

# BLF871

## UHF power LDMOS transistor

Rev. 02 — 5 March 2009

Preliminary data sheet

## 1. Product profile

### 1.1 General description

A 100 W LDMOS RF power transistor for broadcast transmitter applications and industrial applications. The transistor can deliver 100 W broadband from HF to 1 GHz. The excellent ruggedness and broadband performance of this device makes it ideal for digital transmitter applications.

**Table 1. Typical performance**

RF performance at  $V_{DS} = 40$  V in a common-source 860 MHz test circuit.

Mode of operation	f (MHz)	$P_L$ (W)	$P_{L(PEP)}$ (W)	$P_{L(AV)}$ (W)	$G_p$ (dB)	$\eta_D$ (%)	IMD3 (dBc)	PAR (dB)
CW, class AB	860	100	-	-	21	60	-	-
2-tone, class AB	$f_1 = 860; f_2 = 860.1$	-	100	-	21	47	-35	-
DVB-T (8k OFDM)	858	-	-	24	22	33	-34 <sup>[1]</sup>	8.3 <sup>[2]</sup>

[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.

### CAUTION



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

### 1.2 Features

- 2-tone performance at 860 MHz, a drain-source voltage  $V_{DS}$  of 40 V and a quiescent drain current  $I_{Dq} = 0.5$  A:
  - ◆ Peak envelope power load power = 100 W
  - ◆ Power gain = 21 dB
  - ◆ Drain efficiency = 47 %
  - ◆ Third order intermodulation distortion = -35 dBc
- DVB performance at 858 MHz, a drain-source voltage  $V_{DS}$  of 40 V and a quiescent drain current  $I_{Dq} = 0.5$  A:
  - ◆ Average output power = 24 W
  - ◆ Power gain = 22 dB
  - ◆ Drain efficiency = 33 %
  - ◆ Third order intermodulation distortion = -34 dBc (4.3 MHz from center frequency)

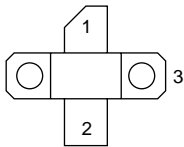
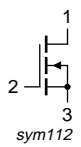
- Integrated ESD protection
- Excellent ruggedness
- High power gain
- High efficiency
- Excellent reliability
- Easy power control
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

### 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	drain		 sym112
2	gate		
3	source <a href="#">[1]</a>		

[1] Connected to flange.

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLF871	-	flanged LDMOST ceramic package; 2 mounting holes; 2 leads	SOT467C

## 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		-	89	V
$V_{GS}$	gate-source voltage		-0.5	+13	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	$T_{case} = 80\text{ °C}$ ; $P_{L(AV)} = 50\text{ W}$	[1]	0.95	K/W

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

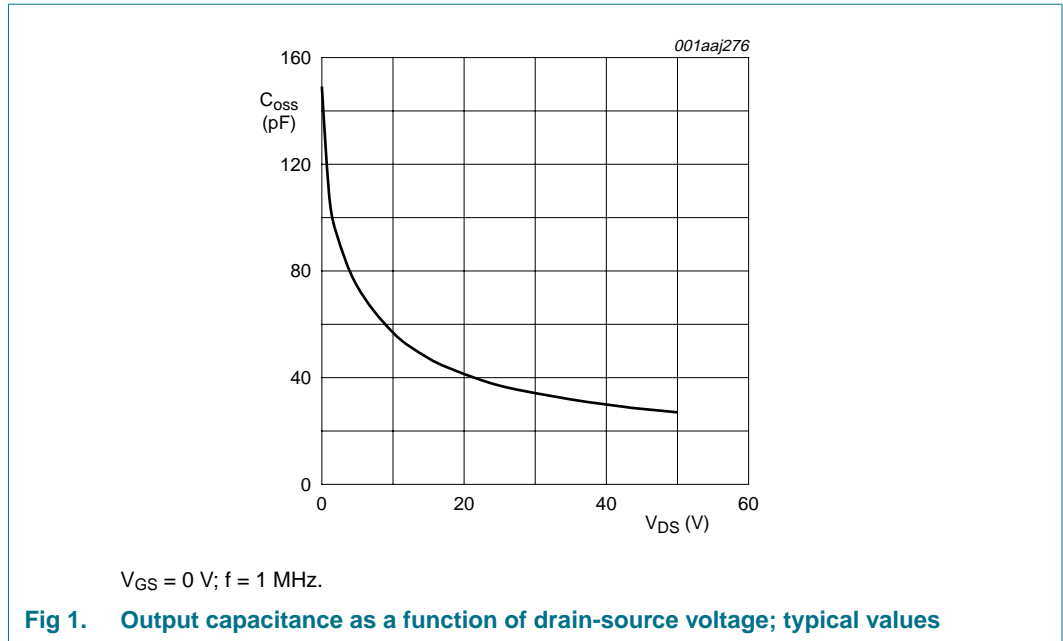
## 6. Characteristics

**Table 6. Characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ ; $I_D = 1.12\text{ mA}$	[1]	89	-	105.5	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}$ ; $I_D = 112\text{ mA}$	[1]	1.4	-	2.4	V
$I_{DSS}$	drain leakage current	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 40\text{ V}$	-	-	1.4	$\mu\text{A}$	
$I_{DSX}$	drain cut-off current	$V_{GS} = V_{GSth} + 3.75\text{ V}$ ; $V_{DS} = 10\text{ V}$	16.7	20	-	A	
$I_{GSS}$	gate leakage current	$V_{GS} = 10\text{ V}$ ; $V_{DS} = 0\text{ V}$	-	-	140	nA	
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GSth} + 3.75\text{ V}$ ; $I_D = 3.7\text{ A}$	[1]	-	210	-	$\text{m}\Omega$
$C_{iss}$	input capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 40\text{ V}$ ; $f = 1\text{ MHz}$	-	95	-	pF	
$C_{oss}$	output capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 40\text{ V}$ ; $f = 1\text{ MHz}$	-	30	-	pF	
$C_{rss}$	reverse transfer capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 40\text{ V}$ ; $f = 1\text{ MHz}$	-	1	-	pF	

[1]  $I_D$  is the drain current.



