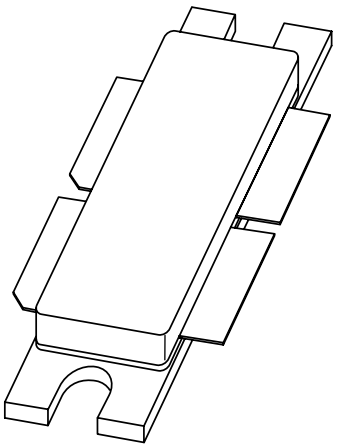
DATA SHEET



BLF2048
UHF push-pull power LDMOS transistor

Preliminary specification

2000 May 24

Philips
Semiconductors

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UHF push-pull power LDMOS transistor BLF2048

FEATURES

- High power gain
- Easy power control
- Excellent ruggedness
- Source on underside eliminates DC isolators, reducing common mode inductance
- Designed for broadband operation (HF to 2.2 GHz).

APPLICATIONS

- Common source class-AB operation for PCN and PCS applications in the 1800 to 2200 MHz frequency range.

DESCRIPTION

Push-pull silicon N-channel enhancement mode lateral D-MOS transistor encapsulated in a 4-lead flange package (SOT539A) with a ceramic cap. The common source is connected to the mounting flange.

PINNING - SOT539A

PIN	DESCRIPTION
1	drain 1
2	drain 2
3	gate 1
4	gate 2
5	source connected to flange

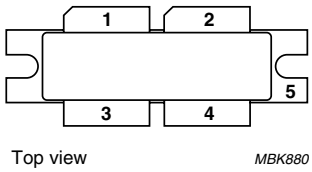


Fig.1 Simplified outline.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)	d_{im} (dBc)
2-tone, class-AB	f_1 = 2200; f_2 = 2200.1	26	120 (PEP)	>10	>30	≤–25
		28	140 (PEP)	typ. 11.2	typ. 31	typ. –25

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage	–	65	V
V_{GS}	gate-source voltage	–	±15	V
I_D	drain current (DC)	–	18	A
T_{stg}	storage temperature	–65	+150	°C
T_j	junction temperature	–	200	°C

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.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	P_L = 120 W; T_{mb} = 50 °C, note 1	0.35	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink		0.15	K/W

Note

1. Thermal resistance is determined under nominal 2-tone RF operating conditions.

CHARACTERISTICS

T_j = 25 °C; per section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 1.4 mA	65	–	–	V
V_{GSth}	gate-source threshold voltage	V_{DS} = 10 V; I_D = 140 mA	1.5	–	3.5	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 26 V	–	–	10	μA
I_{DSX}	drain cut-off current	V_{GS} = V_{GSth} + 9 V; V_{DS} = 10 V	18	–	–	A
I_{GSS}	gate leakage current	V_{GS} = ±15 V; V_{DS} = 0	–	–	250	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 5 A	–	4	–	S
R_{DSon}	drain-source on-state resistance	V_{GS} = V_{GSth} + 9 V; I_D = 5 A	–	0.17	–	Ω
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 26 V; f = 1 MHz; note 1	–	3.4	–	pF

Note

1. Capacitance of die only.

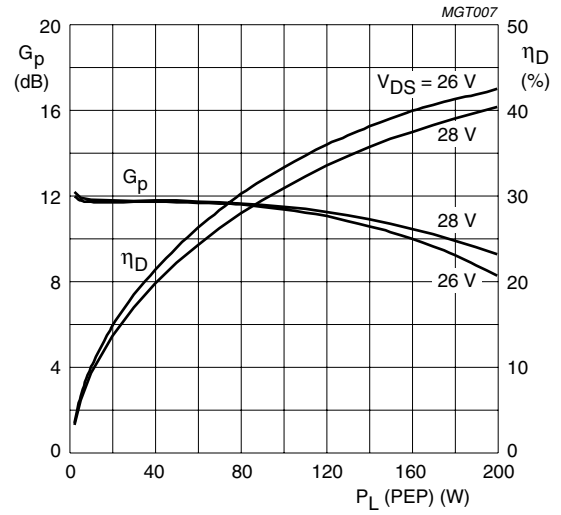
APPLICATION INFORMATION

RF performance in a common source class-AB circuit. T_h = 25 °C; $R_{th\ j\text{-}h}$ = 0.5 K/W; unless otherwise specified.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)	d_{im} (dBc)
2-tone, class-AB	f_1 = 2200; f_2 = 2200.1	26	2 x 400	120 (PEP)	>10	>30	≤–25
		28	2 x 400	140 (PEP)	typ. 11.2	typ. 31	typ. –25

