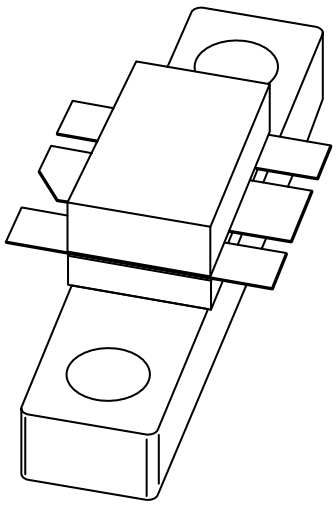
DATA SHEET



BLF542
UHF power MOS transistor

Product specification
Supersedes data of 1998 Jan 08

2003 Sep 18

Philips
Semiconductors

PHILIPS

UHF power MOS transistor BLF542

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability
- Withstands full load mismatch
- Designed for broadband operation.

APPLICATIONS

- Large signal amplifier applications in the UHF frequency range.

DESCRIPTION

N-channel enhancement mode vertical D-MOS power transistor encapsulated in a 6-lead, SOT171A flange package with a ceramic cap. All leads are isolated from the flange.

PINNING - SOT171A

PIN	DESCRIPTION
1	source
2	source
3	gate
4	drain
5	source
6	source

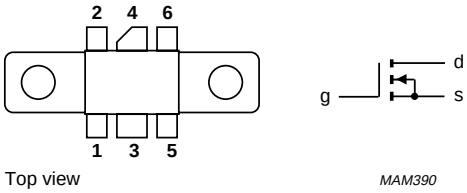


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common source class-B circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	5	>13	>50

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.

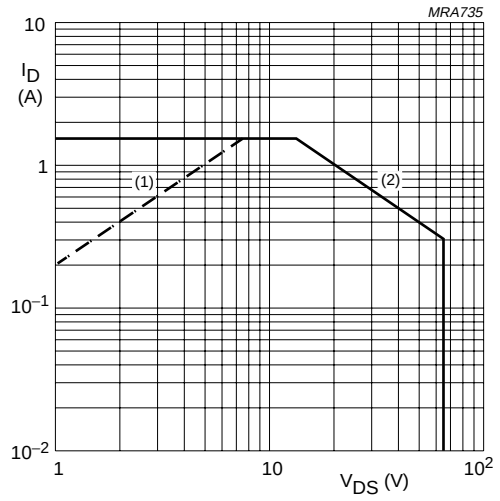
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
V_{GS}	gate-source voltage		–	±20	V
I_D	drain current (DC)		–	1.5	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	20	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C

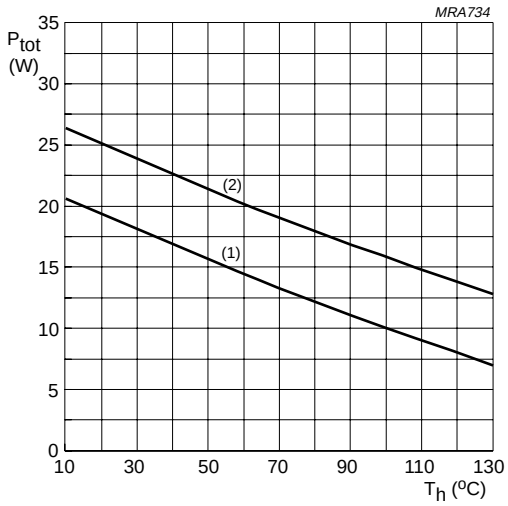
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	8.8	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	0.4	K/W



(1) Current in 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.

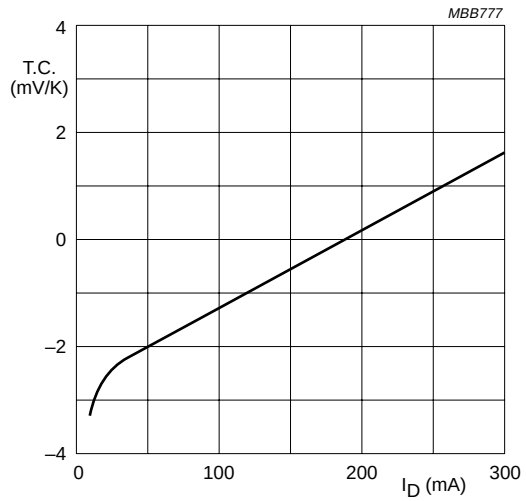
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 0.1 mA; V_{GS} = 0	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	10	μA
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
g_{fs}	forward transconductance	I_D = 0.3 A; V_{DS} = 10 V	160	240	–	mS
R_{DSon}	drain-source on-resistance	I_D = 0.3 A; V_{GS} = 15 V	–	3.3	5	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	–	1.4	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	14	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	9.4	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	1.7	–	pF

