H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB operated high power industrial and military transmitting equipment in the h.f. band. The transistor presents excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched h_{FE} groups are available on request.

The transistor has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to $T_h = 25\ ^oC$

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η_{dt} %	d_3 dB
s.s.b. (class-AB)	50	0,1	1,6 – 28	20 – 160 (P.E.P.)	> 14	> 40*	< –30

* At 160 W P.E.P.

MECHANICAL DATA

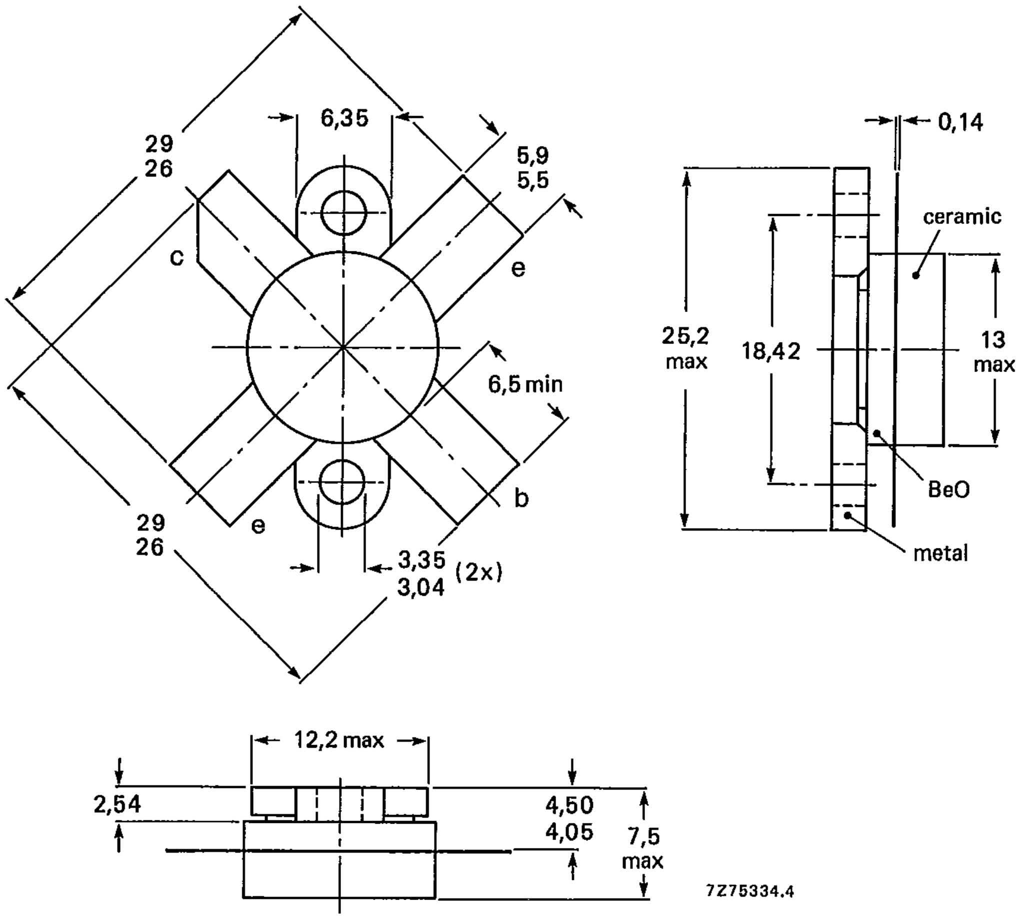
SOT-121A (see Fig. 1).

