

## Features

- 10.5 dB Gain at 2000 MHz
- 33 dBm P1dB at 2000 MHz
- 48 dBm OIP3 at 2000 MHz
- MTTF > 100 Years

## Description

The ASX602, a power amplifier MMIC, has a high linearity, high gain, and high efficiency over a wide range of frequency, being suitable for use in both receiver and transmitter of telecommunication systems up to 3 GHz. The amplifier is available in a SOIC8 package and passes through the stringent DC, RF, and reliability tests.



Package Style: SOIC8

## Typical Performance

(Supply Voltage = Device Voltage,  $T_A = +25\text{ }^\circ\text{C}$ ,  $Z_0 = 50\ \Omega$ )

Parameters	Units	Typical			
		900	2000	2000	2400
Frequency	MHz				
Gain	dB	16.5	10.5	10.0	8.9
S11	dB	-20	-15	-18	-9
S22	dB	-7	-10	-10	-14
Output IP3	dBm	48.0 <sup>1)</sup>	48.0 <sup>1)</sup>	43.0 <sup>1)</sup>	43.5 <sup>2)</sup>
Noise Figure	dB	4.9	5.2	5.0	5.7
Output P1dB	dBm	33.0	32.0	33.0	32.5
Current	mA	580	580	580	580
Device Voltage	V	+5	+5	+5	+5

1) OIP3 measured with two tones at an output power of +14 dBm/tone separated by 1 MHz.

2) OIP3 measured with two tones at an output power of +12 dBm/tone separated by 1 MHz.

## Product Specifications

Parameters	Units	Min	Typ	Max
Testing Frequency	MHz		2000	
Gain	dB		10.5	
S11	dB		-15	
S22	dB		-10	
Output IP3	dBm		48	
Noise Figure	dB		5.2	
Output P1dB	dBm		32	
Current	mA		580	
Device Voltage	V		+5	

## Absolute Maximum Ratings

Parameters	Rating
Operating Case Temperature	-40 to +85 °C
Storage Temperature	-40 to +150 °C
Device Voltage	+5.5 V
Operating Junction Temperature	+150 °C
Input RF Power (CW, 50ohm matched) <sup>1)</sup>	+23 dBm
Thermal Resistance	13 °C/W

The operation of this device in excess of any of these limits may cause permanent damage.

\* Refer to the max. input RF power data at [http://www.asb.co.kr/pdf/Maximum\\_Input\\_Power\\_Analysis.pdf](http://www.asb.co.kr/pdf/Maximum_Input_Power_Analysis.pdf).

The max. input RF power, in principle, depends upon application frequency, matching circuit, and device voltage.

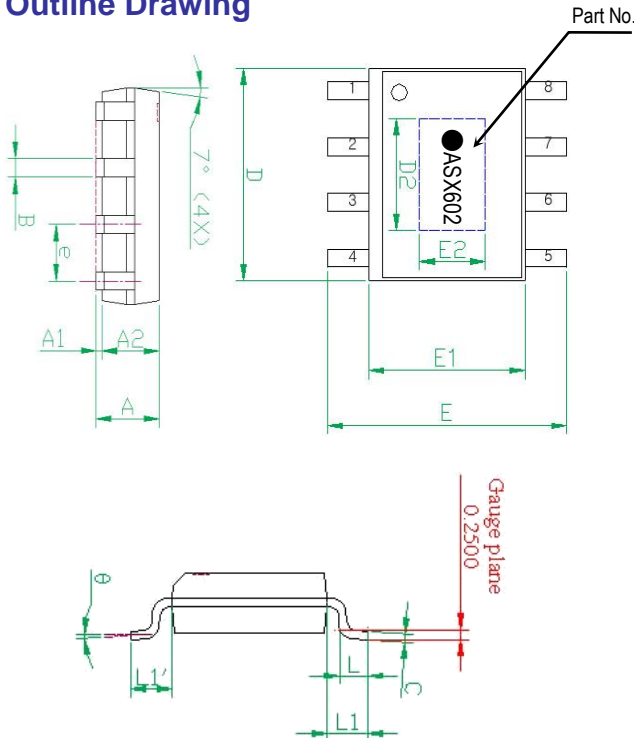
## Application Circuit

- LTE (740 MHz)
- CDMA & GSM (900 MHz)
- RFID (USA)
- Others (1240 ~ 1280 MHz)
- Others (1600 MHz)
- WCDMA (2000 MHz)
- WLAN (2400 MHz)
- 1626.5 ~ 1660.5 MHz (Balanced)
- PCS (1710 ~ 1785 MHz) (Balanced)
- WCDMA (2000 ~ 2200 MHz, Balanced)

## Pin Configuration

Pin No.	Function
1,4,5	GND
2,3	RF IN
6,7	RF OUT
8	Bias

### Outline Drawing

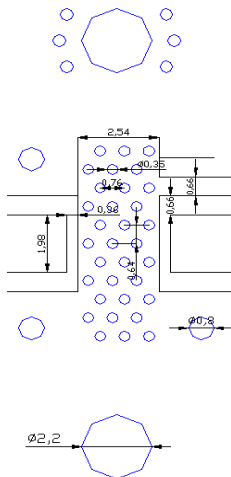


Symbols	Dimensions (In mm)		
	MIN	NOM	MAX
A	1.40	1.50	1.60
A1	0.00	---	0.10
A2	---	1.45	---
B	0.33	---	0.51
C	0.19	---	0.25
D	4.80	---	5.00
D2	3.20	3.30	3.40
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
E2	2.30	2.40	2.50
e	---	1.27	---
L	0.40	---	1.27
y	---	---	0.10
θ	0°	---	8°
L1-L1'	---	---	0.12
L1	1.04REF		

Pin No.	Function	Pin No.	Function.
1	GND	5	GND
2	RF IN	6	RF OUT
3	RF IN	7	RF OUT
4	GND	8	Bias

Note: 1. Backside metal paddle is RF and DC ground.

### Mounting Recommendation (In mm)



- Note:**
1. Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
  2. To ensure reliable operation, device ground paddle-to-ground pad soldering is critical.
  3. Add mounting screws near the part to fasten the board to a heat sinker. Ensure that the ground / thermal via region contacts the heat sinker.
  4. A proper heat dissipation path underneath the area of the PCB for the mounted device is strictly required for proper thermal operation. Damage to the device can result from inappropriate heat dissipation.

