

# DATA SHEET

## **BLF145** HF power MOS transistor

Product specification

September 1992

# HF power MOS transistor

BLF145

## FEATURES

- High power gain
- Low noise figure
- Good thermal stability
- Withstands full load mismatch.

## DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for SSB transmitter applications in the HF frequency range. The transistor is encapsulated in a 4-lead, SOT123 flange envelope, with a ceramic cap. All leads are isolated from the flange. Matched gate-source voltage ( $V_{GS}$ ) groups are available on request.

## PINNING - SOT123

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

## PIN CONFIGURATION

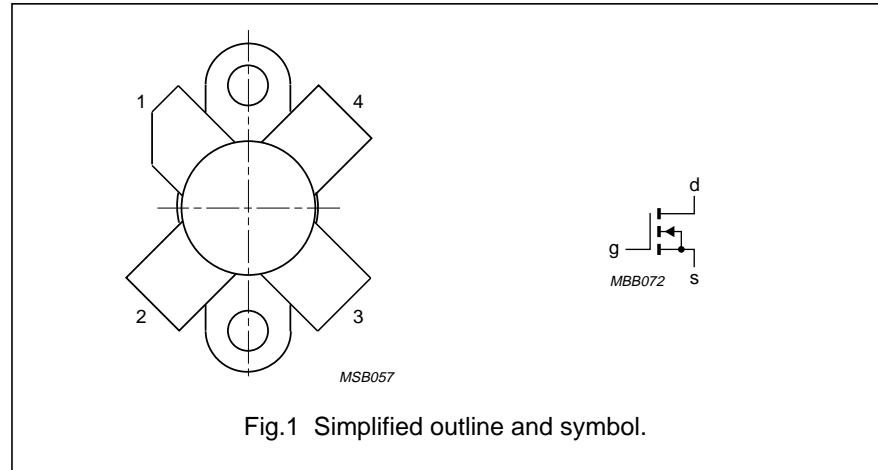


Fig.1 Simplified outline and symbol.

## CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

## 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.

## QUICK REFERENCE DATA

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

| MODE OF OPERATION | f (MHz) | $V_{DS}$ (V) | $I_D$ (A) | $P_L$ (W) | $G_p$ (dB) | $\eta_D$ (%) (note 1) | $d_3$ (dB) |
|-------------------|---------|--------------|-----------|-----------|------------|-----------------------|------------|
| SSB, class-A      | 28      | 28           | 1.3       | 8 (PEP)   | > 24       | –                     | < –40      |
| SSB, class-AB     | 28      | 28           | –         | 30 (PEP)  | typ. 20    | typ. 40               | typ. –35   |

## Note

1. 2-tone efficiency.

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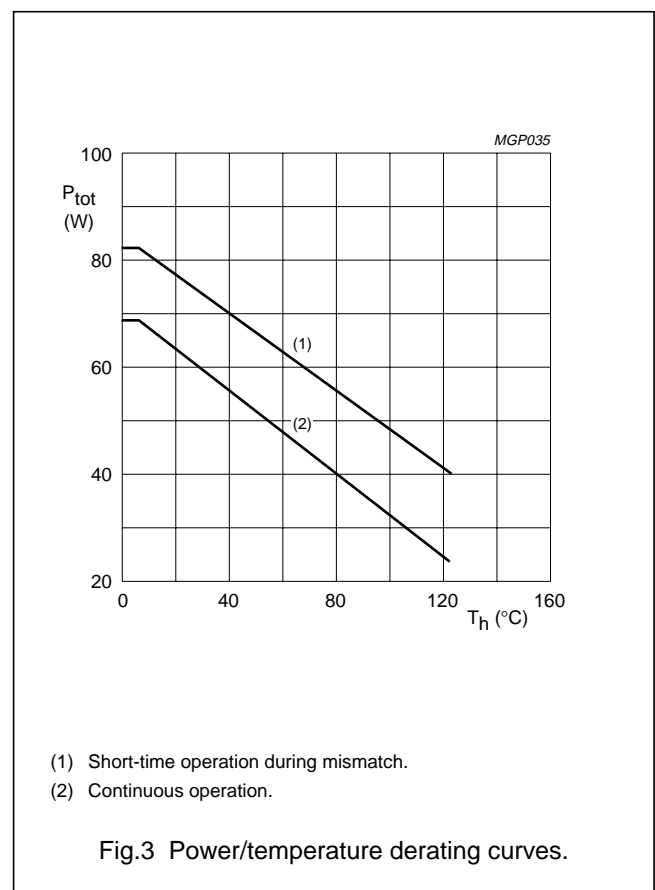
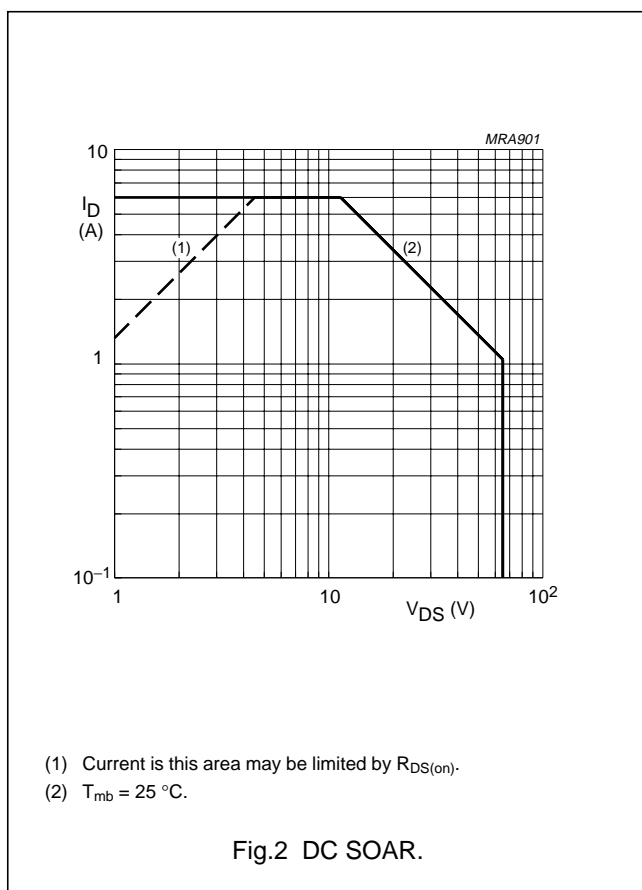
## LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

