BLA9G1011L(S)-300; BLA9G1011L(S)-300G

Power LDMOS transistor

AMPLEON

Rev. 1 — 25 July 2017

Product data sheet

1. Product profile

1.1 General description

300 W LDMOS power transistor for avionics applications at frequencies from 1030 MHz to 1090 MHz.

Table 1. Typical information

Typical RF performance at T_{case} = 25 °C; t_p = 50 μs; δ = 2 %; I_{Dq} = 100 mA; in a class-AB demo test circuit.

Test signal	f	V_{DS}	P_L	G_p	η_D	t_r	t_f
	(MHz)	(V)	(W)	(dB)	(%)	(ns)	(ns)
pulsed RF	1030	32	317	20.6	63.5	14	5
	1060	32	317	21.5	64.8	14	5
	1090	32	317	21.8	64.8	14	5

1.2 Features and benefits

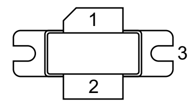
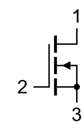
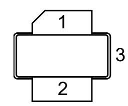
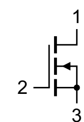
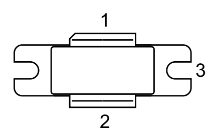
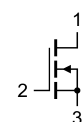
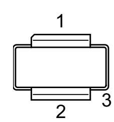
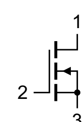
- Easy power control
- Integrated dual sided ESD protection enables excellent off-state isolation
- Enhanced ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (1030 MHz to 1090 MHz)
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- Avionics transmitter applications in the 1030 MHz to 1090 MHz frequency range

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
BLA9G1011L-300 (SOT502A)			
1	drain		 sym112
2	gate		
3	source [1]		
BLA9G1011LS-300 (SOT502B)			
1	drain		 sym112
2	gate		
3	source [1]		
BLA9G1011L-300G (SOT502F)			
1	drain		 sym112
2	gate		
3	source [1]		
BLA9G1011LS-300G (SOT502E)			
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
BLA9G1011L-300	-	flanged ceramic package; 2 mounting holes; 2 leads	SOT502A
BLA9G1011LS-300	-	earless flanged ceramic package; 2 leads	SOT502B
BLA9G1011L-300G	-	eared flanged ceramic package; 2 leads; 2 mounting holes	SOT502F
BLA9G1011LS-300G	-	earless flanged ceramic package; 2 leads	SOT502E

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		–6	+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 online 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} = 25 °C; t_p = 100 μs; δ = 10 %	0.140	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 = 3.3 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 330 mA	1.5	2.0	2.5	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 32 V	-	-	4.2	μA
I_{DSX}	drain cut-off current	$V_{GS} = V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	60	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	420	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 330 mA	-	3	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)}$ + 3.75 V; I_D = 11.55 A	-	0.043	-	Ω

Table 7. RF characteristics

Test signal: pulsed RF; t_p = 50 μs; δ = 2 %; V_{DS} = 32 V; f = 1060 MHz; I_{Dq} = 100 mA; T_{case} = 25 °C; unless otherwise specified; in a class-AB production test circuit for straight leads.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain	P_L = 300 W	18	19.5	-	dB
RL_{in}	input return loss	P_L = 300 W	-	–10	-	dB
η_D	drain efficiency	P_L = 300 W	56	60.5	-	%
t_r	rise time	P_L = 300 W	-	14	-	ns
t_f	fall time	P_L = 300 W	-	5	-	ns

7. Test information

7.1 Ruggedness in class-AB operation

The BLA9G1011L-300, BLA9G1011LS-300, BLA9G1011L-300G and BLA9G1011LS-300G are enhanced rugged devices and are capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: t_p = 50 μs; δ = 2 %; V_{DS} = 32 V; I_{Dq} = 100 mA; P_L = 300 W; f = 1030 MHz to 1090 MHz.

