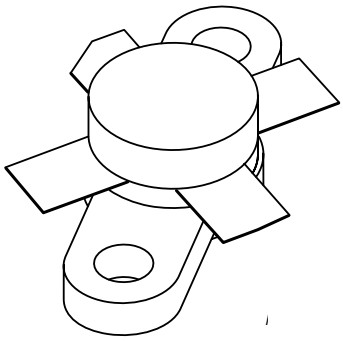
DATA SHEET



BLF245
VHF power MOS transistor

Product specification
Supersedes data of 1997 Dec 17

2003 Sep 02

Philips
Semiconductors

PHILIPS

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.

PIN CONFIGURATION

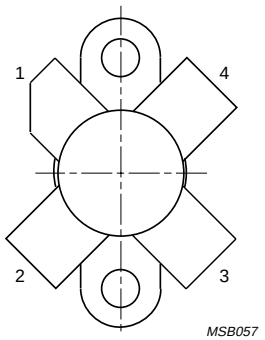


Fig.1 Simplified outline and symbol.

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.

PINNING - SOT123A

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source

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 °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

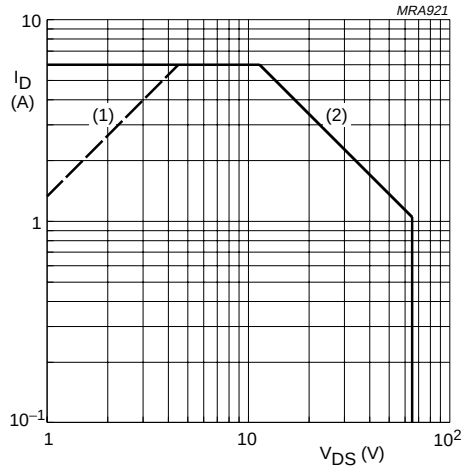
LIMITING VALUES

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	$T_{mb} \leq 25$ °C	–	68	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

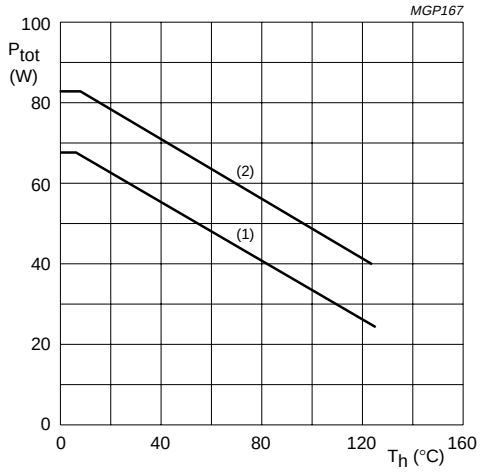
THERMAL CHARACTERISTICS

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



(1) Current is this area may be limited by R_{DSon}.
(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



(1) Continuous operation.
(2) Short-time operation during mismatch.

Fig.3 Power derating curves.

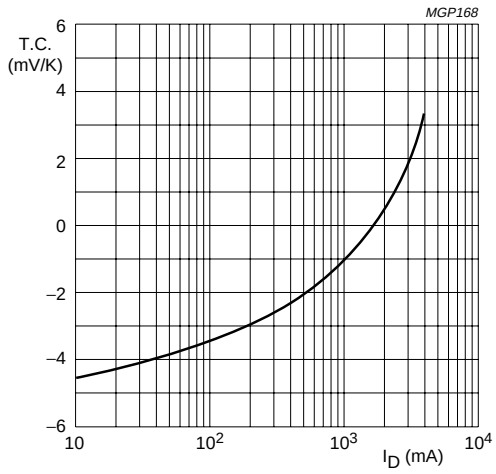
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 10 mA	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	2	mA
I_{GSS}	gate-source leakage current	V_{GS} = ±20 V; V_{DS} = 0	–	–	1	µA
V_{GSth}	gate-source threshold voltage	I_D = 10 mA; V_{DS} = 10 V	2	–	4.5	V
ΔV_{GS}	gate-source voltage difference of matched devices	I_D = 0 mA; V_{DS} = 10 V	–	–	100	mV
g_{fs}	forward transconductance	I_D = 1.5 A; V_{DS} = 10 V	1.2	1.9	–	S
R_{DSon}	drain-source on-state resistance	I_D = 1.5 A; V_{GS} = 10 V	–	0.4	0.75	Ω
I_{DSX}	on-state drain current	V_{GS} = 10 V; V_{DS} = 10 V	–	10	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	125	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	75	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	7	–	pF
F	noise figure	input and output power matched for: I_D = 1 A; V_{DS} = 28 V; P_L = 30 W; R1 = 1 kΩ; T_h = 25 °C; f = 175 MHz; see Fig.14	–	2	–	dB