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.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-121.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	110 V
Collector-emitter voltage (open base)	V_{CEO}	max.	53 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	8 A
Collector current (peak value); $f > 1$ MHz	I_{CM}	max.	20 A
R.F. power dissipation ($f > 1$ MHz); $T_{mb} = 25$ °C	P_{rf}	max.	245 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

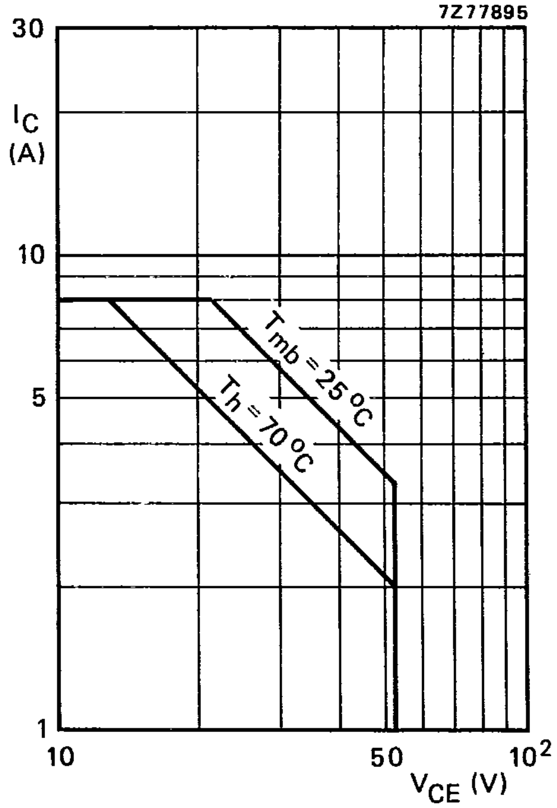


Fig. 2 D.C. SOAR.

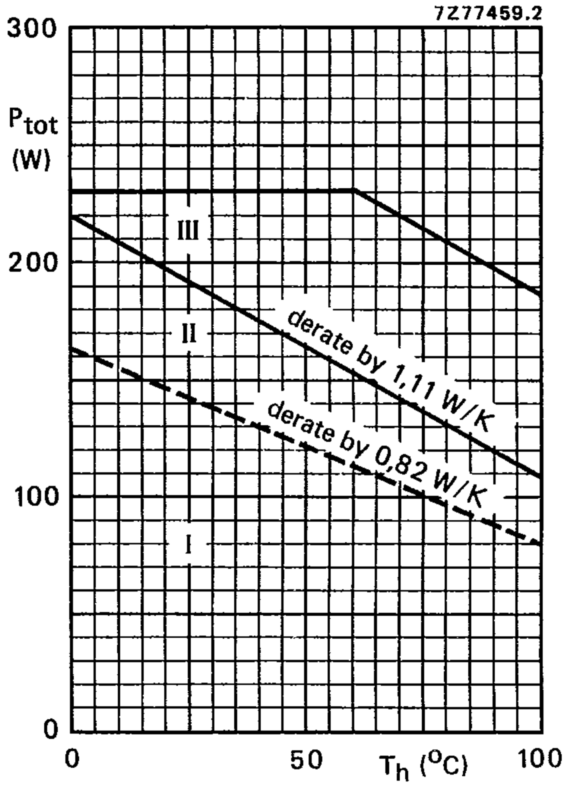


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 50$ V; $f \geqslant 1$ MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 100 W; $T_{mb} = 90$ °C, i.e. $T_h = 70$ °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,0 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,7 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 K/W

CHARACTERISTICS

$T_j = 25\ ^{o}C$

Collector-emitter breakdown voltage				
$V_{BE} = 0;\ I_C = 25$ mA	$V_{(BR)CES}$	>	110	V
Collector-emitter breakdown voltage				
open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	53	V
Emitter-base breakdown voltage				
open collector; $I_E = 20$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
$V_{BE} = 0;\ V_{CE} = 53$ V	I_{CES}	<	10	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	12,5	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	12,5	mJ
D.C. current gain *				
$I_C = 4$ A; $V_{CE} = 5$ V	h_{FE}	typ. 15 to	30 50	
D.C. current gain ratio of matched devices *				
$I_C = 4$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	$\leqslant$	1,2	
Collector-emitter saturation voltage *				
$I_C = 12,5$ A; $I_B = 2,5$ A	V_{CEsat}	typ.	2,2	V
Transition frequency at f = 100 MHz *				
$-I_E = 4$ A; $V_{CB} = 40$ V	f_T	typ.	270	MHz
$-I_E = 12,5$ A; $V_{CB} = 40$ V	f_T	typ.	285	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0;\ V_{CB} = 50$ V	C_c	typ.	185	pF
Feedback capacitance at f = 1 MHz				
$I_C = 150$ mA; $V_{CE} = 50$ V	C_{re}	typ.	115	pF
Collector-flange capacitance	C_{cf}	typ.	3	pF

