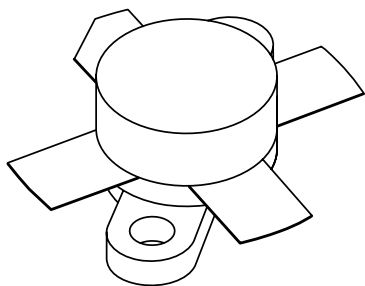


# DATA SHEET



## **BLF177** HF/VHF power MOS transistor

Product specification  
Supersedes data of 1998 Jul 02

2003 Jul 21

# HF/VHF power MOS transistor

# BLF177

## FEATURES

- High power gain
- Low intermodulation distortion
- Easy power control
- Good thermal stability
- Withstands full load mismatch.

## APPLICATIONS

- Designed for industrial and military applications in the HF/VHF frequency range.

## DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor encapsulated in a 4-lead, SOT121B flanged package, with a ceramic cap. All leads are isolated from the flange.

A marking code, showing gate-source voltage ( $V_{GS}$ ) information is provided for matched pair applications. Refer to the handbook 'General' section for further information.

## PIN CONFIGURATION

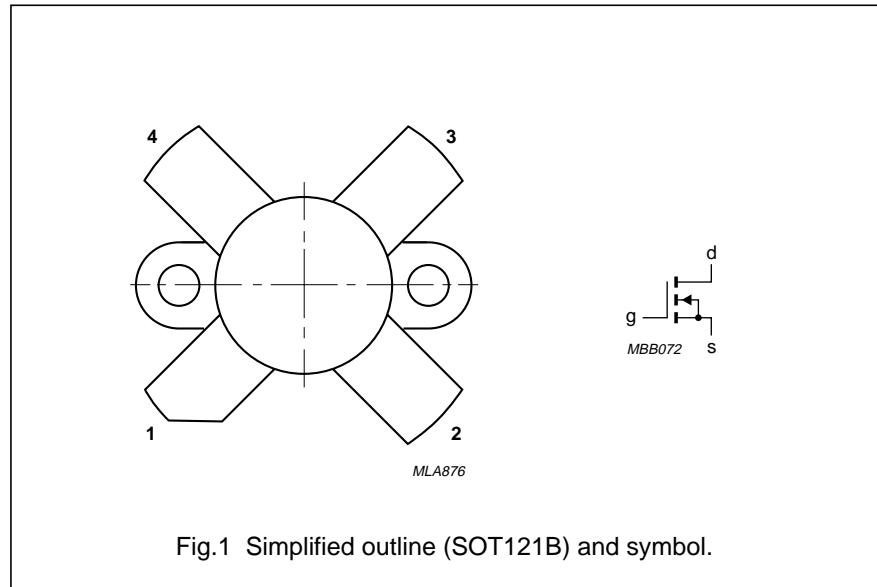


Fig.1 Simplified outline (SOT121B) and symbol.

### 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.

## PINNING

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source

## QUICK REFERENCE DATA

RF performance at  $T_h = 25\text{ }^\circ\text{C}$  in a common source test circuit.

MODE OF OPERATION	f (MHz)	$V_{DS}$ (V)	$P_L$ (W)	$G_p$ (dB)	$\eta_D$ (%)	$d_3$ (dB)	$d_5$ (dB)
SSB class-AB	28	50	150 (PEP)	>20	>35	<-30	<-30
CW class-B	108	50	150	typ. 19	typ. 70	-	-

HF/VHF power MOS transistor

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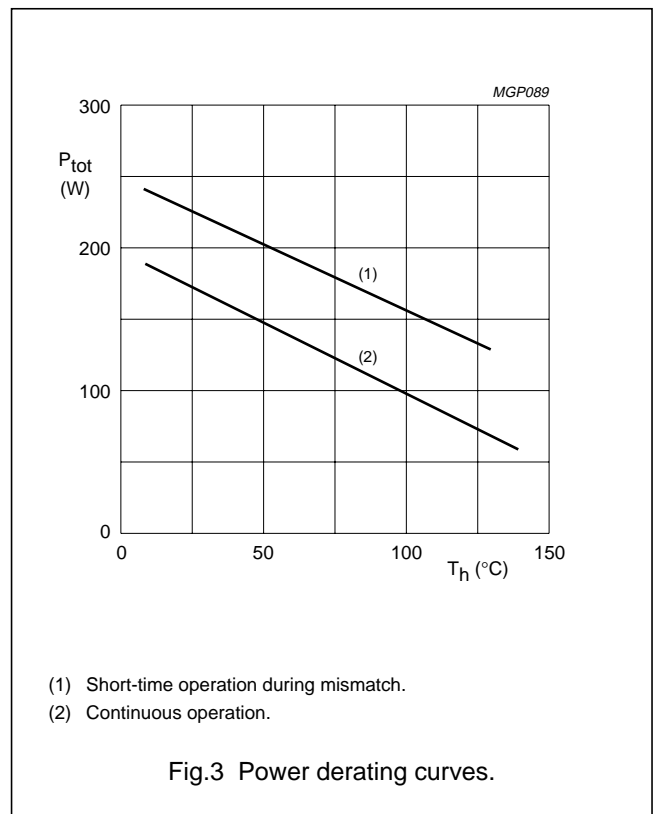
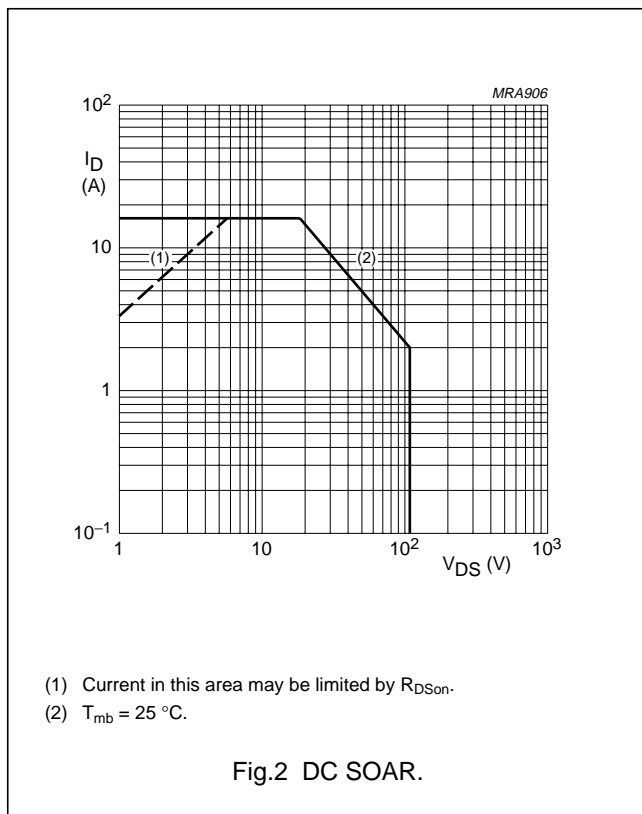
**LIMITING VALUES**

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{DS}$	drain-source voltage		–	125	V
$V_{GS}$	gate-source voltage		–	$\pm 20$	V
$I_D$	drain current (DC)		–	16	A
$P_{tot}$	total power dissipation	$T_{mb} \leq 25\text{ }^\circ\text{C}$	–	220	W
$T_{stg}$	storage temperature		–65	+150	$^\circ\text{C}$
$T_j$	junction temperature		–	200	$^\circ\text{C}$

**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-mb}$	thermal resistance from junction to mounting base	max. 0.8	K/W
$R_{th\ mb-h}$	thermal resistance from mounting base to heatsink	max. 0.2	K/W



## HF/VHF power MOS transistor

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## CHARACTERISTICS

 $T_j = 25\text{ }^\circ\text{C}$  unless otherwise specified.

