V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 15 V. Matched h_{FE} groups are available on request.

It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

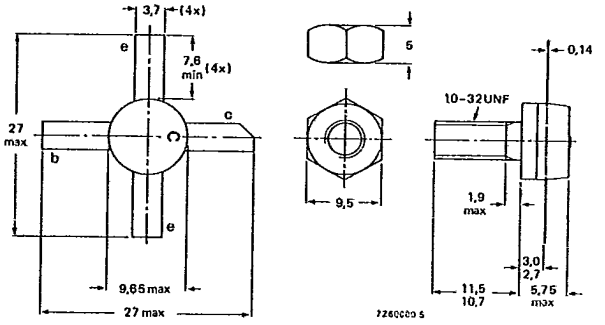
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Z_L}$ Ω	d_3 dB
c.w. (class-B)	12,5	175	45	> 5,0	> 75	1,2 + j1,4	2,6 − j1,2	–
s.s.b. (class-AB)	12,5	1,6–28	3–30 (P.E.P.)	typ. 19,5	typ. 35	–	–	typ. −33

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



When locking is required an adhesive is preferred instead of a lock washer.

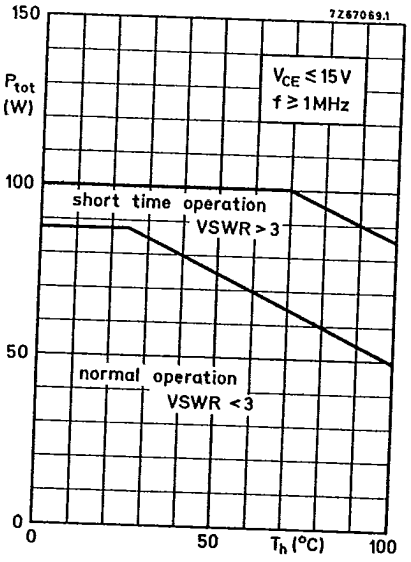
Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

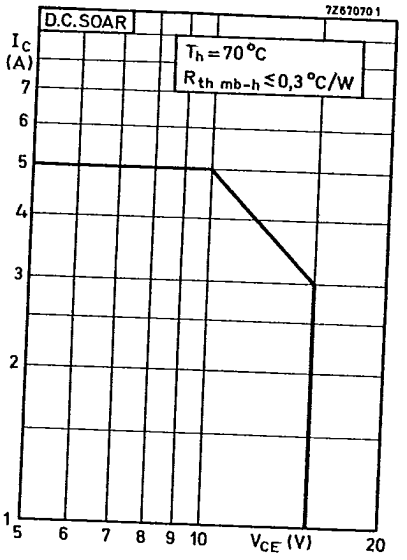
Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	8 A
Collector current (peak value); f ≥ 1MHz	I_{CM}	max.	20 A
Total power dissipation at T_h = 70 °C f ≥ 1 MHz; V_{CE} ≤ 15 V; $R_{th\ mb\text{-}h}$ ≤ 0,3 K/W Derate by 0,5 W/K for 50 °C ≤ T_h ≤ 100 °C	P_{tot}	max.	65 W

