

# BLF888A; BLF888AS

UHF power LDMOS transistor

Rev. 4 — 12 July 2013

Product data sheet

## 1. Product profile

### 1.1 General description

A 600 W LDMOS RF power transistor for broadcast transmitter applications and industrial applications. The excellent ruggedness of this device makes it ideal for digital and analog transmitter applications.

**Table 1. Application information**

RF performance at  $V_{DS} = 50\text{ V}$  unless otherwise specified.

Mode of operation	f (MHz)	$P_{L(AV)}$ (W)	$P_{L(M)}$ (W)	$G_p$ (dB)	$\eta_D$ (%)	IMD3 (dBc)	IMD <sub>shldr</sub> (dBc)	PAR (dB)
<b>RF performance in a common source 860 MHz narrowband test circuit</b>								
2-tone, class-AB	$f_1 = 860; f_2 = 860.1$	250	-	21	46	-32	-	-
pulsed, class-AB [1]	860	-	600	20	58	-	-	-
DVB-T (8k OFDM)	858	110	-	21	31	-	-32 [2]	8.2 [3]
	858	125	-	21	32.5	-	-30 [2]	8.0 [3]
<b>RF performance in a common source 470 MHz to 860 MHz broadband test circuit</b>								
DVB-T (8k OFDM)	858	110	-	20	30	-	-32 [2]	8.0 [3]
	858	120	-	20	31	-	-31 [2]	7.8 [3]

[1] Measured at  $\delta = 10\%$ ;  $t_p = 100\ \mu\text{s}$ .

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

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

### 1.2 Features and benefits

- Excellent ruggedness ( $VSWR \geq 40 : 1$  through all phases)
- Optimum thermal behavior and reliability,  $R_{th(j-c)} = 0.15\text{ K/W}$
- High power gain
- High efficiency
- Designed for broadband operation (470 MHz to 860 MHz)
- Internal input matching for high gain and optimum broadband operation
- Excellent reliability
- Easy power control
- Compliant to Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC

### 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
<b>BLF888A (SOT539A)</b>			
1	drain1		
2	drain2		
3	gate1		
4	gate2		
5	source		
<b>BLF888AS (SOT539B)</b>			
1	drain1		
2	drain2		
3	gate1		
4	gate2		
5	source		

[1] Connected to flange.

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLF888A	-	flanged balanced LDMOST ceramic package; 2 mounting holes; 4 leads	SOT539A
BLF888AS	-	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	$T_{case} = 80\text{ °C}$ ; $P_{L(AV)} = 125\text{ W}$	[1] 0.15	K/W

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

## 6. Characteristics

**Table 6. DC characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ ; $I_D = 2.4\text{ mA}$	[1] 110	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}$ ; $I_D = 240\text{ mA}$	[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	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ; $V_{DS} = 10\text{ V}$	-	36	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 10\text{ V}$ ; $V_{DS} = 0\text{ V}$	-	-	280	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ; $I_D = 8.5\text{ A}$	[1] -	143	-	$\text{m}\Omega$
$C_{iss}$	input capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$	[2] -	220	-	pF
$C_{oss}$	output capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$	-	74	-	pF
$C_{rss}$	reverse transfer capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$	-	1.2	-	pF

[1]  $I_D$  is the drain current.

[2] Capacitance values without internal matching.

**Table 7. RF characteristics**

RF characteristics in NXP production narrowband test circuit;  $T_{case} = 25\text{ °C}$  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		[1] -	1.3	-	A
$P_{L(AV)}$	average output power	$f_1 = 860\text{ MHz}$ ; $f_2 = 860.1\text{ MHz}$	250	-	-	W
$G_p$	power gain	$f_1 = 860\text{ MHz}$ ; $f_2 = 860.1\text{ MHz}$	20	21	-	dB
$\eta_D$	drain efficiency	$f_1 = 860\text{ MHz}$ ; $f_2 = 860.1\text{ MHz}$	42	46	-	%
IMD3	third-order intermodulation distortion	$f_1 = 860\text{ MHz}$ ; $f_2 = 860.1\text{ MHz}$	-	-32	-28	dBc

