

BLF147

VHF power MOS transistor

Rev. 06 — 5 December 2006

Product data sheet

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NXP Semiconductors

VHF power MOS transistor

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FEATURES

- High power gain
- Low intermodulation distortion
- Easy power control
- Good thermal stability
- Withstands full load mismatch.

APPLICATIONS

- Industrial and military applications in the HF/VHF frequency range.

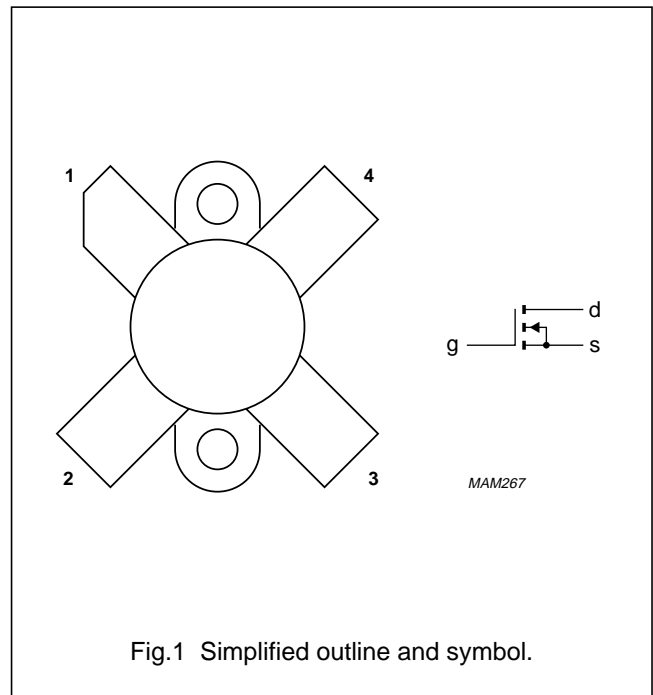
DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor encapsulated in a 4-lead, SOT121B 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. Refer to the "General" section of the handbook for further information.

PINNING - SOT121B

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

| 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. |



QUICK REFERENCE DATA

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

| MODE OF OPERATION | f (MHz) | V_{DS} (V) | P_L (W) | G_p (dB) | η_D (%) | d_3 (dB) | d_5 (dB) |
|-------------------|---------|--------------|-----------|------------|--------------|------------|------------|
| SSB, class-AB | 28 | 28 | 150 (PEP) | >17 | >35 | <-30 | <-30 |
| CW, class-B | 108 | 28 | 150 | typ. 14 | typ. 70 | - | - |

| 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. |

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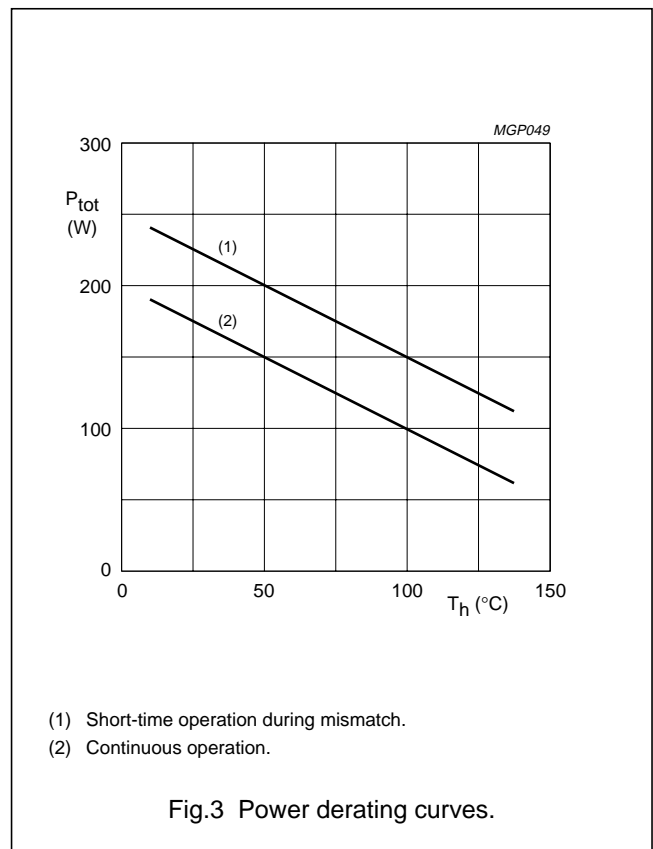
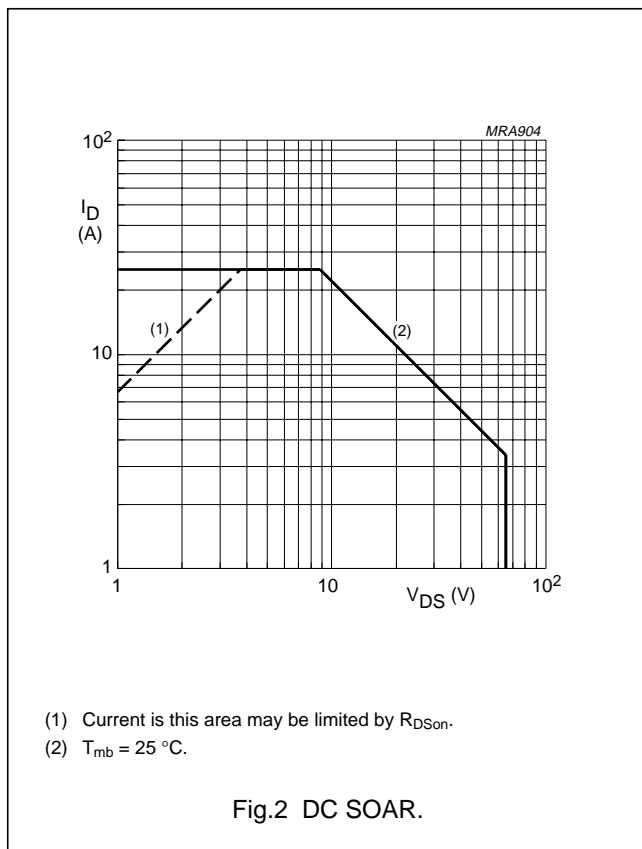
LIMITING VALUES