| SYMBOL        | PARAMETER               | CONDITIONS                                | MIN. | MAX. | UNIT             |
|---------------|-------------------------|---|------|------|------------------|
| $V_{DSS}$     | drain-source voltage    |   | –    | 65   | V                |
| $\pm V_{GSS}$ | gate-source voltage     |   | –    | 20   | V                |
| $I_D$         | DC drain current        |   | –    | 6    | A                |
| $P_{tot}$     | total power dissipation | up to $T_{mb} = 25\text{ }^\circ\text{C}$ | –    | 68   | W                |
| $T_{stg}$     | storage temperature     |   | –65  | 150  | $^\circ\text{C}$ |
| $T_j$         | junction temperature    |   | –    | 200  | $^\circ\text{C}$ |

## THERMAL RESISTANCE

| SYMBOL         | PARAMETER   | THERMAL RESISTANCE |
|----------------|---|--------------------|
| $R_{th\ j-mb}$ | thermal resistance from junction to mounting base | 2.6 K/W            |
| $R_{th\ mb-h}$ | thermal resistance from mounting base to heatsink | 0.3 K/W            |



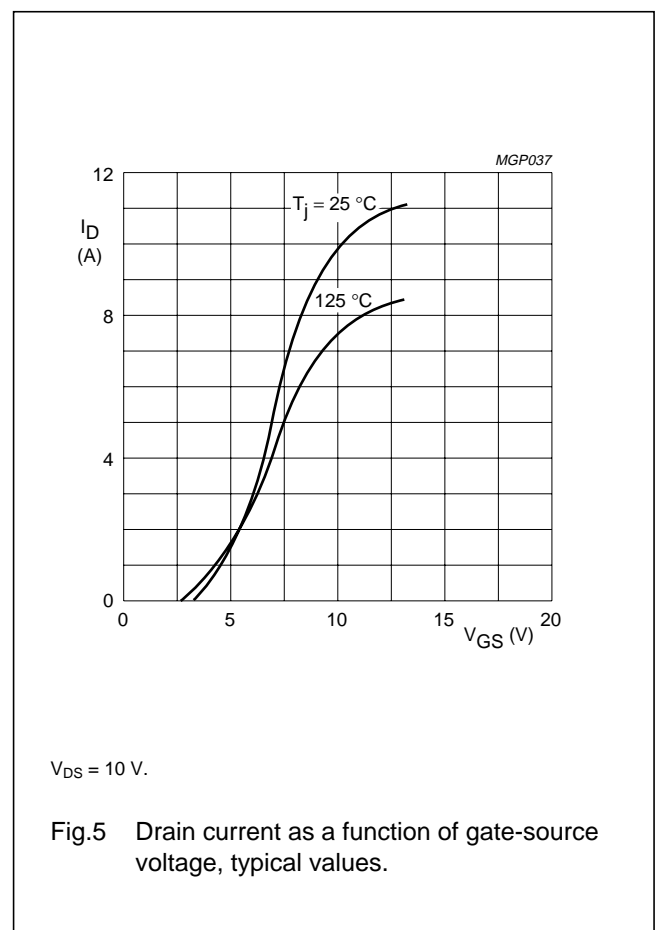
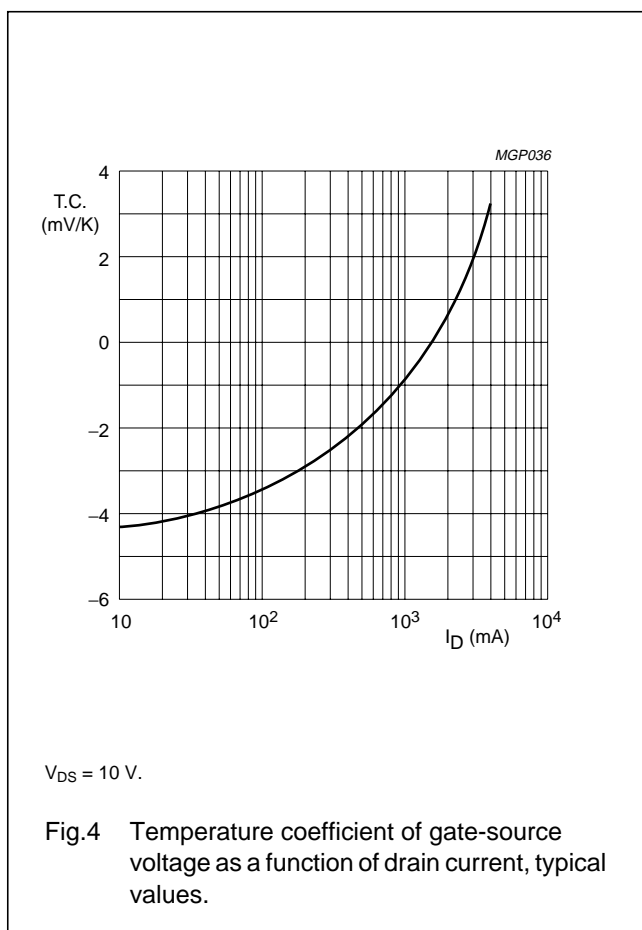
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**CHARACTERISTICS**