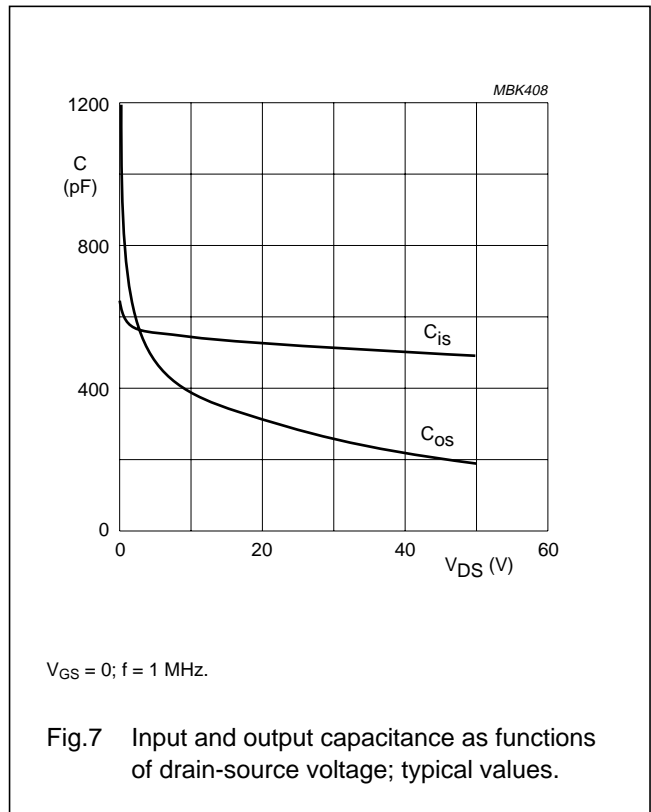
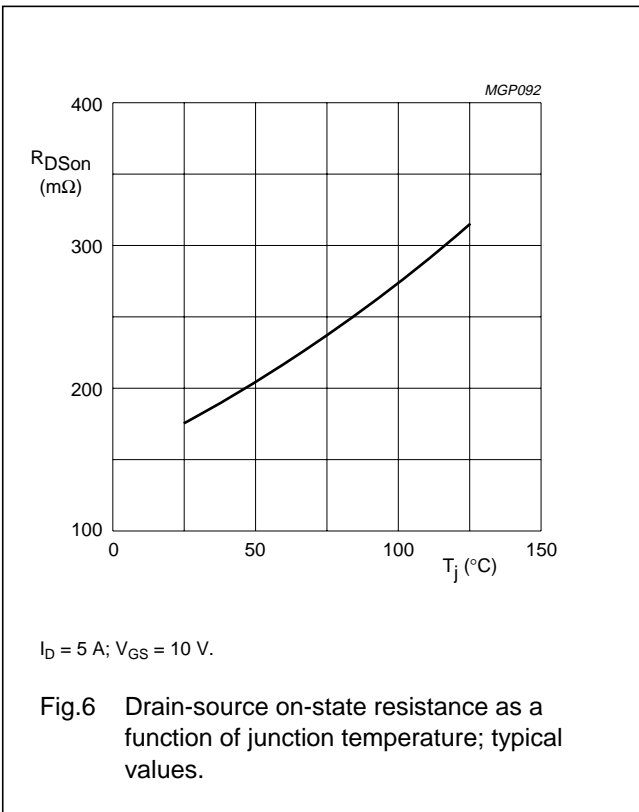
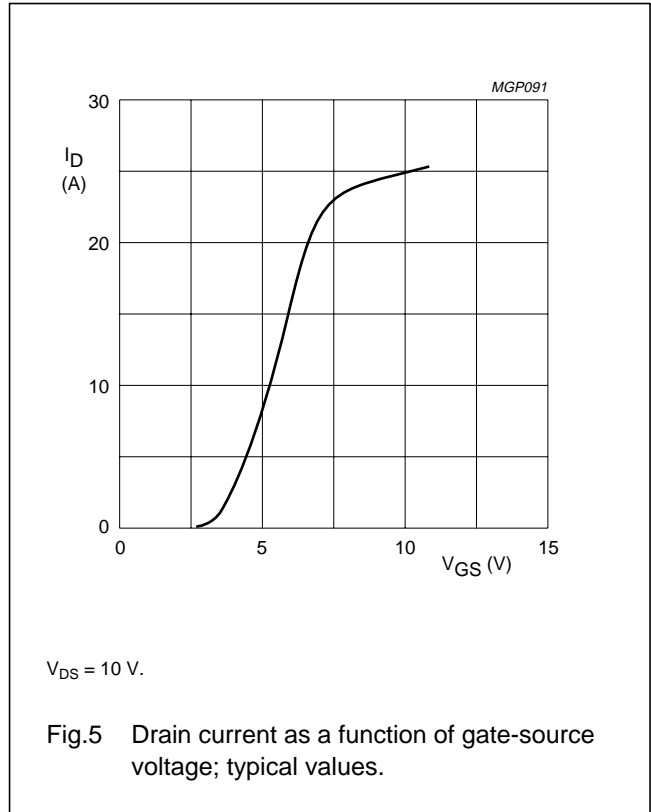
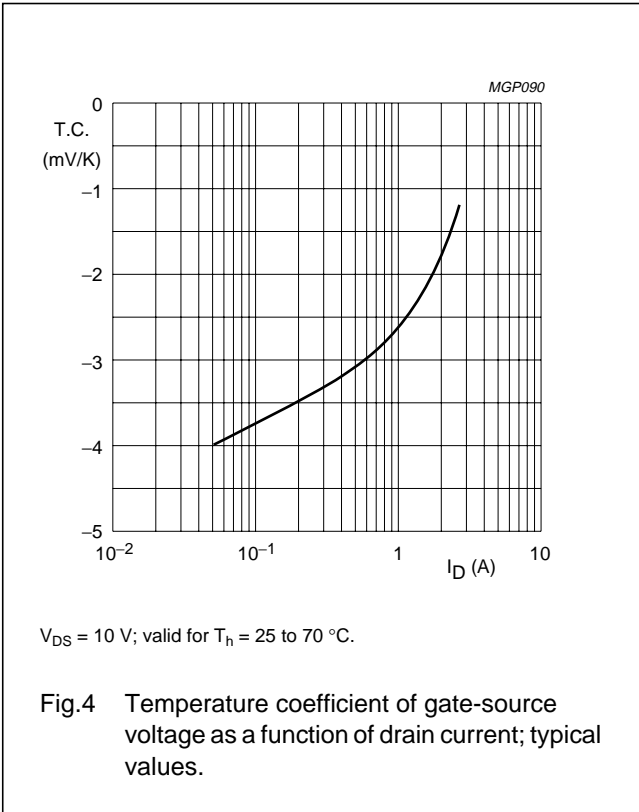
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 100\text{ mA}; V_{GS} = 0$	125	–	–	V
$I_{DSS}$	drain-source leakage current	$V_{GS} = 0; V_{DS} = 50\text{ V}$	–	–	2.5	mA
$I_{GSS}$	gate-source leakage current	$V_{GS} = \pm 20\text{ V}; V_{DS} = 0$	–	–	1	$\mu\text{A}$
$V_{GSth}$	gate-source threshold voltage	$I_D = 50\text{ mA}; V_{DS} = 10\text{ V}$	2	–	4.5	V
$\Delta V_{GS}$	gate-source voltage difference of matched pairs	$I_D = 50\text{ mA}; V_{DS} = 10\text{ V}$	–	–	100	mV
$g_{fs}$	forward transconductance	$I_D = 5\text{ A}; V_{DS} = 10\text{ V}$	4.5	6.2	–	S
$R_{DSon}$	drain-source on-state resistance	$I_D = 5\text{ A}; V_{GS} = 10\text{ V}$	–	0.2	0.3	$\Omega$
$I_{DSX}$	on-state drain current	$V_{GS} = 10\text{ V}; V_{DS} = 10\text{ V}$	–	25	–	A
$C_{is}$	input capacitance	$V_{GS} = 0; V_{DS} = 50\text{ V}; f = 1\text{ MHz}$	–	480	–	pF
$C_{os}$	output capacitance	$V_{GS} = 0; V_{DS} = 50\text{ V}; f = 1\text{ MHz}$	–	190	–	pF
$C_{rs}$	feedback capacitance	$V_{GS} = 0; V_{DS} = 50\text{ V}; f = 1\text{ MHz}$	–	14	–	pF

