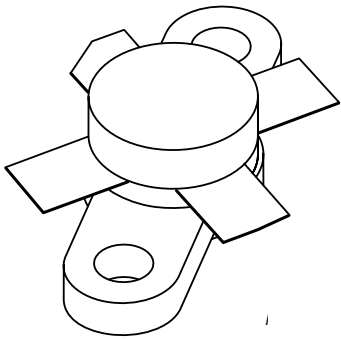


DATA SHEET



BLF245 VHF power MOS transistor

Product specification
Supersedes data of 1997 Dec 17

2003 Sep 02

VHF power MOS transistor

BLF245

FEATURES

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

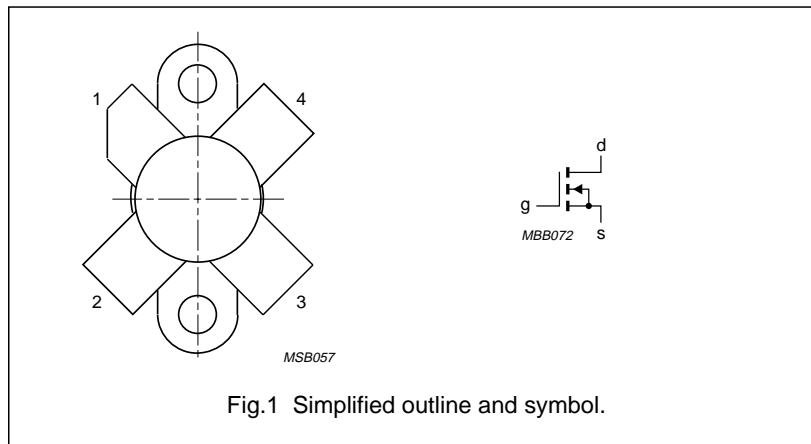
DESCRIPTION

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 SOT123A flange package, with a ceramic cap. All leads are isolated from the flange.

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

PIN CONFIGURATION



CAUTION

This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling. For further information, refer to Philips specs.: SNW-EQ-608, SNW-FQ-302A, and SNW-FQ-302B.

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.

PINNING - SOT123A

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

QUICK REFERENCE DATA

RF performance at $T_h = 25^\circ\text{C}$ in a class-B test circuit.

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

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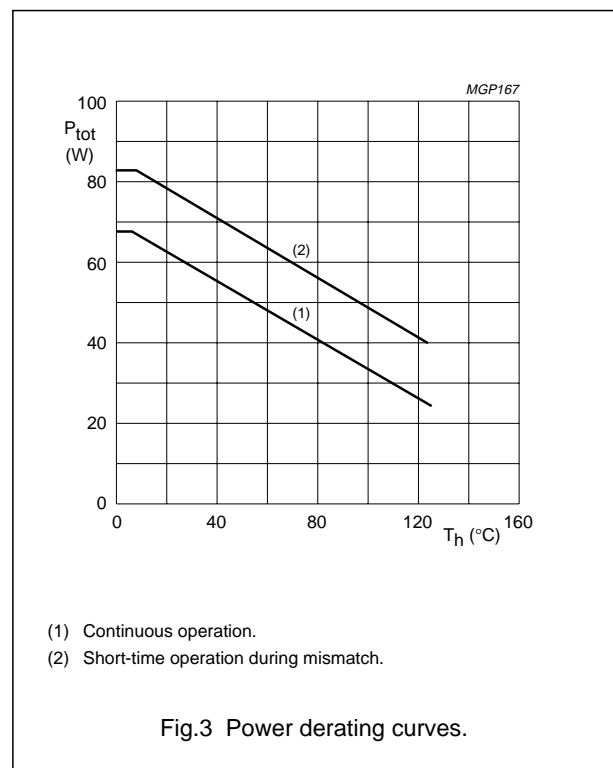
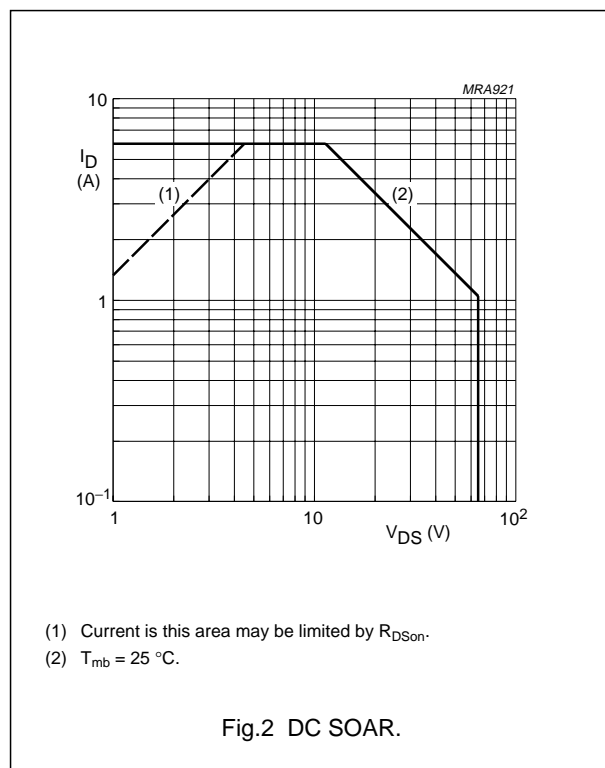
LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 60134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|-----------|-------------------------|----------------------------|------|----------|------|
| V_{DS} | drain-source voltage | $V_{GS} = 0$ | – | 65 | V |
| V_{GS} | gate-source voltage | $V_{DS} = 0$ | – | ± 20 | V |
| I_D | drain current (DC) | | – | 6 | A |
| P_{tot} | total power dissipation | $T_{mb} \leq 25\text{ °C}$ | – | 68 | W |
| T_{stg} | storage temperature | | –65 | 150 | °C |
| T_j | junction temperature | | – | 200 | °C |

THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|----------------|---|---|-------|------|
| $R_{th\ j-mb}$ | thermal resistance from junction to mounting base | $T_{mb} = 25\text{ °C}$; $P_{tot} = 68\text{ W}$ | 2.6 | K/W |
| $R_{th\ mb-h}$ | thermal resistance from mounting base to heatsink | $T_{mb} = 25\text{ °C}$; $P_{tot} = 68\text{ W}$ | 0.3 | K/W |



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CHARACTERISTICS

$T_j = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

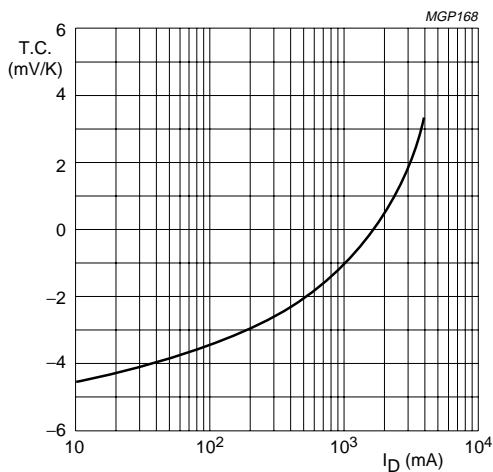
| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-----------------|---|--|------|------|------|---------------|
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $V_{GS} = 0$; $I_D = 10\text{ mA}$ | 65 | – | – | V |
| I_{DSS} | drain-source leakage current | $V_{GS} = 0$; $V_{DS} = 28\text{ V}$ | – | – | 2 | mA |
| I_{GSS} | gate-source leakage current | $V_{GS} = \pm 20\text{ V}$; $V_{DS} = 0$ | – | – | 1 | μA |
| V_{GSth} | gate-source threshold voltage | $I_D = 10\text{ mA}$; $V_{DS} = 10\text{ V}$ | 2 | – | 4.5 | V |
| ΔV_{GS} | gate-source voltage difference of matched devices | $I_D = 0\text{ mA}$; $V_{DS} = 10\text{ V}$ | – | – | 100 | mV |
| g_{fs} | forward transconductance | $I_D = 1.5\text{ A}$; $V_{DS} = 10\text{ V}$ | 1.2 | 1.9 | – | S |
| R_{DSon} | drain-source on-state resistance | $I_D = 1.5\text{ A}$; $V_{GS} = 10\text{ V}$ | – | 0.4 | 0.75 | Ω |
| I_{DSX} | on-state drain current | $V_{GS} = 10\text{ V}$; $V_{DS} = 10\text{ V}$ | – | 10 | – | A |
| C_{is} | input capacitance | $V_{GS} = 0$; $V_{DS} = 28\text{ V}$; $f = 1\text{ MHz}$ | – | 125 | – | pF |
| C_{os} | output capacitance | $V_{GS} = 0$; $V_{DS} = 28\text{ V}$; $f = 1\text{ MHz}$ | – | 75 | – | pF |
| C_{rs} | feedback capacitance | $V_{GS} = 0$; $V_{DS} = 28\text{ V}$; $f = 1\text{ MHz}$ | – | 7 | – | pF |
| F | noise figure | input and output power matched for: $I_D = 1\text{ A}$; $V_{DS} = 28\text{ V}$; $P_L = 30\text{ W}$; $R_1 = 1\text{ k}\Omega$; $T_h = 25\text{ }^{\circ}\text{C}$; $f = 175\text{ MHz}$; see Fig.14 | – | 2 | – | dB |

