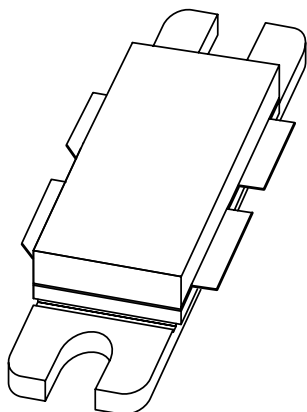


# DATA SHEET



**BLF861A**

**UHF power LDMOS transistor**

Product specification  
Supersedes data of 2000 Aug 04

2001 Feb 09

## UHF power LDMOS transistor

## BLF861A

## FEATURES

- High power gain
- Easy power control
- Excellent ruggedness
- Designed to withstand abrupt load mismatch errors
- Source on underside eliminates DC isolators; reducing common mode inductance
- Designed for broadband operation (UHF band)
- Internal input and output matching for high gain and optimum broadband operation.

## APPLICATIONS

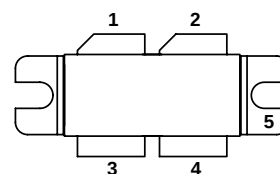
- Communication transmitter applications in the UHF frequency range.

## DESCRIPTION

Silicon N-channel enhancement mode lateral D-MOS push-pull transistor in a SOT540A package with ceramic cap. The common source is connected to the mounting flange.

## PINNING - SOT540A

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



Top view

MBK777

Fig.1 Simplified outline.

## QUICK REFERENCE DATA

RF performance at  $T_h = 25^\circ\text{C}$  in a common source 860 MHz test circuit.

| MODE OF OPERATION     | f<br>(MHz)  | $V_{DS}$<br>(V) | $P_L$<br>(W)                    | $G_p$<br>(dB)      | $\eta_D$<br>(%) | $\Delta G_p$<br>(dB) |
|-----------------------|-------------|-----------------|---------------------------------|--------------------|-----------------|----------------------|
| CW, class-AB          | 860         | 32              | 150                             | >13.5<br>typ. 14.5 | >50             | $\leq 1$             |
| PAL BG (TV); class-AB | 860 (ch 69) | 32              | >150<br>typ. 170<br>(peak sync) | >14                | >40             | note 1               |

## Note

1. Sync compression: input sync  $\geq 33\%$ ; output sync 27%.

## 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     |                                | –    | $\pm 15$ | V                |
| $I_D$     | drain current (DC)      |                                | –    | 18       | A                |
| $P_{tot}$ | total power dissipation | $T_{mb} \leq 25^\circ\text{C}$ | –    | 318      | W                |
| $T_{stg}$ | storage temperature     |                                | –65  | +150     | $^\circ\text{C}$ |
| $T_j$     | junction temperature    |                                | –    | 200      | $^\circ\text{C}$ |

UHF power LDMOS transistor

BLF861A

THERMAL CHARACTERISTICS

| SYMBOL         | PARAMETER                                         | CONDITIONS                                                       | VALUE | UNIT |
|----------------|---------------------------------------------------|------------------------------------------------------------------|-------|------|
| $R_{th\ j-mb}$ | thermal resistance from junction to mounting base | $T_{mb} = 25\text{ }^{\circ}\text{C}$ ; $P_{tot} = 318\text{ W}$ | 0.55  | K/W  |
| $R_{th\ mb-h}$ | thermal resistance from mounting base to heatsink |                                                                  | 0.2   | K/W  |

