

# BLF6G20-180PN

Power LDMOS transistor

Rev. 03 — 30 March 2009

Product data sheet

## 1. Product profile

### 1.1 General description

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

**Table 1. Typical performance**

RF performance at  $T_{case} = 25\text{ }^{\circ}\text{C}$  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 | 32              | 50                 | 18            | 29.5            | -35 <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

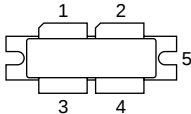
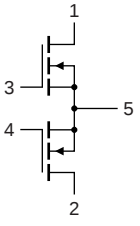
- Typical 2-carrier W-CDMA performance at frequencies of 1805 MHz and 1880 MHz, a supply voltage of 32 V and an  $I_{DQ}$  of 1600 mA:
  - ◆ Average output power = 50 W
  - ◆ Power gain = 18 dB (typ)
  - ◆ Efficiency = 29.5 %
  - ◆ ACPR = -35 dBc
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (1800 MHz to 2000 MHz)
- Internally matched for ease of use
- Qualified up to a supply voltage of 32 V
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

### 1.3 Applications

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

## 2. Pinning information

Table 2. Pinning

| Pin | Description | Simplified outline                                                                  | Graphic symbol                                                                      |
|-----|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | drain1      |  |  |
| 2   | drain2      |                                                                                     |                                                                                     |
| 3   | gate1       |                                                                                     |                                                                                     |
| 4   | gate2       |                                                                                     |                                                                                     |
| 5   | source      |                                                                                     |                                                                                     |

[1] Connected to flange.

## 3. Ordering information

Table 3. Ordering information

| Type number   | Package |                                                                       |         |
|---------------|---------|-----------------------------------------------------------------------|---------|
|               | Name    | Description                                                           | Version |
| BLF6G20-180PN | -       | flanged balanced LDMOST ceramic package;<br>2 mounting holes; 4 leads | SOT539A |

## 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 | $T_{case} = 80\text{ }^{\circ}\text{C}$ ; $P_{L(AV)} = 50\text{ W}$ | 0.45 | 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   | $V_{GS} = 0\text{ V}$ ; $I_D = 0.5\text{ mA}$                     | 65    | -   | -     | V             |
| $V_{GS(th)}$  | gate-source threshold voltage    | $V_{DS} = 10\text{ V}$ ; $I_D = 144\text{ mA}$                    | 1.575 | 1.9 | 2.3   | V             |
| $V_{GSq}$     | gate-source quiescent voltage    | $V_{DS} = 32\text{ V}$ ; $I_D = 800\text{ mA}$                    | 1.725 | 2.1 | 2.45  | 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            | $V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ;<br>$V_{DS} = 10\text{ V}$ | -     | 25  | -     | A             |
| $I_{GSS}$     | gate leakage current             | $V_{GS} = 11\text{ V}$ ; $V_{DS} = 0\text{ V}$                    | -     | -   | 300   | nA            |
| $g_{fs}$      | forward transconductance         | $V_{DS} = 10\text{ V}$ ; $I_D = 7.2\text{ A}$                     | -     | 10  | -     | S             |
| $R_{DS(on)}$  | drain-source on-state resistance | $V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ;<br>$I_D = 5\text{ A}$     | -     | 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;  $f_1 = 1802.5\text{ MHz}$ ;  $f_2 = 1807.5\text{ MHz}$ ;  $f_3 = 1872.5\text{ MHz}$ ;  $f_4 = 1877.5\text{ MHz}$ ; RF performance at  $V_{DS} = 32\text{ V}$ ;  $I_{Dq} = 1600\text{ mA}$ ;  $T_{case} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified; in a class-AB production test circuit.

| Symbol    | Parameter                    | Conditions                | Min  | Typ  | Max  | Unit |
|-----------|------------------------------|---------------------------|------|------|------|------|
| $G_p$     | power gain                   | $P_{L(AV)} = 50\text{ W}$ | 16.8 | 18   | 19.2 | dB   |
| $RL_{in}$ | input return loss            | $P_{L(AV)} = 50\text{ W}$ | -    | -10  | -6.5 | dB   |
| $\eta_D$  | drain efficiency             | $P_{L(AV)} = 50\text{ W}$ | 26   | 29.5 | -    | %    |
| ACPR      | adjacent channel power ratio | $P_{L(AV)} = 50\text{ W}$ | -    | -35  | -33  | dBc  |