 V_{GS} group indicator

| GROUP | LIMITS (V) | | GROUP | LIMITS (V) | |
|-------|------------|------|-------|------------|------|
| | MIN. | MAX. | | MIN. | MAX. |
| A | 2.0 | 2.1 | O | 3.3 | 3.4 |
| B | 2.1 | 2.2 | P | 3.4 | 3.5 |
| C | 2.2 | 2.3 | Q | 3.5 | 3.6 |
| D | 2.3 | 2.4 | R | 3.6 | 3.7 |
| E | 2.4 | 2.5 | S | 3.7 | 3.8 |
| F | 2.5 | 2.6 | T | 3.8 | 3.9 |
| G | 2.6 | 2.7 | U | 3.9 | 4.0 |
| H | 2.7 | 2.8 | V | 4.0 | 4.1 |
| J | 2.8 | 2.9 | W | 4.1 | 4.2 |
| K | 2.9 | 3.0 | X | 4.2 | 4.3 |
| L | 3.0 | 3.1 | Y | 4.3 | 4.4 |
| M | 3.1 | 3.2 | Z | 4.4 | 4.5 |
| N | 3.2 | 3.3 | | | |

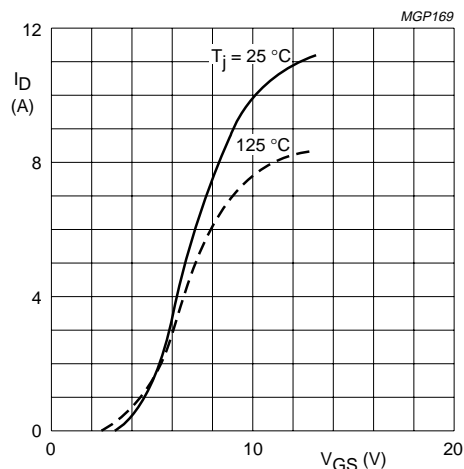
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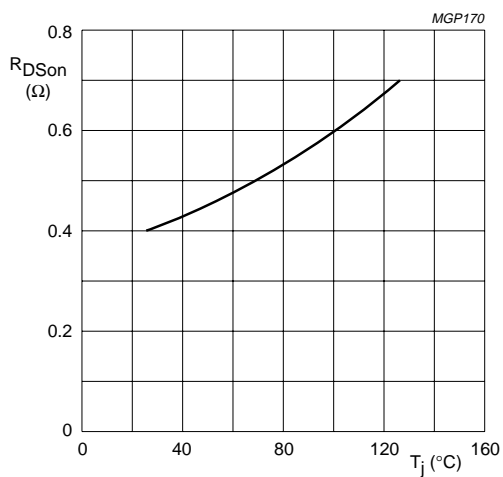
$V_{DS} = 10 \text{ V}$; valid for $T_j = 25$ to $125 \text{ }^\circ\text{C}$.

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



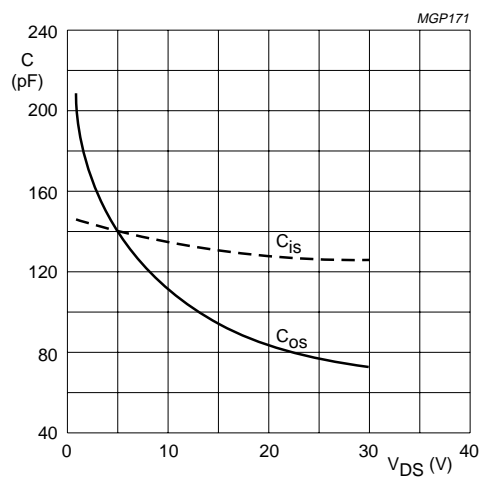
$V_{DS} = 10 \text{ V}$.

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



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

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

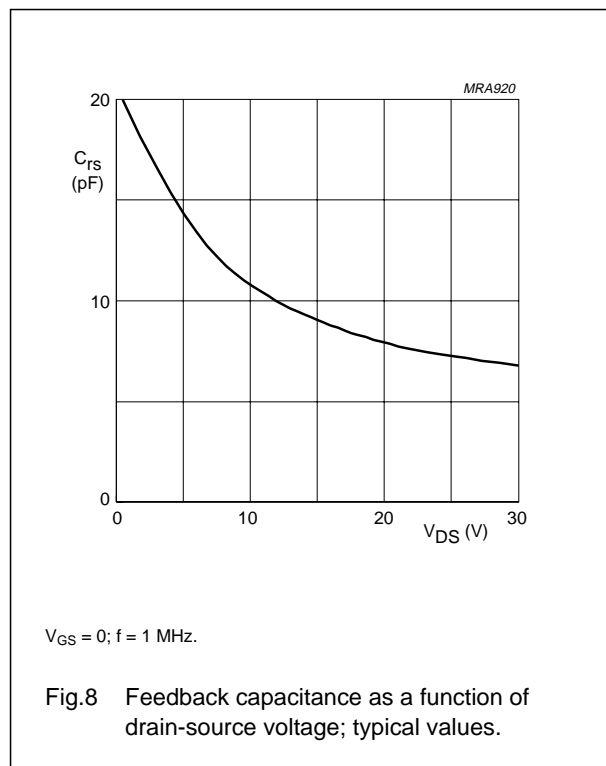


$V_{GS} = 0$; $f = 1 \text{ MHz}$.

