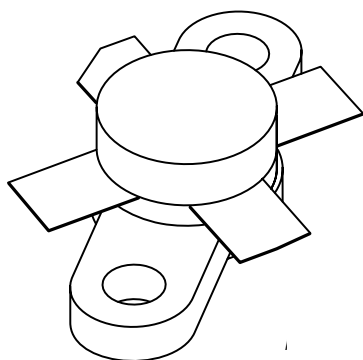


DATA SHEET



BLF245 VHF power MOS transistor

Product specification
Supersedes data of 1997 Dec 17

2003 Sep 02

VHF power MOS transistor

BLF245

FEATURES

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

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for large signal amplifier applications in the VHF frequency range.

The transistor is encapsulated in a 4-lead SOT123A flange package, with a ceramic cap. All leads are isolated from the flange.

Matched gate-source voltage (V_{GS}) groups are available on request.

PINNING - SOT123A

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source

PIN CONFIGURATION

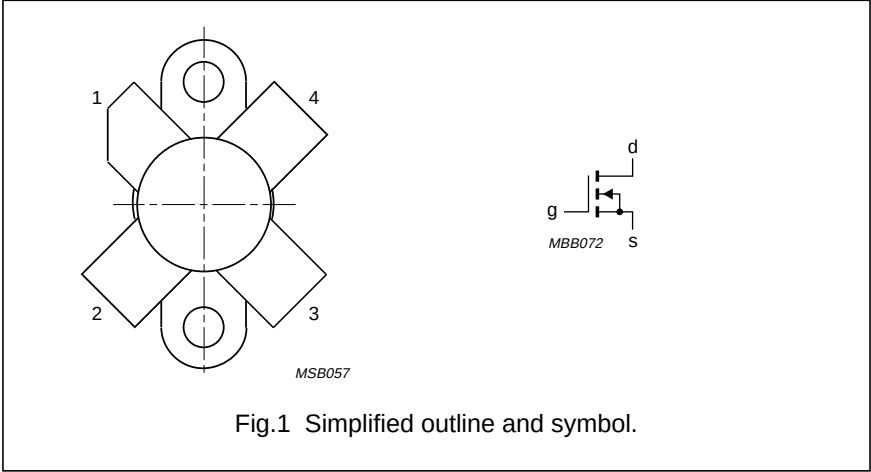


Fig.1 Simplified outline and symbol.

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.

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.

QUICK REFERENCE DATA

RF performance at $T_h = 25\text{ }^{\circ}\text{C}$ in a class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	175	28	30	>13	>50

VHF power MOS transistor

BLF245

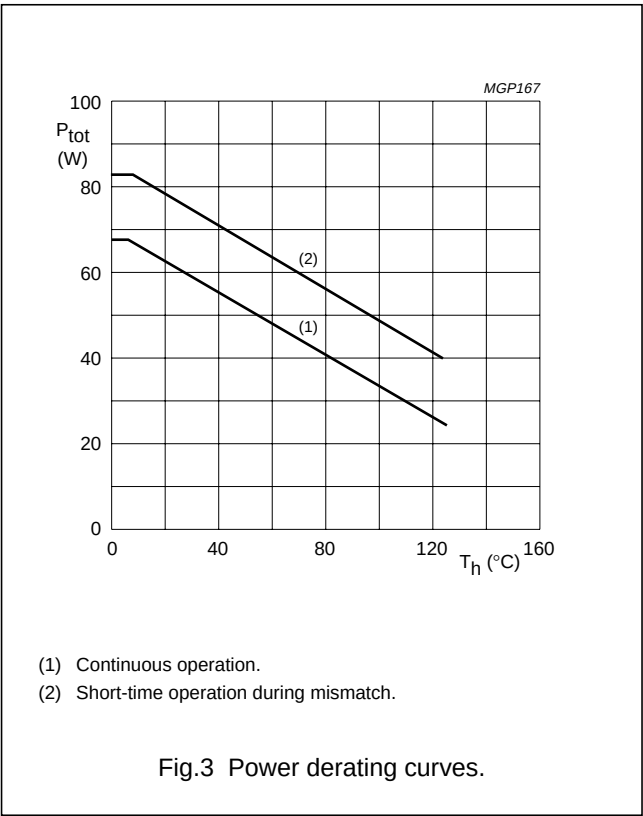
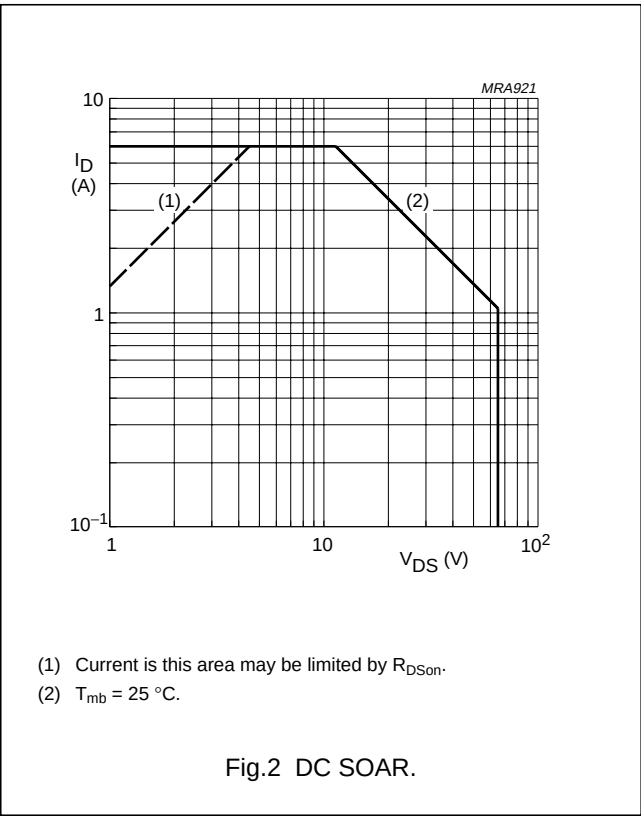
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage	$V_{GS} = 0$	–	65	V
V_{GS}	gate-source voltage	$V_{DS} = 0$	–	± 20	V
I_D	drain current (DC)		–	6	A
P_{tot}	total power dissipation	$T_{mb} \leq 25\text{ }^{\circ}\text{C}$	–	68	W
T_{stg}	storage temperature		–65	150	$^{\circ}\text{C}$
T_j	junction temperature		–	200	$^{\circ}\text{C}$

