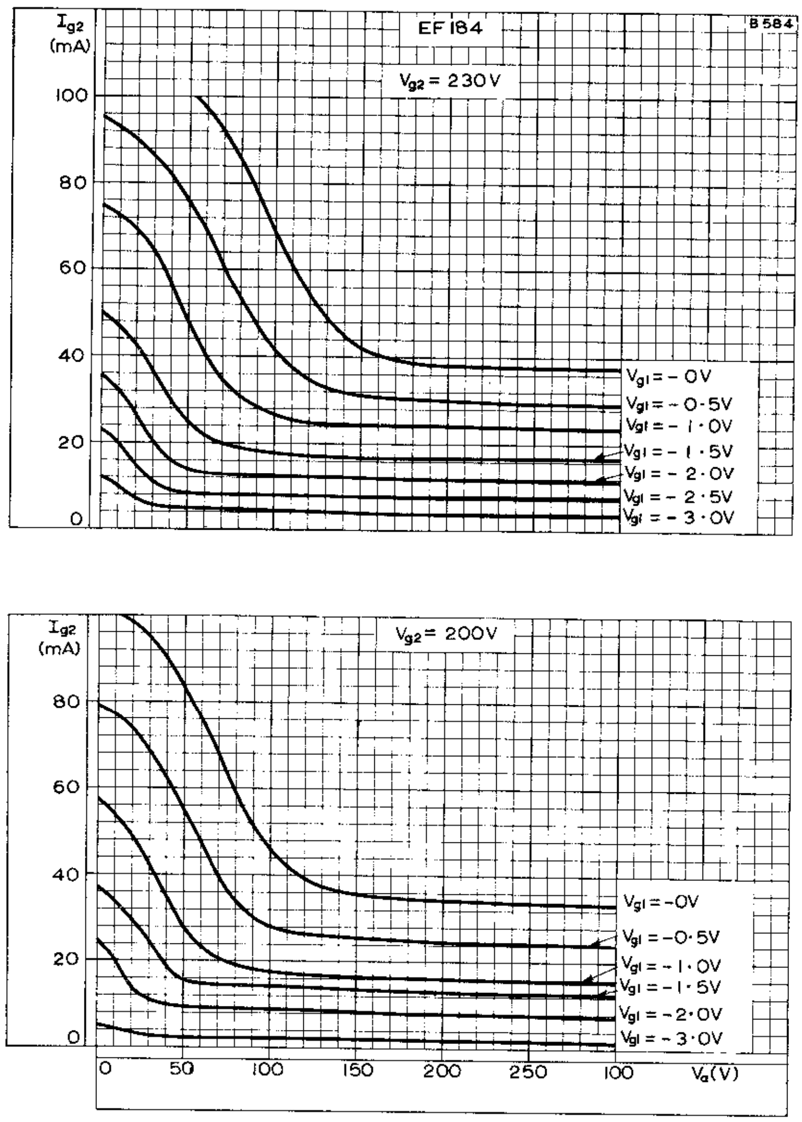
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 170V$



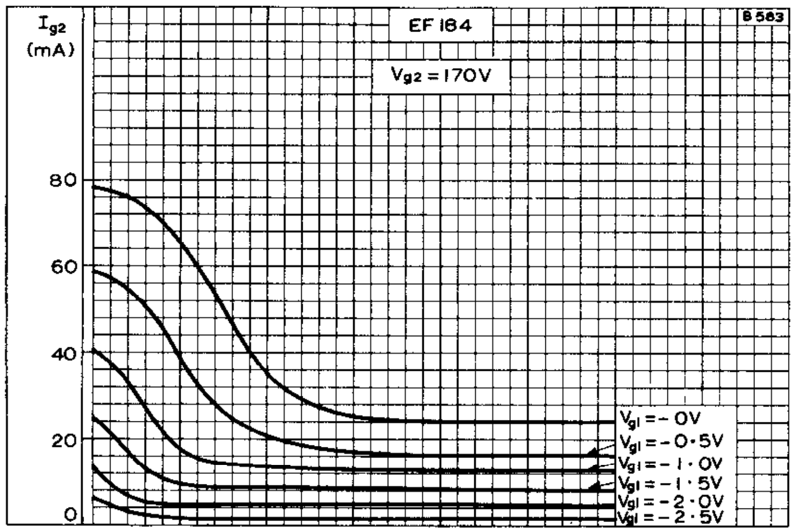
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 140V

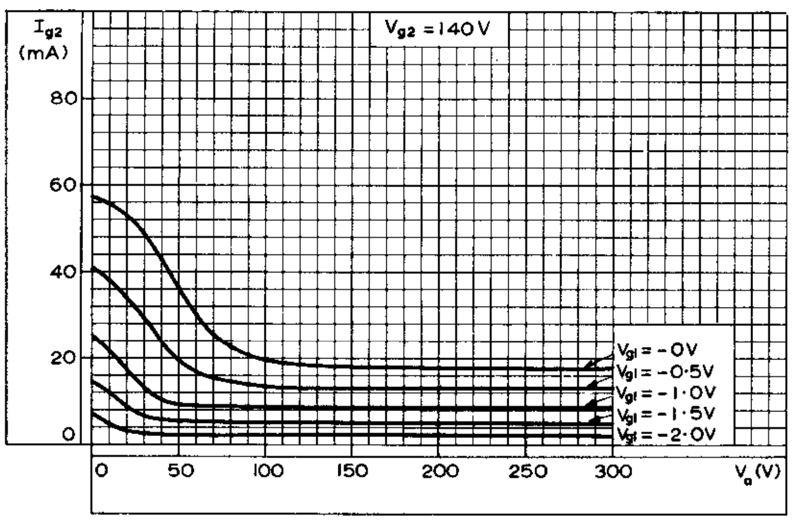
EF184

R.F. PENTODE

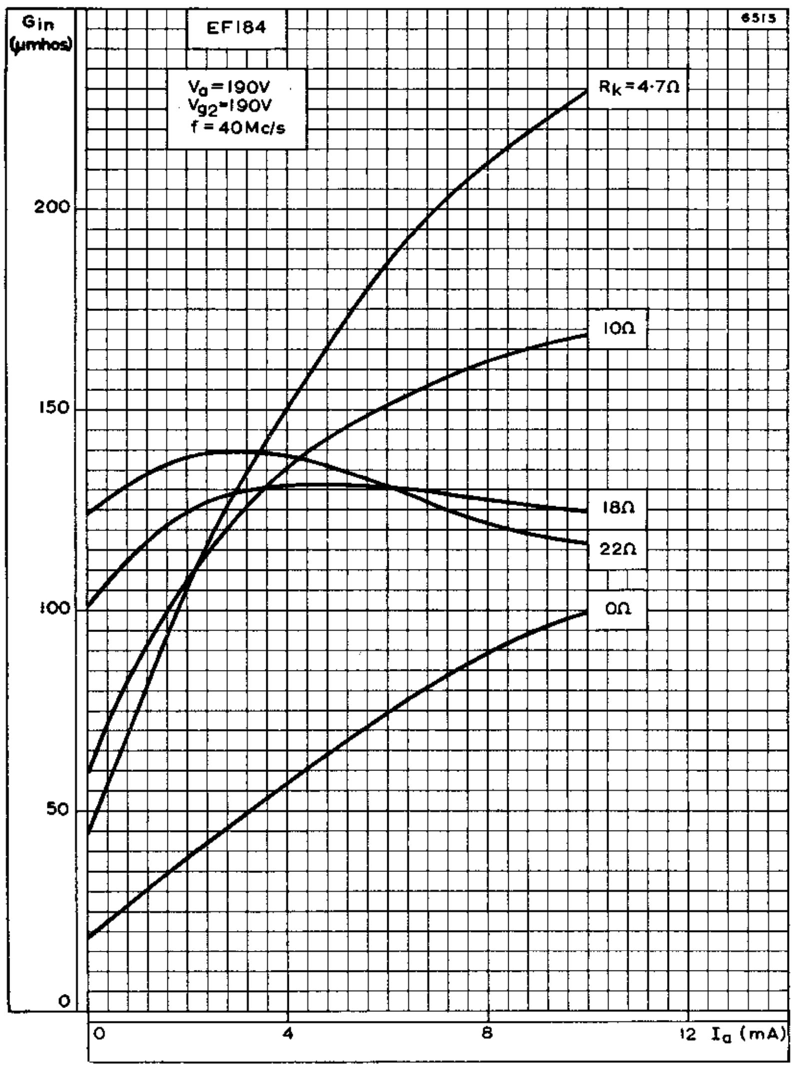


SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

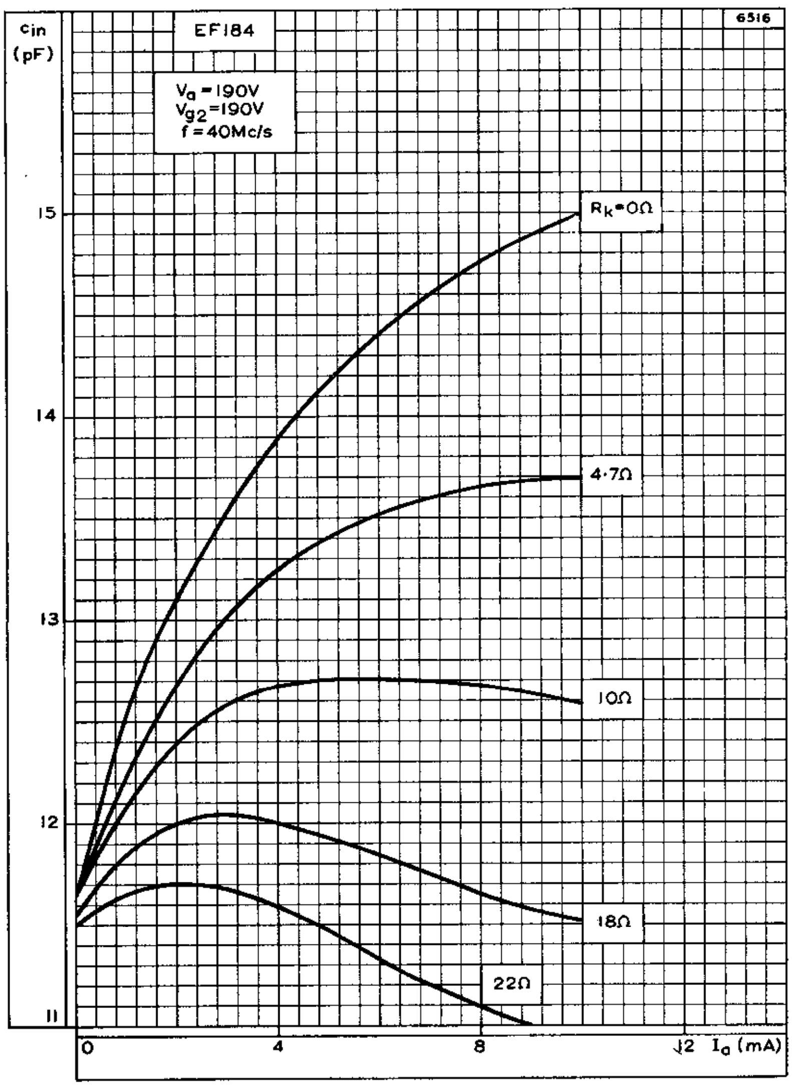




SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER



INPUT CONDUCTANCE PLOTTED AGAINST ANODE CURRENT WITH VARIOUS VALUES OF CATHODE RESISTOR



INPUT CAPACITANCE PLOTTED AGAINST ANODE CURRENT WITH VARIOUS VALUES OF CATHODE RESISTOR

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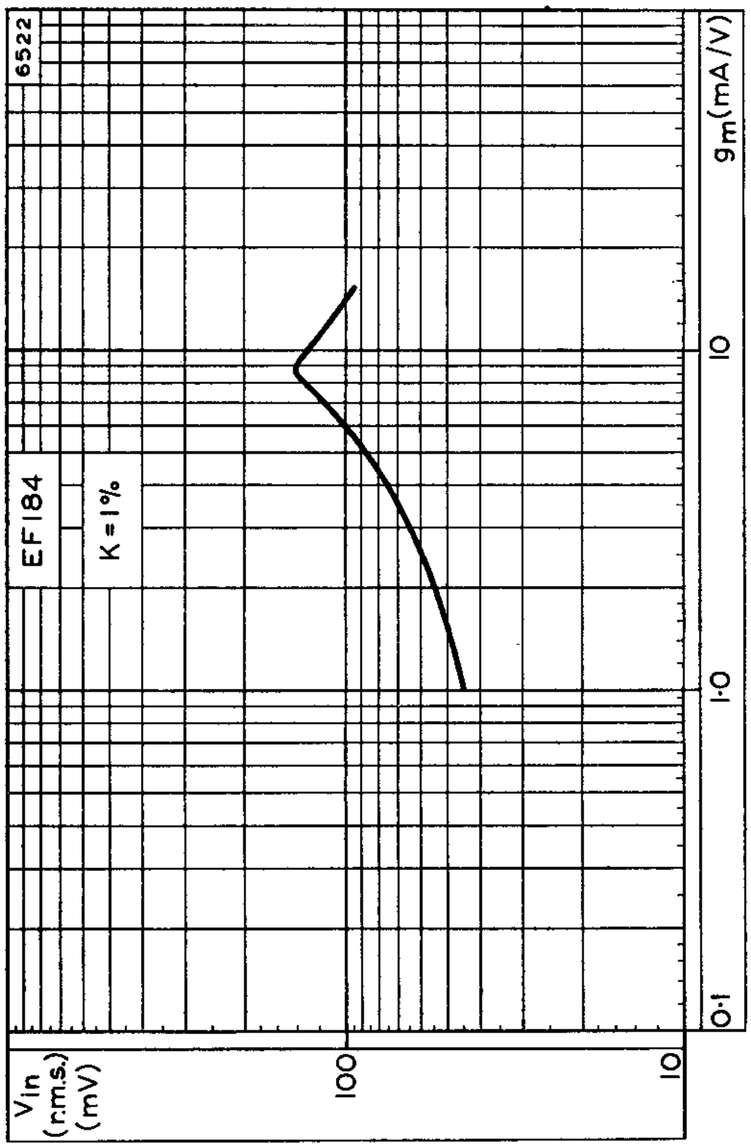


CROSS-MODULATION CURVE

OUTPUT PENTODE

EL84

Output pentode rated for 12W anode dissipation, primarily intended for use in a.c. mains operated equipment.

HEATER

V_h	6.3	V
I_h	760	mA

CAPACITANCES

c_{in}	10.8	pF
c_{out}	6.5	pF
c_{a-g1}	<500	mpF
c_{g1-h}	<250	mpF

CHARACTERISTICS

Pentode connection

V_a	250	V
V_{g2}	250	V
I_a	48	mA
I_{g2}	5.5	mA
V_{g1}	−7.3	V
g_m	11.3	mA/V
r_a	38	kΩ
μ_{g1-g2}	19	

Triode connection
(g_2 connected to a)

V_a	250	V
I_a	34	mA
V_{g1}	−9.0	V
g_m	10	mA/V
r_a	2.0	kΩ
μ	19.5	

OPERATING CONDITIONS AS SINGLE VALVE AMPLIFIER

Pentode connection

V_a	250	250	V
V_{g2}	250	250	V
R_a	5.2	4.5	kΩ
V_{g1}	−7.3	−7.3	V
I_a	48	48	mA
I_{g2}	5.5	5.5	mA
$V_{in(r.m.s.)}$ (P_{out} = 50mW)	300	300	mV
$V_{in(r.m.s.)}$ (D_{tot} = 10%)	4.3	4.4	V
P_{out} (D_{tot} = 10%)	5.7	5.7	W
D_3	9.5	8.0	%
D_2	2.0	5.0	%

Triode connection (g_2 connected to a)

V_a	250	V
R_a	3.5	kΩ
V_{g1}	−9.0	V
$I_{a(0)}$	34	mA
$V_{in(r.m.s.)}$ (P_{out} = 50mW)	1.0	V
$V_{in(r.m.s.)}$	6.0	V
P_{out}	1.5	W
D_{tot}	6.0	%
$I_{a(max.sig.)}$	39	mA

OPERATING CONDITIONS FOR TWO VALVES IN PUSH-PULL

Pentode connection

V_a	250	300	V
V_{g2}	250	300	V
R_k (per valve)	270	270	Ω
R_{a-a}	8.0	8.0	kΩ
$I_{a(0)}$	2×31	2×36	mA
$I_{g2(0)}$	2×3.5	2×4.0	mA
$V_{in(g1-g1)\ r.m.s.}$	16	20	V
P_{out}	11	17	W
D_{tot}	3.0	4.0	%
$I_{a(max.sig.)}$	2×37.5	2×46	mA
$I_{g2(max.sig.)}$	2×7.5	2×11	mA

Distributed load conditions for maximum output (screen-grid tapping at 20% of primary turns)

V_a	300	300	V
V_{g2}	300	300	V
R_k (per valve)	390+47	270	Ω
R_{a-a}	6.0	8.0	kΩ
$I_{k(0)}$	2×28	2×40	mA
$V_{in(g1-g1)r.m.s.}$	17	18.3	V
P_{out}	14.4	15.4	W
D_{tot}	0.85	1.17	%
$I_{k(max.sig.)}$	2×55	2×48.5	mA

Distributed load conditions for minimum distortion (screen-grid tapping at 43% of primary turns)

V_a	300	300	V
V_{g2}	300	300	V
R_k (per valve)	390+47	270	Ω
R_{a-a}	6.0	8.0	kΩ
$I_{k(0)}$	2×28	2×40	mA
$V_{in(g1-g1)r.m.s.}$	16.8	16	V
P_{out}	10.1	11	W
D_{tot}	0.72	0.7	%
$I_{k(max.sig.)}$	2×47	2×45	mA

Triode connection (g_2 connected to a)

V_a	250	300	V
R_k (per valve)	560	560	Ω
R_{a-a}	10	10	kΩ
$I_{a(0)}$	2×20	2×24	mA
$V_{in(g1-g1)r.m.s.}$	16.5	20	V
P_{out}	3.4	5.2	W
D_{tot}	2.5	2.5	%
$I_{a(max.sig.)}$	2×21.5	2×26	mA

OPERATING CONDITIONS WITH CONTINUOUS SINE WAVE DRIVE

Single valve

V_a	250	250	V
$V_{g2(b)}$	250	250	V
*R_{g2}	4.7(±10%)	3.9(±10%)	kΩ
R_k	130	130	Ω
R_a	5.25	4.5	kΩ
$I_{a(o)}$	44	44	mA
$I_{g2(o)}$	5.1	5.2	mA
$V_{in(r.m.s.)}$	4.4	4.65	V
P_{out}	5.4	5.6	W
D_{tot}	12.5	13.9	%
$I_{a(max.sig.)}$	40	42	mA
$I_{g2(max.sig.)}$	8.6	8.4	mA
p_{g2}	1.8	1.8	W

*Decoupled by 8μF capacitor.

Two valves in push-pull

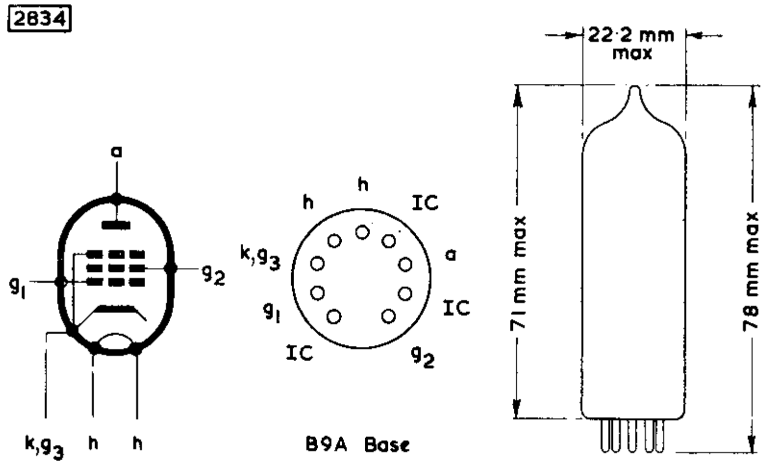
V_a	300	V
$V_{g2(b)}$	300	V
*R_{g2}	1.8(±10%)	kΩ
R_k (per valve)	270	Ω
R_{a-a}	8.0	kΩ
$I_{a(o)}$	2×35	mA
$I_{g2(o)}$	2×4.0	mA
$V_{in(g1-g1)r.m.s.}$	17.4	V
P_{out}	15	W
D_{tot}	3.4	%
$I_{a(max.sig.)}$	2×42	mA
$I_{g2(max.sig.)}$	2×7.0	mA
p_{g2}	1.93	W

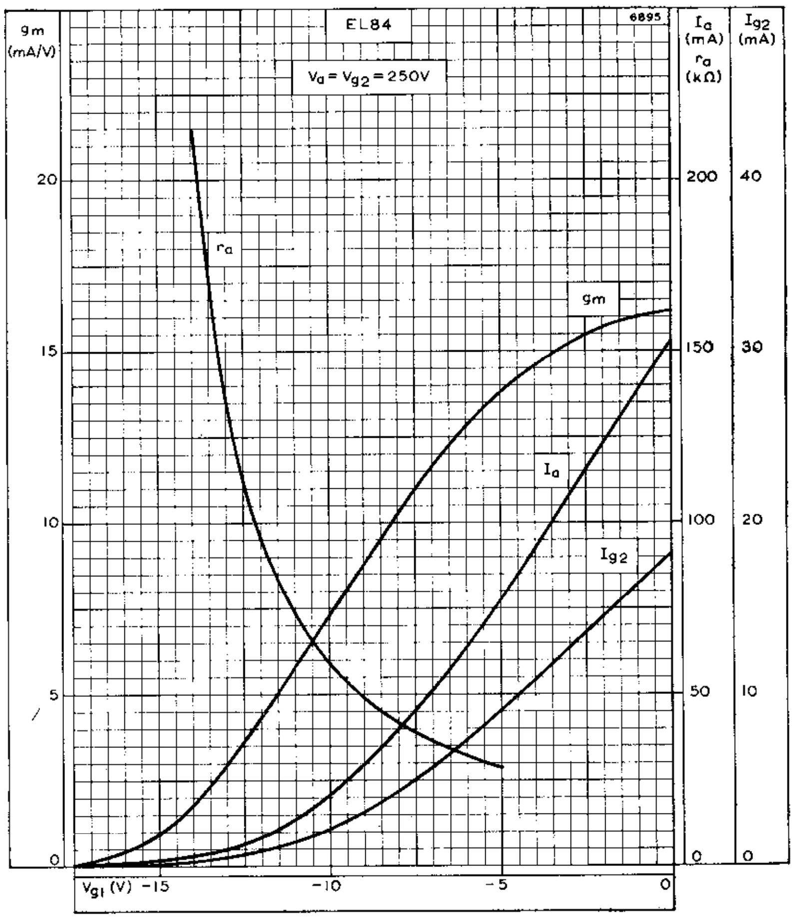
*Screen-grid resistor common to both valves.

LIMITING VALUES

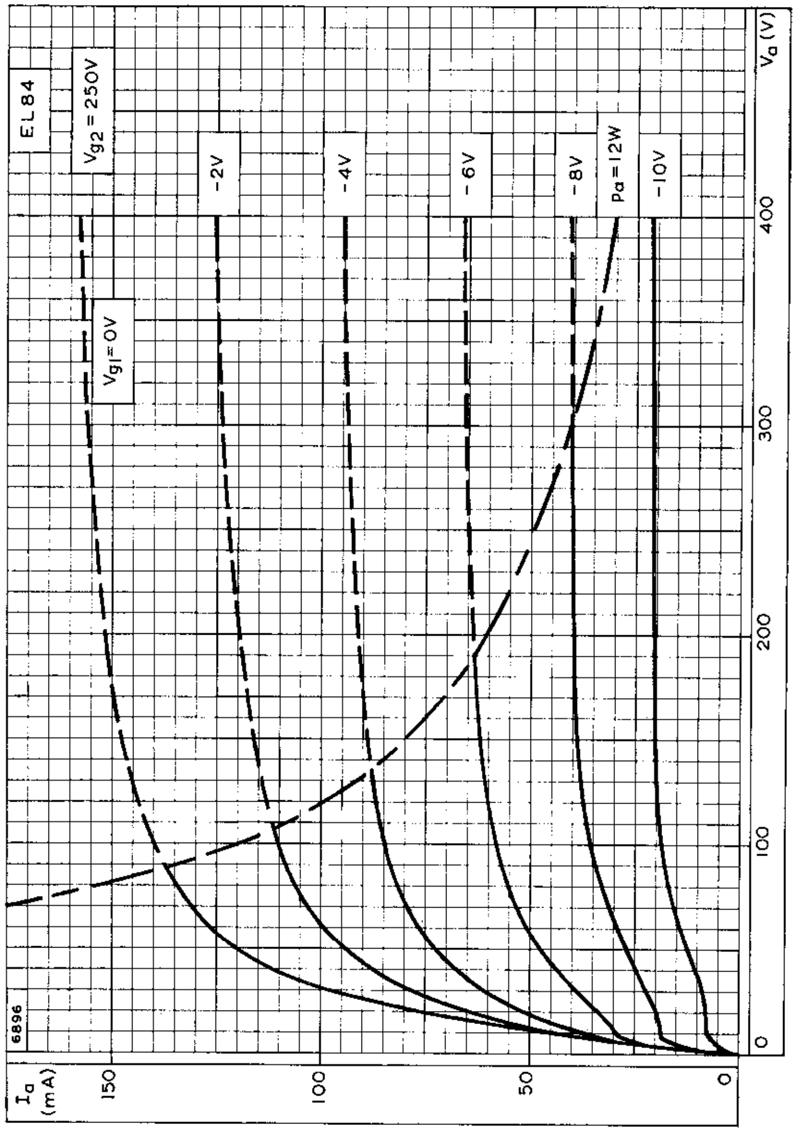
$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	12	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	300	V
p_{g2} max.	2.0	W
I_k max.	65	mA
$-V_g$ max.	100	V
R_{g1-k} max.	300	kΩ
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ

2834

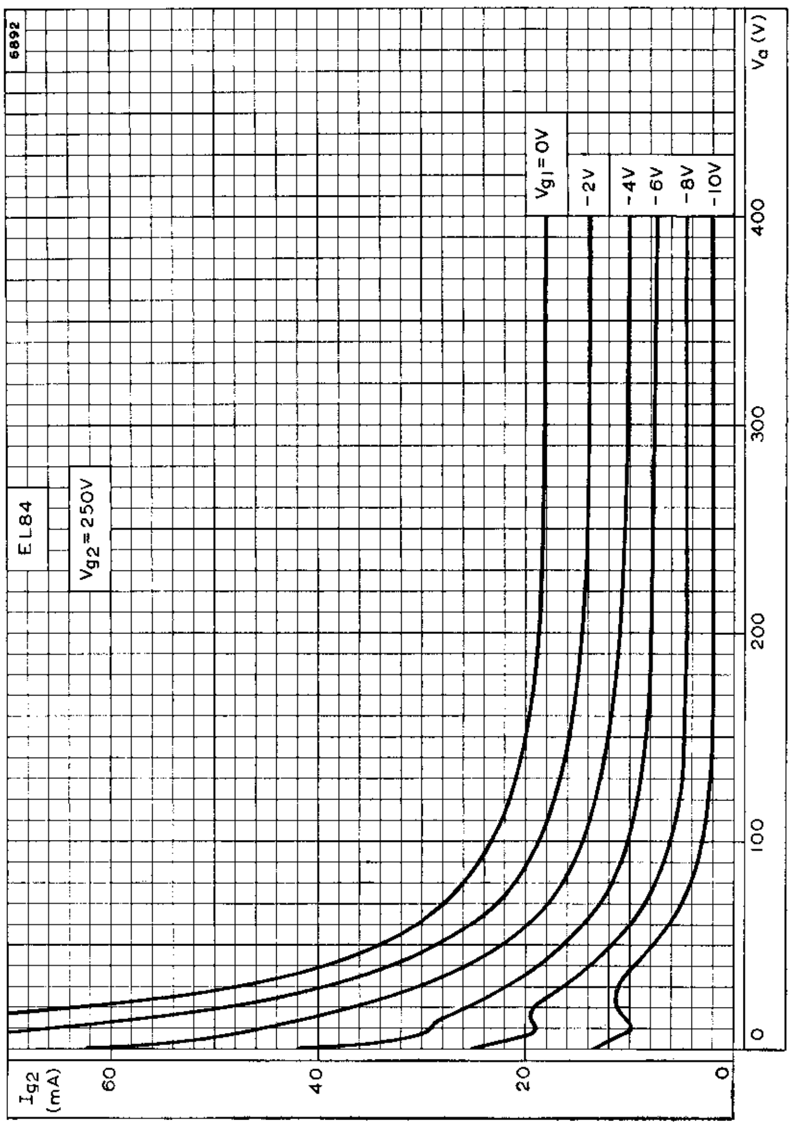

a
g1
g2
k,g3
h
h
h
h
IC
k,g3
a
g1
IC
IC
g2
B9A Base
22·2 mm
max
71 mm max
78 mm max



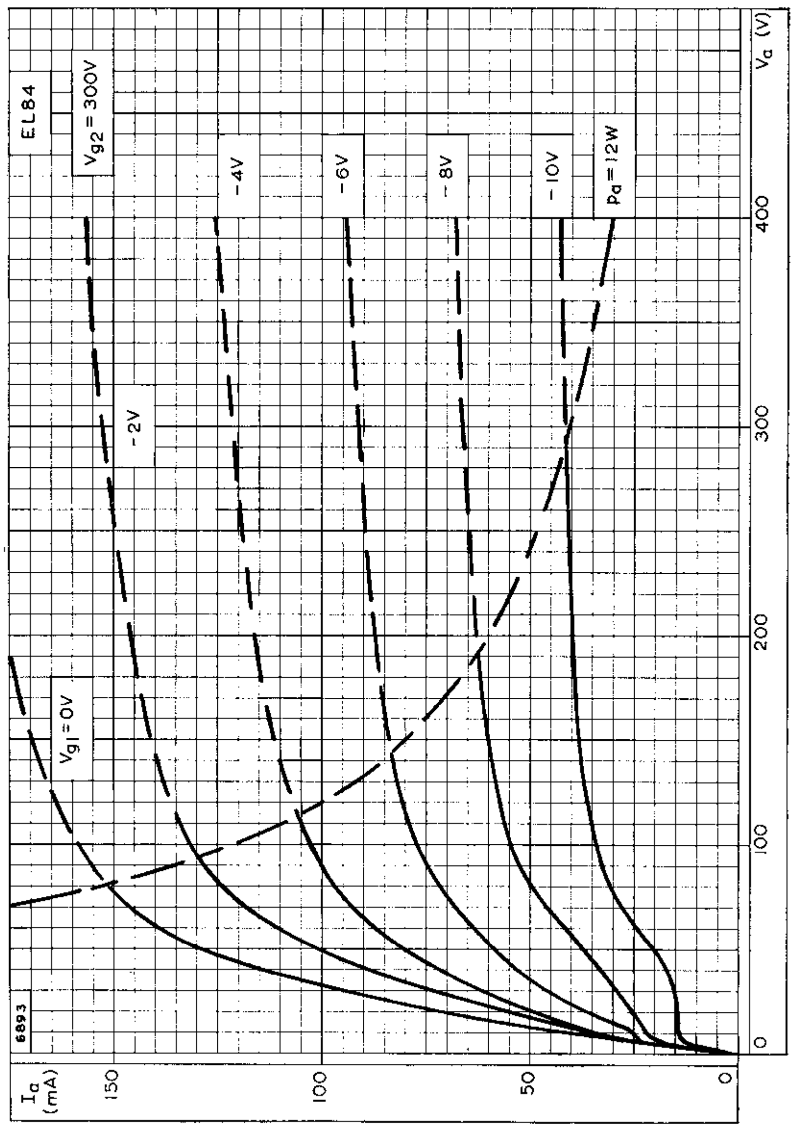
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE



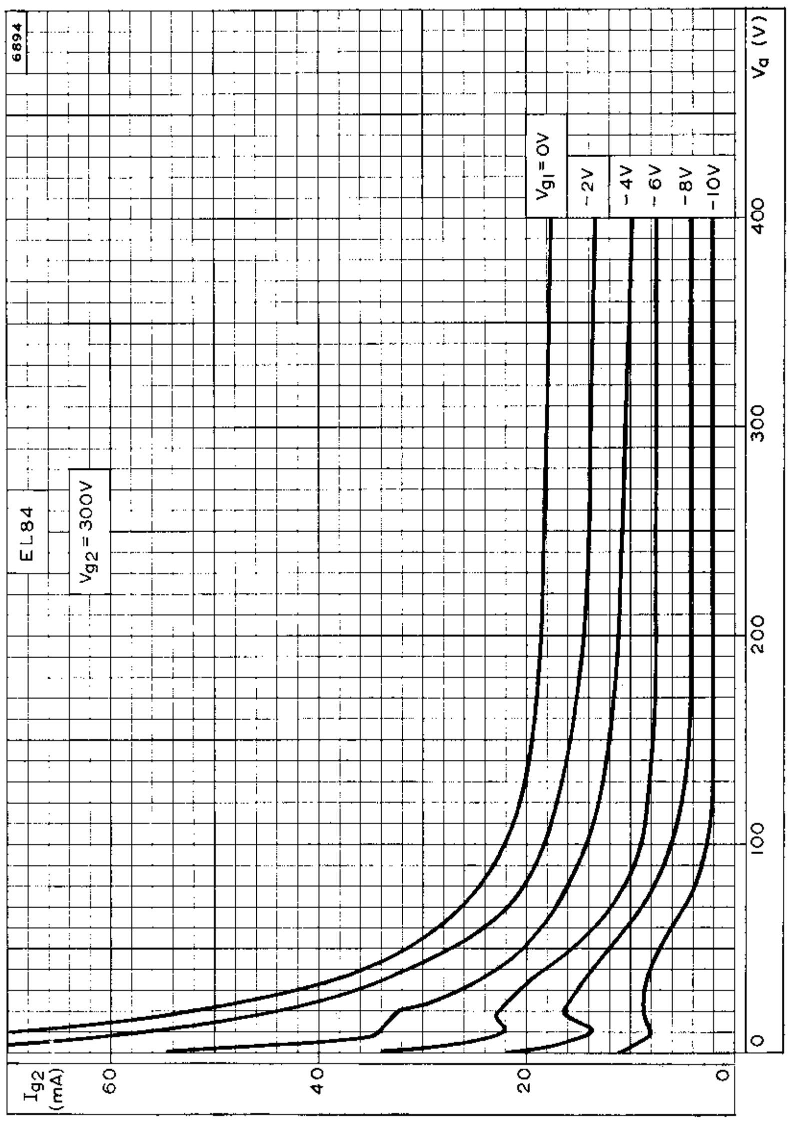
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 250V$



SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 250V



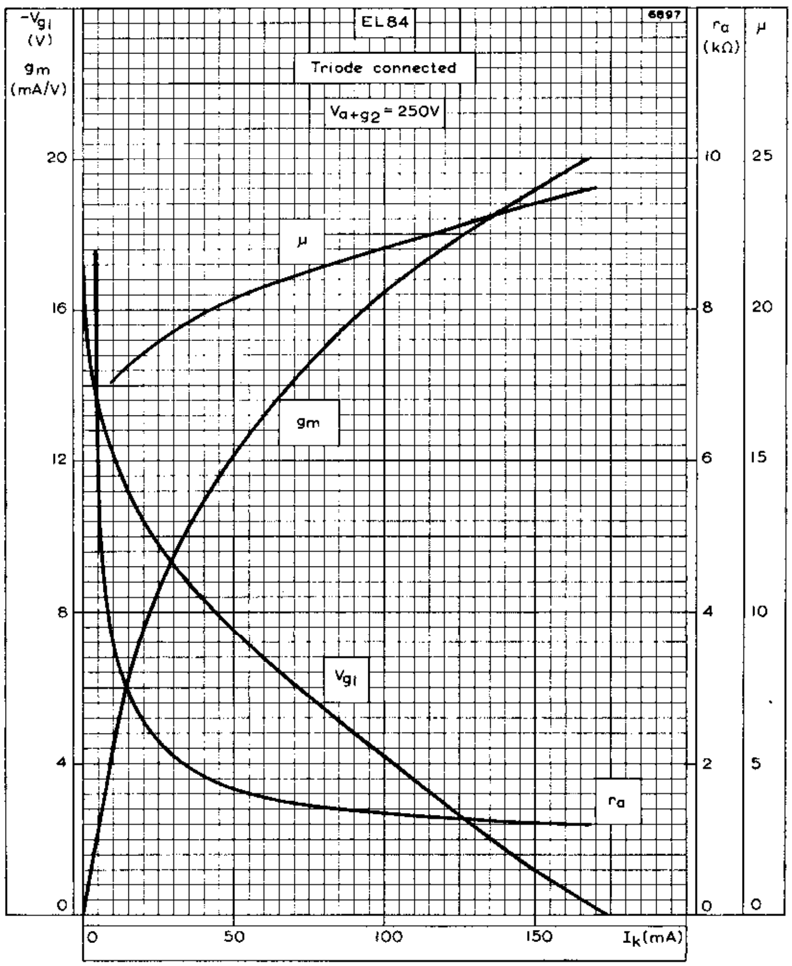
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 300V



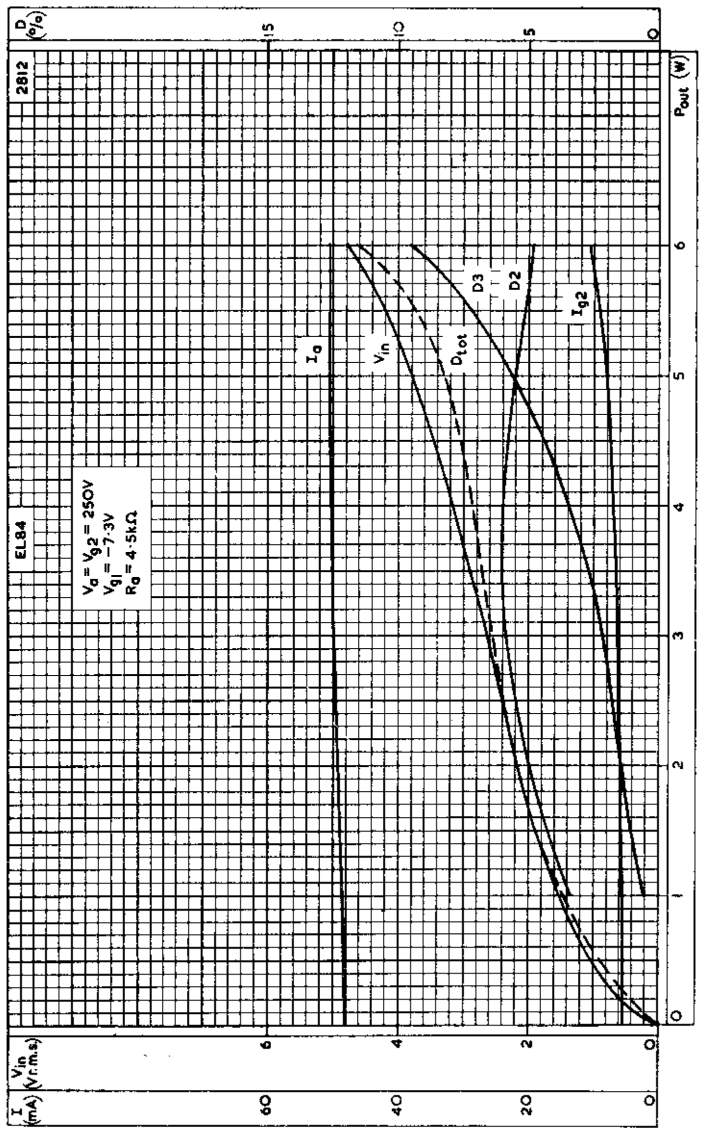
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 300V

EL84

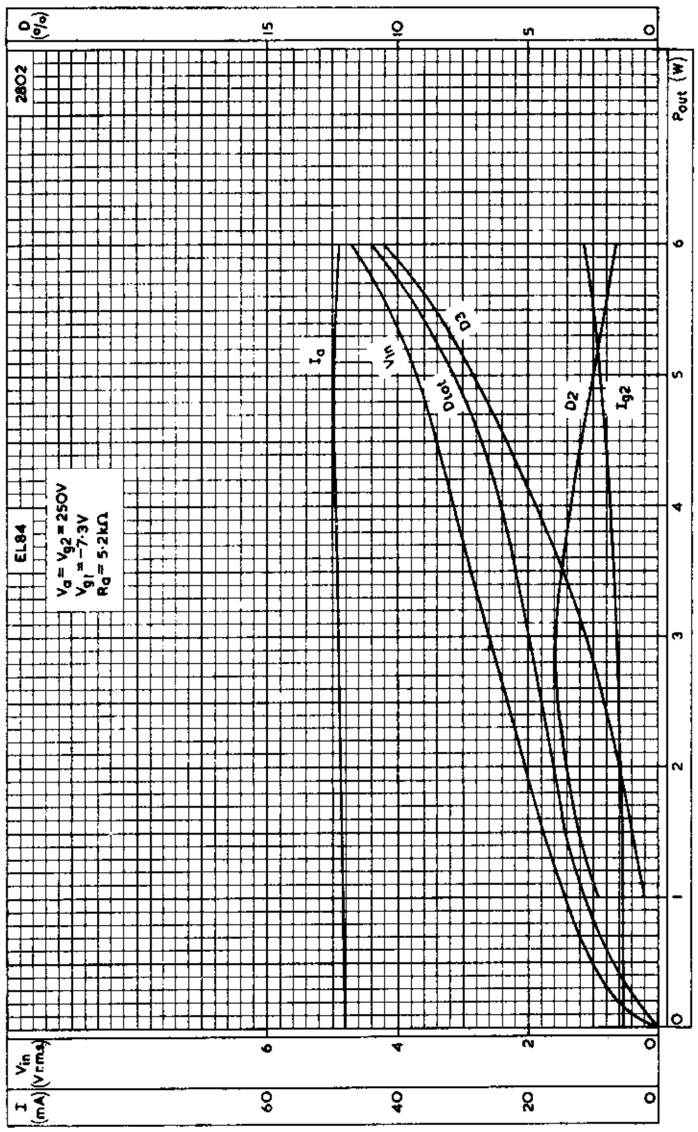
OUTPUT PENTODE



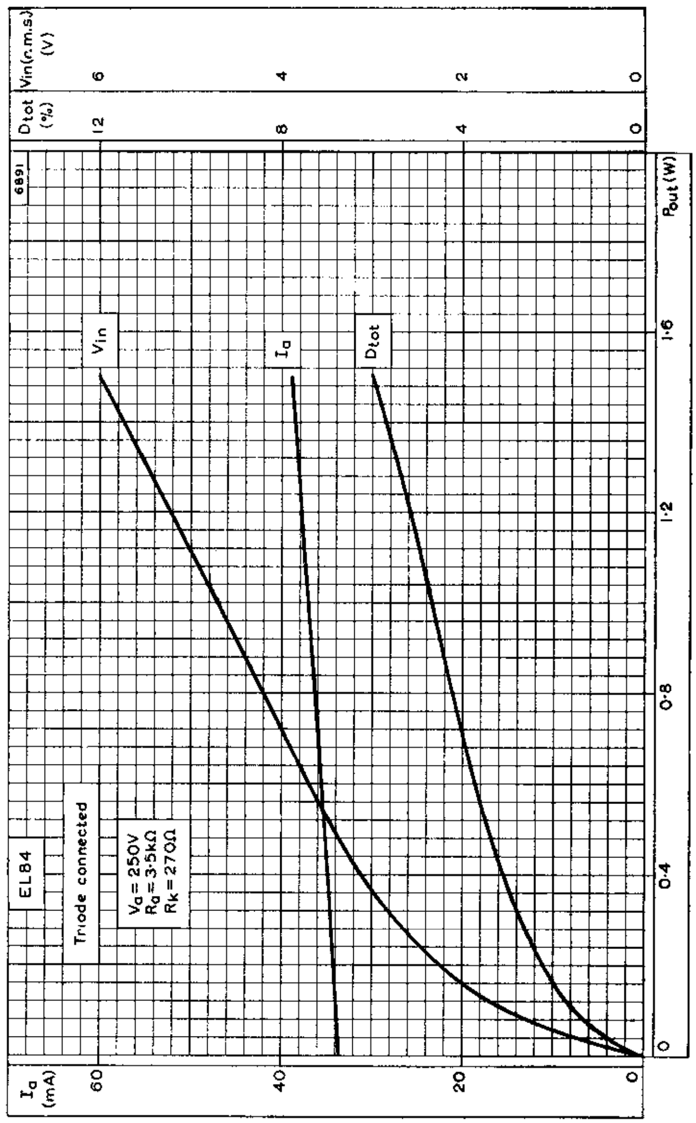
CONTROL-GRID VOLTAGE, AMPLIFICATION FACTOR, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CATHODE CURRENT WHEN TRIODE CONNECTED



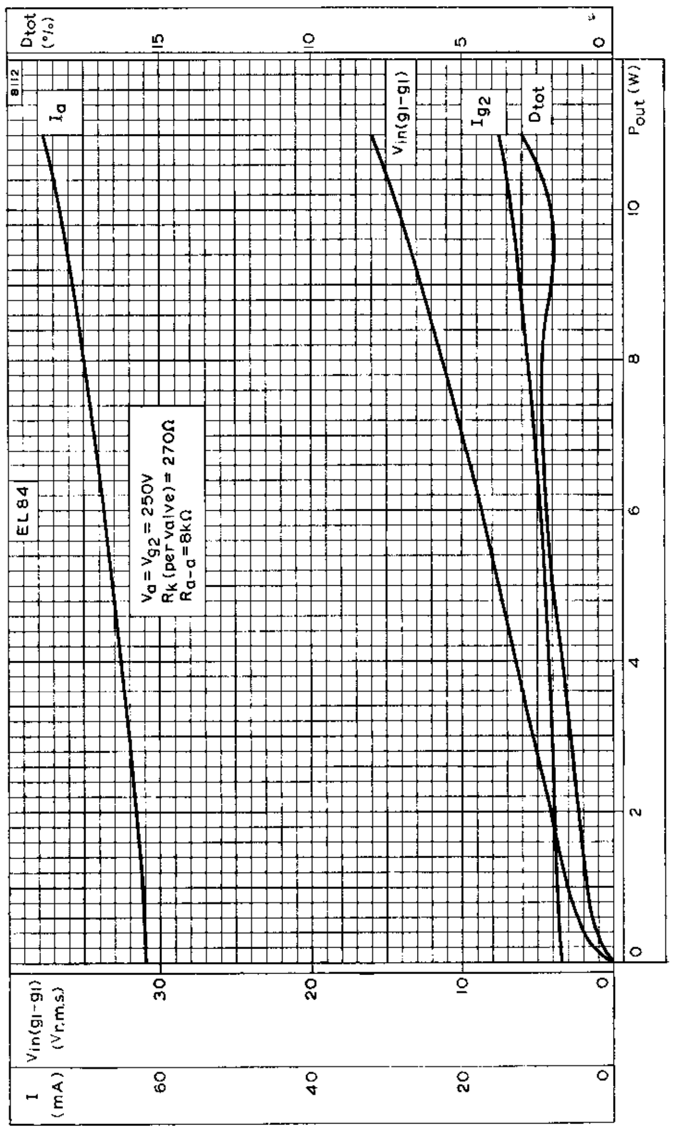
PERFORMANCE OF EL84 WHEN USED AS A SINGLE VALVE AMPLIFIER WITH A LOAD OF 4.5kΩ



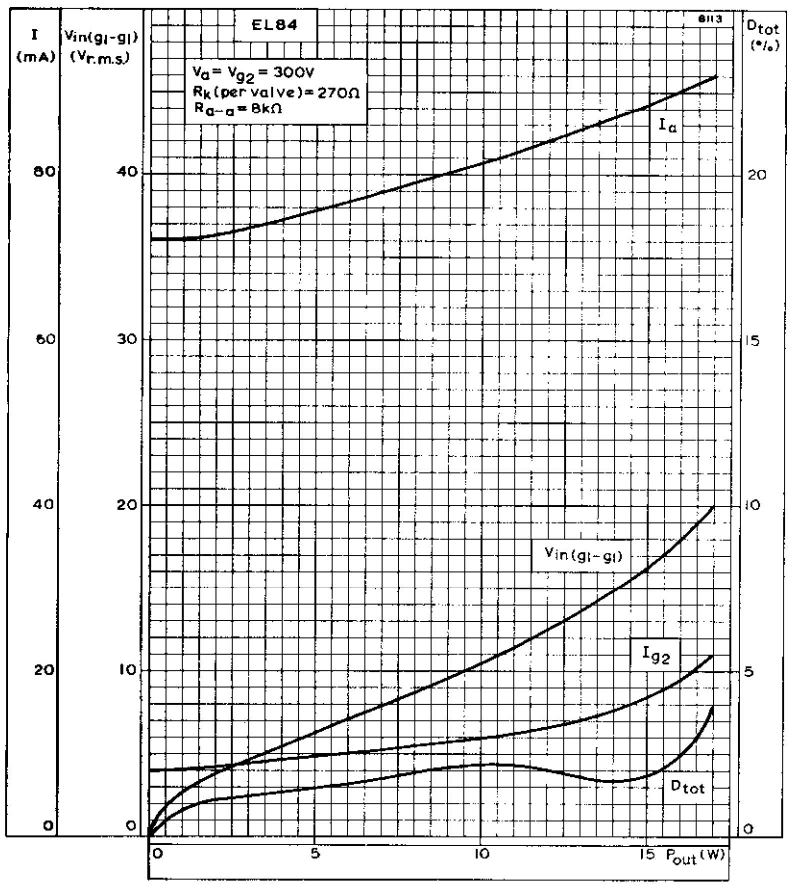
PERFORMANCE OF EL84 WHEN USED AS A SINGLE VALVE AMPLIFIER WITH A LOAD OF 5.2kΩ



PERFORMANCE OF EL84 TRIODE CONNECTED AS A SINGLE VALVE AMPLIFIER



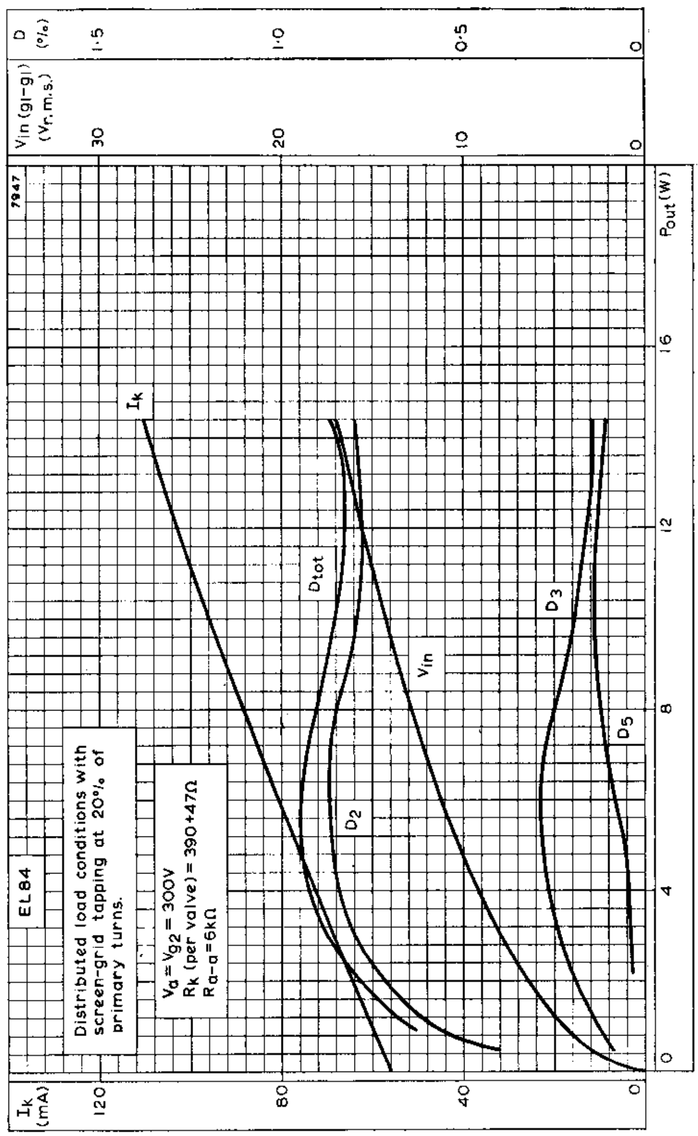
PERFORMANCE OF TWO EL84 IN PUSH-PULL
$V_a = V_{g2} = 250V$



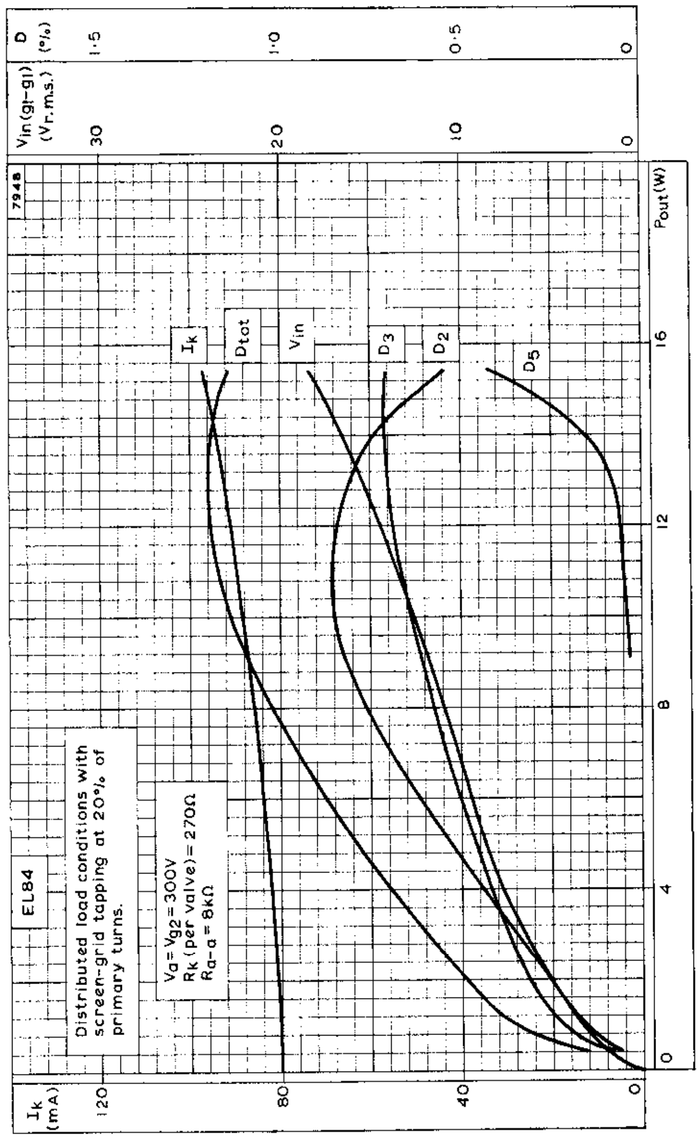
PERFORMANCE OF TWO EL84 IN PUSH-PULL
$V_a = V_{g2} = 300V$

EL84

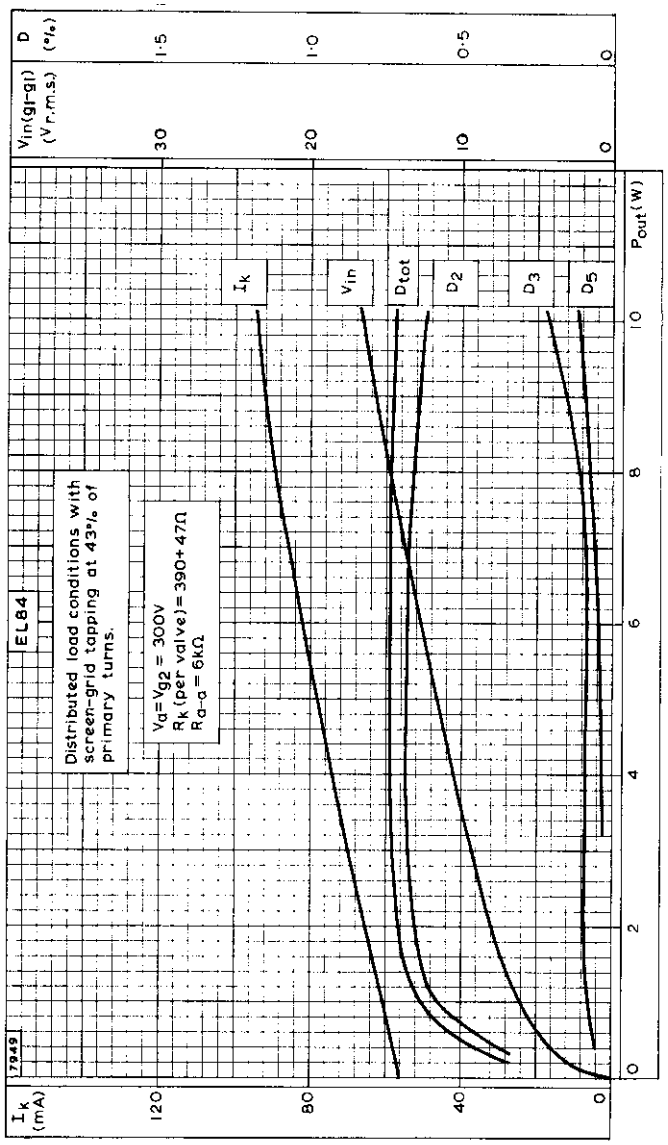
OUTPUT PENTODE



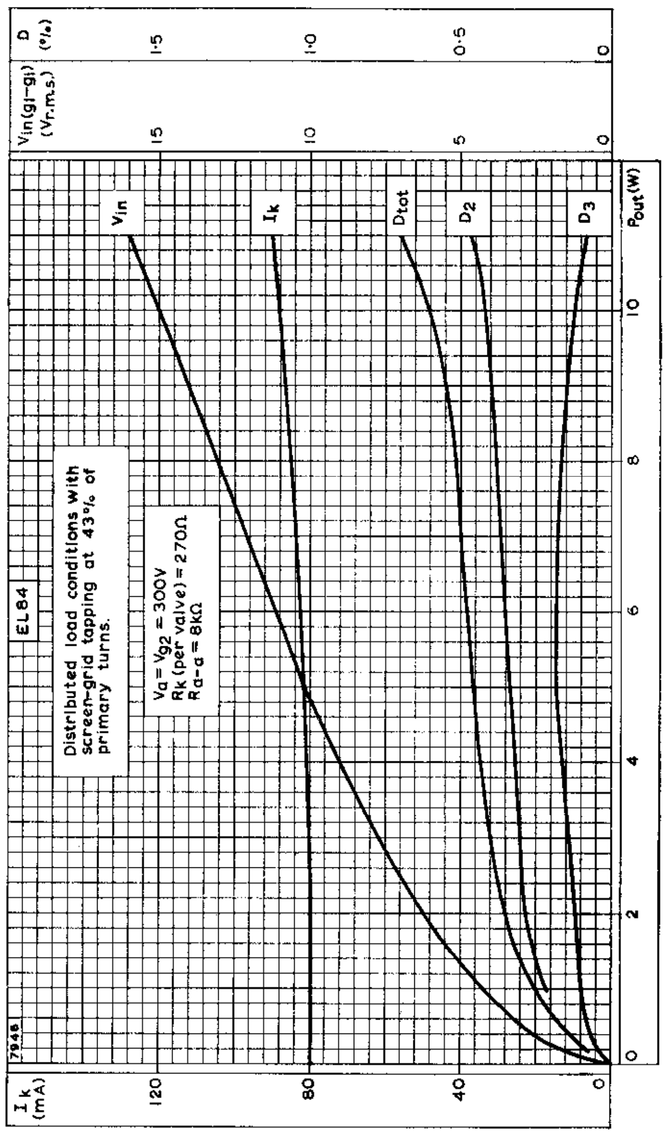
PERFORMANCE OF TWO EL84 IN PUSH-PULL WITH DISTRIBUTED LOAD CONDITIONS. SCREEN-GRID TAPPING AT 20% OF PRIMARY TURNS. $R_{a-a} = 6k\Omega$



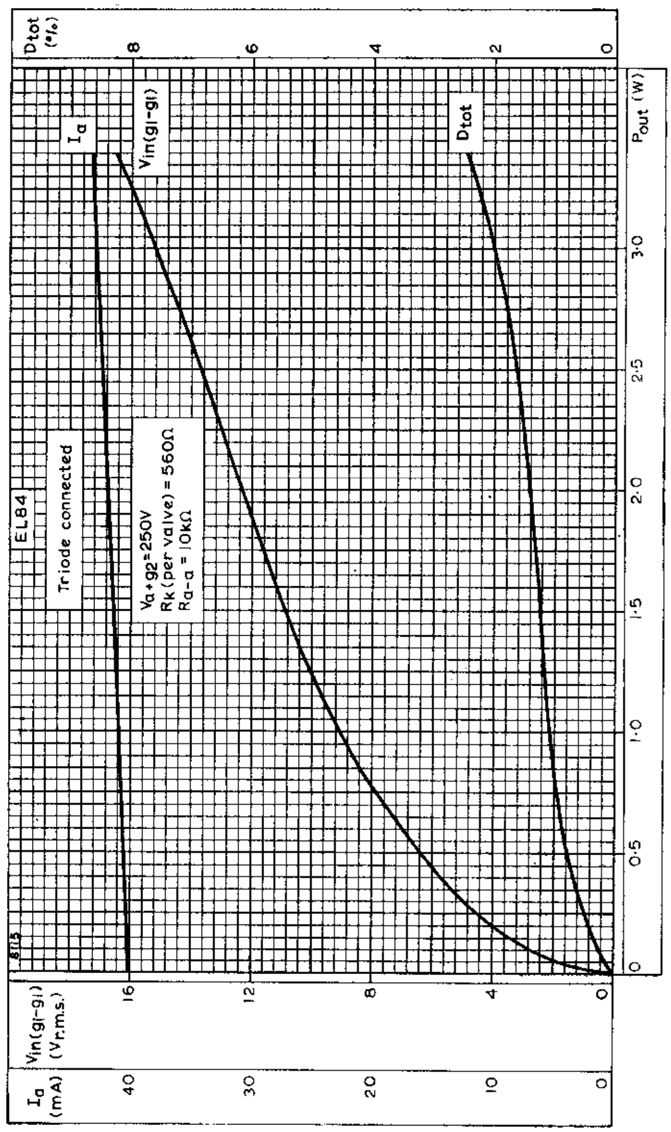
PERFORMANCE OF TWO EL84 IN PUSH-PULL WITH DISTRIBUTED LOAD CONDITIONS. SCREEN-GRID TAPPING AT 20% OF PRIMARY TURNS. $R_{a-a} = 8k\Omega$



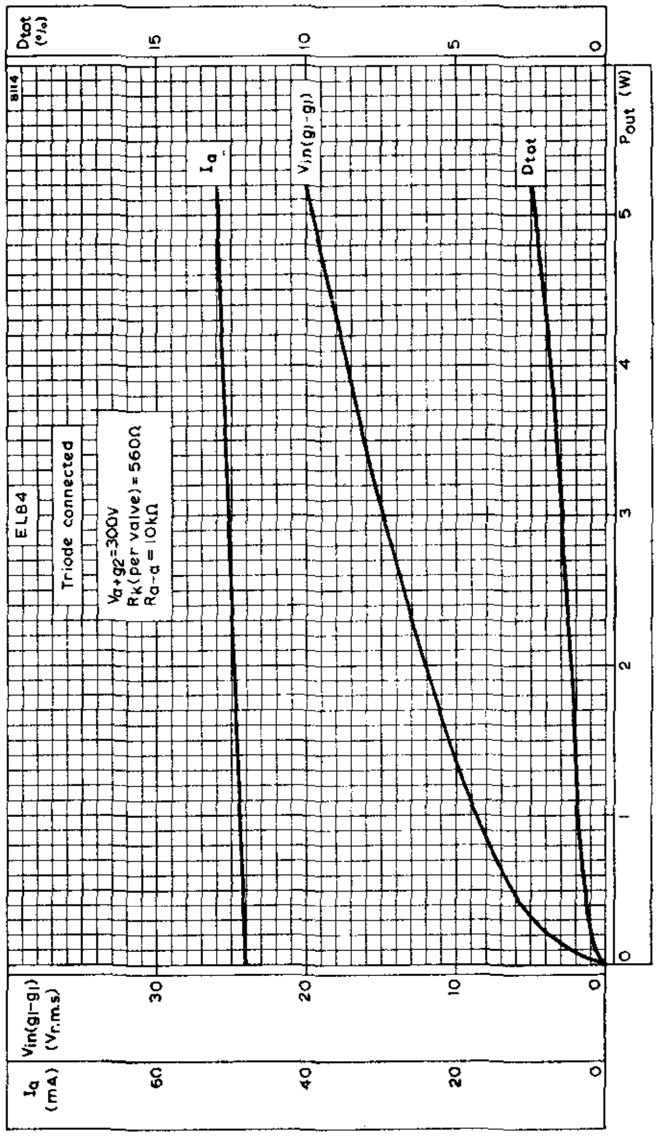
PERFORMANCE OF TWO EL84 IN PUSH-PULL WITH DISTRIBUTED LOAD CONDITIONS. SCREEN-GRID TAPPING AT 43% OF PRIMARY TURNS. $R_{a-a} = 6k\Omega$



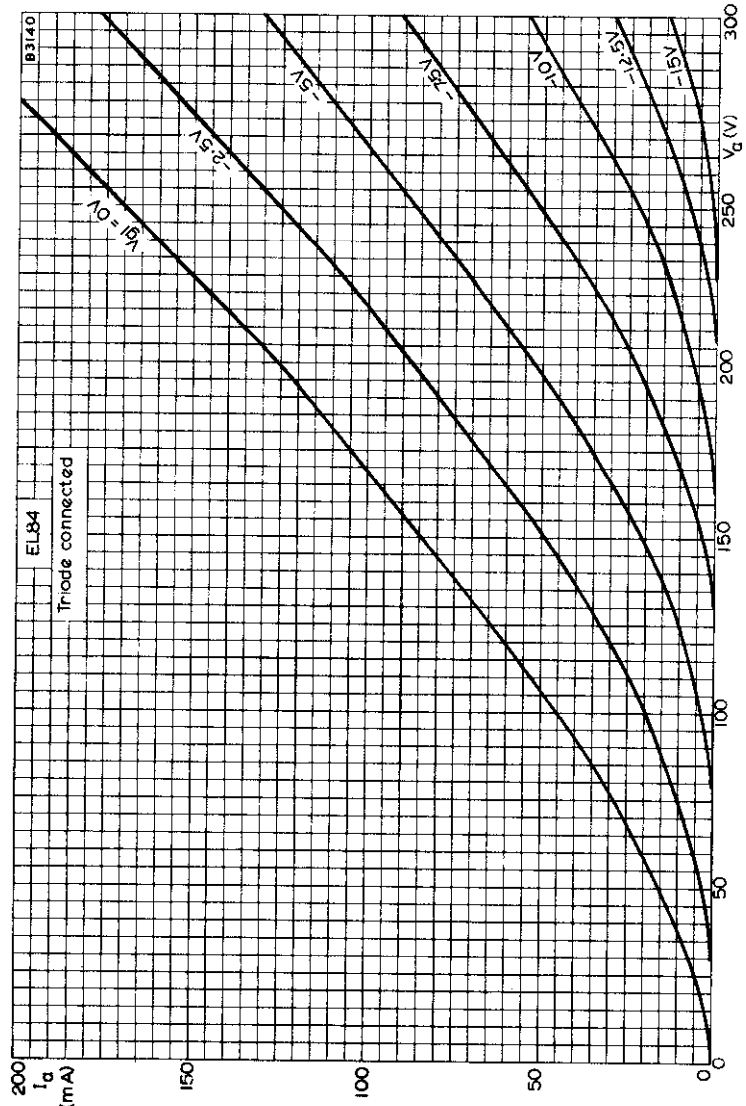
PERFORMANCE OF TWO EL84 IN PUSH-PULL WITH DISTRIBUTED LOAD CONDITIONS. SCREEN-GRID TAPPING AT 43% OF PRIMARY TURNS. $R_{a-a} = 8k\Omega$



PERFORMANCE OF TWO EL84 TRIODE CONNECTED IN PUSH-PULL.
$V_{a+g2} = 250V$



PERFORMANCE OF TWO EL84 TRIODE CONNECTED IN PUSH-PULL.
$V_{a-g2} = 300V$



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER WHEN TRIODE CONNECTED

OUTPUT PENTODE

EL360

Output pentode for use in radar scanning, series regulator and similar applications and in pulse modulator applications.

HEATER

V_h	6.3	V
I_h	1.27	A

CAPACITANCES

c_{out}	7.7	pF
c_{in}	17.5	pF
c_{a-g1}	<1.1	pF

CHARACTERISTICS

Pentode connection

V_a	100	250	V
V_{g2}	100	250	V
V_{g1}	−6.3	−46	V
I_a	120	48	mA
I_{g2}	8.3	5.5	mA
g_m	16.5	6.9	mA/V
r_a	3.7	13.5	kΩ
μ_{g1-g2}	6.0	5.0	

←

Triode connection (g_2 connected to a)

V_a	100	V
I_a	100	mA
V_{g1}	−8.0	V
g_m	14.5	mA/V
r_a	380	Ω
μ	5.5	

EL360 OUTPUT PENTODE

DESIGN CENTRE RATINGS (unless otherwise stated)

Scanning, low voltage series regulator, and similar applications

$V_{a(b)}$ max.	1.0	kV
$v_{a(pk)}$ max.	7.0	kV
$-v_{a(pk)}$ max. (p_a = 15W)	1.0	kV
$-v_{a(pk)}$ max. (p_a = 10W)	1.5	kV
V_a max.	800	V
$V_{g2(b)}$ max.	800	V
V_{g2} max.	400	V
$-v_{g1(pk)}$ max.	1.0	kV
p_a max.	15	W
p_{g2} max.	5.0	W
V_{a+g2} max.	400	V
p_{a+g2} max.	18	W
I_k max.	200	mA
R_{g1-k} max.	500	kΩ
V_{h-k} max.	200	V

High voltage series regulator applications

$V_{a(b)}$ max.	4.0	kV
$V_{g2(b)}$ max.	550	V
V_a max.	2.0	kV
V_{g2} max.	400	V
p_a max.	6.0	W
p_{g2} max.	2.0	W
I_k max.	5.0	mA

Pulse modulator applications

V_a max. (absolute)	5.0	kV
p_a max.	10	W
*$i_{k(pulse)}$ max. (absolute)	4.0	A
V_{g2} max.	550	V
p_{g2} max.	3.0	W
$-V_{g1}$ max.	300	V
$+v_{g1(pulse)}$ max.	60	V

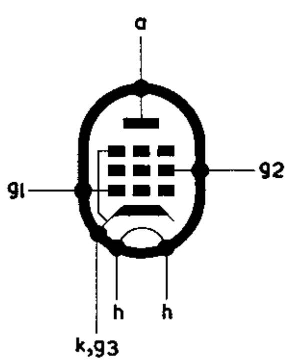
*Max. pulse duration 1μs, duty factor 0.001

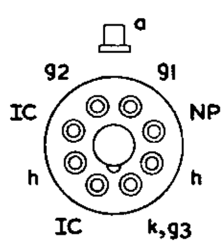
OUTPUT PENTODE

EL360

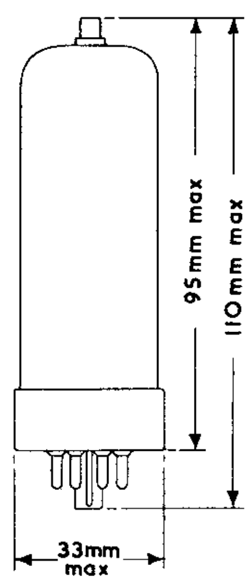
Output pentode for use in radar scanning, series regulator and similar applications and in pulse modulator applications.

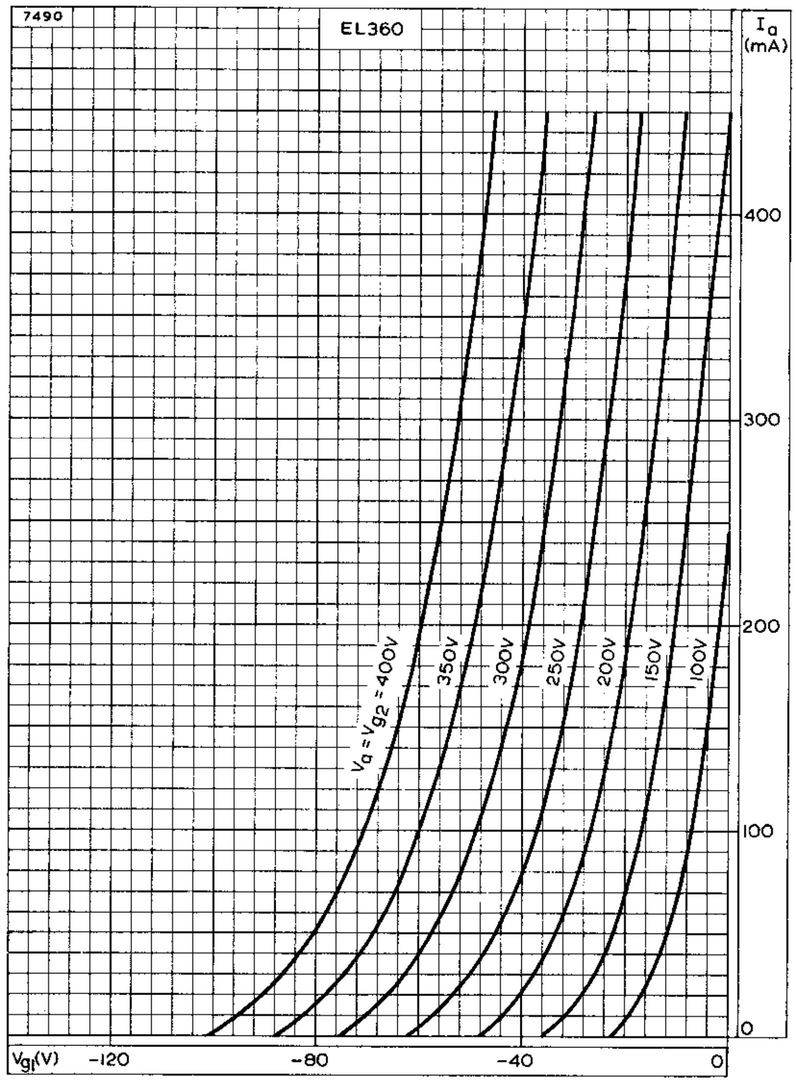
2277



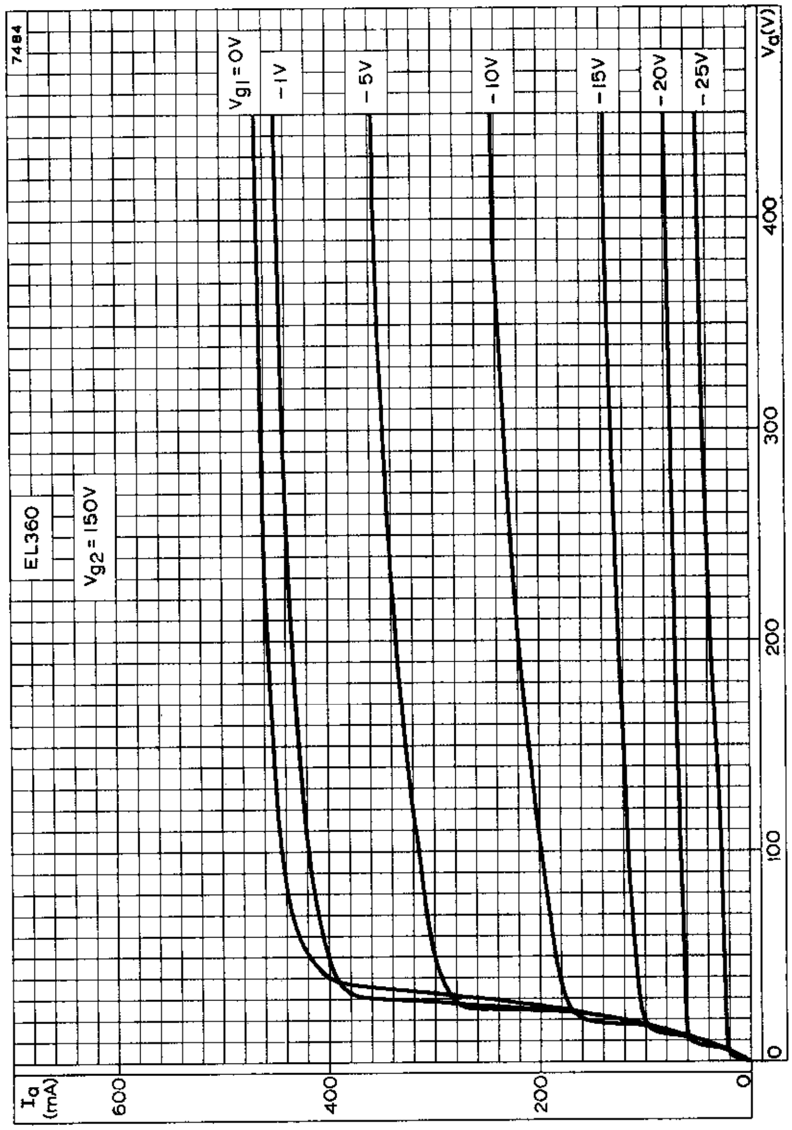


Octal Base

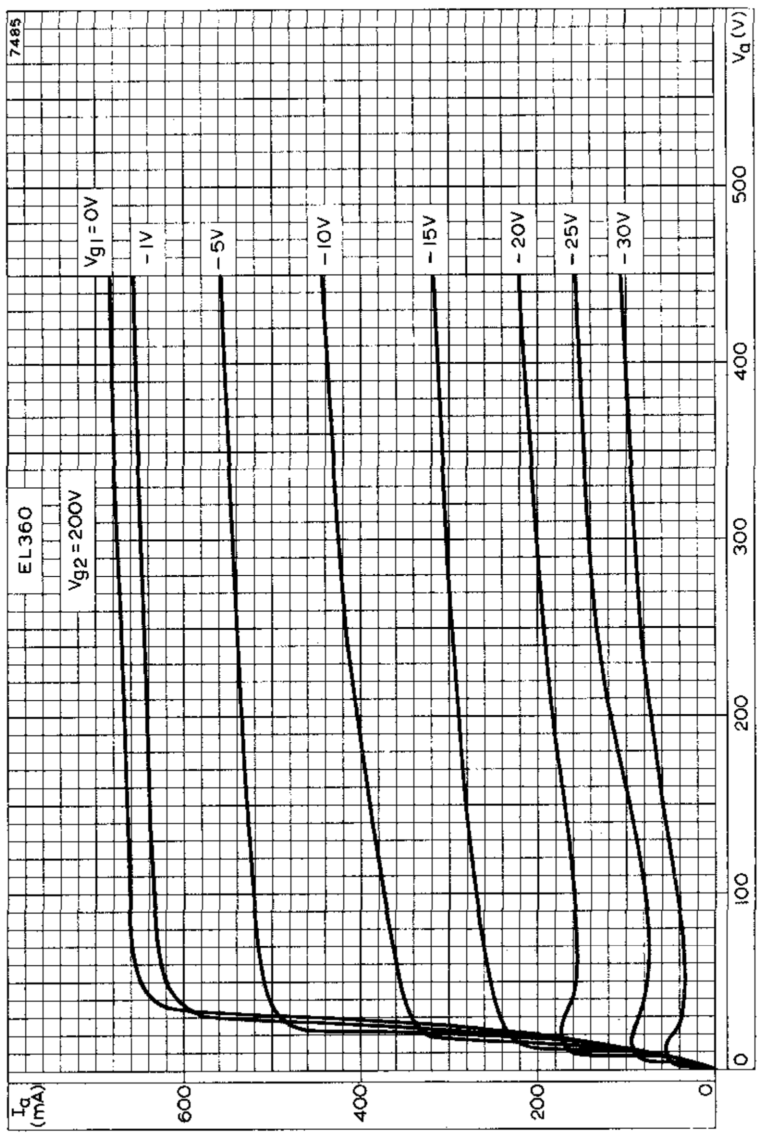




ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETERS



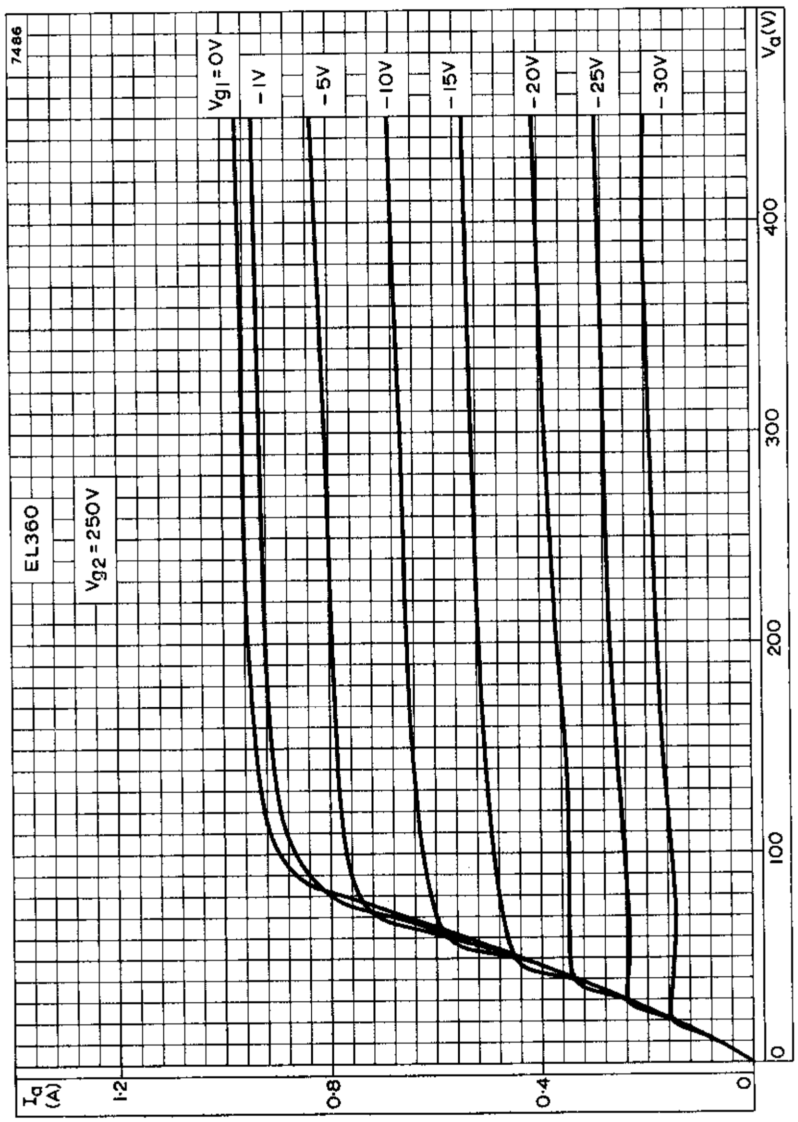
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 150V$



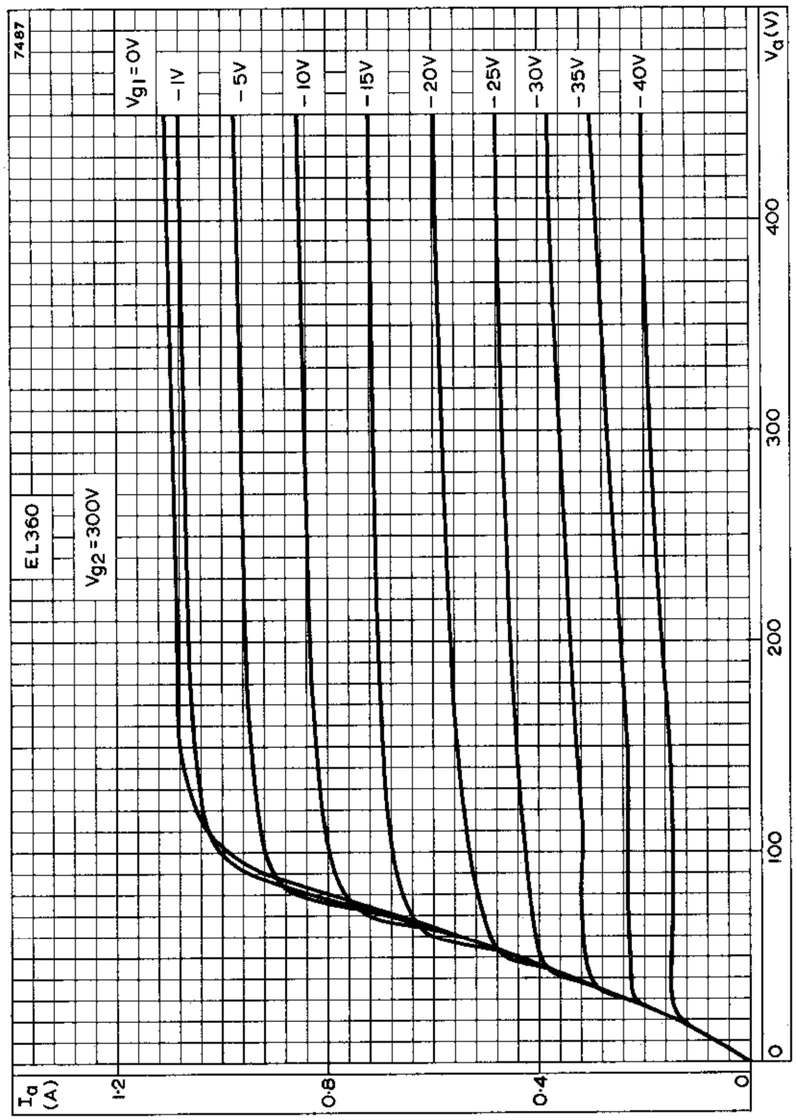
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 200V$

EL360

OUTPUT PENTODE



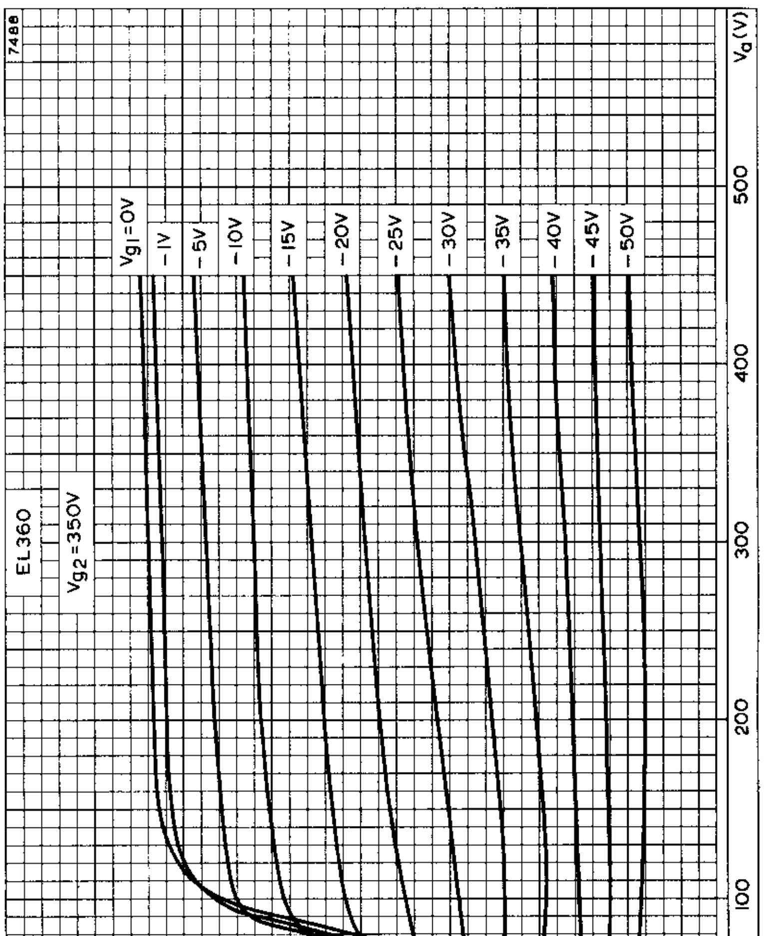
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 250V$



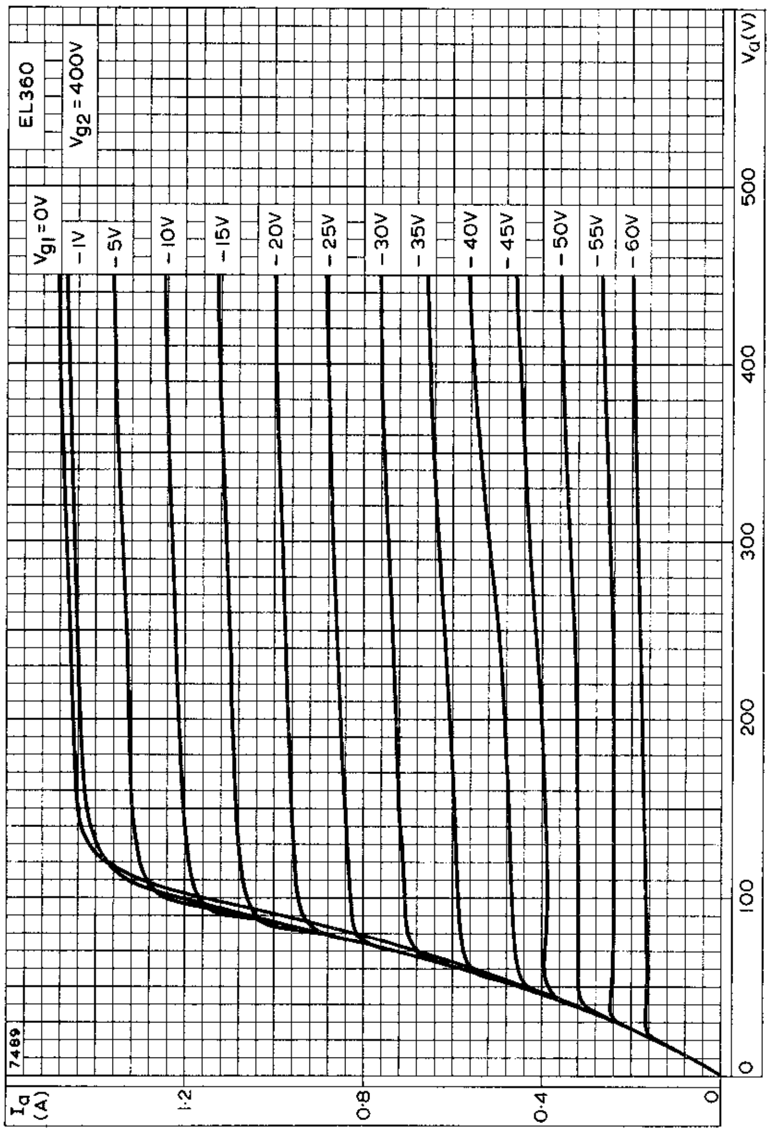
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 300V

EL360

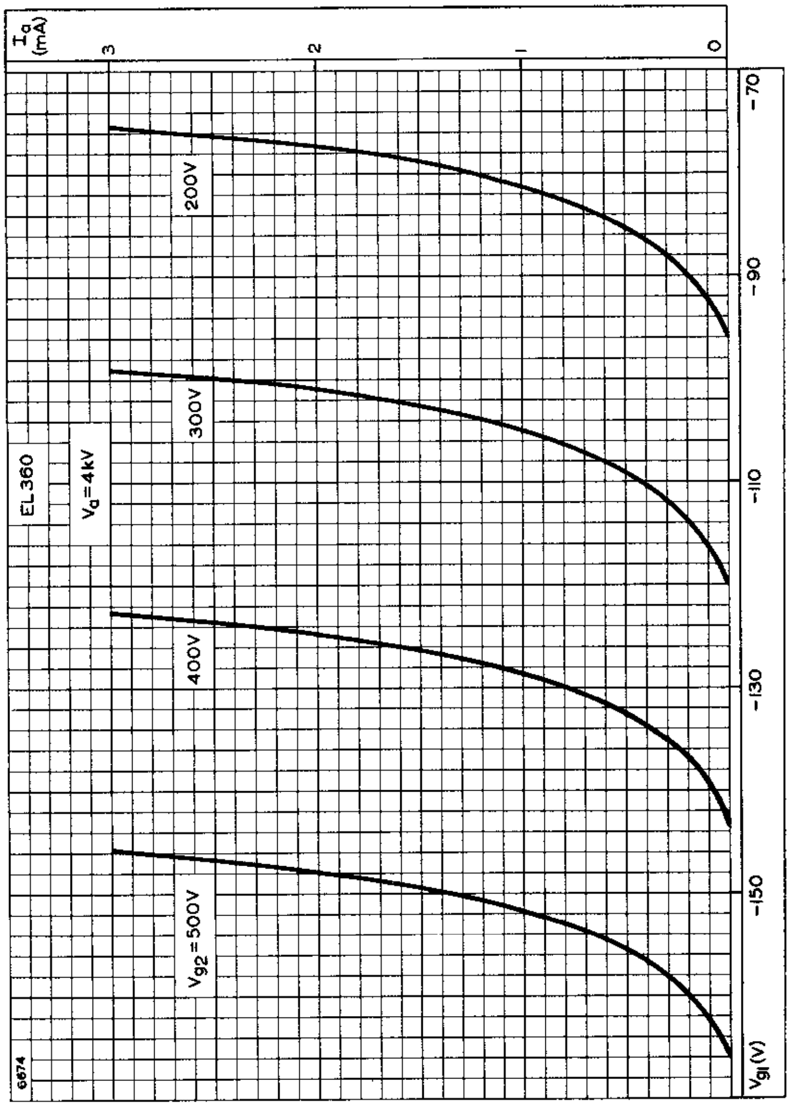
OUTPUT PENTODE



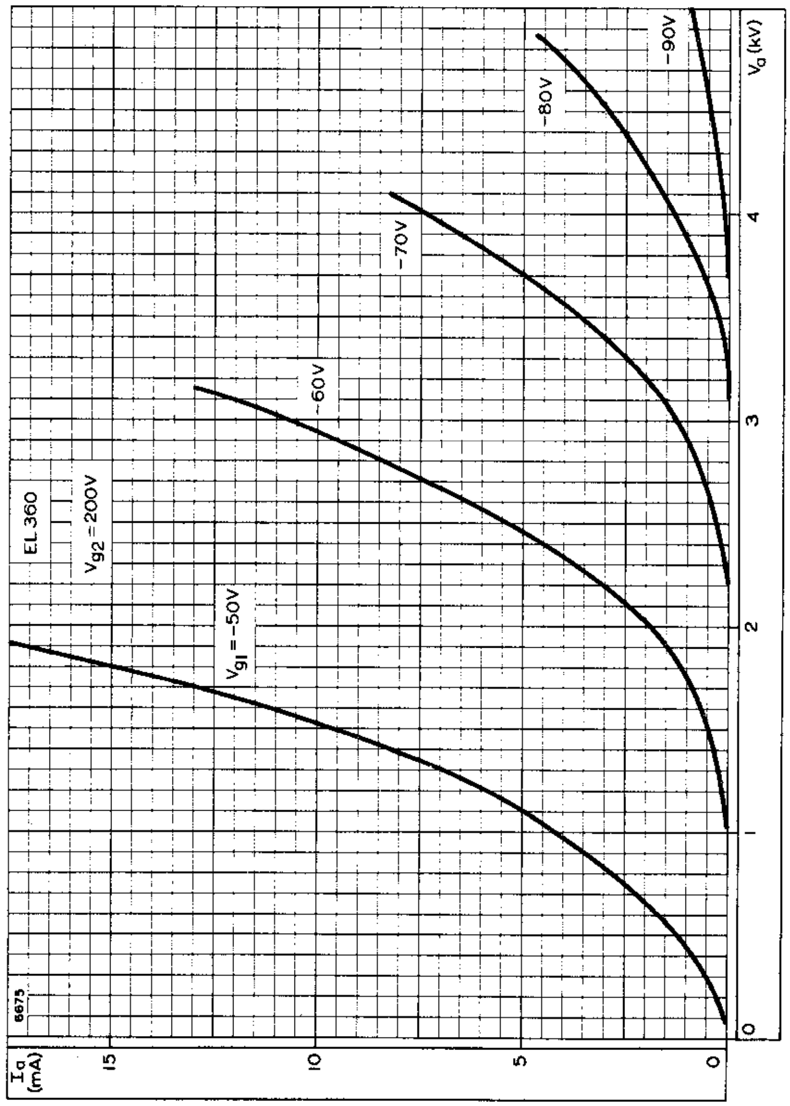
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 350V$



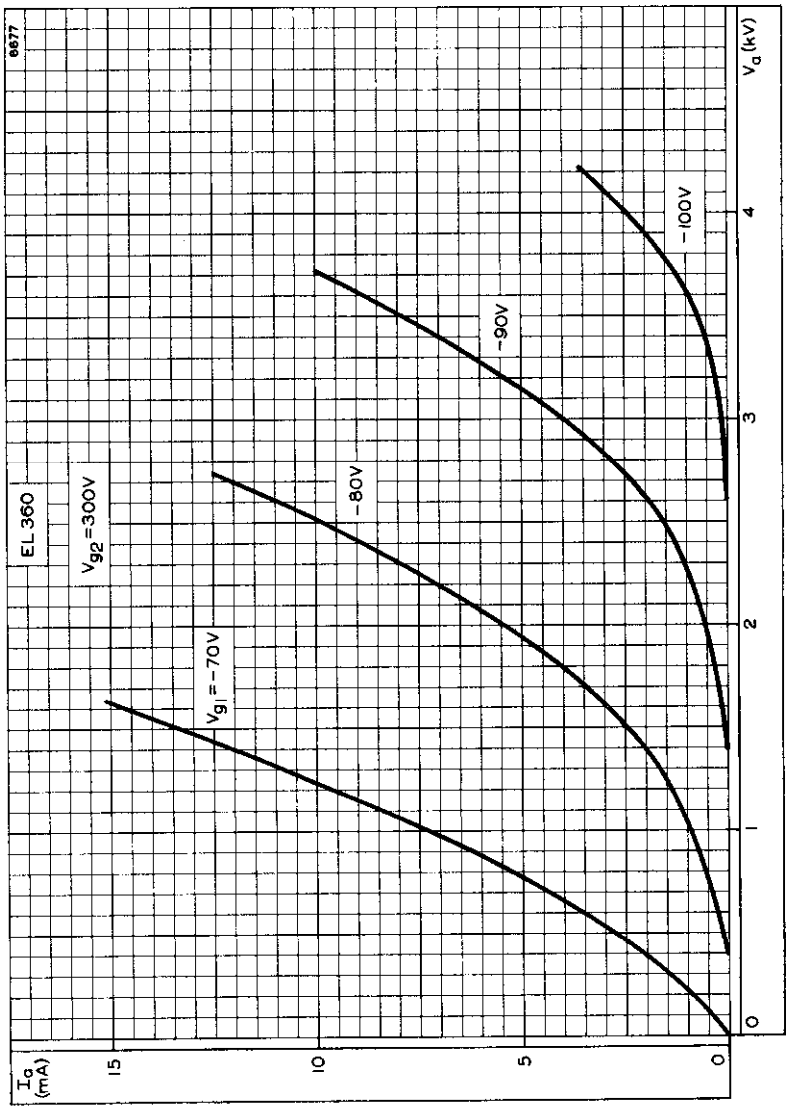
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 400V



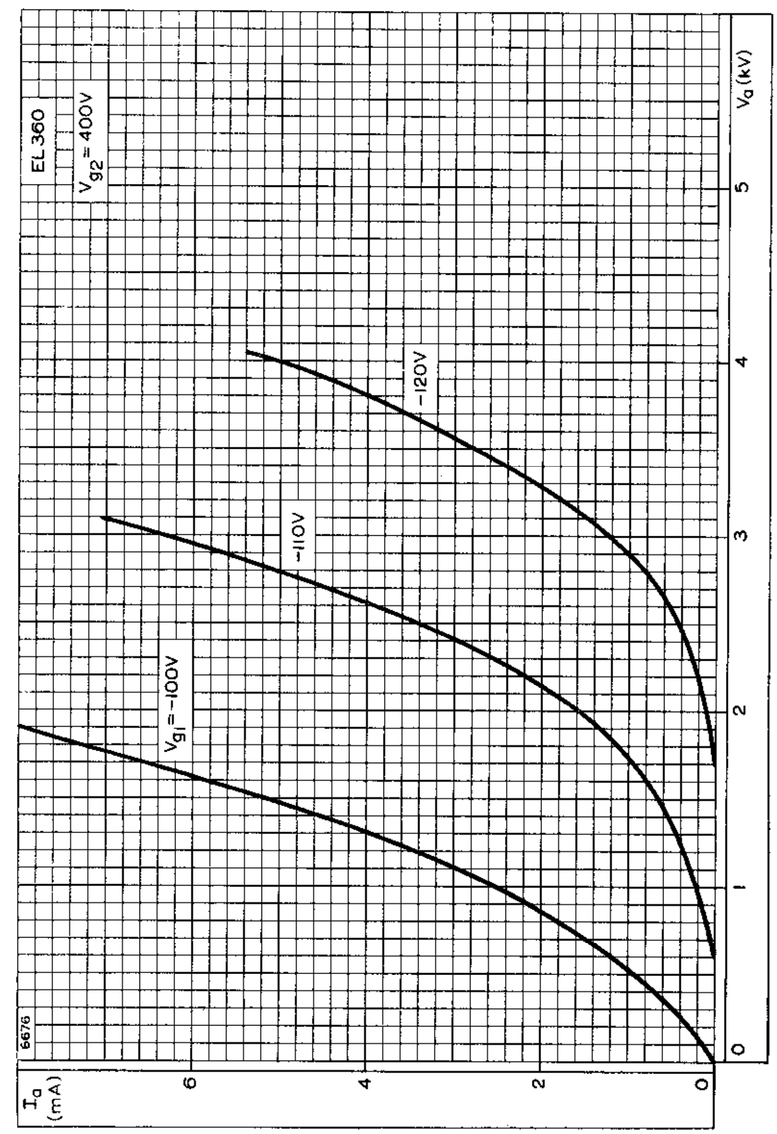
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER. $V_a = 4kV$



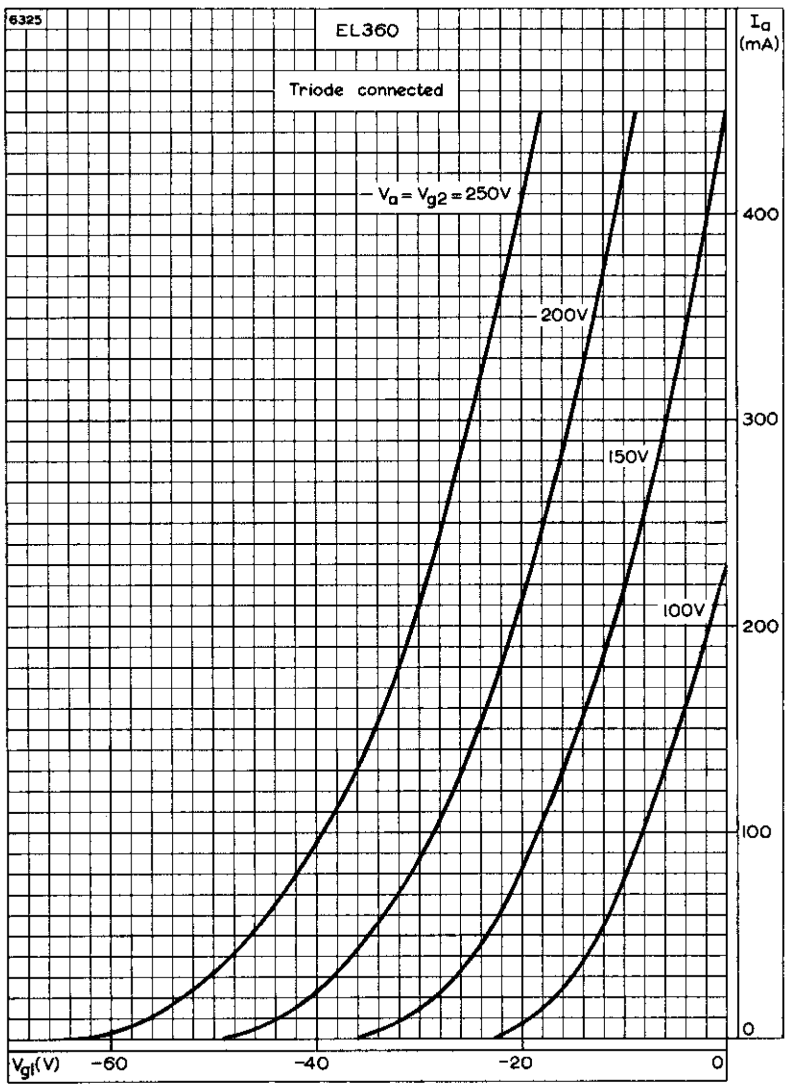
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE UP TO 5kV WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 200V$



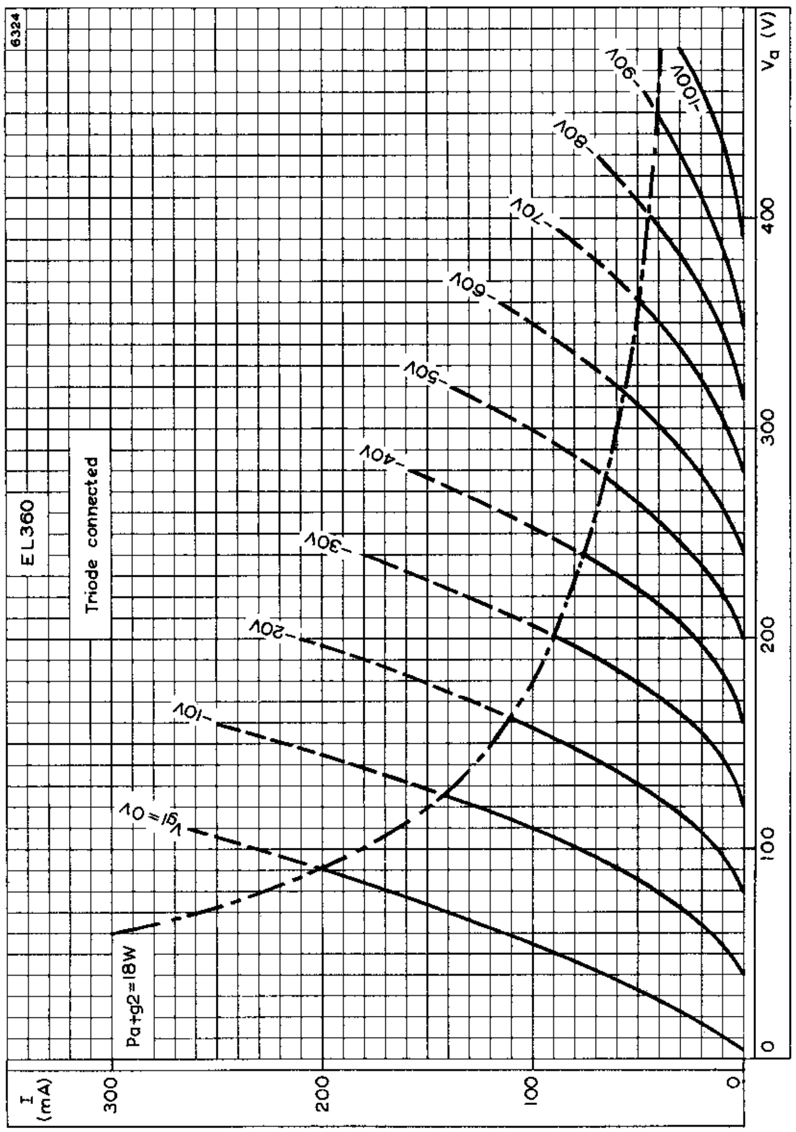
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE UP TO 4kV WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 300V$



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE UP TO 4kV WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 400V$



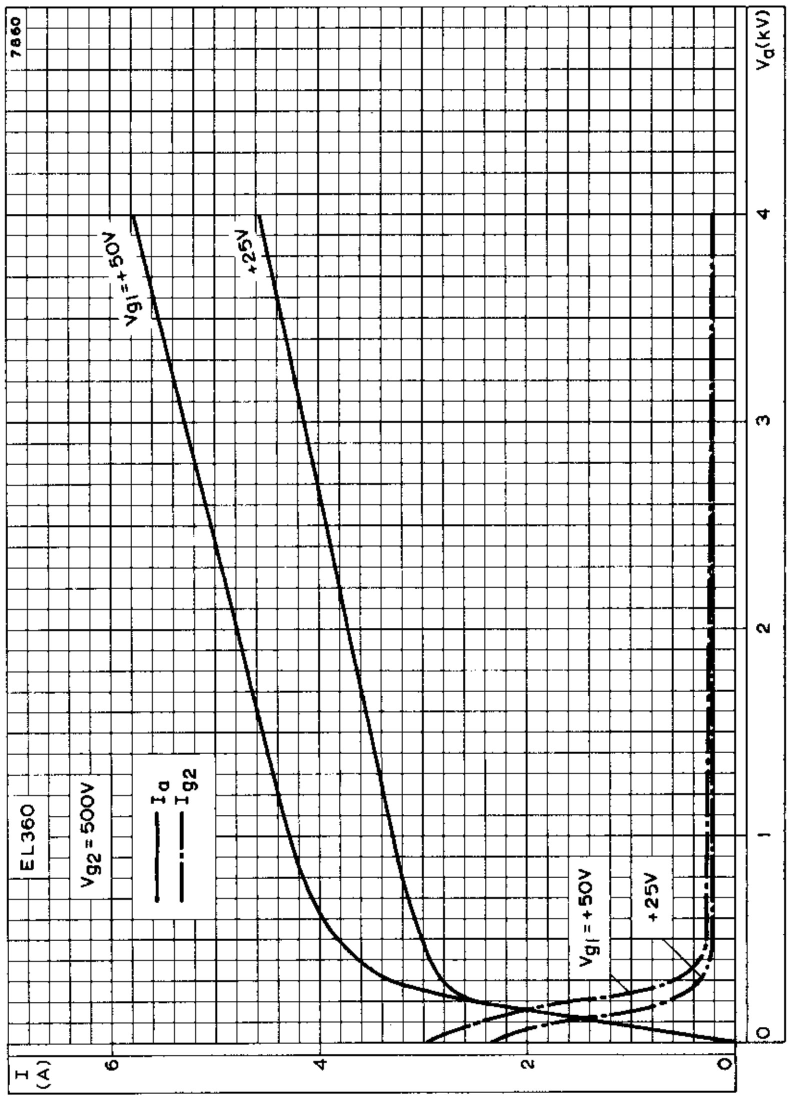
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETER WHEN TRIODE CONNECTED



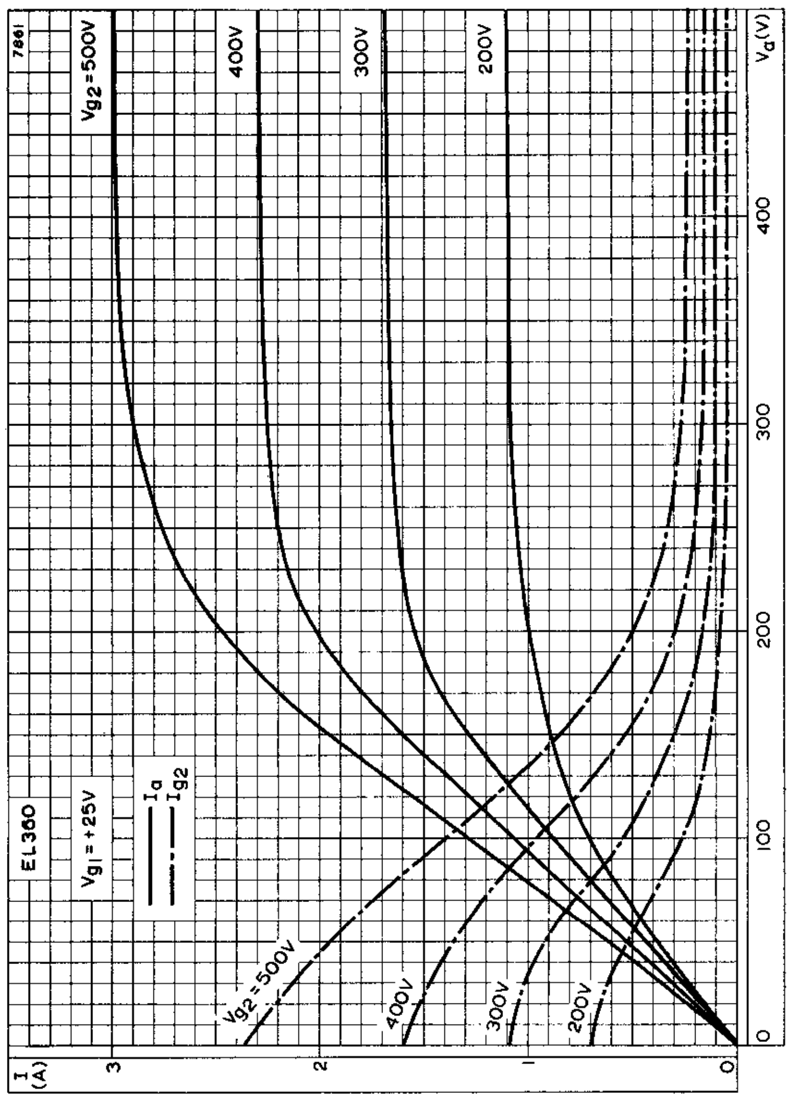
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER WHEN TRIODE CONNECTED

