# BLS6G2731-120; BLS6G2731S-120

## LDMOS S-band radar power transistor

AMPLEON

Rev. 2 — 1 September 2015

Product data sheet

# 1. Product profile

## 1.1 General description

120 W LDMOS power transistor intended for radar applications in the 2.7 GHz to 3.1 GHz range.

**Table 1. Typical performance**

*Typical RF performance at $T_{case}$ = 25 °C; $t_p$ = 100 µs; $\delta$ = 10 %; $I_{Dq}$ = 100 mA; in a class-AB production test circuit.*

| Mode of operation | f | $V_{DS}$ | $P_L$ | $G_p$ | $\eta_D$ | $t_r$ | $t_f$ |
|---|---|---|---|---|---|---|---|
| | (GHz) | (V) | (W) | (dB) | (%) | (ns) | (ns) |
| pulsed RF | 2.7 to 3.1 | 32 | 120 | 13.5 | 48 | 20 | 6 |

**CAUTION**



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

## 1.2 Features

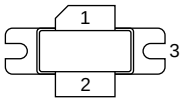
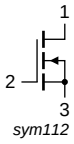
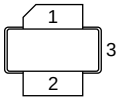
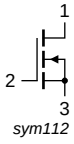
- Typical pulsed RF performance at a frequency of 2.7 GHz to 3.1 GHz, a supply voltage of 32 V, an $I_{Dq}$ of 100 mA, a $t_p$ of 100 µs with $\delta$ of 10 %:
  - Output power = 120 W
  - Power gain = 13.5 dB
  - Efficiency = 48 %
- Easy power control
- Integrated ESD protection
- High flexibility with respect to pulse formats
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (2.7 GHz to 3.1 GHz)
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding restriction of hazardous substances (RoHS)

### 1.3 Applications

- S-band power amplifiers for radar applications in the 2.7 GHz to 3.1 GHz frequency range

## 2. Pinning information

**Table 2. Pinning**

| Pin | Description | | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| **BLS6G2731-120 (SOT502A)** | | | | |
| 1 | drain | |  |  |
| 2 | gate | | | |
| 3 | source | [1] | | |
| **BLS6G2731S-120 (SOT502B)** | | | | |
| 1 | drain | |  |  |
| 2 | gate | | | |
| 3 | source | [1] | | |

[1] Connected to flange.

## 3. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BLS6G2731-120 | - | flanged LDMOST ceramic package; 2 mounting holes; 2 leads | SOT502A |
| BLS6G2731S-120 | - | 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 | Min | Max | Unit |
|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | - | 60 | V |
| $V_{GS}$ | gate-source voltage | −0.5 | +13 | V |
| $I_D$ | drain current | - | 33 | A |
| $T_{stg}$ | storage temperature | −65 | +150 | °C |
| $T_j$ | junction temperature | - | 225 | °C |


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## 5. Thermal characteristics

**Table 5. Thermal characteristics**

| Symbol | Parameter | Conditions | Typ | Unit |
|---|---|---|---|---|
| $Z_{th(j-mb)}$ | transient thermal impedance from junction to mounting base | $T_{case}$ = 85 °C; $P_L$ = 120 W | | |
| | | $t_p$ = 100 μs; δ = 10 % | 0.23 | K/W |
| | | $t_p$ = 200 μs; δ = 10 % | 0.28 | K/W |
| | | $t_p$ = 300 μs; δ = 10 % | 0.32 | K/W |
| | | $t_p$ = 100 μs; δ = 20 % | 0.33 | K/W |

## 6. Characteristics

**Table 6. 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; $I_D$ = 0.6 mA | 60 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $V_{DS}$ = 10 V; $I_D$ = 180 mA | 1.4 | 1.8 | 2.4 | V |
| $I_{DSS}$ | drain leakage current | $V_{GS}$ = 0 V; $V_{DS}$ = 28 V | - | - | 4.2 | μA |
| $I_{DSX}$ | drain cut-off current | $V_{GS}$ = $V_{GS(th)}$ + 3.75 V; $V_{DS}$ = 10 V | 27 | 33 | - | A |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = 11 V; $V_{DS}$ = 0 V | - | - | 450 | nA |
| $g_{fs}$ | forward transconductance | $V_{DS}$ = 10 V; $I_D$ = 9 A | 8.1 | 13 | - | S |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS}$ = $V_{GS(th)}$ + 3.75 V; $I_D$ = 6.3 A | - | 0.085 | 0.135 | Ω |