### ESD Classification

HBM	Class 1B Voltage Level: 500 V ~ 1000 V
MM	Class A Voltage Level: < 200 V

**CAUTION:** Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices

### Moisture Sensitivity Level (MSL)

Level 3 at 260 °C reflow

**APPLICATION CIRCUIT**

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**LTE**

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**740 MHz**

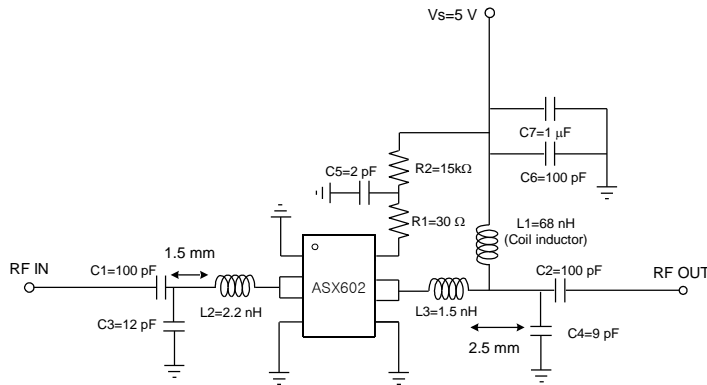
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**+5 V**

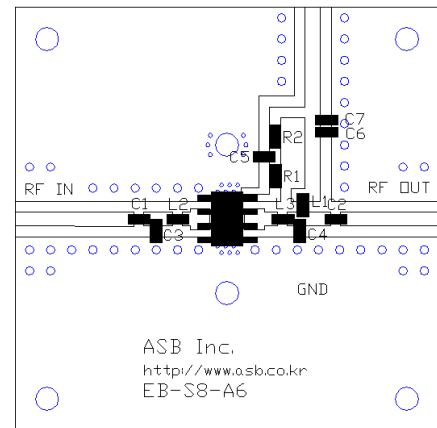
Frequency (MHz)	740
Magnitude S21 (dB)	17.5
Magnitude S11 (dB)	-18
Magnitude S22 (dB)	-10
Output P1dB (dBm)	32.5
Output IP3 <sup>1)</sup> (dBm)	44
Noise Figure (dB)	5.5
Device Voltage (V)	+5
Current (mA)	580

1) OIP3 is measured with two tones at an output power of +13 dBm/tone separated by 1 MHz.

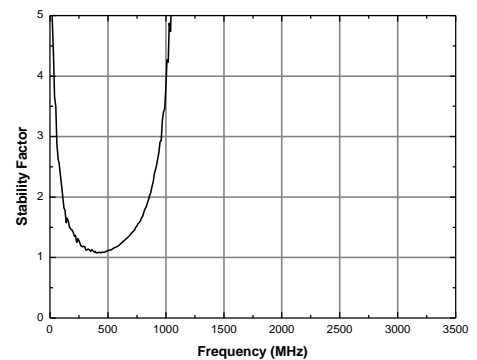
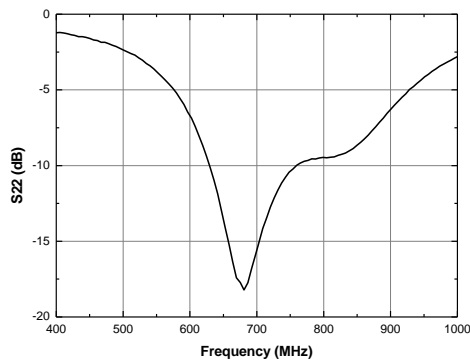
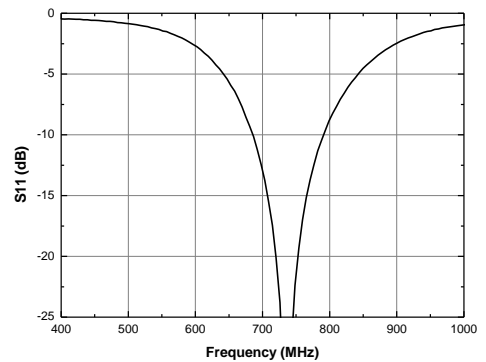
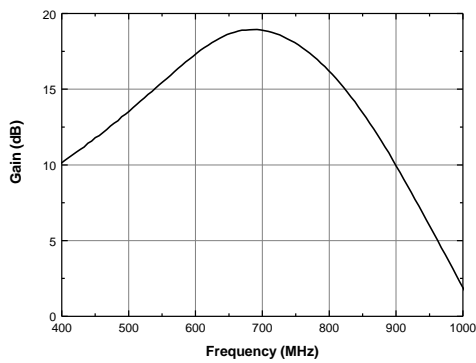
### Schematic



### Board Layout (FR4, 40x40 mm<sup>2</sup>, 0.8T)



### S-parameters & K-factor



**APPLICATION CIRCUIT**

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**CDMA & GSM**

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**900 MHz**

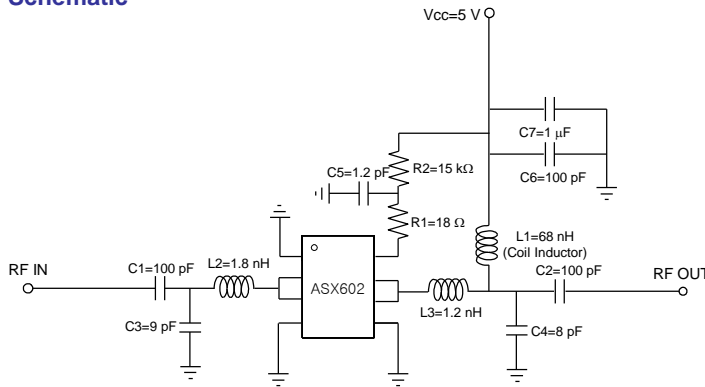
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**+5 V**

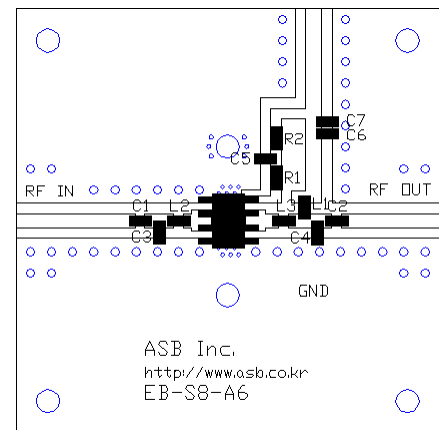
Frequency (MHz)	900
Magnitude S21 (dB)	16.5
Magnitude S11 (dB)	-20
Magnitude S22 (dB)	-7
Output P1dB (dBm)	33
Output IP3 <sup>1)</sup> (dBm)	48
Noise Figure (dB)	4.9
Device Voltage (V)	+5
Current (mA)	580

1) OIP3 is measured with two tones at an output power of +14 dBm/tone separated by 1 MHz.

