BLF188XRG

Power LDMOS transistor

Rev. 2 — 1 September 2015

AMPLEON

Product data sheet

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 (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
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

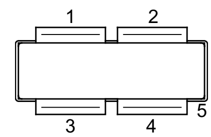
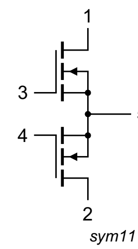
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (HF to 600 MHz)
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

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 [1]		

[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	[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

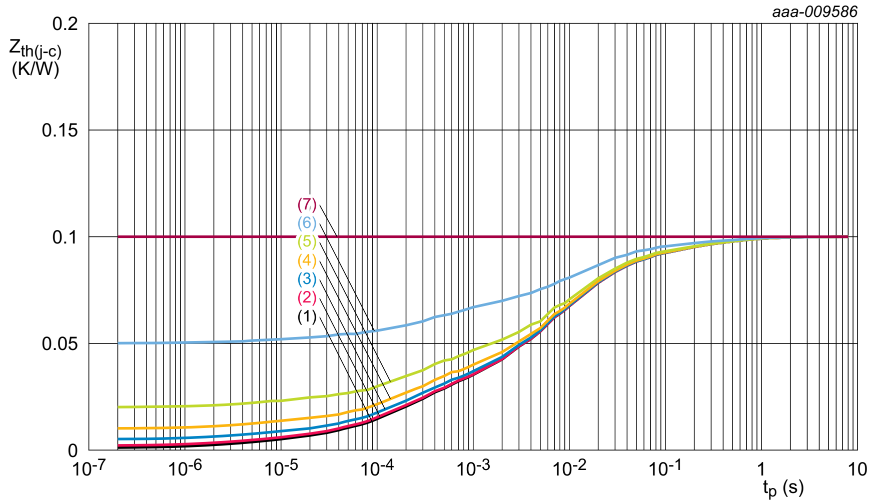
Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	T_j = 150 °C [1][2]	0.10	K/W
$Z_{th(j-c)}$	transient thermal impedance from junction to case	T_j = 150 °C; t_p = 100 μs; δ = 20 % [3]	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.



(1) δ = 1 %

(2) δ = 2 %

(3) δ = 5 %

(4) δ = 10 %

(5) δ = 20 %

(6) δ = 50 %

(7) δ = 100 % (DC)

Fig 1. Transient thermal impedance from junction to case as a function of pulse duration

6. Characteristics

Table 6. DC characteristics

T_j = 25 °C; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 5.5 mA	135	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 550 mA	1.25	1.9	2.25	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 50 V; I_D = 20 mA	0.68	1.3	1.8	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 50 V	-	-	2.8	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	77	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	280	nA
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 19.25 A	-	0.08	-	Ω

Table 7. AC characteristics

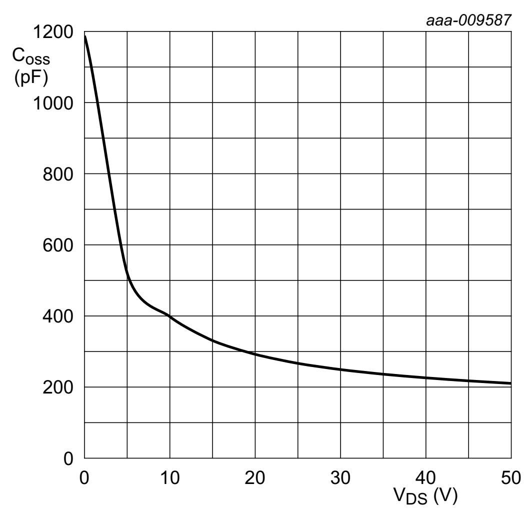
T_j = 25 °C; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{rs}	feedback capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	6.2	-	pF
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	582	-	pF
C_{oss}	output capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	212	-	pF

Table 8. RF characteristics

Test signal: pulsed RF; t_p = 100 μs; δ = 20 %; f = 108 MHz; RF performance at V_{DS} = 50 V; I_{Dq} = 40 mA; T_{case} = 25 °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 W	23.2	24.4	-	dB
RL_{in}	input return loss	P_L = 1400 W	-	−21	−14	dB
η_D	drain efficiency	P_L = 1400 W	69	73	-	%



V_{GS} = 0 V; f = 1 MHz.

Fig 2. Output capacitance as a function of drain-source voltage; typical values per section

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 V; I_{Dq} = 40 mA; P_L = 1400 W pulsed; f = 108 MHz.

