H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in class-A, AB and B operated, industrial and military transmitters in the h.f. and v.h.f. band. Resistance stabilization provides protection against device damage at severe load mismatch conditions. Matched h_{FE} groups are available on request.

It has a 3/8'' flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance

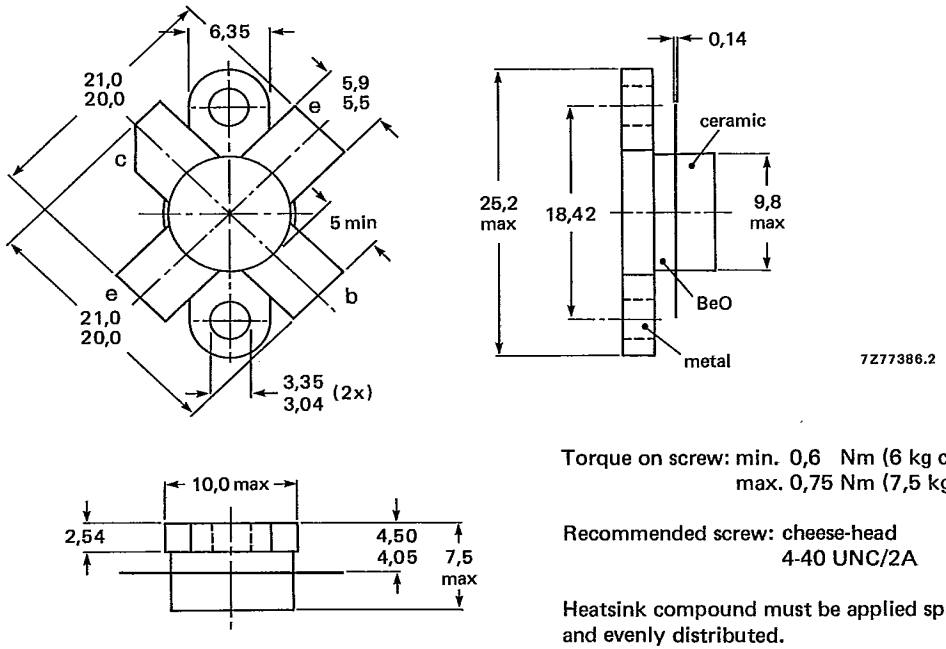
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	$I_{C(ZS)}$ mA	d_3 dB	T_h °C
s.s.b. (class-A)	45	1,6 - 28	0 - 16 (P.E.P.)	> 19,5	–	1,2	–	< –40	70
s.s.b. (class-AB)	50	1,6 - 28	10 - 65 (P.E.P.)	typ. 18	typ. 45*	1,45	50	typ. –30	25

* At 65W P.E.P.

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.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	110 V
Collector-emitter voltage (open base)	V_{CEO}	max.	55 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	2,5 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	7,5 A
D.C. and r.f. (f > 1 MHz) power dissipation; T_{mb} = 25 °C	P_{tot}; P_{rf}	max.	94 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

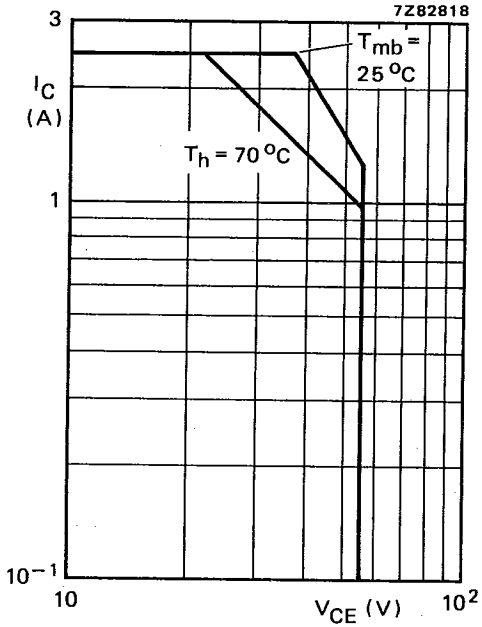


Fig. 2 D.C. SOAR.

