Product Features

Operating Frequency: 6GHz~13GHz

Gain: 21.5dB@10GHz

Gain Flatness: ±1dB, Positive Gain Slope

Output Power for 1dB Compression:

17.1dBm@10GHz

Noise Figure: 1.4dB@8GHz

Output Third-Order Interception:

24.6dBm@10GHz

+3.3V/+5V Single Power Supply

Supply Current:

66mA @ Vdd=5V (Normal Operation Mode)

41mA @ Vdd=5V (Low-power Operation Mode)

37mA @ Vdd=3.3V (Normal Operation Mode)

Die Size: 1300um x 850um x 100um

General Description

The BR9376LDZ is a MMIC low noise amplifier designed using GaAs process which operates between 6GHz and 13GHz. The amplifier is powered by a single supply operation of +5V or +3.3V. At 8GHz, the amplifier typically provides a gain of 20.4dB, noise figure of 1.4dB, output P1dB of 16.5dBm, and output IP3 of 25.6dBm in normal operation mode with +5V power supply. It has been internally matched to 50 ohms and AC coupled, thereby eliminating the need for external DC blocks and RF port matching. The amplifier is ideal for integration into Multi-Chip-Modules (MCMs) due to its small size.

Application

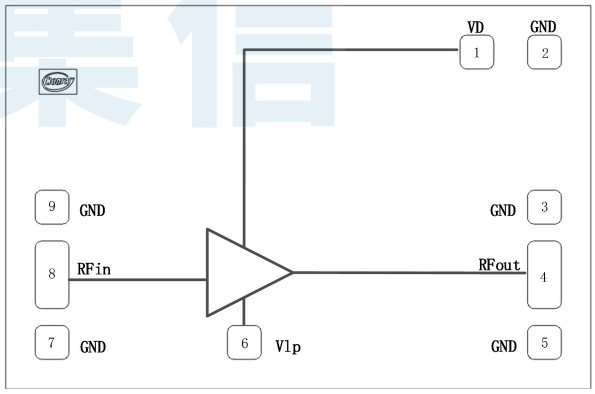
Radar and Electronic Countermeasures

Military and Aerospace

Navigation Equipment

Test Instrumentation

Functional Block Diagram



Ordering Information

Part Number	Package	Description
BR9376LDZ	Die	6GHz~13GHz Low Noise Amplifier

Electrical Specifications

Parameter	Normal Mode with 5V (Typ.)	Low-Power Mode with 5V (Typ.)	Normal Mode with 3.3V (Typ.)	Units	Test Conditions
Gain	20	19.4	19.6	dB	6000MHz
	21.5	20.4	20.9	dB	10000MHz
	22.2	20.4	20.9	dB	13000MHz
Output Power for 1dB Compression	16.1	14.1	13.3	dBm	6000MHz
	15.7	13.8	12.1	dBm	13000MHz
Output Third-Order Interception	26.6	25	25.3	dBm	6000MHz
	21.9	26	24.1	dBm	13000MHz
Noise Figure	1.63	1.43	1.36	dB	10000MHz
Input Return Loss	-20.2	-14.3	-17	dB	10000MHz
Output Return Loss	-25.1	-25.1	-24.1	dB	10000MHz
Reverse Isolation	-38	-38	-37	dB	10000MHz
Supply Voltage	+5	+5	+3.3	V	-
Supply Current	66	41	37	mA	-
Test Condition: OIP3 spacing=1MHz, Pout=5dBm/tone, TA=+25℃					

Absolute Maximum Ratings

Maximum Supply Voltage (Vdd): +6V

Maximum RF Input Power: +19dBm

Recommended Operating Conditions

Supply Voltage: +5V/+3.3V

Supply Current:

66mA @ Vdd=5V (Normal Operation Mode)

41mA @ Vdd=5V (Low-power Operation Mode)

37mA @ Vdd=3.3V (Normal Operation Mode)

Storage Temperature: -66℃ ~ +150℃

Operating Temperature: -55℃ ~ +125℃

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.

