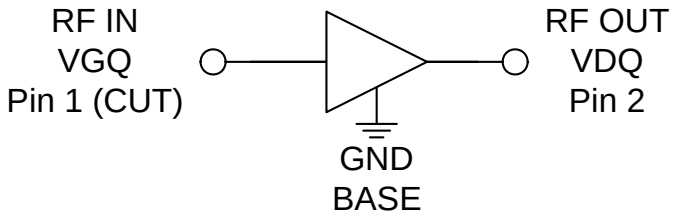
RF3931

30W GaN WIDE-BAND POWER AMPLIFIER

Package Style: Flanged Ceramic

Features

- Broadband Operation DC to 3GHz
- Advanced GaN HEMT Technology
- Advanced Heat-Sink Technology
- Gain=15dB at 2GHz
- 48V Operation Typical Performance
  - Output Power 30W at P3dB
  - Power Added Efficiency 65%
  - -40°C to 85°C Operation
- EAR99 Export Control



Functional Block Diagram

Applications

- Commercial Wireless Infrastructure
- Cellular and WiMAX Infrastructure
- General Purpose Broadband Amplifiers
- Public Mobile Radios
- Industrial, Scientific and Medical

Product Description

The RF3931 is a 48 V 30 W high power discrete amplifier designed for commercial wireless infrastructure, cellular and WiMAX infrastructure, industrial/scientific/medical, and general purpose broadband amplifier applications. Using an advanced high power density Gallium Nitride (GaN) semiconductor process, these high-performance amplifiers achieve high efficiency and flat gain over a broad frequency range in a single amplifier design. The RF3931 is an unmatched GaN transistor packaged in a hermetic, flanged ceramic package. This package provides excellent thermal stability through the use of advanced heat sink and power dissipation technologies. Ease of integration is accomplished through the incorporation of simple, optimized matching networks external to the package that provide wideband gain and power performance in a single amplifier.

RF3931 is the first product released in RFMD's new family of GaN Unmatched Power Transistors. Based on RFMD's robust GaN1 HEMT process technology, it offers customers high power and high efficiency broadband power amplification in a low-cost green solution.

Ordering Information

RF3931	30W GaN Wide-Band Power Amplifier
RF3931PCBA-410	Fully Assembled Evaluation Board Optimized for 2.14GHz: 48V Operation

Optimum Technology Matching® Applied

☐ GaAs HBT	☐ SiGe BiCMOS	☐ GaAs pHEMT	☑ GaN HEMT
☐ GaAs MESFET	☐ Si BiCMOS	☐ Si CMOS	☐ RF MEMS
☐ InGaP HBT	☐ SiGe HBT	☐ Si BJT	☐ LDMOS

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Absolute Maximum Ratings

Parameter	Rating	Unit
Drain Voltage (V_D)	175	V
Gate Voltage (V_G)	-8 to +2	V
Operational Voltage	50	V
RF - Input Power	37	dBm
Ruggedness (VSWR)	10:1	
Storage Temperature Range	-55 to +125	°C
Operating Temperature Range (T_L)	-40 to +85	°C
Operating Junction Temperature (T_J)	200	°C
Human Body Model	Class 1A	
MTTF (T_J < 200°C)	1.00E+06	hours
Thermal Resistance (junction to case)	3.6	°C/W

*MTTF - Estimated conditions and rating

Operation of this device beyond any one of these limits may cause permanent damage. For reliable continuous operation, the device voltage and current must not exceed the maximum operating values specified in the table on page two.

Bias Conditions should also satisfy the following expression:

$I_D V_D < (T_J - T_C) / R_{TH\ J\text{-}C}$ and $T_C = T_{CASE}$

Caution! ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EU Directive 2002/95/EC (at time of this document revision).