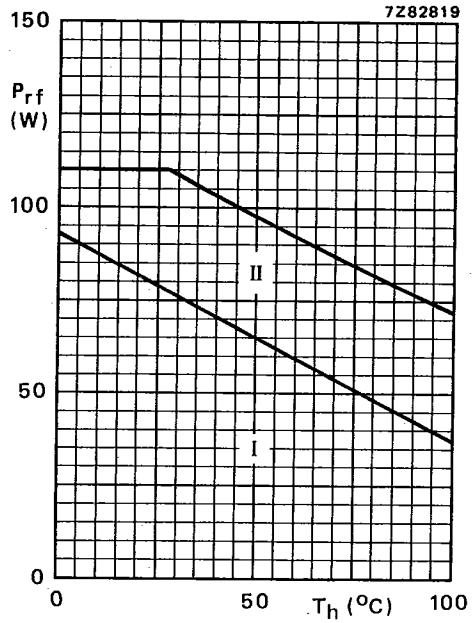


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. and r.f. operation
II Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 54 W; T_{mb} = 86 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. and r.f. dissipation)	$R_{th\ j\text{-}mb}$	=	2,1 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	110 V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	55 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} = 55 V	I_{CES}	<	10 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 = 1,2 A; V_{CE} = 5 V	h_{FE}	typ. 15 to 100	25
D.C. current gain ratio of matched devices* I_C = 1,2 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* I_C = 3,0 A; I_B = 0,6 A	V_{CEsat}	typ.	1,2 V
Transition frequency at f = 100 MHz*			
$-I_E$ = 1,2 A; V_{CB} = 45 V	f_T	typ.	490 MHz
$-I_E$ = 4,0 A; V_{CB} = 45 V	f_T	typ.	540 MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 45 V	C_c	typ.	53 pF
Feedback capacitance at f = 1 MHz I_C = 50 mA; V_{CE} = 45 V	C_{re}	typ.	35 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

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

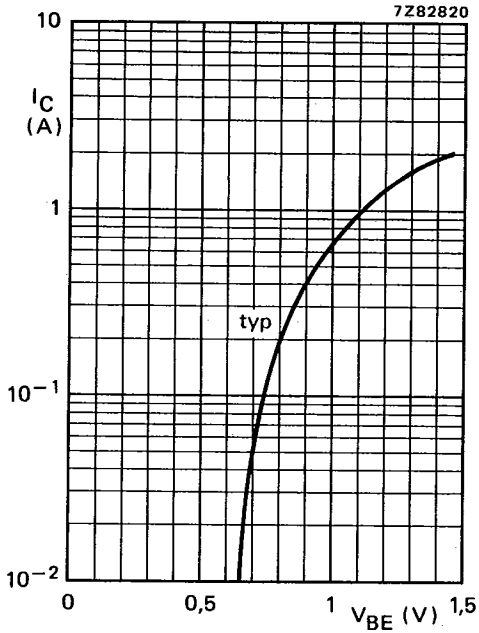


Fig. 4 V_{CE} = 40 V; T_{mb} = 25 °C.

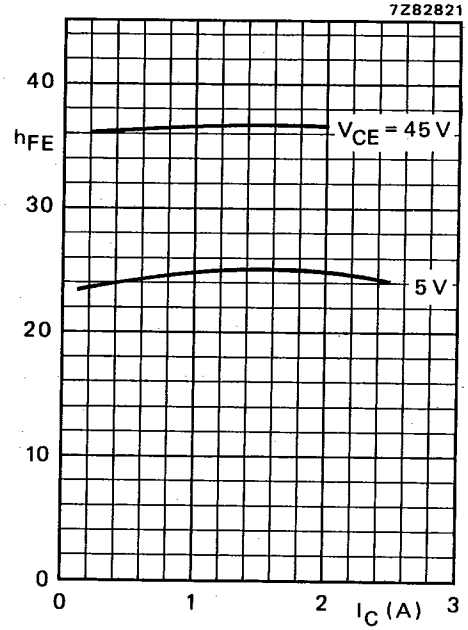


Fig. 5 Typical values; T_j = 25 °C.