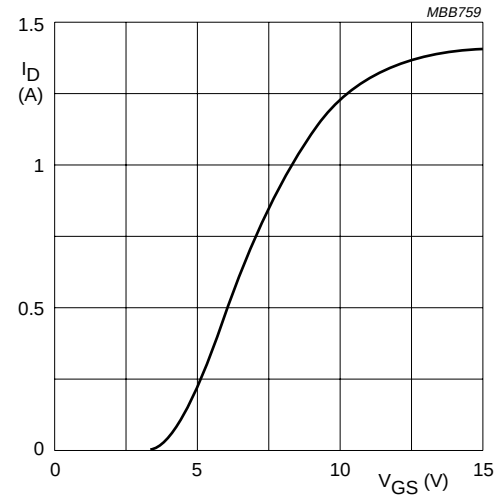
V_{GS} group indicator

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			



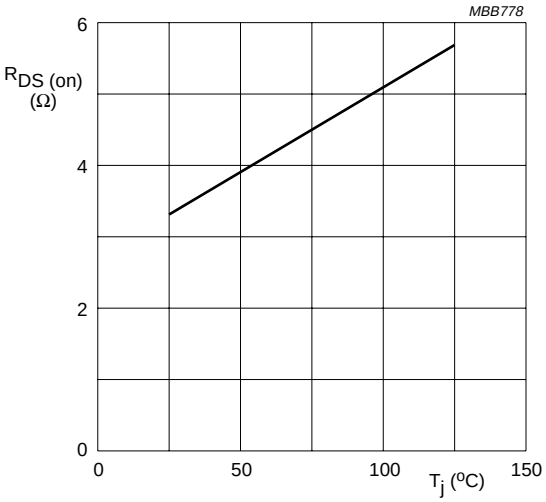
V_{DS} = 10 V.

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



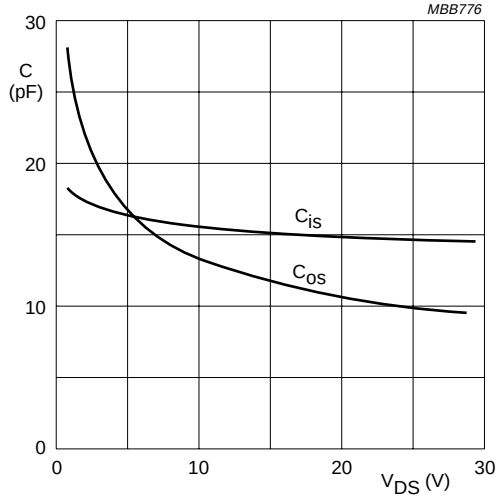
V_{DS} = 10 V; T_j = 25 °C.

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



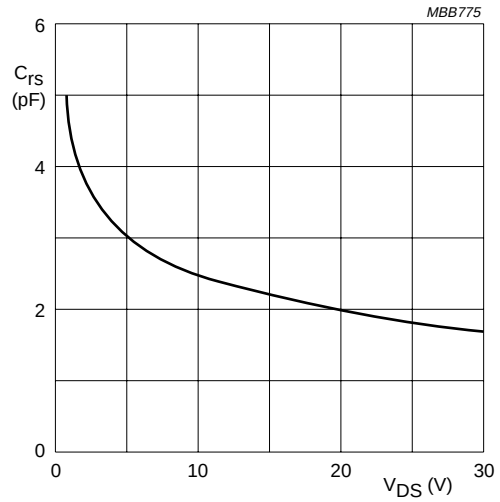
I_D = 0.3 A; V_{GS} = 15 V

Fig.6 Drain-source on-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

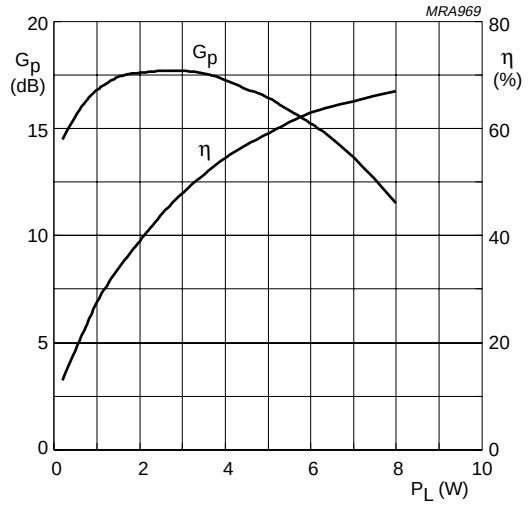
T_{mb} = 25 °C unless otherwise specified.

