V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. The BFQ42 is especially suited as a driver transistor for the BLW29 in a two-stage wideband or semi-wideband v.h.f. amplifier delivering 15 W output power.

It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

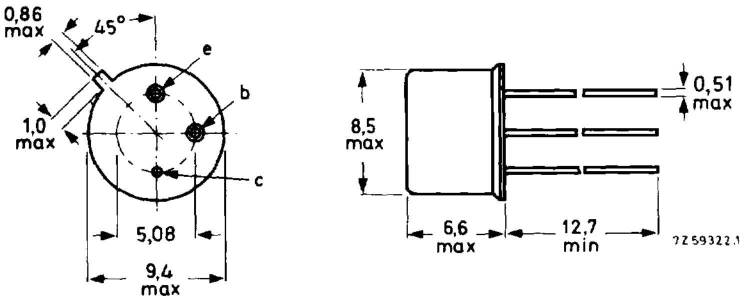
R.F. performance up to T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 K/W

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w. class-B	**13,5**	**175**	**2**	**> 11**	**> 60**	**7,8 – j4,6**	**22 – j18**
c.w. class-B	12,5	175	2	typ. 10,5	typ. 65	–	–

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-39/1; collector connected to case.

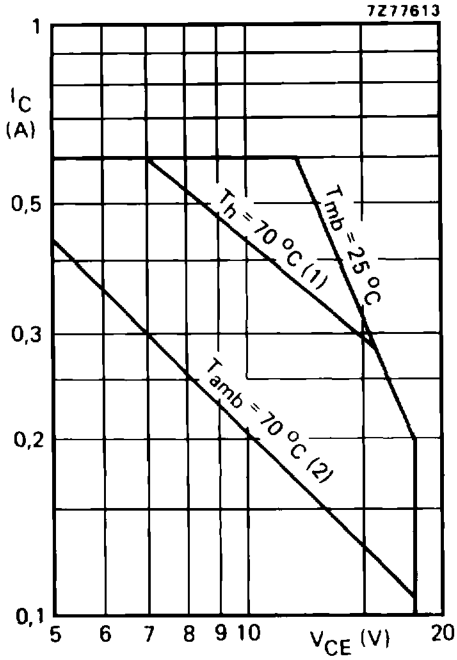


Maximum lead diameter is guaranteed only for 12,7 mm.

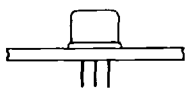
RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	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.	0,6 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	1,8 A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	7,2 W
Storage temperature	T_{stg}		−65 to + 200 °C
Junction temperature	T_j	max.	200 °C



(1) Mounted on a heatsink.



(2) Free-air operation; using a spring cooling clip.

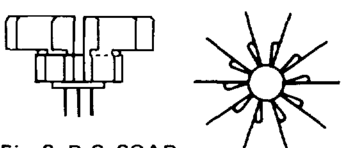
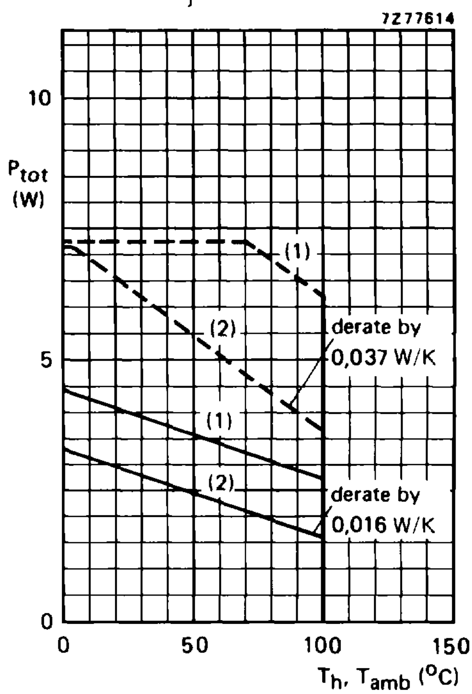


Fig. 2 D.C. SOAR.



(1) Short-time r.f. operation during mismatch; $R_{th\ mb\text{-}h}$ = 3 K/W; $R_{th\ c\text{-}a}$ = 32 K/W; f ⩾ 1 MHz.
(2) Continuous d.c. and r.f. operation; $R_{th\ mb\text{-}h}$ = 3 K/W; $R_{th\ c\text{-}a}$ = 32 K/W.

