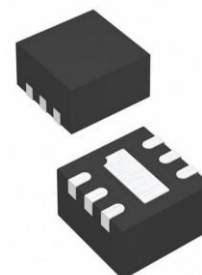


Full Band, Multimode Navigation, RF Low Noise Amplifier

PRODUCT DESCRIPTION

The MS2691 is a low-noise amplifier with full band of 1164MHz ~ 1615MHz and low power dissipation. The chip is equipped with simple external circuit, which makes the frequency band have broadband or narrowband characteristics. It supports various navigation systems in different bands, which have their own characteristics under different bands. Users can configure them according to individual needs.


DFN6

FEATURES

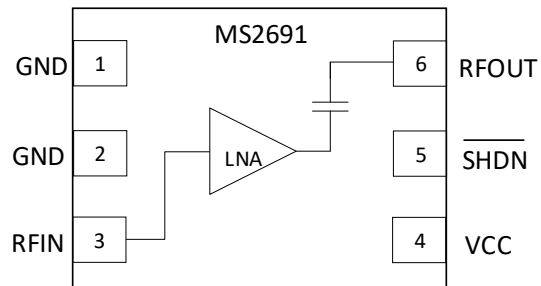
- Supporting for BD, GPS, GALILEO, GLONASS Navigation Satellite Systems in L1 and L2 Dual Frequency Bands
- Typical Noise Figure: 1.0dB
- Typical Power Gain: 19dB
- Typical Output P1dB: 0dBm
- Operating Frequency: 1164MHz ~ 1615MHz
- Current Consumption: 4.4mA
- Wide Power Supply Range: 1.5V ~ 3.5V
- 2kV HBM ESD Pin Protection Circuit
- Integrated 50Ω Output Matching Circuit
- Simple External Circuit
- Operating Temperature Range: -40°C ~ 120°C
- Storage Temperature Range: -40°C ~ 150°C

APPLICATIONS

- Automatic Navigation
- Location Mobile Device
- Personal Navigation Device
- Dual Frequency Measurement Instrument
- Precise Navigation
- Test Instrument

PRODUCT SPECIFICATION

Part Number	Package	Marking
MS2691	DFN6	91D

PIN CONFIGURATION

PIN DESCRIPTION

Pin	Name	Type	Description
1, 2	GND	-	Ground
3	RFIN	I	RF Input
4	VCC	-	Power Supply
5	$\overline{\text{SHDN}}$	I	Operation (High-level), Sleep (Low-level)
6	RFOUT	O	RF Output

ABSOLUTE MAXIMUM RATINGS

Any exceeding absolute maximum rating application causes permanent damage to device. Because long-time absolute operation state affects device reliability. Absolute ratings just conclude from a series of extreme tests. It doesn't represent chip can operate normally in these extreme conditions.

Parameter	Symbol	Ratings	Unit
Power Supply	VCC	-0.3 ~ 5.0	V
RF Input	RFIN	-0.3 ~ 2.0	V
RF Output	RFOUT	-0.3 ~ 5.0	V
Operating State Enable Terminal	$\overline{\text{SHDN}}$	-0.3 ~ 5.0	V
RF Input Power	P _{IN}	+20	dBm
Operating Temperature Range	T _{opr}	-40 ~ +120	°C
Lead Temperature (Soldering,10s)		+260	°C

ELECTRICAL CHARACTERISTICS

DC Characteristics

At room temperature

Parameter	Condition	Min	Typ	Max	Unit
Power Supply		1.5	2.85	3.5	V
Power Supply Current (at 2.85V Power Supply)	$\overline{\text{SHDN}} = 1$	3.4	4.4	5.1	mA
	$\overline{\text{SHDN}} = 0$	0.03	0.54	1	μA
Digital Input Logic High Level		1.2			V
Digital Input Logic Low Level				0.5	V
RFIN DC Bias Voltage	$\overline{\text{SHDN}} = 1$	0.83	0.87	0.90	V

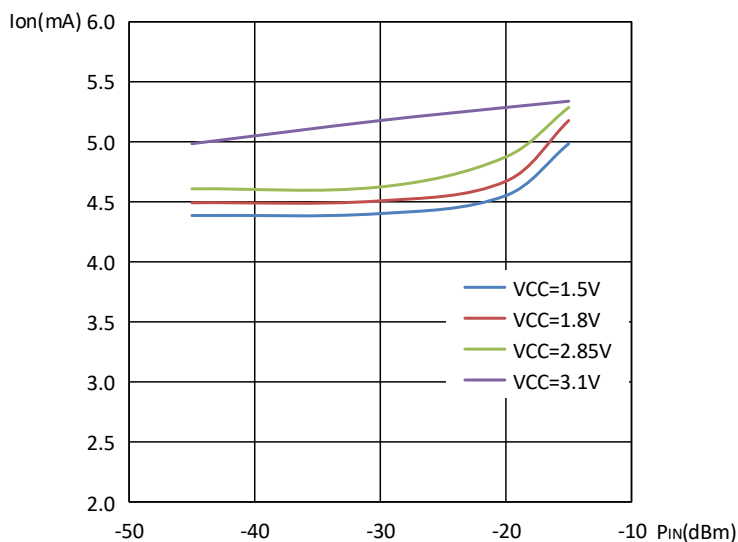


Figure 1. Power Supply Current VS. Input Power at Different Power Supplies

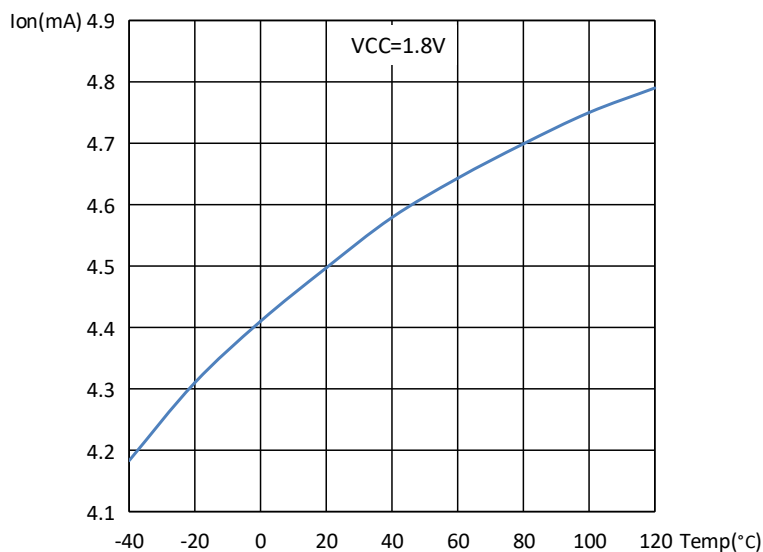
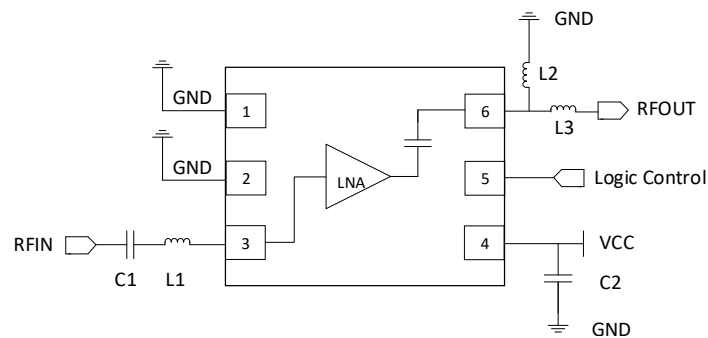