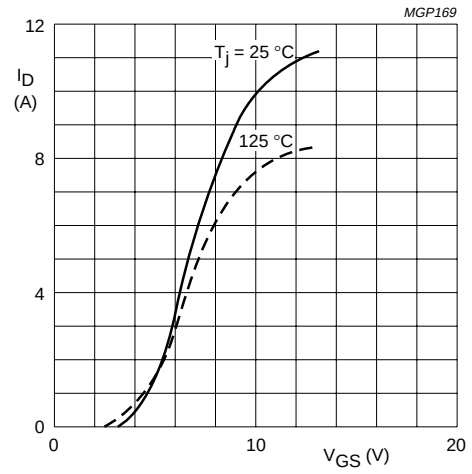
V_{GS} group indicator

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			



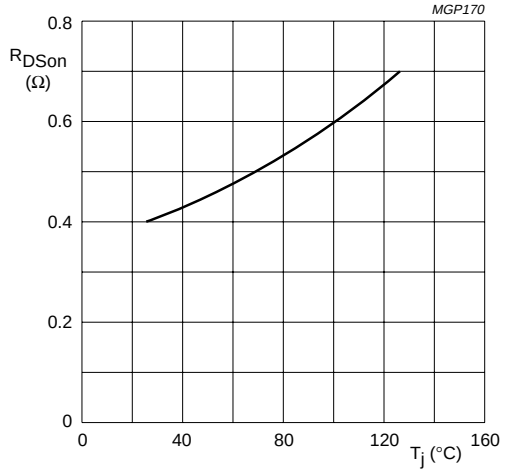
V_{DS} = 10 V; valid for T_j = 25 to 125 °C.

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



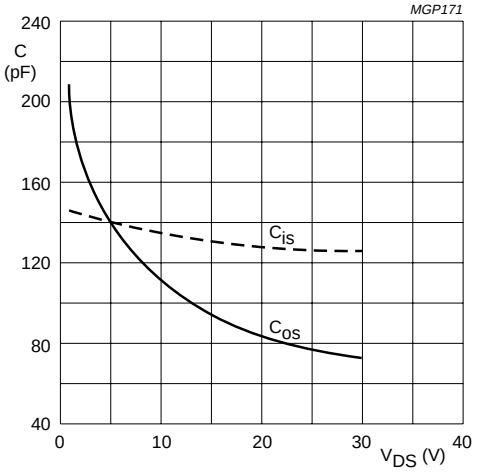
V_{DS} = 10 V.

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



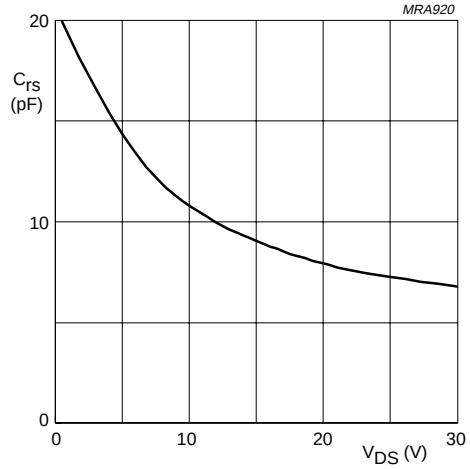
V_{GS} = 10 V; I_D = 1.5 A.

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.



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

Fig.8 Feedback capacitance as a function of drain-source voltage; typical values.

APPLICATION INFORMATION FOR CLASS-B OPERATION

T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; R1 = 1 kΩ.

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

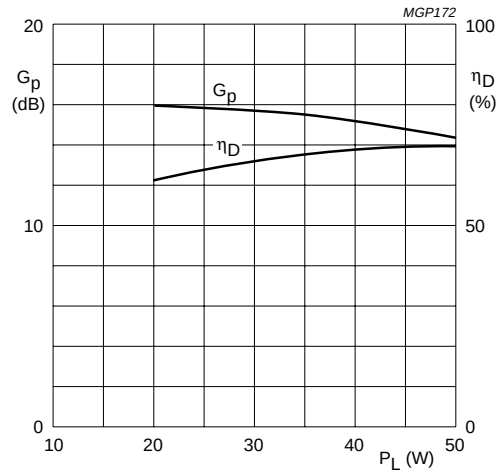
MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)	Z_i (Ω)[1]	Z_L (Ω)
CW, class-B	175	28	50	30	>13 typ. 15.5	< 50 typ. 67	2.0 – j2.7	3.9 + j4.4
	175	12.5	50	12	typ. 12	typ. 66	2.4 – j2.5	3.8 + j1.3

