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BLF888

UHF power LDMOS transistor

AMPLEON

Rev. 6 — 1 September 2015

Product data sheet

1. Product profile

1.1 General description

A 500 W LDMOS RF power transistor for broadcast transmitter applications and industrial applications. The transistor is optimized for digital applications and can deliver 110 W average DVB-T broadband over the full UHF band from 470 MHz to 860 MHz. The excellent ruggedness of this device makes it ideal for digital transmitter applications.

Table 1. Application information

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

Mode of operation	f (MHz)	$P_{L(PEP)}$ (W)	$P_{L(AV)}$ (W)	G_p (dB)	η_D (%)	IMD3 (dBc)	IMD_{shldr} (dBc)
2-Tone, class AB	f_1 = 860; f_2 = 860.1	500	250	19	46	–32	-
DVB-T (8k OFDM)	858	-	110	19	31	-	–31 [1]

[1] Measured [dBc] with delta marker at 4.3 MHz from center frequency.

CAUTION

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

1.2 Features and benefits

- 2-Tone performance at 860 MHz, a drain-source voltage V_{DS} of 50 V and a quiescent drain current I_{Dq} = 1.3 A:
  - Peak envelope power load power = 500 W
  - Power gain = 19 dB
  - Drain efficiency = 46 %
  - Third order intermodulation distortion = –32 dBc
- DVB performance at 858 MHz, a drain-source voltage V_{DS} of 50 V and a quiescent drain current I_{Dq} = 1.3 A:
  - Average output power = 110 W
  - Power gain = 19 dB
  - Drain efficiency = 31 %
  - Shoulder distance = –31 dBc (4.3 MHz from center frequency)
- Integrated ESD protection
- Advanced flange material for optimum thermal behavior and reliability

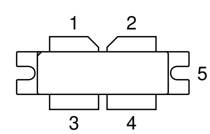
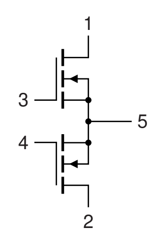
- Excellent ruggedness
- High power gain
- High efficiency
- Designed for broadband operation (470 MHz to 860 MHz)
- Excellent reliability
- Internal input matching for high gain and optimum broadband operation
- Easy power control
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- Communication transmitter applications in the UHF band
- Industrial applications in the UHF band

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
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
BLF888	-	flanged LDMOST ceramic package; 2 mounting holes; 4 leads	SOT979A

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		-	104	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_{case} = 80 °C; $P_{L(AV)}$ = 110 W	[1]	0.24	K/W

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

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 = 2.7 mA	[1]	104	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 270 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		-	43	-	A
I_{GSS}	gate leakage current	V_{GS} = 10 V; V_{DS} = 0 V		-	-	280	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 13.5 A	[1]	-	17	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 9.5 A	[1]	-	105	-	mΩ
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	[2]	-	205	-	pF
C_{oss}	output capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	[2]	-	65	-	pF
C_{rss}	reverse transfer capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	[2]	-	2.2	-	pF

[1] I_D is the drain current.

[2] Capacitance values without internal matching.

Table 7. RF characteristics
T_h = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
2-Tone, class AB						
V_{DS}	drain-source voltage		-	50	-	V
I_{Dq}	quiescent drain current	total device	-	1.3	-	A
$P_{L(PEP)}$	peak envelope power load power		500	-	-	W
$P_{L(AV)}$	average output power		250	-	-	W
G_p	power gain		18	19	-	dB
η_D	drain efficiency		42	46	-	%
IMD3	third-order intermodulation distortion		-	–32	–28	dBc
DVB-T (8k OFDM)						
V_{DS}	drain-source voltage		-	50	-	V
I_{Dq}	quiescent drain current	total device	-	1.3	-	A
$P_{L(AV)}$	average output power		110	-	-	W
G_p	power gain		18	19	-	dB

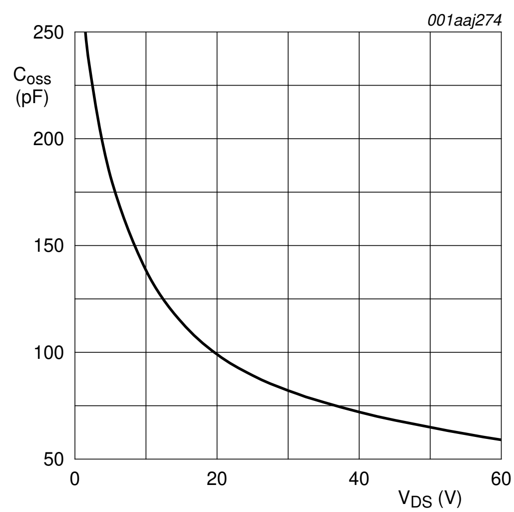
Table 7. RF characteristics *...continued*

