# VHF power MOS transistor BLF245



## FEATURES

- High power gain
- Low noise figure
- Easy power control
- 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 4-lead SOT123 flange envelope, with a ceramic cap. All leads are isolated from the flange.

Matched gate-source voltage ($V_{GS}$) groups are available on request.

## PINNING - SOT123

| PIN | DESCRIPTION |
|---|---|
| 1 | drain |
| 2 | source |
| 3 | gate |
| 4 | source |

## PIN CONFIGURATION

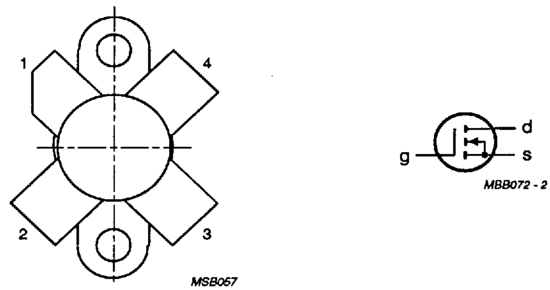



Fig.1 Simplified outline and symbol.

## 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 class-B test circuit.

| MODE OF OPERATION | f (MHz) | $V_{DS}$ (V) | $P_L$ (W) | $G_p$ (dB) | $\eta_D$ (%) |
|---|---|---|---|---|---|
| CW, class-B | 175 | 28 | 30 | > 13 | > 50 |

# VHF power MOS transistor BLF245



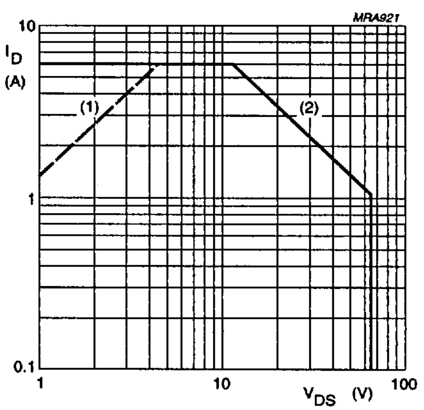
## LIMITING VALUES

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $V_{GS} = 0$ | – | 65 | V |
| $\pm V_{GS}$ | gate-source voltage | $V_{DS} = 0$ | – | 20 | V |
| $I_D$ | DC drain current | | – | 6 | 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 |

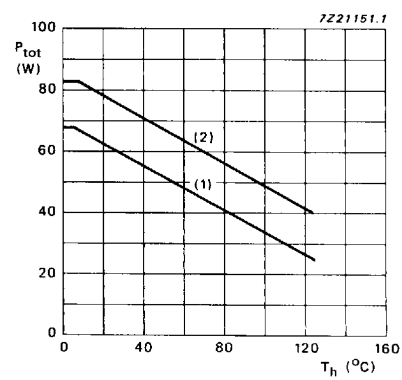
## THERMAL RESISTANCE

| SYMBOL | PARAMETER | CONDITIONS | THERMAL RESISTANCE |
|---|---|---|---|
| $R_{th\ j\text{-}mb}$ | thermal resistance from junction to mounting base | $T_{mb} = 25$ °C; $P_{tot} = 68$ W | 2.6 K/W |
| $R_{th\ mb\text{-}h}$ | thermal resistance from mounting base to heatsink | $T_{mb} = 25$ °C; $P_{tot} = 68$ W | 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.

