

# BLF184XR; BLF184XRS

Power LDMOS transistor

Rev. 4 — 1 September 2015

AMPLEON

Product data sheet

## 1. Product profile

### 1.1 General description

A 700 W extremely rugged LDMOS power transistor for broadcast and industrial applications in the HF to 600 MHz band.

Table 1. Application information

Test signal	f	V <sub>DS</sub>	P <sub>L</sub>	G <sub>p</sub>	η <sub>D</sub>
	(MHz)	(V)	(W)	(dB)	(%)
pulsed RF	108	50	700	23.9	73.5
CW	108	50	750	23.5	81.9

### 1.2 Features and benefits

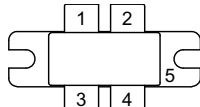
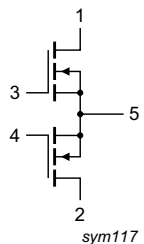
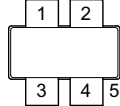
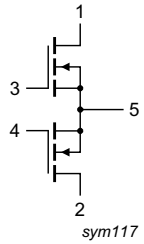
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (HF to 600 MHz)
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

### 1.3 Applications

- Industrial, scientific and medical applications
- Broadcast transmitter applications

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
BLF184XR (SOT1214A)			
1	drain1		 sym117
2	drain2		
3	gate1		
4	gate2		
5	source <a href="#">[1]</a>		
BLF184XRS (SOT1214B)			
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
BLF184XR	-	flanged ceramic package; 2 mounting holes; 4 leads	SOT1214A
BLF184XRS	-	earless flanged ceramic package; 4 leads	SOT1214B

## 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		-	135	V
$V_{GS}$	gate-source voltage		-6	+11	V
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature <sup>[1]</sup>		-	225	°C

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

## 5. Thermal characteristics

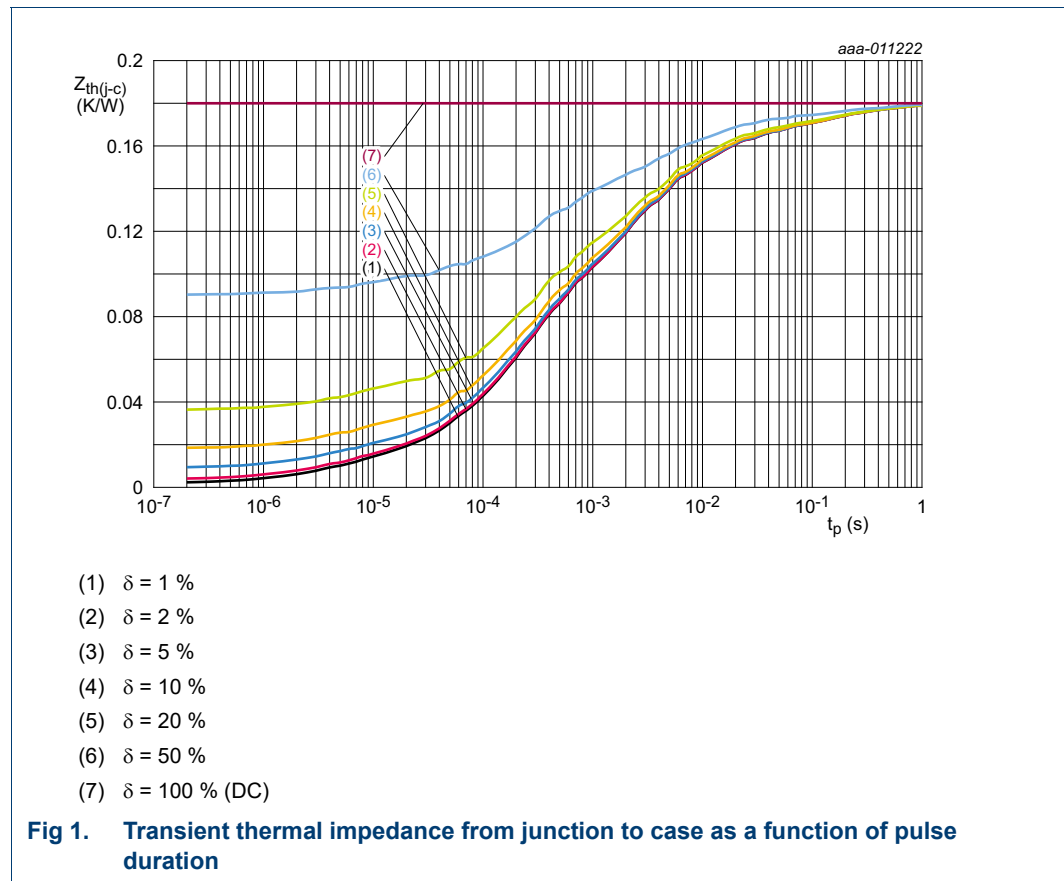
Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	$T_j = 150\text{ }^{\circ}\text{C}$ [1][2]	0.18	K/W
$Z_{th(j-c)}$	transient thermal impedance from junction to case	$T_j = 150\text{ }^{\circ}\text{C}$ ; $t_p = 100\text{ }\mu\text{s}$ ; $\delta = 20\text{ }\%$ [3]	0.065	K/W

