

BLS6G3135-120; BLS6G3135S-120

LDMOS S-Band radar power transistor

Rev. 02 — 29 May 2008

Product data sheet

1. Product profile

1.1 General description

120 W LDMOS power transistor intended for radar applications in the 3.1 GHz to 3.5 GHz range.

Table 1. Typical performance

Typical RF performance at $T_{case} = 25\text{ }^{\circ}\text{C}$; $t_p = 300\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$; $I_{Dq} = 100\text{ mA}$; in a class-AB production test circuit.

| Mode of operation | f (GHz) | V _{DS} (V) | P _L (W) | G _p (dB) | η_D (%) | t _r (ns) | t _f (ns) |
|-------------------|------------|------------------------|-----------------------|------------------------|-----------------|------------------------|------------------------|
| pulsed RF | 3.1 to 3.5 | 32 | 120 | 11 | 43 | 20 | 6 |

CAUTION



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

1.2 Features

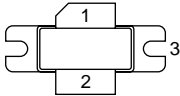
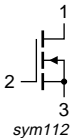
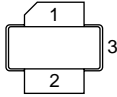
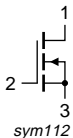
- Typical pulsed RF performance at a frequency of 3.1 GHz to 3.5 GHz, a supply voltage of 32 V, an I_{Dq} of 100 mA, a t_p of up to 300 μs with δ of 10 %:
 - ◆ Output power = 120 W
 - ◆ Gain = 11 dB
 - ◆ Efficiency = 43 %
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (3.1 GHz to 3.5 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 3.1 GHz to 3.5 GHz frequency range

2. Pinning information

Table 2. Pinning

| Pin | Description | Simplified outline | Symbol |
|---------------------------------|-------------|---|--|
| BLS6G3135-120 (SOT502A) | | | |
| 1 | drain |  |  sym112 |
| 2 | gate | | |
| 3 | source | | |
| BLS6G3135S-120 (SOT502B) | | | |
| 1 | drain |  |  sym112 |
| 2 | gate | | |
| 3 | source | | |

[1] Connected to flange

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|----------------|---------|---|---------|
| | Name | Description | Version |
| BLS6G3135-120 | - | flanged LDMOST ceramic package; 2 mounting holes; 2 leads | SOT502A |
| BLS6G3135S-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 | - | 7.2 | A |
| T_{stg} | storage temperature | -65 | +150 | °C |
| T_j | junction temperature | - | 225 | °C |

5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol | Parameter | Conditions | Typ | Max | Unit |
|----------------|--|---|------|------|------|
| $Z_{th(j-mb)}$ | transient thermal impedance from junction to mounting base | $T_{case} = 85\text{ °C}; P_L = 120\text{ W}$ | | | |
| | | $t_p = 300\text{ }\mu\text{s}; \delta = 10\%$ | 0.29 | 0.40 | K/W |
| | | $t_p = 100\text{ }\mu\text{s}; \delta = 20\%$ | 0.30 | 0.41 | K/W |

6. Characteristics

Table 6. Characteristics

$T_j = 25\text{ °C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------|----------------------------------|---|-----|-------|-------|---------------|
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $V_{GS} = 0\text{ V}; I_D = 0.5\text{ mA}$ | 60 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $V_{DS} = 10\text{ V}; I_D = 180\text{ mA}$ | 1.4 | 1.8 | 2.3 | V |
| I_{DSS} | drain leakage current | $V_{GS} = 0\text{ V}; V_{DS} = 28\text{ V}$ | - | - | 5 | μA |
| I_{DSX} | drain cut-off current | $V_{GS} = V_{GS(th)} + 3.75\text{ V}; V_{DS} = 10\text{ V}$ | 27 | 33 | - | A |
| I_{GSS} | gate leakage current | $V_{GS} = 8.3\text{ V}; V_{DS} = 0\text{ V}$ | - | - | 450 | nA |
| g_{fs} | forward transconductance | $V_{DS} = 10\text{ V}; I_D = 9\text{ A}$ | - | 13 | - | S |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = V_{GS(th)} + 3.75\text{ V}; I_D = 6.3\text{ A}$ | - | 0.085 | 0.160 | Ω |

