

## V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers. Diffused emitter ballasting resistors and the application of **gold sandwich metallization** ensure an optimum temperature profile and excellent reliability properties.

The transistor has a  $\frac{1}{4}$ " capstan envelope with ceramic cap. All leads are isolated from the stud.

### QUICK REFERENCE DATA

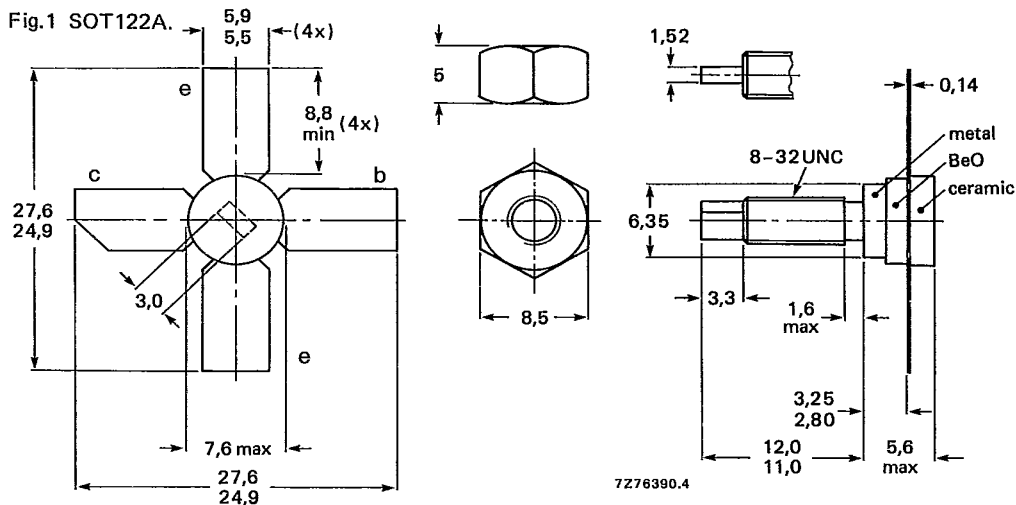
R.F. performance mode of operation	$f_{\text{vision}}$ MHz	$V_{\text{CE}}$ V	$I_{\text{C}}$ A	$T_{\text{h}}$ °C	$d_{\text{im}}^*$ dB	$P_{\text{O sync}}^*$ W	$G_{\text{p}}$ dB
class-A; linear amplifier	224,25 224,25	25 25	0,46 0,46	70 25	-60 -60	> 1,5 typ. 1,7	> 18 typ. 20

\* Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

### 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);  $V_{BE} = 0$

$V_{CESM}$  max. 60 V

open base

$V_{CEO}$  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 A

Total power dissipation at  $T_{mb} = 25$  °C

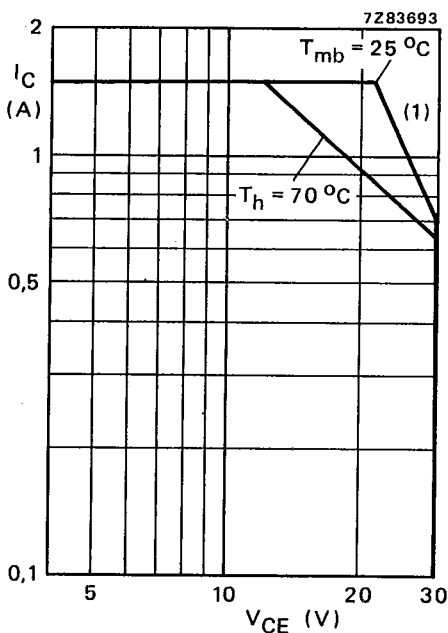
$P_{tot}$  max. 32,5 W

Storage temperature

$T_{stg}$  -65 to +150 °C

Operating junction temperature

$T_j$  max. 200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

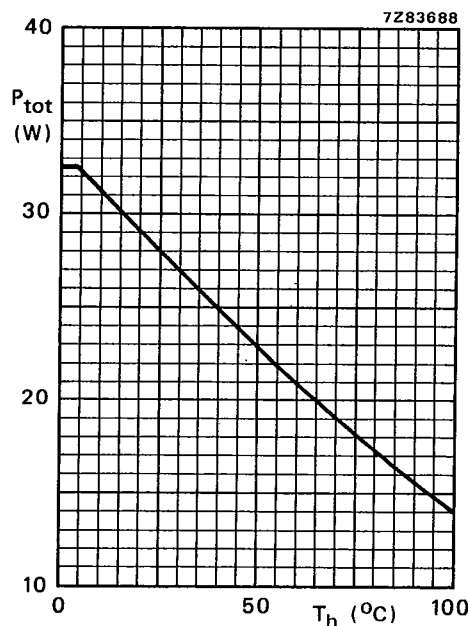


Fig. 3 Power derating curve vs. temperature.

