

BLF888B; BLF888BS

UHF power LDMOS transistor

Rev. 2 — 12 July 2013

Product data sheet

1. Product profile

1.1 General description

A 650 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 $V_{DS} = 50$ V unless otherwise specified.

Mode of operation	f (MHz)	$P_{L(AV)}$ (W)	$P_{L(M)}$ (W)	G_p (dB)	η_D (%)	IMD3 (dBc)	IMD _{shldr} (dBc)	PAR (dB)
RF performance in a common source 860 MHz narrowband test circuit								
2-tone, class-AB	$f_1 = 860$; $f_2 = 860.1$	250	-	21	46	-34	-	-
DVB-T (8k OFDM)	858	120	-	21	33	-	-31 ^[1]	8.2 ^[2]
RF performance in a common source 470 MHz to 860 MHz broadband test circuit								
DVB-T (8k OFDM)	858	120	-	20	32	-	-32 ^[1]	8.0 ^[2]

[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.

1.2 Features and benefits

- Excellent ruggedness
- Optimum thermal behavior and reliability, $R_{th(j-c)} = 0.15$ 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

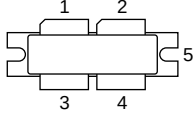
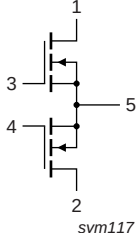
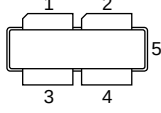
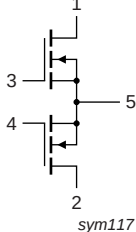
1.3 Applications

- 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
BLF888B (SOT539A)			
1	drain1		
2	drain2		
3	gate1		
4	gate2		
5	source		
BLF888BS (SOT539B)			
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
BLF888B	-	flanged balanced LDMOST ceramic package; 2 mounting holes; 4 leads	SOT539A
BLF888BS	-	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		-	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	$T_{case} = 80\text{ }^{\circ}\text{C}$; $P_{L(AV)} = 125\text{ W}$	[1] 0.15	K/W

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

6. Characteristics

Table 6. DC characteristics

$T_j = 25\text{ }^{\circ}\text{C}$; 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] 104	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}$; $I_D = 240\text{ }\mu\text{A}$	[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	μA
I_{DSX}	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$; $V_{DS} = 10\text{ V}$	-	38	-	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] -	120	-	$\text{m}\Omega$
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 50\text{ V}$; $f = 1\text{ MHz}$	[2] -	210	-	pF
C_{oss}	output capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 50\text{ V}$; $f = 1\text{ MHz}$	-	67	-	pF
C_{rss}	reverse transfer capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 50\text{ V}$; $f = 1\text{ MHz}$	-	1.35	-	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; $T_{case} = 25\text{ }^{\circ}\text{C}$ 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		[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
η_D	drain efficiency	$f_1 = 860\text{ MHz}$; $f_2 = 860.1\text{ MHz}$	42	46	-	%
IMD3	third-order intermodulation distortion	$f_1 = 860\text{ MHz}$; $f_2 = 860.1\text{ MHz}$	-	-34	-30	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
DVB-T (8k OFDM), class-AB						
V_{DS}	drain-source voltage		-	50	-	V
I_{DQ}	quiescent drain current		[1]	-	1.3	A
$P_{L(AV)}$	average output power	$f = 858\text{ MHz}$	120	-	-	W
G_p	power gain	$f = 858\text{ MHz}$	20	21	-	dB
η_D	drain efficiency	$f = 858\text{ MHz}$	30	33	-	%
IMD_{shldr}	intermodulation distortion shoulder	$f = 858\text{ MHz}$	[2]	-	-31	dBc
PAR	peak-to-average ratio	$f = 858\text{ MHz}$	[3]	-	8.2	dB

[1]

