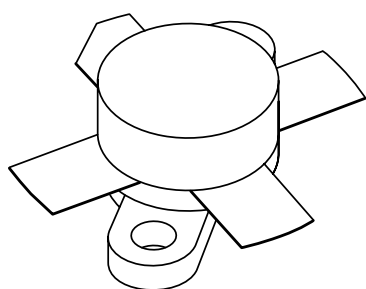


# DATA SHEET



## **BLF246** VHF power MOS transistor

Product specification  
Supersedes data of 1996 Oct 21

2003 Aug 05

VHF power MOS transistor

BLF246

FEATURES

- High power gain
- Low noise figure
- Easy power control
- Good thermal stability
- Withstands full load mismatch.

APPLICATIONS

- Large signal amplifier applications in the VHF frequency range.

DESCRIPTION

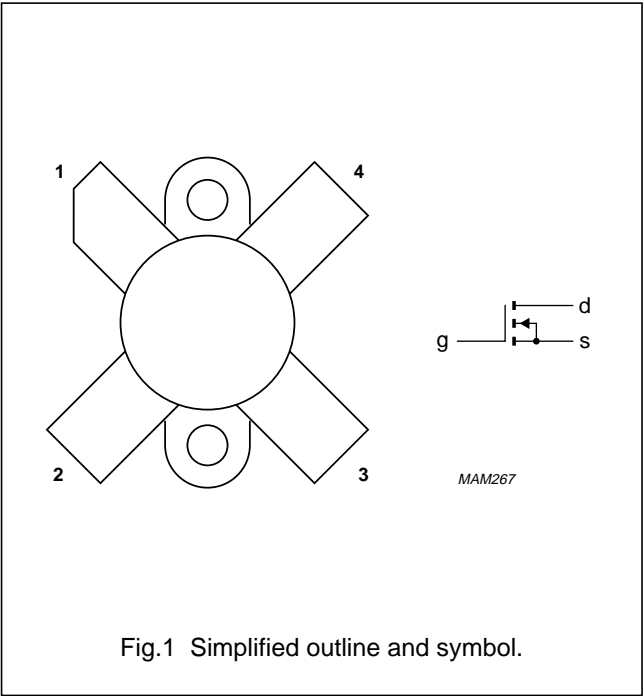
Silicon N-channel enhancement mode vertical D-MOS transistor encapsulated in a 4-lead, SOT121B flange package with a ceramic cap. All leads are isolated from the flange. A marking code, showing gate-source voltage ( $V_{GS}$ ) information is provided for matched pair applications. Refer to the “General” section of the handbook for further information.

CAUTION

This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling. For further information, refer to Philips specs.: SNW-EQ-608, SNW-FQ-302A, and SNW-FQ-302B.

PINNING - SOT121B

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source



QUICK REFERENCE DATA

RF performance at  $T_h = 25\text{ }^{\circ}\text{C}$  in a common source test circuit.

MODE OF OPERATION	f (MHz)	$V_{DS}$ (V)	$P_L$ (W)	$G_p$ (dB)	$\eta_D$ (%)
CW, class-B	108	28	80	$\geq 16$	$\geq 55$

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is 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.

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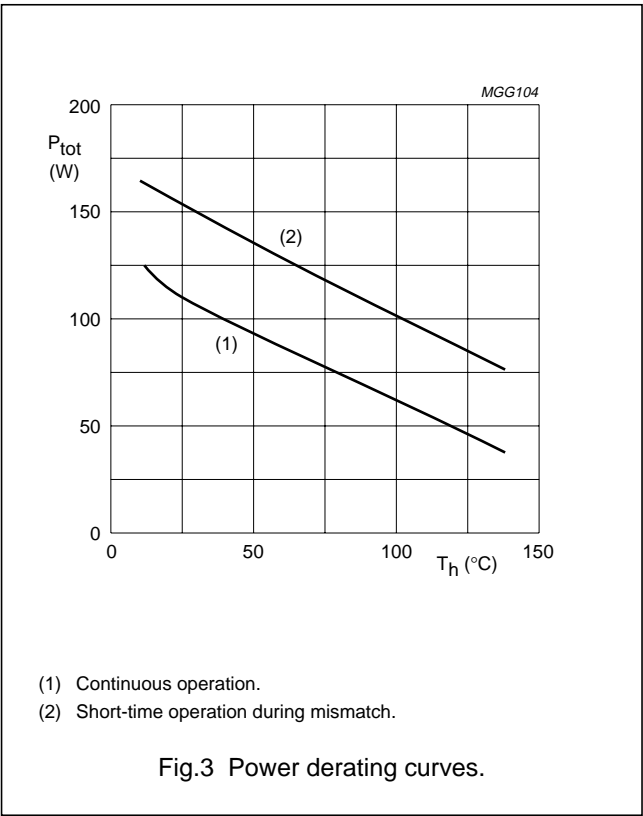
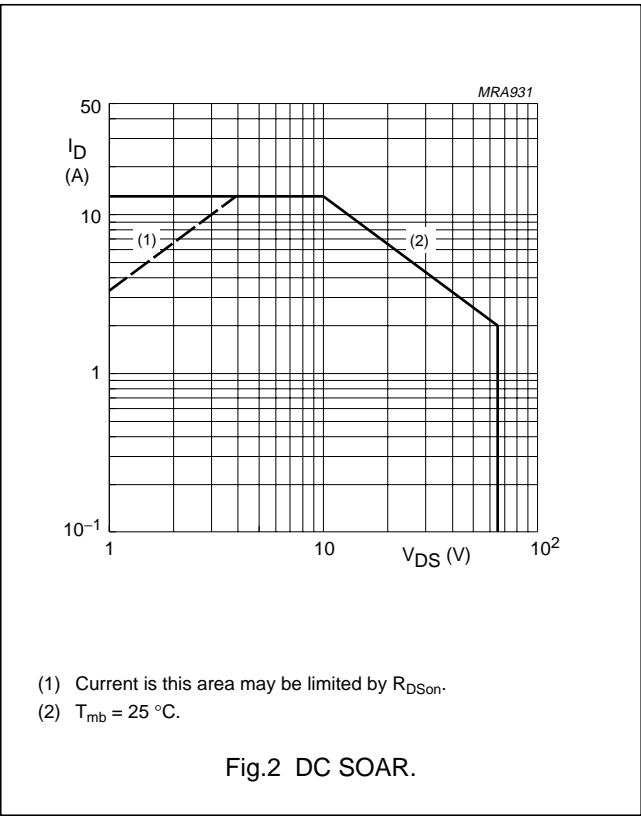
LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 60134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>DS</sub>	drain-source voltage		–	65	V
V <sub>GS</sub>	gate-source voltage		–	±20	V
I <sub>D</sub>	DC drain current		–	13	A
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	–	130	W
T <sub>stg</sub>	storage temperature		–65	+150	°C
T <sub>j</sub>	junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
R <sub>th j-mb</sub>	thermal resistance from junction to mounting base	1.35	K/W
R <sub>th mb-h</sub>	thermal resistance from mounting base to heatsink	0.2	K/W



