VHF LINEAR PUSH-PULL POWER TRANSISTOR

Two NPN silicon planar epitaxial transistor sections in one envelope to be used as a push-pull amplifier. This device is primarily intended for use in linear VHF television transmitters and transposers (vision or sound amplifier).

Features

- Internally matched input for wideband operation and high power gain
- Internal midpoint (RF ground) reduces negative feedback and improves power gain
- Increased input and output impedance (compared with single-ended transistors) simplify wideband matching
- Length of external emitter leads is not critical
- Diffused emitter balancing resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

RF performance in push-pull amplifier

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	T_h °C	G_p dB	η_c %	gain compression dB
CW; class-AB	28	2 x 0.25	224.25	115	25	≥ 11.0 typ. 13.0	≥ 48 typ. 55	≤ 1.0*

* Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, CCIR system).

MECHANICAL DATA

SOT161 (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.**

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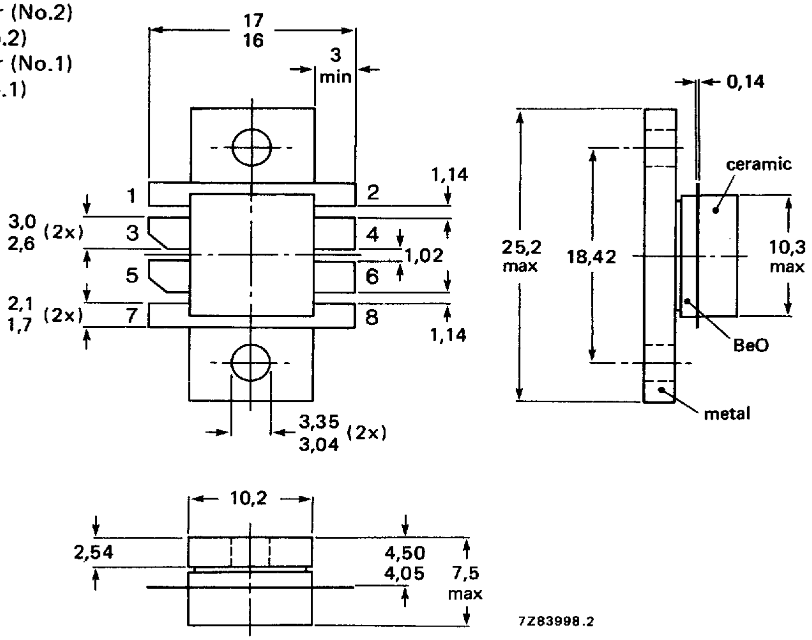
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT161.

Pinning

1 = Emitter
2 = Emitter
3 = Collector (No.2)
4 = Base (No.2)
5 = Collector (No.1)
6 = Base (No.1)
7 = Emitter
8 = Emitter



Torque on screw: min. 0.60 Nm
max. 0.75 Nm

Recommended screw: cheese-head 4-40 UNC/2A
Heatsink compound must be sparingly applied and evenly distributed.

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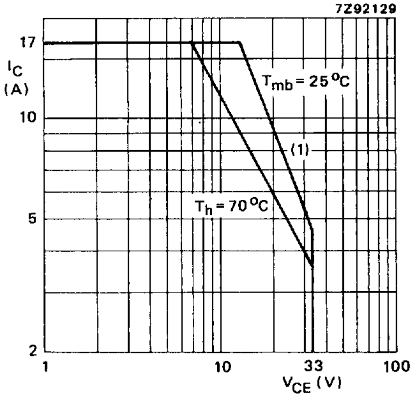
RATINGS

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

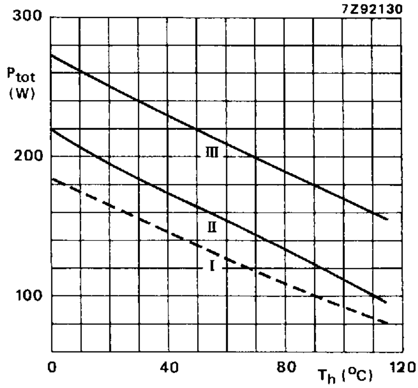
Collector-emitter voltage (peak value);			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	65 V
open base	V_{CEO}	max.	33 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current per transistor section			
DC or average	I_C, $I_{C(AV)}$	max.	8.5 A
(peak value); f > 1 MHz	I_{CM}	max.	17.5 A
Total DC power dissipation; $T_{mb} = 25\ ^oC$	$P_{tot(DC)}$	max.	218 W*
RF power dissipation			
f > 1 MHz; $T_{mb} = 25\ ^oC$	$P_{tot(RF)}$	max.	270 W*
Storage temperature range	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C



(1) Second breakdown limit.

