DATA SHEET

BLV950
UHF push-pull power transistor

Product specification
File under Discrete Semiconductors, SC08b

1996 Jan 26

Philips Semiconductors

PHILIPS

UHF push-pull power transistor BLV950

FEATURES

- Internal input and output matching for easy matching, high gain and efficiency
- Poly-silicon emitter ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

APPLICATIONS

- Base station transmitters in the 800 to 960 MHz range.

DESCRIPTION

Two NPN silicon planar epitaxial transistors in push-pull configuration, intended for linear common emitter class-AB operation. The transistor is encapsulated in a 4-lead SOT262A2 flange envelope with 2 ceramic caps. The flange provides the common emitter connection for both transistors.

PINNING - SOT262A2

PIN	SYMBOL	DESCRIPTION
1	c1	collector 1
2	c2	collector 2
3	b1	base 1
4	b2	base 2
5	e	emitter

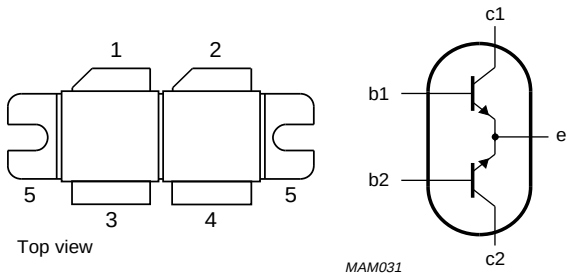


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter push-pull test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)	d_3 (dBc)
CW, class-AB	900	26	150	≥8	≥45	–
	960	26	150	≥7.5	≥45	–
2-tone, class-AB	900	26	150 (PEP)	≥8.5	≥35	≤–30
	960	26	150 (PEP)	≥8	≥35	≤–30

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO discs are not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).
Per transistor section unless otherwise specified.

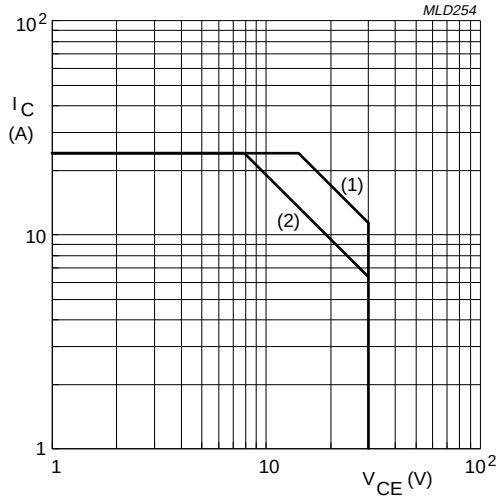
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	12	A
$I_{C(AV)}$	average collector current		–	12	A
P_{tot}	total power dissipation (DC)	T_{mb} = 25 °C; note 1	–	340	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 340 W; T_{mb} = 25 °C; note 1	0.52	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.15	K/W

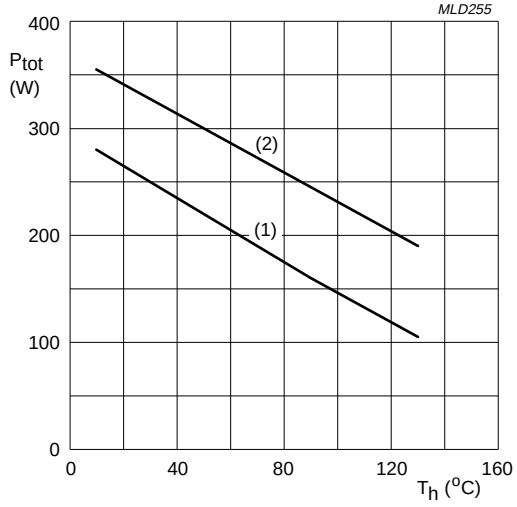
Note to “Limiting values” **and** “Thermal characteristics”

1. Total device; both sections equally loaded.



Total device; both sections equally loaded.
(1) T_{mb} = 25 °C.
(2) T_h = 70 °C.

