

BLA0912-250

Avionics LDMOS transistor

Rev. 3 — 26 November 2010

Product data sheet

1. Product profile

1.1 General description

Silicon N-channel enhancement mode LDMOS transistor encapsulated in a 2-lead SOT502A flange package with a ceramic cap. The common source is connected to the mounting flange.

Table 1. Test information

Typical RF performance measured in common source class-AB test circuit at $P_L = 250\text{ W}$ and 960 MHz to 1215 MHz frequency band. $T_h = 25\text{ °C}$; $Z_{th(j-h)} = 0.15\text{ K/W}$; unless otherwise specified.

| Mode of operation | f (MHz) | t _p (μs) | δ % | V _{DS} (V) | P _L (W) | G _p (dB) | ΔG _p (dB) | η _D (%) | P _{droop(pulse)} (dB) | t _r (ns) | t _f (ns) | Z _{th(j-h)} (K/W) | φ _{ins(rel)} (deg) |
|-------------------|--------------|------------------------|--------|------------------------|-----------------------|------------------------|-------------------------|-----------------------|-----------------------------------|------------------------|------------------------|-------------------------------|--------------------------------|
| all modes | 960 to 1215 | 100 | 10 | 36 | 250 | 13.5 | 0.8 | 50 | 0.1 | 25 | 6 | 0.18 | ±5 |
| TCAS | 1030 to 1090 | 32 | 0.1 | 36 | 250 | 14.0 | 0.8 | 50 | 0 | 25 | 6 | 0.07 | ±5 |
| Mode-S | 1030 to 1090 | 128 | 2 | 36 | 250 | 13.5 | 0.8 | 50 | 0.1 | 25 | 6 | 0.15 | ±5 |
| | 1030 to 1090 | 340 | 1 | 36 | 250 | 13.5 | 0.8 | 50 | 0.2 | 25 | 6 | 0.20 | ±5 |
| JTIDS | 960 to 1215 | 3300 | 22 | 36 | 200 | 13.0 | 1.2 | 45 | 0.2 | 25 | 6 | 0.45 | ±5 |

CAUTION



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

1.2 Features and benefits

- High power gain
- Easy power control
- Excellent ruggedness
- Source on mounting base eliminates DC isolators, reducing common mode inductance.

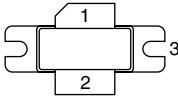

1.3 Applications

- Avionics transmitter applications in the 960 MHz to 1215 MHz frequency range such as Mode-S, TCAS and JTIDS, DME or TACAN.



2. Pinning information

Table 2. Pinning

| Pin | Description | Simplified outline | Graphic symbol |
|-----|-------------|---|---|
| 1 | drain |  |  |
| 2 | gate | | |
| 3 | source | | |

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|--|---------|
| | Name | Description | Version |
| BLA0912-250 | - | flanged LDMOST ceramic package; 2 mounting holes; 2 leads | SOT502A |

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 | | - | 75 | V |
| V_{GS} | gate-source voltage | | - | ± 22 | V |
| P_{tot} | total power dissipation | $T_h \leq 25\text{ }^{\circ}\text{C}$; $t_p = 50\text{ }\mu\text{s}$; $\delta = 2\text{ }\%$ | - | 700 | W |
| T_{stg} | storage temperature | | -65 | +150 | $^{\circ}\text{C}$ |
| T_j | junction temperature | | - | 200 | $^{\circ}\text{C}$ |

5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol | Parameter | Conditions | Typ | Unit |
|---------------|---|------------------------------------|----------|------|
| $Z_{th(j-h)}$ | transient thermal impedance from junction to heatsink | $T_h = 25\text{ }^{\circ}\text{C}$ | [1] 0.18 | K/W |

[1] Thermal resistance is determined under RF operating conditions; $t_p = 100\text{ }\mu\text{s}$, $\delta = 10\text{ }\%$.

