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# MICRF300 Evaluation Board

315/433/868/915MHz, 1.8V to 3.6V,  
Low-Noise Amplifier with Shutdown

## General Description

The MICRF300 evaluation board (EV) allows the customer to easily evaluate the MICRF300 low-noise amplifier (LNA) with low-power shutdown mode. The device is targeted for low-power, low-data rate applications at 315/433.92MHz, achieving a low 1.15dB noise figure with 18dB of gain. This helps to improve receiver system noise figure and sensitivity. The device also performs well at 868/915MHz, achieving 13dB of gain and a noise figure of 1.7dB. The device consumes a low 2.5mA of supply current while operating and under 1 $\mu$ A of supply current in shutdown mode. A simple logic-level enable input enables or disables the MICRF300. The device requires a simple input and output matching network to optimize performance for the desired frequency. Evaluation boards that have been tuned for 315MHz, 433.92MHz, or 900MHz (covers common frequencies of 868MHz and 902MHz to 928MHz) are available. The device can be tuned to support other RF frequencies between 100MHz and 1000MHz.

Data sheets and support documentation can be found on Micrel's web site at [www.micrel.com](http://www.micrel.com).

## Output Measurements

The MICRF300 EV kits are fully assembled and factory tested. Follow the instructions in the "Getting Started" section for proper device evaluation.

## Test Equipment Required

- A DC power supply that can provide 1.8V to 3.6V and 5mA of supply current
- An ammeter used to measure device current
- An RF signal generator that can deliver -50dBm to -30dBm of output power over the 100MHz to 1000MHz frequency range
- An RF spectrum analyzer that covers the operating frequency range
- Two 50 $\Omega$  coaxial cables with SMA connectors
- **Optional:** A noise figure meter with noise source; for example, a HP8970B NF meter with a HP346B noise source
- **Optional:** A network analyzer to measure gain and return loss

## Precautions

The MICRF300 evaluation board does not have reverse polarity protection. Applying a negative voltage to the  $V_{IN}$  terminal may damage the device.

## Ordering Information

Part Number	Description
MICRF300-315EV	MICRF300 Evaluation Board (EV) tuned for 315MHz
MICRF300-433EV	MICRF300 Evaluation Board (EV) tuned for 433.92MHz
MICRF300-900EV	MICRF300 Evaluation Board (EV) tuned for 868/915MHz

## Getting Started

### Measuring Power and Gain

1. Do not turn on power supply. Connect an external supply to VCC. Connect the supply voltage through an ammeter to VCC and GND, paying careful attention to polarity and supply voltage ( $1.8V \leq VCC \leq 3.6V$ ).
2. Enable the MICRF300EV. The evaluation board can be enabled through the EN Pin J4. A voltage  $\leq 0.2V$  on the EN pin places the MICRF300 in shutdown mode. A voltage  $\geq 1.2V$  on the EN pin enables the MICRF300. Connect the output supply voltage to the EN pin. J4.
3. Set the RF generator to the operating frequency of the MICRF300EV at an output power level of  $-30\text{dBm}$ . Leave the RF power off until all connections are made and DC power is applied to the MICRF300.
4. Connect an SMA coaxial cable from the RF input (RFIN), J1, to the RF generator's output. Connect an SMA coaxial cable from the RF output (RFOUT), J2, to the input of the spectrum analyzer.
5. Turn on the DC supply. Supply current is typically  $2.5\text{ mA}$  with  $EN \geq 1.2V$  and  $0.05\mu\text{A}$  with  $EN \leq 0.2V$ .
6. Turn on the output power from the RF signal generator and observe RF output power level at J2. Calculate gain with respect to the RF input power level.

**Optional:** Further evaluation can be conducted using a network analyzer. These measurements include S11, S22, S12, and S21 values. Refer to your network analyzer's user manual for setup requirements.

