

# BLA6H1011-600

LDMOS avionics power transistor

Rev. 01 — 22 April 2010

Product data sheet

## 1. Product profile

### 1.1 General description

600 W LDMOS pulsed power transistor intended for TCAS and IFF applications in the 1030 MHz to 1090 MHz range.

**Table 1. Test information**

Typical RF performance at  $T_{case} = 25\text{ °C}$ ;  $t_p = 50\ \mu\text{s}$ ;  $\delta = 2\%$ ;  $I_{DQ} = 100\ \text{mA}$ ; in a class-AB production test circuit.

Mode of operation	f (MHz)	V <sub>DS</sub> (V)	P <sub>L</sub> (W)	G <sub>p</sub> (dB)	$\eta_D$ (%)	t <sub>r</sub> (ns)	t <sub>f</sub> (ns)
pulsed RF	1030 to 1090	48	600	17	52	11	5

#### 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 1030 MHz to 1090 MHz, a supply voltage of 48 V, an  $I_{DQ}$  of 100 mA, a  $t_p$  of 50  $\mu\text{s}$  with  $\delta$  of 2 %:
  - ◆ Output power = 600 W
  - ◆ Power gain = 17 dB
  - ◆ Efficiency = 52 %
- Easy power control
- Integrated ESD protection
- High flexibility with respect to pulse formats
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (1030 MHz to 1090 MHz)
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding restriction of hazardous substances (RoHS)

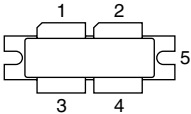
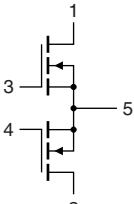


### 1.3 Applications

- 600 W LDMOS pulsed power transistor intended for TCAS and IFF applications in the 1030 MHz to 1090 MHz frequency range

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	drain1		 sym117
2	drain2		
3	gate1		
4	gate2		
5	source		

[1] Connected to flange.

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLA6H1011-600	-	flanged balanced LDMOST ceramic package; 2 mounting holes; 4 leads	SOT539A

## 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		-	72	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
$Z_{th(j-case)}$	transient thermal impedance from junction to case	$T_{case} = 85\text{ °C}; P_L = 600\text{ W}$		
		$t_p = 100\text{ }\mu\text{s}; \delta = 10\%$	0.06	K/W
		$t_p = 50\text{ }\mu\text{s}; \delta = 2\%$	0.035	K/W

## 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	$V_{GS} = 0\text{ V}$ ; $I_D = 2.7\text{ mA}$	100	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}$ ; $I_D = 270\text{ mA}$	1.25	1.8	2.25	V
$I_{DSS}$	drain leakage current	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$	-	-	1.4	$\mu\text{A}$
$I_{DSX}$	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ; $V_{DS} = 10\text{ V}$	32	42	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 11\text{ V}$ ; $V_{DS} = 0\text{ V}$	-	-	140	nA
$g_{fs}$	forward transconductance	$V_{DS} = 10\text{ V}$ ; $I_D = 270\text{ mA}$	1.6	3	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ; $I_D = 9.5\text{ A}$	-	100	169	$\text{m}\Omega$

**Table 7. RF characteristics**

Mode of operation: pulsed RF;  $t_p = 50\text{ }\mu\text{s}$ ;  $\delta = 2\%$ ; RF performance at  $V_{DS} = 48\text{ V}$ ;  $I_{Dq} = 100\text{ mA}$ ;  
 $T_{case} = 25\text{ }^\circ\text{C}$ ; unless otherwise specified, in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_L$	output power		600	-	-	W
$V_{DS}$	drain-source voltage	$P_L = 600\text{ W}$	-	-	48	V
$G_p$	power gain	$P_L = 600\text{ W}$	16	17	-	dB
$RL_{in}$	input return loss	$P_L = 600\text{ W}$	8	12	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression		-	700	-	W
$\eta_D$	drain efficiency	$P_L = 600\text{ W}$	47	52	-	%
$P_{droop(pulse)}$	pulse droop power	$P_L = 600\text{ W}$	-	0	0.3	dB
$t_r$	rise time	$P_L = 600\text{ W}$	-	11	30	ns
$t_f$	fall time	$P_L = 600\text{ W}$	-	5	30	ns

### 6.1 Ruggedness in class-AB operation

The BLA6H1011-600 is capable of withstanding a load mismatch corresponding to  $V_{SWR} = 5 : 1$  through all phases under the following conditions:  $V_{DS} = 48\text{ V}$ ;  
 $I_{Dq} = 100\text{ mA}$ ;  $P_L = 600\text{ W}$ ;  $t_p = 50\text{ }\mu\text{s}$ ;  $\delta = 2\%$ ;  $f = 1030\text{ MHz}$ .