Fig.2 DC SOAR.

Conditions for Figs 2 and 3:
$R_{th\ mb\text{-}h} = 0.25$ K/W; Total device*.



I Continuous DC operation
II Continuous RF operation; (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)

Fig.3 Power/temperature derating curves.

THERMAL RESISTANCE

(dissipation = 180 W; $T_{mb} = 25\ ^oC$)**

From junction to mounting base (DC dissipation)	$R_{th\ j\text{-}mb(DC)}$	=	0.85 K/W
From junction to mounting base (RF dissipation)	$R_{th\ j\text{-}mb(RF)}$	=	0.64 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.25 K/W

* Dissipation of either transistor section shall not exceed half rated power.
** Both transistor sections equally loaded.

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CHARACTERISTICS

Apply to either transistor section unless otherwise specified. $T_j = 25\ ^oC$.

Collector-emitter breakdown voltage				
$V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	65	V
open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	33	V
Emitter-base breakdown voltage				
open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
$V_{BE} = 0$; $V_{CE} = 33$ V	I_{CES}	<	10	mA
Second-breakdown energy; L = 25 mH; f = 50 Hz				
$R_{BE} = 10\ \Omega$	E_{SBR}	>	10	mJ
DC current gain*				
$I_C = 3.5$ A; $V_{CE} = 25$ V	h_{FE}	typ.	45	
		15 to	100	
Transition frequency at f = 100 MHz*				
$-I_E = 3.3$ A; $V_{CB} = 25$ V	f_T	typ.	575	MHz
$-I_E = 10$ A; $V_{CB} = 25$ V	f_T	typ.	600	MHz
Collector capacitance at f = 1 MHz				
$I_E = i_e = 0$; $V_{CB} = 25$ V	C_c	typ.	155	pF
Feedback capacitance at f = 1 MHz				
$I_C = 50$ mA; $V_{CE} = 25$ V	C_{re}	typ.	88	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0.02$.

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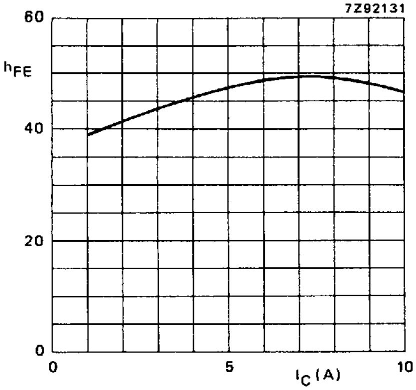

Fig.4 DC current gain as a function of collector current; V_{CE} = 25 V; T_j = 25 °C; typical values.

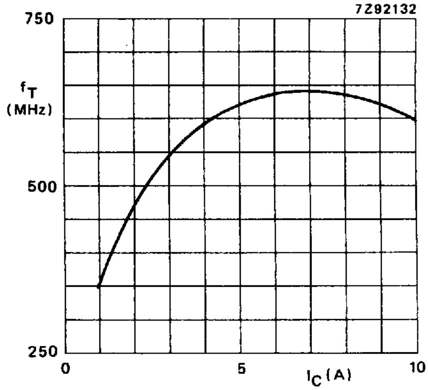

Fig.5 Transition frequency as a function of collector current; V_{CE} = 25 V; f = 100 MHz; T_j = 25 °C; typical values.

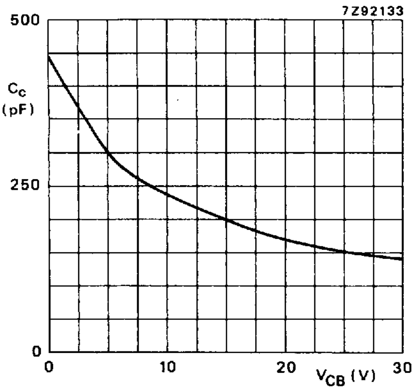

Fig.6 Collector capacitance as a function of collector-base voltage; $I_E = i_e = 0$; f = 1 MHz; typical values.