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

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APPLICATION INFORMATION FOR CLASS-B OPERATION

$T_h = 25\text{ }^{\circ}\text{C}$; $R_{th\text{ mb-h}} = 0.3\text{ K/W}$; $R1 = 1\text{ k}\Omega$.

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_D (%) | Z_i (Ω) ⁽¹⁾ | Z_L (Ω) |
|-------------------|------------|-----------------|------------------|--------------|------------------|-----------------|--------------------------------------|-----------------------|
| CW, class-B | 175 | 28 | 50 | 30 | >13 typ. 15.5 | < 50 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

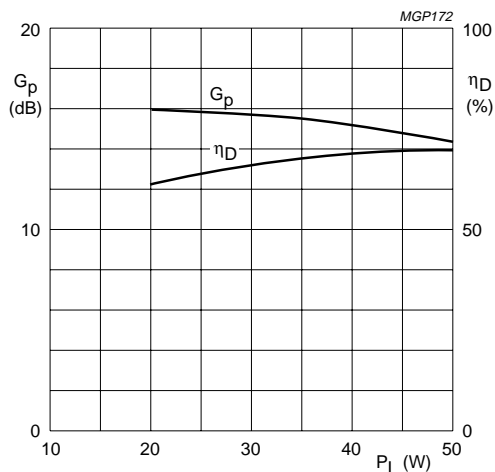
1. R1 included.

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

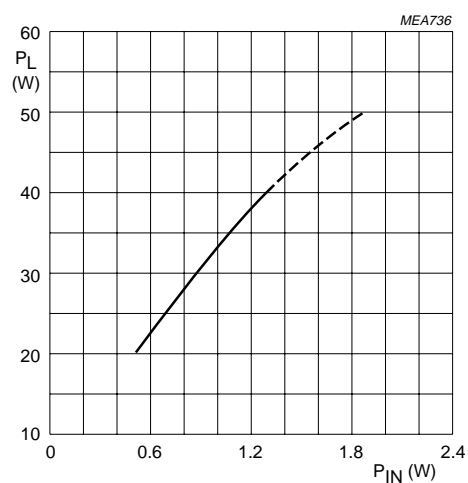
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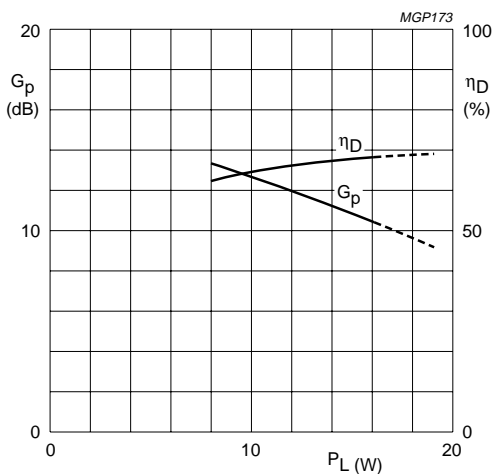
Class-B operation; $V_{DS} = 28$ V; $I_{DQ} = 50$ mA;
 $f = 175$ MHz; $T_h = 25$ °C; $R_{th\ mb-h} = 0.3$ K/W.

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



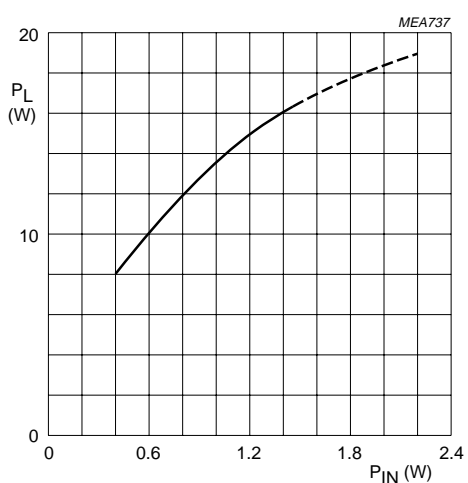
Class-B operation; $V_{DS} = 28$ V; $I_{DQ} = 50$ mA;
 $f = 175$ MHz; $T_h = 25$ °C; $R_{th\ mb-h} = 0.3$ K/W.

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.

