

## IMPORTANT NOTICE

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Thank you for your cooperation and understanding,

Ampleon

# UHF power MOS transistor

# BLF542

### FEATURES

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

### APPLICATIONS

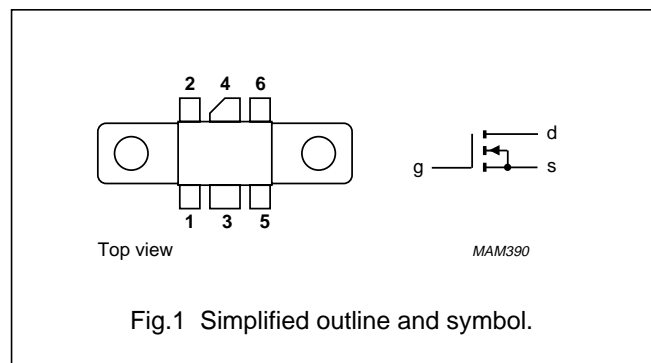
- Large signal amplifier applications in the UHF frequency range.

### 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.

### PINNING - SOT171A

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



### QUICK REFERENCE DATA

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

| MODE OF OPERATION | f (MHz) | $V_{DS}$ (V) | $P_L$ (W) | $G_p$ (dB) | $\eta_D$ (%) |
|-------------------|---------|--------------|-----------|------------|--------------|
| CW, class-B       | 500     | 28           | 5         | >13        | >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

# BLF542

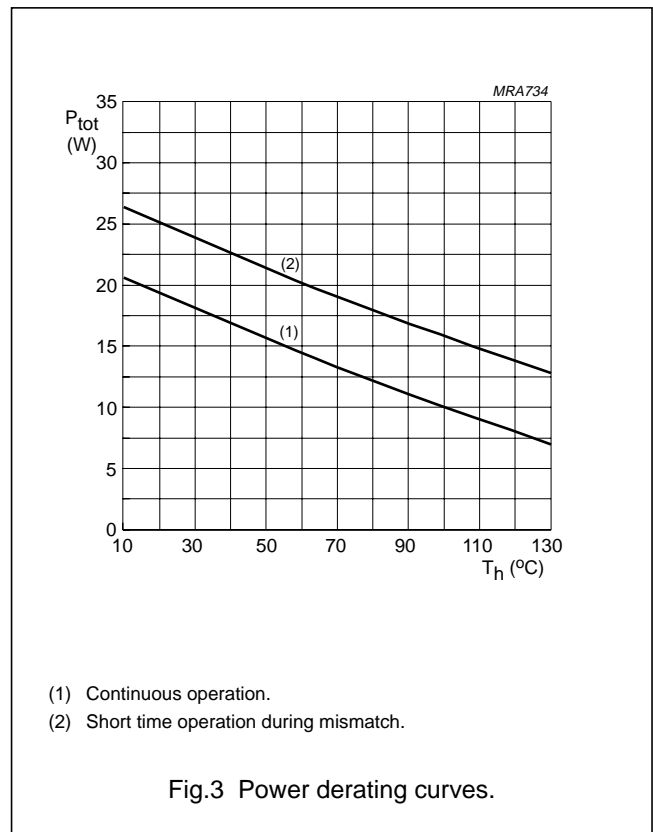
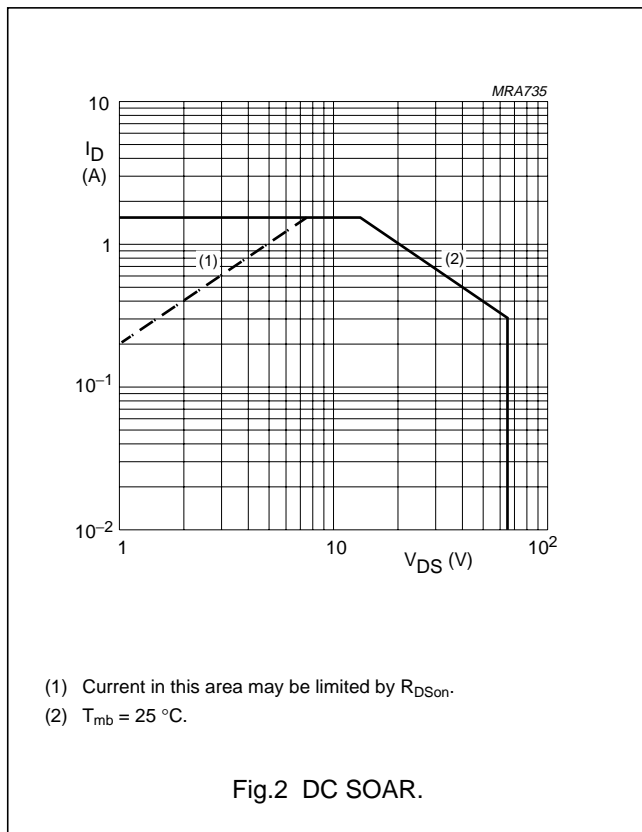
## LIMITING VALUES

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     |                                     | –    | $\pm 20$ | V                |
| $I_D$     | drain current (DC)      |                                     | –    | 1.5      | A                |
| $P_{tot}$ | total power dissipation | $T_{mb} = 25\text{ }^\circ\text{C}$ | –    | 20       | 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 | 8.8   | K/W  |
| $R_{th\ mb-h}$ | thermal resistance from mounting base to heatsink | 0.4   | K/W  |



