Product Specification

RS3213 Low Frequency Wideband LNA

General Description

The RS3213 is a cascadable, wideband LNA in a low-cost surface mount package. At 0.5 GHz, the amplifier provides 26 dB gain, +30 dBm OIP3 and 0.5 dB Noise Figure while drawing 30 mA current from a 3.3V supply.

The RS3213 provides excellent noise figure across a broad range of frequencies with the integration of a shut-down biasing capability to allow for operation for TDD applications. The low noise figure and high linearity performance allows the device to be used in both receiver and transmitter chains for high performance systems. The internal active bias circuit also enables stable operation over bias and temperature variations and can be biased from a single positive supply ranging from +3 to +5 volts. The amplifier is internally matched using a high-performance E-pHEMT process and is housed in a small 2x2 mm surface-mount package.

The RS3213 covers the 0.03 - 2 GHz frequency band and is targeted for land mobile radio or other applications requiring high linearity and/or low noise figure

Applications

- Land mobile radio
- Repeater/DAS
- General purpose RF
- TDD/FDD system

Features

- Wideband and Robust
  - 0.03 – 2 GHz operational frequency
  - Designed to withstand 20dBm input power
- Outstanding performance in small package
  - 26/28 dB Gain
  - 29/34 dBm OIP3
  - 0.5 dB Noise Figure
  - 30 mA current consumption under 3.3 V
  - 60 mA current consumption under 5 V
  - 2 x 2 mm DFN package

Functional Diagram/Application Circuit

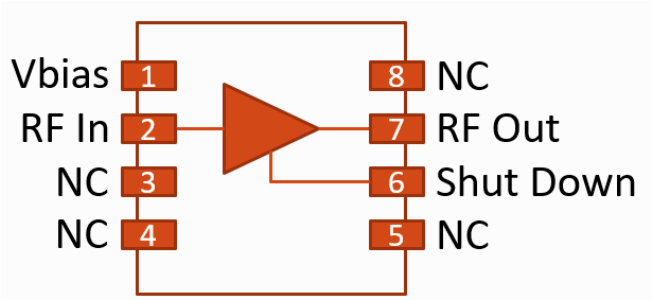


Figure 1

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Absolute Maximum Ratings

Table 1

Parameter	Min	Max	Units
VDD to GND	-0.3	6	V
SD pin to GND	-0.3	6	V
Input Power		27	dBm
Maximum Junction Temperature		175	°C
Storage Temperature Range	-65	150	°C
ESD Voltage– HBM (Per JESD22-A114)		TBD	
ESD Voltage – CDM (Per JESD22-C101)		TBD	

Stresses above those listed above may cause permanent damage to the device. Functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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Recommended Operating Conditions

Table 2

Parameter	Min	Typical	Max	Unit
Supply Voltage (All VDD)	3	3.3	5.25	V
Operating Temp Range	-40	25	105	°C
Control Logic High Voltage	1.17	3.3	5	V
Control Logic Low Voltage	0		0.63	V
Input CW Power			20	dBm

Operation should be restricted to the limits in the Recommended Operating Conditions table. Operation between operating range maximum and absolute maximum for extended periods may reduce reliability.

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Specification

Typical Application Circuit, VDD=3.3V, 30mA IDD, T_C = +25°C, PCB board trace and connector losses are de-embedded unless otherwise noted.

Table 3

Parameters	Conditions	Min	Typ	Max	Units
Operational Frequency Range		30		3000	MHz
Gain	30MHz - 520MHz		26.6		dB
	520MHz - 1000MHz		26		
	1000MHz - 2000MHz, with external matching		23		
	2000MHz - 3000MHz, with external matching		18		
Input Return Loss	30MHz - 520MHz		-12		dB
	520MHz -1000MHz		-18		
	1000MHz - 2000MHz, with external matching		-10		
	2000MHz - 3000MHz, with external matching		-6		
Output Return Loss	30MHz - 520MHz		-15		dB
	520MHz - 1000MHz		-17		
	1000MHz - 2000MHz, with external matching		-12		
	2000MHz - 3000MHz, with external matching		-13		
Output P1dB	3.3V, 30mA		16		dBm
Output IP3	3.3V, 30mA. Pout = +1 dBm/tone, Frequency Spacing = 1 MHz		29		dBm
Noise Figure	30MHz - 520MHz		0.45		dB
	520MHz - 1000MHz		0.45		
	1000MHz - 2000MHz, with external matching		0.5		
	2000MHz - 3000MHz, with external matching		0.5		
Device Current, IDD	ON, Normal operation, VSD = 0 V		30		mA
OFF, Shut down, VSD = 1.8 V			2		mA
Device Control Voltage, VSD	ON, Logic Low	0	0.63		V
OFF, Logic High		1.17		VDD	V
Control Pin Current, ISD			150		µA
Device ON or OFF Timing	50% of VSD to 90% or 10% RF Output		0.5		µS
Thermal Resistance, θ_{jc}	Junction to case		TBD		°C/W

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Specification

Typical Application Circuit, VDD=5V, 60mA IDD, T_C = +25°C, PCB board trace and connector losses are de-embedded unless otherwise noted.

Table 4

Parameters	Conditions	Min	Typ	Max	Units
Operational Frequency Range		30		3000	MHz
Gain	30MHz - 520MHz		28.5		dB
	520MHz - 1000MHz		27.5		
	1000MHz - 2000MHz, with external matching		25		
	2000MHz - 3000MHz, with external matching		21		
Input Return Loss	30MHz - 520MHz		-20		dB
	520MHz - 1000MHz		-20		
	1000MHz - 2000MHz, with external matching		-12		
	2000MHz - 3000MHz, with external matching		-6		
Output Return Loss	30MHz - 520MHz		-25		dB
	520MHz - 1000MHz		-25		
	1000MHz - 2000MHz, with external matching		-12		
	2000MHz - 3000MHz, with external matching		-12		
Output P1dB	5V, 60mA		19.5		dBm
Output IP3	5V, 60mA. Pout = +1 dBm/tone, Frequency Spacing = 1 MHz		34		dBm
Noise Figure	30MHz - 520MHz		0.45		dB
	520MHz - 1000MHz		0.45		
	1000MHz - 2000MHz, with external matching		0.5		
	2000MHz - 3000MHz, with external matching		0.5		
Device Current, IDD	ON, Normal operation, VSD = 0 V		60		mA
OFF, Shut down, VSD = 1.8 V			2		mA
Device Control Voltage, VSD	ON, Logic Low	0	0.63		V
OFF, Logic High		1.17		VDD	V
Control Pin Current, ISD			150		μA
Device ON or OFF Timing	50% of VSD to 90% or 10% RF Output		0.5		μS
Thermal Resistance, θjc	Junction to case		TBD		°C/W