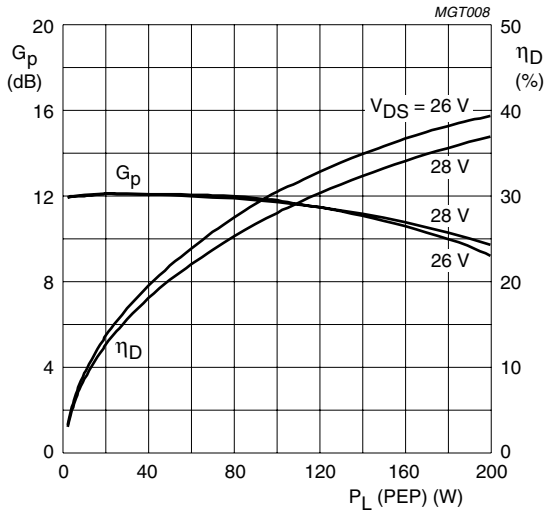
Ruggedness in class-AB operation

The BLF2048 is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: V_{DS} = 26 V; f = 2200 MHz, P_L = 120 W (CW).



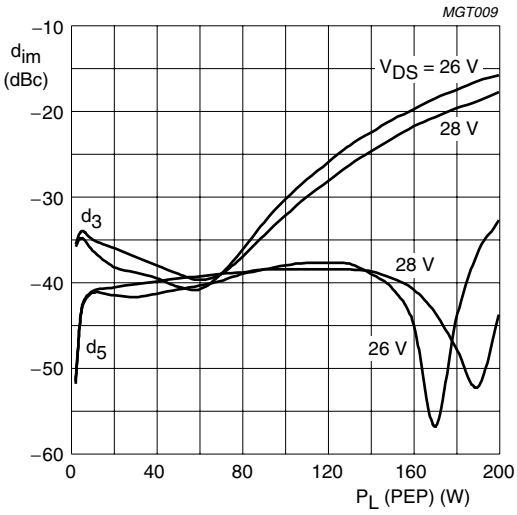
f_1 = 2000 MHz; f_2 = 2000.1 MHz;
I_{DQ} = 2 x 400 mA; $T_h \leq 25$ °C.

Fig.2 Power gain and drain efficiency as functions of peak envelope load power; typical values.



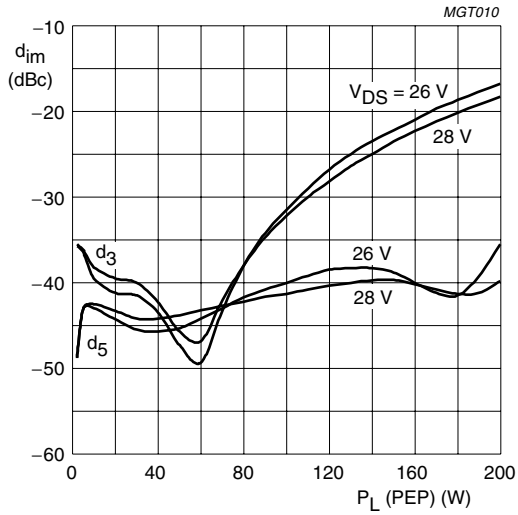
f_1 = 2200 MHz; f_2 = 2200.1 MHz;
I_{DQ} = 2 x 400 mA; $T_h \leq 25$ °C.

Fig.3 Power gain and drain efficiency as functions of peak envelope load power; typical values.



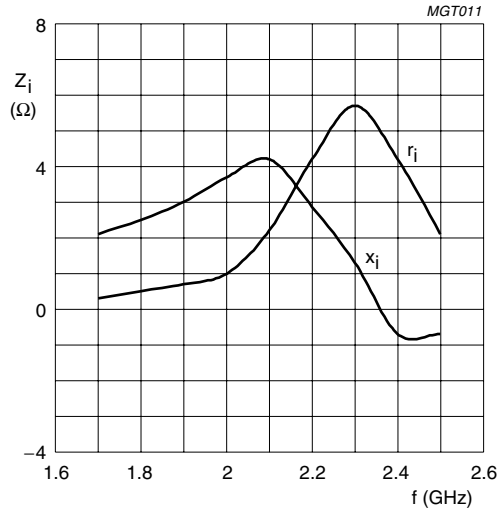
f_1 = 2000 MHz; f_2 = 2000.1 MHz;
I_{DQ} = 2 x 400 mA; $T_h \leq 25$ °C.

