

Product Features

Frequency: 8GHz~12GHz

Gain: 26.2dB@10GHz

Gain Flatness: $\pm 0.5\text{dB}$, positive gain slope

Output Power for 1dB Compression:

16.6dBm@10GHz

Noise Figure: 1.6dB@10GHz

Output Third-Order Interception:

29.1dBm@10GHz

+3.3V/+5V Single Power Supply

73mA @ Vdd=5V (Normal Operation Mode)

47mA @ Vdd=5V (Low-power Operation Mode)

41mA @ Vdd=3.3V (Normal Operation Mode)

Package: QFN16 (3mm×3mm)

General Description

The BR9377FDJ is a high-performance MMIC low noise amplifier designed using GaAs process which operates between 8GHz and 12GHz. The amplifier is powered by a single-supply operation of +5V or +3.3V. The amplifier contains on-chip active bias network to ensure that the quiescent current is not affected by temperature. It has been internally matched to 50 ohms and AC coupled, thereby eliminating the need for external DC blocks and RF port matching. The product has the characteristics of low current, low noise figure and high reliability, which can be used for both receiving systems and transmitting systems.

Application

Radar and Electronic Countermeasures

Military and Aerospace

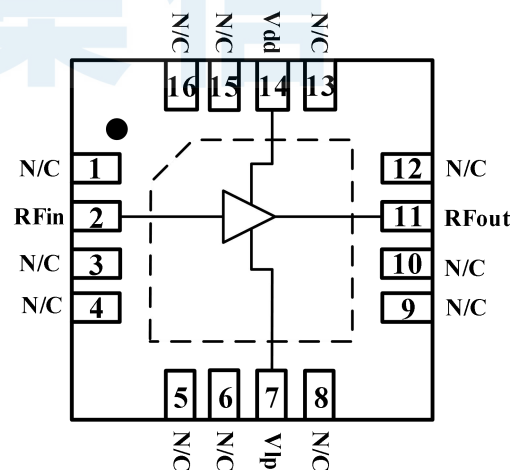
Navigation Equipment

Test Instrumentation

Ordering Information

Part Number	Package	Description
BR9377FDJ	QFN16	8GHz ~ 12GHz Low Noise Amplifier

Functional Block Diagram



Electrical Specifications

Parameter	Normal Mode with 5V (Typ.)	Low-Power Mode with 5V (Typ.)	Normal Mode with 3.3V (Typ.)	Units	Test Condition
Gain	25.8	25.2	25.1	dB	8000MHz
	26.2	25.2	25.3	dB	10000MHz
	26.6	24.9	24.9	dB	12000MHz
Output Power for 1dB	16.0	16.4	14.5	dBm	8000MHz
Compression	16.7	18.1	15.5	dBm	12000MHz
Output Third-Order	29.0	21.4	26.7	dBm	8000MHz
Interception	28.9	21.9	26.2	dBm	12000MHz
Noise Figure	1.6	1.35	1.23	dB	10000MHz
Input Return Loss	-13.3	-12.6	-11.8	dB	10000MHz
Output Return Loss	-14.2	-14.0	-16.0	dB	10000MHz
Reverse Isolation	-39.0	-38.7	-37.0	dB	10000MHz
Operating Voltage	+5	+5	+3.3	V	-
Static Supply Current	73	47	41	mA	-
Test Condition: OIP3 spacing=1MHz, Pout=5dBm/tone, TA=+25°C					

Absolute Maximum Ratings

Maximum Operating Voltage: +6V

Maximum input Power: +20dBm

Recommended Operating Conditions

Supply Voltage: +5V/+3.3V

73mA @ Vdd=5V (Normal Operation Mode)

47mA @ Vdd=5V (Low-power Operation Mode)

41mA @ Vdd=3.3V (Normal Operation Mode)

Operating Temperature: -55°C ~ +125°C

Storage Temperature: -65°C ~ +150°C

Note: Operation of the device outside the parameter ranges given absolute-maximum-ratings conditions may cause permanent damage, and. exposure to absolute-maximum-ratings conditions for extended periods will affect the reliability.

