

# BLF647PS

## Broadband power LDMOS transistor

Rev. 2 — 18 November 2013

Product data sheet

## 1. Product profile

### 1.1 General description

A 200 W LDMOS RF power transistor for broadcast transmitter and industrial applications. The transistor is suitable for the frequency range HF to 1500 MHz. The excellent ruggedness and broadband performance of this device makes it ideal for digital applications.

**Table 1.** Application information

RF performance at  $T_h = 25\text{ }^{\circ}\text{C}$  in a common source test circuit.

Test signal	f (MHz)	V <sub>DS</sub> (V)	I <sub>DQ</sub> (A)	P <sub>L(AV)</sub> (W)	P <sub>L(M)</sub> (W)	G <sub>p</sub> (dB)	$\eta_D$ (%)	IMD3 (dBc)
Pulsed, class-B	1300	32	0.1	-	200	17.5	70	-
CW, class-B	1300	32	0.1	200	-	17.5	70	-
2-tone, class-AB	$f_1 = 1299.95$ ; $f_2 = 1300.05$	32	0.7	75	-	19	48	-33

### 1.2 Features and benefits

- 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)

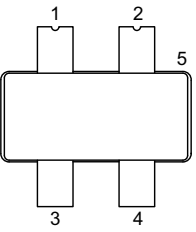
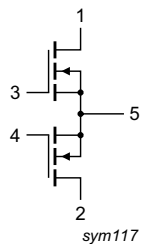
### 1.3 Applications

- Communication transmitter applications in the HF to 1500 MHz frequency range
- Industrial applications in the HF to 1500 MHz frequency range



## 2. Pinning information

**Table 2. Pinning**

Pin	Description	Simplified outline	Graphic symbol
1	drain1		 sym117
2	drain2		
3	gate1		
4	gate2		
5	source		

[1] Connected to flange

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		Version
	Name	Description	
BLF647PS	-	earless flanged ceramic package; 4 leads	SOT1121B

## 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		-	65	V
$V_{GS}$	gate-source voltage		-0.5	+11	V
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature	[1]	-	225	°C

[1] Continuous use at maximum temperature will affect the reliability. For details refer to the on-line MTF calculator.

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	$T_{case} = 80\text{ °C}$ ; $P_L = 200\text{ W}$	[1] 0.34	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	$V_{GS} = 0\text{ V}$ ; $I_D = 1.1\text{ mA}$	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 28\text{ V}$ ; $I_D = 110\text{ mA}$	1.55	1.8	2.25	V
$I_{DSS}$	drain leakage current	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 28\text{ V}$	-	-	1.4	$\mu\text{A}$
$I_{DSX}$	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ; $V_{DS} = 20\text{ V}$	18.1	20	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 11\text{ V}$ ; $V_{DS} = 0\text{ V}$	-	-	140	nA
$g_{fs}$	forward transconductance	$V_{DS} = 20\text{ V}$ ; $I_D = 5500\text{ mA}$	-	7.6	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ; $I_D = 3.85\text{ A}$	-	140	-	$\text{m}\Omega$

**Table 7. AC characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_{iss}$	input capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 32\text{ V}$ ; $f = 1\text{ MHz}$	-	78	-	pF
$C_{oss}$	output capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 32\text{ V}$ ; $f = 1\text{ MHz}$	-	30	-	pF
$C_{rs}$	feedback capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 32\text{ V}$ ; $f = 1\text{ MHz}$	-	1.3	-	pF

**Table 8. RF characteristics**

Test signal: CW;  $f = 1300\text{ MHz}$ ; RF performance at  $V_{DS} = 32\text{ V}$ ;  $I_{DQ} = 100\text{ mA}$ ;  $T_{case} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified; in a class-AB production test circuit.

