

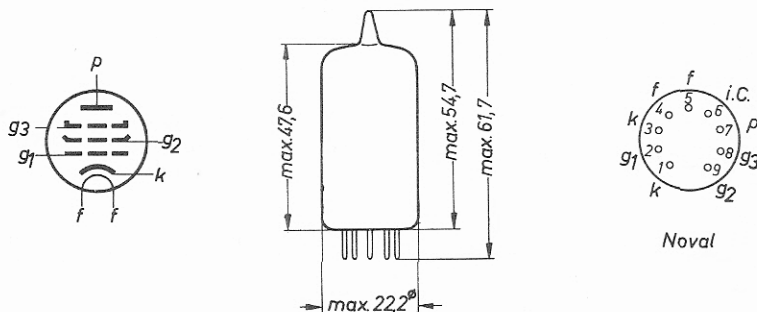
Design and Application

The 7721 is a miniature pentode designed for rf broadband amplifiers in telecommunication systems. It is also useful in low-noise input stages, frequency multipliers, and pulse and distributed amplifiers.

Features of the tube include low noise and high transconductance. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

Quality features

Long life (the average life is more than 10,000 hours)
Reliability
Close tolerances
Cathode free from interface



Dimensions in mm

Base: Miniature button, 9 pin, E9-1
Envelope: T-6-1/2
Socket: Siemens Rel stv 99c

Weight: approx. 10 gm
Mounting position: any

Heating

Heater voltage	=	6.3	V (1)
Heater current	=	315 $\pm$ 16	mA

indirect by AC or DC, parallel supply

Capacitances

		without external shield	with external shield (2)	
Input	=	10 $\pm$ 1.0	10.1 $\pm$ 1.0	μmf
Input at a cathode current = 28 mAdc	=	17	17.1	μmf
Output	=	2.1 $\pm$ 0.3	3.3 $\pm$ 0.4	μmf
Plate to grid No. 1	<	0.040	0.035	μmf
Plate to cathode	<	0.050		μmf
Plate to cathode, grid No. 2	=	0.32 $\pm$ 0.04		μmf
Plate to cathode, grid No. 2, grid No. 3	=	2.0 $\pm$ 0.3		μmf
Plate to heater	<	0.10		μmf
Grid No. 1 to cathode	=	6.8 $\pm$ 0.7		μmf
Grid No. 1 to cathode, grid No. 2	=	9.5 $\pm$ 1.0		μmf
Grid No. 1 to cathode, grid No. 2, grid No. 3	=	10 $\pm$ 1.0		μmf

Triode connection (grid No. 2 to plate, grid No. 3 to cathode)

Input	=	7.3	μmf
Output	=	3.1	μmf
Plate to grid No. 1	=	2.7	μmf

Triode connection (grid No. 2 and grid No. 3 to plate)

Input	=	6.7	μmf
Output	=	1	μmf
Plate to grid No. 1	=	3.3	μmf

(1) The life-guarantee provides a maximum variation of the heater voltage of less than $\pm 5\%$ (absolute limits)

(2) Internal diameter of external shield = 22.2 mm

Characteristics

		min	bogey	max	
Plate supply voltage	=		190		Vdc
Grid No. 3 voltage	=		0		Vdc
Grid No. 2 supply voltage	=		160		Vdc
Grid No. 1 supply voltage	=		+10		Vdc
Cathode resistor	=		400		ohms
Plate current	=	21	22	23	mAdc
Grid No. 2 current	=	5.4	6	6.6	mAdc
Transconductance	=	30000	35000	40000	μmhos
Amplification factor of grid No. 2 with respect to grid No. 1	≈		80		
Plate resistance	=		0.12		Meg
Equivalent grid noise resistance	=		150		ohms
Input conductance at 100 Mc	=		1000		μmhos (1)
Ratio of transconductance to the sum of input and output capacitance	=		2900		$\frac{\mu\text{mhos}}{\mu\text{f}}$
Figure of merit $S_m/2\pi (C_{in}' + C_{out} + 5 \mu\text{f})$	=		230		Mc (2)
Noise figure	=		7		db (3)
Negative grid current	≤			0.3	μAdc
<u>Triode connection</u> (Grid No. 2 to plate, grid No. 3 to cathode)					
Plate supply voltage	=		160		Vdc
Grid No. 3 voltage	=		0		Vdc
Grid No. 1 supply voltage	=		+10		Vdc
Cathode resistor	=		470		ohms
Plate current	=		24		mAdc
Transconductance	=		41000		μmhos
Amplification factor	≈		77		
Plate resistance	=		1900		ohms
Equivalent grid noise resistance	=		65		ohms

When the value of cathode capacitor is greater than 10 μf, the value of the grid resistor must be greater than 1000 ohms.