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 (%)
CW, class-B	500	28	50	5	>13 typ. 16.5	>50 typ. 59

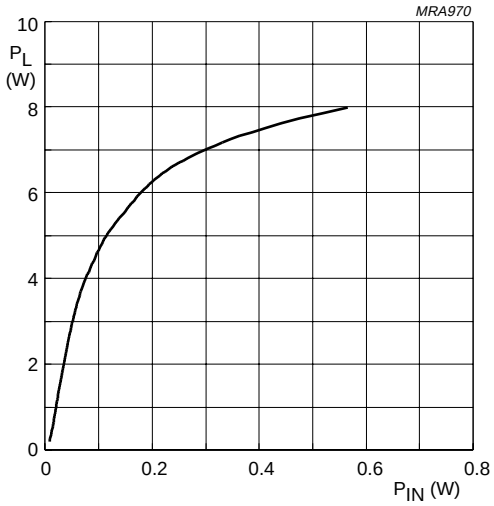
Ruggedness in class-B operation

The BLF542 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases under the following conditions: V_{DS} = 28 V; f = 500 MHz at rated output power.



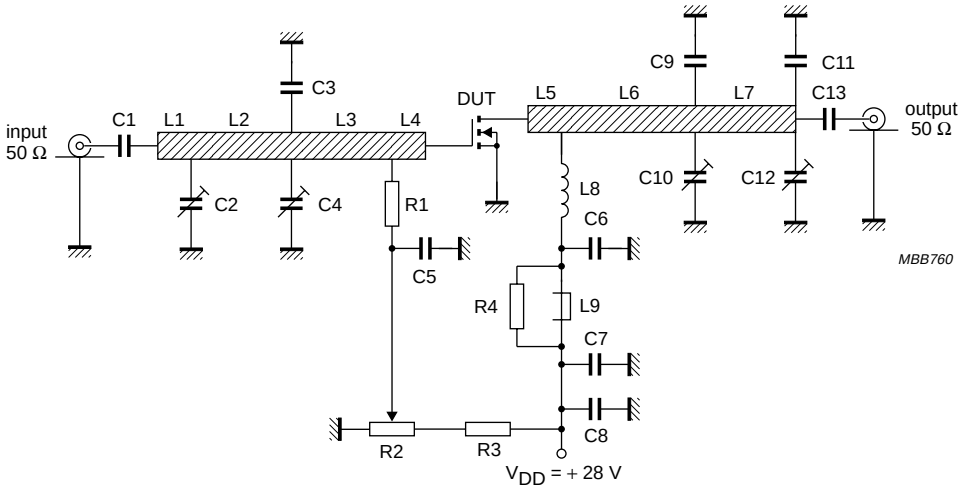
Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA;
Z_L = 9.7 + j24.5 Ω; f = 500 MHz.

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



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA;
Z_L = 9.7 + j24.5 Ω; f = 500 MHz.

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



f = 500 MHz.

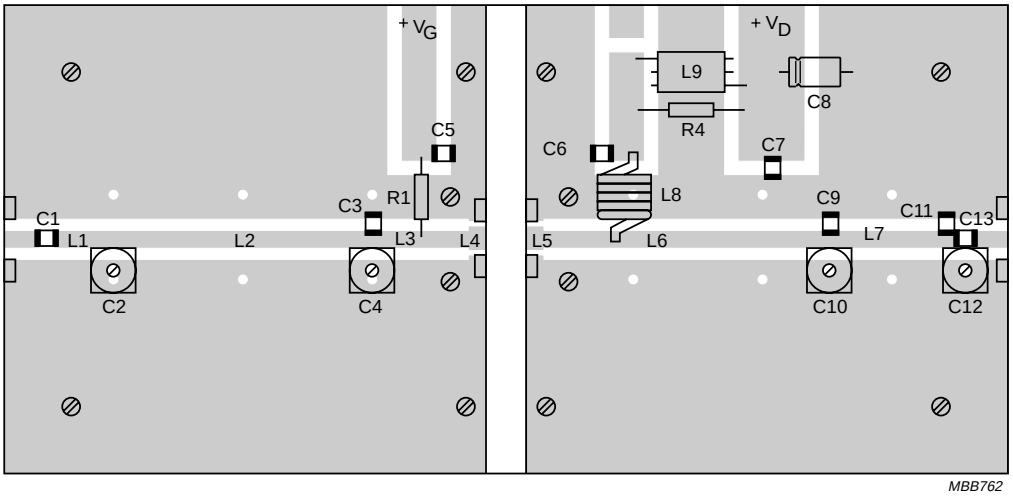
Fig.11 Test circuit for class-B operation.