7. Application information

Table 7. Application information

Mode of operation: pulsed RF; $t_p = 300\text{ }\mu\text{s}; \delta = 10\%$; RF performance at $V_{DS} = 32\text{ V}; I_{Dq} = 100\text{ mA}; T_{case} = 25\text{ °C}$; 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 | $P_L = 120\text{ W}$ | - | - | 32 | V |
| G_p | power gain | $P_L = 120\text{ W}$ | 9.5 | 11 | - | dB |
| IRL | input return loss | $P_L = 120\text{ W}$ | 6 | 10 | - | dB |
| $P_{L(1dB)}$ | output power at 1 dB gain compression | $P_L = 120\text{ W}$ | - | 130 | - | W |
| η_D | drain efficiency | $P_L = 120\text{ W}$ | 39 | 43 | - | % |
| t_r | rise time | $P_L = 120\text{ W}$ | - | 20 | 50 | ns |
| t_f | fall time | $P_L = 120\text{ W}$ | - | 6 | 50 | ns |

Table 8. Typical impedance

| f GHz | Z _S Ω | Z _L Ω |
|----------|---------------------|---------------------|
| 3.1 | 2.7 – j5.4 | 5.9 – j5.9 |
| 3.2 | 3.3 – j4.7 | 4.5 – j6.2 |
| 3.3 | 4.2 – j4.4 | 3.5 – j6.0 |
| 3.4 | 5.2 – j4.8 | 2.7 – j5.6 |
| 3.5 | 5.7 – j6.2 | 2.0 – j5.2 |

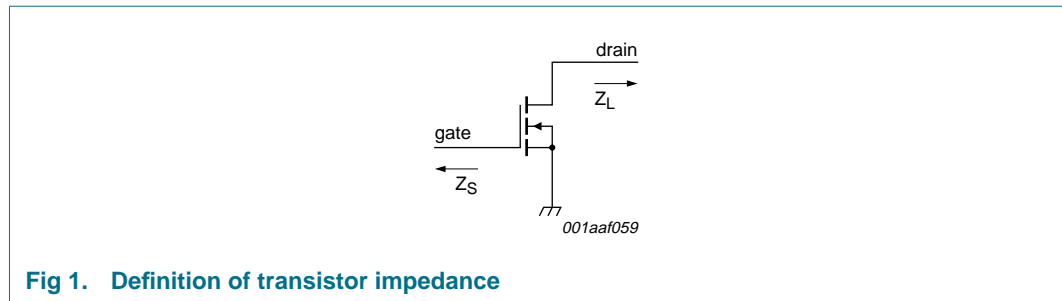
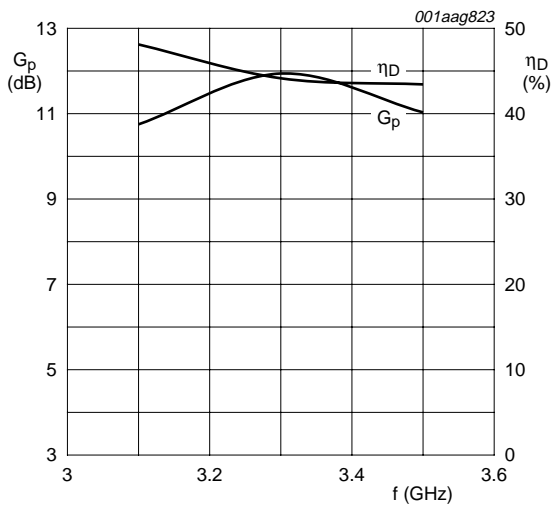


Fig 1. Definition of transistor impedance

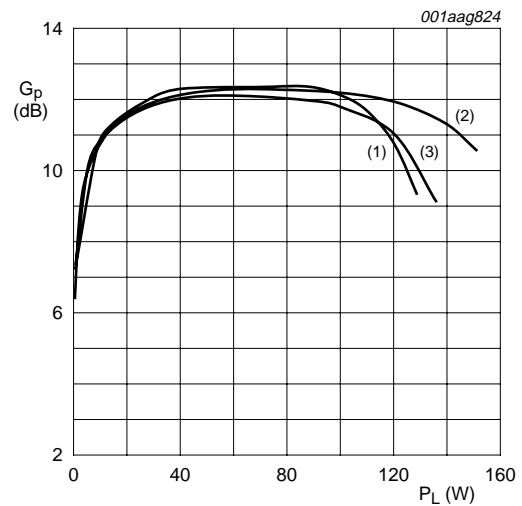
7.1 Ruggedness in class-AB operation

The BLS6G3135-120 and BLS6G3135S-120 are capable of withstanding a load mismatch corresponding to VSWR = 5 : 1 through all phases under the following conditions: $V_{DS} = 32\text{ V}$; $I_{Dq} = 100\text{ mA}$; $P_L = 120\text{ W}$; $t_p = 300\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$.



