BLA1011-300

Avionics LDMOS transistors

Rev. 02 — 5 February 2008 Product data sheet

1. Product profile

1.1 General description

300 W LDMOS pulsed power transistor for TCAS and IFF applications at frequencies from 1030 MHz to 1090 MHz.

Table 1. Typical performance

RF performance at T_{case} = 25 °C in a common source class-AB production test circuit; t_p = 50 µs; δ = 2 %.

Mode of operation	f (MHz)	I_{Dq} (mA)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
Pulsed class-AB	1030 to 1090	150	32	300	16.5	57

CAUTION

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

1.2 Features

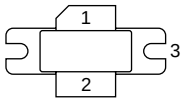
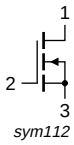
- Typical performance at frequencies between 1030 MHz and 1090 MHz, a supply voltage of 32 V, an I_{Dq} of 150 mA, a t_p of 50 µs and a δ of 2 %:
  - Output power = 300 W
  - Power gain = 16.5 dB (typ)
  - Efficiency = 57 % (typ)
- Easy power control
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for operation in 1030 MHz to 1090 MHz band
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- RF power amplifiers for Avionics applications in the 1030 MHz to 1090 MHz frequency band

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Symbol
1	drain		
2	gate		
3	source [1]		

sym112

[1] Connected to flange

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLA1011-300	-	flanged LDMOST ceramic package; 2 mounting holes; 2 leads	SOT957A

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		-	65	V
V_{GS}	gate-source voltage		–0.5	+15	V
I_D	drain current		-	15	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	Max	Unit
$Z_{th(j-h)}$	transient thermal impedance from junction to heatsink	T_{case} = 25 °C; t_p = 50 µs; δ = 2 %; P_L = 300 W	0.1	0.15	K/W

6. Characteristics

Table 6. 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 = 3.75 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 20 V; I_D = 375 mA	5.2	5.6	6.2	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 32 V; I_D = 150 mA	-	5.48	-	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 32 V	-	-	3.3	µA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 6 V; V_{DS} = 10 V	50	63	73	A
I_{GSS}	gate leakage current	V_{GS} = 13 V; V_{DS} = 0 V	-	-	60	nA
g_{fs}	forward transconductance	V_{DS} = 20 V; I_D = 24 A	-	15	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 6 V; I_D =13.5 A	-	55	80	mΩ

7. Application information

Table 7. Application information

Mode of operation: Pulsed RF; t_p = 50 µs; δ = 2 %; V_{DS} = 32 V; I_{Dq} = 150 mA; T_{case} = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
P_L	output power		300	-	-	W
G_p	power gain	P_L = 300 W	15	16.5	-	dB
RL_{in}	input return loss	P_L = 300 W	-	10	-	dB
η_D	drain efficiency	P_L = 300 W	52	57	-	%
t_r	rise time	P_L = 300 W	-	30	50	ns
t_f	fall time	P_L = 300 W	-	5	50	ns
$P_{droop(pulse)}$	pulse droop power	P_L = 300 W	-	0	0.2	dB

Table 8. Typical impedance

f	Z_S	Z_L
MHz	Ω	Ω
1030	4.25 – j3.57	1.27 – j0.33
1060	4.24 – j3.56	1.04 – j0.41
1090	4.47 – j3.71	0.91 – j0.60

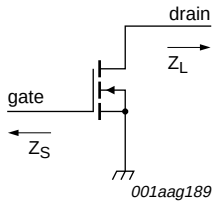
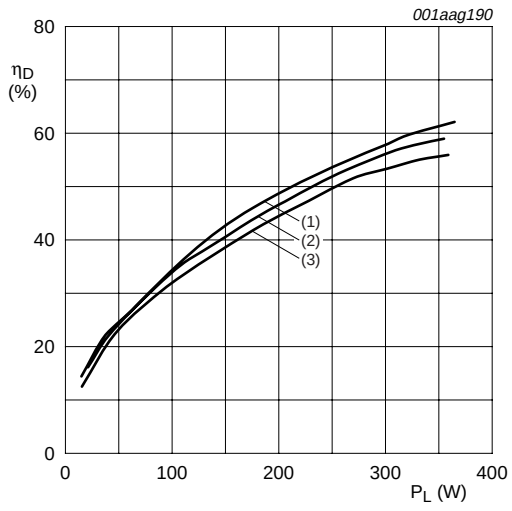


Fig 1. Definition of transistor impedance

7.1 Ruggedness in class-AB operation

The BLA1011-300 is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: V_{DS} = 32 V; I_{Dq} = 150 mA; P_L = 300 W; f = 1030 MHz to 1090 MHz.