ESD Warnings

ELECTROSTATIC SENSITIVE DEVICE

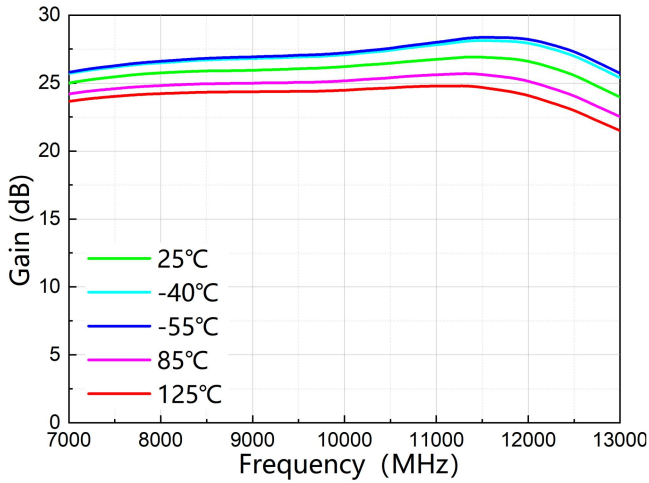
OBSERVE HANDLING PRECAUTIONS

ESD Rating: Class 1A

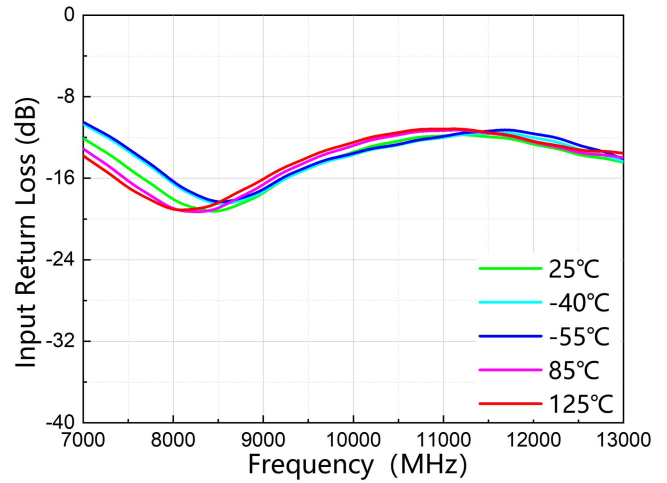
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Typical Performance (EVB test results at +5V supply voltage in normal operation mode)

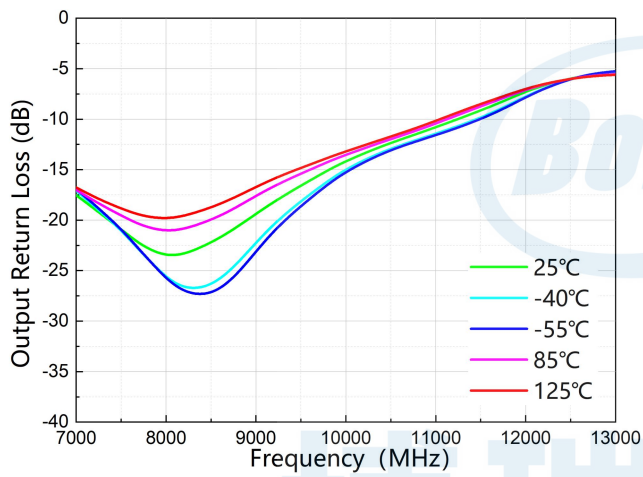
Parameter	Typ.										Units
Frequency	8000	8200	8400	8600	8800	9000	9200	9400	9600	10000	MHz
Gain	25.8	25.8	25.9	25.9	25.9	25.9	26.0	26.0	26.1	26.2	dB
Input Return Loss	-17.9	-19.0	-19.1	-19.0	-18.5	-17.2	-16.5	-15.2	-14.6	-13.3	dB
Output Return Loss	-23.5	-23.3	-22.6	-21.7	-20.6	-19.4	-18.2	-17.2	-16.1	-14.2	dB
Reverse Isolation	-38.6	-38.7	-38.6	-38.7	-38.6	-38.7	-38.6	-38.7	-38.9	-39.0	dB
Output Power for 1dB Compression	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.6	16.6	16.6	dBm
Output Third-Order Intercept	29.0	29.0	29.0	29.0	29.2	29.3	29.4	29.4	29.4	29.2	dBm
Noise Figure	1.61	1.61	1.61	1.61	1.61	1.60	1.59	1.60	1.61	1.60	dB
Frequency	10200	10400	10600	10800	11000	11200	11400	11600	11800	12000	MHz
Gain	26.3	26.4	26.5	26.6	26.7	26.8	26.9	26.9	26.8	26.6	dB
Input Return Loss	-13.0	-12.4	-12.2	-12.0	-11.7	-12.0	-11.7	-12.0	-12.4	-12.4	dB
Output Return Loss	-13.4	-12.7	-12.0	-11.4	-10.8	-10.1	-9.5	-8.8	-8.0	-7.3	dB
Reverse Isolation	-39.0	-39.2	-39.3	-39.7	-40.1	-40.6	-41.1	-42.3	-43.3	-44.4	dB
Output Power for 1dB Compression	16.6	16.5	16.6	16.6	16.6	16.7	16.7	16.8	16.8	16.7	dBm
Output Third-Order Intercept	29.3	29.1	29.2	29.0	28.9	28.8	28.8	28.8	29.1	28.9	dBm
Noise Figure	1.63	1.66	1.72	1.79	1.82	1.82	1.83	1.84	1.88	1.89	dB
Test Conditions: Vdd=+5V, Idd=73mA; OIP3 spacing=1MHz, Pout=5dBm/tone; TA=+25°C											



