V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated 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" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

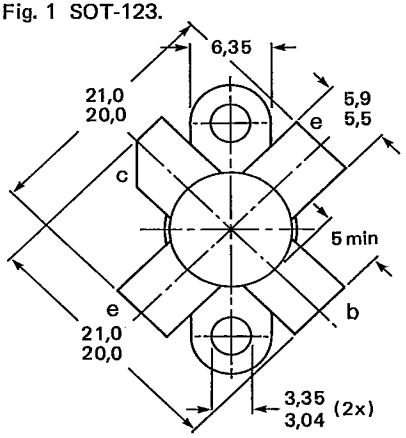
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

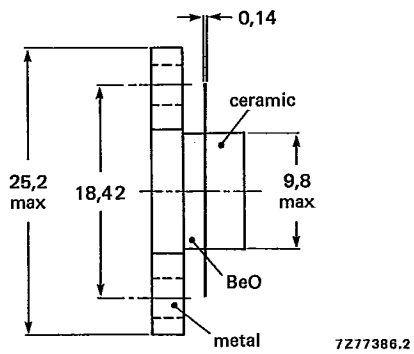
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	25	> 9	> 60	1,0 + j1,2	59 − j54

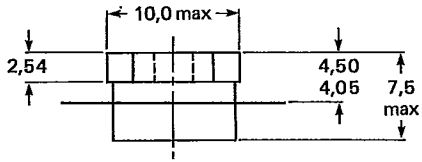
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.







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.

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.

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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.	3 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	76 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

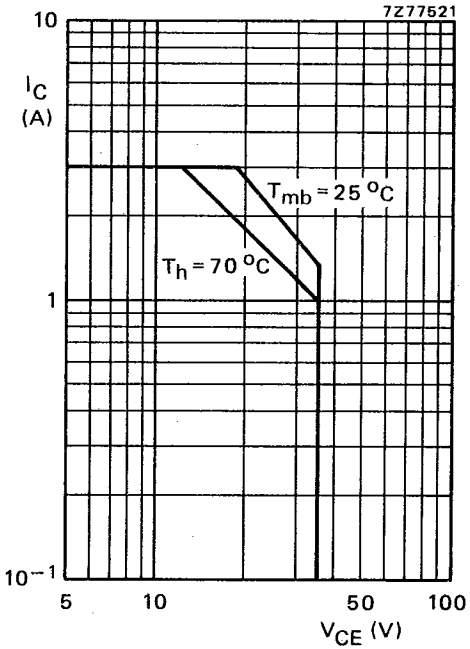


Fig. 2 D.C. SOAR.

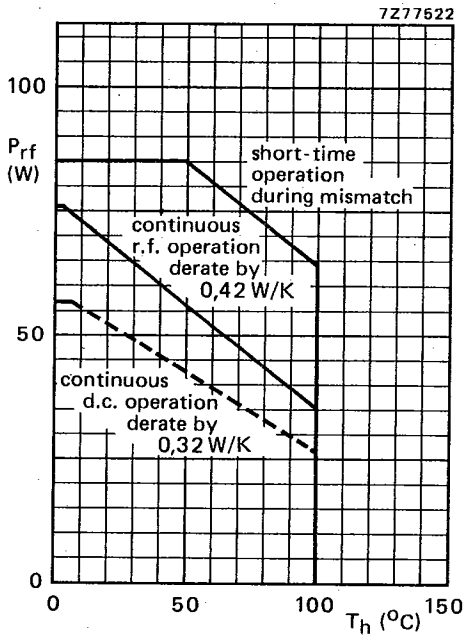


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; $f \geqslant 1$ MHz.