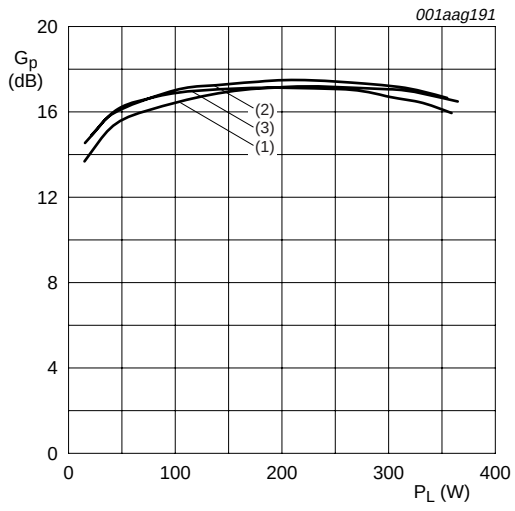
(1) f = 1030 MHz

(2) f = 1060 MHz

(3) f = 1090 MHz

BLA1011-300 in a wideband circuit; V_{DS} = 32 V; I_{Dq} = 150 mA; t_p = 50 µs; δ = 2 %.

Fig 2. Drain efficiency as functions of load power; typical values



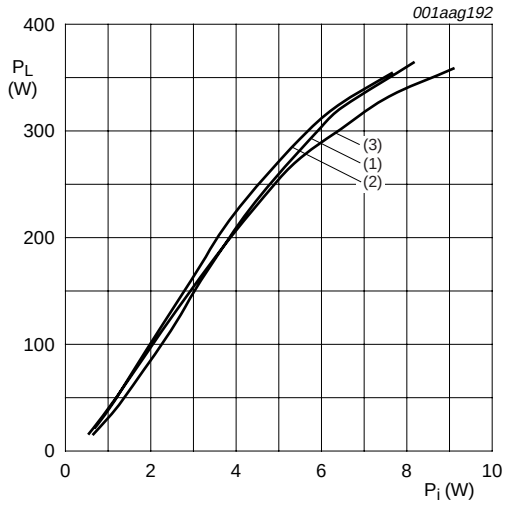
(1) f = 1030 MHz

(2) f = 1060 MHz

(3) f = 1090 MHz

BLA1011-300 in a wideband circuit; V_{DS} = 32 V; I_{Dq} = 150 mA; t_p = 50 µs; δ = 2 %.

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



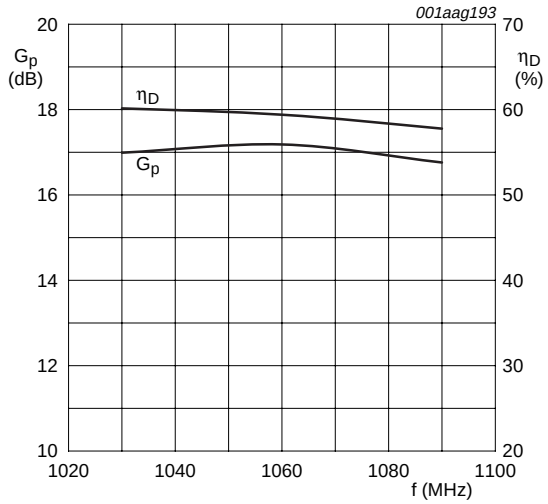
(1) f = 1030 MHz

(2) f = 1060 MHz

(3) f = 1090 MHz

BLA1011-300 in a wideband circuit; V_{DS} = 32 V; I_{Dq} = 150 mA; t_p = 50 µs; δ = 2 %.