## 7. Application information

**Table 7. Application information**

*Mode of operation: pulsed RF; $t_p$ = 100 μs; δ = 10 %; RF performance at $V_{DS}$ = 32 V; $I_{Dq}$ = 100 mA; $T_{case}$ = 25 °C; unless otherwise specified, in a class-AB production circuit.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $P_L$ | output power | | - | 120 | - | W |
| $V_{CC}$ | supply voltage | $P_L$ = 120 W | - | - | 32 | V |
| $G_p$ | power gain | $P_L$ = 120 W | 12 | 13.5 | - | dB |
| $RL_{in}$ | input return loss | $P_L$ = 120 W | - | 7 | - | dB |
| $P_{L(1dB)}$ | output power at 1 dB gain compression | | - | 130 | - | W |
| $\eta_D$ | drain efficiency | $P_L$ = 120 W | 40 | 48 | - | % |
| $P_{droop(pulse)}$ | pulse droop power | $P_L$ = 120 W | - | 0 | 0.5 | dB |
| $t_r$ | rise time | $P_L$ = 120 W | - | 20 | 50 | ns |
| $t_f$ | fall time | $P_L$ = 120 W | - | 6 | 50 | ns |


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**Table 8. Typical impedance**

| f | $Z_S$ | $Z_L$ |
|---|---|---|
| GHz | Ω | Ω |
| 2.7 | 3.4 – j7.2 | 4.6 – j4.4 |
| 2.8 | 3.8 – j5.9 | 3.8 – j4.6 |
| 2.9 | 4.7 – j4.8 | 3.0 – j4.6 |
| 3.0 | 6.3 – j4.1 | 2.3 – j4.3 |
| 3.1 | 8.8 – j4.9 | 1.8 – j3.9 |

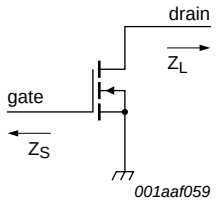


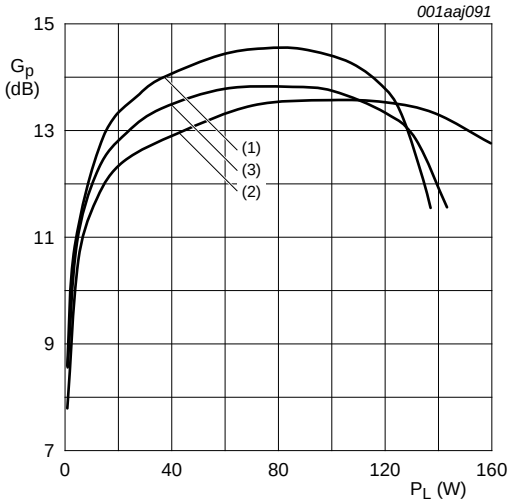

**Fig 1. Definition of transistor impedance**

## 7.1 Ruggedness in class-AB operation

The BLS6G2731-120 and BLS6G2731S-120 are capable of withstanding a load mismatch corresponding to VSWR = 5 : 1 through all phases under the following conditions: $V_{DS}$ = 32 V; $I_{Dq}$ = 100 mA; $P_L$ = 120 W; $t_p$ = 100 μs; δ = 10 %.


