DATA SHEET

BLF246
VHF power MOS transistor

Product specification
Supersedes data of September 1992

1996 Oct 21

Philips
Semiconductors

PHILIPS

VHF power MOS transistor — BLF246

FEATURES

- High power gain
- Low noise figure
- Easy power control
- Good thermal stability
- Withstands full load mismatch.

APPLICATIONS

- Large signal amplifier applications in the VHF frequency range.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor encapsulated in a 4-lead, SOT121 flange 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 General section of Data Handbook SC19a for further information.

CAUTION
The device is supplied in an antistatic package. The gate-source input must be protected against static discharge during transport or handling.

PINNING - SOT121

PIN	SYMBOL	DESCRIPTION
1	d	drain
2	s	source
3	g	gate
4	s	source

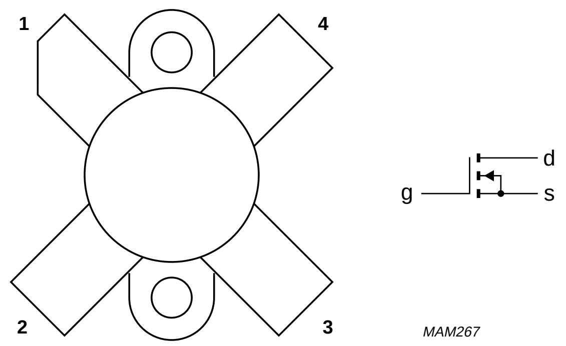


Fig.1 Simplified outline and symbol.

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 (%)
CW, class-B	108	28	80	≥16	≥55

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.

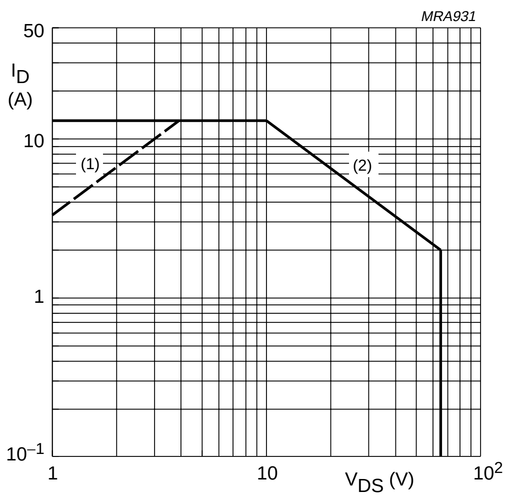
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
V_{GS}	gate-source voltage		–	±20	V
I_D	DC drain current		–	13	A
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	130	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL CHARACTERISTICS

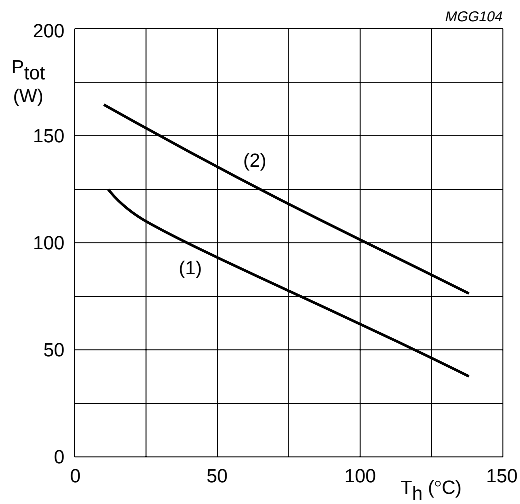
SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	1.35	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	0.2	K/W



(1) Current is this area may be limited by $R_{DS(on)}$.

(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



(1) Continuous operation.

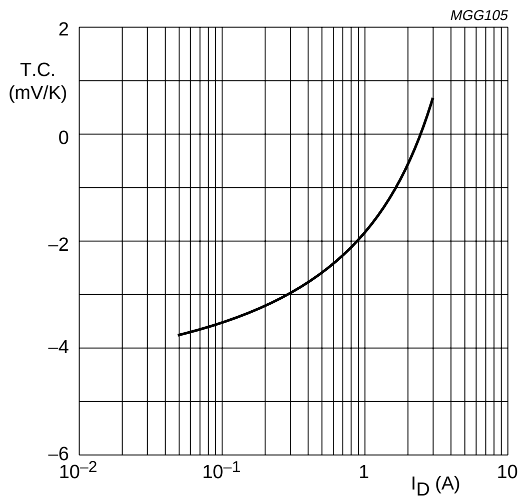
(2) Short-time operation during mismatch.

