



# THE DATASHEET OF BLF989U



# BLF989; BLF989S

UHF power LDMOS transistor

Rev. 3 — 24 May 2019

AMPLEON

Product data sheet

## 1. Product profile

### 1.1 General description

A 900 W LDMOS RF power transistor for broadcast Doherty, class-AB transmitter and industrial applications. The excellent ruggedness of this device makes it ideal for digital and analog transmitter applications in the frequency range from 400 MHz to 860 MHz.

**Table 1. Application information**

RF performance at  $V_{DS} = 50$  V in a class-AB broadband application demo, unless otherwise specified.

Test signal	f (MHz)	$V_{DS}$ (V)	$P_{L(AV)}$ (W)	$G_p$ (dB)	$\eta_D$ (%)	IMD <sub>shldr</sub> (dBc)	PAR (dB)
class-AB broadband/DVB-T (8k OFDM)	470 to 710	50	150	20	34	-30	8.2 [1]
symmetric Doherty/DVB-T (8k OFDM) [2][3]	470 to 500	50	300	19	50	-37	-
symmetric Doherty/DVB-T (8k OFDM) [4][5]	474 to 490	50	200	19	53	-41	-

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

[2] ProTelevision 3000 Exciter corrected DVB-T.

[3] Narrowband classical Doherty application using two transistors.

[4] Anywave CTTB exciter XS.

[5] Narrowband Doherty using one transistor.

### 1.2 Features and benefits

- Designed for broadband and Doherty operation
- High efficiency
- Integrated dual sided ESD protection
- Excellent ruggedness
- High power gain
- Excellent reliability
- Easy power control
- Excellent stability
- For RoHS compliance see the product details on the Ampleon website

### 1.3 Applications

- Broadcast transmitter applications in the UHF band
- Digital and analog broadcasting
- Industrial, scientific and medical applications
- Applicable at frequencies from 400 MHz to 860 MHz

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
<b>BLF989 (SOT539A)</b>			
1	drain1		 sym117
2	drain2		
3	gate1		
4	gate2		
5	source <a href="#">[1]</a>		
<b>BLF989S (SOT539B)</b>			
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
BLF989	-	flanged balanced ceramic package; 2 mounting holes; 4 leads	SOT539A
BLF989S	-	earless flanged balanced 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		-	108	V
$V_{GS}$	gate-source voltage		-6	+11	V
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature	<a href="#">[1]</a>	-	225	°C

[1] Continuous use at maximum temperature will affect the reliability, for details refer to the online MTF calculator.

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	$T_{case} = 90\text{ °C}$ ; $V_{DS} = 50\text{ V}$ ; $I_D = 135\text{ W}$ ; $PAR = 8\text{ dB}$	0.13	K/W

[1] Measured in a broadband application circuit, using DVB-T (8k OFDM) signal; PAR (of output signal) at 0.01 % probability on CCDF; PAR of input signal = 9.5 dB at 0.01 % probability on CCDF.

## 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	$V_{GS} = 0\text{ V}$ ; $I_D = 2.4\text{ mA}$	108	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}$ ; $I_D = 240\text{ mA}$	1.5	2.2	2.5	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	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ; $V_{DS} = 10\text{ V}$	-	41	-	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	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ; $I_D = 8.5\text{ A}$	-	90	-	m $\Omega$

**Table 7. AC characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_{iss}$	input capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$	-	368	-	pF
$C_{oss}$	output capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$	-	69	-	pF
$C_{rss}$	reverse transfer capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$	-	0.86	-	pF

**Table 8. RF characteristics**

RF characteristics in Ampleon production test circuit,  $T_{case} = 25\text{ °C}$ ; unless otherwise specified.