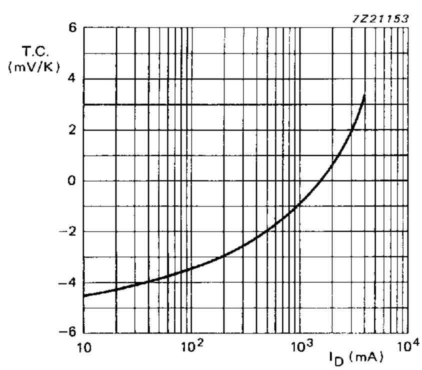
# VHF power MOS transistor BLF245



## CHARACTERISTICS

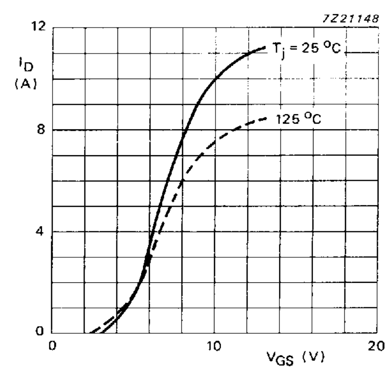
$T_j$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $V_{GS}$ = 0; $I_D$ = 10 mA | 65 | – | – | V |
| $I_{DSS}$ | drain-source leakage current | $V_{GS}$ = 0; $V_{DS}$ = 28 V | – | – | 2 | mA |
| $I_{GSS}$ | gate-source leakage current | $\pm V_{GS}$ = 20 V; $V_{DS}$ = 0 | – | – | 1 | µA |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D$ = 10 mA; $V_{DS}$ = 10 V | 2 | – | 4.5 | V |
| $\Delta V_{GS}$ | gate-source voltage difference of matched devices | $I_D$ = 10 mA; $V_{DS}$ = 10 V | – | – | 100 | mV |
| $g_{fs}$ | forward transconductance | $I_D$ = 1.5 A; $V_{DS}$ = 10 V | 1.2 | 1.9 | – | S |
| $R_{DS(on)}$ | drain-source on-state resistance | $I_D$ = 1.5 A; $V_{GS}$ = 10 V | – | 0.4 | 0.75 | Ω |
| $I_{DSX}$ | on-state drain current | $V_{GS}$ = 10 V; $V_{DS}$ = 10 V | – | 10 | – | A |
| $C_{is}$ | input capacitance | $V_{GS}$ = 0; $V_{DS}$ = 28 V; f = 1 MHz | – | 125 | – | pF |
| $C_{os}$ | output capacitance | $V_{GS}$ = 0; $V_{DS}$ = 28 V; f = 1 MHz | – | 75 | – | pF |
| $C_{rs}$ | feedback capacitance | $V_{GS}$ = 0; $V_{DS}$ = 28 V; f = 1 MHz | – | 7 | – | pF |
| F | noise figure (see Fig.14) | input and output power matched for: $I_D$ = 1 A; $V_{DS}$ = 28 V; $P_L$ = 30 W; R1 = 1 kΩ; $T_h$ = 25 °C; f = 175 MHz | – | 2 | – | dB |




$V_{DS}$ = 10 V; valid for $T_j$ = 25 to 125 °C.

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

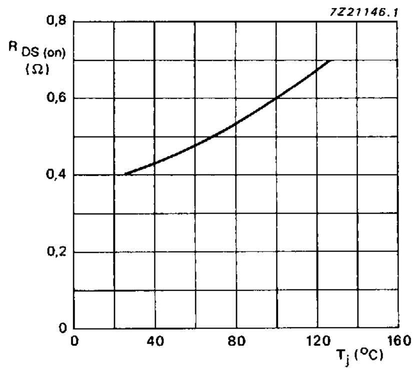



$V_{DS}$ = 10 V.

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

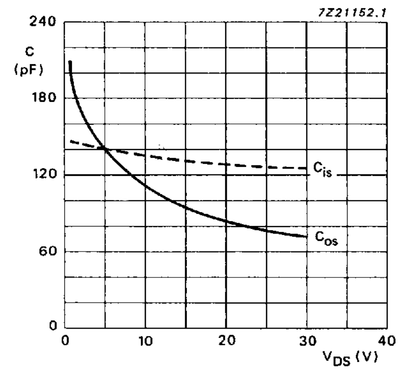
# VHF power MOS transistor BLF245





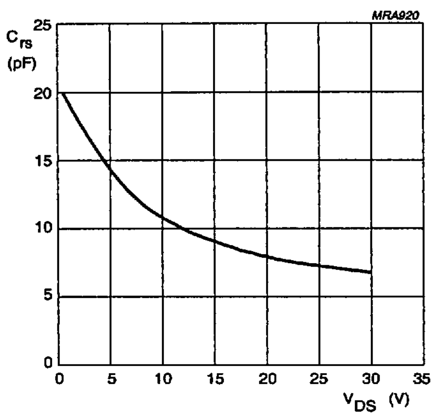

$V_{GS}$ = 10 V; $I_D$ = 1.5 A.