- (1) Measured with the two cathode connections in parallel
- (2) C_{in}' = input capacitance during operation
- (3) Measured at 100 Mc and matched for minimum noise

Maximum Ratings

Plate voltage at zero plate current	max.	400	Vdc
Plate voltage	max.	220	Vdc
Plate dissipation	max.	4.2	W
Grid No. 2 voltage at zero grid No. 2 current	max.	400	Vdc
Grid No. 2 voltage	max.	180	Vdc
Grid No. 2 dissipation	max.	1.0	W
Negative grid No. 1 voltage	max.	30	Vdc
Positive grid No. 1 voltage	max.	0	Vdc
Grid No. 1 resistor	max.	0.5	Meg (1)
Cathode current	max.	30	mAdc
Heater-cathode voltage			
Heater positive with respect to cathode	max.	60	V
Heater negative with respect to cathode	max.	120	V
Heater-cathode resistor	max.	20000	ohms
Bulb temperature	max.	190	°C

Special Tests and Ratings

Transconductance phase angle

Transconductance phase angle at 100 Mc	=	22	degrees
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Measured with the two cathode connections in parallel

Interelectrode Resistance

Grid to all at 50 Vdc	>	200	Meg
Plate to all at 300 Vdc	>	500	Meg
Heater negative with respect to cathode at 100 Vdc	>	20	Meg
Heater positive with respect to cathode at 100 Vdc	>	20	Meg

Measuring by $E_f = 6.3$ V

End of life

Plate current	$\leq$	20	mAdc
Transconductance	$\geq$	24500	μ mhos
Negative grid current	$\leq$	1.0	μ Adc

Test conditions: see characteristics for $R_k = 400$ ohms

(1) With automatic grid bias

Harmonic distortion

Plate supply voltage	=	190	Vdc
Grid No. 3 voltage	=	0	Vdc
Grid No. 2 supply voltage	=	160	Vdc
Grid No. 1 supply voltage	=	+10	Vdc
Cathode resistor	=	400	ohms
Plate load resistor	=	1000	ohms
Frequency	=	300	kc
Plate current	=	22	mA
Power output	P_o =	$\sqrt{1 \quad 120}$	mW (1)
Ratio between harmonic wave and plate current	q =	-27	-6 db (2)
Power level	n_p =	0	21 db (3)
Ratio between second harmonic and fundamental wave	a_{k2} =	48	23 db (4)
Ratio between third harmonic and fundamental wave	a_{k3} =	84	40 db (4)