**THERMAL RESISTANCE** (see Fig. 4)

From junction to mounting base

(dissipation = 12 W;  $T_{mb} = 77$  °C; i.e.  $T_h = 70$  °C)

$R_{thj-mb} = 5,6$  K/W

From mounting base to heatsink

$R_{thmb-h} = 0,6$  K/W

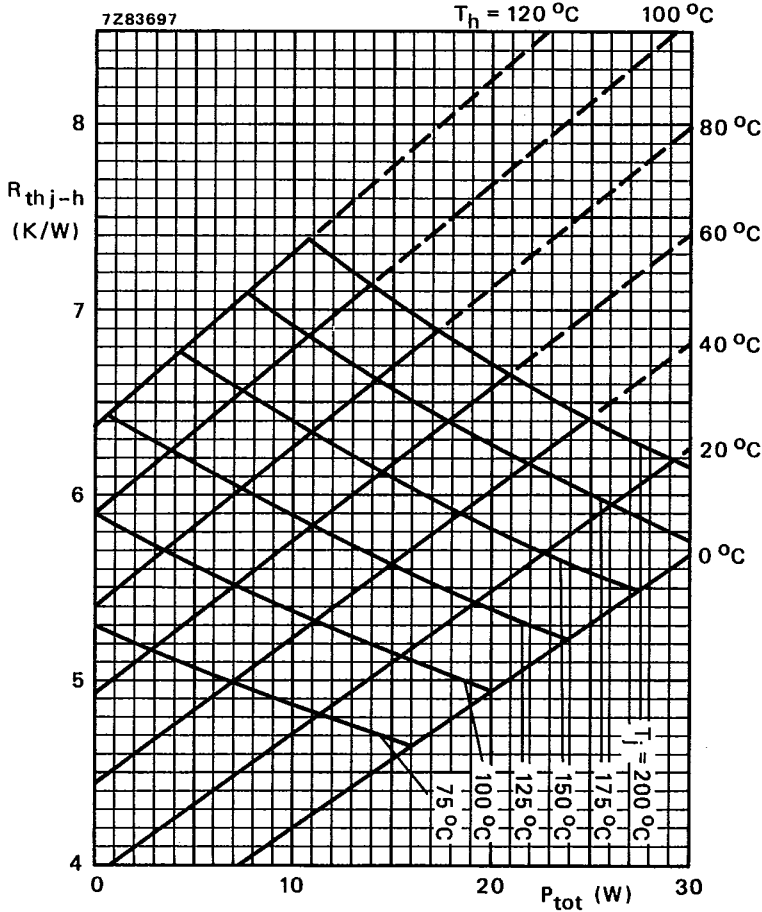


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ( $R_{th\ mb-h} = 0,6\text{ K/W}$ ).

**Example**

Nominal class-A operation;  $V_{CE} = 25\text{ V}$ ;  $I_C = 0,46\text{ A}$ ;  $T_h = 70\text{ °C}$ .

Fig. 4 shows:  $R_{th\ j-h}$  max. 6,13 K/W  
 $T_j$  max. 140,5 °C

Typical device:  $R_{th\ j-h}$  typ. 5,45 K/W  
 $T_j$  typ. 133 °C

## CHARACTERISTICS

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

Collector-emitter breakdown voltage

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

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

D.C. current gain \*

 $I_C = 0,5\text{ A}; V_{CE} = 25\text{ V}$  $h_{FE}$  typ. 65  
15 to 120

Collector-emitter saturation voltage \*

 $I_C = 1,0\text{ A}; I_B = 0,1\text{ A}$  $V_{CEsat}$  typ. 0,8 VTransition frequency at  $f = 500\text{ MHz}$  \*\* $-I_E = 0,5\text{ A}; V_{CB} = 25\text{ V}$  $f_T$  typ. 1,20 GHz $-I_E = 1,0\text{ A}; V_{CB} = 25\text{ V}$  $f_T$  typ. 1,15 GHzCollector capacitance at  $f = 1\text{ MHz}$  $I_E = I_e = 0; V_{CB} = 25\text{ V}$  $C_c$  typ. 18 pFFeedback capacitance at  $f = 1\text{ MHz}$  $I_C = 20\text{ mA}; V_{CE} = 25\text{ V}$  $C_{re}$  typ. 9,2 pF