## VHF power MOS transistor

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## CHARACTERISTICS

$T_j = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

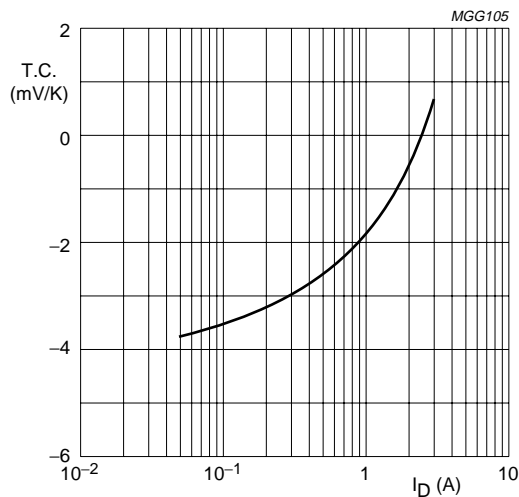
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0$ ; $I_D = 50\text{ mA}$	65	–	–	V
$I_{DSS}$	drain-source leakage current	$V_{GS} = 0$ ; $V_{DS} = 28\text{ V}$	–	–	2.5	mA
$I_{GSS}$	gate-source leakage current	$V_{GS} = \pm 20\text{ V}$ ; $V_{DS} = 0$	–	–	1	$\mu\text{A}$
$V_{GSth}$	gate-source threshold voltage	$I_D = 50\text{ mA}$ ; $V_{DS} = 10\text{ V}$	2	–	4.5	V
$\Delta V_{GS}$	gate-source voltage difference of matched pairs	$I_D = 50\text{ mA}$ ; $V_{DS} = 10\text{ V}$	–	–	100	mV
$g_{fs}$	forward transconductance	$I_D = 2.5\text{ A}$ or $5\text{ A}$ ; $V_{DS} = 10\text{ V}$	3	4.2	–	S
$R_{DSon}$	drain-source on-state resistance	$I_D = 5\text{ A}$ ; $V_{GS} = 10\text{ V}$	–	0.2	0.3	$\Omega$
$I_{DSX}$	on-state drain current	$V_{GS} = 10\text{ V}$ ; $V_{DS} = 10\text{ V}$	–	22	–	A
$C_{is}$	input capacitance	$V_{GS} = 0$ ; $V_{DS} = 28\text{ V}$ ; $f = 1\text{ MHz}$	–	225	–	pF
$C_{os}$	output capacitance	$V_{GS} = 0$ ; $V_{DS} = 28\text{ V}$ ; $f = 1\text{ MHz}$	–	180	–	pF
$C_{rs}$	feedback capacitance	$V_{GS} = 0$ ; $V_{DS} = 28\text{ V}$ ; $f = 1\text{ MHz}$	–	25	–	pF

 $V_{GS}$  group indicator

GROUP	LIMITS (V)		GROUP	LIMITS (V)	
	MIN.	MAX.		MIN.	MAX.
A	2.0	2.1	O	3.3	3.4
B	2.1	2.2	P	3.4	3.5
C	2.2	2.3	Q	3.5	3.6
D	2.3	2.4	R	3.6	3.7
E	2.4	2.5	S	3.7	3.8
F	2.5	2.6	T	3.8	3.9
G	2.6	2.7	U	3.9	4.0
H	2.7	2.8	V	4.0	4.1
J	2.8	2.9	W	4.1	4.2
K	2.9	3.0	X	4.2	4.3
L	3.0	3.1	Y	4.3	4.4
M	3.1	3.2	Z	4.4	4.5
N	3.2	3.3			

