

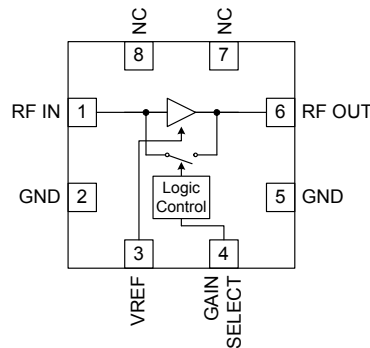


Features

- Low Noise and High Intercept Point
- Adjustable Bias Current
- Power Down Control
- Low Insertion Loss Bypass Feature
- 1.8V to 4V Operation (See Note: Page 2)
- 800MHz to 3.8GHz Operation
- ESD Class 1B

Applications

- WiFi LNA with Bypass Feature
- CDMA PCS LNA with Bypass Feature
- GPS LNA with Bypass Feature
- General Purpose Amplification
- WiMAX LNA with Bypass Function
- CDMA 800 LNA
- CMMB LNA
- LTE Bands LNA



Functional Block Diagram

Product Description

The RF2374 is a switchable low noise amplifier with a high dynamic range designed for digital cellular and WiFi applications. The device functions as an outstanding front end low noise amplifier with I_{CC} as low as 3mA. The bias current may be set externally. The IC is featured in a 2.2mmx2.2mmx0.6mm module-compatible plastic package.

Absolute Maximum Ratings

| Parameter | Rating | Unit |
|--------------------------------|----------------|-----------------|
| Supply Voltage | -0.5 to +6.0 | V _{DC} |
| Input RF Level at F < 2.3GHz | +5 (see note) | dBm |
| Input RF Level at F > 2.3GHz | +10 (see note) | dBm |
| Current Drain, I _{CC} | 32 | mA |
| Operating Ambient Temperature | -40 to +85 | °C |
| Storage Temperature | -40 to +150 | °C |

NOTE: Exceeding any one or a combination of the above maximum rating limits may cause permanent damage. Input RF transients to +15dBm will not harm the device. For sustained operation at inputs $\geq +5$ dBm, a small dropping resistor is recommended in series with the V_{CC} in order to limit the current due to self-biasing to <32mA. Furthermore, while the LNA is in Bypass Mode, and for sustained operation at the input, +10dBm is the maximum recommended power level for Frequencies above 2300MHz. +5dBm is the maximum recommended power level for Frequencies <2300MHz.



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 2011/65/EU (at time of this document revision).

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| Parameter | Specification | | | Unit | Condition |
|---|---------------|-------|------|------|---|
| | Min. | Typ. | Max. | | |
| Operating Range | | | | | T _{AMB} = +25 °C, V _{CC} = 3.0V |
| Frequency Range | 50 | | 4000 | MHz | |
| WiBRO/WiFi/WiMAX Low Noise Amplifier | | | | | |
| Frequency | 2300 | | 2700 | MHz | |
| HIGH GAIN MODE | | | | | Gain Select < 0.8V, V _{REF} = 3V, T = +25 °C |
| Gain | 12.5 | 14.5 | 16.0 | dB | |
| Noise Figure | | 1.3 | 1.5 | dB | |
| Input IP3 | +7 | +9 | | dBm | IP3 will improve if I _{CC} is raised above 7 mA. |
| IP1dB | 0 | | | dBm | |
| Current Drain | | 7 | | mA | |
| BYPASS MODE (Low Gain) | | | | | Gain Select ≥ 1.6 V |
| Gain | -4.0 | -3.0 | -2.0 | dB | Note: Bypass mode insertion loss will degrade gradually as V _{CC} goes below 2.7V. |
| Input IP3 | +20 | +21 | | dBm | |
| Current Drain | | 2.8 | 3.0 | mA | Current drain includes I _{CC} + I _{REF} |
| GPS Low Noise Amplifier | | | | | |
| Frequency | | 1575 | | MHz | |
| Gain | | 17.5 | | dB | I _{CC} = 6.5 mA, I _{CC} + I _{REF} = 7.5 mA |
| Noise Figure | | 1.2 | | dB | |
| Input IP3 | | +7.0 | | dBm | |
| WiMAX Low Noise Amplifier | | | | | |
| Frequency | 3100 | 3500 | 3800 | MHz | I _{CC} = 7 mA |
| Gain | 9.0 | 11.0 | 13.0 | dB | |
| Noise Figure | | 1.6 | 2.5 | dB | |
| Input IP3 | +9.0 | +10.0 | | dBm | IP3 will improve if I _{CC} is raised above 7 mA. |
| BYPASS MODE (Low Gain) | | | | | |
| Gain | -4.0 | -3.0 | -2.5 | dB | |
| Input IP3 | 20.5 | 22.0 | | dBm | |