## 7. Application information

**Table 7. RF performance in a common-source narrowband 860 MHz test circuit**  
*T<sub>h</sub> = 25 °C unless otherwise specified.*

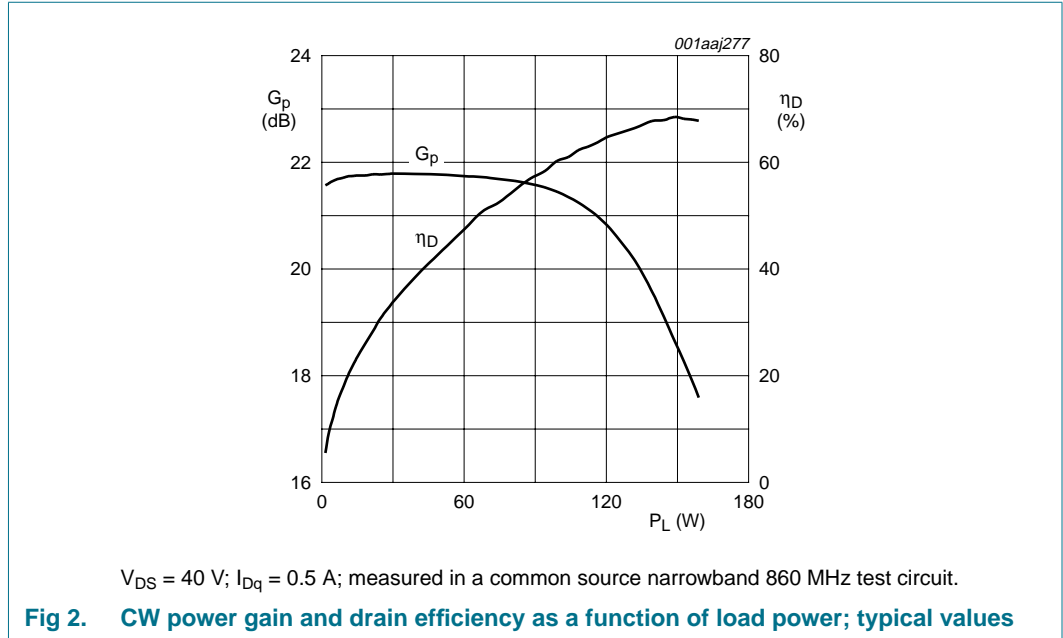
Mode of operation	f (MHz)	V <sub>DS</sub> (V)	I <sub>Dq</sub> (A)	P <sub>L(PEP)</sub> (W)	P <sub>L(AV)</sub> (W)	G <sub>p</sub> (dB)	η <sub>D</sub> (%)	IMD3 (dBc)	PAR (dB)
2-tone, class AB	f <sub>1</sub> = 860; f <sub>2</sub> = 860.1	40	0.5	100	-	> 19	> 44	< -30	-
DVB-T (8k OFDM)	858	40	0.5	-	24	> 19	> 30	< -31 <a href="#">[1]</a>	> 7.8 <a href="#">[2]</a>

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

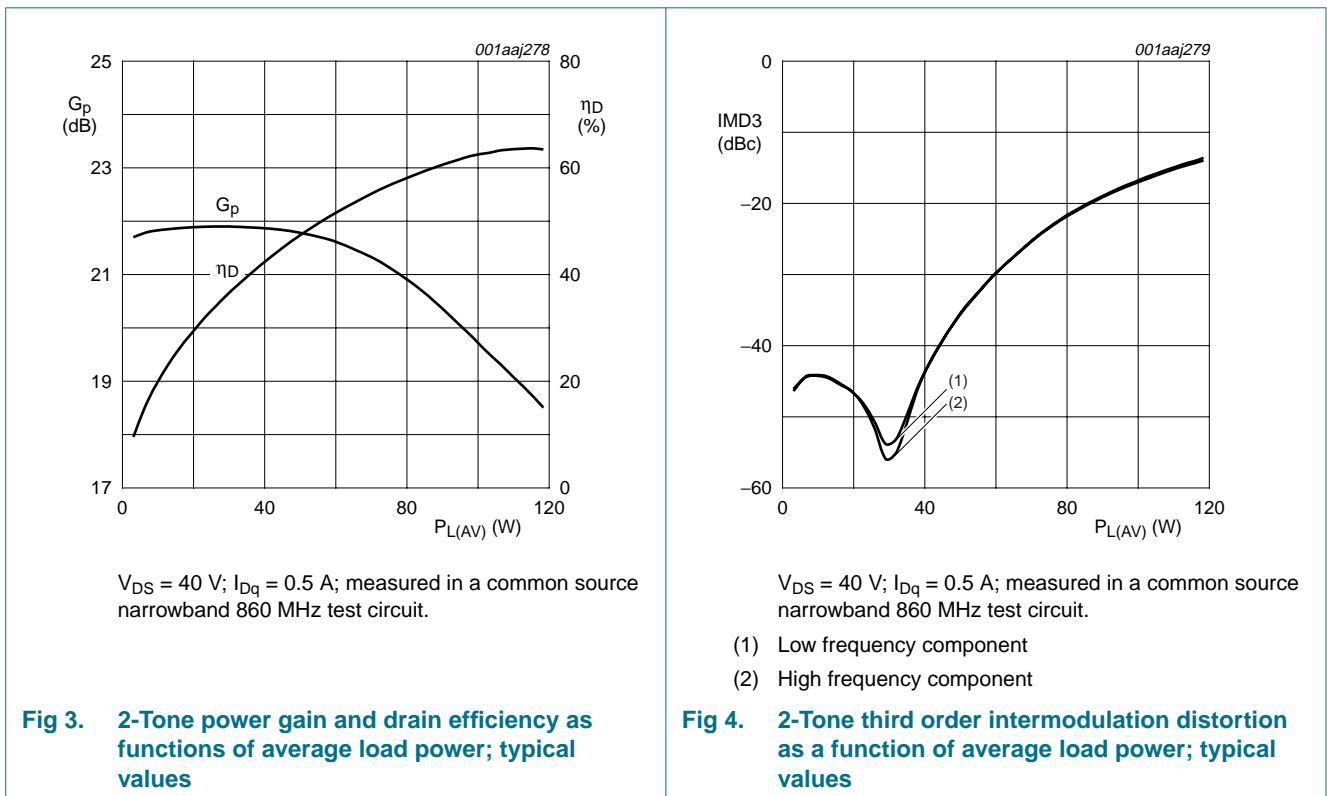
[2] PAR (of output signal) at 0.01 % probability on CCDF; PAR of input signal = 9.5 dB at 0.01 % probability on CCDF.

