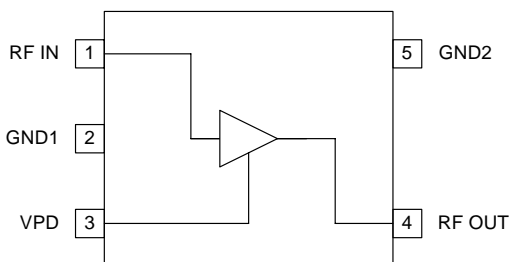


Features

- Low Noise and High Intercept Point
- Adjustable Bias Current
- Power Down Control
- Single 2.5V to 6.0V Power Supply
- 150MHz to 2500MHz Operation
- Extremely Small SOT 5-Lead Package

Applications

- TDMA/CDMA/FM Cellular PCS LNA
- Low Noise Transmit Driver Amplifier
- General Purpose Amplification
- Commercial and Consumer Systems



Functional Block Diagram

Product Description

The RF2361 is a low noise amplifier with a very high dynamic range designed for digital cellular applications. The device functions as an outstanding front end low noise amplifier or power amplifier driver amplifier in the transmit chain of digital subscriber units where low transmit noise power is a concern. When used as an LNA, the bias current can be set externally. When used as a PA driver, the IC can operate directly from a single cell Li-ion battery and includes a power down feature that can be used to completely turn off the device. The IC is featured in a standard SOT 5-lead plastic package.

NOTE: The RF2361 is a non-Pb-free product. If a Pb-free product with the same functionality and package is desired, please see the RF2878.

Ordering Information

| | |
|---------------|--|
| RF2361 | 3V Low Noise Amplifier/ 3V PA Driver Amplifier |
| RF2361 PCBA-D | Fully Assembled Evaluation Board (Driver) |
| RF2361 PCBA-L | Fully Assembled Evaluation Board (LNA) |

Optimum Technology Matching® Applied

- | | | | |
|--|--------------------------------------|-------------------------------------|-----------------------------------|
| <input checked="" type="checkbox"/> GaAs HBT | <input type="checkbox"/> SiGe BiCMOS | <input type="checkbox"/> GaAs pHEMT | <input type="checkbox"/> GaN HEMT |
| <input type="checkbox"/> GaAs MESFET | <input type="checkbox"/> Si BiCMOS | <input type="checkbox"/> Si CMOS | |
| <input type="checkbox"/> InGaP HBT | <input type="checkbox"/> SiGe HBT | <input type="checkbox"/> Si BJT | |

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Absolute Maximum Ratings

| Parameter | Rating | Unit |
|-------------------------------|---------------|-------------|
| Supply Voltage, V_{CC} | -0.5 to +8.0 | V_{DC} |
| Power Down Voltage, V_{PD} | $\leq V_{CC}$ | V_{DC} |
| Input RF Level | +10 | dBm |
| Operating Ambient Temperature | -40 to +85 | $^{\circ}C$ |
| Storage Temperature | -40 to +150 | $^{\circ}C$ |



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.

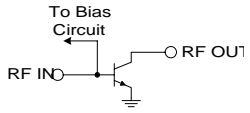
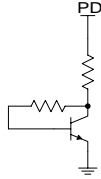
RoHS status based on EU Directive 2002/95/EC (at time of this document revision).

