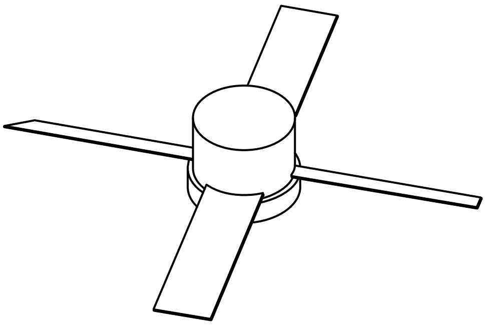
DISCRETE SEMICONDUCTORS

DATA SHEET



BLF521
UHF power MOS transistor

Product specification
Supersedes data of 1998 Jan 07

2003 Sep 02

Philips
Semiconductors

UHF power MOS transistor BLF521

FEATURES

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

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for communications transmitter applications in the UHF frequency range.

The transistor is encapsulated in a 4-lead, SOT172D studless package, with a ceramic cap. All leads are isolated from the mounting base.

PINNING - SOT172D

PIN	DESCRIPTION
1	source
2	gate
3	drain
4	source

PIN CONFIGURATION

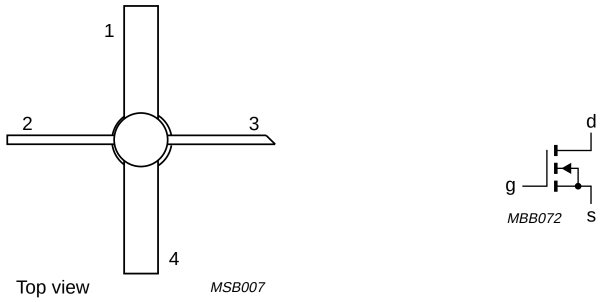


Fig.1 Simplified outline and symbol.

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_{amb} = 25 °C in a common source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	12.5	2	>10	>50

LIMITING VALUES

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

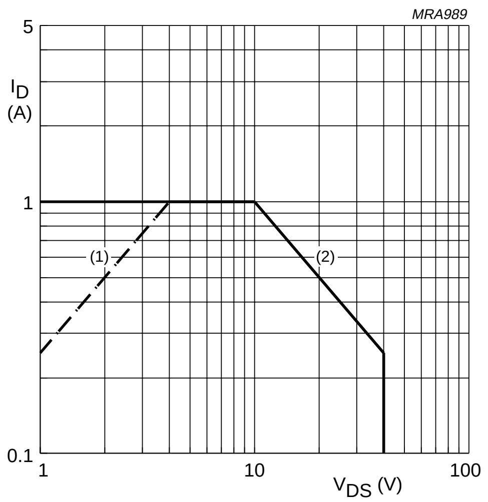
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	40	V
V_{GS}	gate-source voltage		–	±20	V
I_D	drain current (DC)		–	1	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C	–	10	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	17.5	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient; note1	75	K/W

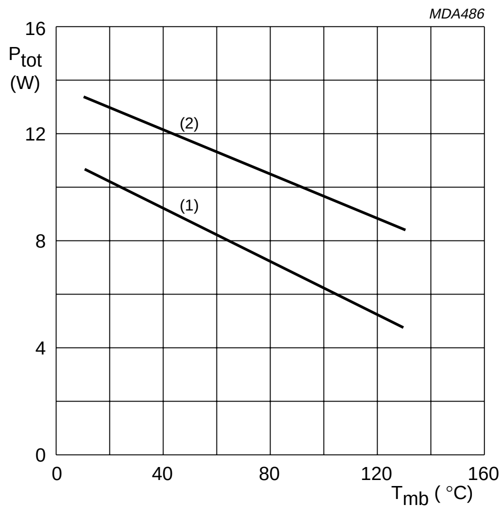
Note

1. Mounted on printed-circuit board; see Fig.12.



(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.

