# BLF7G20L-90P; BLF7G20LS-90P

## Power LDMOS transistor

Rev. 2 — 20 October 2011 Product data sheet

## 1. Product profile

### 1.1 General description

90 W LDMOS power transistor for base station applications at frequencies from 1800 MHz to 2000 MHz, designed for operation at 1427 MHz to1525 MHz, 1805 MHz to 1880 MHz and 2110 MHz to 2170 MHz.

**Table 1. Typical performance**

*Typical RF performance at $T_{case}$ = 25 °C in a common source class-AB production test circuit.*

| Mode of operation | f (MHz) | $I_{Dq}$ (mA) | $V_{DS}$ (V) | $P_{L(AV)}$ (W) | $G_p$ (dB) | $\eta_D$ (%) | $ACPR_{400k}$ (dBc) | $ACPR_{600k}$ (dBc) | $EVM_{rms}$ (%) |
|---|---|---|---|---|---|---|---|---|---|
| CW | 1805 to 1880 | 550 | 28 | 84 | 19 | 54 | - | - | - |
| GSM EDGE | 1805 to 1880 | 550 | 28 | 40 | 19.5 | 41 | –61 | –74 | 2.5 |

### 1.2 Features and benefits

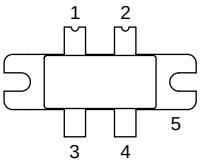
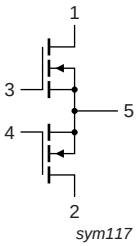
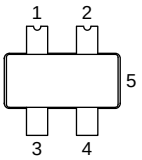
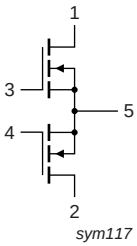
- Excellent ruggedness
- High efficiency
- Low $R_{th}$ providing excellent thermal stability
- Designed for broadband operation (1427 MHz to1525 MHz, 1805 MHz to 1880 MHz and 2110 MHz to 2170 MHz)
- Lower output capacitance for improved performance in Doherty applications
- Designed for low memory effects providing excellent pre-distortability
- Internally matched for ease of use
- Integrated ESD protection
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

### 1.3 Applications

- RF power amplifiers for base stations and multi carrier applications in the frequency bands of 1427 MHz to 1525 MHz, 1805 MHz to 1880 MHz and 2110 MHz to 2170 MHz.

## 2. Pinning information

**Table 2. Pinning**

| Pin | Description | | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| **BLF7G20L-90P (SOT1121A)** | | | | |
| 1 | drain1 | |  |  |
| 2 | drain2 | | | |
| 3 | gate1 | | | |
| 4 | gate2 | | | |
| 5 | source | [1] | | |
| **BLF7G20LS-90P (SOT1121B)** | | | | |
| 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 | | |
|---|---|---|---|
| | Name | Description | Version |
| BLF7G20L-90P | - | flanged LDMOST ceramic package; 2 mounting holes; 4 leads | SOT1121A |
| BLF7G20LS-90P | - | earless flanged LDMOST ceramic package; 4 leads | SOT1121B |

## 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 | | - | 18 | A |
| $T_{stg}$ | storage temperature | | –65 | +150 | °C |
| $T_j$ | junction temperature | | - | 200 | °C |

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

| Symbol | Parameter | Conditions | Typ | Unit |
|---|---|---|---|---|
| $R_{th(j-c)}$ | thermal resistance from junction to case | $T_{case}$ = 80 °C; $P_L$ = 90 W | 0.49 | K/W |

## 6. Characteristics

**Table 6. Characteristics**

*$T_j$ = 25 °C; per section unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $V_{GS}$ = 0 V; $I_D$ = 0.5 mA | 65 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $V_{DS}$ = 10 V; $I_D$ = 50 mA | 1.5 | 1.9 | 2.3 | V |
| $I_{DSS}$ | drain leakage current | $V_{GS}$ = 0 V; $V_{DS}$ = 28 V | - | - | 2 | μA |
| $I_{DSX}$ | drain cut-off current | $V_{GS}$ = $V_{GS(th)}$ + 3.75 V; $V_{DS}$ = 10 V | 8.2 | 9.5 | - | A |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = 11 V; $V_{DS}$ = 0 V | - | - | 200 | nA |
| $g_{fs}$ | forward transconductance | $V_{DS}$ = 10 V; $I_D$ = 2.5 A | - | 3.8 | - | S |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS}$ = $V_{GS(th)}$ + 3.75 V; $I_D$ = 1.75 A | - | 0.28 | - | Ω |