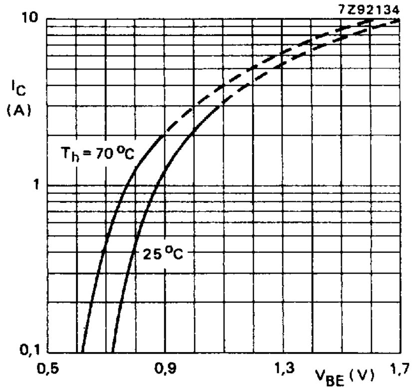

Fig.7 Collector current as a function of base-emitter voltage; V_{CE} = 25 V; typical values.

The above graphs apply to either transistor section.

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APPLICATION INFORMATION

RF performance in VHF class-AB operation (linear push-pull power amplifier) V_{CE} = 28 V;
T_h = 25 °C; f = 224.25 MHz.

mode of operation	P_L W	$I_{C(ZS)}$ A	G_P dB	η_C %	gain compression dB
class-AB; CW	115	2 x 0.15	≥ 11.0 typ. 13.0	≥ 48 typ. 55	≤ 1.0* typ. 0.5*

* Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

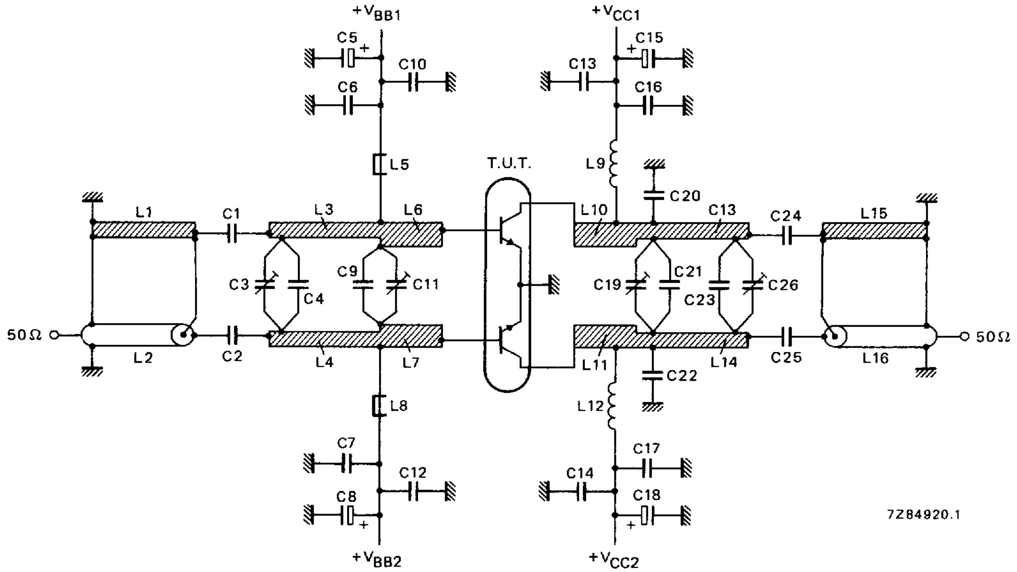

Fig.8 Class-AB test circuit at 224.25 MHz.

List of components:

C1 = C2 = C24 = C25 = 68 pF (500 V) multilayer ceramic chip capacitor.**
C3 = C11 = C26 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002).
C4 = 33 pF (500 V) multilayer ceramic chip capacitor.**
C5 = C8 = 4.7 μF (63 V) electrolytic capacitor.
C6 = C7 = C16 = C17 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 855 48104).
C9 = 2 x 47 pF (500 V) multilayer ceramic chip capacitors in parallel.**
C10 = C12 = C13 = C14 = 470 pF multilayer ceramic chip capacitor (cat. no. 2222 852 13471).
C15 = C18 = 10 μF (63 V) electrolytic capacitor.
C19 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 05003).
C20 = C22 = 3.3 pF (500 V) multilayer ceramic chip capacitor.**
C21 = parallel connection of 2 x 27 pF (500 V) ceramic chip capacitors.**
C23 = 5.6 pF (500 V) multilayer ceramic chip capacitor.**

(C9 and C11 are connected 11 mm from transistor edge and C19 and C21 18 mm from transistor edge.)

