BLA6H0912-500

LDMOS avionics radar power transistor

Rev. 04 — 10 May 2010 **Product data sheet**

1. Product profile

1.1 General description

500 W LDMOS power transistor intended for avionics transmitter applications in the 960 MHz to 1215 MHz range such as Mode-S, TCAS, JTIDS, DME and TACAN.

Table 1. Test information

Typical RF performance at T_{case} = 25 °C; t_p = 128 μs; δ = 10 %; I_{Dq} = 100 mA; in a class-AB production test circuit.

Mode of operation	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)	t_r (ns)	t_f (ns)
pulsed RF	960 to 1200	50	450	17	50	20	6

CAUTION

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

1.2 Features and benefits

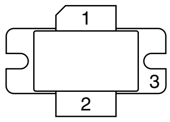
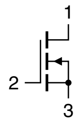
- Typical pulsed RF performance at a frequency of 960 MHz to 1215 MHz, a supply voltage of 50 V, an I_{Dq} of 100 mA, a t_p of 128 μs with δ of 10 %:
  - Output power = 450 W
  - Power gain = 17 dB
  - Efficiency = 50 %
- Easy power control
- Integrated ESD protection
- High flexibility with respect to pulse formats
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (960 MHz to 1215 MHz)
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- A-band power amplifiers for radar applications in the 960 MHz to 1215 MHz frequency range

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	drain		 sym112
2	gate		
3	source [1]		

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLA6H0912-500	-	flanged ceramic package; 2 mounting holes; 2 leads	SOT634A

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		-	100	V
V_{GS}	gate-source voltage		–0.5	+13	V
I_D	drain current		-	54	A
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
$Z_{th(j-c)}$	transient thermal impedance from junction to case	T_{case} = 85 °C; P_L = 450 W		
		t_p = 32 μs; δ = 2 %	0.03	K/W
		t_p = 128 μs; δ = 10 %	0.08	K/W
		t_p = 2400 μs; δ = 6.4 %	0.2	K/W

6. Characteristics

Table 6. DC 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 = 2.7 mA	100	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 270 mA	1.3	1.8	2.2	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 50 V	-	-	3.6	μA
I_{DSX}	drain cut-off current	$V_{GS} = V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	53.5	64	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	360	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 405 mA	2.50	3.5	4.55	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)}$ + 3.75 V; I_D = 14.18 A	-	70	85	mΩ

Table 7. RF characteristics

Mode of operation: pulsed RF; f = 960 MHz to 1215 MHz; t_p = 128 μs; δ = 10 %; RF performance at V_{DS} = 50 V; I_{Dq} = 100 mA; T_{case} = 25 °C; unless otherwise specified, in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
P_L	output power		-	450	-	W
V_{DS}	drain-source voltage	P_L = 450 W	-	-	50	V
G_p	power gain	P_L = 450 W	16	17	-	dB
RL_{in}	input return loss	P_L = 450 W	7	11	-	dB
η_D	drain efficiency	P_L = 450 W	45	50	-	%
$P_{droop(pulse)}$	pulse droop power	P_L = 450 W	-	0	0.3	dB
t_r	rise time	P_L = 450 W	-	20	50	ns
t_f	fall time	P_L = 450 W	-	6	50	ns

6.1 Ruggedness in class-AB operation

The BLA6H0912-500 is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: f = 960 MHz, 1030 MHz, 1090 MHz or 1215 MHz. V_{DS} = 50 V; I_{Dq} = 100 mA; P_L = 450 W; t_p = 128 μs; δ = 10 %.