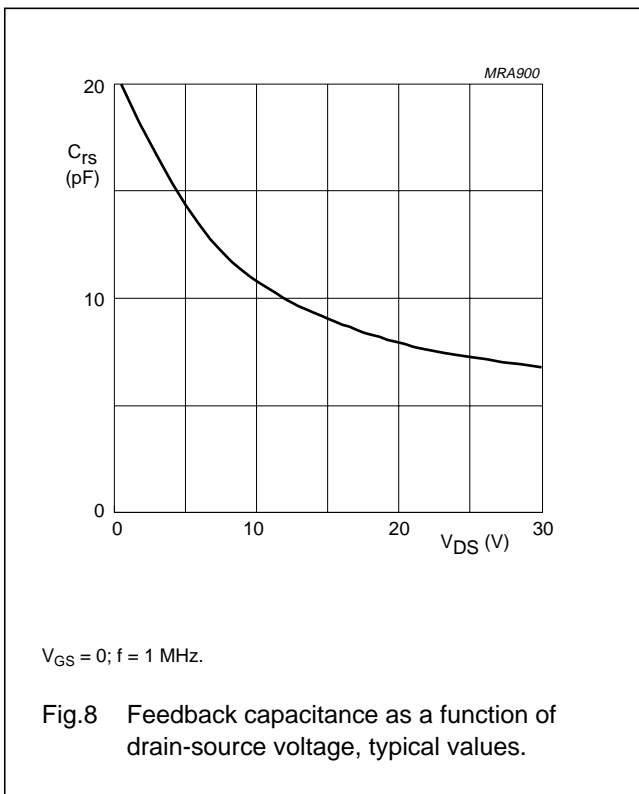
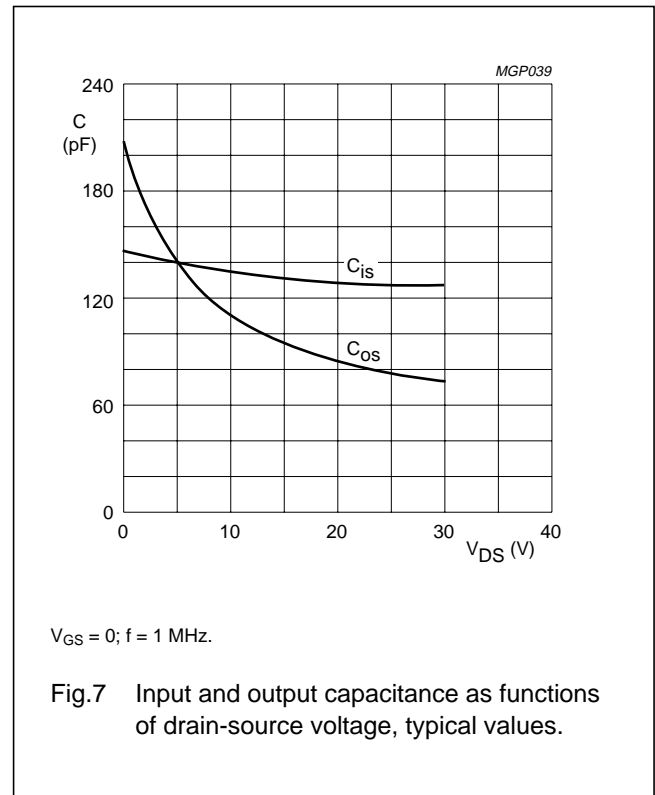
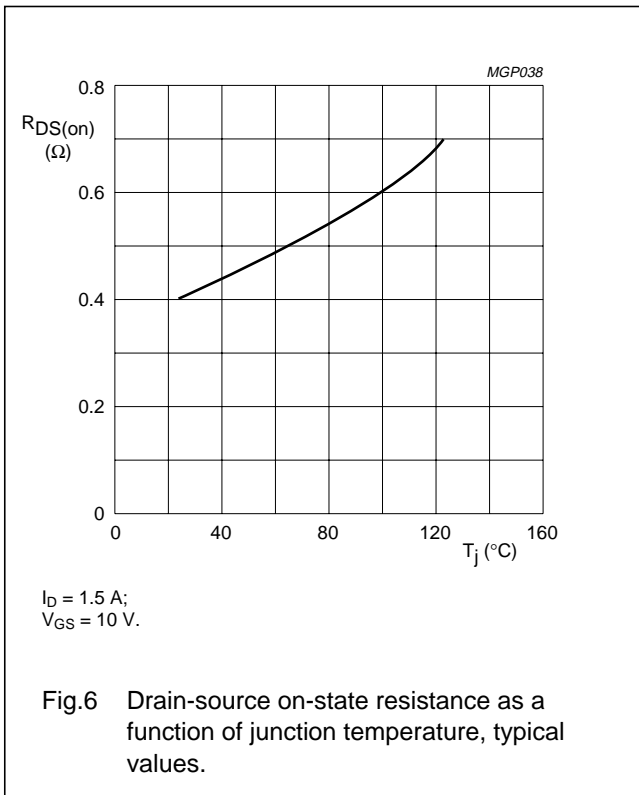
$T_j = 25\text{ }^\circ\text{C}$  unless otherwise specified.

| SYMBOL          | PARAMETER   | CONDITIONS   | MIN. | TYP. | MAX. | UNIT          |
|-----------------|---|--|------|------|------|---------------|
| $V_{(BR)DSS}$   | drain-source breakdown voltage                    | $I_D = 10\text{ mA}; V_{GS} = 0$                     | 65   | –    | –    | V             |
| $I_{DSS}$       | drain-source leakage current                      | $V_{GS} = 0; V_{DS} = 28\text{ V}$                   | –    | –    | 2    | mA            |
| $I_{GSS}$       | gate-source leakage current                       | $\pm V_{GS} = 20\text{ V}; V_{DS} = 0$               | –    | –    | 1    | $\mu\text{A}$ |
| $V_{GS(th)}$    | gate-source threshold voltage                     | $I_D = 10\text{ mA}; V_{DS} = 10\text{ V}$           | 2    | –    | 4.5  | V             |
| $\Delta V_{GS}$ | gate-source voltage difference of matched devices | $I_D = 10\text{ mA}; V_{DS} = 10\text{ V}$           | –    | –    | 100  | mV            |
| $g_{fs}$        | forward transconductance                          | $I_D = 1.5\text{ A}; V_{DS} = 10\text{ V}$           | 1.2  | –    | –    | S             |
| $R_{DS(on)}$    | drain-source on-state resistance                  | $I_D = 1.5\text{ A}; V_{GS} = 10\text{ V}$           | –    | 0.4  | 0.75 | $\Omega$      |
| $I_{DSX}$       | on-state drain current                            | $V_{GS} = 10\text{ V}; V_{DS} = 10\text{ V}$         | –    | 10   | –    | A             |
| $C_{is}$        | input capacitance                                 | $V_{GS} = 0; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$ | –    | 125  | –    | pF            |
| $C_{os}$        | output capacitance                                | $V_{GS} = 0; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$ | –    | 75   | –    | pF            |
| $C_{rs}$        | feedback capacitance                              | $V_{GS} = 0; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$ | –    | 7    | –    | pF            |