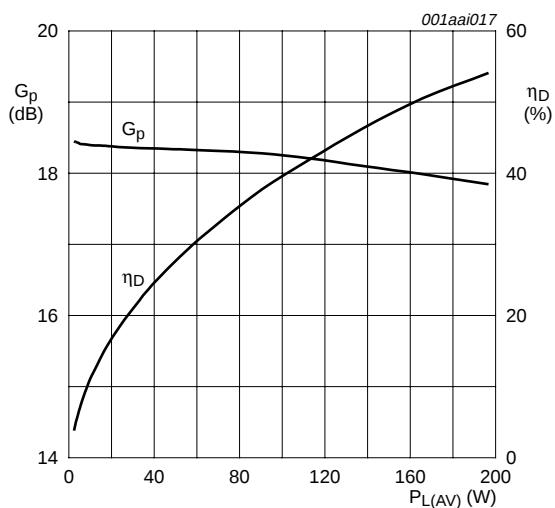
**Table 8. Application information**

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;  $f_1 = 1872.5\text{ MHz}$ ;  $f_2 = 1877.5\text{ MHz}$ ; RF performance at  $V_{DS} = 32\text{ V}$ ;  $I_{Dq} = 1600\text{ mA}$ ;  $T_{case} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified; in a class-AB production test circuit.

| Symbol  | Parameter                    | Conditions                                                    | Min | Typ | Max | Unit |
|---------|------------------------------|---------------------------------------------------------------|-----|-----|-----|------|
| $PAR_O$ | output peak-to-average ratio | $P_{L(AV)} = 115\text{ W}$ ;<br>at 0.01 % probability on CCDF | 4.1 | 4.3 | -   | dB   |

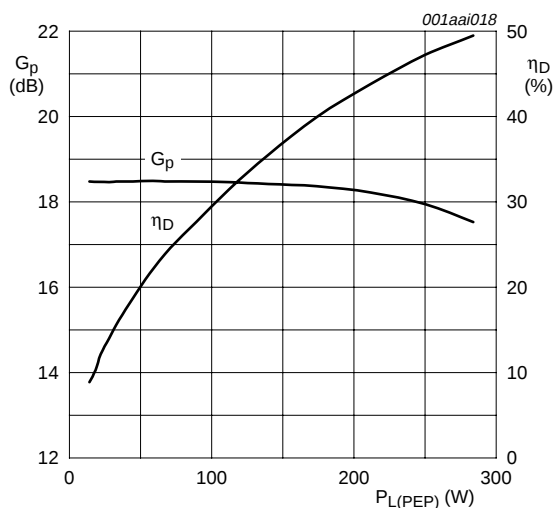
## 7.1 Ruggedness in class-AB operation

The BLF6G20-180PN is capable of withstanding a load mismatch corresponding to  $V_{SWR} = 10 : 1$  through all phases under the following conditions:  $V_{DS} = 28 \text{ V}$ ;  $I_{DQ} = 1600 \text{ mA}$ ;  $P_L = 180 \text{ W (CW)}$ ;  $f = 1880 \text{ MHz}$ .



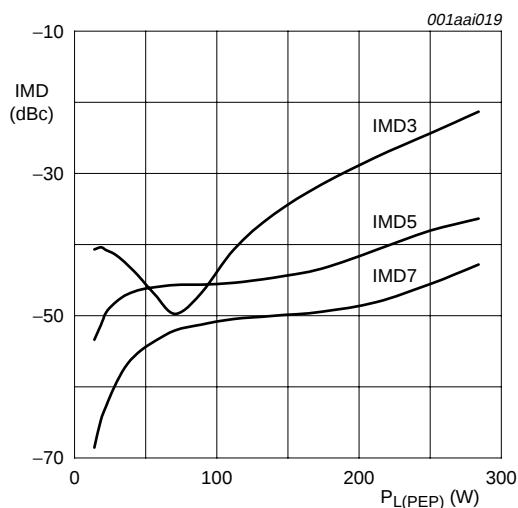
$V_{DS} = 32 \text{ V}$ ;  $I_{DQ} = 1600 \text{ mA}$ ;  $f = 1880 \text{ MHz}$ .

