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

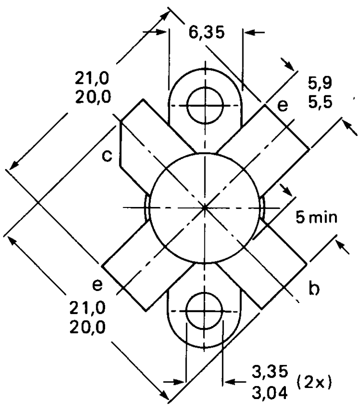
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	$I_{C(ZS)}$ mA	d_3 dB	T_h °C
s.s.b. (class-A)	45	1,6 - 28	0 - 16 (P.E.P.)	> 19,5	–	1,2	–	< −40	70
s.s.b. (class-AB)	50	1,6 - 28	10 - 65 (P.E.P.)	typ. 18	typ. 45*	1,45	50	typ. −30	25

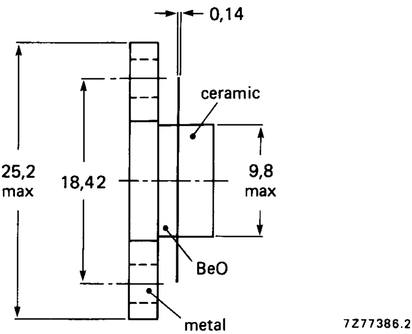
* At 65W P.E.P.

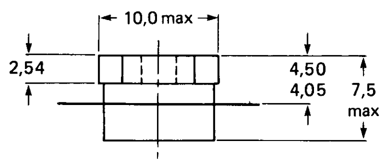
MECHANICAL DATA

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

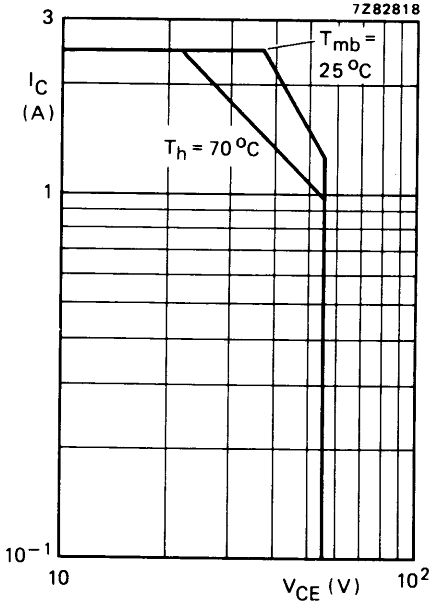


Fig. 2 D.C. SOAR.

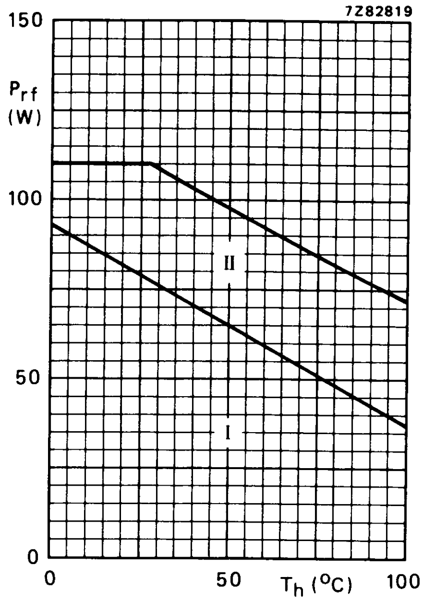


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. and r.f. operation
II Short-time operation during mismatch

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

$T_j = 25\ ^oC$

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
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8 mJ
D.C. current gain* $I_C = 1,2$ A; $V_{CE} = 5$ V	h_{FE}	typ.	25
			15 to 100
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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

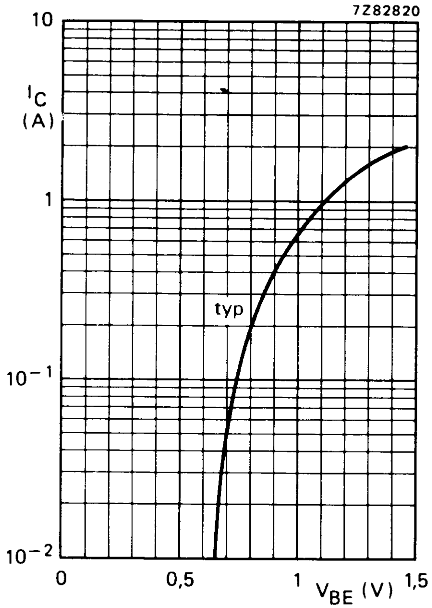


Fig. 4 V_{CE} = 40 V; T_{mb} = 25 °C.

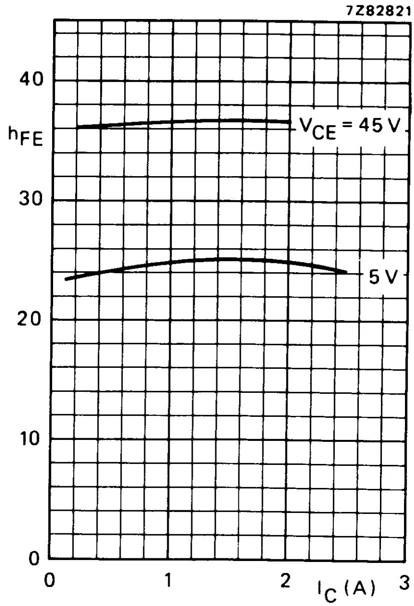


Fig. 5 Typical values; T_j = 25 °C.

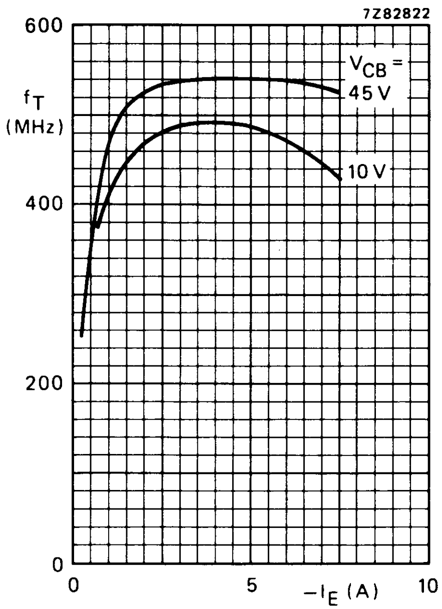


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

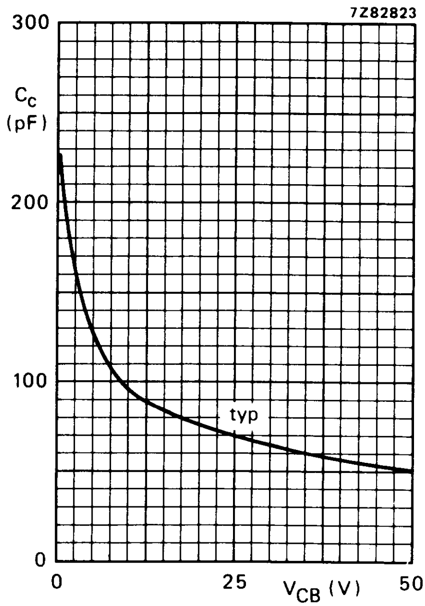


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

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

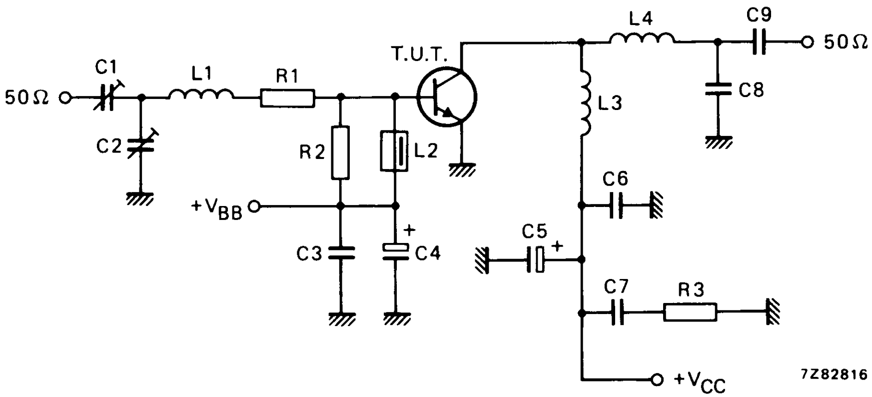


Fig. 8 Test circuit; s.s.b. class-A.

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.

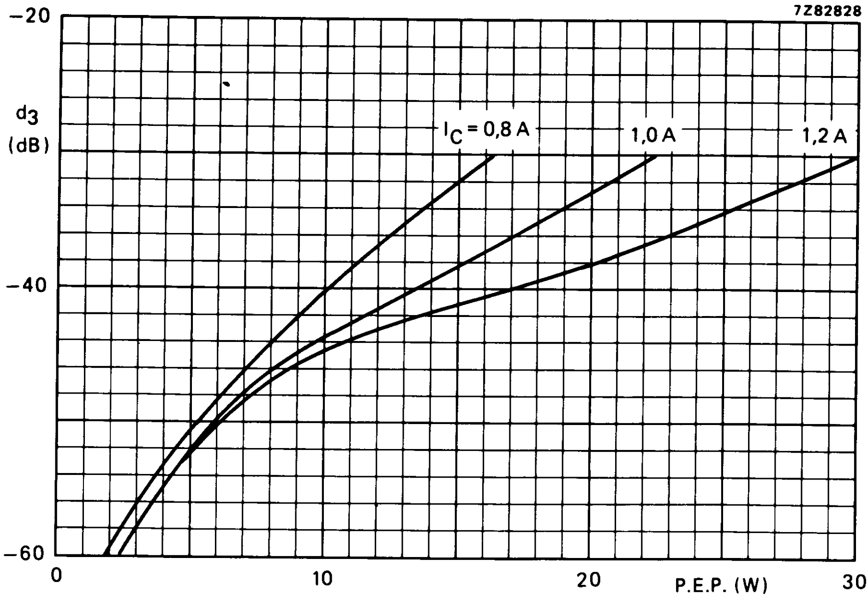


Fig. 9 Intermodulation distortion (see note on page 5) as a function of output power. Typical values; V_{CE} = 45 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C.

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

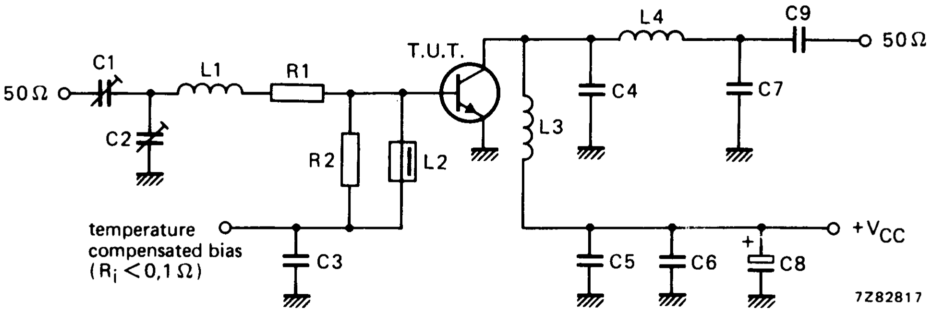


Fig. 10 Test circuit; s.s.b. class-AB.

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.

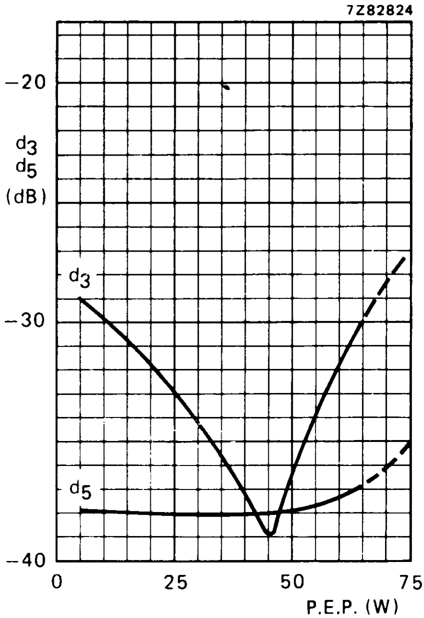


Fig. 11 Intermodulation distortion as a function of output power*.

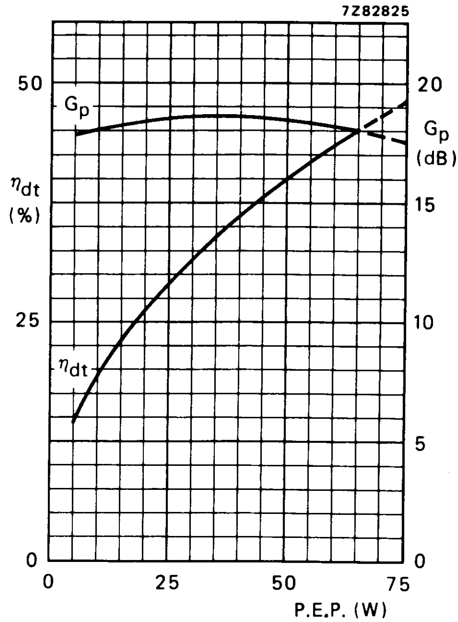


Fig. 12 Double-tone efficiency and power gain as a function of output power.

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.

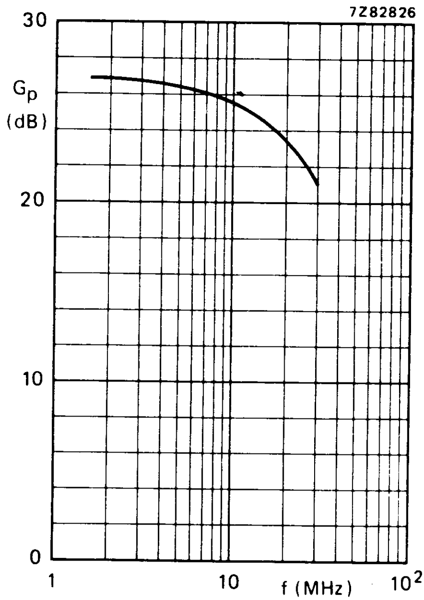


Fig. 13 Power gain as a function of frequency.

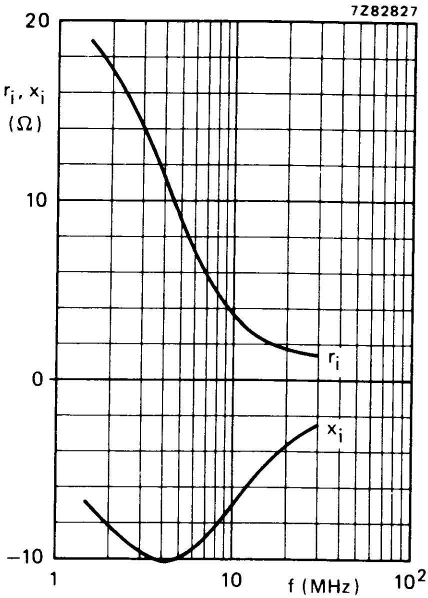


Fig. 14 Input impedance (series components) as a function of frequency.