[1]  $T_j$  is the junction temperature.

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

[3] See Figure 3.



## 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	$V_{GS} = 0\text{ V}$ ; $I_D = 2.75\text{ mA}$	135	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}$ ; $I_D = 275\text{ mA}$	1.25	1.9	2.25	V
$V_{GSq}$	gate-source quiescent voltage	$V_{DS} = 50\text{ V}$ ; $I_D = 50\text{ mA}$	-	1.6	-	V

**Table 6. DC characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{DSS}$	drain leakage current	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$	-	-	1.4	$\mu\text{A}$
$I_{DSX}$	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ; $V_{DS} = 10\text{ V}$	-	38.5	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 11\text{ V}$ ; $V_{DS} = 0\text{ V}$	-	-	140	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ; $I_D = 9.625\text{ A}$	-	0.16	-	$\Omega$

**Table 7. AC characteristics**

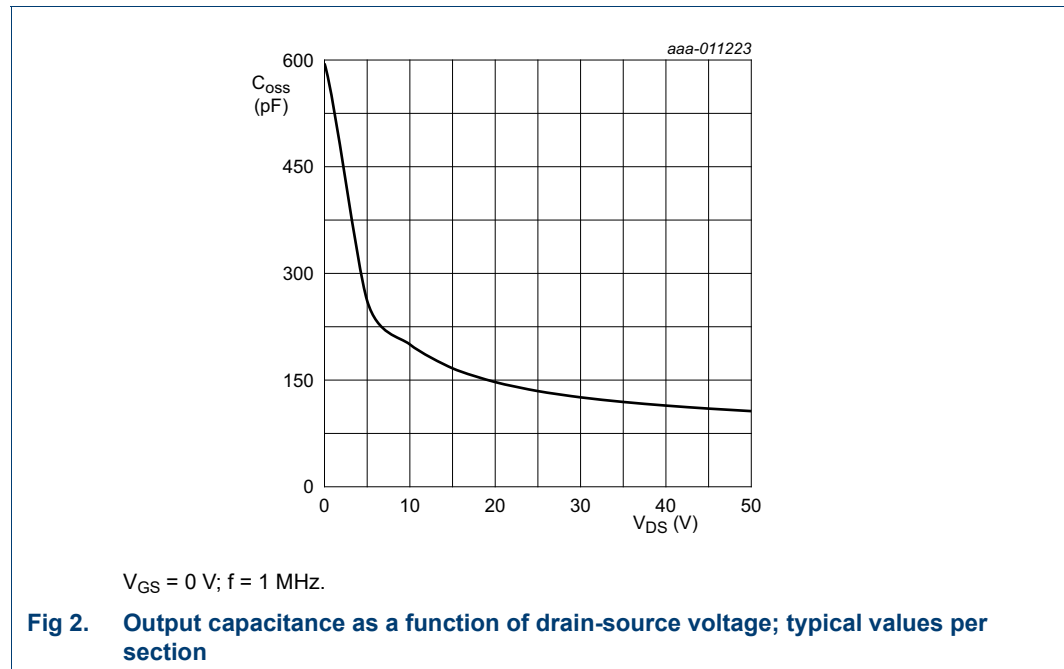
$T_j = 25\text{ }^{\circ}\text{C}$ ; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_{rs}$	feedback capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$	-	3.1	-	pF
$C_{iss}$	input capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$	-	292	-	pF
$C_{oss}$	output capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$	-	107	-	pF

