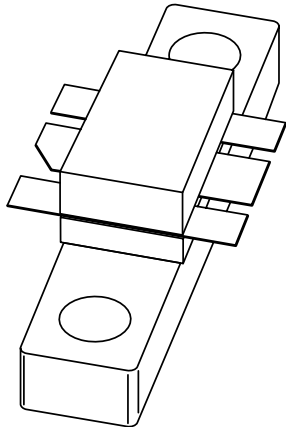


DATA SHEET



BLF544 UHF power MOS transistor

Product specification
Supersedes data of 1998 Jan 21

2003 Sep 18

UHF power MOS transistor

BLF544

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability
- Designed for broadband operation.

APPLICATIONS

- Communication transmitters in the UHF frequency range.

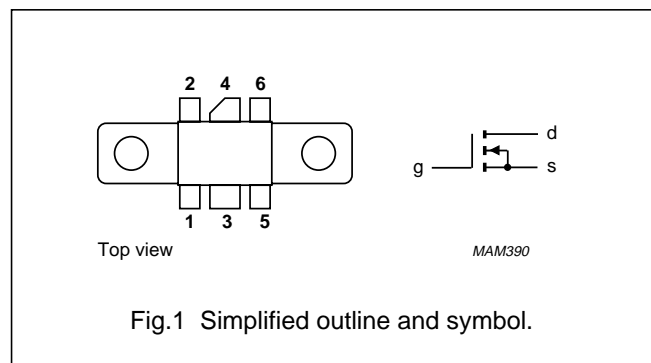
DESCRIPTION

N-channel enhancement mode vertical D-MOS power transistor encapsulated in a 6-lead, SOT171A flange package 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.

PINNING - SOT171A

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



QUICK REFERENCE DATA

RF performance at $T_h = 25\text{ °C}$ in a common source class-B circuit.

| MODE OF OPERATION | f (MHz) | V_{DS} (V) | P_L (W) | G_p (dB) | η_D (%) |
|-------------------|---------|--------------|-----------|------------|--------------|
| CW, class-B | 500 | 28 | 20 | >11 | >50 |
| CW, class-B | 960 | 28 | 20 | typ. 7 | typ. 50 |

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.

UHF power MOS transistor

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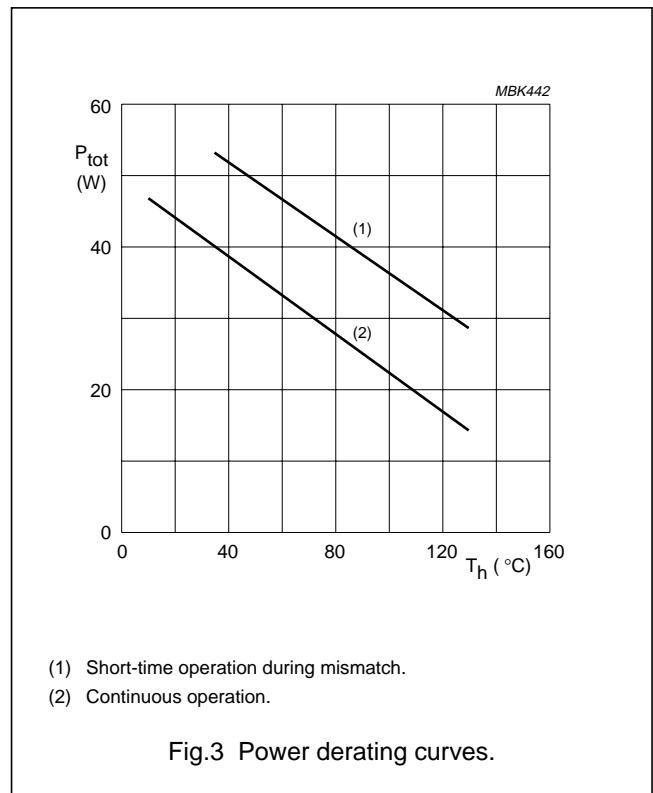
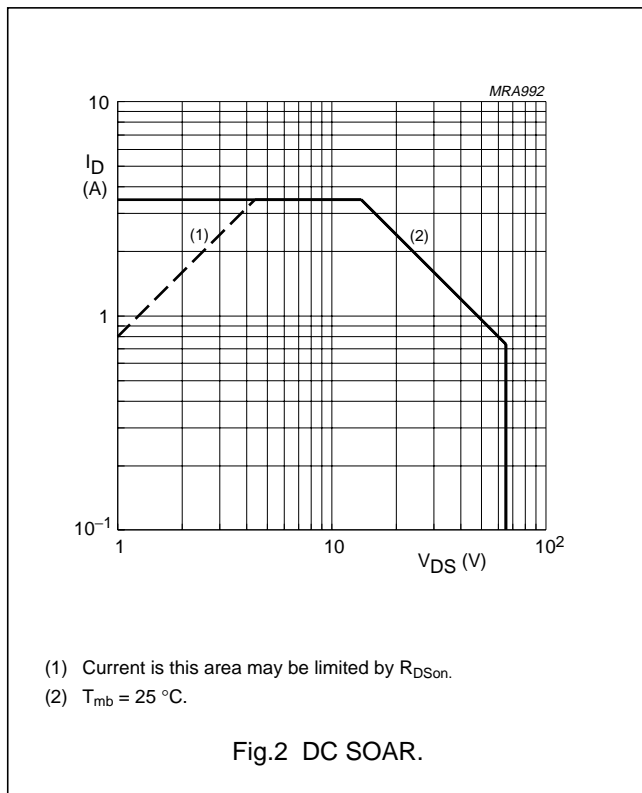
LIMITING VALUES

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|-----------|-------------------------|--|------|----------|------------------|
| V_{DS} | drain-source voltage | | – | 65 | V |
| V_{GS} | gate-source voltage | | – | ± 20 | V |
| I_D | drain current (DC) | | – | 3.5 | A |
| P_{tot} | total power dissipation | $T_{mb} \leq 25\text{ }^\circ\text{C}$ | – | 48 | W |
| T_{stg} | storage temperature | | –65 | +150 | $^\circ\text{C}$ |
| T_j | junction temperature | | – | 200 | $^\circ\text{C}$ |

THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | VALUE | UNIT |
|----------------|---|-------|------|
| $R_{th\ j-mb}$ | thermal resistance from junction to mounting base | 3.7 | K/W |
| $R_{th\ mb-h}$ | thermal resistance from mounting base to heatsink | 0.4 | K/W |



UHF power MOS transistor

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

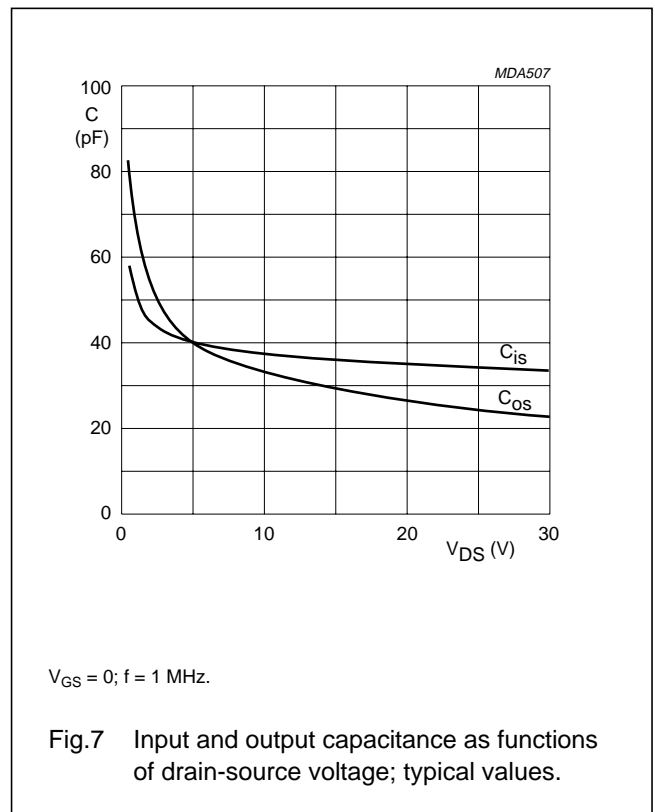
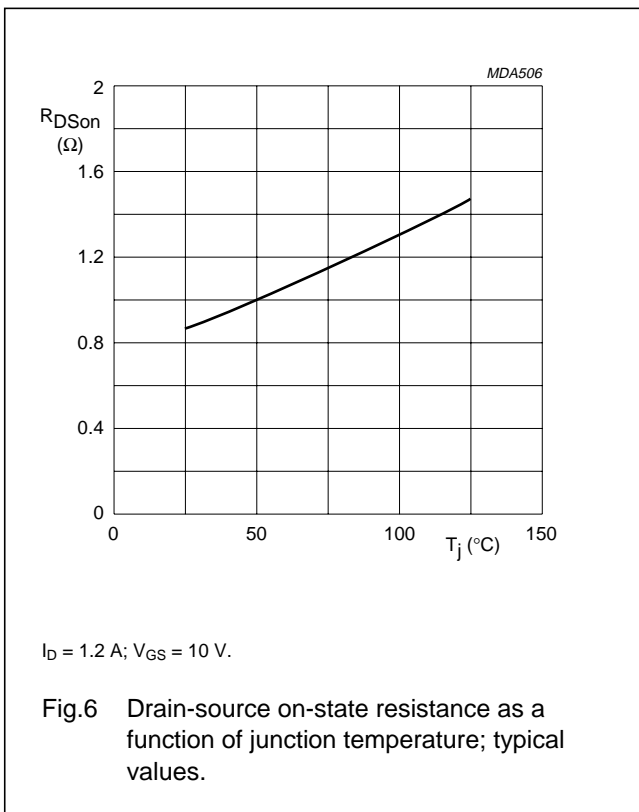
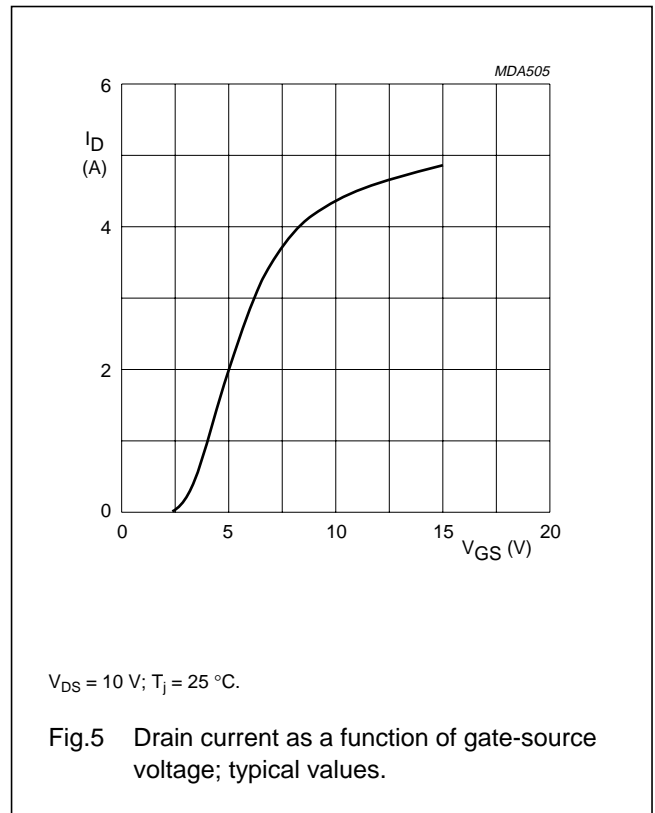
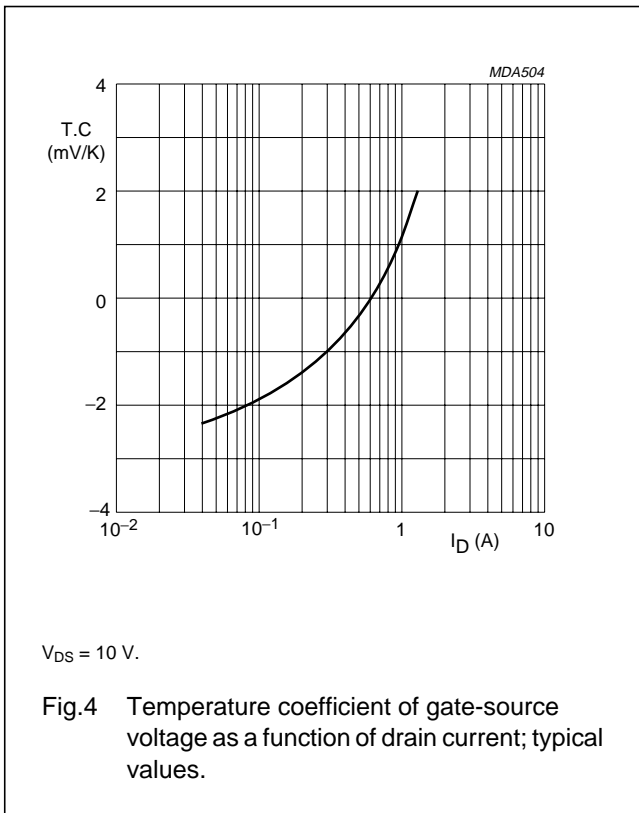
| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-------------------|---|--|------|------|------|---------------|
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $V_{GS} = 0$; $I_D = 10\text{ mA}$ | 65 | – | – | V |
| I_{DSS} | drain-source leakage current | $V_{GS} = 0$; $V_{DS} = 28\text{ V}$ | – | – | 1 | mA |
| I_{GSS} | gate-source leakage current | $V_{GS} = \pm 20\text{ V}$; $V_{DS} = 0$ | – | – | 1 | μA |
| V_{GSth} | gate-source threshold voltage | $I_D = 40\text{ mA}$; $V_{DS} = 10\text{ V}$ | 1 | – | 4 | V |
| ΔV_{GSth} | gate-source voltage difference of matched pairs | $I_D = 40\text{ mA}$; $V_{DS} = 10\text{ V}$ | – | – | 100 | mV |
| g_{fs} | forward transconductance | $I_D = 1.2\text{ A}$; $V_{DS} = 10\text{ V}$ | 600 | 900 | – | mS |
| R_{DSon} | drain-source on-state resistance | $I_D = 1.2\text{ A}$; $V_{GS} = 10\text{ V}$ | – | 0.85 | 1.25 | Ω |
| I_{DSX} | on-state drain current | $V_{GS} = 15\text{ V}$; $V_{DS} = 10\text{ V}$ | – | 4.8 | – | A |
| C_{is} | input capacitance | $V_{GS} = 0$; $V_{DS} = 28\text{ V}$; $f = 1\text{ MHz}$ | – | 32 | – | pF |
| C_{os} | output capacitance | $V_{GS} = 0$; $V_{DS} = 28\text{ V}$; $f = 1\text{ MHz}$ | – | 24 | – | pF |
| C_{rs} | feedback capacitance | $V_{GS} = 0$; $V_{DS} = 28\text{ V}$; $f = 1\text{ MHz}$ | – | 6.4 | – | pF |

