

# BLF6G20-230PRN; BLF6G20S-230PRN

Power LDMOS transistor

Rev. 02 — 9 February 2010

Product data sheet

## 1. Product profile

### 1.1 General description

230 W LDMOS power transistor for base station applications at frequencies from 1800 MHz to 2000 MHz.

**Table 1. Typical performance**

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

| Mode of operation | f<br>(MHz)   | $V_{DS}$<br>(V) | $P_{L(AV)}$<br>(W) | $G_p$<br>(dB) | $\eta_D$<br>(%) | ACPR<br>(dBc)      |
|-------------------|--------------|-----------------|--------------------|---------------|-----------------|--------------------|
| 2-carrier W-CDMA  | 1805 to 1880 | 28              | 65                 | 17.5          | 32              | -31 <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 and benefits

- Typical 2-carrier W-CDMA performance at frequencies of 1805 MHz and 1880 MHz, a supply voltage of 28 V and an  $I_{Dq}$  of 2000 mA:
  - ◆ Average output power = 65 W
  - ◆ Power gain = 17.5 dB
  - ◆ Efficiency = 32 %
  - ◆ ACPR = -32 dBc
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (1800 MHz to 2000 MHz)
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)



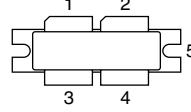
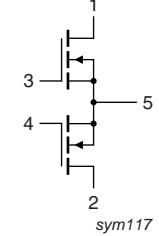
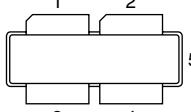
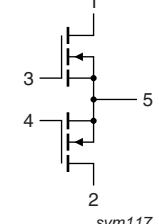
### 1.3 Applications

- RF power amplifiers for W-CDMA base stations and multi carrier applications in the 1800 MHz to 2000 MHz frequency range

## 2. Pinning information

**Table 2. Pinning**

| Pin                              | Description | Simplified outline | Graphic symbol |
|----------------------------------|-------------|--------------------|----------------|
| <b>BLF6G20-230PRN (SOT539A)</b>  |             |                    |                |
| 1                                | drain1      |                    |                |
| 2                                | drain2      |                    |                |
| 3                                | gate1       |                    |                |
| 4                                | gate2       |                    |                |
| 5                                | source      | [1]                |                |
| <b>BLF6G20S-230PRN (SOT539B)</b> |             |                    |                |
| 1                                | drain1      |                    |                |
| 2                                | drain2      |                    |                |
| 3                                | gate1       |                    |                |
| 4                                | gate2       |                    |                |
| 5                                | source      | [1]                |                |

[1] Connected to flange

## 3. Ordering information

**Table 3. Ordering information**

| Type number     | Package |   |  | Version |
|-----------------|---------|---|--|---------|
|                 | Name    | Description   |  |         |
| BLF6G20-230PRN  | -       | flanged balanced LDMOST ceramic package;<br>2 mounting holes; 4 leads |  | SOT539A |
| BLF6G20S-230PRN | -       | earless flanged balanced LDMOST ceramic package;<br>4 leads           |  | SOT539B |

## 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    |
| $T_{stg}$  | storage temperature  |            | -65  | +150 | °C   |
| $T_{case}$ | case temperature     |            | -    | 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 | $T_{case} = 80 \text{ }^{\circ}\text{C}; P_{L(AV)} = 65 \text{ W}$ | 0.38 | K/W  |

## 6. Characteristics

**Table 6. 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   | $V_{GS} = 0 \text{ V}; I_D = 1.8 \text{ mA}$                  | 65  | -   | -     | V             |
| $V_{GS(th)}$  | gate-source threshold voltage    | $V_{DS} = 10 \text{ V}; I_D = 180 \text{ mA}$                 | 1.4 | 1.9 | 2.4   | V             |
| $I_{DSS}$     | drain leakage current            | $V_{GS} = 0 \text{ V}$  |     |     |       |               |
|               |                                  | $V_{DS} = 28 \text{ V}$                                       | -   | -   | 3     | $\mu\text{A}$ |
|               |                                  | $V_{DS} = 60 \text{ V}$                                       | -   | -   | 5     | $\mu\text{A}$ |
| $I_{DSX}$     | drain cut-off current            | $V_{GS} = V_{GS(th)} + 3.75 \text{ V}; V_{DS} = 10 \text{ V}$ | -   | 30  | -     | A             |
| $I_{GSS}$     | gate leakage current             | $V_{GS} = 11 \text{ V}; V_{DS} = 0 \text{ V}$                 | -   | -   | 300   | nA            |
| $g_{fs}$      | forward transconductance         | $V_{DS} = 10 \text{ V}; I_D = 9 \text{ A}$                    | -   | 12  | -     | S             |
| $R_{DS(on)}$  | drain-source on-state resistance | $V_{GS} = V_{GS(th)} + 3.75 \text{ V}; I_D = 6.3 \text{ A}$   | -   | 0.1 | 0.165 | $\Omega$      |