T_h = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
η_D	drain efficiency			28	31	-	%
IMD_{shldr}	intermodulation distortion shoulder		[1]	-	–31	–28	dBc
PAR	peak-to-average ratio		[2]	-	8.3	-	dB

[1] Measured [dBc] with delta marker at 4.3 MHz from center frequency.

[2] PAR (of output signal) at 0.01 % probability on CCDF; PAR of input signal = 9.5 dB at 0.01 % probability on CCDF.



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

Fig 1. Output capacitance as a function of drain-source voltage; typical values per section; capacitance value without internal matching

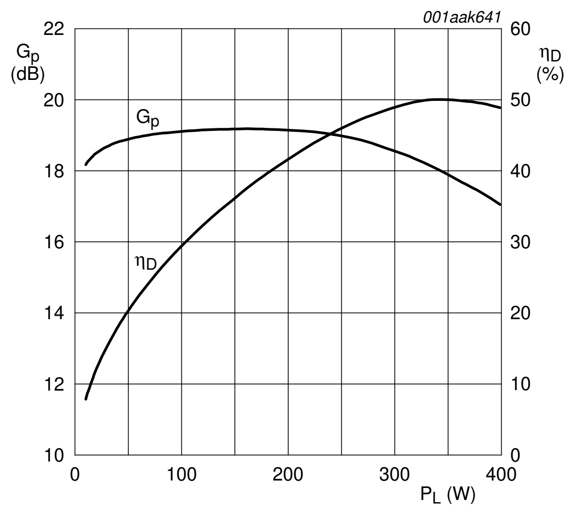
6.1 Ruggedness in class-AB operation

The BLF888 is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: V_{DS} = 50 V; f = 860 MHz at rated power. Ruggedness is measured in the application circuit as described in Section 8.

7. Application information

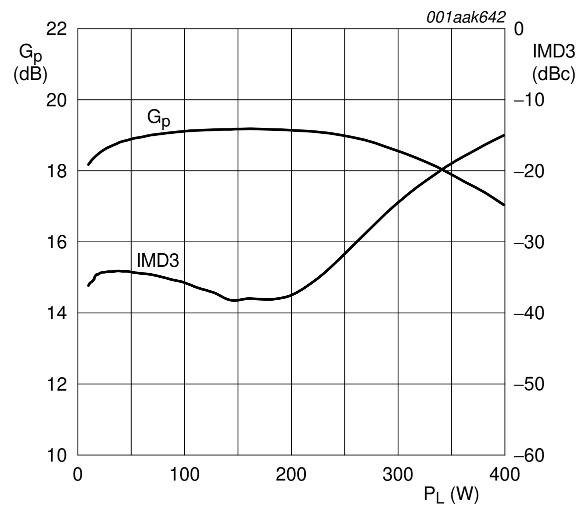
7.1 Narrowband RF figures

7.1.1 2-Tone



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

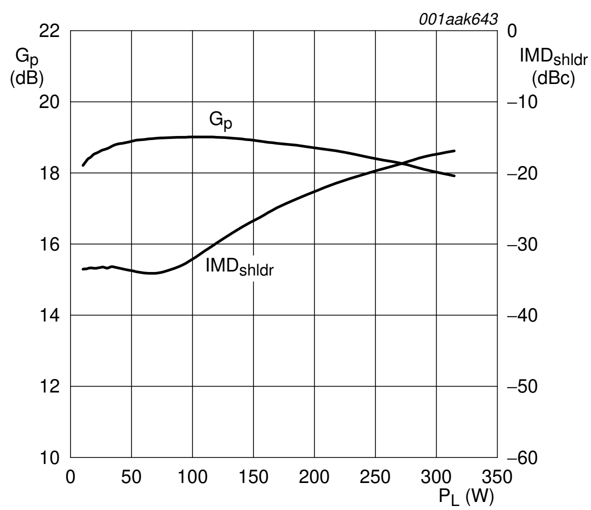
Fig 2. 2-Tone power gain and drain efficiency as function of load power; typical values