Fig.3 Power derating curves.

CHARACTERISTICS

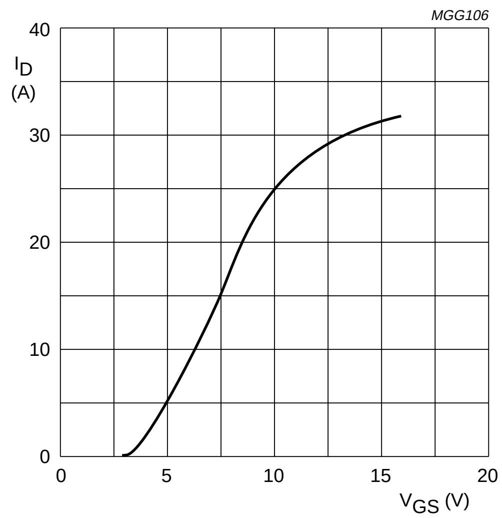
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 50 mA	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	2.5	mA
I_{GSS}	gate-source leakage current	V_{GS} = ±20 V; V_{DS} = 0	–	–	1	μA
V_{GSth}	gate-source threshold voltage	I_D = 50 mA; V_{DS} = 10 V	2	–	4.5	V
ΔV_{GS}	gate-source voltage difference of matched pairs	I_D = 50 mA; V_{DS} = 10 V	–	–	100	mV
g_{fs}	forward transconductance	I_D = 2.5 A or 5 A; V_{DS} = 10 V	3	4.2	–	S
R_{DSon}	drain-source on-state resistance	I_D = 5 A; V_{GS} = 10 V	–	0.2	0.3	Ω
I_{DSX}	on-state drain current	V_{GS} = 10 V; V_{DS} = 10 V	–	22	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	225	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	180	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	25	–	pF



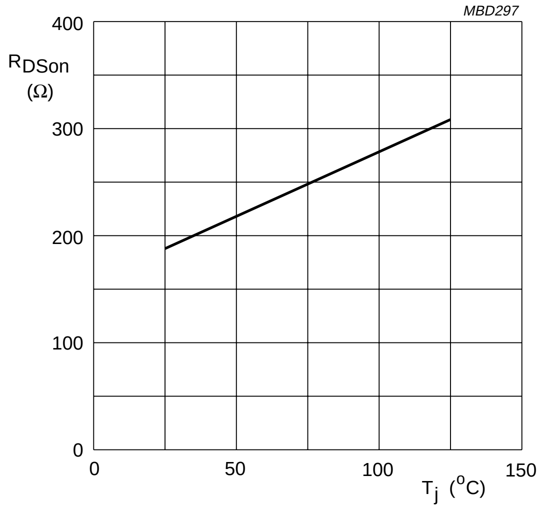
V_{DS} = 10 V; valid for T_h = 25 to 70 °C.

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



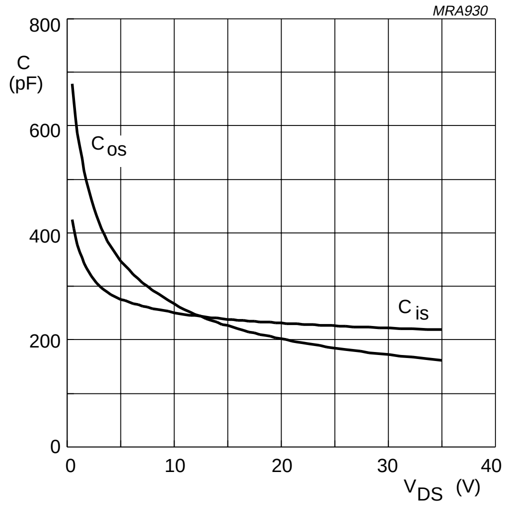
V_{DS} = 10 V; T_j = 25 °C.