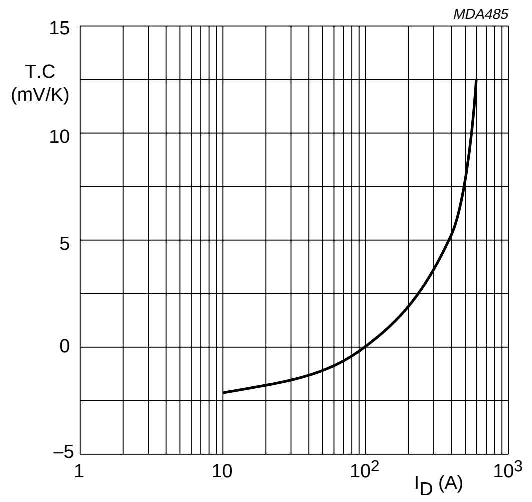
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 3 mA	40	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 12.5 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 = 3 mA; V_{DS} = 10 V	2	–	4.5	V
g_{fs}	forward transconductance	I_D = 0.3 A; V_{DS} = 10 V	80	135	–	mS
R_{DSon}	drain-source on-state resistance	I_D = 0.3 A; V_{GS} = 15 V	–	3.5	4	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	–	1.3	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	5.3	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	7.8	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	1.8	–	pF

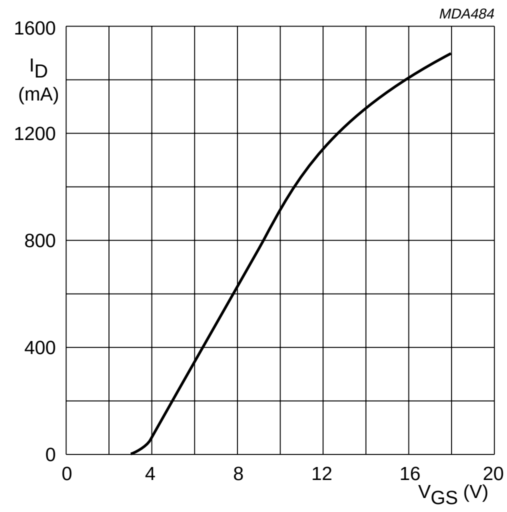
V_{GS} group indicator

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			



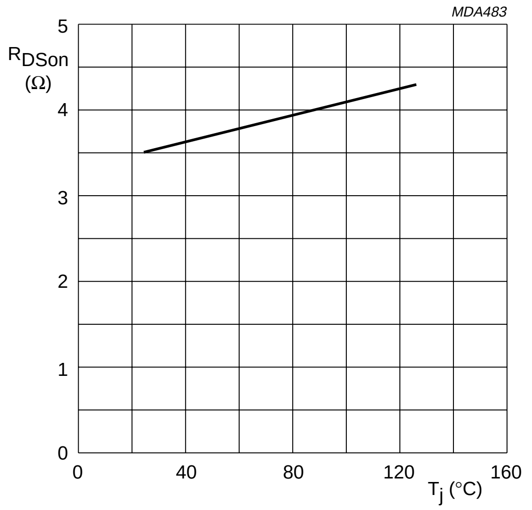
V_{DS} = 10 V.

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



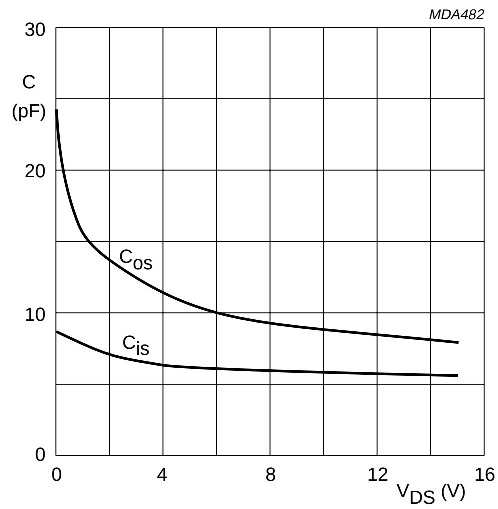
V_{DS} = 10 V; T_j = 25 °C.