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BLF542

**CHARACTERISTICS** $T_j = 25\text{ °C}$  unless otherwise specified.

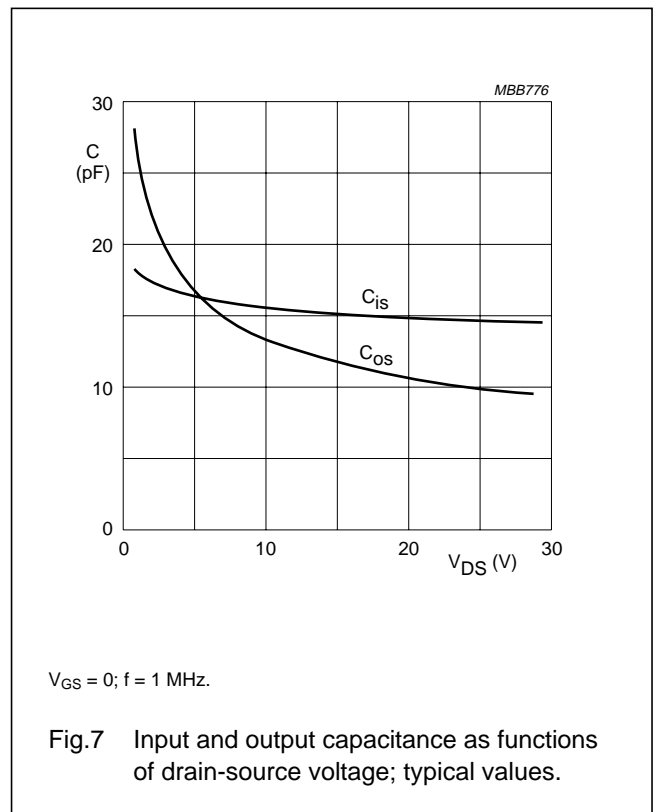
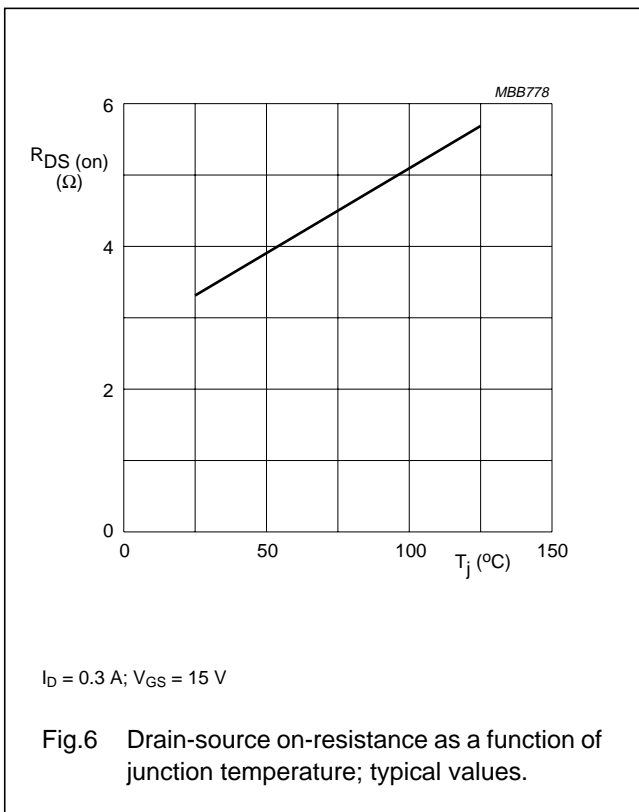
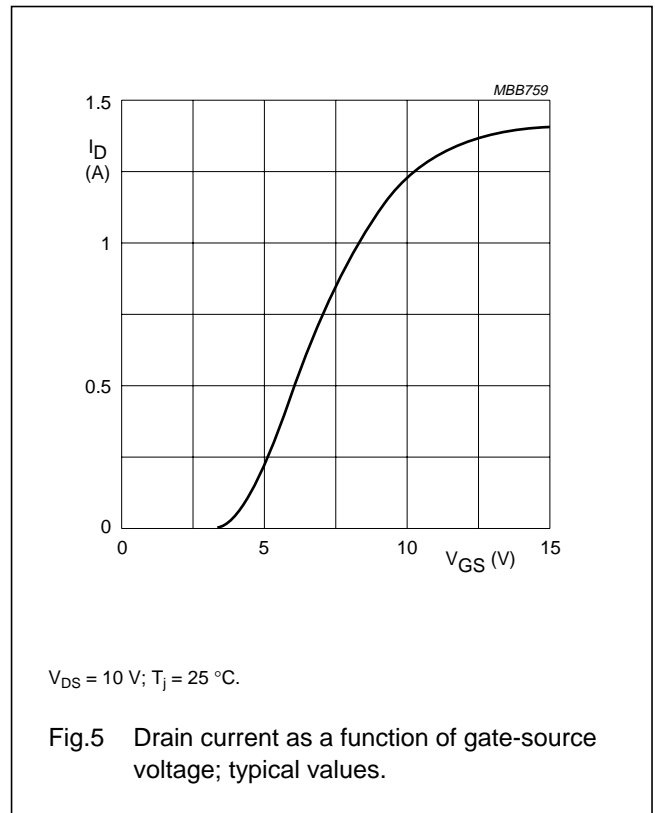
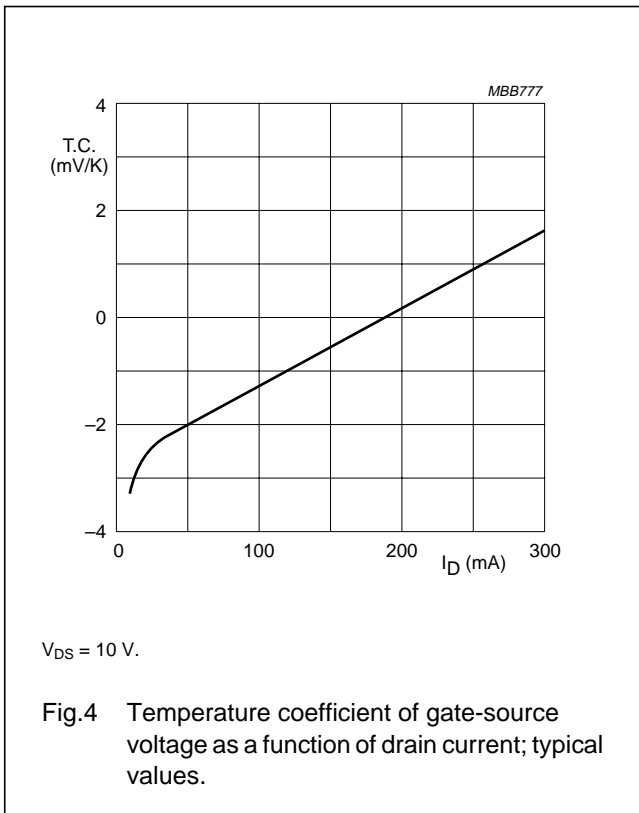
| SYMBOL        | PARAMETER                      | CONDITIONS   | MIN. | TYP. | MAX. | UNIT          |
|---------------|--------------------------------|--|------|------|------|---------------|
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 0.1\text{ mA}; V_{GS} = 0$                    | 65   | –    | –    | V             |
| $I_{DSS}$     | drain-source leakage current   | $V_{GS} = 0; V_{DS} = 28\text{ V}$                   | –    | –    | 10   | $\mu\text{A}$ |
| $I_{GSS}$     | gate-source leakage current    | $V_{GS} = \pm 20\text{ V}; V_{DS} = 0$               | –    | –    | 1    | $\mu\text{A}$ |
| $V_{GSth}$    | gate-source threshold voltage  | $I_D = 10\text{ mA}; V_{DS} = 10\text{ V}$           | 2    | –    | 4.5  | V             |
| $g_{fs}$      | forward transconductance       | $I_D = 0.3\text{ A}; V_{DS} = 10\text{ V}$           | 160  | 240  | –    | mS            |
| $R_{DSon}$    | drain-source on-resistance     | $I_D = 0.3\text{ A}; V_{GS} = 15\text{ V}$           | –    | 3.3  | 5    | $\Omega$      |
| $I_{DSX}$     | on-state drain current         | $V_{GS} = 15\text{ V}; V_{DS} = 10\text{ V}$         | –    | 1.4  | –    | A             |
| $C_{is}$      | input capacitance              | $V_{GS} = 0; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$ | –    | 14   | –    | pF            |
| $C_{os}$      | output capacitance             | $V_{GS} = 0; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$ | –    | 9.4  | –    | pF            |
| $C_{rs}$      | feedback capacitance           | $V_{GS} = 0; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$ | –    | 1.7  | –    | 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  |       |            |      |