| Parameter | Specification | | | Unit | Condition |
|---------------------------------|---------------|------|------|------|--|
| | Min. | Typ. | Max. | | |
| CDMA Low Noise Amplifier | | | | | |
| HIGH GAIN MODE | | | | | |
| Frequency | 869 | | 894 | MHz | |
| Gain | | 19 | | dB | |
| Noise Figure | | 1.0 | | dB | |
| Input IP3 | | +2.0 | | dBm | IIP3 will improve if I _{CC} is raised above 7 mA. |
| Current Drain | | 7 | | mA | |
| Low Band LNA | | | | | |
| HIGH GAIN MODE | | | | | |
| Frequency | 50 | | 950 | MHz | |
| Gain | | 20 | | dB | 88MHz |
| Gain | | 19 | | dB | 870MHz |
| Noise Figure | | 2.5 | | dB | 88MHz |
| Noise Figure | | 1.5 | | dB | 870MHz |
| Input IP3 | | +2.0 | | dBm | IIP3 will improve if I _{CC} is raised above 7 mA. |
| PCS and LTE Band LNA | | | | | |
| Frequency | 1750 | | 2050 | MHz | V _{CC} =2.2V, 25 °C |
| HIGH GAIN MODE | | | | | |
| Gain | 15 | 16 | | dB | Gain Select < 0.8V |
| Noise Figure | | 1.1 | 1.3 | dB | |
| Input IP3 | 8 | 9 | 10 | dBm | IIP3 will improve if I _{CC} is raised above 7 mA |
| Current Drain | | 7 | | mA | |
| BYPASS MODE (Low Gain) | | | | | |
| Gain | -3 | -2 | | dB | Gain Select > 1.6V |
| Input IP3 | 17 | 18 | | dBm | |
| Noise Figure | | 2.7 | 3.5 | dB | |
| LTE Low Band LNA | | | | | |
| Frequency | 704 | | 950 | MHz | V _{CC} =2.2V, 25 °C |
| HIGH GAIN MODE | | | | | |
| Gain | 17 | 18 | | dB | Gain Select < 0.8V |
| Noise Figure | | 1.4 | 1.6 | dB | |
| Input IP3 | -3 | 0 | | dBm | IIP3 will improve if I _{CC} is raised above 7 mA |
| Current Drain | | 7 | | mA | |
| BYPASS MODE (Low Gain) | | | | | |
| Gain | -5 | -4 | | dB | |
| Input IP3 | 14 | 15 | | dBm | |
| Noise Figure | | 5 | 6.6 | dB | |

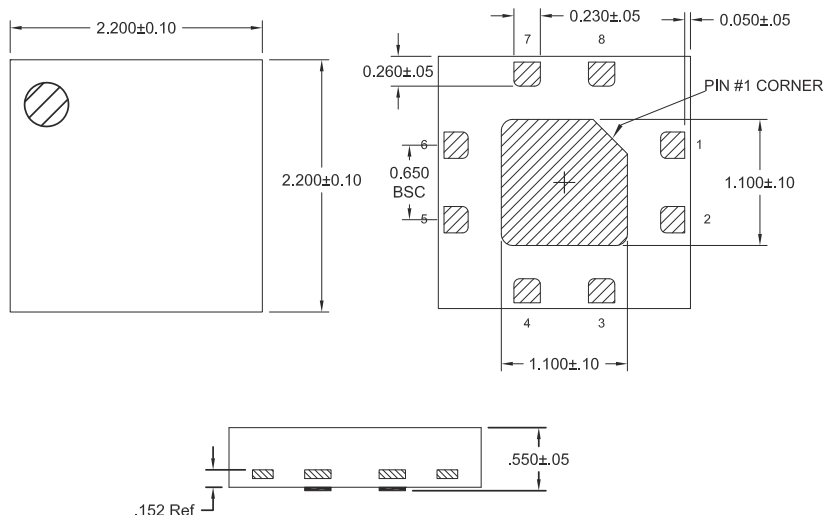
| Parameter | Specification | | | Unit | Condition |
|--|---------------|------|------|---------|--|
| | Min. | Typ. | Max. | | |
| Power Supply | | | | | |
| Voltage (V_{CC}) | | 3 | | V | |
| Gain Select Low Level (High Gain Mode) | | | 0.8 | V | High Gain mode. Gain Select < 0.8V, V_{REF} = 3V (typical) |
| Gain Select High Level (Bypass Mode) | 1.6 | | | V | Low Gain mode. Gain Select \geq 1.6V, V_{REF} : see bias note 2 |
| Gain Select On/Off Time | | | <150 | nSec | (C1 values range from 3 to 10pF), Temp = -40 °C to +85 °C, and over process |
| Power Down | 0 | | 5 | μ A | Gain Select < 0.8V, V_{REF} = 0V, V_{CC} = 3.0V |

Bias note: Due to the presence of ESD protection circuitry on the RF2374, the maximum allowable collector bias voltage (pin 6) is 4.0V. Higher supply voltages such as 5V are permissible if a series resistor is used to drop V_{CC} to \leq 4.0V for a given I_{CC} .

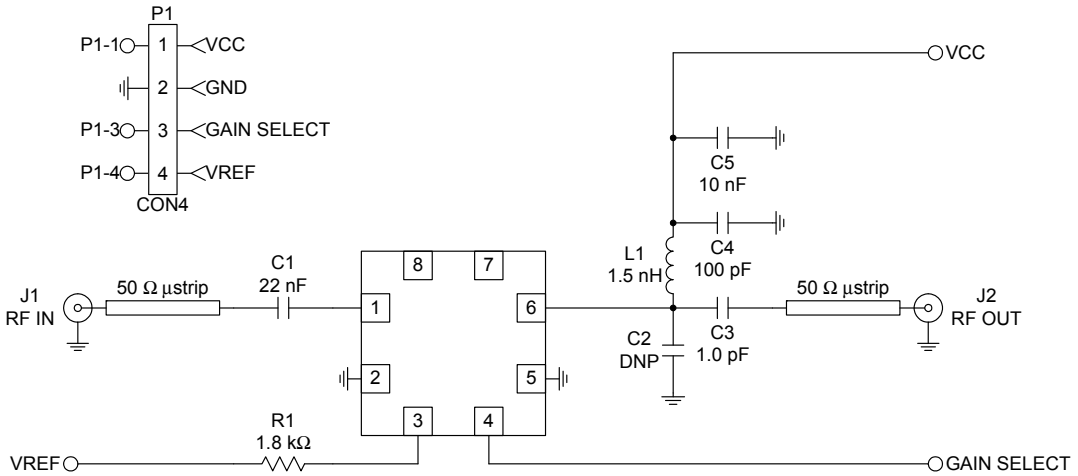
Bias note 2: In bypass mode, V_{REF} is essentially a "don't care" condition. Pulling V_{REF} low when in bypass mode does conserve the small 1mA to 2mA supplied by V_{REF} .