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	1.36 – j1.45	1.49 – j1.48
1030	1.54 – j1.25	1.51 – j1.45
1090	1.67 – j1.22	1.36 – j1.47
1140	1.68 – j1.29	1.15 – j1.41
1215	1.43 – j1.42	0.79 – j1.17

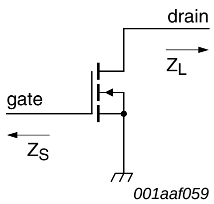
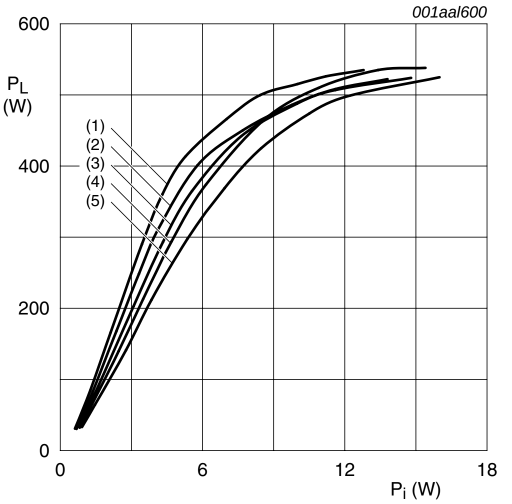


Fig 1. Definition of transistor impedance

7.2 Performance curves



V_{DS} = 50 V; I_{Dq} = 100 mA; t_p = 128 μs; δ = 10 %.

(1) f = 960 MHz

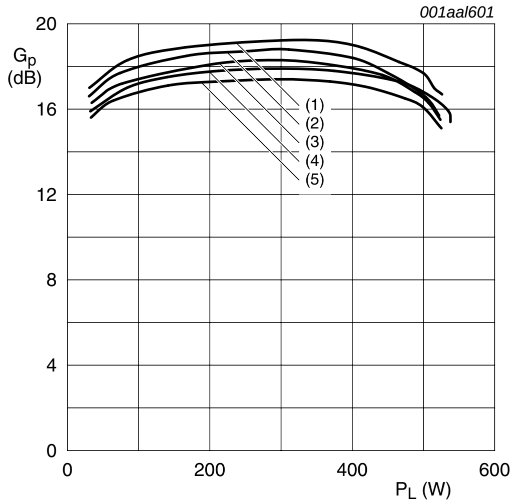
(2) f = 1030 MHz

(3) f = 1090 MHz

(4) f = 1140 MHz

(5) f = 1215 MHz

Fig 2. Load power as a function of input power; typical values



V_{DS} = 50 V; I_{Dq} = 100 mA; t_p = 128 μs; δ = 10 %.

(1) f = 960 MHz

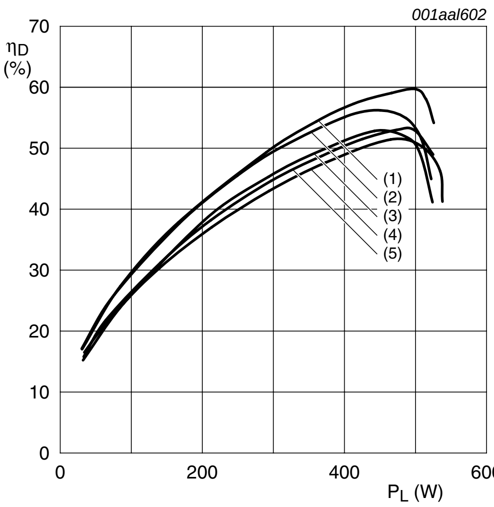
(2) f = 1030 MHz

(3) f = 1090 MHz

(4) f = 1140 MHz

(5) f = 1215 MHz

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



V_{DS} = 50 V; I_{Dq} = 100 mA; t_p = 128 μs; δ = 10 %.