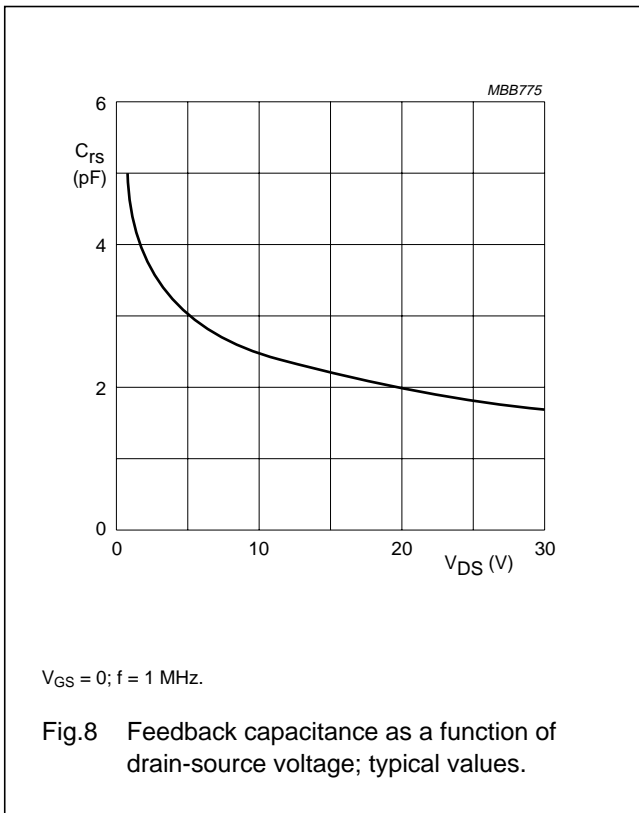
UHF power MOS transistor

BLF542



UHF power MOS transistor

BLF542



**APPLICATION INFORMATION FOR CLASS-B OPERATION**

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

RF performance in CW operation in a common source class-B test circuit.

