RF2374

3V LOW NOISE AMPLIFIER

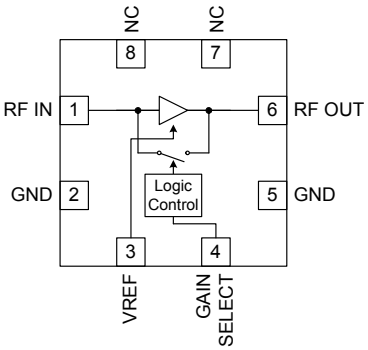
Package Style: QFN, 8-Pin, 2.2mmx2.2mmx0.55mm

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.

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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 ≥+5dBm, 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).

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	IIP3 will improve if I_{CC} is raised above 7mA.
IP1dB	0			dBm	
Current Drain		7		mA	
BYPASS MODE (Low Gain)					Gain Select≥1.6V
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}=6.5mA, I_{CC}+I_{REF}=7.5mA
Noise Figure		1.2		dB	
Input IP3		+7.0		dBm	
WiMAX Low Noise Amplifier					
Frequency	3100	3500	3800	MHz	I_{CC}=7mA
Gain	9.0	11.0	13.0	dB	
Noise Figure		1.6	2.5	dB	
Input IP3	+9.0	+10.0		dBm	IIP3 will improve if I_{CC} is raised above 7mA.
BYPASS MODE (Low Gain)					
Gain	-4.0	-3.0	-2.5	dB	
Input IP3	20.5	22.0		dBm	

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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 7mA.
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 7mA.
PCS and LTE Band LNA					V_{CC}=2.2V, 25°C
Frequency	1750		2050	MHz	
HIGH GAIN MODE					Gain Select<0.8V
Gain	15	16		dB	
Noise Figure		1.1	1.3	dB	
Input IP3	8	9	10	dBm	IIP3 will improve if I_{CC} is raised above 7mA
Current Drain		7		mA	
BYPASS MODE (Low Gain)					Gain Select>1.6V
Gain	-3	-2		dB	
Input IP3	17	18		dBm	
Noise Figure		2.7	3.5	dB	
LTE Low Band LNA					V_{CC}=2.2V, 25°C
Frequency	704		950	MHz	
HIGH GAIN MODE					Gain Select<0.8V
Gain	17	18		dB	
Noise Figure		1.4	1.6	dB	
Input IP3	-3	0		dBm	IIP3 will improve if I_{CC} is raised above 7mA
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≥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	µA	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 ≤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}.

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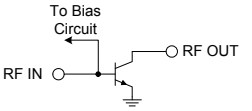
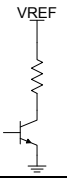
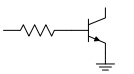
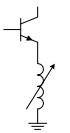
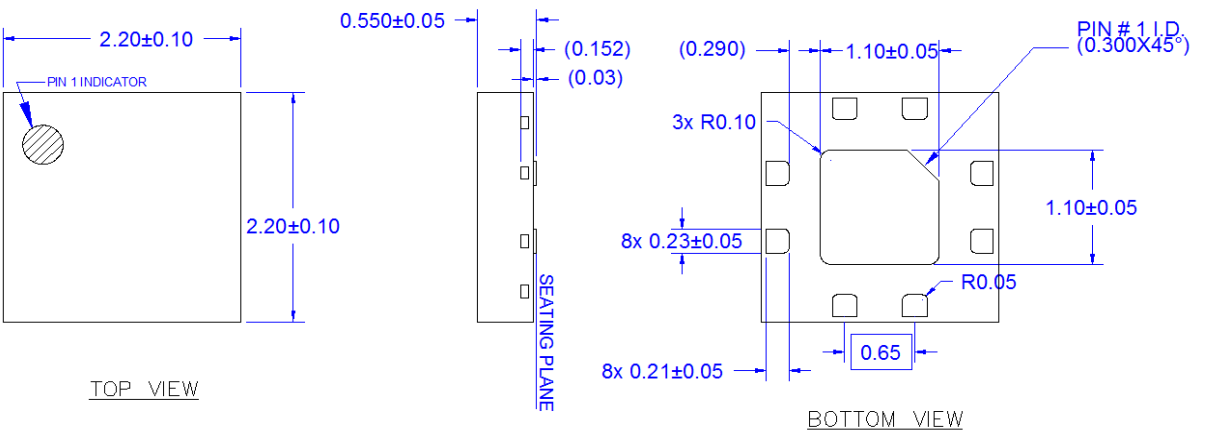
Pin	Function	Description	Interface Schematic
1	RF IN	RF input pin. This part is designed such that 50Ω is the optimal source impedance for best noise figure. Best noise figure is achieved with only a series capacitor on the input.	
2	GND1	Ground connection. For best performance, keep traces physically 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≤0.8V, high gain. Gain Select≥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