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|-----------|-------------------------|--|------|----------|------------------|
| V_{DS} | drain-source voltage | | – | 65 | V |
| V_{GS} | gate-source voltage | | – | ± 20 | V |
| I_D | drain current (DC) | | – | 25 | A |
| P_{tot} | total power dissipation | $T_{mb} \leq 25\text{ }^\circ\text{C}$ | – | 220 | 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 | 0.8 | K/W |
| $R_{th\ mb-h}$ | thermal resistance from mounting base to heatsink | 0.2 | K/W |



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CHARACTERISTICS

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

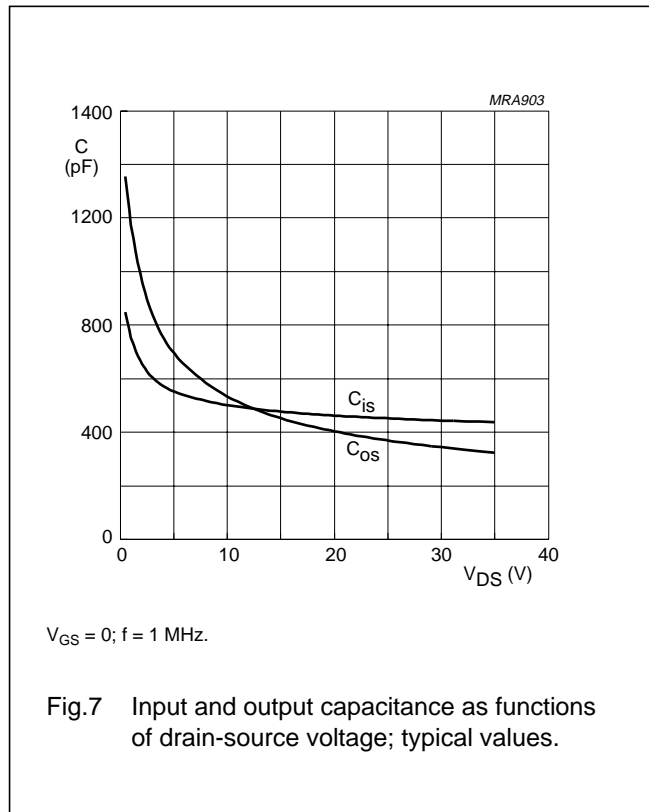
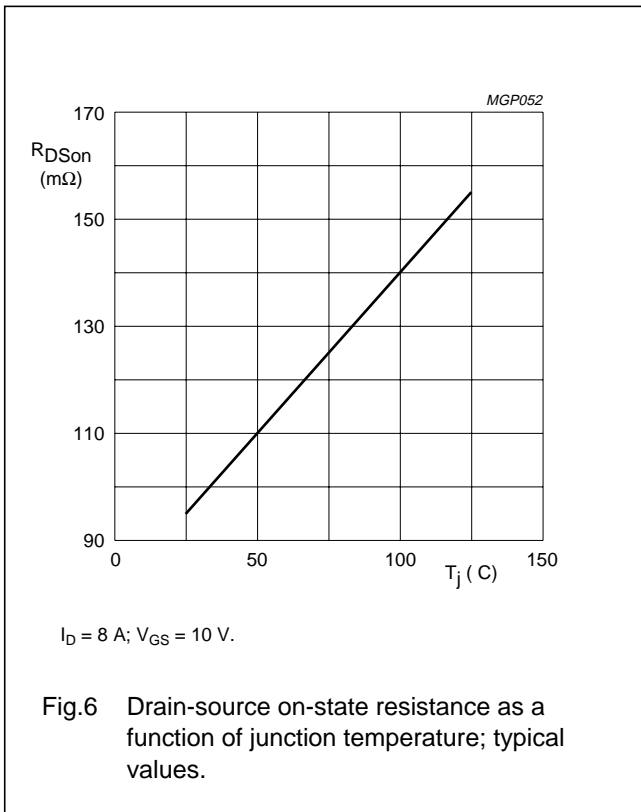
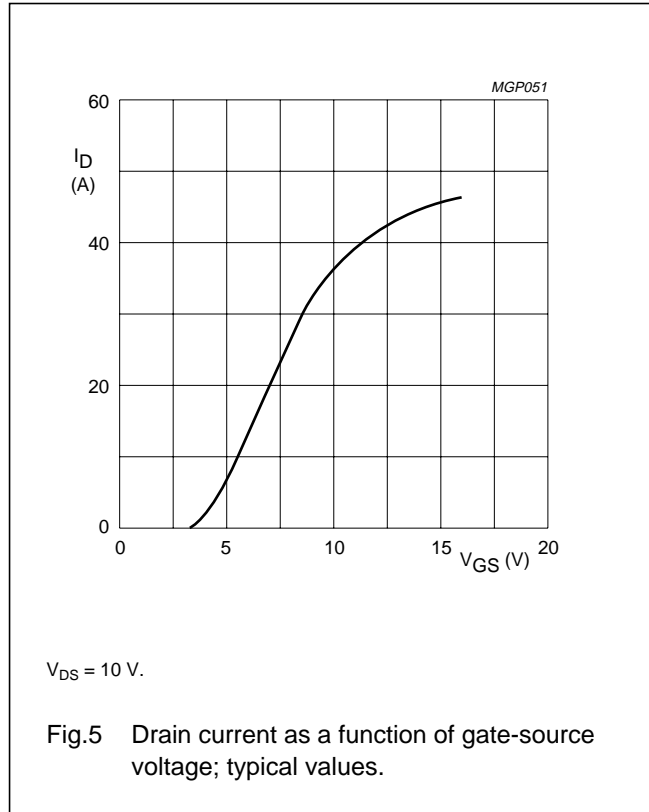
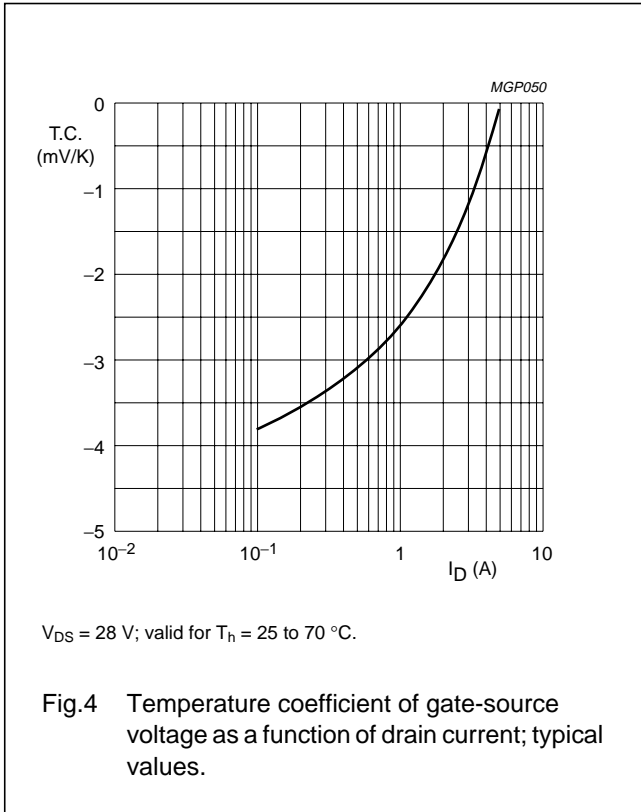
| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-----------------|---|--|------|------|------|---------------|
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 100\text{ mA}; V_{GS} = 0$ | 65 | – | – | V |
| I_{DSS} | drain-source leakage current | $V_{GS} = 0; V_{DS} = 28\text{ V}$ | – | – | 5 | mA |
| I_{GSS} | gate-source leakage current | $V_{GS} = \pm 20\text{ V}; V_{DS} = 0$ | – | – | 1 | μA |
| V_{GSth} | gate-source threshold voltage | $I_D = 200\text{ mA}; V_{DS} = 10\text{ V}$ | 2 | – | 4.5 | V |
| ΔV_{GS} | gate-source voltage difference of matched pairs | $I_D = 100\text{ mA}; V_{DS} = 10\text{ V}$ | – | – | 100 | mV |
| g_{fs} | forward transconductance | $I_D = 8\text{ A}; V_{DS} = 10\text{ V}$ | 5 | 7.5 | – | S |
| R_{DSon} | drain-source on-state resistance | $I_D = 8\text{ A}; V_{GS} = 10\text{ V}$ | – | 0.1 | 0.15 | Ω |
| I_{DSX} | on-state drain current | $V_{GS} = 10\text{ V}; V_{DS} = 10\text{ V}$ | – | 37 | – | A |
| C_{is} | input capacitance | $V_{GS} = 0; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$ | – | 450 | – | pF |
| C_{os} | output capacitance | $V_{GS} = 0; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$ | – | 360 | – | pF |
| C_{rs} | feedback capacitance | $V_{GS} = 0; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$ | – | 55 | – | 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 | | | |