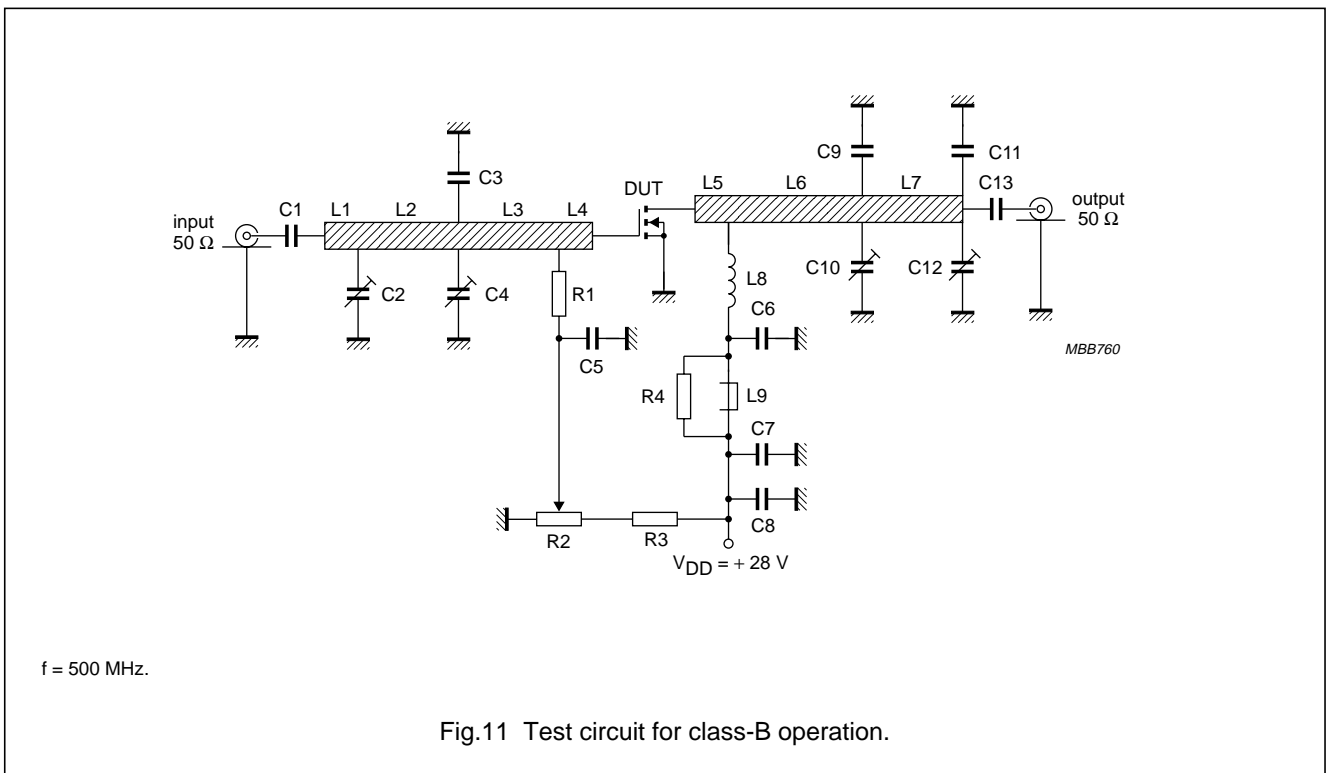
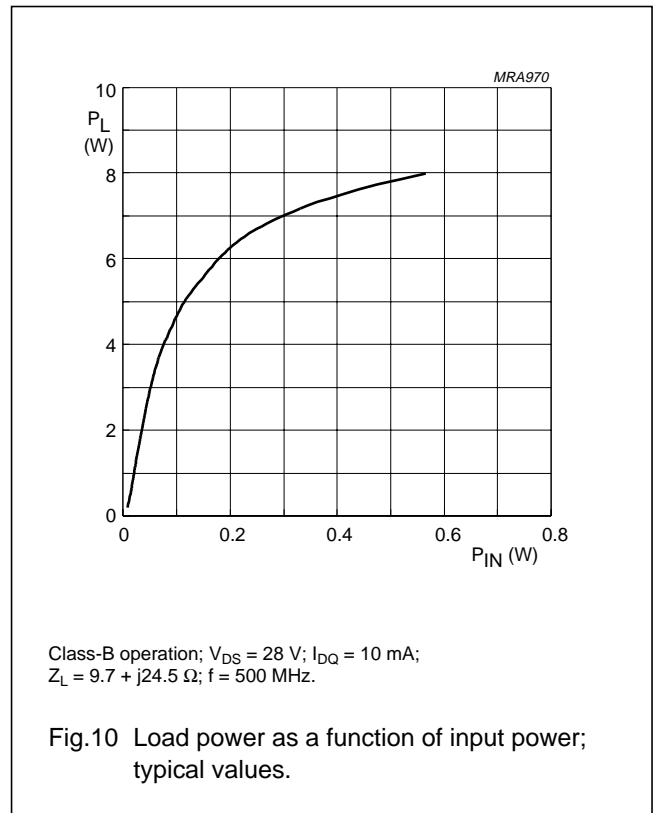
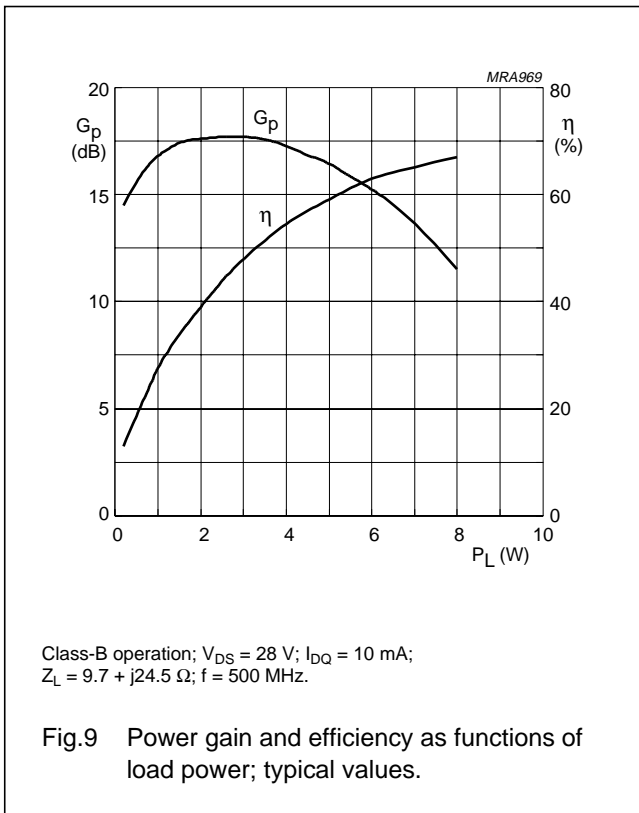
| MODE OF OPERATION | f (MHz) | $V_{DS}$ (V) | $I_{DQ}$ (mA) | $P_L$ (W) | $G_p$ (dB)       | $\eta_D$ (%)   |
|-------------------|---------|--------------|---------------|-----------|------------------|----------------|
| CW, class-B       | 500     | 28           | 50            | 5         | >13<br>typ. 16.5 | >50<br>typ. 59 |