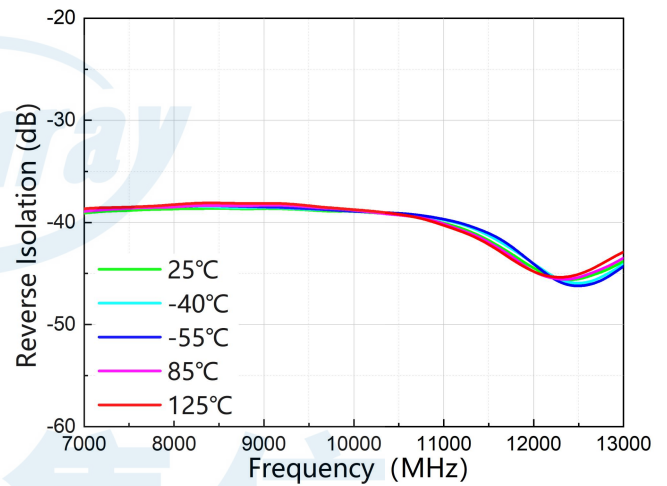
Gain vs. Freq



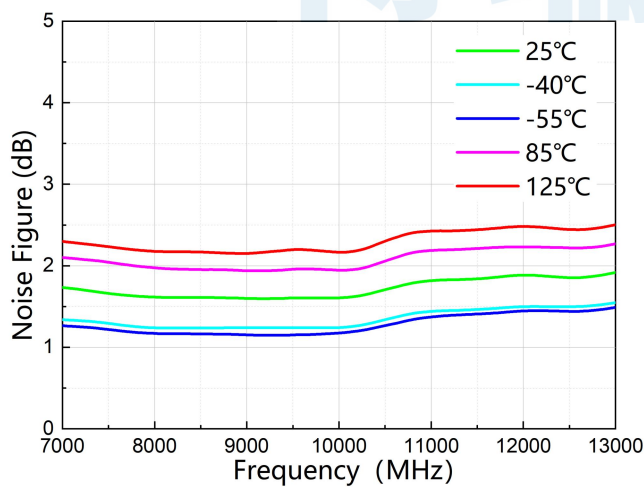
Input Return Loss vs. Freq



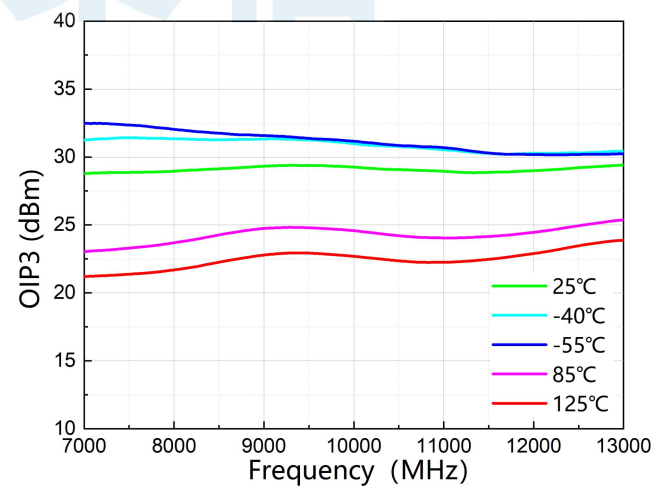
Output Return Loss vs. Freq



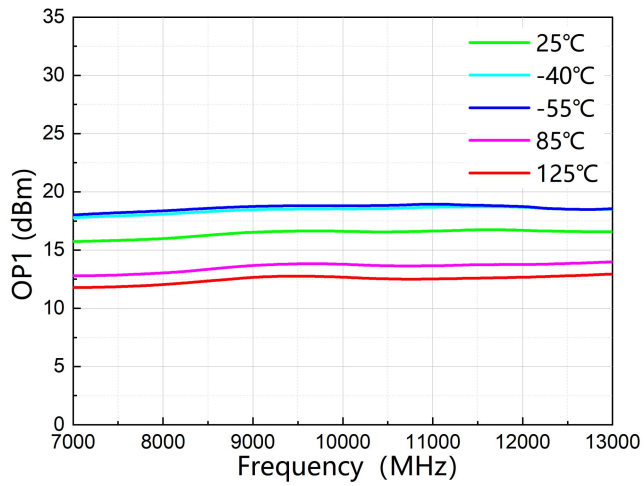
Reverse Isolation vs. Freq



Noise Figure vs. Freq



Output Third-Order Intercept vs. Freq



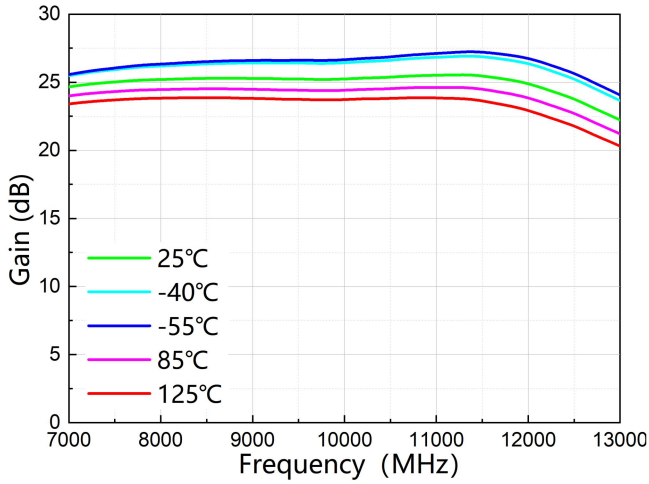
Output power 1dB Compression point vs. Freq