Fig.2 DC SOAR.



Total device; both sections equally loaded.
(1) Continuous operation.
(2) Short time during mismatch.

Fig.3 Power derating curve.

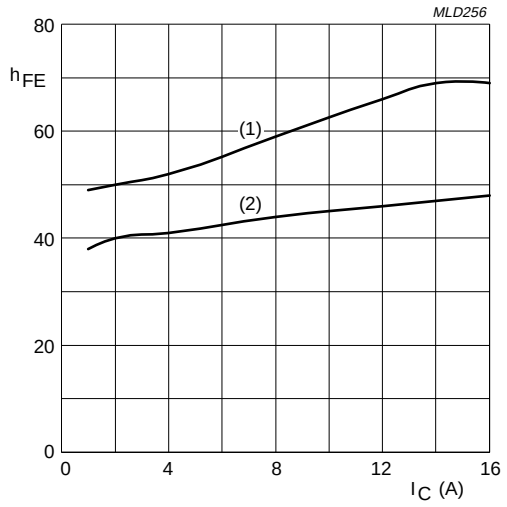
CHARACTERISTICS

Values apply to either transistor section; T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 60 mA	70	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 150 mA	30	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 3 mA	3	–	–	V
I_{CES}	collector leakage current	V_{BE} = 0; V_{CE} = 28 V	–	–	5	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 4.5 A; note 1	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; $I_E = i_e$ = 0; f = 1 MHz; note 2	–	75	–	pF

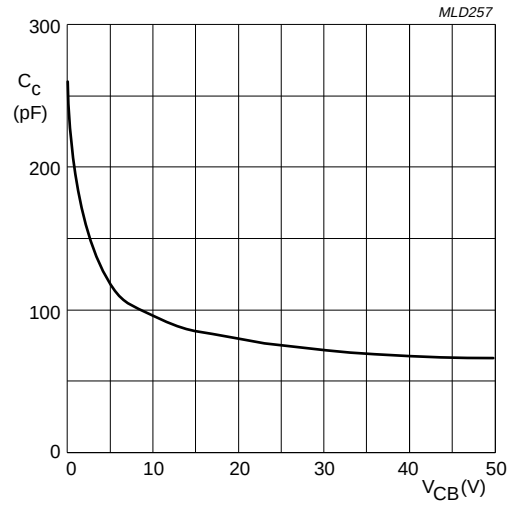
Notes

1. Measured under pulse conditions: $t_p \leq 300$ μs; $\delta \leq 0.01$.
2. Value C_c is that of the die only, it is not measurable because of internal matching network.



Measured under pulsed conditions; $t_p \leq 300$ μs; $\delta \leq 0.01$.
(1) V_{CE} = 26 V.
(2) V_{CE} = 10 V.

Fig.4 DC current gain as a function of collector current; typical values.



Value C_c is that of the die only, it is not measurable because of internal matching network.
$I_E = i_e$ = 0; f = 1 MHz.

Fig.5 Collector capacitance as a function of collector-base voltage; typical values.

APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter push-pull test circuit; $R_{th\ mb\text{-}h}$ = 0.15 K/W.