 $V_{GS}$  group indication

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			

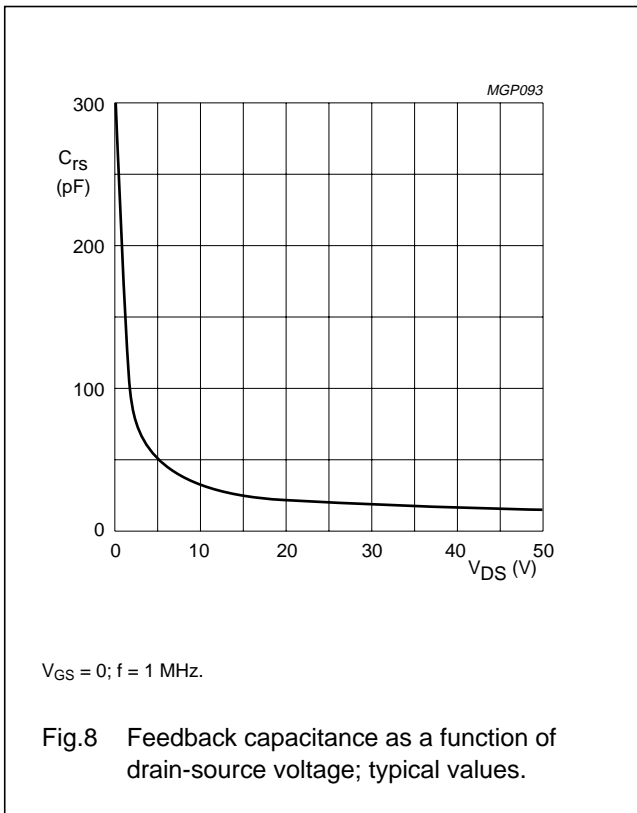
HF/VHF power MOS transistor

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HF/VHF power MOS transistor

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**APPLICATION INFORMATION FOR CLASS-AB OPERATION**

RF performance in SSB operation in a common source class-AB test circuit (see Fig.13).

$T_h = 25 \text{ }^\circ\text{C}; R_{th\text{ mb-h}} = 0.2 \text{ K/W}; Z_L = 6.25 + j0 \text{ } \Omega; f_1 = 28.000 \text{ MHz}; f_2 = 28.001 \text{ MHz}$  unless otherwise specified.

MODE OF OPERATION	f (MHz)	$V_{DS}$ (V)	$I_{DQ}$ (A)	$P_L$ (W)	$G_p$ (dB)	$\eta_D$ (%)	$d_3$ (dB) (note 1)	$d_5$ (dB) (note 1)
SSB, class-AB	28	50	0.7	20 to 150 (PEP)	>20 typ. 35	>35 typ. 40	<-30 typ. -35	<-30 typ. -38