| Pin | Function | Description | Interface Schematic |
|---------|-------------|--|---------------------|
| 1 | RF IN | RF input pin. This part is designed such that 50Ω is the optimal source impedance for best noise figure. Best noise figure is achieved with only a series capacitor on the input. | |
| 2 | GND1 | Ground connection. For best performance, keep traces physically short and connect immediately to ground plane. | |
| 3 | VREF | For low noise amplifier applications, this pin is used to control the bias current. An external resistor can be used to set the bias current for any V_{BIAS} voltage. This device will have good gain and noise figure with I_{CC} as low as 3mA. | |
| 4 | GAIN SELECT | This pin selects high gain and bypass modes. Gain Select $\leq 0.8V$, high gain. Gain Select $\geq 1.6V$, low gain. | |
| 5 | GND2 | See GND1. | |
| 6 | RF OUT | Amplifier output pin. This pin is an open-collector output. It must be biased to V_{CC} through a choke or matching inductor. | |
| 7 | NC | Not connected. | |
| 8 | NC | Not connected. | |
| Pkg Gnd | GND | This pad should be connected to the ground plane by vias directly under the device. | |

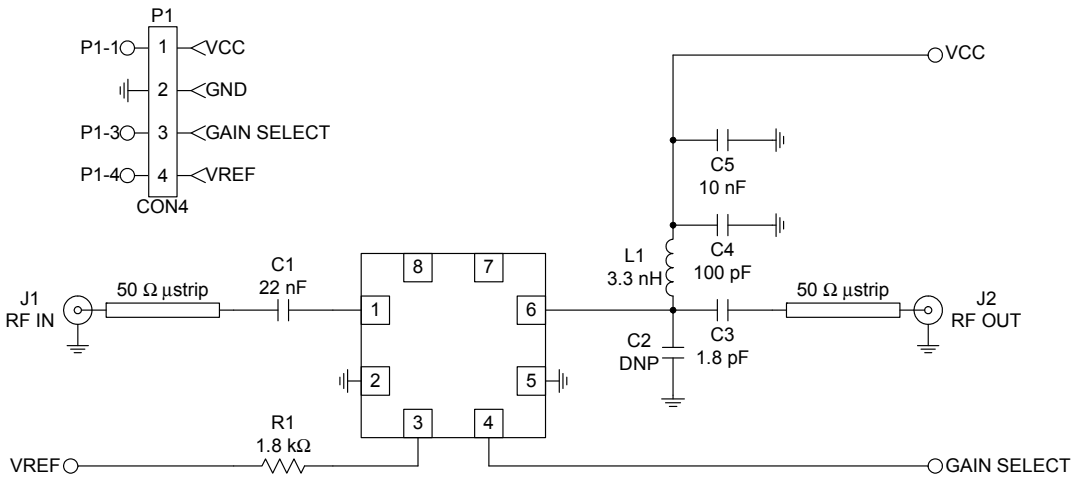
Package Drawing



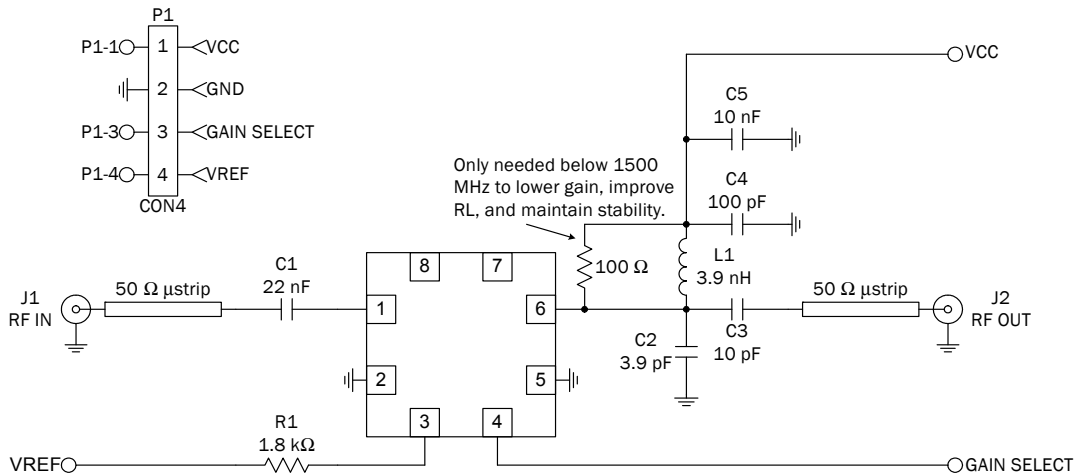
Evaluation Board Schematic WiFi (2.4GHz to 2.5GHz)



