

# AR201090

BLF974P, 225 MHz

v1.0 – May 12, 2020

AMPLEON

Application Report

## Document information

**Status** v1.0

**Abstract** Measurement results of a demoboard design with BLF974P optimized for 225 MHz.

## 1. Revision History

Table 1 – Report revisions

Revision	Date	Description	Author
1.0	2020.05.12	Initial document	

## 2. Contents

1.	Revision History .....	2
2.	Contents .....	2
3.	List of figures .....	2
4.	List of tables .....	3
5.	General description .....	4
6.	CW RF characteristics.....	5
7.	CW Performance Details .....	5
8.	CW RF Characteristics – Swept VDS .....	6
9.	CW Performance Details – Swept VDS .....	6
10.	CW RF Characteristics – Swept Idq .....	7
11.	CW Performance Details – Swept Idq .....	7
12.	CW RF Characteristics – Swept T .....	8
13.	CW Performance Details – Swept T .....	8
14.	User Guide .....	10
14.1	Biasing .....	10
14.2	Bill of Materials .....	11
14.3	Temperature behavior .....	13
14.4	Device markings.....	13
15.	Legal information.....	14
15.1	Definitions .....	14
15.2	Disclaimers.....	14
15.3	Trademarks .....	14
15.4	Contact information .....	14

## 3. List of figures

Figure 1 – Demo view of the BLF974P .....	4
Figure 2 – BLF974P demo board CW performance.....	5
Figure 3 – BLF974P Demo board Swept VDS CW performance.....	6
Figure 4 – BLF974P Demo board Swept Idq CW performance .....	7
Figure 5 – Gain-Efficiency-Power at 2dBcp versus water temperature.....	8
Figure 6 – BLF974P application board pin configuration .....	10
Figure 7 – BLF974P application board components placement .....	12

**4. List of tables**

---

Table 1 – Report revisions .....	2
Table 2 – Test circuit information .....	4
Table 3 – RF characteristics .....	5
Table 4 – RF Performance overview .....	5
Table 5 – RF characteristics .....	6
Table 6 – RF Performance overview .....	6
Table 7 – RF characteristics .....	7
Table 8 – RF Performance overview .....	7
Table 9 – RF characteristics .....	8
Table 10 – RF Performance overview .....	9
Table 11 – Pin description .....	10
Table 12 – Bill of Materials .....	11
Table 13 – Module specifics .....	13

5. General description

This report presents the measurement results of the demoboard designed for 225 MHz using the BLF974P, GEN 9 High Voltage LDMOS transistor. During assembly, PCB has been screwed down without soldering it and transistor is pressed with a pressing block.

The dedicated demo-circuit is matched to 50 Ω at input and output.

