VHF power MOS transistor

BLF225

FEATURES

- Easy power control
- Good thermal stability
- Withstands full load mismatch.

DESCRIPTION

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

The transistor is encapsulated in a 4-lead, SOT123 flange envelope, with a ceramic cap. All leads are isolated from the flange.

PIN CONFIGURATION

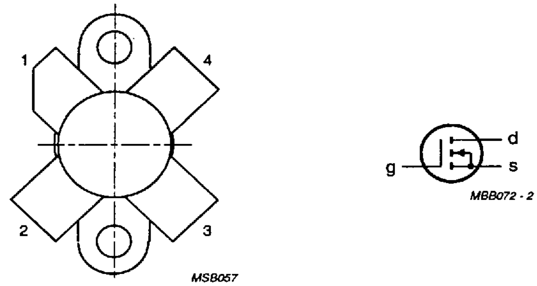


Fig.1 Simplified outline and symbol.

PINNING - SOT123

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source

CAUTION

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

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_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	175	12.5	30	> 8.5	> 60

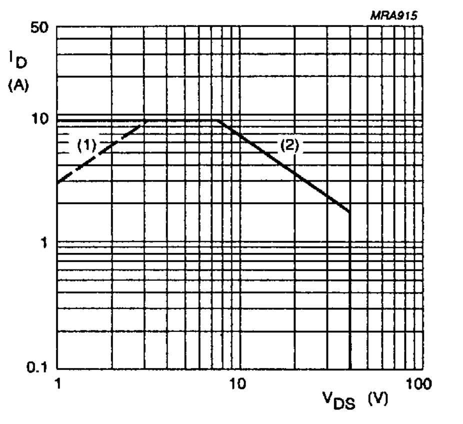
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	40	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	9	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	68	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

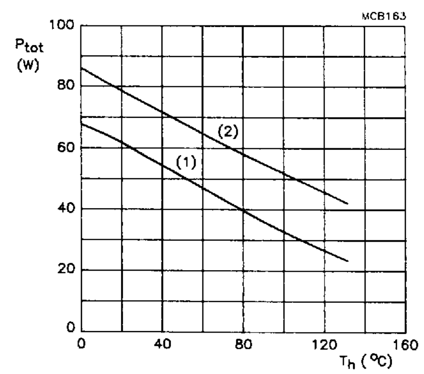
THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	2.6 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	0.3 K/W



(1) Current is this area may be limited by $R_{DS(on)}$.
(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



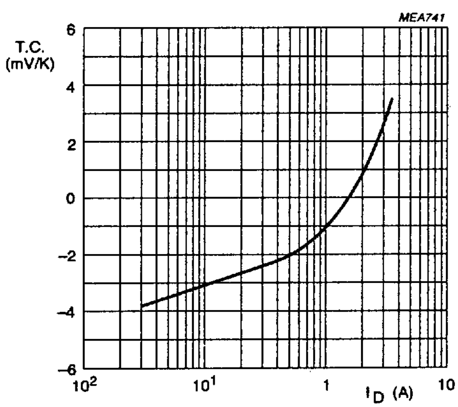
(1) Continuous operation.
(2) Short-time operation during mismatch.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS

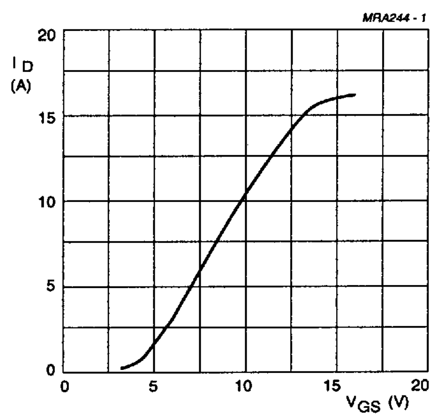
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 30 mA	40	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 12.5 V	–	–	1	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 30 mA; V_{DS} = 10 V	2	–	4.5	V
g_{fs}	forward transconductance	I_D = 3.5 A; V_{DS} = 10 V	1.5	2.2	–	S
$R_{DS(on)}$	drain-source on-state resistance	I_D = 3.5 A; V_{GS} = 15 V	–	0.25	0.35	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	–	16	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	120	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	140	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	20	–	pF



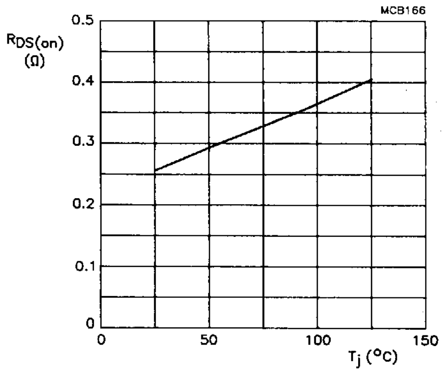
V_{DS} = 10 V.