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## APPLICATION INFORMATION FOR CLASS-A OPERATION

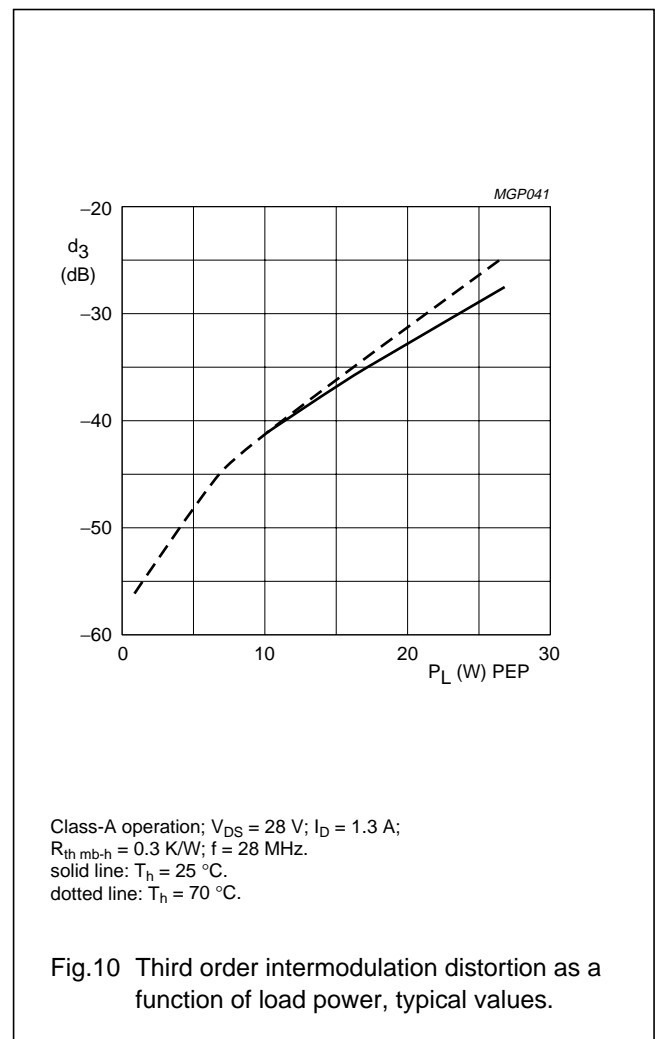
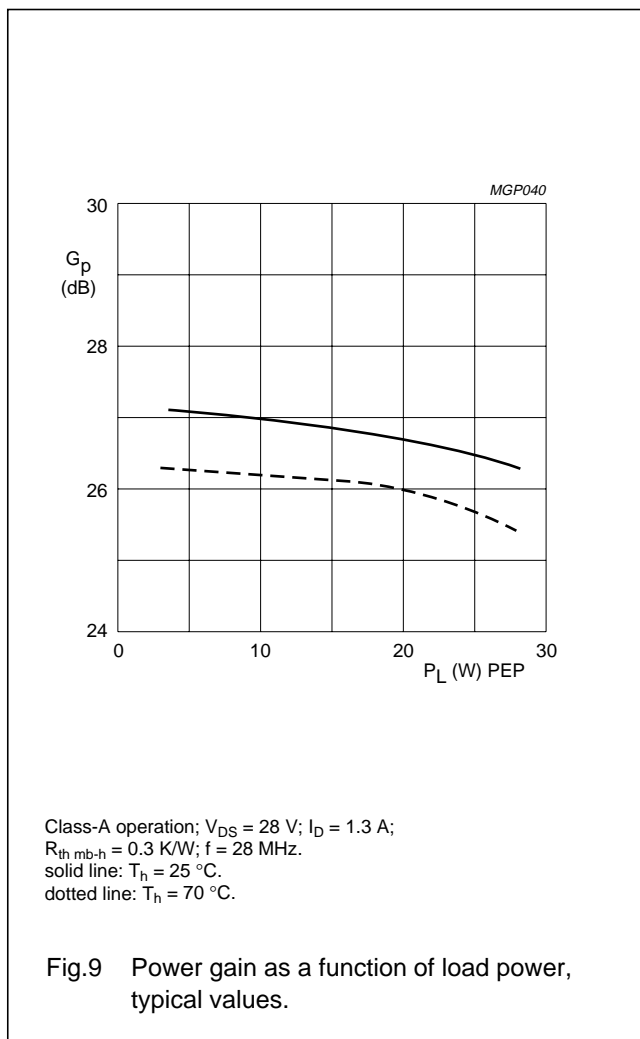
$T_h = 25\text{ }^\circ\text{C}$ ;  $R_{th\text{ mb-h}} = 0.3\text{ K/W}$ ;  $R1 = 26\text{ }\Omega$ ; unless otherwise specified.

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

| MODE OF OPERATION | f (MHz) | V <sub>DS</sub> (V) | I <sub>D</sub> (A) | P <sub>L</sub> (W) | G <sub>P</sub> (dB) | d <sub>3</sub> (dB) (note 1) | d <sub>5</sub> (dB) (note 1) | Z <sub>L</sub> ( $\Omega$ ) |
|-------------------|---------|---------------------|--------------------|--------------------|---------------------|------------------------------|------------------------------|-----------------------------|
| SSB, class-A      | 28      | 28                  | 1.3                | 8 (PEP)            | > 24<br>typ. 27     | > -40<br>typ. -43            | < -40<br>typ. -70            | 18.4 + j5.2                 |