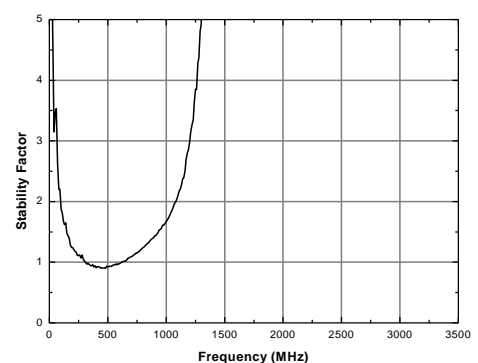
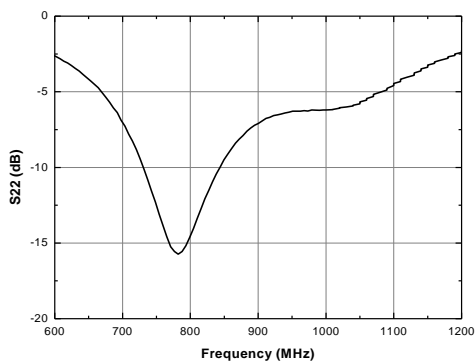
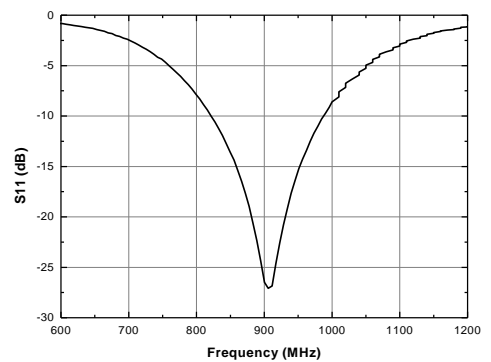
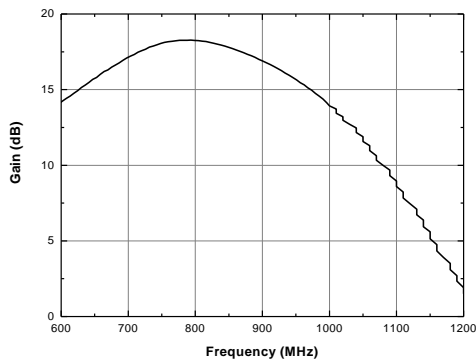
### Schematic



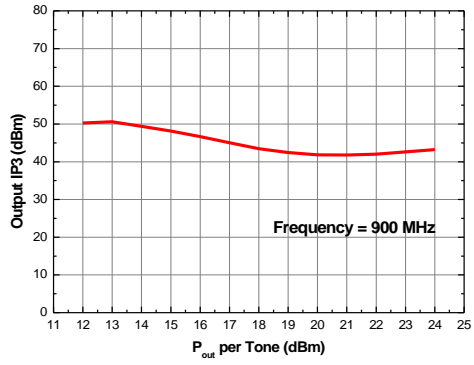
### Board Layout (FR4, 40x40 mm<sup>2</sup>, 0.8T)



### S-parameters & K-factor



### Output IP3 vs. Tone Power



**APPLICATION CIRCUIT**

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**RFID (USA)**

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**902 ~ 928 MHz**

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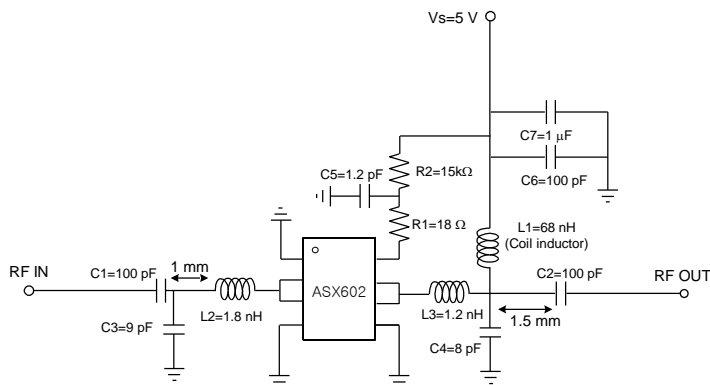
**+5 V**

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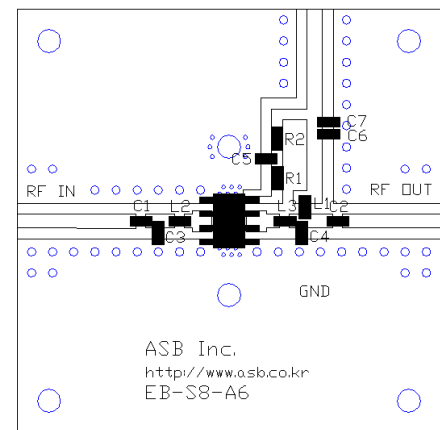
Frequency (MHz)	902	928
Magnitude S21 (dB)	16.8	16.0
Magnitude S11 (dB)	-18	-12
Magnitude S22 (dB)	-7	-7
Output P1dB (dBm)	32.5	33.0
Output IP3 <sup>1)</sup> (dBm)	48	45
Noise Figure (dB)	4.9	5.0
Device Voltage (V)	+5	+5
Current (mA)	580	580

1) OIP3 is measured with two tones at an output power of +13 dBm/tone separated by 1 MHz.

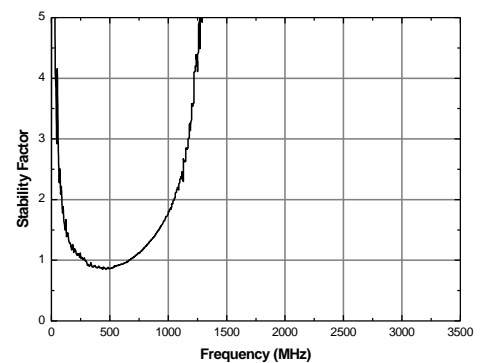
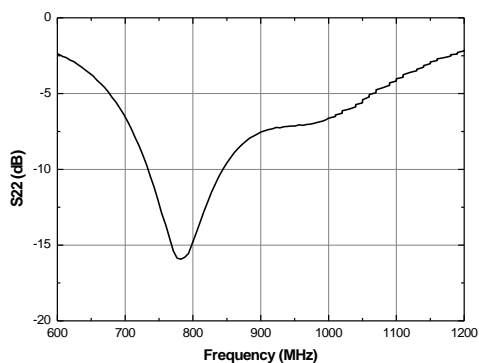
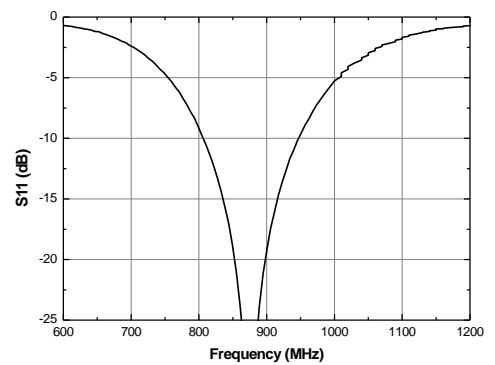
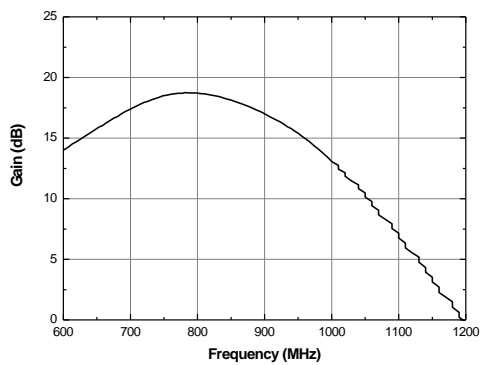
### Schematic



