BLF978P

HF / VHF power LDMOS transistor

Rev. 2 — 13 June 2022

AMPLEON

Product data sheet

1. Product profile

1.1 General description

A 1200 W LDMOS power transistor for broadcast applications and industrial applications in the HF to 700 MHz band.

Table 1. Application information

Test signal	f	V_{DS}	P_L	G_p	η_D
	(MHz)	(V)	(W)	(dB)	(%)
CW pulsed [1]	225	50	1200	25.5	80.0
CW pulsed [2]	352	50	1150	25.0	79.6
CW [2]	352	50	1150	23.6	76.7
CW [3]	500	45	800	22.3	71.6
CW [4]	650	50	1000	20.0	66.2

[1] On production test circuit t_p = 100 μs; δ = 10 %.

[2] AR191160.

[3] AR191195.

[4] AR201049.

1.2 Features and benefits

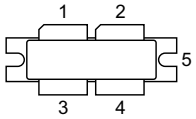
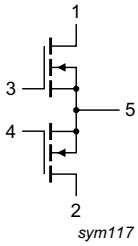
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (10 MHz to 700 MHz)
- For RoHS compliance see the product details on the Ampleon website

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
BLF978P	-	flanged balanced ceramic package; 2 mounting holes; 4 leads	SOT539A

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		-	108	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 online MTF calculator.

5. Thermal characteristics

Table 5. Thermal characteristics

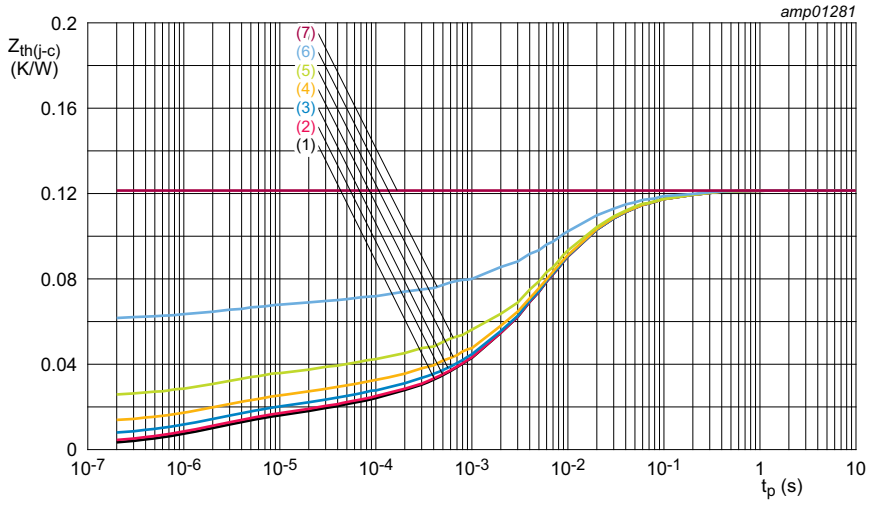
Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	T_{case} = 90 °C [1]	0.121	K/W
$Z_{th(j-c)}$	transient thermal impedance from junction to case	T_{case} = 90 °C; t_p = 100 µs; δ = 10 % [2]	0.033	K/W

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

[2] See Figure 1.

All information provided in this document is subject to legal disclaimers.

© Ampleon Netherlands B.V. 2022. All rights reserved.



(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 = 3.94 mA	108	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 394 mA	1.5	2.0	2.5	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	54	71.7	-	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 = 13.79 A	-	54	-	mΩ

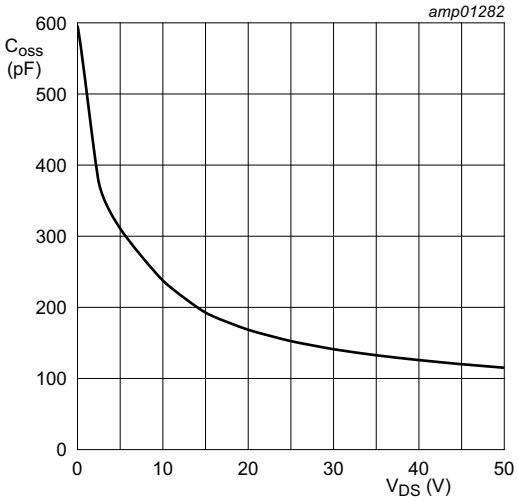
Table 7. AC characteristics

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	-	1.45	-	pF
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	392	-	pF
C_{oss}	output capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	115	-	pF

All information provided in this document is subject to legal disclaimers.

© Ampleon Netherlands B.V. 2022. All rights reserved.