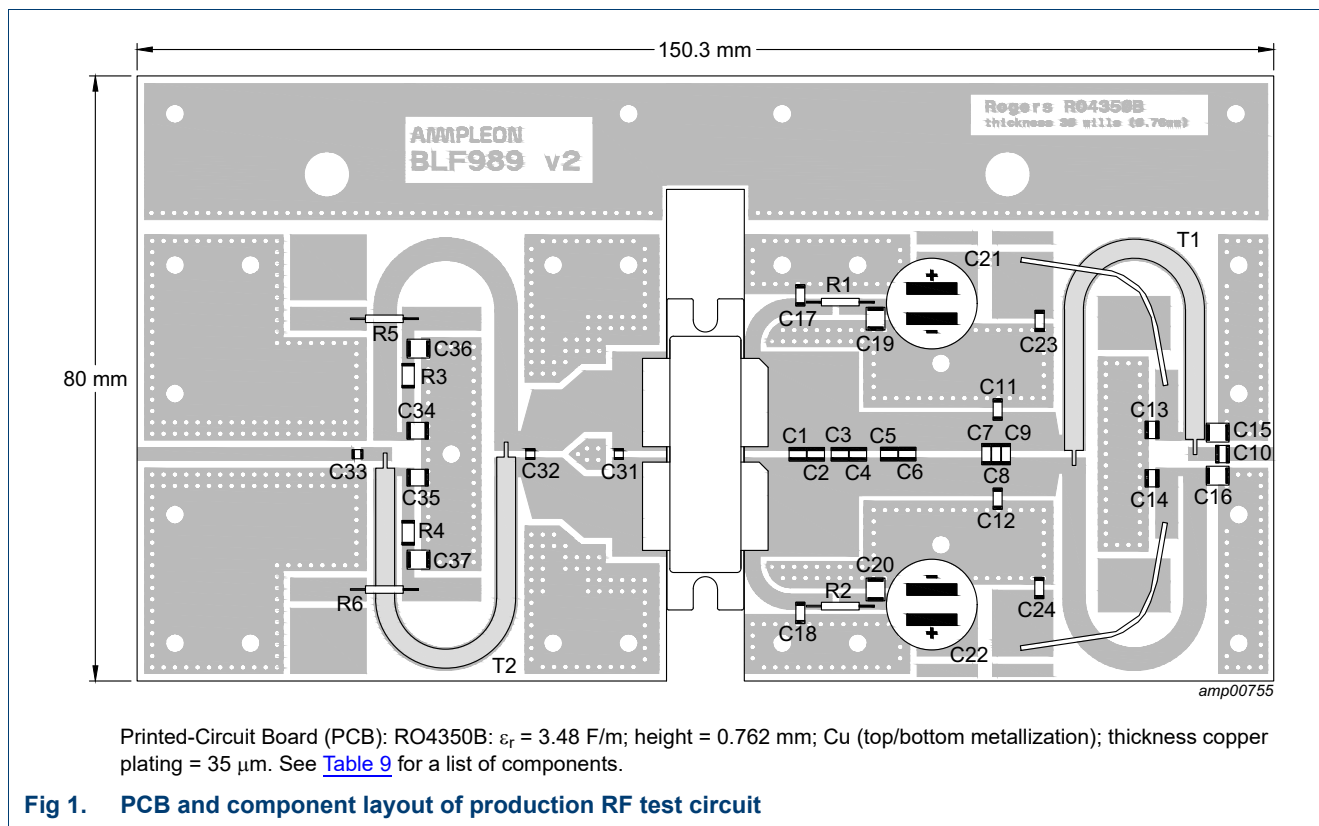
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>DVB-T (8k OFDM), class-AB operation</b>						
$V_{DS}$	drain-source voltage		-	50	-	V
$I_{Dq}$	quiescent drain current	per section	-	650	-	mA
$P_{L(AV)}$	average output power	$f = 700\text{ MHz}$	135	-	-	W
$G_p$	power gain	$f = 700\text{ MHz}$	21.5	22.5	-	dB
$\eta_D$	drain efficiency	$f = 700\text{ MHz}$	32	35	-	%
ACPR	adjacent channel power ratio	$f = 700\text{ MHz}$	-	-30	-27	dBc
PAR	peak-to-average ratio	$f = 700\text{ MHz}$	-	8	-	dB

## 7. Test information

### 7.1 Ruggedness in class-AB operation

The BLF989 and BLF989S are capable of withstanding a load mismatch corresponding to  $VSWR \geq 40 : 1$  through all phases under the following conditions:  $V_{DS} = 60 \text{ V}$ ;  $f = 700 \text{ MHz}$ ;  $P_L = 135 \text{ W}$ : DVB-T;  $PAR = 8 \text{ dB}$ .