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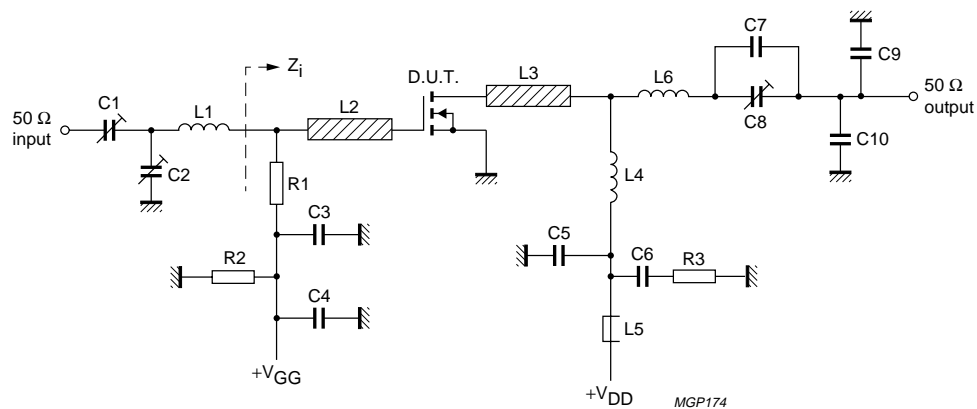
 $f = 175 \text{ MHz.}$

Fig.13 Test circuit for class-B operation.

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List of components class-B test circuit (see Fig.14)

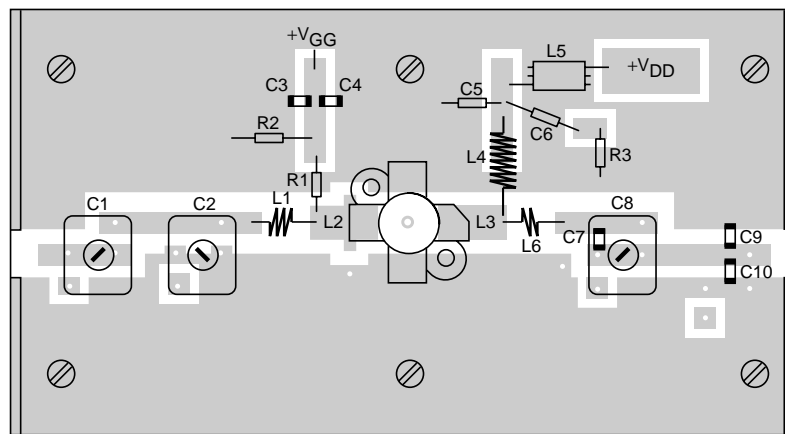
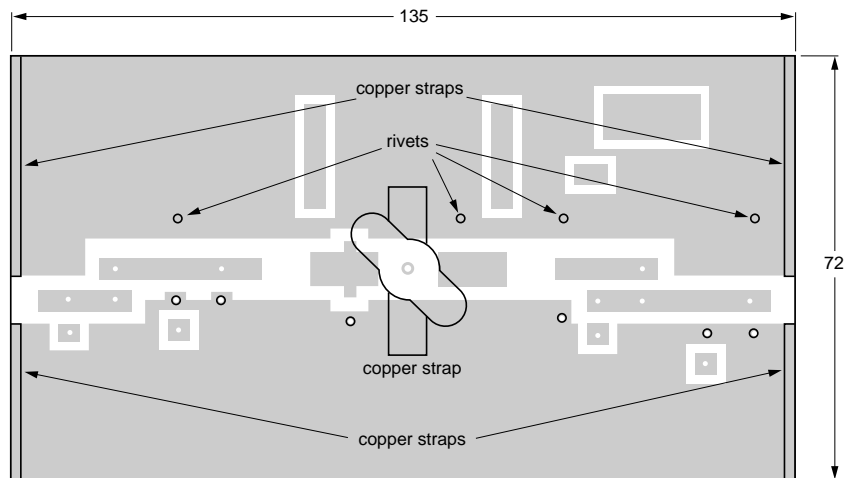
| COMPONENT | DESCRIPTION | VALUE | DIMENSIONS | CATALOGUE NO. |
|-----------|---|------------|--|----------------|
| C1 | film dielectric trimmer | 4 to 40 pF | | 2222 809 07008 |
| C2, C8 | film dielectric trimmer | 5 to 60 pF | | 2222 809 07011 |
| C3 | multilayer ceramic chip capacitor | 100 pF | | 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 int. dia. 2 mm leads 2 × 2 mm | |
| L2, L3 | stripline; note 2 | 30 Ω | 10 × 6 mm | |
| L4 | 6 turns enamelled 1.5 mm copper wire | 98 nH | length 12.5 mm int. dia. 5 mm leads 2 × 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 int. dia. 5 mm leads 2 × 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 $\frac{1}{16}$ inch.

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MGP175

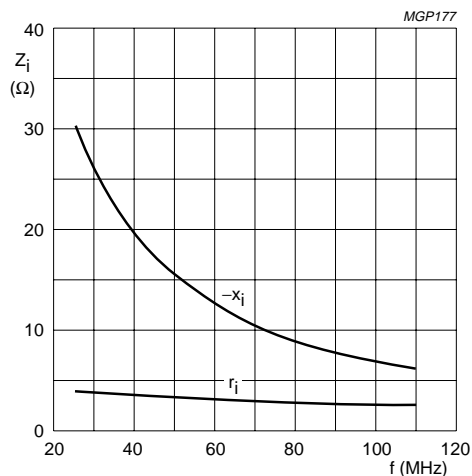
Dimensions in mm.