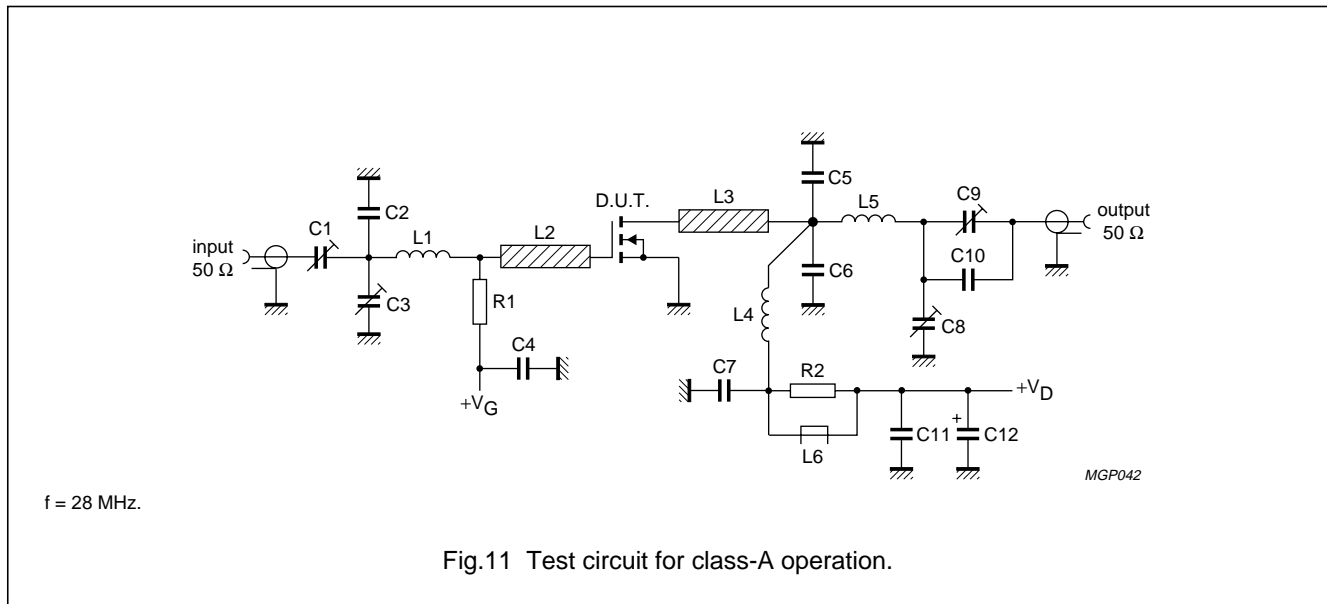
### Note

1. Stated figures are maximum values encountered at any driving level between the specified value of PEP and are referred to the according level of either the equal amplified tones. Related to the according peak envelope power these figures should be decreased by 6 dB.



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## List of components (class-A test circuit)

| COMPONENT      | DESCRIPTION                                | VALUE        | DIMENSIONS                      | CATALOGUE NO.  |
|----------------|--|--------------|---------------------------------|----------------|
| C1, C3, C8, C9 | film dielectric trimmer                    | 7 to 100 pF  |                                 | 2222 809 07015 |
| C2, C10        | multilayer ceramic chip capacitor (note 1) | 39 pF        |                                 |                |
| C4, C7         | multilayer ceramic chip capacitor          | 100 nF       |                                 | 2222 852 47104 |
| C5, C6         | multilayer ceramic chip capacitor (note 1) | 27 pF        |                                 |                |
| C11            | multilayer ceramic chip capacitor          | 3 × 100 nF   |                                 | 2222 852 47104 |
| C12            | electrolytic capacitor                     | 2.2 μF, 63 V |                                 | 2222 030 38228 |
| L1             | 12 turns enamelled 0.5 mm copper wire      | 307 nH       | length 8 mm;<br>int. dia. 4 mm  |                |
| L2, L3         | stripline (note 2)                         | 30 Ω         | length 15 × 6 mm                |                |
| L4             | 14 turns enamelled 1 mm copper wire        | 1039 nH      | length 14 mm;<br>int. dia. 9 mm |                |
| L5             | 9 turns enamelled 1 mm copper wire         | 305 nH       | length 10 mm;<br>int. dia. 6 mm |                |
| L6             | grade 3B Ferroxcube wideband HF choke      |              |                                 | 4312 020 36640 |
| R1             | 0.25 W metal film resistor                 | 26 Ω         |                                 |                |
| R2             | 0.25 W metal film resistor                 | 10 Ω         |                                 |                |

## 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 ( $\epsilon_r = 4.5$ ), thickness  $\frac{1}{16}$  mm.

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## APPLICATION INFORMATION FOR CLASS-B OPERATION

$T_h = 25\text{ }^\circ\text{C}$ ;  $R_{th\text{ mb-h}} = 0.3\text{ K/W}$ ;  $R_1 = 34\text{ }\Omega$ ; unless otherwise specified.

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

| 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) | $\eta_D$ (%) | d <sub>3</sub> (dB) (note 1) | d <sub>5</sub> (dB) (note 1) | Z <sub>L</sub> ( $\Omega$ ) |
|-------------------|---------|---------------------|---------------------|--------------------|---------------------|--------------|------------------------------|------------------------------|-----------------------------|
| SSB, class-AB     | 28      | 28                  | 0.25                | 30 (PEP)           | typ. 20             | typ. 40      | typ. -35                     | typ. -40                     | 8.9 + j1.0                  |