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



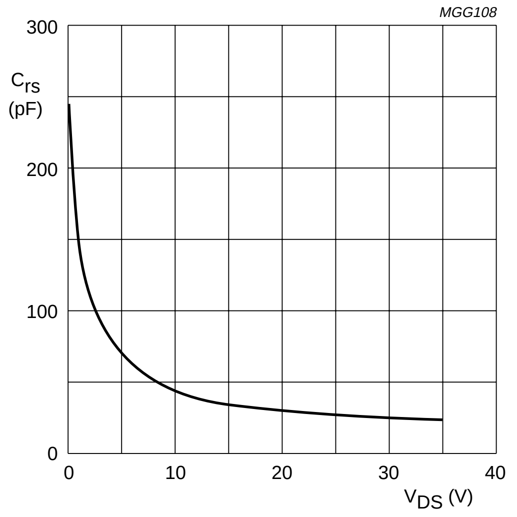
V_{GS} = 10 V; I_D = 5 A.

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

RF performance in CW operation in a common source test circuit.
T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W; R_{GS} = 12 Ω unless otherwise specified.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_D (A)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	108	28	0.1	80	>16	>55
CW, class-B	108	28	0.1	80	typ. 18	typ. 65
CW, class-C	108	28	0[1]	80	typ. 15	typ. 72

Note

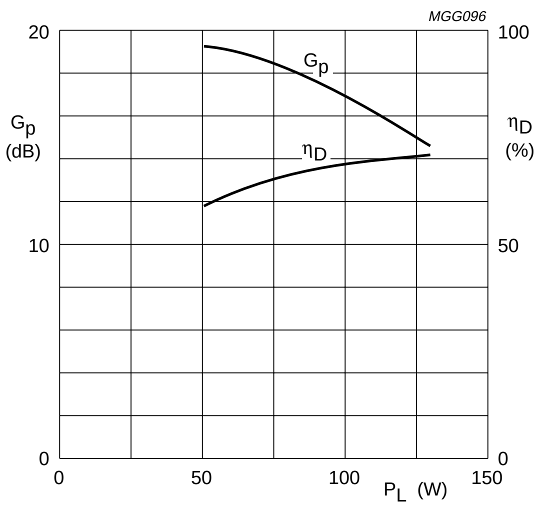
1. V_{GS} = 0 (class-C).

Ruggedness in class-B operation

The BLF246 is capable of withstanding a load mismatch corresponding to VSWR = 50: 1 through all phases under the following conditions: V_{DS} = 28 V; f = 108 MHz; T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W at rated output power.

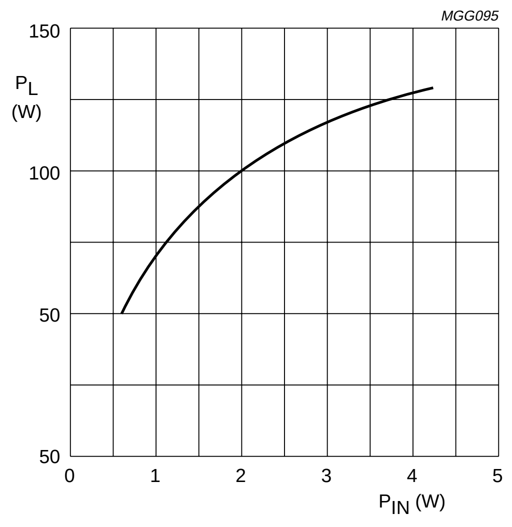
Noise figure

Measured with 80 W power-matched source and load in the test circuit (see Fig.9) with V_{DS} = 28 V; I_D = 2 A; f = 108 MHz; R_{GS} = 27 Ω; T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W; F = typ. 3 dB.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 0.1 A; R_{GS} = 12 Ω; f = 108 MHz; T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W.

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



Class-B operation; V_{DS} = 28 V; I_{DQ} = 0.1 A; R_{GS} = 12 Ω; f = 108 MHz; T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W.