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



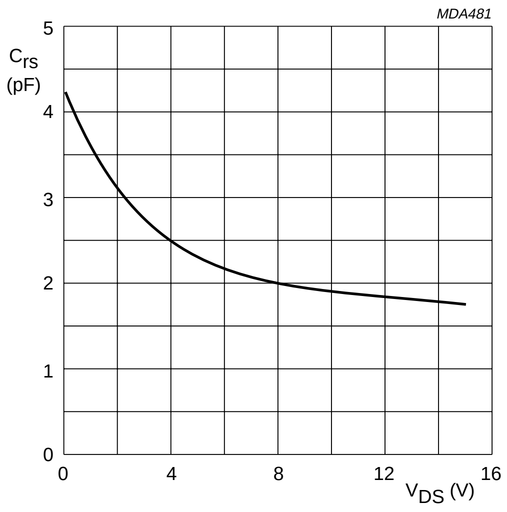
I_D = 0.3 A; V_{GS} = 15 V.

Fig.6 Drain-source on-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.

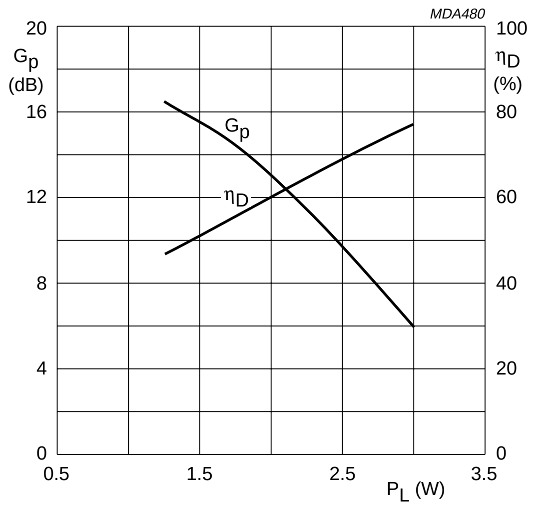
APPLICATION INFORMATION FOR CLASS-B OPERATION

T_{amb} = 25 °C; R_{GS} = 274 Ω, unless otherwise specified.
RF performance 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	12.5	10	2	> 10 typ. 13	> 50 typ. 60

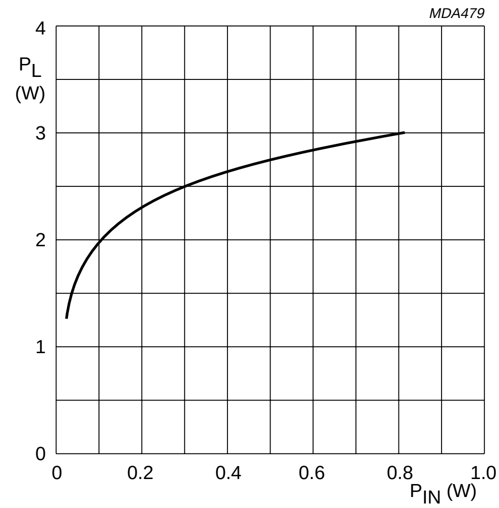
Ruggedness in class-B operation

The BLF521 is capable of withstanding a load mismatch corresponding to VSWR = 50:1 through all phases under the following conditions: V_{DS} = 15.5 V; f = 500 MHz at rated output power.



