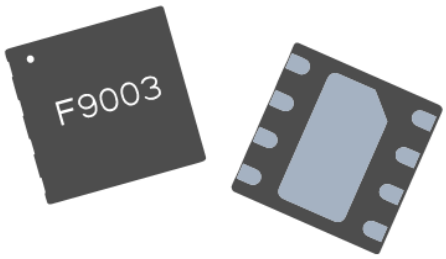
1. Description

- The F9003 is a linear LNA designed for SDARS, GPS, small cell and other high performance RF applications requiring ultra-low NF, high gain and linearity.
- The F9003 is an ideal LNA solution for high performance, multistage SDARS LNA designs offering a drop-in alternative to legacy SDARS LNA solutions.



F9003-PDS-F01

Figure 1. F9003 Package Outline

2. Applications

- SDARS LNA
- Cellular Boosters (Compensator)
- Cellular Infrastructure
- High Performance GPS/BDS

3. Features[1]

- Operating Frequency: 700-2700MHz
- Small Signal Gain: 21dB
- Output P1dB: 20.7dBm
- Output IP3: 39dBm
- Noise Figure: 0.3dB
- Operating Voltage/Current: 5V/58mA
- Package Size: 2.0 x 2.0 x 0.55mm

1. Measured in Raytron DEMO @1900MHz

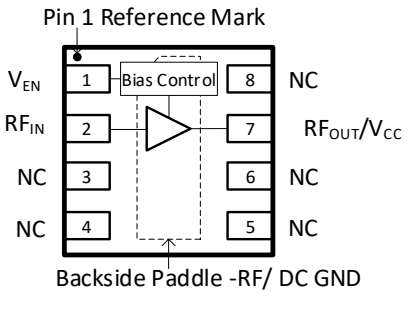
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter[1]	1200MHz	1500MHz	1900MHz	2332.5MHz	Units
Small Signal Gain	25.5	22.7	21	18.9	dB
Output P1dB[2]	19.2	20.2	20.7	20.5	dBm
Output IP3[3]	37	39	39	40	dBm
Noise Figure[4]	0.35	0.21	0.3	0.7	dB

1. V_{DD}=5V, I_{DQ}=55mA,I_{EN}=3mA, Temp=25℃, 50Ω test system
2. Input signal: CW
3. Input signal: 2-tone, P_{OUT}=2dBm/tone, Δf=1MHz @ 1200MHz and 1500MHz, P_{OUT}=4dBm/tone, Δf=2MHz @ 1900MHz and 2332.5MHz
4. SMA to SMA data

5. Block Diagram



F9003-PDS-F02

Figure 2. F9003 Block Diagram TOP View

Table of Contents

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6. Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Operating Voltage	V_{DD}	5.5	V
Input Power	P_{IN}	23	dBm
Storage Temperature Range	T_{STG}	- 55 ~ +125	°C
Operating Junction Temperature	T_J	150	°C

7. Recommended Operating Conditions

Table 3. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Operating Temperature Range	-40	25	105	°C
Operating Voltage (V_{DD}, V_{EN})	3	5.0	5.25	V
Operating Frequency	700	-	2700	MHz

8. Typical Performance

8.1 Typical Performance at 1600-2700MHz

8.1.1 Electronic Characteristics

Table 4. Electrical Characteristics (V_{DD}=V_{EN}=5V, I_{DQ}=55mA, I_{EN}=3mA, T_C=25℃, 50Ω test system)

Parameter	Conditions	Typical Values		Units
Frequency	-	1900	2332.5	MHz
Small Signal Gain	-	21	18.9	dB
Input Return Loss (S11)	-	11	9.4	dB
Output Return Loss (S22)	-	10.8	10.8	dB
Output P1dB	-	20.7	20.5	dBm
Output IP3	P_{OUT}=4dBm/tone, Δf=2MHz	39	40	dBm
Noise Figure	DEMO SMA to SMA	0.3	0.7	dB
Device Operating Current	-	58		mA

8.1.2 Performance Plot [C]

(V_{DD}=V_{EN}=5V, I_{DQ}=55mA, I_{EN}=3mA, T=25℃, 50Ω test system)

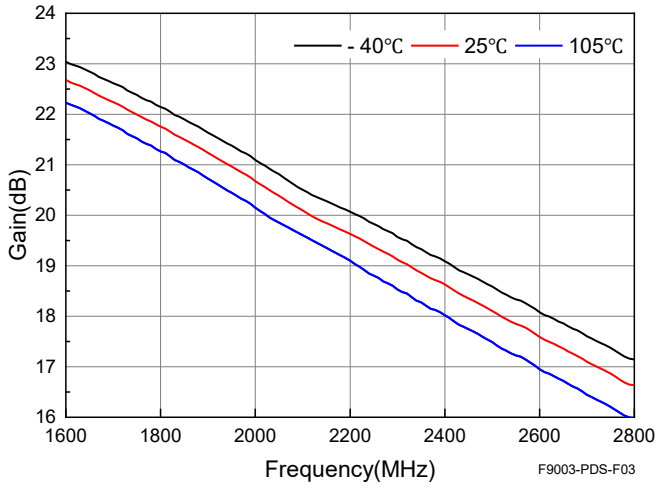


Figure 3. Gain vs. Freq.