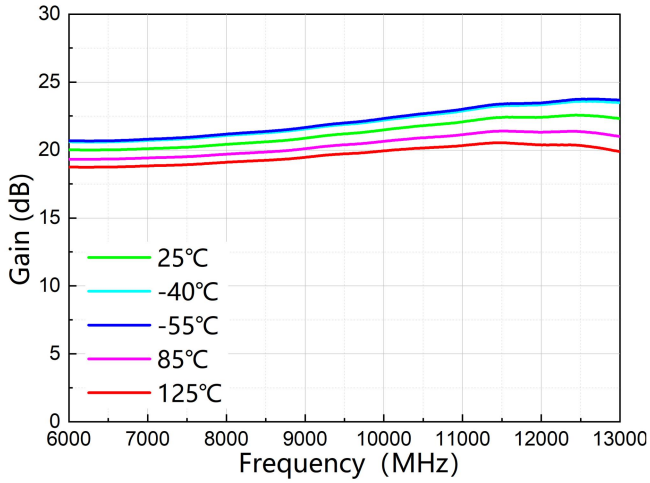
ESD Warnings

ELECTROSTATIC SENSITIVE DEVICE

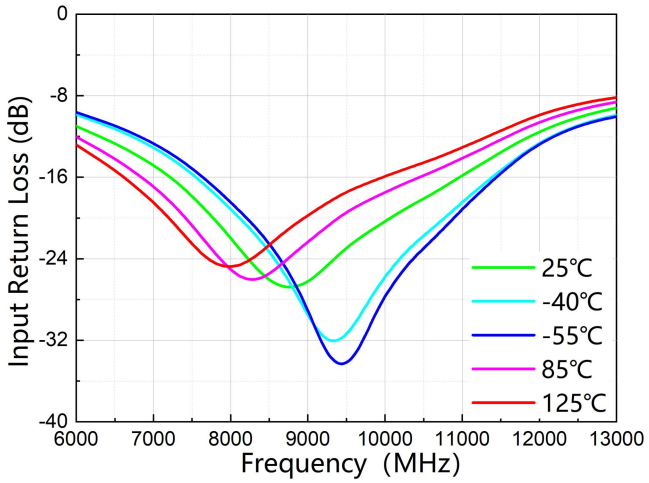
OBSERVE HANDLING PRECAUTIONS

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

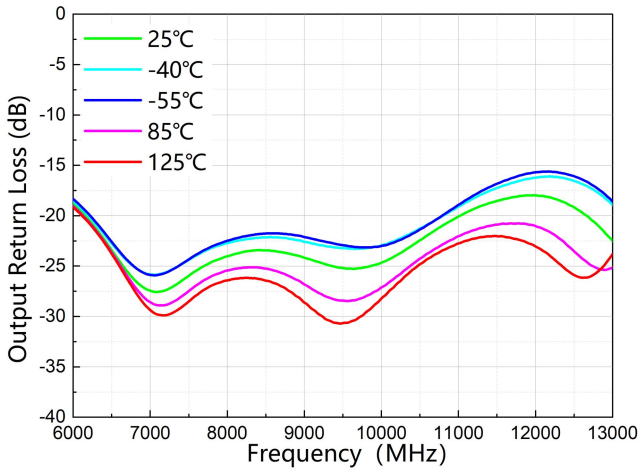
Parameter	Typ.							Units
Frequency	6000	7000	7500	8000	8500	9000	9500	MHz
Gain	20	20.1	20.2	20.4	20.6	20.9	21.1	dB
Input Return Loss	-11	-14.9	-17.9	-22	-25.7	-26	-23.5	dB
Output Return Loss	-19.1	-27.6	-25.8	-24.1	-23.5	-24.6	-25.9	dB
Reverse Isolation	-45.7	-41.2	-40	-39.5	-38.6	-38.3	-38.3	dB
Output Power for 1dB Compression	16.1	16.6	16.7	16.5	16.7	16.8	16.9	dBm
Output Third-Order Interception	26.6	25.9	25.7	25.6	25.5	25.3	25	dBm
Noise Figure	1.8	1.5	1.46	1.4	1.45	1.59	1.53	dB
Frequency	10000	10500	11000	11500	12000	12500	13000	MHz
Gain	21.5	21.7	22	22.2	22.4	22.8	22.2	dB
Input Return Loss	-20.2	-18.5	-15.7	-13.9	-11.6	-10.2	-9.2	dB
Output Return Loss	-25.1	-23.1	-20.4	-19	-18.3	-19.8	-22.8	dB
Reverse Isolation	-38	-38	-38.1	-38.5	-39	-39.2	-40.3	dB
Output Power for 1dB Compression	17.1	17.1	17	17.1	17	16.4	15.7	dBm
Output Third-Order Interception	24.6	24.2	23.9	23.5	22.9	22.3	21.9	dBm
Noise Figure	1.63	1.58	1.7	1.84	1.86	2.0	2.31	dB
Test Conditions: Vdd=+5V, Idd=66mA; OIP3 spacing=1MHz, Pout=5dBm/tone; TA=+25℃								