**Table 8. RF characteristics**

Test signal: pulsed RF;  $t_p = 100\text{ }\mu\text{s}$ ;  $\delta = 20\%$ ;  $f = 108\text{ MHz}$ ; RF performance at  $V_{DS} = 50\text{ V}$ ;  $I_{DQ} = 100\text{ mA}$ ;  $T_{case} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified; in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$G_p$	power gain	$P_L = 700\text{ W}$	22.8	23.9	-	dB
$RL_{in}$	input return loss	$P_L = 700\text{ W}$	-	-20	-13	dB
$\eta_D$	drain efficiency	$P_L = 700\text{ W}$	71	73.5	-	%



7. Test information

7.1 Ruggedness in class-AB operation

The BLF184XR and BLF184XRS are capable of withstanding a load mismatch corresponding to VSWR > 65 : 1 through all phases under the following conditions:  
V<sub>DS</sub> = 50 V; I<sub>Dq</sub> = 100 mA; P<sub>L</sub> = 700 W pulsed; f = 108 MHz.

7.2 Impedance information

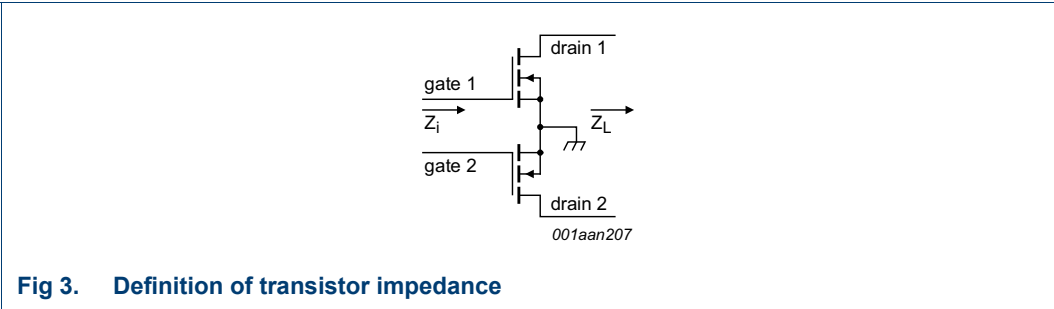


Table 9. Typical push-pull impedance  
Simulated Zi and ZL device impedance; impedance info at V<sub>DS</sub> = 50 V and P<sub>L</sub> = 700 W.

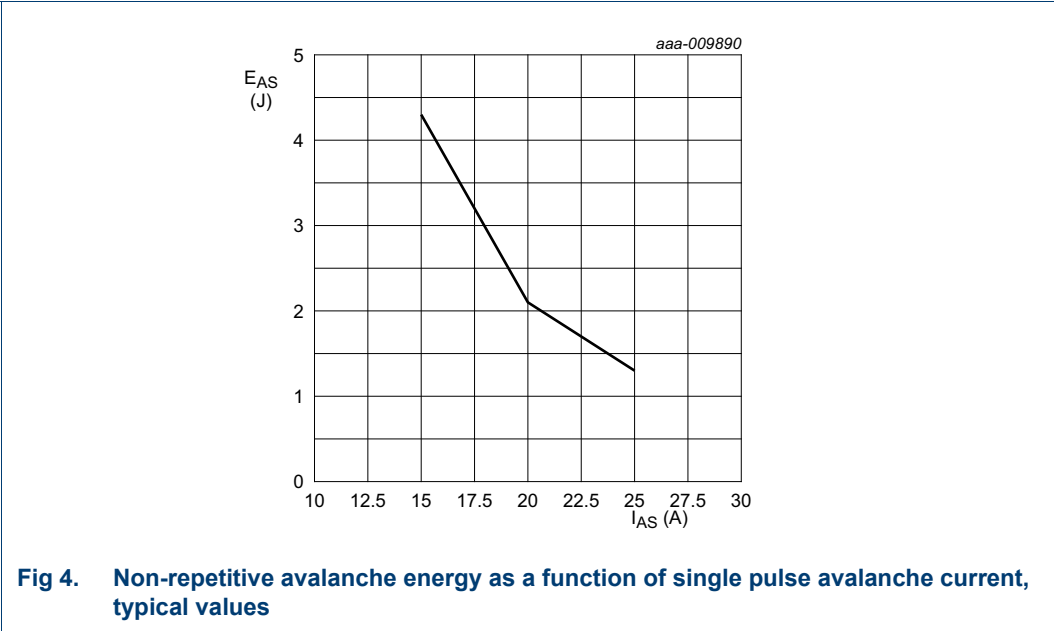
f	Z <sub>i</sub>	Z <sub>L</sub>
(MHz)	(Ω)	(Ω)
108	5.8 – j19.1	5.5 + j1.0

7.3 UIS avalanche energy

Table 10. Typical avalanche data per section  
T<sub>amb</sub> = 25 °C; typical test data; test jig without water cooling.