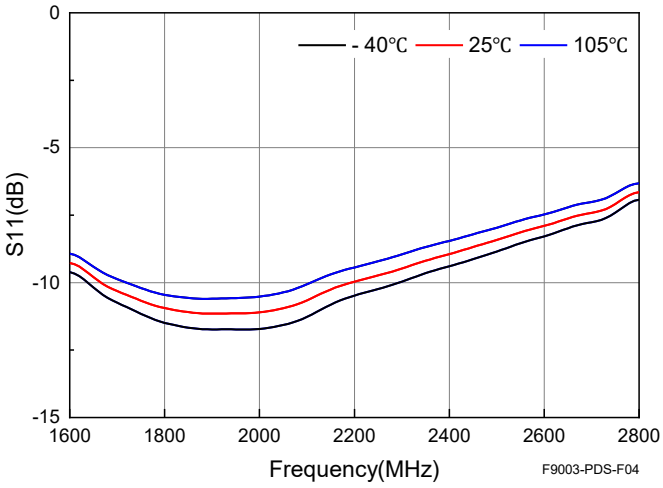


Figure 4. S11 vs. Freq.

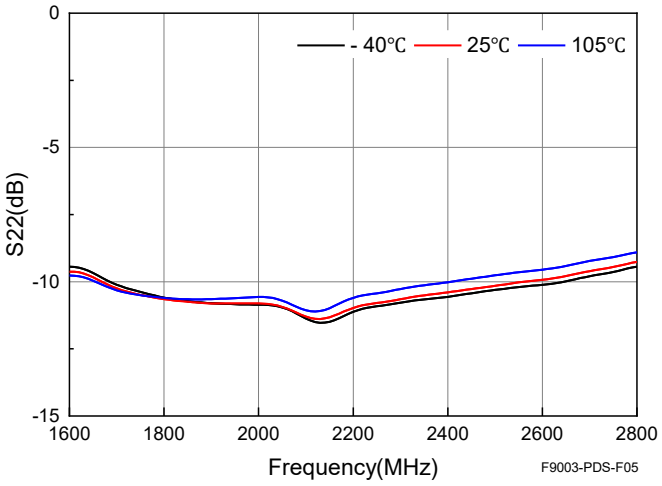


Figure 5. S22 vs. Freq.

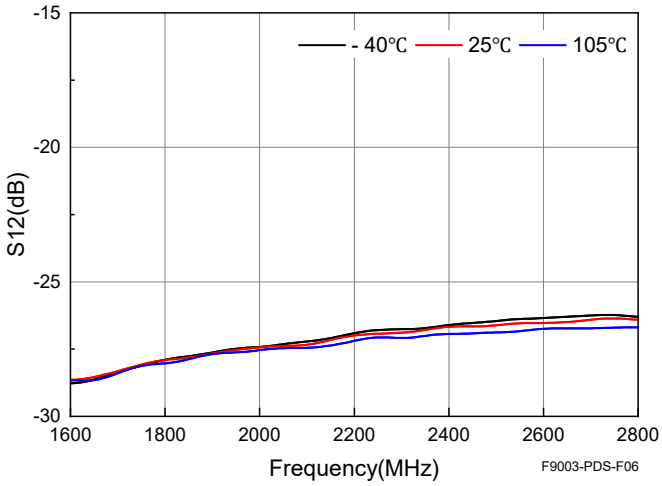


Figure 6. S12 vs. Freq.

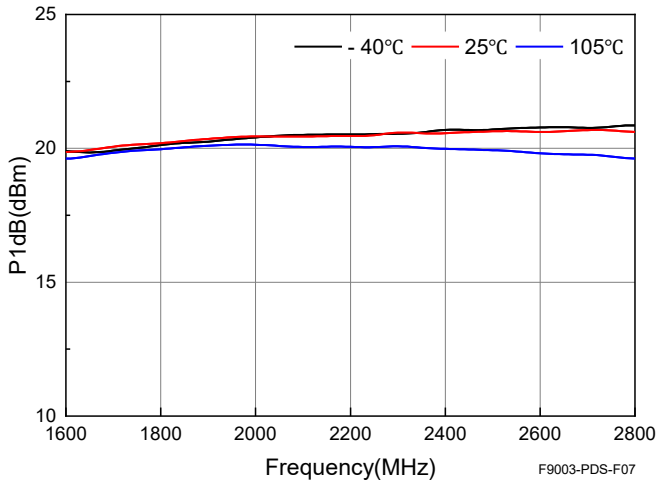


Figure 7. P1dB vs. Freq.

