

### U.H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon transistor for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13,8 V.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

#### QUICK REFERENCE DATA

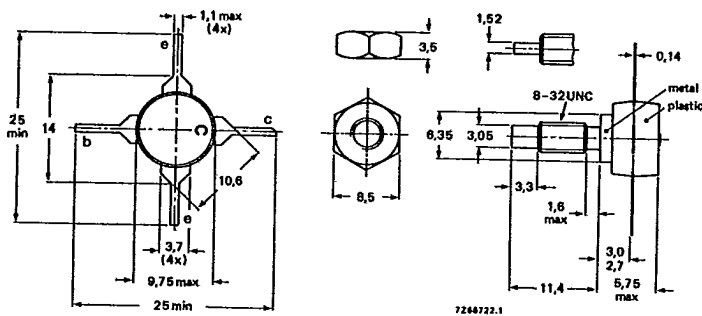
R.F. performance up to  $T_h = 25\text{ }^\circ\text{C}$  in an unneutralized common-emitter class-B circuit.

mode of operation	$V_{CE}$ V	f MHz	$P_S$ W	$P_L$ W	$I_C$ A	$G_p$ dB	$\eta$ %	$\bar{z}_i$ $\Omega$	$\bar{Y}_L$ mS
c.w.	13,8	470	< 2,0	7,0	< 0,78	> 5,4	> 65	—	—
c.w.	13,8	470	typ. 2,0	7,8	typ. 0,81	typ. 5,9	typ. 70	2,4 + j6,7	60 - j20
c.w.	12,5	470	< 2,2	7,0	< 0,86	> 5,0	> 65	—	—
c.w.	12,5	175	typ. 0,4	7,2	typ. 0,87	typ. 12,6	typ. 66	—	—

#### MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/3.



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.

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

Collector-base voltage (open emitter) peak value	V <sub>CBOM</sub>	max.	36 V
Collector-emitter voltage (R <sub>BE</sub> = 0) peak value	V <sub>CESM</sub>	max.	36 V
Collector-emitter voltage (open base)	V <sub>CEO</sub>	max.	18 V
Emitter-base voltage (open collector)	V <sub>EBO</sub>	max.	4 V
Collector current (average)	I <sub>C(AV)</sub>	max.	1.0 A
Collector current (peak value) f > 1 MHz	I <sub>CM</sub>	max.	4.0 A
Total power dissipation up to T <sub>h</sub> = 70 °C f > 10 MHz	P <sub>tot</sub>	max.	10 W
Storage temperature	T <sub>stg</sub>	-65 to +150	°C
Junction temperature	T <sub>j</sub>	max.	150 °C

**THERMAL RESISTANCE**

From junction to mounting base	R <sub>th j-mb</sub>	=	7.0 K/W
From mounting base to heatsink	R <sub>th mb-h</sub>	=	0.6 K/W

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## CHARACTERISTICS

 $T_j = 25\text{ }^\circ\text{C}$  unless otherwise specified

## Breakdown voltages

Collector-base voltage  
open emitter,  $I_C = 10\text{ mA}$  $V_{(BR)CBO} > 36\text{ V}$ Collector-emitter voltage  
 $V_{BE} = 0$ ;  $I_C = 10\text{ mA}$  $V_{(BR)CES} > 36\text{ V}$ Collector-emitter voltage  
open base,  $I_C = 25\text{ mA}$  $V_{(BR)CEO} > 18\text{ V}$ Emitter-base voltage  
open collector,  $I_E = 1.0\text{ mA}$  $V_{(BR)EBO} > 4\text{ V}$ 

## Collector-emitter saturation voltage

 $I_C = 500\text{ mA}$ ;  $I_B = 100\text{ mA}$  $V_{CEsat}$  typ.  $0.2\text{ V}$ 