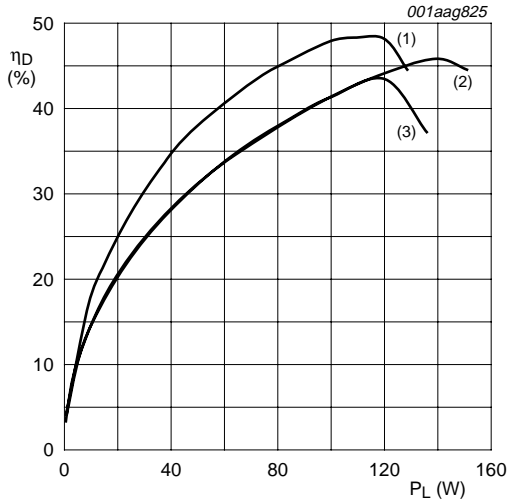
$V_{DS} = 32\text{ V}$; $I_{Dq} = 100\text{ mA}$; $t_p = 300\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$;
 $P_L = 120\text{ W}$.

Fig 2. Power gain and drain efficiency as functions of frequency; typical values



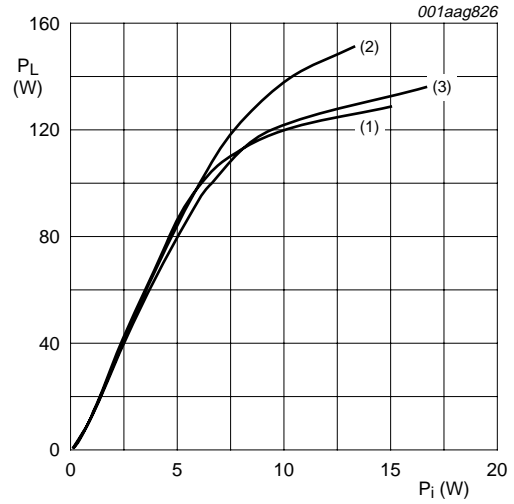
(1) $f = 3.1\text{ GHz}$
(2) $f = 3.3\text{ GHz}$
(3) $f = 3.5\text{ GHz}$
 $V_{DS} = 32\text{ V}$; $I_{Dq} = 100\text{ mA}$; $t_p = 300\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$.

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



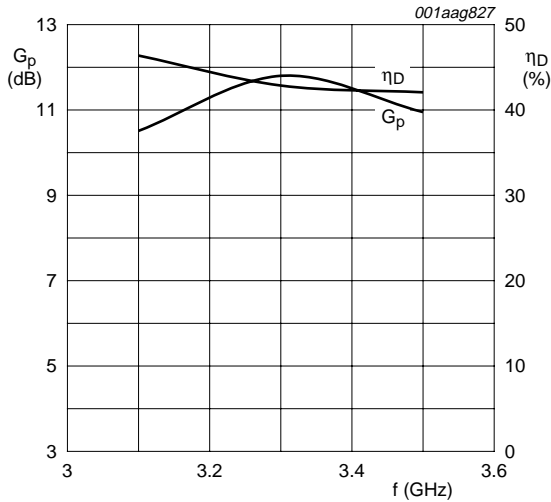
(1) $f = 3.1 \text{ GHz}$
 (2) $f = 3.3 \text{ GHz}$
 (3) $f = 3.5 \text{ GHz}$
 $V_{DS} = 32 \text{ V}; I_{Dq} = 100 \text{ mA}; t_p = 300 \mu\text{s}; \delta = 10 \%$.