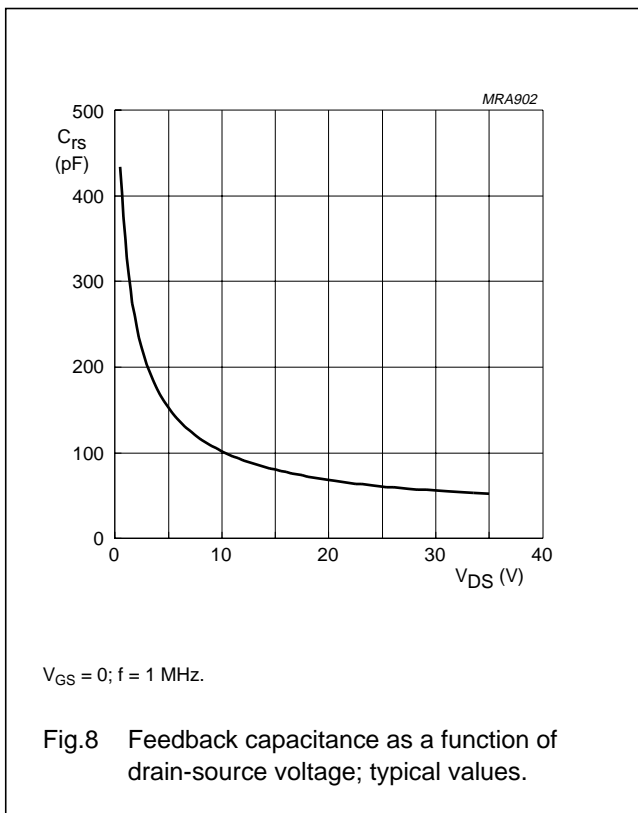
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APPLICATION INFORMATION FOR CLASS-AB OPERATION

RF performance in SSB operation in a common source class-AB circuit.

$T_h = 25 \text{ }^\circ\text{C}; R_{th\text{ mb-h}} = 0.2 \text{ K/W}; R_{GS} = 9.8 \text{ } \Omega; f_1 = 28.000 \text{ MHz}; f_2 = 28.001 \text{ MHz};$ unless otherwise specified.

| P_L (W) | f (MHz) | V_{DS} (V) | I_{DQ} (A) | G_p (dB) | η_D (%) | d_3 (dB) (note 2) | d_5 (dB) (note 2) |
|-----------------|------------|-----------------|-----------------|----------------|-----------------|---------------------------|---------------------------|
| 20 to 150 (PEP) | 28 | 28 | 1 | >17 typ. 19 | >35 typ. 40 | <-30 typ. -34 | <-30 typ. -40 |