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Recommended Operating Conditions					
Drain Voltage (V_{dsq})	28		48	V	
Gate Voltage (V_{gsq})	-5	-3	-2.5	V	
Drain Bias Current		130		mA	
RF Input Power (Pin)			37	dBm	
RF Performance Characteristics					
Frequency Range	DC		3000	MHz	
Linear Gain		20		dB	P_{OUT}=30dBm, 900MHz [1, 2]
	13	15		dB	P_{OUT}=30dBm, 2.14GHz [1, 2]
Input Return Loss			-10	dB	2.14GHz [1, 2]
Gain Variation with Temperature		-0.015		dB/°C	
Output Power (P3dB)		50		W	900MHz [1, 2]
		47		dBm	900MHz [1, 2]
	32	44.7		W	2.14GHz [1, 2]
	45	46.5		dBm	2.14GHz [1, 2]
Power Added Efficiency (PAE)		65		%	900MHz [1, 2]
	59	62		%	2.14GHz [1, 2]

[1] Test Conditions: CW Operation, V_{dsq}=48V, I_{dq}=130mA, T=25°C

[2] Performance in a standard tuned test fixture

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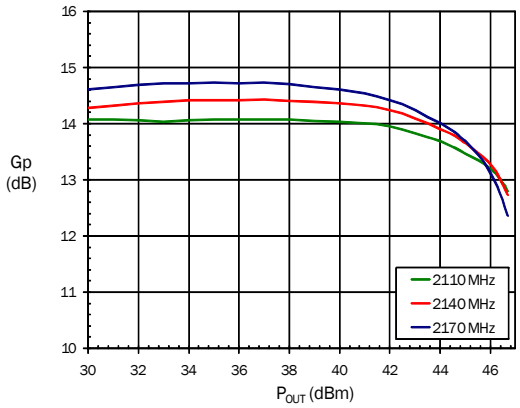
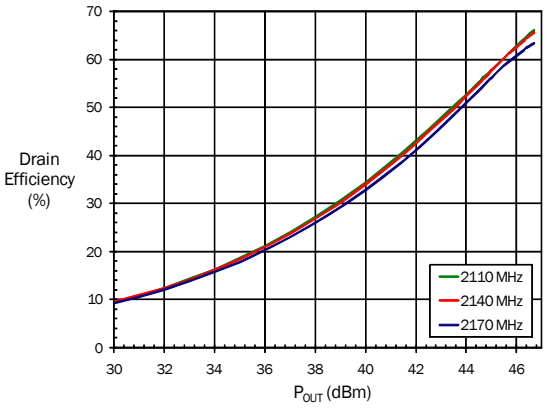
Typical Performance in standard fixed tuned test fixture (CW, T=25°C)

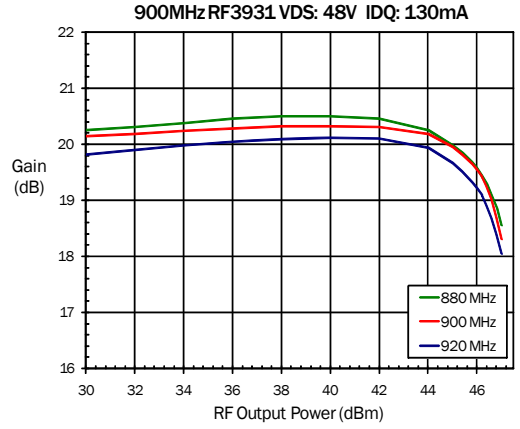
Power Gain Vs Output Power
RF3931 VDS: 48V IDQ: 130mA



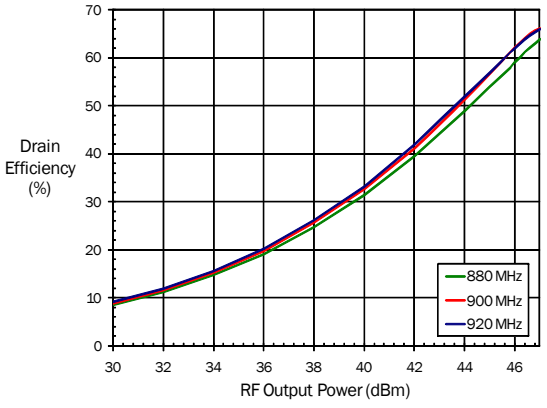
Drain Efficiency Vs Output Power
RF3931 VDS: 48V IDQ: 130mA