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



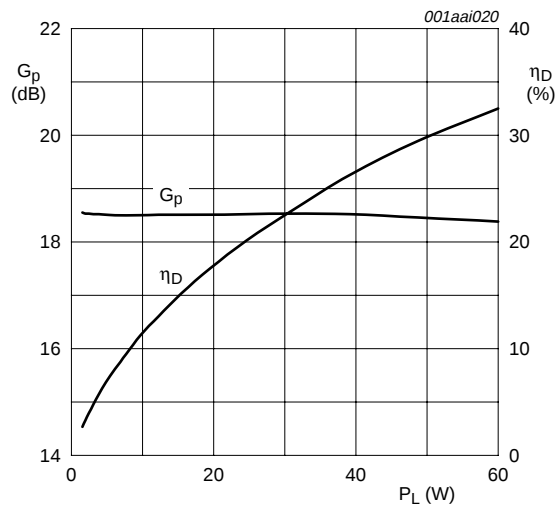
$V_{DS} = 32 \text{ V}$ ;  $I_{DQ} = 1600 \text{ mA}$ ;  $f_1 = 1880 \text{ MHz}$ ;  
 $f_2 = 1880.1 \text{ MHz}$ .

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



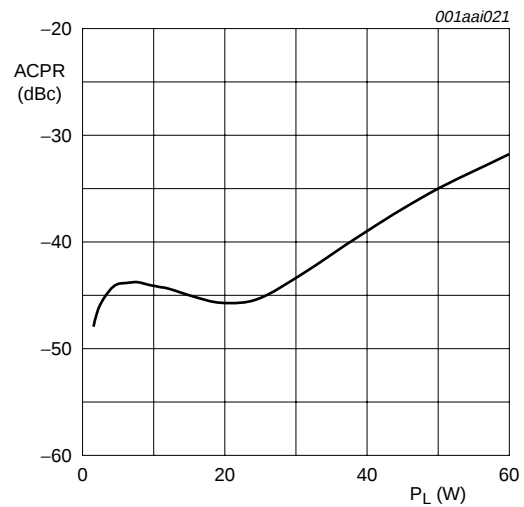
$V_{DS} = 32 \text{ V}$ ;  $I_{DQ} = 1600 \text{ mA}$ ;  $f_1 = 1880 \text{ MHz}$ ;  
 $f_2 = 1880.1 \text{ MHz}$ .

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



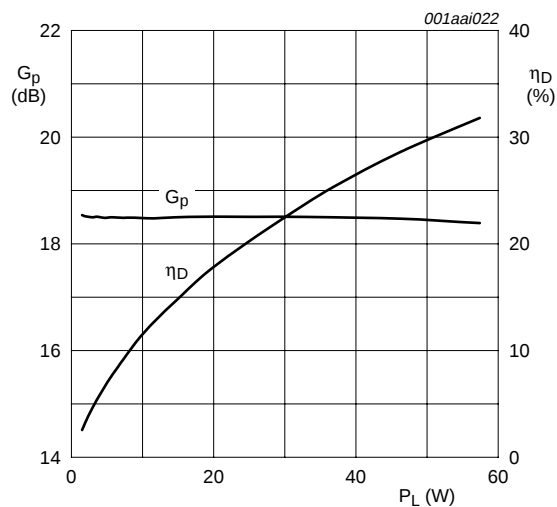
$V_{DS} = 32\text{ V}$ ;  $I_{DQ} = 1600\text{ mA}$ ;  $f_1 = 1872.5\text{ MHz}$ ;  
 $f_2 = 1877.5\text{ MHz}$ ; carrier spacing 5 MHz.

**Fig 4. 2-carrier W-CDMA power gain and drain efficiency as function of load power; typical values**



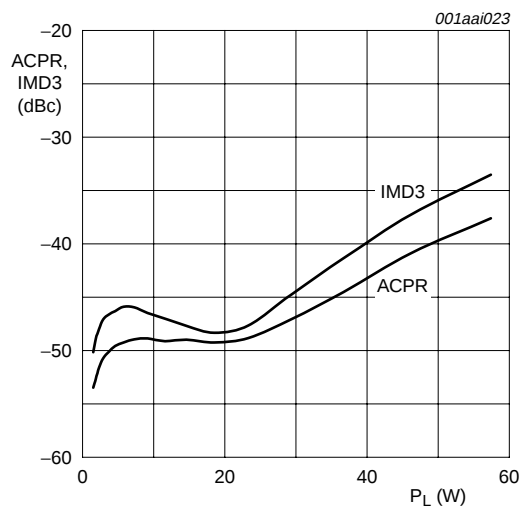
$V_{DS} = 32\text{ V}$ ;  $I_{DQ} = 1600\text{ mA}$ ;  $f_1 = 1872.5\text{ MHz}$ ;  
 $f_2 = 1877.5\text{ MHz}$ ; carrier spacing 5 MHz.