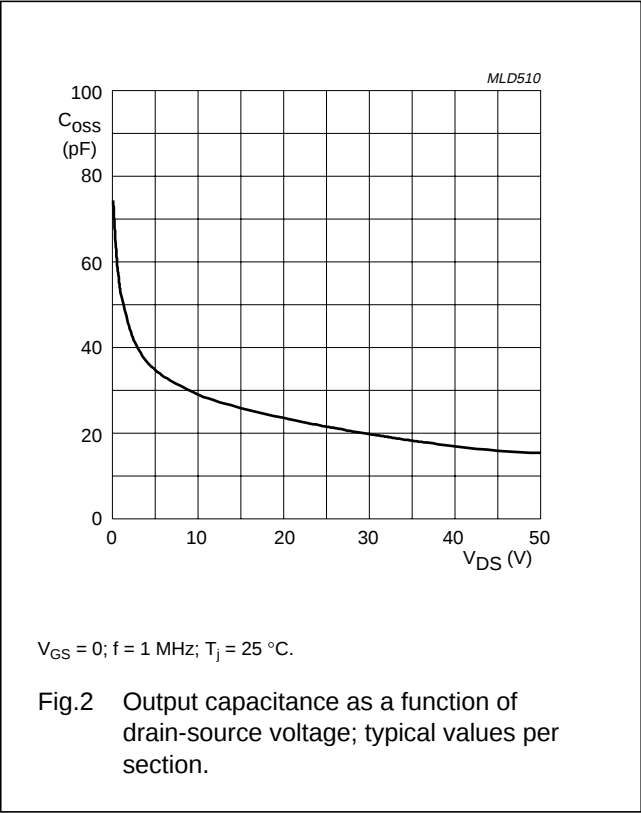
CHARACTERISTICS

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

| SYMBOL        | PARAMETER                        | CONDITIONS                                                                | MIN. | TYP. | MAX. | UNIT          |
|---------------|----------------------------------|---------------------------------------------------------------------------|------|------|------|---------------|
| $V_{(BR)DSS}$ | drain-source breakdown voltage   | $V_{GS} = 0$ ; $I_D = 1.5\text{ mA}$                                      | 65   | –    | –    | V             |
| $V_{GSth}$    | gate-source threshold voltage    | $V_{DS} = 10\text{ V}$ ; $I_D = 150\text{ mA}$                            | 4    | –    | 5.5  | V             |
| $I_{DSS}$     | drain-source leakage current     | $V_{GS} = 0$ ; $V_{DS} = 32\text{ V}$                                     | –    | –    | 2.2  | $\mu\text{A}$ |
| $I_{DSX}$     | drain cut-off current            | $V_{GS} = V_{GSth} + 9\text{ V}$ ; $V_{DS} = 10\text{ V}$                 | 18   | –    | –    | A             |
| $I_{GSS}$     | gate leakage current             | $V_{GS} = \pm 15\text{ V}$ ; $V_{DS} = 0$                                 | –    | –    | 25   | nA            |
| $g_{fs}$      | forward transconductance         | $V_{DS} = 10\text{ V}$ ; $I_D = 4\text{ A}$                               | –    | 4    | –    | S             |
| $R_{DSon}$    | drain-source on-state resistance | $V_{GS} = V_{GSth} + 9\text{ V}$ ; $I_D = 4\text{ A}$                     | –    | 160  | –    | m $\Omega$    |
| $C_{iss}$     | input capacitance                | $V_{GS} = 0$ ; $V_{DS} = 32\text{ V}$ ; $f = 1\text{ MHz}$ <sup>(1)</sup> | –    | 82   | –    | pF            |
| $C_{oss}$     | output capacitance               | $V_{GS} = 0$ ; $V_{DS} = 32\text{ V}$ ; $f = 1\text{ MHz}$ <sup>(1)</sup> | –    | 40   | –    | pF            |
| $C_{rss}$     | feedback capacitance             | $V_{GS} = 0$ ; $V_{DS} = 32\text{ V}$ ; $f = 1\text{ MHz}$ <sup>(1)</sup> | –    | 6    | –    | pF            |

Note

1. Capacitance values without internal matching.



UHF power LDMOS transistor

BLF861A

APPLICATION INFORMATION

RF performance in a common source 860 MHz test circuit.  $T_h = 25\text{ }^{\circ}\text{C}$ ;  $R_{th\text{ mb-h}} = 0.15\text{ K/W}$ ; unless otherwise specified.

| MODE OF OPERATION     | f (MHz)                                        | V <sub>DS</sub> (V) | I <sub>DQ</sub> (A) | P <sub>L</sub> (W)               | G <sub>p</sub> (dB) | η <sub>D</sub> (%) | d <sub>Im</sub> (dBc) | ΔG <sub>p</sub> (dB) |
|-----------------------|------------------------------------------------|---------------------|---------------------|----------------------------------|---------------------|--------------------|-----------------------|----------------------|
| CW; class-AB          | 860                                            | 32                  | 1                   | 150                              | >13.5<br>typ. 14.5  | >50                | –                     | ≤1                   |
| 2-tone; class-AB      | f <sub>1</sub> = 860<br>f <sub>1</sub> = 860.1 | 32                  | 1                   | 150 (PEP)                        | >14                 | >40                | ≤–25                  | –                    |
| PAL BG (TV); class-AB | 860<br>(ch 69)                                 | 32                  | 1                   | > 150<br>typ. 170<br>(peak sync) | >14                 | >40                | –                     | note 1               |

