

## 1. Product profile

### 1.1 General description

A 1400 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)	(%)
CW	108	50	1200	26.5	83
pulsed RF	108	50	1400	28	72
pulsed RF	81.4	50	1200	25.8	85

### 1.2 Features and benefits

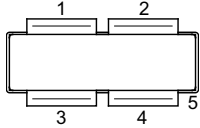
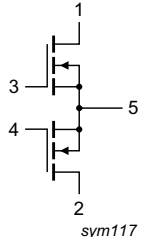
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (HF to 600 MHz)
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

### 1.3 Applications

- Industrial, scientific and medical applications
- Broadcast transmitter applications

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	drain1		
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
BLF188XRG	-	earless flanged LDMOST ceramic package; 4 leads	SOT1248C

## 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 <a href="#">[1]</a>		-	225	°C

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

## 5. Thermal characteristics

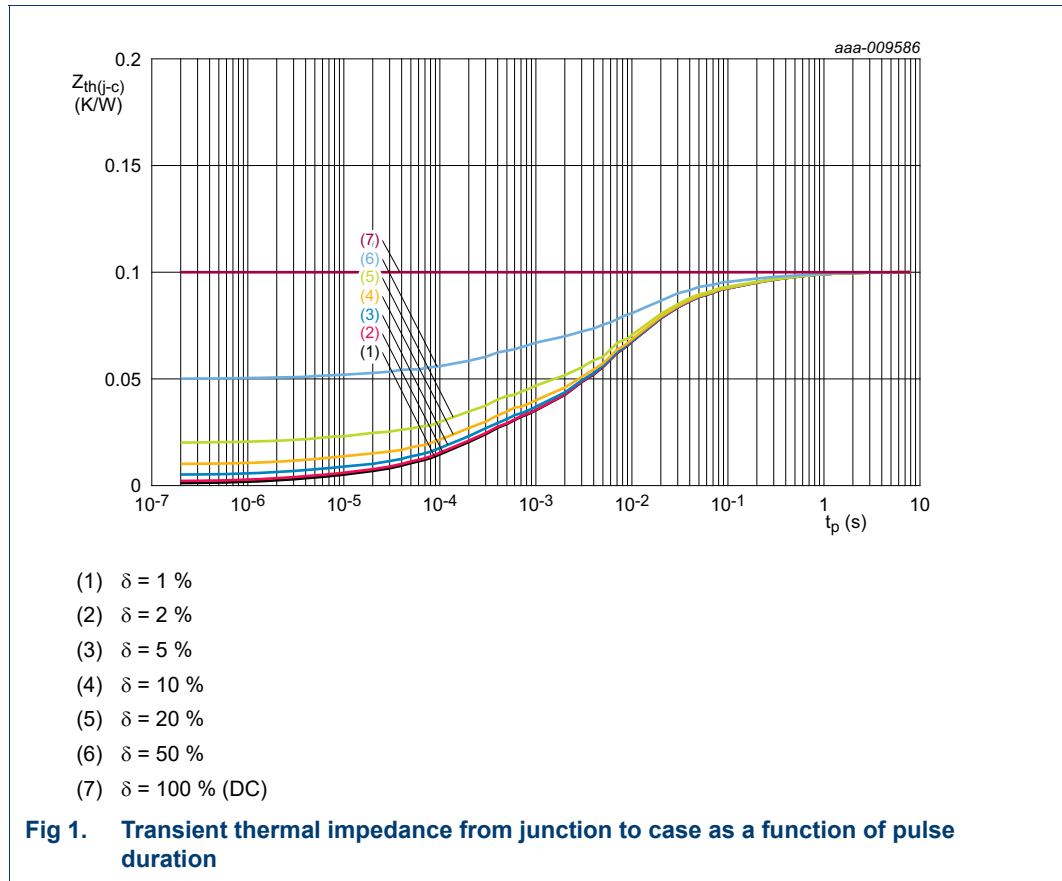
Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	$T_j = 150\text{ °C}$ <a href="#">[1][2]</a>	0.10	K/W
$Z_{th(j-c)}$	transient thermal impedance from junction to case	$T_j = 150\text{ °C}$ ; $t_p = 100\text{ }\mu\text{s}$ ; $\delta = 20\text{ %}$ <a href="#">[3]</a>	0.03	K/W

[1]  $T_j$  is the junction temperature.