Gain Vs. Output Power and Frequency
900MHz RF3931 VDS: 48V IDQ: 130mA



Drain Efficiency Vs. Output Power and Frequency
RF3931 VDS: 48V IDQ: 130mA (20mA/mm)



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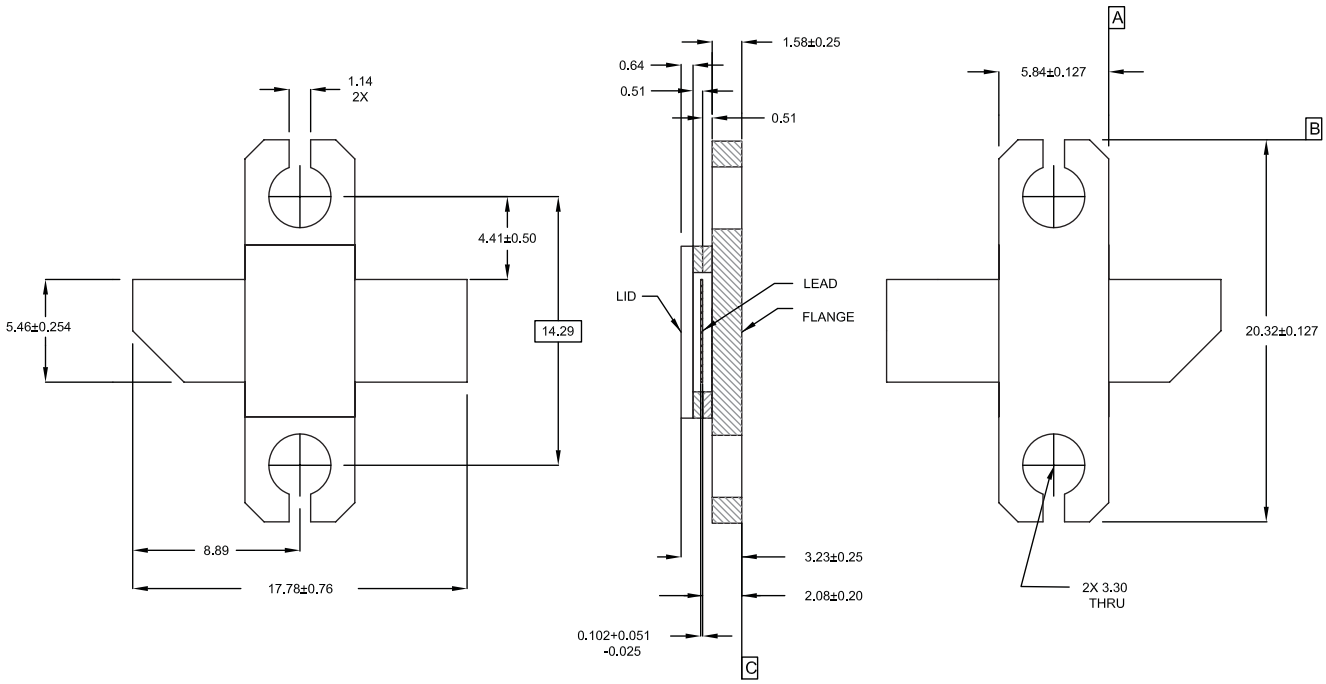
Package Drawing



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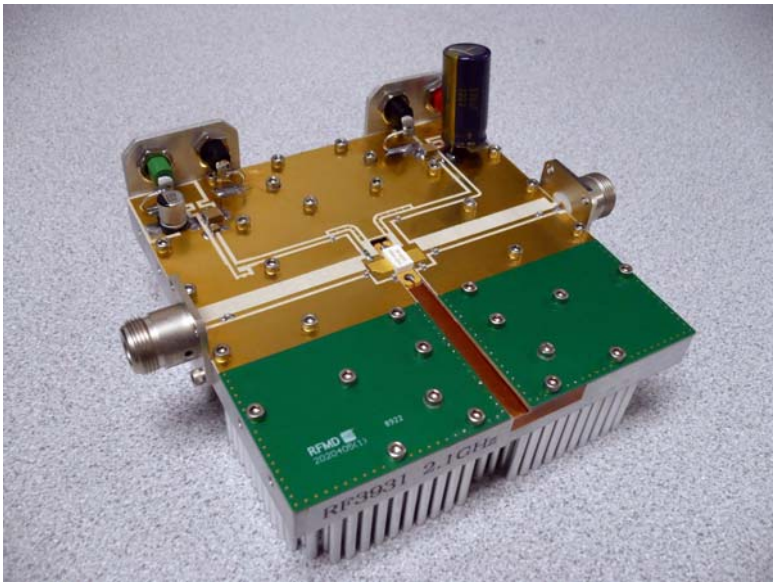
Bias Instruction for RF3931 Evaluation Board