7.2 Impedance information

Table 8. Typical impedance

Typical values unless otherwise specified.

f	Z_S	Z_L
(MHz)	(Ω)	(Ω)
1000	0.87 – j2.02	1.38 – j1.78
1050	1.34 – j2.26	1.4 – j1.54
1100	1.82 – j2.77	1.4 – j1.54

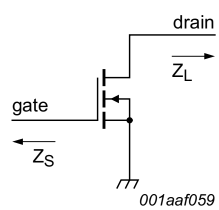
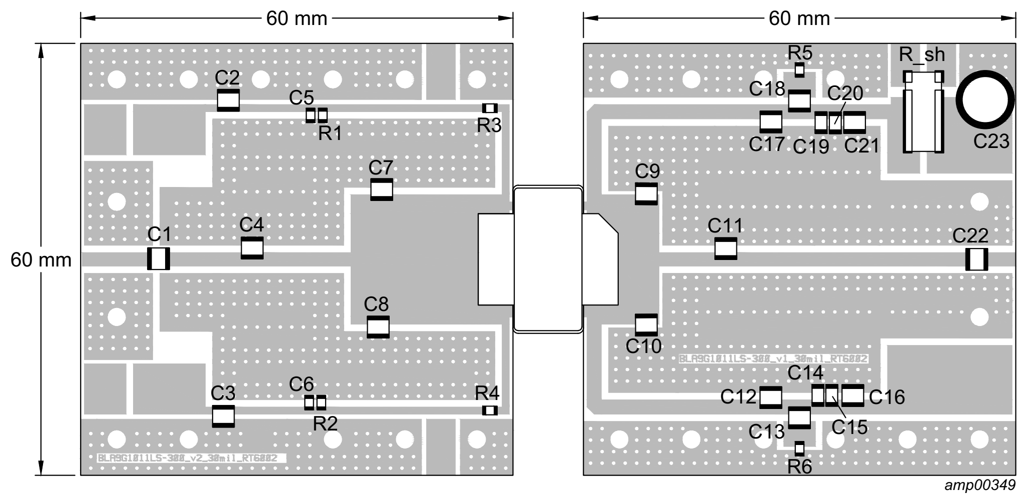


Fig 1. Definition of transistor impedance

7.3 Test circuit



Printed-Circuit Board (PCB): Rogers RT/duroid 6002; thickness = 0.762 mm; top/bottom copper plating.

See Table 9 for a list of components.

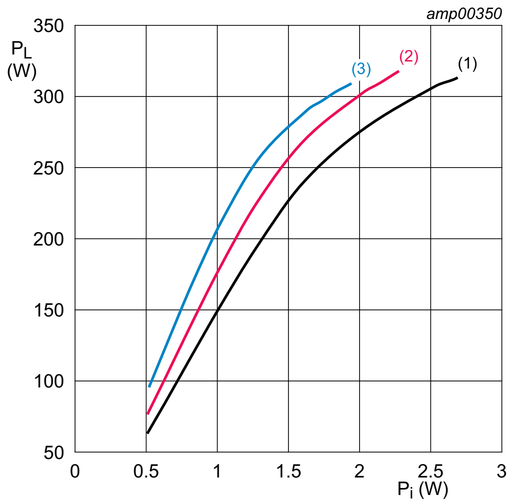
Fig 2. Demo test circuit component layout

Table 9. Demo test circuit list of components

See Figure 2 for component layout.

Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	56 pF	ATC: ATC100A560FT150XTV
C2, C3	multilayer ceramic chip capacitor	750 pF	ATC: ATC100B750FT500XTV
C4	multilayer ceramic chip capacitor	2.4 pF	ATC: ATC100B2R4BT500XTV
C5, C6	multilayer ceramic chip capacitor	62 pF	ATC: ATC100A620FT150XTV
C7, C8	multilayer ceramic chip capacitor	3.3 pF	ATC: ATC100B3R3BT500XTV
C9, C10	multilayer ceramic chip capacitor	7.5 pF	ATC: ATC100B7R5BT500XTV
C11	multilayer ceramic chip capacitor	4.7 pF	ATC: ATC100B4R7BT500XTV
C12, C17	multilayer ceramic chip capacitor	62 pF	ATC: ATC100B620FT500XTV
C13, C18	multilayer ceramic chip capacitor	750 pF	ATC: ATC100B751FT500XTV
C14, C19	multilayer ceramic chip capacitor	10 nF	Murata: GRM188R71H103KA01D
C15, C20	multilayer ceramic chip capacitor	100 nF	Murata: GRM31C5C1E104JA01L
C16, C21	multilayer ceramic chip capacitor	10 μF	Murata: GRM319R71H104KA01D
C22	multilayer ceramic chip capacitor	56 pF	ATC: ATC100B560FT500XTV
C23	electrolytic capacitor	470 μF, 63 V	Nichicon: UVZ1J471MHD1TO
R1, R2	SMD resistor	1 kΩ	0603
R3, R4	SMD resistor	5.1 Ω	0603
R5, R6	SMD resistor	3.9 Ω	0603
R_sh	SMD resistor	10 mΩ	Ohmite: FC4L110R010FER

7.4 Graphical data



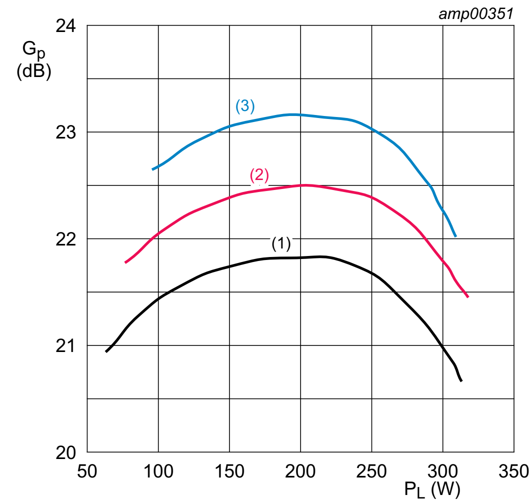
V_{DS} = 32 V; I_{Dq} = 100 mA; t_p = 50 µs; δ = 2 %.

(1) f = 1030 MHz

(2) f = 1060 MHz

(3) f = 1090 MHz

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



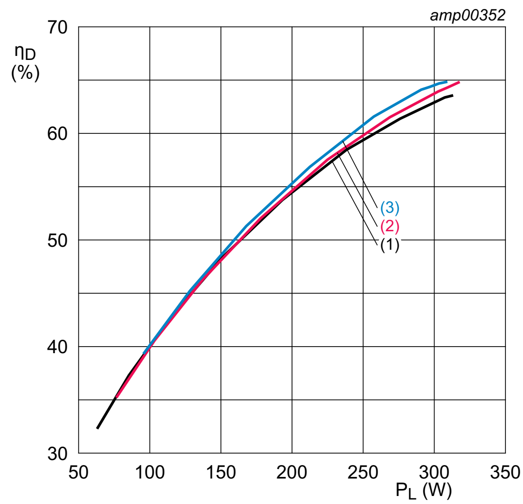
V_{DS} = 32 V; I_{Dq} = 100 mA; t_p = 50 µs; δ = 2 %.

(1) f = 1030 MHz

(2) f = 1060 MHz

(3) f = 1090 MHz

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



V_{DS} = 32 V; I_{Dq} = 100 mA; t_p = 50 µs; δ = 2 %.