EL360

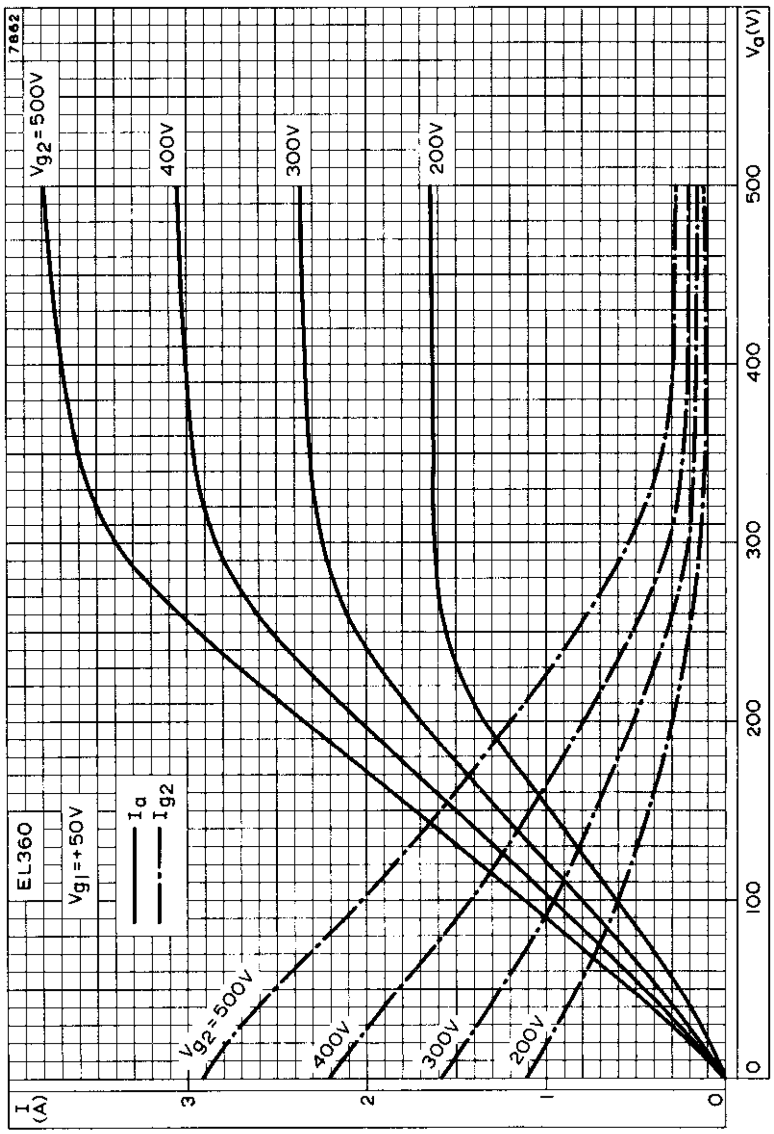
OUTPUT PENTODE



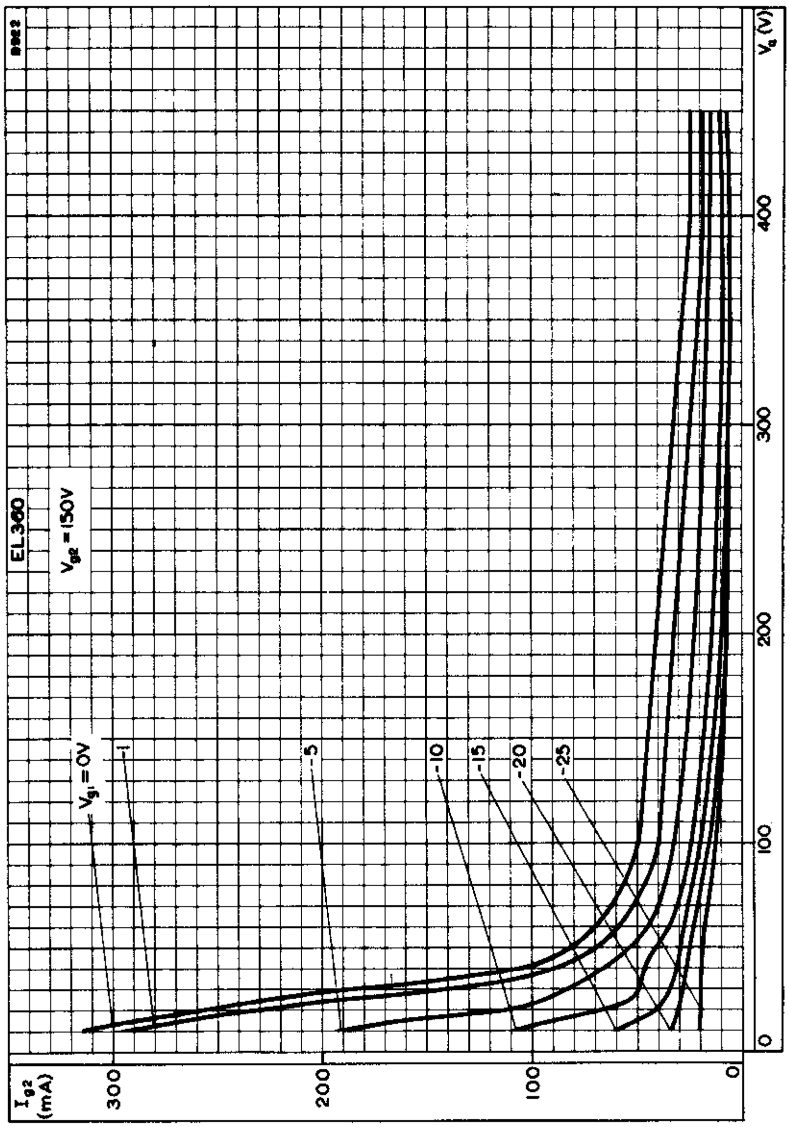
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER



ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER. $V_{g1} = +25V$



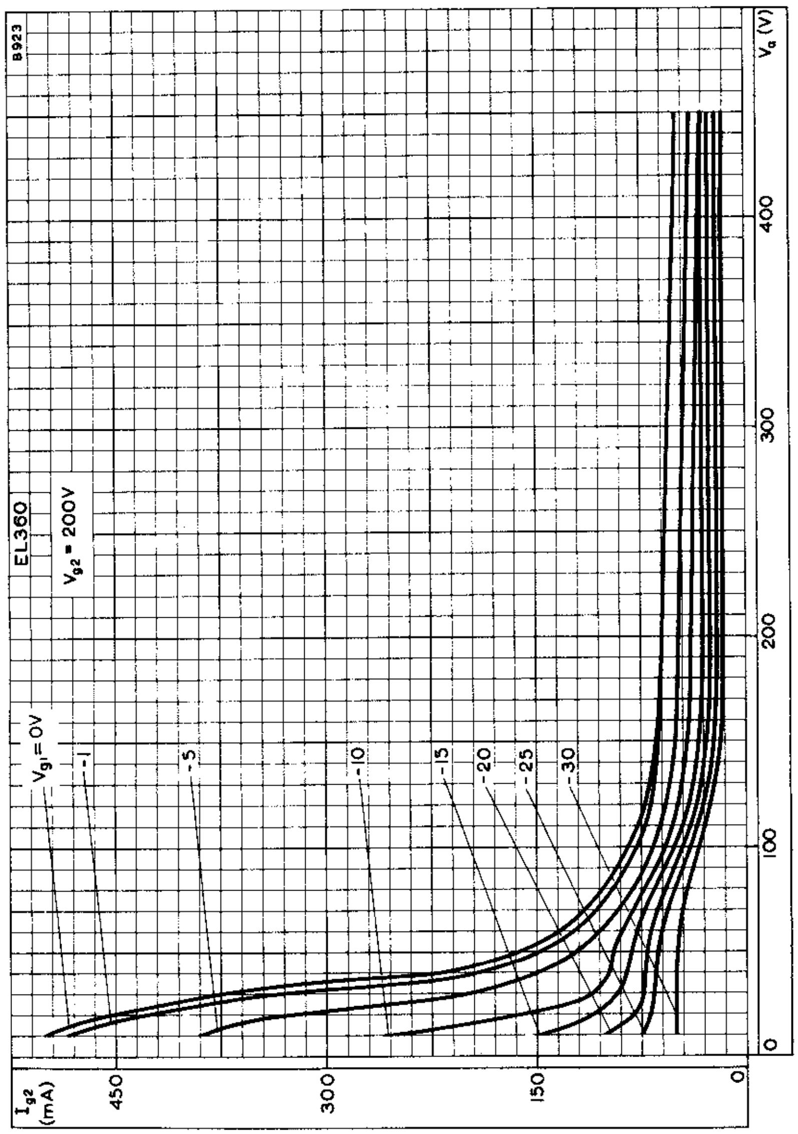
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER. $V_{g1} = +50V$



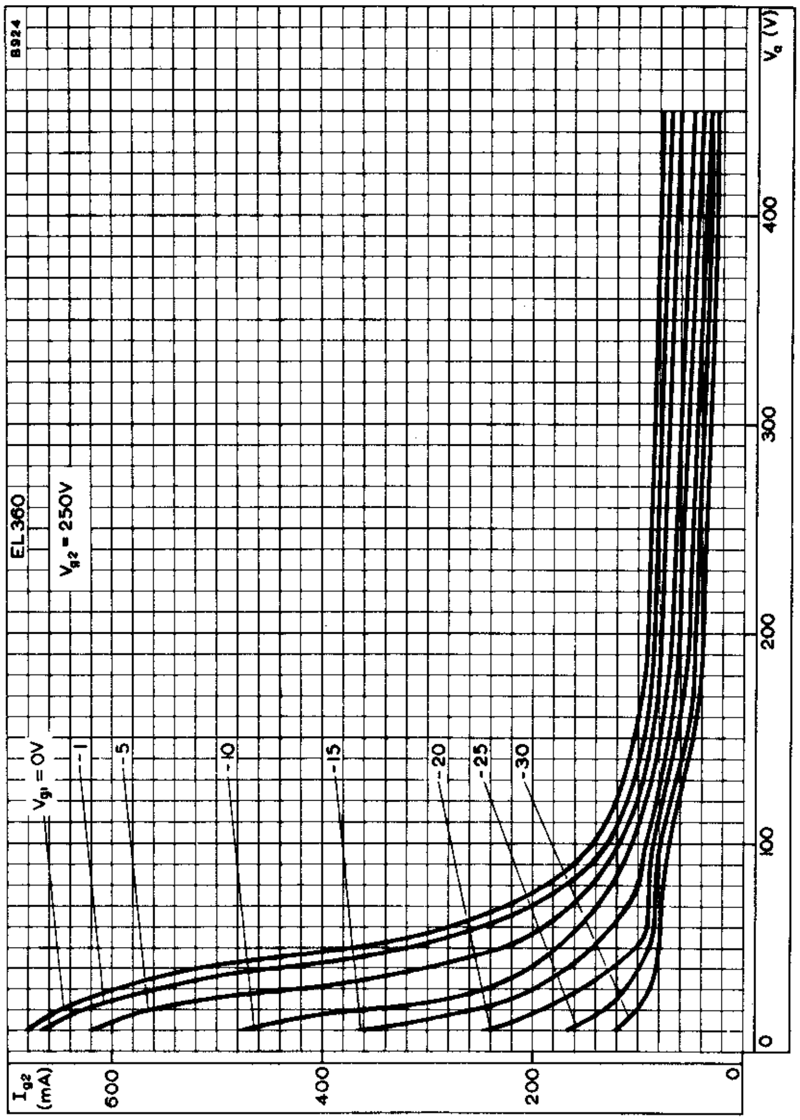
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 150V$

EL360

OUTPUT PENTODE



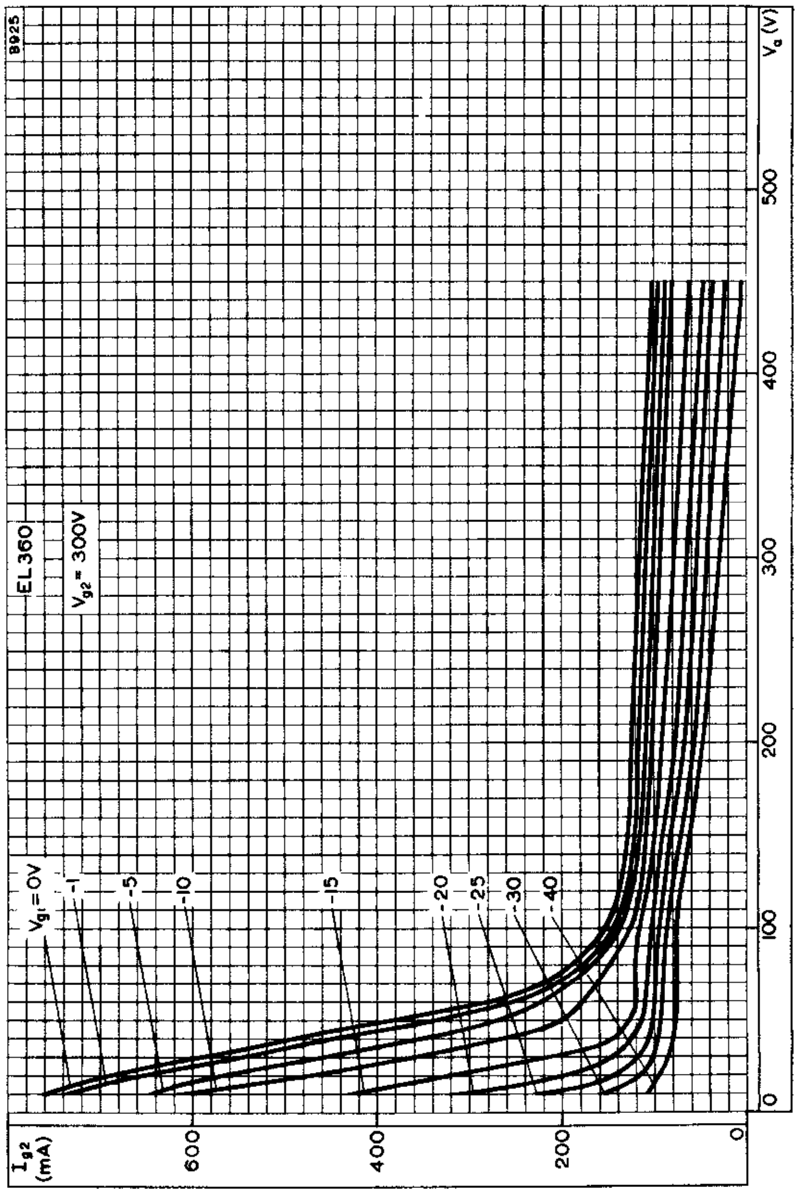
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 200V$



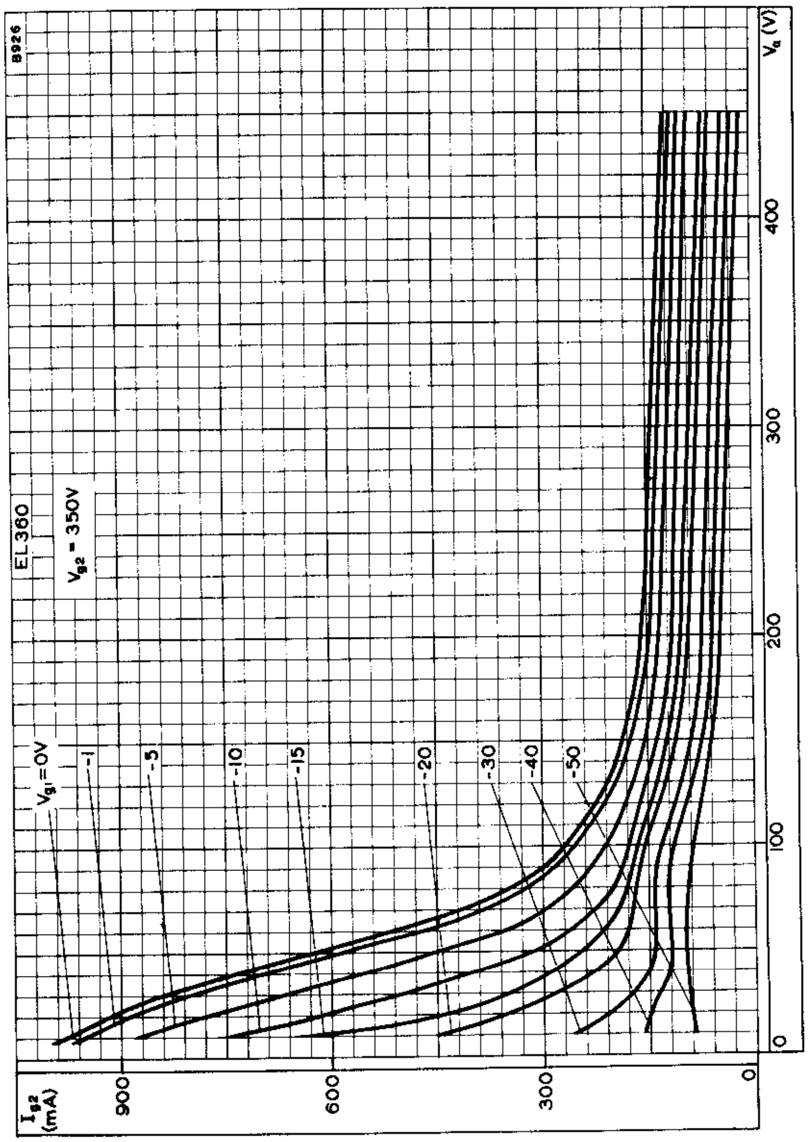
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 250V$

EL360

OUTPUT PENTODE



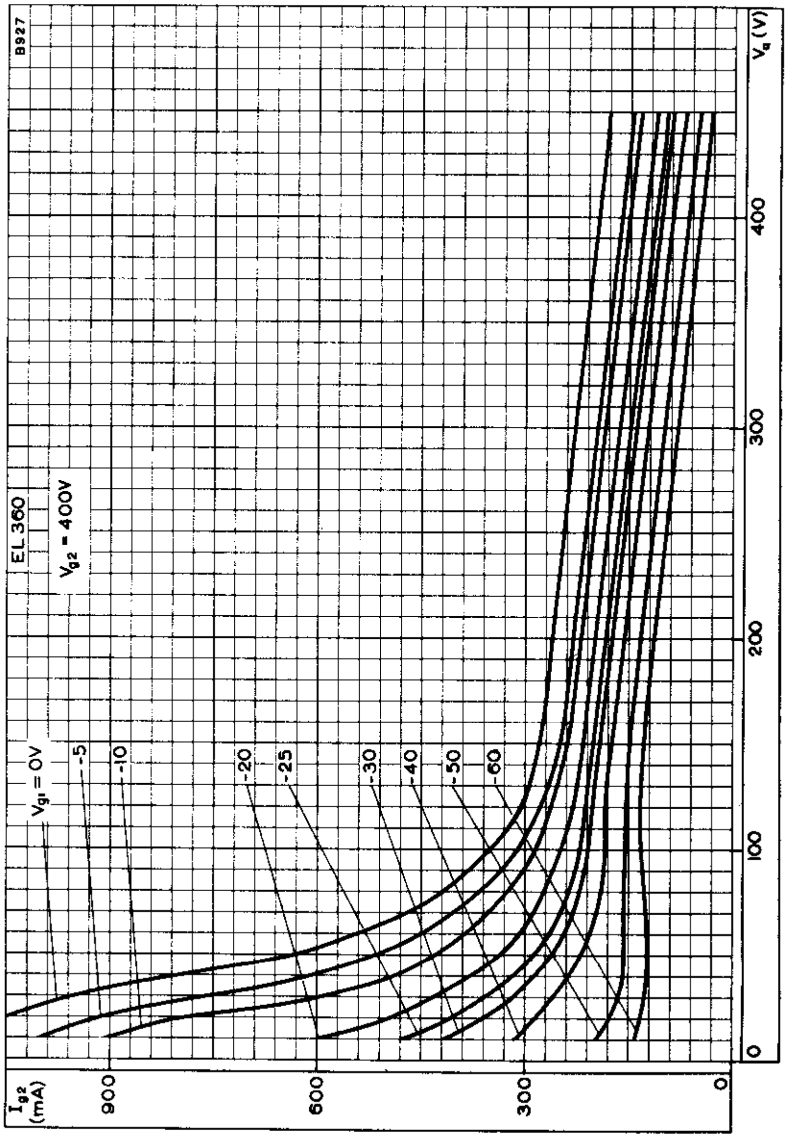
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 300V



SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 350V

EL360

OUTPUT PENTODE



SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 400V

TUNING INDICATOR

EM81

Electron beam tube for use as tuning indicator in f.m. or a.m. receivers or as a level indicator in tape recorders.

PRELIMINARY DATA

HEATER

Suitable for series or parallel operation a.c. or d.c.

V_h	6.3	V
I_h	300	mA

TYPICAL OPERATING CONDITIONS

V_b		250		V
V_t		250		V
R_a		500		kΩ
R_{g-k}		3.0		MΩ
V_g	−1.0		−10.5	V
β	65		5.0	deg.
I_a	370		20	μA
I_t	2.0		2.3	mA

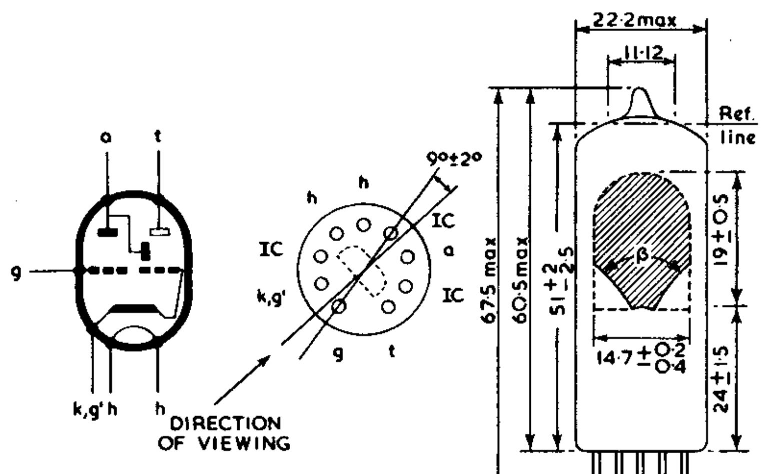
LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	200	mW
$V_{t(b)}$ max.	550	V
V_t max.	300	V
V_t min.	165	V
I_k max.	3.0	mA
R_{g-k} max.	3.0	MΩ
V_g max. (I_g = + 0.3μA)	−1.3	V
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ

EM81

TUNING INDICATOR

Electron beam tube for use as tuning indicator in f.m. or a.m. receivers or as a level indicator in tape recorders.



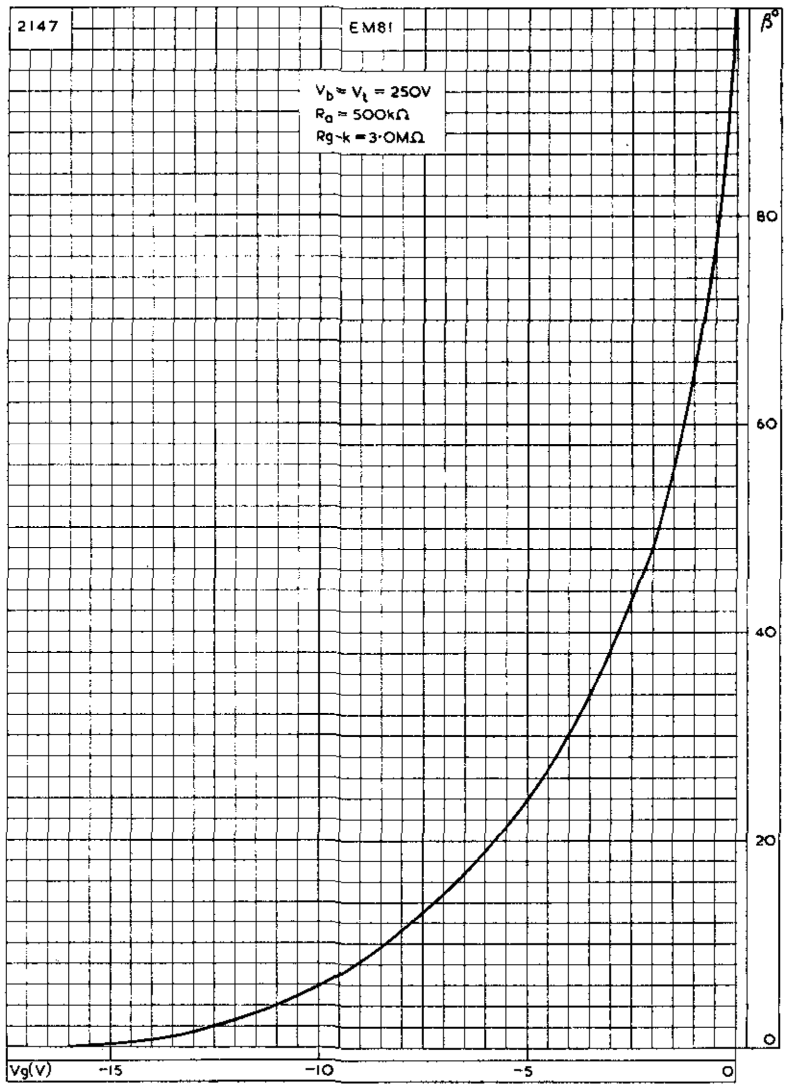
B9A
Noval Base

2149 All dimensions in mm

TUNING INDICATOR

EM81

Electron beam tube for use as tuning indicator in f.m. or a.m. receivers or as a level indicator in tape recorders.



LIGHT ANGLE PLOTTED AGAINST CONTROL-GRID VOLTAGE

VOLTAGE INDICATOR

EM87

Short grid-base electron beam tube for use as a voltage indicator in tape recorders. The pattern consists of a vertical column with a fluorescent area at the top and bottom. As the grid is driven negative these fluorescent areas converge, until they meet at $V_g = -10V$. At $V_g = -15V$ there is a 1.5mm cross-over which can be utilised to indicate overloading.

HEATER

V_h	6.3	V
I_h	300	mA

TYPICAL OPERATING CONDITIONS

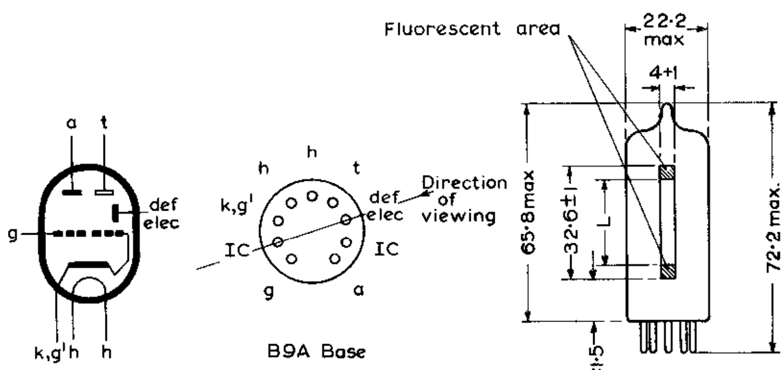
(deflection electrode connected to anode)

V_b		250		V
V_t		250		V
R_a		100		kΩ
R_{g-k}		3.0		MΩ
V_g	0	−10	−15	V
I_a	2.0	0.5	0.2	mA
I_t	1.0	1.8	2.0	mA
*L	21	0	−1.5	mm

*Length of column. A negative value of L indicates overlapping.

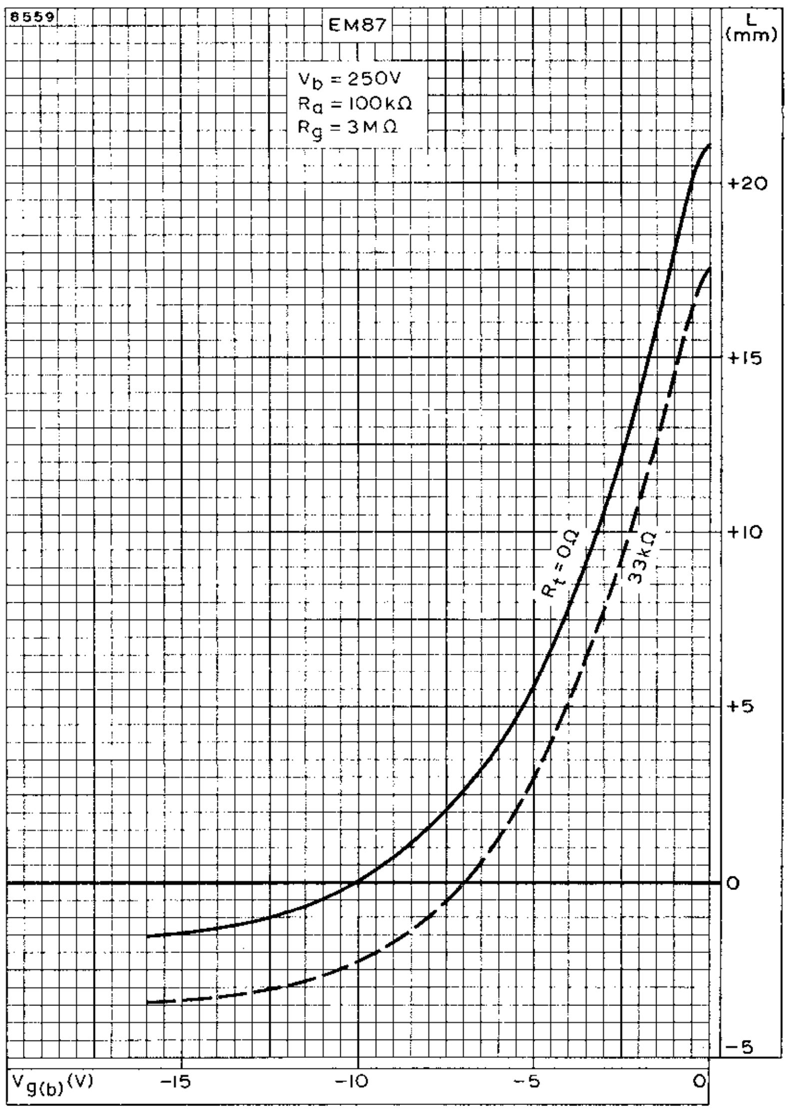
DESIGN CENTRE RATINGS

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	600	mW
$V_{def.elec.(b)}$ max.	550	V
$V_{def.elec.}$ max.	300	V
$V_{t(b)}$ max.	550	V
V_t max.	300	V
V_t min.	170	V
I_k max.	5.0	mA
R_{g-k} max.	3.0	MΩ
R_{h-k} max.	100	kΩ
V_{h-k} max.	250	V
T_{bulb} max.	120	°C



All dimensions in mm

9669



LENGTH OF COLUMN PLOTTED AGAINST CONTROL-GRID VOLTAGE

These general notes include definitions and general test procedures. They should be read in conjunction with the data sheets for Special Quality Thyratrons. Where reference should be made to a specific note, this is indicated on the data sheet by an index number, e.g. Group quality level.[9]

1. *Heater voltage.* Life and reliability of performance are a function of the value and degree of regulation of the heater voltage. In order to achieve the maximum useful life the heater should be maintained as close as possible to its rated value, and unless specific recommendations are made on individual data sheets, designers should aim to maintain the voltage at the valve pins within ±5% of the published nominal value.

2. *Capacitances.* Unless otherwise stated the capacitances quoted are measured with the valve cold in a fully screened socket. The measurements are made with or without an external shield, as stated on the individual data sheets.

3. *Limiting Values.* The limiting values given on the data sheets are absolute ratings. Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any valve of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

   These values are chosen by the valve manufacturer to provide acceptable serviceability of the valve, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the valve under consideration and of all other electron devices in the equipment.

   The equipment manufacturer should design so that initially and throughout life no absolute maximum value for the intended service is exceeded with any valve under the worst probable operating conditions with respect to supply voltage variations, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the valve under consideration and of all other devices in the equipment.

   Heater to cathode voltage. In the interests of reliability the heater to cathode voltage should always be kept as low as possible, and it is preferable to have the cathode positive with respect to the heater.

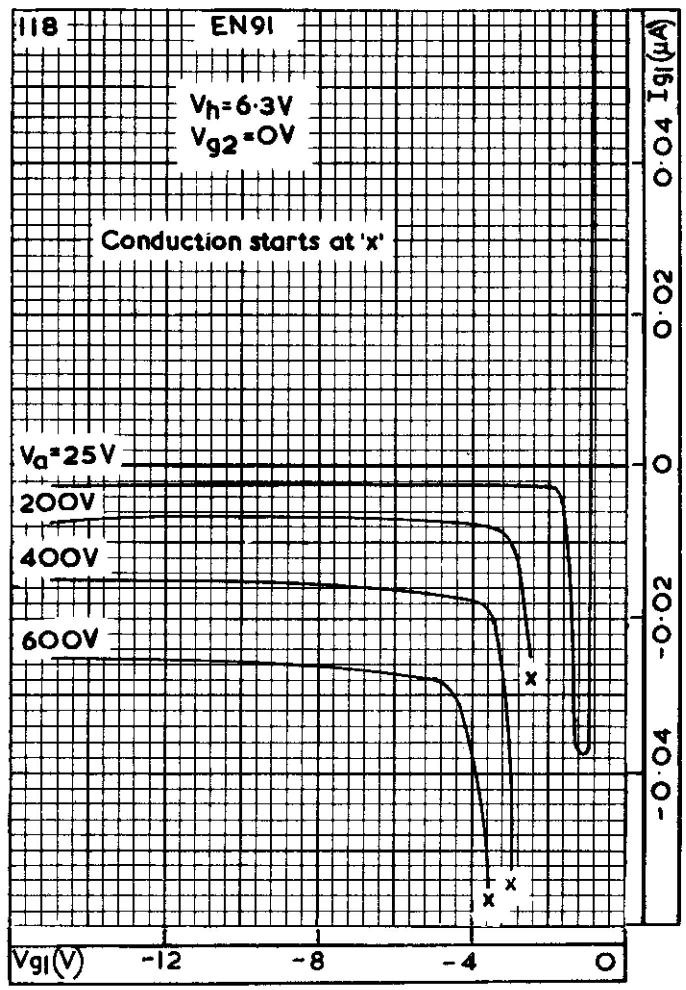
   Bulb temperature. In the interests of reliability the bulb temperature should always be kept as low as possible.

4. *The A.Q.L.* (Acceptable quality level) is the limit below which the average percentage of defectives is controlled.
5. *Maximum and minimum values for the individuals* are the limits to which valves are tested.
6. *Maximum and minimum for lot average* are the limits between which the average value of the characteristic of a lot or batch is controlled.
7. *Lot standard deviation* is the standard deviation of a single lot or batch.
8. *Bogey value* is the target value.
9. *Group quality level.* This is the A.Q.L. over a whole group of tests. *Sub-group quality level.* The A.Q.L. over a number of tests, which do not constitute a complete group.
10. *Glass envelope strain test.*
    (A) This test is carried out on a sampling basis and consists of completely submerging the valves in boiling water at a temperature between 97 and 100°C for 15 seconds and then immediately plunging them in ice cold water for 5 seconds. The valves are then examined for glass cracks.
    (B) This test is carried out on a sampling basis and consists of completely submerging the valves in boiling water not less than 85°C for 15 seconds and then immediately plunging them in ice cold water not more than 5°C for 5 seconds. The valves are then examined for glass cracks.
11. *Base strain test.* This test is carried out on a sampling basis and consists of forcing the pins of the valves over specified cones and then completely submerging the valves and cones in boiling water at a temperature between 97 and 100°C for 10 seconds. The valves and cones are allowed to cool to room temperature before examining for glass cracks.
12. This test is carried out on a sampling basis under the conditions detailed in the data.
13. *Shock test.* This test is carried out on a sampling basis and subjects the valves to 5 blows of the specified acceleration in each of 4 directions.
14. *Inoperatives.* An inoperative is defined as a valve having an open or short circuited electrode, an air leak or a broken pin.

TETRODE THYRATRON

Tetrode inert gas-filled thyratron with negative control characteristic. Primarily designed for use in relay or grid-controlled rectifier circuits.

EN91
(2D21)



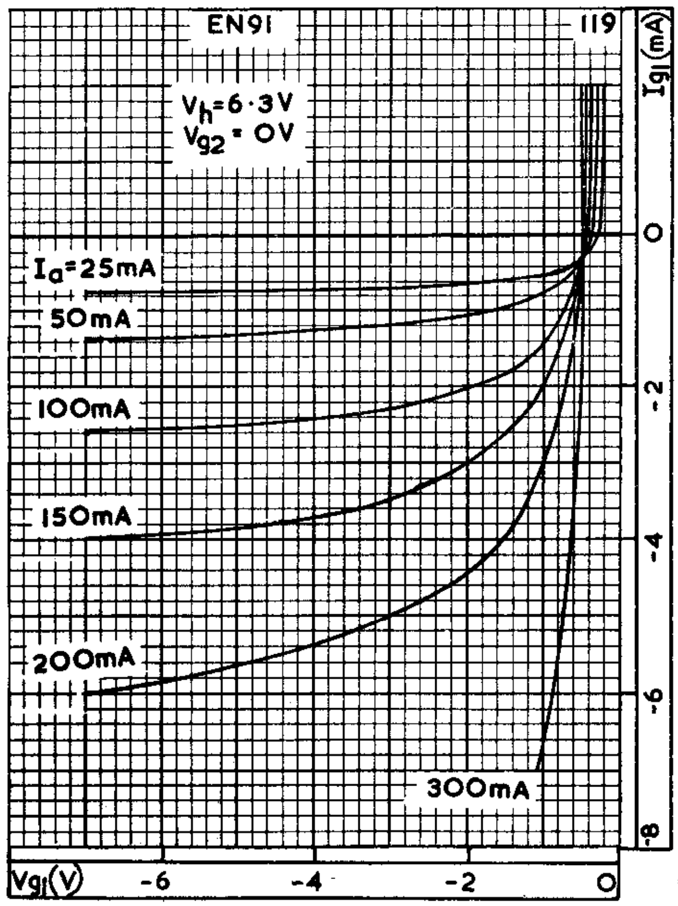
CONTROL-GRID CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE BEFORE CONDUCTION

EN91

(2D21)

TETRODE THYRATRON

Tetrode inert gas-filled thyratron with negative control characteristic. Primarily designed for use in relay or grid-controlled rectifier circuits.



CONTROL-GRID CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE DURING CONDUCTION

TETRODE THYRATRON

EN91

(2D21)

Tetrode inert gas-filled thyratron with negative control characteristic. Primarily designed for use in relay or grid-controlled rectifier circuits.

This data sheet should be read in conjunction with "DEFINITIONS AND OPERATIONAL RECOMMENDATIONS—THYRATRONS", preceding this section of the Handbook.

LIMITING VALUES (absolute ratings, not design centre)

It is important that these limits are never exceeded and such variations as mains fluctuations, component tolerances and switching surges must be taken into consideration in arriving at actual valve operating conditions.

Max. peak anode voltage		
Inverse	1.3	kV
Forward	650	V
Max. cathode current		
Peak	500	mA
Average (Max. averaging time 30 secs.)	00	mA
Surge (Fault protection max. duration 0.1 secs.)	1 10	A
Max. negative control-grid voltage		
Before conduction	100	V
During conduction	10	V
Max. average positive control-grid current for anode voltage more positive than –10 V (averaging time 1 cycle)	10	mA
Max. peak positive control-grid current during the time that the anode voltage is more positive than –10 V	50	mA
*Max. peak positive control-grid current during the time that the anode voltage is more negative than –10 V	30	μA
Max. control-grid resistor	10	MΩ
*(Recommended min. control-grid resistor 0.1 M Ω)		
Max. negative shield-grid voltage		
Before conduction	100	V
During conduction	10	V
Max. average positive shield-grid current for anode voltage more positive than –10 V (averaging time 1 cycle)	10	mA
**Max. shield-grid resistor	1.0	MΩ
Max. peak heater-cathode voltage		
Heater positive	25	V
Heater negative	100	V
Heater voltage limits	5.7 to 6.9	V
Min. valve heating time	10	s
Max. operating frequency	500	c/s
Ambient temperature limits	–75 to +90	°C

*It is not desirable that the control-grid should be positive when the anode is more negative than –10 V, but where this condition is unavoidable the control-grid resistor may need to be greater than the recommended minimum value.

**Where circuit conditions permit, the shield-grid should be connected directly to the cathode.

EN91

(2D21)

TETRODE THYRATRON

Tetrode inert gas-filled thyratron with negative control characteristic. Primarily designed for use in relay or grid-controlled rectifier circuits.

CHARACTERISTICS

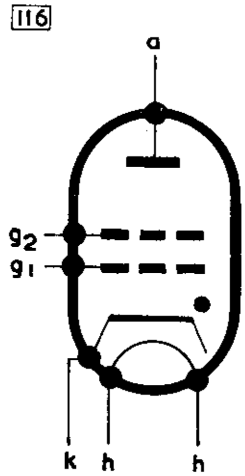
Electrical

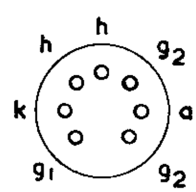
Heater voltage	6.3	V
Heater current at 6.3 V		
Average	0.60	A
Maximum	0.66	A
Anode to control-grid capacitance	0.03	pF
Control-grid to cathode and shield-grid capacitance	2.5	pF
Deionisation time (approx.)		
(a) $V_{g1}=-100$ V, $I_a=100$ mA	35	µs
(b) $V_{g1}=-10$ V, $I_a=100$ mA	75	µs
Ionisation time (approx.)	0.5	µs
Anode voltage drop	8	V
Critical grid current at $V_a=460$ V r.m.s.	0.5	µA

Mechanical

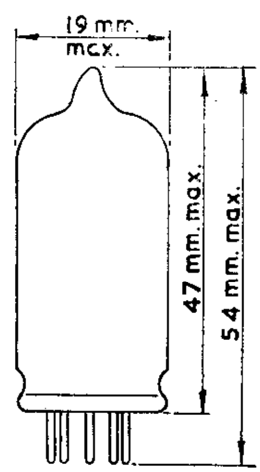
Type of cooling	Convection	
Mounting position	Any	
Max. net weight	0.5	oz
	14	g

116





B7G BASE

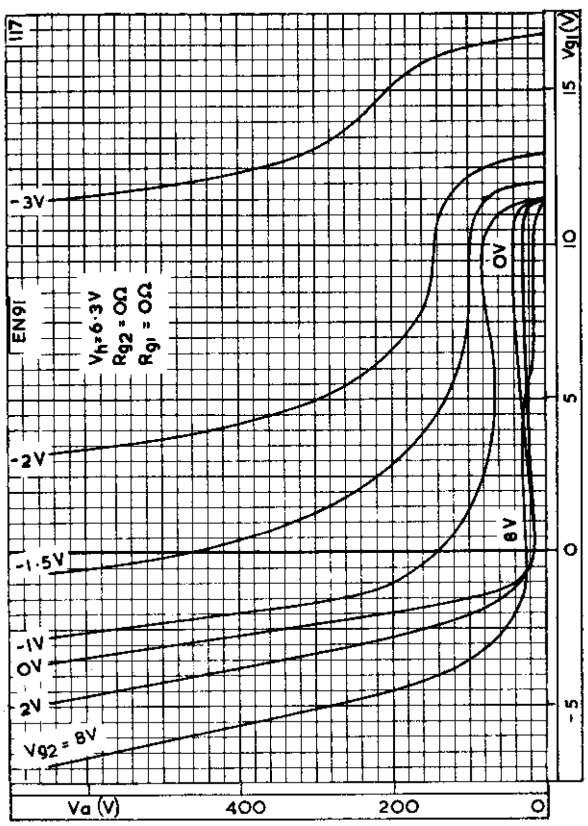


TETRODE THYRATRON

EN91

(2D21)

Tetrode inert gas-filled thyratron with negative control characteristic. Primarily designed for use in relay or grid-controlled rectifier circuits.



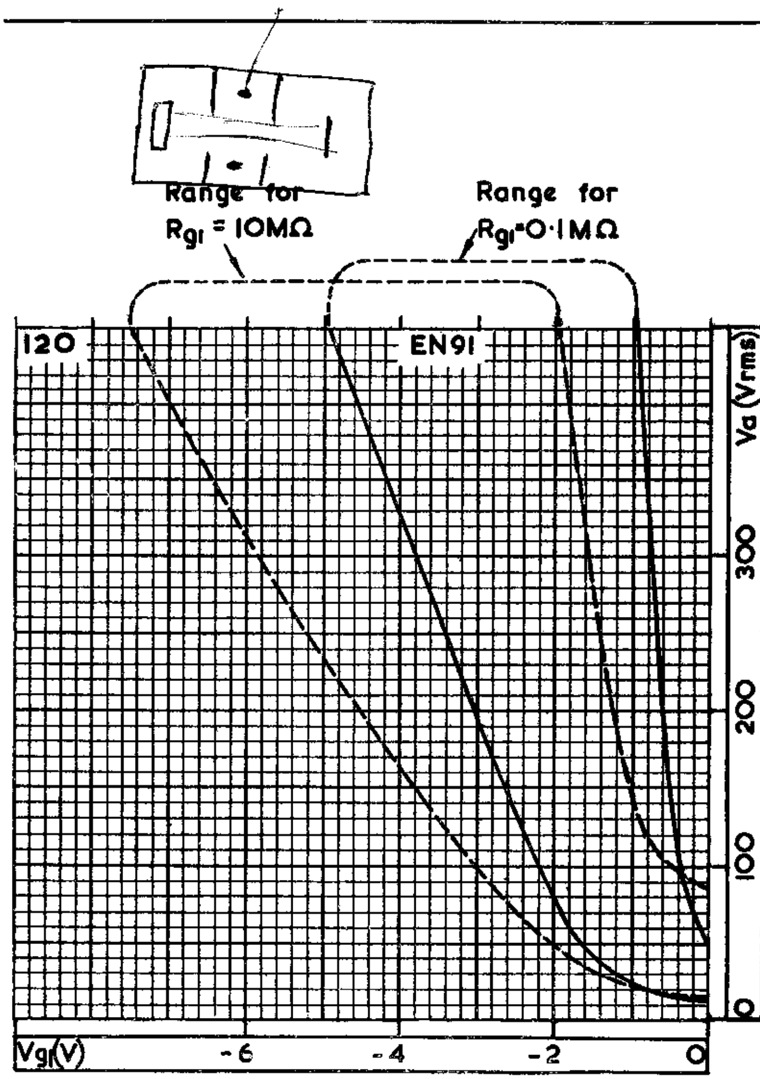
CONTROL CHARACTERISTIC

EN91

(2D21)

TETRODE THYRATRON

Tetrode inert gas-filled thyratron with negative control characteristic. Primarily designed for use in relay or grid-controlled rectifier circuits.



OPERATING RANGE OF CRITICAL GRID VOLTAGE

HALF-WAVE RECTIFIERS

EY86
EY87

High voltage half-wave rectifiers particularly suitable for use in cathode ray tube e.h.t. supply units. The EY87 is electrically identical to the EY86 but has a chemically treated bulb to prevent flash-over under conditions of high humidity.

HEATER

V_h	6.3	V
I_h	90	mA
Heater voltage tolerances $I_{out} \leq 200\mu A$	±15*	%
$I_{out} > 200\mu A$	±7*	%

*These tolerances apply when the power supply voltage is at its nominal value and when a valve having bogey heater characteristics is employed. In addition, fluctuations in the mains supply voltage not exceeding ±10% are permissible.

CAPACITANCE

$c_{a-(h+k+s)}$	1.7	pF

LIMITING VALUES

Pulsed input

†P.I.V. max.	22	kV
I_{out} max.	800	μA
††$i_{a(pk)}$ max.	40	mA
C max.	2000	pF

†Max. duration 18% of a line scanning cycle with a max. of 18μs.

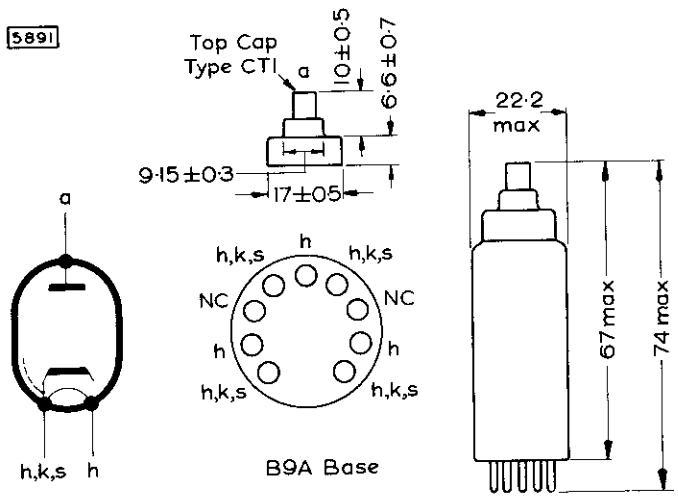
††Max. duration 10% of a line scanning cycle with a max. of 10μs.

Sinusoidal input (50c/s)

$V_{in(r.m.s.)}$ max.	5.0	kV
I_{out} max.	3.0	mA
C max.	0.2	μF
R_{lim} min.	100	kΩ

WARNING

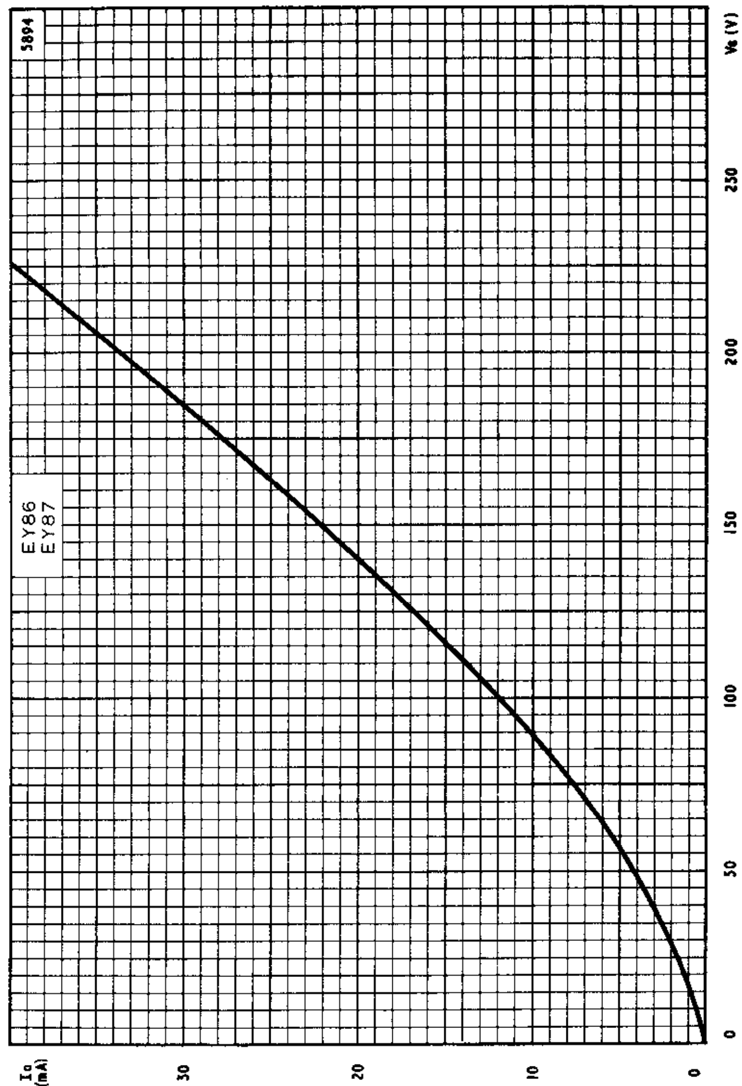
X-ray shielding is advisable to give protection against possible danger of personal injury arising from prolonged exposure at close range to this tube when operated above 16kV. The level of X-radiation is likely to be considerably higher when the heater circuit of the tube is open.



All dimensions in mm

Pins 1, 4, 6 and 9 may be used for fixing an anti-corona shield.

Pins 3 and 7 may only be connected to points in the heater circuit and must not be earthed.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

FULL-WAVE RECTIFIER

EZ80

Indirectly heated full-wave rectifier, primarily intended for use in a.c. mains-operated equipment.

PRELIMINARY DATA

HEATER

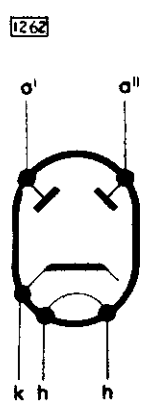
V_h	6.3	V
I_h	0.6	A

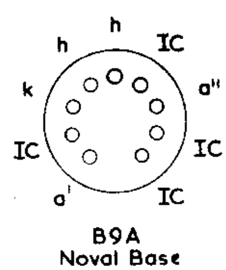
OPERATING CONDITIONS

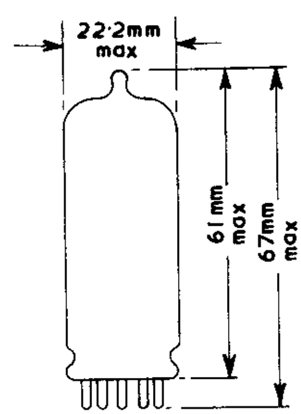
$V_{a(r.m.s.)}$	2×250	2×275	2×300	2×350	V
C	50	50	50	50	μF
R_{lim} min. (per anode)	125	175	215	300	Ω
I_{out}	90	90	90	90	mA
V_{out}	265	285	310	360	V

LIMITING VALUES

$V_{a(r.m.s.)}$ max.	2×350	V
I_{out} max.	90	mA
C max.	50	μF
$i_{a(pk)}$ max. (per anode)	270	mA
$v_{h-k(pk)}$ max.	500	V



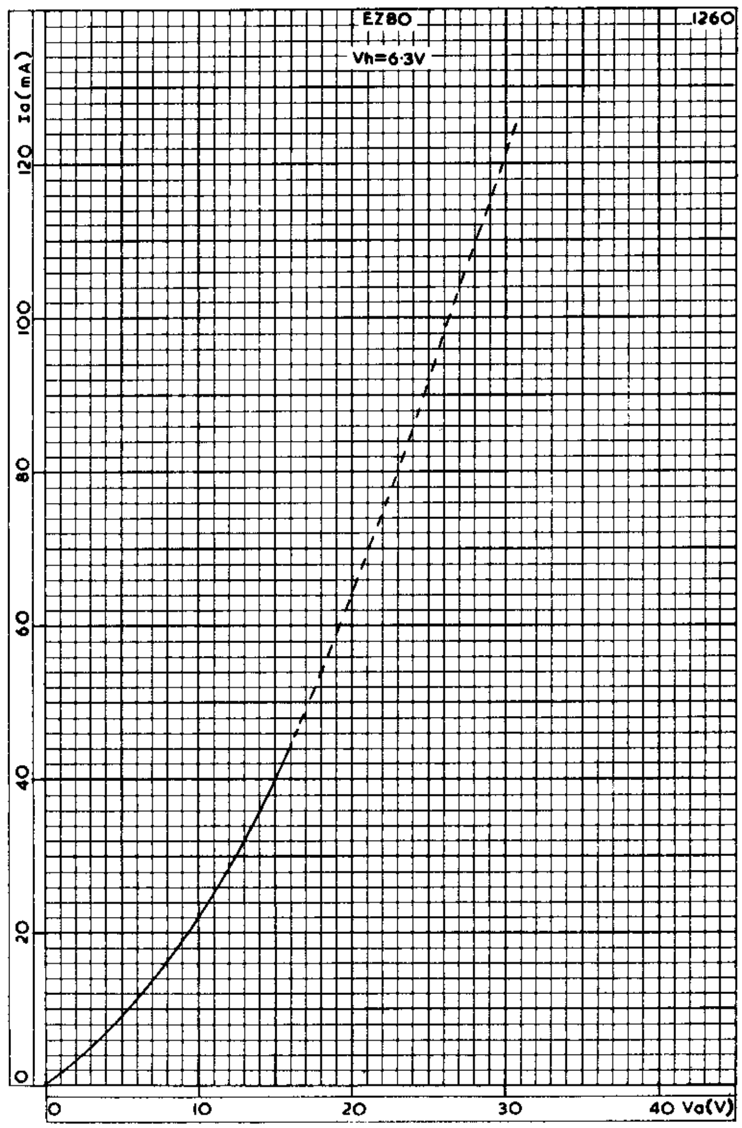




EZ80

FULL-WAVE RECTIFIER

Indirectly heated full-wave rectifier, primarily intended for use in a.c. mains-operated equipment.

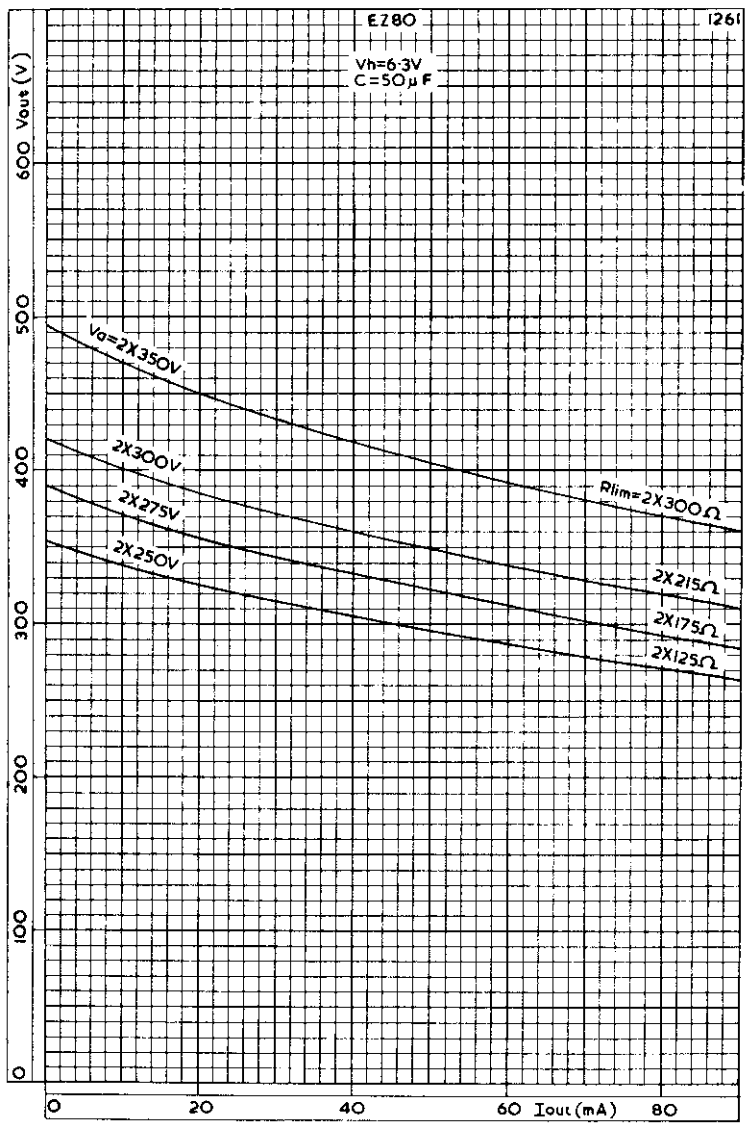


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

FULL-WAVE RECTIFIER

EZ80

Indirectly heated full-wave rectifier, primarily intended for use in a.c. mains-operated equipment.



REGULATION CURVES

HALF-WAVE RECTIFIER GY501

E.H.T. rectifier for colour television receivers. This valve has a chemically treated envelope to avoid flashover under conditions of high humidity and low atmospheric pressure (450mm of mercury).

HEATER

V_h (see note 1)	3.15	V
I_h	400	mA

CAPACITANCES

c_{a-h+k}	1.2	pF ←

OPERATING CONDITIONS

I_{out}	1.5	mA
V_{out}	25	kV

RATINGS (DESIGN CENTRE SYSTEM)

P.I.V. max. (see note 2)	31	kV
V_{out} max.	25	kV
$I_{a(out)}$ max.	1.7	mA

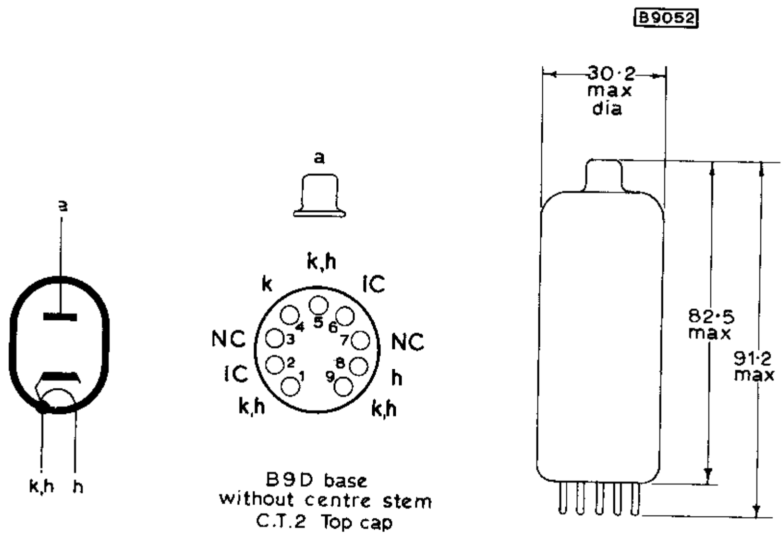
OPERATING NOTES

1. The nominal heater voltage value applies to operation with the average beam current to be expected in practice. Heater voltage variations up to max. ±15% are permitted for a nominal tube under the worst probable conditions.

2. Maximum pulse duration 22% of one cycle with a maximum of 18μs. The negative peak due to ringing in the line output transformer should be taken into account.

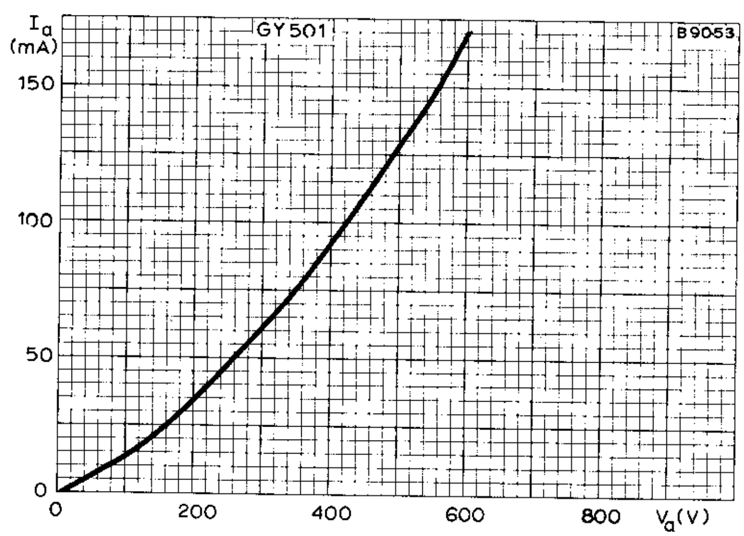
3. When operated in a television receiver this valve will produce X-radiation in excess of permissible dosage and a suitable screen should be incorporated.

OUTLINE DRAWING OF GY501



All dimensions in mm

Pins 1, 5 and 9 may be used to connect an anti-corona ring. Circuit elements having the same potential as the heater, eg. series resistor, may be connected to pins 3 and 7. These pins must not be earthed



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

U.H.F. TRIODE

PC86

Frame-grid triode for use as grounded-grid amplifier or self-oscillating mixer in Bands IV and V.

HEATER

I_h	300	mA
V_h	4.0	V ←

CAPACITANCES ←

Unshielded

c_{a-g}	2.2	pF
c_{a-k}	240	mpF
c_{a-k+h}	350	mpF
c_{a-g+h}	2.3	pF
c_{g-k}	3.5	pF
c_{g-k} (I_a = 12mA)	5.6	pF
c_{g-k+h}	3.8	pF
c_{g-h}	300	mpF
c_{k-g+h}	6.3	pF

Shielded

$c_{h+k-g+s}$	4.1	pF
c_{a-g+s}	3.3	pF
c_{a-k+h}	300	mpF

CHARACTERISTICS

V_a	175	V
V_g	-1.5	V
I_a	12	mA
g_m	14	mA/V
r_a	4.85	kΩ
μ	68	
R_{eq}	230	Ω

OPERATING CONDITIONS

As grounded-grid amplifier

V_a	175	V
I_a	12	mA
R_k	125	Ω
g_m	14	mA/V

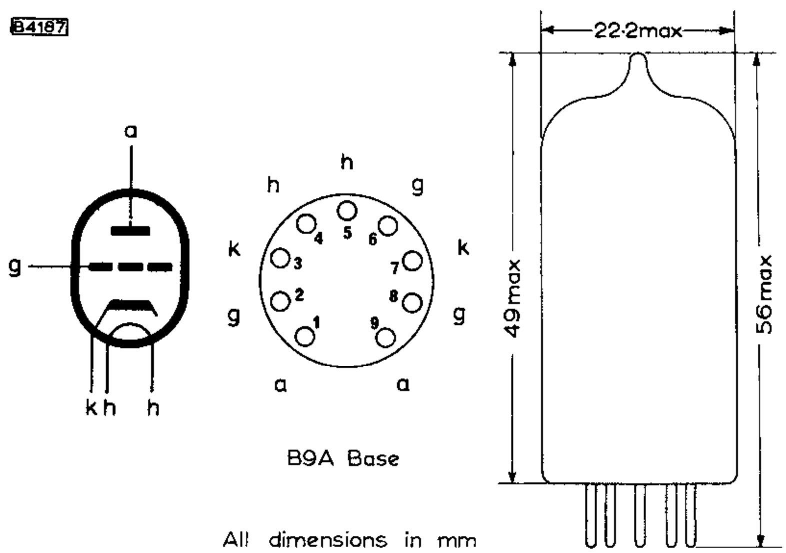
As self-oscillating mixer

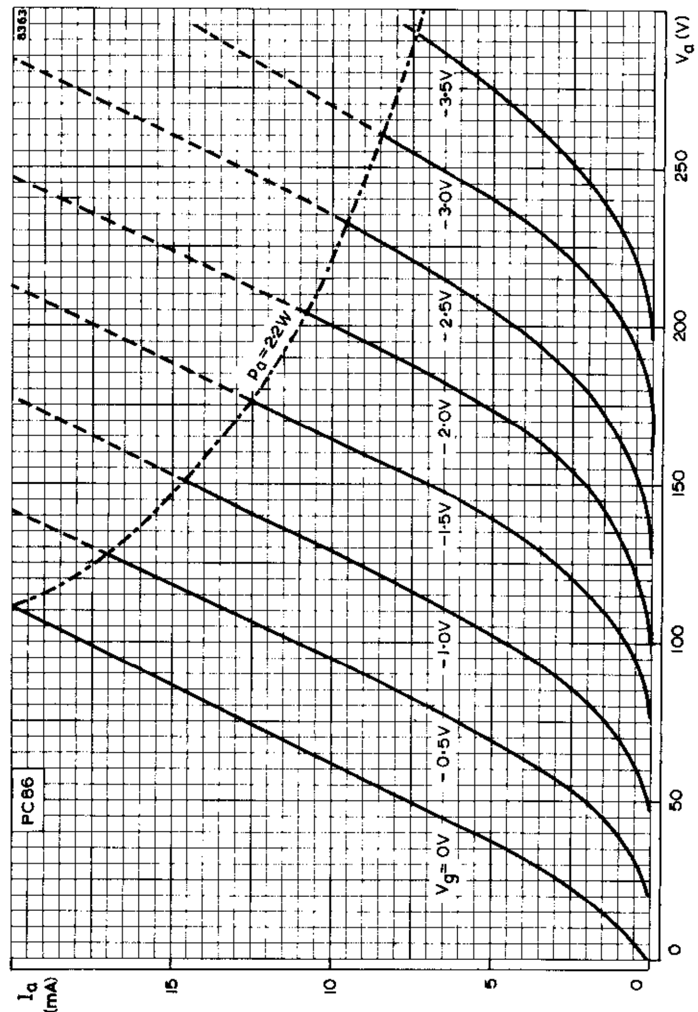
$V_{a(b)}$	220	V
R_a	5.6	kΩ
R_g	47	kΩ
I_a	12	mA
I_g	50	μA
v_{osc} (r.m.s.)	2.5	V
g_c	5.5	mA/V

DESIGN CENTRE RATINGS

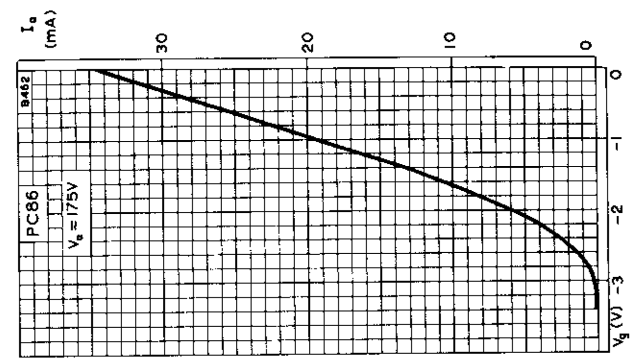
$V_{a(b)}$ max.	550	V
V_a max.	220	V
p_a max.	2.2	W
I_k max.	20	mA
$-V_g$ max.	50	V
R_{g-k} max.	1.0	MΩ
V_{h-k} max.	100	V

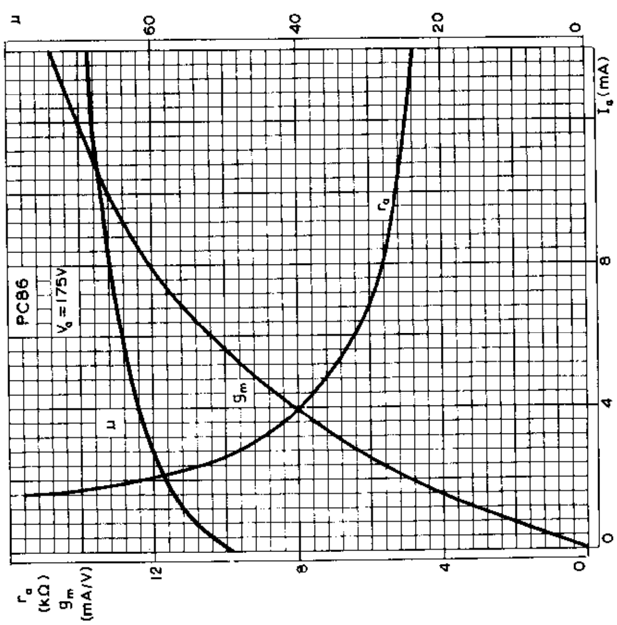
B4187





ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER.





ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE. Va = 175V

MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND ANODE IMPEDANCE PLOTTED AGAINST ANODE CURRENT. Va = 175 V

U.H.F. TRIODE

Frame-grid triode for use as grounded-grid amplifier in Bands IV and V.

PC88

HEATER

I_h	300	mA
V_h	3.8	V

CAPACITANCES *(measured with close fitting shield connected to the grid)*

$c_{h+k-g+s}$	3.8	pF
c_{a-g+s}	1.7	pF
c_{a-k+h}	55	mpF
	Unshielded	
c_{a-g}	1.2	pF

CHARACTERISTICS

V_a	160	V
I_a	12.5	mA
V_g	−1.25	V
g_m	13.5	mA/V
r_a	4.8	kΩ
μ	65	
R_{eq}	240	Ω

OPERATING CONDITIONS

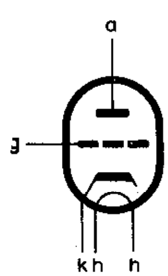
V_a	160	V
R_k	100	Ω
I_a	12.5	mA
g_m	13.5	mA/V
r_a	4.8	kΩ
μ	65	
Noise factor	10	dB

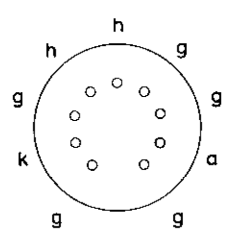
DESIGN CENTRE RATINGS

$V_{a(b)}$ max.	550	V
V_a max.	175	V
p_a max.	2.0	W
I_k max.	13	mA
$-V_g$ max.	50	V
R_{g-k} max.	1.0	MΩ
V_{h-k} max.	100	V

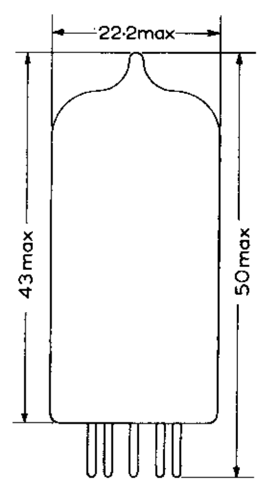
PC88

U.H.F. TRIODE



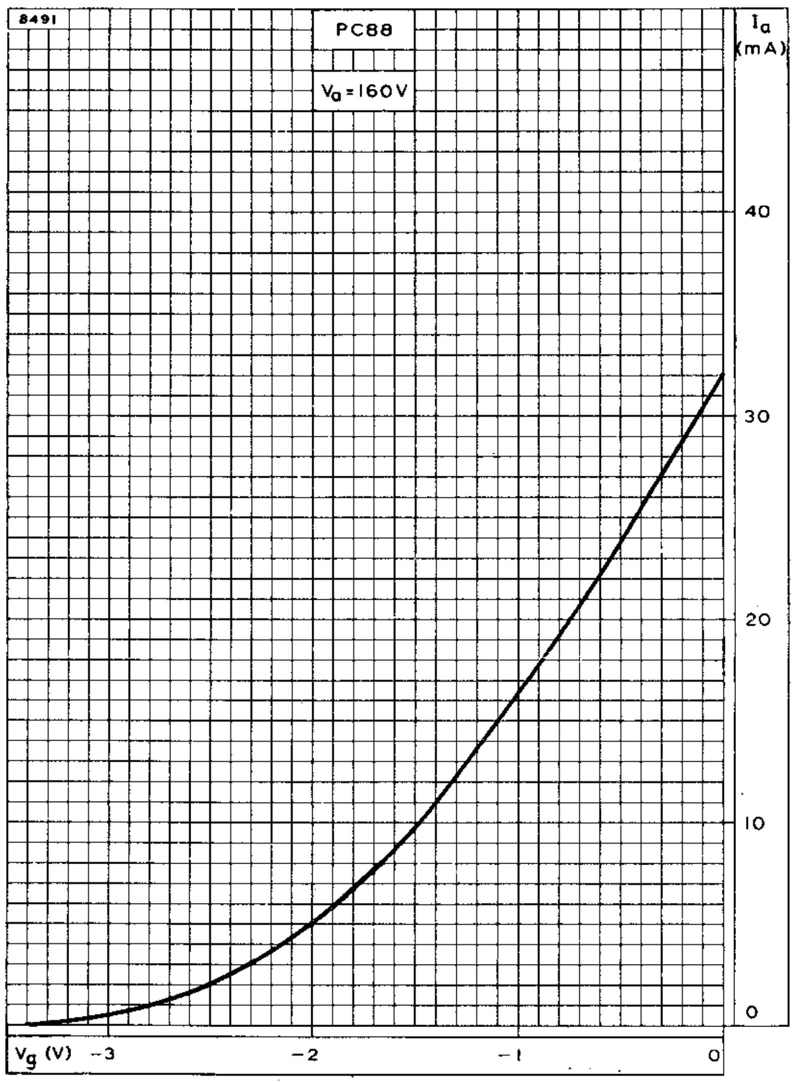


B9A Base



All dimensions in mm

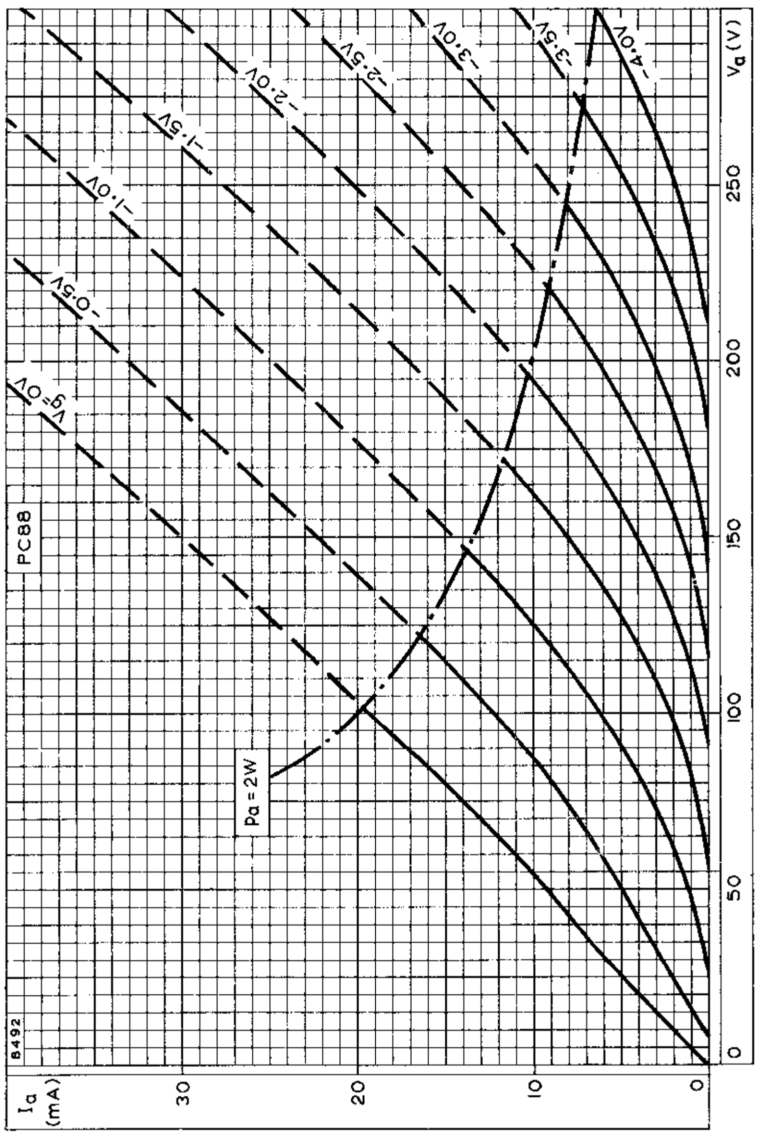
8371



ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE

PC88

U.H.F. TRIODE



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

R.F. TRIODE

PC900

Triode with low anode-to-grid capacitance intended for use as an r.f. amplifier in v.h.f. television receivers.

HEATER

Suitable for series operation a.c. or d.c.

I_h	300	mA
V_h	3.9	V←

CAPACITANCES (with external shield)

c_{a-g}	350	mpF
$c_{a-k+h+s}$	3.0	pF
$c_{g-k+h+s}$	4.5	pF
c_{a-k}	80	mpF
c_{g-k}	3.3	pF
c_{g-h}	<70	mpF
c_{k-h}	2.3	pF

CHARACTERISTICS

V_a	135	V
I_a	11.5	mA
V_g	-1.0	V
g_m	14.5	mA/V
μ	76	←
r_a	5.25	kΩ←

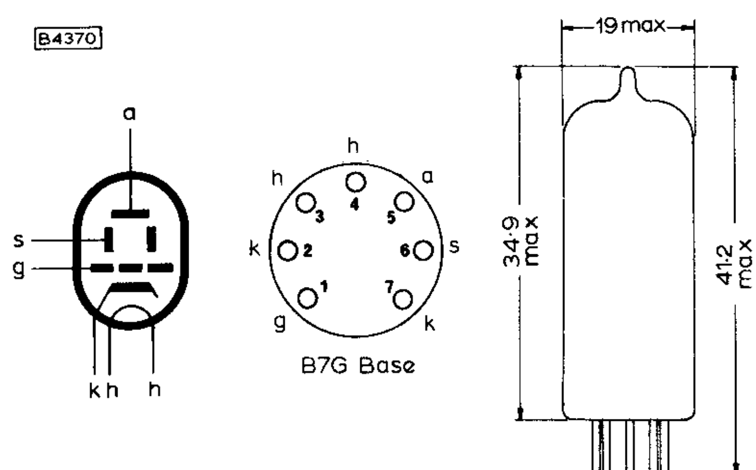
OPERATING CONDITIONS	1	2	3	
V_b	200	200	135	V
R_a	5.6	5.6	1.5	kΩ←
R_k	0	87	0	Ω←
I_a	16.5	11.5	16.5	mA←
I_g	20	0	20	μA←
V_g	-0.5	1.0	-0.5	V
g_m	20	14.5	20	mA/V
μ	84	76	84	←
V_g for 10:1 reduction in g_m	-3.2	-3.8	-2.3	V←
V_g for 100:1 reduction in g_m	-7.7	-8.3	-5.3	V←

RATINGS (DESIGN CENTRE SYSTEM)

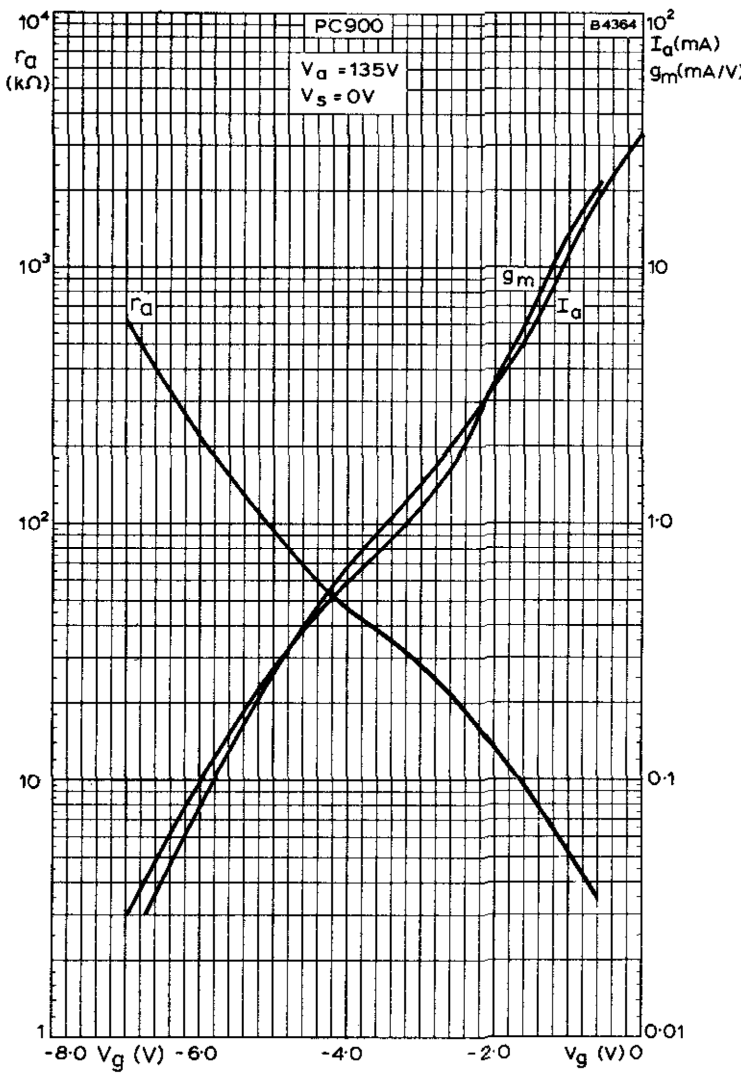
$V_{a(b)}$ max.	550	V
V_a max.	200	V
p_a max.	2.2	W
I_k max.	20	mA
$-V_g$ max.	50	V
Rg-k max.	1.0	MΩ
R_{g-k} max. (a.g.c. circuits)	3.0	MΩ
*V_{h-k} max.	100	V

*To fulfil modulation hum requirement, V_{h-k} should not exceed 55V r.m.s. ←

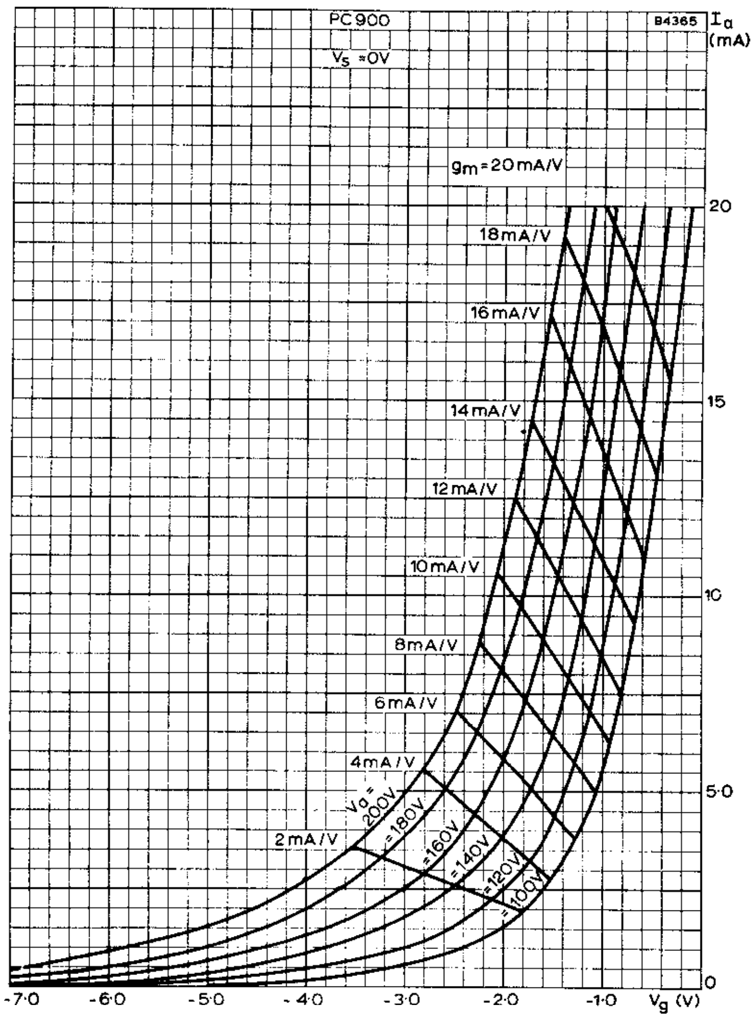
B4370



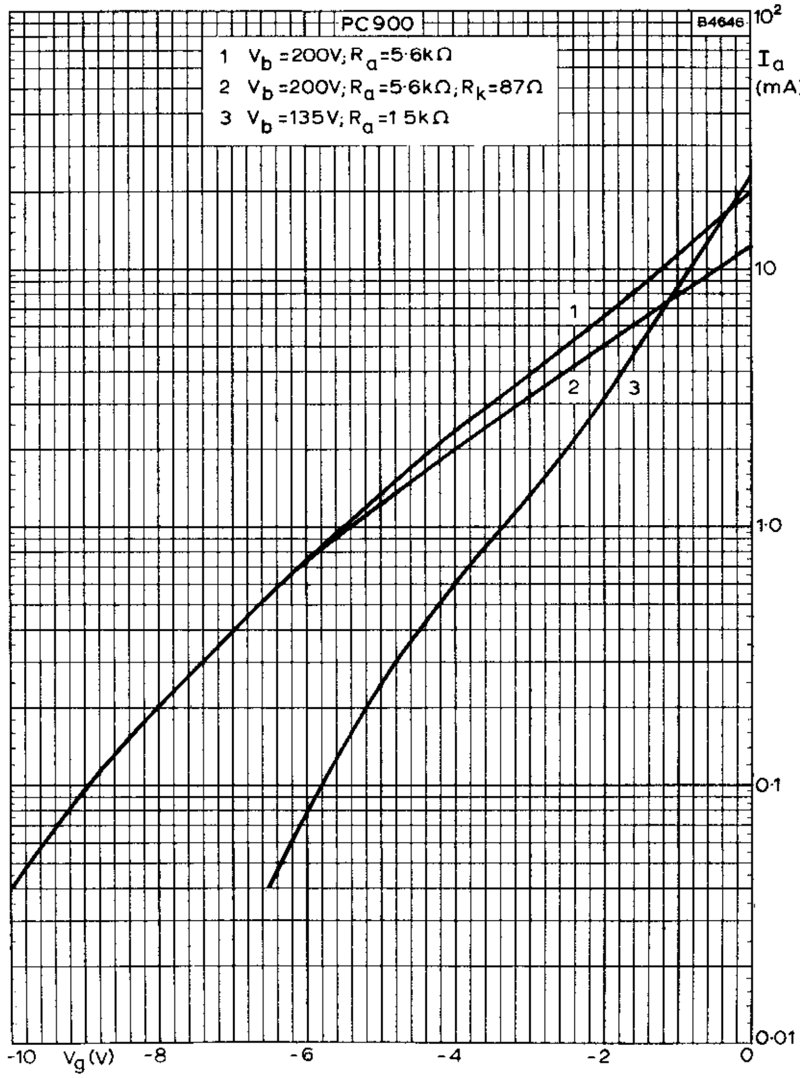
All dimensions in mm



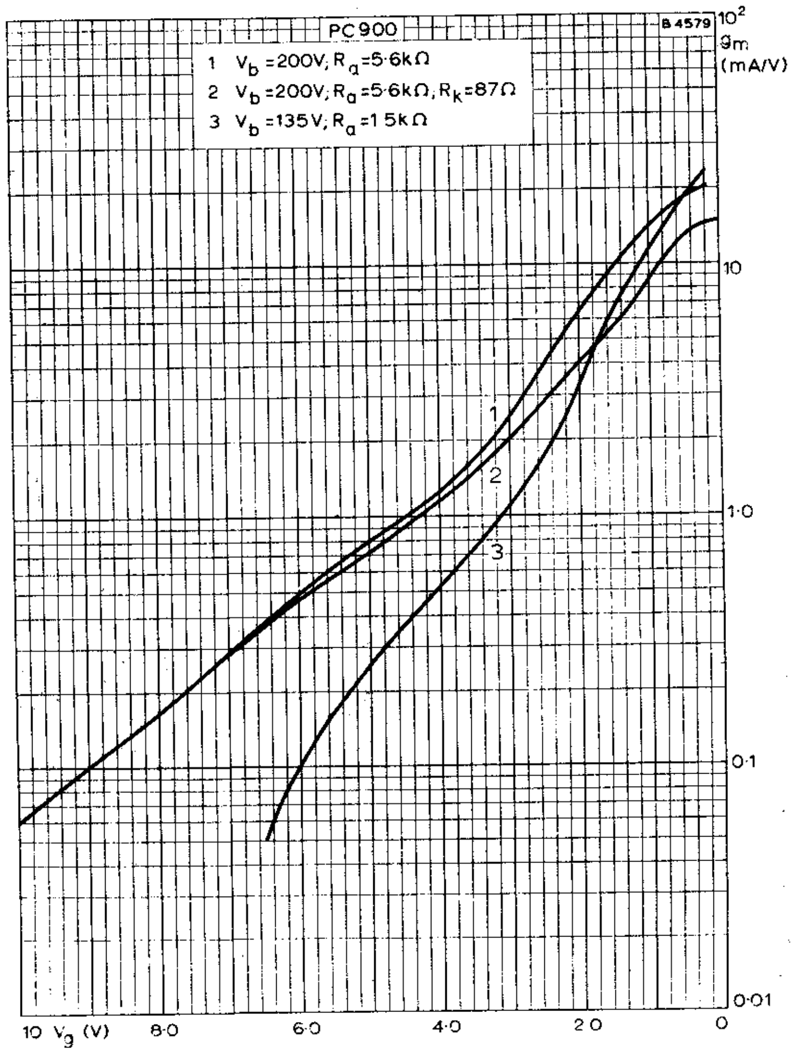
ANODE CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST GRID VOLTAGE



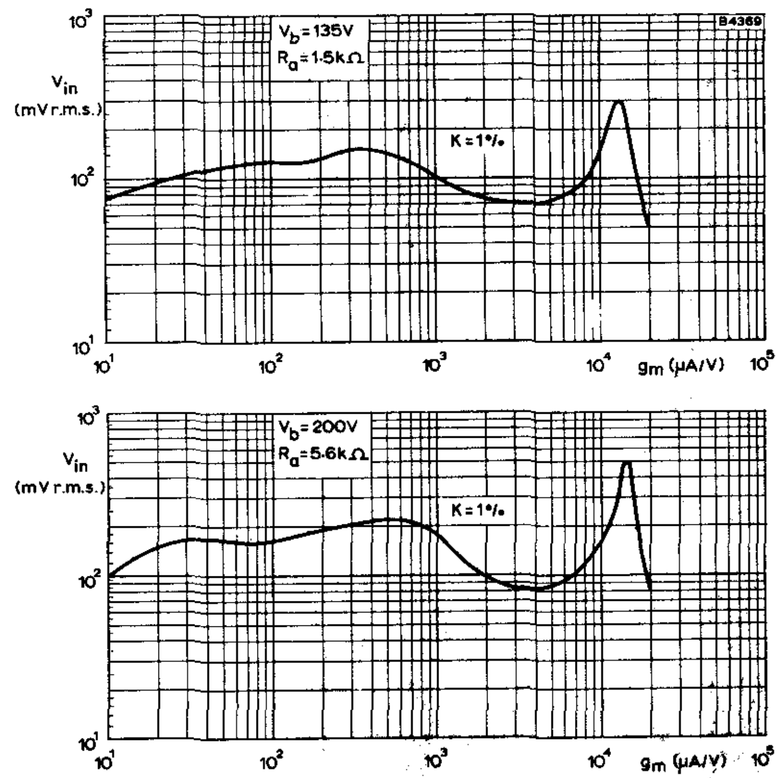
ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE WITH ANODE VOLTAGE AND MUTUAL CONDUCTANCE AS PARAMETERS



ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE



MUTUAL CONDUCTANCE PLOTTED AGAINST GRID VOLTAGE



CROSS MODULATION CURVE

R. F. DOUBLE TRIODE **PCC85**

Double triode primarily intended for use as an oscillator and mixer at frequencies up to 200Mc/s in television receivers.

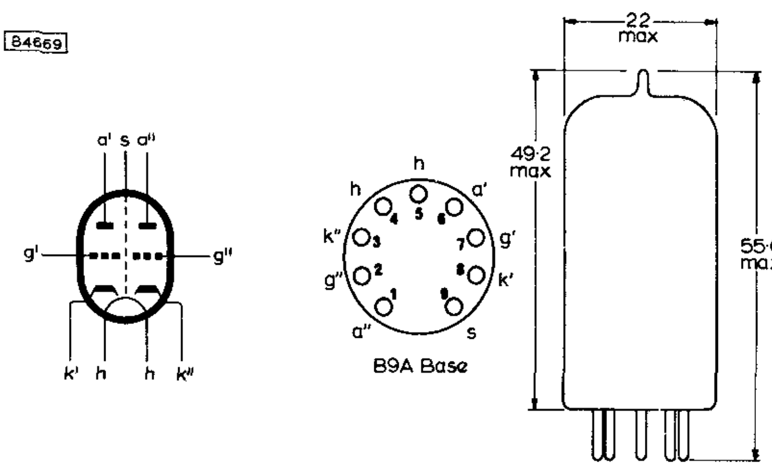
HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	9.0	V

For characteristics, operating conditions and limiting values see type UCC85.

B84669



All dimensions in mm

The triode on pins 6, 7 and 8 should be used as the r.f. amplifier and that on pins 1, 2 and 3 as the self-oscillating additive mixer.

R.F. DOUBLE TRIODE

PCC89

Variable-mu frame grid double triode primarily intended for use as a cascode amplifier at frequencies up to 220Mc/s in television receivers with series connected heaters.

HEATER

Suitable for series operation a.c. or d.c.

I_h	300	mA
V_h	7.5	V←

CAPACITANCES (measured with an external shield)

$c_{a'-a''}$	<15	mpF
$c_{g'-a''}$	<5	mpF

Grounded cathode section

$c_{a'-g'}$	1.9	pF
$c_{g'-k'+h+g''+s}$	3.8	pF
$c_{a'-k'+h+g''+s}$	2.5	pF
$c_{g'-h}$	<300	mpF

Grounded grid section

$c_{a''-g''}$	4.1	pF
$c_{a''-k''}$	<200	mpF
$c_{k''-g''+h+s}$	6.3	pF
$c_{a''-g''+h+s}$	4.5	pF
$c_{k''-h}$	2.9	pF

CHARACTERISTICS (each section)

V_a	90	V
I_a	15	mA
V_g	−1.2	V
g_m	12.3	mA/V
r_a	2.9	kΩ
μ	36	

PCC89

R.F. DOUBLE TRIODE

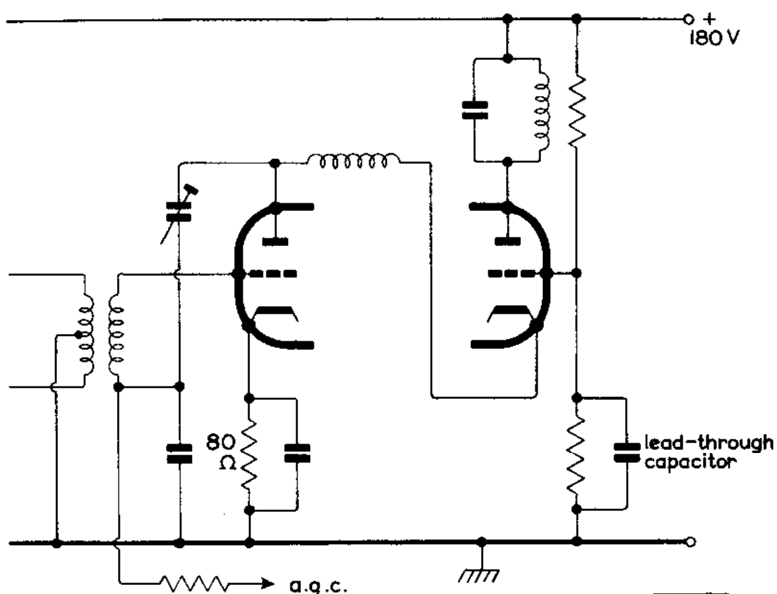
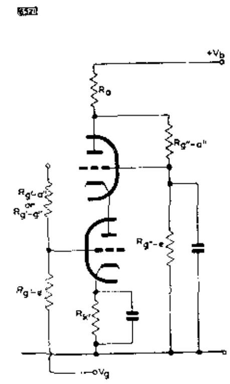


Fig. 1

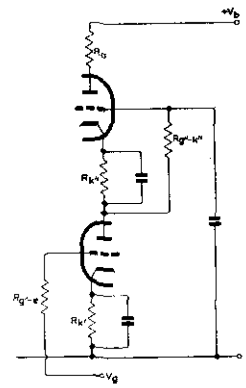
CHARACTERISTICS (cascode—see Fig. 1)

V_b	180	V
I_a	15	mA
g_m	12	mA/V
*$V_{g'}$	−9.0	V
Noise factor	5.5	dB

*For 100 : 1 reduction in cascode slope.



Circuit A



Circuit B

OPERATING CONDITIONS

Condition	1	2	3	4	
Circuit	A	A	A	A	
V_b	190	190	190	190	V
$R_{a''}$	1.5	3.3	3.9	3.9	kΩ
$R_{g''-a''}$	100	100	100	100	kΩ
$R_{g''-e}$	100	100	100	100	kΩ
$R_{g'-e}$	—	470	470	470	kΩ
$R_{g'-g''}$	—	—	22	15	MΩ
$R_{k'}$	68	0	0	0	Ω
I_a	15	14.8	14.7	14.9	mA
g_m	13	14.4	14.7	14.8	mA/V
V_g for 100 : 1 reduction in g_m	−9.3	−9.0	−11	−12	V

Condition	5	6	7	8	9	
Circuit	A	A	A	B	B	
V_b	190	190	190	190	190	V
$R_{a''}$	3.9	3.9	4.7	1.5	3.3	kΩ
$R_{g''-a''}$	100	100	100	—	—	kΩ
$R_{g''-e}$	100	100	100	—	—	kΩ
$R_{g''-k''}$	—	—	—	—	470	kΩ
$R_{k''}$	0	0	0	68	0	Ω
$R_{g'-e}$	470	470	470	470	470	kΩ
$R_{g'-g''}$	—	10	—	—	—	MΩ
$R_{g'-a''}$	22	—	15	—	—	MΩ
$R_{k'}$	0	0	0	68	0	Ω
I_a	15	15.1	14	15	14.4	mA
g_m	14.9	15	14.7	13	14.3	mA/V
V_g for 100 : 1 reduction in g_m	−12.5	−13.5	−15	−16.5	−16	V

The gain/slope ratio depends upon the circuit and will differ at high and low frequencies.

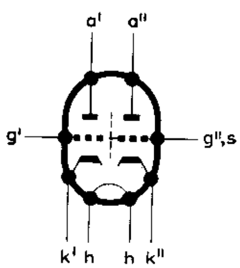
PCC89

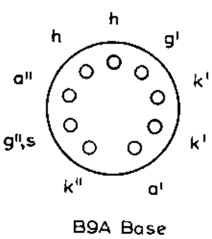
R.F. DOUBLE TRIODE

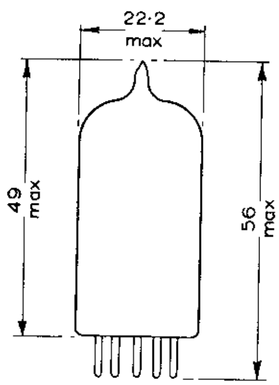
LIMITING VALUES (each section, unless otherwise stated)

V_a max.	130	V
p_a max.	1.8	W
I_k max.	18	mA ←
$-V_g$ max.	50	V
$R_{g'-k'}$ max.	1.0	MΩ
$R_{g''-k''}$ max.	500	kΩ
$V_{h-k''}$ max. (cathode positive)	200	V ←
R_{h-k} max.	20	kΩ

To fulfil hum requirements, $V_{h-k'}$ must be less than $50V_{r.m.s.}$



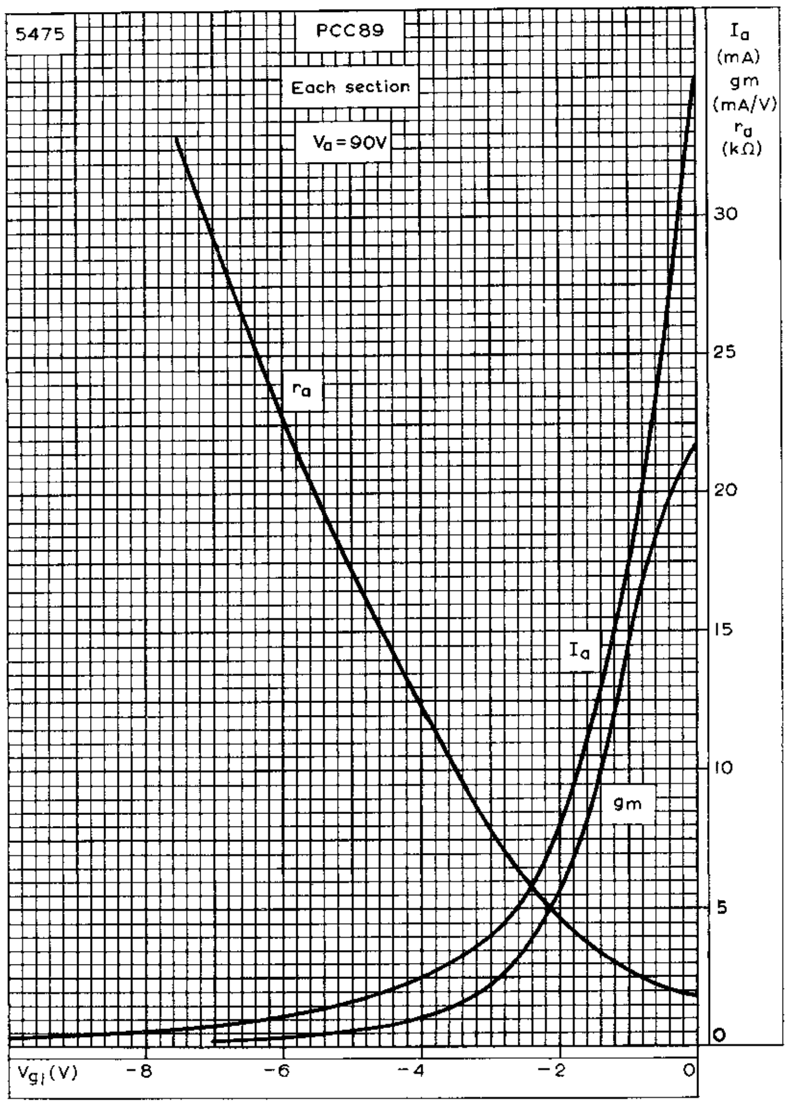




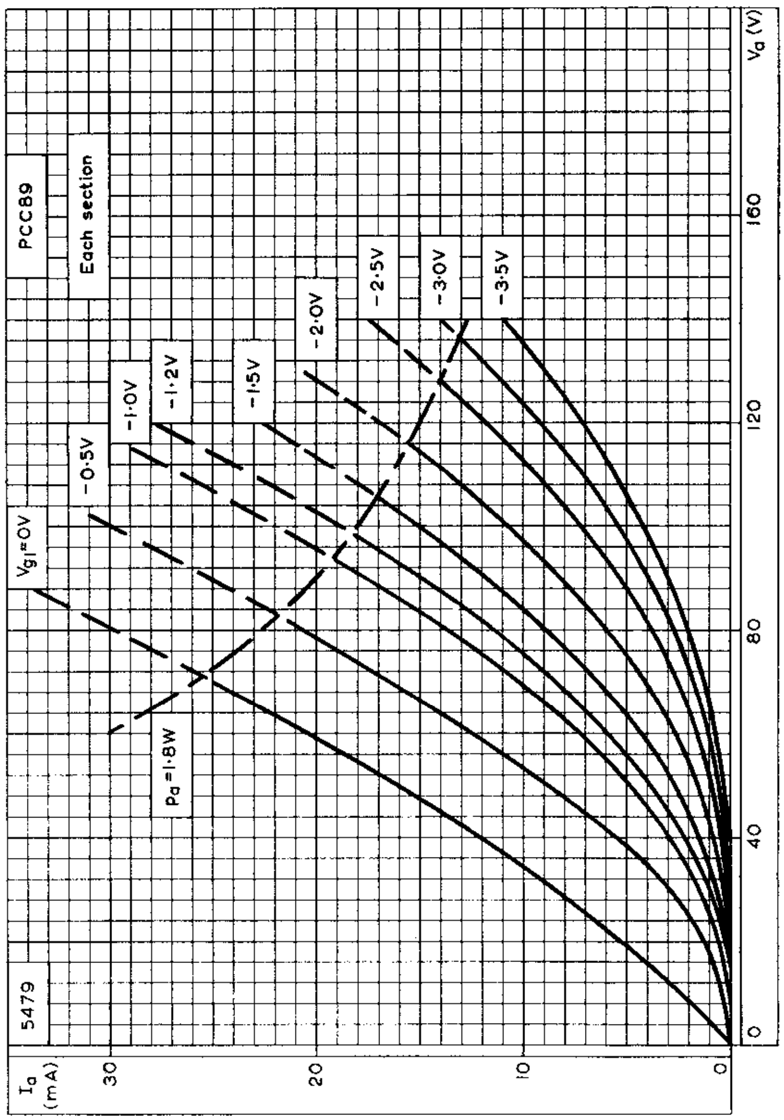
4473

All dimensions in mm

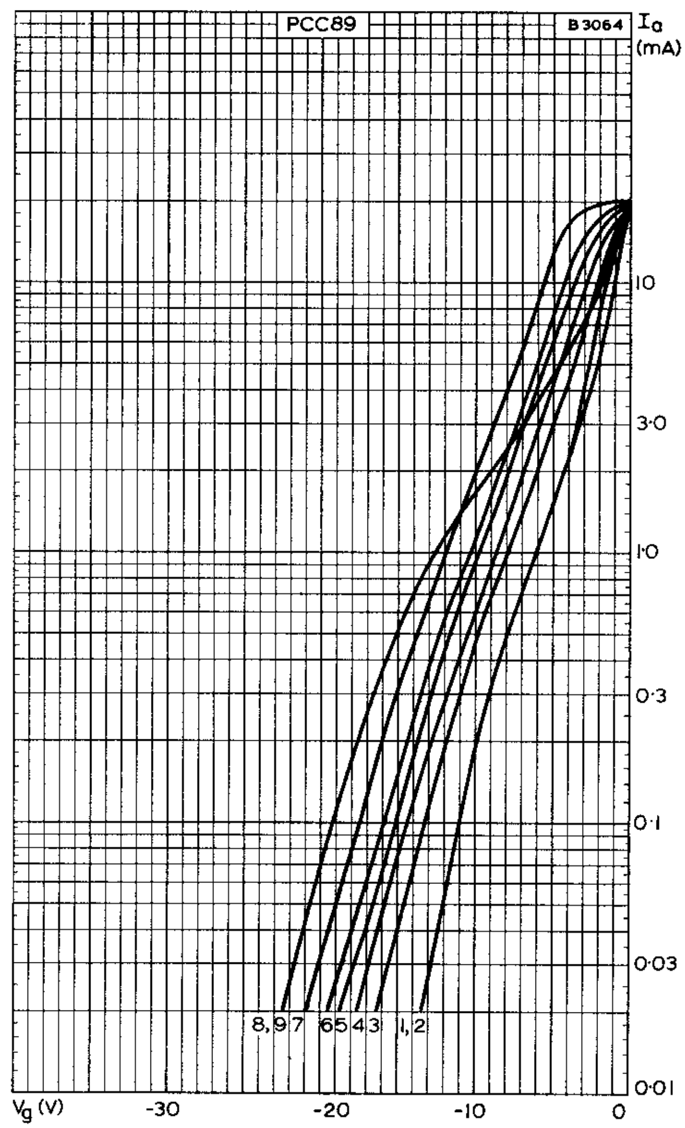
The triode on pins 6, 7, 8 and 9 should have the grounded cathode connection, and that on pins 1, 2 and 3 should have the grounded grid connection. It is recommended that pins 7 and 8 be strapped.



ANODE CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST GRID VOLTAGE



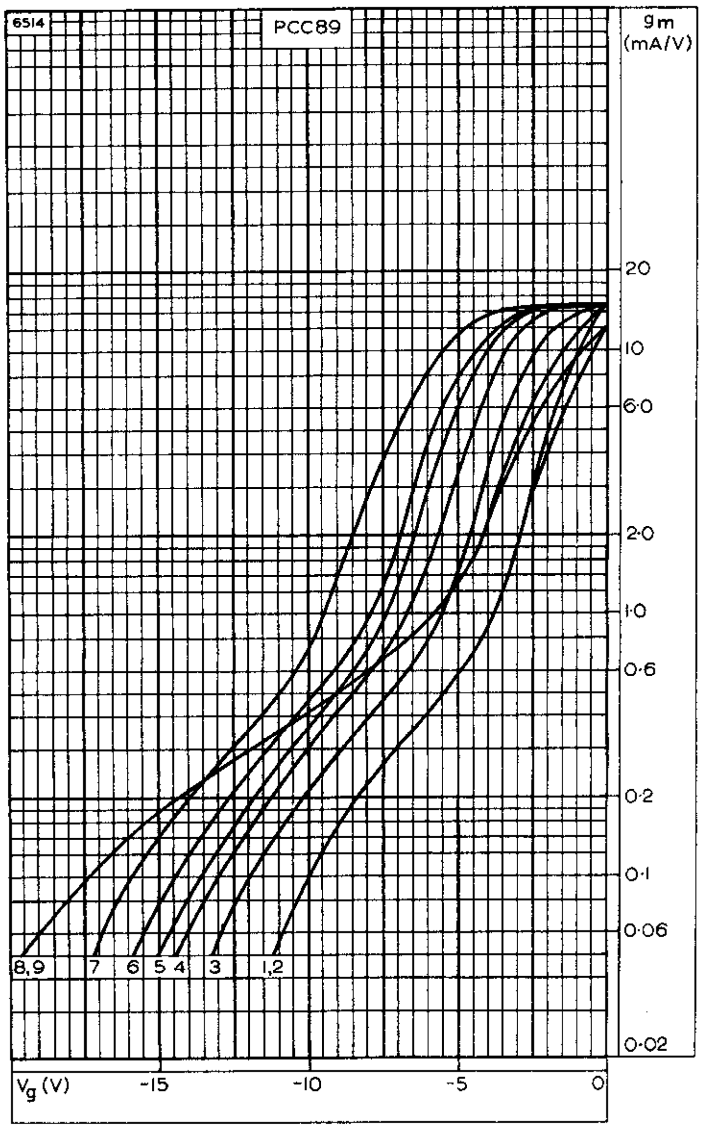
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE UNDER CONDITIONS 1 to 9 (See page D3)

PCC89

R.F. DOUBLE TRIODE



MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE UNDER CONDITIONS 1 to 9 (See page D3)

V.H.F. DOUBLE TRIODE

PCC189

Variable-mu, low noise v.h.f. frame grid double triode with high mutual conductance for use as a cascode amplifier.