**Table 7. RF characteristics ...continued**

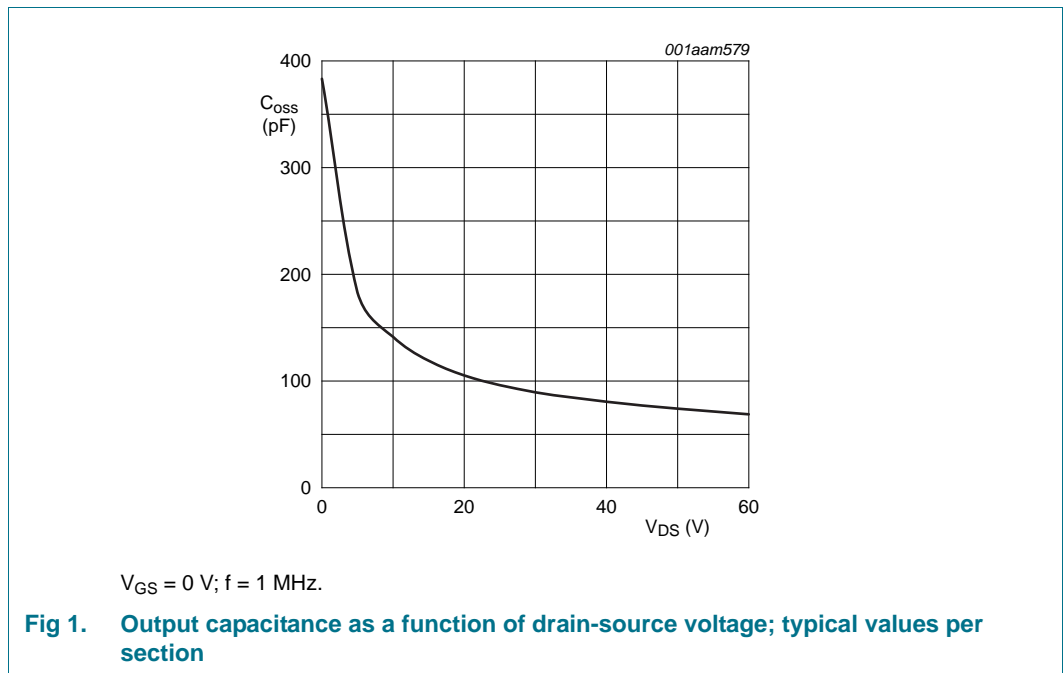
RF characteristics in NXP production narrowband test circuit;  $T_{case} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>DVB-T (8k OFDM), class-AB</b>							
$V_{DS}$	drain-source voltage		-	50	-	V	
$I_{Dq}$	quiescent drain current		[1]	-	1.3	A	
$P_{L(AV)}$	average output power	$f = 858\text{ MHz}$	110	-	-	W	
$G_p$	power gain	$f = 858\text{ MHz}$	20	21	-	dB	
$\eta_D$	drain efficiency	$f = 858\text{ MHz}$	28	31	-	%	
$IMD_{shldr}$	intermodulation distortion shoulder	$f = 858\text{ MHz}$	[2]	-	-32	-28	dBc
PAR	peak-to-average ratio	$f = 858\text{ MHz}$	[3]	-	8.2	-	dB

[1]  $I_{Dq}$  for total device.

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

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



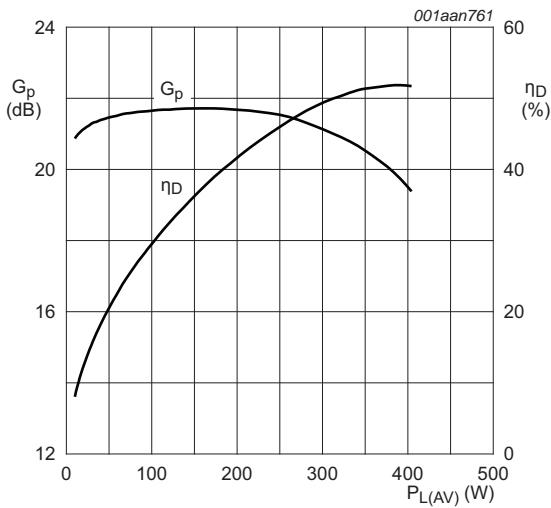
### 6.1 Ruggedness in class-AB operation

The BLF888A and BLF888AS are capable of withstanding a load mismatch corresponding to  $VSWR \geq 40 : 1$  through all phases under the following conditions:  $V_{DS} = 50\text{ V}$ ;  $f = 860\text{ MHz}$  at rated power.