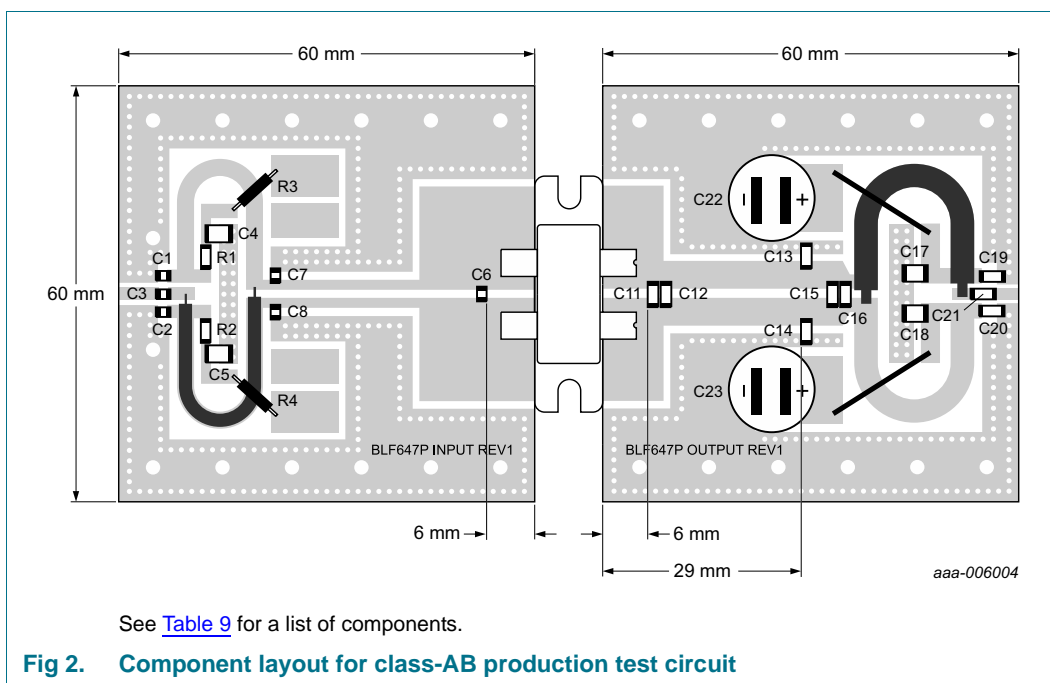
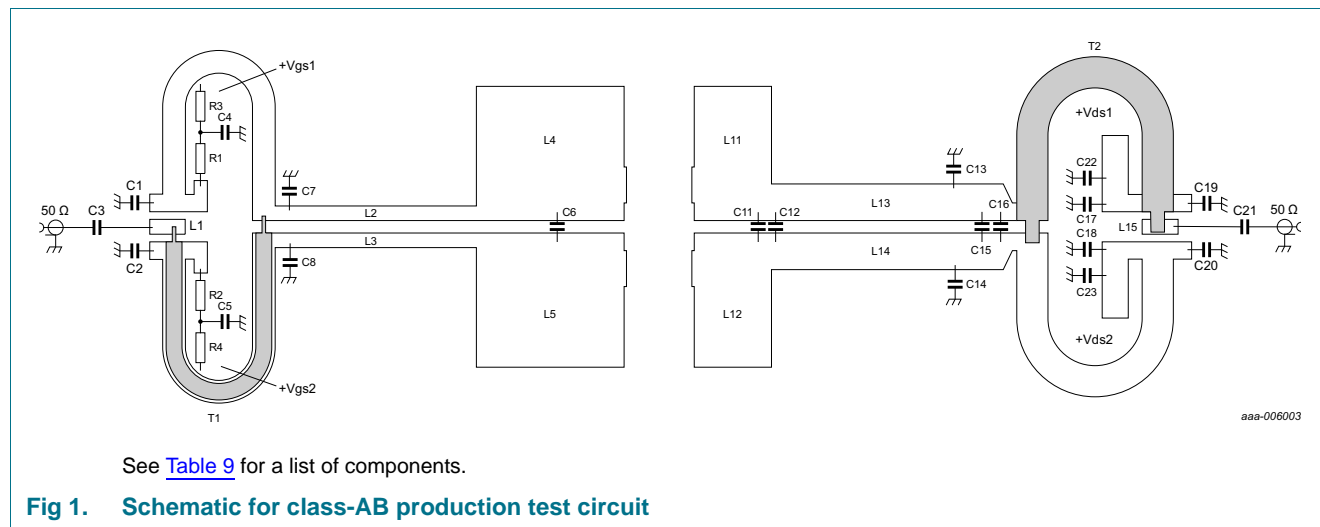
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$G_p$	power gain	$P_L = 200\text{ W}$	16.5	17.5	-	dB
$\eta_D$	drain efficiency	$P_L = 200\text{ W}$	66	70	-	%