## 7. Test information

**Table 7. Application information**

*f = 1805 MHz to 1880 MHz; RF performance at $V_{DS}$ = 28 V; $I_{Dq}$ = 550 mA; $T_{case}$ = 25 °C; 2 sections combined unless otherwise specified; in a class-AB production test circuit.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Mode of operation: GSM EDGE; $P_{L(AV)}$ = 40 W** | | | | | | |
| $G_p$ | power gain | | 18.3 | 19.5 | - | dB |
| $RL_{in}$ | input return loss | | - | –15 | –8 | dB |
| $\eta_D$ | drain efficiency | | 38 | 41 | - | % |
| $ACPR_{400k}$ | adjacent channel power ratio (400 kHz) | | - | –61 | –58 | dBc |
| $ACPR_{600k}$ | adjacent channel power ratio (600 kHz) | | - | –74 | –70.5 | dBc |
| $EVM_{rms}$ | RMS EDGE signal distortion error | | - | 2.5 | 3.8 | % |
| $EVM_M$ | peak EDGE signal distortion error | | - | 8 | 12.5 | % |
| **Mode of operation: CW; $P_{L(AV)}$ = 84 W** | | | | | | |
| $G_p$ | power gain | | 17.8 | 19 | - | dB |
| $\eta_D$ | drain efficiency | | 51 | 54 | - | % |

## 7.1 Ruggedness in class-AB operation

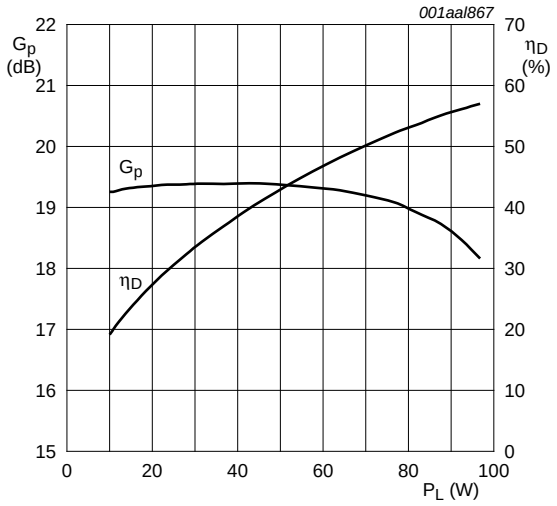
The BLF7G20L-90P and BLF7G20LS-90P are capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions:

$V_{DS}$ = 28 V; $I_{Dq}$ = 550 mA; $P_L$ = 90 W (CW), f = 1805 MHz,

$V_{DS}$ = 28 V; $I_{Dq}$ = 380 mA; $P_L$ = 40 W (CW, half device), f = 2110 MHz,

$V_{DS}$ = 28 V; $I_{Dq}$ = 380 mA; $P_L$ = 55 W (CW pulse, 10 %, 100 μs, halve device), f = 1427 MHz.

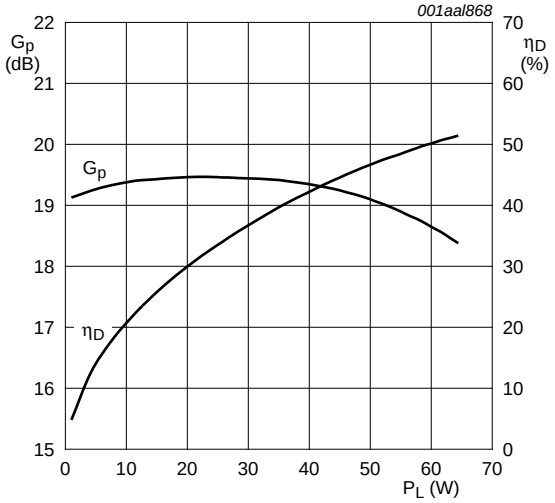
## 7.2 One-tone CW




$V_{DS}$ = 28 V; $I_{Dq}$ = 550 mA; f = 1880 MHz.

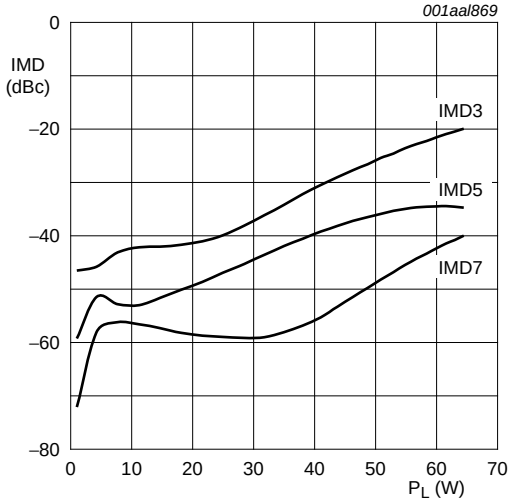
**Fig 1. One-tone CW power gain and drain efficiency as function of load power; typical values**

## 7.3 Two-tone CW




$V_{DS}$ = 28 V; $I_{Dq}$ = 550 mA; $f_1$ = 1879.95 MHz; $f_2$ = 1880.05 MHz.

