

# BLF6G10LS-200

## Power LDMOS transistor

Rev. 01 — 18 January 2008

Preliminary data sheet

## 1. Product profile

### 1.1 General description

200 W LDMOS power transistor for base station applications at frequencies from 800 MHz to 1000 MHz.

**Table 1. Typical performance**

Typical RF performance at  $T_{case} = 25\text{ }^{\circ}\text{C}$  in a class-AB production test circuit.

| Mode of operation | f<br>(MHz) | V <sub>DS</sub><br>(V) | P <sub>L(AV)</sub><br>(W) | G <sub>p</sub><br>(dB) | $\eta_D$<br>(%) | ACPR<br>(dBc)      |
|-------------------|------------|------------------------|---------------------------|------------------------|-----------------|--------------------|
| 2-carrier W-CDMA  | 869 to 894 | 28                     | 40                        | 20                     | 27              | -41 <sup>[1]</sup> |

[1] Test signal: 3GPP; test model 1; 64 DPCH; PAR = 7.5 dB at 0.01 % probability on CCDF per carrier; carrier spacing 5 MHz.

### CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

### 1.2 Features

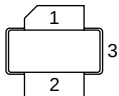
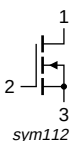
- Typical 2-carrier W-CDMA performance at frequencies of 869 MHz and 894 MHz, a supply voltage of 28 V and an I<sub>DQ</sub> of 1400 mA:
  - ◆ Average output power = 40 W
  - ◆ Power gain = 20 dB
  - ◆ Efficiency = 27 %
  - ◆ ACPR = -41 dBc
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (800 MHz to 1000 MHz)
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

## 1.3 Applications

- RF power amplifiers for GSM, GSM EDGE, W-CDMA and CDMA base stations and multicarrier applications in the 800 MHz to 1000 MHz frequency range.

## 2. Pinning information

Table 2. Pinning

| Pin | Description | Simplified outline                                                                  | Symbol                                                                              |
|-----|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | drain       |  |  |
| 2   | gate        |                                                                                     |                                                                                     |
| 3   | source      |                                                                                     |                                                                                     |

[1] Connected to flange

## 3. Ordering information

Table 3. Ordering information

| Type number   | Package |                                                 |         |
|---------------|---------|-------------------------------------------------|---------|
|               | Name    | Description                                     | Version |
| BLF6G10LS-200 | -       | earless flanged LDMOST ceramic package; 2 leads | SOT502B |

## 4. Limiting values

Table 4. 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  |            | -0.5 | +13  | V    |
| $I_D$     | drain current        |            | -    | 49   | A    |
| $T_{stg}$ | storage temperature  |            | -65  | +150 | °C   |
| $T_j$     | junction temperature |            | -    | 225  | °C   |

## 5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol           | Parameter                                | Conditions                                      | Typ  | Unit |
|------------------|------------------------------------------|-------------------------------------------------|------|------|
| $R_{th(j-case)}$ | thermal resistance from junction to case | $T_{case} = 80\text{ °C}$ ; $P_L = 40\text{ W}$ | 0.34 | K/W  |

## 6. Characteristics

**Table 6. 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   | $V_{GS} = 0\text{ V}; I_D = 0.9\text{ mA}$                    | 65  | -    | -   | V             |
| $V_{GS(th)}$  | gate-source threshold voltage    | $V_{DS} = 10\text{ V}; I_D = 270\text{ mA}$                   | 1.4 | 1.9  | 2.4 | V             |
| $V_{GSq}$     | gate-source quiescent voltage    | $V_{DS} = 28\text{ V}; I_D = 1620\text{ mA}$                  | 1.7 | 2.2  | 2.7 | V             |
| $I_{DSS}$     | drain leakage current            | $V_{GS} = 0\text{ V}; V_{DS} = 28\text{ V}$                   | -   | -    | 5   | $\mu\text{A}$ |
| $I_{DSX}$     | drain cut-off current            | $V_{GS} = V_{GS(th)} + 3.75\text{ V}; V_{DS} = 10\text{ V}$   | 40  | 45   | -   | A             |
| $I_{GSS}$     | gate leakage current             | $V_{GS} = 11\text{ V}; V_{DS} = 0\text{ V}$                   | -   | -    | 450 | nA            |
| $g_{fs}$      | forward transconductance         | $V_{DS} = 10\text{ V}; I_D = 9.45\text{ A}$                   | -   | 19   | -   | S             |
| $R_{DS(on)}$  | drain-source on-state resistance | $V_{GS} = V_{GS(th)} + 3.75\text{ V}; I_D = 9.45\text{ A}$    | -   | 0.06 | -   | $\Omega$      |
| $C_{rs}$      | feedback capacitance             | $V_{GS} = 0\text{ V}; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$ | -   | 3.7  | -   | pF            |