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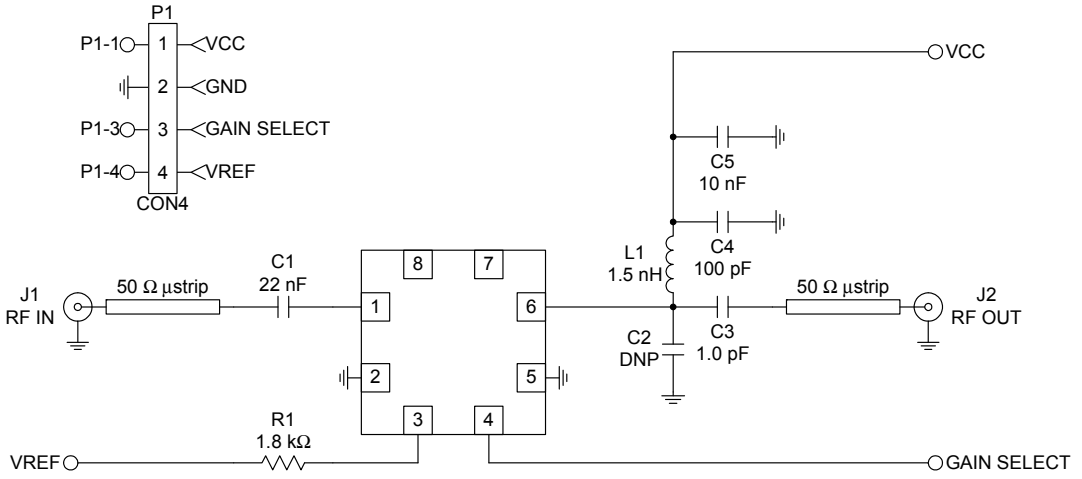
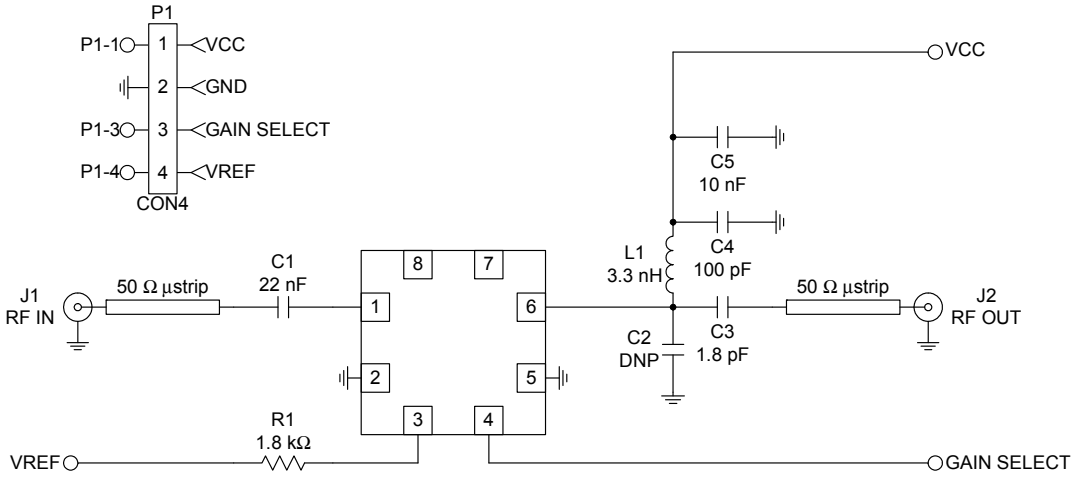
Evaluation Board Schematic
WiFi (2.4GHz to 2.5GHz)