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

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

Table 8. RF characteristics

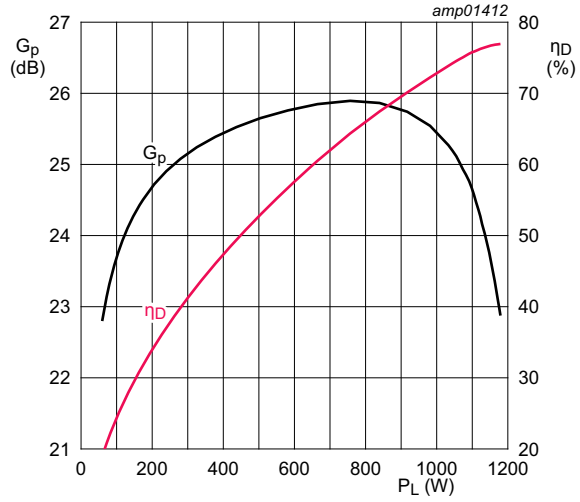
Test signal: CW pulsed; t_p = 100 μs; δ = 10 %; f = 225 MHz; RF performance at V_{DS} = 50 V; I_{Dq} = 50 mA per section; T_{case} = 25 °C; unless otherwise specified; in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain	P_L = 1200 W	23	24.5	-	dB
RL_{in}	input return loss	P_L = 1200 W	-	–20	–12	dB
η_D	drain efficiency	P_L = 1200 W	78	80.6	-	%

All information provided in this document is subject to legal disclaimers.

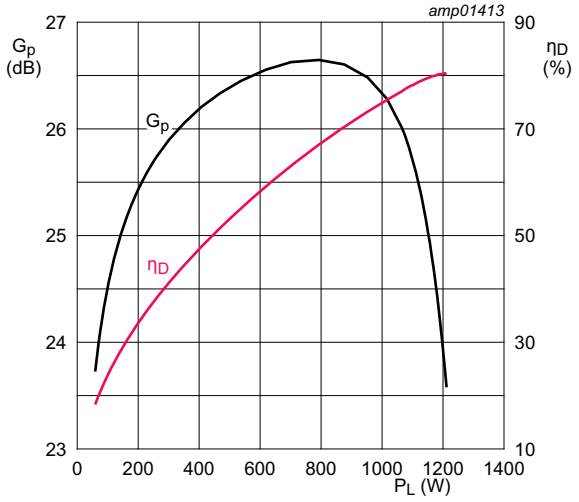
© Ampleon Netherlands B.V. 2022. All rights reserved.

7. Application information



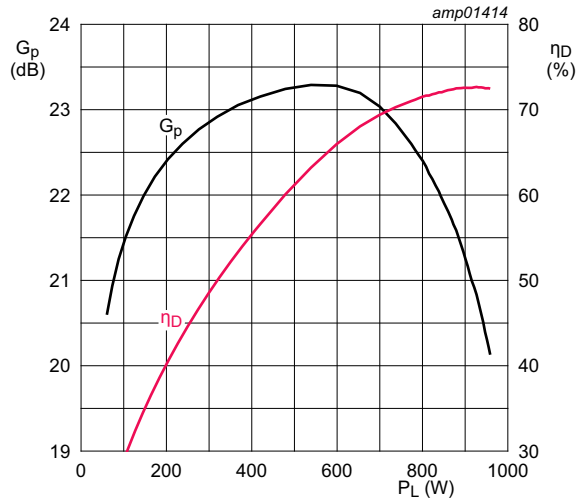
V_{DS} = 50 V; I_{Dq} = 2 × 5 mA; f = 352 MHz; CW.

Fig 3. Power gain and drain efficiency on AR191160 as function of output power; typical values



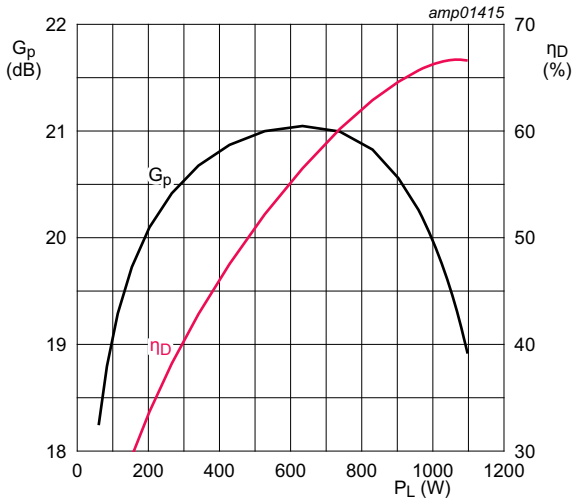
V_{DS} = 50 V; I_{Dq} = 2 × 50 mA; f = 352 MHz; CW pulsed (t_p = 100 μs; δ = 10 %).