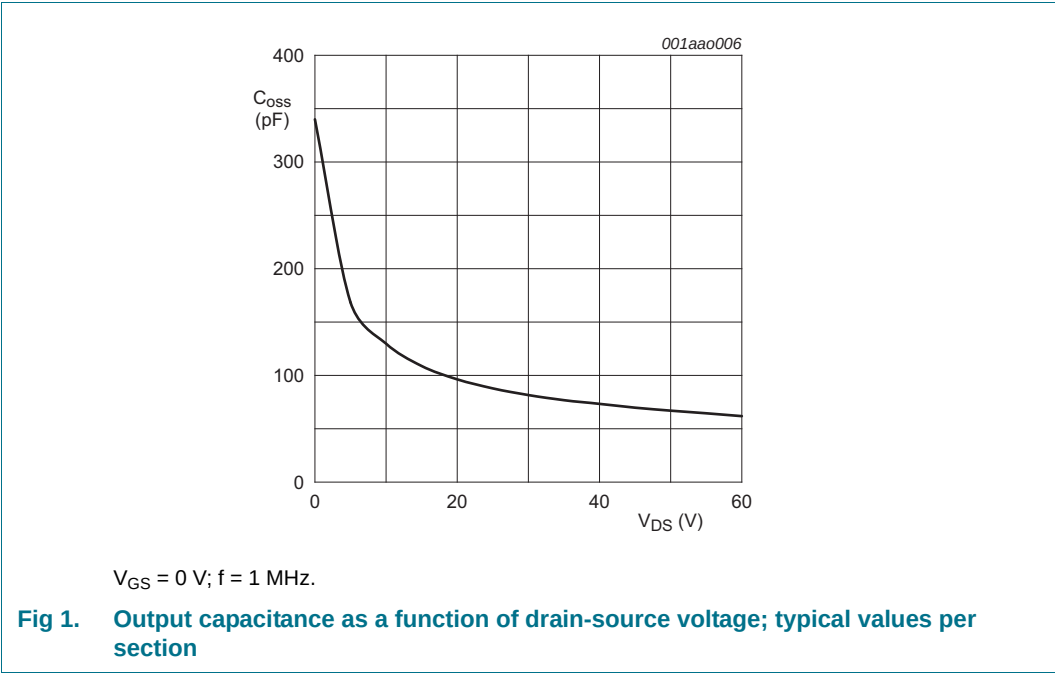
I_{dq} for total device

[2]

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

[3]

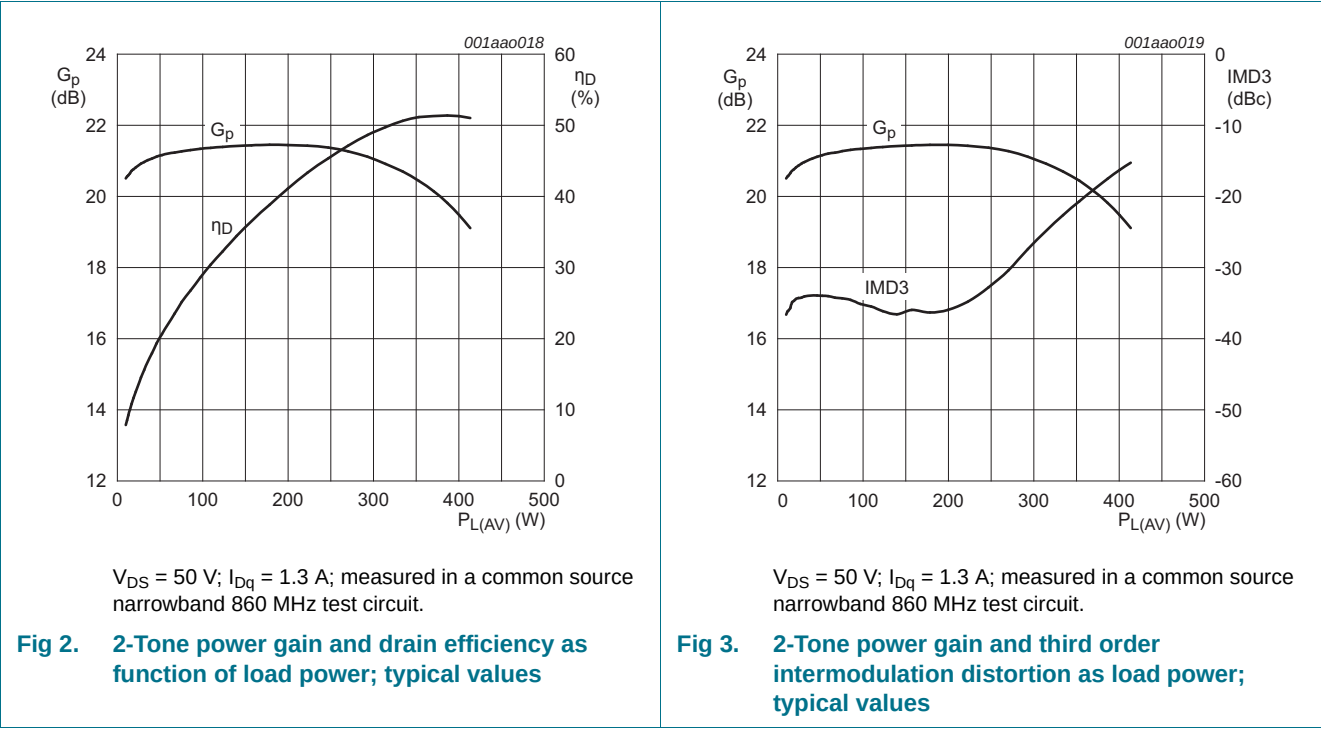
PAR (of output signal) at 0.01 % probability on CCDF; PAR of input signal = 9.5 dB at 0.01 % probability on CCDF.