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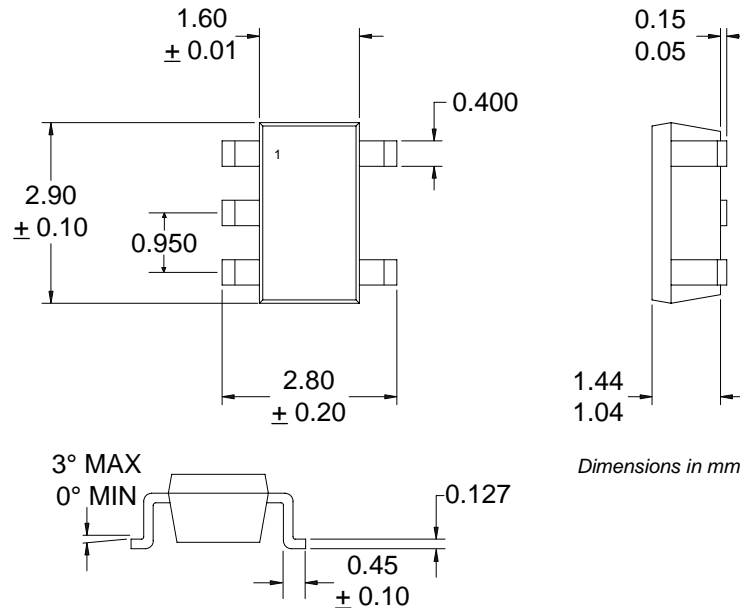
| Parameter | Specification | | | Unit | Condition |
|--|---------------|-------------|-------|------|---|
| | Min. | Typ. | Max. | | |
| Overall | | | | | |
| RF Frequency Range | | 150 to 2500 | | MHz | |
| Low Noise Amplifier 881MHz Performance | | | | | Schematic per LNA Application; T=25 $^{\circ}C$, RF=881MHz, V_{PD} =2.8V, R1=1k Ω |
| Gain | 19.5 | 20 | | dB | V_{CC} =3.0V, I_{CC} =7.6mA |
| | 19.5 | 20 | | dB | V_{CC} =2.7V, I_{CC} =7.5mA |
| Noise Figure | | 1.4 | 1.6 | dB | V_{CC} =3.0V, I_{CC} =7.6mA |
| | | 1.4 | 1.6 | dB | V_{CC} =2.7V, I_{CC} =7.5mA |
| Input IP3 | | +6.0 | | dBm | V_{CC} =3.0V, I_{CC} =7.6mA |
| | | +5.5 | | dBm | V_{CC} =2.7V, I_{CC} =7.5mA |
| Low Noise Amplifier 1950MHz Performance | | | | | Schematic per LNA Application; T=25 $^{\circ}C$, RF=1950MHz, V_{PD} =2.8V, R1=1k Ω |
| Gain | 12.5 | 13 | | dB | V_{CC} =3.0V, I_{CC} =6.4mA |
| | 12.5 | 13 | | dB | V_{CC} =2.7V, I_{CC} =6.3mA |
| Noise Figure | | 1.3 | 1.5 | dB | V_{CC} =3.0V, I_{CC} =6.4mA |
| | | 1.3 | 1.5 | dB | V_{CC} =2.7V, I_{CC} =6.3mA |
| Input IP3 | | +16.5 | | dBm | V_{CC} =3.0V, I_{CC} =6.4mA |
| | | +16.0 | | dBm | V_{CC} =2.7V, I_{CC} =6.3mA |
| Driver Amplifier 836MHz Performance | | | | | Schematic per Driver Amplifier Application; T=25 $^{\circ}C$, RF=836MHz, V_{PD} =2.8V |
| Gain | 19.5 | 20.5 | 21.5 | dB | V_{CC} =3.5V |
| | 19.5 | 20.5 | 21.5 | dB | V_{CC} =3.0V |
| | 19.5 | 20.5 | 21.5 | dB | V_{CC} =2.7V |
| Output IP3 | 25 | +32.0 | 35 | dBm | V_{CC} =3.5V |
| | | +29.0 | | dBm | V_{CC} =3.0V |
| | | +27.8 | | dBm | V_{CC} =2.7V |
| Noise Figure | | 1.9 | 2.0 | dB | V_{CC} =3.5V |
| | | 1.85 | 2.0 | dB | V_{CC} =3.0V |
| | | 1.8 | 2.0 | dB | V_{CC} =2.7V |
| Reverse Isolation | | 25 | | dB | V_{CC} =3.5V |
| | | 25 | | dB | V_{CC} =3.0V |
| | | 25 | | dB | V_{CC} =2.7V |
| Input VSWR | | 1.8:1 | 2.0:1 | | |

| Parameter | Specification | | | Unit | Condition |
|---|---------------|------------|-------|------|---|
| | Min. | Typ. | Max. | | |
| Driver Amplifier 836MHz Performance, cont. | | | | | |
| Output VSWR | | 1.25:1 | 2.0:1 | | Using External LC network used on evaluation board. |
| P _{1dB} | 13 | 14.4 | | dBm | V _{CC} =3.5V |
| | 12 | 12.5 | | dBm | V _{CC} =3.0V |
| | 10.5 | 11.5 | | dBm | V _{CC} =2.7V |
| Power Supply | | | | | |
| | | | | | T = 25 °C |
| Voltage (V _{CC}) | | 2.5 to 6.0 | | V | |
| Voltage (V _{PD}) | 2.7 | 2.8 | 2.9 | V | |
| Current Consumption - Driver Amplifier | 12.5 | 21.5 | 27 | mA | V _{CC} =3.5V; V _{PD} =2.8V; V _{PD} +V _{CC} - Current Consumption from V _{PD} is 2.0mA Typ. @ V _{PD} =2.8V and 3.0mA Max @ V _{PD} =2.9V |
| | 18 | 20 | 22 | mA | V _{CC} =3.5V; V _{PD} =2.7V; V _{PD} + V _{CC} |
| | 19 | 23 | 29 | mA | V _{CC} =3.5V; V _{PD} =2.9V; V _{PD} + V _{CC} |
| Power Down | | | 10 | μA | V _{CC} =3.5V; V _{PD} ≤ 0.9V |
| Driver Amplifier 1880MHz Performance | | | | | |
| | | | | | Schematic per Driver Amplifier Application; T=25 °C, RF=1880MHz, V _{PD} =2.8V |
| Gain | 13.0 | 14.0 | 14.5 | dB | V _{CC} =3.5V |
| | 13.0 | 14.0 | 14.5 | dB | V _{CC} =3.0V |
| | 13.0 | 14.0 | 14.5 | dB | V _{CC} =2.7V |
| Output IP3 | 27 | +35.0 | 38 | dBm | V _{CC} =3.5V |
| | | +31.0 | | dBm | V _{CC} =3.0V |
| | | +28.8 | | dBm | V _{CC} =2.7V |
| Noise Figure | | 1.85 | 2.0 | dB | V _{CC} =3.5V |
| | | 1.8 | 2.0 | dB | V _{CC} =3.0V |
| | | 1.75 | 2.0 | dB | V _{CC} =2.7V |
| Reverse Isolation | | 19 | | dB | V _{CC} =3.5V |
| | | 19 | | dB | V _{CC} =3.0V |
| | | 19 | | dB | V _{CC} =2.7V |
| Input VSWR | | 1.6:1 | 2.0:1 | | |
| Output VSWR | | 1.6:1 | 2.0:1 | | Using External LC network used on evaluation board. |
| P _{1dB} | 14 | 15.6 | | dBm | V _{CC} =3.5V |
| | 13 | 14.1 | | dBm | V _{CC} =3.0V |
| | 12 | 13.1 | | dBm | V _{CC} =2.7V |