Note

1. R1 included.

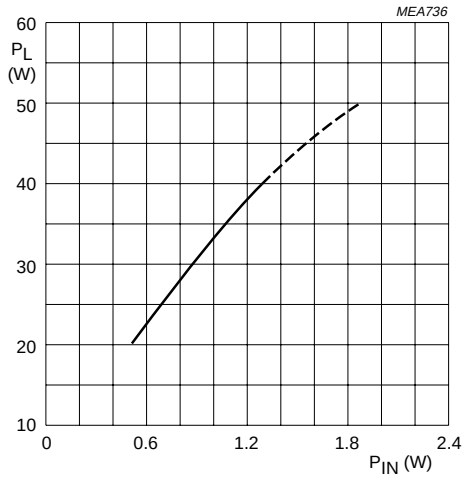
Ruggedness in class-B operation

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



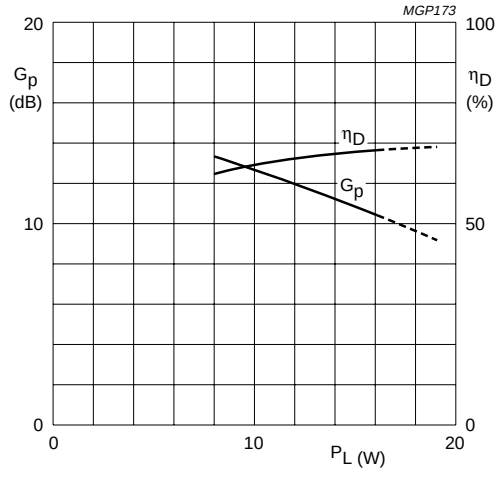
Class-B operation; V_{DS} = 28 V; I_{DQ} = 50 mA;
f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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



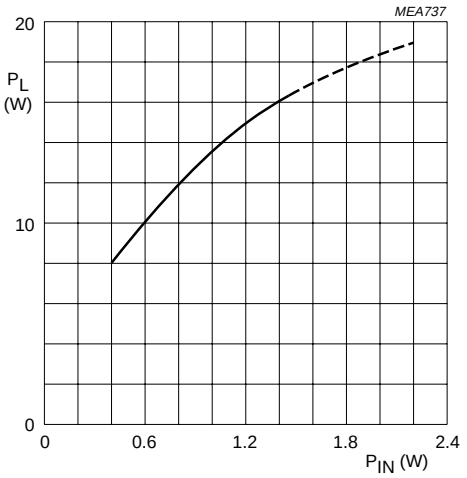
Class-B operation; V_{DS} = 28 V; I_{DQ} = 50 mA;
f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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



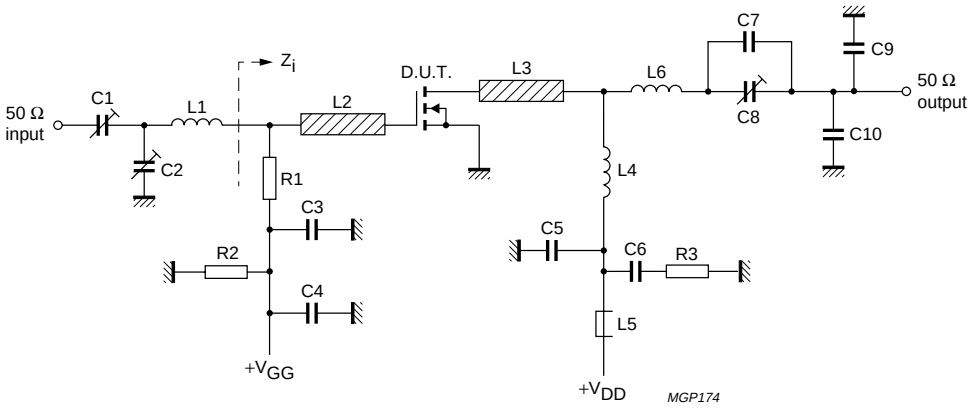
Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 50 mA;
f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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



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

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



f = 175 MHz.