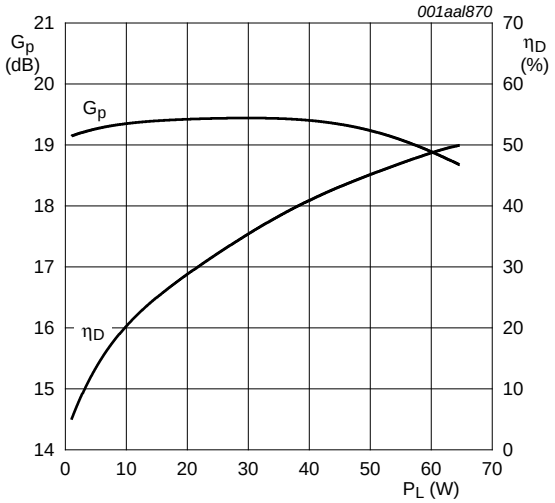
**Fig 2. Two-tone CW power gain and drain efficiency as function of load power; typical values**




$V_{DS}$ = 28 V; $I_{Dq}$ = 550 mA; $f_1$ = 1879.95 MHz; $f_2$ = 1880.05 MHz.

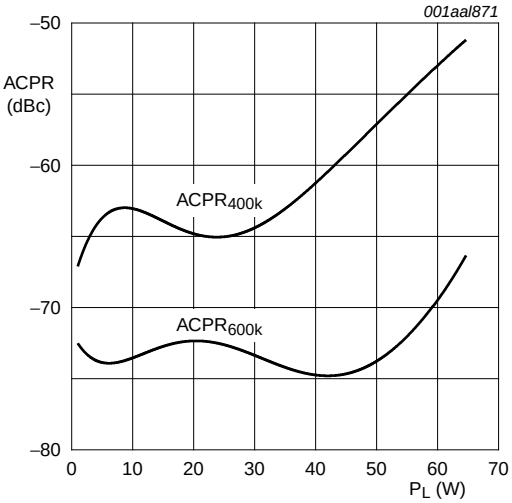
**Fig 3. Two-tone CW intermodulation distortion as a function of load power; typical values**

## 7.4 GSM EDGE



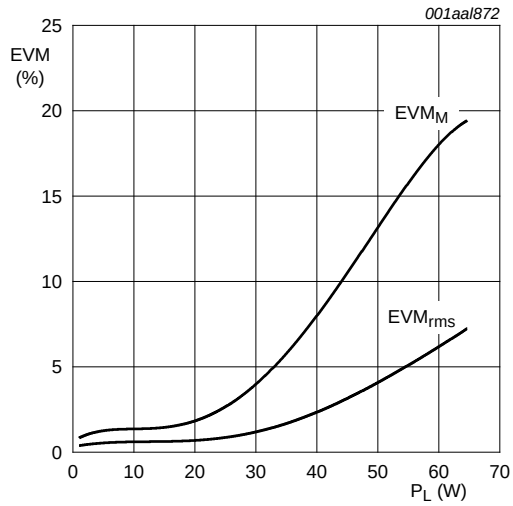

$V_{DS}$ = 28 V; $I_{Dq}$ = 550 mA; f = 1880 MHz.

**Fig 4. GSM EDGE power gain and drain efficiency as function of load power; typical values**




$V_{DS}$ = 28 V; $I_{Dq}$ = 550 mA; f = 1880 MHz.