(1) f = 960 MHz

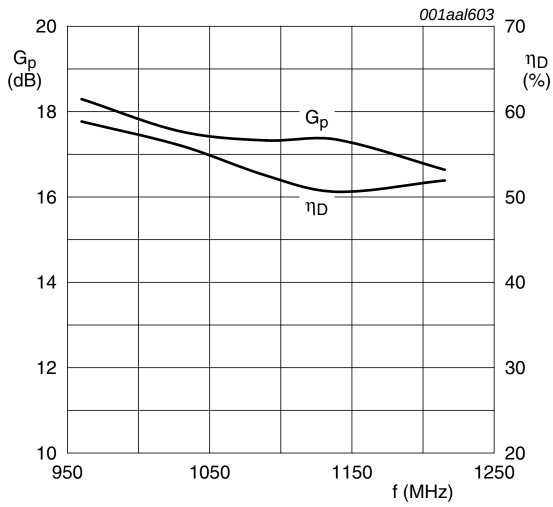
(2) f = 1030 MHz

(3) f = 1090 MHz

(4) f = 1140 MHz

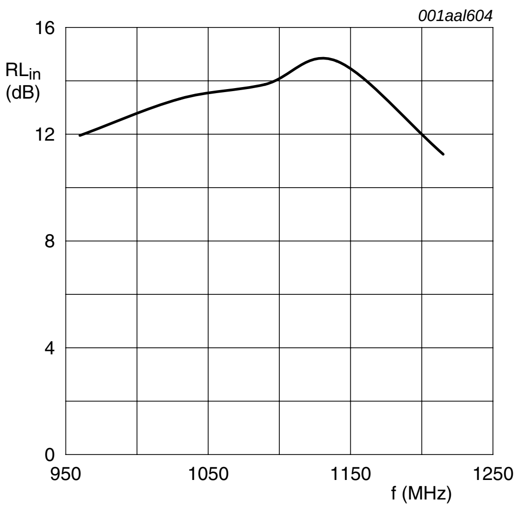
(5) f = 1215 MHz

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



V_{DS} = 50 V; I_{Dq} = 100 mA; t_p = 128 μs; δ = 10 %.

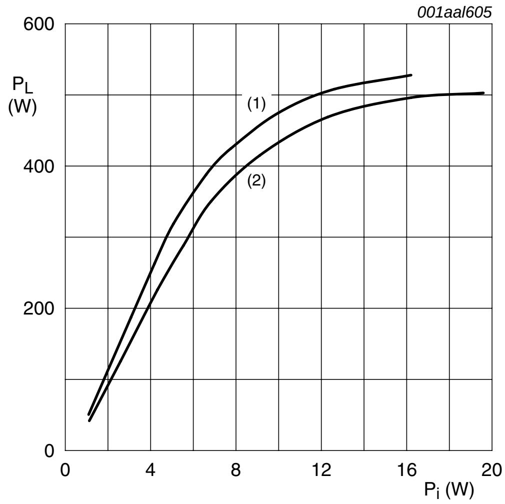
Fig 5. Power gain and drain efficiency as function of frequency; typical values



P_L = 500 W; V_{DS} = 50 V; I_{Dq} = 100 mA; t_p = 128 μs; δ = 10 %.

Fig 6. Input return loss as a function of frequency; typical values

7.3 Curves measured under Mode-S ELM pulse-conditions

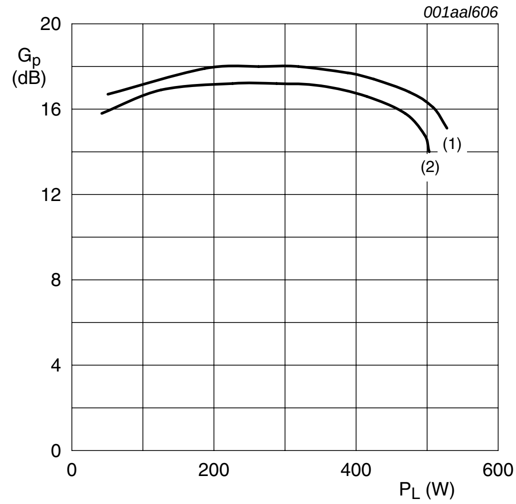


f = 1030 MHz; V_{DS} = 50 V; I_{Dq} = 100 mA.