6. Characteristics

Table 6. DC 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 | $V_{GS} = 0\text{ V}$; $I_D = 3\text{ mA}$ | 75 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $V_{DS} = 10\text{ V}$; $I_D = 300\text{ mA}$ | 4 | - | 5 | V |
| I_{DSS} | drain leakage current | $V_{GS} = 0\text{ V}$; $V_{DS} = 36\text{ V}$ | - | - | 1 | μA |
| I_{DSX} | drain cut-off current | $V_{GS} = V_{GSth} + 9\text{ V}$; $V_{DS} = 10\text{ V}$ | 45 | - | - | A |
| I_{GSS} | gate leakage current | $V_{GS} = 20\text{ V}$; $V_{DS} = 0\text{ V}$ | - | - | 1 | μA |
| g_{fs} | forward transconductance | $V_{DS} = 10\text{ V}$; $I_D = 10\text{ A}$ | - | 9 | - | S |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 9\text{ V}$; $I_D = 10\text{ A}$ | - | 60 | - | $\text{m}\Omega$ |

Table 7. RF characteristics

RF performance in common source class-AB circuit; $T_h = 25\text{ }^{\circ}\text{C}$; $Z_{th} = 0.15\text{ K/W}$; unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------------------|---|--|-----|-----|------|--------------------|
| V_{DS} | drain-source voltage | | - | - | 36 | V |
| f | frequency | | 960 | - | 1215 | MHz |
| P_L | output power | $t_p = 100\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$ | 250 | - | - | W |
| G_p | power gain | $P_L = 250\text{ W}$ | 12 | 13 | - | dB |
| η_D | drain efficiency | $t_p = 100\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$ | 40 | 50 | - | % |
| $Z_{th(j-h)}$ | transient thermal impedance from junction to heatsink | $t_p = 100\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$ | - | - | 0.2 | K/W |
| T_h | heatsink temperature | | -55 | - | +70 | $^{\circ}\text{C}$ |
| $P_{\text{droop(pulse)}}$ | pulse droop power | $t_p = 100\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$ | - | 0.1 | 0.5 | dB |
| $\alpha_{\text{resp(sp)}}$ | spurious response | $VSWR_{\text{load}} = 2 : 1$ | - | - | -60 | dBc |
| t_r | rise time | | - | 25 | 50 | ns |
| t_f | fall time | | - | 6 | 25 | ns |

6.1 Ruggedness in class-AB operation

The BLA0912-250 is capable of withstanding a load mismatch corresponding to $VSWR = 5 : 1$ through all phases under the following conditions: $V_{DS} = 36\text{ V}$; $f = 960\text{ MHz}$ to 1215 MHz at rated load power.

7. Application information

7.1 Impedance information

Table 8. Typical impedance
Typical values per section unless otherwise specified.

| f | Z _S | Z _L |
|------|----------------|----------------|
| MHz | Ω | Ω |
| 960 | 0.89 – j1.70 | 1.53 – j1.13 |
| 1030 | 1.37 – j1.23 | 1.47 – j0.99 |
| 1090 | 2.09 – j1.27 | 1.38 – j0.85 |
| 1140 | 2.40 – j1.97 | 1.30 – j0.71 |
| 1215 | 1.51 – j2.61 | 1.17 – j0.47 |