Fig. 3 Total power dissipation; V_{CE} ⩽ 16,5 V.
– – – Mounted on a heatsink.
—— Free-air operation; using a spring cooling clip having a thermal resistance of 32 K/W.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	24 K/W
From junction to case	$R_{th\ j\text{-}c}$	=	29 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	3 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 2$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	1 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain * $I_C = 0{,}25$ A; $V_{CE} = 5$ V	h_{FE}	typ.	30
			10 to 60
Collector-emitter saturation voltage* $I_C = 0{,}75$ A; $I_B = 0{,}15$ A	V_{CEsat}	typ.	0,9 V
Transition frequency at f = 100 MHz * $-I_E = 0{,}25$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	750 MHz
$-I_E = 0{,}75$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	625 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13{,}5$ V	C_c	typ.	8,6 pF
Feedback capacitance at f = 1 MHz $I_C = 20$ mA; $V_{CE} = 13{,}5$ V	C_{re}	typ.	3,8 pF

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

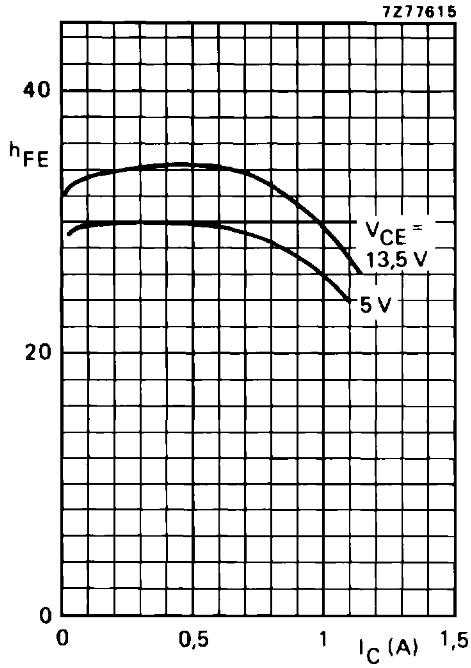


Fig. 4 Typical values; T_j = 25 °C.