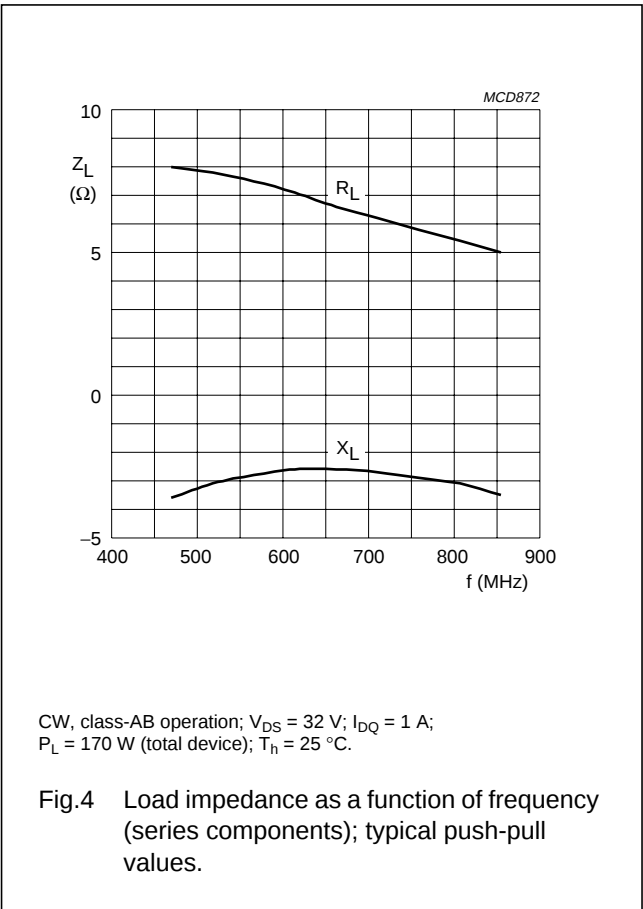
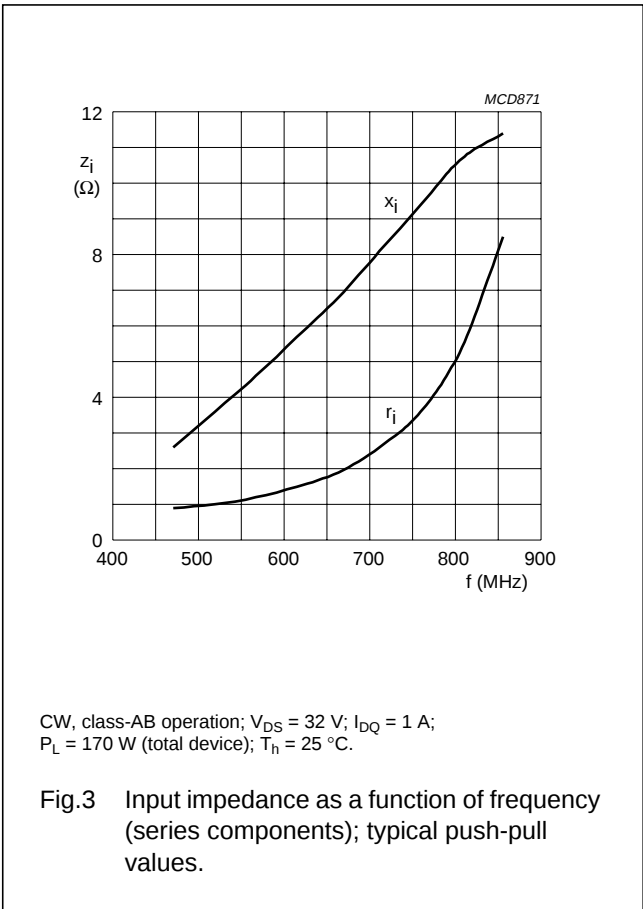
Note