**Ruggedness in class-B operation**

The BLF542 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

BLF542



## UHF power MOS transistor

BLF542

## List of components (see Fig.11)

| COMPONENT        | DESCRIPTION                               | VALUE                  | DIMENSIONS   | CATALOGUE NO.  |
|------------------|---|------------------------|--|----------------|
| C1, C5, C13      | multilayer ceramic chip capacitor; note 1 | 390 pF                 |  |                |
| C2, C4, C10, C12 | film dielectric trimmer                   | 2 to 18 pF             |  | 222 809 05217  |
| C3, C9           | multilayer ceramic chip capacitor; note 1 | 39 pF                  |  |                |
| C6               | multilayer ceramic chip capacitor; note 2 | 220 pF                 |  |                |
| C7               | multilayer ceramic chip capacitor         | 100 nF                 |  | 2222 852 47104 |
| C8               | electrolytic capacitor                    | 63 V, 10 $\mu$ F       |  | 2222 030 28109 |
| C11              | multilayer ceramic chip capacitor; note 1 | 10 pF                  |  |                |
| L1               | stripline; note 3                         | 50 $\Omega$            | 11 mm $\times$ 2.5 mm                                  |                |
| L2               | stripline; note 3                         | 50 $\Omega$            | 37 mm $\times$ 2.5 mm                                  |                |
| L3               | stripline; note 3                         | 50 $\Omega$            | 13 mm $\times$ 2.5 mm                                  |                |
| L4, L5           | stripline; note 3                         | 42 $\Omega$            | 3 mm $\times$ 3 mm                                     |                |
| L6               | stripline; note 3                         | 50 $\Omega$            | 39 mm $\times$ 2.5 mm                                  |                |
| L7               | stripline; note 3                         | 50 $\Omega$            | 22 mm $\times$ 2.5 mm                                  |                |
| L8               | 8 turns 0.8 mm enamelled copper wire      | 250 nH                 | length 9 mm<br>int. dia. 6 mm<br>leads 2 $\times$ 5 mm |                |
| L9               | grade 3B Ferroxcube wideband RF choke     |                        |  | 4312 020 36640 |
| R1               | metal film resistor                       | 10 k $\Omega$ , 0.4 W  |  | 2322 151 71003 |
| R2               | 10 turn potentiometer                     | 50 k $\Omega$          |  |                |
| R3               | metal film resistor                       | 205 k $\Omega$ , 0.4 W |  | 2322 151 72054 |
| R4               | metal film resistor                       | 10 $\Omega$ , 0.4 W    |  | 2322 151 71009 |

