

# BLF888

## UHF power LDMOS transistor

Rev. 5 — 21 January 2011

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)	$\eta_D$ (%)	IMD3 (dBc)	IMD <sub>shldr</sub> (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 <a href="#">[1]</a>

[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



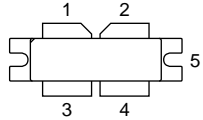
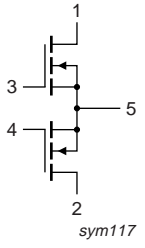
- Excellent ruggedness
- High power gain
- High efficiency
- Designed for broadband operation (470 MHz to 860 MHz)
- Excellent reliability
- Internal input matching for high gain and optimum broadband operation
- Easy power control
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous 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		 sym117
2	drain2		
3	gate1		
4	gate2		
5	source <a href="#">[1]</a>		

[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	$T_{case} = 80\text{ °C}; P_{L(AV)} = 110\text{ W}$	[1]	0.24 K/W

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

## 6. Characteristics

**Table 6. DC characteristics**

$T_j = 25\text{ °C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 2.7\text{ mA}$	[1]	104	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}; I_D = 270\text{ mA}$	[1]	1.4	1.9	2.4 V
$I_{DSS}$	drain leakage current	$V_{GS} = 0\text{ V}; V_{DS} = 50\text{ V}$	-	-	2.8	$\mu\text{A}$
$I_{DSX}$	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V}; V_{DS} = 10\text{ V}$	-	43	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 10\text{ V}; V_{DS} = 0\text{ V}$	-	-	280	nA
$g_{fs}$	forward transconductance	$V_{DS} = 10\text{ V}; I_D = 13.5\text{ A}$	[1]	-	17	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V}; I_D = 9.5\text{ A}$	[1]	-	105	$\text{m}\Omega$
$C_{iss}$	input capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 50\text{ V}; f = 1\text{ MHz}$	[2]	-	205	pF
$C_{oss}$	output capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 50\text{ V}; f = 1\text{ MHz}$	[2]	-	65	pF
$C_{rss}$	reverse transfer capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 50\text{ V}; f = 1\text{ MHz}$	[2]	-	2.2	pF

[1]  $I_D$  is the drain current.

[2] Capacitance values without internal matching.

**Table 7. RF characteristics**

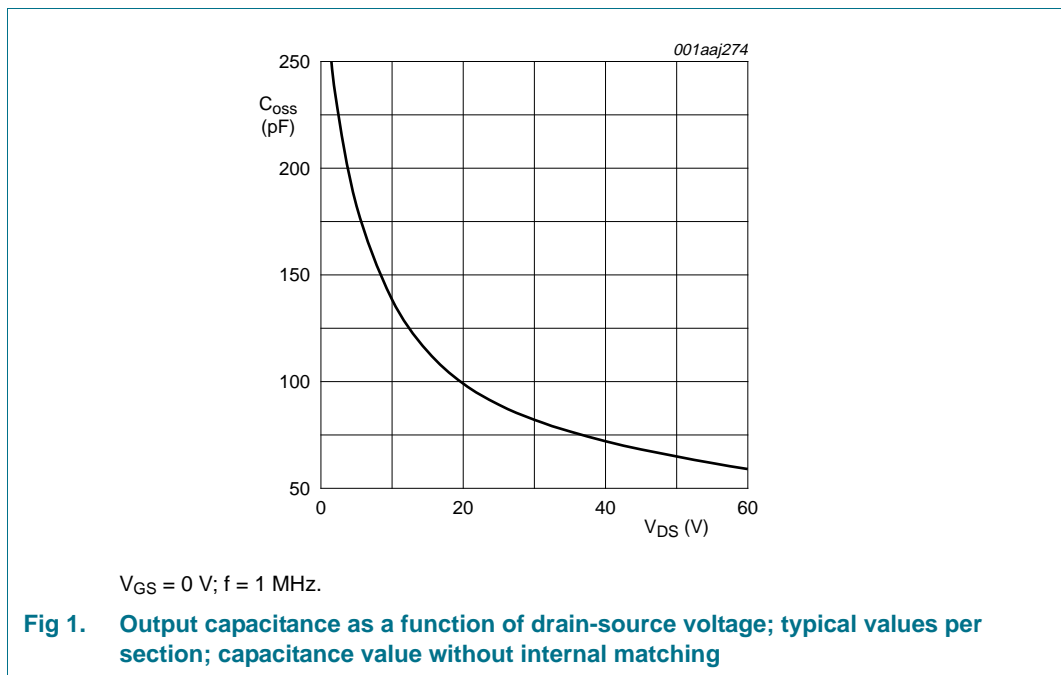
$T_h = 25\text{ °C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>2-Tone, class AB</b>						
$V_{DS}$	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
$\eta_D$	drain efficiency		42	46	-	%
IMD3	third-order intermodulation distortion		-	-32	-28	dBc
<b>DVB-T (8k OFDM)</b>						
$V_{DS}$	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**  
 $T_h = 25\text{ }^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$\eta_D$	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.



