BLA6H0912L-1000; BLA6H0912LS-1000

LDMOS avionics power transistor

Rev. 5 — 1 September 2015

AMPLEON

Product data sheet

1. Product profile

1.1 General description

1000W LDMOS pulsed power transistor intended for avionics transmitter applications in the 960 MHz to 1215 MHz frequency range such as Mode-S, TCAS, JTIDS, DME and TACAN.

Table 1. Application information

Typical RF performance at T_{case} = 25 °C; t_p = 50 μs; δ = 2 %; I_{Dq} = 200 mA; in a class-AB application circuit.

Test signal	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)	t_r (ns)	t_f (ns)
pulsed RF	1030	50	1000	16	52	11	5

1.2 Features and benefits

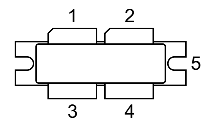
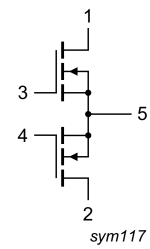
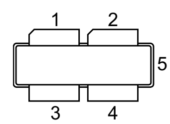
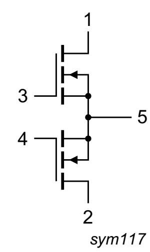
- Easy power control
- Integrated ESD protection
- High flexibility with respect to pulse formats
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (960 MHz to 1215 MHz)
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- 1000 W LDMOS pulsed power transistor intended for Mode-S, TCAS, JTIDS, DME and TACAN applications in the 960 MHz to 1215 MHz frequency range

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
BLA6H0912L-1000 (SOT539A)			
1	drain1		
2	drain2		
3	gate1		
4	gate2		
5	source [1]		
BLA6H0912LS-1000 (SOT539B)			
1	drain1		
2	drain2		
3	gate1		
4	gate2		
5	source [1]		

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLA6H0912L-1000	-	flanged balanced ceramic package; 2 mounting holes; 4 leads	SOT539A
BLA6H0912LS-1000	-	earless flanged balanced ceramic package; 4 leads	SOT539B

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
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature	[1]	-	225	°C

[1] Continuous use at maximum temperature will affect the reliability, for details refer to the on-line MTF calculator.

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} = 80 °C; P_L = 1000 W		
		t_p = 50 μs; δ = 2 %	0.011	K/W
		t_p = 100 μs; δ = 10 %	0.021	K/W
		t_p = 200 μs; δ = 10 %	0.025	K/W
		t_p = 300 μs; δ = 10 %	0.027	K/W
		t_p = 2.4 ms; δ = 6.4 %	0.041	K/W

6. Characteristics

Table 6. DC characteristics

T_j = 25 °C; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 4 mA	104	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 400 mA	1.25	1.8	2.25	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 50 V	-	-	2.8	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	62	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	280	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 20 A	-	34	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 14 A	-	75	-	mΩ

Table 7. RF characteristics

Test signal: pulsed RF; t_p = 50 μs; δ = 2 %; RF performance at V_{DS} = 50 V; I_{Dq} = 200 mA; f = 1030 MHz; T_{case} = 25 °C; unless otherwise specified, in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	P_L = 1000 W	-	-	50	V
G_p	power gain	P_L = 1000 W	14	15.5	-	dB
RL_{in}	input return loss	P_L = 1000 W	-	−19	−11	dB
η_D	drain efficiency	P_L = 1000 W	47	51	-	%
$P_{droop(pulse)}$	pulse droop power	P_L = 1000 W	-	0	0.3	dB
t_r	rise time	P_L = 1000 W	-	11	30	ns
t_f	fall time	P_L = 1000 W	-	5	30	ns

7. Test information

7.1 Ruggedness in class-AB operation

The BLA6H0912L-1000 and the BLA6H0912LS-1000 are capable of withstanding a load mismatch corresponding to VSWR = 3 : 1 through all phases under the following conditions: V_{DS} = 50 V; I_{Dq} = 200 mA; P_L = 1000 W; t_p = 50 μs; δ = 2 %; f = 1030 MHz.