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* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

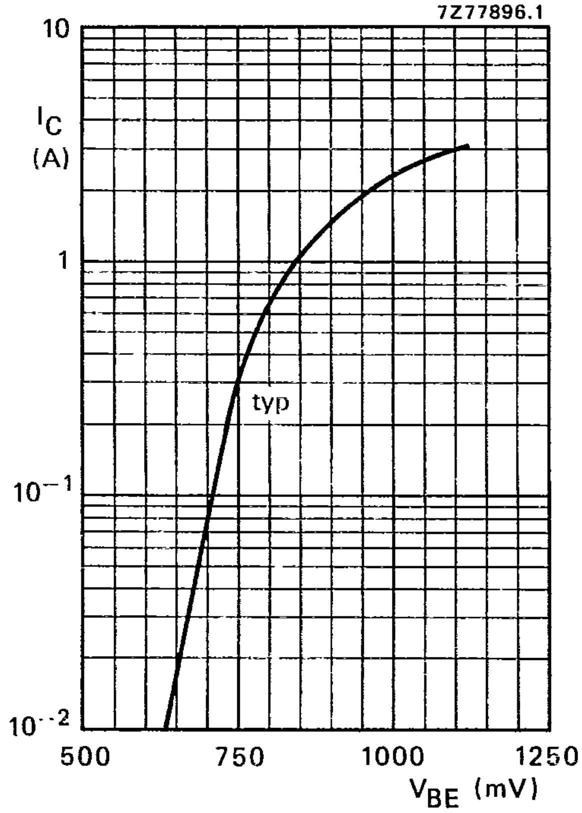

Fig. 4 $V_{CE} = 40$ V; $T_h = 25$ °C.

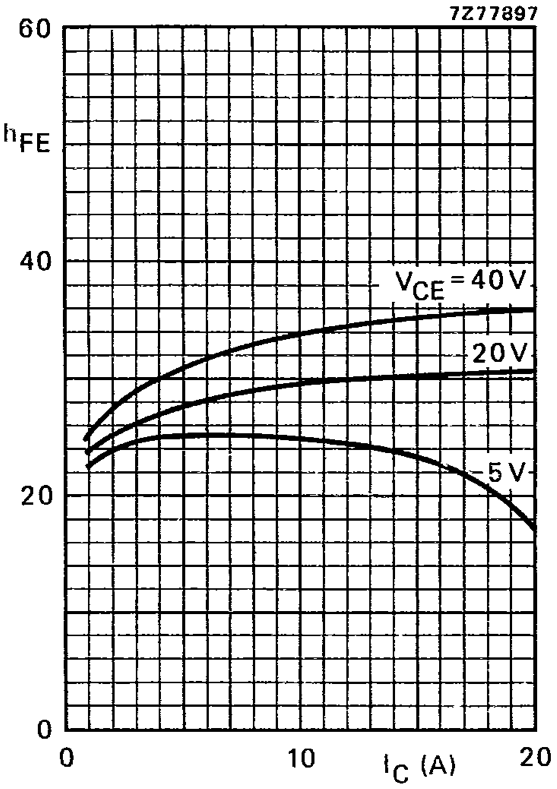

Fig. 5 Typical values; $T_j = 25$ °C.