## 7. Application information

**Table 7. Application information**

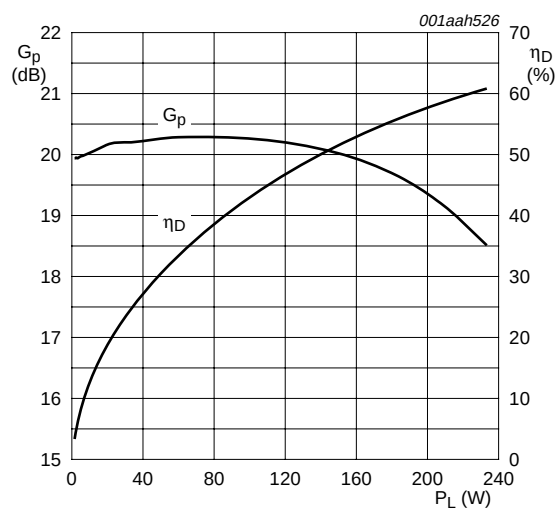
Mode of operation: 2-carrier W-CDMA; PAR 7.5 dB at 0.01 % probability on CCDF; 3GPP test model 1; 1-64 PDPCH;  $f_1 = 871.5\text{ MHz}$ ;  $f_2 = 876.5\text{ MHz}$ ;  $f_3 = 886.5\text{ MHz}$ ;  $f_4 = 891.5\text{ MHz}$ ; RF performance at  $V_{DS} = 28\text{ V}$ ;  $I_{Dq} = 1400\text{ mA}$ ;  $T_{case} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified; in a class-AB production test circuit.

| Symbol      | Parameter                    | Conditions                | Min  | Typ  | Max  | Unit |
|-------------|------------------------------|---------------------------|------|------|------|------|
| $P_{L(AV)}$ | average output power         |                           | -    | 40   | -    | W    |
| $G_p$       | power gain                   | $P_{L(AV)} = 40\text{ W}$ | 18.5 | 20.2 | 21.5 | dB   |
| $RL_{in}$   | input return loss            | $P_{L(AV)} = 40\text{ W}$ | -    | -6.4 | -4.5 | dB   |
| $\eta_D$    | drain efficiency             | $P_{L(AV)} = 40\text{ W}$ | 24   | 27   | -    | %    |
| ACPR        | adjacent channel power ratio | $P_{L(AV)} = 40\text{ W}$ | -    | -41  | -37  | dBc  |

### 7.1 Ruggedness in class-AB operation

The BLF6G10LS-200 is capable of withstanding a load mismatch corresponding to  $VSWR = 7 : 1$  through all phases under the following conditions:  $V_{DS} = 28\text{ V}$ ;  $I_{Dq} = 1400\text{ mA}$ ;  $P_L = 200\text{ W}$ ;  $f = 894\text{ MHz}$ .