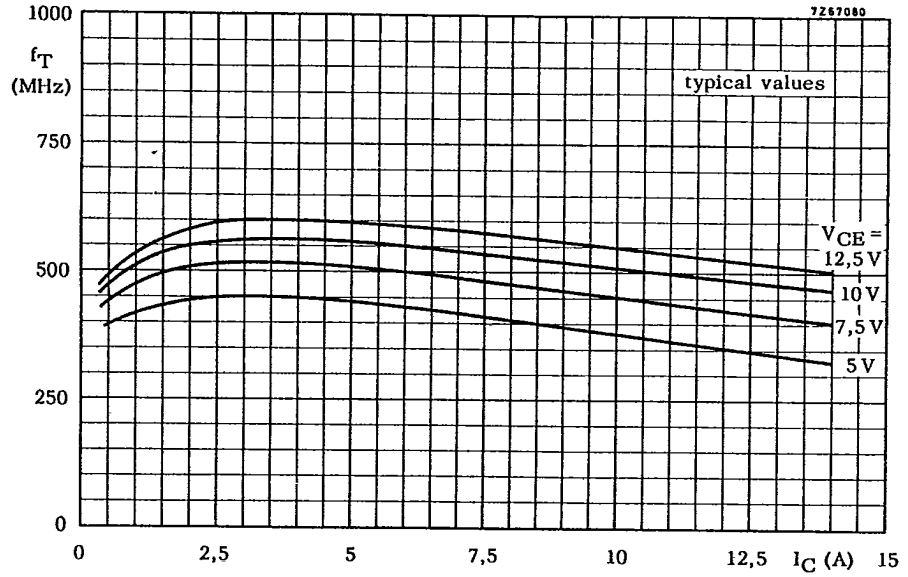


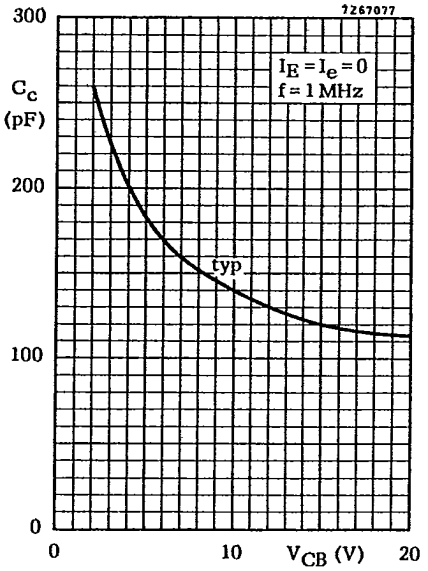


Storage temperature T_{stg} −65 to +200 °C

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter; I_C = 100 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector; I_E = 25 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8	ms
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	8	ms
D.C. current gain				
I_C = 1 A; V_{CE} = 5 V	h_{FE}		20 to 100	
D.C. current gain ratio of matched devices				
I_C = 1 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2	
Transition frequency				
I_C = 6 A; V_{CE} = 10 V	f_T	typ.	550	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 15 V	C_c	typ. <	120 160	pF pF
Feedback capacitance				
I_C = 200 mA; V_{CE} = 15 V	C_{re}	typ.	80	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF





APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f MHz	V_{CE} V	P_L W	P_S W	G_p dB	I_C A	η %	$\overline{z_i}$ Ω	$\overline{Z_L}$ Ω
175	12,5	45	< 14,2	> 5,0	< 4,8	> 75	1,2 + j1,4	2,6 − j1,2

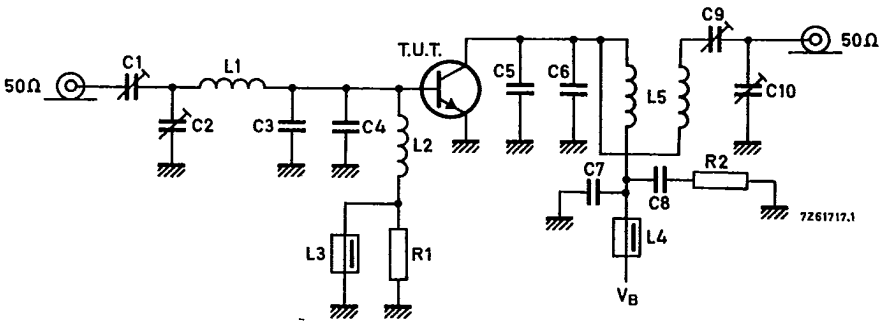


Fig. 6 Test circuit; c.w. class-B.