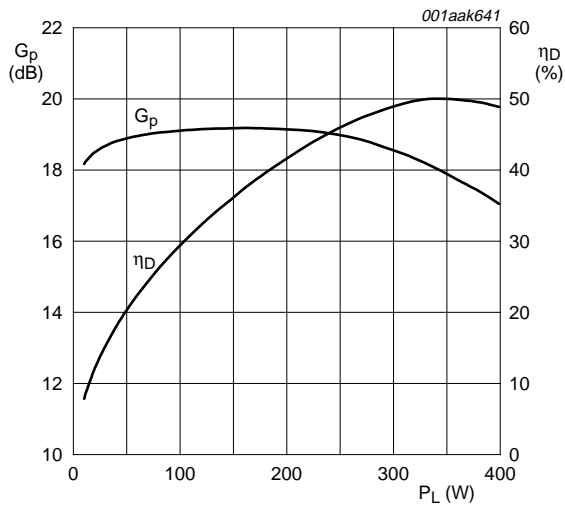
### 6.1 Ruggedness in class-AB operation

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

## 7. Application information

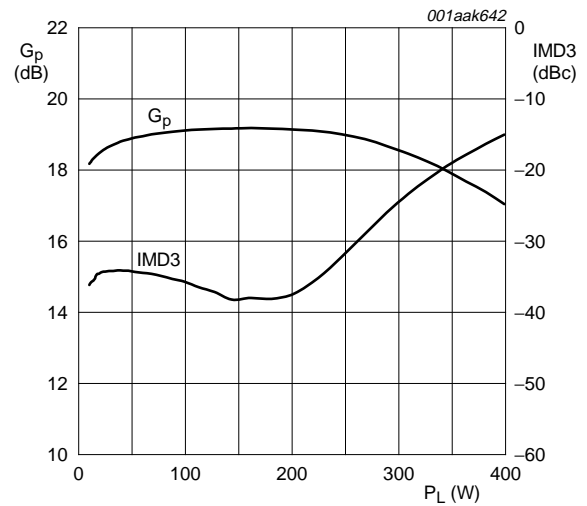
### 7.1 Narrowband RF figures

#### 7.1.1 2-Tone



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

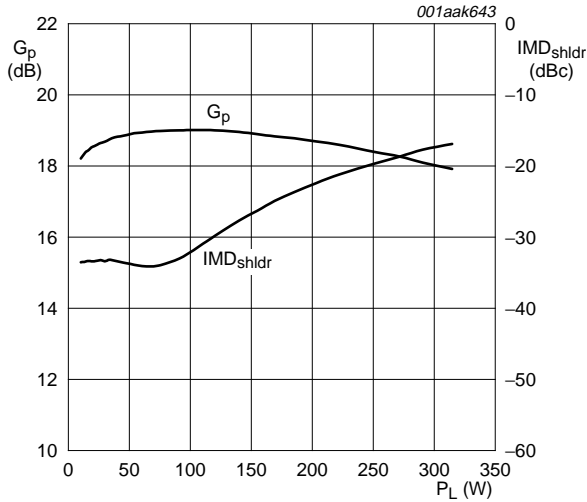
**Fig. 2. 2-Tone power gain and drain efficiency as function of load power; typical values**