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

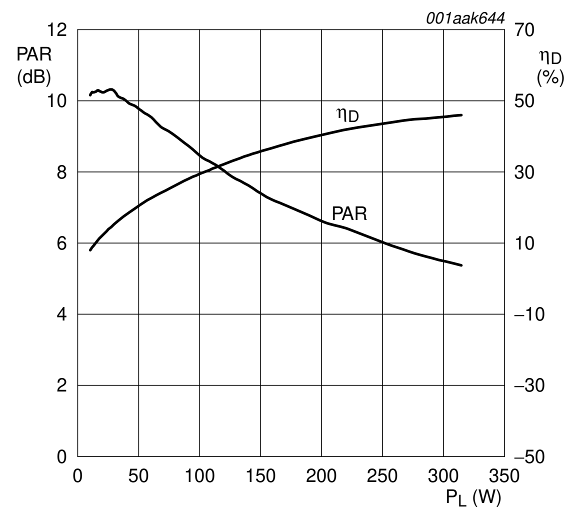
Fig 3. 2-Tone power gain and third order intermodulation distortion as function of load power; typical values

7.1.2 DVB-T



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

Fig 4. DVB-T power gain and intermodulation distortion shoulder as function of load power; typical values

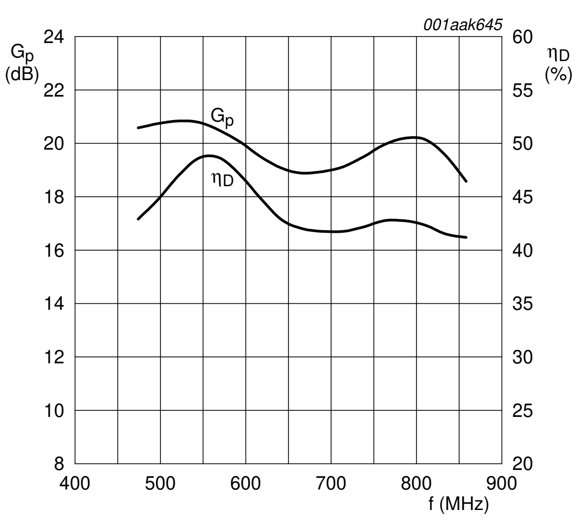


V_{DS} = 50 V; I_{Dq} = 1.3 A; measured in a common source narrowband 860 MHz test circuit.

Fig 5. DVB-T peak-to-average ratio and drain efficiency as function of load power; typical values

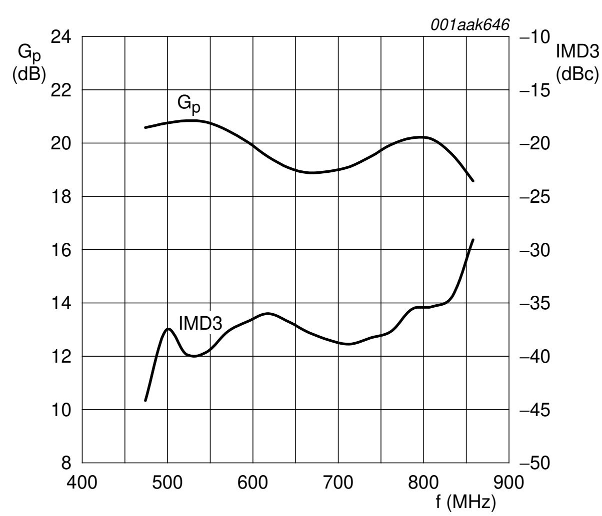
7.2 Broadband RF figures

7.2.1 2-Tone



$P_{L(AV)}$ = 250 W; V_{DS} = 50 V; I_{Dq} = 1.3 A; measured in a common source broadband test circuit as described in Section 8.

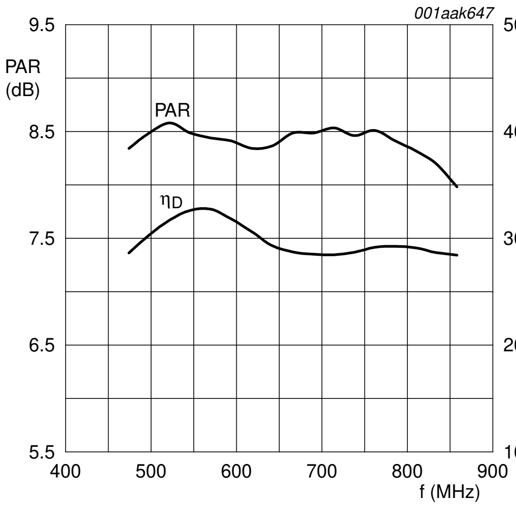
Fig 6. 2-Tone power gain and drain efficiency as function of frequency; typical values



$P_{L(AV)}$ = 250 W; V_{DS} = 50 V; I_{Dq} = 1.3 A; measured in a common source broadband test circuit as described in Section 8.