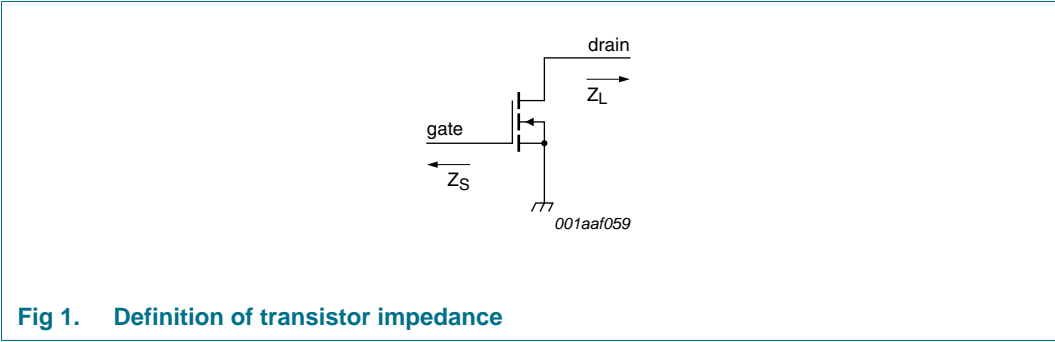


Fig 1. Definition of transistor impedance

7.2 Application circuit

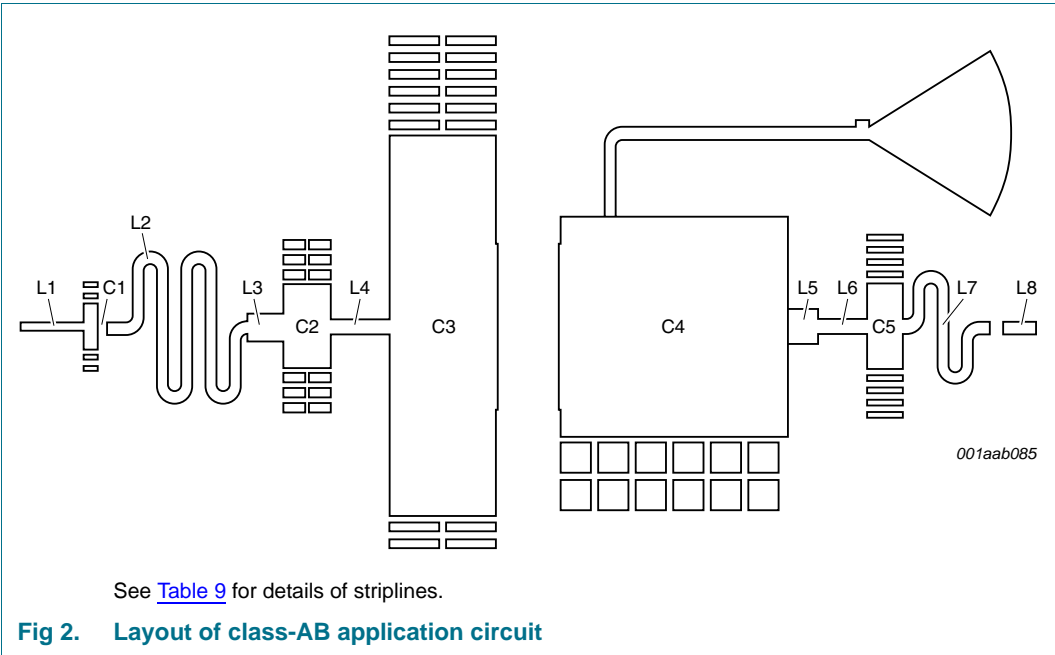


Fig 2. Layout of class-AB application circuit

Table 9. Layout detailsSee [Figure 2](#).

Striplines are on a Rogers Duroid 6010 Printed-Circuit Board (PCB); $\epsilon_r = 10.2$ F/m;
thickness = 0.64 mm

| Component | Description | Dimensions |
|-----------------------|-------------|--|
| Input circuit | | |
| L1 | stripline | 5 mm × 0.8 mm |
| C1 | stripline | 1.2 mm × 3.5 mm |
| L2 | stripline | capacitor pad: 1 mm × 1 mm (1×) curve: width 0.8 mm; angle 90°; radius 0.8 mm (10×) vertical: 3.9 mm × 0.8 mm (2×) vertical: 9.4 mm × 0.8 mm (3×) horizontal: 0.5 mm × 0.8 mm (4×) |
| L3 | stripline | 3 mm × 2 mm |
| C2 | stripline | 4 mm × 6.5 mm |
| L4 | stripline | 5 mm × 1 mm |
| C3 | stripline | 8.8 mm × 30 mm + 0.2 mm × 13 mm |
| Output circuit | | |
| C4 | stripline | 0.2 mm × 13 mm + 19 mm × 17.1 mm |
| L5 | stripline | 2.5 mm × 2.3 mm |
| L6 | stripline | 4 mm × 1 mm |
| C5 | stripline | 3 mm × 6.6 mm |
| L7 | stripline | curve: width 0.8 mm; angle 90°; radius 0.8 mm (6×) vertical: 2.2 mm × 0.8 mm (2×) vertical: 6 mm × 0.8 mm (1×) horizontal: 1 mm × 0.8 mm (2×) |
| L8 | stripline | 2.5 mm × 0.8 mm |
| 1/4 λ line | stripline | curve: width 1 mm; angle 90°; radius 0.8 mm vertical: 5 mm × 1 mm horizontal: 19 mm × 1 mm |