7.2 Impedance information

Table 8. Typical impedance
Typical values per section unless otherwise specified.

f	Z_S	Z_L [1]	Z_L [2]
(MHz)	(Ω)	(Ω)	(Ω)
950	1.12 – j2.27	0.60 + j0.21	0.62 – j0.02
1000	1.39 – j2.69	0.54 + j0.08	0.66 – j0.06
1050	1.79 – j2.79	0.40 + j0.03	0.52 – j0.28
1100	2.44 – j2.72	0.41 – j0.12	0.67 – j0.29
1150	1.68 – j2.52	0.49 – j0.21	0.53 – j0.35
1200	4.68 – j2.97	0.36 – j0.30	0.57 – j0.40

[1] Optimized for drain efficiency.

[2] Optimized for power gain.

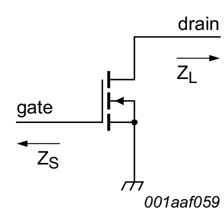
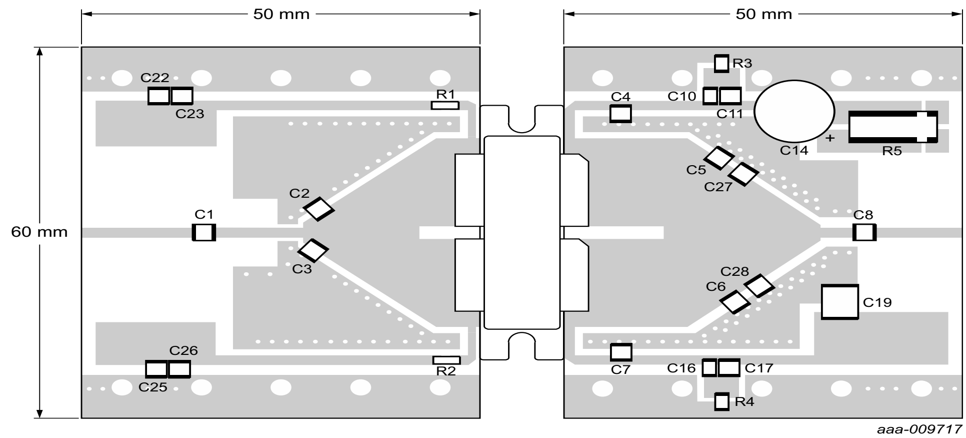


Fig 1. Definition of transistor impedance

7.3 Circuit information



Printed-Circuit Board (PCB) material: Rogers Duroid 6002 with ε_r = 2.94 and thickness = 0.762 mm.

See Table 9 for list of components.

Fig 2. Component layout

Table 9. List of components

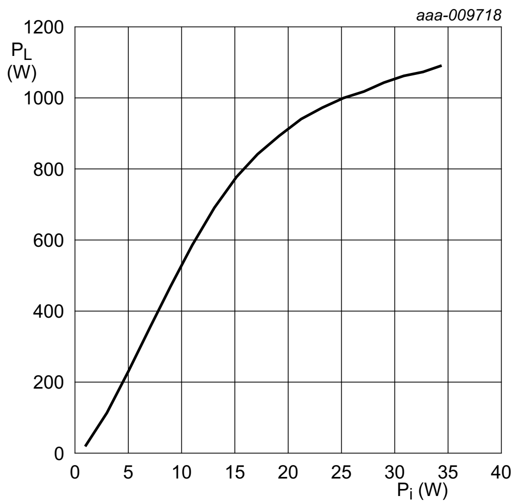
See Figure 2 for component layout.

