BLU6H0410L-600P; BLU6H0410LS-600P

Power LDMOS transistor

Rev. 3 — 1 September 2015

AMPLEON

Product data sheet

1. Product profile

1.1 General description

A 600 W LDMOS RF power transistor for radar transmitter applications and industrial applications in the frequency range of 400 MHz to 900 MHz.

Table 1. Application information

Typical RF performance at V_{DS} = 50 V; in a common source 860 MHz narrowband test circuit; unless otherwise specified.

Test signal	f (MHz)	I_{Dq} (mA)	$P_{L(AV)}$ (W)	$P_{L(M)}$ (W)	G_p (dB)	η_D (%)	IMD3 (dBc)
pulsed, class-AB [1]	860	1.3	-	600	20	58	-

[1] Measured at δ = 10 %; t_p = 1 ms.

1.2 Features and benefits

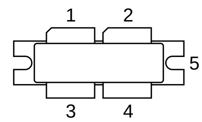
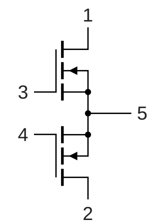
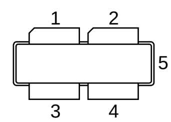
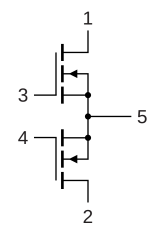
- Excellent ruggedness (VSWR ≥ 40 : 1 through all phases)
- Optimum thermal behavior and reliability, $R_{th(j-c)}$ = 0.15 K/W
- High power gain
- High efficiency
- Internal input matching for high gain and optimum broadband operation
- Excellent reliability
- Easy power control
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- Power amplifier for radar transmitter applications in the 400 MHz to 900 MHz frequency range

2. Pinning information

Table 2. Pinning

Pin	Description		Simplified outline	Graphic symbol
BLU6H0410L-600P (SOT539A)				
1	drain1			 sym117
2	drain2			
3	gate1			
4	gate2			
5	source	[1]		
BLU6H0410LS-600P (SOT539B)				
1	drain1			 sym117
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
BLU6H0410L-600P	-	flanged balanced LDMOST ceramic package; 2 mounting holes; 4 leads	SOT539A
BLU6H0410LS-600P	-	earless flanged balanced LDMOST 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		-	110	V
V_{GS}	gate-source voltage		–0.5	+11	V
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
$R_{th(j-c)}$	thermal resistance from junction to case	T_j = 150 °C	[1]	0.15	K/W
$Z_{th(j-c)}$	transient thermal impedance from junction to case	T_j = 150 °C			
		t_p = 100 μs; δ = 10 %		0.020	K/W
		t_p = 200 μs; δ = 10 %		0.023	K/W
		t_p = 300 μs; δ = 10 %		0.025	K/W
		t_p = 500 μs; δ = 10 %		0.028	K/W
		t_p = 100 μs; δ = 20 %		0.035	K/W

[1] $R_{th(j-c)}$ is measured under RF conditions.

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 = 2.4 mA	[1]	110	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 240 mA	[1]	1.4	1.9	2.4	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		-	36	-	A
I_{GSS}	gate leakage current	V_{GS} = 10 V; V_{DS} = 0 V		-	-	280	nA
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 8.5 A	[1]	-	143	-	mΩ
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	[2]	-	220	-	pF
C_{oss}	output capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz		-	74	-	pF
C_{rss}	reverse transfer capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz		-	1.2	-	pF

[1] I_D is the drain current.

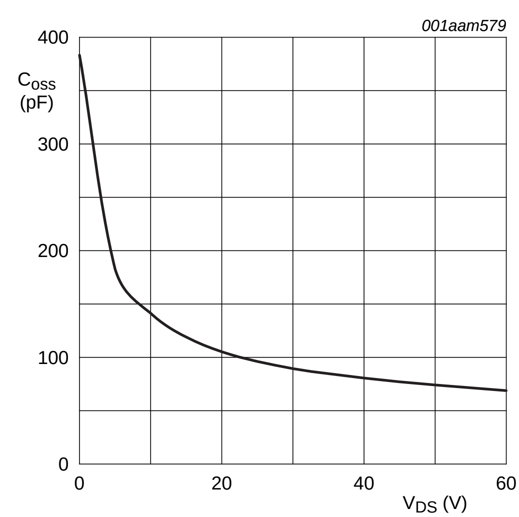
[2] Capacitance values without internal matching.