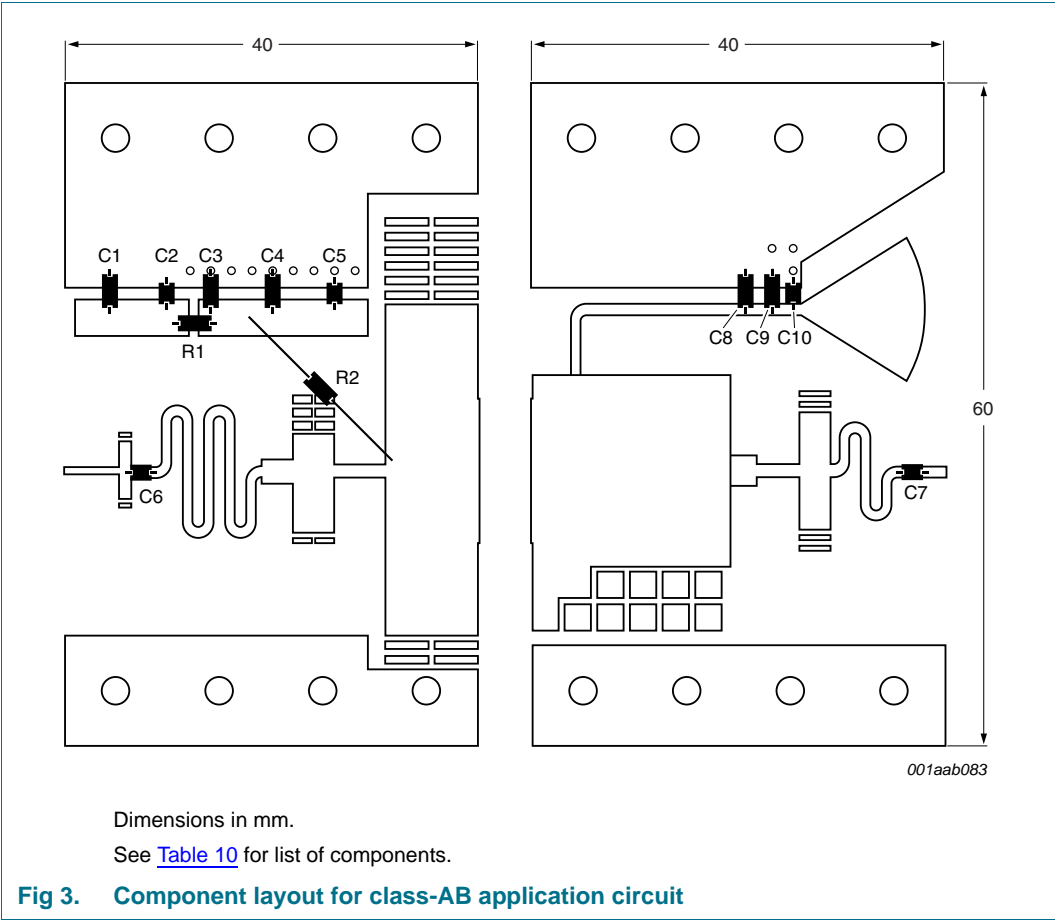


Table 10. List of components

See [Figure 3](#).

| Component | Description | Value | Remarks |
|-------------|-----------------------------------|------------------|-----------------------|
| C1, C3, C9 | multilayer ceramic chip capacitor | 1 nF | [1] |
| C2, C6, C10 | multilayer ceramic chip capacitor | 22 pF | [2] |
| C4 | tantalum SMD capacitor | 47 μ F; 20 V | KEMET: T491D476M020AS |
| C5 | multilayer ceramic chip capacitor | 56 pF | [2] |
| C7 | multilayer ceramic chip capacitor | 47 pF | [2] |
| C8 | tantalum SMD capacitor | 22 μ F; 63 V | |
| R1 | SMD resistor | 51 Ω | 0805 |
| R2 | resistor | 49.9 Ω | |

