# BLF3G21-6

## UHF power LDMOS transistor

Rev. 2 — 11 April 2013 Product data sheet

## 1. Product profile

### 1.1 General description

6 W LDMOS power transistor for base station applications at frequencies from HF to 2200 MHz

**Table 1. Typical class-AB RF performance**

*$I_{Dq}$ = 90 mA; $T_h$ = 25 °C in a common source test circuit.*

| Mode of operation | f (MHz) | $P_L$ (W) | $G_p$ (dB) | $\eta_D$ (%) | IMD3 (dB) | $P_{L(1dB)}$ (W) |
|---|---|---|---|---|---|---|
| CW | 2000 | 7 | 12.5 | 43 | - | 7 |
| Two-tone | 2000 | 6 | 15.5 | 39 | –32 | - |
| | | < 2 | 15.8 | - | < –50 | - |

**Table 2. Typical class-A RF performance**

*$I_{Dq}$ = 200 mA; $T_h$ = 25 °C in a modified PHS test fixture.*

| Mode of operation | f (MHz) | $P_{L(AV)}$ (W) | $G_p$ (dB) | $\eta_D$ (%) | $ACPR_{600k}$ (dBc) |
|---|---|---|---|---|---|
| PHS | 1880 to 1920 | 2 | 16 | 20 | –75 |

**CAUTION**

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

### 1.2 Features and benefits

- Excellent back-off linearity
- Typical PHS performance at a supply voltage of 26 V and $I_{Dq}$ of 200 mA:
  - Average output power = 2 W
  - Power gain = 16 dB
  - Efficiency = 20 %
  - $ACPR_{600k}$ = –75 dBc
- Easy power control
- Excellent ruggedness
- High power gain
- Excellent thermal stability
- Designed for broadband operation (HF to 2200 MHz)

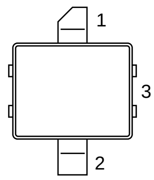
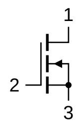
- No internal matching for broadband operation
- ESD protection

### 1.3 Applications

- RF power amplifiers for GSM, PHS, EDGE, CDMA and W-CDMA base stations and multicarrier applications in the HF to 2200 MHz frequency range
- Broadcast drivers

## 2. Pinning information

**Table 3. Pinning**

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| 1 | drain |  | <br>sym112 |
| 2 | gate | | |
| 3 | source [1] | | |

[1] Connected to flange.

## 3. Ordering information

**Table 4. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BLF3G21-6 | - | ceramic surface-mounted package; 2 leads | SOT538A |

## 4. Limiting values

**Table 5. 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 | | - | 2.3 | A |
| $T_{stg}$ | storage temperature | | −65 | +200 | °C |
| $T_j$ | junction temperature | | - | 200 | °C |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# 5. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | | Typ | Unit |
|---|---|---|---|---|---|
| $R_{th(j-c)}$ | thermal resistance from junction to case | $T_h$ = 25 °C; $P_{L(AV)}$ = 15 W | [1] | 10 | K/W |

[1] Thermal resistance is determined under specified RF operating conditions.

# 6. Characteristics

**Table 7. Characteristics**

*$T_j$ = 25 °C unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $V_{GS}$ = 0 V; $I_D$ = 0.13 mA | 65 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $V_{DS}$ = 10 V; $I_D$ = 13 mA | 2.0 | 2.6 | 3.0 | V |
| $I_{DSS}$ | drain leakage current | $V_{GS}$ = 0 V; $V_{DS}$ = 28 V | - | - | 1 | μA |
| $I_{DSX}$ | drain cut-off current | $V_{GS} = V_{GS(th)}$ + 6 V; $V_{DS}$ = 10 V | 1.85 | 2.3 | - | A |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = ±15 V; $V_{DS}$ = 0 V | - | - | 140 | nA |
| $g_{fs}$ | forward transconductance | $V_{DS}$ = 10 V; $I_D$ = 0.5 A | - | 0.6 | - | S |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = V_{GS(th)}$ + 9 V; $I_D$ = 0.5 A | - | 1.6 | 2.07 | Ω |
| $C_{rs}$ | feedback capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 28 V; f = 1 MHz | - | 0.3 | - | pF |