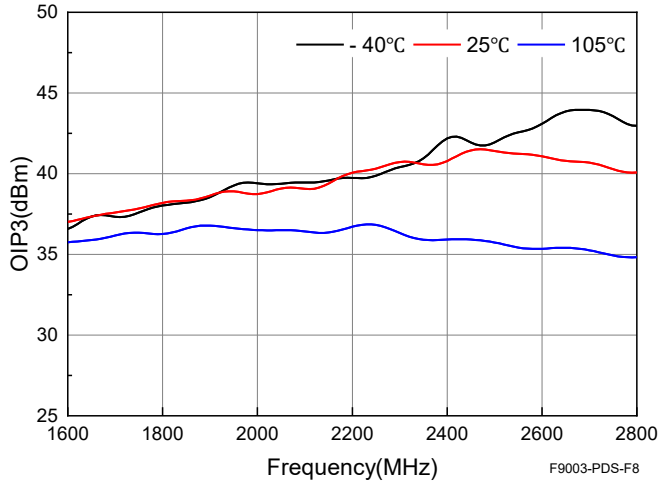


Figure 8. OIP3 vs. Freq.

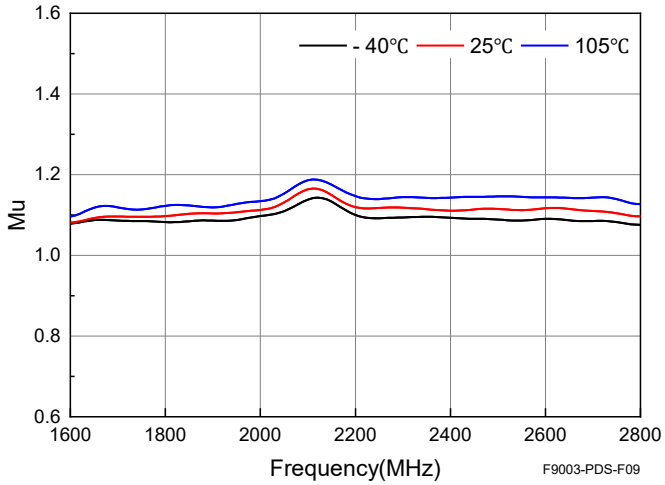


Figure 9. Stability Mu vs. Freq.

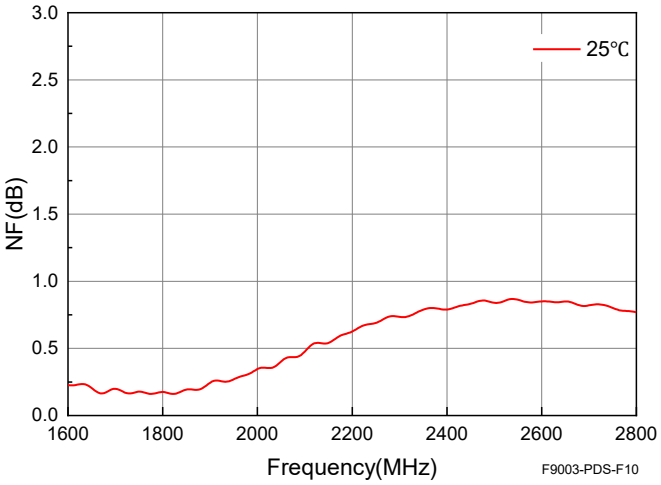


Figure 10. Noise Figure vs. Freq.

8.2 Typical Performance at 900-1900MHz

8.2.1 Electronic Characteristics

Table 5. Electrical Characteristics (V_{DD}=V_{EN}=5V, I_{DQ}=60mA, I_{EN}=3mA, T_C=25℃, 50Ω test system)

Parameter	Conditions	Typical Values		Units
Frequency	-	1200	1500	MHz
Small Signal Gain	-	25.5	22.7	dB
Input Return Loss (S11)	-	12.9	13	dB
Output Return Loss (S22)	-	10.7	7	dB
Output P1dB	-	19.2	20.2	dBm
Output IP3	P_{OUT}=2dBm/tone, Δf=1MHz	37	39	dBm
Noise Figure	DEMO SMA to SMA	0.35	0.21	dB
Device Operating Current	-	63		mA

8.2.2 Performance Plot

(V_{DD} =V_{EN}=5V, I_{DQ}=60mA, I_{EN}=3mA, T_C=25℃, 50Ω test system)

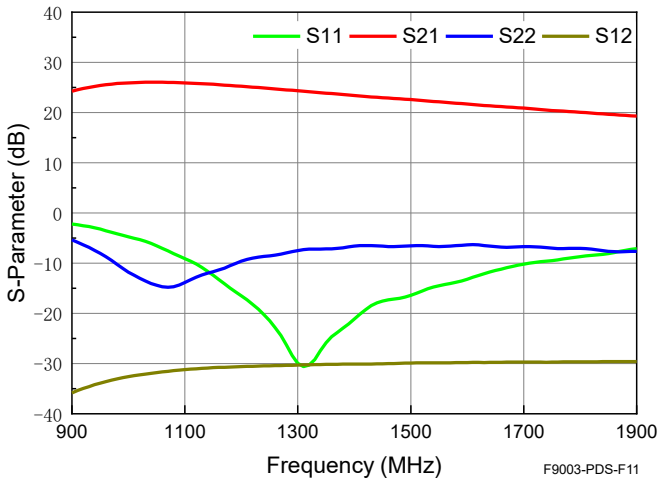


Figure 11. S-Parametet vs. Freq.