**Fig 5. GSM EDGE ACPR at 400 kHz and at 600 kHz as function of load power; typical values**

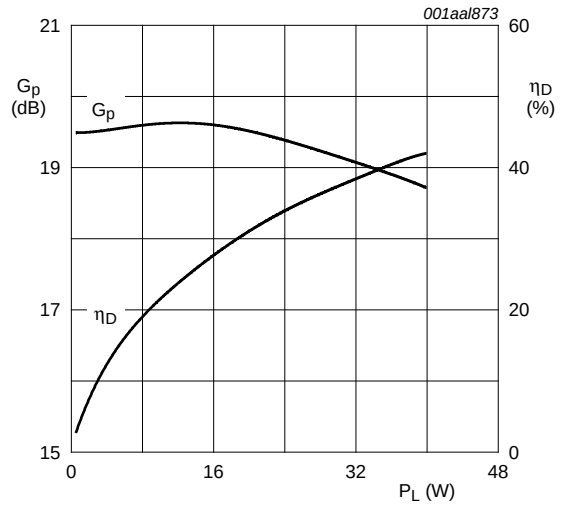



$V_{DS}$ = 28 V; $I_{Dq}$ = 550 mA; f = 1880 MHz.

**Fig 6. GSM EDGE RMS EDGE and peak EDGE as function of load power; typical values**

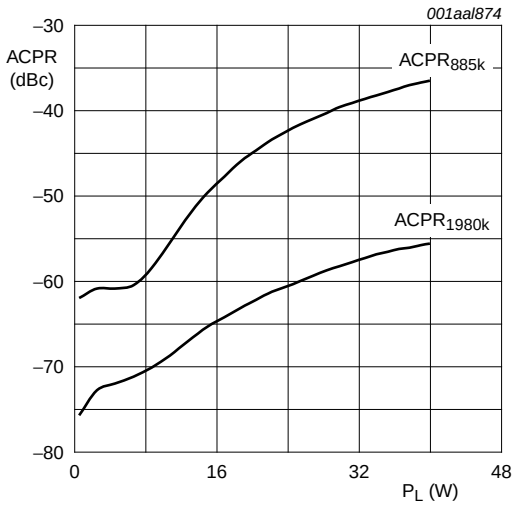
## 7.5 Single carrier IS-95

Single carrier IS-95 with pilot, paging, sync and 6 traffic channels (Walsh codes 8 - 13). PAR = 9.7 dB at 0.01 % probability on the CCDF. Channel bandwidth is 1.2288 MHz.



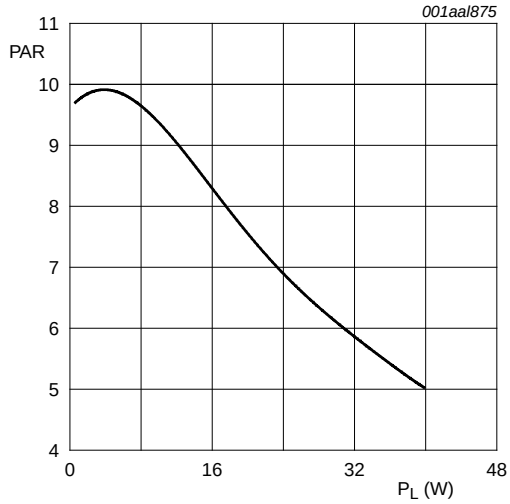

$V_{DS}$ = 28 V; $I_{Dq}$ = 600 mA; f = 1880 MHz.

**Fig 7. Single carrier IS-95 power gain and drain efficiency as function of load power; typical values**




$V_{DS}$ = 28 V; $I_{Dq}$ = 600 mA; f = 1880 MHz.

**Fig 8. Single carrier IS-95 ACPR at 885 kHz and at 1980 kHz as function of load power; typical values**

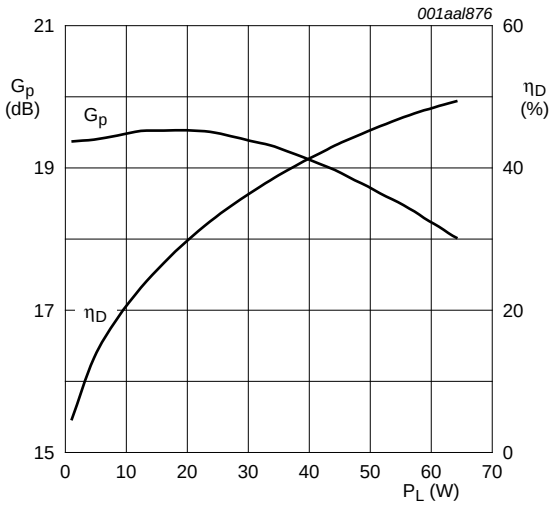



$V_{DS}$ = 28 V; $I_{Dq}$ = 600 mA; f = 1880 MHz.