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-mb}$	thermal resistance from junction to mounting base	$T_{mb} = 25\text{ }^{\circ}\text{C}; P_{tot} = 68\text{ W}$	2.6	K/W
$R_{th\ mb-h}$	thermal resistance from mounting base to heatsink	$T_{mb} = 25\text{ }^{\circ}\text{C}; P_{tot} = 68\text{ W}$	0.3	K/W



VHF power MOS transistor

BLF245

CHARACTERISTICS

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

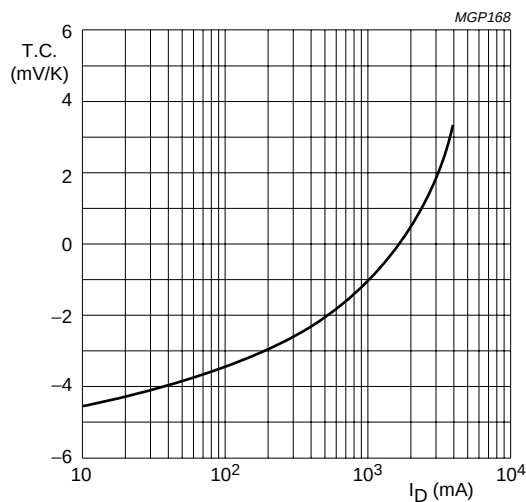
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0$; $I_D = 10\text{ mA}$	65	—	—	V
I_{DSS}	drain-source leakage current	$V_{GS} = 0$; $V_{DS} = 28\text{ V}$	—	—	2	mA
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 20\text{ V}$; $V_{DS} = 0$	—	—	1	μA
V_{GSth}	gate-source threshold voltage	$I_D = 10\text{ mA}$; $V_{DS} = 10\text{ V}$	2	—	4.5	V
ΔV_{GS}	gate-source voltage difference of matched devices	$I_D = 0\text{ mA}$; $V_{DS} = 10\text{ V}$	—	—	100	mV
g_{fs}	forward transconductance	$I_D = 1.5\text{ A}$; $V_{DS} = 10\text{ V}$	1.2	1.9	—	S
R_{DSon}	drain-source on-state resistance	$I_D = 1.5\text{ A}$; $V_{GS} = 10\text{ V}$	—	0.4	0.75	Ω
I_{DSX}	on-state drain current	$V_{GS} = 10\text{ V}$; $V_{DS} = 10\text{ V}$	—	10	—	A
C_{is}	input capacitance	$V_{GS} = 0$; $V_{DS} = 28\text{ V}$; $f = 1\text{ MHz}$	—	125	—	pF
C_{os}	output capacitance	$V_{GS} = 0$; $V_{DS} = 28\text{ V}$; $f = 1\text{ MHz}$	—	75	—	pF
C_{rs}	feedback capacitance	$V_{GS} = 0$; $V_{DS} = 28\text{ V}$; $f = 1\text{ MHz}$	—	7	—	pF
F	noise figure	input and output power matched for: $I_D = 1\text{ A}$; $V_{DS} = 28\text{ V}$; $P_L = 30\text{ W}$; $R_1 = 1\text{ k}\Omega$; $T_h = 25\text{ }^{\circ}\text{C}$; $f = 175\text{ MHz}$; see Fig.14	—	2	—	dB