**7. Application information**

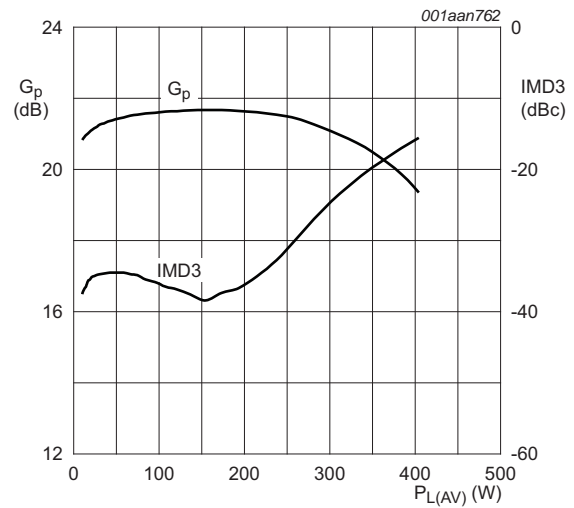
**7.1 Narrowband RF figures**

**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.

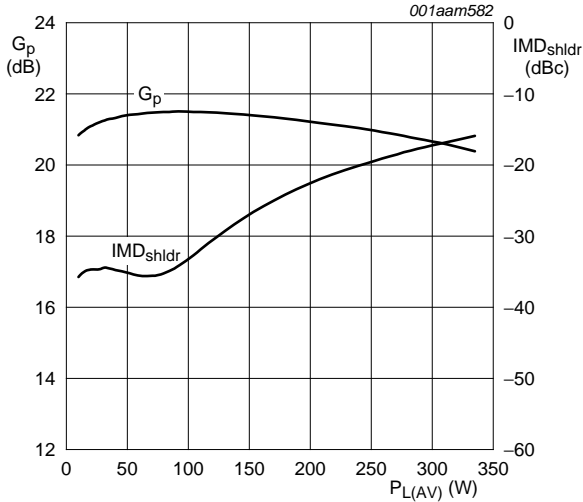
**Fig 2. 2-Tone power gain and drain efficiency as function of load power; typical values**



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

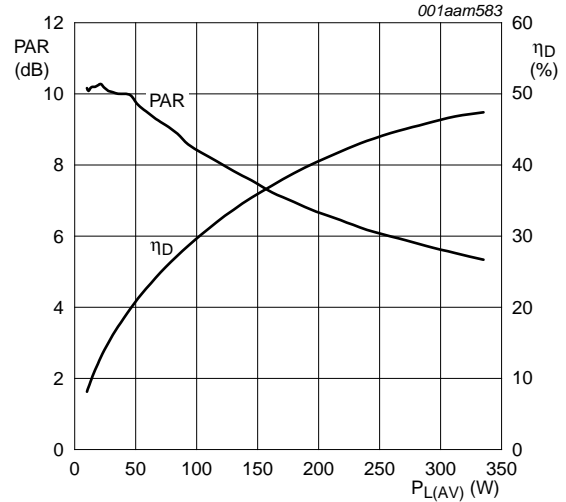
**Fig 3. 2-Tone power gain and third order intermodulation distortion as load power; typical values**

**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**

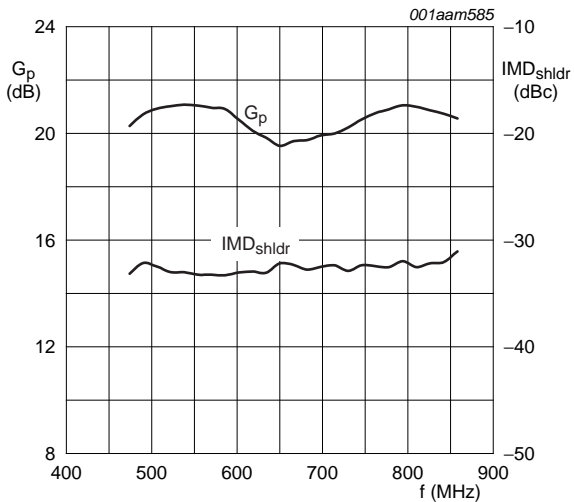


$V_{DS} = 50\text{ V}$ ;  $I_{Dq} = 1.3\text{ A}$ ; measured in a common source narrowband 860 MHz test circuit.

