V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

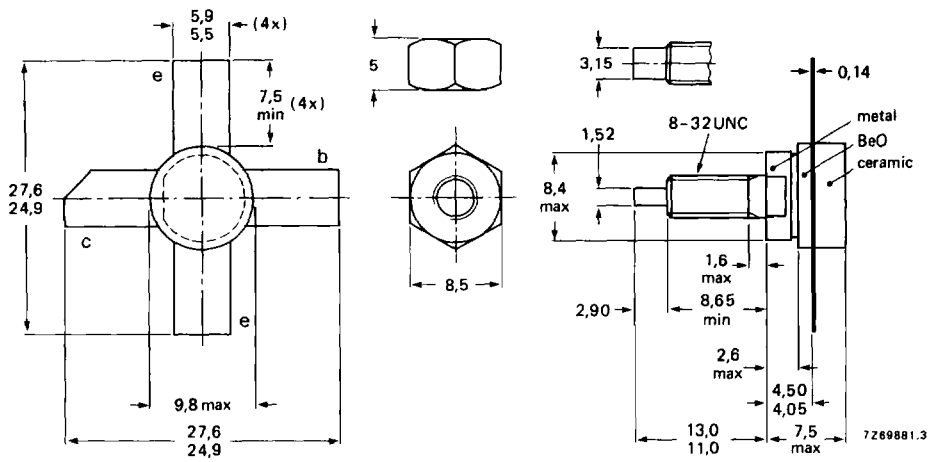
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\bar{z}_i$ Ω	$\bar{Y}_L$ mS
c.w.	28	175	8	> 12	> 65	1,8 + j0,7	18 – j20

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 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.

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

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 (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65 V
Collector-emitter voltage (open base)	V_{CEO}	max.	36 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	0,9 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	2,5 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

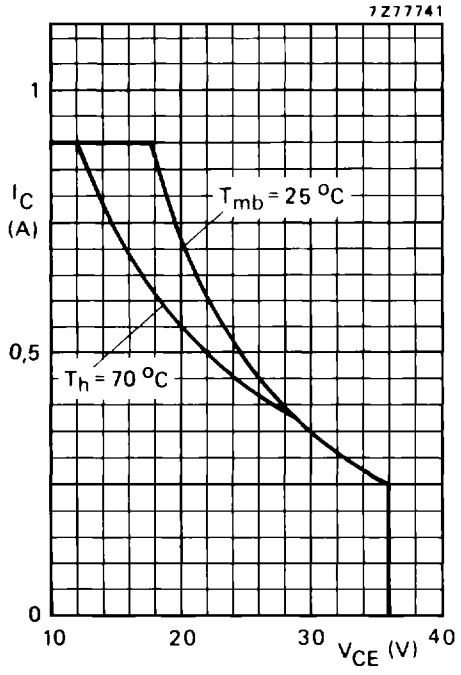


Fig. 2 D.C. SOAR.