 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 | | | |

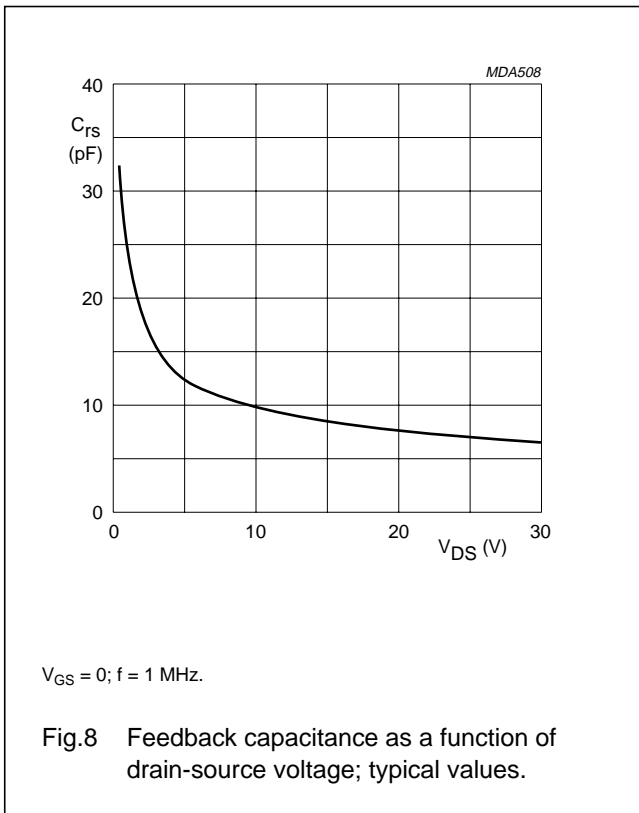
UHF power MOS transistor

BLF544



UHF power MOS transistor

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APPLICATION INFORMATION

$T_h = 25 \text{ }^\circ\text{C}; R_{th\text{ mb-h}} = 0.4 \text{ K/W}$ unless otherwise specified.
 RF performance in a common source class-B circuit.