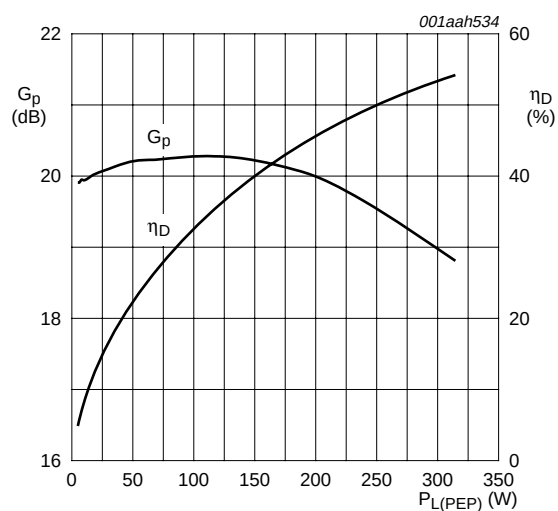
## 7.2 One-tone CW



$V_{DS} = 28$  V;  $I_{DQ} = 1400$  mA;  $f = 894$  MHz.

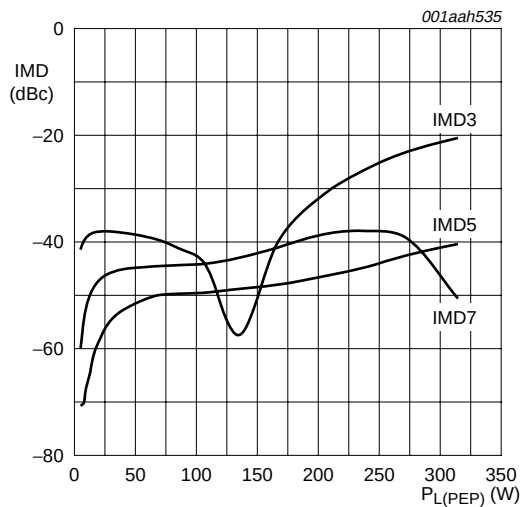
**Fig 1. One-tone CW power gain and drain efficiency as functions of load power; typical values**

## 7.3 Two-tone CW



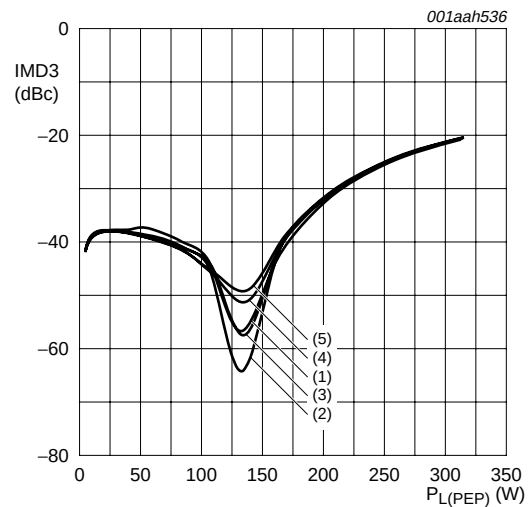
$V_{DS} = 28$  V;  $I_{DQ} = 1400$  mA;  $f_1 = 893.95$  MHz;  $f_2 = 894.05$  MHz.

**Fig 2. Two-tone CW power gain and drain efficiency as functions of peak envelope load power; typical values**



$V_{DS} = 28$  V;  $I_{DQ} = 1400$  mA;  $f_1 = 893.95$  MHz;  
 $f_2 = 894.05$  MHz.

**Fig 3. Two-tone CW intermodulation distortion as function of peak envelope load power; typical values**

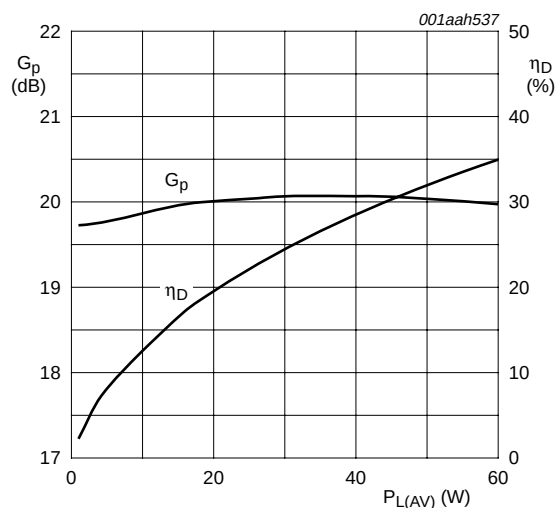


$V_{DS} = 28$  V;  $f_1 = 893.95$  MHz;  $f_2 = 894.05$  MHz.