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

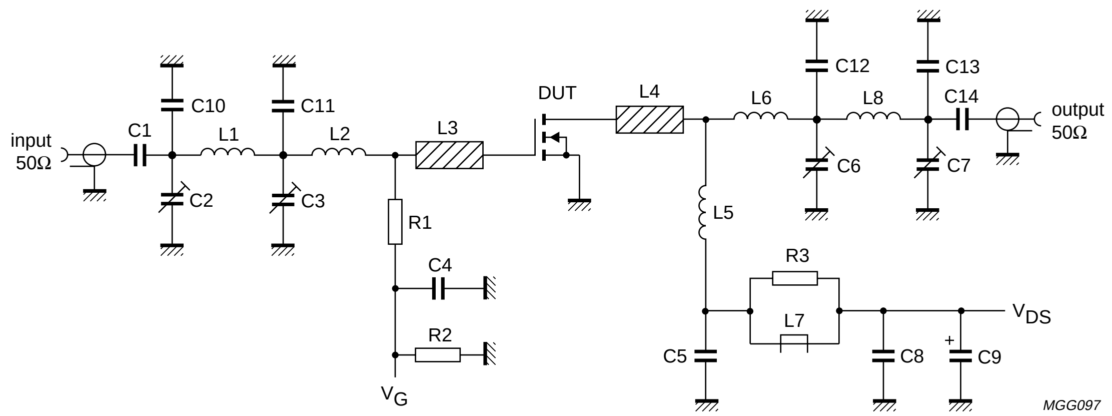


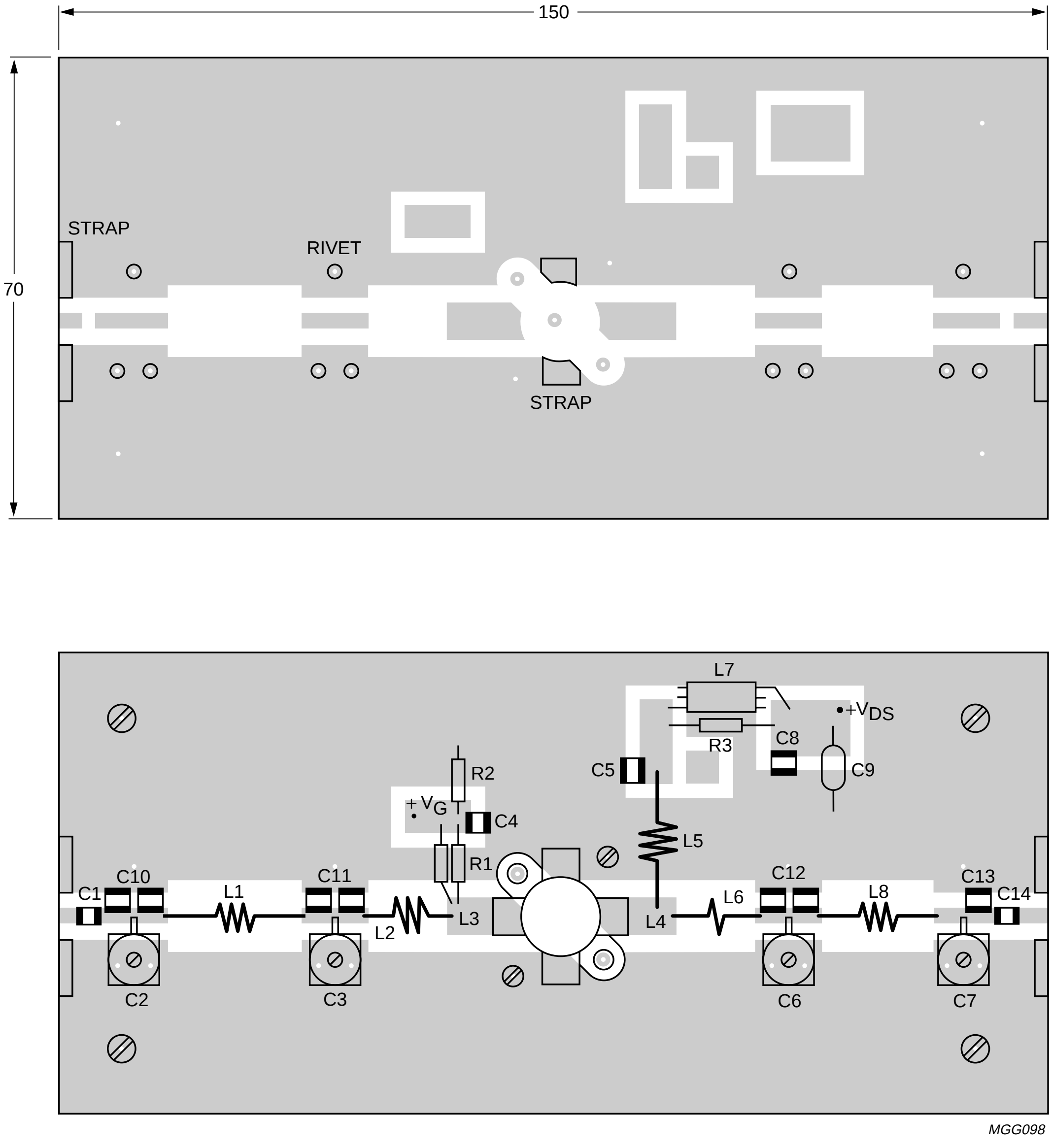
Fig.11 Test circuit for class-B operation at 108 MHz.