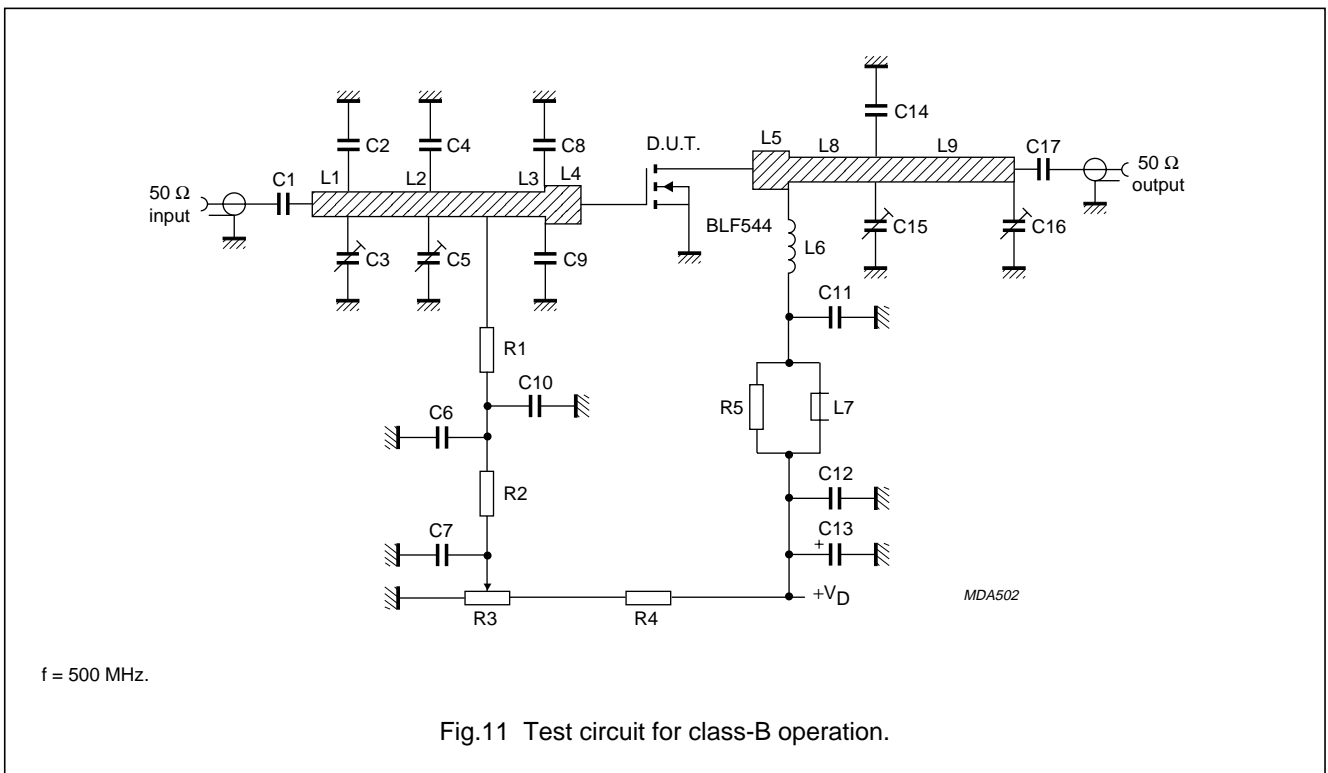
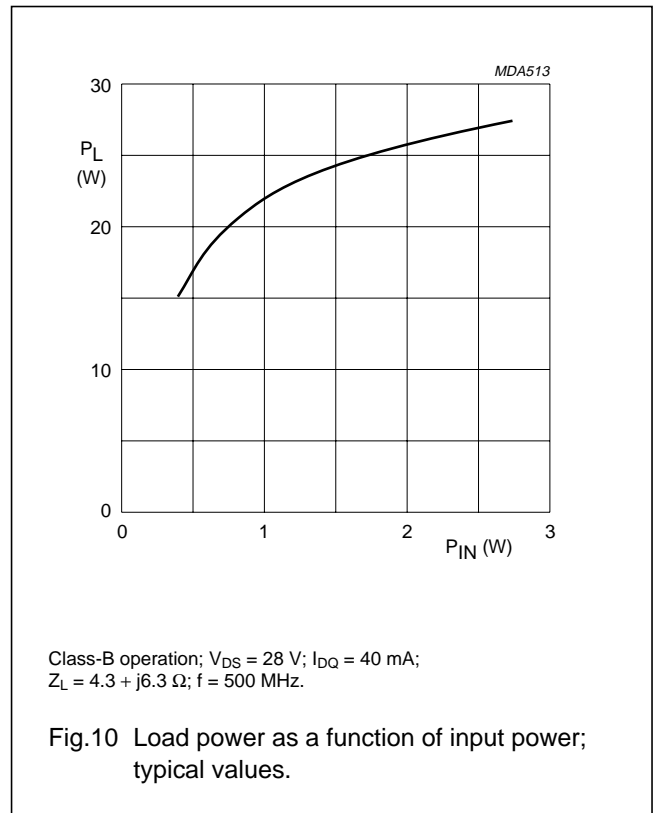
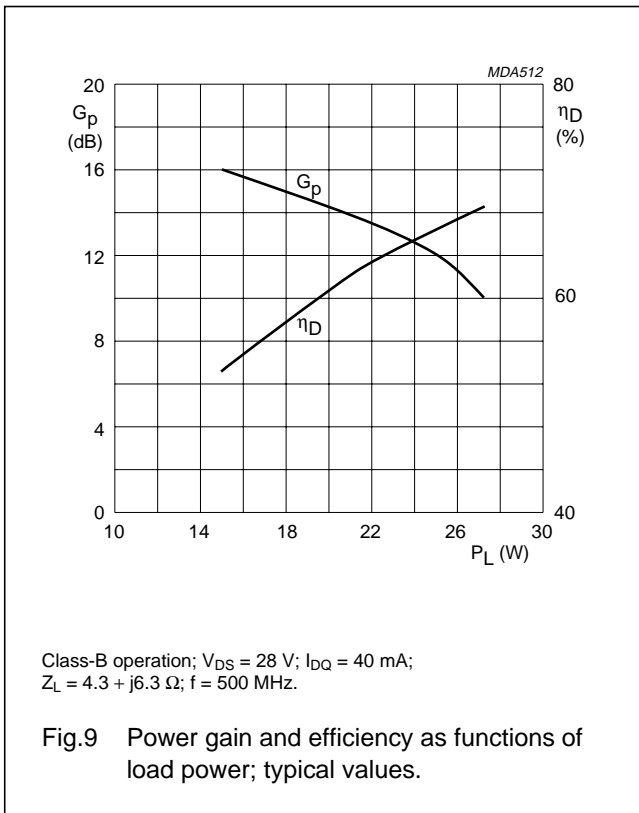
| MODE OF OPERATION | f (MHz) | V_{DS} (V) | I_{DQ} (mA) | P_L (W) | G_p (dB) | η_D (%) |
|-------------------|---------|--------------|---------------|-----------|----------------|----------------|
| CW, class-B | 500 | 28 | 40 | 20 | >11 typ. 14 | >50 typ. 60 |
| CW, class-B | 960 | 28 | 40 | 20 | typ. 7 | typ. 50 |
| CW, class-B | 960 | 24 | 40 | 15 | typ. 7 | typ. 50 |

Ruggedness in class-B operation

The BLF544 is capable of withstanding a full load mismatch corresponding to $V_{SWR} = 50 : 1$ through all phases under the following conditions: $V_{DS} = 28 \text{ V}; f = 500 \text{ MHz}$ at rated output power.