HEATER

I_h	300	mA
V_h	7.6	V

CAPACITANCES

	Shielded	Unshielded	
$c_{a'-a''}$	< 15	< 45	mpF
$c_{g'-a''}$	< 4.0	< 4.0	mpF
Grounded cathode section			
$c_{a'-g'}$	1.9	1.9	pF
$c_{g'-k'+h+s}$	3.5	3.5	pF
$c_{a'-k'+h+s}$	2.3	1.7	pF
$c_{g'-h}$	< 280	< 280	mpF
Grounded grid section			
$c_{a''-g''}$	1.9	1.9	pF
$c_{k''-g''+h+s}$	6.0	6.0	pF
$c_{a''-g''+h+s}$	4.0	3.4	pF
$c_{k''-h}$	3.0	3.0	pF
$c_{a''-k''}$	170	180	mpF

CHARACTERISTICS (each section)

V_a	90	V
V_g	−1.4	V
I_a	15	mA
g_m	12.5	mA/V
r_a	2.5	kΩ
μ	34	
V_g (for 20 : 1 reduction in g_m)	−5.0	V
V_g (for 100 : 1 reduction in g_m)	−9.0	V

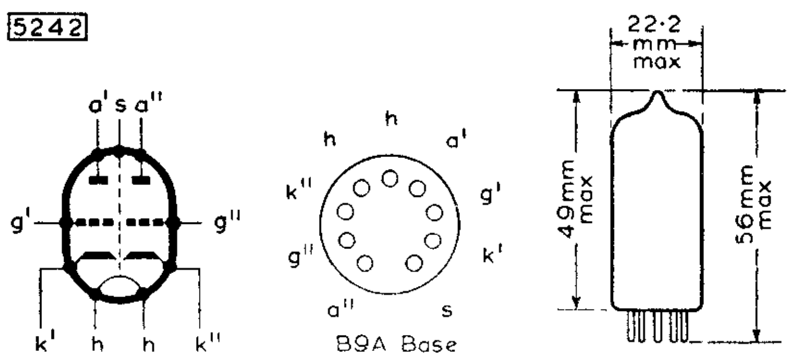
DESIGN CENTRE RATINGS (each section)

$V_{a(b)}$ max.	550	V
V_a max.	130	V
p_a max.	1.8	W
I_k max.	22	mA
$-V_g$ max.	50	V
$R_{g'-k}$ max.	1.0	MΩ
$R_{g''-k}$ max.	500	kΩ
$V_{h-k'}$ max.	80	V
$V_{h-k''}$ max. (cathode positive)	180	V
R_{h-k} max.	20	kΩ

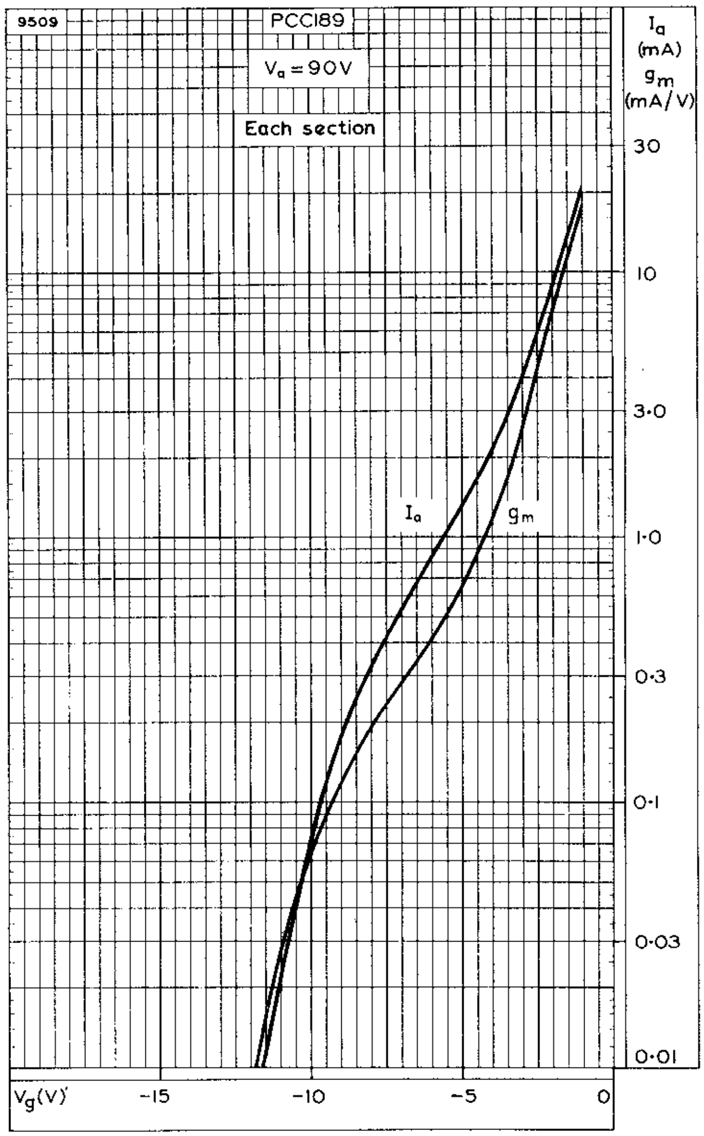
NOTE

In order not to exceed the maximum permissible anode voltage when the cascode amplifier is controlled, it is necessary to use a voltage divider for the grid of the grounded grid section.

5242



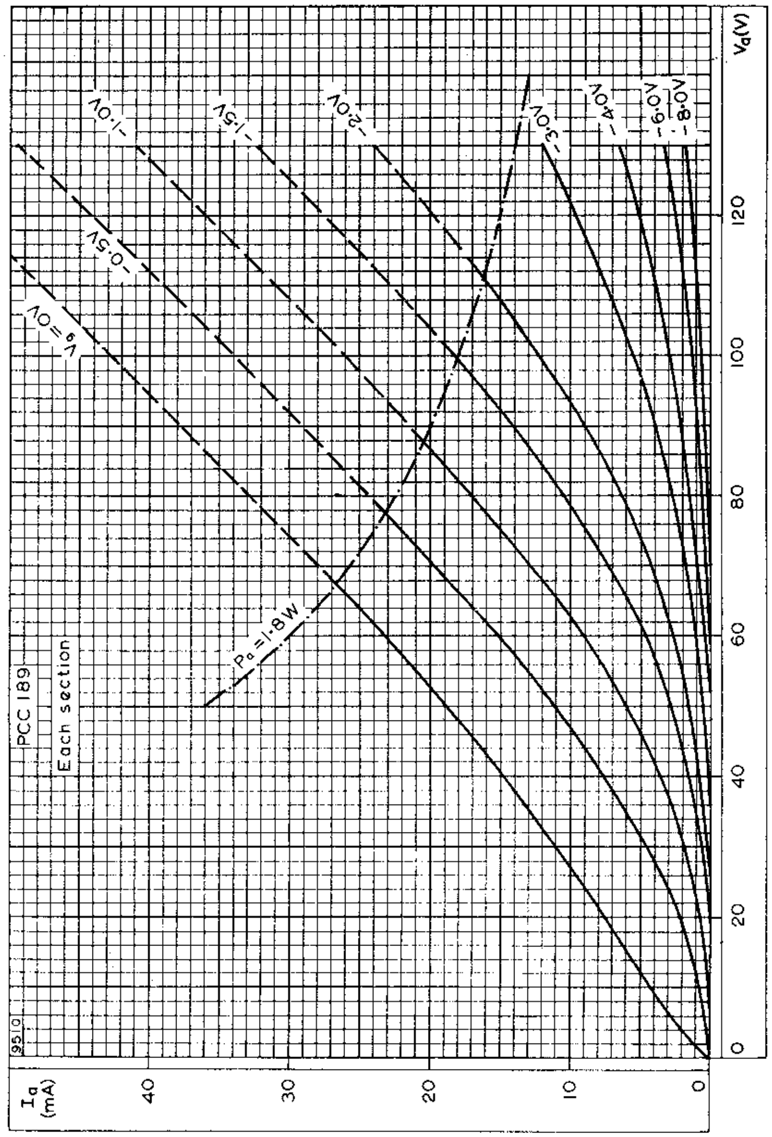
The triode on pins 6, 7, 8, should have the grounded cathode connection and that on pins 1, 2, 3, should have the grounded grid connection.



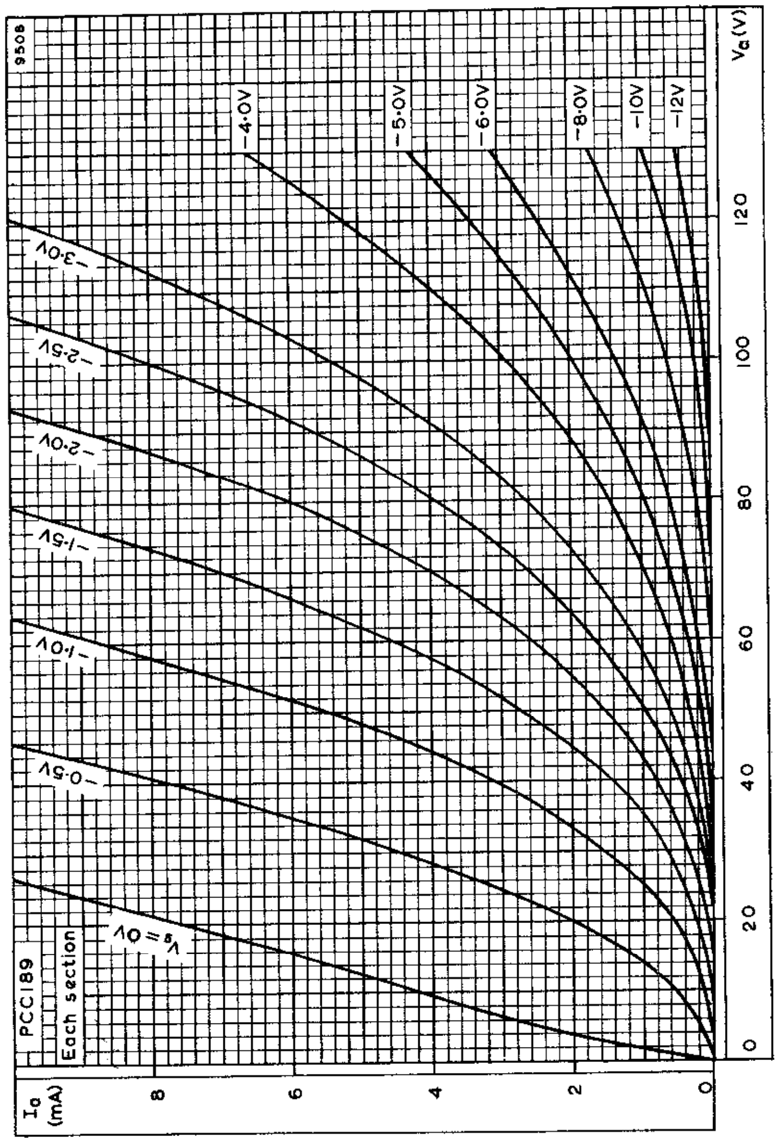
ANODE CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST GRID VOLTAGE

PCC189

V.H.F. DOUBLE TRIODE



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER IN THE REGION OF THE ORIGIN

TRIODE PENTODE

PCF80

Combined triode and high slope r.f. pentode with separate cathodes. Primarily designed for use as a frequency changer at frequencies up to 220Mc/s in television equipment with series connected heaters.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	9.0	V

MOUNTING POSITION

Any

CAPACITANCES (measured without external shield)

c_{ap-at}	<0.06	pF
c_{ap-gt}	<0.02	pF
c_{gp-at}	<0.16	pF
c_{gp-gt}	<0.02	pF

Pentode section

$^*c_{a-g1}$	<0.025	pF
c_{in}	5.5	pF
c_{out}	3.8	pF

*May be reduced to <0.01pF by the use of a skirted base.

Triode section

c_{g-k+h}	2.5	pF
c_{a-k+h}	1.8	pF
c_{a-g}	1.5	pF

CHARACTERISTICS

Pentode section

V_a	170	V
V_{g2}	170	V
I_a	10	mA
V_{g1}	−2.0	V
I_{g2}	2.8	mA
g_m	6.2	mA/V
μ_{g1-g2}	47	
r_a	400	kΩ
R_{in} (f = 50Mc/s)	10	kΩ
R_{eq}	1.5	kΩ

Triode section

V_a	100	V
I_a	14	mA
V_g	−2.0	V
g_m	5.0	mA/V
μ	20	
r_a	4.0	kΩ

PCF80

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily designed for use as a frequency changer at frequencies up to 220Mc/s in television equipment with series connected heaters.

TYPICAL OPERATING CONDITIONS

As a frequency changer

V_a	170	170	V
V_{g2}	170	170	V
R_{g1}	100	100	kΩ
R_k	820	0	Ω
I_a	5.2	6.3	mA
I_{g2}	1.5	2.5	mA
$V_{osc(r.m.s.)}$	3.5	4.0	V
I_{g1}	0	53	μA
g_c	2.1	2.05	mA/V
r_a	870	720	kΩ

LIMITING VALUES

Pentode section

$V_{a(b)}$ max.	550	V	
V_a max.	250	V	
p_a max.	1.7	W	
$V_{g2(b)}$ max.	550	V	
V_{g2} max. ($I_k \leq 10$mA)	200	V	
V_{g2} max. ($I_k > 10$mA)	175	V	
p_{g2} max. ($p_a \leq 1.2$W)	750	mW	←
p_{g2} max. ($p_a > 1.2$W)	500	mW	←
I_k max.	17	mA	←
V_{g1} max. ($I_{g1} = +0.3\mu$A)	−1.3	V	
R_{g1-k} max. (cathode bias)	1.0	MΩ	
R_{g1-k} max. (fixed bias)	500	kΩ	
*V_{h-k} max. (cathode positive)	225	V	←
V_{h-k} max. (cathode negative)	100	V	←

*Max. d.c. component 150V

Triode section

$V_{a(b)}$ max.	550	V	
V_a max.	250	V	
p_a max.	1.5	W	
I_k max.	17	mA	←
†$i_{k(pk)}$ max.	200	mA	
R_{g-k} max.	500	kΩ	
V_g max. ($I_{g1} = +0.3\mu$A)	−1.3	V	
$-v_{g(pk)}$ max.	350	V	←
*V_{h-k} max. (cathode positive)	225	V	←
V_{h-k} max. (cathode negative)	100	V	←

*Max. d.c. component 150V
†Max. pulse duration 200μs ←

OPERATING NOTE

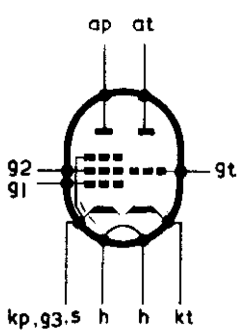
It is anticipated that variations in heater-to-cathode capacitance may render this valve unsuitable for use in Hartley oscillator circuits, particularly in f.m. receivers. For this reason it is recommended that a Colpitts type of circuit be employed.

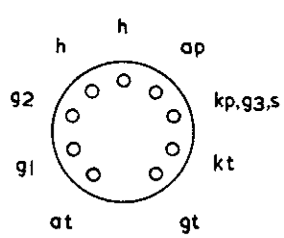
TRIODE PENTODE

PCF80

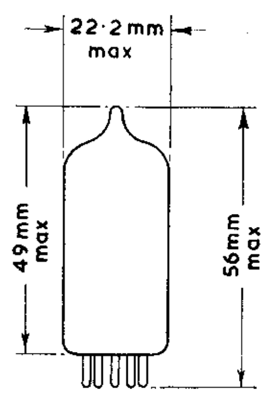
Combined triode and high slope r.f. pentode with separate cathodes. Primarily designed for use as a frequency changer at frequencies up to 220Mc/s in television equipment with series connected heaters.

3222





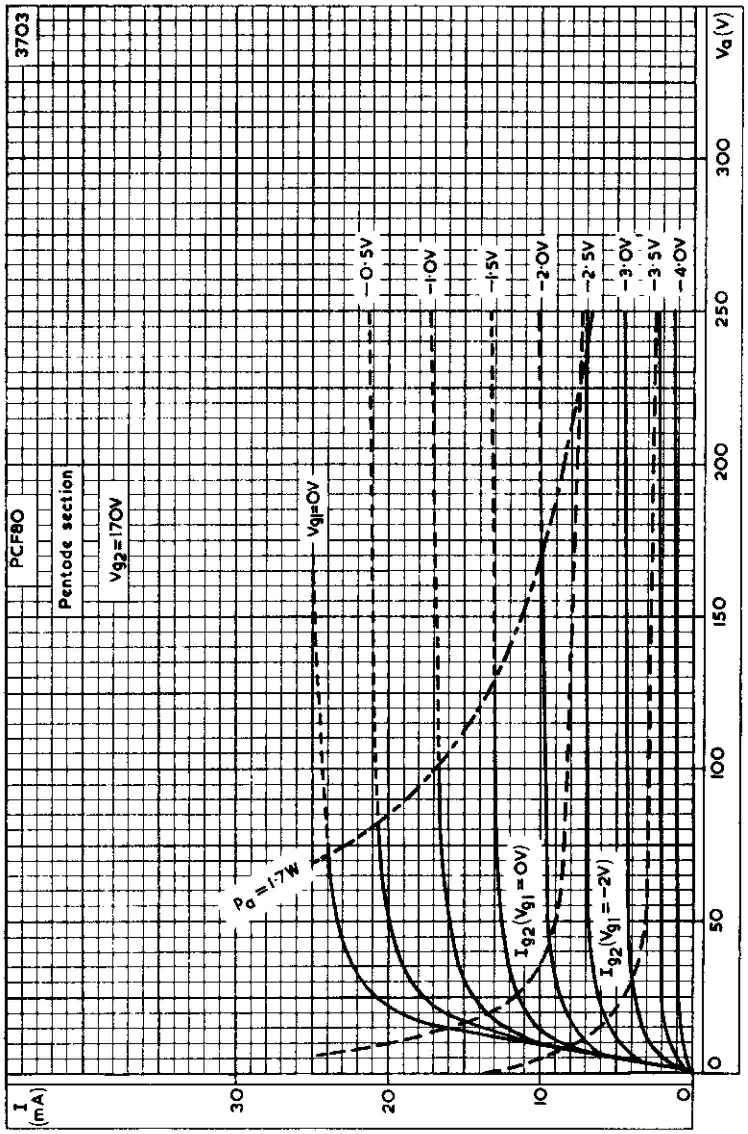
B9A Base



PCF80

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily designed for use as a frequency changer at frequencies up to 220Mc/s in television equipment with series connected heaters.

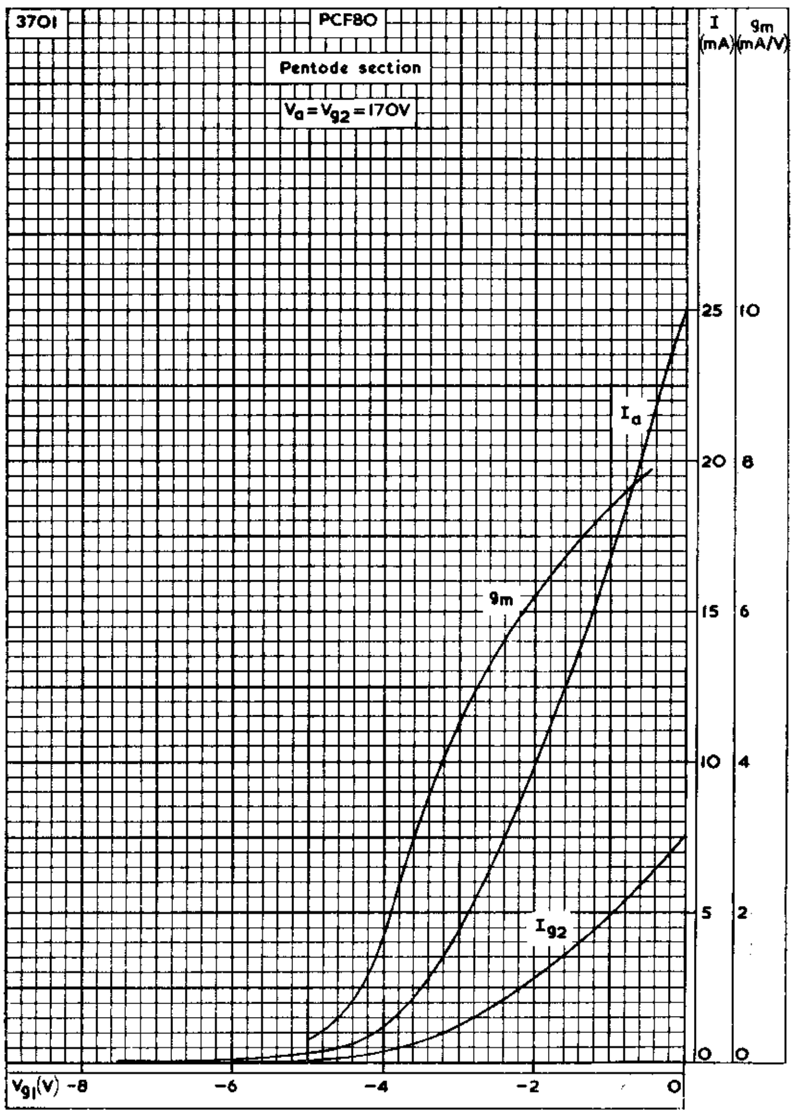


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE FOR PENTODE SECTION WITH CONTROL-GRID VOLTAGE AS PARAMETER

TRIODE PENTODE

PCF80

Combined triode and high slope r.f. pentode with separate cathodes. Primarily designed for use as a frequency changer at frequencies up to 220Mc/s in television equipment with series connected heaters.

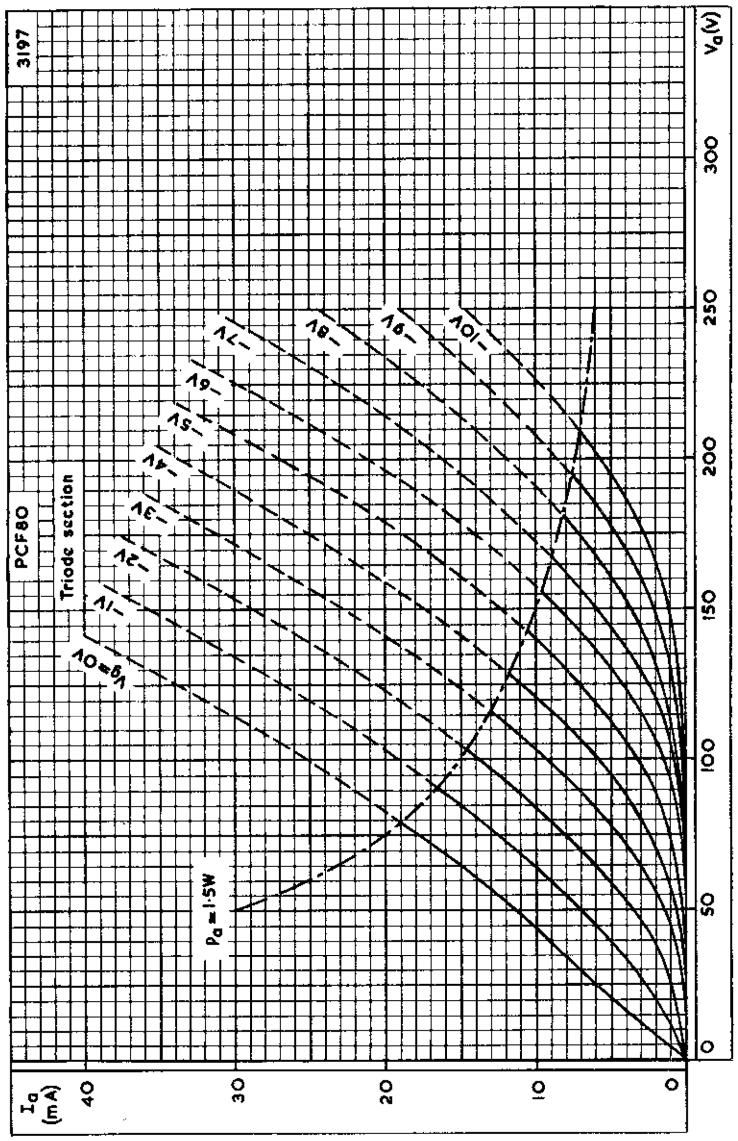


ANODE AND SCREEN-GRID CURRENTS AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE OF PENTODE SECTION. $V_a = V_{g2} = 170V$

PCF80

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily designed for use as a frequency changer at frequencies up to 220Mc/s in television equipment with series connected heaters.

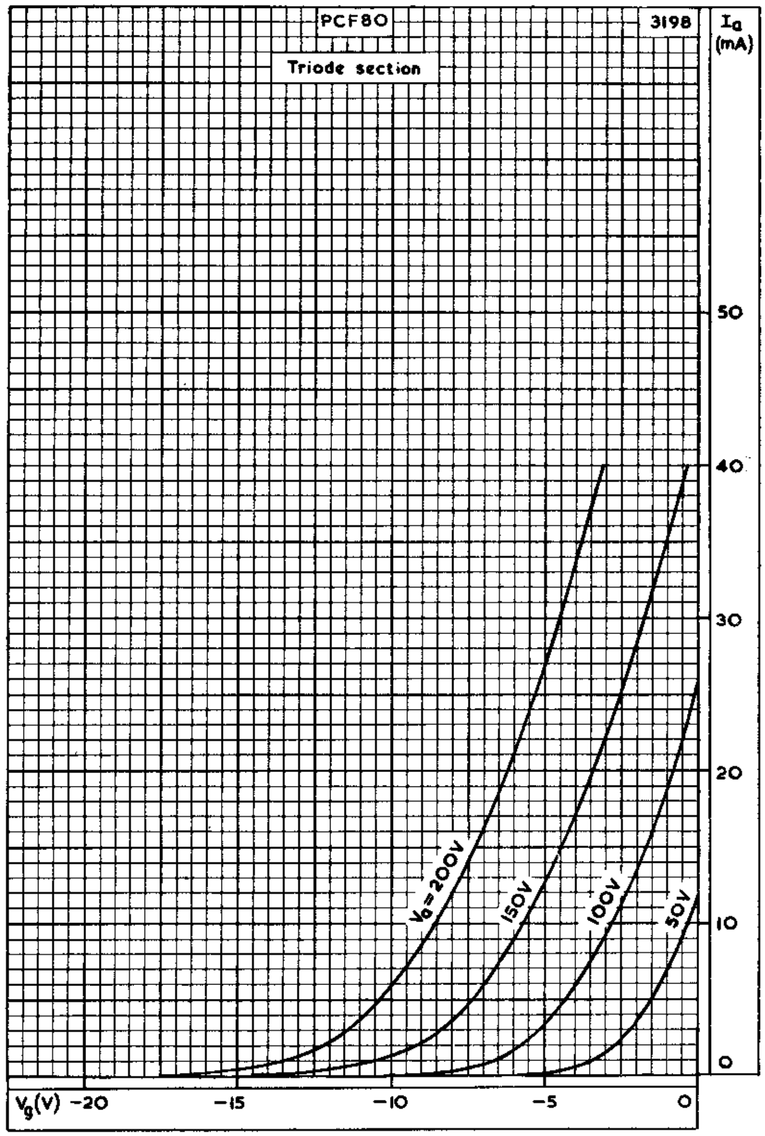


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR TRIODE SECTION WITH GRID VOLTAGE AS PARAMETER

TRIODE PENTODE

PCF80

Combined triode and high slope r.f. pentode with separate cathodes. Primarily designed for use as a frequency changer at frequencies up to 220Mc/s in television equipment with series connected heaters.

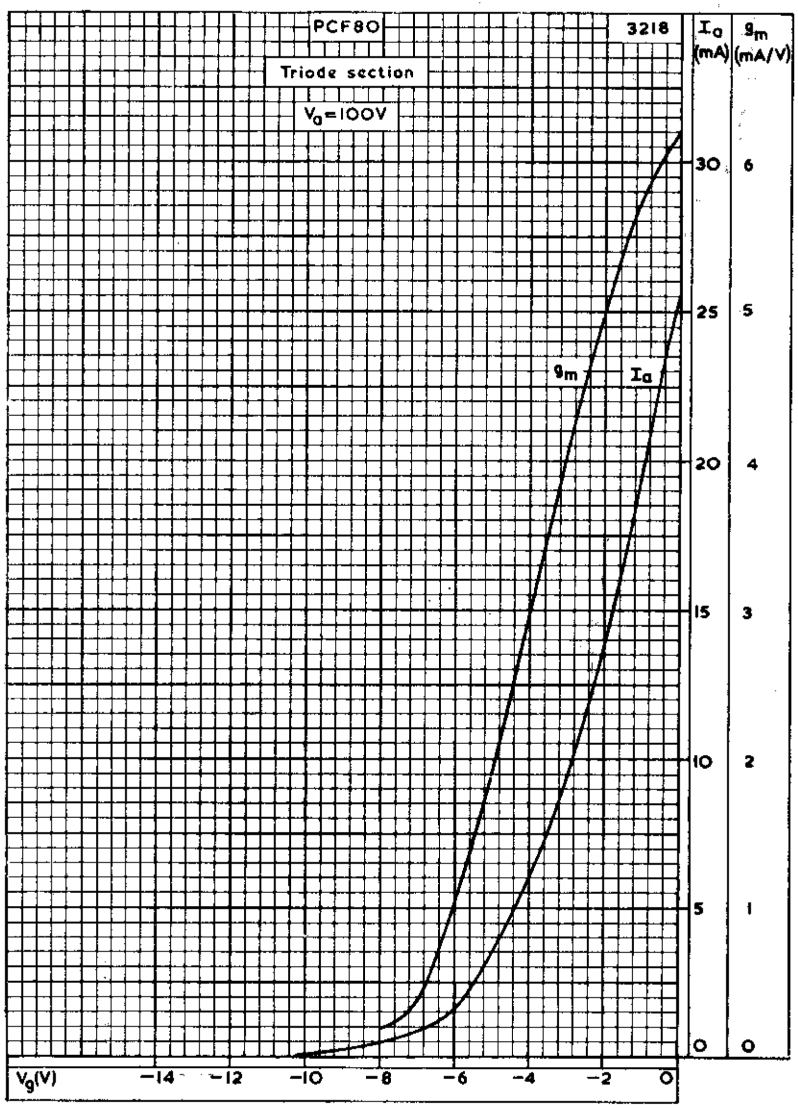


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR TRIODE SECTION FOR VARIOUS VALUES OF ANODE VOLTAGE

PCF80

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily designed for use as a frequency changer at frequencies up to 220Mc/s in television equipment with series connected heaters.

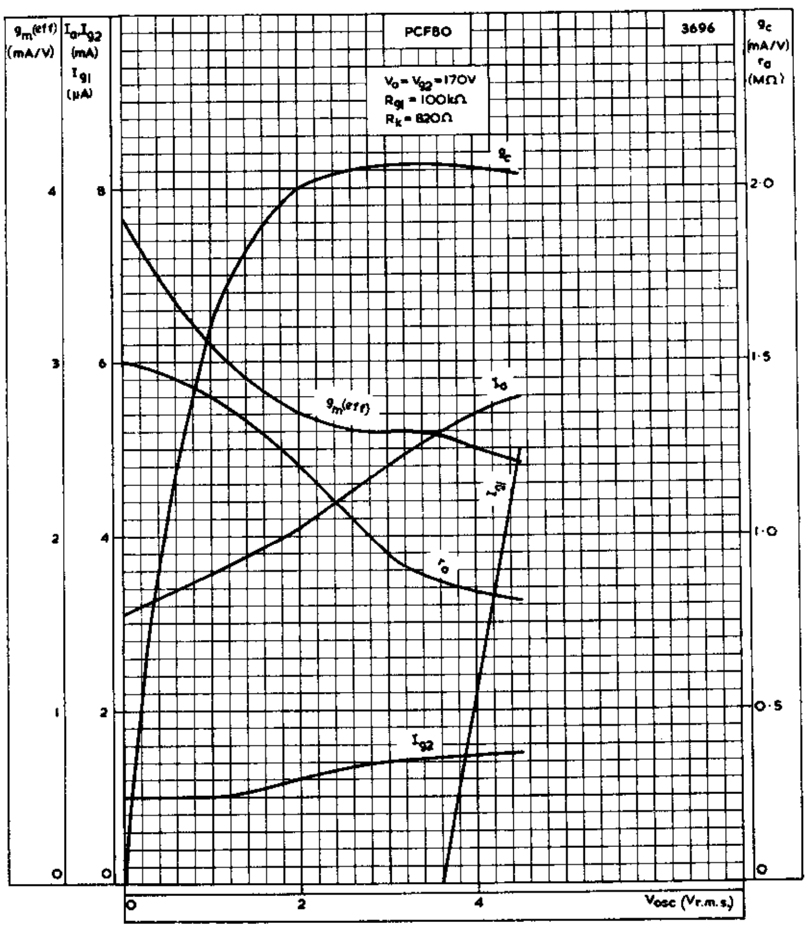


ANODE CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST GRID VOLTAGE FOR TRIODE SECTION. $V_a = 100V$

TRIODE PENTODE

PCF80

Combined triode and high slope r.f. pentode with separate cathodes. Primarily designed for use as a frequency changer at frequencies up to 220Mc/s in television equipment with series connected heaters.

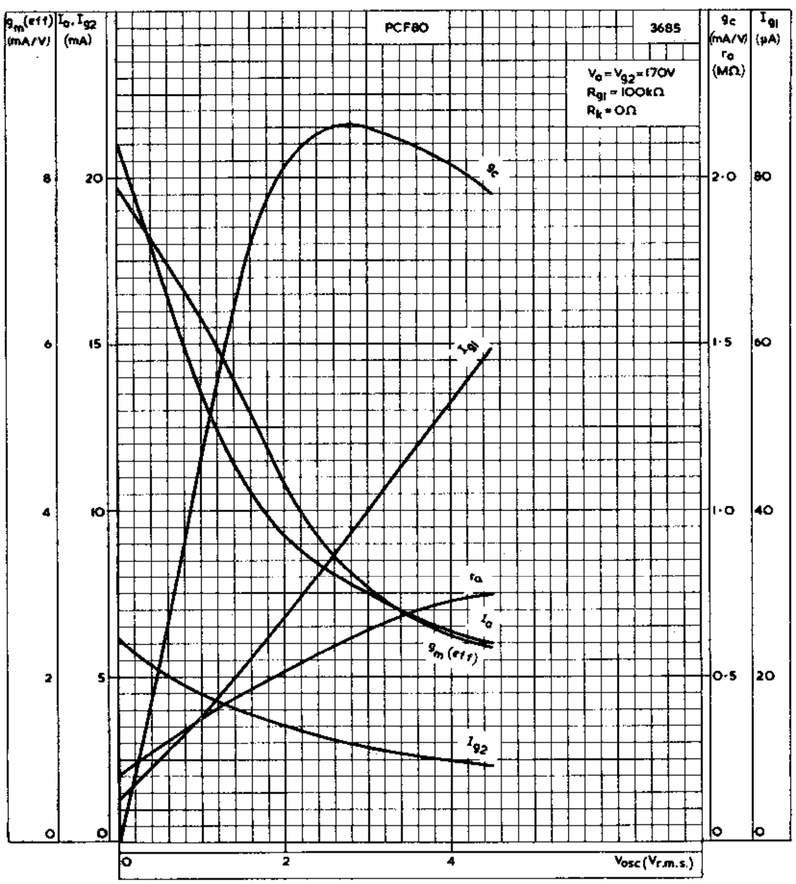


PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER WITH $R_k = 820\Omega$

PCF80

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily designed for use as a frequency changer at frequencies up to 220Mc/s in television equipment with series connected heaters.

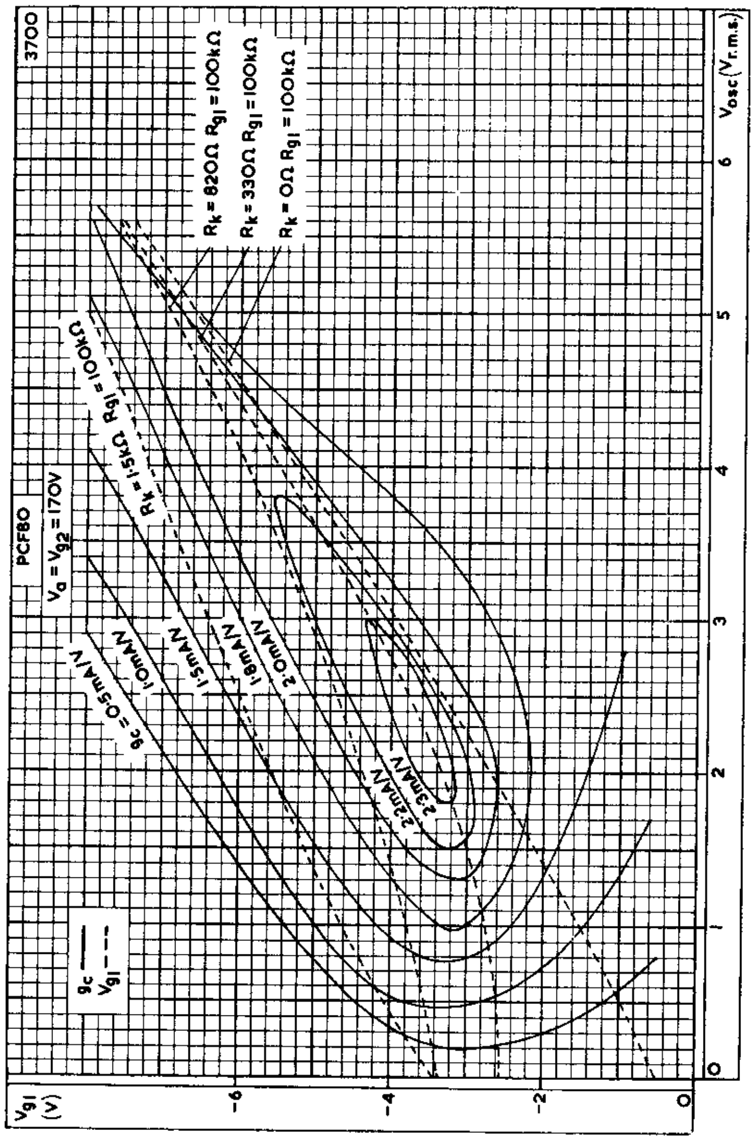


PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER WITH $R_k = 0\Omega$

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily designed for use as a frequency changer at frequencies up to 220Mc/s in television equipment with series connected heaters.

PCF80



CONTROL-GRID BIAS PLOTTED AGAINST OSCILLATOR VOLTAGE FOR VARIOUS VALUES OF CATHODE RESISTOR AND GRID RESISTOR, TOGETHER WITH 'CONTOUR LINES' OF CONSTANT CONVERSION CONDUCTANCE

TRIODE PENTODE

PCF86

Combined triode and high slope frame grid r.f. pentode for use as a frequency changer at frequencies up to 220Mc/s in television tuners.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	8.0	V

CAPACITANCES (measured without an external shield)

c_{ap-at}	125	mpF←
c_{ap-gt}	14	mpF
c_{g1-at}	<10	mpF
c_{g1-gt}	<10	mpF

Pentode section

c_{a-g1}	12	mpF
c_{g1-g2}	1.7	pF
c_{in}	5.8	pF←
c_{out}	3.5	pF

Triode section

c_{g-k+h}	2.4	pF
c_{a-k+h}	1.1	pF
c_{a-g}	2.0	pF

CHARACTERISTICS

Pentode section

V_a	170	V
V_{g2}	150	V
I_a	10	mA
I_{g2}	3.3	mA
g_m	12	mA/V
r_a	>350	kΩ
μ_{g1-g2}	70	
V_{g1}	−1.2	V
R_{eq}	1.0	kΩ

Triode section

V_a	100	V
I_a	14	mA
g_m	5.7	mA/V←
μ	17	
V_g	−3.0	V

PCF86

TRIODE PENTODE

OPERATING CONDITIONS AS A FREQUENCY CHANGER

Pentode section

V_a	190	V
$V_{g2(b)}$	190	V
R_{g2}	18	kΩ
R_{g1}	100	kΩ
I_a	8.5	mA
I_{g2}	2.7	mA
$V_{osc(r.m.s.)}$	2.3	V
g_c	4.5	mA/V

LIMITING VALUES

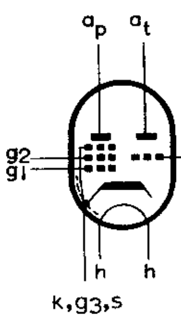
Pentode section

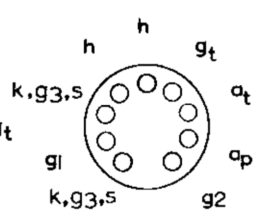
V_a max.	250	V
p_a max.	2.0	W
V_{g2} max.	150	V
p_{g2} max.	500	mW
I_k max.	18	mA
R_{g1-k} max.	250	kΩ

Triode section

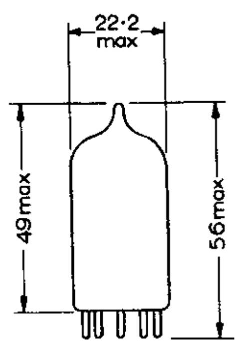
V_a max.	125	V
p_a max.	1.5	W
I_k max.	15	mA
R_{g-k} max.	500	kΩ
*V_{h-k} max.	100	V

*To fulfil hum requirements on a.m. sound, it will be necessary for V_{h-k} to be less than $50V_{r.m.s.}$ For intercarrier receivers V_{h-k} should not exceed $75V_{r.m.s.}$

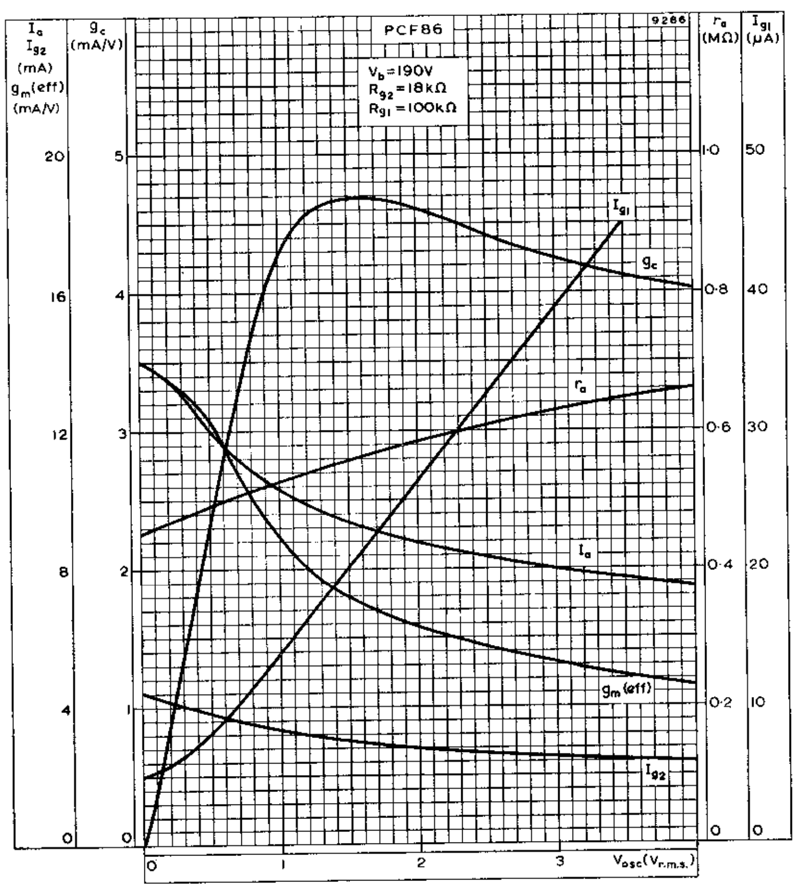




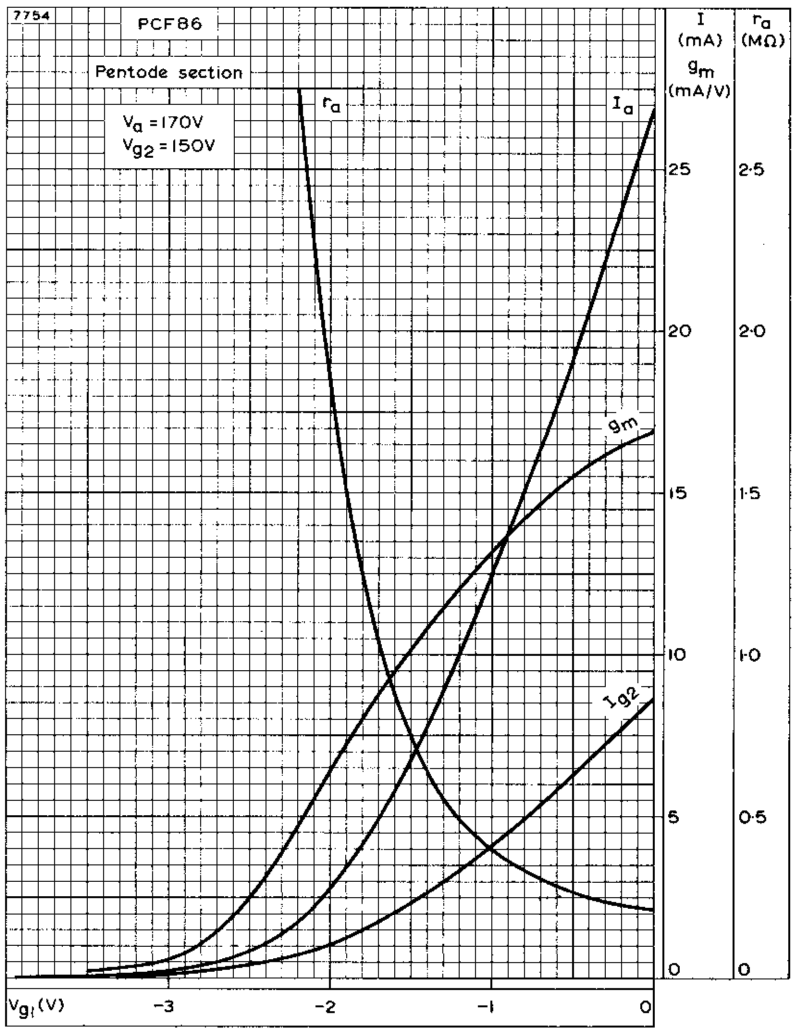
B9A Base
All dimensions in mm



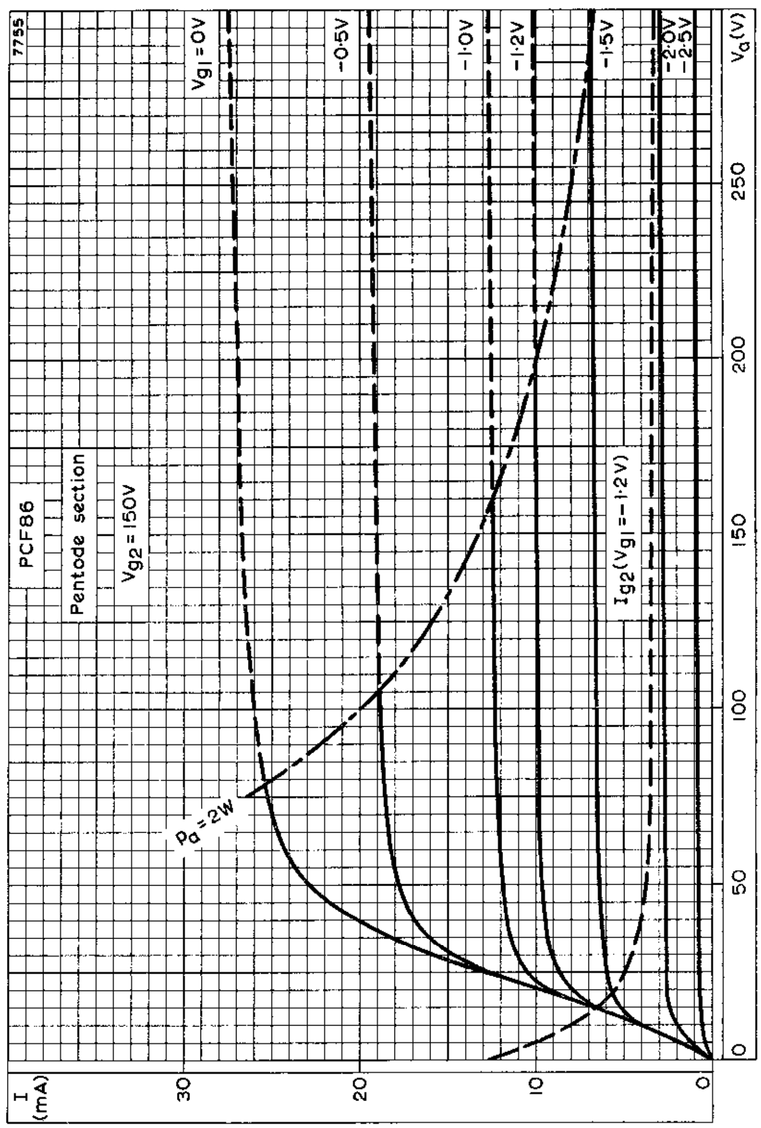
7408



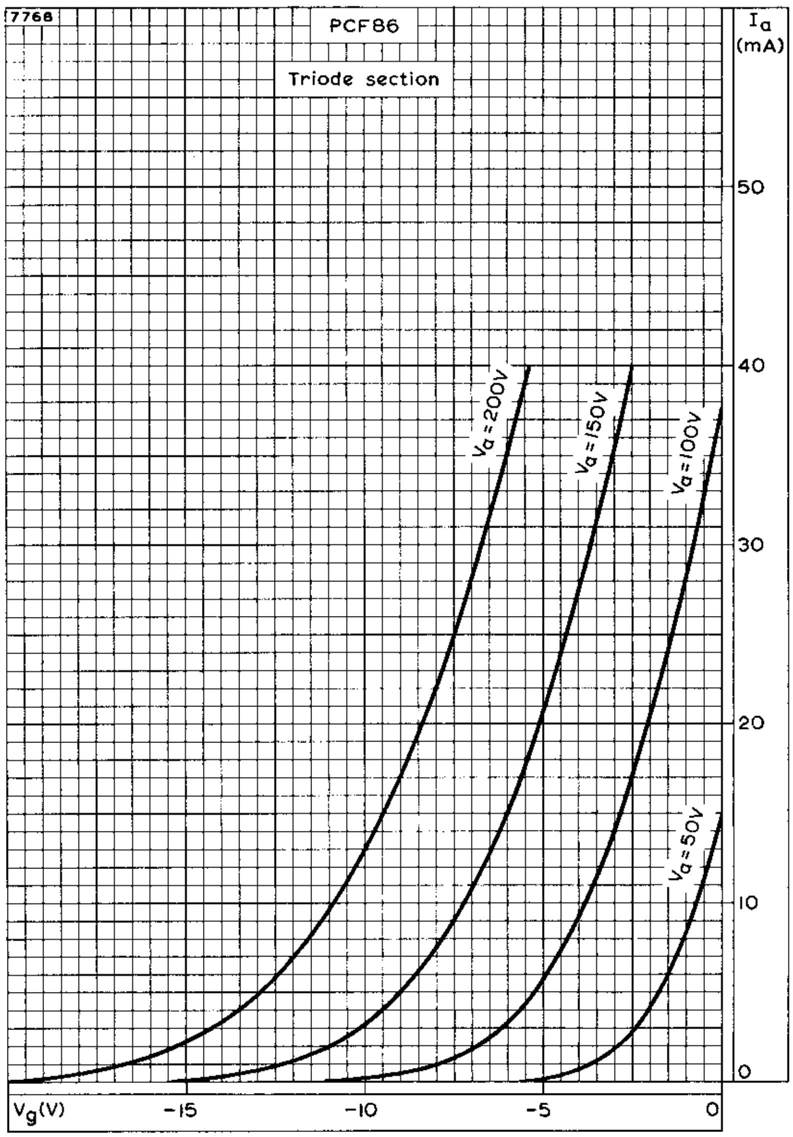
PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER



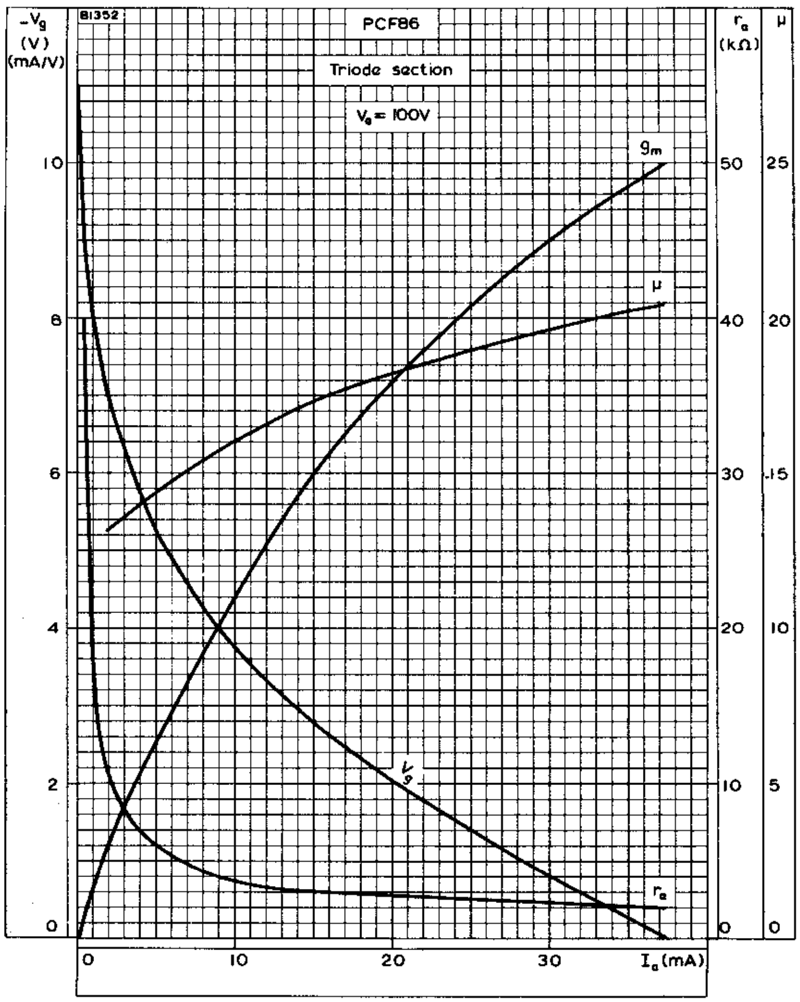
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE. PENTODE SECTION



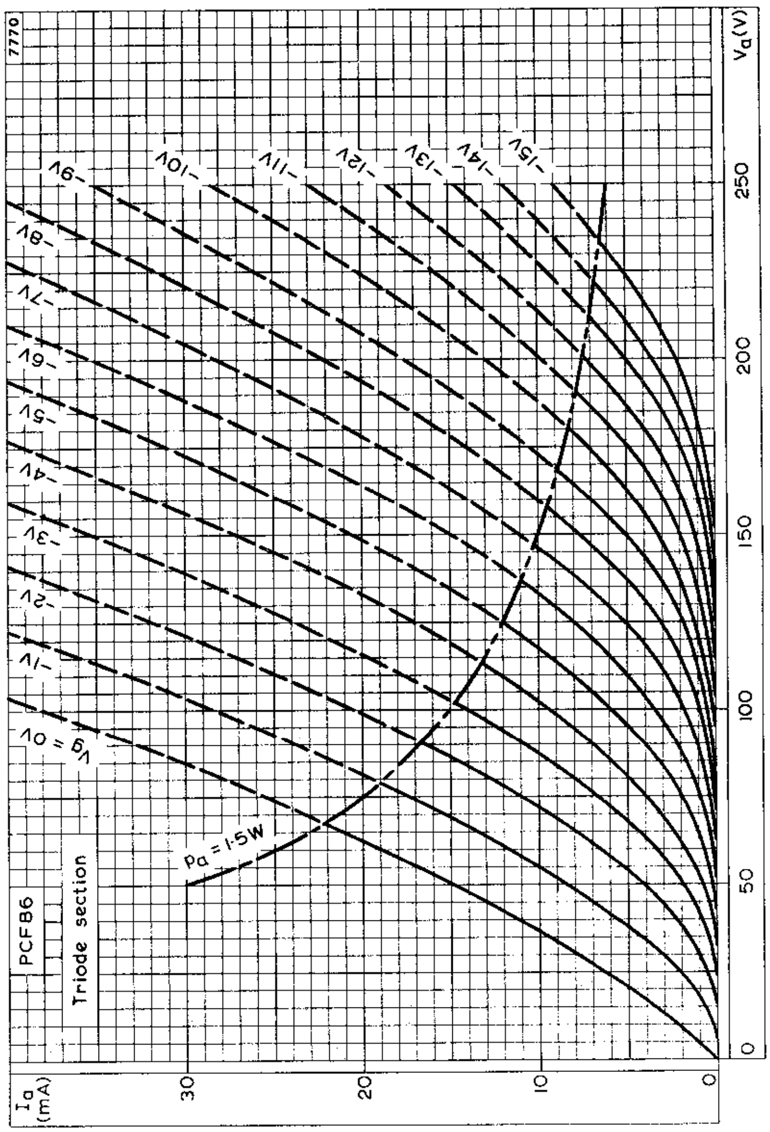
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. PENTODE SECTION



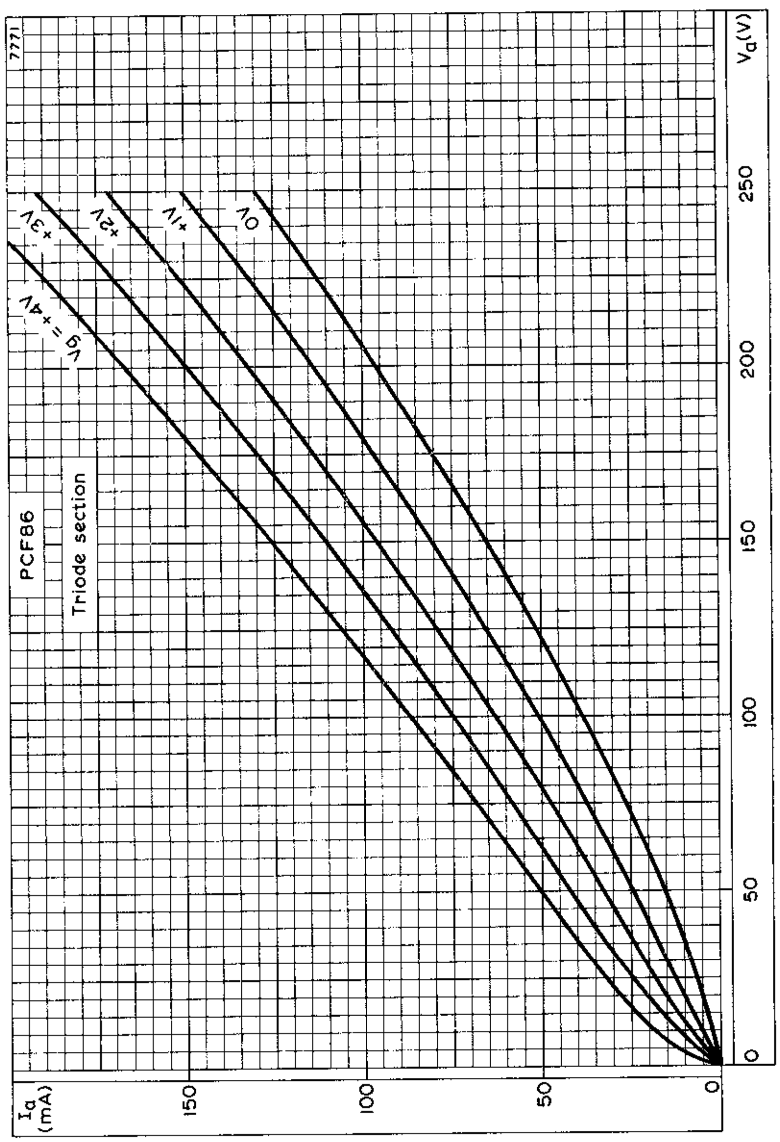
ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE FOR VARIOUS VALUES OF ANODE VOLTAGE. TRIODE SECTION



GRID VOLTAGE, MUTUAL CONDUCTANCE, ANODE IMPEDANCE AND AMPLIFICATION FACTOR PLOTTED AGAINST ANODE CURRENT. TRIODE SECTION



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER. TRIODE SECTION



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH POSITIVE GRID VOLTAGE AS PARAMETER. TRIODE SECTION

TRIODE PENTODE PCF801

Combined triode and frame-grid, variable-mu pentode for use as a frequency changer and i.f. amplifier at frequencies up to 200Mc/s in television receivers.

HEATER

Suitable for series operation a.c. or d.c.

Ih	300	mA
Vh	8.5	V

CAPACITANCES (shielded)

cap-at	< 25	mpF
cap-gt	< 10	mpF
cg1-at	< 10	mpF
cg1-gt	< 10	mpF
Pentode section		
ca-g1	9.0	mpF
ca-g1 max.	12	mpF
cg1-g2	1.6	pF
cin	6.2	pF
cout	3.7	pF
Triode section		
ca-g	1.8	pF
cin	3.3	pF
cout	1.7	pF

CHARACTERISTICS

Pentode section

Va	170	V
Vg2	120	V
Ia	10	mA
Ig2	3.0	mA
Vg1	- 1.4	V
gm	11	mA/V
ra	> 350	kΩ
μg1-g2	55	
Req	1.5	kΩ

Triode section

Va	100	V
Ia	15	mA
Vg	- 3.0	V
gm	9.0	mA/V
μ	20	

OPERATING CONDITIONS AS FREQUENCY CHANGER

Pentode section

Vb	200	200	V
Ra	2.7	4.7	kΩ
Rg2	27	27	kΩ
Rg1	0.1	1.0	MΩ
Ia	10	9.3	mA
Ig2	3.0	2.9	mA
Ig1	8.0	2.3	μA
Vg1	- 1.4	*	V
Vosc (r.m.s.)	1.6	1.6	V
gc	5.0	4.7	mA/V

* With grid current bias.

OPERATING CONDITIONS AS I.F. AMPLIFIER

Pentode section

Vb	200	200	V
Ra	2.7	4.7	kΩ
Rg2	27	27	kΩ
Rg1	0.1	1.0	MΩ
Ia	10	13	mA
Ig2	3.0	3.9	mA
Vg1	- 1.4	*	V
gm	11	14.5	mA/V
Vg1 for 100 : 1 reduction in gm	- 12		V
Rin (f = 50 Mc/s)	10	10	kΩ

* With grid current bias.

OPERATING CONDITIONS AS OSCILLATOR

Triode section

Va	200	200	V
Ra	8.2	12	kΩ

Rg	10	10	kΩ
Vosc	4.5	3.3	Vr.m.s.
Ia	16	12	mA
gm	3.7	3.7	mA/V

DESIGN CENTRE RATINGS

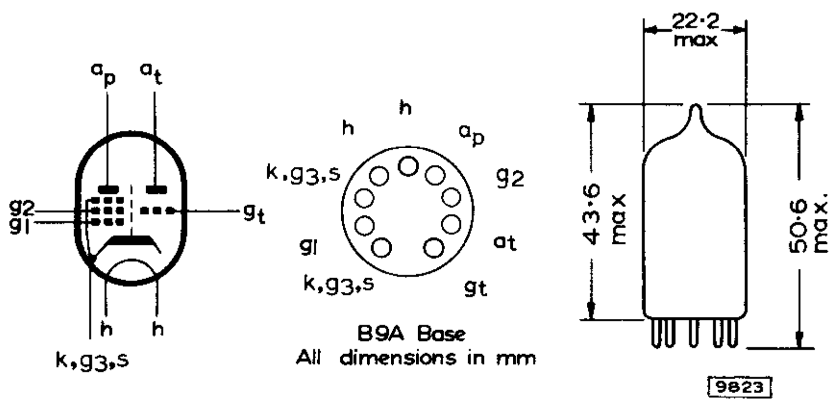
Pentode section

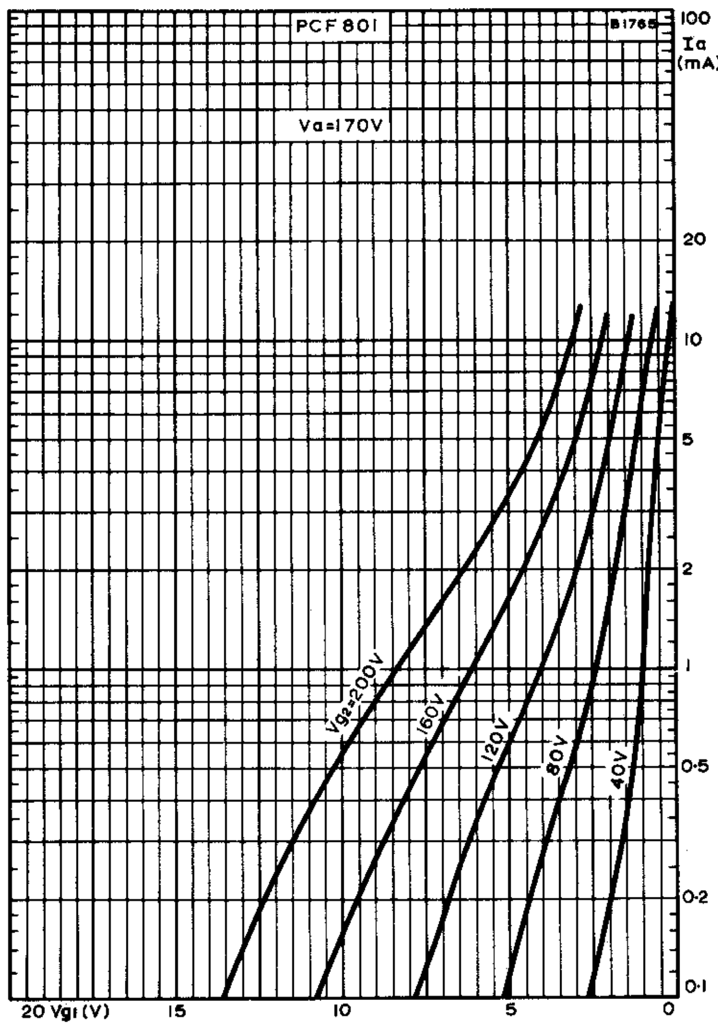
Va(b) max.	550	V
Va max.	250	V
pa max.	2.0	W
Vg2(b) max.	550	V
Vg2 max.	250	V
pg2 max.	see page C4	
Ik max.	18	mA
-Vg1 max.	50	V
Rg1-k max.	1.0	MΩ

Triode section

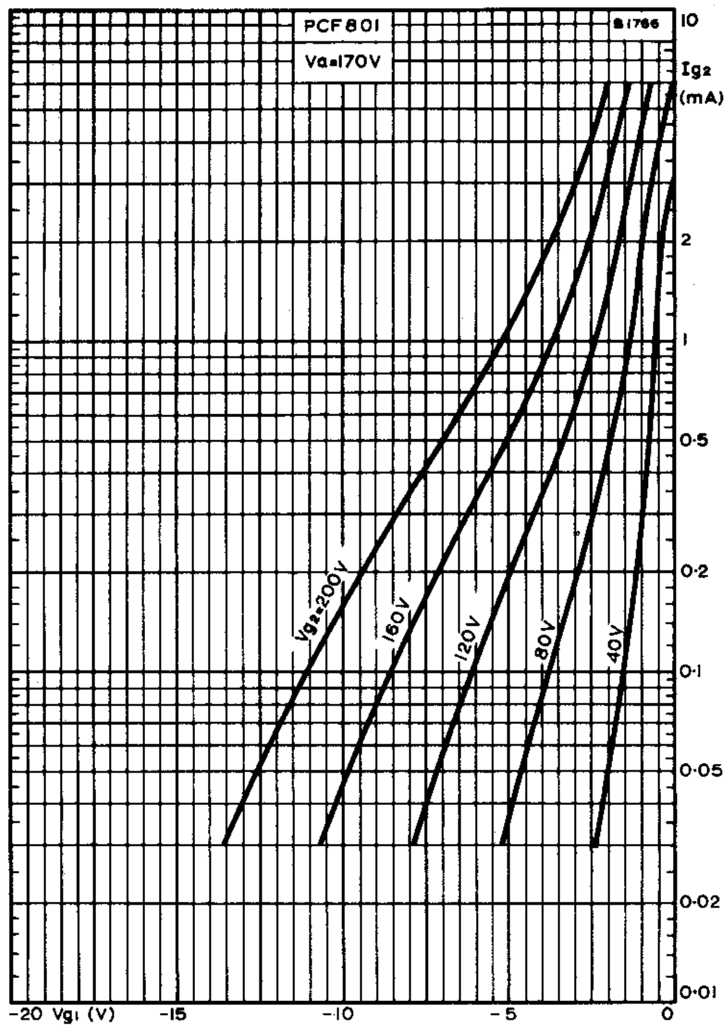
Va(b) max.	550	V
pa max.	1.5	W
Ik max.	20	mA
-Vg max.	50	V
Rg-k max.	500	kΩ
* Vh-k max.	100	V

* To fulfil hum requirements on a.m. sound, it will be necessary for Vh-k to be less than 50 Vr.m.s.

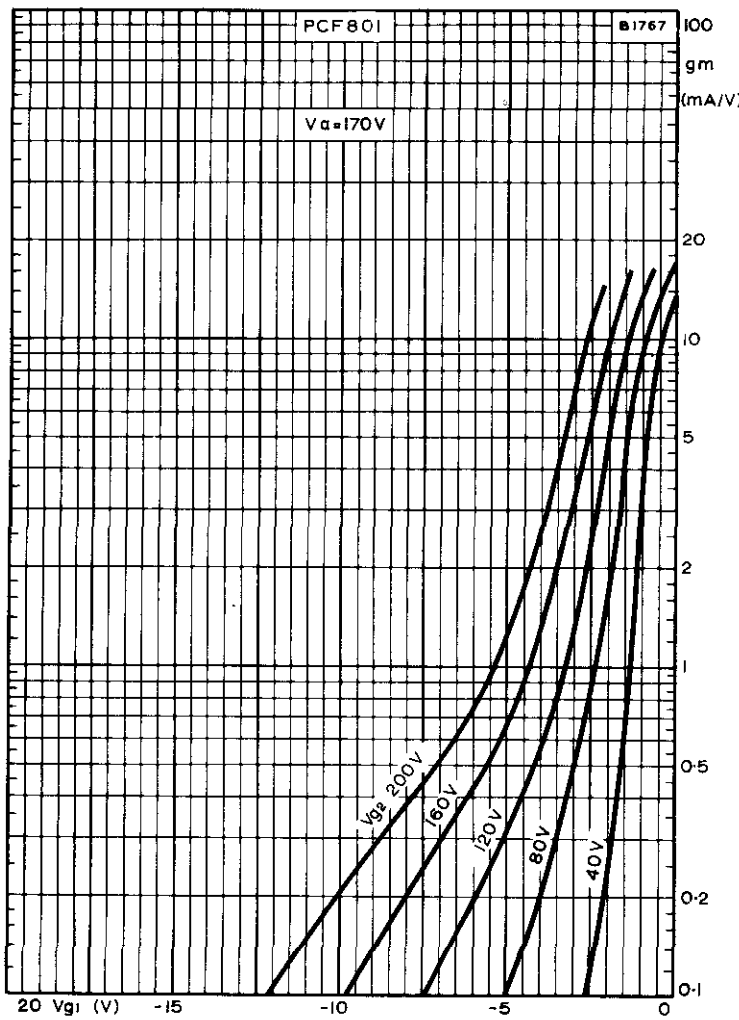




ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER Va = 170V

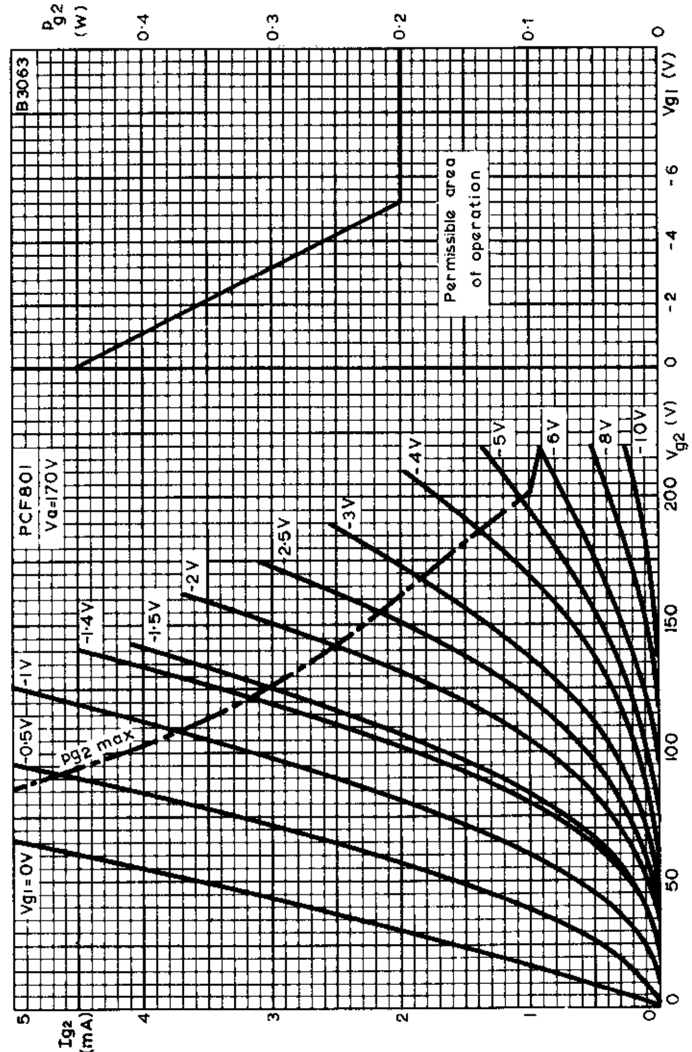


SCREEN-GRID CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER Va = 170V



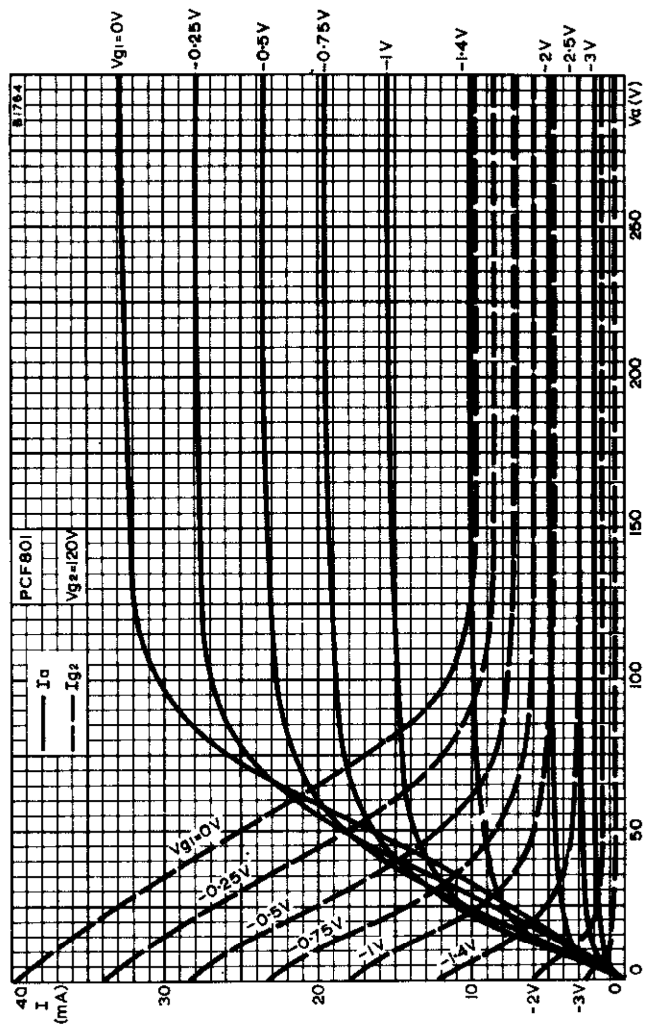
MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID AS PARAMETER, Va = 170V.

→

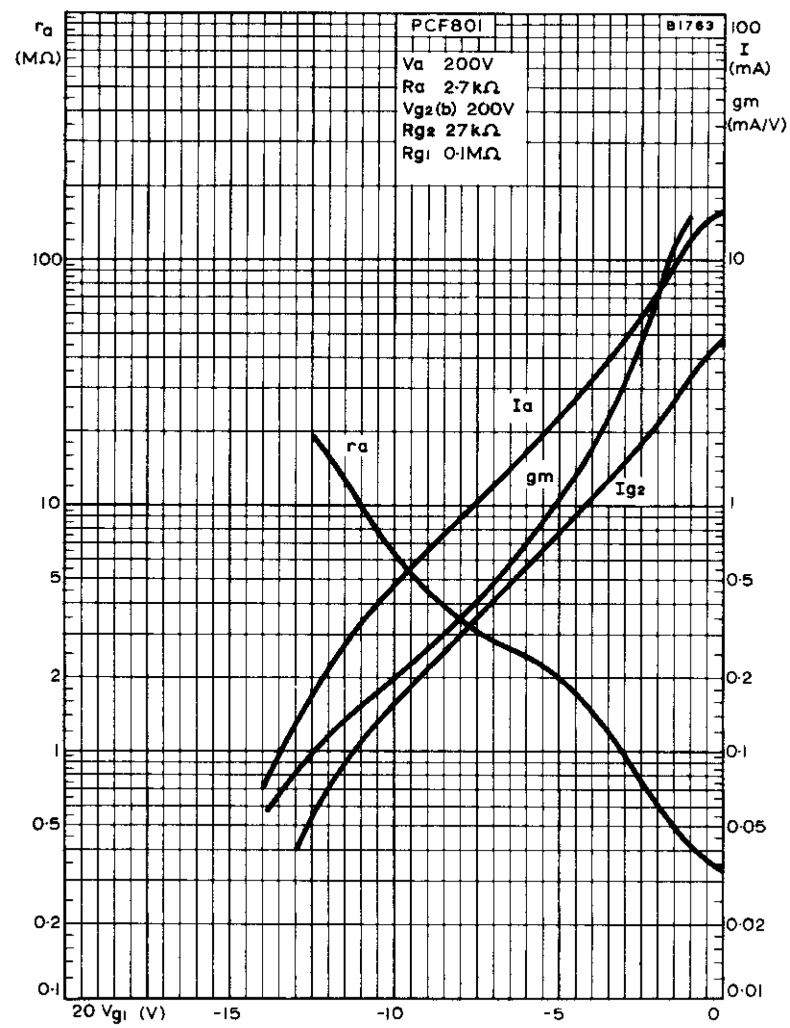


LIMITS OF SCREEN-GRID DISSIPATION

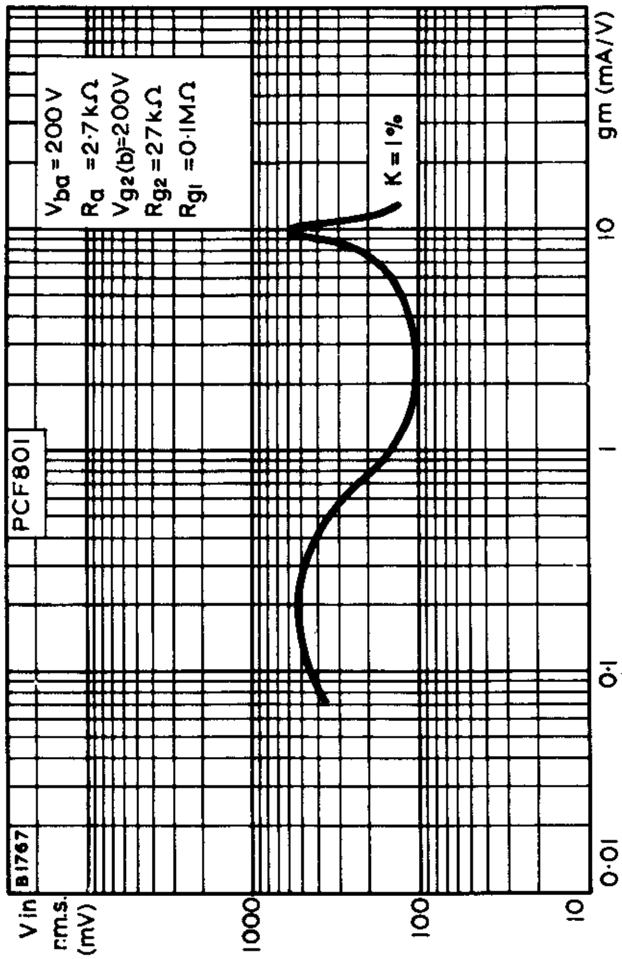
SCREEN-GRID CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER, Va = 170V.



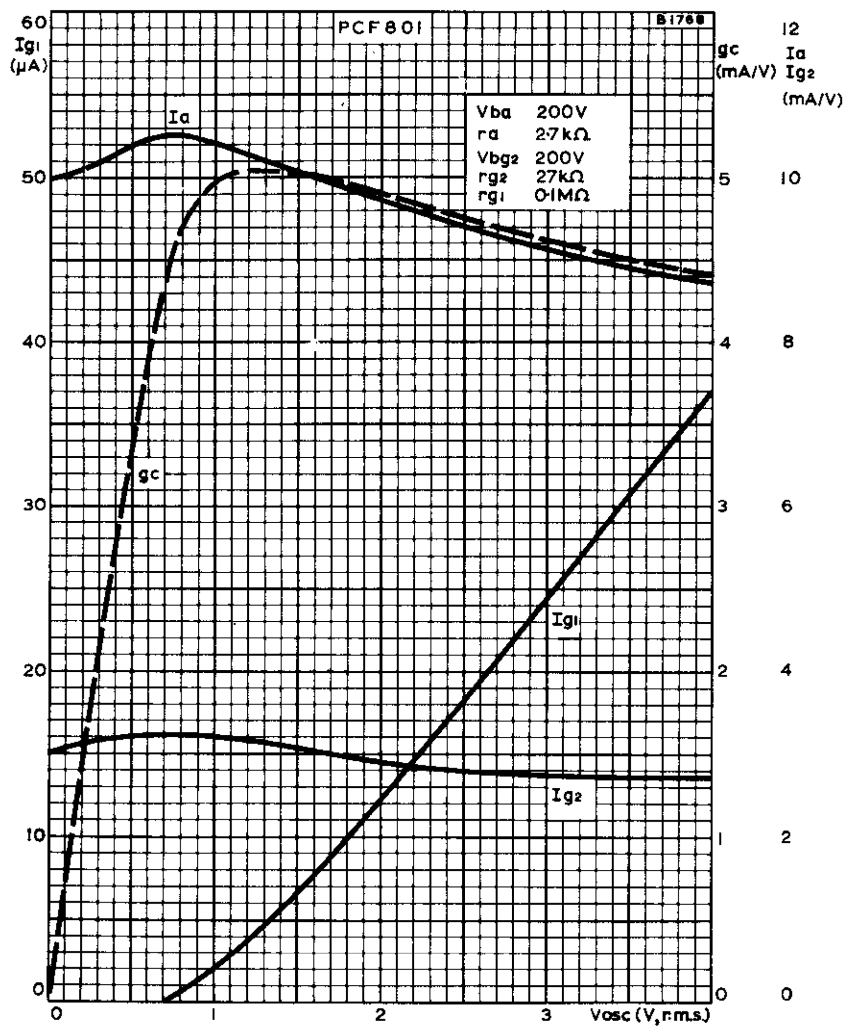
ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER (Vg2 = 120 V)



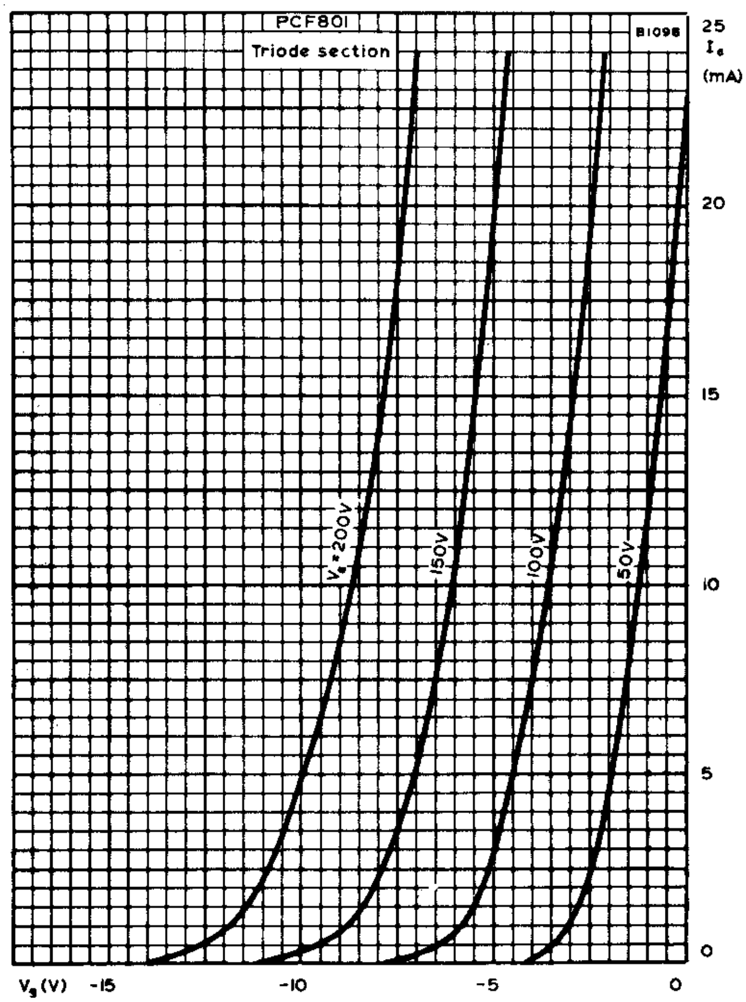
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.



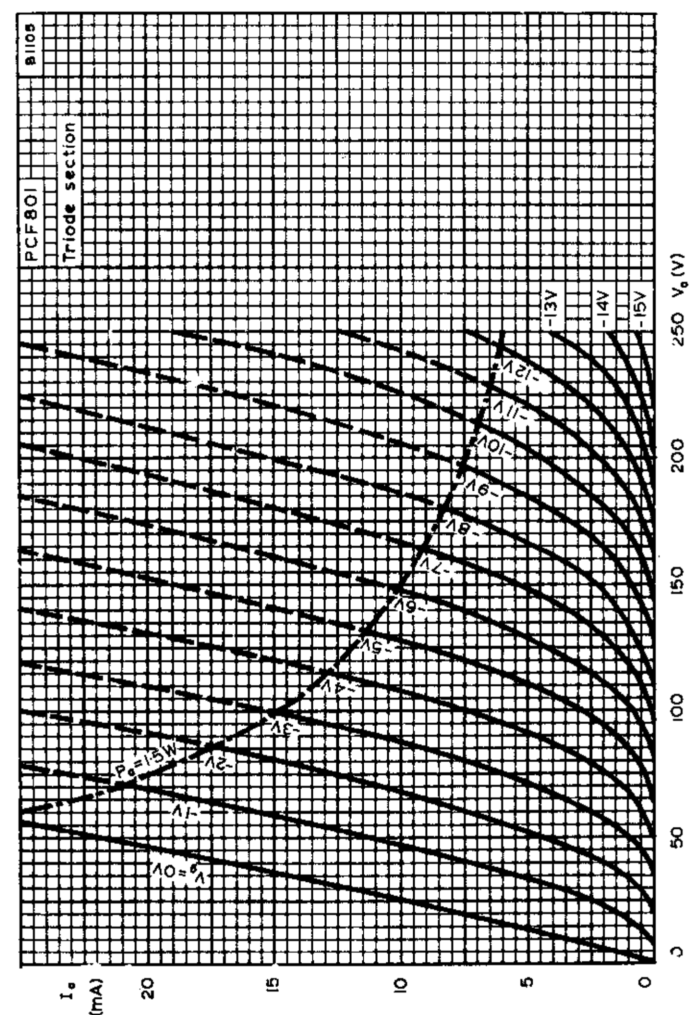
CROSS MODULATION CURVE



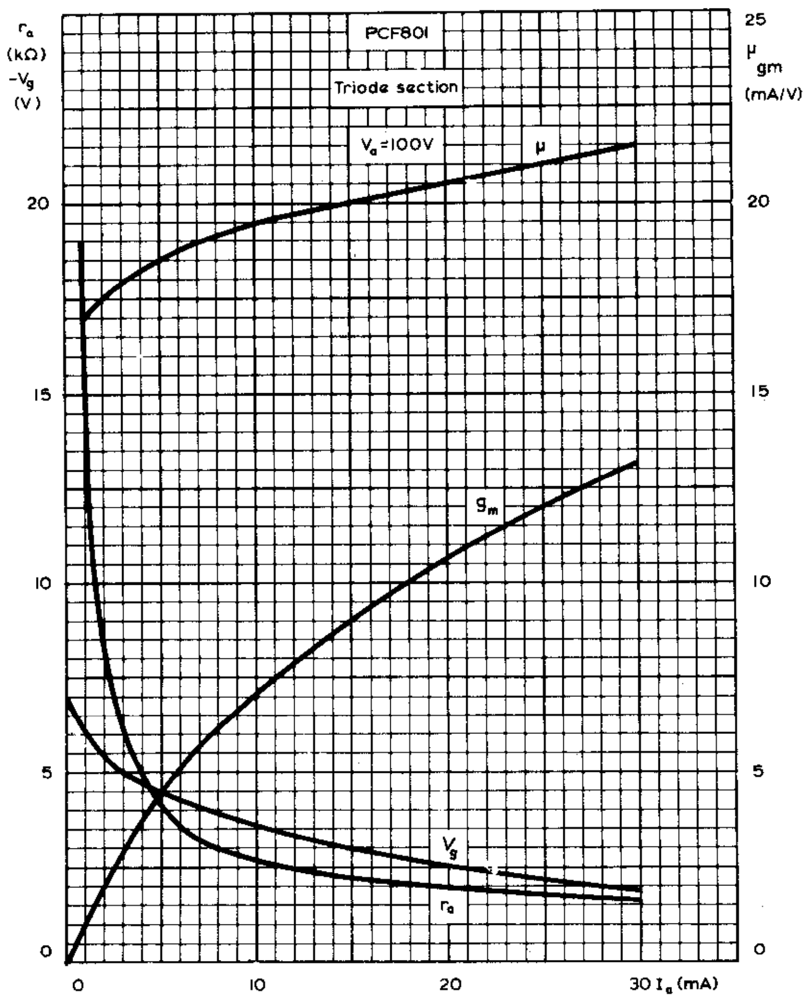
PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER.



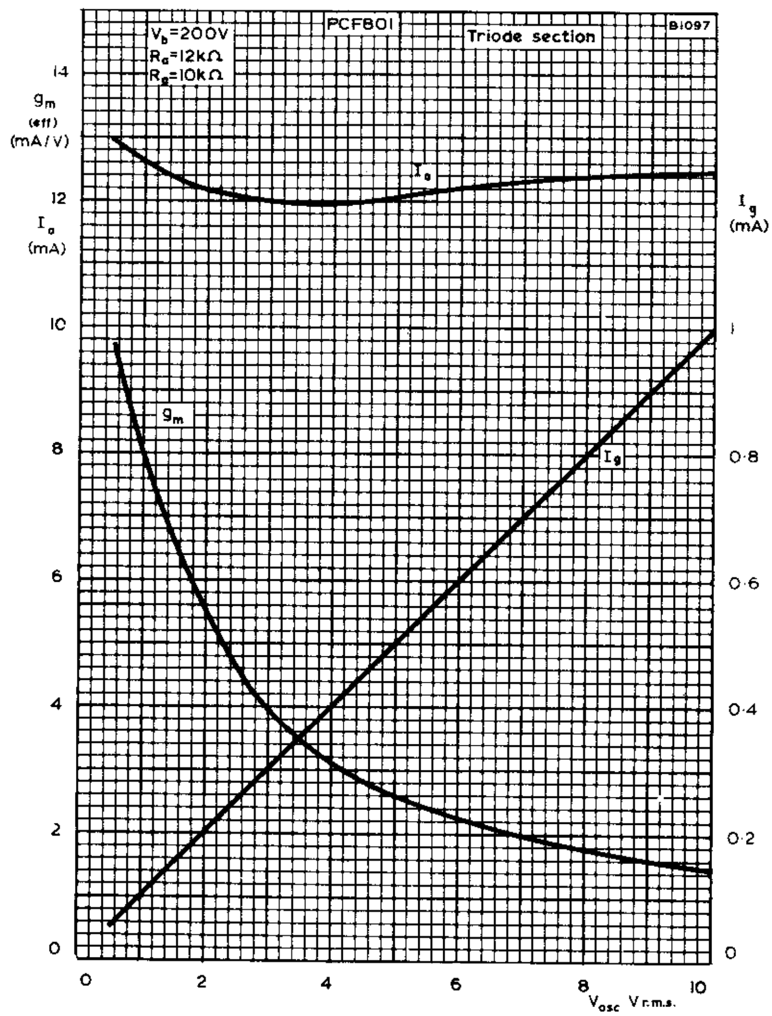
ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETERS. TRIODE SECTION.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETERS. TRIODE SECTION.



ANODE IMPEDANCE, MUTUAL CONDUCTANCE, GRID VOLTAGE AND AMPLIFICATION FACTOR PLOTTED AGAINST ANODE CURRENT. Va = 100V. TRIODE SECTION.



PERFORMANCE CURVES FOR USE AS OSCILLATOR. TRIODE SECTION.

TRIODE PENTODE PCF802

Triode pentode for use in line oscillator circuits, the pentode section as an oscillator and the triode section as a reactance valve.

HEATER

Suitable for series operation a.c. or d.c.

Ih	300	mA
Vh	9.0	V

CAPACITANCES

Pentode section

ca-g1	60	mpF
cg1-h	< 100	mpF
cin	5.4	pF

Triode section

ca-g	1.5	pF
cg-h	< 100	mpF
cin	2.4	pF

CHARACTERISTICS

Pentode section

Va	100	V
Vg2	100	V
Ia	6.0	mA
Ig2	1.7	mA
Vg1	- 1.0	V
gm	5.5	mA/V
μg1-g2	47	
ra	400	kΩ
Ia (Vg1 = 0V)	12.5	mA
Ig2 (Vg1 = 0V)	3.5	mA

- Vg1 (Va = Vg2 = 200V, Ia = 10μA)	< 16	V
- Vg1 max. (Ig1 = +0.3μA)	- 1.3	V

Triode section

Va	200	V
Ia	3.5	mA
Vg	- 2.0	V
gm	3.5	mA/V
μ	70	
ra	20	kΩ
Ia (Ig =+10μA, Va = 200V)	10	mA
-Vg max. (Ig = +0.3μA)	- 1.3	V

DESIGN CENTRE RATINGS

Pentode section

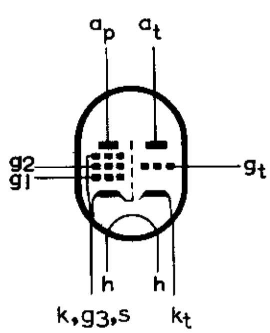
Va(b) max.	550	V
Va max.	250	V
pa max.	1.2	W
Vg2(b) max.	550	V
Vg2 max.	250	V
pg2 max.	800	mW
Ik max.	15	mA
* ik(pk) max.	50	mA
Rg1-k max.	560	kΩ

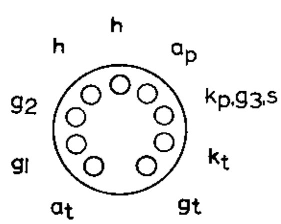
* Duty factor max. = 30%, tp max. = 30μs

Triode section

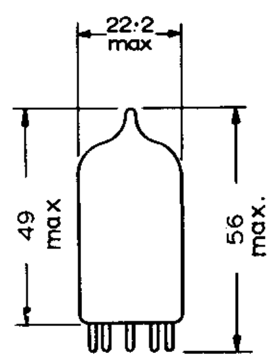
Va(b) max.	550	V
Va max.	1.4	W
Ik max.	10	mA
Rg-k max.	3.0	MΩ
* Vh-k max.	100	V

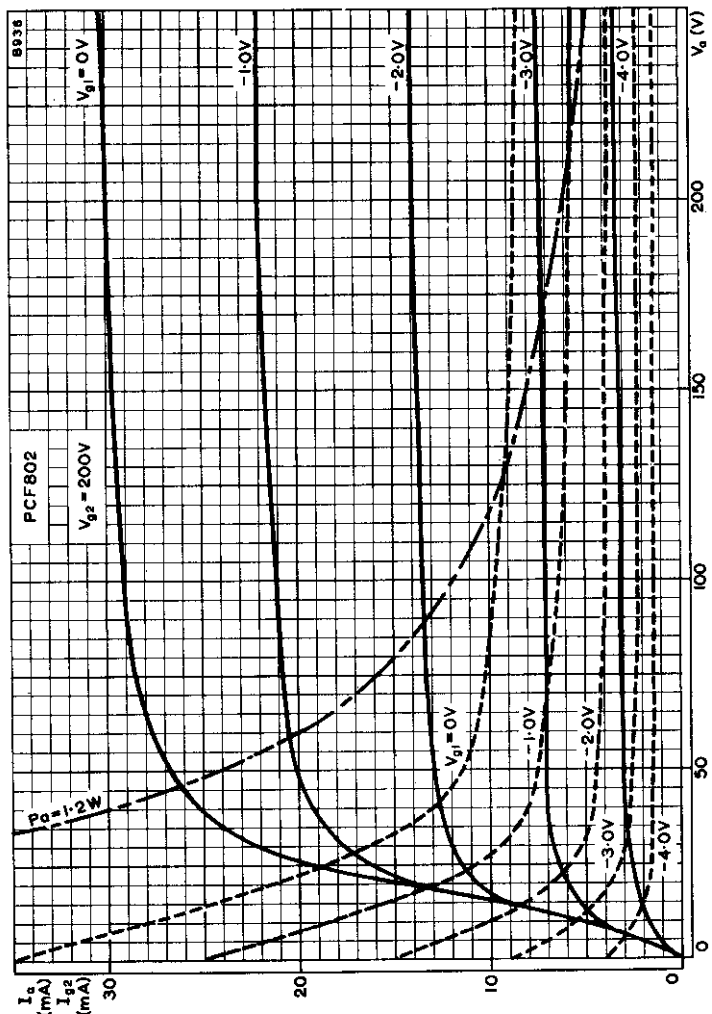
TRIODE PENTODE PCF802



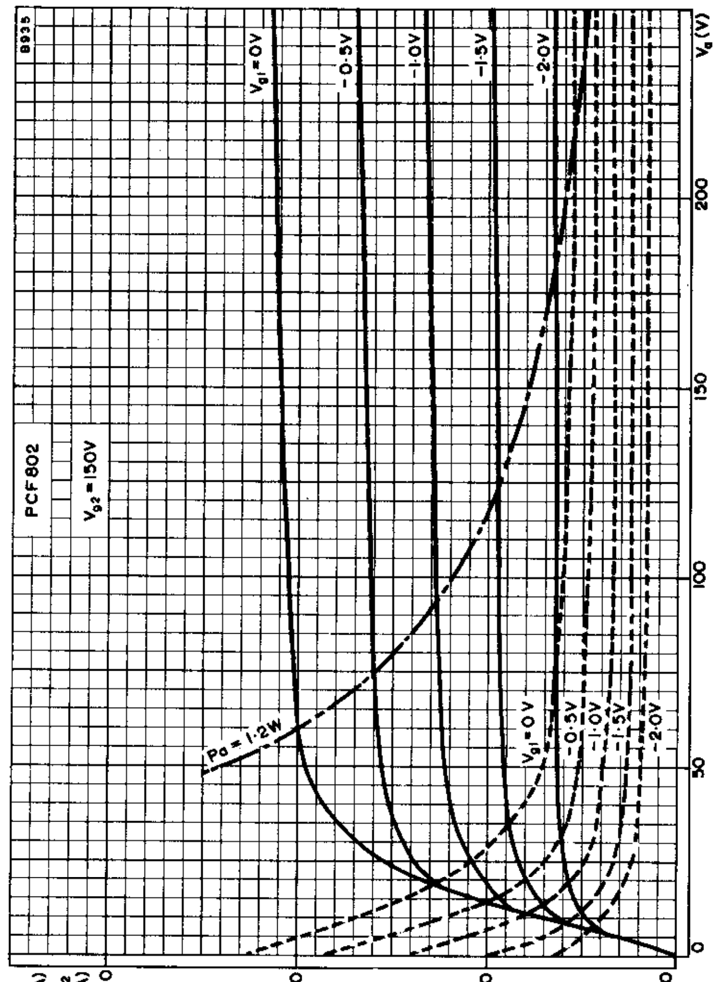


B9A Base
All dimensions in mm

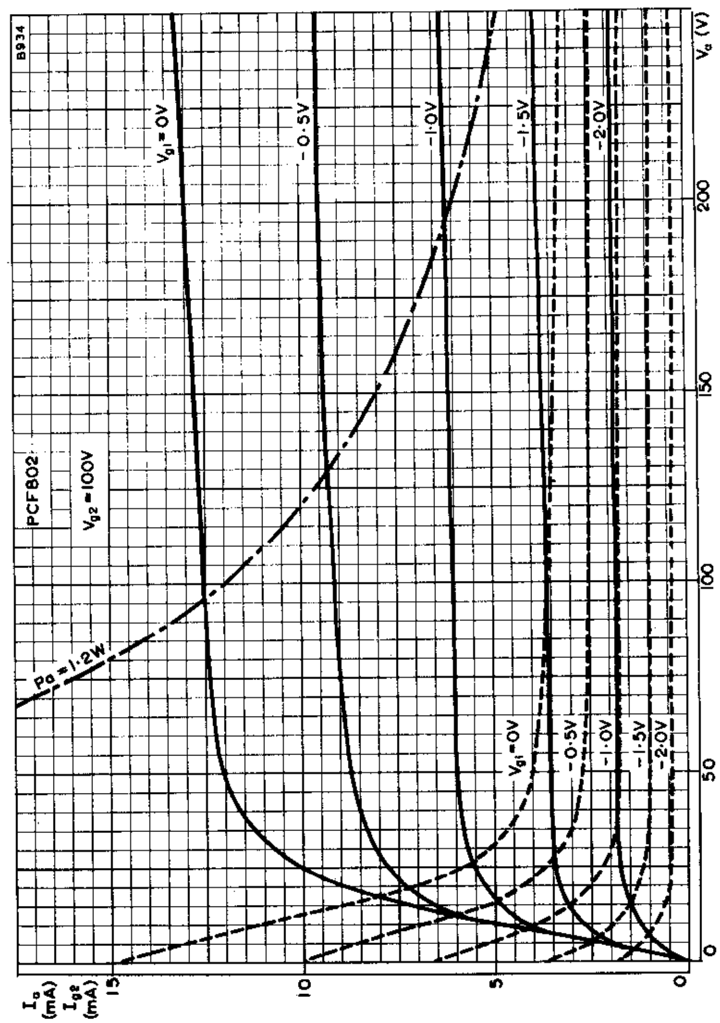




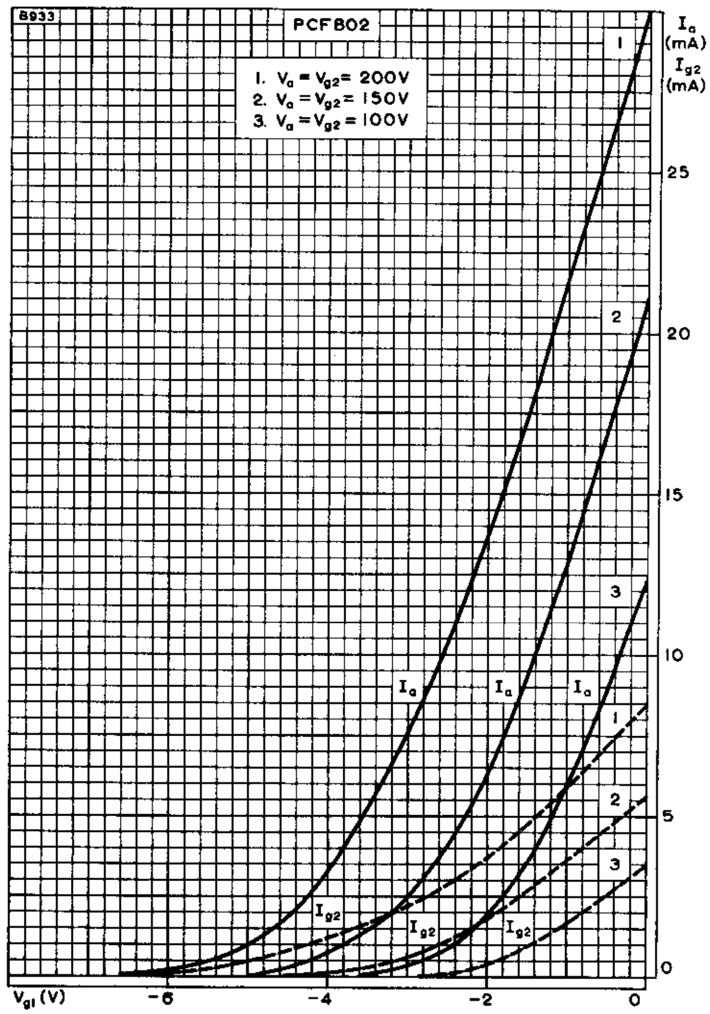
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER. Vg2 = 200V



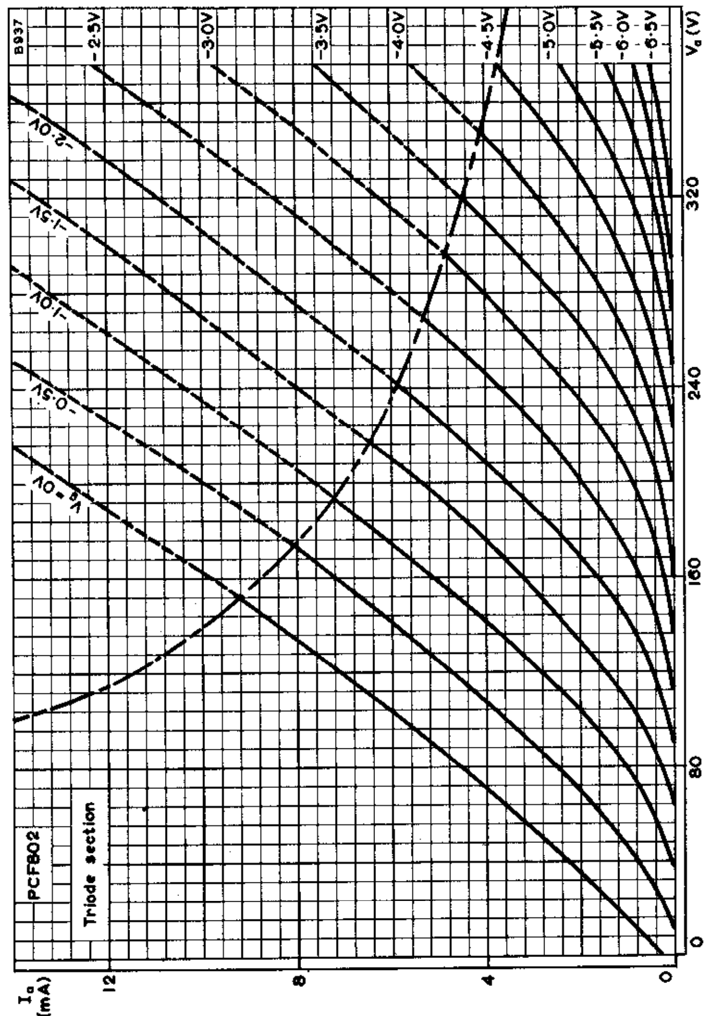
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER. Vg2 = 150V



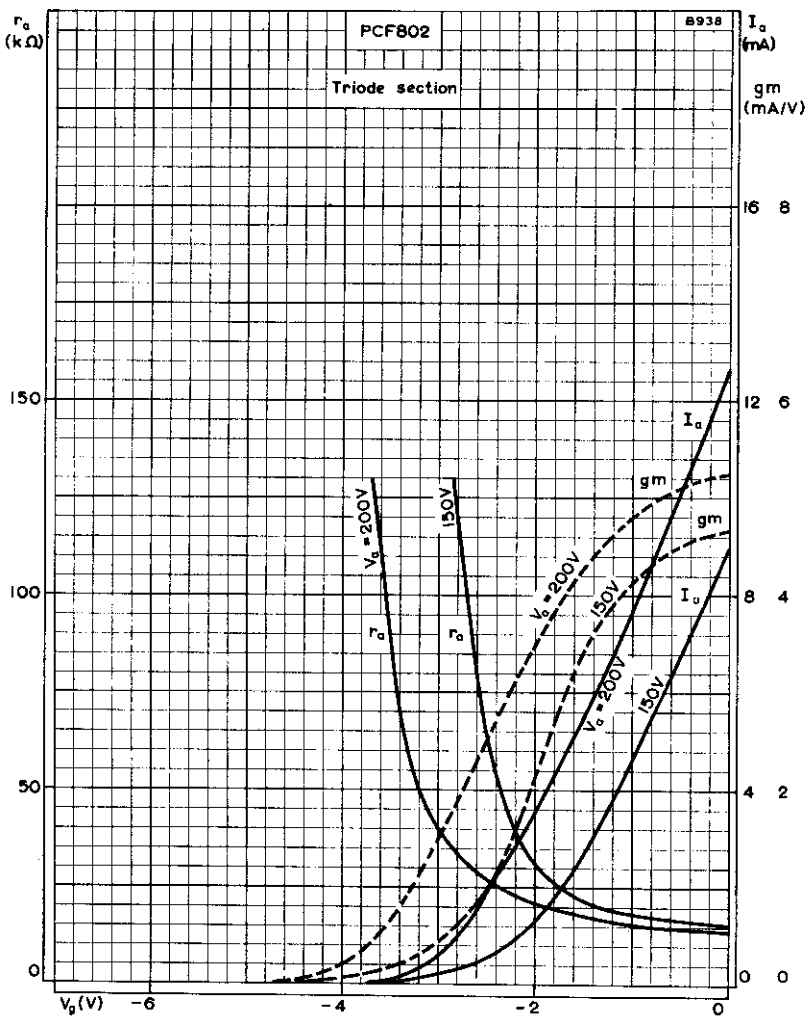
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. Vg2 = 100V



ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGE AS PARAMETER



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. TRIODE SECTION



ANODE CURRENT, MUTUAL CONDUCTANCE, AND ANODE IMPEDANCE
PLOTTED AGAINST CONTROL-GRID VOLTAGE. TRIODE SECTION

TRIODE PENTODE

PCF806

Combined triode and high slope frame grid r.f. pentode for use as a frequency changer at frequencies up to 220Mc/s in television tuners.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	8.0	V

CAPACITANCES (measured without an external shield)

c_{ap-at}	<30	mpF
c_{ap-gt}	<10	mpF
c_{g1-at}	<10	mpF
c_{g1-gt}	<10	mpF

Pentode section

c_{a-g1}	12	mpF
c_{g1-g2}	1.6	pF ←
c_{in}	6.0	pF
c_{out}	3.3	pF ←

Triode section

c_{g-k+h}	2.2	pF ←
c_{a-k+h}	1.2	pF ←
c_{a-g}	2.0	pF

CHARACTERISTICS

Pentode section

V_a	170	V
V_{g2}	150	V
I_a	10	mA
I_{g2}	3.3	mA
g_m	12	mA/V
r_a	>350	kΩ
μ_{g1-g2}	70	
V_{g1}	−1.2	V
R_{eq}	1.0	kΩ

Triode section

V_a	100	V
I_a	14	mA
g_m	5.5	mA/V
μ	17	
V_g	−3.0	V

PCF806

TRIODE PENTODE

OPERATING CONDITIONS AS A FREQUENCY CHANGER

Pentode section

V_b	190	V
$V_{g2(b)}$	190	V
R_{g2}	18	kΩ
R_{g1}	100	kΩ
I_a	8.5	mA
I_{g2}	2.7	mA
$V_{osc(r.m.s.)}$	2.3	V
g_c	4.5	mA/V

DESIGN CENTRE RATINGS

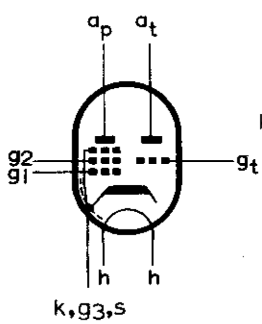
Pentode section

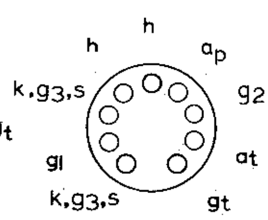
V_a max.	250	V
p_a max.	2.0	W
V_{g2} max.	150	V
p_{g2} max.	500	mW
I_k max.	18	mA
R_{g1-k} max.	250	kΩ

Triode section

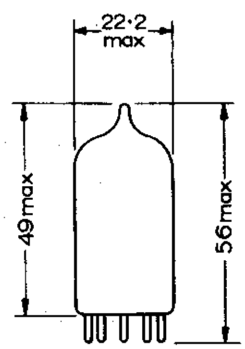
V_a max.	125	V
p_a max.	1.5	W
I_k max.	15	mA
R_{g-k} max.	500	kΩ
*V_{h-k} max.	100	V

*To fulfil hum requirements on a.m. sound, it will be necessary for V_{h-k} to be less than $50V_{r.m.s.}$

