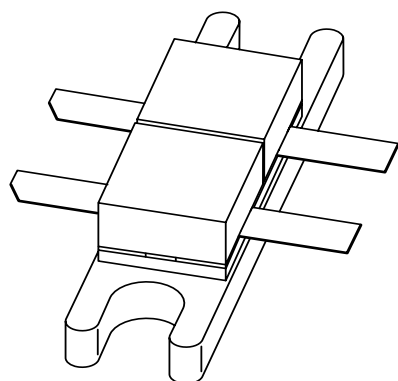


# DATA SHEET



## **BLF546** UHF push-pull power MOS transistor

Product specification  
Supersedes data of 1998 Jan 09

2003 Sep 22

UHF push-pull power MOS transistor

BLF546

FEATURES

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

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS push-pull transistor designed for communications transmitter applications in the UHF frequency range.

The transistor is encapsulated in a 4-lead, SOT268A balanced flange package, with two ceramic caps. The mounting flange provides the common source connection for the transistors.

PINNING - SOT268A

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

PIN CONFIGURATION

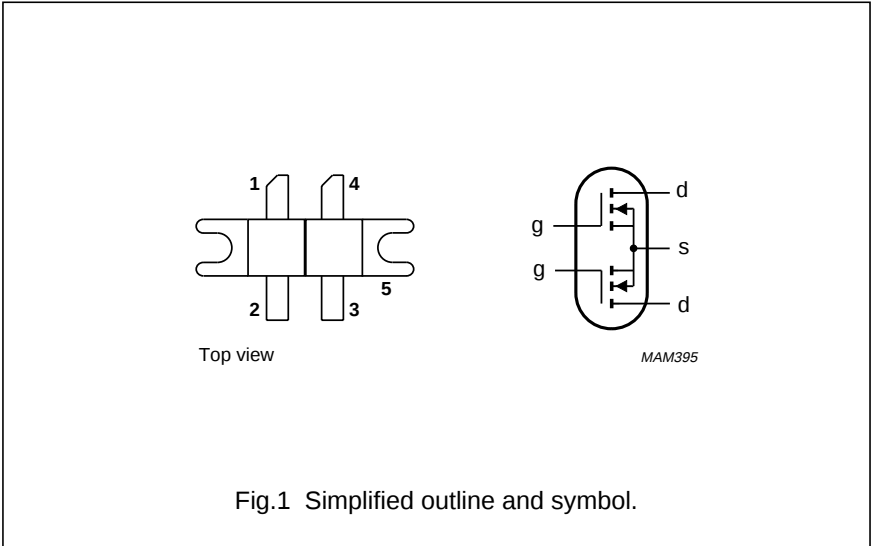


Fig.1 Simplified outline and symbol.

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 discs are 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  $T_h = 25\text{ }^{\circ}\text{C}$  in a push-pull common source test circuit.

| MODE OF OPERATION | f<br>(MHz) | $V_{DS}$<br>(V) | $P_L$<br>(W) | $G_p$<br>(dB) | $\eta_D$<br>(%) |
|-------------------|------------|-----------------|--------------|---------------|-----------------|
| CW, class-B       | 500        | 28              | 80           | >11           | >50             |