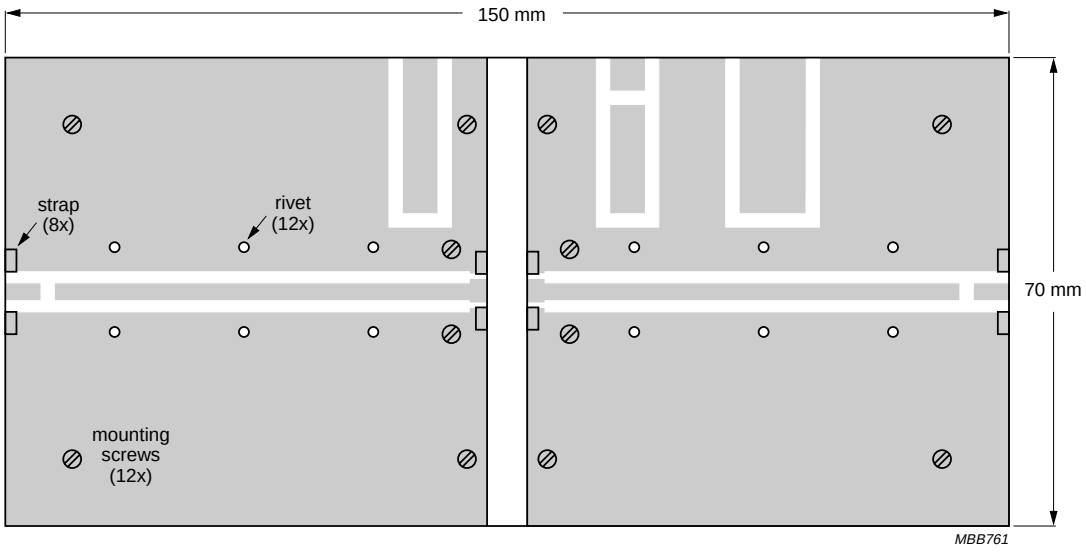
List of components (see Fig.11**)**

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C5, C13	multilayer ceramic chip capacitor; note 1	390 pF		
C2, C4, C10, C12	film dielectric trimmer	2 to 18 pF		222 809 05217
C3, C9	multilayer ceramic chip capacitor; note 1	39 pF		
C6	multilayer ceramic chip capacitor; note 2	220 pF		
C7	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C8	electrolytic capacitor	63 V, 10 μF		2222 030 28109
C11	multilayer ceramic chip capacitor; note 1	10 pF		
L1	stripline; note 3	50 Ω	11 mm × 2.5 mm	
L2	stripline; note 3	50 Ω	37 mm × 2.5 mm	
L3	stripline; note 3	50 Ω	13 mm × 2.5 mm	
L4, L5	stripline; note 3	42 Ω	3 mm × 3 mm	
L6	stripline; note 3	50 Ω	39 mm × 2.5 mm	
L7	stripline; note 3	50 Ω	22 mm × 2.5 mm	
L8	8 turns 0.8 mm enamelled copper wire	250 nH	length 9 mm int. dia. 6 mm leads 2 × 5 mm	
L9	grade 3B Ferroxcube wideband RF choke			4312 020 36640
R1	metal film resistor	10 kΩ, 0.4 W		2322 151 71003
R2	10 turn potentiometer	50 kΩ		
R3	metal film resistor	205 kΩ, 0.4 W		2322 151 72054
R4	metal film resistor	10 Ω, 0.4 W		2322 151 71009