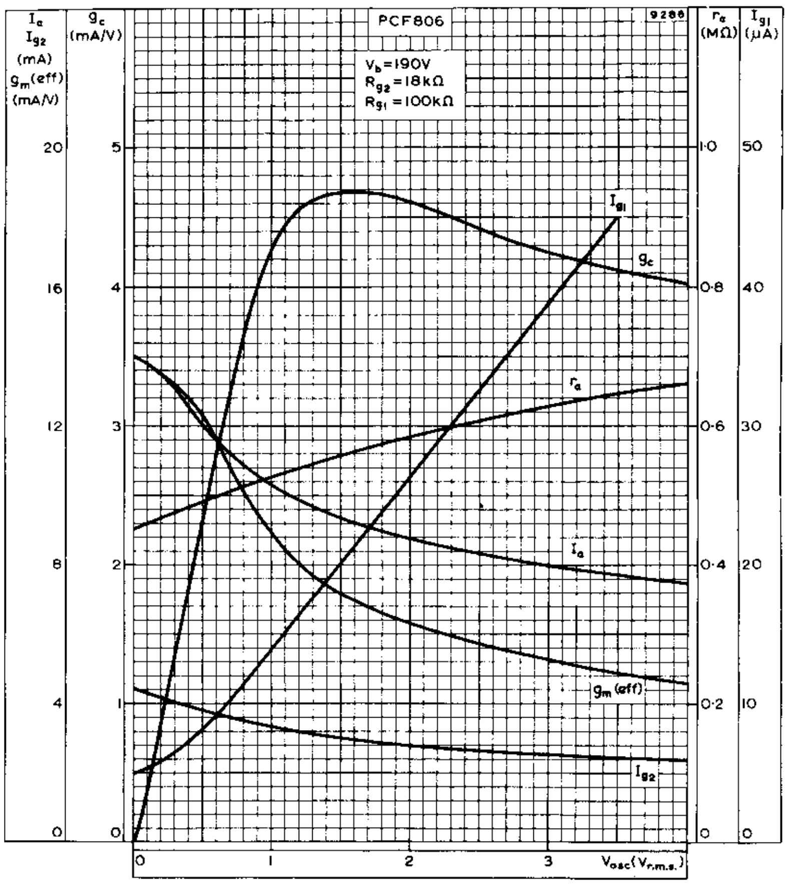




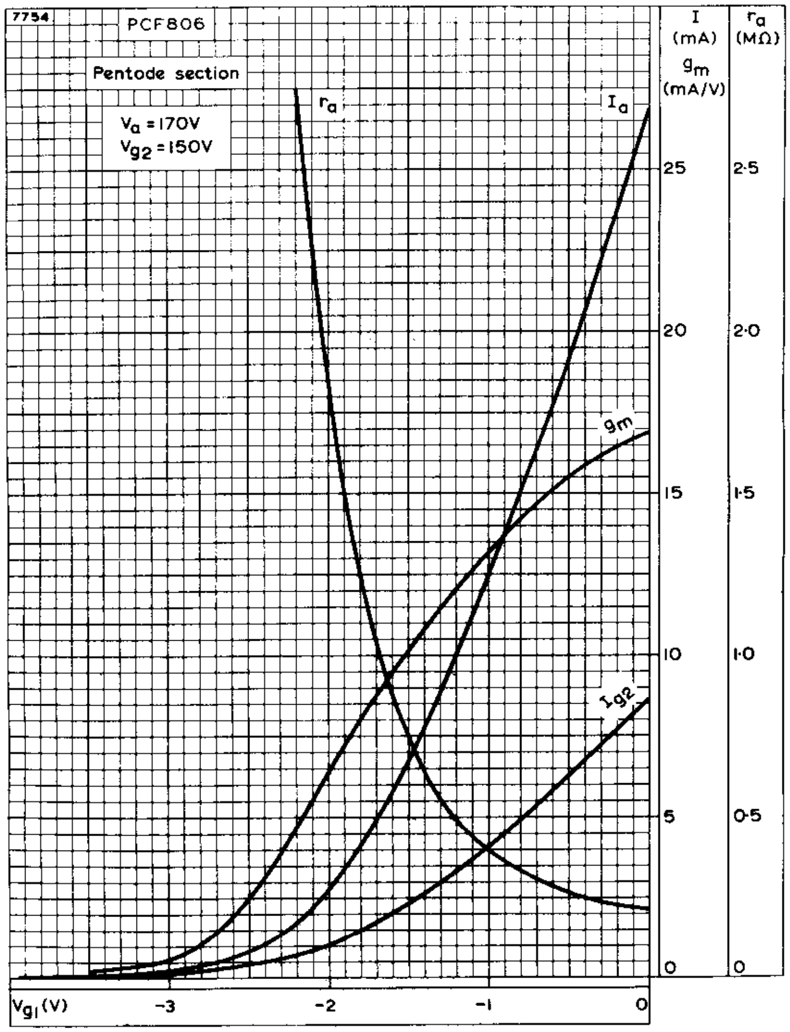
B9A Base
All dimensions in mm



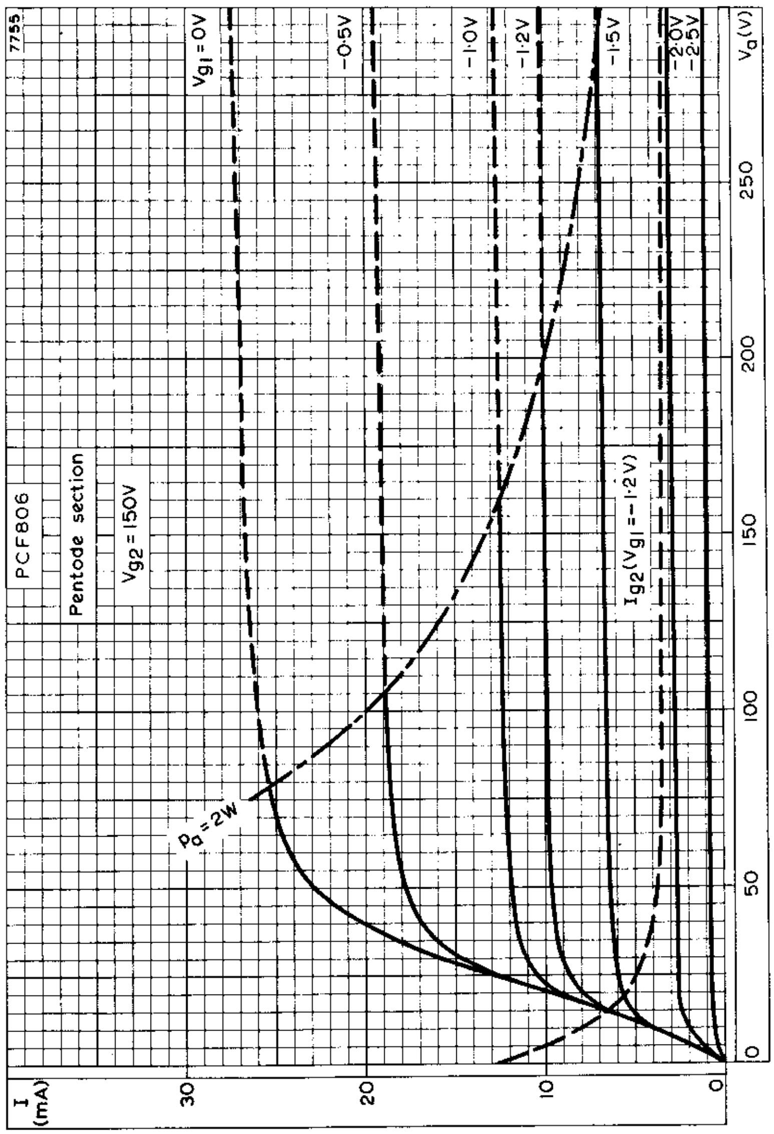
9111



PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER



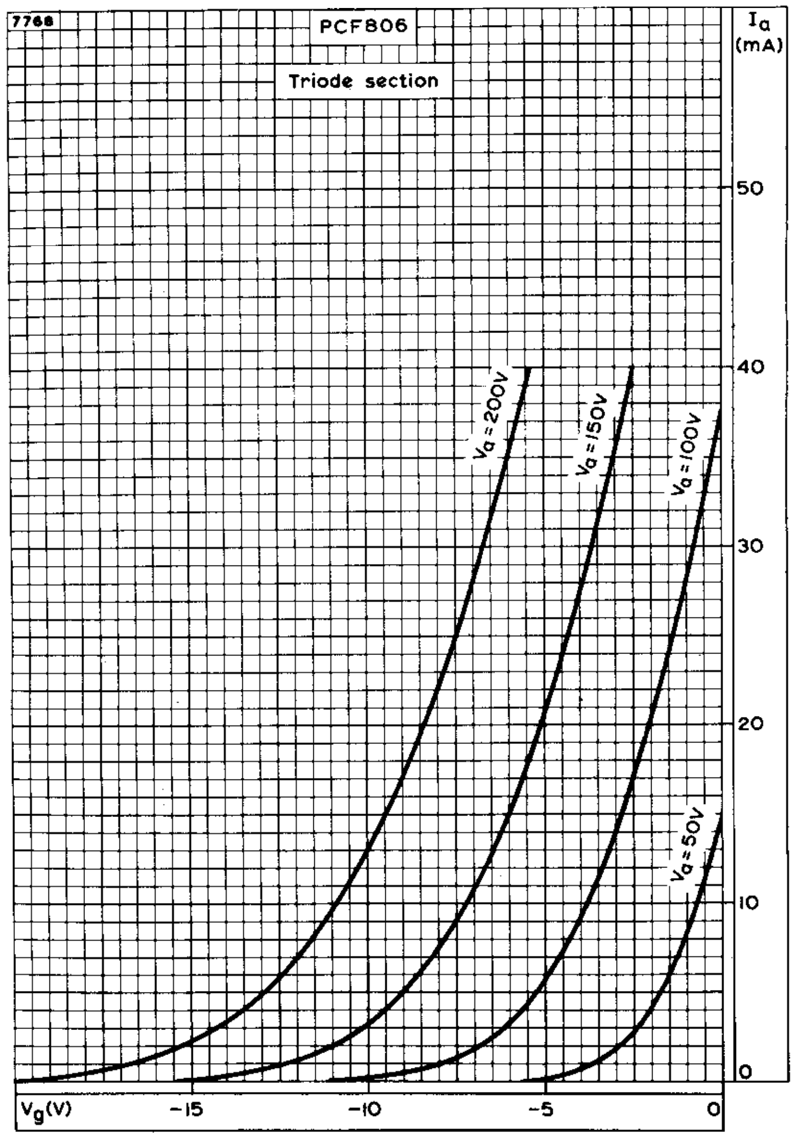
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE. PENTODE SECTION



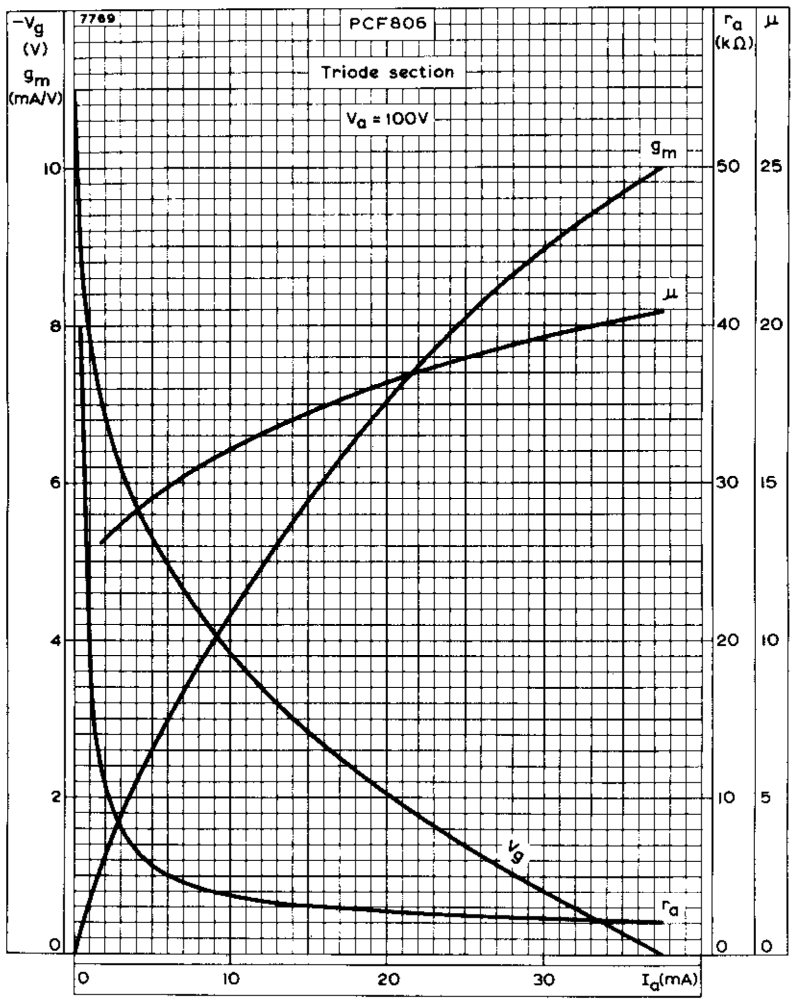
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. PENTODE SECTION

PCF806

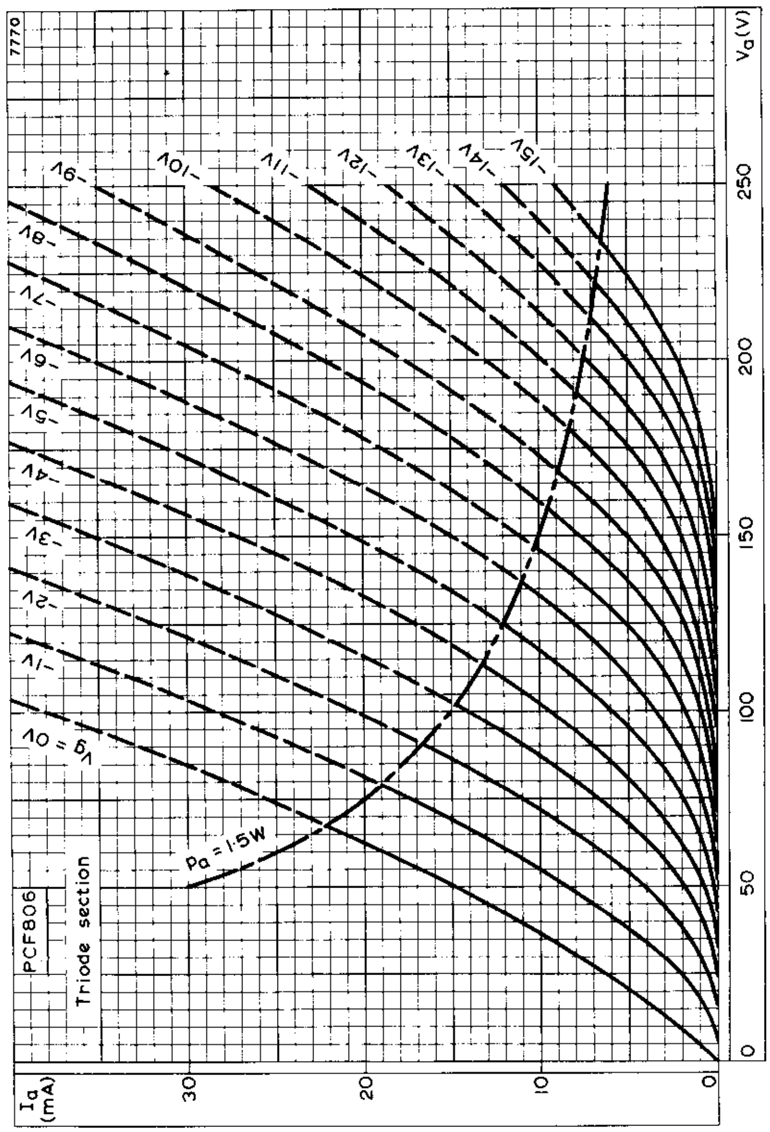
TRIODE PENTODE



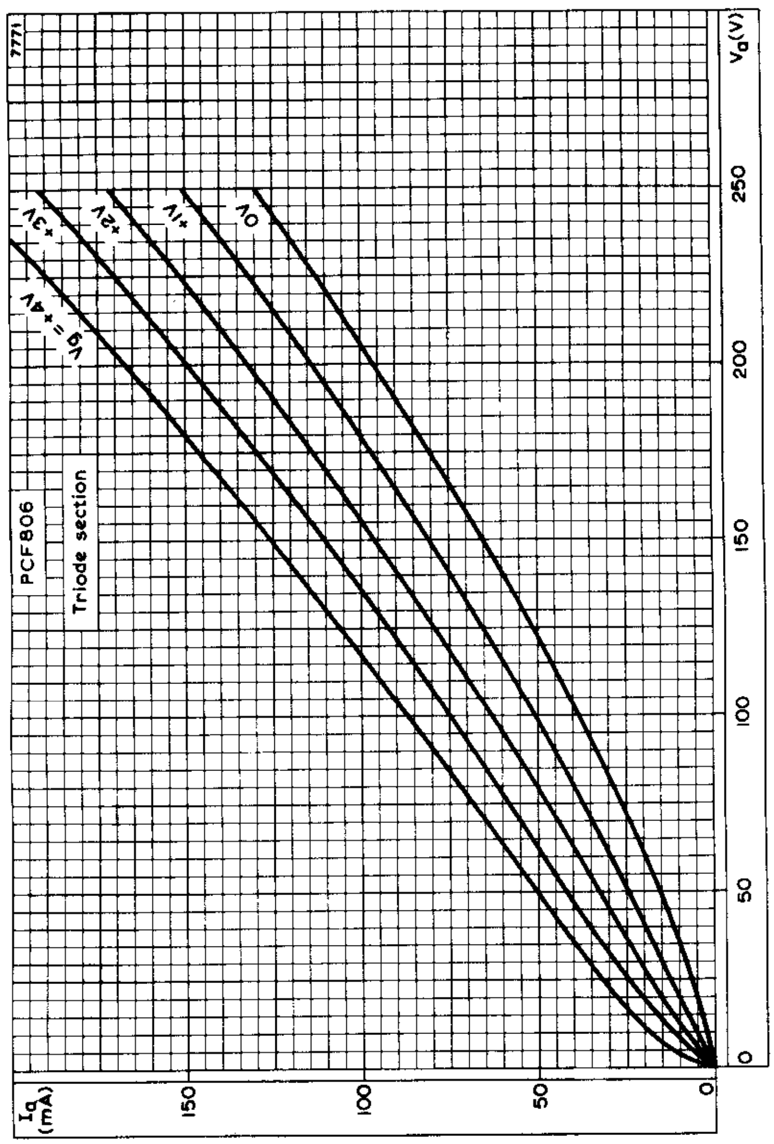
ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE FOR VARIOUS VALUES OF ANODE VOLTAGE. TRIODE SECTION



GRID VOLTAGE, MUTUAL CONDUCTANCE, ANODE IMPEDANCE AND AMPLIFICATION FACTOR PLOTTED AGAINST ANODE CURRENT. TRIODE SECTION



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER. TRIODE SECTION



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH POSITIVE GRID VOLTAGE AS PARAMETER. TRIODE SECTION

TRIODE HEPTODE PCH200

TENTATIVE DATA

Triode heptode intended for use as a noise cancelled synchronising pulse separator and clipper.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

I_h	300	mA
V_h	8.5	V ←

CAPACITANCES

c_{ah-at}	<150	mpF
c_{g1-at}	<10	mpF
c_{g1-gt}	<5.0	mpF ←
c_{g3-gt}	<20	mpF
Heptode section		
c_{in}	4.4	pF
c_{out}	5.4	pF ←
c_{a-g1}	<100	mpF
c_{a-g3}	<250	mpF
c_{g1-g3}	300	mpF
Triode section		
c_{in}	3.3	pF ←
c_{out}	1.7	pF ←
c_{a-g}	1.8	pF

CHARACTERISTICS

Heptode section

V_a	14	V
V_{g2+g4}	14	V
I_a	1.5	mA ←
I_{g2+g4}	1.3	mA ←
I_{g3}	1.0	μA
V_{g3}	0	V
V_{g1}	0	V
V_{g3} max. ($I_{g3} = 0.3\mu A$)	<-1.3	V
V_{g1} max. ($I_{g1} = 0.3\mu A$)	<-1.3	V

Triode section

V_a	100	V
I_a	9.0	mA ←
V_g	-1.0	V
g_m	8.8	mA/V ←
μ	50	←

OPERATING CONDITIONS

Heptode section

V_{ah}	1.0	14	V
V_{g2+g4}	14	14	V
I_{ah}	>300	750	µA
I_{g3}	1.0	1.0	µA
I_{g1}	100	100	µA

RATINGS (DESIGN CENTRE SYSTEM)

Heptode section

$V_{a(b)}$ max.	550	V
V_a max.	100	V ←
p_a max.	500	mW ←
$V_{g2+g4(b)}$ max.	550	V
V_{g2+g4} max. (see note 1)	50	V
p_{g2+g4} max.	500	mW
$-v_g$ (pk) max.	100	V ←
$-v_{g3}$ (pk) max.	150	V
I_k max.	8.0	mA ←
R_{g1-k} max.	3.0	MΩ
R_{g3-k} max.	3.0	MΩ
V_{h-k} max.	100	V

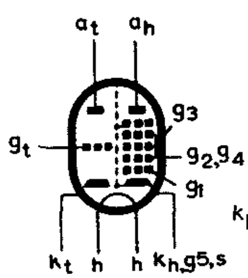
Triode section

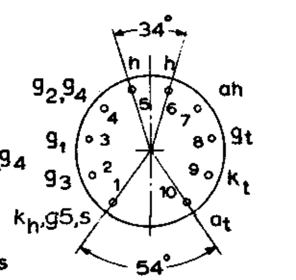
$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	1.5	W
$-v_{g1}$ (pk) max.	200	V
I_k max.	20	mA
R_{g-k} max.	2.0	MΩ
V_{h-k} max. (cathode positive)	70V d.c. + 100V r.m.s. ←	

NOTES

1. The minimum V_{g2+g4} is 6V under design maximum conditions.

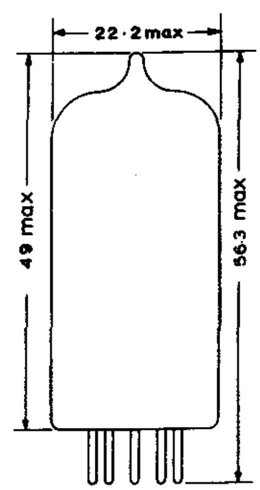
B4461



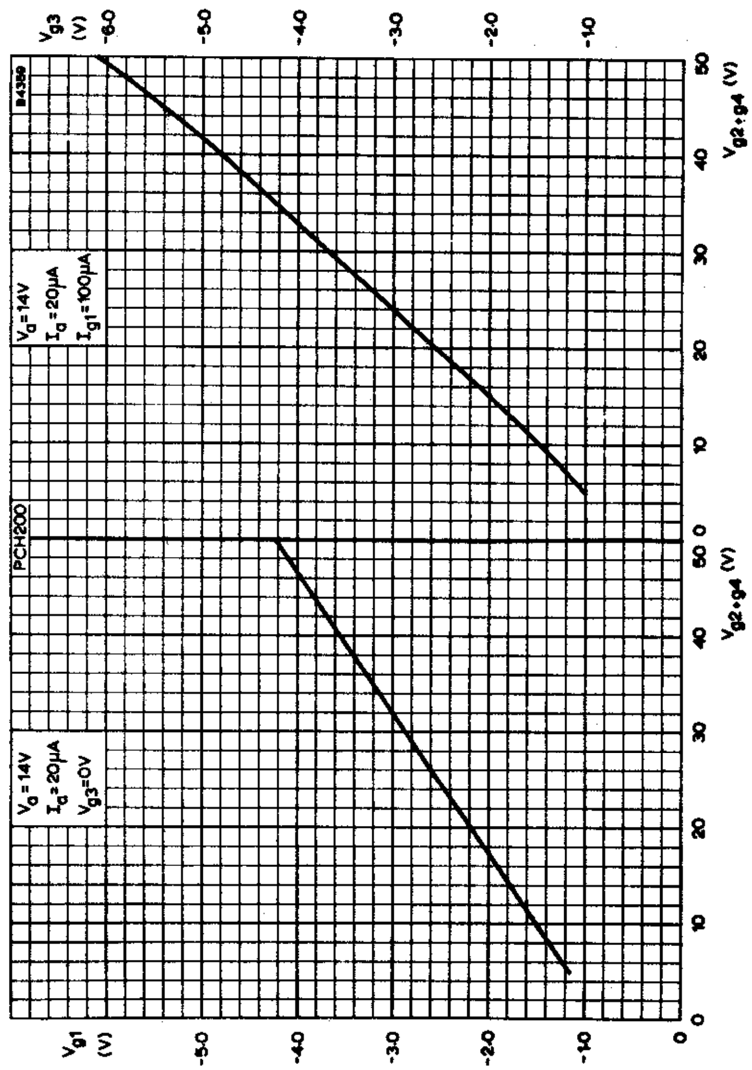


Pin circle diameter = 11·9mm
Pin diameter = 1·0mm

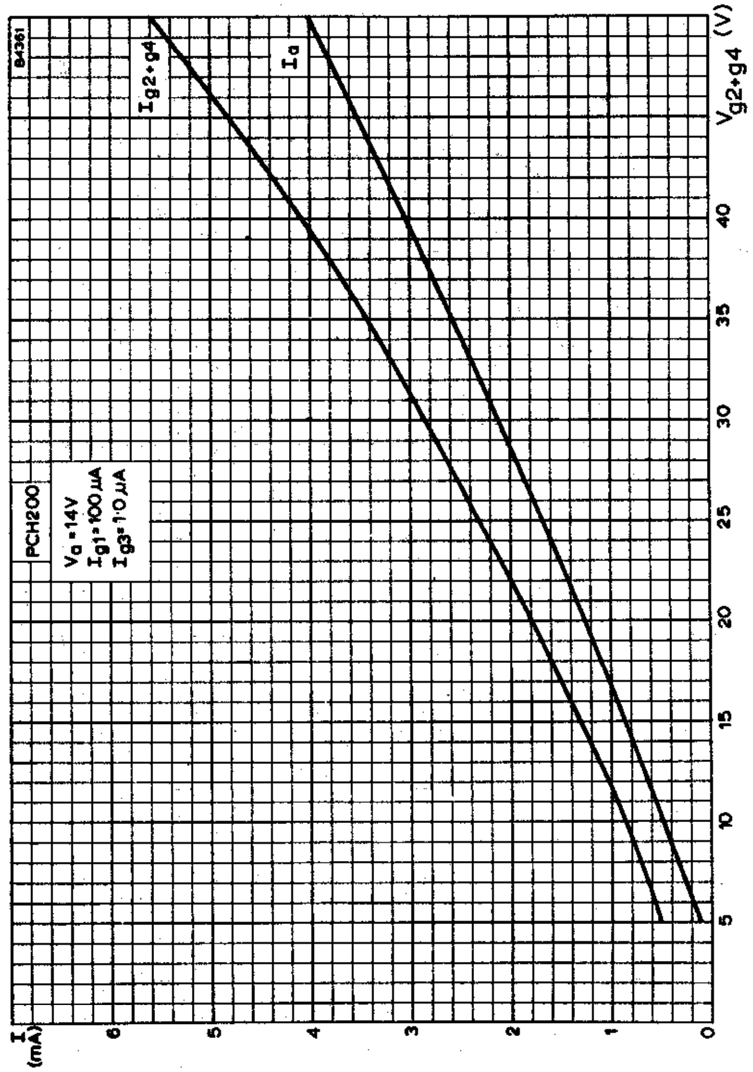
B10B base



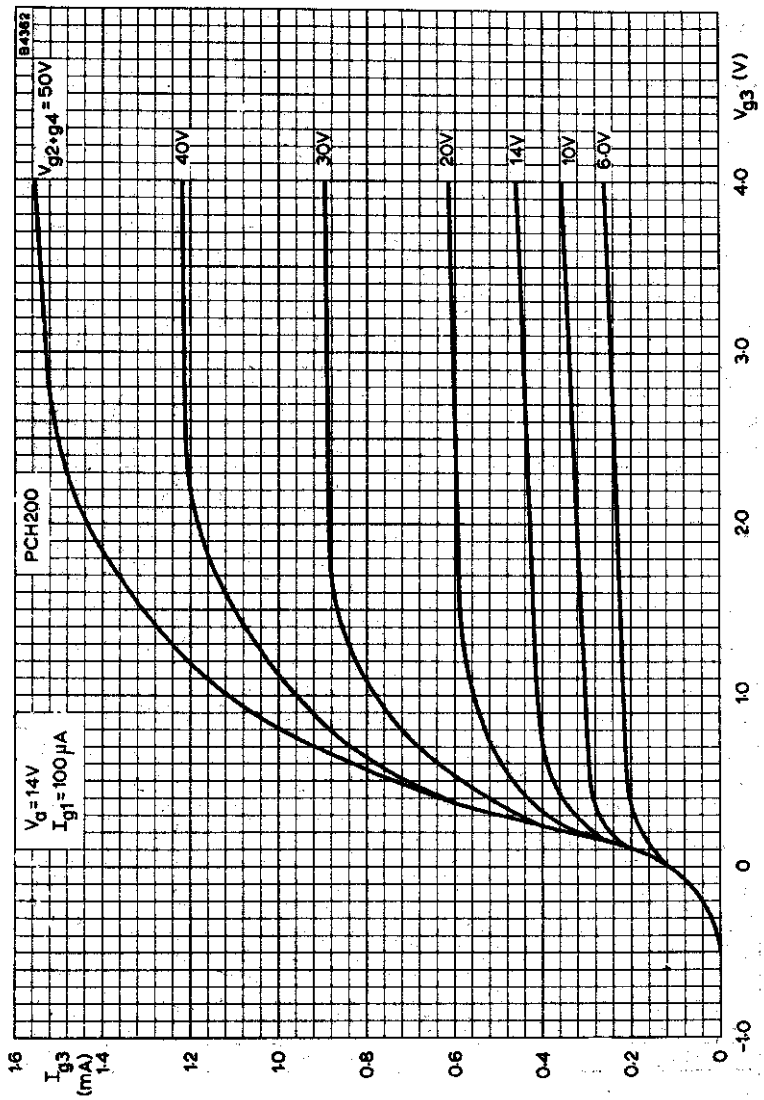
All dimensions in mm



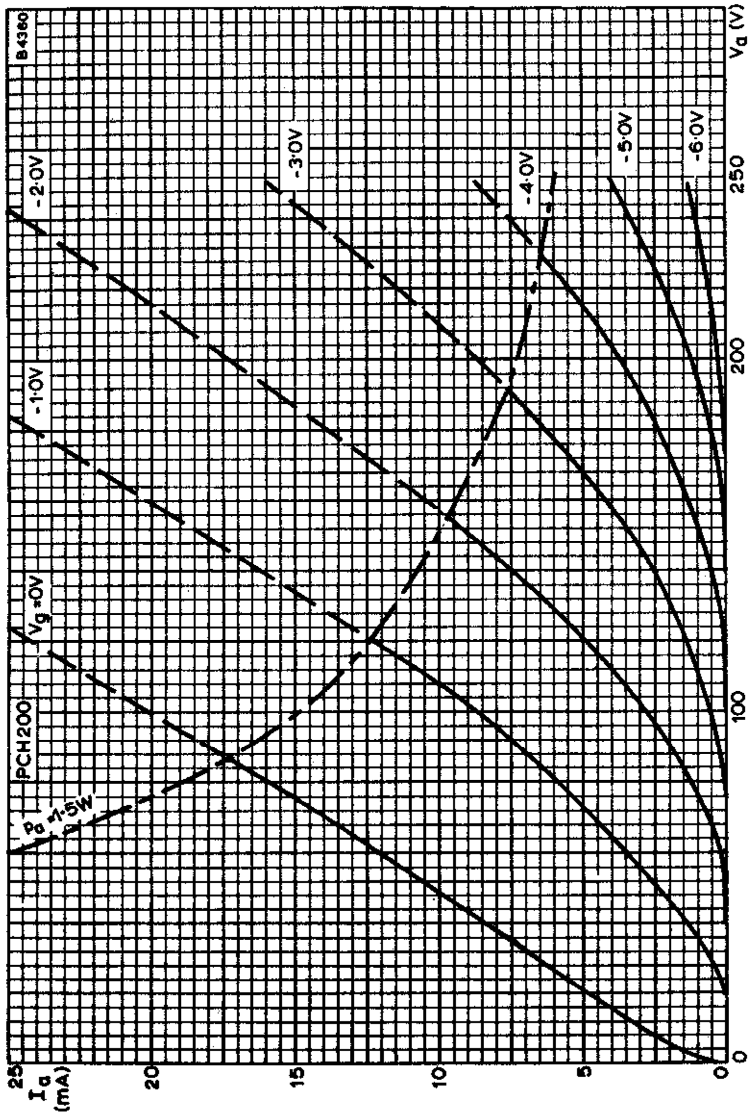
FIRST-GRID AND THIRD-GRID VOLTAGES PLOTTED
AGAINST SCREEN-GRID VOLTAGE
HEPTODE SECTION



ANODE AND SCREEN-GRID CURRENTS PLOTTED
AGAINST SCREEN-GRID VOLTAGE
HEPTODE SECTION

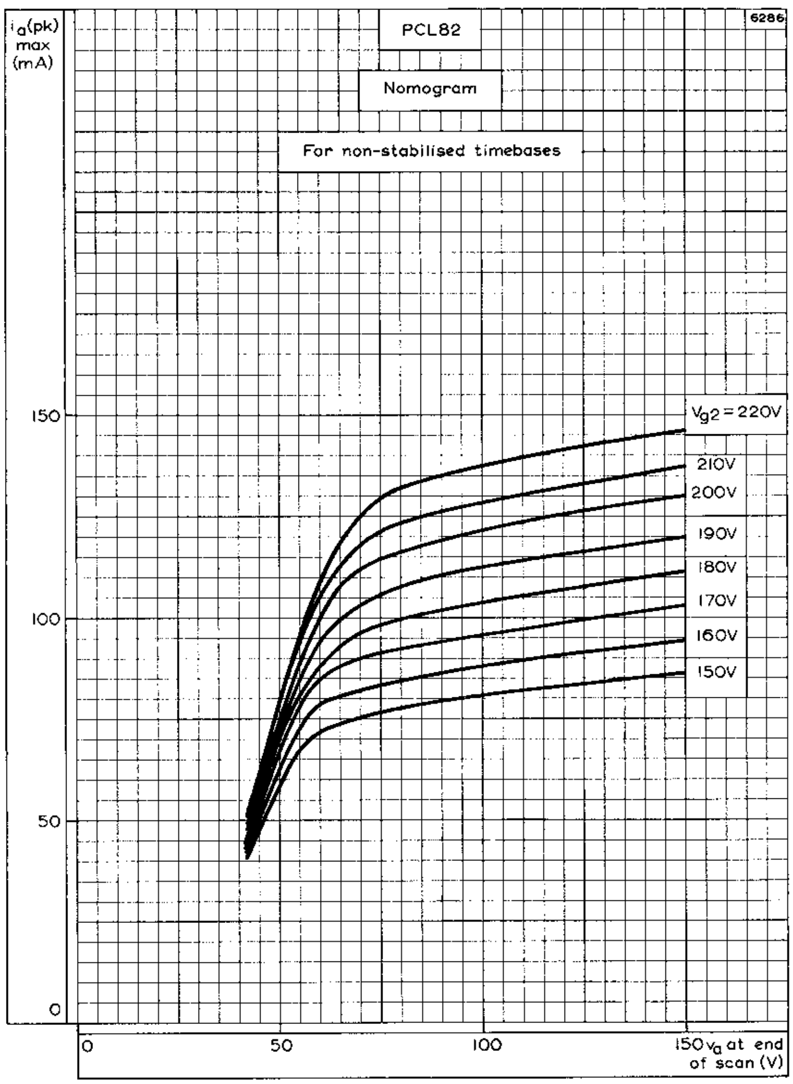


THIRD-GRID CURRENT PLOTTED AGAINST THIRD-GRID VOLTAGE
WITH SCREEN-GRID VOLTAGE AS PARAMETER
HEPTODE SECTION

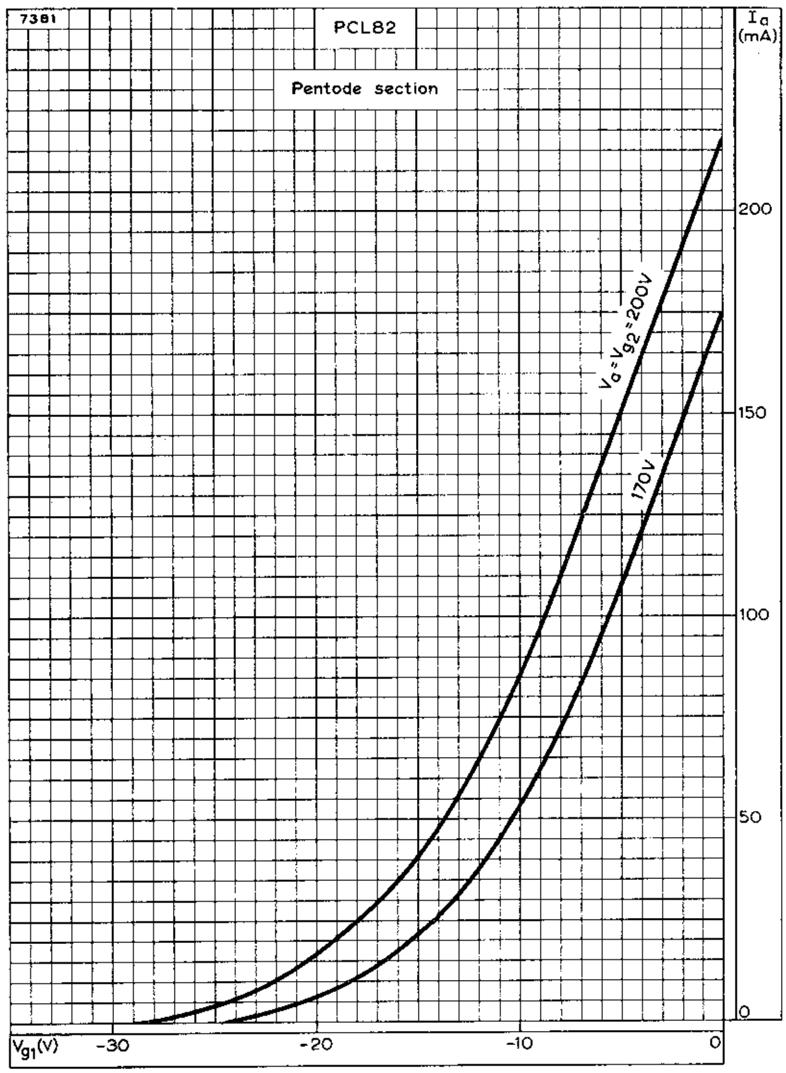


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

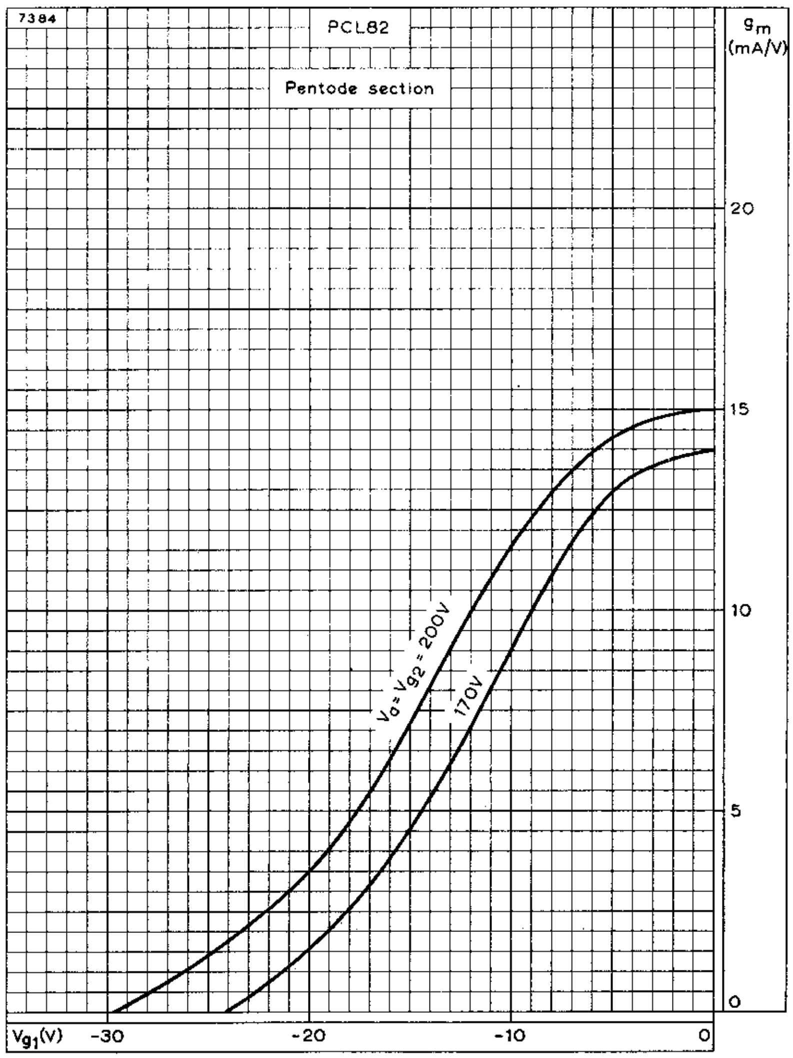
TRIODE SECTION



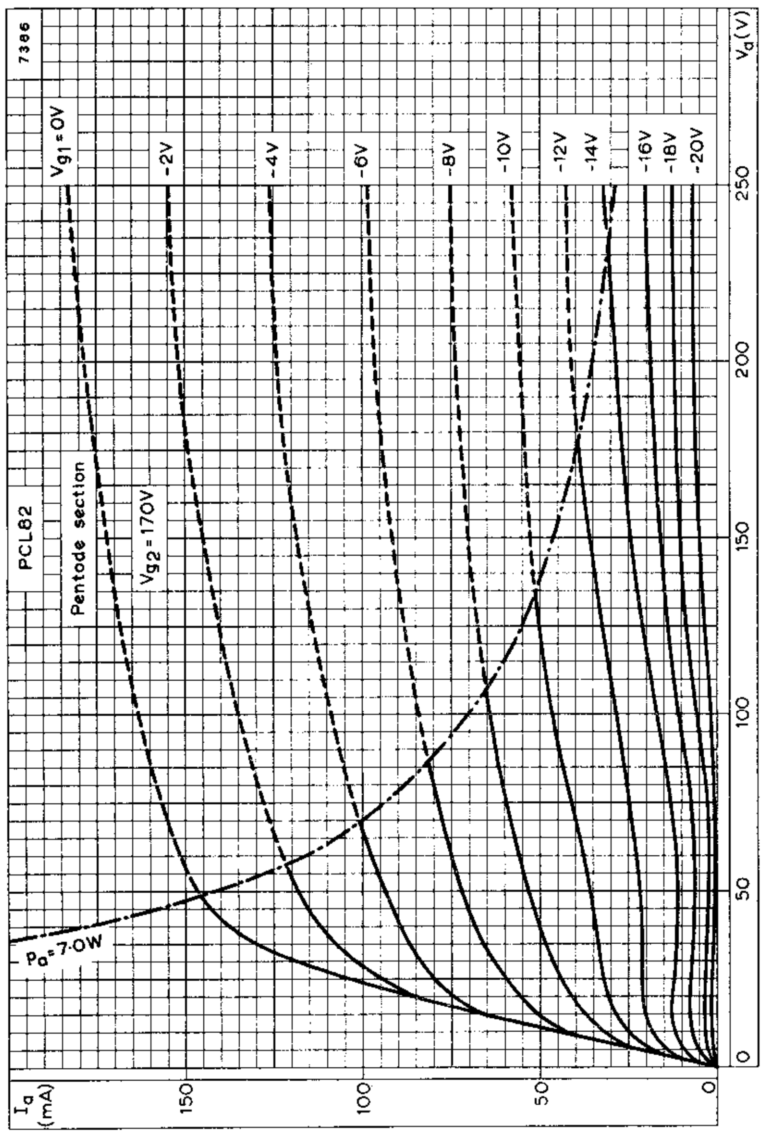
PEAK ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE AT THE END OF SCAN



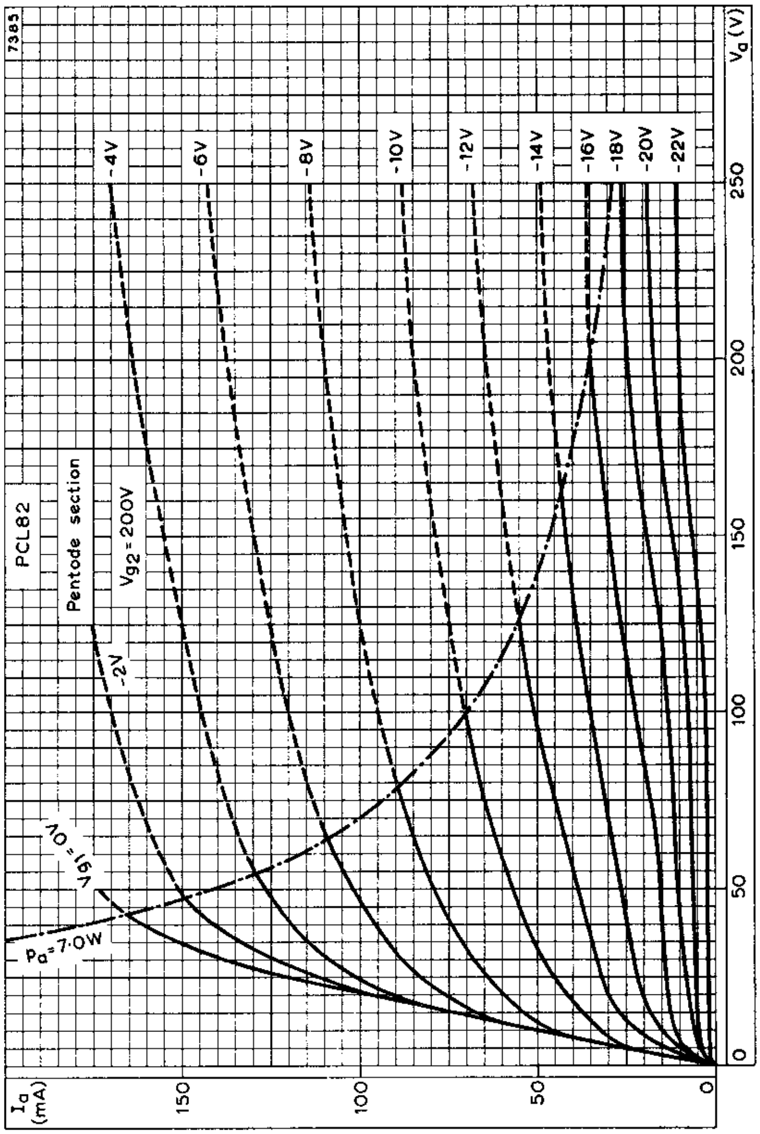
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETER. PENTODE SECTION



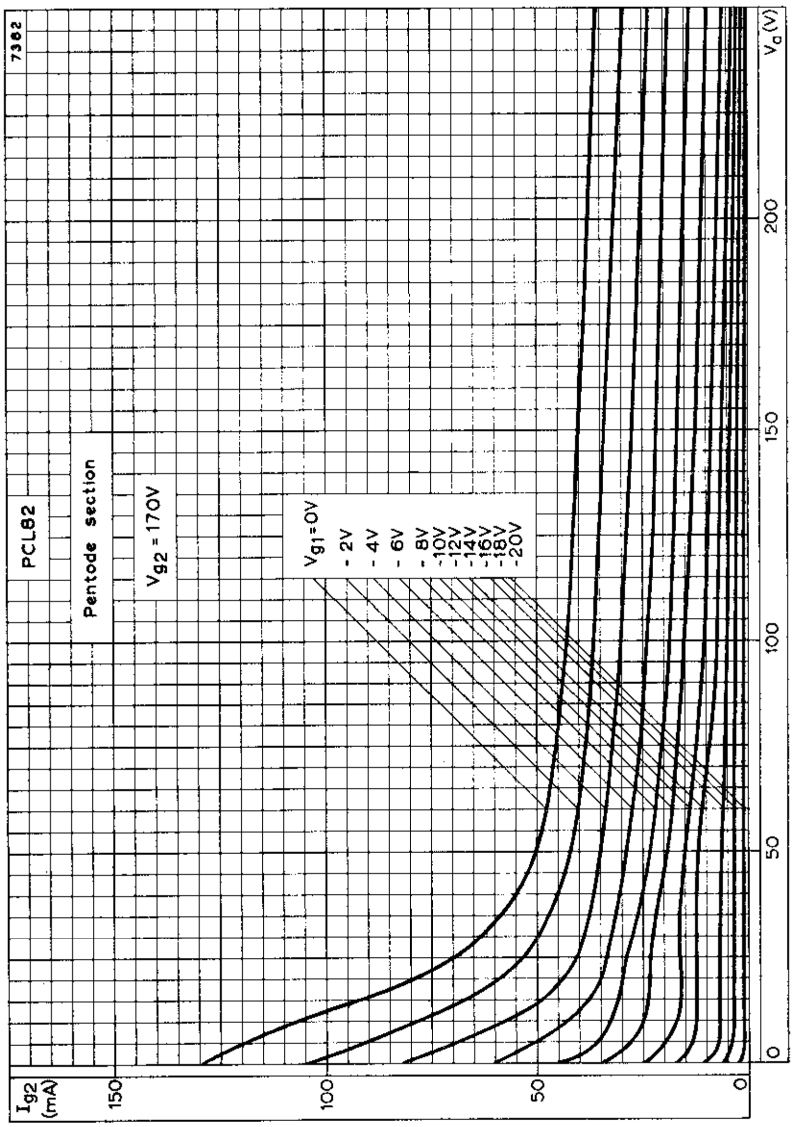
MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETER. PENTODE SECTION



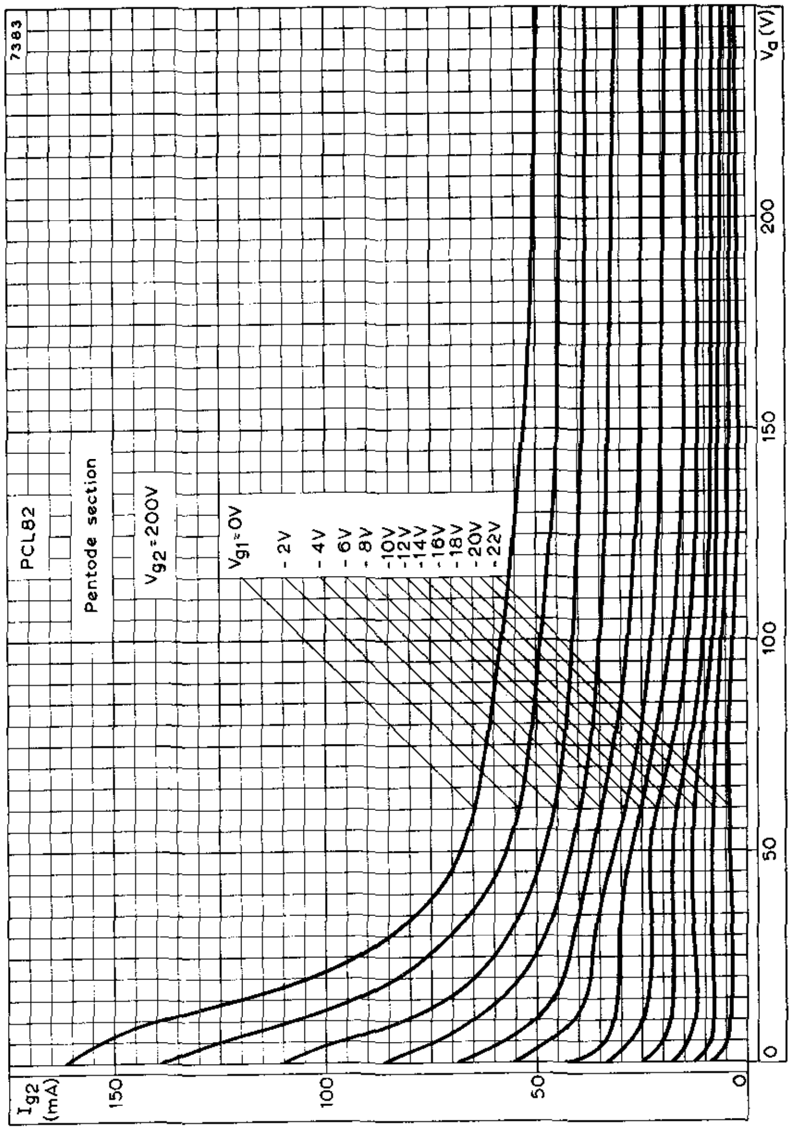
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. PENTODE SECTION. V_{g2} = 170V



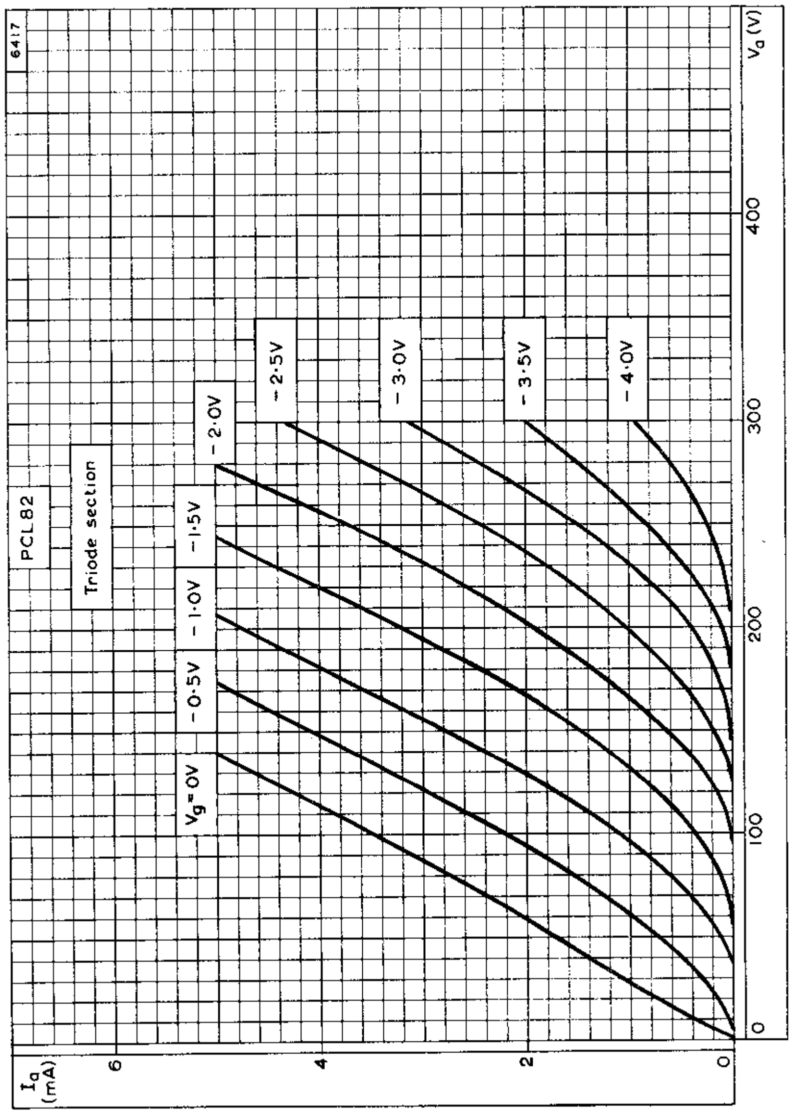
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. PENTODE SECTION. $V_{g2} = 200V$



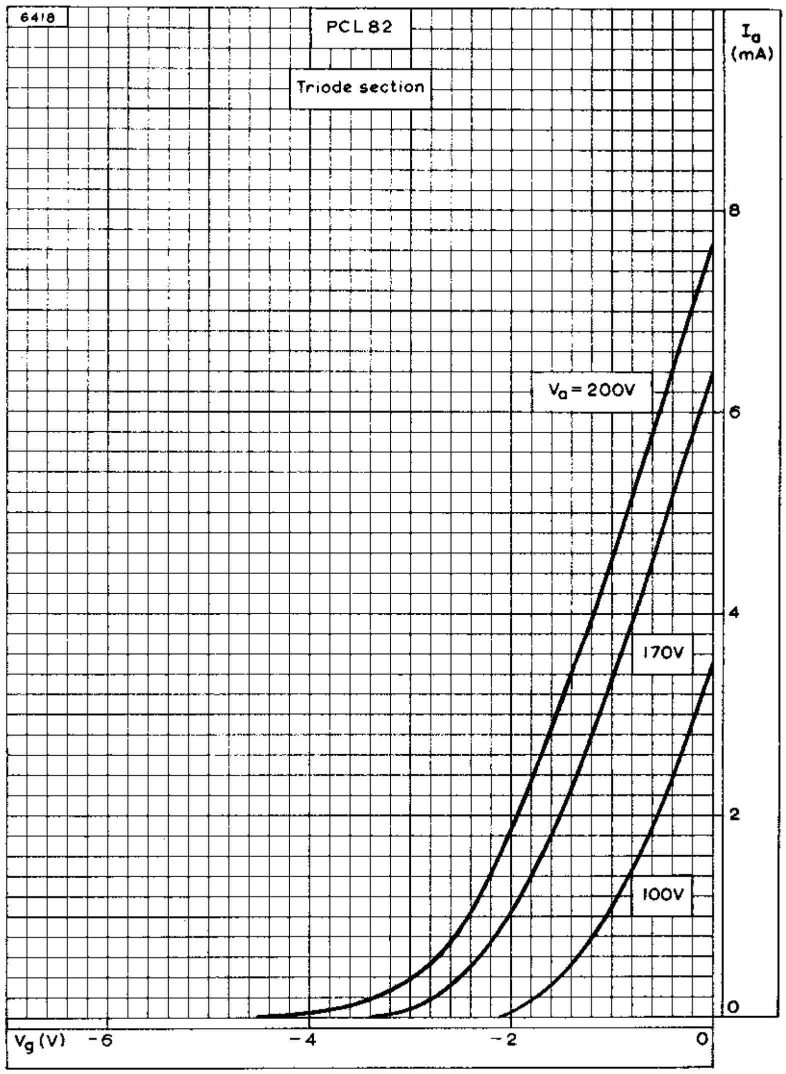
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. PENTODE SECTION. V_{g2} = 170V



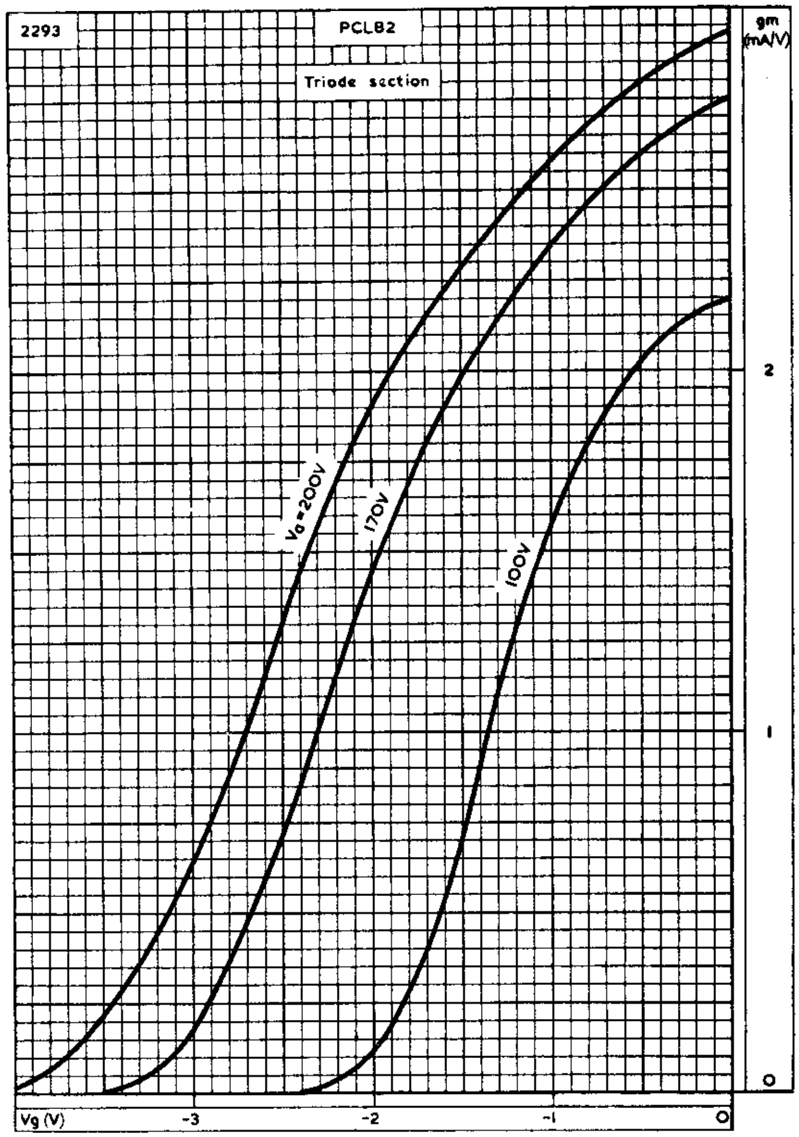
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. PENTODE SECTION. $V_{g2} = 200V$



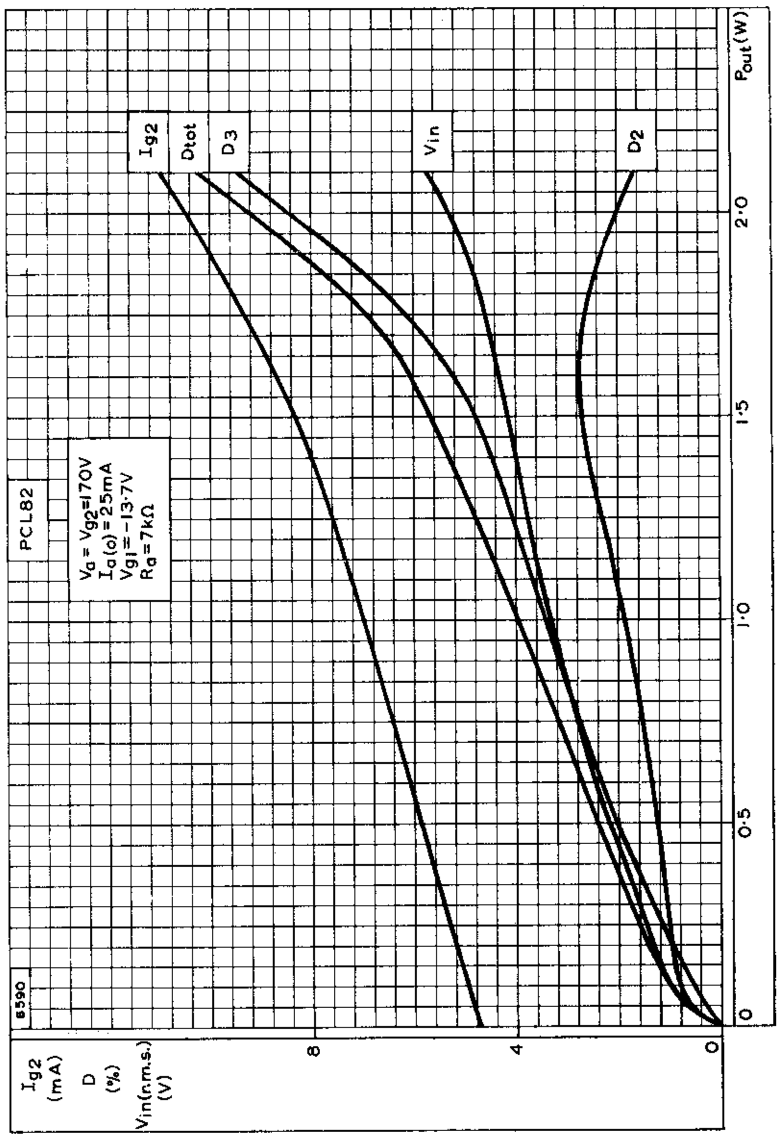
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE.
TRIODE SECTION



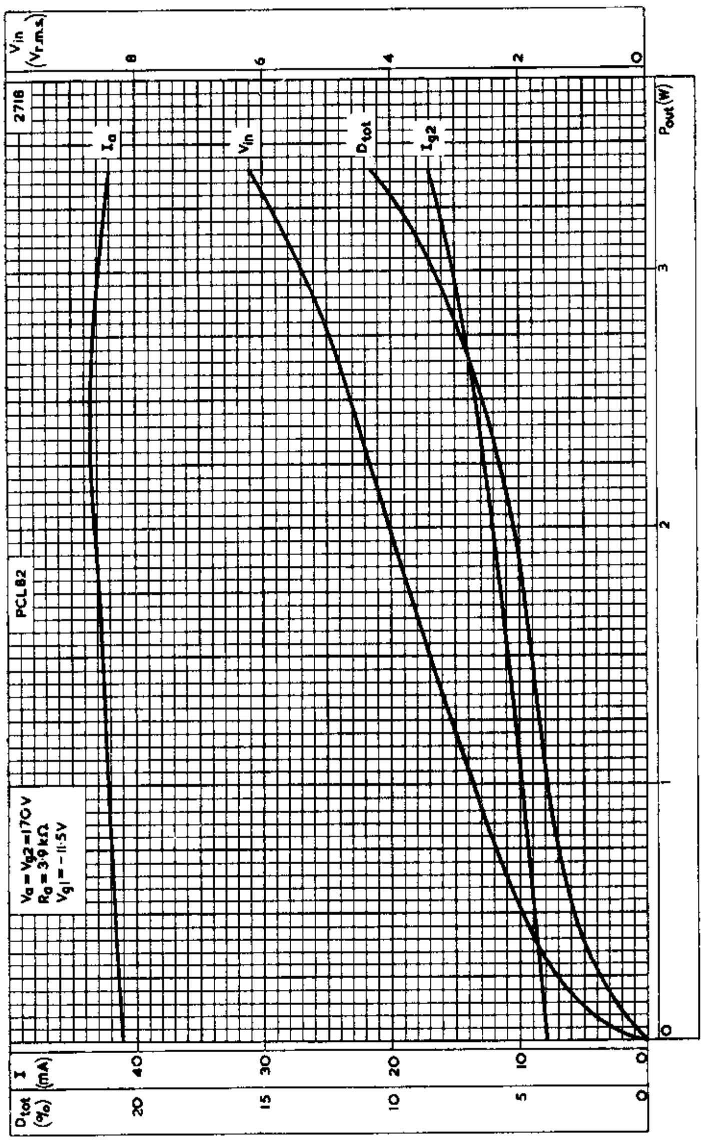
ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE.
TRIODE SECTION



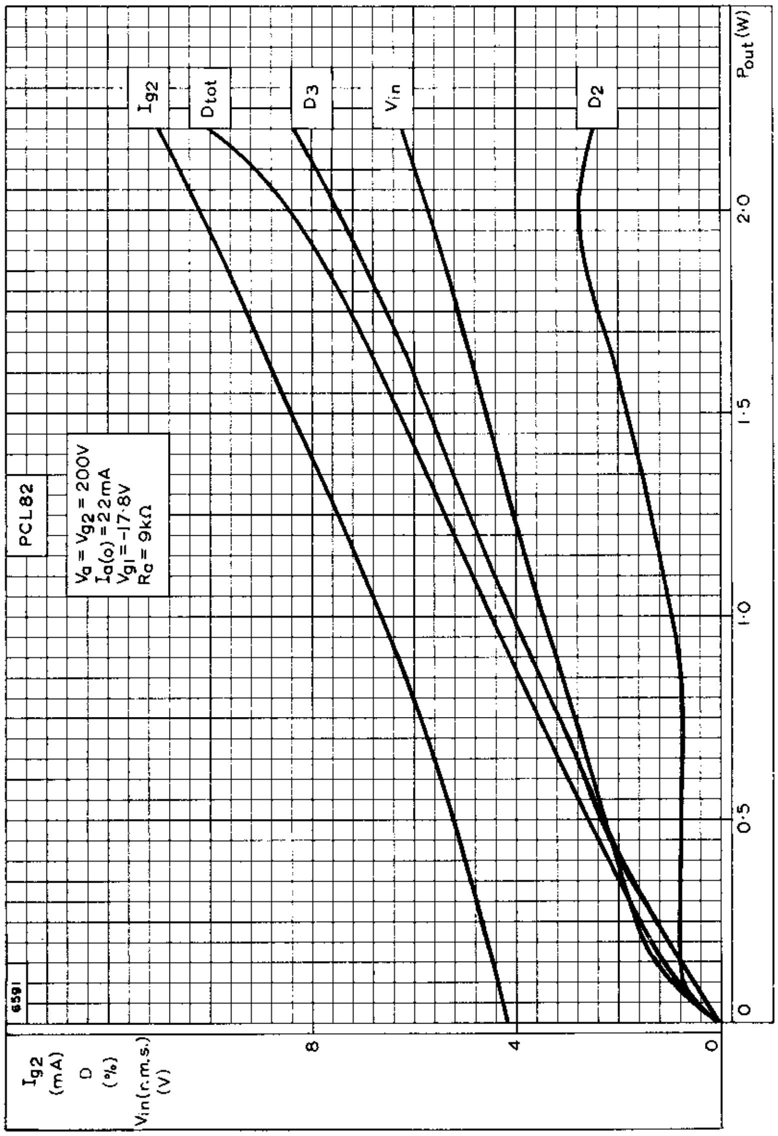
MUTUAL CONDUCTANCE PLOTTED AGAINST GRID VOLTAGE.
TRIODE SECTION



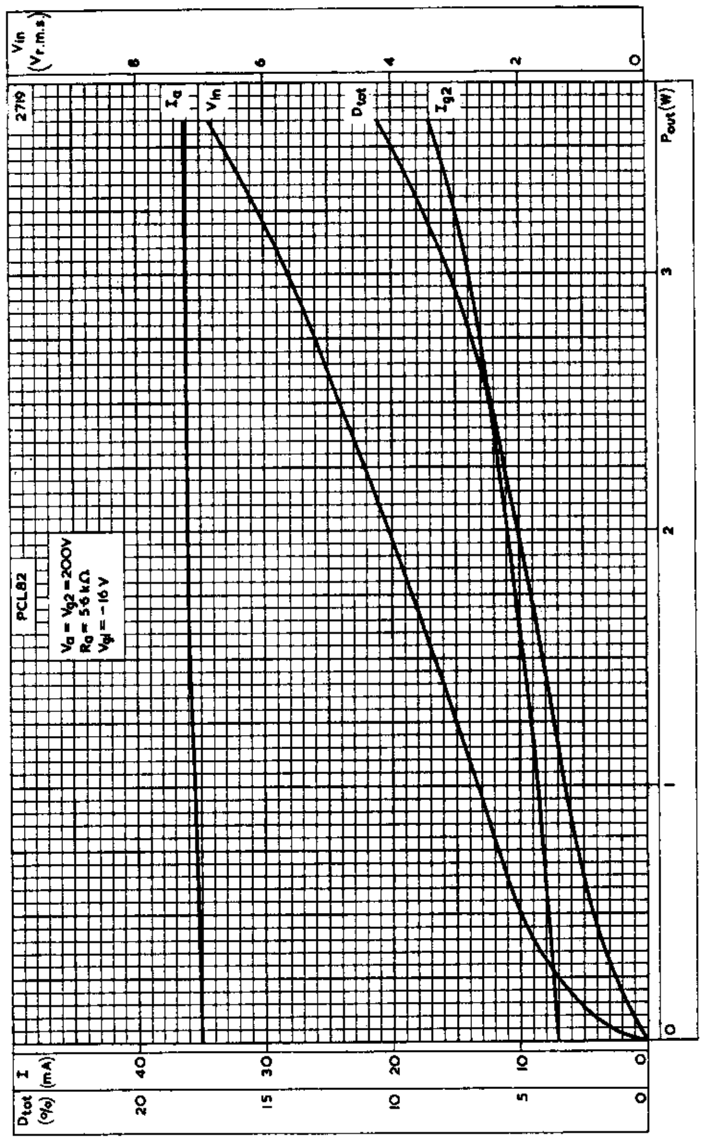
PERFORMANCE OF PENTODE SECTION AS CLASS 'A' AMPLIFIER WITH FIXED BIAS. $V_a = 170V$, $R_a = 7k\Omega$



PERFORMANCE OF PENTODE SECTION AS CLASS 'A' AMPLIFIER WITH FIXED BIAS. $V_a = 170V$, $R_a = 3.9k\Omega$



PERFORMANCE OF PENTODE SECTION AS CLASS 'A' AMPLIFIER WITH FIXED BIAS. $V_a = 200V$, $R_a = 9k\Omega$



PERFORMANCE OF PENTODE SECTION AS CLASS 'A' AMPLIFIER WITH FIXED BIAS. $V_a = 200V$, $R_a = 5.6k\Omega$

TRIODE PENTODE

PCL84

Triode pentode for use in television circuits as keyed a.g.c. valve, sync-separator, sync-amplifier or in noise suppression circuits. Pentode section for use as video output valve.

HEATER

I_h	300	mA
V_h	15	V

CAPACITANCES

c_{at-g1}	<10	mpF
c_{gt-g1}	<10	mpF
Pentode section		
c_{in}	8.7	pF
c_{out}	4.2	pF
c_{a-g1}	<100	mpF
Triode section		
c_{g-k}	3.8	pF
c_{a-k}	2.3	pF
c_{a-g}	2.7	pF
c_{g-h}	<100	mpF

CHARACTERISTICS

Pentode section

V_a	170	200	220	V
V_{g2}	170	200	220	V
V_{g1}	−2.1	−2.9	−3.4	V
I_a	18	18	18	mA
I_{g2}	3.0	3.0	3.0	mA
g_m	11	10.4	10	mA/V
r_a	100	130	150	kΩ
μ_{g1-g2}	36	36	36	
V_{g1} max. ($I_{g1} = +0.3\mu A$)			−1.3	V

Triode section

V_a	200	V
V_g	−1.7	V
I_a	3.0	mA
g_m	4.0	mA/V
r_a	16.2	kΩ
μ	65	
V_g max. ($I_g = +0.3\mu A$)	−1.3	V

PCL84

TRIODE PENTODE

PENTODE SECTION AS VIDEO OUTPUT VALVE

$V_b = V_{g2}$	170	200	220	V
V_{g1}	−2.0	−2.8	−3.3	V
R_a	3.0	3.0	3.0	kΩ
I_a	18	18	18	mA
I_{g2}	3.2	3.1	3.1	mA
g_m	10.4	10	9.7	mA/V

LIMITING VALUES

Pentode section

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	4.0	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
p_{g2} max.	1.7	W
I_k max.	40	mA
R_{g1-k} max. (fixed bias)	1.0	MΩ
R_{g1-k} max. (self bias)	2.0	MΩ
V_{h-k} max.	200	V
R_{h-k} max.	20	kΩ

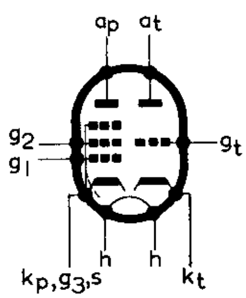
Triode section

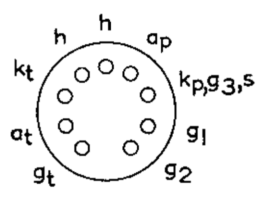
$V_{a(b)}$ max.	550	V
V_a max.	250	V
$v_{a(pk)}$ max.	600	V
p_a max.	1.0	W
*$i_{k(pk)}$ max.	160	mA
I_k max.	12	mA
R_{g-k} max. (fixed bias)	1.0	MΩ
R_{g-k} max. (self bias)	3.0	MΩ
V_{h-k} max. (cathode negative)	150	V
†V_{h-k} max. (cathode positive)	350	V
R_{h-k} max.	20	kΩ

*Maximum pulse duration = 800μs.

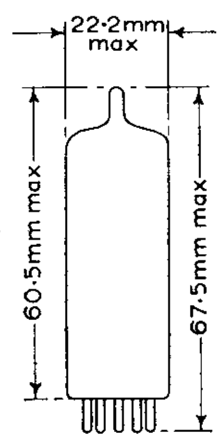
†Maximum d.c. component = 200V.

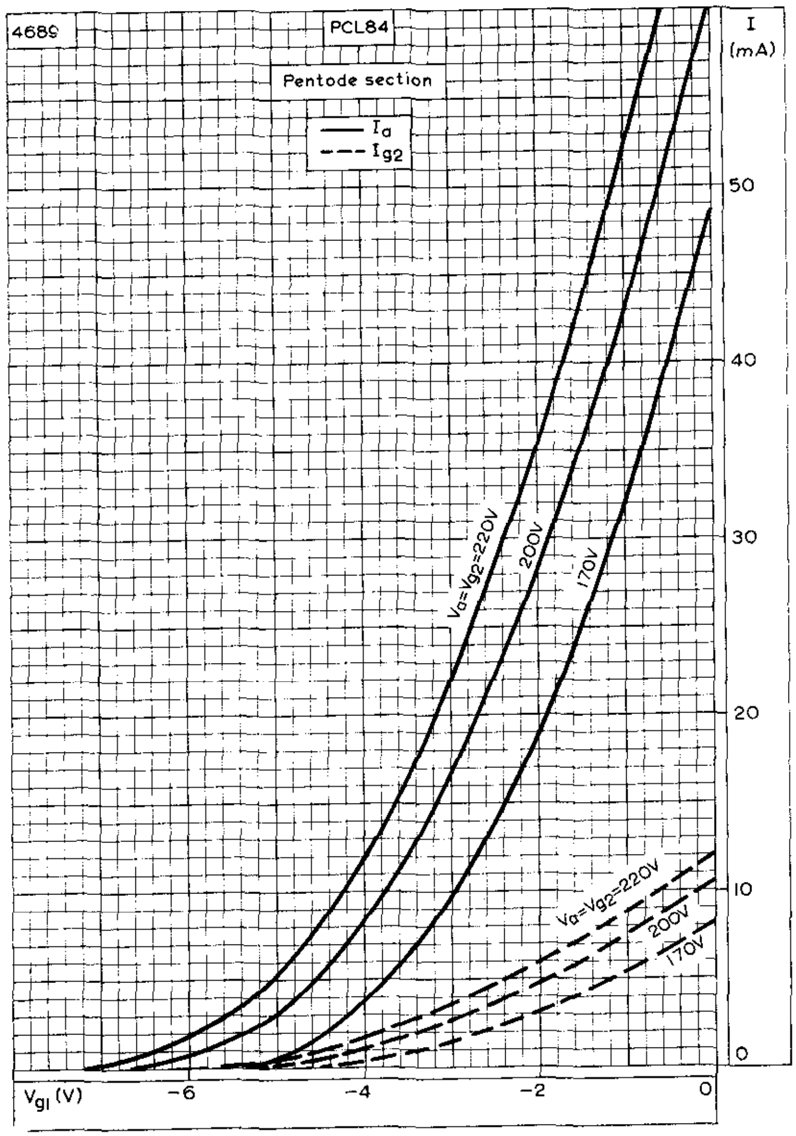
4690





B9A Base

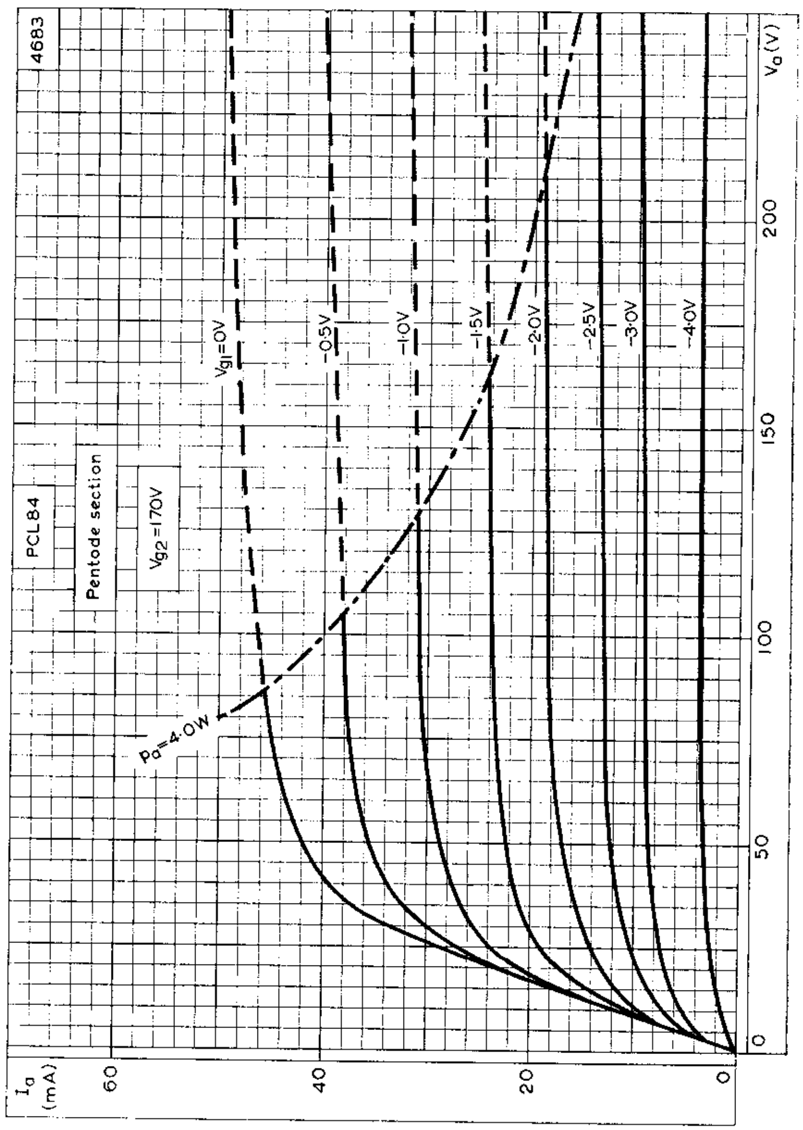




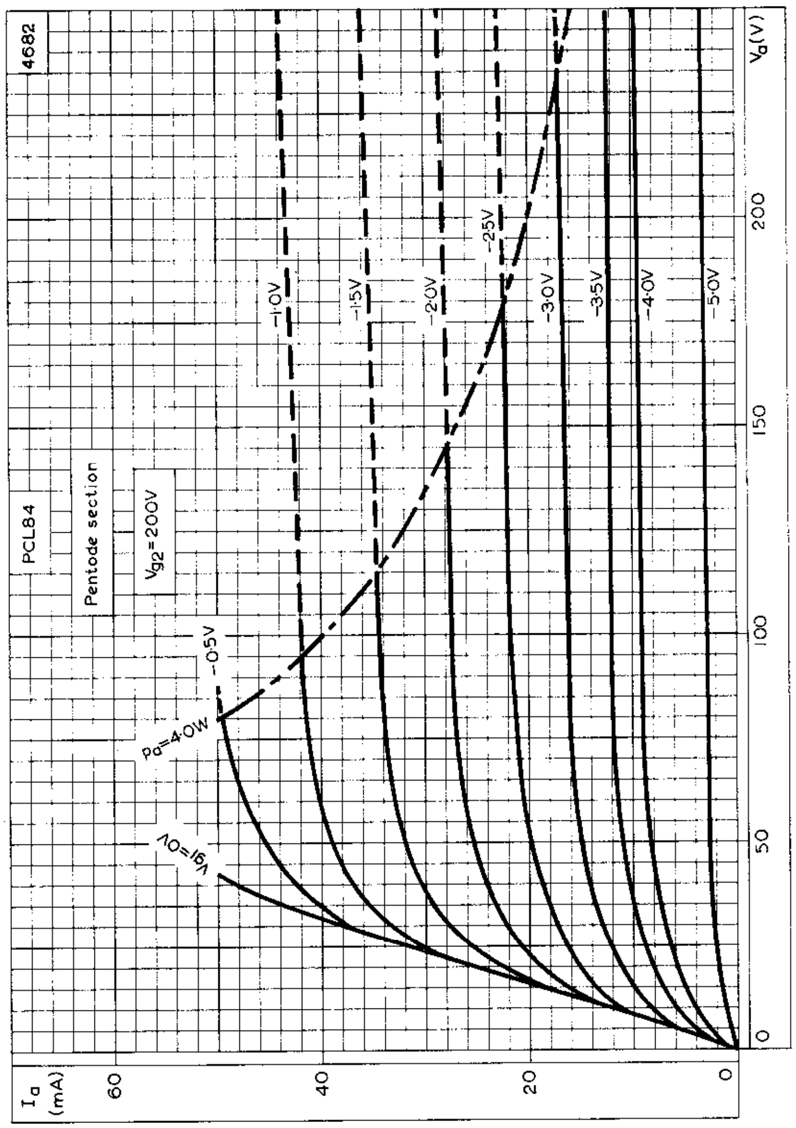
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR VARIOUS ANODE AND SCREEN-GRID VOLTAGES

PCL84

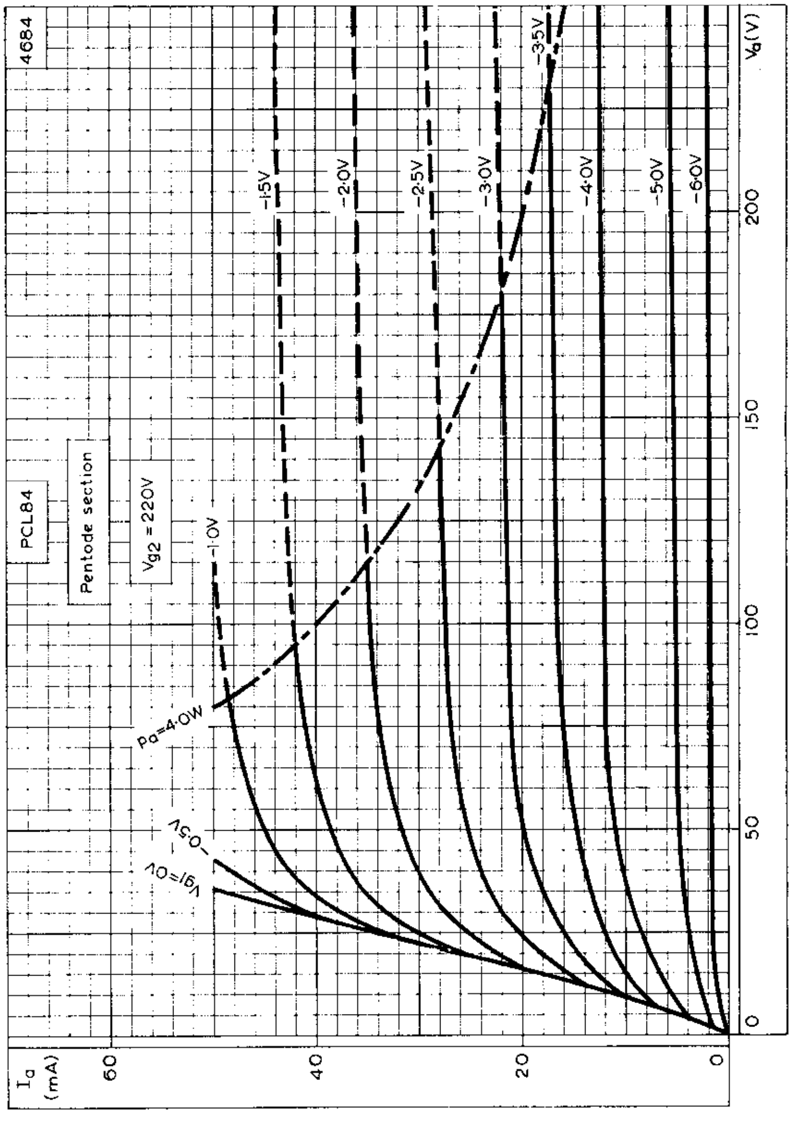
TRIODE PENTODE



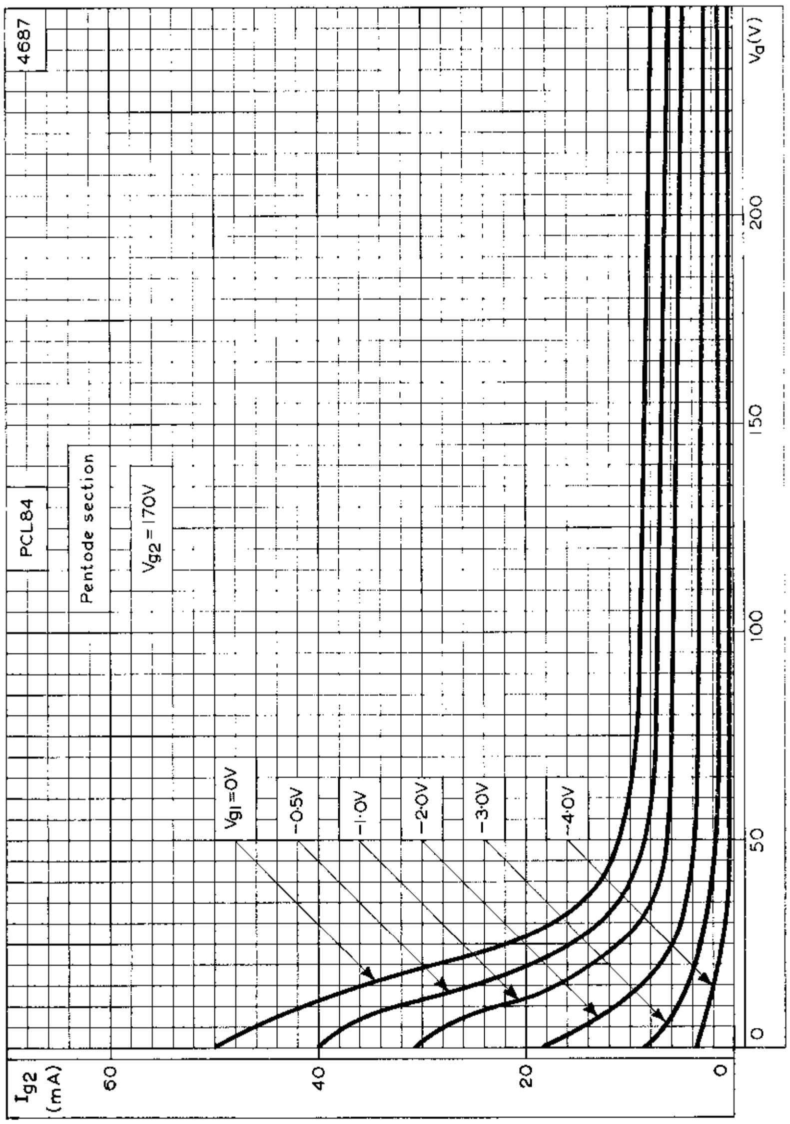
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER.
V_{g2} = 170V



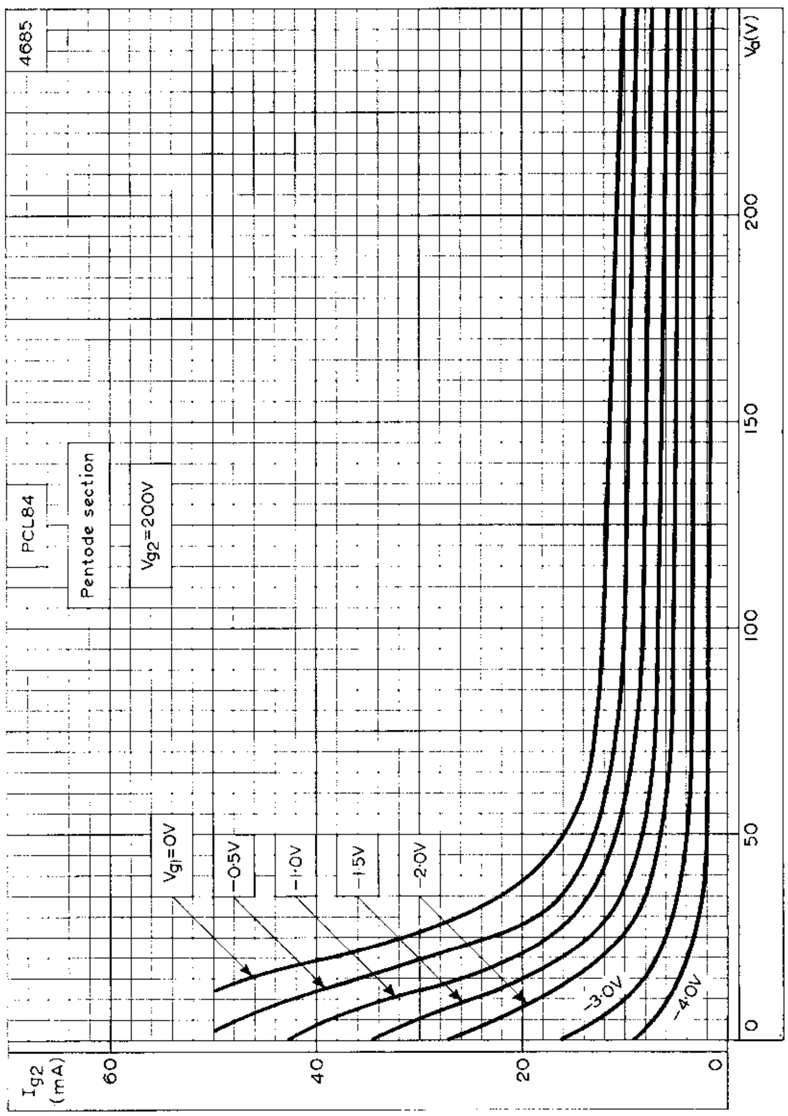
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER
$V_{g2} = 200V$



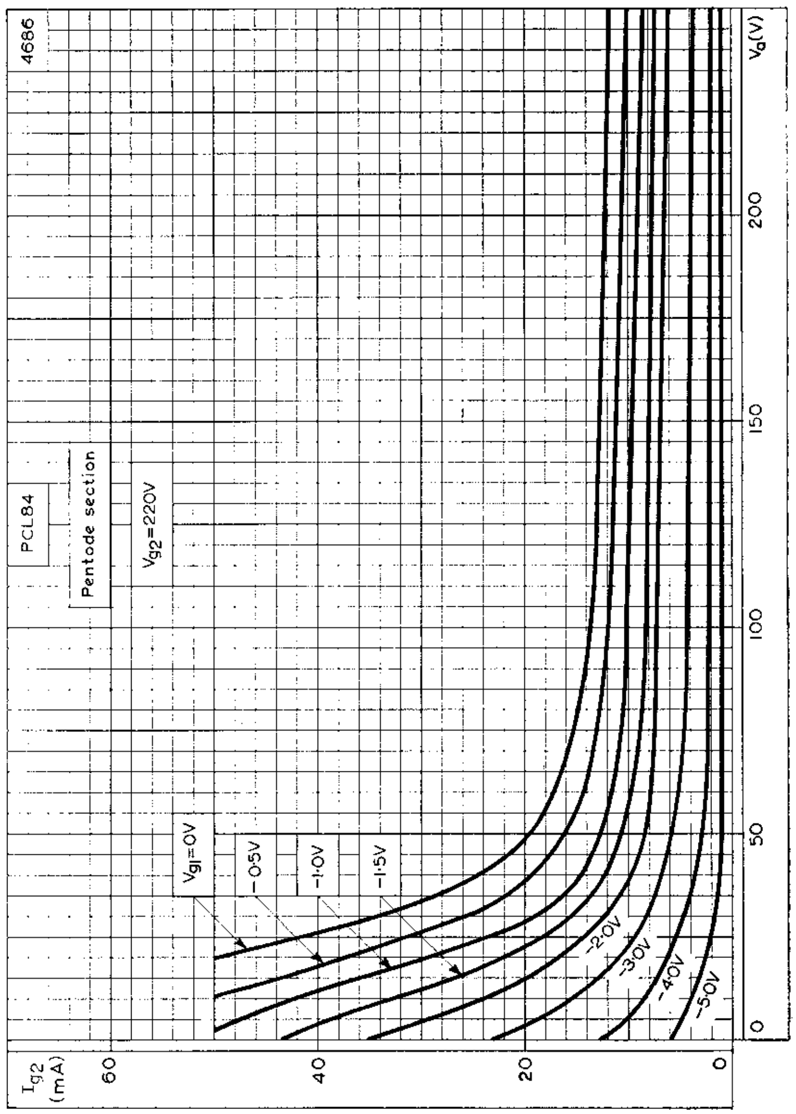
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER
V_{g2} — 220V



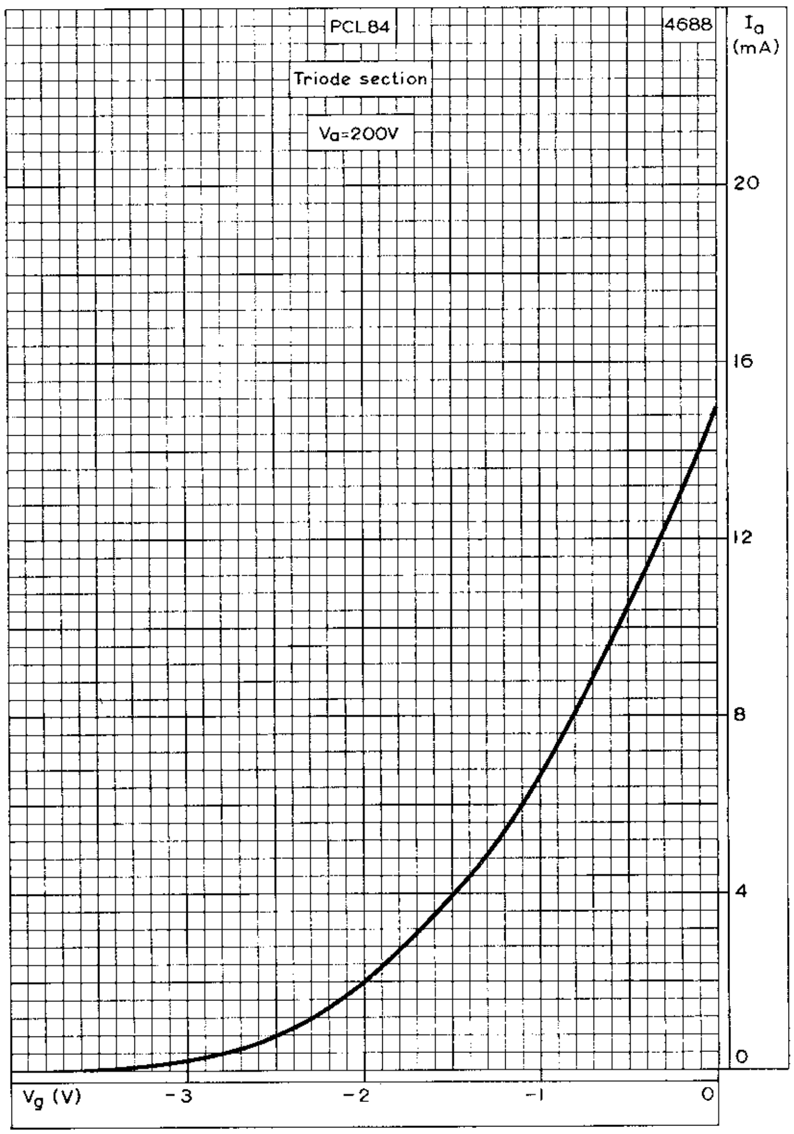
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER
V_{g2} — 170V



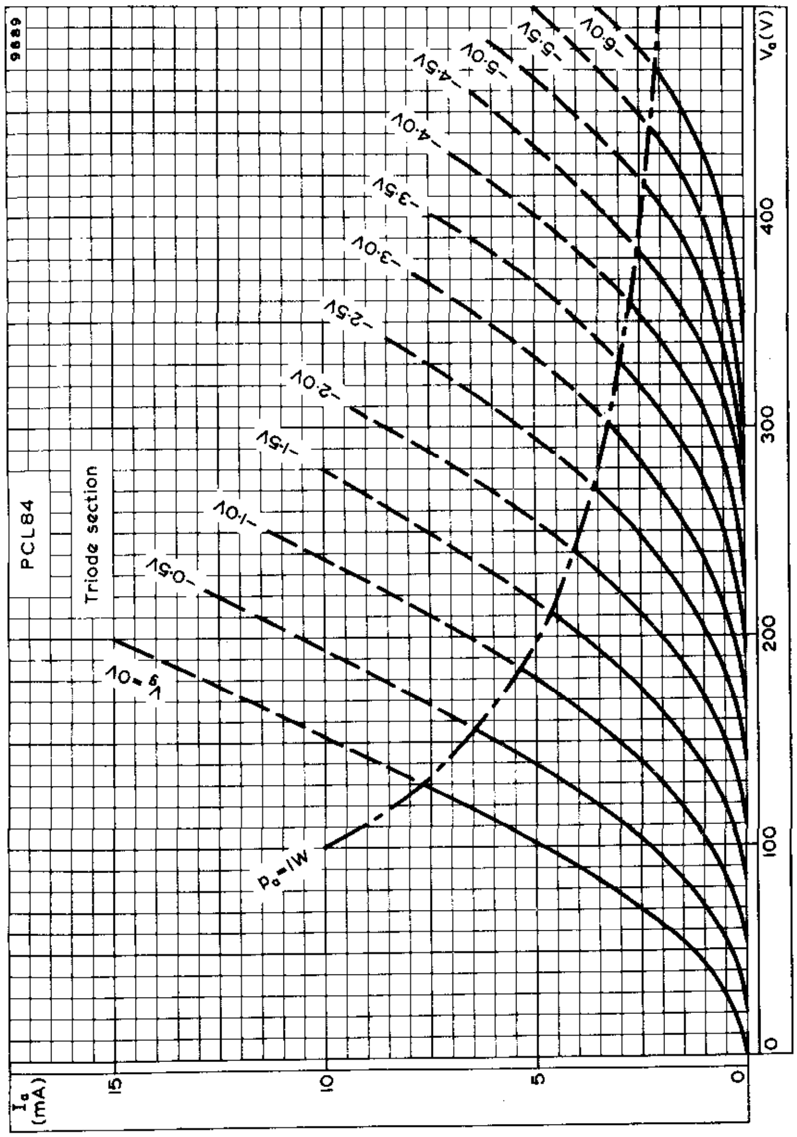
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER
V_{g2} = 200V



SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER
V_{g2} = 220V



ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE
FOR TRIODE SECTION



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. TRIODE SECTION

TRIODE PENTODE

PCL86

Combined high-μ triode and output pentode for use in the audio amplifier stage of television receivers.

HEATER

I_h	300	mA
V_h	13.3	V

CAPACITANCES

c_{ap-gt}	<6.0	mpF
c_{at-g1}	<200	mpF
c_{gt-g1}	<20	mpF
c_{at-ap}	<150	mpF
Pentode section		
c_{in}	10	pF
c_{a-g1}	<400	mpF
c_{g1-h}	<240	mpF
Triode section		
c_{in}	2.3	pF
c_{out}	2.5	pF
c_{a-g}	1.4	pF
c_{g-h}	<6.0	mpF

CHARACTERISTICS

Pentode section		
V_a	230	V
V_{g2}	230	V
V_{g1}	−5.7	V
I_a	39	mA
I_{g2}	6.5	mA
g_m	10.5	mA/V
r_a	45	kΩ
μ_{g1-g2}	21	
$-V_{g1}$ max ($I_{g1} = +0.3\mu A$)	1.3	V
Triode section		
V_a	230	V
V_g	−1.7	V
I_a	1.2	mA
g_m	1.6	mA/V
μ	100	
r_a	62	kΩ
$-V_{g1}$ max ($I_{g1} = +0.3\mu A$)	1.3	V

OPERATING CONDITIONS AS SINGLE VALVE AMPLIFIER

Pentode section			
V_a	230	200	V
V_{g2}	230	200	V
V_{g1}	−5.7	−4.7	V
R_k	125	115	Ω
I_a	41	34	mA
I_{g2}	10.5	9.0	mA
R_a	5.1	5.6	kΩ
P_{out}	4.1	3.1	W
$V_{in(r.m.s.)}$	3.6	3.2	V
D_{tot}	10	10	%
$V_{in(r.m.s.)}$ (P_{out} = 50mW)	300	290	mV

PCL86 TRIODE PENTODE

OPERATING CONDITIONS FOR TRIODE SECTION AS RESISTANCE COUPLED A.F. AMPLIFIER

Grid current bias (R_g = 10MΩ)

				Z_s = 0kΩ		Z_s = 220kΩ	
V_b (V)	R_a (kΩ)	R_g† (kΩ)	I_a (mA)	$\frac{V_{out}}{V_{in}}$	$V_{out(r.m.s.)}$* (V)	$\frac{V_{out}}{V_{in}}$	$V_{out(r.m.s.)}$** (V)
230	47	150	1.37	40	15	32	18
170	47	150	0.82	36	9	29	11
230	100	330	0.90	57	22	45	26
170	100	330	0.58	53	13	42	16
230	220	680	0.57	72	26	55	33
170	220	680	0.37	67	15	52	21

*Output voltage measured at D_{tot} = 5%.

$\frac{V_{out}}{V_{in}}$ measured with $V_{in(r.m.s.)}$ = 100mV.

†Grid resistor of following valve.

**When operating this valve with grid current bias and a high source impedance, the second harmonic distortion rises to a peak at quite low levels of output (about $10V_{r.m.s.}$) and then falls with increasing drive. The third harmonic then begins to rise, and D_{tot} finally reaches 5% at a much higher output level than with zero source impedance. The maximum value of this distortion peak varies inversely with the anode load, being about 5.5% with R_a = 47kΩ, 4.5% with R_a = 100kΩ and 4% with R_a = 220kΩ.

LIMITING VALUES

Pentode section

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	9.0	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
p_{g2} max.	1.8	W
I_k max.	55	mA
R_{g1-k} max.	1.0	MΩ
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ

Triode section

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	500	mW
I_k max.	4.0	mA
R_{g-k} max.	1.0	MΩ
V_{h-k} max.	100	V
†R_{h-k} max.	20	kΩ

†When used as a phase inverter immediately preceding the output stage, R_{h-k} max. may be 120kΩ.

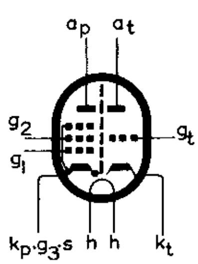
OPERATING NOTES

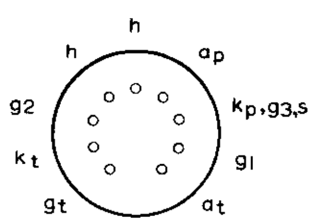
1. Microphony

This valve may be used without special precautions against microphony in equipment where the input voltage is not less than 10mV for an output of 50mW.

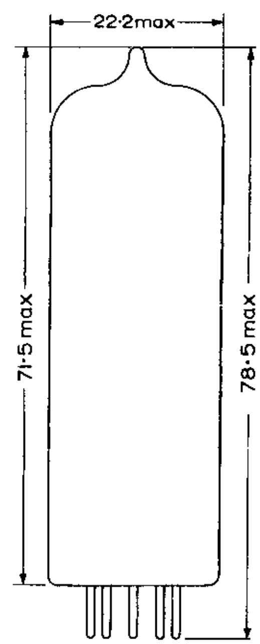
2. Hum

To obtain the minimum value of hum, the a.c. voltage between pin 4 and triode cathode should not exceed 30V.