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

[3] See [Figure 1](#).



## 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	$V_{GS} = 0 \text{ V}$ ; $I_D = 5.5 \text{ mA}$	135	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10 \text{ V}$ ; $I_D = 550 \text{ mA}$	1.25	1.9	2.25	V
$V_{GSq}$	gate-source quiescent voltage	$V_{DS} = 50 \text{ V}$ ; $I_D = 20 \text{ mA}$	0.68	1.3	1.8	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	$V_{GS} = V_{GS(th)} + 3.75 \text{ V}$ ; $V_{DS} = 10 \text{ V}$	-	77	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 11 \text{ V}$ ; $V_{DS} = 0 \text{ V}$	-	-	280	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75 \text{ V}$ ; $I_D = 19.25 \text{ A}$	-	0.08	-	$\Omega$

**Table 7. AC characteristics**

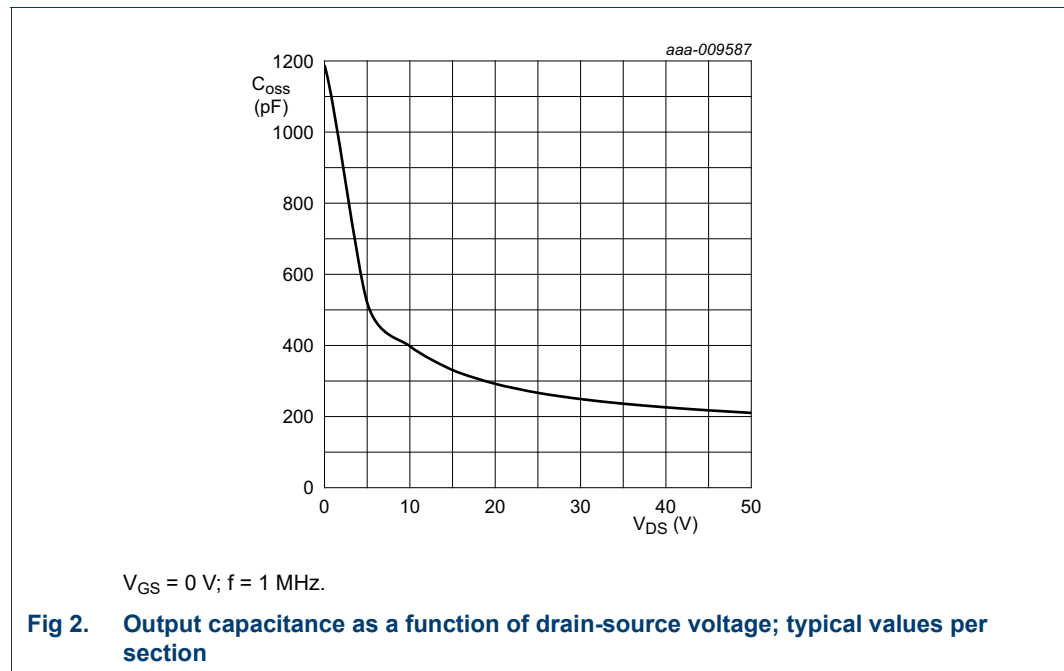
$T_j = 25\text{ }^{\circ}\text{C}$ ; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_{rs}$	feedback capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$	-	6.2	-	pF
$C_{iss}$	input capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$	-	582	-	pF
$C_{oss}$	output capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$	-	212	-	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  $V_{DS} = 50\text{ V}$ ;  $I_{Dq} = 40\text{ mA}$ ;  $T_{case} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified; in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$G_p$	power gain	$P_L = 1400\text{ W}$	23.2	24.4	-	dB
$RL_{in}$	input return loss	$P_L = 1400\text{ W}$	-	-21	-14	dB
$\eta_D$	drain efficiency	$P_L = 1400\text{ W}$	69	73	-	%



## 7. Test information

### 7.1 Ruggedness in class-AB operation

The BLF188XRG is capable of withstanding a load mismatch corresponding to  $VSWR > 65 : 1$  through all phases under the following conditions:  $V_{DS} = 50\text{ V}$ ;  $I_{Dq} = 40\text{ mA}$ ;  $P_L = 1400\text{ W}$  pulsed;  $f = 108\text{ MHz}$ .