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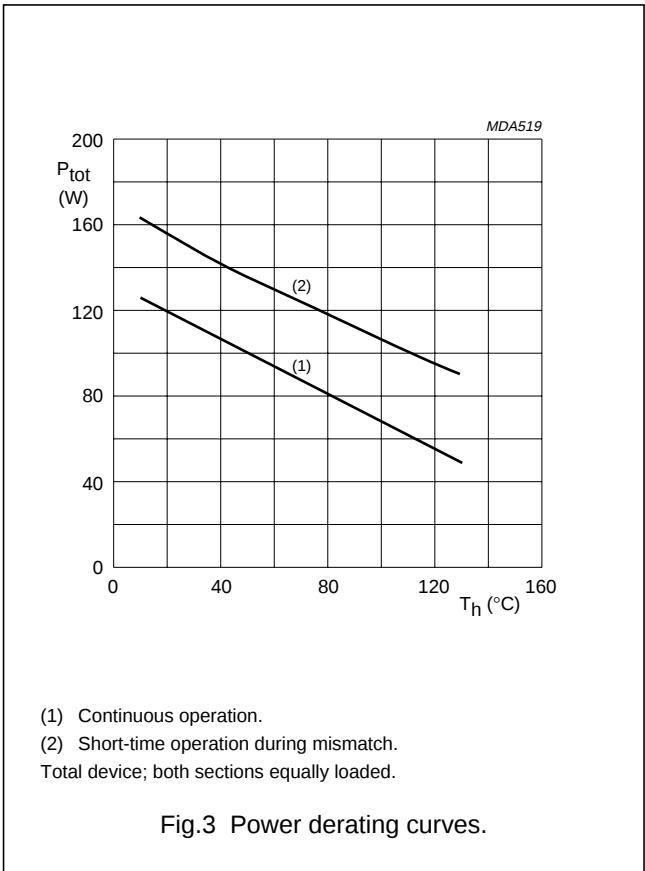
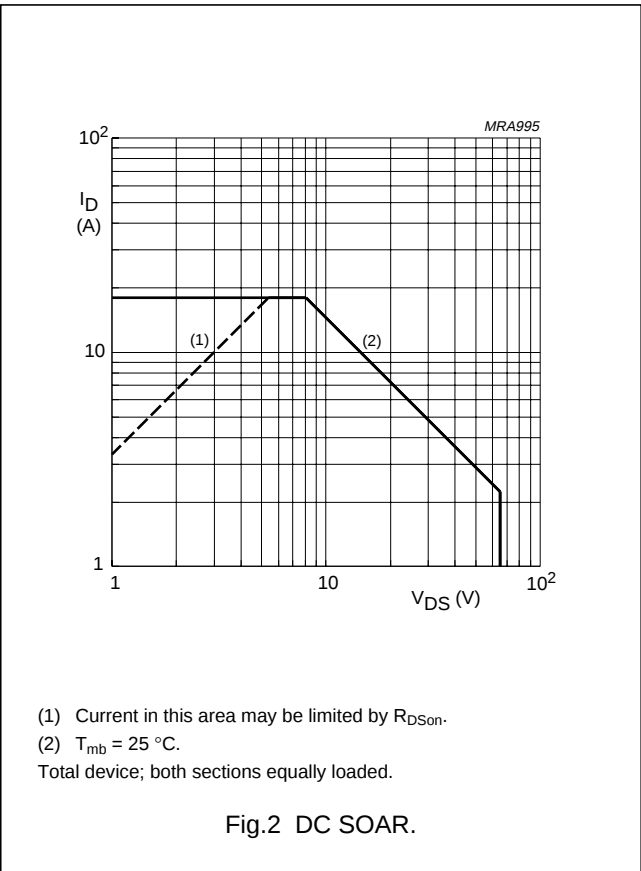
LIMITING VALUES

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

| SYMBOL                                              | PARAMETER               | CONDITIONS                                                                               | MIN. | MAX.     | UNIT               |
|-----------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------|------|----------|--------------------|
| Per transistor section (unless otherwise specified) |                         |                                                                                          |      |          |                    |
| $V_{DS}$                                            | drain-source voltage    |                                                                                          | –    | 65       | V                  |
| $V_{GS}$                                            | gate-source voltage     |                                                                                          | –    | $\pm 20$ | V                  |
| $I_D$                                               | drain current (DC)      |                                                                                          | –    | 9        | A                  |
| $P_{tot}$                                           | total power dissipation | $T_{mb} \leq 25\text{ }^{\circ}\text{C}$ ; total device;<br>both sections equally loaded | –    | 145      | W                  |
| $T_{stg}$                                           | storage temperature     |                                                                                          | –65  | 150      | $^{\circ}\text{C}$ |
| $T_j$                                               | junction temperature    |                                                                                          | –    | 200      | $^{\circ}\text{C}$ |

THERMAL CHARACTERISTICS

| SYMBOL         | PARAMETER                                         | CONDITIONS                                    | VALUE | UNIT |
|----------------|---------------------------------------------------|-----------------------------------------------|-------|------|
| $R_{th\ j-mb}$ | thermal resistance from junction to mounting base | total device;<br>both sections equally loaded | 1.2   | K/W  |
| $R_{th\ mb-h}$ | thermal resistance from mounting base to heatsink | total device;<br>both sections equally loaded | 0.25  | K/W  |