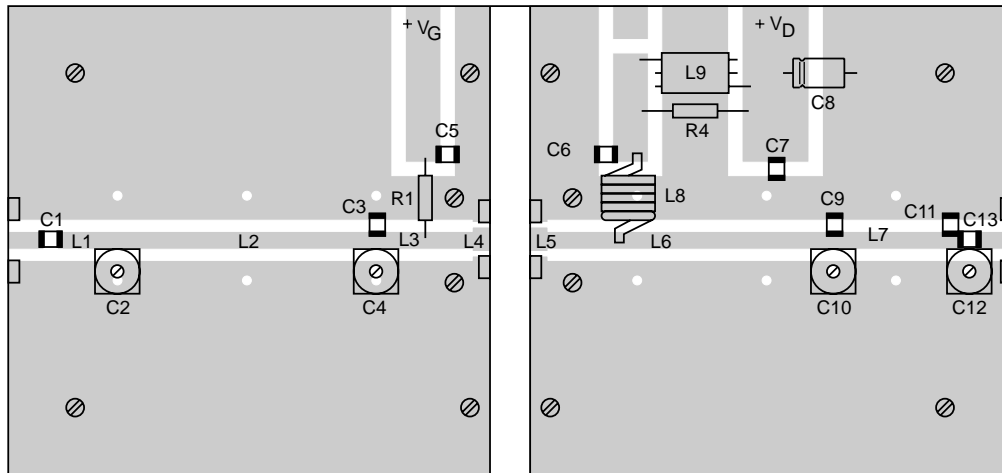
## Notes

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

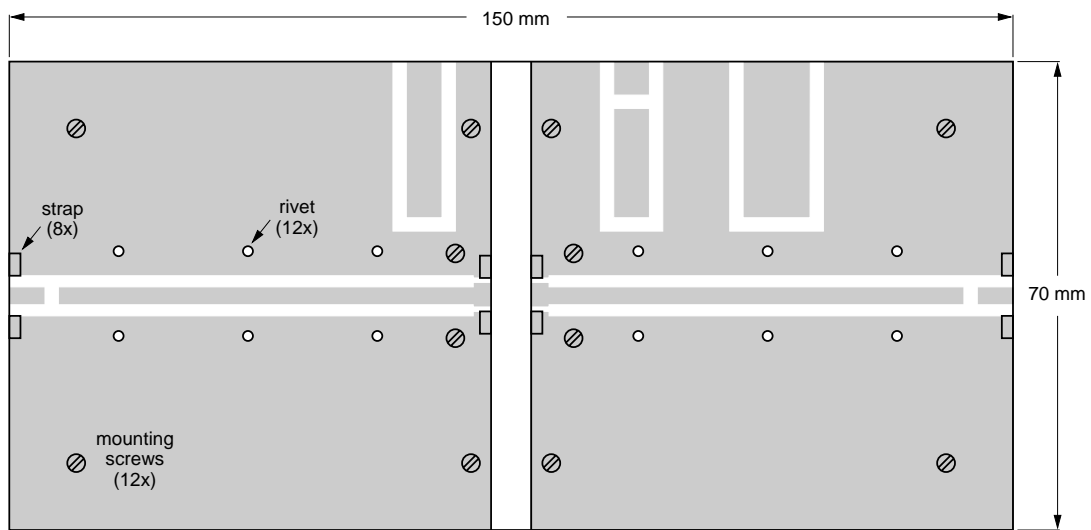


UHF power MOS transistor

BLF542



MBB762



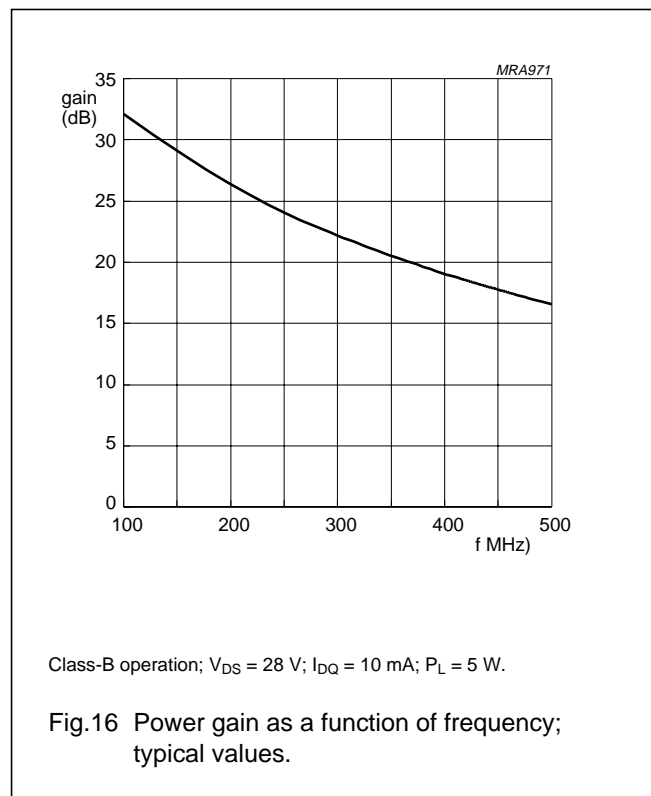
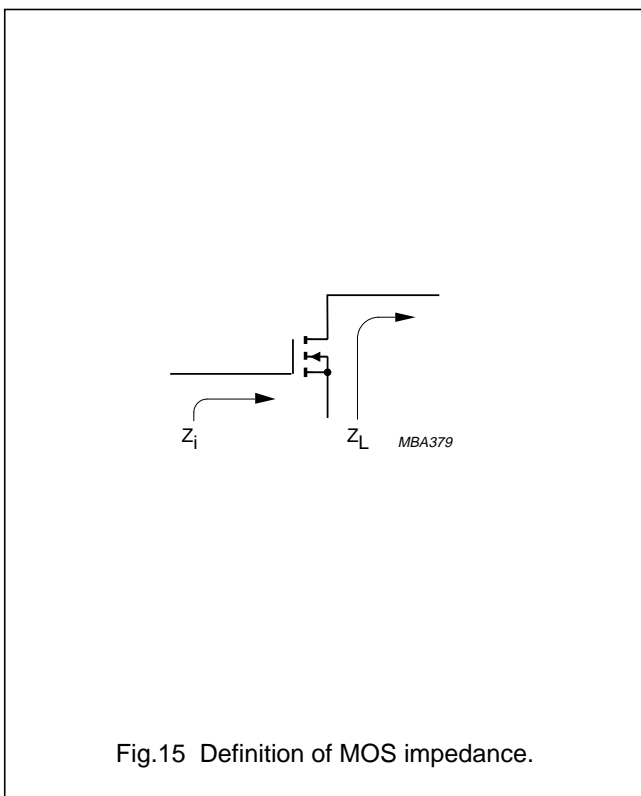
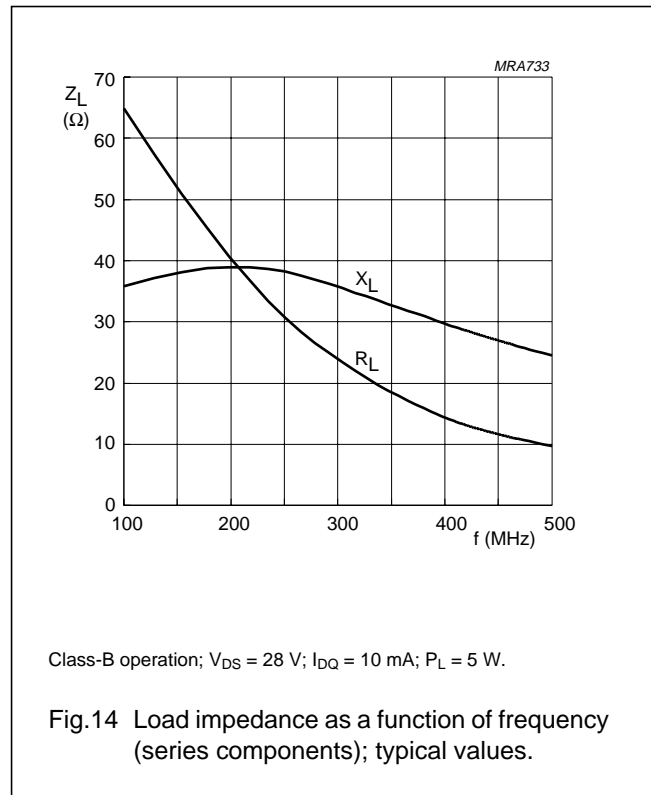
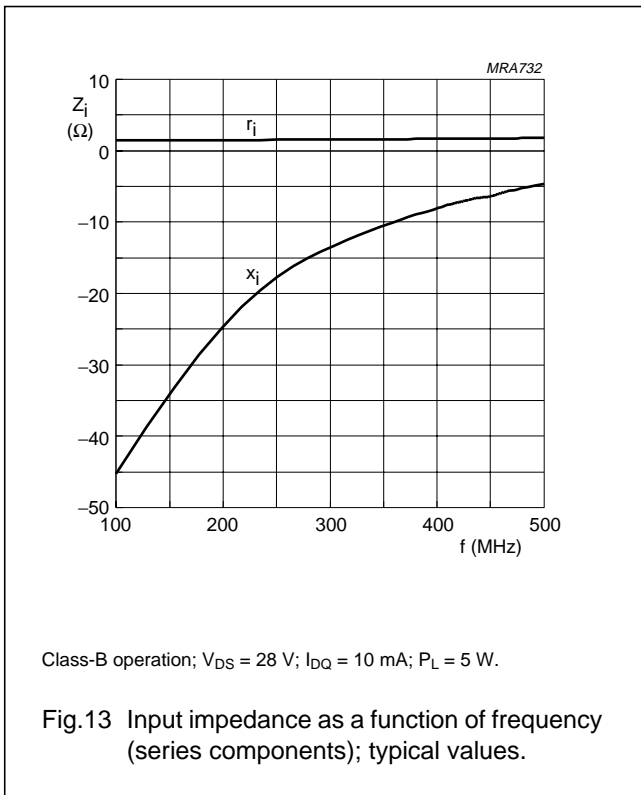
MBB761

The components are mounted on one side of a copper-clad printed circuit board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws, hollow rivets and copper foil straps, as shown.