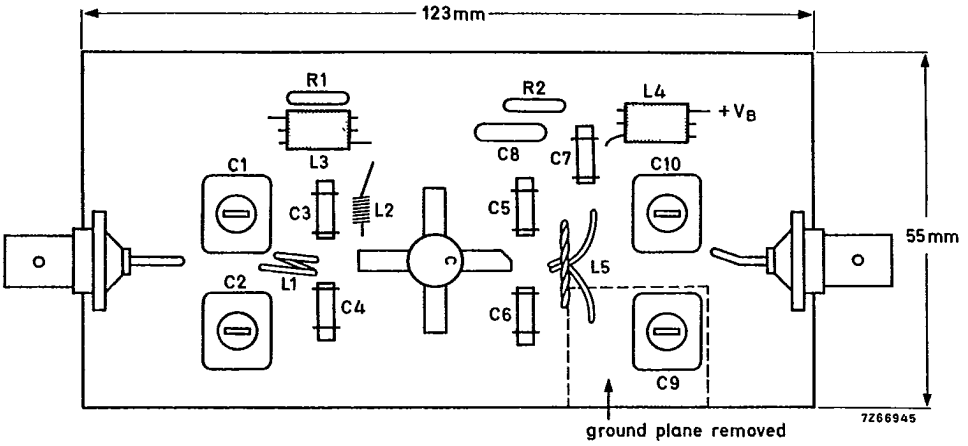
List of components:

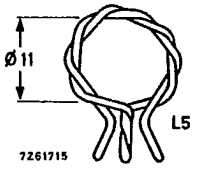
C1 = 2 to 20 pF film dielectric trimmer
C2 = 4 to 40 pF film dielectric trimmer
C3 = C4 = C5 = C6 = 56 pF ceramic capacitor
C7 = 100 pF ceramic capacitor
C8 = 100 nF polyester capacitor
C9 = 4 to 80 pF film dielectric trimmer
C10 = 4 to 60 pF film dielectric trimmer

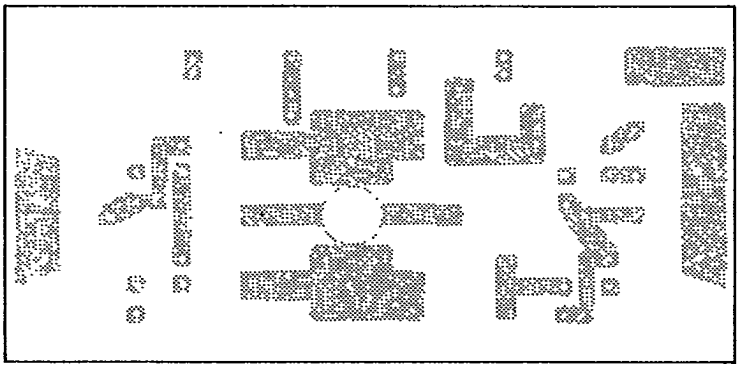
L1 = 1½ turns enamelled Cu wire (1,6 mm); int. dia. 6,0 mm; length 4 mm; leads 2 x 5 mm
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3,0 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = bifilar wound enamelled Cu wire (1,0 mm); see figure on

R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

APPLICATION INFORMATION (continued)