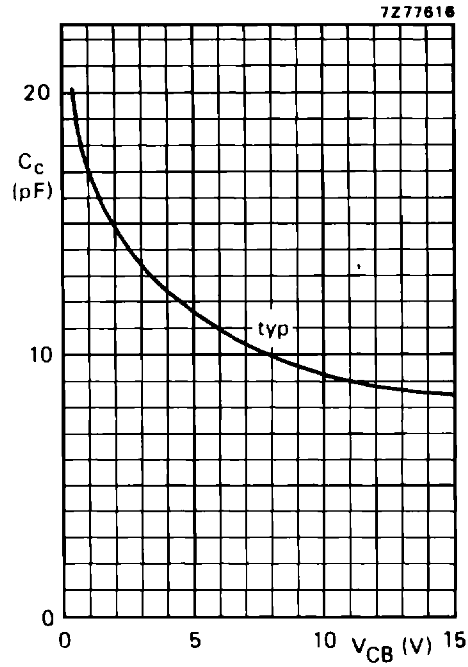


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

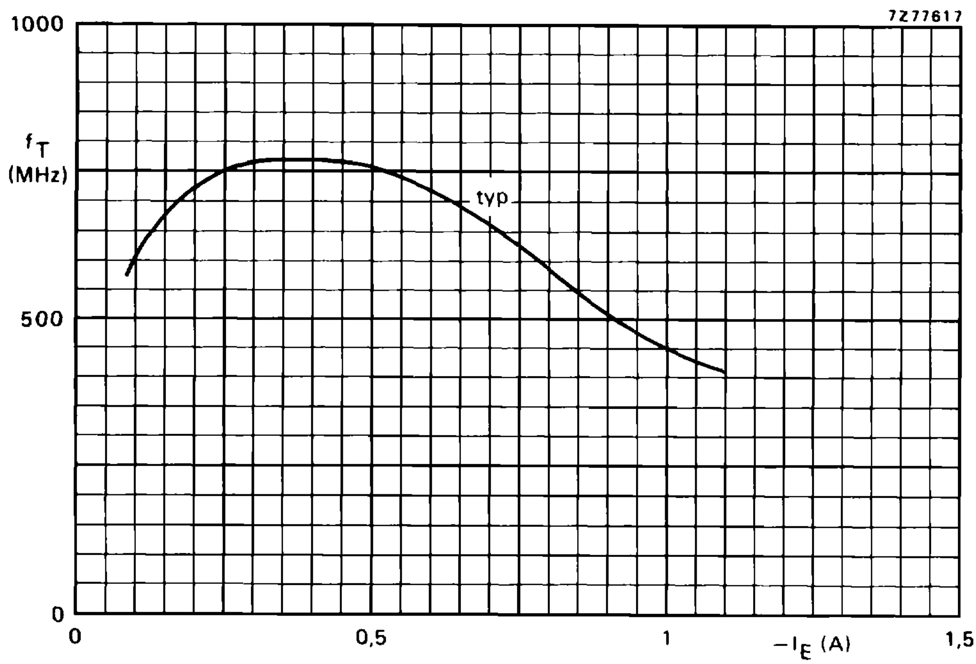


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

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

T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 K/W

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	**13,5**	**2**	**< 0,16**	**> 11**	**< 0,25**	**> 60**	**7,8 – j4,6**	**22 – j18**
175	12,5	2	–	typ. 10,5		typ. 65	–	–

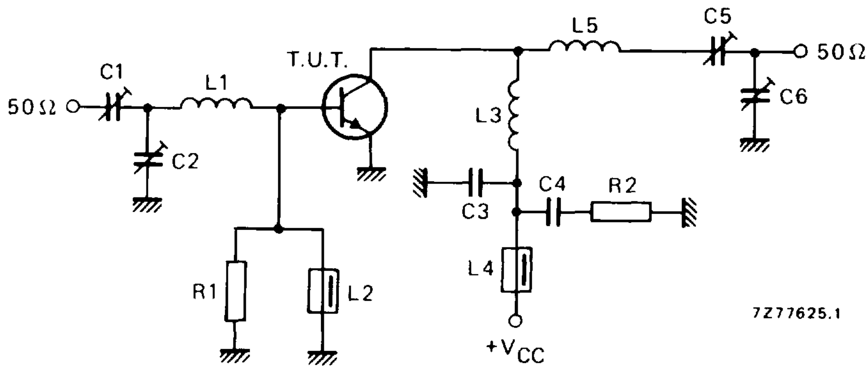


Fig. 7 Test circuit; c.w. class-B.

List of components:

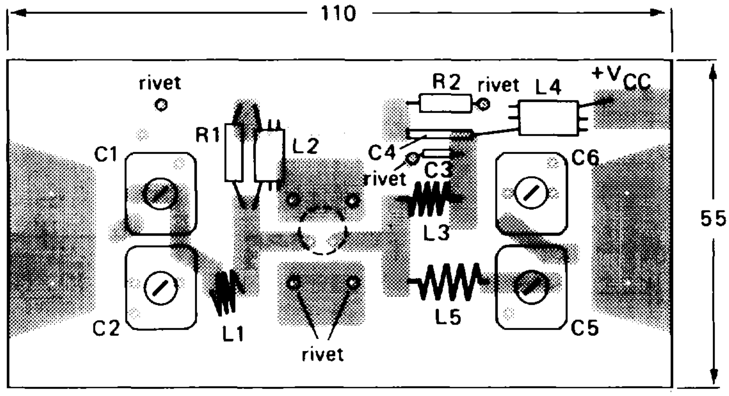
C1 = C2 = C5 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 100 pF ceramic capacitor
C4 = 100 nF polyester capacitor
C6 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)

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

R1 = 220 Ω carbon resistor
R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



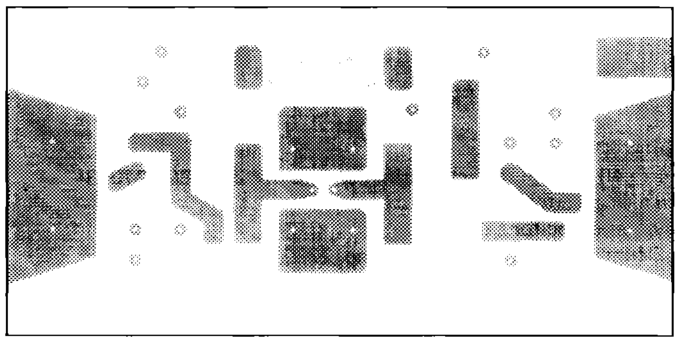


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

Material of printed-circuit board: 1,6 mm epoxy fibre-glass.