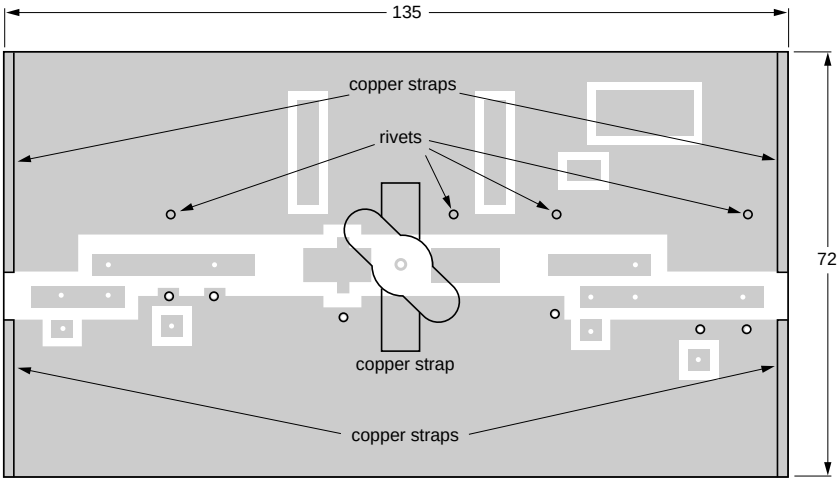
Fig.13 Test circuit for class-B operation.

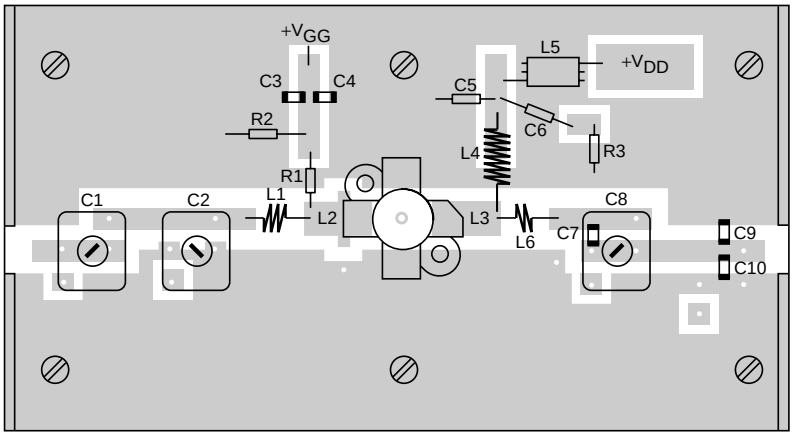
List of components class-B test circuit (see Fig.14)

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 (ε_r = 4.5), thickness $\frac{1}{16}$ inch.

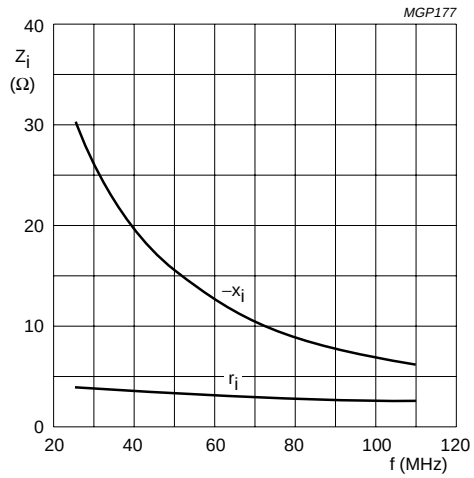




Dimensions in mm.

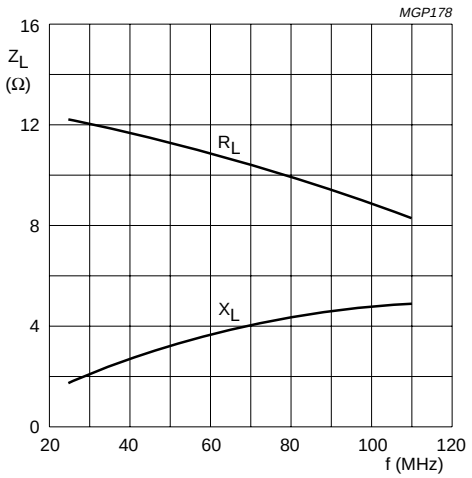
The circuit and components are situated on one side of the epoxy fibre-glass board; the other side is unetched copper and serves as an earth. Earth connections are made by means of fixing screws, hollow rivets and copper straps under the sources and around the edges, to provide a direct contact between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

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



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

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



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

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

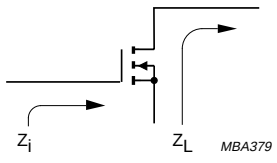
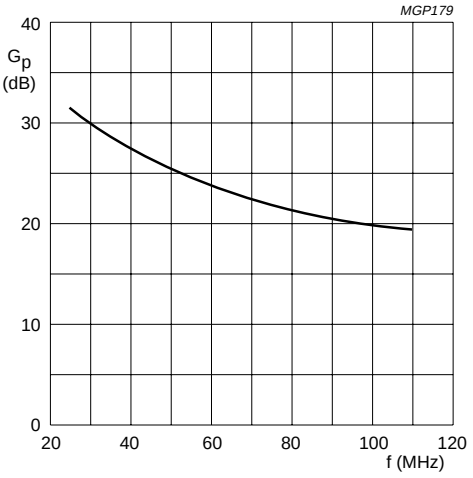


Fig.17 Definition of MOS impedance.