ESD Sensitive Material. Please use proper ESD precautions when handling devices of evaluation board.

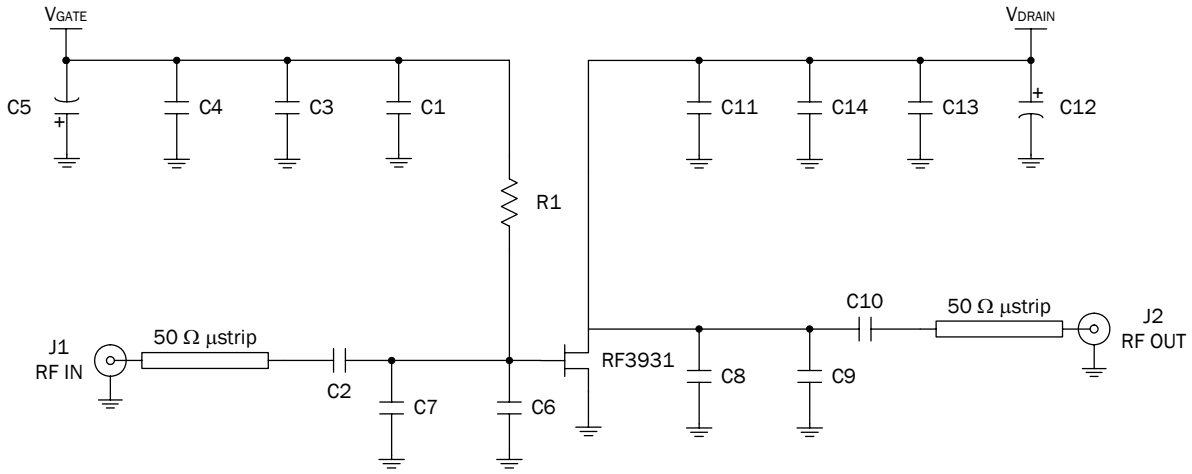
Evaluation board requires additional external fan cooling.

Connect all supplies before powering up the evaluation board.