## UHF push-pull power MOS transistor

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## CHARACTERISTICS

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

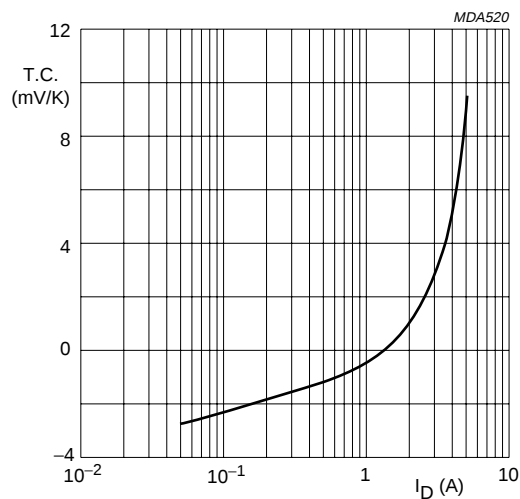
| SYMBOL        | PARAMETER                        | CONDITIONS                                                 | MIN. | TYP. | MAX. | UNIT          |
|---------------|----------------------------------|------------------------------------------------------------|------|------|------|---------------|
| Per section   |                                  |                                                            |      |      |      |               |
| $V_{(BR)DSS}$ | drain-source breakdown voltage   | $V_{GS} = 0$ ; $I_D = 20\text{ mA}$                        | 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    | $\mu\text{A}$ |
| $V_{GSth}$    | gate-source threshold voltage    | $I_D = 80\text{ mA}$ ; $V_{DS} = 10\text{ V}$              | 1    | –    | 4    | V             |
| $g_{fs}$      | forward transconductance         | $I_D = 2.4\text{ A}$ ; $V_{DS} = 10\text{ V}$              | 1.2  | 1.7  | –    | S             |
| $R_{DSon}$    | drain-source on-state resistance | $I_D = 2.4\text{ A}$ ; $V_{GS} = 10\text{ V}$              | –    | 0.4  | 0.6  | $\Omega$      |
| $I_{DSX}$     | on-state drain current           | $V_{GS} = 15\text{ V}$ ; $V_{DS} = 10\text{ V}$            | –    | 10   | –    | A             |
| $C_{is}$      | input capacitance                | $V_{GS} = 0$ ; $V_{DS} = 28\text{ V}$ ; $f = 1\text{ MHz}$ | –    | 60   | –    | pF            |
| $C_{os}$      | output capacitance               | $V_{GS} = 0$ ; $V_{DS} = 28\text{ V}$ ; $f = 1\text{ MHz}$ | –    | 46   | –    | pF            |
| $C_{rs}$      | feedback capacitance             | $V_{GS} = 0$ ; $V_{DS} = 28\text{ V}$ ; $f = 1\text{ MHz}$ | –    | 15   | –    | pF            |

 $V_{GS}$  group indicator

| GROUP | LIMITS<br>(V) |      | GROUP | LIMITS<br>(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  |       |               |      |

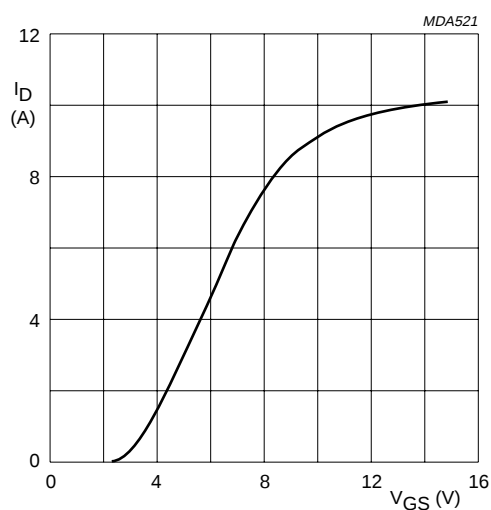
UHF push-pull power MOS transistor

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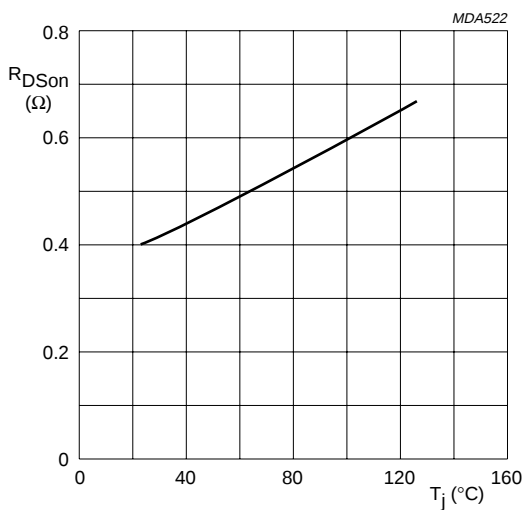
$V_{DS} = 10$  V.

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



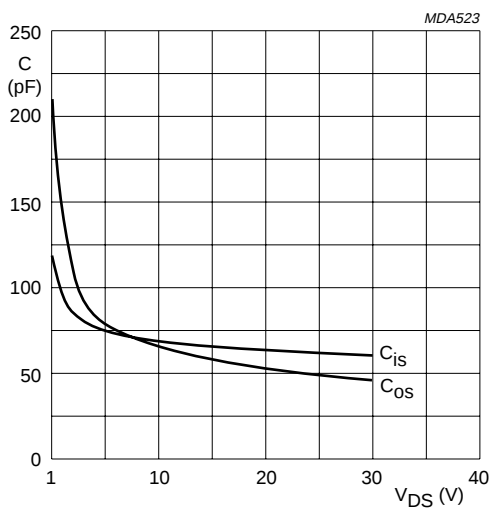
$V_{DS} = 10$  V;  $T_j = 25$  °C.

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



$I_D = 2.4$  A;  $V_{GS} = 10$  V.