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

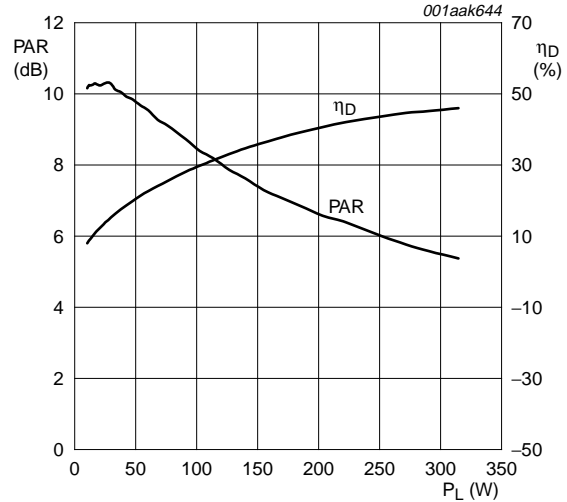
**Fig. 3. 2-Tone power gain and third order intermodulation distortion as function of load power; typical values**

7.1.2 DVB-T



$V_{DS} = 50\text{ V}$ ;  $I_{Dq} = 1.3\text{ A}$ ; 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

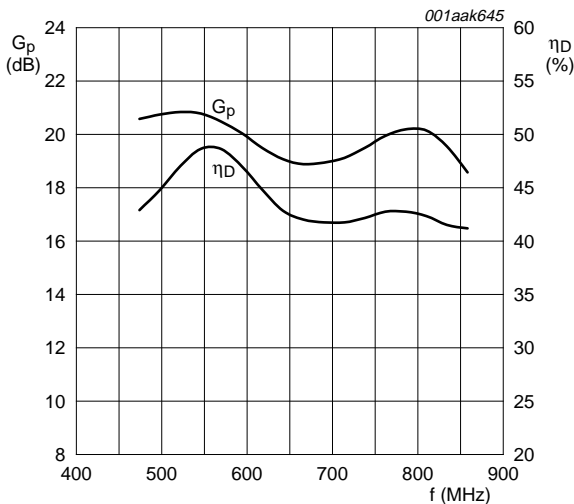


$V_{DS} = 50\text{ V}$ ;  $I_{Dq} = 1.3\text{ A}$ ; measured in a common source narrowband 860 MHz test circuit.