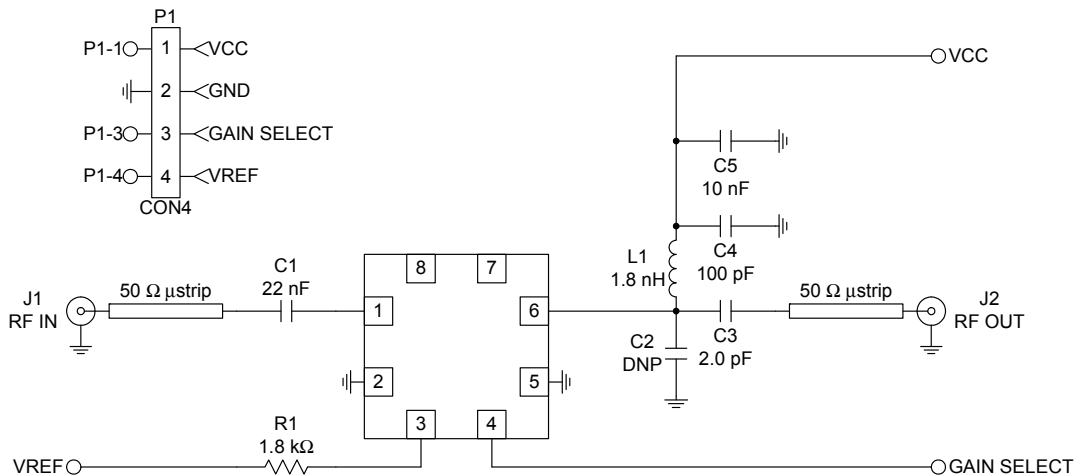
Evaluation Board Schematic GPS/PCS (1.5GHz to 2.2GHz)



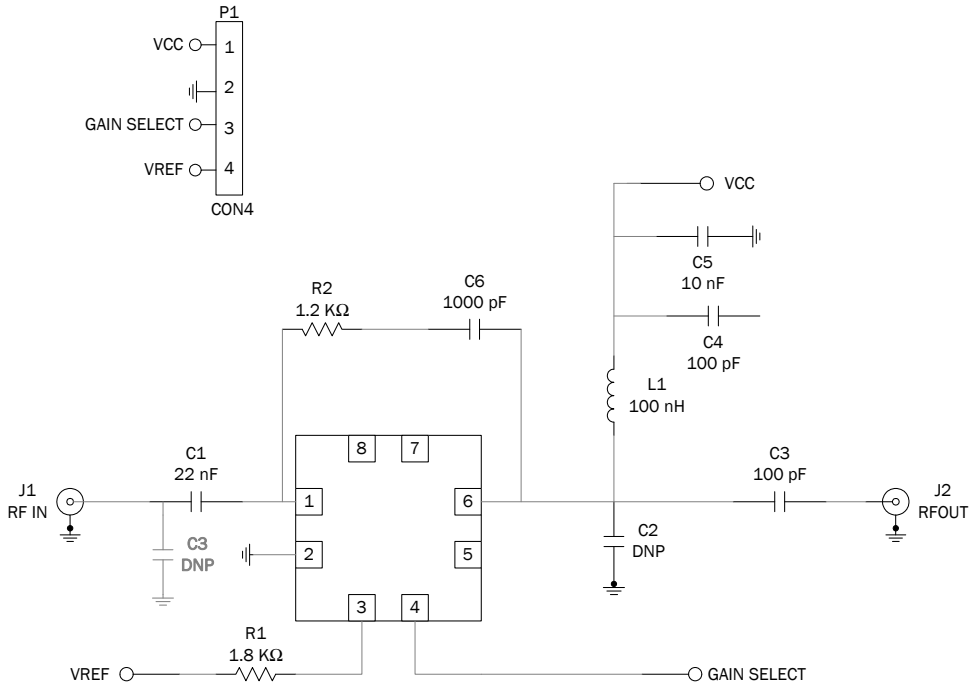
Application Schematic - 869MHz to 894MHz Tune



Application Schematic for Wide Band Tune WiBRO/WiFi/WiMAX (2.3GHz to 3.8GHz)

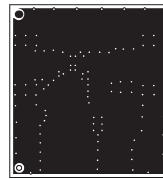
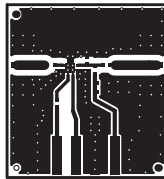
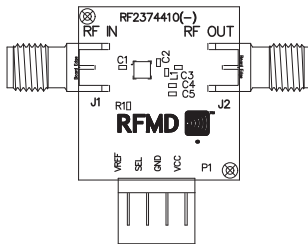


Application Schematic for Low Band Tune



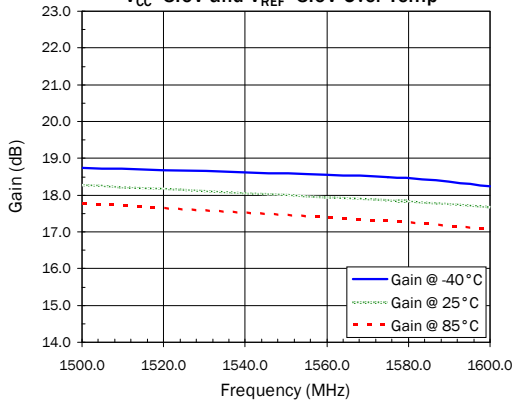
Evaluation Board Layout Board Size 0.835" x 0.900"

