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RF5515

4.9GHz TO 5.85GHZ LOW NOISE AMPLIFIER WITH ENABLE

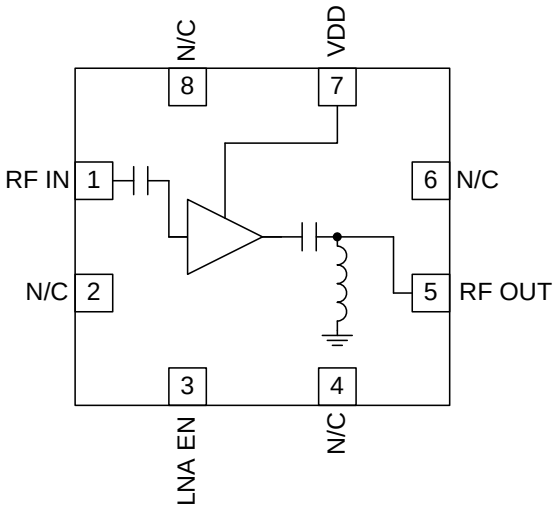
Package Style: 2.2mm x 2.2mm x 0.5mm

Features

- 4.9GHz to 5.85GHz Operation
- 2.3V to 4.8V Single Supply
- 1.6dB Noise Figure
- 11dB Typical Gain

Applications

- High Band WiFi LNA/Driver
- General Purpose Amplifier for Portable Applications



Functional Block Diagram

Product Description

The RF5515 is a high performance Low Noise Amplifier design for 802.11a applications (4.9GHz to 5.85GHz) and other portable consumer electronics. This miniature LNA features a high dynamic range and high intercept point with low current consumption around 12mA. The LNA is DC blocked and internally matched to 50Ω at input and output pins. The IC is featured in a 2.2mm x 2.2mm x 0.5mm module compatible plastic package.

Ordering Information

RF5515	Standard 25 piece bag
RF5515SR	Standard 100 piece reel
RF5515TR7	Standard 2500 piece reel
RF5515PCK-410	Fully assembled evaluation board and 5 piece loose samples

Optimum Technology Matching® Applied

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

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Absolute Maximum Ratings

Parameter	Rating	Unit
DC Supply Voltage (No RF Applied)	6.0	V
DC Supply Voltage (RF Applied)	5.25	V
Maximum Input Power (No Damage)	10	dBm
Operating Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°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.

RFMD Green: RoHS compliant per EU Directive 2002/95/EC, halogen free per IEC 61249-2-21, < 1000 ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Typical Conditions					Temp = 25°C, V_{DD} = 3.3V, LNA_EN = 3.3V, Frequency = 4.9GHz to 5.85GHz unless otherwise noted in the condition column.
Frequency	4.9		5.85	GHz	
LNA Voltage Supply (V_{DD})	2.7	3.3	4.8	V	
LNA Enable Voltage (LNA_EN)	2.5		4.8	VDD	LNA Enabled
		0	0.2	V	LNA Off
LNA Current					
LNA V_{DD}	6	12	20	mA	LNA in "On" state, over operating temperature range, Full V_{DD} range, full LNA_EN range, and full frequency band.
	0		5	µA	LNA in "Off" state
LNA Enable			200	µA	
Gain					
LNA in "ON" State	8	11	14	dB	Over full operating temperature range, full V_{CC} range, Full LNA_EN range, and full frequency range.
Noise Figure					
LNA in "ON" State	1.2	1.7	2.4	dB	Over Full V_{DD} range, full LNA_EN range, Full frequency range, and over operating temperature range.
Passband Ripple	-0.5		+0.5	dB	Rx Mode, LNA ON
Input P1dB	-4	-1		dBm	Over operating temperature range, full voltage range, full LNA_EN range, and full frequency range.
RF OUT Port Return Loss			-9.6	dB	4.9GHz to 5.85GHz
RF IN Port Return Loss			-9.6	dB	
RF OUT Rx Port Impedance		50		Ω	No external matching