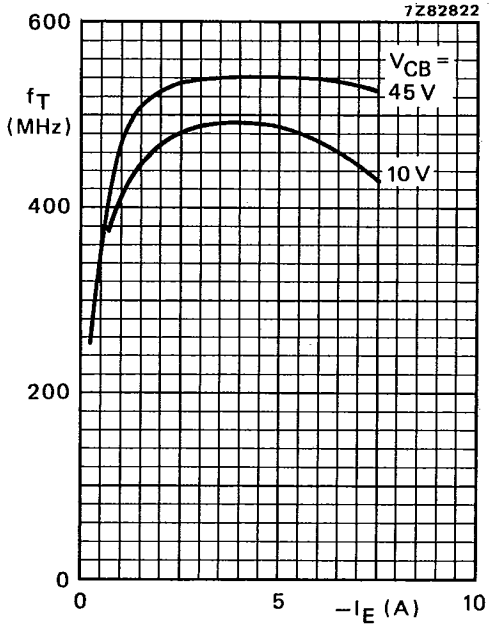


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

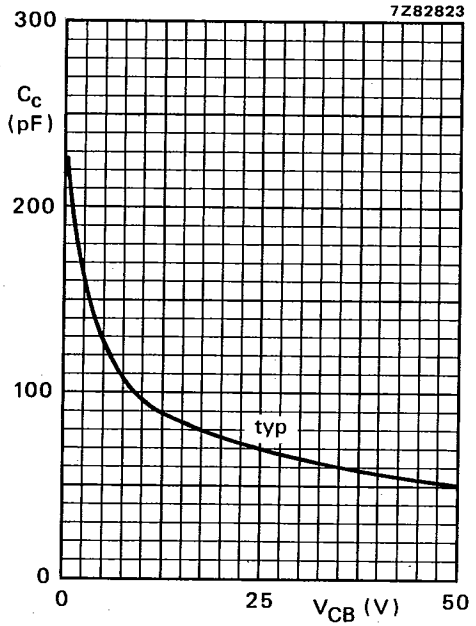


Fig. 7 $I_E = I_e$ = 0; f = 1 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 45 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3* dB	d_5* dB	T_h °C
> 16 (P.E.P.)	> 19,5	1,2	−40	<−40	70
typ. 17 (P.E.P.)	typ. 20,5	1,2	−40	<−40	70

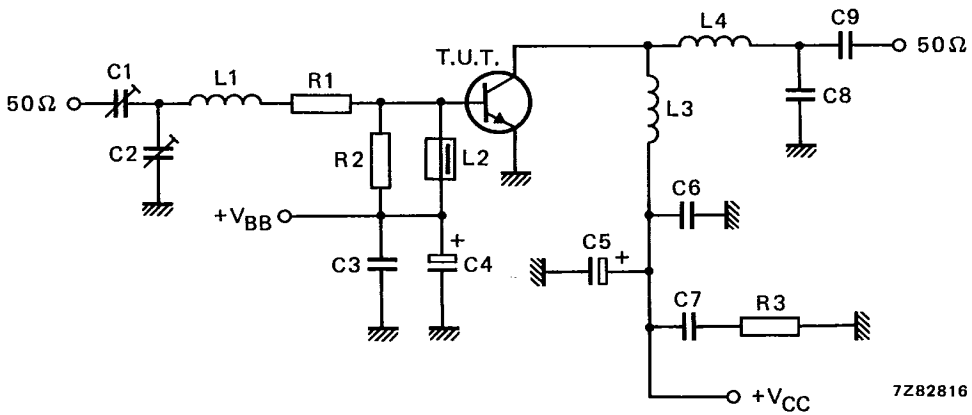


Fig. 8 Test circuit; s.s.b. class-A.

List of components in Fig. 8:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 4,7 μF/16 V electrolytic capacitor
C5 = 1 μF/75 V solid tantalum capacitor
C6 = C7 = 47 nF polyester capacitor (100 V)
C8 = 68 pF ceramic capacitor (500 V)
C9 = 3,9 nF ceramic capacitor

L1 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 1,05 μH; 15 turns enamelled Cu wire (1,0 mm); int. dia. 10,0 mm; length 17,4 mm; leads 2 x 5 mm
L4 = 162 nH; 6 turns enamelled Cu wire (1,0 mm); int. dia. 7,0 mm; length 11,6 mm; leads 2 x 5 mm

R1 = 1,6 Ω; parallel connection of 3 x 4,7 Ω carbon resistors (± 5%; 0,125 W)
R2 = 47 Ω carbon resistor (± 5%; 0,25 W)
R3 = 4,7 Ω carbon resistor (± 5%; 0,25 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