**Note**

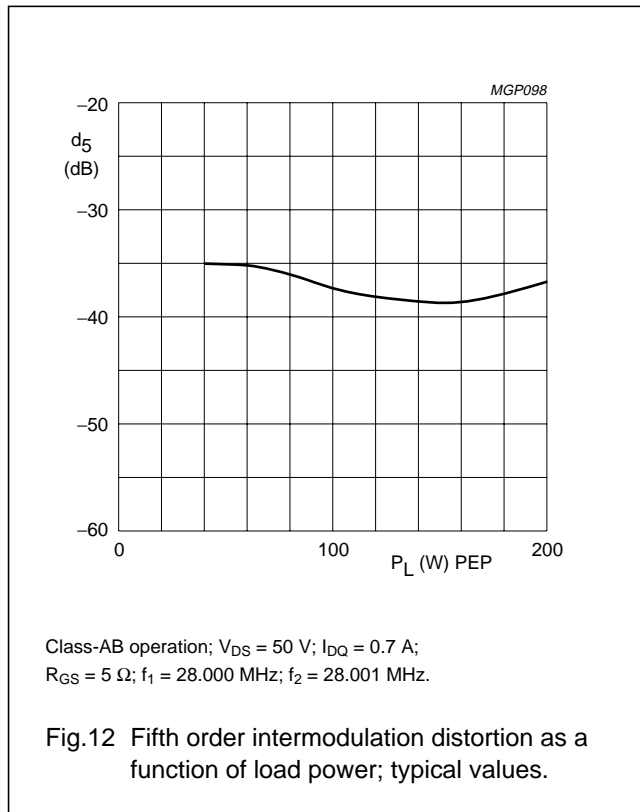
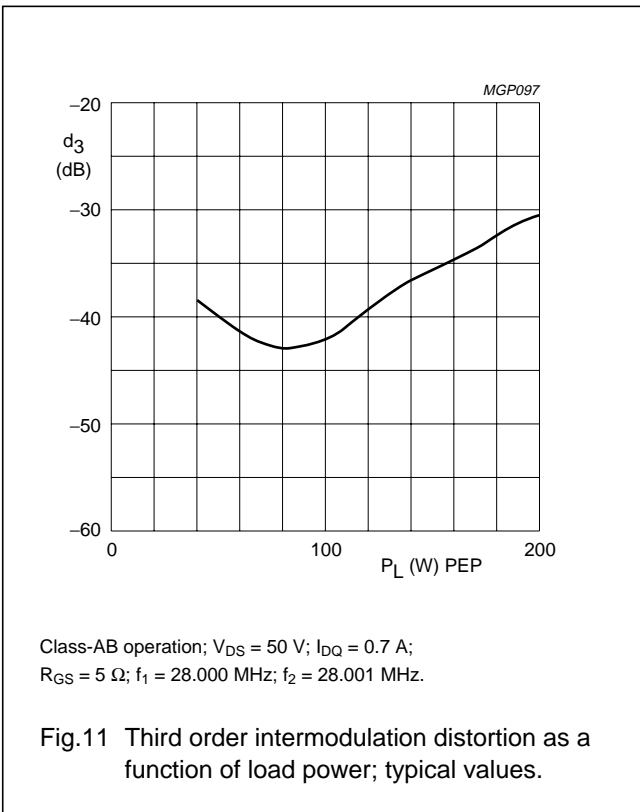
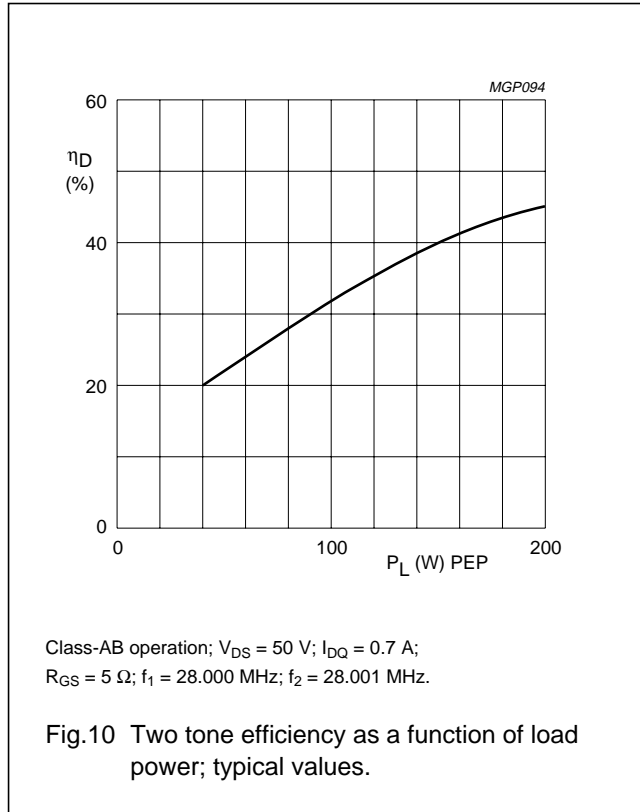
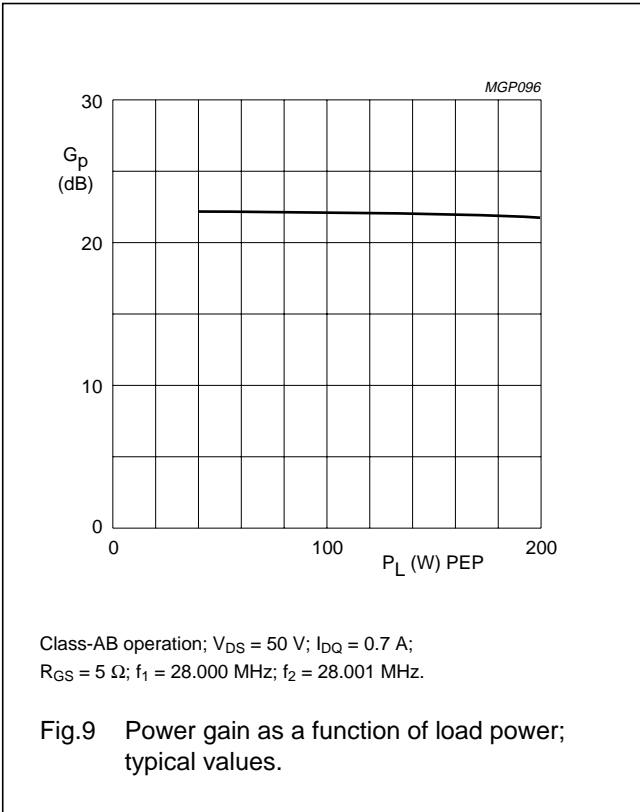
1. Maximum values at drive levels within the specified PEP values for either amplified tone. For the peak envelope power the values should be decreased by 6 dB.

**Ruggedness in class-AB operation**

The BLF177 is capable of withstanding a load mismatch corresponding to  $V_{SWR} = 50$  through all phases under the following conditions:  $f = 28 \text{ MHz}; V_{DS} = 50 \text{ V}$  at rated output power.

HF/VHF power MOS transistor

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HF/VHF power MOS transistor

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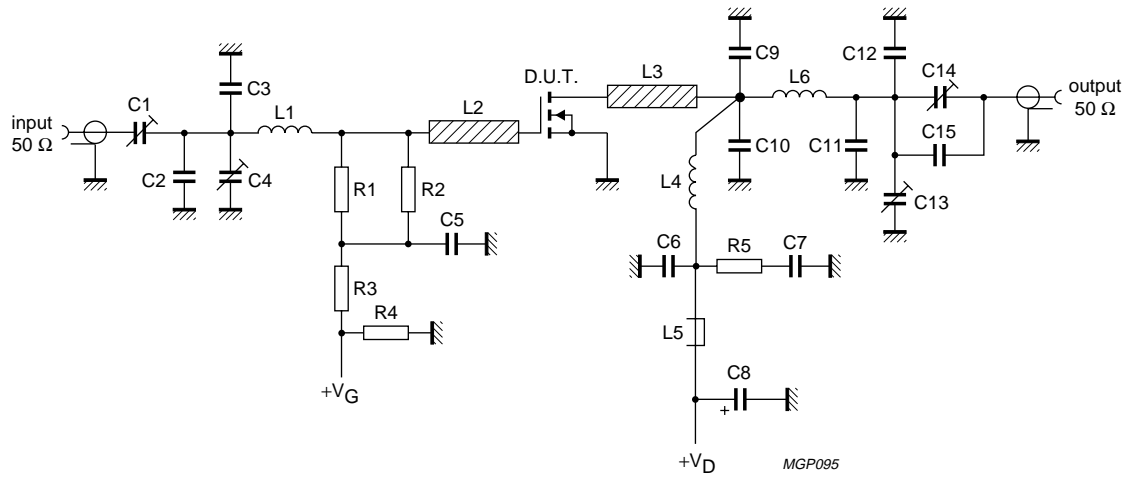


Fig.13 Input impedance as a function of frequency (series components); typical values.