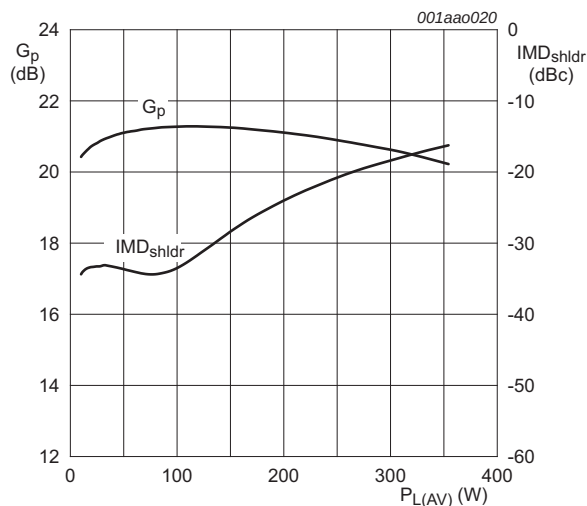
7. Application information

7.1 Narrowband RF figures

7.1.1 2-Tone

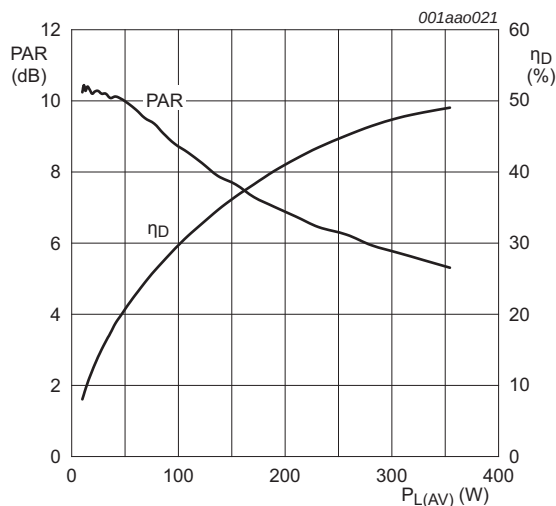


7.1.2 DVB-T



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

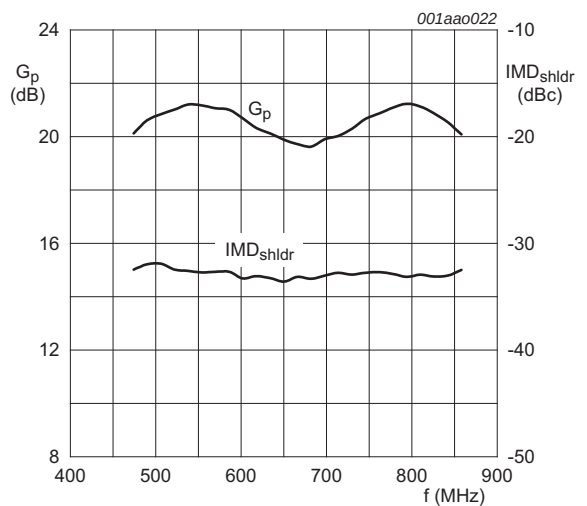


$V_{DS} = 50\text{ V}$; $I_{Dq} = 1.3\text{ A}$; measured in a common source narrowband 860 MHz test circuit.