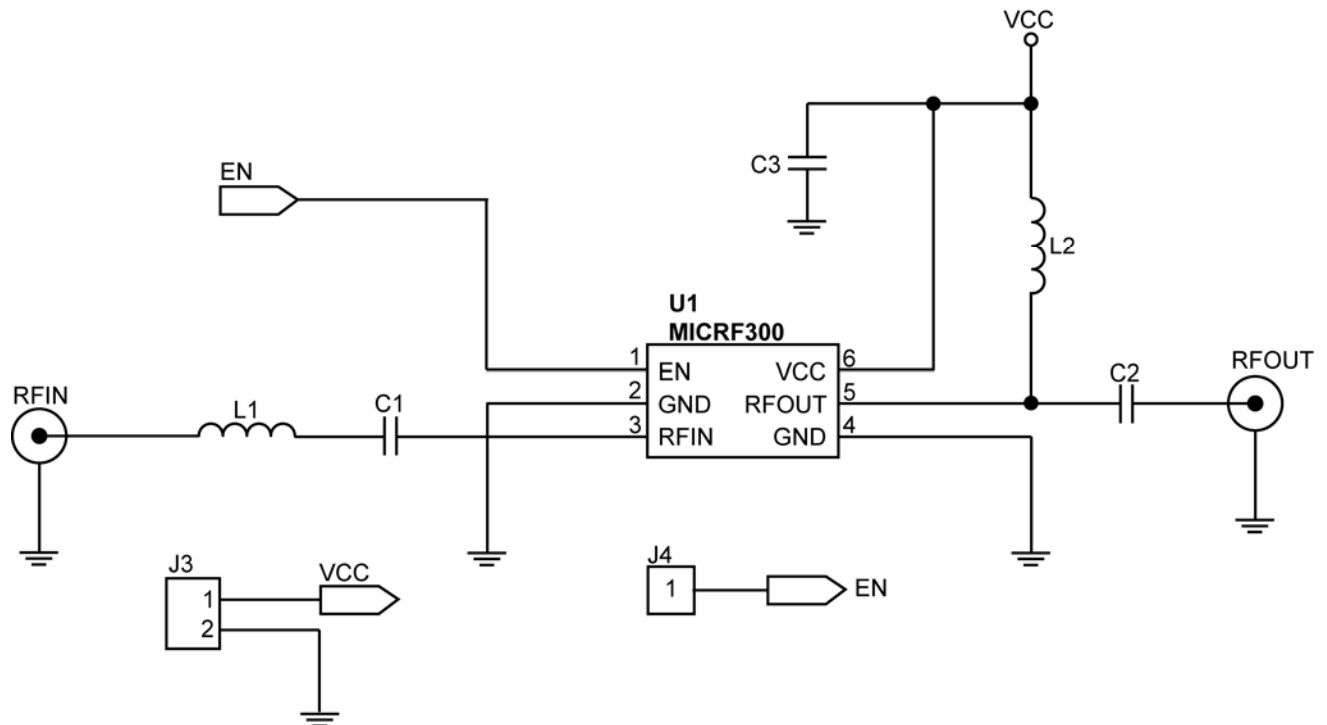
### Checking Noise Figure

Noise figure measurements on a low-noise device such as the MICRF300 are sensitive to board parasitic and lab setup losses. Connector, cable, and board losses must be taken into account. There are many techniques and precautions for measuring low noise-figure values. A discussion on low-level noise-figure measurements is beyond the scope of this document. For more information about performing low-level noise-figure measurements refer to Hewlett Packard's *Application Note #57-2, Noise Figure Measurement Accuracy*.

### Layout Considerations

Good PC board layout procedures are important for successful RF circuit design. The MICRF300EV kit can be used as a guide for laying out the printed circuit board. Locate a decoupling capacitor close to the device VCC pin and additional capacitors on long VCC traces. These decoupling capacitors, with a proper ground, minimize supply noise coupling. Good grounding includes connecting the device GND pin directly to the ground plane through vias. Also connect any other component requiring a GND connection directly through to the ground plane using a via.