## HF/VHF power MOS transistor

BLF177

## List of components class-AB test circuit (see Fig.13)

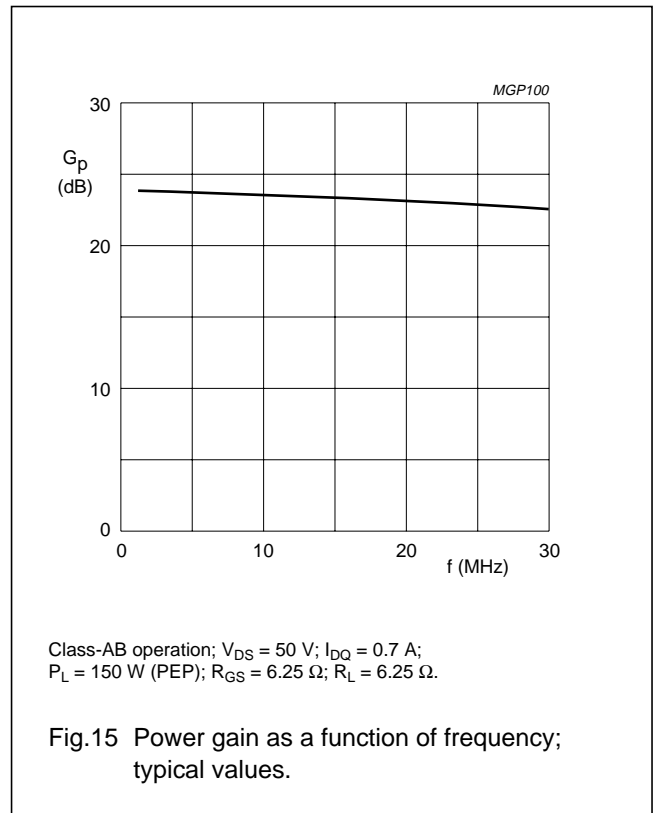
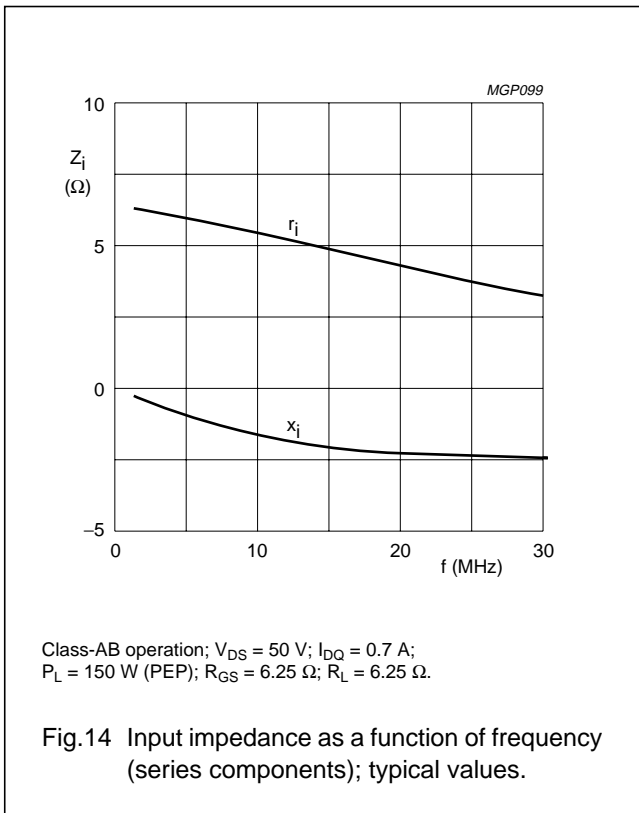
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C4, C13, C14	film dielectric trimmer	7 to 100 pF		2222 809 07015
C2	multilayer ceramic chip capacitor (note 1)	56 pF		
C3, C11	multilayer ceramic chip capacitor (note 1)	62 pF		
C5, C6	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C7	multilayer ceramic chip capacitor	3 × 100 nF		2222 852 47104
C8	electrolytic capacitor	2.2 μF, 63 V		
C9, C10	multilayer ceramic chip capacitor (note 1)	20 pF		
C12	multilayer ceramic chip capacitor (note 1)	100 pF		
C15	multilayer ceramic chip capacitor (note 1)	150 pF		
L1	5 turns enamelled 0.7 mm copper wire	133 nH	length 4.5 mm; int. dia. 6 mm; leads 2 × 5 mm	
L2, L3	stripline (note 2)	41.1 Ω	length 13 × 6 mm	
L4	7 turns enamelled 1.5 mm copper wire	236 nH	length 12.5 mm; int. dia. 8 mm; leads 2 × 5 mm	
L5	grade 3B Ferroxcube wideband HF choke			4312 020 36642
L6	5 turns enamelled 2 mm copper wire	170 nH	length 11.5 mm; int. dia. 8 mm; leads 2 × 5 mm	
R1, R2	metal film resistor	10 Ω, 1 W		
R2	metal film resistor	10 kΩ, 0.4 W		
R3	metal film resistor	1 MΩ, 0.4 W		
R5	metal film resistor	10 kΩ, 1 W		

## Notes

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

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**APPLICATION INFORMATION FOR CLASS-B OPERATION**

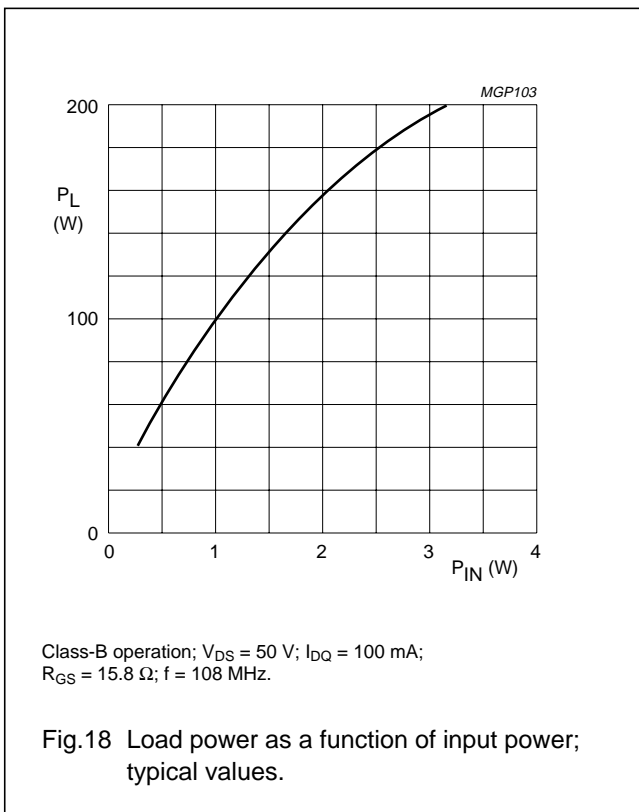
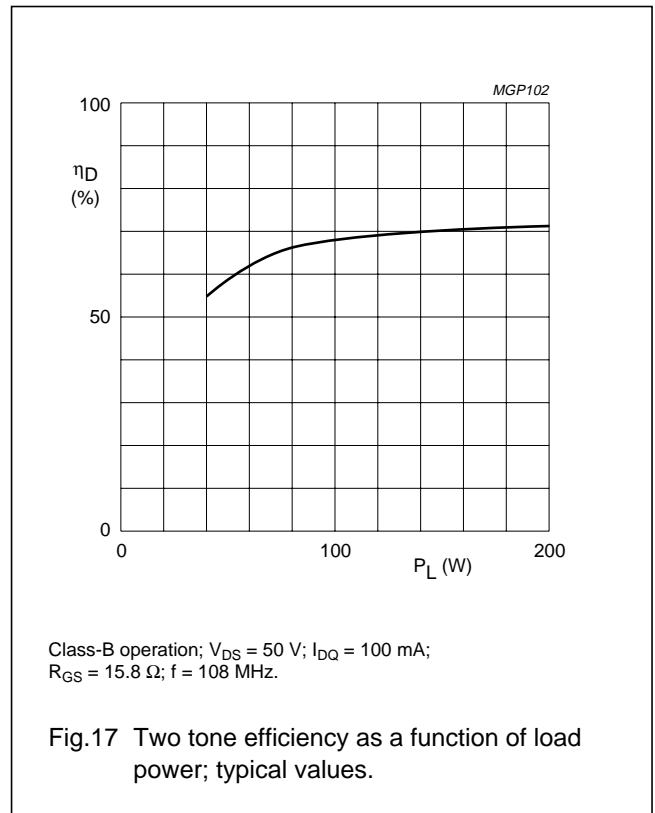
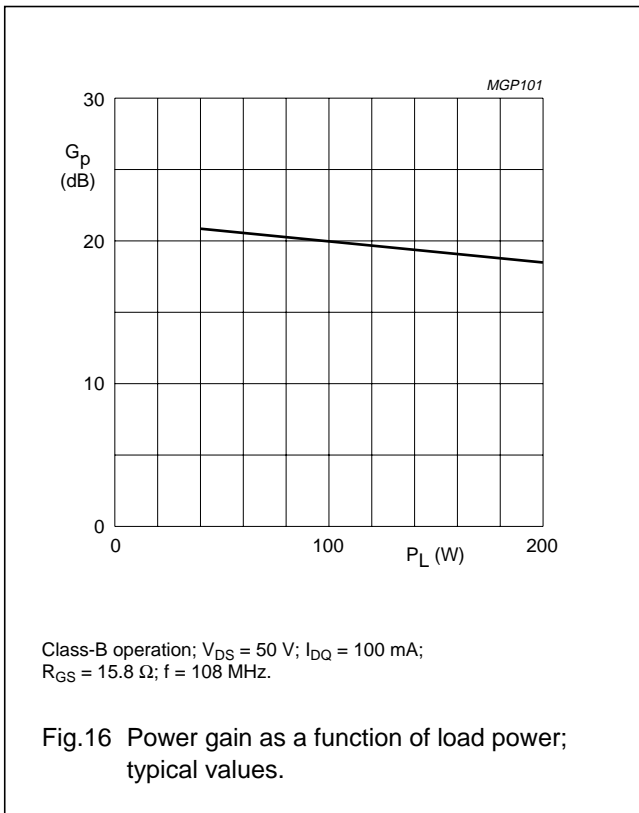
RF performance in CW operation in a common source class-B test circuit (see Fig.19).