Figure 2. Power Supply Current VS. Temperature at 1.8V Power Supply

1.2 GHz Band Narrowband
1.2 GHz Band Narrowband Application Diagram

External Component Description

Component	Description
C1	470pF ± 10%
C2	0.1μF ± 10%
L1	6.8nH ± 5%
L2	15nH ± 5%
L3	5.6nH ± 0.3nH

AC Characteristics

Test conditions, 2.85V power supply, 25°C room temperature

Parameter	Typical Value 1			Unit
Operating Band	1207.14 (Bandwidth: ±2.046) (Mode: BD2 B2)			MHz
Operating Frequency Point	1205.094	1207.14	1209.186	MHz
Power Gain	19.2	19.2	19.3	dB
Noise Figure ¹	1.01	1.01	1.00	dB
Input Return Loss	15.8	16.2	16.3	dB
Output Return Loss	13.3	13.4	13.7	dB
Reverse Isolation	24.5	24.4	24.4	dB
Output P1dB	-1.9	-1.9	-1.9	dBm
OIP3	7.7	7.7	7.7	dBm

Parameter	Typical Value 2			Unit
Operating Band	1227.60 (Bandwidth: ±10.23) (Mode: GPS L2)			MHz
Operating Frequency Point	1217.37	1227.60	1237.83	MHz
Power Gain	19.3	19.3	19.4	dB
Noise Figure ¹	0.99	0.99	1.00	dB
Input Return Loss	17.3	17.4	18.1	dB
Output Return Loss	14.6	15.6	16.0	dB

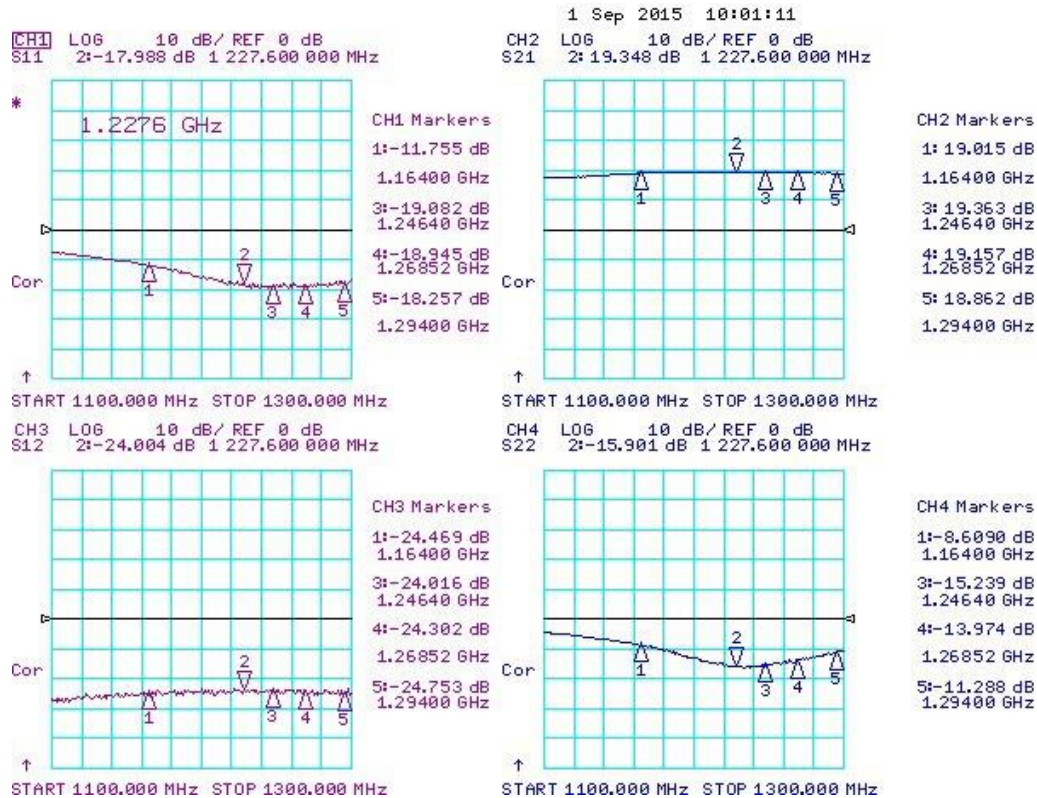
Parameter	Typical Value 2			Unit
Reverse Isolation	24.3	24.5	23.7	dB
Output P1dB	-1	-1	-1	dBm
OIP3	8.6	8.6	8.6	dBm

Parameter	Typical Value 3			Unit
Operating Band	1246.40 (Bandwidth: ± 5) (Mode: GLONASS L2)			MHz
Operating Frequency Point	1241.40	1246.40	1251.40	MHz
Power Gain	19.4	19.5	19.5	dB
Noise Figure ¹	1.00	1.00	0.99	dB
Input Return Loss	18.4	18.4	18.5	dB
Output Return Loss	15.9	14.4	15.3	dB
Reverse Isolation	24.2	23.8	23.8	dB
Output P1dB	0	0	0	dBm
OIP3	9.6	9.6	9.6	dBm

