



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

N-P-N transistor intended 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

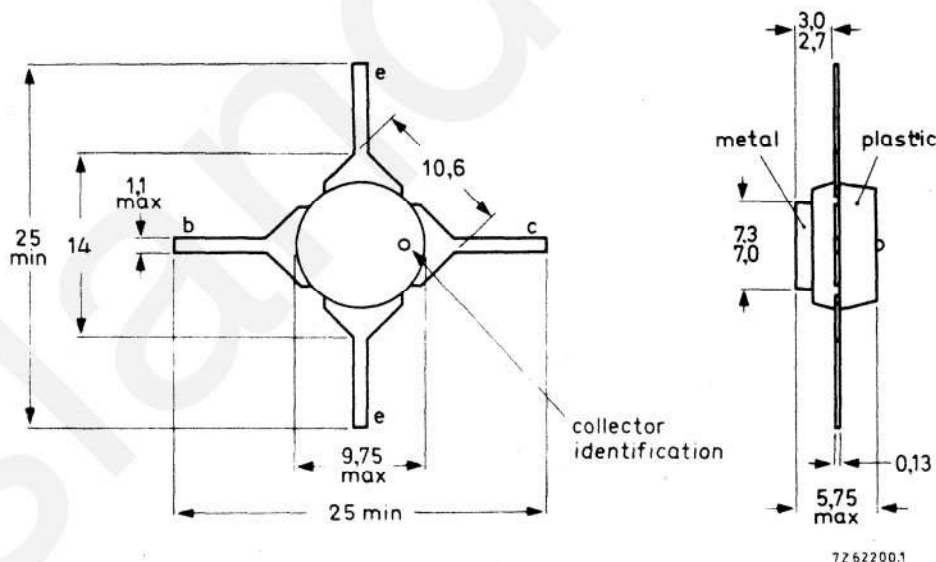
R.F. performance up to  $T_{mb} = 25\text{ }^{\circ}\text{C}$  in an unneutralized common-emitter class-B circuit

mode of operation	$V_{CE}$ V	f MHz	$P_S$ W	$P_L$ W	$I_C$ A	$G_p$ dB	$\eta$ %	$\bar{z}_i$ $\Omega$	$\bar{Y}_L$ mA/V
c.w.	13,8	470	typ. 0,15	1,5	typ. 0,17	typ. 10	typ. 65	—	—
c.w.	13,8	470	typ. 0,28	2,5	typ. 0,24	typ. 9,5	typ. 75	$2,6 + j4,8$	$23 - j23$
c.w.	12,5	470	$< 0,35$	2,5	$< 0,31$	$> 8,5$	$> 65$	—	—
c.w.	12,5	175	typ. 0,03	3,0	typ. 0,29	typ. 20	typ. 84	—	—

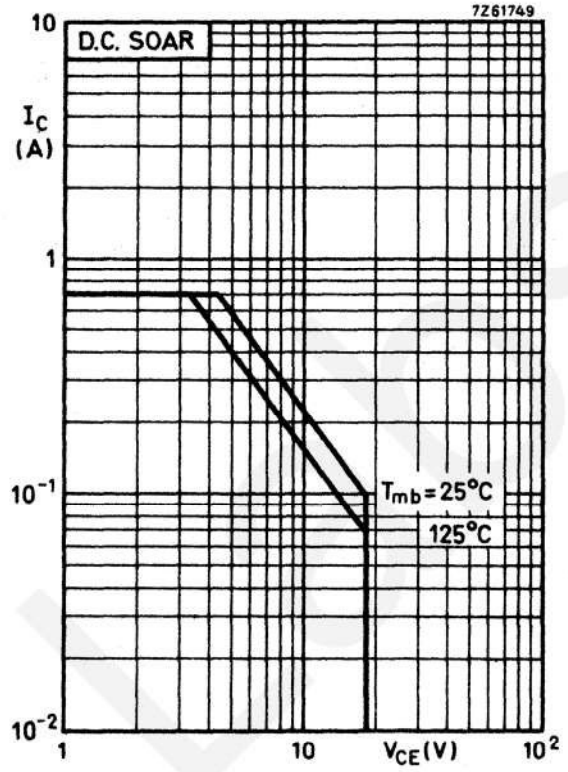
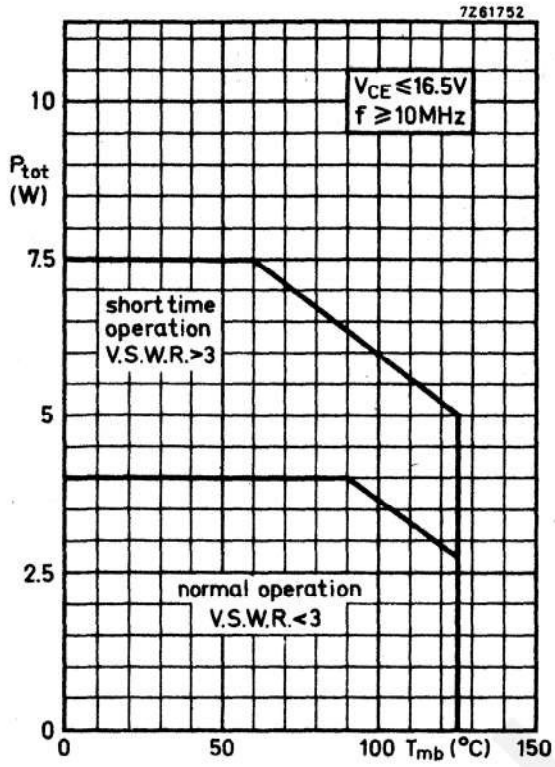
### MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48 (without stud).



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

Voltages

Collector-base voltage (open emitter) peak value	$V_{CBOM}$	max.	36	V
Collector-emitter voltage ( $R_{BE} = 0$ ) 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

Currents

Collector current (average)	$I_{C(AV)}$	max.	0.7	A
Collector current (peak value) $f > 1$ MHz	$I_{CM}$	max.	2.0	A

Power dissipation

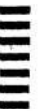
Total power dissipation up to $T_{mb} = 90$ °C $f > 10$ MHz	$P_{tot}$	max.	4.0	W
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Temperatures

Storage temperature	$T_{stg}$	-65 to +150	°C
Junction temperature	$T_j$	max. 150	°C

**THERMAL RESISTANCE**

From junction to mounting base	$R_{th\ j-mb}$	=	12	°C/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

$I_C = 100\text{ mA}; I_B = 20\text{ mA}$

$V_{CEsat}$  typ. 0,1 V

D.C. current gain

$I_C = 100\text{ mA}; V_{CE} = 5\text{ V}$

$h_{FE} >$  10  
typ. 40

Transition frequency

$I_C = 200\text{ mA}; V_{CE} = 5\text{ V}; f = 500\text{ MHz}$

$f_T$  typ. 1400 MHz

Collector capacitance at  $f = 1\text{ MHz}$

$I_E = I_e = 0; V_{CB} = 10\text{ V}$

$C_c$  typ. 6,5 pF  
< 9,0 pF

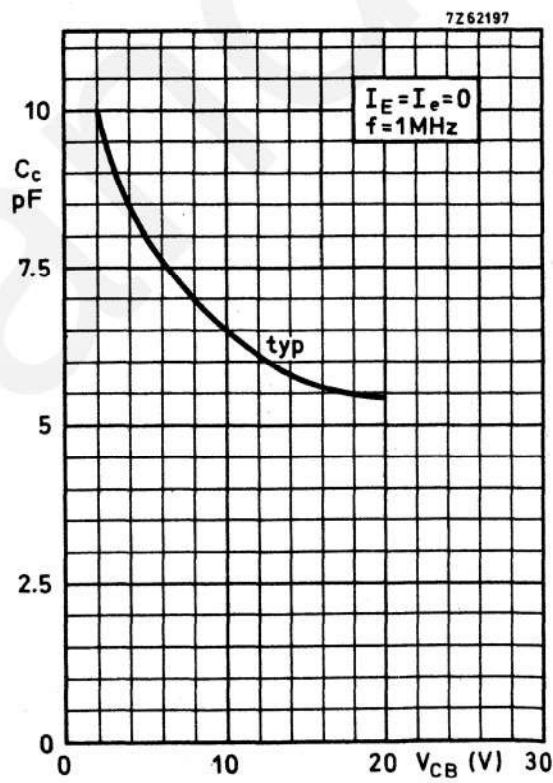
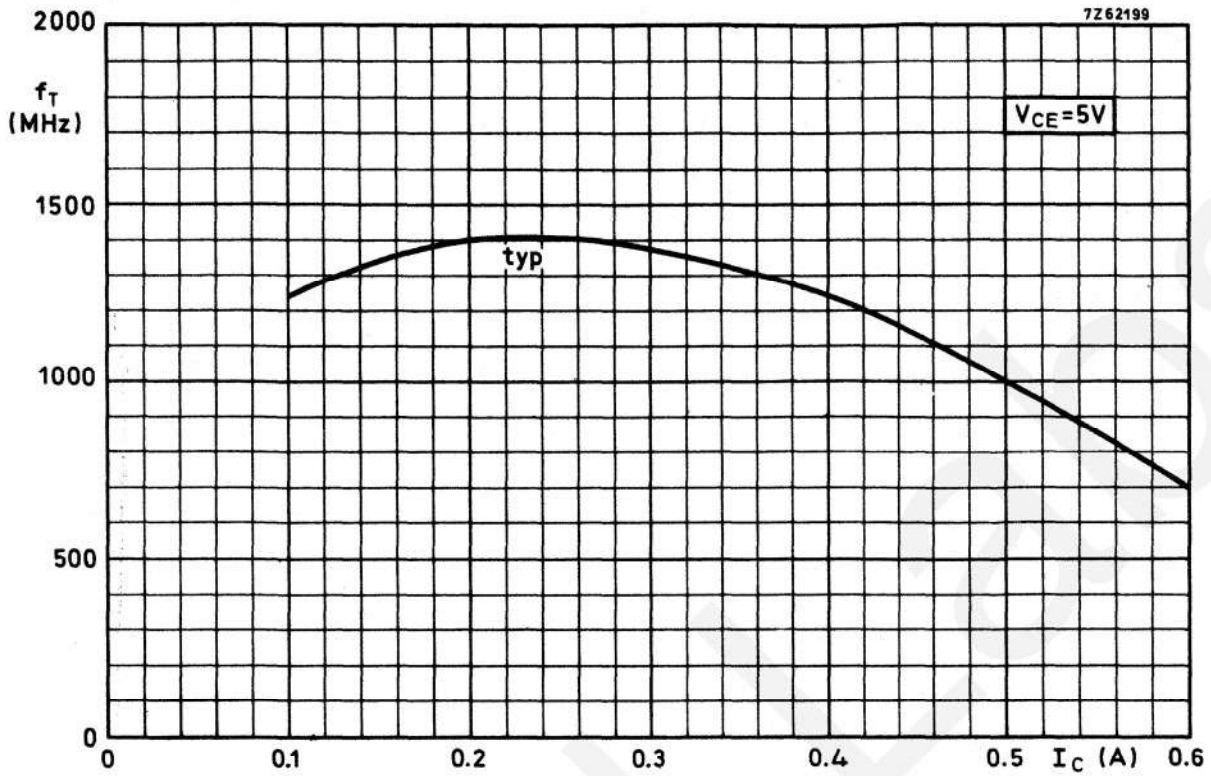
Feedback capacitance at  $f = 1\text{ MHz}$

$I_C = 20\text{ mA}; V_{CE} = 10\text{ V}$

$C_{re}$  typ. 4,8 pF

Collector-stud capacitance

$C_{cs}$  typ. 2 pF



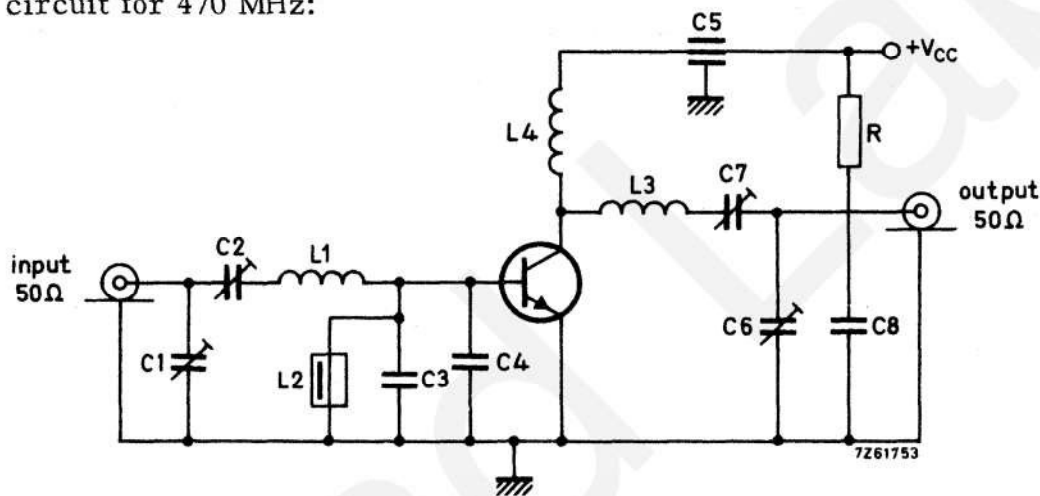
## APPLICATION INFORMATION

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

$T_{mb} = 25\text{ }^{\circ}\text{C}$

f (MHz)	V <sub>CC</sub> (V)	P <sub>S</sub> (W)	P <sub>L</sub> (W)	I <sub>C</sub> (A)	G <sub>p</sub> (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mA/V)
470	13.8	typ. 0.15	1.5	typ. 0.17	typ. 10	typ. 65	-	-
470	13.8	typ. 0.28	2.5	typ. 0.24	typ. 9.5	typ. 75	2.6 + j4.8	23 - j23
470	12.5	< 0.35	2.5	< 0.31	> 8.5	> 65	-	-
175	12.5	typ. 0.03	3.0	typ. 0.29	typ. 20	typ. 84	-	-

Test circuit for 470 MHz:



- C1 = C2 = C6 = C7 = 1.8 to 18 pF film dielectric trimmer
- C3 = C4 = 18 pF disc ceramic capacitor
- C5 = 4 nF feed-through capacitor
- C8 = 0.1 μF polyester capacitor

L1 = 1 turn Cu wire (1.2 mm); int. diam. 6 mm; max. lead length 1 mm.

L2 = 1 μH choke

L3 = 30 mm straight Cu wire (2 mm); height above print 2 mm.

L4 = 2 turns closely wound Cu wire (0.5 mm); int. diam. 3 mm; max. lead length 8 mm.

R = 10 Ω carbon

At  $P_L = 2.5\text{ W}$  and  $V_{CC} = 12.5\text{ V}$  the output power at mounting-base temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/°C

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions:  $V_{CC} = 16.5\text{ V}$ ;  $f = 470\text{ MHz}$ ;  $T_{mb} = 70\text{ }^{\circ}\text{C}$ ;

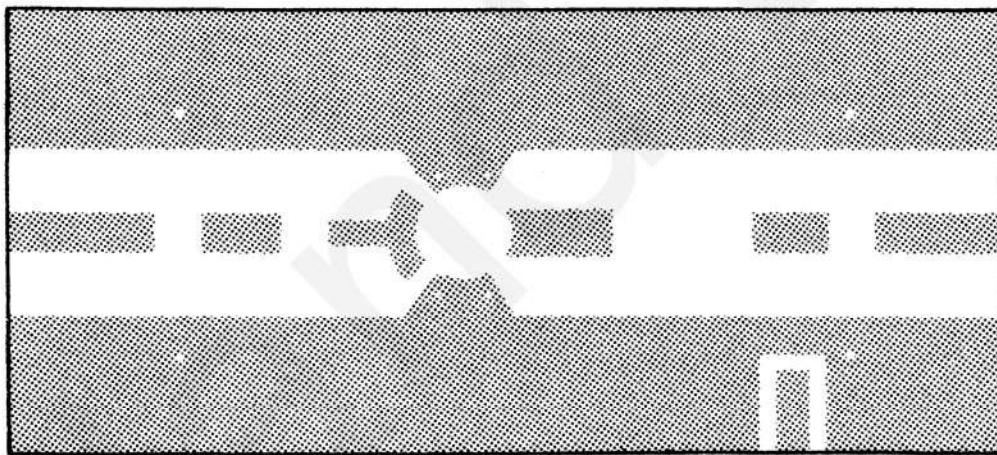
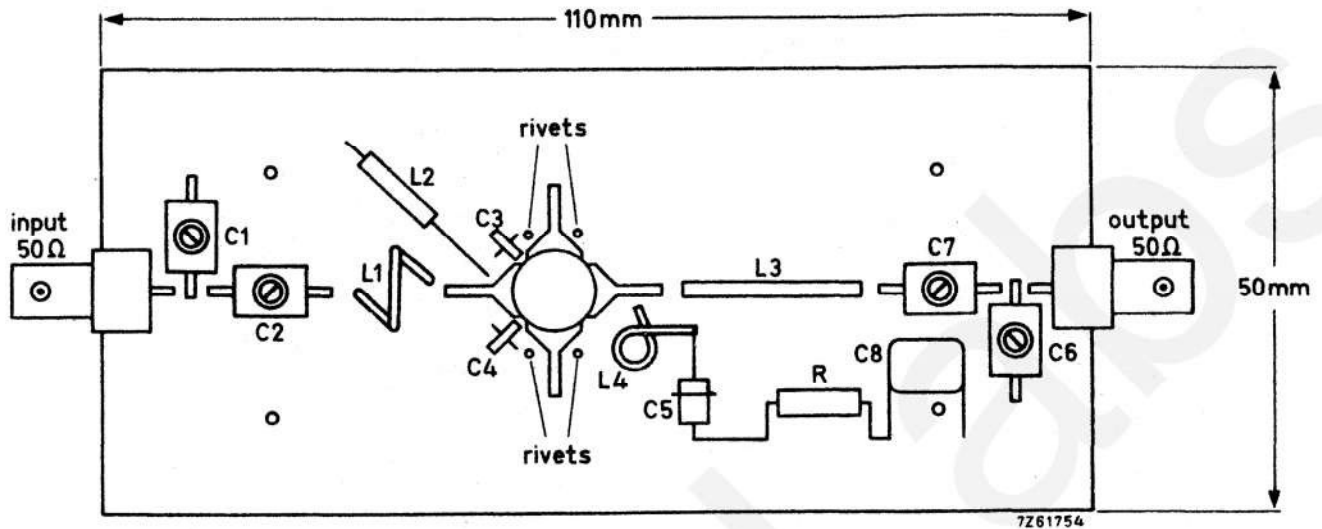
V.S.W.R. = 50 : 1 through all phases;  $P_S = P_{Snom} + 20\%$

where  $P_{Snom} = P_S$  for 2.5 W transistor output into 50 Ω load at  $V_{CC} = 13.8\text{ V}$

Component lay-out for 470 MHz see page 7

APPLICATION INFORMATION (continued)

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

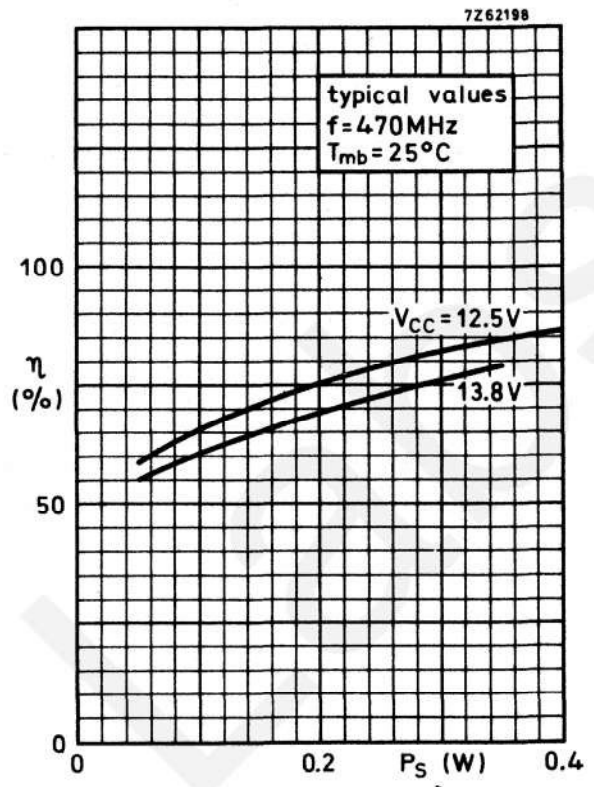
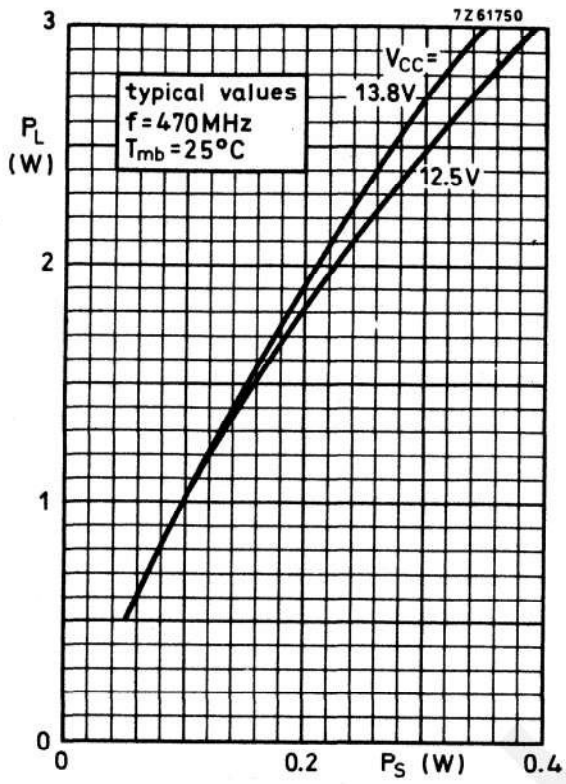


Shaded area copper

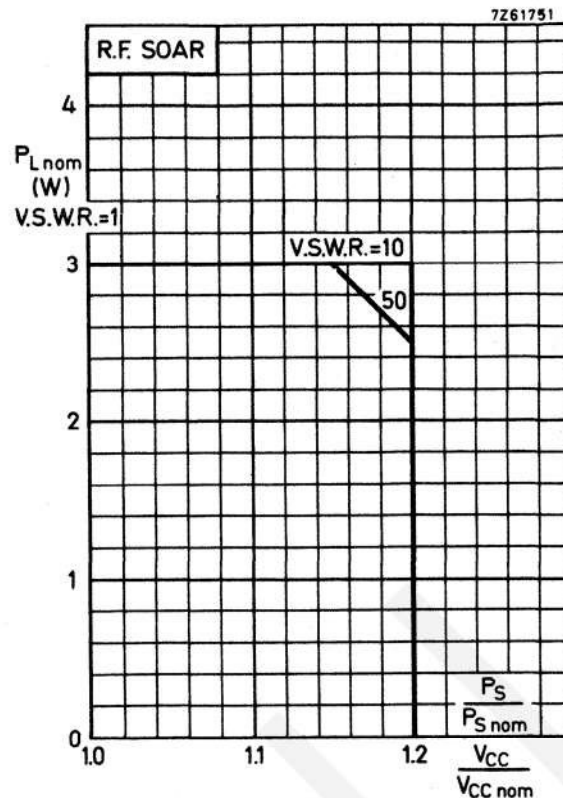
Back area completely copper clad

Material of printed circuit board: 1.5 mm epoxy fibre glass









#### Conditions for R. F. SOAR

$$f = 470 \text{ MHz}$$

$$P_{Snom} = P_S \text{ at } V_{CC} = V_{CCnom} \text{ and } V.S.W.R. = 1$$

$$T_{mb} = 70 \text{ }^\circ\text{C}$$

$$V_{CCnom} = 13.8 \text{ V}$$

see also page 6

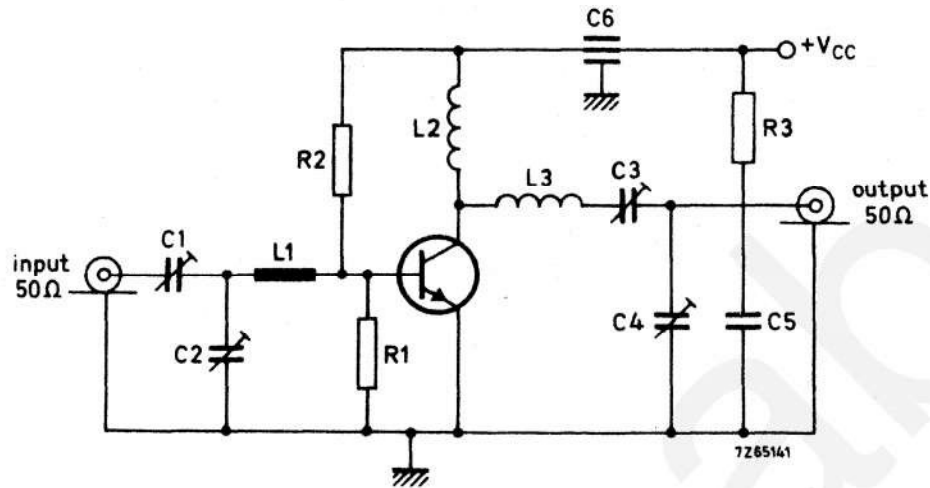
The transistor was developed for use with unstabilized supply voltage  $V_{CC}$ .

The above graph is based on its measured performance in the circuit given on page 6. Supply voltage was varied from  $V_{CCnom}$  to  $1.2 V_{CCnom}$ , and V.S.W.R. from 1 to 50. It shows the max. allowable output power under nominal conditions in order not to exceed the max. allowable power dissipation under conditions of supply overvoltage ( $V_{CC} > V_{CCnom}$ ) and load mismatch ( $V.S.W.R. > 1$ ).

It is assumed that the drive power increases linearly with the supply voltage; i. e.  $P_S/P_{Snom} = V_{CC}/V_{CCnom}$ .

**APPLICATION INFORMATION (continued)**

Test circuit for 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 nF feed-through capacitor

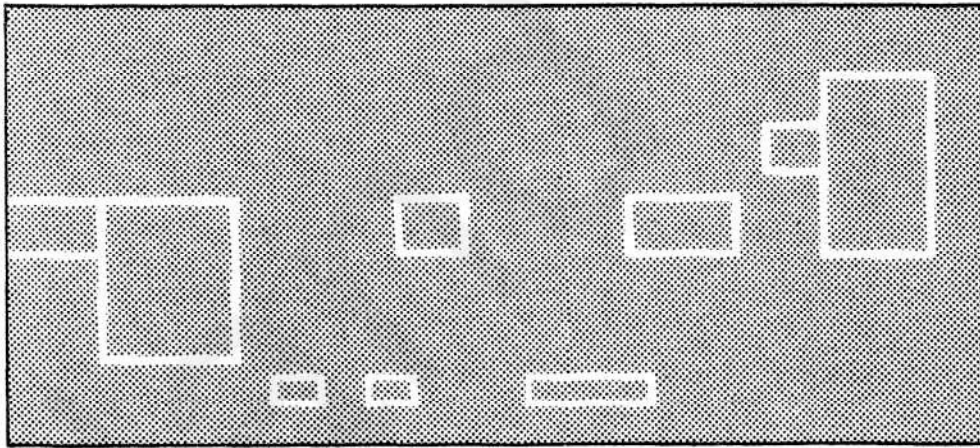
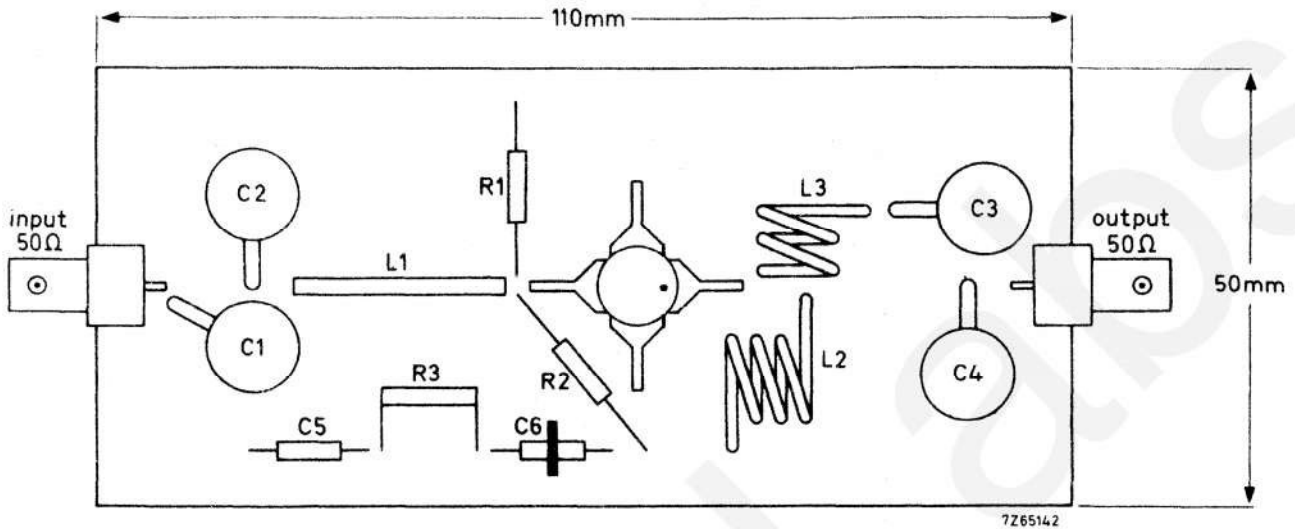
- L1 = 25 mm straight Cu wire (1.2 mm); height above print max. 3 mm
- L2 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; max. lead length 5 mm
- L3 = 2 turns closely wound Cu wire (1.7 mm); int. diam. 12 mm; max. lead length 5 mm

- R1 = 50  $\Omega$  carbon
- R2 = 1.2 k $\Omega$  carbon
- R3 = 5  $\Omega$  carbon

Component lay-out for 175 MHz see page 11.

APPLICATION INFORMATION (continued)

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



Shaded area copper

Back area not metallized

Material of printed circuit board: 1.5 mm epoxy fibre glass

**OPERATING NOTE** Below 280 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