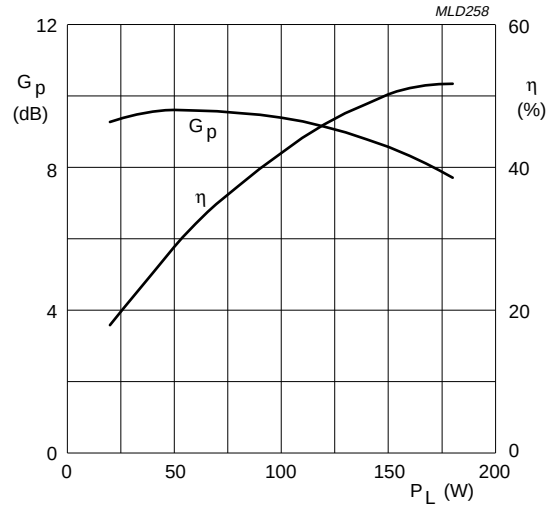
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)	d_3 (dBc)
CW, class-AB	900	26	2 × 100	150	≥8 typ. 9	≥45 typ. 50	–
	960	26	2 × 100	150	≥7.5 typ. 8.5	≥45 typ. 50	–
2-tone, class-AB	note 1	26	2 × 100	150 (PEP)	≥8.5 typ. 9.5	≥35 typ. 40	≤–28 typ. –31
	note 2	26	2 × 100	150 (PEP)	≥8 typ. 9	≥35 typ. 40	≤–30 typ. –33

Notes

1. f_1 = 900.0 MHz; f_2 = 900.1 MHz.
2. f_1 = 960.0 MHz; f_2 = 960.1 MHz.

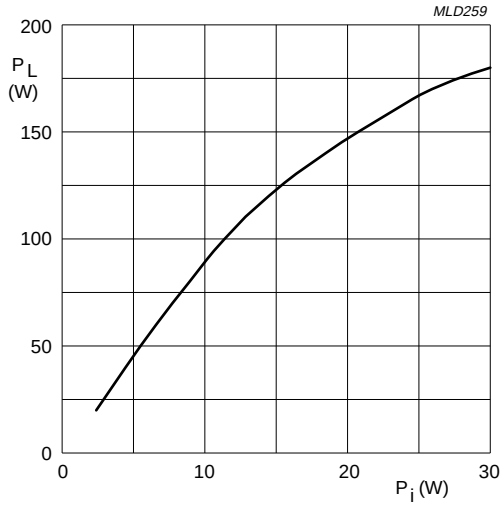
Ruggedness in class-AB operation

The BLV950 is capable of withstanding a load mismatch corresponding to VSWR = 2 : 1 through all phases under the conditions: P_L = 150 W; f = 960 MHz; V_{CE} = 26 V; I_{CQ} = 2 × 100 mA; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.15 K/W and also a load mismatch of VSWR = 5 : 1 through all phases at P_L = 150 W (PEP) and f_1 = 960.0 MHz and f_2 = 960.1 MHz.



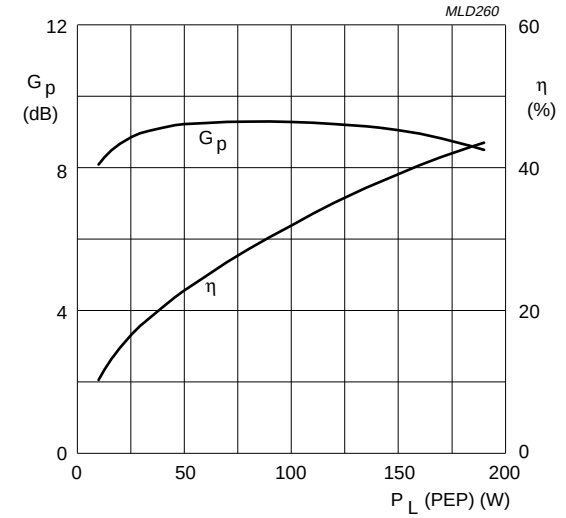
V_{CE} = 26 V.
I_{CQ} = 2 × 100 mA.
f = 960 MHz.

Fig.6 Power gain and efficiency as functions of load power; typical values.