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## 7.2 Graphs



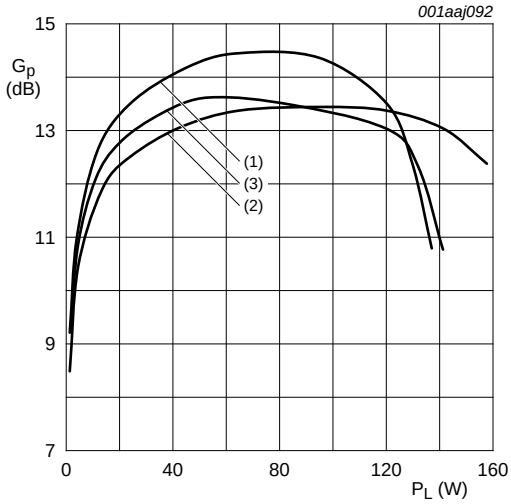

$V_{DS}$ = 32 V; $I_{Dq}$ = 100 mA; $t_p$ = 300 μs; δ = 10 %.

(1) f = 2.7 GHz

(2) f = 2.9 GHz

(3) f = 3.1 GHz

**Fig 2. Power gain as a function of load power; typical values**



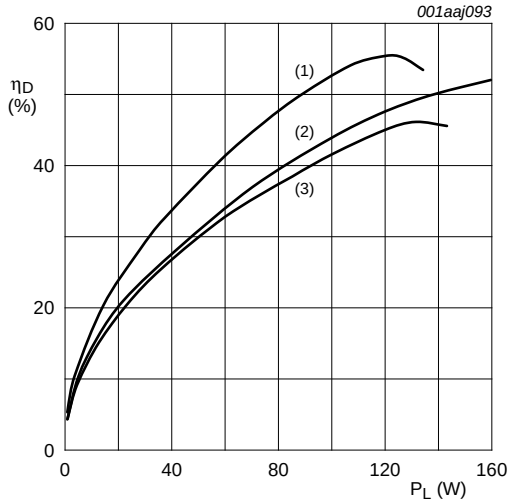

$V_{DS}$ = 32 V; $I_{Dq}$ = 100 mA; $t_p$ = 100 μs; δ = 20 %.

(1) f = 2.7 GHz

(2) f = 2.9 GHz

(3) f = 3.1 GHz

**Fig 3. Power gain as a function of load power; typical values**



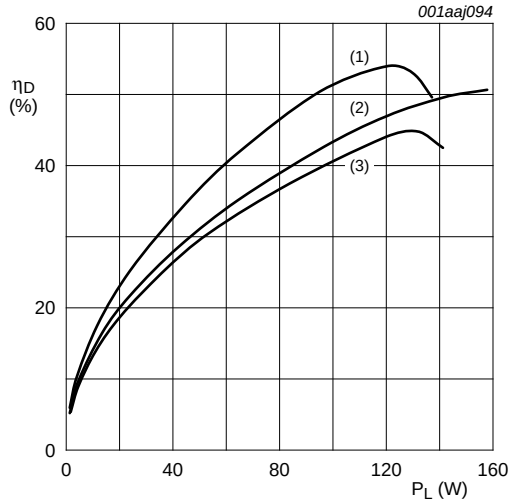

$V_{DS}$ = 32 V; $I_{Dq}$ = 100 mA; $t_p$ = 300 μs; δ = 10 %.

(1) f = 2.7 GHz

(2) f = 2.9 GHz

(3) f = 3.1 GHz

**Fig 4. Drain efficiency as a function of load power; typical values**




$V_{DS}$ = 32 V; $I_{Dq}$ = 100 mA; $t_p$ = 100 μs; δ = 20 %.