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



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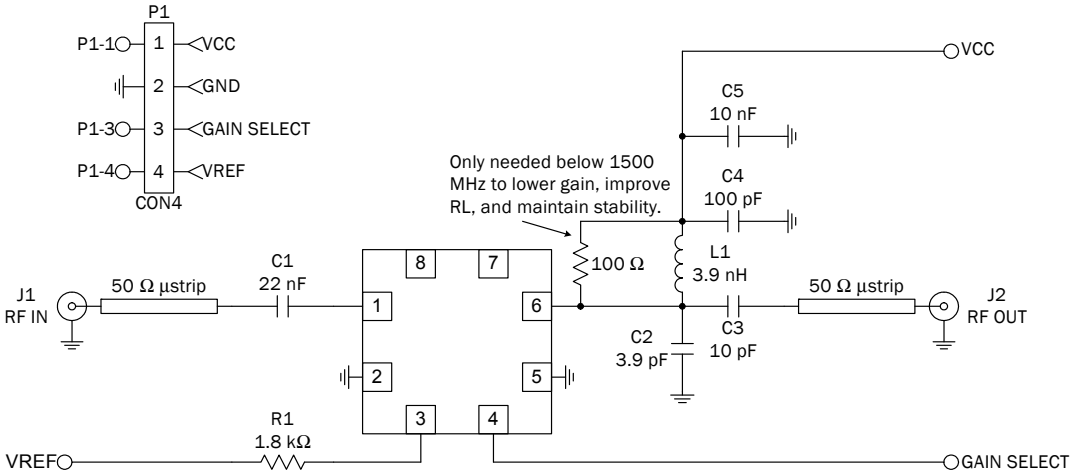
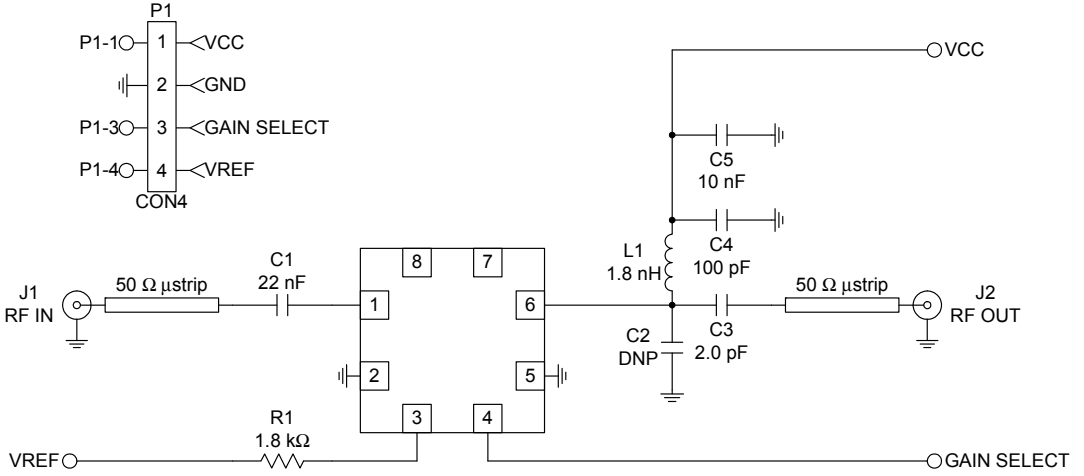
Application Schematic - 869MHz to 894MHz Tune



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



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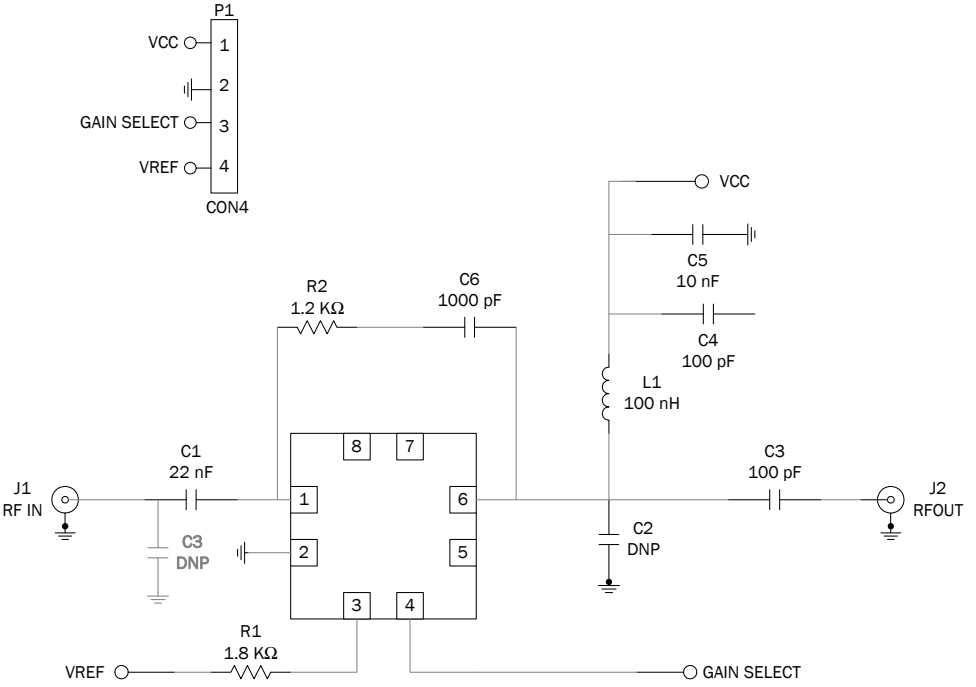
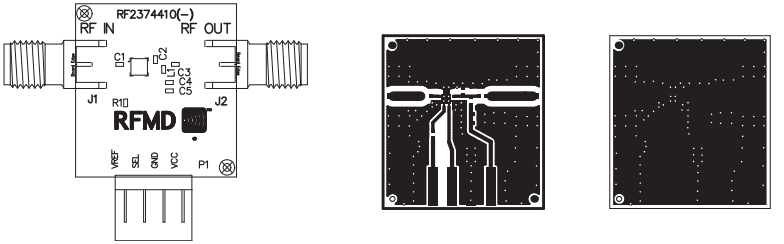
Application Schematic for Low Band Tune