**Fig 5. 2-carrier W-CDMA adjacent channel power ratio as a function of load power; typical values**



$V_{DS} = 32\text{ V}$ ;  $I_{DQ} = 1600\text{ mA}$ ;  $f_1 = 1867.5\text{ MHz}$ ;  
 $f_2 = 1877.5\text{ MHz}$ ; carrier spacing 10 MHz.

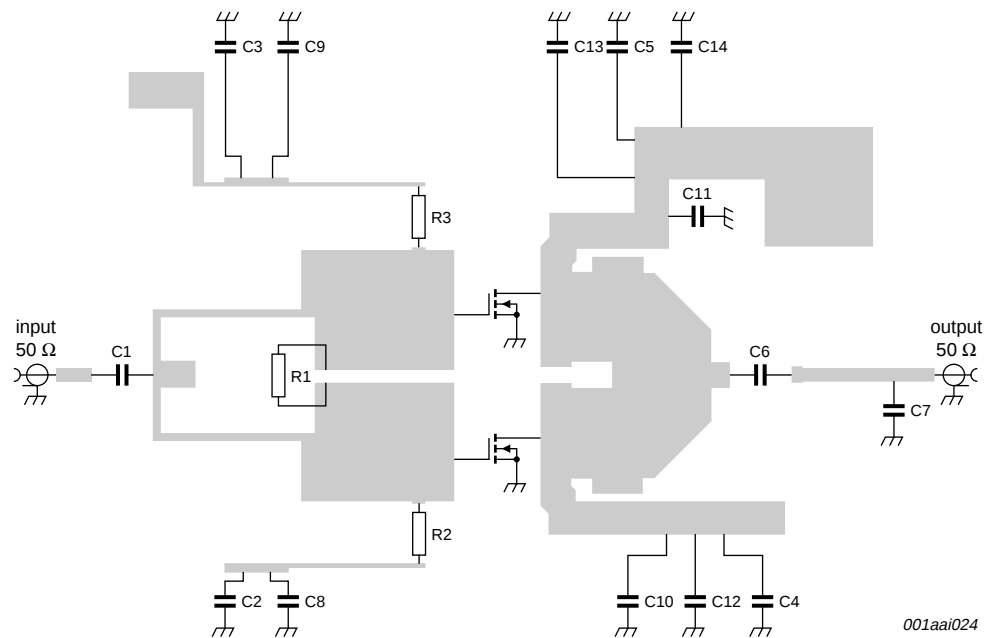
**Fig 6. 2-carrier W-CDMA power gain and drain efficiency as function of load power; typical values**



$V_{DS} = 32\text{ V}$ ;  $I_{DQ} = 1600\text{ mA}$ ;  $f_1 = 1867.5\text{ MHz}$ ;  
 $f_2 = 1877.5\text{ MHz}$ ; carrier spacing 10 MHz.