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.

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

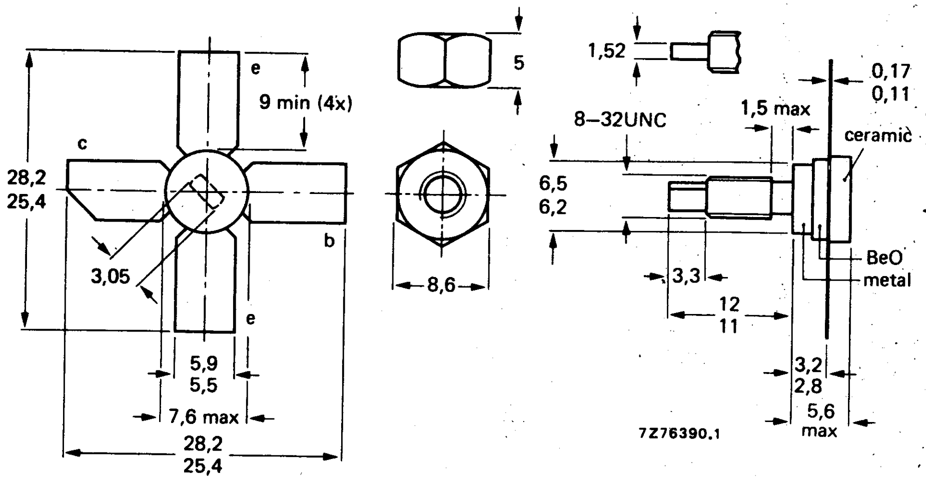
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %
c.w.	28	470	2	> 12	> 50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



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.

CAUTION 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.	0,32 A
(peak value); f > 1 MHz	I_{CM}	max.	1,0 A
Total power dissipation (d.c. and r.f.) up to T_{mb} = 50 °C	P_{tot}	max.	9,6 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

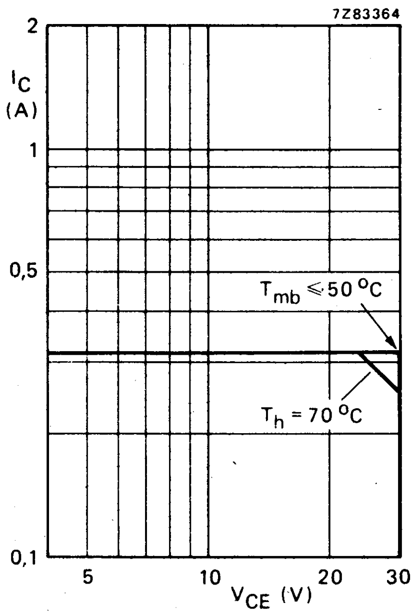


Fig. 2 D.C. SOAR.

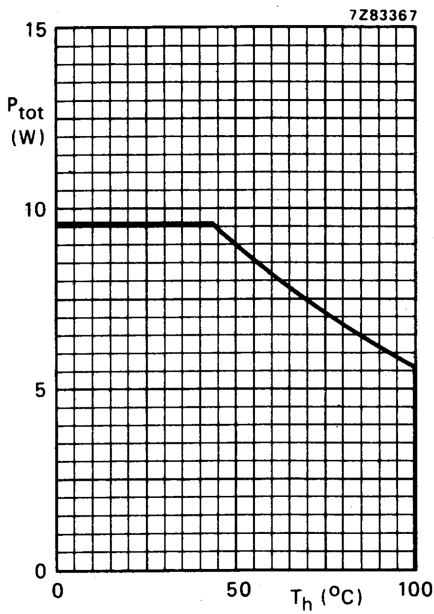


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (dissipation = 3,5 W; T_{mb} = 72 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. and r.f. dissipation)	$R_{th\ j\text{-}mb}$	=	13,0 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 2 mA	$V_{(BR)CES}$	>	60 V
Collector-emitter breakdown voltage open base; I_C = 10 mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage open collector; I_E = 1 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 30 V	I_{CES}	<	1 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
R_{BE} = 10 Ω	E_{SBR}	>	0,5 mJ
D.C. current gain * I_C = 0,15 A; V_{CE} = 5 V	h_{FE}	typ.	40
			10 to 100
Collector-emitter saturation voltage * I_C = 0,5 A; I_B = 0,1 A	V_{CEsat}	typ.	0,9 V
Transition frequency at f = 500 MHz * $-I_E$ = 0,15 A; V_{CB} = 28 V	f_T	typ.	1,20 GHz
$-I_E$ = 0,50 A; V_{CB} = 28 V	f_T	typ.	0,85 GHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	5,5 pF
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 28 V	C_{re}	typ.	2 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

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

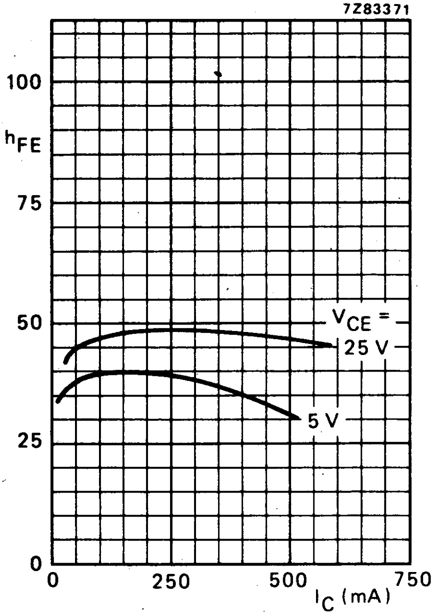


Fig. 4 Typical values; T_j = 25 °C.

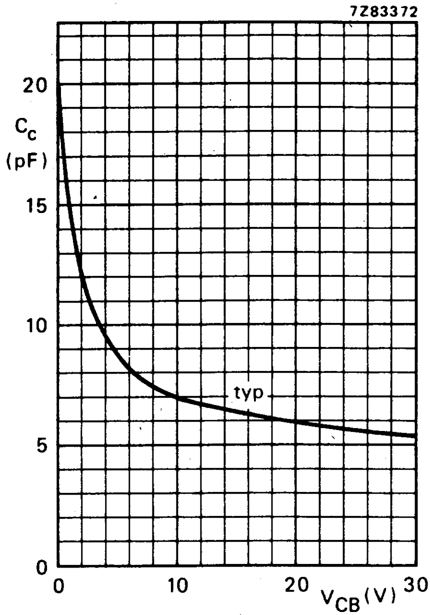


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

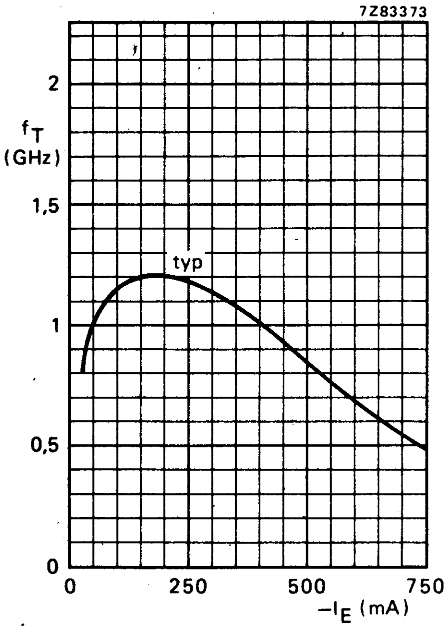


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

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

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
470	**28**	**2**	**< 0,13**	**> 12**	**< 0,145**	**> 50**	**3,0 – j0,4**	**12 + j45**
470	28	2	typ. 0,09	typ. 13,5	typ. 0,135	typ. 53	–	–

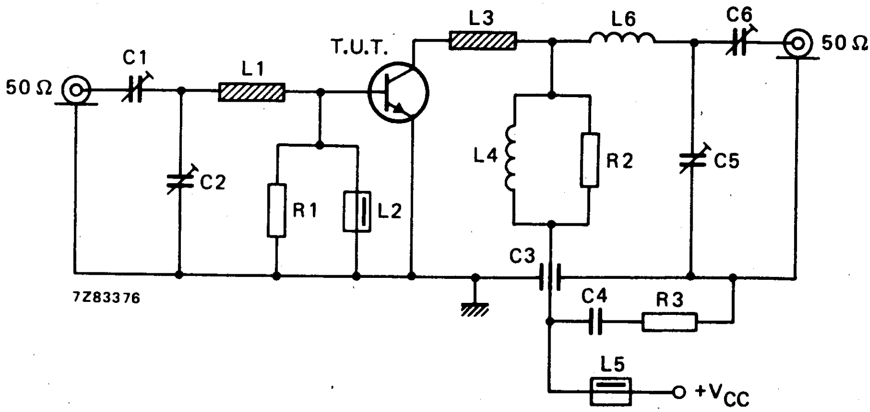


Fig. 7 Test circuit; c.w. class-B.

List of components:

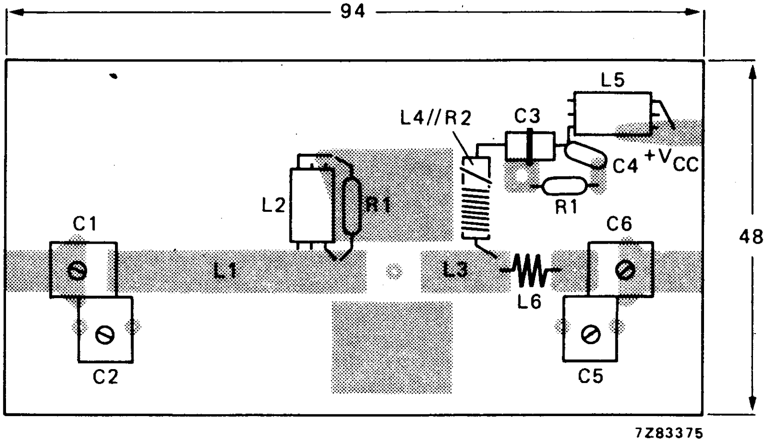
C1 = C5 = C6 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = 100 pF ceramic feed-through capacitor
C4 = 100 nF polyester capacitor

L1 = stripline (34,8 mm x 6,0 mm)
L2 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = stripline (12,0 mm x 6,0 mm)
L4 = 220 nH; 10 turns enamelled Cu wire (0,35 mm) closely wound around R2
L6 = 29 nH; 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 3,5 mm; leads 2 x 4 mm

L1 and L3 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16″

R1 = 100 Ω carbon resistor
R2 = 10 kΩ carbon resistor (style CR37)
R3 = 10 Ω carbon resistor

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



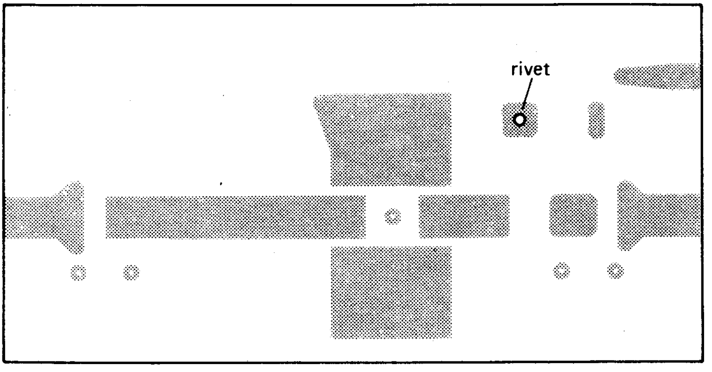


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

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.

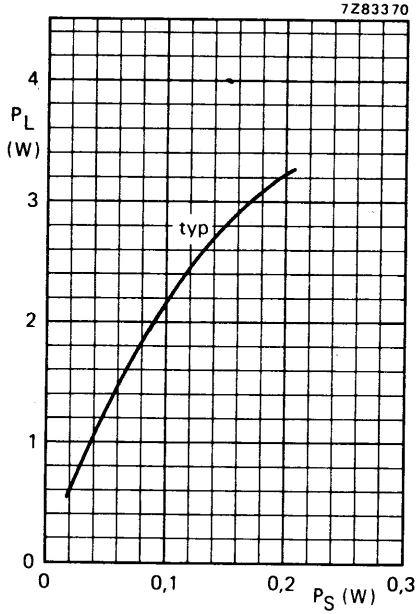


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

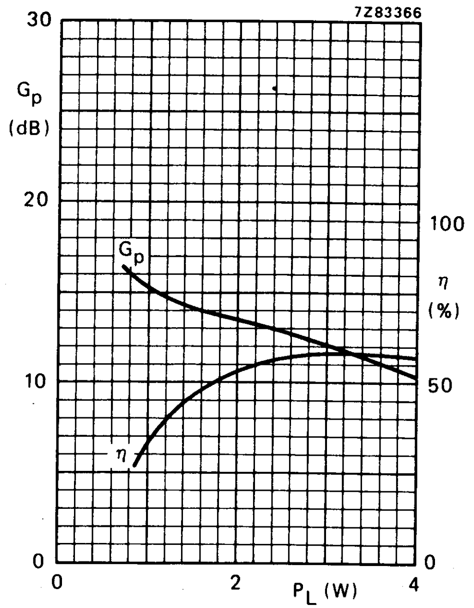


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

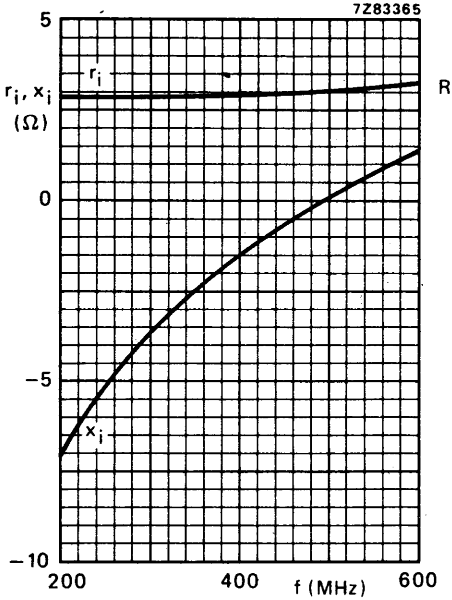


Fig. 11 Input impedance (series components).