$T_h = 25\text{ }^\circ\text{C}$ ;  $R_{th\text{ mb-h}} = 0.2\text{ K/W}$ ;  $R_{GS} = 15.8\ \Omega$  unless otherwise specified.

MODE OF OPERATION	f (MHz)	$V_{DS}$ (V)	$I_{DQ}$ (A)	$P_L$ (W)	$G_p$ (dB)	$\eta_D$ (%)
CW, class-B	108	50	0.1	150	typ. 19	typ. 70

HF/VHF power MOS transistor

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## HF/VHF power MOS transistor

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## List of components class-B test circuit (see Fig.19)

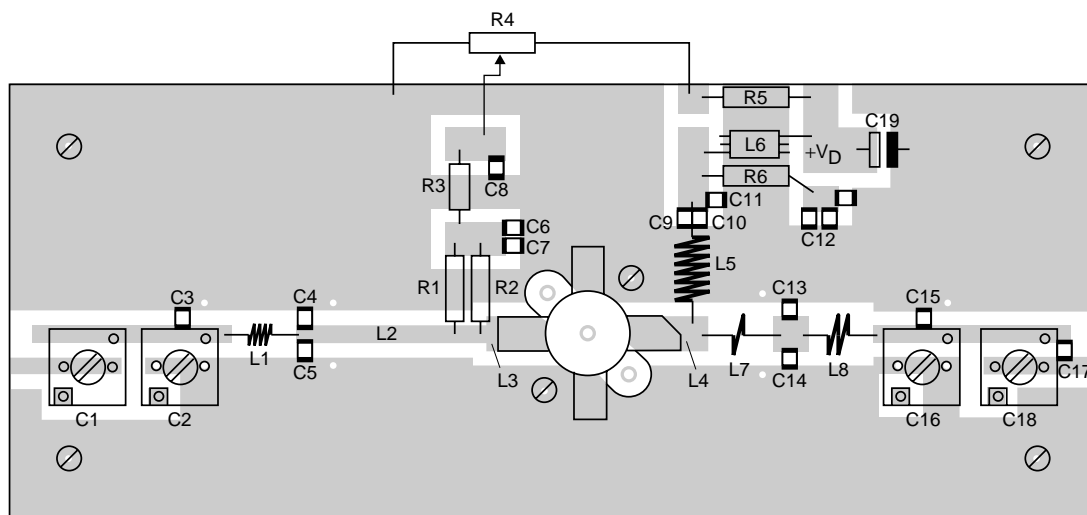
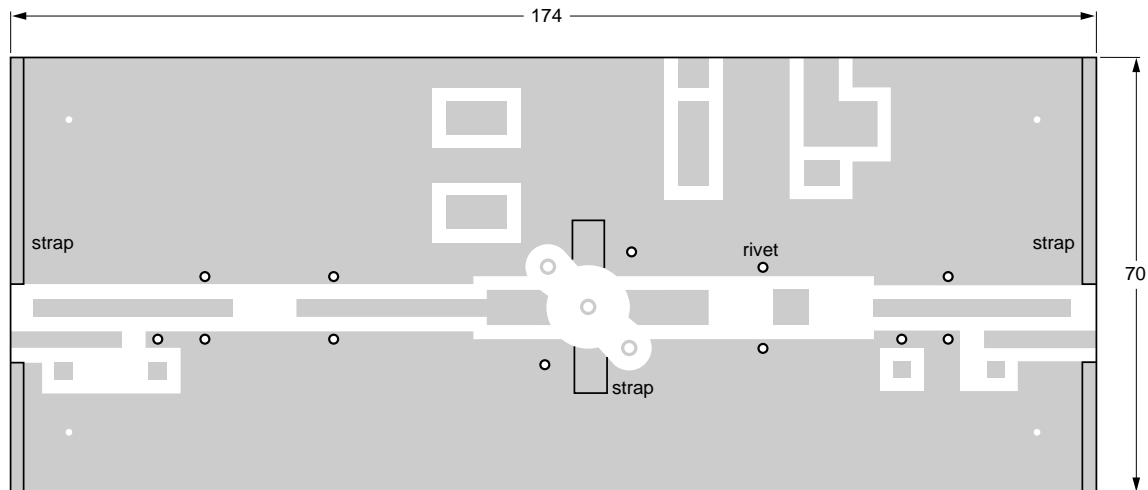
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2, C16, C18	film dielectric trimmer	2.5 to 20 pF		2222 809 07004
C3	multilayer ceramic chip capacitor (note 1)	20 pF		
C4, C5	multilayer ceramic chip capacitor (note 1)	62 pF		
C6, C7, C9, C10	multilayer ceramic chip capacitor (note 1)	1 nF		
C8	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C11	multilayer ceramic chip capacitor	10 nF		2222 852 47103
C12	multilayer ceramic chip capacitor	3 × 100 nF		2222 852 47104
C13, C14	multilayer ceramic chip capacitor (note 1)	36 pF		
C15	multilayer ceramic chip capacitor (note 1)	12 pF		
C17	multilayer ceramic chip capacitor (note 1)	5.6 pF		
C19	electrolytic capacitor	4.4 μF, 63 V		2222 030 28478
L1	3 turns enamelled 0.8 mm copper wire	22 nH	length 5.5 mm; int. dia. 3 mm; leads 2 × 5 mm	
L2	stripline (note 2)	64.7 Ω	31 × 3 mm	
L3, L4	stripline (note 2)	41.1 Ω	10 × 6 mm	
L5	6 turns enamelled 1.6 mm copper wire	122 nH	length 13.8 mm; int. dia. 6 mm; leads 2 × 5 mm	
L6	grade 3B Ferroxcube wideband HF choke			4312 020 36642
L7	1 turn enamelled 1.6 mm copper wire	16.5 nH	int. dia. 9 mm; leads 2 × 5 mm	
L8	2 turns enamelled 1.6 mm copper wire	34.4 nH	length 3.9 mm; int. dia. 6 mm; leads 2 × 5 mm	
R1, R2	metal film resistor	31.6 Ω, 1 W		
R3	metal film resistor	1 kΩ, 0.4 W		
R4	cermet potentiometer	5 kΩ		
R5	metal film resistor	44.2 Ω, 0.4 W		
R6	metal film resistor	10 Ω, 1 W		