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



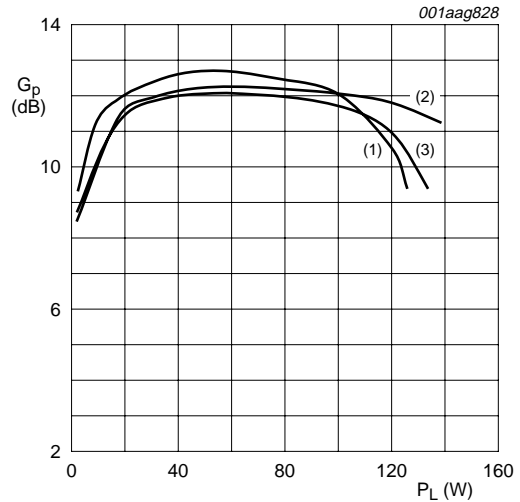
(1) $f = 3.1 \text{ GHz}$
 (2) $f = 3.3 \text{ GHz}$
 (3) $f = 3.5 \text{ GHz}$
 $V_{DS} = 32 \text{ V}; I_{Dq} = 100 \text{ mA}; t_p = 300 \mu\text{s}; \delta = 10 \%$.

Fig 5. Load power as a function of input power; typical values



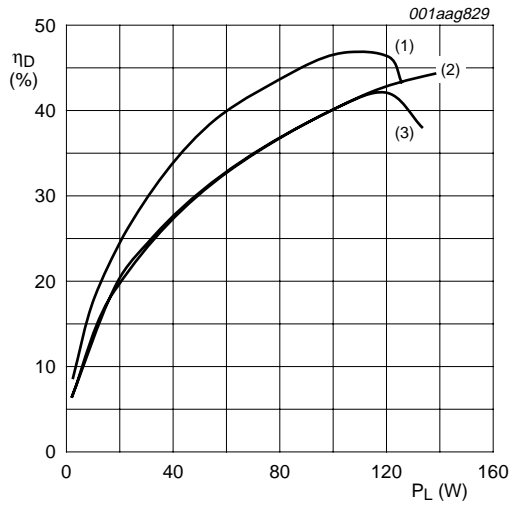
$V_{DS} = 32 \text{ V}; I_{Dq} = 100 \text{ mA}; t_p = 100 \mu\text{s}; \delta = 20 \%$;
 $P_L = 120 \text{ W}$.

Fig 6. Power gain and drain efficiency as functions of frequency; typical values



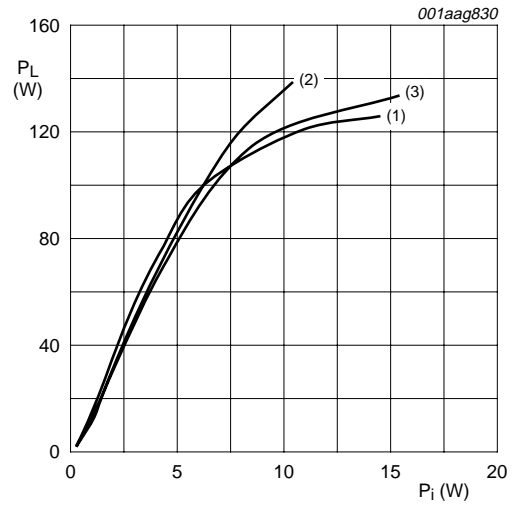
(1) $f = 3.1 \text{ GHz}$
 (2) $f = 3.3 \text{ GHz}$
 (3) $f = 3.5 \text{ GHz}$
 $V_{DS} = 32 \text{ V}; I_{Dq} = 100 \text{ mA}; t_p = 100 \mu\text{s}; \delta = 20 \%$.

Fig 7. Power gain as a function of load power; typical values



(1) $f = 3.1$ GHz
 (2) $f = 3.3$ GHz
 (3) $f = 3.5$ GHz
 $V_{DS} = 32$ V; $I_{Dq} = 100$ mA; $t_p = 100$ μ s; $\delta = 20$ %.

Fig 8. Drain efficiency as a function of load power; typical values



(1) $f = 3.1$ GHz
 (2) $f = 3.3$ GHz
 (3) $f = 3.5$ GHz
 $V_{DS} = 32$ V; $I_{Dq} = 100$ mA; $t_p = 100$ μ s; $\delta = 20$ %.