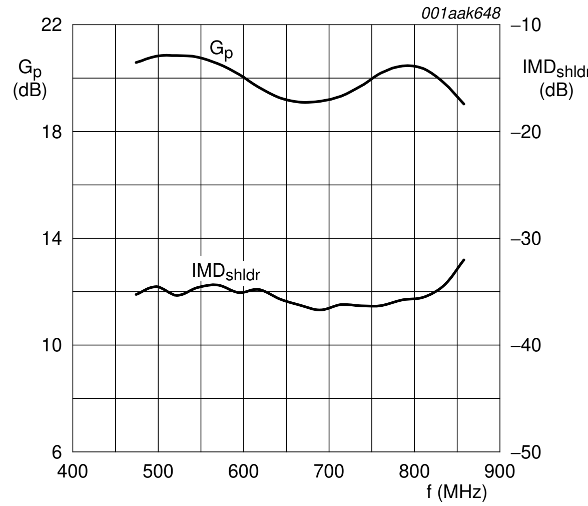
Fig 7. 2-Tone power gain and third order intermodulation distortion as function of frequency; typical values

7.2.2 DVB-T



$P_{L(AV)}$ = 110 W; V_{DS} = 50 V; I_{Dq} = 1.3 A; measured in a common source broadband test circuit as described in Section 8.

Fig 8. DVB-T peak-to-average ratio and drain efficiency as function of frequency; typical values



$P_{L(AV)}$ = 110 W; V_{DS} = 50 V; I_{Dq} = 1.3 A; measured in a common source broadband test circuit as described in Section 8.

Fig 9. DVB-T power gain and intermodulation distortion shoulder as a function of frequency; typical values

7.3 Impedance information

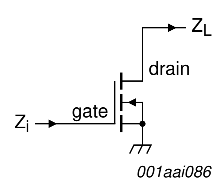


Fig 10. Definition of transistor impedance

Table 8. Typical push-pull impedance

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

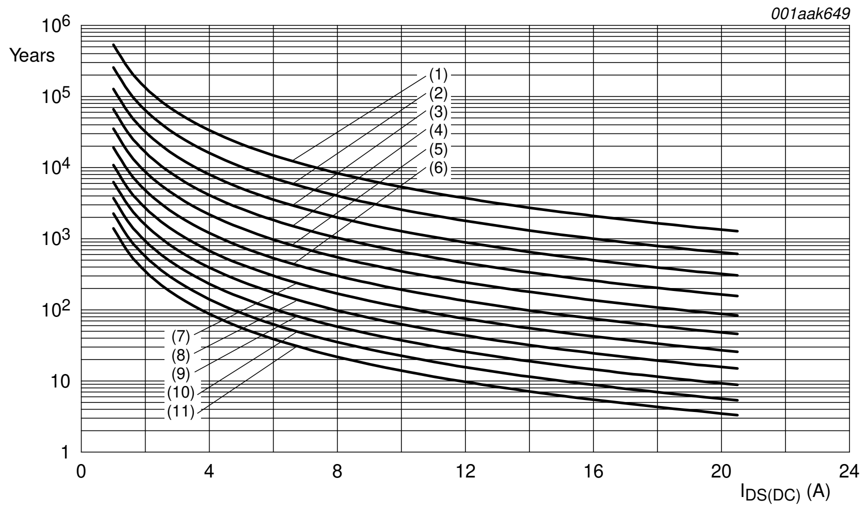
f MHz	Z_i Ω	Z_L Ω
300	1.018 − j1.350	5.565 + j0.747
325	1.045 − j1.022	5.435 + j0.752
350	1.076 − j0.722	5.303 + j0.746
375	1.110 − j0.444	5.167 + j0.730
400	1.148 − j0.183	5.030 + j0.704
425	1.190 + j0.064	4.892 + j0.668
450	1.238 + j0.299	4.754 + j0.622
475	1.291 + j0.526	4.617 + j0.567
500	1.351 + j0.746	4.481 + j0.504