Board Thickness 0.032", Board Material FR-4

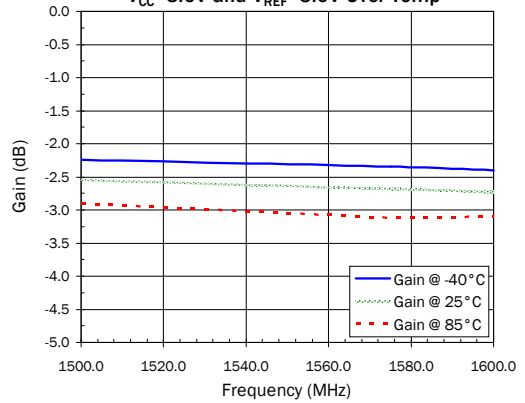


GPS Band Data

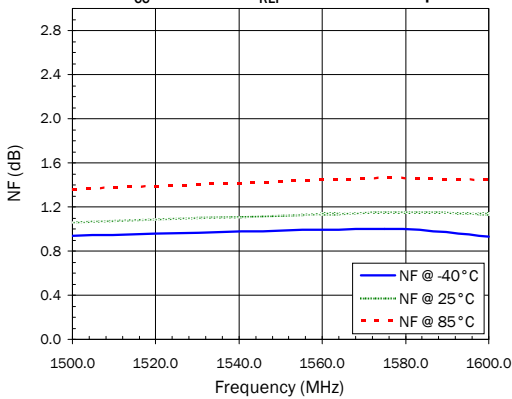
Gain @ GPS Band in High Gain Mode
 $V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



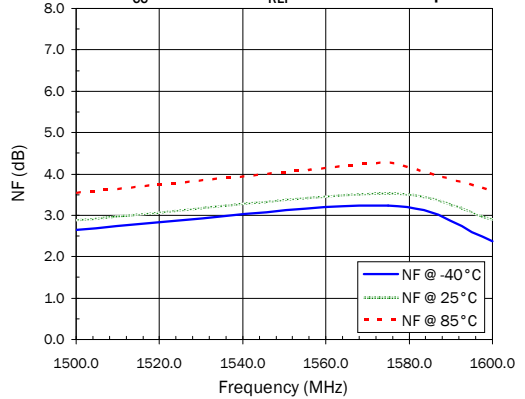
Gain @ GPS Band in Bypass Mode
 $V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



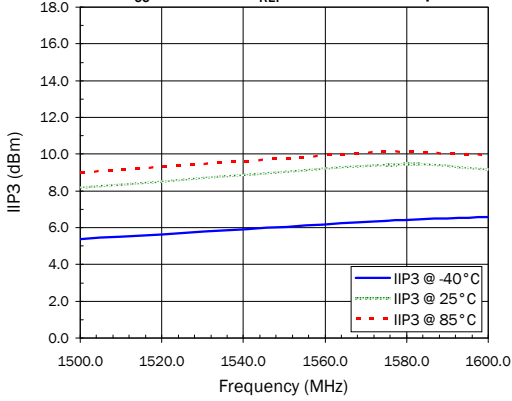
Noise Figure @ GPS Band in High Gain Mode
 $V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



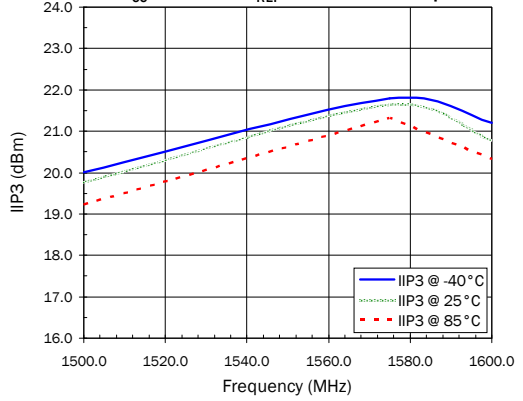
Noise Figure @ GPS Band in Bypass Mode
 $V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



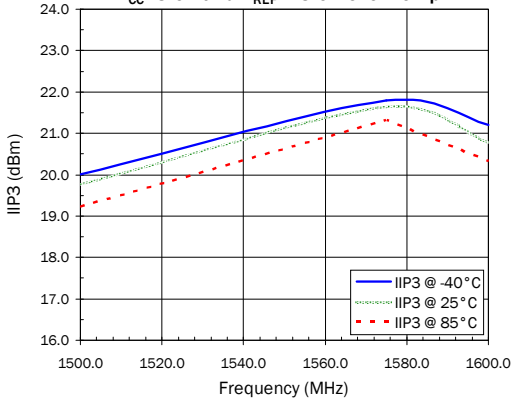
IIP3 @ GPS Band in High Gain Mode
 $V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



IIP3 @ GPS Band in Bypass Mode
 $V_{CC}=3.0V$ and $V_{REF} = 3.0V$ Over Temp



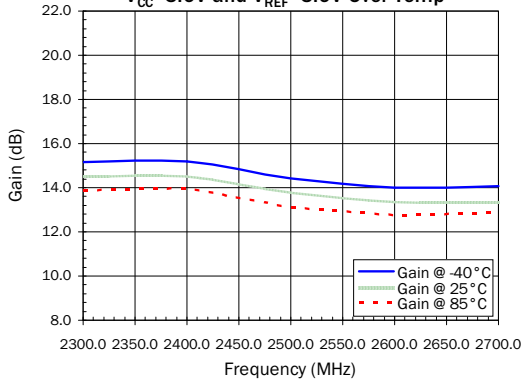
IIP3 @ GPS Band in Bypass Mode
 $V_{CC}=3.0V$ and $V_{REF} = 3.0V$ Over Temp