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



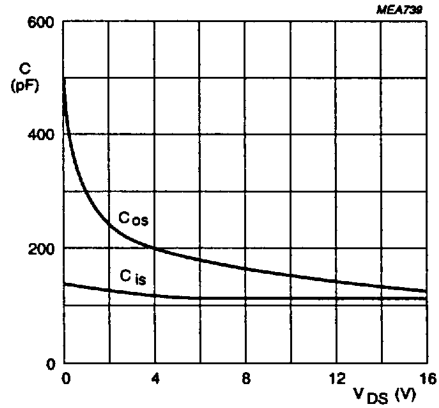
V_{DS} = 10 V.

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



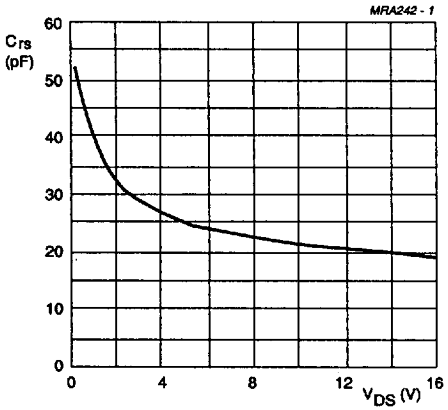
V_{GS} = 15 V; I_D = 3.5 A.

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 FOR CLASS-B OPERATION

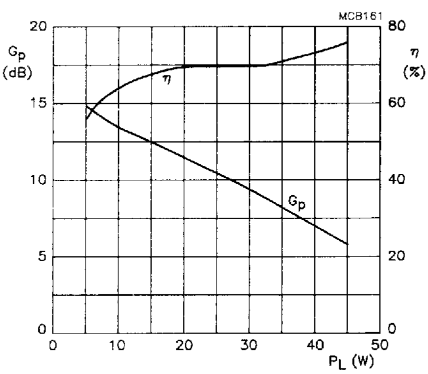
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; unless otherwise specified.
RF performance in CW operation in a common source class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_c (%)
CW, class-B	175	12.5	100	30	> 8.5 typ. 9.5	> 60 typ. 70

Ruggedness in class-B operation

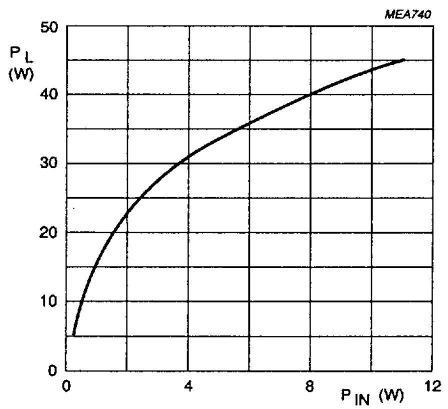
The BLF225 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases under the following conditions:

V_{DS} = 15.5 V; f = 175 MHz at rated load power.



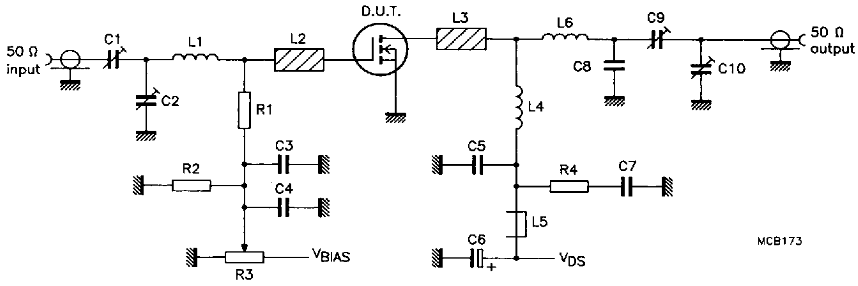
Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; f = 175 MHz.

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



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; f = 175 MHz.

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



f = 175 MHz.

Fig.11 Test circuit for class-B operation.