1. Sync compression: input sync ≥ 33%; output sync 27% measured in an 860 MHz test circuit.

Ruggedness in class-AB operation

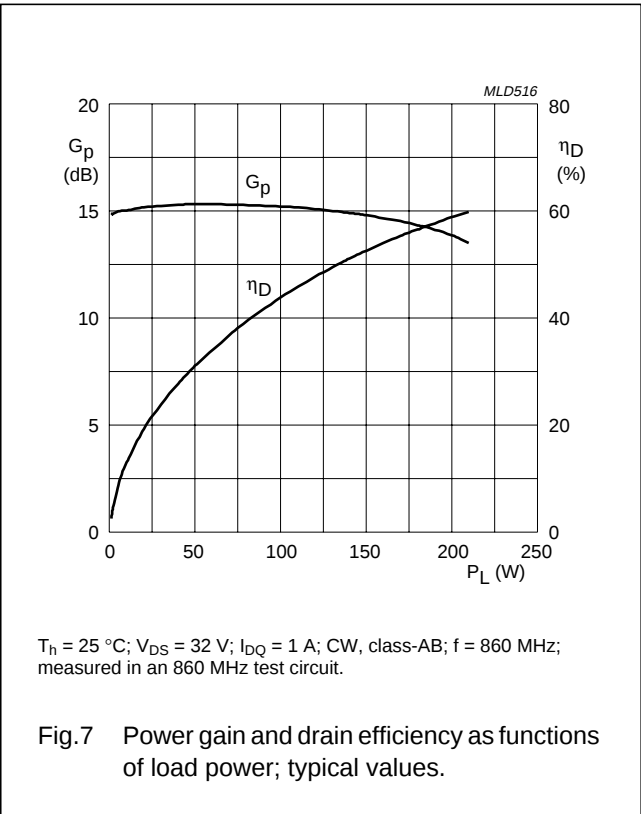
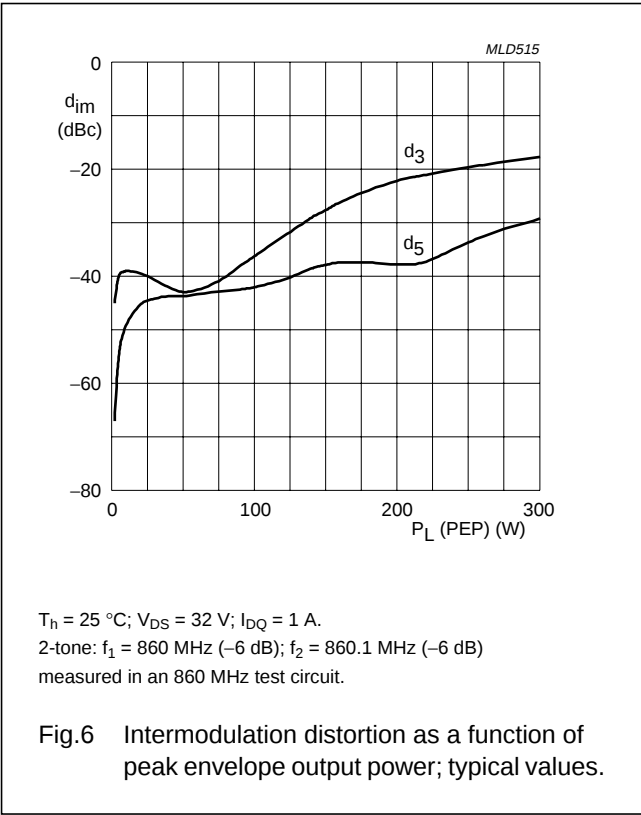
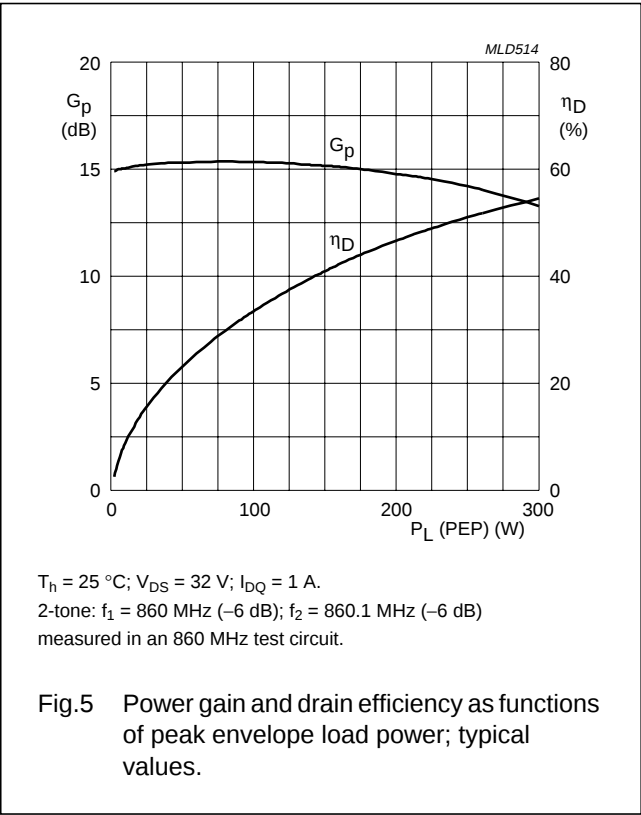
The BLF861A is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: V<sub>DS</sub> = 32 V; f = 860 MHz at rated load power.

The BLF861A is an improved version of the BLF861 on ruggedness and is capable to withstand abrupt source or load mismatch errors under the nominal power condition.