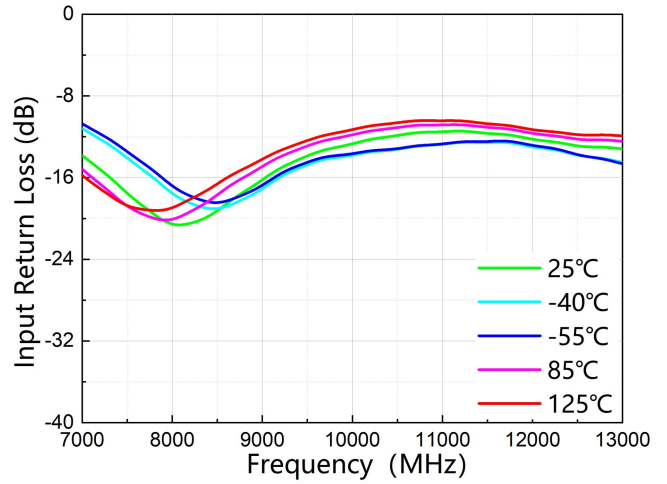
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Typical Performance (EVB test results at +5V supply voltage in low-power operation mode)

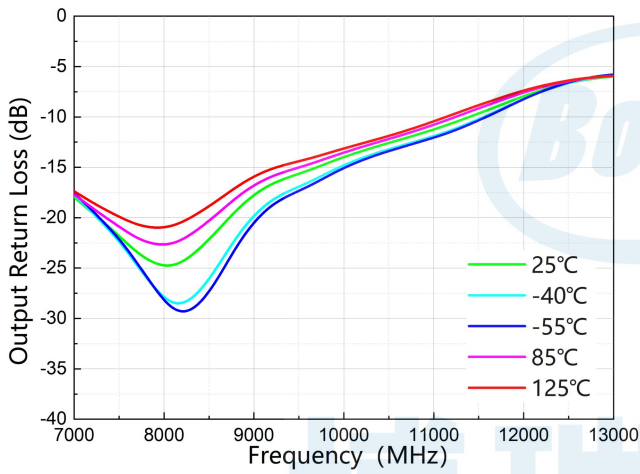
Parameter	Typ.										Units
Frequency	8000	8200	8400	8600	8800	9000	9200	9400	9600	10000	MHz
Gain	25.2	25.2	25.3	25.3	25.3	25.3	25.3	25.2	25.2	25.2	dB
Input Return Loss	-20.3	-20.8	-19.5	-18.7	-17.4	-16.1	-15.2	-14.1	-13.6	-12.6	dB
Output Return Loss	-24.9	-24.3	-23.0	-21.1	-19.3	-17.7	-16.6	-16.0	-15.3	-14.0	dB
Reverse Isolation	-38.8	-38.7	-38.9	-39.0	-39.0	-38.9	-38.7	-38.5	-38.6	-38.7	dB
Output Power for 1dB Compression	16.4	16.5	16.5	16.6	16.8	17.0	17.2	17.3	17.4	17.5	dBm
Output Third-Order Intercept	21.4	21.4	21.4	21.3	21.7	21.9	22.1	22.1	22.4	22.5	dBm
Noise Figure	1.48	1.47	1.45	1.45	1.42	1.41	1.40	1.40	1.40	1.36	dB
Frequency	10200	10400	10600	10800	11000	11200	11400	11600	11800	12000	MHz
Gain	25.3	25.3	25.4	25.5	25.5	25.5	25.5	25.4	25.2	24.9	dB
Input Return Loss	-12.4	-11.8	-11.8	-11.6	-11.3	-11.7	-11.4	-11.7	-12.1	-12.0	dB
Output Return Loss	-13.3	-12.9	-12.3	-11.8	-11.2	-10.6	-10.0	-9.3	-8.6	-8.0	dB
Reverse Isolation	-38.9	-39.1	-39.3	-39.7	-40.1	-40.8	-41.3	-41.9	-43.1	-43.7	dB
Output Power for 1dB Compression	17.6	17.6	17.7	17.8	17.9	18.0	18.0	18.0	18.1	18.1	dBm
Output Third-Order Intercept	22.6	22.5	22.4	22.2	21.9	21.8	21.8	21.9	22.1	21.9	dBm
Noise Figure	1.37	1.39	1.45	1.51	1.53	1.53	1.53	1.53	1.54	1.54	dB
Test Conditions: Vdd=+5V, Idd=47mA; OIP3 spacing=1MHz, Pout=5dBm/tone; TA=+25°C											