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

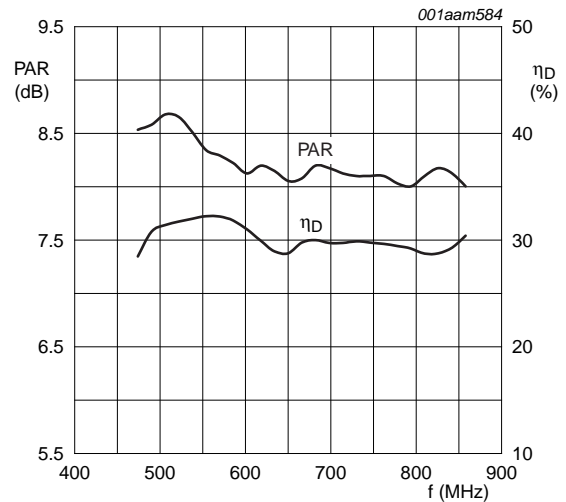
**7.2 Broadband RF figures**

**7.2.1 DVB-T**



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

**Fig 6. DVB-T power gain and intermodulation distortion shoulder as a function of frequency; typical values**



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

**Fig 7. DVB-T peak-to-average ratio and drain efficiency as function of frequency; typical values**

7.3 Impedance information

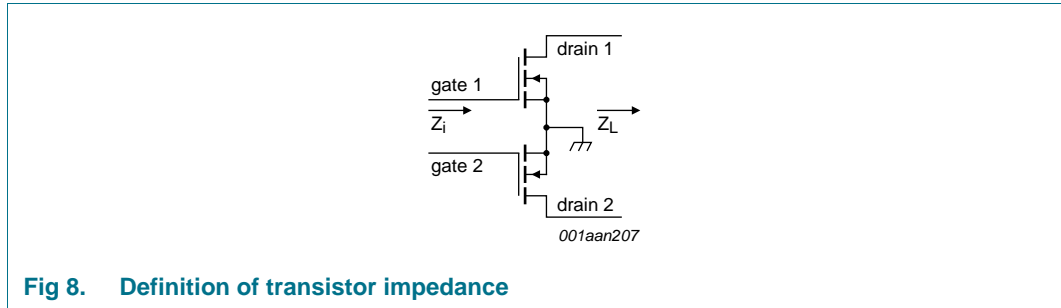


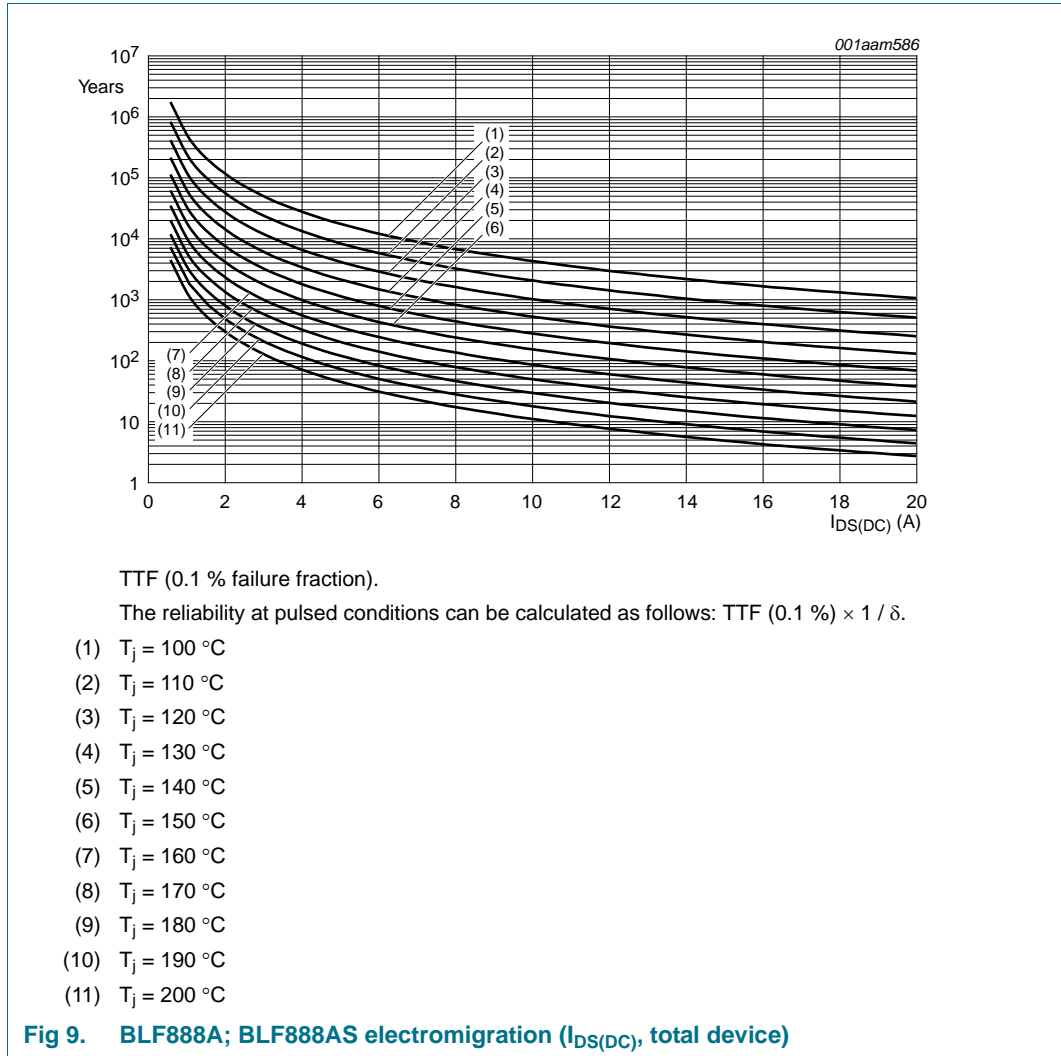
Fig 8. Definition of transistor impedance

Table 8. Typical push-pull impedance

Simulated  $Z_i$  and  $Z_L$  device impedance; impedance info at  $V_{DS} = 50\text{ V}$  and  $P_{L(AV)} = 110\text{ W}$  (DVB-T).

f MHz	$Z_i$ $\Omega$	$Z_L$ $\Omega$
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
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

**7.4 Reliability**





## 8. Test information

**Table 9. List of components**

For test circuit, see [Figure 10](#), [Figure 11](#) and [Figure 12](#).