# 7. Application information

**Table 8. Application information**

*$V_{DS}$ = 26 V; $T_h$ = 25 °C unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Mode of operation: Two-tone CW (100 kHz tone spacing); f = 2000 MHz; $I_{Dq}$ = 90 mA** | | | | | | |
| $G_p$ | power gain | $P_{L(PEP)}$ = 6 W | 14 | 15.5 | - | dB |
| $RL_{in}$ | input return loss | $P_{L(PEP)}$ = 6 W | - | −7 | −3 | dB |
| $\eta_D$ | drain efficiency | $P_{L(PEP)}$ = 6 W | 35 | 39 | - | % |
| IMD3 | third order intermodulation distortion | $P_{L(PEP)}$ = 6 W | - | −32 | −29 | dBc |
| | | $P_{L(PEP)}$ < 2 W | - | < −50 | - | dBc |
| **Mode of operation: one-tone CW; f = 2000 MHz; $I_{Dq}$ = 90 mA** | | | | | | |
| $G_p$ | power gain | $P_L = P_{L(1dB)}$ = 7 W | - | 12.5 | - | dB |
| $\eta_D$ | drain efficiency | $P_L = P_{L(1dB)}$ = 7 W | - | 43 | - | % |
| **Mode of operation: PHS; f = 1900 MHz; $I_{Dq}$ = 200 mA** | | | | | | |
| $G_p$ | power gain | $P_{L(AV)}$ = 2 W | - | 16 | - | dB |
| $\eta_D$ | drain efficiency | $P_{L(AV)}$ = 2 W | - | 20 | - | % |
| $ACPR_{600k}$ | adjacent channel power ratio (600 kHz) | $P_{L(AV)}$ = 2 W | - | −75 | - | dBc |


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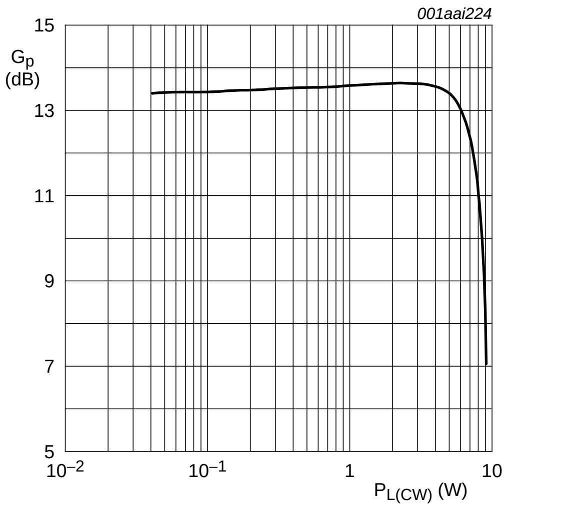
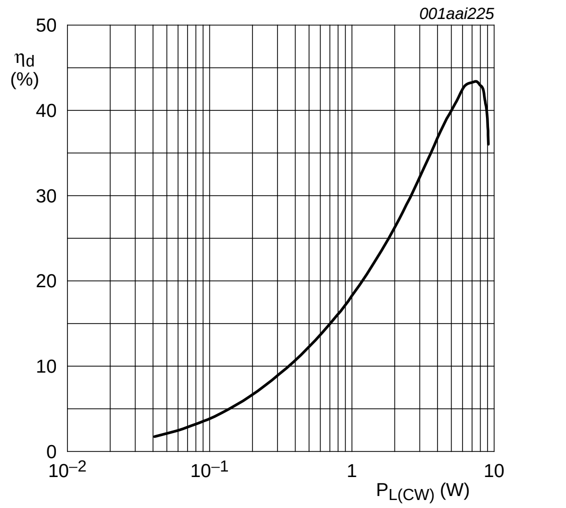
## 7.1 Ruggedness in class-AB operation

The BLF3G21-6 is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: $V_{DS}$ = 26 V; f = 2200 MHz at rated load power.