 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			

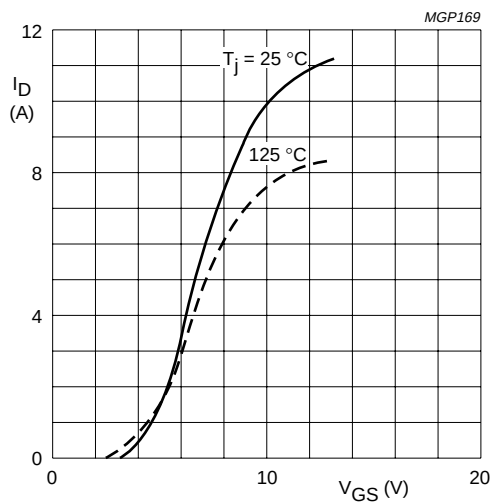
VHF power MOS transistor

BLF245



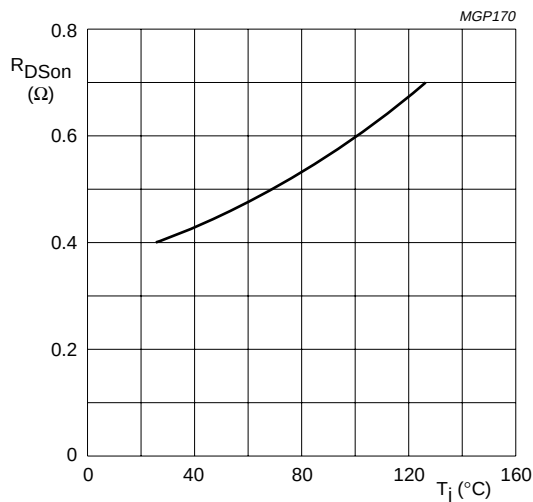
$V_{DS} = 10$ V; valid for $T_j = 25$ to 125 °C.

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



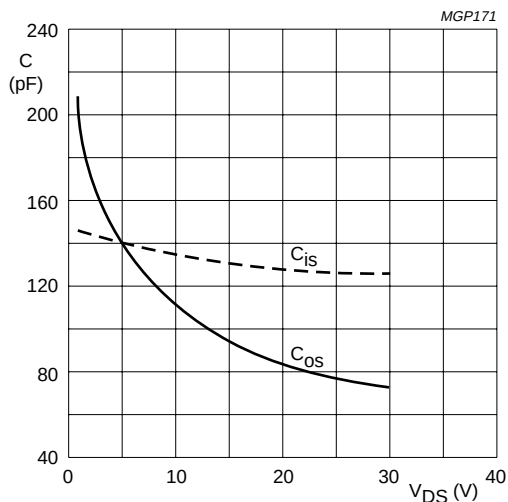
$V_{DS} = 10$ V.

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



$V_{GS} = 10$ V; $I_D = 1.5$ A.

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

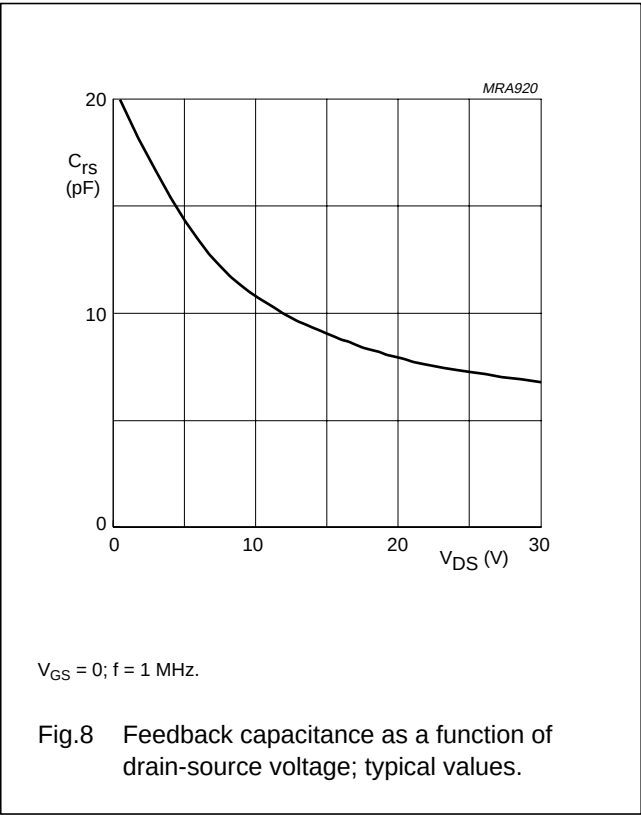


$V_{GS} = 0$; $f = 1$ MHz.