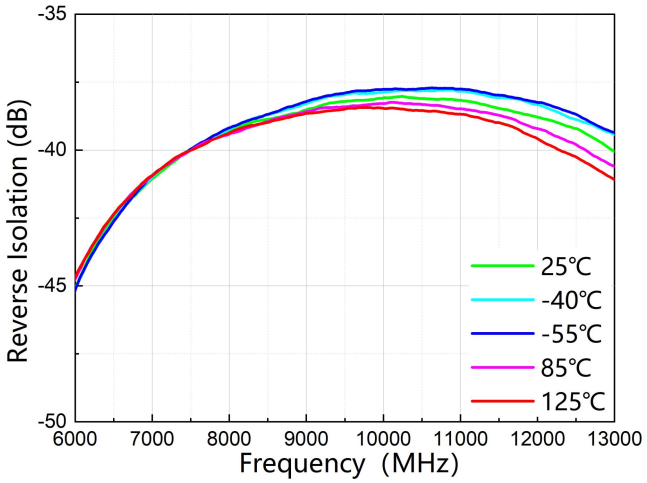
Gain vs. Freq



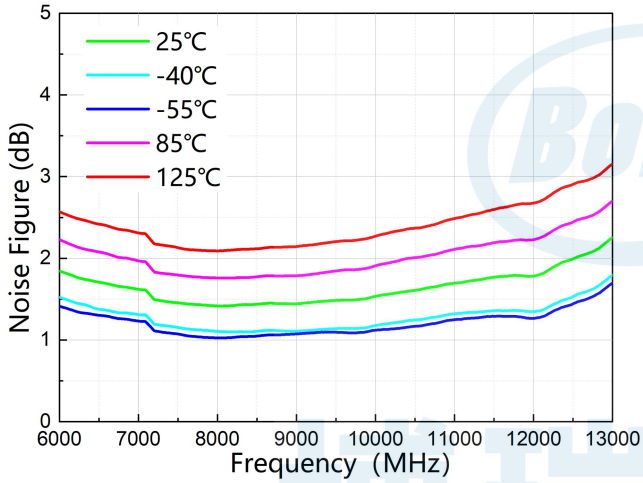
Input Return Loss vs. Freq



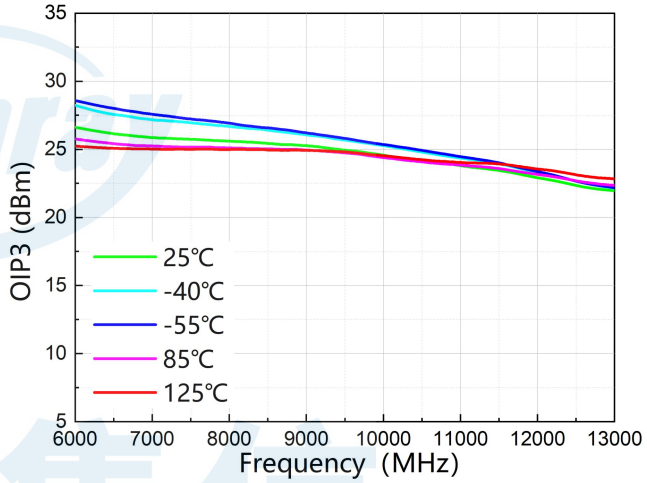
Output Return Loss vs. Freq



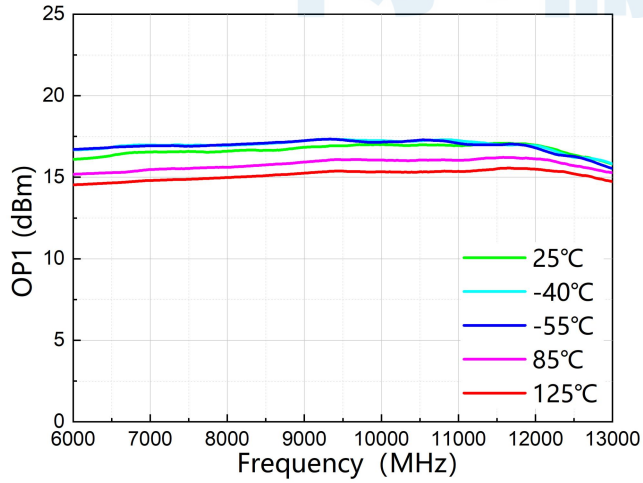
Reverse Isolation vs. Freq



Noise Figure vs. Freq



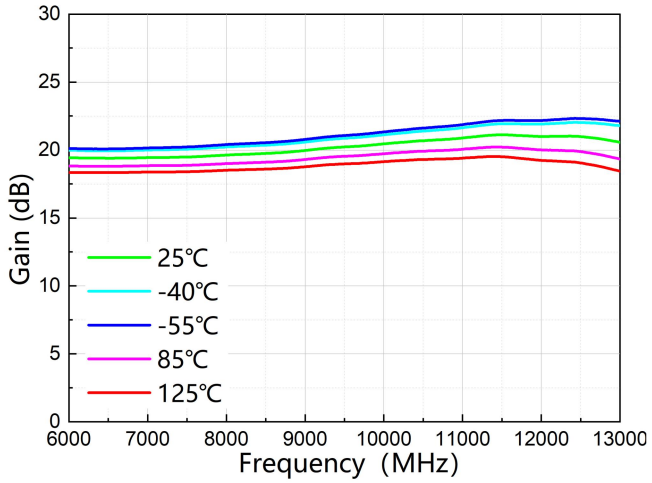
Output Third-Order Interception vs. Freq