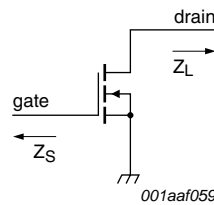
## 7. Application information

### 7.1 Impedance information

**Table 8. Typical impedance**

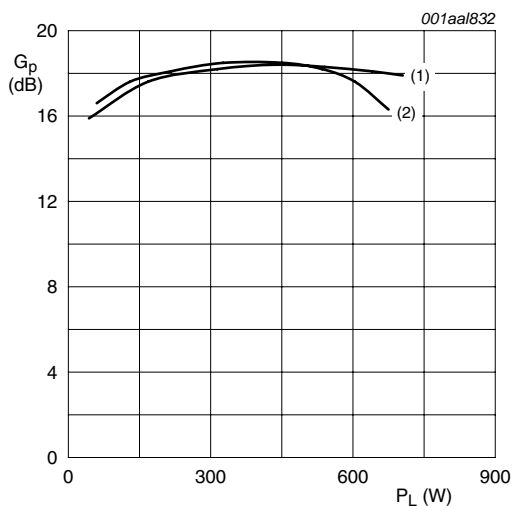
Typical values per section unless otherwise specified.

f MHz	$Z_S$ $\Omega$	$Z_L$ $\Omega$
1030	1.702 - j1.816	0.977 + j0.049
1060	1.815 - j1.760	1.033 + j0.221
1090	1.912 - j1.751	1.086 + j0.379



**Fig 1. Definition of transistor impedance**

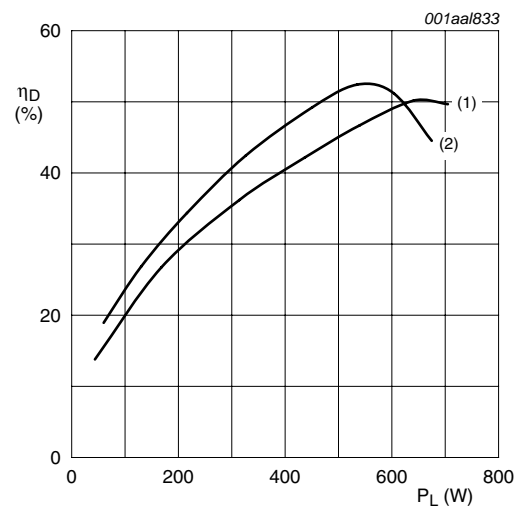
### 7.2 Performance curves



$T_h = 25\text{ }^\circ\text{C}$ ;  $V_{DS} = 48\text{ V}$ ;  $I_{DQ} = 100\text{ mA}$ ;  $t_p = 50\text{ }\mu\text{s}$ ;  
 $\delta = 2\text{ }\%$ .

- (1)  $f = 1030\text{ MHz}$
- (2)  $f = 1090\text{ MHz}$

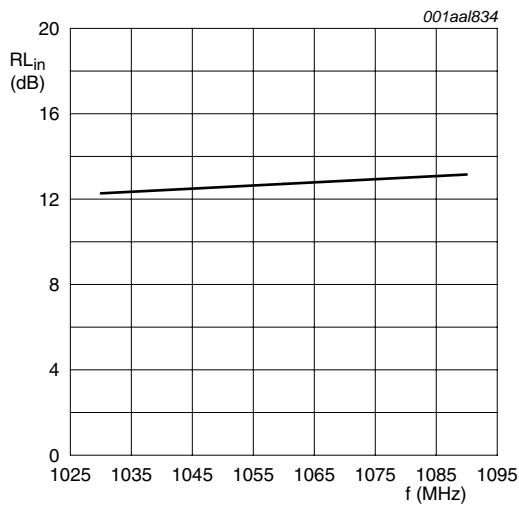
**Fig 2. Power gain as a function of load power; typical values**



$T_h = 25\text{ }^\circ\text{C}$ ;  $V_{DS} = 48\text{ V}$ ;  $I_{DQ} = 100\text{ mA}$ ;  $t_p = 50\text{ }\mu\text{s}$ ;  
 $\delta = 2\text{ }\%$ .