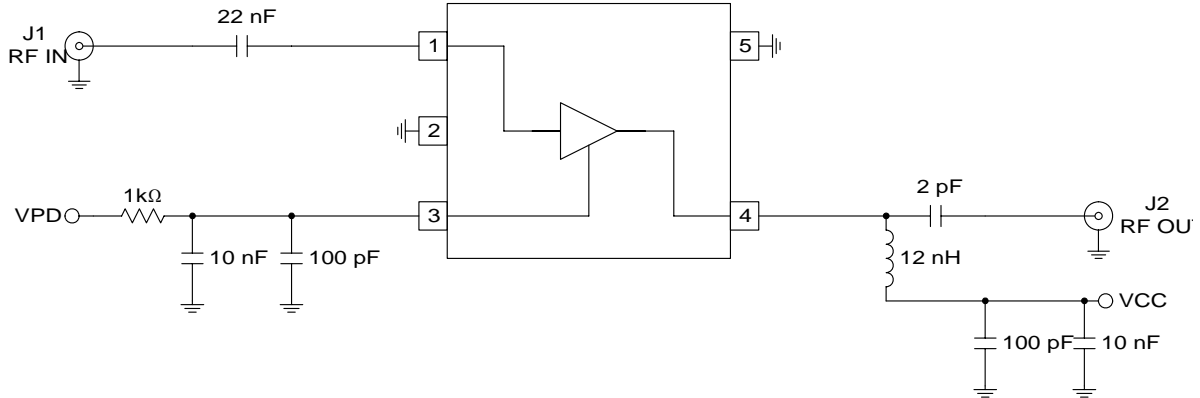
| Parameter | Specification | | | Unit | Condition |
|--|---------------|------------|------|------|---|
| | Min. | Typ. | Max. | | |
| Power Supply | | | | | T = 25 °C |
| Voltage (V _{CC}) | | 2.5 to 6.0 | | V | |
| Voltage (V _{PD}) | 2.7 | 2.8 | 2.9 | V | |
| Current Consumption - Driver Amplifier | 11.5 | 19.5 | 25.5 | mA | V _{CC} =3.5V; V _{PD} =2.8V; V _{PD} +V _{CC} - Current Consumption from V _{PD} is 2.0mA Typ. @ V _{PD} =2.8V and 3.0mA Max @ V _{PD} =2.9V |
| | 16 | 18 | 20 | mA | V _{CC} =3.5V; V _{PD} =2.7V; V _{PD} + V _{CC} |
| | 18 | 20.5 | 27 | mA | V _{CC} =3.5V; V _{PD} =2.9V; V _{PD} + V _{CC} |
| Power Down | | | 10 | μA | V _{CC} =3.5V; V _{PD} ≤ 0.9V |

| Pin | Function | Description | Interface Schematic |
|-----|----------|---|---|
| 1 | RF IN | RF input pin. This pin is DC coupled and matched to 50Ω at 836 MHz. |  |
| 2 | GND1 | Ground connection. Keep traces physically short and connect immediately to ground plane for best performance. | |
| 3 | VPD | For low noise amplifier applications, this pin is used to control the bias current. See plots for bias current settings. An external resistor (R1) can be used to set the bias current for any V _{PD} voltage. For driver amplifier applications, this is the Power Down pin for the IC. V _{PD} =2.8V +/- 0.1V is required for proper operation. V _{PD} < 0.9V turns off the Part. External RF bypassing is required. The trace length between the pin and the bypass capacitors should be minimized. The ground side of the bypass capacitors should connect immediately to ground plane. Nominal current required for V _{PD} =2.8V is 2.0mA typical and 3.0mA Max (@ V _{PD} =2.9V). |  |
| 4 | RF OUT | Amplifier Output pin. This pin is an open-collector output. It must be biased to either V _{CC} or pin 4 through a choke or matching inductor. This pin is typically matched to 50Ω with a shunt bias/matching inductor and series blocking/matching capacitor. Refer to application schematics. | |
| 5 | GND2 | Ground connection. Keep traces physically short and connect immediately to ground plane for best performance. | |