## D. C. current gain

 $I_C = 500\text{ mA}$ ;  $V_{CE} = 5\text{ V}$  $h_{FE} > 10$   
typ.  $40$ 

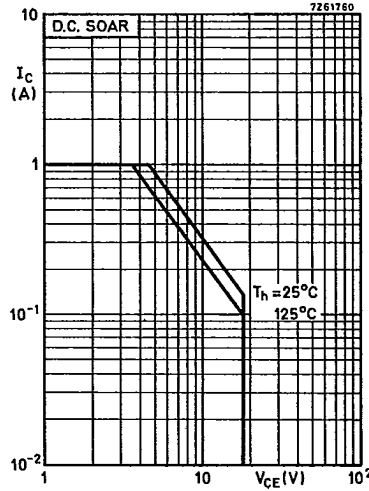
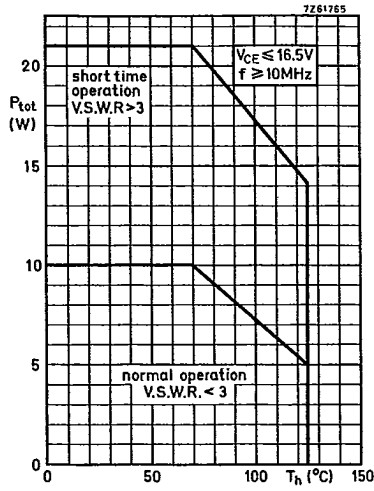
## Transition frequency

 $I_C = 500\text{ mA}$ ;  $V_{CE} = 5\text{ V}$ ;  $f = 500\text{ MHz}$  $f_T$  typ.  $1300\text{ MHz}$ Collector capacitance at  $f = 1\text{ MHz}$  $I_E = I_e = 0$ ;  $V_{CB} = 10\text{ V}$  $C_c$  typ.  $14\text{ pF}$   
<  $20\text{ pF}$ Emitter capacitance at  $f = 1\text{ MHz}$  $I_C = I_c = 0$ ;  $V_{EB} = 0$  $C_e$  typ.  $65\text{ pF}$ Feedback capacitance at  $f = 1\text{ MHz}$  $I_C = 50\text{ mA}$ ;  $V_{CE} = 10\text{ V}$  $C_{re}$  typ.  $10.5\text{ pF}$ 

## Collector-stud capacitance

 $C_{cs}$  typ.  $2\text{ pF}$

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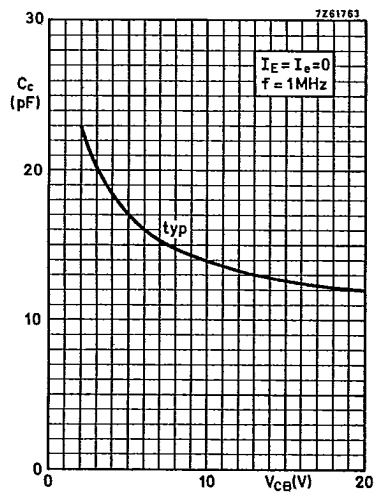
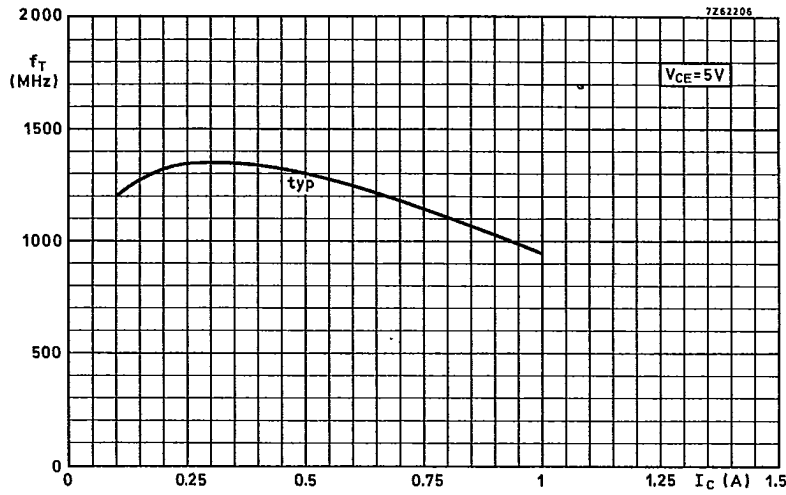
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V.H.F./U.H.F. power transistor