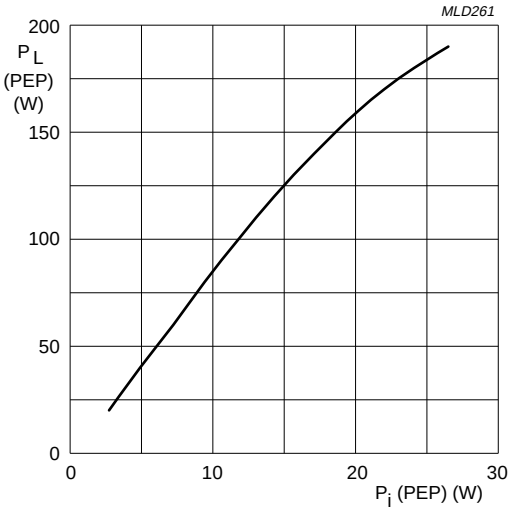
V_{CE} = 26 V.
I_{CQ} = 2 × 100 mA.
f = 960 MHz.

Fig.7 Load power as a function of input power; typical values.



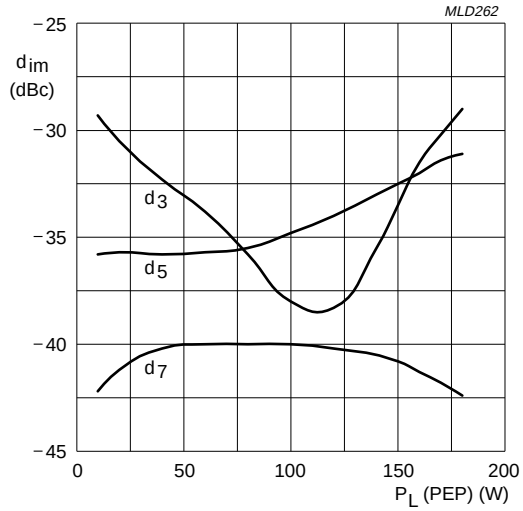
V_{CE} = 26 V.
I_{CQ} = 2 × 100 mA.
f_1 = 960.0 MHz.
f_2 = 960.1 MHz.

Fig.8 Power gain and efficiency as functions of load power; typical values.



V_{CE} = 26 V.
I_{CQ} = 2 × 100 mA.
f_1 = 960.0 MHz.
f_2 = 960.1 MHz.

Fig.9 Load power as a function of input power; typical values



V_{CE} = 26 V.
I_{CQ} = 2 × 100 mA.
f_1 = 960.0 MHz.
f_2 = 960.1 MHz.

Fig.10 Intermodulation distortion as a function of load power; typical values.