### Board Layout (FR4, 40x40 mm<sup>2</sup>, 0.8T)



### S-parameters & K-factor



**APPLICATION CIRCUIT**

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**Others**

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**1240 ~ 1280 MHz**

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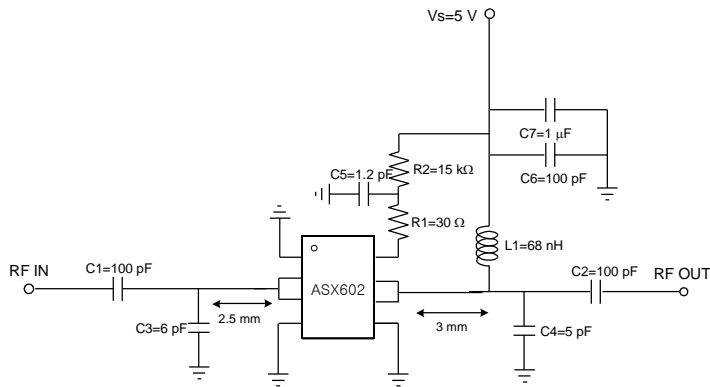
**+5 V**

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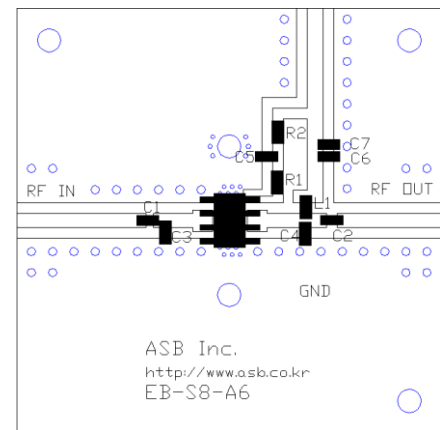
Frequency (MHz)	1240	1280
Magnitude S21 (dB)	14	13
Magnitude S11 (dB)	-18	-12
Magnitude S22 (dB)	-9	-9
Output P1dB (dBm)	33	
Output IP3 <sup>1)</sup> (dBm)	41.5	
Noise Figure (dB)	5.1	
Device Voltage (V)	+5	
Current (mA)	580	

1) OIP3 is measured with two tones at an output power of +11 dBm/tone separated by 1 MHz.

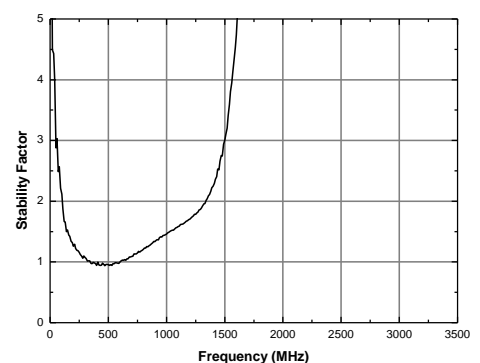
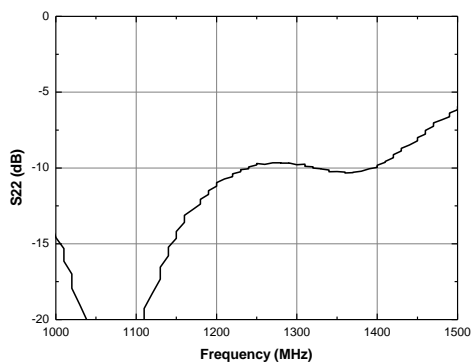
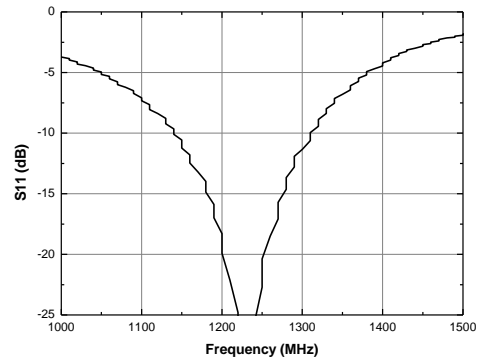
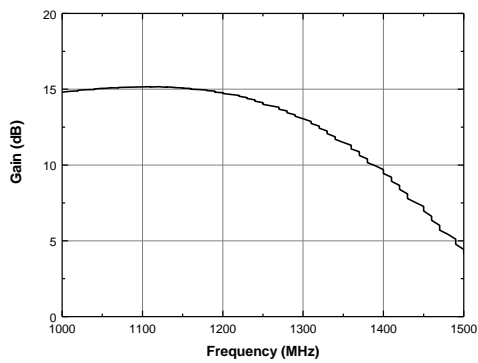
### Schematic



### Board Layout (FR4, 40x40 mm<sup>2</sup>, 0.8T)



### S-parameters & K-factor



**APPLICATION CIRCUIT**

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**Others**

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**1600 MHz**

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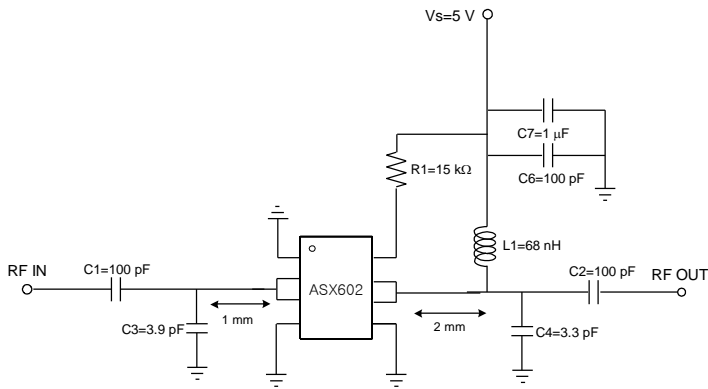
**+5 V**

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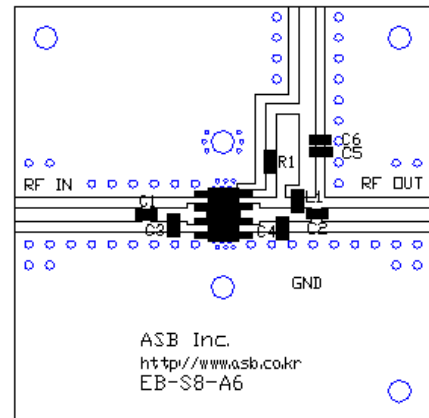
Frequency (MHz)	1600
Magnitude S21 (dB)	12.5
Magnitude S11 (dB)	-14
Magnitude S22 (dB)	-9
Output P1dB (dBm)	32.5
Output IP3 <sup>1)</sup> (dBm)	45
Noise Figure (dB)	5.0
Device Voltage (V)	+5
Current (mA)	580

1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1 MHz.