(1) f = 1030 MHz

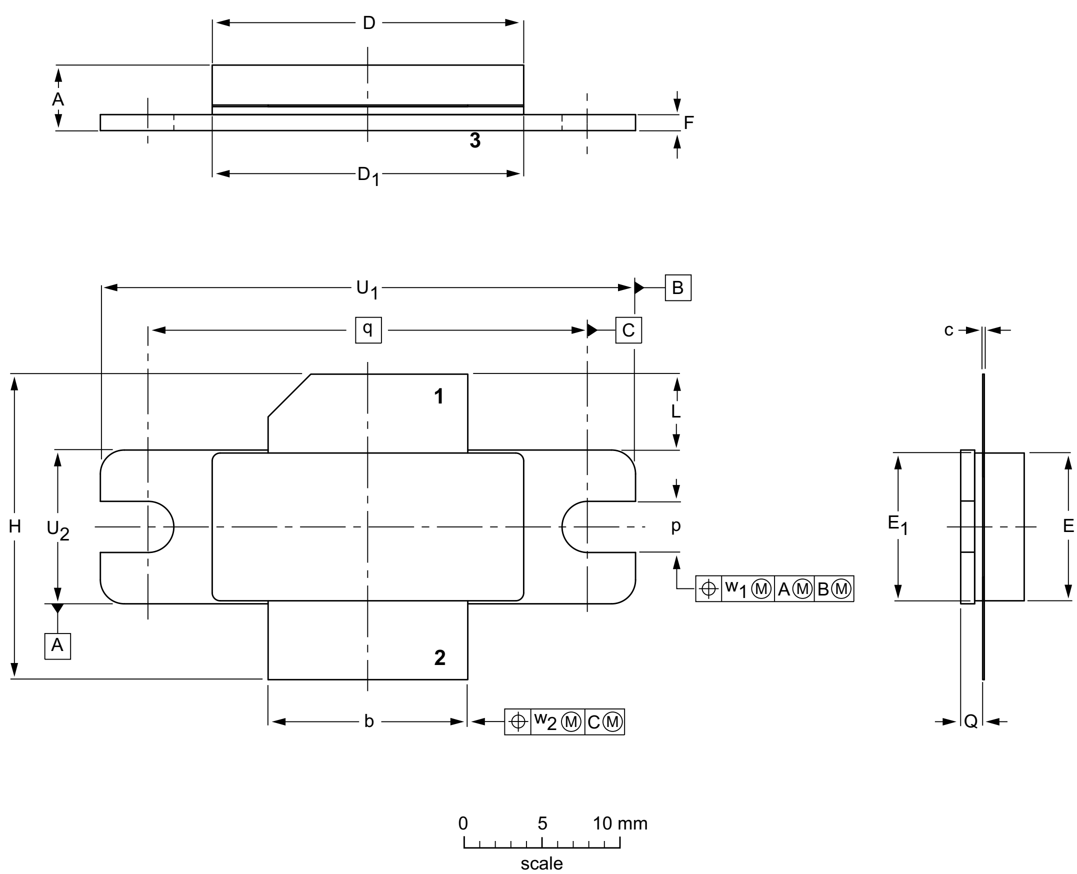
(2) f = 1060 MHz

(3) f = 1090 MHz

Fig 5. Drain efficiency as a function of output power; typical values

8. Package outline

Flanged ceramic package; 2 mounting holes; 2 leads **SOT502A**



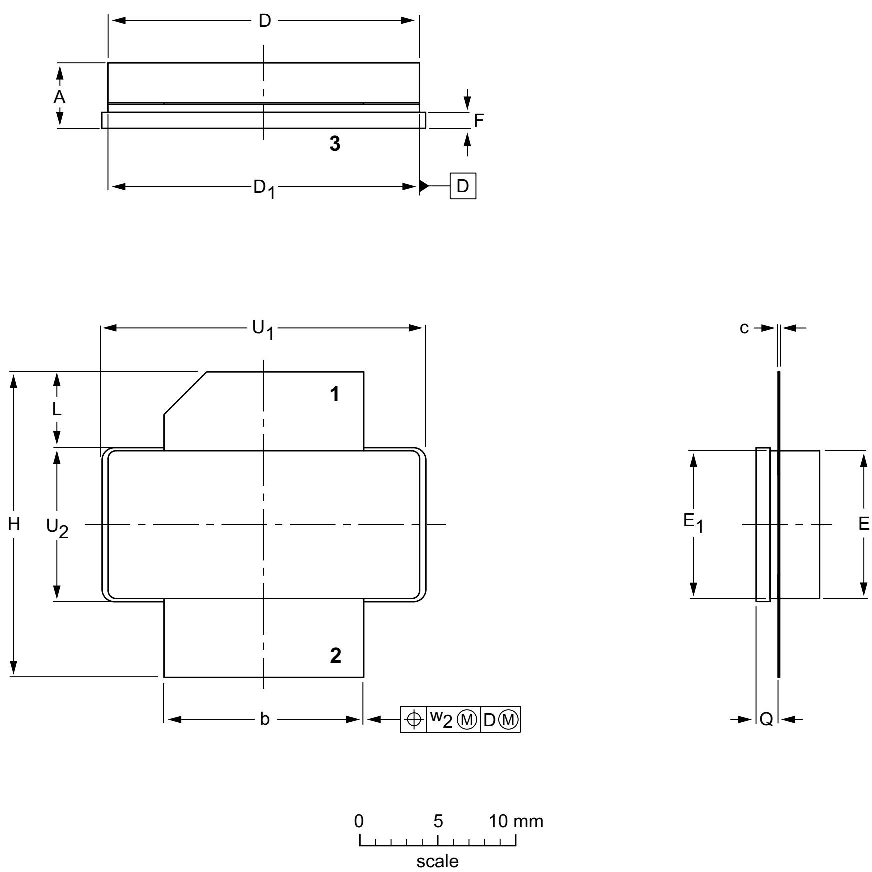
DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

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	4.72 3.43	12.83 12.57	0.15 0.08	20.02 19.61	19.96 19.66	9.50 9.30	9.53 9.25	1.14 0.89	19.94 18.92	5.33 4.32	3.38 3.12	1.70 1.45	27.94	34.16 33.91	9.91 9.65	0.25	0.51
inches	0.186 0.135	0.505 0.495	0.006 0.003	0.788 0.772	0.786 0.774	0.374 0.366	0.375 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	0.02

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT502A						~~03-01-10~~ 12-05-02