Fig.12 Component layout for 500 MHz test circuit.

UHF power MOS transistor

BLF542



## UHF power MOS transistor

BLF542

**BLF542 scattering parameters** $V_{DS} = 28\text{ V}$ ;  $I_D = 10\text{ mA}$ ; note 1

| f (MHz) | S <sub>11</sub> |        | S <sub>21</sub> |       | S <sub>12</sub> |       | S <sub>22</sub> |        |
|---------|-----------------|--------|-----------------|-------|-----------------|-------|-----------------|--------|
|         | S <sub>11</sub> | ∠ Φ    | S <sub>21</sub> | ∠ Φ   | S <sub>12</sub> | ∠ Φ   | S <sub>22</sub> | ∠ Φ    |
| 5       | 1.00            | -3.0   | 5.88            | 178.0 | 0.00            | 0.0   | 1.00            | -2.3   |
| 10      | 1.00            | -6.0   | 5.88            | 175.0 | 0.01            | 84.7  | 1.01            | -6.0   |
| 20      | 1.00            | -12.0  | 5.86            | 169.0 | 0.02            | 80.4  | 1.00            | -11.0  |
| 30      | 0.99            | -17.9  | 5.74            | 164.0 | 0.03            | 74.8  | 1.00            | -17.2  |
| 40      | 0.98            | -23.6  | 5.65            | 159.0 | 0.04            | 70.2  | 0.99            | -22.4  |
| 50      | 0.98            | -29.3  | 5.55            | 154.0 | 0.04            | 65.6  | 0.98            | -27.3  |
| 60      | 0.97            | -34.8  | 5.43            | 150.0 | 0.05            | 61.2  | 0.97            | -32.1  |
| 70      | 0.96            | -40.1  | 5.31            | 145.0 | 0.06            | 56.9  | 0.96            | -36.8  |
| 80      | 0.94            | -45.3  | 5.19            | 140.0 | 0.07            | 52.4  | 0.96            | -41.8  |
| 90      | 0.93            | -50.3  | 5.03            | 135.0 | 0.07            | 47.9  | 0.94            | -46.9  |
| 100     | 0.92            | -54.9  | 4.86            | 131.0 | 0.08            | 43.6  | 0.93            | -51.6  |
| 125     | 0.89            | -65.5  | 4.42            | 122.0 | 0.09            | 34.7  | 0.89            | -61.6  |
| 150     | 0.87            | -75.5  | 4.06            | 113.0 | 0.10            | 26.8  | 0.88            | -70.0  |
| 175     | 0.85            | -84.2  | 3.71            | 105.0 | 0.10            | 19.0  | 0.86            | -78.2  |
| 200     | 0.83            | -91.7  | 3.35            | 97.3  | 0.10            | 12.4  | 0.83            | -85.3  |
| 250     | 0.82            | -105.0 | 2.81            | 84.6  | 0.11            | 1.2   | 0.82            | -96.8  |
| 300     | 0.81            | -116.0 | 2.34            | 73.6  | 0.11            | -8.6  | 0.81            | -107.0 |
| 350     | 0.81            | -125.0 | 2.00            | 64.0  | 0.10            | -16.7 | 0.82            | -115.0 |
| 400     | 0.81            | -133.0 | 1.70            | 55.5  | 0.10            | -23.8 | 0.82            | -121.0 |
| 450     | 0.82            | -140.0 | 1.48            | 47.7  | 0.09            | -30.2 | 0.83            | -128.0 |
| 500     | 0.83            | -146.0 | 1.28            | 40.9  | 0.09            | -35.6 | 0.84            | -133.0 |
| 600     | 0.86            | -157.0 | 1.00            | 29.0  | 0.08            | -44.9 | 0.87            | -142.0 |
| 700     | 0.87            | -166.0 | 0.79            | 18.6  | 0.07            | -52.3 | 0.89            | -149.0 |
| 800     | 0.89            | -175.0 | 0.64            | 9.8   | 0.06            | -58.1 | 0.90            | -155.0 |
| 900     | 0.90            | 178.0  | 0.53            | 2.0   | 0.05            | -62.4 | 0.92            | -160.0 |
| 1000    | 0.91            | 171.0  | 0.45            | -4.8  | 0.04            | -64.9 | 0.93            | -165.0 |