### 7.2 Test circuit



**Table 9. List of components**

See [Figure 1](#) for component layout.

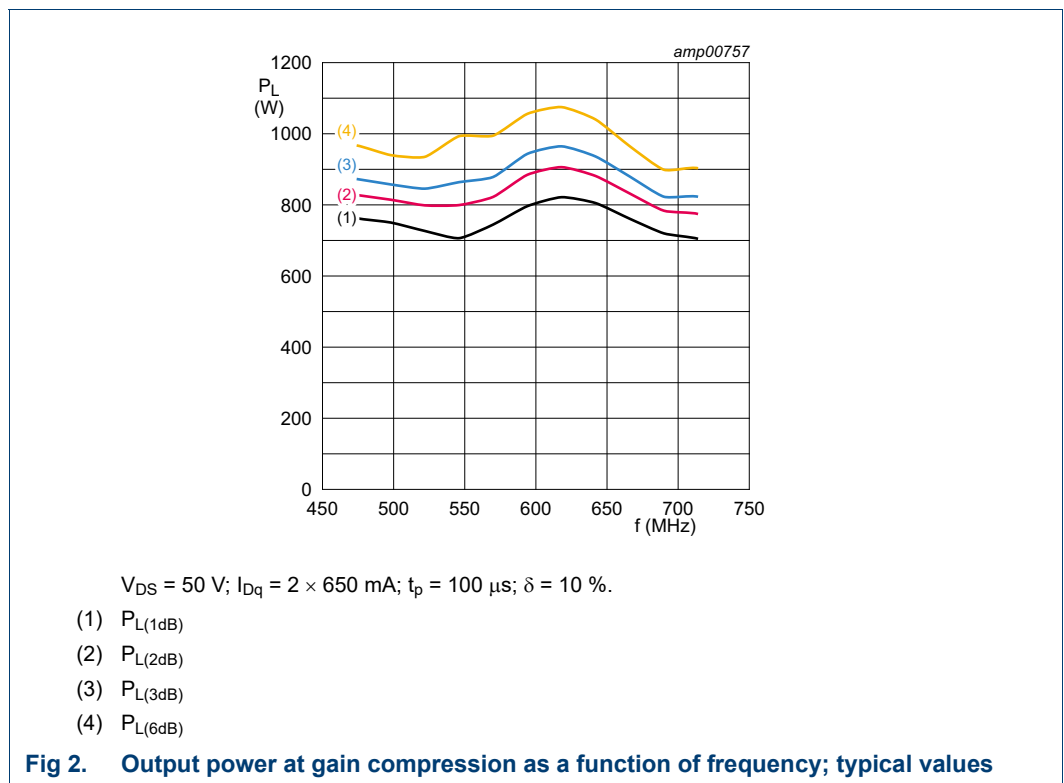
Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	12 pF	ATC800R
C2, C3,C4,C5,C6	multilayer ceramic chip capacitor	8.2 pF	ATC800R
C7	multilayer ceramic chip capacitor	6.8 pF	ATC800B
C8	multilayer ceramic chip capacitor	2.7 pF	ATC800B
C9	multilayer ceramic chip capacitor	22 pF	ATC800B
C10, C13, C14	multilayer ceramic chip capacitor	100 pF	ATC180R
C11, C12	multilayer ceramic chip capacitor	10 pF	ATC800B
C15, C16	multilayer ceramic chip capacitor	4.7 $\mu\text{F}$ , 50 V	Kemet: C1210X475K5RAC-TU or similar
C17, C18, C23, C24	multilayer ceramic chip capacitor	100 pF	ATC800B
C19, C20	multilayer ceramic chip capacitor	10 $\mu\text{F}$ , 50 V	TDK: C570X7R1H106KT000N or similar

Table 9. List of components ...continued  
See Figure 1 for component layout.