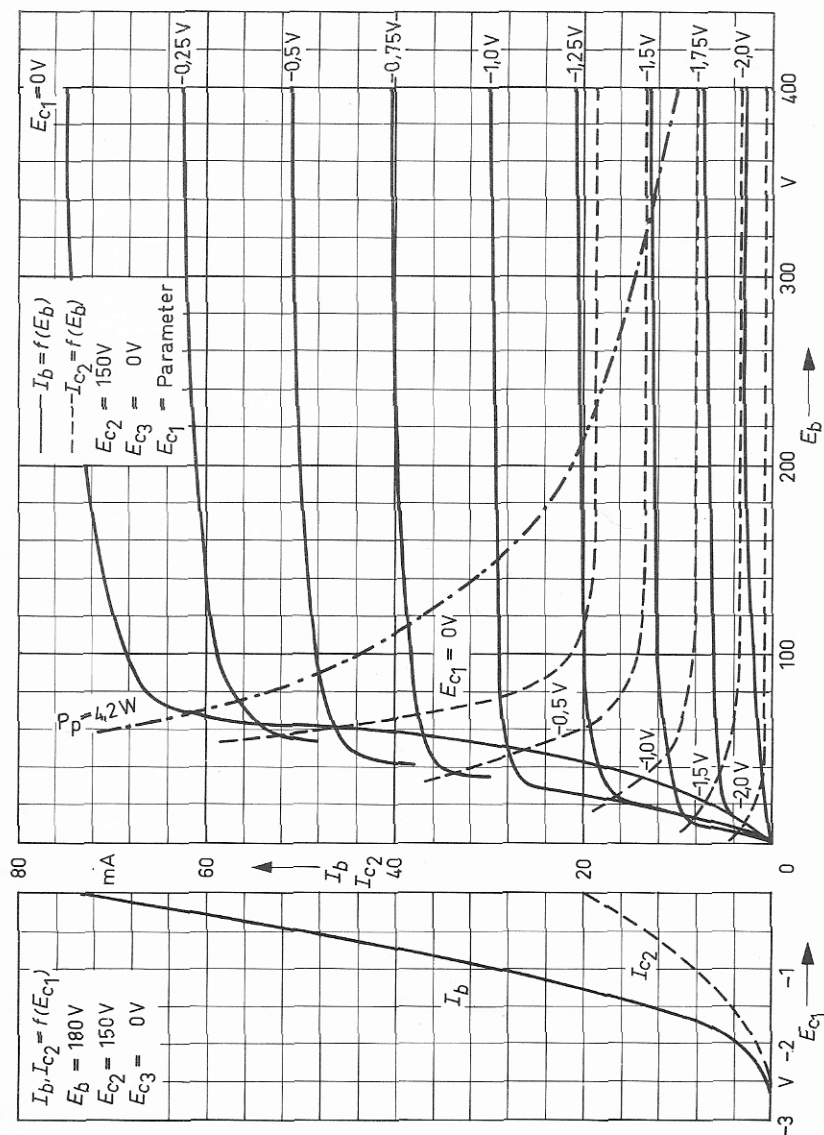
(1) P_o = (ac component of plate current of the fundamental wave)² × Resistance in series with plate

(2) q = $20 \log \frac{\text{rms value of ac component of plate current of the fundamental wave}}{\text{dc plate current in operation without signal}}$

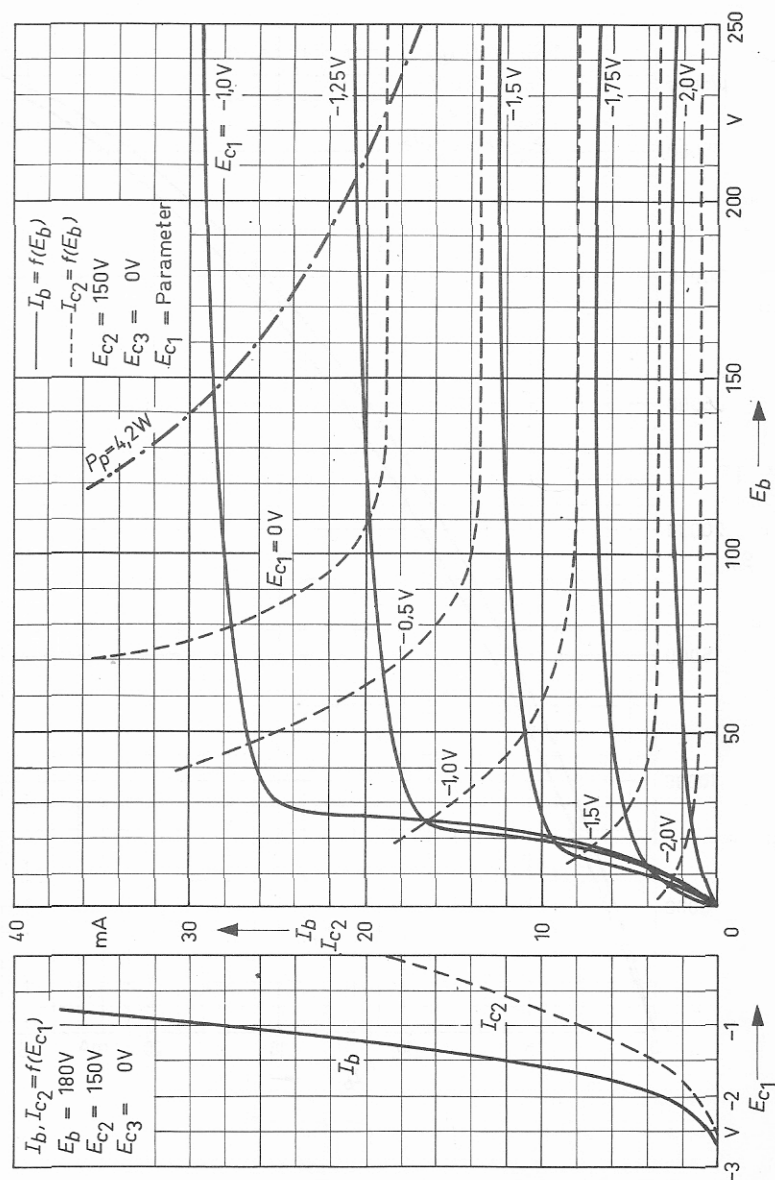
(3) n_p = $10 \log \frac{\text{power output of the fundamental wave}}{\text{relative value 1 mW}}$