UHF power LDMOS transistor

BLF861A



UHF power LDMOS transistor

BLF861A

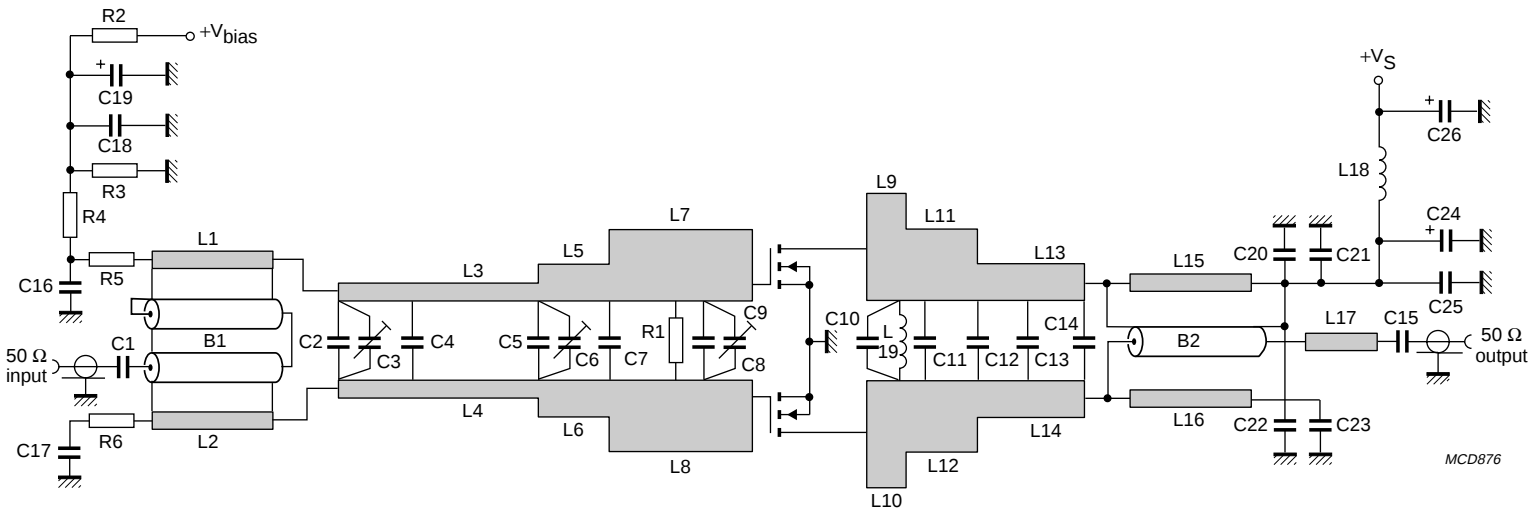


Fig.8 Class-AB common source broadband test circuit.

## UHF power LDMOS transistor

## BLF861A

List of components class-AB broadband test circuit (see Figs 8 and 9)

| COMPONENT          | DESCRIPTION                               | VALUE                          | DIMENSIONS           | CATALOGUE No.  |
|--------------------|-------------------------------------------|--------------------------------|----------------------|----------------|
| C1                 | multilayer ceramic chip capacitor; note 1 | 20 pF                          |                      |                |
| C2                 | multilayer ceramic chip capacitor; note 1 | 4.3 pF                         |                      |                |
| C3, C6, C9         | tekelec trimmer                           | 0.6 to 4.5 pF                  |                      |                |
| C4                 | multilayer ceramic chip capacitor; note 1 | 9.1 pF                         |                      |                |
| C5                 | multilayer ceramic chip capacitor; note 1 | 10 pF                          |                      |                |
| C7                 | multilayer ceramic chip capacitor; note 1 | 5.1 pF                         |                      |                |
| C8                 | multilayer ceramic chip capacitor; note 1 | 13 pF                          |                      |                |
| C10, C11           | multilayer ceramic chip capacitor; note 2 | 8.2 pF                         |                      |                |
| C12, C13           | multilayer ceramic chip capacitor; note 2 | 6.8 pF                         |                      |                |
| C14                | multilayer ceramic chip capacitor; note 3 | 1 pF                           |                      |                |
| C15                | multilayer ceramic chip capacitor; note 3 | 20 pF                          |                      |                |
| C16, C17           | multilayer ceramic chip capacitor         | 1 nF                           |                      |                |
| C18                | multilayer ceramic chip capacitor         | 100 nF                         |                      |                |
| C19, C26           | multilayer ceramic chip capacitor         | 100 $\mu$ F                    |                      |                |
| C20, C21, C22, C23 | multilayer ceramic chip capacitor; note 2 | 100 pF                         |                      |                |
| C24                | electrolytic capacitor                    | 1000 $\mu$ F                   |                      |                |
| C25                | multilayer ceramic chip capacitor         | 1 $\mu$ F                      |                      | 2222 595 16754 |
| L1, L2             | stripline; note 4                         |                                | 30.6 $\times$ 2.4 mm |                |
| L3, L4             | stripline; note 4                         |                                | 28 $\times$ 2.4 mm   |                |
| L5, L6             | stripline; note 4                         |                                | 10 $\times$ 5 mm     |                |
| L7, L8             | stripline; note 4                         |                                | 20 $\times$ 10 mm    |                |
| L9, L10            | stripline; note 4                         |                                | 5.5 $\times$ 15 mm   |                |
| L11, L12           | stripline; note 4                         |                                | 10 $\times$ 10 mm    |                |
| L13, L14           | stripline; note 4                         |                                | 15 $\times$ 5 mm     |                |
| L15, L16           | stripline; note 4                         |                                | 48.5 $\times$ 2.4 mm |                |
| L17                | stripline; note 4                         |                                | 10 $\times$ 2.4 mm   |                |
| L18                | ferrite                                   |                                |                      |                |
| L19                | wire inductor (hairpin)                   |                                | length = 17 mm       |                |
| B1                 | semi rigid coax balun UT70-25             | $Z = 25 \Omega \pm 1.5 \Omega$ | 70 mm                |                |
| B2                 | semi rigid coax balun UT70-25             | $Z = 25 \Omega \pm 1.5 \Omega$ | 48.5 mm              |                |

