BLA6H0912-500

LDMOS avionics radar power transistor

Rev. 03 — 30 March 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 $T_{case} = 25\ ^\circ C$; $t_p = 128\ \mu s$; $\delta = 10\ \%$; $I_{Dq} = 100\ mA$; in a class-AB production test circuit.

Mode of operation	f	V_{DS}	P_L	G_p	η_D	t_r	t_f
	(MHz)	(V)	(W)	(dB)	(%)	(ns)	(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
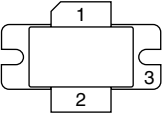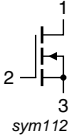■ Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

■ L-band power amplifiers for radar applications in the 1.2 GHz to 1.4 GHz frequency range

2. Pinning information

Table 2.   Pinning

Pin	Description	Simplified outline	Graphic symbol
1	drain		
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

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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	Z_S	Z_L
MHz	Ω	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
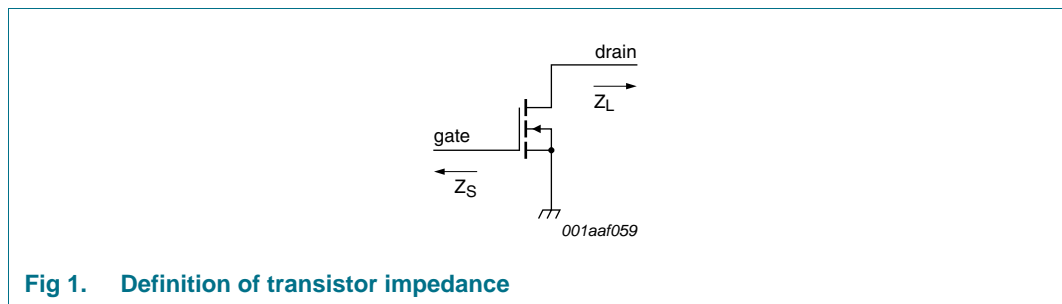
Fig 1. Definition of transistor impedance

7.2 Application circuit

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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 2.   Component layout
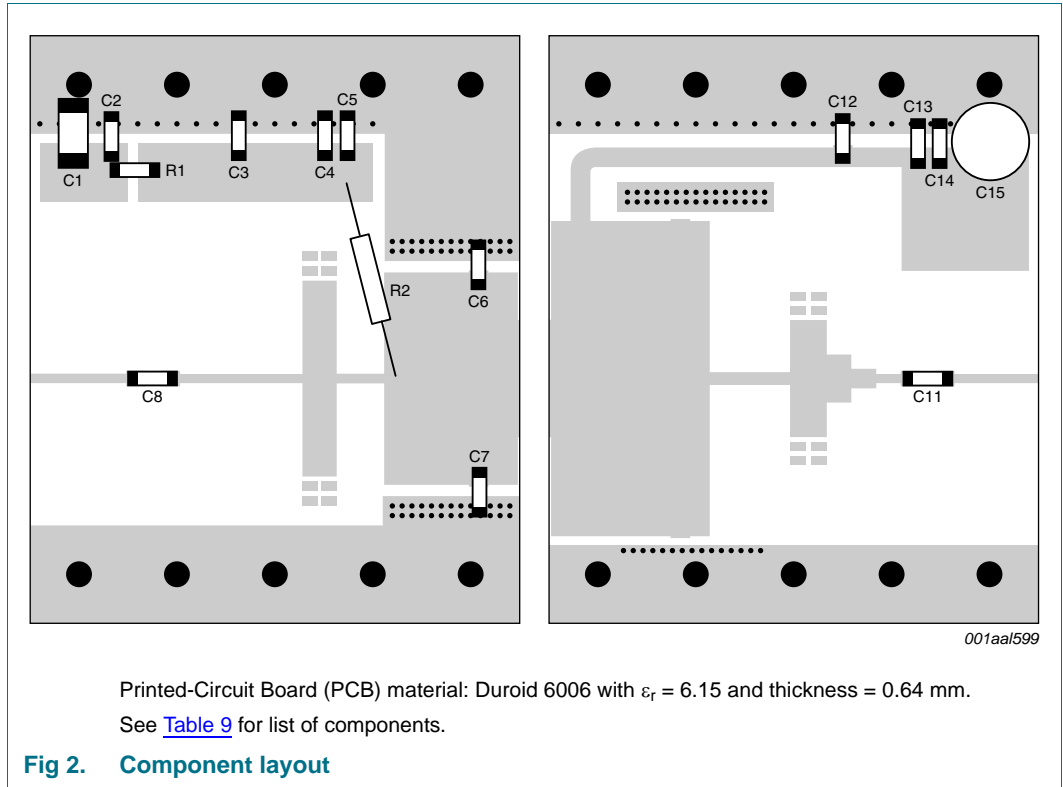
Table 9.   List of components
See Figure 2 for component layout.