Component	Description	Value	Remarks
C1, C4, C7, C8, C22, C25	multilayer ceramic chip capacitor	33 pF [1]	
C2, C3, C27, C28	multilayer ceramic chip capacitor	6.2 pF [1]	
C5, C6	multilayer ceramic chip capacitor	3.9 pF [1]	
C23, C26	multilayer ceramic chip capacitor	1 nF [1]	
C10, C16	multilayer ceramic chip capacitor	10 nF	Murata
C11, C17	multilayer ceramic chip capacitor	100 nF	TDK
C14	electrolytic capacitor	220 μF, 63 V	
C19	multilayer ceramic chip capacitor	10 μF, 100 V	
R1	SMD resistor	1 kΩ	SMD 0603
R2	SMD resistor	20 Ω	SMD 0603
R3, R4	SMD resistor	2.4 Ω	SMD 0603
R5	current sense resistor	0.005 Ω	

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

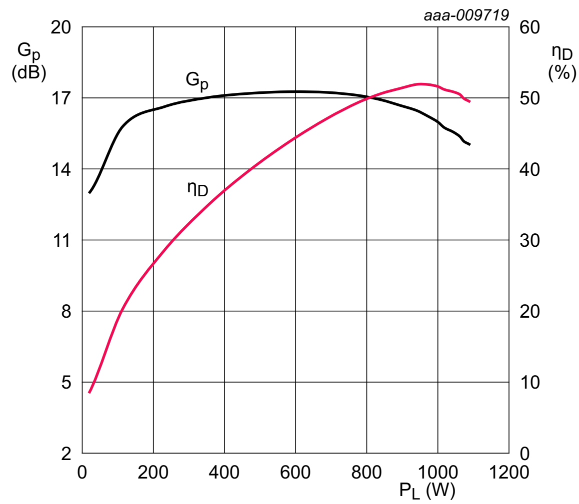
7.4 Graphical data

7.4.1 Pulsed CW



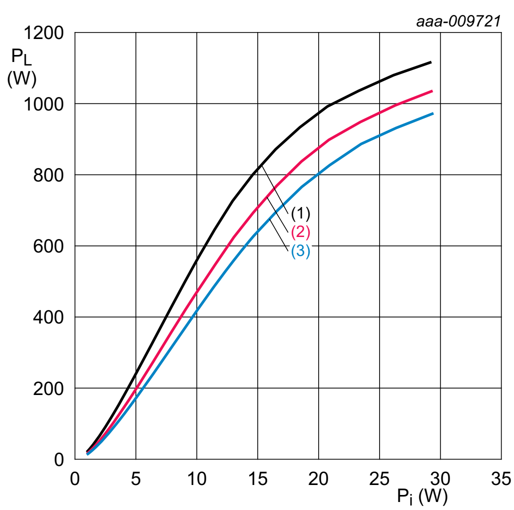
V_{DS} = 50 V; I_{Dq} = 200 mA; f = 1030 MHz; t_p = 50 µs; δ = 2 %.

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



V_{DS} = 50 V; I_{Dq} = 200 mA; f = 1030 MHz; t_p = 50 µs; δ = 2 %.

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



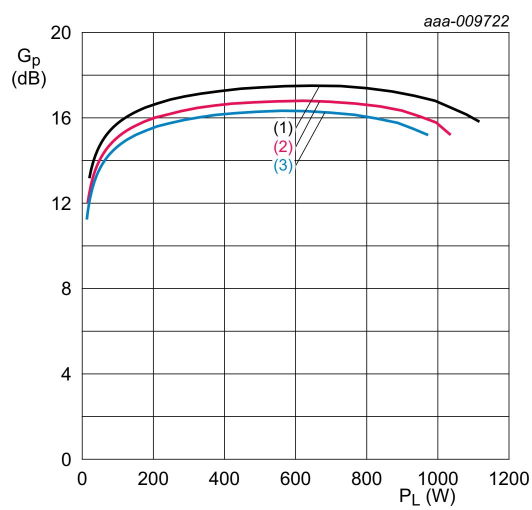
V_{DS} = 50 V; I_{Dq} = 200 mA; f = 1030 MHz; t_p = 50 µs; δ = 2 %.