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

VHF power MOS transistor

BLF245



APPLICATION INFORMATION FOR CLASS-B OPERATION

$T_h = 25\text{ }^{\circ}\text{C}; R_{th\text{ mb-h}} = 0.3\text{ K/W}; R1 = 1\text{ k}\Omega.$

RF performance in CW operation in a common source class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)	Z_i (Ω) ⁽¹⁾	Z_L (Ω)
CW, class-B	175	28	50	30	>13 typ. 15.5	< 50 typ. 67	$2.0 - j2.7$	$3.9 + j4.4$
	175	12.5	50	12	typ. 12	typ. 66	$2.4 - j2.5$	$3.8 + j1.3$

Note

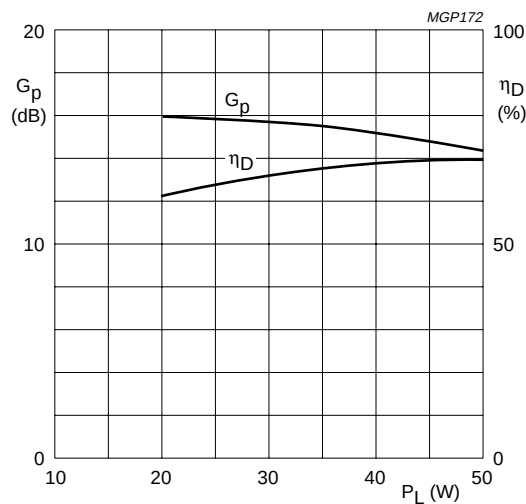
1. R1 included.

Ruggedness in class-B operation

The BLF245 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases under the following conditions: $T_h = 25\text{ }^{\circ}\text{C}; R_{th\text{ mb-h}} = 0.3\text{ K/W};$ at rated load power.

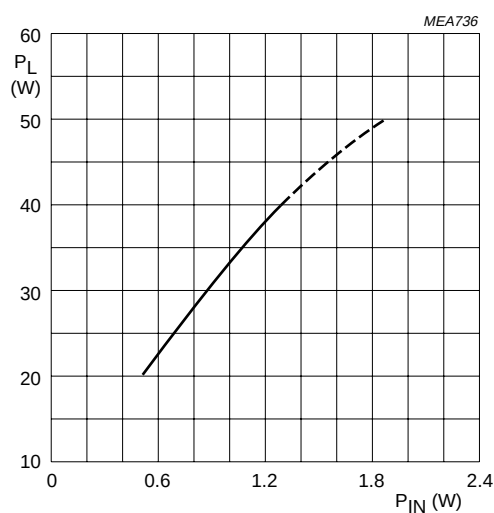
VHF power MOS transistor

BLF245



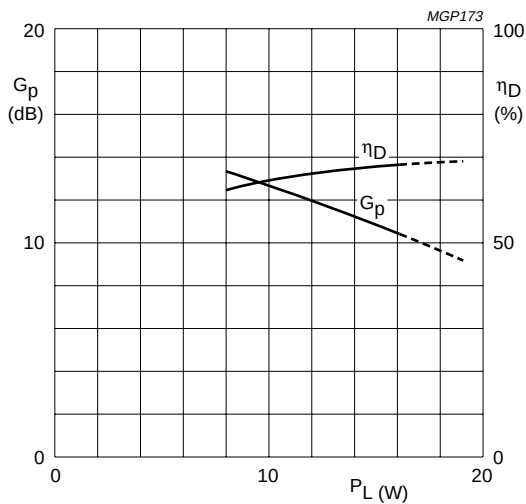
Class-B operation; $V_{DS} = 28\text{ V}$; $I_{DQ} = 50\text{ mA}$;
 $f = 175\text{ MHz}$; $T_h = 25\text{ }^\circ\text{C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$.

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



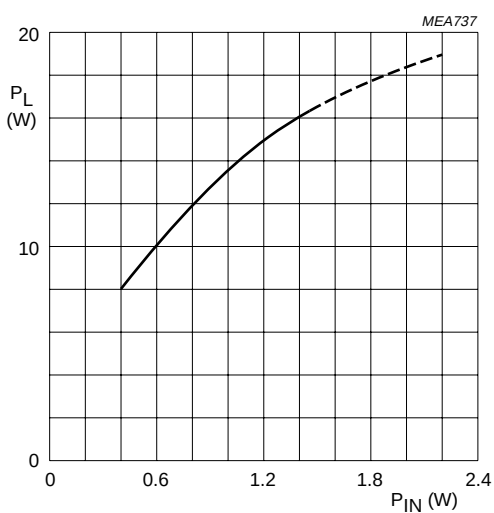
Class-B operation; $V_{DS} = 28\text{ V}$; $I_{DQ} = 50\text{ mA}$;
 $f = 175\text{ MHz}$; $T_h = 25\text{ }^\circ\text{C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$.

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



Class-B operation; $V_{DS} = 12.5\text{ V}$; $I_{DQ} = 50\text{ mA}$;
 $f = 175\text{ MHz}$; $T_h = 25\text{ }^\circ\text{C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$.

Fig.11 Power gain and efficiency as functions of load power; typical values.