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Pin Diagram

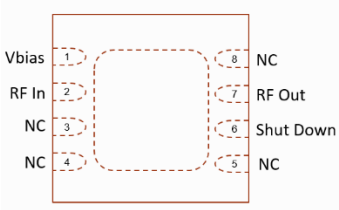


Figure 2

Pin Description

Table 5

Pad No.	Label	Description
1	Vbias	Bias voltage. Bias input voltage for reference, and internal control circuits
2	RF In	RF Input. Requires a DC-blocking capacitor and an inductor.
3,4,5,8	NC	No connection. Recommend to connect to the PCB ground plane.
6	Shut Down	Shutdown Input. A logic-high disables the device.
7	RF Out	RF Output. RFOUT is internally matched to 50Ω and incorporates an internal DC-blocking capacitor.

Control Logic

Table 6

Mode	Shut Down Pin 6 logic
Amplifier Enable	0
Amplifier Shunt down	1

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Application Match from 30MHz to 1GHz

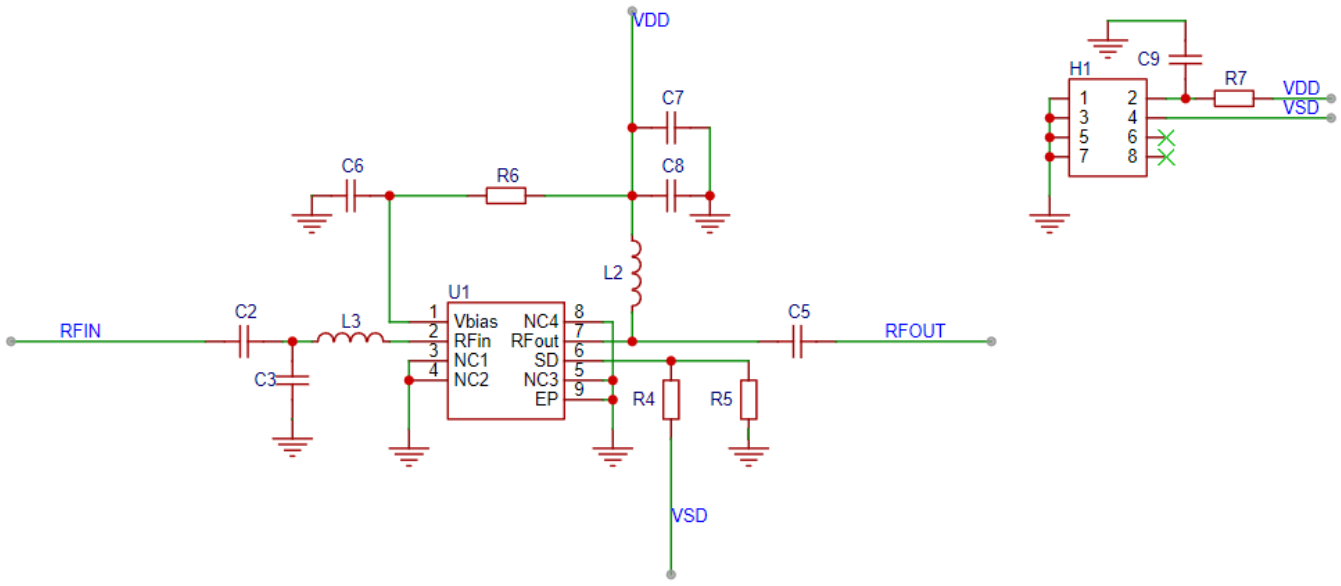
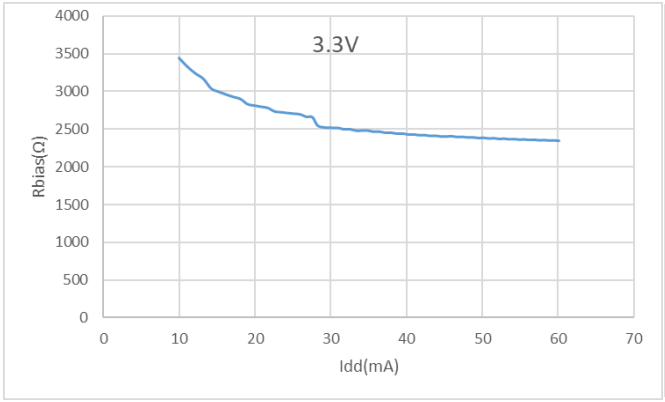


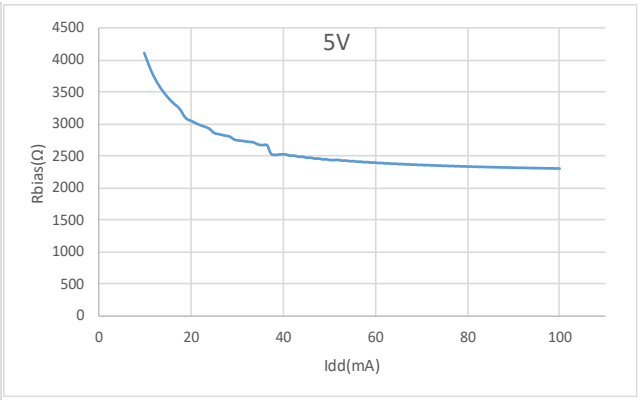
Figure 3

Table 7

Reference Designator	Value	Description
R4, R7	0Ω	C0402
R6	2.4KΩ(VDD=3.3V)/2.2KΩ(VDD=5V)	C0402
C2, C5, C7	10nF	C0402
C9	10uF	C0603
H1	\	HDR4X2
L3	8nH	L0402
R5	220K	R0402
U1	\	RS3213
L2	1uH	L0402
C8, C6	100pF	C0402
C3	1.7pF	C0402