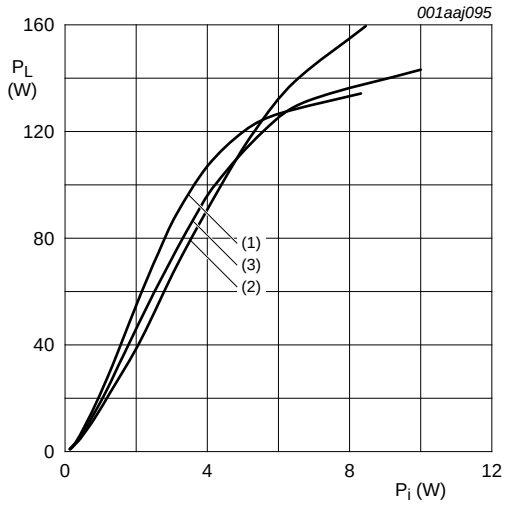
(1) f = 2.7 GHz

(2) f = 2.9 GHz

(3) f = 3.1 GHz

**Fig 5. Drain efficiency as a function of load power; typical values**


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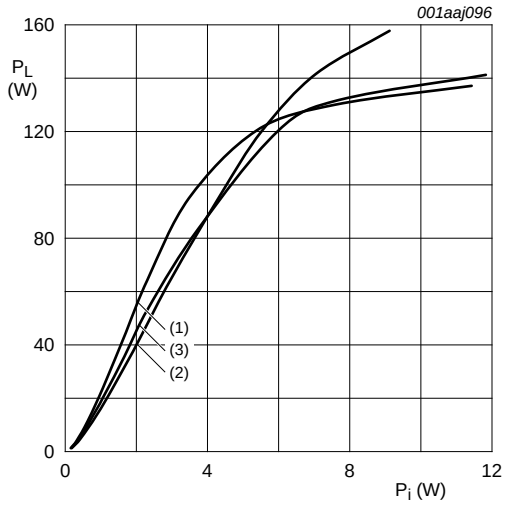

$V_{DS}$ = 32 V; $I_{Dq}$ = 100 mA; $t_p$ = 300 μs; δ = 10 %.

(1) f = 2.7 GHz

(2) f = 2.9 GHz

(3) f = 3.1 GHz

**Fig 6. Load power as a function of input power; typical values**



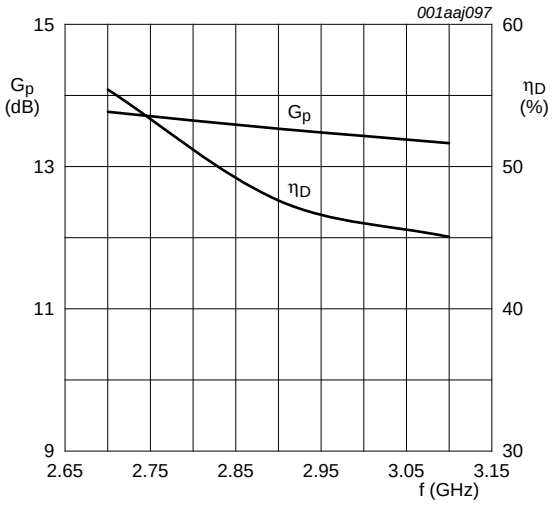

$V_{DS}$ = 32 V; $I_{Dq}$ = 100 mA; $t_p$ = 100 μs; δ = 20 %.

(1) f = 2.7 GHz

(2) f = 2.9 GHz

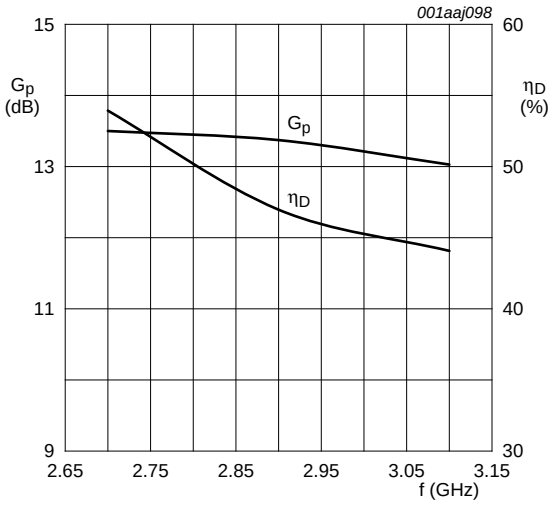
(3) f = 3.1 GHz

**Fig 7. Load power as a function of input power; typical values**




$P_L$ = 120 W; $V_{DS}$ = 32 V; $I_{Dq}$ = 100 mA; $t_p$ = 300 μs; δ = 10 %.