Fig 6. Package outline SOT502A

Earless flanged ceramic package; 2 leads **SOT502B**



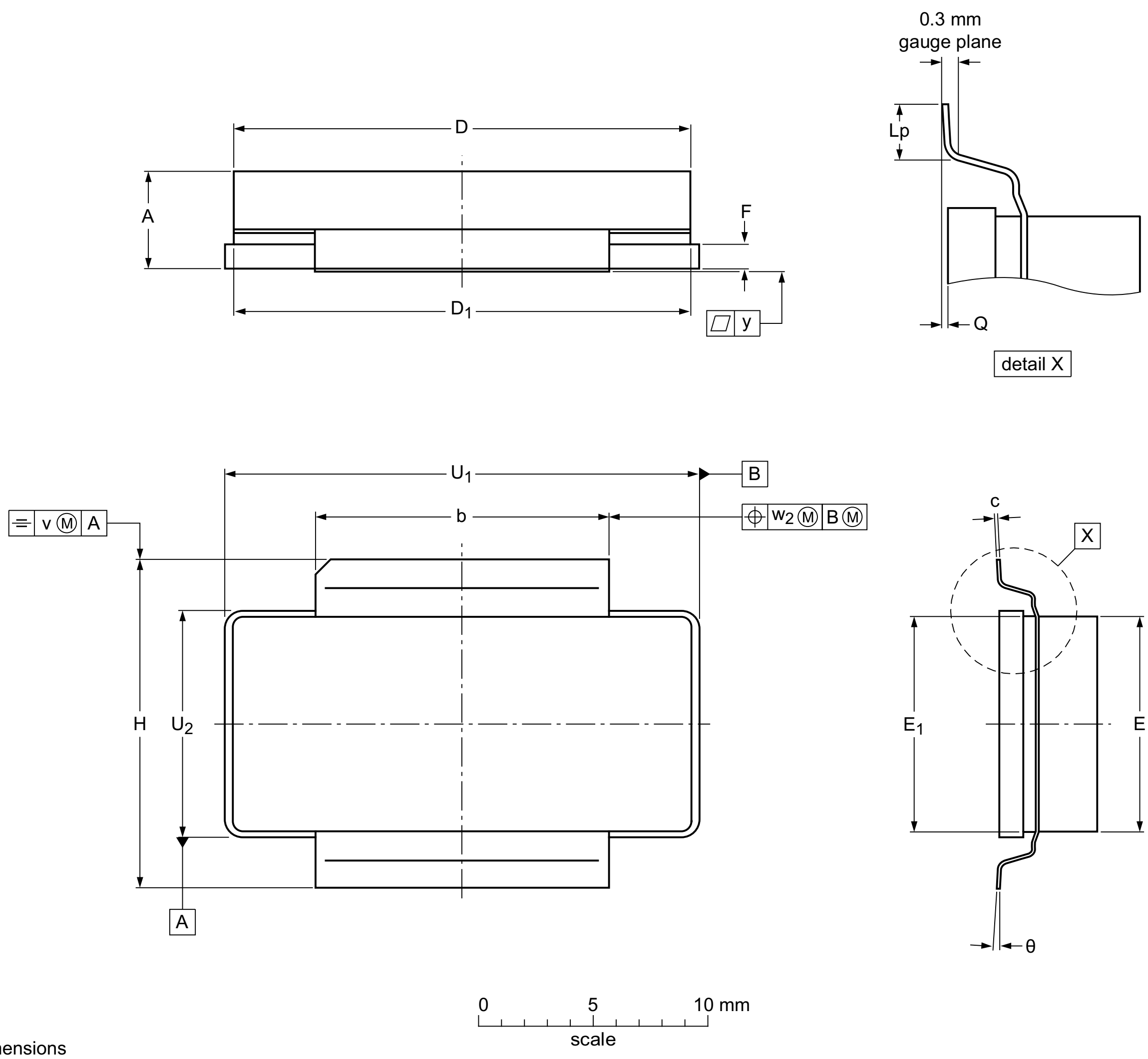
DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	c	D	D_1	E	E_1	F	H	L	Q	U_1	U_2	w_2
mm	4.72 3.43	12.83 12.57	0.15 0.08	20.02 19.61	19.96 19.66	9.50 9.30	9.53 9.25	1.14 0.89	19.94 18.92	5.33 4.32	1.70 1.45	20.70 20.45	9.91 9.65	0.25
inches	0.186 0.135	0.505 0.495	0.006 0.003	0.788 0.772	0.786 0.774	0.374 0.366	0.375 0.364	0.045 0.035	0.785 0.745	0.210 0.170	0.067 0.057	0.815 0.805	0.390 0.380	0.010

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT502B						~~07-05-09~~ 12-05-02

Fig 7. Package outline SOT502B

Earless flanged ceramic package; 2 leads **SOT502E**



Dimensions

Unit(1)		A	b	c	D	D_1	E	E_1	F	H	L_p	Q	U_1	U_2	v	w_2	y	θ
mm	max	4.72	12.83	0.15	20.02	19.96	9.53	9.53	1.14	14.3	1.38	0.195	20.70	9.91	0.25	0.25	0.15	7°
	nom																	
	min	3.43	12.57	0.07	19.61	19.66	9.27	9.27	0.89	14.1	0.98	0.055	20.45	9.65				0°
inches	max	0.185	0.505	0.006	0.788	0.786	0.375	0.375	0.045	0.563	0.055	0.008	0.815	0.390	0.010	0.010	0.006	7°
	nom																	
	min	0.135	0.495	0.003	0.772	0.774	0.365	0.365	0.035	0.555	0.039	0.002	0.805	0.380				0°

Note
1. Millimeter dimensions are derived from the original inch dimensions.