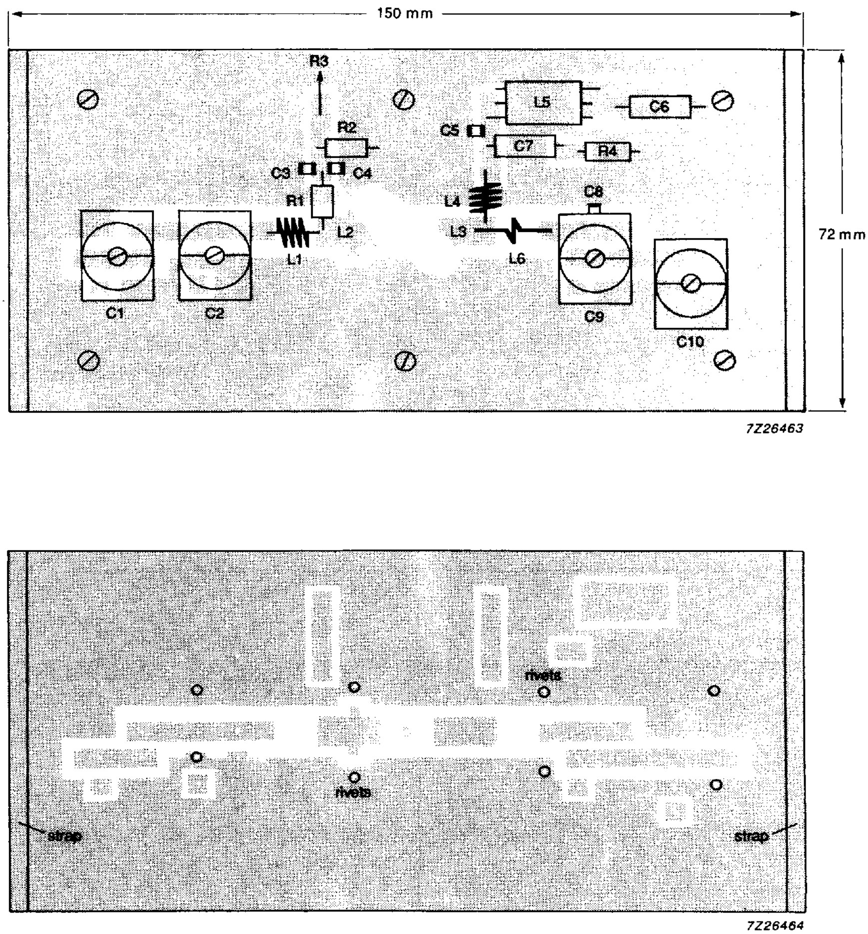
VHF power MOS transistor BLF225

List of components (class-B test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	film dielectric trimmer	4 to 40 pF		2222 809 07008
C2, C10	film dielectric trimmer	5 to 60 pF		2222 809 07011
C3	multilayer ceramic chip capacitor (note 1)	100 pF, 500 V		
C4	ceramic chip capacitor	100 nF, 50 V		2222 852 47104
C5	multilayer ceramic chip capacitor (note 1)	680 pF, 500 V		
C6	electrolytic capacitor	10 µF, 63 V		2222 030 38109
C7	polyester capacitor	100 nF, 250 V		
C8	multilayer ceramic chip capacitor (note 1)	43 pF, 500 V		
C9	film dielectric trimmer	7 to 100 pF		2222 809 07015
L1	3 turns enamelled 0.5 mm copper wire	18 nH	length 3.3 mm int. dia. 2 mm leads 2 x 5 mm	
L2, L3	stripline (note 2)	31 Ω	12 x 6 mm	
L4	3 turns enamelled 1.5 mm copper wire	28 nH	length 8.2 mm int. dia. 4 mm leads 2 x 5 mm	
L5	grade 3B Ferroxcube RF choke			4312 020 36642
L6	1 turn enamelled 1.5 mm copper wire	36 nH	length 4 mm int. dia. 3.5 mm leads 2 x 5 mm	
R1	0.4 W metal film resistor	1 kΩ		2322 151 51002
R2	0.4 W metal film resistor	1 MΩ		2322 151 51005
R3	10 turns cermet potentiometer	5 kΩ		
R4	0.4 W metal film resistor	10 Ω		2322 151 51009

Notes

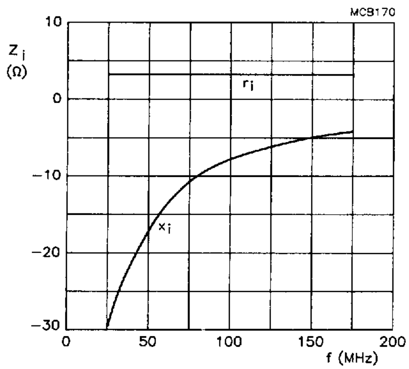
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with epoxy fibre-glass dielectric (ε_r = 4.5), thickness 1⁄16 inch.



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

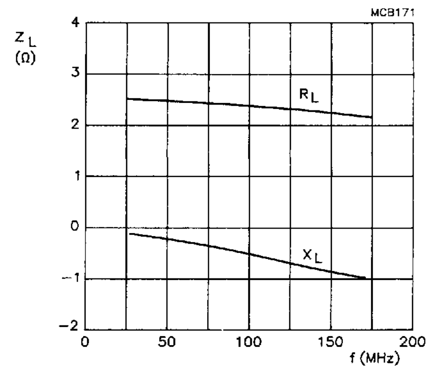
Fig.12 Component layout for 175 MHz class-B test circuit.

VHF power MOS transistor BLF225



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; P_L = 30 W.

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



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; P_L = 30 W.

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

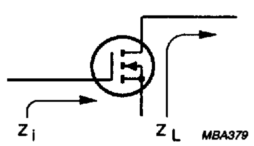
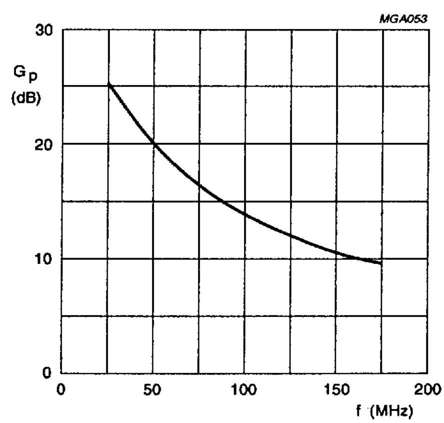


Fig.15 Definition of MOS impedance.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; P_L = 30 W.

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