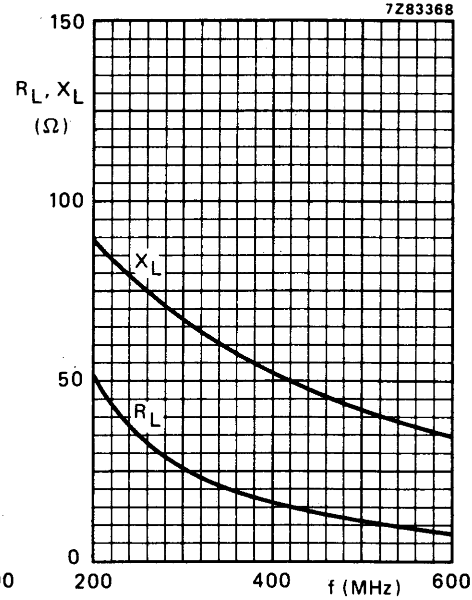


Fig. 12 Load impedance (series components).

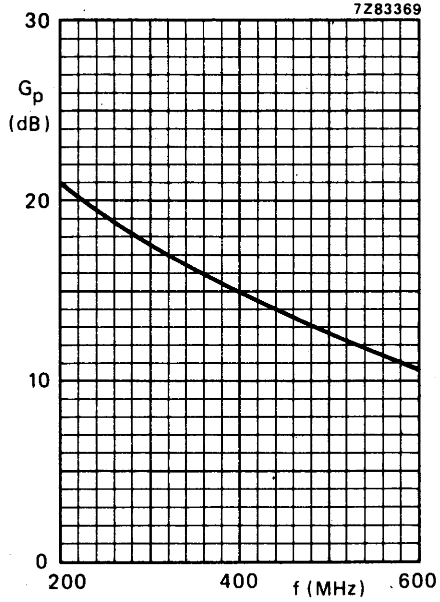


Fig. 13.

Conditions for Figs 11, 12 and 13:

Typical values; V_{CE} = 28 V; P_L = 2 W; T_h = 25 °C.

Ruggedness

The BLW89 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 2 W under the following conditions:

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

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

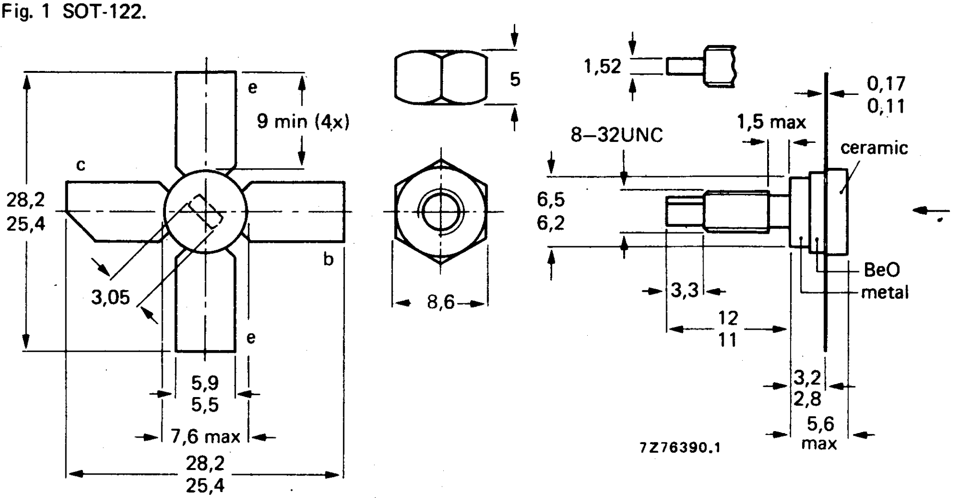
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %
c.w.	28	470	4	> 11	> 55

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



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.

CAUTION 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.	0,62 A
(peak value); f > 1 MHz	I_{CM}	max.	2,0 A
Total power dissipation (d.c. and r.f.) up to T_{mb} = 25 °C	P_{tot}	max.	18,6 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

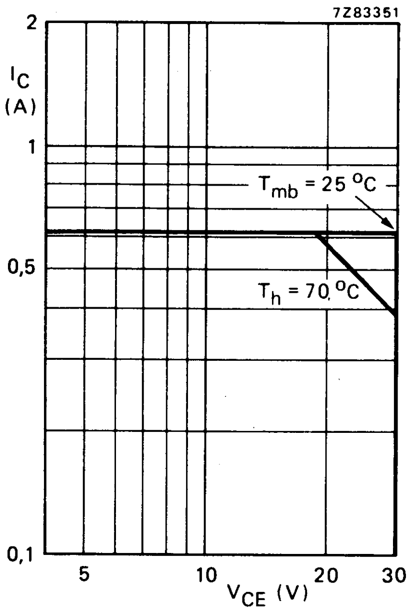


Fig. 2 D.C. SOAR.

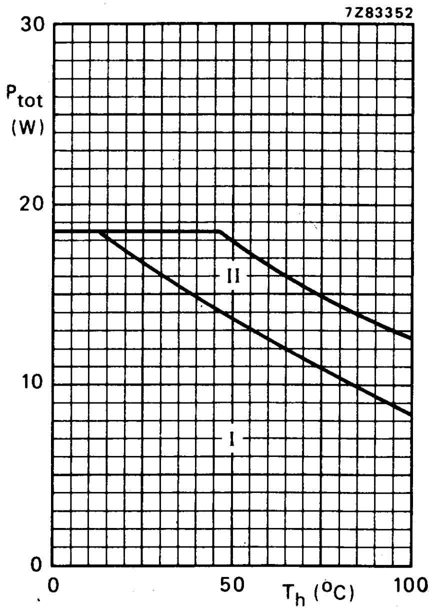


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. and r.f. operation
II Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 6 W; T_{mb} = 73,6 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. and r.f. dissipation)	$R_{th\ j\text{-}mb}$	=	9,0 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage				
$V_{BE} = 0$; $I_C = 4$ mA	$V_{(BR)CES}$	>	60	V
Collector-emitter breakdown voltage				
open base; $I_C = 20$ mA	$V_{(BR)CEO}$	>	30	V
Emitter-base breakdown voltage				
open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
$V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	2	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	1	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	1	mJ
D.C. current gain *				
$I_C = 0,3$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40	
			10 to 100	
Collector-emitter saturation voltage *				
$I_C = 1,0$ A; $I_B = 0,2$ A	V_{CEsat}	typ.	0,9	V
Transition frequency at f = 500 MHz *				
$-I_E = 0,3$ A; $V_{CB} = 28$ V	f_T	typ.	1,2	GHz
$-I_E = 1,0$ A; $V_{CB} = 28$ V	f_T	typ.	0,9	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	8,4	pF
Feedback capacitance at f = 1 MHz				
$I_C = 20$ mA; $V_{CE} = 28$ V	C_{re}	typ.	3,6	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF

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

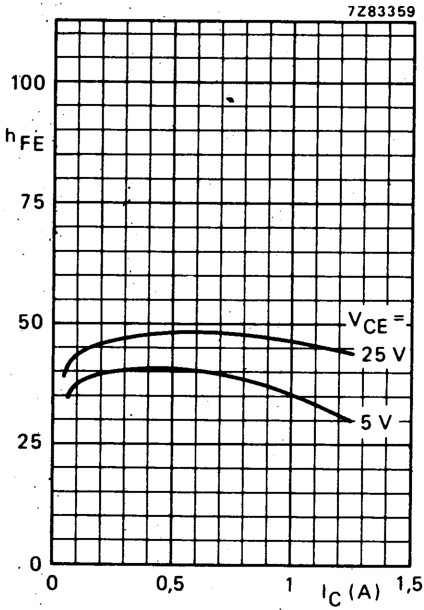


Fig. 4 Typical values; T_j = 25 °C.

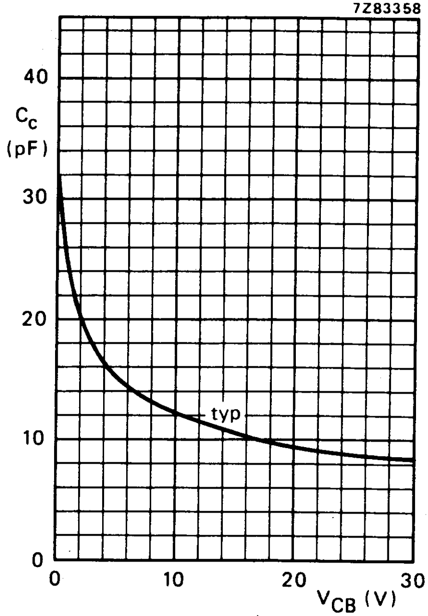


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

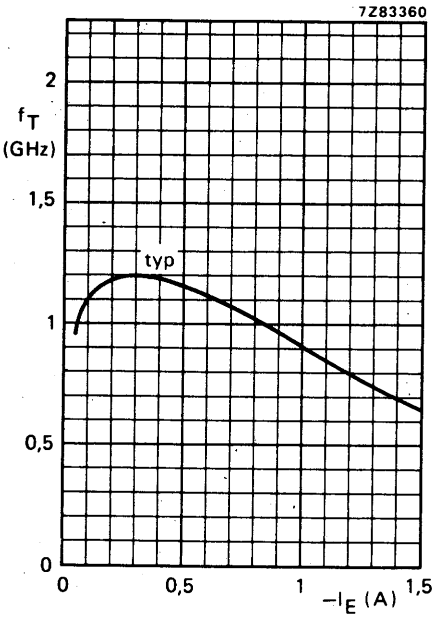


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

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

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
470	28	4	< 0,32	> 11	< 0,26	> 55	1,7 + j1,8	8 + j26
470	28	4	typ. 0,23	typ. 12,5	typ. 0,25	typ. 58	–	–

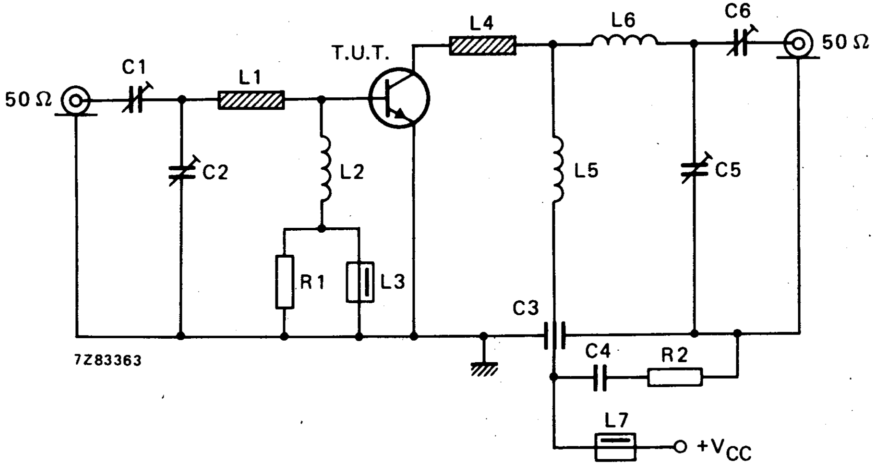


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = C5 = C6 = 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 = 100 pF feed-through capacitor
C4 = 100 nF polyester capacitor

L1 = stripline (34,8 mm x 6,0 mm)
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 = 265 nH; 13 turns closely wound enamelled Cu wire (0,35 mm); int. dia. 3,5 mm; leads 2 x 4 mm
L6 = 29 nH; 3 turns closely wound enamelled Cu wire (1 mm); int. dia. 3,5 mm; leads 2 x 4 mm

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = 100 Ω carbon resistor
R2 = 10 Ω carbon resistor

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

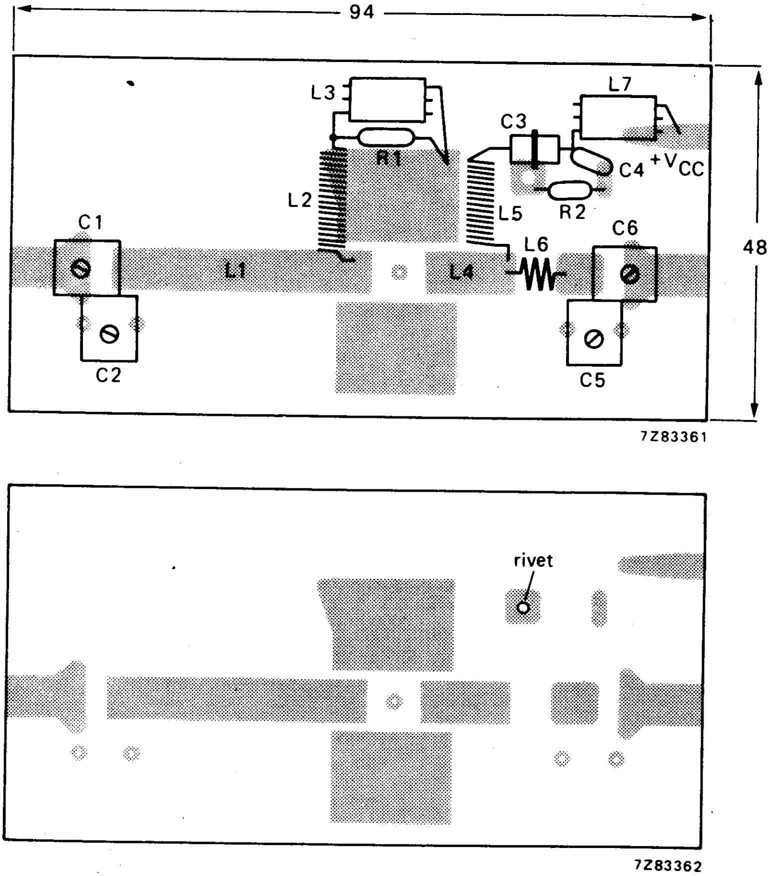


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

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.