(1) T_h = 25 °C

(2) T_h = 65 °C

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

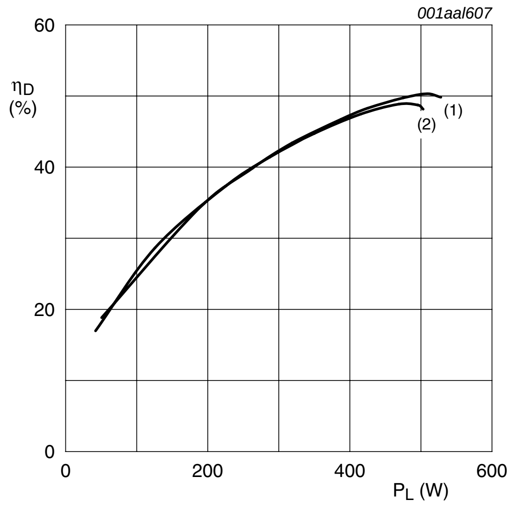


f = 1030 MHz; V_{DS} = 50 V; I_{Dq} = 100 mA.

(1) T_h = 25 °C

(2) T_h = 65 °C

Fig 8. Power gain as a function of load power; typical values



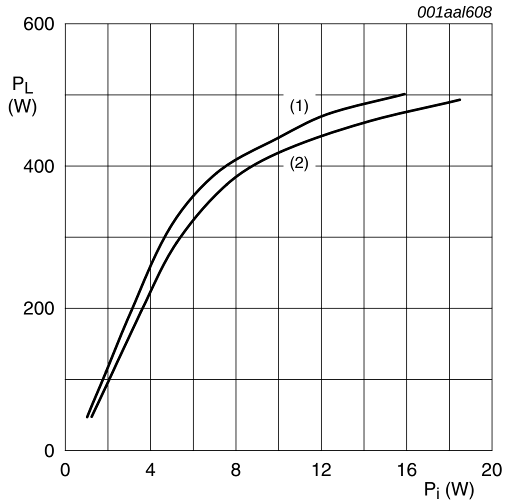
f = 1030 MHz; V_{DS} = 50 V; I_{Dq} = 100 mA.

(1) T_h = 25 °C

(2) T_h = 65 °C

Fig 9. Drain efficiency as function of load power; typical values

7.4 Curves measured under Mode-S interrogator pulse-conditions

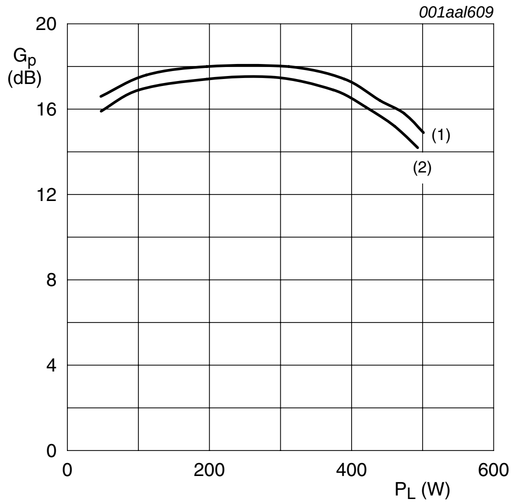


f = 1030 MHz; V_{DS} = 50 V; I_{Dq} = 100 mA.

(1) T_h = 25 °C

(2) T_h = 65 °C

Fig 10. Load Power as a function of input power; typical values

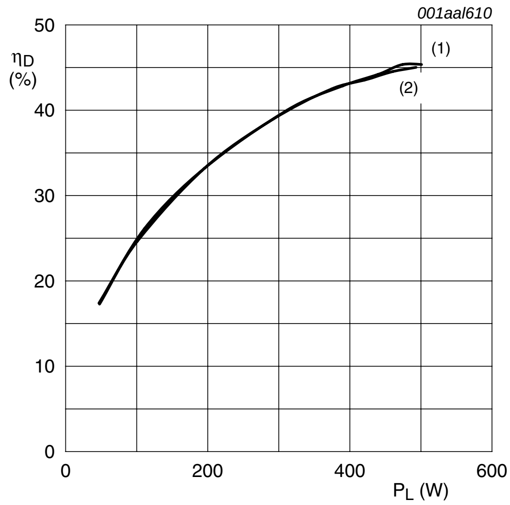


f = 1030 MHz; V_{DS} = 50 V; I_{Dq} = 100 mA.