Fig.4 Intermodulation distortion as a function of peak envelope load power; typical values.



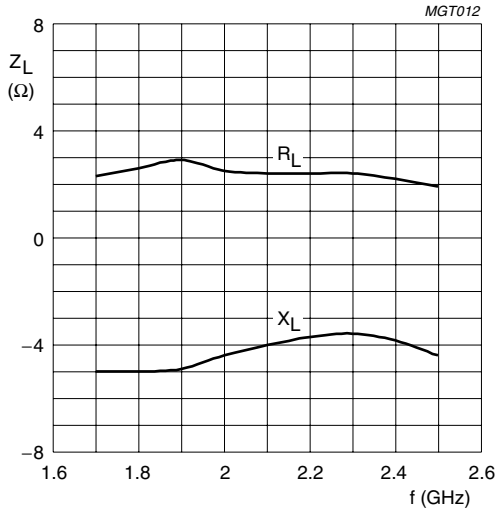
f_1 = 2200 MHz; f_2 = 2200.1 MHz;
I_{DQ} = 2 x 400 mA; $T_h \leq 25$ °C.

Fig.5 Intermodulation distortion as a function of peak envelope load power; typical values.



V_{DS} = 26 V; I_{DQ} = 2 x 400 mA; P_L = 160 W (total device); $T_h \leq 25$ °C.

Fig.6 Input impedance per section as a function of frequency (series components); typical values.



V_{DS} = 26 V; I_{DQ} = 2 x 400 mA; P_L = 160 W (total device); $T_h \leq 25$ °C.

Fig.7 Load impedance per section as a function of frequency (series components); typical values.

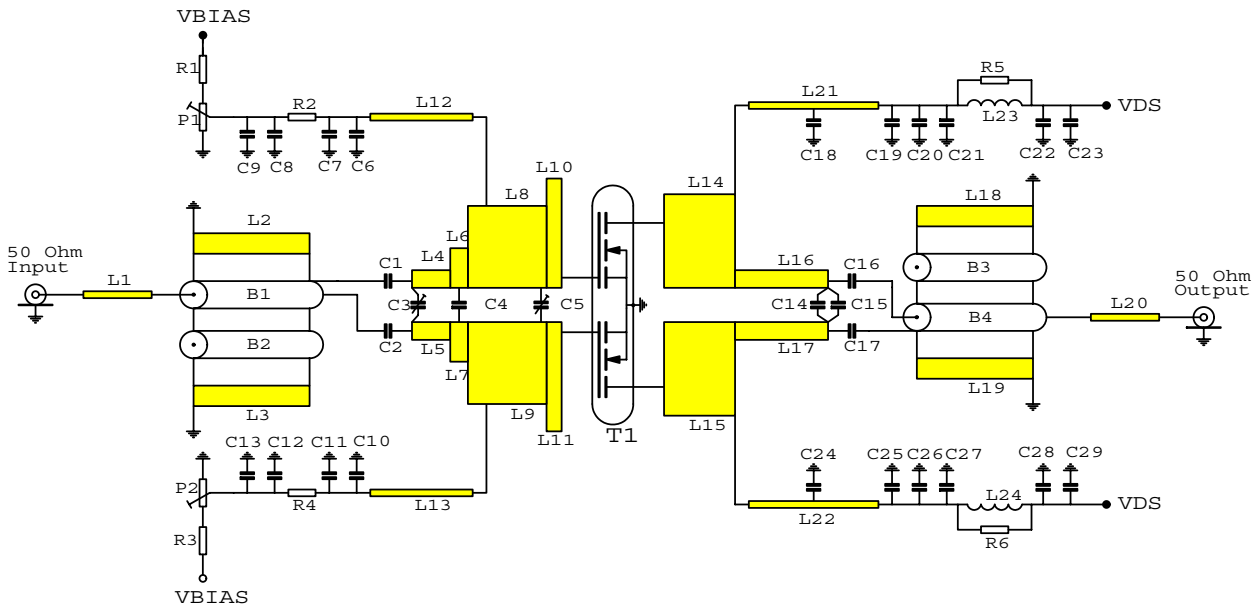


Fig.8 2.2 GHz class-AB test circuit.

