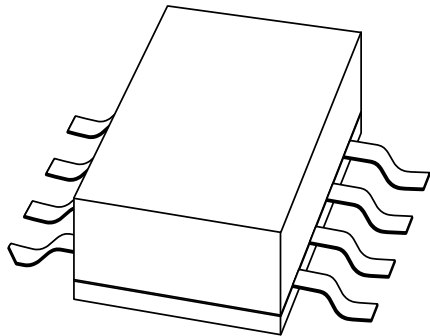


# DATA SHEET



## **BLF404** UHF power MOS transistor

Product specification  
Supersedes data of 1998 Jan 29

2003 Sep 26

# UHF power MOS transistor

# BLF404

### FEATURES

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

### APPLICATIONS

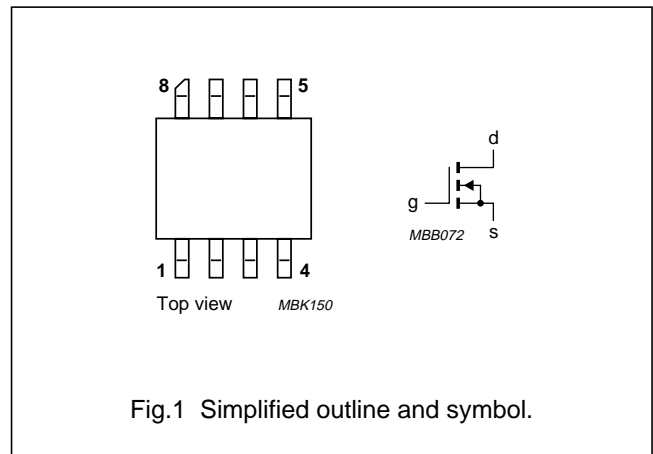
- Communication transmitters in the VHF/UHF range with a nominal supply voltage of 12.5 V.

### DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS power transistor in an 8-lead SOT409A SMD package with a ceramic cap.

### PINNING - SOT409A

PIN	DESCRIPTION
1, 8	source
2, 3	gate
4, 5	source
6, 7	drain



### QUICK REFERENCE DATA

RF performance at  $T_{mb} \leq 60 \text{ }^\circ\text{C}$  in a common source test circuit.

MODE OF OPERATION	f (MHz)	V <sub>DS</sub> (V)	P <sub>L</sub> (W)	G <sub>p</sub> (dB)	$\eta_D$ (%)
CW class-AB	500	12.5	4	$\geq 10$	$\geq 50$

### 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.

# UHF power MOS transistor

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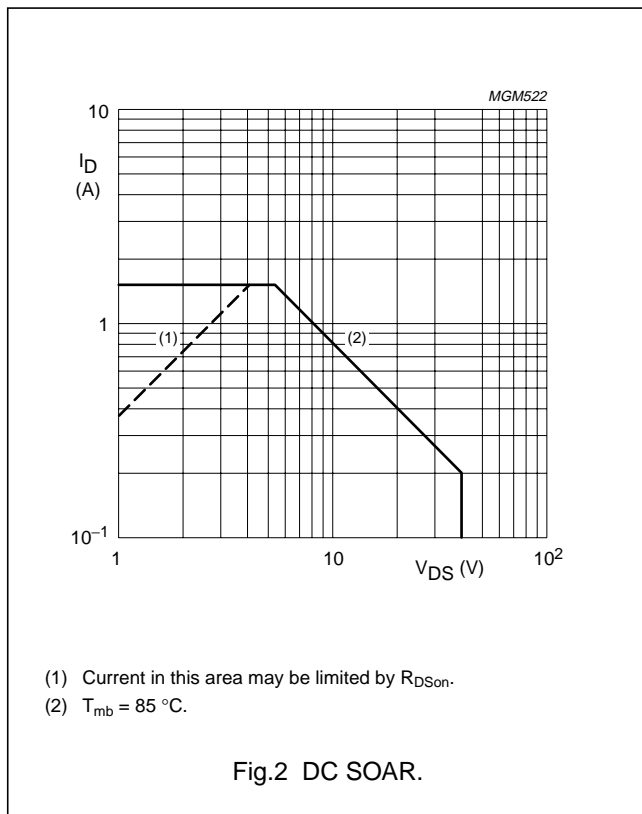
## LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{DS}$	drain-source voltage		–	40	V
$V_{GS}$	gate-source voltage		–	$\pm 20$	V
$I_D$	drain current (DC)		–	1.5	A
$P_{tot}$	total power dissipation	$T_{mb} \leq 85\text{ }^\circ\text{C}$	–	8.3	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	$T_{mb} \leq 85\text{ }^\circ\text{C}, P_{tot} = 8.3\text{ W}$	12.1	K/W