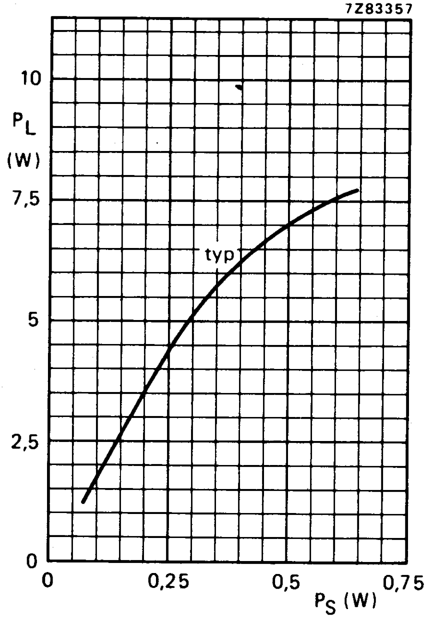


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

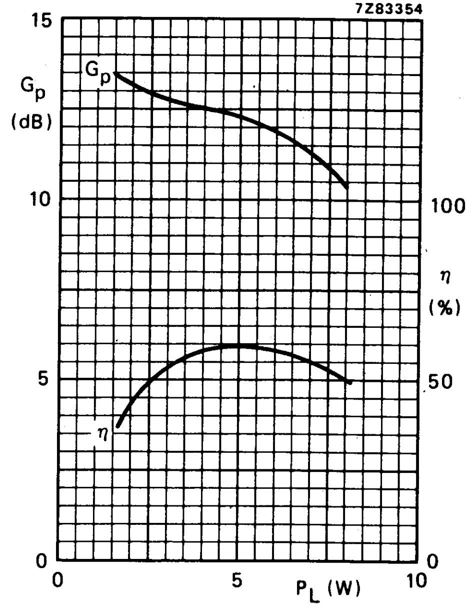


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

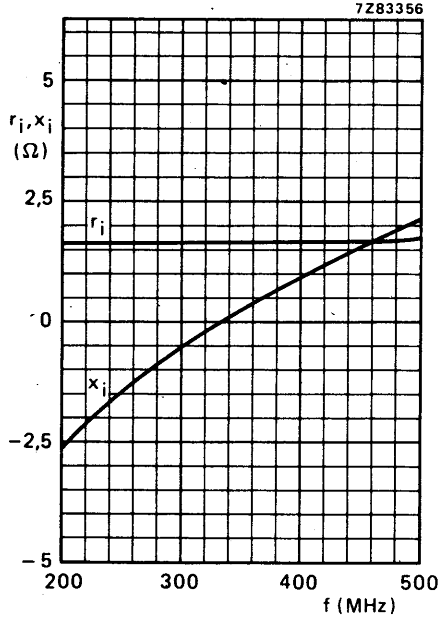


Fig. 11 Input impedance (series components).

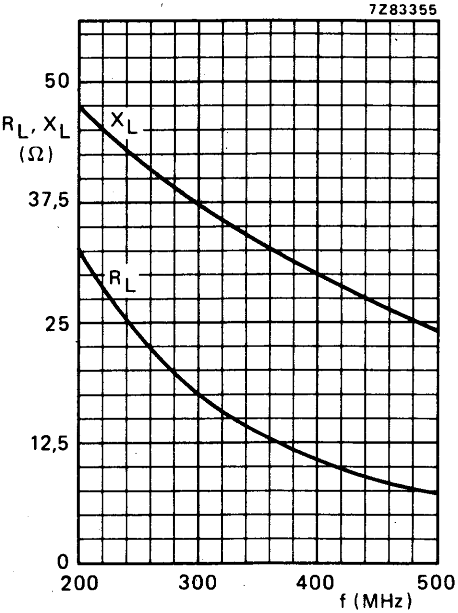


Fig. 12 Load impedance (series components).

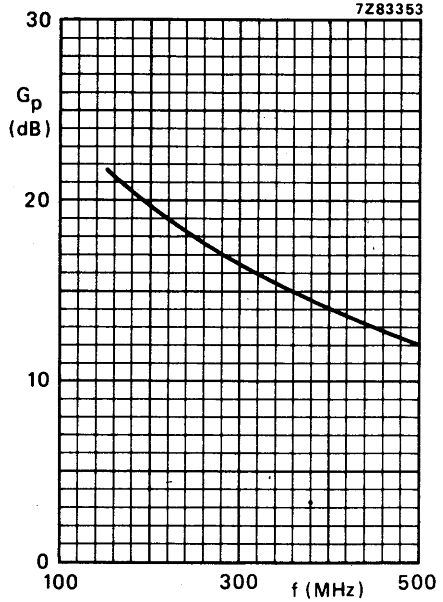


Fig. 13.

Conditions for Figs 11, 12 and 13:

Typical values; V_{CE} = 28 V; P_L = 4 W;
T_h = 25 °C.

Ruggedness

The BLW90 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 4 W under the following conditions:

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

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

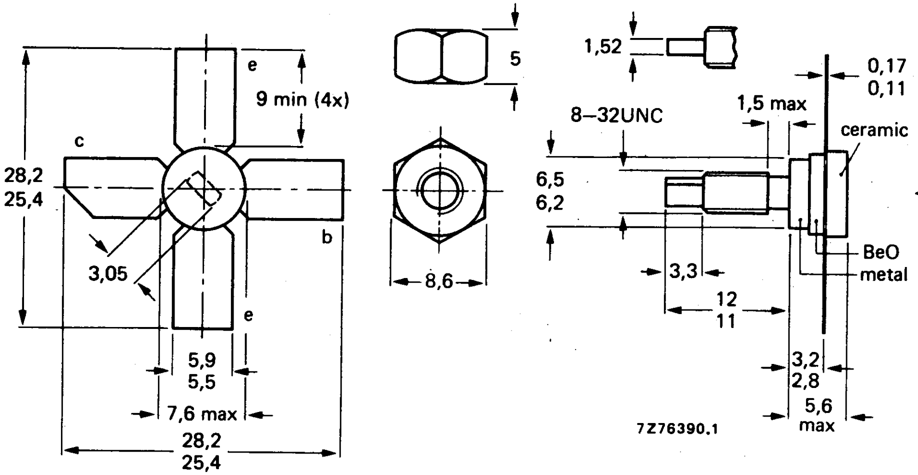
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



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.

CAUTION 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 up to T_{mb} = 35 °C	P_{tot}	max.	30 W
R.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

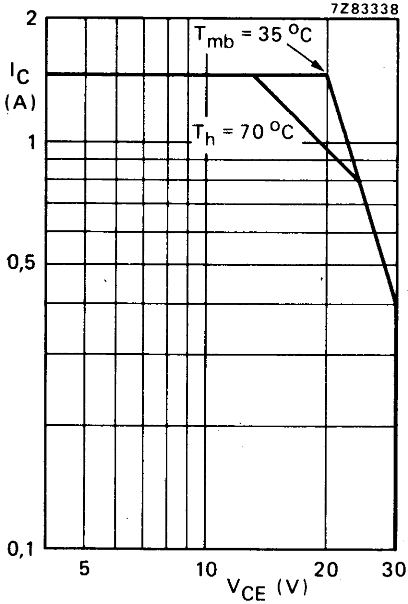


Fig. 2 D.C. SOAR.

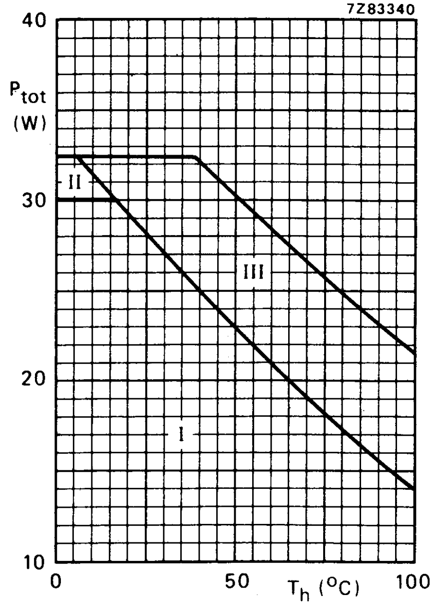


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

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)	$R_{th\ j\text{-}mb}$	=	6,2 K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W*

* K/W is SI unit for °C/W.

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	60 V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage open collector; I_E = 4 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 30 V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	2 mJ
R_{BE} = 10 Ω	E_{SBR}	>	2 mJ
D.C. current gain * I_C = 0,6 A; V_{CE} = 5 V	h_{FE}	typ.	40
			10 to 100
Collector-emitter saturation voltage * I_C = 2,0 A; I_B = 0,4 A	V_{CEsat}	typ.	1,0 V
Transition frequency at f = 500 MHz * $-I_E$ = 0,6 A; V_{CB} = 28 V	f_T	typ.	1,2 GHz
$-I_E$ = 2,0 A; V_{CB} = 28 V	f_T	typ.	1,0 GHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	17 pF
Feedback capacitance at f = 1 MHz I_C = 20 mA; V_{CE} = 28 V	C_{re}	typ.	8,5 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

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

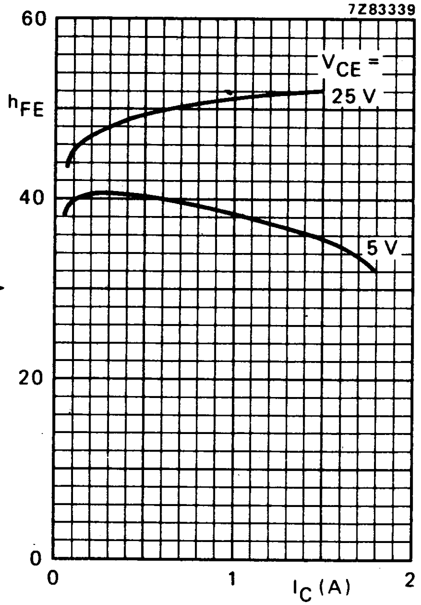


Fig. 4 Typical values; T_j = 25 °C.

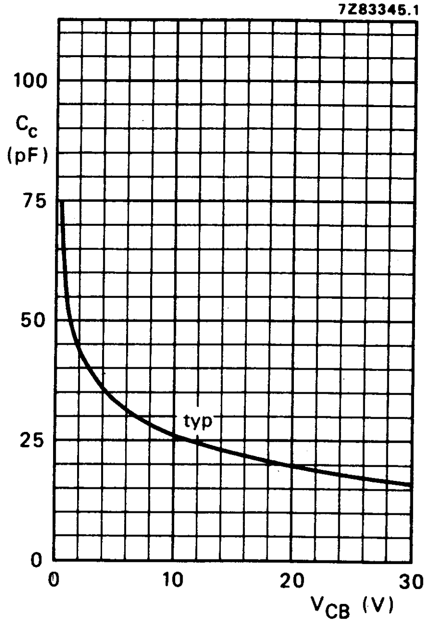


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

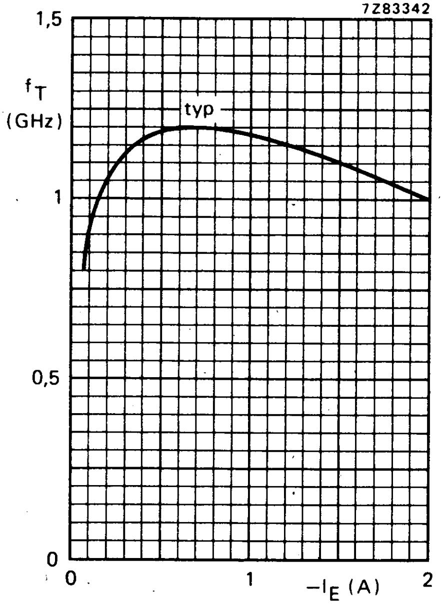


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

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

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
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	–	–

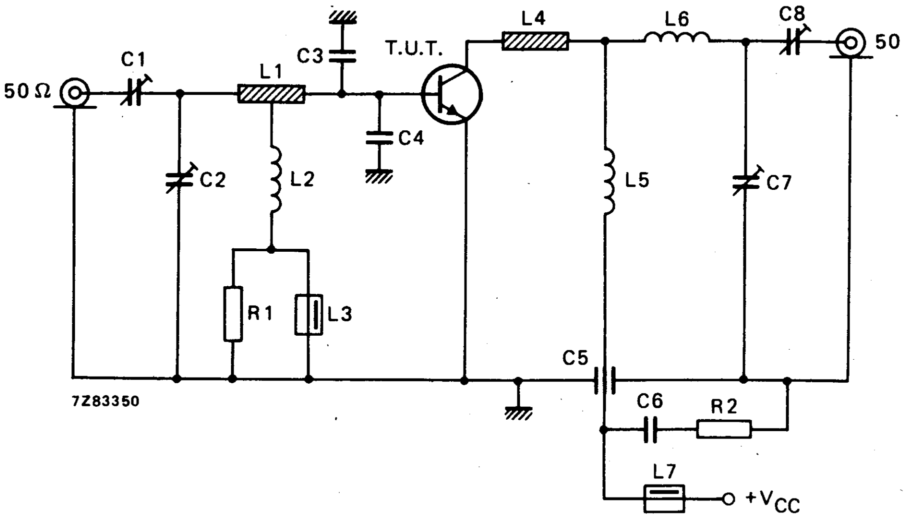


Fig. 7 Test circuit; c.w. class-B. For component layout and p.c.b. see Fig. 8.

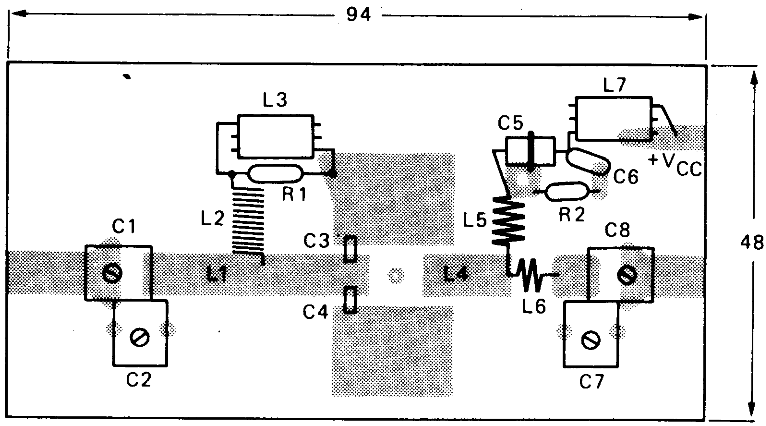
List of components:

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 Ω carbon resistor



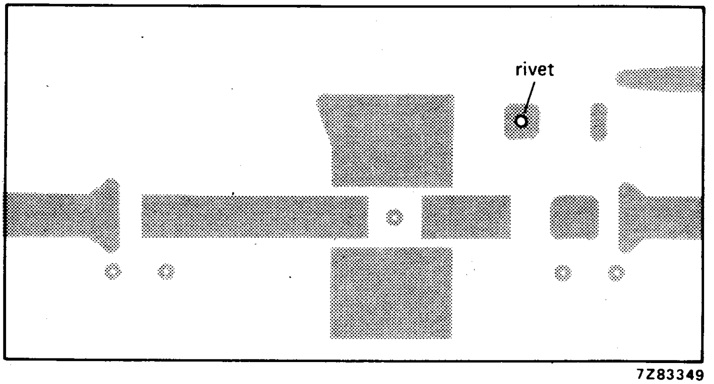


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

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.