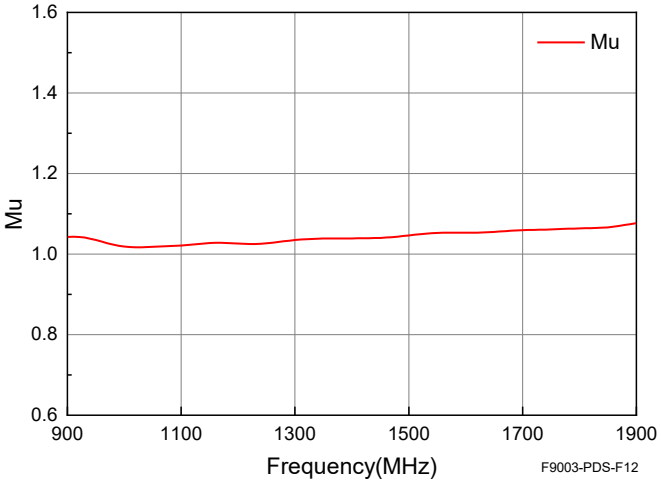


Figure 12. Stability Mu vs. Freq.

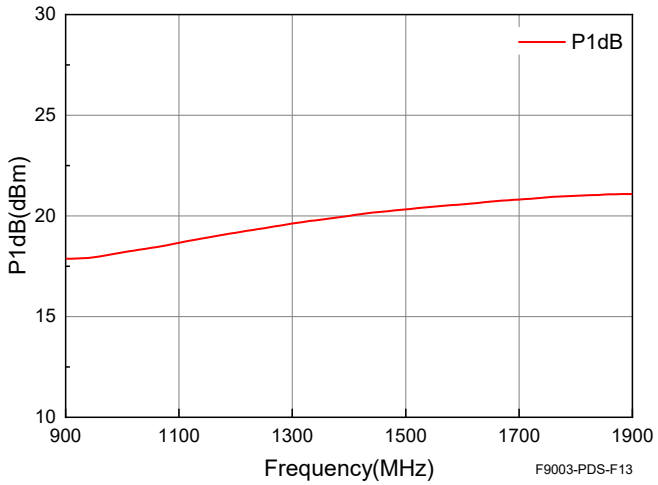


Figure 13. P1dB vs. Freq.

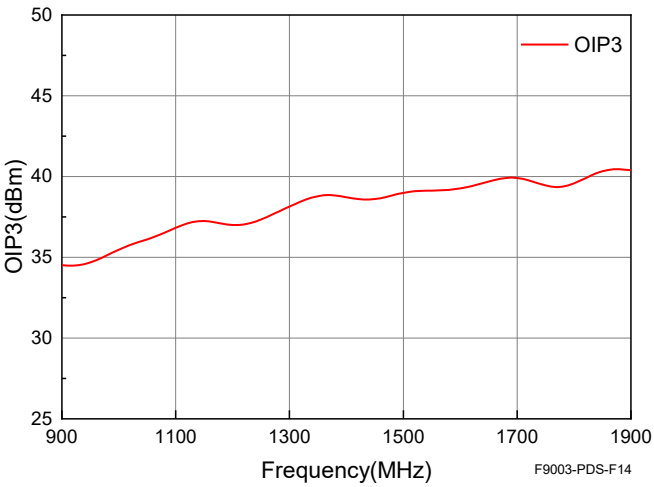


Figure 14. OIP3 vs. Freq.

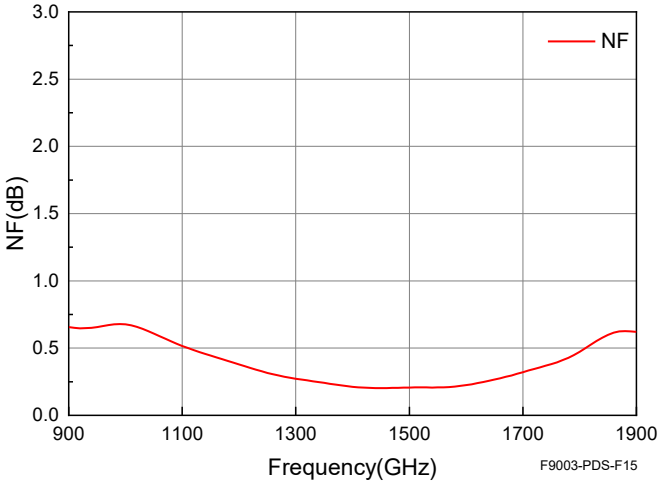


Figure 15. Noise Figure vs. Freq.