THERMAL RESISTANCE (dissipation = 20 W; T_{mb} = 76 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb\ (dc)}$	=	3,0 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb\ (rf)}$	=	2,25 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 K/W

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CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage				
V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter breakdown voltage				
open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage				
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	4	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	8	mJ
R_{BE} = 10 Ω	E_{SBR}	>	8	mJ
D.C. current gain *				
I_C = 1,25 A; V_{CE} = 5 V	h_{FE}	typ.	45	
			10 to 100	
Collector-emitter saturation voltage *				
I_C = 3,75 A; I_B = 0,75 A	V_{CEsat}	typ.	1,5	V
Transition frequency at f = 100 MHz *				
$-I_E$ = 1,25 A; V_{CB} = 28 V	f_T	typ.	650	MHz
$-I_E$ = 3,75 A; V_{CB} = 28 V	f_T	typ.	650	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	45	pF
Feedback capacitance at f = 1 MHz				
I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	28	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

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

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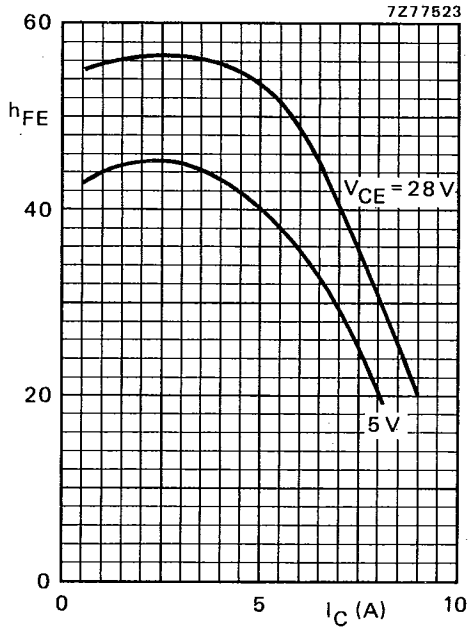


Fig. 4 Typical values; T_j = 25 °C.