(4) $a_{k2/3} = -20 \log \frac{\text{rms value of ac component of plate current of 2nd or 3rd harmonic}}{\text{rms value of ac component of the plate current of the fundamental wave}}$

$$I_b, I_{c2} = f(E_{c1}) \quad I_b, I_{c2} = f(E_b)$$



$$I_b, I_{c2} = f(E_{c1}) \quad I_b, I_{c2} = f(E_b)$$

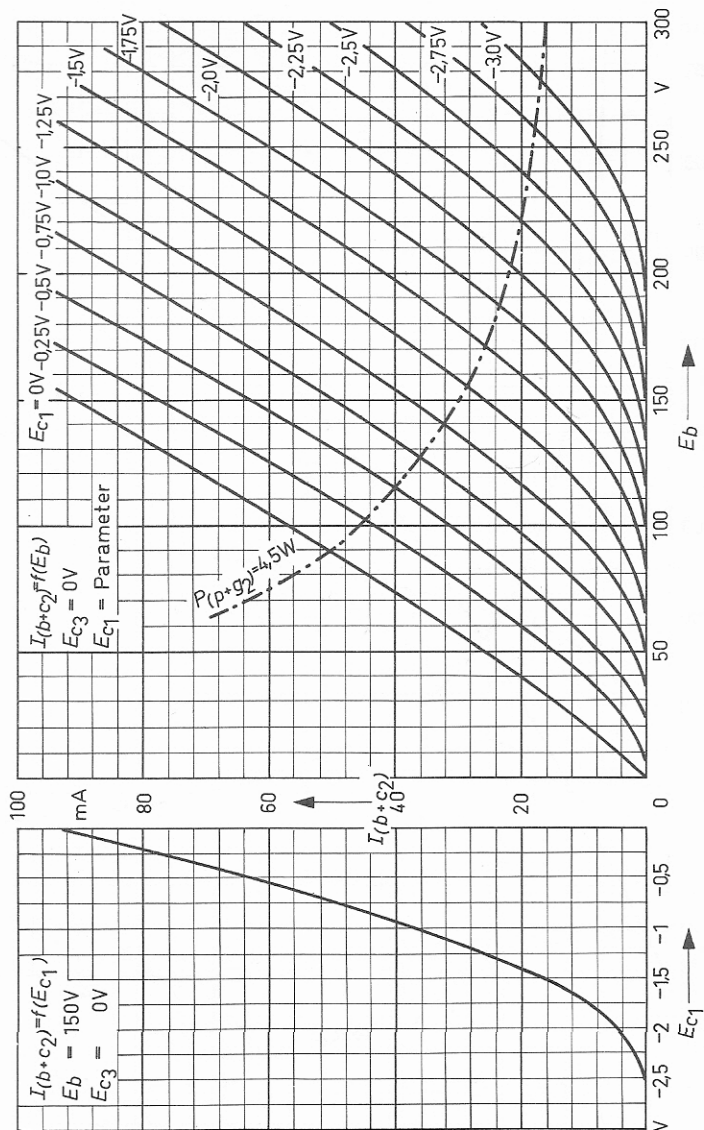


$$S_m = f(I_b)$$

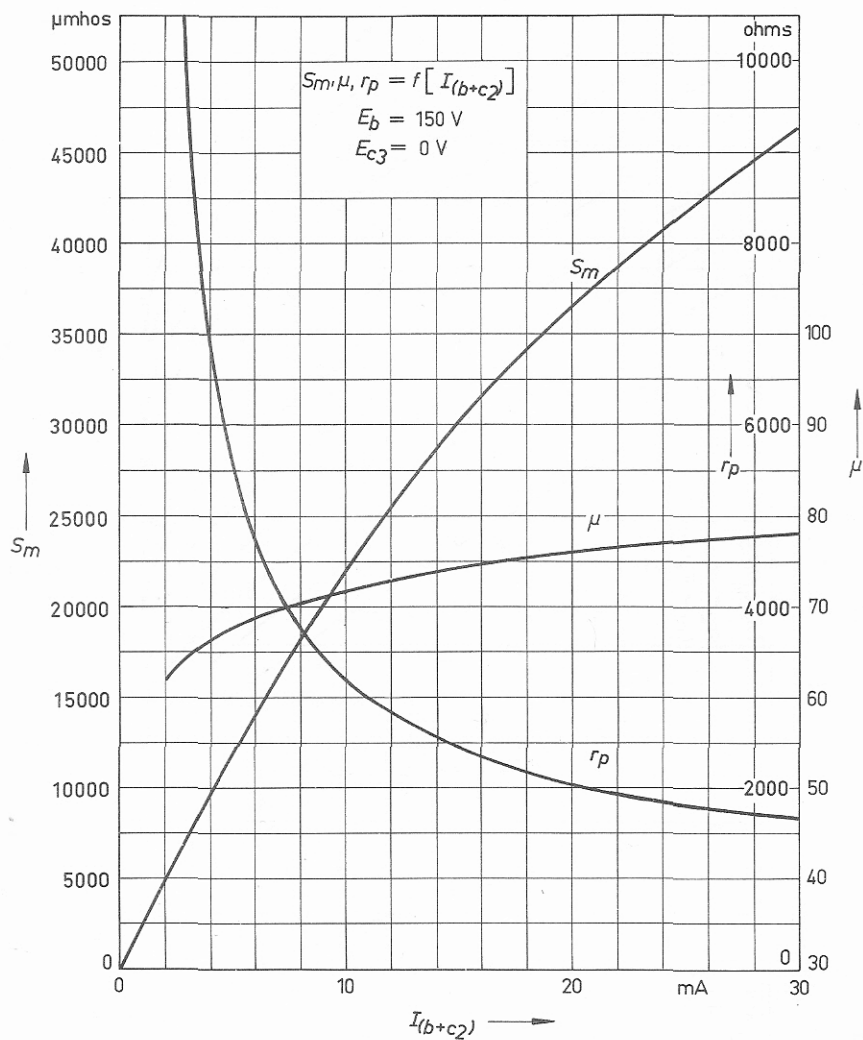


$$I_{(b+c2)} = f(E_{c1}) \quad I_{(b+c2)} = f(E_b)$$

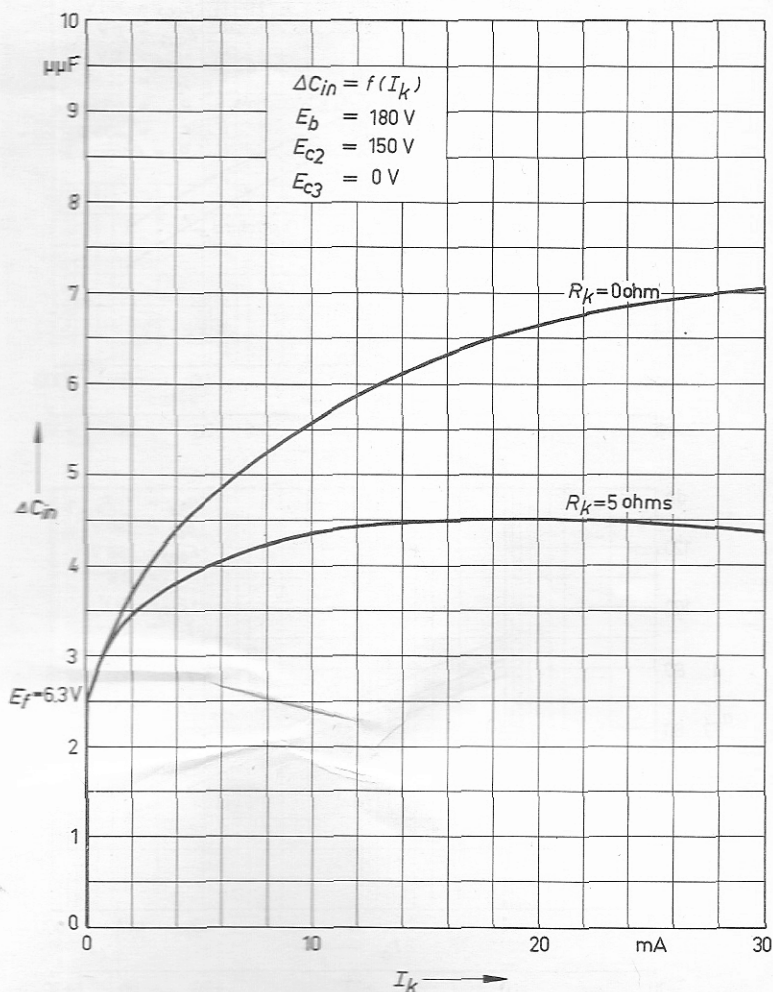