**Fig 8. Power gain and drain efficiency as function of frequency; typical values**

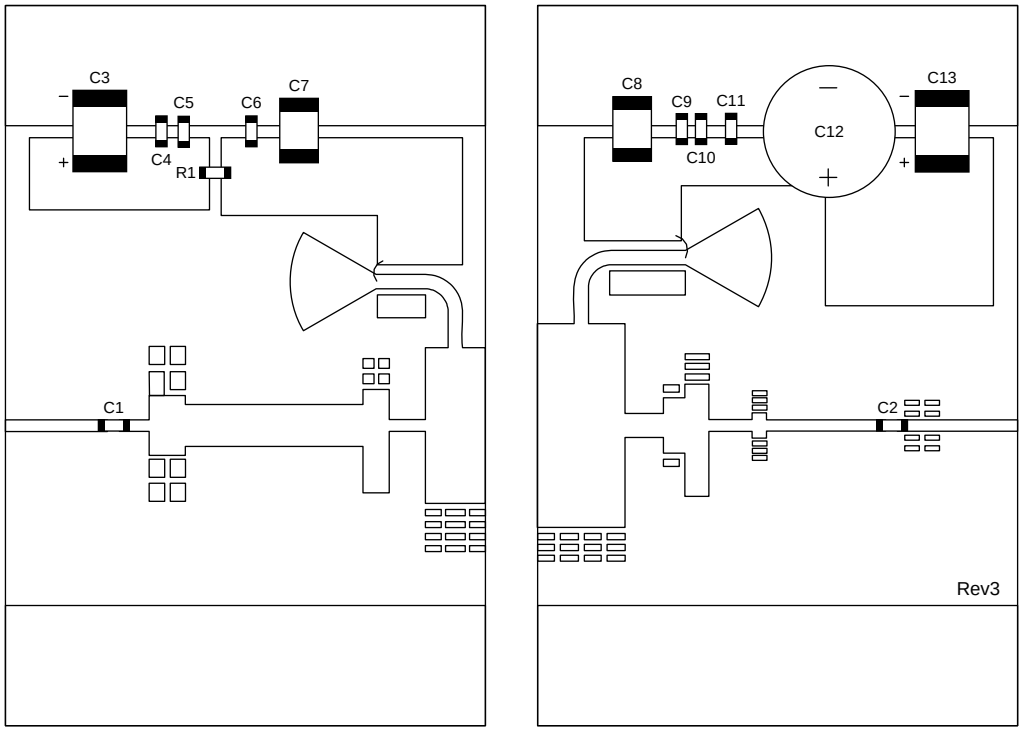



$P_L$ = 120 W; $V_{DS}$ = 32 V; $I_{Dq}$ = 100 mA; $t_p$ = 100 μs; δ = 20 %.

**Fig 9. Power gain and drain efficiency as function of frequency; typical values**


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## 8. Test information




Striplines are on a double copper-clad Duroid 6006 Printed-Circuit Board (PCB) with $\varepsilon_r$ = 6.15 and thickness = 0.64 mm.
See Table 9 for list of components.