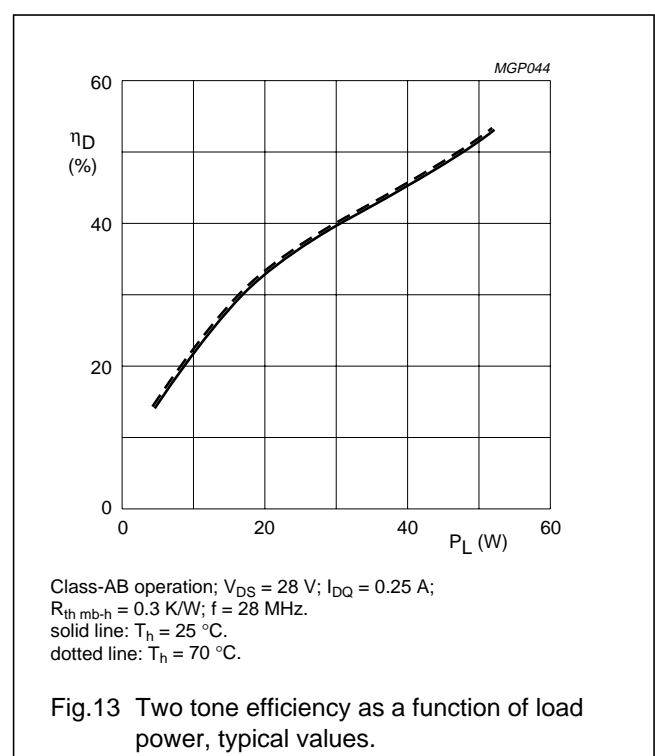
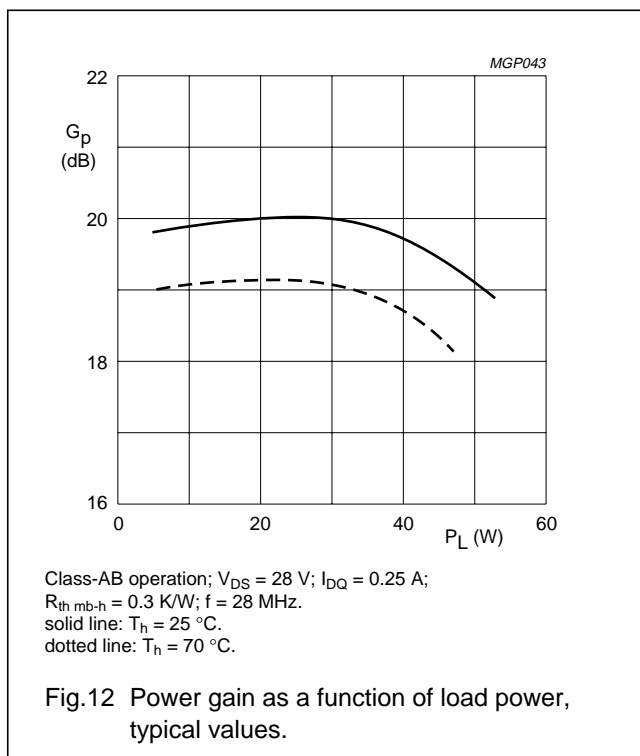
### Note

1. Stated figures are maximum values encountered at any driving level between the specified value of PEP and are referred to the according level of either the equal amplified tones. Related to the according peak envelope power these figures should be decreased by 6 dB.

### Ruggedness in class-AB operation

The BLF145 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases at  $P_L = 30\text{ W}$  single tone under the following conditions:

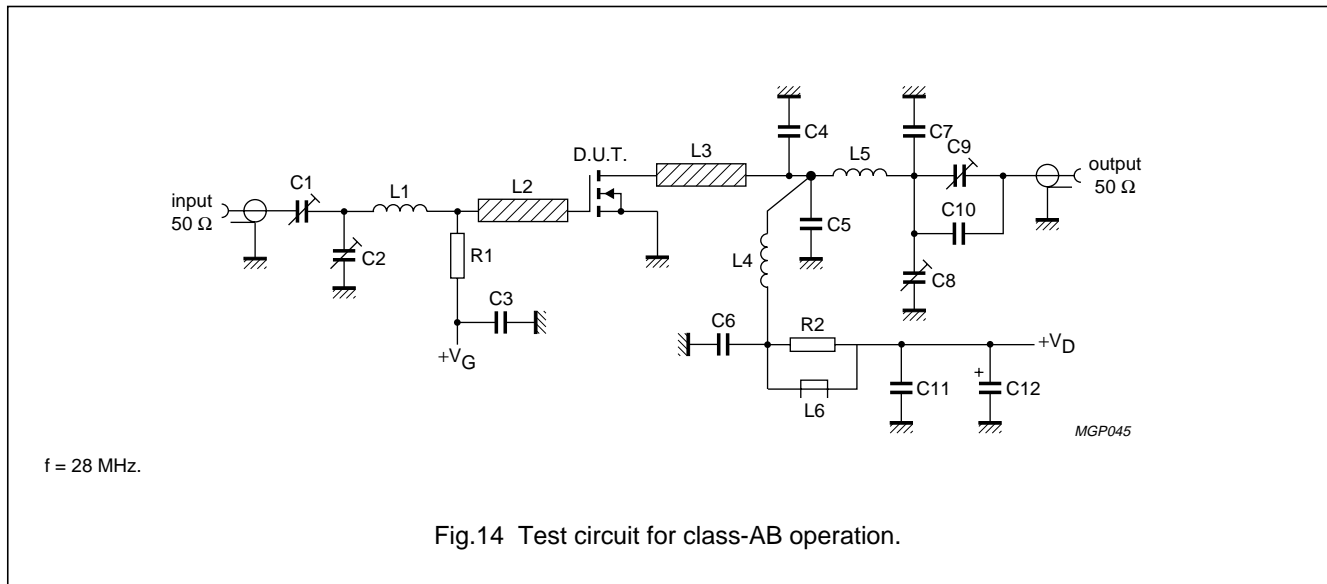
$V_{DS} = 28\text{ V}$ ;  $f = 28\text{ MHz}$ ;  $T_h = 25\text{ }^\circ\text{C}$ ;  $R_{th\text{ mb-h}} = 0.3\text{ K/W}$  at rated load power.





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## List of components (class-AB test circuit)

| COMPONENT | DESCRIPTION                                | VALUE        | DIMENSIONS                      | CATALOGUE NO.  |
|-----------|--|--------------|---------------------------------|----------------|
| C1, C2    | film dielectric trimmer                    | 5 to 60 pF   |                                 | 2222 809 07011 |
| C3, C6    | multilayer ceramic chip capacitor          | 100 nF       |                                 | 2222 852 47104 |
| C4, C5    | multilayer ceramic chip capacitor (note 1) | 27 pF        |                                 |                |
| C7, C10   | multilayer ceramic chip capacitor (note 1) | 39 pF        |                                 |                |
| C8, C9    | film dielectric trimmer                    | 7 to 100 pF  |                                 | 2222 809 07015 |
| C11       | multilayer ceramic chip capacitor          | 3 × 100 nF   |                                 | 2222 852 47104 |
| C12       | electrolytic capacitor                     | 2.2 μF, 63 V |                                 | 2222 030 38228 |
| L1        | 13 turns enamelled 0.5 mm copper wire      | 415 nH       | length 10 mm;<br>int. dia. 5 mm |                |
| L2, L3    | stripline (note 2)                         | 30 Ω         | length 15 × 6 mm                |                |
| L4        | 10 turns enamelled 1 mm copper wire        | 390 nH       | length 13 mm;<br>int. dia. 7 mm |                |
| L5        | 9 turns enamelled 1 mm copper wire         | 245 nH       | length 10 mm;<br>int. dia. 5 mm |                |
| L6        | grade 3B Ferroxcube wideband HF choke      |              |                                 | 4312 020 36640 |
| R1        | 0.5 W metal film resistor                  | 34 Ω         |                                 |                |
| R2        | 0.25 W metal film resistor                 | 10 Ω         |                                 |                |