Table 7. RF characteristics

Test signal: 2-Tone; T_{case} = 25 °C unless otherwise specified; in a class-AB Ampleon production narrowband test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage		-	50	-	V
I_{Dq}	quiescent drain current	[1]	-	1.3	-	A
$P_{L(AV)}$	average output power	f_1 = 860 MHz; f_2 = 860.1 MHz	250	-	-	W
G_p	power gain	f_1 = 860 MHz; f_2 = 860.1 MHz	20	21	-	dB
η_D	drain efficiency	f_1 = 860 MHz; f_2 = 860.1 MHz	42	46	-	%
IMD3	third-order intermodulation distortion	f_1 = 860 MHz; f_2 = 860.1 MHz	-	–32	–28	dBc

[1] I_{Dq} for total device.



V_{GS} = 0 V; f = 1 MHz.

Fig 1. Output capacitance as a function of drain-source voltage; typical values per section

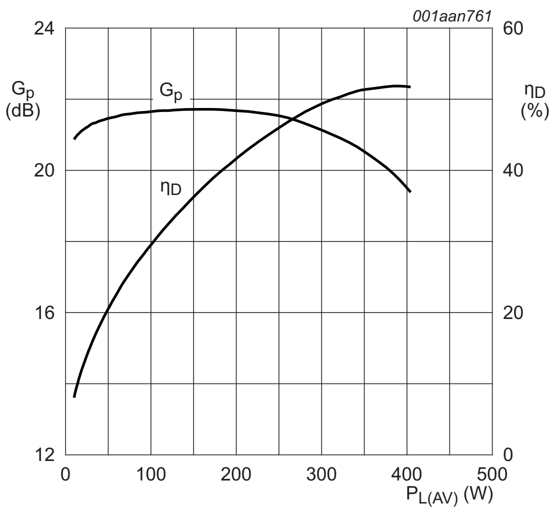
6.1 Ruggedness in class-AB operation

The BLU6H0410L-600P and BLU6H0410LS-600P are capable of withstanding a load mismatch corresponding to VSWR ≥ 40 : 1 through all phases under the following conditions: V_{DS} = 50 V; f = 860 MHz at rated power.

7. Application information

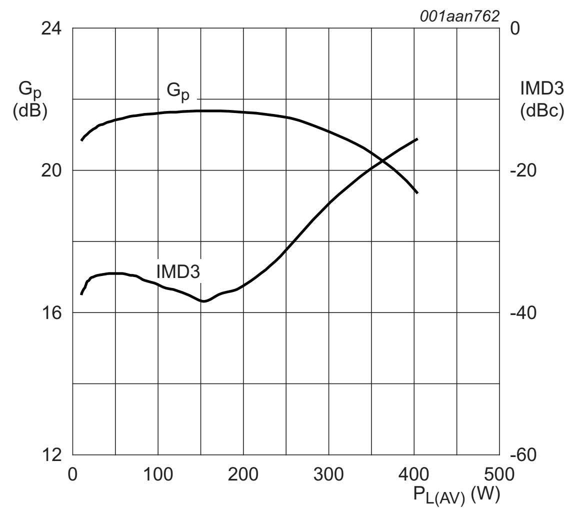
7.1 Narrowband RF figures

7.1.1 2-Tone



V_{DS} = 50 V; I_{Dq} = 1.3 A; measured in a common source narrowband 860 MHz test circuit.

Fig 2. 2-Tone power gain and drain efficiency as function of load power; typical values



V_{DS} = 50 V; I_{Dq} = 1.3 A; measured in a common source narrowband 860 MHz test circuit.