## Notes

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

HF/VHF power MOS transistor

BLF177



MGP105

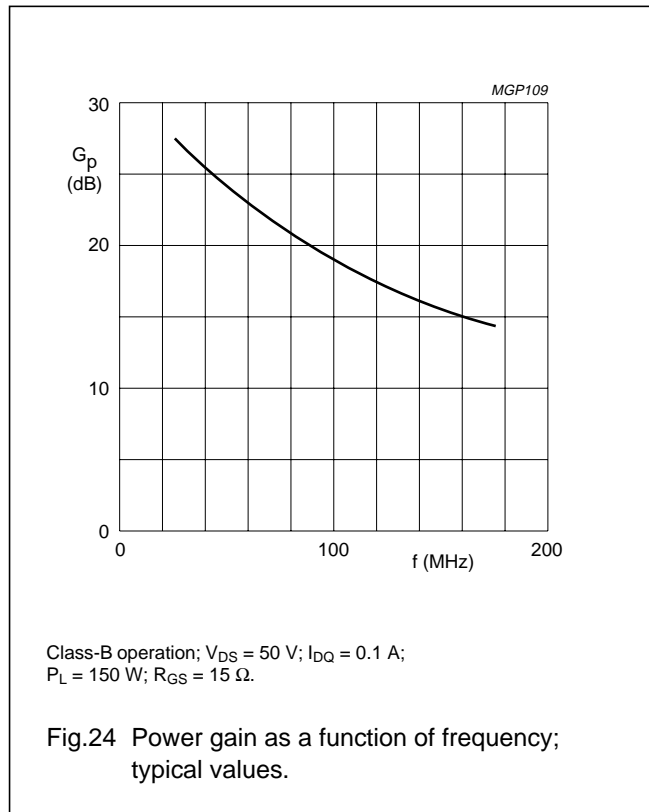
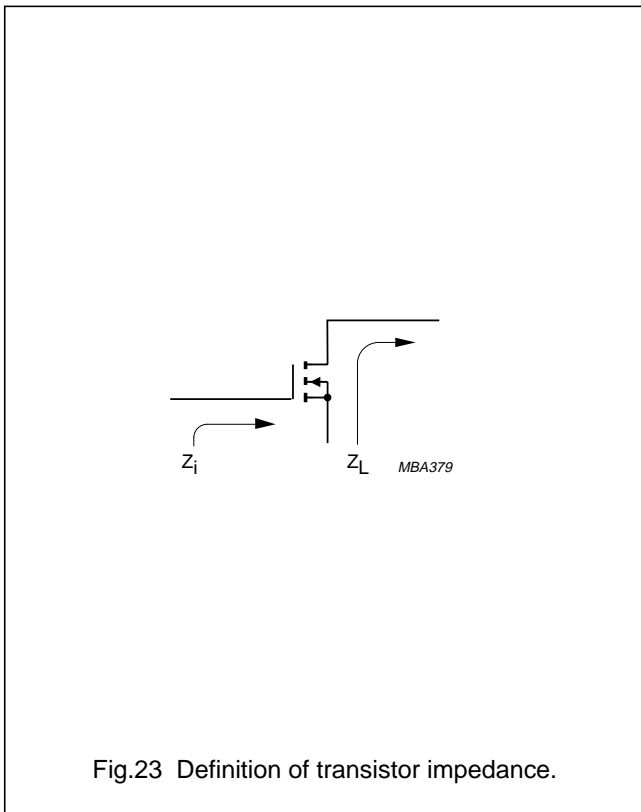
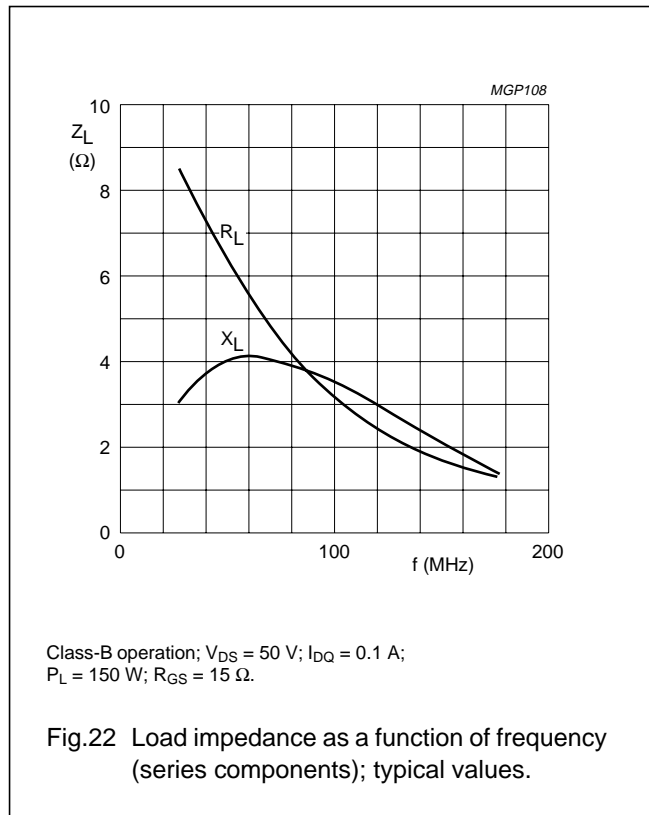
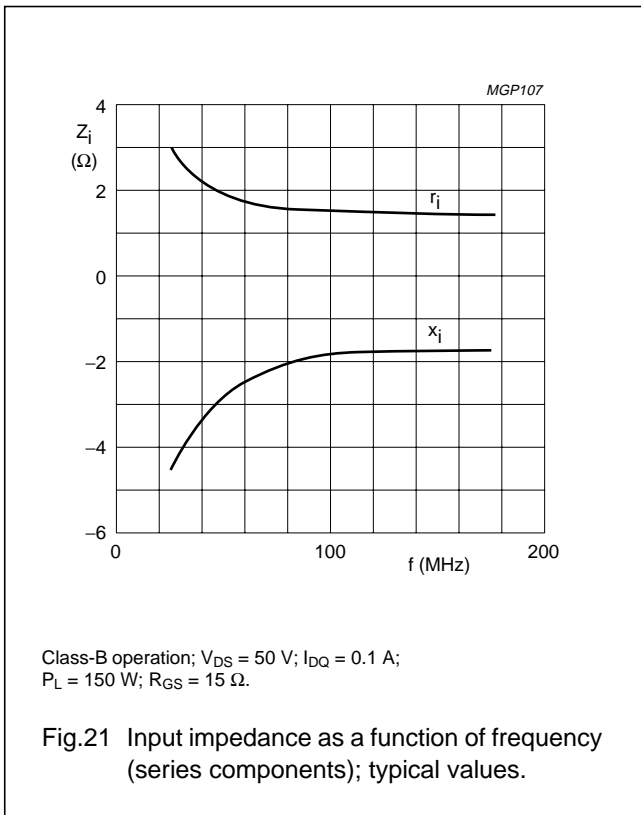
Dimensions in mm.

The circuit and components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as a ground. Earth connections are made by means of hollow rivets, whilst under the source leads and at the input and output copper straps are used for a direct contact between upper and lower sheets.

Fig.20 Component layout for 108 MHz class-B test circuit.