Notes

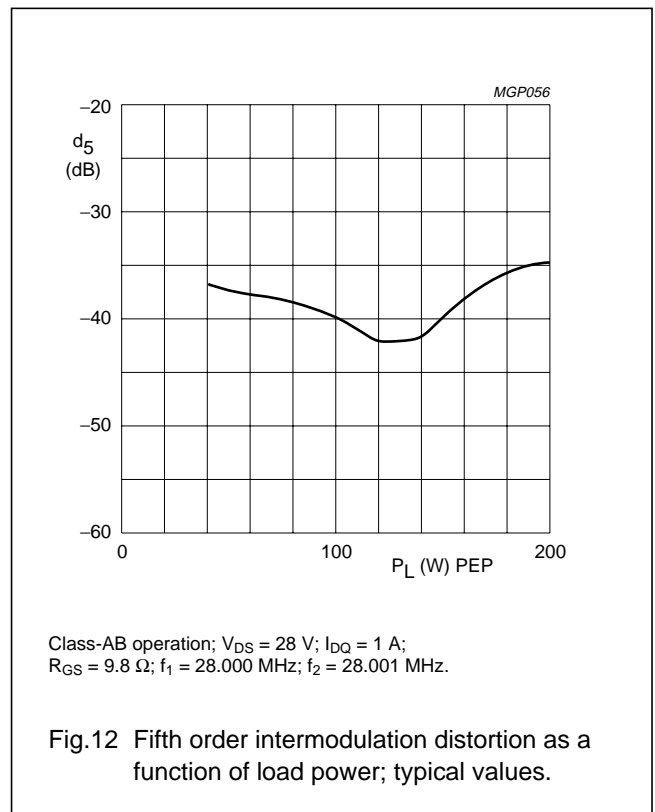
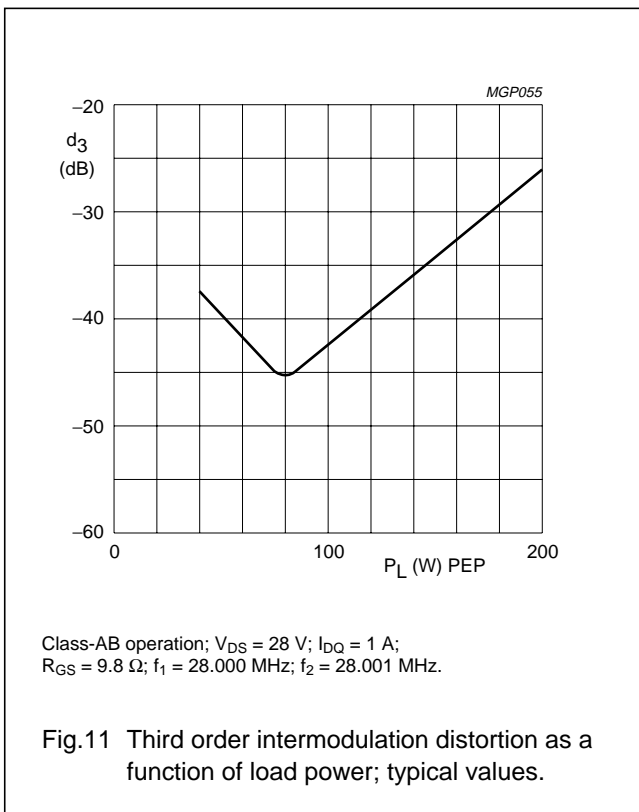
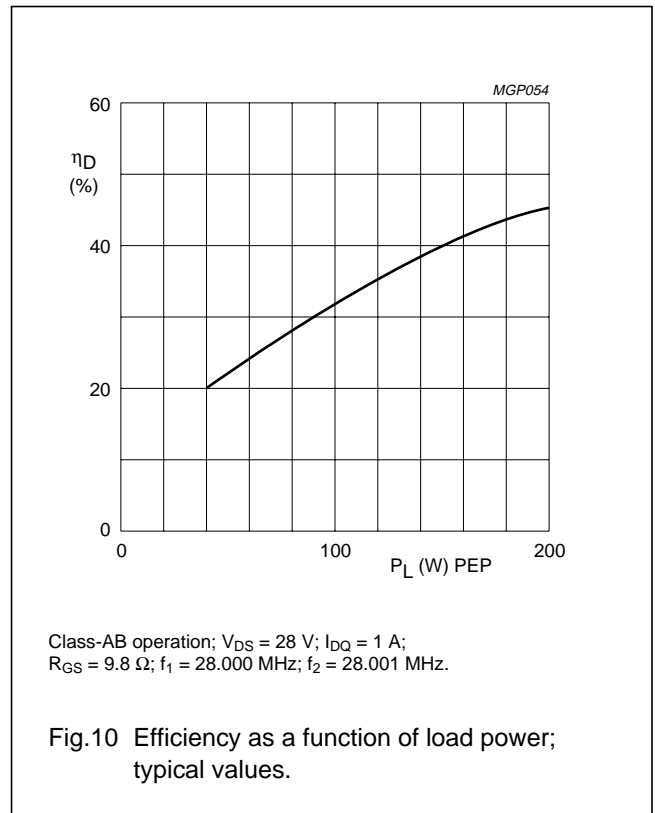
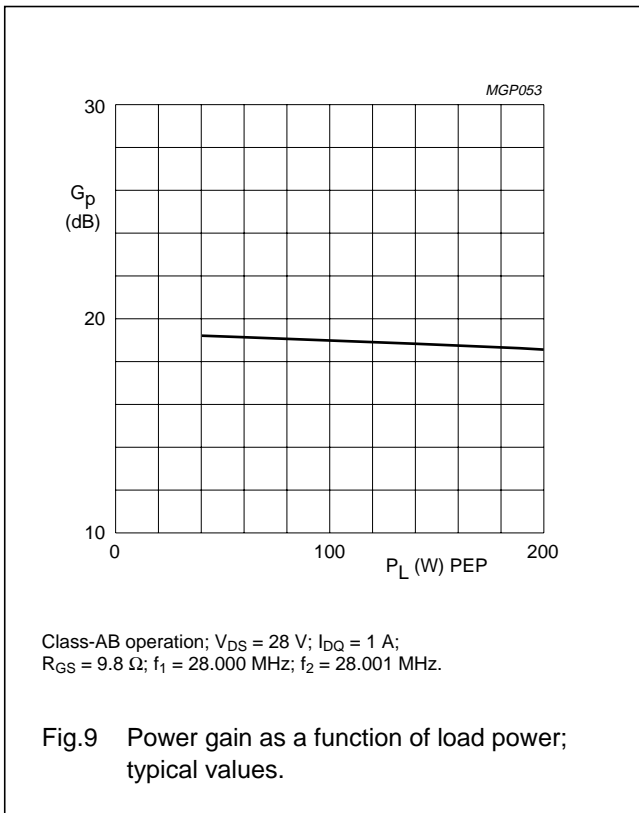
- Optimum load impedance: $2.1 + j0 \text{ } \Omega$.
- Maximum values at drive levels within the specified PEP values for either amplified tone. For the peak envelope power the values should be decreased by 6 dB.