Component	Description	Value	Remarks
C21, C22	electrolytic capacitor	470 $\mu$ F, 63 V	
C31	multilayer ceramic chip capacitor	18 pF	ATC800A
C32	multilayer ceramic chip capacitor	13 pF	ATC800A
C33, C34, C35	multilayer ceramic chip capacitor	100 pF	ATC100A
C36, C37	multilayer ceramic chip capacitor	4.7 $\mu$ F, 50 V	TDK: C4532X7R1E475MT020U or similar
R1, R2	wire resistor	10 $\Omega$	
R3, R4	SMD resistor	5.6 $\Omega$	
R5, R6	wire resistor	100 $\Omega$	
T1, T2	semi rigid coax	25 $\Omega$ , 60 mm	EZ90-25

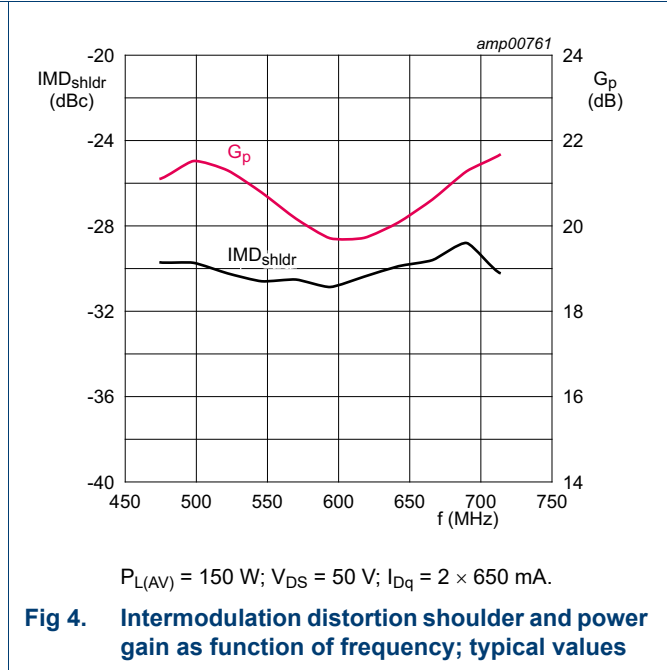
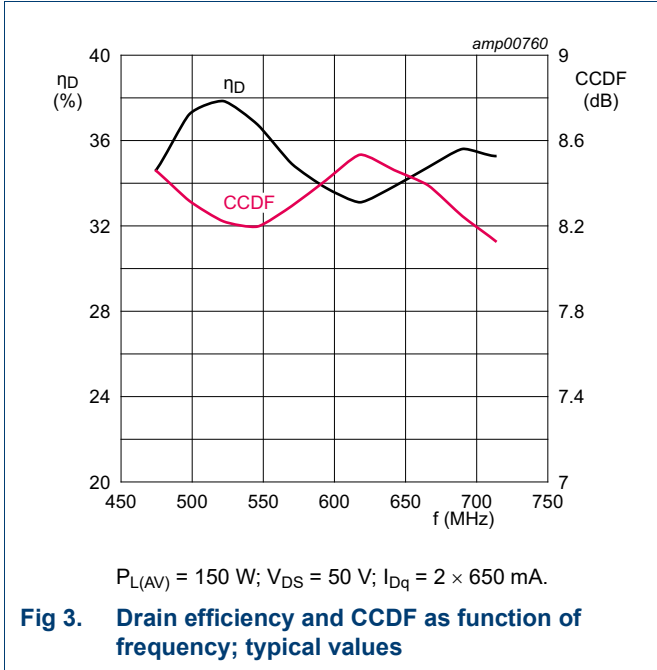
### 7.3 Graphical data