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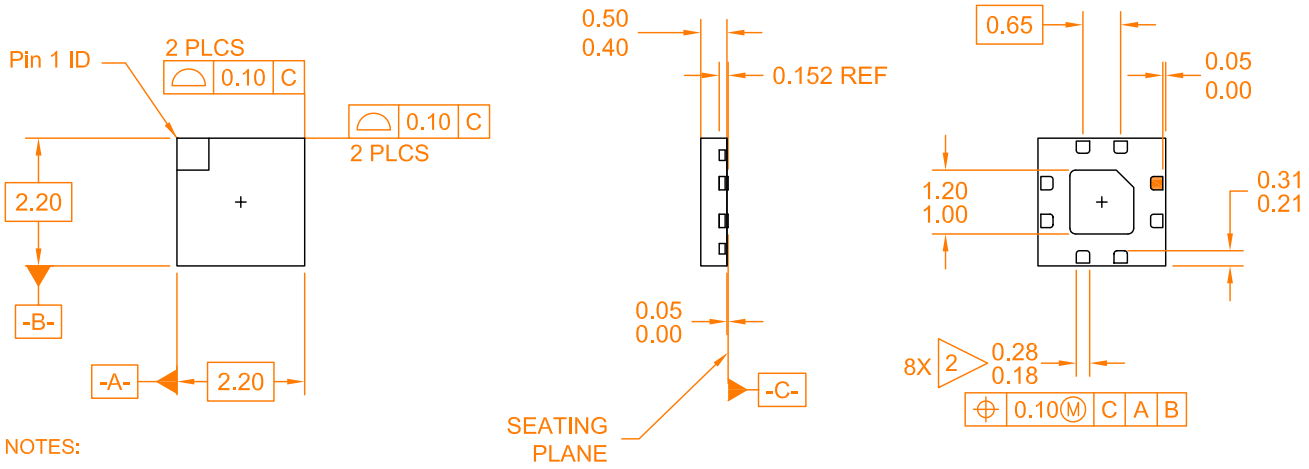
Pin	Function	Description
1	RF IN	RF Input. Input is matched to 50Ω and DC block is provided internally.
2	NC	No Connect
3	LNA_EN	LNA Enable. Voltage which is a high impedance pin could require bypassing depending on the nature of the supply voltage and the layout.
4	NC	No Connect
5	RF OUT	RF Output. This pin is matched to 50Ω internally and it is a DC short to GND. See functional block diagram for more details.
6	NC	No Connect
7	VDD	Supply Voltage for the LNA circuit. It is recommended that bypass capacitors are placed on this voltage line as needed depending on the nature of the supply voltage and layout.
8	NC	No Connect
Pkg Base	GND	The center metal base of the QFN package provides DC and RF ground as well as heat sink for the amplifier.