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

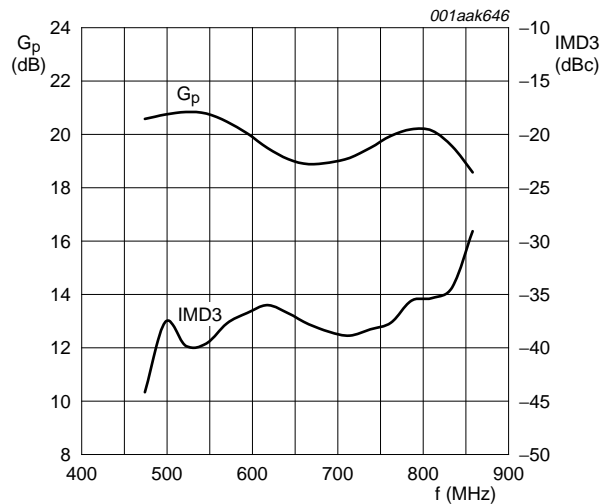
7.2 Broadband RF figures

7.2.1 2-Tone



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

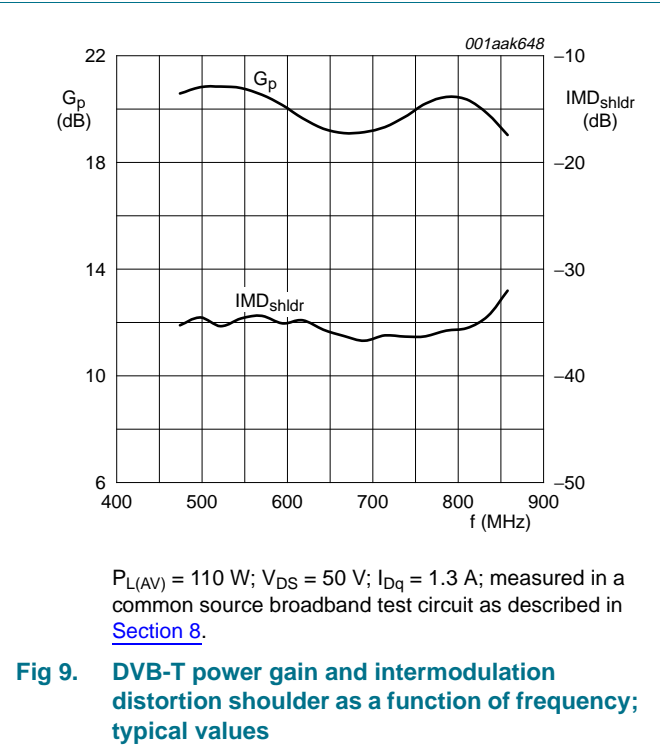
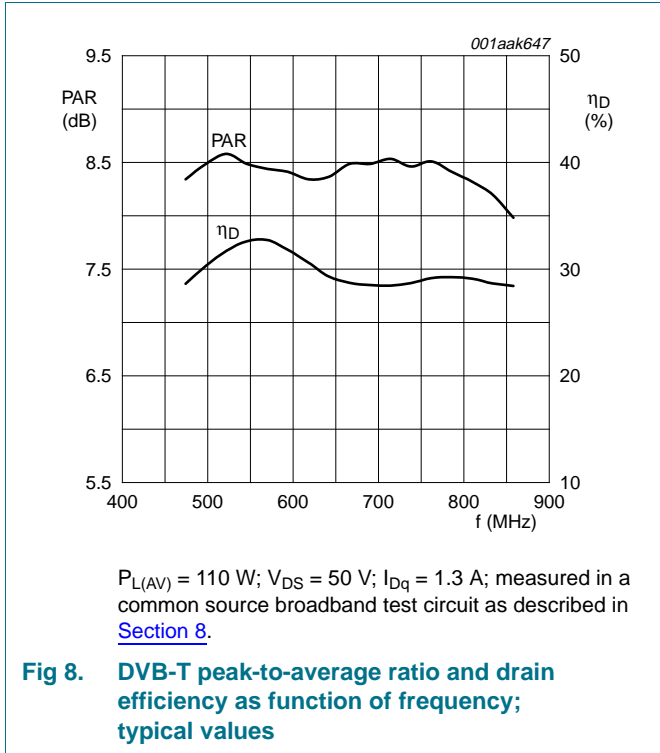
Fig 6. 2-Tone power gain and drain efficiency as function of frequency; typical values



$P_{L(AV)} = 250\text{ W}$ ;  $V_{DS} = 50\text{ V}$ ;  $I_{Dq} = 1.3\text{ A}$ ; 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