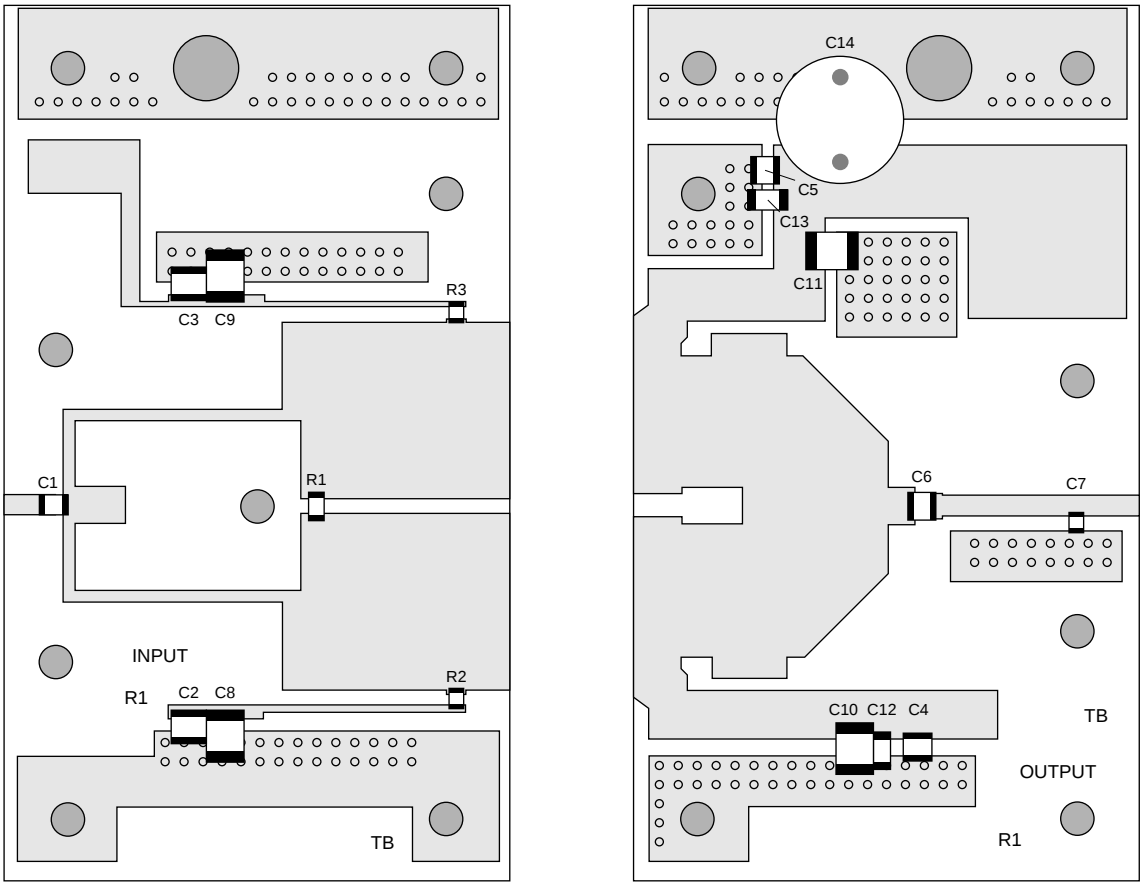
**Fig 7. 2-carrier W-CDMA adjacent channel power ratio and third order intermodulation distortion as function of load power; typical values**

## 8. Test information



See [Table 9](#) for list of components.

**Fig 8. Test circuit for operation at 1805 MHz and 1880 MHz**



001aai025

Striplines are on a double copper-clad Rogers R04350 Printed-Circuit Board (PCB) with  $\epsilon_r = 3.5$  and thickness = 0.76 mm. See [Table 9](#) for list of components.

**Fig 9. Component layout for 1805 MHz and 1880 MHz test circuit**

**Table 9. List of components**  
For test circuit, see [Figure 8](#) and [Figure 9](#).

| Component        | Description                           | Value             | Remarks |
|------------------|---------------------------------------|-------------------|---------|
| C1               | ATC multilayer ceramic chip capacitor | 6.2 pF            | [1]     |
| C2, C3           | ATC multilayer ceramic chip capacitor | 16 pF             | [1]     |
| C4, C5, C6       | ATC multilayer ceramic chip capacitor | 18 pF             | [2]     |
| C7               | ATC multilayer ceramic chip capacitor | 1.1 pF            | [3]     |
| C8, C9, C10, C11 | TDK multilayer ceramic chip capacitor | 4.7 $\mu$ F       |         |
| C12, C13         | AVX multilayer ceramic chip capacitor | 220 nF            |         |
| C14              | electrolytic capacitor                | 100 $\mu$ F; 63 V | [2]     |
| R1               | chip resistor                         | 33 $\Omega$       |         |
| R2, R3           | chip resistor                         | 8.2 $\Omega$      |         |