WiBRO/WiFi/WiMAX Data

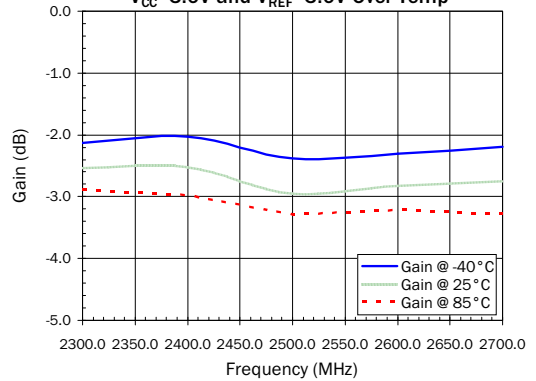
Gain at WiFi Band in High Gain Mode

$V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



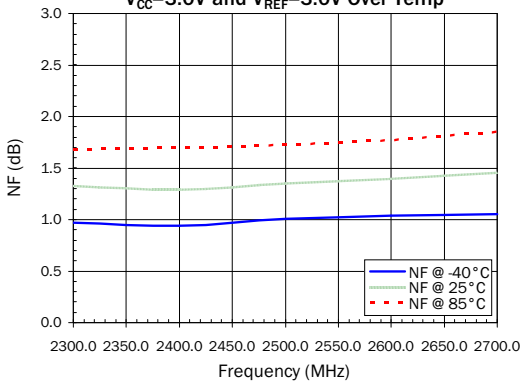
Gain at WiFi Band in Bypass Mode

$V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



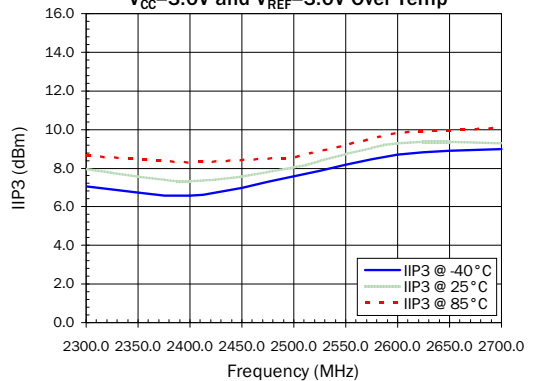
Noise Figure at WiFi Band in High Gain Mode

$V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



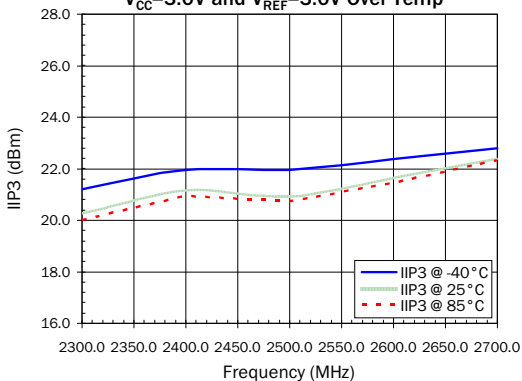
IIP3 at WiFi Band in High Gain Mode

$V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



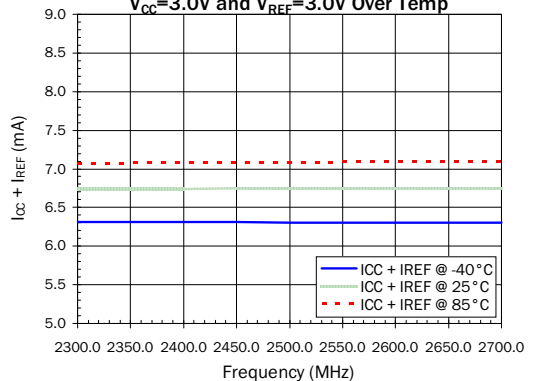
IIP3 at WiFi Band in Bypass Mode

$V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



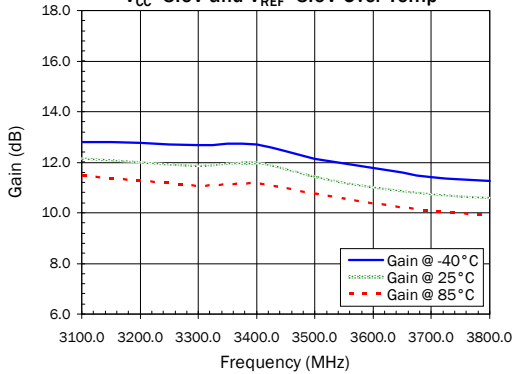
$I_{CC} + I_{REF}$ at WiFi Band in High Gain Mode