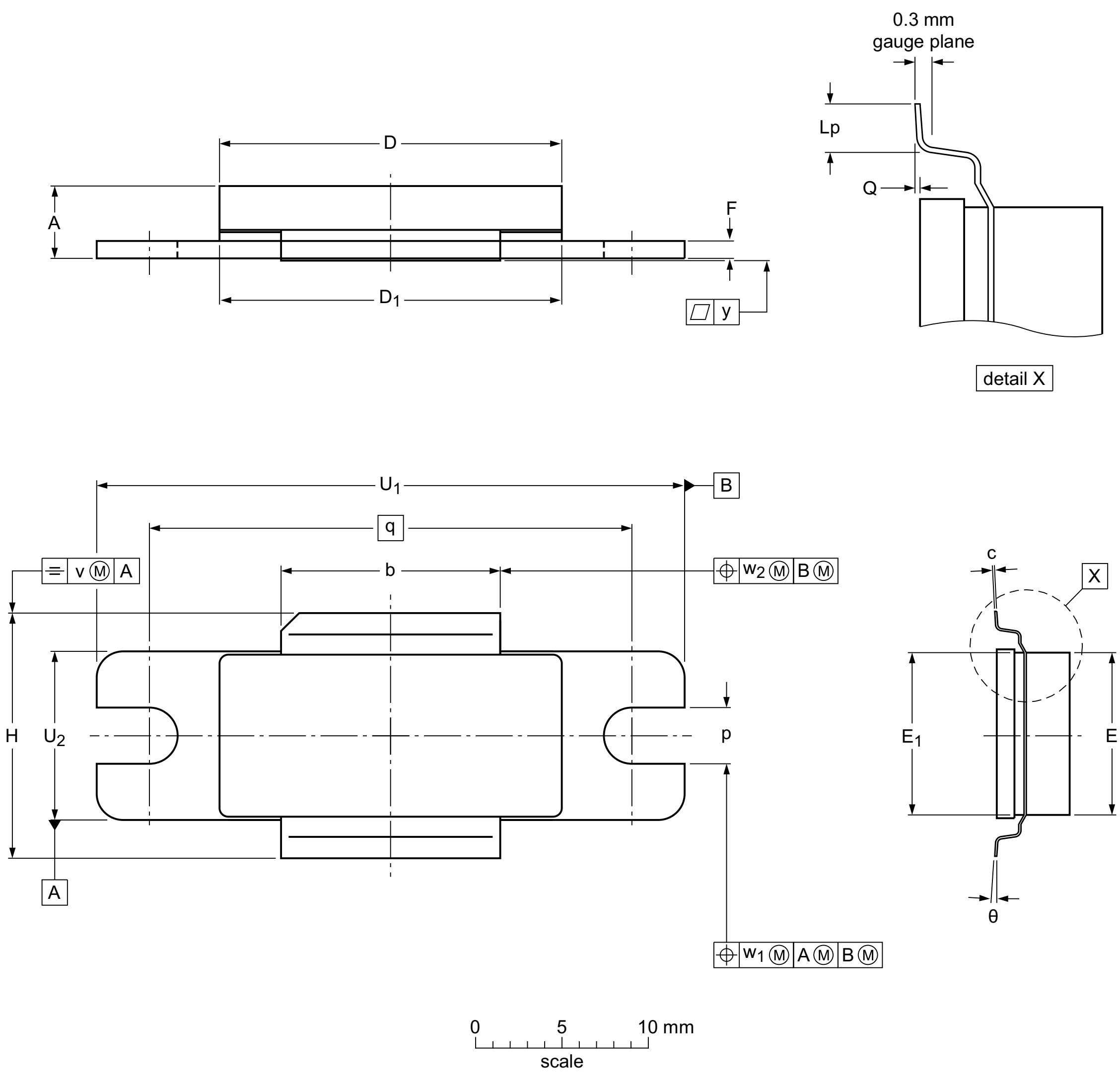
sot502e_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT502E						~~12-05-14~~ 12-05-30

Fig 8. Package outline SOT502E

All information provided in this document is subject to legal disclaimers.