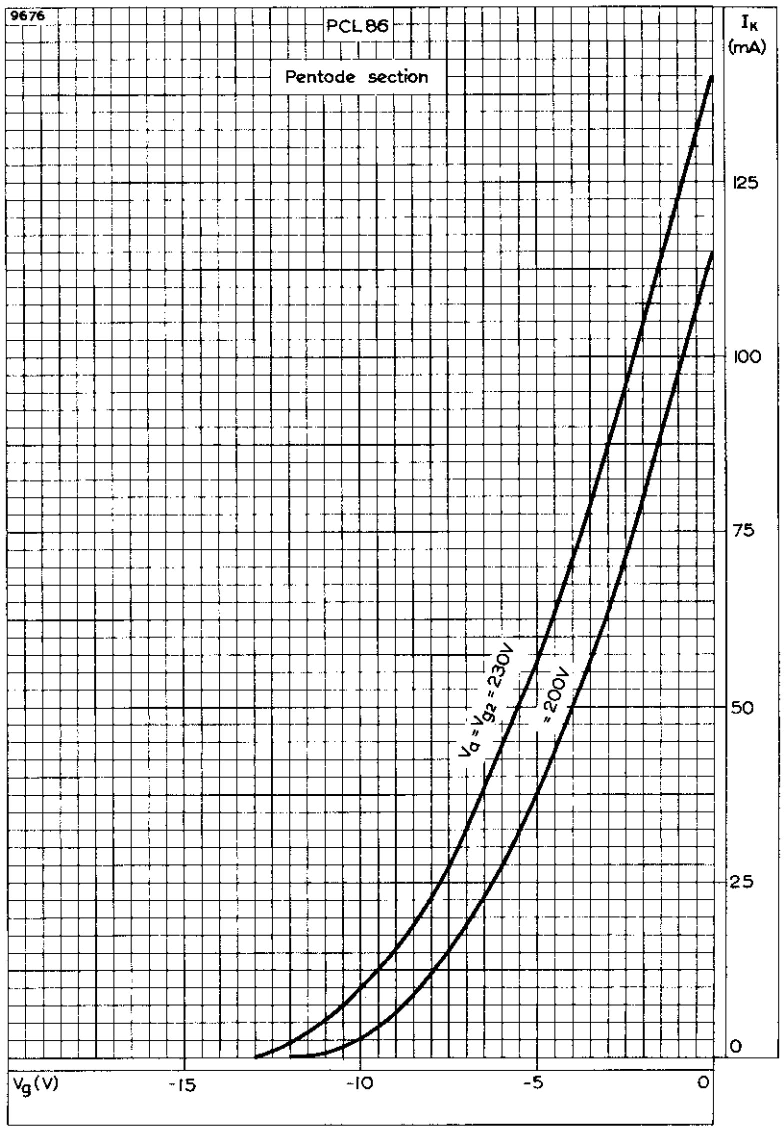


B9A Base



All dimensions in mm

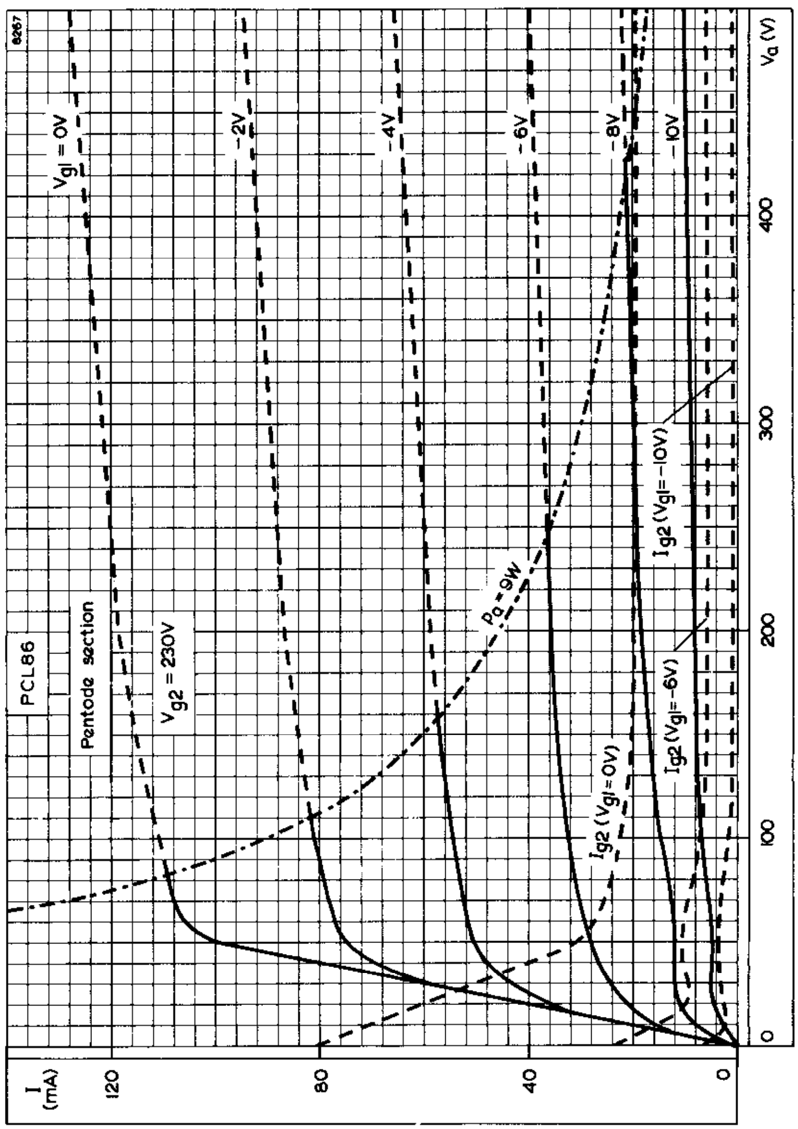
7471



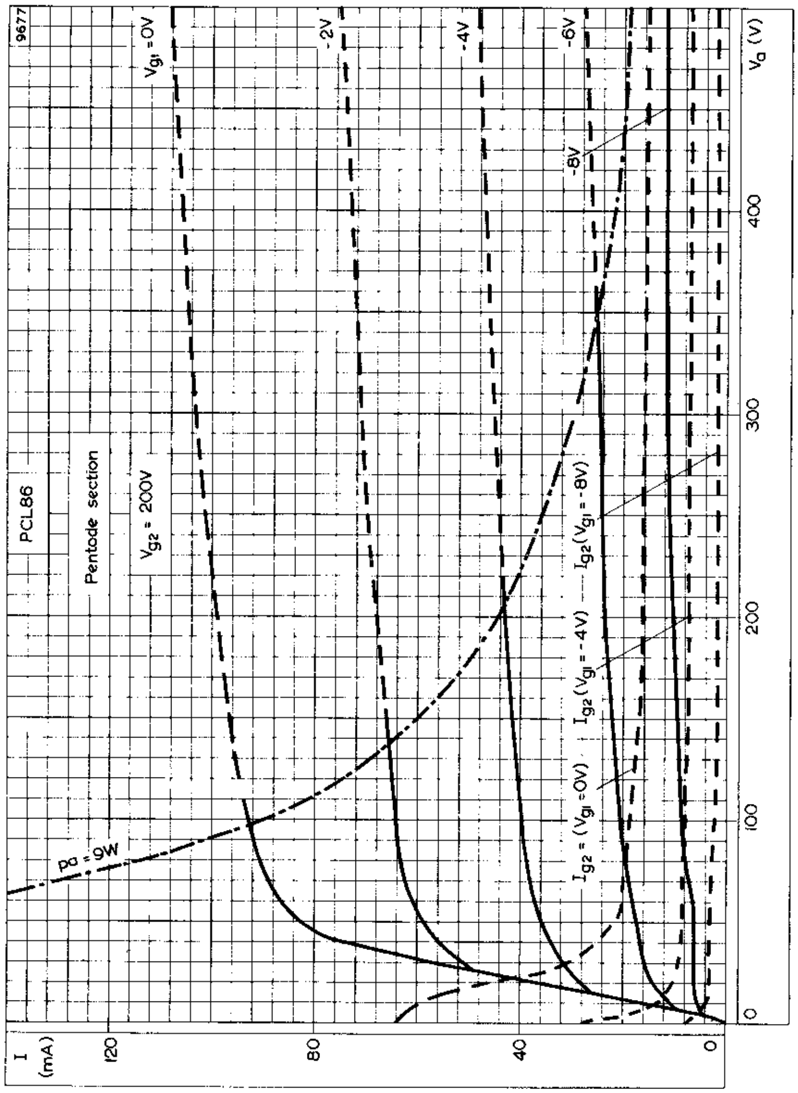
CATHODE CURRENT PLOTTED AGAINST CONTROL GRID VOLTAGE WITH ANODE AND SCREEN GRID VOLTAGES AS PARAMETER. PENTODE SECTION

PCL86

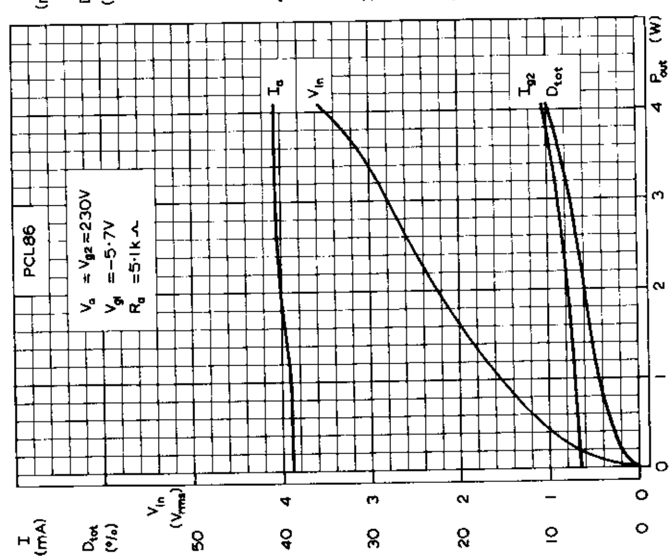
TRIODE PENTODE



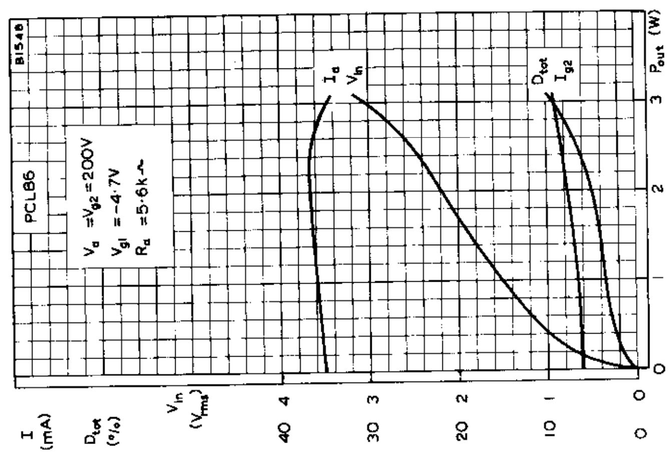
ANODE AND SCREEN GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL GRID VOLTAGE AS PARAMETER.
PENTODE SECTION $V_{g2} = 230V$



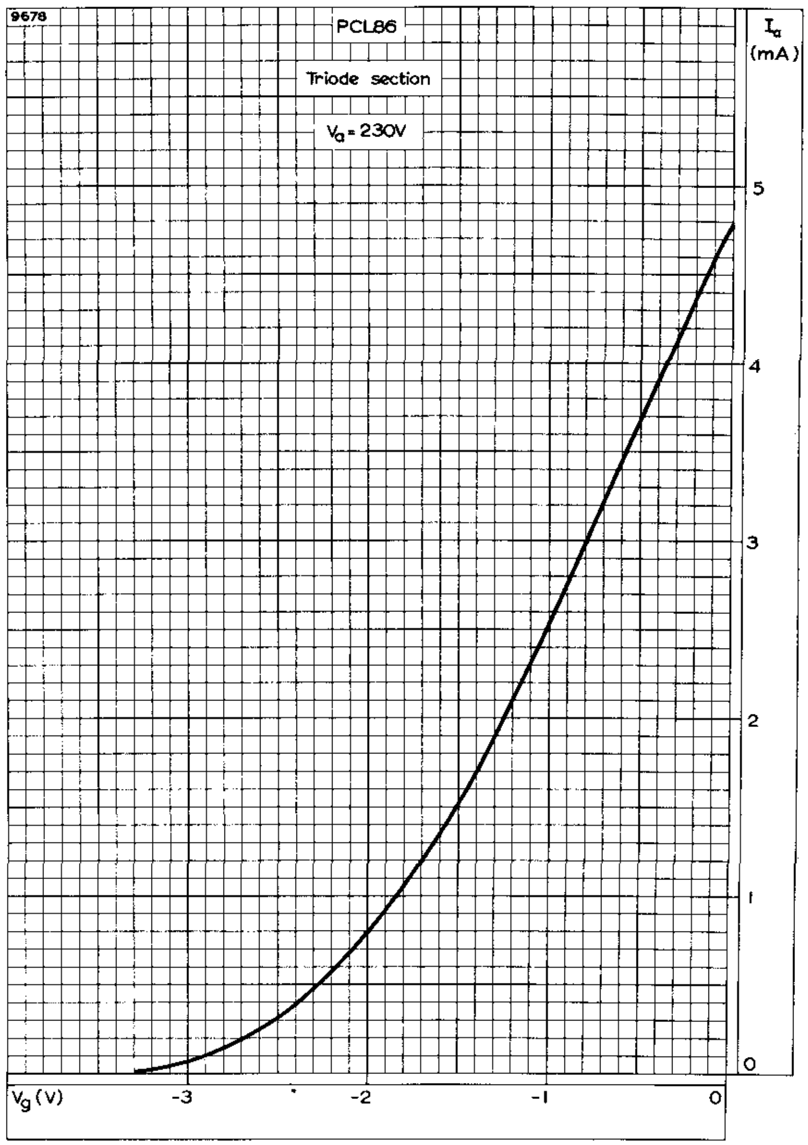
ANODE AND SCREEN GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL GRID VOLTAGE AS PARAMETER.
PENTODE SECTION $V_{g2} = 200V$



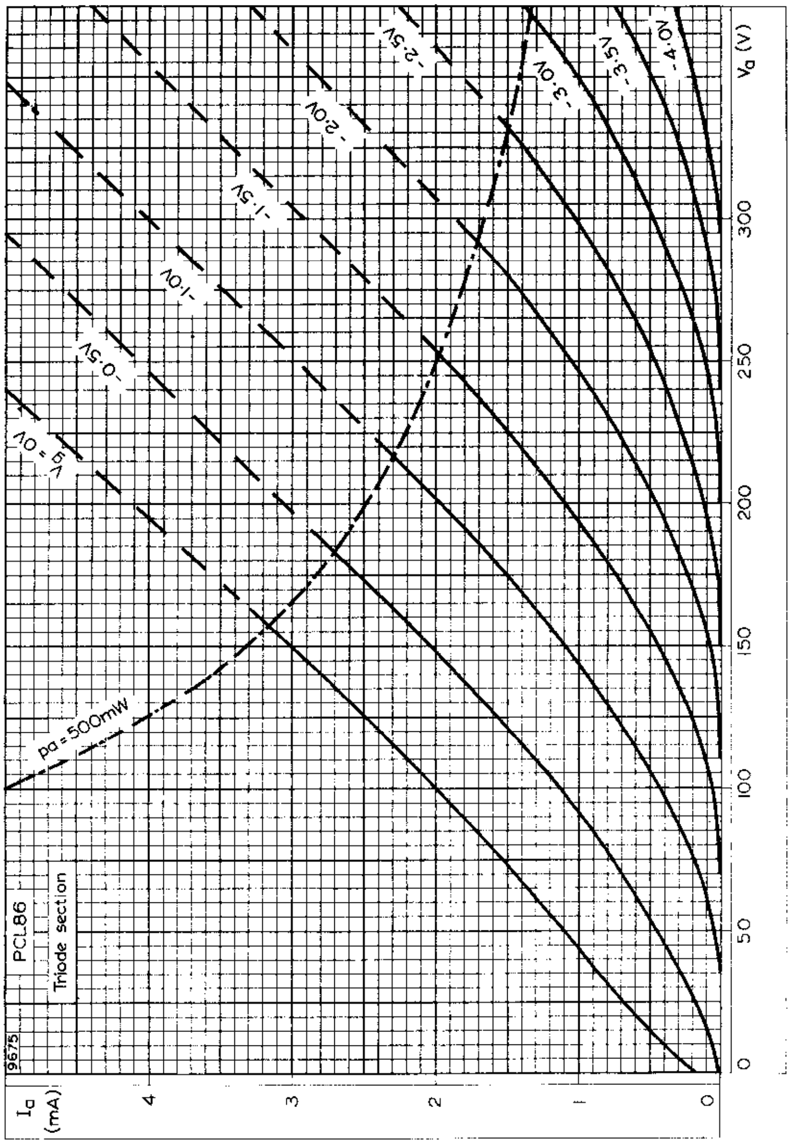
PERFORMANCE OF PCL86 AS SINGLE VALVE AMPLIFIER. PENTODE SECTION $V_a = V_{g2} = 230V$, $R_k = 125\Omega$



PERFORMANCE OF PCL86 AS SINGLE VALVE AMPLIFIER. PENTODE SECTION $V_a = V_{g2} = 200V$, $R_k = 115\Omega$



ANODE CURRENT PLOTTED AGAINST CONTROL GRID VOLTAGE.
TRIODE SECTION $V_a = 230V$



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL GRID VOLTAGE AS PARAMETER.
TRIODE SECTION

TRIODE PENTODES

PCL805
PCL85

Combined triode pentode with separate cathodes for use as a field oscillator and field output valve in television receivers
Data is applicable to both types

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	17.5	V ←

←

CAPACITANCES

c_{ap-gt}	< 0.03	pF
c_{ap-g1}	< 0.6	pF
c_{at-g1}	< 0.08	pF
c_{g1-h}	< 0.2	pF
c_{gt-h}	< 0.15	pF

CHARACTERISTICS (See NOTES) ←

Pentode section (field output application)

V_a	50	65	V
V_{g2}	170	210	V
V_{g1}	-1	-1	V
$I_{a(pk)}$	200	285	mA
$I_{g2(pk)}$	35	45	mA

Triode section

V_a	100	100	V
V_g	-0.85	0	V
I_a	5	10.5	mA
g_m	5.5	7	mA/V
μ	60	63	
r_a	11	9	kΩ

HUM ←

The equivalent pentode grid hum voltage without negative feedback is ≤ 10mV when Z_{g1} (f = 50Hz) ≤ 500kΩ, c_{g1-h} = 0.2pF and V_{h-k} = 150V r.m.s.

RATINGS (DESIGN CENTRE SYSTEM unless otherwise stated) ←

Pentode section

$V_{a(b)}$ max.	550	V
V_a max.	300	V
*$v_{a(pk)}$ max.	2.0	kV
P_a max.	8.0	W
P_a max. (design maximum rating)	10.5	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
P_{g2} max.	1.5	W
P_{g2} max. (design maximum rating)	2.0	W
I_k max.	75	mA
R_{g1-k} max. (fixed bias)	1.0	MΩ
R_{g1-k} max. (automatic bias)	2.2	MΩ
V_{h-k} max.	200	V

*Maximum pulse duration 5% of one cycle with a maximum of 1ms.

Triode section

$V_{a(b)}$ max.	550	V
V_a max.	300	V
P_a max.	0.5	W
I_k max.	15	mA
**$i_{k(pk)}$ max.	150	mA
***$i_{k(pk)}$ max.	100	mA
R_{g-k} max. (fixed bias)	1.0	MΩ
R_{g-k} max. (automatic bias)	3.3	MΩ
†V_{h-k} max.	200	V

**Maximum pulse duration 2% of one cycle with a maximum of 0.4ms.

***Maximum pulse duration 4% of one cycle with a maximum of 0.8ms.

†During warm-up the d.c. component of V_{h-k} may rise to a maximum of 315V, cathode positive.

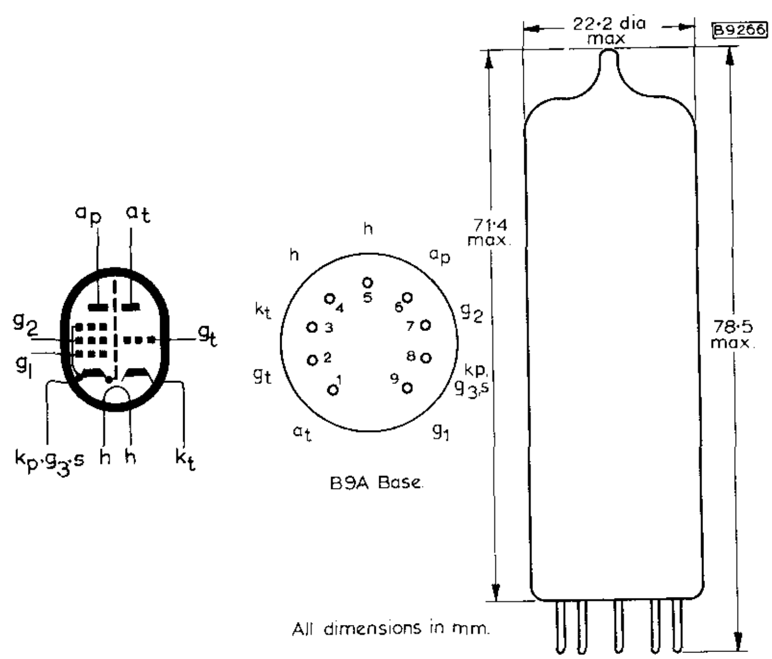
NOTES

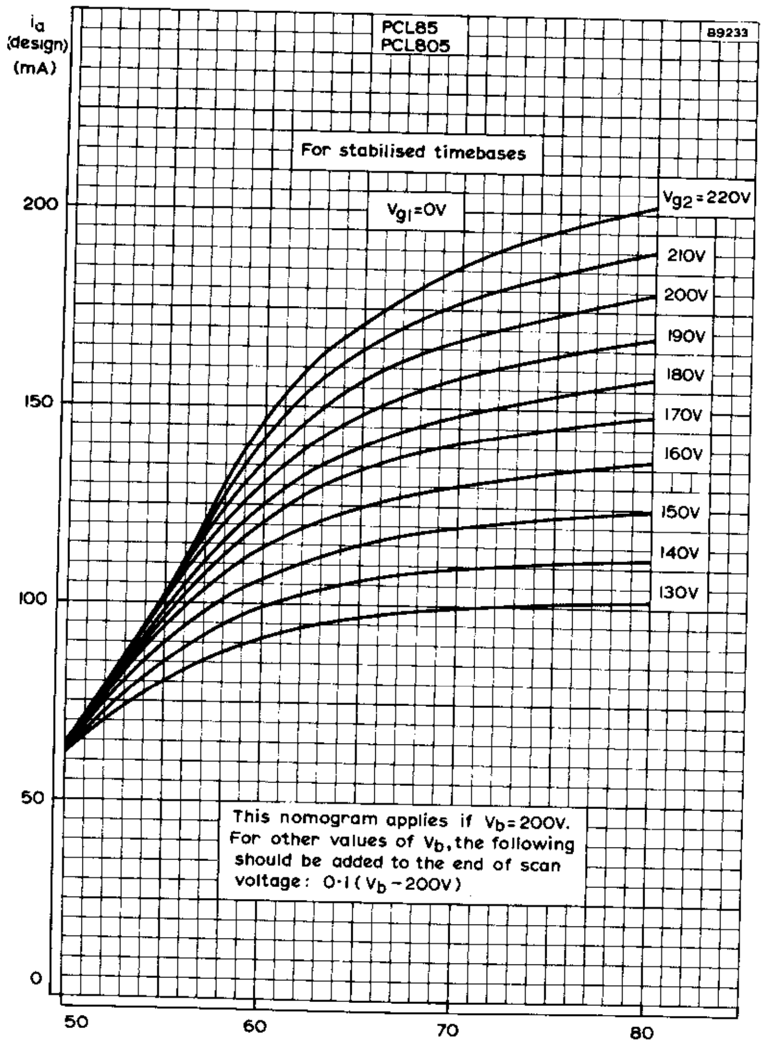
The minimum value of $i_{a(pk)}$ (pentode section) to be expected as a result of spread in valve characteristics, valve deterioration during life and decrease of the mains voltage by 10% of its nominal value, can be derived from the curves on page 9 by applying the formula:

$$i_{a(pk)} \text{ min.} = 0.6\, I_{a(1)}$$

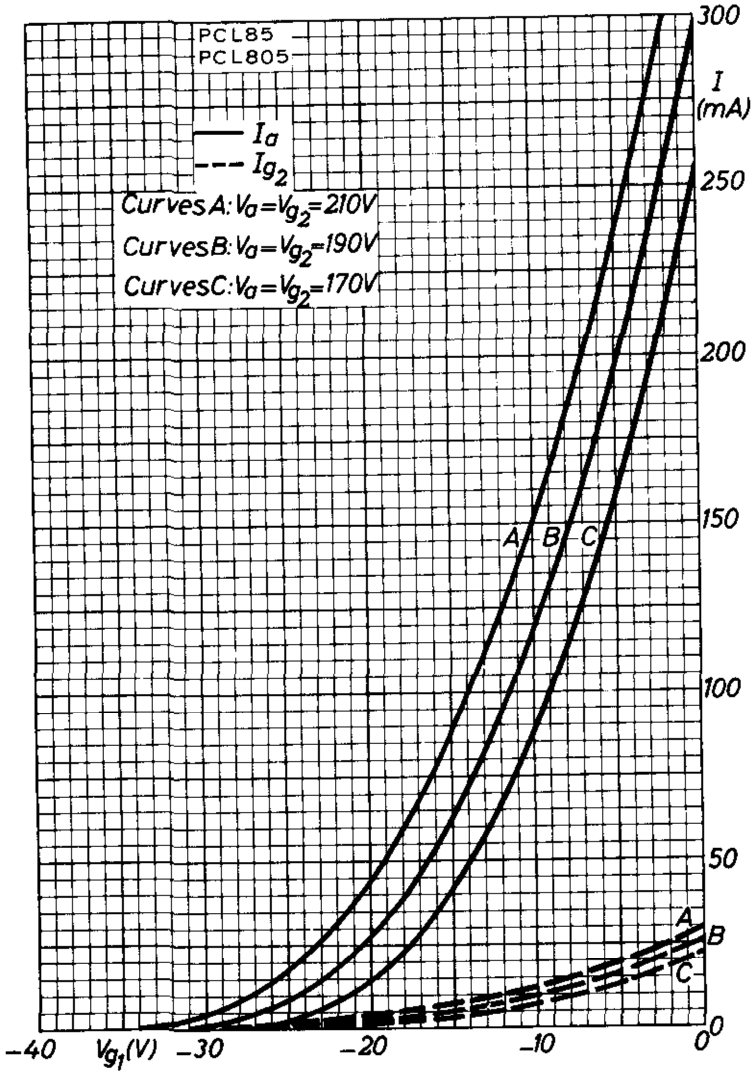
where $I_{a(1)}$ is the value of I_a at the intersection of line AB and the curve for the value of V_{g2} at the reduced mains voltage.

OUTLINE AND SCHEMATIC DRAWINGS

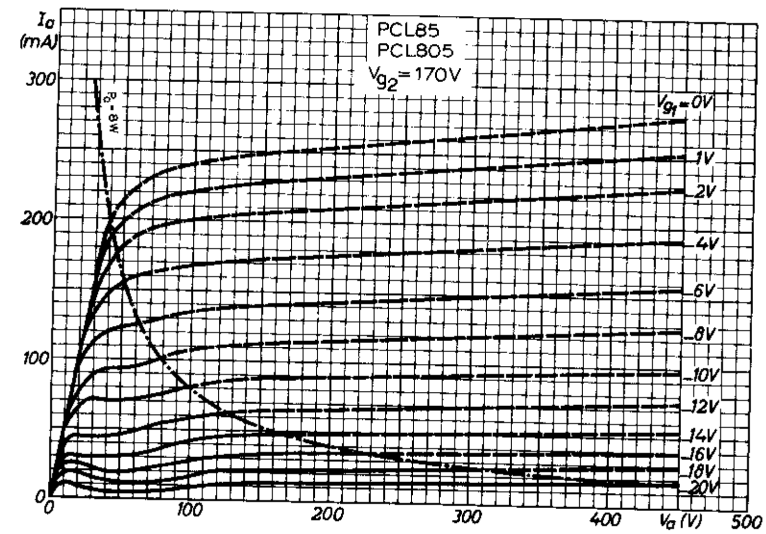




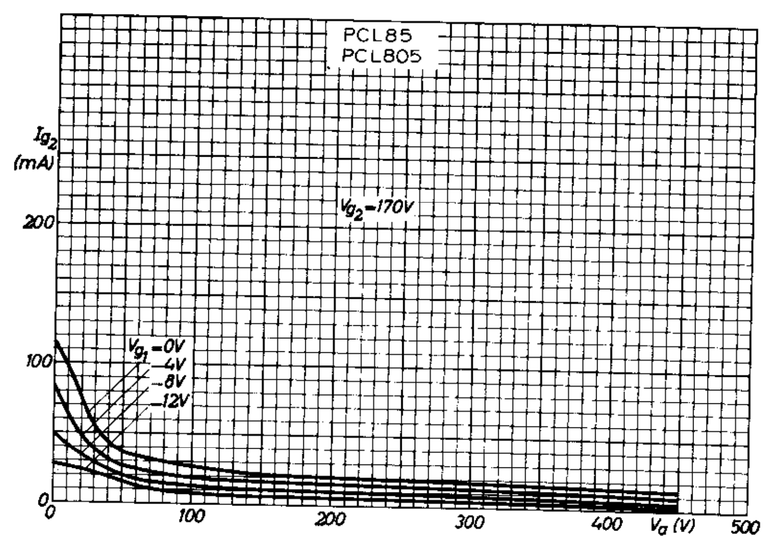
DESING CHART FOR STABILISED TIME BASES:
PENTODE SECTION



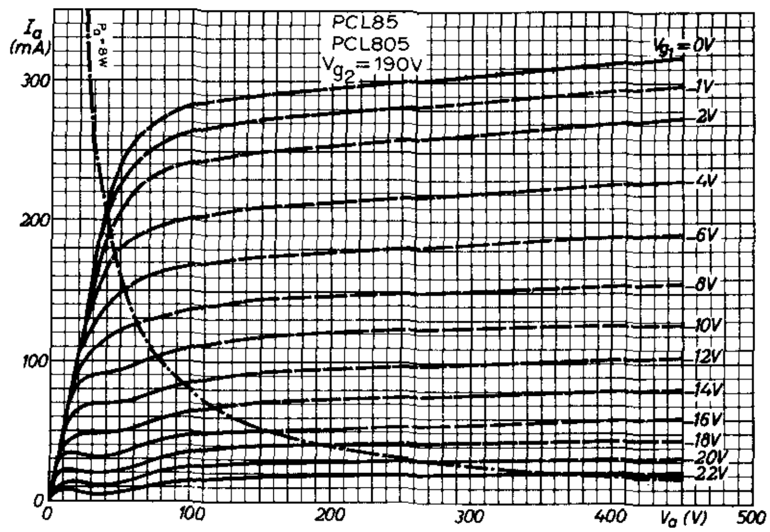
ANODE AND SCREEN GRID CURRENTS PLOTTED AGAINST GRID VOLTAGE WITH ANODE AND SCREEN GRID VOLTAGE AS PARAMETER. PENTODE SECTION



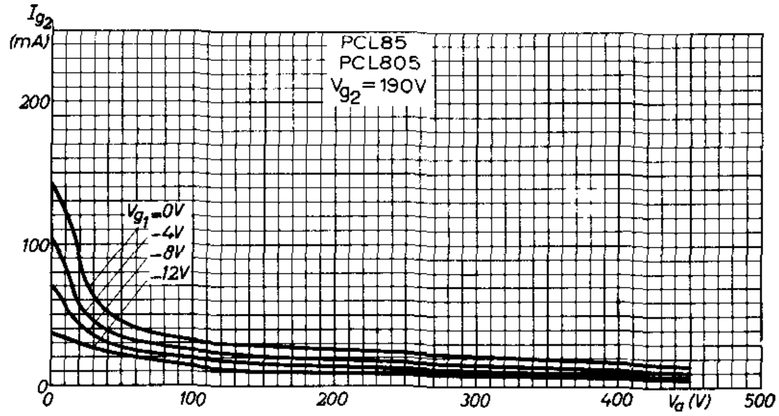
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH GRID VOLTAGE AS PARAMETER:
PENTODE SECTION



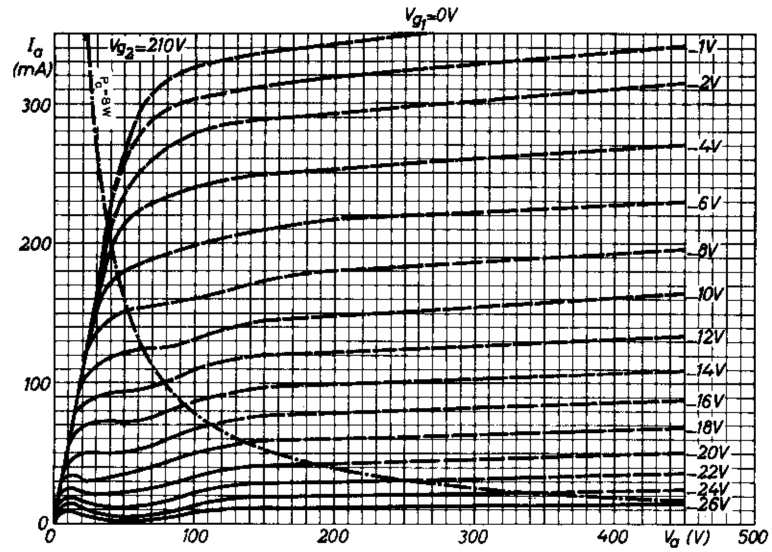
SCREEN GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL GRID AS PARAMETER:
PENTODE SECTION



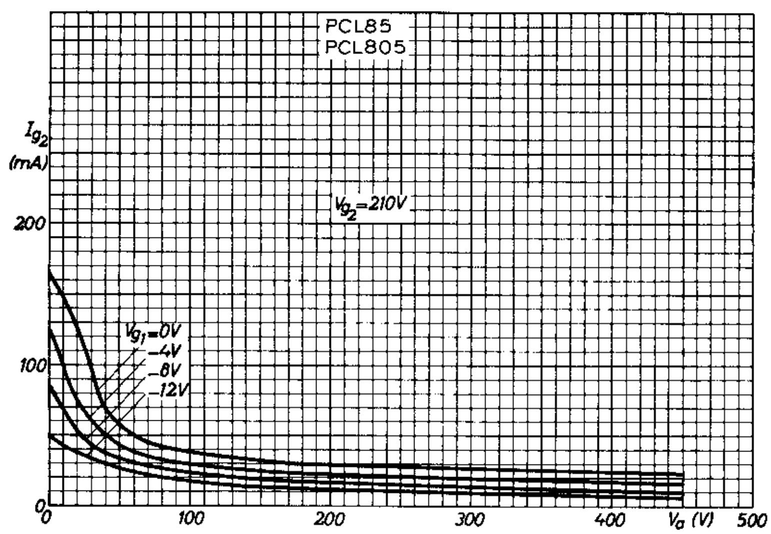
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH GRID VOLTAGE AS PARAMETER:
PENTODE SECTION



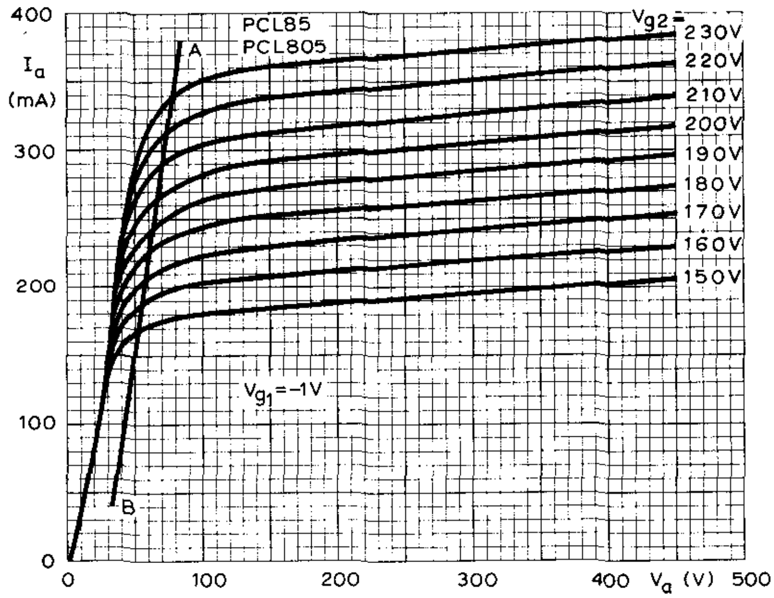
SCREEN GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL GRID AS PARAMETER:
PENTODE SECTION



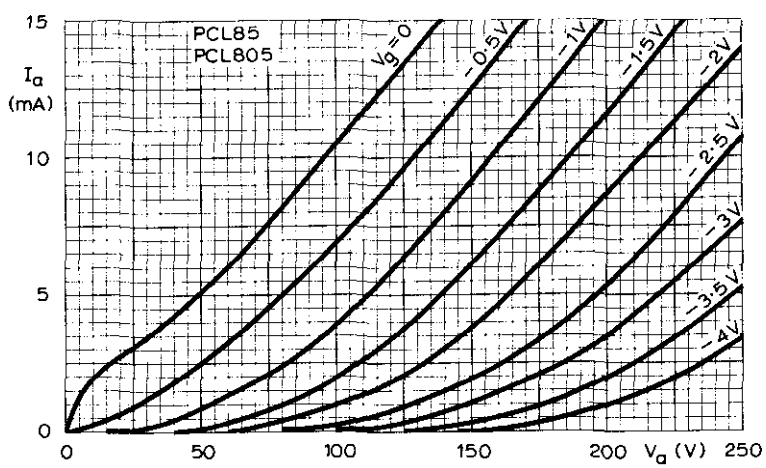
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH GRID VOLTAGE AS PARAMETER:
PENTODE SECTION



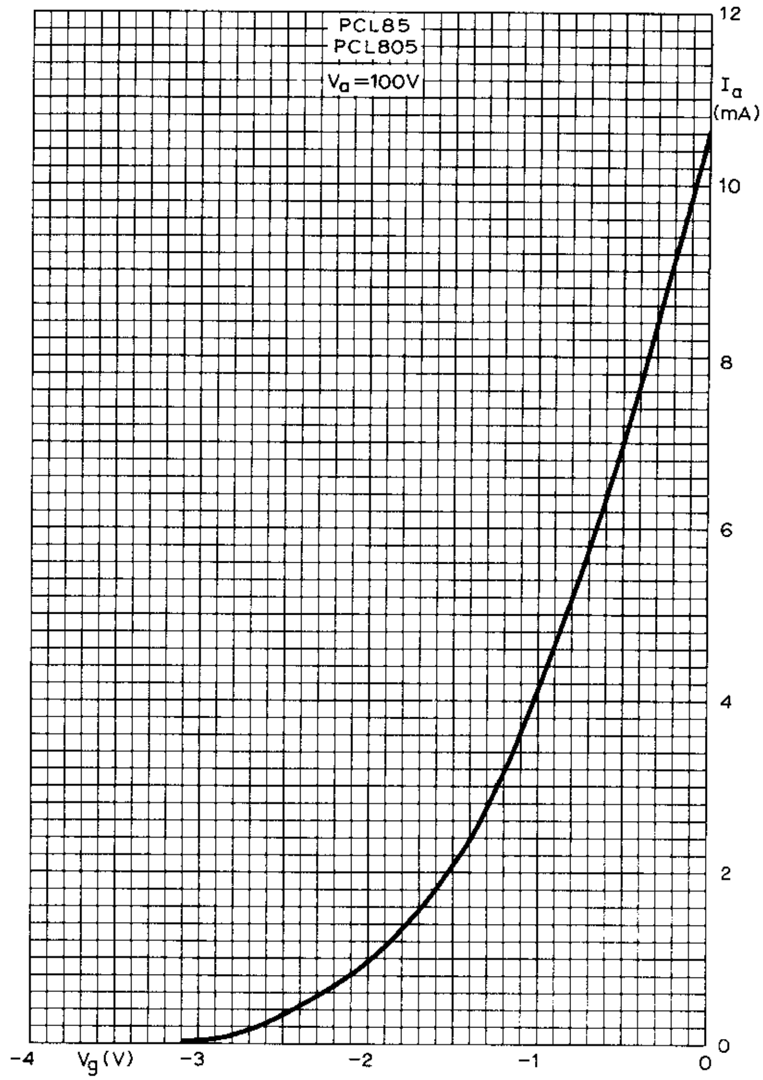
SCREEN GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL GRID AS PARAMETER:
PENTODE SECTION



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH SCREEN GRID VOLTAGE AS PARAMETER:
PENTODE SECTION



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL GRID VOLTAGE AS PARAMETER:
TRIODE SECTION



ANODE CURRENT PLOTTED AGAINST CONTROL GRID VOLTAGE:
TRIODE SECTION

SHUNT STABILISER TRIODE

PD500

High voltage triode for use as a shunt stabiliser in colour television receivers.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	7.3	V

CHARACTERISTICS

V_a	25	kV
V_s	0	V
$-V_g$ at I_a = 1.5mA	7 to 30	V
$-V_g$ *max. at* I_a = 0.1mA	40	V
ΔV_g max. between I_a = 0.1mA and I_a = 1.5mA	10	V

RATINGS (DESIGN CENTRE SYSTEM)

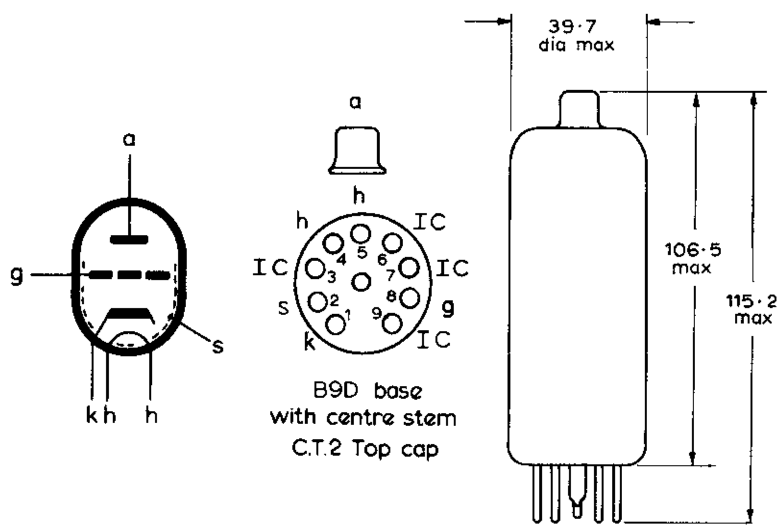
V_a max.	25	kV
V_a (absolute max. see note 1)	27.5	kV
$-V_g$ max. (see note 2)	150	V
p_a	30	W
p_a max. (intermittent rating *t.v. shunt stabiliser - see note 3*)	40	W
I_a max.	1.6	mA ←
R_{g-k} max.	5.0	MΩ
V_{h-k} max. (cathode positive)	400V d.c.+250V a.c.	
V_{h-k} max. (cathode negative)	250	V
V_{s-k} max. (shield negative - see note 4)	400	V
$T_{anode\ seal}$ (absolute max.)	200	°C

NOTES

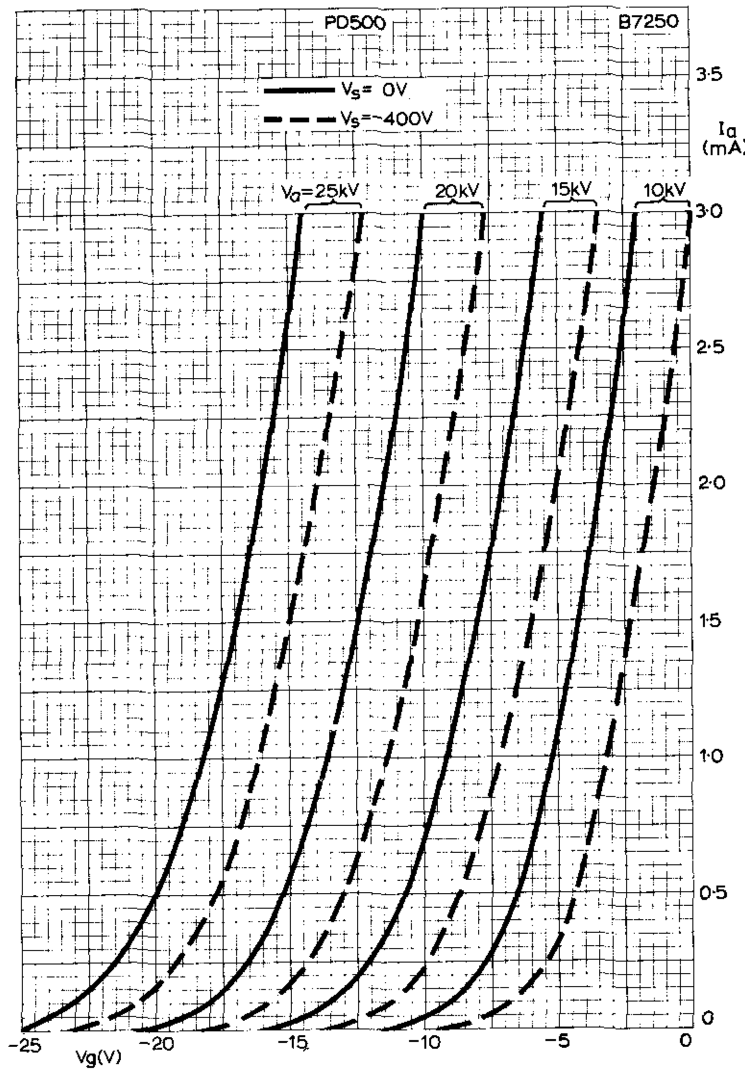
1. If due to a circuit failure the anode current becomes zero, the anode voltage should never exceed 45kV (abs. max.).
2. During equipment warm-up period and for brief intervals during equipment adjustment only, the grid voltage may rise to 440V maximum.
3. This rating applies to operation for a maximum of 10% of the time.
4. Operation with the shield positive with respect to cathode is not recommended. The shield may function as a spark trap and should have a low impedance return path to the external coating of the picture tube. A.C. potential between the shield and cathode can modulate the anode current; the maximum sensitivity is 2.5µA/V.
5. Additional support is required at the top of the valve. To prevent corona effects, any metal screening around the valve should be at least 50mm from the nearest point of the bulb. Adequate ventilation should be provided for.

X-RAYS

When operated in a television receiver this valve will produce X-radiation in excess of permissible dosage, and a suitable screen should be incorporated.



All dimensions in mm



ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE
WITH ANODE VOLTAGE AS PARAMETER

DOUBLE PENTODE PFL200

Double pentode for video output plus sync, separator, a.g.c. amplifier or i.f. amplifier applications.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	17	V ←

CAPACITANCES (unshielded) ←

$c_{a'-a''}$	<150	mpF
$c_{g1'-g1''}$	<10	mpF
$c_{a'-g1''}$	<100	mpF
$c_{a''-g1'}$	<5.0	mpF

L Section

$c_{in'}$	12.5	pF
$c_{out'}$	6.5	pF
$c_{a'-g1'}$	100	mpF

F Section

$c_{in''}$	10.5	pF
$c_{a''-g2''+k''g3''+h+k'g3',s}$	10.5	pF
$c_{a''-g1''}$	150	mpF
$c_{g1''-h}$	<150	mpF

CHARACTERISTICS ←

	Amplifier section		Output section	
V_a	150	50	170	V
V_{g2}	150	75	170	V
I_a	10	5.0	30	mA
I_{g2}	3.0	1.6	7.0	mA
V_{g1}	-2.1	-0.65	-2.7	V
g_m	8.5	6.8	22	mA/V
μ_{g1-g2}	38	34	38	
r_a	150	110	33	kΩ

RATINGS (DESIGN CENTRE SYSTEM)

Output section

V_a max.	250	V
V_{g2} max.	250	V
p_a max.	5.0	W
p_{g2} max.	2.5	W
p_{g2} max. (intermittent rating, short duration)	3.2	W
I_k max.	60	mA
I_k max. (intermittent rating, short duration)	85	mA
R_{g1-k} max.	1.0	MΩ
V_{h-k} max.	200	V

Amplifier section

$V_{a(b)}$ max.	550	V
$V_{g2(b)}$ max.	550	V
V_a max.	250	V
V_{g2} max.	250	V
p_a max.	1.5	W
p_{g2} max.	0.5	W
I_k max.	15	mA
R_{g1-k} max.	1.0	MΩ
V_{h-k} max.	200	V

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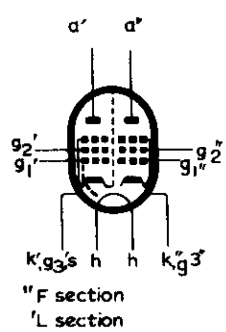
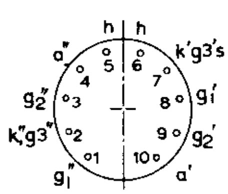
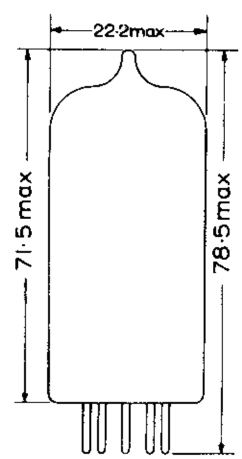
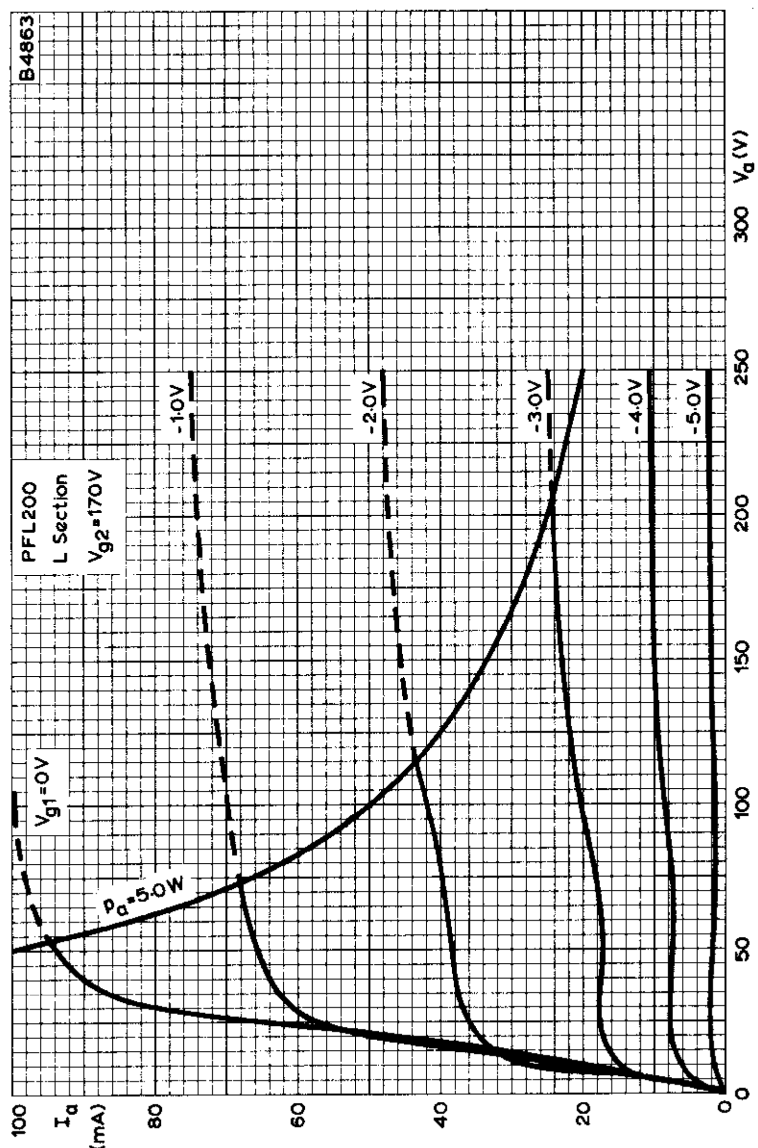


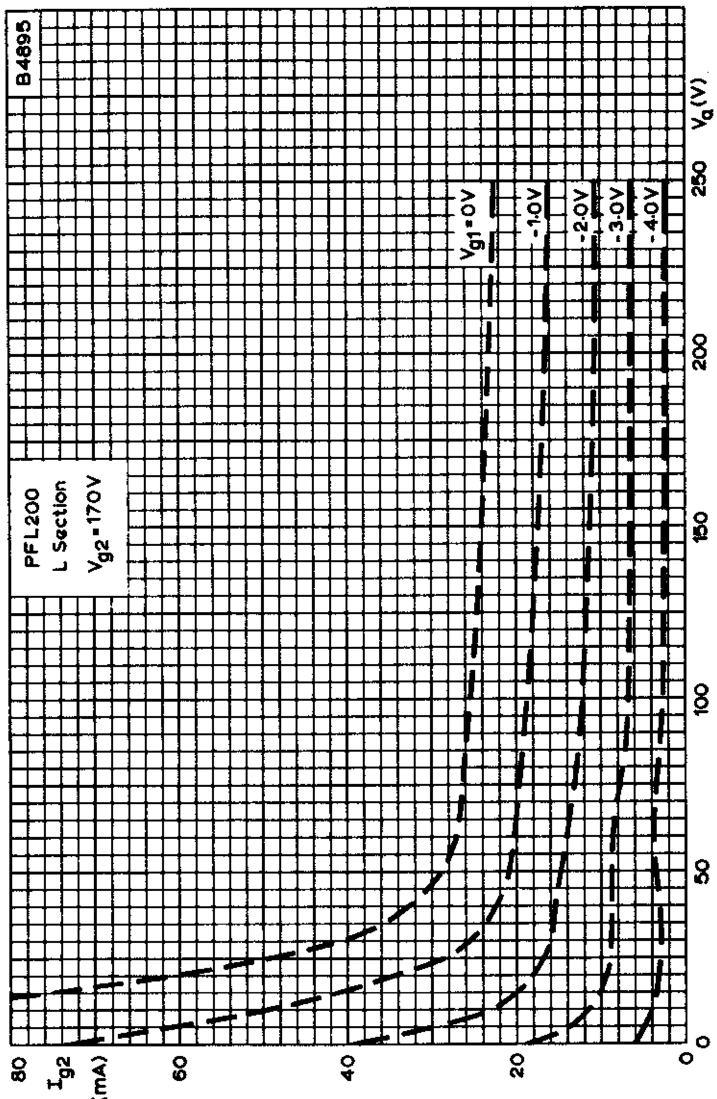


B10B base

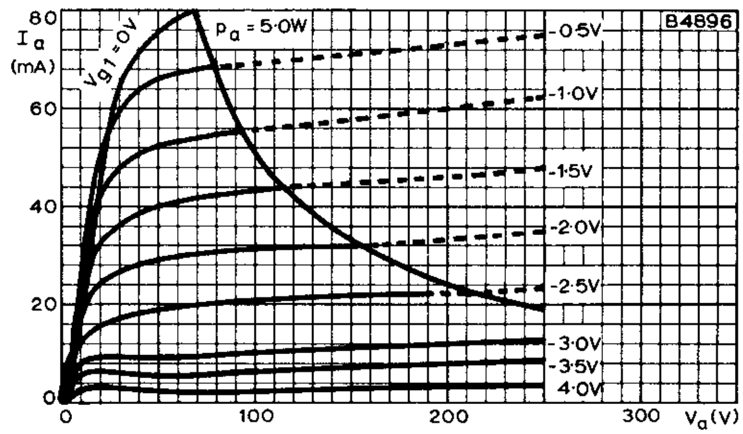


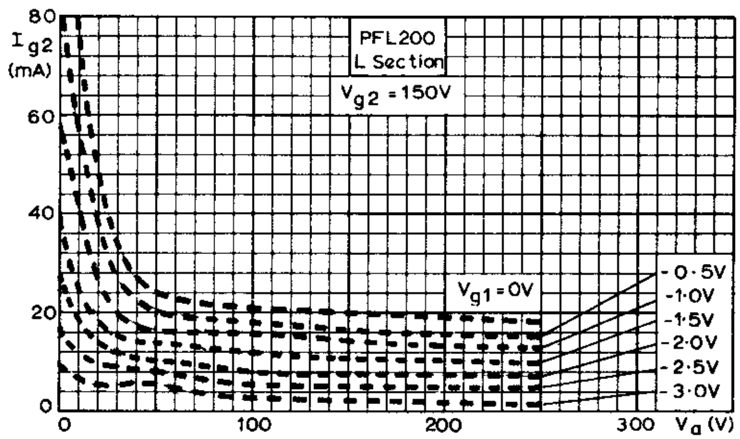


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 170V. L SECTION

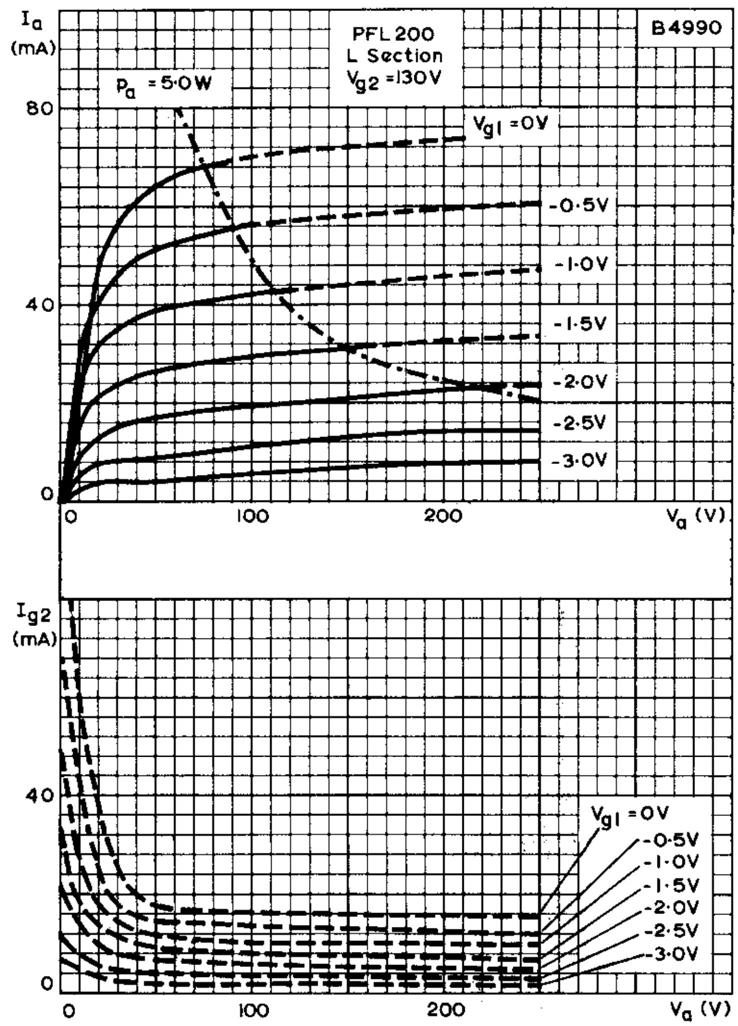


SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE, WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 170V.
L SECTION

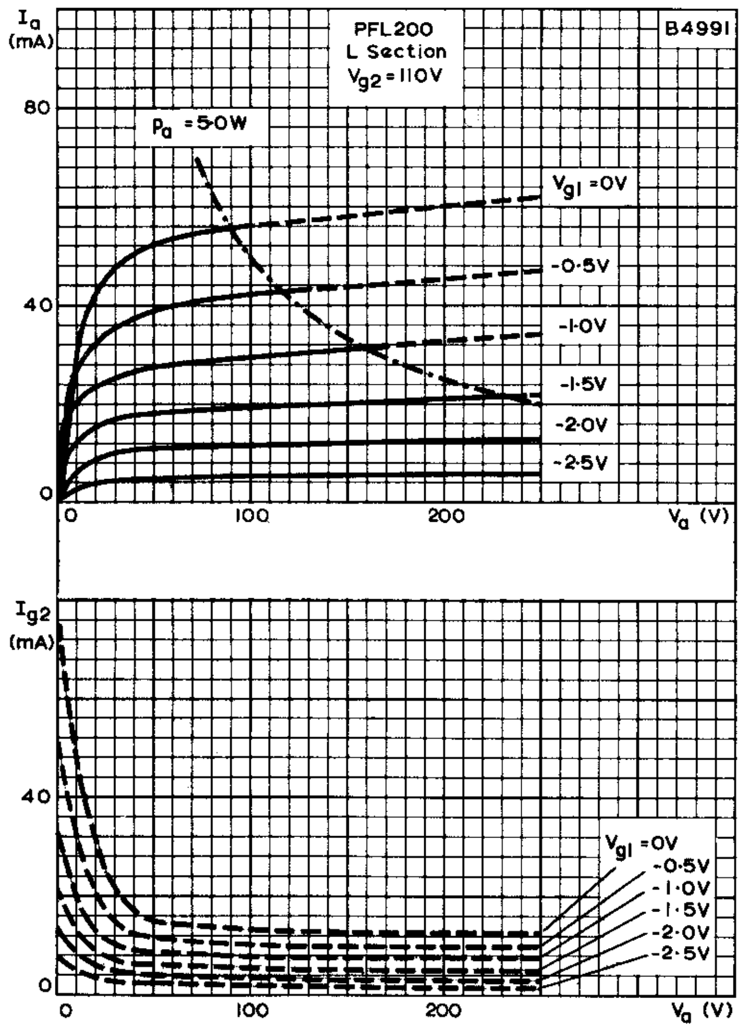




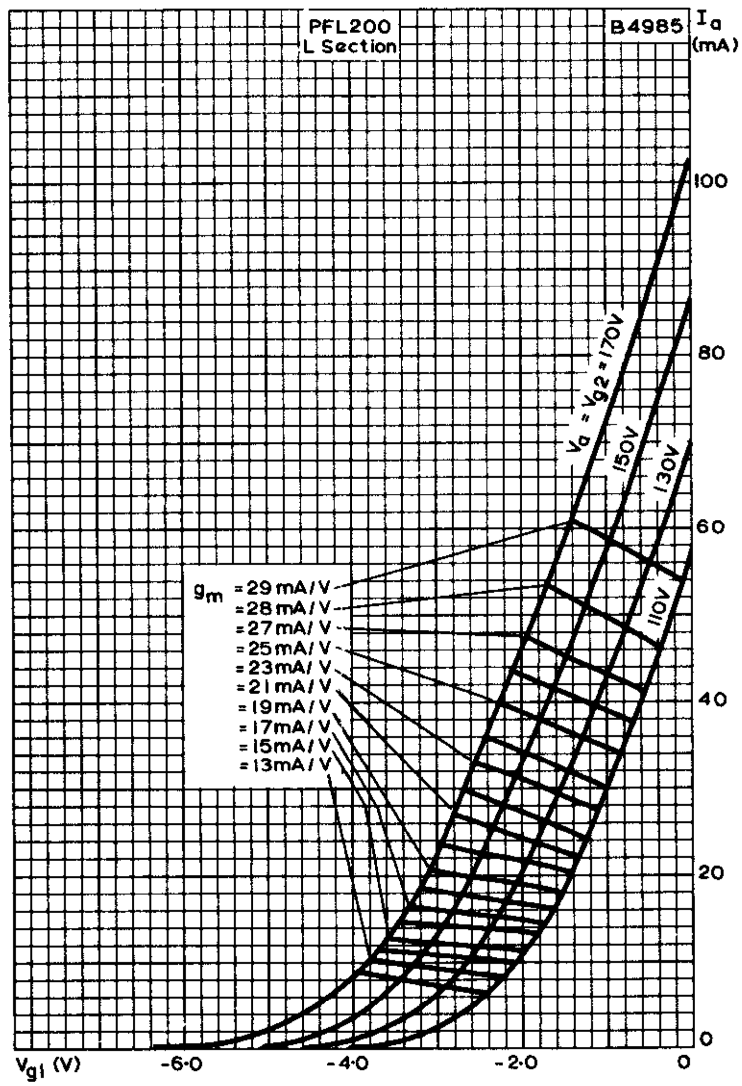
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 150V. L SECTION



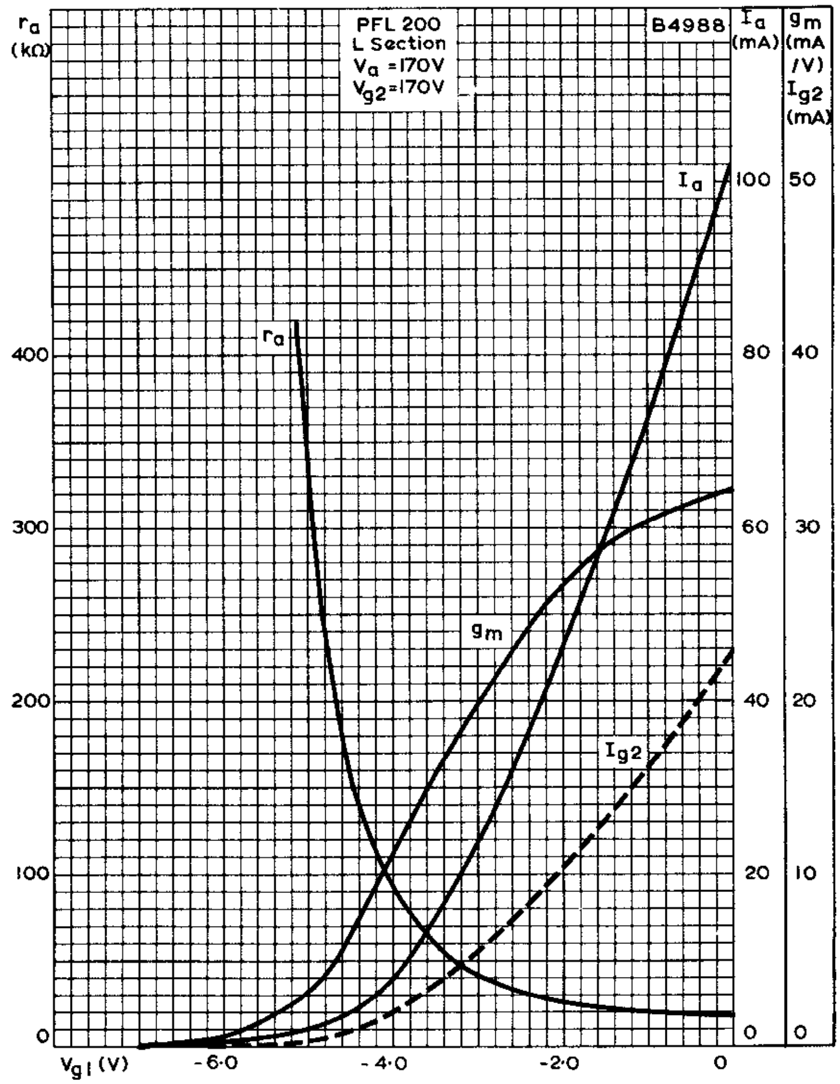
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 130V. L SECTION



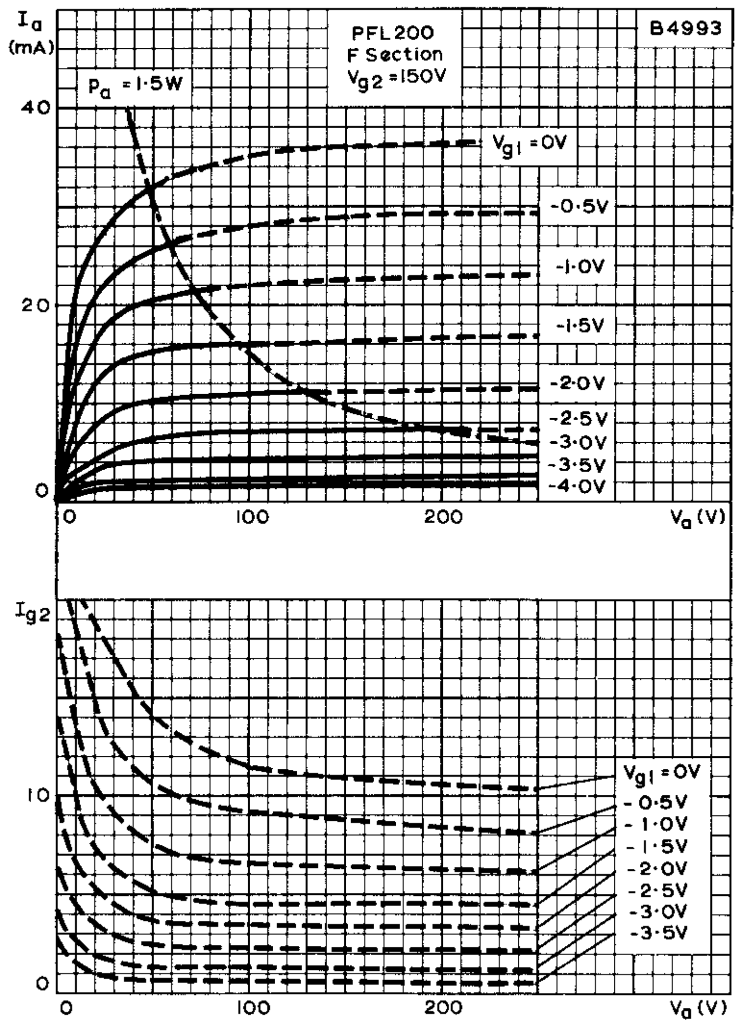
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 110V. L SECTION



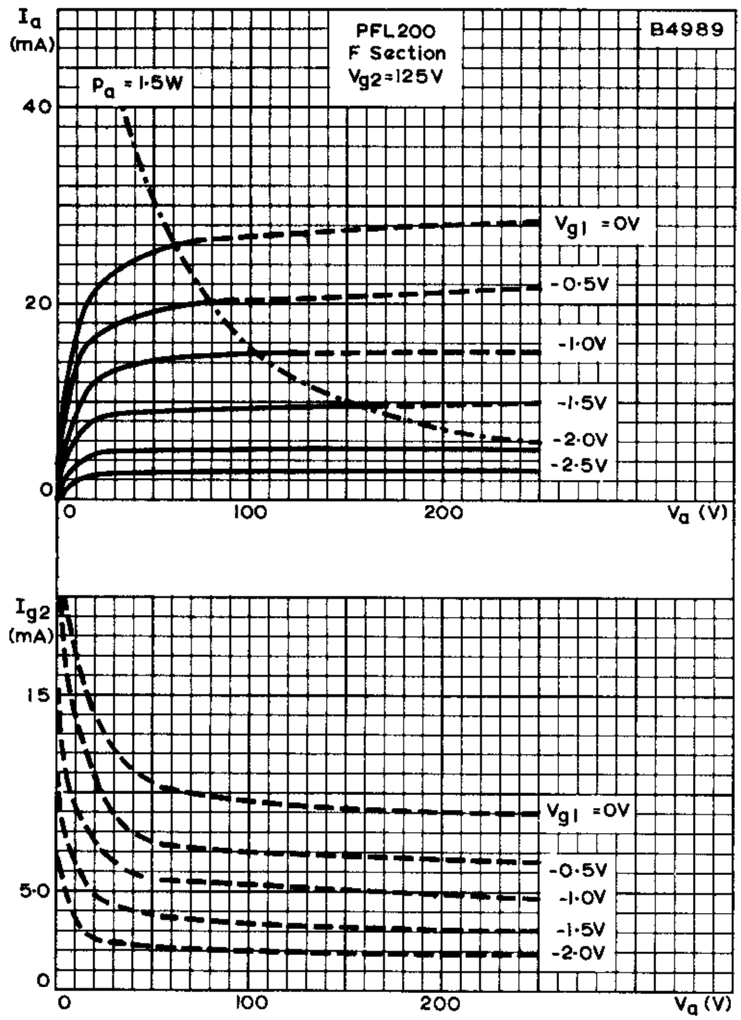
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETERS AND WITH MUTUAL CONDUCTANCE CONTOURS.
L SECTION



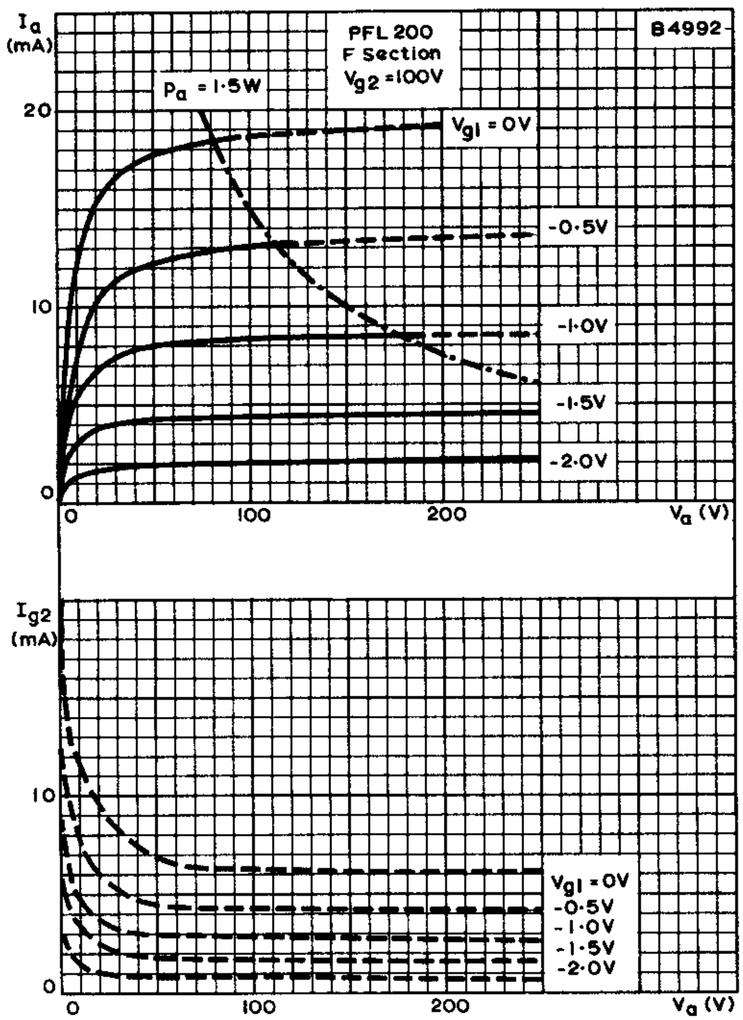
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
$V_a = V_{g2} = 170V$.
L SECTION



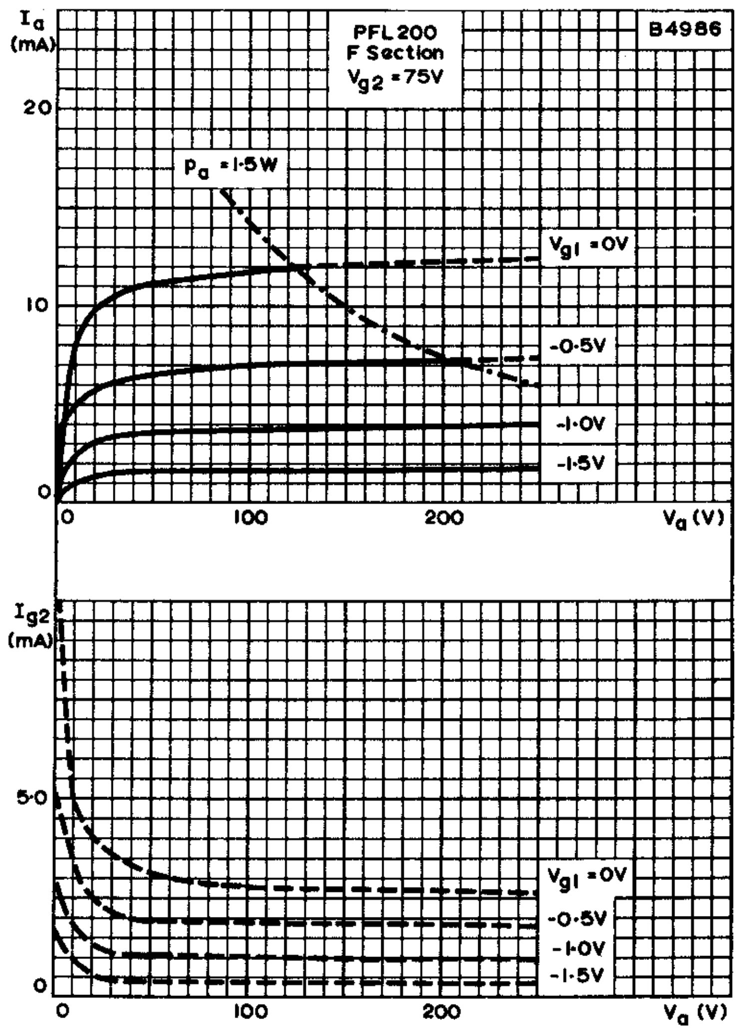
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 150V. F SECTION



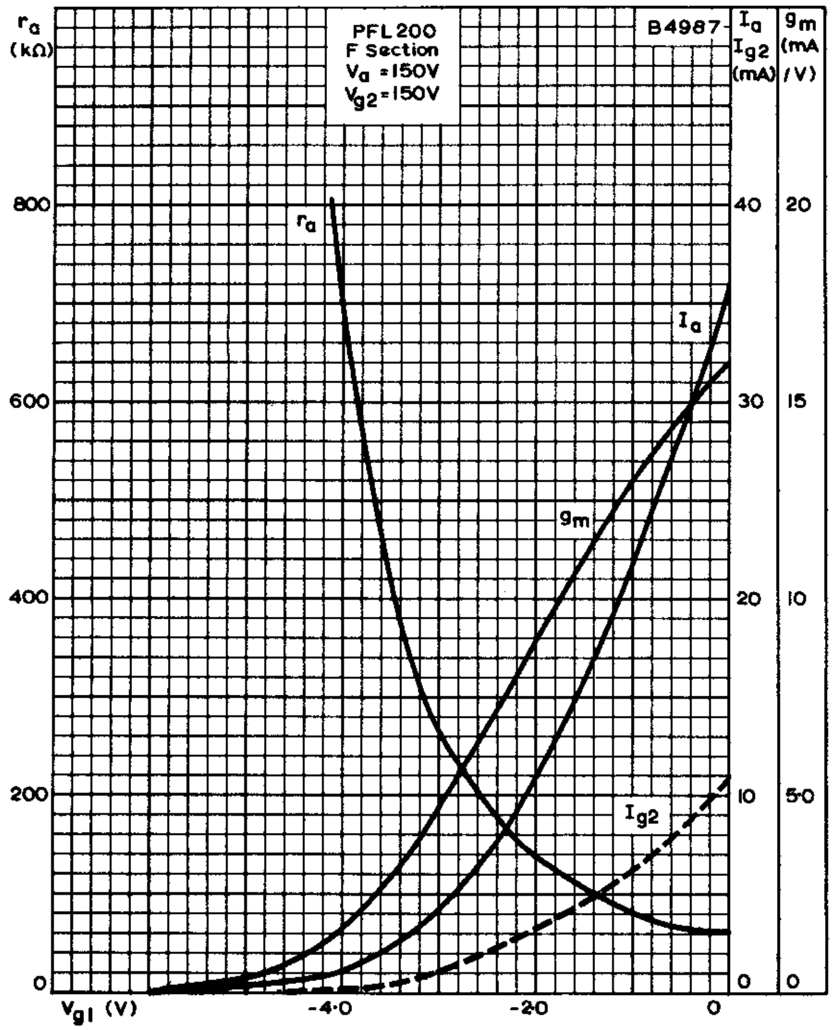
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 125V. F SECTION



ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 100V. F SECTION



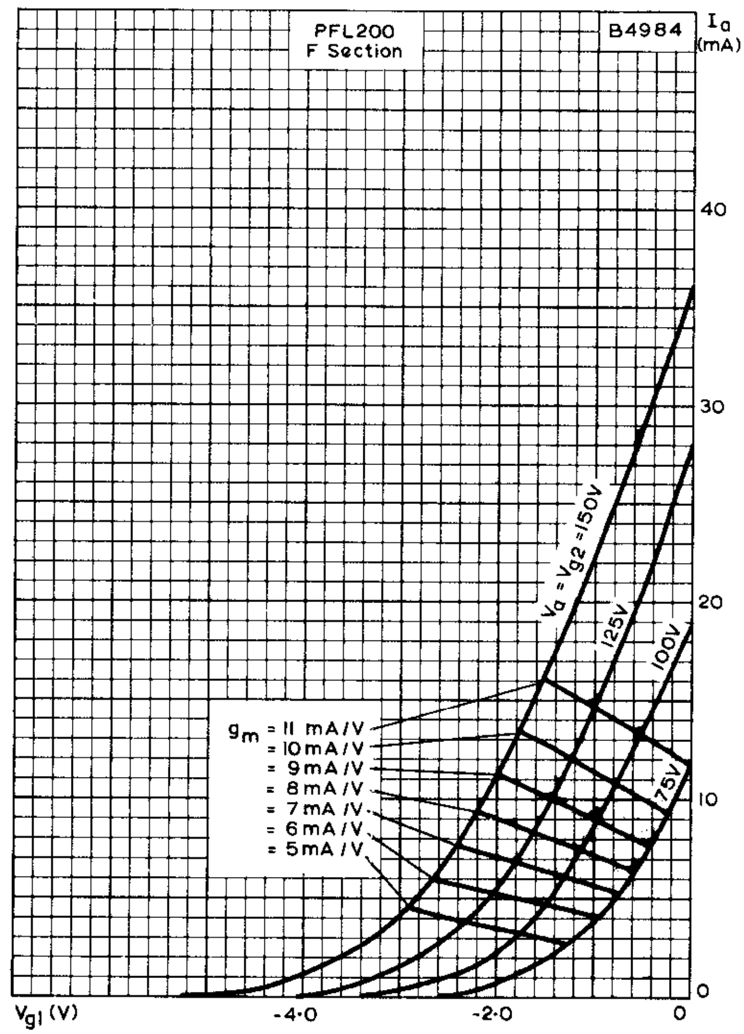
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 75V. F SECTION



ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.

$V_a = V_{g2} = 150V.$

F SECTION



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETERS AND WITH MUTUAL CONDUCTANCE CONTOURS.
F SECTION

LINE OUTPUT PENTODE

PL36

Output pentode primarily intended for use in the line timebase of television receivers.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	25	V

CAPACITANCES

c_{in}	17.5	pF
c_{out}	8.0	pF
c_{a-g1}	< 1.1	pF

CHARACTERISTICS

V_a	100	V
V_{g2}	100	V
V_{g1}	−8.2	V
I_a	100	mA
I_{g2}	7.0	mA
g_m	14	mA/V
r_a	5.0	kΩ
μ_{g1-g2}	5.6	

OPERATION AS LINE OUTPUT PENTODE

Circuit design

In calculating the peak anode current for circuit design purposes the knee is taken as the reference point. Operation so that the anode potential of the output valve at the end of scan is above the knee of the anode characteristic is only recommended when an effective feedback stabilising circuit is employed. A nomogram is given on page C1.
For operation below the knee of the characteristic the nomogram on page C2 should be used.

LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	250	V
*$+v_{a(pk)}$ max.	7.0	kV
*$-v_{a(pk)}$ max.	1.5	kV
p_a max.	12	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
*$-v_{g1(pk)}$ max.	1.0	kV
†p_{g2} max.	5.0	W
$p_{a}+p_{g2}$ max.	13	W
I_k max.	200	mA
V_{h-k} max. (cathode negative)	200	V
V_{h-k} max. (cathode positive)	250	V
R_{g1-k} max. (fixed bias)	500	kΩ
R_{g1-k} max. (line timebase applications)	3.3	MΩ
Min. drive at $v_{a(pk)} = 5kV$	100	V
Min. drive at $v_{a(pk)} = 7kV$	120	V
T_{bulb} max.	250	°C←

*Max. duration 22% of one cycle with a maximum of 18μs.

†Max. average p_{g2} is 7W during the period between the commencement of I_{g2} and the instant when I_a attains one half of its normal operating value.

PL36

LINE OUTPUT PENTODE

PEAK ANODE CURRENT NOMOGRAMS

Stabilised timebases

The nomogram shown on page C1 gives directly the values of peak anode current and end-of-scan anode voltage which should be used in designing a stabilised line timebase. The nomogram is based on an h.t. line voltage of 200V, and a correction factor is included for other h.t. voltages.

Non-stabilised timebases

The nomogram shown on page C2 gives directly the values of peak anode current and end-of-scan anode voltage which should be used in designing a non-stabilised line timebase. It assumes 'below-the-knee' operation, undecoupled screen-grid resistor (excluding capacitors of a few hundred microfarad), and control-grid potential of +1V.

Measurements

When measurements are made specifically for the purpose of comparison with the nomogram, all the components comprising the timebase, including the valves, should be nominal. The h.t. line should also be nominal. In receivers designed for a range of declared values of mains voltage, measurements should be made at the nominal declared value of mains voltage producing the lowest nominal h.t. voltage. The timebase should be synchronised and the raster adjusted to nominal scan. The beam current drawn from the e.h.t. supply should be 300µA.

The use of the nomogram does not exempt the designer from checking that the valve is operating within its limiting values.

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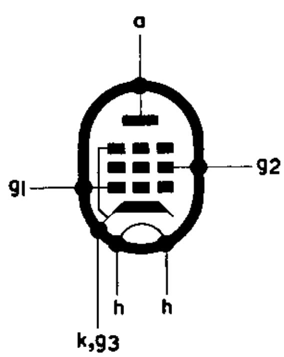
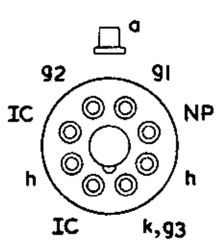
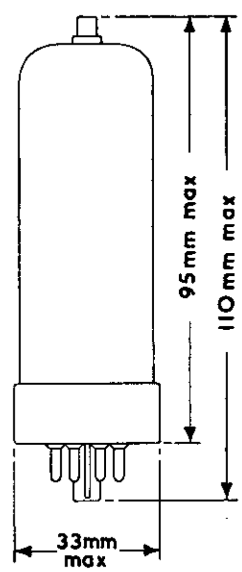
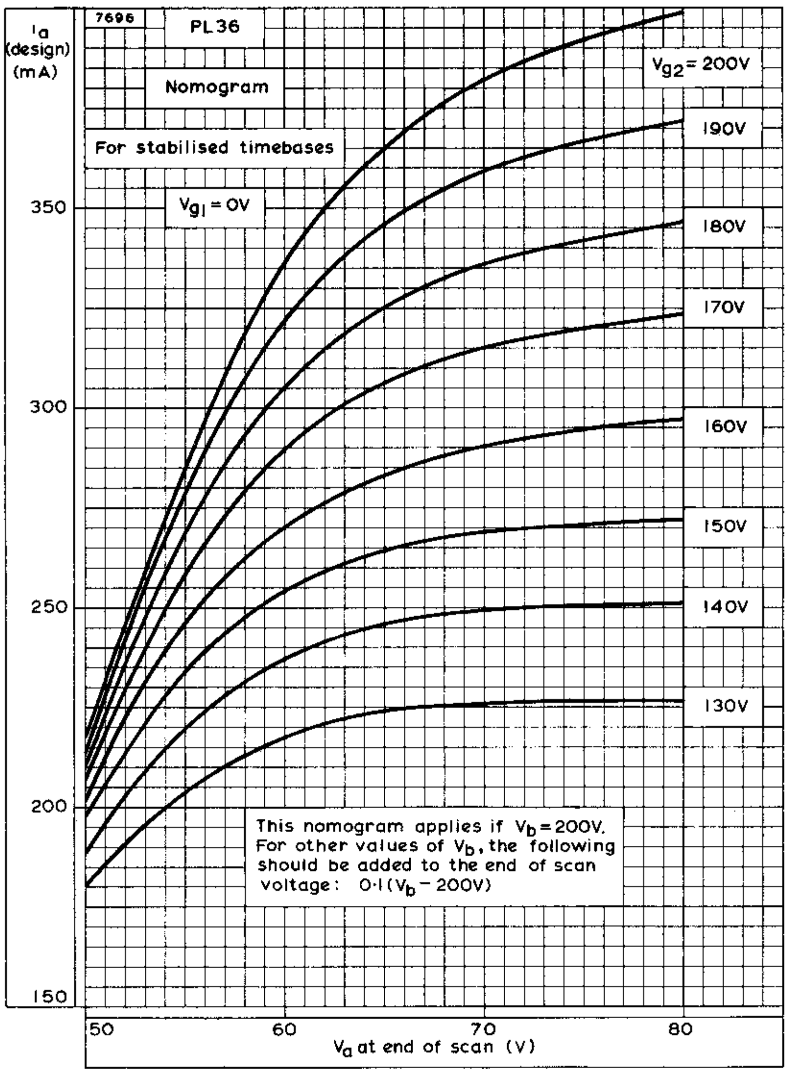




Octal Base

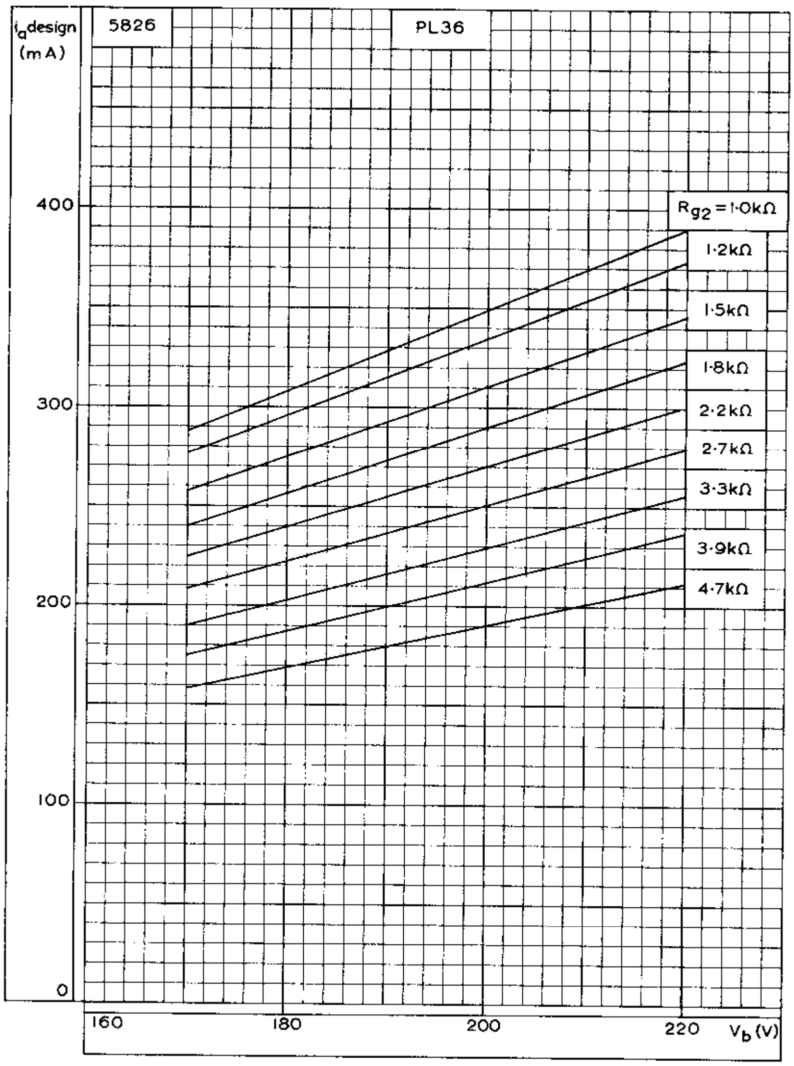




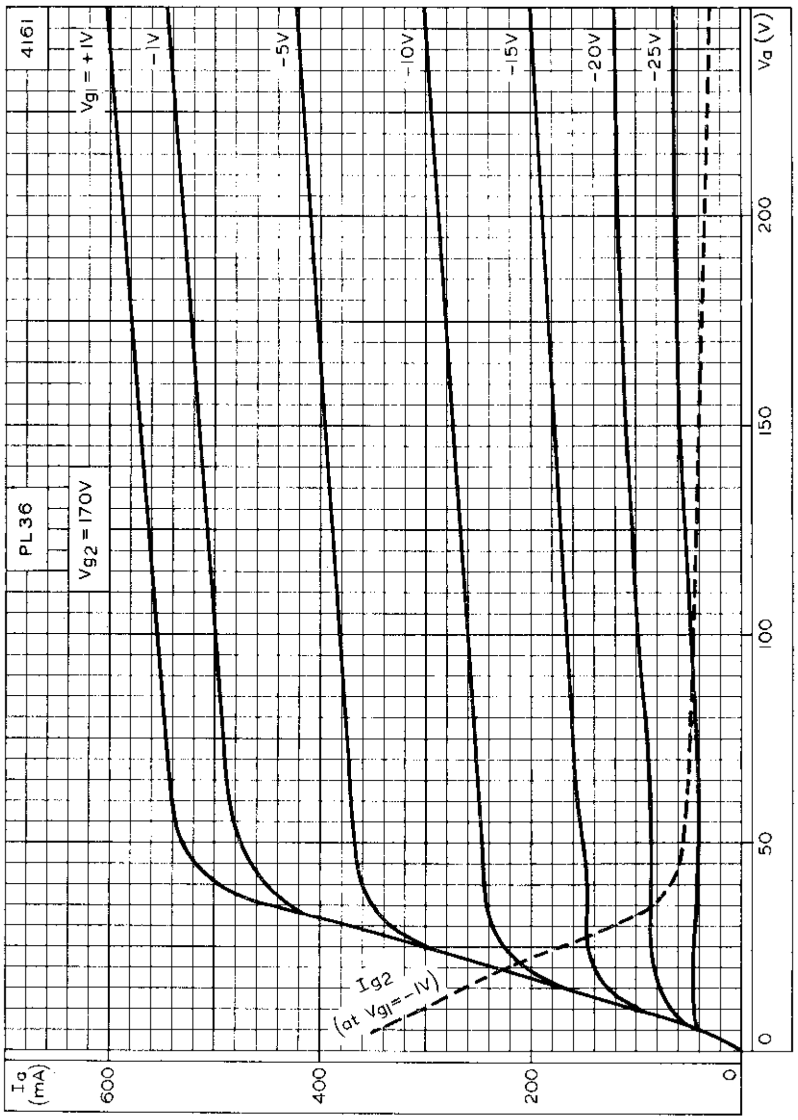
NOMOGRAM FOR STABILISED TIMEBASES

PL36

LINE OUTPUT PENTODE



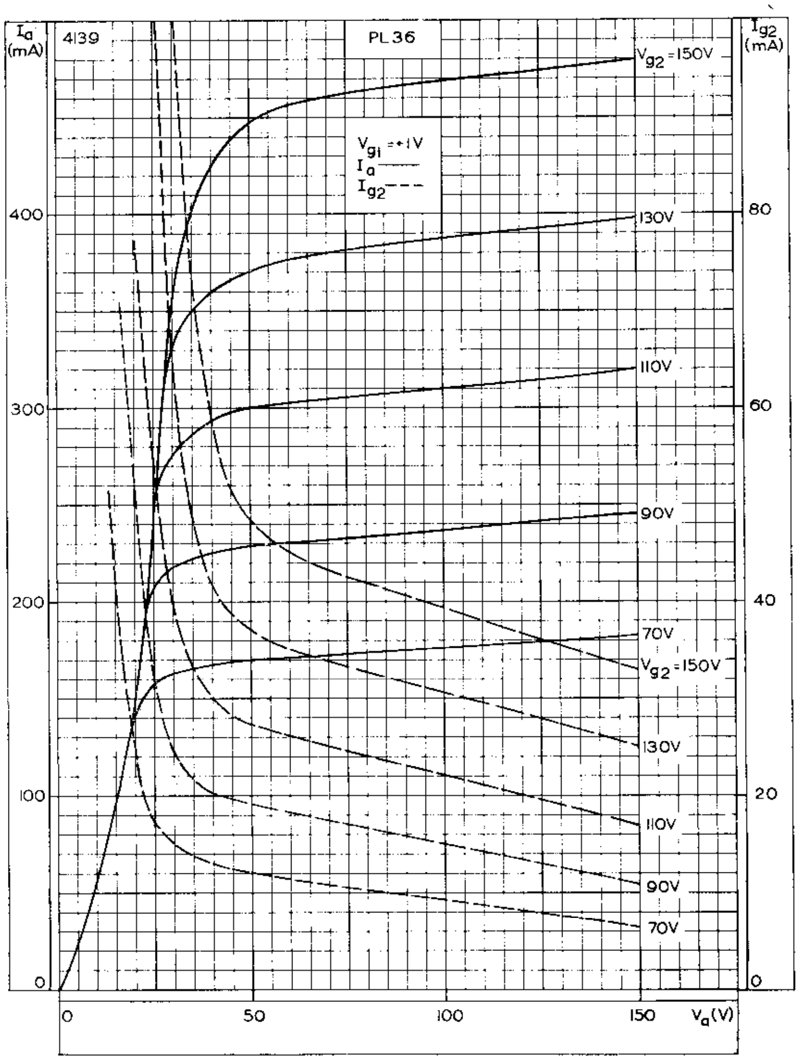
NOMOGRAM FOR NON-STABILISED TIMEBASES



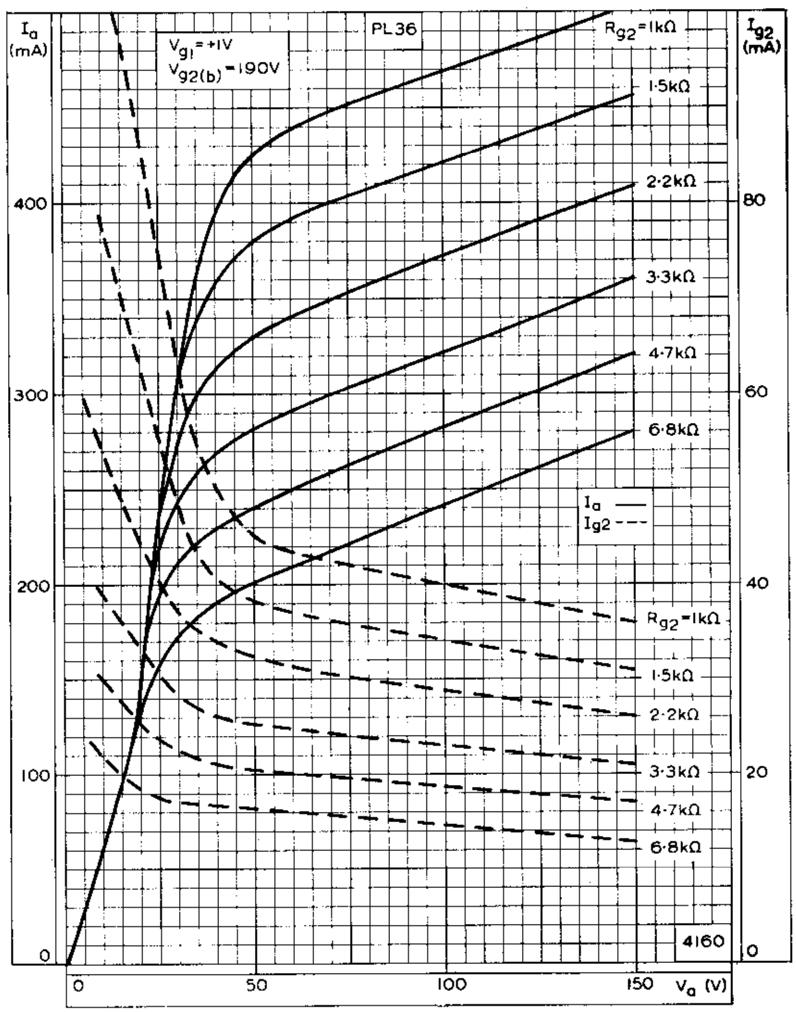
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

PL36

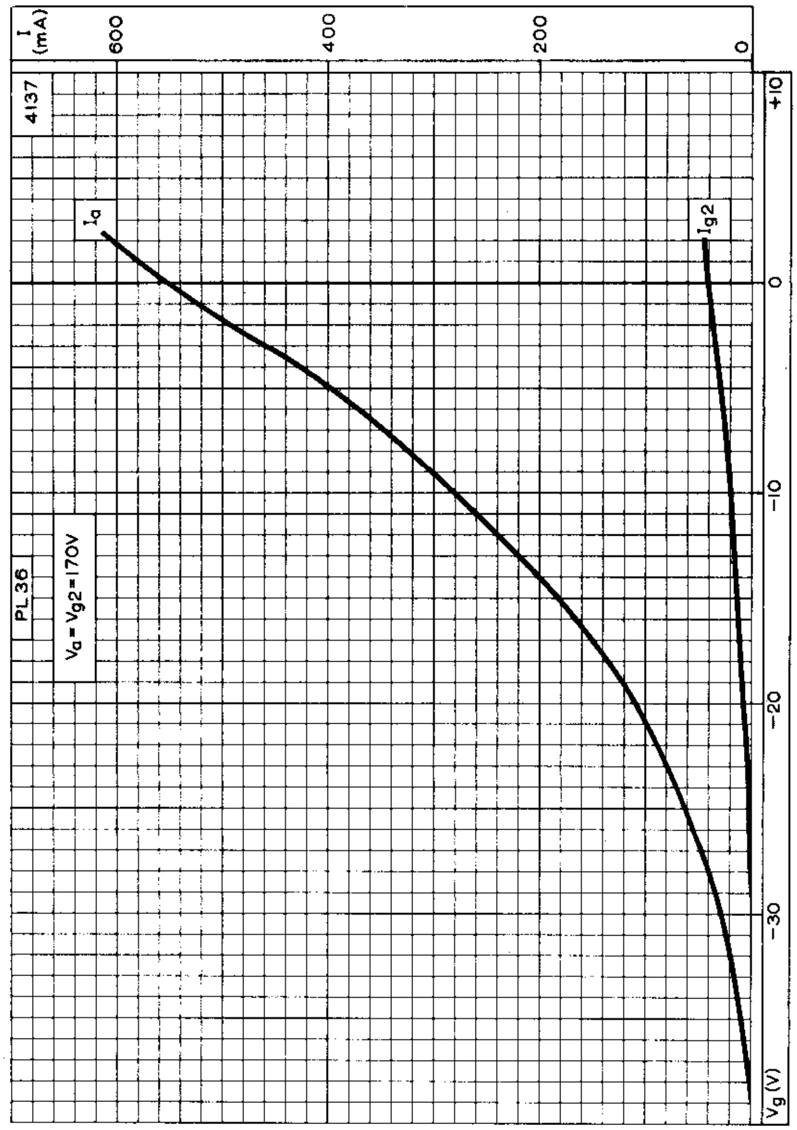
LINE OUTPUT PENTODE



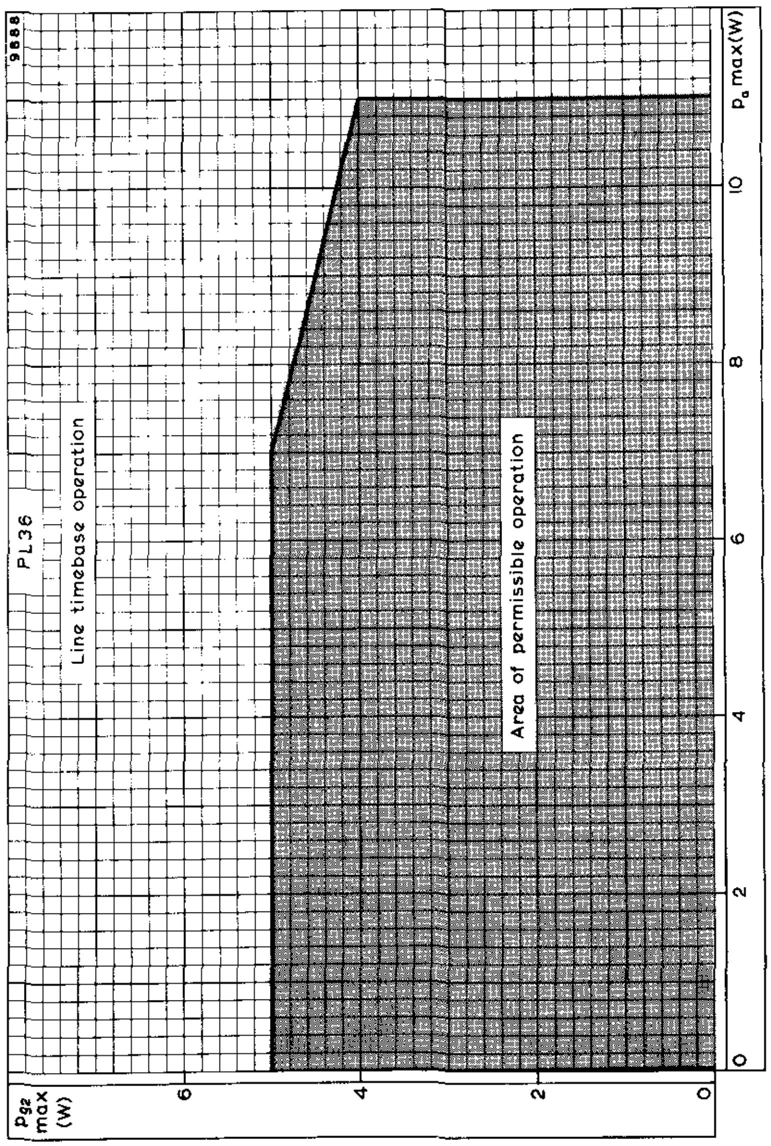
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER



ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH SCREEN-GRID RESISTANCE AS PARAMETER



ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST CONTROL-GRID VOLTAGE



BOUNDARY OF OPERATION FOR LINE TIMEBASE APPLICATIONS

LINE OUTPUT PENTODE PL81A

Line output pentode for use in portable television receivers.

HEATER

Suitable for series operation a.c. or d.c.

I_h	300	mA
V_h	21.5	V

CAPACITANCES

c_{in}	14	pF
c_{out}	6.0	pF
c_{a-g1}	<800	mpF
c_{g1-h}	<200	mpF
c_{a-k}	<100	mpF

CHARACTERISTICS

V_a	170	V
V_{g2}	170	V
V_{g1}	-24.5	V
I_a	45	mA
I_{g2}	2.2	mA
g_m	6.0	mA/V
r_a	11.5	kΩ
μ_{g1-g2}	4.9	

OPERATION AS LINE OUTPUT VALVE

Circuit design

Operation so that the anode potential of the output valve at the end of the scan is above the knee of the anode characteristic is recommended. An effective feedback stabilising circuit should be employed. A design chart is given on page C5.

Minimum values of R_{g2} required to prevent excessive screen-grid dissipation during the warming-up period.

V_b	170	200	230	V
R_{g2} min.	1.2	1.8	2.2	kΩ

High voltage cut-off

The minimum value of V_{g1} for cut-off during the fly-back period, when $v_{a(pk)}$ = 7.0kV, is -120V.

PEAK ANODE CURRENT DESIGN CHARTS

Stabilised timebases

The design chart shown on page C5 gives directly the values of peak anode current and end-of-scan anode voltage which should be used in designing a stabilised line timebase. The design chart is based on an h.t. line voltage of 200V, and a correction factor is included for other h.t. voltages.

Measurements

When measurements are made specifically for the purpose of comparison with the design chart, all the components comprising the timebase, including the valves, should be nominal. The h.t. line should also be nominal. In receivers designed for a range of declared values of mains voltage, measurements should be made at the nominal declared value of mains voltage producing the lowest nominal h.t. voltage. The timebase should be synchronised and the raster adjusted to nominal scan. The beam current drawn from the e.h.t. supply should be 300μA.

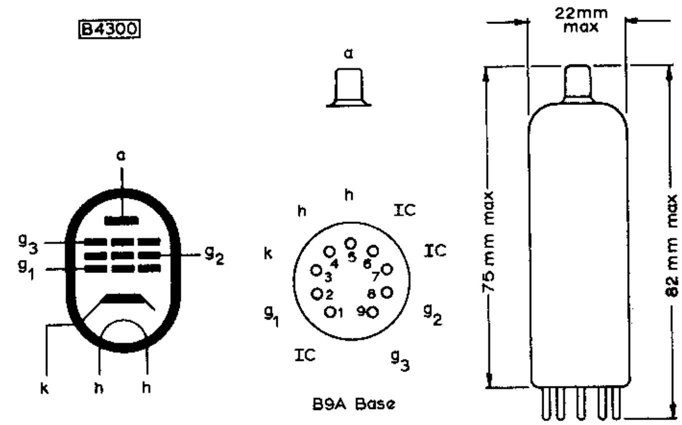
The use of the design chart does not exempt the designer from checking that the valve is operating within its limiting values.

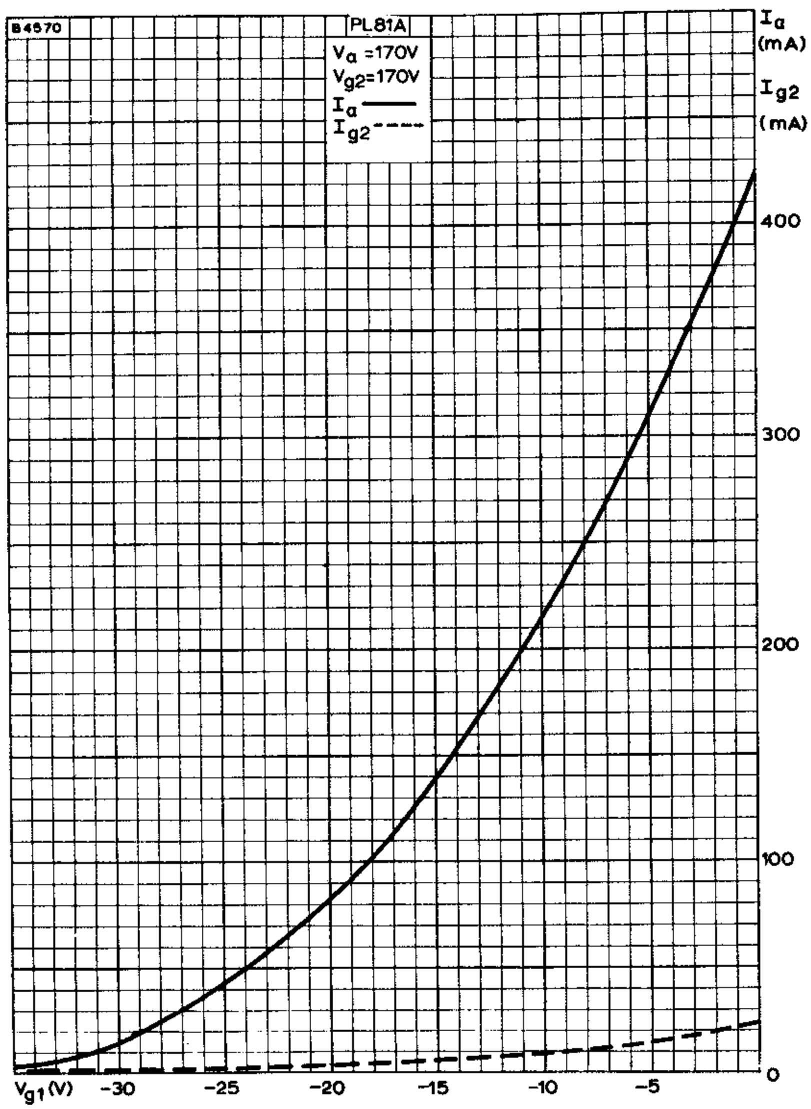
LINE OUTPUT PENTODE PL81A

RATINGS (DESIGN CENTRE SYSTEM)

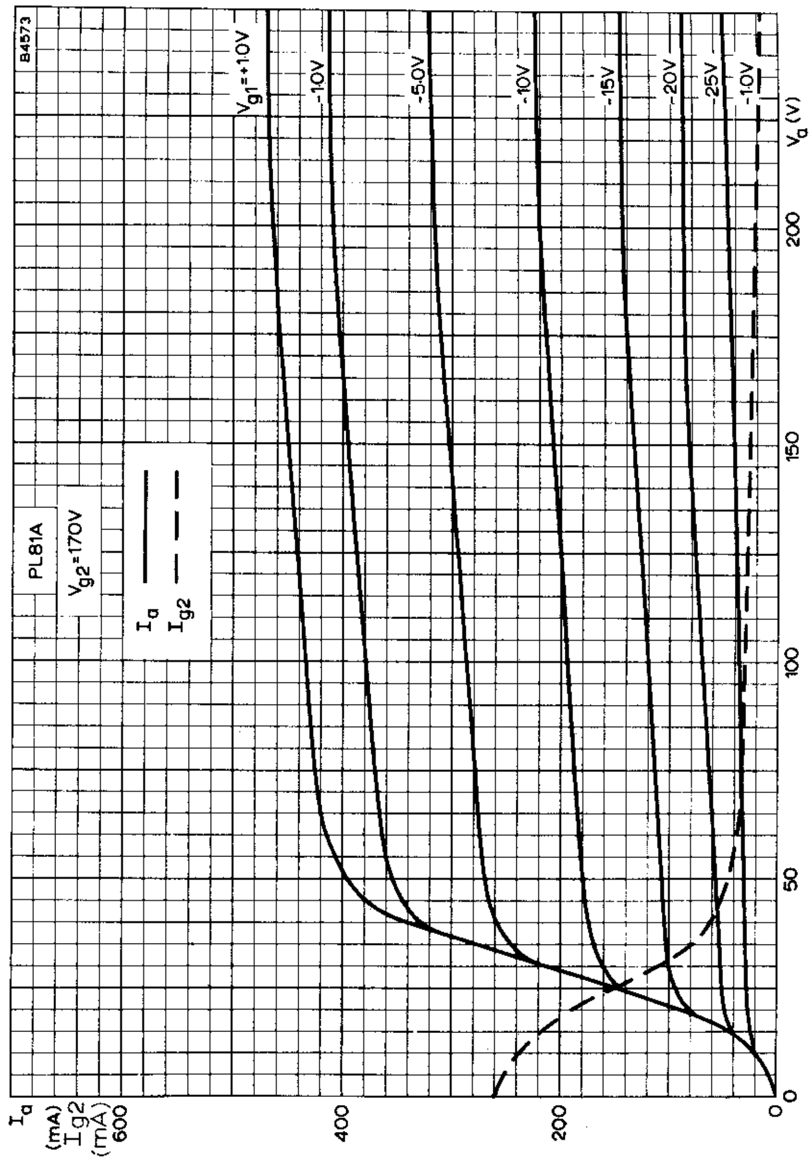
$V_{a(b)}$ max.	650	V
V_a	250	V
* $v_{a(pk)}$ max.	7.0	kV
p_a max.	see page C6	
$p_a + p_{g2}$	see page C6	
$V_{g2\ (b)}$ max.	550	V
V_{g2} max.	250	V
$v_{g1\ (pk)}$ max.	1.0	kV
p_{g2} max.	see page C6	
I_k max.	180	mA
R_{g1-k} max.	500	kΩ
R_{g1-k} max. (line timebase applications)	2.2	MΩ
R_{h-k} max.	20	kΩ
V_{h-k} max. (cathode negative)	200	V
V_{h-k} max. (cathode positive)	200	V
T_{bulb} max.	240	°C

*Maximum pulse duration 22% of one cycle with a maximum of 18μs.

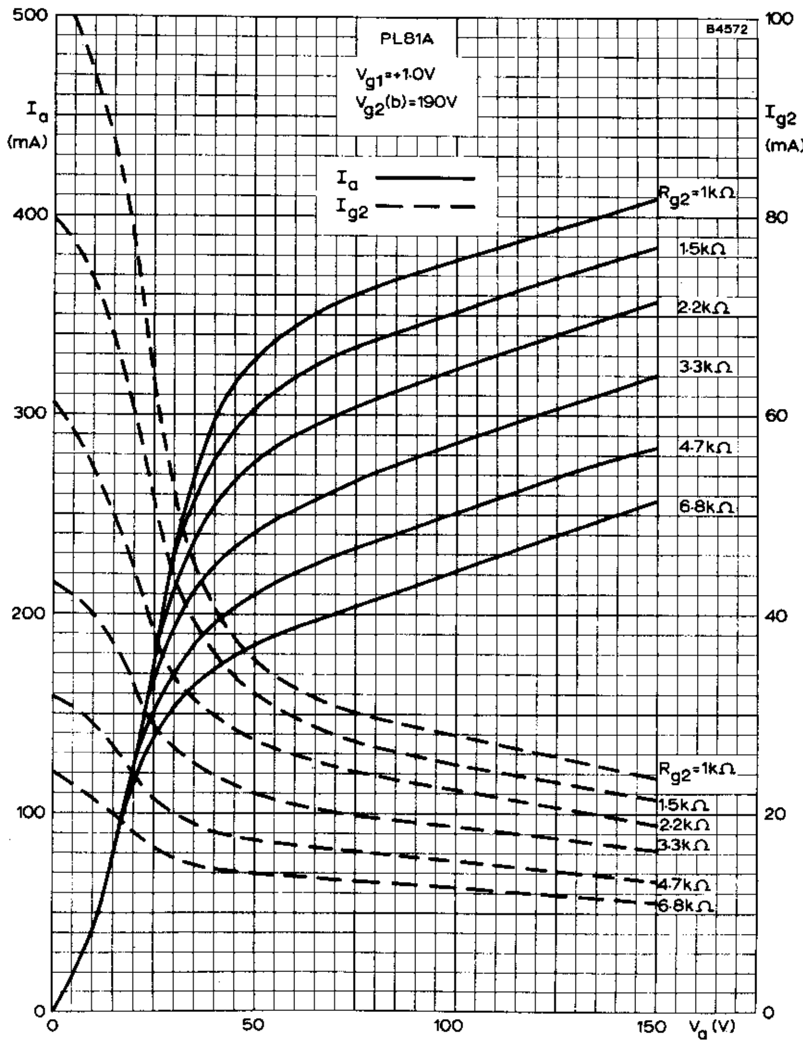




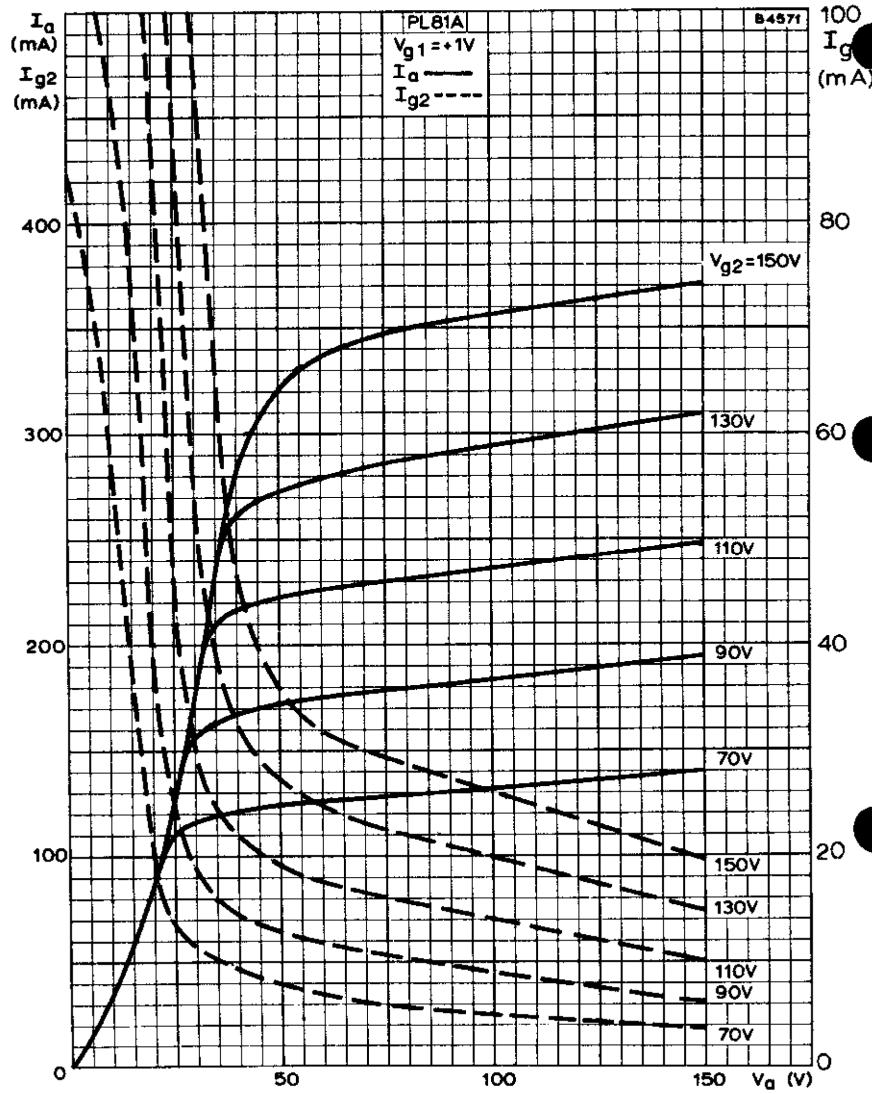
ANODE AND SCREEN CURRENTS PLOTTED AGAINST CONTROL-GRID VOLTAGE



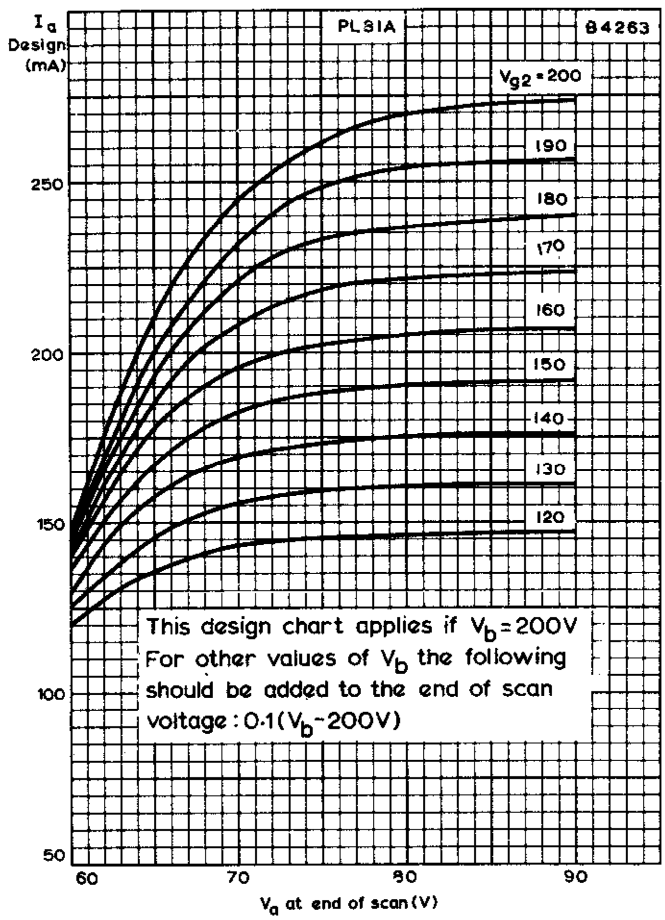
ANODE AND SCREEN CURRENTS PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER



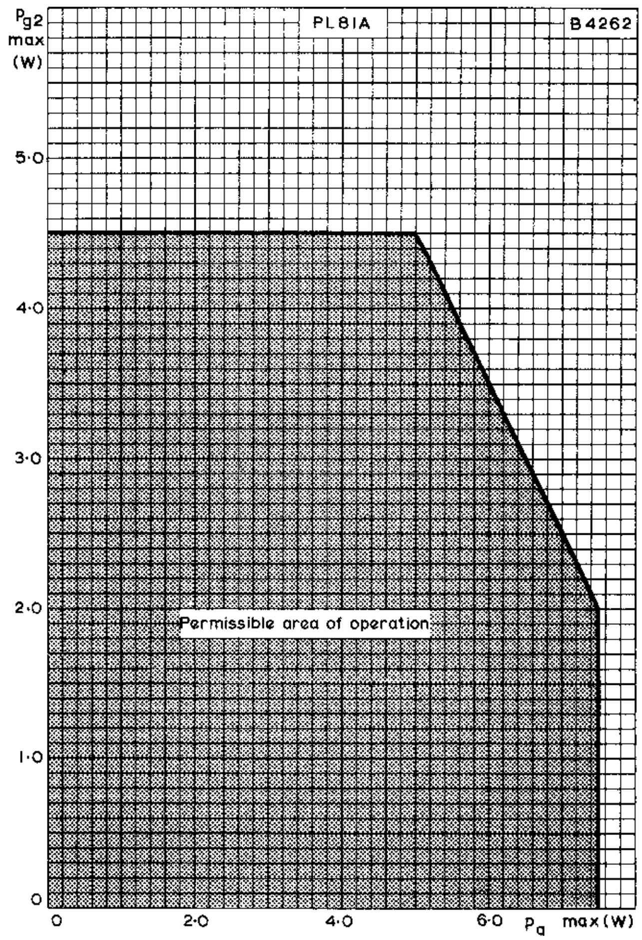
ANODE AND SCREEN CURRENTS PLOTTED AGAINST ANODE VOLTAGE
WITH SCREEN-GRID RESISTOR AS PARAMETER



ANODE AND SCREEN CURRENTS PLOTTED AGAINST ANODE VOLTAGE
WITH SCREEN-GRID VOLTAGE AS PARAMETER



DESIGN CHART FOR STABILISED TIMEBASES



DESIGN CENTRE RATINGS FOR p_a max. AND p_{g2} max.