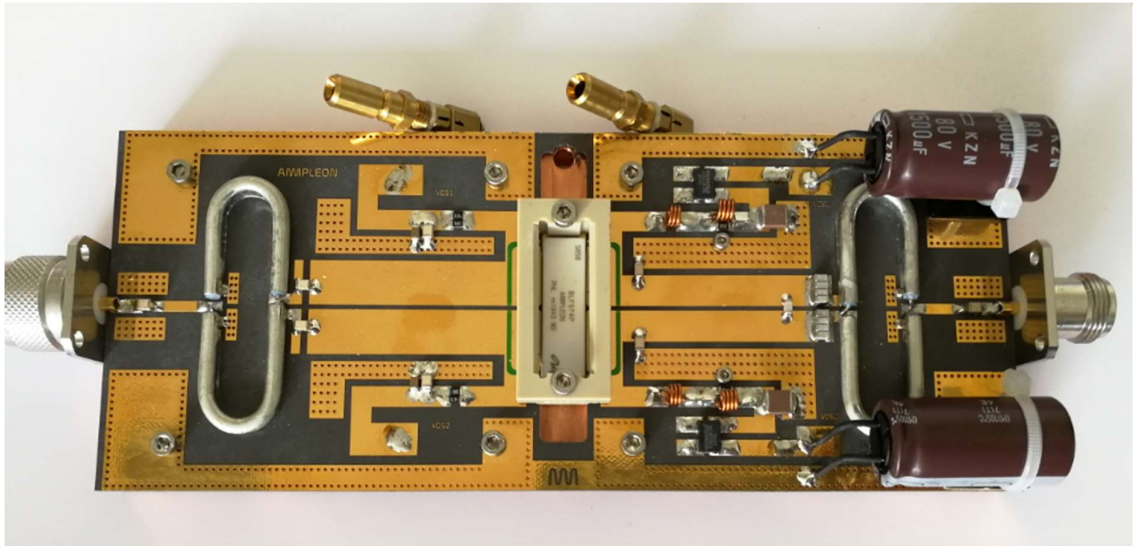


Figure 1 – Demo view of the BLF974P

Table 2 – Test circuit information

Parameter	Description	Unit
Input Laminate Type	Rogers RT duroid 5880	
Output Laminate Type	Rogers RT duroid 5880	
Dk	2.2	
Df	0.0009 @10 GHz	
Laminate thickness	0.79	mm
Overall dimensions	200.3 x 80	mm
Cooling type	Indirect water cooling	
Device Package	SOT539	

## 6. CW RF characteristics

Table 3 – RF characteristics

Test signal: CW; RF performance at  $V_{DS}=50V$ ; Total  $I_{Dq}=100mA$ ;  $T_{cooling\ water}=25^{\circ}C$

Symbol	Parameter	Conditions	Typical	Unit
f	Frequency		225	MHz
$V_{DS}$	Drain-source voltage		50	V
$V_{GS}$	Gate-source voltage	$I_{Dq} = 50mA \times section$	1.9	V
$G_p$	Power gain	$P_{1dBcp} = 587.2W$	24.7	dB
$\eta_D$	Drain efficiency	$P_{1dBcp} = 587.2W$	82.2	%