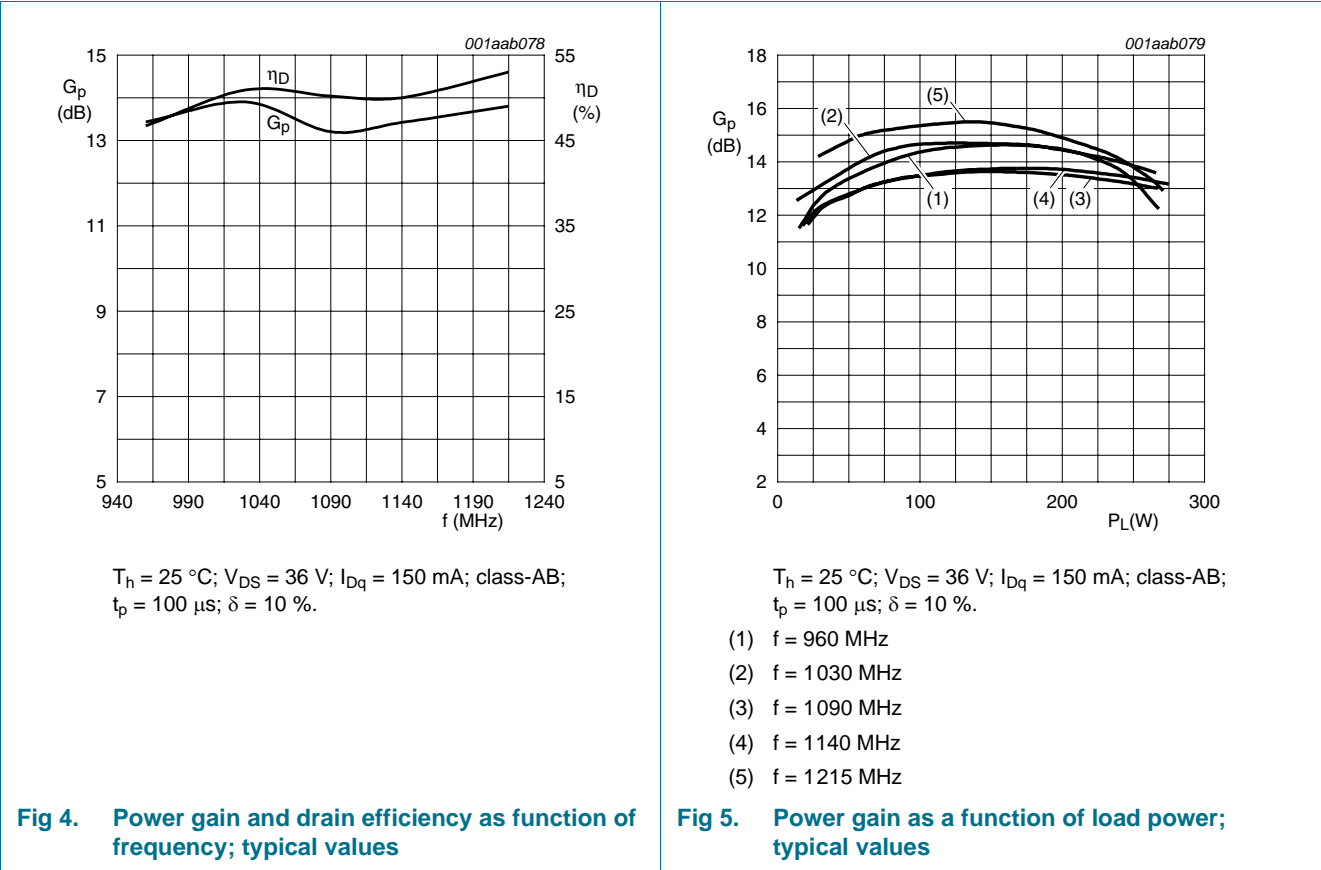
[1] American Technical Ceramics type 100B or capacitor of same quality.