**Fig 9. Single carrier IS-95 peak-to-average power ratio as a function of load power; typical values**

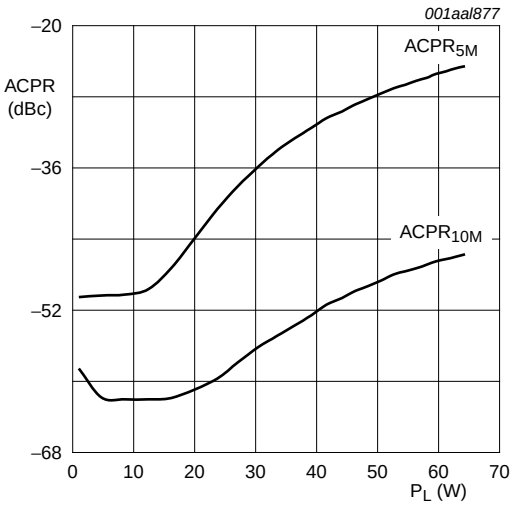
## 7.6 Single carrier W-CDMA

3GPP; test model 1; 64 DPCH; PAR = 7.2 dB at 0.01 % probability on CCDF. Channel bandwidth is 3.84 MHz.




$V_{DS}$ = 28 V; $I_{Dq}$ = 600 mA; f = 1880 MHz.

**Fig 10. Single carrier W-CDMA power gain and drain efficiency as function of load power; typical values**




$V_{DS}$ = 28 V; $I_{Dq}$ = 600 mA; f = 1880 MHz.

**Fig 11. Single carrier W-CDMA ACPR at 5 MHz and at 10 MHz as function of load power; typical values**

## 7.7 Test circuit

**Table 8. List of components**

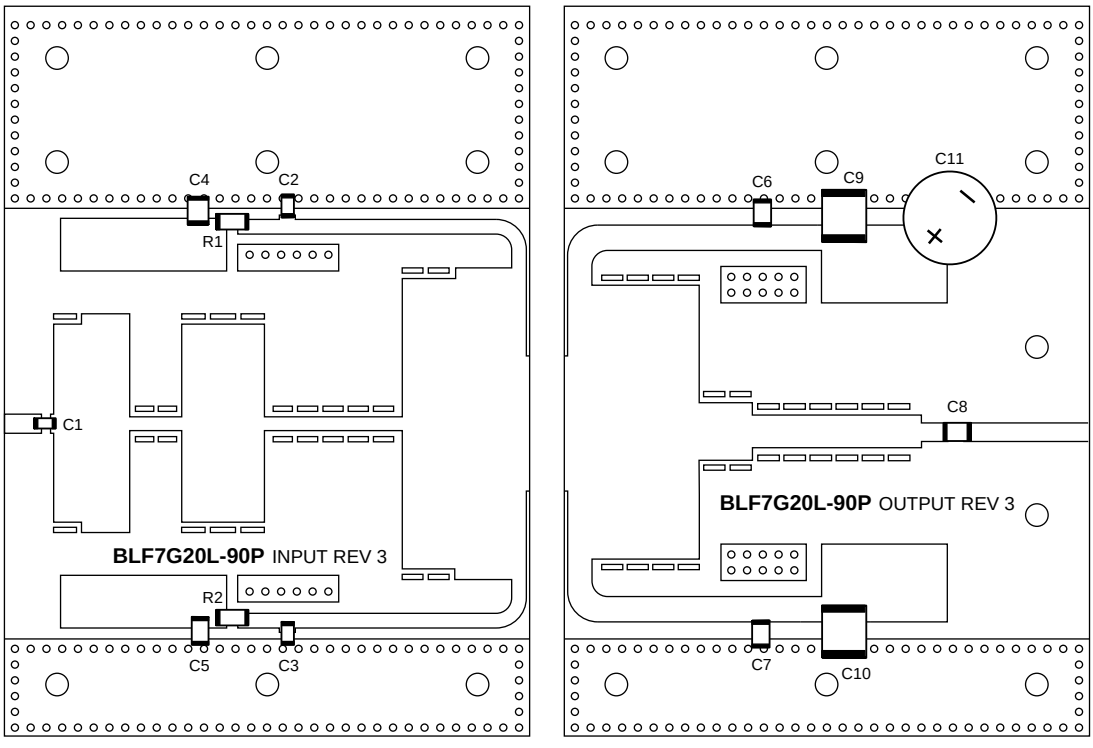
*For test circuit see Figure 12.*

| Component | Description | Value | | Remarks |
|---|---|---|---|---|
| C1, C2, C3 | multilayer ceramic chip capacitor | 24 pF | [1] | |
| C4, C5 | multilayer ceramic chip capacitor | 4.7 μF | [2] | |
| C6, C7, C8 | multilayer ceramic chip capacitor | 11 pF | [3] | |
| C9, C10 | multilayer ceramic chip capacitor | 10 μF | [2] | |
| C11 | electrolytic capacitor | 470 μF; 63 V | | |
| R1, R2 | SMD resistor | 12 Ω | | Philips 1206 |

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

[2] TDK or capacitor of same quality.