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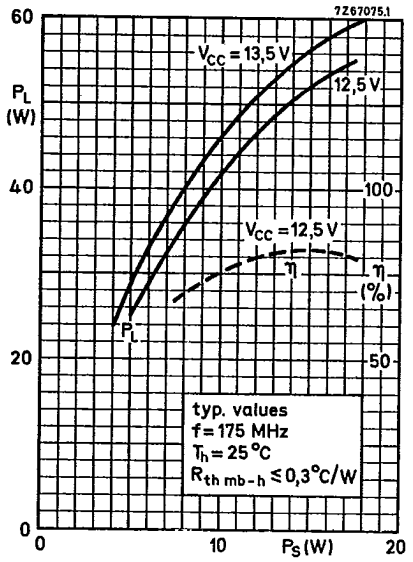
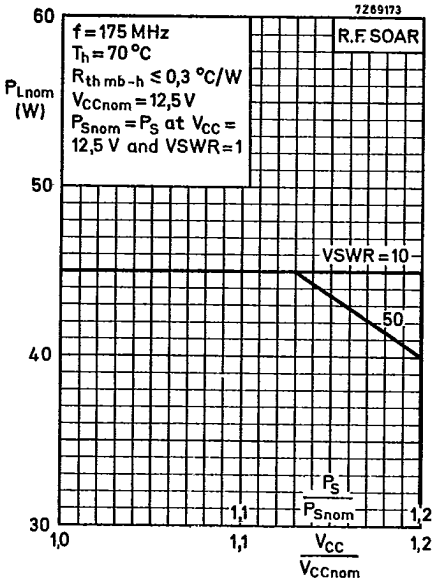
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.



At P_L = 45 W and V_{CC} = 12,5 V, the output power at heatsink temperatures between 25 °C and 70 °C relative to that at 25 °C is diminished by 60 mW/K



The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power (P_{Lnom}) must be derated in accordance with the adjacent graph for safe operation at supply voltages other than nominal.
The graph shows the allowable output power under nominal conditions as a function of the supply overvoltage ratio with VSWR as parameter. The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio (V_{CC}/V_{CCnom}).

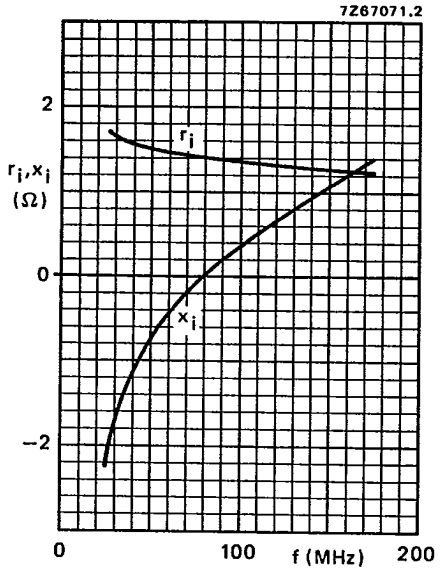


Fig. 10 Input impedance (series components).

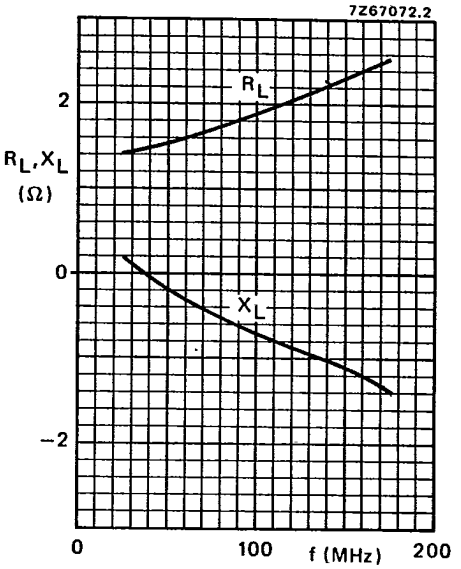


Fig. 11 Load impedance (series components).

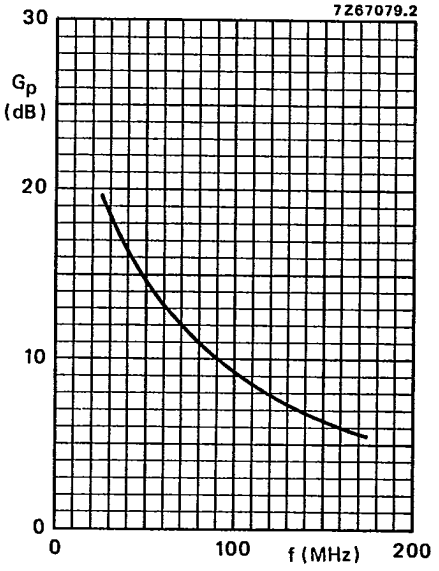


Fig. 12.