7.1 Narrowband RF figures

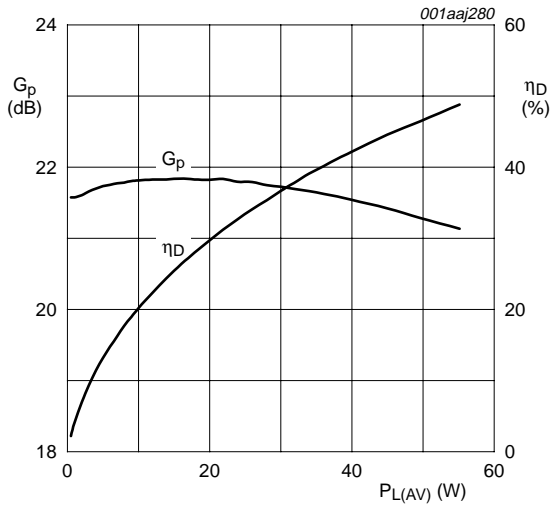
7.1.1 CW



7.1.2 2-Tone

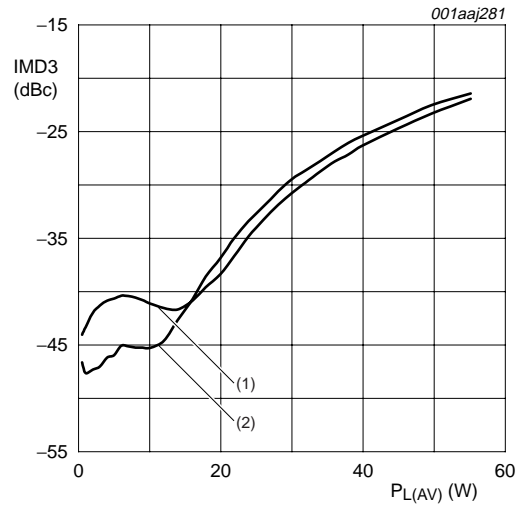


7.1.3 DVB-T



$V_{DS} = 40\text{ V}$ ;  $I_{DQ} = 0.5\text{ A}$ ; measured in a common source narrowband 860 MHz test circuit.

Fig 5. DVB-T power gain and drain efficiency as functions of average load power; typical values



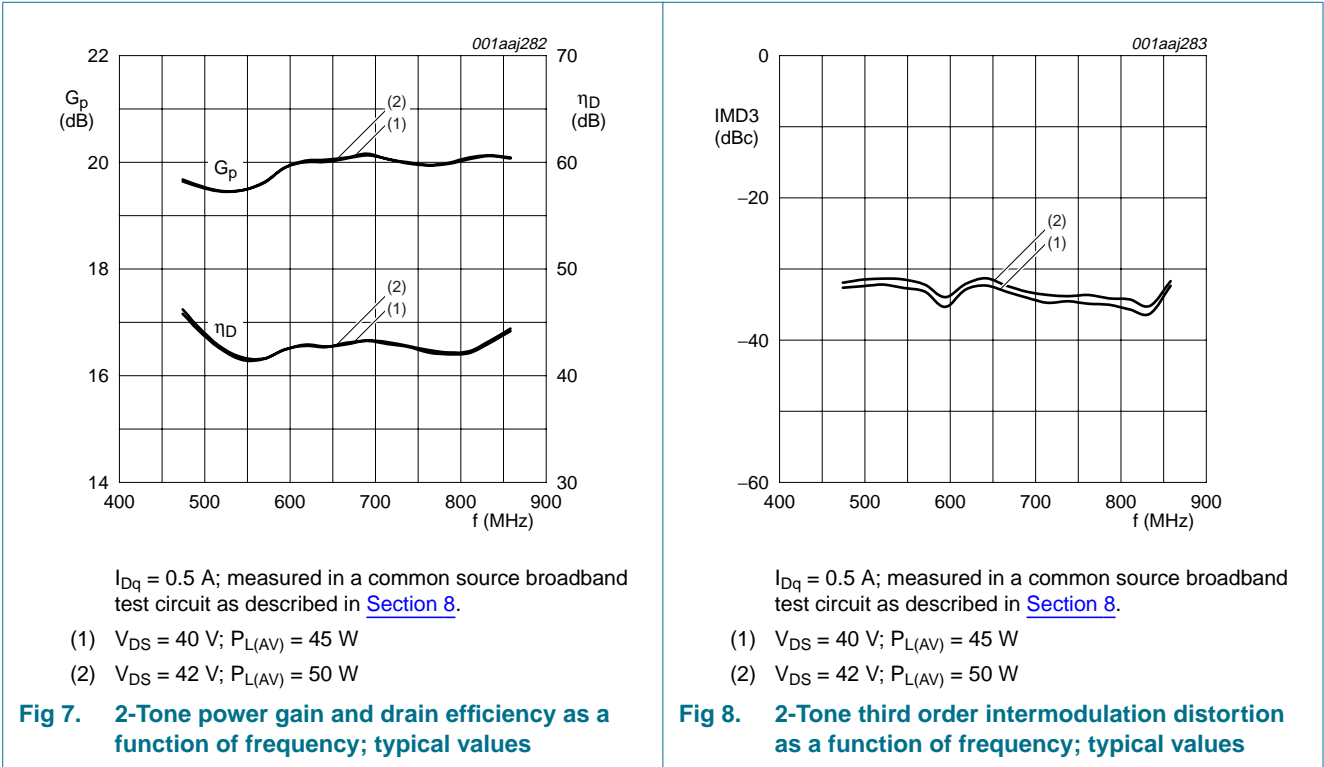
$V_{DS} = 40\text{ V}$ ;  $I_{DQ} = 0.5\text{ A}$ ; measured in a common source narrowband 860 MHz test circuit.