## 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 to 64 PDPCH;  $f_1 = 1802.5$  MHz;  $f_2 = 1807.5$  MHz;  $f_3 = 1872.5$  MHz;  $f_4 = 1877.5$  MHz; RF performance at  $V_{DS} = 28$  V;  $I_{Dq} = 2000$  mA;  $T_{case} = 25$  °C; unless otherwise specified; in a class-AB production test circuit

| Symbol    | Parameter                    | Conditions         | Min  | Typ  | Max  | Unit |
|-----------|------------------------------|--------------------|------|------|------|------|
| $G_p$     | power gain                   | $P_{L(AV)} = 65$ W | 16.3 | 17.5 | 18.7 | dB   |
| $RL_{in}$ | input return loss            | $P_{L(AV)} = 65$ W | -    | -11  | -6.5 | dB   |
| $\eta_D$  | drain efficiency             | $P_{L(AV)} = 65$ W | 29   | 32   | -    | %    |
| ACPR      | adjacent channel power ratio | $P_{L(AV)} = 65$ W | -    | -31  | -27  | dBc  |

**Table 8. Application information**

Mode of operation: 1-carrier W-CDMA; PAR 7.5 dB at 0.01 % probability on CCDF; 3GPP test model 1; 1 to 64 PDPCH;  $f_1 = 1872.5$  MHz;  $f_2 = 1877.5$  MHz; RF performance at  $V_{DS} = 28$  V;  $I_{Dq} = 2000$  mA;  $T_{case} = 25$  °C; unless otherwise specified; in a class-AB production test circuit.

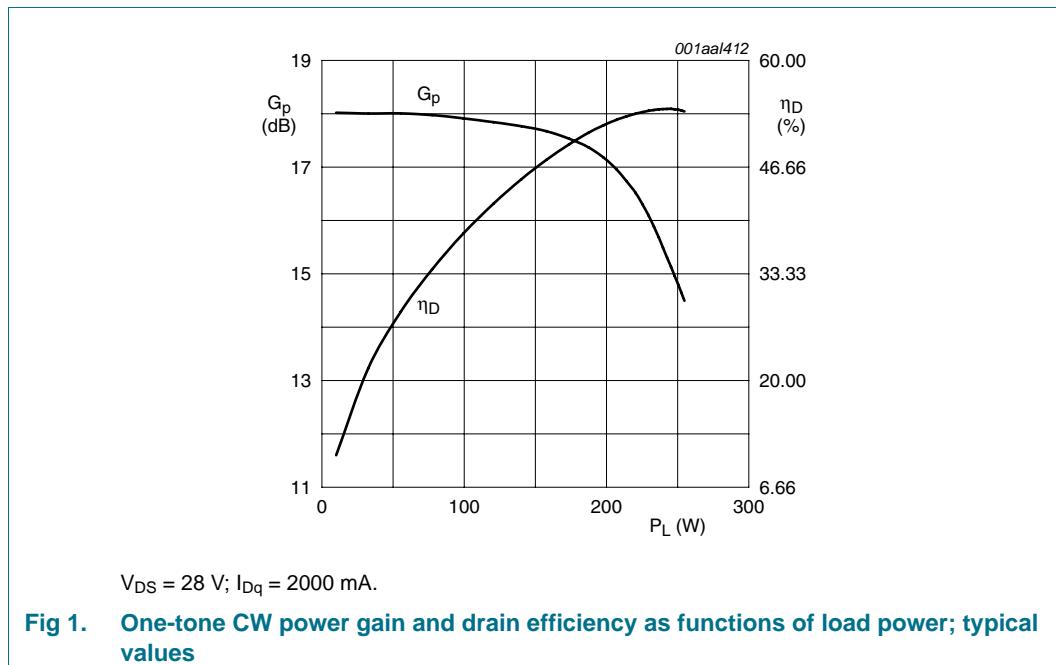
| Symbol  | Parameter                    | Conditions  | Min | Typ | Max | Unit |
|---------|------------------------------|---|-----|-----|-----|------|
| $PAR_O$ | output peak-to-average ratio | $P_{L(AV)} = 125$ W;<br>at 0.01 % probability on CCDF | 3.5 | 4.2 | -   | dB   |