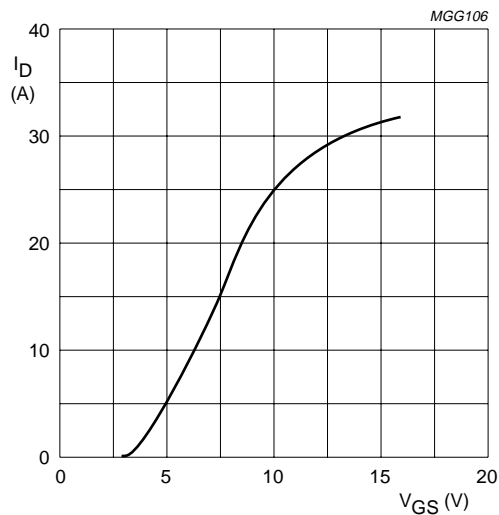
VHF power MOS transistor

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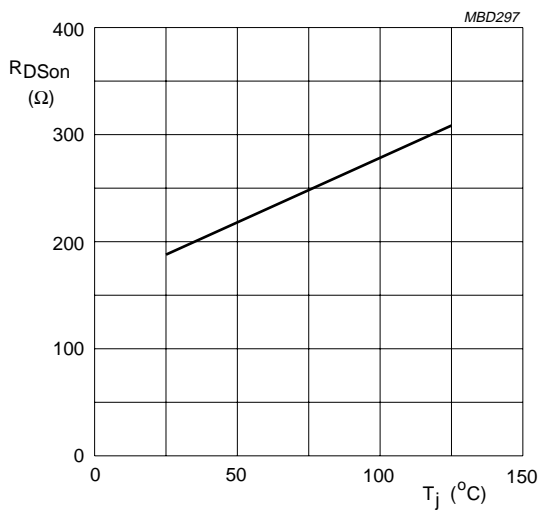
$V_{DS} = 10$  V; valid for  $T_h = 25$  to  $70$  °C.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current; typical values.



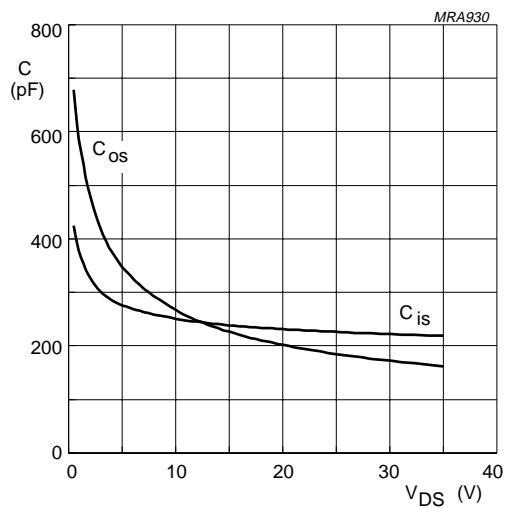
$V_{DS} = 10$  V;  $T_j = 25$  °C.

Fig.5 Drain current as a function of gate-source voltage; typical values.



$V_{GS} = 10$  V;  $I_D = 5$  A.

Fig.6 Drain-source on-state resistance as a function of junction temperature; typical values.

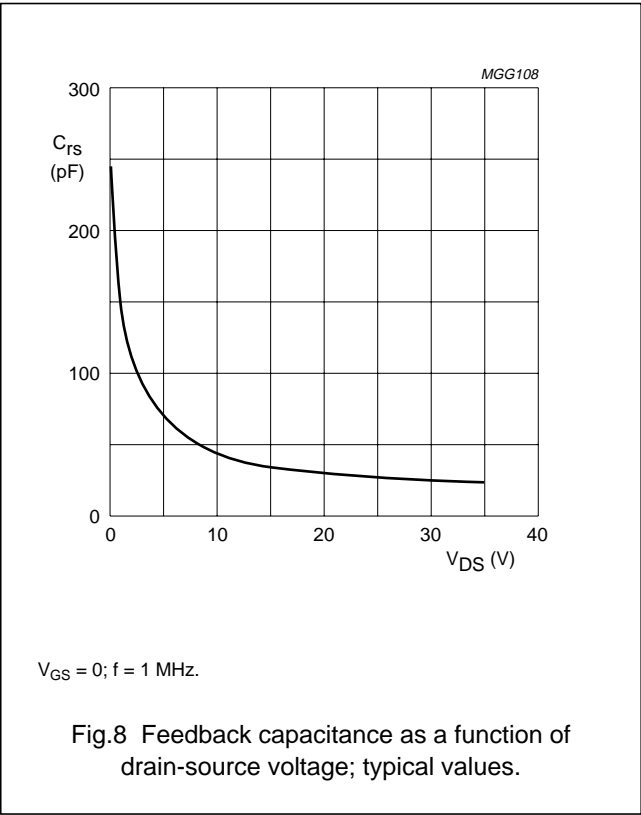


$V_{GS} = 0$ ;  $f = 1$  MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage; typical values.

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APPLICATION INFORMATION

RF performance in CW operation in a common source test circuit.  
 $T_h = 25\text{ }^{\circ}\text{C}$ ;  $R_{th\text{ mb-h}} = 0.2\text{ K/W}$ ;  $R_{GS} = 12\text{ }\Omega$  unless otherwise specified.