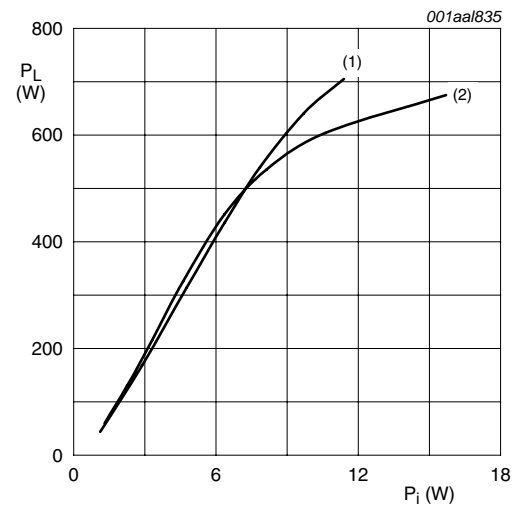
- (1)  $f = 1030\text{ MHz}$
- (2)  $f = 1090\text{ MHz}$

**Fig 3. Drain efficiency as a function of load power; typical values**



$T_h = 25\text{ }^\circ\text{C}$ ;  $P_L = 600\text{ W}$ ;  $V_{DS} = 48\text{ V}$ ;  $I_{DQ} = 100\text{ mA}$ ;  
 $t_p = 50\text{ }\mu\text{s}$ ;  $\delta = 2\%$ .

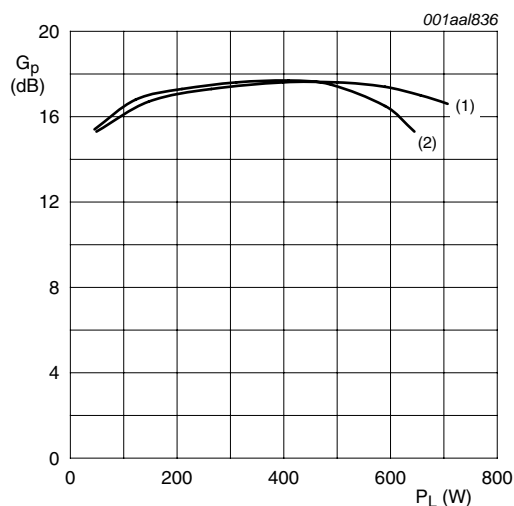
**Fig 4. Input return loss as a function of frequency; typical values**



$T_h = 25\text{ }^\circ\text{C}$ ;  $V_{DS} = 48\text{ V}$ ;  $I_{DQ} = 100\text{ mA}$ ;  $t_p = 50\text{ }\mu\text{s}$ ;  
 $\delta = 2\%$ .

- (1)  $f = 1030\text{ MHz}$   
 (2)  $f = 1090\text{ MHz}$

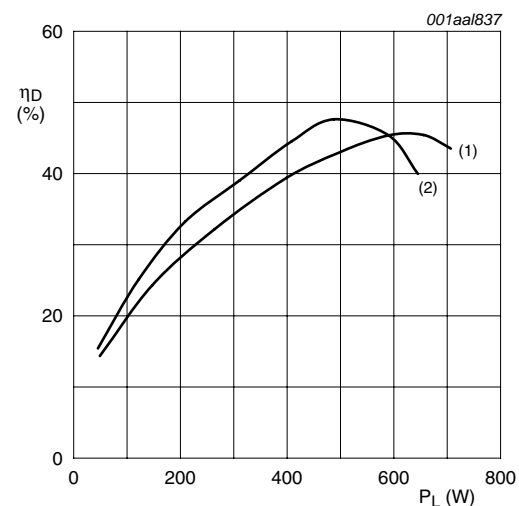
**Fig 5. Load power as a function of input power; typical values**



$T_h = 65\text{ }^\circ\text{C}$ ;  $V_{DS} = 48\text{ V}$ ;  $I_{DQ} = 100\text{ mA}$ ;  $t_p = 50\text{ }\mu\text{s}$ ;  
 $\delta = 2\%$ .