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

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

f MHz	Z_i Ω	Z_L Ω
525	1.417 + j0.961	4.346 + j0.432
550	1.492 + j1.171	4.214 + j0.353
575	1.577 + j1.378	4.084 + j0.266
600	1.672 + j1.582	3.958 + j0.173
625	1.779 + j1.783	3.834 + j0.074
650	1.901 + j1.983	3.713 – j0.031
675	2.039 + j2.180	3.596 – j0.142
700	2.196 + j2.373	3.482 – j0.257
725	2.376 + j2.563	3.372 – j0.377
750	2.581 + j2.745	3.266 – j0.501
775	2.817 + j2.918	3.163 – j0.628
800	3.087 + j3.076	3.064 – j0.759
825	3.395 + j3.212	2.968 – j0.893
850	3.746 + j3.317	2.876 – j1.030
875	4.142 + j3.377	2.787 – j1.170
900	4.583 + j3.374	2.701 – j1.312
925	5.063 + j3.288	2.619 – j1.455
950	5.566 + j3.094	2.540 – j1.601
975	6.064 + j2.770	2.464 – j1.749
1000	6.514 + j2.299	2.391 – j1.898

7.4 Reliability



TTF (0.1 % failure fraction).

The reliability at pulsed conditions can be calculated as follows: TTF (0.1 %) × 1 / δ.

(1) T_j = 100 °C

(2) T_j = 110 °C

(3) T_j = 120 °C

(4) T_j = 130 °C

(5) T_j = 140 °C

(6) T_j = 150 °C

(7) T_j = 160 °C

(8) T_j = 170 °C

(9) T_j = 180 °C

(10) T_j = 190 °C

(11) T_j = 200 °C

Fig 11. BLF888 electromigration ($I_{DS(DC)}$, total device)

8. Test information

Table 9. List of components

For test circuit, see Figure 12, Figure 13 and Figure 14.

Component	Description	Value		Remarks
B1, B2	semi rigid coax	25 Ω; 49.5 mm		EZ90-25-TP
C1	multilayer ceramic chip capacitor	12 pF	[1]	
C2, C9, C10	multilayer ceramic chip capacitor	10 pF	[1]	
C3	multilayer ceramic chip capacitor	4.7 pF	[2]	
C4, C5, C6	multilayer ceramic chip capacitor	8.2 pF	[1]	
C7	multilayer ceramic chip capacitor	5.6 pF	[2]	
C8, C13, C14	multilayer ceramic chip capacitor	100 pF	[1]	
C11, C12	multilayer ceramic chip capacitor	2.0 pF	[2]	

Table 9. List of components *...continued*

For test circuit, see Figure 12, Figure 13 and Figure 14.

