

# BLA0912-250R

## Avionics LDMOS power transistor

Rev. 01 — 3 March 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  $P_L = 250$  W and 960 MHz to 1215 MHz frequency band.  $T_h = 25$  °C;  $Z_{th(j-h)} = 0.15$  K/W; unless otherwise specified.

Mode of operation	f (MHz)	t <sub>p</sub> (μs)	δ %	V <sub>DS</sub> (V)	P <sub>L</sub> (W)	G <sub>p</sub> (dB)	ΔG <sub>p</sub> (dB)	η <sub>D</sub> (%)	P <sub>droop(pulse)</sub> (dB)	t <sub>r</sub> (ns)	t <sub>f</sub> (ns)	Z <sub>th(j-h)</sub> (K/W)	φ <sub>ins(rel)</sub> (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.

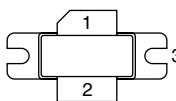
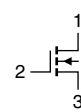
### 1.3 Applications

- 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		 sym039
2	gate		
3	source		

[1] Connected to flange.

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		
	Name	Description	Version
BLA0912-250R	-	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	$T_h \leq 25\text{ °C}$ ; $t_p = 50\text{ }\mu\text{s}$ ; $\delta = 2\text{ %}$	-	700	W
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature		-	200	°C

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

Symbol	Parameter	Conditions	Typ	Unit
$Z_{th(j-h)}$	transient thermal impedance from junction to heatsink	$T_h = 25\text{ °C}$	[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**

$T_j = 25\text{ °C}$ ; 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	$\mu\text{A}$
$I_{DSX}$	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	$\mu\text{A}$
$g_{fs}$	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;  $T_h = 25\text{ °C}$ ;  $Z_{th} = 0.15\text{ K/W}$ ; 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
$\eta_D$	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
$\alpha_{\text{resp(spur)}}$	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 BLA0912-250R is capable of withstanding a load mismatch corresponding to  $VSWR = 10 : 1$  through all phases under the following conditions:  $V_{DS} = 36\text{ V}$ ;  $f = 960\text{ MHz}$  to  $1215\text{ MHz}$  at rated load power.