Collector-stud capacitance

 $C_{cs}$  typ. 1,2 pF\* Measured under pulse conditions:  $t_p \leq 300\ \mu\text{s}; \delta \leq 0,02$ .\*\* Measured under pulse conditions:  $t_p \leq 50\ \mu\text{s}; \delta \leq 0,01$ .

PHILIPS INTERNATIONAL

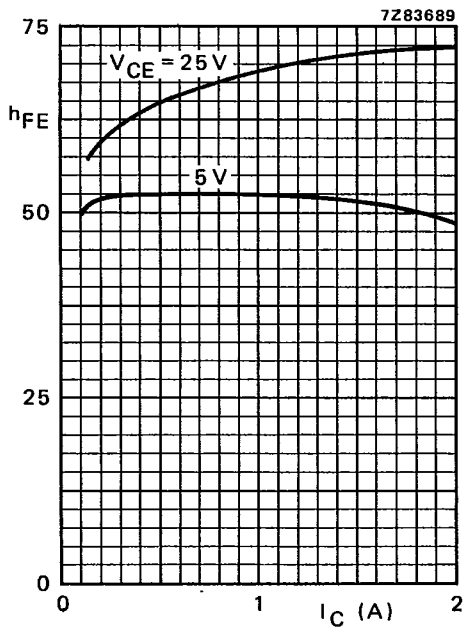


Fig. 5 Typical values;  $T_j = 25^\circ\text{C}$ .

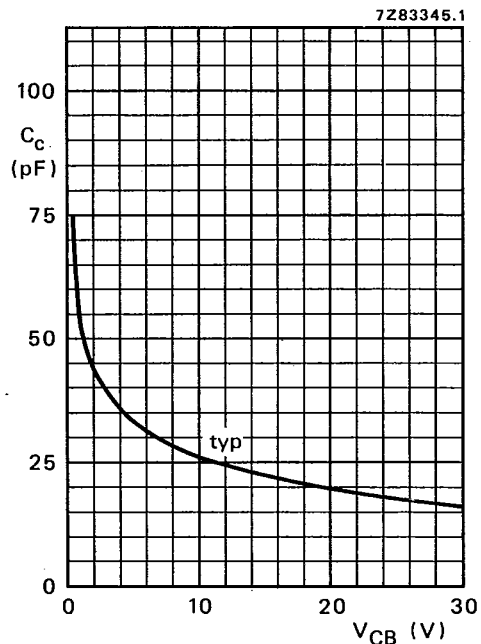


Fig. 6  $I_E = I_e = 0$ ;  $f = 1\text{ MHz}$ ;  $T_j = 25^\circ\text{C}$ .