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.

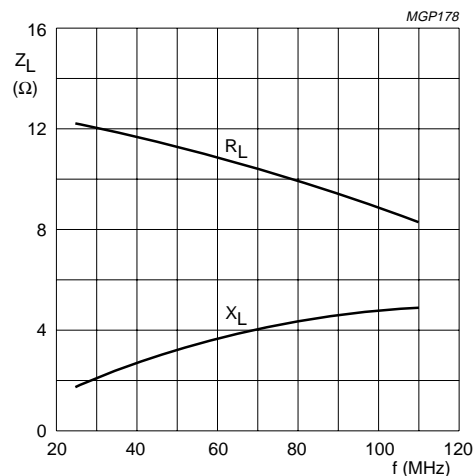
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Class-B operation; $V_{DS} = 28$ V; $I_{DQ} = 50$ mA;
 $P_L = 30$ W; $T_h = 25$ °C; $R_{th\ mb-h} = 0.3$ K/W.

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; $R_{th\ mb-h} = 0.3$ K/W.

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

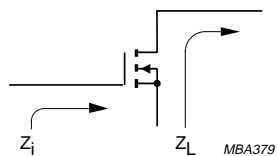
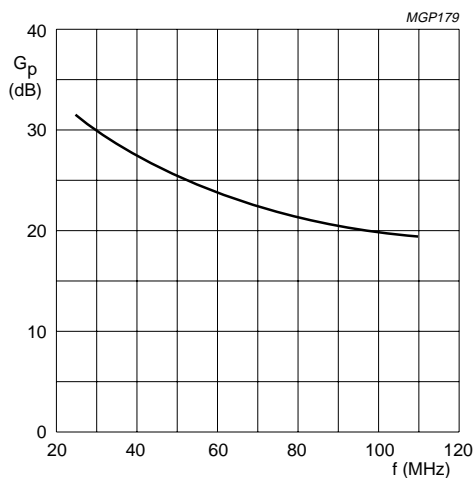


Fig.17 Definition of MOS impedance.



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

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

VHF power MOS transistor

BLF245

BLF245 scattering parameters $V_{DS} = 12.5\text{ V}$; $I_D = 50\text{ mA}$; note 1

| f (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|---------|-----------------|--------|-----------------|-------|-----------------|-------|-----------------|--------|
| | S ₁₁ | ∠ Φ | S ₂₁ | ∠ Φ | S ₁₂ | ∠ Φ | S ₂₂ | ∠ Φ |
| 5 | 0.91 | -48.3 | 25.72 | 147.1 | 0.03 | 57.9 | 0.92 | -47.8 |
| 10 | 0.80 | -81.4 | 19.43 | 125.8 | 0.05 | 36.8 | 0.81 | -81.3 |
| 20 | 0.71 | -116.7 | 11.79 | 102.4 | 0.06 | 15.0 | 0.71 | -115.5 |
| 30 | 0.68 | -132.3 | 8.04 | 89.7 | 0.06 | 3.3 | 0.69 | -131.1 |
| 40 | 0.69 | -140.3 | 5.97 | 80.8 | 0.06 | -4.4 | 0.69 | -139.0 |
| 50 | 0.71 | -145.2 | 4.67 | 73.6 | 0.06 | -10.2 | 0.71 | -143.8 |
| 60 | 0.73 | -148.6 | 3.76 | 67.5 | 0.05 | -14.8 | 0.73 | -147.2 |
| 70 | 0.75 | -151.1 | 3.10 | 62.4 | 0.05 | -18.4 | 0.75 | -149.9 |
| 80 | 0.77 | -153.1 | 2.61 | 57.9 | 0.05 | -21.3 | 0.77 | -152.1 |
| 90 | 0.79 | -155.1 | 2.24 | 53.7 | 0.04 | -23.8 | 0.79 | -154.2 |
| 100 | 0.81 | -157.3 | 1.94 | 49.8 | 0.04 | -25.9 | 0.81 | -156.1 |
| 125 | 0.84 | -161.9 | 1.39 | 41.2 | 0.03 | -28.0 | 0.85 | -160.1 |
| 150 | 0.87 | -165.0 | 1.04 | 35.4 | 0.02 | -23.3 | 0.88 | -163.4 |
| 175 | 0.91 | -167.9 | 0.81 | 30.8 | 0.01 | -8.4 | 0.91 | -166.3 |
| 200 | 0.92 | -171.0 | 0.65 | 26.6 | 0.01 | 22.4 | 0.92 | -168.9 |
| 250 | 0.94 | -175.5 | 0.44 | 21.6 | 0.02 | 72.1 | 0.95 | -173.3 |
| 300 | 0.95 | -179.8 | 0.32 | 19.2 | 0.03 | 83.0 | 0.96 | -176.8 |
| 350 | 0.96 | 176.9 | 0.24 | 19.7 | 0.04 | 86.1 | 0.97 | -179.8 |
| 400 | 0.96 | 173.5 | 0.19 | 22.1 | 0.05 | 86.1 | 0.97 | 177.5 |
| 450 | 0.97 | 170.6 | 0.16 | 26.1 | 0.06 | 86.2 | 0.97 | 174.9 |
| 500 | 0.97 | 167.8 | 0.14 | 31.6 | 0.08 | 84.7 | 0.98 | 172.6 |
| 600 | 0.96 | 162.4 | 0.13 | 43.5 | 0.10 | 82.6 | 0.98 | 168.4 |
| 700 | 0.96 | 157.2 | 0.13 | 52.9 | 0.12 | 80.0 | 0.97 | 164.4 |
| 800 | 0.94 | 152.4 | 0.14 | 58.9 | 0.13 | 77.9 | 0.97 | 160.6 |
| 900 | 0.95 | 147.8 | 0.16 | 63.1 | 0.15 | 74.4 | 0.95 | 157.1 |
| 1000 | 0.95 | 142.7 | 0.18 | 68.2 | 1.70 | 40.5 | 3.52 | 46.0 |