- (1)  $f = 1030\text{ MHz}$   
 (2)  $f = 1090\text{ MHz}$

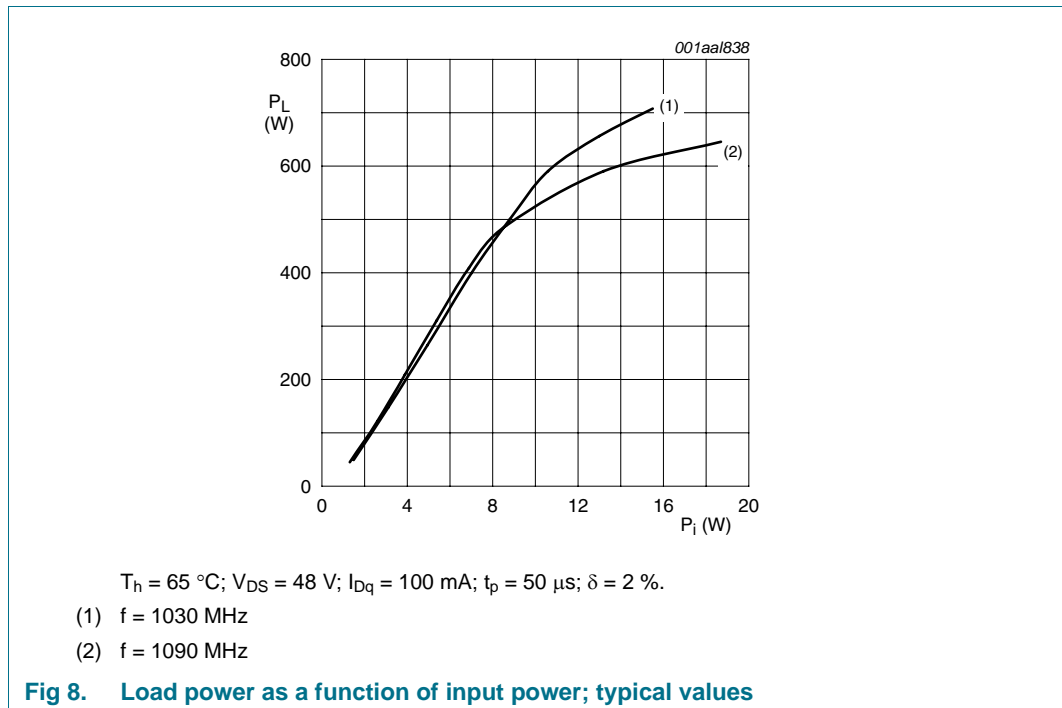
**Fig 6. Power gain as a function of load power; typical values**



