

BLF147

VHF power MOS transistor

Rev. 7 — 1 September 2015

AMPLEON

Product data sheet

IMPORTANT NOTICE

Dear customer,

As of December 7th, 2015 BL RF Power of NXP Semiconductors will operate as an independent company under the new trade name Ampleon, which will be used in future data sheets together with new contact details.

In data sheets, where the previous Philips references is mentioned, please use the new links as shown below.

<http://www.philips.semiconductors.com> use <http://www.ampleon.com>

<http://www.semiconductors.philips.com> use <http://www.ampleon.com> (Internet)

sales.addresses@www.semiconductors.philips.com use
<http://www.ampleon.com/sales>

The copyright notice at the bottom of each page (or elsewhere in the document, depending on the version)

- © Koninklijke Philips Electronics N.V. (year). All rights reserved -
is replaced with:

- © Ampleon B.V. (year). All rights reserved. -

If you have any questions related to the data sheet, please contact our nearest sales office (details via <http://www.ampleon.com/sales>).

Thank you for your cooperation and understanding,

Ampleon

VHF power MOS transistor

BLF147

FEATURES

- High power gain
- Low intermodulation distortion
- Easy power control
- Good thermal stability
- Withstands full load mismatch.

APPLICATIONS

- Industrial and military applications in the HF/VHF frequency range.

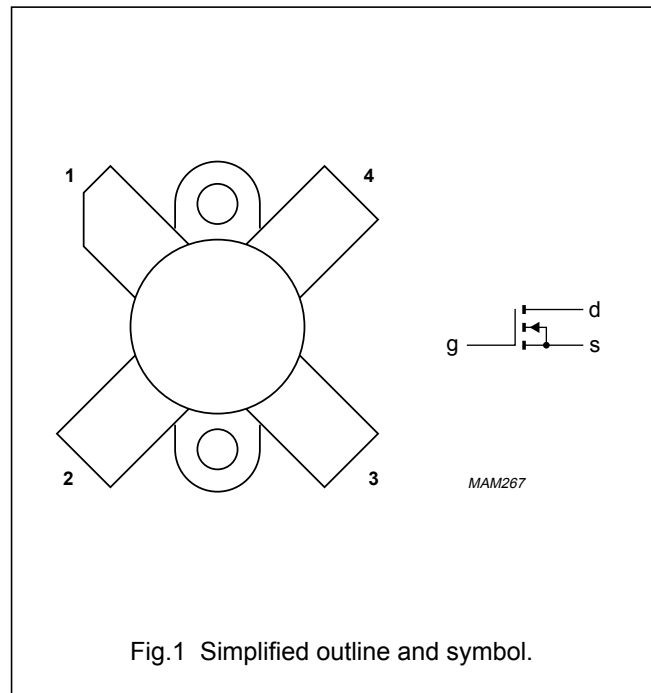
DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor encapsulated in a 4-lead, SOT121B flange package with a ceramic cap. All leads are isolated from the flange. A marking code, showing gate-source voltage (V_{GS}) information is provided for matched pair applications. Refer to the “General” section of the handbook for further information.

PINNING - SOT121B

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source

CAUTION
This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling. For further information, refer to Philips specs.: SNW-EQ-608, SNW-FQ-302A, and SNW-FQ-302B.



QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)	d_3 (dB)	d_5 (dB)
SSB, class-AB	28	28	150 (PEP)	>17	>35	<-30	<-30
CW, class-B	108	28	150	typ. 14	typ. 70	-	-

WARNING
Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

VHF power MOS transistor

BLF147

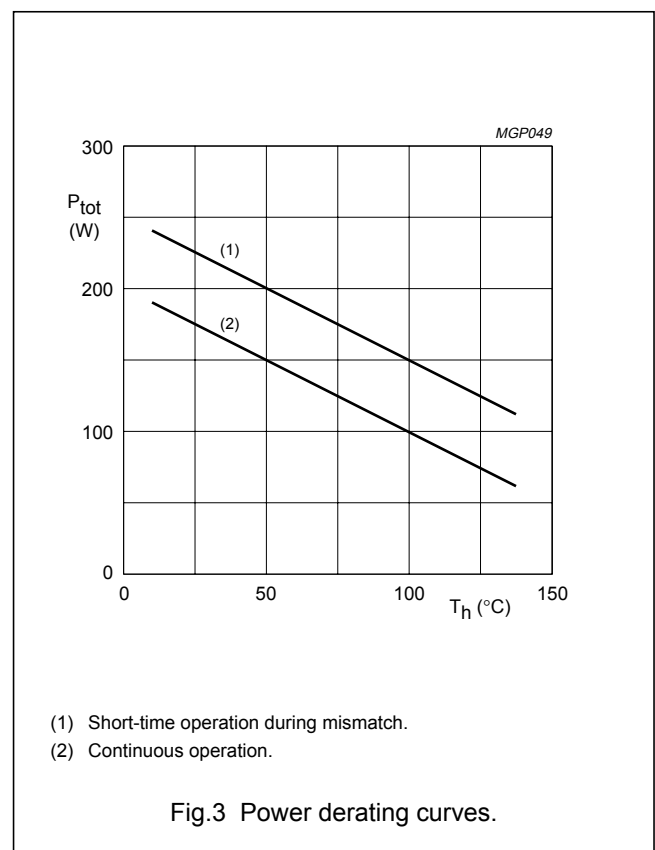
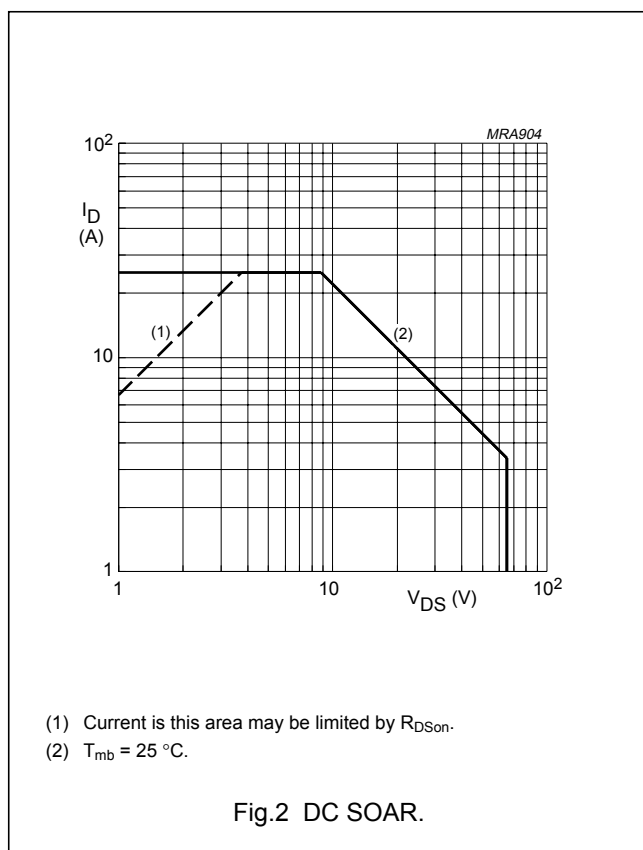
LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 60134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
V_{GS}	gate-source voltage		–	± 20	V
I_D	drain current (DC)		–	25	A
P_{tot}	total power dissipation	$T_{mb} \leq 25\text{ }^\circ\text{C}$	–	220	W
T_{stg}	storage temperature		–65	150	$^\circ\text{C}$
T_j	junction temperature		–	200	$^\circ\text{C}$