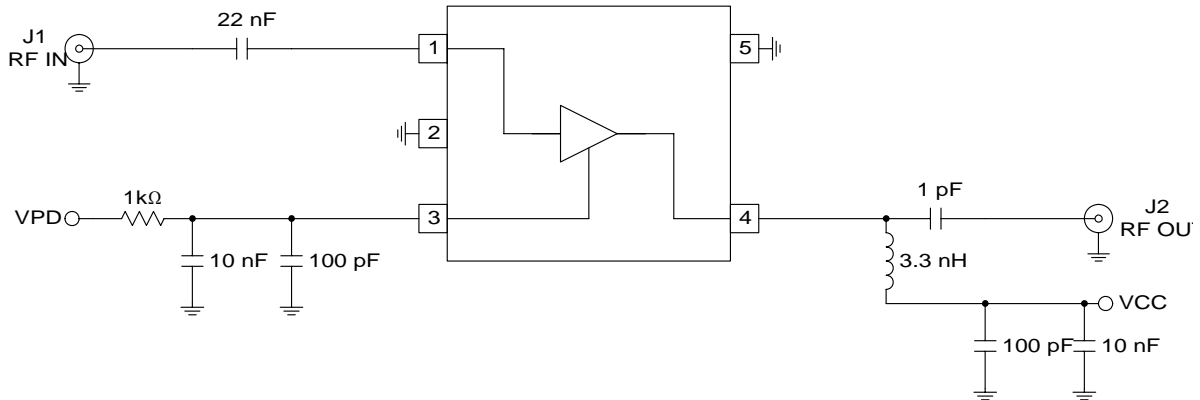
Package Drawing



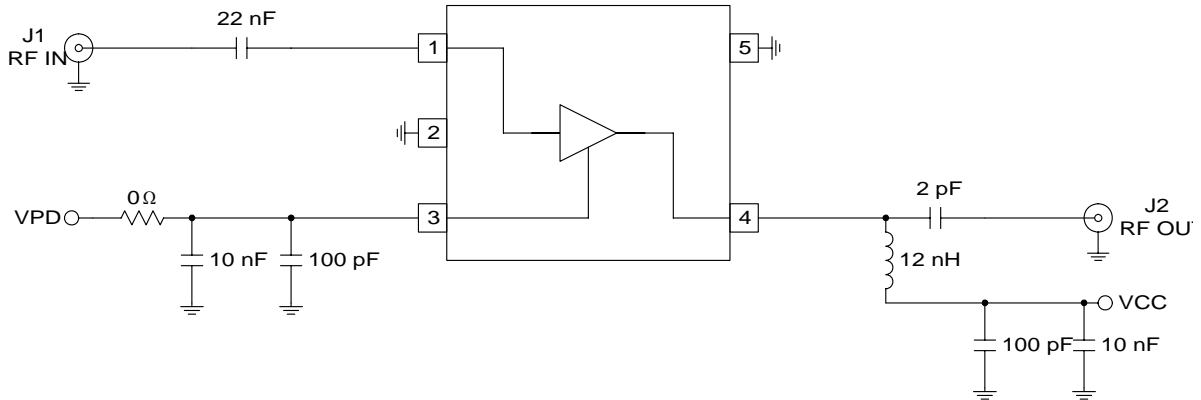
Application Schematic: Low Noise Amplifier ~881MHz Operation



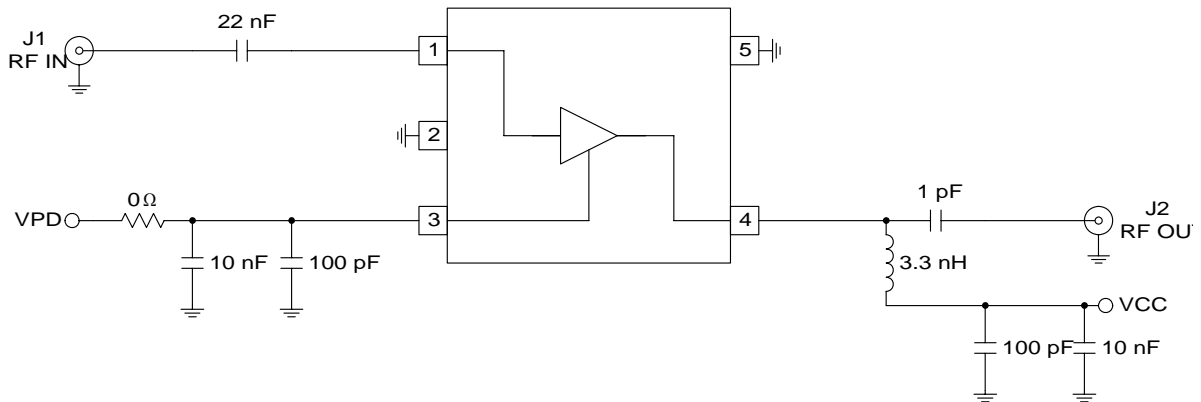
Application Schematic: Low Noise Amplifier ~1950MHz Operation



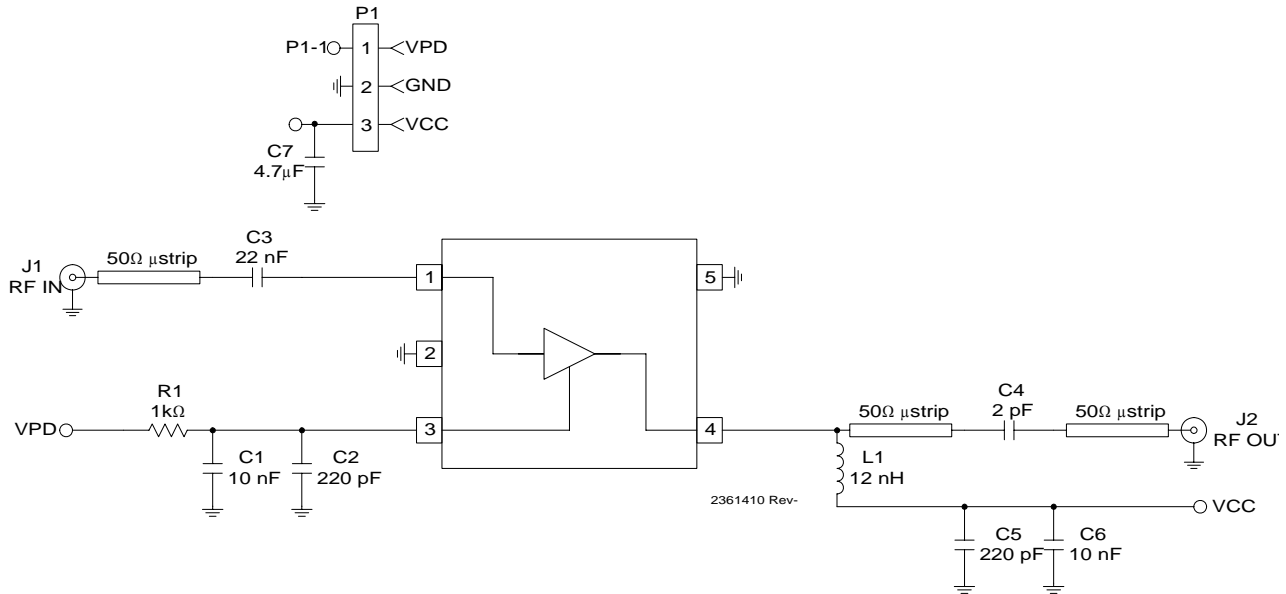
**Application Schematic:
Driver Amplifier ~836MHz Operation**