Package Drawing

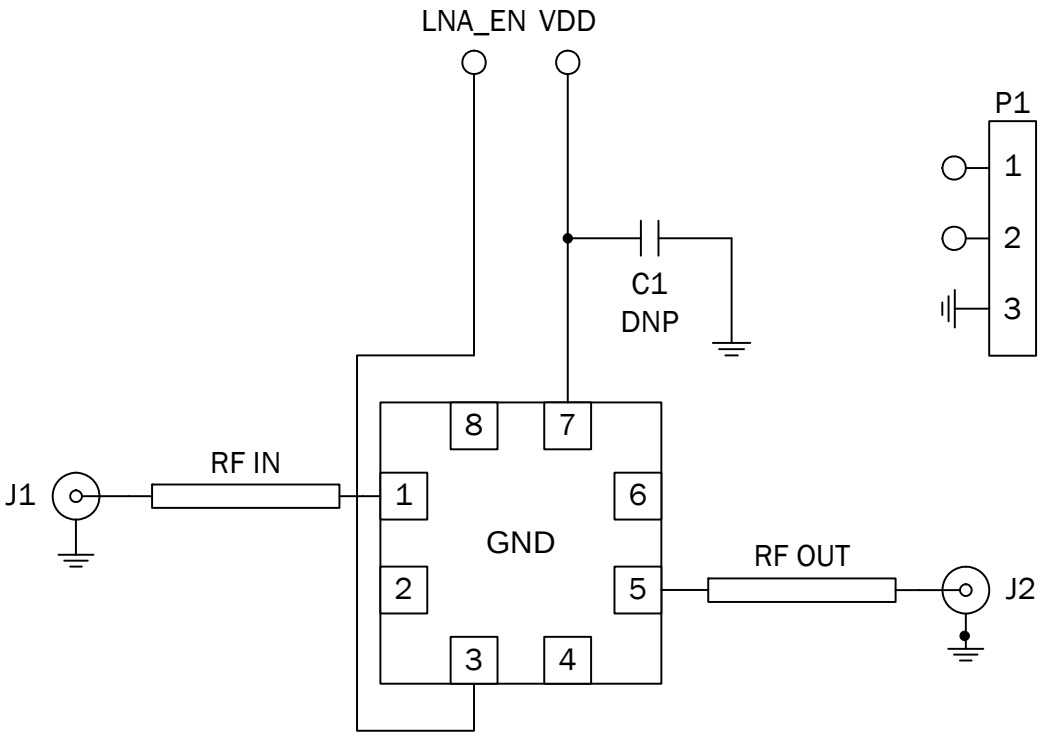
2.2mm x 2.2mm x 0.5mm



NOTES:

1. SHADED LEAD IS PIN 1.
2. DIMENSION APPLIES TO METALLIZED PAD AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM PAD TIP.

Evaluation Board Schematic



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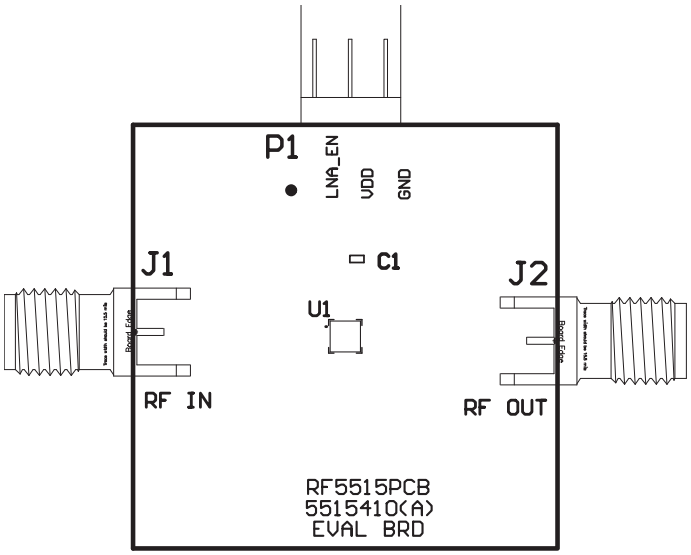
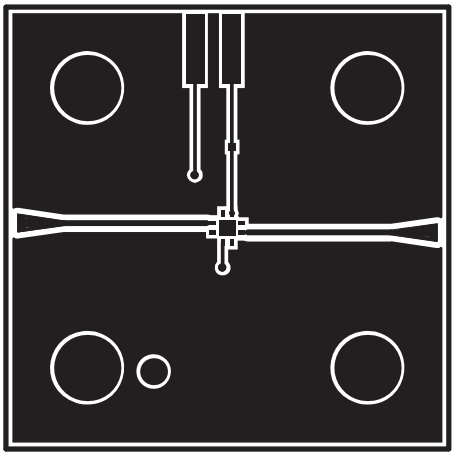
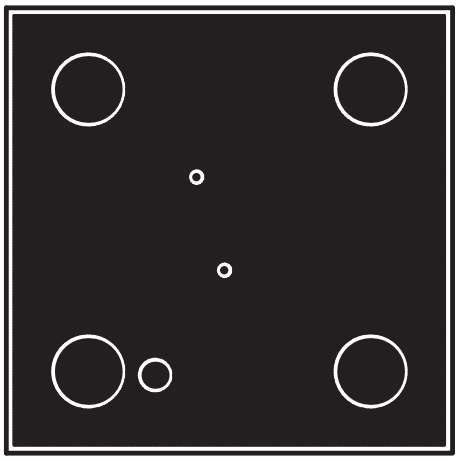
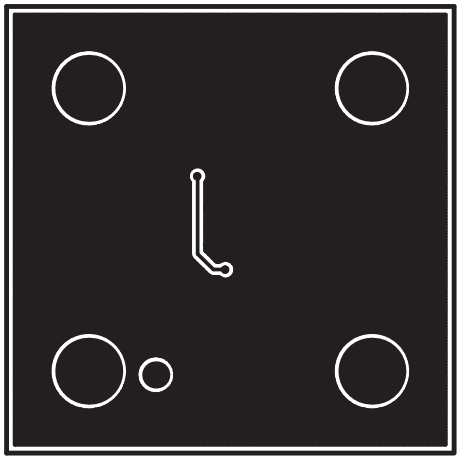
Evaluation Board Layout