MODE OF OPERATION	f (MHz)	$V_{DS}$ (V)	$I_D$ (A)	$P_L$ (W)	$G_p$ (dB)	$\eta_D$ (%)
CW, class-B	108	28	0.1	80	>16	>55
CW, class-B	108	28	0.1	80	typ. 18	typ. 65
CW, class-C	108	28	0 <sup>(1)</sup>	80	typ. 15	typ. 72

Note

1.  $V_{GS} = 0$  (class-C).

Ruggedness in class-B operation

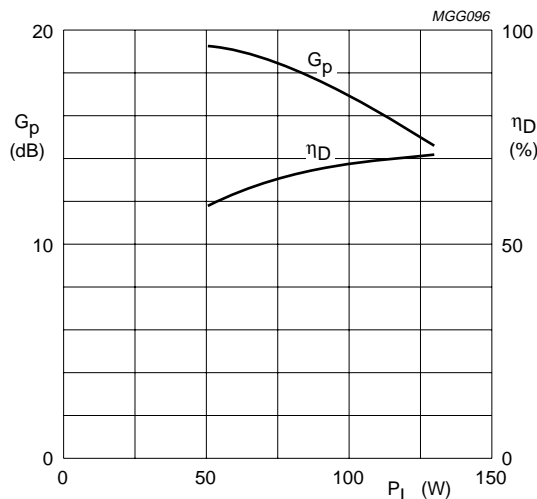
The BLF246 is capable of withstanding a load mismatch corresponding to  $VSWR = 50:1$  through all phases under the following conditions:  $V_{DS} = 28\text{ V}$ ;  $f = 108\text{ MHz}$ ;  $T_h = 25\text{ }^{\circ}\text{C}$ ;  $R_{th\text{ mb-h}} = 0.2\text{ K/W}$  at rated output power.

Noise figure

Measured with 80 W power-matched source and load in the test circuit (see Fig.9) with  $V_{DS} = 28\text{ V}$ ;  $I_D = 2\text{ A}$ ;  $f = 108\text{ MHz}$ ;  $R_{GS} = 27\text{ }\Omega$ ;  $T_h = 25\text{ }^{\circ}\text{C}$ ;  $R_{th\text{ mb-h}} = 0.2\text{ K/W}$ ;  $F = \text{typ. } 3\text{ dB}$ .

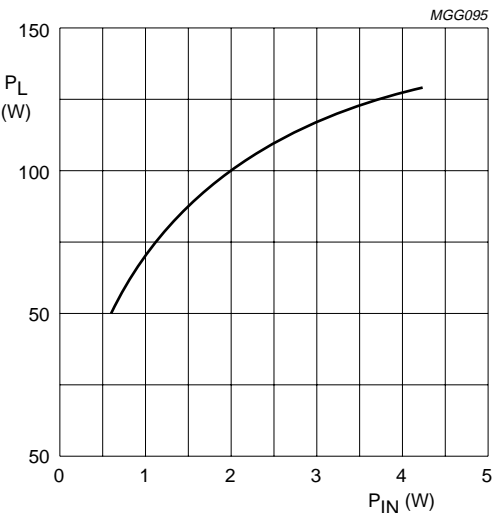
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Class-B operation;  $V_{DS} = 28$  V;  $I_{DQ} = 0.1$  A;  $R_{GS} = 12$   $\Omega$ ;  
 $f = 108$  MHz;  $T_h = 25$   $^{\circ}$ C;  $R_{th\ mb-h} = 0.2$  K/W.

Fig.9 Power gain and efficiency as functions of load power; typical values.



Class-B operation;  $V_{DS} = 28$  V;  $I_{DQ} = 0.1$  A;  $R_{GS} = 12$   $\Omega$ ;  
 $f = 108$  MHz;  $T_h = 25$   $^{\circ}$ C;  $R_{th\ mb-h} = 0.2$  K/W.

Fig.10 Load power as a function of input power; typical values.

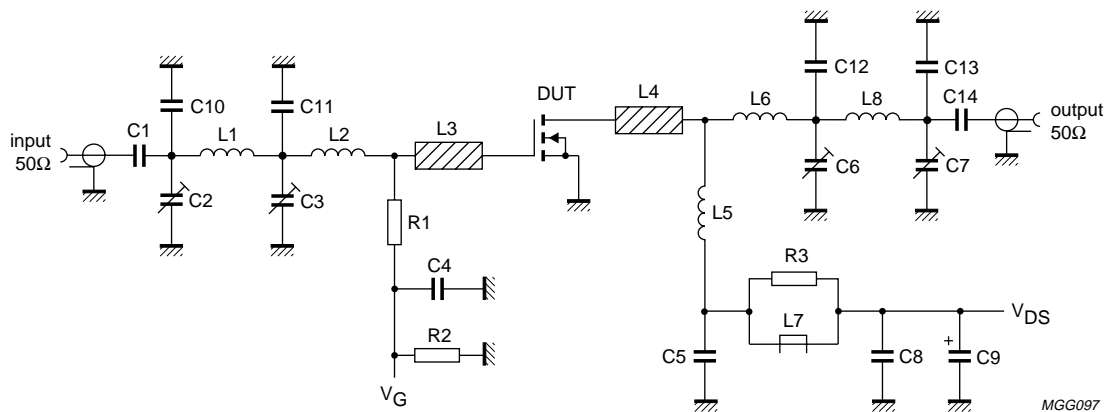


Fig.11 Test circuit for class-B operation at 108 MHz.