Notes

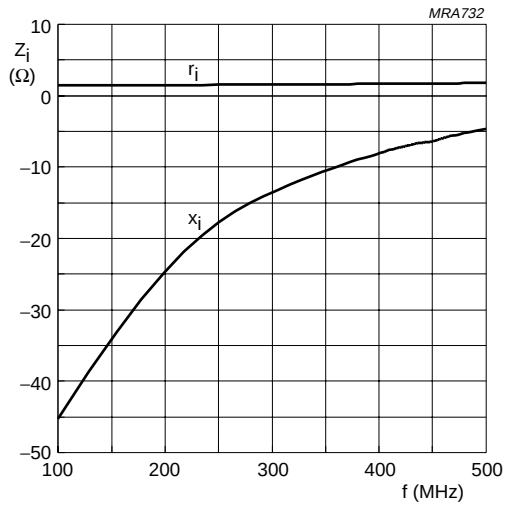
1. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed circuit board with PTFE fibre-glass dielectric (ε_r = 2.2); thickness $^1/_{32}$ inch.





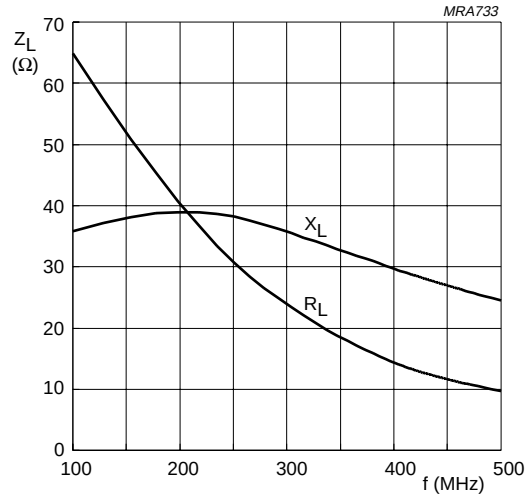
The components are mounted on one side of a copper-clad printed circuit board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws, hollow rivets and copper foil straps, as shown.

Fig.12 Component layout for 500 MHz test circuit.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; P_L = 5 W.

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



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; P_L = 5 W.

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

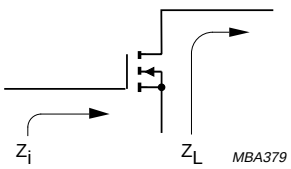
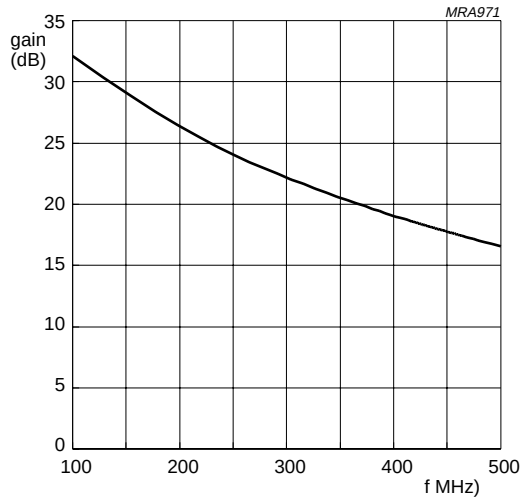


Fig.15 Definition of MOS impedance.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; P_L = 5 W.

Fig.16 Power gain as a function of frequency; typical values.