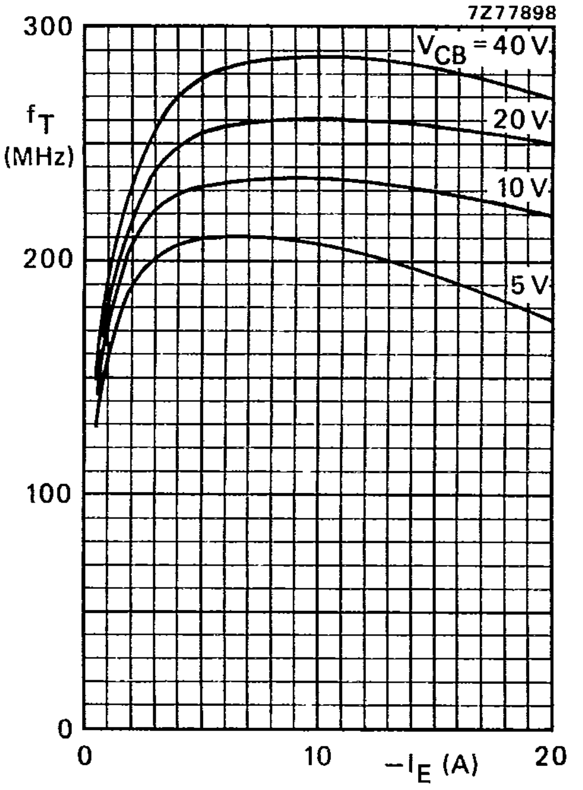

Fig. 6 Typical values; f = 100 MHz; $T_j = 25$ °C.

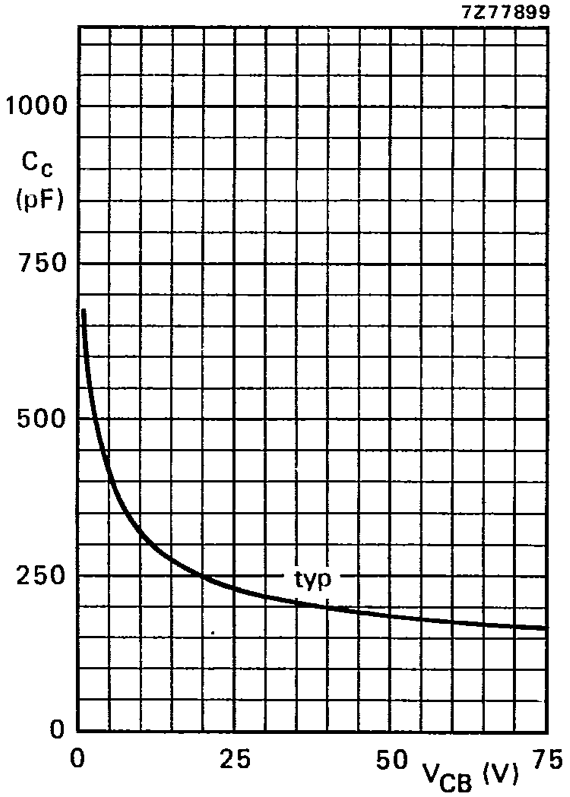

Fig. 7 $I_E = I_e = 0$; f = 1 MHz; $T_j = 25$ °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 50 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 160 W (P.E.P.)	I_C (A) at 160 W (P.E.P.)	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ A
20 to 160 (P.E.P.)	> 14	> 40	$< 4,0$	< -30	< -30	0,1