(1) T_h = 25 °C

(2) T_h = 65 °C

Fig 11. Power gain as a function of load power; typical values



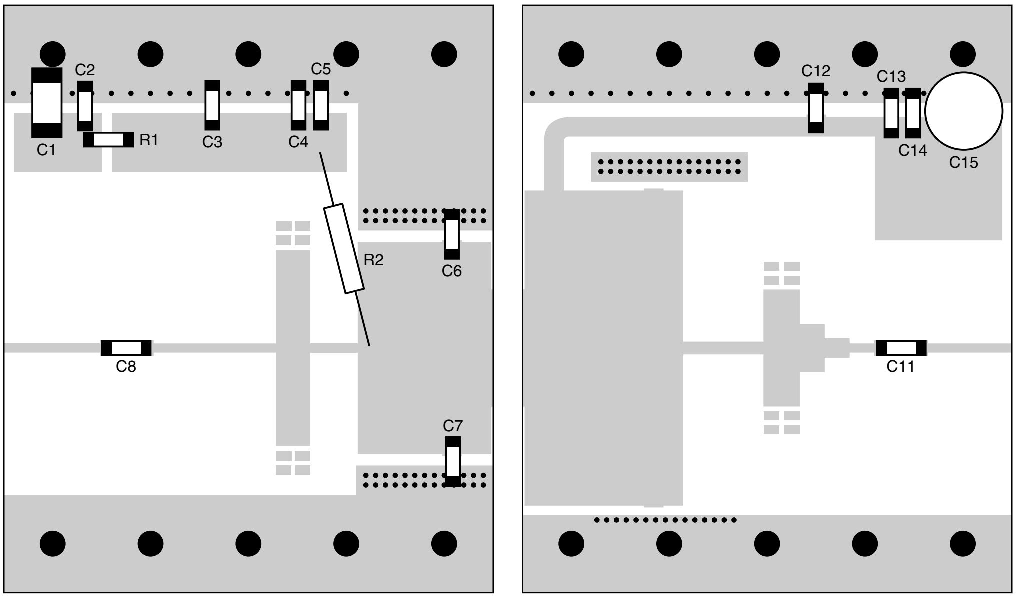
f = 1030 MHz; V_{DS} = 50 V; I_{Dq} = 100 mA.

(1) T_h = 25 °C

(2) T_h = 65 °C

Fig 12. Drain efficiency as function of load power; typical values

8. Test information



Printed-Circuit Board (PCB) material: Duroid 6006 with ε_r = 6.15 and thickness = 0.64 mm.

See Table 9 for list of components.

Fig 13. Component layout

Table 9. List of components

See Figure 13 for component layout.