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

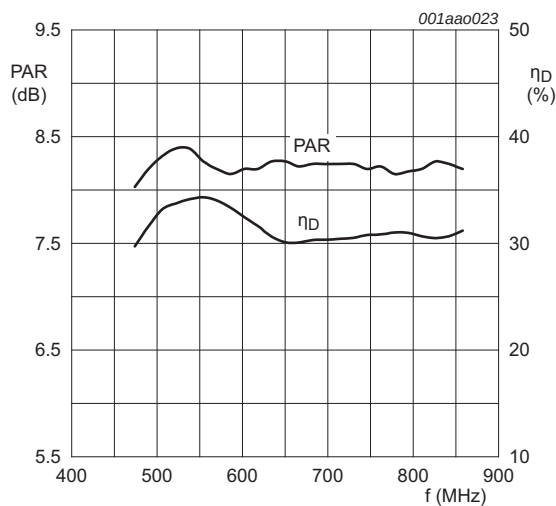
7.2 Broadband RF figures

7.2.1 DVB-T



$P_{L(AV)} = 120\text{ W}$; $V_{DS} = 50\text{ V}$; $I_{Dq} = 1.3\text{ A}$; measured in a common source broadband test circuit as described in [Section 8](#).

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



$P_{L(AV)} = 120\text{ W}$; $V_{DS} = 50\text{ V}$; $I_{Dq} = 1.3\text{ A}$; 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

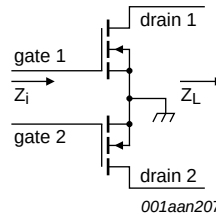


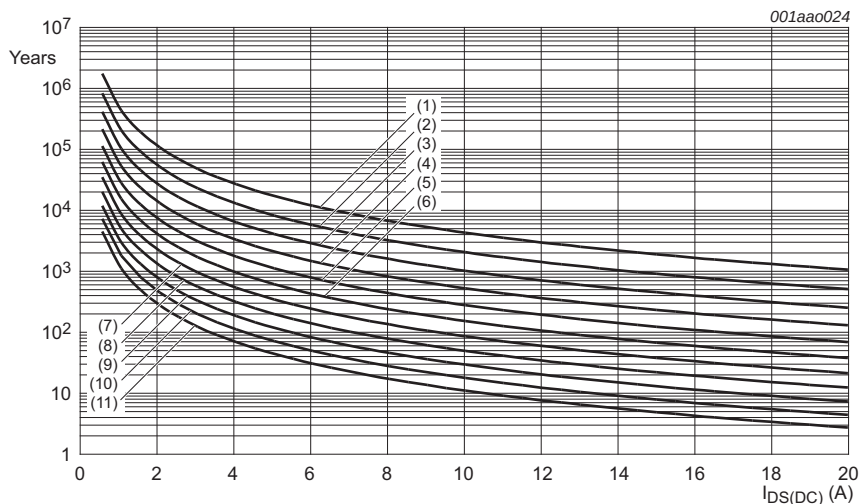
Fig 8. Definition of transistor impedance

Table 8. Typical push-pull impedance

Simulated Z_i and Z_L device impedance; impedance info at $V_{DS} = 50\text{ V}$ and $P_{L(AV)} = 120\text{ W}$ (DVB-T).

f MHz	Z_i Ω	Z_L Ω
300	$0.617 - j1.715$	$4.792 + j0.947$
325	$0.635 - j1.355$	$4.707 + j0.994$
350	$0.655 - j1.026$	$4.619 + j1.035$
375	$0.677 - j0.721$	$4.528 + j1.069$
400	$0.702 - j0.435$	$4.435 + j1.097$
425	$0.731 - j0.164$	$4.340 + j1.118$
450	$0.762 + j0.096$	$4.243 + j1.134$
475	$0.798 + j0.347$	$4.147 + j1.143$
500	$0.839 + j0.592$	$4.049 + j1.146$
525	$0.884 + j0.833$	$3.952 + j1.144$
550	$0.936 + j1.072$	$3.855 + j1.136$
575	$0.995 + j1.310$	$3.759 + j1.123$
600	$1.063 + j1.549$	$3.663 + j1.105$
625	$1.141 + j1.791$	$3.569 + j1.083$
650	$1.230 + j2.037$	$3.477 + j1.055$
675	$1.334 + j2.289$	$3.385 + j1.024$
700	$1.456 + j2.548$	$3.296 + j0.989$
725	$1.599 + j2.814$	$3.209 + j0.949$
750	$1.768 + j3.090$	$3.123 + j0.907$
775	$1.971 + j3.376$	$3.039 + j0.861$
800	$2.214 + j3.671$	$2.958 + j0.812$
825	$2.510 + j3.975$	$2.879 + j0.761$
850	$2.873 + j4.282$	$2.801 + j0.706$
875	$3.320 + j4.584$	$2.726 + j0.650$
900	$3.875 + j4.865$	$2.654 + j0.591$
925	$4.562 + j5.095$	$2.583 + j0.530$
950	$5.409 + j5.223$	$2.514 + j0.467$
975	$6.426 + j5.166$	$2.448 + j0.403$
1000	$7.587 + j4.807$	$2.384 + j0.337$

7.4 Reliability



TTF (0.1 % failure fraction).