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

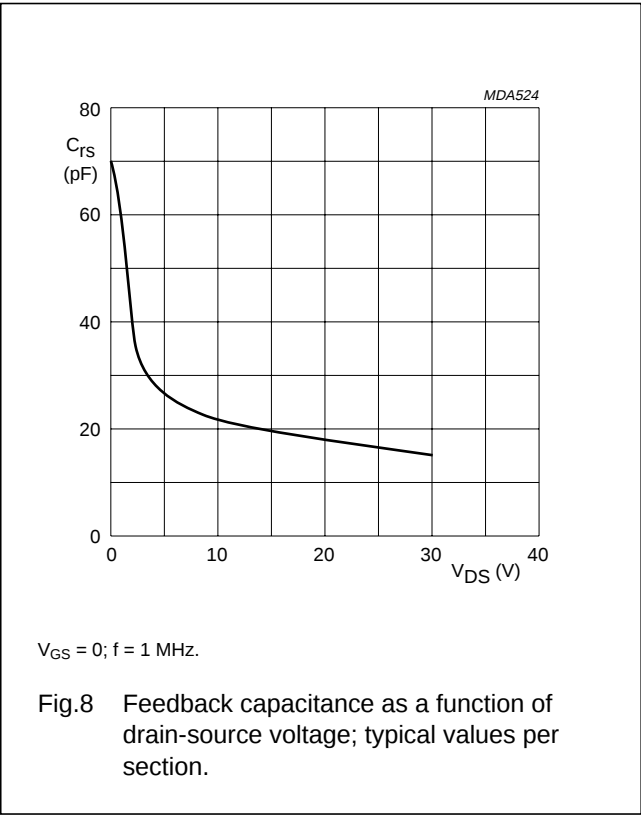


$V_{GS} = 0$ ;  $f = 1$  MHz.

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

UHF push-pull power MOS transistor

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APPLICATION INFORMATION FOR CLASS-B OPERATION

$T_h = 25\text{ }^{\circ}\text{C}$ ;  $R_{th\text{ mb-h}} = 0.25\text{ K/W}$ , unless otherwise specified.  
RF performance in a common source, class-B, push-pull circuit.

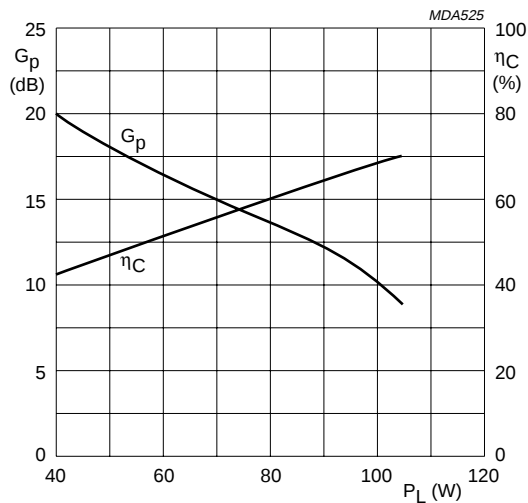
| MODE OF OPERATION | f (MHz) | $V_{DS}$ (V) | $I_{DQ}$ (mA) | $P_L$ (W) | $G_p$ (dB)     | $\eta_D$ (%)   |
|-------------------|---------|--------------|---------------|-----------|----------------|----------------|
| CW, class-B       | 500     | 28           | $2 \times 80$ | 80        | >11<br>typ. 13 | >50<br>typ. 60 |

Ruggedness in class-B operation

The BLF546 is capable of withstanding a full load mismatch corresponding to  $VSWR = 10$  through all phases under the following conditions:  $V_{DS} = 28\text{ V}$ ;  $f = 500\text{ MHz}$  at rated output power.

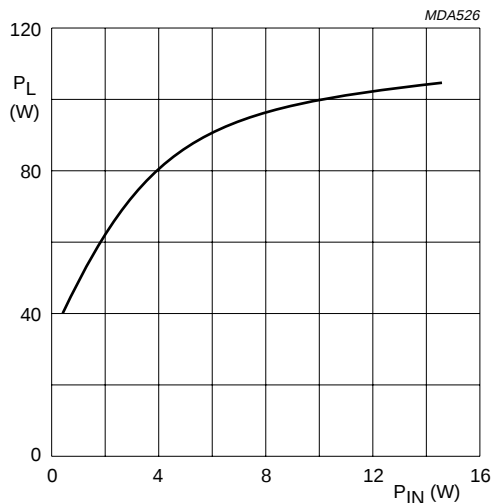
UHF push-pull power MOS transistor

BLF546



Class-B operation;  $V_{DS} = 28\text{ V}$ ;  $I_{DQ} = 2 \times 80\text{ mA}$ ;  
 $Z_L = 2.3 + j2.7\ \Omega$ (per section);  $f = 500\text{ MHz}$ .