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.

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8. Test information

8.1 Performance curves

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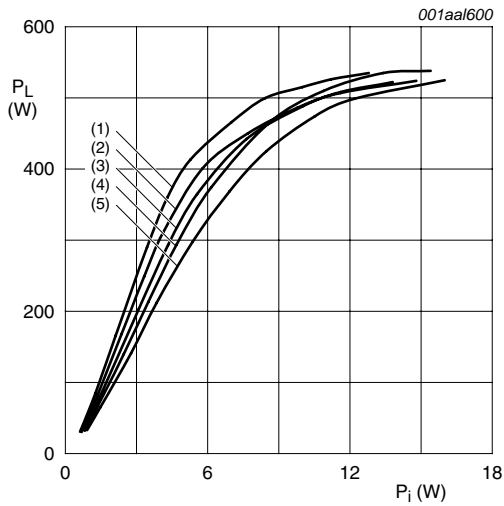
V_{DS} = 50 V; I_{Dq} = 100 mA; t_p = 128 μs; δ = 10 %.

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

Fig 3. Load power as a function of input power; typical values

001aal601
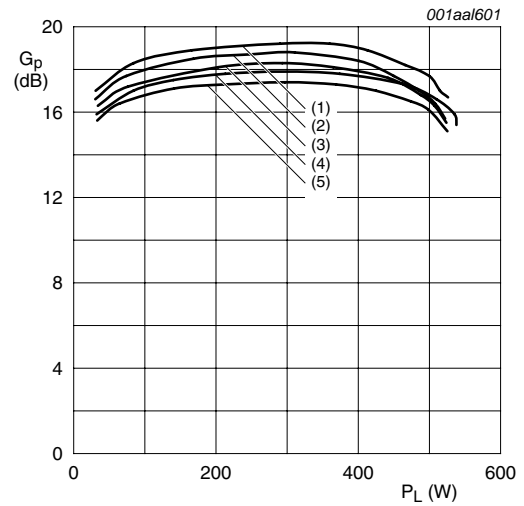
V_{DS} = 50 V; I_{Dq} = 100 mA; t_p = 128 μs; δ = 10 %.

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

Fig 4. Power gain as a function of load power; typical values

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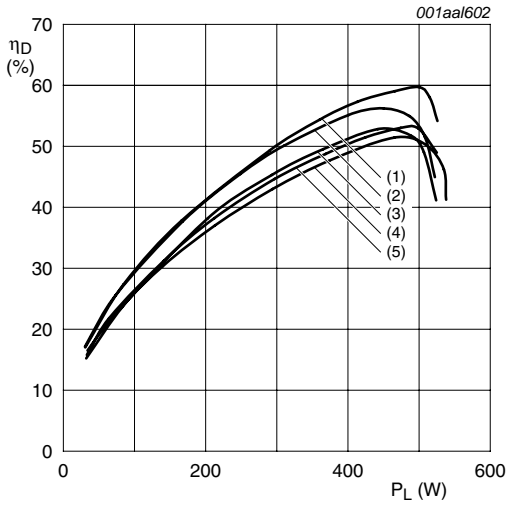
V_{DS} = 50 V; I_{Dq} = 100 mA; t_p = 128 µs; δ = 10 %.