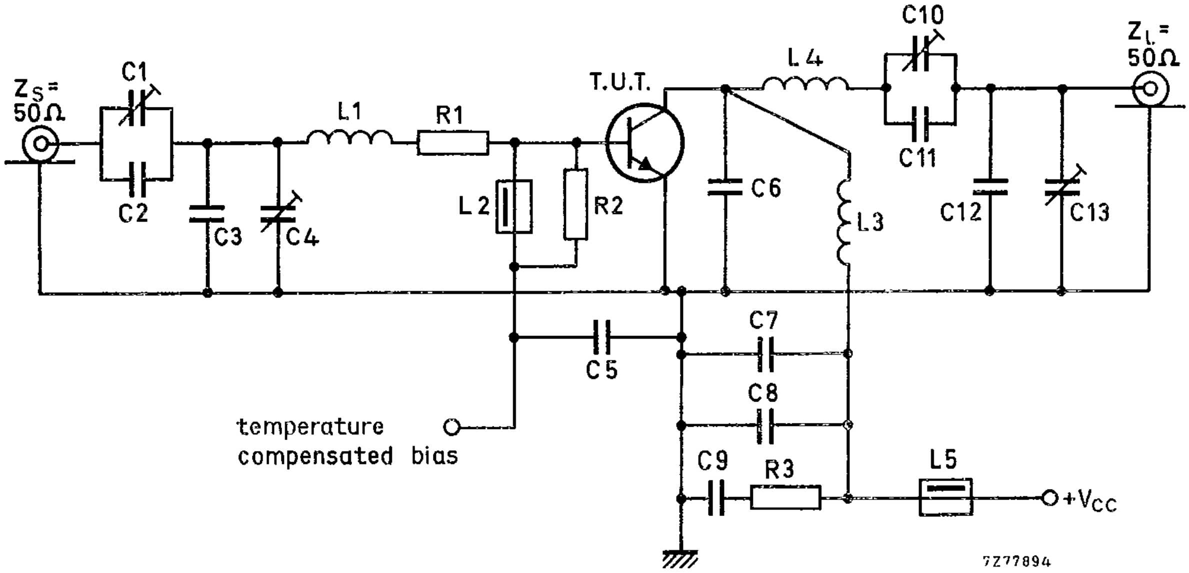

Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

C1 = C10 = 100 pF film dielectric trimmer
C2 = C6 = 27 pF ceramic capacitor (500 V)
C3 = 220 pF polystyrene capacitor
C4 = C13 = 100 pF film dielectric trimmer
C5 = C7 = 3,9 nF ceramic capacitor
C8 = 100 nF polyester capacitor
C9 = 2,2 μF moulded metallized polyester capacitor
C11 = 68 pF ceramic capacitor (500 V)
C12 = 220 pF polystyrene capacitor

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9,0 mm; length 6,1 mm; leads 2 x 5 mm
L2 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 180 nH; 4 turns enamelled Cu wire (1,6 mm); int. dia. 12,0 mm; length 9,9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1,6 mm); int. dia. 12,0 mm; length 19,1 mm; leads 2 x 10 mm

R1 = 0,66 Ω; parallel connection of 5 x 3,3 Ω carbon resistors (± 5%; 0,5 W each)
R2 = 27 Ω carbon resistor (± 5%; 0,5 W)
R3 = 4,7 Ω carbon resistor (± 5%; 0,5 W)

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* 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.