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-mb}$	thermal resistance from junction to mounting base	0.8	K/W
$R_{th\ mb-h}$	thermal resistance from mounting base to heatsink	0.2	K/W



VHF power MOS transistor

BLF147

CHARACTERISTICS

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

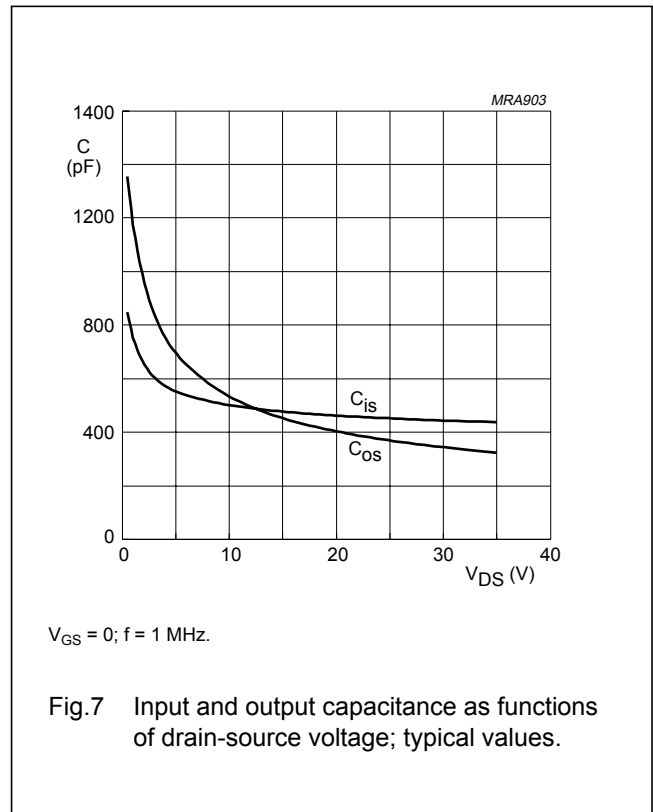
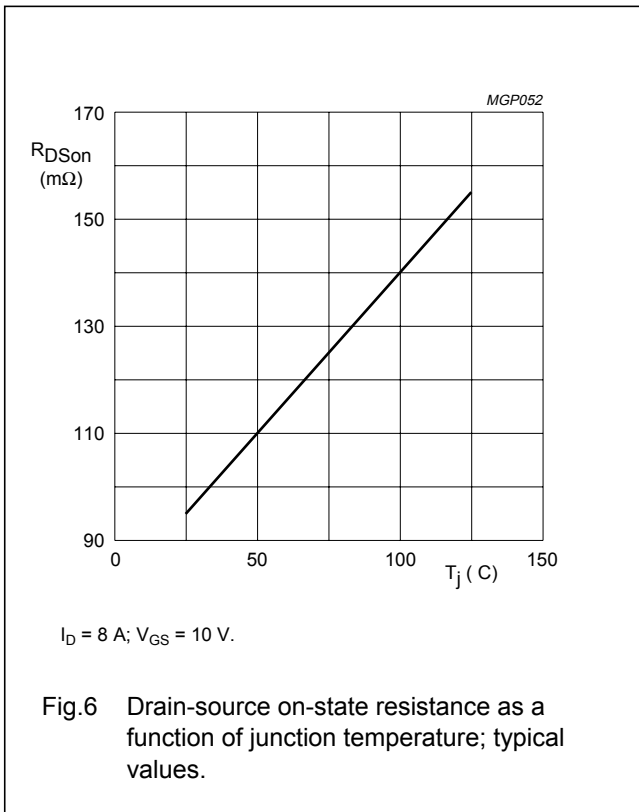
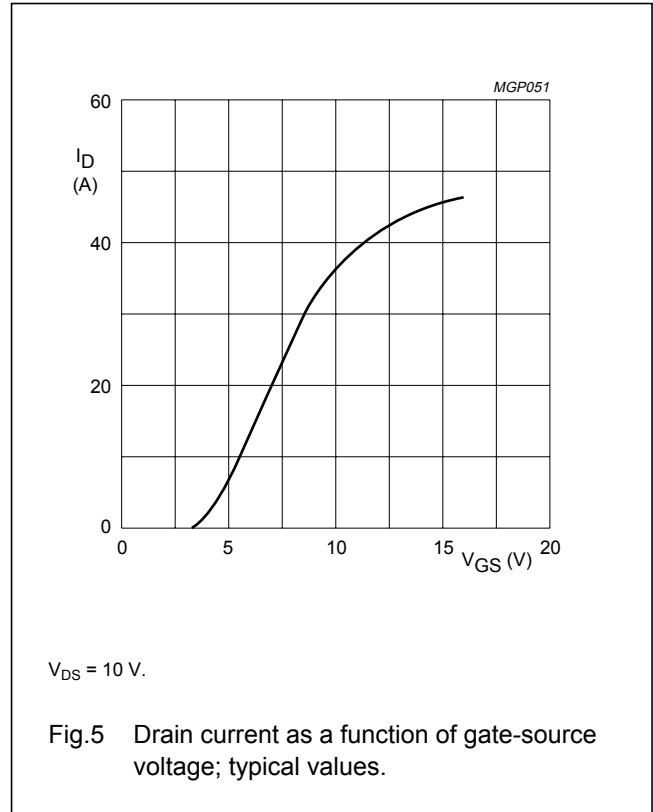
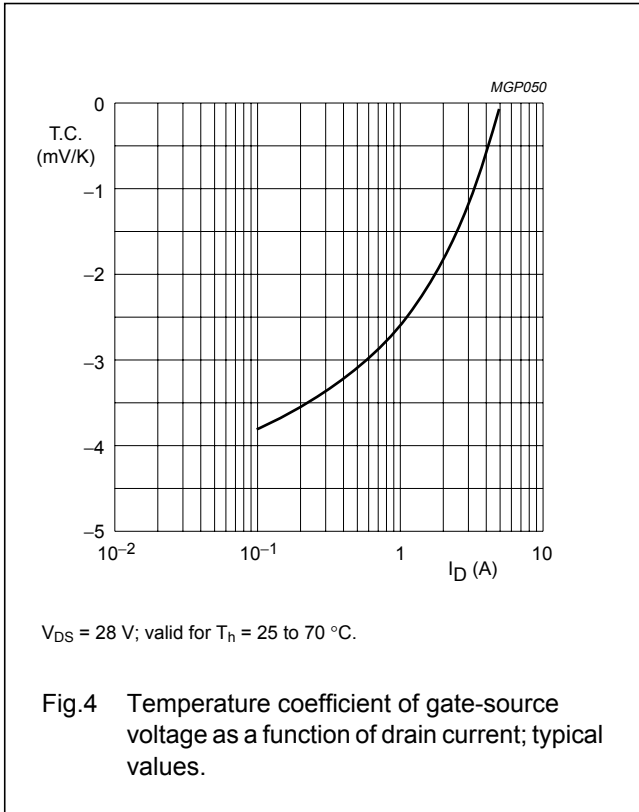
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 100\text{ mA}; V_{GS} = 0$	65	–	–	V
I_{DSS}	drain-source leakage current	$V_{GS} = 0; V_{DS} = 28\text{ V}$	–	–	5	mA
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 20\text{ V}; V_{DS} = 0$	–	–	1	μA
V_{GSth}	gate-source threshold voltage	$I_D = 200\text{ mA}; V_{DS} = 10\text{ V}$	2	–	4.5	V
ΔV_{GS}	gate-source voltage difference of matched pairs	$I_D = 100\text{ mA}; V_{DS} = 10\text{ V}$	–	–	100	mV
g_{fs}	forward transconductance	$I_D = 8\text{ A}; V_{DS} = 10\text{ V}$	5	7.5	–	S
R_{DSon}	drain-source on-state resistance	$I_D = 8\text{ A}; V_{GS} = 10\text{ V}$	–	0.1	0.15	Ω
I_{DSX}	on-state drain current	$V_{GS} = 10\text{ V}; V_{DS} = 10\text{ V}$	–	37	–	A
C_{is}	input capacitance	$V_{GS} = 0; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$	–	450	–	pF
C_{os}	output capacitance	$V_{GS} = 0; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$	–	360	–	pF
C_{rs}	feedback capacitance	$V_{GS} = 0; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$	–	55	–	pF