## VHF power MOS transistor

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List of components (see Figs 11 and 12).

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C4, C5, C8, C14	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C2, C3, C6, C7	film dielectric trimmer	5 to 60 pF		2222 809 08003
C9	electrolytic capacitor	2.2 $\mu$ F, 63 V		2222 030 38228
C10	multilayer ceramic chip capacitor; note 1	68 pF + 39 pF in parallel		
C11	multilayer ceramic chip capacitor; note 1	69 pF + 100 pF in parallel		
C12	multilayer ceramic chip capacitor; note 1	2x 100 pF in parallel		
C13	multilayer ceramic chip capacitor; note 1	62 pF		
L1	5 turns enamelled 0.6 mm copper wire	52 nH	length 6.5 mm int. dia. 3 mm leads 2 $\times$ 10 mm	
L2	2 turns enamelled 0.6 mm copper wire	19 nH	length 3.5 mm int. dia. 3 mm leads 2 $\times$ 7.5 mm	
L3, L4	stripline; note 2	31 $\Omega$	length 13 mm width 6 mm	
L5	3 turns enamelled 1.6 mm copper wire	36 nH	length 12 mm int. dia. 6 mm leads 2 $\times$ 5 mm	
L6	hairpin of enamelled 1.6 mm copper wire	14 nH	length 20 mm	
L7	grade 3B Ferroxcube HF choke			4312 020 36640
L8	3 turns enamelled 1.6 mm copper wire	52 nH	length 8 mm int. dia. 6 mm leads 2 $\times$ 9 mm	
R1	metal film resistor	2 $\times$ 24 $\Omega$ in parallel, 0.4 W		
R2	metal film resistor	100 k $\Omega$ , 0.4 W		
R3	metal film resistor	10 $\Omega$ , 0.4 W		