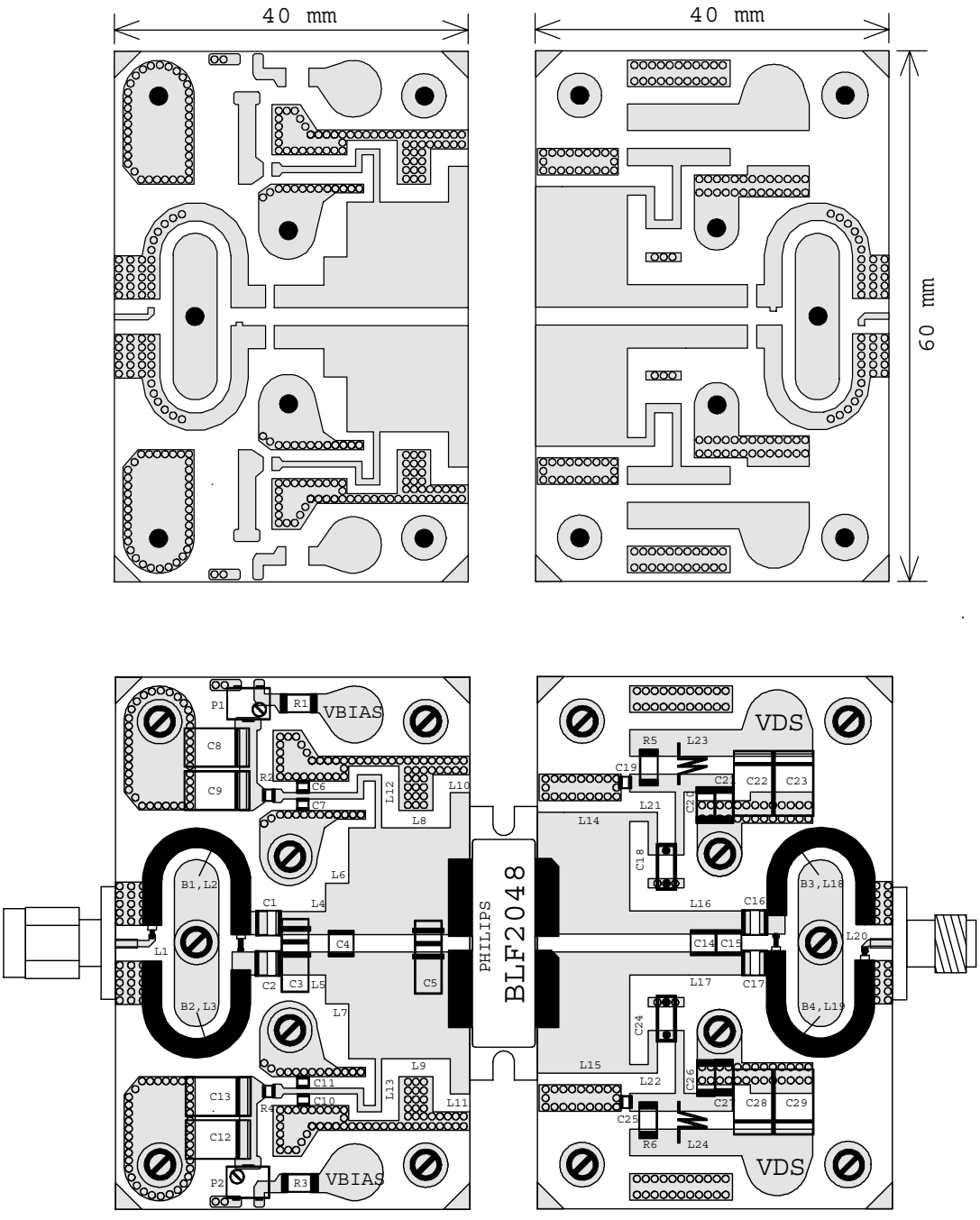
List of components (see Figs 8 and 9)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	multilayer ceramic chip capacitor; note 1	5.1 pF		
C3, C5	Tekelec variable capacitor	0.6 to 4.5 pF		
C4	multilayer ceramic chip capacitor; note 1	2.4 pF		
C6, C10	multilayer ceramic chip capacitor; note 2	100 pF		
C7, C11	multilayer ceramic chip capacitor; note 2	18 pF		
C8, C12, C23, C29	tantalum SMD capacitor	4.7 µF; 35 V		
C9, C13, C24, C30	tantalum SMD capacitor	10 µF; 35 V		
C14	multilayer ceramic chip capacitor; note 3	1 pF		
C15	multilayer ceramic chip capacitor; note 3	0.5 pF		
C16	multilayer ceramic chip capacitor; note 1	1.5 pF		
C17, C18	multilayer ceramic chip capacitor; note 1	10 pF		
C19, C25	MKT ceramic chip capacitor	33 nF		2222 370 11333
C20, C26	multilayer ceramic chip capacitor; note 2	6.2 pF		
C21, C27	multilayer ceramic chip capacitor	100 nF		2222 581 16641
C22, C28	multilayer ceramic chip capacitor; note 1	8.2 pF		