8.3 Typical Performance at 1100-1700MHz

8.3.1 Electronic Characteristics

Table 6. Electrical Characteristics (V_{DD}=V_{EN}=5V, I_{DQ}=15mA, I_{EN}=3mA, T_C=25℃, 50Ω test system)

Parameter	Conditions	Typical Values		Units
Frequency	-	1200	1600	MHz
Small Signal Gain	-	21.4	17.5	dB
Input Return Loss (S11)	-	9.8	11.5	dB
Output Return Loss (S22)	-	30.7	12.5	dB
Output P1dB	-	16.6	19.4	dBm
Output IP3	P_{OUT}=2dBm/tone, Δf=1MHz	28.7	26.0	dBm
Noise Figure	DEMO SMA to SMA	0.40	0.50	dB
Device Operating Current	-	15		mA

8.3.2 Performance Plot

(V_{DD} =V_{EN}=5V, I_{DQ}=15mA, I_{EN}=3mA, T_C=25℃, 50Ω test system)

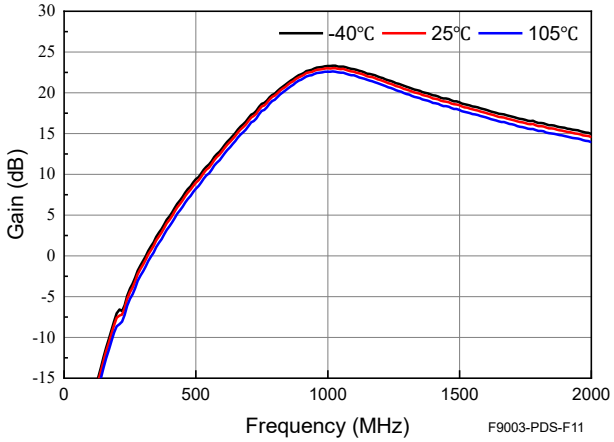


Figure 11. Gain vs. Freq.

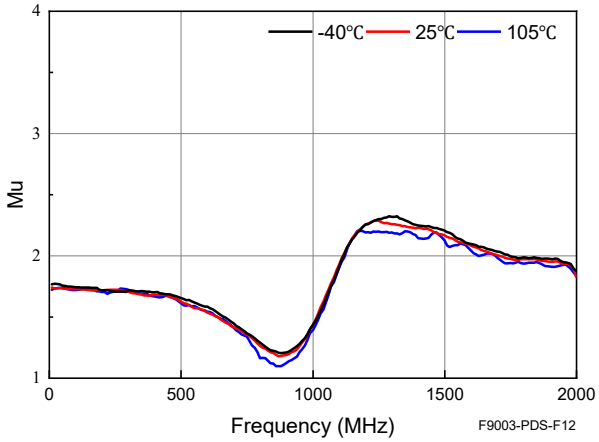


Figure 12. Stability Mu vs. Freq.

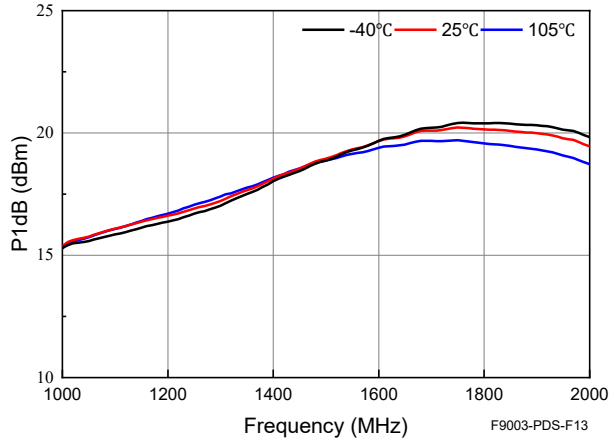


Figure 13. P1dB vs. Freq.

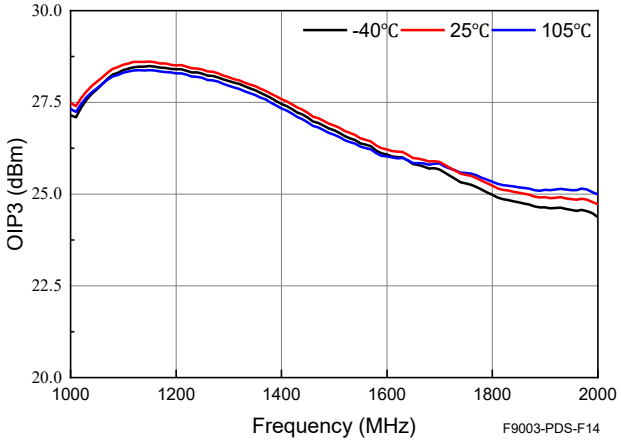


Figure 14. OIP3 vs. Freq.