The reliability at pulsed conditions can be calculated as follows: $TTF (0.1 \%) \times 1 / \delta$.

- (1) $T_j = 100 \text{ }^{\circ}\text{C}$
- (2) $T_j = 110 \text{ }^{\circ}\text{C}$
- (3) $T_j = 120 \text{ }^{\circ}\text{C}$
- (4) $T_j = 130 \text{ }^{\circ}\text{C}$
- (5) $T_j = 140 \text{ }^{\circ}\text{C}$
- (6) $T_j = 150 \text{ }^{\circ}\text{C}$
- (7) $T_j = 160 \text{ }^{\circ}\text{C}$
- (8) $T_j = 170 \text{ }^{\circ}\text{C}$
- (9) $T_j = 180 \text{ }^{\circ}\text{C}$
- (10) $T_j = 190 \text{ }^{\circ}\text{C}$
- (11) $T_j = 200 \text{ }^{\circ}\text{C}$

Fig 9. BLF888B; BLF888BS electromigration ($I_{DS(DC)}$, total device)

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 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 μ 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 μ F, 50 V	TDK C570X7R1H106KT000N or capacitor of same quality.
C21, C22	electrolytic capacitor	470 μ 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 μ 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 Ω	
R3, R4	SMD resistor	5.6 Ω	0805
R5, R6	wire resistor	100 Ω	
R7, R8	potentiometer	10 k Ω	

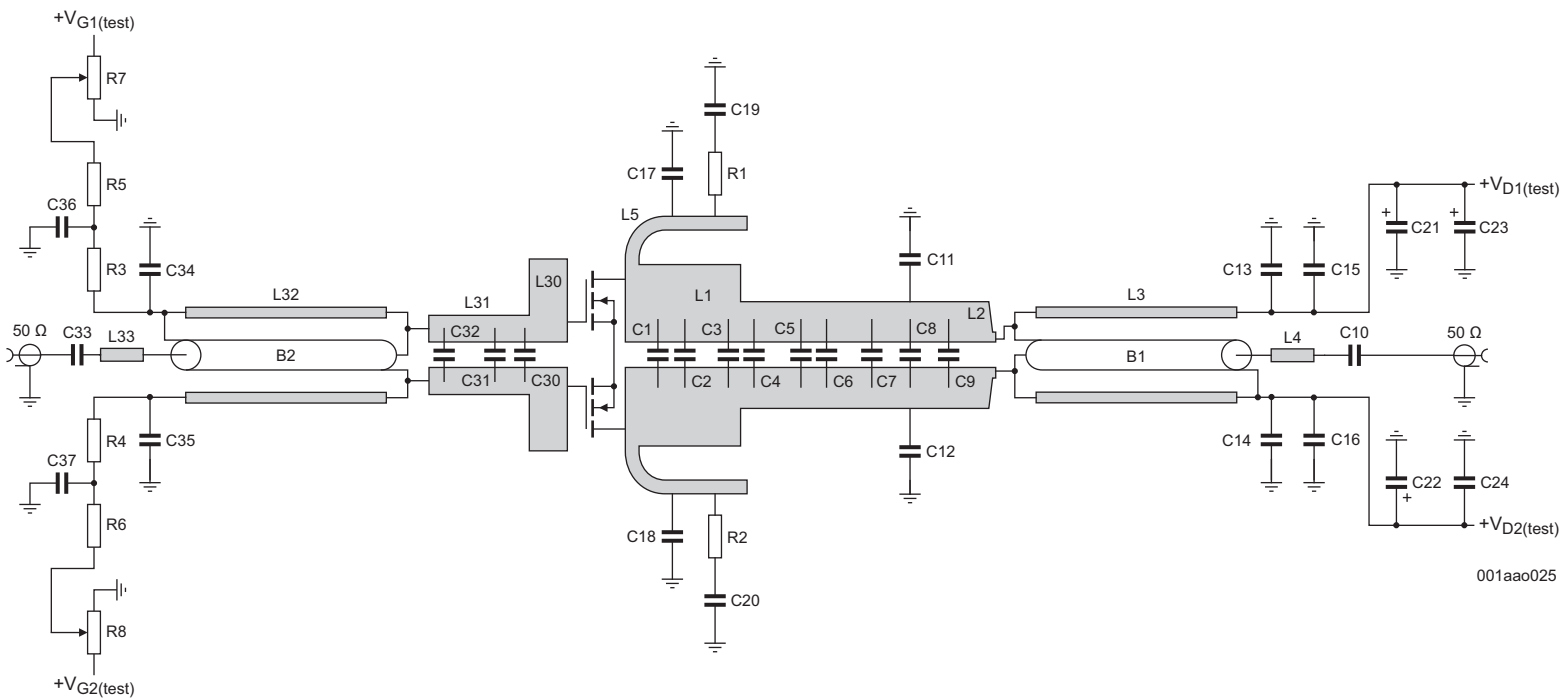
[1] American technical ceramics type 800R or capacitor of same quality.