7.2 Impedance information

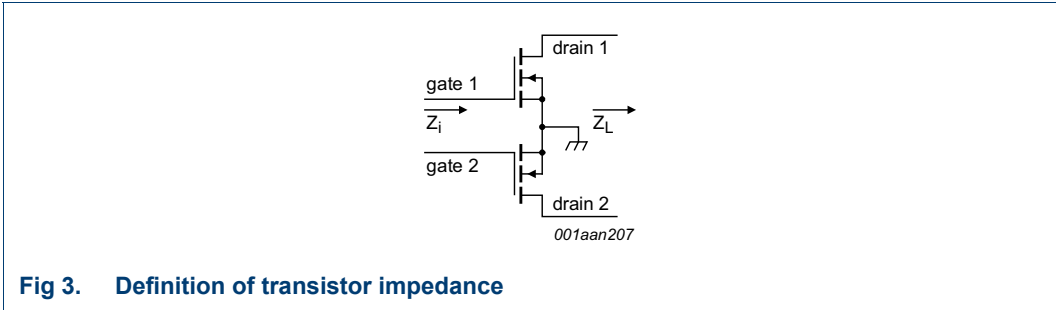


Fig 3. Definition of transistor impedance

Table 9. Typical push-pull impedance  
Simulated  $Z_i$  and  $Z_L$  device impedance; impedance info at  $V_{DS} = 50\text{ V}$  and  $P_L = 1400\text{ W}$ .

f	$Z_i$	$Z_L$
(MHz)	( $\Omega$ )	( $\Omega$ )
108	$2.94 - j9.64$	$2.74 + j0.57$

7.3 UIS avalanche energy

Table 10. Typical avalanche data per section  
 $T_{amb} = 25\text{ }^\circ\text{C}$ ; typical test data; test jig without water cooling.

$I_{AS}$	$E_{AS}$
(A)	(J)
35	4.5
40	3.4
45	2.4
50	2.0

For information see application note AN10273.

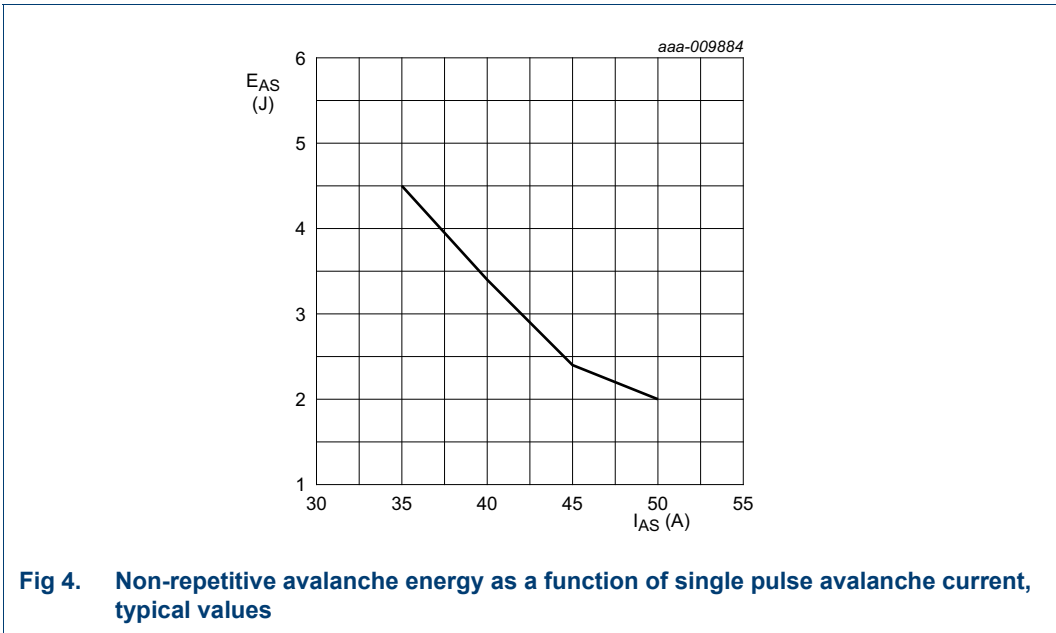
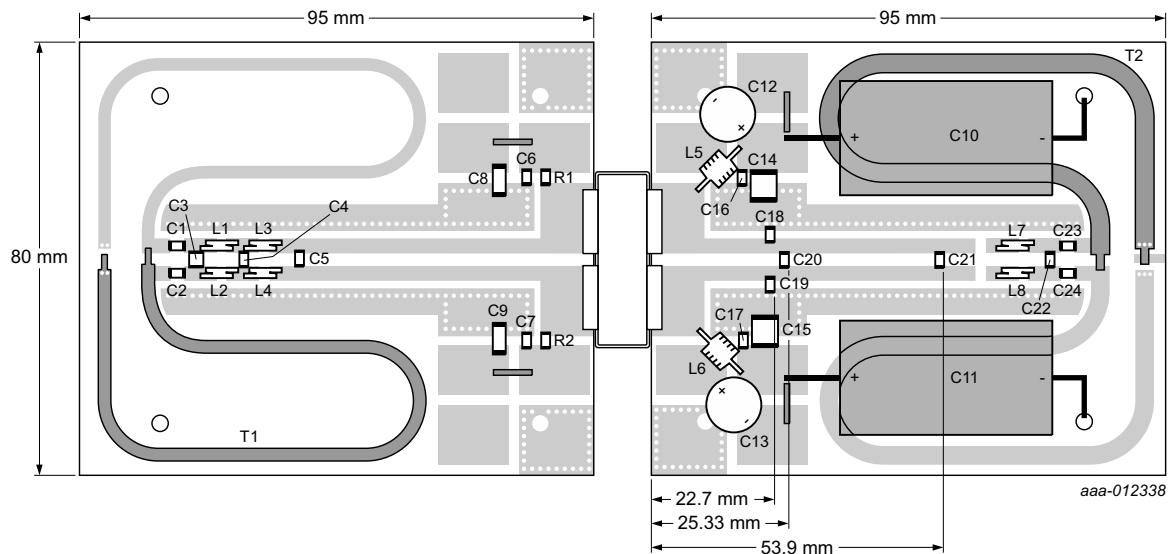