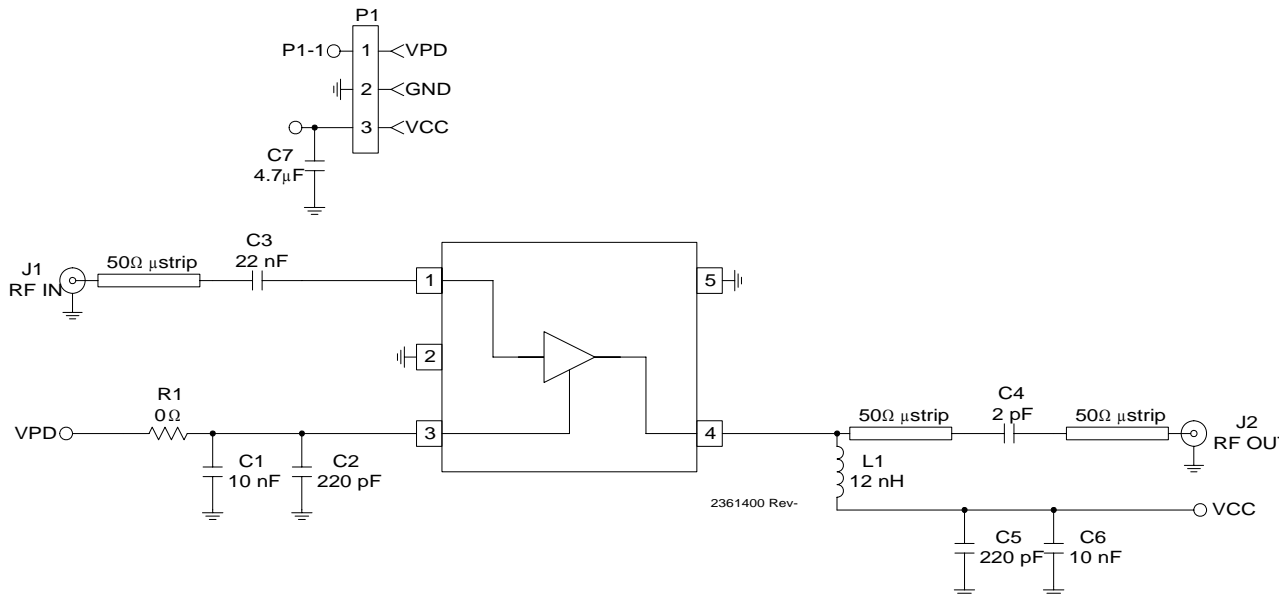
**Application Schematic:
Driver Amplifier ~1880MHz Operation**



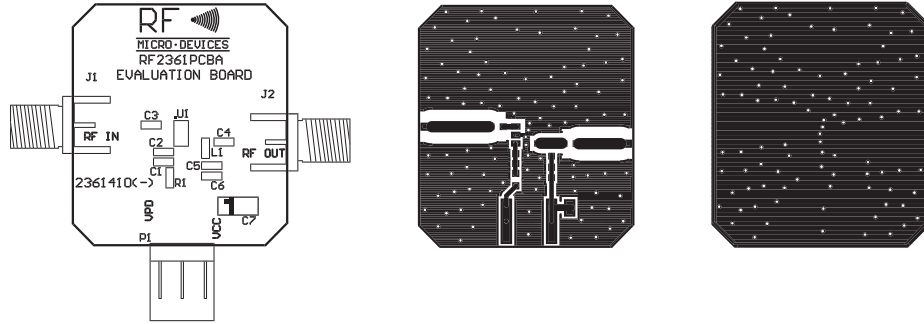
Evaluation Board Schematic: Low Noise Amplifier ~881MHz Operation



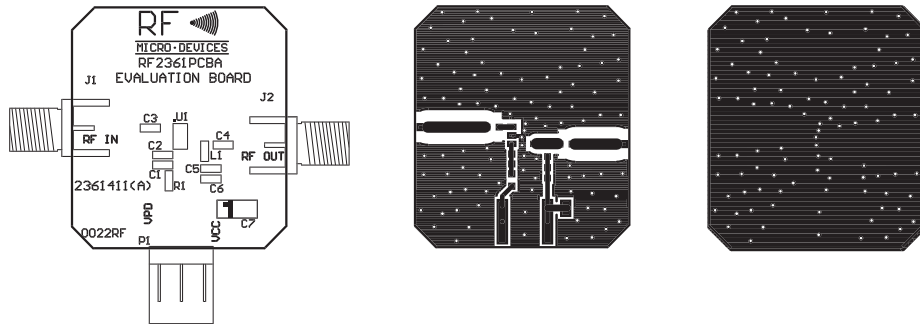
Evaluation Board Schematic: Driver Amplifier ~836MHz Operation