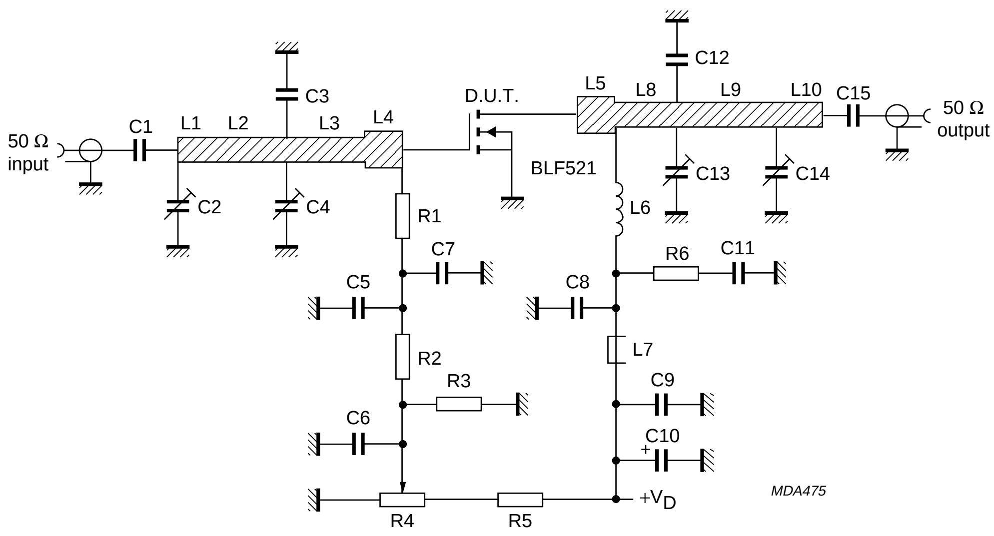
Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 10 mA;
Z_L = 9.5 + j12.8; f = 500 MHz.

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



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 20 mA;
Z_L = 9.5 + j12.8; f = 175 MHz.

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



f = 500 MHz.

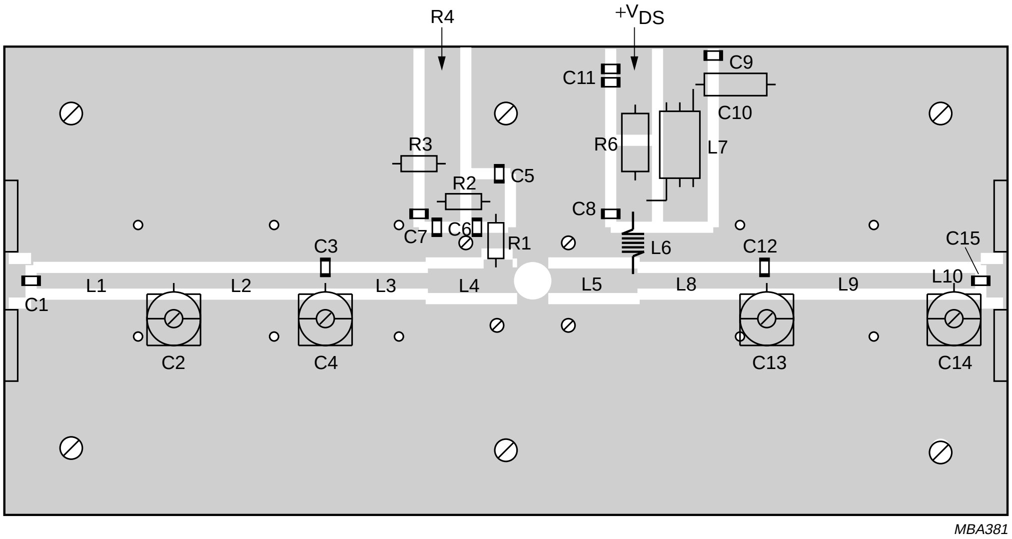
Fig.11 Test circuit for class-B operation.

