VHF power MOS transistor

BLF277

FEATURES

- High power gain
- Easy power control
- Gold metallization ensures excellent reliability
- Good thermal stability
- Withstands full load mismatch.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for large signal amplifier applications in the VHF frequency range.

The transistor is encapsulated in a 6-lead, SOT119 flange envelope, 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 for further information.

PINNING - SOT119

PIN	DESCRIPTION
1	source
2	source
3	gate
4	drain
5	source
6	source

PIN CONFIGURATION

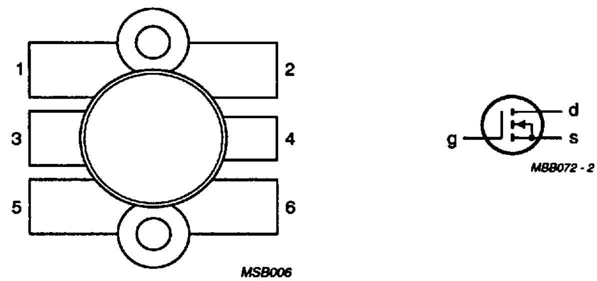


Fig.1 Simplified outline and symbol.

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 circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	175	50	150	> 14	> 50

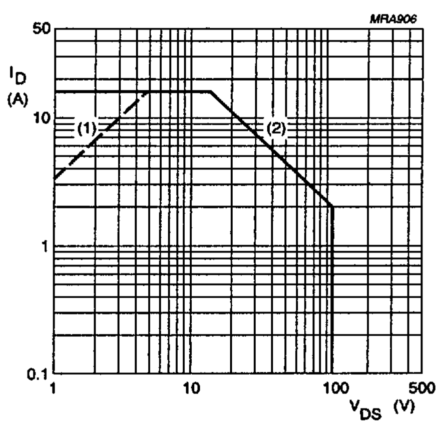
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	110	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	16	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	220	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

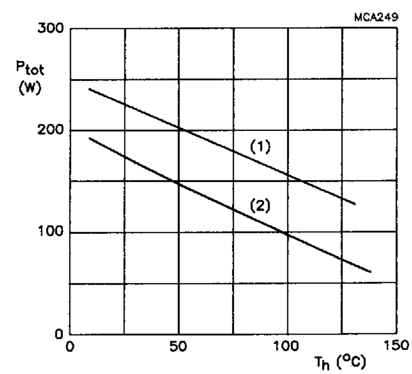
SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_{mb} = 25 °C; P_{tot} = 220 W	0.8 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	T_{mb} = 25 °C; P_{tot} = 220 W	0.2 K/W



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

(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



(1) Continuous operation.

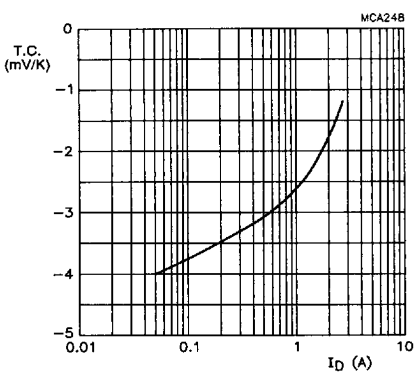
(2) Short-time operation during mismatch.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS

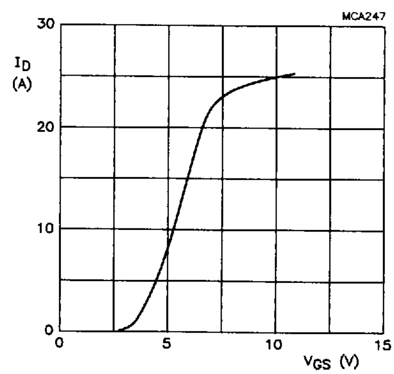
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 50 mA	110	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 50 V	–	–	2.5	mA
I_{GSS}	gate-source leakage current	±V_{GS} = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	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 = 5 A; V_{DS} = 10 V	4.5	6.2	–	S
$R_{DS(on)}$	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	–	25	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 50 V; f = 1 MHz	–	480	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 50 V; f = 1 MHz	–	190	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 50 V; f = 1 MHz	–	14	–	pF



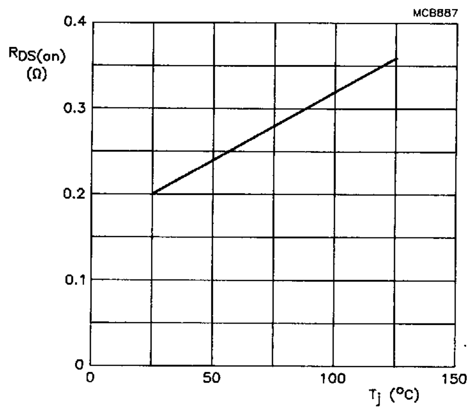
V_{DS} = 10 V.