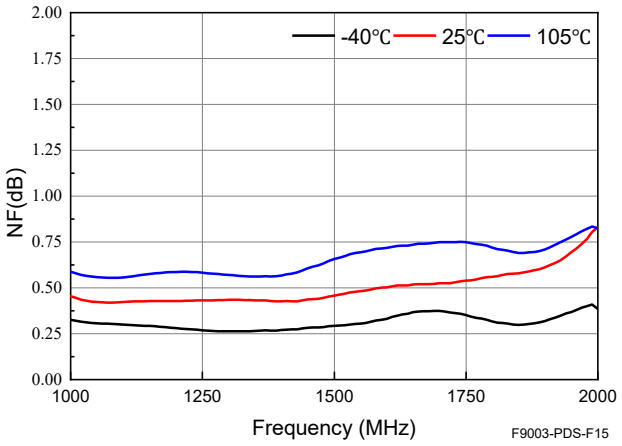


Figure 15. Noise Figure vs. Freq.

9. Package Outline

■ Pin Layout

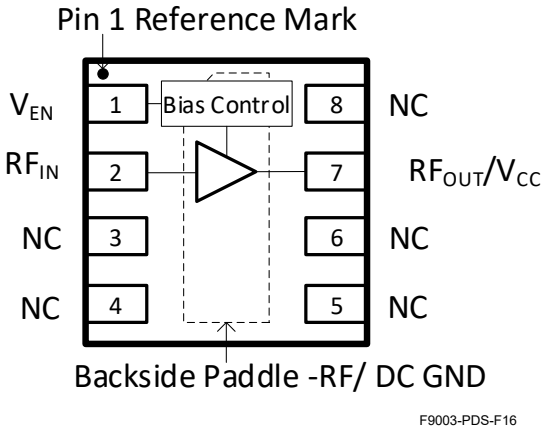


Figure 16. F9003 Pin Layout

Table 7. Pin Description

Pin	Symbol	Description
1	V_{EN}	V_{EN} and series resistor set $I_{DQ.}$ V_{EN}≤0.2V disables device.
2	RF_{IN}	RF Input. External DC Block capacitor required.
7	RF_{OUT}/V_{DD}	RF Output and DC supply input. External DC Block capacitor required.
3,4,5,6,8	NC	Not Connected
Backside Paddle	GND	RF/DC ground