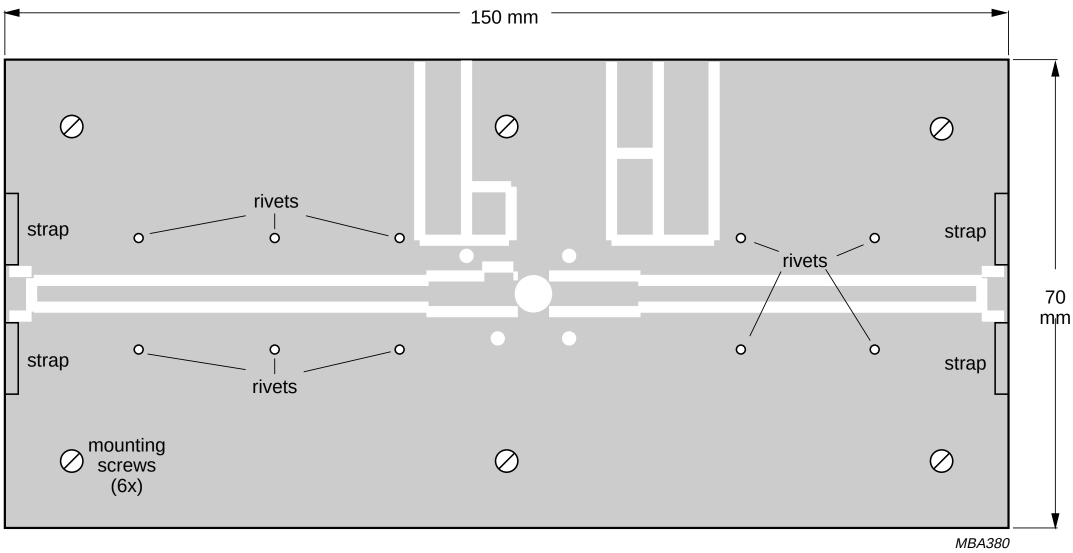
List of components class-AB test circuit (see Fig.12)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C5, C8, C15	multilayer ceramic chip capacitor; note 1	390 pF, 500 V		
C2, C13	film dielectric trimmer	2 to 9 pF		2222 809 09002
C3	multilayer ceramic chip capacitor; note 2	5.6 pF, 500 V		
C4	film dielectric trimmer	2 to 18 pF		2222 809 09003
C6, C11	multilayer ceramic chip capacitor	2 × 100 nF in parallel, 50 V		2222 852 47104
C7, C9	multilayer ceramic chip capacitor	100 nF, 50 V		2222 852 47104
C10	electrolytic capacitor	10 μF, 63 V		2222 030 38109
C12	multilayer ceramic chip capacitor; note 2	9.1 pF, 50 V		
C14	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
L1	stripline; note 3	83 Ω	20 × 2 mm	
L2	stripline; note 3	83 Ω	21 × 2 mm	
L3	stripline; note 3	83 Ω	19 × 2 mm	
L4, L5	stripline; note 3	67 Ω	12 × 3 mm	
L6	5 turns enamelled 0.5 mm copper wire	62 nH	length 3.75 mm int. dia. 3 mm leads 2 × 4 mm	
L7	grade 3B Ferroxcube RF choke			4312 020 36642
L8	stripline; note 3	83 Ω	18.6 × 2 mm	
L9	stripline; note 3	83 Ω	31.6 × 2 mm	
L10	stripline; note 3	83 Ω	2 × 2 mm	
R1	0.4 W metal film resistor	274 Ω		2322 151 72741
R2	0.4 W metal film resistor	1.96 kΩ		2322 151 71962
R3	0.4 W metal film resistor	1 MΩ		2322 151 71005
R4	cermet potentiometer	5 kΩ		
R5	0.4 W metal film resistor	7.5 kΩ		2322 151 77502
R6	1 W metal film resistor	10 Ω		2322 153 51009

Notes

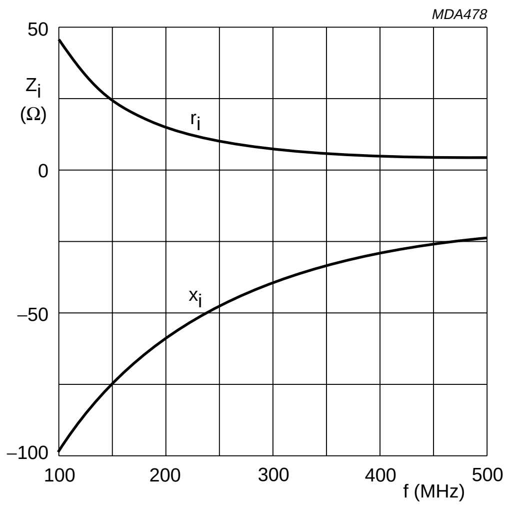
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed-circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2), thickness 1.6 mm.