Rbias(R6) VS Idd





Typical Performance Characteristics(3.3V 30mA, 0.03-1GHz matching)

Figure 4. Gain

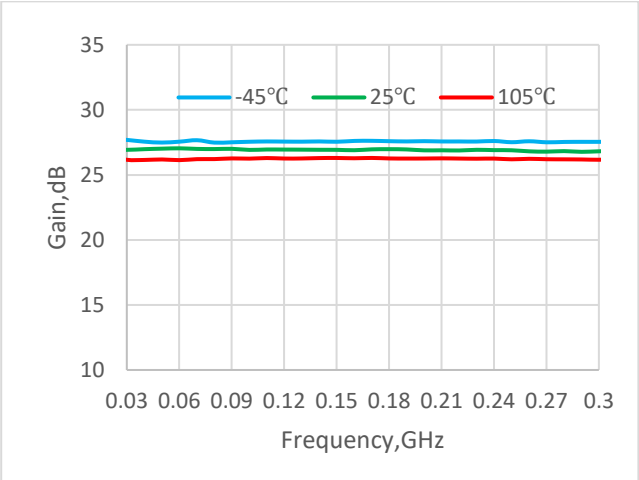


Figure 5. Input Return Loss

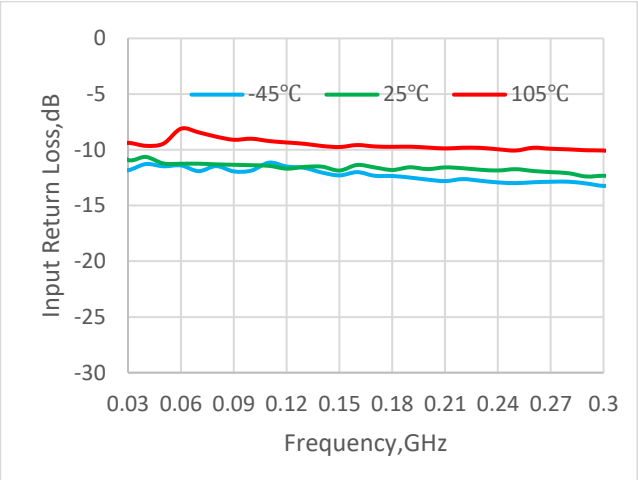


Figure 6. Output Return Loss

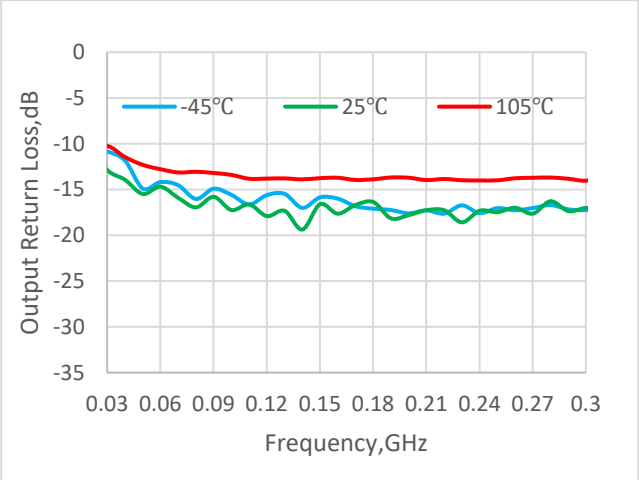


Figure 7. Noise Figure

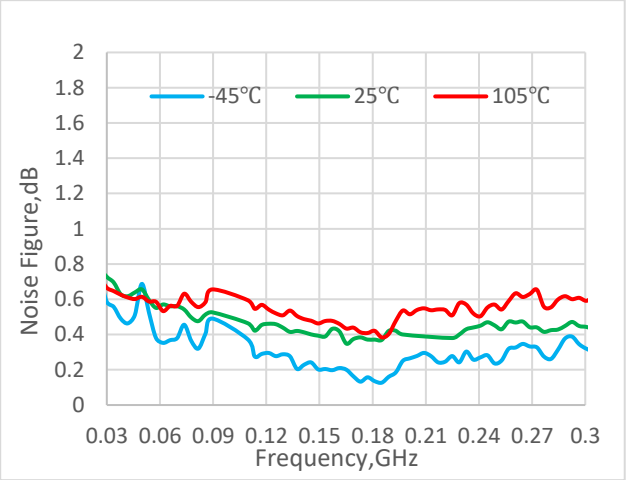


Figure 8. P1dB

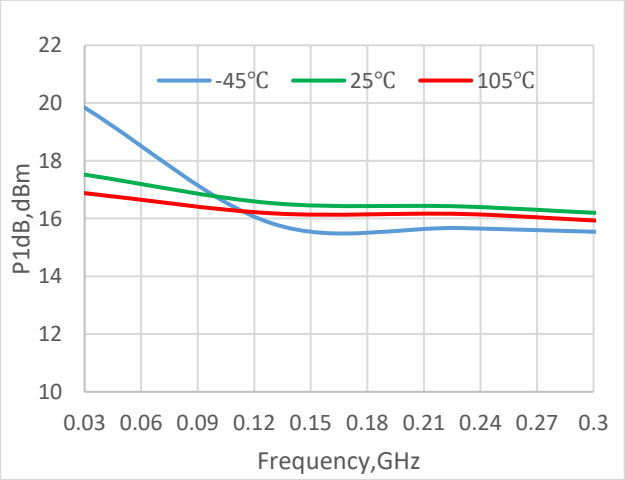
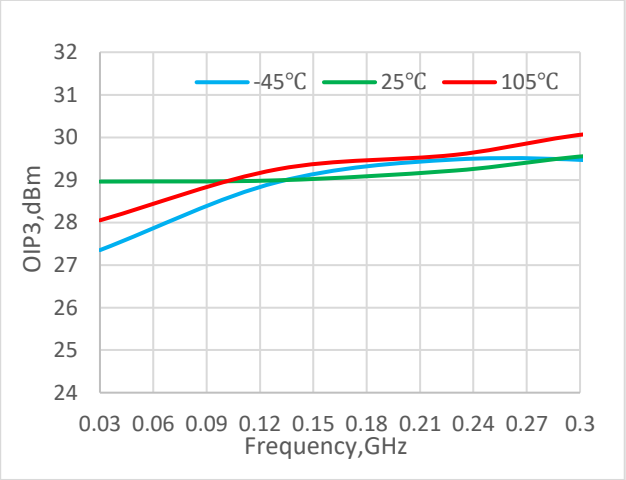