### Evaluation Board Schematic



### Bill of Materials for 315MHz

Item	Part Number	Manufacturer	Description	Qty.
C1	GRM155R71H102K	Murata <sup>(1)</sup>	1nF ±10% 0402 capacitor	1
C2	GRM1555C1H5R6C	Murata	5.6pF ±0.25pF 0402 capacitor	1
C3	GRM155R61A104K	Murata	0.1µF ±10% 0402 capacitor	1
L1	0402CS-33NXJ	Coilcraft <sup>(2)</sup>	33nH ±5% 0402 wire wound inductor	1
L2	LQG15HS47NJ	Murata	47nH ±5% 0402 multilayer inductor	1
U1	MICRF300YC6	Micrel, Inc. <sup>(3)</sup>	Low-Noise Amplifier (LNA) with Shutdown in SC70-6	1

**Notes:**

1. Murata: [www.murata.com](http://www.murata.com).
2. Coilcraft: [www.coilcraft.com](http://www.coilcraft.com).
3. Micrel, Inc: [www.micrel.com](http://www.micrel.com).

**Bill of Materials for 433.92MHz**

Item	Part Number	Manufacturer	Description	Qty.
C1	GRM155R71H102K	Murata <sup>(1)</sup>	1nF ±10% 0402 capacitor	1
C2	GRM1555C1H3R9C	Murata	3.9pF ±0.25pF 0402 capacitor	1
C3	GRM155R61A104K	Murata	0.1µF ±10% 0402 capacitor	1
L1	0402CS-22NXJ	Coilcraft <sup>(2)</sup>	22nH ±5% 0402 wire wound inductor	1
L2	LQG15HS33NJ	Murata	33nH ±5% 0402 multilayer inductor	1
U1	<b>MICRF300YC6</b>	<b>Micrel, Inc.<sup>(3)</sup></b>	<b>Low-Noise Amplifier (LNA) with Shutdown in SC70-6</b>	<b>1</b>

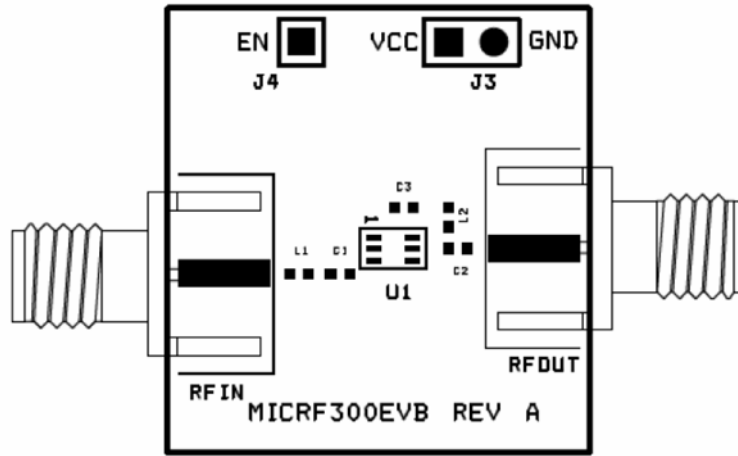
**Bill of Materials for 900MHz (868/915MHz)**

Item	Part Number	Manufacturer	Description	Qty.
C1	GRM1555C1H271J	Murata(1)	270pF ±5% 0402 capacitor	1
C2	GRM1555C1H1R8C	Murata	1.8pF ±0.25pF 0402 capacitor	1
C3	GRM155R71E104K	Murata	0.1µF ±10% 0402 capacitor	1
L1	LQG15HS2N7S	Murata	2.7nH ±0.3nH 0402 multilayer inductor	1
L2	LQG15HS10NJ	Murata	10nH ±5% 0402 multilayer inductor	1
U1	<b>MICRF300YC6</b>	<b>Micrel, Inc.<sup>(3)</sup></b>	<b>Low-Noise Amplifier (LNA) with Shutdown in SC70-6</b>	<b>1</b>