Fig 3. 2-Tone power gain and third order intermodulation distortion as function of load power; typical values

7.2 Impedance information

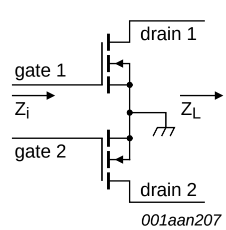


Fig 4. Definition of transistor impedance

Table 8. Typical push-pull impedance

Simulated Z_i and Z_L device impedance; impedance info at V_{DS} = 50 V and $P_{L(M)}$ = 600 W.

f MHz	Z_i Ω	Z_L Ω
300	0.617 – j1.715	4.989 + j1.365
325	0.635 – j1.355	4.867 + j1.424
350	0.655 – j1.026	4.741 + j1.472
375	0.677 – j0.721	4.614 + j1.511

Table 8. Typical push-pull impedance *...continued*

Simulated Z_i and Z_L device impedance; impedance info at V_{DS} = 50 V and $P_{L(M)}$ = 600 W.

f MHz	Z_i Ω	Z_L Ω
400	0.702 − j0.435	4.486 + j1.540
425	0.731 − j0.164	4.357 + j1.559
450	0.762 + j0.096	4.228 + j1.570
475	0.798 + j0.347	4.100 + j1.573
500	0.839 + j0.592	4.974 + j1.567
525	0.884 + j0.833	3.850 + j1.554
550	0.936 + j1.072	3.728 + j1.534
575	0.995 + j1.310	3.608 + j1.508
600	1.063 + j1.549	3.492 + j1.475
625	1.141 + j1.791	3.378 + j1.437
650	1.230 + j2.037	3.268 + j1.394
675	1.334 + j2.289	3.161 + j1.347
700	1.456 + j2.548	3.057 + j1.295
725	1.599 + j2.814	2.957 + j1.239
750	1.768 + j3.090	2.860 + j1.180
775	1.971 + j3.376	2.676 + j1.118
800	2.214 + j3.671	2.677 + j1.053
825	2.510 + j3.975	2.591 + j0.985
850	2.873 + j4.282	2.508 + j0.915
875	3.320 + j4.584	2.428 + j0.843
900	3.875 + j4.865	2.351 + j0.770
925	4.562 + j5.095	2.277 + j0.695
950	5.409 + j5.223	2.206 + j0.618
975	6.426 + j5.166	2.138 + j0.540
1000	7.587 + j4.807	2.073 + j0.461

8. Test information

Table 9. List of components

For test circuit, see Figure 5, Figure 6 and Figure 7.

Component	Description	Value		Remarks
B1, B2	semi rigid coax	25 Ω; 49.5 mm		UT-090C-25 (EZ 90-25)
C1	multilayer ceramic chip capacitor	12 pF	[1]	
C2, C3, C4, C5, C6	multilayer ceramic chip capacitor	8.2 pF	[1]	
C7	multilayer ceramic chip capacitor	6.8 pF	[2]	
C8	multilayer ceramic chip capacitor	2.7 pF	[2]	
C9	multilayer ceramic chip capacitor	2.2 pF	[2]	
C10, C13, C14	multilayer ceramic chip capacitor	100 pF	[3]	
C11, C12	multilayer ceramic chip capacitor	10 pF	[2]	
C15, C16	multilayer ceramic chip capacitor	4.7 μF; 50 V		Kemet C1210X475K5RAC-TU or capacitor of same quality.
C17, C18, C23, C24	multilayer ceramic chip capacitor	100 pF	[2]	
C19, C20	multilayer ceramic chip capacitor	10 μF; 50 V		TDK C570X7R1H106KT000N or capacitor of same quality.
C21, C22	electrolytic capacitor	470 μF; 63 V		
C30	multilayer ceramic chip capacitor	10 pF	[4]	
C31	multilayer ceramic chip capacitor	9.1 pF	[4]	
C32	multilayer ceramic chip capacitor	3.9 pF	[4]	
C33, C34, C35	multilayer ceramic chip capacitor	100 pF	[4]	
C36, C37	multilayer ceramic chip capacitor	4.7 μF; 50 V		TDK C4532X7R1E475MT020U or capacitor of same quality.
L1	microstrip	-	[5]	(W × L) 15 mm × 13 mm
L2	microstrip	-	[5]	(W × L) 5 mm × 26 mm
L3, L32	microstrip	-	[5]	(W × L) 2 mm × 49.5 mm
L4	microstrip	-	[5]	(W × L) 1.7 mm × 3.5 mm
L5	microstrip	-	[5]	(W × L) 2 mm × 9.5 mm
L30	microstrip	-	[5]	(W × L) 5 mm × 13 mm
L31	microstrip	-	[5]	(W × L) 2 mm × 11 mm
L33	microstrip	-	[5]	(W × L) 2 mm × 3 mm
R1, R2	wire resistor	10 Ω		
R3, R4	SMD resistor	5.6 Ω		0805
R5, R6	wire resistor	100 Ω		
R7, R8	potentiometer	10 kΩ		