### 7.1 Ruggedness in class-AB operation

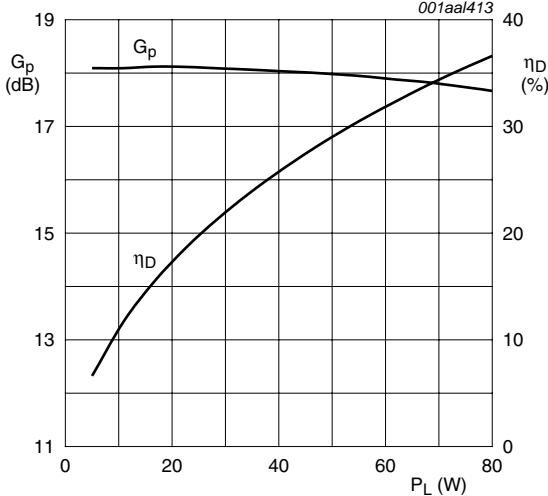
The BLF6G20-230PRN and BLF6G20S-230PRN are capable of withstanding a load mismatch corresponding to  $VSWR = 10 : 1$  through all phases under the following conditions:  $V_{DS} = 28$  V;  $I_{Dq} = 2000$  mA;  $P_L = 230$  W (CW);  $f = 1805$  MHz.

## 7.2 Graphs

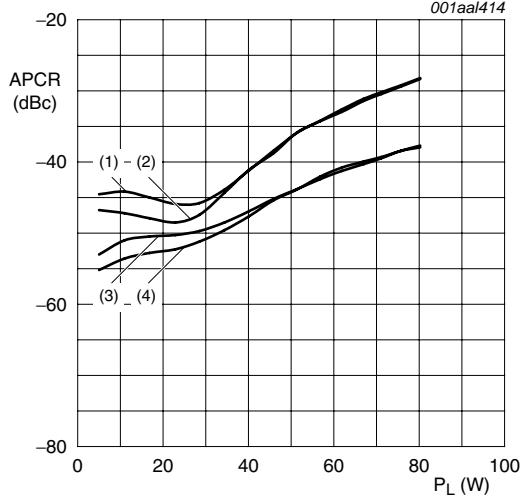
### 7.2.1 One tone CW



### 7.2.2 2-carrier W-CDMA



$V_{DS} = 28$  V;  $I_{Dq} = 2000$  mA.

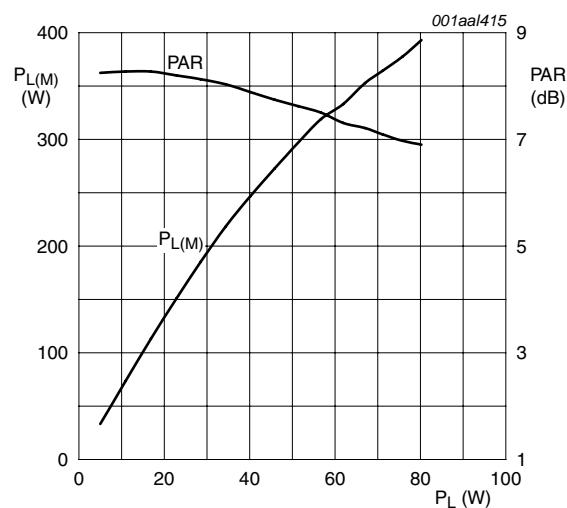


$V_{DS} = 28$  V;  $I_{Dq} = 2000$  mA.