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.

# VHF power MOS transistor BLF245



## APPLICATION INFORMATION FOR CLASS-B OPERATION

$T_h$ = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; R1 = 1 kΩ.
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) | $\eta_D$ (%) | $Z_i$ (Ω) (note 1) | $Z_L$ (Ω) |
|---|---|---|---|---|---|---|---|---|
| CW, class-B | 175 | 28 | 50 | 30 | > 13<br>typ. 15.5 | < 50<br>typ. 67 | 2.0 − j2.7 | 3.9 + j4.4 |
| | 175 | 12.5 | 50 | 12 | typ. 12 | typ. 66 | 2.4 − j2.5 | 3.8 + j1.3 |

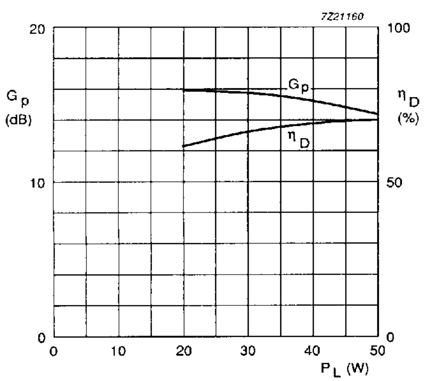
**Note**

1. R1 included.

### Ruggedness in class-B operation

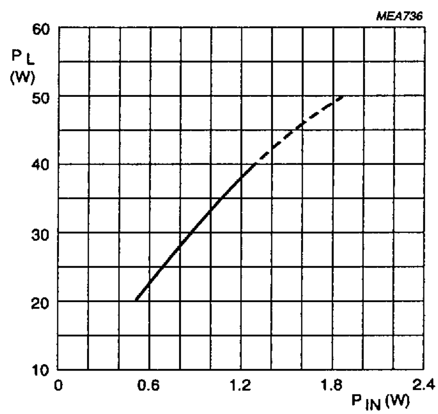
The BLF245 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases under the following conditions:

$T_h$ = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; at rated load power.



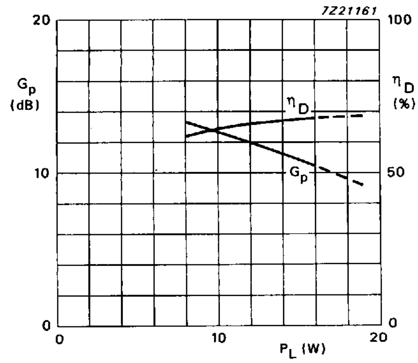

Class-B operation; $V_{DS}$ = 28 V; $I_{DQ}$ = 50 mA; f = 175 MHz; $T_h$ = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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



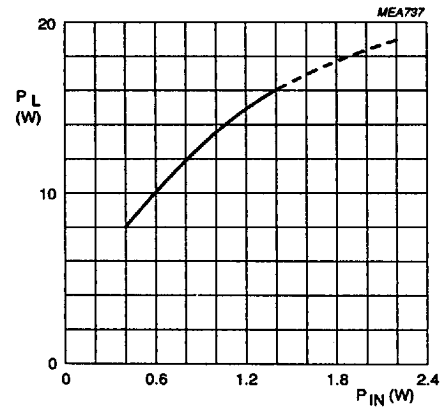

Class-B operation; $V_{DS}$ = 28 V; $I_{DQ}$ = 50 mA; f = 175 MHz; $T_h$ = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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