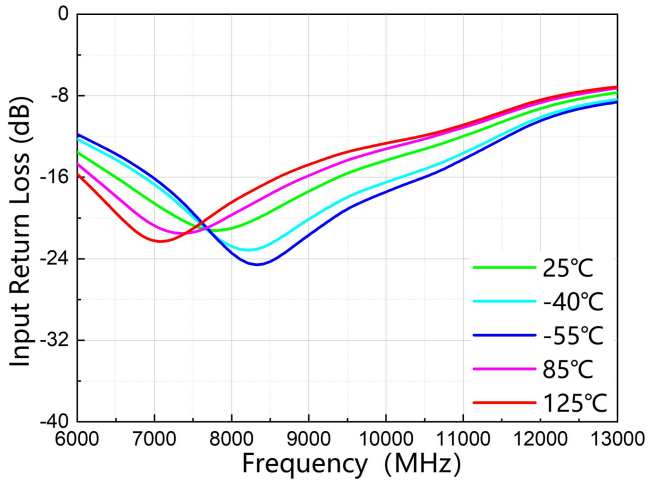
Output Power for 1dB Compression vs. Freq

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

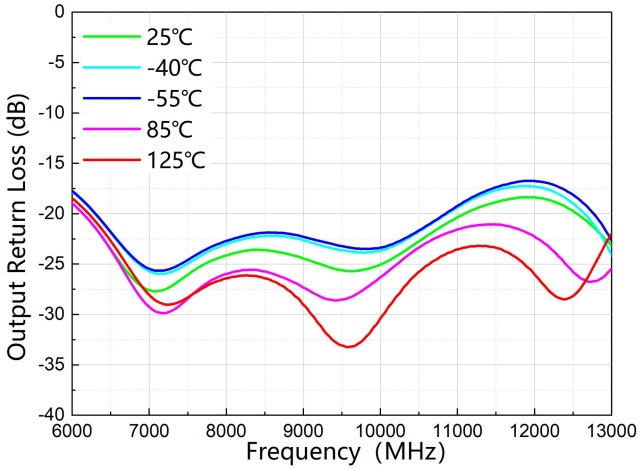
Parameter	Typical values							Units
Frequency	6000	7000	7500	8000	8500	9000	9500	MHz
Gain	19.4	19.5	19.5	19.6	19.8	20	20.2	dB
Input Return Loss	-13.6	-18.6	-20.7	-20.9	-19.8	-17.3	-15.9	dB
Output Return Loss	-19.1	-27.6	-25.9	-24.2	-23.5	-24.6	-25.9	dB
Reverse Isolation	-43.7	-40.5	-39.5	-39	-38.9	-38.5	-38.1	dB
Output Power for 1dB Compression	14.1	14.5	14.2	14.1	14.2	13.9	13.9	dBm
Output Third-Order Interception	25	26.1	26.6	27	27.3	27.3	27.5	dBm
Noise Figure	1.61	1.4	1.35	1.33	1.32	1.39	1.33	dB
Frequency	10000	10500	11000	11500	12000	12500	13000	MHz
Gain	20.4	20.6	20.8	20.9	21	21.3	20.4	dB
Input Return Loss	-14.3	-13.5	-11.9	-10.8	-9.25	-8.6	-7.6	dB
Output Return Loss	-25.1	-23.1	-20.4	-19	-18.3	-19.8	-22.8	dB
Reverse Isolation	-38	-38	-38.4	-38.8	-39.3	-40	-40.7	dB
Output Power for 1dB Compression	14	14	14	14.1	14.1	14.1	13.8	dBm
Output Third-Order Interception	27.1	27	26.6	26.5	26.3	26.2	26	dBm
Noise Figure	1.43	1.47	1.58	1.6	1.61	1.75	2.07	dB
Test Condition: Vdd=+5V, Idd=41mA; OIP3 spacing=1MHz, Pout=5dBm/tone; TA=+25℃								