## UHF power MOS transistor

BLF404

**CHARACTERISTICS** $T_j = 25\text{ °C}$  unless otherwise specified.

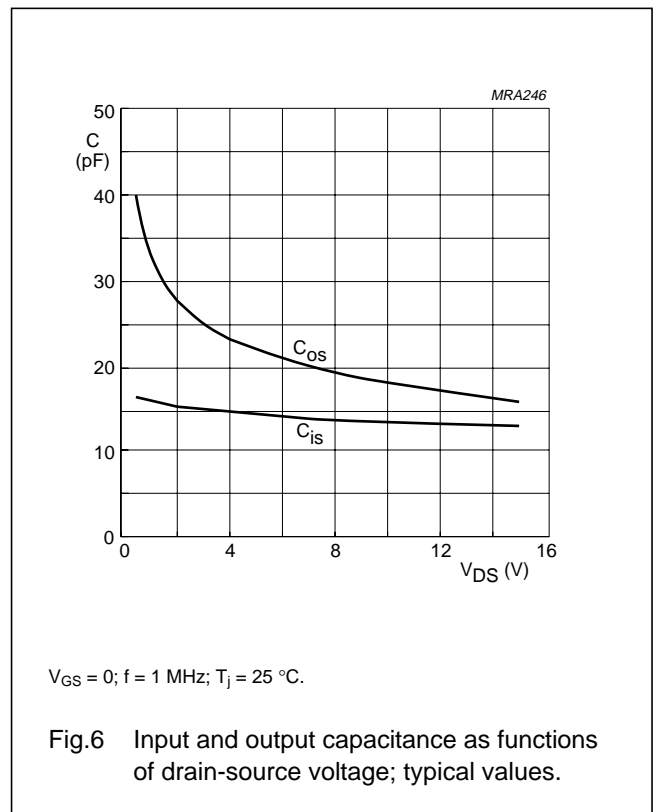
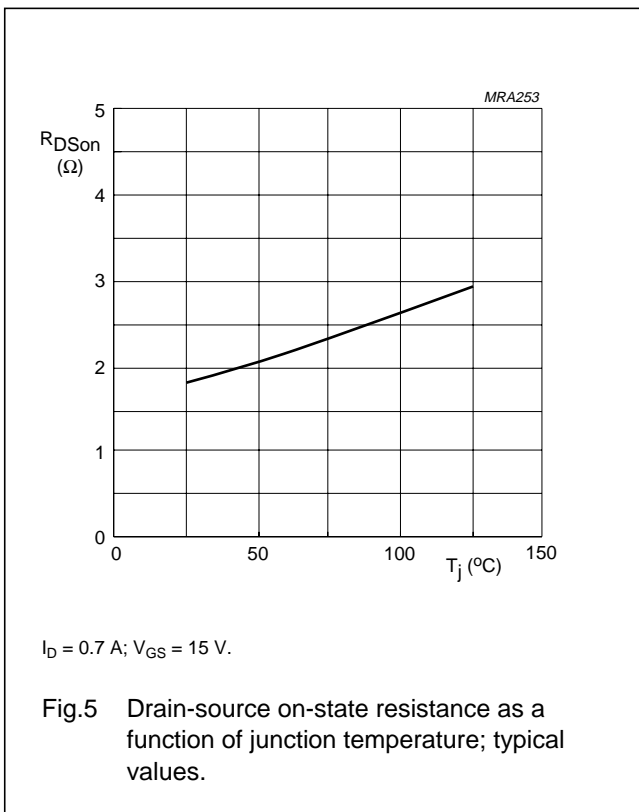
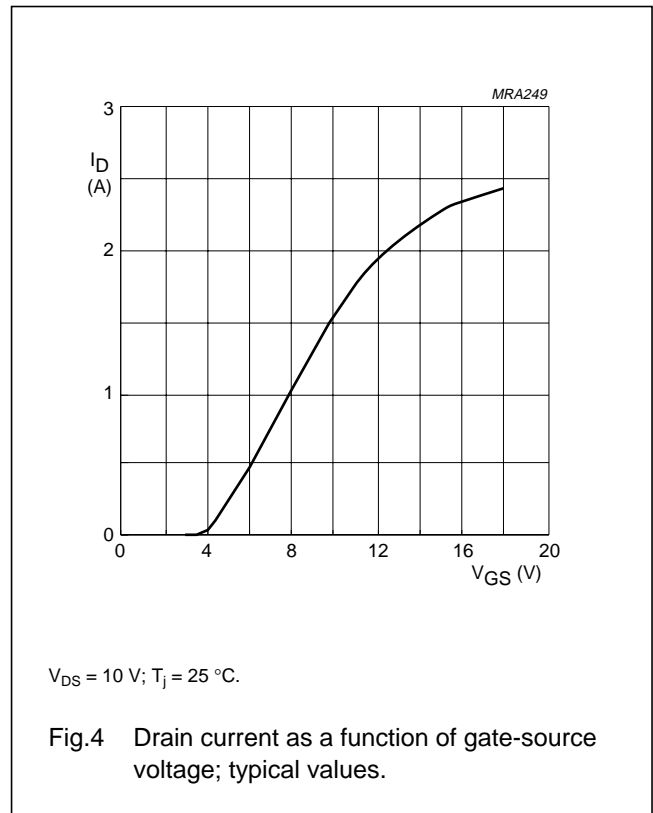
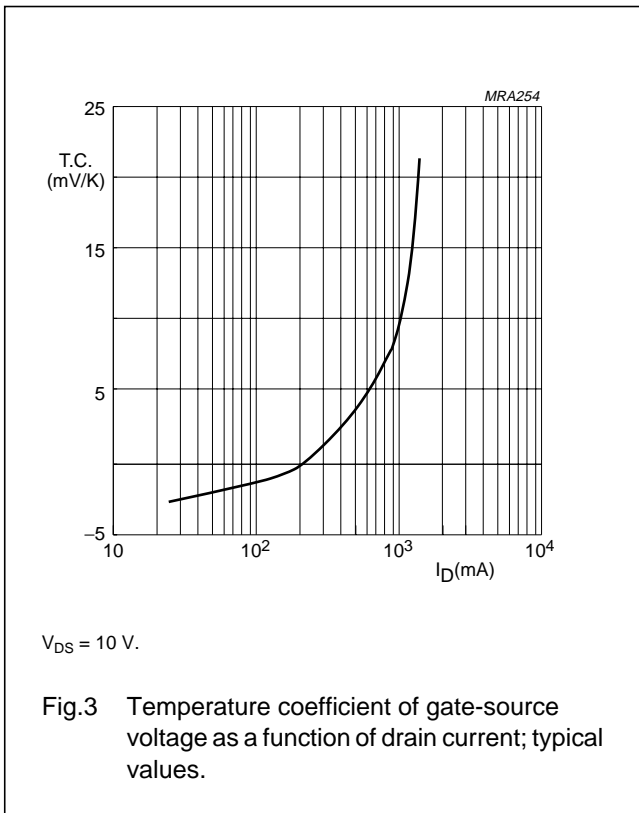
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0; I_D = 5\text{ mA}$	40	–	–	V
$V_{GSth}$	gate-source threshold voltage	$I_D = 50\text{ mA}; V_{DS} = 10\text{ V}$	2	–	4.5	V
$I_{DSS}$	drain-source leakage current	$V_{GS} = 0; V_{DS} = 12.5\text{ V}$	–	–	0.5	mA
$I_{GSS}$	gate-source leakage current	$V_{GS} = \pm 20\text{ V}; V_{DS} = 0$	–	–	1	$\mu\text{A}$
$I_{DSX}$	on-state drain current	$V_{GS} = 15\text{ V}; V_{DS} = 10\text{ V}$	–	2.3	–	A
$R_{DSon}$	drain-source on-state resistance	$I_D = 0.7\text{ A}; V_{GS} = 15\text{ V}$	–	1.8	2.7	$\Omega$
$g_{fs}$	forward transconductance	$I_D = 0.7\text{ A}; V_{DS} = 10\text{ V}$	200	270	–	mS
$C_{is}$	input capacitance	$V_{GS} = 0; V_{DS} = 12.5\text{ V}; f = 1\text{ MHz}$	–	14	–	pF
$C_{os}$	output capacitance	$V_{GS} = 0; V_{DS} = 12.5\text{ V}; f = 1\text{ MHz}$	–	17	–	pF
$C_{rs}$	feedback capacitance	$V_{GS} = 0; V_{DS} = 12.5\text{ V}; f = 1\text{ MHz}$	–	3	–	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			