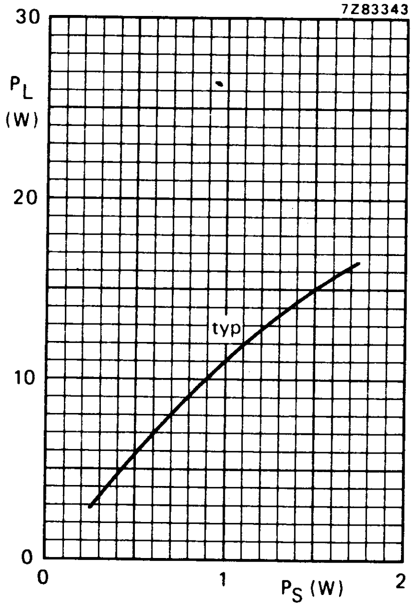


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

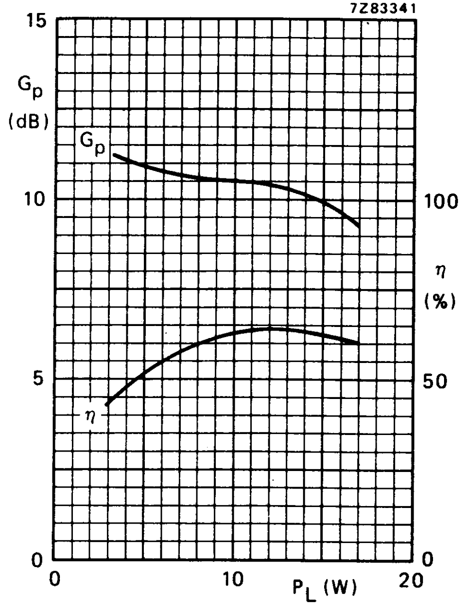


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

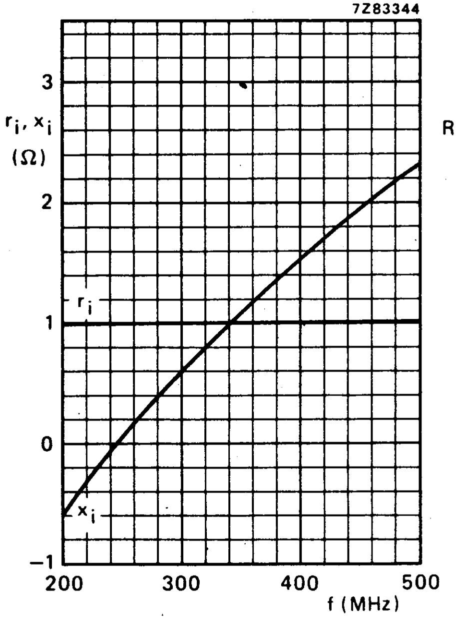


Fig. 11 Input impedance (series components).

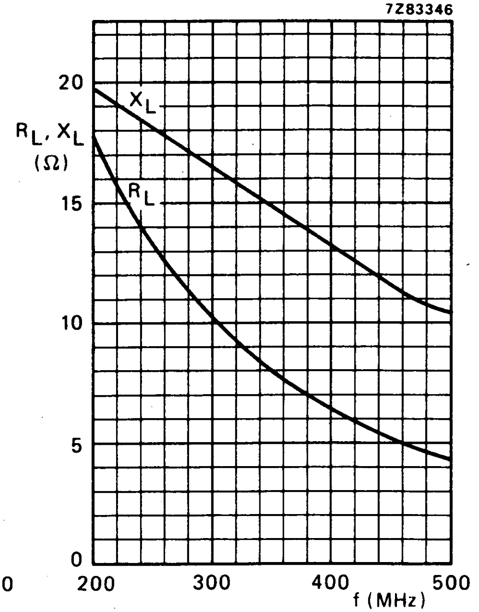
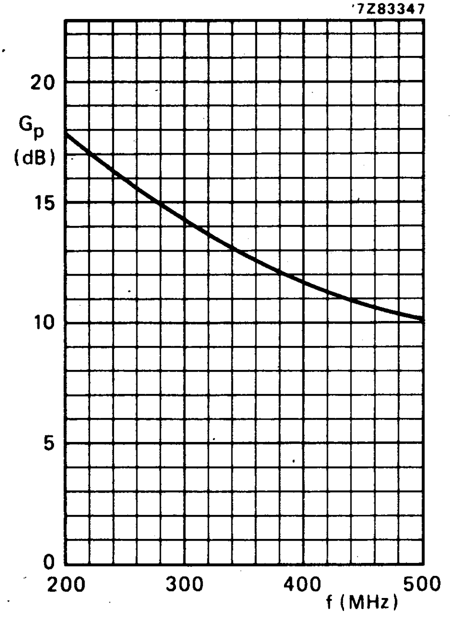


Fig. 12 Load impedance (series components).



Conditions for Figs 11, 12 and 13:

Typical values; V_{CE} = 28 V; P_L = 10 W; T_h = 25 °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 V; f = 470 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,6 K/W.

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

N-P-N silicon planar epitaxial transistor intended for use in class-A, AB and B operated high power industrial and military transmitting equipment in the h.f. and v.h.f. band. The transistor presents excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Transistors are supplied in matched h_{FE} groups.

The transistor has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	d_3 dB	d_5 dB	$I_{C(ZS)}$ (I_C) A
s.s.b. (class-AB)	**50**	**1,6 – 28**	**25 – 200 (P.E.P.)**	> **13,5**	> **40***	< **–30**	< **–30**	**0,1**
c.w. (class-B)	50	108	200	typ. 6,5	typ. 67	–	–	(6)
s.s.b. (class-A)	40	28	50 (P.E.P.)	typ. 19	–	typ. –40	< –40	(4)

* η_{dt} at 200 W P.E.P.

MECHANICAL DATA

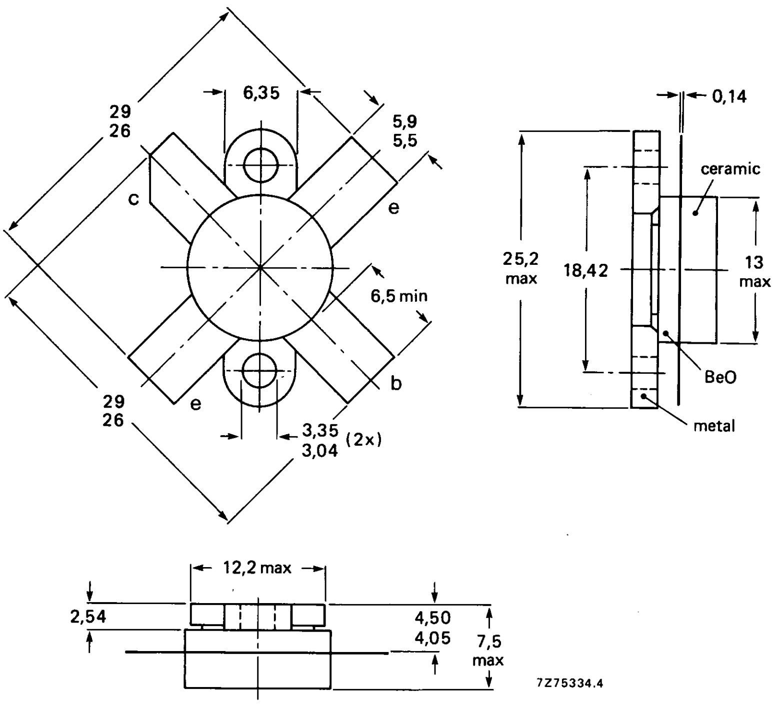
SOT-121 (see Fig. 1).

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.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-121.



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.

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.	12	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	40	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 45 °C	P_{rf}	max.	340	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

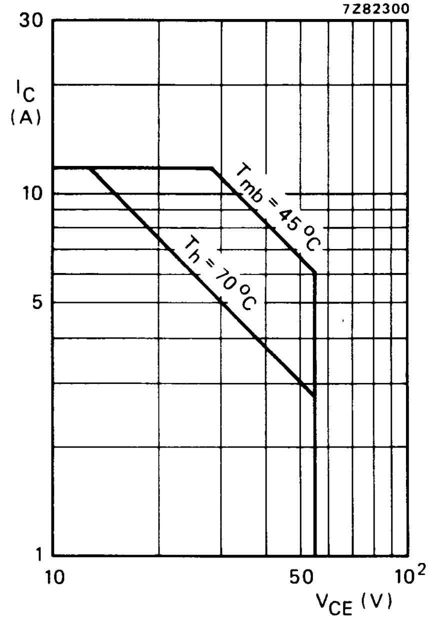


Fig. 2 D.C. SOAR.

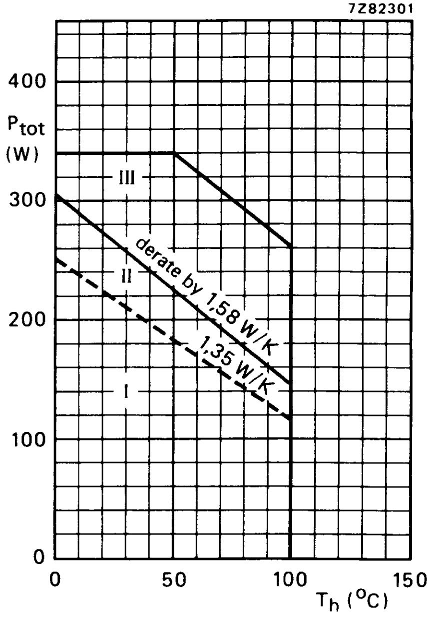


Fig. 3 Power/temperature derating curves.
I Continuous d.c. operation
II Continuous r.f. operation; f > 1 MHz
III Short-time operation during mismatch; f > 1 MHz

THERMAL RESISTANCE (dissipation = 150 W; T_{mb} = 100 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\,j\text{-}mb(dc)}$	=	0,63	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\,j\text{-}mb(rf)}$	=	0,45	K/W
From mounting base to heatsink	$R_{th\,mb\text{-}h}$	=	0,2	K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 50 mA	$V_{(BR)CES}$	>	110 V
Collector-emitter breakdown voltage open base; I_C = 200 mA	$V_{(BR)CEO}$	>	55 V
Emitter-base breakdown voltage open collector; I_E = 20 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}	>	20 mJ
R_{BE} = 10 Ω	E_{SBR}	>	20 mJ
D.C. current gain* I_C = 7 A; V_{CE} = 5 V	h_{FE}	typ.	30 15 to 50
D.C. current gain ratio of matched devices* I_C = 7 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	⩽	1,2
Collector-emitter saturation voltage* I_C = 20 A; I_B = 4 A	V_{CEsat}	typ.	1,9 V
Transition frequency at f = 100 MHz** $-I_E$ = 7 A; V_{CB} = 45 V	f_T	typ.	235 MHz
$-I_E$ = 20 A; V_{CB} = 45 V	f_T	typ.	245 MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 50 V	C_c	typ.	280 pF
Feedback capacitance at f = 1 MHz I_C = 150 mA; V_{CE} = 50 V	C_{re}	typ.	170 pF
Collector-flange capacitance	C_{cf}	typ.	4,4 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

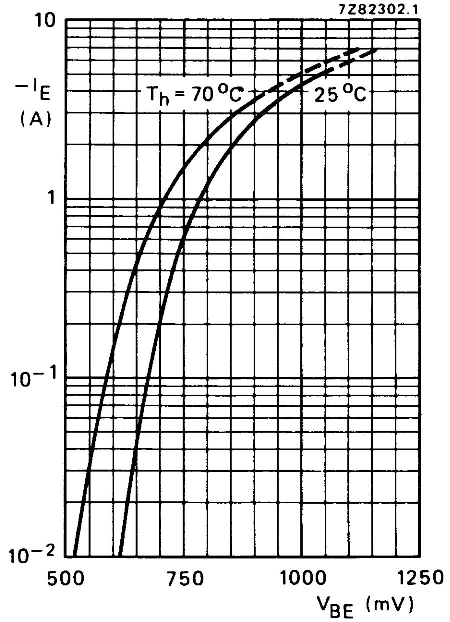


Fig. 4 Typical values; V_{CE} = 40 V.

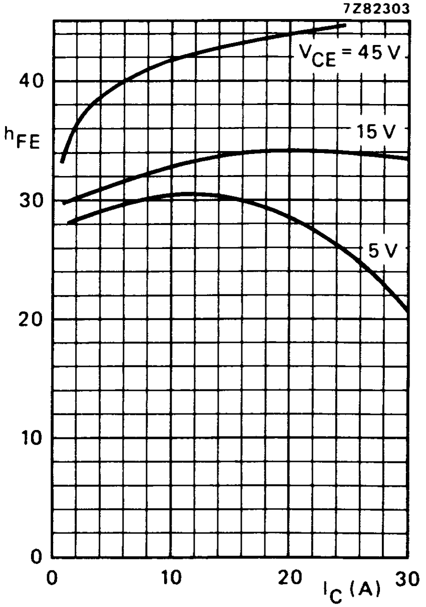


Fig. 5 Typical values; T_j = 25 °C.