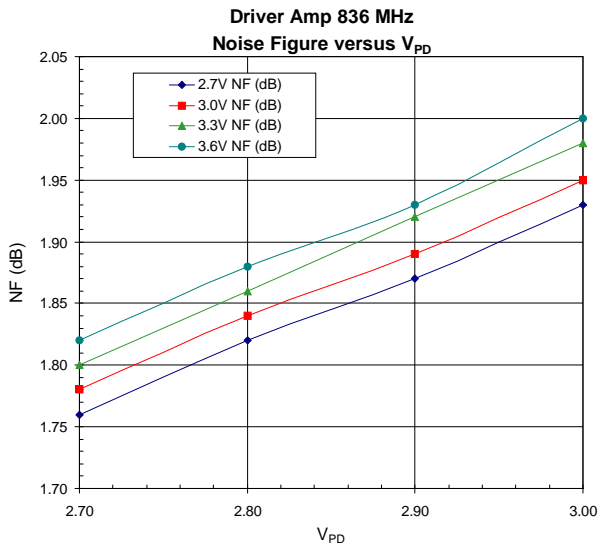
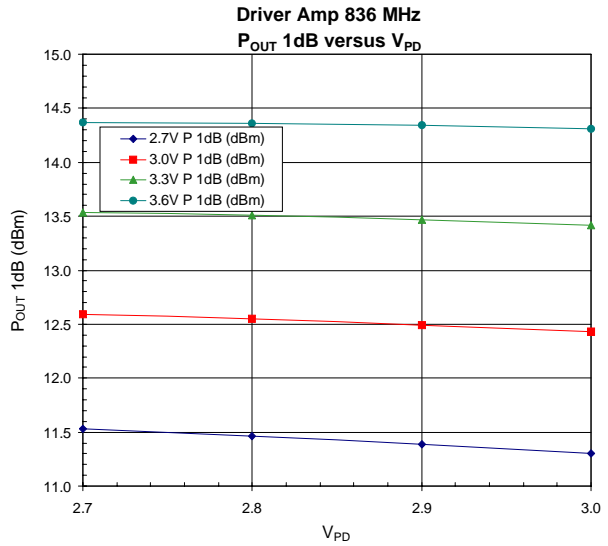
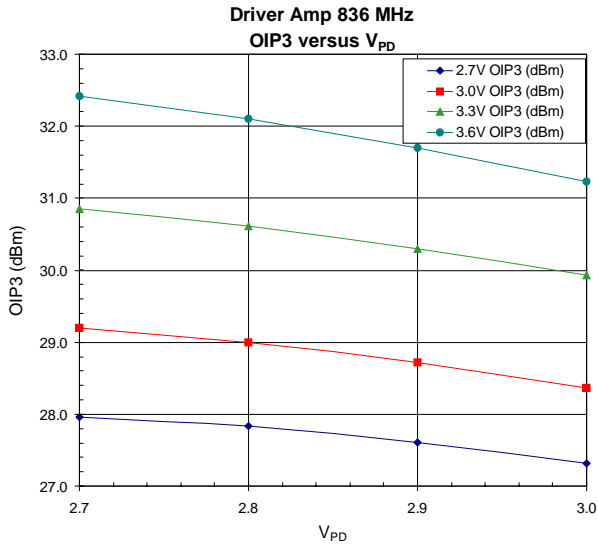
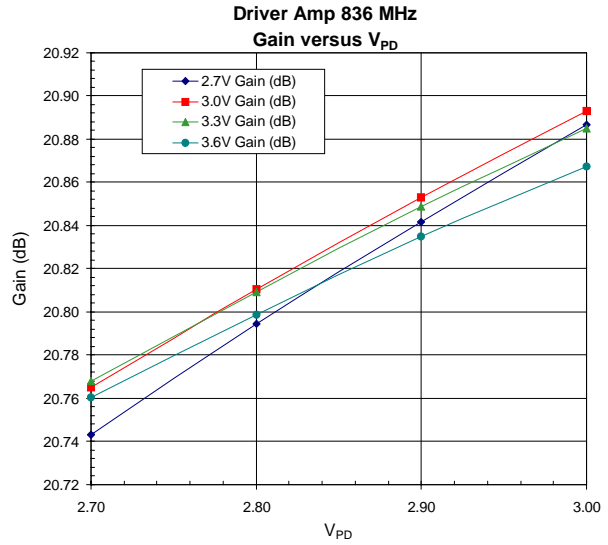
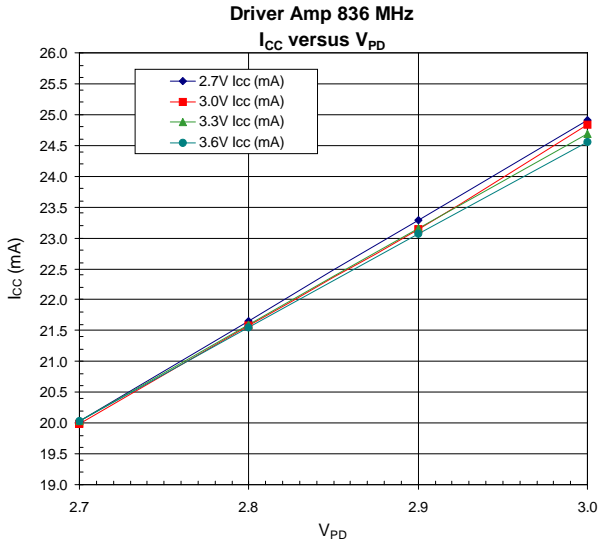