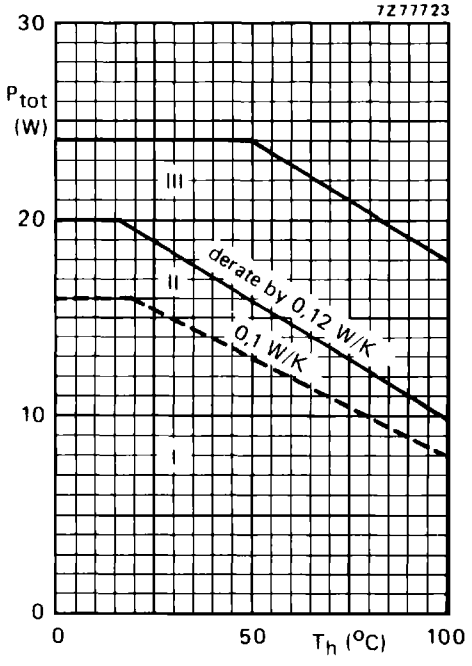


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f > 1 MHz.
I Continuous d.c operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 73,6 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 2 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; I_C = 10 mA	$V_{(BR)CEO}$	>	36 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} = 36 V	I_{CES}	<	1 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	0,5 mJ
R_{BE} = 10 Ω	E_{SBR}	>	0,5 mJ
D.C. current gain *			
I_C = 0,4 A; V_{CE} = 5 V	h_{FE}	typ.	50 10 to 100
Collector-emitter saturation voltage*			
I_C = 1,25 A; I_B = 0,25 A	V_{CEsat}	typ.	0,8 V
Transition frequency at f = 100 MHz*			
$-I_E$ = 0,4 A; V_{CB} = 28 V	f_T	typ.	600 MHz
$-I_E$ = 1,25 A; V_{CB} = 28 V	f_T	typ.	525 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	10 pF
Feedback capacitance at f = 1 MHz			
I_C = 50 mA; V_{CE} = 28 V	C_{re}	typ.	7,1 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

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

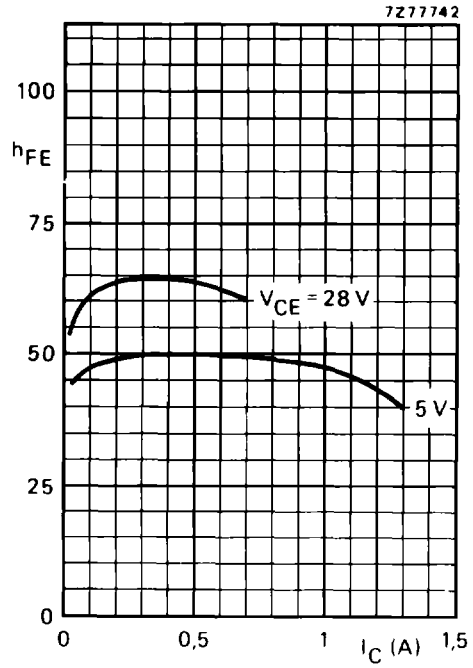


Fig.4 Typical values; T_j = 25 °C.