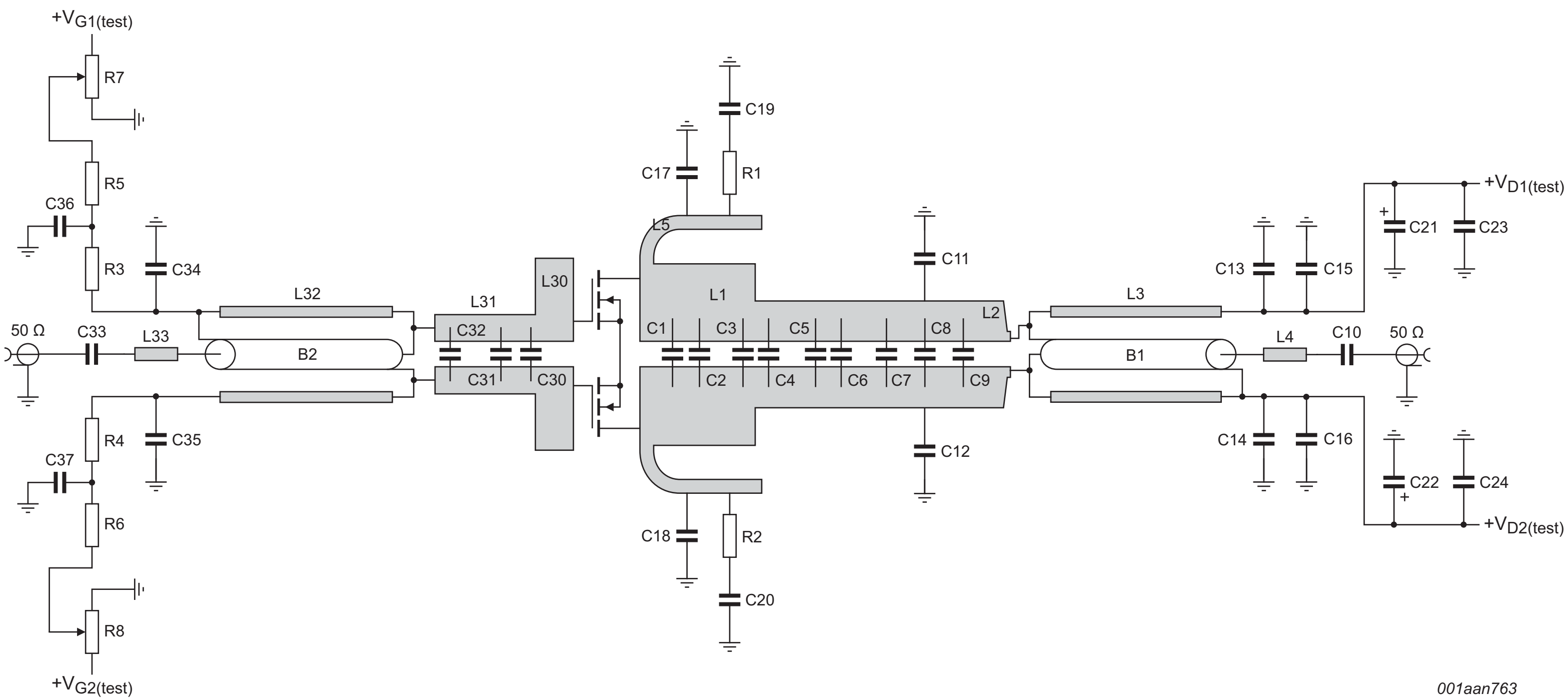
[1] American technical ceramics type 800R or capacitor of same quality.

[2] American technical ceramics type 800B or capacitor of same quality.

[3] American technical ceramics type 180R or capacitor of same quality.