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1	stripline; note 4	47 Ω	4.5 × 1 mm	
L2, L3, L18, L19	stripline; note 4		15 × 2 mm	
L4, L5	stripline; note 4		5.6 × 2.6 mm	
L6, L7	stripline; note 4		2.6 × 5.8 mm	
L8, L9	stripline; note 4		11.5 × 12 mm	
L10, L11	stripline; note 4		2.2 × 16 mm	
L12, L13	stripline; note 4	57 Ω	1/4 λ at 2.2 GHz	
L14, L15	stripline; note 4		10.4 × 13.7 mm	
L16, L17	stripline; note 4		13.6 × 2.6 mm	
L20	stripline; note 4	47 Ω	4 x 1 mm	
L21, L22	stripline; note 4	47 Ω	1/4 λ at 2.2 GHz	
L23, L24	1 turn enamelled 0.7 mm copper wire		int.dia. 7 mm; length: tbf	
B1, B4	balun of semi-rigid cable	50 Ω		
B2, B3	semi-rigid cable; note 5	50 Ω		
R1, R3, R5, R6	metal film resistor	5.6 Ω, 0.6 W		
R2, R4	metal film resistor	10 Ω, 0.6 W		
P1, P2	variable resistor (multiturn)	5 kΩ		

Notes

1. American Technical Ceramics type 100B or capacitor of same quality.
2. American Technical Ceramics type 100A or capacitor of same quality.
3. American Technical Ceramics type 180R or capacitor of same quality.
4. Semi-rigid cable soldered along the stub to establish balance.
5. The striplines are on a double copper-clad printed-circuit board with Teflon dielectric ($\varepsilon r = 6.15$); thickness 0.64 mm.