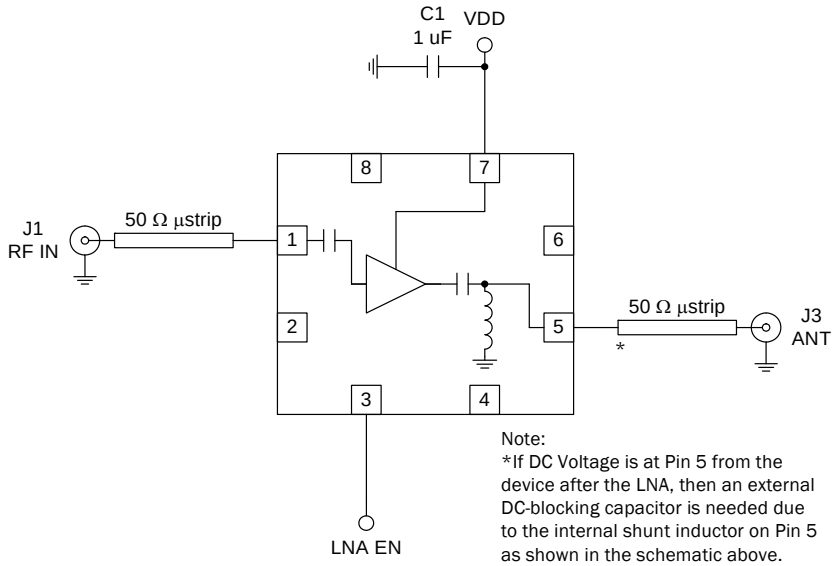








Application Schematic - 4.9GHz to 5.85GHz



Note:
*If DC Voltage is at Pin 5 from the device after the LNA, then an external DC-blocking capacitor is needed due to the internal shunt inductor on Pin 5 as shown in the schematic above.
** On the evaluation board adding C1, which is 1 uF, did not make any difference but could be needed depending on the layout and the nature of the supply voltage used in the system.

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PCB Design Requirements

PCB Surface Finish

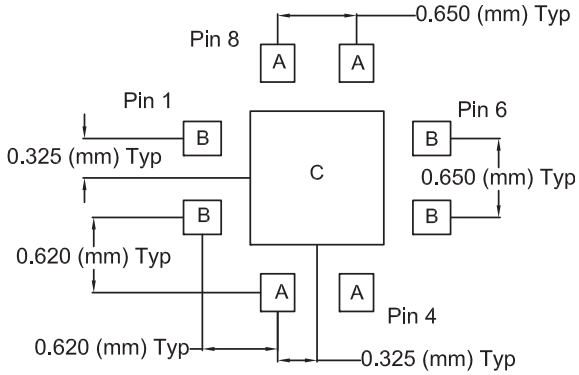
The PCB surface finish used for RFMD's qualification process is electroless nickel, immersion gold. Typical thickness is 3 micro-inch to 8 micro-inch gold over 180 micro-inch nickel.

PCB Land Pattern Recommendation *

PCB land patterns for RFMD components are based on IPC-7351 standards and RFMD empirical data. The pad pattern shown has been developed and tested for optimized assembly at RFMD. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from company to company, careful process development is recommended.

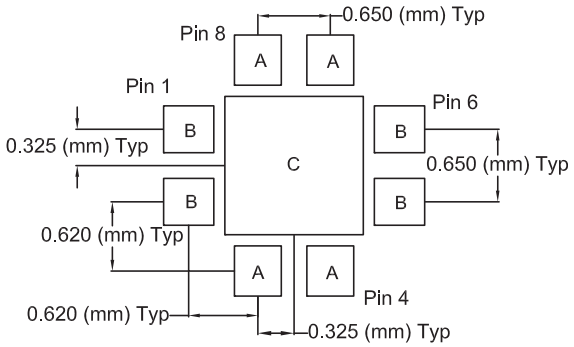
PCB Metal Land Pattern

A = 0.280 x 0.310 (mm) Typ
B = 0.310 x 0.280 (mm) Typ
C = 1.100 (mm) Sq



PCB Solder Mask Pattern

A = 0.42 x 0.45 (mm) Typ
B = 0.45 x 0.42 (mm) Typ
C = 1.24 (mm) Sq



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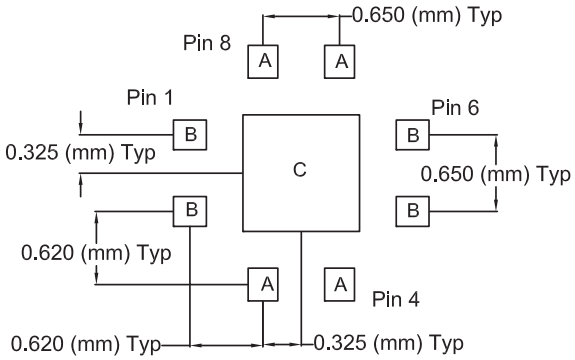
PCB Stencil Pattern