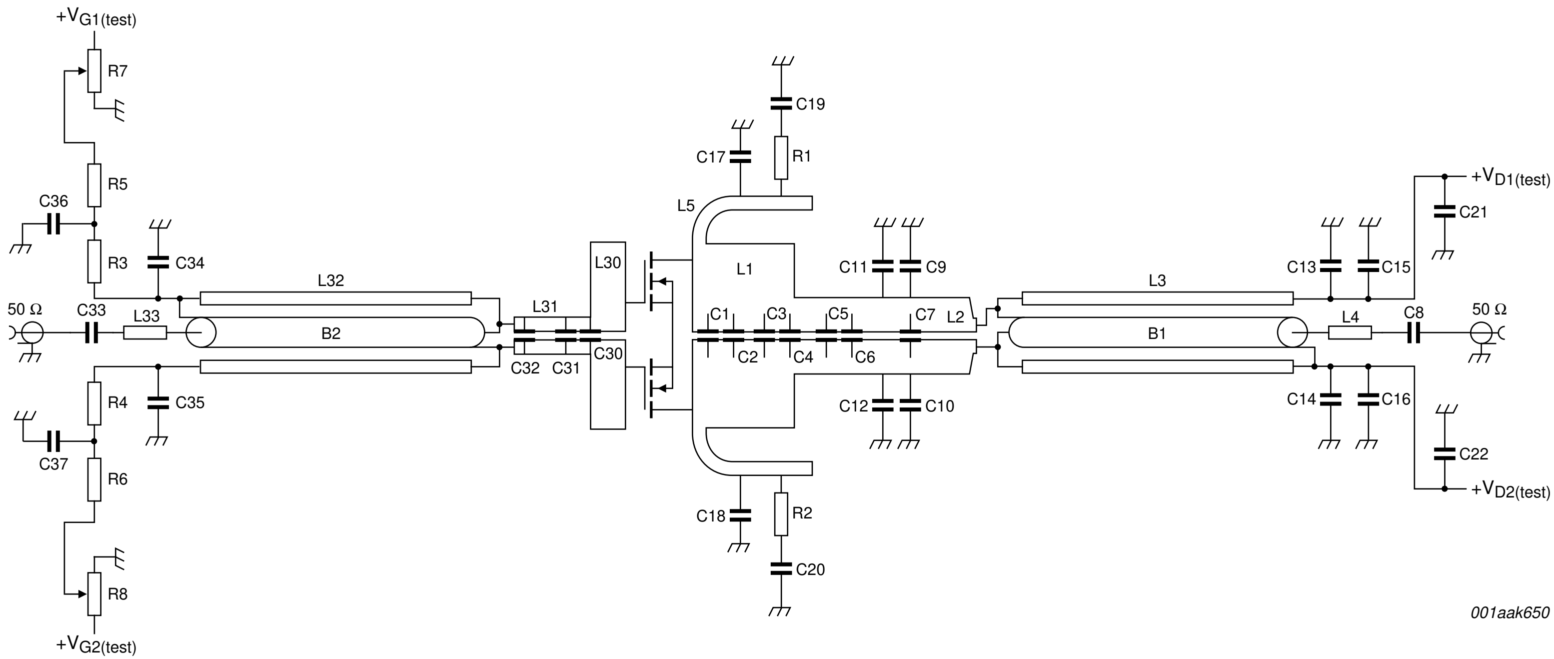
Component	Description	Value		Remarks
C15, C16	multilayer ceramic chip capacitor	4.7 μF, 50 V		TDK C4532X7R1E475MT020U or capacitor of same quality.
C17, C18	multilayer ceramic chip capacitor	100 pF	[2]	
C19, C20	multilayer ceramic chip capacitor	10 μF, 50 V		TDK C570X7R1H106KT000N or capacitor of same quality.
C21, C22	electrolytic capacitor	470 μF; 63 V		
C30, C31	multilayer ceramic chip capacitor	10 pF	[3]	
C32	multilayer ceramic chip capacitor	5.6 pF	[3]	
C33, C34, C35	multilayer ceramic chip capacitor	100 pF	[3]	
C36, C37	multilayer ceramic chip capacitor	4.7 μF		TDK C4532X7R1E475MT020U or capacitor of same quality.
L1	microstrip	-	[4]	(W × L) 15 mm × 13 mm
L2	microstrip	-	[4]	(W × L) 5 mm × 26 mm
L3, L32	microstrip	-	[4]	(W × L) 2 mm × 49.5 mm
L4	microstrip	-	[4]	(W × L) 1.7 mm 3.5 mm
L5	microstrip	-	[4]	(W × L) 2 mm × 9.5 mm
L30	microstrip	-	[4]	(W × L) 5 mm × 13 mm
L31	microstrip	-	[4]	(W × L) 2 mm × 11 mm
L33	microstrip	-	[4]	(W × L) 2 mm × 3 mm
R1, R2	resistor	10 Ω		
R3, R4	resistor	5.6 Ω		
R5, R6	resistor	100 Ω		
R7, R8	potentiometer	1 kΩ		

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

[2] American technical ceramics type 100B or capacitor of same quality.

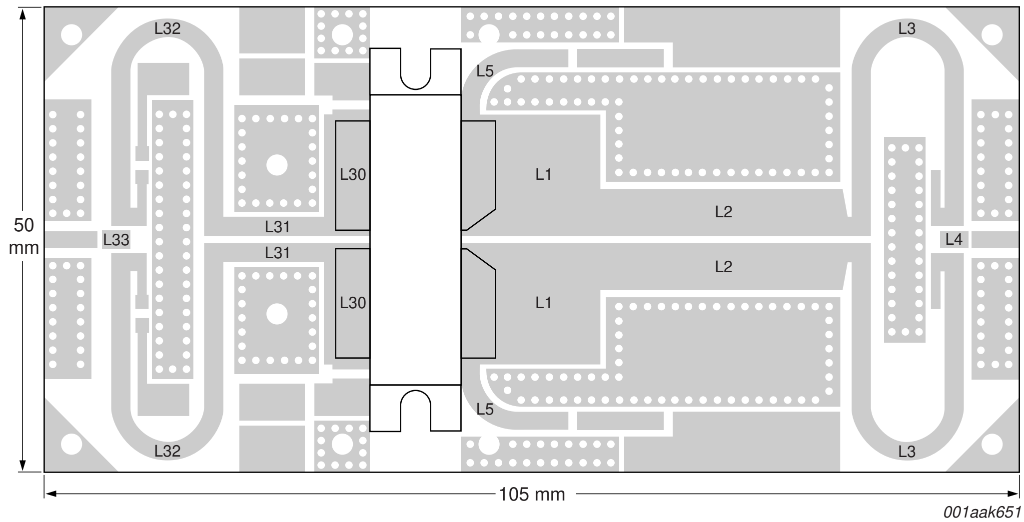
[3] American technical ceramics type 100A or capacitor of same quality.