List of components (see Figs 11 and 12).

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C4, C5, C8, C14	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C2, C3, C6, C7	film dielectric trimmer	5 to 60 pF		2222 809 08003
C9	electrolytic capacitor	2.2 µF, 63 V		2222 030 38228
C10	multilayer ceramic chip capacitor; note 1	68 pF + 39 pF in parallel		
C11	multilayer ceramic chip capacitor; note 1	69 pF + 100 pF in parallel		
C12	multilayer ceramic chip capacitor; note 1	2x 100 pF in parallel		
C13	multilayer ceramic chip capacitor; note 1	62 pF		
L1	5 turns enamelled 0.6 mm copper wire	52 nH	length 6.5 mm int. dia. 3 mm leads 2 × 10 mm	
L2	2 turns enamelled 0.6 mm copper wire	19 nH	length 3.5 mm int. dia. 3 mm leads 2 × 7.5 mm	
L3, L4	stripline; note 2	31 Ω	length 13 mm width 6 mm	
L5	3 turns enamelled 1.6 mm copper wire	36 nH	length 12 mm int. dia. 6 mm leads 2 × 5 mm	
L6	hairpin of enamelled 1.6 mm copper wire	14 nH	length 20 mm	
L7	grade 3B Ferroxcube HF choke			4312 020 36640
L8	3 turns enamelled 1.6 mm copper wire	52 nH	length 8 mm int. dia. 6 mm leads 2 × 9 mm	
R1	metal film resistor	2 × 24 Ω in parallel, 0.4 W		
R2	metal film resistor	100 kΩ, 0.4 W		
R3	metal film resistor	10 Ω, 0.4 W		

Notes

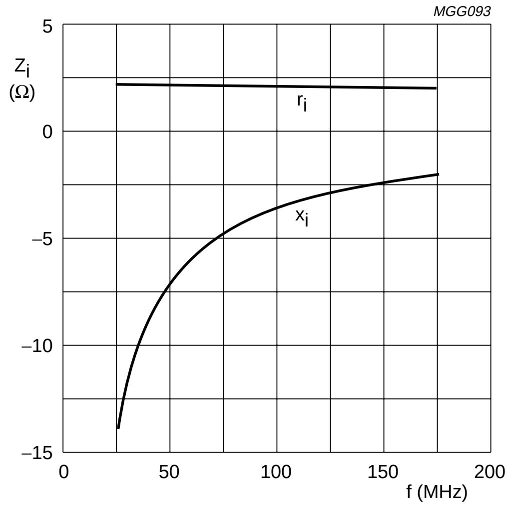
1. American Technical Ceramics capacitor, type 100B or other capacitor of the same quality.
2. The striplines are mounted on a double copper-clad PCB with epoxy fibre-glass dielectric (ε_r = 4.5), thickness 1.6 mm.



Dimensions in mm.

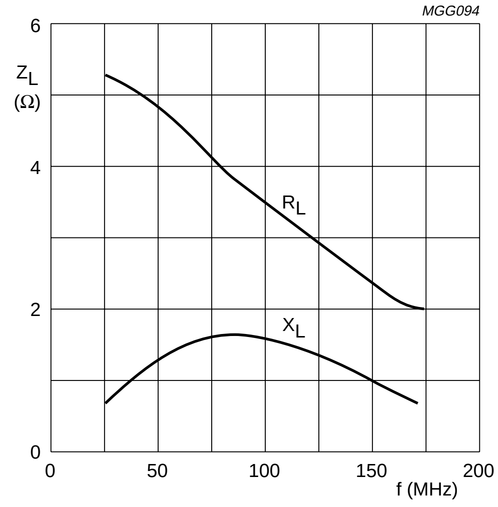
The circuit and components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as a ground. Earth connections are made by means of hollow rivets, whilst under the source leads, copper straps are used for a direct contact between the upper and lower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

Fig.12 Component layout for 108 MHz class-B test circuit.