## 7. CW Performance Details

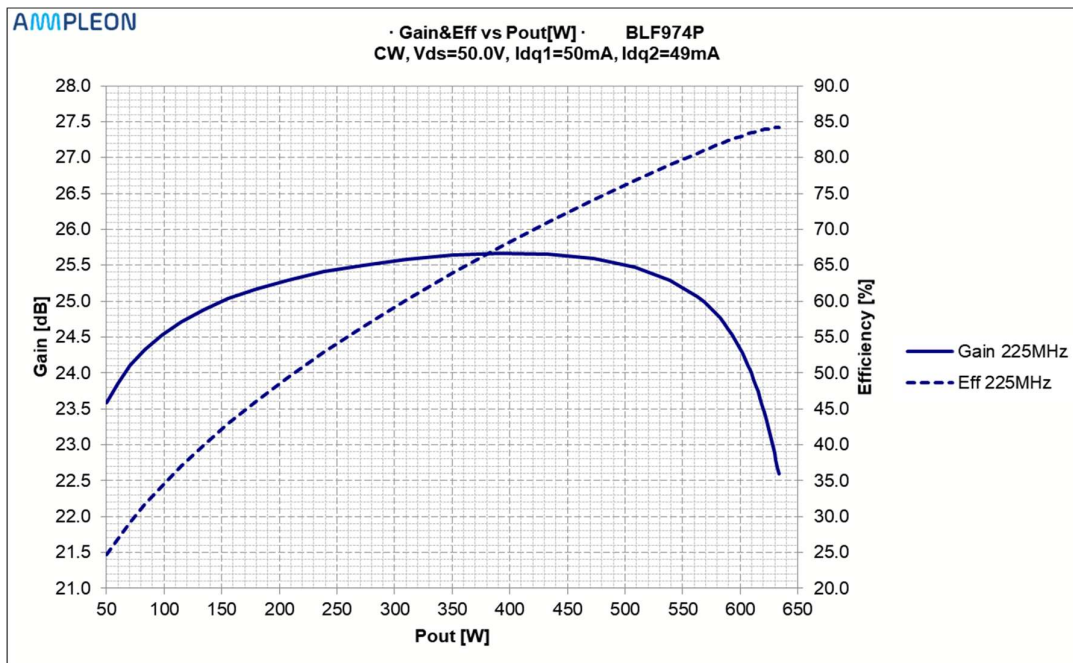


Figure 2 – BLF974P demo board CW performance

Table 4 – RF Performance overview

Freq [MHz]	Gmax [dB]	Pout@Gmax [W]	P1dB [W]	P2dB [W]	P3dB [W]	Effmax [%]	Pout@Effmax [W]	Eff P1dB [%]	Eff P2dB [%]	Eff P3dB [%]
225	25.7	391.4	587.2	616.7	632.6	84.2	633.4	82.2	83.7	84.2

### 8. CW RF Characteristics – Swept VDS

Table 5 – RF characteristics

Test signal: CW; RF performance at  $V_{DS}$ =Swept from 30V to 50V; Total  $I_{Dq}$ =100mA;  $T_{cooling\ water}$  =25°C

Symbol	Parameter	Conditions	Typical	Unit
f	Frequency		225	MHz
$V_{GS}$	Gate-source voltage	$I_{Dq} = 50\text{mA x section}$	1.9	V

### 9. CW Performance Details – Swept VDS

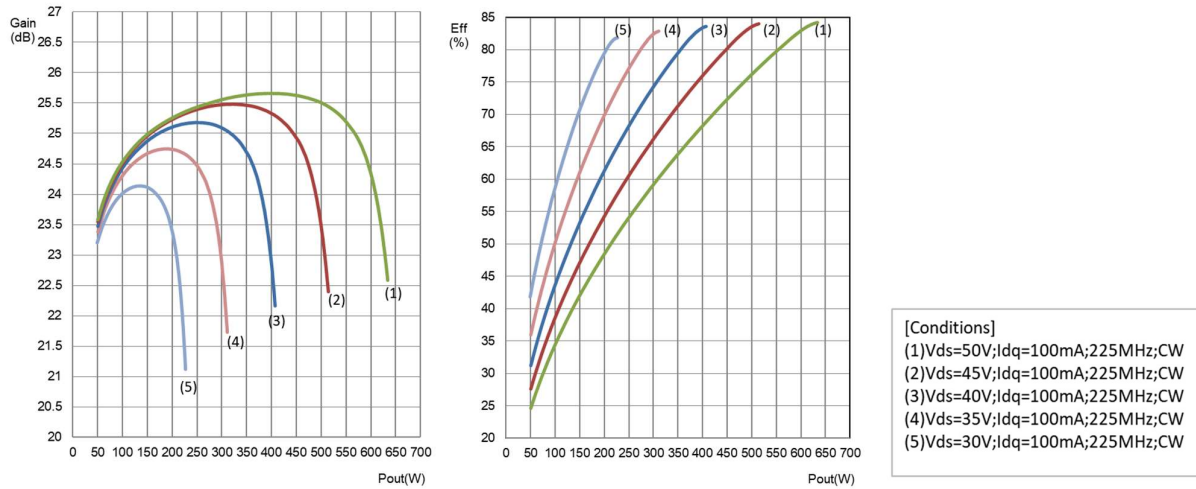


Figure 3 – BLF974P Demo board Swept VDS CW performance

Table 6 – RF Performance overview

Freq [MHz]	Vds [V]	Gmax [dB]	Pout@ Gmax [W]	P1dB [W]	P2dB [W]	P3dB [W]	Effmax [%]	Pout@ Effmax [W]	Eff P1dB [%]	Eff P2dB [%]	Eff P3dB [%]
225	50	25.7	391.4	587.2	616.7	632.6	84.2	633.4	82.2	83.7	84.2
225	45	25.5	306.1	475	500.4	514.1	84	515.1	82.1	83.6	84
225	40	25.2	259.7	373.7	394.9	406.5	83.5	406.7	81.7	83.1	83.5
225	35	24.7	192.5	283.8	301.1	310.8	82.8	310.9	81	82.5	82.8
225	30	24.1	137.5	206.7	220	227.4	81.8	227	80.2	81.5	81.8