Fig 4. Power gain and drain efficiency on AR191160 as function of output power; typical values



V_{DS} = 45 V; I_{Dq} = 2 × 10 mA; f = 500 MHz; CW.

Fig 5. Power gain and drain efficiency on AR191195 as function of output power; typical values



V_{DS} = 50 V; I_{Dq} = 2 × 10 mA; f = 650 MHz; CW.

Fig 6. Power gain and drain efficiency on AR201049 as function of output power; typical values

All information provided in this document is subject to legal disclaimers.

© Ampleon Netherlands B.V. 2022. All rights reserved.

8. Test information

8.1 Ruggedness in class-AB operation

The BLF978P is capable of withstanding a load mismatch corresponding to VSWR = 40 : 1 through all phases under the following conditions: V_{DS} = 50 V; I_{Dq} = 50 mA per section; P_L = 1200 W; f = 225 MHz; CW pulsed (t_p = 100 μs; δ = 10 %).

8.2 Impedance information

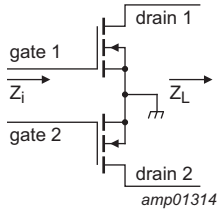


Fig 7. Definition of transistor impedance

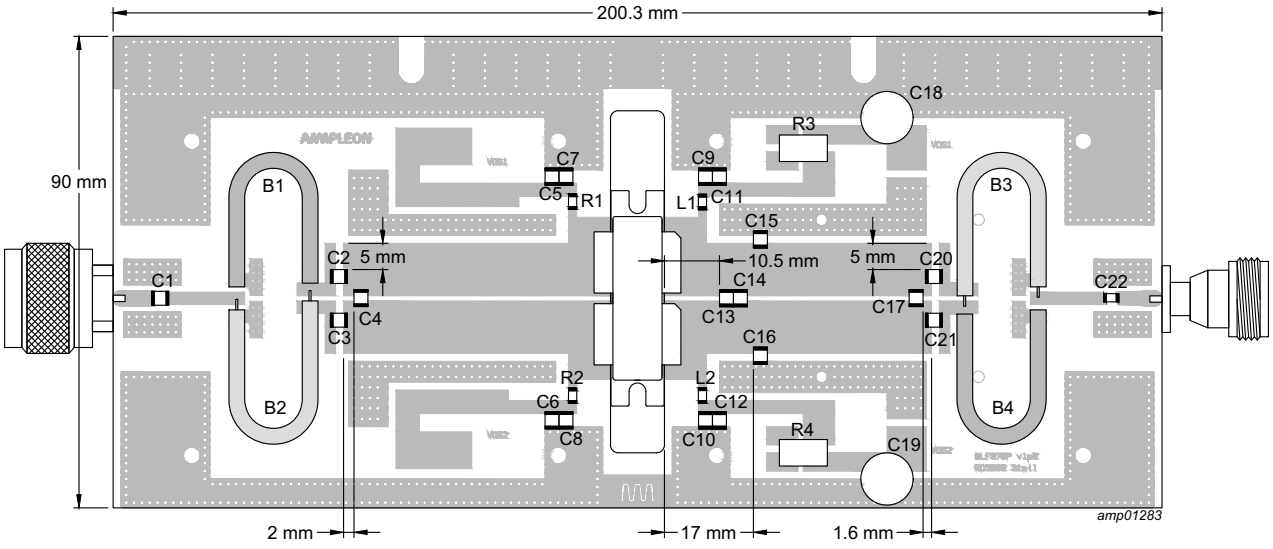
Table 9. Typical push-pull impedance

Simulated Z_i and Z_L device impedance; impedance info at V_{DS} = 50 V and P_L = 1200 W.

f	Z_i	Z_L
(MHz)	(Ω)	(Ω)
225	1.1 – j4.4	3.7 + j1.1

All information provided in this document is subject to legal disclaimers.
© Ampleon Netherlands B.V. 2022. All rights reserved.

8.3 Test circuit



Printed-Circuit Board (PCB): Rogers RT/duroid 5880; thickness = 0.79 mm.

See Table 10 for a list of components.