HF/VHF power MOS transistor

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## HF/VHF power MOS transistor

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**BLF177 scattering parameters** $V_{DS} = 50\text{ V}$ ;  $I_D = 100\text{ mA}$ ; 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	0.86	-110.20	36.90	114.20	0.02	25.20	0.64	-84.90
10	0.83	-139.40	20.39	93.30	0.02	5.10	0.55	-112.00
20	0.85	-155.70	9.82	72.60	0.02	-13.40	0.60	-129.30
30	0.88	-161.50	5.96	59.30	0.02	-24.70	0.69	-138.00
40	0.90	-164.90	3.98	49.30	0.02	-31.70	0.76	-144.30
50	0.92	-167.10	2.83	41.90	0.01	-35.80	0.82	-149.30
60	0.94	-169.00	2.11	36.00	0.01	-36.80	0.86	-153.50
70	0.96	-170.70	1.63	31.20	0.01	-33.70	0.89	-157.00
80	0.96	-172.20	1.29	27.40	0.00	-23.00	0.91	-159.90
90	0.97	-173.40	1.04	24.20	0.00	3.30	0.92	-162.40
100	0.97	-174.30	0.86	21.70	0.00	42.50	0.94	-164.50
125	0.99	-176.50	0.57	16.40	0.01	81.60	0.95	-168.80
150	0.99	-178.10	0.40	13.40	0.01	88.70	0.97	-171.90
175	0.99	-179.80	0.30	11.60	0.02	90.70	0.98	-174.50
200	1.00	179.20	0.23	11.00	0.02	90.80	0.98	-176.70
250	1.00	177.00	0.15	11.70	0.03	90.50	0.99	179.80
300	1.00	175.10	0.11	16.70	0.03	89.60	0.99	176.90
350	0.99	173.30	0.08	24.10	0.04	88.30	0.99	174.30
400	1.00	171.80	0.07	33.10	0.05	88.00	0.99	171.90
450	0.99	170.10	0.07	42.70	0.05	87.80	0.99	169.60
500	0.99	168.50	0.07	51.90	0.06	86.50	0.99	167.40
600	0.99	165.40	0.07	64.20	0.07	84.90	0.99	163.10
700	0.99	162.30	0.09	70.60	0.09	83.10	0.98	158.90
800	0.99	158.90	0.10	73.80	0.10	82.20	0.98	154.80
900	0.99	155.30	0.12	74.90	0.12	80.70	0.97	150.60
1000	0.98	151.80	0.14	76.40	0.14	79.80	0.97	146.20

**Note**

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

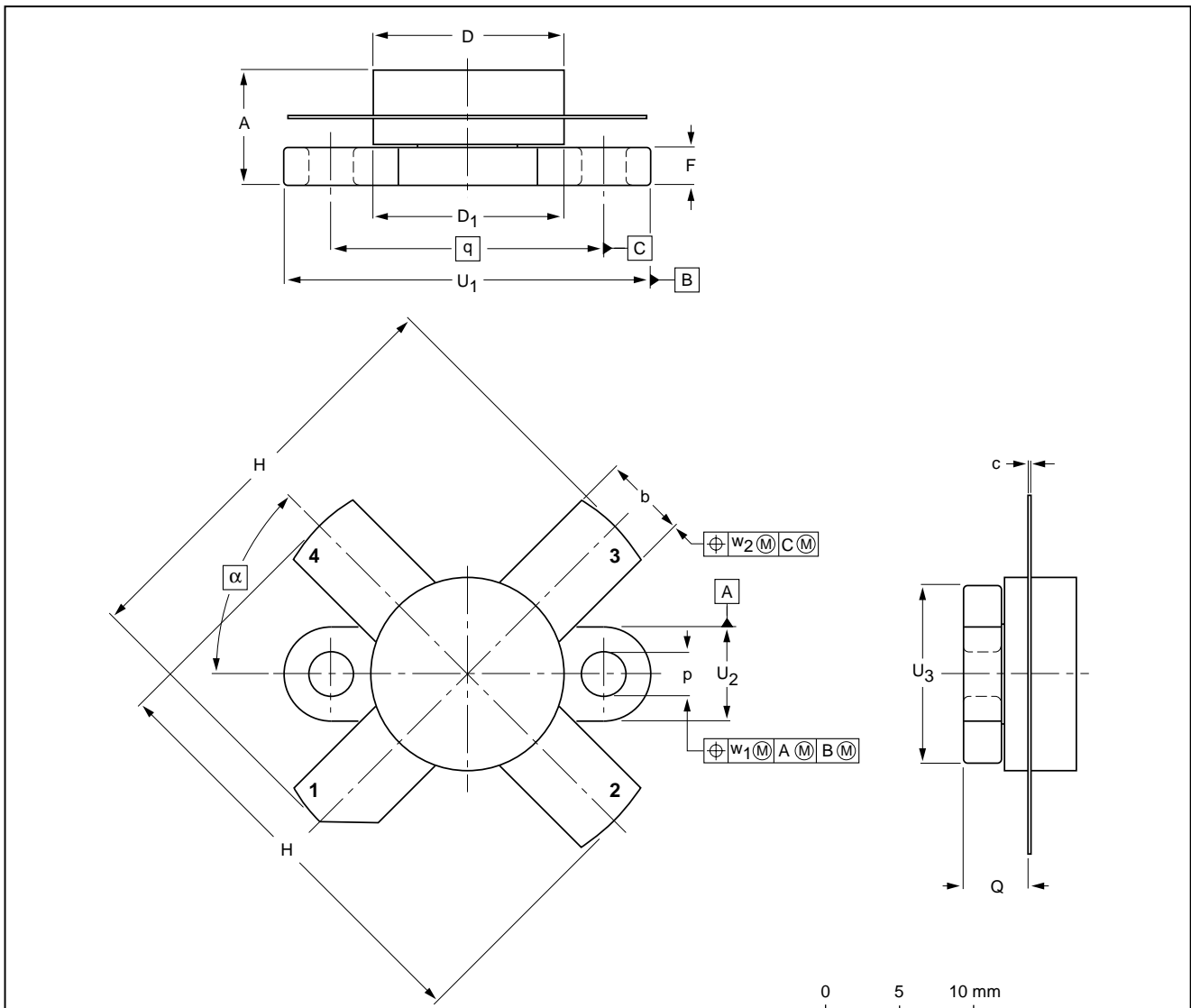
HF/VHF power MOS transistor

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PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 4 leads

SOT121B



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

UNIT	A	b	c	D	D <sub>1</sub>	F	H	p	Q	q	U <sub>1</sub>	U <sub>2</sub>	U <sub>3</sub>	w <sub>1</sub>	w <sub>2</sub>	α
mm	7.27 6.17	5.82 5.56	0.16 0.10	12.86 12.59	12.83 12.57	2.67 2.41	28.45 25.52	3.30 3.05	4.45 3.91	18.42	24.90 24.63	6.48 6.22	12.32 12.06	0.25	0.51	45°
inches	0.286 0.243	0.229 0.219	0.006 0.004	0.506 0.496	0.505 0.495	0.105 0.095	1.120 1.005	0.130 0.120	0.175 0.154	0.725	0.98 0.97	0.255 0.245	0.485 0.475	0.01	0.02	

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT121B						99-03-29

## HF/VHF power MOS transistor

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## DATA SHEET STATUS

LEVEL	DATA SHEET STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)(3)</sup>	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.

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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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