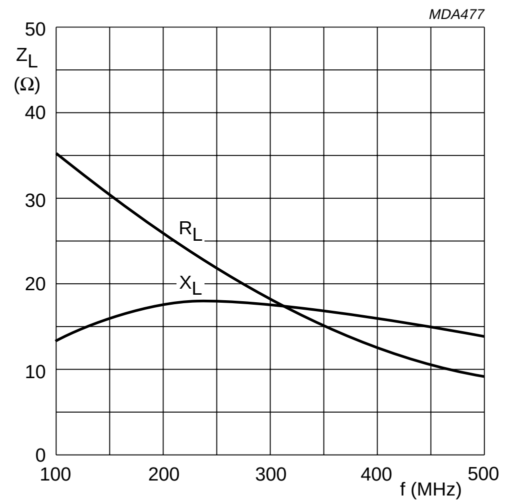
The circuit and components are situated on one side of the printed-circuit board, the other side being fully metallized, to serve as a ground plane. Earth connections are made by means of copper straps and hollow rivets for a direct contact between upper and lower sheets.

Fig.12 Component layout for 500 MHz test circuit.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 10 mA;
R_{GS} = 274 Ω; P_L = 2 W.

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



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 10 mA;
R_{GS} = 274 Ω; P_L = 2 W.

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

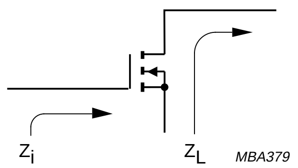
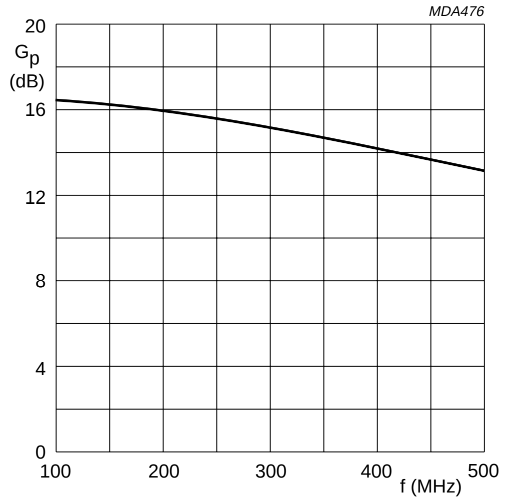


Fig.15 Definition of MOS impedance.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 10 mA;
R_{GS} = 274 Ω; P_L = 2 W.