Evaluation Board Layout
Board Size 0.835” x 0.900”

Board Thickness 0.032”, Board Material FR-4



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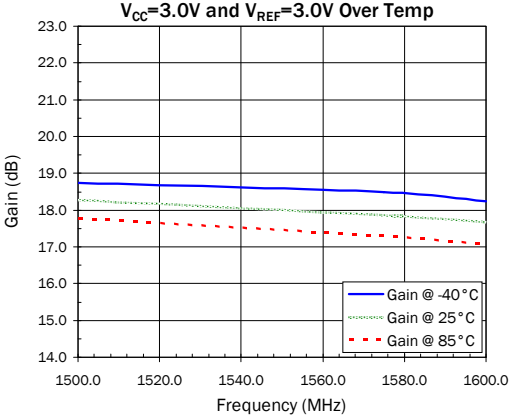
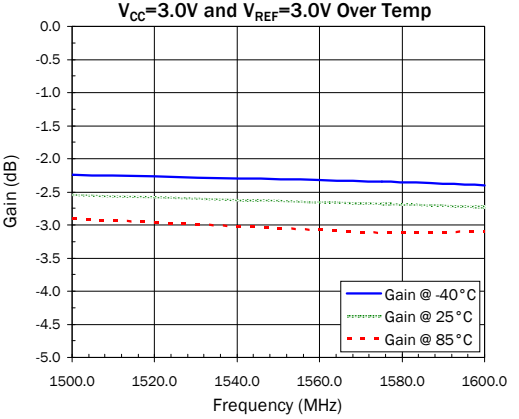
GPS Band Data

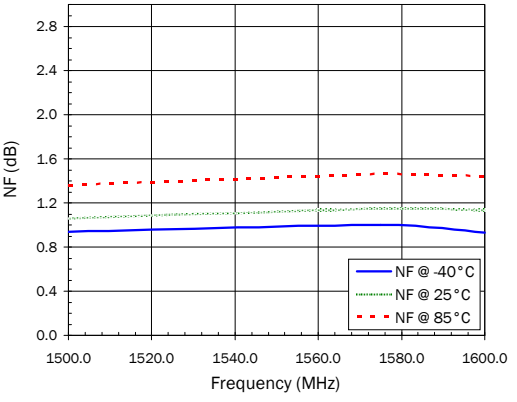
Gain @ GPS Band in High Gain Mode
V_{CC}=3.0V and V_{REF}=3.0V Over Temp



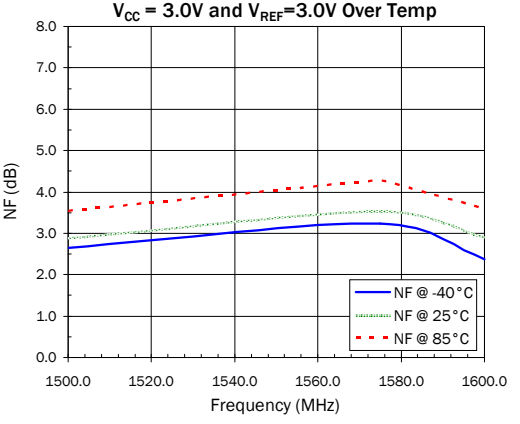
Gain @ GPS Band in Bypass Mode
V_{CC}=3.0V and V_{REF}=3.0V Over Temp