I <sub>AS</sub>	E <sub>AS</sub>
(A)	(J)
15	4.3
20	2.1
25	1.3

For information see application note AN10273.



7.4 Test circuit

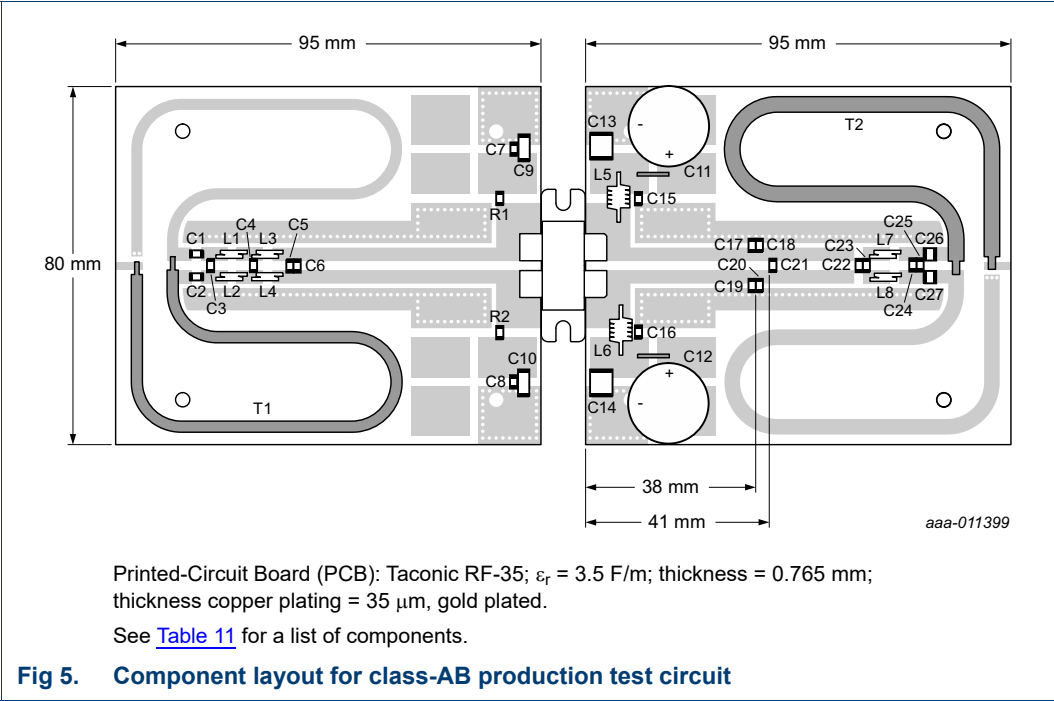


Table 11. List of components  
For test circuit see [Figure 5](#).

Component	Description	Value	Remarks
C1, C2	multilayer ceramic chip capacitor	910 pF <a href="#">[1]</a>	
C3	multilayer ceramic chip capacitor	47 pF <a href="#">[1]</a>	
C4	multilayer ceramic chip capacitor	51 pF <a href="#">[1]</a>	

**Table 11. List of components ...continued**

For test circuit see [Figure 5](#).

Component	Description	Value	Remarks
C5	multilayer ceramic chip capacitor	100 pF <a href="#">[1]</a>	
C6, C23	multilayer ceramic chip capacitor	20 pF	
C7, C8, C15, C16	multilayer ceramic chip capacitor	820 pF <a href="#">[1]</a>	
C9, C10, C13, C14	multilayer ceramic chip capacitor	4.7 $\mu$ F, 100 V	TDK C5750X7R2A475KT
C11, C12	electrolytic capacitor	1000 $\mu$ F, 63 V	
C17, C19	multilayer ceramic chip capacitor	39 pF <a href="#">[1]</a>	
C18, C20	multilayer ceramic chip capacitor	27 pF <a href="#">[1]</a>	
C21	multilayer ceramic chip capacitor	7.5 pF <a href="#">[1]</a>	
C22	multilayer ceramic chip capacitor	22 pF <a href="#">[1]</a>	
C24, C25	multilayer ceramic chip capacitor	27 pF <a href="#">[1]</a>	
C26, C27	multilayer ceramic chip capacitor	1 nF <a href="#">[2]</a>	
L1, L2, L3, L4	1.5 turn 0.8 mm copper wire	D = 2.8 mm	
L5, L6	5.5 turn 0.8 mm copper wire	D = 3.6 mm	
L7, L8	1 turn 1.5 mm copper wire	D = 4 mm	
R1, R2	resistor	10 $\Omega$	SMD 1206
T1	semi rigid coax	25 $\Omega$ , length = 160 mm	Micro-Coax UT-090C-25
T2	semi rigid coax	25 $\Omega$ , length = 160 mm	Micro-Coax UT-141C-25

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

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

7.5 Graphical data

The following figures are measured in a class-AB production test circuit.