Fig 4. Non-repetitive avalanche energy as a function of single pulse avalanche current, typical values

## 7.4 Test circuit



Printed-Circuit Board (PCB): RF 35;  $\epsilon_r = 3.5$ ; thickness = 0.765 mm; thickness copper plating = 35  $\mu\text{m}$ , gold plated.

See [Table 11](#) for a list of components.

**Fig 5. Component layout for class-AB production test circuit**

**Table 11. List of components**

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

Component	Description	Value	Remarks
C1, C2, C6, C7, C16, C17, C23, C24	multilayer ceramic chip capacitor	1000 pF	<a href="#">[1]</a>
C3	multilayer ceramic chip capacitor	47 pF	<a href="#">[2]</a>
C4	multilayer ceramic chip capacitor	39 pF	<a href="#">[1]</a>
C5	multilayer ceramic chip capacitor	200 pF	<a href="#">[1]</a>
C8, C9, C14, C15	multilayer ceramic chip capacitor	4.7 $\mu\text{F}$ , 100 V	TDK C5750X7R2A475KT
C10, C11	electrolytic capacitor	2200 $\mu\text{F}$ , 63 V	
C12, C13	electrolytic capacitor	470 $\mu\text{F}$ , 63 V	
C18, C19	multilayer ceramic chip capacitor	120 pF	<a href="#">[1]</a>
C20	multilayer ceramic chip capacitor	82 pF	<a href="#">[1]</a>
C21	multilayer ceramic chip capacitor	120 pF	<a href="#">[1]</a>
C22	multilayer ceramic chip capacitor	56 pF	<a href="#">[1]</a>
L1, L2, L3, L4	1.5 turn 0.8 mm copper wire	D = 3.2 mm, length = 1.6 mm	
L5, L6	5.0 turn 0.8 mm copper wire	D = 3.0 mm, length = 4 mm	
L7, L8	2.5 turn 0.8 mm copper wire	D = 3.0 mm, length = 2.4 mm	