Fig 9. Load power as a function of input power; typical values

8. Test information

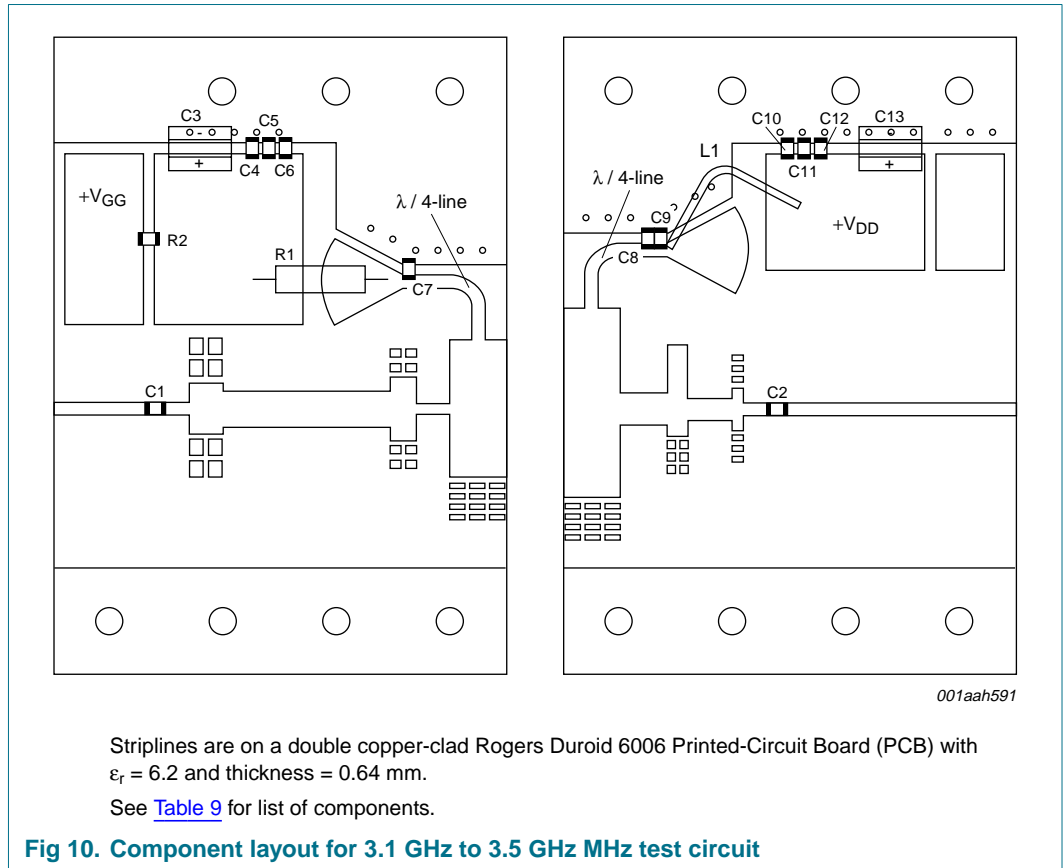


Table 9. List of components (see Figure 10)

To ensure good power supply of the device, adding an electrolytical capacitor close to the supply connection of the circuit may be required. The actual capacitor value may differ depending on the pulse format, the quality of the power supply and the length of the connecting wires to the power supply. In general a value of 470 μF will be sufficient.

| Component | Description | Value | Remarks |
|-------------------------------------|-----------------------------------|--------------------|---------|
| C1, C2, C4, C5, C6, C7, C8, C9, C11 | multilayer ceramic chip capacitor | 24 pF | [1] |
| C3 | electrolytic capacitor | 20 μF ; 20 V | |
| C10 | multilayer ceramic chip capacitor | 33 pF | [1] |
| C12 | multilayer ceramic chip capacitor | 1 nF | [2] |
| C13 | electrolytic capacitor | 100 μF ; 63 V | |
| L1 | copper wire | - | |
| R1 | resistor | 49.9 Ω | |
| R2 | SMD resistor | 49.9 Ω | |

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

[2] American Technical Ceramics type 700A or capacitor of same quality.