## UHF power LDMOS transistor

BLF861A

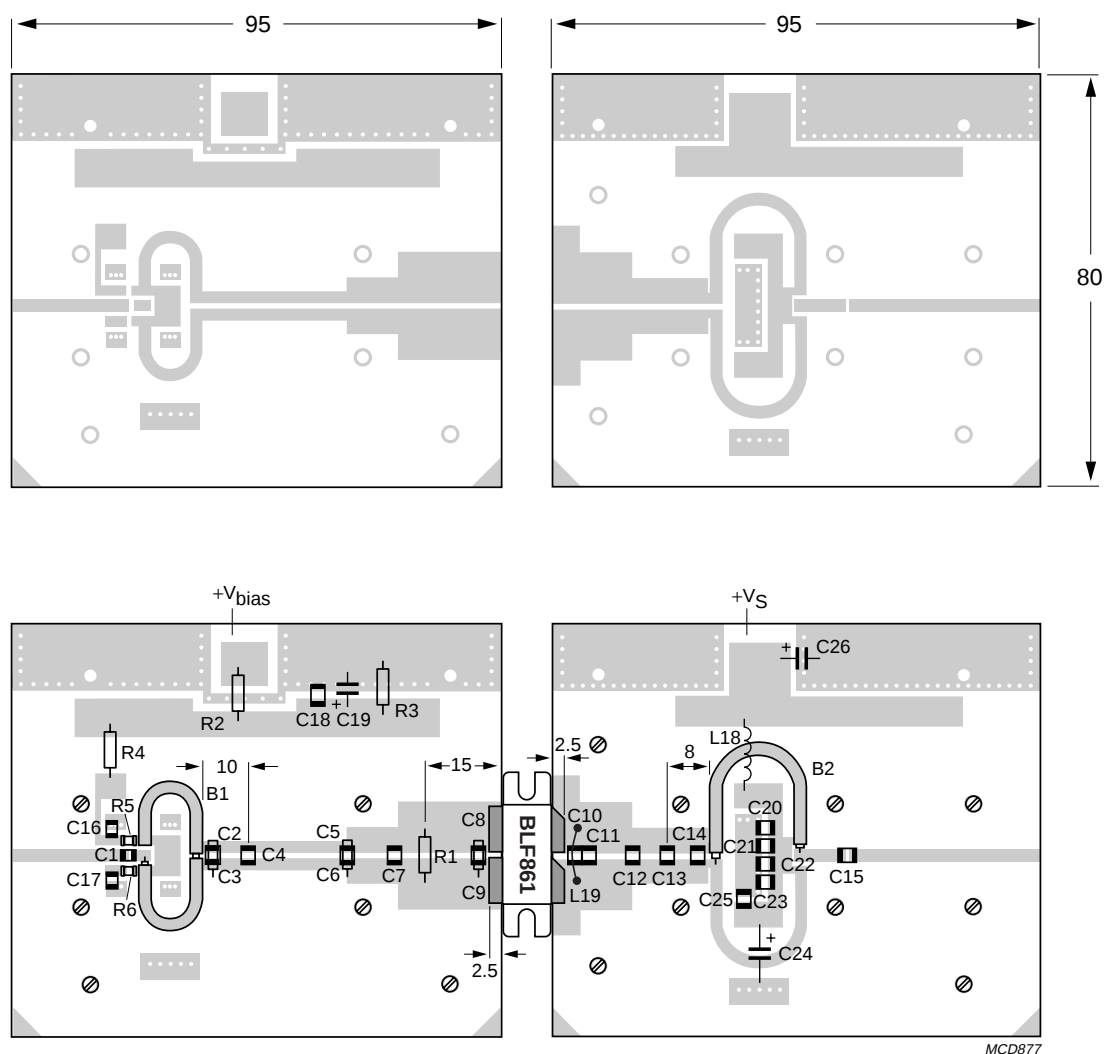
| COMPONENT | DESCRIPTION  | VALUE          | DIMENSIONS | CATALOGUE No. |
|-----------|--------------|----------------|------------|---------------|
| R1        | resistor     | 33 $\Omega$    |            |               |
| R2        | resistor     | 1 k $\Omega$   |            |               |
| R3        | resistor     | 100 k $\Omega$ |            |               |
| R4        | resistor     | 100 $\Omega$   |            |               |
| R5, R6    | SMD resistor | 3.9 $\Omega$   |            |               |

**Notes**

1. American Technical Ceramics type 100A or capacitor of same quality.
2. American Technical Ceramics type 180R or capacitor of same quality.
3. American Technical Ceramics type 100B or capacitor of same quality.
4. The striplines are on a double copper-clad printed-circuit board: Rogers 5880 ( $\epsilon_r = 2.2$ ); thickness 0.79 mm.