[4] Printed-Circuit Board (PCB): Taconic RF35; ε_r = 3.5 F/m; height = 0.76 mm; Cu (top/bottom metallization); thickness copper plating = 35 μm.



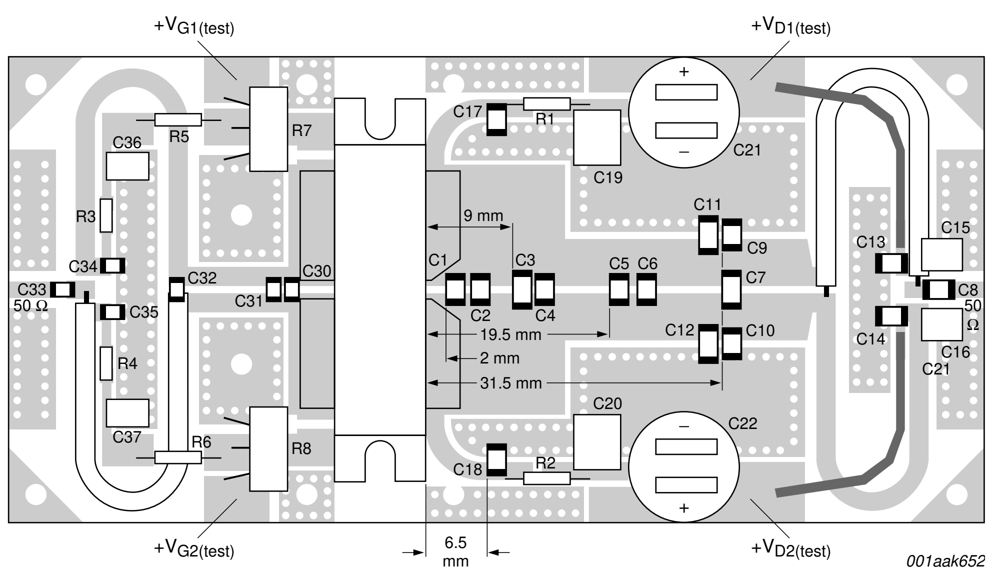
See Table 9 for a list of components.

Fig 12. 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 13. Printed-Circuit Board (PCB) for class-AB common source amplifier