- (1) Low frequency component
- (2) High frequency component

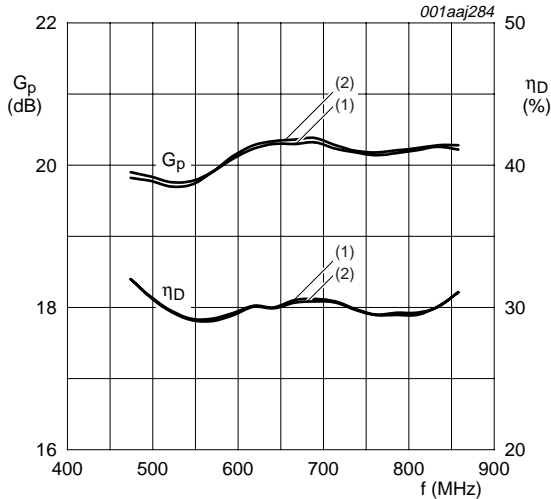
Fig 6. DVB-T third order intermodulation distortion as a function of average load power; typical values

7.2 Broadband RF figures

7.2.1 2-Tone



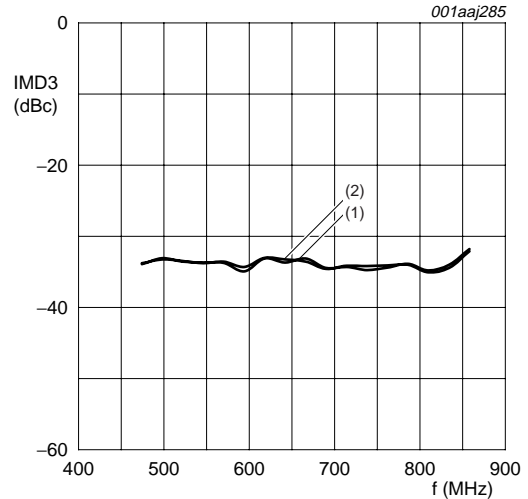
7.2.2 DVB-T



$I_{Dq} = 0.5$  A; measured in a common source broadband test circuit as described in [Section 8](#).

- (1)  $V_{DS} = 40$  V;  $P_{L(AV)} = 22$  W
- (2)  $V_{DS} = 42$  V;  $P_{L(AV)} = 24$  W

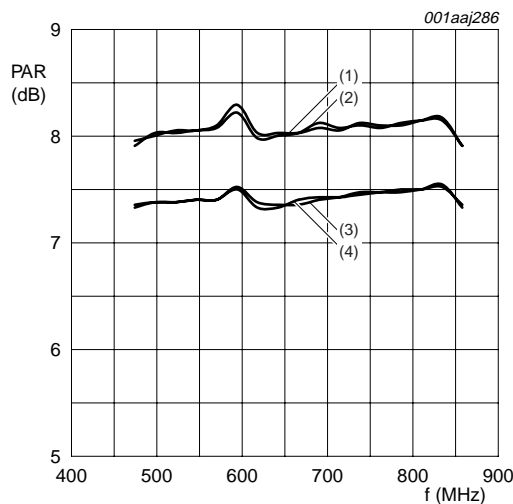
**Fig 9. DVB-T power gain and drain efficiency as functions of frequency; typical values**



$I_{Dq} = 0.5$  A; measured in a common source broadband test circuit as described in [Section 8](#).

- (1)  $V_{DS} = 40$  V;  $P_{L(AV)} = 22$  W
- (2)  $V_{DS} = 42$  V;  $P_{L(AV)} = 24$  W

**Fig 10. DVB-T third order intermodulation distortion as a function of frequency; typical values**



$I_{Dq} = 0.5$  A; measured in a common source broadband test circuit as described in [Section 8](#).  
 PAR of input signal = 9.5 dB at 0.01 % probability on CCDF.

- (1) PAR at 0.01 % probability on the CCDF;  $V_{DS} = 40$  V;  $P_{L(AV)} = 22$  W
- (2) PAR at 0.01 % probability on the CCDF;  $V_{DS} = 42$  V;  $P_{L(AV)} = 24$  W
- (3) PAR at 0.1 % probability on the CCDF;  $V_{DS} = 40$  V;  $P_{L(AV)} = 22$  W
- (4) PAR at 0.1 % probability on the CCDF;  $V_{DS} = 42$  V;  $P_{L(AV)} = 24$  W

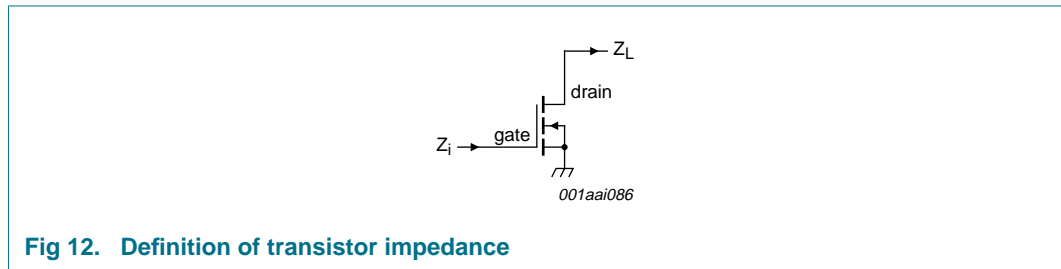
**Fig 11. DVB-T PAR at 0.1 % and at 0.01 % probability on the CCDF as function of frequency; typical values**



**7.3 Ruggedness in class-AB operation**

The BLF871 is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions:  $V_{DS} = 42\text{ V}$ ;  $f = 860\text{ MHz}$  at rated power.

**7.4 Impedance information**



**Fig 12. Definition of transistor impedance**

**Table 8. Typical impedance**

Simulated  $Z_i$  and  $Z_L$  device impedance; impedance info at  $V_{DS} = 42\text{ V}$ .