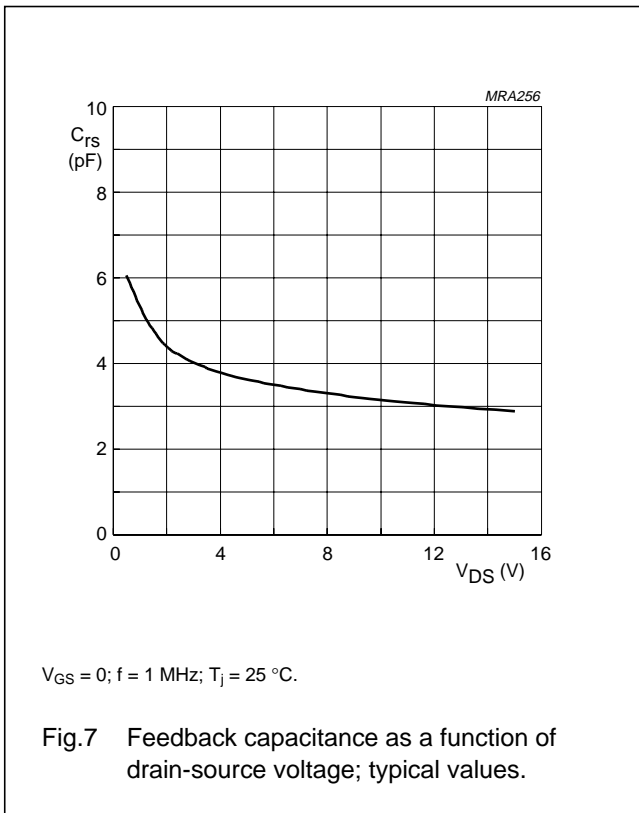
UHF power MOS transistor

BLF404



UHF power MOS transistor

BLF404



**APPLICATION INFORMATION**

RF performance at  $T_{mb} \leq 60$  °C in a common source test circuit with the device soldered on a printed-circuit board with through metallized holes.