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

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

BLF245 scattering parameters

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

f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	$\|s_{11}\|$	$\angle\Phi$	$\|s_{21}\|$	$\angle\Phi$	$\|s_{12}\|$	$\angle\Phi$	$\|s_{22}\|$	$\angle\Phi$
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

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

BLF245 scattering parameters

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

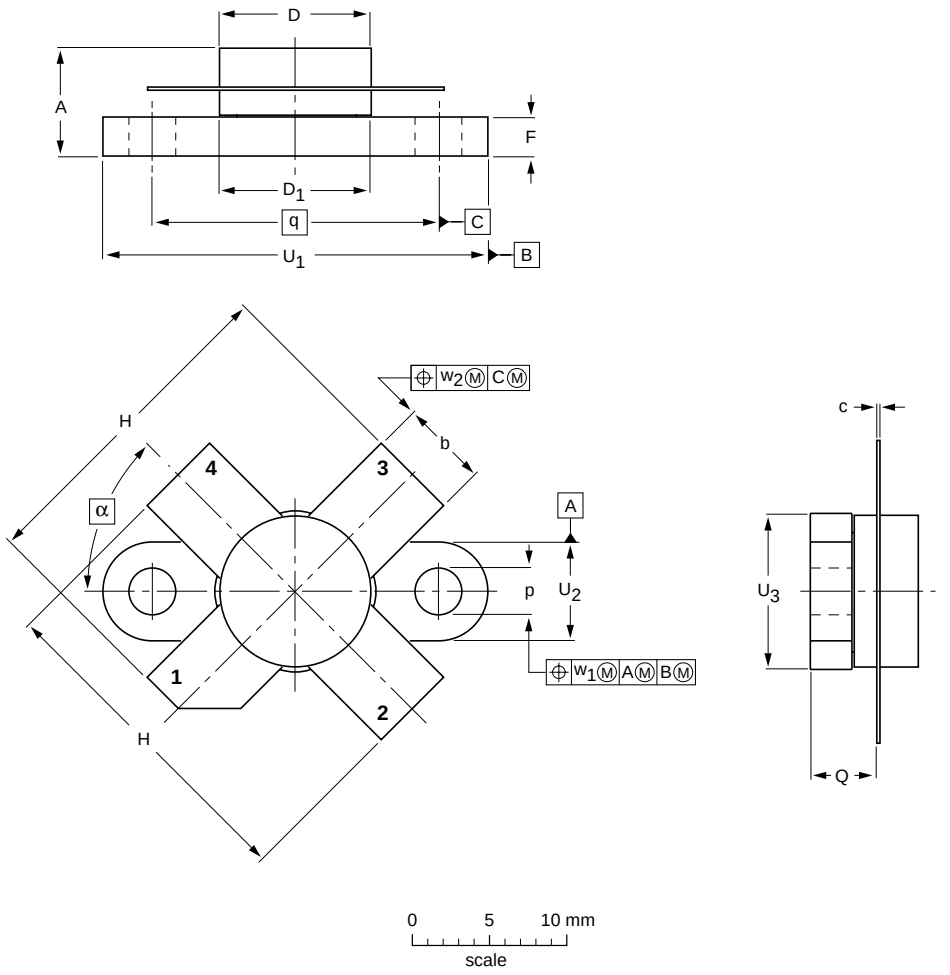
f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	$\|s_{11}\|$	$\angle\Phi$	$\|s_{21}\|$	$\angle\Phi$	$\|s_{12}\|$	$\angle\Phi$	$\|s_{22}\|$	$\angle\Phi$
5	0.95	–40.5	27.84	152.9	0.02	63.8	0.93	–35.8
10	0.86	–71.3	22.60	133.3	0.04	44.4	0.83	–64.1
20	0.77	–108.6	14.77	109.1	0.05	21.7	0.69	–97.8
30	0.73	–126.8	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

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

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

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.
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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.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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.

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