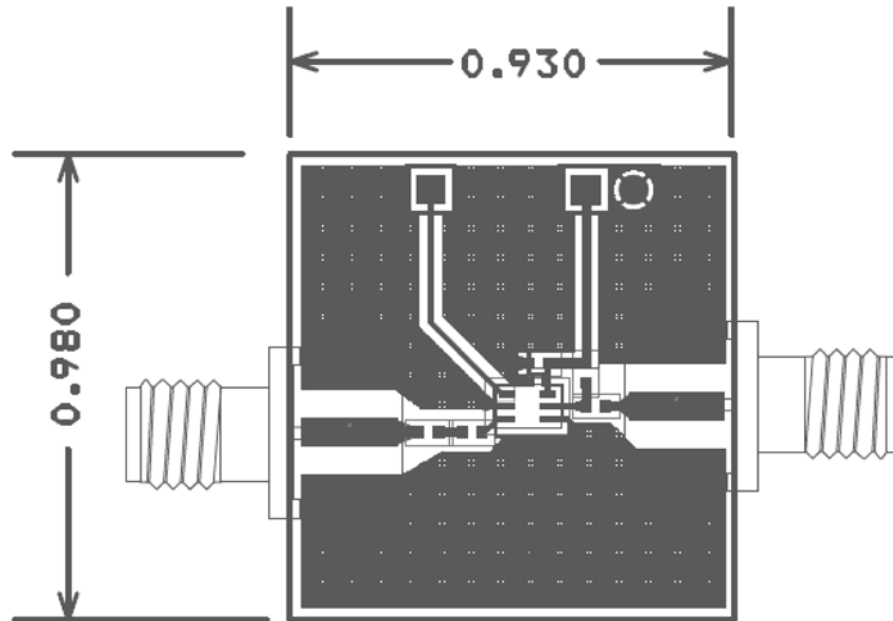
**Notes:**

1. Murata: [www.murata.com](http://www.murata.com).
2. Coilcraft: [www.coilcraft.com](http://www.coilcraft.com).
3. Micrel, Inc: [www.micrel.com](http://www.micrel.com).

### PCB Layout Recommendations

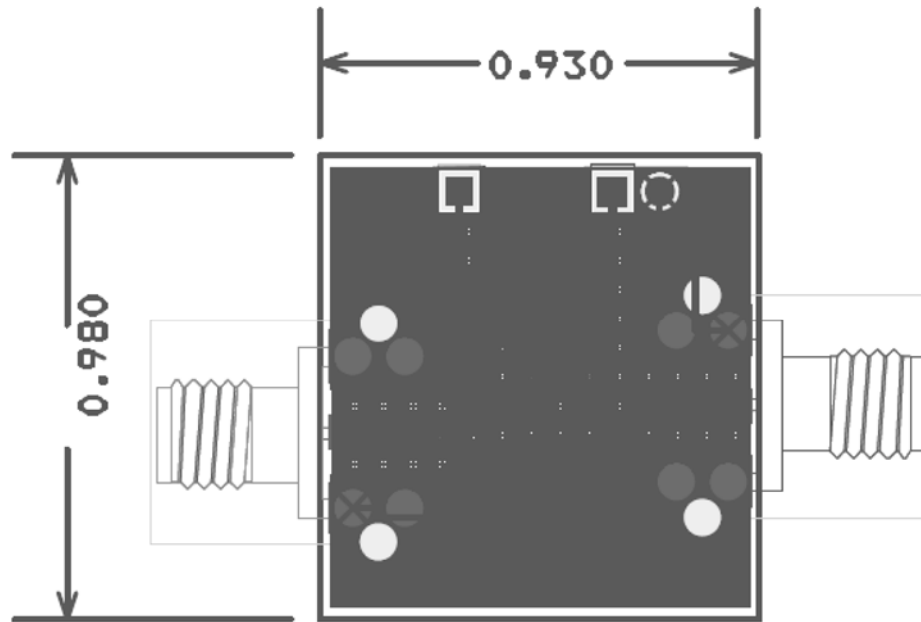


Component Placement



Top Layer

## PCB Layout Recommendations (Continued)



**Bottom Layer**

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