BLF542 scattering parameters

V_{DS} = 28 V; I_D = 10 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	1.00	–3.0	5.88	178.0	0.00	0.0	1.00	–2.3
10	1.00	–6.0	5.88	175.0	0.01	84.7	1.01	–6.0
20	1.00	–12.0	5.86	169.0	0.02	80.4	1.00	–11.0
30	0.99	–17.9	5.74	164.0	0.03	74.8	1.00	–17.2
40	0.98	–23.6	5.65	159.0	0.04	70.2	0.99	–22.4
50	0.98	–29.3	5.55	154.0	0.04	65.6	0.98	–27.3
60	0.97	–34.8	5.43	150.0	0.05	61.2	0.97	–32.1
70	0.96	–40.1	5.31	145.0	0.06	56.9	0.96	–36.8
80	0.94	–45.3	5.19	140.0	0.07	52.4	0.96	–41.8
90	0.93	–50.3	5.03	135.0	0.07	47.9	0.94	–46.9
100	0.92	–54.9	4.86	131.0	0.08	43.6	0.93	–51.6
125	0.89	–65.5	4.42	122.0	0.09	34.7	0.89	–61.6
150	0.87	–75.5	4.06	113.0	0.10	26.8	0.88	–70.0
175	0.85	–84.2	3.71	105.0	0.10	19.0	0.86	–78.2
200	0.83	–91.7	3.35	97.3	0.10	12.4	0.83	–85.3
250	0.82	–105.0	2.81	84.6	0.11	1.2	0.82	–96.8
300	0.81	–116.0	2.34	73.6	0.11	–8.6	0.81	–107.0
350	0.81	–125.0	2.00	64.0	0.10	–16.7	0.82	–115.0
400	0.81	–133.0	1.70	55.5	0.10	–23.8	0.82	–121.0
450	0.82	–140.0	1.48	47.7	0.09	–30.2	0.83	–128.0
500	0.83	–146.0	1.28	40.9	0.09	–35.6	0.84	–133.0
600	0.86	–157.0	1.00	29.0	0.08	–44.9	0.87	–142.0
700	0.87	–166.0	0.79	18.6	0.07	–52.3	0.89	–149.0
800	0.89	–175.0	0.64	9.8	0.06	–58.1	0.90	–155.0
900	0.90	178.0	0.53	2.0	0.05	–62.4	0.92	–160.0
1000	0.91	171.0	0.45	–4.8	0.04	–64.9	0.93	–165.0

Note

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

BLF542 scattering parameters

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

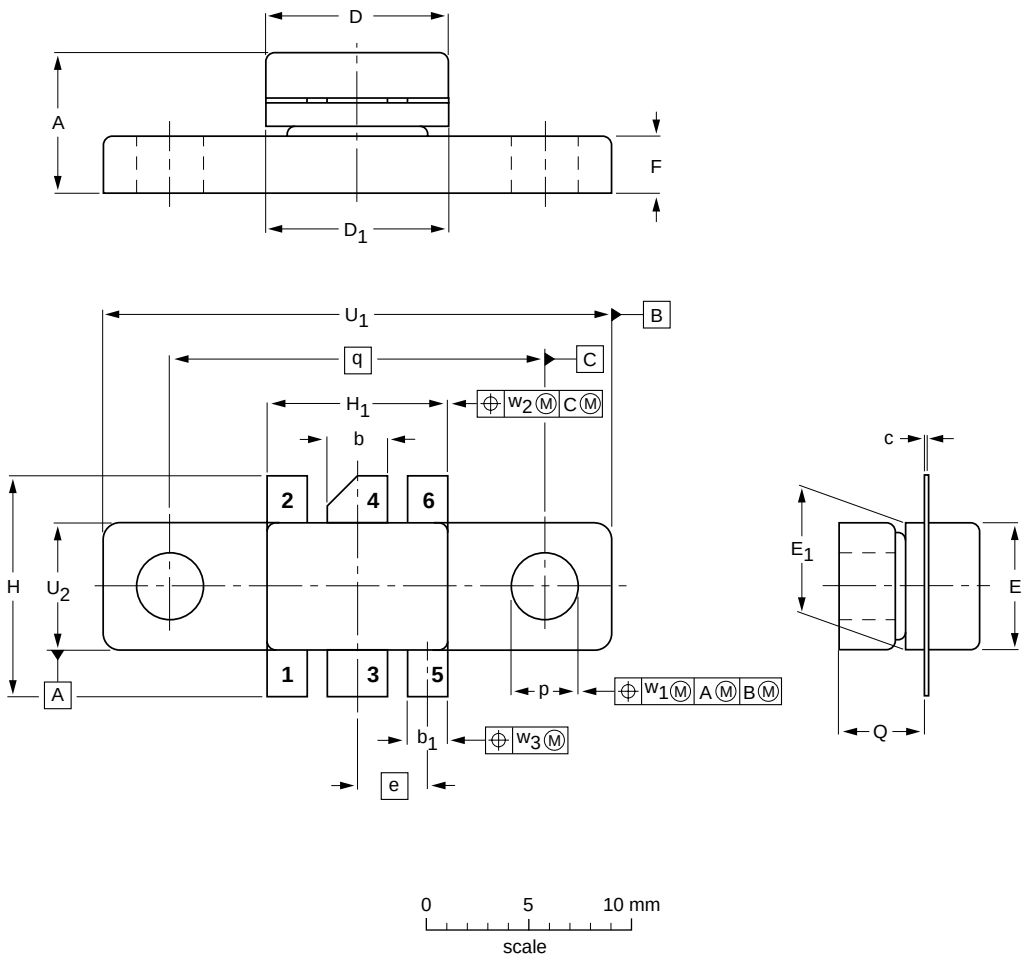
f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	$\|s_{11}\|$	$\angle\Phi$	$\|s_{21}\|$	$\angle\Phi$	$\|s_{12}\|$	$\angle\Phi$	$\|s_{22}\|$	$\angle\Phi$
5	1.00	–4.1	12.20	177.0	0.00	0.0	0.99	–3.2
10	1.00	–8.2	12.20	173.0	0.01	83.5	1.00	–7.8
20	0.99	–16.3	12.10	167.0	0.02	78.1	0.99	–14.5
30	0.98	–24.1	11.70	161.0	0.03	71.7	0.98	–22.3
40	0.97	–31.7	11.40	155.0	0.03	66.2	0.96	–28.8
50	0.95	–39.1	11.10	150.0	0.04	60.9	0.94	–35.1
60	0.93	–46.1	10.70	144.0	0.05	55.8	0.93	–41.1
70	0.92	–52.7	10.30	139.0	0.06	51.1	0.91	–46.8
80	0.90	–59.1	9.92	134.0	0.06	46.2	0.89	–52.7
90	0.88	–65.1	9.47	129.0	0.07	41.6	0.87	–58.4
100	0.86	–70.3	9.00	125.0	0.07	37.3	0.85	–63.6
125	0.82	–81.9	7.95	116.0	0.08	28.7	0.80	–74.1
150	0.80	–92.5	7.12	107.0	0.08	21.2	0.78	–82.8
175	0.77	–101.0	6.37	99.9	0.08	14.2	0.75	–90.7
200	0.75	–109.0	5.68	93.5	0.08	8.5	0.73	–97.4
250	0.74	–121.0	4.67	82.4	0.09	–1.3	0.72	–108.0
300	0.73	–130.0	3.87	72.9	0.08	–9.4	0.71	–116.0
350	0.74	–138.0	3.29	64.5	0.08	–16.3	0.72	–123.0
400	0.75	–145.0	2.81	57.2	0.08	–22.2	0.73	–129.0
450	0.76	–151.0	2.44	50.3	0.07	–27.7	0.74	–134.0
500	0.77	–156.0	2.13	44.2	0.07	–32.2	0.75	–138.0
600	0.79	–165.0	1.67	33.3	0.06	–40.0	0.79	–145.0
700	0.82	–173.0	1.34	23.6	0.05	–46.1	0.82	–152.0
800	0.84	180.0	1.10	15.2	0.04	–50.4	0.85	–157.0
900	0.86	173.0	0.92	7.5	0.04	–52.9	0.87	–162.0
1000	0.87	167.0	0.78	0.7	0.03	–52.8	0.88	–166.0