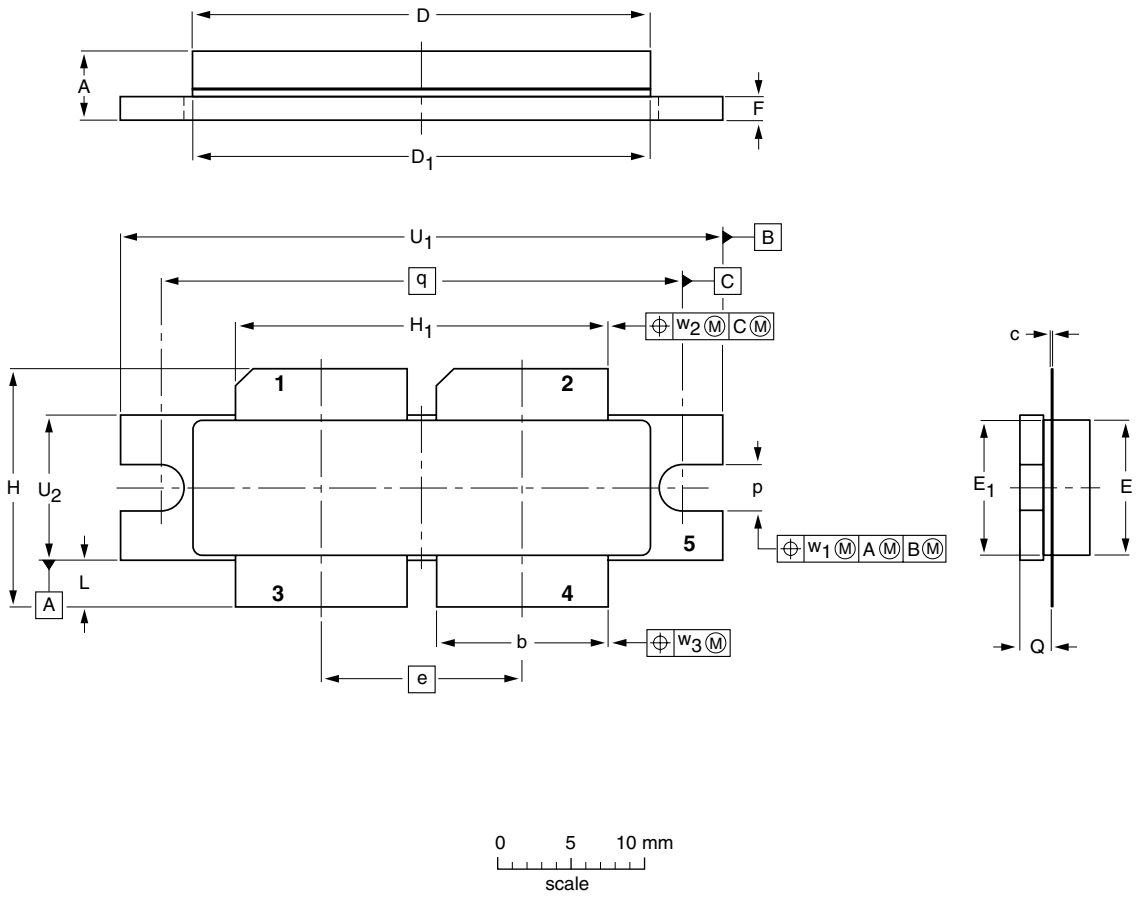
Dimensions in mm.

The components are situated on one side of the copper-clad printed-circuit board with Teflon dielectric (ε_r = 6.15), thickness 0.64 mm. The other side is unetched and serves as a ground plane.

Fig.9 Component layout for 2.2 GHz class-AB test circuit.

PACKAGE OUTLINE

Flanged balanced LDMOST ceramic package; 2 mounting holes; 4 leads **SOT539A**



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

UNIT	A	b	c	D	D_1	e	E	E_1	F	H	H_1	L	p	Q	q	U_1	U_2	w_1	w_2	w_3
mm	5.33 3.96	11.81 11.56	0.15 0.08	31.55 30.94	31.52 30.96	13.72	9.50 9.30	9.53 9.27	1.75 1.50	17.12 16.10	25.53 25.27	3.73 2.72	3.30 3.05	2.31 2.01	35.56	41.28 41.02	10.29 10.03	0.25	0.51	0.25
inches	0.210 0.156	0.465 0.455	0.006 0.003	1.242 1.218	1.241 1.219	0.540	0.374 0.366	0.375 0.365	0.069 0.059	0.674 0.634	1.005 0.995	0.147 0.107	0.130 0.120	0.091 0.079	1.400	1.625 1.615	0.405 0.395	0.010	0.020	0.010

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT539A						~~99-12-28~~ 00-03-03

DATA SHEET STATUS

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Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

Note

1. Please consult the most recently issued data sheet before initiating or completing a design.

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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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Philips Semiconductors – a worldwide company

Argentina: see South America

Australia: 3 Figtree Drive, HOMEBUSH, NSW 2140,
Tel. +61 2 9704 8141, Fax. +61 2 9704 8139

Austria: Computerstr. 6, A-1101 WIEN, P.O. Box 213,
Tel. +43 1 60 101 1248, Fax. +43 1 60 101 1210

Belarus: Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6,
220050 MINSK, Tel. +375 172 20 0733, Fax. +375 172 20 0773

Belgium: see The Netherlands

Brazil: see South America

Bulgaria: Philips Bulgaria Ltd., Energoproject, 15th floor,
51 James Bourchier Blvd., 1407 SOFIA,
Tel. +359 2 68 9211, Fax. +359 2 68 9102

Canada: PHILIPS SEMICONDUCTORS/COMPONENTS,
Tel. +1 800 234 7381, Fax. +1 800 943 0087

China/Hong Kong: 501 Hong Kong Industrial Technology Centre,
72 Tat Chee Avenue, Kowloon Tong, HONG KONG,
Tel. +852 2319 7888, Fax. +852 2319 7700