A = 0.25 x 0.28 (mm) Typ
B = 0.28 x 0.25 (mm) Typ
C = 0.99 (mm) Sq



Note: Thermal vias for center slug “C” should be incorporated into the PCB design. The number and size of thermal vias will depend on the application. Example of the number and size of vias can be found on the RFMD evaluation board layout.

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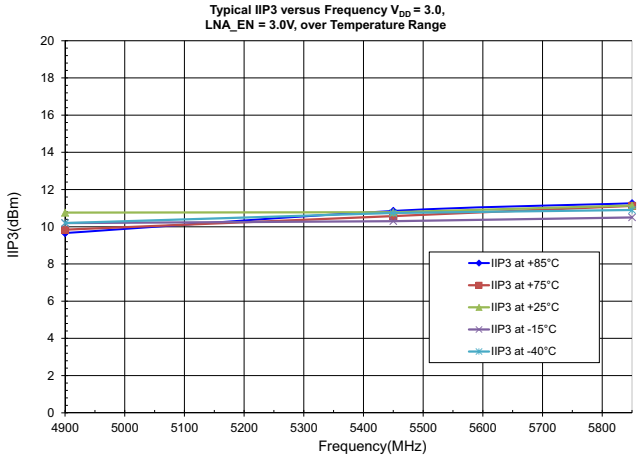
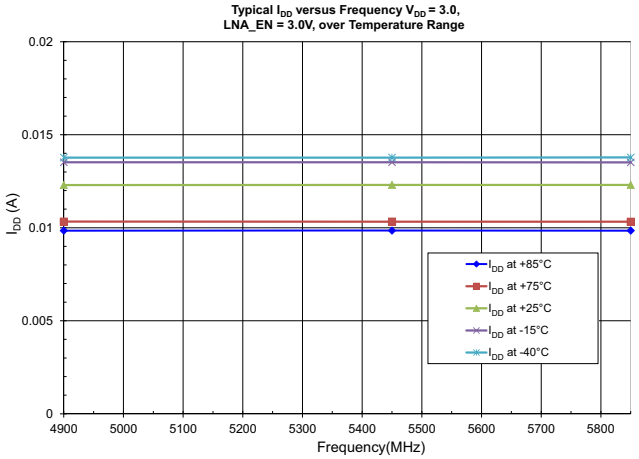
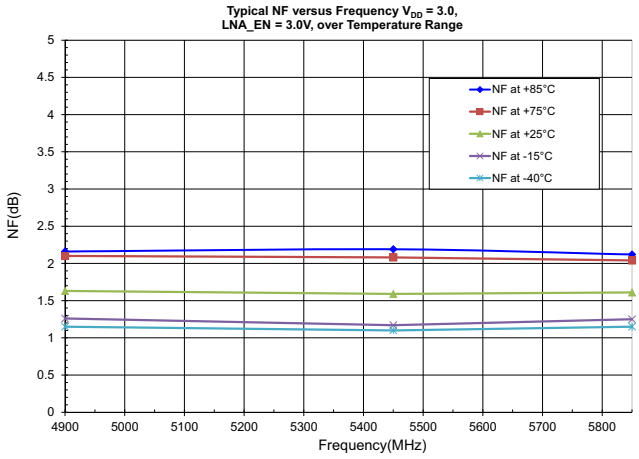
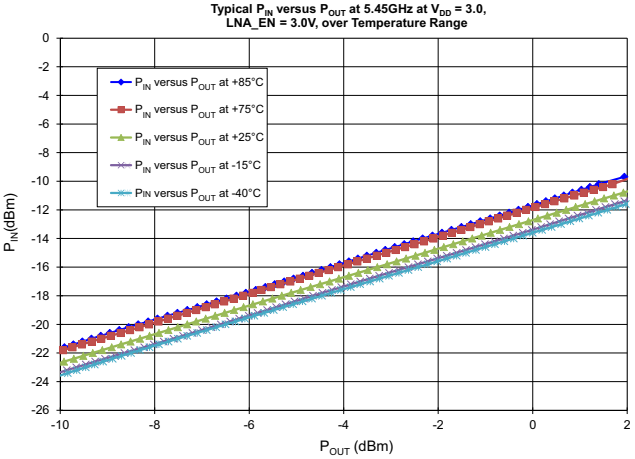
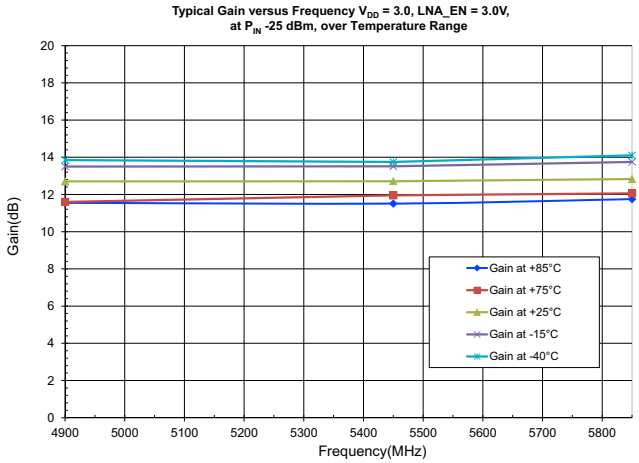
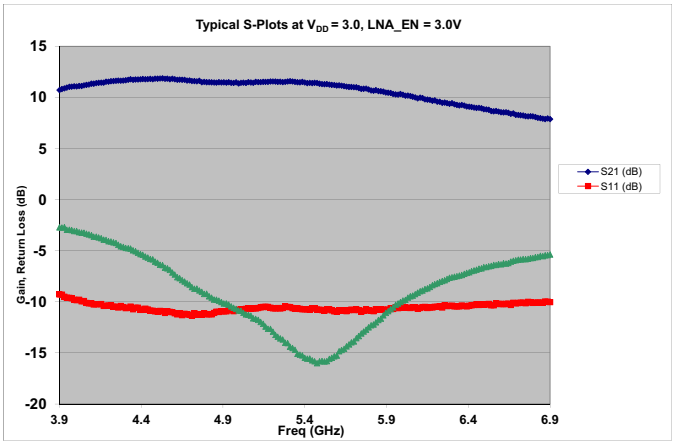