(1) T_{case} = 20 °C

(2) T_{case} = 50 °C

(3) T_{case} = 70 °C

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



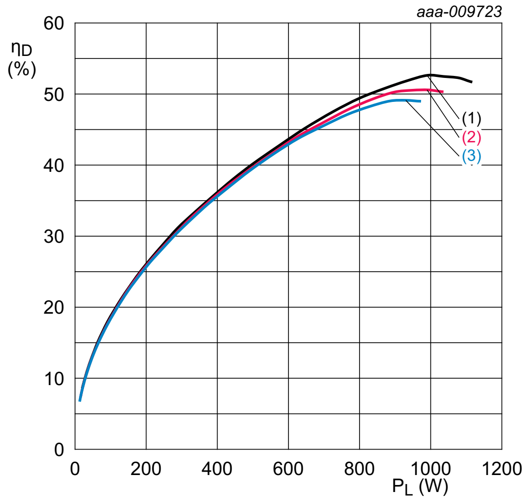
V_{DS} = 50 V; I_{Dq} = 200 mA; f = 1030 MHz; t_p = 50 µs; δ = 2 %.

(1) T_{case} = 20 °C

(2) T_{case} = 50 °C

(3) T_{case} = 70 °C

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



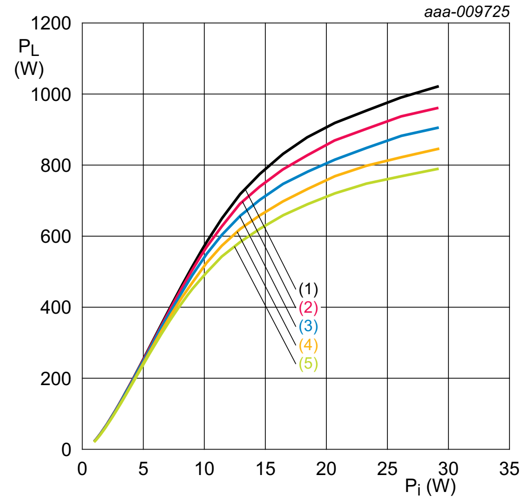
V_{DS} = 50 V; I_{Dq} = 200 mA; f = 1030 MHz; t_p = 50 μs; δ = 2 %.

(1) T_{case} = 20 °C

(2) T_{case} = 50 °C

(3) T_{case} = 70 °C

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



I_{Dq} = 200 mA; t_p = 50 μs; δ = 2 %.

(1) V_{DS} = 50 V

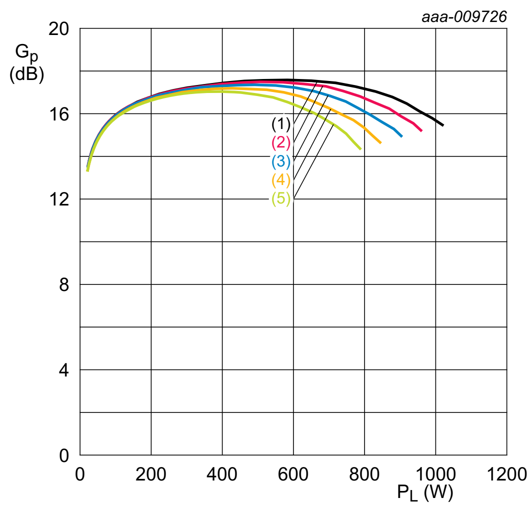
(2) V_{DS} = 48 V

(3) V_{DS} = 46 V

(4) V_{DS} = 44 V

(5) V_{DS} = 42 V

Fig 8. Output power as a function of input power; typical values



I_{Dq} = 200 mA; t_p = 50 μs; δ = 2 %.