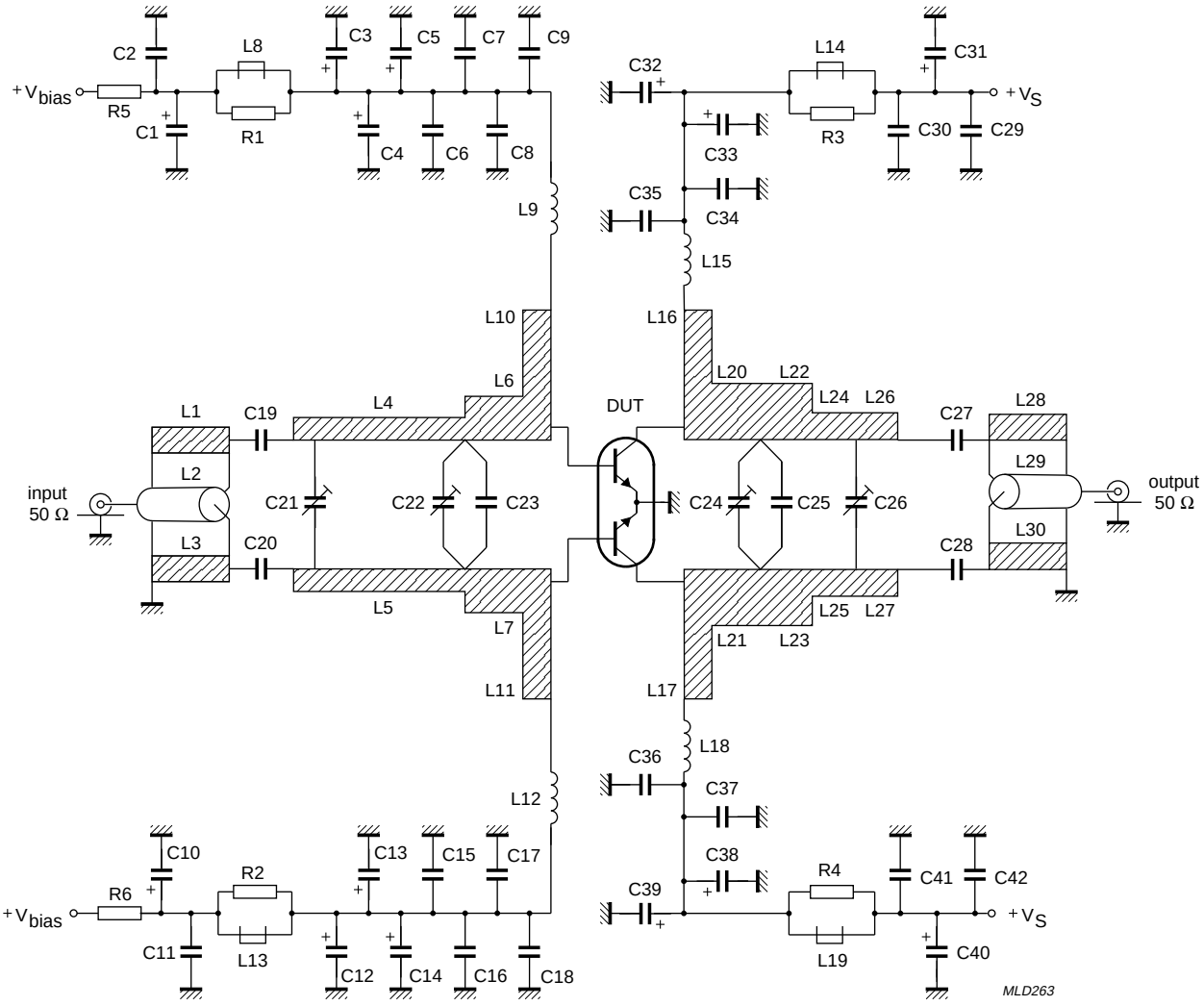


Fig.11 Class-AB test circuit at 900 to 960 MHz.