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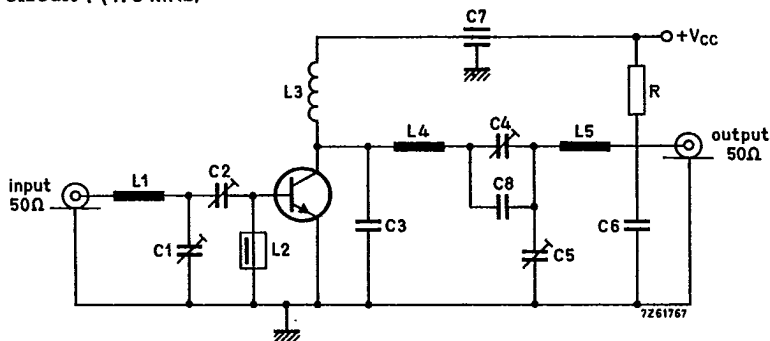
APPLICATION INFORMATION

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

$T_h$  up to 25 °C

f (MHz)	$V_{CC}$ (V)	$P_S$ (W)	$P_L$ (W)	$I_C$ (A)	$G_D$ (dB)	$\eta$ (%)	$\bar{Z}_i$ ( $\Omega$ )	$\bar{Y}_L$ (mS)
470	13.8	< 2.0	7.0	< 0.78	> 5.4	> 65	-	-
470	13.8	typ. 2.0	7.8	typ. 0.81	typ. 5.9	typ. 70	2.4 + j6.7	60 - j20
470	12.5	< 2.2	7.0	< 0.86	> 5.0	> 65	-	-
175	12.5	typ. 0.4	7.2	typ. 0.87	typ. 12.6	typ. 66	-	-

Test circuit I (470 MHz)



C1 = C2 = C4 = C5 = 1.8 to 18 pF film dielectric trimmer

C3 = 6.8 pF ceramic capacitor

C6 = 0.1  $\mu$ F polyester capacitor

C7 = 4 nF feed-through capacitor

C8 = 10 pF ceramic capacitor

L1 = L4 = L5 = 20 mm straight Cu wire (1.2 mm); height above print 12 mm

L2 = 0.47  $\mu$ H choke

L3 = 1 turn Cu wire (1.7 mm); int. diam. 10 mm; max. lead length 5 mm

R = 10  $\Omega$  carbon

At  $P_L = 7.0$  W and  $V_{CC} = 12.5$  V the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 10 mW/K

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions:  $V_{CC} = 16.5$  V;  $f = 470$  MHz;  $T_h = 70$  °C;

V.S.W.R. = 50 : 1 through all phases;  $P_S = P_{Snom} + 20\%$

where  $P_{Snom} = P_S$  for 7.0 W transistor output into 50  $\Omega$  load at  $V_{CC} = 13.8$  V

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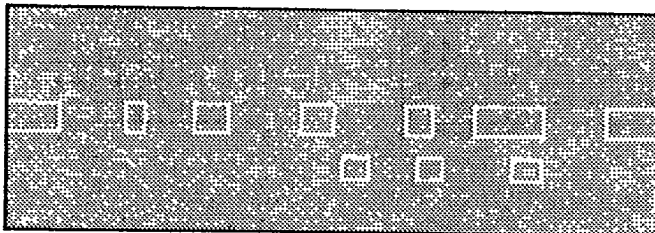
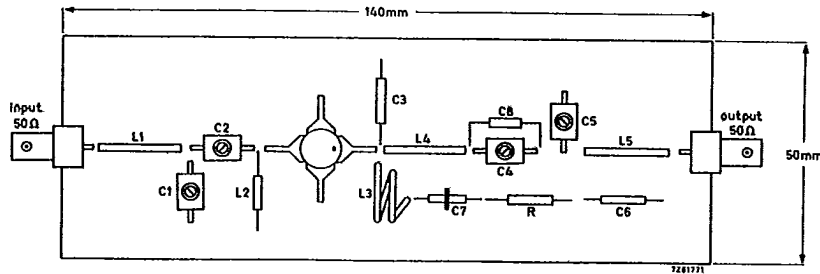
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APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.