Fig 8. Component layout for class-AB production test circuit

Table 10. List of components

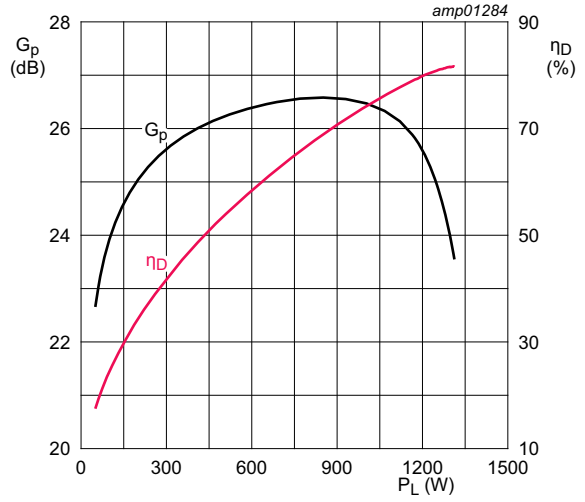
For test circuit see Figure 8.

Component	Description	Value	Remarks
C1, C7, C8, C9, C10, C22	multilayer ceramic chip capacitor	1 nF	ATC 100B
C2, C3	multilayer ceramic chip capacitor	62 pF	ATC 100B
C4	multilayer ceramic chip capacitor	111 pF	ATC 100B
C5, C6, C11, C12	multilayer ceramic chip capacitor	4.7 μF, 100 V	C3225X7S2A475K200AE
C13, C14, C20, C21	multilayer ceramic chip capacitor	47 pF	ATC 100B
C15, C16	multilayer ceramic chip capacitor	43 pF	ATC 100B
C17	multilayer ceramic chip capacitor	51 pF	ATC 100B
C18, C19	electrolytic capacitor	1500 μF, 80 V	
L1, L2	air core inductor	17.5 nH	B06TJLB
R1, R2	SMD resistor	5.1 Ω	SMD 1206
R3, R4	shunt resistor	0.01 Ω	Ohmite: FC4L110R010FER
B1, B2, B3, B4	coaxial line	50 Ω, 58 mm	HUBER+SUHNER: EZ-141-AL-TP-M17

All information provided in this document is subject to legal disclaimers.
© Ampleon Netherlands B.V. 2022. All rights reserved.

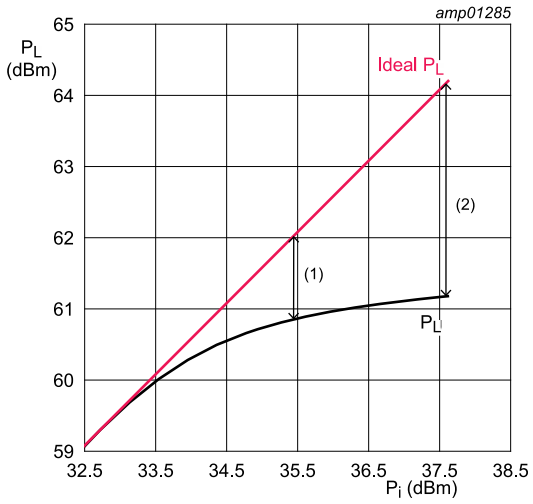
8.4 Graphical data

8.4.1 1-Tone CW pulsed



V_{DS} = 50 V; I_{Dq} = 2 × 50 mA; f = 225 MHz; t_p = 100 μs; δ = 10 %.

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



V_{DS} = 50 V; I_{Dq} = 2 × 50 mA; f = 225 MHz; t_p = 100 μs; δ = 10 %.

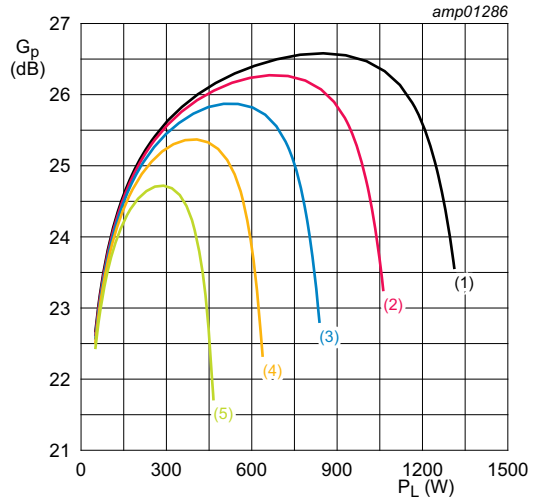
(1) $P_{L(1dB)}$ = 60.79 dBm (1200 W)

(2) $P_{L(3dB)}$ = 61.17 dBm (1310 W)

Fig 10. Output power as a function of input power; typical values

All information provided in this document is subject to legal disclaimers.