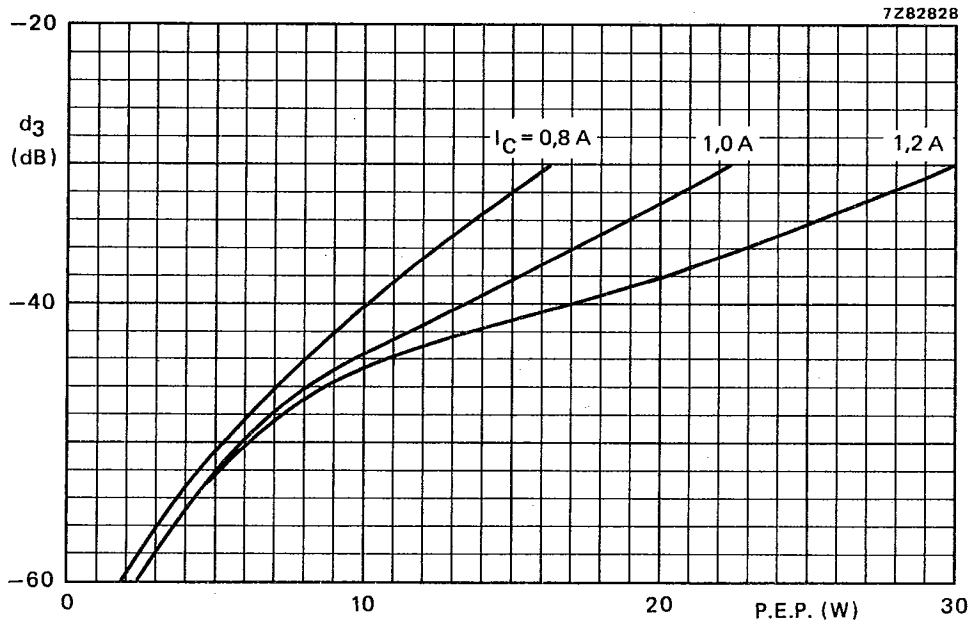


Fig. 9 Intermodulation distortion (see note on page 5) as a function of output power. Typical values; V_{CE} = 45 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)
V_{CE} = 50 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 65 W P.E.P.	I_C (A) at 65 W P.E.P.	d_3* dB	d_5* dB	$I_{C(ZS)}$ mA	T_h °C
10 to 65 (P.E.P.)	typ. 18	typ. 45	typ. 1,45	typ. −30	< −30	50	25

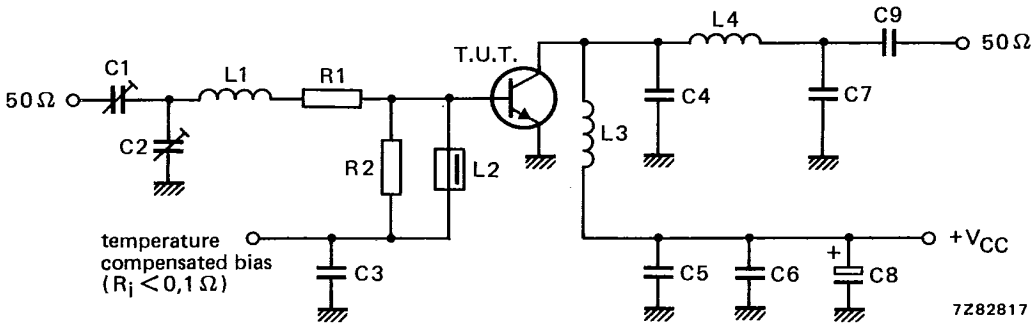


Fig. 10 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 120 pF ceramic capacitor (500 V)
C7 = 150 pF ceramic capacitor (500 V)
C8 = 47 μF/63 V electrolytic capacitor
C9 = 3,9 nF ceramic capacitor

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 9 turns enamelled Cu wire (1,0 mm); int. dia. 10 mm; length 14,5 mm; leads 2 x 5 mm
L4 = 6 turns enamelled Cu wire (1,0 mm); int. dia. 6,5 mm; length 11,0 mm; leads 2 x 5 mm

R1 = 2,4 Ω; parallel connection of 2 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