## 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 ( $\epsilon_r = 4.5$ ), thickness  $\frac{1}{16}$  mm.

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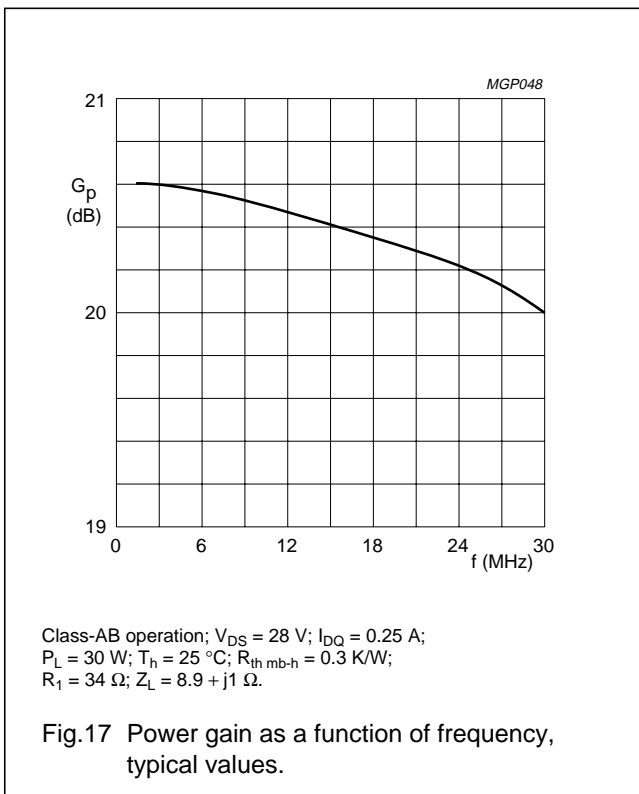
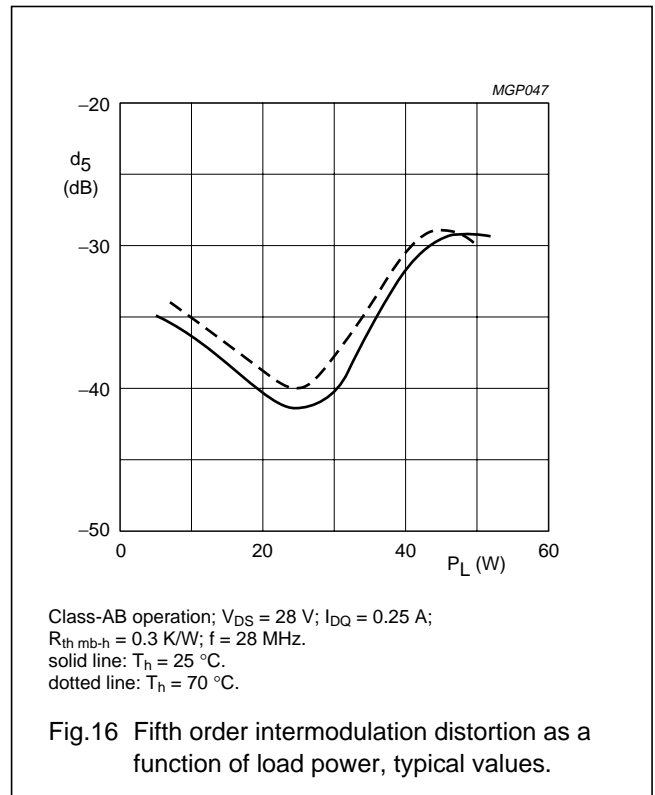
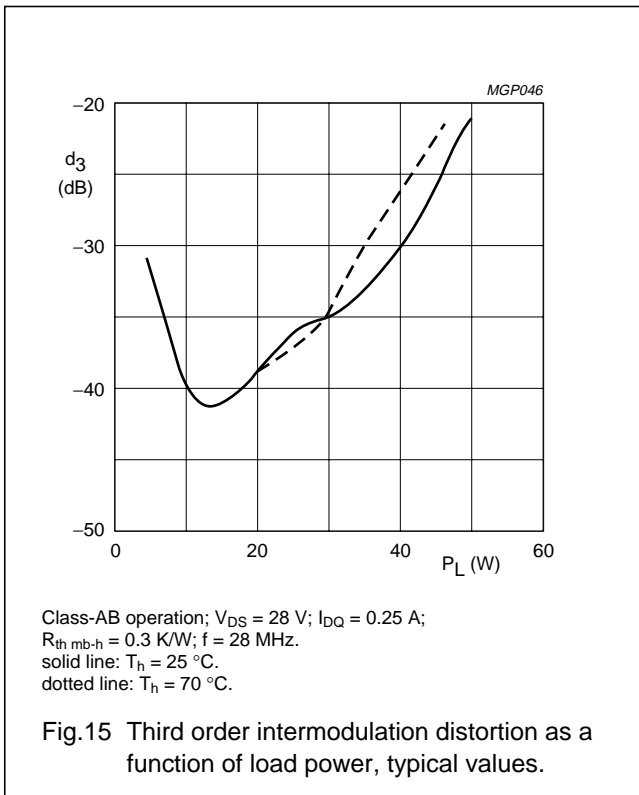