Note

- For more extensive s-parameters see internet:
<http://www.semiconductors.philips.com/markets/communications/wirelesscommunication/broadcast>

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BLF245 scattering parameters $V_{DS} = 28\text{ V}$; $I_D = 50\text{ mA}$; note 1

| f (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|---------|-----------------|--------|-----------------|-------|-----------------|-------|-----------------|--------|
| | S ₁₁ | ∠ Φ | S ₂₁ | ∠ Φ | S ₁₂ | ∠ Φ | S ₂₂ | ∠ Φ |
| 5 | 0.95 | -40.5 | 27.84 | 152.9 | 0.02 | 63.8 | 0.93 | -35.8 |
| 10 | 0.86 | -71.3 | 22.60 | 133.3 | 0.04 | 44.4 | 0.83 | -64.1 |
| 20 | 0.77 | -108.6 | 14.77 | 109.1 | 0.05 | 21.7 | 0.69 | -97.8 |
| 30 | 0.73 | -126.8 | 10.37 | 95.5 | 0.05 | 9.1 | 0.65 | -115.5 |
| 40 | 0.73 | -136.8 | 7.81 | 86.2 | 0.05 | 1.0 | 0.64 | -125.2 |
| 50 | 0.74 | -142.9 | 6.17 | 78.8 | 0.05 | -5.0 | 0.65 | -131.3 |
| 60 | 0.75 | -147.1 | 5.01 | 72.7 | 0.05 | -9.6 | 0.67 | -135.7 |
| 70 | 0.76 | -150.0 | 4.17 | 67.5 | 0.05 | -13.3 | 0.69 | -139.1 |
| 80 | 0.78 | -152.3 | 3.54 | 63.0 | 0.04 | -16.3 | 0.72 | -142.0 |
| 90 | 0.80 | -154.5 | 3.06 | 58.8 | 0.04 | -18.8 | 0.74 | -144.6 |
| 100 | 0.81 | -156.8 | 2.66 | 54.7 | 0.04 | -20.9 | 0.76 | -146.9 |
| 125 | 0.84 | -161.5 | 1.93 | 46.0 | 0.03 | -23.2 | 0.81 | -152.0 |
| 150 | 0.87 | -164.5 | 1.46 | 39.8 | 0.02 | -18.9 | 0.84 | -156.1 |
| 175 | 0.90 | -167.4 | 1.15 | 34.7 | 0.01 | -5.0 | 0.87 | -159.7 |
| 200 | 0.91 | -170.5 | 0.93 | 30.1 | 0.01 | 23.3 | 0.89 | -162.9 |
| 250 | 0.93 | -175.0 | 0.63 | 23.9 | 0.02 | 72.9 | 0.93 | -168.1 |
| 300 | 0.95 | -179.3 | 0.46 | 20.1 | 0.03 | 84.5 | 0.94 | -172.4 |
| 350 | 0.96 | 177.3 | 0.35 | 18.8 | 0.04 | 87.7 | 0.96 | -175.9 |
| 400 | 0.96 | 173.9 | 0.27 | 19.1 | 0.05 | 87.6 | 0.96 | -179.1 |
| 450 | 0.97 | 171.0 | 0.22 | 20.9 | 0.06 | 87.6 | 0.97 | 178.1 |
| 500 | 0.96 | 168.1 | 0.19 | 24.2 | 0.07 | 86.0 | 0.97 | 175.5 |
| 600 | 0.96 | 162.7 | 0.16 | 34.0 | 0.10 | 83.7 | 0.97 | 170.8 |
| 700 | 0.96 | 157.5 | 0.15 | 43.8 | 0.11 | 81.1 | 0.97 | 166.5 |
| 800 | 0.94 | 152.4 | 0.15 | 51.6 | 0.13 | 78.8 | 0.97 | 162.5 |
| 900 | 0.95 | 148.1 | 0.16 | 57.8 | 0.15 | 75.2 | 0.95 | 158.8 |
| 1000 | 0.95 | 142.9 | 0.18 | 64.3 | 1.92 | 53.7 | 4.01 | 59.9 |