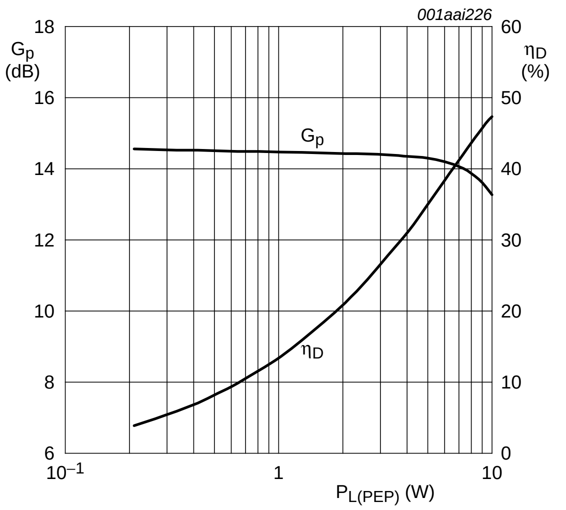

$V_{DS}$ = 26 V; $I_{Dq}$ = 90 mA; $T_h$ = 25 °C; f = 2000 MHz.

**Fig 1. Power gain as a function of CW load power; typical values**



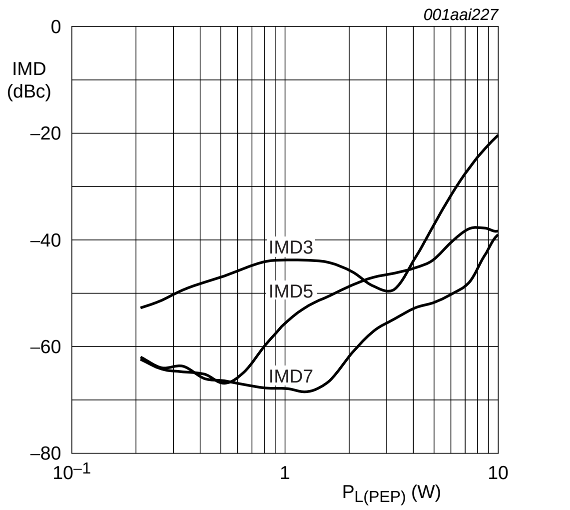

$V_{DS}$ = 26 V; $I_{Dq}$ = 90 mA; $T_h$ = 25 °C; f = 2000 MHz.

**Fig 2. Drain efficiency as a function of CW load power; typical values**




$V_{DS}$ = 26 V; $I_{Dq}$ = 90 mA; $T_h \leq$ 25 °C; $f_1$ = 2000 MHz; $f_2$ = 2000.1 MHz.

**Fig 3. Two-tone power gain and drain efficiency as function of peak envelope load power; typical values**




$V_{DS}$ = 26 V; $I_{Dq}$ = 90 mA; $T_h \leq$ 25 °C; $f_1$ = 2000 MHz; $f_2$ = 2000.1 MHz.

**Fig 4. Two-tone intermodulation distortion as a function of peak envelope load power; typical values**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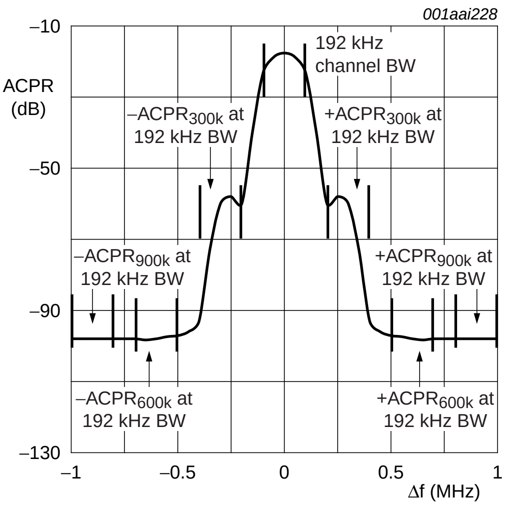



$V_{DS}$ = 26 V; $I_{Dq}$ = 200 mA; $T_h \leq 25$ °C; $f_c$ = 1900 MHz; $P_{L(AV)}$ = 2 W.