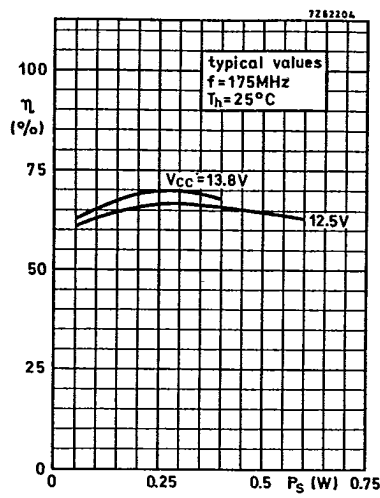
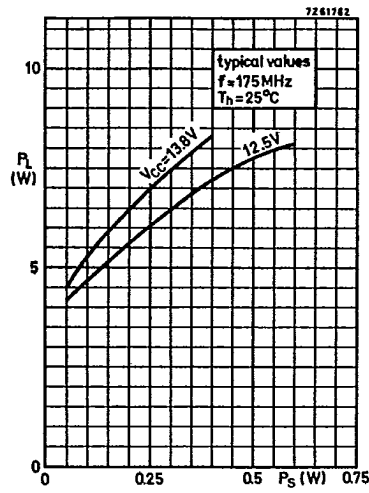
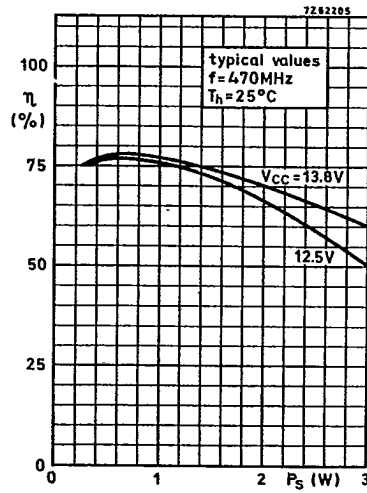
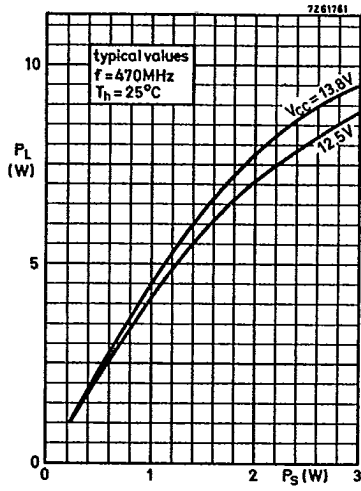