Triode connection



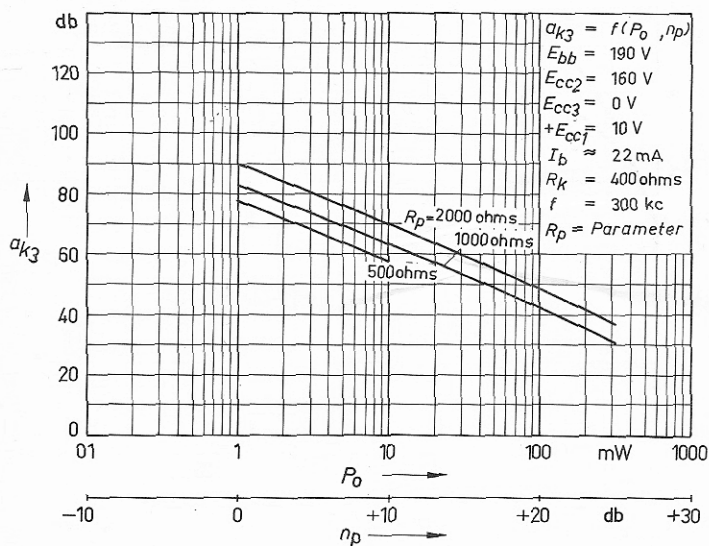
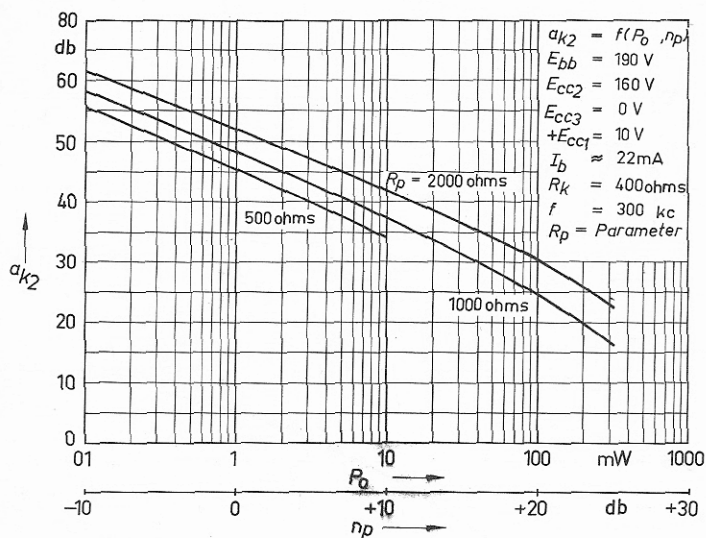
Triode connection



$$\Delta C_{in} = f(I_k)$$



$$a_{k2} = f(P_o, n_p) \quad a_{k3} = f(P_o, n_p)$$



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