Ruggedness in class-AB operation

The BLF147 is capable of withstanding a load mismatch corresponding to $VSWR = 50:1$ through all phases under the following conditions: $V_{DS} = 28 \text{ V}; f = 28 \text{ MHz}$ at rated load power.

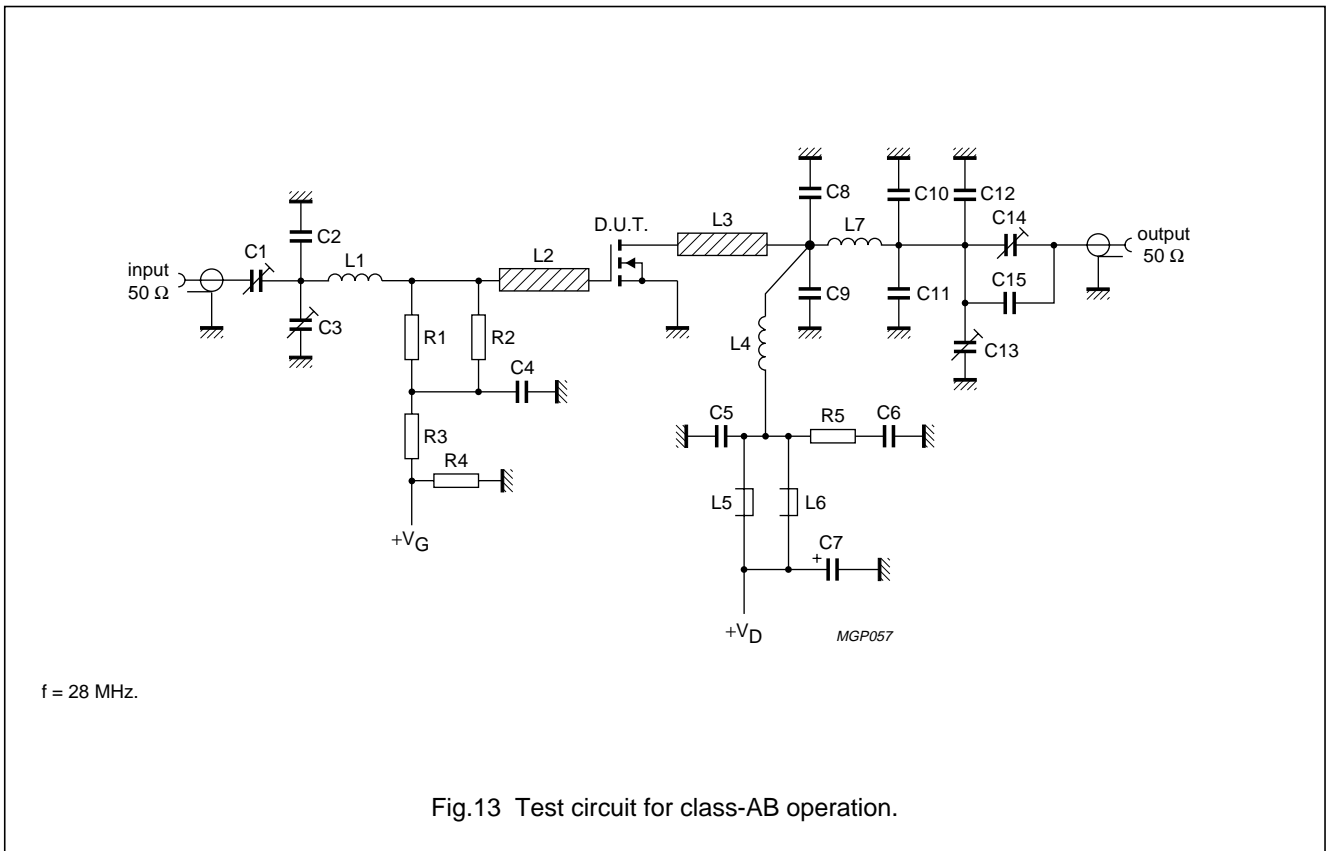
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List of components (see Fig 13).