Note

- For more extensive s-parameters see internet:
<http://www.semiconductors.philips.co/.markets/communications/wirelesscommunication/broadcast>

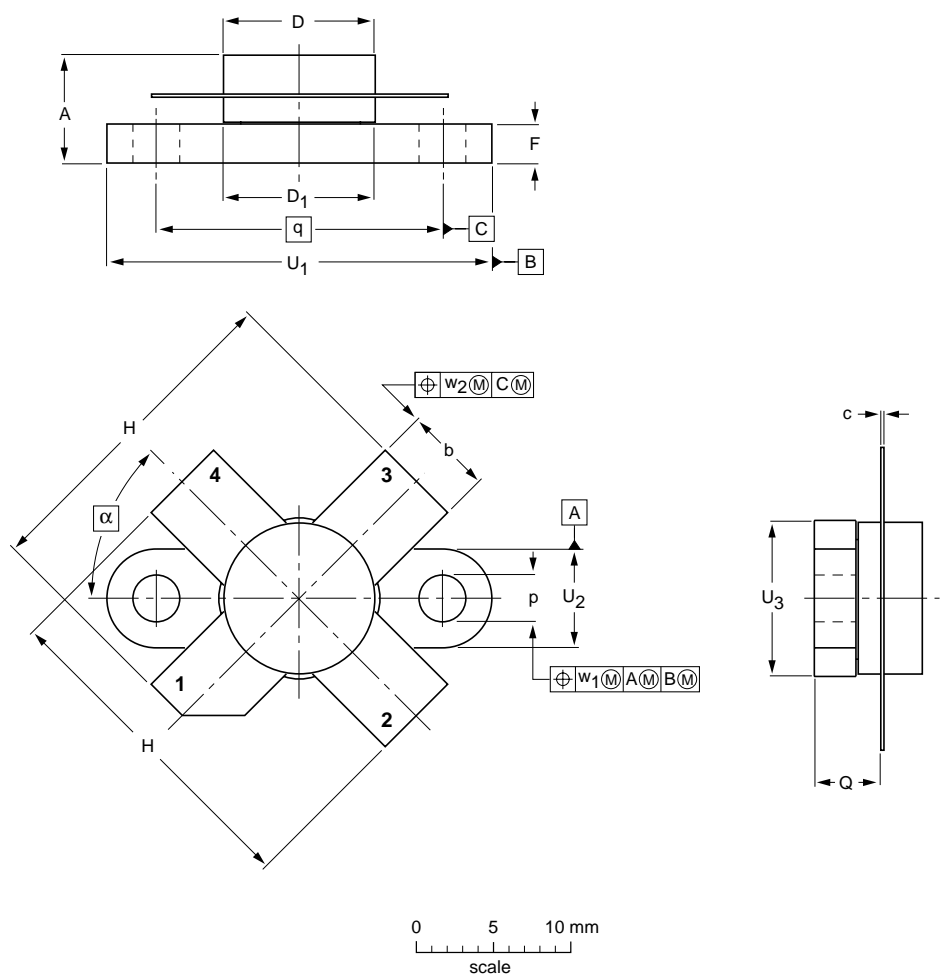
VHF power MOS transistor

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PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 4 leads

SOT123A



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

| UNIT | A | b | c | D | D ₁ | F | H | p | Q | q | U ₁ | U ₂ | U ₃ | w ₁ | w ₂ | α |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|----------------|-----|
| mm | 7.47 6.37 | 5.82 5.56 | 0.18 0.10 | 9.73 9.47 | 9.78 9.42 | 2.72 2.31 | 20.71 19.93 | 3.33 3.04 | 4.63 4.11 | 18.42 | 24.87 24.64 | 6.48 6.22 | 9.78 9.39 | 0.25 | 0.51 | 45° |
| inches | 0.294 0.251 | 0.229 0.219 | 0.007 0.004 | 0.383 0.373 | 0.385 0.371 | 0.107 0.091 | 0.815 0.785 | 0.131 0.120 | 0.182 0.162 | 0.725 | 0.980 0.970 | 0.255 0.245 | 0.385 0.370 | 0.010 | 0.020 | |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|--------------------|------------|-------|------|--|------------------------|------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT123A | | | | | | 99-03-29 |

VHF power MOS transistor

BLF245

DATA SHEET STATUS

| LEVEL | DATA SHEET STATUS ⁽¹⁾ | PRODUCT STATUS ⁽²⁾⁽³⁾ | DEFINITION |
|-------|----------------------------------|----------------------------------|--|
| I | Objective data | Development | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice. |
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