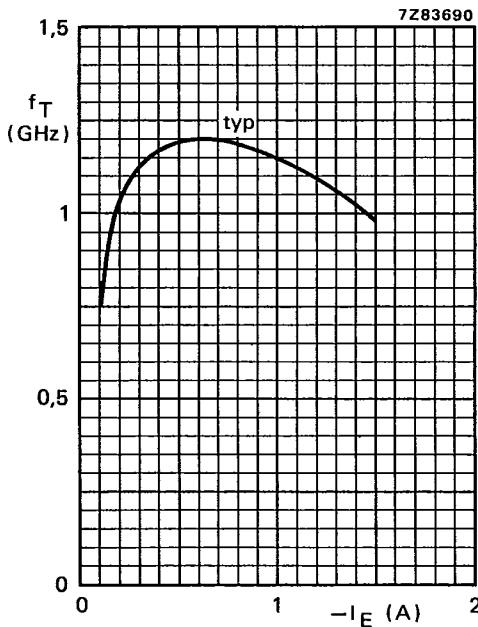


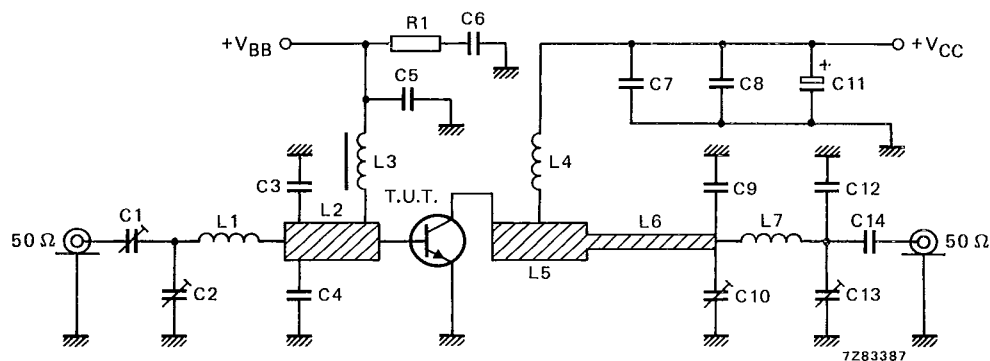
Fig. 7  $V_{CB} = 25\text{ V}$ ;  $f = 500\text{ MHz}$ ;  $T_j = 25^\circ\text{C}$ .

## APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

$f_{\text{vision}}$ (MHz)	$V_{\text{CE}}$ (V)	$I_{\text{C}}$ (A)	$T_{\text{h}}$ (°C)	$d_{\text{im}}$ (dB)*	$P_{\text{o sync}}$ (W)*	$G_{\text{p}}$ (dB)
224,25	25	0,46	70	-60	> 1,5	> 18
224,25	25	0,46	70	-60	typ. 1,7	typ. 19,5
224,25	25	0,46	25	-60	typ. 1,8	typ. 20

\* Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB), zero dB corresponds to peak sync level.

Fig. 8 Test circuit at  $f_{\text{vision}} = 224,25$  MHz.

## List of components:

C1 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)

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

C3 = C4 = 82 pF multilayer ceramic chip capacitor (ATC<sup>▲</sup>), placed 7 mm from transistor edge

C5 = C7 = C14 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)

C6 = C8 = 330 nF polyester capacitor

C9 = 43 pF (500 V) multilayer ceramic chip capacitor (ATC<sup>▲</sup>)

C10 = C13 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)

C11 = 10  $\mu$ F/40 V solid aluminium electrolytic capacitorC12 = 18 pF (500 V) multilayer ceramic chip capacitor (ATC<sup>▲</sup>)

L1 = 49 nH; 4 turns enamelled Cu wire (1,0 mm); int. dia. 3,6 mm; length 6,3 mm; leads 2 x 5 mm

L2 = L5 = 30  $\Omega$  stripline (10,0 mm x 6,0 mm)L3 = 0,1  $\mu$ H; microchoke (cat. no. 4322 057 01070)

L4 = 130 nH; 6 turns enamelled Cu wire (1,0 mm); int. dia. 6,0 mm; length 10,7 mm; leads 2 x 5 mm

L6 = 60  $\Omega$  stripline (50,5 mm x 2,0 mm)

L7 = 30 nH; 4 turns enamelled Cu wire (1,0 mm); int. dia. 3,0 mm; length 7,9 mm; leads 2 x 5 mm

L2, L5 and L6 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ( $\epsilon_r \approx 4,5$ ); thickness 1/16".R1 = 10  $\Omega$  carbon resistor

▲ ATC means American Technical Ceramics.