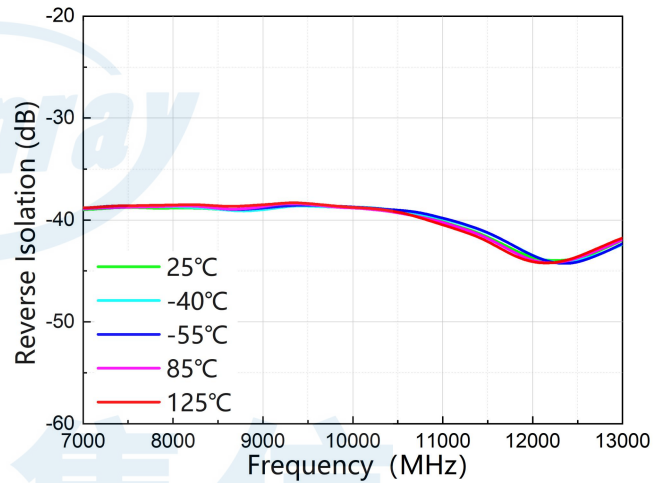
Gain vs. Freq



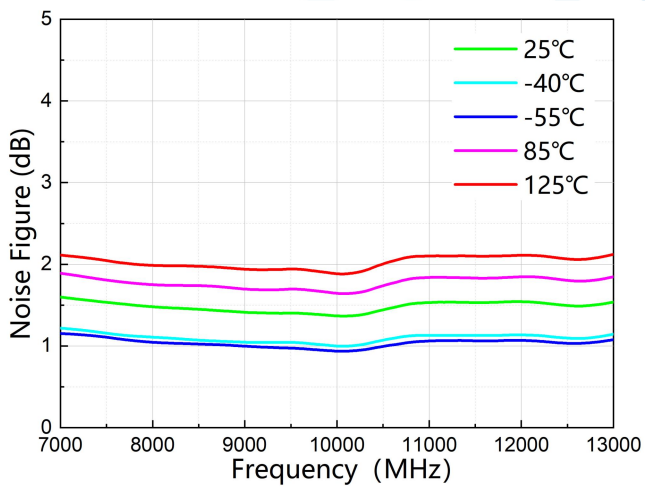
Input Return Loss vs. Freq



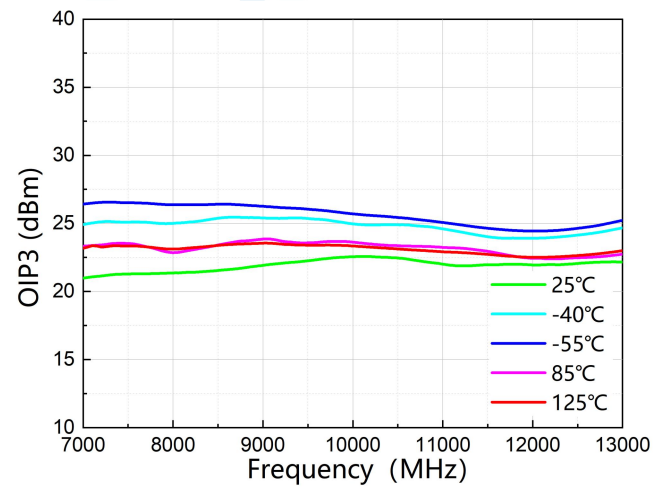
Output Return Loss vs. Freq



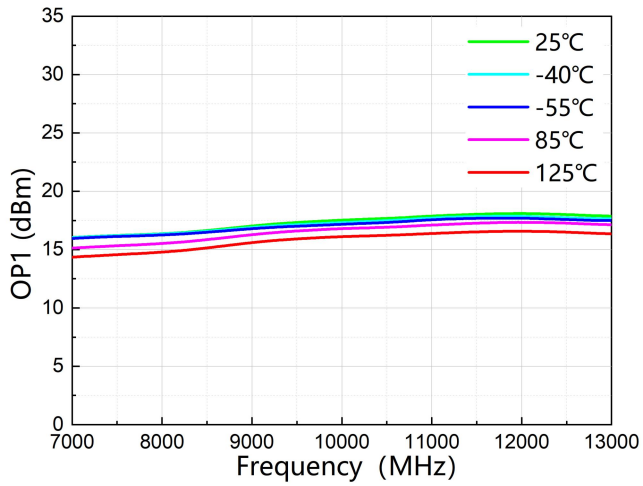
Reverse Isolation vs. Freq



Noise Figure vs. Freq



Output Third-Order Intercept vs. Freq



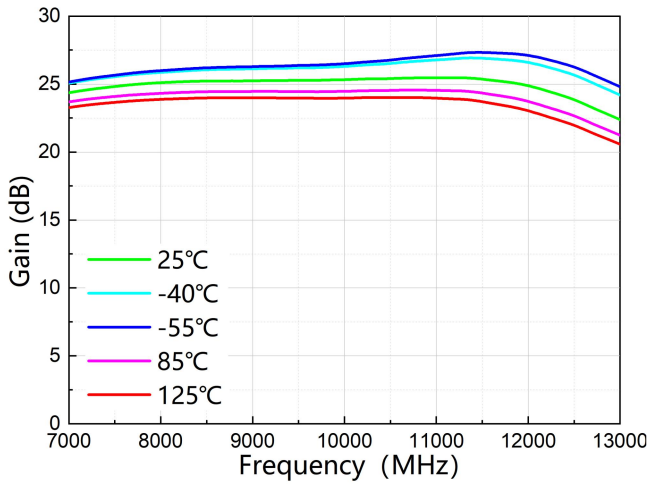
Output Power for 1dB Compression vs. Freq