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

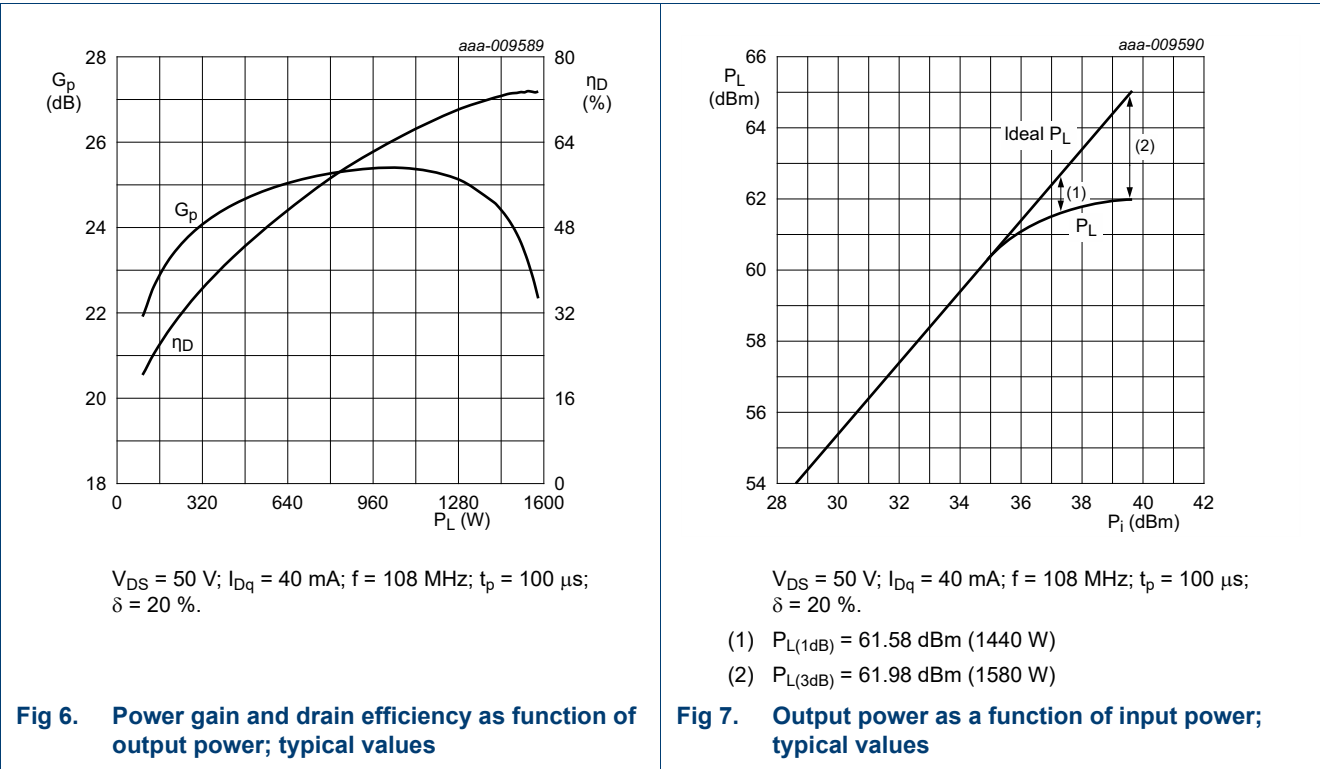
Component	Description	Value	Remarks
R1, R2	resistor	9.1 Ω	SMD 1206
T1	semi rigid coax	25 Ω, length = 160 mm	Micro-Coax UT-090C-25
T2	semi rigid coax	25 Ω, length = 160 mm	Micro-Coax UT-141C-25

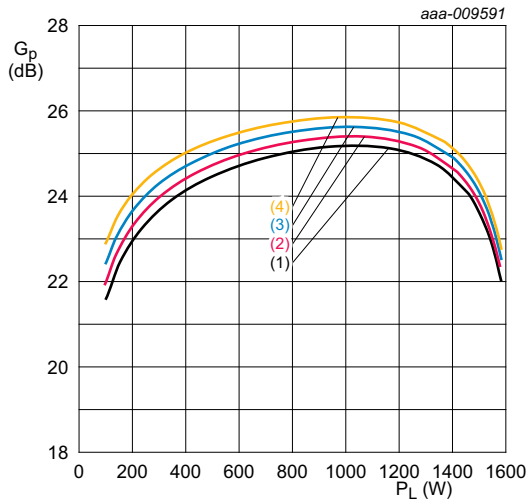
- [1] American Technical Ceramics type 800B or capacitor of same quality.  
[2] American Technical Ceramics type 100B or capacitor of same quality.