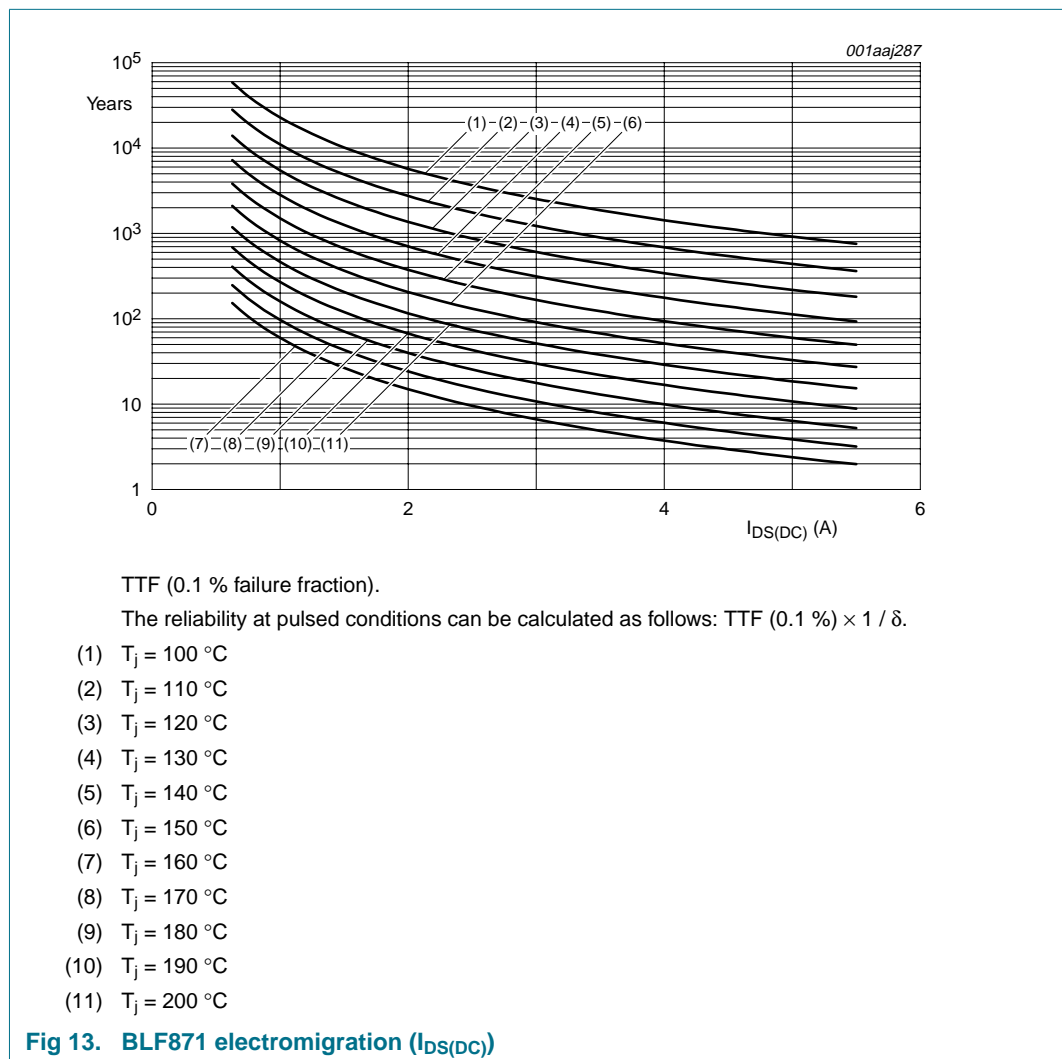
<b>f</b> <b>MHz</b>	<b><math>Z_i</math></b> <b><math>\Omega</math></b>	<b><math>Z_L</math></b> <b><math>\Omega</math></b>
300	0.977 - j3.327	5.506 + j1.774
325	0.977 - j2.983	5.366 + j1.858
350	0.978 - j2.681	5.223 + j1.930
375	0.979 - j2.414	5.078 + j1.990
400	0.979 - j2.174	4.932 + j2.040
425	0.980 - j1.956	4.786 + j2.079
450	0.981 - j1.758	4.640 + j2.108
475	0.982 - j1.576	4.495 + j2.128
500	0.982 - j1.407	4.352 + j2.138
525	0.983 - j1.250	4.212 + j2.140
550	0.984 - j1.103	4.074 + j2.135
575	0.985 - j0.964	3.940 + j2.122
600	0.986 - j0.834	3.809 + j2.102
625	0.987 - j0.709	3.682 + j2.077
650	0.988 - j0.591	3.558 + j2.045
675	0.990 - j0.478	3.438 + j2.009
700	0.991 - j0.370	3.323 + j1.968
725	0.992 - j0.266	3.211 + j1.923
750	0.993 - j0.165	3.103 + j1.874
775	0.995 - j0.068	3.000 + j1.822
800	0.996 + j0.026	2.900 + j1.766
825	0.997 + j0.117	2.804 + j1.708
850	0.999 + j0.206	2.711 + j1.648
875	1.000 + j0.292	2.623 + j1.586
900	1.002 + j0.376	2.538 + j1.521

**Table 8. Typical impedance ...continued**

Simulated  $Z_i$  and  $Z_L$  device impedance; impedance info at  $V_{DS} = 42\text{ V}$ .

f MHz	$Z_i$ $\Omega$	$Z_L$ $\Omega$
925	1.004 + j0.459	2.456 + j2.455
950	1.005 + j0.540	2.378 + j2.388
975	1.007 + j0.619	2.303 + j2.320
1000	1.009 + j0.696	2.230 + j2.250

### 7.5 Reliability



## 8. Test information

**Table 9. List of components**

For test circuit, see [Figure 14](#), [Figure 15](#) and [Figure 16](#).