- (1) 1300 MHz
- (2) 1350 MHz
- (3) 1400 MHz
- (4) 1450 MHz
- (5) 1500 MHz

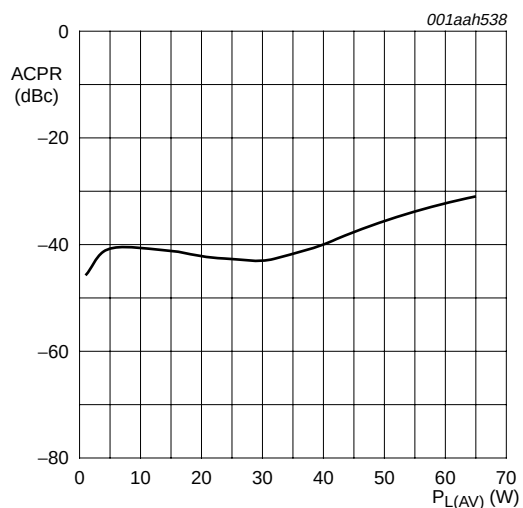
**Fig 4. Third order intermodulation distortion as a function of peak envelope load power; typical values**

## 7.4 2-carrier W-CDMA



$V_{DS} = 28$  V;  $I_{DQ} = 1400$  mA;  $f_1 = 886.5$  MHz;  
 $f_2 = 891.5$  MHz; carrier spacing 5 MHz.

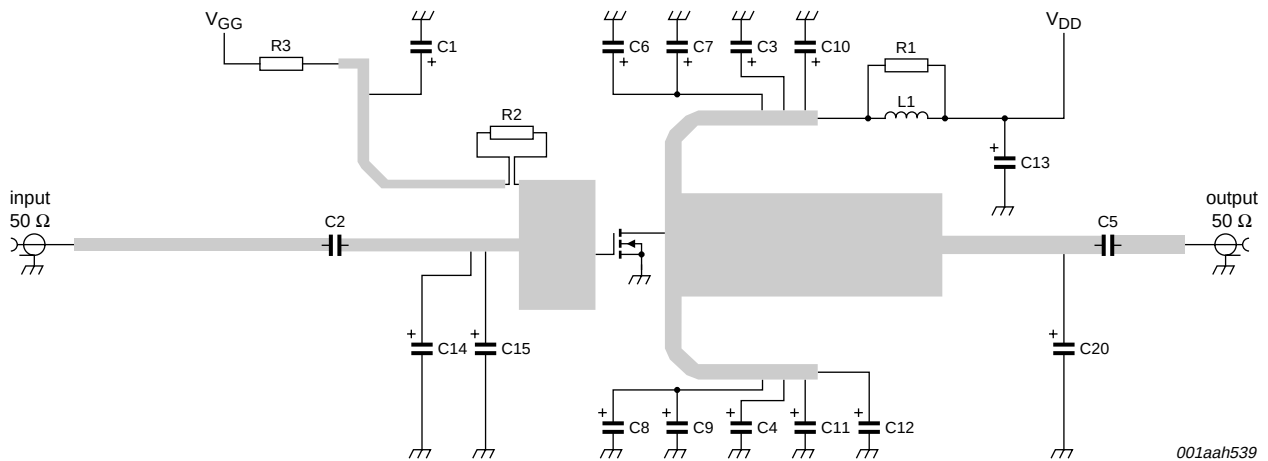
**Fig 5. 2-carrier W-CDMA power gain and drain efficiency as functions of average load power; typical values**



$V_{DS} = 28$  V;  $I_{DQ} = 1400$  mA;  $f_1 = 886.5$  MHz;  
 $f_2 = 891.5$  MHz; carrier spacing 5 MHz.