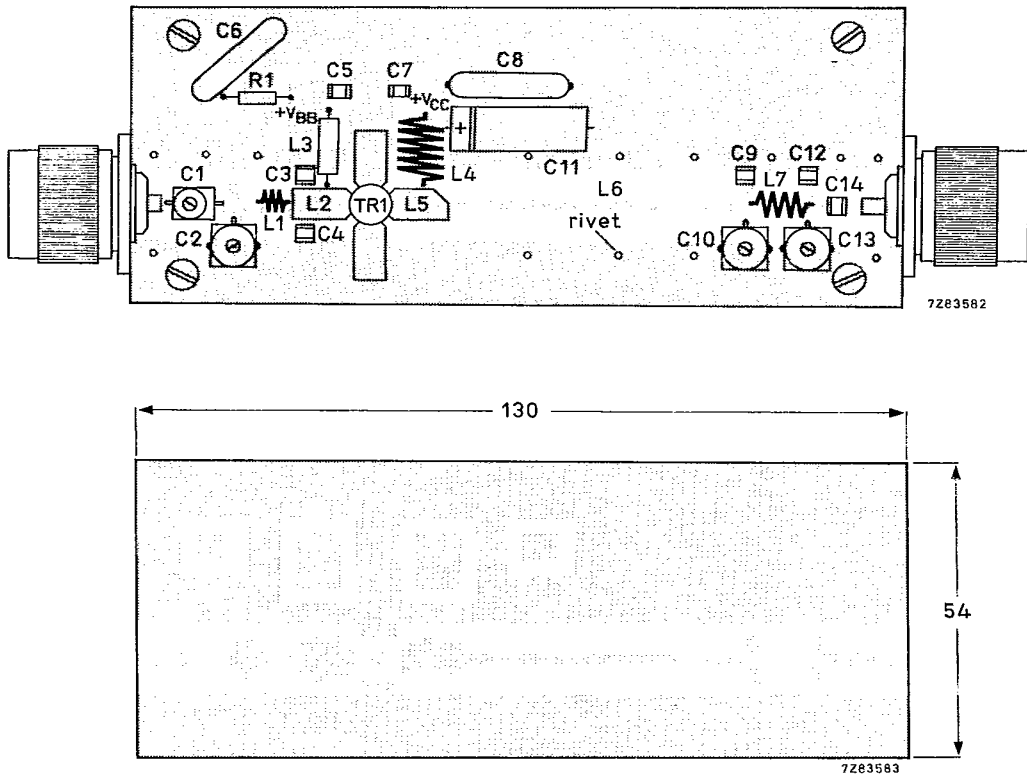


Fig. 9 Component layout and printed-circuit board for 224,25 MHz test circuit.

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.

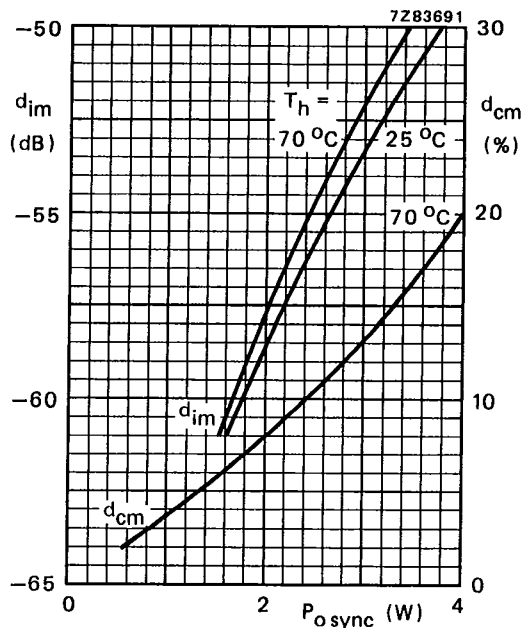


Fig. 10 Intermodulation distortion ( $d_{im}^*$ ) and cross-modulation distortion ( $d_{cm}^{**}$ ) as a function of output power.

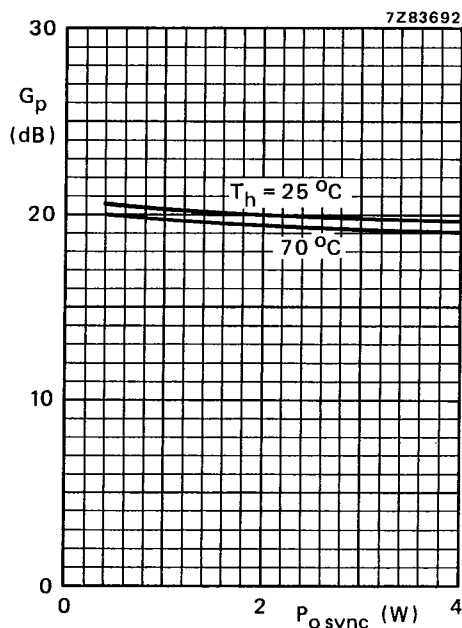


Fig. 11 Power gain as a function of output power.