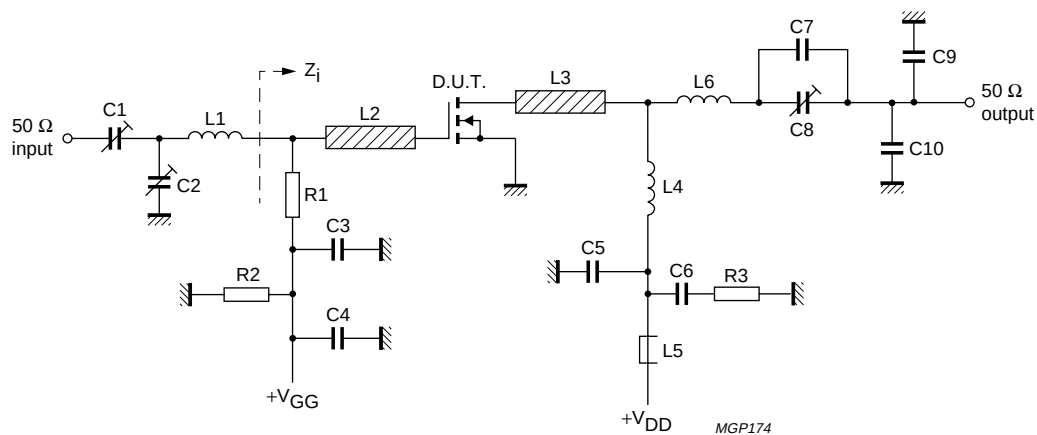


Class-B operation; $V_{DS} = 12.5\text{ V}$; $I_{DQ} = 50\text{ mA}$;
 $f = 175\text{ MHz}$; $T_h = 25\text{ }^\circ\text{C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$.

Fig.12 Load power as a function of input power; typical values.

VHF power MOS transistor

BLF245



$f = 175 \text{ MHz.}$

Fig.13 Test circuit for class-B operation.

VHF power MOS transistor

BLF245

List of components class-B test circuit (see Fig.14)

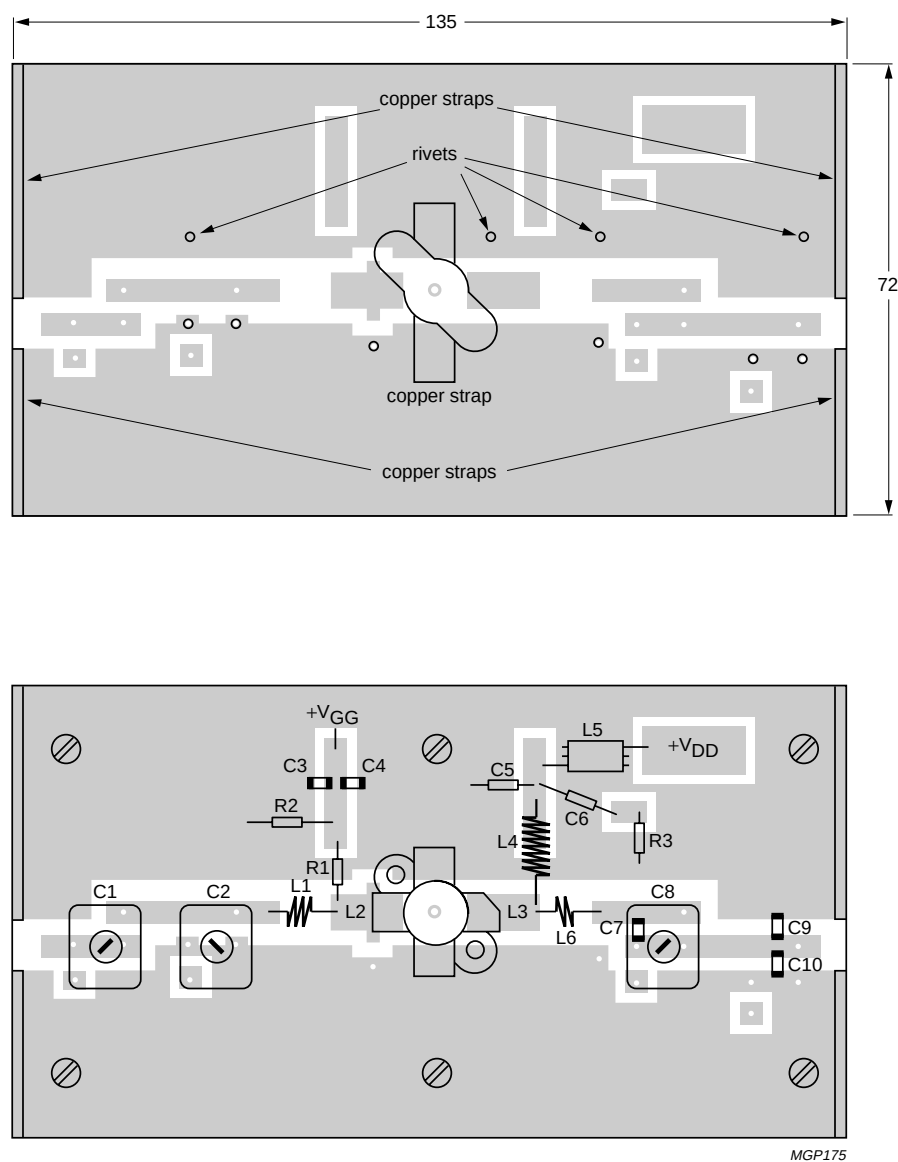
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	film dielectric trimmer	4 to 40 pF		2222 809 07008
C2, C8	film dielectric trimmer	5 to 60 pF		2222 809 07011
C3	multilayer ceramic chip capacitor	100 pF		2222 854 13101
C4, C6	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C5	ceramic capacitor	100 pF		2222 680 10101
C7	multilayer ceramic chip capacitor; note 1	18 pF		
C9	multilayer ceramic chip capacitor; note 1	27 pF		
C10	multilayer ceramic chip capacitor; note 1	24 pF		
L1	3 turns enamelled 0.5 mm copper wire	13.5 nH	length 3.5 mm int. dia. 2 mm leads 2 × 2 mm	
L2, L3	stripline; note 2	30 Ω	10 × 6 mm	
L4	6 turns enamelled 1.5 mm copper wire	98 nH	length 12.5 mm int. dia. 5 mm leads 2 × 2 mm	
L5	grade 3B Ferroxcube RF choke			4312 020 36640
L6	2 turns enamelled 1.5 mm copper wire	24.5 nH	length 4 mm int. dia. 5 mm leads 2 × 2 mm	
R1	metal film resistor	1 kΩ		
R2	metal film resistor	1 MΩ		
R3	metal film resistor	10 Ω		