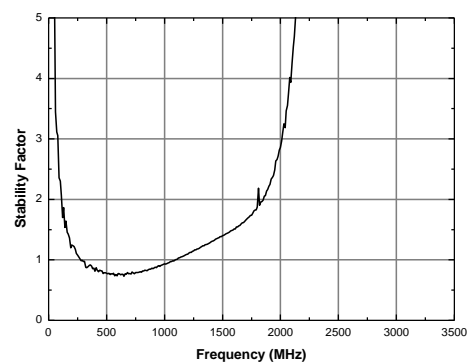
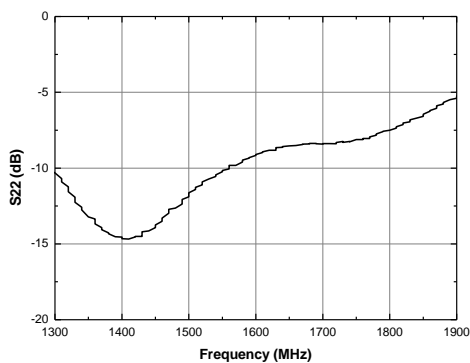
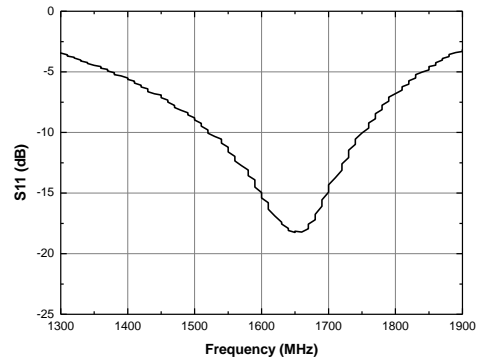
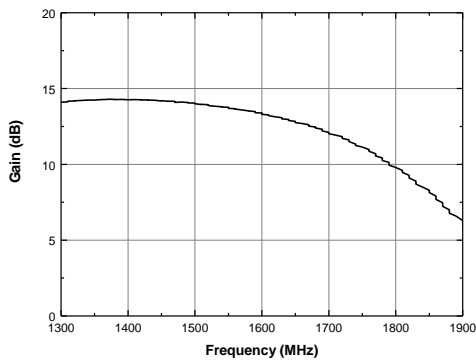
### Schematic



### Board Layout (FR4, 40x40 mm<sup>2</sup>, 0.8T)



### S-parameters & K-factor





**APPLICATION CIRCUIT**

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**WCDMA**

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**2000 MHz**

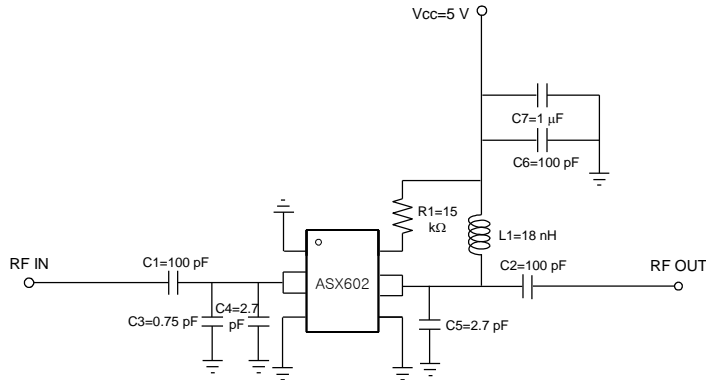
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**+5 V**

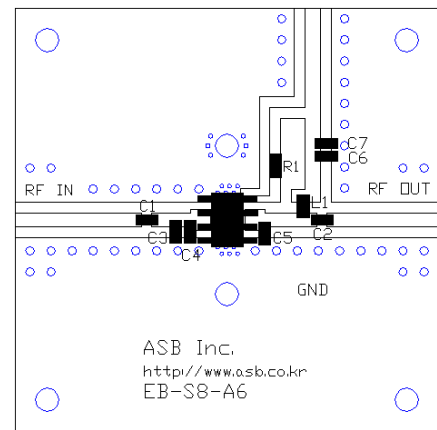
Frequency (MHz)	2000
Magnitude S21 (dB)	10.5
Magnitude S11 (dB)	-15
Magnitude S22 (dB)	-10
Output P1dB (dBm)	32
Output IP3 <sup>1)</sup> (dBm)	48
Noise Figure (dB)	5.2
Device Voltage (V)	+5
Current (mA)	580

1) OIP3 is measured with two tones at an output power of +14 dBm/tone separated by 1 MHz.

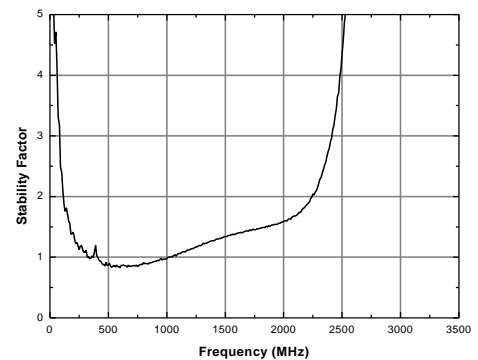
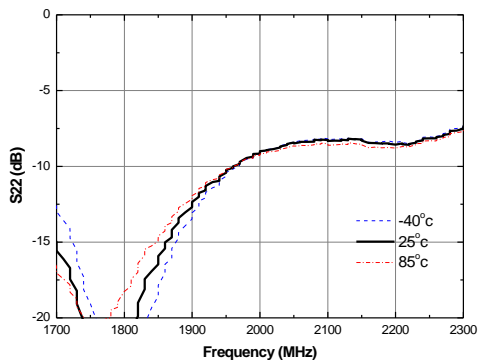
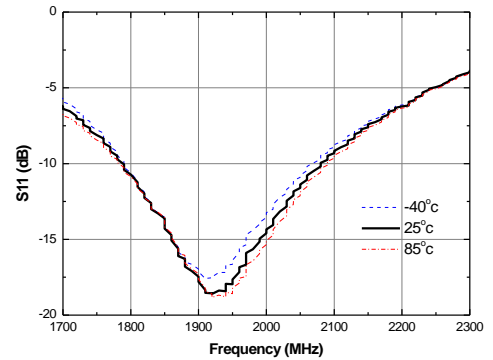
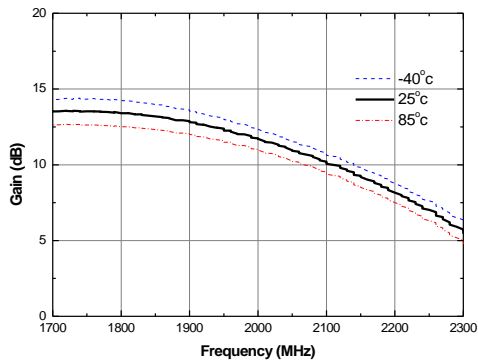
### Schematic



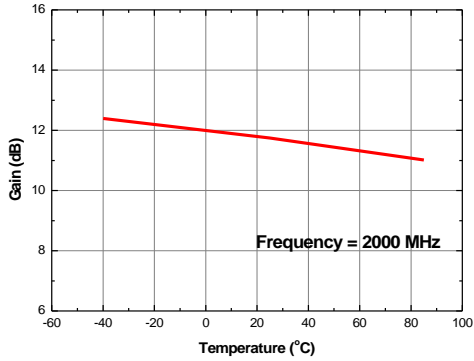
### Board Layout (FR4, 40x40 mm<sup>2</sup>, 0.8T)