(1) V_{DS} = 50 V

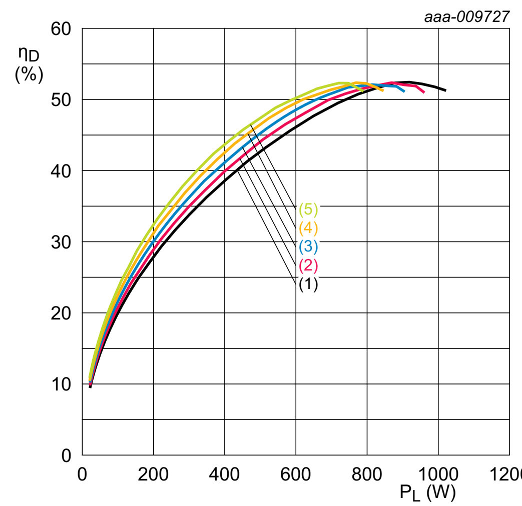
(2) V_{DS} = 48 V

(3) V_{DS} = 46 V

(4) V_{DS} = 44 V

(5) V_{DS} = 42 V

Fig 9. Power gain as a function of output power; typical values



I_{Dq} = 200 mA; t_p = 50 μs; δ = 2 %.

(1) V_{DS} = 50 V

(2) V_{DS} = 48 V

(3) V_{DS} = 46 V

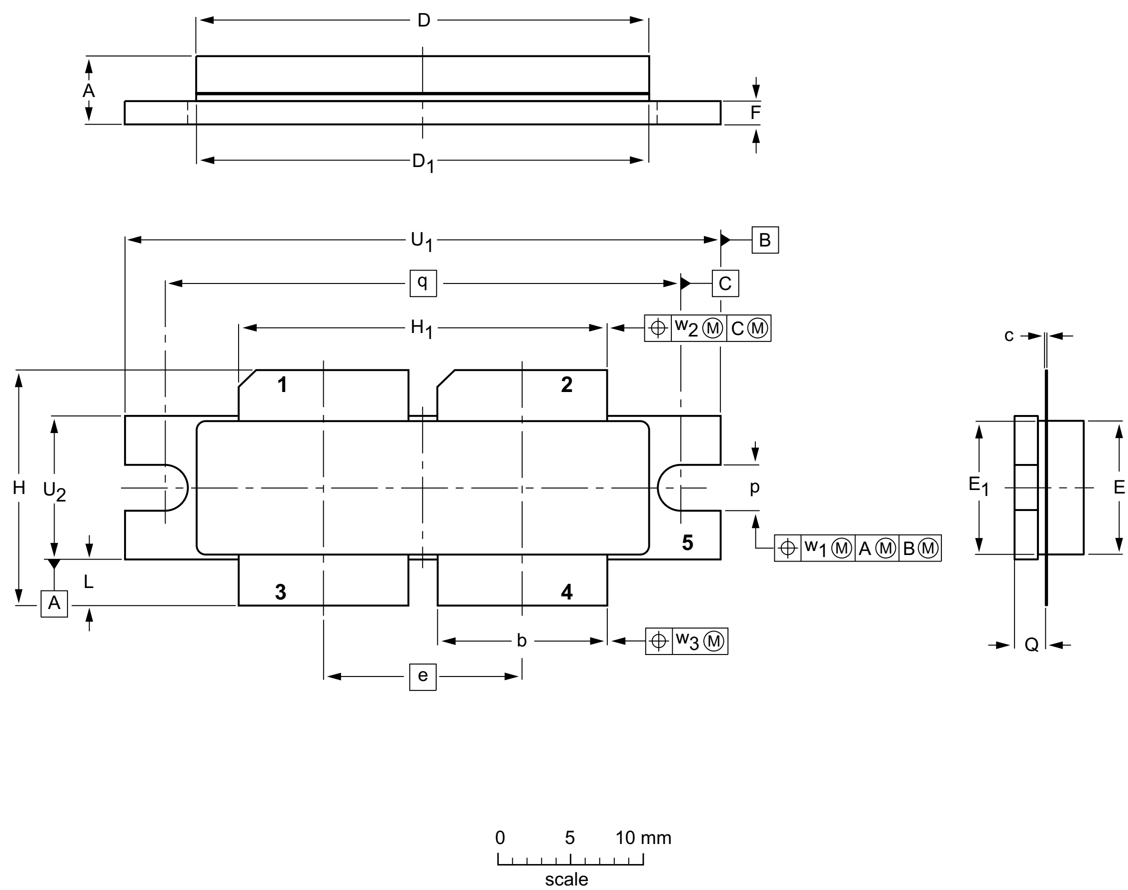
(4) V_{DS} = 44 V

(5) V_{DS} = 42 V

Fig 10. Drain efficiency as a function of output power; typical values

8. Package outline

Flanged balanced ceramic package; 2 mounting holes; 4 leads **SOT539A**