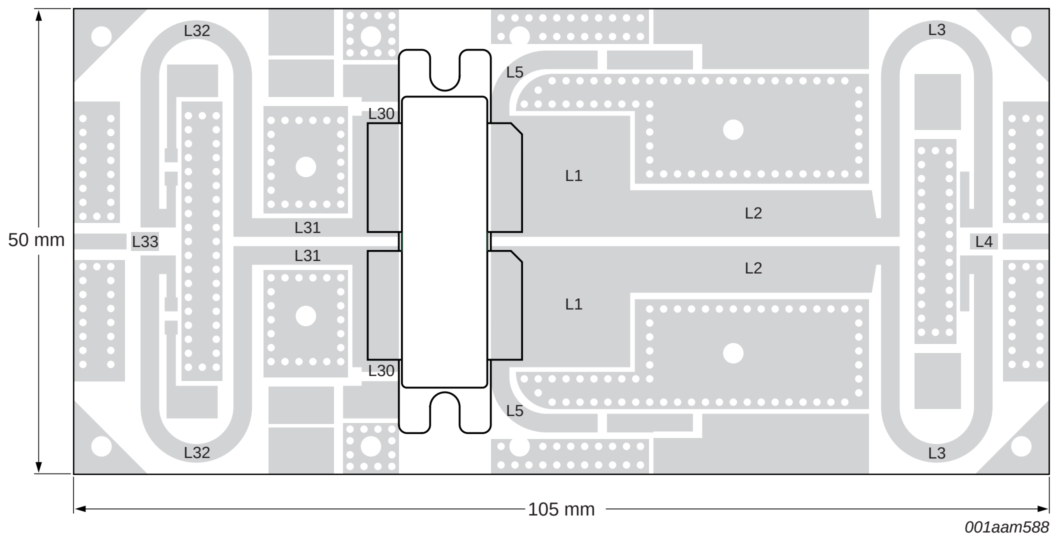
[4] American technical ceramics type 100A or capacitor of same quality.

[5] Printed-Circuit Board (PCB): Taconic RF35; ε_r = 3.5 F/m; height = 0.762 mm; Cu (top/bottom metallization); thickness copper plating = 35 μm.



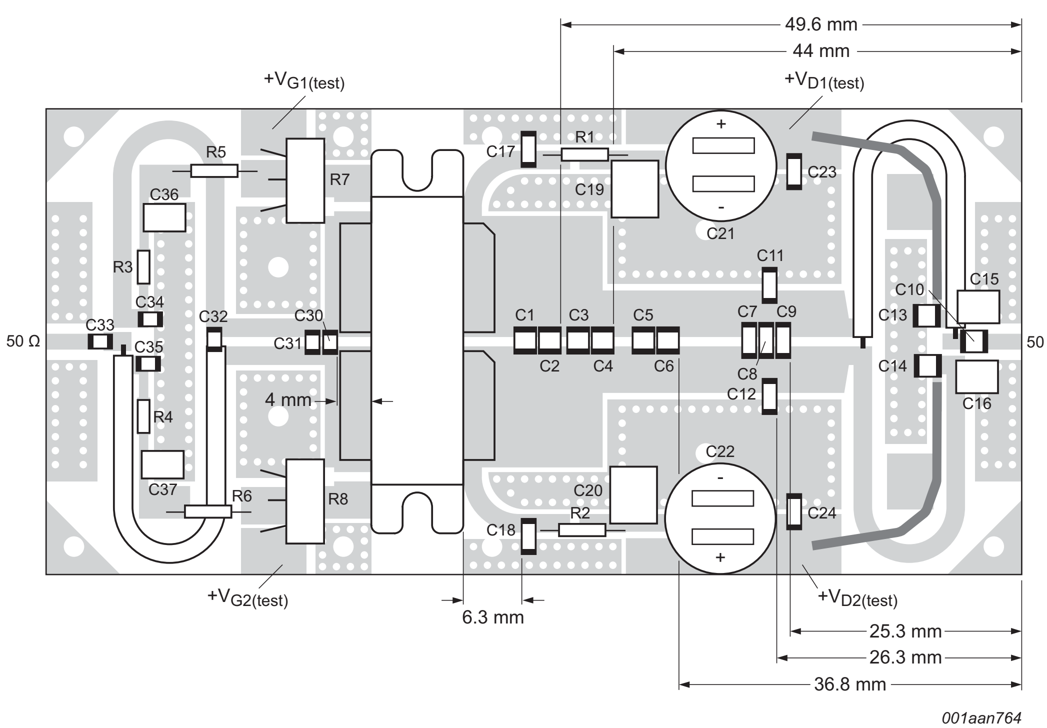
See Table 9 for a list of components.

Fig 5. Class-AB common source broadband amplifier; $V_{D1(test)}$, $V_{D2(test)}$, $V_{G1(test)}$ and $V_{G2(test)}$ are drain and gate test voltages



See Table 9 for a list of components.