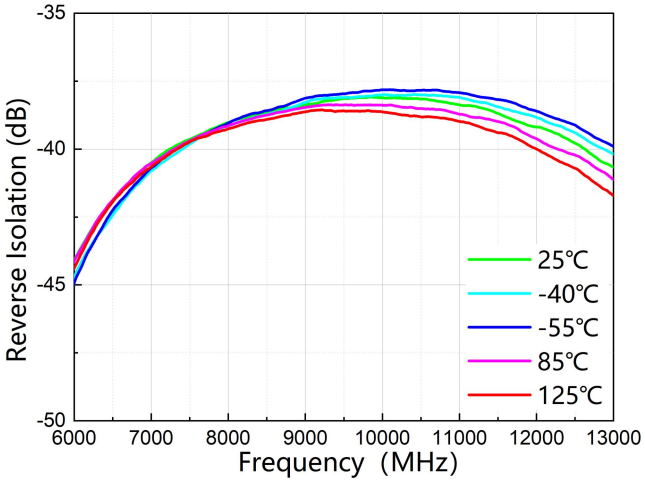
Gain vs. Freq



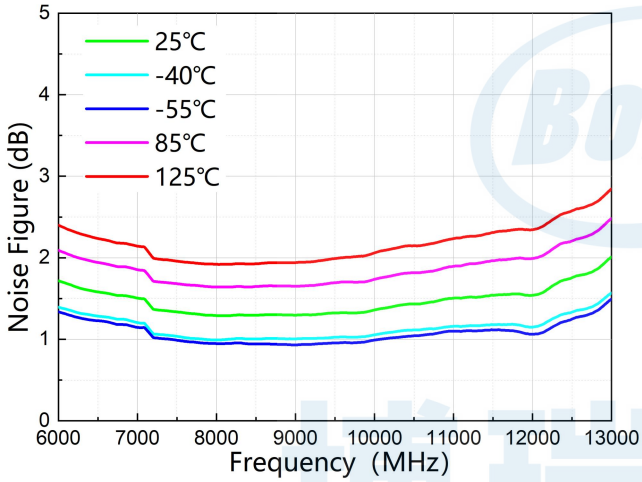
Input Return Loss vs. Freq



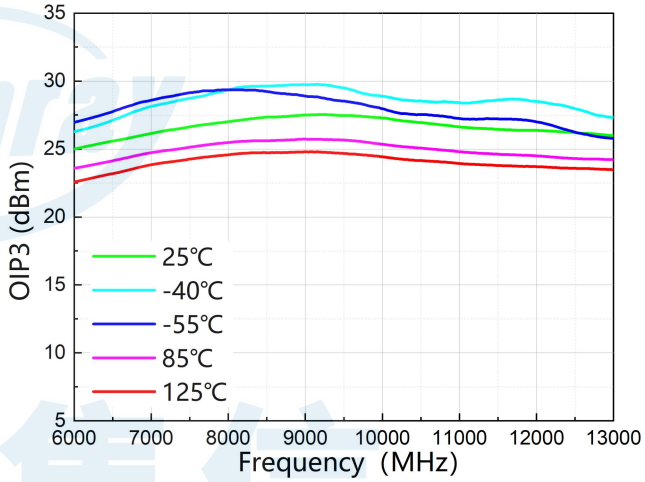
Output Return Loss vs. Freq



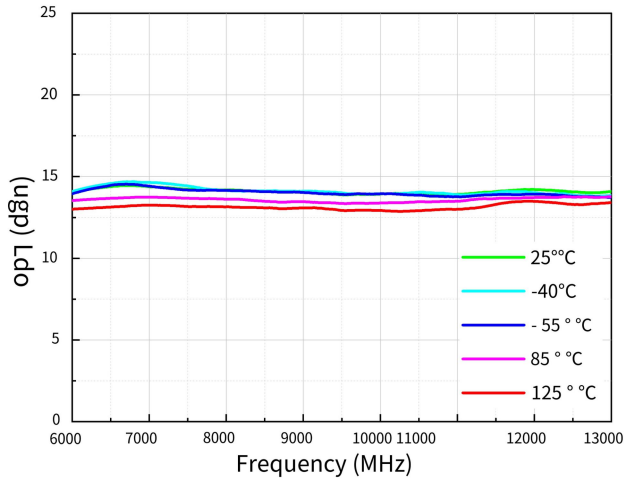
Reverse Isolation vs. Freq



Noise Figure vs. Freq



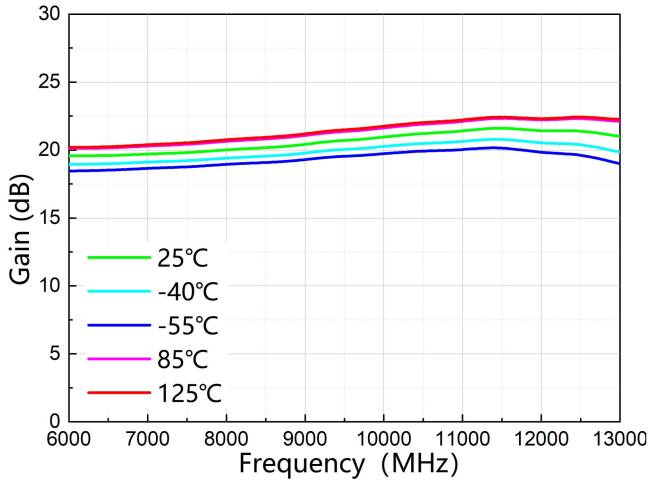
Output Third-Order Interception vs. Freq



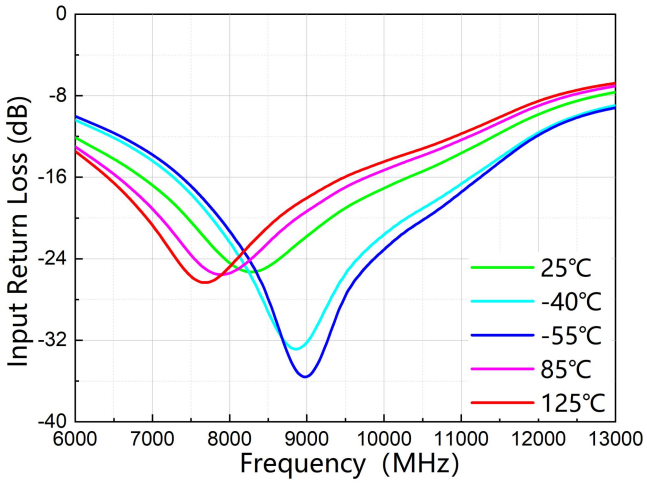
Output power for 1dB Compression vs. Freq