**Note**

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

## UHF power MOS transistor

BLF542

**BLF542 scattering parameters** $V_{DS} = 28\text{ V}$ ;  $I_D = 50\text{ mA}$ .; note 1

| f (MHz) | S <sub>11</sub> |        | S <sub>21</sub> |       | S <sub>12</sub> |       | S <sub>22</sub> |        |
|---------|-----------------|--------|-----------------|-------|-----------------|-------|-----------------|--------|
|         | S <sub>11</sub> | ∠ Φ    | S <sub>21</sub> | ∠ Φ   | S <sub>12</sub> | ∠ Φ   | S <sub>22</sub> | ∠ Φ    |
| 5       | 1.00            | -4.1   | 12.20           | 177.0 | 0.00            | 0.0   | 0.99            | -3.2   |
| 10      | 1.00            | -8.2   | 12.20           | 173.0 | 0.01            | 83.5  | 1.00            | -7.8   |
| 20      | 0.99            | -16.3  | 12.10           | 167.0 | 0.02            | 78.1  | 0.99            | -14.5  |
| 30      | 0.98            | -24.1  | 11.70           | 161.0 | 0.03            | 71.7  | 0.98            | -22.3  |
| 40      | 0.97            | -31.7  | 11.40           | 155.0 | 0.03            | 66.2  | 0.96            | -28.8  |
| 50      | 0.95            | -39.1  | 11.10           | 150.0 | 0.04            | 60.9  | 0.94            | -35.1  |
| 60      | 0.93            | -46.1  | 10.70           | 144.0 | 0.05            | 55.8  | 0.93            | -41.1  |
| 70      | 0.92            | -52.7  | 10.30           | 139.0 | 0.06            | 51.1  | 0.91            | -46.8  |
| 80      | 0.90            | -59.1  | 9.92            | 134.0 | 0.06            | 46.2  | 0.89            | -52.7  |
| 90      | 0.88            | -65.1  | 9.47            | 129.0 | 0.07            | 41.6  | 0.87            | -58.4  |
| 100     | 0.86            | -70.3  | 9.00            | 125.0 | 0.07            | 37.3  | 0.85            | -63.6  |
| 125     | 0.82            | -81.9  | 7.95            | 116.0 | 0.08            | 28.7  | 0.80            | -74.1  |
| 150     | 0.80            | -92.5  | 7.12            | 107.0 | 0.08            | 21.2  | 0.78            | -82.8  |
| 175     | 0.77            | -101.0 | 6.37            | 99.9  | 0.08            | 14.2  | 0.75            | -90.7  |
| 200     | 0.75            | -109.0 | 5.68            | 93.5  | 0.08            | 8.5   | 0.73            | -97.4  |
| 250     | 0.74            | -121.0 | 4.67            | 82.4  | 0.09            | -1.3  | 0.72            | -108.0 |
| 300     | 0.73            | -130.0 | 3.87            | 72.9  | 0.08            | -9.4  | 0.71            | -116.0 |
| 350     | 0.74            | -138.0 | 3.29            | 64.5  | 0.08            | -16.3 | 0.72            | -123.0 |
| 400     | 0.75            | -145.0 | 2.81            | 57.2  | 0.08            | -22.2 | 0.73            | -129.0 |
| 450     | 0.76            | -151.0 | 2.44            | 50.3  | 0.07            | -27.7 | 0.74            | -134.0 |
| 500     | 0.77            | -156.0 | 2.13            | 44.2  | 0.07            | -32.2 | 0.75            | -138.0 |
| 600     | 0.79            | -165.0 | 1.67            | 33.3  | 0.06            | -40.0 | 0.79            | -145.0 |
| 700     | 0.82            | -173.0 | 1.34            | 23.6  | 0.05            | -46.1 | 0.82            | -152.0 |
| 800     | 0.84            | 180.0  | 1.10            | 15.2  | 0.04            | -50.4 | 0.85            | -157.0 |
| 900     | 0.86            | 173.0  | 0.92            | 7.5   | 0.04            | -52.9 | 0.87            | -162.0 |
| 1000    | 0.87            | 167.0  | 0.78            | 0.7   | 0.03            | -52.8 | 0.88            | -166.0 |

**Note**

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

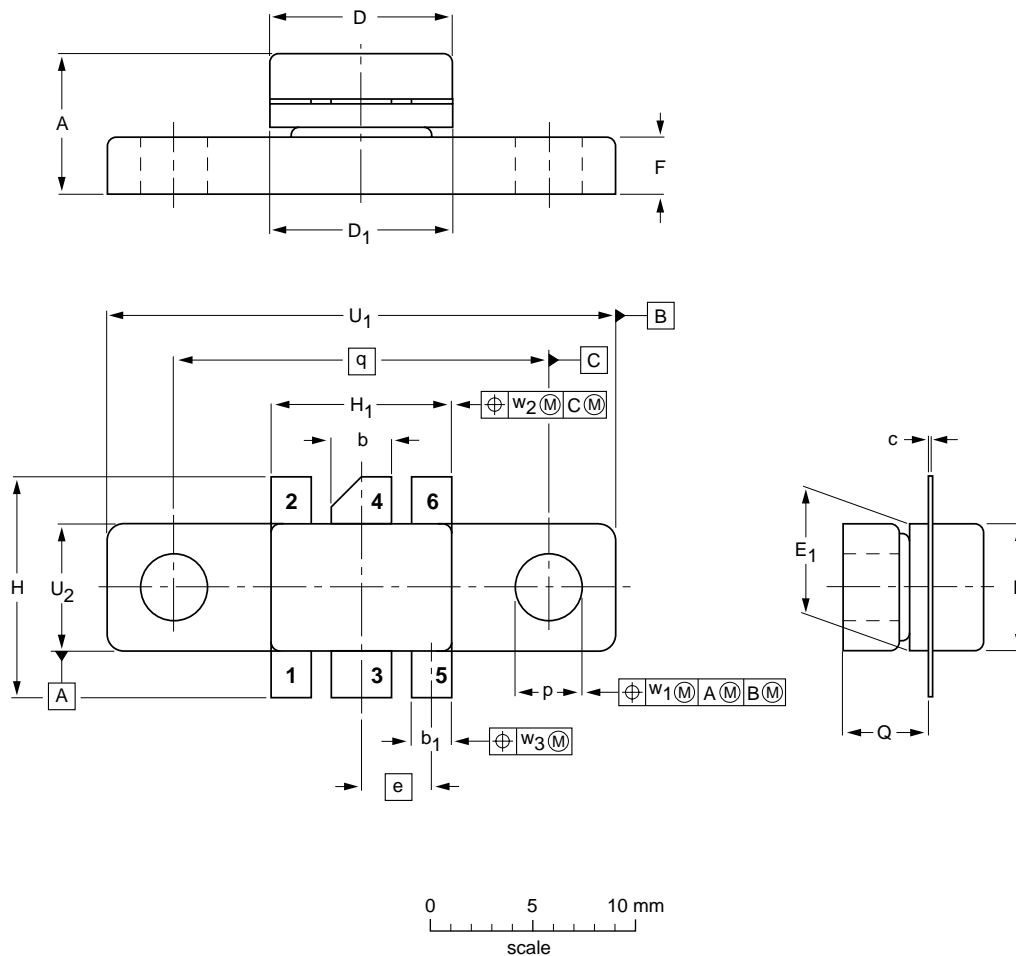
UHF power MOS transistor

BLF542

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

BLF542

## DATA SHEET STATUS

| LEVEL | DATA SHEET STATUS <sup>(1)</sup> | PRODUCT STATUS <sup>(2)(3)</sup> | 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.

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**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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## **Contact information**

For additional information please visit <http://www.semiconductors.philips.com>. Fax: +31 40 27 24825

For sales offices addresses send e-mail to: [sales.addresses@www.semiconductors.philips.com](mailto:sales.addresses@www.semiconductors.philips.com).

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