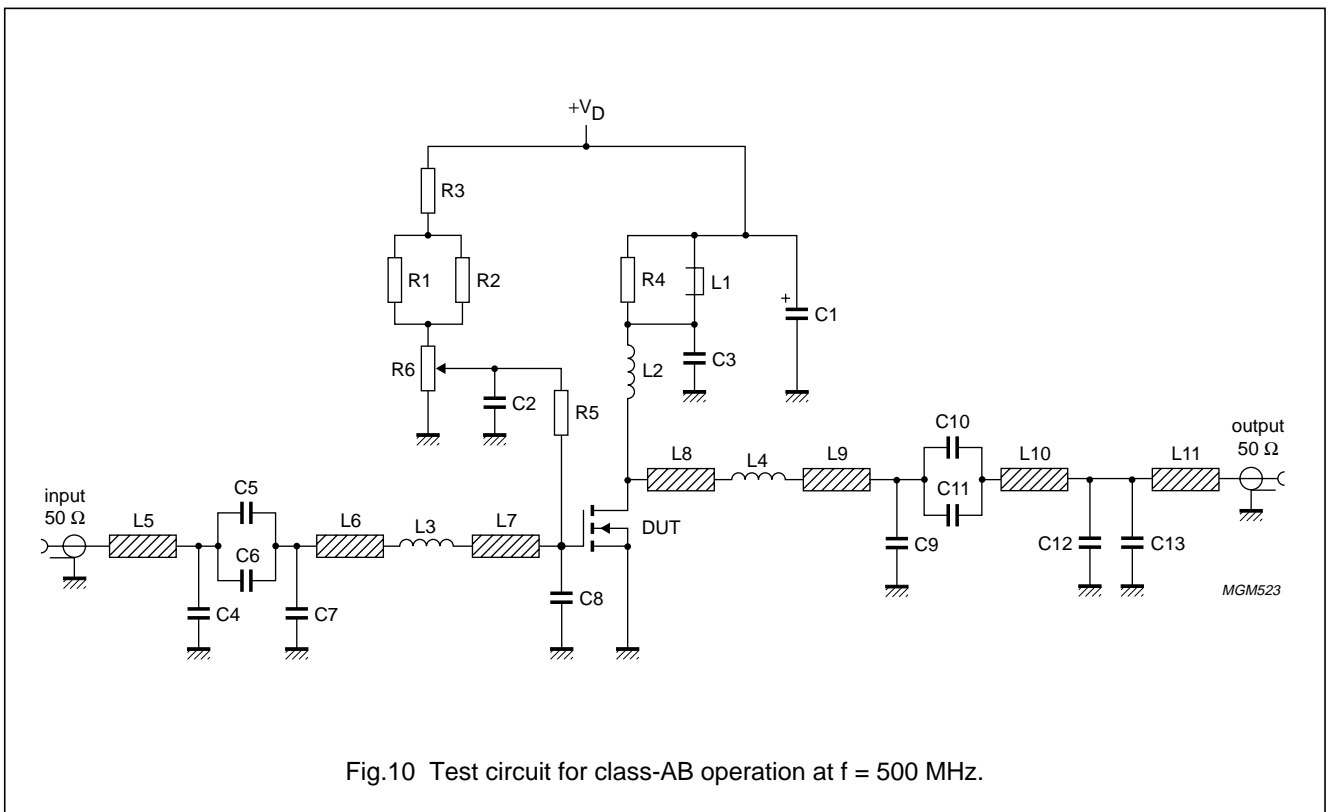
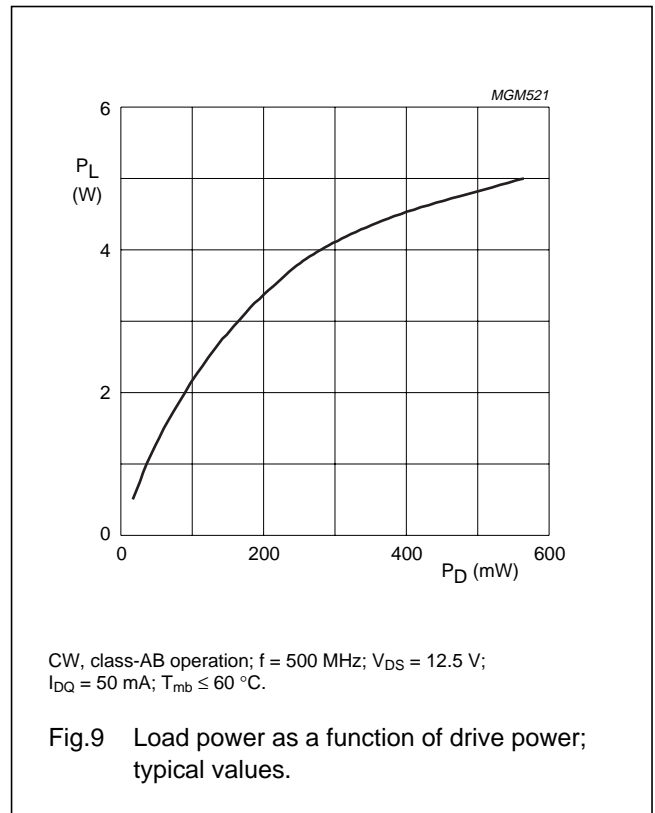
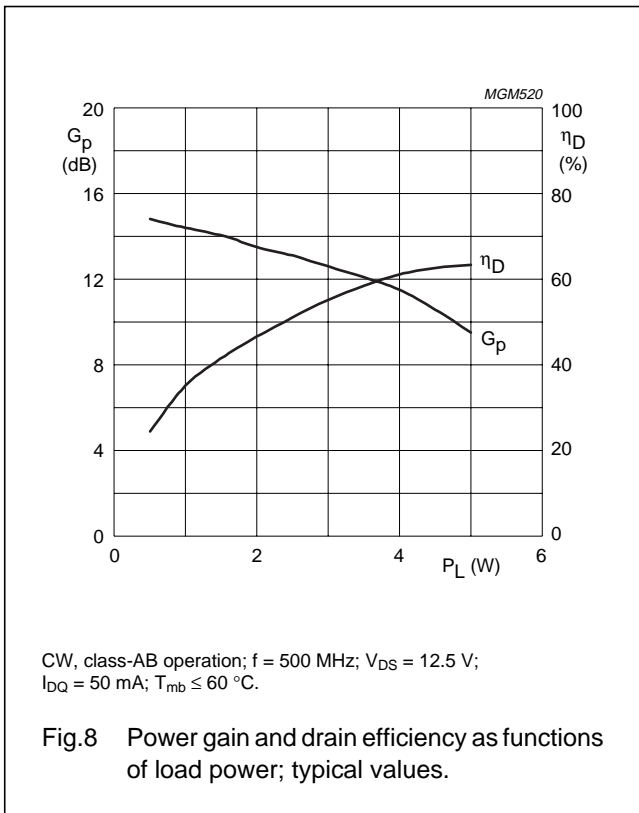
MODE OF OPERATION	f (MHz)	$V_{DS}$ (V)	$I_{DQ}$ (A)	$P_L$ (W)	$G_p$ (dB)	$\eta_D$ (%)
CW, class-AB	500	12.5	50	4	$\geq 10$ typ. 11.5	$\geq 50$ typ. 55