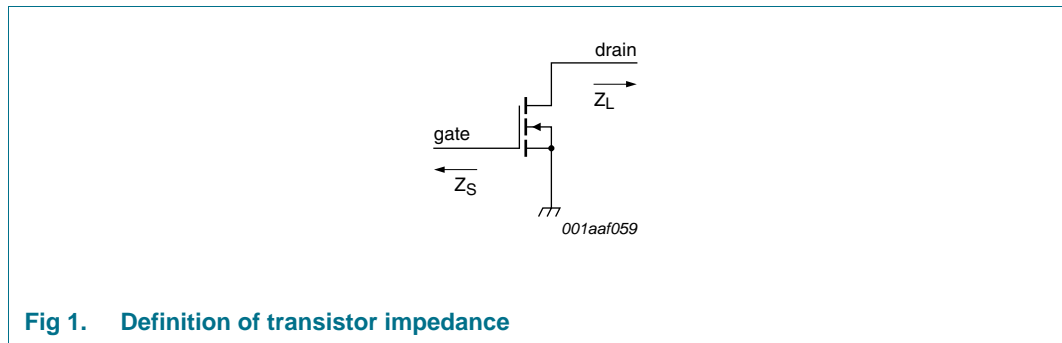
## 7. Application information

### 7.1 Impedance information

**Table 8. Typical impedance**

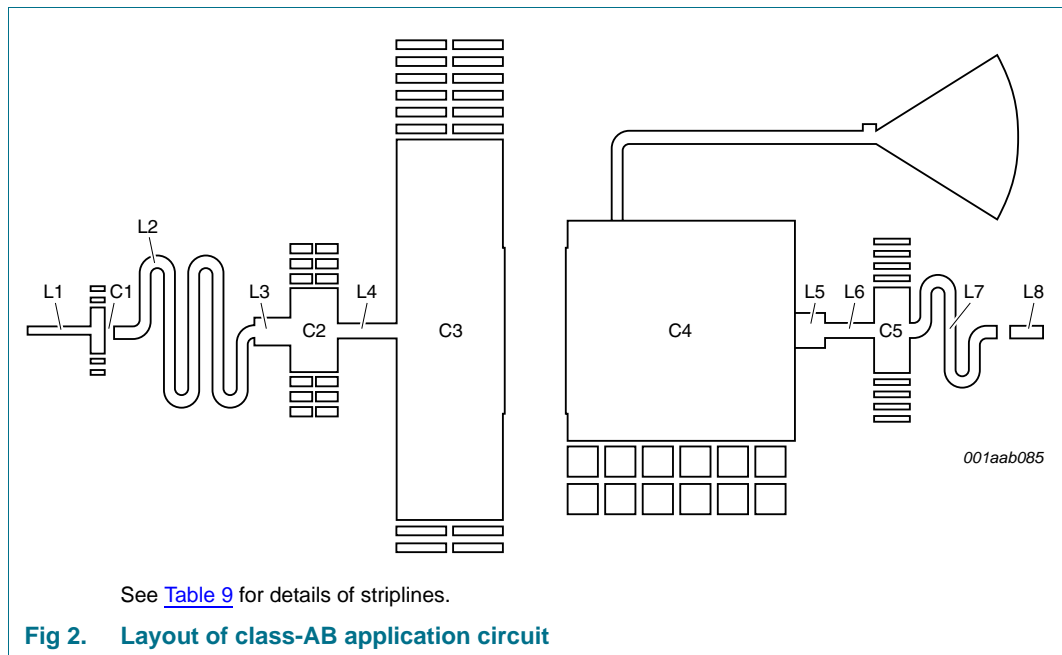
Typical values per section unless otherwise specified.

f MHz	Z <sub>S</sub> Ω	Z <sub>L</sub> 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



See [Table 9](#) for details of striplines.

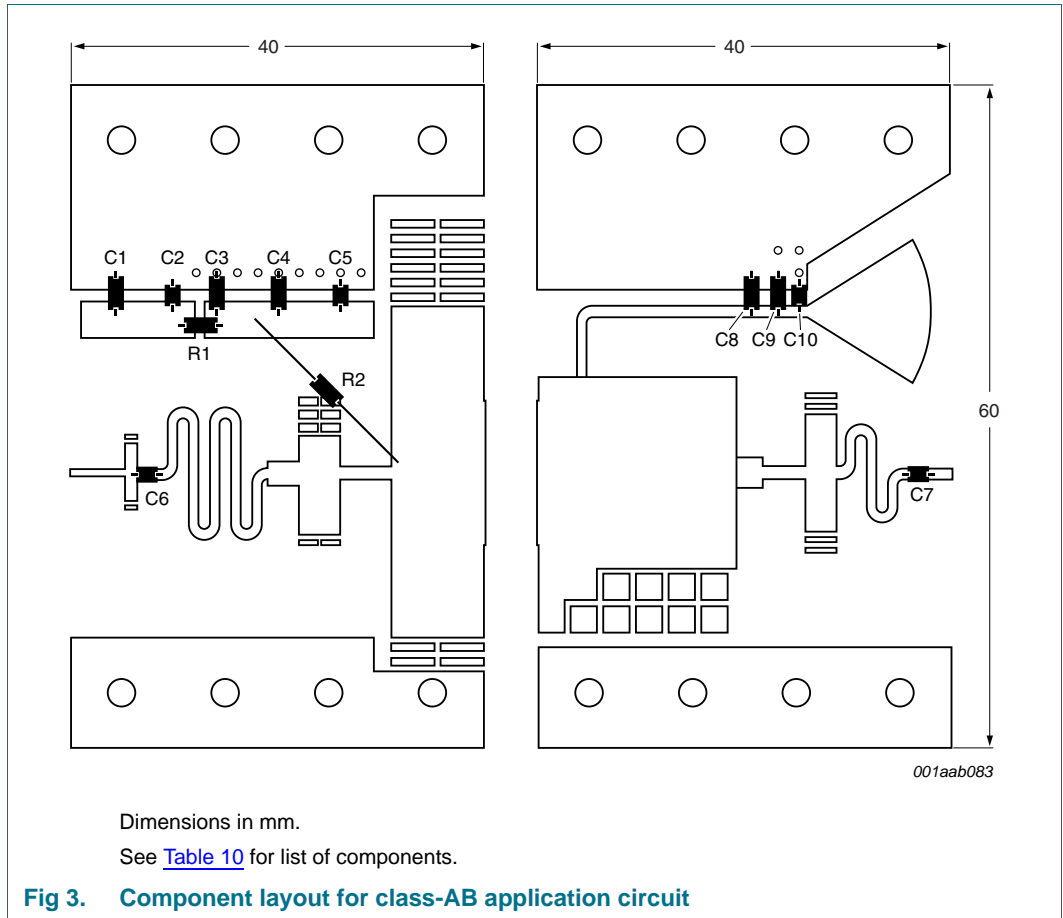
**Fig 2. Layout of class-AB application circuit**