7.5 Graphical data

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

7.5.1 1-Tone CW pulsed

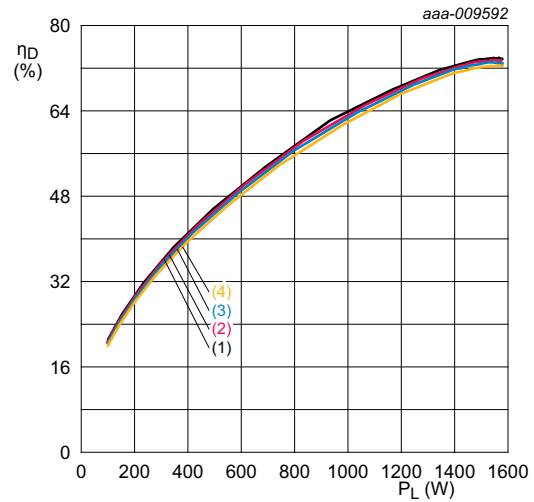




$V_{DS} = 50 \text{ V}$ ;  $f = 108 \text{ MHz}$ ;  $t_p = 100 \text{ } \mu\text{s}$ ;  $\delta = 20 \text{ } \%$ .

- (1)  $I_{Dq} = 20 \text{ mA}$
- (2)  $I_{Dq} = 40 \text{ mA}$
- (3)  $I_{Dq} = 80 \text{ mA}$
- (4)  $I_{Dq} = 160 \text{ mA}$

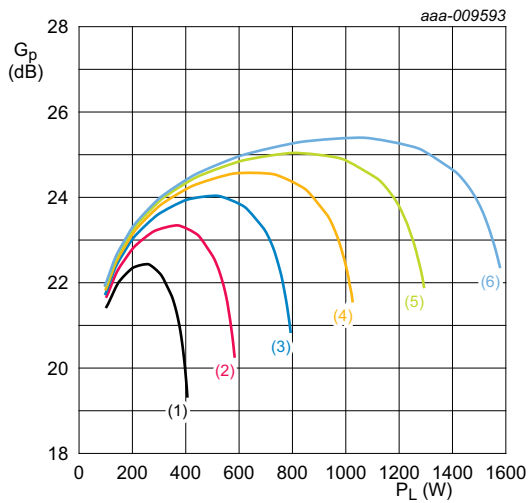
**Fig 8. Power gain as a function of output power; typical values**



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

- (1)  $I_{Dq} = 20 \text{ mA}$
- (2)  $I_{Dq} = 40 \text{ mA}$
- (3)  $I_{Dq} = 80 \text{ mA}$
- (4)  $I_{Dq} = 160 \text{ mA}$

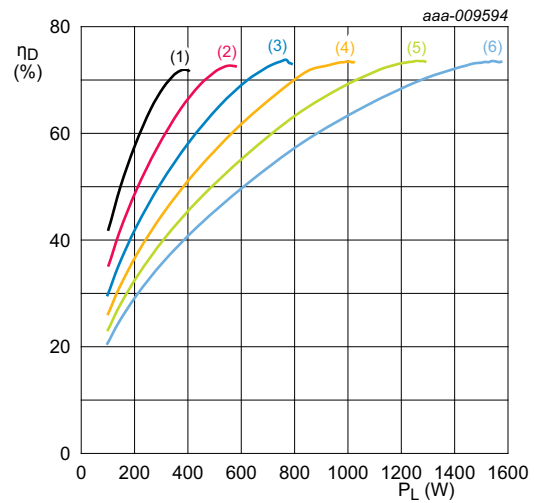
**Fig 9. Drain efficiency as a function of output power; typical values**



$I_{Dq} = 40 \text{ mA}$ ;  $f = 108 \text{ MHz}$ ;  $t_p = 100 \text{ } \mu\text{s}$ ;  $\delta = 20 \text{ } \%$ .

- (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**



$I_{Dq} = 40 \text{ mA}$ ;  $f = 108 \text{ MHz}$ ;  $t_p = 100 \text{ } \mu\text{s}$ ;  $\delta = 20 \text{ } \%$ .