10.CW RF Characteristics – Swept Idq

Table 7 – RF characteristics

Test signal: CW; RF performance at  $V_{DS}=50V$ ;  $I_{Dq}$ =Swept from 20 mA to 1500 mA;  $T_{cooling\ water}=25^{\circ}C$

Symbol	Parameter	Conditions	Typical	Unit
f	Frequency		225	MHz
$V_{DS}$	Drain-source voltage		50	V

11.CW Performance Details – Swept Idq

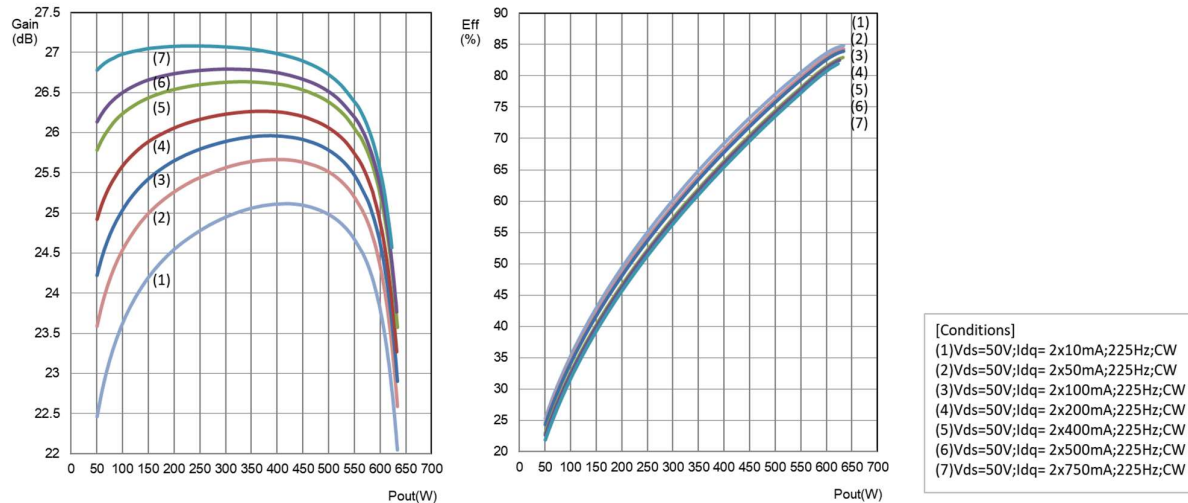


Figure 4 – BLF974P Demo board Swept Idq CW performance

Table 8 – RF Performance overview

Freq [MHz]	Idq [mA]	Gmax [dB]	Pout@ Gmax [W]	P1dB [W]	P2dB [W]	P3dB [W]	Effmax [%]	Pout@ Effmax [W]	Eff P1dB [%]	Eff P2dB [%]	Eff P3dB [%]
225	2x10	25.1	435.4	588	616.9	632.3	84.8	633.2	82.9	84.4	84.7
225	2x50	25.7	391.4	587.2	616.7	632.6	84.2	633.4	82.2	83.7	84.2
225	2x100	26	367.2	586.6	617.3	633.1	84	633.7	81.7	83.4	83.9
225	2x200	26.3	379	585.6	616.4	632.7	83.5	632.7	81.3	82.9	83.5
225	2x400	26.6	341.4	582.6	615.6	632.3	83	633.1	80.4	82.3	83
225	2x500	26.8	292.1	580.7	614.7	631.9	82.7	632.2	80	82	82.7
225	2x750	27.1	214.5	576.1	613	630.9	82.3	632	79.2	81.5	82.2

### 12.CW RF Characteristics – Swept T

Table 9 – RF characteristics

Test signal: CW; RF performance at  $V_{DS}=50V$ ; Total  $I_{Dq}=100mA$ ;  $T_{cooling\ water}$  =swept from 5°C to 85°C

Symbol	Parameter	Conditions	Typical	Unit
f	Frequency		225	MHz
$V_{DS}$	Drain-source voltage		50	V
$V_{GS}$	Gate-source voltage	$I_{Dq} = 50mA$ x section	1.9	V