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

BLF521 scattering parameters

V_{DS} = 12.5 V; I_D = 10 mA.; note 1

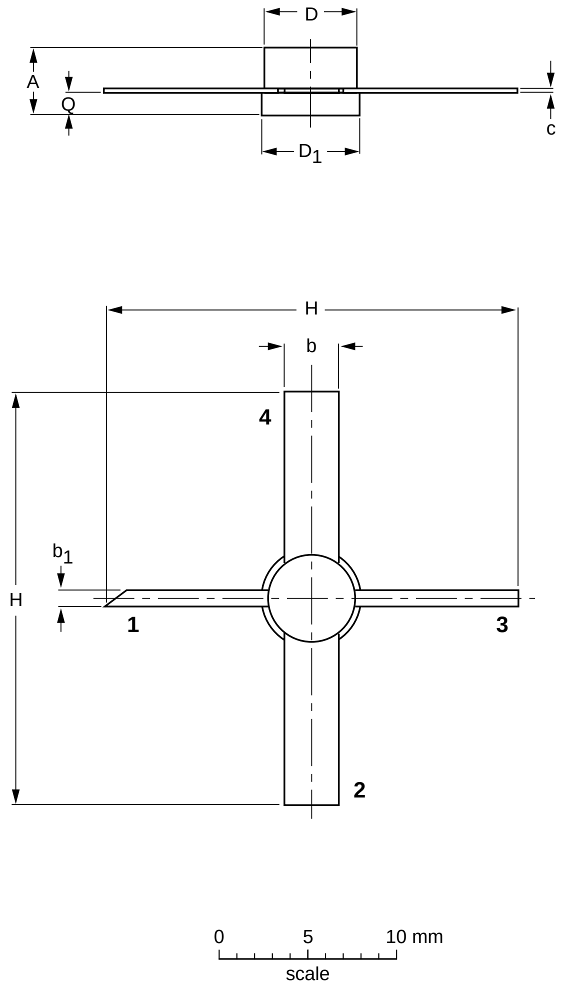
f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	$\lvert s_{11}\rvert$	∠ Φ	$\lvert s_{21}\rvert$	∠ Φ	$\lvert s_{12}\rvert$	∠ Φ	$\lvert s_{22}\rvert$	∠ Φ
5	1.00	–1.6	4.51	178.5	0.01	88.5	0.98	–2.0
10	1.00	–3.2	4.51	177.0	0.01	87.2	0.98	–4.0
20	1.00	–6.4	4.50	173.9	0.02	84.5	0.98	–8.0
30	1.00	–9.6	4.48	170.9	0.03	81.7	0.98	–12.0
40	0.99	–12.8	4.45	167.9	0.04	79.0	0.97	–16.0
50	0.99	–16.0	4.43	164.9	0.05	76.2	0.97	–19.9
60	0.98	–19.1	4.39	161.9	0.06	73.5	0.97	–23.8
70	0.97	–22.1	4.34	158.9	0.07	70.9	0.96	–27.6
80	0.97	–25.1	4.28	156.1	0.08	68.3	0.96	–31.3
90	0.96	–28.0	4.22	153.3	0.08	65.8	0.95	–34.9
100	0.95	–30.9	4.16	150.5	0.09	63.3	0.94	–38.5
125	0.92	–37.9	4.00	144.0	0.11	57.5	0.93	–47.1
150	0.90	–44.3	3.83	137.6	0.13	51.8	0.91	–55.2
175	0.87	–50.4	3.64	131.8	0.14	46.7	0.89	–62.7
200	0.85	–56.0	3.46	126.5	0.15	42.2	0.88	–69.6
250	0.80	–66.2	3.12	116.4	0.17	33.4	0.85	–81.9
300	0.77	–75.1	2.81	108.0	0.18	26.4	0.82	–92.3
350	0.74	–82.9	2.54	100.1	0.19	19.8	0.81	–101.3
400	0.72	–89.7	2.31	93.5	0.19	14.4	0.79	–108.9
450	0.70	–95.9	2.10	87.1	0.19	9.5	0.79	–115.5
500	0.69	–101.5	1.93	81.4	0.19	4.9	0.78	–121.2
600	0.69	–111.3	1.64	71.2	0.19	–2.6	0.78	–130.7
700	0.69	–119.9	1.41	62.2	0.18	–8.7	0.77	–138.5
800	0.69	–127.9	1.23	54.3	0.17	–13.6	0.78	–145.2
900	0.70	–135.1	1.08	47.3	0.15	–17.7	0.78	–151.4
1000	0.72	–142.0	0.97	40.9	0.14	–21.1	0.79	–156.9

Note

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

PACKAGE OUTLINE

Studless ceramic package; 4 leads **SOT172D**



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

UNIT	A	b	b_1	c	D	D_1	H	Q
mm	3.71 2.89	3.31 3.04	0.89 0.63	0.16 0.10	5.20 4.95	5.33 5.08	26.17 24.63	1.15 0.88
inches	0.146 0.114	0.13 0.12	0.035 0.025	0.006 0.004	0.205 0.195	0.210 0.200	1.03 0.97	0.045 0.035

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT172D						97-06-28

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**.

© Koninklijke Philips Electronics N.V. 2003

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

SCA75

Printed in The Netherlands 613524/05/pp14 Date of release: 2003 Sep 02 Document order number: 9397 750 11587

Let's make things better.

Philips Semiconductors

PHILIPS

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

NXP:

BLF521,112