Figure 9. IP3



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Typical Performance Characteristics(3.3V 30mA, 0.03-1GHz matching)

Figure 10. Gain

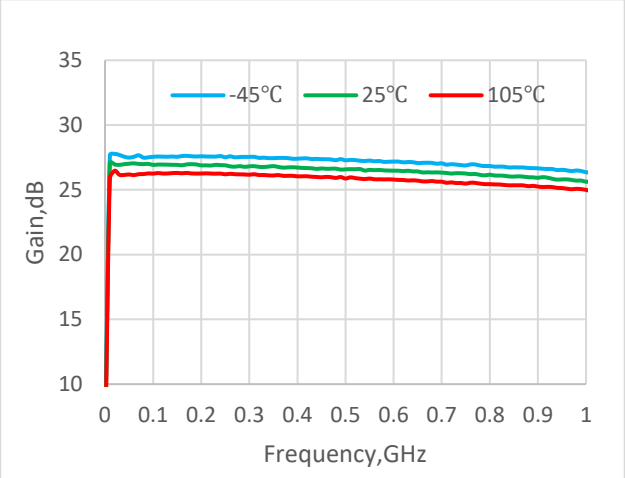


Figure 11. Input Return Loss

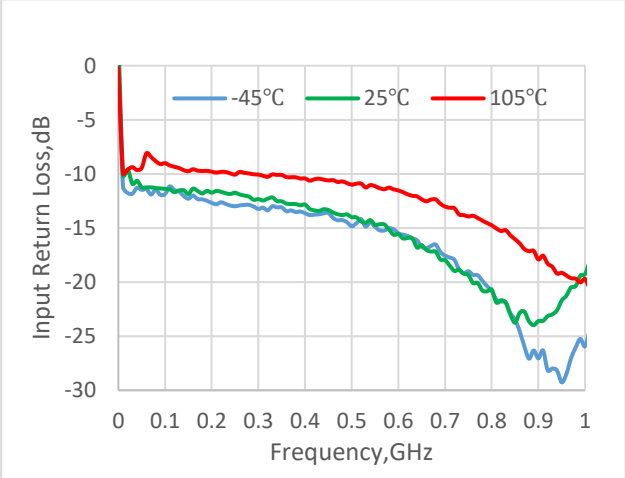


Figure 12. Output Return Loss

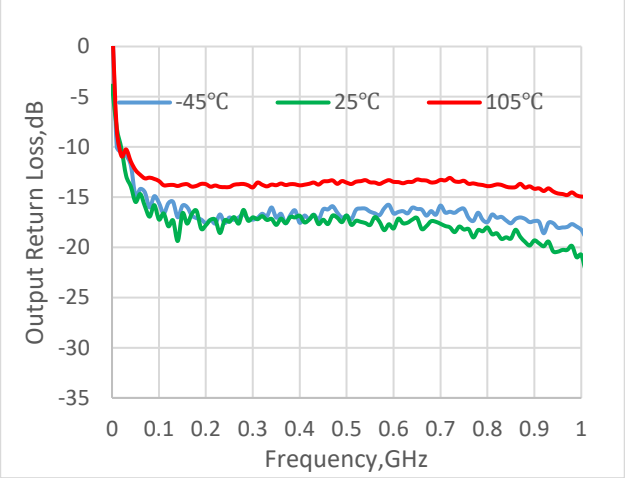


Figure 13. Noise Figure

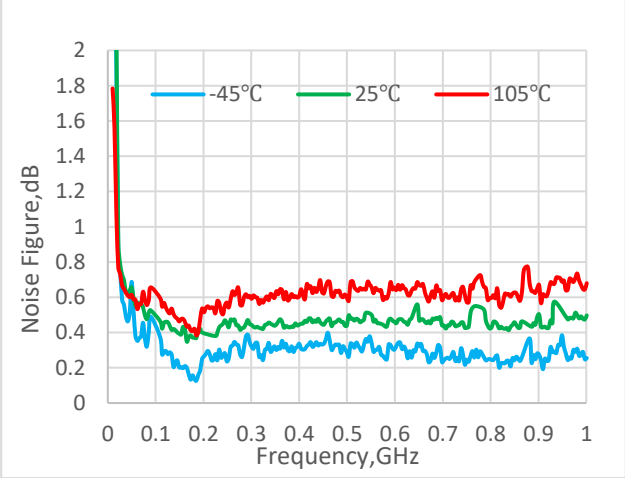


Figure 14. P1dB

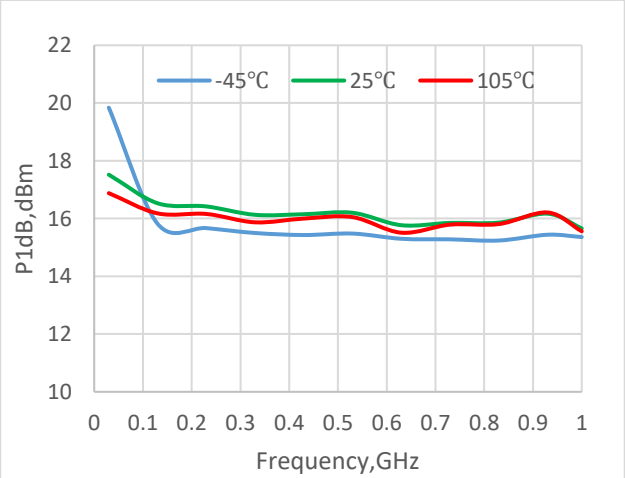
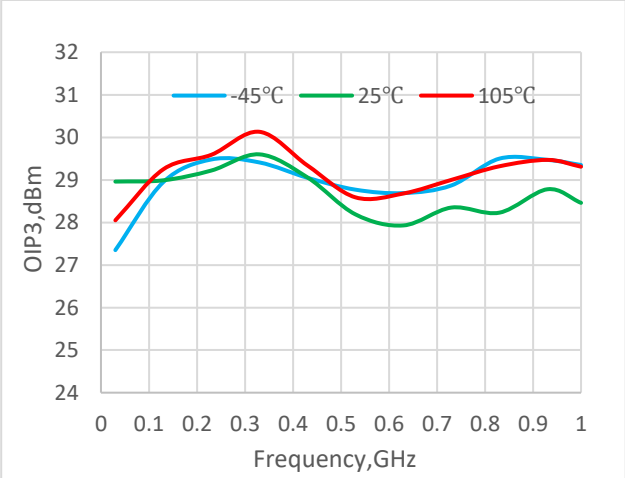