- (1)  $f = 5$  MHz low
- (2)  $f = 5$  MHz high
- (3)  $f = 10$  MHz low
- (4)  $f = 10$  MHz high

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

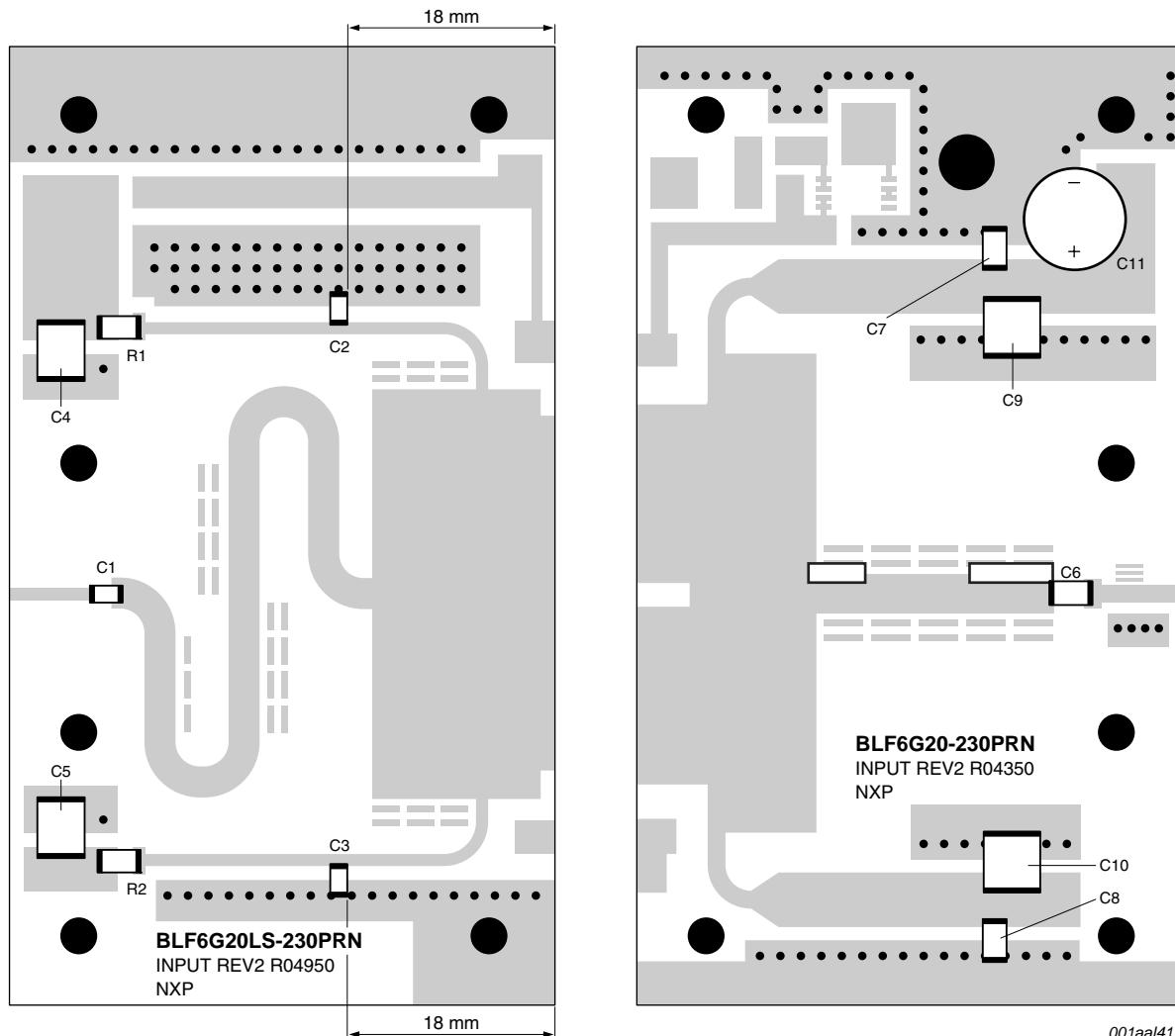
**Fig 3. 2-carrier W-CDMA adjacent channel power ratio as function of load power; typical values**



$V_{DS} = 28$  V;  $I_{Dq} = 2000$  mA.

**Fig 4. 2-carrier W-CDMA peak output power and output peak-to-average ratio as function of load power; typical values**

## 8. Test information



See [Table 9](#) for list of components. The drawing is not to scale.