**Fig 5. ACPR performance under PHS conditions, measured in application board.**

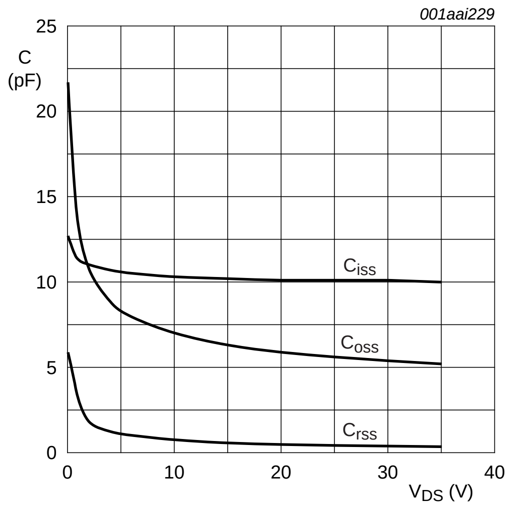
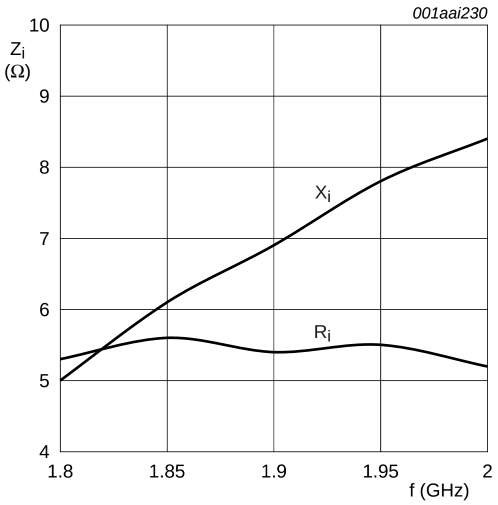
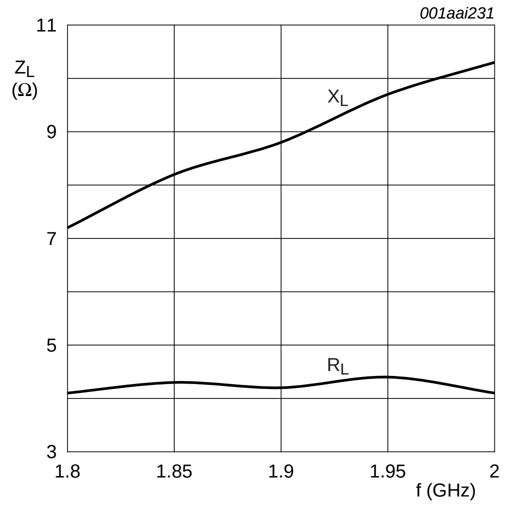



**Fig 6. $C_{iss}$, $C_{rss}$ and $C_{oss}$ as function of drain supply voltage; typical values.**




$V_{DS}$ = 26 V; $I_{Dq}$ = 90 mA; $P_L$ = 45 W; $T_h \leq 25$ °C.

**Fig 7. Input impedance as a function of frequency (series components); typical values**




$V_{DS}$ = 26 V; $I_{Dq}$ = 90 mA; $P_L$ = 45 W; $T_h \leq 25$ °C.

**Fig 8. Load impedance as a function of frequency (series components); typical values**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# 8. Test information