7.2 Impedance information

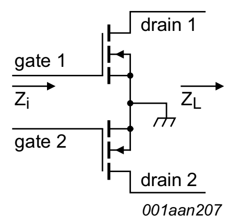


Fig 3. Definition of transistor impedance

Table 9. Typical push-pull impedance

Simulated Z_i and Z_L device impedance; impedance info at V_{DS} = 50 V and P_L = 1400 W.

f	**Z_i**	**Z_L**
(MHz)	**(Ω)**	**(Ω)**
108	2.94 – j9.64	2.74 + j0.57

7.3 UIS avalanche energy

Table 10. Typical avalanche data per section

T_{amb} = 25 °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*.

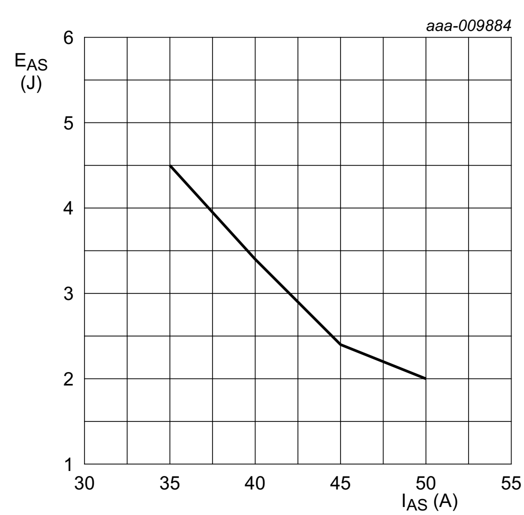
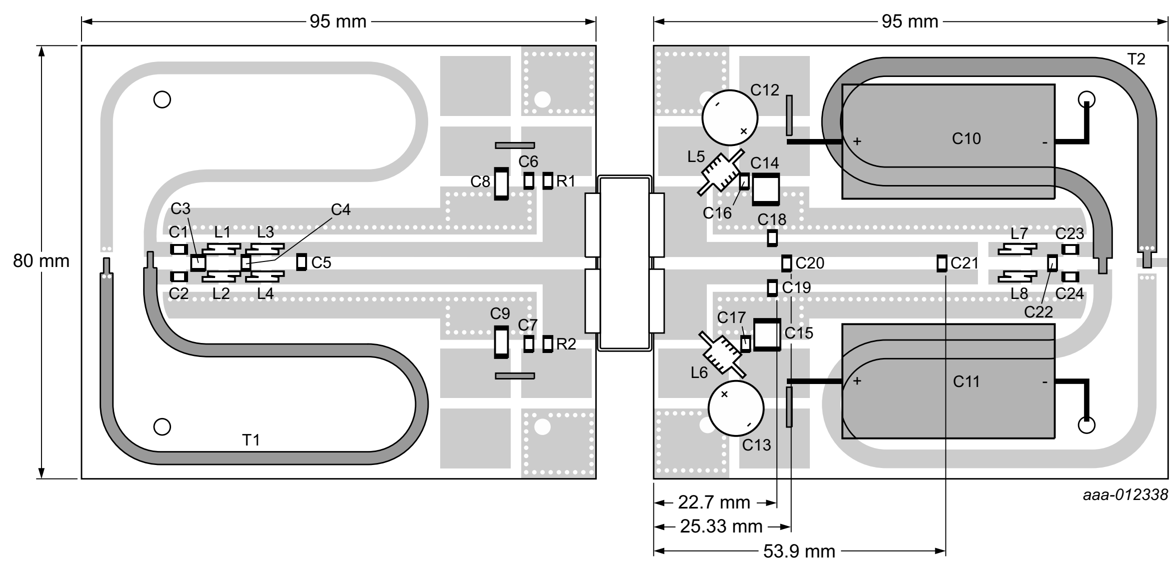


Fig 4. Non-repetitive avalanche energy as a function of single pulse avalanche current, typical values