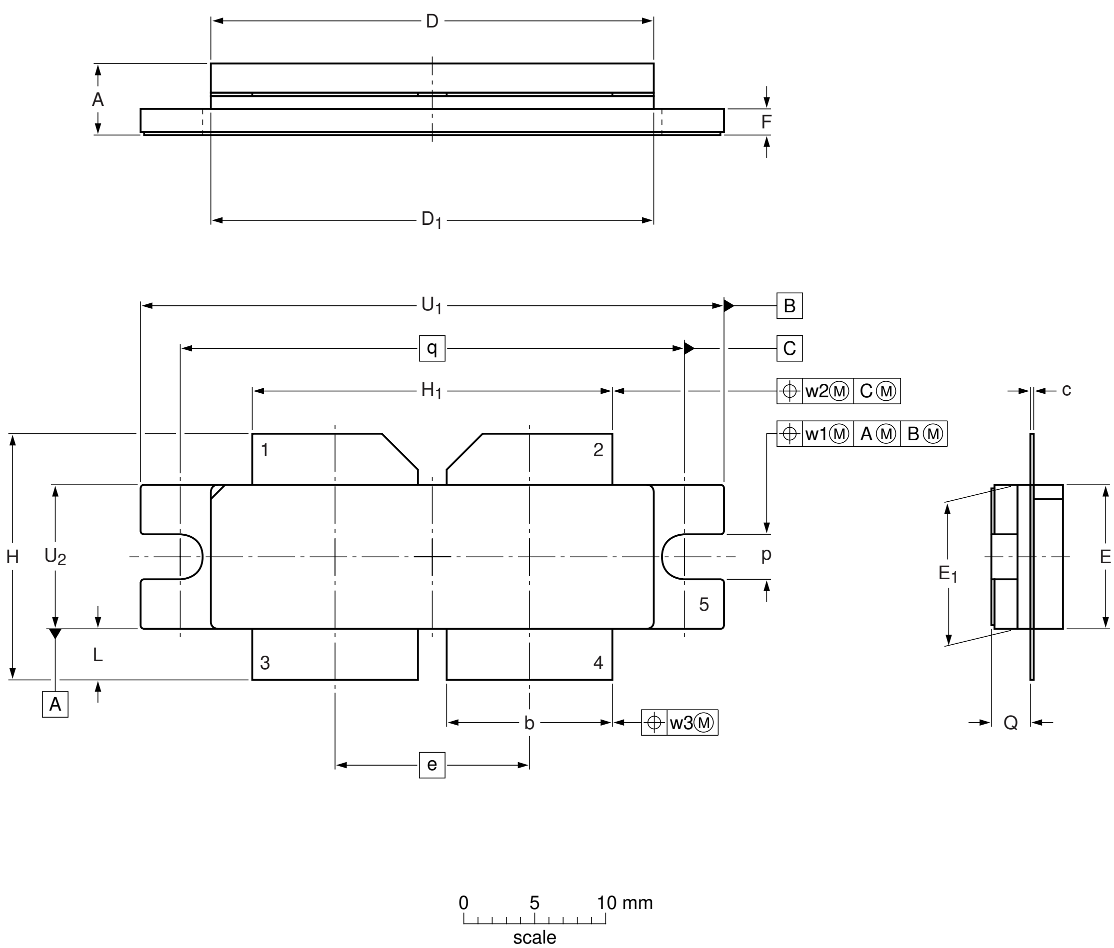


See Table 9 for a list of components.

Fig 14. Component layout for class-AB common source amplifier

9. Package outline

Flanged LDMOST ceramic package; 2 mounting holes; 4 leads **SOT979A**



Dimensions

Unit(1)		A	b	c	D	D_1	E	E_1	e	F	H	H_1	L	p	Q	q	U_1	U_2	w_1	w_2	w_3
mm	max	5.77	11.81	0.15	31.55	31.37	10.29	10.29		1.969	17.50	25.53	3.86	3.30	3.02		41.28	10.29			
	nom								13.72							35.56			0.25	0.51	0.25
	min	4.80	11.56	0.10	30.94	31.12	10.03	10.03		1.689	17.25	25.27	3.35	3.05	2.77		41.02	10.03			
inches	max	0.227	0.465	0.006	1.242	1.235	0.405	0.405		0.078	0.689	1.005	0.152	0.130	0.119		1.625	0.405			
	nom								0.540							1.400			0.010	0.020	0.010
	min	0.189	0.455	0.004	1.218	1.225	0.395	0.395		0.067	0.679	0.995	0.132	0.120	0.109		1.615	0.395			

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

sot979a_po

Outline version	References: IEC	References: JEDEC	References: JEITA		European projection	Issue date
SOT979A						~~08-04-24~~ 08-09-04

Fig 15. Package outline SOT979A

10. Abbreviations

Table 10. Abbreviations

Acronym	Description
CCDF	Complementary Cumulative Distribution Function
DVB	Digital Video Broadcast
DVB-T	Digital Video Broadcast - Terrestrial
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
LDMOST	Laterally Diffused Metal-Oxide Semiconductor Transistor
OFDM	Orthogonal Frequency Division Multiplexing
PAR	Peak-to-Average power Ratio
RF	Radio Frequency
TTF	Time To Failure
UHF	Ultra High Frequency
VSWR	Voltage Standing-Wave Ratio

11. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF888#6	20150901	Product data sheet	-	BLF888 v.5
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.			
BLF888 v.5	20110121	Product data sheet	-	BLF888 v.4
BLF888 v.4	20100429	Product data sheet	-	BLF888 v.3
BLF888 v.3	20100211	Product data sheet	-	BLF888 v.2
BLF888 v.2	20091022	Preliminary data sheet	-	BLF888 v.1
BLF888 v.1	20081216	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".

[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.

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13. Contact information

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

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

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