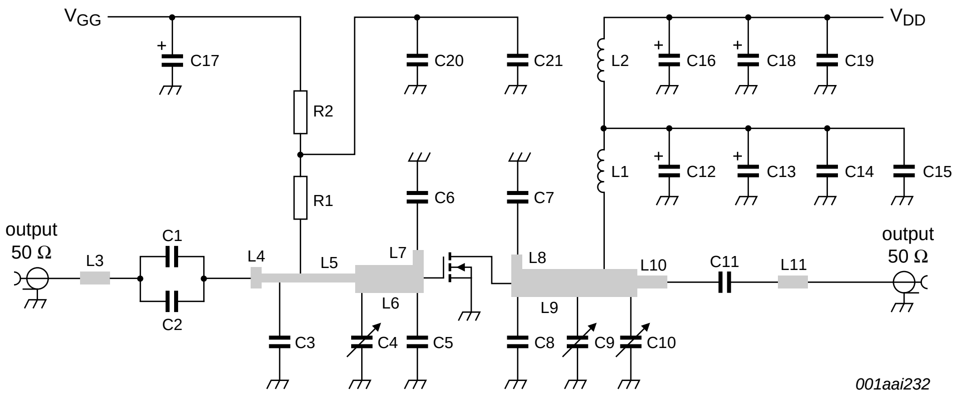


**Fig 9. Class-AB test circuit for 2 GHz**


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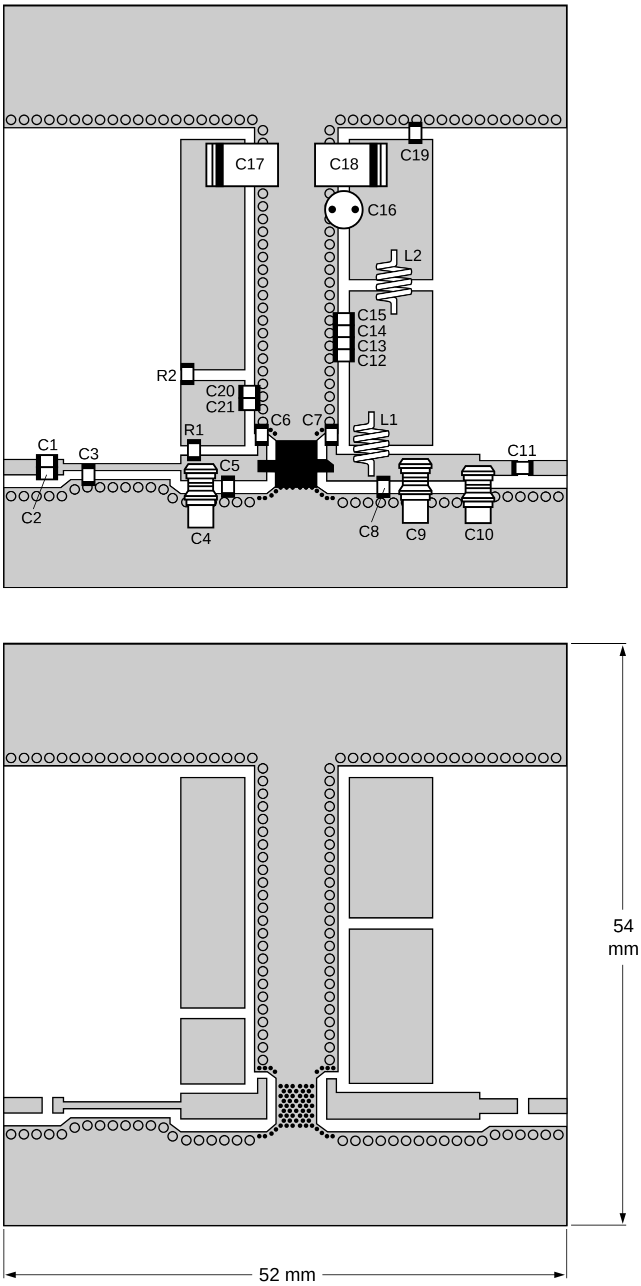


Dimensions in mm.

The components are situated on one side of the copper-clad Printed-Circuit Board (PCB) with Teflon dielectric ($\varepsilon_r$ = 2.2); thickness = 0.51 mm.

The other side is unetched and serves as a ground plane.

See Table 9 for list of components.