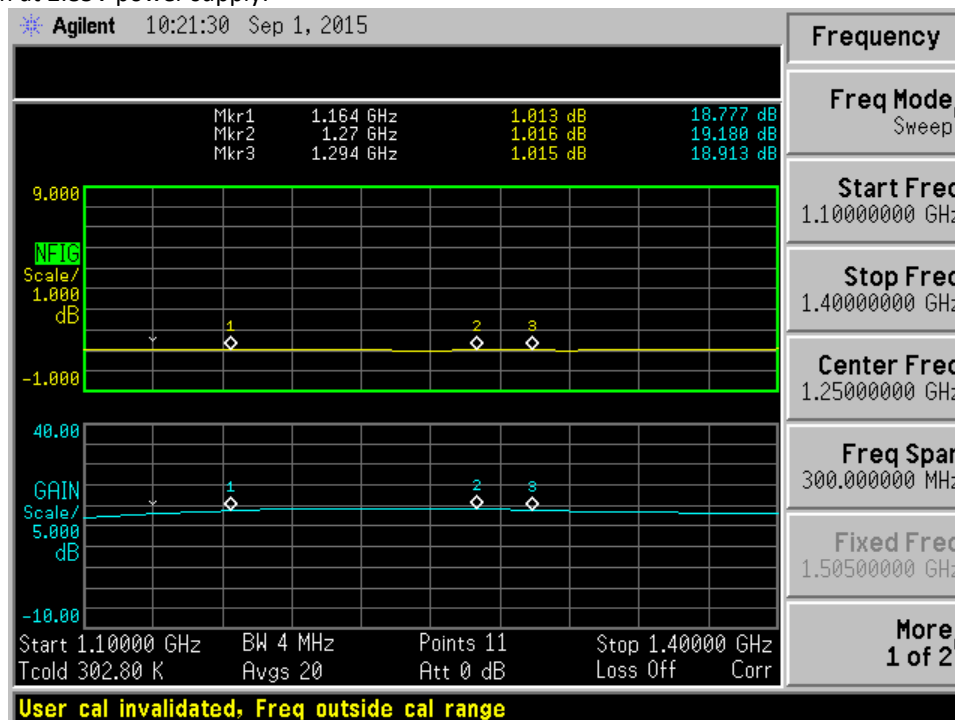
Parameter	Typical Value 4			Unit
Operating Band	1268.52 (Bandwidth: ± 10.23) (Mode: BD2 B3)			MHz
Operating Frequency Point	1258.29	1268.52	1278.75	MHz
Power Gain	19.5	19.5	19.5	dB
Noise Figure ¹	0.99	0.99	1.00	dB
Input Return Loss	18.4	18.4	17.9	dB
Output Return Loss	14.7	14.0	12.8	dB
Reverse Isolation	24.2	24.8	24.2	dB
Output P1dB	0.7	0.7	0.7	dBm
OIP3	10.3	10.3	10.3	dBm

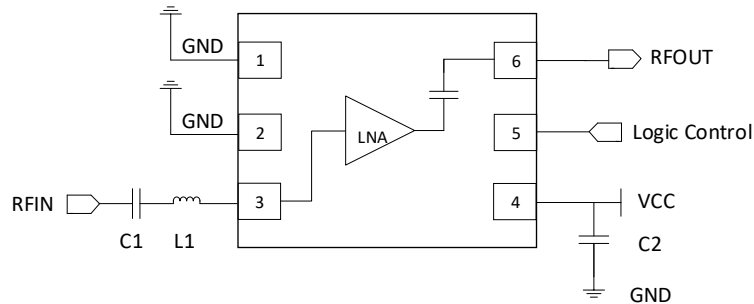
Note1: Measured value (including PCB, SMA and other board-level access losses).

The following figure shows S parameter curves in L2 band narrowband applications at 2.85V power supply:



The following figure shows the noise figure curve and relevant gain curve in L2 band narrowband application at 2.85V power supply:



1.5 GHz Band Narrowband
L1 Band Narrowband Application Diagram

External Component Description

Component	Description
C1	470pF ± 10%
C2	0.1µF ± 10%
L1	5.6nH ± 5%

AC Characteristics

Test conditions, 2.85V power supply, 25°C room temperature

Parameter	Typical Value 1			Unit
Operating Band	1561.098 (Bandwidth: ±2.046) (Mode: BD2 B1)			MHz
Operating Frequency Point	1559.052	1561.098	1563.144	MHz
Power Gain	21.7	21.8	21.9	dB
Noise Figure ¹	0.97	0.97	0.97	dB
Input Return Loss	14.5	14.8	14.9	dB
Output Return Loss	20.1	19.3	18.5	dB
Reverse Isolation	30.1	30.2	30.3	dB
Output P1dB	3.3	3.3	3.3	dBm
OIP3	12.9	12.9	12.9	dBm

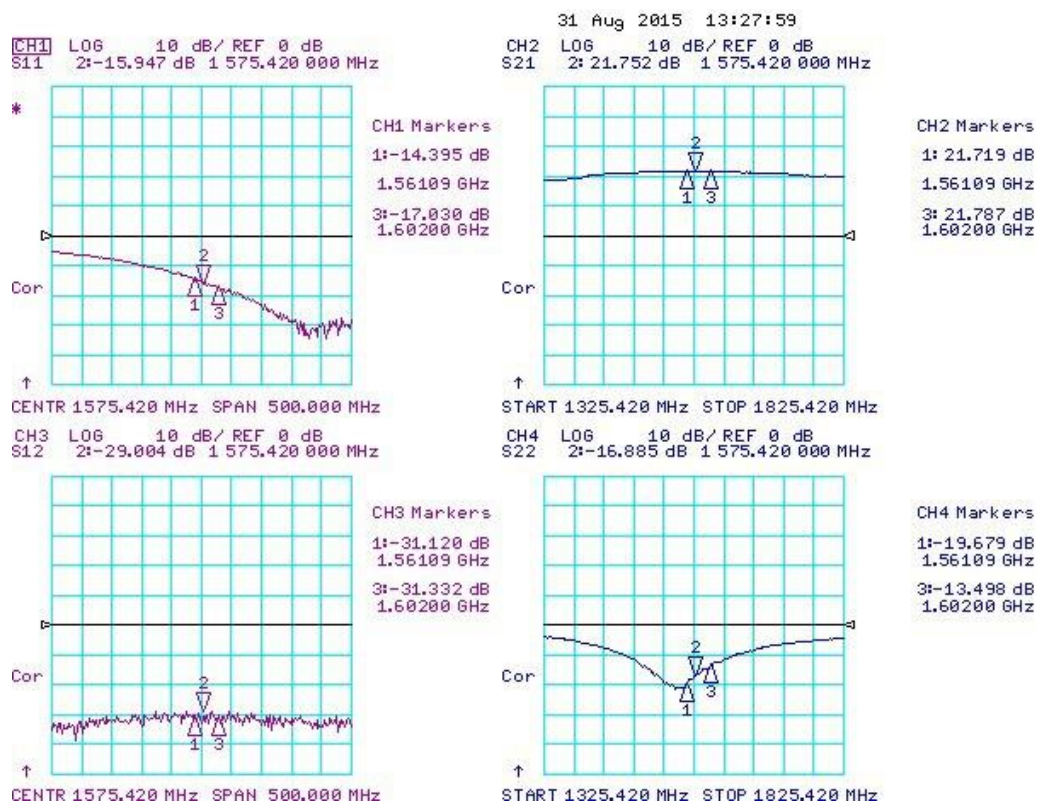
Parameter	Typical Value 2			Unit
Operating Band	1575.42 (Bandwidth: ±1.023) (Mode: GPS L1)			MHz
Operating Frequency Point	1574.397	1575.42	1576.443	MHz
Power Gain	22.0	22.0	22.0	dB
Noise Figure ¹	0.95	0.95	0.95	dB
Input Return Loss	15.5	16.1	15.8	dB
Output Return Loss	17.1	17.0	16.7	dB
Reverse Isolation	30.6	30.5	30.0	dB