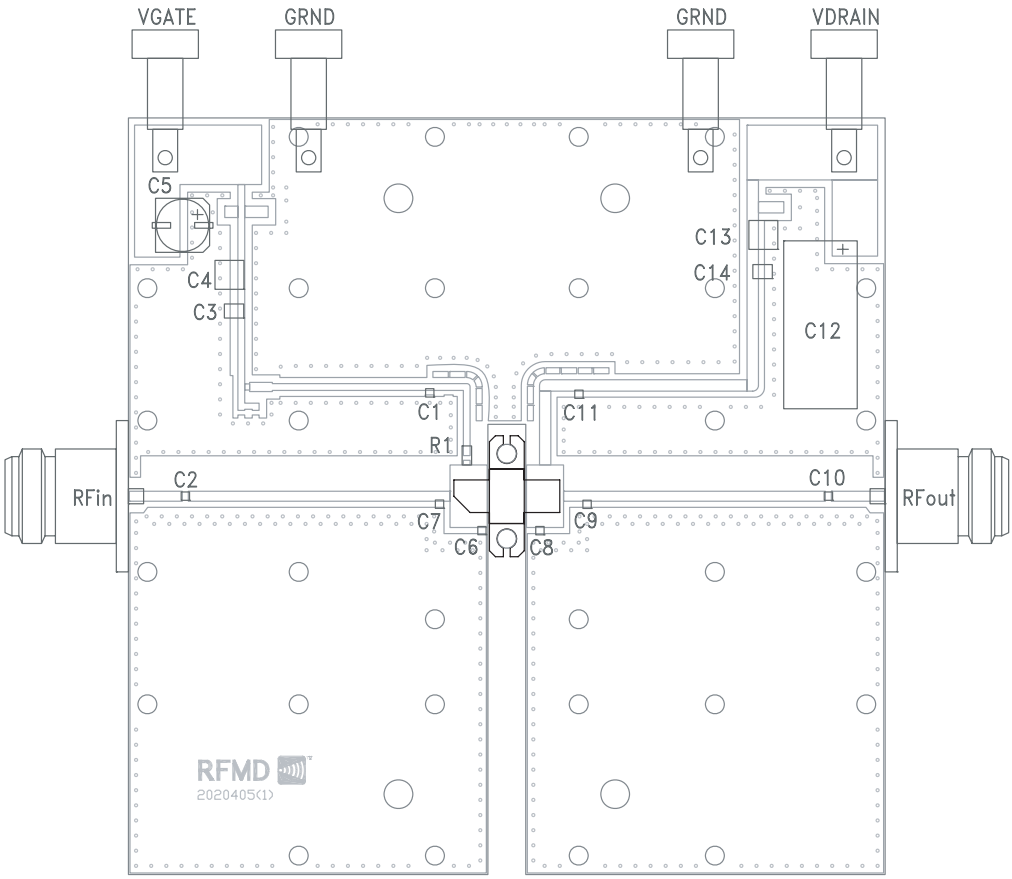
1. Connect RF cables at RF_{IN} and RF_{OUT}.
2. Connect ground to the ground supply terminal, and ensure that both the V_G and V_D grounds are also connected to this ground supply terminal.
3. Apply -6V to V_G.
4. Apply 48V to V_D.
5. Increase V_G until drain current reaches desired bias point.
6. Turn on the RF input.



2.1GHz Evaluation Board Schematic



2.1GHz Evaluation Board Layout



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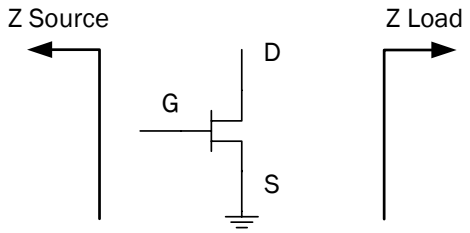
2.1GHz Evaluation Board Bill of Materials

Designator	Description	QTY
C1, C2, C10, C11	33pF, ± 5%, NPO Ceramic, ATC800A	4
C3, C14	0.1uF, 100V, 1210, X7R Ceramic, Murata GRM32NR72A104KA01L	2
C4, C13	4.7uF, 100V, 2220, X7R Ceramic, Murata GRM55ER72A475KA01L	2
C5	100uF, 50V, Electrolytic, Panasonic ECE-V1HA101UP	1
C6	2.2pF, ± 0.1pF, NPO Ceramic, ATC800A	1
C7	0.7pF, ± 0.1pF, NPO Ceramic, ATC800A	1
C8	1.0pF, ± 0.1pF, NPO Ceramic, ATC800A	1
C9	2.7pF, ± 0.1pF, NPO Ceramic, ATC800A	1
C12	330uF, 100V, Electrolytic, Panasonic EEU-FC2A331	1
R1	10 Ohm, ¼ W, 1206, SMT resistor	1
-	PCB, Taconic RF35, Er=3.5, H=0.030"	

RF3931 Source and Load Impedances



Frequency (MHz)	Z Source (Ω)	Z Load (Ω)
450	5+j10.5	20+j8.2
750	3.2+j5.6	15.6+j10.2
900	2.5+j3.6	13.6+j10.4
1300	1.6+j0.4	9.6+j9.5
1700	1.2-j1.6	7.2+j7.9
1900	1.1-j2.6	6.4+j7.1
2100	1.1-j3.7	5.8+j6.3
2300	1.1-j5.0	5.3+j5.5
2500	1.1-j6.4	5.0+j4.7

Impedances for optimized output power, VDS=48V, IDQ=130mA