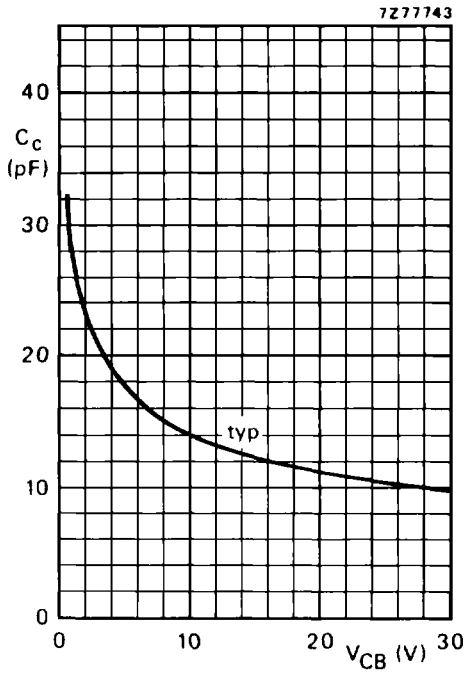


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

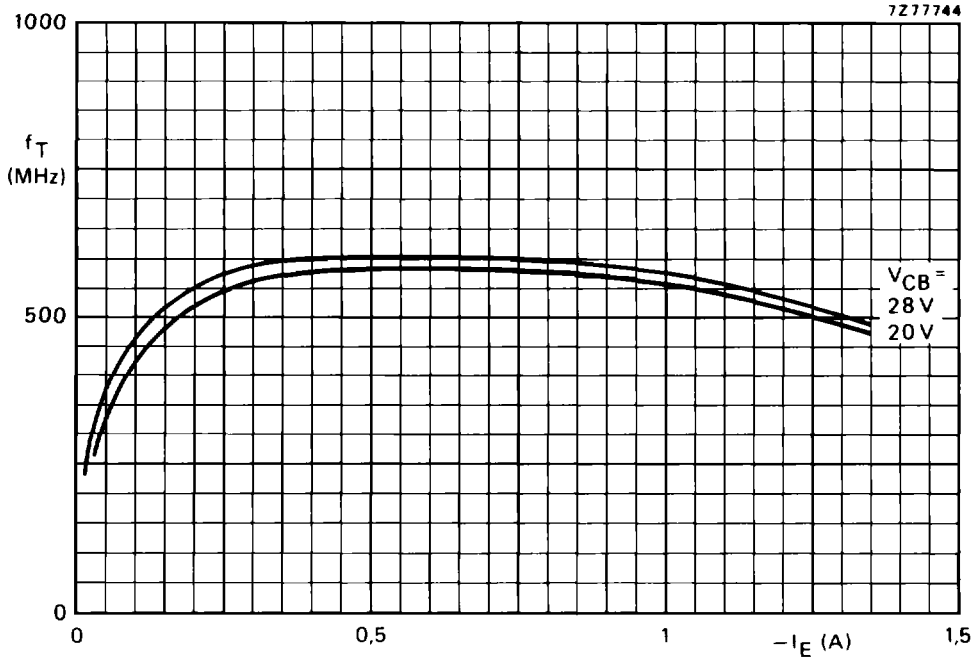


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

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)	$\overline{Y_L}$ (mS)
175	28	8	<0,5	>12	<0,44	>65	1,8 + j0,7	18 − j20

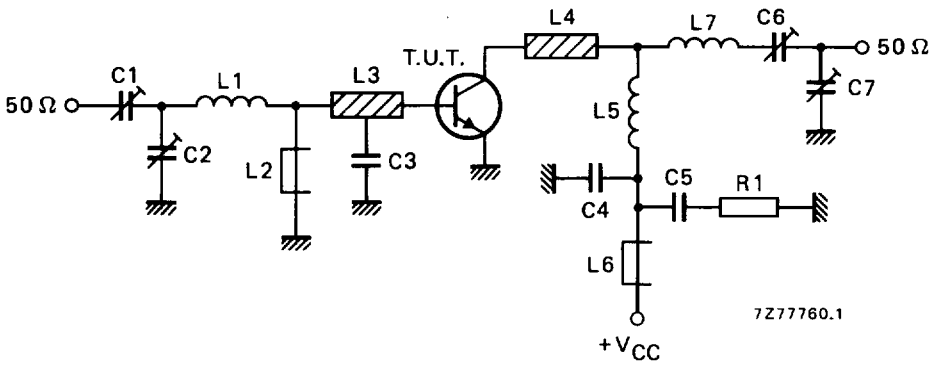


Fig. 7 Test circuit; c.w. class-B.

List of components:

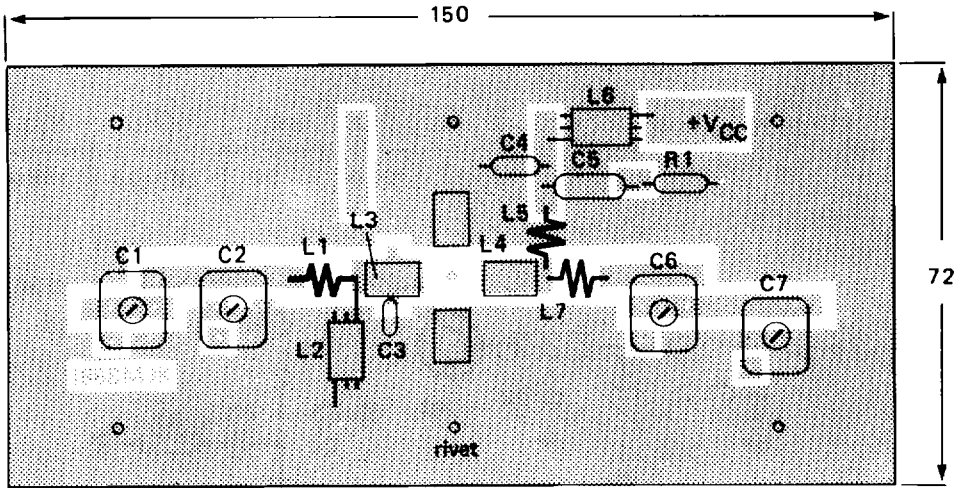
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 27 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor

L1 = 1 turn Cu wire (1,6 mm); int. dia. 8,4 mm; leads 2 x 5 mm
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L6 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L7 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 8,2 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

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



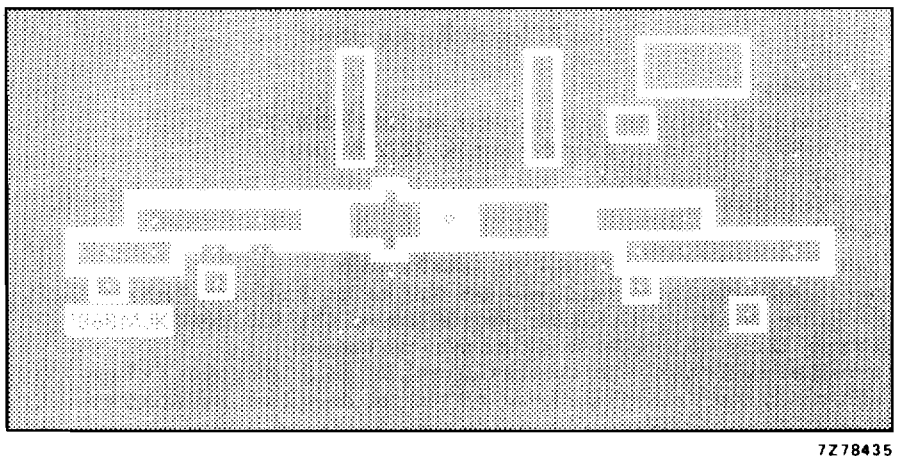


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

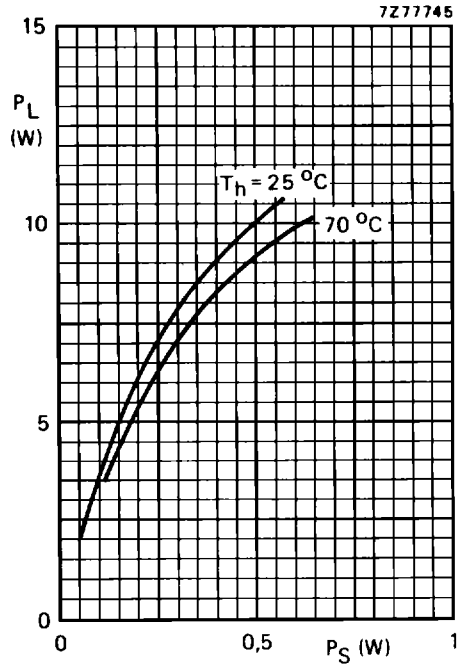


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

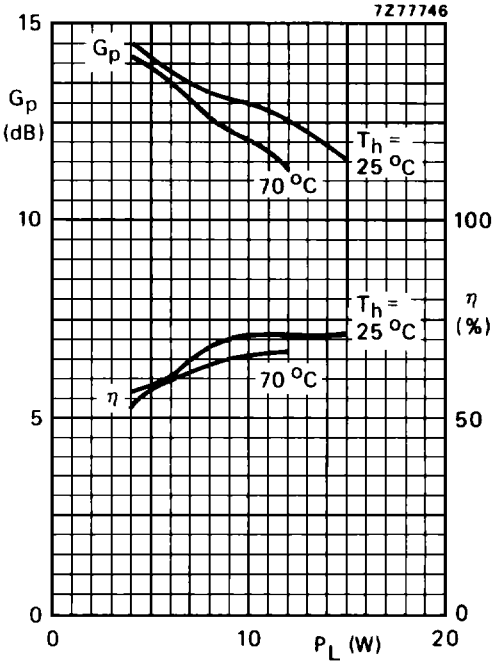