**Fig 10. Component layout for 2 GHz class-AB test circuit**


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**Table 9. List of components (see Figure 9 and Figure 10)**

| Component | Description | | Value | Remarks |
|---|---|---|---|---|
| C1, C2, C11 | multilayer ceramic chip capacitor | [1] | 6.8 pF | |
| C4, C10 | Tekelec variable capacitor; type 37281 | | 0.4 pF to 2.5 pF | |
| C6 | multilayer ceramic chip capacitor | [1] | 2.7 pF | |
| C7 | multilayer ceramic chip capacitor | [1] | 2.0 pF | |
| C8 | multilayer ceramic chip capacitor | [1] | 0.2 nF | |
| C9 | Tekelec variable capacitor; type 37281 | | 0.6 pF to 4.5 pF | |
| C12 | multilayer ceramic chip capacitor | [1] | 10 pF | |
| C13 | multilayer ceramic chip capacitor | [1] | 51 pF | |
| C14 | multilayer ceramic chip capacitor | [1] | 120 pF | |
| C15 | multilayer ceramic chip capacitor | | 100 nF | |
| C16 | electrolytic capacitor | | 100 μF; 63 V | |
| C17, C18 | tantalum SMD capacitor | | 10 μF; 35 V | |
| C19 | multilayer ceramic chip capacitor | [2] | 1 nF | |
| C20 | multilayer ceramic chip capacitor | [1] | 22 pF | |
| C21 | multilayer ceramic chip capacitor | [1] | 560 pF | |
| L1, L2 | 3 turns enamelled copper wire | [3] | D = 2 mm;<br>d = 0.8 mm;<br>length = 3 mm | |
| L3 | stripline | [3] | 50 Ω | (L × W) 3.5 mm × 1.5 mm |
| L3 | stripline | [3] | 34.3 Ω | (L × W) 1.0 mm × 1.5 mm |
| L4 | stripline | [3] | 50 Ω | (L × W) 11.0 mm × 0.8 mm |
| L5 | stripline | [3] | 34.3 Ω | (L × W) 8.0 mm × 3.0 mm |
| L6 | stripline | [3] | 23.6 Ω | (L × W) 1.5 mm × 1.0 mm |
| L7, L8 | stripline | [3] | 5.6 Ω | (L × W) 14.4 mm × 3.0 mm |
| L9 | stripline | [3] | 3.5 Ω | (L × W) 3.5 mm × 1.5 mm |
| L10, L11 | stripline | [3] | 31.9 Ω | (L × W) 12.0 mm × 1.9 mm |
| R1 | SMD resistor | | 470 Ω | |
| R2 | SMD resistor | | 1 kΩ | |

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

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

[3] The striplines are on a double copper-clad Printed-Circuit Board (PCB) with Rogers 5880 dielectric ($\varepsilon_r$ = 2.2); thickness = 0.51 mm.