7.3 Impedance information

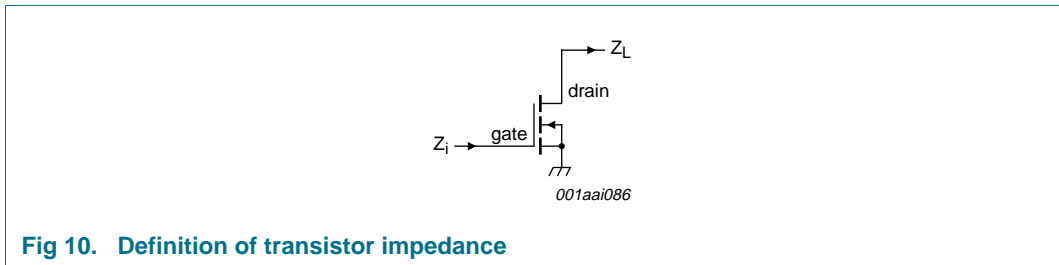


Table 8. Typical push-pull impedance

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

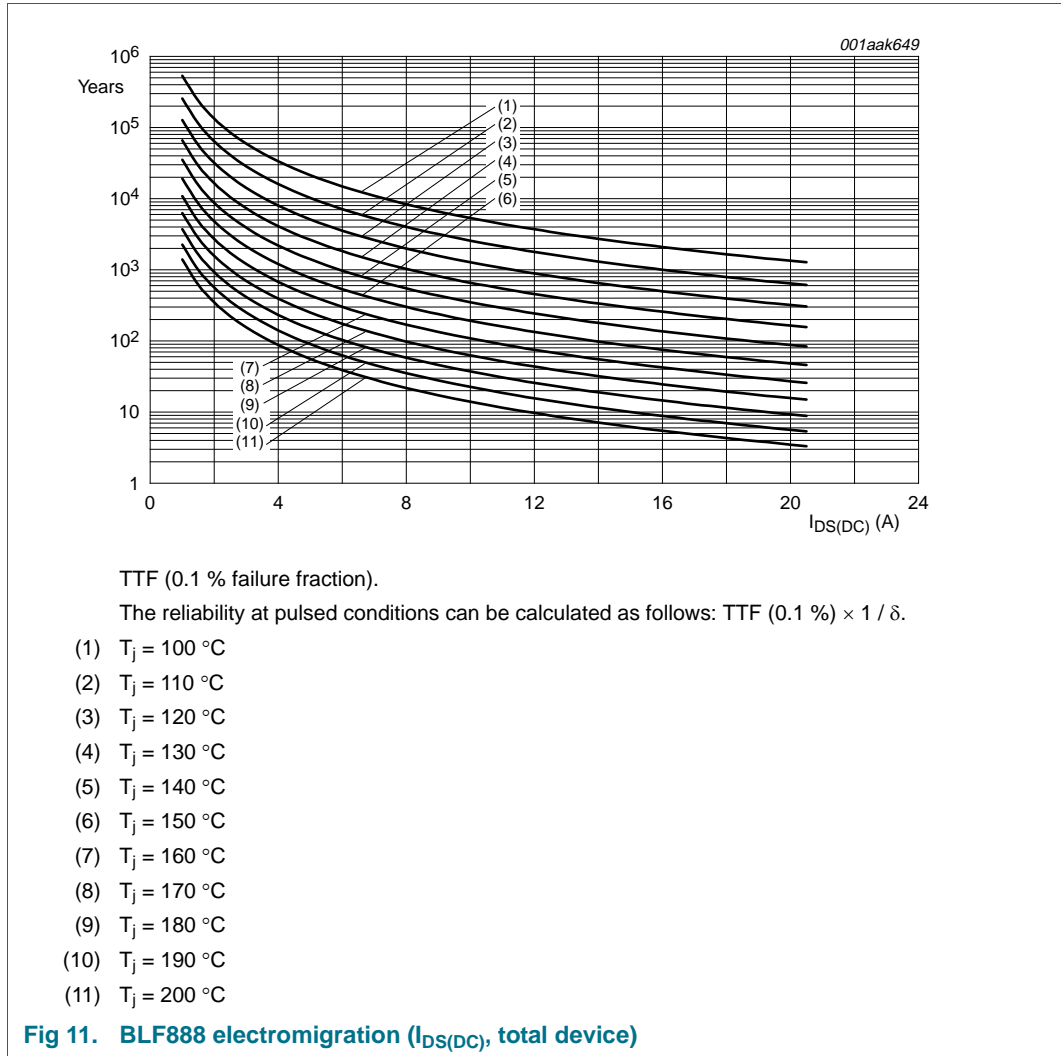
f MHz	$Z_i$ $\Omega$	$Z_L$ $\Omega$
300	1.018 - j1.350	5.565 + j0.747
325	1.045 - j1.022	5.435 + j0.752
350	1.076 - j0.722	5.303 + j0.746
375	1.110 - j0.444	5.167 + j0.730
400	1.148 - j0.183	5.030 + j0.704
425	1.190 + j0.064	4.892 + j0.668
450	1.238 + j0.299	4.754 + j0.622
475	1.291 + j0.526	4.617 +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



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 $\Omega$ ; 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](#).