## 7. Test information

### 7.1 Ruggedness in class-AB operation

The BLF647PS is capable of withstanding a load mismatch corresponding to  $VSWR = 10 : 1$  through all phases under the following conditions:  $V_{DS} = 32\text{ V}$ ;  $f = 1300\text{ MHz}$  at rated load power.

## 7.2 Test circuit information



**Table 9. List of components**

Printed-Circuit Board (PCB): RF 35;  $\epsilon_r = 3.5$  F/m; thickness = 0.765 mm; thickness copper plating = 35  $\mu\text{m}$ .  
See [Figure 1](#) and [Figure 2](#).

Component	Description	Value	Remarks
C1, C2, C3	multilayer ceramic chip capacitor	68 pF	[1]
C4, C5	multilayer ceramic chip capacitor	4.7 $\mu\text{F}$ , 50 V	
C6	multilayer ceramic chip capacitor	2.4 pF	[2]
C7, C8	multilayer ceramic chip capacitor	4.7 pF	[1]
C11	multilayer ceramic chip capacitor	3.3 pF	[3]
C12	multilayer ceramic chip capacitor	2.4 pF	[3]
C13, C14	multilayer ceramic chip capacitor	3.3 pF	[3]
C15, C16	multilayer ceramic chip capacitor	1.2 pF	[3]
C17, C18	multilayer ceramic chip capacitor	4.7 $\mu\text{F}$ , 50 V	
C19, C20, C21	multilayer ceramic chip capacitor	220 pF	[3]
C22, C23	electrolytic capacitor	470 $\mu\text{F}$ , 63 V	
L1	microstrip		(L $\times$ W) 4 mm $\times$ 1.7 mm
L2, L3	microstrip		(L $\times$ W) 22.5 mm $\times$ 1.6 mm
L4, L5	microstrip		(L $\times$ W) 16.5 mm $\times$ 15 mm
L11, L12	microstrip		(L $\times$ W) 8.5 mm $\times$ 15 mm
L13, L14	microstrip		(L $\times$ W) 26 mm $\times$ 4.2 mm
L15	microstrip		(L $\times$ W) 4 mm $\times$ 1.7 mm
R1, R2	SMD resistor	5.6 $\Omega$	SMD1206
R3, R4	wire resistor	100 $\Omega$	
T1	semi rigid coax	25 $\Omega$ , 40 mm	Micro-Coax UT-090C-25
T2	semi rigid coax	25 $\Omega$ , 40 mm	Micro-Coax UT-141C-25

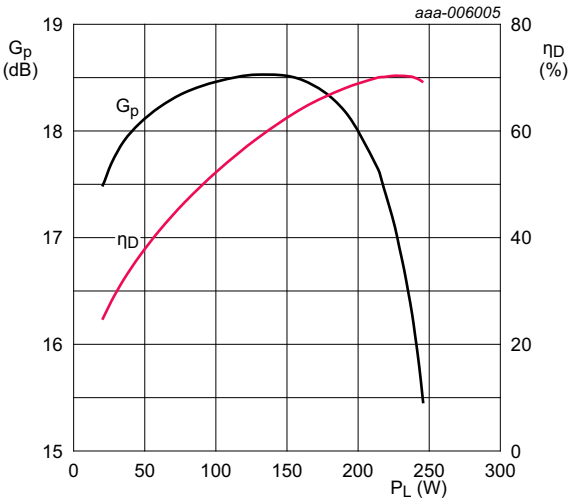
[1] American Technical Ceramics type 800A or capacitor of same quality.