Figure 15. IP3



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Typical Performance Characteristics(5V 60mA, 0.03-1GHz matching)

Figure 16. Gain

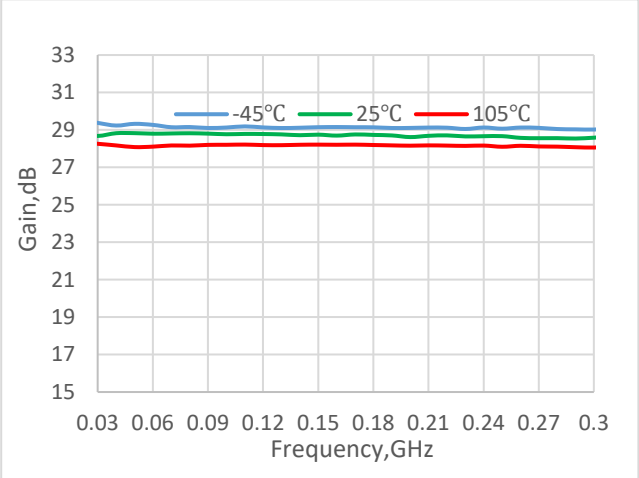


Figure 17. Input Return Loss

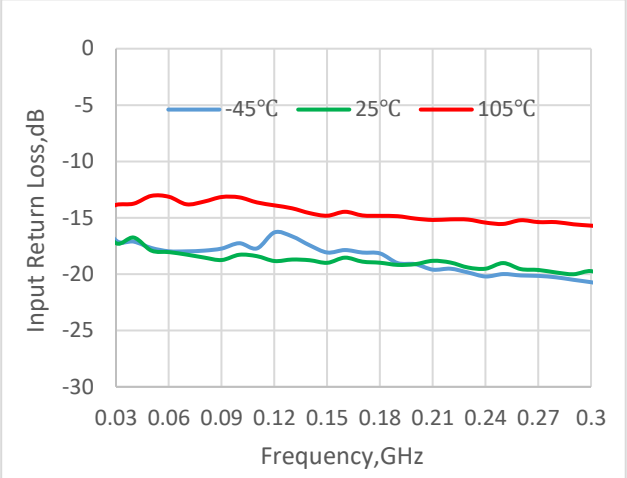


Figure 18. Output Return Loss

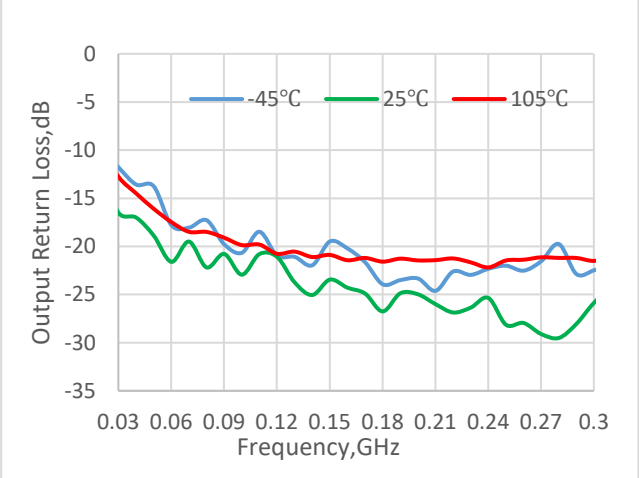


Figure 19. Noise Figure

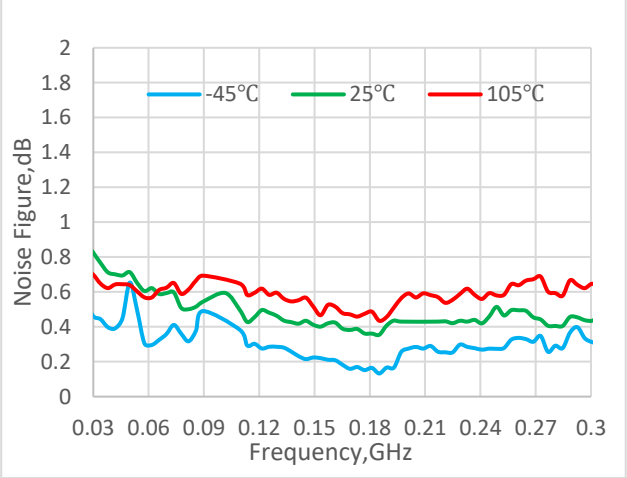


Figure 20. P1dB

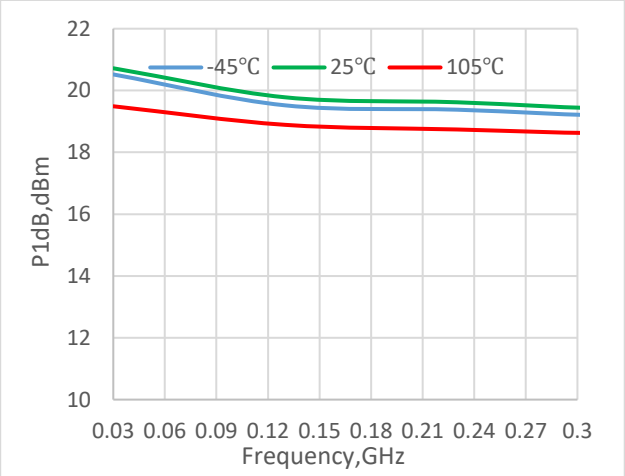
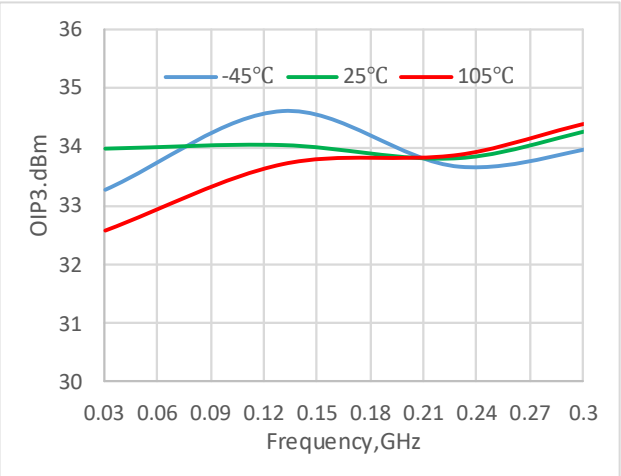


Figure 21. IP3



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Typical Performance Characteristics(5V 60mA, 0.03-1GHz matching)