■ Mechanical Drawing

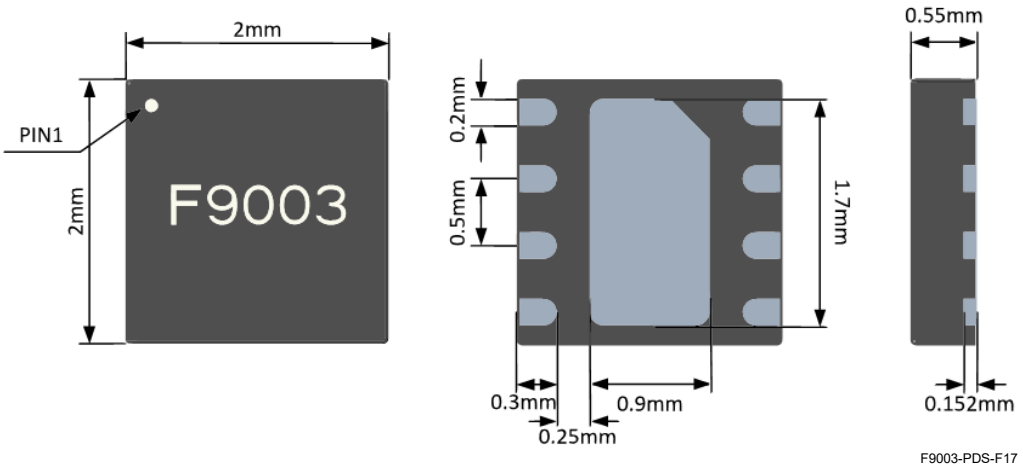


Figure 17. F9003 Mechanical Drawing

10. Application Circuit

■ 1600-2700MHz&900-1900MHz

■ Schematic

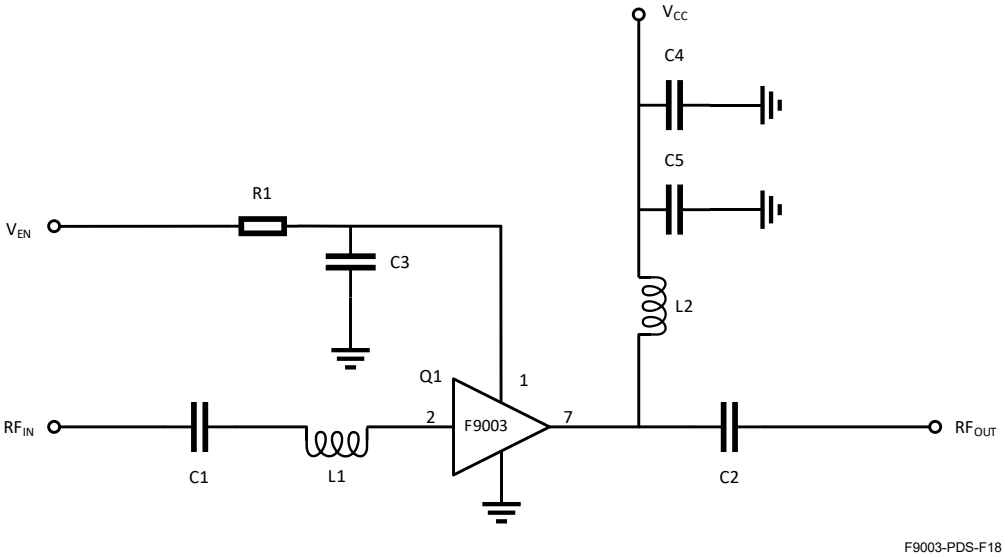


Figure 18. F9003 Application Circuit Schematic

■ Layout

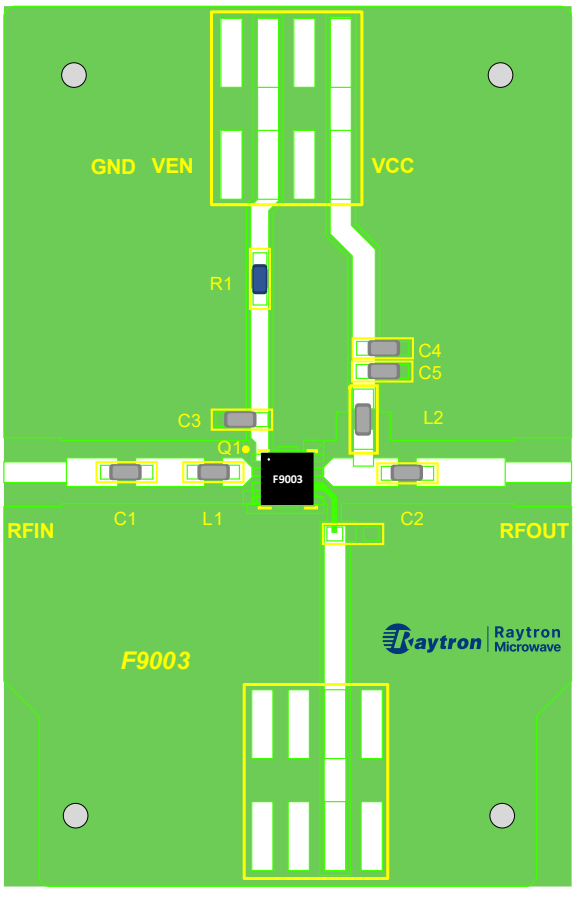


Figure 19. F9003 Application Circuit Layout

Table 8. Bill of Materials (1600-2700MHz Reference Design)

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
Q1	N/A	F9003, DFN-8 package	Raytron	F9003
C1	5.1pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E5R1BB12
C2	2.4pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E2R4BB12
C3	1000pF	0603 Capacitor	Various	N/A
C4	0.1uF	0603 Capacitor	Various	N/A
C5	82pF	C0G 250V 0603 Capacitor	Various	GQM1875C2E820GB12
L1	3.9nH	High Q 0603 Inductance	Murata	LQW18AN3N9C80D
L2	4.3nH	High Q 0603 Inductance	Murata	LQW18AN4N3C80D
R1	1kΩ	1/4W 0603 Resistor	Various	N/A

Table 9. Bill of Materials (900-1900MHz Reference Design)

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
Q1	N/A	F9003, DFN-8 package	Raytron	F9003
C1	10pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E100GB12
C2	2pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E2R0BB12
C3	1000pF	0603 Capacitor	Various	N/A
C4	0.1uF	0603 Capacitor	Various	N/A
C5	82pF	C0G 250V 0603 Capacitor	Various	GQM1875C2E820GB12
L1	5.6nH	High Q 0603 Inductance	Murata	LQW18AN5N6C80D
L2	9.1nH	High Q 0603 Inductance	Murata	LQW18AN9N1C80D
R1	820Ω	1/4W 0603 Resistor	Various	N/A