Conditions for Figs 10, 11 and 12:
Typical values; V_{CE} = 12,5 V; P_L = 45 W; T_h = 25 °C.

APPLICATION INFORMATION (continued)

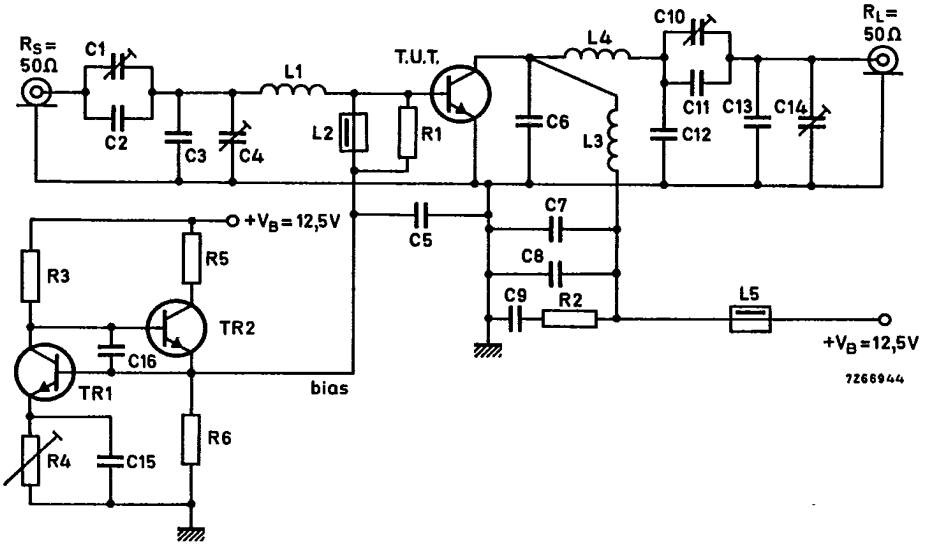
R.F. performance in s.s.b. class-AB operation

V_{CE} = 12,5 V; T_h up to 25 °C; $R_{th\ mb\text{-}h} \leqslant 0{,}3$ K/W

f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ mA
3 to 30 (P.E.P.)	typ. 19,5	typ. 35	typ. −33	typ. −36	25

Test circuit; s.s.b. class-AB.



List of components on

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

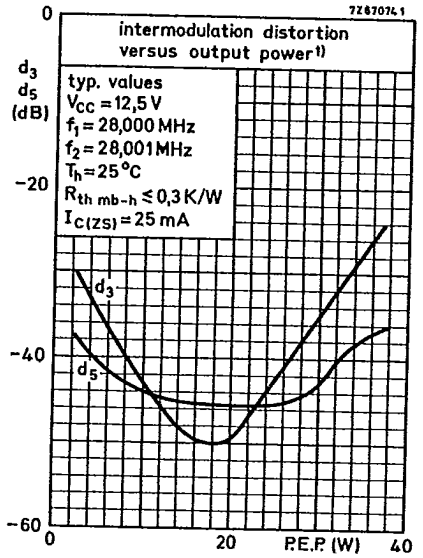
List of components:

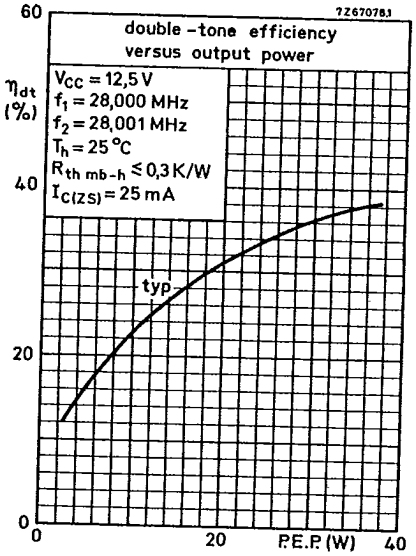
Tr1 = Tr2 = BD137

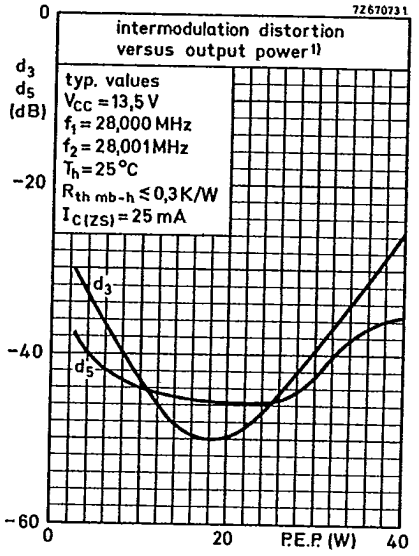
C1	=	100 pF air dielectric capacitor (single insulated rotor)
C2	=	27 pF ceramic capacitor
C3	=	180 pF ceramic capacitor
C4	=	100 pF air dielectric capacitor (single non-insulated rotor)
C5 = C7	=	3,9 nF polyester capacitor (±10%)
C6	=	2 x 270 pF polystyrene capacitors in parallel
C8 = C15 = C16	=	100 nF polyester capacitor (±10%)
C9	=	2,2 µF moulded metallized polyester capacitor
C10	=	2 x 385 pF film dielectric trimmers in parallel
C11	=	68 pF ceramic capacitor
C12	=	2 x 82 pF ceramic capacitors in parallel
C13	=	47 pF ceramic capacitor
C14	=	385 pF film dielectric trimmer

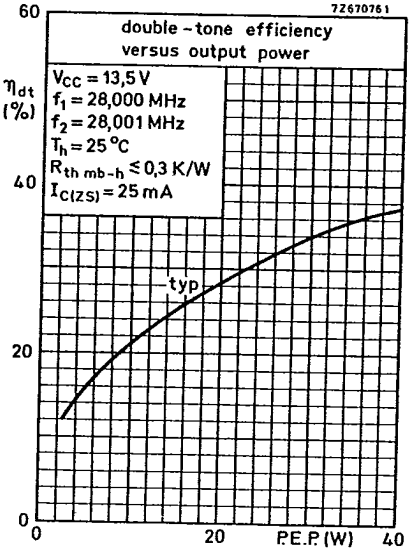
L1 = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm; leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36640)
L3 = 68 nH; 3 turns enamelled Cu wire (1,6 mm); internal diameter 8 mm; coil length 8,3 mm; leads 2 x 5 mm
L4 = 96 nH; 3 turns enamelled Cu wire (1,6 mm); internal diameter 10 mm; coil length 7,6 mm; leads 2 x 5 mm

R1	=	27 Ω carbon resistor (±5%)
R2	=	4,7 Ω carbon resistor (±5%)
R3	=	1,5 kΩ carbon resistor (±5%)
R4	=	10 Ω wire-wound potentiometer (3 W)
R5	=	47 Ω wire-wound resistor (5,5 W)
R6	=	150 Ω carbon resistor (±5%)