## UHF power LDMOS transistor

## BLF861A



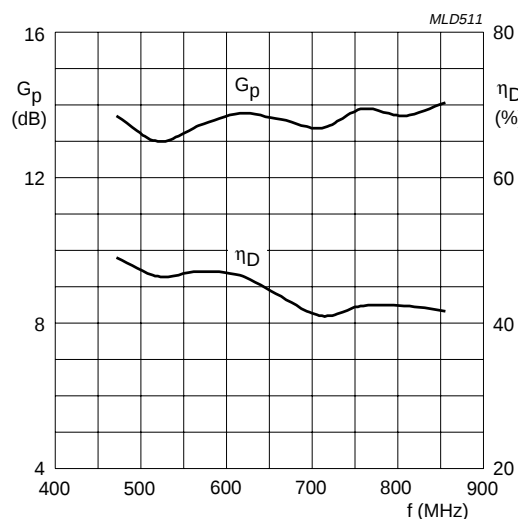
Dimensions in mm.

The components are situated on one side of the Rogers 5880 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 through-metallization.

Fig.9 Printed-circuit board and component layout for class-AB broadband test circuit.

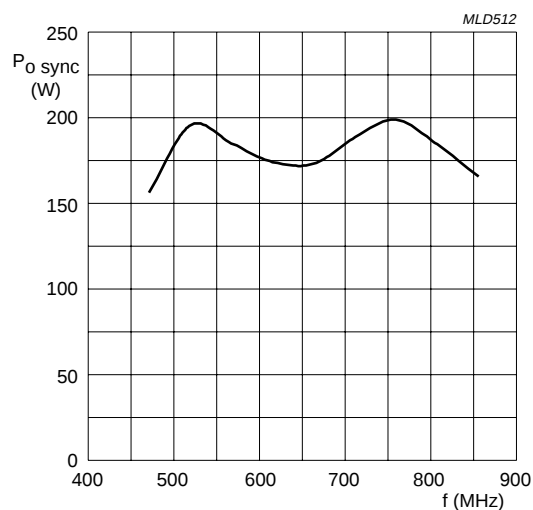
## UHF power LDMOS transistor

## BLF861A



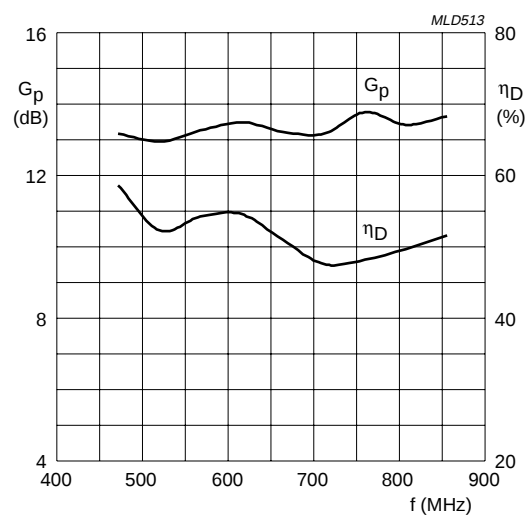
$T_h = 25\text{ }^\circ\text{C}$ ;  $V_{CE} = 32\text{ V}$ ;  $I_{DQ} = 1\text{ A}$ ; PAL BG signal (TV);  
sync compression: input 33%, output 27%;  
measured in broadband test circuit.

Fig.10 Power gain and drain efficiency as functions of frequency; typical values.



$T_h = 25\text{ }^\circ\text{C}$ ;  $V_{CE} = 32\text{ V}$ ;  $I_{DQ} = 1\text{ A}$ ; PAL BG signal (TV);  
sync compression: input 33%, output 27%;  
measured in broadband test circuit.

Fig.11 Peak envelope sync power as a function of frequency; typical values.



$T_h = 25\text{ }^\circ\text{C}$ ;  $V_{DS} = 32\text{ V}$ ;  $I_{DQ} = 1\text{ A}$ ; CW, class-AB operation;  
 $P_L = 150\text{ W}$ ; measured in broadband test circuit.

Fig.12 Power gain and drain efficiency as functions of frequency; typical values.