### 13.CW Performance Details – Swept T

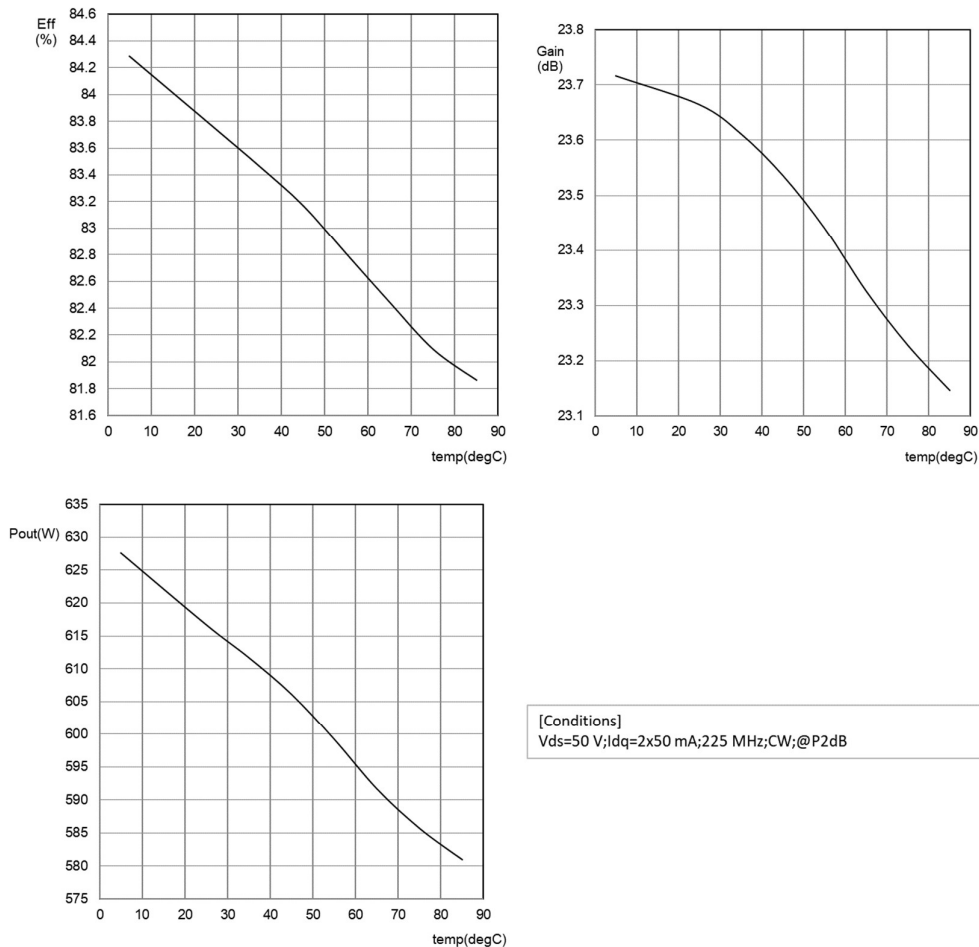


Figure 5 – Gain-Efficiency-Power at 2dBcp versus water temperature



Table 10 – RF Performance overview

Free [MHz]	T [°C]	Gmax [dB]	Pout@Gmax [W]	P1dB [W]	P2dB [W]	P3dB [W]	Effmax [%]	Pout@Effmax [W]	Eff P1dB [%]	Eff P2dB [%]	Eff P3dB [%]
225	5	25.716	430.77	601.2	627.67	642.05	84.706	641.94	82.864	84.286	84.705
225	25	25.664	391.39	587.24	616.74	632.56	84.214	633.42	82.216	83.739	84.208
225	35	25.611	392.5	581.5	611.72	627.86	83.957	628.09	81.895	83.463	83.951
225	45	25.536	392.21	575.72	606.13	622.28	83.67	621.71	81.584	83.171	83.661
225	55	25.44	391.03	568.53	599.2	615.4	83.323	616.32	81.177	82.805	83.307
225	65	25.325	390.92	561.52	591.68	607.8	82.939	607.92	80.847	82.442	82.935
225	75	25.227	388.85	555.28	585.7	601.76	82.584	601.04	80.462	82.093	82.582
225	85	25.146	390.28	550.8	580.97	596.92	82.375	598.01	80.262	81.863	82.332