**Fig 5. Component layout**

**Table 9. List of components**

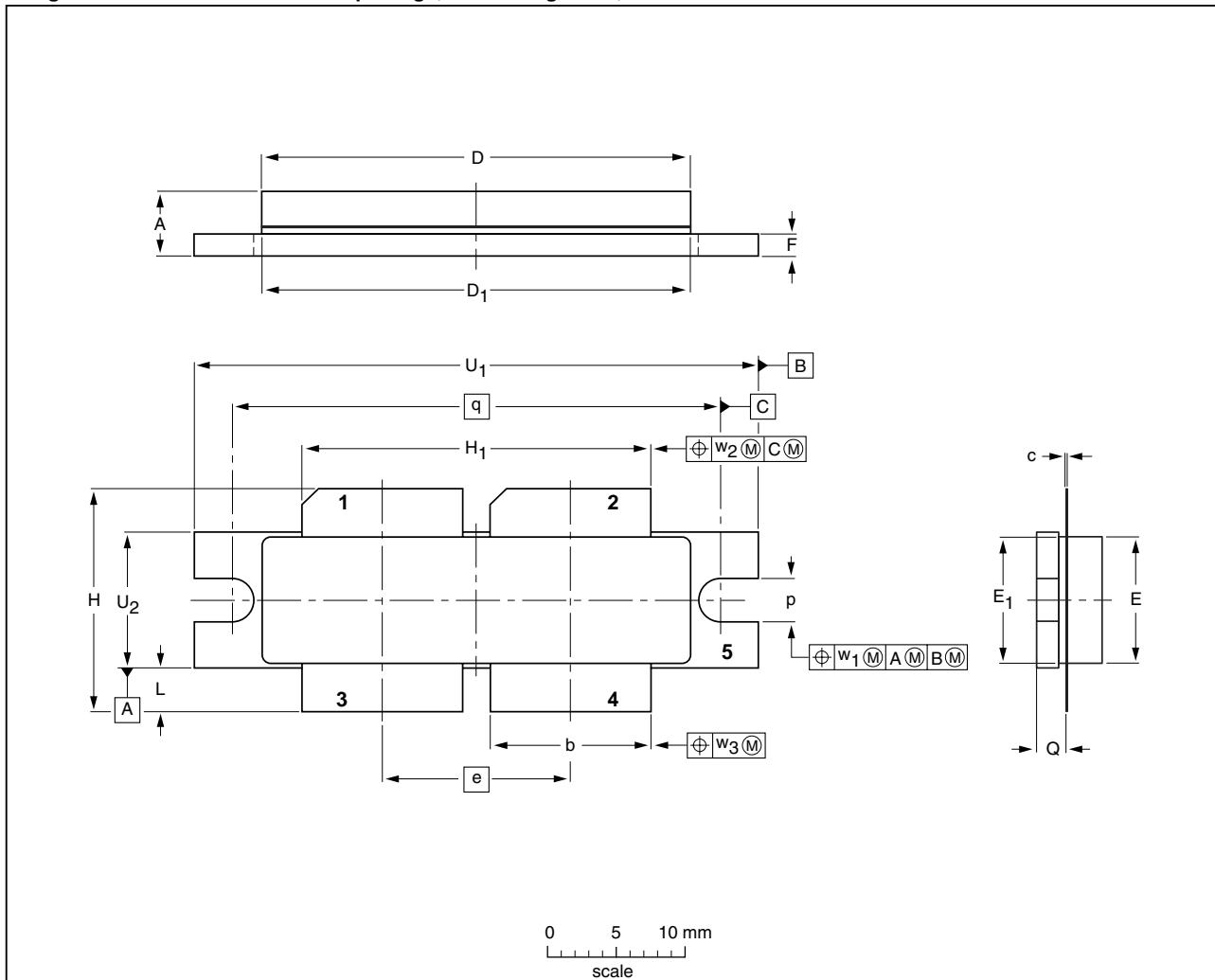
See [Figure 5](#) for component layout.

| Component  | Description                       | Value       | Remarks      |
|------------|-----------------------------------|-------------|--------------|
| C1, C2, C3 | multilayer ceramic chip capacitor | 24 pF       | ATC100A      |
| C4, C5     | multilayer ceramic chip capacitor | 4.7 µF      | TDK          |
| C6         | multilayer ceramic chip capacitor | 33 pF       | ATC8008      |
| C7, C8     | multilayer ceramic chip capacitor | 12 pF       | ATC100B      |
| C9, C10    | multilayer ceramic chip capacitor | 10 µF       | TDK          |
| C11        | electrolytic capacitor            | 220 µF/63 V |              |
| R1, R2     | SMD resistor                      | 10 Ω        | Philips 1206 |