$V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp

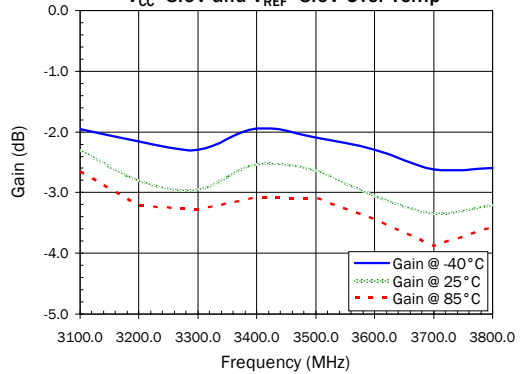


WiMAX Data

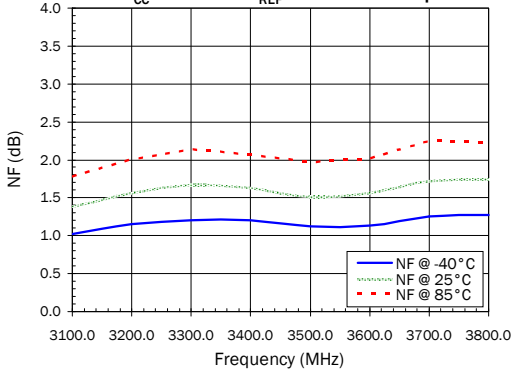
Gain @ WiMAX Band in High Gain Mode
 $V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



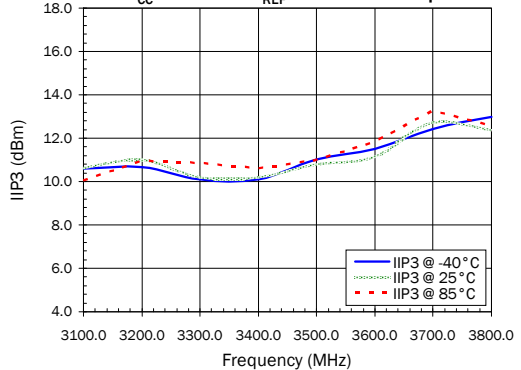
Gain @ WiMAX Band in Bypass Mode
 $V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



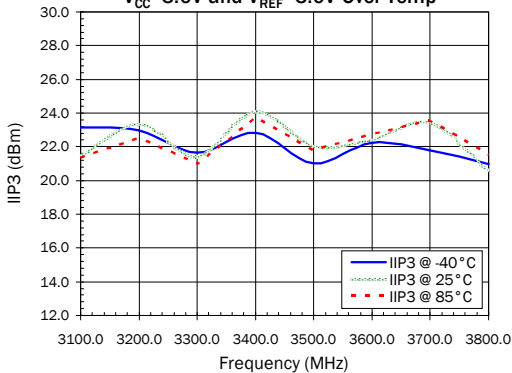
Noise Figure @ WiMAX Band in High Gain Mode
 $V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



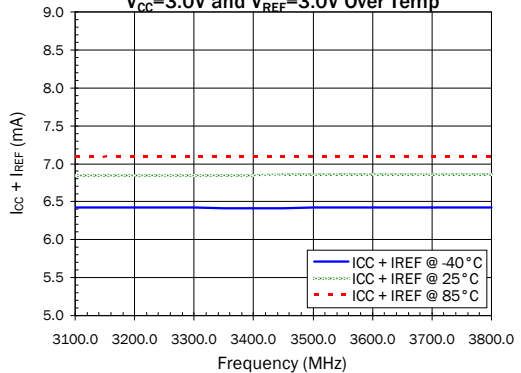
IIP3 @ WiMAX Band in High Gain Mode
 $V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



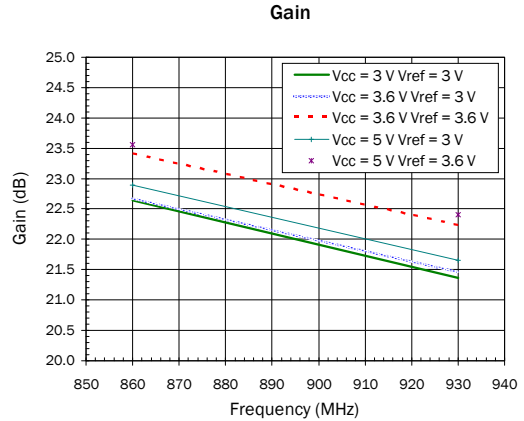
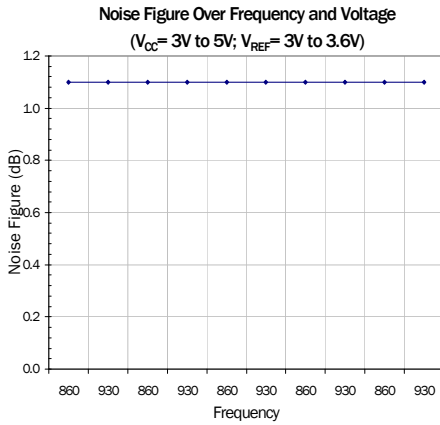
IIP3 @ WiMAX Band in Bypass Mode
 $V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp



$I_{CC} + I_{REF}$ @ WiMAX Band in High Gain Mode
 $V_{CC}=3.0V$ and $V_{REF}=3.0V$ Over Temp