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



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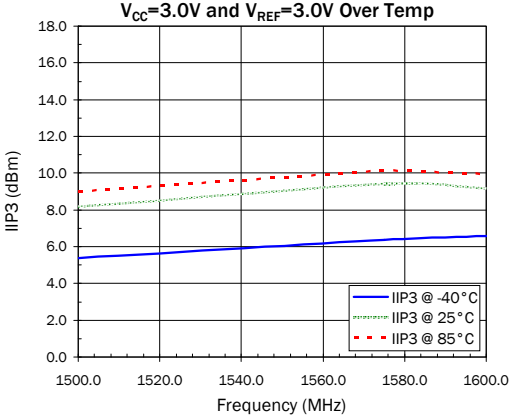
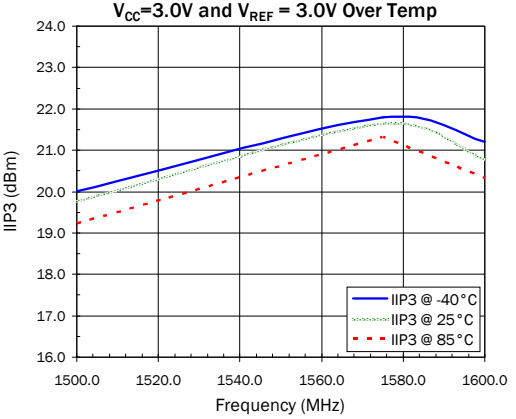
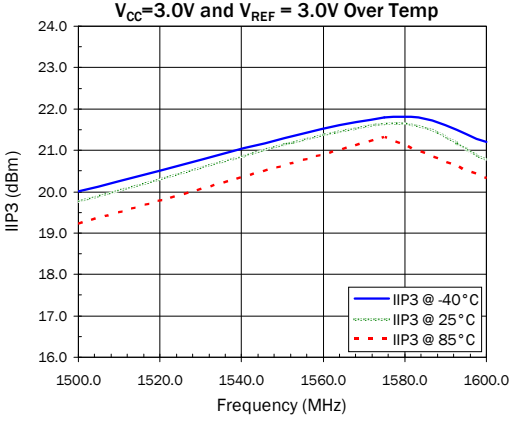
IIP3 @ GPS Band in High Gain Mode
V_{CC}=3.0V and V_{REF}=3.0V Over Temp



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



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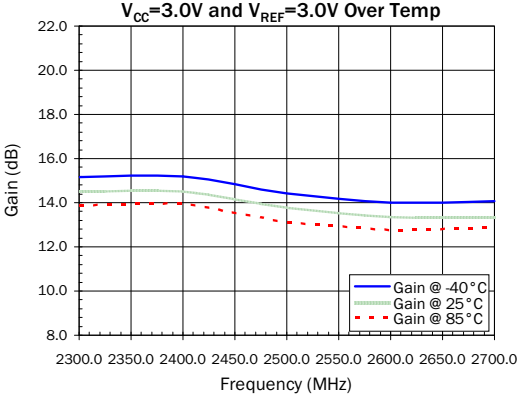
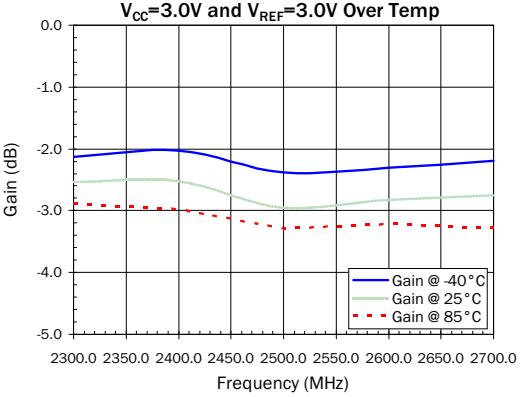
WiBRO/WiFi/WiMAX Data

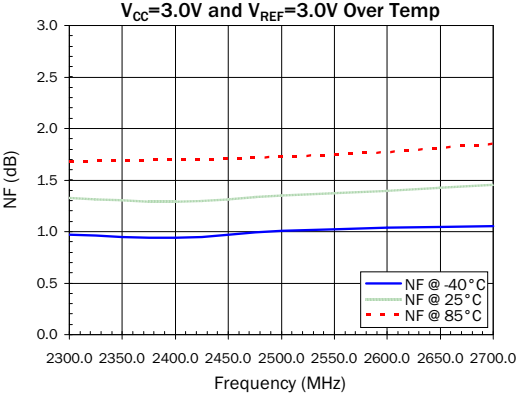
Gain at WiFi Band in High Gain Mode
V_{CC}=3.0V and V_{REF}=3.0V Over Temp