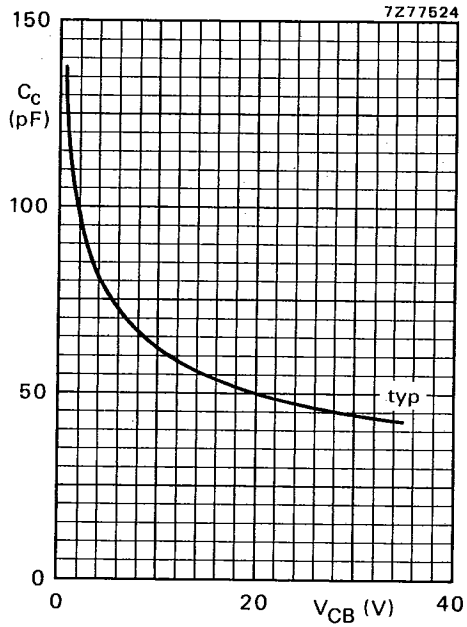


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

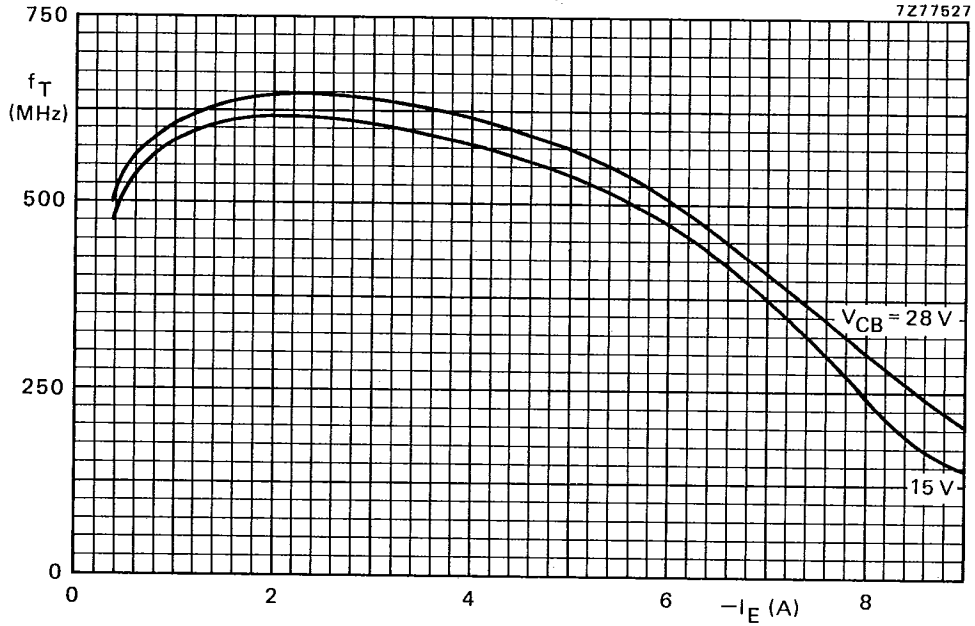


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

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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	25	< 3,15	> 9	< 1,49	> 60	1,0 + j1,2	59 − j54

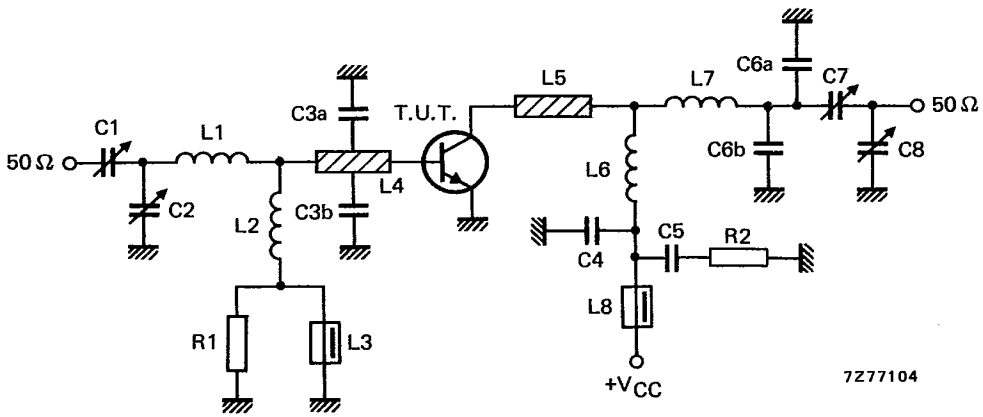


Fig. 7 Test circuit; c.w. class-B.

List of components

C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF (± 10%) polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 14 nH; 1 turn enamelled Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 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); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

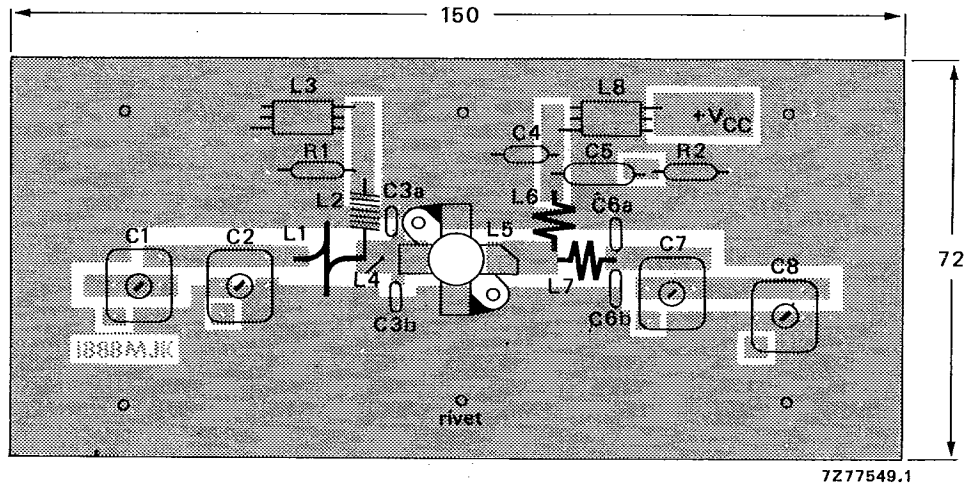
L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω (± 10%) carbon resistor (0,25 W)

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

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APPLICATION INFORMATION (continued)