Parameter	Typical Value 2			Unit
Output P1dB	3.5	3.5	3.5	dBm
OIP3	13.1	13.1	13.1	dBm

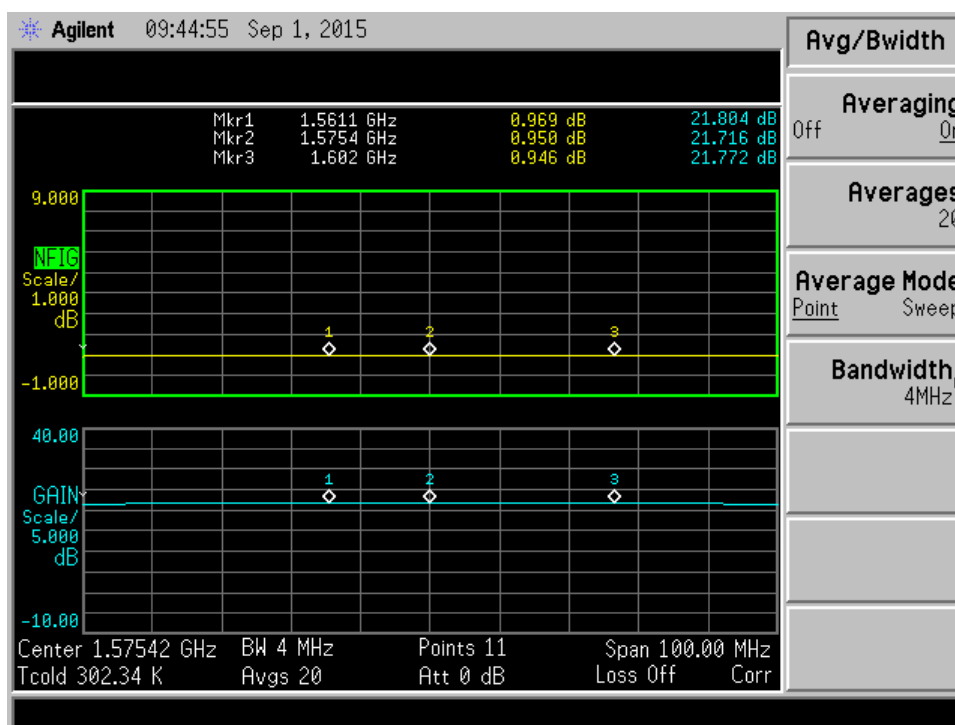
Parameter	Typical Value 3			Unit
Operating Band	1603.5 (Bandwidth: ±6) (Mode: GLONASS L1)			MHz
Operating Frequency Point	1597.5	1603.5	1609.5	MHz
Power Gain	22.1	22.1	22.1	dB
Noise Figure ¹	0.95	0.95	0.95	dB
Input Return Loss	17.3	17.6	17.9	dB
Output Return Loss	14.3	13.1	12.5	dB
Reverse Isolation	30.0	30.9	30.1	dB
Output P1dB	4.1	4.1	4.1	dBm
OIP3	13.7	13.7	13.7	dBm

Note1: Measured value (including PCB, SMA and other board-level access losses).

The following figure shows S parameter curves in L1 band narrowband applications at 2.85V power supply:

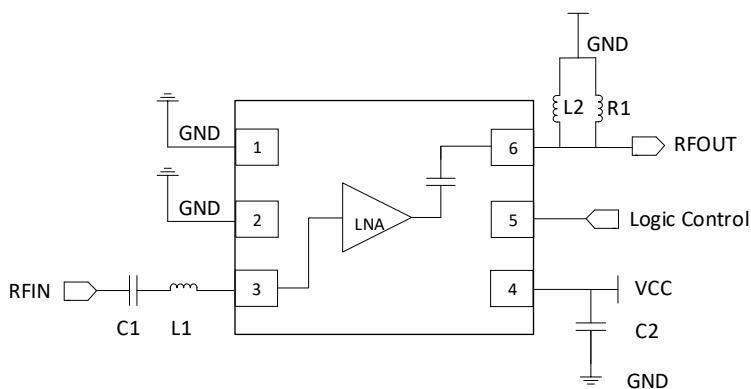


The following figure shows the noise figure curve and relevant gain curve in L1 band narrowband applications at 2.85V power supply:



1.2 GHz and 1.5 GHz Band Broadband

1.2 GHz and 1.5 GHz Band Broadband Application Diagram



External Component Description

Component	Description
C1	470pF ± 10%
C2	0.1μF ± 10%
L1	7.5nH ± 5%
L2	22nH ± 5%
R1	150Ω ± 5%

AC Characteristics

Test conditions, 2.85V power supply, 25°C room temperature

Parameter	Typical Value 1			Unit
Operating Band	1207.14 (Bandwidth: ± 2.046) (Mode: BD2 B2)			MHz
Operating Frequency Point	1205.094	1207.14	1209.186	MHz
Power Gain	17.2	17.4	17.2	dB
Noise Figure ¹	1.02	1.02	1.02	dB
Input Return Loss	11.3	11.1	11.6	dB
Output Return Loss	10.1	10.1	10.3	dB
Reverse Isolation	27.5	27.2	27.0	dB
Output P1dB	-5.4	-5.4	-5.4	dBm
OIP3	4.2	4.2	4.2	dBm

Parameter	Typical Value 2			Unit
Operating Band	1227.60 (Bandwidth: ± 10.23) (Mode: GPS L2)			MHz
Operating Frequency Point	1217.37	1227.60	1237.83	MHz
Power Gain	17.4	17.6	17.7	dB
Noise Figure ¹	1.02	1.00	1.01	dB
Input Return Loss	11.8	11.7	12.3	dB
Output Return Loss	10.4	10.4	10.8	dB
Reverse Isolation	27.1	27.3	26.9	dB
Output P1dB	-4.2	-4.2	-4.2	dBm
OIP3	5.4	5.4	5.4	dBm

Parameter	Typical Value3			Unit
Operating Band	1246.40 (Bandwidth: ± 5) (Mode: GLONASS L2)			MHz
Operating Frequency Point	1241.40	1246.40	1251.40	MHz
Power Gain	17.8	17.9	18.1	dB
Noise Figure ¹	1.00	1.01	1.00	dB
Input Return Loss	12.0	11.9	12.0	dB
Output Return Loss	10.8	10.9	10.9	dB
Reverse Isolation	26.6	26.1	26.1	dB
Output P1dB	-3.7	-3.7	-3.7	dBm
OIP3	5.9	5.9	5.9	dBm