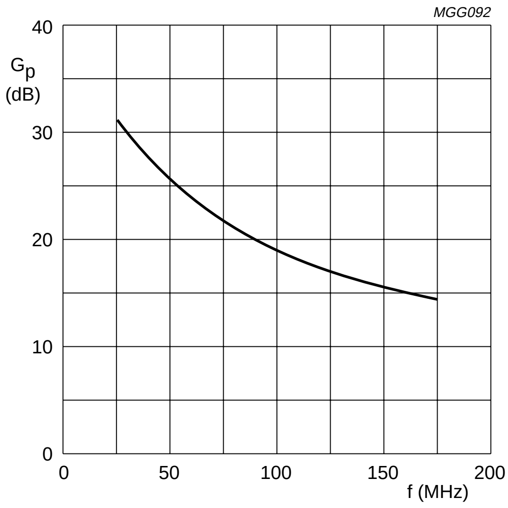
Class-B operation; V_{DS} = 28 V; I_{DQ} = 0.1 A; R_{GS} = 12 Ω;
P_L = 80 W; T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W.

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



Class-B operation; V_{DS} = 28 V; I_{DQ} = 0.1 A; R_{GS} = 12 Ω;
P_L = 80 W; T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W.

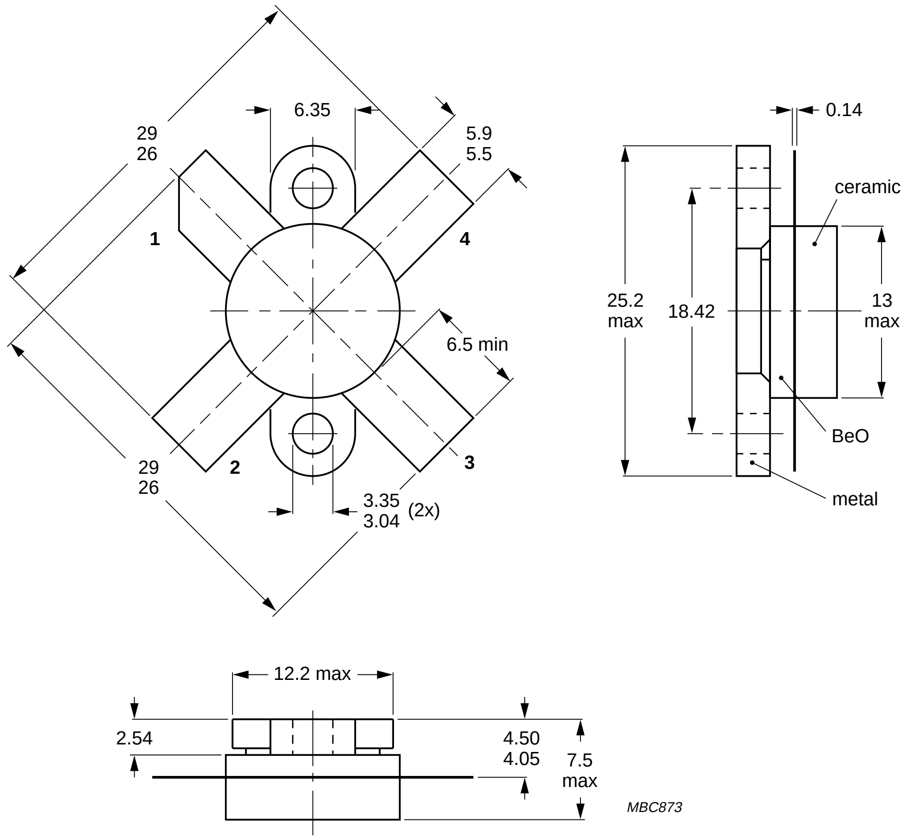
Fig.14 Load impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 0.1 A; R_{GS} = 12 Ω;
P_L = 80 W; T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W.

Fig.15 Power gain as a function of frequency, typical values.

PACKAGE OUTLINE



Dimensions in mm.

Fig.16 SOT121.

DEFINITIONS

Data Sheet Status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). 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	
Where application information is given, it is advisory and does not form part of the specification.	

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