 V_{GS} group indicator

GROUP	LIMITS (V)		GROUP	LIMITS (V)	
	MIN.	MAX.		MIN.	MAX.
A	2.0	2.1	O	3.3	3.4
B	2.1	2.2	P	3.4	3.5
C	2.2	2.3	Q	3.5	3.6
D	2.3	2.4	R	3.6	3.7
E	2.4	2.5	S	3.7	3.8
F	2.5	2.6	T	3.8	3.9
G	2.6	2.7	U	3.9	4.0
H	2.7	2.8	V	4.0	4.1
J	2.8	2.9	W	4.1	4.2
K	2.9	3.0	X	4.2	4.3
L	3.0	3.1	Y	4.3	4.4
M	3.1	3.2	Z	4.4	4.5
N	3.2	3.3			

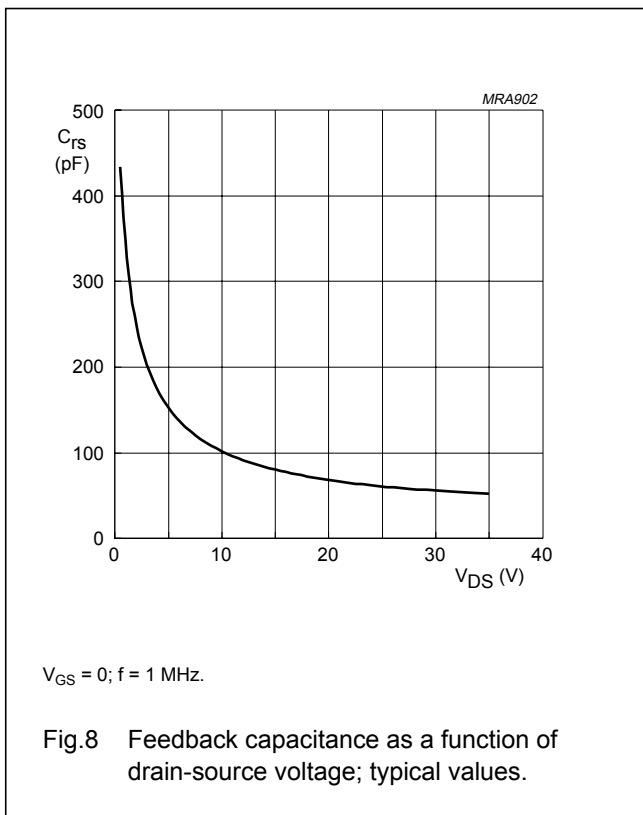
VHF power MOS transistor

BLF147



VHF power MOS transistor

BLF147



APPLICATION INFORMATION FOR CLASS-AB OPERATION

RF performance in SSB operation in a common source class-AB circuit.