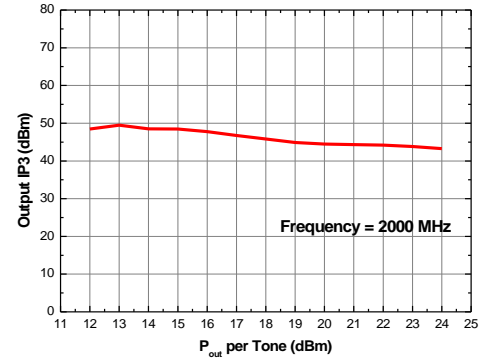
### S-parameters & K-factor



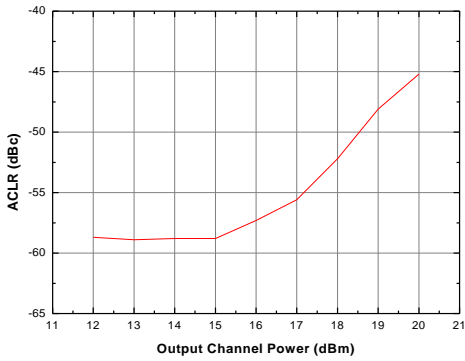
### Gain vs. Temperature



### Output IP3 vs. Tone Power

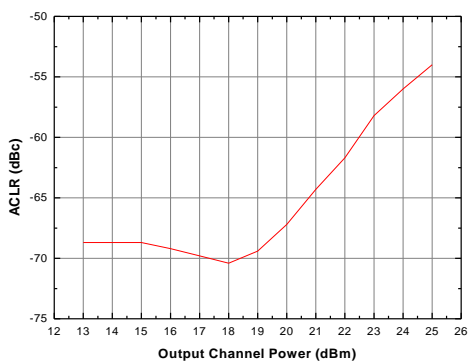


### WCDMA ACLR – 4FA



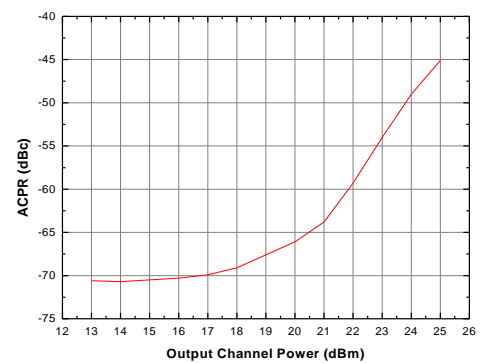
• Test Source: WCDMA 4FA (3GPP 3.4 12-00), Test Model1 w/64 DPCH, PAR = 13 dB @ 0.01 % probability on CCDF, 2000 MHz, 5 MHz offset

### WCDMA ACLR – 1FA



• Test Source: WCDMA 1FA (3GPP 3.4 12-00), Test Model1 w/64 DPCH, PAR = 13 dB @ 0.01 % probability on CCDF, 2000 MHz, 5 MHz offset

### CDMA ACPR – 1FA



• Test Source: IS-95, 9ch. Forward 30 kHz Meas BW, 2000 MHz, 750 kHz offset

### APPLICATION CIRCUIT

WCDMA (2000 MHz)

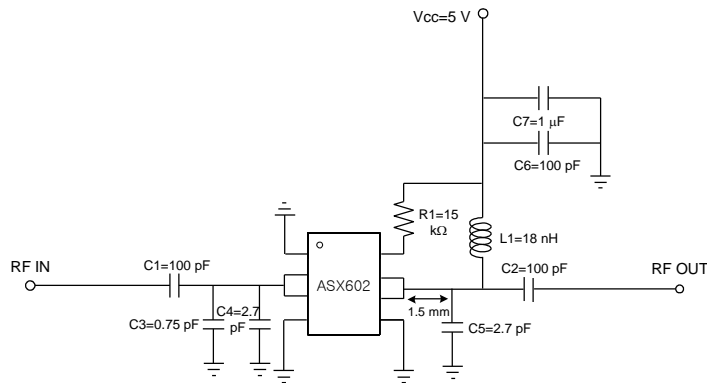
P1dB = 33 dBm

+5 V

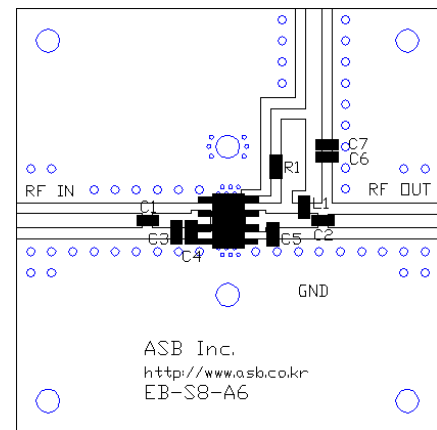
Frequency (MHz)	2000
Magnitude S21 (dB)	10.0
Magnitude S11 (dB)	-18
Magnitude S22 (dB)	-10
Output P1dB (dBm)	33
Output IP3 <sup>1)</sup> (dBm)	43
Noise Figure (dB)	5.0
Device Voltage (V)	+5
Current (mA)	580

1) OIP3 is measured with two tones at an output power of +14 dBm/tone separated by 1 MHz.

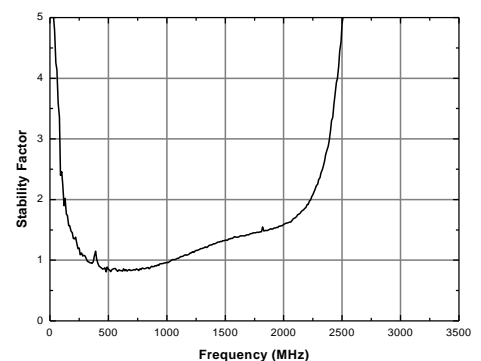
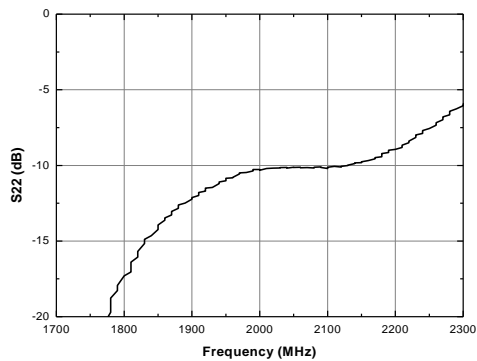
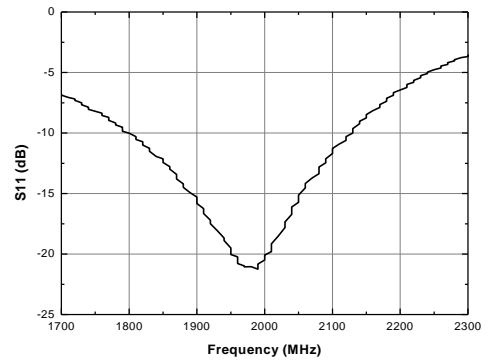
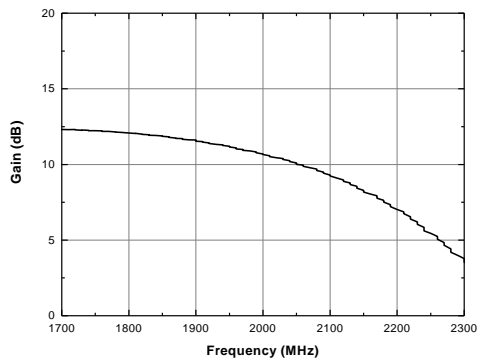
### Schematic