Component	Description	Value	Remarks
B1, B2	semi rigid coax	25 $\Omega$ ; 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 $\mu$ F, 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 $\mu$ F, 50 V	TDK C570X7R1H106KT000N or capacitor of same quality.
C21, C22	electrolytic capacitor	470 $\mu$ F; 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 $\mu$ F, 50 V	TDK C4532X7R1E475MT020U or capacitor of same quality.
L1	microstrip	-	[5] (W $\times$ L) 15 mm $\times$ 13 mm
L2	microstrip	-	[5] (W $\times$ L) 5 mm $\times$ 26 mm
L3, L32	microstrip	-	[5] (W $\times$ L) 2 mm $\times$ 49.5 mm
L4	microstrip	-	[5] (W $\times$ L) 1.7 mm $\times$ 3.5 mm
L5	microstrip	-	[5] (W $\times$ L) 2 mm $\times$ 9.5 mm
L30	microstrip	-	[5] (W $\times$ L) 5 mm $\times$ 13 mm
L31	microstrip	-	[5] (W $\times$ L) 2 mm $\times$ 11 mm
L33	microstrip	-	[5] (W $\times$ L) 2 mm $\times$ 3 mm
R1, R2	wire resistor	10 $\Omega$	
R3, R4	SMD resistor	5.6 $\Omega$	0805
R5, R6	wire resistor	100 $\Omega$	
R7, R8	potentiometer	10 k $\Omega$	

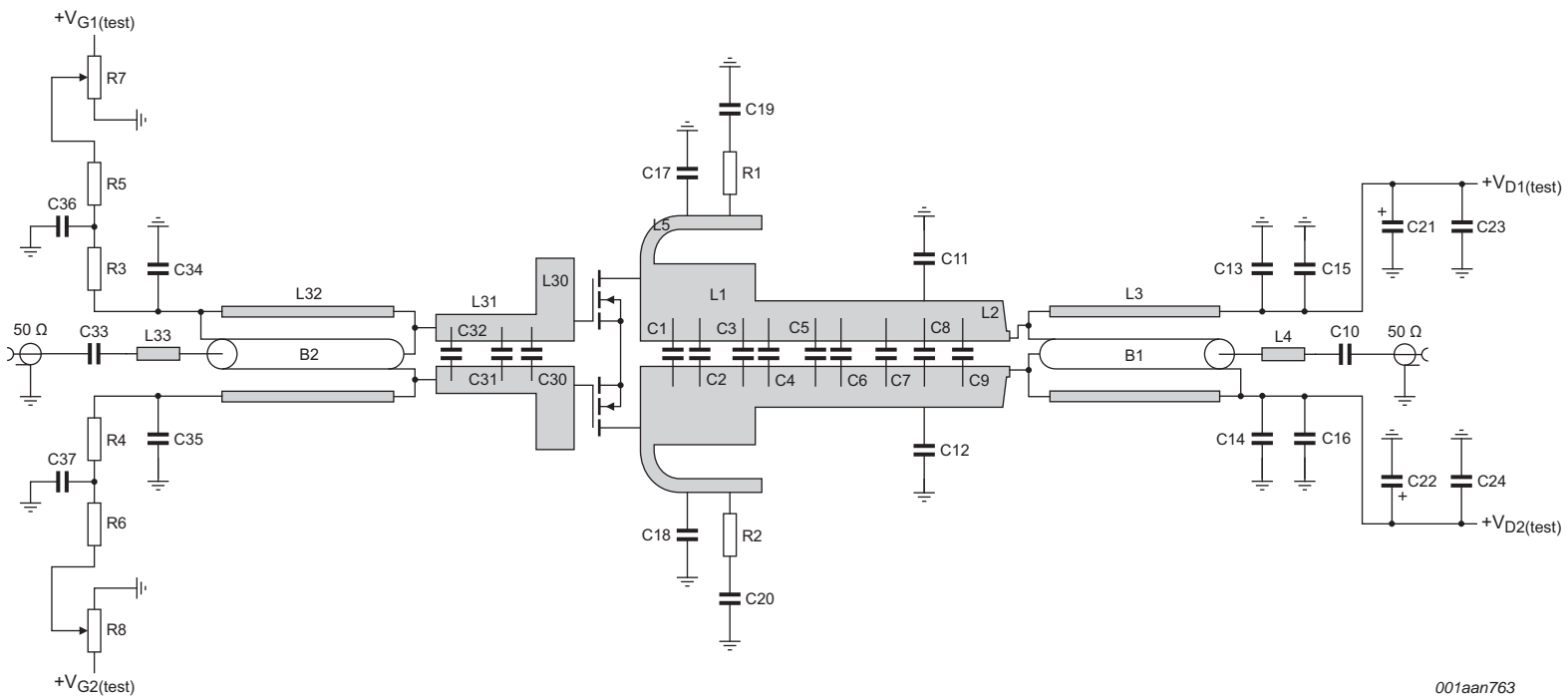
[1] American technical ceramics type 800R or capacitor of same quality.