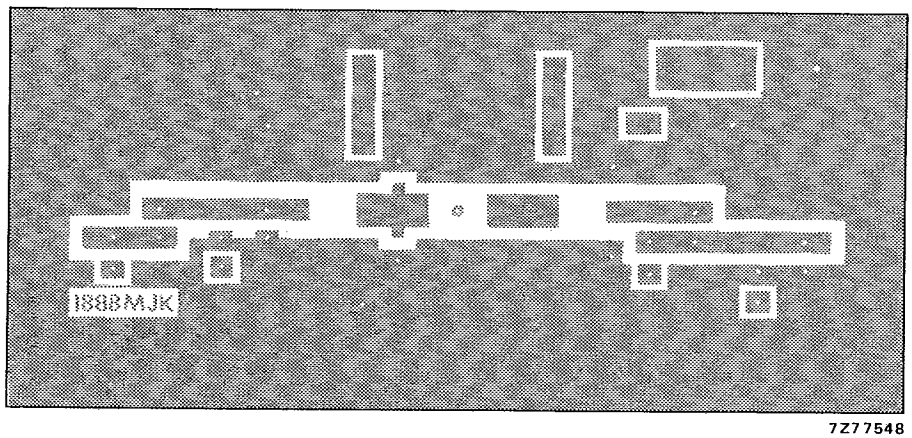


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

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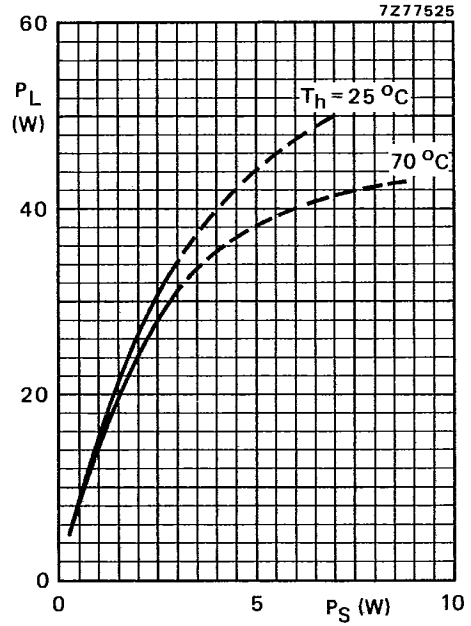


Fig. 9 V_{CE} = 28 V; f = 175 MHz; typical values.

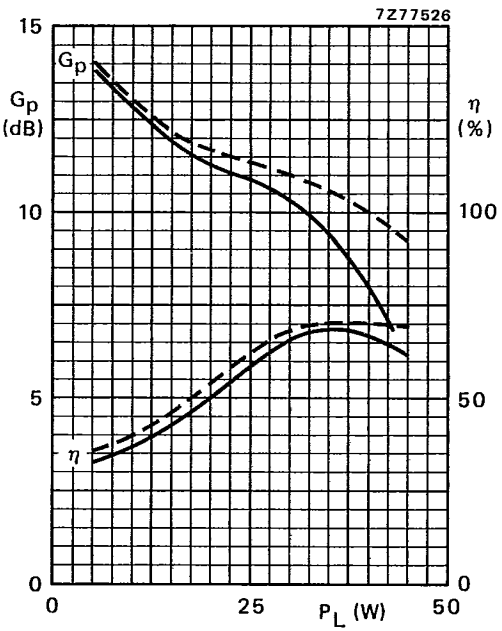


Fig. 10 V_{CE} = 28 V; f = 175 MHz; typical values; – – – T_h = 25 °C; —— T_h = 70 °C.

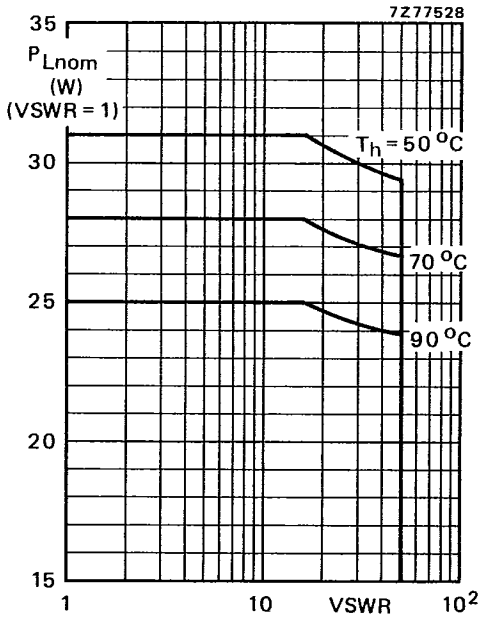


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,3 K/W

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.