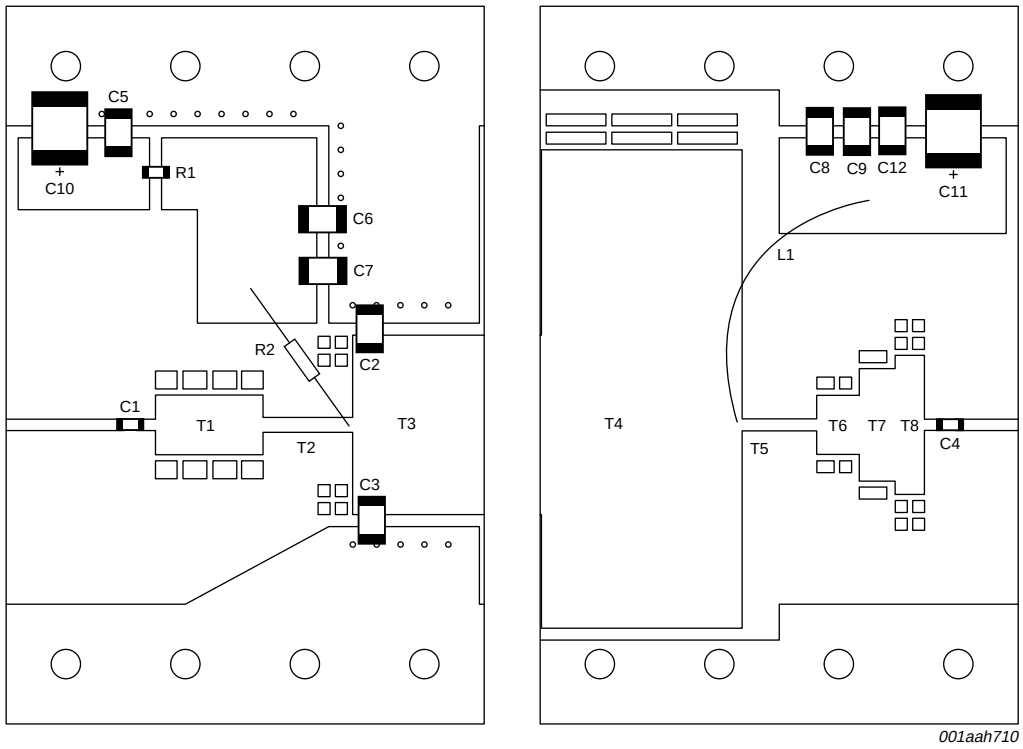
Fig 4. Load power as a function of input power; typical values



V_{DS} = 32 V; I_{Dq} = 150 mA; t_p = 50 µs; δ = 2 %.

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

8. Test information



Printed-Circuit Board (PCB): Rogers Duroid 6006; ε_r = 6.2 F/m; height = 0.64 mm.

See Table 9 for list of components.

Fig 6. Component layout for common source class-AB pulsed production test circuit

Table 9. List of components (see Figure 6)

To ensure good power supply of the device, adding an electrolytic capacitor close to the supply connection of the circuit may be required. The actual capacitor value may differ depending on the pulse format, the quality of the power supply and the length of the connecting wires to the power supply. In general a value of 470 µF will be sufficient.

Component	Description	Value		Remarks
C1, C4	multilayer ceramic chip capacitor	62 pF	[1]	
C2, C3	multilayer ceramic chip capacitor	1.5 pF	[2]	
C5	multilayer ceramic chip capacitor	100 pF	[2]	
C6, C8	multilayer ceramic chip capacitor	62 pF	[2]	
C7	multilayer ceramic chip capacitor	10 pF	[2]	
C9	multilayer ceramic chip capacitor	1.2 nF	[1]	
C10	electrolytic capacitor	47 µF; 20 V		
C11	electrolytic capacitor	47 µF; 63 V		
C12	multilayer ceramic chip capacitor	47 pF	[1]	
L1	Ω-shaped enameled copper wire	d = 1 mm; length = 38 mm		
R1	SMD resistor	18 Ω		0508 package

Table 9. List of components (see Figure 6) *…continued*

To ensure good power supply of the device, adding an electrolytic capacitor close to the supply connection of the circuit may be required. The actual capacitor value may differ depending on the pulse format, the quality of the power supply and the length of the connecting wires to the power supply. In general a value of 470 μF will be sufficient.