[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.

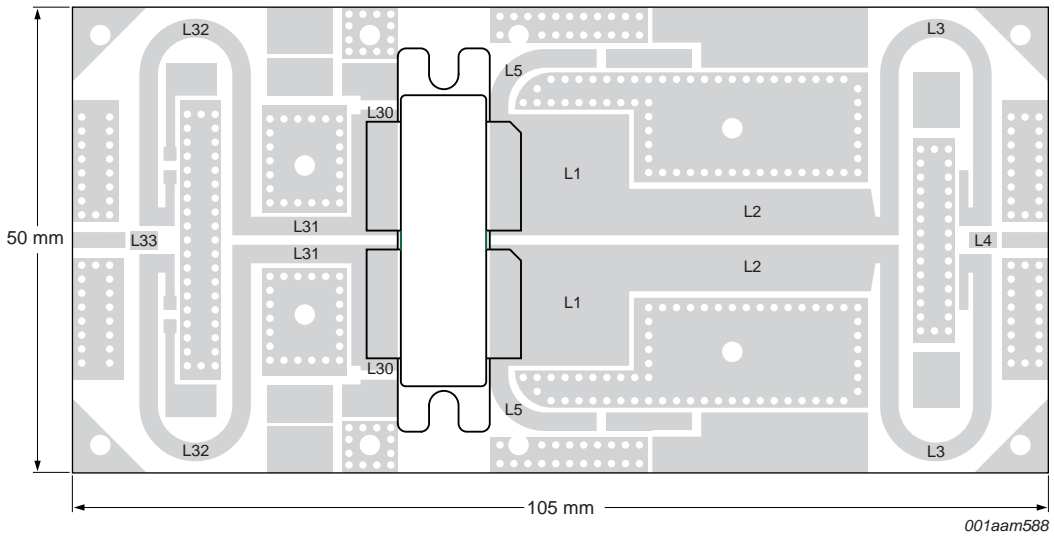
[5] Printed-Circuit Board (PCB): Taconic RF35;  $\epsilon_r = 3.5$  F/m; height = 0.762 mm; Cu (top/bottom metallization); thickness copper plating = 35  $\mu$ m.



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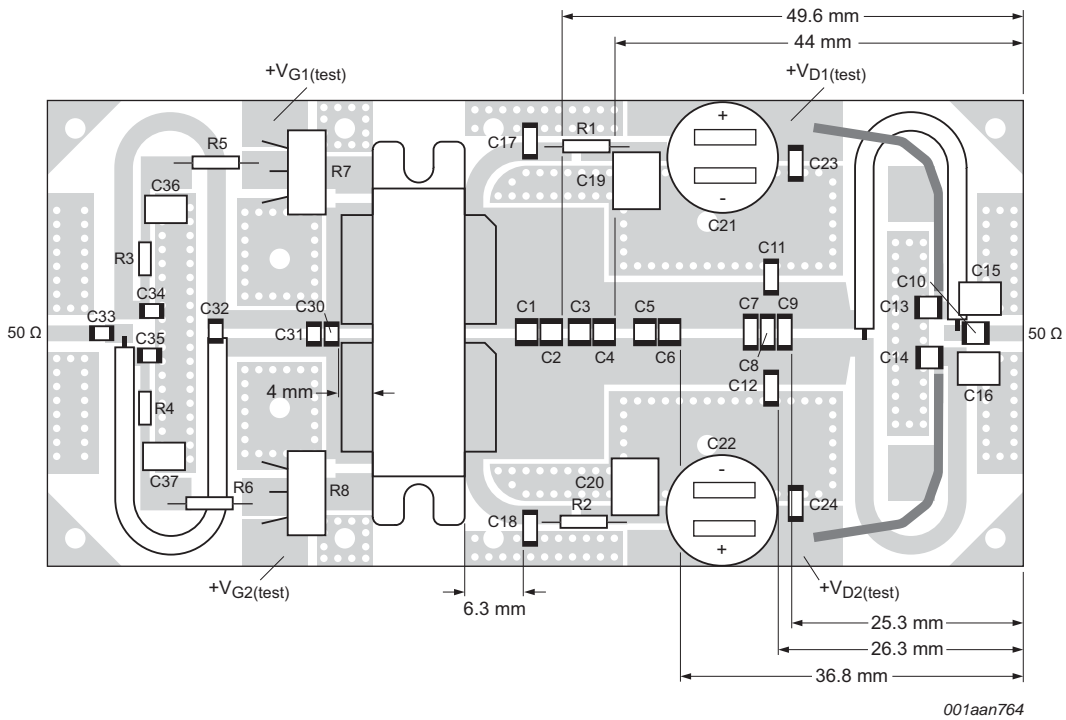
See [Table 9](#) for a list of components.