VIDEO OUTPUT PENTODE

PL83

Video output pentode for use in television receivers with series connected heaters. It is particularly suitable for use in projection television receivers or with high definition television systems.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	15	V

CAPACITANCES

c_{in}	10.4	pF
c_{out}	6.6	pF
c_{a-g1}	<0.06	pF
c_{g1-h}	<0.15	pF

CHARACTERISTICS

V_a	170	200	V
V_{g2}	170	200	V
V_{g3}	0	0	V
I_a	36	36	mA
I_{g2}	5	5	mA
V_{g1}	−2.3	−3.5	V
g_m	10	10	mA/V
r_a	100	100	kΩ
μ_{g1-g2}	24	24	

TYPICAL OPERATING CONDITIONS FOR DRIVING A CATHODE RAY TUBE WITH CATHODE INJECTION

V_b	170	V
V_{g2}	170	V
V_{g3}	0	V
I_a	4	mA
I_{g2}	0.25	mA
V_{g1}	−6.7	V
R_a	2.2	kΩ
$V_{out\,(pk)}$	>70	V

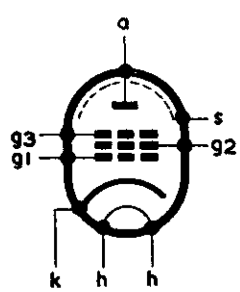
PL83

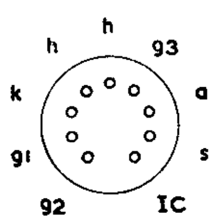
VIDEO OUTPUT PENTODE

Video output pentode for use in television receivers with series connected heaters. It is particularly suitable for use in projection television receivers or with high definition television systems.

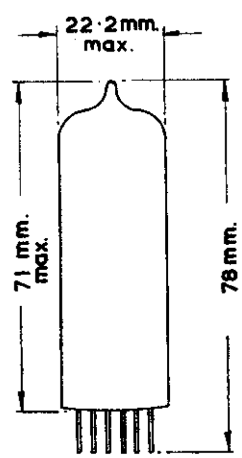
LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	9	W
$V_{g2\,(b)}$ max.	550	V
V_{g2} max.	250	V
p_{g2} max.	2	W
I_k max.	70	mA
V_{g1} max. ($I_{g1}=+0.3\ \mu A$)	-1.3	V
R_{g1-k} max. (self bias)	1.0	MΩ
R_{g1-k} max. (fixed bias)	500	kΩ
V_{h-k} max.	150	V
R_{h-k} max.	20	kΩ





B9A
Noval Base



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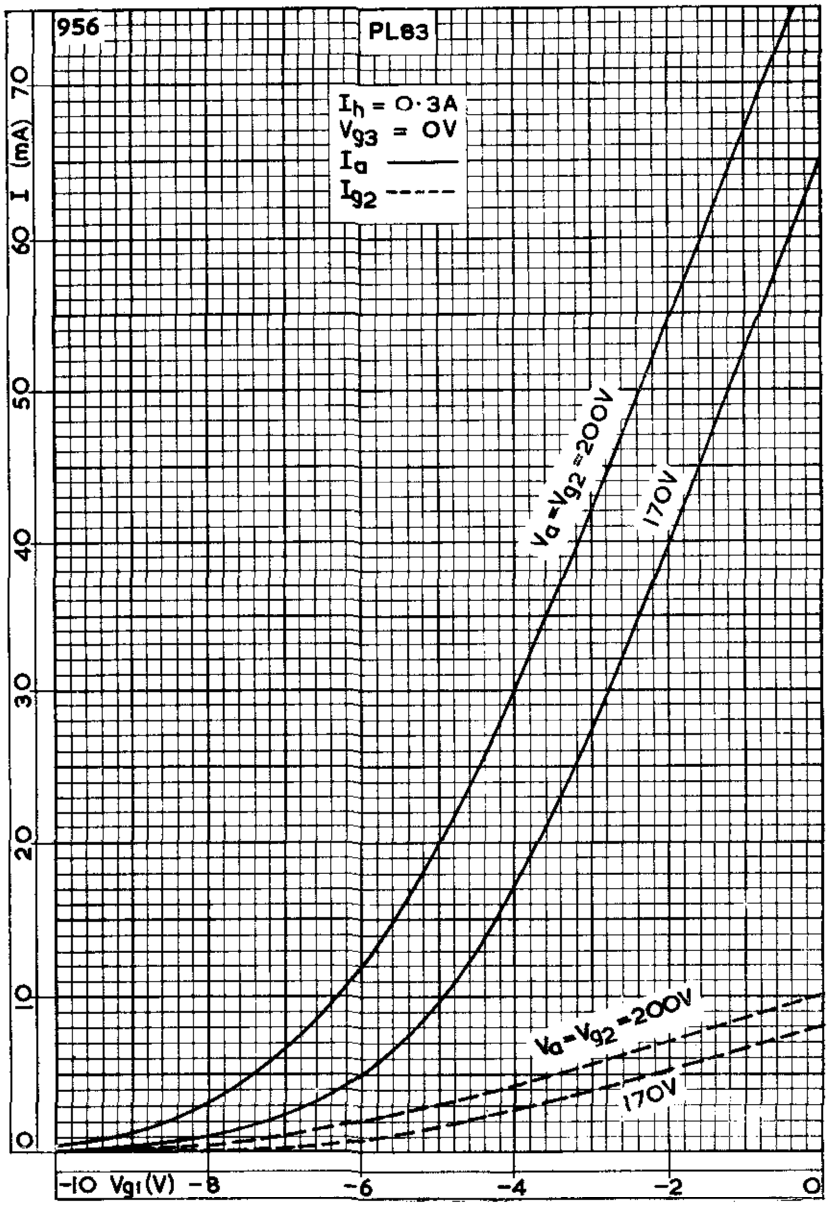
VIDEO OUTPUT PENTODE

PL83

Video output pentode for use in television receivers with series connected heaters. It is particularly suitable for use in projection television receivers or with high definition television systems.

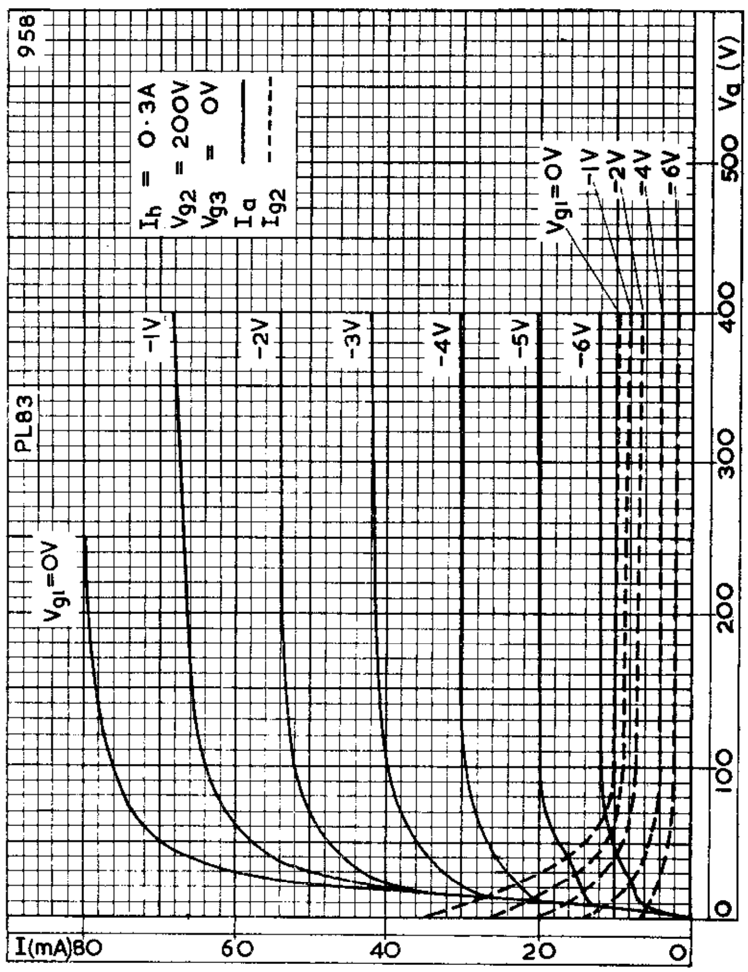


ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE

PL83

VIDEO OUTPUT PENTODE

Video output pentode for use in television receivers with series connected heaters. It is particularly suitable for use in projection television receivers or with high definition television systems.

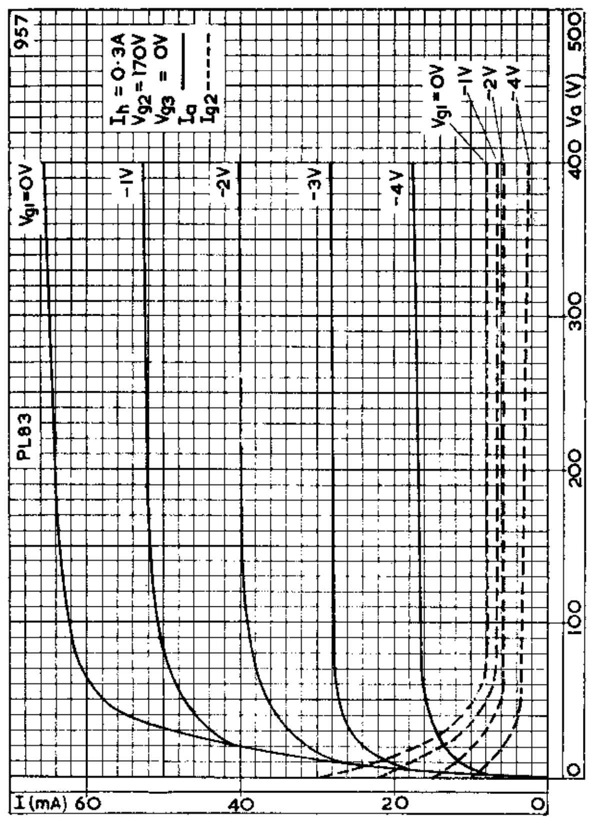


ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE, WITH SCREEN-GRID VOLTAGE AT 200V

VIDEO OUTPUT PENTODE

PL83

Video output pentode for use in television receivers with series connected heaters. It is particularly suitable for use in projection television receivers or with high definition television systems.



ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE, WITH SCREEN-GRID VOLTAGE AT 170V

Output pentode primarily intended for use in the line timebase of television receivers.

HEATER

Suitable for series operation a.c. or d.c.

I_h	300	mA
V_h	27	V

CAPACITANCES

c_{in}	22	pF
c_{out}	9.0	pF
c_{a-g1}	<1.75	pF
c_{g1-h}	< 200	mpF

CHARACTERISTICS

V_a	75	V
V_{g2}	200	V
V_{g1}	-10	V
I_a	440	mA
I_{g2}	30	mA

OPERATION AS LINE OUTPUT VALVE

Circuit design

Operation so that the anode potential of the output valve at the end of the scan is above the knee of the anode characteristic is recommended. An effective feedback stabilising circuit should be employed. A design chart is given on page C7.

Minimum values of R_{g2} required to prevent excessive screen-grid dissipation during the warming-up period;

V_b	170	200	230	V
R_{g2} min.	1.0	1.5	1.8	kΩ

High voltage cut-off

The minimum value of V_{g1} for cut-off during the fly-back period, when $v_{a(pk)}$ = 7.0kV, is -120V.

PEAK ANODE CURRENT DESIGN CHARTS

Stabilised timebases

The design chart shown on page C7 gives directly the values of peak anode current and end-of-scan anode voltage which should be used in designing a stabilised line timebase. The design chart is based on an h.t. line voltage of 200V, and a correction factor is included for other h.t. voltages.

Measurements

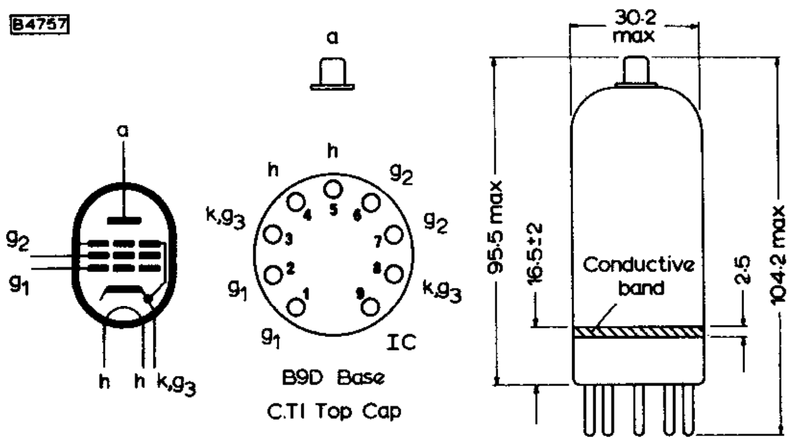
When measurements are made specifically for the purpose of comparison with the design chart, all the components comprising the timebase, including the valves, should be nominal. The h.t. line should also be nominal. In receivers designed for a range of declared values of mains voltage, measurements should be made at the nominal declared value of mains voltage producing the lowest nominal h.t. voltage. The timebase should be synchronised and the raster adjusted to nominal scan. The beam current drawn from the e.h.t. supply should be 300μA.

The use of the design chart does not exempt the designer from checking that the valve is operating within its limiting values.

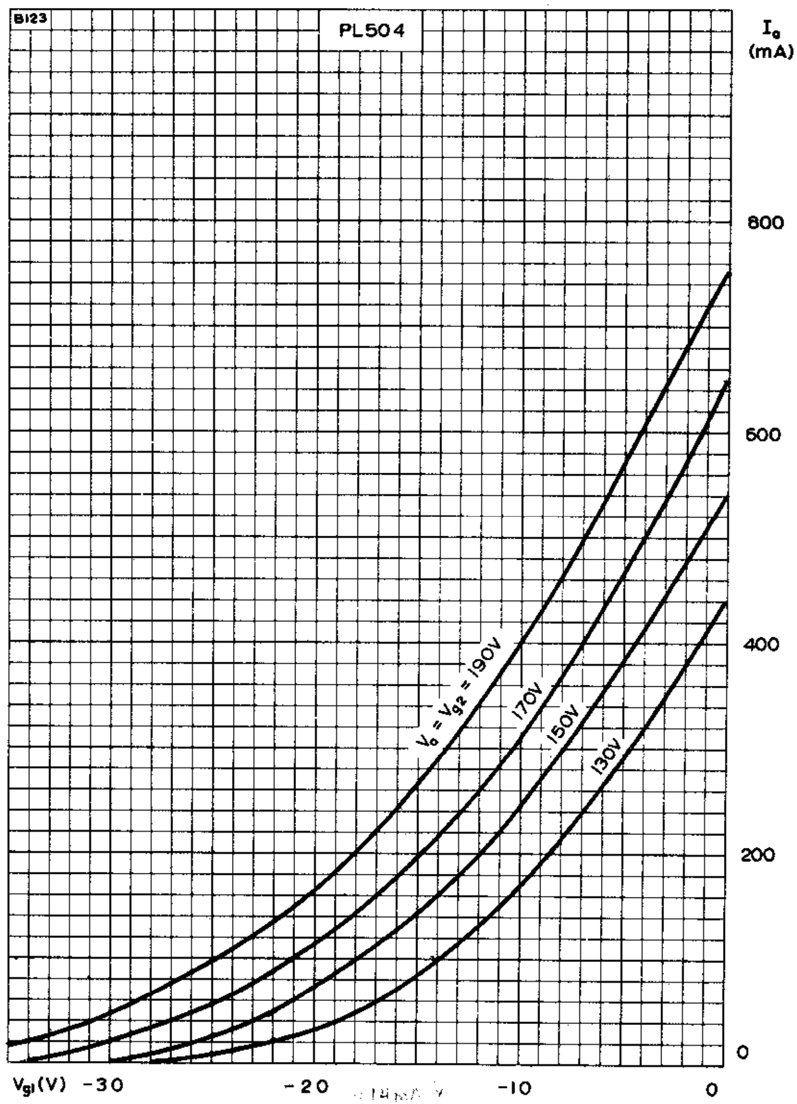
RATINGS (DESIGN CENTRE SYSTEM)

$V_{a(b)}$ max.	550	V
V_a max.	250	V
* $v_{a(pk)}$ max.	7.0	kV
p_a max.	see page C6	
$p_a + p_{g2}$	see page C6	
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
p_{g2} max.	see page C6	
I_k max.	250	mA
R_{g1-k} max.	500	kΩ
R_{g1-k} max. (line timebase applications)	2.2	MΩ

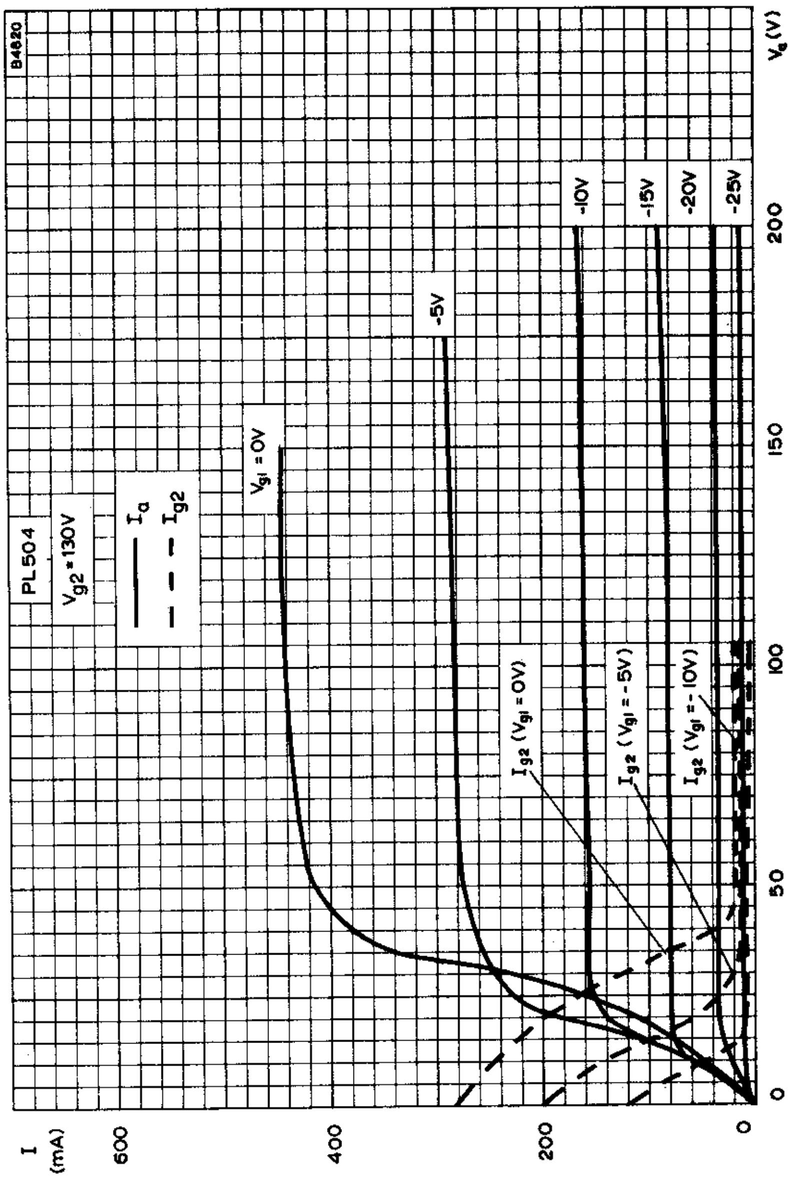
*Maximum pulse duration of 22% of one cycle with a maximum of 22μs.



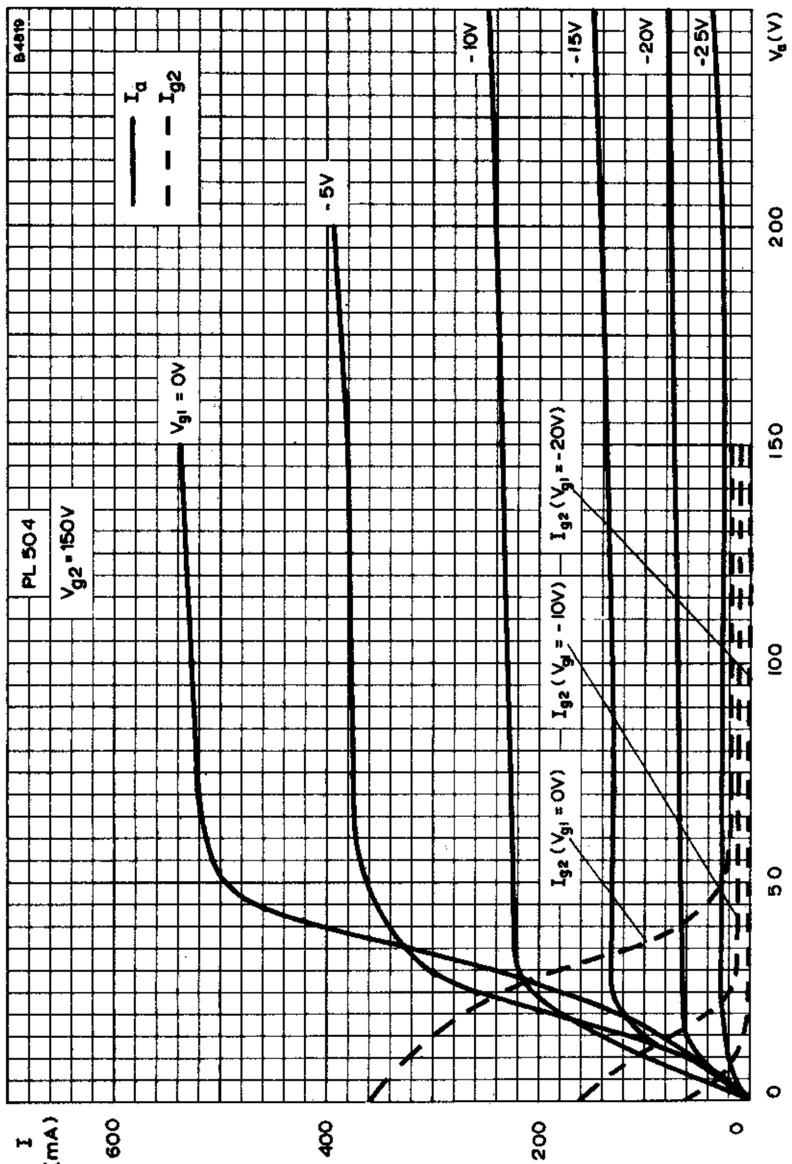
All dimensions in mm



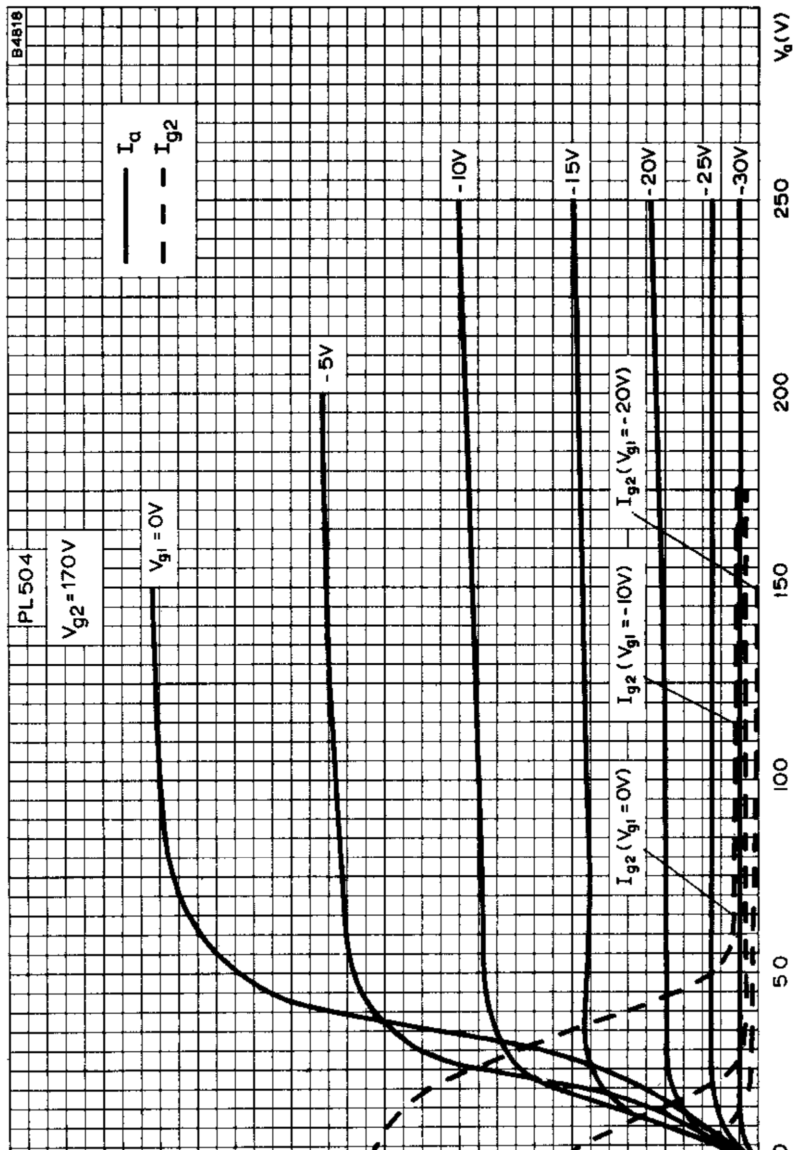
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE
WITH ANODE AND SCREEN-GRID VOLTAGE AS PARAMETER



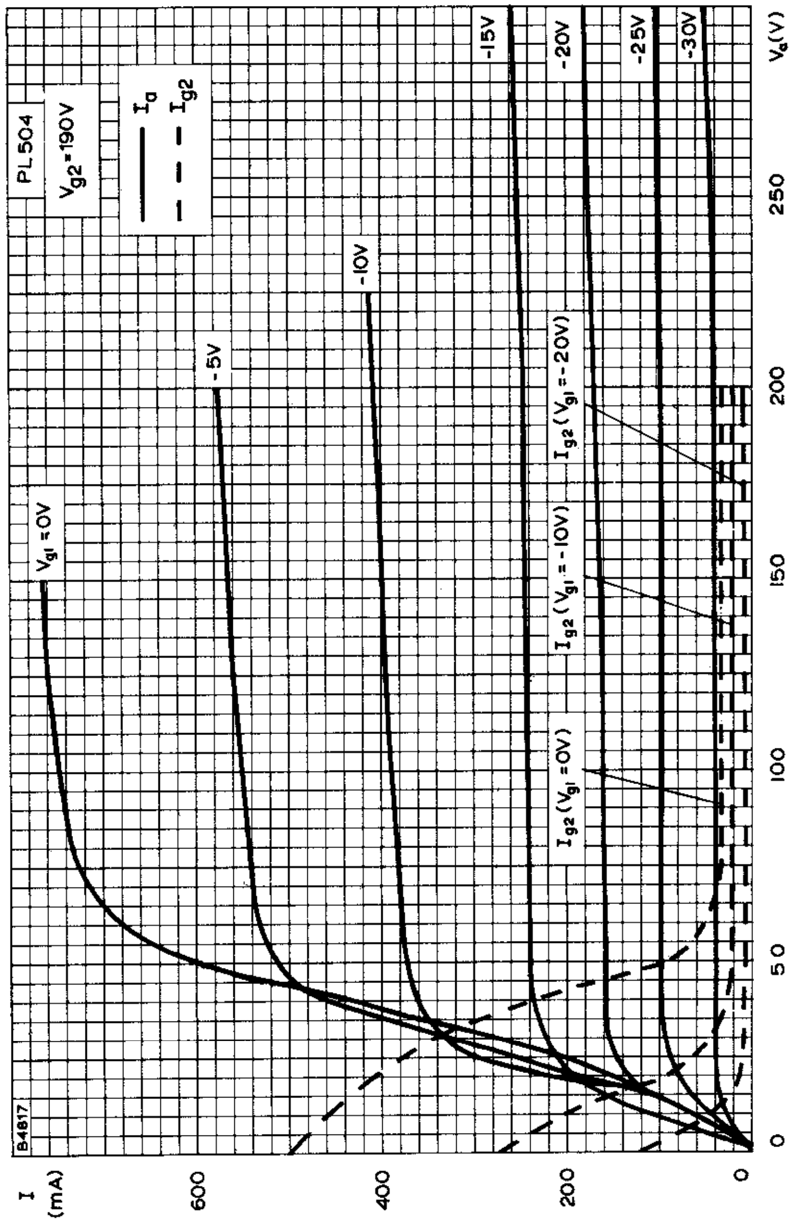
ANODE AND SCREEN CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 130V



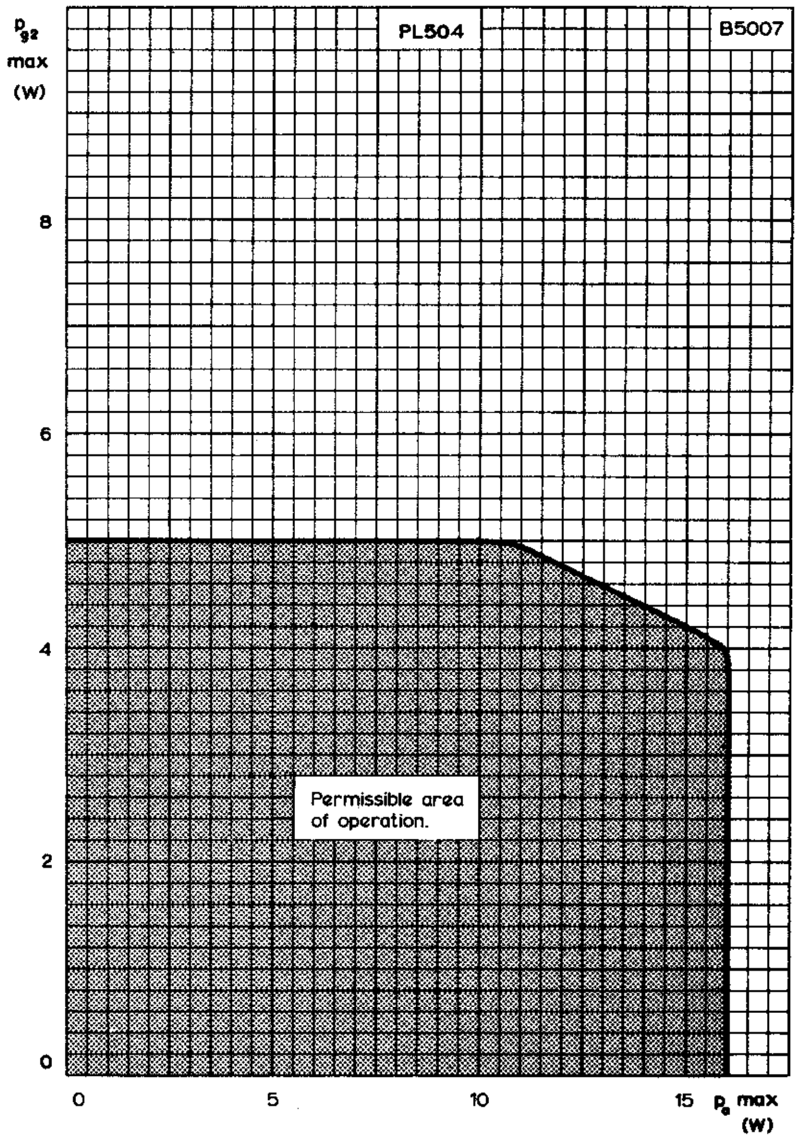
ANODE AND SCREEN CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 150V



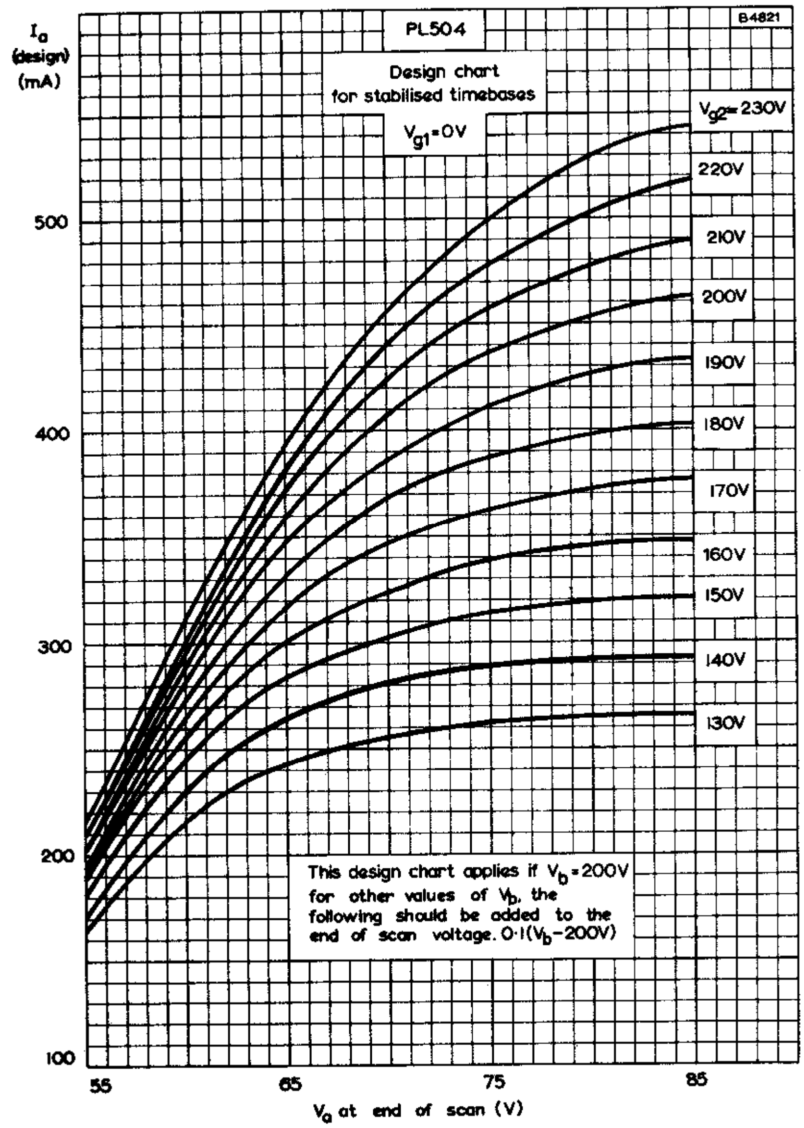
ANODE AND SCREEN CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 170V



ANODE AND SCREEN CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2}=190V$



DESIGN CENTRE RATINGS FOR p_a max. AND p_{g2} max.



DESIGN CHART FOR STABILISED TIMEBASES

OUTPUT PENTODE PL508

Field output pentode for colour television

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	17	V

CAPACITANCES (unshielded)

c_{a-g1}	1.4	pF
c_{g1-h}	<0.2	pF

CHARACTERISTICS ←

V_a	50	190	V
V_{g2}	190	190	V
I_a	320 pk	60	mA
I_{g2}	approx. 60	5.0	mA
V_{g1}	-1.0	-17	V
g_m		9.0	mA/V
μ_{g1-g2}		8.0	
r_a		10	kΩ

OPERATING CONDITIONS

For operating conditions when used as a field output valve in stabilised timebases, see graph on page 5.

RATINGS (DESIGN CENTRE SYSTEM)

$V_{a(b)}$ max.	700	V
V_a max.	400	V
*$v_{a(pk)}$ max.	2.5	kV
p_a max.	12	W
$V_{g2(b)}$ max.	700	V
V_{g2} max.	275	V
p_{g2} max.	3.0	W
I_k max.	100	mA
R_{g1-k} max. (fixed bias)	1.0	MΩ
R_{g1-k} max. (automatic bias)	2.2	MΩ
V_{h-k} max.	220	V

*Maximum pulse duration 5% of one cycle with a maximum of 1ms.

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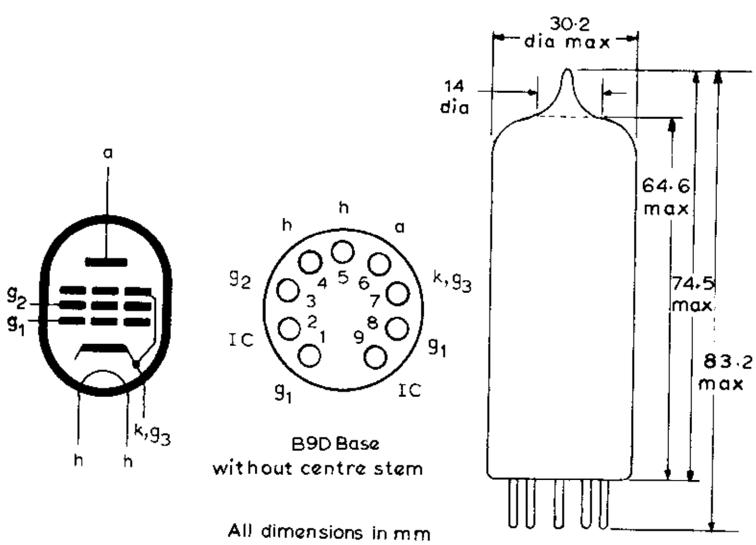
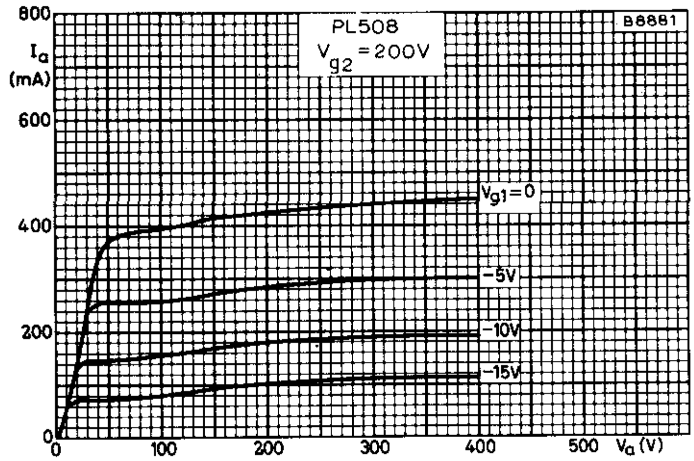
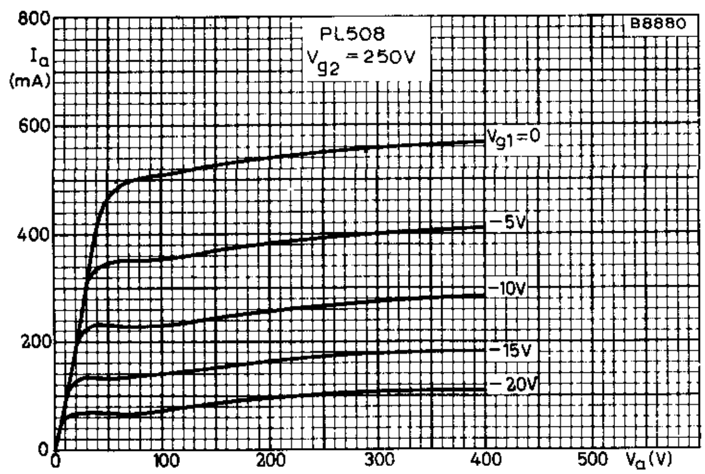
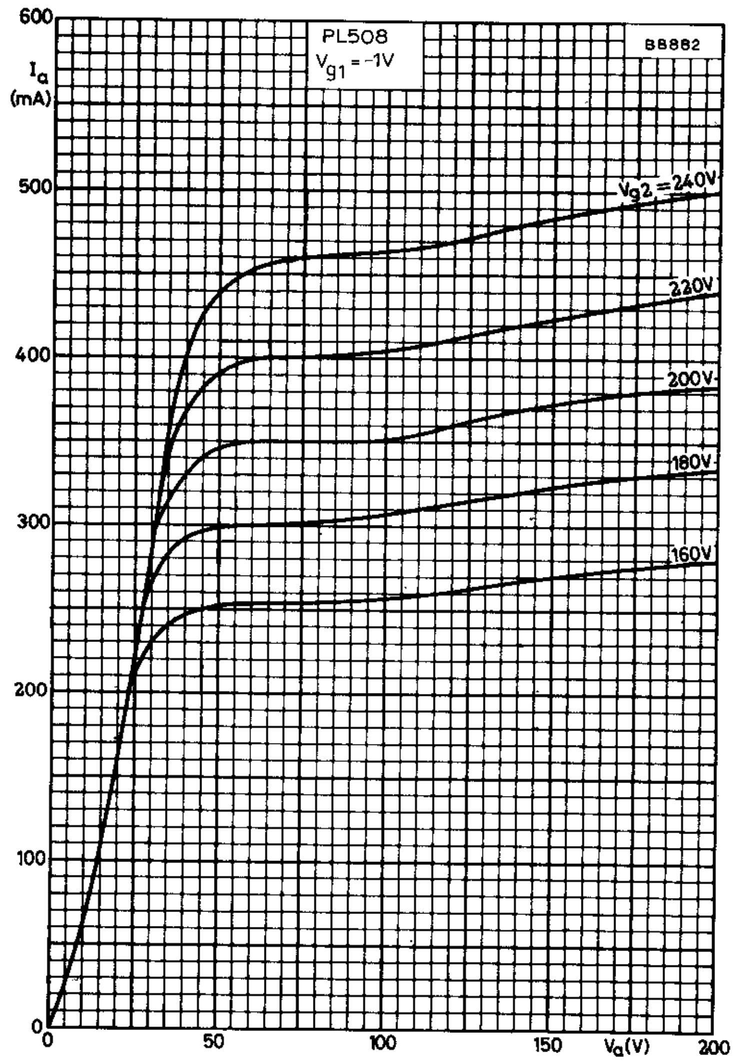


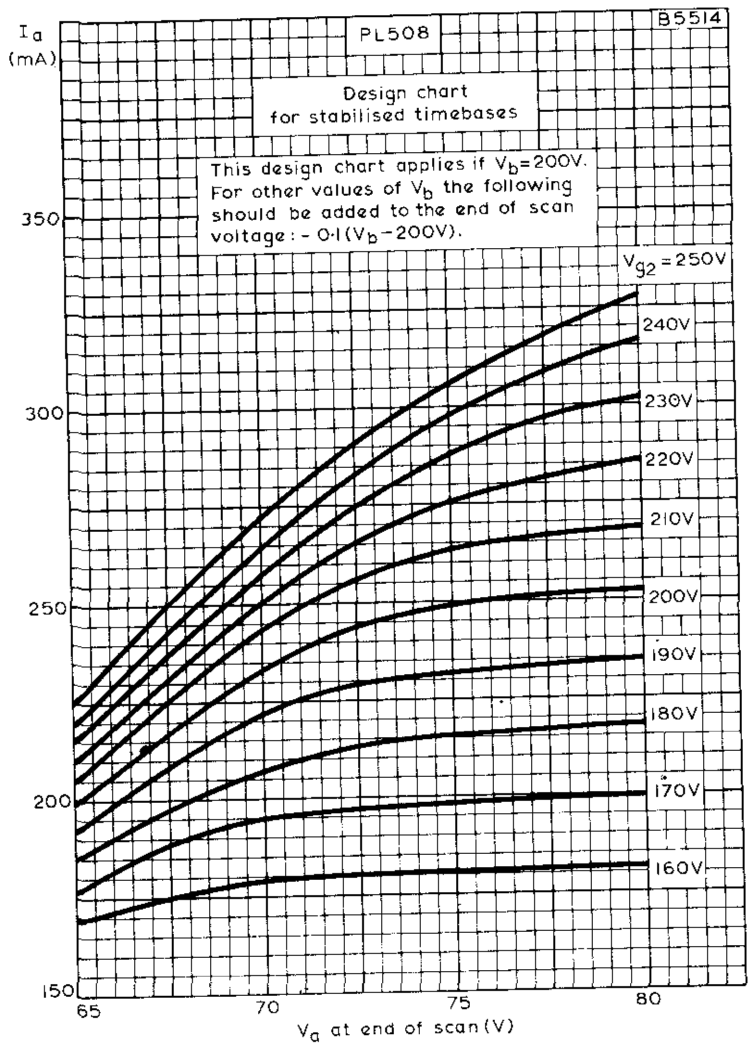




ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL GRID VOLTAGE AS PARAMETER



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH SCREEN GRID VOLTAGE AS PARAMETER



DESIGN CHART FOR STABILISED TIMEBASES

OUTPUT PENTODE PL509

Output pentode for colour television line deflection circuits

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	40	V

CAPACITANCES

c_{a-g1}	2.5	pF
c_{a-g1} max.	3.0	pF ←
c_{g1-h} max.	0.2	pF

DYNAMIC CHARACTERISTICS ←

V_a	160	50	V
V_{g3}	0	0	V
V_{g2}	160	175	V
V_{g1}	0	-10	V
I_a	1.4	0.8	A
I_{g2}	45	70	mA

OPERATING CONDITIONS ←

Stabilised circuits (d.c. feedback)

The minimum required cut-off voltage ($-V_{g1}$) during flyback at V_a=7.0kV and Z_{g1} = 1.0kΩ at line frequency is:-

V_{g2} = 150V: V_{g1} = -175V
V_{g2} = 200V: V_{g1} = -195V
V_{g2} = 250V: V_{g1} = -215V

Design chart for stabilised timebases See page 4

In order to prevent Barkhausen interference and loss of stabilisation, care should be taken to ensure that the anode voltage never drops below the specified minimum value during the scanning period.

When optimum suppression of Barkhausen oscillations is required, g3 may be connected to a positive voltage of approximately 20V.

Hum

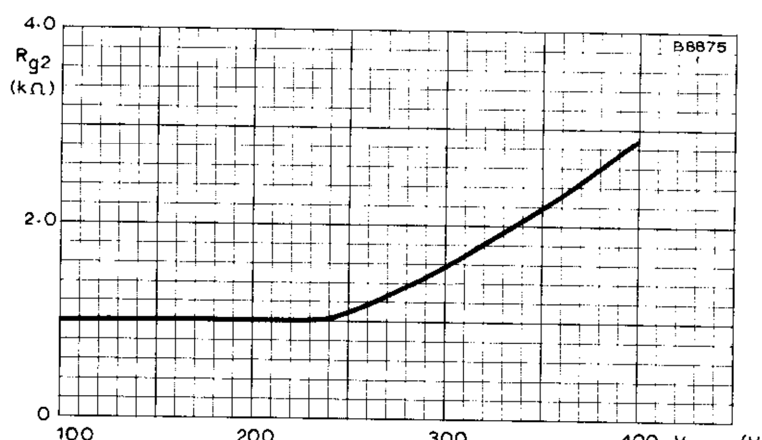
At Z_{g1} = 200kΩ (f = 50Hz), V_{h-k} = 220Vr.m.s. and without wiring and socket capacitances, the equivalent grid hum voltage is less than 5.0mV.

RATINGS (DESIGN CENTRE SYSTEM)

$V_{a(b)}$ max.	700	V
$v_{a(pk)}$ max. (see note 1)	7.0	kV
V_{g3} max.	50	V
$V_{g2(b)}$ max.	700	V
V_{g2} max.	275	V
$-v_{g1(pk)}$ max. (design maximum system) (see note 1)	550	V
p_a max.	30	W
p_{a+g2} max. (triode connected)	31	W
p_{g2} max. (see note 2)	7.0	W
I_k max.	500	mA
R_{g1} max. (fixed bias) (see note 3)	0.5	MΩ
R_{g1} max. (stabilised line timebases) (see note 3)	2.2	MΩ
R_{g3} max. (see note 4)	10	kΩ
V_{h-k} max.	250	V
T_{bulb} max. (absolute maximum rating)	300	°C

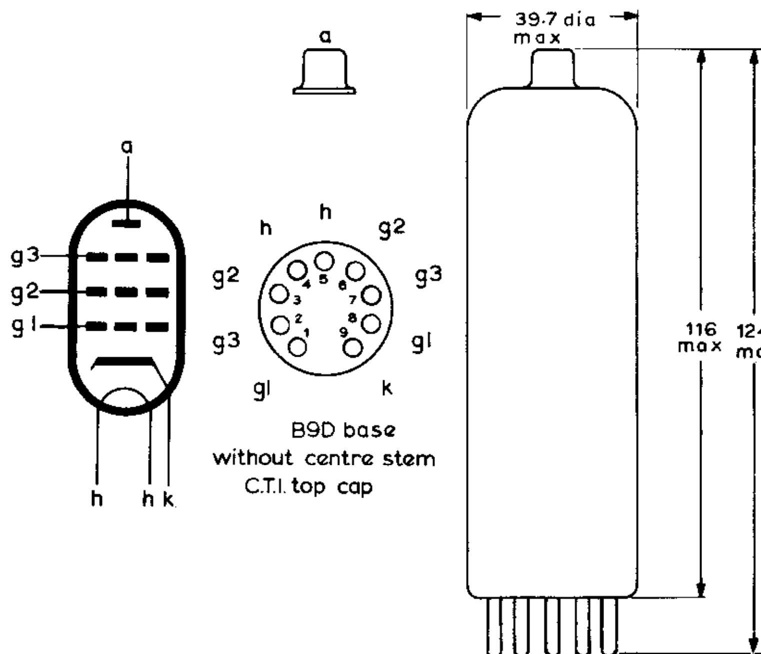
NOTES

1. Maximum pulse duration 22% of one cycle with a maximum of 18µs.
2. To prevent an excessive value of p_{g2} the minimum values of series resistance are given below.

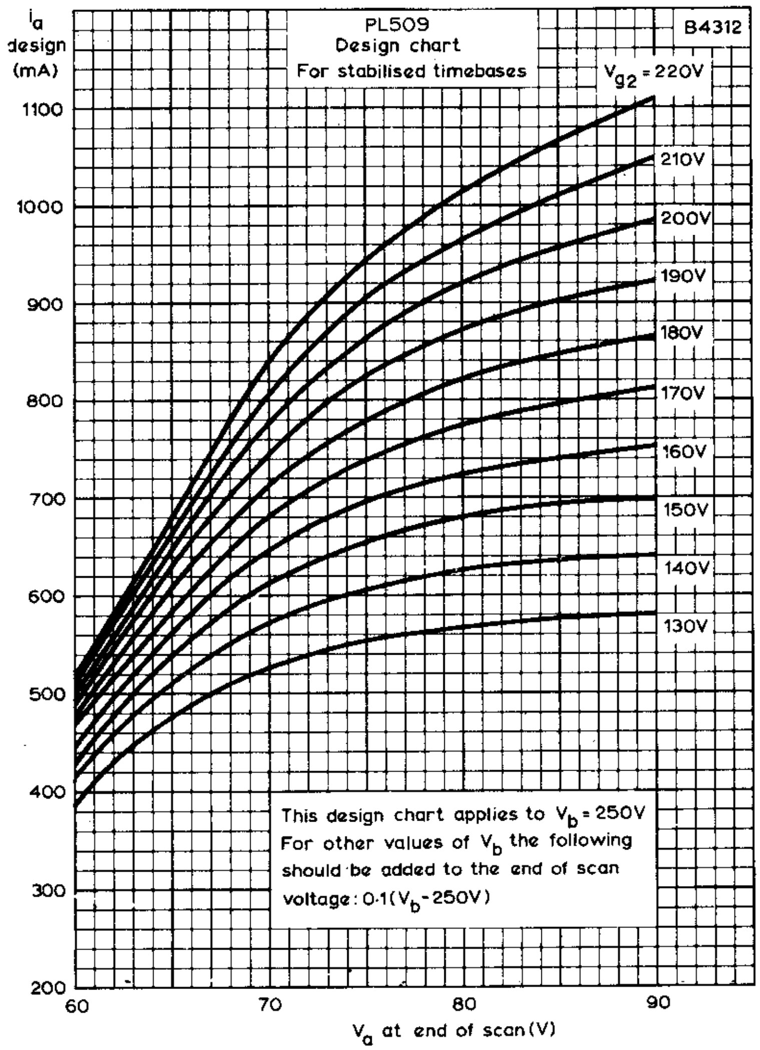


3. The circuit design must be such that negative control grid currents up to 5µA do not have any detrimental effect upon performance. Care should be taken that with 5µA grid current the limiting values for I_k, p_a and p_{g2} are not exceeded.
4. With $R_{g3} \leq 10k\Omega$ capacitive decoupling of g3 is not required.

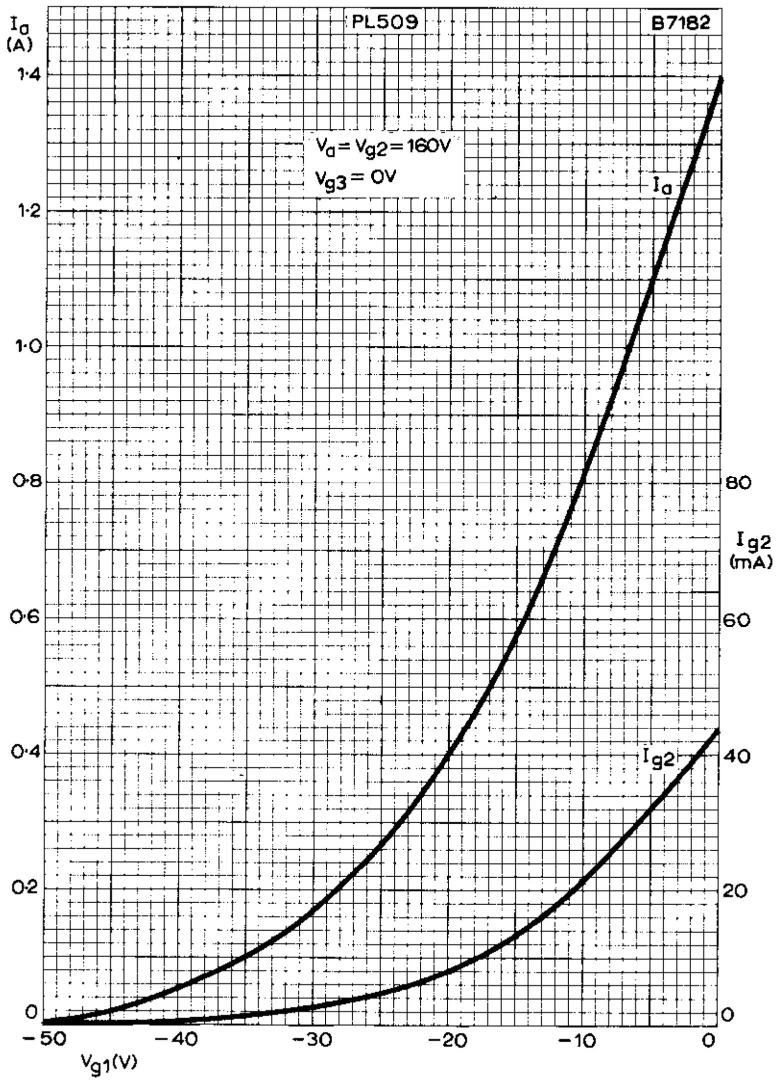
OUTPUT PENTODE PL509



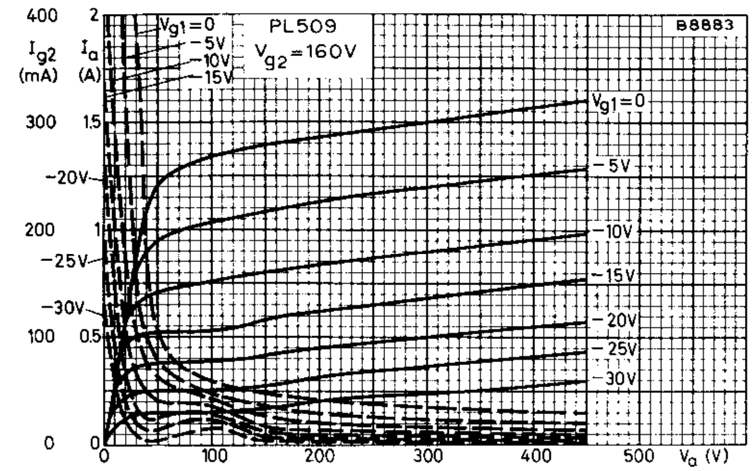
B3533 All dimensions in mm



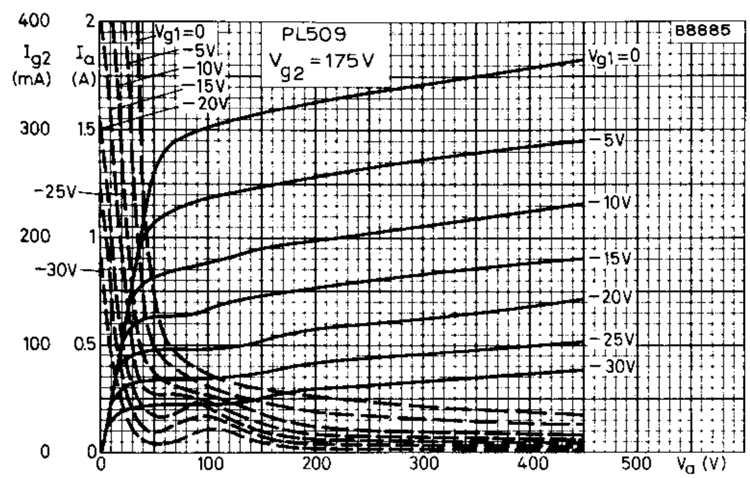
DESIGN CHART FOR STABILISED TIMEBASES



ANODE AND SCREEN CURRENTS PLOTTED AGAINST CONTROL GRID VOLTAGE

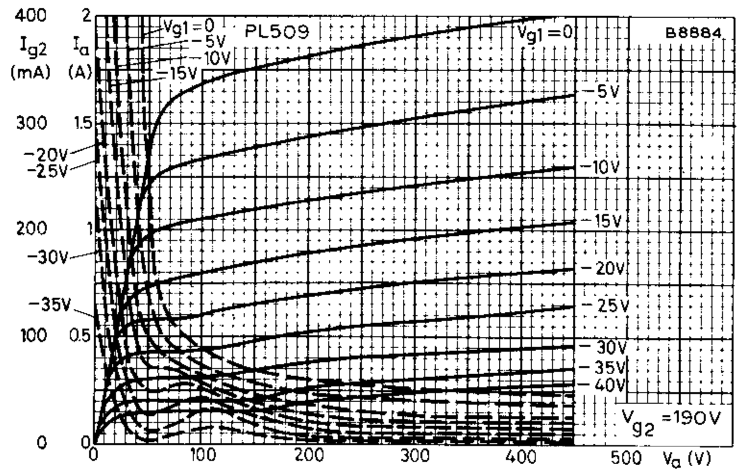


ANODE AND SCREEN GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE: V_{g2} = 160V



ANODE AND SCREEN GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE; V_{g2} = 175V

OUTPUT PENTODE PL509



ANODE AND SCREEN GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE: V_{g2} = 190V

VIDEO OUTPUT PENTODE PL802

Video output pentode for colour television receivers

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	16	V

CAPACITANCES

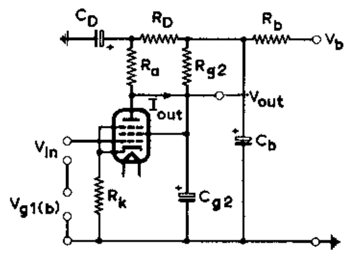
c_{in}	20	pF
c_{out}	4.0	pF
c_{a-g1}	0.075	pF
c_{a-g1} max.	0.1	pF ←

CHARACTERISTICS

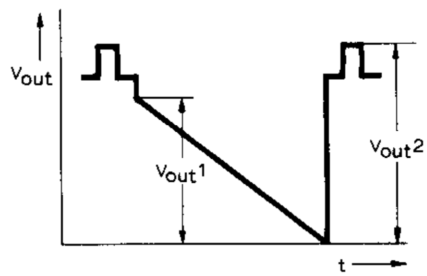
V_a	170	V
V_{g3}	0	V
V_{g2}	170	V
V_{g1}	-1.3	V ←
I_a	30	mA
I_{g2}	6.5	mA
g_m	40	mA/V
μ_{g1-g2}	70	

OPERATING CONDITIONS (negative modulation)

V_b	250V
R_b	330Ω
R_D	560Ω
C_D	16μF
R_a	2.7kΩ
R_{g2}	5.6kΩ
C_{g2}	2.0μF
R_k (no bypass capacitor)	39Ω
$V_{g1(b)}$	+4.0V



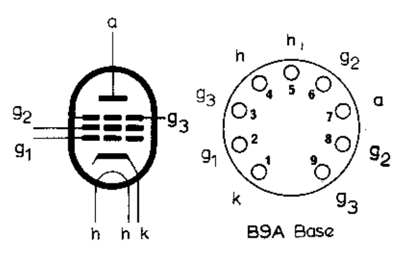
$V_{out(1)}$	100V
$V_{out(2)}$ p-p	≥140V
Video linearity	≥0.8
V_{in} p-p	approx. 5.0V
I_{out} max.	7.0mA

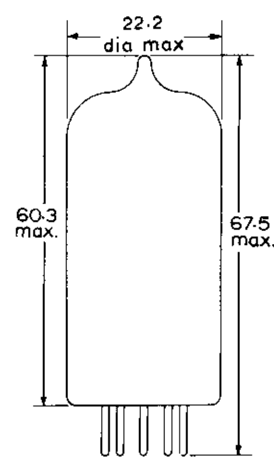


VIDEO OUTPUT PENTODE PL802

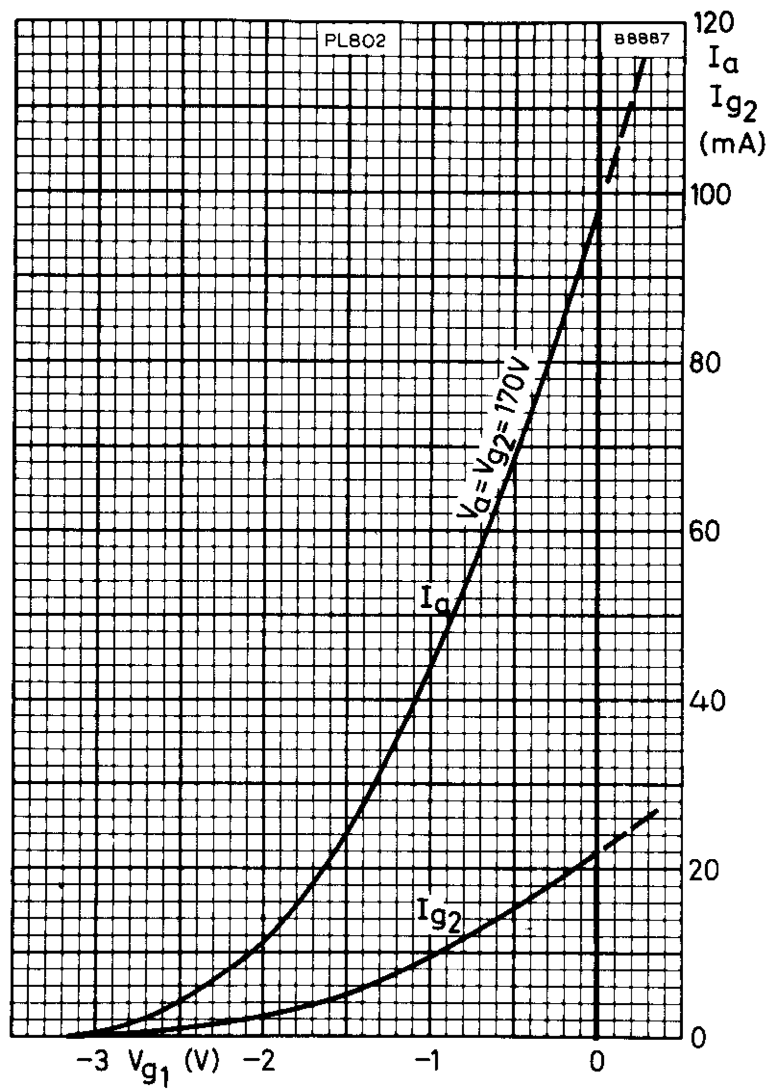
RATINGS (DESIGN CENTRE SYSTEM)

$V_{a(b)}$ max. (supply)	400	V
V_a max. (long term average)	300	V
V_a max. ($I_k = 0$)	550	V
p_a max.	6.0	W
V_{g2} max.	300	V
V_{g2} max. ($I_k = 0$)	550	V
p_{g2} max.	2.5	W
p_{g2} max. (intermittent rating, short duration)	3.0	W
I_k max.	100	mA
R_{g1-k} max.	100	kΩ
R_{g1-k} max. ($R_k \geq 39\Omega$)	500	kΩ
V_{h-k} max.	200	V



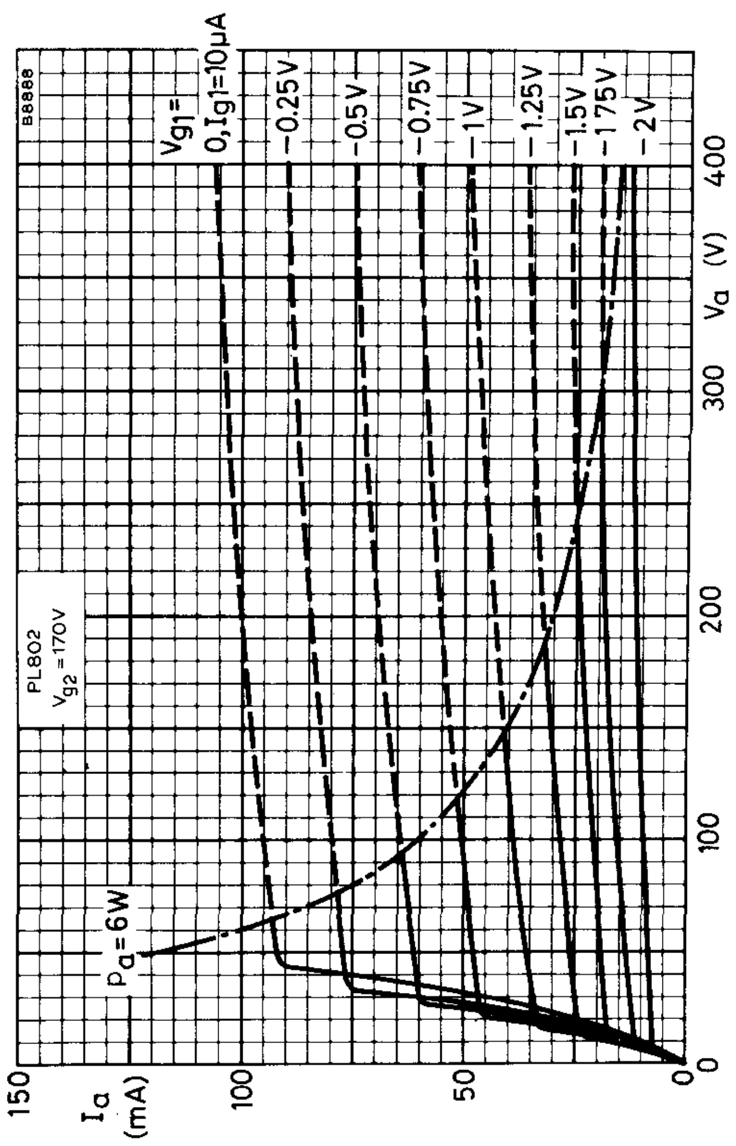


All dimensions in mm

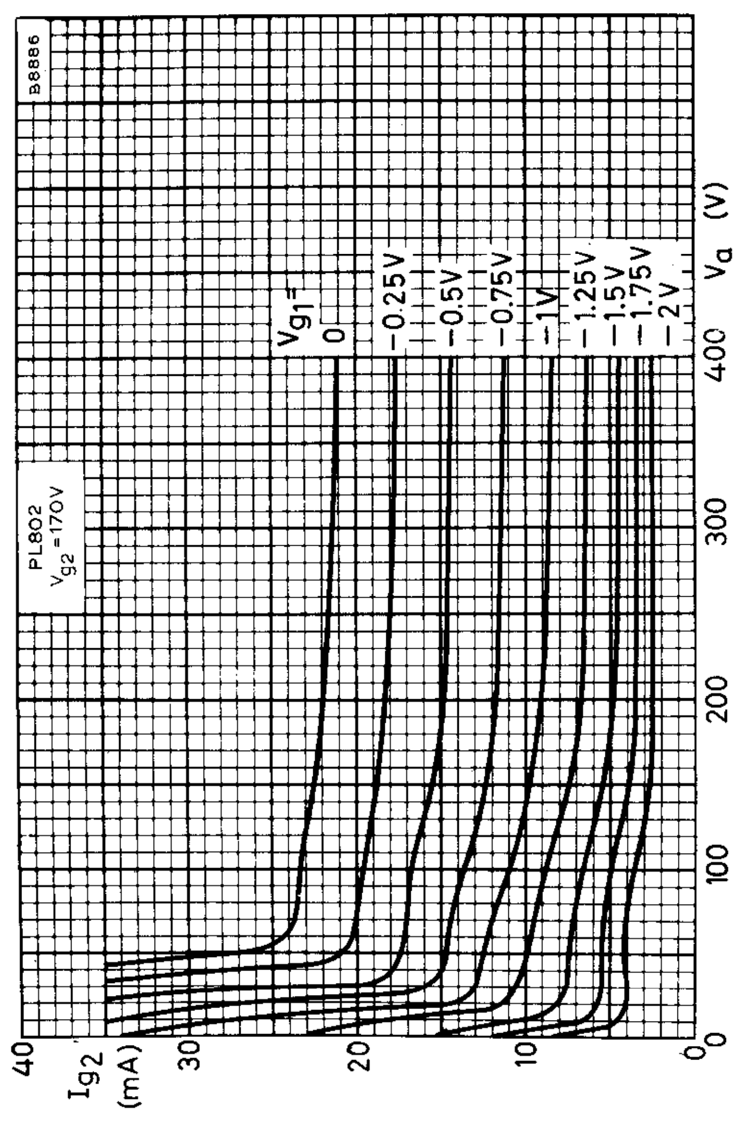


ANODE AND SCREEN GRID CURRENTS PLOTTED AGAINST CONTROL GRID VOLTAGE

VIDEO OUTPUT PENTODE PL802



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL GRID VOLTAGE AS PARAMETER



SCREEN GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL GRID VOLTAGE AS PARAMETER

BOOSTER DIODE

PY81

Booster diode with a maximum peak inverse voltage of 4.75kV intended for use in television receivers with series connected heaters.

HEATER

Suitable for series operation a.c. or d.c.

I_h	300	mA
V_h	17	V

CAPACITANCES

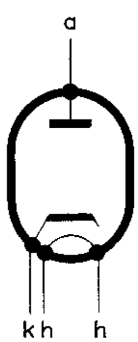
c_{a-k}	6.4	pF
c_{h-k}	2.8	pF←

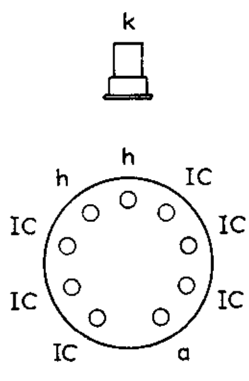
LIMITING VALUES

*P.I.V. max.	4.75	kV←
*$i_{a(pk)}$ max.	450	mA
$I_{a(av)}$ max.	150	mA
C max.	4.0	μF
$V_{h-e(r.m.s.)}$ max.	220	V
*$v_{h-k(pk)}$ max. (cathode positive)	4.75	kV←
*$v_{a-h(pk)}$ max. (anode negative)	3.0	kV

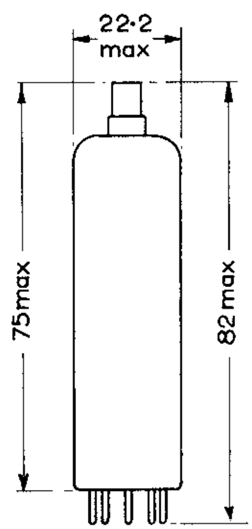
*Maximum pulse duration 22% of one cycle with a maximum of 18μs.

6151

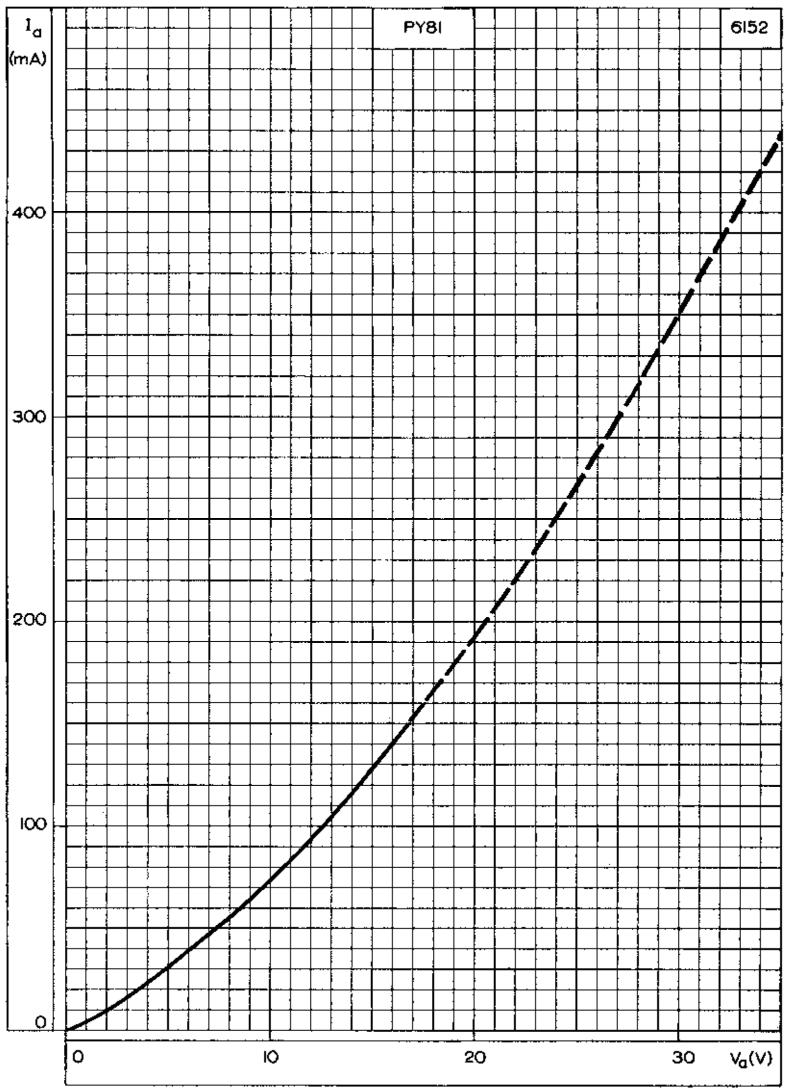




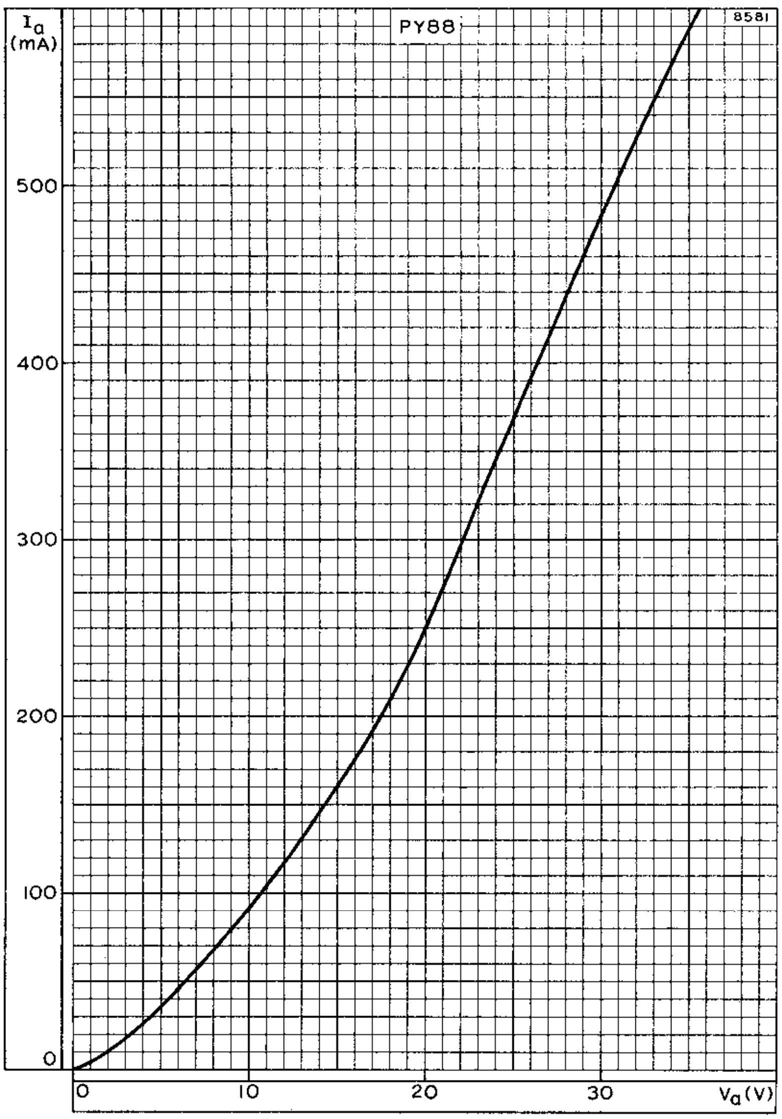
B9A Base



All dimensions in mm



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

BOOSTER DIODE PY500

TENTATIVE DATA

Booster diode for colour television timebase circuits

HEATER : Suitable for series a.c. or d.c. operation

I_h	300	mA
V_h	42	V

During operation the minimum resistance between any heater pin and any mains terminal for the heater chain should be 100Ω. The hot heater resistances of the other valves in the chain can serve for this resistance.

CAPACITANCES

c_{a-k}	13.5	pF
c_{h-k}	3.7	pF

CHARACTERISTICS

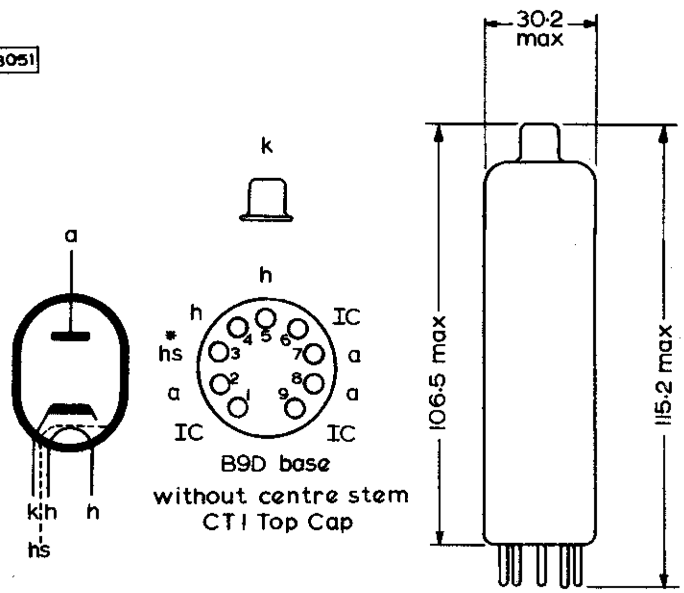
I_a	440	mA
r_i	42	Ω

LIMITING VALUES (DESIGN CENTRE RATINGS)

*P.I.V. max.	5.6	kV
i_a (pk) max.	800	mA
I_a max.	440	mA
*v_{h-k} (pk) max. (cathode positive)	6.3	kV
p_a max.	11	W

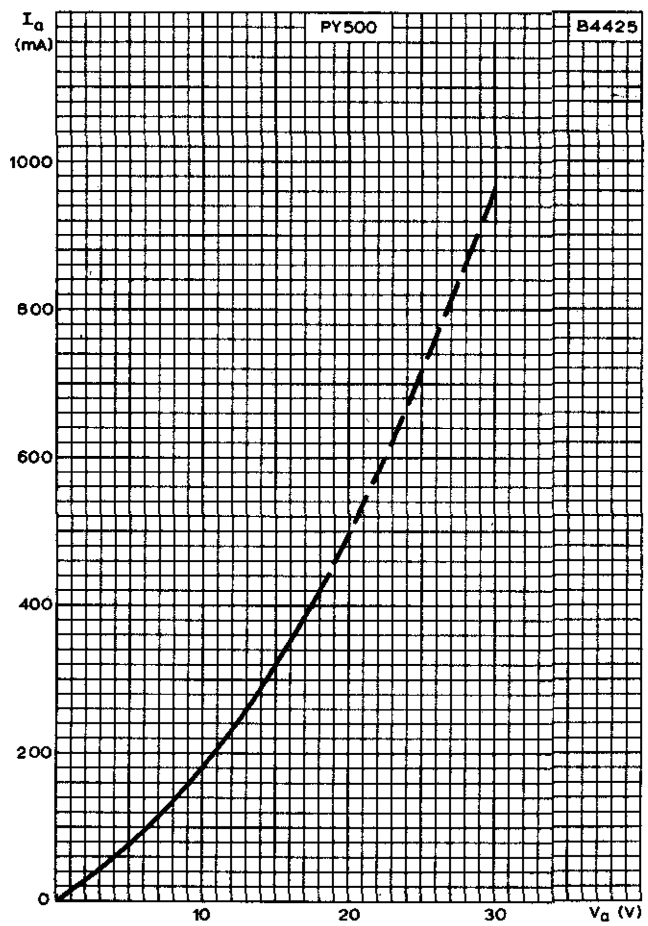
*Maximum pulse duration 22% of one cycle with a maximum of 18μs.

B3051



All dimensions in millimetres

*Insertion of a 1.0W non-inductive 330Ω carbon resistor between pins 3 and 4 is recommended to improve the high-tension properties of the tube. If no resistor is used, pins 3 and 4 should be interconnected.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

BOOSTER DIODE PY500A

Booster diode for colour television timebase circuits. In existing equipment the PY500A is a direct replacement for the PY500. In new equipment designs the 300Ω protection resistance from pin 3 to pin 4 or 5 is not required with the PY500A.

HEATER: Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	42	V

During operation the minimum resistance between any heater pin and any mains terminal for the heater chain should be 100Ω. The hot heater resistances of the other valves in the chain can serve for this resistance.

CAPACITANCES

c_{a-k}	13	pF
c_{h-k}	3.7	pF

CHARACTERISTICS

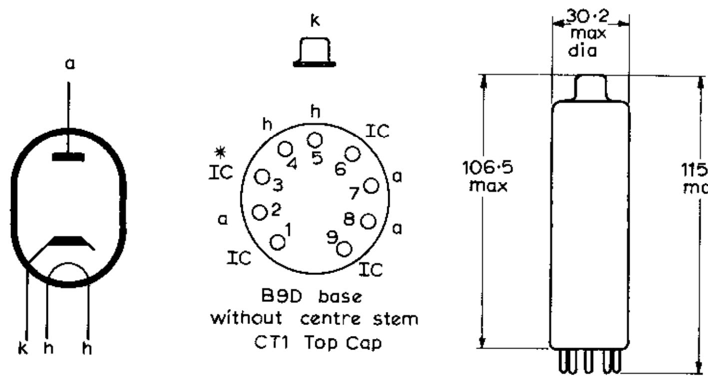
I_a	440	mA
r_i	45.5	Ω

RATINGS (DESIGN CENTRE SYSTEM)

*P.I.V. max.	5.6	kV
*P.I.V. max. (absolute rating)	7.0	kV
$i_{a(pk)}$ max.	800	mA
I_a max.	440	mA
*$v_{h-k(pk)}$ max. (cathode positive)	6.3	kV
p_a max.	11	W

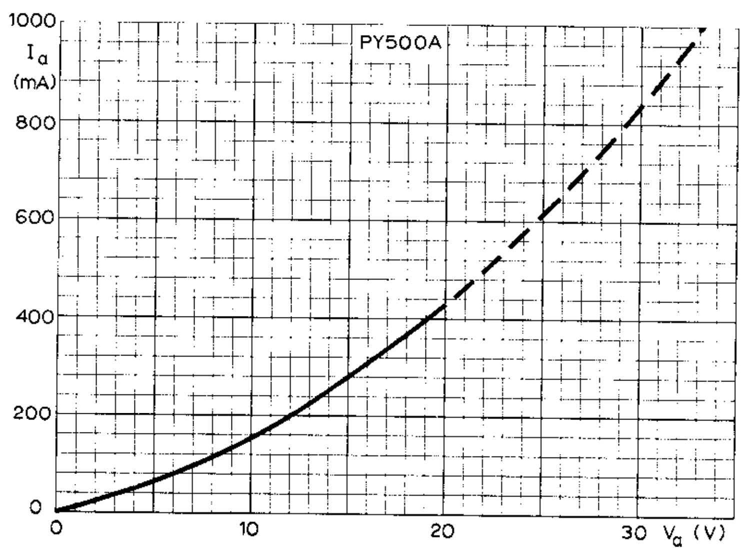
*Maximum pulse duration 22% of one cycle with a maximum of 18μs.

OUTLINE DRAWING



All dimensions in mm

*In existing equipment using the PY500 a resistor may be wired from pin 3 to pin 4 or 5, or pins 3 and 4 may be interconnected. When replacing the PY500 with the PY500A the resistor or interconnection need not be removed. In new equipment designs using the PY500A pin 3 should be left unconnected.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

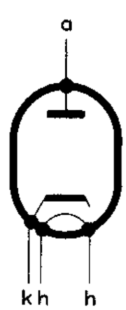
BOOSTER DIODE PY800

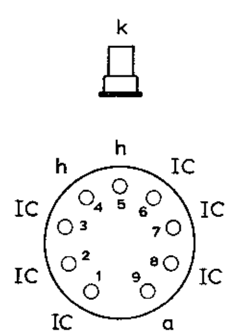
Booster diode for use in television receivers employing 110° deflection angle cathode ray tubes.

HEATER		
I_h	300	mA
V_h	19	V
CAPACITANCES		
c_{a-k}	6.0	pF ←
c_{h-k}	2.2	pF ←
LIMITING VALUES		
*P.I.V. max.	5.75	kV ←
i_a (pk) max.	450	mA ←
I_a (av) max.	175	mA ←
*v_{h-k} (pk) max. (cathode positive)	6.0	kV ←

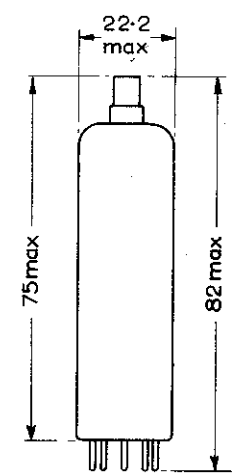
*Maximum pulse duration 22% of one cycle with a maximum of 18µs. ←

6151

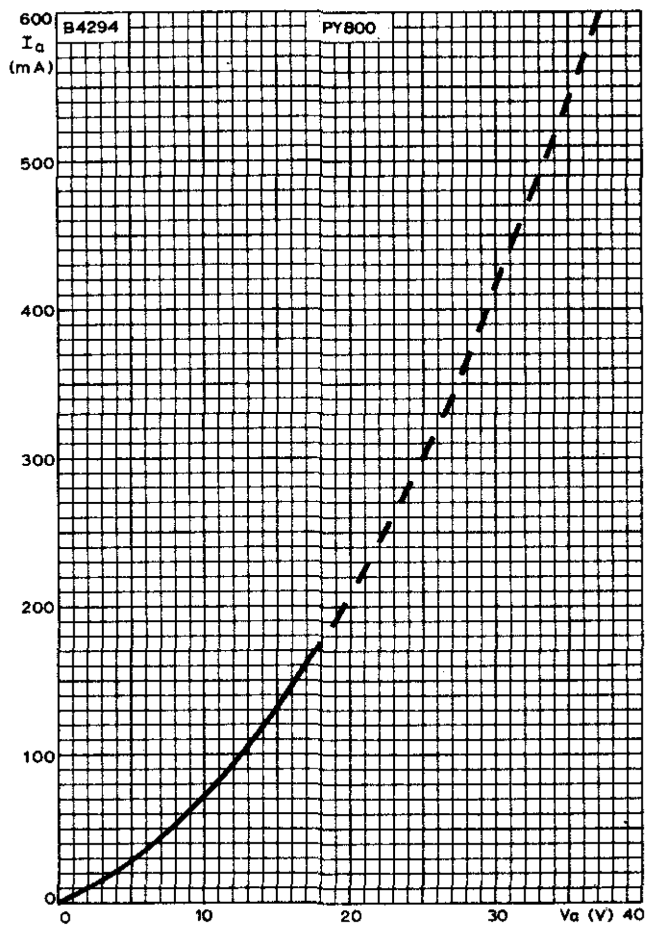




B9A Base



All dimensions in mm



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

TRIPLE DIODE TRIODE

UABC80

Triple diode triode with 100mA heater and one diode having a separate cathode. Primarily intended for use in f.m./a.m. receivers.

PRELIMINARY DATA

HEATER Suitable for series operation a.c. or d.c.

I_h	0.1	A
V_h	28	V

CAPACITANCES

$c_{g-a'd}$	<0.07	pF
$c_{at-a'd}$	<0.12	pF
$c_{at-a'''d}$	<0.1	pF
$c_{at-k''d}$	<0.01	pF
$c_{g-a'''d}$	<0.02	pF
$c_{g-k''d}$	<0.005	pF

Triode Section

c_{in}	1.9	pF
c_{out}	1.4	pF
c_{a-g}	2.0	pF
c_{g-h}	<0.04	pF

Diode Sections

$c_{a'd-(h+kt,k'd,k'''d,s)}$	0.8	pF
$c_{a''d-(h+k''d+kt,k'd,k'''d,s)}$	4.8	pF
$c_{a'''d-(h+kt,k'd,k'''d,s)}$	4.8	pF
$c_{k''d-all}$	5.0	pF
$c_{a'd-h}$	<0.25	pF
$c_{a'''d-h}$	<0.2	pF
$c_{k''d-h}$	2.5	pF

CHARACTERISTICS

Triode Section

V_a	170	200	V
V_g	−1.85	−2.3	V
I_a	1.0	1.0	mA
g_m	1.45	1.4	mA/V
μ	70	70	
r_a	48	50	kΩ

Diode Sections

$r_{a'd}$ ($V_{a'd} = +10V$)	5.0	kΩ
$r_{a''d}$ ($V_{a''d} = +5V$)	200	Ω
$r_{a'''d}$ ($V_{a'''d} = +5V$)	200	Ω
$r_{a''d}/r_{a'''d}$	0.65 to 1.5	

UABC80

TRIPLE DIODE TRIODE

Triple diode triode with 100mA heater and one diode having a separate cathode. Primarily intended for use in f.m./a.m. receivers.

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER* (with grid current biasing)

V_b (V)	R_a (k Ω)	I_a (mA)	$\frac{V_{out}}{V_{in}}$	D_{tot} (%) for $V_{out(r.m.s.)}$ =3V	=5V	=8V	R_g† (k Ω)
170	47	1.25	32	0.6	1.1	2.0	150
170	100	0.82	42	0.5	0.8	1.3	330
170	220	0.46	51	0.4	0.5	1.1	680
200	47	1.6	34	0.5	0.9	1.5	150
200	100	1.0	44	0.4	0.6	1.0	330
200	220	0.56	53	0.3	0.4	0.9	680
250	47	2.2	36	0.3	0.6	1.0	150
250	100	1.4	47	0.25	0.5	0.8	330
250	220	0.76	54	0.2	0.25	0.6	680

*Measured with a grid resistor of 10MΩ.

†R_g=grid resistor of following value.

LIMITING VALUES

Triode Section

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	1.0	W
I_k max.	5.0	mA
V_g max. (I_g= +0.3μA)	-1.3	V
*R_{g-k} max.	3.0	MΩ
R_{h-k} max.	20	kΩ
†V_{h-k} max.	150	V

*With grid current biasing R_{g-k} max.=22MΩ

†In order to avoid excessive hum the a.c. component should be as low as possible (<$30V_{r.m.s.}$)

Diode Sections

P.I.V.$_{(a'd)}$ max.	350	V
P.I.V.$_{(a''d)}$ max.	350	V
P.I.V.$_{(a'''d)}$ max.	350	V
$I_{a'd}$ max.	1.0	mA
$I_{a''d}$ max.	10	mA
$I_{a'''d}$ max.	10	mA
$i_{a'd(pk)}$ max.	6.0	mA
$i_{a''d(pk)}$ max.	75	mA
$i_{a'''d(pk)}$ max.	75	mA

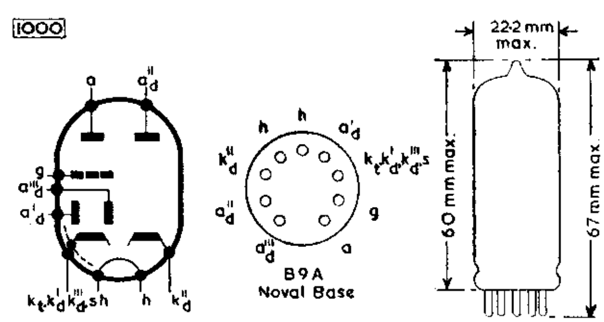
TRIPLE DIODE TRIODE

UABC80

Triple diode triode with 100mA heater and one diode having a separate cathode. Primarily intended for use in f.m./a.m. receivers.

MICROPHONY

This valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 10mV for an output of 50mW from the output stage at 800c/s and higher frequencies.

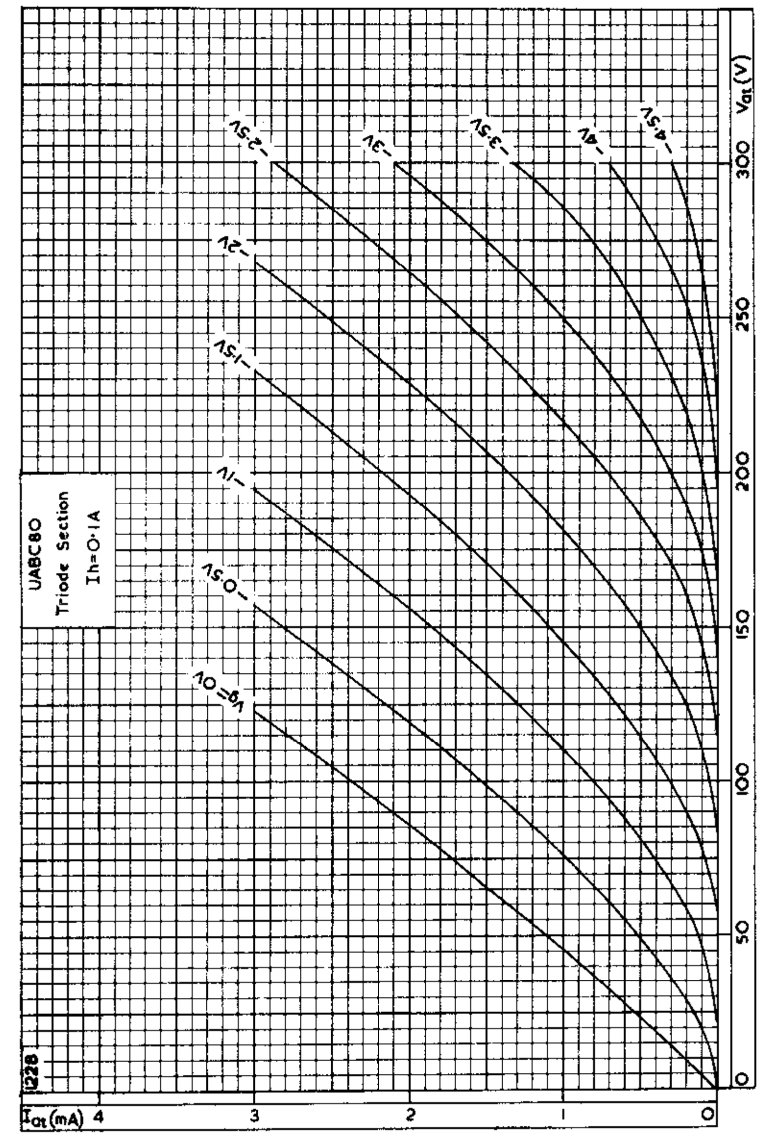


It is recommended that pin 5 be earthed.

UABC80

TRIPLE DIODE TRIODE

Triple diode triode with 100mA heater and one diode having a separate cathode. Primarily intended for use in f.m./a.m. receivers.

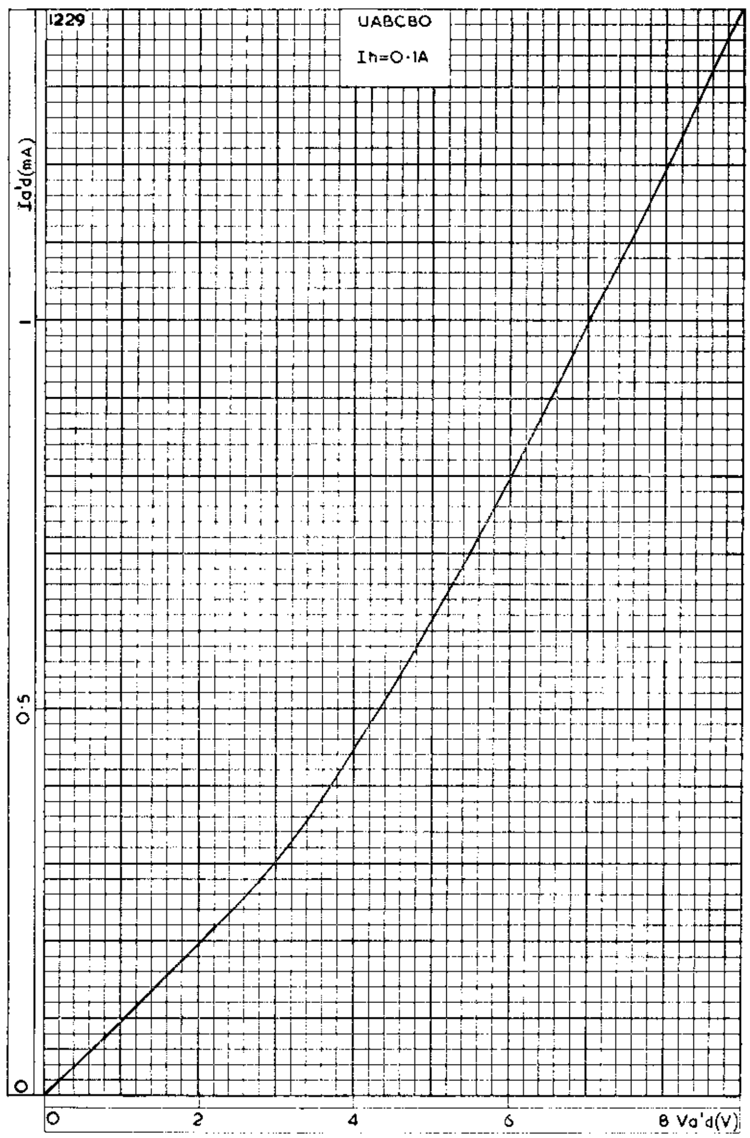


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

TRIPLE DIODE TRIODE

UABC80

Triple diode triode with 100mA heater and one diode having a separate cathode. Primarily intended for use in f.m./a.m. receivers.

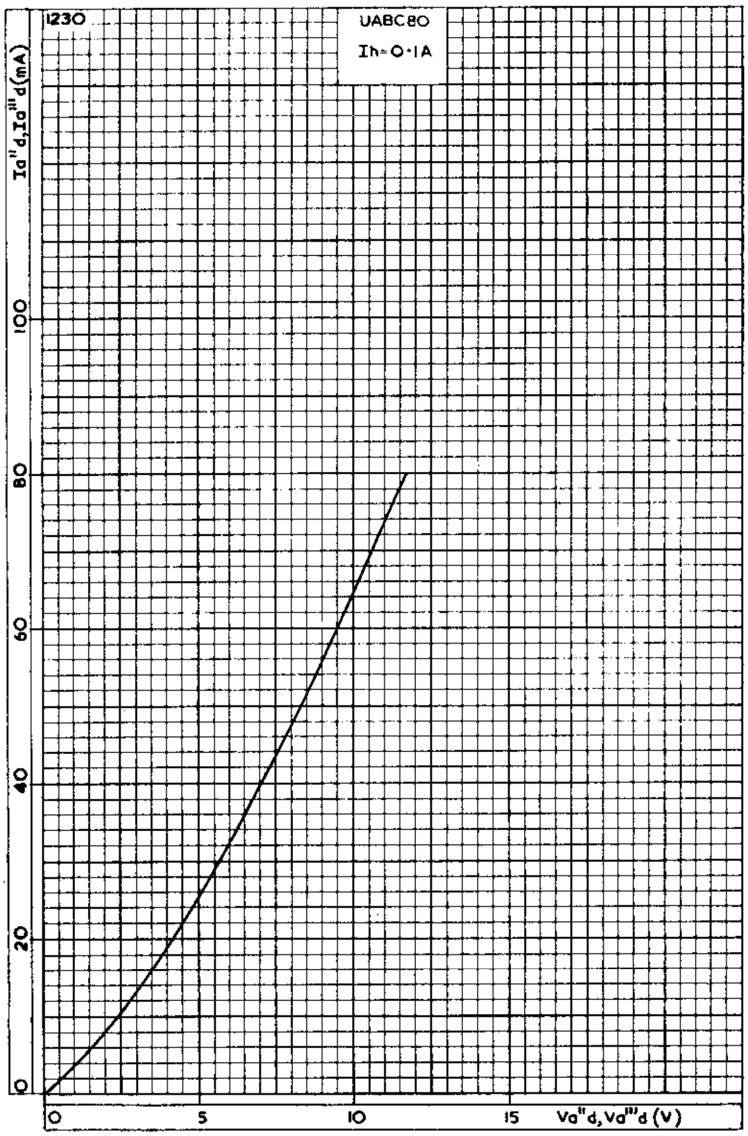


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR DIODE SECTION a'$_d$

UABC80

TRIPLE DIODE TRIODE

Triple diode triode with 100mA heater and one diode having a separate cathode. Primarily intended for use in f.m./a.m. receivers.

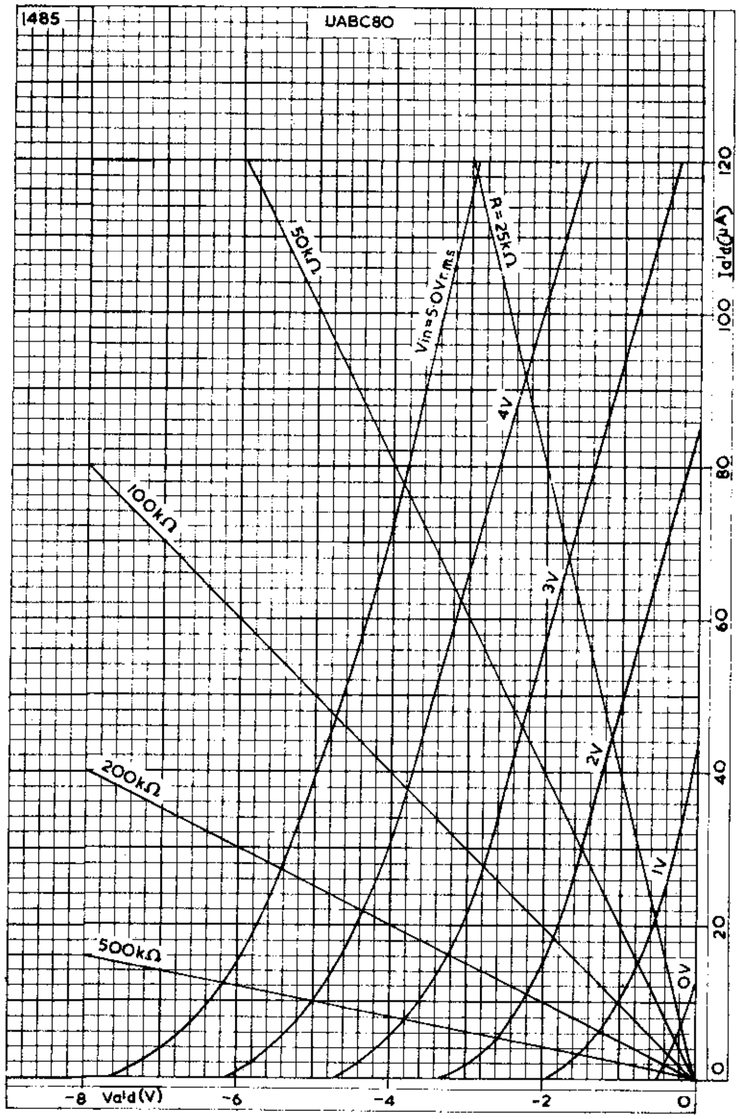


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR DIODE SECTIONS a''_d and a'''_d

TRIPLE DIODE TRIODE

UABC80

Triple diode triode with 100mA heater and one diode having a separate cathode. Primarily intended for use in f.m./a.m. receivers.

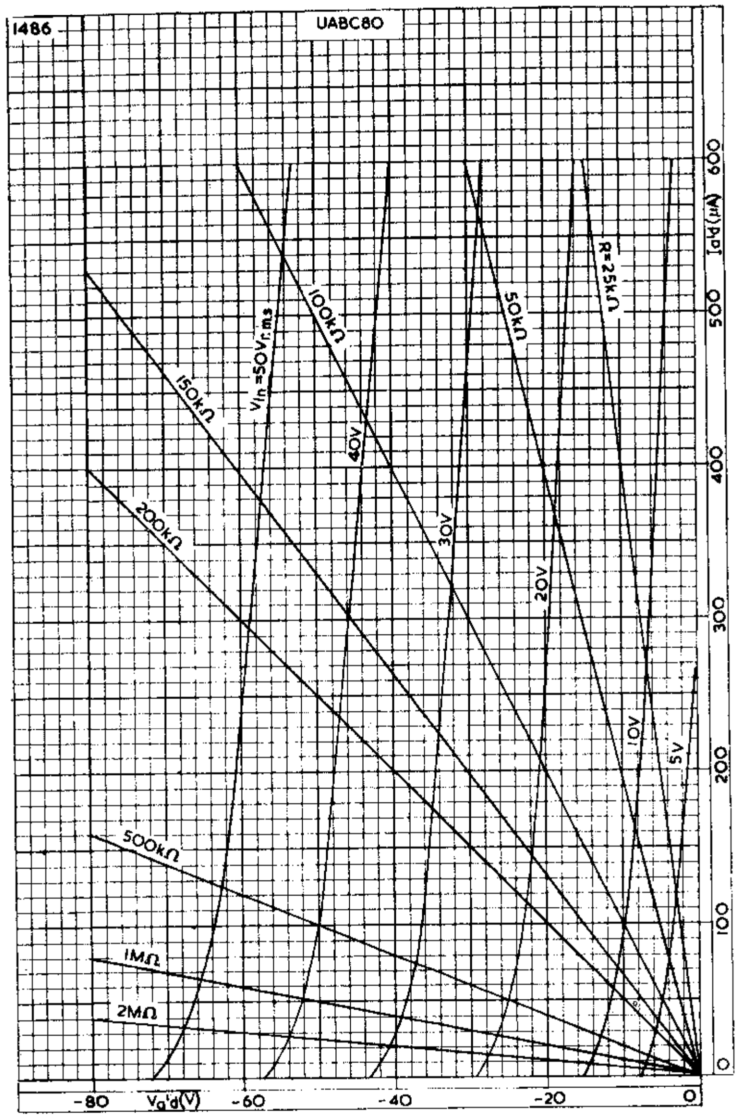


RECTIFIED CURRENT PLOTTED AGAINST OUTPUT VOLTAGE WITH INPUT VOLTAGE BETWEEN 0V AND 5Vr.m.s. AS PARAMETER FOR DIODE SECTION a'_d

UABC80

TRIPLE DIODE TRIODE

Triple diode triode with 100mA heater and one diode having a separate cathode. Primarily intended for use in f.m./a.m. receivers.

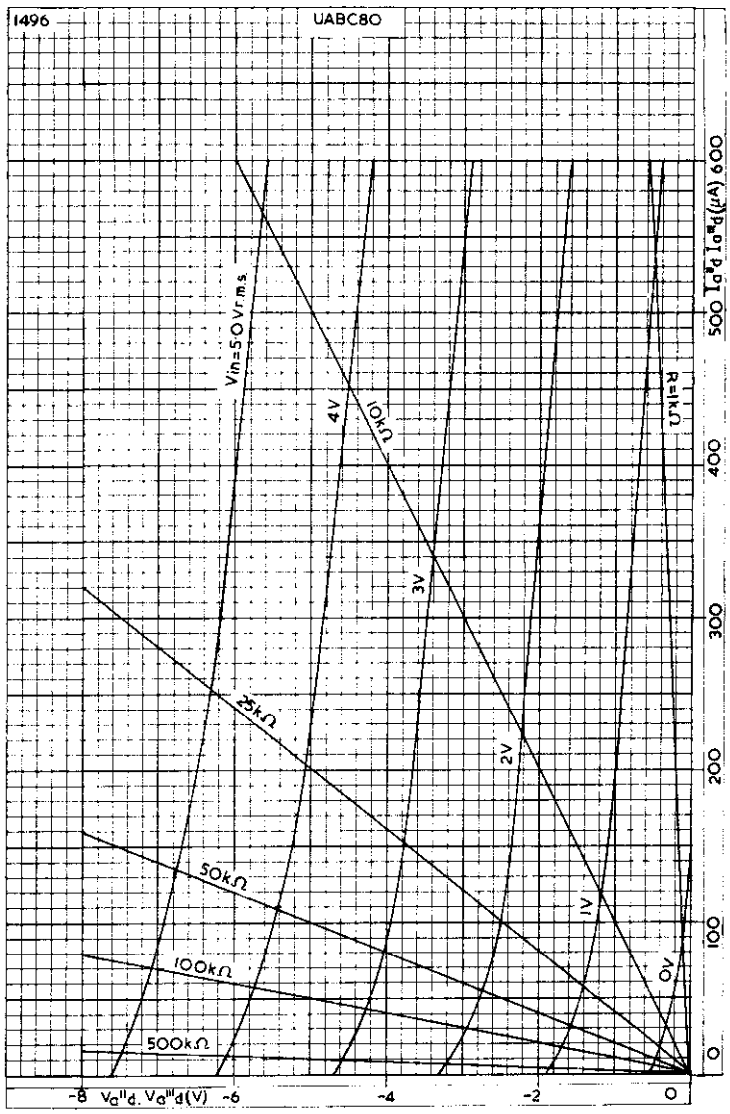


RECTIFIED CURRENT PLOTTED AGAINST OUTPUT VOLTAGE WITH INPUT VOLTAGE BETWEEN 5Vr.m.s. AND 50Vr.m.s. AS PARAMETER FOR DIODE SECTION a'd

TRIPLE DIODE TRIODE

UABC80

Triple diode triode with 100mA heater and one diode having a separate cathode. Primarily intended for use in f.m./a.m. receivers.