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




Printed-Circuit Board (PCB): Taconic RF35; $\varepsilon_r$ = 3.5 F/m; thickness = 0.76 mm; thickness copper plating = 35 μm.

See Table 8 for a list of components.

**Fig 12. Component layout for class-AB production test circuit**

## 7.8 Impedance information

**Table 9. Typical impedance**

*Typical values valid for both section in parallel unless otherwise specified.*

| f | $Z_S$ | $Z_L$ |
|---|---|---|
| **MHz** | Ω | Ω |
| 1800 | 1.0 – j3.3 | 2.8 – j2.7 |
| 1840 | 1.2 – j3.3 | 2.8 – j2.5 |
| 1880 | 1.1 – j3.4 | 2.7 – j2.4 |

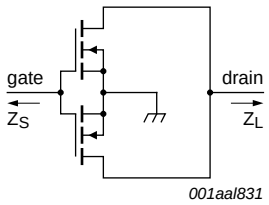
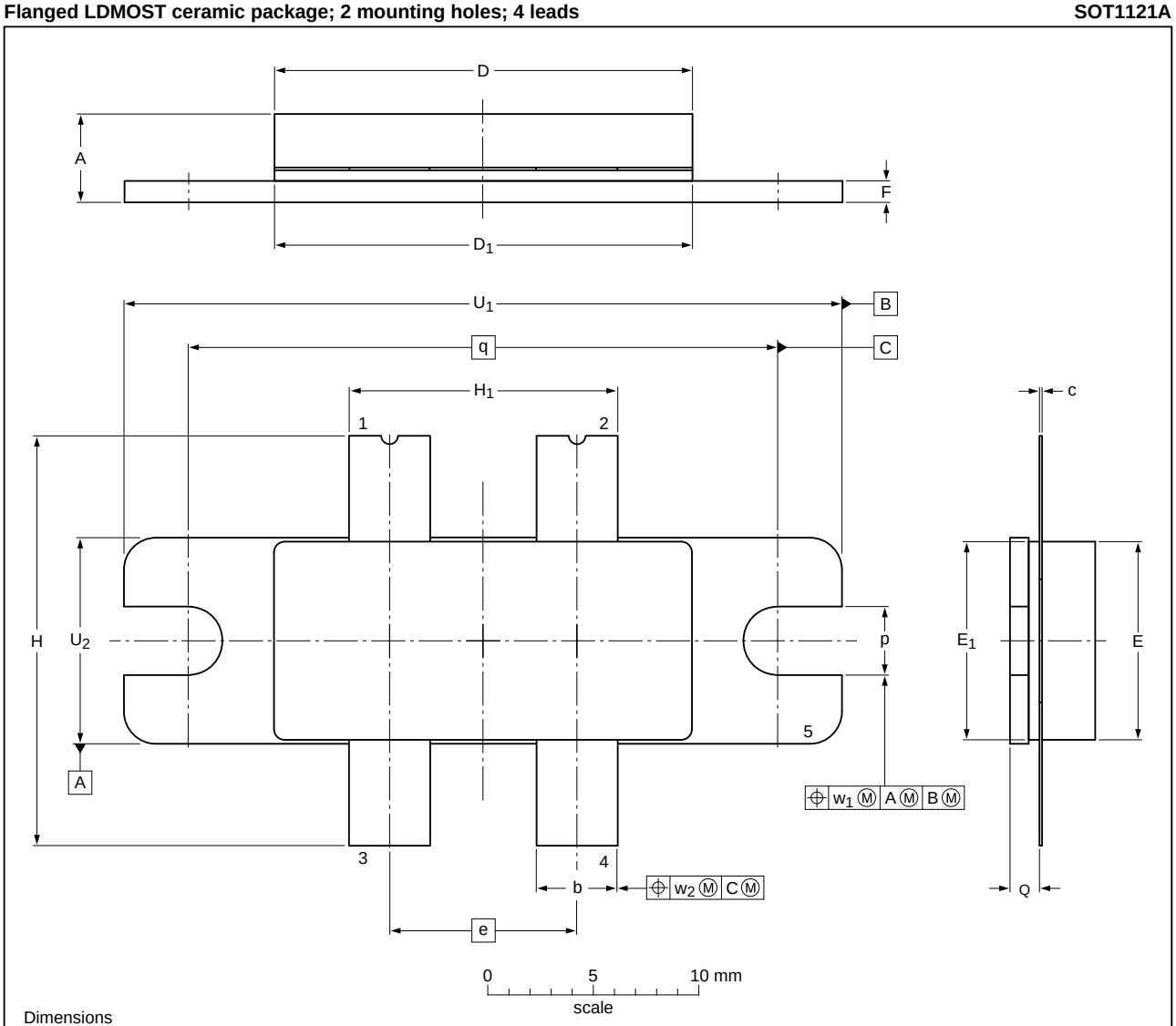