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

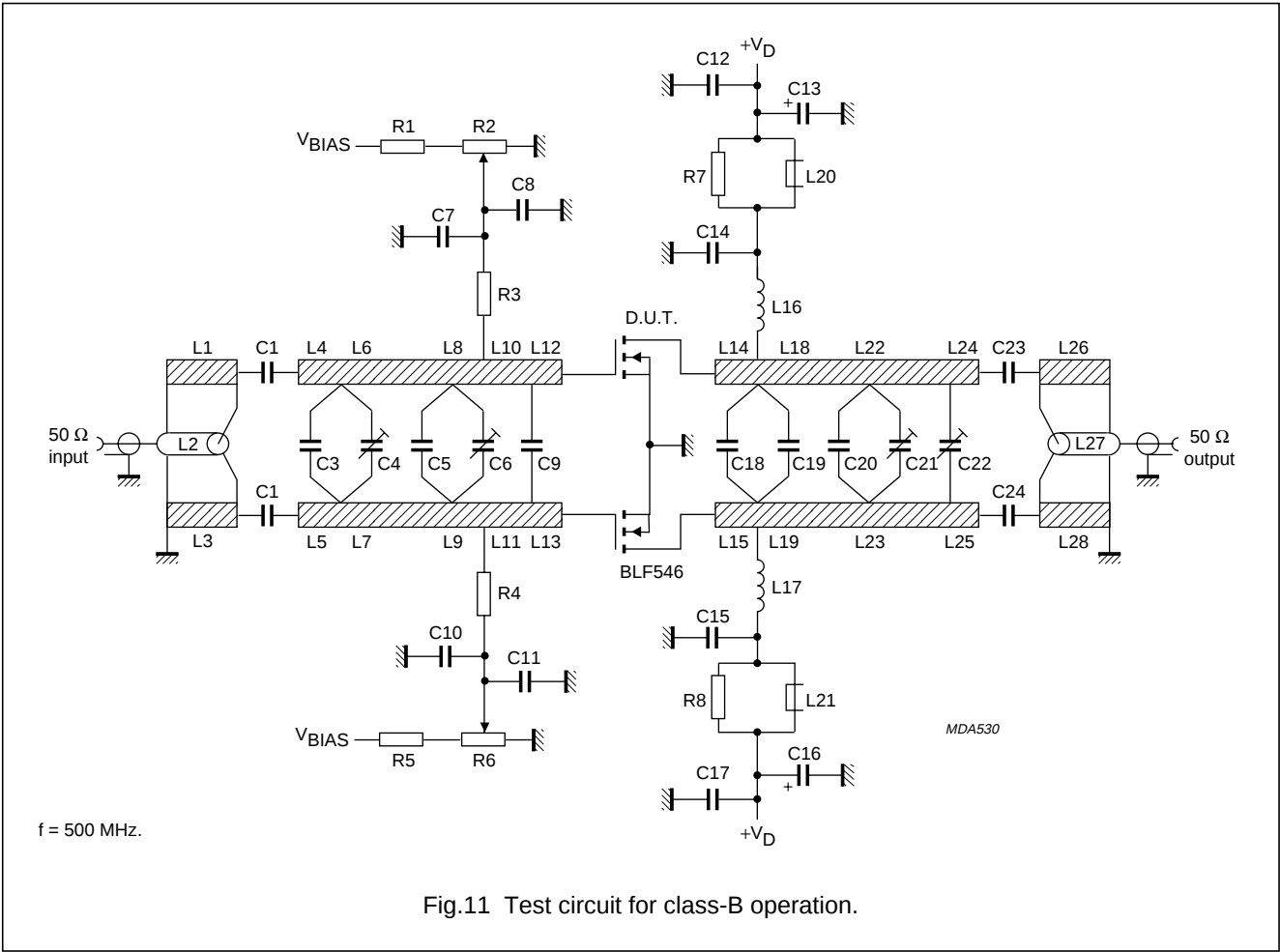


Class-B operation;  $V_{DS} = 28\text{ V}$ ;  $I_{DQ} = 2 \times 80\text{ mA}$ ;  
 $Z_L = 2.3 + j2.7\ \Omega$ (per section);  $f = 500\text{ MHz}$ .

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

UHF push-pull power MOS transistor

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List of components (see Fig.11)

| COMPONENT         | DESCRIPTION                                  | VALUE             | DIMENSIONS | CATALOGUE NO.  |
|-------------------|----------------------------------------------|-------------------|------------|----------------|
| C1, C2            | multilayer ceramic chip capacitor;<br>note 1 | 33 pF, 500 V      |            |                |
| C3                | multilayer ceramic chip capacitor;<br>note 1 | 11 pF, 500 V      |            |                |
| C4, C6, C21, C22  | film dielectric trimmer                      | 2 to 9 pF         |            | 2222 809 09005 |
| C5                | multilayer ceramic chip capacitor;<br>note 2 | 12 pF, 500 V      |            |                |
| C7, C10, C14, C15 | multilayer ceramic chip capacitor;<br>note 1 | 390 pF, 500 V     |            |                |
| C8, C11, C12, C17 | multilayer ceramic chip capacitor            | 100 nF, 50 V      |            | 2222 852 47104 |
| C9                | multilayer ceramic chip capacitor;<br>note 2 | 39 pF, 500 V      |            |                |
| C13, C16          | electrolytic capacitor                       | 4.7 $\mu$ F, 63 V |            | 2222 030 38478 |