**Ruggedness in class-AB operation**

The BLF404 is capable of withstanding a load mismatch corresponding to  $V_{SWR} = 10 : 1$  through all phases under the following conditions:  $f = 500$  MHz;  $V_{DS} = 12.5$  V;  $P_L = 4$  W;  $T_{mb} \leq 60$  °C.

UHF power MOS transistor

BLF404



## UHF power MOS transistor

BLF404

List of components; see Figs 10 and 11.

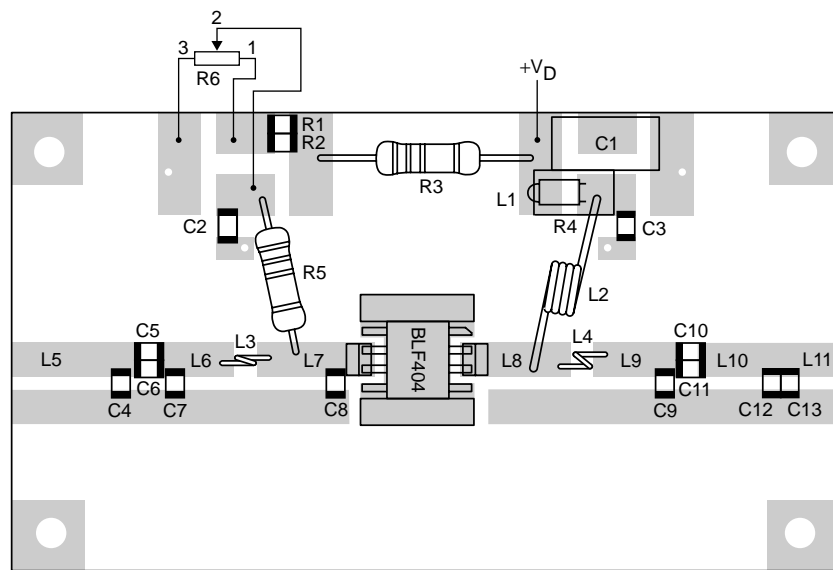
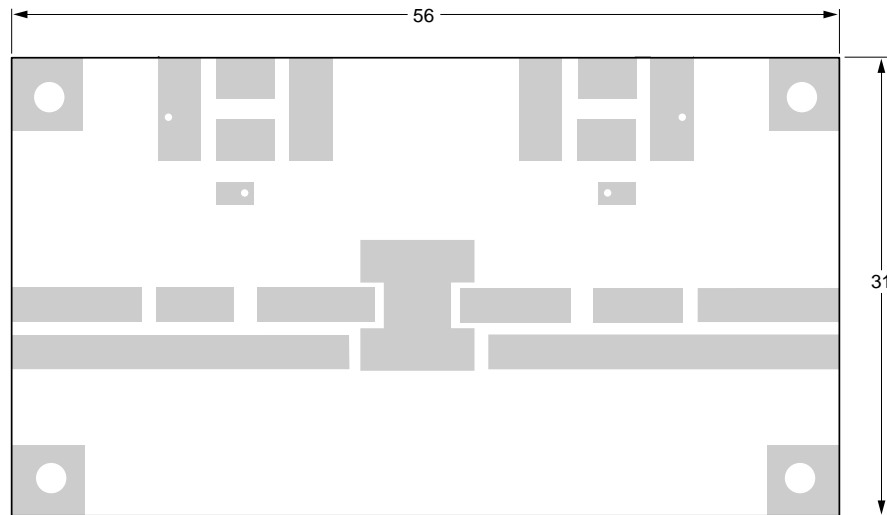
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	electrolytic capacitor	4.7 $\mu$ F, 10 V		
C2, C3	multilayer ceramic chip capacitor	47 nF		
C4	multilayer ceramic chip capacitor; note 1	18 pF		
C5, C10	multilayer ceramic chip capacitor; note 1	180 pF		
C6, C11	multilayer ceramic chip capacitor; note 1	270 pF		
C7	multilayer ceramic chip capacitor; note 1	22 pF		
C8	multilayer ceramic chip capacitor; note 1	8.2 pF		
C9	multilayer ceramic chip capacitor; note 1	2.7 pF		
C12	multilayer ceramic chip capacitor; note 1	1.2 pF		
C13	multilayer ceramic chip capacitor; note 1	12 pF		
L1	2 turns 1 mm enamelled copper wire on a grade 4B1 Ferroxcube core		ext. dia. = 4.2 mm int. dia. = 2 mm length = 6 mm	
L2	3 turns 1 mm enamelled copper wire		int. dia. = 4.6 mm leads = 2 x 5 mm	
L3	bifilar coil		lead dia. = 0.8 mm	
L4	bifilar coil		lead dia. = 1 mm	
L5	stripline; note 2	50 $\Omega$	8.8 x 2.38 mm	
L6	stripline; note 2	50 $\Omega$	5.8 x 2.38 mm	
L7	stripline; note 2	50 $\Omega$	6.8 x 2.38 mm	
L8	stripline; note 2	50 $\Omega$	3.76 x 2.38 mm	
L9	stripline; note 2	50 $\Omega$	5.8 x 2.38 mm	
L10	stripline; note 2	50 $\Omega$	4.48 x 2.38 mm	
L11	stripline; note 2	50 $\Omega$	3.13 x 2.38 mm	
R1, R2	SMD resistor	3.9 k $\Omega$		
R3	metal film resistor	1 k $\Omega$ , 0.25 W		
R4	metal film resistor	22 $\Omega$ , 0.25 W		
R5	metal film resistor	10 k $\Omega$ , 0.25 W		
R6	potentiometer	10 k $\Omega$		

## Notes

- American Technical Ceramics type 100A or capacitor of same quality.
- The striplines are on a double copper-clad printed-circuit board, with DUROID dielectric ( $\epsilon_r = 2.2$ ); thickness 0.79 mm, thickness of the copper sheet 2 x 35  $\mu$ m.

UHF power MOS transistor

BLF404



MGM524

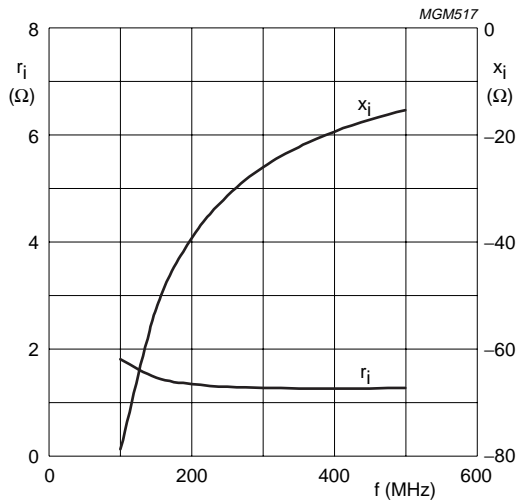
Dimensions in mm.

The components are situated on one side of the 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 through metallization.

Fig.11 Component layout for 500 MHz class-AB test circuit.