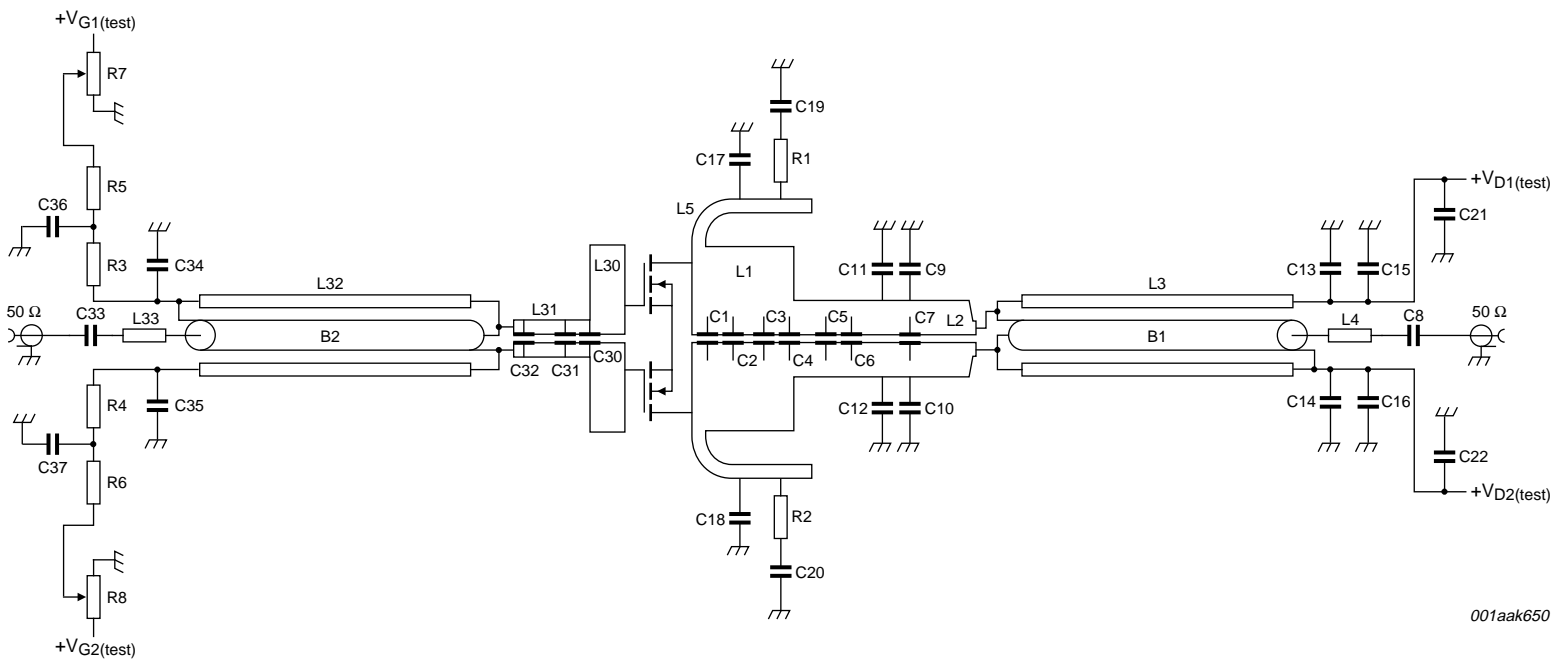
Component	Description	Value	Remarks
C15, C16	multilayer ceramic chip capacitor	4.7 $\mu$ F, 50 V	TDK C4532X7R1E475MT020U or capacitor of same quality.
C17, C18	multilayer ceramic chip capacitor	100 pF	[2]
C19, C20	multilayer ceramic chip capacitor	10 $\mu$ F, 50 V	TDK C570X7R1H106KT000N or capacitor of same quality.
C21, C22	electrolytic capacitor	470 $\mu$ F; 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 $\mu$ F	TDK C4532X7R1E475MT020U or capacitor of same quality.
L1	microstrip	-	[4] (W $\times$ L) 15 mm $\times$ 13 mm
L2	microstrip	-	[4] (W $\times$ L) 5 mm $\times$ 26 mm
L3, L32	microstrip	-	[4] (W $\times$ L) 2 mm $\times$ 49.5 mm
L4	microstrip	-	[4] (W $\times$ L) 1.7 mm $\times$ 3.5 mm
L5	microstrip	-	[4] (W $\times$ L) 2 mm $\times$ 9.5 mm
L30	microstrip	-	[4] (W $\times$ L) 5 mm $\times$ 13 mm
L31	microstrip	-	[4] (W $\times$ L) 2 mm $\times$ 11 mm
L33	microstrip	-	[4] (W $\times$ L) 2 mm $\times$ 3 mm
R1, R2	resistor	10 $\Omega$	
R3, R4	resistor	5.6 $\Omega$	
R5, R6	resistor	100 $\Omega$	
R7, R8	potentiometer	1 k $\Omega$	

