

BLA0912-250R

Avionics LDMOS power transistor

Rev. 3 — 1 December 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 _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.

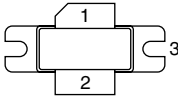
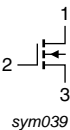
1.3 Applications

- 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		 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	$T_h \leq 25\text{ °C}$; $t_p = 50\ \mu\text{s}$; $\delta = 2\ \%$	-	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; $t_p = 100\ \mu\text{s}$, $\delta = 10\ \%$.

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 BLA0912-250R 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 MHz	Z _S Ω	Z _L 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

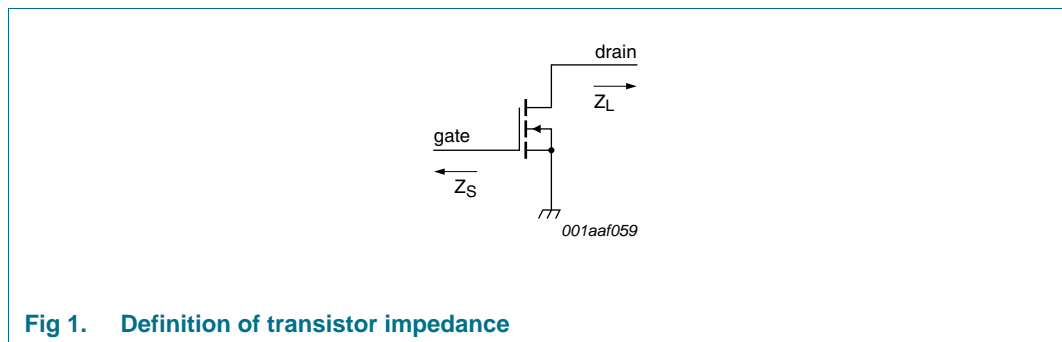


Fig 1. Definition of transistor impedance

7.2 Application circuit

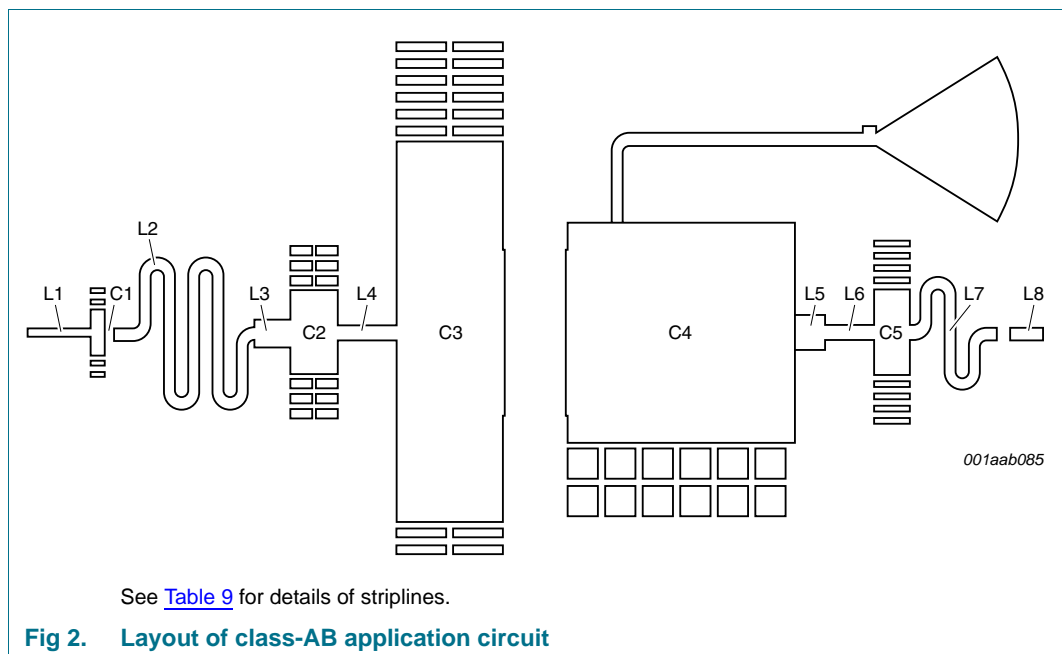


Fig 2. Layout of class-AB application circuit

Table 9. Layout 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
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