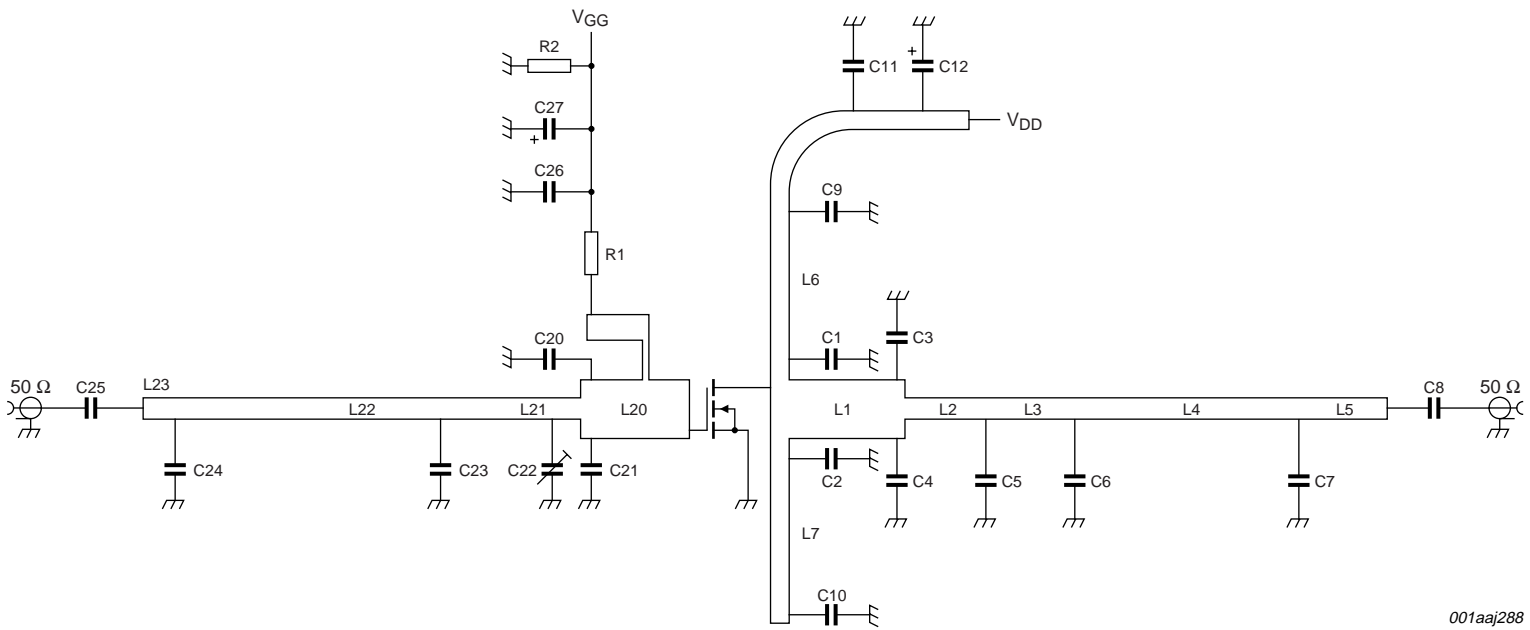
Component	Description	Value	Remarks
C1, C2	multilayer ceramic chip capacitor	5.1 pF	[1]
C3, C4	multilayer ceramic chip capacitor	10 pF	[2]
C5	multilayer ceramic chip capacitor	6.8 pF	[1]
C6	multilayer ceramic chip capacitor	4.7 pF	[1]
C7	multilayer ceramic chip capacitor	2.7 pF	[1]
C8, C9, C10, C25, C26	multilayer ceramic chip capacitor	100 pF	[1]
C11, C27	multilayer ceramic chip capacitor	10 $\mu$ F	TDK C570X7R1H106KT000N or capacitor of same quality.
C12	electrolytic capacitor	470 $\mu$ F; 63 V	
C20	multilayer ceramic chip capacitor	10 pF	[3]
C21	multilayer ceramic chip capacitor	8.2 pF	[3]
C22	trimmer	0.6 pF to 4.5 pF	Tekelec
C23	multilayer ceramic chip capacitor	6.8 pF	[3]
C24	multilayer ceramic chip capacitor	3.9 pF	[3]
L1	stripline	-	[4] (W $\times$ L) 7 mm $\times$ 15 mm
L2	stripline	-	[4] (W $\times$ L) 2.4 mm $\times$ 9 mm
L3	stripline	-	[4] (W $\times$ L) 2.4 mm $\times$ 10 mm
L4	stripline	-	[4] (W $\times$ L) 2.4 mm $\times$ 25 mm
L5	stripline	-	[4] (W $\times$ L) 2.4 mm $\times$ 10 mm
L6	stripline	-	[4] (W $\times$ L) 2.0 mm $\times$ 20 mm
L7	stripline	-	[4] (W $\times$ L) 2.0 mm $\times$ 21 mm
L20	stripline	-	[4] (W $\times$ L) 7 mm $\times$ 12 mm
L21	stripline	-	[4] (W $\times$ L) 2.4 mm $\times$ 13 mm
L22	stripline	-	[4] (W $\times$ L) 2.4 mm $\times$ 31 mm
L23	stripline	-	[4] (W $\times$ L) 2.4 mm $\times$ 5 mm
R1	resistor	100 $\Omega$	
R2	resistor	10 k $\Omega$	

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

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

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

[4] Printed-Circuit Board (PCB): Rogers 5880;  $\epsilon_r = 2.2$  F/m; height = 0.79 mm; Cu (top/bottom metallization); thickness copper plating = 35  $\mu$ m.



001aaj288

See [Table 9](#) for a list of components.