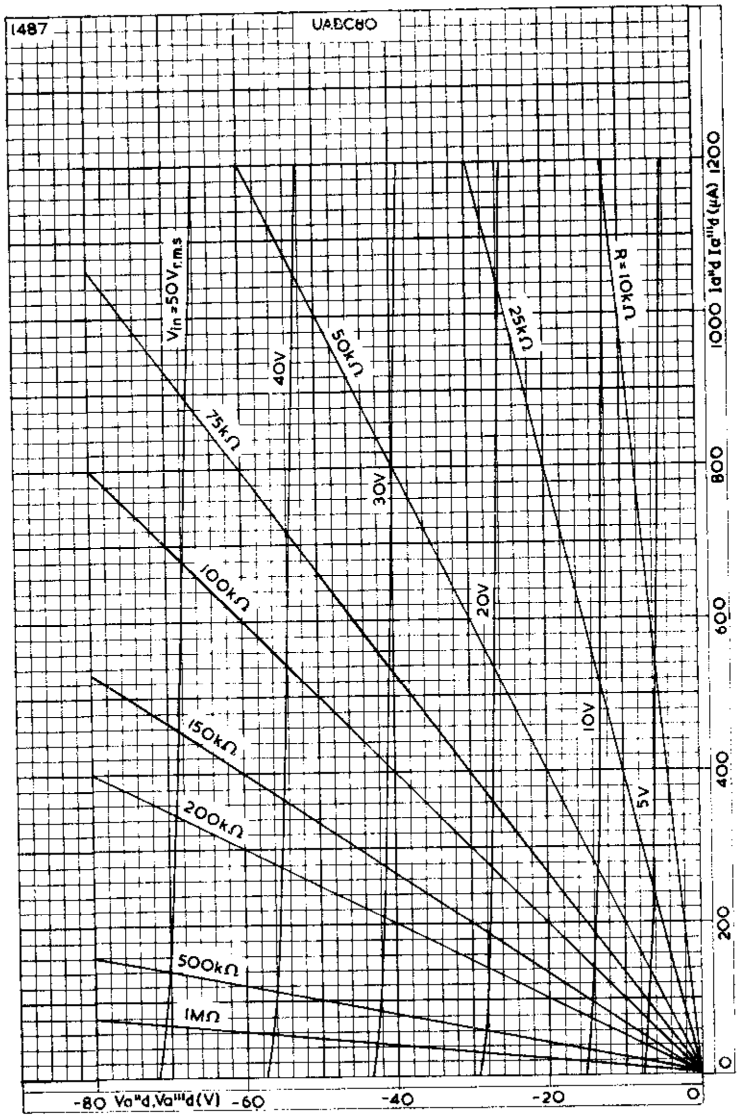


RECTIFIED CURRENT PLOTTED AGAINST OUTPUT VOLTAGE WITH INPUT VOLTAGE BETWEEN 0V AND $5V_{r.m.s.}$ AS PARAMETER FOR DIODE SECTIONS a''_d AND a'''_d

UABC80

TRIPLE DIODE TRIODE

Triple diode triode with 100mA heater and one diode having a separate cathode. Primarily intended for use in f.m./a.m. receivers.



RECTIFIED CURRENT PLOTTED AGAINST OUTPUT VOLTAGE WITH INPUT VOLTAGE BETWEEN $5V_{r.m.s.}$ AND $50V_{r.m.s.}$ AS PARAMETER FOR DIODE SECTIONS a''_d AND a'''_d

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

UBF89

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.

HEATER

Suitable for series operation a.c. or d.c.

I_h	100	mA
V_h	19	V

MOUNTING POSITION

Any

CAPACITANCES

$c_{a'd-g1}$	<0.0008	pF
$c_{a''d-g1}$	<0.001	pF
$c_{a'd-a}$	<0.15	pF
$c_{a''d-a}$	<0.025	pF

Pentode section

c_{a-g1}	<0.0025	pF
c_{out}	5.2	pF
c_{in}	5.0	pF
c_{g1-h}	0.05	pF

Diode sections

$c_{a'd-k}$	2.5	pF
$c_{a''d-k}$	2.5	pF
$c_{a'd-a''d}$	<0.25	pF
$c_{a'd-h}$	<0.015	pF
$c_{a''d-h}$	<0.003	pF

CHARACTERISTICS

V_a	100	200	V
V_{g3}	0	0	V
V_{g2}	100	100	V
V_{g1}	−2.0	−1.5	V
I_a	8.5	11	mA
I_{g2}	2.8	3.3	mA
g_m	3.5	4.5	mA/V
r_a	300	600	kΩ
μ_{g1-g2}	—	20	
V_{g1} (g_m = 120μA/V)	−10	−20	V

UBF89

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f amplifier. The diode sections are only suitable for a.m. detection.

TYPICAL OPERATING CONDITIONS

$V_a = V_b$	170	170	200	200	V
V_{g3}	0	0	0	0	V
R_{g2}	27	21	47	30	kΩ
V_{g1}	−0.5*	−1.5	−0.5*	−1.5	V
R_k	—	105	—	105	Ω
I_a	11	11	9.5	11	mA
I_{g2}	3.4	3.4	2.8	3.3	mA
g_m	5.0	4.5	5.0	4.5	mA/V
r_a	450	450	600	600	kΩ
R_{eq}	2.5	3.5	2.5	3.5	kΩ
g_m ($V_{g1} = -20V$)	65	65	115	120	μA/V

*This voltage is produced by the grid current flowing through the grid resistor and the steady current of the diode. If this condition is not acceptable the negative grid bias should be increased to −1.5V

LIMITING VALUES

Pentode section

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	2.25	W
$V_{g2(b)}$ max.	550	V
V_{g2} max. ($I_a < 4.0mA$)	250	V
V_{g2} max. ($I_a > 8.0mA$)	125	V
p_{g2} max.	450	mW
I_k max.	16.5	mA
V_{g1} max. ($I_{g1} = +0.3\mu A$)	−1.3	V
R_{g1-k} max.	3.0	MΩ
R_{g1-k} max. (grid current biasing)	22	MΩ
R_{g3-k} max.	10	kΩ
R_{h-k} max.	20	kΩ
V_{h-k} max.	100	V

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

UBF89

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.

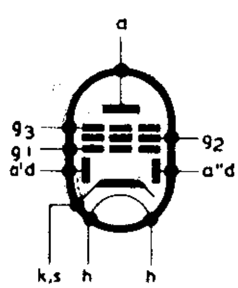
Diode sections (each section)

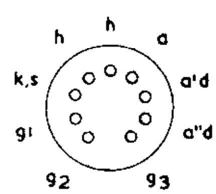
P.I.V. max.	200	V
I_{ad} max.	800	μA
$i_{ad(pk)}$ max.	5.0	mA
R_{h-k} max.	20	kΩ
V_{h-k} max.	100	V

MICROPHONY

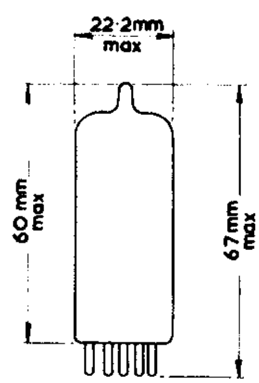
This valve can be used without special precautions against microphony in circuits in which the input voltage is >25mV (r.m.s) for an output of 50mW from the output valve.

2845



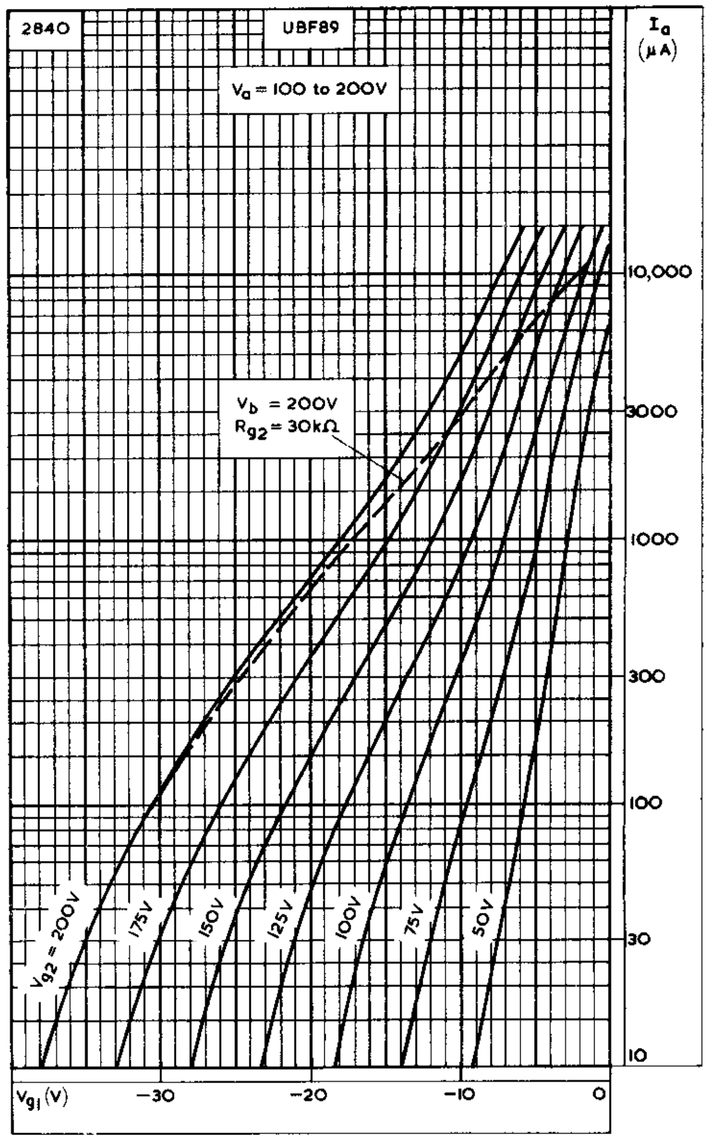


B9A Base



DOUBLE DIODE VARIABLE-MU R.F. PENTODE

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.

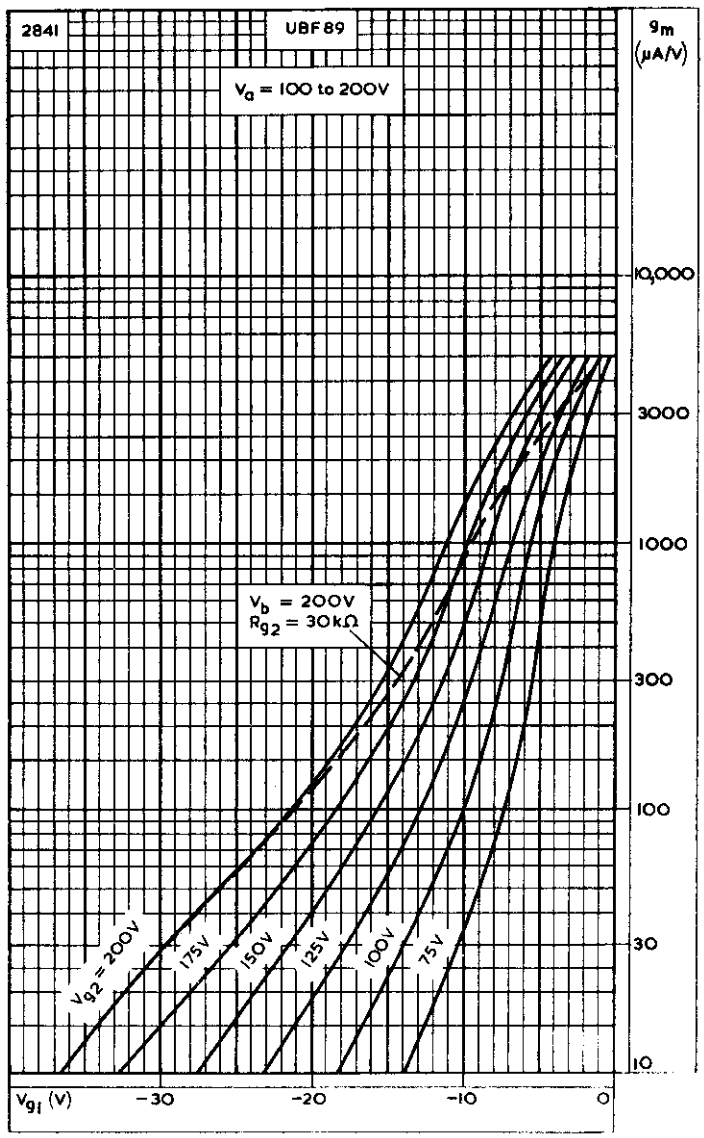


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

UBF89

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.

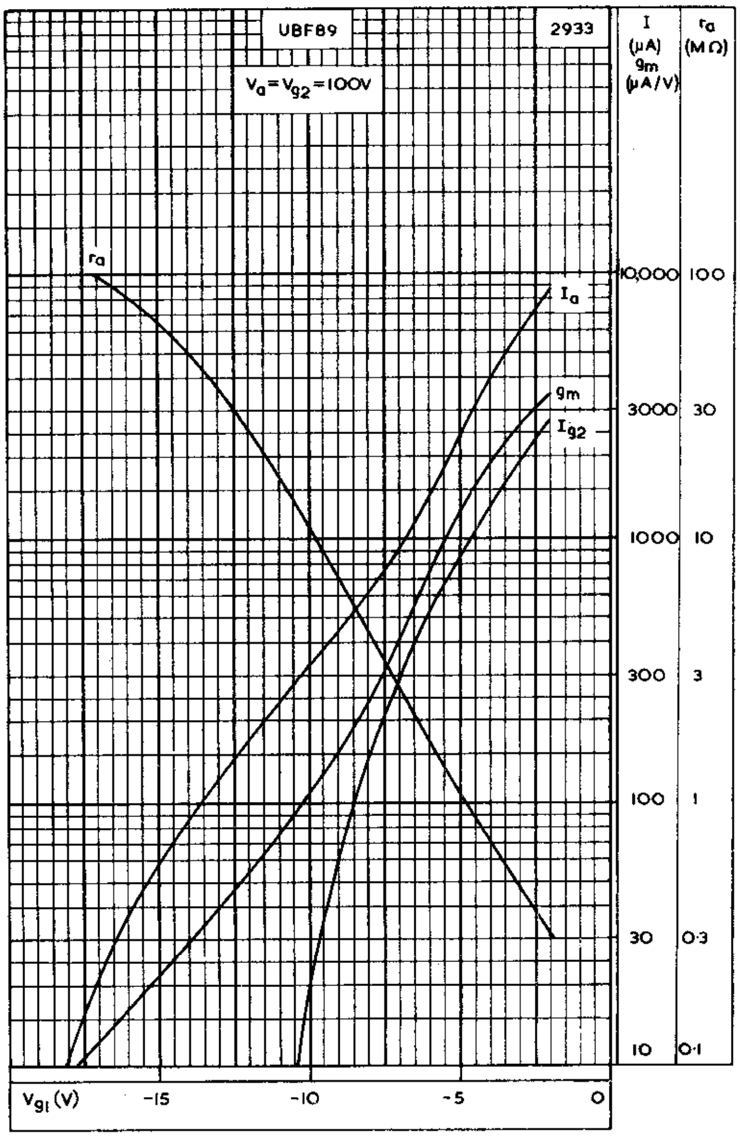


MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER

UBF89

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.

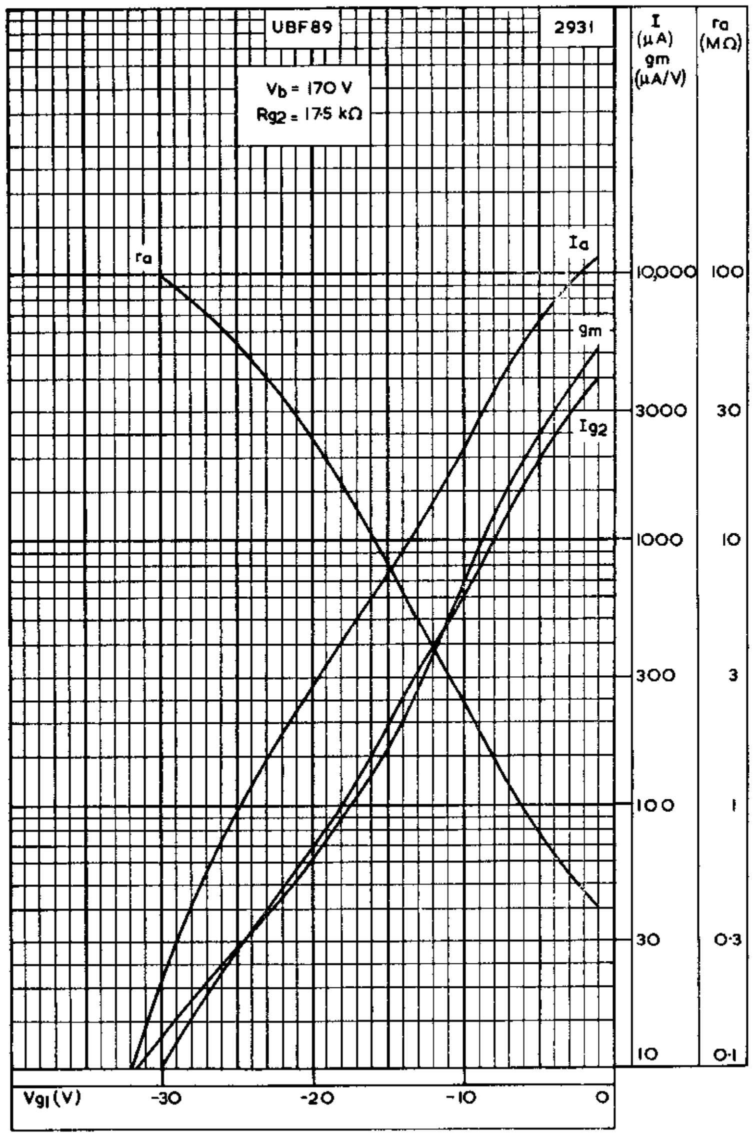


ANODE AND SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE
$V_a = V_{g2} = 100V$

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

UBF89

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.

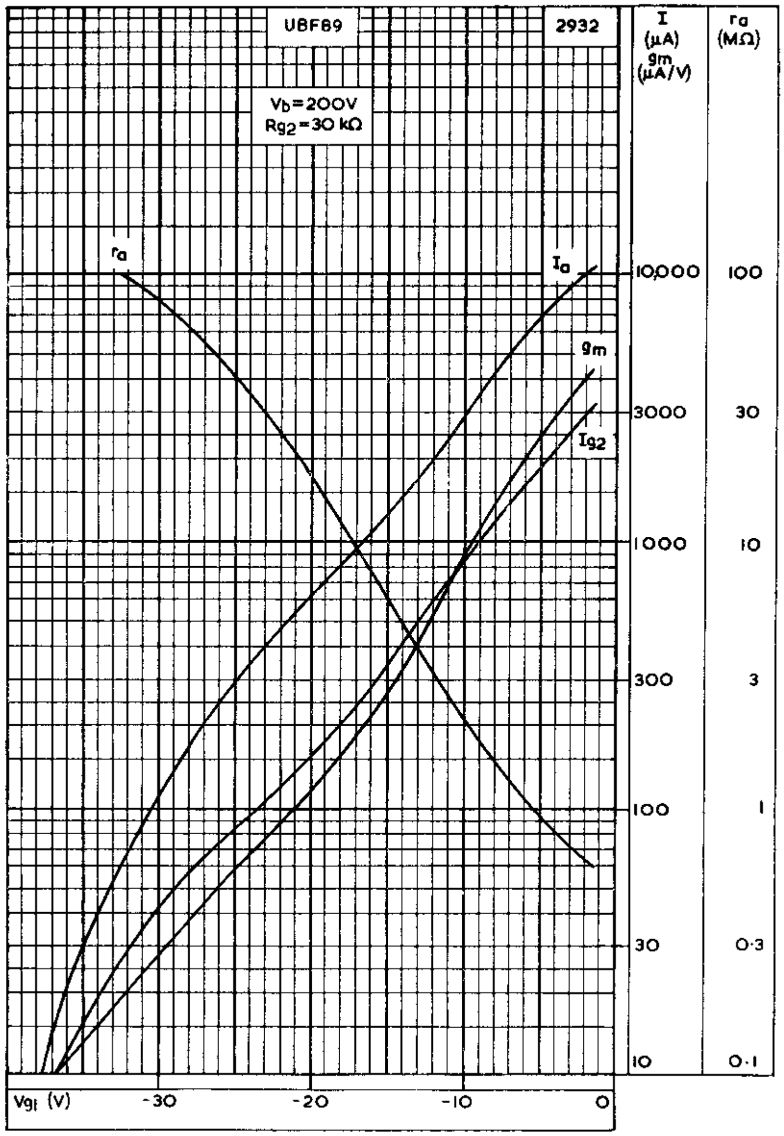


ANODE AND SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE
$V_b = 170V$

UBF89

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f amplifier. The diode sections are only suitable for a.m. detection.

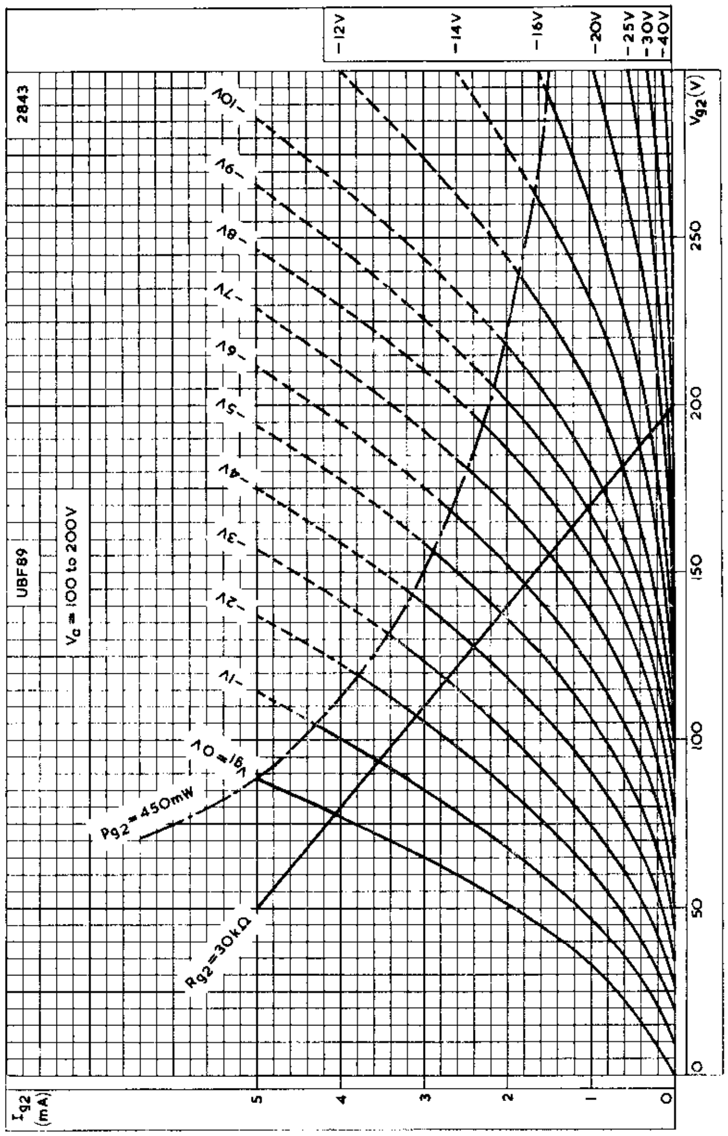


ANODE AND SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE
$V_b = 200V$

DOUBLE DIODE VARIABLE-MU R.F. PENTODE

UBF89

Double diode variable-mu pentode. The pentode section is suitable for use as an r.f. or i.f. amplifier. The diode sections are only suitable for a.m. detection.



SCREEN-GRID CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

R.F. DOUBLE TRIODE UCC85

Double triode with 100mA heater primarily intended for use in f.m./a.m. receivers as an r.f. amplifier and self-oscillating additive mixer.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	100	mA
V_h	26	V

CAPACITANCES

$^*c_{a-g}$	1.5	pF
$^*c_{g-k+h+s}$	3.1	pF ←
$^*c_{a-k}$	180	mpF
$^*c_{a-k+h+s}$	1.2	pF
$^{*\dagger}c_{a-k+h+s}$	1.8	pF ←
$c_{a'-a''}$	<40	mpF
$^\dagger c_{a'-a''}$	<8.0	mpF
$c_{g'-g''}$	<3.0	mpF
$c_{a''-g'}$	<8.0	mpF
$c_{a'-g''}$	<8.0	mpF
$c_{a''-k'}$	<8.0	mpF
$c_{a'-k''}$	<8.0	mpF
$c_{g''-k'}$	<3.0	mpF
$c_{g'-k''}$	<3.0	mpF

*Each section

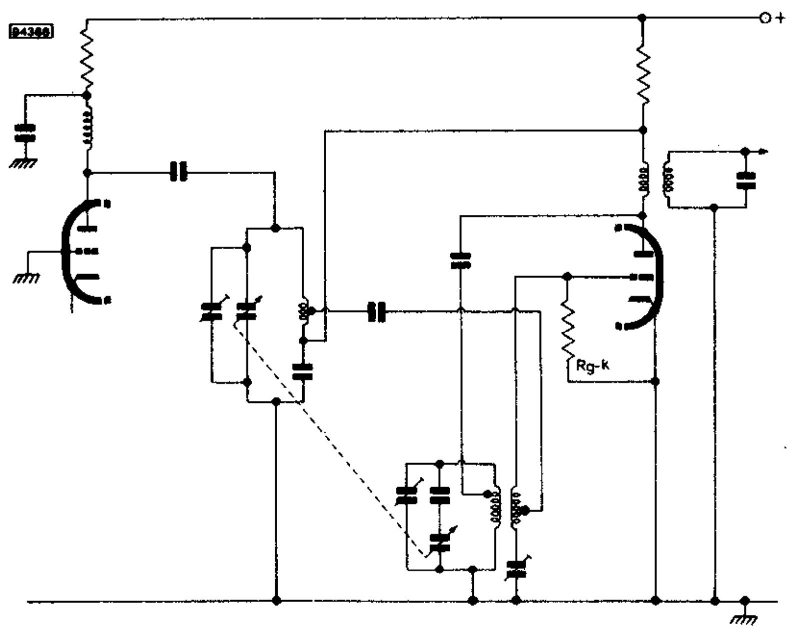
†Measured with an external shield.

CHARACTERISTICS (each section)

V_a	170	200	V
I_a	10	10	mA
V_g	-1.75	-2.4	V ←
g_m	6.7	6.0	mA/V ←
μ	48	46	←
r_a	7.1	7.7	kΩ ←

OPERATING CONDITIONS AS R.F. AMPLIFIER

V_a	155	161	V
V_b	170	170	V
R_a	1.5	1.3	kΩ
I_a	9.8	6.6	mA ←
R_k	150	330	Ω ←
g_m	6.7	5.1	mA/V ←
r_a	7.0	8.5	kΩ ←
r_{gl} (f = 100Mc/s)	3.8	5.2	kΩ ←
R_{eq}	550	820	Ω



OPERATING CONDITIONS AS SELF-OSCILLATING ADDITIVE MIXER (with i.f. feedback, see basic circuit in fig.1.)

V_b	170	200	V
R_a	4.7	8.2	kΩ
*R_{g-k}	1.0	1.0	MΩ
I_a	5.5	6.0	mA ←
V_{osc} (r.m.s.)	2.8	2.8	V
g_c	2.8	2.9	mA/V ←
r_a	15	14	kΩ

*The presence of the i.f. feedback voltage tends to stabilise the performance of the oscillator and hence permits this relatively high value to be used for the grid leak.

R.F. DOUBLE TRIODE

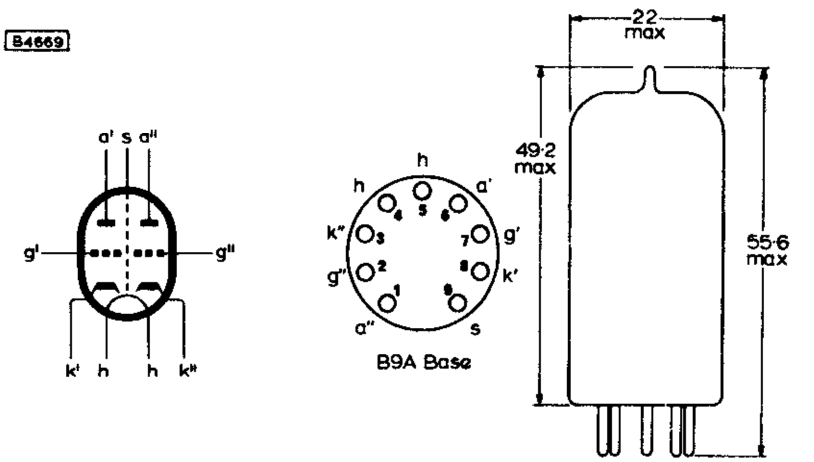
UCC85

RATINGS (ABSOLUTE MAXIMUM SYSTEM)
(each section unless otherwise specified)

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	2.5	W
$p_{a'} + p_{a''}$ max.	4.5	W
I_k max.	15	mA
$-V_g$ max.	100	V
R_{g-k} max.	1.0	MΩ
* V_{h-k} max.	90	V
R_{h-k} max.	20	kΩ

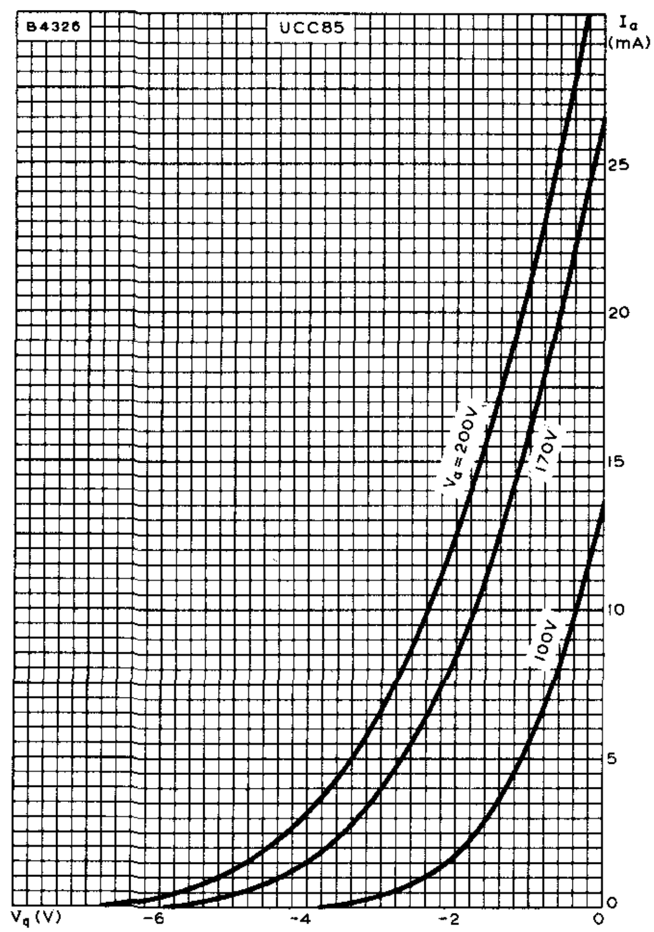
*When operating as an oscillator no r.f. voltage should be applied between heater and cathode. ←

B4669

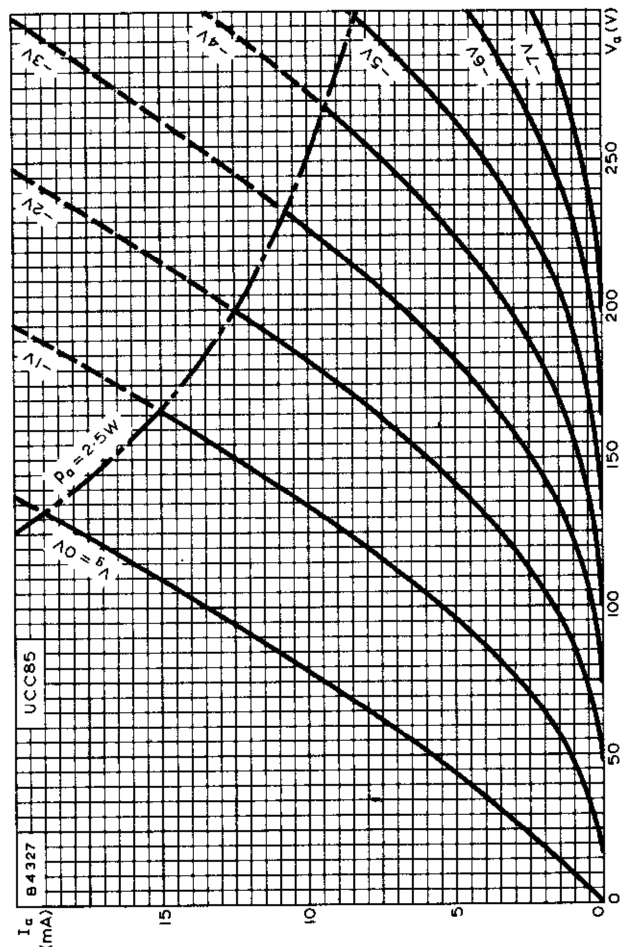


All dimensions in mm ←

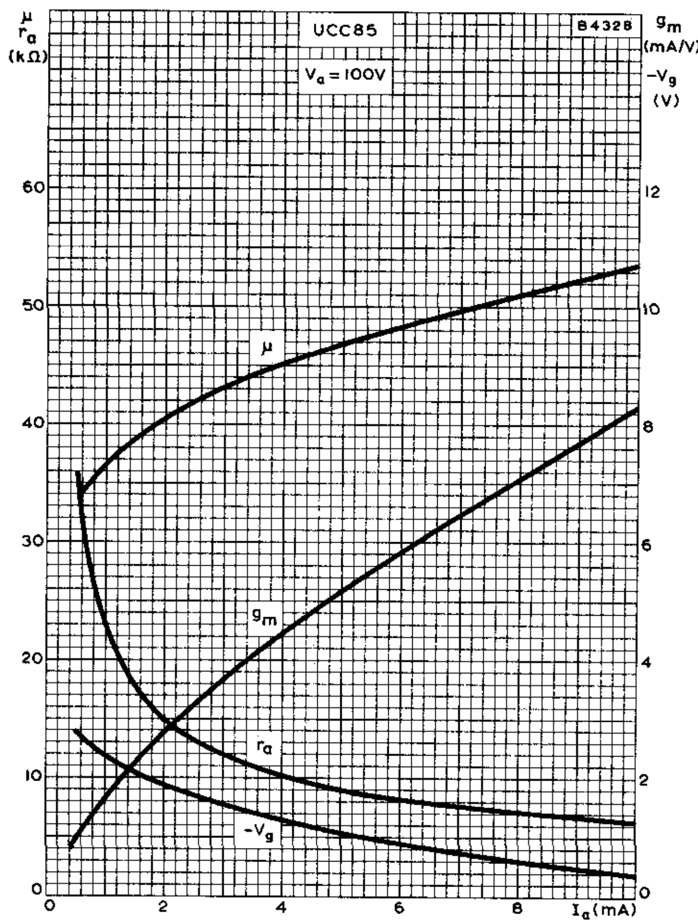
The triode on pins 6, 7, 8 should be used as the r.f. amplifier and that on pins 1, 2, 3 as the self-oscillating additive mixer.



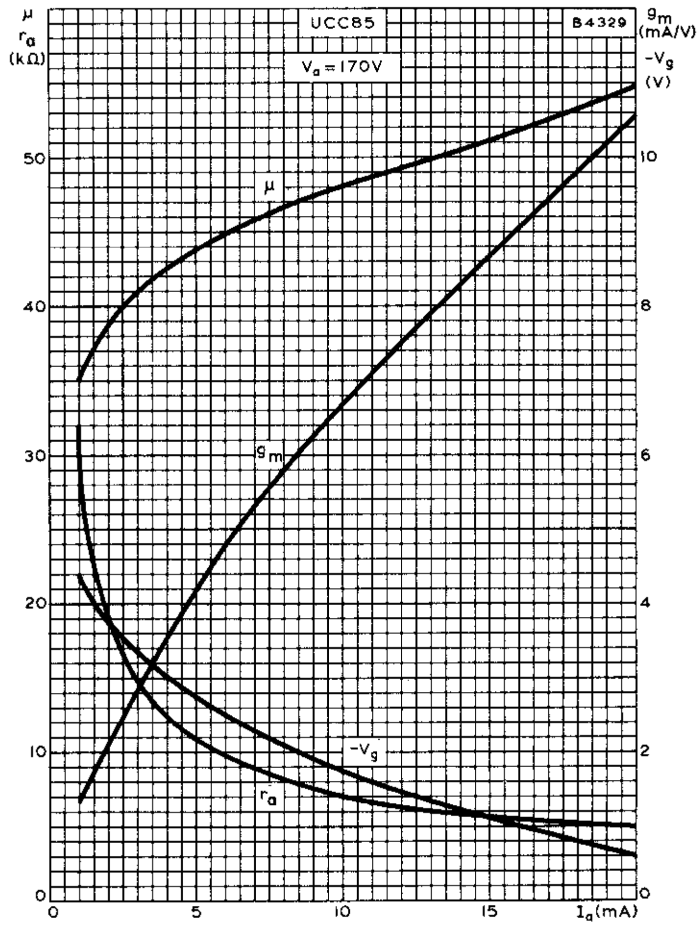
ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER



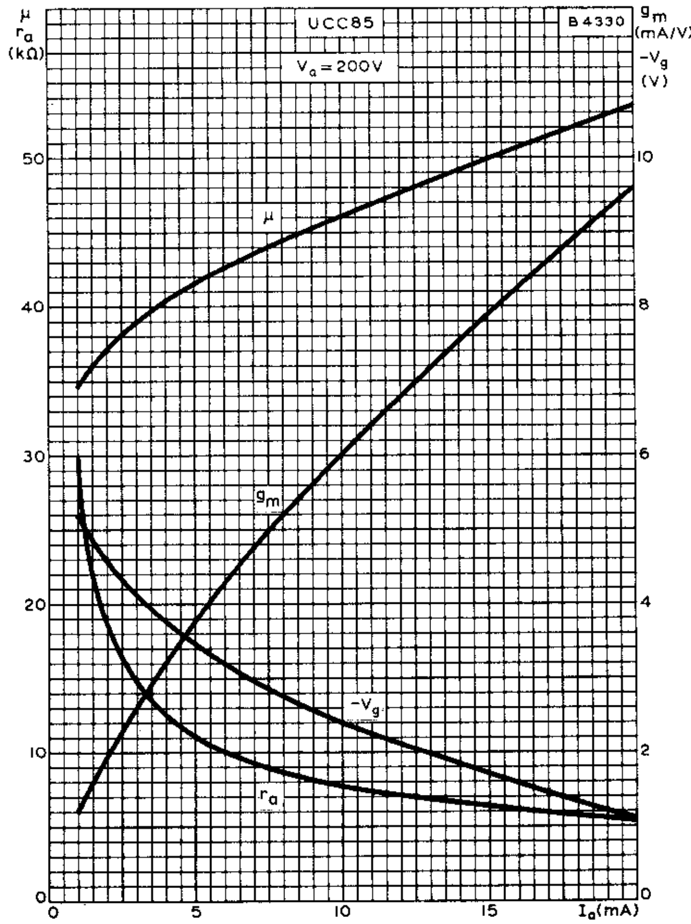
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER



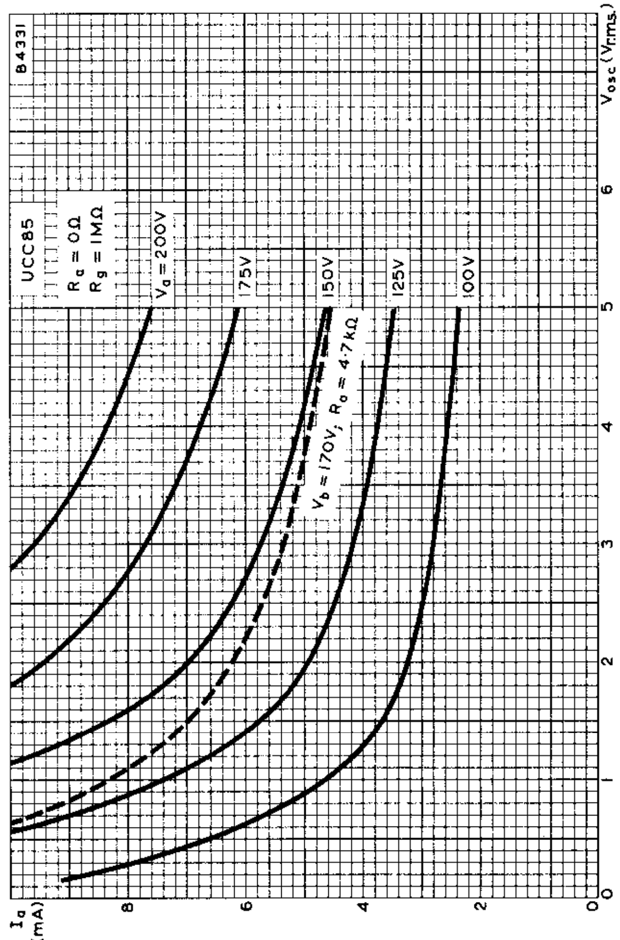
MUTUAL CONDUCTANCE, ANODE IMPEDANCE, AMPLIFICATION FACTOR AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT, V_a = 100V



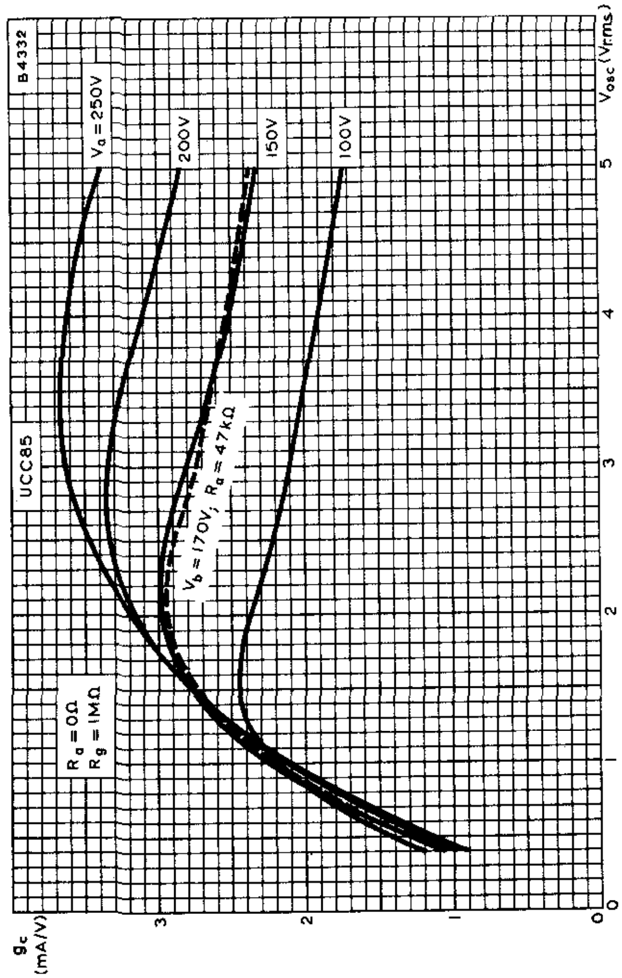
MUTUAL CONDUCTANCE, ANODE IMPEDANCE, AMPLIFICATION FACTOR AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT, $V_a = 170V$



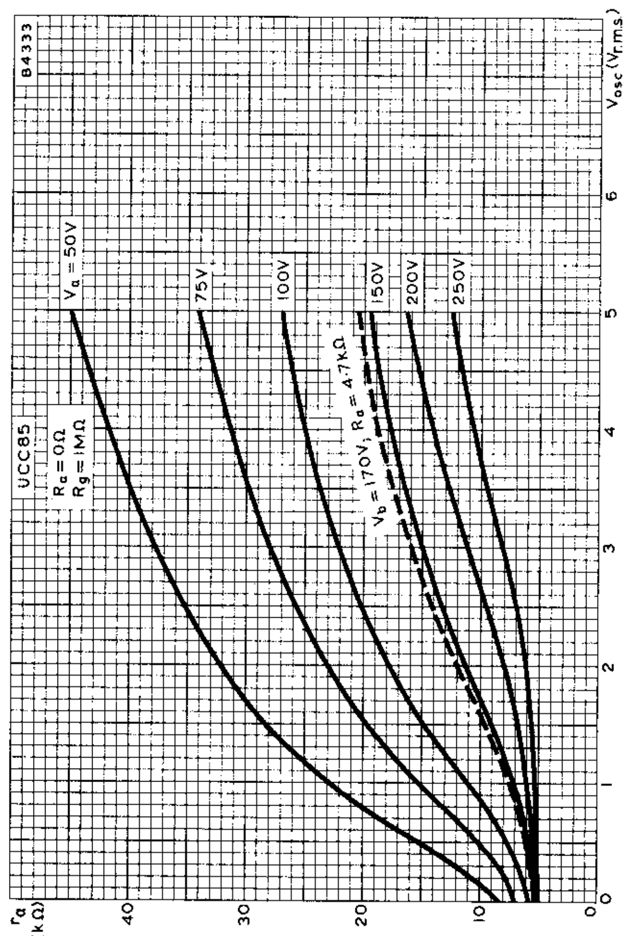
MUTUAL CONDUCTANCE, ANODE IMPEDANCE, AMPLIFICATION FACTOR AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT, $V_a = 200V$



ANODE CURRENT PLOTTED AGAINST OSCILLATOR VOLTAGE WITH ANODE VOLTAGE AS PARAMETER



CONVERSION CONDUCTANCE PLOTTED AGAINST OSCILLATOR VOLTAGE WITH ANODE VOLTAGE AS PARAMETER



ANODE IMPEDANCE PLOTTED AGAINST OSCILLATOR VOLTAGE WITH ANODE VOLTAGE AS PARAMETER

TRIODE HEPTODE

UCH81

Triode heptode with 100mA heater primarily intended for use as a frequency changer.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	100	mA
V_h	19	V

CAPACITANCES

c_{ah-at}	200	mpF
c_{ah-gt}	<90	mpF
$c_{ah-g3+gt}$	<350	mpF
c_{g1-at}	<60	mpF
c_{g1-gt}	<170	mpF
$c_{g1-g3+gt}$	<450	mpF

Heptode section

$c_{in(g1)}$	4.8	pF
$c_{in(g3)}$	6.0	pF
c_{out}	7.9	pF
c_{a-g1}	<6.0	mpF
c_{g1-g3}	<300	mpF
c_{g1-h}	<170	mpF
c_{g3-h}	<60	mpF

Triode section

c_{in}	2.6	pF
c_{out}	2.1	pF
c_{a-g}	1.0	pF
c_{g-h}	<20	mpF

OPERATING CONDITIONS FOR HEPTODE SECTION AS R.F. OR I.F. AMPLIFIER

$V_a = V_b$	170	200	V
V_{g3}	0	0	V
R_{g2+g4}	18	18	kΩ
V_{g1}	−2.2	−2.6	V
R_k	220	220	Ω
V_{g2+g4}	102	123	V
I_a	6.2	7.6	mA
I_{g2+g4}	3.8	4.3	mA
g_m	2.3	2.4	mA/V
r_a	600	600	kΩ
$\mu_{g1-(g2+g4)}$	20	20	
R_{eq}	8.8	9.7	kΩ
V_{g1} (for 100 : 1 reduction in g_m)	−28	−33	V
V_{g1} max. ($I_{g1} = +0.3\mu A$)		−1.3	V
V_{g3} max. ($I_{g3} = +0.3\mu A$)		−1.3	V

UCH81

TRIODE HEPTODE

OPERATING CONDITIONS OF HEPTODE SECTION AS A.M. FREQUENCY CHANGER

$V_a = V_b$	170	200	V
R_{g2+g4}	10	10	kΩ
R_{g3+gt}	47	47	kΩ
V_{g1}	−2.2	−2.6	V
V_{g2+g4}	102	119	V
I_a	3.2	3.7	mA
I_{g2+g4}	6.8	8.1	mA
I_{g3+gt}	200	230	µA
g_c	750	775	µA/V
r_a	0.9	1.0	MΩ
R_{eq}	70	75	kΩ
V_{g1} (for 100 : 1 reduction in g_c)	−24	−28	V

CHARACTERISTICS

Triode section

V_a	100	V
I_a	13.5	mA
V_g	0	V
g_m	3.7	mA/V
μ	22	
V_g max. ($I_g = +0.3\mu A$)	−1.3	V

OPERATING CONDITIONS OF TRIODE SECTION AS R.F. OSCILLATOR

V_b	170	200	V
R_{at}	15	15	kΩ
R_{gt+g3}	47	47	kΩ
I_{g3+gt}	200	240	µA
I_{at}	4.5	5.4	mA
g_m (eff)	580	580	µA/V

LIMITING VALUES

Heptode section

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	1.7	W
$V_{g2+g4(b)}$ max.	550	V
V_{g2+g4} max. ($I_a = 7.6mA$)	125	V
V_{g2+g4} max. ($I_a < 1mA$)	250	V
p_{g2+g4} max.	1.0	W
I_k max.	12.5	mA
R_{g1-k} max.	3.0	MΩ
*R_{g3-k} max.	3.0	MΩ
R_{h-k} max.	20	kΩ
V_{h-k} max.	100	V

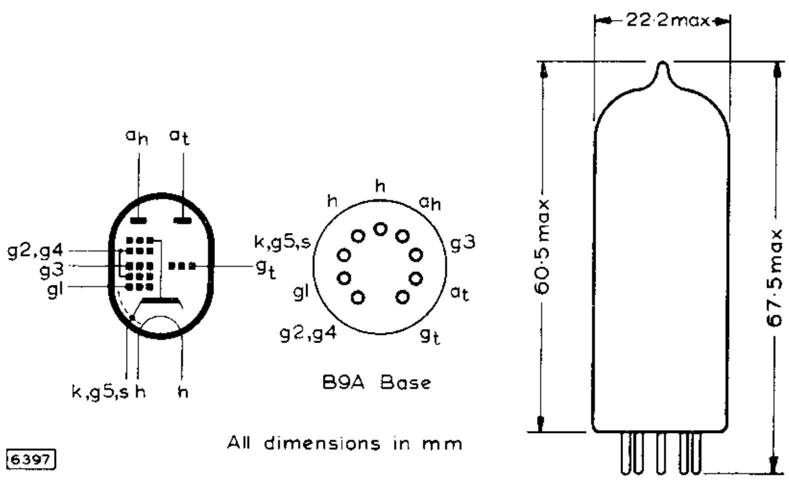
*If the two sections of the valve are switched during operation so that there is no direct connection between g_3 and g_t, as may occur in f.m./a.m. receivers, then R_{g3-k} max. = 20kΩ.

TRIODE HEPTODE UCH81

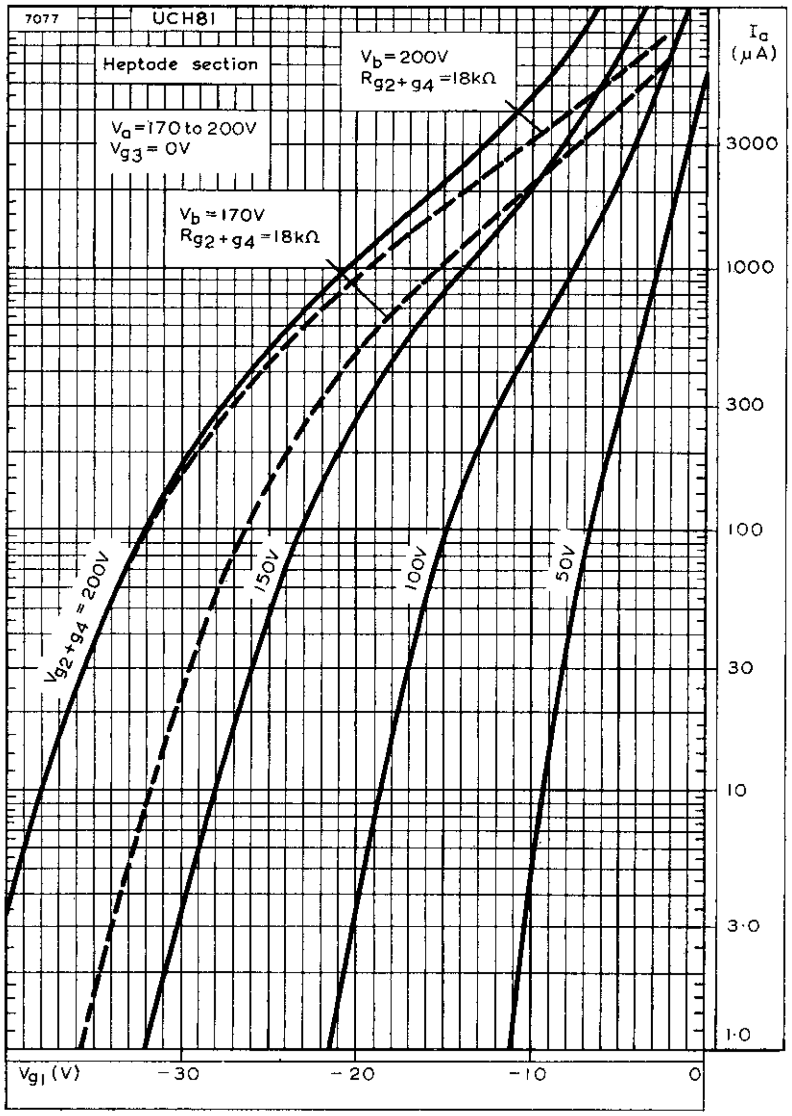
Triode section

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	800	mW
I_k max.	6.5	mA
R_{g-k} max.	3.0	MΩ
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ

The heptode section of this valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 50mV for an output of 50mW from the output stage. The corresponding figure for the triode section is 25mV.



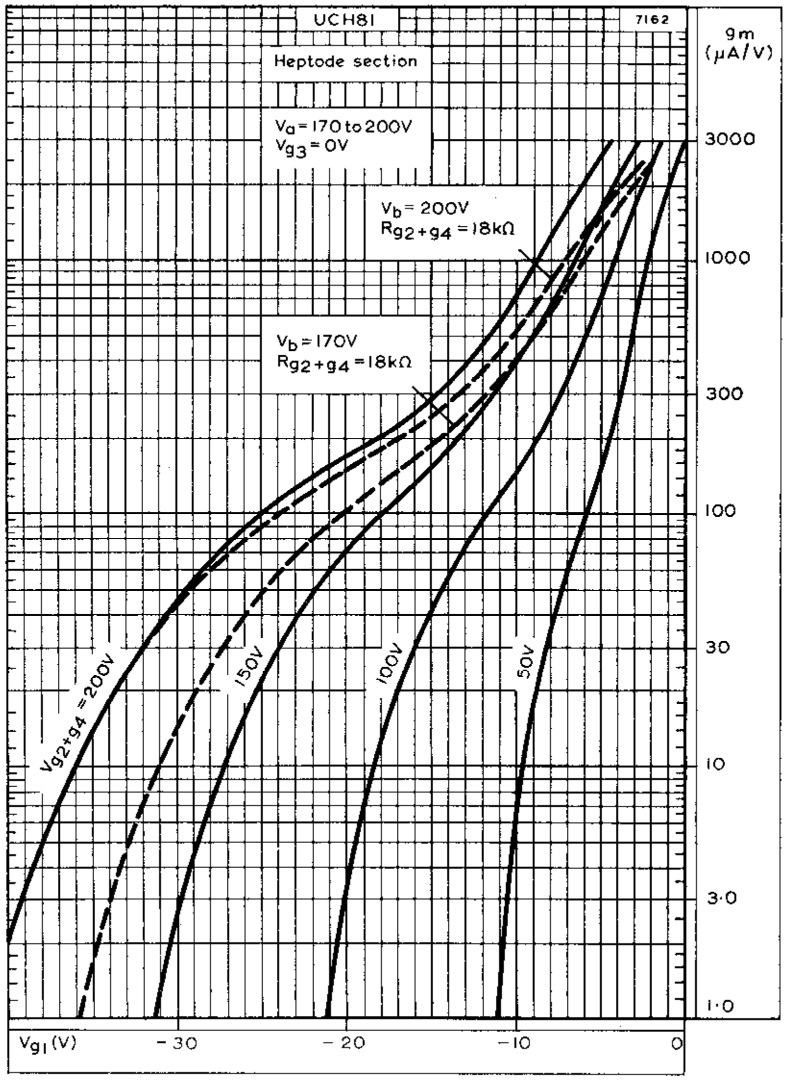
All dimensions in mm



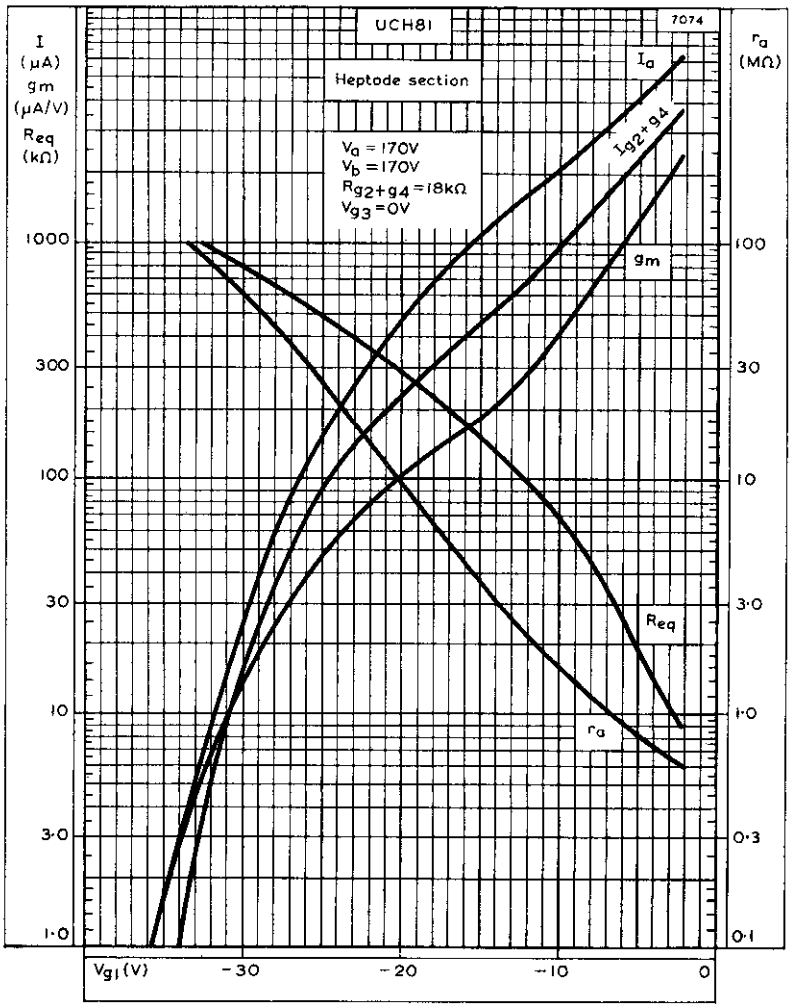
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR HEPTODE SECTION

UCH81

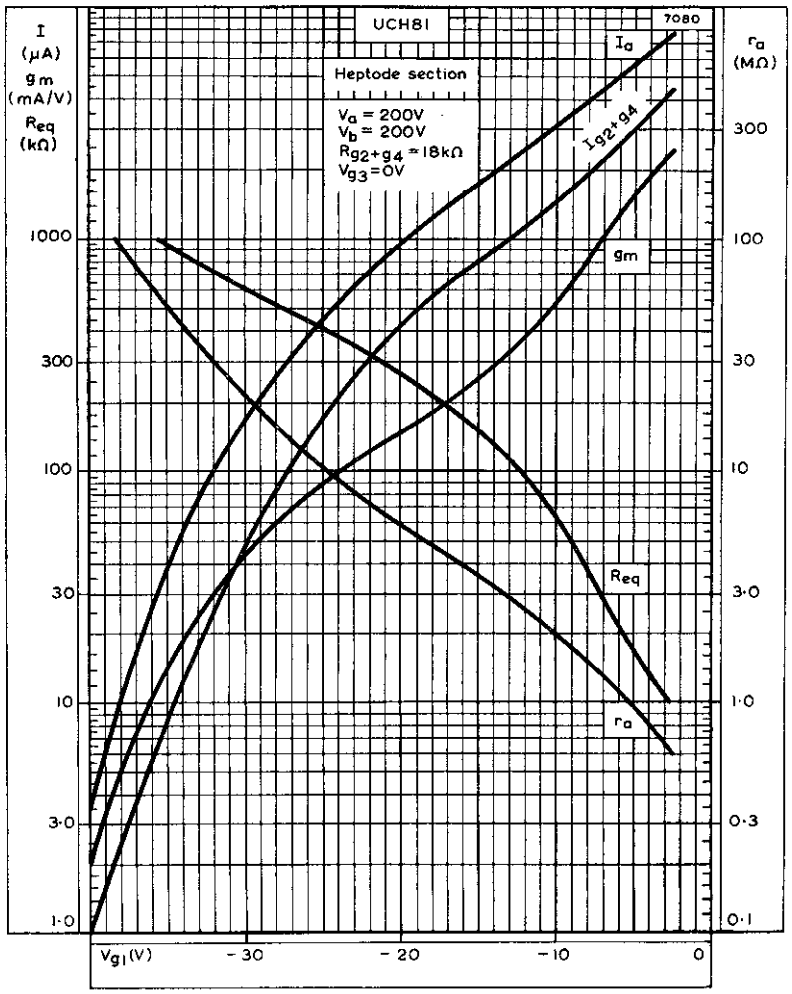
TRIODE HEPTODE



MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR HEPTODE SECTION

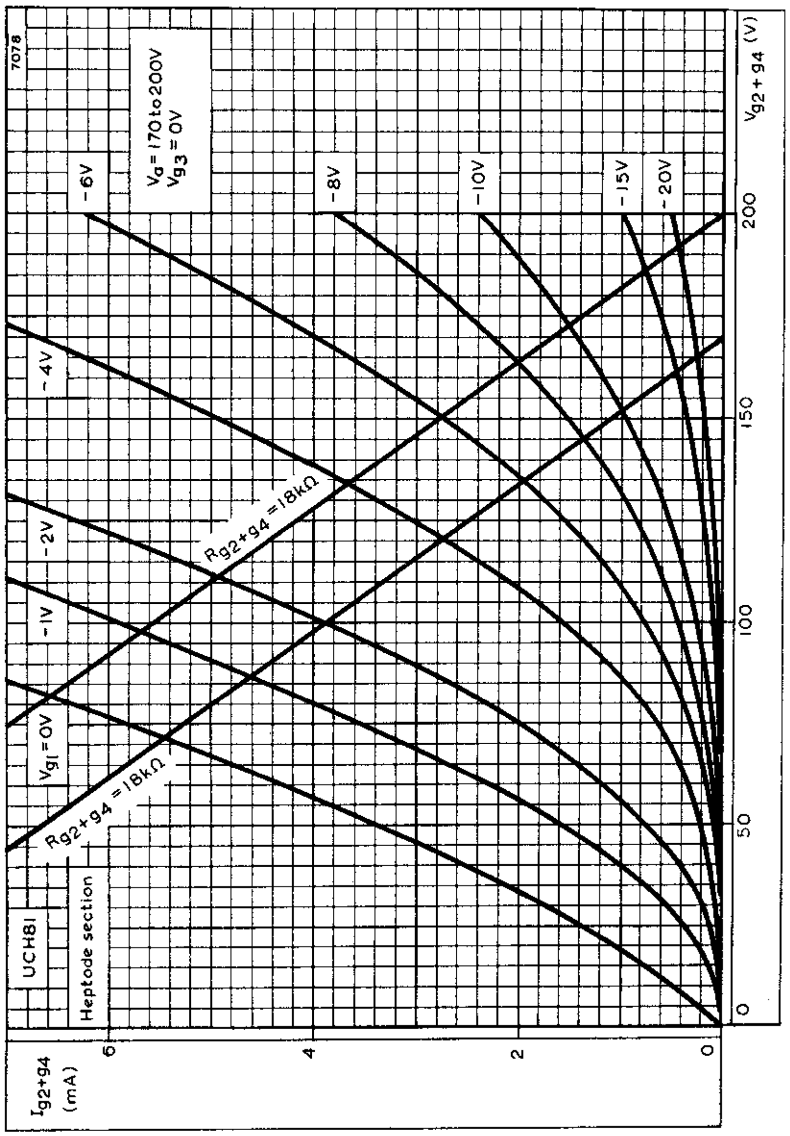


ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE, ANODE IMPEDANCE, AND EQUIVALENT NOISE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR HEPTODE SECTION.
$V_B = 170V$

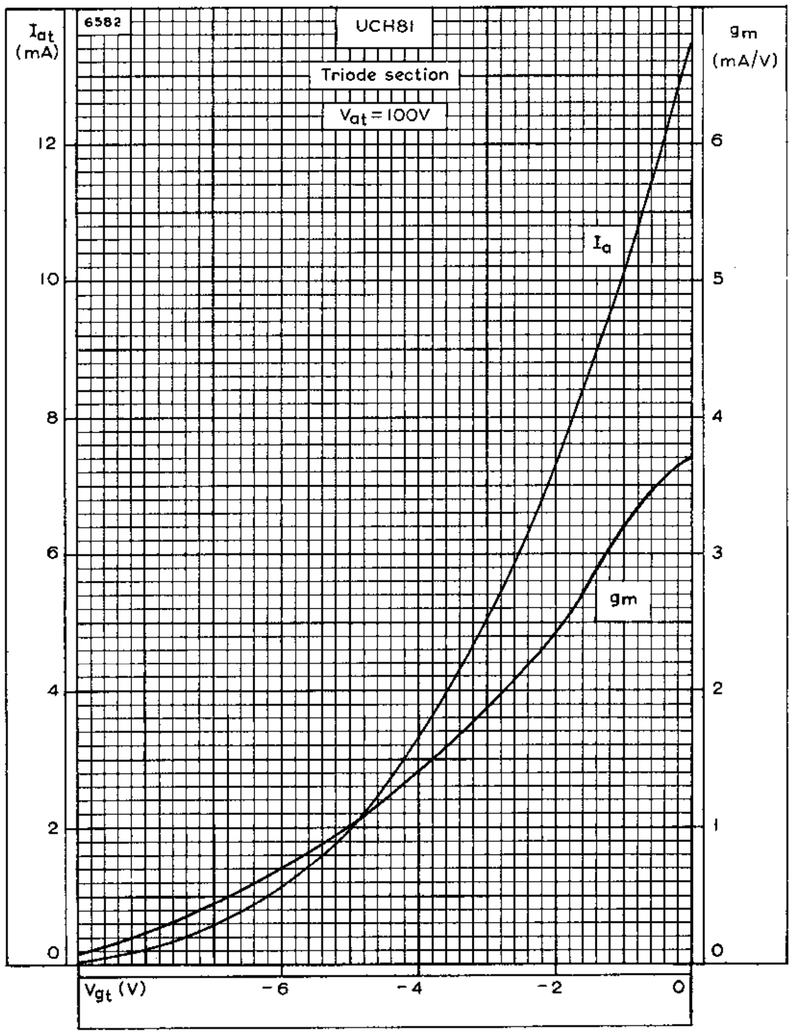


ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE, ANODE IMPEDANCE, AND EQUIVALENT NOISE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR HEPTODE SECTION

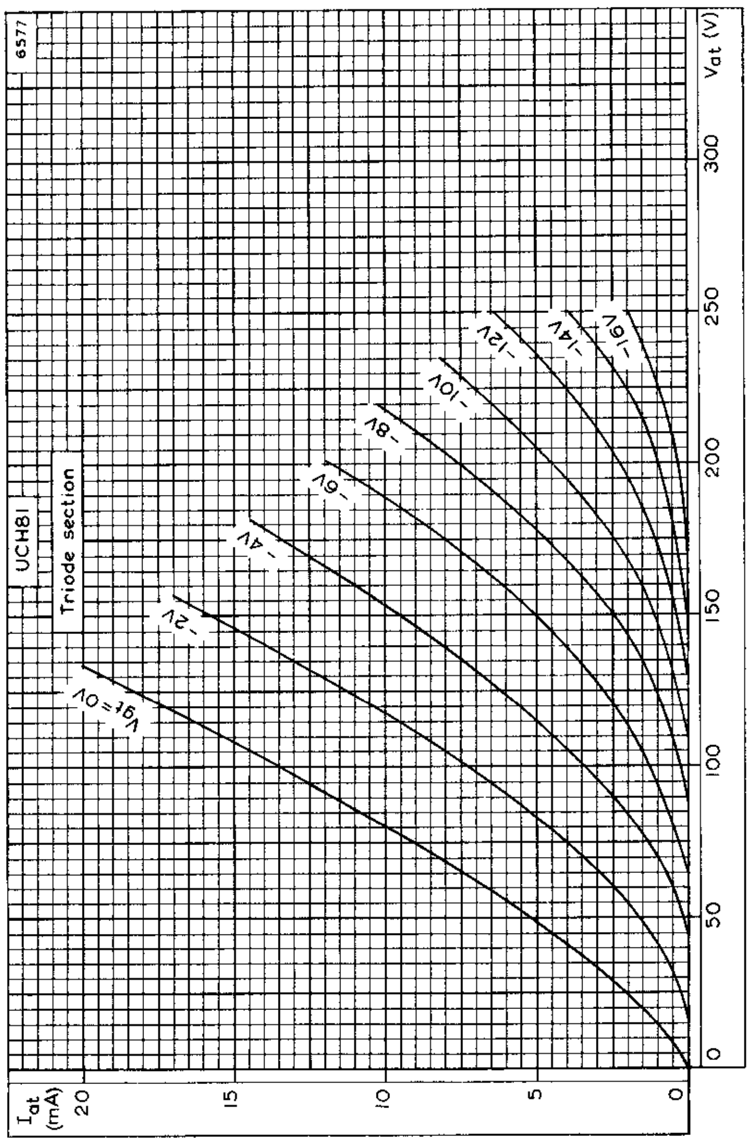
$V_a = 200V$



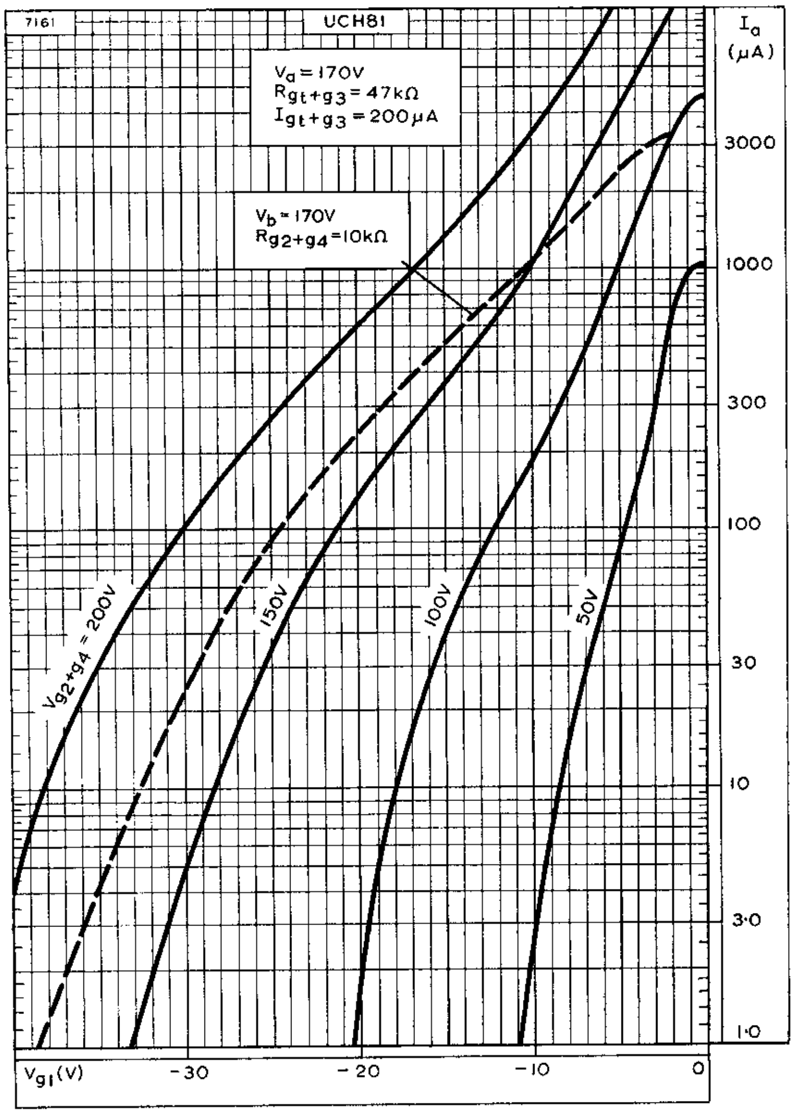
SCREEN-GRID CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER FOR HEPTODE SECTION



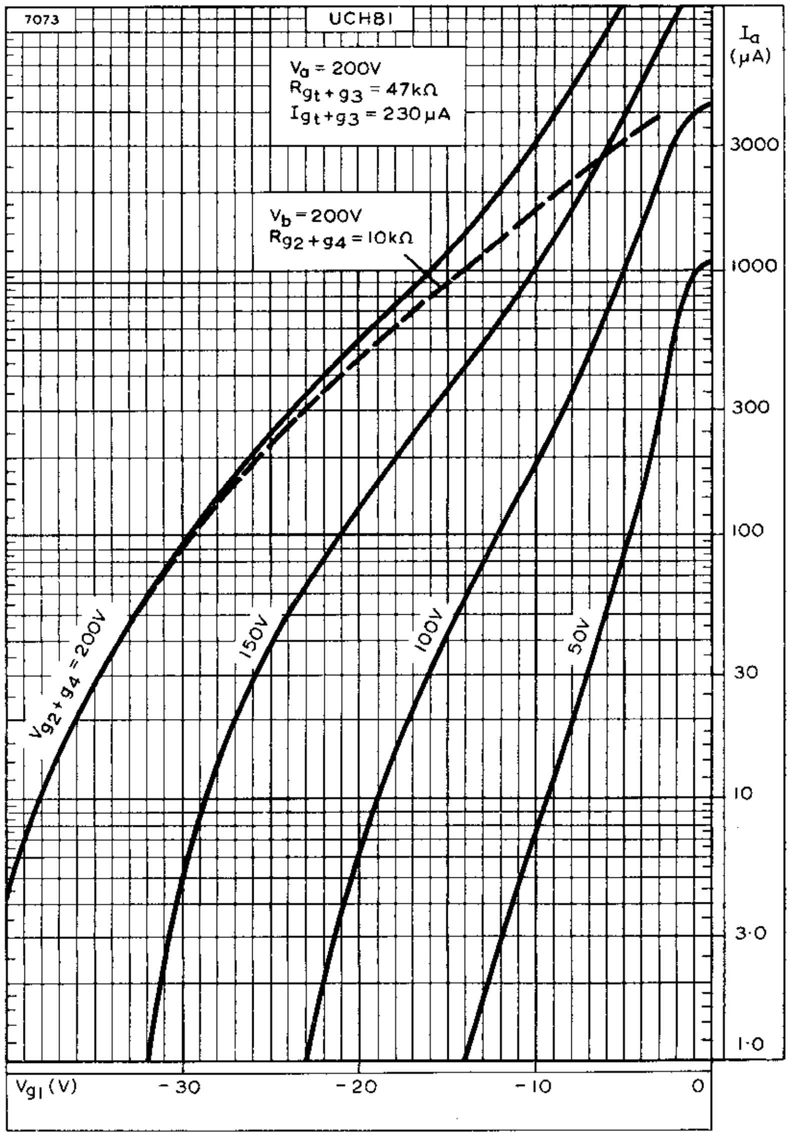
ANODE CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST GRID VOLTAGE FOR TRIODE SECTION



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR TRIODE SECTION



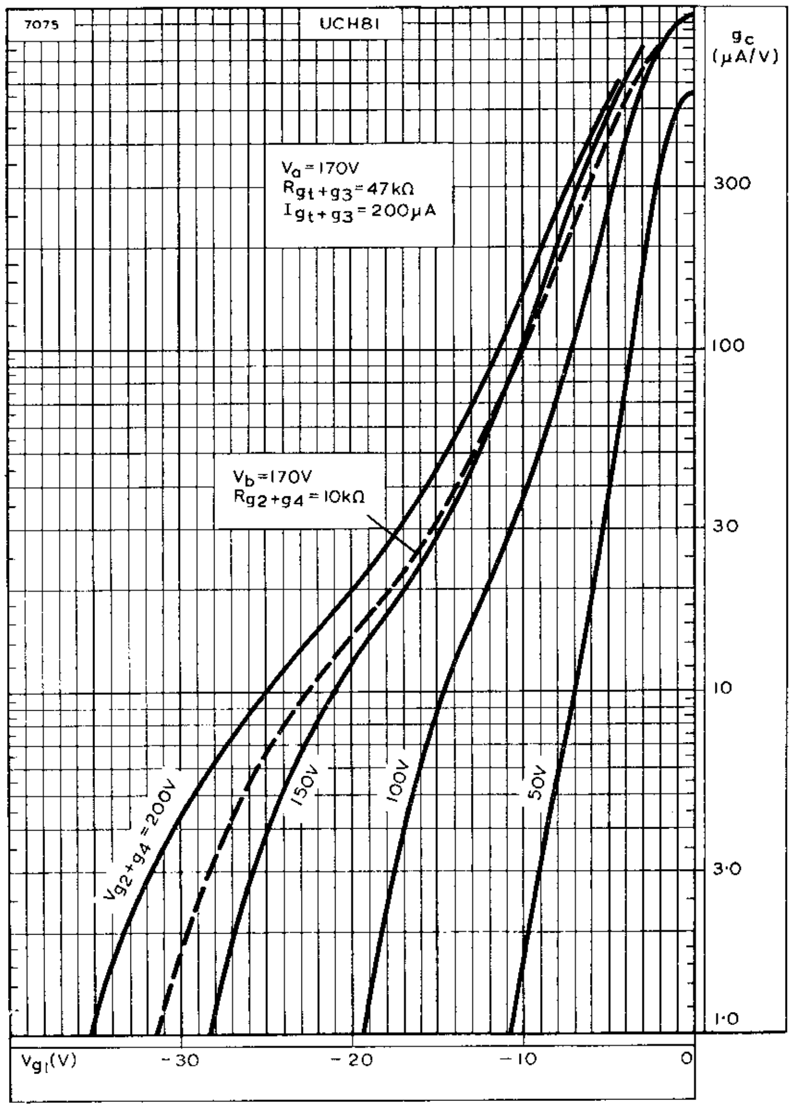
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WHEN USED AS A FREQUENCY CHANGER.
$V_a = 170V$



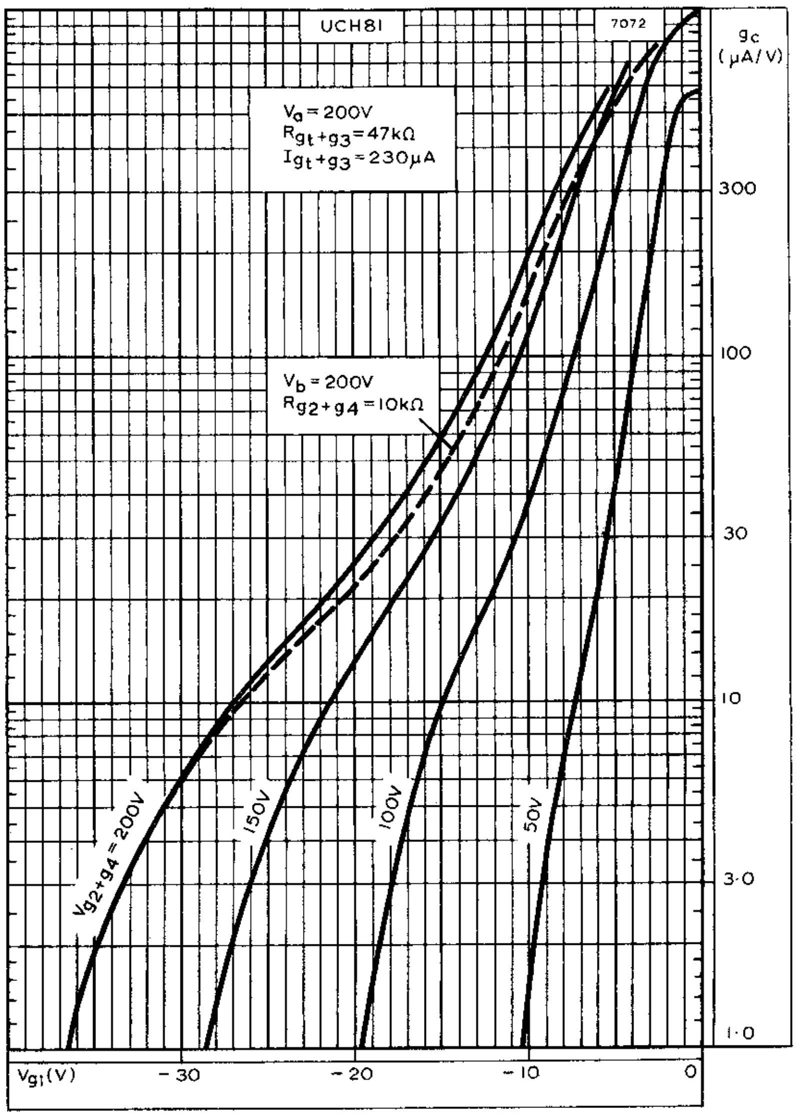
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WHEN USED AS FREQUENCY CHANGER.
V_a = 200V

UCH81

TRIODE HEPTODE



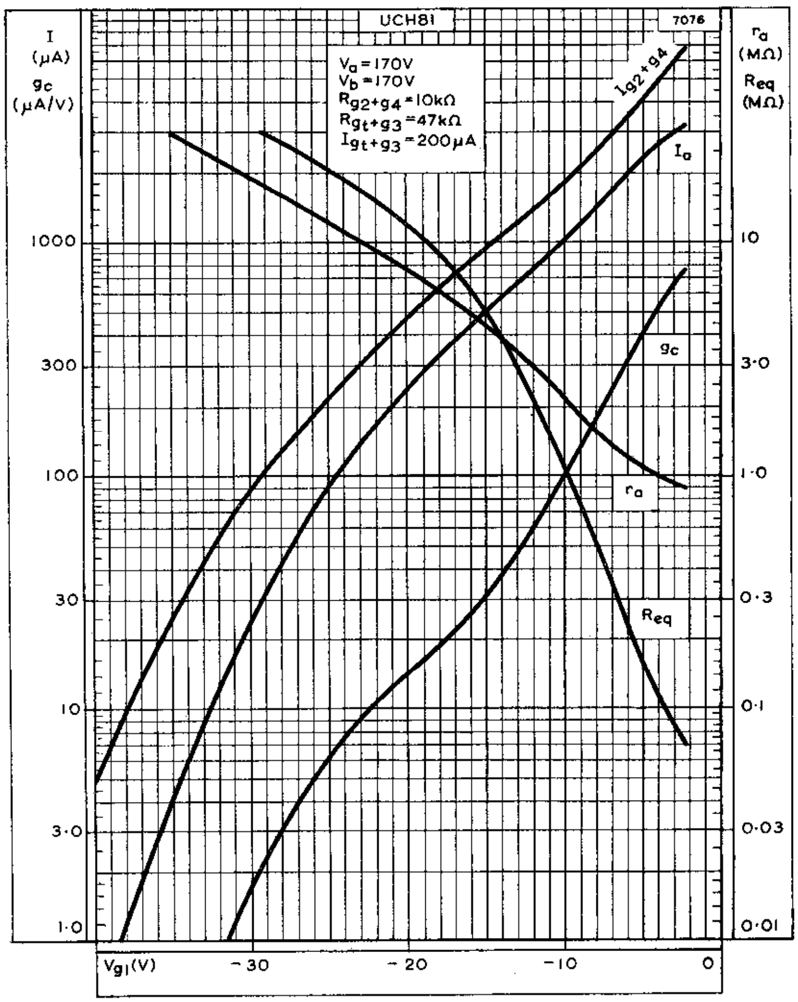
CONVERSION CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE WHEN USED AS A FREQUENCY CHANGER.
V_a = 170V



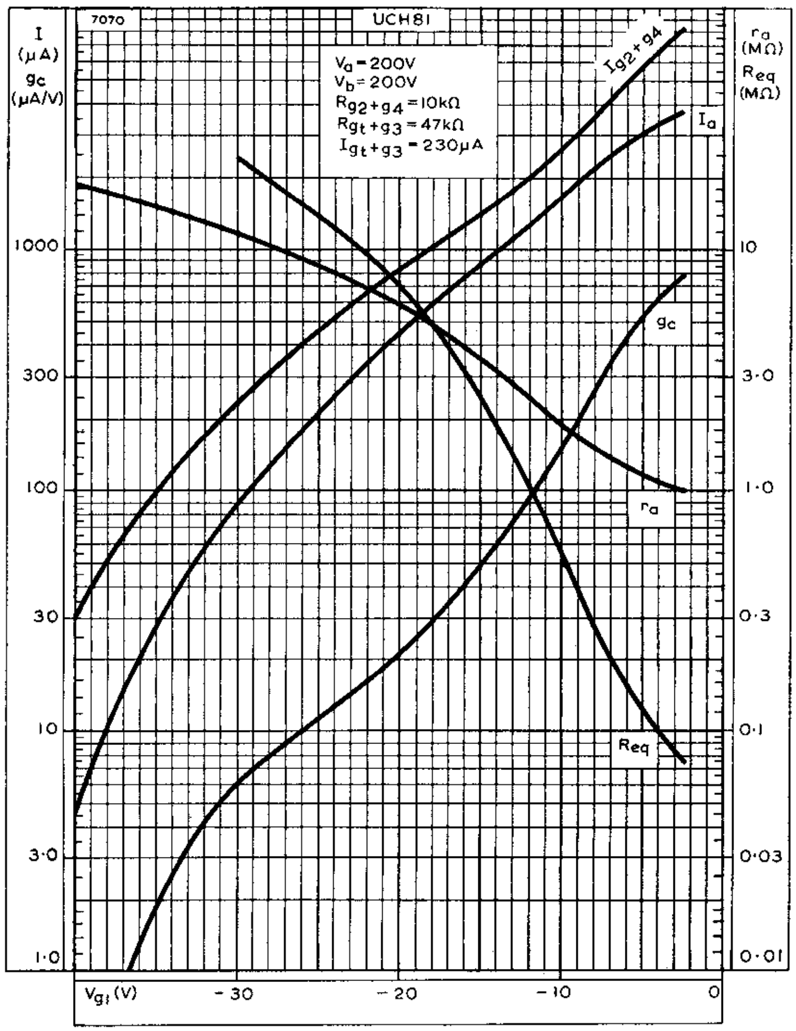
CONVERSION CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE WHEN USED AS A FREQUENCY CHANGER.
$V_a = 200V$

UCH81

TRIODE HEPTODE



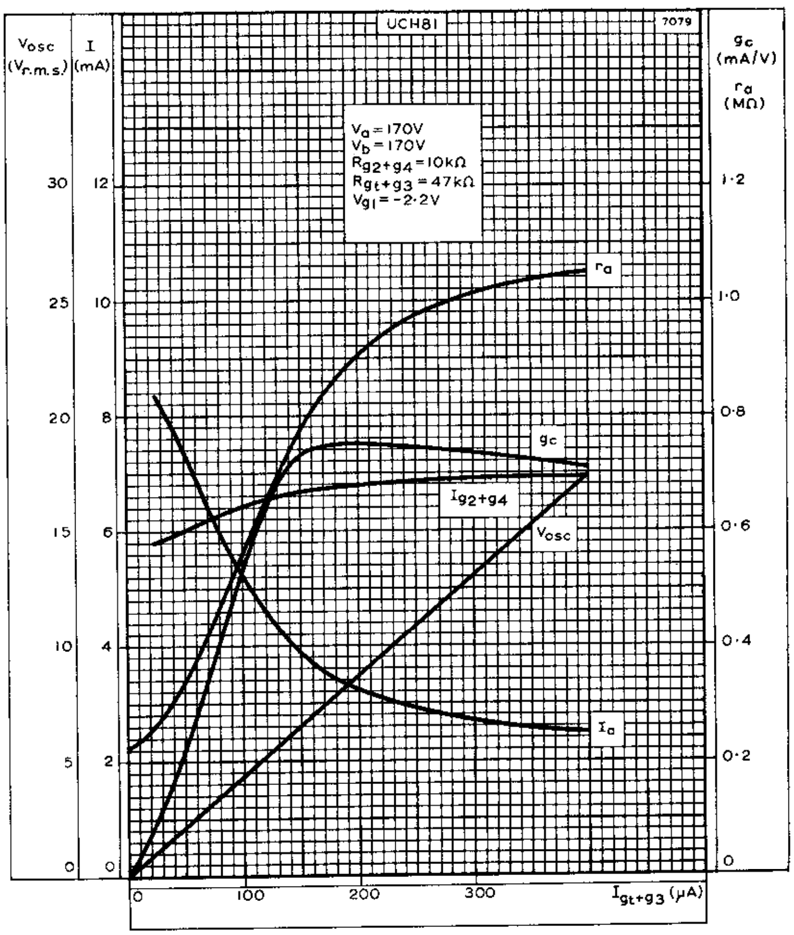
ANODE AND SCREEN-GRID CURRENTS, CONVERSION CONDUCTANCE, ANODE IMPEDANCE AND EQUIVALENT NOISE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE WHEN USED AS A FREQUENCY CHANGER. $V_a = 170V$



ANODE AND SCREEN-GRID CURRENTS, CONVERSION CONDUCTANCE, ANODE IMPEDANCE AND EQUIVALENT NOISE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE WHEN USED AS A FREQUENCY CHANGER. $V_a = 200V$

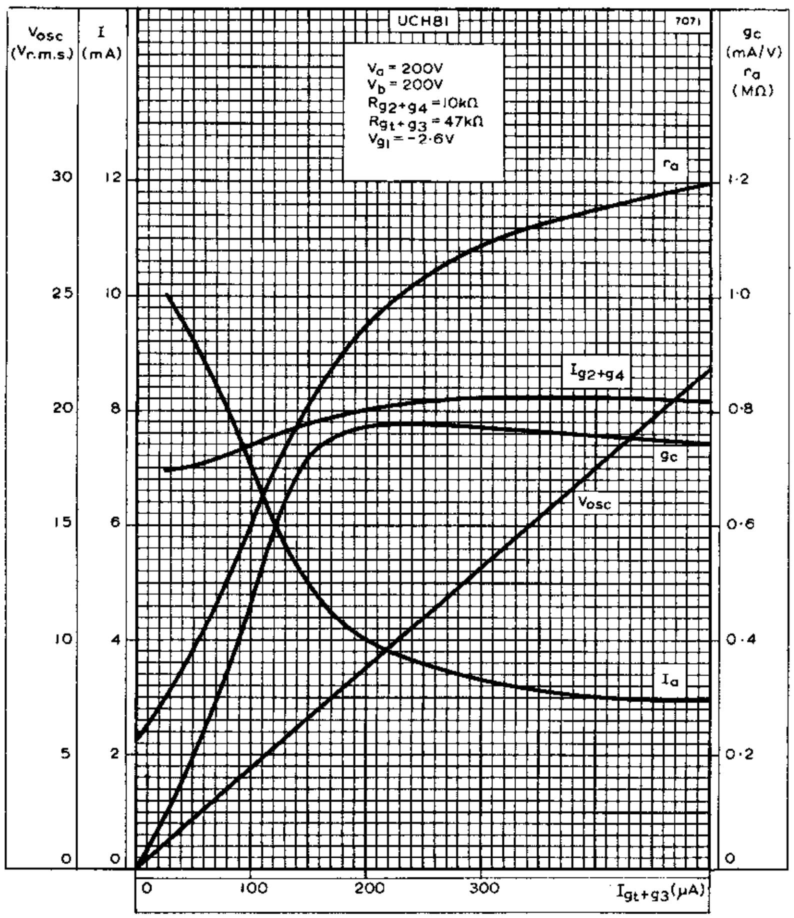
UCH81

TRIODE HEPTODE



ANODE AND SCREEN-GRID CURRENTS, CONVERSION CONDUCTANCE, ANODE IMPEDANCE AND OSCILLATOR VOLTAGE PLOTTED AGAINST OSCILLATOR-GRID CURRENT.

$V_a = 170V$



ANODE AND SCREEN-GRID CURRENTS, CONVERSION CONDUCTANCE, ANODE IMPEDANCE AND OSCILLATOR VOLTAGE PLOTTED AGAINST OSCILLATOR-GRID CURRENT.

V_a = 200V

TRIODE PENTODE

UCL82

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.

HEATER

Suitable for series operation a.c. or d.c.

I_h	100	mA
V_h	50	V

MOUNTING POSITION

Any

CAPACITANCES (measured without external shield)

c_{at-g1p}	<0.02	pF
c_{gt-ap}	<0.02	pF
c_{gt-g1p}	<0.025	pF
c_{at-ap}	<0.25	pF

Pentode section

c_{in}	9.3	pF
c_{out}	8.0	pF
c_{a-g1}	<0.3	pF
c_{g1-h}	<0.3	pF

Triode section

c_{a-k+h}	4.3	pF
c_{g-k+h}	2.7	pF
c_{a-g}	4.2	pF
c_{g-h}	<0.02	pF

CHARACTERISTICS

Pentode section

V_a	100	200	V
V_{g2}	100	200	V
I_a	26	35	mA
I_{g2}	5.0	7.0	mA
V_{g1}	−6.0	−16	V
g_m	6.8	6.4	mA/V
r_a	15	20	kΩ
μ_{g1-g2}	10	9.5	

Triode section

V_a	100	V
I_a	3.5	mA
V_g	0	V
g_m	2.5	mA/V
r_a	28	kΩ
μ	70	

UCL82

TRIODE PENTODE

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.

PENTODE SECTION AS AUDIO OUTPUT VALVE

Single valve class 'A'

V_a	100	200	V
V_{g2}	100	200	V
V_{g1}	−6.0	−16	V
$I_{a(o)}$	26	35	mA
$I_{g2(o)}$	5.0	7.0	mA
$V_{in(r.m.s.)}$ P_{out}=50mW	650	600	mV
R_a	3.9	5.6	kΩ
$V_{in(r.m.s.)}$	3.8	6.6	V
*P_{out}	1.0	3.5	W
D_{tot}	9.0	10	%

Two valves in class 'AB' push-pull

V_a	100	200	V
V_{g2}	100	200	V
†R_k	150	190	Ω
$I_{a(o)}$	2×20	2×35	mA
I_a (max. sig.)	2×22.5	2×39.5	mA
$I_{g2(o)}$	2×4.0	2×7.0	mA
I_{g2} (max. sig.)	2×7.0	2×16.5	mA
R_{a-a}	5.0	6.0	kΩ
$V_{in(g1-g1)r.m.s.}$	12.4	25	V
P_{out}	2.3	9.8	W
D_{tot}	4.0	4.0	%

†Common cathode bias resistor.

*P_{out} and D_{tot} are measured at fixed bias and therefore represent the power output available during the reproduction of speech and music.

TRIODE PENTODE

UCL82

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.

TRIODE SECTION AS A.F. AMPLIFIER

V_b (V)	R_a (kΩ)	I_a (mA)	R_k (kΩ)	R_g (MΩ)	Z_{source} (kΩ)	$\frac{V_{out}}{V_{in}}$	D_{tot} (%)	R_{g1}* (kΩ)
200	100	0.85	1.5	3.3	0	47	1.0	330
150	100	0.6	1.8	3.3	0	45	1.9	330
100	100	0.38	1.8	3.3	0	41	6.0	330
200	100	0.85	1.5	3.3	220	43	0.85	330
150	100	0.6	1.8	3.3	220	41	1.05	330
100	100	0.38	1.8	3.3	220	34	3.6	330
200	220	0.52	2.2	3.3	0	54.5	1.0	680
150	220	0.36	2.7	3.3	0	52	1.85	680
100	220	0.23	2.7	3.3	0	47	4.25	680
200	220	0.52	2.2	3.3	220	50	0.5	680
150	220	0.36	2.7	3.3	220	47	1.0	680
100	220	0.23	2.7	3.3	220	38	3.75	680
200	100	1.05	0	22	0	48.5	0.7	330
150	100	0.7	0	22	0	46	1.55	330
100	100	0.37	0	22	0	44	8.0	330
200	100	1.05	0	22	220	44	2.1	330
150	100	0.7	0	22	220	42.5	1.6	330
100	100	0.37	0	22	220	37	5.9	330
200	220	0.59	0	22	0	56	0.8	680
150	220	0.4	0	22	0	53	1.7	680
100	220	0.21	0	22	0	46	5.6	680
200	220	0.59	0	22	220	51	2.0	680
150	220	0.4	0	22	220	48.5	1.4	680
100	200	0.21	0	22	220	42	3.1	680

$\frac{V_{out}}{V_{in}}$ measured with an input voltage of 100mV

D_{tot} measured for $V_{out} = 10V$

*Grid resistor of following valve.

MICROPHONY

The triode section can be used without special precautions against microphony in circuits in which the input voltage is $\geq 10mV_{(r.m.s.)}$ for an output of 50mW from the output stage.

UCL82

TRIODE PENTODE

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.

LIMITING VALUES

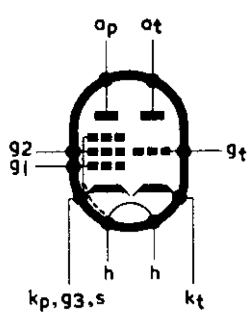
Pentode Section

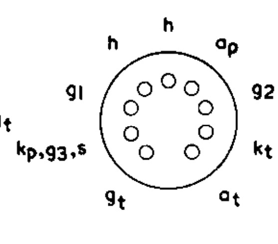
$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	7.0	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
p_{g2} max.	1.8	W
p_{g2} max. (max. sig. speech and music)	3.2	W
I_k max.	50	mA
R_{g1-k} max. (self bias)	2.0	MΩ
R_{g1-k} max. (fixed bias)	1.0	MΩ
V_{h-k} max.	200	V
R_{h-k} max.	20	kΩ

Triode Section

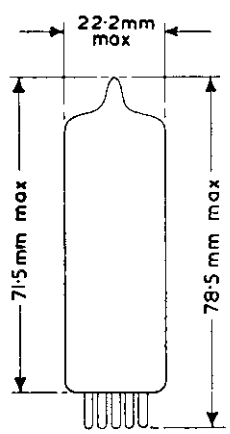
$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	1.0	W
I_k max.	15	mA
R_{g-k} max. (self bias)	3.0	MΩ
R_{g-k} max. (fixed bias)	1.0	MΩ
R_{g-k} max. (grid current biasing)	22	MΩ
Z_{g-k} max. (f=50c/s)	500	kΩ
V_{h-k} max.	200	V
R_{h-k} max.	20	kΩ

2324





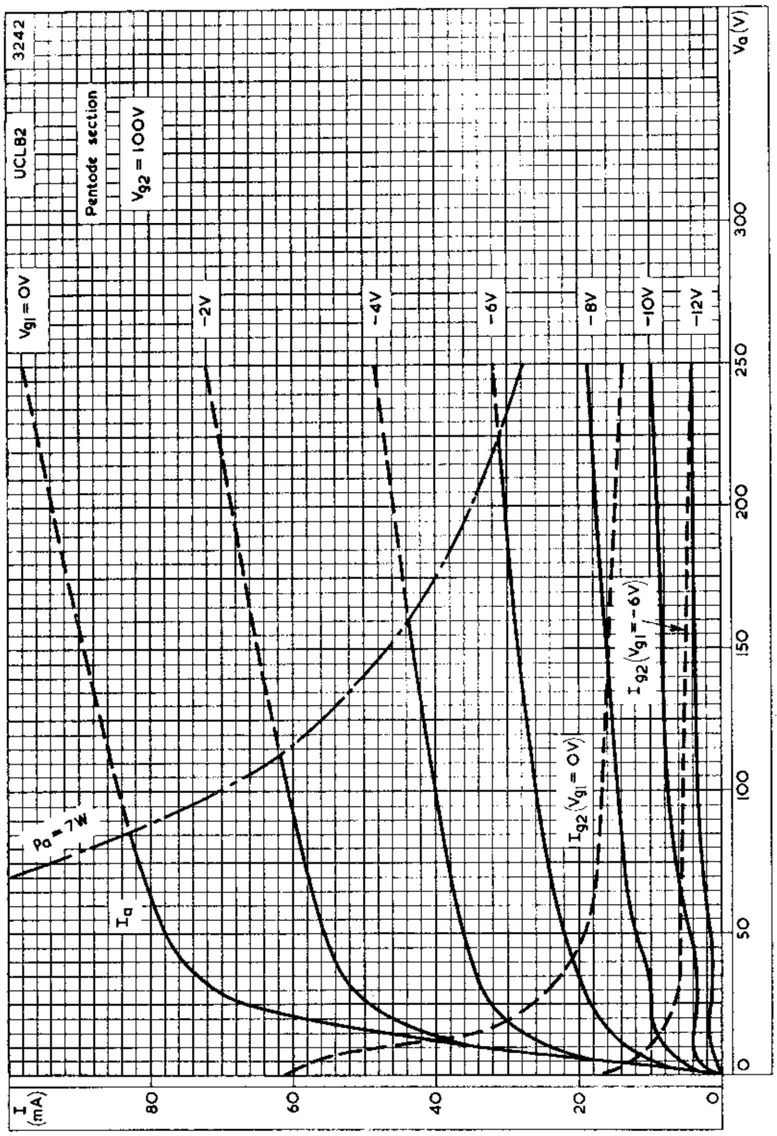
B9A Base



TRIODE PENTODE

UCL82

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.

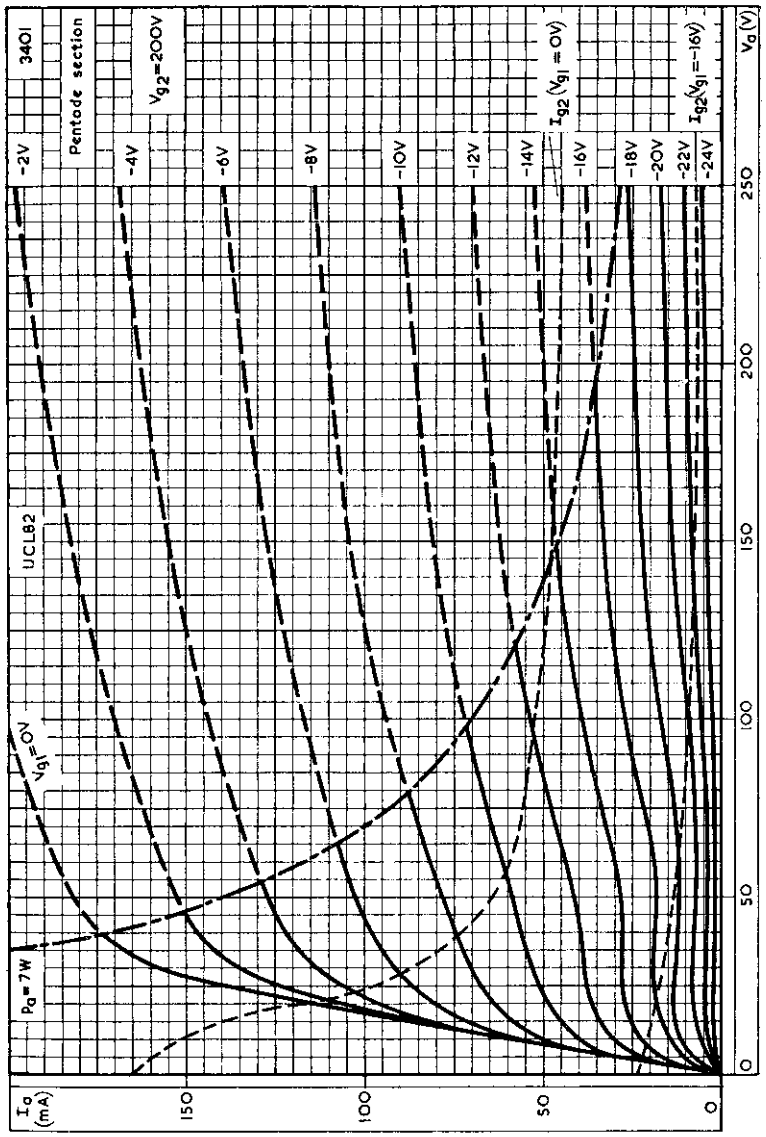


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 100V

UCL82

TRIODE PENTODE

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.

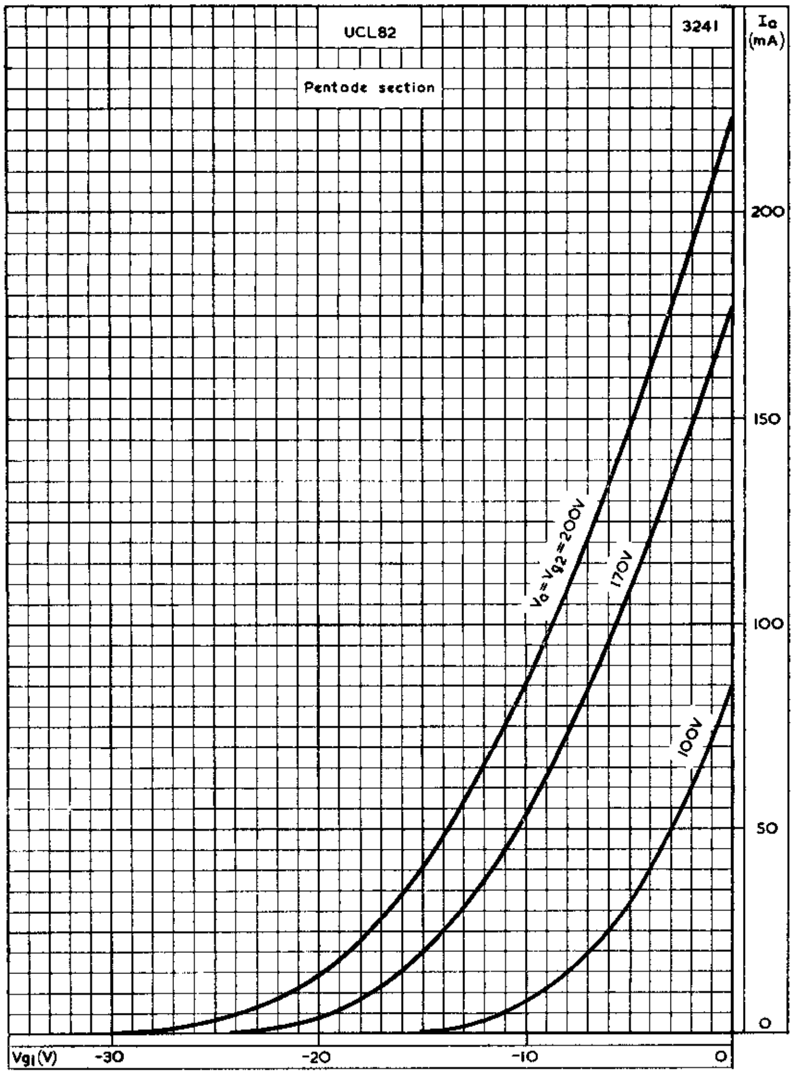


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 200V

TRIODE PENTODE

UCL82

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.

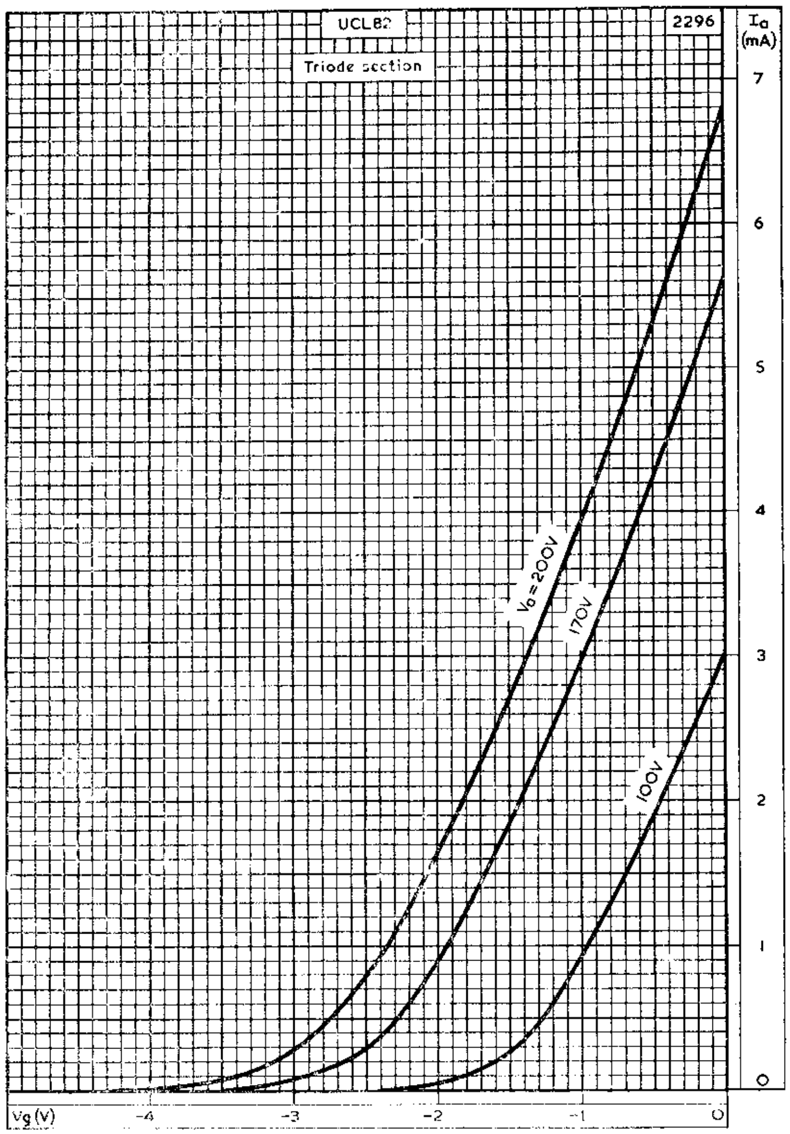


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR VARIOUS VALUES OF ANODE AND SCREEN-GRID VOLTAGE

UCL82

TRIODE PENTODE

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.

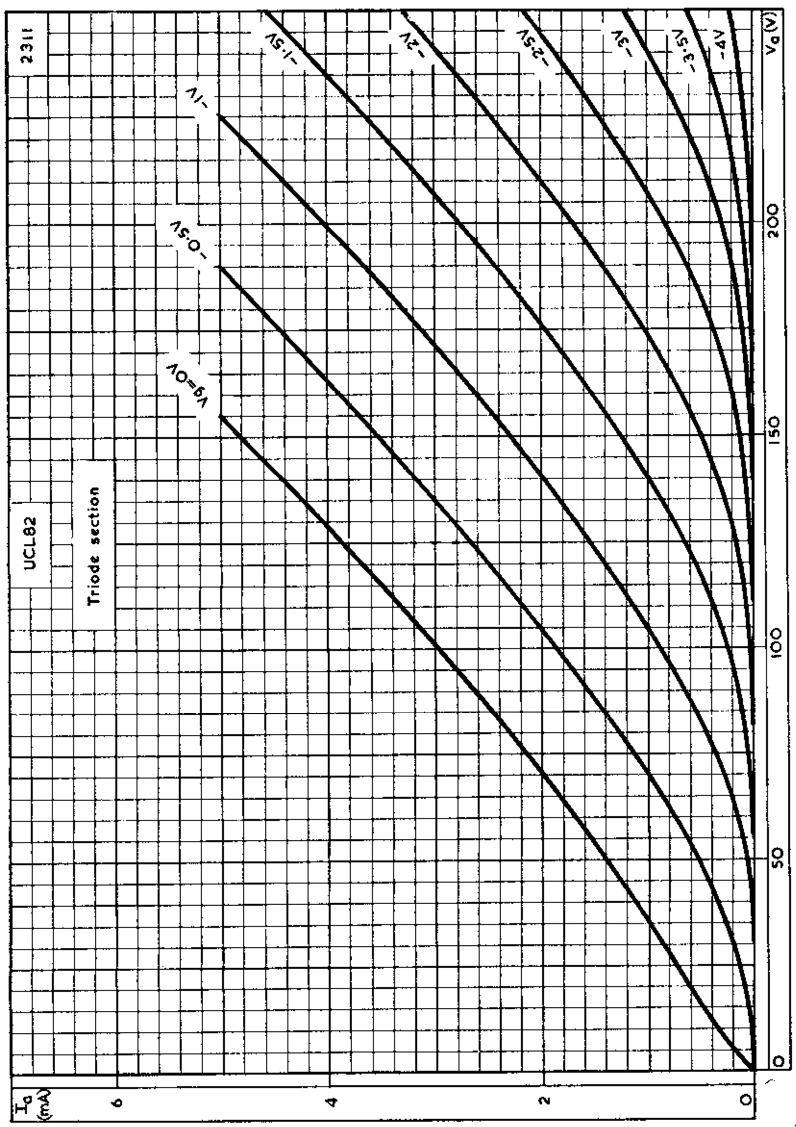


ANODE CURRENT OF THE TRIODE SECTION PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR VARIOUS VALUES OF ANODE VOLTAGE

TRIODE PENTODE

UCL82

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.

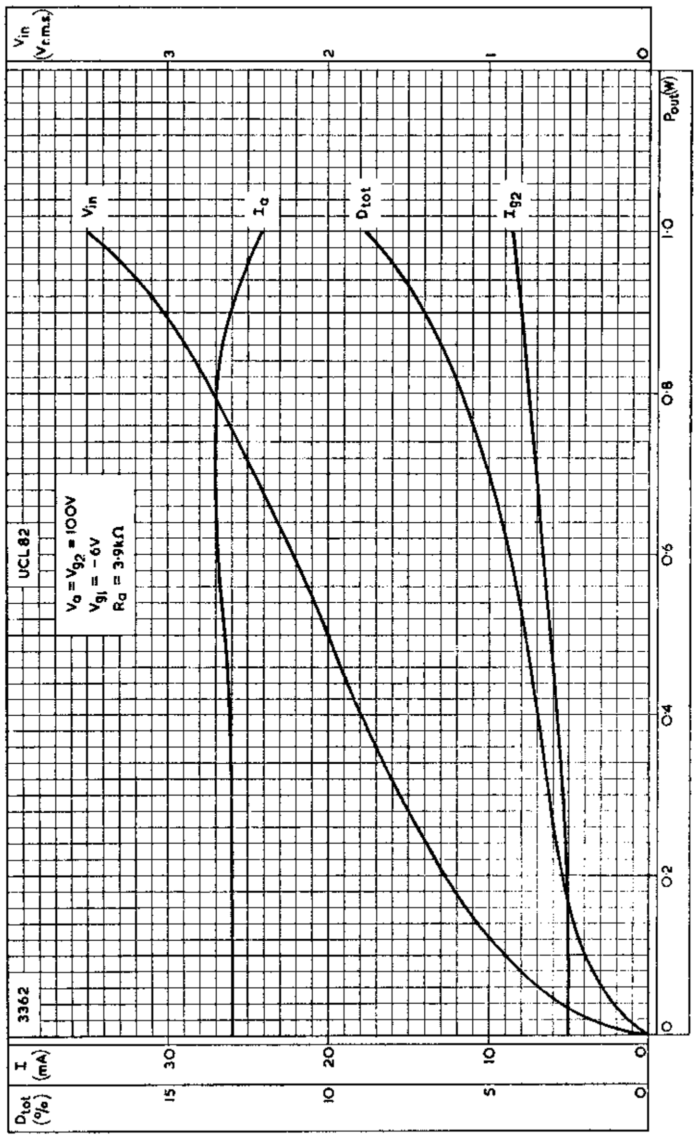


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR VARIOUS VALUES OF GRID VOLTAGE

UCL82

TRIODE PENTODE

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.