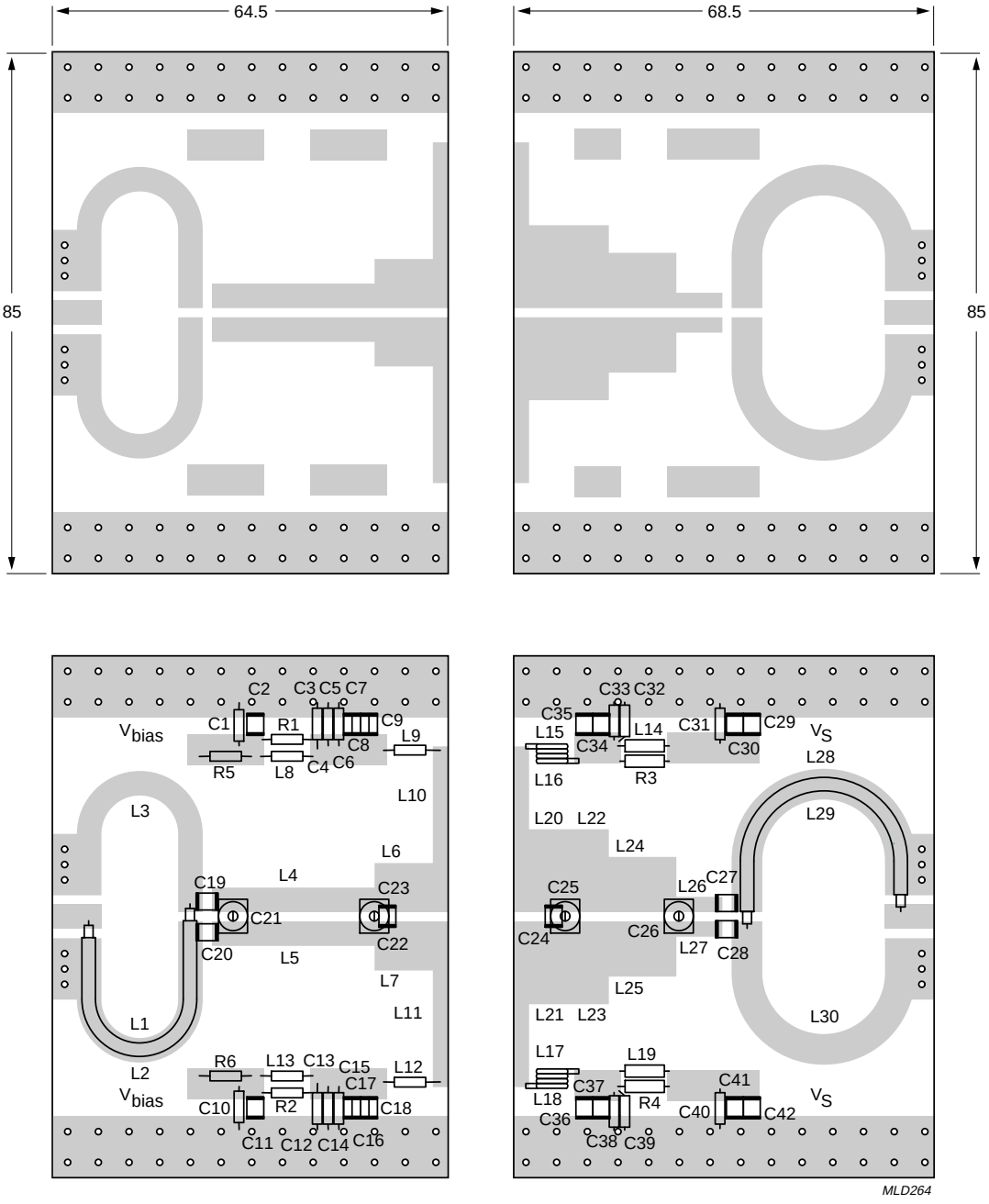
List of components (see Figs 11 and 12)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C10	tantalum capacitor	2.2 μF, 35 V		2022 019 00058
C2, C11, C30, C34, C37, C41	multilayer ceramic chip capacitor; note 1	300 pF, 200 V		
C3, C12	electrolytic capacitor	1 μF, 63 V		2222 085 78108
C4, C13	electrolytic capacitor	10 μF, 16 V		2222 085 75109
C5, C14, C31, C40	tantalum capacitor	1 μF, 35 V		2022 019 00056
C6, C15, C29, C42	multilayer ceramic chip capacitor	100 nF, 50 V		2222 581 76641
C7, C16	multilayer ceramic chip capacitor	10 nF, 50 V		2222 581 76627
C8, C17	multilayer ceramic chip capacitor; note 1	330 pF, 200 V		
C9, C18, C19, C20, C35, C36	multilayer ceramic chip capacitor; note 1	39 pF, 500 V		
C23	multilayer ceramic chip capacitor; note 1	2 pF, 500 V		
C25	multilayer ceramic chip capacitor; note 1	3.9 pF, 500 V		
C21, C22	film dielectric trimmer	9 pF		2222 809 09005
C24, C26	film dielectric trimmer	3.5 pF		2222 809 05215
C27, C28	multilayer ceramic chip capacitor; note 1	68 pF, 500 V		
C32, C39	electrolytic capacitor	10 μF, 63 V		2222 030 28109
C33, C38	electrolytic capacitor	1 μF, 63 V		2222 030 38108
L1, L3	stripline; note 2	35 Ω	length 50.7 mm width 4 mm	
L2	semi-rigid cable; note 3	50 Ω	ext. conductor length 50.7 mm ext. diameter 2.2 mm	
L4, L5	stripline; note 2	35 Ω	length 26.5 mm width 4 mm	
L6, L7	stripline; note 2	20 Ω	length 9.2 mm width 8 mm	
L10, L11, L16, L17	stripline; note 2	7 Ω	length 2.5 mm width 27 mm	
L8, L13, L14, L19	grade 4S2 Ferroxcube chip-bead			4330 030 36300
L9, L12	microchoke	4.7 μH		4322 057 04781
L15, L18	4 turns enamelled 1 mm copper wire	100 nH	int. diameter 6 mm close wound	
L20, L21	stripline; note 2	14 Ω	length 6 mm width 12.5 mm	