[2] American Technical Ceramics type 100A or capacitor of same quality.

[3] American Technical Ceramics type 800B or capacitor of same quality.

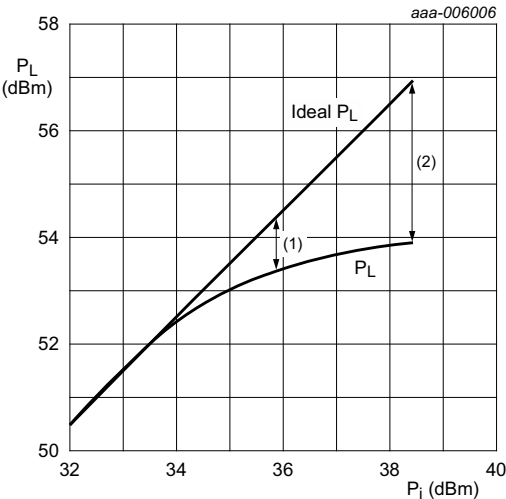
7.3 Graphical data

7.3.1 1-Tone CW



$V_{DS} = 32$  V;  $I_{DQ} = 100$  mA;  $f = 1300$  MHz.

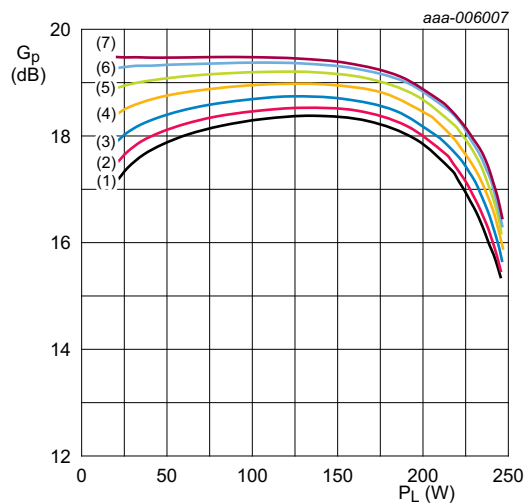
Fig 3. Power gain and drain efficiency as function of output power; typical values



$V_{DS} = 32$  V;  $I_{DQ} = 100$  mA;  $f = 1300$  MHz.

- (1)  $P_{L(1dB)} = 53.4$  dBm (217 W)
- (2)  $P_{L(3dB)} = 53.9$  dBm (245 W)

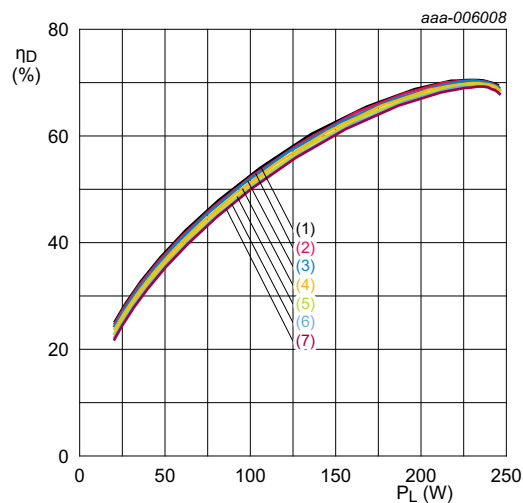
Fig 4. Output power as a function of input power; typical values



$V_{DS} = 32$  V;  $f = 1300$  MHz.

- (1)  $I_{Dq} = 50$  mA
- (2)  $I_{Dq} = 100$  mA
- (3)  $I_{Dq} = 200$  mA
- (4)  $I_{Dq} = 300$  mA
- (5)  $I_{Dq} = 700$  mA
- (6)  $I_{Dq} = 1000$  mA
- (7)  $I_{Dq} = 1200$  mA