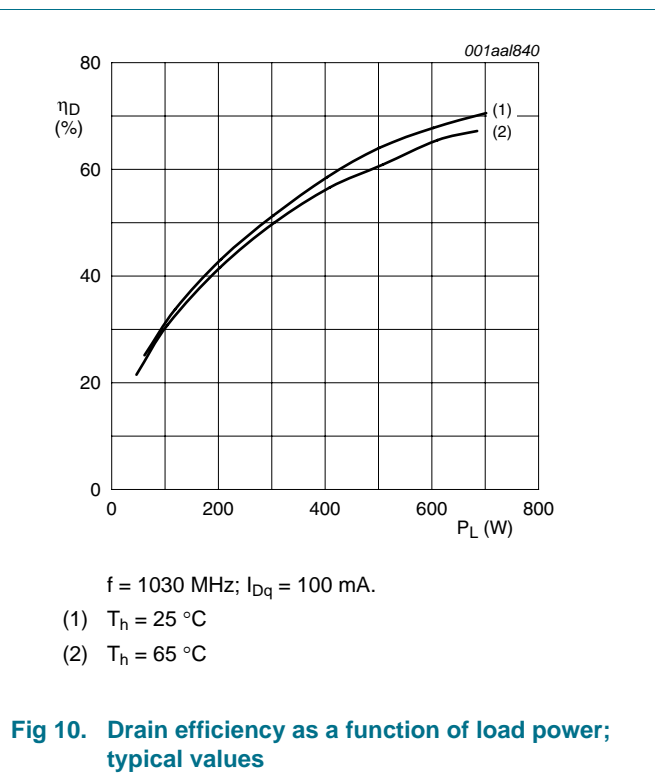
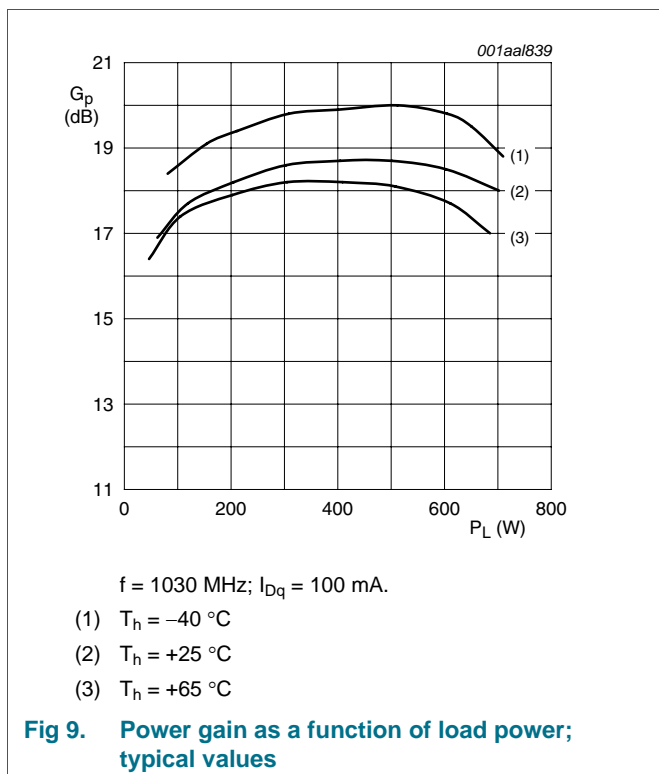
$T_h = 65\text{ }^\circ\text{C}$ ;  $V_{DS} = 48\text{ V}$ ;  $I_{DQ} = 100\text{ mA}$ ;  $t_p = 50\text{ }\mu\text{s}$ ;  
 $\delta = 2\%$ .

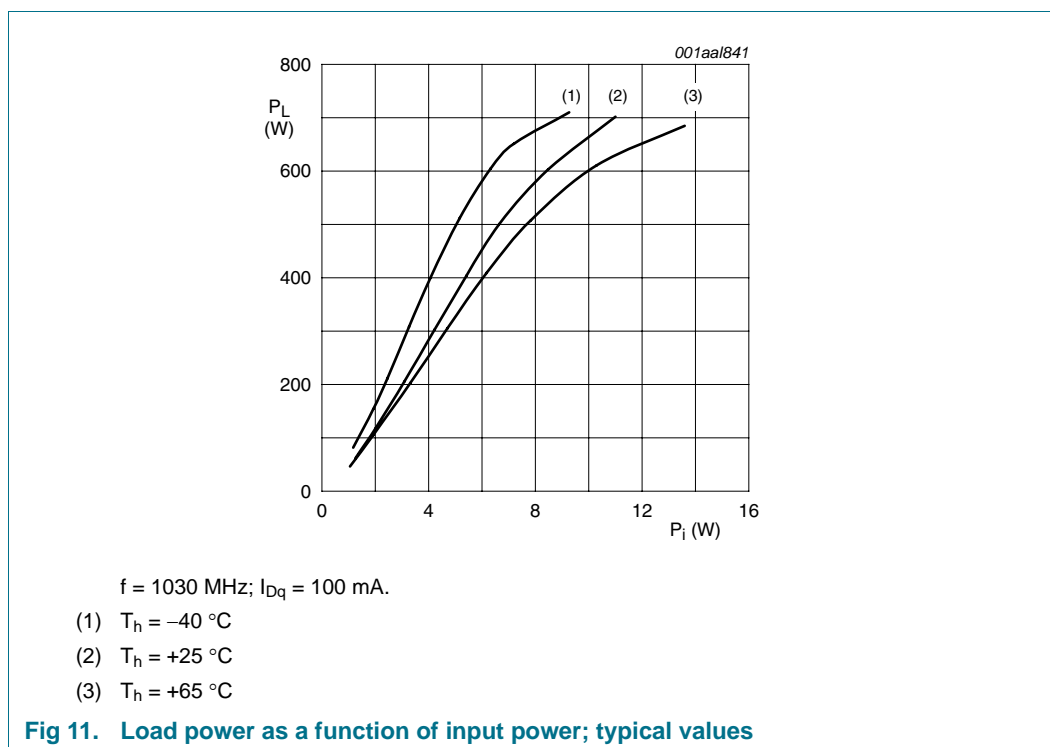
- (1)  $f = 1030\text{ MHz}$   
 (2)  $f = 1090\text{ MHz}$