The length of the external emitter lead is 1,2 mm.

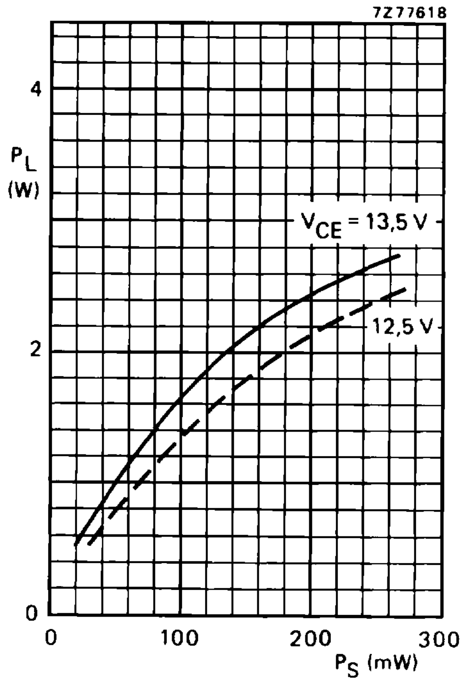


Fig. 9 Typical values; f = 175 MHz;
T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 K/W.

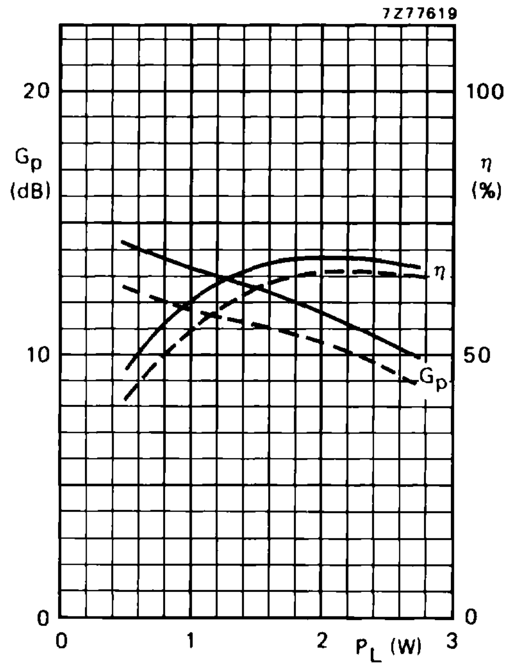


Fig. 10 Typical values; f = 175 MHz;
T_{amb} = 25 °C; —— V_{CE} = 13,5 V;
– – – V_{CE} = 12,5 V; $R_{th\ c\text{-}a}$ = 32 K/W.

APPLICATION INFORMATION (continued)

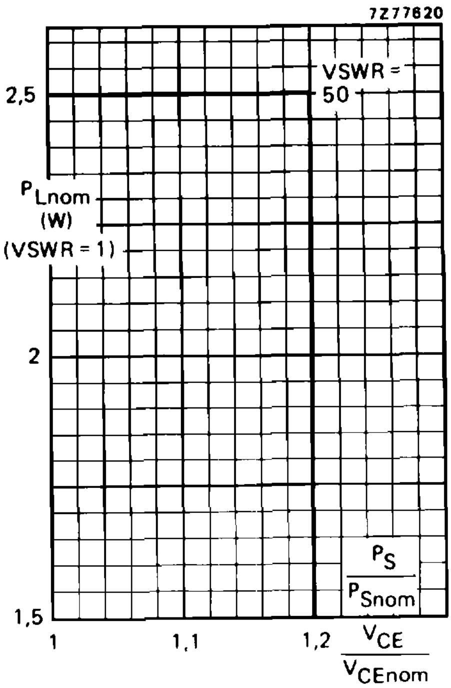


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 3 K/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