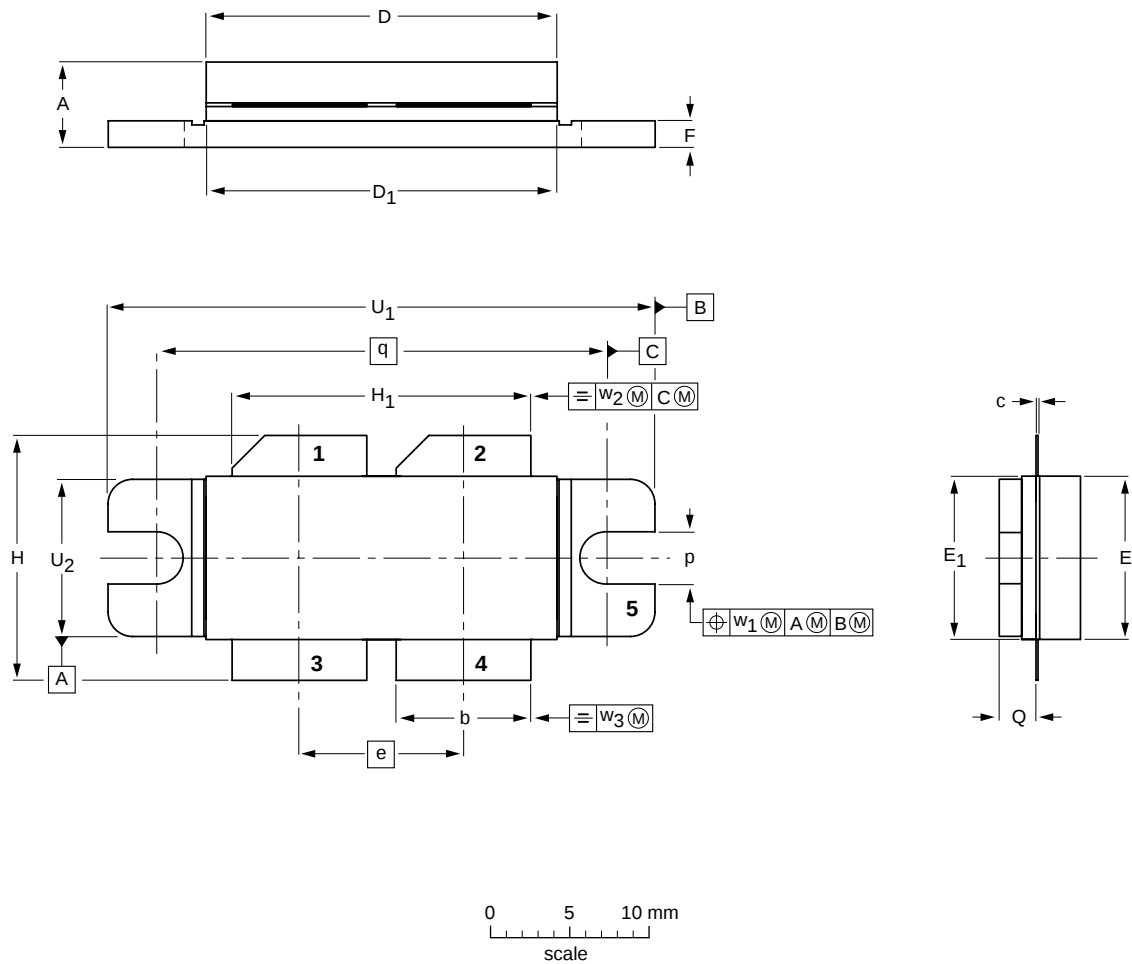
UHF power LDMOS transistor

BLF861A

PACKAGE OUTLINE

Flanged balanced LDMOST ceramic package; 2 mounting holes; 4 leads

SOT540A



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

| UNIT   | A              | b              | c              | D              | D <sub>1</sub> | e     | E              | E <sub>1</sub> | 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     | 5.77<br>5.00   | 8.51<br>8.26   | 0.15<br>0.10   | 22.05<br>21.64 | 22.05<br>21.64 | 10.21 | 10.26<br>10.06 | 10.31<br>10.01 | 1.78<br>1.52   | 15.75<br>14.73 | 18.72<br>18.47 | 3.38<br>3.12   | 2.72<br>2.46   | 27.94 | 34.16<br>33.91 | 9.91<br>9.65   | 0.25           | 0.51           | 0.25           |
| inches | 0.227<br>0.197 | 0.335<br>0.325 | 0.006<br>0.004 | 0.868<br>0.852 | 0.868<br>0.852 | 0.402 | 0.404<br>0.396 | 0.406<br>0.394 | 0.070<br>0.060 | 0.620<br>0.580 | 0.737<br>0.727 | 0.133<br>0.123 | 0.107<br>0.097 | 1.100 | 1.345<br>1.335 | 0.390<br>0.380 | 0.010          | 0.020          | 0.010          |

| OUTLINE<br>VERSION | REFERENCES |       |      |  | EUROPEAN<br>PROJECTION                                                                | ISSUE DATE           |
|--------------------|------------|-------|------|--|---------------------------------------------------------------------------------------|----------------------|
|                    | IEC        | JEDEC | EIAJ |  |                                                                                       |                      |
| SOT540A            |            |       |      |  |  | 99-08-27<br>99-12-28 |

## UHF power LDMOS transistor

BLF861A

## DATA SHEET STATUS

| DATA SHEET STATUS         | PRODUCT STATUS | DEFINITIONS <sup>(1)</sup>                                                                                                                                                                                                                                 |
|---------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objective specification   | Development    | This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.                                                                                                          |
| Preliminary specification | Qualification  | This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |
| Product specification     | Production     | This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.                                                       |

## Note

1. Please consult the most recently issued data sheet before initiating or completing a design.

## 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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## 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.

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UHF power LDMOS transistor

BLF861A

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**NOTES**

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**NOTES**

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**NOTES**

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SCA 71

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