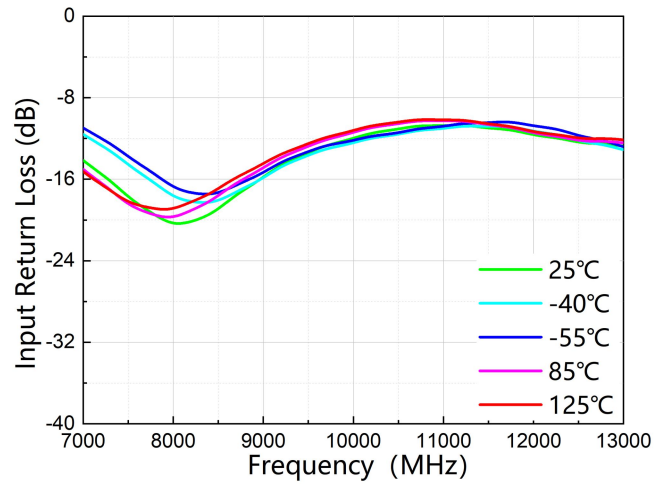
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Typical Performance (EVB test results at +3.3V supply voltage in normal operation mode)

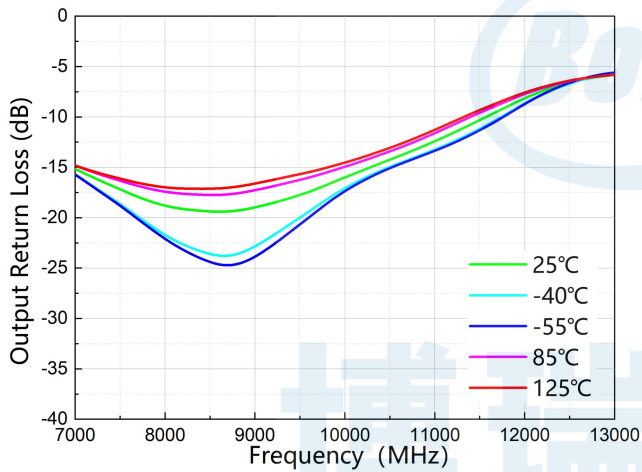
Parameter	Typ.										Units
Frequency	8000	8200	8400	8600	8800	9000	9200	9400	9600	10000	MHz
Gain	25.1	25.2	25.2	25.2	25.2	25.2	25.3	25.3	25.3	25.3	dB
Input Return Loss	-20.1	-20.4	-19.2	-18.3	-17.0	-15.6	-14.8	-13.6	-13.1	-11.8	dB
Output Return Loss	-18.8	-19.1	-19.3	-19.4	-19.3	-19.0	-18.5	-18.1	-17.4	-16.0	dB
Reverse Isolation	-36.5	-36.5	-36.5	-36.5	-36.5	-36.4	-36.6	-36.7	-36.8	-37.0	dB
Output Power for 1dB Compression	14.5	14.6	14.7	14.8	14.9	15.0	15.0	15.1	15.1	15.2	dBm
Output Third-Order Intercept	26.7	26.7	26.7	26.7	26.8	26.9	27.0	26.9	26.9	26.8	dBm
Noise Figure	1.36	1.35	1.35	1.32	1.30	1.29	1.28	1.29	1.29	1.23	dB
Frequency	10200	10400	10600	10800	11000	11200	11400	11600	11800	12000	MHz
Gain	25.4	25.4	25.4	25.5	25.5	25.5	25.4	25.3	25.1	24.9	dB
Input Return Loss	-11.6	-11.1	-10.9	-10.8	-10.6	-10.9	-10.7	-11.1	-11.4	-11.3	dB
Output Return Loss	-15.2	-14.6	-13.9	-13.2	-12.4	-11.5	-10.7	-9.9	-9.0	-8.2	dB
Reverse Isolation	-37.1	-37.4	-37.6	-37.9	-38.4	-38.7	-39.4	-40.2	-40.9	-41.4	dB
Output Power for 1dB Compression	15.2	15.3	15.3	15.4	15.5	15.5	15.5	15.6	15.5	15.5	dBm
Output Third-Order Intercept	26.8	26.7	26.7	26.6	26.4	26.5	26.3	26.3	26.3	26.2	dBm
Noise Figure	1.25	1.27	1.34	1.39	1.40	1.39	1.39	1.39	1.39	1.41	dB
Test Conditions: Vdd=+3.3V, Idd=41mA; OIP3 spacing=1MHz, Pout=0dBm/tone; TA=+25°C											