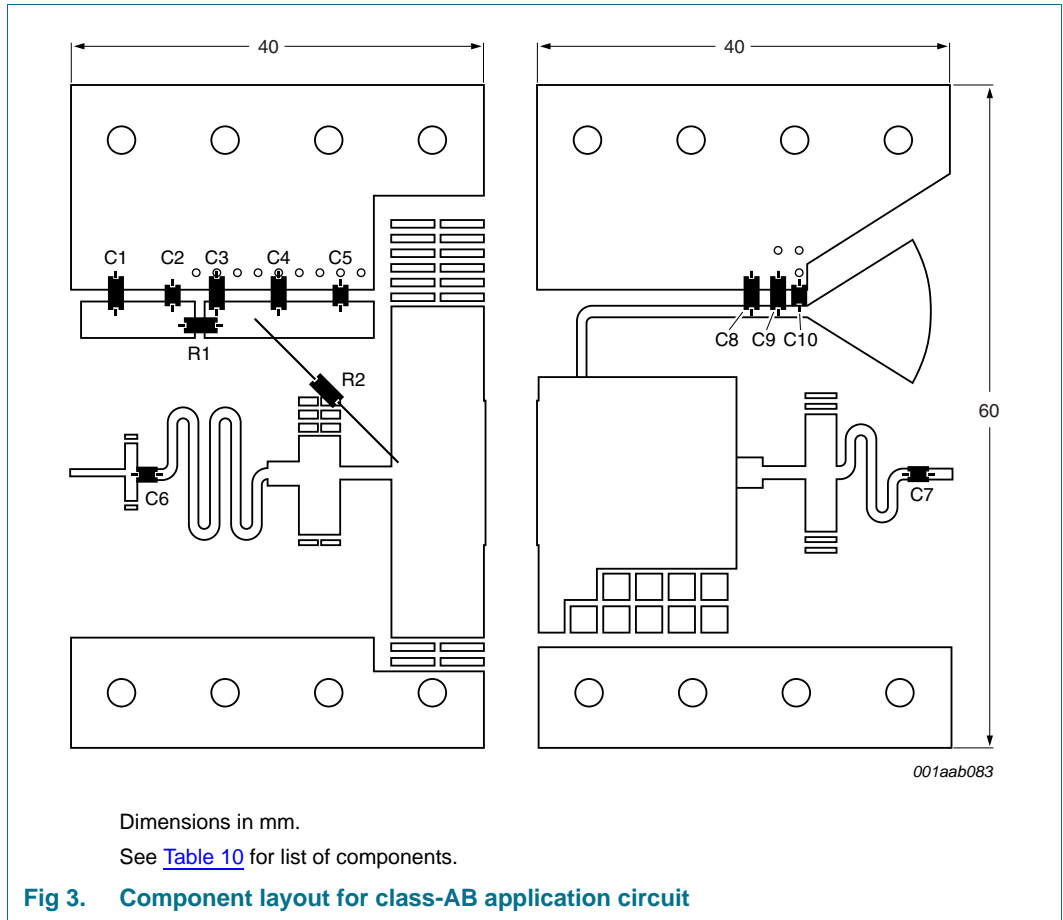


Table 10. List of components

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	

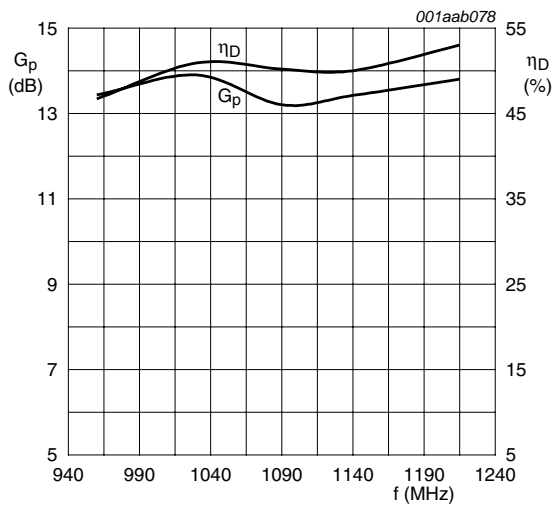
[1] American Technical Ceramics type 100B or capacitor of same quality.