#### 7.3.1 Pulsed CW performance measured in class-AB broadband application



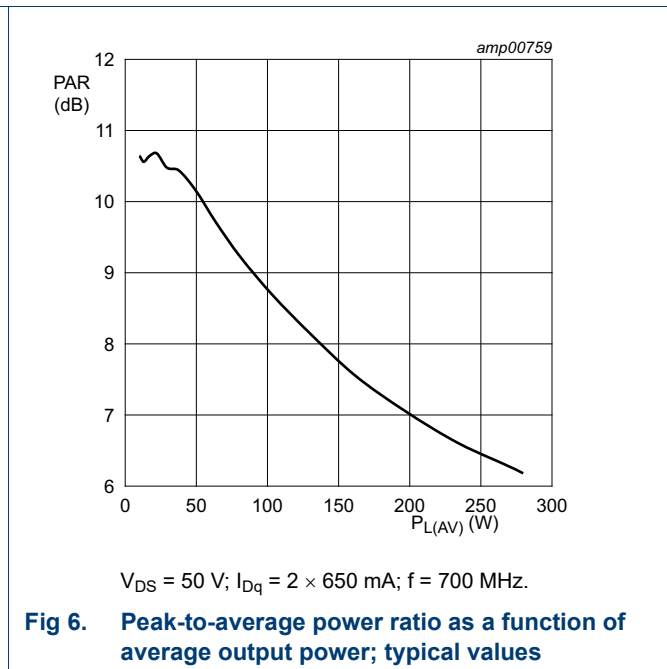
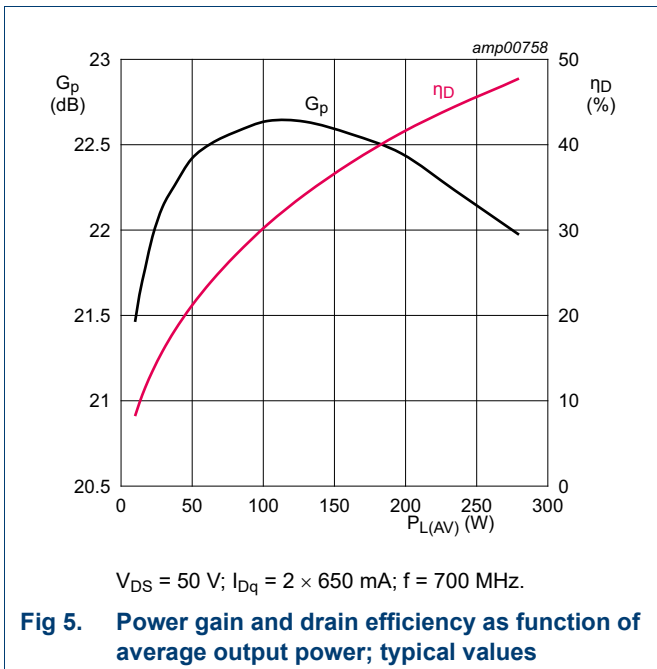
7.3.2 DVB-T performance measured in class-AB broadband application