7.4 Test circuit



Printed-Circuit Board (PCB): RF 35; ε_r = 3.5; thickness = 0.765 mm; thickness copper plating = 35 μm, 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 [1]	
C3	multilayer ceramic chip capacitor	47 pF [2]	
C4	multilayer ceramic chip capacitor	39 pF [1]	
C5	multilayer ceramic chip capacitor	200 pF [1]	
C8, C9, C14, C15	multilayer ceramic chip capacitor	4.7 μF, 100 V	TDK C5750X7R2A475KT
C10, C11	electrolytic capacitor	2200 μF, 63 V	
C12, C13	electrolytic capacitor	470 μF, 63 V	
C18, C19	multilayer ceramic chip capacitor	120 pF [1]	
C20	multilayer ceramic chip capacitor	82 pF [1]	
C21	multilayer ceramic chip capacitor	120 pF [1]	
C22	multilayer ceramic chip capacitor	56 pF [1]	
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

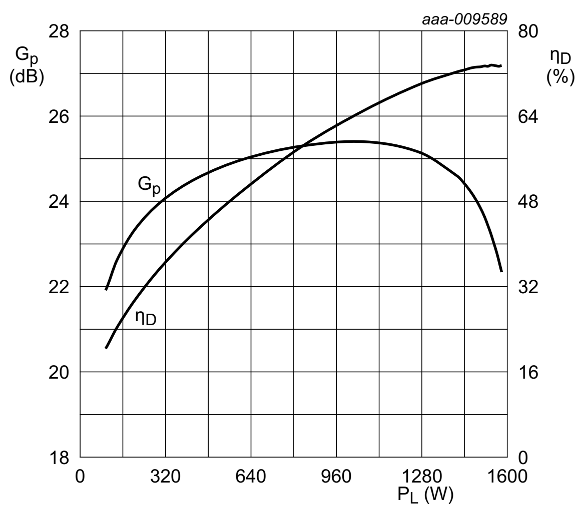
[1] American Technical Ceramics type 800B or capacitor of same quality.

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

7.5 Graphical data

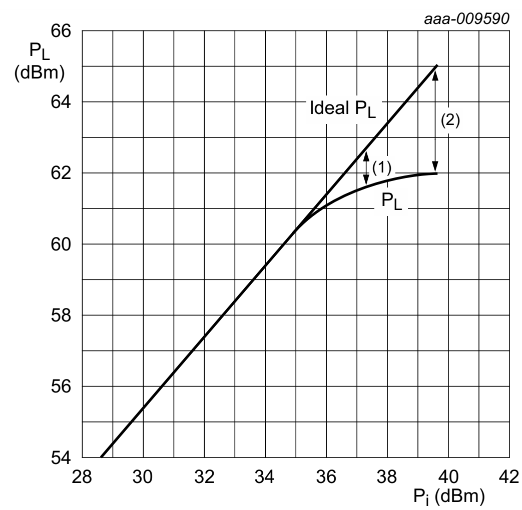
The following figures are measured in a class-AB production test circuit.

7.5.1 1-Tone CW pulsed



V_{DS} = 50 V; I_{Dq} = 40 mA; f = 108 MHz; t_p = 100 µs; δ = 20 %.

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

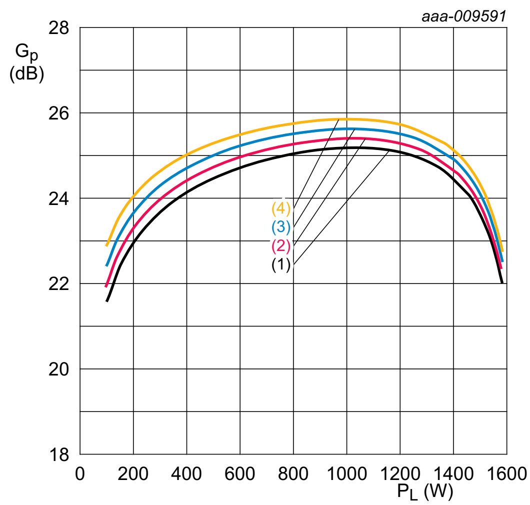


V_{DS} = 50 V; I_{Dq} = 40 mA; f = 108 MHz; t_p = 100 µs; δ = 20 %.

(1) $P_{L(1dB)}$ = 61.58 dBm (1440 W)

(2) $P_{L(3dB)}$ = 61.98 dBm (1580 W)

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



V_{DS} = 50 V; f = 108 MHz; t_p = 100 μs; δ = 20 %.