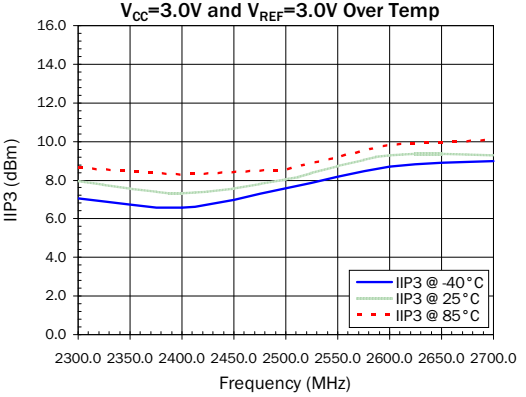
Gain at WiFi Band in Bypass Mode
V_{CC}=3.0V and V_{REF}=3.0V Over Temp



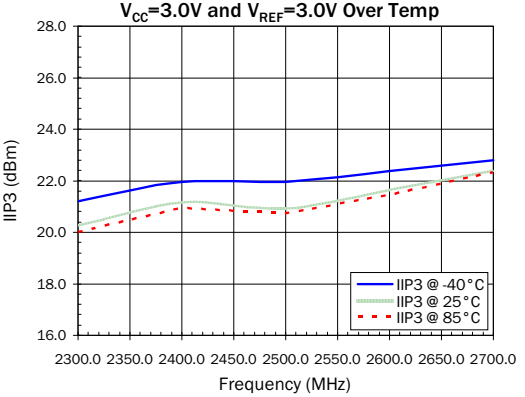
Noise Figure at WiFi Band in High Gain Mode
V_{CC}=3.0V and V_{REF}=3.0V Over Temp



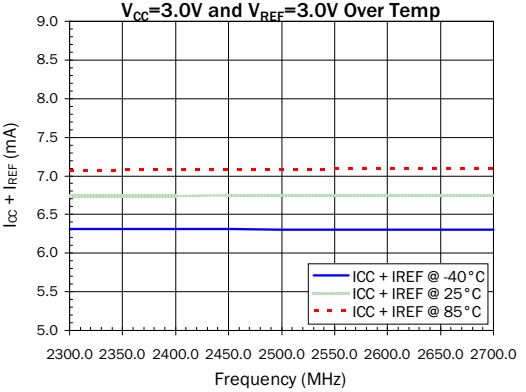
IIP3 at WiFi Band in High Gain Mode
V_{CC}=3.0V and V_{REF}=3.0V Over Temp



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



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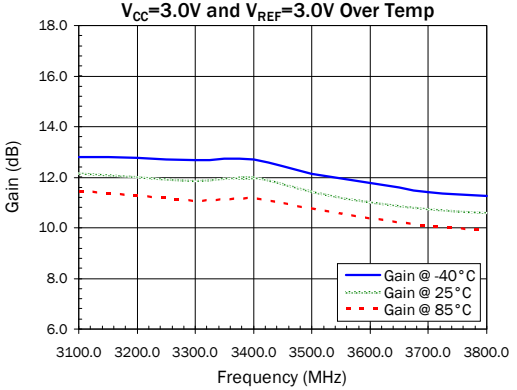
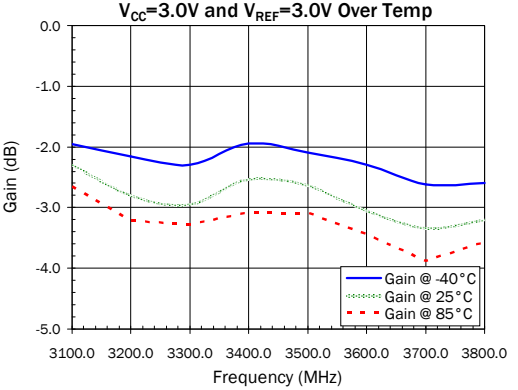
WiMAX Data

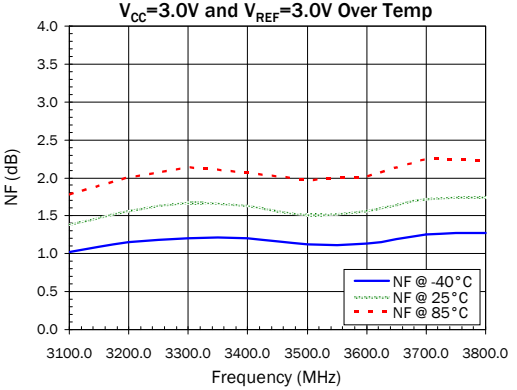
Gain @ WiMAX Band in High Gain Mode
V_{CC}=3.0V and V_{REF}=3.0V Over Temp