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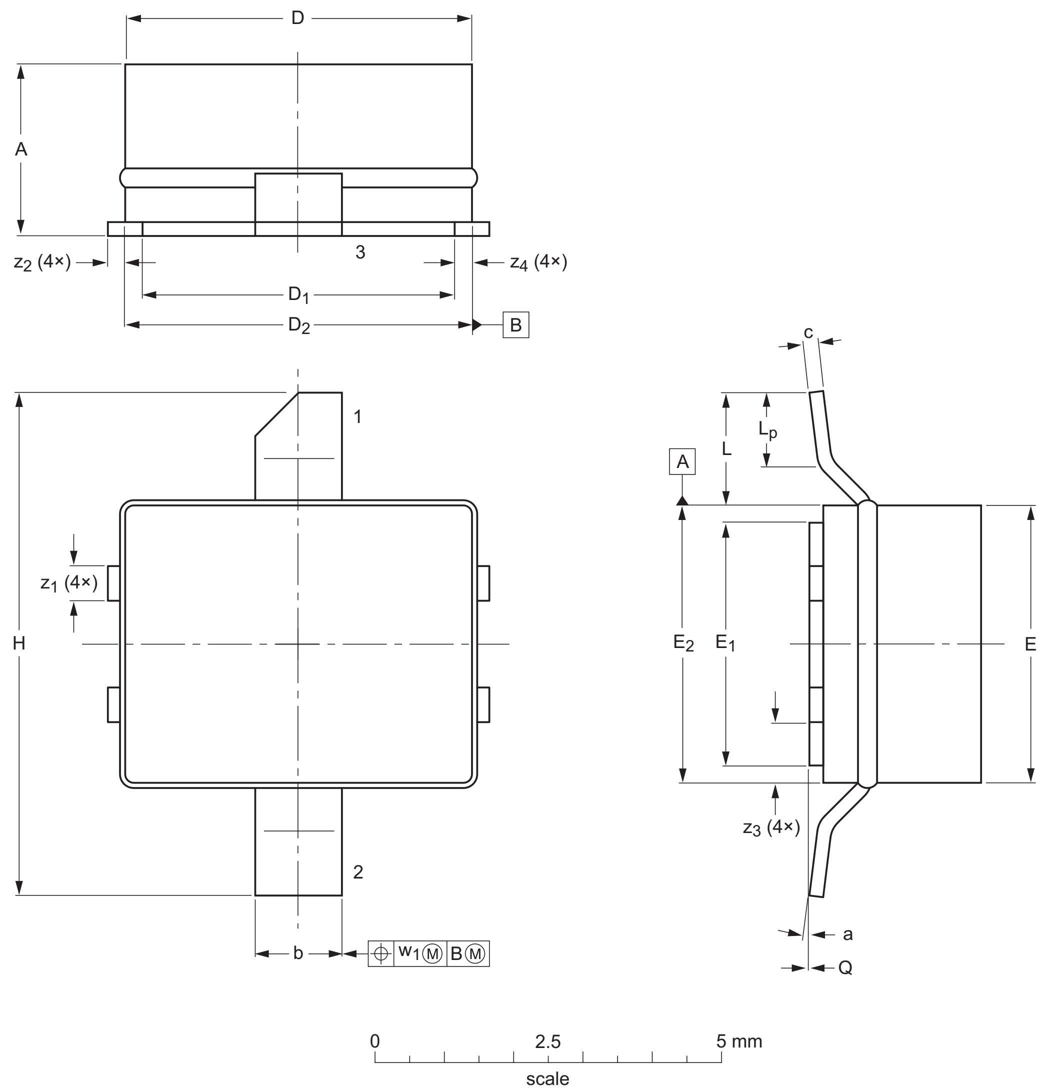
## 9. Package outline

**Ceramic surface-mounted package; 2 leads** **SOT538A**




Dimensions (mm are the original dimensions)

| Unit | | A | b | c | D | $D_1$ | $D_2$ | E | $E_1$ | $E_2$ | H | L | $L_p$ | Q | $w_1$ | $z_1$ | $z_2$ | $z_3$ | $z_4$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 2.34 | 1.35 | 0.23 | 5.16 | 4.65 | 5.16 | 4.14 | 3.63 | 4.14 | 7.49 | 2.03 | 1.02 | 0.1 | | 0.58 | 0.25 | 0.97 | 0.51 | 7° |
| | nom | | | | | | | | | | | | | | 0.25 | | | | | |
| | min | 2.13 | 1.19 | 0.18 | 5.00 | 4.50 | 5.00 | 3.99 | 3.48 | 3.99 | 7.24 | 1.27 | 0.51 | 0.0 | | 0.43 | 0.18 | 0.81 | 0.00 | 0° |

*sot538a_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT538A | | | | | | ~~06-03-16~~ 13-02-07 |

**Fig 11. Package outline SOT538A**



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## 10. Abbreviations

**Table 10. Abbreviations**

| Acronym | Description |
|---|---|
| CDMA | Code Division Multiple Access |
| EDGE | Enhanced Data rates for GSM Evolution |
| GSM | Global System for Mobile communications |
| HF | High Frequency |
| LDMOS | Laterally Diffused Metal-Oxide Semiconductor |
| PHS | Personal Handy-phone System |
| RF | Radio Frequency |
| SMD | Surface Mount Device |
| UHF | Ultra High 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 |
|---|---|---|---|---|
| BLF3G21-6 v.2 | 20130411 | Product data sheet | - | BLF3G21-6 v.1 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Package outline drawings have been updated to the latest version. | | | |
| BLF3G21-6 v.1 | 20080625 | Product data sheet | - | - |


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