Notes

1. American Technical Ceramics (ATC) 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 $\frac{1}{16}$ inch.

VHF power MOS transistor

BLF245



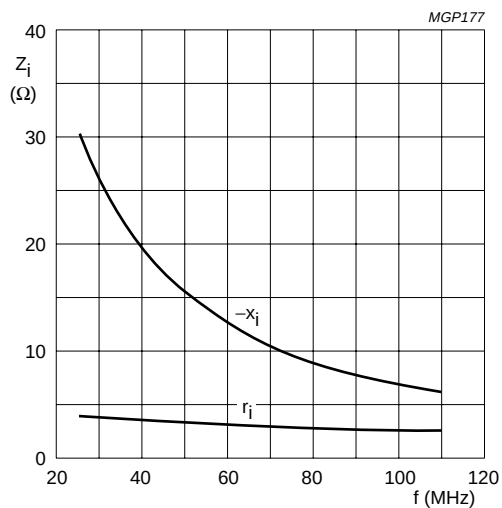
Dimensions in mm.

The circuit and components are situated on one side of the epoxy fibre-glass board; the other side is unetched copper and serves as an earth. Earth connections are made by means of fixing screws, hollow rivets and copper straps under the sources and around the edges, to provide a direct contact between the copper on the component side and the ground plane.

Fig.14 Component layout for 175 MHz class-B test circuit.

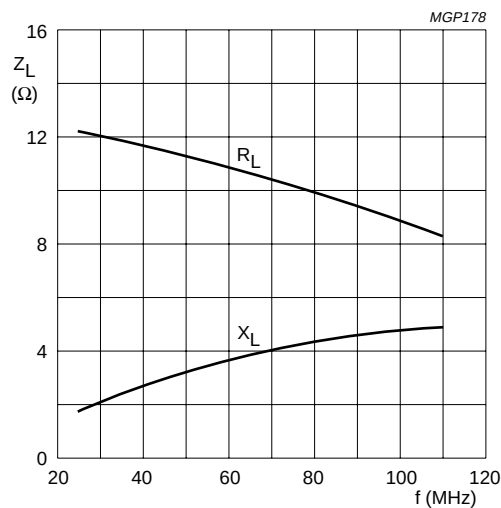
VHF power MOS transistor

BLF245



Class-B operation; $V_{DS} = 28\text{ V}$; $I_{DQ} = 50\text{ mA}$;
 $P_L = 30\text{ W}$; $T_h = 25\text{ °C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$.

Fig.15 Input impedance as a function of frequency (series components); typical values.



Class-B operation; $V_{DS} = 28\text{ V}$; $I_{DQ} = 50\text{ mA}$;
 $P_L = 30\text{ W}$; $T_h = 25\text{ °C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$.

Fig.16 Load impedance as a function of frequency (series components); typical values.

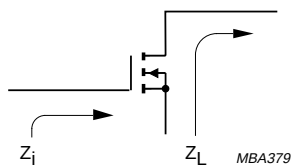
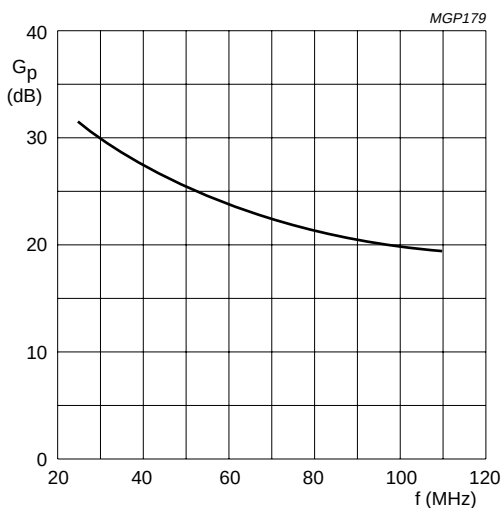


Fig.17 Definition of MOS impedance.