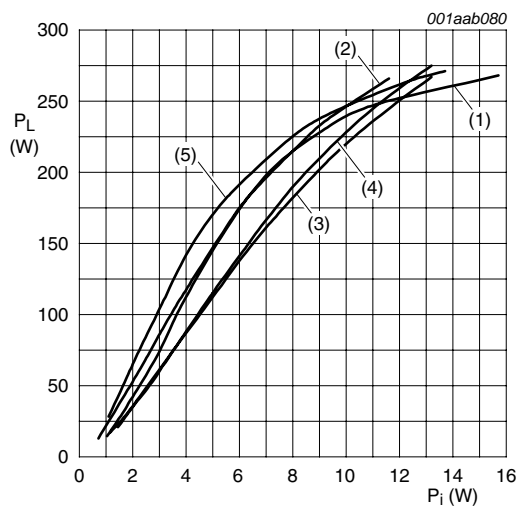
[2] American Technical Ceramics type 100A or capacitor of same quality.

8. Test information

8.1 RF performance

Typical RF performance measured in common source class-AB test circuit at $P_L = 250\text{ W}$ and 960 MHz to 1215 MHz frequency band. $T_h = 25\text{ }^{\circ}\text{C}$; $Z_{th(j-h)} = 0.15\text{ K/W}$; unless otherwise specified.

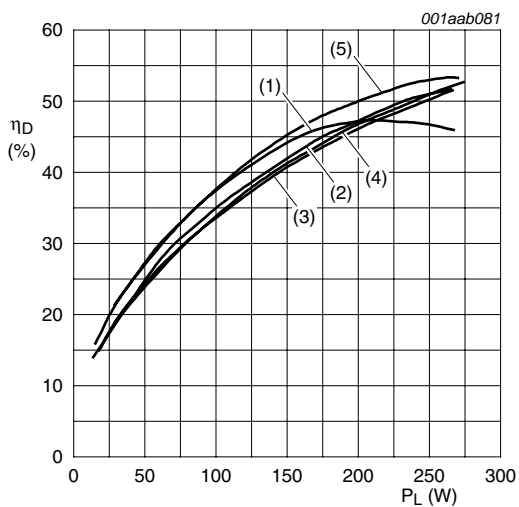




$T_h = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 36\text{ V}$; $I_{DQ} = 150\text{ mA}$; class-AB;
 $t_p = 100\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$.

- (1) $f = 960\text{ MHz}$
- (2) $f = 1030\text{ MHz}$
- (3) $f = 1090\text{ MHz}$
- (4) $f = 1140\text{ MHz}$
- (5) $f = 1215\text{ MHz}$

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



$T_h = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 36\text{ V}$; $I_{DQ} = 150\text{ mA}$; class-AB;
 $t_p = 100\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$.

- (1) $f = 960\text{ MHz}$
- (2) $f = 1030\text{ MHz}$
- (3) $f = 1090\text{ MHz}$
- (4) $f = 1140\text{ MHz}$
- (5) $f = 1215\text{ MHz}$