Figure 22. Gain

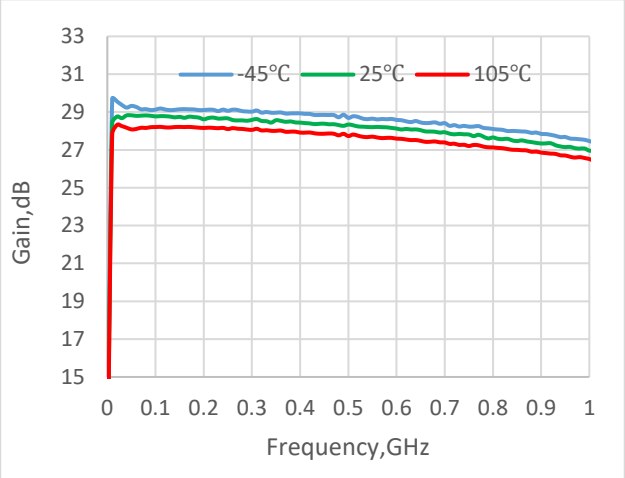


Figure 23. Input Return Loss

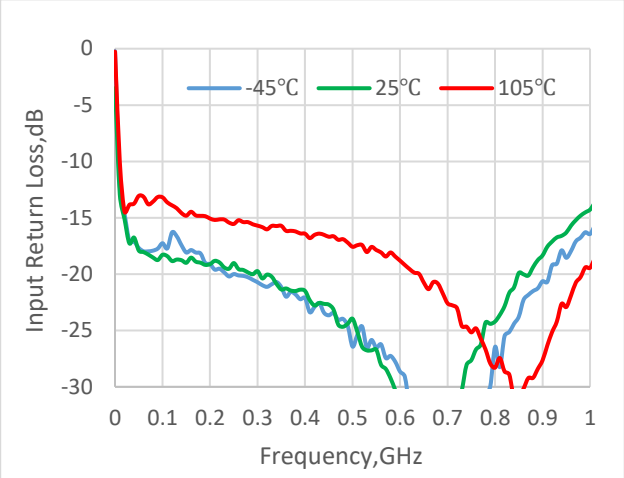


Figure 24. Output Return Loss

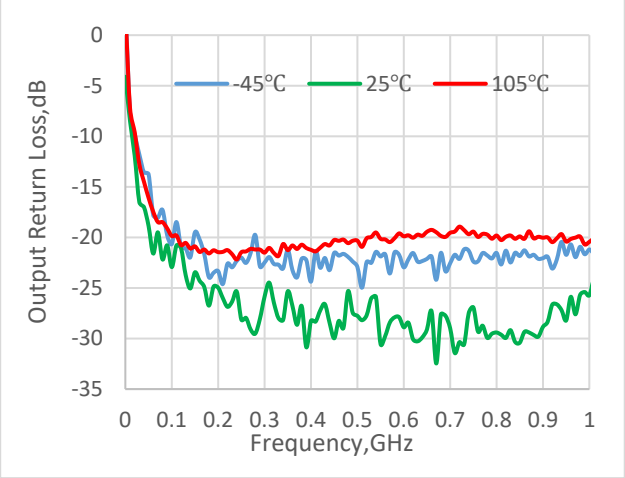


Figure 25. Noise Figure

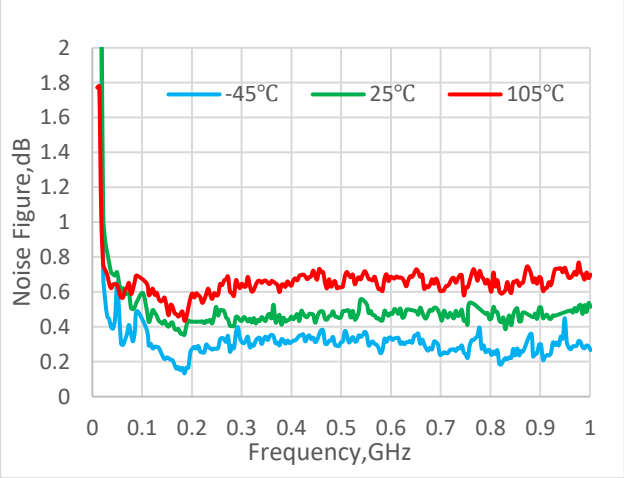


Figure 26. P1dB

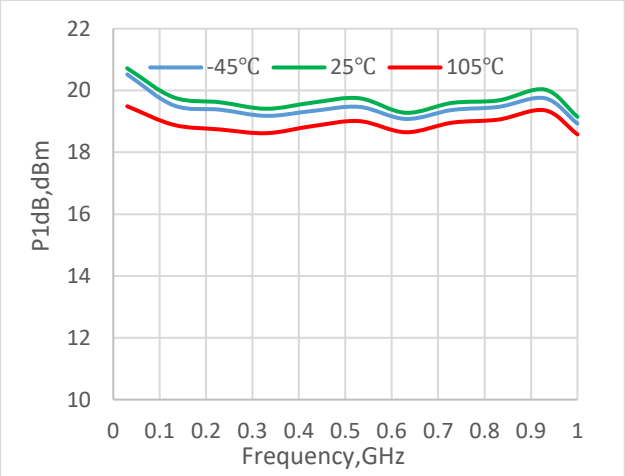
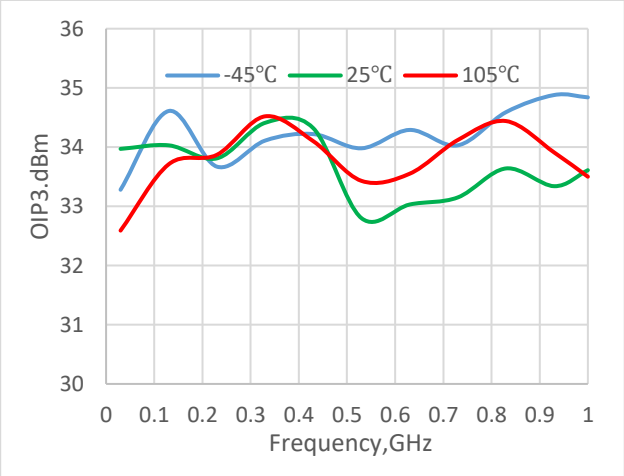


Figure 27. IP3



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Application Match from 30MHz to 2GHz

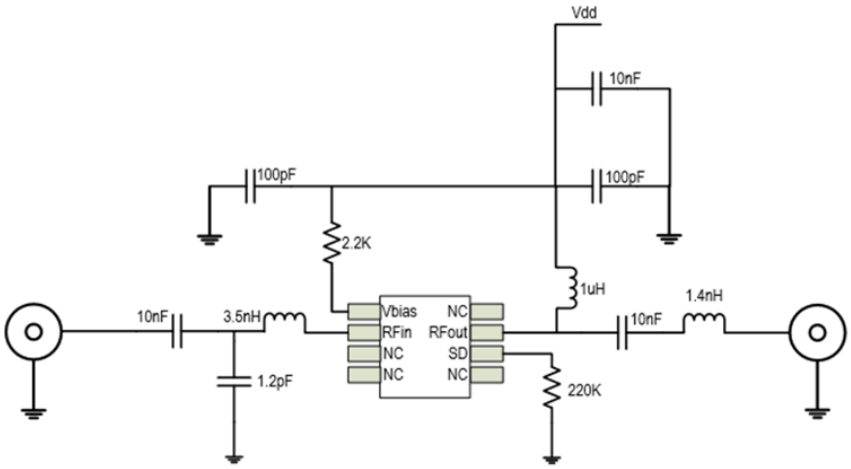


Figure 28

Typical Performance Characteristics(3.3V&5V,0.03-2GHz matching)