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

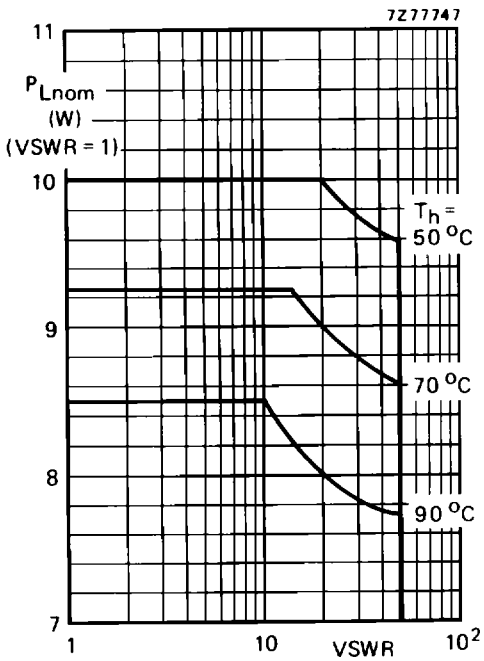


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 K/W The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

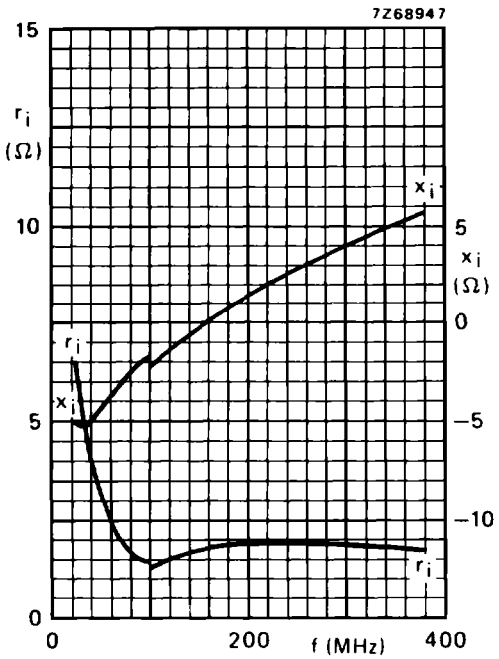


Fig. 12 Input impedance (series components).

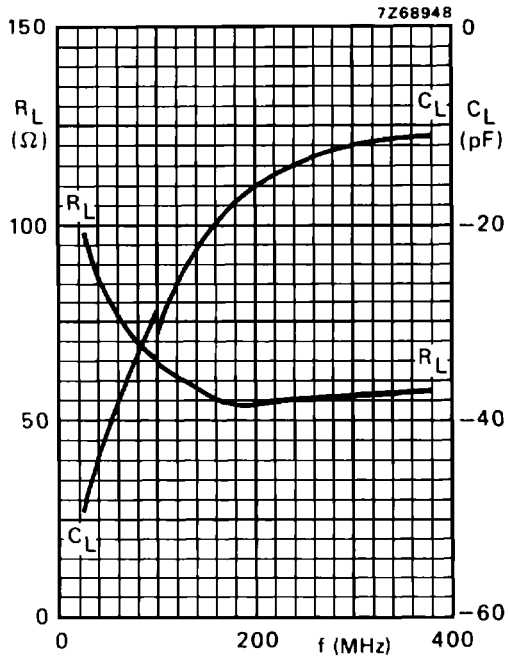


Fig. 13 Load impedance (parallel components).

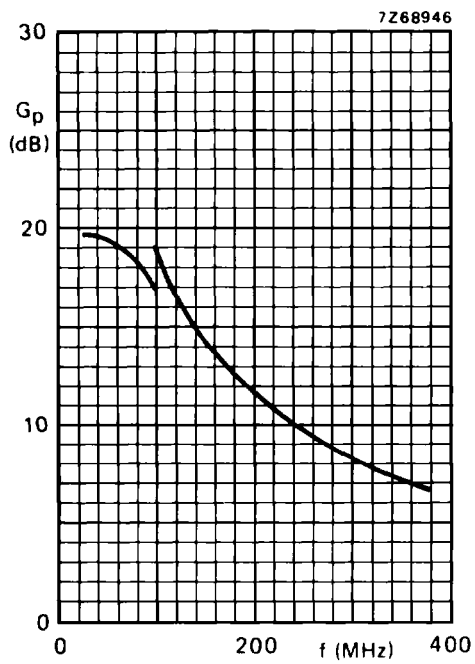


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 8 W; T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.