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

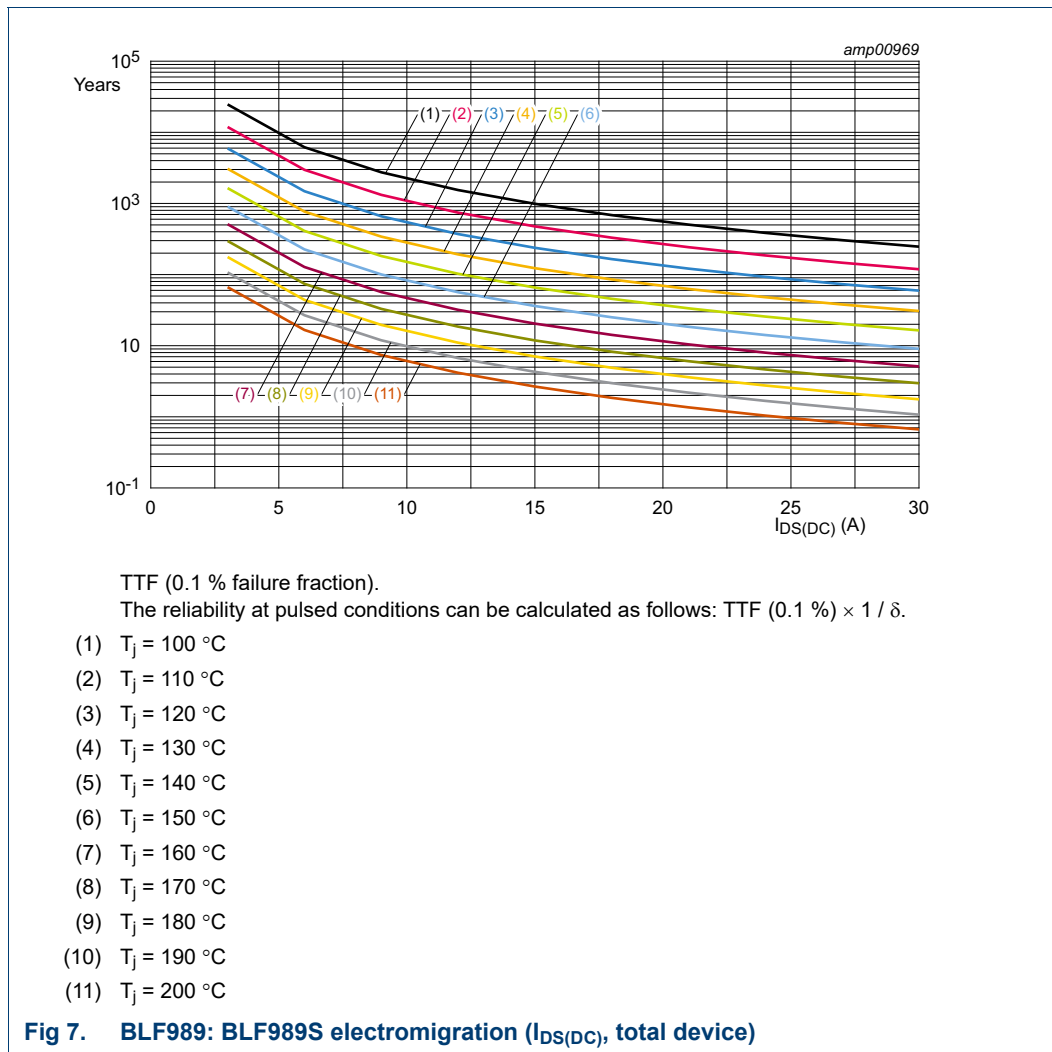


7.3.3 DVB-T performance measured in production RF test circuit

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



7.3.4 Reliability



8. Package outline

Flanged balanced ceramic package; 2 mounting holes; 4 leads

SOT539A

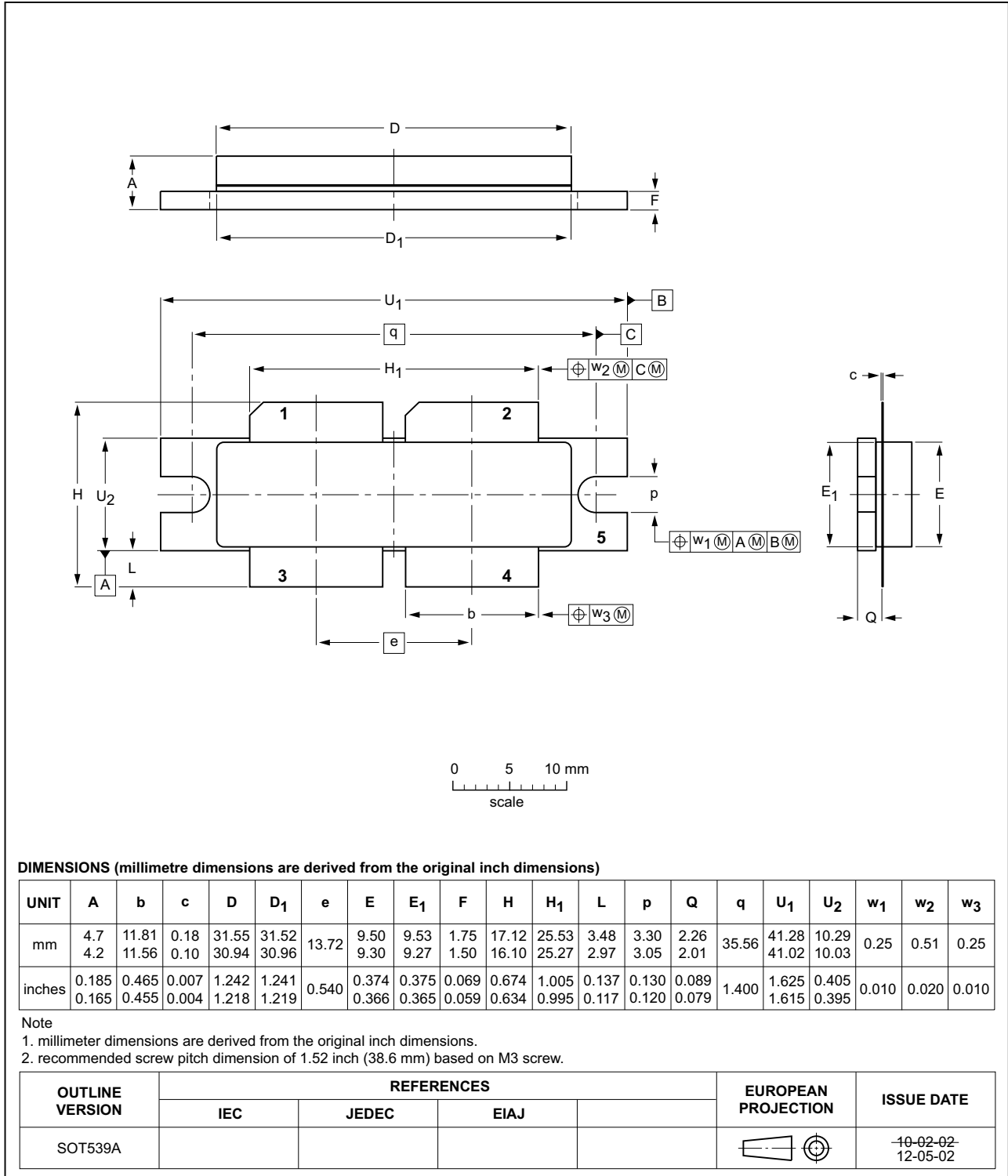


Fig 8. Package outline SOT539A

Earless flanged balanced ceramic package; 4 leads

SOT539B

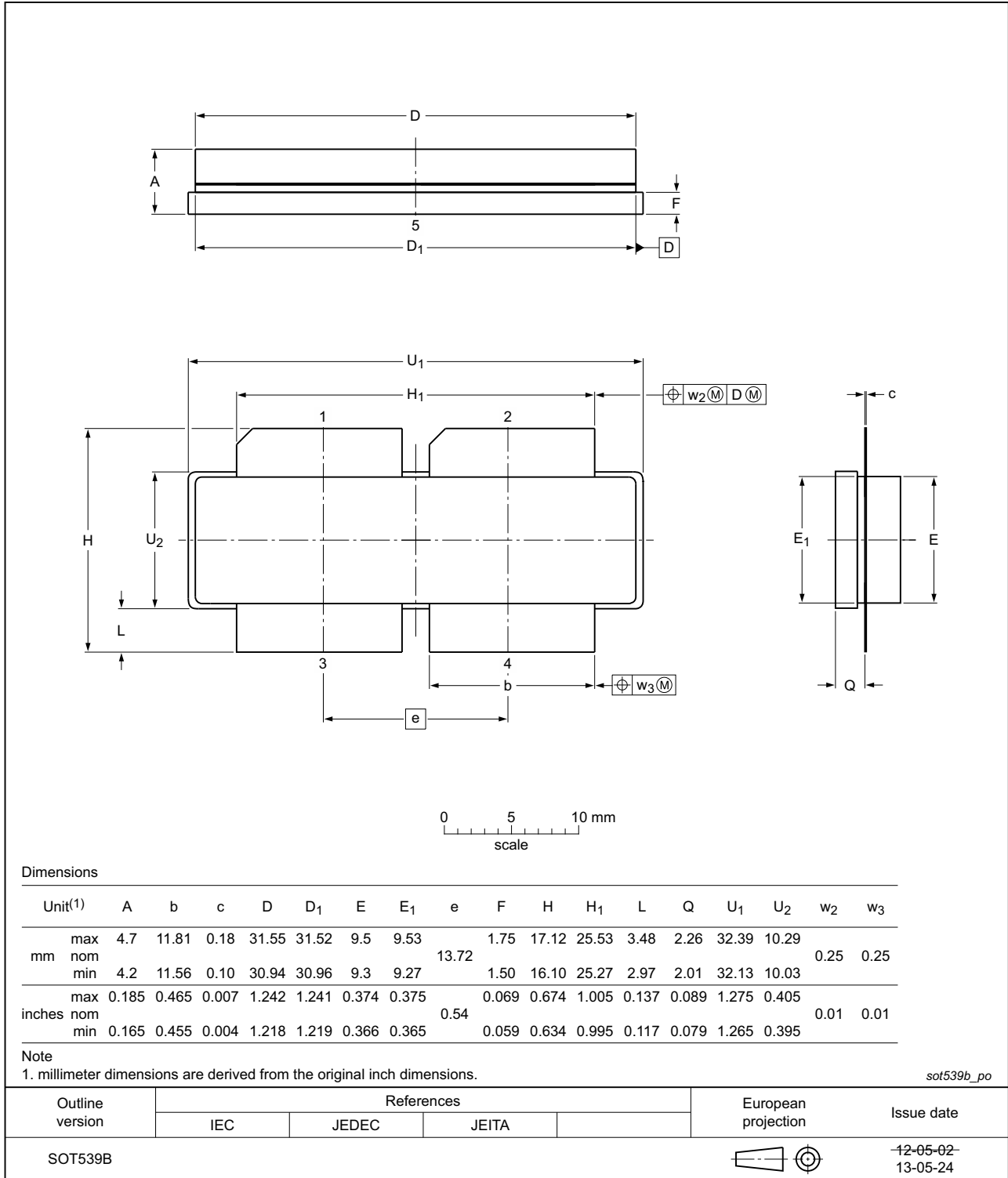


Fig 9. Package outline SOT539B

## 9. 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.

**Table 10. ESD sensitivity**

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C2A <a href="#">[1]</a>