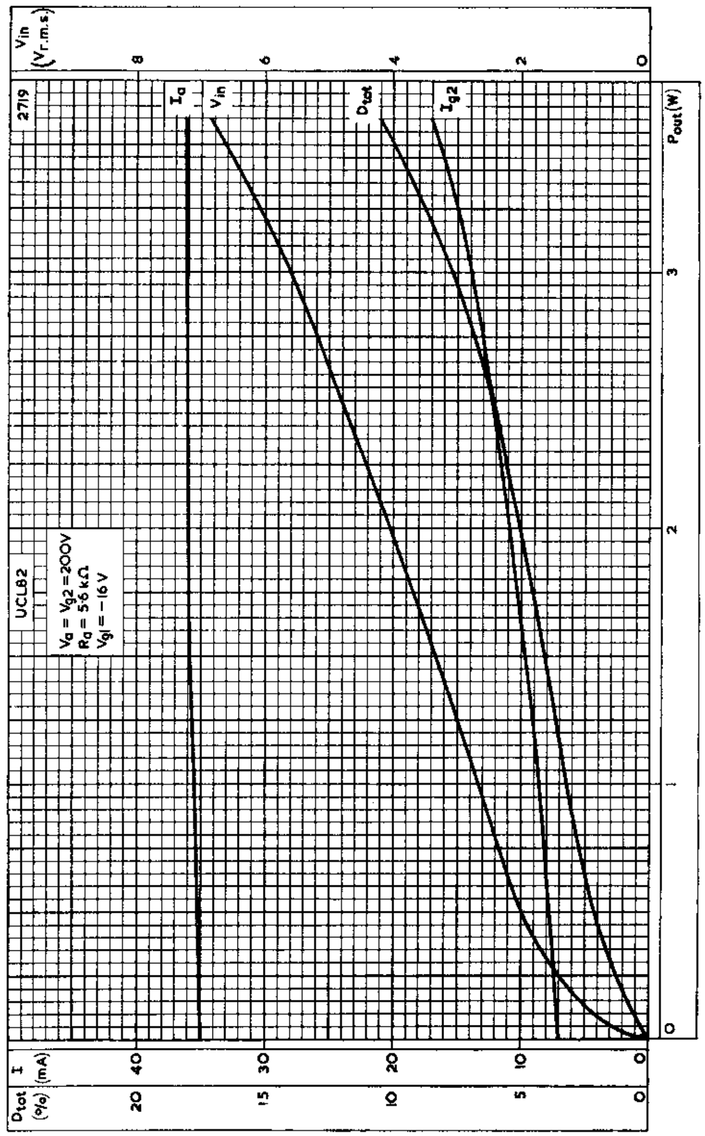


PERFORMANCE OF SINGLE UCL82 CLASS 'A' AMPLIFIER. $V_a = V_{g2} = 100V$

TRIODE PENTODE

UCL82

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.

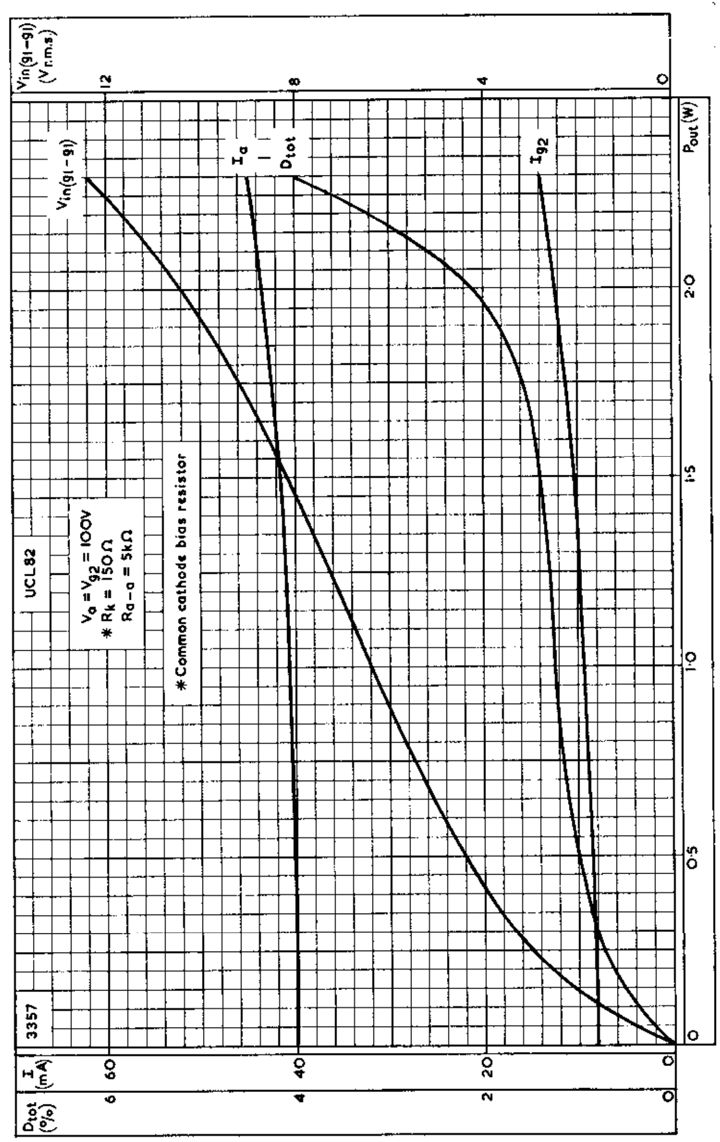


PERFORMANCE OF SINGLE UCL82 CLASS 'A' AMPLIFIER. $V_a = V_{g2} = 200V$

UCL82

TRIODE PENTODE

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.

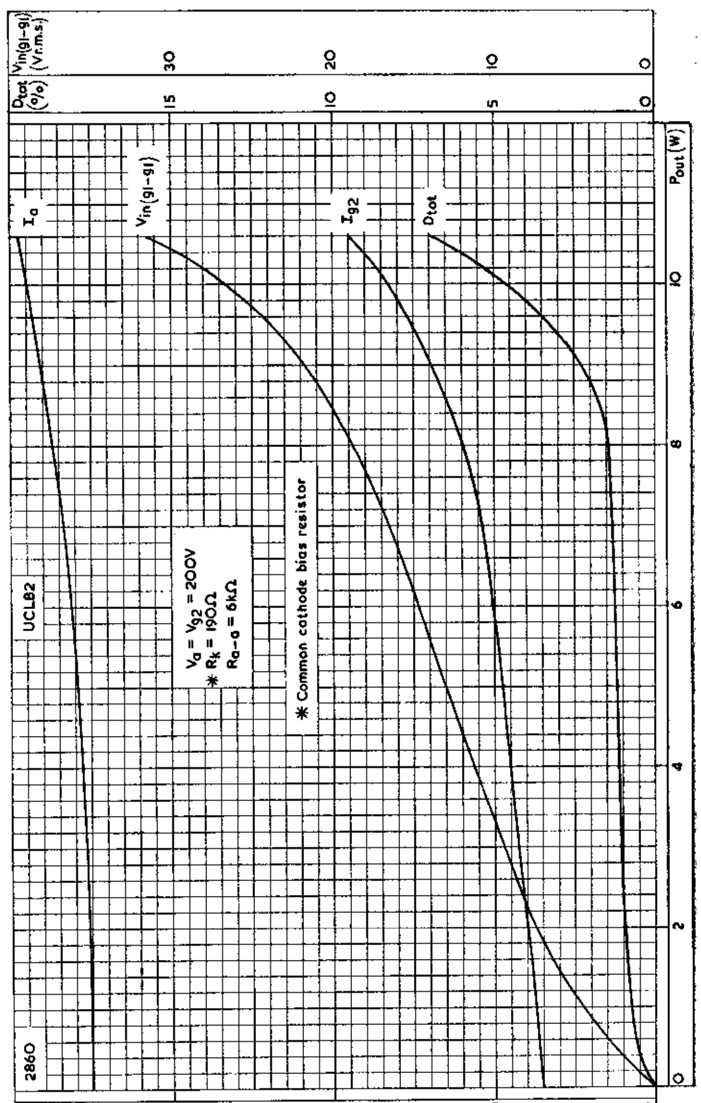


PERFORMANCE OF UCL82 IN PUSH-PULL. $V_a = V_{g2} = 100V$

TRIODE PENTODE

UCL82

Combined triode and output pentode with separate cathodes and 100mA heater intended for use in audio frequency applications.



PERFORMANCE OF UCL82 IN PUSH-PULL. $V_a = V_{g2} = 200V$

VARIABLE-MU R.F. PENTODE

UF89

Variable-mu pentode for use as r.f. or i.f. amplifier in f.m./a.m. receivers with series connected heaters.

HEATER

I_h	100	mA
V_h	12.6	V

CAPACITANCES

c_{in}	5.5	pF
c_{out}	5.1	pF
c_{a-g1}	<2.0	mpF
c_{g1-h}	50	mpF
c_{g1-g2}	2.1	pF

CHARACTERISTICS

V_a	170	170	V
V_{g3}	0	0	V
V_{g2}	100	110	V
V_{g1}	−1.2*	−2.0	V
I_a	12	12	mA
I_{g2}	4.4	3.9	mA
g_m	4.4	3.8	mA/V
r_a	400	525	kΩ
μ_{g1-g2}	21	—	

*At this voltage, grid current may occur. If this is not acceptable the negative bias should be increased to −2.0V.

OPERATING CONDITIONS

$V_a = V_b$	170	170	200	200	V
V_{g3}	0	0	0	0	V
R_{g2}	22	15	33	24	kΩ
V_{g1}	−0.5*	−2.0	−0.5*	−2.0	V
R_k	—	130	—	130	Ω
R_{g1}	10	—	10	—	MΩ
I_a	11.8	11	11.3	11.1	mA
I_{g2}	4.3	3.9	3.9	3.8	mA
g_m	5.2	3.8	5.15	3.85	mA/V
r_a	400	450	475	550	kΩ
R_{eq}	2.6	4.5	2.5	4.2	kΩ
g_m ($V_{g1} = -20V$)	110	110	150	160	μA/V
r_g (f=50Mc/s)	—	10	—	10	kΩ

*This voltage is produced by the grid current flowing through the grid resistor and the steady current of the diode. If this condition is not acceptable the negative grid bias should be increased to −2.0V.

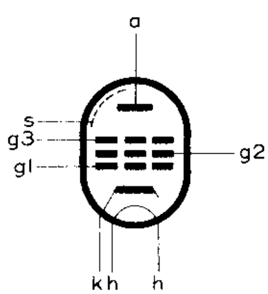
UF89

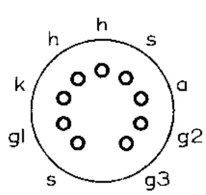
VARIABLE-MU R.F. PENTODE

LIMITING VALUES

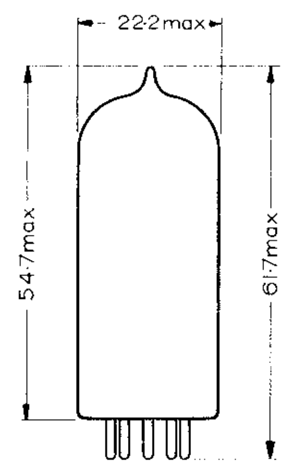
$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	2.25	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
p_{g2} max.	450	mW
I_k max.	16.5	mA
*R_{g1-k} max.	3.0	MΩ
R_{g3-k} max.	10	kΩ
V_{h-k} max.	150	V
R_{h-k} max.	20	kΩ

*With grid current biasing R_{g1-k} max. = 22MΩ.



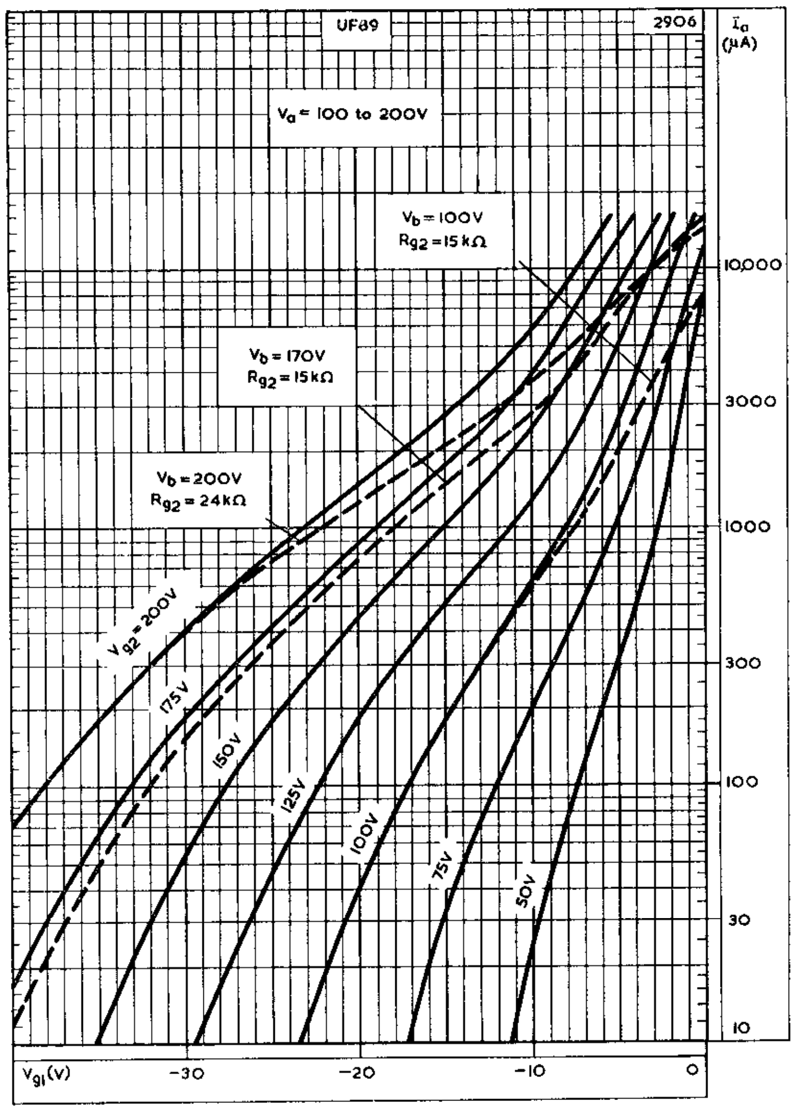


B9A Base



6394

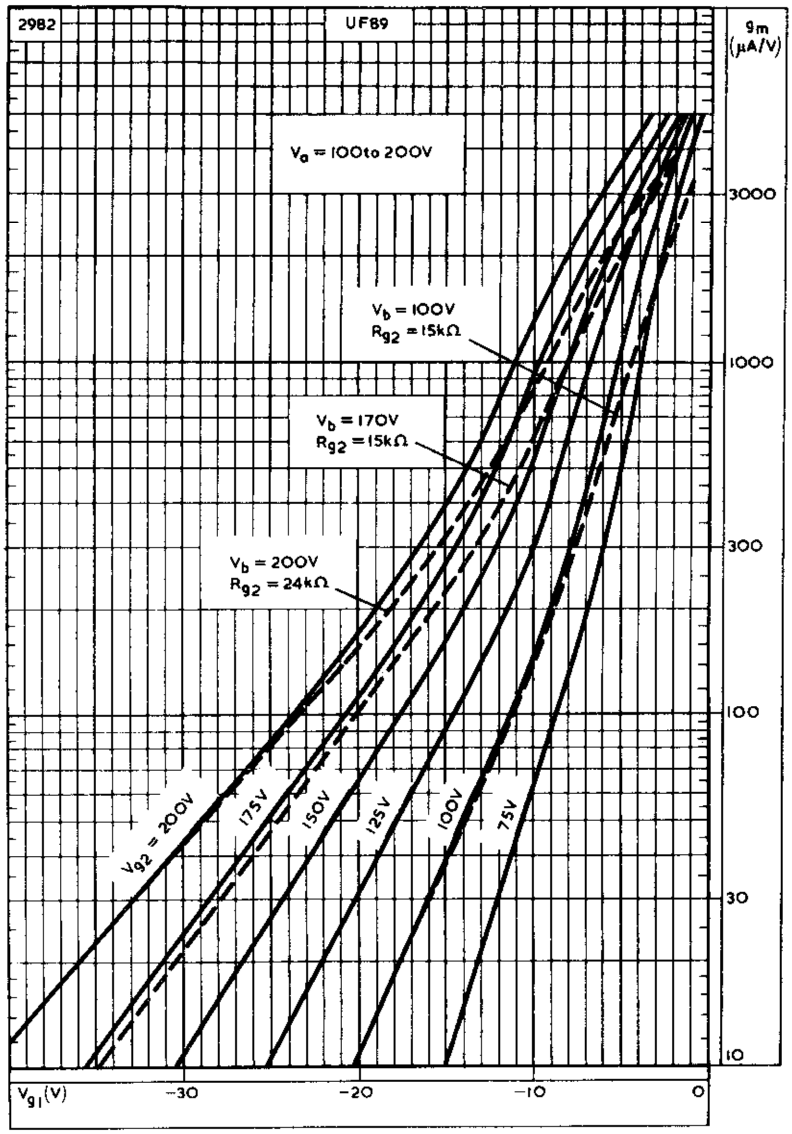
All dimensions in mm



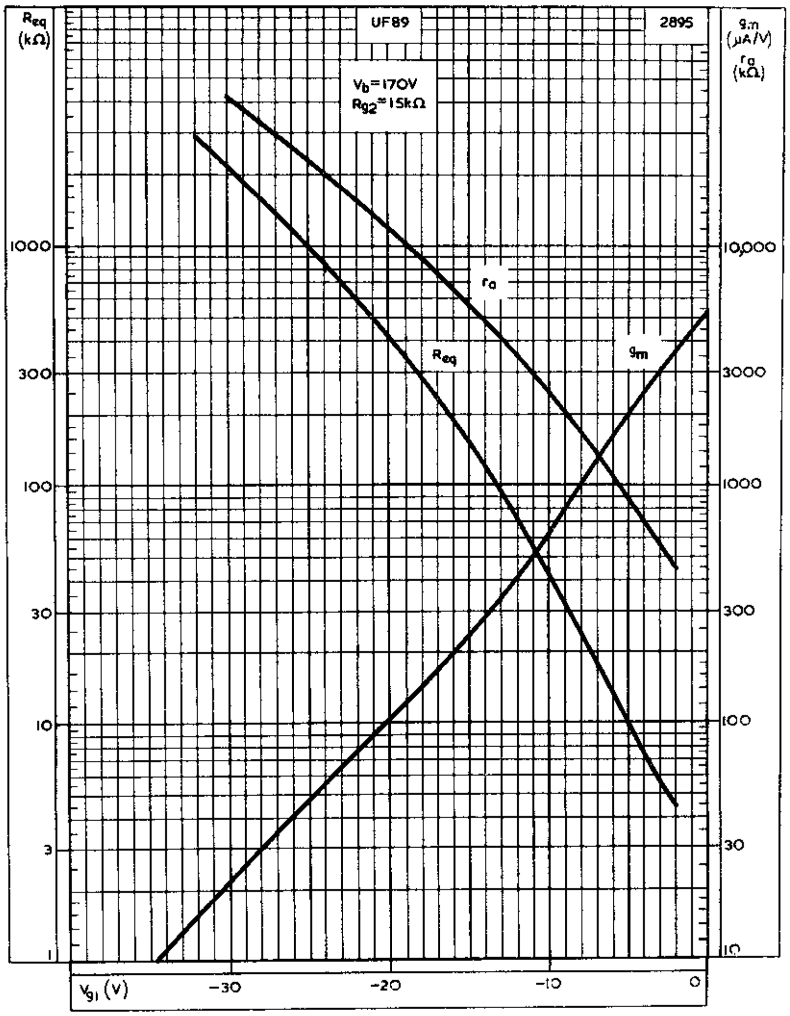
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE
WITH SCREEN-GRID VOLTAGE AS PARAMETER

UF89

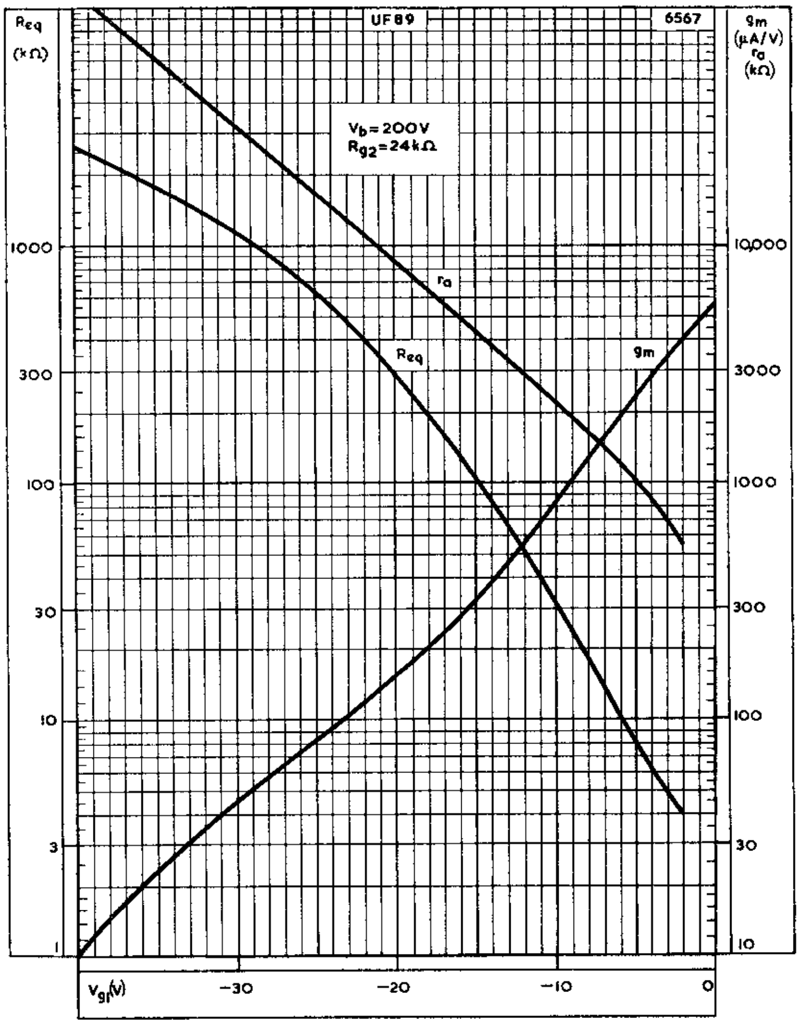
VARIABLE-MU R.F. PENTODE



MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER



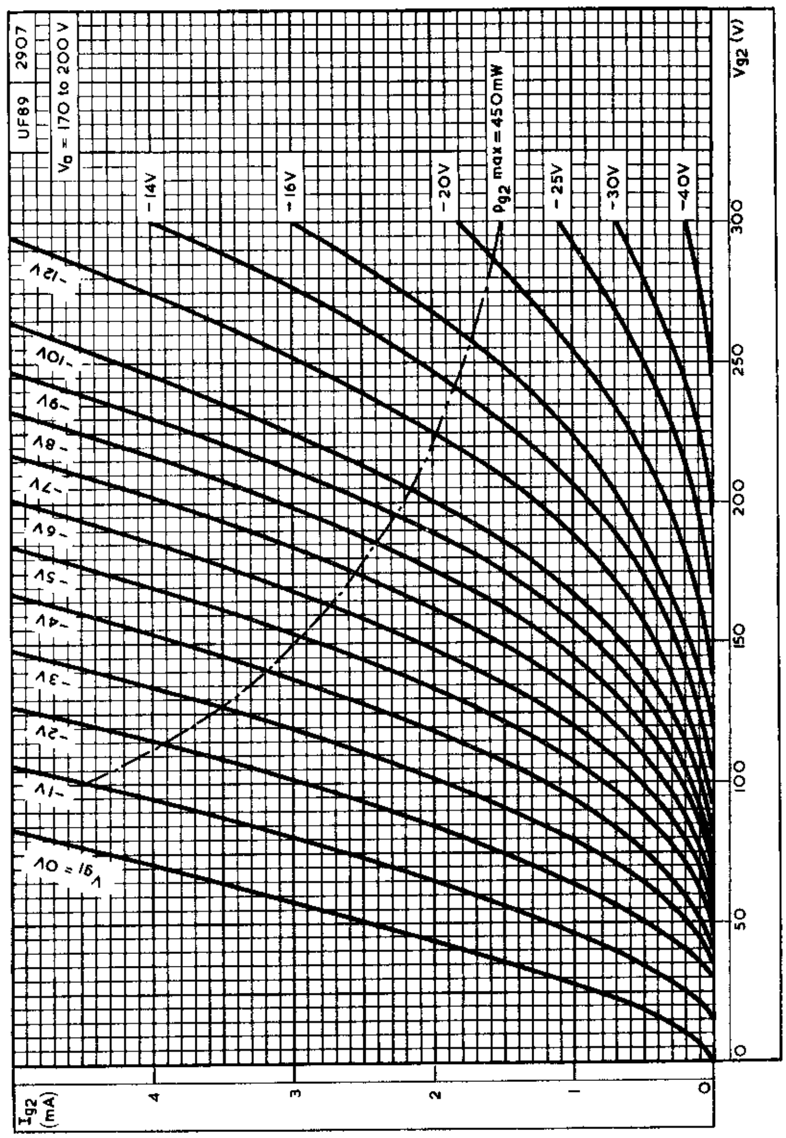
MUTUAL CONDUCTANCE, ANODE IMPEDANCE, AND EQUIVALENT NOISE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE V_b = 170V



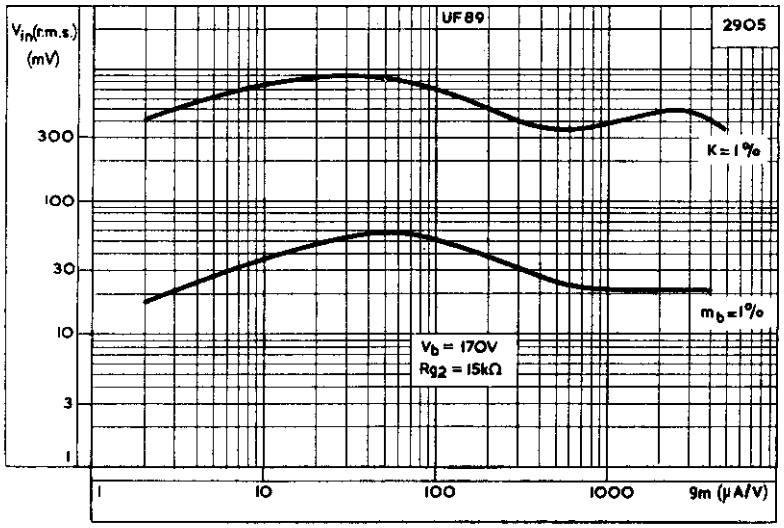
MUTUAL CONDUCTANCE, ANODE IMPEDANCE, AND EQUIVALENT NOISE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE $V_b = 200V$

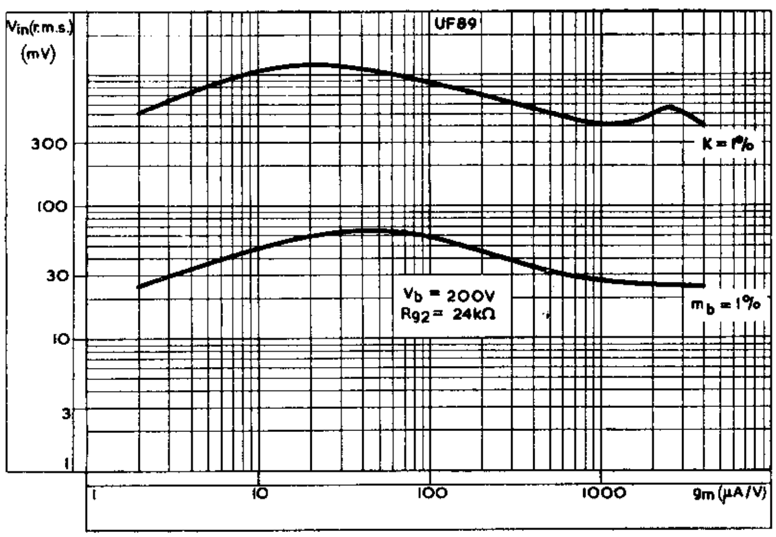
VARIABLE-MU R.F. PENTODE

UF89



SCREEN-GRID CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER





CROSS MODULATION AND MODULATION HUM CURVES

OUTPUT PENTODE

UL84

Output pentode rated for 12W anode dissipation and with 100mA heater for use in equipment with series connected heaters.

HEATER

I_h	100	mA
V_h	45	V

CAPACITANCES

c_{in}	12	pF
c_{out}	6.5	pF←
c_{a-g1}	<600	mpF
c_{g1-h}	<250	mpF

CHARACTERISTICS

V_a	100	170	200	V
V_{g2}	100	170	*	V
I_a	43	70	60	mA
I_{g2}	3.0	5.0	4.1	mA
V_{g1}	−6.7	−12.5	−17.3	V
g_m	9.0	10	8.8	mA/V
r_a	23	23	28	kΩ
μ_{g1-g2}	8.0	8.0	8.0	

*$V_{g2(b)}$ = 200V, R_{g2} = 470Ω

OPERATING CONDITIONS AS SINGLE VALVE AMPLIFIER

V_a	100	170	200	V
V_{g2}	100	170	*	V
R_k	145	170	270	Ω
R_a	2.4	2.4	2.4	kΩ
I_a	43	70	60	mA
$I_{g2\ (0)}$	3.0	5.0	4.1	mA
$V_{in(r.m.s.)}$ (P_{out}=50mW)	500	500	550	mV
$V_{in(r.m.s.)}$	4.3	7.0	7.8	V
P_{out}	1.9	5.6	5.2	W
D_{tot}	10	10	10	%
$I_{g2\ (max.\ sig.)}$	11	22	12.5	mA

*$V_{g2(b)}$ = 200V, R_{g2} = 470Ω undecoupled.

P_{out} and D_{tot} are measured at fixed bias and therefore represent the power output available during the reproduction of speech and music. When a sustained sine wave is applied to the control grid the bias across the cathode resistor will readjust itself as a result of the increased anode and screen-grid currents. This will result in approximately 10% reduction in power output.

UL84

OUTPUT PENTODE

OPERATING CONDITIONS FOR TWO VALVES IN PUSH-PULL

Pentode connection

V_a	100	170	200	V
V_{g2}	100	170	200	V
R_k (per valve)	270	240	300	Ω
R_{a-a}	3.5	3.5	3.5	kΩ
$I_{a(0)}$	2×29	2×56.5	2×55	mA
$I_{g2(0)}$	2×1.6	2×3.0	2×2.8	mA
$V_{in(g1-g1)r.m.s.}$	14	26	29	V
P_{out}	3.6	13	15	W
D_{tot}	3.0	4.5	3.5	%
$I_{a(max.\ sig.)}$	2×31	2×57.5	2×60	mA
$I_{g2(max.\ sig.)}$	2×7.0	2×20.5	2×15	mA

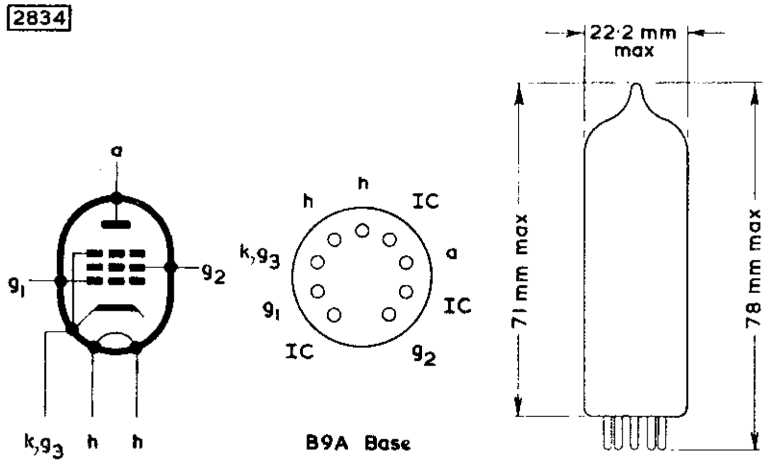
Distributed load conditions with screen-grid tapping at 20% of primary turns

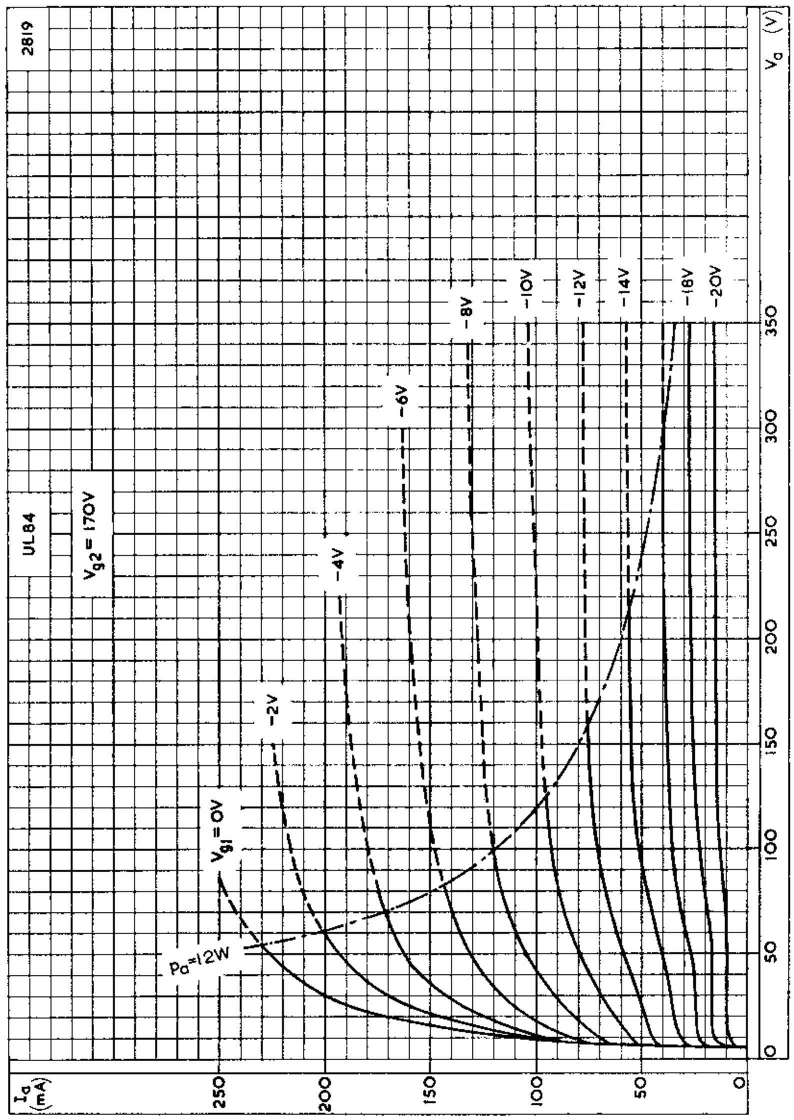
$V_a + V_{Rk}$	200	V
$V_{g2} + V_{Rk}$	200	V
R_k (per valve)	300	Ω
R_{a-a}	3.5	kΩ
$I_{k(0)}$	2×56.5	mA
$V_{in(g1-g1)r.m.s.}$	23	V
P_{out}	10	W
D_{tot}	0.8	%
$I_{k(max.\ sig.)}$	2×65	mA

LIMITING VALUES

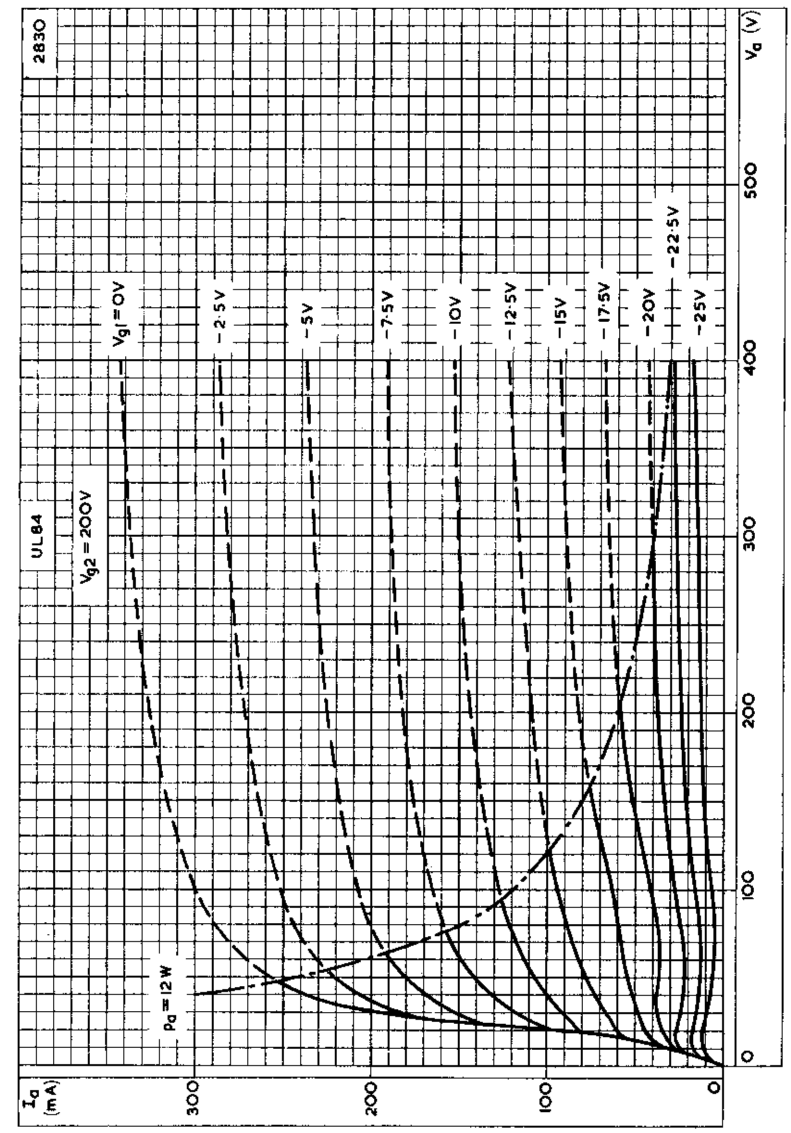
$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	12	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	200	V
p_{g2} max.	1.75	W
I_k max.	100	mA
R_{g1-k} max.	300	kΩ
V_{h-k} max.	200	V
R_{h-k} max.	20	kΩ

2834

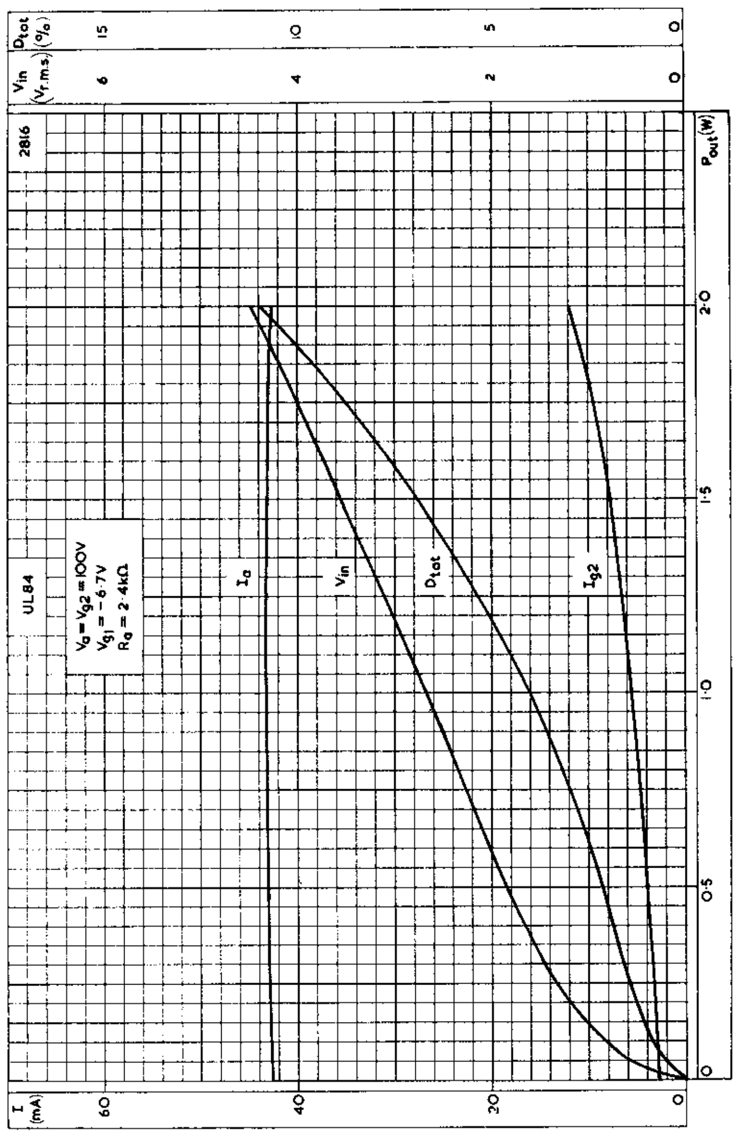

a
g1
g2
k,g3
h
h
h
h
IC
k,g3
a
g1
IC
IC
g2
B9A Base
22·2 mm
max
71 mm max
78 mm max



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 170V



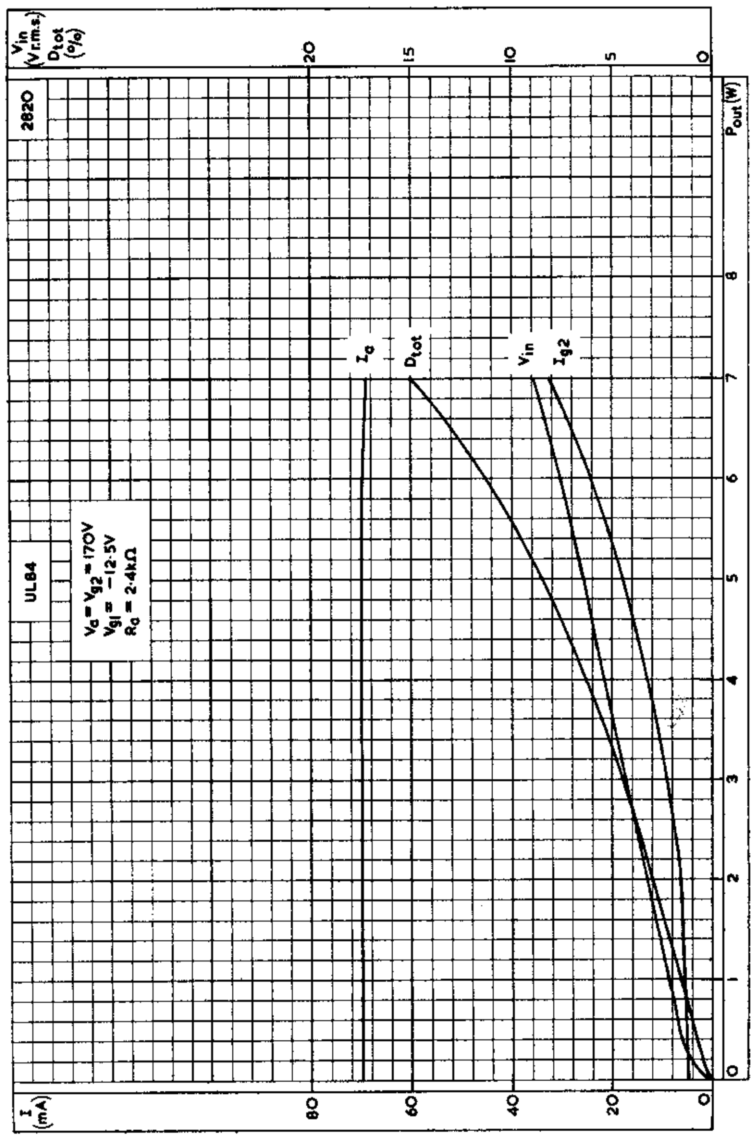
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 200V$



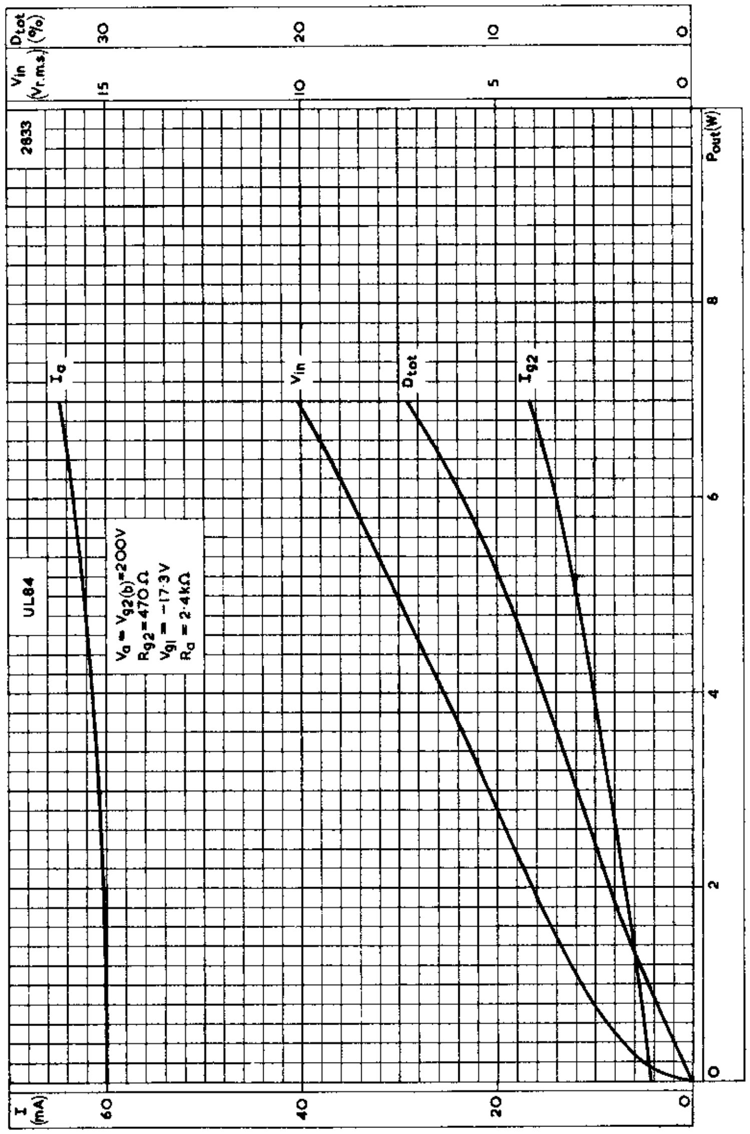
PERFORMANCE OF UL84 WHEN USED AS SINGLE VALVE AMPLIFIER
$V_a = V_{g2} = 100V$

UL84

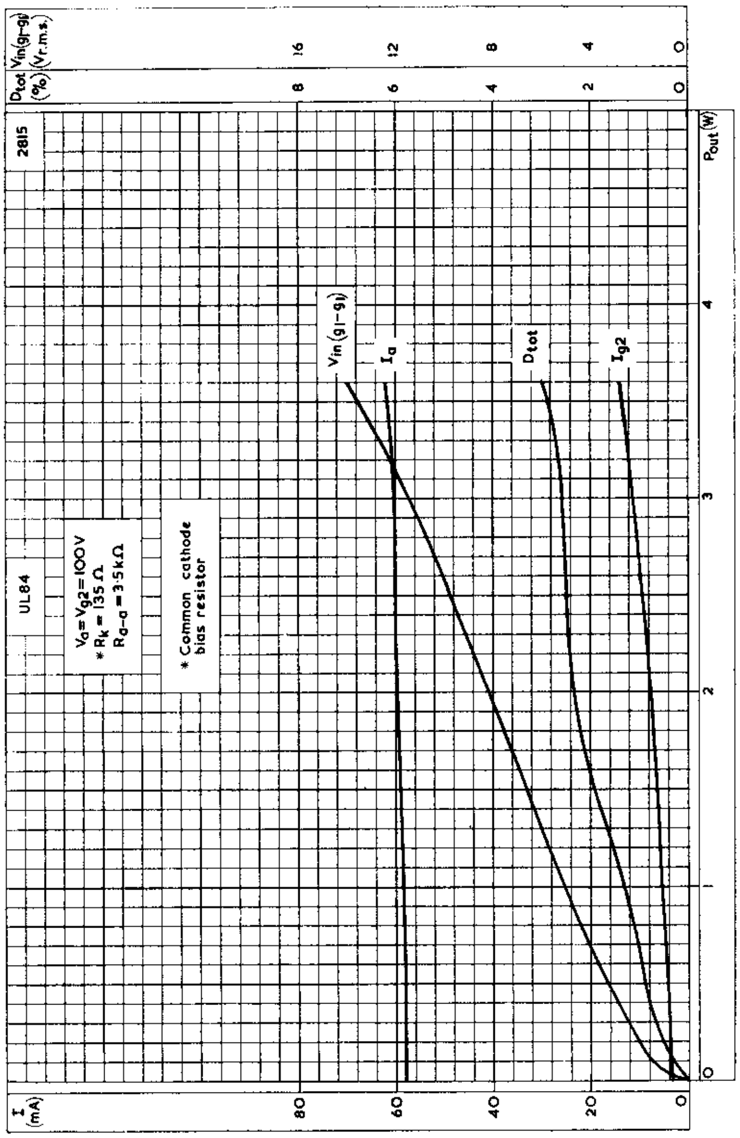
OUTPUT PENTODE



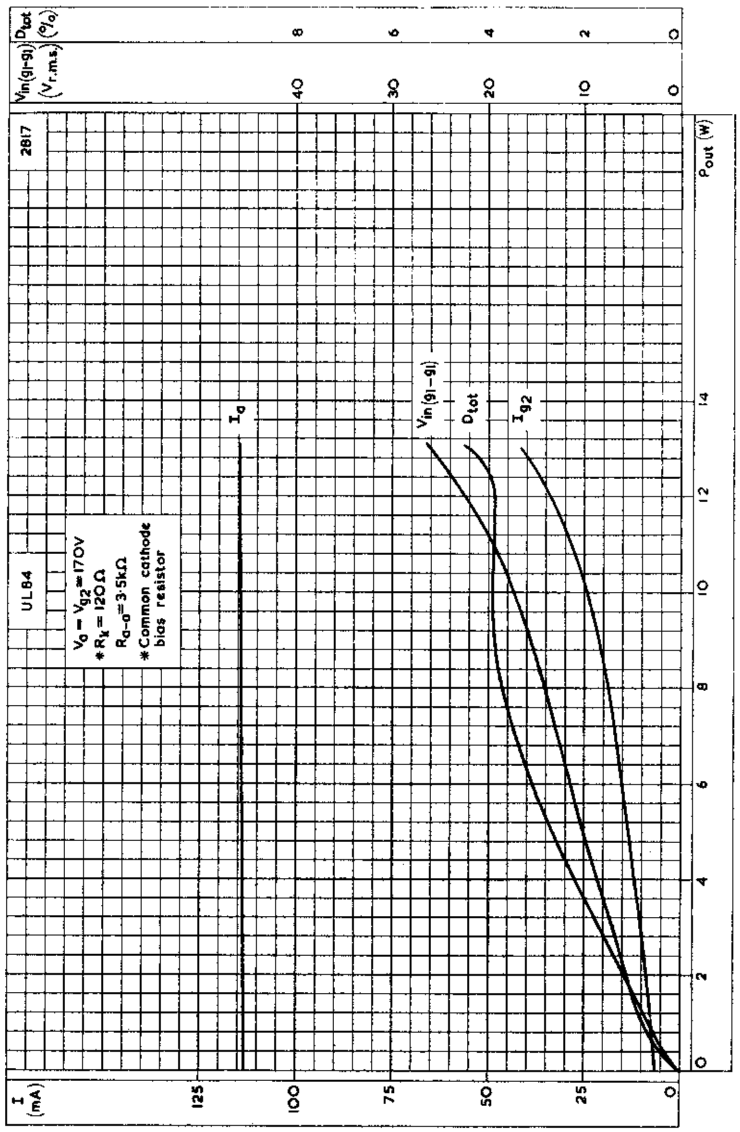
PERFORMANCE OF UL84 WHEN USED AS SINGLE VALVE AMPLIFIER
$V_a = V_{g2} = 170V$



PERFORMANCE OF UL84 WHEN USED AS SINGLE VALVE AMPLIFIER
$V_a = V_{g2(b)} = 200V$



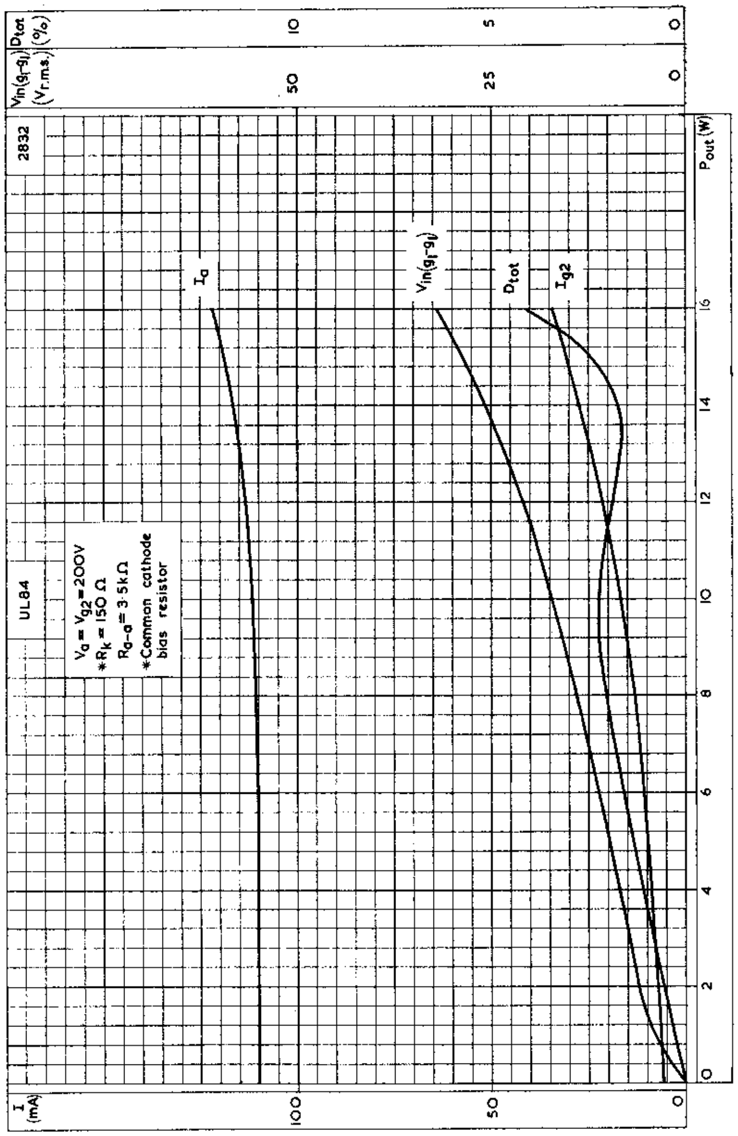
PERFORMANCE OF TWO UL84 IN PUSH-PULL. $V_a = V_{g2} = 100V$



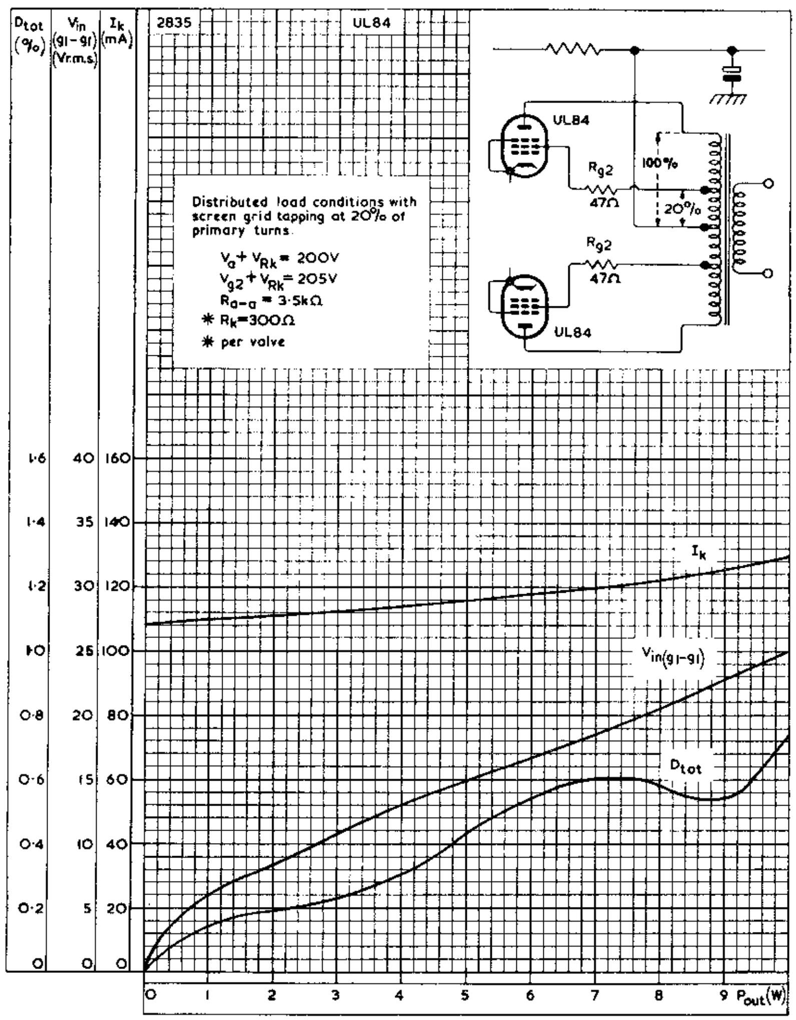
PERFORMANCE OF TWO UL84 IN PUSH-PULL. $V_a = V_{g2} = 170V$

UL84

OUTPUT PENTODE



PERFORMANCE OF TWO UL84 IN PUSH-PULL. $V_a = V_{g2} = 200V$



PERFORMANCE OF TWO UL84 IN PUSH-PULL WITH DISTRIBUTED LOAD CONDITIONS. SCREEN-GRID TAPPING AT 20% OF PRIMARY TURNS

HALF-WAVE RECTIFIER

UY85

Indirectly heated half-wave rectifier with 100mA heater for use in equipment with series connected heaters.

PRELIMINARY DATA

HEATER

Suitable for series or parallel operation, a.c. or d.c.

I_h	100	mA
V_h	38	V

LIMITING VALUES

P.I.V. max.	700	V
$V_{a(r.m.s.)}$ max.	250	V
I_{out} max.	110	mA
$i_{a(pk)}$ max.	660	mA
$v_{h-k(pk)}$ max. (cathode positive)	550	V

TYPICAL OPERATING CONDITIONS

C	100	μF
I_{out}	110	mA

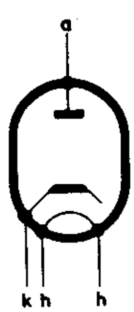
$V_{a(r.m.s.)}$ (V)	R_{lim} min. (Ω)	V_{out} (V)
110	0	112
220	90	215
250	100	245

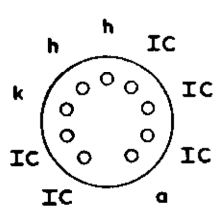
UY85

HALF-WAVE RECTIFIER

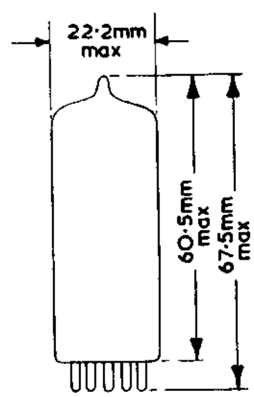
Indirectly heated half-wave rectifier with 100mA heater for use in equipment with series connected heaters.

2442





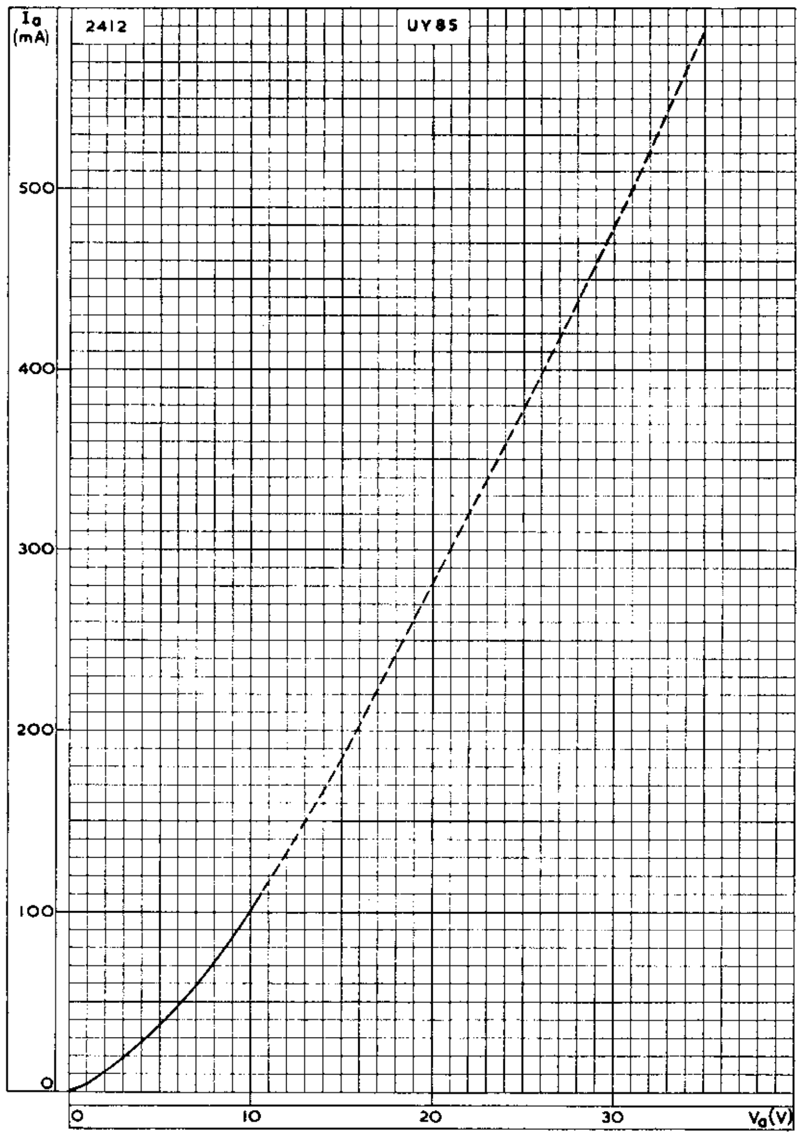
B9A
Noval Base



HALF-WAVE RECTIFIER

UY85

Indirectly heated half-wave rectifier with 100mA heater for use in equipment with series connected heaters.

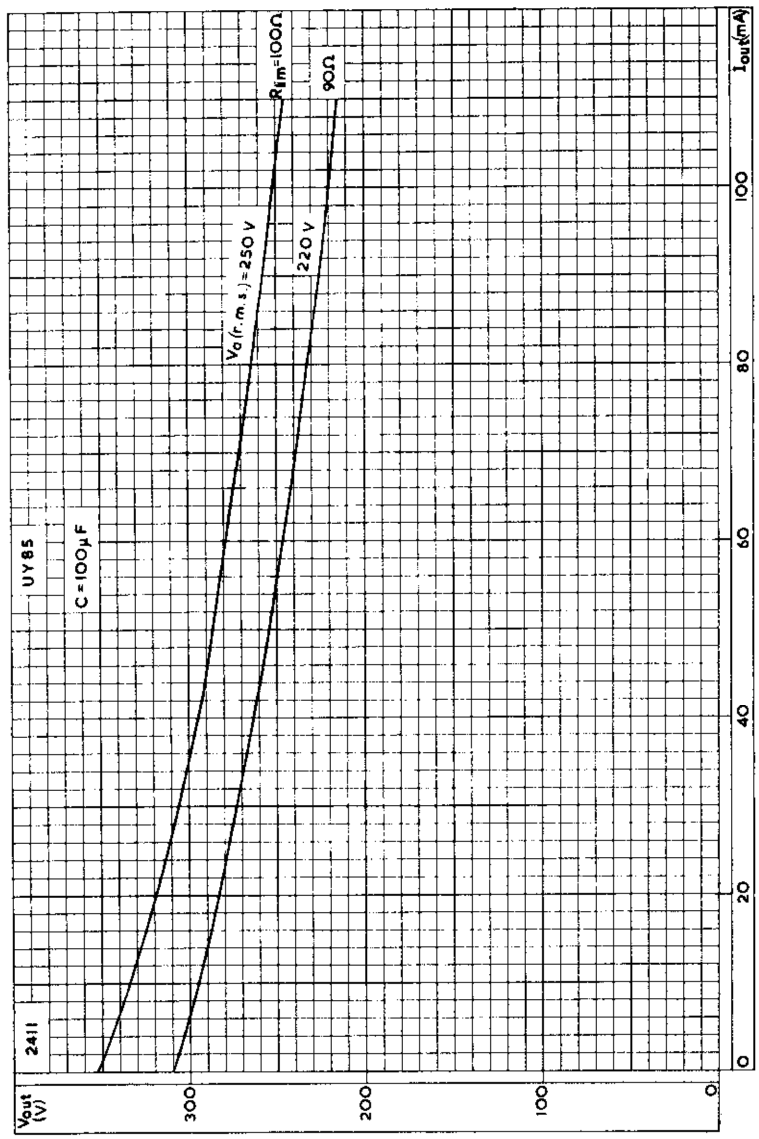


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

UY85

HALF-WAVE RECTIFIER

Indirectly heated half-wave rectifier with 100mA heater for use in equipment with series connected heaters



REGULATION CURVE

PENTODE

6AS6

Dual control pentode for switching or gating control or for use as a frequency changer.

HEATER

V_h	6.3	V
I_h	175	mA

MOUNTING POSITION

Any

CAPACITANCES

	Shielded	Unshielded	
c_{a-g1}	<20	<25	mpF
c_{a-g3}	700	700	mpF
c_{in}	4.0	3.9	pF
c_{g3-all}	3.4	3.3	pF
c_{out}	3.0	2.2	pF
c_{g1-g3}	<150	<150	mpF

CHARACTERISTICS

V_a	120	120	V
V_{g2}	120	120	V
V_{g3}	−3.0	0	V
I_a	3.5	5.1	mA
I_{g2}	4.8	3.5	mA
V_{g1}	−2.0	−2.0	V
$g_{m(g1-a)}$	2.0	3.2	mA/V
$g_{m(g3-a)}$	660	450	µA/V
r_a	—	150	kΩ
$V_{g1}(I_a = 100\mu A)$	—	<−7.5	V
$V_{g3}(I_a = 20\mu A)$	−10	<−15	V

OPERATING CONDITIONS

Frequency changer with oscillator voltage on g_3

V_a	120	V
V_{g2}	120	V
V_{g1}	−2.0	V
I_a	2.1	mA
I_{g2}	5.8	mA
$V_{osc(r.m.s.)}$	6.0	V
I_{g3}	70	µA
R_{g3}	100	kΩ
g_c	1.0	mA/V
r_a	130	kΩ
R_{eq}	12	kΩ

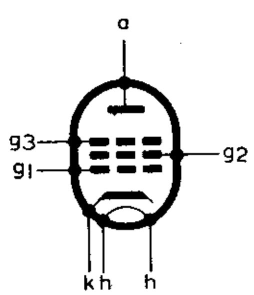
DESIGN CENTRE RATINGS

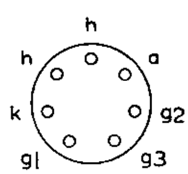
$V_{a(b)}$ max.	300	V
V_a max.	180	V
p_a max.	1.7	W
$V_{g2(b)}$ max.	300	V
V_{g2} max.	140	V
p_{g2} max.	750	mW
V_{g3} max.	27	V
R_{g1-k} max.	4.0	MΩ←
I_k max.	18	mA
V_{h-k} max.	90	V

6AS6

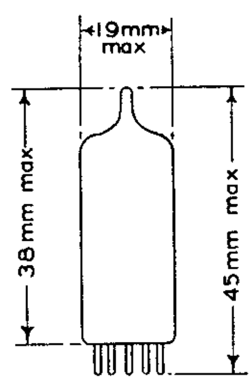
PENTODE

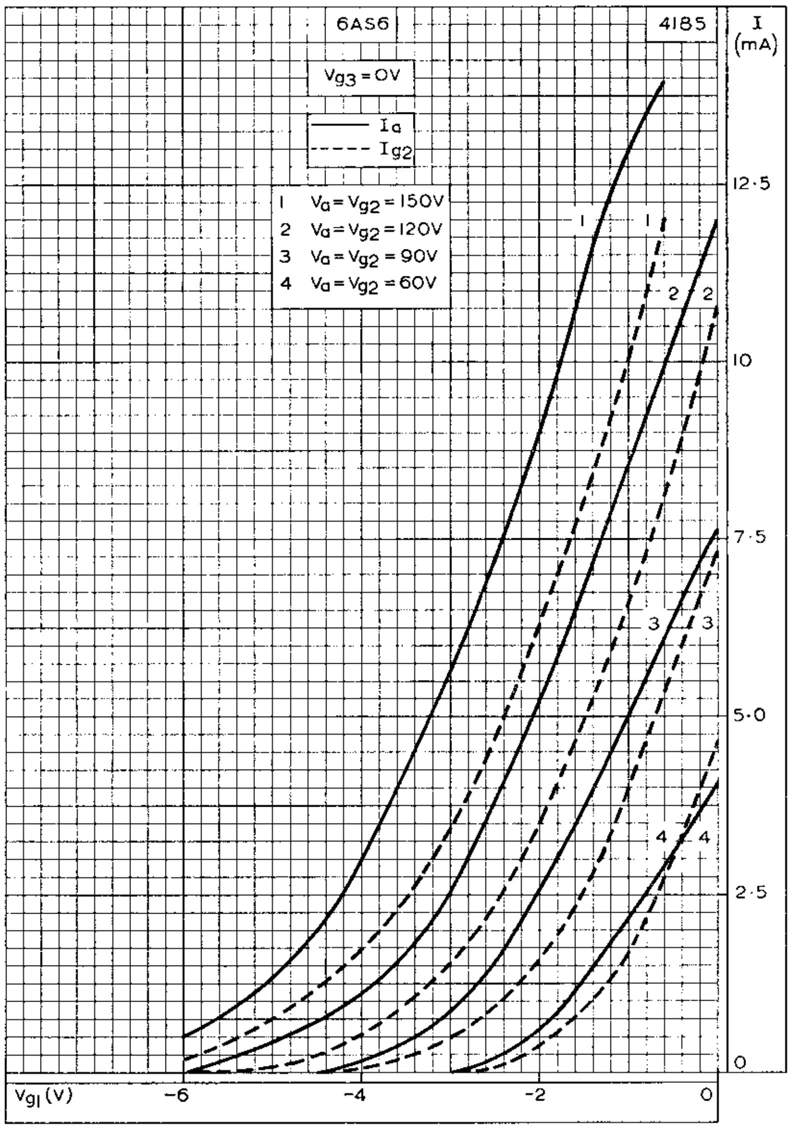
4491



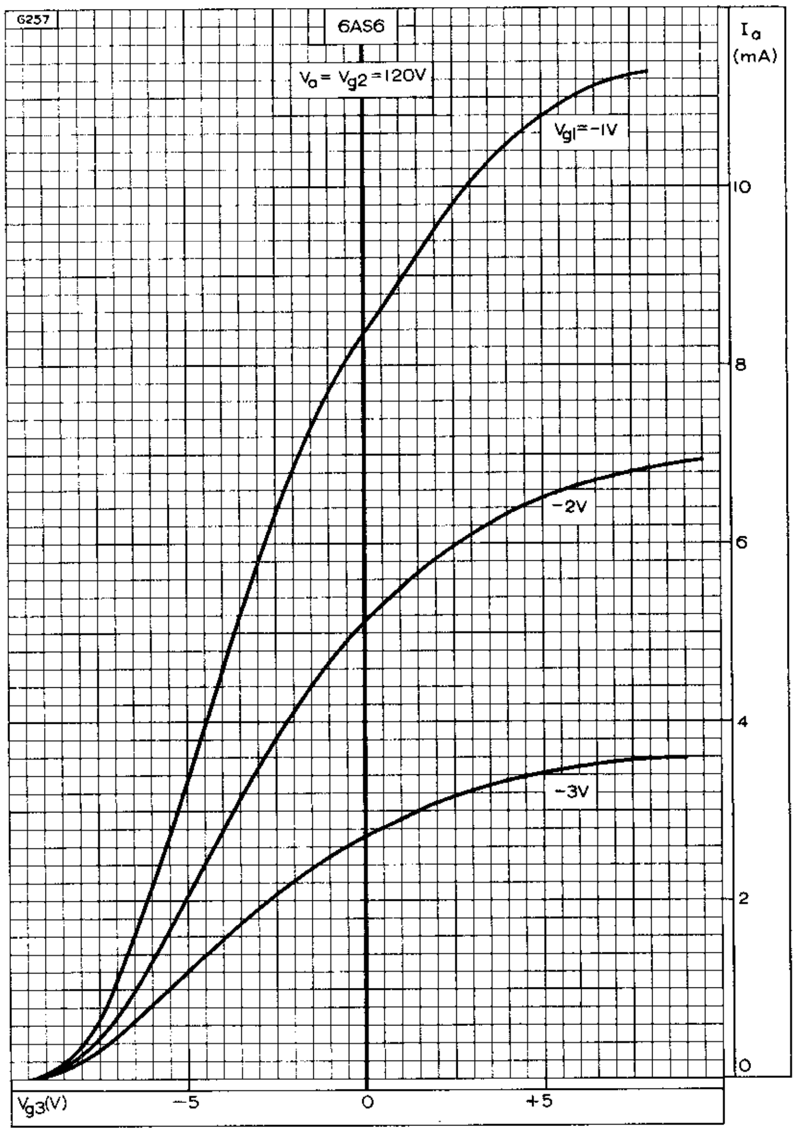


B7G Base

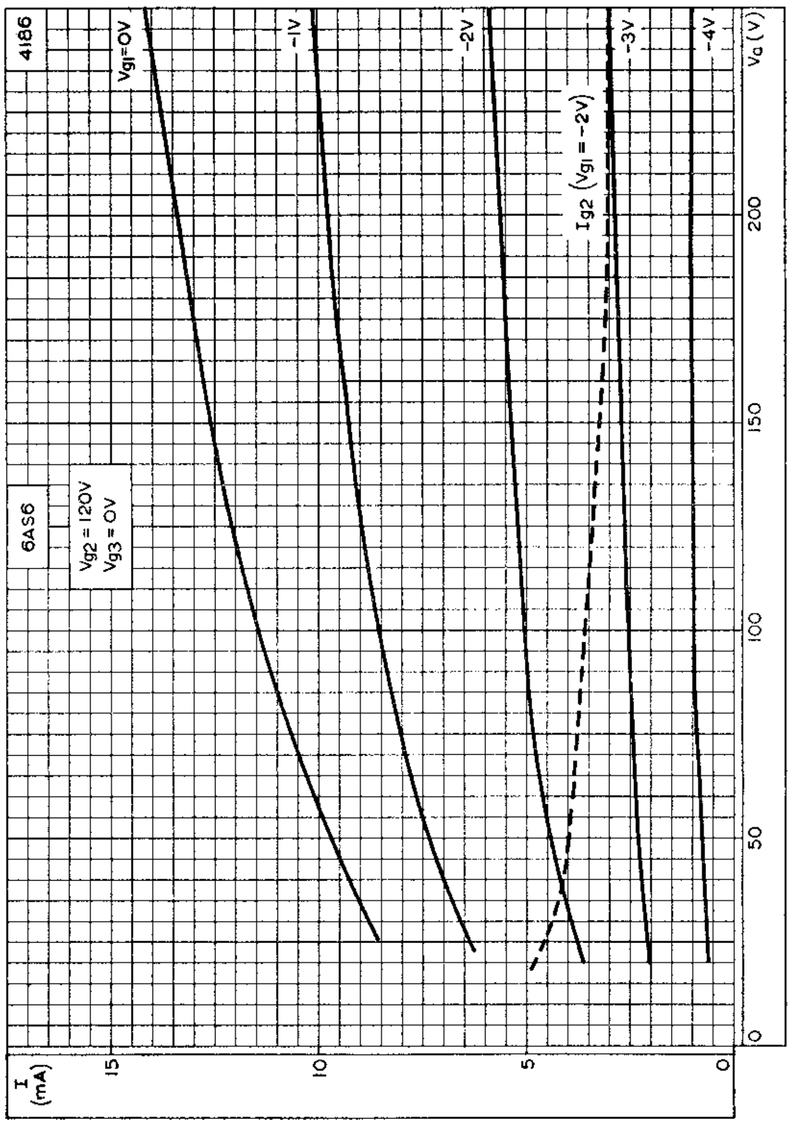




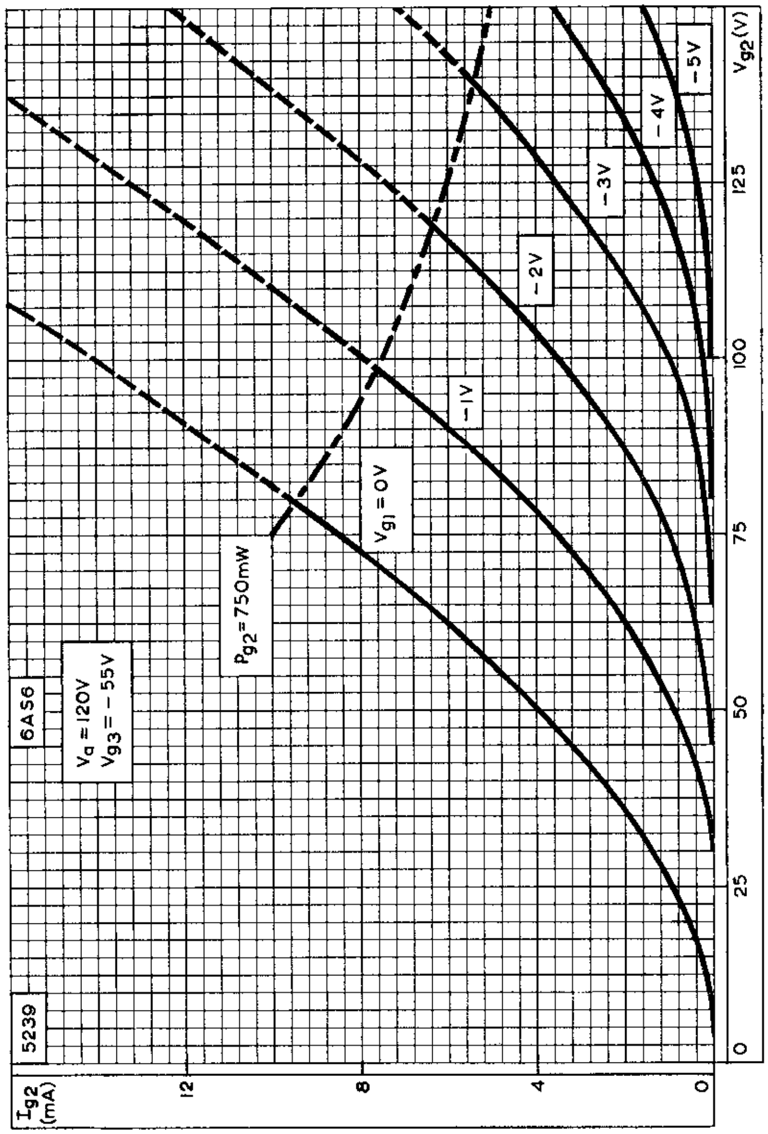
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETERS



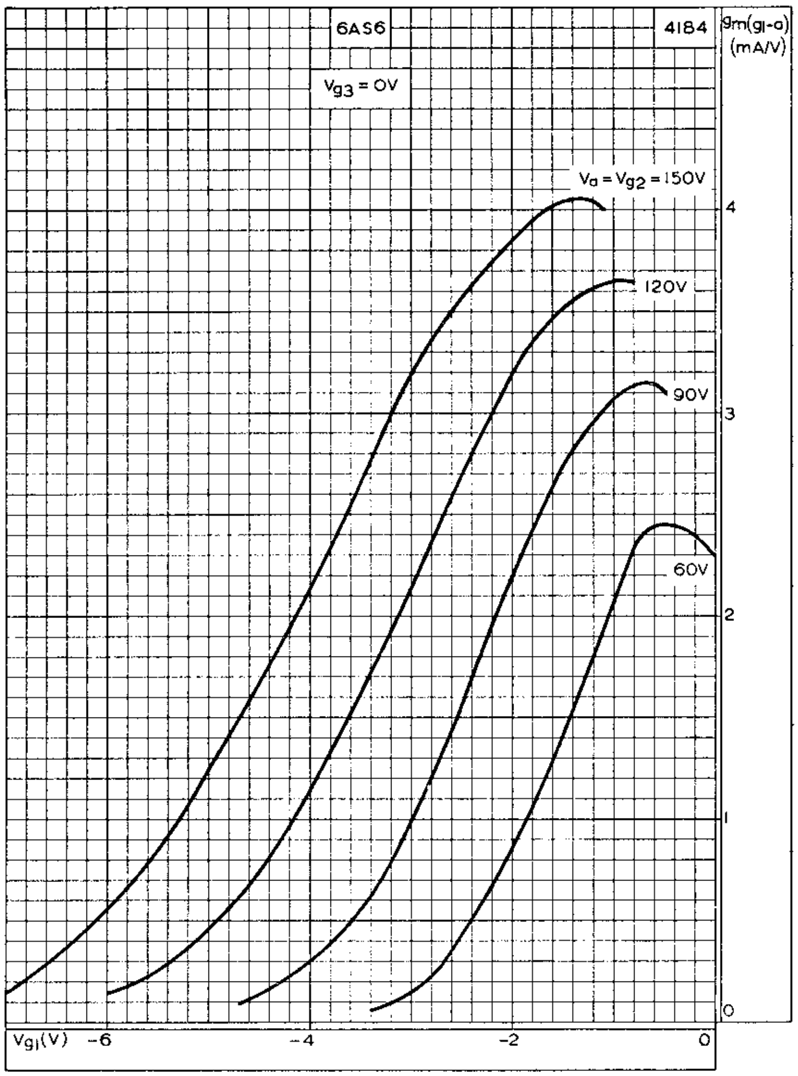
ANODE CURRENT PLOTTED AGAINST SUPPRESSOR-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER



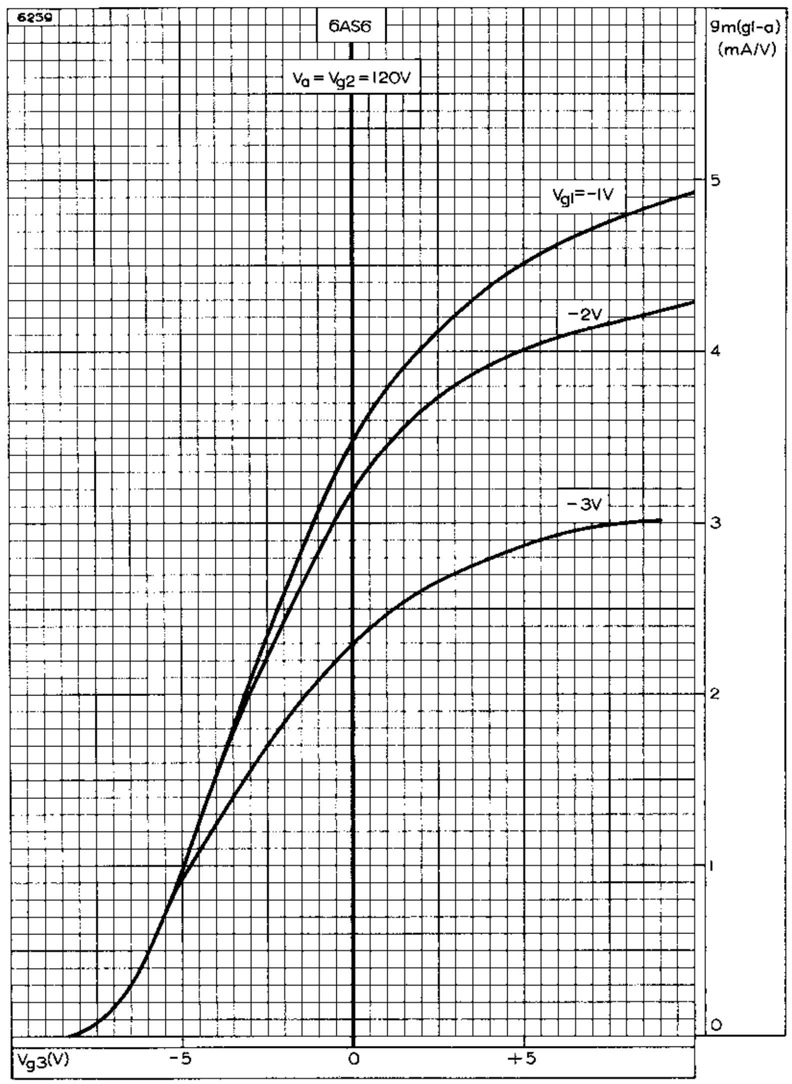
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER



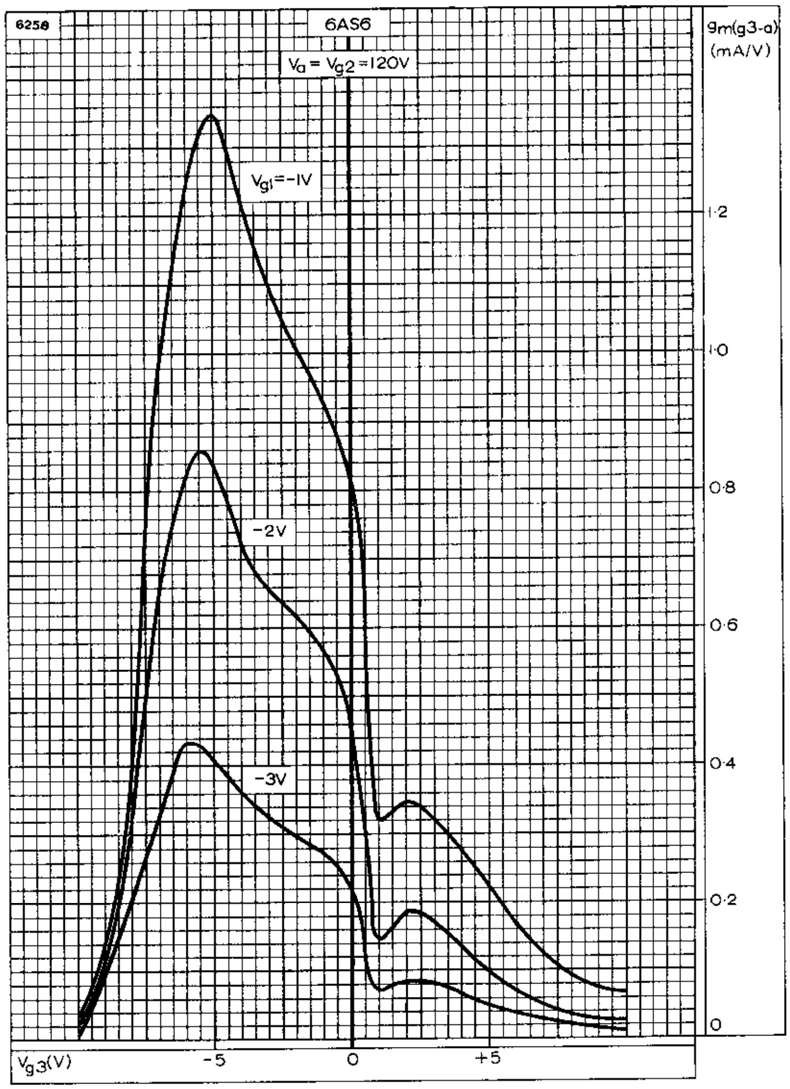
SCREEN-GRID CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER



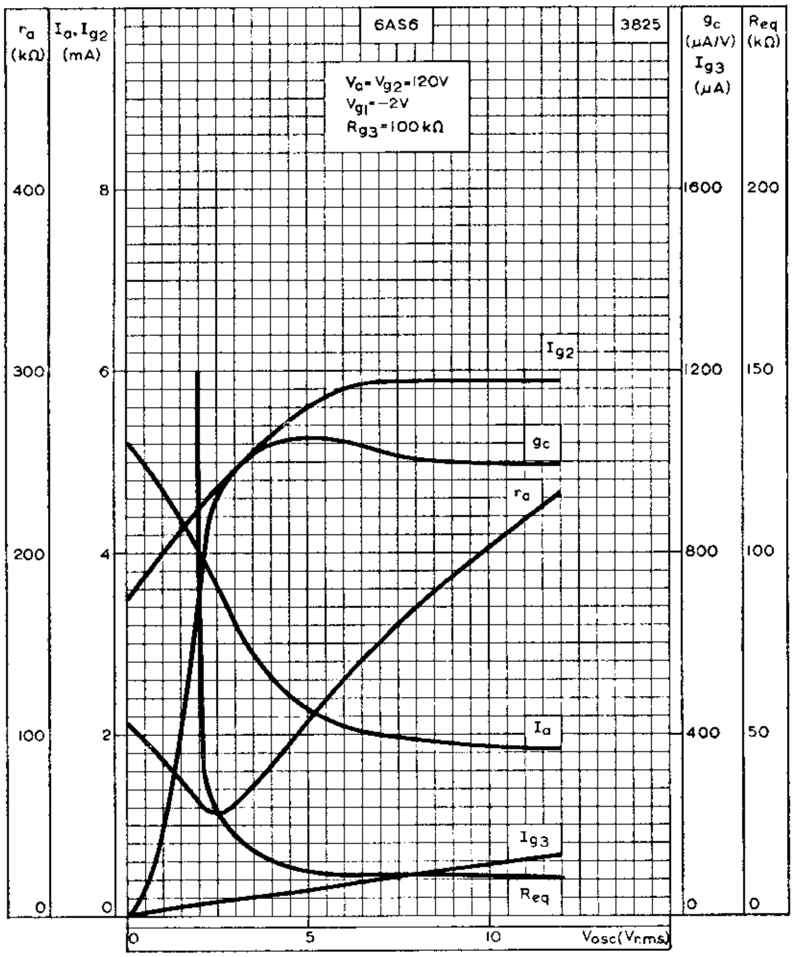
MUTUAL CONDUCTANCE (g_1-a) PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETERS



MUTUAL CONDUCTANCE (g_{1-a}) PLOTTED AGAINST SUPPRESSOR-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER



MUTUAL CONDUCTANCE (g_{3-a}) PLOTTED AGAINST SUPPRESSOR-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

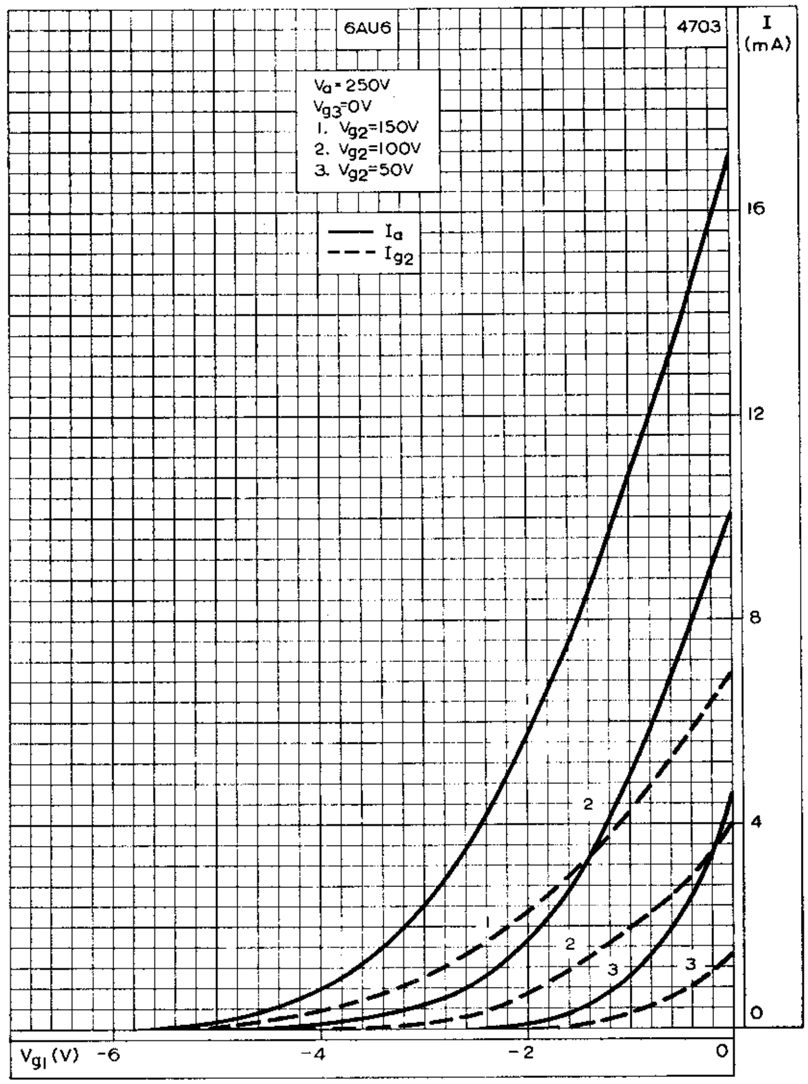


PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER

R.F. PENTODE

Short-grid base pentode primarily intended for use as r.f. amplifier.

6AU6

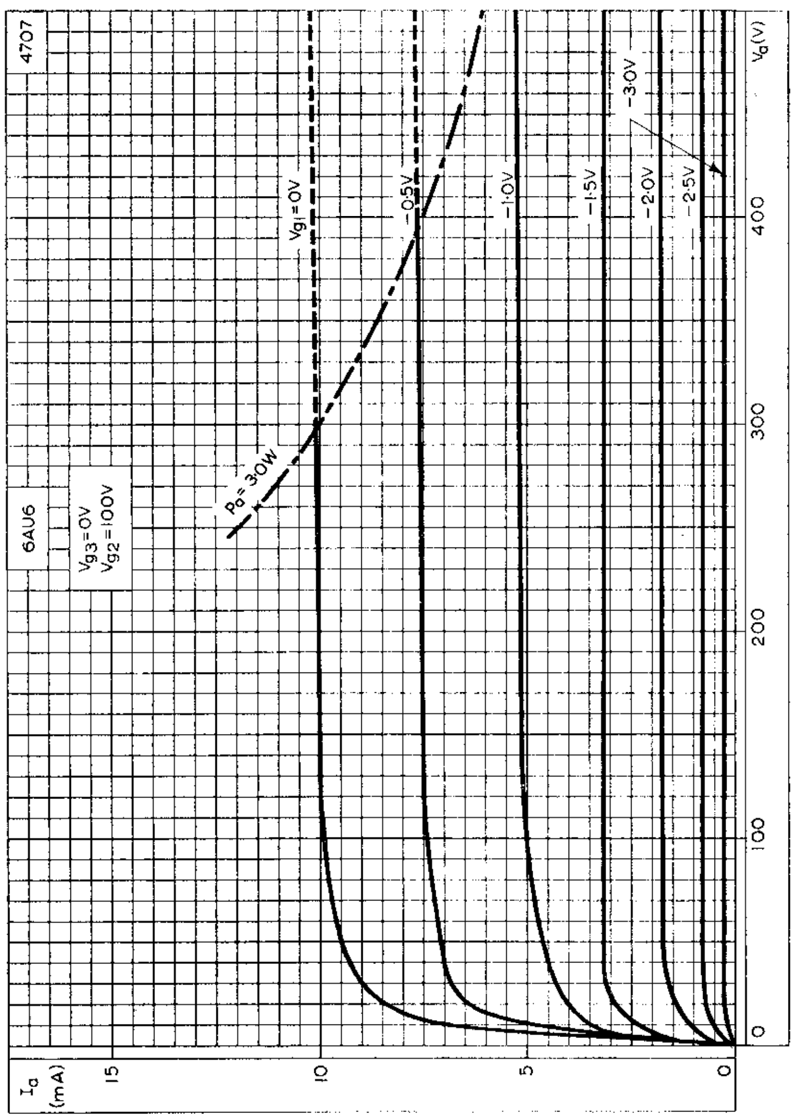


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER

6AU6

R.F. PENTODE

Short-grid base pentode primarily intended for use as r.f. amplifier.

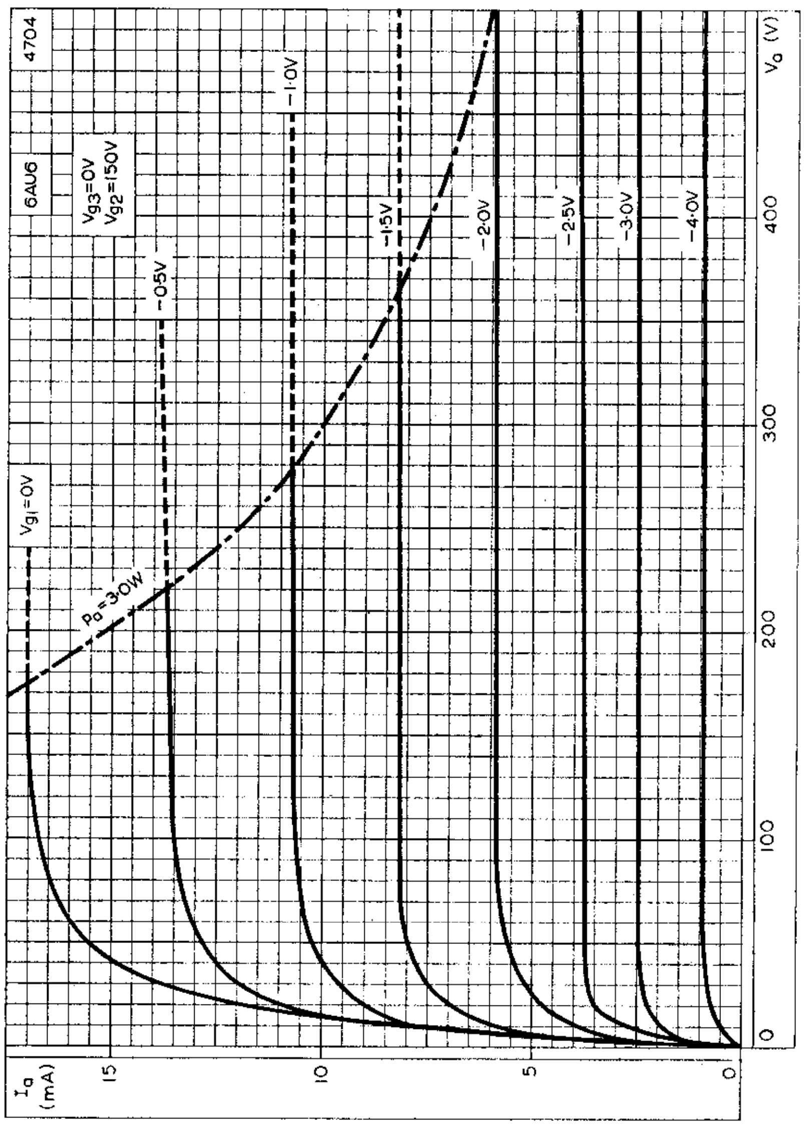


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 100V

R.F. PENTODE

6AU6

Short-grid base pentode primarily intended for use as r.f. amplifier.

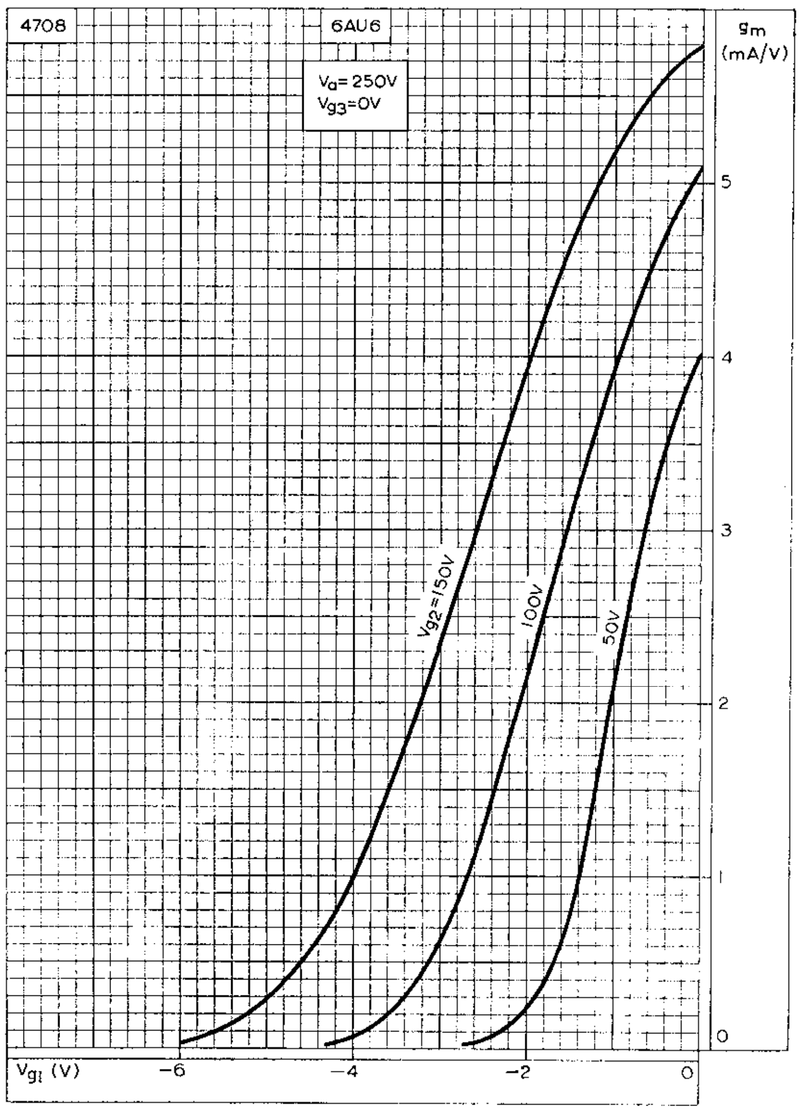


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 150V

6AU6

R.F. PENTODE

Short-grid base pentode primarily intended for use as r.f. amplifier.

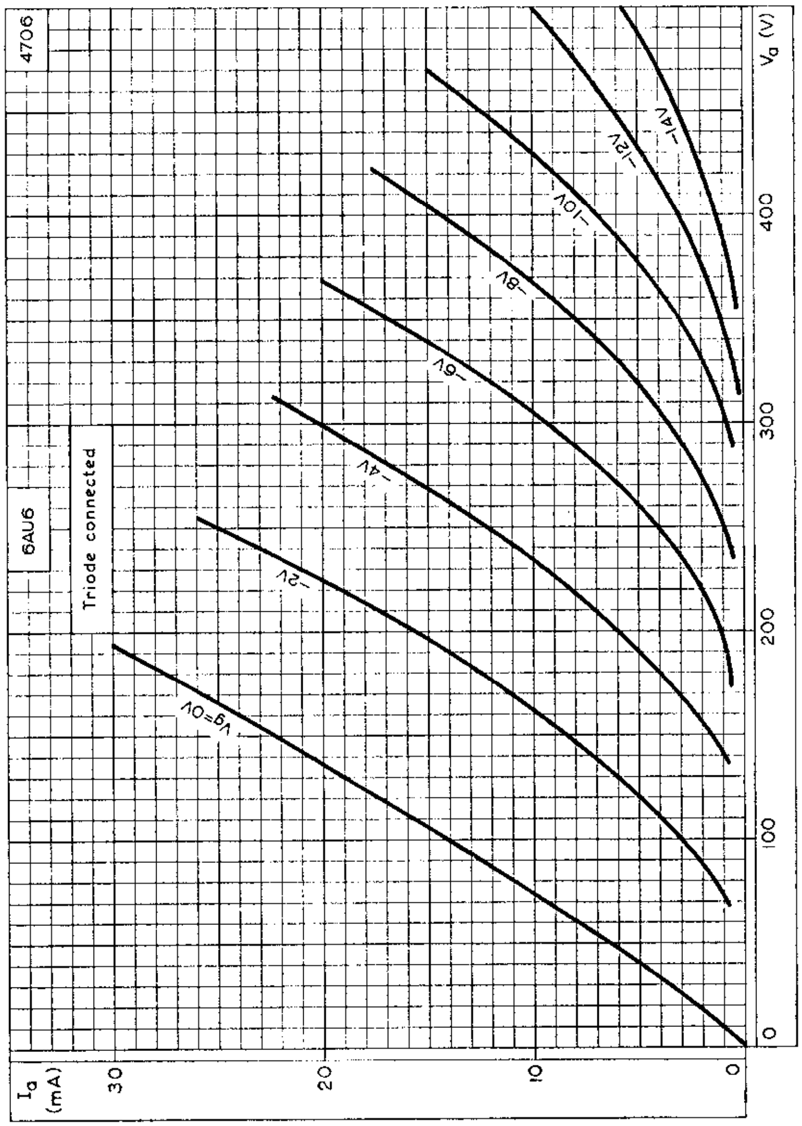


MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER

R.F. PENTODE

6AU6

Short-grid base pentode primarily intended for use as r.f. amplifier.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER WHEN TRIODE CONNECTED

R.F. PENTODE

6CB6

High slope pentode primarily intended for use as r.f. or i.f. amplifier.

HEATER

Suitable for series or parallel operation

V_h	6.3	V
I_h	300	mA

MOUNTING POSITION

Any

CAPACITANCES

	Shielded	Unshielded	
c_{in}	6.5	6.5	pF
c_{out}	3.0	1.9	pF
c_{a-g1}	<0.01	<0.02	pF

CHARACTERISTICS

V_a	200	V
V_{g3}	0	V
V_{g2}	150	V
V_{g1}	−2.2	V
I_a	9.5	mA
I_{g2}	2.8	mA
r_a	600	kΩ
g_m	8.0	mA/V ←
$V_{g1}(I_a = 10\mu A)$	−8.0	V

LIMITING VALUES

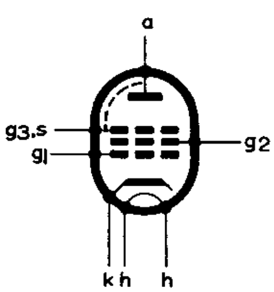
$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	2.0	W
$V_{g2(b)}$ max.	300	V
V_{g2} max.	150	V
p_{g2} max.	500	mW
V_{h-k} max.	100	V
$v_{h-k(pk)}$ max.	200	V

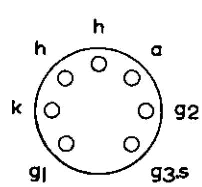
6CB6

R.F. PENTODE

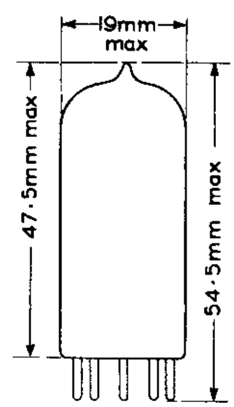
High slope pentode primarily intended for use as r.f. or i.f. amplifier.

4694





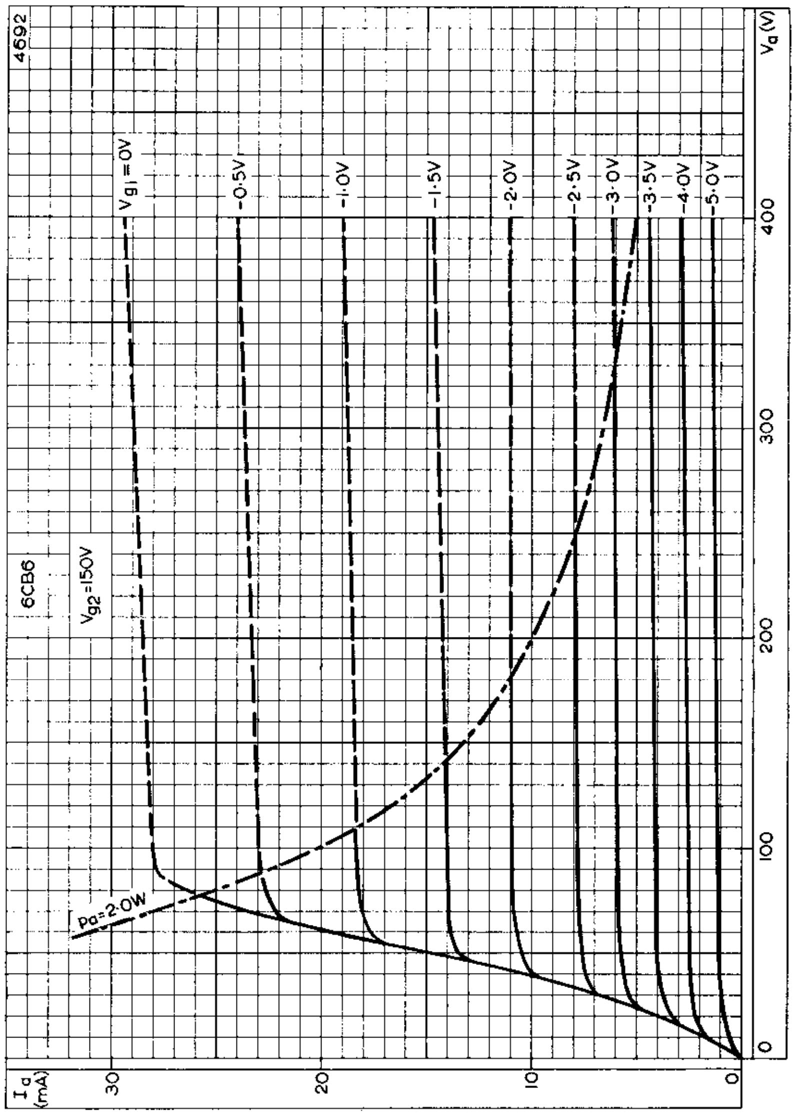
B7G Base



R.F. PENTODE

6CB6

High slope pentode primarily intended for use as r.f. or i.f. amplifier.

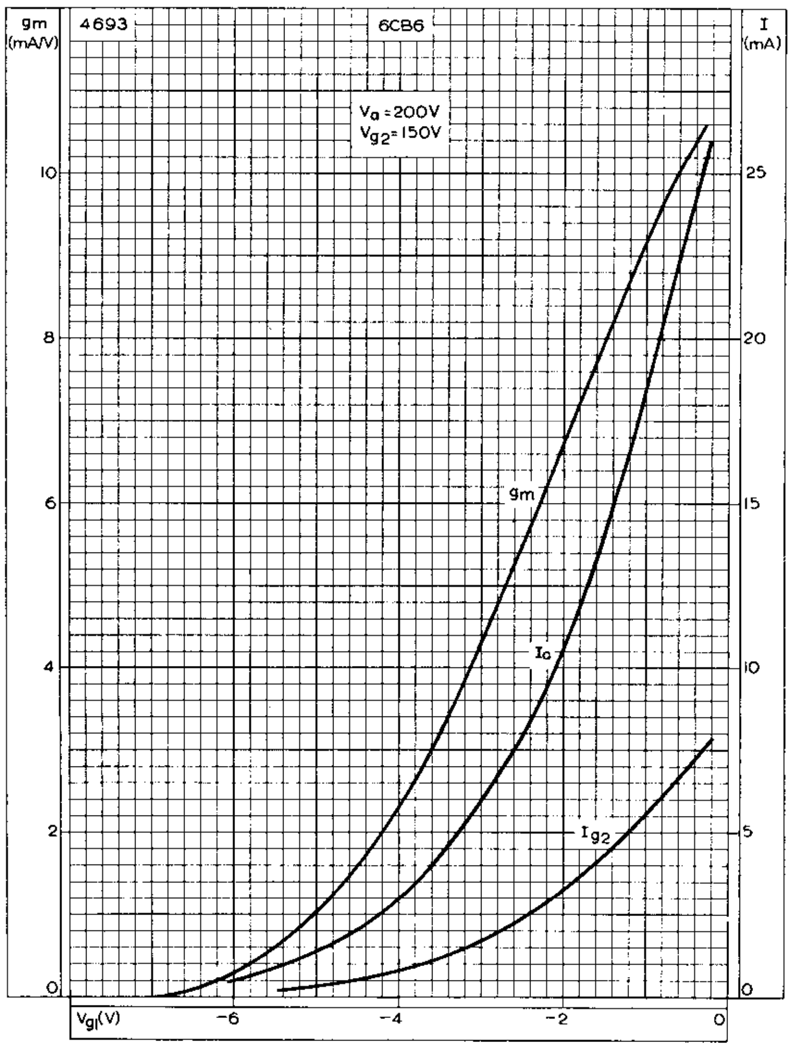


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

6CB6

R.F. PENTODE

High slope pentode primarily intended for use as r.f. or i.f. amplifier.



ANODE CURRENT, SCREEN-GRID CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE