

PHILIPS INTERNATIONAL

## U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor suitable for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand infinite VSWR at rated output power. High reliability is ensured by a gold sandwich metallization.

The transistor is housed in a ¼" capstan envelope with a ceramic cap. All leads are isolated from the stud.

### QUICK REFERENCE DATA

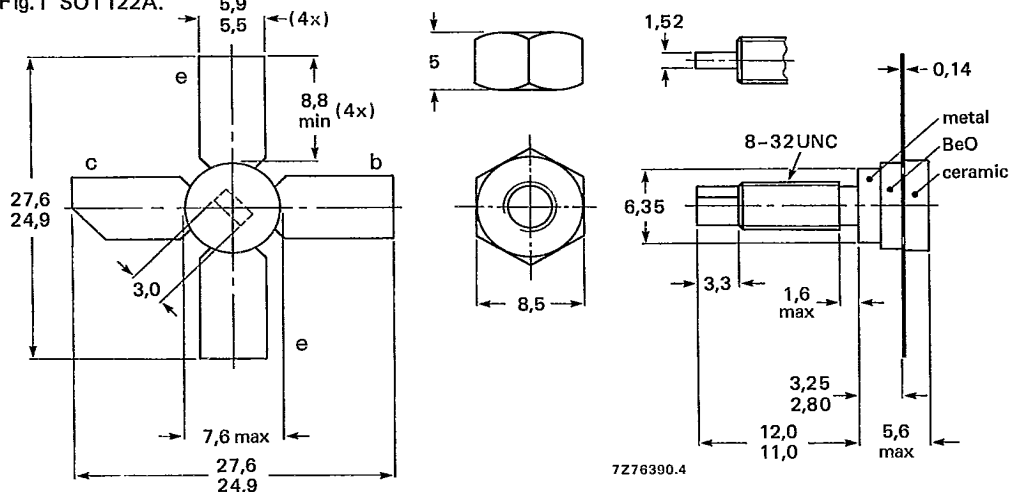
R.F. performance up to  $T_h = 25^\circ\text{C}$  in an unneutralized common-emitter class-B circuit

mode of operation	$V_{CE}$ V	f MHz	$P_L$ W	$G_p$ dB	$\eta$ %
c.w.	28	470	10	>9	>60

### MECHANICAL DATA

Dimensions in mm

Fig.1 SOT122A.



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

(peak value);  $V_{BE} = 0$ 

open base

 $V_{CESM}$  max. 60 V $V_{CEO}$  max. 30 V

Emitter-base voltage (open collector)

 $V_{EBO}$  max. 4 V

Collector current

d.c. or average

 $I_C; I_{C(AV)}$  max. 1,5 A(peak value);  $f > 1$  MHz $I_{CM}$  max. 3,5 ATotal power dissipation up to  $T_{mb} = 35$  °C $P_{tot}$  max. 30 WR.F. power dissipation ( $f > 1$  MHz);  $T_{mb} = 25$  °C $P_{rf}$  max. 32,5 W

Storage temperature

 $T_{stg}$  -65 to +150 °C

Operating junction temperature

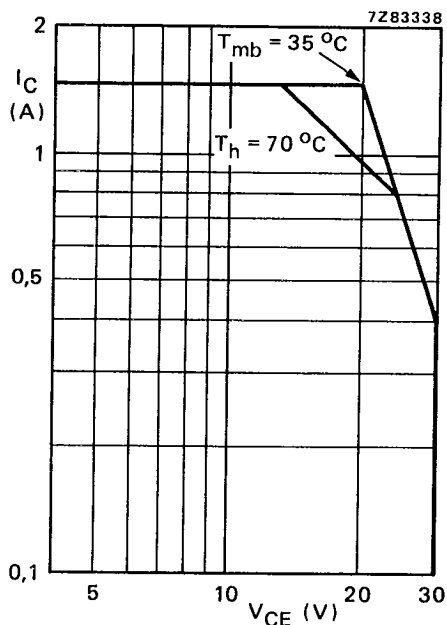
 $T_j$  max. 200 °C

Fig. 2 D.C. SOAR.

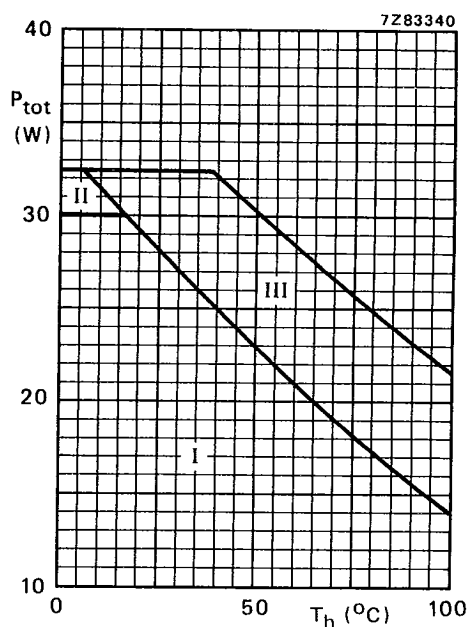


Fig. 3 Power derating curves vs. temperature.

I Continuous d.c. operation

II Continuous r.f. operation

III Short-time operation during mismatch

**THERMAL RESISTANCE** (dissipation = 10 W;  $T_{mb} = 76$  °C, i.e.  $T_h = 70$  °C)

From junction to mounting base (d.c. and r.f. dissipation)

 $R_{th\ j-mb}$  = 6,2 K/W

From mounting base to heatsink

 $R_{th\ mb-h}$  = 0,6 K/W

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## CHARACTERISTICS

 $T_j = 25\text{ }^\circ\text{C}$ 

Collector-emitter breakdown voltage

 $V_{BE} = 0; I_C = 10\text{ mA}$  $V_{(BR)CES} > 60\text{ V}$ 

Collector-emitter breakdown voltage

open base;  $I_C = 50\text{ mA}$  $V_{(BR)CEO} > 30\text{ V}$ 

Emitter-base breakdown voltage

open collector;  $I_E = 4\text{ mA}$  $V_{(BR)EBO} > 4\text{ V}$ 

Collector cut-off current

 $V_{BE} = 0; V_{CE} = 30\text{ V}$  $I_{CES} < 4\text{ mA}$ Second breakdown energy;  $L = 25\text{ mH}; f = 50\text{ Hz}$ 

open base

 $R_{BE} = 10\text{ }\Omega$  $ESBO > 2\text{ mJ}$  $ESBR > 2\text{ mJ}$ 

D.C. current gain \*

 $I_C = 0,6\text{ A}; V_{CE} = 5\text{ V}$  $h_{FE}$  typ. 40  
10 to 100

Collector-emitter saturation voltage \*

 $I_C = 2,0\text{ A}; I_B = 0,4\text{ A}$  $V_{CEsat}$  typ. 1,0 VTransition frequency at  $f = 500\text{ MHz}$  \* $-I_E = 0,6\text{ A}; V_{CB} = 28\text{ V}$  $f_T$  typ. 1,2 GHz $-I_E = 2,0\text{ A}; V_{CB} = 28\text{ V}$  $f_T$  typ. 1,0 GHzCollector capacitance at  $f = 1\text{ MHz}$  $I_E = I_e = 0; V_{CB} = 28\text{ V}$  $C_C$  typ. 17 pFFeedback capacitance at  $f = 1\text{ MHz}$  $I_C = 20\text{ mA}; V_{CE} = 28\text{ V}$  $C_{re}$  typ. 8,5 pF

Collector-stud capacitance

 $C_{cs}$  typ. 1,2 pF\* Measured under pulse conditions:  $t_p \leq 200\text{ }\mu\text{s}; \delta \leq 0,02$ .

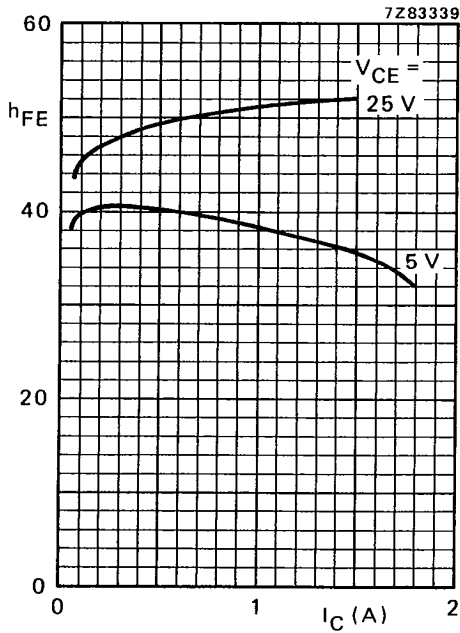


Fig. 4 Typical values;  $T_j = 25\text{ }^\circ\text{C}$ .

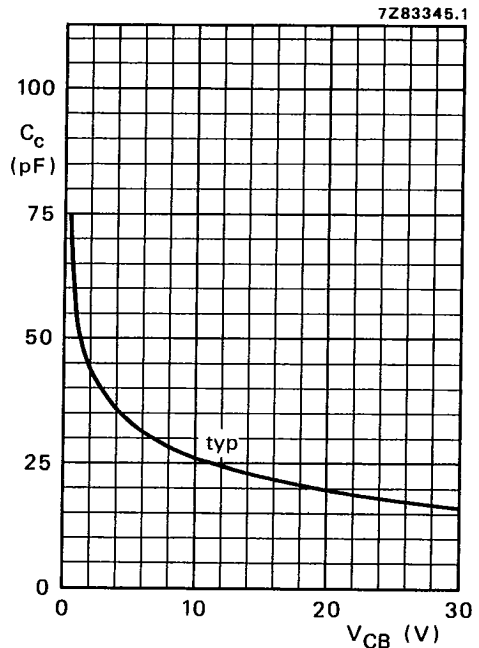


Fig. 5  $I_E = I_e = 0$ ;  $f = 1\text{ MHz}$ ;  $T_j = 25\text{ }^\circ\text{C}$ .

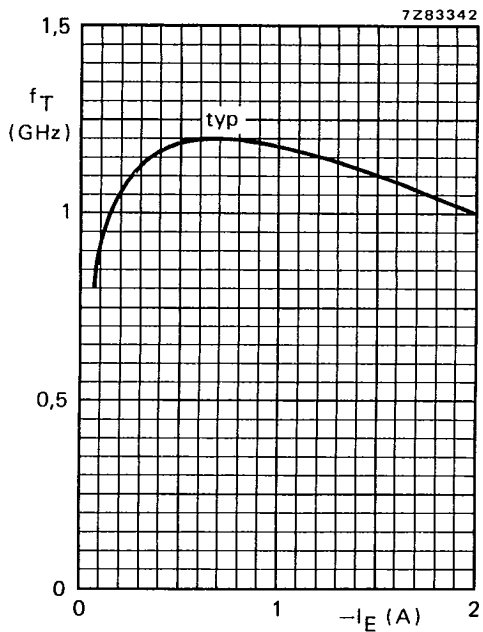


Fig. 6  $V_{CB} = 28\text{ V}$ ;  $f = 500\text{ MHz}$ ;  $T_j = 25\text{ }^\circ\text{C}$ .

## APPLICATION INFORMATION

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

 $T_h = 25\text{ }^\circ\text{C}$ 

f (MHz)	$V_{CE}$ (V)	$P_L$ (W)	$P_S$ (W)	$G_p$ (dB)	$I_C$ (A)	$\eta$ (%)	$\bar{z}_i$ ( $\Omega$ )	$\bar{z}_L$ ( $\Omega$ )
470	28	10	< 1,26 >	9	< 0,6 >	> 60	$1,0 + j2,1$	$4,9 + j11$
470	28	10	typ. 0,9	typ. 10,5	typ. 0,56	typ. 63	—	—

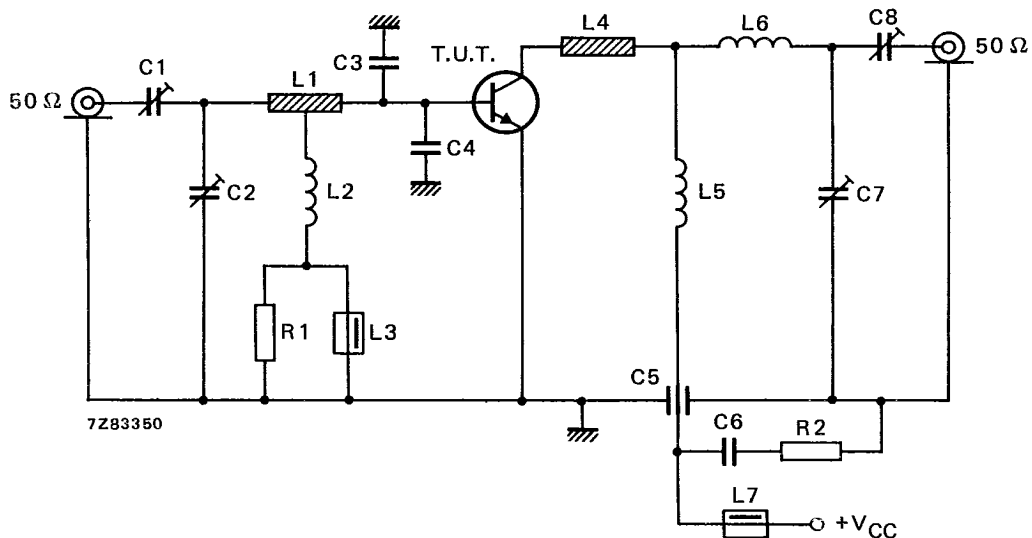


Fig. 7 Test circuit; c.w. class-B. For component layout and p.c.b. see Fig. 8.

List of components:

C1 = C7 = C8 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)

C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)

C3 = C4 = 15 pF multilayer ceramic chip capacitor (cat. no. 2222 851 13159), middle of capacitor 3 mm from transistor edge

C5 = 100 pF feed-through capacitor

C6 = 100 nF polyester capacitor

L1 = stripline (30,4 mm x 6,0 mm); tap for L2 placed 11 mm from transistor edge

L2 = 320 nH; 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; leads 2 x 4 mm

L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)

L4 = stripline (12,0 mm x 6,0 mm)

L5 = 78 nH; 5 turns enamelled Cu wire (1,0 mm); int. dia. 5 mm; length 9,3 mm; leads 2 x 5 mm

L6 = 22 nH; 2 turns enamelled Cu wire (1,0 mm); int. dia. 4 mm; length 3,2 mm; leads 2 x 5 mm

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric ( $\epsilon_r = 2,74$ ); thickness 1/16".R1 = R2 = 10  $\Omega$  carbon resistor

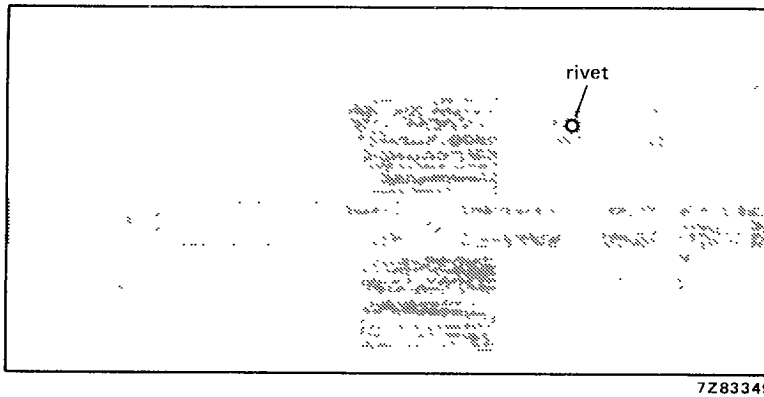
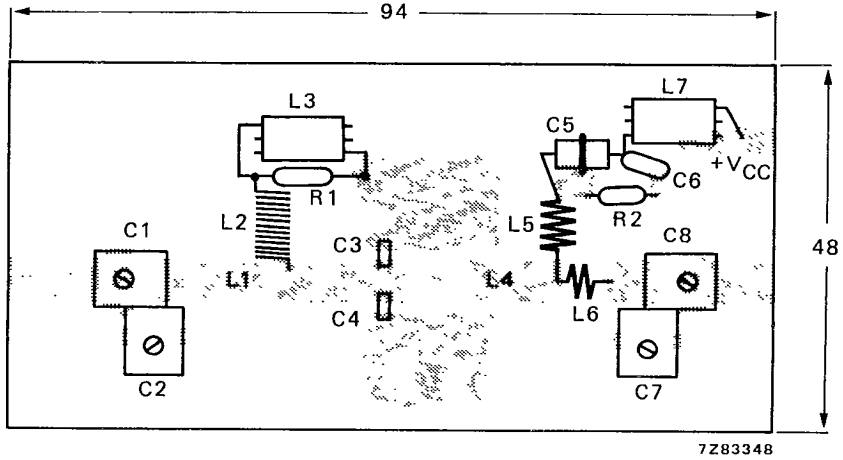


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE 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.

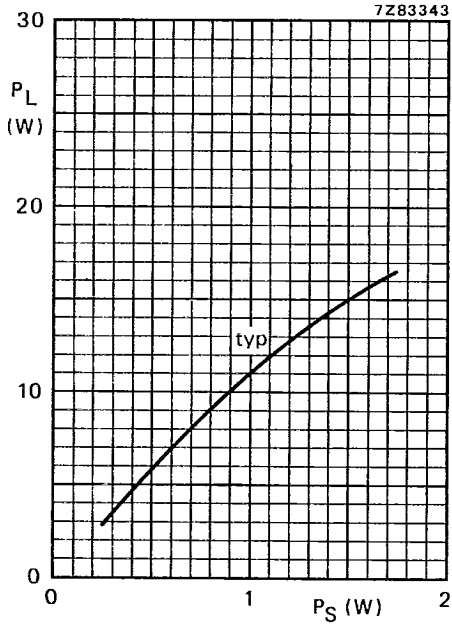


Fig. 9  $V_{CE} = 28$  V;  $f = 470$  MHz;  $T_h = 25$  °C.

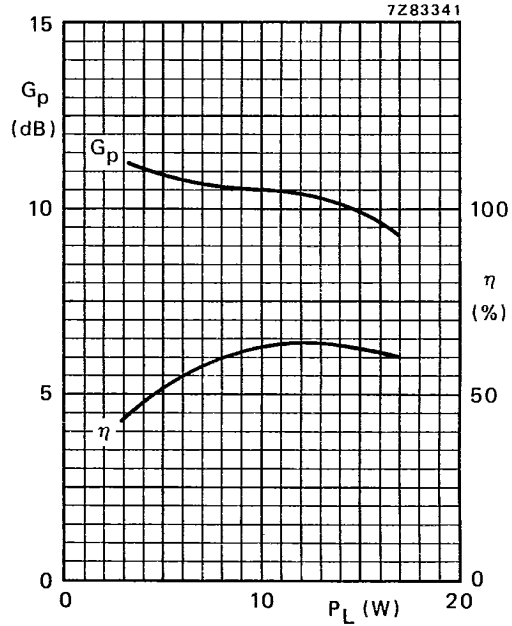


Fig. 10 Typical values;  $V_{CE} = 28$  V;  $f = 470$  MHz;  $T_h = 25$  °C.

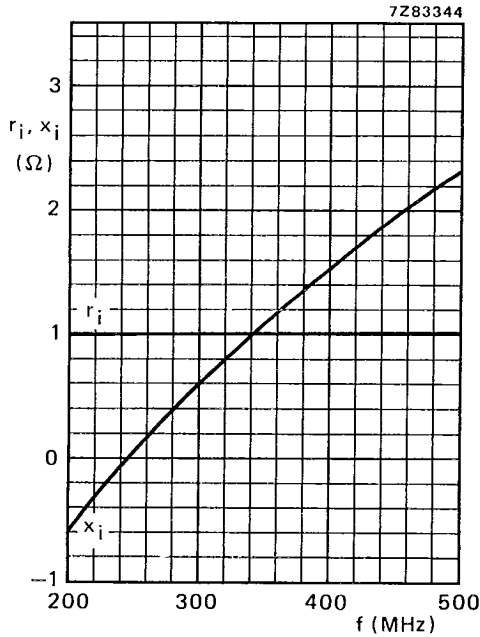


Fig. 11 Input impedance (series components).

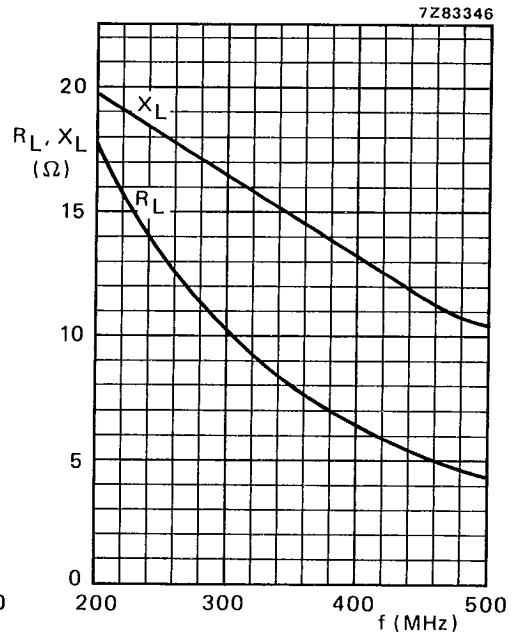


Fig. 12 Load impedance (series components).

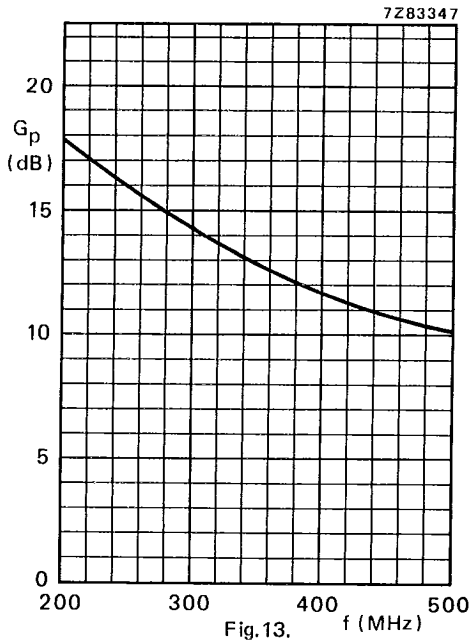


Fig. 13.

Conditions for Figs 11, 12 and 13:

Typical values;  $V_{CE} = 28 \text{ V}$ ;  $P_L = 10 \text{ W}$ ;  
 $T_h = 25 \text{ }^\circ\text{C}$ .

**Ruggedness**

The BLW91 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 10 W under the following conditions:

$V_{CE} = 28 \text{ V}$ ;  $f = 470 \text{ MHz}$ ;  $T_h = 70 \text{ }^\circ\text{C}$ ;  
 $R_{th \text{ mb-h}} = 0,6 \text{ K/W}$ .