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OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

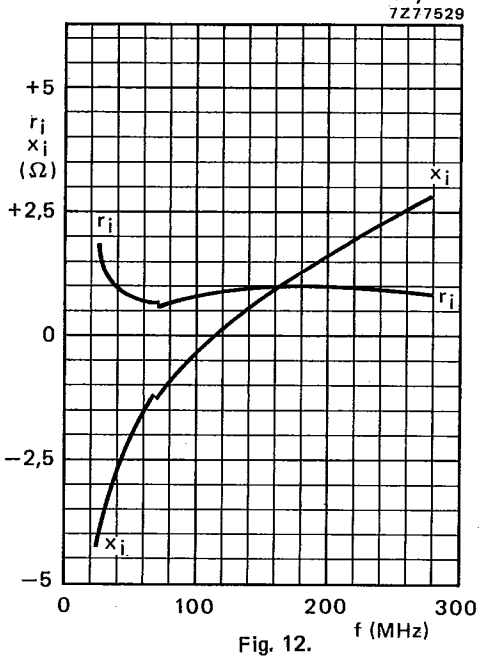


Fig. 12.

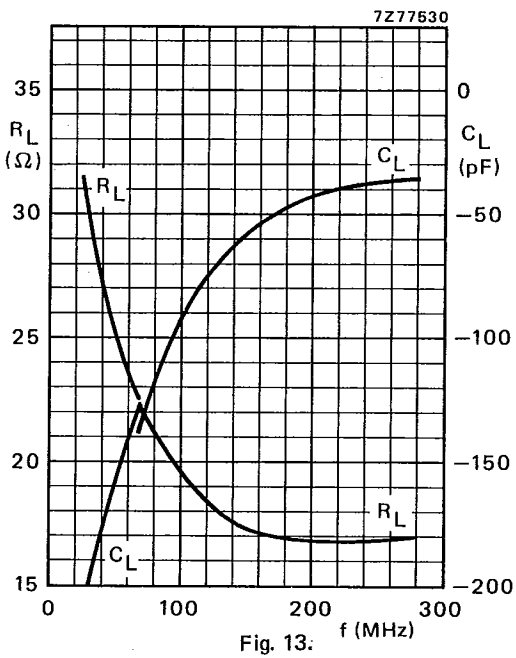
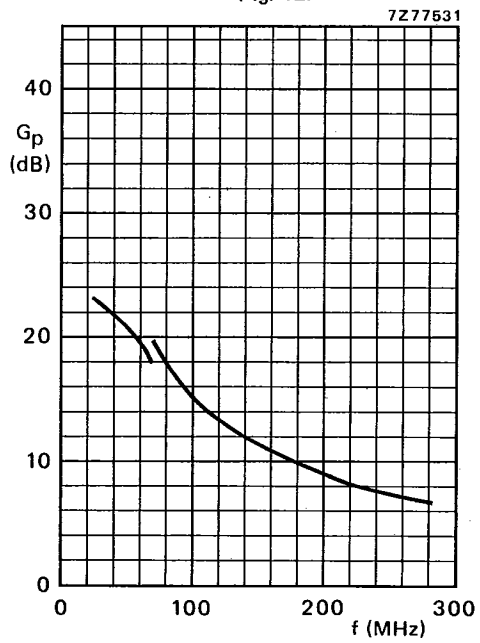


Fig. 13.



Conditions for Figs 12, 13 and 14:
Typical values; V_{CE} = 28 V; P_L = 25 W;
T_h = 25 °C.

Fig. 14.

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