## UHF push-pull power MOS transistor

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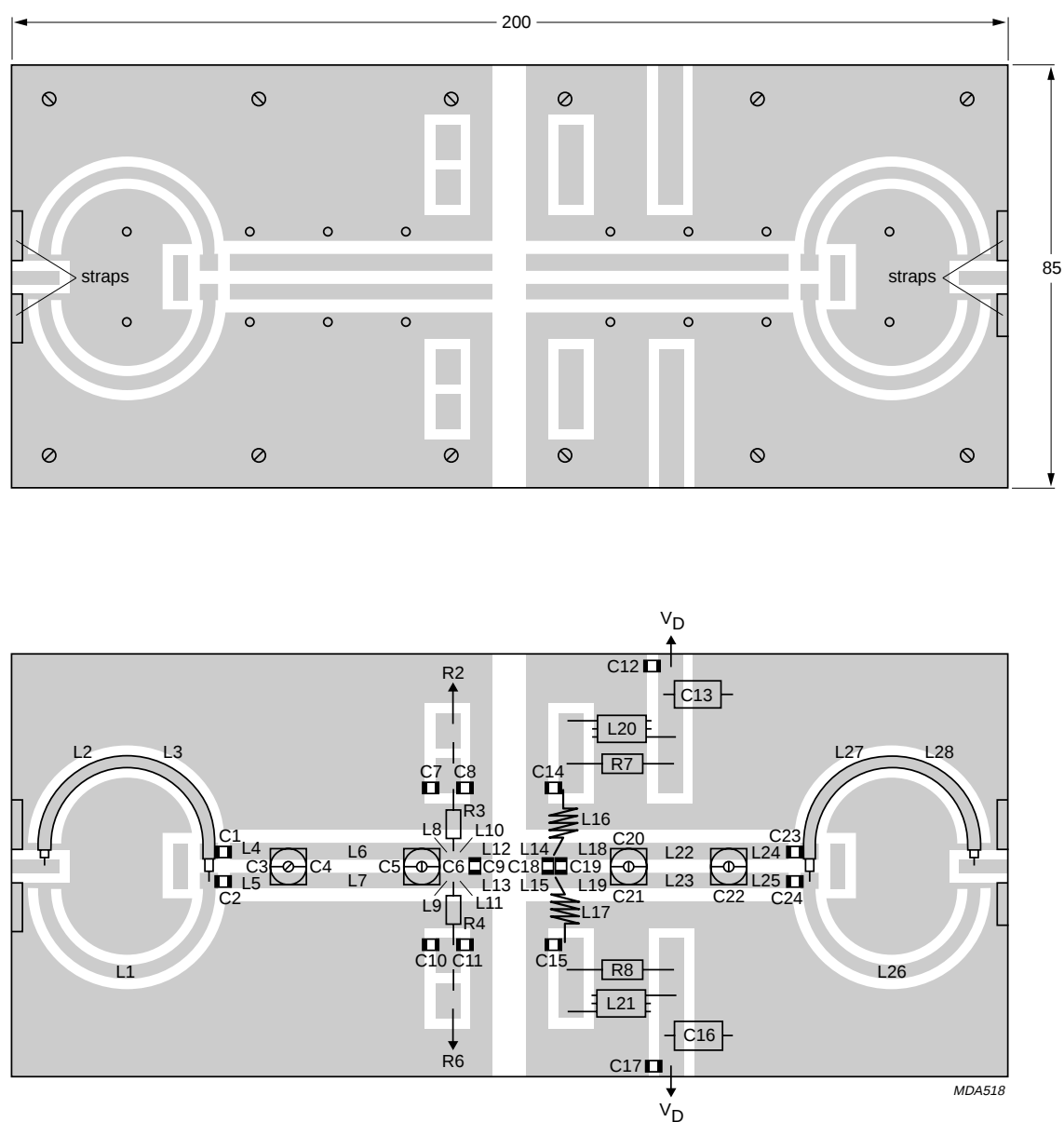
| COMPONENT        | DESCRIPTION                                  | VALUE           | DIMENSIONS                                                 | CATALOGUE NO.  |
|------------------|----------------------------------------------|-----------------|------------------------------------------------------------|----------------|
| C18, C19         | multilayer ceramic chip capacitor;<br>note 2 | 18 pF, 500 V    |                                                            |                |
| C20              | multilayer ceramic chip capacitor;<br>note 2 | 15 pF, 500 V    |                                                            |                |
| C23, C24         | multilayer ceramic chip capacitor;<br>note 1 | 15 pF, 500 V    |                                                            |                |
| L1, L3, L26, L28 | stripline; note 3                            | 50 $\Omega$     | 55.6 $\times$ 2.4 mm                                       |                |
| L2               | semi-rigid cable; note 4                     | 50 $\Omega$     | ext. dia. 2 mm<br>ext. conductor<br>length 55.6 mm         |                |
| L4, L5           | stripline; note 3                            | 42 $\Omega$     | 12 $\times$ 3 mm                                           |                |
| L6, L7           | stripline; note 3                            | 42 $\Omega$     | 26.5 $\times$ 3 mm                                         |                |
| L8, L9           | stripline; note 3                            | 42 $\Omega$     | 5.5 $\times$ 3 mm                                          |                |
| L10, L11         | stripline; note 3                            | 42 $\Omega$     | 6 $\times$ 3 mm                                            |                |
| L12, L13         | stripline; note 3                            | 42 $\Omega$     | 3 $\times$ 3 mm                                            |                |
| L14, L15         | stripline; note 3                            | 42 $\Omega$     | 7 $\times$ 3 mm                                            |                |
| L16, L17         | 3 turns enamelled 1 mm copper wire           | 15.6 nH         | length 8.5 mm<br>int. dia. 5.4 mm<br>leads 2 $\times$ 5 mm |                |
| L18, L19         | stripline; note 3                            | 42 $\Omega$     | 12 $\times$ 3 mm                                           |                |
| L20, L21         | grade 3B Ferroxcube RF choke                 |                 |                                                            | 4312 020 36642 |
| L22, L23         | stripline; note 3                            | 42 $\Omega$     | 20 $\times$ 3 mm                                           |                |
| L24, L25         | stripline; note 3                            | 42 $\Omega$     | 14 $\times$ 3 mm                                           |                |
| L27              | semi-rigid cable; note 5                     | 50 $\Omega$     | ext. dia. 2 mm<br>ext. conductor<br>length 55.6 mm         |                |
| R1, R5           | 0.4 W metal film resistor                    | 11.5 k $\Omega$ |                                                            | 2322 151 71153 |
| R2, R6           | 10 turns cermet potentiometer                | 50 k $\Omega$   |                                                            |                |
| R3, R4           | 0.4 W metal film resistor                    | 10 k $\Omega$   |                                                            | 2322 151 71003 |
| R7, R8           | 1 W metal film resistor                      | 10 $\Omega$     |                                                            | 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 175B 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.
4. Semi-rigid cable L2 is soldered on to stripline L3.
5. Semi-rigid cable L27 is soldered on to stripline L28.