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

9. Package outline

Flanged LDMOST ceramic package; 2 mounting holes; 2 leads

SOT502A

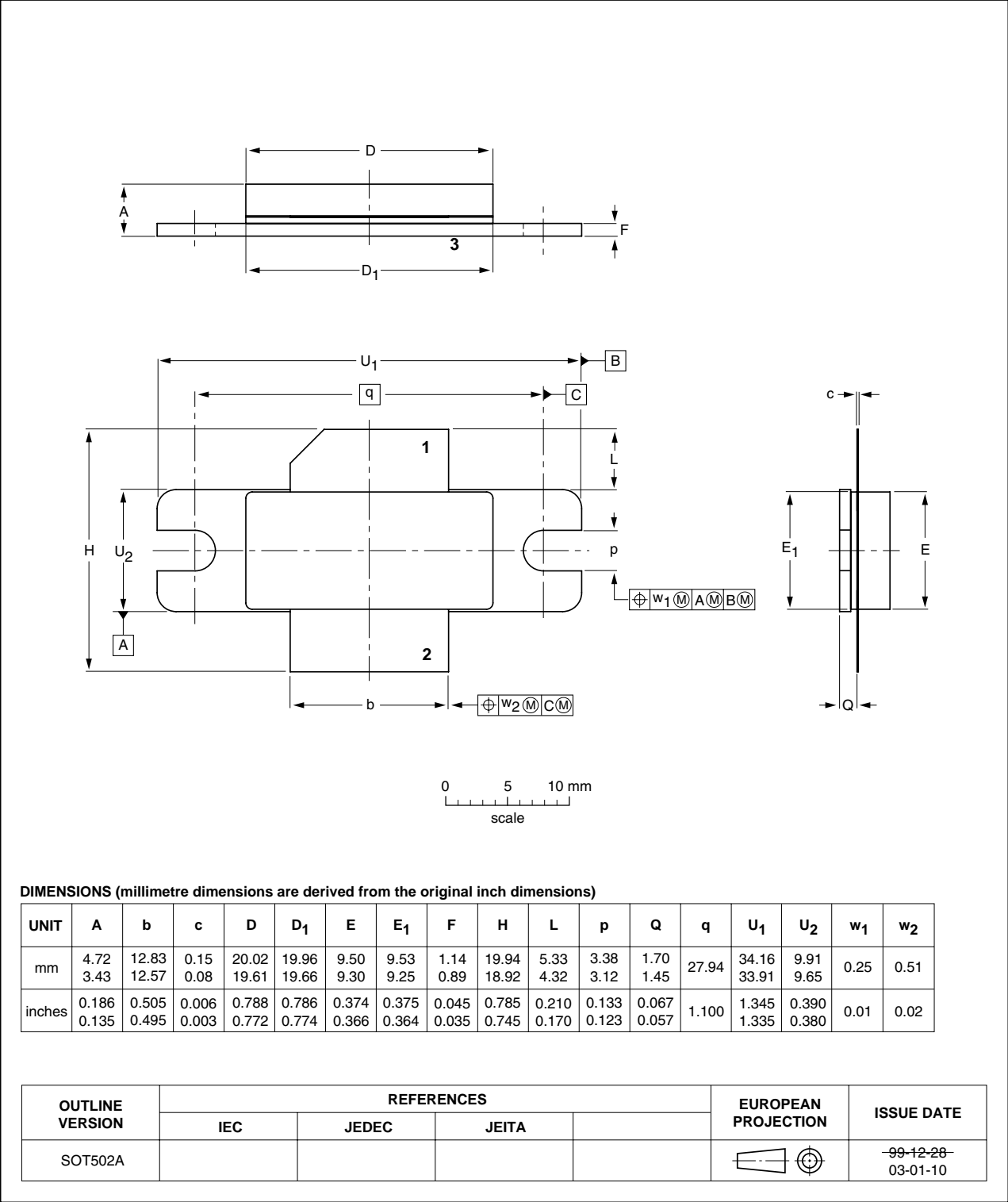


Fig 8. Package outline SOT502A

10. Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|---|
| DC | Direct Current |
| DME | Distance Measuring Equipment |
| JTIDS | Joint Tactical Information Distribution System |
| LDMOS | Laterally Diffused Metal-Oxide Semiconductor |
| LDMOST | Laterally Diffused Metal-Oxide Semiconductor Transistor |
| Mode-S | Mode Select |
| RF | Radio Frequency |
| SMD | Surface Mounted Device |
| TACAN | TACTical Air Navigation |
| TCAS | Traffic Collision Avoidance System |
| VSWR | Voltage Standing-Wave Ratio |

11. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|--|------------------------|---------------|-----------------|
| BLA0912-250 v.3 | 20101126 | Product data sheet | - | BLA0912-250_2 |
| Modifications: | <ul style="list-style-type: none">• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.• Legal texts have been adapted to the new company name where appropriate.• Table 10 on page 6: The remark of component C8 has been removed.• Table 10 on page 6: The value of component C8 has been specified in more detail. | | | |
| BLA0912-250_2 | 20040722 | Product data sheet | - | BLA0912-250_N_1 |
| BLA0912-250_N_1 | 20031024 | Preliminary data sheet | - | 9397 750 12224 |

12. Legal information

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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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