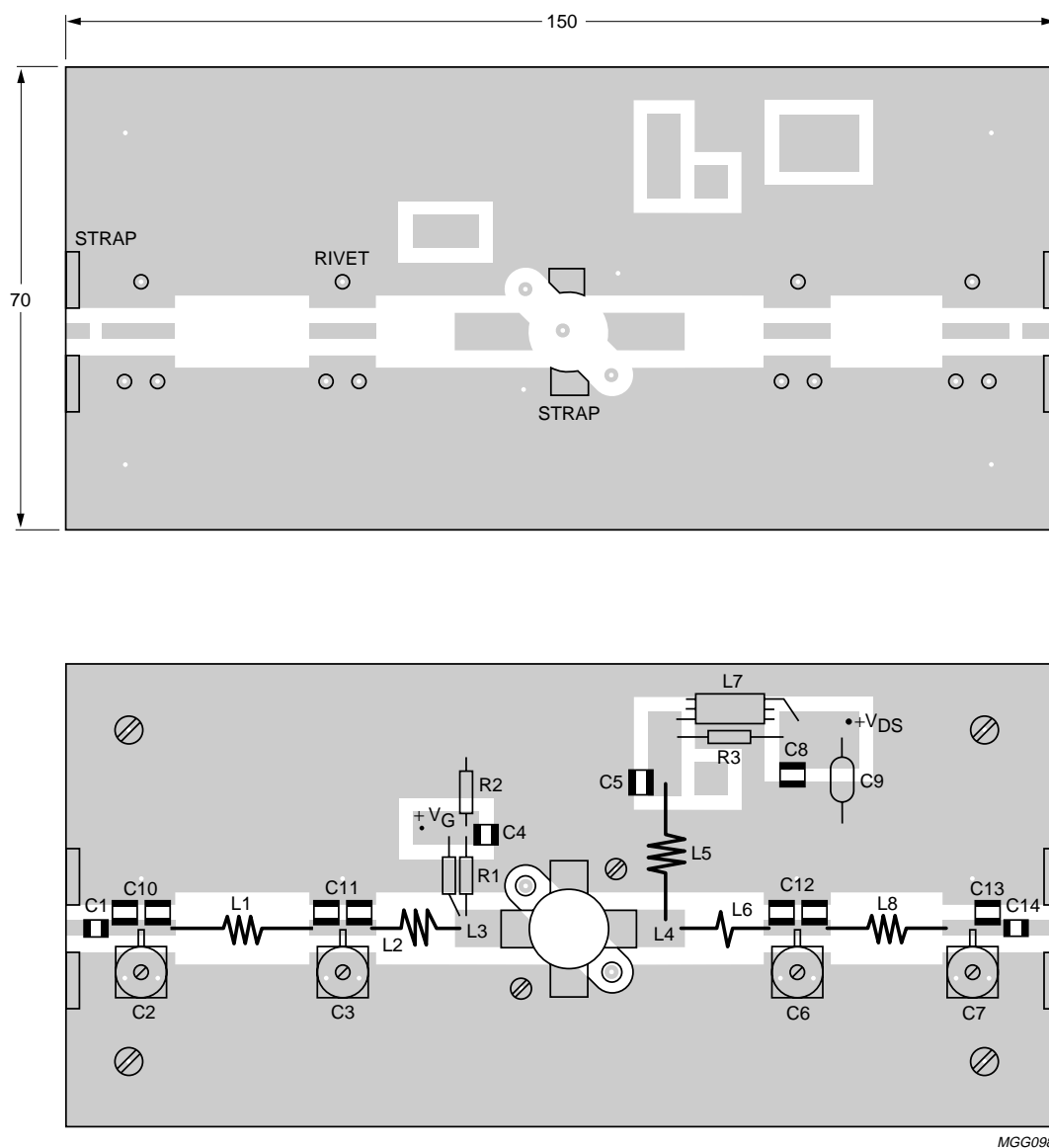
## Notes

1. American Technical Ceramics capacitor, type 100B or other capacitor of the same quality.
2. The striplines are mounted on a double copper-clad PCB with epoxy fibre-glass dielectric ( $\epsilon_r = 4.5$ ), thickness 1.6 mm.



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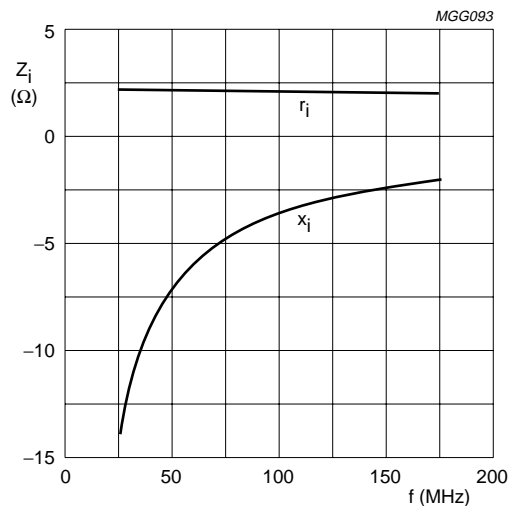
Dimensions in mm.

The circuit and components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as a ground. Earth connections are made by means of hollow rivets, whilst under the source leads, copper straps are used for a direct contact between the upper and lower sheets.

Fig.12 Component layout for 108 MHz class-B test circuit.

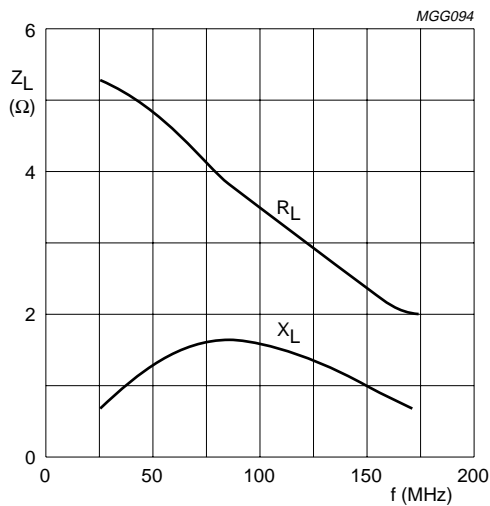
VHF power MOS transistor

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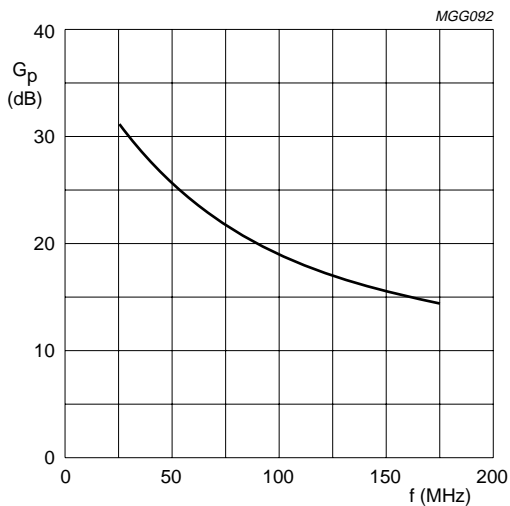
Class-B operation;  $V_{DS} = 28\text{ V}$ ;  $I_{DQ} = 0.1\text{ A}$ ;  $R_{GS} = 12\text{ }\Omega$ ;  
 $P_L = 80\text{ W}$ ;  $T_h = 25\text{ }^\circ\text{C}$ ;  $R_{th\text{ mb-h}} = 0.2\text{ K/W}$ .

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



Class-B operation;  $V_{DS} = 28\text{ V}$ ;  $I_{DQ} = 0.1\text{ A}$ ;  $R_{GS} = 12\text{ }\Omega$ ;  
 $P_L = 80\text{ W}$ ;  $T_h = 25\text{ }^\circ\text{C}$ ;  $R_{th\text{ mb-h}} = 0.2\text{ K/W}$ .

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



Class-B operation;  $V_{DS} = 28\text{ V}$ ;  $I_{DQ} = 0.1\text{ A}$ ;  $R_{GS} = 12\text{ }\Omega$ ;  
 $P_L = 80\text{ W}$ ;  $T_h = 25\text{ }^\circ\text{C}$ ;  $R_{th\text{ mb-h}} = 0.2\text{ K/W}$ .