## UHF push-pull power MOS transistor

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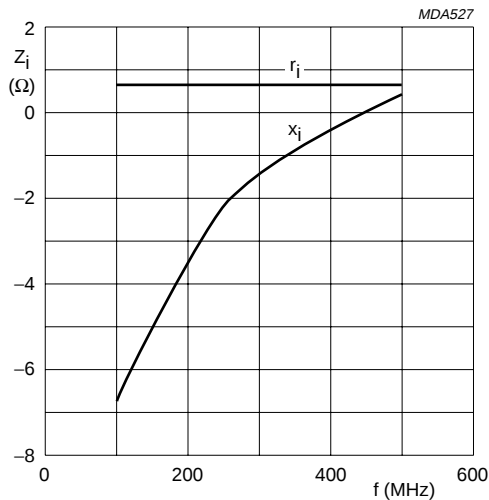
Dimensions in mm.

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 test circuit.

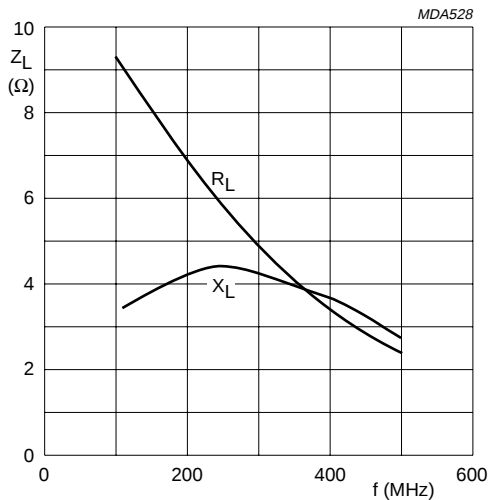
UHF push-pull power MOS transistor

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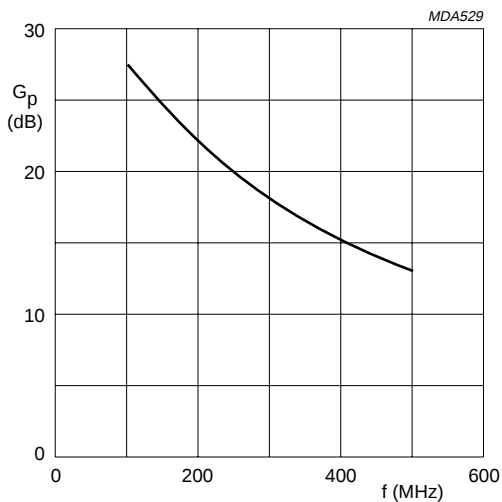
Class-B operation;  $V_{DS} = 28\text{ V}$ ;  $I_{DQ} = 2 \times 80\text{ mA}$ ;  $P_L = 80\text{ W}$ .