Colombia: see South America

Czech Republic: see Austria

Denmark: Sydhavnsgade 23, 1780 COPENHAGEN V,
Tel. +45 33 29 3333, Fax. +45 33 29 3905

Finland: Sinikalliontie 3, FIN-02630 ESPOO,
Tel. +358 9 615 800, Fax. +358 9 6158 0920

France: 51 Rue Carnot, BP317, 92156 SURESNES Cedex,
Tel. +33 1 4099 6161, Fax. +33 1 4099 6427

Germany: Hammerbrookstraße 69, D-20097 HAMBURG,
Tel. +49 40 2353 60, Fax. +49 40 2353 6300

Hungary: see Austria

India: Philips INDIA Ltd, Band Box Building, 2nd floor,
254-D, Dr. Annie Besant Road, Worli, MUMBAI 400 025,
Tel. +91 22 493 8541, Fax. +91 22 493 0966

Indonesia: PT Philips Development Corporation, Semiconductors Division,
Gedung Philips, Jl. Buncit Raya Kav.99-100, JAKARTA 12510,
Tel. +62 21 794 0040 ext. 2501, Fax. +62 21 794 0080

Ireland: Newstead, Clonskeagh, DUBLIN 14,
Tel. +353 1 7640 000, Fax. +353 1 7640 200

Israel: RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053,
TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

Italy: PHILIPS SEMICONDUCTORS, Via Casati, 23 - 20052 MONZA (MI),
Tel. +39 039 203 6838, Fax +39 039 203 6800

Japan: Philips Bldg 13-37, Kohnan 2-chome, Minato-ku,
TOKYO 108-8507, Tel. +81 3 3740 5130, Fax. +81 3 3740 5057

Korea: Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL,
Tel. +82 2 709 1412, Fax. +82 2 709 1415

Malaysia: No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR,
Tel. +60 3 750 5214, Fax. +60 3 757 4880

Mexico: 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905,
Tel. +9-5 800 234 7381, Fax +9-5 800 943 0087

Middle East: see Italy

Netherlands: Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB,
Tel. +31 40 27 82785, Fax. +31 40 27 88399

New Zealand: 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,
Tel. +64 9 849 4160, Fax. +64 9 849 7811

Norway: Box 1, Manglerud 0612, OSLO,
Tel. +47 22 74 8000, Fax. +47 22 74 8341

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Philippines: Philips Semiconductors Philippines Inc.,
106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI,
Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

Poland: Al.Jerozolimskie 195 B, 02-222 WARSAW,
Tel. +48 22 5710 000, Fax. +48 22 5710 001

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Russia: Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW,
Tel. +7 095 755 6918, Fax. +7 095 755 6919

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Tel. +65 350 2538, Fax. +65 251 6500

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2092 JOHANNESBURG, P.O. Box 58088 Newville 2114,
Tel. +27 11 471 5401, Fax. +27 11 471 5398

South America: Al. Vicente Pinzon, 173, 6th floor,
04547-130 SÃO PAULO, SP, Brazil,
Tel. +55 11 821 2333, Fax. +55 11 821 2382

Spain: Balmes 22, 08007 BARCELONA,
Tel. +34 93 301 6312, Fax. +34 93 301 4107

Sweden: Kottbygatan 7, Akalla, S-16485 STOCKHOLM,
Tel. +46 8 5985 2000, Fax. +46 8 5985 2745

Switzerland: Allmendstrasse 140, CH-8027 ZÜRICH,
Tel. +41 1 488 2741 Fax. +41 1 488 3263

Taiwan: Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1,
TAIPEI, Taiwan Tel. +886 2 2134 2886, Fax. +886 2 2134 2874

Thailand: PHILIPS ELECTRONICS (THAILAND) Ltd.,
209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260,
Tel. +66 2 745 4090, Fax. +66 2 398 0793

Turkey: Yukari Dudullu, Org. San. Blg., 2.Cad. Nr. 28 81260 Umraniye,
ISTANBUL, Tel. +90 216 522 1500, Fax. +90 216 522 1813

Ukraine: PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7,
252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

United Kingdom: Philips Semiconductors Ltd., 276 Bath Road, Hayes,
MIDDLESEX UB3 5BX, Tel. +44 208 730 5000, Fax. +44 208 754 8421

United States: 811 East Arques Avenue, SUNNYVALE, CA 94088-3409,
Tel. +1 800 234 7381, Fax. +1 800 943 0087

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