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

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L1 = L15 = 50 Ω stripline (2.8 mm x 91.3 mm).
L2 = L16 = 50 Ω semi-rigid cable; outer diameter 2.2 mm; outer conductor length 91.3 mm.
L3 = L4 = L13 = L14 = 60 Ω stripline (2.0 mm x 27.9 mm).
L5 = L8 = 100 nH microchoke.
L6 = L7 = L10 = L11 = 48 Ω stripline (3.0 mm x 14.6 mm).
L9 = L12 = 20.5 nH; 2 turns enamelled Cu wire (1.0 mm); int. dia. 4.5 mm; length 3 mm; leads 2 x 10 mm; connected 15 mm from transistor edge.

L1, L3, L4, L6, L7, L10, L11, L13, L14 and L15 are striplines on a double Cu-clad printed circuit board with epoxy fibre-glass dielectric (ϵ_r = 4.5); thickness 1/16 inch.

The printed circuit board and component layout for a 224.25 MHz, class-AB test are given in Fig. 9 and Fig. 10 respectively.

The circuit and the components are on one side of the epoxy fibre-glass board; the other side is unetched copper to serve as ground plane. Earth connections are made by hollow rivets and in addition by fixing screws and also by copper straps under the emitters and at the input and output.

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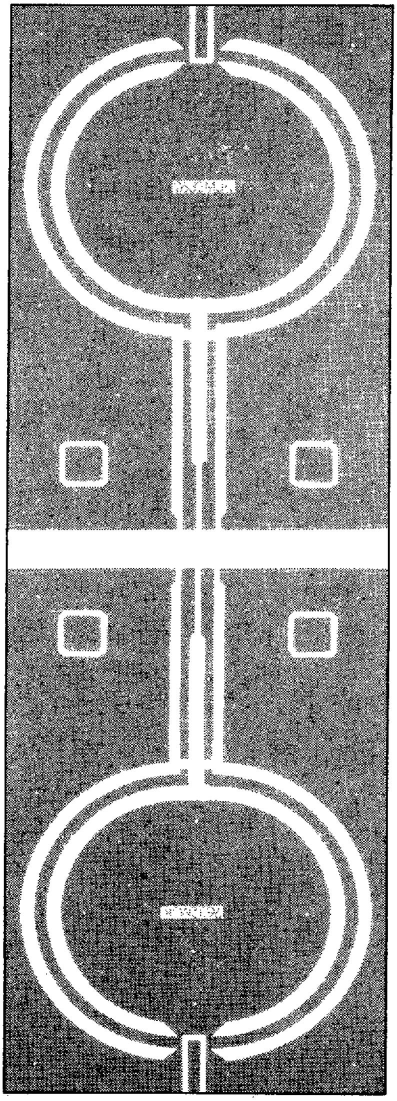

Fig. 9 Printed circuit board for 224.25 MHz class-AB test circuit.

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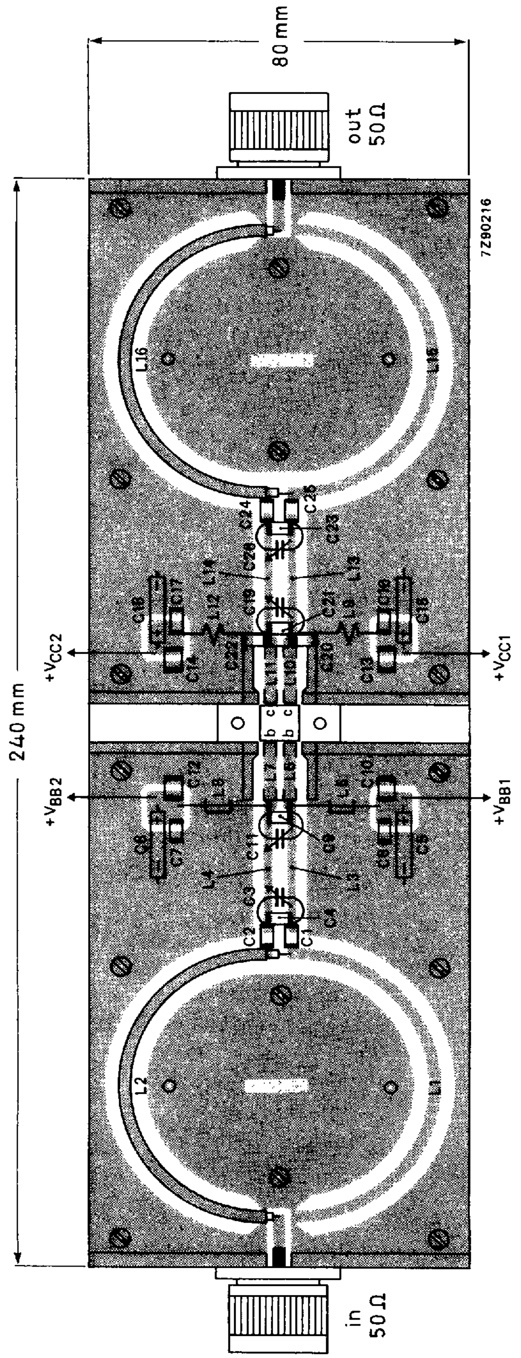

Fig. 10 Component layout of a 224.25 MHz class-AB test circuit.