9. Package outline

Flanged LDMOST ceramic package; 2 mounting holes; 2 leads

SOT502A

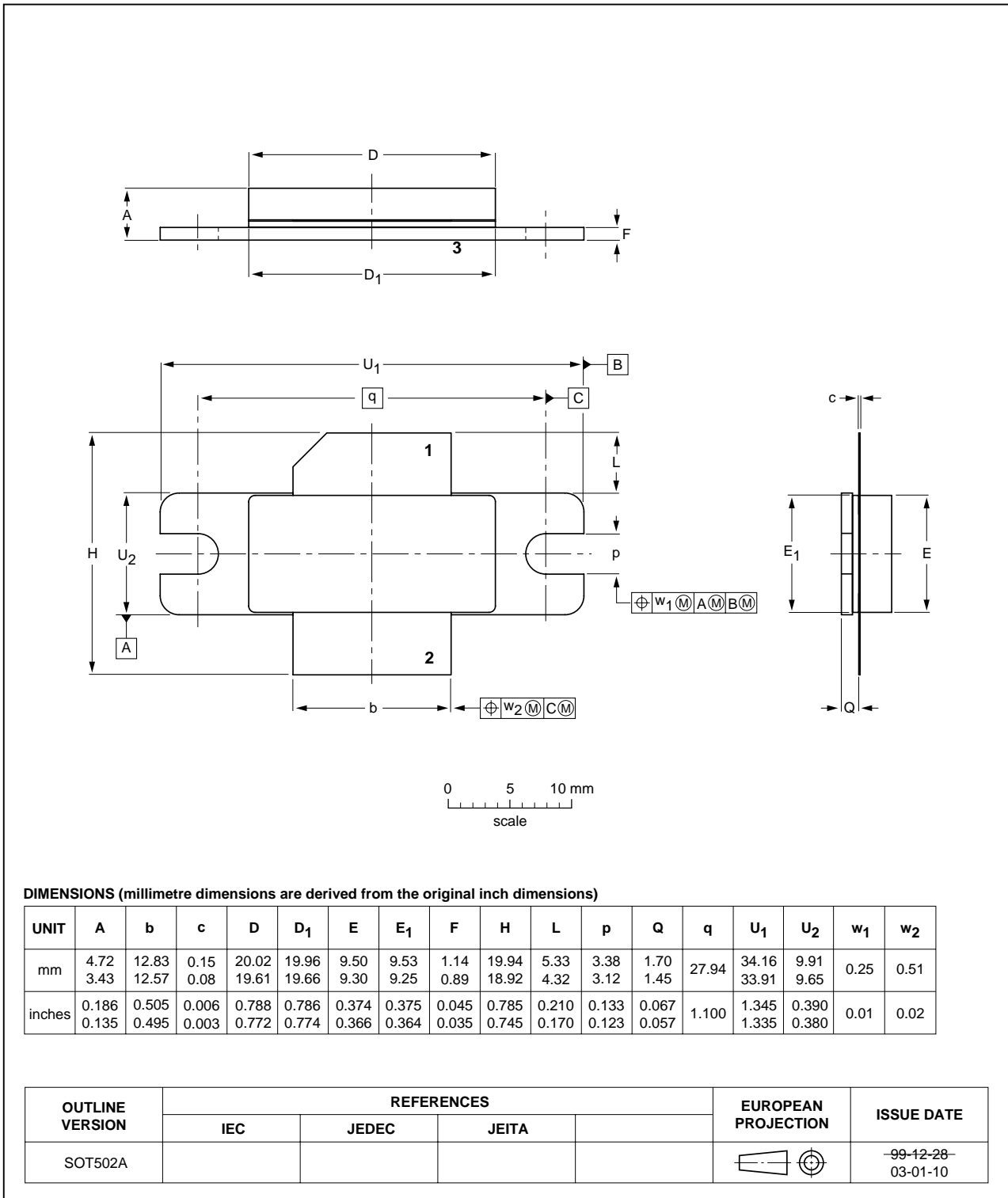


Fig 11. Package outline SOT502A

Earless flanged LDMOST ceramic package; 2 leads

SOT502B

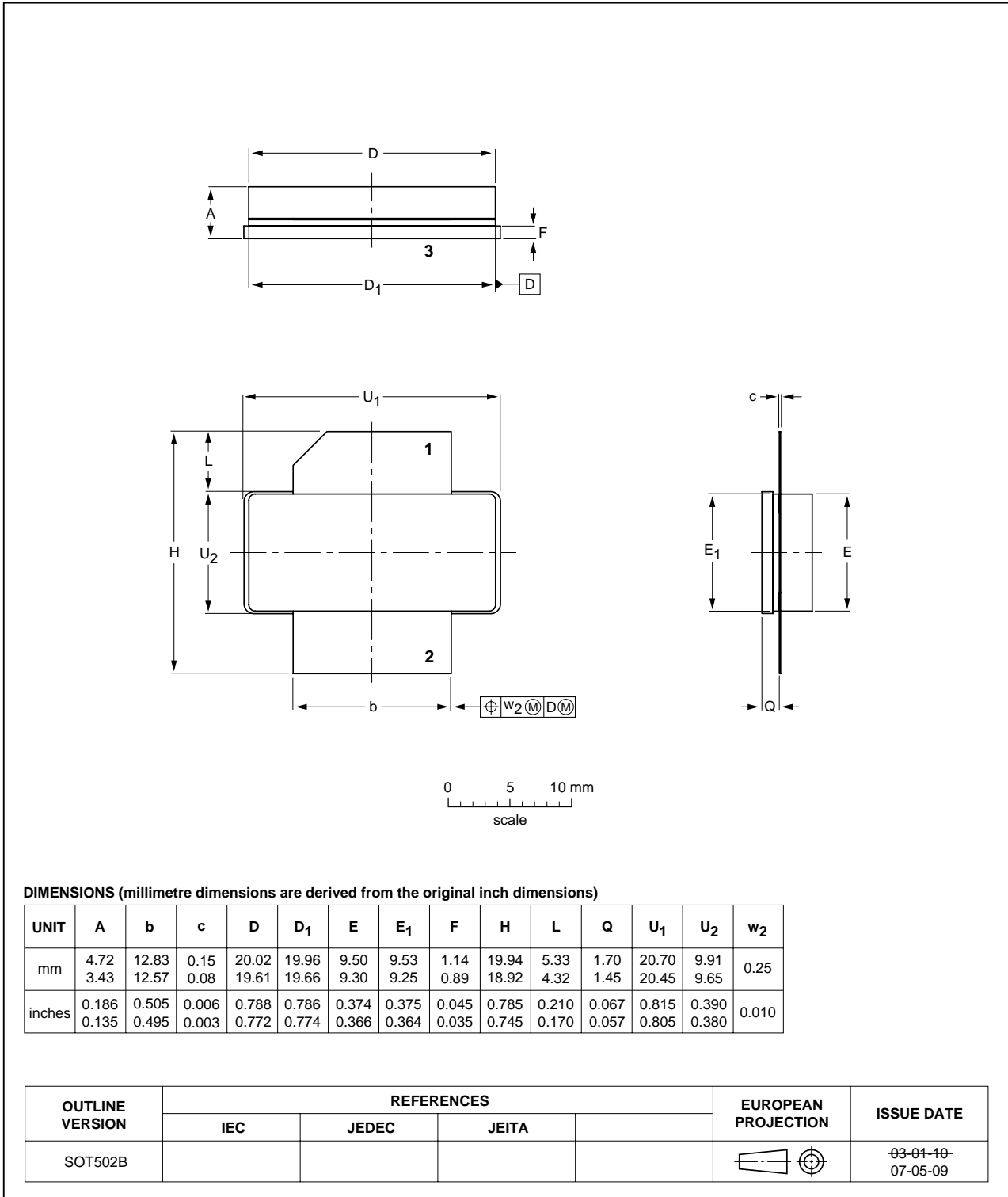


Fig 12. Package outline SOT502B

10. Abbreviations

Table 10. Abbreviations

| Acronym | Description |
|---------|---|
| LDMOS | Laterally Diffused Metal Oxide Semiconductor |
| LDMOST | Lateral 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 |
|-----------------------------|---|------------------------|---------------|-----------------------------|
| BLS6G3135-120_6G3135S-120_2 | 20080529 | Product data sheet | - | BLS6G3135-120_6G3135S-120_1 |
| Modifications: | <ul style="list-style-type: none"> • Section 8 on page 7: Component layout was added | | | |
| BLS6G3135-120_6G3135S-120_1 | 20070814 | Preliminary data sheet | - | - |

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12.1 Data sheet status

| 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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Date of release: 29 May 2008

Document identifier: BLS6G3135-120_6G3135S-120_2