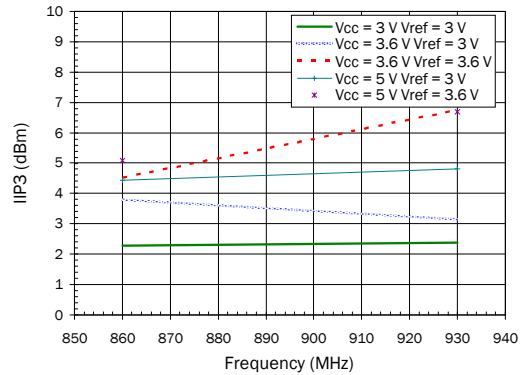
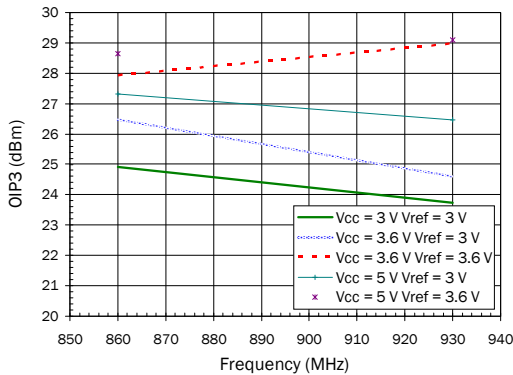


CDMA Data



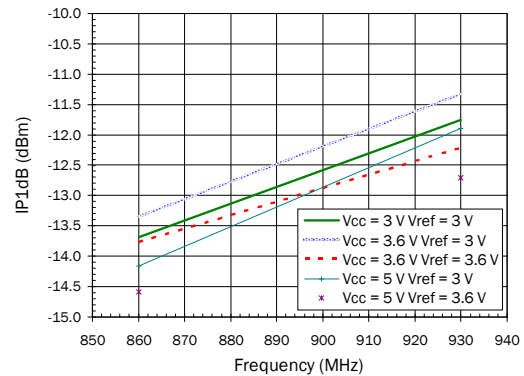
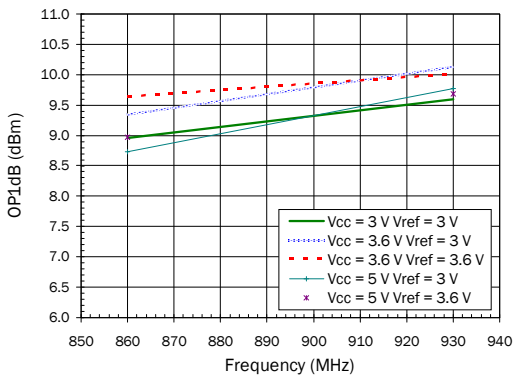
OIP3

IIP3



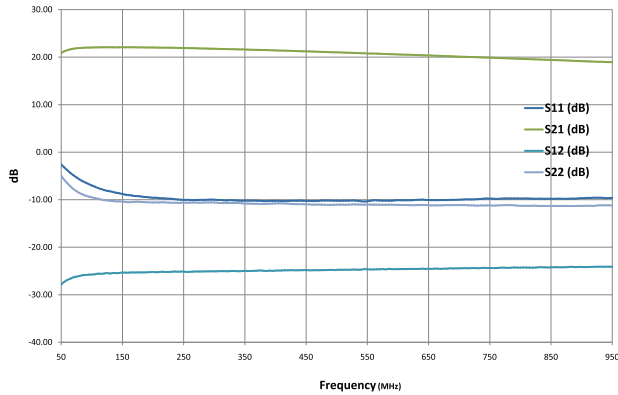
OP1dB

IP1dB

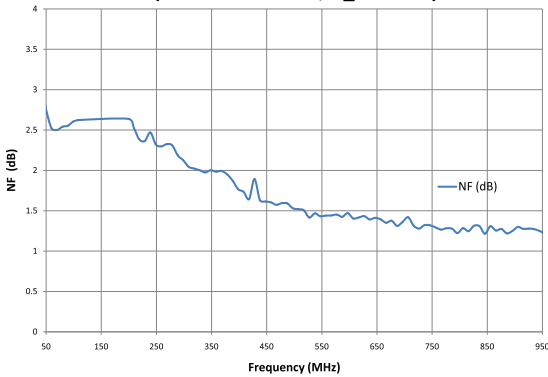


Low Band Tune Data

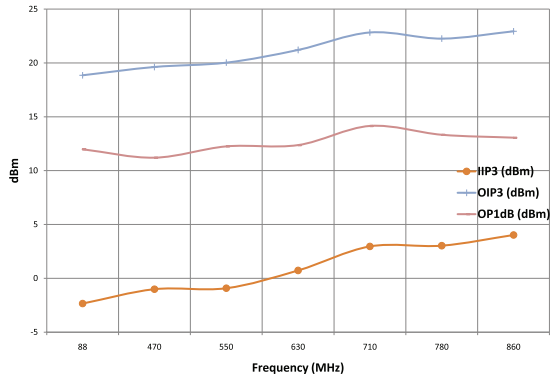
[S] Parameters Over Frequency
 (V_{cc} = V_{ref} = 3.6V; V_{SEL} = 0V; I_{cc} = 8mA)



NF
 (V_{cc} = V_{ref} = 3.6V ; V_{SEL} = 0V)



OP1dB, IIP3 and OIP3 over frequency
 (V_{cc} = B_{ref} = 3.3V; I_{cc} = 8mA)



Ordering Information

| Ordering Code | Description |
|---------------|---|
| RF2374 | Standard 25 piece bag |
| RF2374SR | Standard 100 piece reel |
| RF2374TR7 | Standard 2500 piece reel |
| RF2374PCK-410 | Fully assembled evaluation board tuned for 2.4 GHz to 2.5GHz with standard tune |
| RF2374PCK-411 | Fully assembled evaluation board tuned for 1.5 GHz to 2.2GHz with standard tune |