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
L22, L23	stripline; note 2	14 Ω	length 7 mm width 12.5 mm	
L24, L25	stripline; note 2	18 Ω	length 11 mm width 9 mm	
L26, L27	stripline; note 2	50 Ω	length 6.5 mm width 2.5 mm	
L28, L30	stripline; note 2	30 Ω	length 49.3 mm width 5 mm	
L29	semi-rigid cable; note 3	50 Ω	ext. conductor length 49.3 mm ext. diameter 3.6 mm	
R5, R6	metal film resistor	0.4 W, 1 Ω		2322 151 71008
R1, R2	metal film resistor	0.4 W, 5.11 Ω		2322 151 75118
R3, R4	metal resistor	1 W, 5.11 Ω		2322 153 75118

Notes

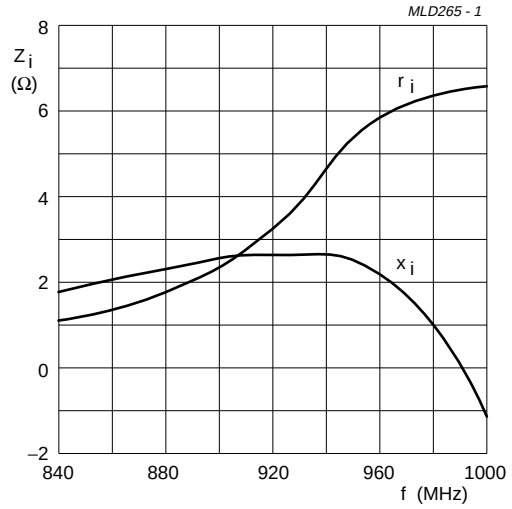
1. American Technical Ceramics type 100B or capacitor of same quality.
2. The striplines are on a double copper-clad printed-circuit board, with microfibre-glass dielectric (ε_r = 2.2); thickness $^1/_{32}$"; thickness of the copper sheet 2 × 35 μm.
3. Semi-rigid cables soldered respectively on striplines L1 and L28.



Dimensions in mm.

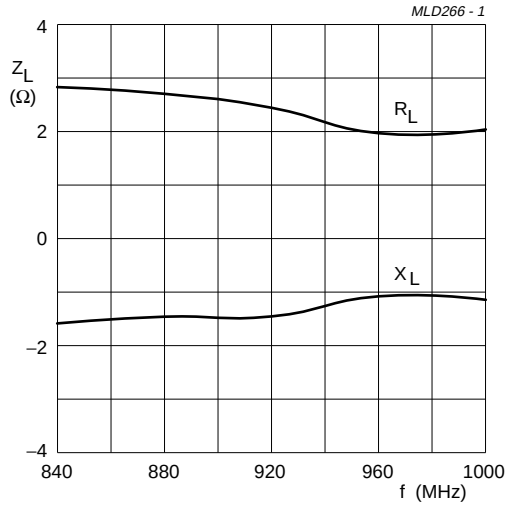
The components are situated on one side of the copper-clad PTFE microfibre-glass board, the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

Fig.12 Component layout and printed-circuit board for 900 to 960 MHz class-AB test circuit.