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

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**BLF246 scattering parameters** $V_{DS} = 28\text{ V}$ ;  $I_D = 50\text{ mA}$ ; note 1

f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	S <sub>11</sub>	∠ Φ	S <sub>21</sub>	∠ Φ	S <sub>12</sub>	∠ Φ	S <sub>22</sub>	∠ Φ
5	0.83	-91.4	23.64	124.0	0.05	34.6	0.79	-88.1
10	0.75	-125.6	13.95	103.2	0.05	14.4	0.69	-122.2
20	0.73	-147.1	7.17	84.8	0.06	-2.7	0.68	-143.6
30	0.75	-154.3	4.64	73.4	0.05	-12.7	0.70	-150.6
40	0.78	-157.9	3.30	64.6	0.05	-20.1	0.73	-154.2
50	0.80	-160.3	2.48	57.5	0.04	-25.9	0.77	-156.7
60	0.83	-162.2	1.94	51.4	0.04	-30.5	0.80	-158.9
70	0.86	-164.1	1.56	46.1	0.04	-34.1	0.83	-160.8
80	0.88	-165.8	1.27	41.4	0.03	-36.8	0.85	-162.7
90	0.89	-167.3	1.06	37.6	0.03	-38.6	0.87	-164.3
100	0.91	-168.6	0.89	34.2	0.02	-39.6	0.89	-165.9
125	0.93	-171.7	0.62	27.1	0.02	-37.1	0.92	-169.3
150	0.95	-174.2	0.45	22.3	0.01	-20.7	0.94	-172.1
175	0.96	-176.6	0.34	19.3	0.01	24.3	0.95	-174.6
200	0.97	-178.3	0.27	17.4	0.01	62.3	0.96	-176.7
250	0.98	178.3	0.18	16.1	0.02	81.9	0.97	179.7
300	0.98	175.4	0.13	19.5	0.03	85.4	0.98	176.8
350	0.98	172.6	0.10	24.8	0.04	86.0	0.98	174.1
400	0.98	170.3	0.09	33.5	0.05	85.6	0.98	171.6
450	0.98	167.9	0.08	41.5	0.06	85.3	0.98	169.2
500	0.98	165.6	0.08	49.6	0.06	83.9	0.98	166.9
600	0.98	161.1	0.09	61.3	0.08	81.9	0.98	162.5
700	0.98	156.7	0.10	66.5	0.10	79.6	0.98	158.0
800	0.97	152.0	0.12	69.1	0.12	78.2	0.97	153.7
900	0.97	147.0	0.14	69.5	0.13	76.0	0.97	149.3
1000	0.96	142.0	0.16	70.1	0.16	74.3	0.97	144.8

**Note**

- For more extensive S-parameters see internet:  
<http://www.semiconductors.philips.com.markets/communications/wirelesscommunicationms/broadcast>.

## VHF power MOS transistor

## BLF246

**BLF246 scattering parameters** $V_{DS} = 28\text{ V}$ ;  $I_D = 100\text{ mA}$ ; note 1

f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	S <sub>11</sub>	∠ Φ	S <sub>21</sub>	∠ Φ	S <sub>12</sub>	∠ Φ	S <sub>22</sub>	∠ Φ
5	0.81	-113.3	30.83	116.1	0.04	26.8	0.77	-111.3
10	0.77	-142.3	17.04	99.5	0.04	11.1	0.72	-140.7
20	0.76	-158.6	8.64	85.7	0.04	-0.8	0.71	-156.6
30	0.77	-163.5	5.67	77.3	0.04	-7.7	0.72	-161.5
40	0.79	-165.8	4.12	70.5	0.04	-12.7	0.74	-163.3
50	0.80	-167.2	3.18	64.6	0.03	-16.7	0.76	-164.5
60	0.82	-168.2	2.54	59.3	0.03	-19.9	0.78	-165.4
70	0.84	-169.2	2.08	54.5	0.03	-22.4	0.80	-166.3
80	0.85	-170.0	1.74	50.4	0.03	-24.0	0.82	-167.1
90	0.87	-170.9	1.48	46.6	0.02	-24.9	0.84	-168.0
100	0.88	-171.8	1.27	43.0	0.02	-25.1	0.86	-169.0
125	0.90	-173.9	0.90	35.4	0.02	-20.6	0.89	-171.3
150	0.92	-175.9	0.67	29.8	0.01	-5.0	0.91	-173.3
175	0.94	-177.8	0.51	26.0	0.01	24.7	0.93	-175.2
200	0.95	-179.6	0.41	22.7	0.01	52.6	0.94	-177.1
250	0.96	177.3	0.27	18.6	0.02	76.2	0.96	179.7
300	0.97	174.4	0.20	17.8	0.03	82.2	0.97	176.9
350	0.97	171.7	0.15	19.4	0.03	84.2	0.97	174.3
400	0.97	169.2	0.13	23.4	0.04	84.3	0.98	171.9
450	0.97	166.7	0.11	28.4	0.05	84.6	0.98	169.6
500	0.97	164.3	0.10	34.9	0.06	83.3	0.98	167.4
600	0.97	159.5	0.09	46.8	0.07	81.6	0.98	163.1
700	0.96	154.5	0.10	55.1	0.09	79.5	0.98	158.8
800	0.96	149.3	0.11	61.0	0.10	78.8	0.98	154.5
900	0.95	143.6	0.12	63.0	0.11	76.3	0.97	150.0
1000	0.92	136.3	0.12	67.1	0.12	78.0	0.97	145.2

**Note**

- For more extensive S-parameters see internet:  
<http://www.semiconductors.philips.com.markets/communications/wirelesscommunicationms/broadcast>.