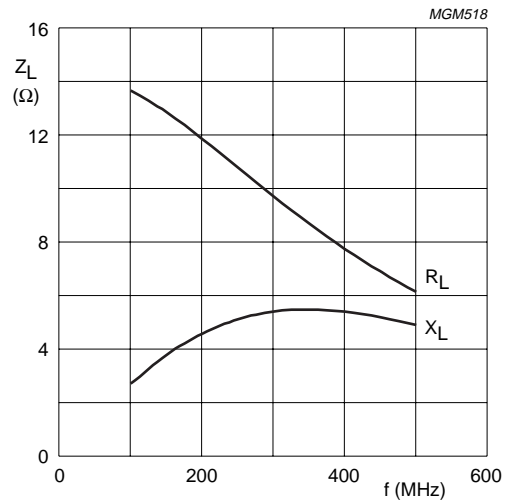
UHF power MOS transistor

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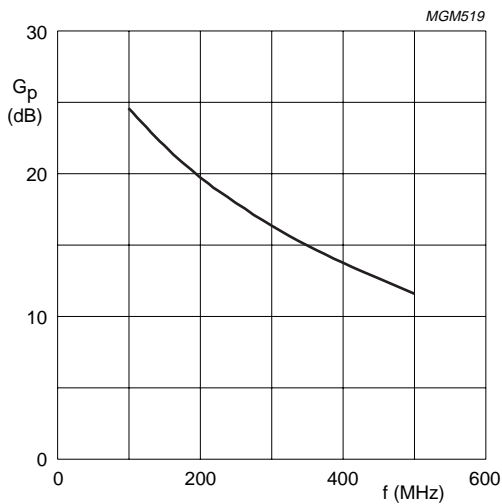
CW, class-AB operation;  $V_{DS} = 12.5$  V;  $I_D = 50$  mA;  
 $P_L = 4$  W;  $T_{mb} \leq 60$  °C.

Fig.12 Input impedance as a function of frequency (series components); typical values.



CW, class-AB operation;  $V_{DS} = 12.5$  V;  $I_D = 50$  mA;  
 $P_L = 4$  W;  $T_{mb} \leq 60$  °C.

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



CW, class-AB operation;  $V_{DS} = 12.5$  V;  $I_{DQ} = 50$  mA;  
 $P_L = 4$  W;  $T_{mb} \leq 60$  °C.

Fig.14 Power gain as a function of frequency (series components); typical values.

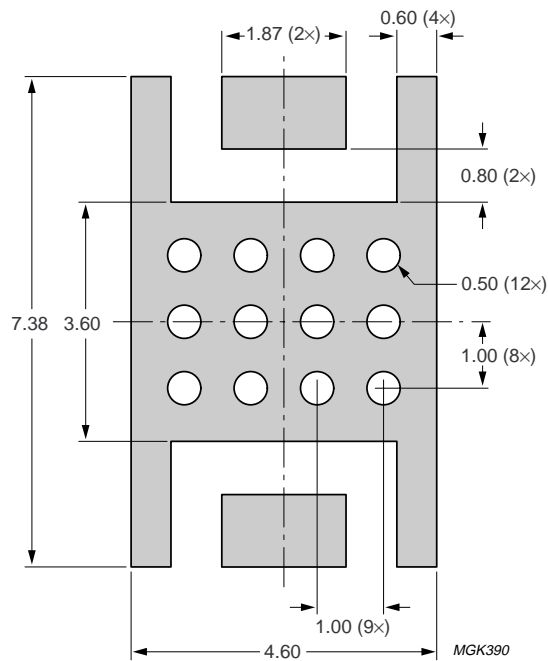
UHF power MOS transistor

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**MOUNTING RECOMMENDATIONS**

Both the metallized ground plate and the device leads contribute to the heat flow. It is recommended that the transistor be mounted on a grounded metallized area of the printed-circuit board. This area should be of maximum 0.8 mm thickness and include at least 12 x 0.5 diameter through metallized holes filled with solder.

A thermal resistance  $R_{th(mb-h)}$  of 5 K/W can be achieved if heatsink compound is applied when the transistor is mounted on the printed-circuit board.



Dimensions in mm.

Fig.15 Reflow soldering footprint for SOT409A.

## UHF power MOS transistor

## BLF404

**BLF404 scattering parameters** $V_{DS} = 12.5\text{ V}$ ;  $I_D = 50\text{ mA}$ ; note 1.

f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	s <sub>11</sub>	∠ Φ	s <sub>21</sub>	∠ Φ	s <sub>12</sub>	∠ Φ	s <sub>22</sub>	∠ Φ
5	1.00	-5.2	12.97	176.0	0.01	86.0	0.96	-6.0
10	0.99	-10.1	12.89	171.9	0.02	82.2	0.96	-12.0
20	0.98	-20.6	12.61	164.1	0.03	74.8	0.95	-23.5
30	0.96	-30.4	12.18	156.6	0.05	67.6	0.93	-34.7
40	0.93	-39.6	11.62	149.6	0.06	60.9	0.91	-45.1
50	0.89	-48.0	11.00	143.2	0.07	54.8	0.89	-54.7
60	0.86	-55.8	10.37	137.4	0.08	49.4	0.87	-63.5
70	0.83	-62.9	9.74	132.2	0.09	44.4	0.85	-71.4
80	0.80	-69.4	9.15	127.5	0.10	40.1	0.83	-78.5
90	0.78	-75.3	8.60	123.2	0.10	36.2	0.82	-84.8
100	0.75	-80.7	8.08	119.3	0.10	32.7	0.80	-90.5
125	0.71	-92.2	6.96	110.7	0.11	25.1	0.77	-102.6
150	0.68	-101.4	6.03	103.9	0.12	19.1	0.76	-111.9
175	0.66	-108.9	5.30	98.3	0.12	14.4	0.74	-119.2
200	0.64	-115.2	4.73	93.2	0.12	10.2	0.74	-125.1
250	0.63	-124.9	3.81	84.5	0.12	3.5	0.73	-134.1
300	0.64	-132.5	3.19	77.4	0.12	-1.8	0.74	-140.5
350	0.64	-138.6	2.70	71.2	0.11	-6.1	0.74	-145.3
400	0.66	-143.8	2.34	65.7	0.11	-9.7	0.75	-149.1
450	0.67	-148.4	2.03	60.5	0.10	-12.5	0.76	-152.4
500	0.69	-152.6	1.80	56.0	0.09	-15.1	0.78	-155.2
600	0.72	-160.2	1.44	47.7	0.08	-18.2	0.80	-159.9
700	0.75	-167.1	1.18	40.4	0.07	-18.6	0.82	-163.9
800	0.78	-173.6	0.99	34.4	0.05	-15.0	0.84	-167.5
900	0.81	-179.8	0.84	29.2	0.04	-6.0	0.86	-170.7
1000	0.83	174.3	0.73	25.1	0.04	9.9	0.88	-173.6

