HF/VHF power MOS transistor

BLF241

FEATURES

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

DESCRIPTION

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

The transistor is encapsulated in a 3-lead SOT5 (TO-39) metal envelope with the drain connected to the case.

PINNING - SOT5

PIN	DESCRIPTION
1	source
2	gate
3	drain

PIN CONFIGURATION

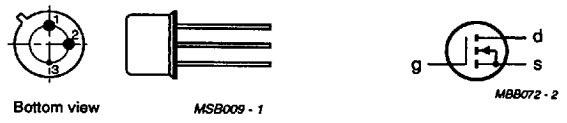


Fig.1 Simplified outline and symbol.

CAUTION

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

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
CW, class-AB	175	12.5	100	2	> 10; typ. 12.5	< 50; typ. 55
CW, class-B	175	28	10	3	typ. 14	typ. 50

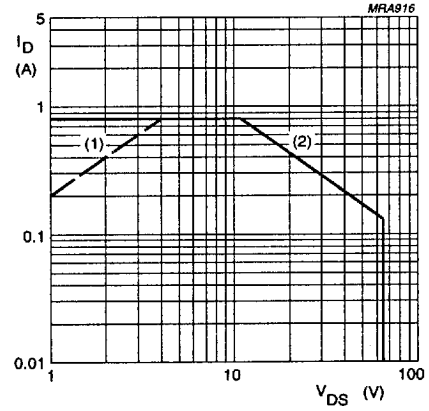
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	0.8	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	8.75	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

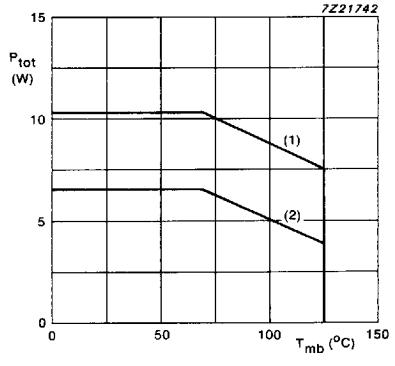
THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	20 K/W



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

Fig.2 DC SOAR.



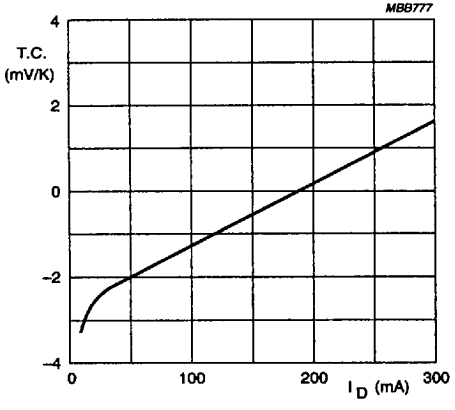
(1) Short-time operation during mismatch.
(2) Continuous operation.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS

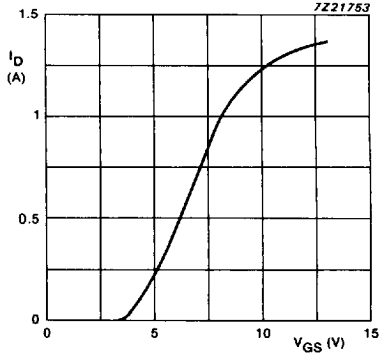
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 50 mA; V_{GS} = 0	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	10	μA
I_{GSS}	gate-source leakage current	±V_{GS} = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 3 mA; V_{DS} = 10 V	2	–	4.5	V
g_{fs}	forward transconductance	I_D = 0.3 A; V_{DS} = 10 V	0.16	0.24	–	S
$R_{DS(on)}$	drain-source on-state resistance	I_D = 0.3 A; V_{GS} = 10 V	–	3.3	5	Ω
I_{DSX}	on-state drain current	V_{GS} = 10 V; V_{DS} = 10 V	–	1.2	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	16	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	13	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	2.4	–	pF



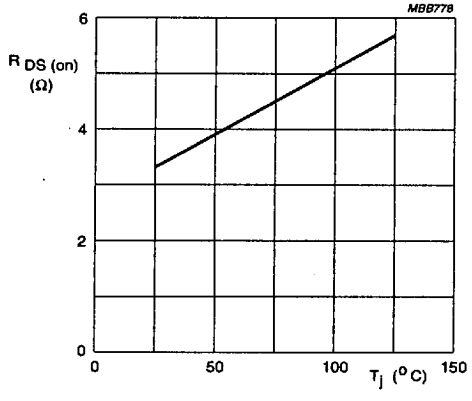
V_{DS} = 12.5 V.