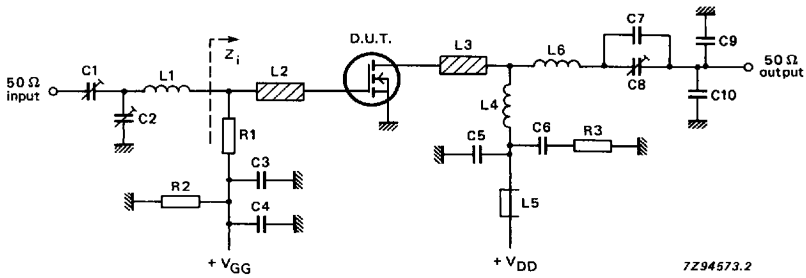

Class-B operation; $V_{DS}$ = 12.5 V; $I_{DQ}$ = 50 mA; f = 175 MHz; $T_h$ = 25 °C; $R_{th\ mb-h}$ = 0.3 K/W.

Fig.11 Power gain and efficiency as functions of load power, typical values.




Class-B operation; $V_{DS}$ = 12.5 V; $I_{DQ}$ = 50 mA; f = 175 MHz; $T_h$ = 25 °C; $R_{th\ mb-h}$ = 0.3 K/W.

Fig.12 Load power as a function of input power, typical values.




f = 175 MHz.

Fig.13 Test circuit for class-B operation.

# VHF power MOS transistor BLF245

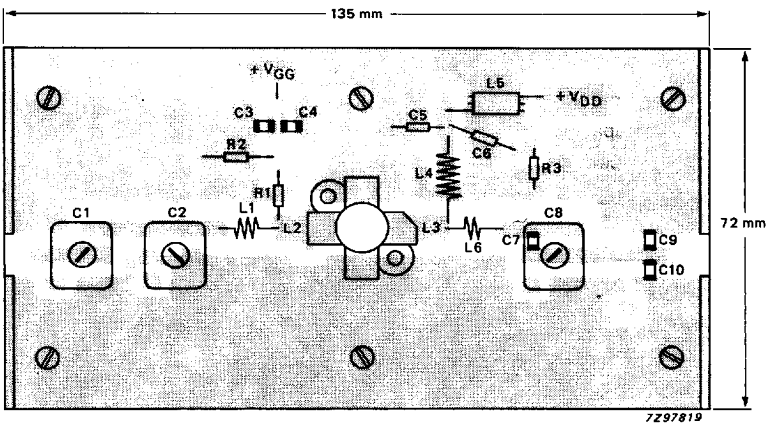


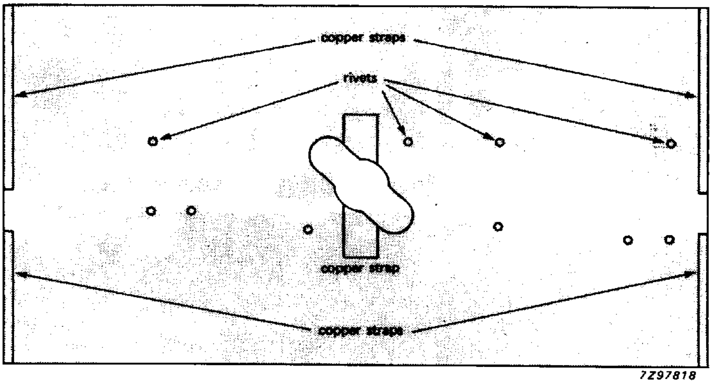
**List of components (class-B test circuit)**