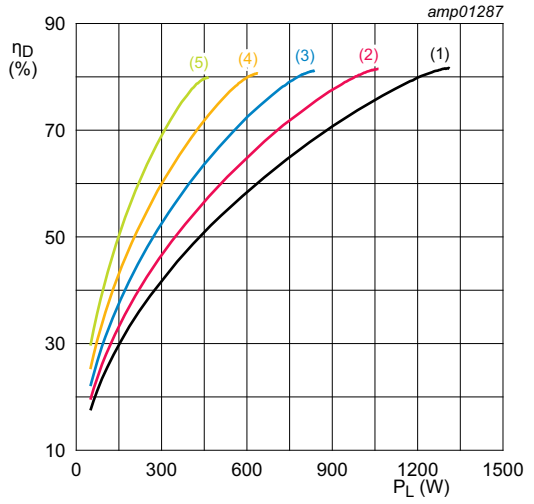
© Ampleon Netherlands B.V. 2022. All rights reserved.



I_{Dq} = 2 × 50 mA; f = 225 MHz; t_p = 100 μs; δ = 10 %.

(1) V_{DS} = 50 V
(2) V_{DS} = 45 V
(3) V_{DS} = 40 V
(4) V_{DS} = 35 V
(5) V_{DS} = 30 V

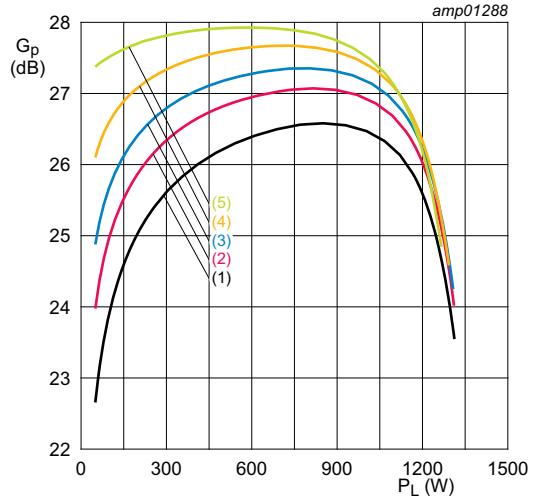
Fig 11. Power gain as a function of output power; typical values



I_{Dq} = 2 × 50 mA; f = 225 MHz; t_p = 100 μs; δ = 10 %.

(1) V_{DS} = 50 V
(2) V_{DS} = 45 V
(3) V_{DS} = 40 V
(4) V_{DS} = 35 V
(5) V_{DS} = 30 V

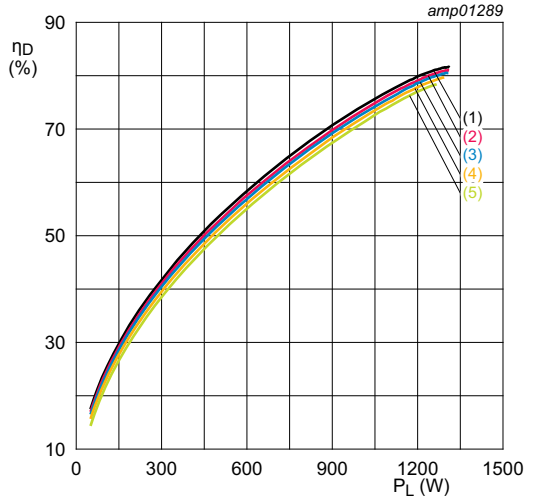
Fig 12. Drain efficiency as a function of output power; typical values



V_{DS} = 50 V; f = 225 MHz; t_p = 100 μs; δ = 10 %.

(1) I_{Dq} = 2 × 50 mA
(2) I_{Dq} = 2 × 200 mA
(3) I_{Dq} = 2 × 400 mA
(4) I_{Dq} = 2 × 800 mA
(5) I_{Dq} = 2 × 1400 mA

Fig 13. Power gain as a function of output power; typical values



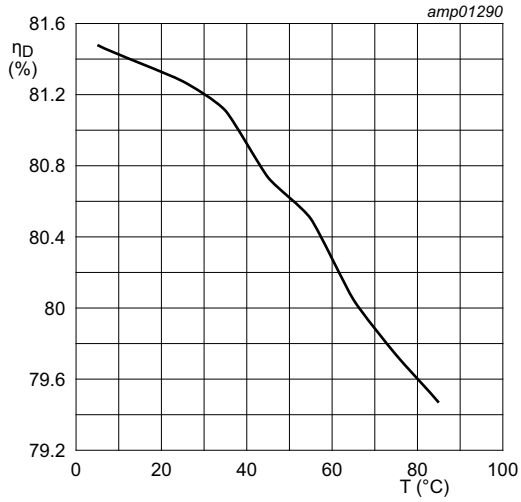
V_{DS} = 50 V; f = 225 MHz; t_p = 100 μs; δ = 10 %.