Fig 6. Printed-Circuit Board (PCB) for class-AB common source amplifier

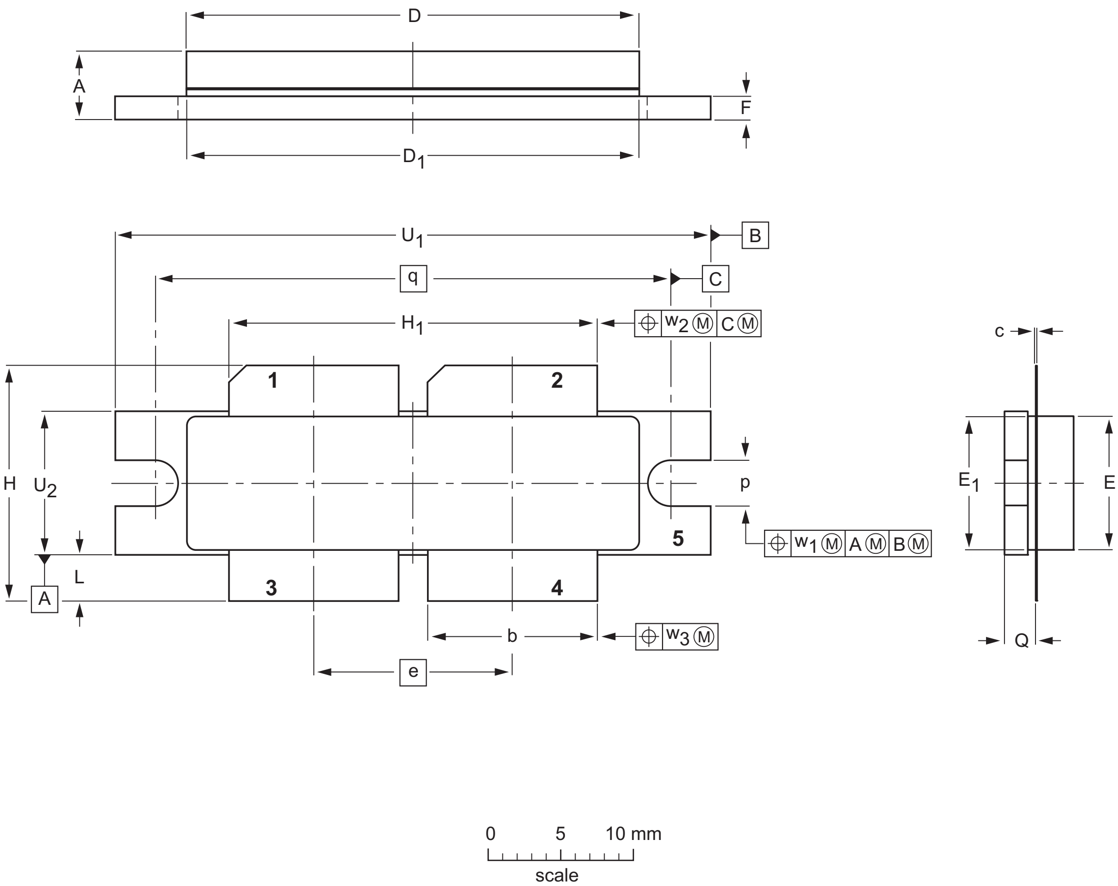


See Table 9 for a list of components.