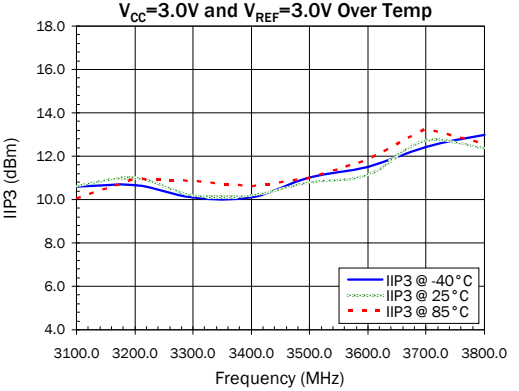
Gain @ WiMAX Band in Bypass Mode
V_{CC}=3.0V and V_{REF}=3.0V Over Temp



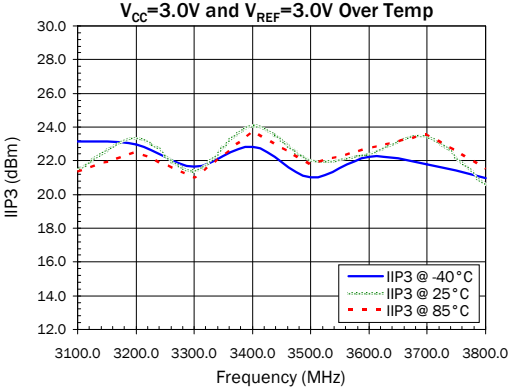
Noise Figure @ WiMAX Band in High Gain Mode
V_{CC}=3.0V and V_{REF}=3.0V Over Temp



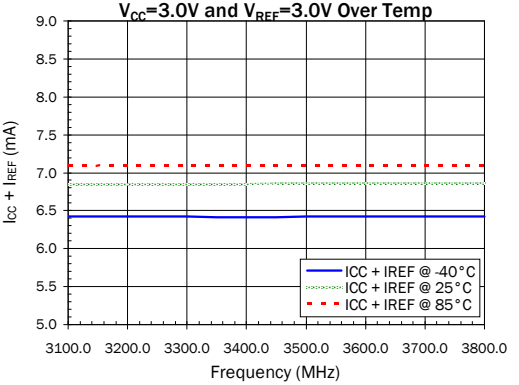
IIP3 @ WiMAX Band in High Gain Mode
V_{CC}=3.0V and V_{REF}=3.0V Over Temp



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



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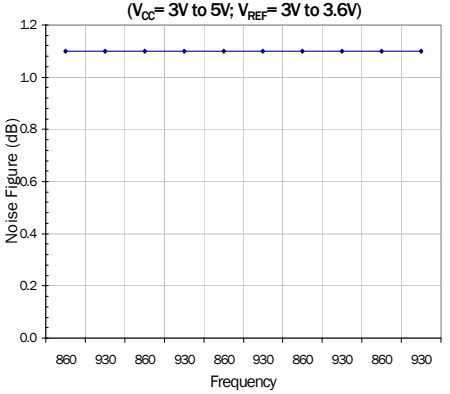
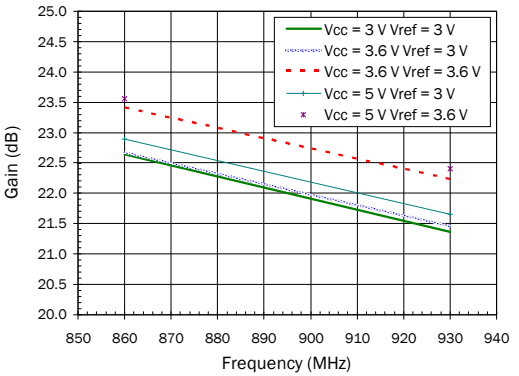
CDMA Data

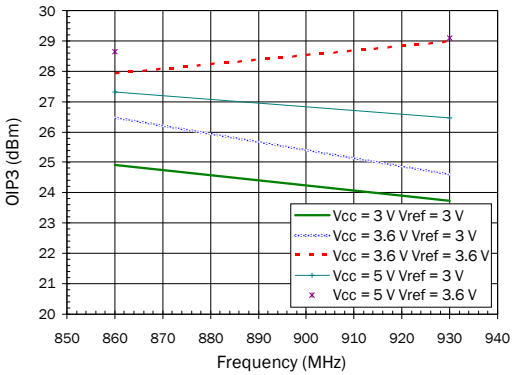
Noise Figure Over Frequency and Voltage
(V_{CC}= 3V to 5V; V_{REF}= 3V to 3.6V)