**Fig 13. Definition of transistor impedance**

## 8. Package outline

**Flanged LDMOST ceramic package; 2 mounting holes; 4 leads** **SOT1121A**




Dimensions

| Unit[1] | | A | b | c | D | D1 | e | E | E1 | F | H | H1 | p | Q[2] | q | U1 | U2 | w1 | w2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 4.75 | 3.94 | 0.18 | 20.02 | 19.96 | | 9.53 | 9.53 | 1.14 | 19.94 | 12.83 | 3.38 | 1.70 | | 34.16 | 9.91 | | |
| | nom | | | | | | 8.89 | | | | | | | | 27.94 | | | 0.25 | 0.51 |
| | min | 3.45 | 3.68 | 0.10 | 19.61 | 19.66 | | 9.27 | 9.27 | 0.89 | 18.92 | 12.57 | 3.12 | 1.45 | | 33.91 | 9.65 | | |
| inches | max | 0.187 | 0.155 | 0.007 | 0.788 | 0.786 | | 0.375 | 0.375 | 0.045 | 0.785 | 0.505 | 0.133 | 0.067 | | 1.345 | 0.39 | | |
| | nom | | | | | | 0.35 | | | | | | | | 1.1 | | | 0.01 | 0.02 |
| | min | 0.136 | 0.145 | 0.004 | 0.772 | 0.774 | | 0.365 | 0.365 | 0.035 | 0.745 | 0.495 | 0.123 | 0.057 | | 1.335 | 0.38 | | |

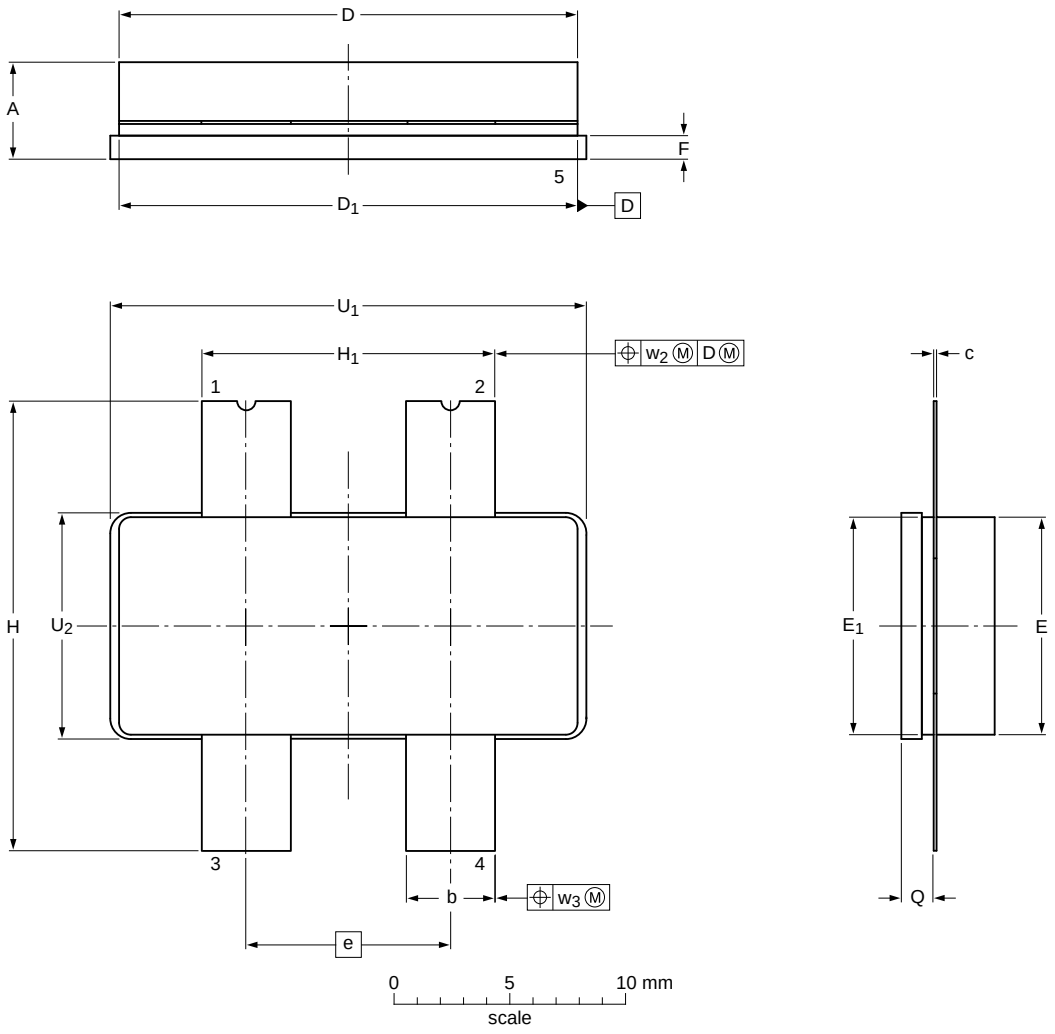
Note
1. millimeter dimensions are derived from the original inch dimensions.
2. dimension is measured 0.030 inch (0.76 mm) from the body.