(1) I_{Dq} = 2 × 50 mA
(2) I_{Dq} = 2 × 200 mA
(3) I_{Dq} = 2 × 400 mA
(4) I_{Dq} = 2 × 800 mA
(5) I_{Dq} = 2 × 1400 mA

Fig 14. Drain efficiency as a function of output power; typical values

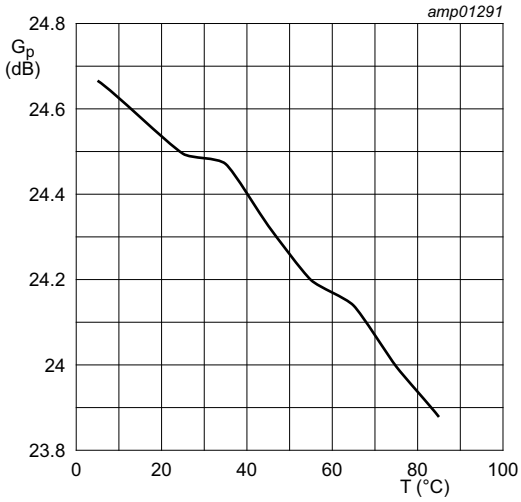
All information provided in this document is subject to legal disclaimers.

© Ampleon Netherlands B.V. 2022. All rights reserved.



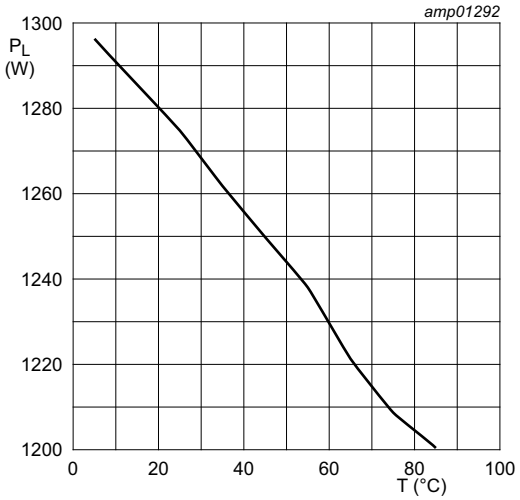
V_{DS} = 50 V; I_{Dq} = 2 × 50 mA; f = 225 MHz; at $P_{L(2dB)}$.

Fig 15. Drain efficiency as a function of temperature; typical values



V_{DS} = 50 V; I_{Dq} = 2 × 50 mA; f = 225 MHz; at $P_{L(2dB)}$.

Fig 16. Power gain as a function of temperature; typical values



V_{DS} = 50 V; I_{Dq} = 2 × 50 mA; f = 225 MHz; at $P_{L(2dB)}$.