**Fig 10. Component layout for 2700 MHz to 3100 MHz test circuit**

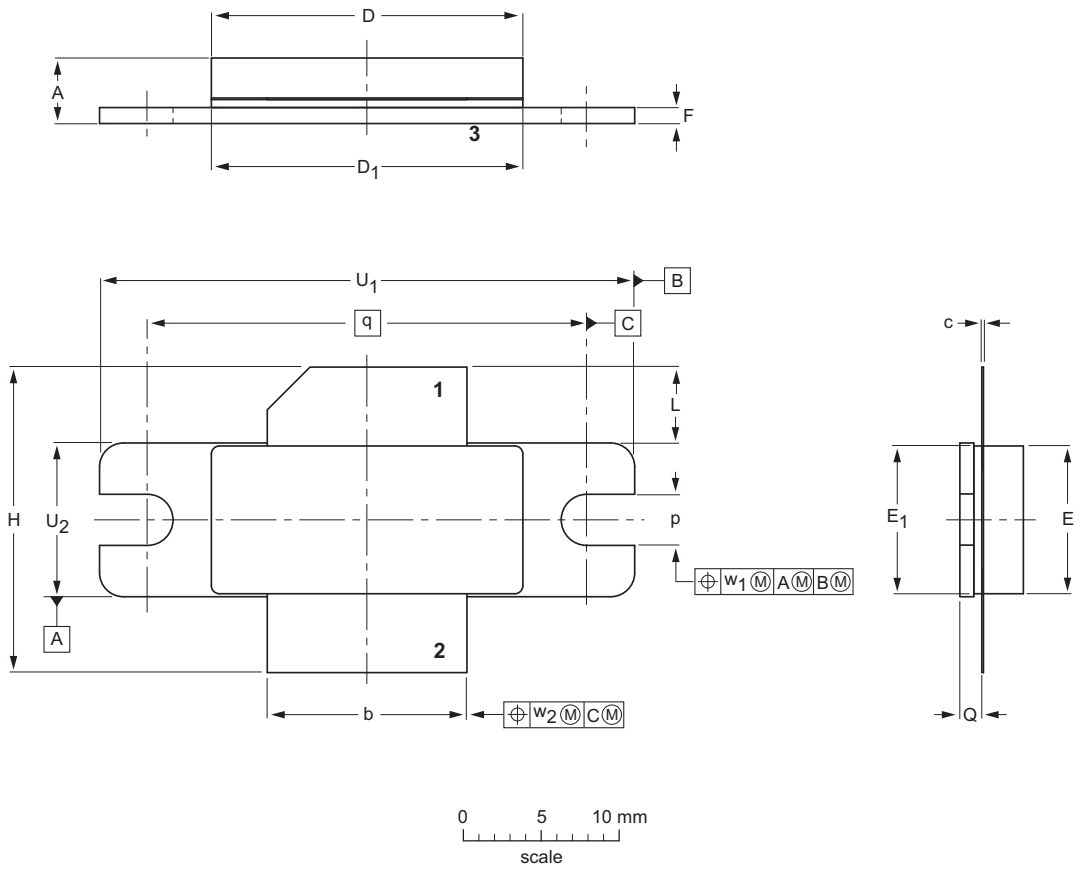
**Table 9. List of components**
*See Figure 10.*

| Component | Description | Value | Remarks |
|---|---|---|---|
| C1, C2 | multilayer ceramic chip capacitor | 24 pF | ATC 100A or equivalent |
| C3 | multilayer ceramic chip capacitor | 47 μF; 20 V | |
| C4, C6, C9, C10 | multilayer ceramic chip capacitor | 33 pF | ATC 100A or equivalent |
| C5, C11 | multilayer ceramic chip capacitor | 1 nF | ATC 100A or equivalent |
| C7, C8 | multilayer ceramic chip capacitor | 100 pF | ATC 100B or equivalent |
| C12 | electrolytic capacitor | 47 μF; 63 V | |
| C13 | multilayer ceramic chip capacitor | 10 μF; 35 V | |
| R1 | SMD resistor | 56 Ω | SMD 0603 |