Fig.13 Input impedance as a function of frequency (series components); typical values per section.



Class-B operation;  $V_{DS} = 28\text{ V}$ ;  $I_{DQ} = 2 \times 80\text{ mA}$ ;  $P_L = 80\text{ W}$ .

Fig.14 Load impedance as a function of frequency (series components); typical values per section.



Class-B operation;  $V_{DS} = 28\text{ V}$ ;  $I_{DQ} = 2 \times 80\text{ mA}$ ;  $P_L = 80\text{ W}$ .

Fig.15 Power gain as a function of frequency; typical values per section.

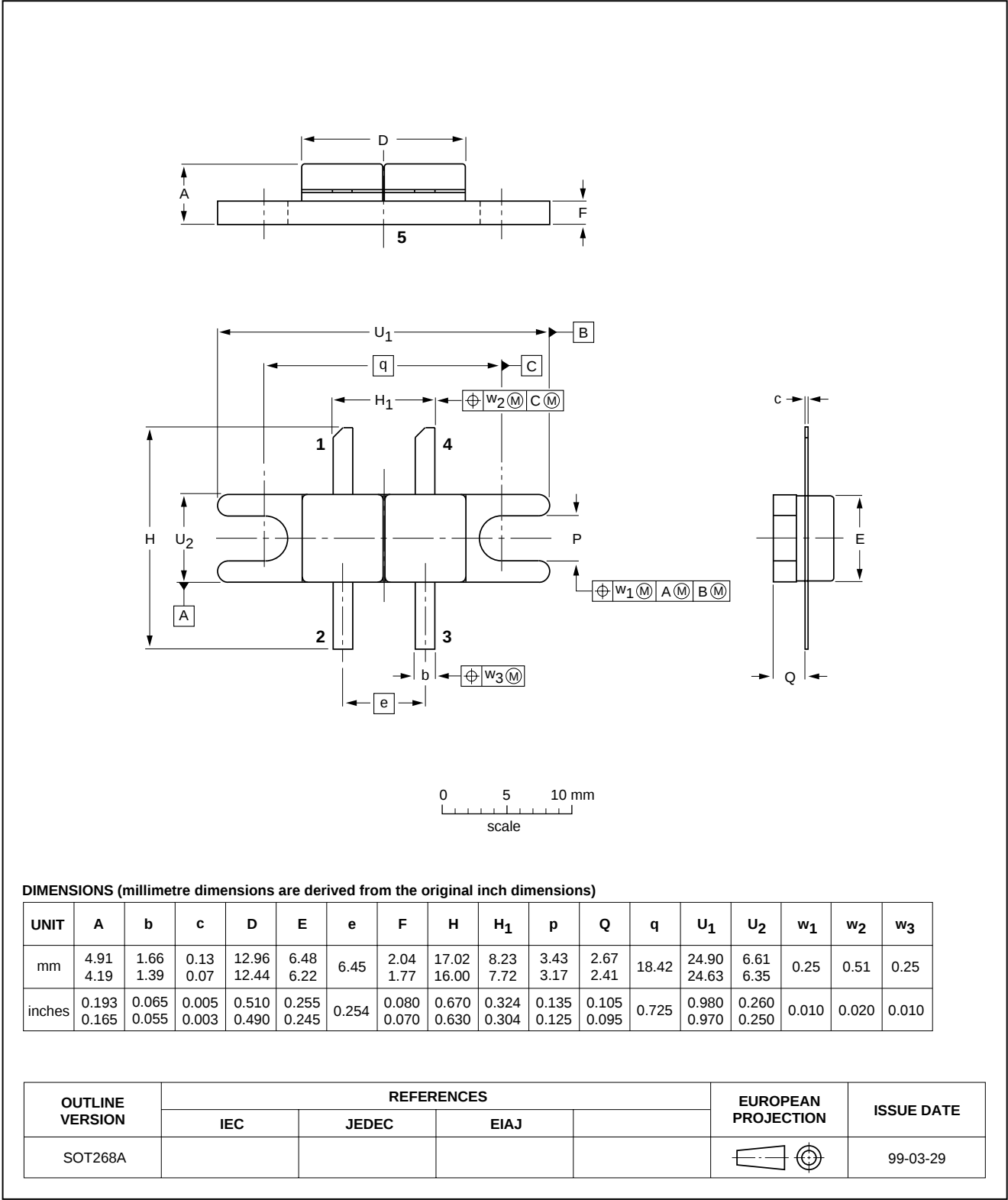
UHF push-pull power MOS transistor

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PACKAGE OUTLINE

Flanged double-ended ceramic package; 2 mounting holes; 4 leads

SOT268A



## UHF push-pull power MOS transistor

BLF546

## 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.             |
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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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