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

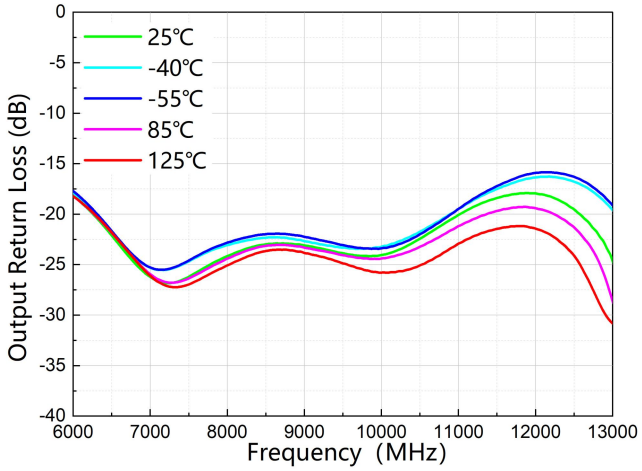
Parameter	Typ.							Units
Frequency	6000	7000	7500	8000	8500	9000	9500	MHz
Gain	19.6	19.7	19.8	20	20.2	20.4	20.6	dB
Input Return Loss	-12	-16.8	-20.3	-24.5	-25.3	-21.7	-19.5	dB
Output Return Loss	-18.3	-26.3	-26.3	-24.2	-23	-23.3	-23.9	dB
Reverse Isolation	-43.7	-39.9	-39	-38.3	-37.7	-37.7	-37.1	dB
Output Power for 1dB Compression	13.3	13.3	12.3	12.7	12.8	12.8	12.5	dBm
Output Third-Order Interception	25.3	25.5	25.6	25.9	25.9	25.8	26.4	dBm
Noise Figure	1.57	1.36	1.3	1.23	1.28	1.34	1.32	dB
Frequency	10000	10500	11000	11500	12000	12500	13000	MHz
Gain	20.9	21.1	21.4	21.4	21.4	21.7	20.9	dB
Input Return Loss	-17	-15.7	-13.6	-12	-9.8	-8.5	-7.6	dB
Output Return Loss	-24.1	-22.7	-20.1	-18.6	-18	-19.7	-24.8	dB
Reverse Isolation	-37	-37	-37	-37.4	-38	-38.5	-39.4	dB
Output Power for 1dB Compression	12.6	12.6	12.3	12.3	12.1	11.9	12.1	dBm
Output Third-Order Interception	25.7	25.4	25.6	25	25	24.5	24.1	dBm
Noise Figure	1.36	1.38	1.39	1.45	1.48	1.58	1.85	dB
Test Conditions: Vdd=+3.3V, Idd=37mA; OIP3 spacing=1MHz, Pout=0dBm/tone; TA=+25℃								