Class-B operation; $V_{DS} = 28\text{ V}$; $I_{DQ} = 50\text{ mA}$;
 $P_L = 30\text{ W}$; $T_h = 25\text{ °C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$.

Fig.18 Power gain as a function of frequency; typical values.

VHF power MOS transistor

BLF245

BLF245 scattering parameters

 $V_{DS} = 12.5\text{ V}$; $I_D = 50\text{ mA}$; note 1

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	S ₁₁	∠ Φ	S ₂₁	∠ Φ	S ₁₂	∠ Φ	S ₂₂	∠ Φ
5	0.91	-48.3	25.72	147.1	0.03	57.9	0.92	-47.8
10	0.80	-81.4	19.43	125.8	0.05	36.8	0.81	-81.3
20	0.71	-116.7	11.79	102.4	0.06	15.0	0.71	-115.5
30	0.68	-132.3	8.04	89.7	0.06	3.3	0.69	-131.1
40	0.69	-140.3	5.97	80.8	0.06	-4.4	0.69	-139.0
50	0.71	-145.2	4.67	73.6	0.06	-10.2	0.71	-143.8
60	0.73	-148.6	3.76	67.5	0.05	-14.8	0.73	-147.2
70	0.75	-151.1	3.10	62.4	0.05	-18.4	0.75	-149.9
80	0.77	-153.1	2.61	57.9	0.05	-21.3	0.77	-152.1
90	0.79	-155.1	2.24	53.7	0.04	-23.8	0.79	-154.2
100	0.81	-157.3	1.94	49.8	0.04	-25.9	0.81	-156.1
125	0.84	-161.9	1.39	41.2	0.03	-28.0	0.85	-160.1
150	0.87	-165.0	1.04	35.4	0.02	-23.3	0.88	-163.4
175	0.91	-167.9	0.81	30.8	0.01	-8.4	0.91	-166.3
200	0.92	-171.0	0.65	26.6	0.01	22.4	0.92	-168.9
250	0.94	-175.5	0.44	21.6	0.02	72.1	0.95	-173.3
300	0.95	-179.8	0.32	19.2	0.03	83.0	0.96	-176.8
350	0.96	176.9	0.24	19.7	0.04	86.1	0.97	-179.8
400	0.96	173.5	0.19	22.1	0.05	86.1	0.97	177.5
450	0.97	170.6	0.16	26.1	0.06	86.2	0.97	174.9
500	0.97	167.8	0.14	31.6	0.08	84.7	0.98	172.6
600	0.96	162.4	0.13	43.5	0.10	82.6	0.98	168.4
700	0.96	157.2	0.13	52.9	0.12	80.0	0.97	164.4
800	0.94	152.4	0.14	58.9	0.13	77.9	0.97	160.6
900	0.95	147.8	0.16	63.1	0.15	74.4	0.95	157.1
1000	0.95	142.7	0.18	68.2	1.70	40.5	3.52	46.0

Note

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

VHF power MOS transistor

BLF245

BLF245 scattering parameters

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

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	S ₁₁	∠ Φ	S ₂₁	∠ Φ	S ₁₂	∠ Φ	S ₂₂	∠ Φ
5	0.95	-40.5	27.84	152.9	0.02	63.8	0.93	-35.8
10	0.86	-71.3	22.60	133.3	0.04	44.4	0.83	-64.1
20	0.77	-108.6	14.77	109.1	0.05	21.7	0.69	-97.8
30	0.73	-126.8	10.37	95.5	0.05	9.1	0.65	-115.5
40	0.73	-136.8	7.81	86.2	0.05	1.0	0.64	-125.2
50	0.74	-142.9	6.17	78.8	0.05	-5.0	0.65	-131.3
60	0.75	-147.1	5.01	72.7	0.05	-9.6	0.67	-135.7
70	0.76	-150.0	4.17	67.5	0.05	-13.3	0.69	-139.1
80	0.78	-152.3	3.54	63.0	0.04	-16.3	0.72	-142.0
90	0.80	-154.5	3.06	58.8	0.04	-18.8	0.74	-144.6
100	0.81	-156.8	2.66	54.7	0.04	-20.9	0.76	-146.9
125	0.84	-161.5	1.93	46.0	0.03	-23.2	0.81	-152.0
150	0.87	-164.5	1.46	39.8	0.02	-18.9	0.84	-156.1
175	0.90	-167.4	1.15	34.7	0.01	-5.0	0.87	-159.7
200	0.91	-170.5	0.93	30.1	0.01	23.3	0.89	-162.9
250	0.93	-175.0	0.63	23.9	0.02	72.9	0.93	-168.1
300	0.95	-179.3	0.46	20.1	0.03	84.5	0.94	-172.4
350	0.96	177.3	0.35	18.8	0.04	87.7	0.96	-175.9
400	0.96	173.9	0.27	19.1	0.05	87.6	0.96	-179.1
450	0.97	171.0	0.22	20.9	0.06	87.6	0.97	178.1
500	0.96	168.1	0.19	24.2	0.07	86.0	0.97	175.5
600	0.96	162.7	0.16	34.0	0.10	83.7	0.97	170.8
700	0.96	157.5	0.15	43.8	0.11	81.1	0.97	166.5
800	0.94	152.4	0.15	51.6	0.13	78.8	0.97	162.5
900	0.95	148.1	0.16	57.8	0.15	75.2	0.95	158.8
1000	0.95	142.9	0.18	64.3	1.92	53.7	4.01	59.9