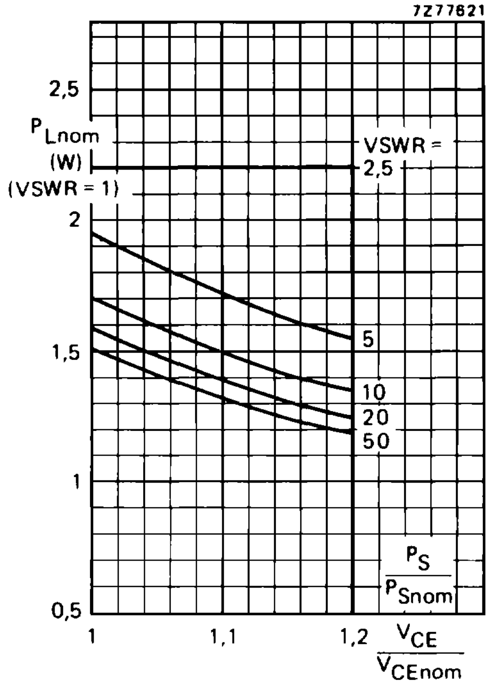


Fig. 12 R.F. SOAR (short-time operation during mismatch); f = 175 °C; T_{amb} = 70 °C; $R_{th\ c\text{-}a}$ = 32 K/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Figs 11 and 12:
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 must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 22 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

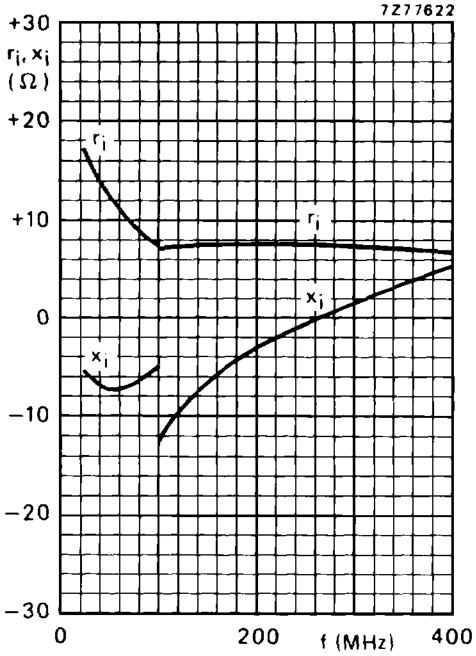


Fig. 13.

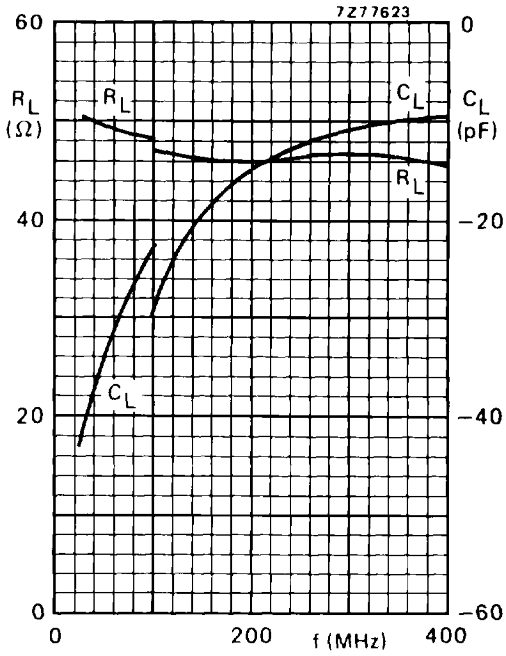
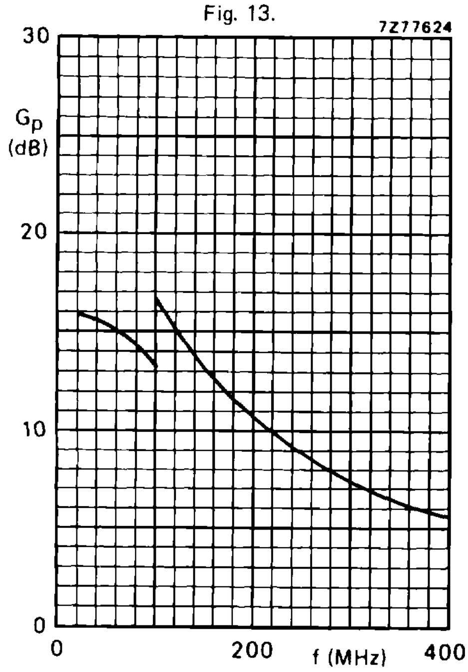


Fig. 14.



Conditions for Figs 13, 14 and 15:

Typical values; V_{CE} = 13,5 V; P_L = 2 W; T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 K/W.

Fig. 15.