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- (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

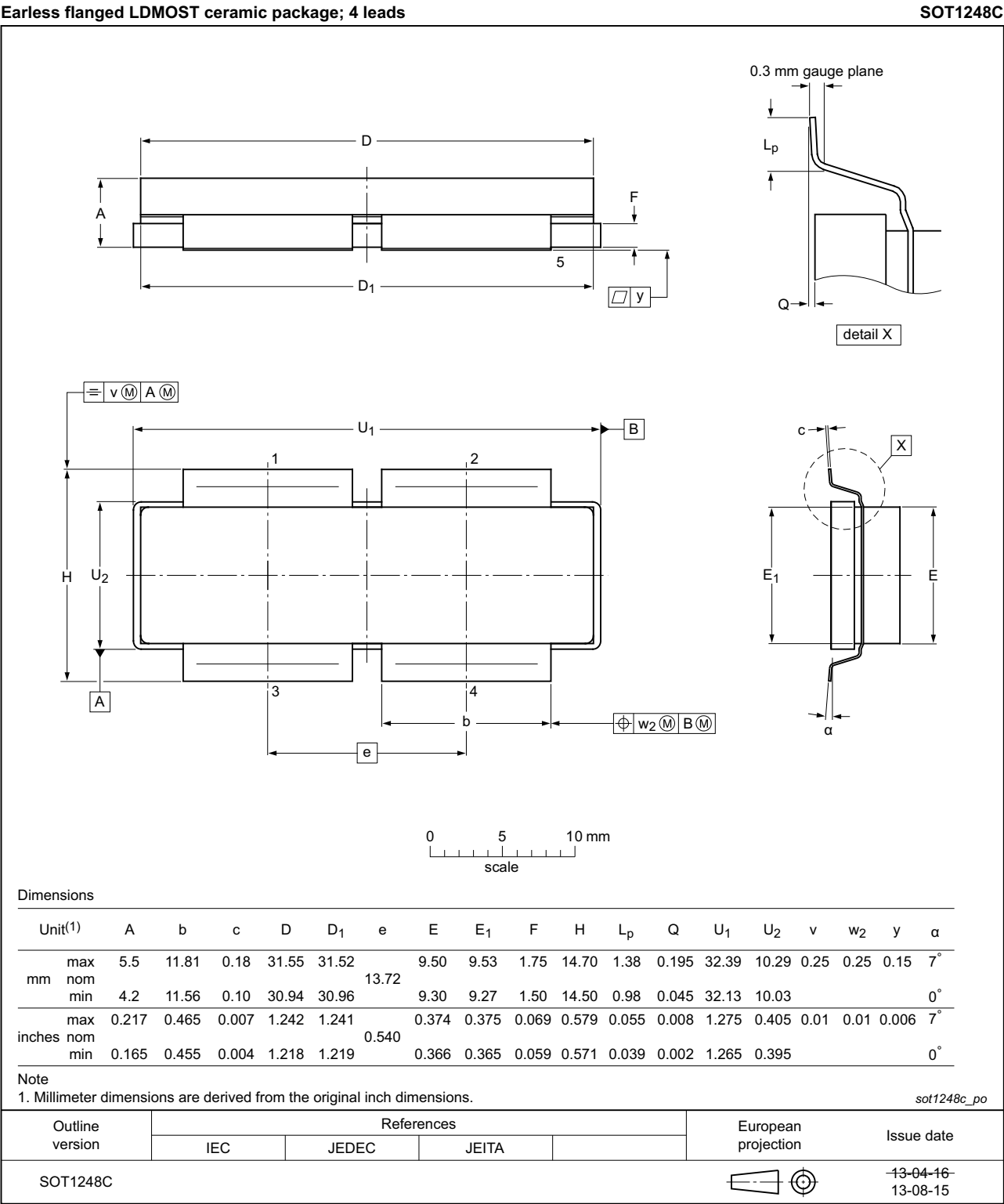


Fig 12. Package outline SOT1248C

## 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	Continuous Wave
CW	Continuous Wave
ESD	ElectroStatic Discharge
HF	High Frequency
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
LDMOST	Laterally Diffused Metal-Oxide Semiconductor Transistor
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
BLF188XRG#2	20150901	Product data sheet	-	BLF188XRG v.1
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>			
BLF188XRG v.1	20140630	Product data sheet	-	-

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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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