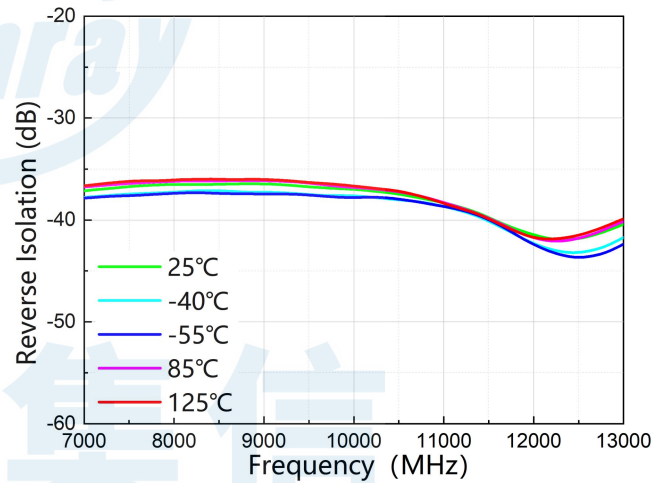
Gain vs. Freq



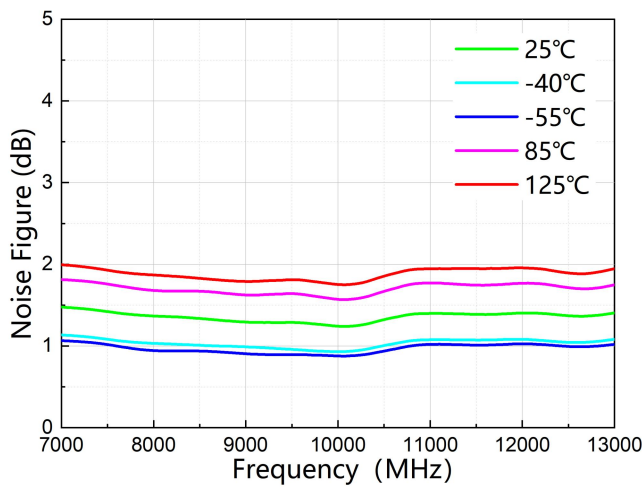
Input Return Loss vs. Freq



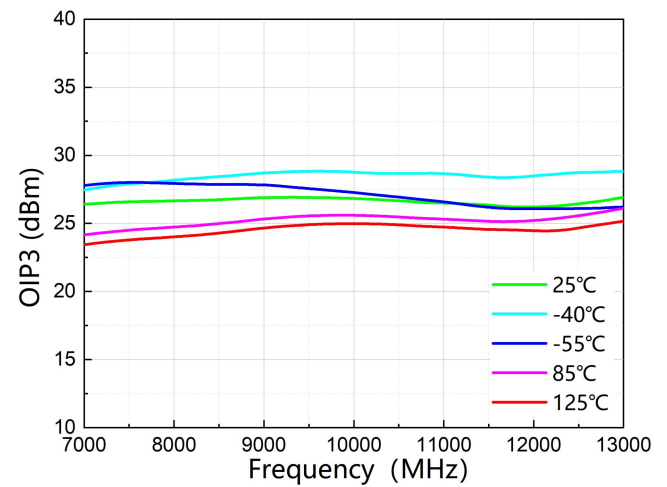
Output Return Loss vs. Freq



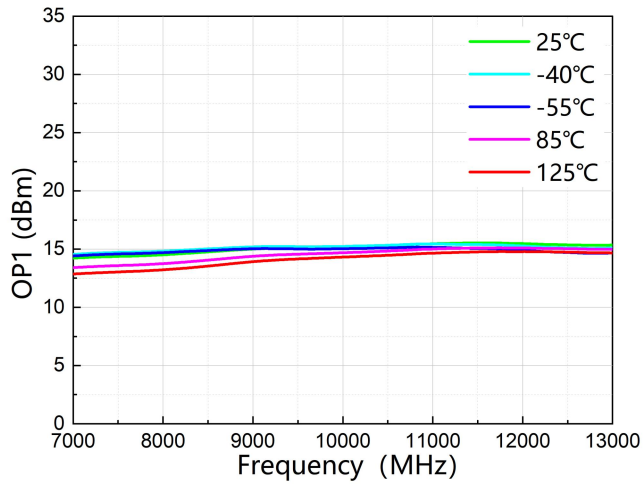
Reverse Isolation vs. Freq



Noise Figure vs. Freq



Output Third-Order Intercept vs. Freq

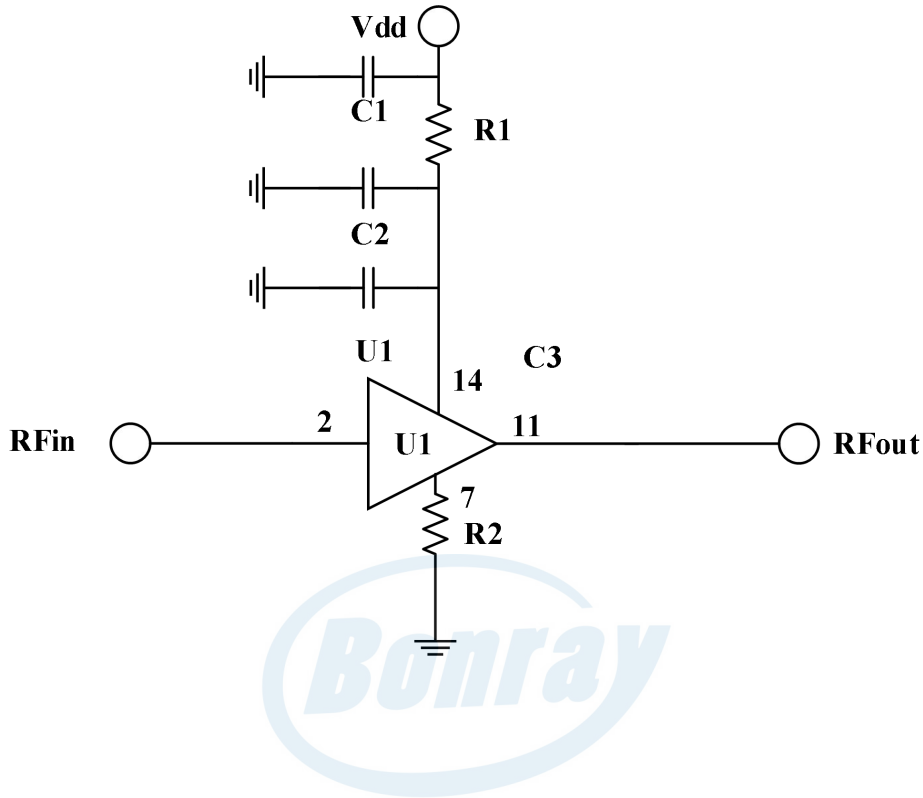


Output Power 1dB Compression vs. Freq



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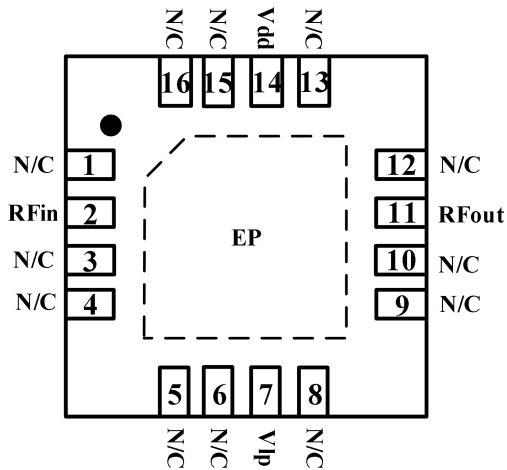
Typical Application Schematic



Bill of Material

Reference Designator	Package Size	Value	P/N
U1	QFN16	8GHz~12GHz low noise amplifier	BR9377FDJ
C1	0603	1uF	GCM188R71C105KA64D
C2	0402	1nF	GCM155R71H102KA37D
C3	0402	100pF	GRM1555C1H101JA01D
R1	0402	0 Ω	RC0402FR-070RL
R2 (Normal operation mode)	/	Idle	/
R2 (Low-Power operation mode)	0402	0 Ω	RC0402FR-070RL

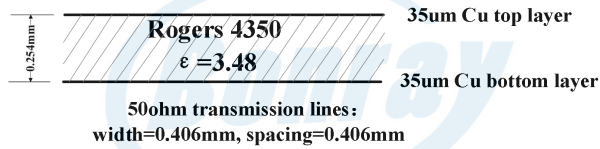
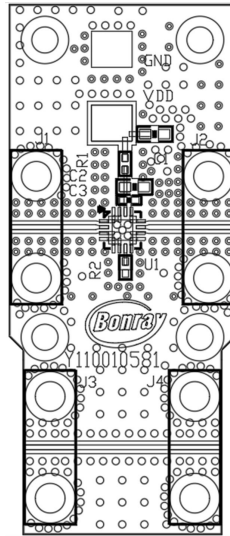