$T_h = 25$ °C; $R_{th\ mb-h} = 0.2$ K/W; $R_{GS} = 9.8$ Ω; $f_1 = 28.000$ MHz; $f_2 = 28.001$ MHz; unless otherwise specified.

P_L (W)	f (MHz)	V_{DS} (V)	I_{DQ} (A)	G_p (dB)	η_D (%)	d_3 (dB) (note 2)	d_5 (dB) (note 2)
20 to 150 (PEP)	28	28	1	>17 typ. 19	>35 typ. 40	<-30 typ. -34	<-30 typ. -40

Notes

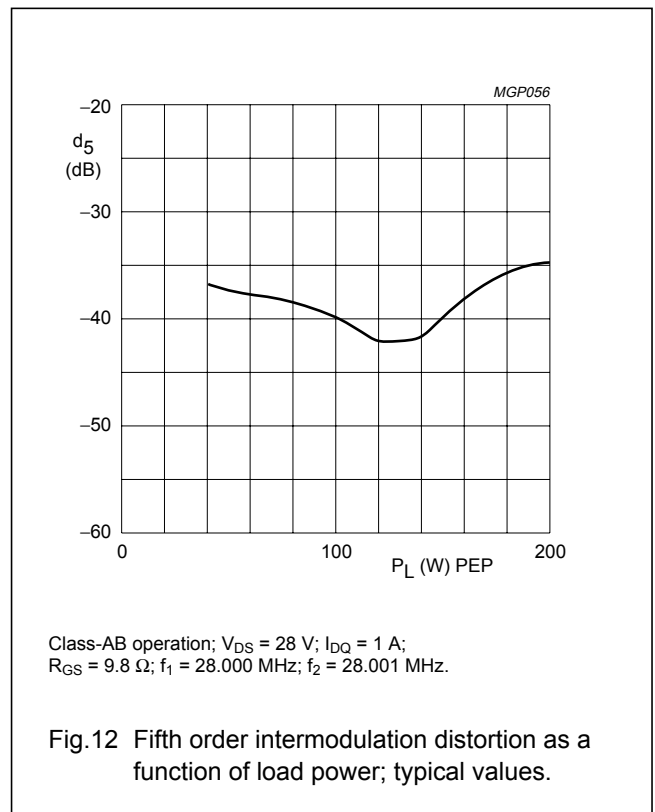
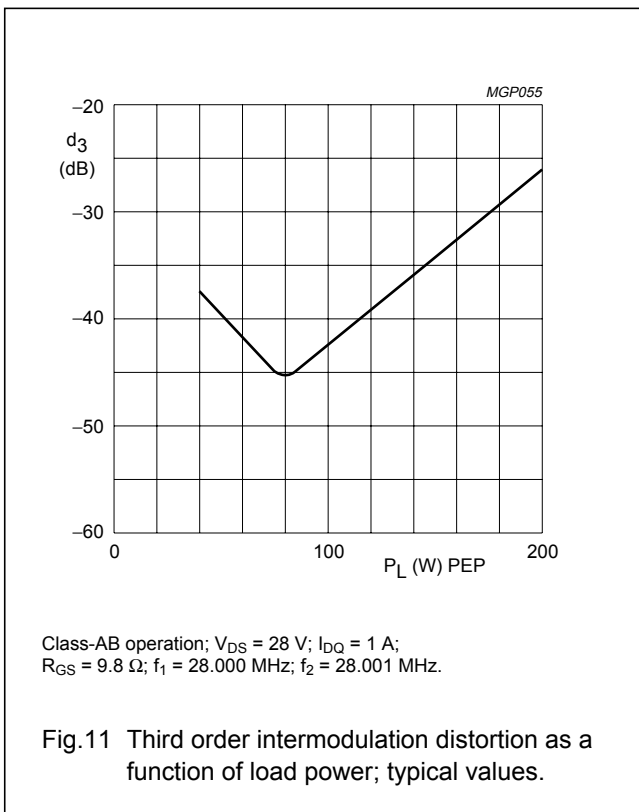
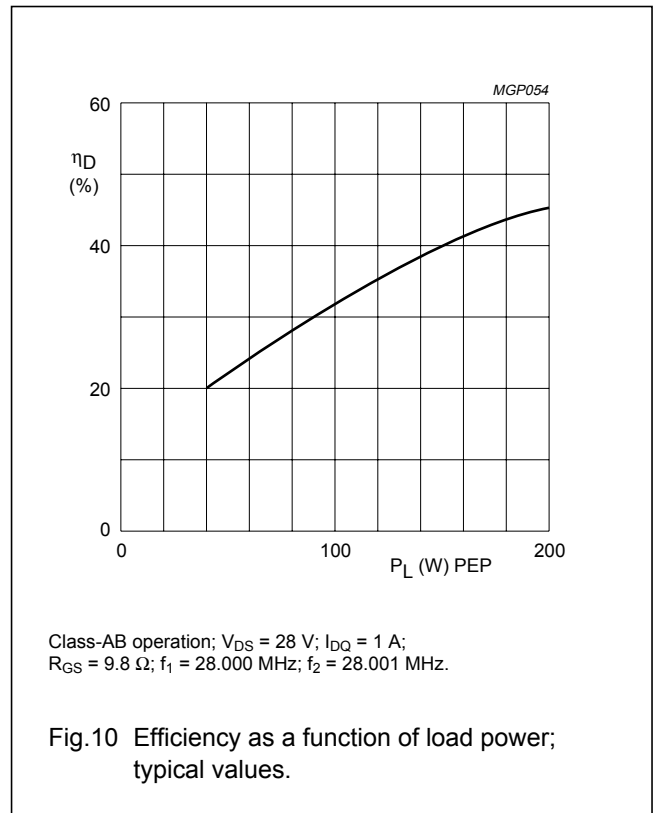
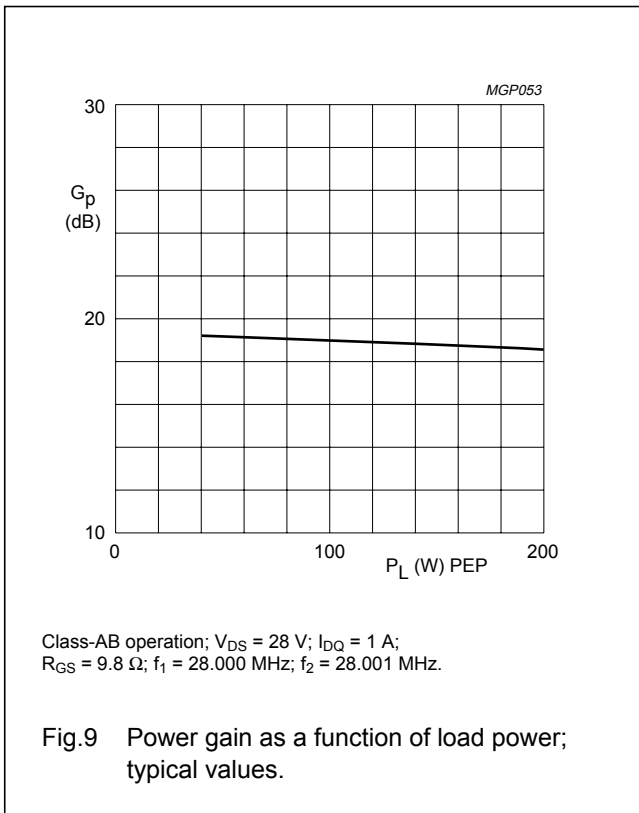
- Optimum load impedance: $2.1 + j0$ Ω.
- Maximum values at drive levels within the specified PEP values for either amplified tone. For the peak envelope power the values should be decreased by 6 dB.