■ 1100-1700MHz

■ Schematic

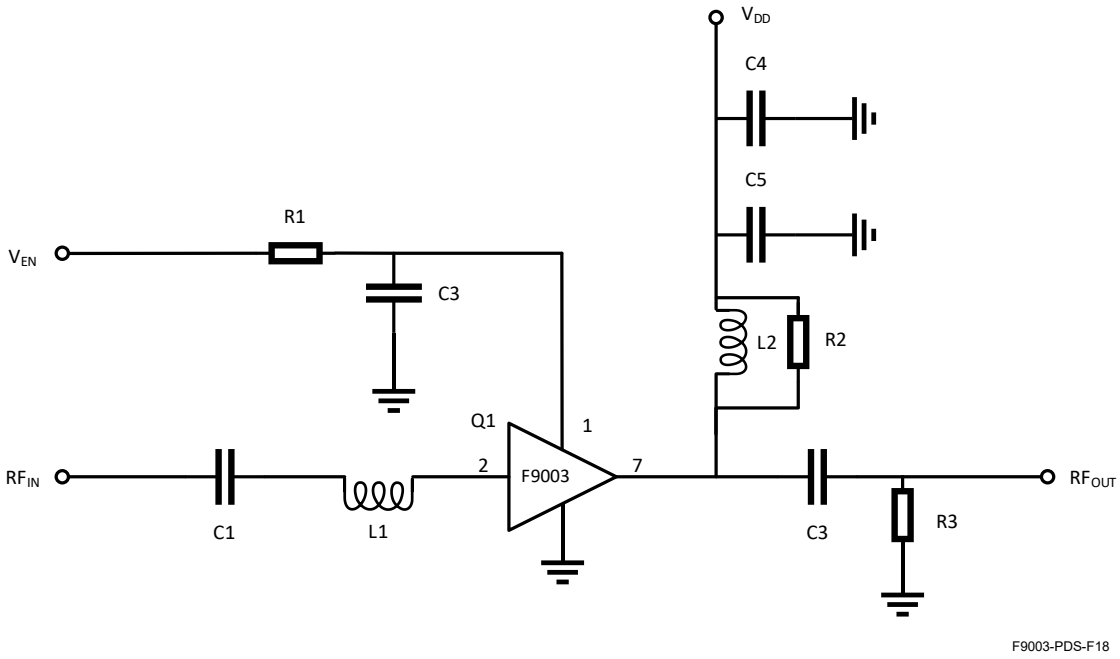


Figure 18. F9003 Application Circuit Schematic

■ Layout

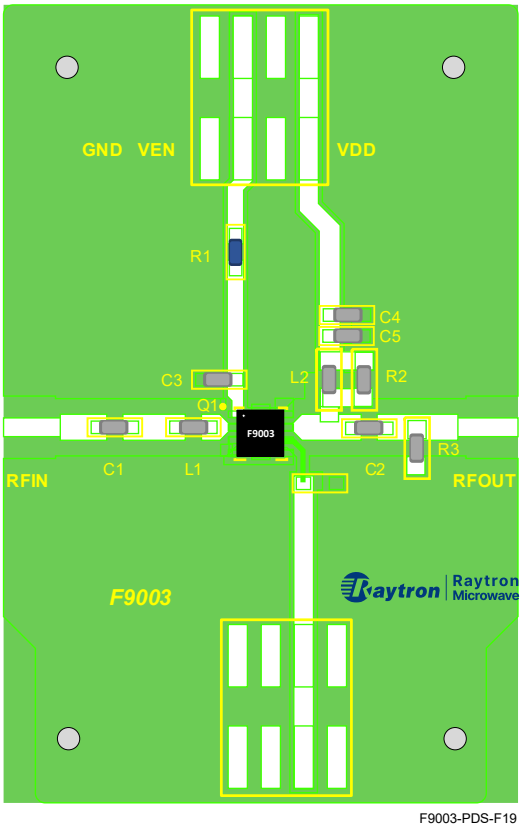


Figure 19. F9003 Application Circuit Layout

Table 10. Bill of Materials (1100-1700MHz Reference Design)

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
Q1	N/A	F9003, DFN-8 package	Raytron	F9003
C1	22pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E220GB12
C2	82pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E820GB12
C3	1.8pF	0603 Capacitor	Various	GQM1875C2E1R8BB12
C4	1000pF	0603 Capacitor	Various	GRM1885C1H102JA01D
C5	1uF	C0G 250V 0603 Capacitor	Various	GCM188R71E105KA64D
L1	4.7nH	High Q 0603 Inductance	Murata	LQW18AN4N7C80D
L2	6.5nH	High Q 0603 Inductance	Murata	LQW18AN6N5C80D
R1	6.8kΩ	1/4W 0603 Resistor	Various	N/A
R2	510Ω	1/4W 0603 Resistor	Various	N/A
R3	180Ω	1/4W 0603 Resistor	Various	N/A

11. Handling Precautions

- **ESD Caution**

Table 11. ESD/MSL Rating

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1B	ESDA / JEDEC JS-001-2014
ESD – Charged Device Model (CDM)	Class C3	ESDA / JEDEC JS-002-2014
MSL – Moisture Sensitivity Level	Level 1	IPCJEDEC J-STD-020

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore proper ESD precautions should be taken to avoid performance degradation or loss of functionality.



12. Contact Information

For the latest specifications, additional product information, technical support and sales support, please contact:

- **Email:** RF.support@raytrontek.com
- **Web:** www.raytrontek.com

13. Disclaimer

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