14. User Guide

14.1 Biasing

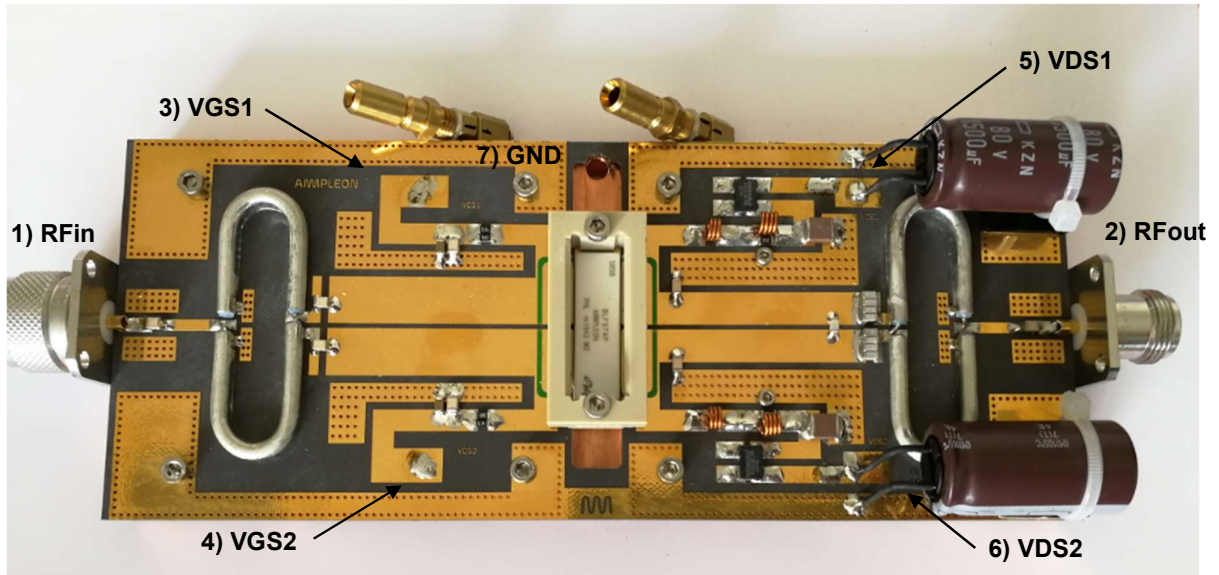


Figure 6 – BLF974P application board pin configuration

Table 11 – Pin description

Symbol	Pin	Description
RF <sub>IN</sub>	1	RF input
RF <sub>OUT</sub>	2	RF output
V <sub>GS1</sub>	3	Gate-source voltage section 1
V <sub>GS2</sub>	4	Gate-source voltage section 2
V <sub>DS1</sub>	4	Drain-source voltage section 1
V <sub>DS2</sub>	4	Drain-source voltage section 2
GND	5	Negative supply terminal for V <sub>DS</sub> and V <sub>GS</sub>

Remark: Use an electrolytic capacitor, 470µF/63V or 1000µF/63V, external to the application circuit but close to supply pin 5,6 and 7 for usage in Pulsed mode.