Note

- For more extensive s-parameters see internet:
<http://www.semiconductors.philips.co/markets/communications/wirelesscommunication/broadcast>

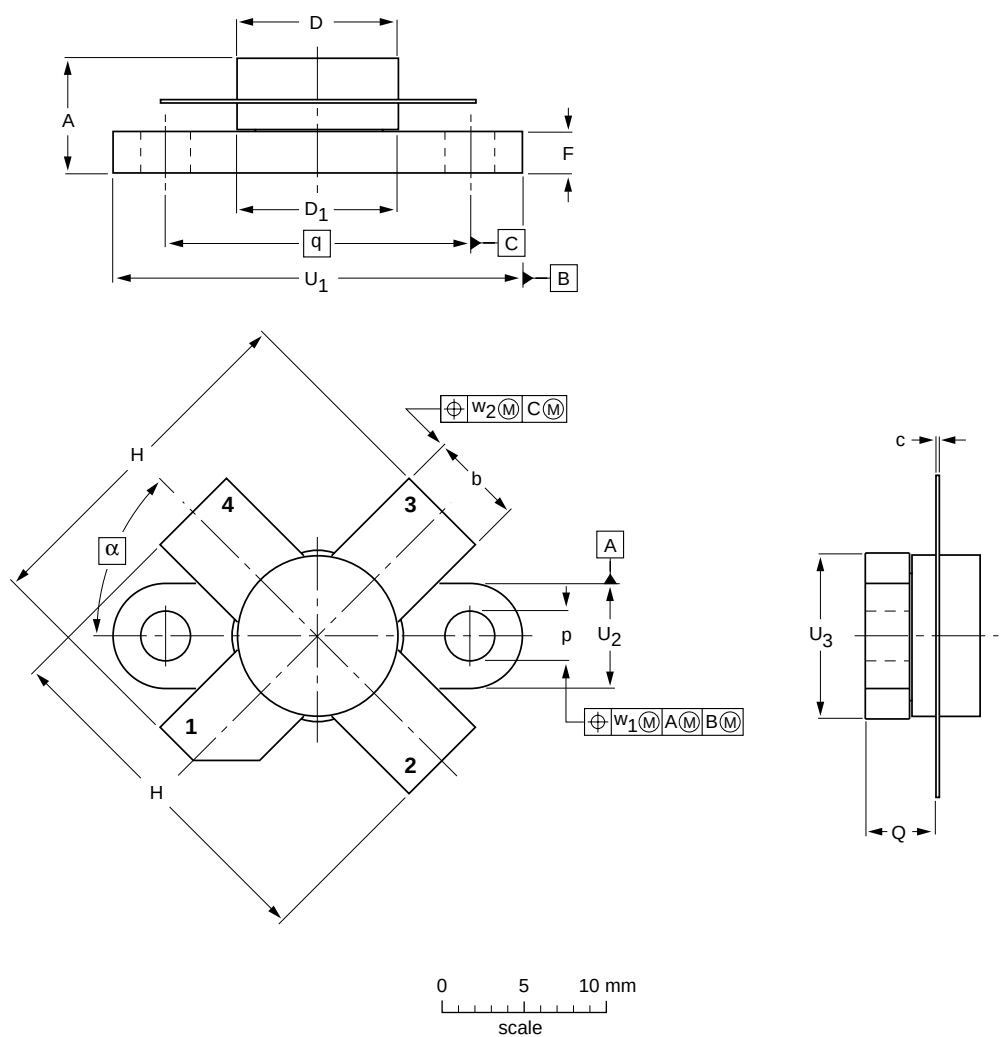
VHF power MOS transistor

BLF245

PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 4 leads

SOT123A



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

UNIT	A	b	c	D	D ₁	F	H	p	Q	q	U ₁	U ₂	U ₃	w ₁	w ₂	α
mm	7.47 6.37	5.82 5.56	0.18 0.10	9.73 9.47	9.78 9.42	2.72 2.31	20.71 19.93	3.33 3.04	4.63 4.11	18.42	24.87 24.64	6.48 6.22	9.78 9.39	0.25	0.51	45°
inches	0.294 0.251	0.229 0.219	0.007 0.004	0.383 0.373	0.385 0.371	0.107 0.091	0.815 0.785	0.131 0.120	0.182 0.162	0.725	0.980 0.970	0.255 0.245	0.385 0.370	0.010	0.020	

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT123A						99-03-29

VHF power MOS transistor

BLF245

DATA SHEET STATUS

LEVEL	DATA SHEET STATUS ⁽¹⁾	PRODUCT STATUS ⁽²⁾⁽³⁾	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.
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Printed in The Netherlands

613524/04/pp16

Date of release: 2003 Sep 02

Document order number: 9397 750 11585

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