Note

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

PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 6 leads **SOT171A**



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

UNIT	A	b	b_1	c	D	D_1	E	E_1	e	F	H	H_1	p	Q	q	U_1	U_2	w_1	w_2	w_3
mm	6.81 6.07	3.18 2.92	2.13 1.88	0.16 0.07	9.25 9.04	9.27 9.02	5.95 5.74	5.97 5.72	3.58	3.05 2.54	11.31 10.54	9.27 9.01	3.43 3.17	4.32 4.11	18.42	24.90 24.63	5.97 5.72	0.25	0.51	0.25
inches	0.268 0.239	0.125 0.115	0.084 0.074	0.006 0.003	0.364 0.356	0.365 0.355	0.234 0.226	0.235 0.225	0.140	0.120 0.100	0.445 0.415	0.365 0.355	0.135 0.125	0.170 0.162	0.725	0.980 0.970	0.235 0.225	0.010	0.020	0.010

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT171A						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.
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.

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.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

DISCLAIMERS

Life support applications — 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 Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

Right to make changes — Philips Semiconductors reserves the right to make changes in the products - including circuits, standard cells, and/or software - described or contained herein in order to improve design and/or performance. When the product is in full production (status ‘Production’), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no licence or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

Philips Semiconductors – a worldwide company

Contact information

For additional information please visit **http://www.semiconductors.philips.com**. Fax: **+31 40 27 24825**
For sales offices addresses send e-mail to: **sales.addresses@www.semiconductors.philips.com**.

Printed in The Netherlands 613524/03/pp15 Date of release: 2003 Sep 18 Document order number: 9397 750 11588

Let's make things better.

Philips
Semiconductors

PHILIPS