14.2 Bill of Materials

Table 12 – Bill of Materials

Part	Description	Part number	Value/Remark
C1, C6, C7, C21	Multilayer ceramic chip capacitor	1 nF	ATC100B
C2, C3	Multilayer ceramic chip capacitor	68 pF	ATC100B
C4, C5, C10, C11	Multilayer ceramic chip capacitor	4.7uF / 100V	C3225X7S2A475K200AE
C8, C9	Multilayer ceramic chip capacitor	51 pF	ATC100B
C12	Multilayer ceramic chip capacitor	20 pF	ATC800B
C13, C14, C15, C16, C17, C18	Multilayer ceramic chip capacitor	10 pF	ATC800B
C19, C20	Multilayer ceramic chip capacitor	20pF	ATC800B
C22, C23	Electrolytic capacitor	1500 uF/80V	
R1, R2	SMD resistor	10 Ohm	SMD 1206
R3, R4	SMD resistor	4R7 Ohm	SMD 1206
R5, R6	Shunt resistor	0.01R	Ohmite/FC4L110R010FER
R7,R8	SMD resistor	2x3R6 Ohm	0.6W 1210
L1, L2	SMD air core inductor	17.5 nH	B06TJLB Coilcraft
L3, L4	SMD air core inductor	35.5 nH	B09TJLC Coilcraft
B1, B2, B3, B4	Coaxial line	50 Ohm, 58mm	HUBER+SUHNER EZ-141-AL-TP-M17

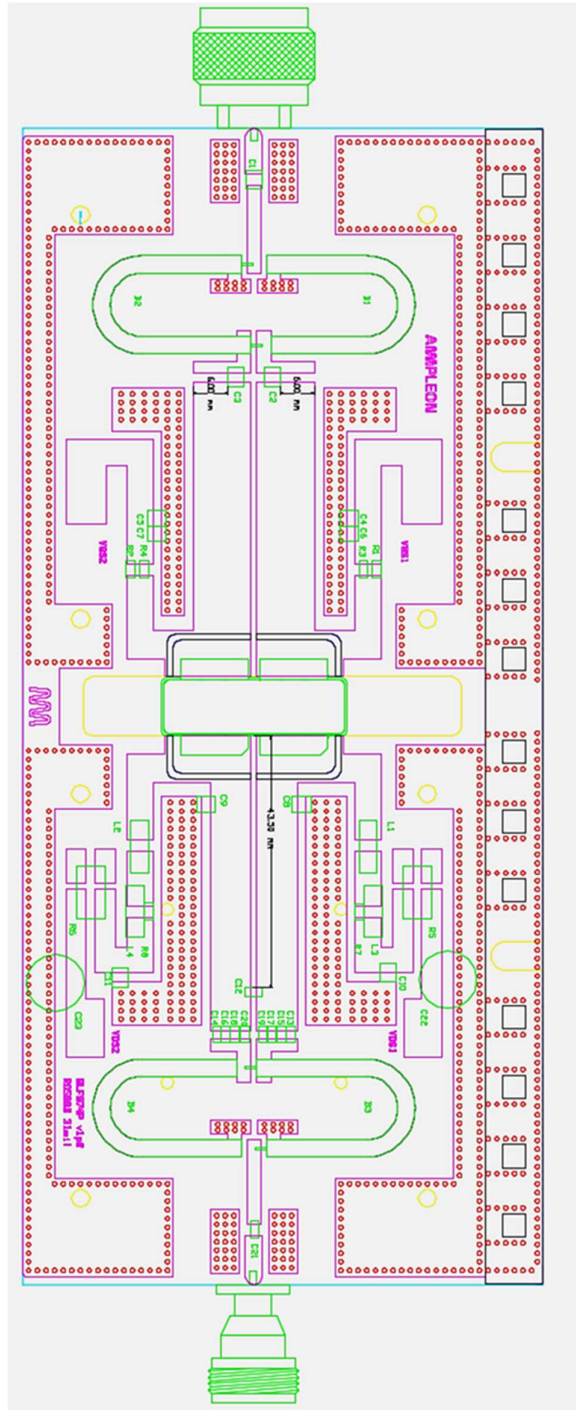


Figure 7 – BLF974P application board components placement

### 14.3 Temperature behavior

For operation of this demo board water cooling should be applied.  
Water temperature should be kept below 85 °C.

### 14.4 Device markings

*Table 13 – Module specifics*

Parameter	Value
Manufacturer	Ampleon
Device	BLF974P
Comments	Engineering sample

## 15. Legal information

### 15.1 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.

### 15.2 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'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 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 accepts 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.

**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.

### 15.3 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 trademarks.

### 15.4 Contact information

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

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