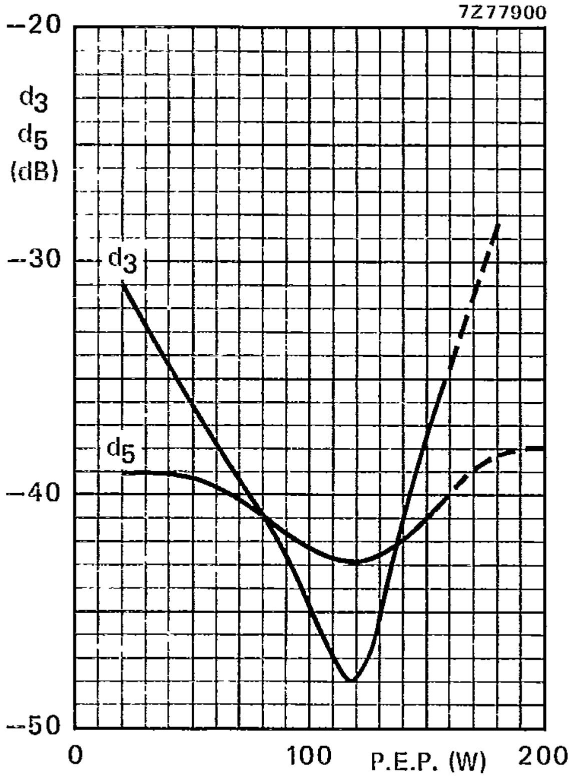

Fig. 9 Intermodulation distortion as a function of output power.*

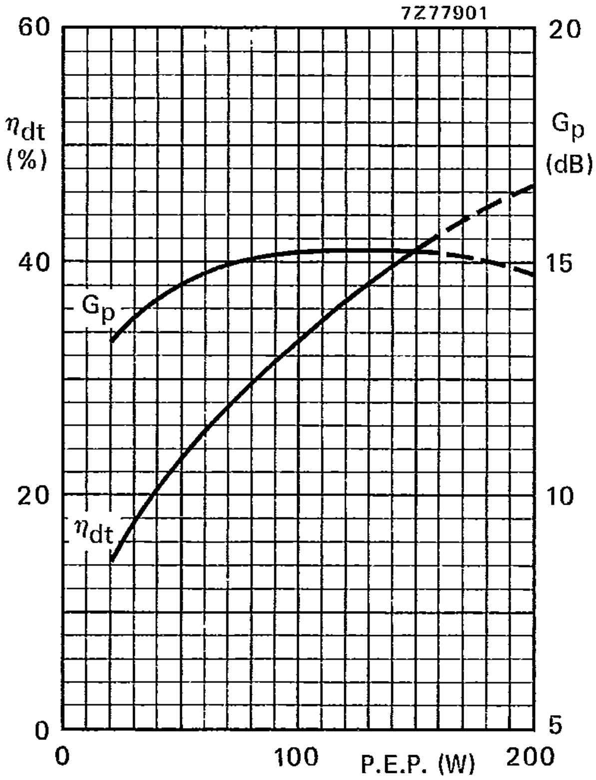

Fig.10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:

V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Ruggedness

The BLW95 is capable of withstanding full load mismatch (VSWR = 50) up to 150 W (P.E.P.) under the following conditions:

V_{CE} = 45V; f = 28 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

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* See note on previous page.

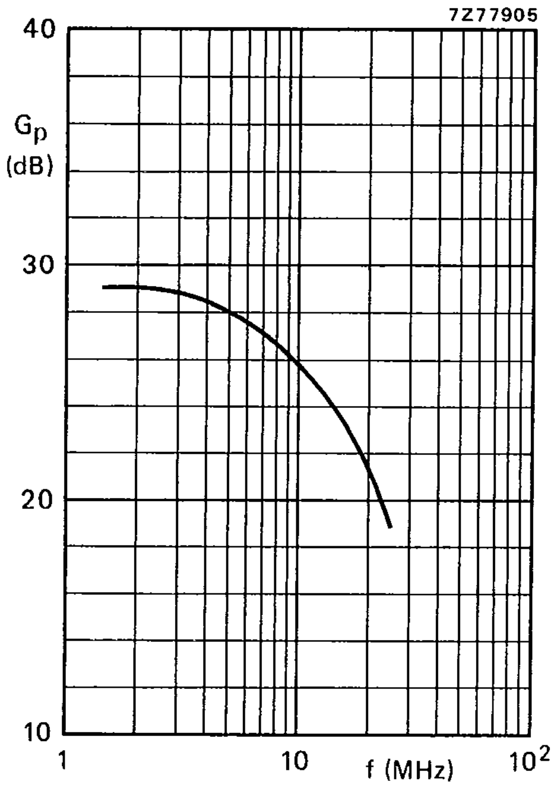

Fig. 11 Power gain as a function of frequency.