Parameter	Typical Value 4			Unit
Operating Band	1268.52 (Bandwidth: ± 10.23) (Mode: BD2 B3)			MHz
Operating Frequency Point	1258.29	1268.52	1278.75	MHz
Power Gain	18.2	18.4	18.5	dB
Noise Figure ¹	1.00	0.99	0.99	dB
Input Return Loss	11.9	11.8	11.6	dB
Output Return Loss	11.0	11.1	11.2	dB
Reverse Isolation	26.2	25.8	25.4	dB
Output P1dB	-2.6	-2.6	-2.6	dBm
OIP3	7	7	7	dBm

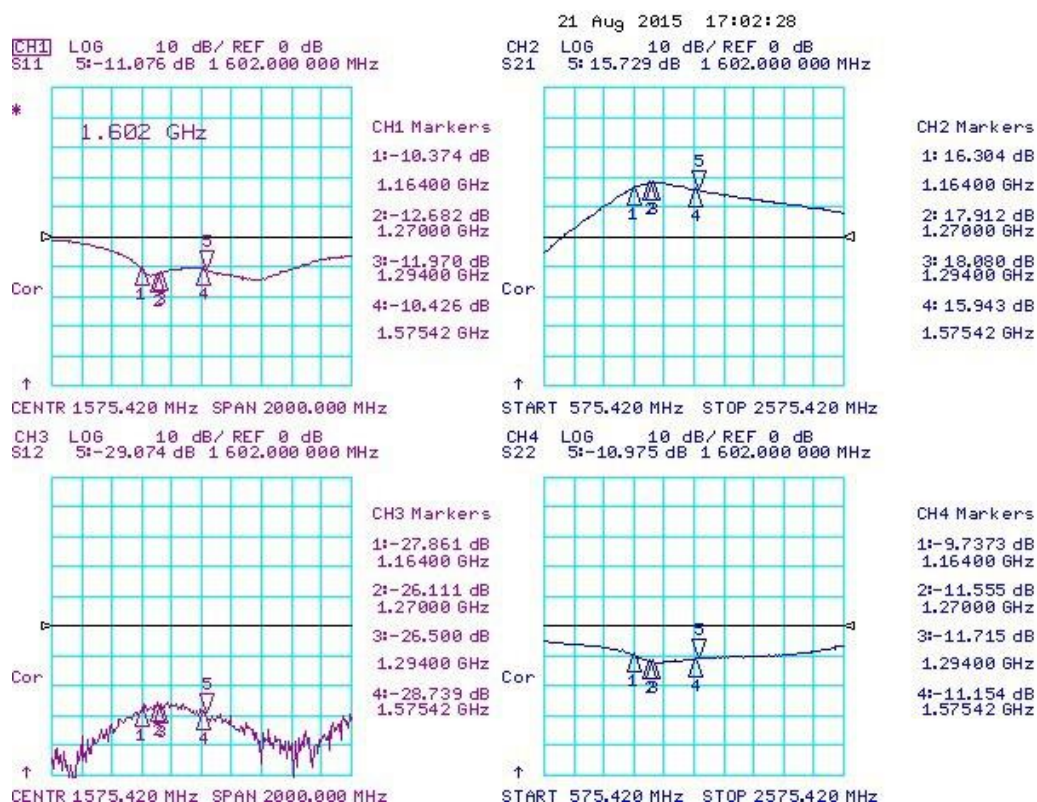
Parameter	Typical Value 5			Unit
Operating Band	1561.098 (Bandwidth: ± 2.046) (Mode: BD2 B1)			MHz
Operating Frequency Point	1559.052	1561.098	1563.144	MHz
Power Gain	16.6	16.6	16.6	dB
Noise Figure ¹	1.13	1.13	1.13	dB
Input Return Loss	9.8	9.8	9.8	dB
Output Return Loss	11.1	11.1	11.1	dB
Reverse Isolation	28.5	27.9	27.5	dB
Output P1dB	3.6	3.6	3.6	dBm
OIP3	13.2	13.2	13.2	dBm

Parameter	Typical Value 6			Unit
Operating Band	1575.42 (Bandwidth: ± 1.023) (Mode: GPS L1)			MHz
Operating Frequency Point	1574.397	1575.42	1576.443	MHz
Power Gain	16.6	16.6	16.6	dB
Noise Figure ¹	1.14	1.14	1.15	dB
Input Return Loss	9.5	9.5	9.6	dB
Output Return Loss	10.8	10.9	10.9	dB
Reverse Isolation	28.4	28.1	28.4	dB
Output P1dB	3.6	3.6	3.6	dBm
OIP3	13.2	13.2	13.2	dBm

Parameter	Typical Value 7			Unit
Operating Band	1603.5 (Bandwidth: ±6) (Mode: GLONASS L1)			MHz
Operating Frequency Point	1597.5	1603.5	1609.5	MHz
Power Gain	16.5	16.4	16.3	dB
Noise Figure ¹	1.15	1.15	1.16	dB
Input Return Loss	9.9	10.0	10.0	dB
Output Return Loss	10.8	10.8	10.7	dB
Reverse Isolation	28.8	28.8	28.6	dB
Output P1dB	3.6	3.6	3.6	dBm
OIP3	13.2	13.2	13.2	dBm

Note1: Measured value (including PCB, SMA and other board-level access losses).

The following figure shows S parameter curves in L1 and L2 band broadband applications at 2.85V power supply:



The following figure shows the noise figure curve and relevant gain curve in L1 and L2 band broadband applications at 2.85V power supply:

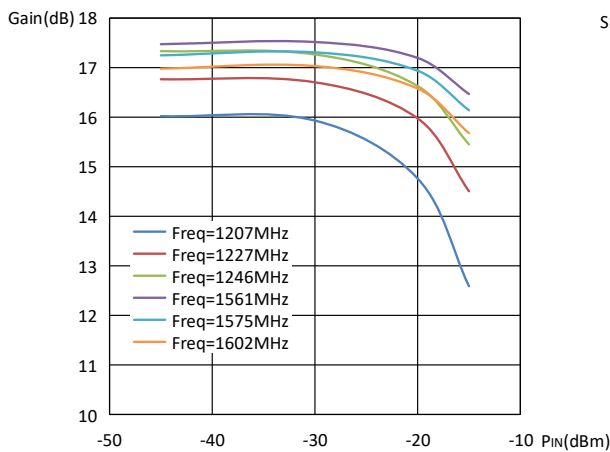
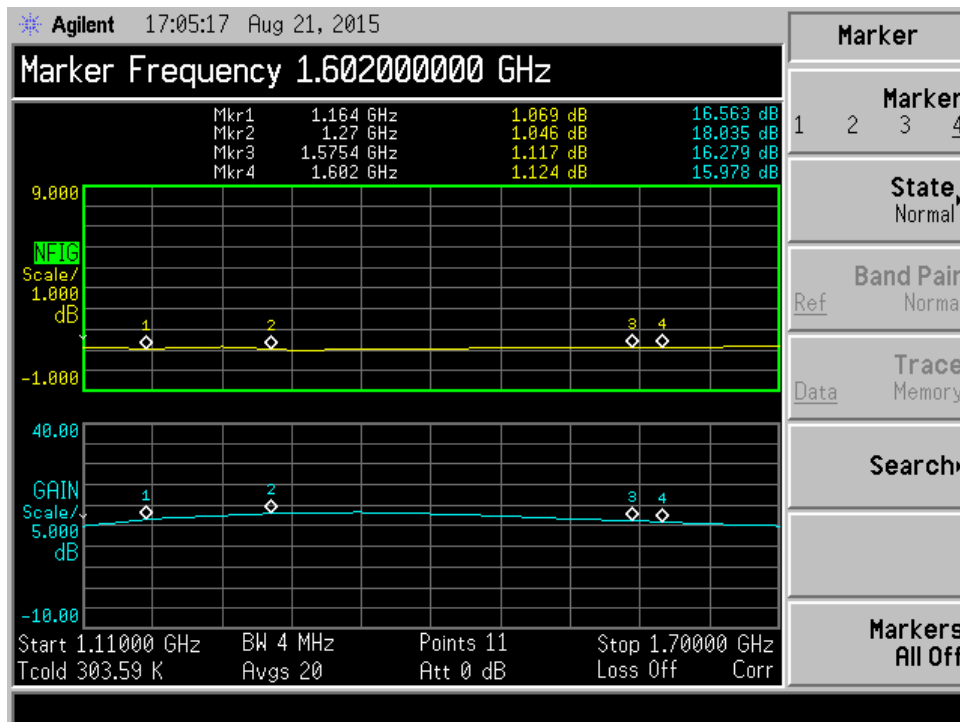


Figure 3. Gain VS. Input Power at Different Frequencies

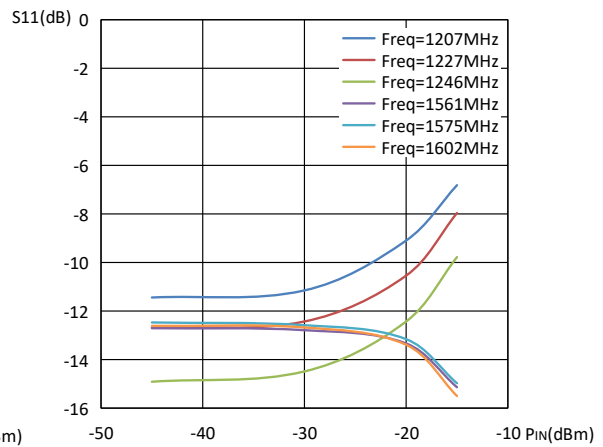


Figure 4. S11 VS. Input Power at Different Frequencies

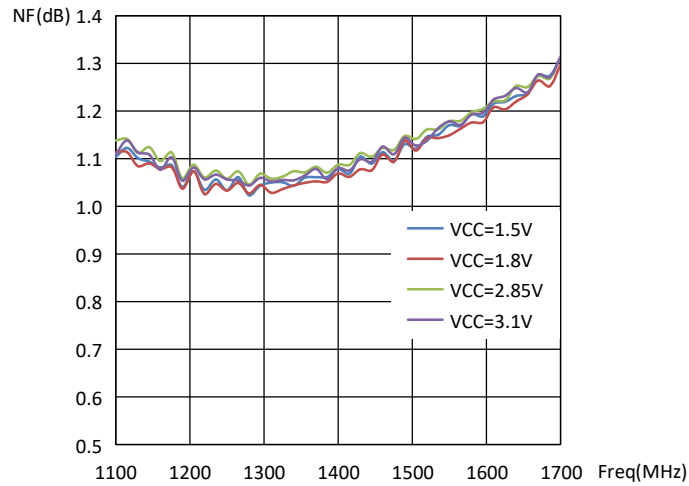


Figure 5. Noise Figure VS. Frequency at Different Power Supplies

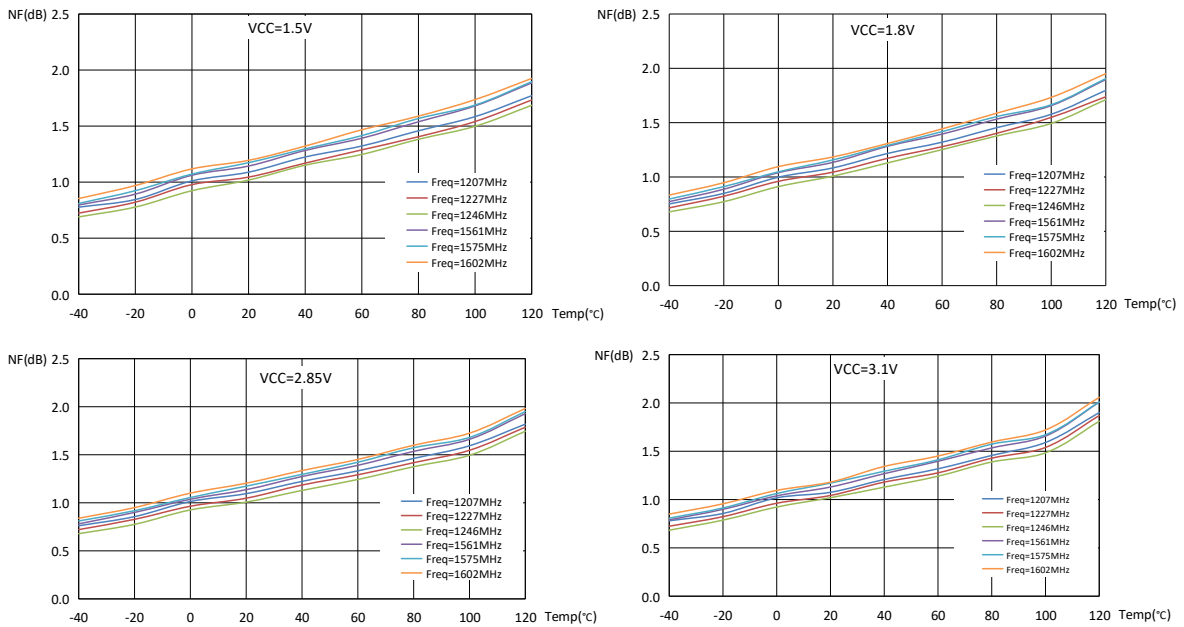


Figure 6. Noise Figure VS. Temperature at Different Power Supplies and Different Frequencies