Pin Configuration and Description



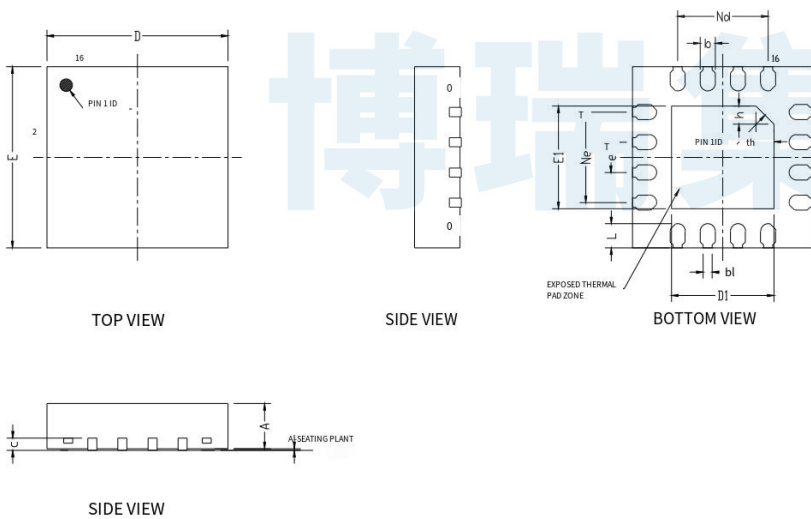
Pin Number	Pin Name	Description
2	RFin	RF input pin. No external DC block is required.
7	Vlp	Operation modes setting pin; This pin is suspended in normal operation mode and grounded in low-power operation mode.
11	RFout	RF output pin. No external DC block is required.
14	Vdd	Power supply pin. External bypass capacitor is required.
1,3 to 6,8 to 10, 12,13,15,16	N/C	No electrical connection. Provide grounded land pads for PCB mounting integrity.
-	EP	Exposed pins that must be connected to RF/DC ground.

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PCB Evaluation Board



Package Dimensions (mm)



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.02	0.05
b	0.20	0.25	0.30
bl	0.15REF		
c	0.203REF		
D	2.90	3.00	3.10
D1	1.60	1.70	1.80
e	0.50BSC		
Ne	1.50BSC		
Nd	1.50BSC		
E	2.90	3.00	3.10
E1	1.60	1.70	1.80
L	0.25	0.30	0.35
h	0.25	0.30	0.35