Conditions for Figs 10 and 11:

Typical values;  $V_{CE} = 25\text{ V}$ ;  $I_C = 0,46\text{ A}$ ;  $f_{\text{vision}} = 224,25\text{ MHz}$ .

- \* Three-tone test method (vision carrier  $-8\text{ dB}$ , sound carrier  $-7\text{ dB}$ , sideband signal  $-16\text{ dB}$ ), zero dB corresponds to peak sync level.  
Intermodulation distortion of input signal  $\leq -75\text{ dB}$ .
- \*\* Two-tone test method (vision carrier  $0\text{ dB}$ , sound carrier  $-7\text{ dB}$ ), zero dB corresponds to peak sync level.  
Cross-modulation distortion ( $d_{cm}$ ) is the voltage variation (%) of sound carrier when vision carrier is switched from  $0\text{ dB}$  to  $-20\text{ dB}$ .



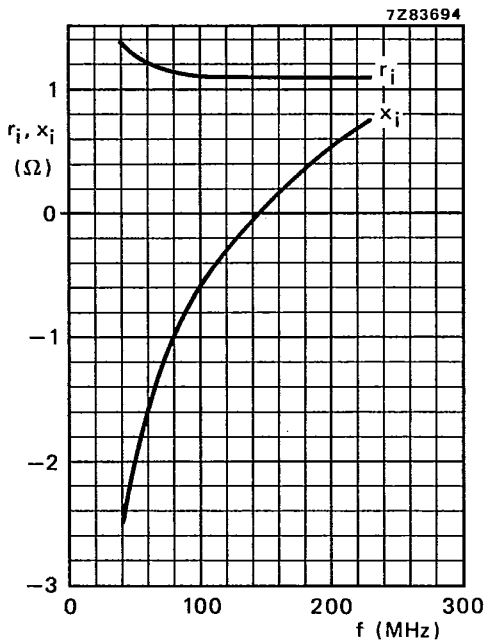


Fig. 12 Input impedance (series components).

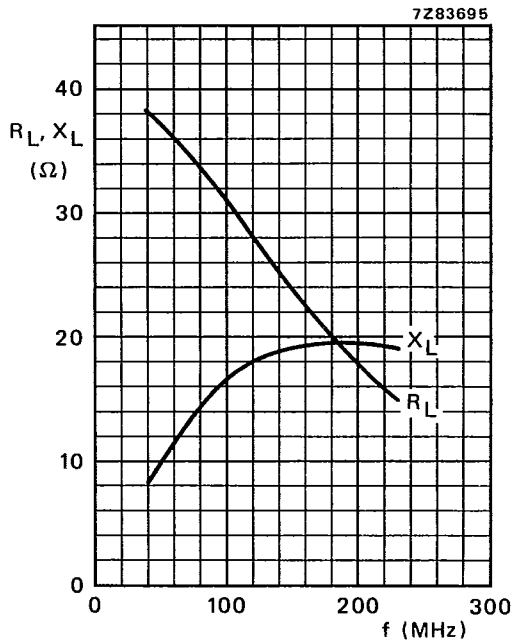


Fig. 13 Load impedance (series components).

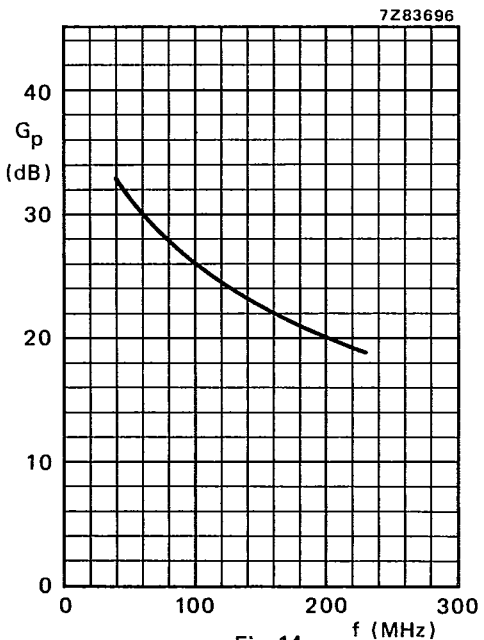


Fig. 14.

Conditions for Figs 12, 13 and 14:  
Typical values;  $V_{CE} = 25$  V;  $I_C = 0,46$  A;  
 $T_h = 70$  °C.