**Fig 7. Drain efficiency as a function of load power; typical values**



### 7.3 Curves measured under Mode-S ELM pulse-conditions





## 8. Test information

**Table 9. List of components**

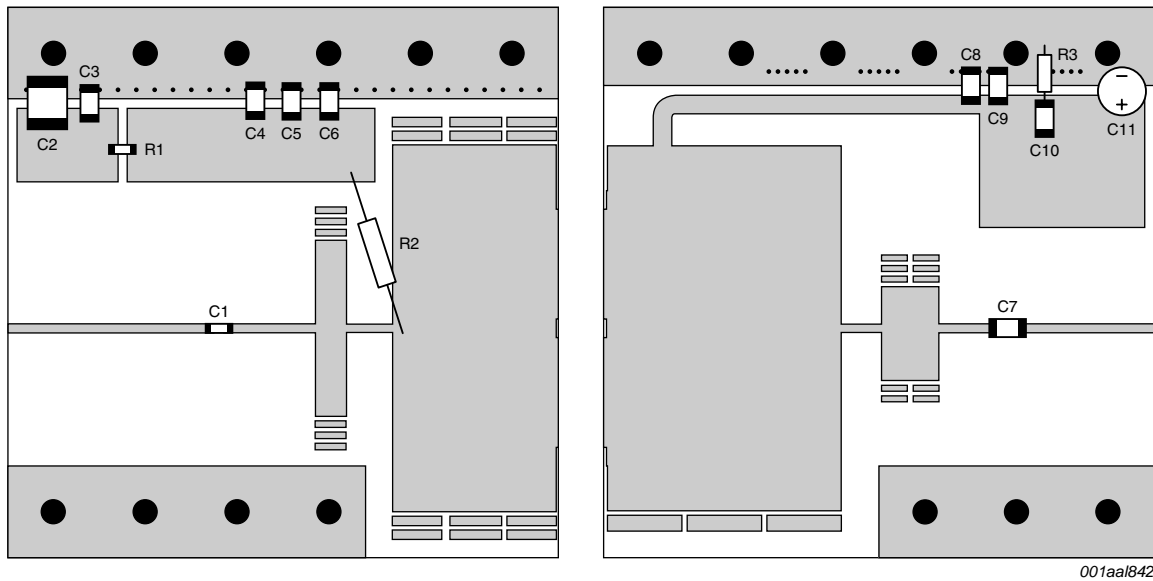
For test circuit see [Figure 12](#).

Component	Description	Value	Remarks
C1, C4, C7	multilayer ceramic chip capacitor	82 pF	[1]
C2	multilayer ceramic chip capacitor	22 $\mu\text{F}$ ; 35 V	
C3, C5, C8	multilayer ceramic chip capacitor	39 pF	[2]
C6, C9	multilayer ceramic chip capacitor	1 nF	[2]
C10	multilayer ceramic chip capacitor	20 nF	[3]
C11	electrolytic capacitor	47 $\mu\text{F}$ ; 63 V	
R1	SMD resistor	56 $\Omega$	0603
R2	metal film resistor	51 $\Omega$	
R3	resistor	11 $\Omega$	

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

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

[3] American Technical Ceramics type 200B or capacitor of same quality.



Printed-Circuit Board (PCB): Duroid 6006;  $\epsilon_r = 6.15$  F/m; thickness = 0.64 mm; thickness copper plating = 35  $\mu\text{m}$ .