Ruggedness in class-AB operation

The BLF147 is capable of withstanding a load mismatch corresponding to VSWR = 50:1 through all phases under the following conditions: $V_{DS} = 28$ V; $f = 28$ MHz at rated load power.

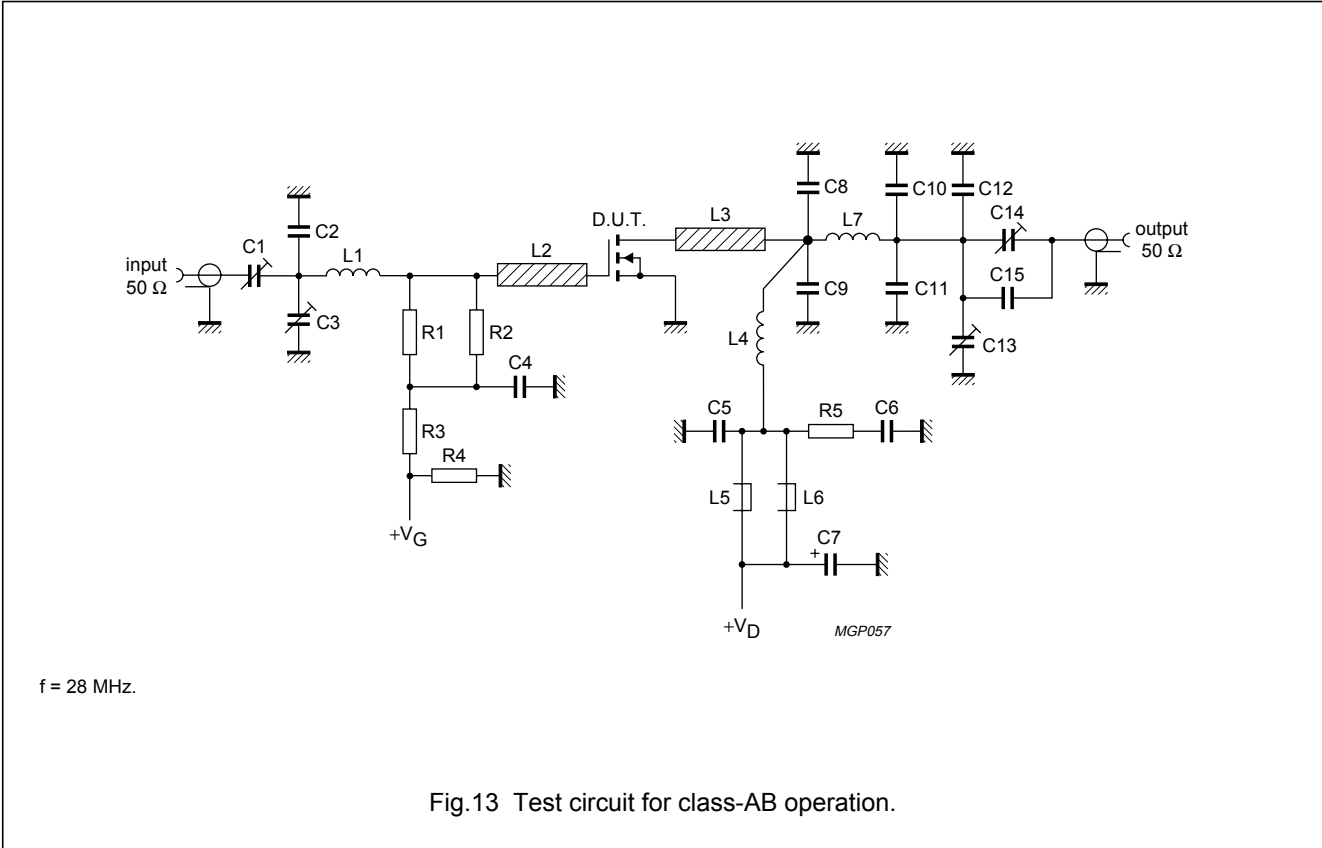
VHF power MOS transistor

BLF147



VHF power MOS transistor

BLF147



VHF power MOS transistor

BLF147

List of components (see Fig 13).