**Fig 14. Class-AB common-source broadband amplifier**

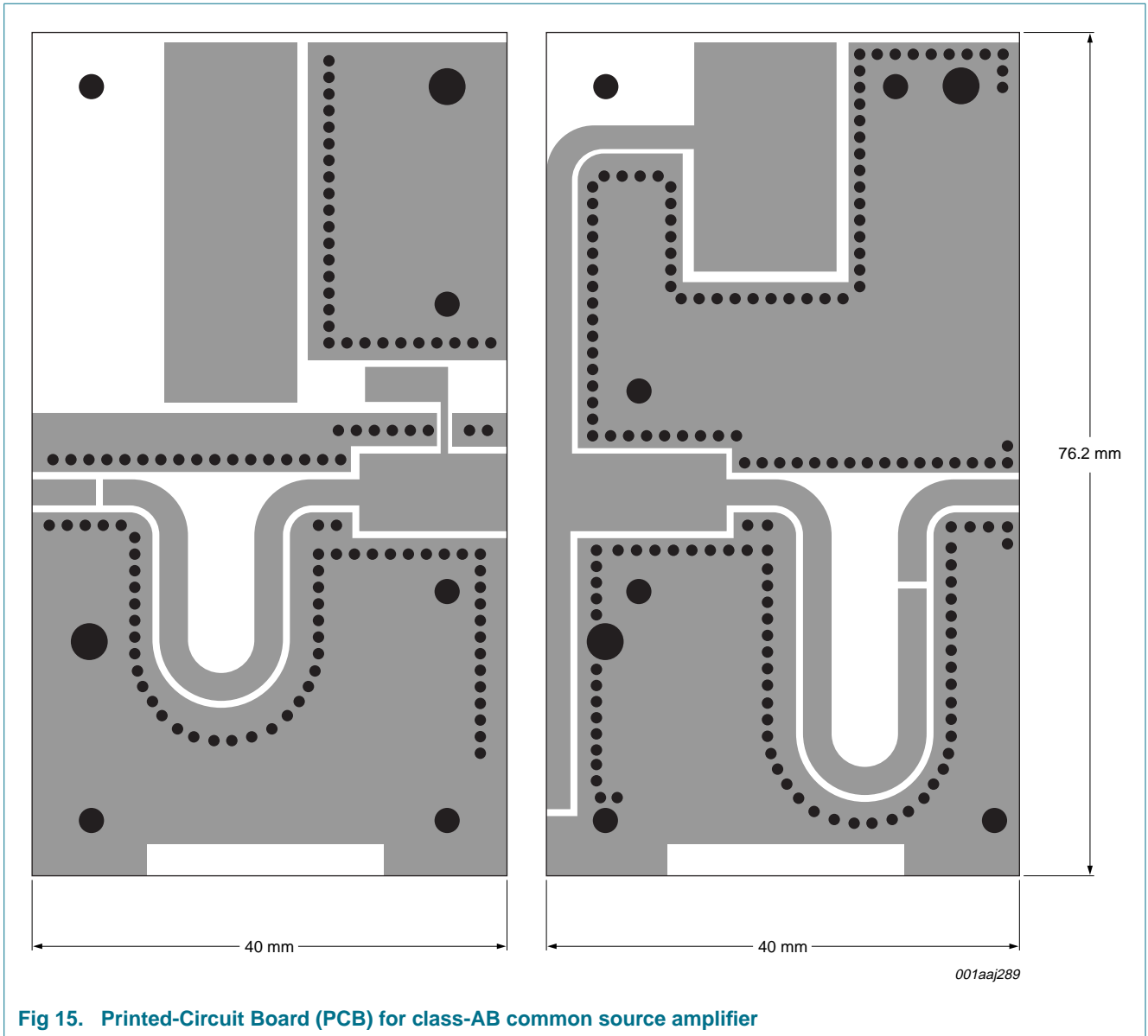
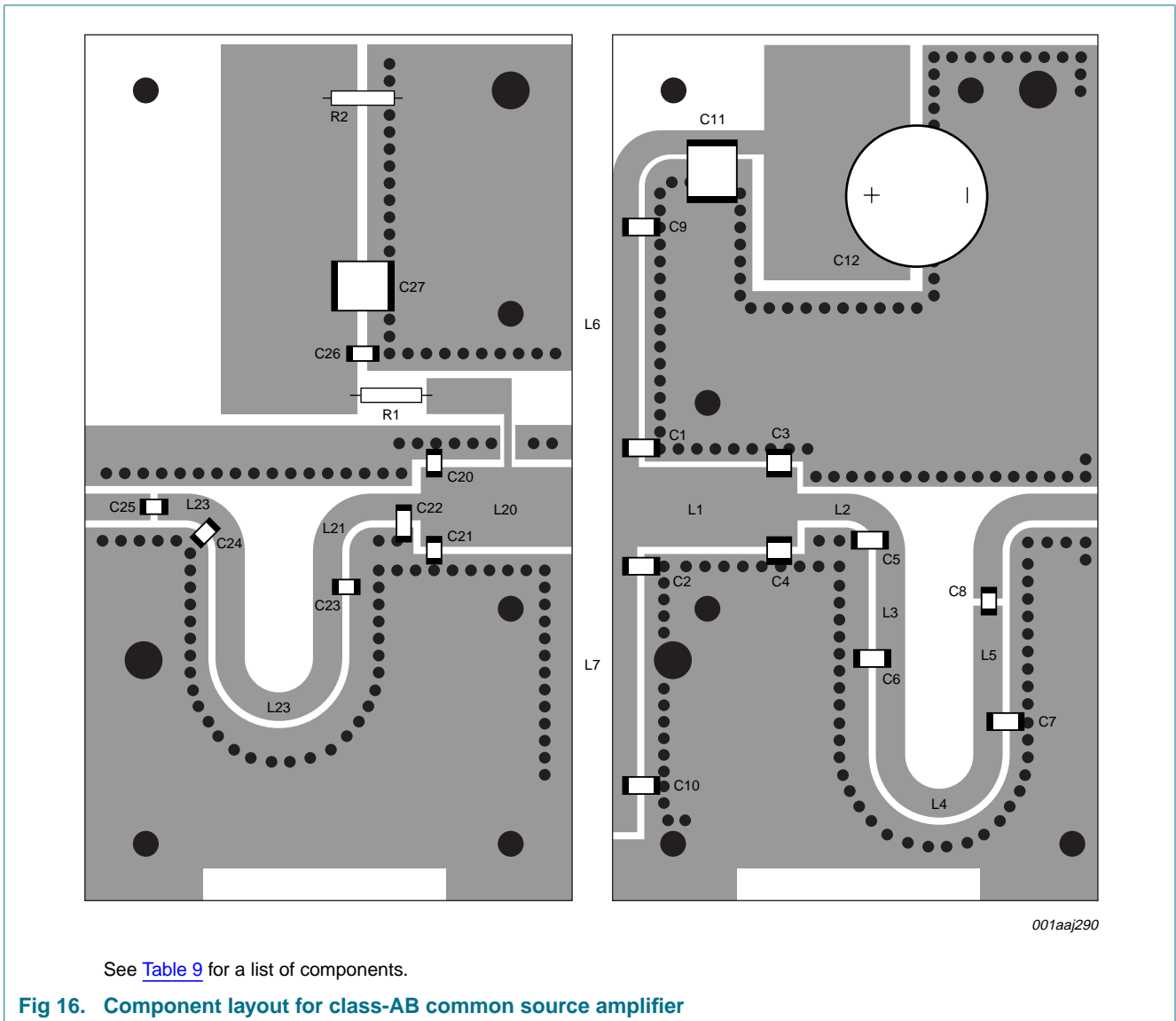