**Fig 6. 2-carrier W-CDMA adjacent channel power ratio as function of average load power; typical values**

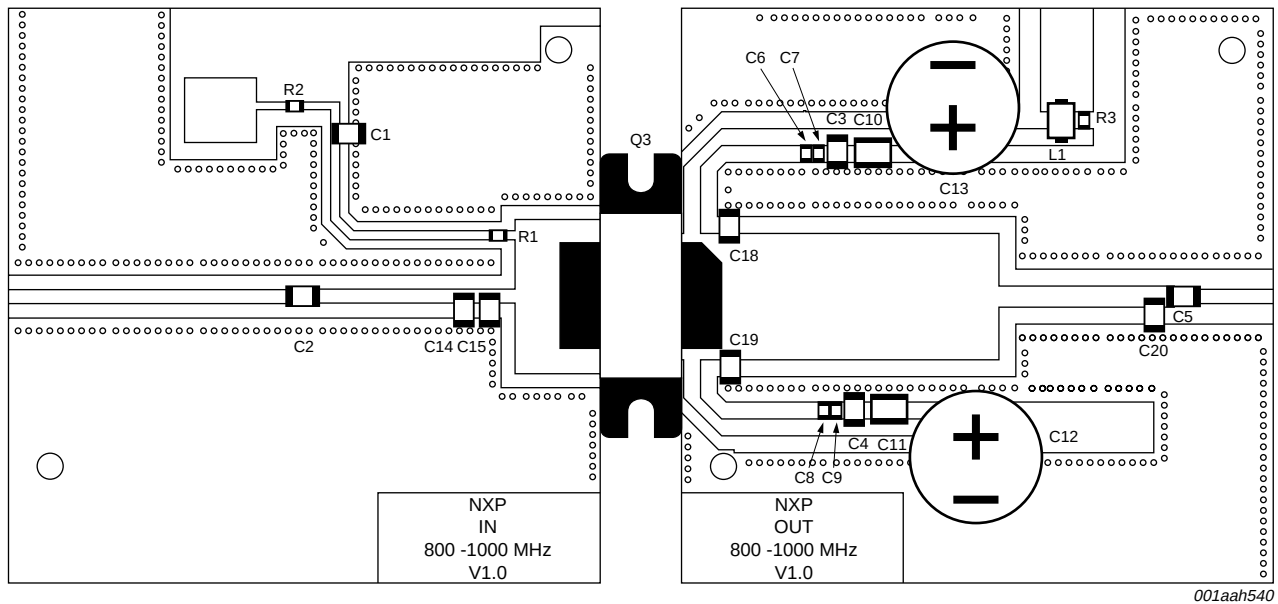
## 8. Test information



The striplines are on a double copper-clad Taconic RF35 Printed-Circuit Board (PCB) with  $\epsilon_r = 3.5$  and thickness = 0.76 mm.

See [Table 8](#) for list of components.

**Fig 7. Test circuit for operation at 800 MHz**



The striplines are on a double copper-clad Taconic RF35 Printed-Circuit Board (PCB) with  $\epsilon_r = 3.5$  and thickness = 0.76 mm.

See [Table 8](#) for list of components.

**Fig 8. Component layout**

**Table 8.** List of components (see [Figure 7](#) and [Figure 8](#))

All capacitors should be soldered vertically except C20.

| Component          | Description                       | Value                | Remarks                                  |
|--------------------|-----------------------------------|----------------------|------------------------------------------|
| C1, C2, C3, C4, C5 | multilayer ceramic chip capacitor | 68 pF                | <a href="#">[1]</a>                      |
| C6, C7, C8, C9     | multilayer ceramic chip capacitor | 330 nF               | <a href="#">[2]</a>                      |
| C10, C11           | multilayer ceramic chip capacitor | 4.7 $\mu$ F          | <a href="#">[2]</a>                      |
| C12, C13           | Electrolytic capacitor            | 220 $\mu$ F; 63 V    |                                          |
| C14                | multilayer ceramic chip capacitor | 4.7 pF; 50 V         | <a href="#">[1]</a>                      |
| C15                | multilayer ceramic chip capacitor | 9.1 pF               | <a href="#">[1]</a>                      |
| C18, C19           | multilayer ceramic chip capacitor | 10 pF                | <a href="#">[1]</a>                      |
| C20                | multilayer ceramic chip capacitor | 1.5 pF; 20 V         | <a href="#">[1]</a>                      |
| L1                 | Ferrite SMD bead                  | -                    | Ferroxcube BDS 3/3/4.6-4S2 or equivalent |
| Q1                 | BLC6G10LS-160                     | -                    |                                          |
| R1, R2, R3         | SMD resistor                      | 9.1 $\Omega$ ; 0.1 W |                                          |