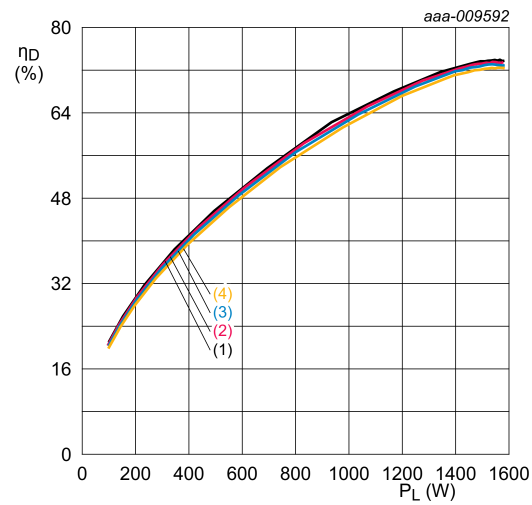
(1) I_{Dq} = 20 mA

(2) I_{Dq} = 40 mA

(3) I_{Dq} = 80 mA

(4) I_{Dq} = 160 mA

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



V_{DS} = 50 V; f = 108 MHz; t_p = 100 μs; δ = 20 %.

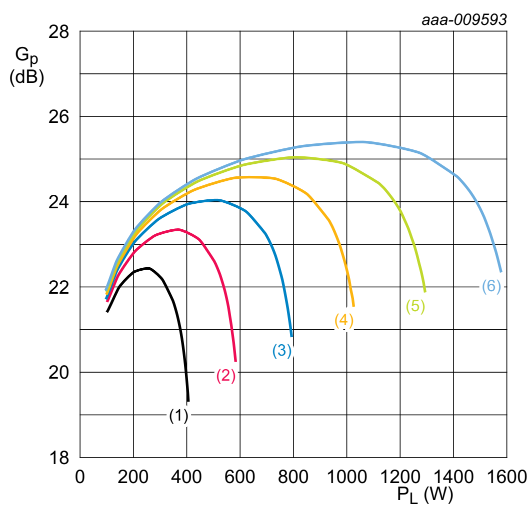
(1) I_{Dq} = 20 mA

(2) I_{Dq} = 40 mA

(3) I_{Dq} = 80 mA

(4) I_{Dq} = 160 mA

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



I_{Dq} = 40 mA; f = 108 MHz; t_p = 100 μs; δ = 20 %.

(1) V_{DS} = 25 V

(2) V_{DS} = 30 V

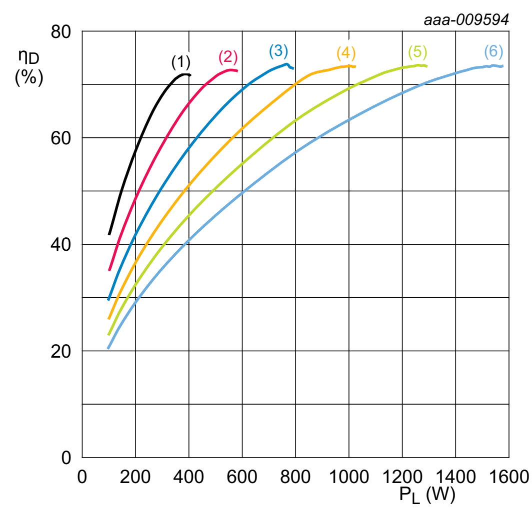
(3) V_{DS} = 35 V

(4) V_{DS} = 40 V

(5) V_{DS} = 45 V

(6) V_{DS} = 50 V

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



I_{Dq} = 40 mA; f = 108 MHz; t_p = 100 μs; δ = 20 %.