Shaded area copper

Back area completely copper clad

Material of printed circuit board: 1.5 mm epoxy fibre glass

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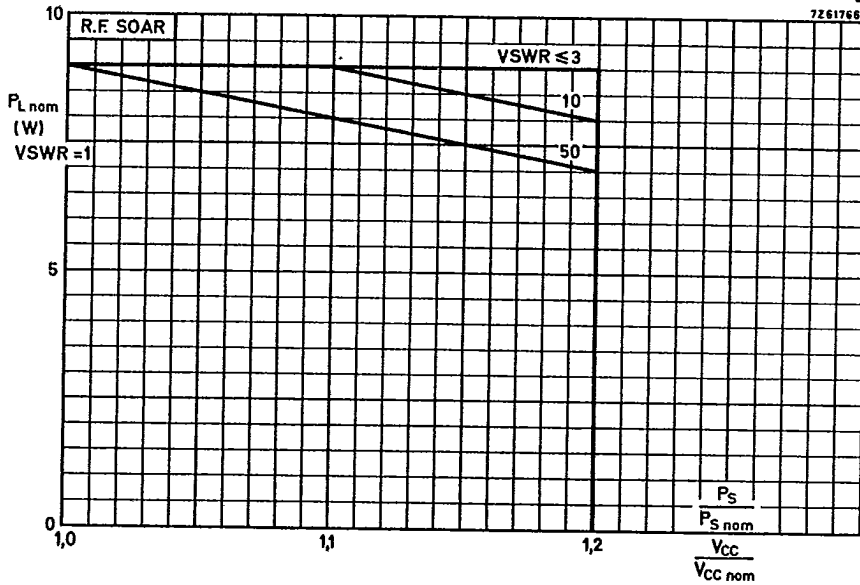
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Conditions for R. F. SOAR :

$f = 470$  MHz

$P_{Snom} = P_S$  at  $V_{CC} = V_{CCnom}$  and  $VSWR = 1$

$T_h = 70$  °C

$V_{CCnom} = 13,8$  V

The transistor was developed for use with unstabilized supply voltage  $V_{CC}$ .

The above graph is based on its measured performance in test circuit 1.

Supply voltage was varied from  $V_{CCnom}$  to  $1,2 V_{CCnom}$ , and  $VSWR$  from 1 to 50.

It shows the max. permissible output power under nominal conditions in order not to exceed the max. permissible power dissipation under conditions of supply over-voltage ( $V_{CC} > V_{CCnom}$ ) and load mismatch ( $VSWR > 1$ ).

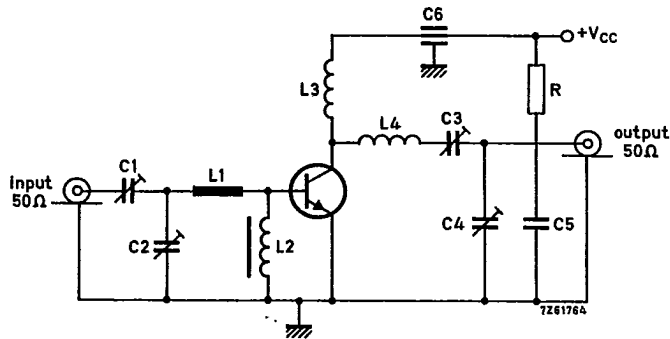
It is assumed that the drive power increases linearly with the supply voltage; i. e.

$$P_S/P_{Snom} = V_{CC}/V_{CCnom}$$

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APPLICATION INFORMATION (continued)

Test circuit II (175 MHz)



- C1 = C3 = C4 = 30 pF concentric air trimmer
- C2 = 60 pF concentric air trimmer
- C5 = 0.25  $\mu$ F polyester capacitor
- C6 = 4.0 nF feed-through capacitor

- L1 = 25 mm straight Cu wire (1.2 mm); height above print 3 mm
- L2 = 3 turns Cu wire (0.5 mm) on Ferrite FX1115, d = 2 mm, D = 4 mm, l = 5 mm material 3B (code number 3113 991 16740)
- L3 = 5 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
- L4 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
- R = 10  $\Omega$  carbon

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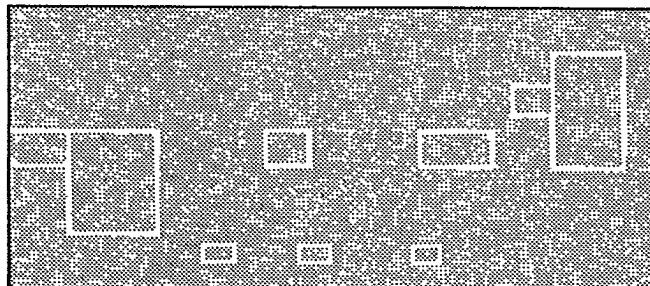
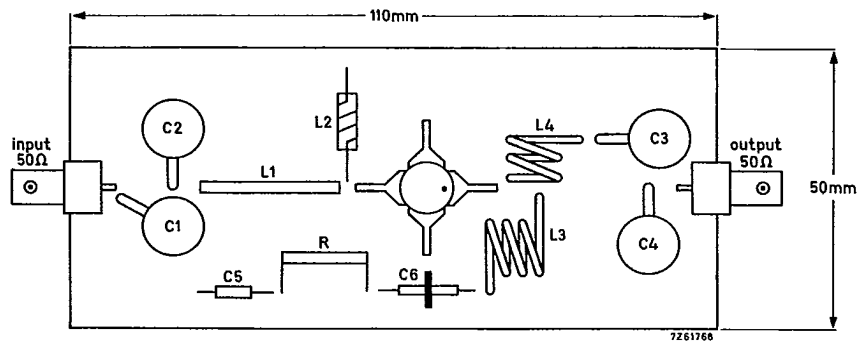
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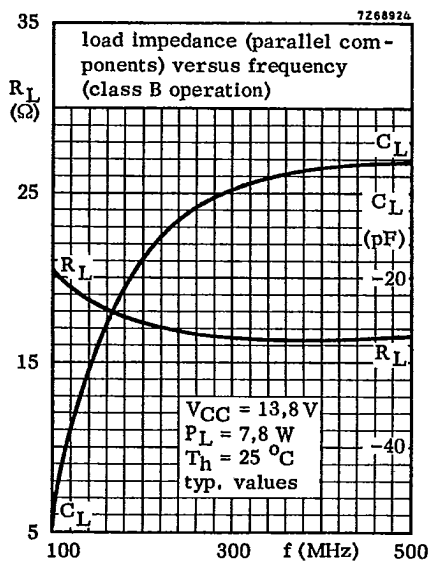
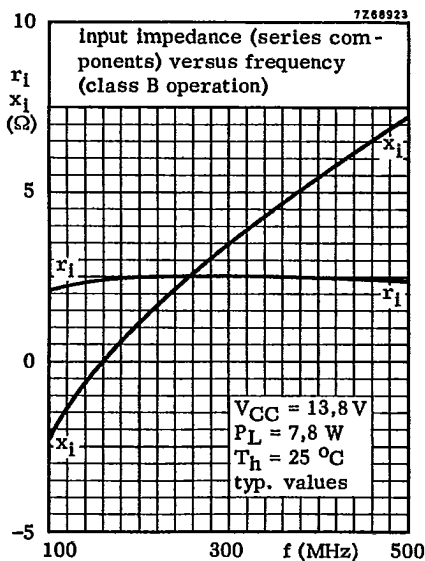
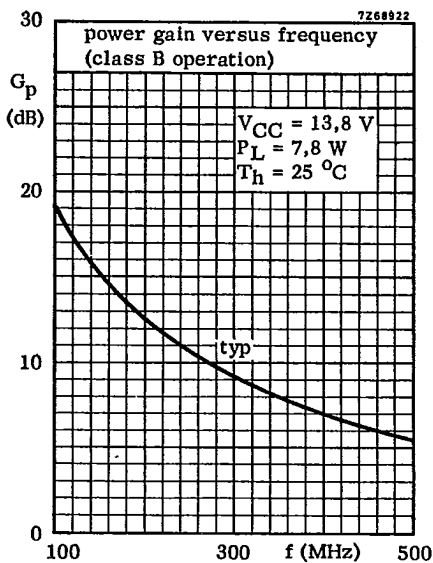
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APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit



Shaded area copper  
 Back area not metalized  
 Material of printed circuit board: 1.5 mm epoxy fibre glass



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