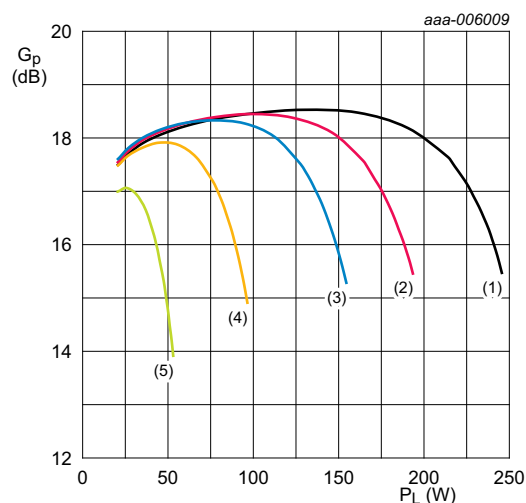
**Fig 5. Power gain as a function of output power; typical values**



$V_{DS} = 32$  V;  $f = 1300$  MHz.

- (1)  $I_{Dq} = 50$  mA
- (2)  $I_{Dq} = 100$  mA
- (3)  $I_{Dq} = 200$  mA
- (4)  $I_{Dq} = 300$  mA
- (5)  $I_{Dq} = 700$  mA
- (6)  $I_{Dq} = 1000$  mA
- (7)  $I_{Dq} = 1200$  mA

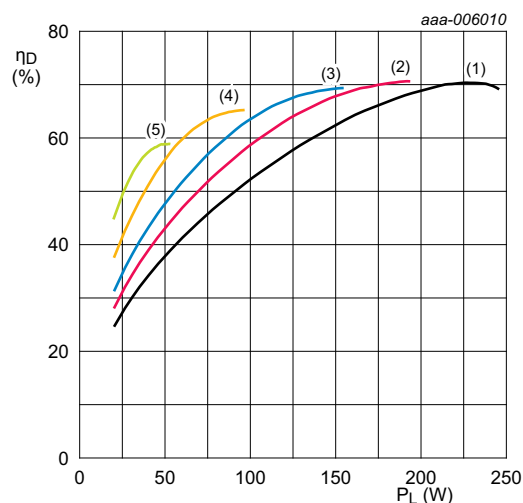
**Fig 6. Drain efficiency as a function of output power; typical values**



$I_{DQ} = 100$  mA;  $f = 1300$  MHz.

- (1)  $V_{DS} = 32$  V
- (2)  $V_{DS} = 28$  V
- (3)  $V_{DS} = 25$  V
- (4)  $V_{DS} = 20$  V
- (5)  $V_{DS} = 15$  V

**Fig 7. Power gain as a function of output power; typical values**

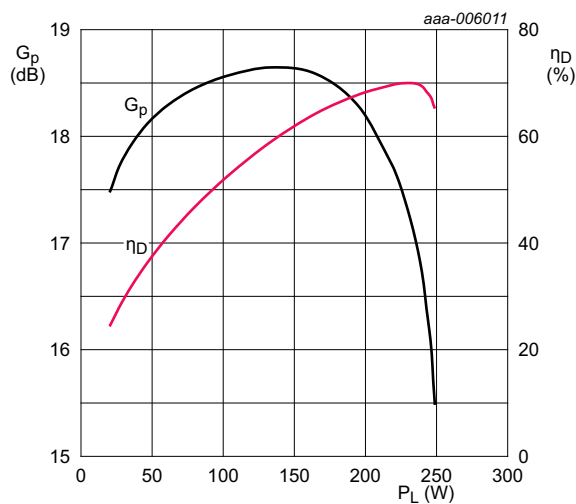


$I_{DQ} = 100$  mA;  $f = 1300$  MHz.