Table 1

Input impedance as a function of frequency  
 Class-AB operation;  $V_{DS} = 28\text{ V}$ ;  $I_{DQ} = 0.25\text{ A}$ ;  
 $P_L = 30\text{ W}$ ;  $T_h = 25\text{ °C}$ ;  
 $R_{th\text{ mb-h}} = 0.3\text{ K/W}$ ;  $R_1 = 34\text{ }\Omega$ ;  $Z_L = 8.9 + j1\text{ }\Omega$ .

| f (MHz) | $Z_i$ ( $\Omega$ ) |
|---------|--------------------|
| 1.5     | 32.9 – j2.2        |
| 3.0     | 32.4 – j4.3        |
| 6.0     | 30.7 – j8.1        |
| 10      | 27.4 – j11.9       |
| 15      | 32.9 – j14.6       |
| 20      | 18.5 – j15.4       |
| 25      | 15.1 – j15.3       |
| 30      | 12.5 – j14.6       |

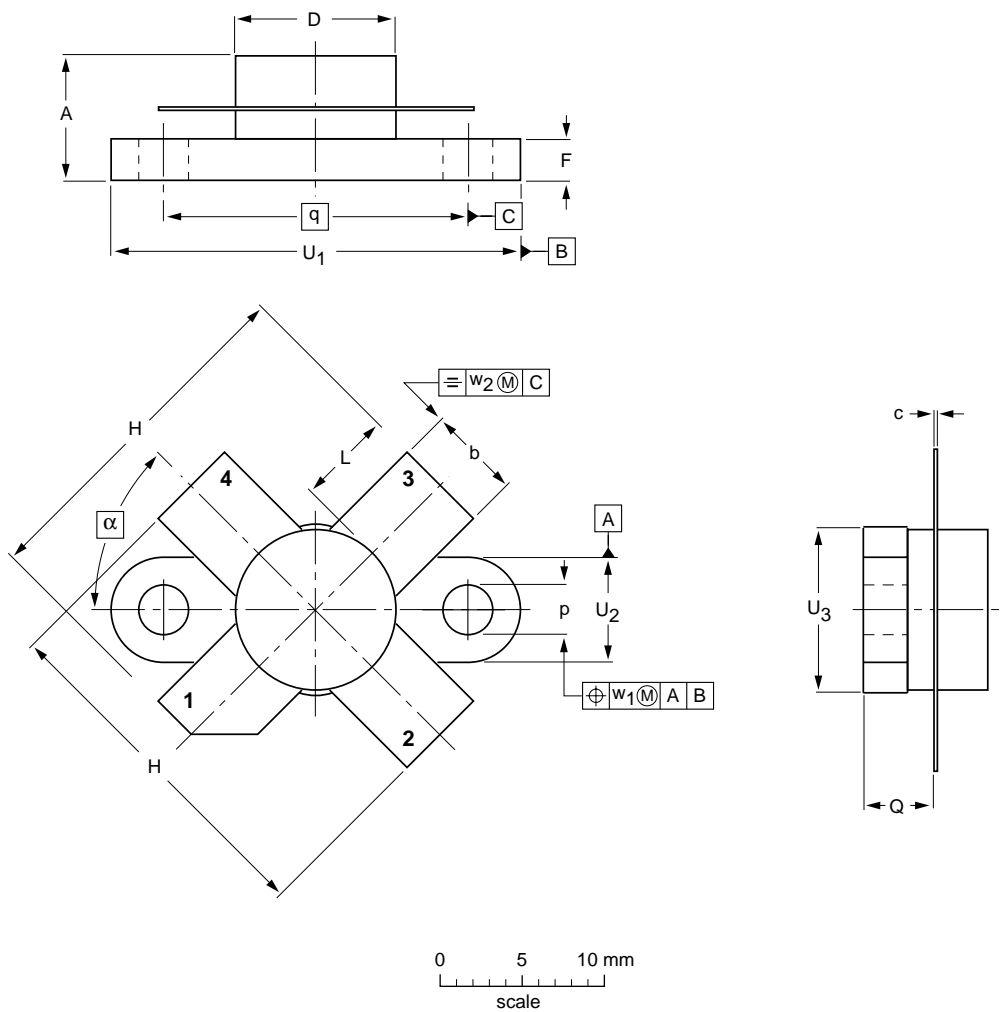
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PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 4 leads

SOT123A



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

| UNIT   | A              | b              | c              | D              | D <sub>1</sub> | F              | H              | L              | p              | Q              | q     | U <sub>1</sub> | U <sub>2</sub> | U <sub>3</sub> | w <sub>1</sub> | w <sub>2</sub> | α   |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|----------------|-----|
| mm     | 7.47<br>6.37   | 5.82<br>5.56   | 0.18<br>0.10   | 9.73<br>9.47   | 9.63<br>9.42   | 2.72<br>2.31   | 20.71<br>19.93 | 5.61<br>5.16   | 3.33<br>3.04   | 4.63<br>4.11   | 18.42 | 25.15<br>24.38 | 6.61<br>6.09   | 9.78<br>9.39   | 0.51           | 1.02           | 45° |
| inches | 0.294<br>0.251 | 0.229<br>0.219 | 0.007<br>0.004 | 0.383<br>0.373 | 0.397<br>0.371 | 0.107<br>0.091 | 0.815<br>0.785 | 0.221<br>0.203 | 0.131<br>0.120 | 0.182<br>0.162 | 0.725 | 0.99<br>0.96   | 0.26<br>0.24   | 0.385<br>0.370 | 0.02           | 0.04           |     |

| OUTLINE VERSION | REFERENCES |       |      |  | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|------|--|---------------------|------------|
|                 | IEC        | JEDEC | EIAJ |  |                     |            |
| SOT123A         |            |       |      |  |                     | 97-06-28   |

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**DEFINITIONS**

|   |   |
|---|---|
| <b>Data Sheet Status</b>  |   |
| Objective specification   | This data sheet contains target or goal specifications for product development.       |
| Preliminary specification   | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification   | This data sheet contains final product specifications.                                |
| <b>Limiting values</b>  |   |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). 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. |   |
| <b>Application information</b>  |   |
| Where application information is given, it is advisory and does not form part of the specification.   |   |

**LIFE SUPPORT APPLICATIONS**

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