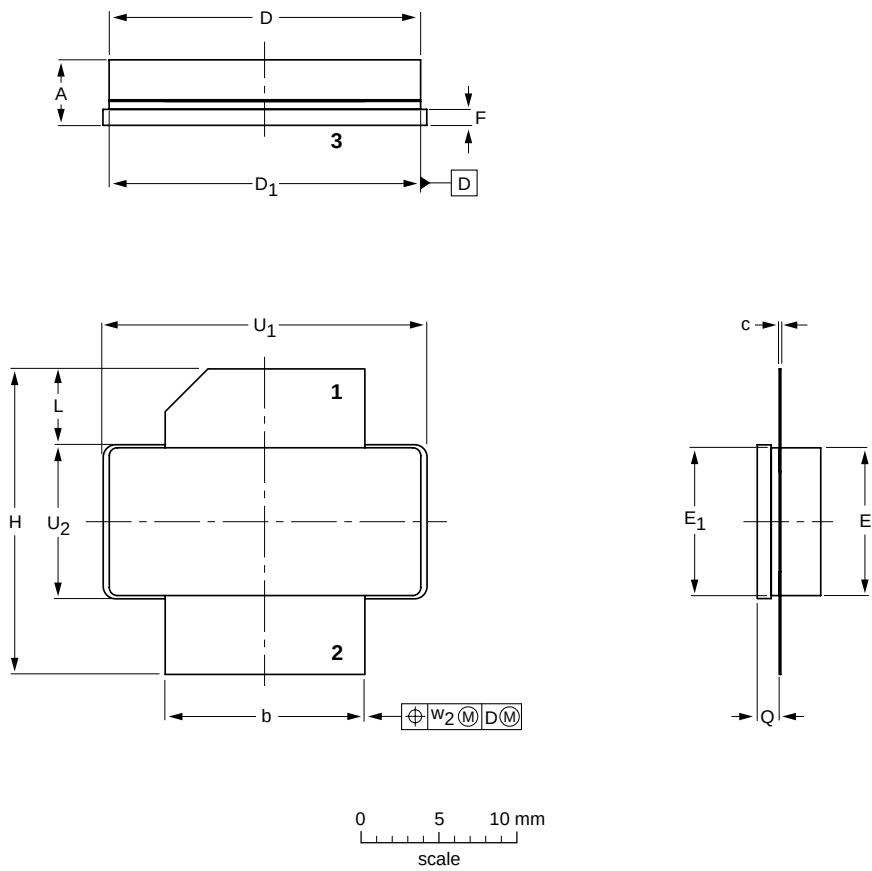
[1] American Technical Ceramics type 100B or capacitor of same quality.

[2] TDK or capacitor of same quality.

9. Package outline

Earless flanged LDMOST ceramic package; 2 leads

SOT502B



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

| UNIT   | A              | b              | c              | D              | D <sub>1</sub> | E              | E <sub>1</sub> | F              | H              | L              | Q              | U <sub>1</sub> | U <sub>2</sub> | w <sub>2</sub> |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| mm     | 4.72<br>3.43   | 12.83<br>12.57 | 0.15<br>0.08   | 20.02<br>19.61 | 19.96<br>19.66 | 9.50<br>9.30   | 9.53<br>9.25   | 1.14<br>0.89   | 19.94<br>18.92 | 5.33<br>4.32   | 1.70<br>1.45   | 20.70<br>20.45 | 9.91<br>9.65   | 0.25           |
| inches | 0.186<br>0.135 | 0.505<br>0.495 | 0.006<br>0.003 | 0.788<br>0.772 | 0.786<br>0.774 | 0.374<br>0.366 | 0.375<br>0.364 | 0.045<br>0.035 | 0.785<br>0.745 | 0.210<br>0.170 | 0.067<br>0.057 | 0.815<br>0.805 | 0.390<br>0.380 | 0.010          |

| OUTLINE<br>VERSION | REFERENCES |       |       |  | EUROPEAN<br>PROJECTION                                                                | ISSUE DATE           |
|--------------------|------------|-------|-------|--|---------------------------------------------------------------------------------------|----------------------|
|                    | IEC        | JEDEC | JEITA |  |                                                                                       |                      |
| SOT502B            |            |       |       |  |  | 03-01-10<br>07-05-09 |