7.5.1 1-Tone CW pulsed

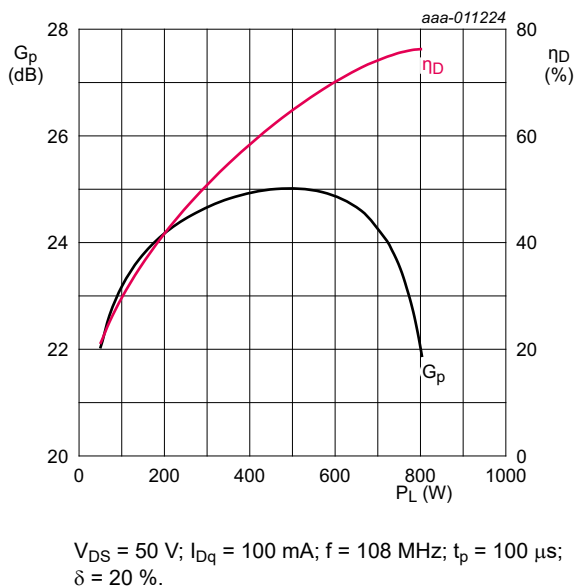


Fig 6. Power gain and drain efficiency as function of output power; typical values

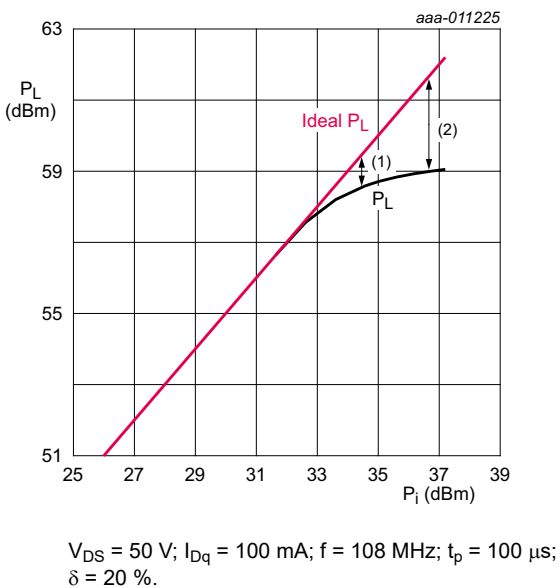
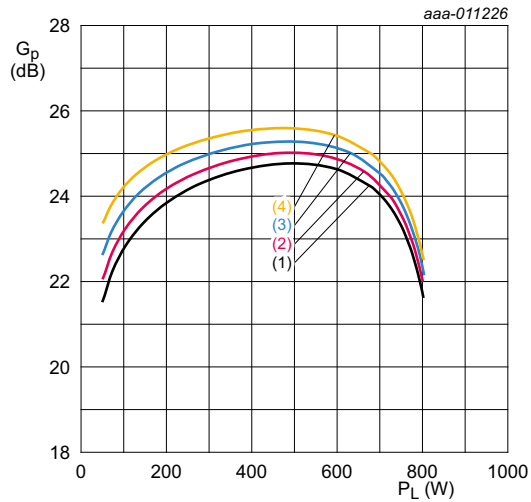


Fig 7. Output power as a function of input power; typical values

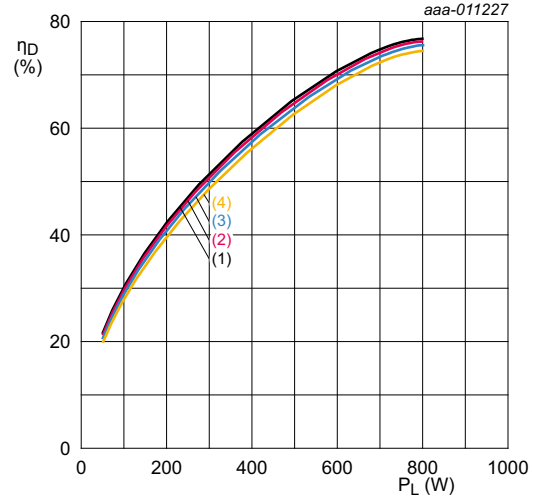




$V_{DS} = 50 \text{ V}$ ;  $f = 108 \text{ MHz}$ ;  $t_p = 100 \text{ } \mu\text{s}$ ;  $\delta = 20 \text{ } \%$ .