See [Table 9](#) for a list of components.

**Fig 12. Component layout for class-AB production test circuit**



**9. Package outline**

Flanged balanced LDMOST ceramic package; 2 mounting holes; 4 leads

SOT539A

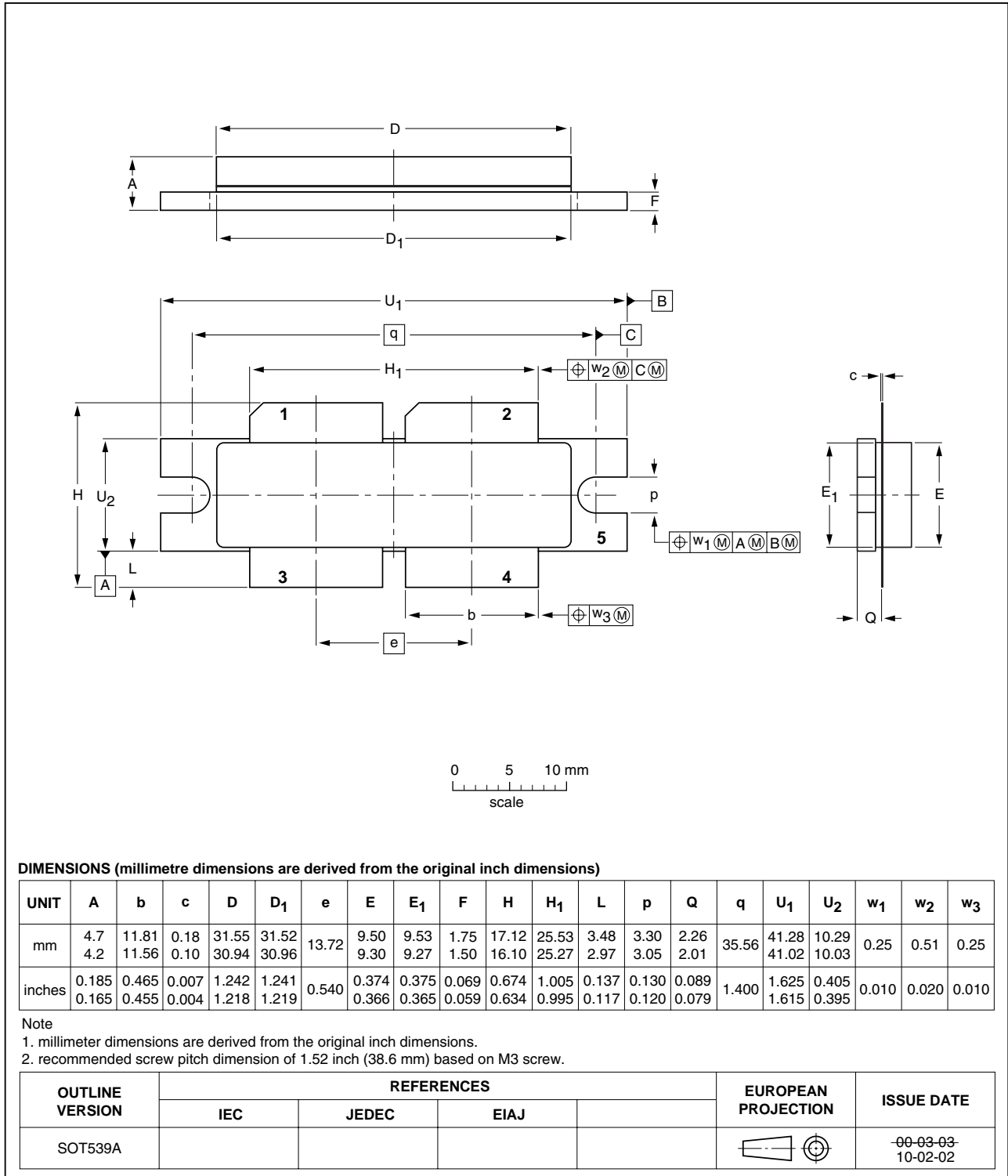


Fig 13. Package outline SOT539A

## 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
SMD	Surface Mounted Device
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
BLA6H1011-600_1	20100422	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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