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

8. Test information

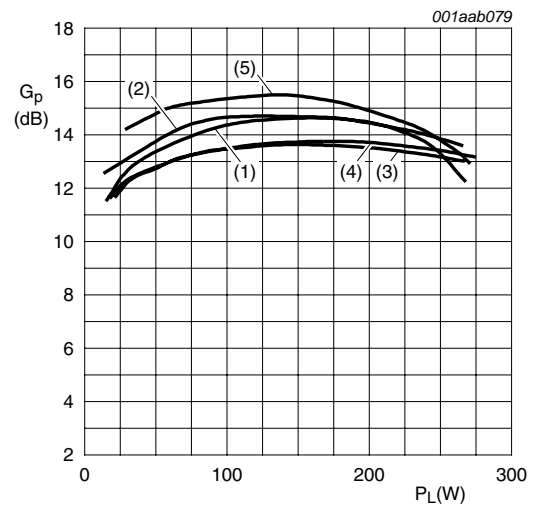
8.1 RF performance

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



$T_h = 25$ °C; $V_{DS} = 36$ V; $I_{Dq} = 150$ mA; class-AB;
 $t_p = 100$ μ s; $\delta = 10$ %.

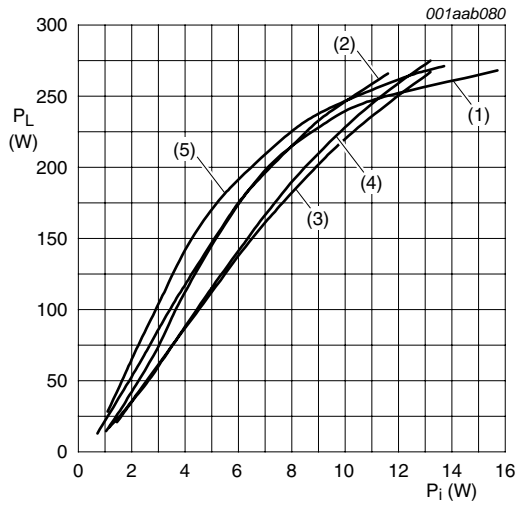
Fig 4. Power gain and drain efficiency as function of frequency; typical values



$T_h = 25$ °C; $V_{DS} = 36$ V; $I_{Dq} = 150$ mA; class-AB;
 $t_p = 100$ μ s; $\delta = 10$ %.

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

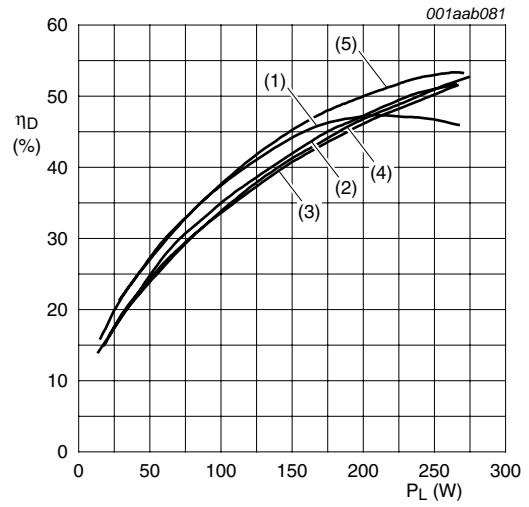
Fig 5. Power gain as a function of load power; typical values