**Fig 10. 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 11. Printed-Circuit Board (PCB) for class-AB common source amplifier**



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

**Fig 12. Component layout for class-AB common source amplifier**

**9. Package outline**

Flanged balanced ceramic package; 2 mounting holes; 4 leads

SOT539A

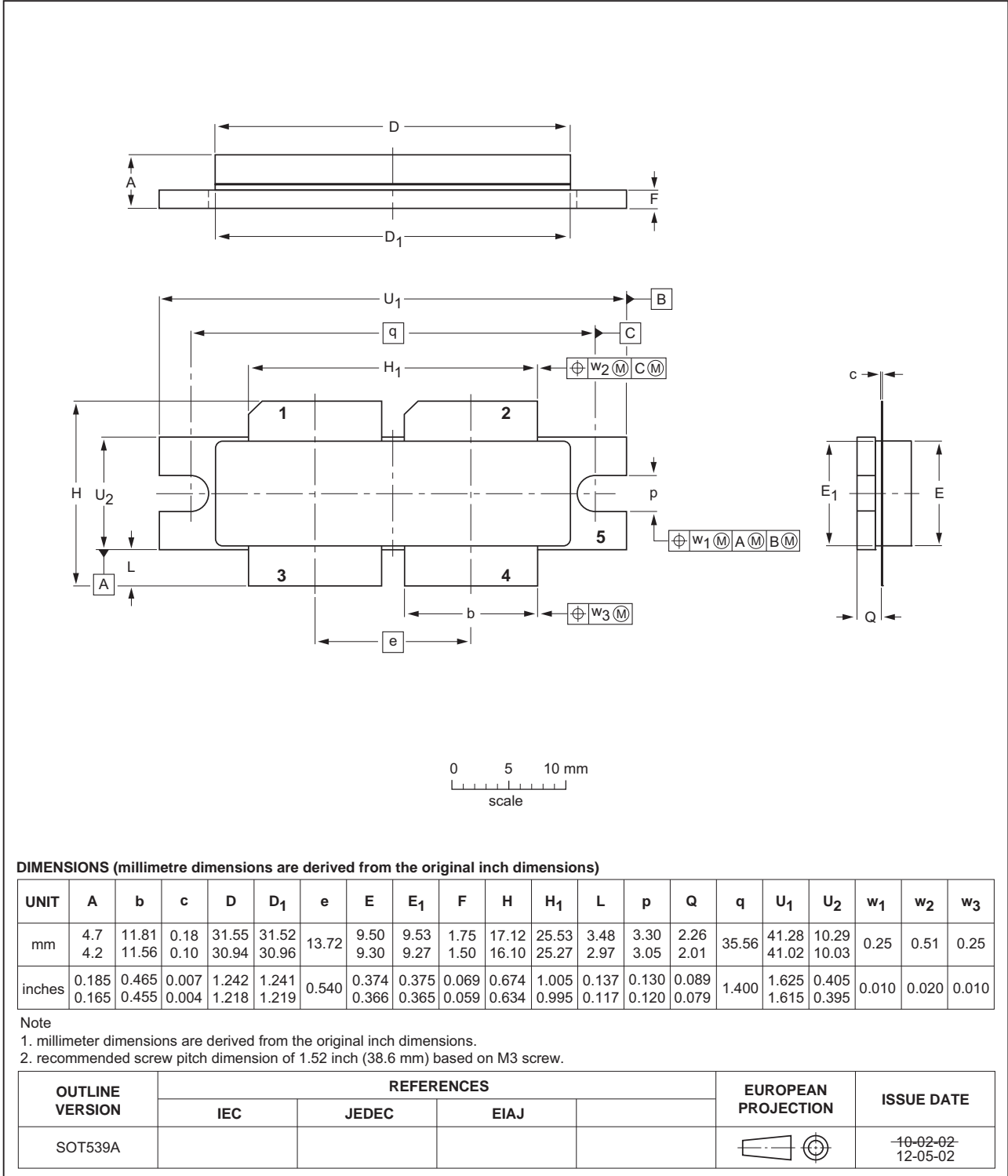


Fig 13. Package outline SOT539A

Earless flanged balanced ceramic package; 4 leads

SOT539B

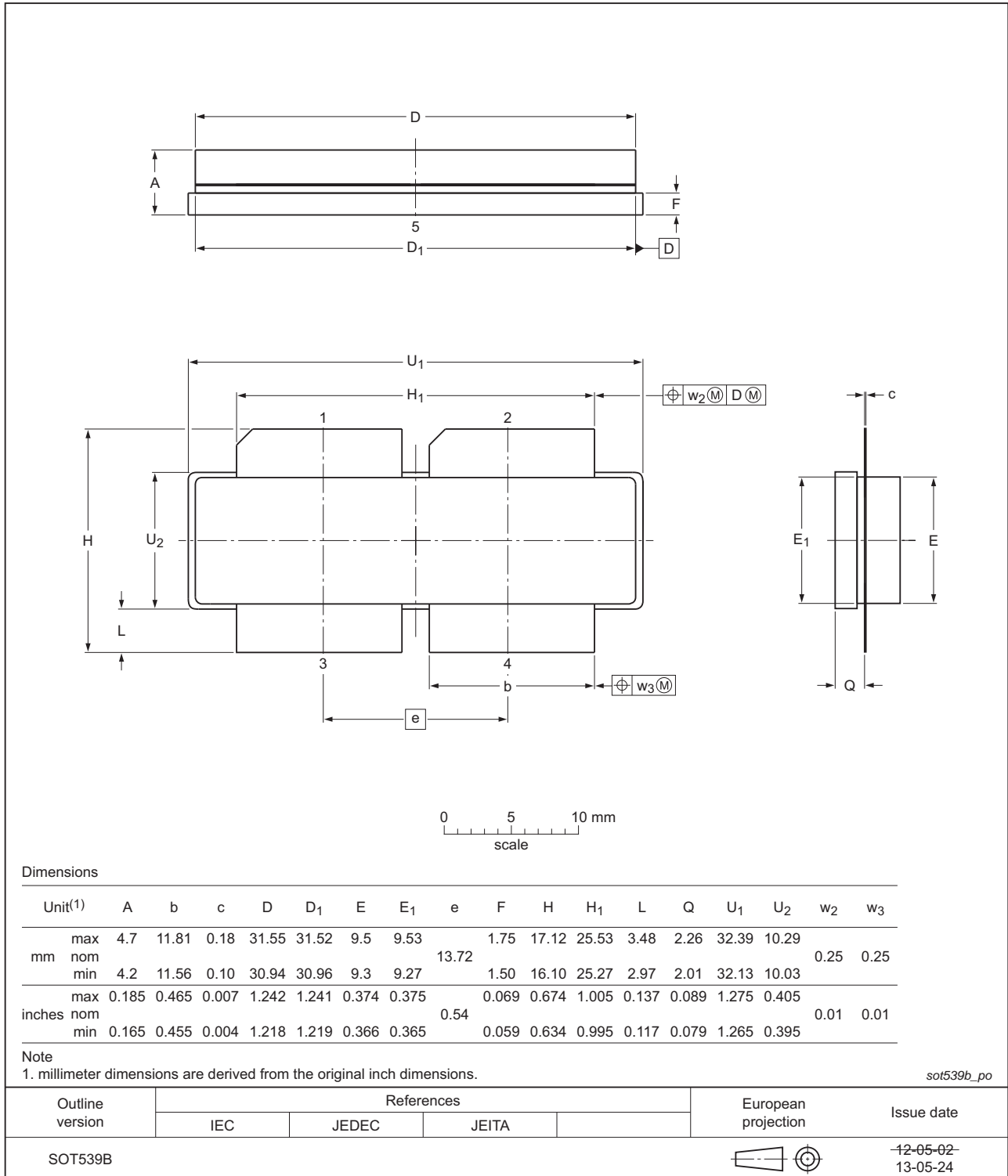


Fig 14. Package outline SOT539B

## 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
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
SMD	Surface Mounted Device
UHF	Ultra High Frequency
VSWR	Voltage Standing-Wave Ratio

## 12. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF888A_BLF888AS v.4	20130712	Product data sheet	-	BLF888A_BLF888AS v.3
Modifications:	<ul style="list-style-type: none"> <li>The package outline <a href="#">Figure 14</a> is updated.</li> <li>Translation disclaimer added to the legal text.</li> </ul>			
BLF888A_BLF888AS v.3	20110830	Product data sheet	-	BLF888A_BLF888AS v.2
Modifications:	<ul style="list-style-type: none"> <li>The status of this document has been changed to Product data sheet.</li> <li>Table 7 on page 3: The values in the Conditions column for <math>V_{DS}</math> and <math>I_{Dq}</math> have been removed.</li> </ul>			
BLF888A_BLF888AS v.2	20110301	Preliminary data sheet	-	BLF888A_BLF888AS v.1
BLF888A_BLF888AS v.1	20100921	Objective data sheet	-	-

## 13. Legal information

### 13.1 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".

[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.nxp.com>.

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