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

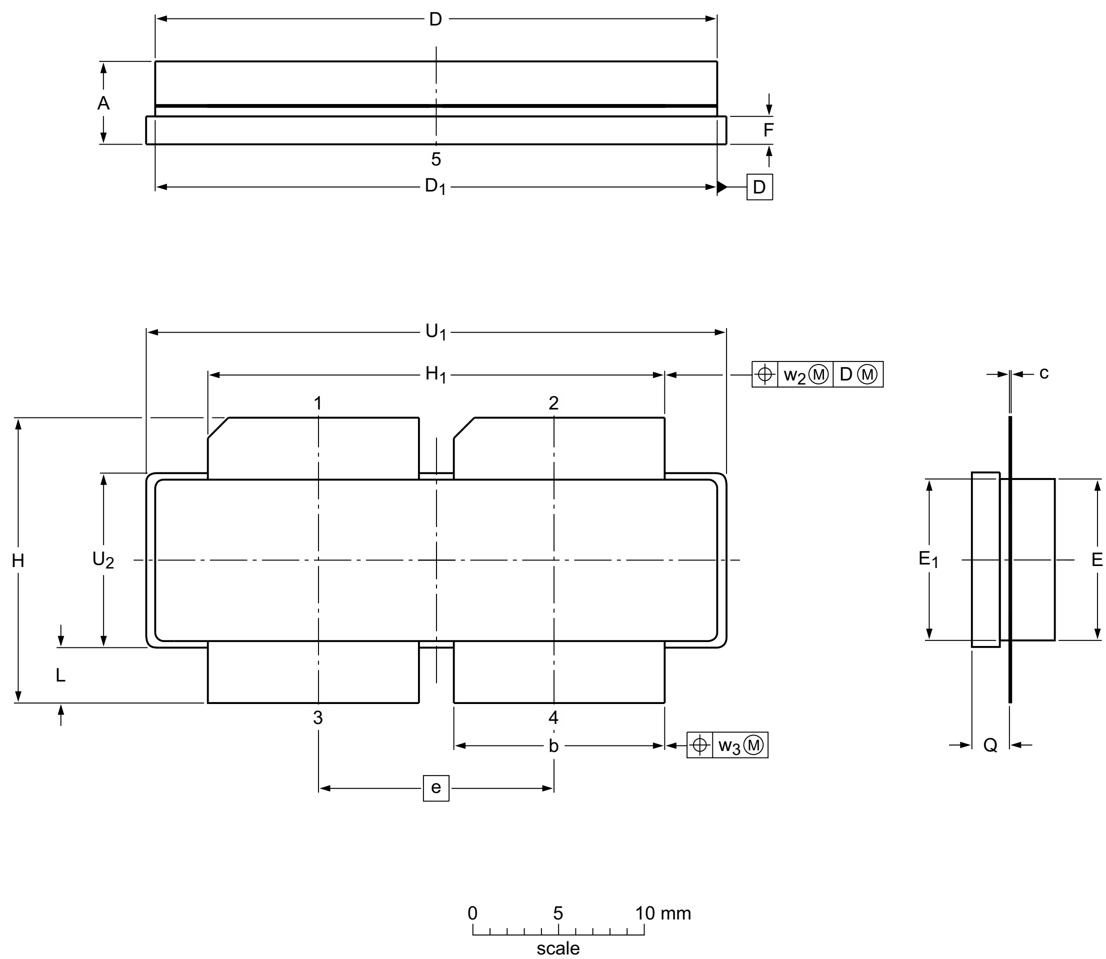
UNIT	A	b	c	D	D_1	e	E	E_1	F	H	H_1	L	p	Q	q	U_1	U_2	w_1	w_2	w_3
mm	4.7 4.2	11.81 11.56	0.18 0.10	31.55 30.94	31.52 30.96	13.72	9.50 9.30	9.53 9.27	1.75 1.50	17.12 16.10	25.53 25.27	3.48 2.97	3.30 3.05	2.26 2.01	35.56	41.28 41.02	10.29 10.03	0.25	0.51	0.25
inches	0.185 0.165	0.465 0.455	0.007 0.004	1.242 1.218	1.241 1.219	0.540	0.374 0.366	0.375 0.365	0.069 0.059	0.674 0.634	1.005 0.995	0.137 0.117	0.130 0.120	0.089 0.079	1.400	1.625 1.615	0.405 0.395	0.010	0.020	0.010