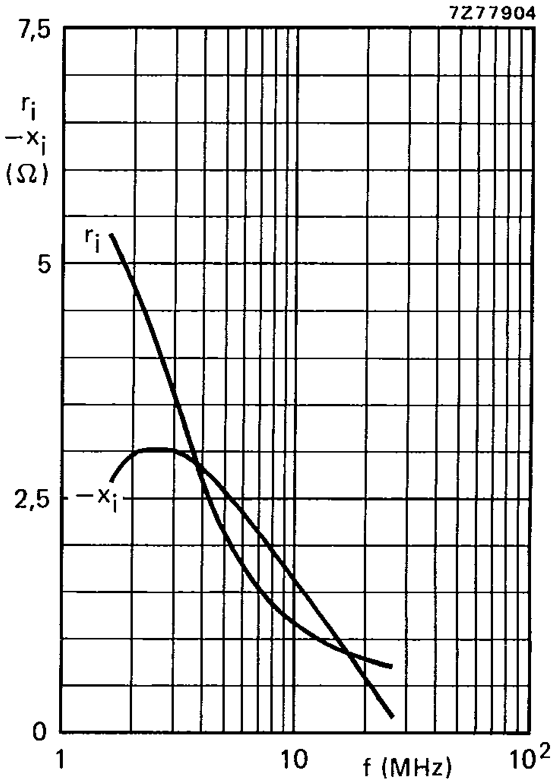

Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

$V_{CE} = 50$ V; $I_{C(ZS)} = 0,1$ A; $P_L = 160$ W (P.E.P.); $T_h = 25$ °C; $Z_L = 6,25\ \Omega$ in series with 7,3 nH (in parallel with −188 pF).

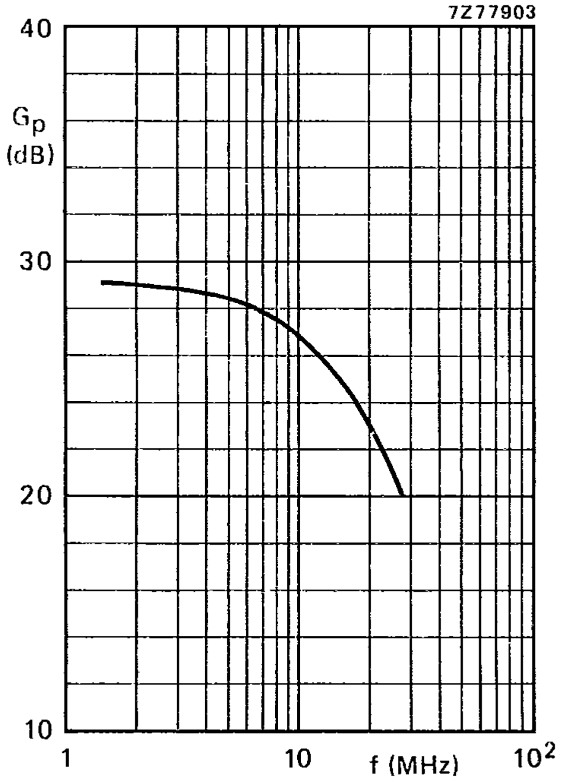

Fig. 13 Power gain as a function of frequency.

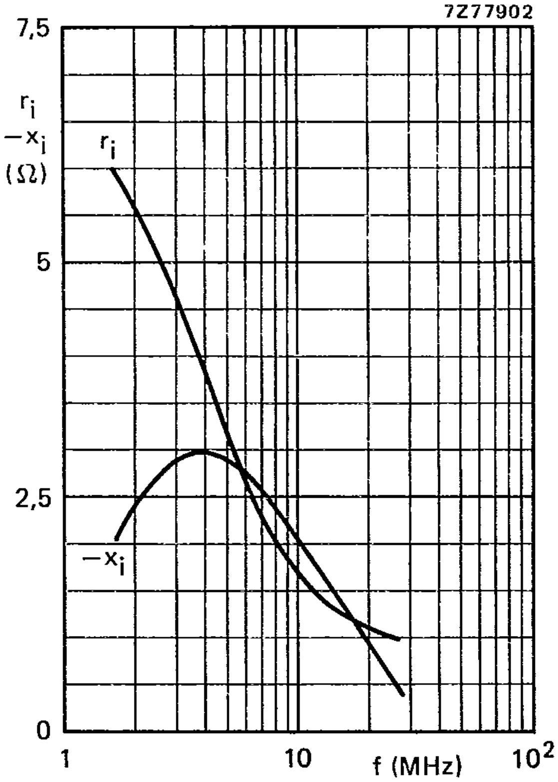

Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for one transistor of a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:
V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; P_L = 160 W (P.E.P.); T_h = 25 °C; Z_L = 6,25 Ω in series with 10,4 nH (in parallel with −267 pF); neutralizing capacitor: 82 pF.