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

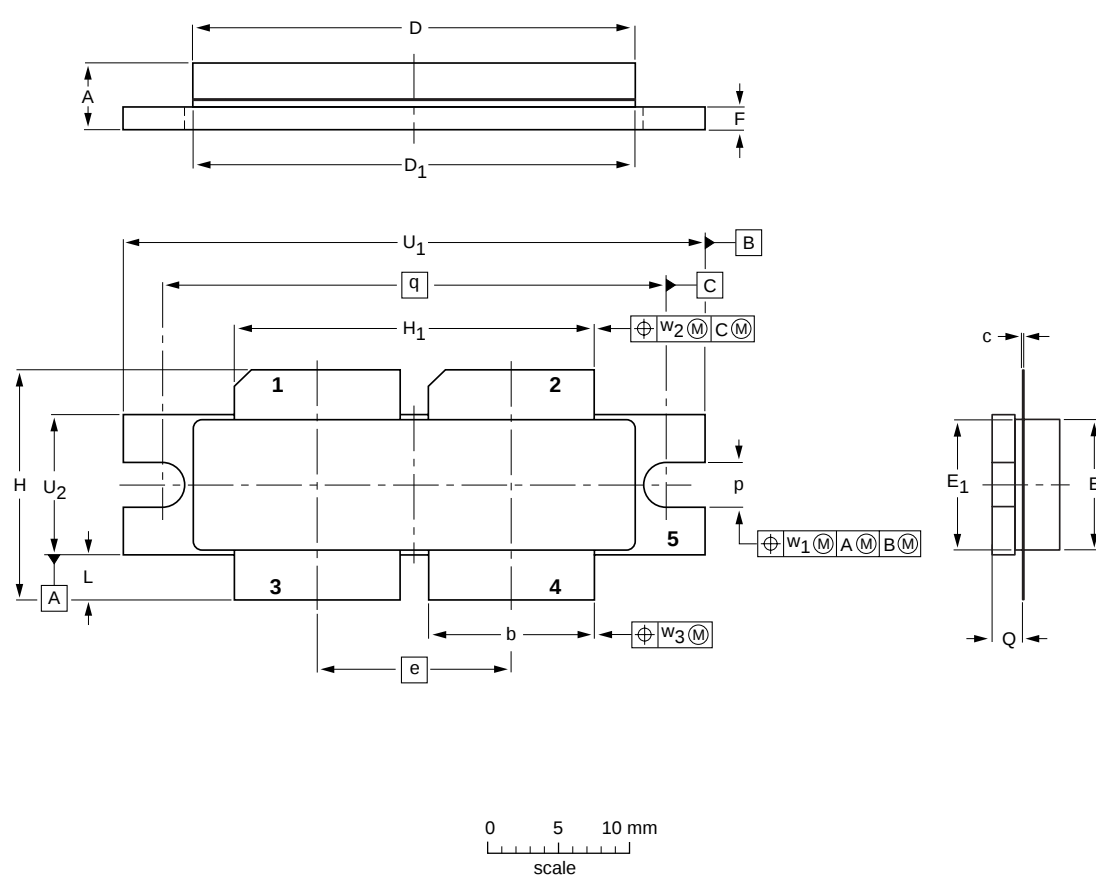
[2] American Technical Ceramics type 180R or capacitor of same quality.

[3] American Technical Ceramics type 100A or capacitor of same quality.

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     | 5.33<br>3.96   | 11.81<br>11.56 | 0.15<br>0.08   | 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 | 3.73<br>2.72   | 3.30<br>3.05   | 2.31<br>2.01   | 35.56 | 41.28<br>41.02 | 10.29<br>10.03 | 0.25           | 0.51           | 0.25           |
| inches | 0.210<br>0.156 | 0.465<br>0.455 | 0.006<br>0.003 | 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 | 0.147<br>0.107 | 0.130<br>0.120 | 0.091<br>0.079 | 1.400 | 1.625<br>1.615 | 0.405<br>0.395 | 0.010          | 0.020          | 0.010          |

| OUTLINE<br>VERSION | REFERENCES |       |      |  | EUROPEAN<br>PROJECTION | ISSUE DATE                      |
|--------------------|------------|-------|------|--|------------------------|---------------------------------|
|                    | IEC        | JEDEC | EIAJ |  |                        |                                 |
| SOT539A            |            |       |      |  |                        | <del>99-12-28</del><br>00-03-03 |

Fig 10. Package outline SOT539A

## 10. Abbreviations

**Table 10. Abbreviations**

| Acronym | Description                                             |
|---------|---------------------------------------------------------|
| 3GPP    | 3rd Generation Partnership Project                      |
| CCDF    | Complementary Cumulative Distribution Function          |
| CW      | Continuous Wave                                         |
| DPCH    | Dedicated Physical CHannel                              |
| IMD     | InterModulation Distortion                              |
| 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 11. Revision history**

| Document ID     | Release date                                                                                                                                                                               | Data sheet status      | Change notice | Supersedes      |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------|-----------------|
| BLF6G20-180PN_3 | 20090330                                                                                                                                                                                   | Product data sheet     | -             | BLF6G20-180PN_2 |
| BLF6G20-180PN_2 | 20090121                                                                                                                                                                                   | Preliminary data sheet | -             | BLF6G20-180PN_1 |
| Modifications:  | <ul style="list-style-type: none"> <li>Table 7 on page 3: Maximum adjacent channel power ratio changed</li> <li>Table 8 on page 3: Minimum output peak-to-average ratio changed</li> </ul> |                        |               |                 |
| BLF6G20-180PN_1 | 20080428                                                                                                                                                                                   | 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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