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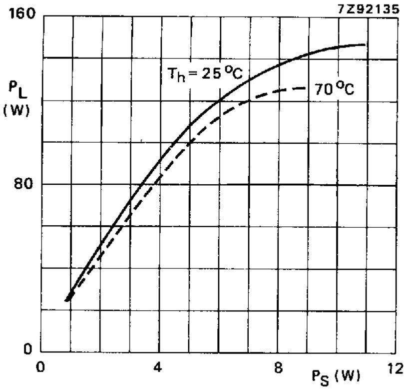

Fig.11 Load power as a function of source power; typical values.

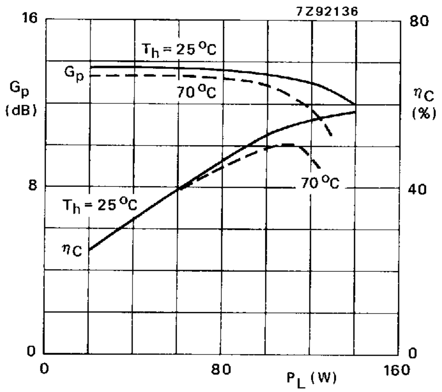

Fig.12 Power gain and efficiency as functions of load power; typical values.

Conditions for Figs 11 and 12:
V_{CE} = 28 V; $I_{C(ZS)}$ = 2 x 0.15 A; f = 224.25 MHz; class-AB.

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RUGGEDNESS

The BLV36 is capable of continuously withstanding a load mismatch (VSWR = 5, through all phases) up to 80 W under the following conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 2 x 0.15 A; T_h = 25 °C; f = 224.25 MHz; $R_{th\ mb\text{-}h}$ = 0.25 K/W.

The instantaneous collector current should not exceed 10 A.

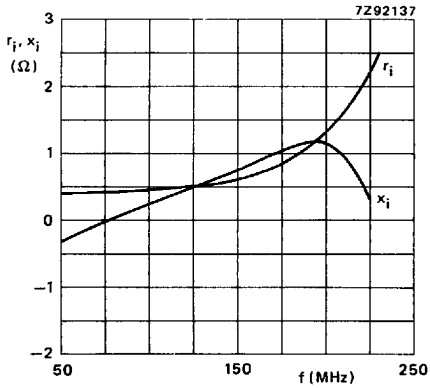

Fig.13 Input impedance (series components) as a function of frequency; typical values.

Conditions for Figs 13, 14 and 15:

The graphs apply to either transistor section assuming class-AB push-pull operation
V_{CE} = 28 V; $I_{C(ZS)}$ = 0.15 A; P_L = 70 W;
T_h = 25 °C.

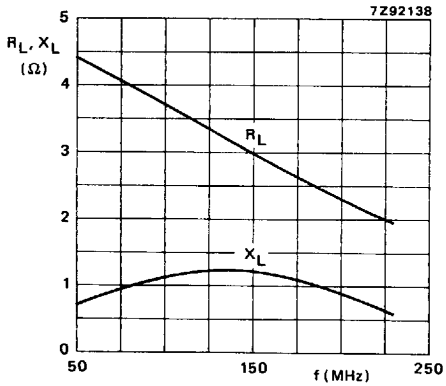

Fig.14 Load impedance (series components) as a function of frequency; typical values.

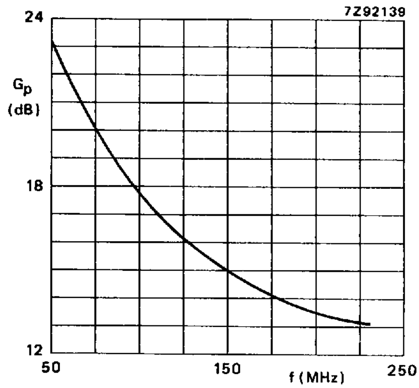

Fig.15 Power gain as a function of frequency; typical values.

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