**Table 9. Layout details**

See [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
<b>Input circuit</b>		
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
<b>Output circuit</b>		
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 $\lambda$ 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 $\mu$ F	KEMET: T491D476M020AS
C5	multilayer ceramic chip capacitor	56 pF	[2]
C7	multilayer ceramic chip capacitor	47 pF	[2]
C8	tantalum SMD capacitor	22 $\mu$ F	KEMET: T491D226M020AS
R1	SMD resistor	51 $\Omega$	0805
R2	resistor	49.9 $\Omega$	Philips: 2333 156 14999

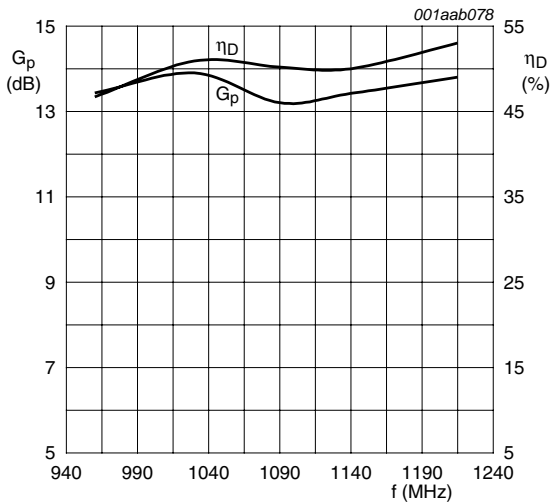
[1] American Technical Ceramics type 100B or capacitor of same quality.

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

**8. Test information**

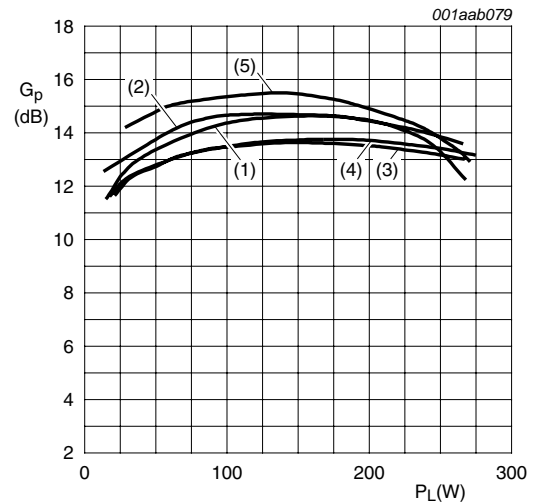
**8.1 RF performance**

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;  
 $t_p = 100\text{ }\mu\text{s}$ ;  $\delta = 10\text{ }\%$ .

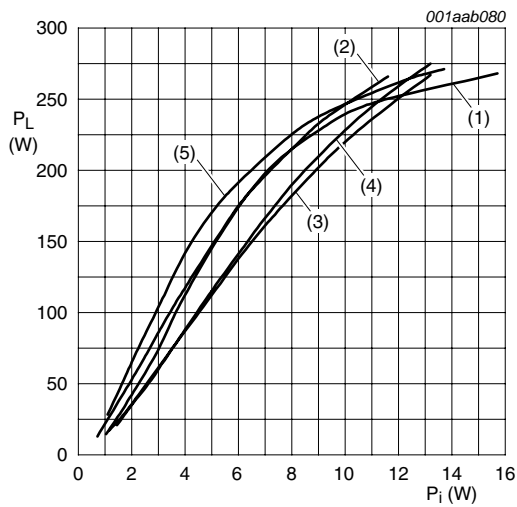
**Fig 4. Power gain and drain efficiency as function of frequency; typical values**



$T_h = 25\text{ }^\circ\text{C}$ ;  $V_{DS} = 36\text{ V}$ ;  $I_{Dq} = 150\text{ mA}$ ; 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)  $f = 1215\text{ MHz}$

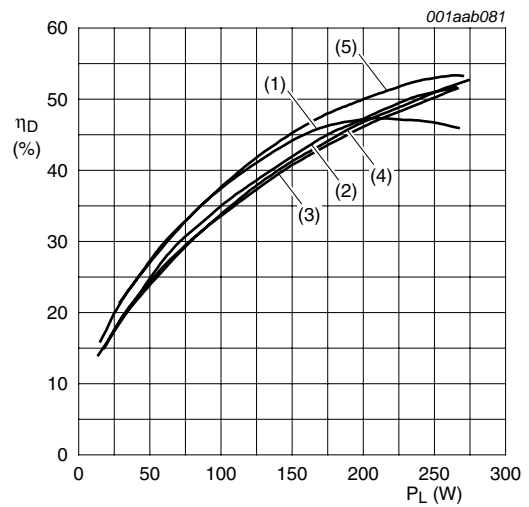
**Fig 5. Power gain as a function of load power; typical values**