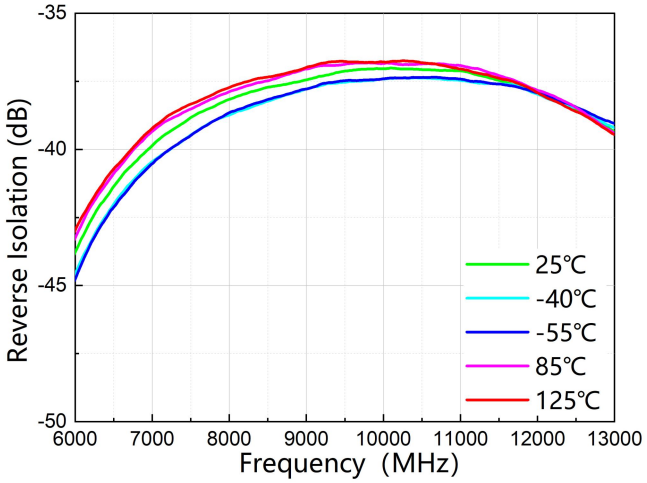
Gain vs. Freq



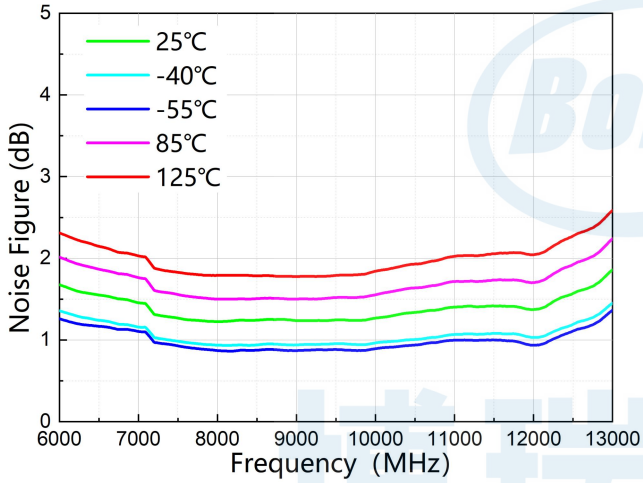
Input Return Loss vs. Freq



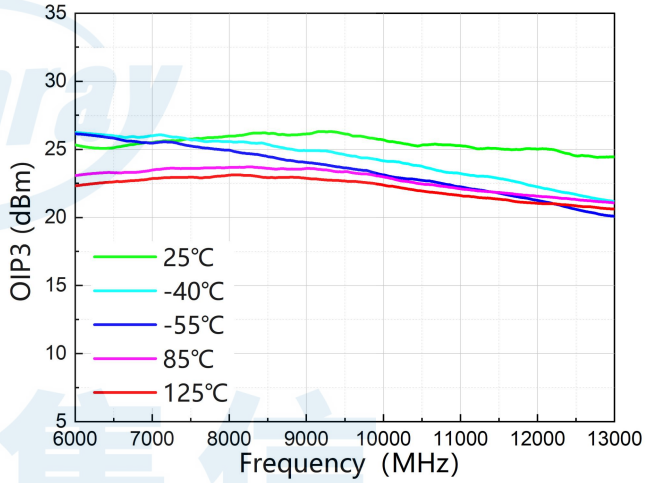
Output Return Loss vs. Freq



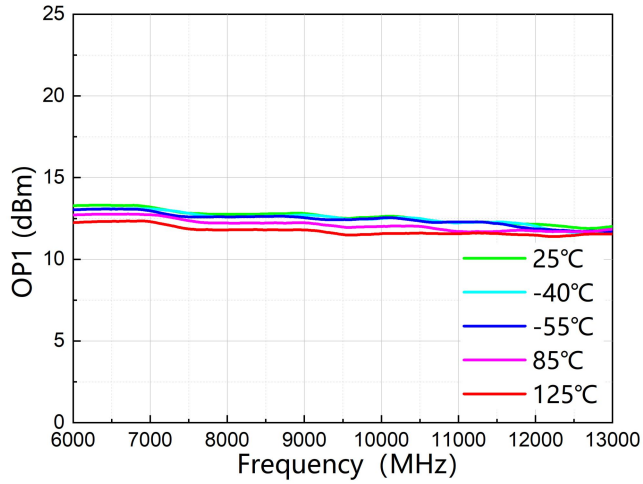
Reverse Isolation vs. Freq



Noise Figure vs. Freq

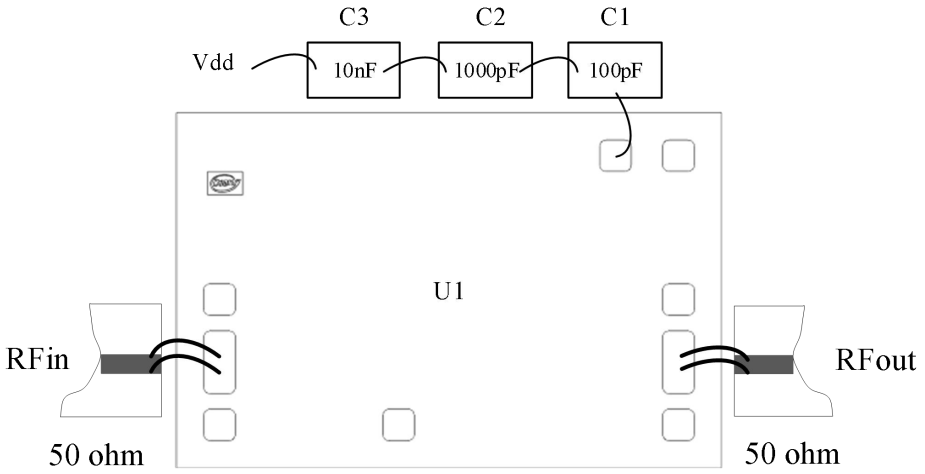


Output Third-Order Interception vs. Freq

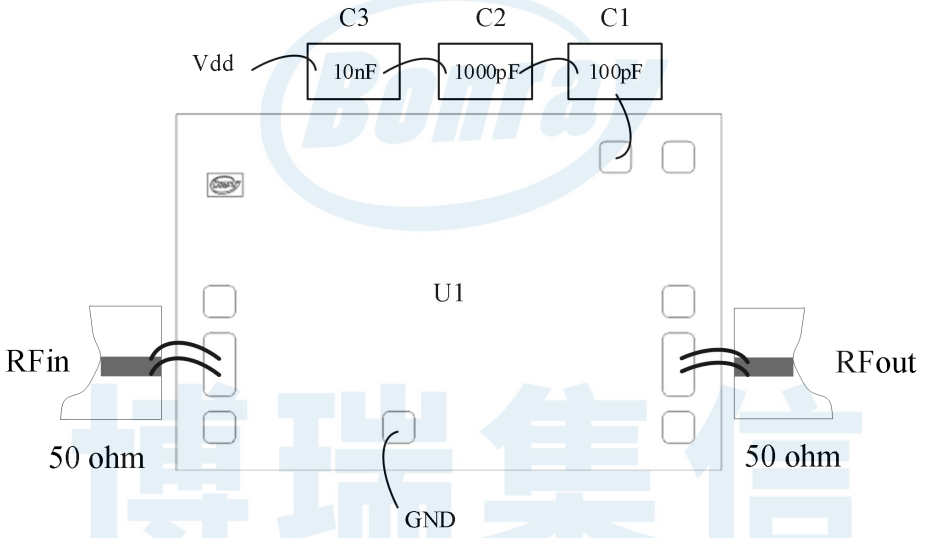


Output Power for 1dB Compression vs. Freq

Assembly Diagram



Assembly diagram for normal Operation Mode



Assembly diagram for low-power Operation Mode

Note: Chip capacitors as close as possible to power supply pad

Bill of Material

Reference Designator	Package Size	Value	P/N
U1	Naked Die	6GHz~13GHz	BR9376LDZ
C1	Chip capacitor	100pF	SG201N101MSTW
C2	Chip capacitor	1000pF	CT91202X102M100TW
C3	Chip capacitor	10nF	CT91-20-2X-103-M-50-C-W

Handling Precautions:

1. **Storage:** All bare dies are placed in ESD protective containers, and then sealed in an ESD protective bag for shipment. Once the sealed ESD protective bag has been opened, all die should be stored in a dry nitrogen environment.

2. Cleanliness: Handle the chips in a clean environment. DO NOT attempt to clean the chip using liquid cleaning systems.

3. Electrostatic protection: Follow ESD precautions to protect against ESD strikes.

4. Transients: Suppress instrument and bias supply transients while bias is applied. Use shielded signal and bias cables to minimize inductive pickup.

5. General Handling: Handle the chip along the edges with a vacuum collet or with a sharp pair of bent tweezers. The surface of the chip should not be touched with vacuum collet, tweezers, or fingers.