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



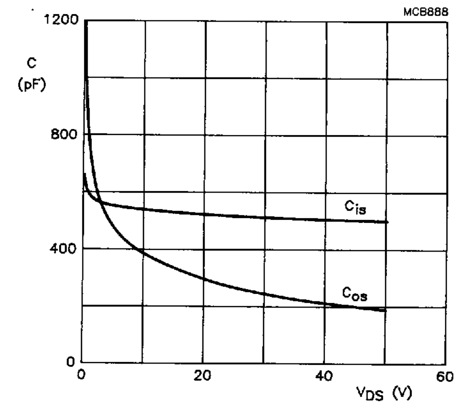
V_{DS} = 10 V; T_j = 25 °C.

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



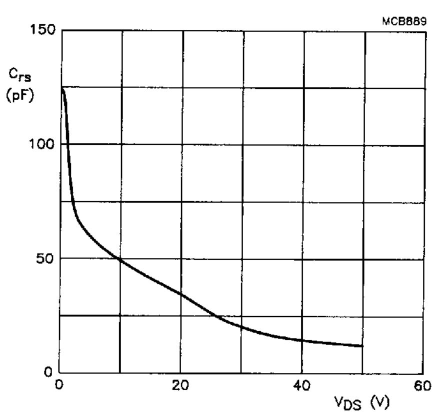
I_D = 5 A; V_{GS} = 10 V.

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

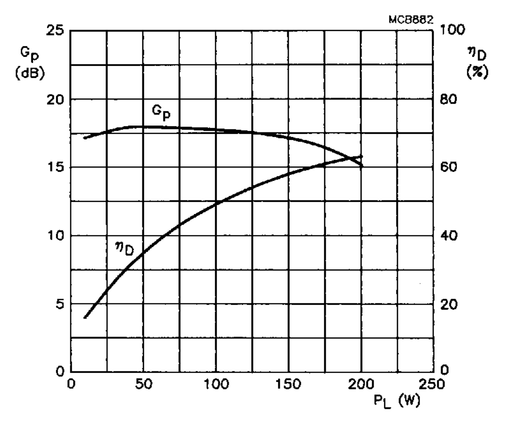
T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W; R_{GS} = 16 Ω; unless otherwise specified.
RF performance in CW operation in a common source class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (A)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	175	50	0.1	150	> 14 typ. 17	> 50 typ. 58

Ruggedness in class-B operation

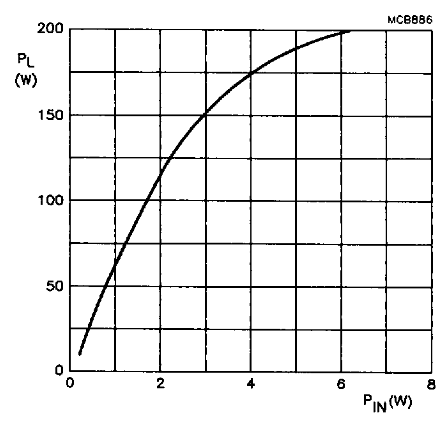
The BLF277 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases under the following conditions:

V_{DS} = 50 V; f = 175 MHz at rated load power.