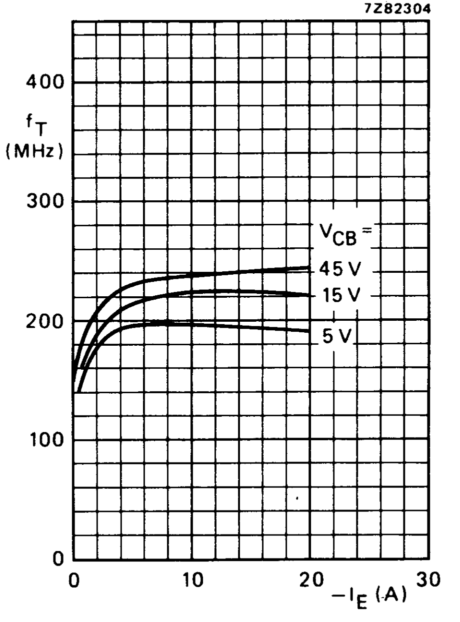


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

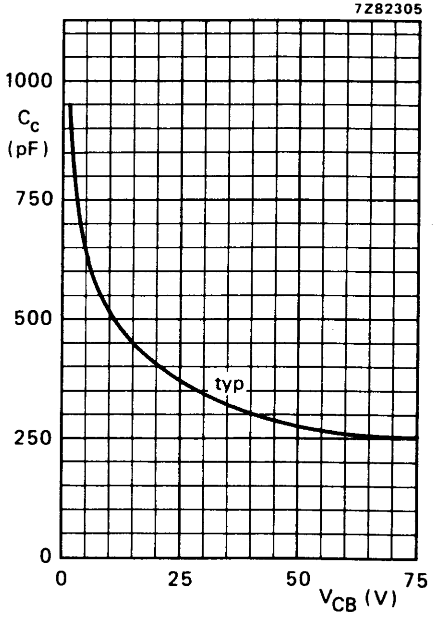


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

APPLICATION INFORMATION

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

V_{CE} = 50 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt}(%) at 200 W (P.E.P.)	I_C (A) at 200 W (P.E.P.)	d_3 * dB	d_5* dB	$I_{C(ZS)}$ A
25 to 200 (P.E.P.)	> 13,5	> 40	< 5,0	< −30	< −30	0,1

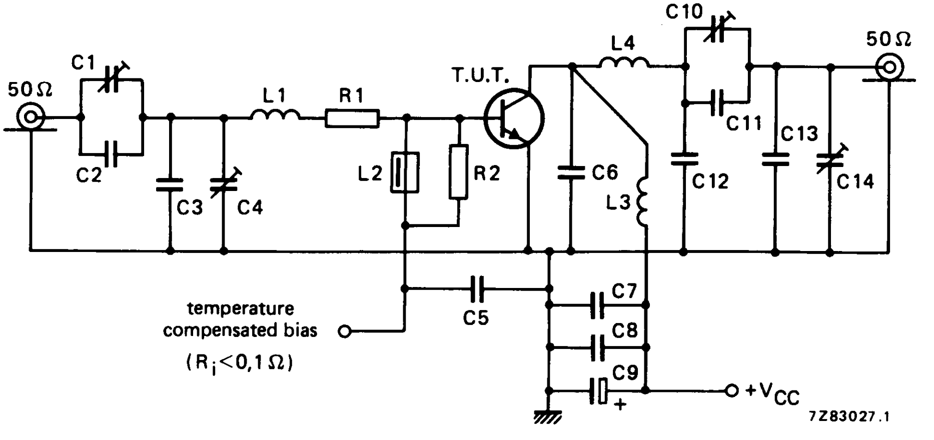


Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

C1 = C4 = C10 = C14 = 100 pF film dielectric trimmer
C2 = 27 pF ceramic capacitor (500 V)
C3 = 270 pF polysterene capacitor (630 V)
C5 = C7 = C8 =220 nF multilayer ceramic chip capacitor
C6 = 27 pF multilayer ceramic chip capacitor (500 V; ATC▲)
C9 = 47 μF/63 V electrolytic capacitor
C11 = 2 x 36 pF multilayer ceramic chip capacitors (500 V; ATC▲) in parallel
C12 = 2 x 43 pF multilayer ceramic chip capacitors (500 V; ATC▲) in parallel
C13 = 43 pF multilayer ceramic chip capacitor (500 V; ATC▲)

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9,0 mm; length 6,1 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 150 nH; 5 turns Cu wire (2,0 mm); int. dia. 10,0 mm; length 18,7 mm; leads 2 x 5 mm
L4 = 197 nH; 5 turns Cu wire (2,0 mm); int. dia. 12,0 mm; length 18,6 mm; leads 2 x 5 mm

R1 = 0,66 Ω; parallel connection of 5 x 3,3 Ω metal film resistors (PR37; ± 5%; 1,6 W each)
R2 = 27 Ω carbon resistor (± 5%; 0,5 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.

▲ ATC means American Technical Ceramics.

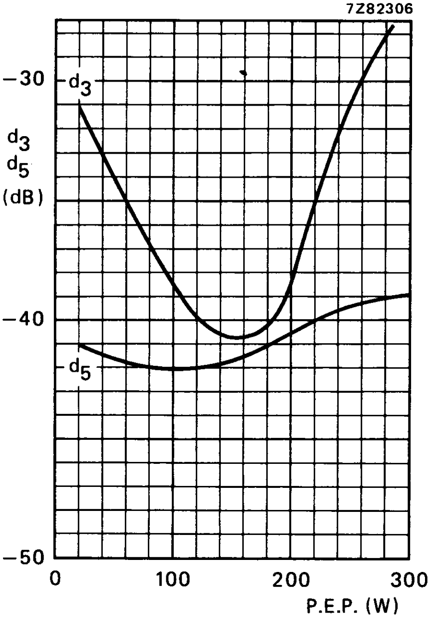


Fig. 9 Intermodulation distortion as a function of output power.*

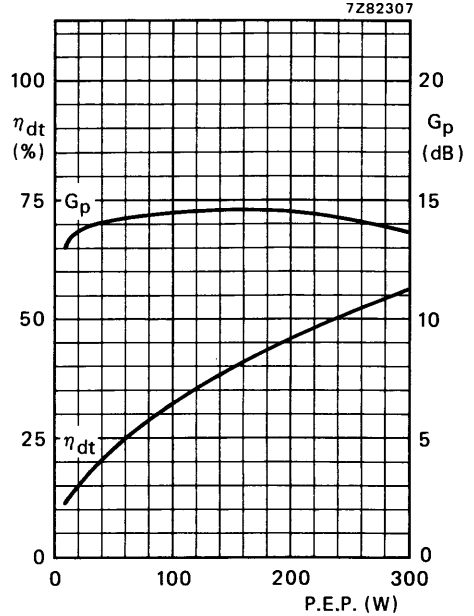


Fig. 10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:

V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Ruggedness

The BLW96 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 150 W (P.E.P.) or a load mismatch (VSWR = 5 through all phases) up to 200 W (P.E.P.) under the following conditions:

V_{CE} = 45 V; f = 28 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

* See note on previous page.

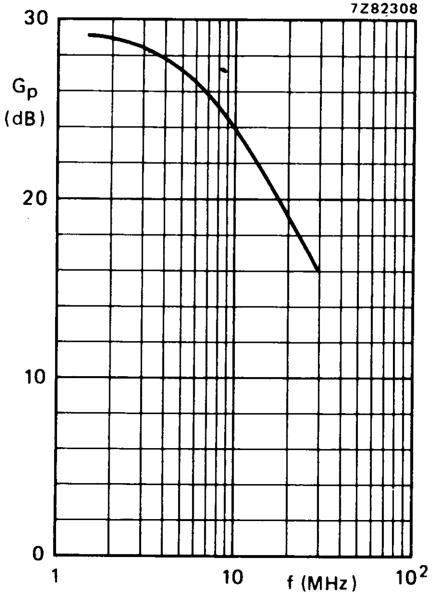


Fig. 11 Power gain as a function of frequency.

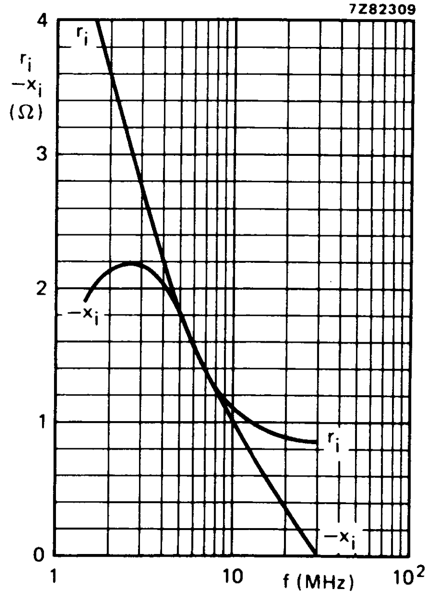


Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for one transistor of a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:

V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; P_L = 200 W (P.E.P.); T_h = 25 °C; Z_L = 5 Ω; neutralizing capacitor: 47 pF.

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

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)
108	50	200	typ. 45	typ. 6,5	typ. 6	typ. 67

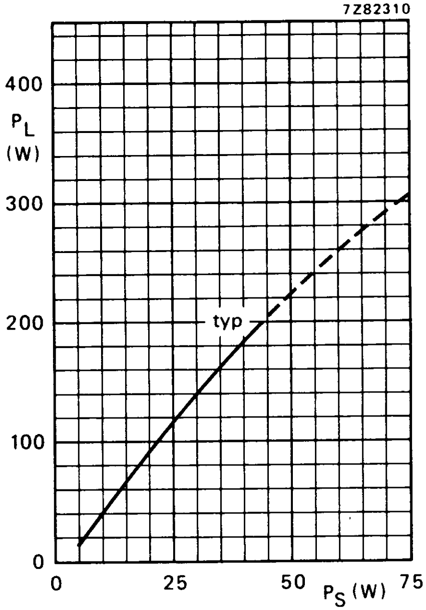


Fig. 13 V_{CE} = 50 V; f = 108 MHz; T_h = 25 °C.

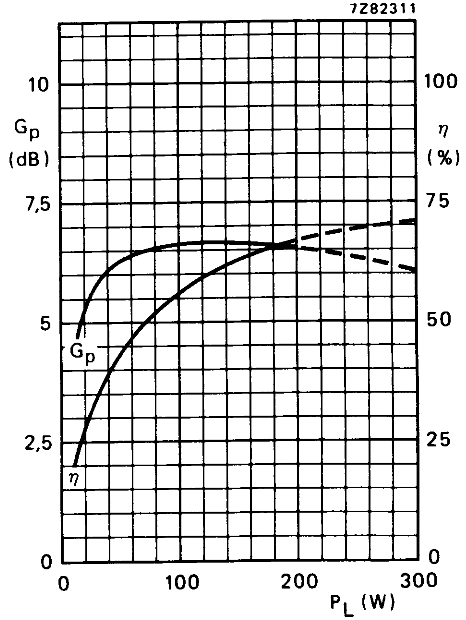


Fig. 14 V_{CE} = 50 V; f = 108 MHz; T_h = 25 °C; typical values.

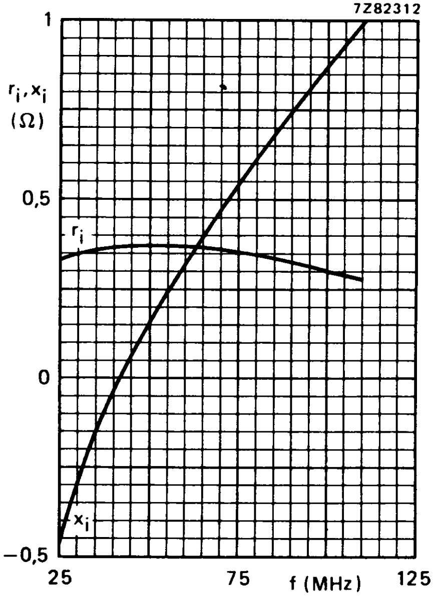


Fig. 15 Input impedance (series components).

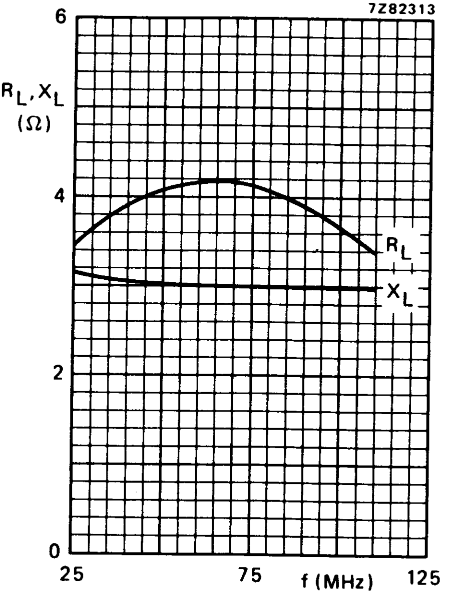


Fig. 16 Load impedance (series components).

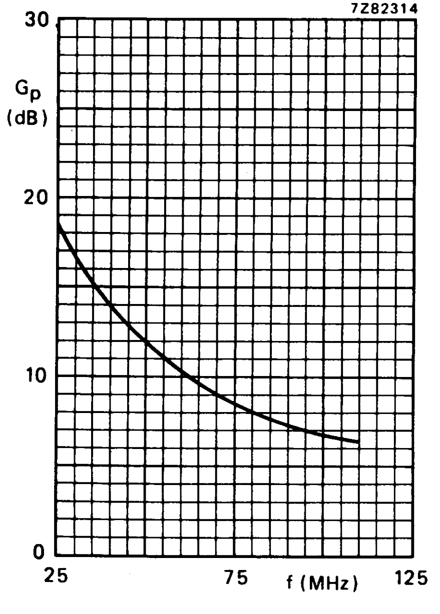


Fig. 17.

Conditions for Figs 15, 16 and 17:

Typical values; V_{CE} = 50 V; P_L = 200 W; T_h = 25 °C; class-B operation.

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

V_{CE} = 40 V; T_h = 25 °C; 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
typ. 50 (P.E.P.)	typ. 19	4	typ. −40	< −40

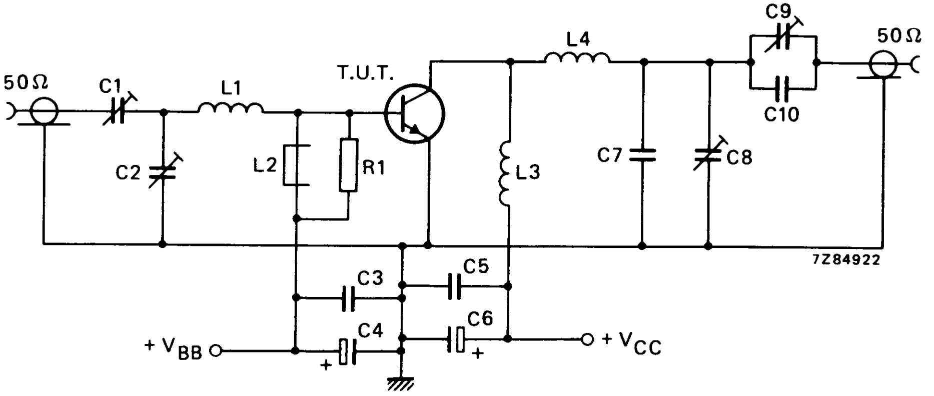


Fig. 18 Test circuit; s.s.b. class-A.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 220 nF polyester capacitor (100 V)
C4 = 100 μF/4 V electrolytic capacitor
C5 = 2 x 330 nF polyester capacitors (100 V) in parallel
C6 = 47 μF/63 V electrolytic capacitor
C7 = C10 = 2 x 82 pF ceramic capacitors (500 V) in parallel
C8 = C9 = 10 to 150 pF air dielectric trimmer

L1 = 45 nH; 2 turns enamelled Cu wire (1,6 mm); int. dia. 8,0 mm; length 4,0 mm; leads 2 x 3 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 110 nH; 4 turns enamelled Cu wire (2,0 mm); int. dia. 10,0 mm; length 8,0 mm; leads 2 x 2 mm
L4 = 210 nH; 5 turns enamelled Cu wire (2,0 mm); int. dia. 12,0 mm; length 10,0 mm; leads 2 x 2 mm

R1 = 27 Ω carbon resistor (± 5%; 0,5 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.