UHF power MOS transistor

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UHF power MOS transistor

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List of components (see Figs 11 and 12).

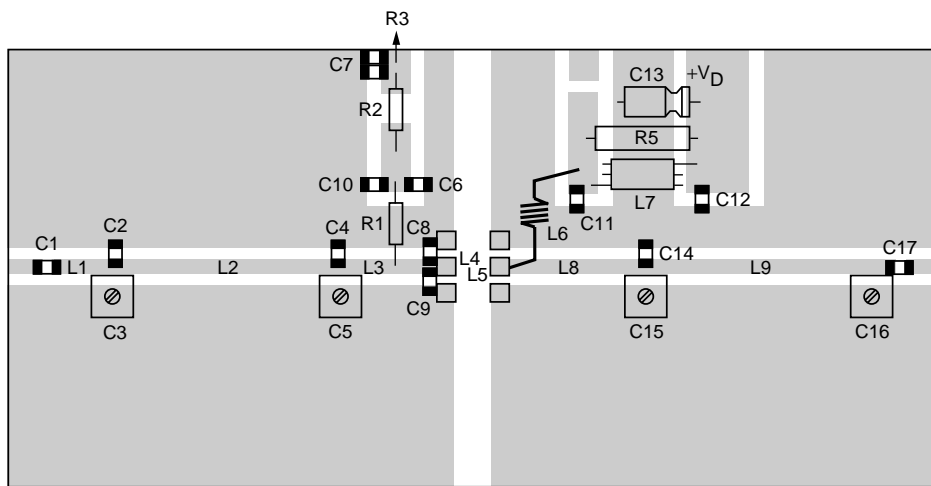
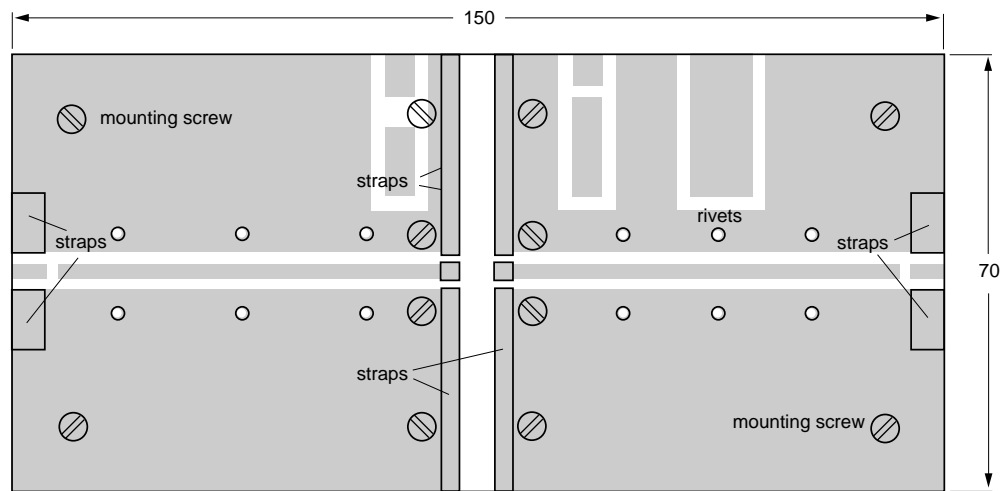
| COMPONENT | DESCRIPTION | VALUE | DIMENSIONS | CATALOGUE NO. |
|------------------|--|---------------------------------|---|----------------|
| C1, C6, C11, C17 | multilayer ceramic chip capacitor; note 1 | 390 pF; 500 V | | |
| C2 | multilayer ceramic chip capacitor; note 2 | 16 pF; 50 V | | |
| C3, C5 | film dielectric trimmer | 2 to 9 pF | | 2222 809 09002 |
| C4 | multilayer ceramic chip capacitor; note 2 | 27 pF; 50 V | | |
| C7 | multilayer ceramic chip capacitor | 2 × 100 nF in parallel; 50 V | | 2222 852 47104 |
| C8, C9 | multilayer ceramic chip capacitor; note 2 | 39 pF | | |
| C10, C12 | multilayer ceramic chip capacitor | 100 nF; 50 V | | 2222 852 47104 |
| C13 | electrolytic capacitor | 4.7 µF; 63 V | | 2222 030 38478 |
| C14 | multilayer ceramic chip capacitor; note 1 | 20 pF; 500 V | | |
| C15, C16 | film dielectric trimmer | 2 to 18 pF | | 2222 809 09003 |
| L1 | stripline note 3 | 50 Ω | 9.5 × 2.5 mm | |
| L2 | stripline note 3 | 50 Ω | 34.5 × 2.5 mm | |
| L3 | stripline note 3 | 50 Ω | 17.5 × 2.5 mm | |
| L4, L5 | stripline note 3 | 42 Ω | 3 × 3 mm | |
| L6 | 4 turns enamelled 0.8 mm copper wire | 31 nH | length 7.5 mm int. dia. 3 mm leads 2 × 5 mm | |
| L7 | grade 3B Ferroxcube RF choke | | | 4312 020 36642 |
| L8 | stripline note 3 | 50 Ω | 22 × 2.5 mm | |
| L9 | stripline note 3 | 50 Ω | 39.5 × 2.5 mm | |
| R1, R2 | 0.4 W metal film resistor | 1 kΩ | | 2322 151 11002 |
| R3 | 10 turns cermet potentiometer | 50 kΩ | | |
| R4 | 0.4 W metal film resistor | 140 kΩ | | 2322 151 11404 |
| R5 | 1 W metal film resistor | 10 Ω | | 2322 153 51009 |

Notes

- American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
- American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
- The striplines are on a double copper-clad printed circuit board, with glass microfibre reinforced PTFE ($\epsilon_r = 2.2$); thickness $\frac{1}{32}$ inch.