Fig 15. Printed-Circuit Board (PCB) for class-AB common source amplifier



9. Package outline

Flanged LDMOST ceramic package; 2 mounting holes; 2 leads

SOT467C

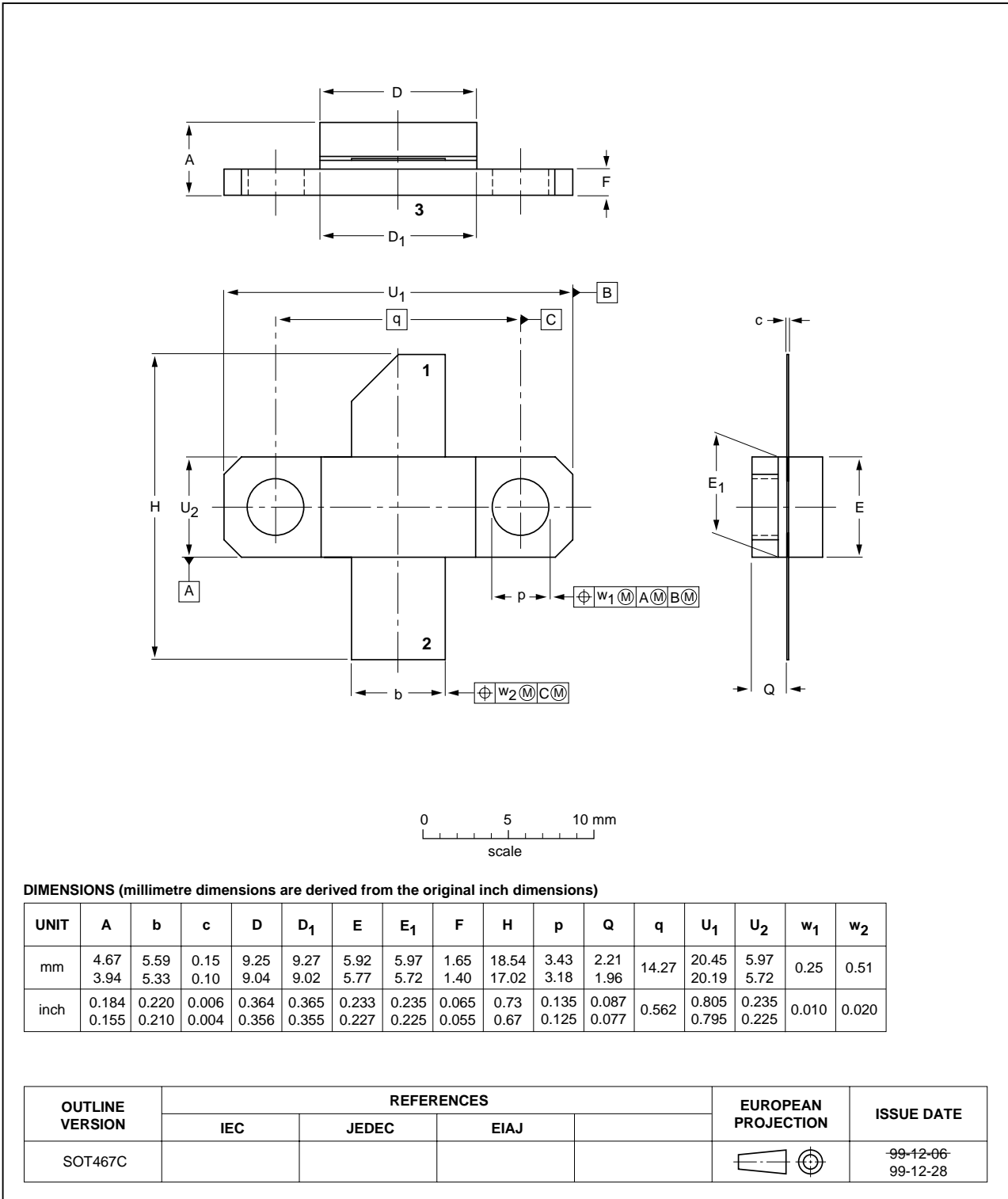


Fig 17. Package outline SOT467C

## 10. Abbreviations

**Table 10. Abbreviations**

Acronym	Description
CW	Continuous Wave
CCDF	Complementary Cumulative Distribution Function
DVB	Digital Video Broadcast
DVB-T	Digital Video Broadcast - Terrestrial
ESD	ElectroStatic Discharge
HF	High Frequency
IMD3	Third order InterModulation Distortion
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
LDMOST	Laterally Diffused Metal-Oxide Semiconductor Transistor
OFDM	Orthogonal Frequency Division Multiplexing
PAR	Peak-to-Average power Ratio
PEP	Peak Envelope Power
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
BLF871_2	20090305	Preliminary data sheet	-	BLF871_1
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Table 1 on page 1</a>: corrected some values</li> <li>• <a href="#">Section 1.2 on page 1</a>: corrected some values</li> <li>• <a href="#">Table 6 on page 3</a>: corrected some values</li> <li>• <a href="#">Table 6 on page 3</a>: removed <math>g_{fs}</math> specification</li> <li>• <a href="#">Table 7 on page 4</a>: corrected some values.</li> </ul>			
BLF871_1	20081218	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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