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

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

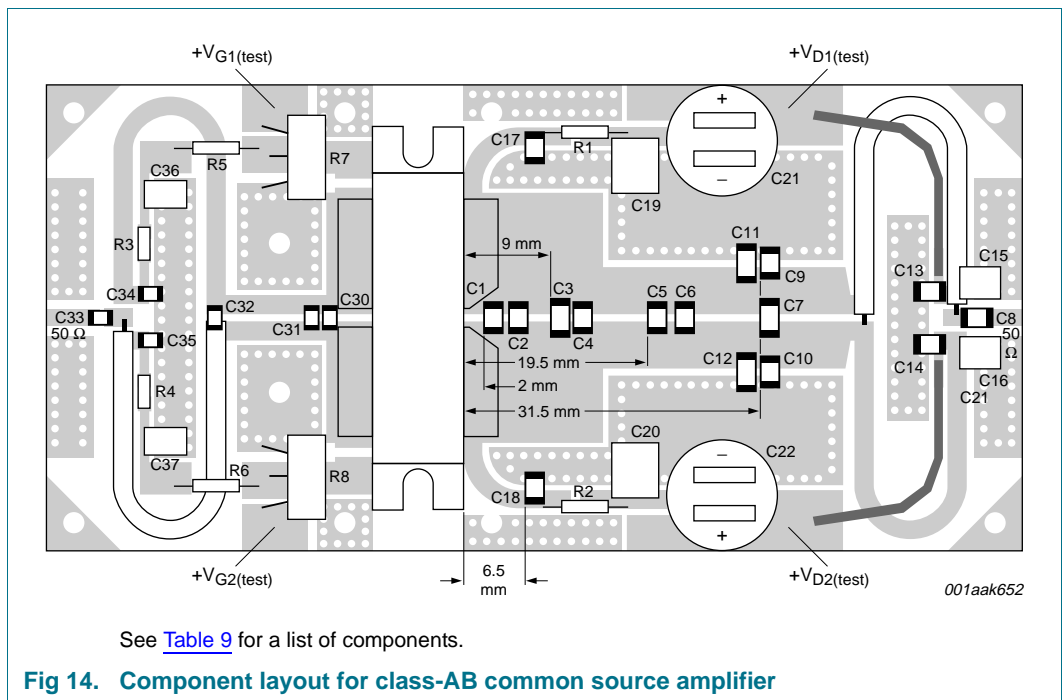
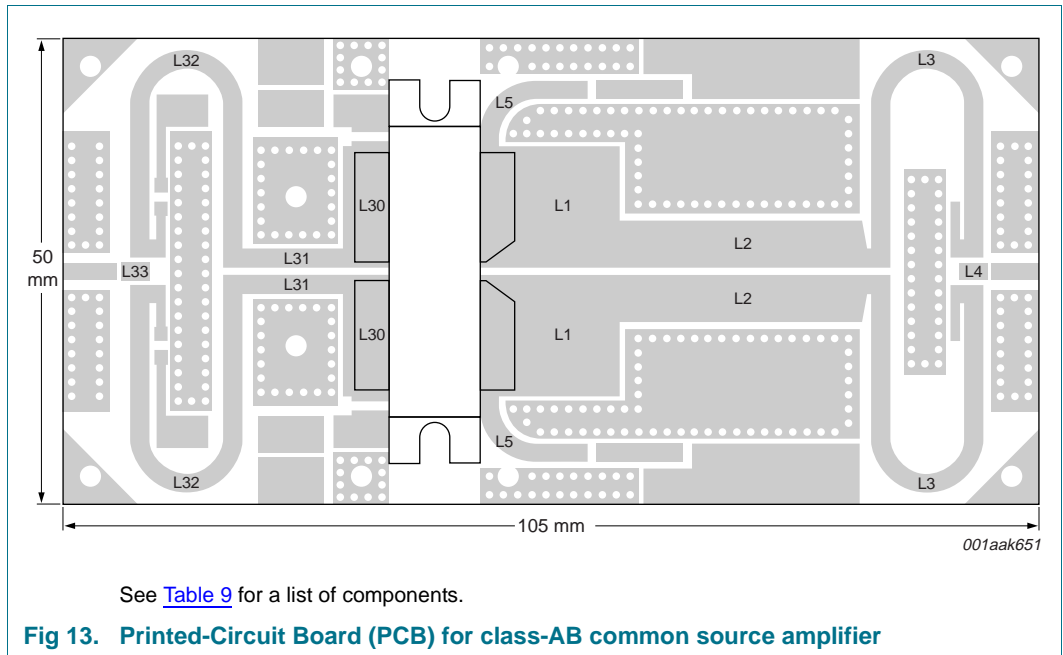
[3] American technical ceramics type 100A or capacitor of same quality.