(1) f = 960 MHz

(2) f = 1030 MHz

(3) f = 1090 MHz

(4) f = 1140 MHz

(5) f = 1215 MHz

Fig 5. **Drain efficiency as a function of load power; typical values**
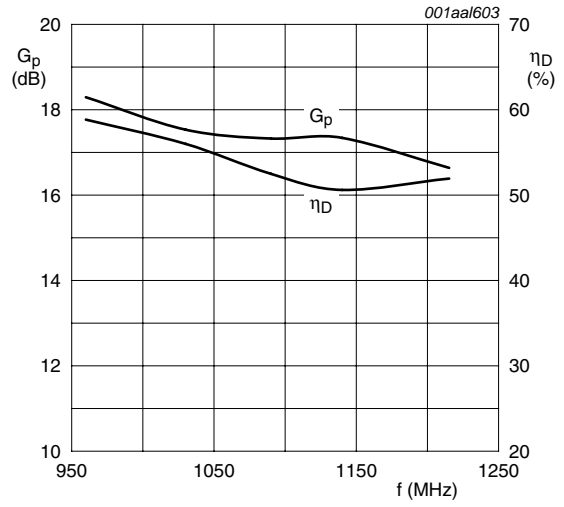
V_{DS} = 50 V; I_{Dq} = 100 mA; t_p = 128 µs; δ = 10 %.

**Fig 6.** **Power gain and drain efficiency as function of frequency; typical values**
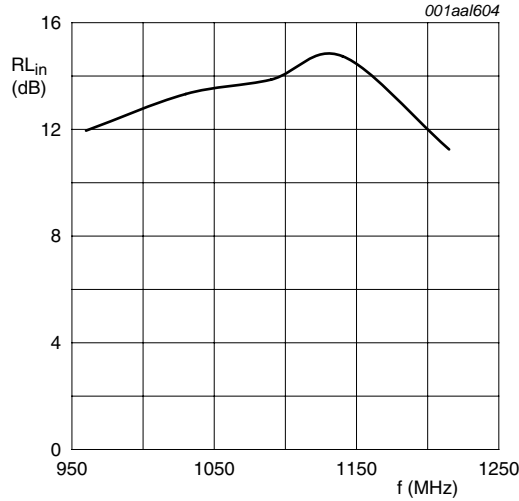
P_L = 500 W; V_{DS} = 50 V; I_{Dq} = 100 mA; t_p = 128 µs; δ = 10 %.

Fig 7. **Input return loss as a function of frequency; typical values**

8.2 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 8. 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 9. 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