**Note**

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

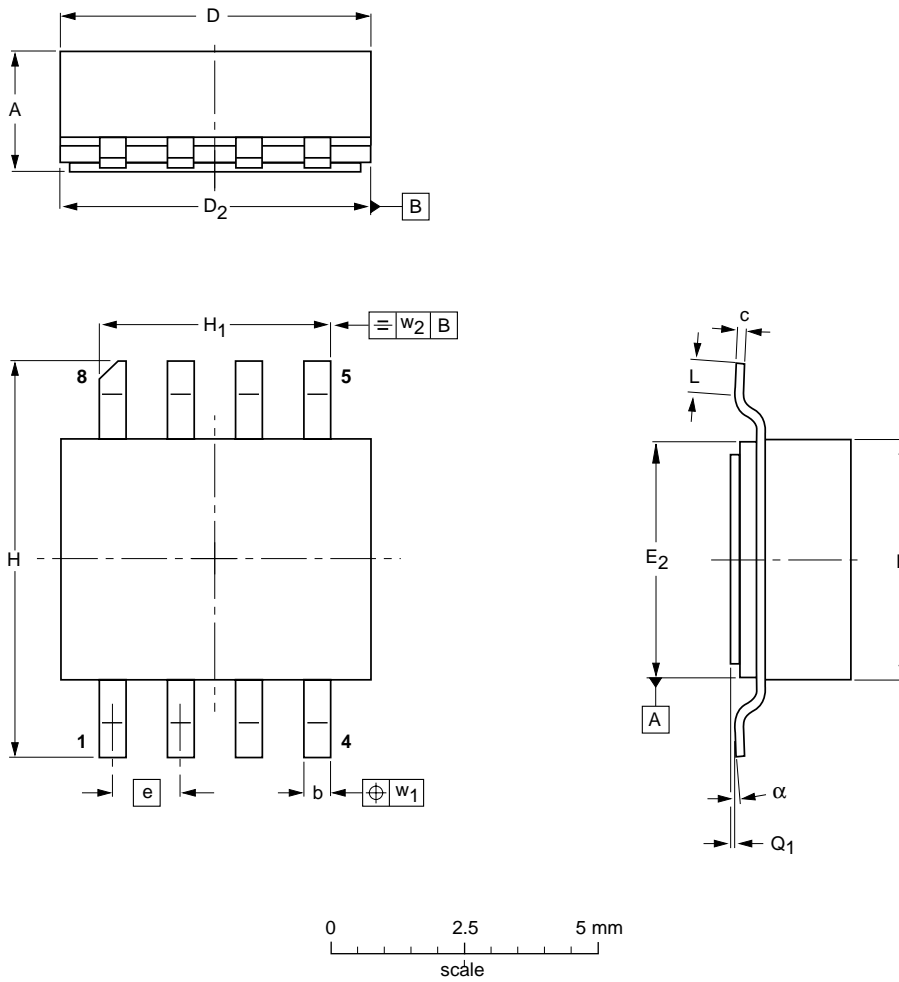
UHF power MOS transistor

BLF404

PACKAGE OUTLINE

Ceramic surface mounted package; 8 leads

SOT409A



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

UNIT	A	b	c	D	D <sub>2</sub>	E	E <sub>2</sub>	e	H	H <sub>1</sub>	L	Q <sub>1</sub>	w <sub>1</sub>	w <sub>2</sub>	α
mm	2.36 2.06	0.58 0.43	0.23 0.18	5.94 5.03	5.16 5.00	4.93 4.01	4.14 3.99	1.27	7.47 7.26	4.39 4.24	1.02 0.51	0.10 0.00	0.25	0.25	7° 0°
inches	0.093 0.081	0.023 0.017	0.009 0.007	0.234 0.198	0.203 0.197	0.194 0.158	0.163 0.157	0.050	0.294 0.286	0.173 0.167	0.040 0.020	0.004 0.000	0.010	0.010	7° 0°

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT409A						98-01-27

## UHF power MOS transistor

BLF404

## DATA SHEET STATUS

LEVEL	DATA SHEET STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)(3)</sup>	DEFINITION
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For sales offices addresses send e-mail to: [sales.addresses@www.semiconductors.philips.com](mailto:sales.addresses@www.semiconductors.philips.com).

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