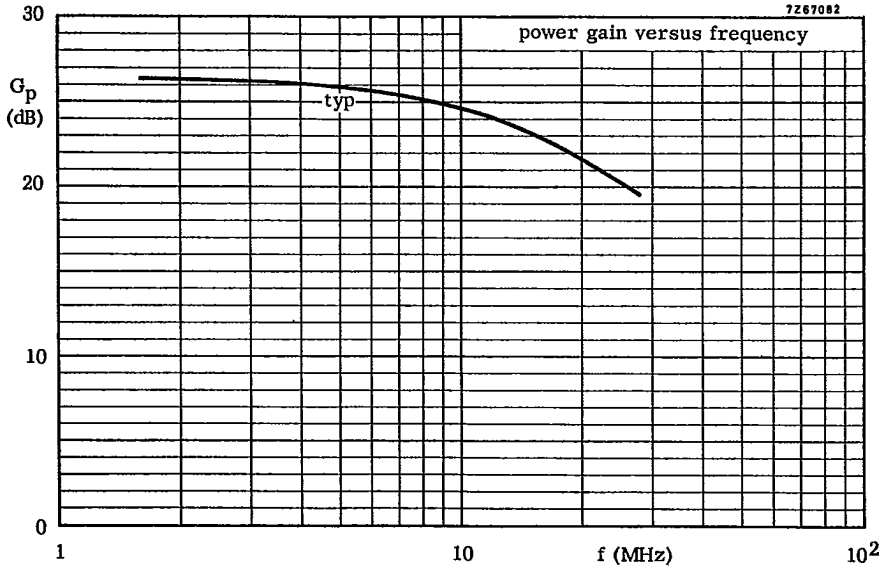








1) Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

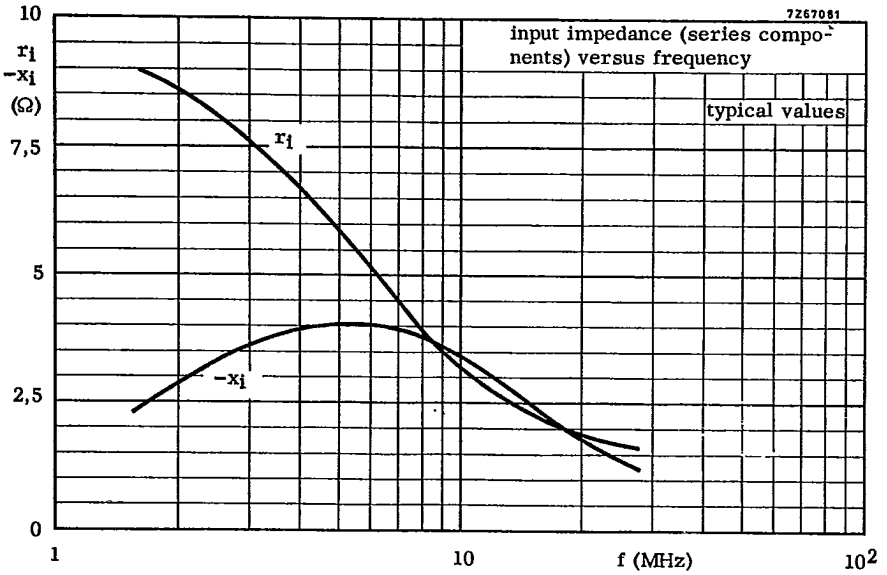


S.S.B. class AB operation

Conditions:

P_L	= 30 W (PEP)	P_L	= 35 W (PEP)
V_{CC}	= 12,5 V	V_{CC}	= 13,5 V
$I_{C(ZS)}$	= 25 mA	$I_{C(ZS)}$	= 25 mA
T_h	= 25 °C	T_h	= 25 °C
$R_{th\ mb\text{-}h}$	≤ 0,3 K/W	$R_{th\ mb\text{-}h}$	≤ 0,3 K/W
Z_L	= 1,9 Ω	Z_L	= 1,9 Ω

The curve (both conditions) holds for an unneutralized amplifier.



S.S.B. class AB operation

Conditions:

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V_{CC}	= 12,5 V	V_{CC}	= 13,5 V
$I_{C(ZS)}$	= 25 mA	$I_{C(ZS)}$	= 25 mA
T_h	= 25 °C	T_h	= 25 °C
$R_{th\ mb\text{-}h}$	≤ 0,3 K/W	$R_{th\ mb\text{-}h}$	≤ 0,3 K/W
Z_L	= 1,9 Ω	Z_L	= 1,9 Ω

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