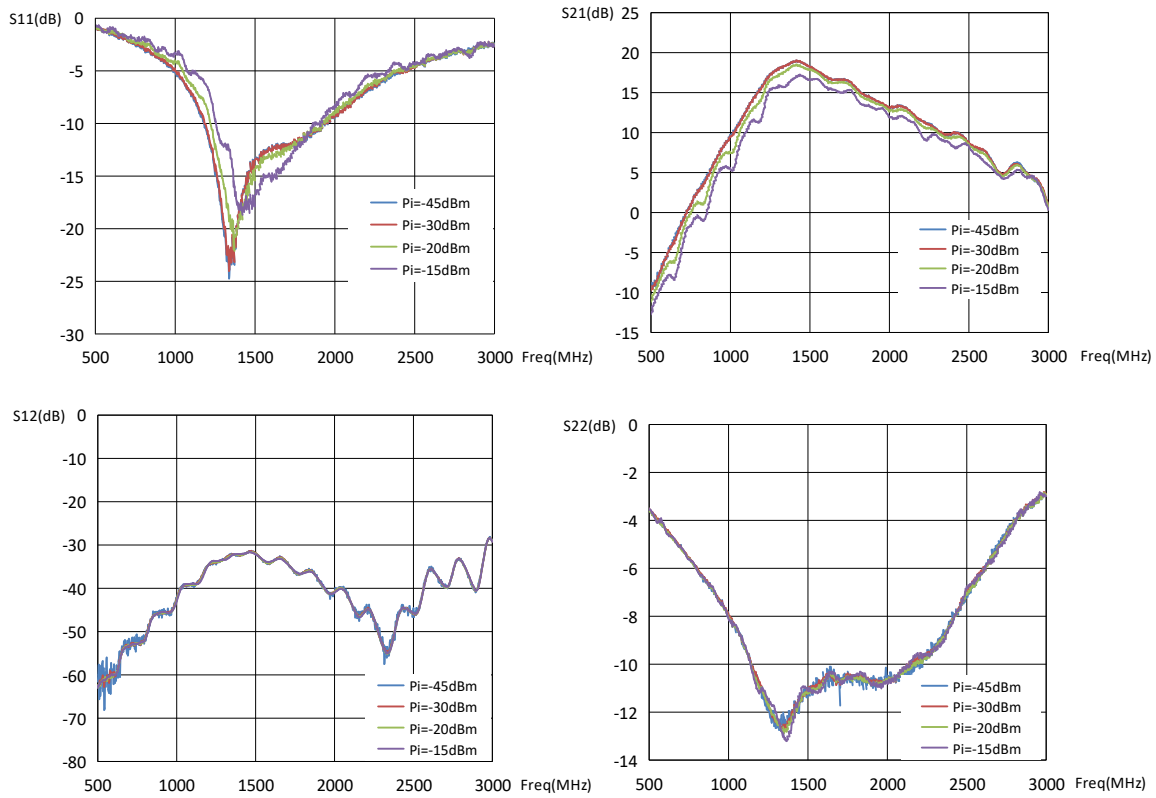


Figure 7. S Parameters VS. Frequency at Different Input Power

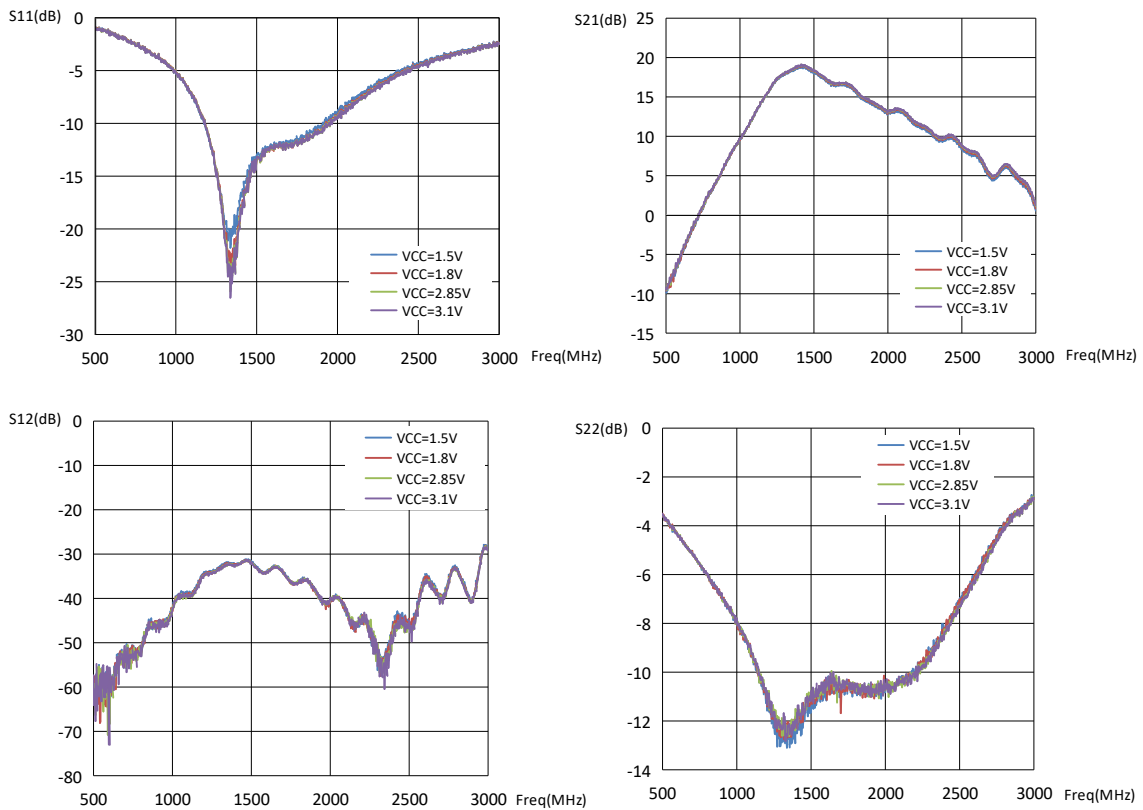


Figure 8. S Parameters VS. Frequency at Different Power Supplies

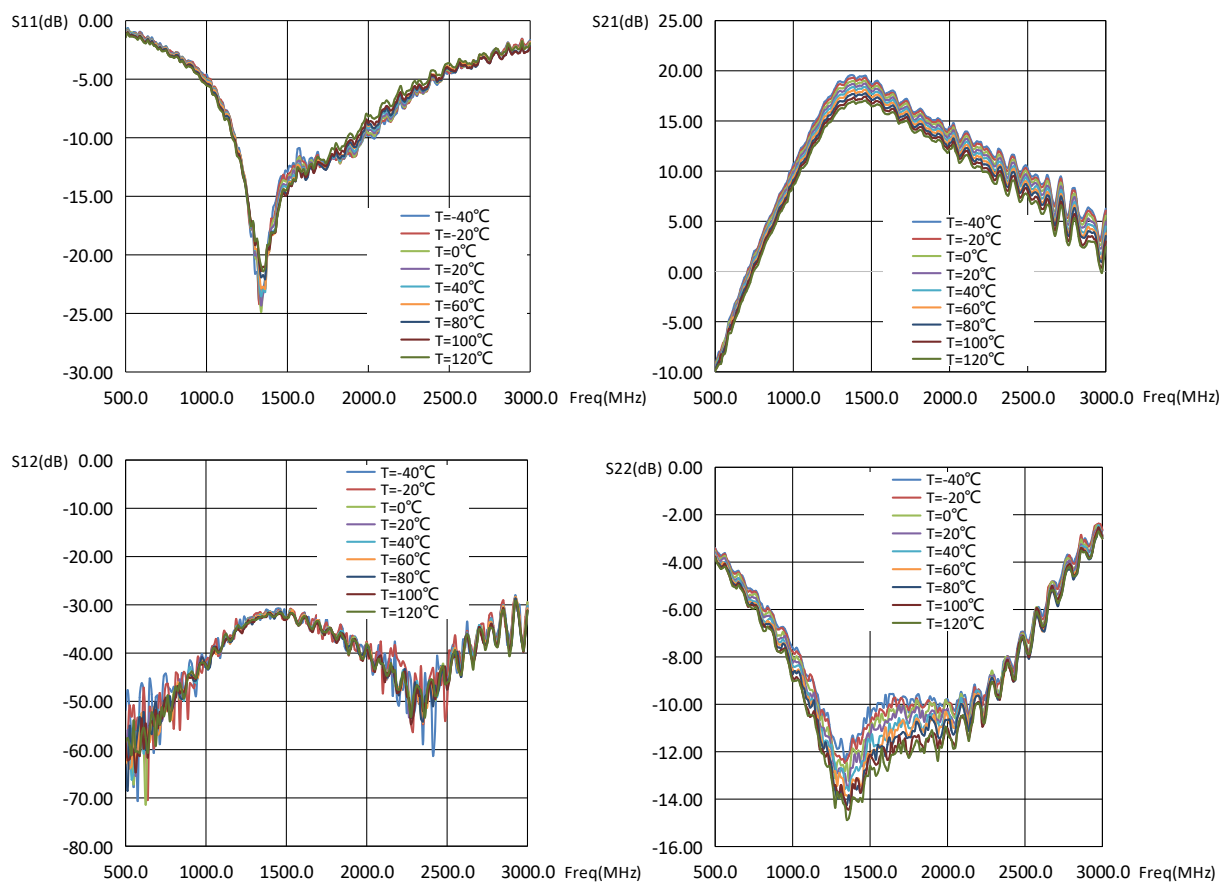
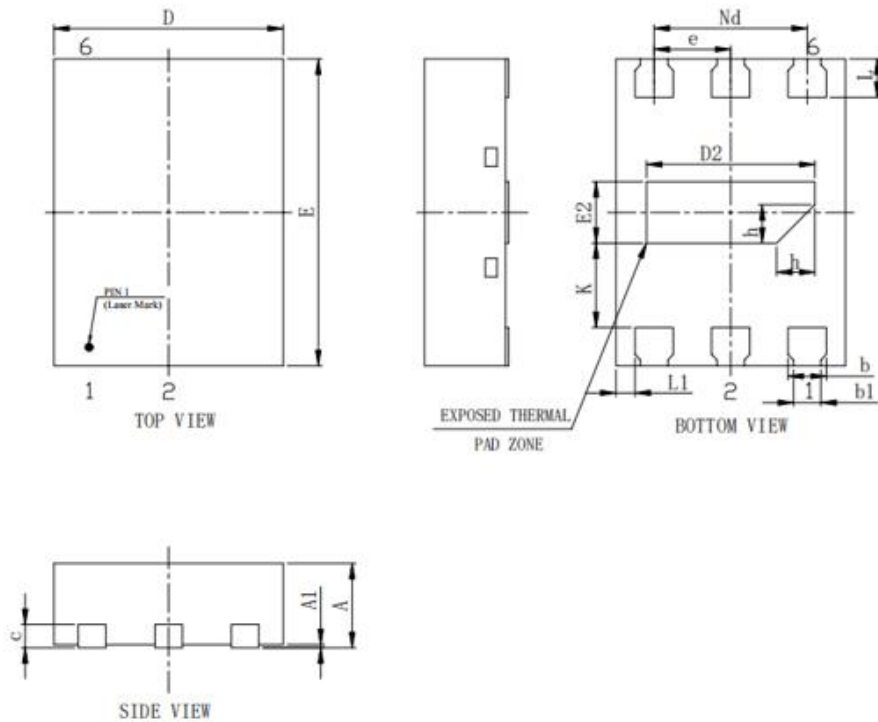


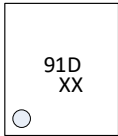
Figure 9. S Parameters VS. Frequency at 1.8V Power Supply and Different Temperatures

PACKAGE OUTLINE DIMENSIONS
DFN6


Symbol	Dimensions in Millimeters		
	Min	Typ	Max
A	0.50	0.55	0.60
A1	0	0.02	0.05
b	0.20	0.25	0.30
b1	0.18REF		
c	0.152REF		
D	1.45	1.50	1.55
D2	1.00	1.10	1.20
e	0.50BSC		
Nd	1.00BSC		
E	1.95	2.00	2.05
E2	0.30	0.40	0.50
L	0.20	0.25	0.30
L1	0.125REF		
h	0.20	0.25	0.30
K	0.55REF		

MARKING and PACKAGING SPECIFICATIONS

1. Marking Drawing Description



Product Name: 91D

Product Code: XX

2. Marking Drawing Demand

Laser printing, contents in the middle, font type Arial.

3. Packaging Specification

Device	Package	Piece/Reel	Reel/Box	Piece /Box	Box/Carton	Piece/Carton
MS2691	DFN6	2500	10	25000	4	100000

STATEMENT

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- When using Ruimeng products to design and produce, purchaser has the responsibility to observe safety standard and adopt corresponding precautions, in order to avoid personal injury and property loss caused by potential failure risk.
- The process of improving product is endless. And our company would sincerely provide more excellent product for customer.

**MOS CIRCUIT OPERATION PRECAUTIONS**

Static electricity can be generated in many places. The following precautions can be taken to effectively prevent the damage of MOS circuit caused by electrostatic discharge:

- 1、 The operator shall ground through the anti-static wristband.
- 2、 The equipment shell must be grounded.
- 3、 The tools used in the assembly process must be grounded.
- 4、 Must use conductor packaging or anti-static materials packaging or transportation.



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