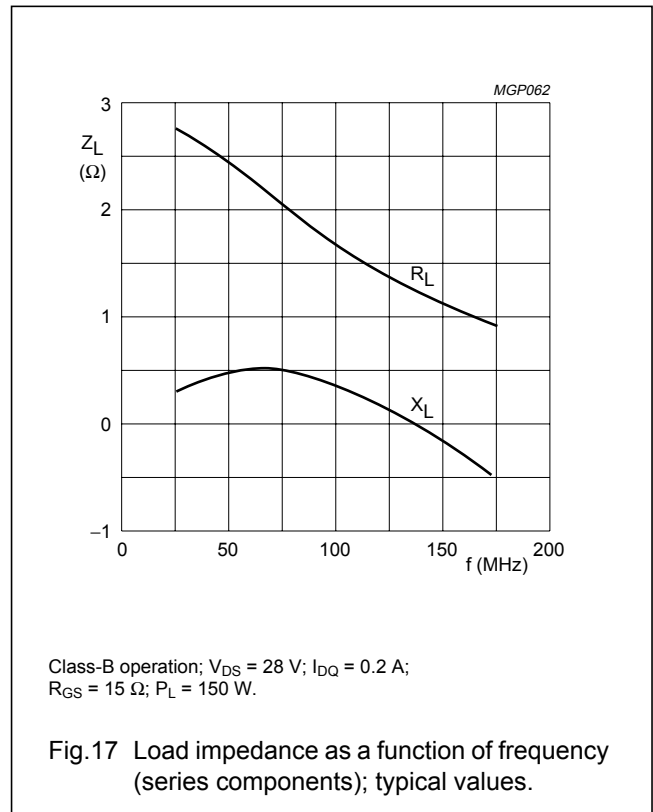
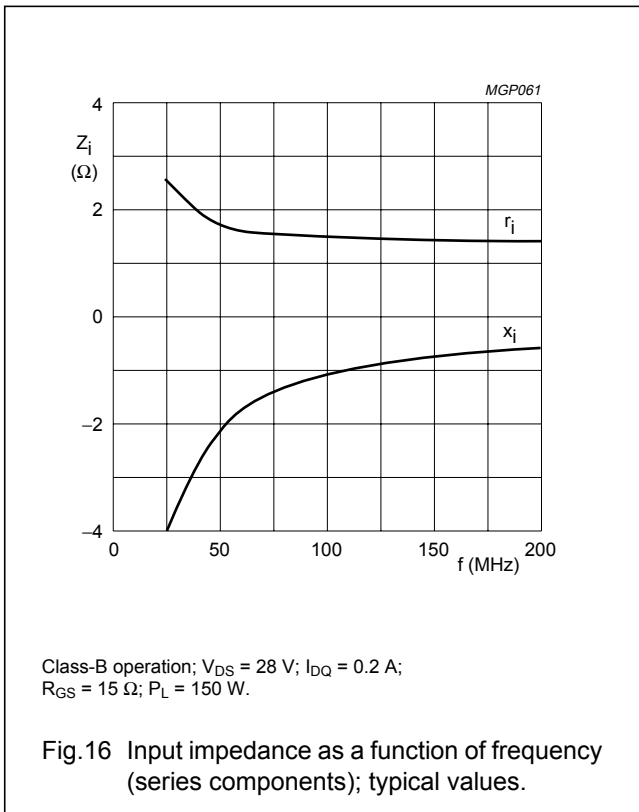
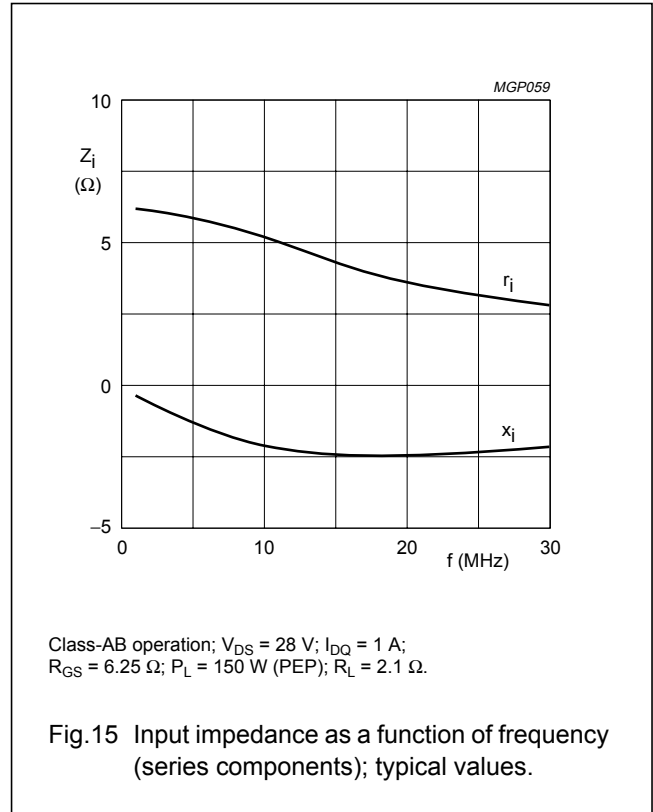
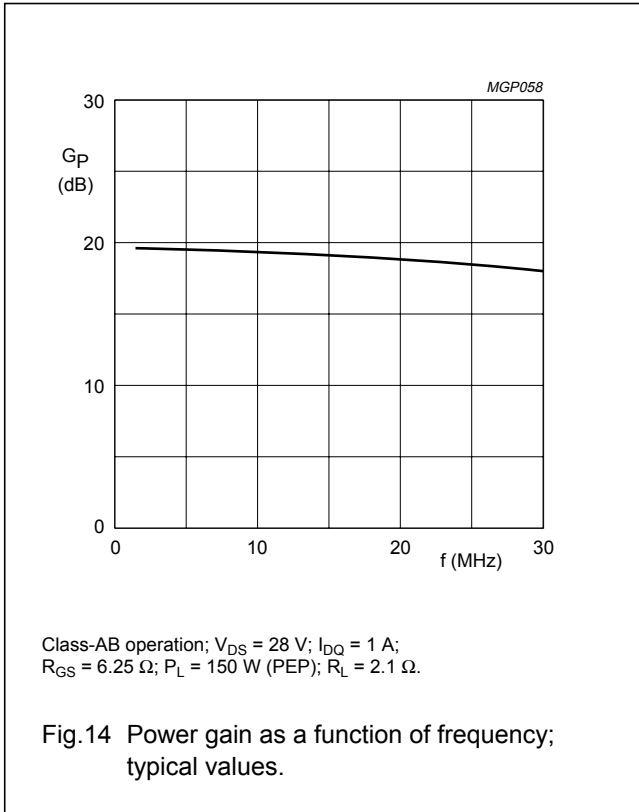
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C3, C13, C14	film dielectric trimmer	7 to 100 pF		2222 809 07015
C2, C8, C9	multilayer ceramic chip capacitor; note 1	75 pF		
C4, C5	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C6	multilayer ceramic chip capacitors in parallel	3 × 100 nF		2222 852 47104
C7	electrolytic capacitor	2.2 μF, 63 V		
C10	multilayer ceramic chip capacitor; note 1	100 pF		
C11, C12	multilayer ceramic chip capacitor; note 1	150 pF		
C15	multilayer ceramic chip capacitor; note 1	240 pF		
L1	6 turns enamelled 0.7 mm copper wire	145 nH	length 5 mm; int. dia. 6 mm; leads 2 × 5 mm	
L2, L3	stripline; note 2	41.1 Ω	length 13 × 6 mm	
L4	4 turns enamelled 1.5 mm copper wire	148 nH	length 8 mm; int. dia. 10 mm; leads 2 × 5 mm	
L5, L6	grade 3B Ferroxcube wideband HF choke			4312 020 36642
L7	3 turns enamelled 2.2 mm copper wire	79 nH	length 8 mm; int. dia. 8 mm; leads 2 × 5 mm	
R1, R2	1 W metal film resistor	19.6 Ω		2322 153 51969
R3	0.4 W metal film resistor	10 kΩ		2322 151 71003
R4	0.4 W metal film resistor	1 MΩ		2322 151 71005
R5	1 W metal film resistor	10 Ω		2322 153 51009

Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric ($\epsilon_r = 2.2$), thickness 1.6 mm.

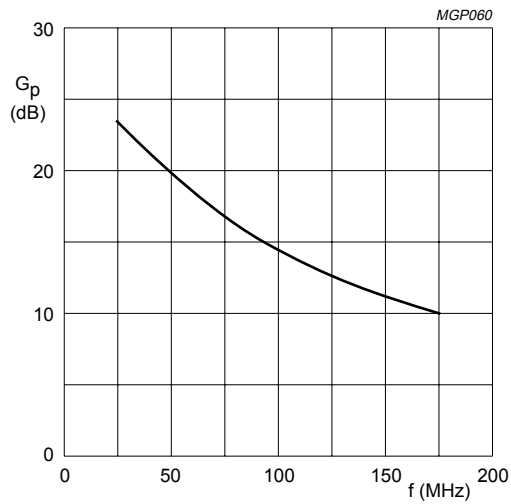
VHF power MOS transistor

BLF147



VHF power MOS transistor

BLF147



Class-B operation; $V_{DS} = 28$ V; $I_{DQ} = 0.2$ A;
 $R_{GS} = 15$ Ω ; $P_L = 150$ W.

Fig. 18 Power gain as a function of frequency;
typical values.

VHF power MOS transistor

BLF147

BLF147 scattering parameters $V_{DS} = 28\text{ V}$; $I_D = 1000\text{ mA}$; note 1

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	S ₁₁	∠ Φ	S ₂₁	∠ Φ	S ₁₂	∠ Φ	S ₂₂	∠ Φ
5	0.91	-170.00	23.90	93.40	0.01	5.80	0.88	-171.20
10	0.91	-174.60	12.25	89.40	0.01	3.60	0.89	-177.20
20	0.92	-177.40	5.94	81.00	0.01	5.40	0.83	-179.60
30	0.92	-178.40	3.87	79.10	0.01	8.90	0.86	-178.90
40	0.92	-178.80	2.84	75.70	0.01	12.00	0.85	-178.60
50	0.92	-178.80	2.26	73.30	0.01	16.90	0.87	-176.90
60	0.92	-179.00	1.88	69.80	0.01	20.30	0.90	-177.30
70	0.93	-179.20	1.58	66.20	0.01	24.00	0.90	-178.10
80	0.93	-179.60	1.36	63.20	0.01	28.80	0.90	-178.40
90	0.93	-179.70	1.19	60.40	0.01	34.20	0.90	-178.60
100	0.94	-179.70	1.05	57.00	0.01	39.30	0.90	-179.40
125	0.95	179.50	0.77	49.30	0.01	52.30	0.88	179.20
150	0.95	179.00	0.60	45.80	0.01	64.90	0.91	-179.50
175	0.96	178.10	0.49	41.50	0.02	72.40	0.95	179.80
200	0.96	177.50	0.40	36.80	0.02	75.80	0.94	177.70
250	0.97	175.80	0.28	33.20	0.03	82.30	0.95	176.20
300	0.98	174.20	0.22	30.10	0.03	83.00	0.96	173.60
350	0.98	172.70	0.17	31.00	0.04	85.00	0.97	171.90
400	0.98	171.10	0.14	32.40	0.05	84.90	0.97	169.50
450	0.98	169.50	0.12	36.10	0.05	85.90	0.97	167.70
500	0.98	167.90	0.11	39.90	0.06	84.30	0.98	165.50
600	0.98	164.80	0.10	50.20	0.07	83.20	0.97	161.50
700	0.98	161.60	0.10	57.90	0.09	81.70	0.97	157.50
800	0.98	158.20	0.11	63.70	0.10	81.00	0.97	153.50
900	0.97	154.60	0.13	67.20	0.12	79.50	0.97	149.30
1000	0.97	151.10	0.14	70.20	0.14	78.80	0.96	144.90

Note

- For more extensive S-parameters see internet:
<http://www.semiconductors.philips.com/markets/communications/wirelesscommunications/broadcast>.