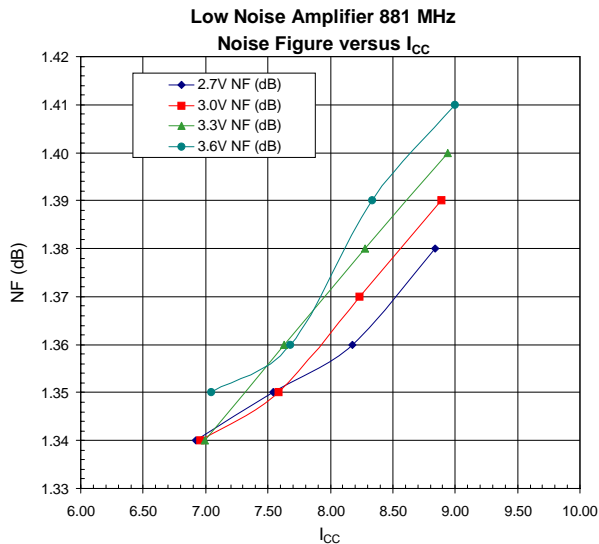
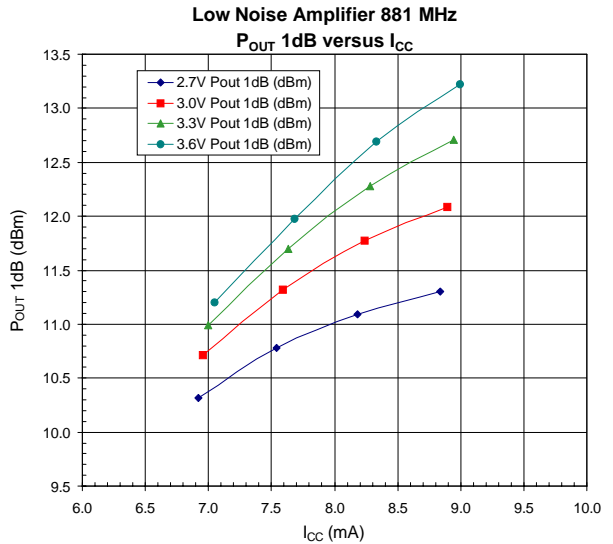
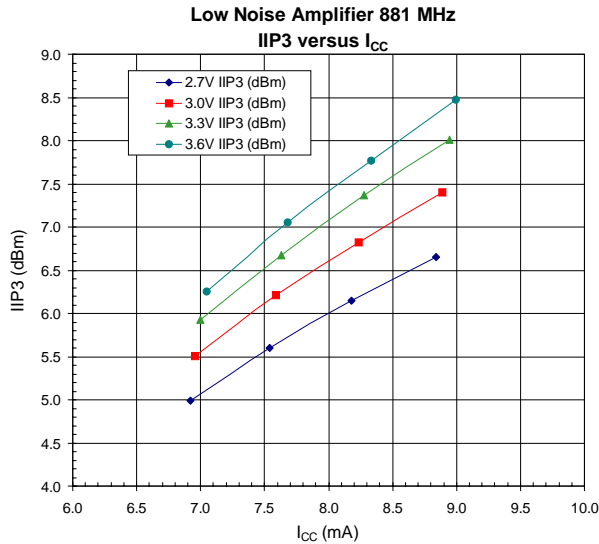
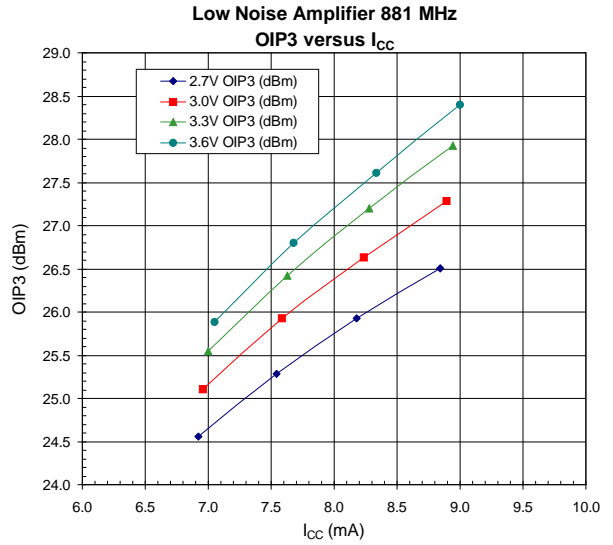
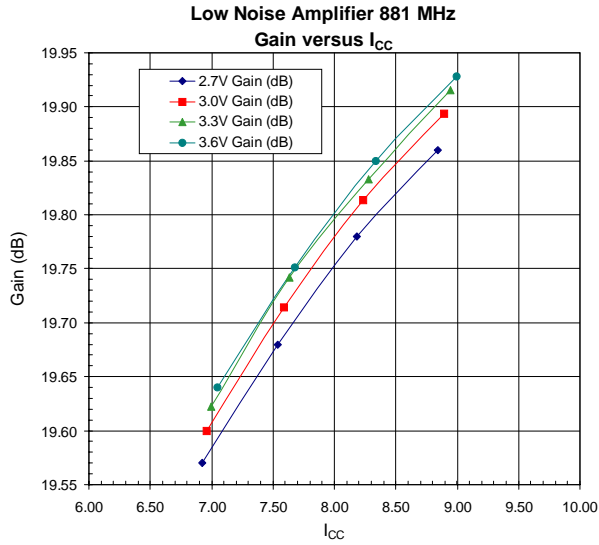
Evaluation Board Layout - 900MHz Driver
Board Size 0.948" x 1.063"
Board Thickness 0.031"; Board Material FR-4