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

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

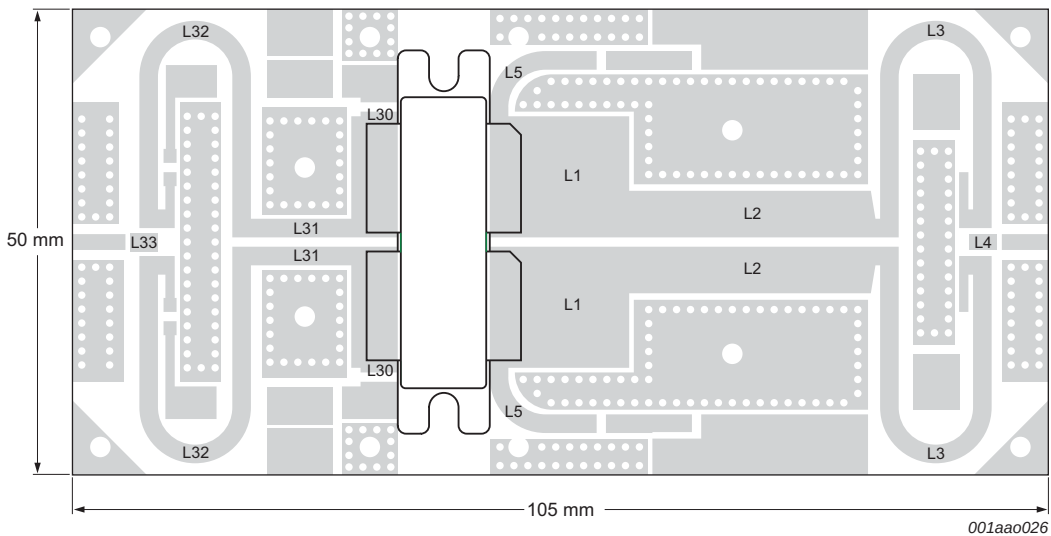
[4] American technical ceramics type 100A or capacitor of same quality.

[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 μ m.



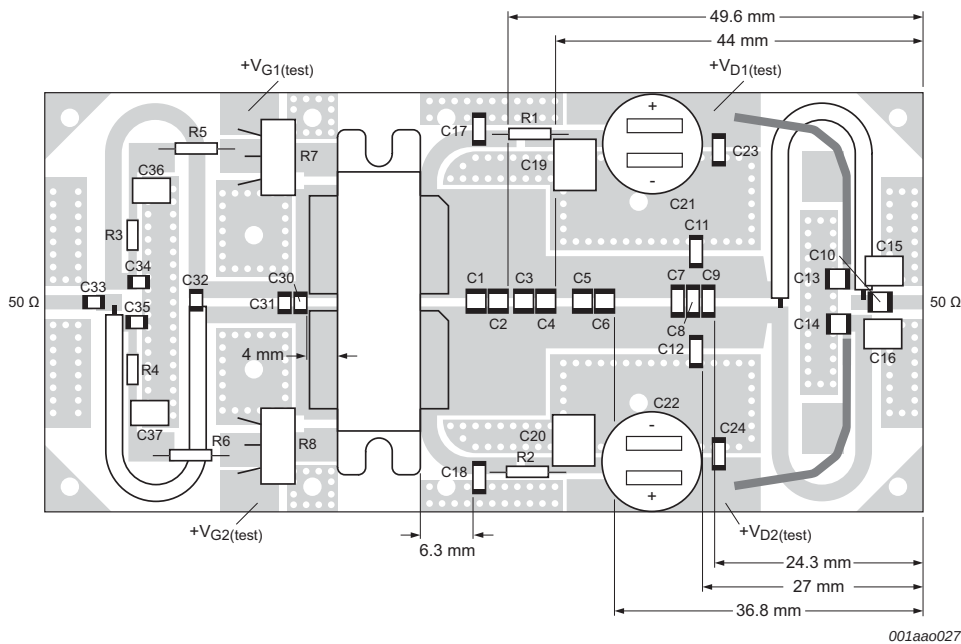
See [Table 9](#) for a list of components.