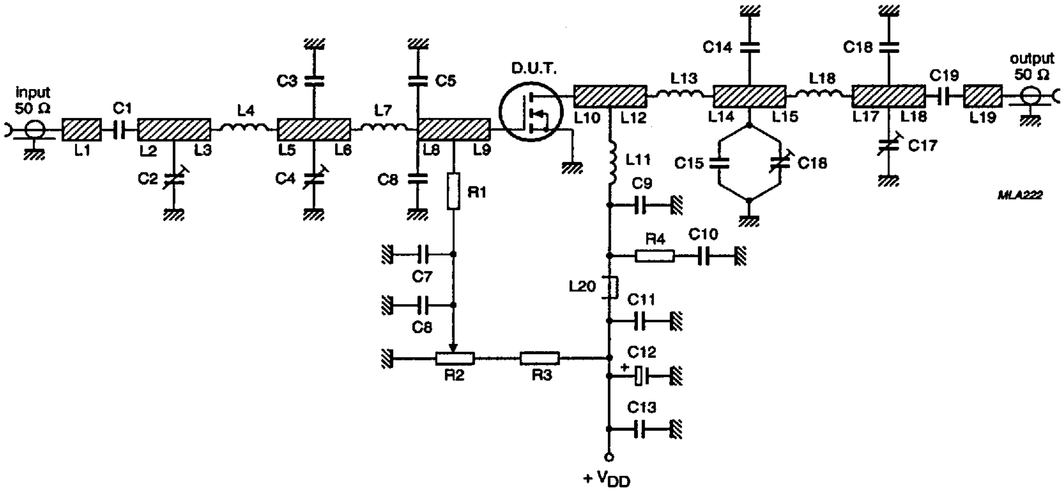
Class-B operation; V_{DS} = 50 V; I_{DQ} = 0.1 A;
Z_L = 1.4 + j1.6 Ω; f = 175 MHz.

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



Class-B operation; V_{DS} = 50 V; I_{DQ} = 0.1 A;
Z_L = 1.4 + j1.6 Ω; 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.

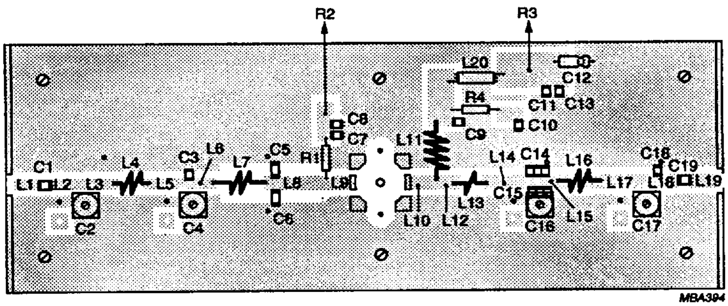
List of components (class-B test circuit)

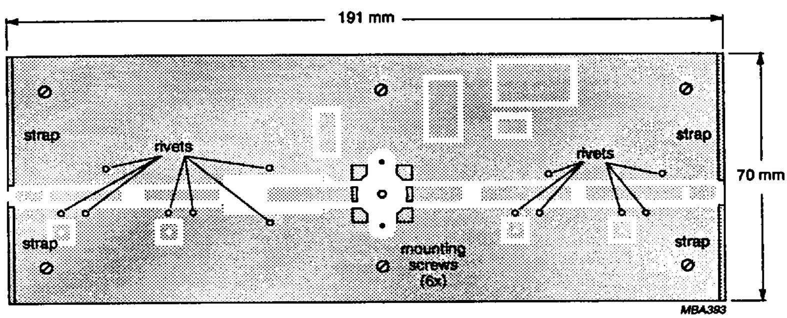
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C8, C19	multilayer ceramic chip capacitor (note 1)	680 pF		
C2, C4, C17	film dielectric trimmer	5 to 60 pF		2222 809 08003
C3	multilayer ceramic chip capacitor (note 1)	33 pF		
C5, C6, C9	multilayer ceramic chip capacitor (note 1)	100 pF		
C7, C10, C13	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C11	multilayer ceramic chip capacitor	10 nF		2222 852 47103
C12	electrolytic capacitor	10 µF, 63 V		
C14, C15	multilayer ceramic chip capacitor (note 2)	3 x 22 pF in parallel		
C16	film dielectric trimmer	4 to 40 pF		2222 809 08002
C18	multilayer ceramic chip capacitor (note 1)	18 pF		
L1	stripline (note 3)	49 Ω	length 8 mm width 4 mm	
L2	stripline (note 3)	49 Ω	length 12 mm width 4 mm	
L3	stripline (note 3)	49 Ω	length 7.5 mm width 4 mm	
L4	2 turns enamelled 1.5 mm copper wire	25 nH	length 3.7 mm int. dia. 5 mm leads 2 x 1 mm	
L5	stripline (note 3)	49 Ω	length 15.5 mm width 4 mm	
L6	stripline (note 3)	49 Ω	length 5 mm width 4 mm	
L7	2 turns enamelled 1.5 mm copper wire	25 nH	length 4.2 mm int. dia. 5 mm leads 2 x 4 mm	
L8	stripline (note 3)	31 Ω	length 18 mm width 6 mm	
L9	stripline (note 3)	31 Ω	length 6 mm width 6 mm	
L10, L12	stripline (note 3)	31 Ω	length 7 mm width 6 mm	
L11	3 turns enamelled 1.5 mm copper wire	40 nH	length 6.8 mm int. dia. 5 mm leads 2 x 3 mm	
L13	1 turn enamelled 1.5 mm copper wire	3 nH	int. dia. 2.8 mm leads 2 x 1 mm	