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



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**



9. Package outline

Flanged LDMOST ceramic package; 2 mounting holes; 4 leads

SOT979A

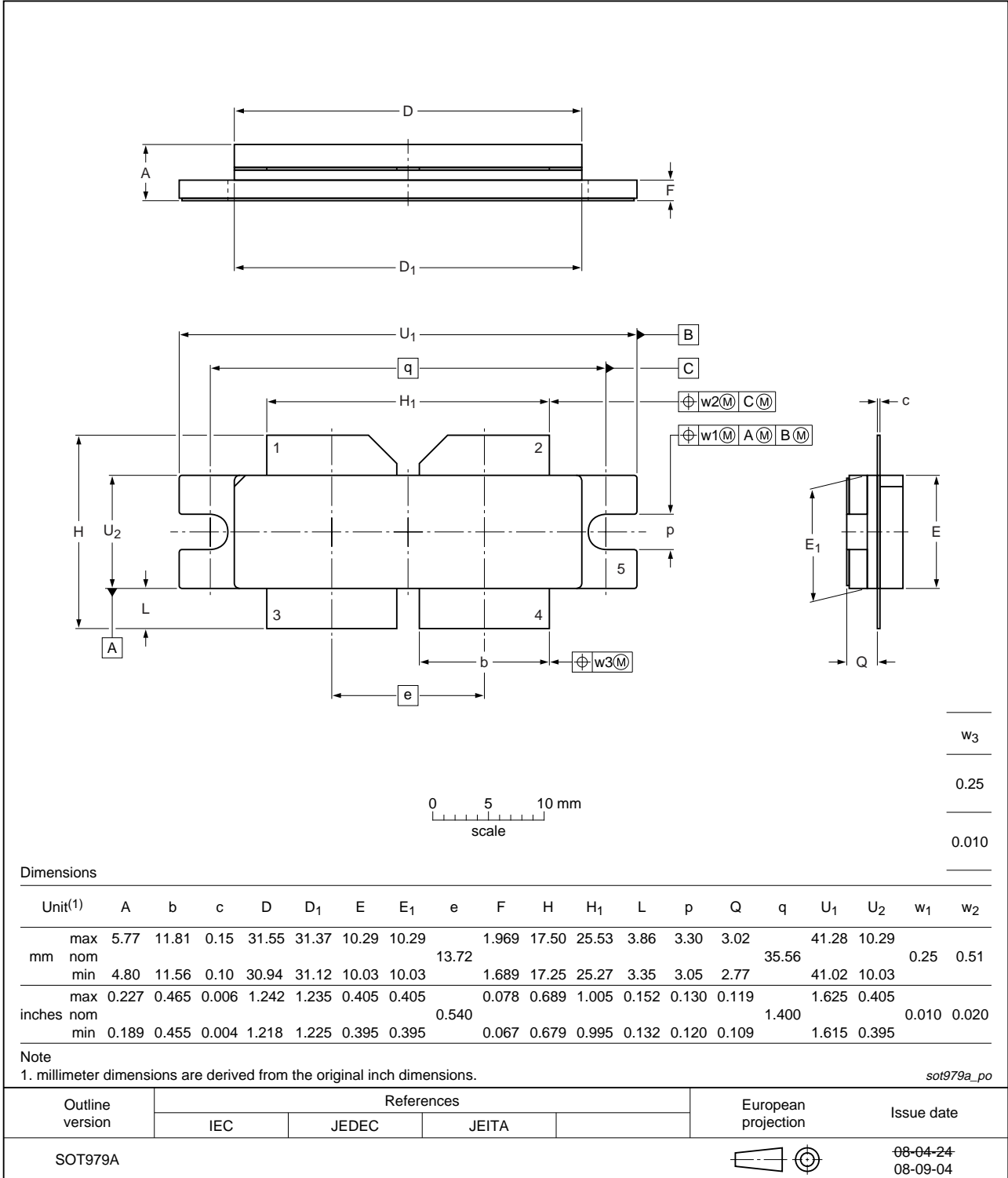


Fig 15. Package outline SOT979A

## 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 v.5	20110121	Product data sheet	-	BLF888 v.4
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Table 6 on page 3</a>: in the conditions column of <math>g_{fs}</math> the symbol <math>V_{GS}</math> has been changed to <math>V_{DS}</math>.</li> </ul>			
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 <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.

[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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