UHF power MOS transistor

BLF544



MDA501

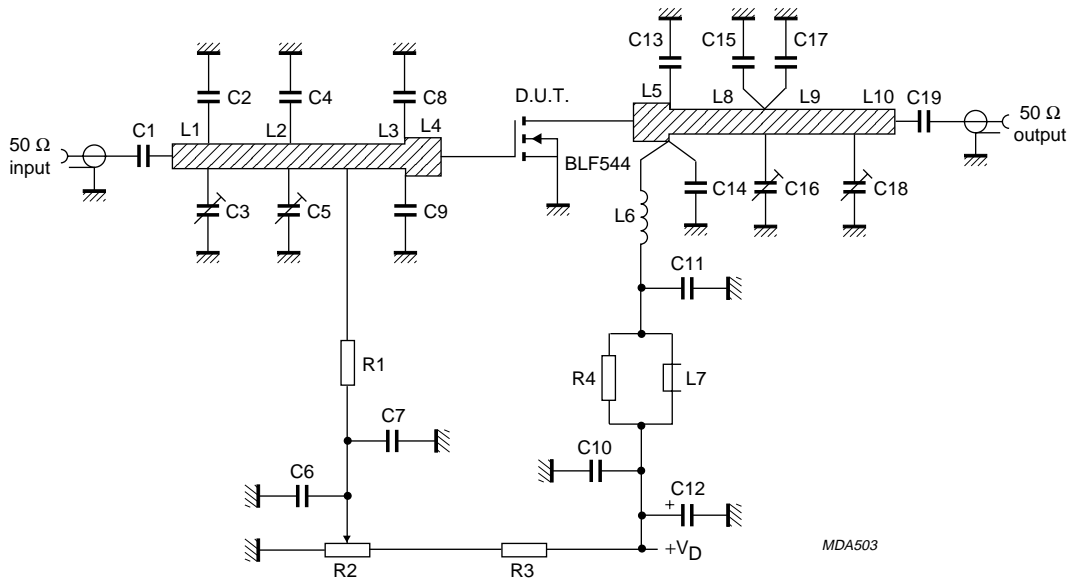
Dimensions in mm.

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 for a direct contact between upper and lower sheets.

Fig.12 Component layout for 500 MHz class-B test circuit.

UHF power MOS transistor

BLF544



MDA503

f = 960 MHz.

Fig.13 Test circuit for class-B operation.

UHF power MOS transistor

BLF544

List of components (see Figs 12 and 13)

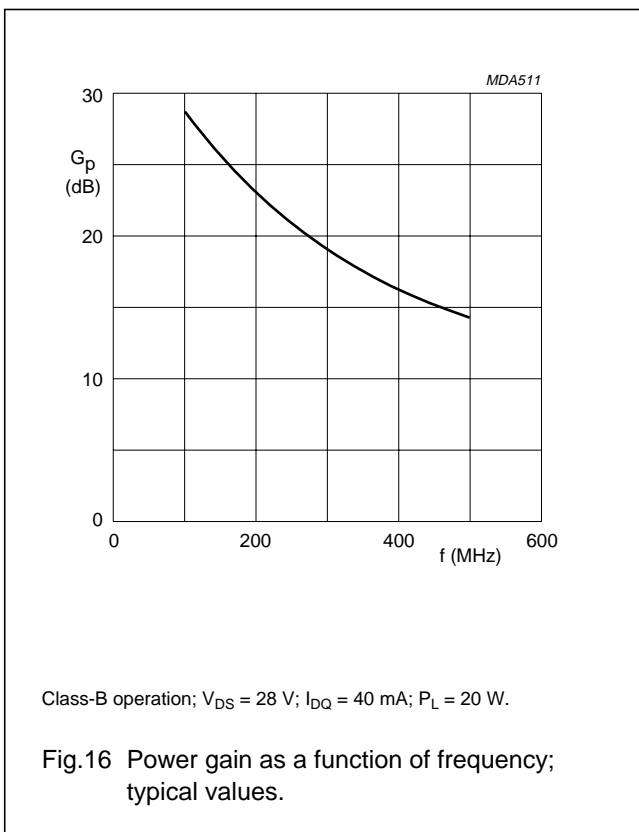
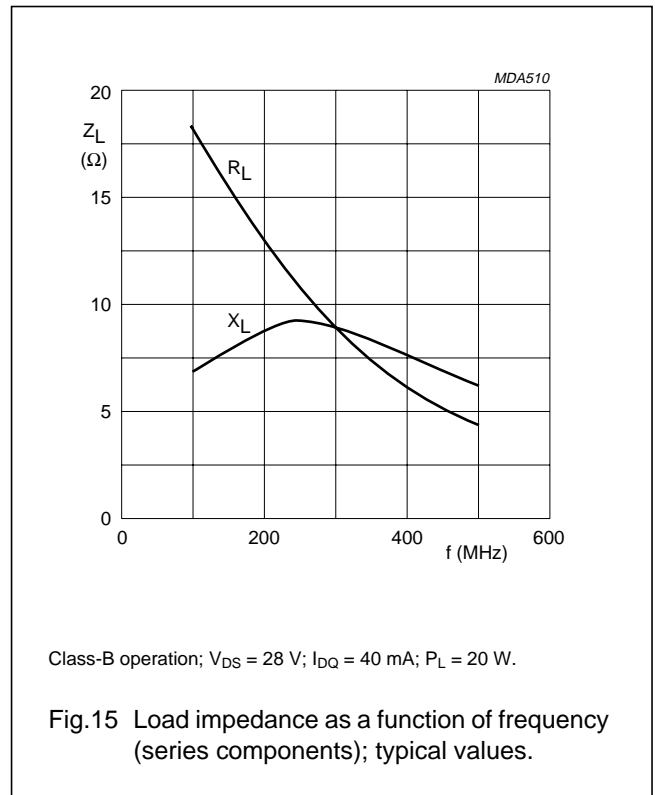
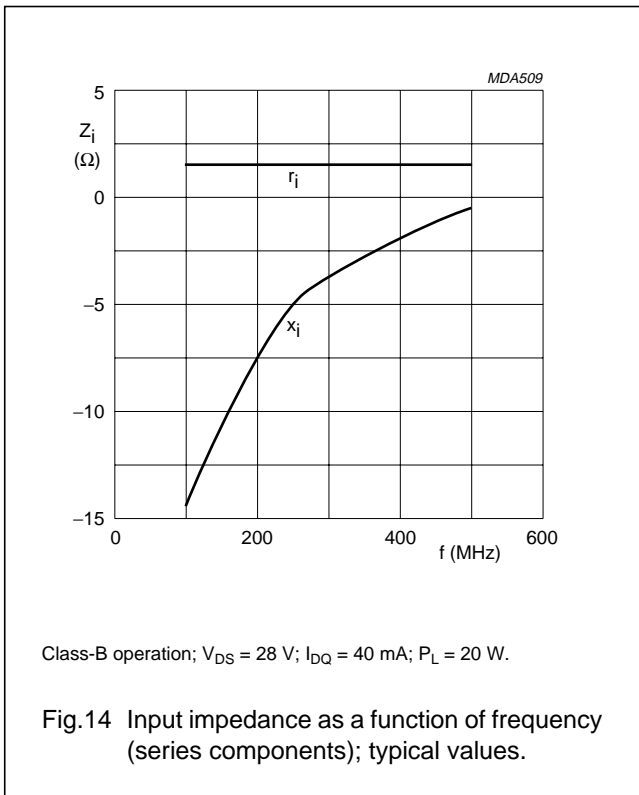
| COMPONENT | DESCRIPTION | VALUE | DIMENSIONS | CATALOGUE NO. |
|------------------|--|-------------------|--|----------------|
| C1 | multilayer ceramic chip capacitor; note 1 | 68 pF; 500 V | | |
| C2 | multilayer ceramic chip capacitor; note 2 | 1.6 pF; 50 V | | |
| C3, C5, C16, C18 | film dielectric trimmer | 1.4 to 5.5 pF | | 2222 809 09001 |
| C4 | multilayer ceramic chip capacitor; note 2 | 1 pF; 50 V | | |
| C6 | multilayer ceramic chip capacitor | 10 nF; 50 V | | 2222 852 47103 |
| C7, C11 | multilayer ceramic chip capacitor; note 1 | 56 μ F; 500 V | | |
| C8, C9, C15, C17 | multilayer ceramic chip capacitor; note 2 | 6.8 μ F; 50 V | | |
| C10 | multilayer ceramic chip capacitor | 100 nF; 50 V | | 2222 852 47104 |
| C12 | electrolytic capacitor | 4.7 μ F; 63 V | | 2222 030 38478 |
| C13 | multilayer ceramic chip capacitor; note 2 | 16 pF; 50 V | | |
| C14 | multilayer ceramic chip capacitor; note 2 | 18 pF; 50 V | | |
| C19 | multilayer ceramic chip capacitor; note 1 | 62 pF; 500 V | | |
| L1, L8 | stripline; note 3 | 50 Ω | 6 \times 2.5 mm | |
| L2 | stripline; note 3 | 50 Ω | 38 \times 2.5 mm | |
| L3 | stripline; note 3 | 50 Ω | 17.5 \times 2.5 mm | |
| L4, L5 | stripline; note 3 | 42 Ω | 3 \times 3 mm | |
| L6 | 2 turns enamelled 1 mm copper wire | 16 nH | length 3.4 mm int. dia. 3 mm leads 2 \times 5 mm | |
| L7 | grade 3B Ferroxcube RF choke | | | 4312 020 36642 |
| L9 | stripline; note 3 | 50 Ω | 21 \times 2.5 mm | |
| L10 | stripline; note 3 | 50 Ω | 34.5 \times 2.5 mm | |
| R1 | 0.4 W metal film resistor | 15 k Ω | | 2322 151 11473 |
| R2 | 10 turns potentiometer | 50 k Ω | | |
| R3 | 0.4 W metal film resistor | 140 k Ω | | 2322 151 11404 |
| R4 | 0.4 W metal film resistor | 10 Ω | | 2322 153 51009 |

Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed-circuit board with glass microfibre reinforced PTFE ($\epsilon_r = 2.2$); thickness $\frac{1}{32}$ inch.

UHF power MOS transistor

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Optimum input and load impedances

Optimum input impedance: $1.2 + j4.8\ \Omega$.
 Optimum load impedance: $2.6 - j3.1\ \Omega$.
 Conditions: class-B operation; $V_{DS} = 24\text{ V}$;
 $I_{DQ} = 40\text{ mA}$; $f = 960\text{ MHz}$; $P_L = 15\text{ W}$; typical values.

UHF power MOS transistor

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BLF544 scattering parameters $V_{DS} = 28\text{ V}$; $I_D = 40\text{ mA}$; 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 | 0.99 | -14.0 | 13.60 | 171.0 | 0.02 | 81.0 | 0.89 | -12.8 |
| 10 | 0.98 | -27.6 | 13.20 | 162.0 | 0.04 | 72.4 | 0.87 | -25.3 |
| 20 | 0.93 | -52.0 | 11.90 | 146.0 | 0.07 | 57.1 | 0.82 | -48.0 |
| 30 | 0.88 | -72.0 | 10.30 | 134.0 | 0.09 | 44.8 | 0.77 | -66.6 |
| 40 | 0.84 | -87.7 | 8.93 | 124.0 | 0.10 | 35.2 | 0.72 | -81.3 |
| 50 | 0.81 | -100.0 | 7.75 | 116.0 | 0.11 | 27.7 | 0.68 | -93.0 |
| 60 | 0.79 | -110.0 | 6.78 | 110.0 | 0.12 | 21.6 | 0.66 | -102.0 |
| 70 | 0.77 | -118.0 | 6.00 | 104.0 | 0.12 | 16.7 | 0.64 | -109.0 |
| 80 | 0.76 | -124.0 | 5.36 | 99.8 | 0.12 | 12.5 | 0.63 | -115.0 |
| 90 | 0.75 | -129.0 | 4.82 | 95.9 | 0.12 | 8.9 | 0.62 | -120.0 |
| 100 | 0.75 | -133.0 | 4.37 | 92.3 | 0.13 | 5.7 | 0.61 | -124.0 |
| 125 | 0.74 | -141.0 | 3.53 | 84.7 | 0.13 | -1.1 | 0.61 | -131.0 |
| 150 | 0.74 | -147.0 | 2.94 | 78.3 | 0.13 | -6.6 | 0.61 | -137.0 |
| 175 | 0.74 | -151.0 | 2.50 | 72.6 | 0.12 | -11.5 | 0.62 | -140.0 |
| 200 | 0.75 | -154.0 | 2.16 | 67.5 | 0.12 | -15.8 | 0.64 | -143.0 |
| 250 | 0.77 | -159.0 | 1.67 | 58.4 | 0.12 | -23.3 | 0.67 | -148.0 |
| 300 | 0.78 | -163.0 | 1.33 | 50.4 | 0.11 | -29.7 | 0.70 | -151.0 |
| 350 | 0.80 | -167.0 | 1.09 | 43.1 | 0.10 | -35.3 | 0.73 | -154.0 |
| 400 | 0.82 | -169.0 | 0.91 | 36.6 | 0.10 | -40.3 | 0.75 | -157.0 |
| 450 | 0.84 | -172.0 | 0.77 | 30.6 | 0.09 | -44.7 | 0.78 | -160.0 |
| 500 | 0.85 | -175.0 | 0.66 | 25.1 | 0.08 | -48.6 | 0.80 | -162.0 |
| 600 | 0.89 | -179.0 | 0.50 | 15.6 | 0.07 | -55.2 | 0.84 | -167.0 |
| 700 | 0.90 | 177.0 | 0.39 | 7.5 | 0.06 | -60.4 | 0.88 | -170.0 |
| 800 | 0.92 | 173.0 | 0.32 | 0.6 | 0.05 | -64.3 | 0.90 | -174.0 |
| 900 | 0.93 | 169.0 | 0.26 | -5.4 | 0.04 | -67.3 | 0.92 | -177.0 |
| 1000 | 0.94 | 166.0 | 0.22 | -10.8 | 0.04 | -69.2 | 0.93 | -179.0 |