- (1)  $V_{DS} = 32$  V
- (2)  $V_{DS} = 28$  V
- (3)  $V_{DS} = 25$  V
- (4)  $V_{DS} = 20$  V
- (5)  $V_{DS} = 15$  V

**Fig 8. Drain efficiency as a function of output power; typical values**

### 7.3.2 1-Tone pulsed

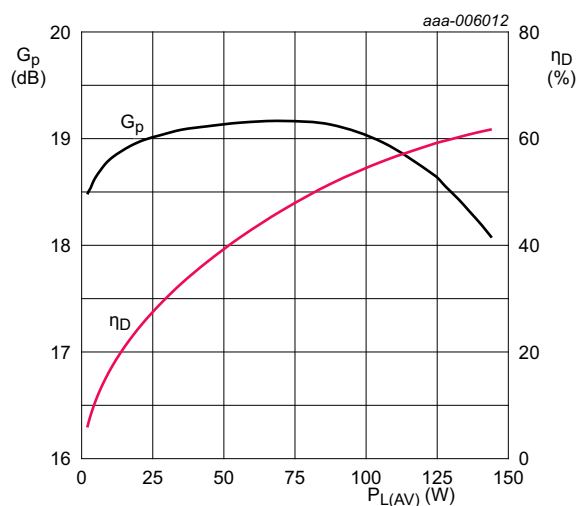


$V_{DS} = 32$  V;  $I_{DQ} = 100$  mA;  $f = 1300$  MHz;  $t_p = 100$  μs;  $\delta = 20$  %.

**Fig 9. Power gain and drain efficiency as function of output power; typical values**

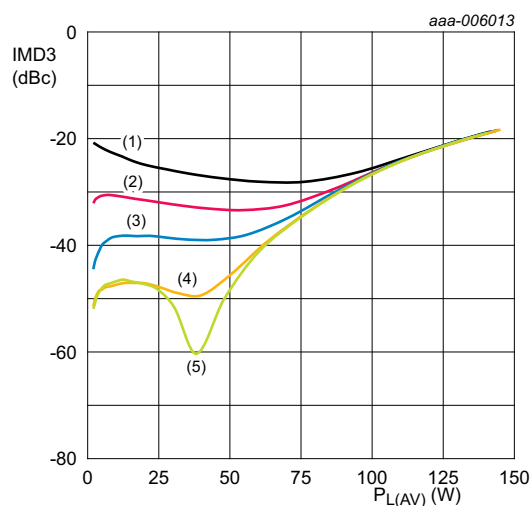


### 7.3.3 2-Tone CW



$V_{DS} = 50$  V;  $I_{DQ} = 700$  mA;  $f_1 = 1299.95$  MHz;  
 $f_2 = 1300.05$  MHz.

**Fig 10. Power gain and drain efficiency as function of average output power; typical values**



$V_{DS} = 32$  V;  $f_1 = 1299.95$  MHz;  $f_2 = 1300.05$  MHz.

- (1)  $I_{DQ} = 100$  mA
- (2)  $I_{DQ} = 400$  mA
- (3)  $I_{DQ} = 700$  mA
- (4)  $I_{DQ} = 1000$  mA
- (5)  $I_{DQ} = 1200$  mA