| COMPONENT | DESCRIPTION | VALUE | DIMENSIONS | CATALOGUE NO. |
|---|---|---|---|---|
| C1 | film dielectric trimmer | 4 to 40 pF | | 2222 809 07008 |
| C2, C8 | film dielectric trimmer | 5 to 60 pF | | 2222 809 07011 |
| C3 | multilayer ceramic chip capacitor | 100 pF | | 2222 854 13101 |
| C4, C6 | multilayer ceramic chip capacitor | 100 nF | | 2222 852 47104 |
| C5 | ceramic capacitor | 100 pF | | 2222 680 10101 |
| C7 | multilayer ceramic chip capacitor (note 1) | 18 pF | | |
| C9 | multilayer ceramic chip capacitor (note 1) | 27 pF | | |
| C10 | multilayer ceramic chip capacitor (note 1) | 24 pF | | |
| L1 | 3 turns enamelled 0.5 mm copper wire | 13.5 nH | length 3.5 mm<br>int. dia. 2 mm<br>leads 2 x 2 mm | |
| L2, L3 | stripline (note 2) | 30 Ω | 10 x 6 mm | |
| L4 | 6 turns enamelled 1.5 mm copper wire | 98 nH | length 12.5 mm<br>int. dia. 5 mm<br>leads 2 x 2 mm | |
| L5 | grade 3B Ferroxcube RF choke | | | 4312 020 36640 |
| L6 | 2 turns enamelled 1.5 mm copper wire | 24.5 nH | length 4 mm<br>int. dia. 5 mm<br>leads 2 x 2 mm | |
| R1 | metal film resistor | 1 kΩ | | |
| R2 | metal film resistor | 1 MΩ | | |
| R3 | metal film resistor | 10 Ω | | |

**Notes**

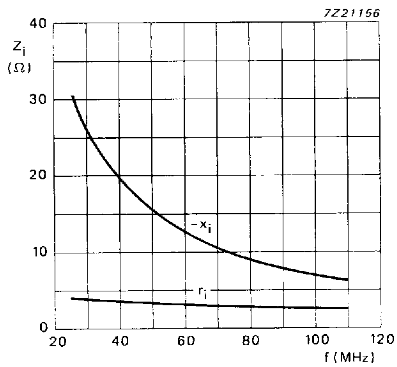
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are mounted on a double copper-clad PCB with epoxy fibre-glass dielectric ($\epsilon_r = 4.5$), thickness 1/16 inch.



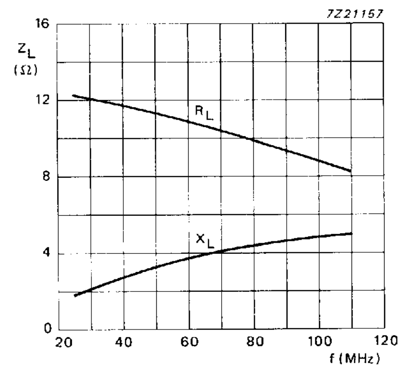

The circuit and components are situated on one side of the epoxy fibre-glass board; the other side is unetched copper and serves as an earth. Earth connections are made by means of fixing screws, hollow rivets and copper straps under the sources and around the edges, to provide a direct contact between the copper on the component side and the ground plane.

Fig.14 Component layout for 175 MHz class-B test circuit.




Class-B operation; $V_{DS}$ = 28 V; $I_{DQ}$ = 50 mA;
$P_L$ = 30 W; $T_h$ = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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




Class-B operation; $V_{DS}$ = 28 V; $I_{DQ}$ = 50 mA;
$P_L$ = 30 W; $T_h$ = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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

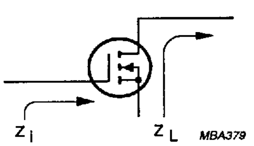
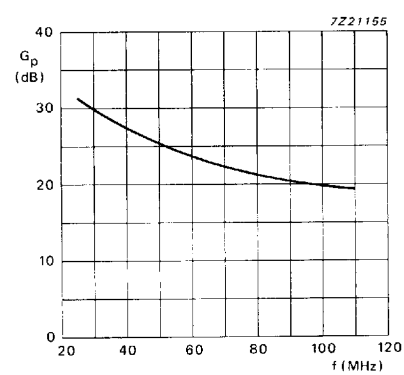



Fig.17 Definition of MOS impedance.




Class-B operation; $V_{DS}$ = 28 V; $I_{DQ}$ = 50 mA;
$P_L$ = 30 W; $T_h$ = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

Fig.18 Power gain as a function of frequency, typical values.