$T_h = 25\text{ }^\circ\text{C}$ ;  $V_{DS} = 36\text{ V}$ ;  $I_{Dq} = 150\text{ mA}$ ; 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 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

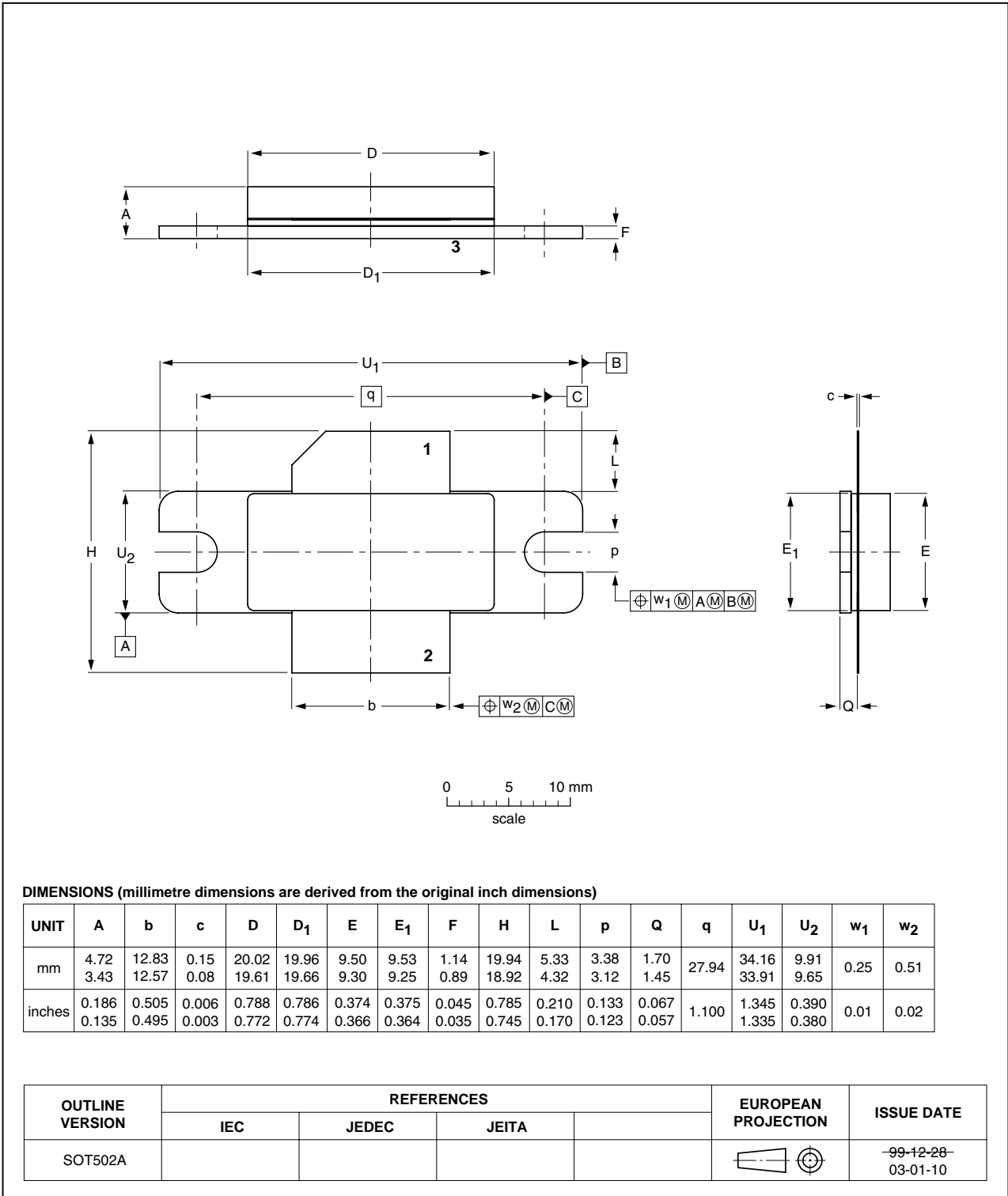


Fig 8. Package outline SOT502A

## 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
BLA0912-250R_1	20100303	Product data sheet	-	-

## 12. Legal information

### 12.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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