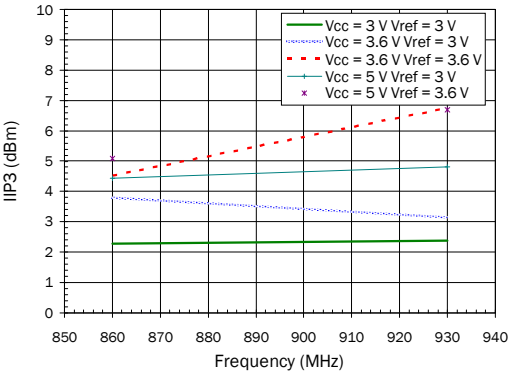
Gain



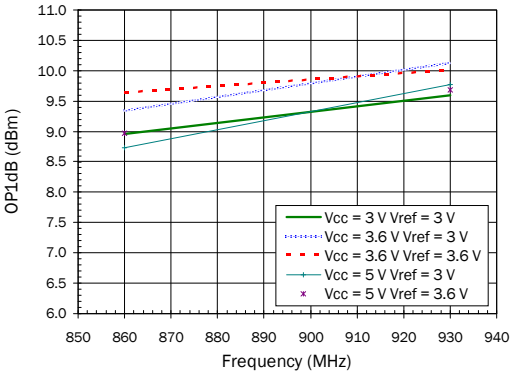
OIP3



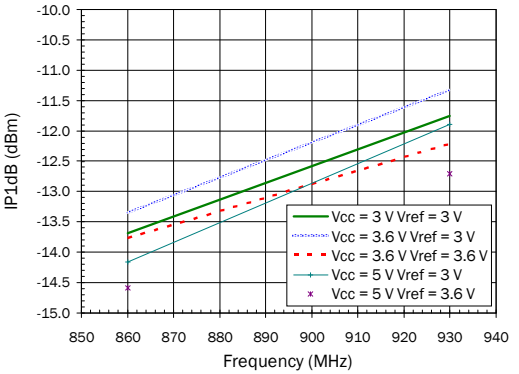
IIP3



OP1dB



IP1dB



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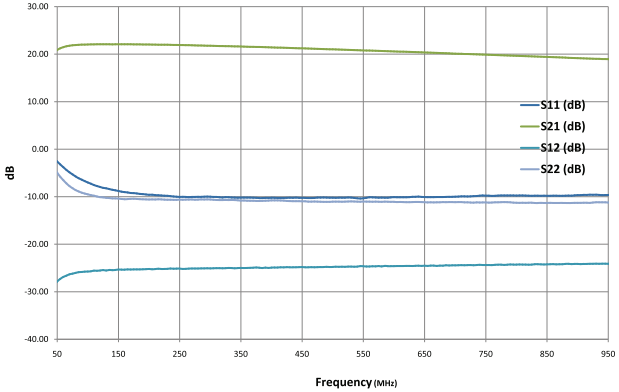
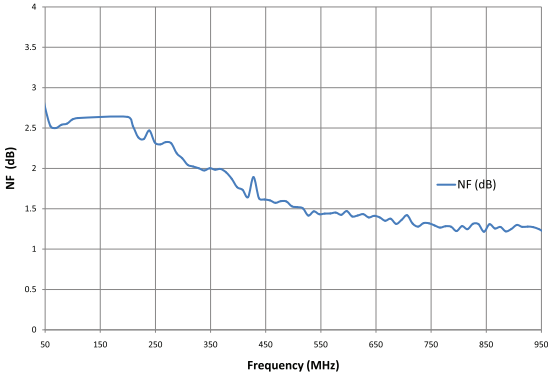
Low Band Tune Data

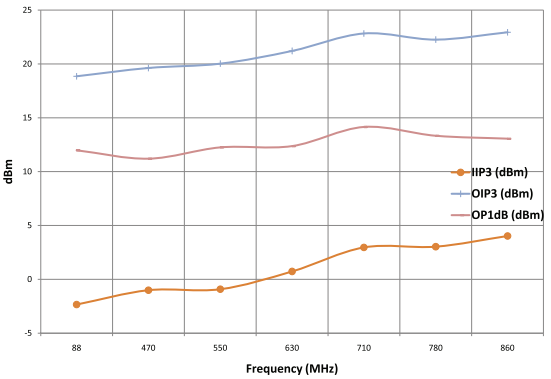
[S] Parameters Over Frequency
(Vcc = Vref = 3.6V; V_SEL = 0V; Icc = 8mA)



NF
(Vcc = Vref = 3.6V ; V_SEL = 0V)



OP1dB, IIP3 and OIP3 over frequency
(Vcc = Bref = 3.3V; Icc = 8mA)



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