Note
1. millimeter dimensions are derived from the original inch dimensions.
2. recommended screw pitch dimension of 1.52 inch (38.6 mm) based on M3 screw.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT539A						~~10-02-02~~ 12-05-02

Fig 11. Package outline SOT539A

Earless flanged balanced ceramic package; 4 leads **SOT539B**



Dimensions

Unit[1]		A	b	c	D	D_1	E	E_1	e	F	H	H_1	L	Q	U_1	U_2	w_2	w_3
mm	max	4.7	11.81	0.18	31.55	31.52	9.5	9.53		1.75	17.12	25.53	3.48	2.26	32.39	10.29		
	nom								13.72								0.25	0.25
	min	4.2	11.56	0.10	30.94	30.96	9.3	9.27		1.50	16.10	25.27	2.97	2.01	32.13	10.03		
inches	max	0.185	0.465	0.007	1.242	1.241	0.374	0.375		0.069	0.674	1.005	0.137	0.089	1.275	0.405		
	nom								0.54								0.01	0.01
	min	0.165	0.455	0.004	1.218	1.219	0.366	0.365		0.059	0.634	0.995	0.117	0.079	1.265	0.395		

Note

1. millimeter dimensions are derived from the original inch dimensions.

sot539b_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT539B						~~12-05-02~~ 13-05-24

Fig 12. Package outline SOT539B

9. Handling information

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

10. Abbreviations

Table 10. Abbreviations

Acronym	Description
CW	Continuous Wave
DME	Distance Measuring Equipment
ESD	ElectroStatic Discharge
JTIDS	Joint Tactical Information Distribution System
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
Mode-S	Mode Select
MTF	Median Time to Failure
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
BLA6H0912L-1000_0912LS-1000#5	20150901	Product data sheet	-	BLA6H0912L-1000_ 0912LS-1000 v.4
Modifications	• The format of this document has been redesigned to comply with the new identity guidelines of Ampleon. • Legal texts have been adapted to the new company name where appropriate.			
BLA6H0912L-1000_0912LS-1000 v.4	20150702	Product data sheet	-	BLA6H0912L-1000_ 0912LS-1000 v.3
BLA6H0912L-1000_0912LS-1000 v.3	20150615	Product data sheet	-	BLA6H0912L-1000_ 0912LS-1000 v.2
BLA6H0912L-1000_0912LS-1000 v.2	20140210	Objective data sheet	-	BLA6H0912L-1000_ 0912LS-1000 v.1
BLA6H0912L-1000_0912LS-1000 v.1	20131104	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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13. Contact information

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For sales office addresses, please visit: http://www.ampleon.com/sales

14. Contents

Date of release: 1 September 2015

Document identifier: BLA6H0912L-1000_0912LS-1000#5