Figure 29. Gain

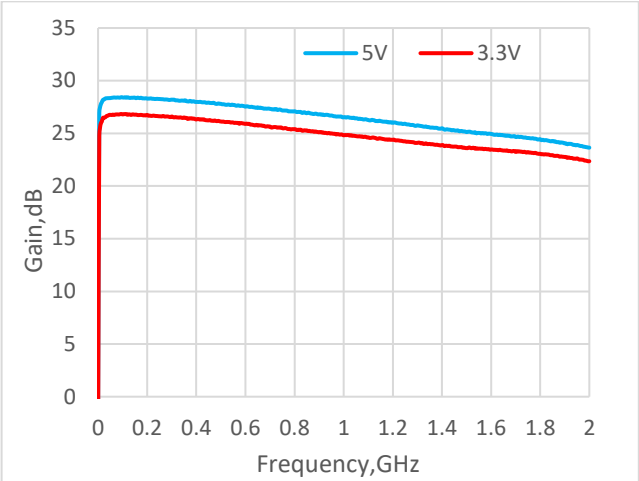


Figure 30. Input Return Loss

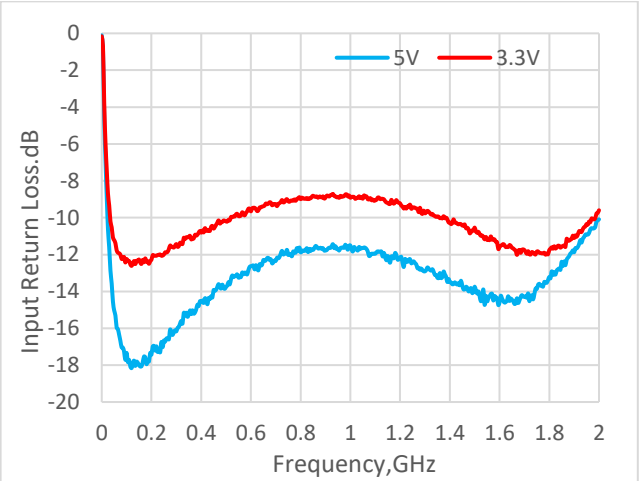


Figure 31. Output Return Loss

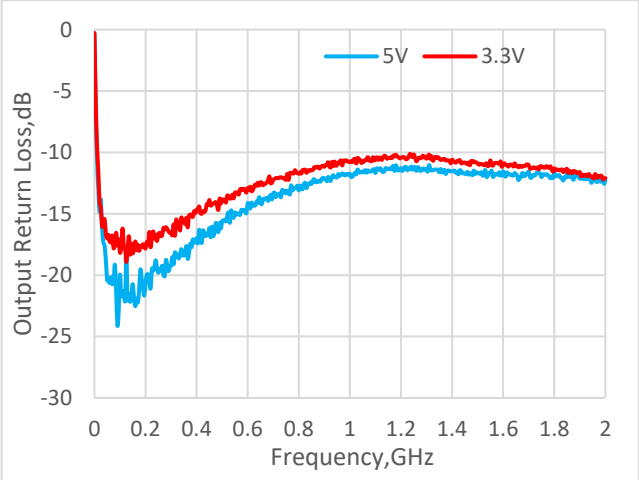


Figure 32. Noise Figure

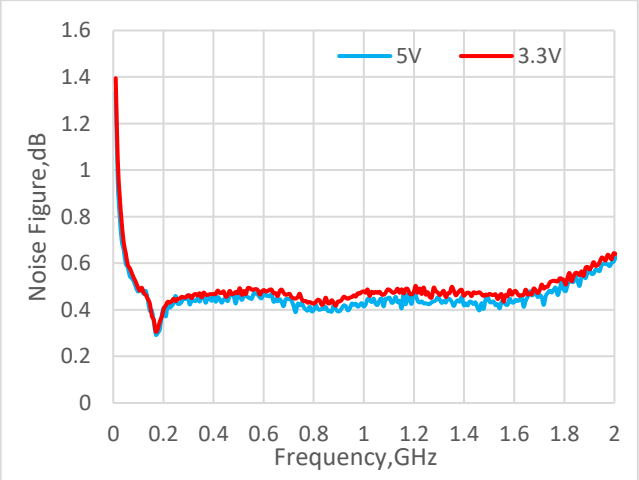


Figure 33. P1dB

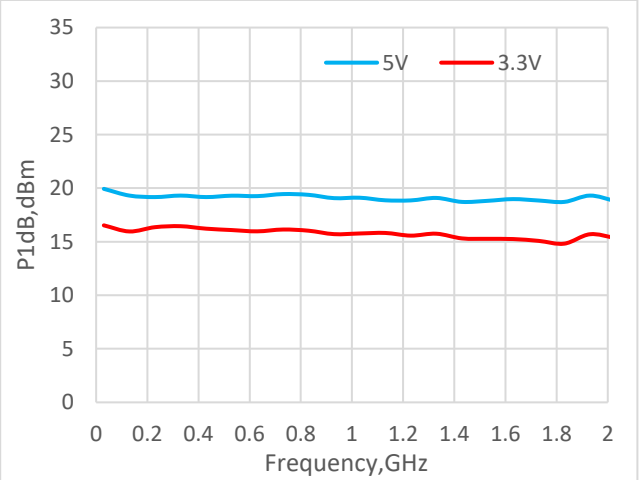
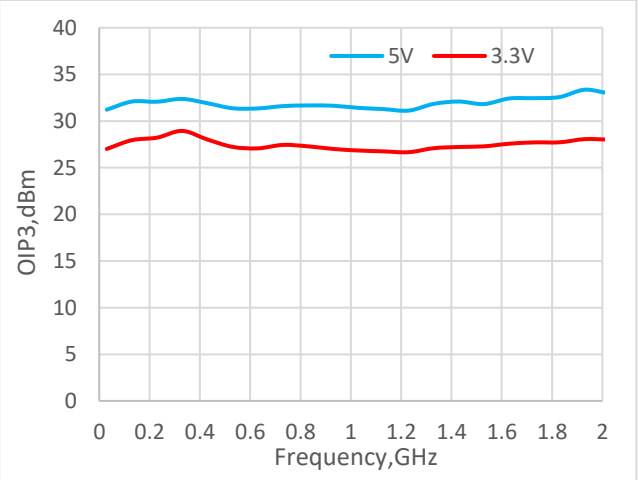


Figure 34. OIP3



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Package Drawing

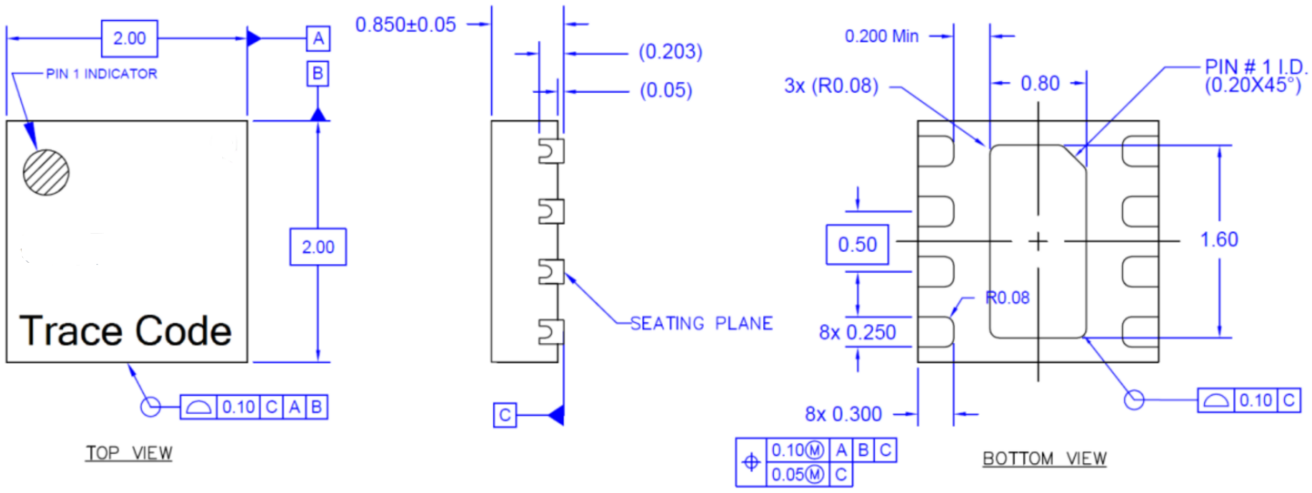


Figure 35

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Revision History

Table 8

Revision Number	Revision Date	Description	Modifications
0.1	2022/9/6	Draft	—
0.2	2023/4/18	initial release	
0.3	2023/5/19	Advance Information	Add Application Information
0.4	2023/6/19	Preliminary Specification	
0.5	2024/9/30	Specification	
0.6	2025/05/08		General Description/Features/Specification/Pin Diagram/Typical Performance Characteristics/Application Circuit/Package Drawing

Document Categories

Advance Information

The product is in a formative or design stage. The datasheet contains design target specifications for product development. Specifications and features may change in any manner without notice.

Preliminary Specification

The datasheet contains preliminary data. Additional data may be added at a later date. RFone Technology reserves the right to change specifications at any time without notice in order to supply the best possible product.

Product Specification

The datasheet contains final data. In the event RFone Technology decides to change the specifications, RFone Technology will notify customers of the intended changes by issuing a CNF (Customer Notification Form).

Sales Contact

For additional information, contact Sales at sales@rfonetech.com.

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