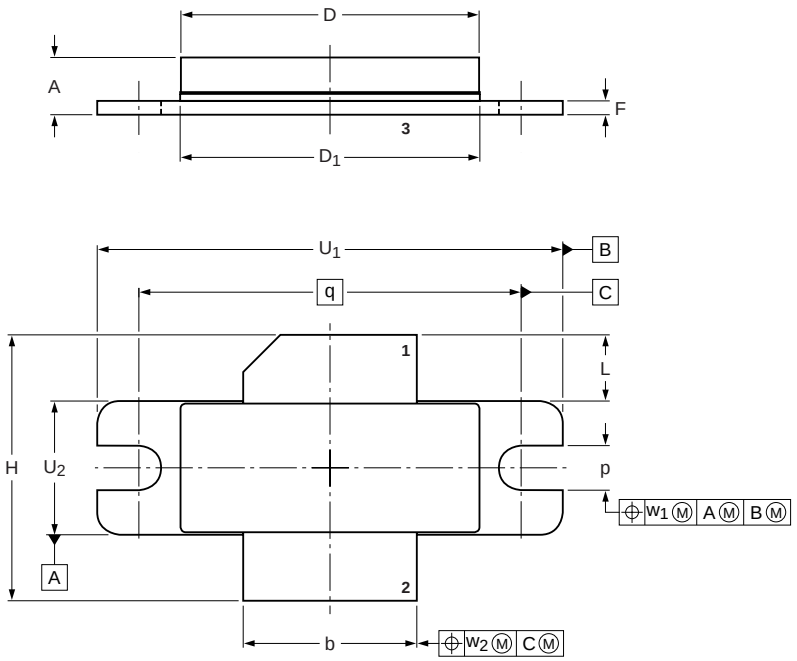
Component	Description	Value	Remarks
R2	metal film resistor	49.9 Ω	
T1	stripline	-	(W × L) 5 mm × 9 mm
T2	stripline	-	(W × L) 1.25 mm × 7.5 mm
T3	stripline	-	(W × L) 15 mm × 11 mm
T4	stripline	-	(W × L) 40 mm × 16.8 mm
T5	stripline	-	(W × L) 1 mm × 6.25 mm
T6	stripline	-	(W × L) 4.95 mm × 3.55 mm
T7	stripline	-	(W × L) 9.4 mm × 3 mm
T8	stripline	-	(W × L) 12 mm × 2.45 mm

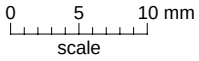
[1] American Technical Ceramics type 100A or capacitor of same quality.

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

9. Package outline

Flanged LDMOST ceramic package; 2 mounting holes; 2 leads **SOT957A**





DIMENSIONS (mm are the original dimensions)

UNIT	A	b	c	D	D_1	E	E_1	F	H	L	P	Q	q	U_1	U_2	w_1	w_2
mm	4.67 4.08	12.83 12.57	0.15 0.10	22.07 21.62	22.04 21.64	9.53 9.27	9.55 9.25	1.14 0.89	19.94 18.92	5.33 4.31	3.38 3.12	1.70 1.45	27.94	34.16 33.91	9.91 9.65	0.25	0.25
inches	0.184 0.1605	0.505 0.495	0.006 0.004	0.869 0.851	0.868 0.852	0.375 0.365	0.376 0.364	0.045 0.035	0.785 0.745	0.210 0.170	0.133 0.123	0.067 0.057	1.100	1.345 1.335	0.390 0.380	0.01	0.01

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT957A						~~06-06-29~~ 07-03-01

Fig 7. Package outline SOT957A

10. Abbreviations

Table 10. Abbreviations

Acronym	Description
IFF	Identification Friend or Foe
LDMOS	Laterally Diffused Metal Oxide Semiconductor
LDMOST	Laterally Diffused Metal-Oxide Semiconductor Transistor
RF	Radio Frequency
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
BLA1011-300_2	20080205	Product data sheet	-	BLA1011-300_1
Modifications:	• Section 1.2 “Features” on page 1: added RoHS compliance statement • Added Section 8 “Test information” on page 6.			
BLA1011-300_1	20070403	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".

[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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