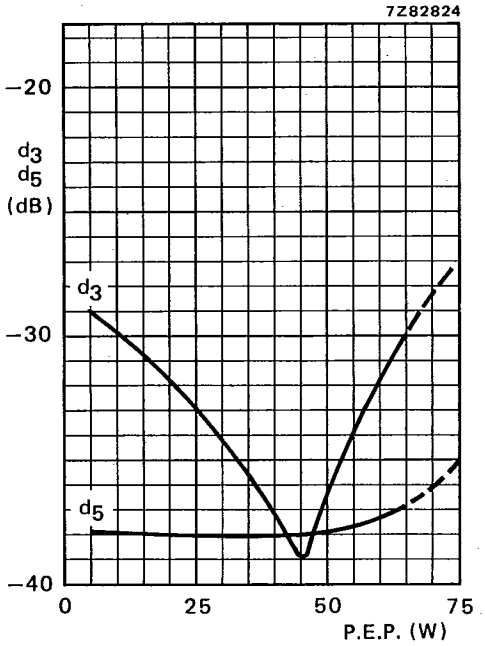


Fig. 11 Intermodulation distortion as a function of output power*.

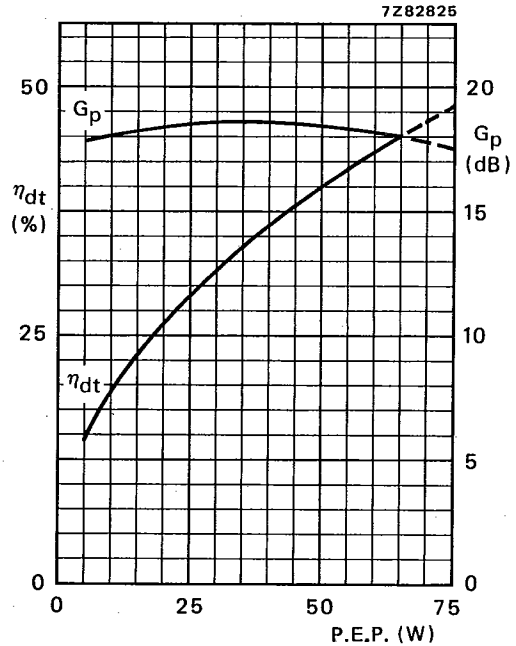


Fig. 12 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 11 and 12:

V_{CE} = 50 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Ruggedness in s.s.b. operation

The BLW50F is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 45 W (P.E.P.) under the following conditions:

V_{CE} = 50 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,3 K/W.

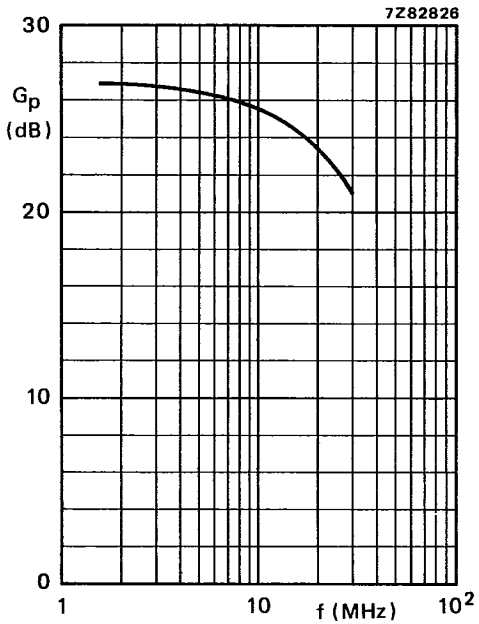


Fig. 13 Power gain as a function of frequency.

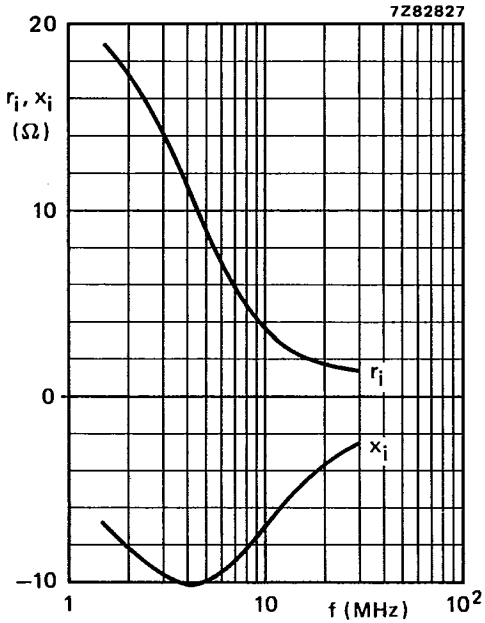


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions for Figs 13 and 14:

V_{CE} = 50 V; $I_{C(ZS)}$ = 50 mA; P_L = 60 W; T_h = 25 °C; Z_L = 16 Ω.