**Fig 11. Third order intermodulation distortion as a function of average output power; typical values**

# 8. Package outline

Earless flanged ceramic package; 4 leads

SOT1121B

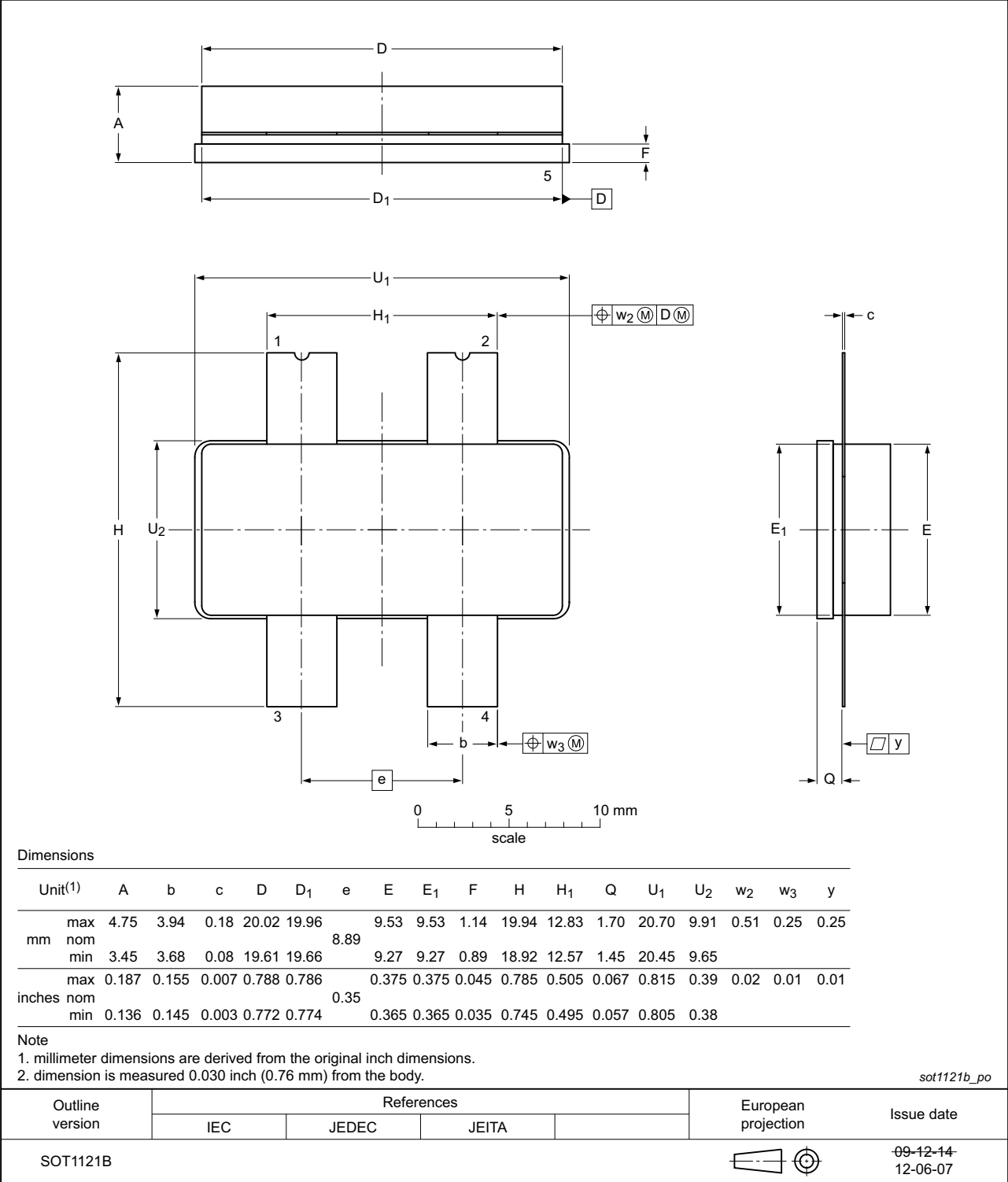


Fig 12. Package outline SOT1121B

## 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.

## 10. Abbreviations

**Table 10. Abbreviations**

Acronym	Description
CW	Continuous Wave
ESD	ElectroStatic Discharge
HF	High Frequency
LDMOS	Laterally Diffused Metal Oxide Semiconductor
SMD	Surface Mounted Device
VSWR	Voltage Standing-Wave Ratio

## 11. Revision history

**Table 11. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF647PS v.2	20131118	Product data sheet	-	BLF647P_BLF647PS v.1
Modifications:				
<ul style="list-style-type: none"> <li>This document now only describes the BLF647PS product.</li> <li><a href="#">Table 1 on page 1</a>: table has been updated</li> <li><a href="#">Section 1.2 on page 1</a>: some items have been removed</li> <li><a href="#">Table 4 on page 2</a>: table has been updated</li> <li><a href="#">Table 5 on page 2</a>: typical value has been changed to 0.34</li> <li><a href="#">Table 6 on page 3</a>: table has been updated</li> <li><a href="#">Table 8 on page 3</a>: table has been updated</li> <li><a href="#">Section 7 on page 3</a>: section has been added</li> <li><a href="#">Section 7.1 on page 3</a>: section has been moved to <a href="#">Section 7</a></li> <li><a href="#">Section 9 on page 11</a>: section has been added</li> </ul>				
BLF647P_BLF647PS v.1	20120803	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.
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[1] Please consult the most recently issued document before initiating or completing a design.

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- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
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- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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