Evaluation Board Layout - 900MHz LNA







PCB Design Requirements

PCB Surface Finish

The PCB surface finish used for RFMD's qualification process is electroless nickel, immersion gold. Typical thickness is 3µinch to 8µinch gold over 180µinch nickel.

PCB Land Pattern Recommendation

PCB land patterns are based on IPC-SM-782 standards when possible. The pad pattern shown has been developed and tested for optimized assembly at RFMD; however, it may require some modifications to address company specific assembly processes. The PCB land pattern has been developed to accommodate lead and package tolerances.

PCB Metal Land Pattern

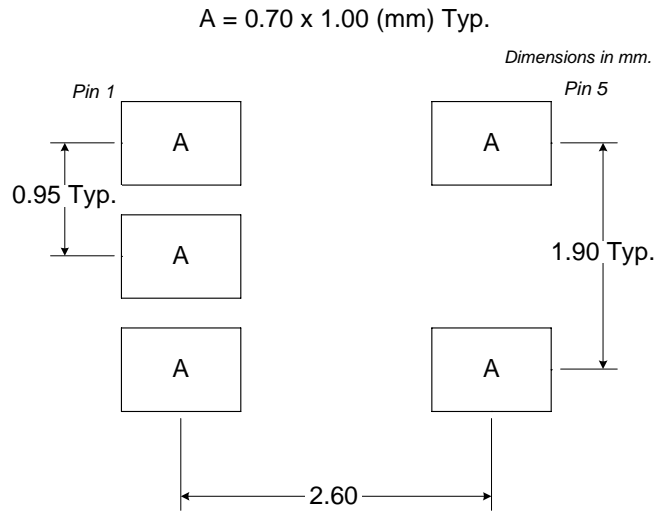


Figure 1. PCB Metal Land Pattern (Top View)

PCB Solder Mask Pattern

Liquid Photo-Imageable (LPI) solder mask is recommended. The solder mask footprint will match what is shown for the PCB metal land pattern with a 2mil to 3mil expansion to accommodate solder mask registration clearance around all pads. The center-grounding pad shall also have a solder mask clearance. Expansion of the pads to create solder mask clearance can be provided in the master data or requested from the PCB fabrication supplier.

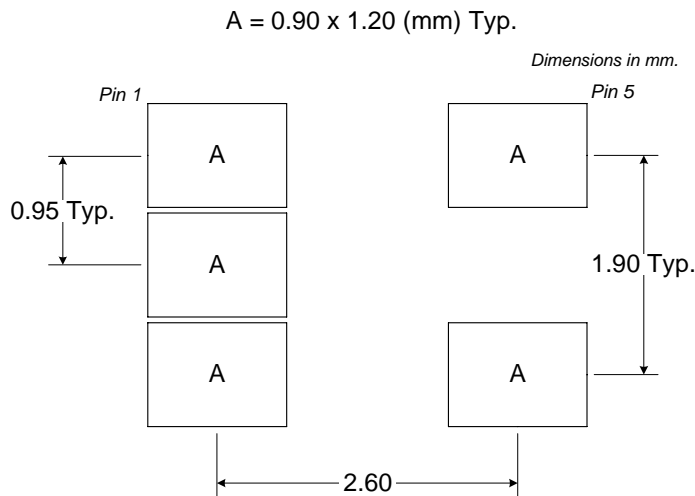


Figure 2. PCB Solder Mask (Top View)

RoHS* Banned Material Content

RoHS Compliant: No
 Package total weight in gram: 0.015
 Compliance Date Code: N/A
 Bill of Materials Revision: Rev-
 Pb Free Category: Contains Pb

| Bill of Materials | Parts Per Million (PPM) | | | | | |
|-------------------|-------------------------|----|----|-------|-----|------|
| | Pb | Cd | Hg | Cr VI | PBB | PBDE |
| Die | 0 | 0 | 0 | 0 | 0 | 0 |
| Molding Compound | 0 | 0 | 0 | 0 | 0 | 0 |
| Lead Frame | 0 | 0 | 0 | 0 | 0 | 0 |
| Die Attach Epoxy | 0 | 0 | 0 | 0 | 0 | 0 |
| Wire | 0 | 0 | 0 | 0 | 0 | 0 |
| Solder Plating | 4753 | 0 | 0 | 0 | 0 | 0 |

This RoHS banned material content declaration was prepared solely on information, including analytical data, provided to RFMD by its suppliers, and applies to the Bill of Materials (BOM) revision noted

* DIRECTIVE 2002/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