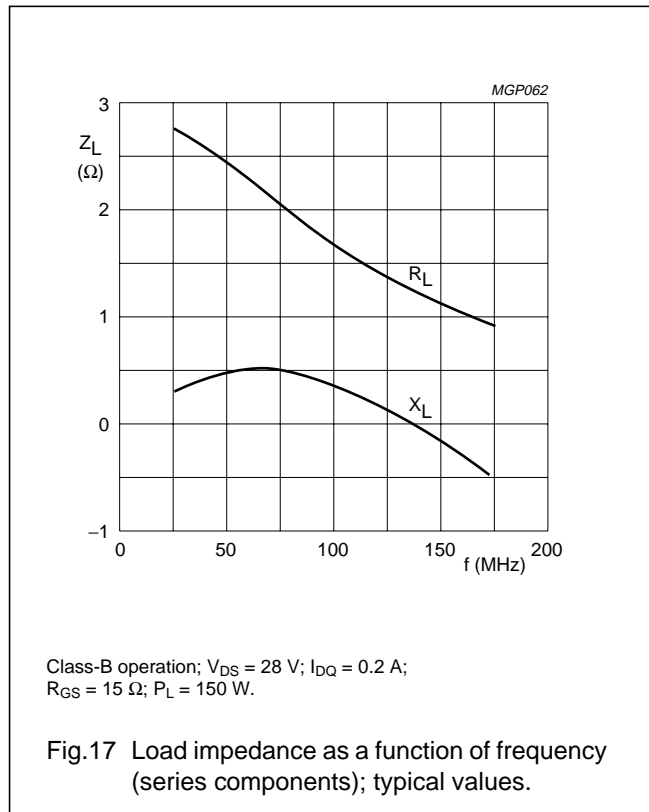
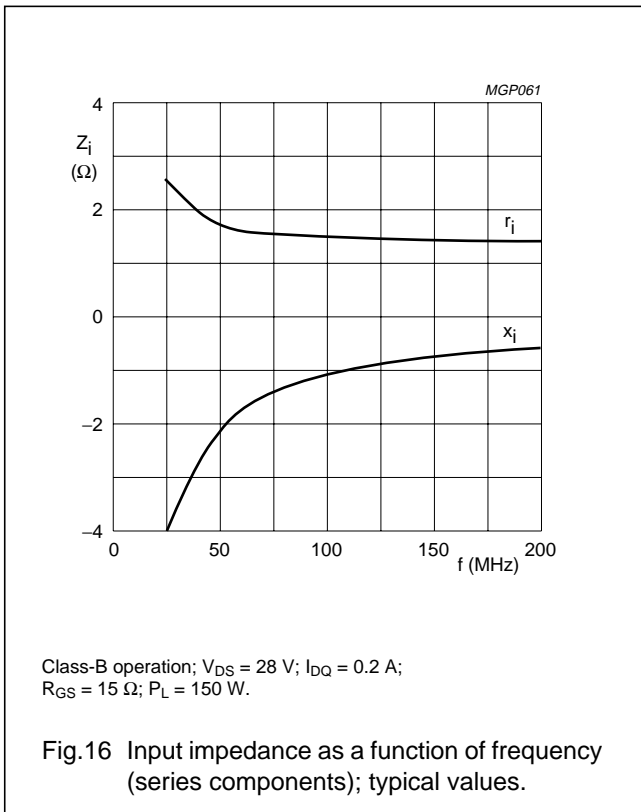
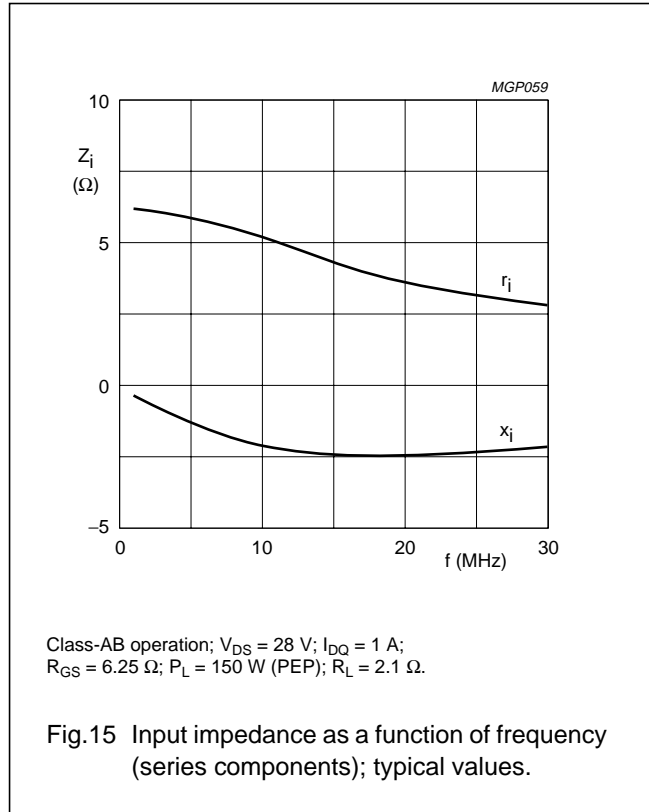
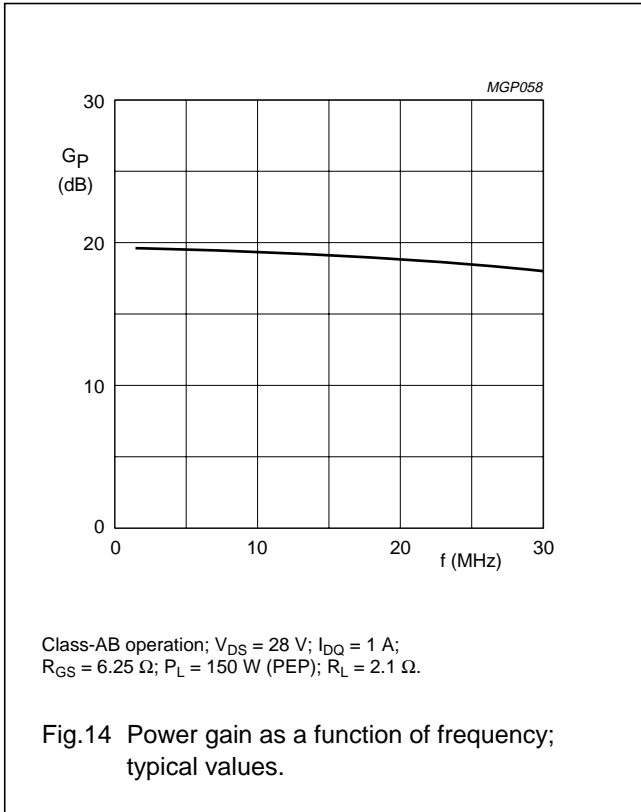
| COMPONENT | DESCRIPTION | VALUE | DIMENSIONS | CATALOGUE NO. |
|------------------|---|--------------|--|----------------|
| C1, C3, C13, C14 | film dielectric trimmer | 7 to 100 pF | | 2222 809 07015 |
| C2, C8, C9 | multilayer ceramic chip capacitor; note 1 | 75 pF | | |
| C4, C5 | multilayer ceramic chip capacitor | 100 nF | | 2222 852 47104 |
| C6 | multilayer ceramic chip capacitors in parallel | 3 × 100 nF | | 2222 852 47104 |
| C7 | electrolytic capacitor | 2.2 μF, 63 V | | |
| C10 | multilayer ceramic chip capacitor; note 1 | 100 pF | | |
| C11, C12 | multilayer ceramic chip capacitor; note 1 | 150 pF | | |
| C15 | multilayer ceramic chip capacitor; note 1 | 240 pF | | |
| L1 | 6 turns enamelled 0.7 mm copper wire | 145 nH | length 5 mm; int. dia. 6 mm; leads 2 × 5 mm | |
| L2, L3 | stripline; note 2 | 41.1 Ω | length 13 × 6 mm | |
| L4 | 4 turns enamelled 1.5 mm copper wire | 148 nH | length 8 mm; int. dia. 10 mm; leads 2 × 5 mm | |
| L5, L6 | grade 3B Ferroxcube wideband HF choke | | | 4312 020 36642 |
| L7 | 3 turns enamelled 2.2 mm copper wire | 79 nH | length 8 mm; int. dia. 8 mm; leads 2 × 5 mm | |
| R1, R2 | 1 W metal film resistor | 19.6 Ω | | 2322 153 51969 |
| R3 | 0.4 W metal film resistor | 10 kΩ | | 2322 151 71003 |
| R4 | 0.4 W metal film resistor | 1 MΩ | | 2322 151 71005 |
| 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.
- The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric ($\epsilon_r = 2.2$), thickness 1.6 mm.