*sot1121a_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT1121A | | | | | | ~~09-10-12~~ 10-02-02 |

**Fig 14. Package outline SOT1121A**

**Earless flanged LDMOST ceramic package; 4 leads** **SOT1121B**




Dimensions

| Unit[1] | | A | b | c | D | $D_1$ | e | E | $E_1$ | F | H | $H_1$ | Q | $U_1$ | $U_2$ | $w_2$ | $w_3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 4.75 | 3.94 | 0.18 | 20.02 | 19.96 | | 9.53 | 9.53 | 1.14 | 19.94 | 12.83 | 1.70 | 20.70 | 9.91 | | |
| | nom | | | | | | 8.89 | | | | | | | | | 0.51 | 0.25 |
| | min | 3.45 | 3.68 | 0.08 | 19.61 | 19.66 | | 9.27 | 9.27 | 0.89 | 18.92 | 12.57 | 1.45 | 20.45 | 9.65 | | |
| inches | max | 0.187 | 0.155 | 0.007 | 0.788 | 0.786 | | 0.375 | 0.375 | 0.045 | 0.785 | 0.505 | 0.067 | 0.815 | 0.39 | | |
| | nom | | | | | | 0.35 | | | | | | | | | 0.02 | 0.01 |
| | min | 0.136 | 0.145 | 0.003 | 0.772 | 0.774 | | 0.365 | 0.365 | 0.035 | 0.745 | 0.495 | 0.057 | 0.805 | 0.38 | | |

Note

1. millimeter dimensions are derived from the original inch dimensions.
2. dimension is measured 0.030 inch (0.76 mm) from the body.

*sot1121b_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT1121B | | | | | | ~~09-10-12~~ 09-12-14 |

**Fig 15. Package outline SOT1121B**

## 9. Abbreviations

Table 10. Abbreviations

| Acronym | Description |
|---|---|
| 3GPP | 3rd Generation Partnership Project |
| CW | Continuous Wave |
| CCDF | Complementary Cumulative Distribution Function |
| DPCH | Dedicated Physical Channel |
| EDGE | Enhanced Data rates for GSM Evolution |
| ESD | ElectroStatic Discharge |
| GSM | Global System for Mobile Communications |
| IS-95 | Interim Standard 95 |
| LDMOS | Laterally Diffused Metal Oxide Semiconductor |
| LDMOST | Laterally Diffused Metal Oxide Semiconductor Transistor |
| PAR | Peak-to-Average power Ratio |
| RF | Radio Frequency |
| SMD | Surface Mounted Device |
| VSWR | Voltage Standing Wave Ratio |
| W-CDMA | Wideband Code Division Multiple Access |

## 10. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BLF7G20L-90P_7G20LS-90P v.2 | 20111020 | Product data sheet | - | BLF7G20L-90P_7G20LS-90P v.1 |
| Modifications: | • Section 1.1 on page 1: General description changed<br>• Section 1.2 on page 1: Designed for broadband operation changed<br>• Section 1.3 on page 1: Description changed<br>• Section 7.1 on page 4: Conditions changed | | | |
| BLF7G20L-90P_7G20LS-90P v.1 | 20100428 | Product data sheet | - | - |

# 11. Legal information

## 11.1 Data sheet status

| Document status[1][2] | Product status[3] | 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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