Eared flanged ceramic package; 2 leads; 2 mounting holes **SOT502F**



Dimensions (mm are the original dimensions)

Unit(1)		A	b	c	D	D_1	E	E_1	F	H	L_p	p	Q	q	U_1	U_2	v	w_1	w_2	θ	U1
mm	max	4.70	12.83	0.15	20.02	19.96	9.53	9.53	1.14	14.3	1.38	3.38	0.195		34.16	9.91				7°	
	nom													27.94			0.25	0.25	0.25		0.15
	min	3.43	12.57	0.07	19.61	19.66	9.27	9.27	0.89	14.1	0.98	3.12	0.055		33.91	9.65				0°	

sot502f_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT502F						~~14-02-19~~ 14-03-14

Fig 9. Package outline SOT502F

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.

Table 10. ESD sensitivity

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C2A [1]
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	2 [2]

[1] CDM classification C2A is granted to any part that passes after exposure to an ESD pulse of 500 V, but fails after exposure to an ESD pulse of 750 V.

[2] HBM classification 2 is granted to any part that passes after exposure to an ESD pulse of 2000 V, but fails after exposure to an ESD pulse of 4000 V.

10. Abbreviations

Table 11. Abbreviations

Acronym	Description
ESD	ElectroStatic Discharge
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
MTF	Median Time to Failure
SMD	Surface Mounted Device
VSWR	Voltage Standing-Wave Ratio

11. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLA9G1011L-300_LS-300_L-300G_LS-300G v.1	20170725	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.ampleon.com.

12.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Ampleon does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Ampleon sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Ampleon and its customer, unless Ampleon and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Ampleon product is deemed to offer functions and qualities beyond those described in the Product data sheet.

12.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Ampleon does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Ampleon takes no responsibility for the content in this document if provided by an information source outside of Ampleon.

In no event shall Ampleon be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Ampleon's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of Ampleon.

Right to make changes — Ampleon reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — Ampleon products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an Ampleon product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Ampleon and its suppliers accept no liability for inclusion and/or use of Ampleon products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Ampleon makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Ampleon products, and Ampleon accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Ampleon product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Ampleon does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Ampleon products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Ampleon does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Ampleon products are sold subject to the general terms and conditions of commercial sale, as published at http://www.ampleon.com/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Ampleon hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Ampleon products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — Unless this data sheet expressly states that this specific Ampleon product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. Ampleon accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Ampleon's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Ampleon's specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies Ampleon for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond Ampleon's standard warranty and Ampleon's product specifications.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

12.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Any reference or use of any 'NXP' trademark in this document or in or on the surface of Ampleon products does not result in any claim, liability or entitlement vis-à-vis the owner of this trademark. Ampleon is no longer part of the NXP group of companies and any reference to or use of the 'NXP' trademarks will be replaced by reference to or use of Ampleon's own trademarks.

13. Contact information

For more information, please visit: **http://www.ampleon.com**

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

14. Contents

1 Product profile 1
1.1 General description 1
1.2 Features and benefits 1
1.3 Applications 1
2 Pinning information 2
3 Ordering information 2
4 Limiting values 3
5 Thermal characteristics 3
6 Characteristics 3
7 Test information 4
7.1 Ruggedness in class-AB operation 4
7.2 Impedance information 4
7.3 Test circuit 5
7.4 Graphical data 6
8 Package outline 7
9 Handling information 11
10 Abbreviations 11
11 Revision history 11
12 Legal information 12
12.1 Data sheet status 12
12.2 Definitions 12
12.3 Disclaimers 12
12.4 Trademarks 13
13 Contact information 13
14 Contents 14

Date of release: 25 July 2017
Document identifier: BLA9G1011L-300_LS-300_L-300G_LS-300G