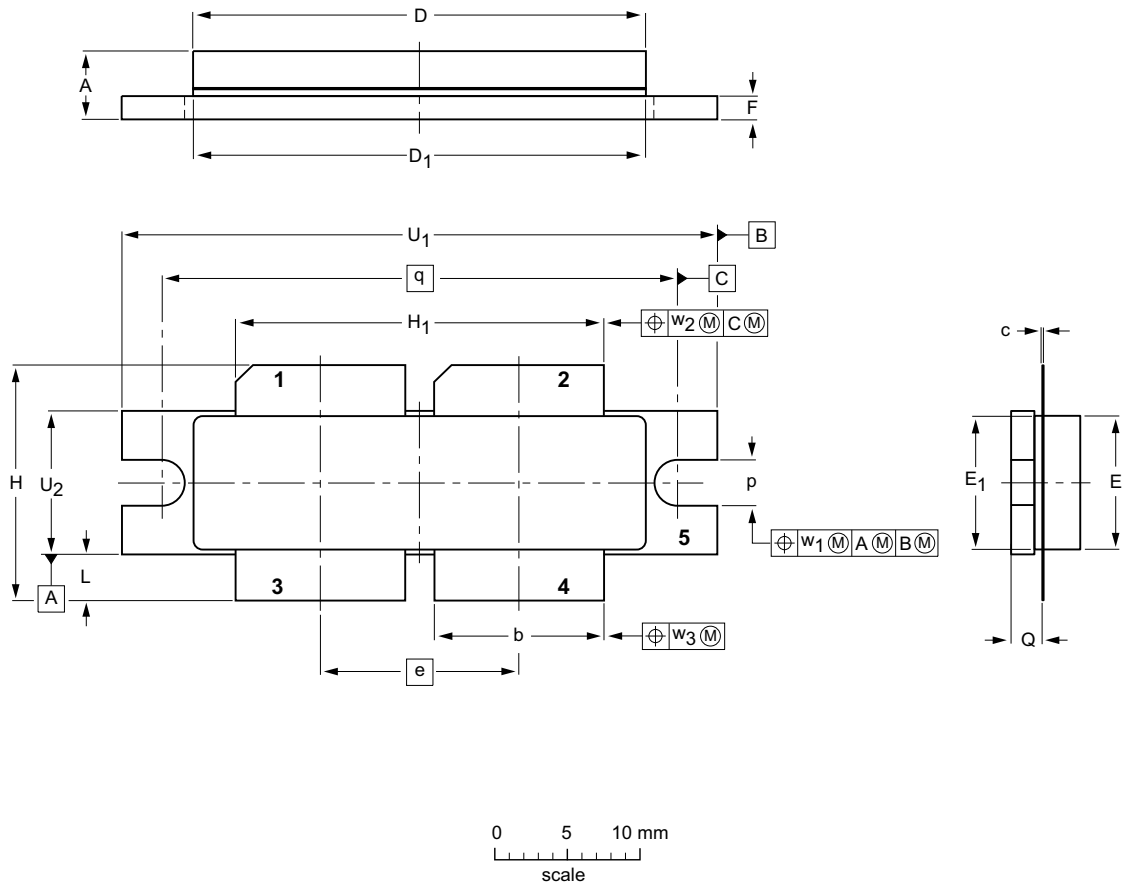
Fig 17. Output power as a function of temperature; typical values

All information provided in this document is subject to legal disclaimers.

© Ampleon Netherlands B.V. 2022. All rights reserved.

9. Package outline

Flanged balanced ceramic package; 2 mounting holes; 4 leads **SOT539A**



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

UNIT	A	b	c	D	D_1	e	E	E_1	F	H	H_1	L	p	Q	q	U_1	U_2	w_1	w_2	w_3
mm	4.7 4.2	11.81 11.56	0.18 0.10	31.55 30.94	31.52 30.96	13.72	9.50 9.30	9.53 9.27	1.75 1.50	17.12 16.10	25.53 25.27	3.48 2.97	3.30 3.05	2.26 2.01	35.56	41.28 41.02	10.29 10.03	0.25	0.51	0.25
inches	0.185 0.165	0.465 0.455	0.007 0.004	1.242 1.218	1.241 1.219	0.540	0.374 0.366	0.375 0.365	0.069 0.059	0.674 0.634	1.005 0.995	0.137 0.117	0.130 0.120	0.089 0.079	1.400	1.625 1.615	0.405 0.395	0.010	0.020	0.010

Note
1. millimeter dimensions are derived from the original inch dimensions.
2. recommended screw pitch dimension of 1.52 inch (38.6 mm) based on M3 screw.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT539A						~~10-02-02~~ 12-05-02

Fig 18. Package outline SOT539A

All information provided in this document is subject to legal disclaimers.

© Ampleon Netherlands B.V. 2022. All rights reserved.

10. 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.

Table 11. ESD sensitivity

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C2A [1]
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	2 [2]

[1] CDM classification C2A is granted to any part that passes after exposure to an ESD pulse of 500 V.

[2] HBM classification 2 is granted to any part that passes after exposure to an ESD pulse of 2000 V.

11. Abbreviations

Table 12. Abbreviations

Acronym	Description
CW	Continuous Wave
HF	High Frequency
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
MTF	Median Time to Failure
RoHS	Restriction of Hazardous Substances
SMD	Surface Mounted Device
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

12. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF978P v.2	20220613	Product data sheet	-	BLF978P v.1
Modifications:	• Section 8.1 on page 6: changed value of VSWR from 13 : 1 to 40 : 1 • Section 13.2 on page 13: updated section • Section 13.3 on page 13: updated section			
BLF978P v.1	20200403	Product data sheet	-	-

All information provided in this document is subject to legal disclaimers.
© Ampleon Netherlands B.V. 2022. All rights reserved.

13. Legal information

13.1 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.

13.2 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. An agreement according to which the functions and qualities of Ampleon products exceed those described in the Product data sheet is invalid.

13.3 Disclaimers

Maturity — After the relevant product(s) have passed the Release Gate in Ampleon's release process, Ampleon will confirm the final version in writing.