(1) V_{DS} = 25 V

(2) V_{DS} = 30 V

(3) V_{DS} = 35 V

(4) V_{DS} = 40 V

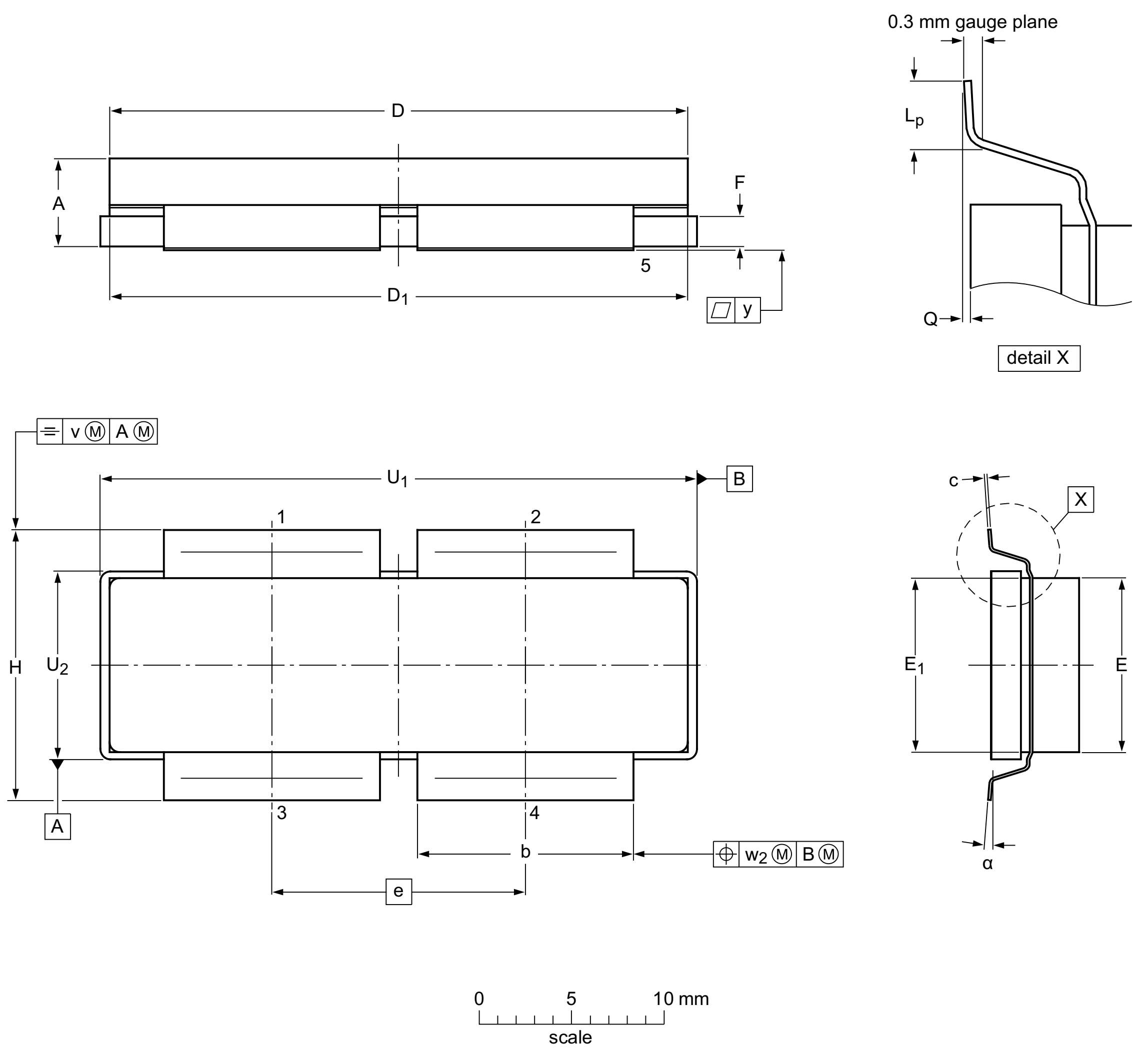
(5) V_{DS} = 45 V

(6) V_{DS} = 50 V

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

8. Package outline

Earless flanged LDMOST ceramic package; 4 leads **SOT1248C**



Dimensions

Unit[1]		A	b	c	D	D_1	e	E	E_1	F	H	L_p	Q	U_1	U_2	v	w_2	y	α
mm	max	5.5	11.81	0.18	31.55	31.52		9.50	9.53	1.75	14.70	1.38	0.195	32.39	10.29	0.25	0.25	0.15	7°
	nom						13.72												
	min	4.2	11.56	0.10	30.94	30.96		9.30	9.27	1.50	14.50	0.98	0.045	32.13	10.03				0°
inches	max	0.217	0.465	0.007	1.242	1.241		0.374	0.375	0.069	0.579	0.055	0.008	1.275	0.405	0.01	0.01	0.006	7°
	nom						0.540												
	min	0.165	0.455	0.004	1.218	1.219		0.366	0.365	0.059	0.571	0.039	0.002	1.265	0.395				0°

Note
1. Millimeter dimensions are derived from the original inch dimensions.

sot1248c_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1248C						~~13-04-16~~ 13-08-15

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:	• The format of this document has been redesigned to comply with the new identity guidelines of Ampleon. • Legal texts have been adapted to the new company name where appropriate.			
BLF188XRG v.1	20140630	Product data sheet	-	-

12. Legal information

12.1 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.ampleon.com.

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14. Contents

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