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

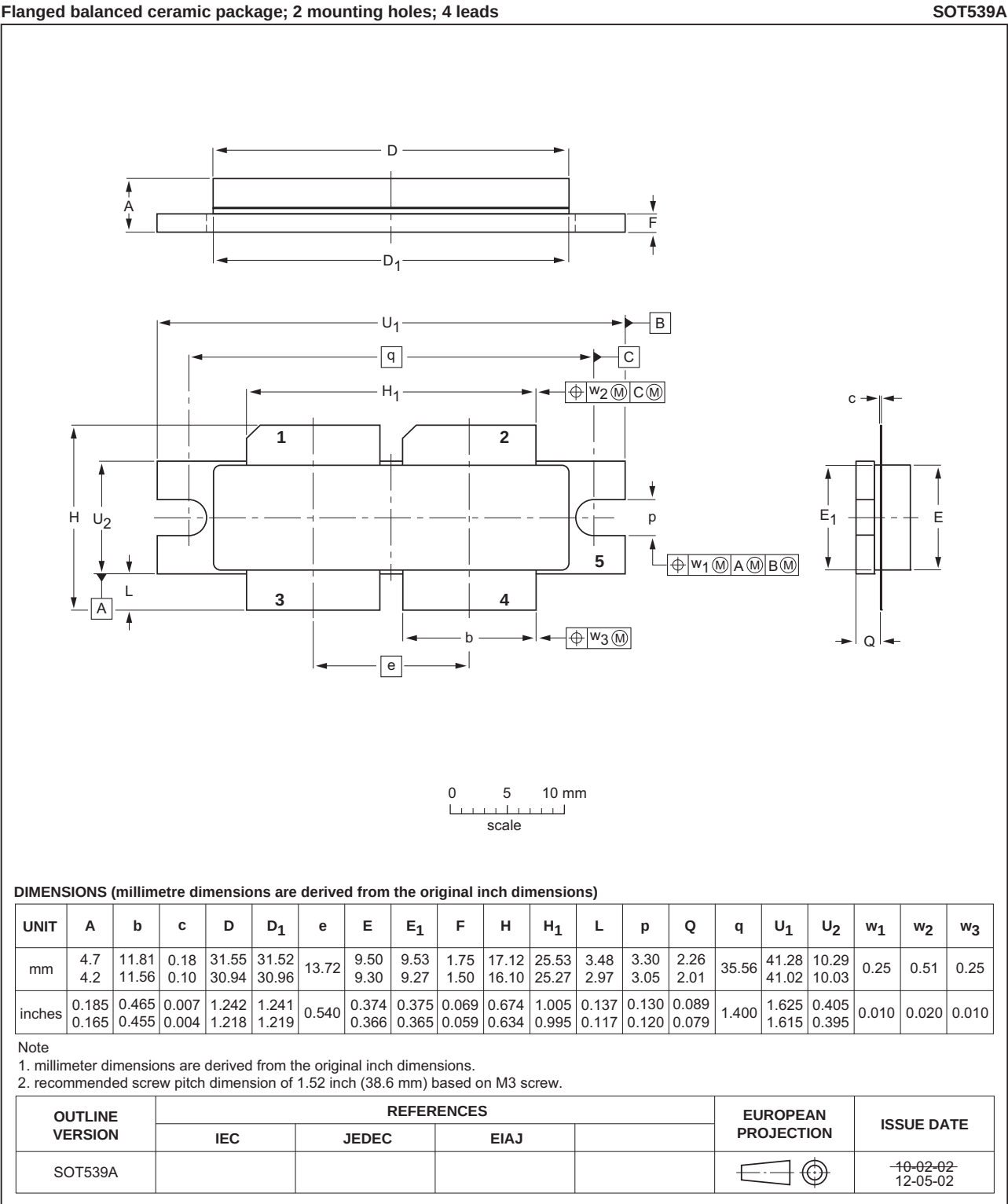


Fig 13. Package outline SOT539A

Earless flanged balanced ceramic package; 4 leads

SOT539B

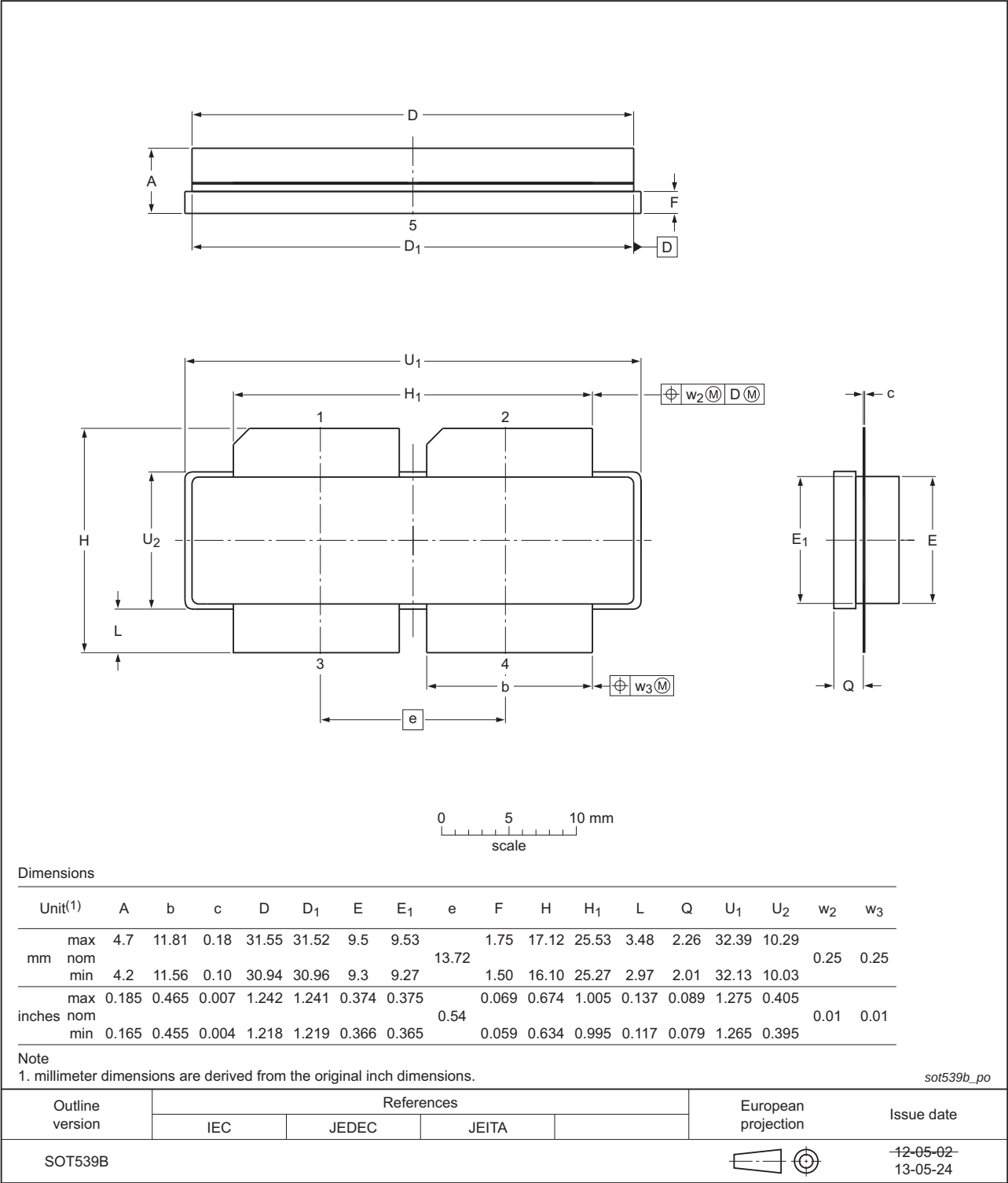


Fig 14. Package outline SOT539B

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
TTF	Time-To-Failure
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
BLF888B_BLF888BS v.2	20130712	Product data sheet	-	BLF888B_BLF888BS v.1
Modifications:	- The package outline Figure 14 is updated. - Translation disclaimer added to the legal text.			
BLF888B_BLF888BS v.1	20111017	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

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