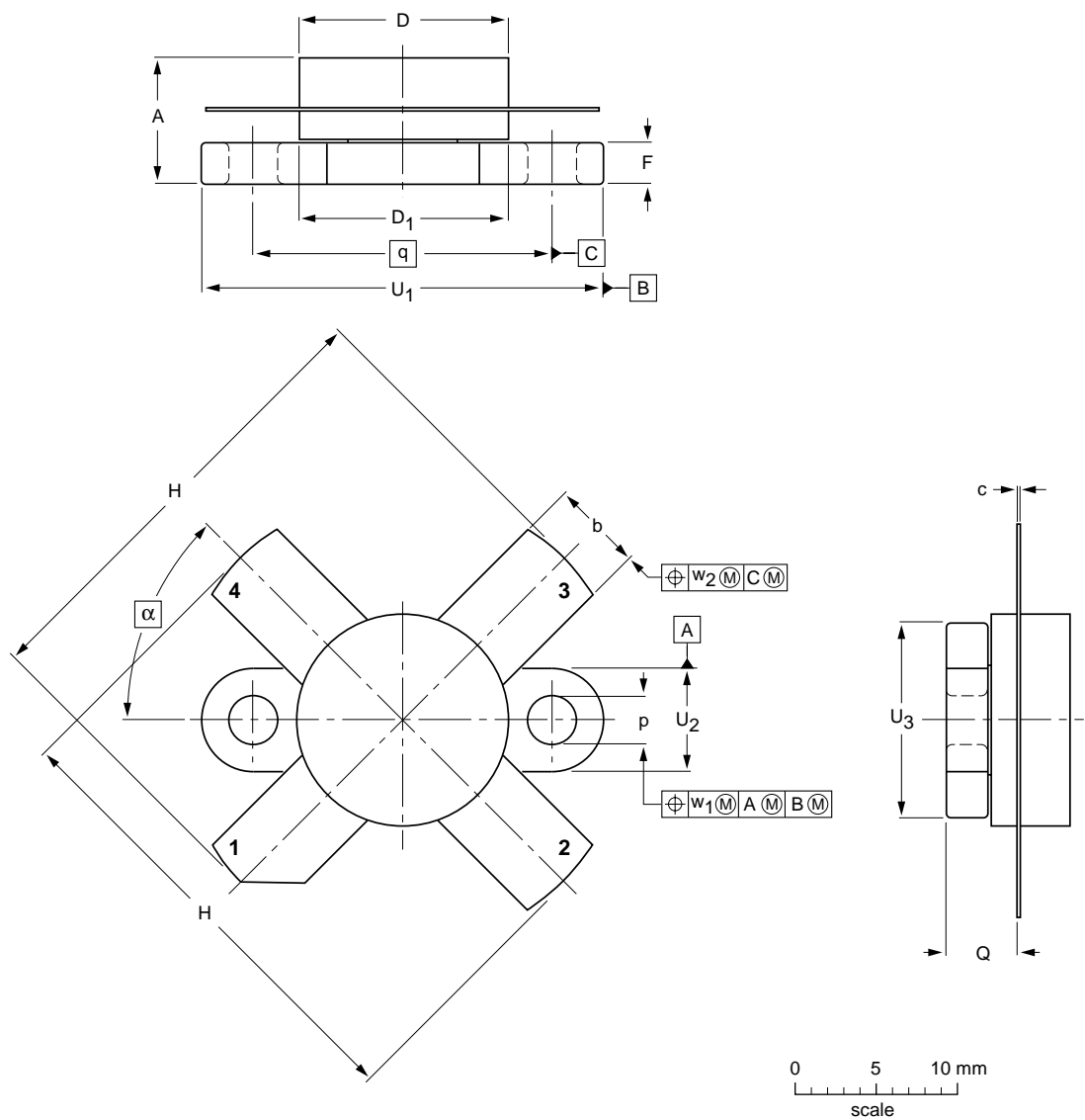
VHF power MOS transistor

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PACKAGE OUTLINE


Flanged ceramic package; 2 mounting holes; 4 leads

SOT121B



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	c	D	D <sub>1</sub>	F	H	p	Q	q	U <sub>1</sub>	U <sub>2</sub>	U <sub>3</sub>	w <sub>1</sub>	w <sub>2</sub>	α
mm	7.27 6.17	5.82 5.56	0.16 0.10	12.86 12.59	12.83 12.57	2.67 2.41	28.45 25.52	3.30 3.05	4.45 3.91	18.42 3.91	24.90 24.63	6.48 6.22	12.32 12.06	0.25	0.51	45°
inches	0.286 0.243	0.229 0.219	0.006 0.004	0.506 0.496	0.505 0.495	0.105 0.095	1.120 1.005	0.130 0.120	0.175 0.154	0.725 0.154	0.98 0.97	0.255 0.245	0.485 0.475	0.01	0.02	

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT121B						99-03-29

## VHF power MOS transistor

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## DATA SHEET STATUS

LEVEL	DATA SHEET STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)(3)</sup>	DEFINITION
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

## Notes

1. Please consult the most recently issued data sheet before initiating or completing a design.
2. The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.
3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

## DEFINITIONS

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

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