### Board Layout (FR4, 40x40 mm<sup>2</sup>, 0.8T)



### S-parameters & K-factor



**APPLICATION CIRCUIT**

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**WLAN**

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**2400 MHz**

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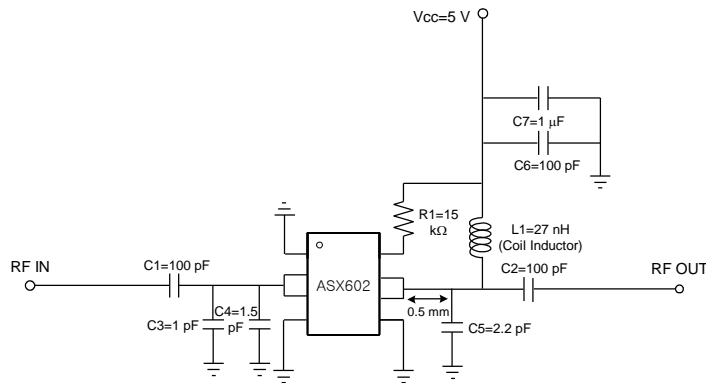
**+5 V**

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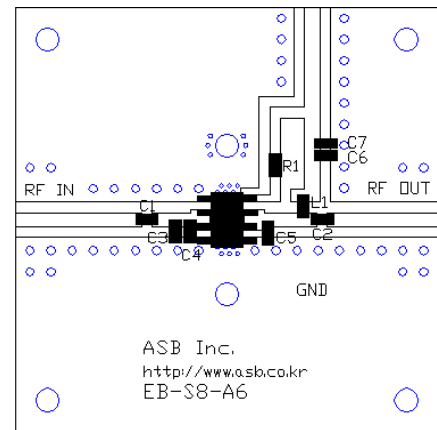
Frequency (MHz)	2400
Magnitude S21 (dB)	8.9
Magnitude S11 (dB)	-9
Magnitude S22 (dB)	-14
Output P1dB (dBm)	32.5
Output IP3 <sup>1)</sup> (dBm)	43.5
Noise Figure (dB)	5.7
Device Voltage (V)	+5
Current (mA)	580

1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1 MHz.

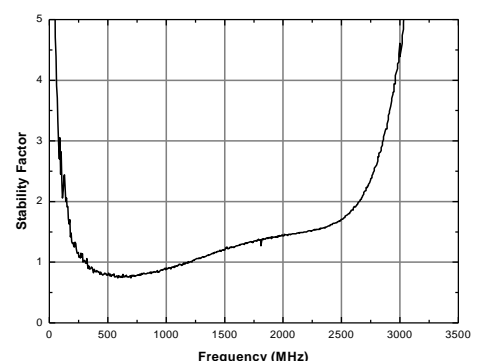
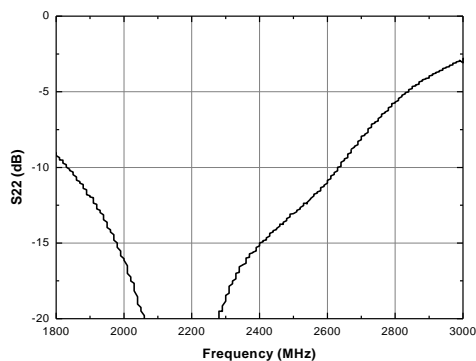
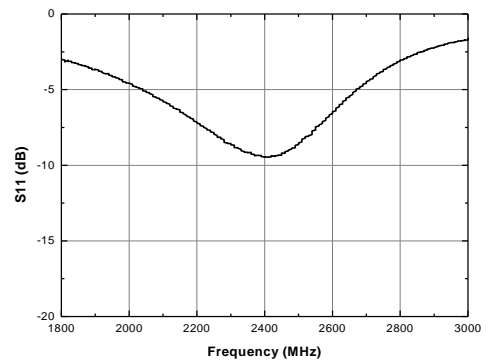
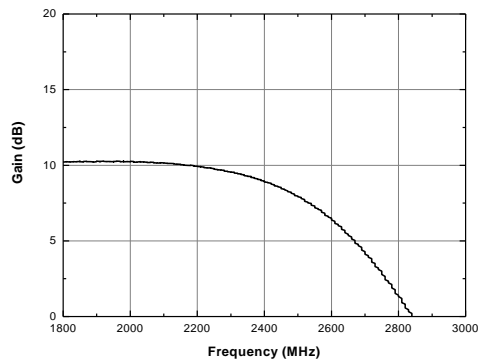
### Schematic



### Board Layout (FR4, 40x40 mm<sup>2</sup>, 0.8T)



### S-parameters & K-factor



### APPLICATION CIRCUIT

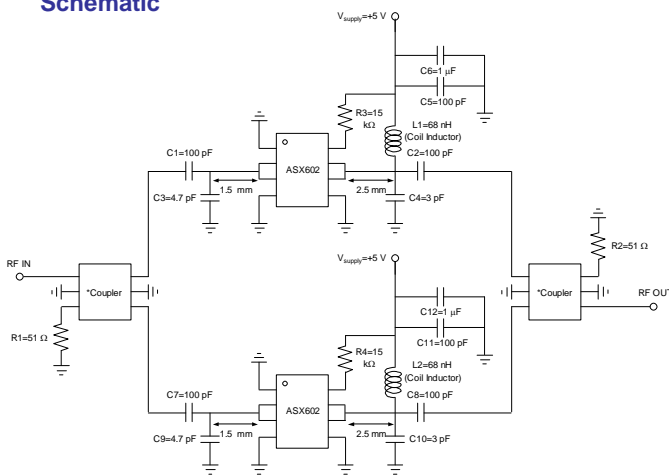
1626.5 ~ 1660.5 MHz

+5 V

Frequency (MHz)	1626.5	1660.5
Magnitude S21 (dB)	11.9	11.0
Magnitude S11 (dB)	-25.0	-25.0
Magnitude S22 (dB)	-25.0	-25.0
Output P1dB (dBm)	35.0	35.2
Output IP3 <sup>1)</sup> (dBm)	39	38
Noise Figure (dB)	6.0	6.6
Device Voltage (V)	+5	+5
Current (mA)	1100	1100

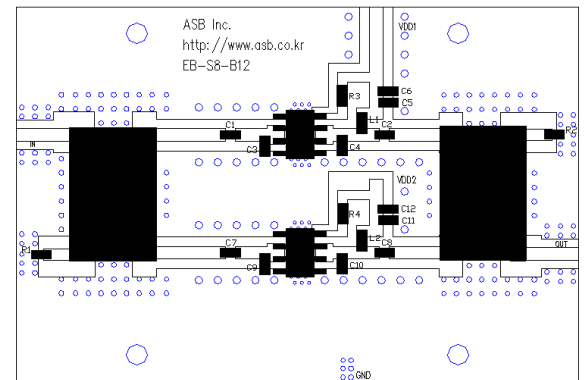
1) OIP3 is measured with two tones at an output power of +11 dBm/tone separated by 1 MHz.