Note

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

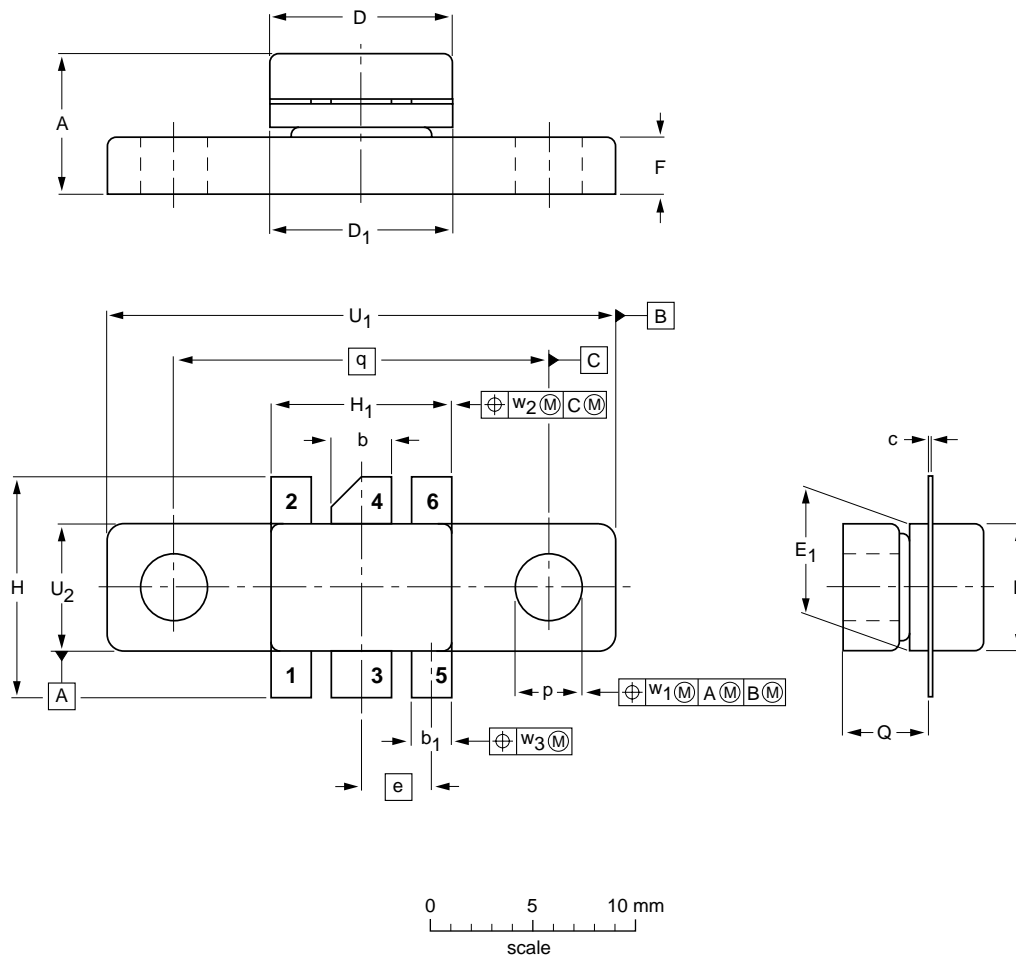
UHF power MOS transistor

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PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 6 leads

SOT171A



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

| UNIT | A | b | b ₁ | c | D | D ₁ | E | E ₁ | e | F | H | H ₁ | p | Q | q | U ₁ | U ₂ | w ₁ | w ₂ | w ₃ |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|----------------|
| mm | 6.81 6.07 | 3.18 2.92 | 2.13 1.88 | 0.16 0.07 | 9.25 9.04 | 9.27 9.02 | 5.95 5.74 | 5.97 5.72 | 3.58 | 3.05 2.54 | 11.31 10.54 | 9.27 9.01 | 3.43 3.17 | 4.32 4.11 | 18.42 | 24.90 24.63 | 5.97 5.72 | 0.25 | 0.51 | 0.25 |
| inches | 0.268 0.239 | 0.125 0.115 | 0.084 0.074 | 0.006 0.003 | 0.364 0.356 | 0.365 0.355 | 0.234 0.226 | 0.235 0.225 | 0.140 | 0.120 0.100 | 0.445 0.415 | 0.365 0.355 | 0.135 0.125 | 0.170 0.162 | 0.725 | 0.980 0.970 | 0.235 0.225 | 0.010 | 0.020 | 0.010 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|------|--|---------------------|------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT171A | | | | | | 99-03-29 |

UHF power MOS transistor

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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. |
| II | Preliminary data | Qualification | This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product. |
| III | Product data | Production | This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). |

Notes

1. Please consult the most recently issued data sheet before initiating or completing a design.
2. The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.
3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

DEFINITIONS

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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