Limited warranty and liability — Ampleon uses its best efforts to keep the information in this document accurate and reliable. However, Ampleon gives no representations or warranties, expressed or implied, as to the accuracy or completeness of such information and assumes no liability for the consequences of the use of such information. Ampleon is not liable for content provided by an external information source.

In no event and irrespective of the legal basis (contract, tort (including negligence) statutory liability, misrepresentation, indemnity or any other area of law) shall Ampleon be liable for any indirect, incidental, punitive, special or consequential damages (including but without limitation loss of profit or revenue, loss of use or loss of production, loss of data, cost of capital, cost of substitute goods, property damage external to the Ampleon products and any damage, expenditure or loss arising out of such damage, business interruption, costs related to the removal or replacement of any products or rework charges) or any of the foregoing suffered by any third party.

Notwithstanding any damages that customer might incur for any reason whatsoever, Ampleon's 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 change information including but without limitation specifications and product descriptions published in this document at any time and without notice. This document supersedes and replaces all information regarding these products 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. Insofar as a customer or another party nevertheless uses Ampleon products unlawfully for such purposes, Ampleon and its suppliers are not liable for any damages.

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 is not liable 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 shall provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Ampleon is not liable 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 and shall do 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 is not liable 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 guaranteed. 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 the event of signing an individual agreement the terms and conditions of the respective agreement shall apply. Ampleon hereby expressly objects to and rejects the validity of customer's terms and conditions regarding the purchase of Ampleon products by customer.

All information provided in this document is subject to legal disclaimers.

© Ampleon Netherlands B.V. 2022. All rights reserved.

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 is not liable for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer breaches this and uses the products for design and use in automotive applications in accordance with automotive specifications and standards, (a) Ampleon gives no warranty, representation or other guarantees of any kind with respect to such automotive applications, use and specifications, and (b) such use is solely and exclusively at customer's own risk, and (c) customer fully indemnifies Ampleon against any and all liability, damages or failed product claims, including against third parties, arising out of customer's design and use of the product for automotive applications.

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.

13.4 Trademarks

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

14. Contact information

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

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

All information provided in this document is subject to legal disclaimers.

© Ampleon Netherlands B.V. 2022. All rights reserved.

15. Contents

1 Product profile 1
1.1 General description 1
1.2 Features and benefits 1
1.3 Applications 1
2 Pinning information 2
3 Ordering information 2
4 Limiting values 2
5 Thermal characteristics 2
6 Characteristics 3
7 Application information 5
8 Test information 6
8.1 Ruggedness in class-AB operation 6
8.2 Impedance information 6
8.3 Test circuit 7
8.4 Graphical data 8
8.4.1 1-Tone CW pulsed 8
9 Package outline 11
10 Handling information 12
11 Abbreviations 12
12 Revision history 12
13 Legal information 13
13.1 Data sheet status 13
13.2 Definitions 13
13.3 Disclaimers 13
13.4 Trademarks 14
14 Contact information 14
15 Contents 15

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

© Ampleon Netherlands B.V. 2022. 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: 13 June 2022
Document identifier: BLF978P

ENTEGRECİ

Bu belge www.entegreci.com üzerinden sunulmaktadır.

Elektronik komponent tedarikinde Entegreci

Entegreci, Eskişehir merkezli, Türkiye geneline satış yapan bir elektronik komponent mağazasıdır. Entegreler (IC), mikrodenetleyiciler, transistörler, diyotlar, pasif elemanlar, konnektörler, modüller ve geliştirme kartları tek adetten seri üretim adetlerine kadar satılır. Ürün sayfalarında güncel stok durumunu, fiyatı ve datasheet bağlantısını bulabilirsiniz.

Parça koduyla arama

Üretici parça numarasını yazın; stok ve fiyatı hemen görün.

www.entegreci.com

Ürün kategorileri

Entegreden kapasitöre tüm elektronik komponent kategorileri.

Kategorilere göz atın

Üreticiler

Aradığınız üreticinin ürünlerini tek sayfada inceleyin.

Üreticileri görün

Toplu alım ve teklif

Listede olmayan ya da yüksek adetli parçalar için teklif isteyin.

Teklif isteyin

www.entegreci.com | **destek@entegreci.com** | **0850 305 90 34**

Entegreci is an online electronic components store based in Türkiye. Search by manufacturer part number to see stock, prices and datasheets for integrated circuits, microcontrollers, transistors, passive components and connectors, or request a quote for parts that are not listed.

Bu sayfa Entegreci tarafından eklenmiştir. Belgenin önceki sayfaları asıl yayıncısına aittir ve içeriği değiştirilmemiştir; en güncel sürüm için belgenin yayıncısına başvurun.