Typical IIP3 versus Frequency V_{DD} = 3.0, LNA_EN = 3.0V, over Temperature Range
IIP3(dBm)
Frequency(MHz)
IIP3 at +85°C
IIP3 at +75°C
IIP3 at +25°C
IIP3 at -15°C
IIP3 at -40°C


Typical I_{DD} versus Frequency V_{DD} = 3.0, LNA_EN = 3.0V, over Temperature Range
I_{DD} (A)
Frequency(MHz)
I_{DD} at +85°C
I_{DD} at +75°C
I_{DD} at +25°C
I_{DD} at -15°C
I_{DD} at -40°C


Typical NF versus Frequency V_{DD} = 3.0, LNA_EN = 3.0V, over Temperature Range
NF(dB)
Frequency(MHz)
NF at +85°C
NF at +75°C
NF at +25°C
NF at -15°C
NF at -40°C


Typical P_{IN} versus P_{OUT} at 5.45GHz at V_{DD} = 3.0, LNA_EN = 3.0V, over Temperature Range
P_{IN}(dBm)
P_{OUT} (dBm)
P_{IN} versus P_{OUT} at +85°C
P_{IN} versus P_{OUT} at +75°C
P_{IN} versus P_{OUT} at +25°C
P_{IN} versus P_{OUT} at -15°C
PIN versus P_{OUT} at -40°C


Typical Gain versus Frequency V_{DD} = 3.0, LNA_EN = 3.0V, at P_{IN} -25 dBm, over Temperature Range
Gain(dB)
Frequency(MHz)
Gain at +85°C
Gain at +75°C
Gain at +25°C
Gain at -15°C
Gain at -40°C


Typical S-Plots at V_{DD} = 3.0, LNA_EN = 3.0V
Gain, Return Loss (dB)
Freq (GHz)
S21 (dB)
S11 (dB)