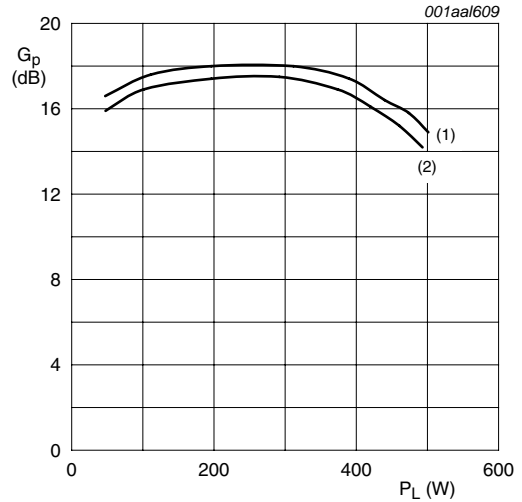**Fig 10. Drain efficiency as function of load power; typical values**
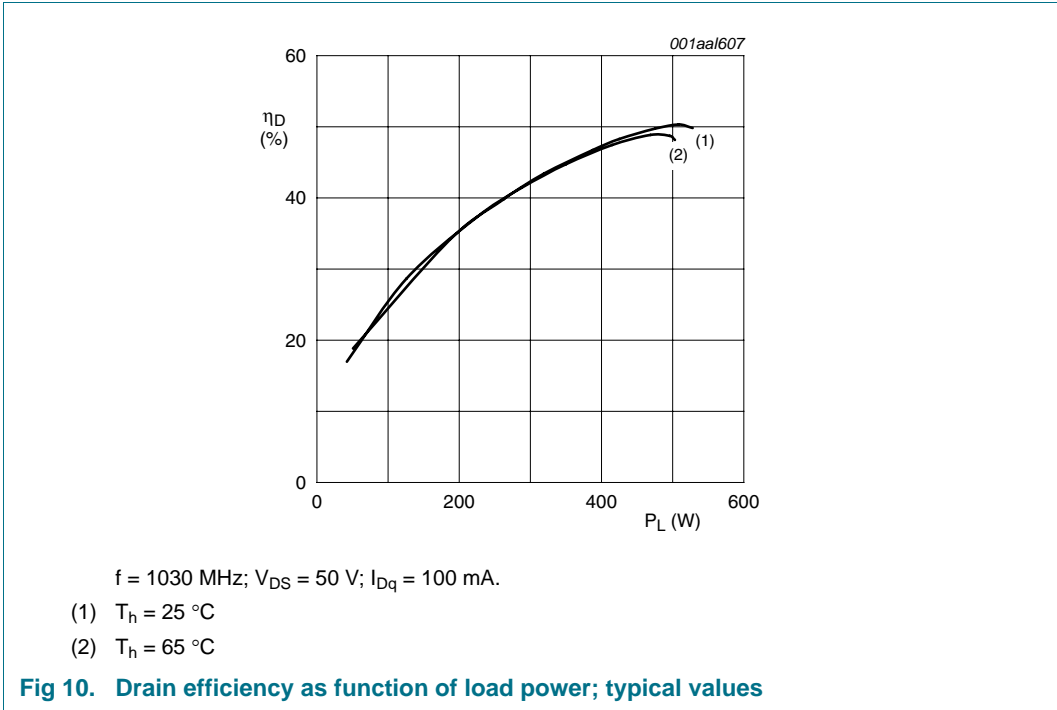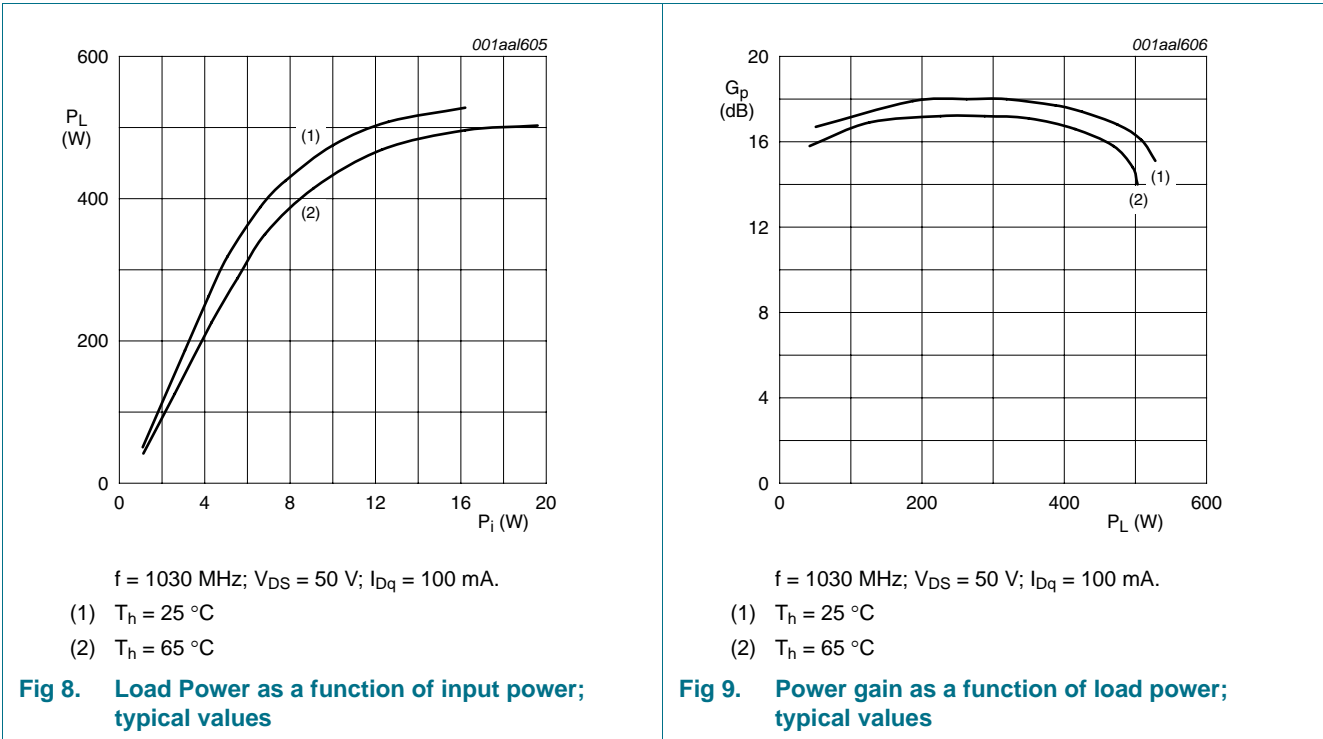
8.3 Curves measured under Mode-S interrogator pulse-conditions