Fig 9. Package outline SOT502B



## 10. Abbreviations

Table 9. Abbreviations

| Acronym | Description                                             |
|---------|---------------------------------------------------------|
| 3GPP    | Third Generation Partnership Project                    |
| CCDF    | Complementary Cumulative Distribution Function          |
| CDMA    | Code Division Multiple Access                           |
| CW      | Continuous Wave                                         |
| DPCH    | Dedicated Physical CHannel                              |
| EDGE    | Enhanced Data rates for GSM Evolution                   |
| GSM     | Global System for Mobile communications                 |
| LDMOS   | Laterally Diffused Metal Oxide Semiconductor            |
| LDMOST  | Laterally Diffused Metal-Oxide Semiconductor Transistor |
| PAR     | Peak-to-Average power Ratio                             |
| PDPCH   | transmission Power of the Dedicated Physical CHannel    |
| RF      | Radio Frequency                                         |
| VSWR    | Voltage Standing Wave Ratio                             |
| W-CDMA  | Wideband Code Division Multiple Access                  |

## 11. Revision history

Table 10. Revision history

| Document ID     | Release date | Data sheet status      | Change notice | Supersedes |
|-----------------|--------------|------------------------|---------------|------------|
| BLF6G10LS-200_1 | 20080118     | Preliminary data sheet | -             | -          |

## 12. Legal information

### 12.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | Definition                                                                            |
|-----------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet      | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
| Product [short] data sheet        | Production                    | This document contains the product specification.                                     |

[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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## 14. Contents

|           |                                           |           |
|-----------|-------------------------------------------|-----------|
| <b>1</b>  | <b>Product profile</b> . . . . .          | <b>1</b>  |
| 1.1       | General description. . . . .              | 1         |
| 1.2       | Features . . . . .                        | 1         |
| 1.3       | Applications . . . . .                    | 2         |
| <b>2</b>  | <b>Pinning information</b> . . . . .      | <b>2</b>  |
| <b>3</b>  | <b>Ordering information</b> . . . . .     | <b>2</b>  |
| <b>4</b>  | <b>Limiting values</b> . . . . .          | <b>2</b>  |
| <b>5</b>  | <b>Thermal characteristics</b> . . . . .  | <b>2</b>  |
| <b>6</b>  | <b>Characteristics</b> . . . . .          | <b>3</b>  |
| <b>7</b>  | <b>Application information</b> . . . . .  | <b>3</b>  |
| 7.1       | Ruggedness in class-AB operation. . . . . | 3         |
| 7.2       | One-tone CW . . . . .                     | 4         |
| 7.3       | Two-tone CW . . . . .                     | 4         |
| 7.4       | 2-carrier W-CDMA . . . . .                | 5         |
| <b>8</b>  | <b>Test information</b> . . . . .         | <b>6</b>  |
| <b>9</b>  | <b>Package outline</b> . . . . .          | <b>8</b>  |
| <b>10</b> | <b>Abbreviations</b> . . . . .            | <b>9</b>  |
| <b>11</b> | <b>Revision history</b> . . . . .         | <b>9</b>  |
| <b>12</b> | <b>Legal information</b> . . . . .        | <b>10</b> |
| 12.1      | Data sheet status . . . . .               | 10        |
| 12.2      | Definitions . . . . .                     | 10        |
| 12.3      | Disclaimers . . . . .                     | 10        |
| 12.4      | Trademarks . . . . .                      | 10        |
| <b>13</b> | <b>Contact information</b> . . . . .      | <b>10</b> |
| <b>14</b> | <b>Contents</b> . . . . .                 | <b>11</b> |

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