6. Mouning: The chip is back-metallized and can be die mounted with electrically conductive epoxy. The mounting surface should be clean and flat.

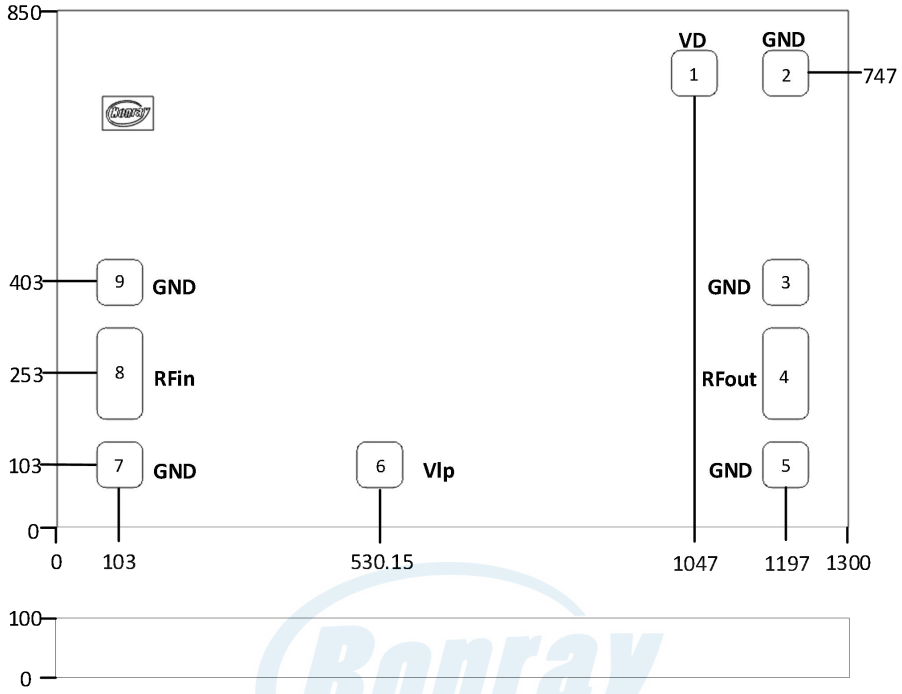
7. Conductive epoxy Die Attach: Apply conductive epoxy to the mounting surface so that the overflow of conductive epoxy on all four sides should not be less than 75%, and the height of conductive epoxy climbing on all four sides should not exceed the surface of the chip. Cure conductive epoxy per the manufacturer's schedule

8. Bonding process: Ball or wedge bond with 0.025mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 °C is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. **The length of all bonds should be as short as possible and the arc height as low as possible.**

9. Die bonding void rate: not more than 10%.

10. Please contact customer service if you have any problem.

Mechanical Information (Units: um)



Notes:

1. Backside and bond pad metal: Gold;
2. Backside is RF and DC ground;
3. Pads size: RFin 75um×150um, RFout 75um×150um, VD 75um×75um, Vlp 75um×75um, GND 75um×75um;
4. Cannot be bonded on the hole.

Functional Description

Pad	Function	Description
1	VD	Power Supply. See assembly for required external components.
2,3,5,7,9	GND	Connected to die bottom through hole
4	RFout	RF Output. No external DC block is required.
6	Vlp	Operation modes Setting. See assembly for required operation mode
8	RFin	RF Input. No external DC block is required.
Die Bottom	GND	Die bottom must be well grounded to RF/DC