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

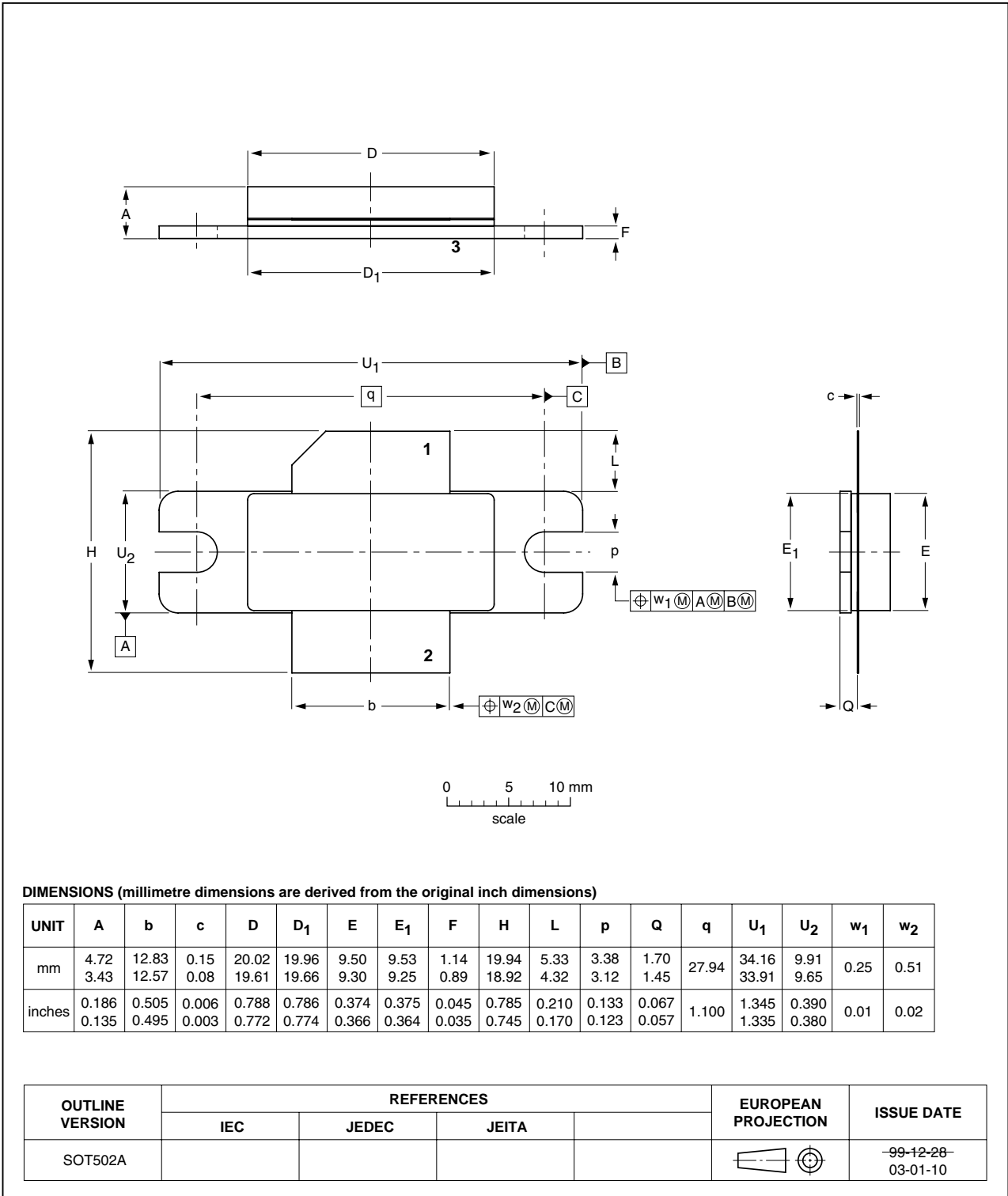


Fig 8. Package outline SOT502A

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 v.3	20101201	Product data sheet	-	BLA0912-250R v.2
Modifications:	<ul style="list-style-type: none"> • 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. 			
BLA0912-250R v.2	20101015	Product data sheet	-	BLA0912-250R v.1
BLA0912-250R v.1	20100303	Product data sheet	-	-

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".

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14. Contents

1	Product profile	1
1.1	General description	1
1.2	Features and benefits	1
1.3	Applications	1
2	Pinning information	2
3	Ordering information	2
4	Limiting values	2
5	Thermal characteristics	2
6	Characteristics	3
6.1	Ruggedness in class-AB operation	3
7	Application information	4
7.1	Impedance information	4
7.2	Application circuit	4
8	Test information	7
8.1	RF performance	7
9	Package outline	9
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	12
13	Contact information	12
14	Contents	13

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Date of release: 1 December 2010

Document identifier: BLA0912-250R