## 9. Package outline

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

SOT539A



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> | L              | p              | Q              | q              | U <sub>1</sub> | U <sub>2</sub> | w <sub>1</sub> | w <sub>2</sub> | w <sub>3</sub> |
|--------|----------------|----------------|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| mm     | 4.7<br>4.2     | 11.81<br>11.56 | 0.18<br>0.10   | 31.55<br>30.94 | 31.52<br>30.96 | 13.72 | 9.50<br>9.30   | 9.53<br>9.27   | 1.75<br>1.50   | 17.12<br>16.10 | 25.53<br>25.27 | 3.48<br>2.97   | 3.30<br>3.05   | 2.26<br>2.01   | 35.56<br>41.02 | 41.28<br>40.29 | 10.29<br>10.03 | 0.25           | 0.51           | 0.25           |
| inches | 0.185<br>0.165 | 0.465<br>0.455 | 0.007<br>0.004 | 1.242<br>1.218 | 1.241<br>1.219 | 0.540 | 0.374<br>0.366 | 0.375<br>0.365 | 0.069<br>0.059 | 0.674<br>0.634 | 1.005<br>0.995 | 0.137<br>0.117 | 0.130<br>0.120 | 0.089<br>0.079 | 1.400<br>1.615 | 1.625<br>1.405 | 0.405<br>0.395 | 0.010          | 0.020          | 0.010          |

Note

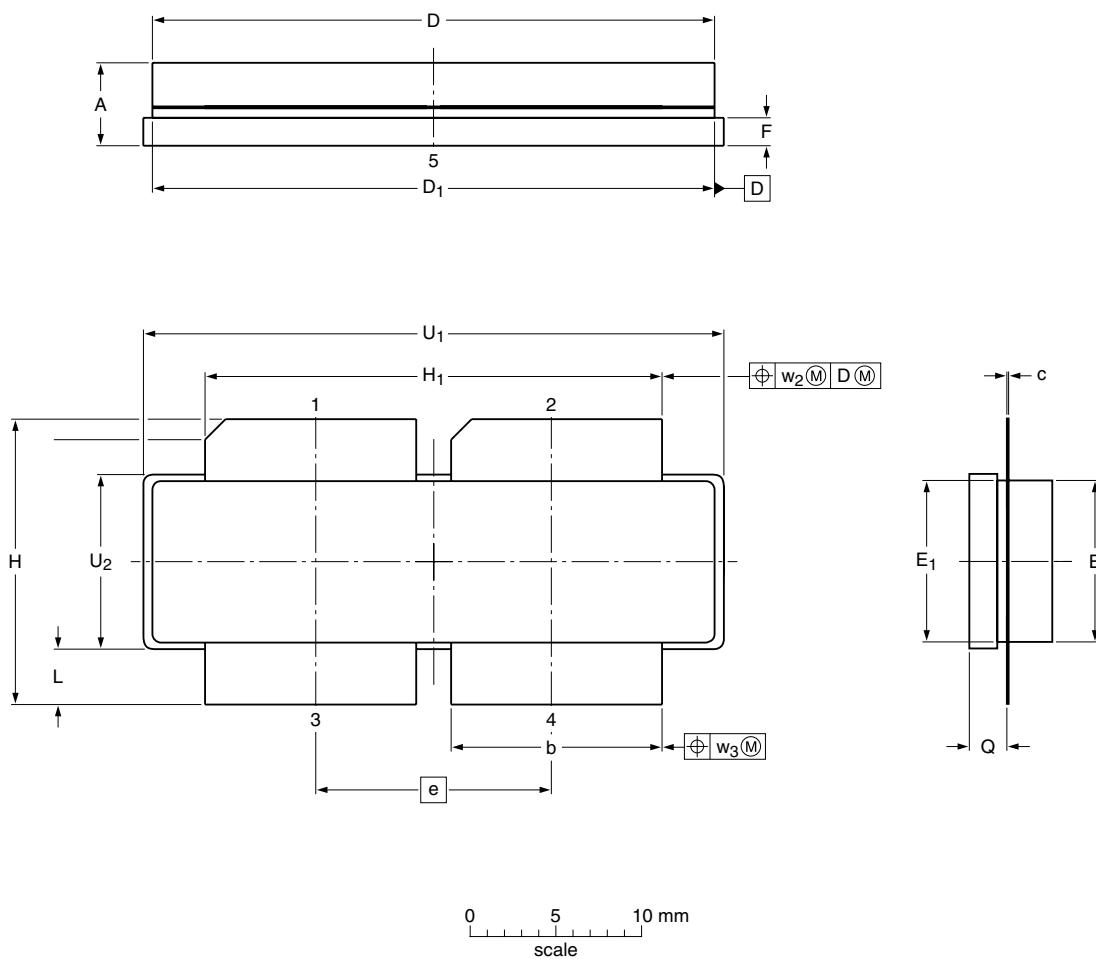
1. millimeter dimensions are derived from the original inch dimensions.
2. recommended screw pitch dimension of 1.52 inch (38.6 mm) based on M3 screw.