Fig 7. Component layout for class-AB common source amplifier

9. Package outline

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



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

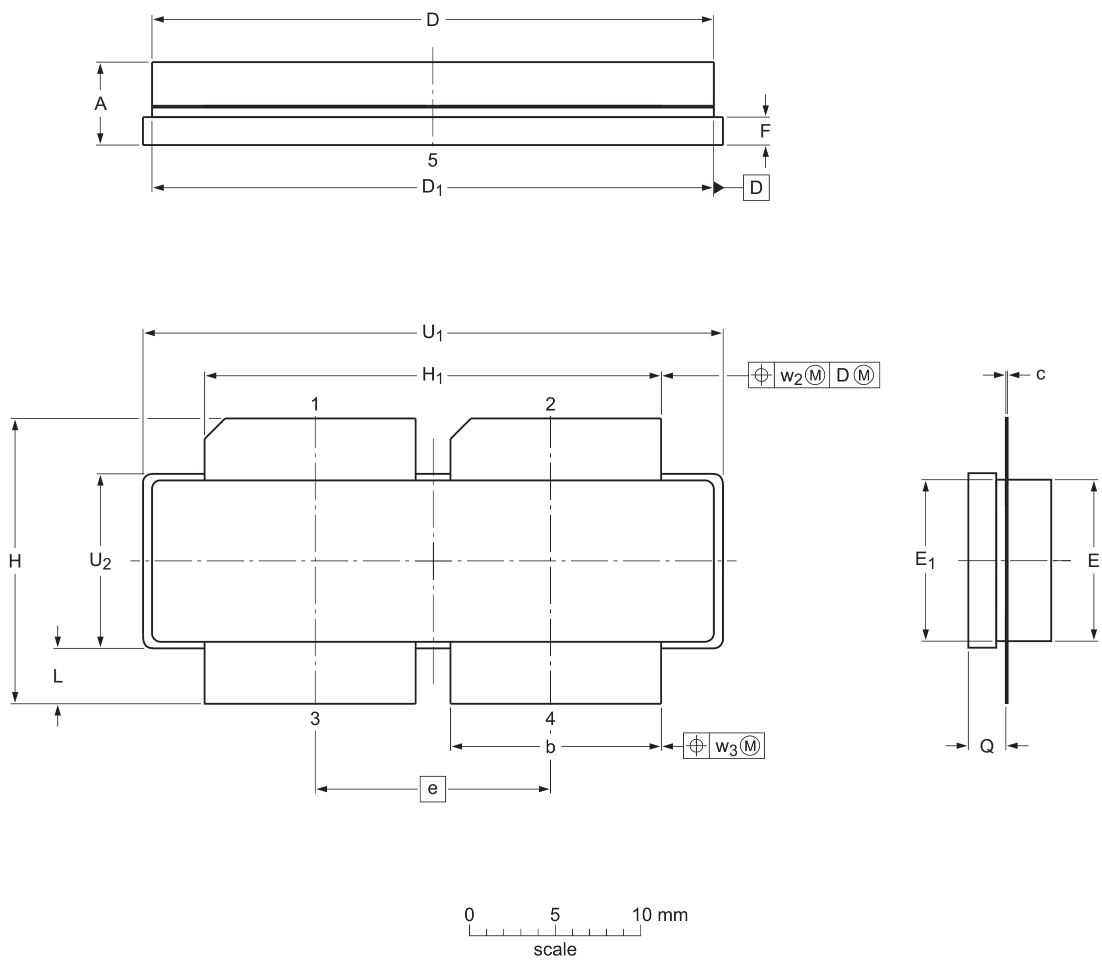
UNIT	A	b	c	D	D_1	e	E	E_1	F	H	H_1	L	p	Q	q	U_1	U_2	w_1	w_2	w_3
mm	4.7 4.2	11.81 11.56	0.18 0.10	31.55 30.94	31.52 30.96	13.72	9.50 9.30	9.53 9.27	1.75 1.50	17.12 16.10	25.53 25.27	3.48 2.97	3.30 3.05	2.26 2.01	35.56	41.28 41.02	10.29 10.03	0.25	0.51	0.25
inches	0.185 0.165	0.465 0.455	0.007 0.004	1.242 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 8. Package outline SOT539A

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



Dimensions

Unit(1)		A	b	c	D	D1	E	E1	e	F	H	H1	L	Q	U1	U2	w2	w3
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 9. Package outline SOT539B

10. 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.

11. Abbreviations

Table 10. Abbreviations

Acronym	Description
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
LDMOST	Laterally Diffused Metal-Oxide Semiconductor Transistor
RF	Radio Frequency
SMD	Surface Mounted Device
VSWR	Voltage Standing-Wave Ratio

12. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLU6H0410L-600P_6H0410LS-600P#3	20150901	Product data sheet		BLU6H0410L-600P_6H0410LS-600P v.2
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.			
BLU6H0410L-600P_6H0410LS-600P v.2	20130712	Product data sheet	-	BLU6H0410L-600P_6H0410LS-600P v.1
BLU6H0410L-600P_6H0410LS-600P v.1	20120426	Product data sheet	-	-

13. Legal information

13.1 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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14. Contact information

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

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

15. Contents

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