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



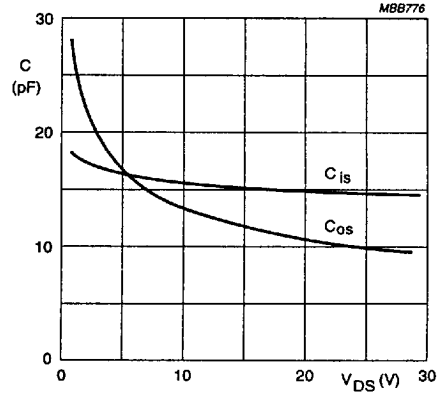
V_{DS} = 10 V; T_j = 25 °C.

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



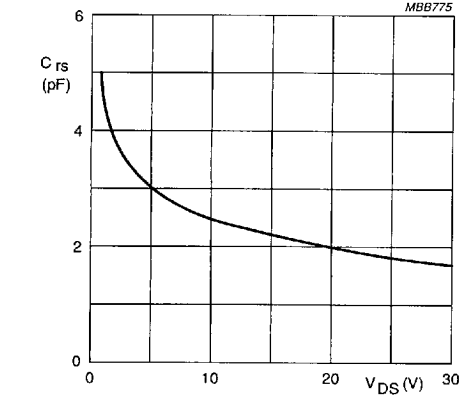
I_D = 0.3 A; V_{GS} = 10 V.

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values.



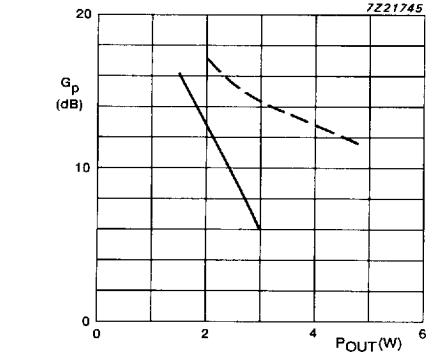
V_{GS} = 0; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values.



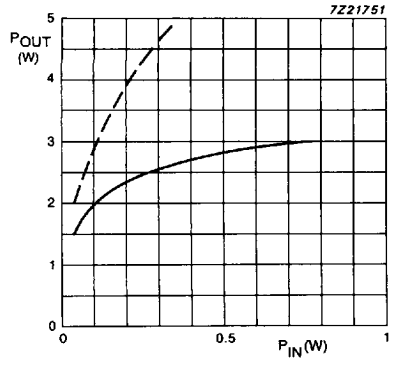
V_{GS} = 0; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values.



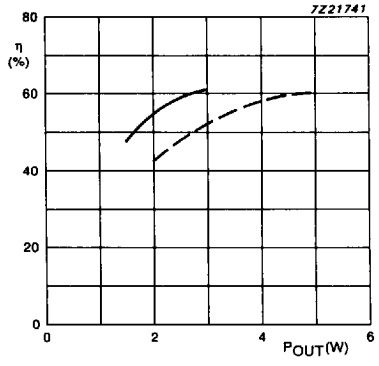
solid line: V_{DS} = 12.5 V.
dotted line: V_{DS} = 28 V.

Fig.9 Power gain as a function of load power, typical values.



solid line: V_{DS} = 12.5 V.
dotted line: V_{DS} = 28 V.

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



solid line: V_{DS} = 12.5 V; I_{DQ} = 100 mA; R_{GS} = 220 Ω.
dotted line: V_{DS} = 28 V; I_{DQ} = 10 mA; R_{GS} = 47 Ω.

Fig.11 Efficiency as a function of output power, typical values.