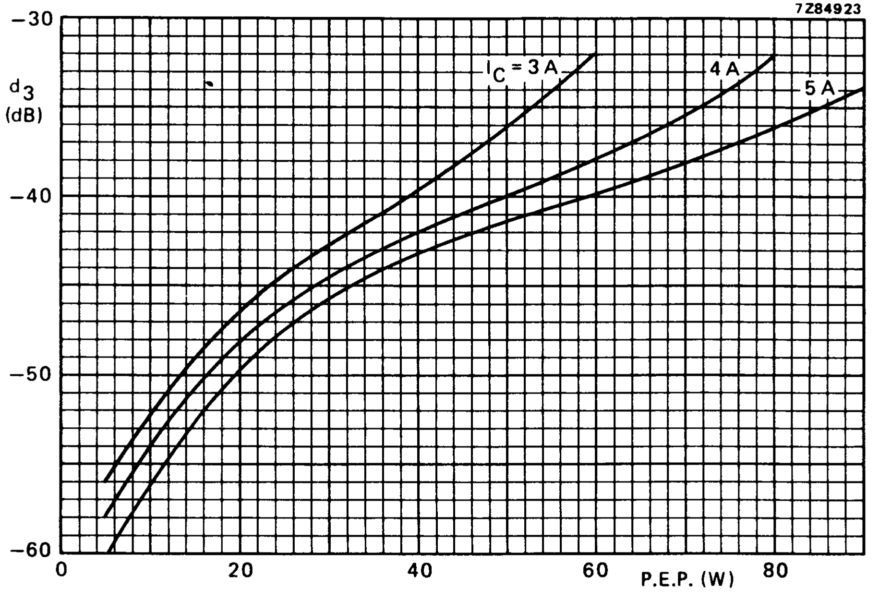


Fig. 19 Third order intermodulation distortion as a function of output power.*
Typical values; V_{CE} = 40 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

* 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.

H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor designed for use in class-A, AB and B operated high-power industrial and military transmitting equipment in the h.f. band.

The transistor offers excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is made to withstand severe load-mismatch conditions. All leads are isolated from the flange.

The transistors are supplied in matched h_{FE} groups.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η_{dt} %	d_3 dB	d_5 dB
s.s.b. (class-AB)	28	0,1	1,6 – 28	175 (PEP)	> 11,5	> 40	< –30	< –30

MECHANICAL DATA

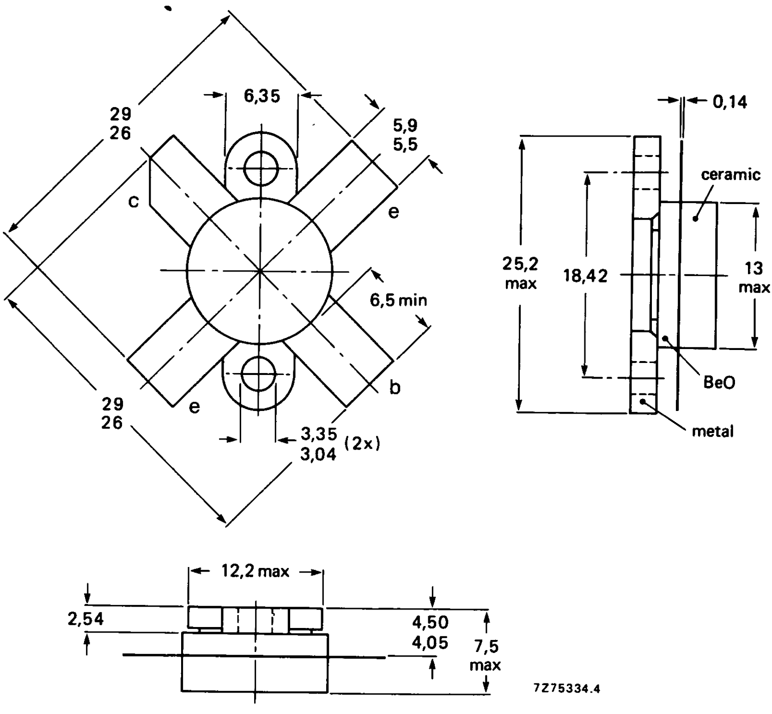
SOT-121 (see Fig. 1).

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.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-121.



Torque on screw: min. 0,60 Nm (6,0 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.

RATINGS

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

Collector-emitter voltage (peak value)				
$V_{BE} = 0$	V_{CESM}	max.	65	V
open base	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
average	$I_{C(AV)}$	max.	15	A
peak value; f > 1 MHz	I_{CM}	max.	50	A
Total d.c. power dissipation at T_h = 25°C	$P_{tot(d.c.)}$	max.	190	W
R.F. power dissipation				
f > 1 MHz; T_h = 25°C	$P_{tot(rf)}$	max.	230	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

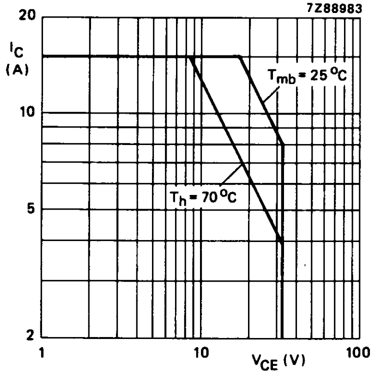


Fig. 2 D.C. SOAR.

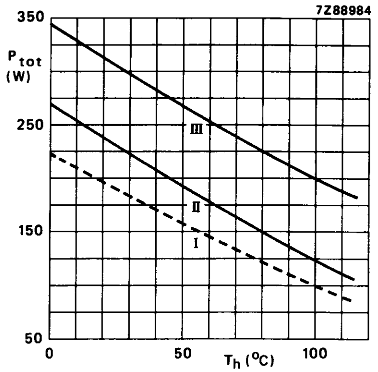


Fig. 3 Power/temperature derating curves.

I Continuous d.c. operation
II Continuous r.f. operation (f > 1 MHz).
III Short-time operation during mismatch; (f > 1 MHz).

THERMAL RESISTANCE (dissipation = 120 W; T_h = 25 °C i.e. T_{mb} = 49 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	0,63	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	0,48	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,20	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage				
$V_{BE} = 0$; I_C = 50 mA	$V_{(BR)CES}$	>	65	V
I_C = 100 mA; open base	$V_{(BR)CEO}$	>	33	V
Emitter-base breakdown voltage				
I_E = 20 mA; open collector	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
V_{CE} = 33 V; $V_{BE} = 0$	I_{CES}	<	20	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	20	mJ
R_{BE} = 10 Ω	E_{SBR}	>	20	mJ
D.C. current gain*				
I_C = 10 A; V_{CE} = 5 V	h_{FE}	typ.	30	
		15 to	50	
D.C. current gain ratio of matched devices*				
→ I_C = 10 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2	
Collector-emitter saturation voltage*				
I_C = 25 A; I_B = 5 A	V_{CEsat}	typ.	2,4	V
Transition frequency at f = 100 MHz**				
$-I_E$ = 10 A; V_{CB} = 28 V	f_T	typ.	230	MHz
$-I_E$ = 20 A; V_{CB} = 28 V	f_T	typ.	235	MHz
Collector capacitance at f = 1 MHz				
$I_E = i_e = 0$; V_{CB} = 28 V	C_c	typ.	380	pF
Feedback capacitance at f = 1 MHz				
$I_C = 0$; V_{CE} = 28 V	C_{re}	typ.	235	pF
Collector-flange capacitance	C_{cf}	typ.	4,5	pF

* Measured under pulse conditions: t_p = 500 μs.
** Measured under pulse conditions: t_p = 300 μs; δ = 0,02.

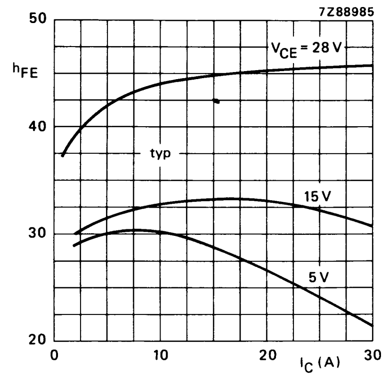


Fig. 4 T_j = 25 °C.

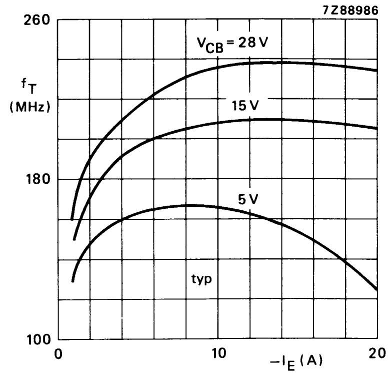


Fig. 5 T_j = 25 °C; f = 100 MHz; t_p = 300 μs.

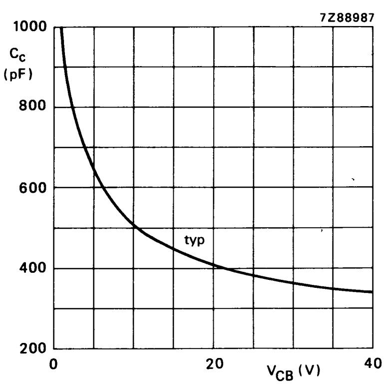


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

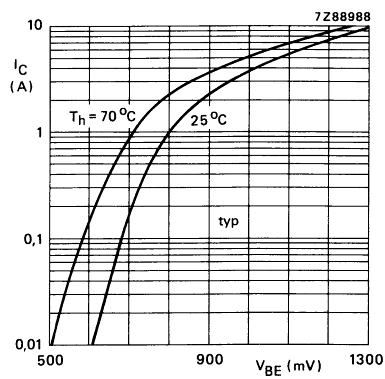


Fig. 7 V_{CE} = 28 V.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier).
V_{CE} = 28 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

output power W	G_p dB	η_{dt} %	I_C A	d_3* dB	d_5* dB	$I_{C(ZS)}$ A
175 (PEP)	> 11,5 typ. 13,0	> 40 typ. 50	< 7,8 typ. 6,3	< −30 typ. −34	< −30 typ. −38	0,1

* The stated intermodulation distortion levels 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.

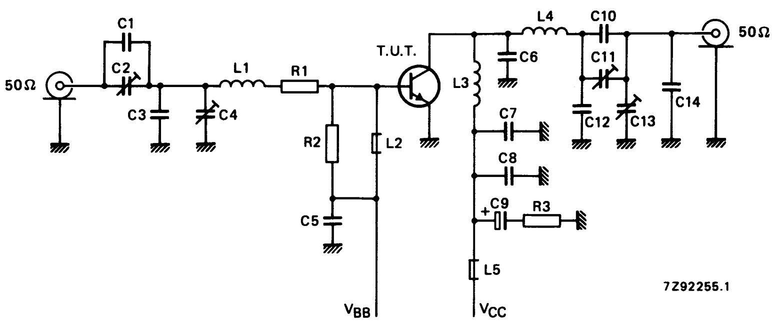


Fig. 8 Class-AB (s.s.b.) test circuit.

List of components:

C1 = 47 pF (500 V) multilayer ceramic chip capacitor*
C2 = 100 pF film dielectric trimmer
C3 = 2 x 130 pF (300 V) multilayer ceramic chip capacitors in parallel*
C4 = 280 pF film dielectric trimmer
C5 = 10 nF (50 V) multilayer ceramic chip capacitor 2222 856 13103
C6 = 2 x 180 pF (300 V) multilayer ceramic chip capacitors in parallel*
C7 = 100 nF (50 V) multilayer ceramic chip capacitor 2222 856 48104
C8 = 10 nF (50 V) multilayer ceramic chip capacitor 2222 856 13103
C9 = 2,2 μF - 63 V solid aluminium electrolytic capacitor
C10 = 5 x 82 pF (500 V) multilayer ceramic chip capacitors in parallel*
C11 = 250 pF air dielectric trimmer
C12 = 5 x 33 pF ceramic feed-through capacitors mounted in parallel on a brass plate
C13 = 100 pF air dielectric trimmer
C14 = 3 x 91 pF (500 V) multilayer ceramic chip capacitors in parallel*

R1 = 0,7 Ω - 7 W (7 x 4,7 Ω - 1 W carbon resistors in parallel)
R2 = 27 Ω - 0,25 W carbon resistor
R3 = 4,7 Ω - 0,25 W carbon resistor

* American Technical Ceramics capacitor or capacitor of same quality.

L1 = 73 nH; 4 turns Cu wire (1,5 mm); int. dia. 7 mm; length 9,4 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke grade 3B (cat. no. 4312 020 36640); 6 leads in parallel
L3 = 70,4 nH; 4 turns Cu wire (2 mm); int. dia. 7 mm; length 14,8 mm; leads 2 x 5 mm
L4 = 83,5 nH; 4 turns Cu wire (2 mm); int. dia. 8 mm; length 15 mm; leads 2 x 5 mm
L5 = Ferroxcube wide-band h.f. choke grade 3 B (cat. no. 4312 020 36640) with 6 leads in parallel

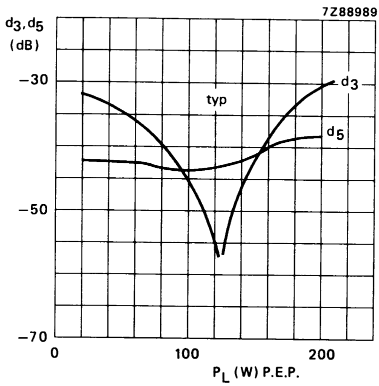


Fig. 9 Intermodulation distortion (see note on preceding page).

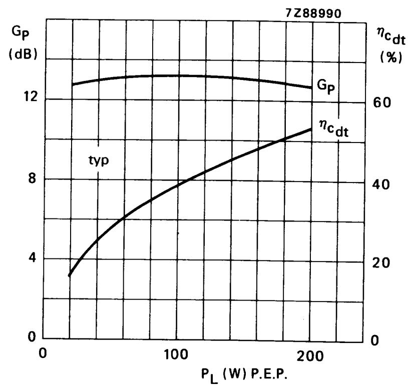


Fig. 10 Power gain and double-tone efficiency.

Conditions for Figs 9 and 10:
V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C.

RUGGEDNESS

The BLW97 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 150 W (P.E.P.) or a load mismatch (VSWR = 5 through all phases) up to 175 W (P.E.P.) under the following conditions:
V_{CE} = 28 V; f = 28 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

Figures 11 and 12 on the next page present typical curves which are valid for one transistor of a push-pull amplifier in s.s.b. class-AB operation.

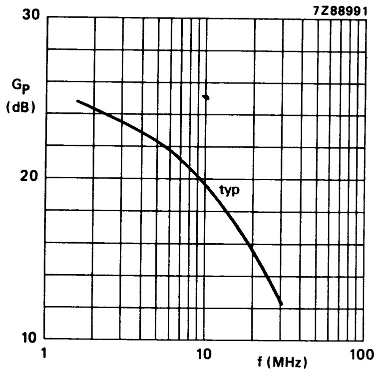


Fig. 11 Power gain.