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L14	stripline (note 3)	36 Ω	length 15.5 mm width 5 mm	
L15	stripline (note 3)	36 Ω	length 8 mm width 5 mm	
L16	2 turns enamelled 2.5 mm copper wire	28 nH	length 5.5 mm int. dia. 5 mm leads 2 x 3 mm	
L17	stripline (note 3)	36 Ω	length 12 mm width 5 mm	
L18, L19	stripline (note 3)	36 Ω	length 8.5 mm width 5 mm	
L20	grade 3B Ferroxcube RF choke			4312 020 36642
R1	0.4 W metal film resistor	16 Ω		
R2	10 turn potentiometer	50 kΩ		
R3	0.4 W metal film resistor	400 kΩ		
R4	0.4 W metal film resistor	100 Ω		

Notes

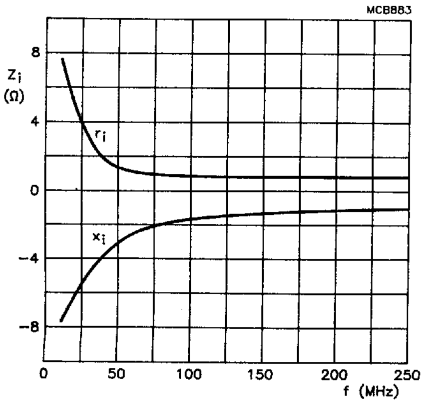
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 175B or other capacitor of the same quality.
3. The striplines are mounted double copper-clad printed circuit board, with epoxy glass dielectric ($\varepsilon_r = 4.5$); thickness 1.6 mm.





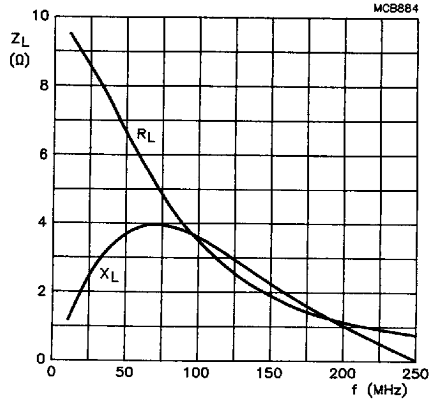
The circuit and components are situated on one side of the printed circuit board, the other side being fully metallized, to serve as a ground plane. Earth connections are made by means of copper straps and hollow rivets.

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



Class-B operation; V_{DS} = 50 V; I_{DQ} = 0.1 A; R_{GS} = 16 Ω; P_L = 150 W.

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



Class-B operation; V_{DS} = 50 V; I_{DQ} = 0.1 A; R_{GS} = 16 Ω; P_L = 150 W.

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

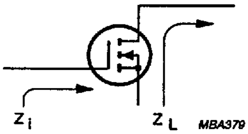
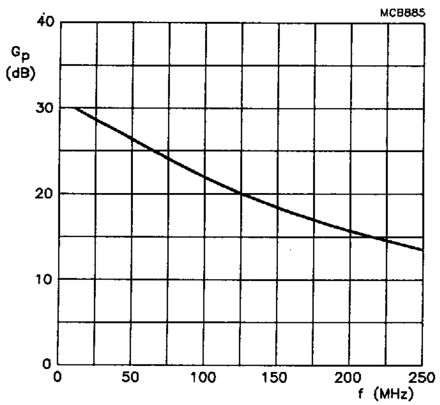


Fig.15 Definition of MOS impedance.



Class-B operation; V_{DS} = 50 V; I_{DQ} = 0.1 A; R_{GS} = 16 Ω; P_L = 150 W.

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