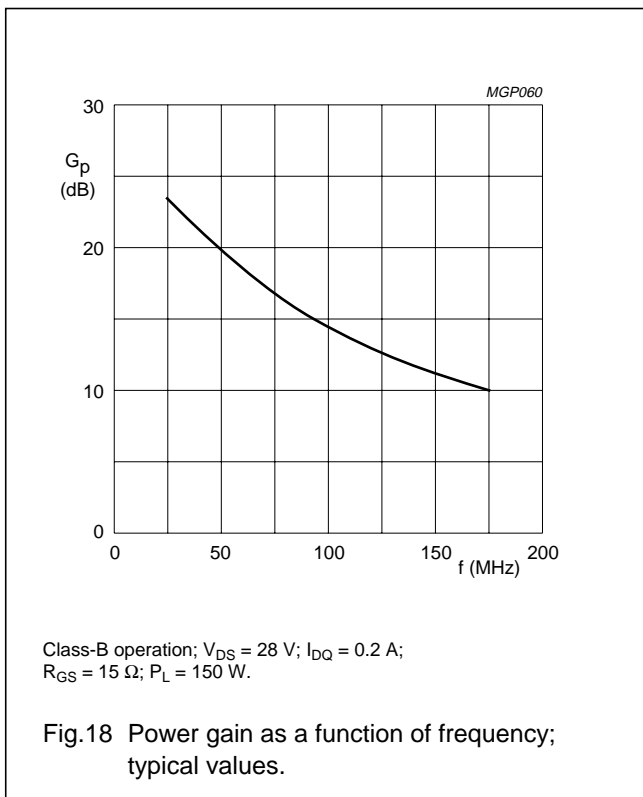
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BLF147 scattering parameters $V_{DS} = 28\text{ V}$; $I_D = 1000\text{ mA}$; note 1

| f (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|---------|-----------------|---------|-----------------|-------|-----------------|-------|-----------------|---------|
| | S ₁₁ | ∠ Φ | S ₂₁ | ∠ Φ | S ₁₂ | ∠ Φ | S ₂₂ | ∠ Φ |
| 5 | 0.91 | -170.00 | 23.90 | 93.40 | 0.01 | 5.80 | 0.88 | -171.20 |
| 10 | 0.91 | -174.60 | 12.25 | 89.40 | 0.01 | 3.60 | 0.89 | -177.20 |
| 20 | 0.92 | -177.40 | 5.94 | 81.00 | 0.01 | 5.40 | 0.83 | -179.60 |
| 30 | 0.92 | -178.40 | 3.87 | 79.10 | 0.01 | 8.90 | 0.86 | -178.90 |
| 40 | 0.92 | -178.80 | 2.84 | 75.70 | 0.01 | 12.00 | 0.85 | -178.60 |
| 50 | 0.92 | -178.80 | 2.26 | 73.30 | 0.01 | 16.90 | 0.87 | -176.90 |
| 60 | 0.92 | -179.00 | 1.88 | 69.80 | 0.01 | 20.30 | 0.90 | -177.30 |
| 70 | 0.93 | -179.20 | 1.58 | 66.20 | 0.01 | 24.00 | 0.90 | -178.10 |
| 80 | 0.93 | -179.60 | 1.36 | 63.20 | 0.01 | 28.80 | 0.90 | -178.40 |
| 90 | 0.93 | -179.70 | 1.19 | 60.40 | 0.01 | 34.20 | 0.90 | -178.60 |
| 100 | 0.94 | -179.70 | 1.05 | 57.00 | 0.01 | 39.30 | 0.90 | -179.40 |
| 125 | 0.95 | 179.50 | 0.77 | 49.30 | 0.01 | 52.30 | 0.88 | 179.20 |
| 150 | 0.95 | 179.00 | 0.60 | 45.80 | 0.01 | 64.90 | 0.91 | -179.50 |
| 175 | 0.96 | 178.10 | 0.49 | 41.50 | 0.02 | 72.40 | 0.95 | 179.80 |
| 200 | 0.96 | 177.50 | 0.40 | 36.80 | 0.02 | 75.80 | 0.94 | 177.70 |
| 250 | 0.97 | 175.80 | 0.28 | 33.20 | 0.03 | 82.30 | 0.95 | 176.20 |
| 300 | 0.98 | 174.20 | 0.22 | 30.10 | 0.03 | 83.00 | 0.96 | 173.60 |
| 350 | 0.98 | 172.70 | 0.17 | 31.00 | 0.04 | 85.00 | 0.97 | 171.90 |
| 400 | 0.98 | 171.10 | 0.14 | 32.40 | 0.05 | 84.90 | 0.97 | 169.50 |
| 450 | 0.98 | 169.50 | 0.12 | 36.10 | 0.05 | 85.90 | 0.97 | 167.70 |
| 500 | 0.98 | 167.90 | 0.11 | 39.90 | 0.06 | 84.30 | 0.98 | 165.50 |
| 600 | 0.98 | 164.80 | 0.10 | 50.20 | 0.07 | 83.20 | 0.97 | 161.50 |
| 700 | 0.98 | 161.60 | 0.10 | 57.90 | 0.09 | 81.70 | 0.97 | 157.50 |
| 800 | 0.98 | 158.20 | 0.11 | 63.70 | 0.10 | 81.00 | 0.97 | 153.50 |
| 900 | 0.97 | 154.60 | 0.13 | 67.20 | 0.12 | 79.50 | 0.97 | 149.30 |
| 1000 | 0.97 | 151.10 | 0.14 | 70.20 | 0.14 | 78.80 | 0.96 | 144.90 |