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	2 <a href="#">[2]</a>

[1] CDM classification C2A is granted to any part that passes after exposure to an ESD pulse of 500 V.

[2] HBM classification 2 is granted to any part that passes after exposure to an ESD pulse of 2000 V.

## 10. Abbreviations

**Table 11. Abbreviations**

Acronym	Description
CCDF	Complementary Cumulative Distribution Function
CTTB	China Terrestrial Television Broadcasting
DVB-T	Digital Video Broadcast - Terrestrial
ESD	ElectroStatic Discharge
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
MTF	Median Time to Failure
OFDM	Orthogonal Frequency Division Multiplexing
PAR	Peak-to-Average Ratio
RoHS	Restriction of Hazardous Substances
SMD	Surface Mounted Device
TTF	Time To Failure
UHF	Ultra High Frequency
VSWR	Voltage Standing Wave Ratio

## 11. Revision history

**Table 12. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF989_BLF989S v.3	20190524	Product data sheet	-	BLF989_BLF989S v.2
Modifications	<ul style="list-style-type: none"> <li><a href="#">Table 1 on page 1</a>: third row added</li> <li><a href="#">Section 7.3.4 on page 7</a>: section added</li> </ul>			
BLF989_BLF989S v.2	20190122	Product data sheet	-	BLF989_BLF989S v.1
BLF989_BLF989S v.1	20180907	Product 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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