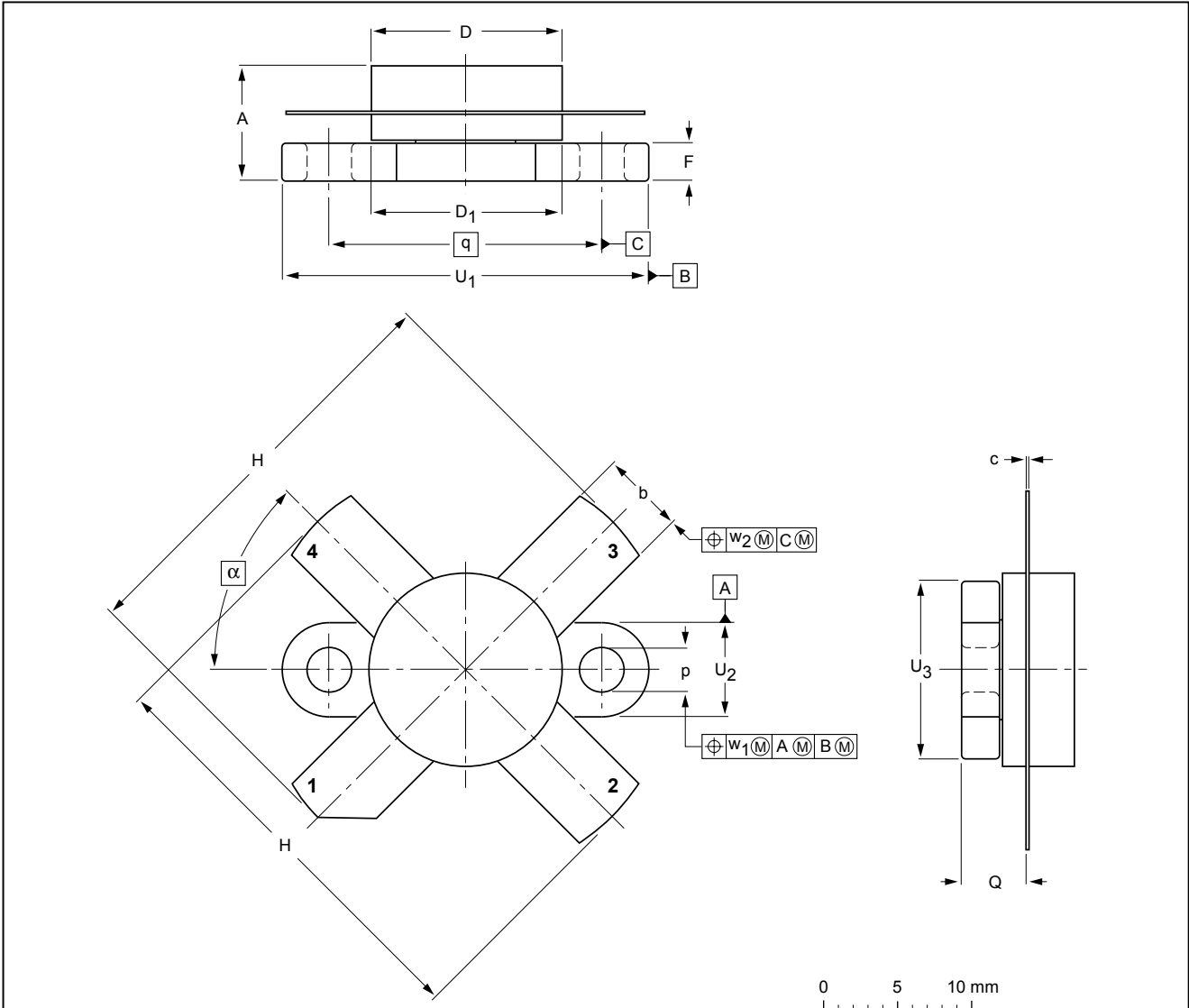
VHF power MOS transistor

BLF147

PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 4 leads

SOT121B



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	c	D	D ₁	F	H	p	Q	q	U ₁	U ₂	U ₃	w ₁	w ₂	α
mm	7.27 6.17	5.82 5.56	0.16 0.10	12.86 12.59	12.83 12.57	2.67 2.41	28.45 25.52	3.30 3.05	4.45 3.91	18.42	24.90 24.63	6.48 6.22	12.32 12.06	0.25	0.51	45°
inches	0.286 0.243	0.229 0.219	0.006 0.004	0.506 0.496	0.505 0.495	0.105 0.095	1.120 1.005	0.130 0.120	0.175 0.154	0.725	0.98 0.97	0.255 0.245	0.485 0.475	0.01	0.02	

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT121B						99-03-29

Legal information

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>.

Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Ampleon does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Ampleon sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Ampleon and its customer, unless Ampleon and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Ampleon product is deemed to offer functions and qualities beyond those described in the Product data sheet.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Ampleon does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Ampleon takes no responsibility for the content in this document if provided by an information source outside of Ampleon.

In no event shall Ampleon be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Ampleon' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of Ampleon.

Right to make changes — Ampleon reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — Ampleon products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an

Ampleon product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Ampleon and its suppliers accept no liability for inclusion and/or use of Ampleon products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Ampleon makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Ampleon products, and Ampleon accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Ampleon product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Ampleon does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Ampleon products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Ampleon does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Ampleon products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.ampleon.com/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Ampleon hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Ampleon products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — Unless this data sheet expressly states that this specific Ampleon product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. Ampleon accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Ampleon' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Ampleon' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies Ampleon for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond Ampleon' standard warranty and Ampleon' product specifications.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Contact information

For more information, please visit:
<http://www.ampleon.com>

Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Any reference or use of any 'NXP' trademark in this document or in or on the surface of Ampleon products does not result in any claim, liability or entitlement vis-à-vis the owner of this trademark. Ampleon is no longer part of the NXP group of companies and any reference to or use of the 'NXP' trademarks will be replaced by reference to or use of Ampleon's own Any reference or use of any 'NXP' trademark in this document or in or on the surface of Ampleon products does not result in any claim, liability or entitlement vis-à-vis the owner of this trademark. Ampleon is no longer part of the NXP group of companies and any reference to or use of the 'NXP' trademarks will be replaced by reference to or use of Ampleon's own trademarks.

For sales office addresses, please visit:
<http://www.ampleon.com/sales>

Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF147#7	20150901	Product data sheet	-	BLF147_6
Modifications:	<ul style="list-style-type: none"> 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. 			
BLF147_6	20061205	Product data sheet	-	BLF147_5
BLF147_5	20061108	Product data sheet	-	BLF147_4
BLF147_4 (9397 750 11593)	20030901	Product specification	-	BLF147_3
BLF147_3 (9397 750 08411)	20010523	Product specification	-	BLF147_CNV_2
BLF147_CNV_2 (9397 750 xxxxx)	19971215	Product specification	-	-

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© Ampleon B.V. 2015.

All rights reserved.

For more information, please visit: <http://www.ampleon.com>

For sales office addresses, please visit: <http://www.ampleon.com/sales>

Date of release: 1 September 2015

Document identifier: BLF147#7