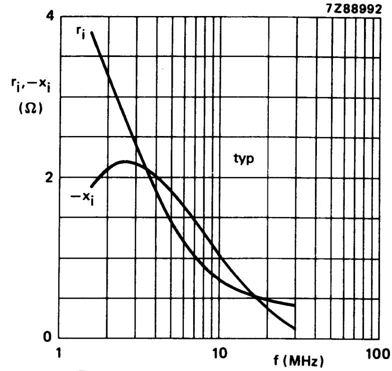


Fig. 12 Input impedance (series components).

Conditions for Figs 11 and 12:
V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A;
P_L = 175 W(PEP); T_h = 25 °C;
Z_L = 1,55 Ω

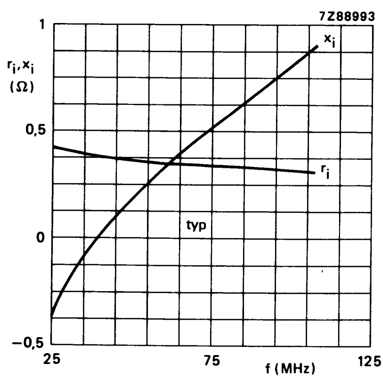


Fig. 13 Input impedance (series components).

Conditions for Figs 13, 14 and 15:
V_{CE} = 28 V; P_L = 175 W; T_h = 25 °C;
class-B operation.

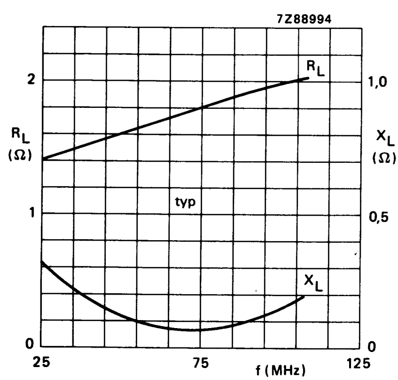


Fig. 14 Load impedance (series components).

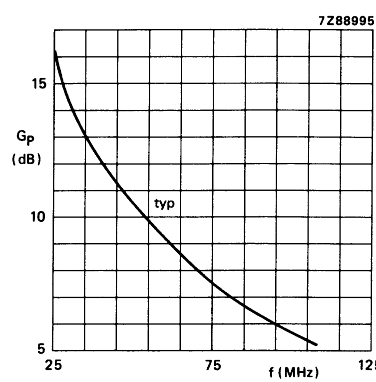


Fig. 15 Power gain.

H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB and B operated high-power mobile transmitting equipment in the h.f. band.

The transistors are resistance-stabilized and are guaranteed to withstand severe load mismatch conditions. They are supplied in matched h_{FE} groups.

The transistor has a 1/2 in 4-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

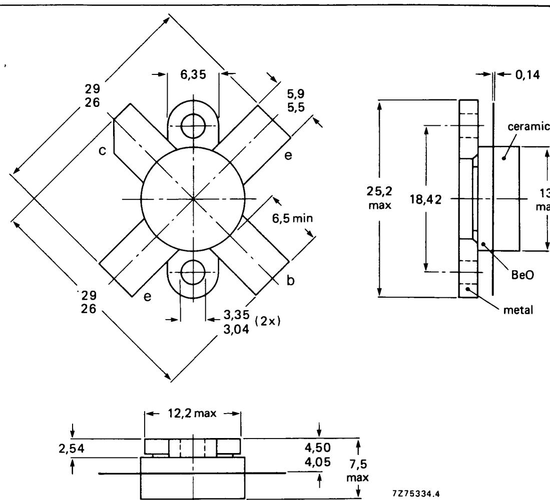
QUICK REFERENCE DATA

R.F. performance at T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_P dB	η_{dt} %	d_3 dB	d_5 dB
s.s.b. class-AB	12,5	0,15	1,6-28	80 (P.E.P.)	> 12,5	> 35	< −24	< −24

MECHANICAL DATA

Fig. 1 SOT-121.



Torque on screw: min. 0,60 Nm (6,0 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				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	36	V
open base	V_{CEO}	max.	17	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
average	$I_{C(AV)}$	max.	18	A
(peak value); f > 1 MHz	I_{CM}	max.	55	A
D.C. power dissipation at $T_{mb} = 25\ ^oC$	$P_{tot(d.c.)}$	max.	154	W
R.F. power dissipation				
f > 1 MHz; $T_{mb} = 25\ ^oC$	$P_{tot(rf)}$	max.	192	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

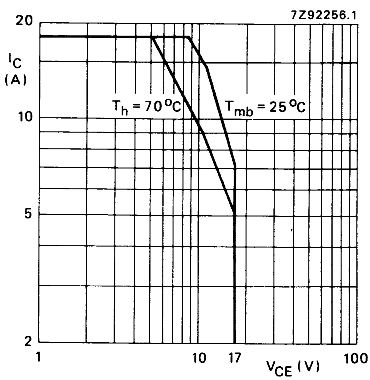


Fig. 2 D.C. SOAR.

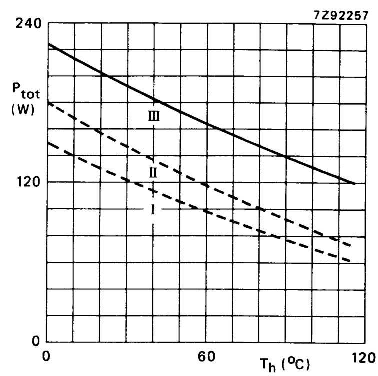


Fig. 3 Power/temperature derating curves.

I Continuous d.c. operation
II Continuous r.f. operation; (f > 1 MHz)
III Short-time r.f. operation during mismatch (f > 1 MHz)

THERMAL RESISTANCE

Dissipation = 100 W; $T_{mb} = 25\ ^oC$

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,00 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,75 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage			
V_{BE} = 0; I_C = 50 mA	$V_{(BR)CES}$	>	36 V
open base; I_C = 100 mA	$V_{(BR)CEO}$	>	17 V
Emitter-base breakdown voltage			
open collector; I_E = 20 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
V_{BE} = 0; V_{CE} = 17 V	I_{CES}	<	20 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	12,5 mJ
R_{BE} = 10 Ω	E_{SBR}	>	12,5 mJ
D.C. current gain*			
I_C = 10 A; V_{CE} = 5 V	h_{FE}	typ. 15 to	35 80
D.C. current gain ratio of matched devices*			
I_C = 10 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage*			
I_C = 25 A; I_B = 5 A	V_{CEsat}	typ.	1,7 V
Transition frequency at f = 100 MHz**			
$-I_E$ = 10 A; V_{CB} = 12,5 V	f_T	typ.	290 MHz
$-I_E$ = 20 A; V_{CB} = 12,5 V	f_T	typ.	275 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 12,5 V	C_c	typ.	400 pF
Feedback capacitance at f = 1 MHz			
I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	265 pF
Collector-flange capacitance	C_{cf}	typ.	4,5 pF

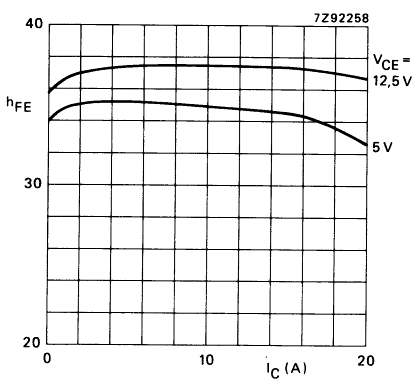


Fig. 4 T_j = 25 °C.

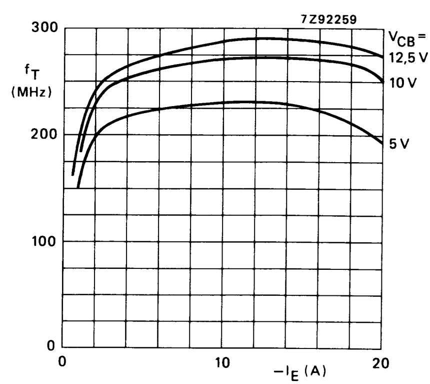


Fig. 5 f = 100 MHz; T_j = 25 °C.

* Measured under pulse conditions: t_p = 500 μs.
** Measured under pulse conditions: t_p = 300 μs; δ = 0,02.

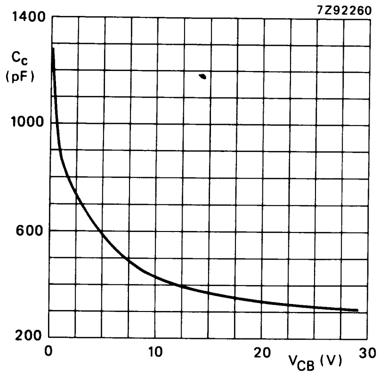


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

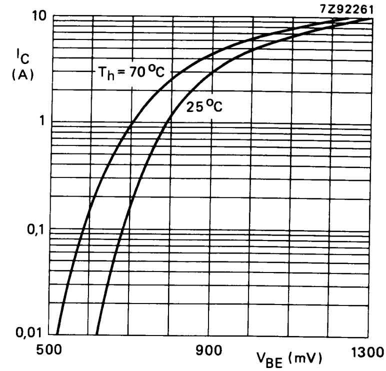


Fig. 7 V_{CE} = 12,5 V; typ. values.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier) V_{CE} = 12,5 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	I_C A	d_3* dB	d_5* dB	$I_{C(ZS)}$ A
80 (P.E.P.)	> 12,5 typ. 14	> 35 typ. 40	< 9,1 typ. 7,6	< −24 typ. −27	< −24 typ. −36	0,15

* The stated intermodulation distortion levels 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.

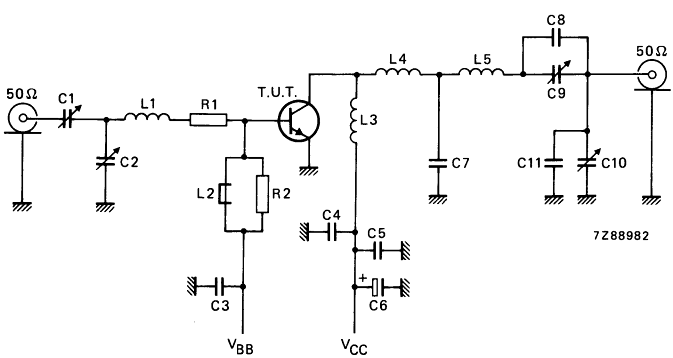


Fig. 8 Class-AB test circuit, s.s.b.

List of components:

C1 = C2 = 270 pF film dielectric trimmer capacitor
C3 = 220 nF chip capacitor
C4 = 1 nF chip capacitor*
C5 = 100 nF chip capacitor
C6 = 47 μF − 63 V electrolytic capacitor
C7 = 3 x 180 pF multilayer ceramic chip capacitors in parallel*
C8 = 2 x 150 pF (500 V) multilayer ceramic chip capacitors*
C9 = C10 = 100 pF film dielectric trimmer capacitor
C11 = 150 pF multilayer ceramic chip capacitor*

R1 = 4 x 1,2 Ω carbon resistors in parallel (4 x 0,125 W)
R2 = 27 Ω carbon resistor (0,5 W)

L1 = 3 turns Cu wire (2 mm); int. dia. 8 mm; length 9 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke (cat. no. 4312 020 36640)
L3 = L4 = 2 turns Cu wire (2 mm); int. dia. 8 mm; length 5 mm; leads 2 x 5 mm
L5 = 3 turns Cu wire (2 mm); int. dia. 8,5 mm; length 8,5 mm; length 8,5 mm; leads 2 x 5 mm

* American Technical Ceramics capacitor type 100 B or capacitor of same quality.

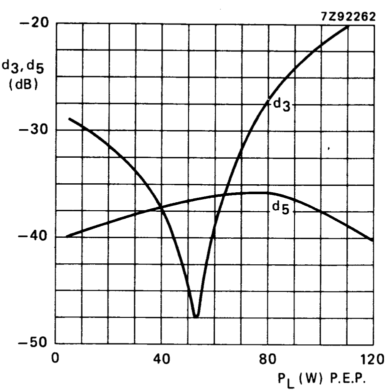


Fig. 9 Intermodulation distortion (see note on preceding page); typ. values.

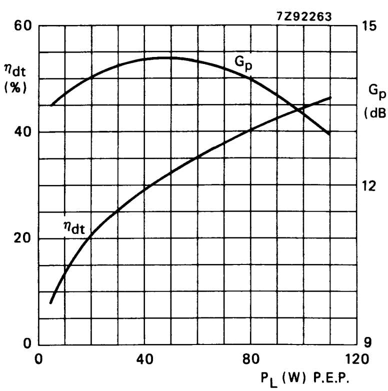


Fig. 10 Double-tone efficiency and power gain; typ. values.

Conditions for Figs 9 and 10:

V_{CE} = 12,5 V; $I_{C(ZS)}$ = 0,15 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C.

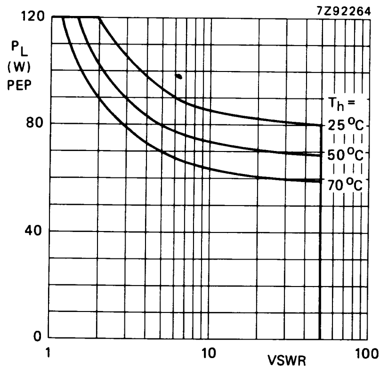


Fig. 11 R.F. SOAR: s.s.b. class-AB operation; V_{CE} = 15 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

This graph shows the permissible output power as a function of VSWR during mismatch conditions with the heatsink temperature as parameter.

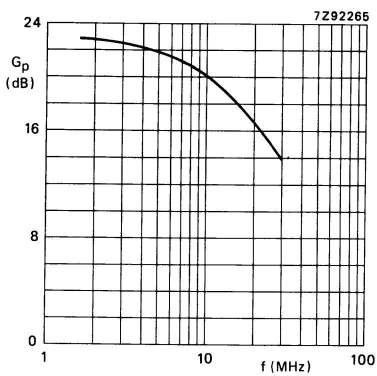


Fig. 12 Power gain.

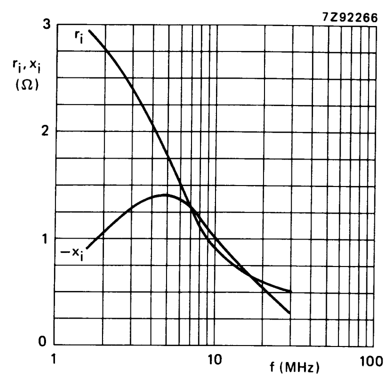


Fig. 13 Input impedance (series components).

Conditions for Figs 12 and 13:

V_{CE} = 12,5 V; $I_{C(ZS)}$ = 0,15 A; Z_L = 0,65 Ω; P_L = 80 W (PEP); T_h = 25 °C.

The curves in Figs 12 and 13 are typical and hold for one transistor of a push-pull amplifier in s.s.b. class-AB operation.