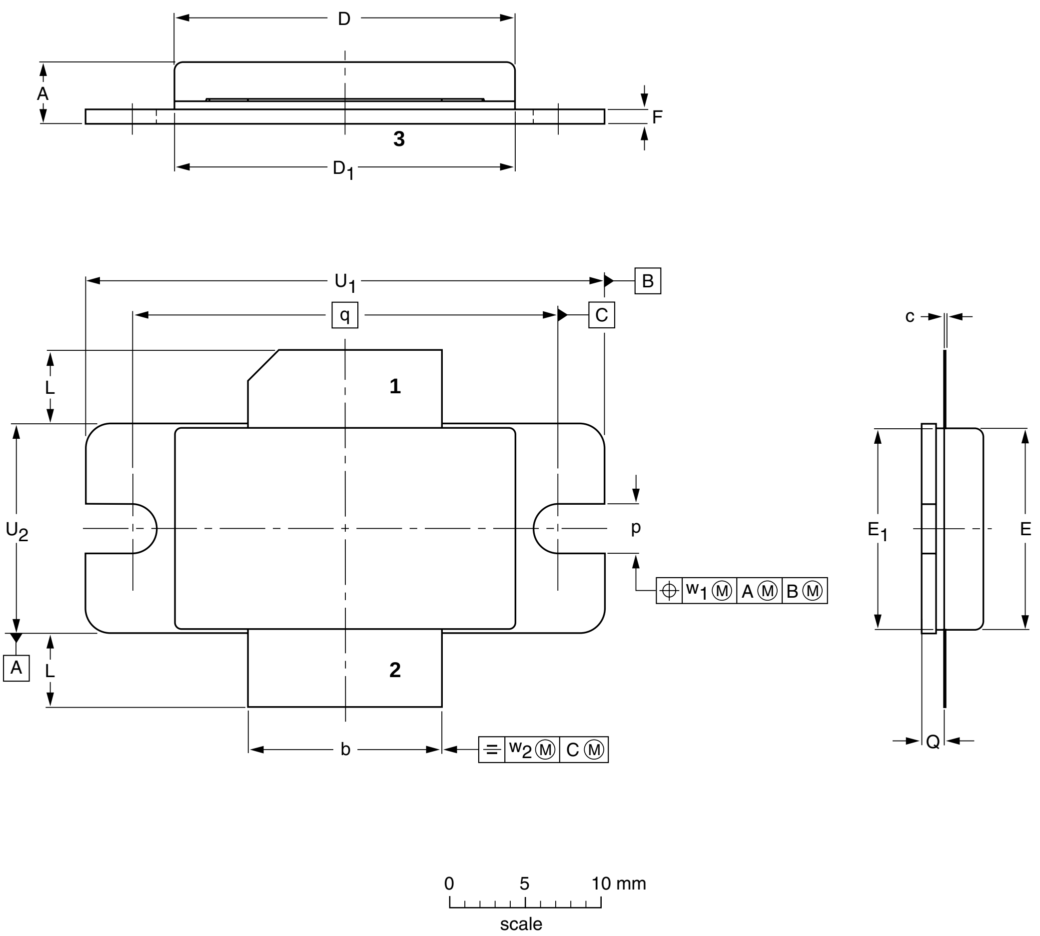
Component	Description	Value		Remarks
C1, C3	multilayer ceramic chip capacitor	10 μF; 35 V		
C2, C3, C14	multilayer ceramic chip capacitor	39 pF	[1]	
C4, C13	multilayer ceramic chip capacitor	1 nF	[1]	
C6, C7	multilayer ceramic chip capacitor	6.8 pF	[2]	
C5, C8, C11, C12	multilayer ceramic chip capacitor	82 pF	[2]	
C15	electrolytic capacitor	47 μF; 63 V		
R1	SMD resistor	56 Ω		SMD 0603
R2	metal film resistor	51 Ω		

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

[2] American Technical Ceramics type 800B or capacitor of same quality.

9. Package outline

Flanged ceramic package; 2 mounting holes; 2 leads **SOT634A**



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

UNIT	A	b	c	D	D_1	E	E_1	F	L	p	Q	q	U_1	U_2	w_1	w_2
mm	4.83 3.68	12.82 12.57	0.15 0.08	22.58 22.12	22.56 22.15	13.34 13.08	13.34 13.08	1.14 0.89	5.33 4.32	3.38 3.12	1.70 1.45	27.94	34.16 33.91	13.84 13.59	0.25	0.51
inches	0.190 0.145	0.505 0.495	0.006 0.003	0.889 0.871	0.888 0.872	0.525 0.515	0.525 0.515	0.045 0.035	0.210 0.170	0.133 0.123	0.067 0.057	1.100	1.345 1.335	0.545 0.535	0.010	0.020

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT634A						~~01-11-27~~ 03-05-01

Fig 14. Package outline SOT634A

10. Abbreviations

Table 10. Abbreviations

Acronym	Description
DME	Distance Measuring Equipment
ELM	Extended Length Message
JTIDS	Joint Tactical Information Distribution System
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
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 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLA6H0912-500_4	20100510	Product data sheet	-	BLA6H0912-500_3
Modifications:	• Section 1.3 on page 2: the application has been corrected.			
BLA6H0912-500_3	20100330	Product data sheet	-	BLA6H0912-500_2
BLA6H0912-500_2	20100302	Product data sheet	-	BLA6H0912-500_1
BLA6H0912-500_1	20090305	Objective 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".

[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.nxp.com.

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14. Contents

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Date of release: 10 May 2010

Document identifier: BLA6H0912-500_4