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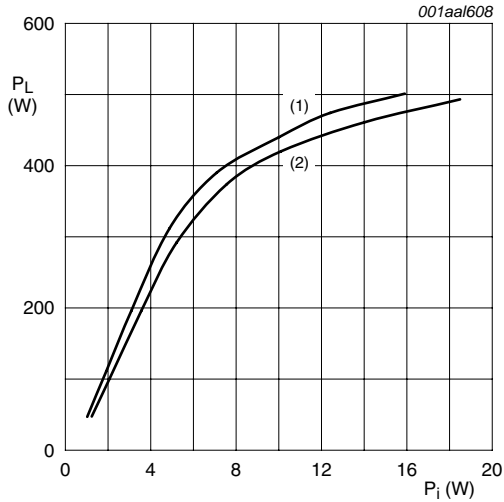
f = 1030 MHz; V_{DS} = 50 V; I_{Dq} = 100 mA.

(1) T_h = 25 °C

(2) T_h = 65 °C

Fig 11. Load Power as a function of input power; typical values

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

(1) T_h = 25 °C

(2) T_h = 65 °C

Fig 12. Power gain as a function of load power; typical values

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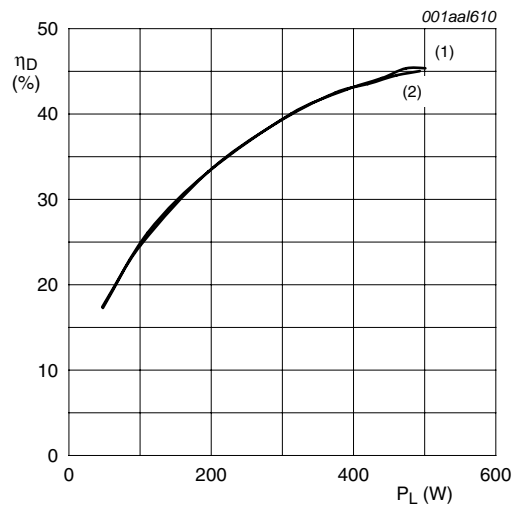
f = 1030 MHz; V_{DS} = 50 V; I_{Dq} = 100 mA.

(1) T_h = 25 °C

(2) T_h = 65 °C

Fig 13. Drain efficiency as function of load power; typical values

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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	D₁	E	E₁	F	L	p	Q	q	U₁	U₂	w₁	w₂
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_3	20100330	Product data sheet	-	BLA6H0912-500_2
Modifications:	• Table 7 on page 3: V_{CC} changed into V_{DS}. • Table 1 on page 1: changed value of P_L. • Table 4 on page 2: changed minimum value of V_{GS}. • Table 5 on page 2: changed several values. • Table 6 on page 3: changed several values. • Table 7 on page 3: changed several values. • Section 6.1 on page 3: changed several values. • Table 8 on page 4: changed several values. • Added Section 7.2 on page 5. • Added Section 8 on page 6.			
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".

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