| OUTLINE VERSION | REFERENCES |       |      |  | EUROPEAN PROJECTION | ISSUE DATE             |
|-----------------|------------|-------|------|--|---------------------|------------------------|
|                 | IEC        | JEDEC | EIAJ |  |                     |                        |
| SOT539A         |            |       |      |  |                     | -00-09-09-<br>10-02-02 |

Fig 6. Package outline SOT539A

Earless flanged balanced LDMOST ceramic package; 4 leads

SOT539B



## Dimensions

| Unit <sup>(1)</sup> | A     | b     | c     | D     | D <sub>1</sub> | E     | E <sub>1</sub> | e     | F     | H     | H <sub>1</sub> | L     | Q     | U <sub>1</sub> | U <sub>2</sub> | w <sub>2</sub> | w <sub>3</sub> |
|---------------------|-------|-------|-------|-------|----------------|-------|----------------|-------|-------|-------|----------------|-------|-------|----------------|----------------|----------------|----------------|
| mm max              | 4.7   | 11.81 | 0.18  | 31.55 | 31.52          | 9.5   | 9.53           |       | 1.75  | 17.12 | 25.53          | 3.48  | 2.26  | 32.77          | 10.29          |                |                |
| mm nom              |       |       |       |       |                |       |                | 13.72 |       |       |                |       |       |                |                | 0.25           | 0.25           |
| mm min              | 4.2   | 11.56 | 0.10  | 30.94 | 30.96          | 9.3   | 9.27           |       | 1.50  | 16.10 | 25.27          | 2.97  | 2.01  | 32.13          | 10.03          |                |                |
| mm max              | 0.185 | 0.465 | 0.007 | 1.242 | 1.241          | 0.374 | 0.375          |       | 0.069 | 0.674 | 1.005          | 0.137 | 0.089 | 1.275          | 0.405          |                |                |
| mm nom              |       |       |       |       |                |       |                | 0.54  |       |       |                |       |       |                |                | 0.01           | 0.01           |
| mm min              | 0.165 | 0.455 | 0.004 | 1.218 | 1.219          | 0.366 | 0.365          |       | 0.059 | 0.634 | 0.995          | 0.117 | 0.079 | 1.265          | 0.395          |                |                |

## Note

1. millimeter dimensions are derived from the original inch dimensions.

sot539b\_po

| Outline version | References |       |       | European projection | Issue date |
|-----------------|------------|-------|-------|---------------------|------------|
|                 | IEC        | JEDEC | JEITA |                     |            |
| SOT539B         |            |       |       |                     |            |

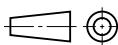
-09-10-16-  
10-02-02

Fig 7. Package outline SOT539B

## 10. Abbreviations

**Table 10. Abbreviations**

| Acronym | Description   |
|---------|---|
| 3GPP    | Third Generation Partnership Project                    |
| CCDF    | Complementary Cumulative Distribution Function          |
| DPCH    | Dedicated Physical CHannel                              |
| 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   |
| W-CDMA  | Wideband Code Division Multiple Access                  |

## 11. Revision history

**Table 11. Revision history**

| Document ID                 | Release date | Data sheet status  | Change notice | Supersedes       |
|-----------------------------|--------------|--|---------------|------------------|
| BLF6G20-230PRN_20S-230PRN_2 | 20100209     | Product data sheet   | -             | BLF6G20-230PRN_1 |
| Modifications               |              | <ul style="list-style-type: none"> <li>• Data sheet status changed to productive data sheet.</li> <li>• Data sheet expanded to include the BLF6G20S-230PRN transistor.</li> <li>• <a href="#">Section 12 "Legal information"</a> export control disclaimer added.</li> </ul> |               |                  |
| BLF6G20-230PRN_1            | 20081202     | Objective 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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