APPLICATION INFORMATION

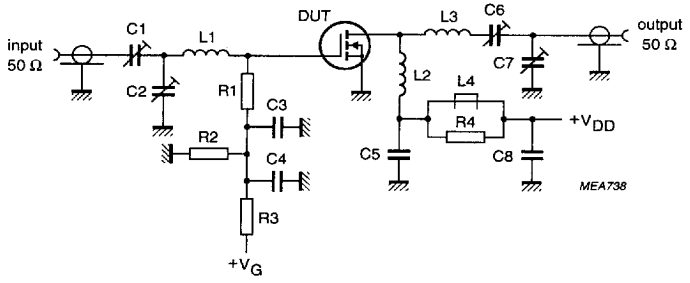
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W; unless otherwise specified.
RF performance in SSB operation in a common source circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)	R_{GS} (Ω)
CW class-AB	175	12.5	100	2	> 10 typ. 12.5	< 50 typ. 55	220
CW class-B	175	28	10	3	typ. 14	typ. 50	47

Ruggedness in class-B operation

The BLF241 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases under the following conditions:

V_{DS} = 28 V; f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 8.8 K/W at rated output power.



f = 175 MHz.

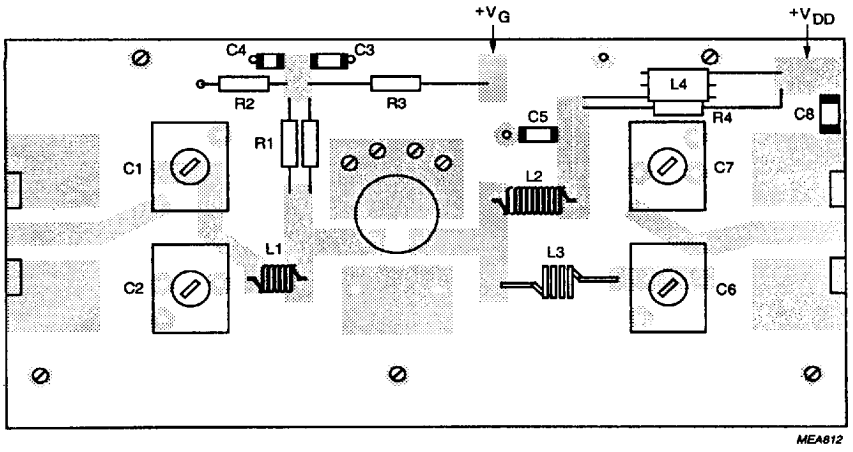
Fig.12 Test circuit.

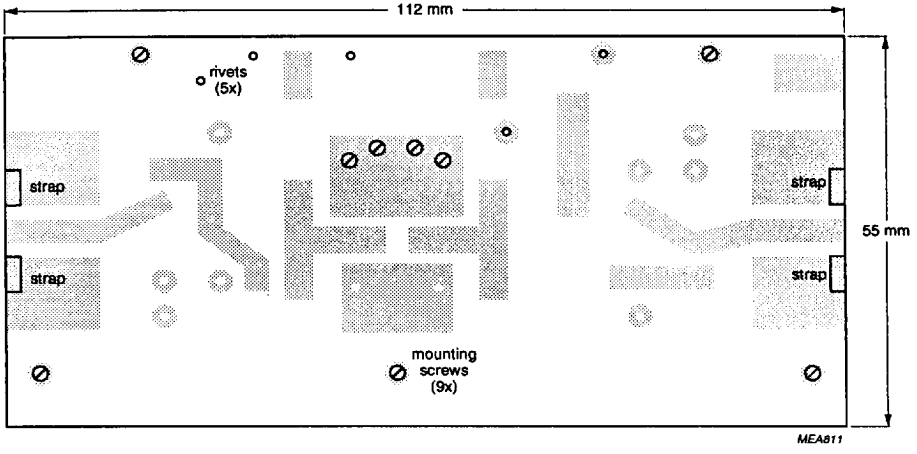
List of components

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C6	film dielectric trimmer	4 to 40 pF		2222 809 07008
C2, C7	film dielectric trimmer	2.5 to 20 pF		2222 809 07004
C3, C5	multilayer ceramic chip capacitor	1 nF		2222 581 13102
C4, C8	multilayer ceramic chip capacitor	100 nF		2222 852 47104
L1	6 turns enamelled 0.5 mm copper wire	64.7 nH	length 5.8 mm int. dia. 3 mm leads 2 x 5 mm	
L2	10 turns enamelled 0.5 mm copper wire	178 nH	length 7.4 mm int. dia. 3.5 mm leads 2 x 5 mm	
L3	4 turns enamelled 1 mm copper wire	56.9 nH	length 6.5 mm int. dia. 4.5 mm leads 2 x 5 mm	
L4	grade 3B Ferroxcube RF choke			4312 020 36640
R1	0.4 W metal film resistor	2 x 442 Ω in parallel		
R2	0.4 W metal film resistor	100 kΩ		
R3	0.4 W metal film resistor	1 kΩ		
R4	0.4 W metal film resistor	10 Ω		