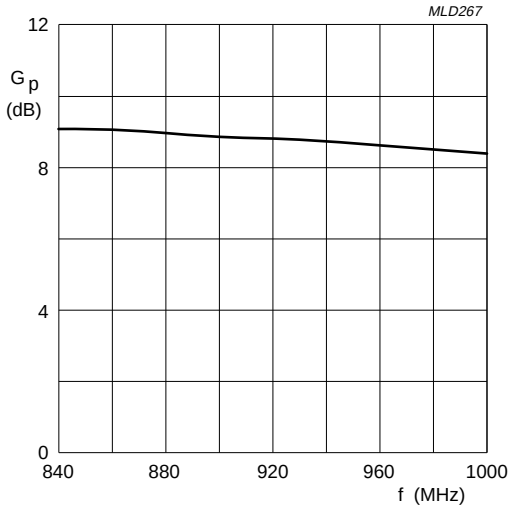
V_{CE} = 26 V; I_{CQ} = 2 × 100 mA; P_L = 150 W (total device);
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.15 K/W.

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



V_{CE} = 26 V; I_{CQ} = 2 × 100 mA; P_L = 150 W (total device);
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.15 K/W.

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



V_{CE} = 26 V; I_{CQ} = 2 × 100 mA; P_L = 150 W (total device);
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.15 K/W.

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

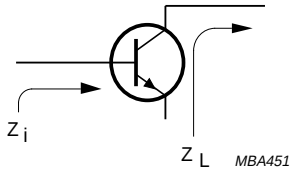
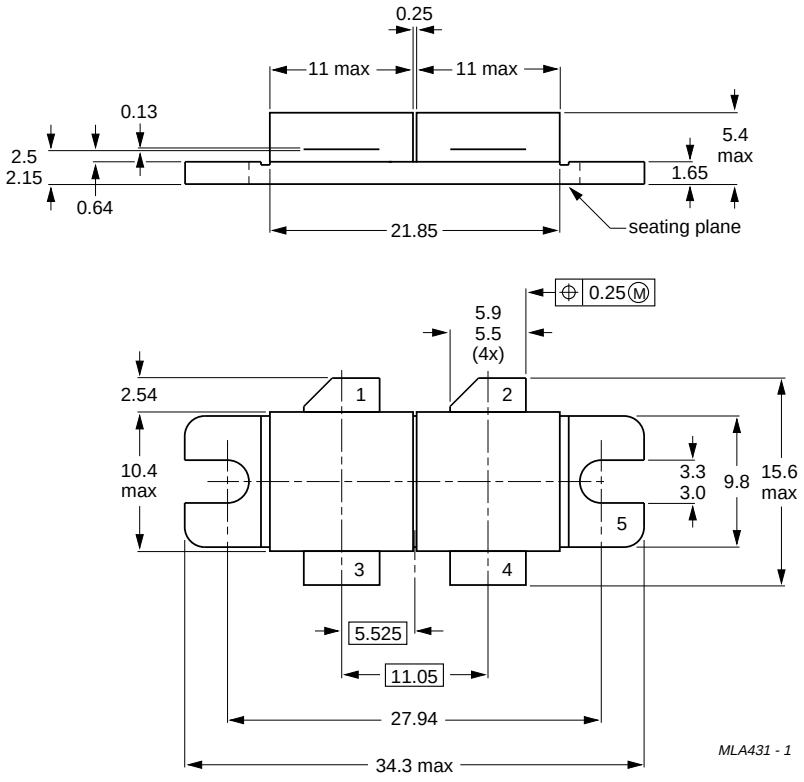


Fig.16 Definition of transistor impedance.

PACKAGE OUTLINE



Dimensions in mm.

Torque on screw: min. 0.6 Nm; max. 0.75 Nm.

Recommended screw: cheese-head 4-40 UNC/2A.

Heatsink compound must be applied sparingly and evenly distributed.

Fig.17 SOT262A2.

DEFINITIONS

Data Sheet Status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

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