- (1)  $I_{Dq} = 50 \text{ mA}$
- (2)  $I_{Dq} = 100 \text{ mA}$
- (3)  $I_{Dq} = 200 \text{ mA}$
- (4)  $I_{Dq} = 400 \text{ mA}$

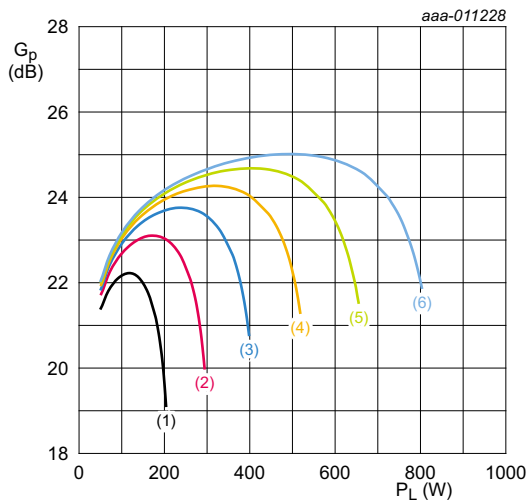
**Fig 8. Power gain as a function of output power; typical values**



$V_{DS} = 50 \text{ V}$ ;  $f = 108 \text{ MHz}$ ;  $t_p = 100 \text{ } \mu\text{s}$ ;  $\delta = 20 \text{ } \%$ .

- (1)  $I_{Dq} = 50 \text{ mA}$
- (2)  $I_{Dq} = 100 \text{ mA}$
- (3)  $I_{Dq} = 200 \text{ mA}$
- (4)  $I_{Dq} = 100 \text{ mA}$

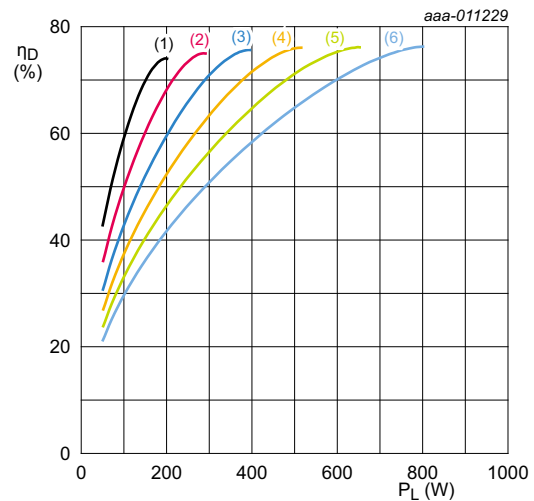
**Fig 9. Drain efficiency as a function of output power; typical values**



$I_{Dq} = 100 \text{ mA}$ ;  $f = 108 \text{ MHz}$ ;  $t_p = 100 \text{ } \mu\text{s}$ ;  $\delta = 20 \text{ } \%$ .

- (1)  $V_{DS} = 25 \text{ V}$
- (2)  $V_{DS} = 30 \text{ V}$
- (3)  $V_{DS} = 35 \text{ V}$
- (4)  $V_{DS} = 40 \text{ V}$
- (5)  $V_{DS} = 45 \text{ V}$
- (6)  $V_{DS} = 50 \text{ V}$

**Fig 10. Power gain as a function of output power; typical values**



$I_{Dq} = 100 \text{ mA}$ ;  $f = 108 \text{ MHz}$ ;  $t_p = 100 \text{ } \mu\text{s}$ ;  $\delta = 20 \text{ } \%$ .