Note

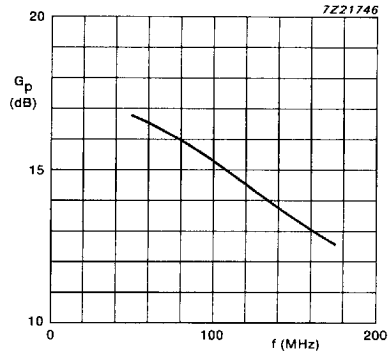
1. At V_{DS} = 28 V operation, L3 = 102.2 nH and R1 = 2 x 95.3 Ω in parallel.





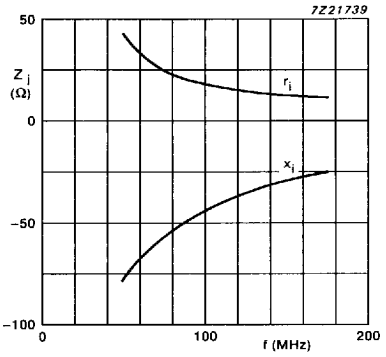
The other side of the board is fully metallized, to serve as a ground plane. Earth connections are made by means of copper foil straps and hollow rivets for a direct contact between upper and lower sheets. Heatsinking is achieved by pressing the transistor against an insulating thermal conductor (Al_2O_3-disc), which is attached to a track on the printed circuit board. This track is connected to the heatsink by means of four screws.

Fig.13 Component layout for 175 MHz test circuit.



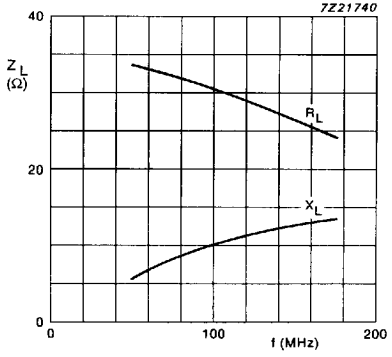
Class-AB operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; R_{GS} = 220 Ω.

Fig.14 Power gain as a function of frequency, typical values.



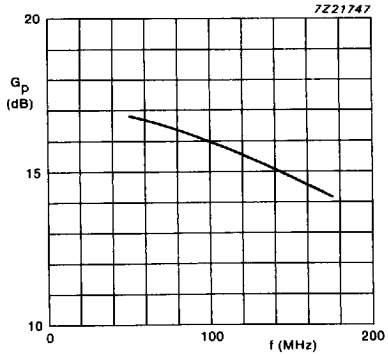
Class-AB operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; R_{GS} = 220 Ω.

Fig.15 Input impedance as a function of frequency (series components), typical values.



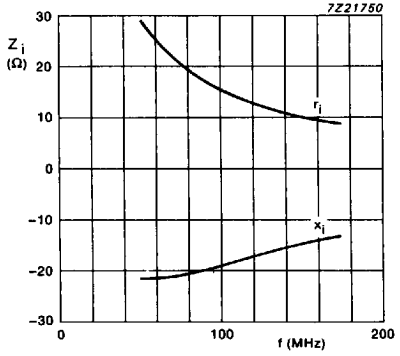
Class-AB operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; R_{GS} = 220 Ω.

Fig.16 Load impedance as a function of frequency (series components), typical values.



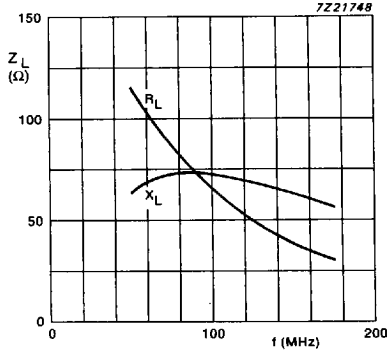
Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; R_{GS} = 47 Ω.

Fig.17 Power gain as a function of frequency, typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; R_{GS} = 47 Ω.

Fig.18 Input impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; R_{GS} = 47 Ω.

Fig.19 Load impedance as a function of frequency (series components), typical values.