Note

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

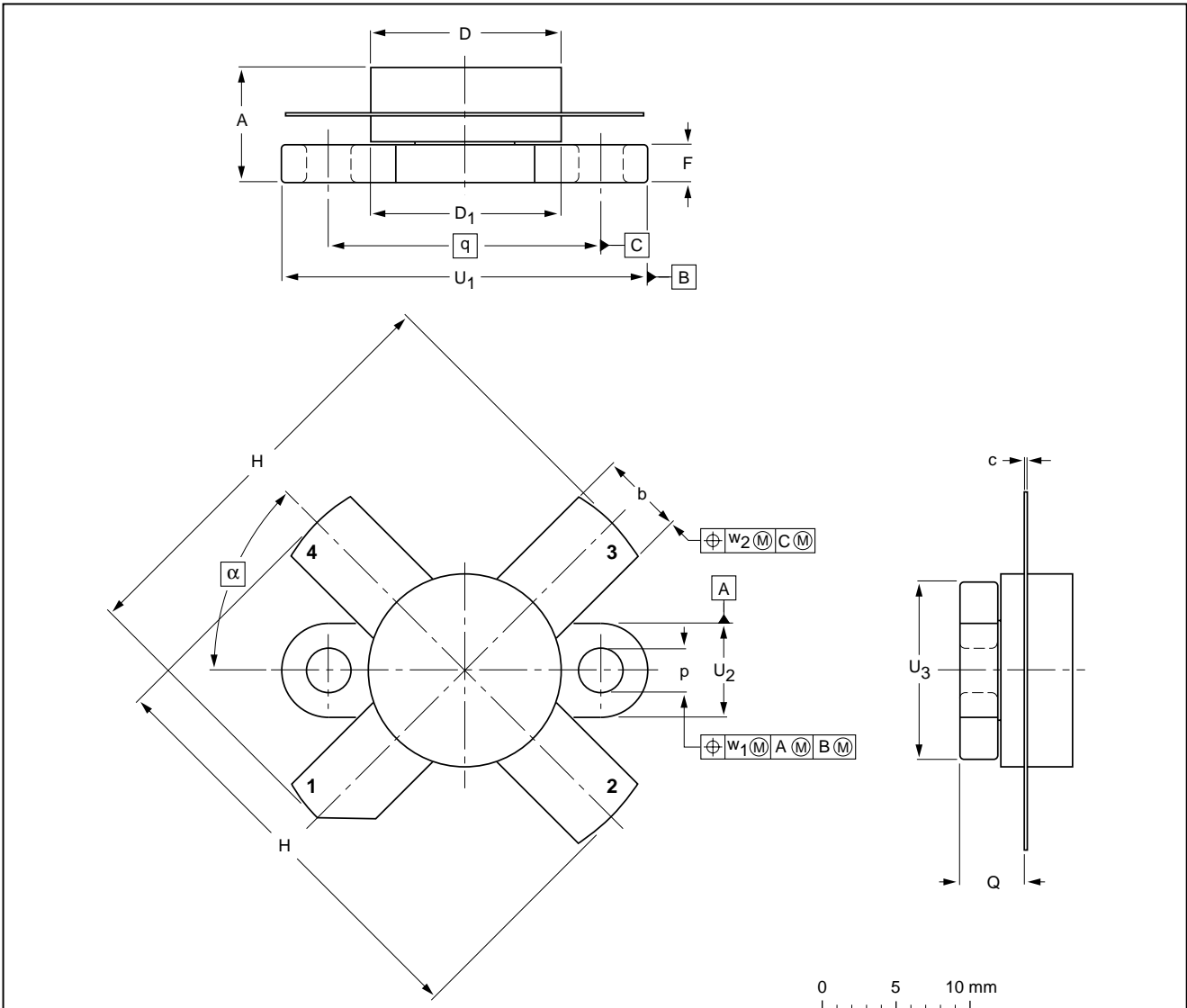
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PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 4 leads

SOT121B



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

| UNIT | A | b | c | D | D ₁ | F | H | p | Q | q | U ₁ | U ₂ | U ₃ | w ₁ | w ₂ | α |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|----------------|-----|
| mm | 7.27 6.17 | 5.82 5.56 | 0.16 0.10 | 12.86 12.59 | 12.83 12.57 | 2.67 2.41 | 28.45 25.52 | 3.30 3.05 | 4.45 3.91 | 18.42 | 24.90 24.63 | 6.48 6.22 | 12.32 12.06 | 0.25 | 0.51 | 45° |
| inches | 0.286 0.243 | 0.229 0.219 | 0.006 0.004 | 0.506 0.496 | 0.505 0.495 | 0.105 0.095 | 1.120 1.005 | 0.130 0.120 | 0.175 0.154 | 0.725 | 0.98 0.97 | 0.255 0.245 | 0.485 0.475 | 0.01 | 0.02 | |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|------|--|---------------------|------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT121B | | | | | | 99-03-29 |

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| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---|
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[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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Revision history

Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------------------------|--|-----------------------|---------------|--------------|
| BLF147_6 | 20061205 | Product data sheet | - | BLF147_5 |
| Modifications: | <ul style="list-style-type: none"> Correction made to page 9 "List of components" | | | |
| BLF147_5 | 20061108 | Product data sheet | - | BLF147_4 |
| BLF147_4 (9397 750 11593) | 20030901 | Product specification | - | BLF147_3 |
| BLF147_3 (9397 750 08411) | 20010523 | Product specification | - | BLF147_CNV_2 |
| BLF147_CNV_2 (9397 750 xxxxx) | 19971215 | Product specification | - | - |

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