- (1)  $V_{DS} = 25 \text{ V}$
- (2)  $V_{DS} = 30 \text{ V}$
- (3)  $V_{DS} = 35 \text{ V}$
- (4)  $V_{DS} = 40 \text{ V}$
- (5)  $V_{DS} = 45 \text{ V}$
- (6)  $V_{DS} = 50 \text{ V}$

**Fig 11. Drain efficiency as a function of output power; typical values**

8. Package outline

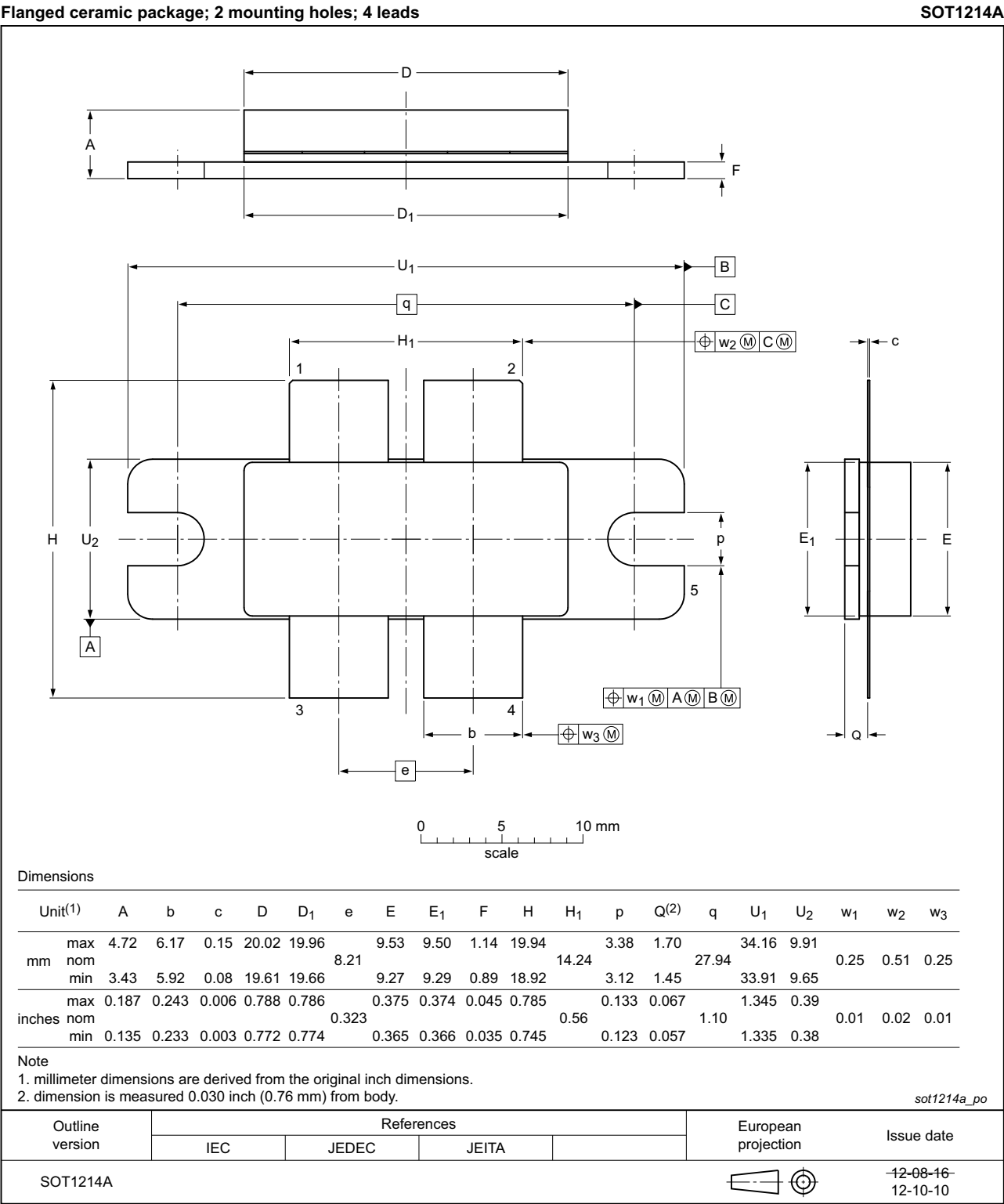


Fig 12. Package outline SOT1214A

Earless flanged ceramic package; 4 leads

SOT1214B

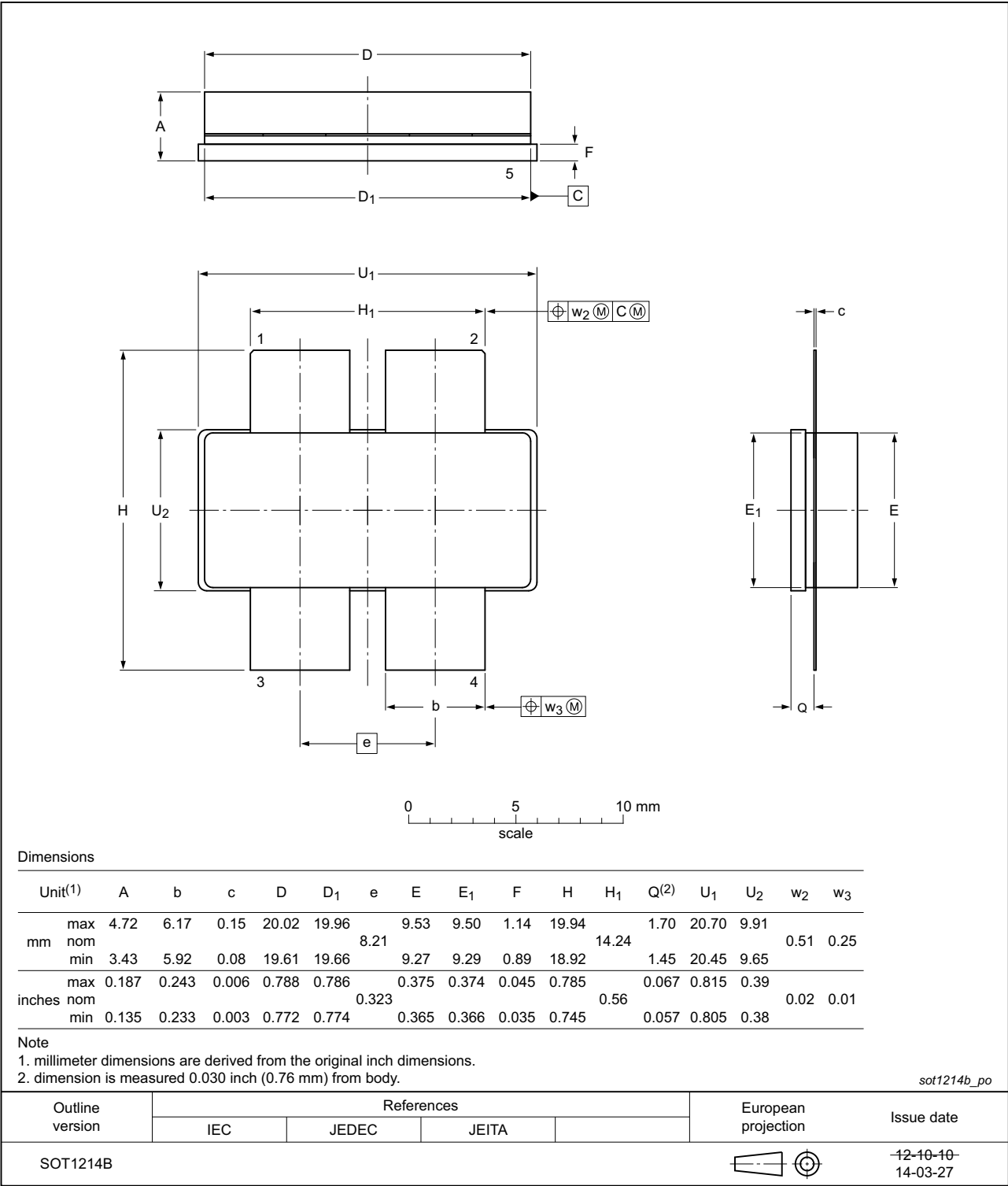


Fig 13. Package outline SOT1214B

## 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 12. Abbreviations

Acronym	Description
CW	Continuous Wave
ESD	ElectroStatic Discharge
HF	High Frequency
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
MTF	Median Time to Failure
SMD	Surface Mounted Device
UIS	Unclamped Inductive Switching
VSWR	Voltage Standing-Wave Ratio

## 11. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF184XR_BLF184XRS v.4	20150901	Product data sheet	-	BLF184XR_BLF184XRS v.3
Modifications:	<ul style="list-style-type: none"> <li>The format of this document has been redesigned to comply with the new identity guidelines of Ampleon.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>			
BLF184XR_BLF184XRS v.3	20140401	Product data sheet	-	BLF184XR_BLF184XRS v.2
BLF184XR_BLF184XRS v.2	20140227	Preliminary data sheet	-	BLF184XR_BLF184XRS v.1
BLF184XR_BLF184XRS v.1	20130506	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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Date of release: 1 September 2015

Document identifier: BLF184XR\_BLF184XRS#4