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## 9. Package outline

**Flanged ceramic package; 2 mounting holes; 2 leads** **SOT502A**




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

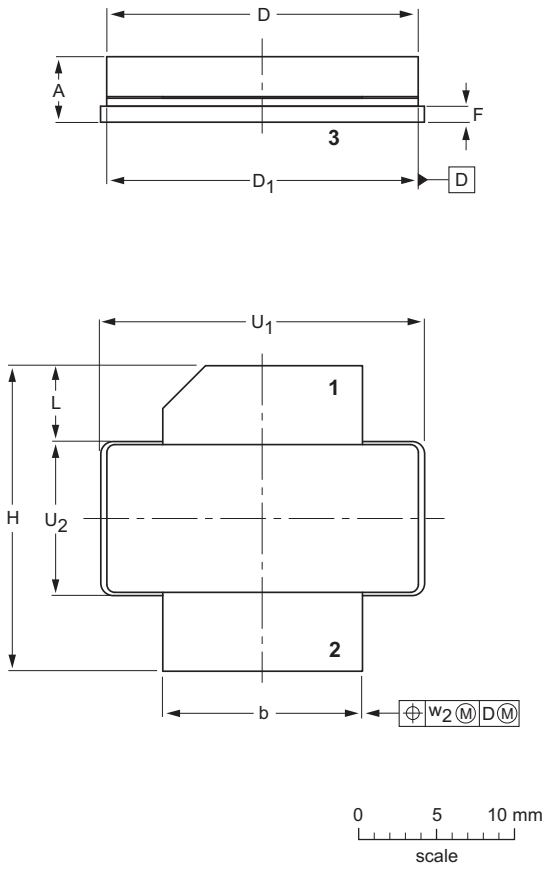
| UNIT | A | b | c | D | $D_1$ | E | $E_1$ | F | H | L | p | Q | q | $U_1$ | $U_2$ | $w_1$ | $w_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.72<br>3.43 | 12.83<br>12.57 | 0.15<br>0.08 | 20.02<br>19.61 | 19.96<br>19.66 | 9.50<br>9.30 | 9.53<br>9.25 | 1.14<br>0.89 | 19.94<br>18.92 | 5.33<br>4.32 | 3.38<br>3.12 | 1.70<br>1.45 | 27.94 | 34.16<br>33.91 | 9.91<br>9.65 | 0.25 | 0.51 |
| 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 | 0.133<br>0.123 | 0.067<br>0.057 | 1.100 | 1.345<br>1.335 | 0.390<br>0.380 | 0.01 | 0.02 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT502A | | | | | | ~~03-01-10~~<br>12-05-02 |

**Fig 11. Package outline SOT502A**


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**Earless flanged ceramic package; 2 leads** **SOT502B**




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

| UNIT | A | b | c | D | $D_1$ | E | $E_1$ | F | H | L | Q | $U_1$ | $U_2$ | $w_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT502B | | | | | | ~~07-05-09~~<br>12-05-02 |

**Fig 12. Package outline SOT502B**


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## 10. Abbreviations

**Table 10. Abbreviations**

| Acronym | Description |
|---|---|
| LDMOS | Laterally Diffused Metal-Oxide Semiconductor |
| LDMOST | Laterally Diffused Metal-Oxide Semiconductor Transistor |
| RF | Radio Frequency |
| S-band | Short wave Band |
| VSWR | Voltage Standing-Wave Ratio |

## 11. Revision history

**Table 11. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BLS6G2731-120_6G2731S-120#2 | 20150901 | Product data sheet | | BLS6G2731-120_6G2731S-120 #1 |
| Modifications: | • The format of this document has been redesigned to comply with the new identity guidelines of Ampleon.<br>• Legal texts have been adapted to the new company name where appropriate. | | | |
| BLS6G2731-120_6G2731S-120#1 | 20081114 | Product data sheet | - | - |


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# 12. Legal information

## 12.1 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.ampleon.com.

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## 14. Contents

**1 Product profile . . . . . 1**
1.1 General description . . . . . 1
1.2 Features . . . . . 1
1.3 Applications . . . . . 2
**2 Pinning information . . . . . 2**
**3 Ordering information . . . . . 2**
**4 Limiting values . . . . . 2**
**5 Thermal characteristics . . . . . 3**
**6 Characteristics . . . . . 3**
**7 Application information . . . . . 3**
7.1 Ruggedness in class-AB operation . . . . . 4
7.2 Graphs . . . . . 5
**8 Test information . . . . . 7**
**9 Package outline . . . . . 8**
**10 Abbreviations . . . . . 10**
**11 Revision history . . . . . 10**
**12 Legal information . . . . . 11**
12.1 Data sheet status . . . . . 11
12.2 Definitions . . . . . 11
12.3 Disclaimers . . . . . 11
12.4 Trademarks . . . . . 11
**13 Contact information . . . . . 11**
**14 Contents . . . . . 12**

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