### Schematic

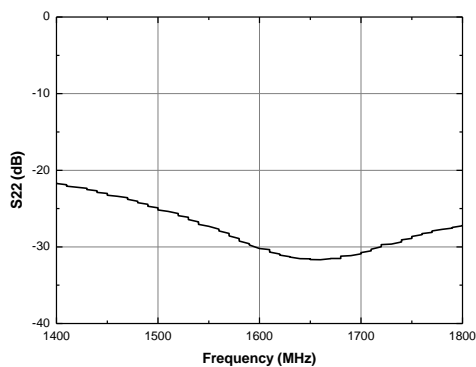
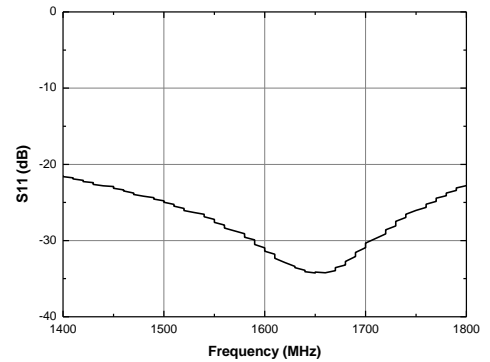
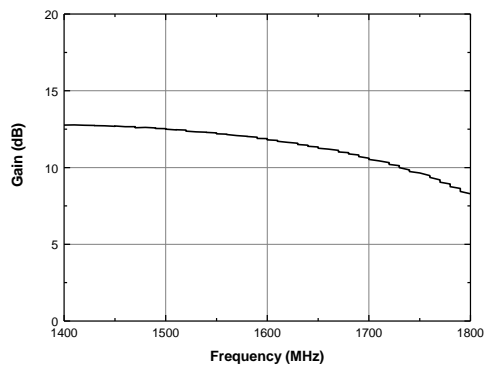


\*Coupler: RN2, RCP1850A03

### Board Layout (FR4, 59.5x39.5 mm<sup>2</sup>, 0.8T)



### S-parameters & K-factor



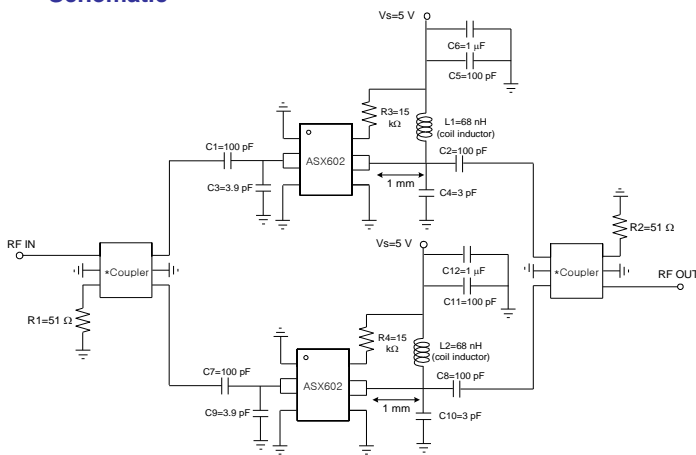
### APPLICATION CIRCUIT

**PCS**  
**1710 ~ 1785 MHz**  
**+5 V**

Frequency (MHz)	1710 ~ 1785
Magnitude S21 (dB)	11.3
Magnitude S11 (dB)	-18
Magnitude S22 (dB)	-18
Output P1dB (dBm)	35
Output IP3 <sup>1)</sup> (dBm)	42.5
Noise Figure (dB)	5.5
Device Voltage (V)	+5
Current (mA)	1100

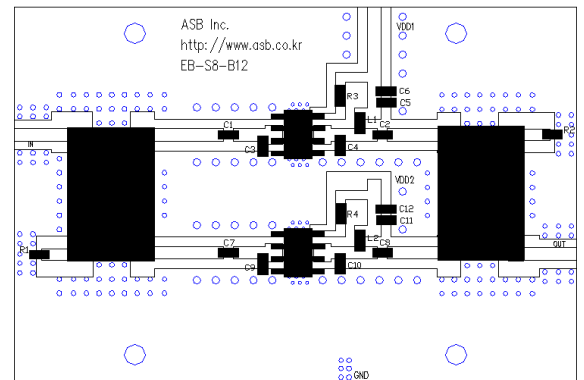
1) OIP3 is measured with two tones at an output power of +11 dBm/tone separated by 1 MHz.

### Schematic

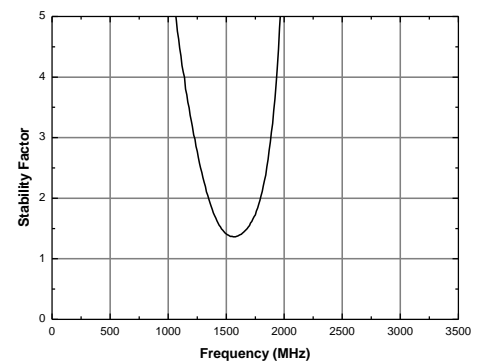
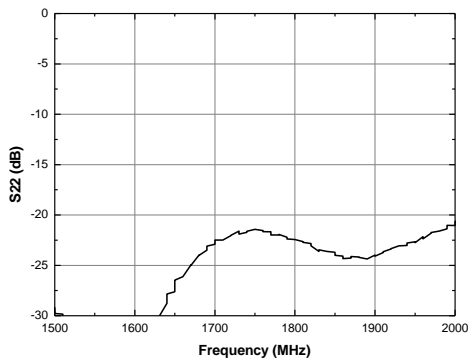
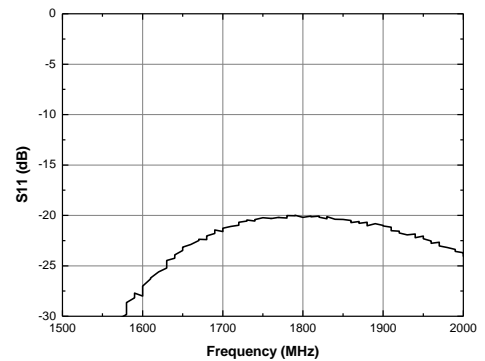
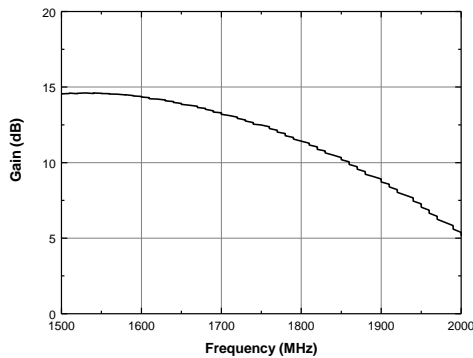


\*Coupler: RN2, RCP1850A03

### Board Layout (FR4, 59.5x39.5 mm<sup>2</sup>, 0.8T)



### S-parameters & K-factor



**APPLICATION CIRCUIT**

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**WCDMA**

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**2000 ~ 2200 MHz**

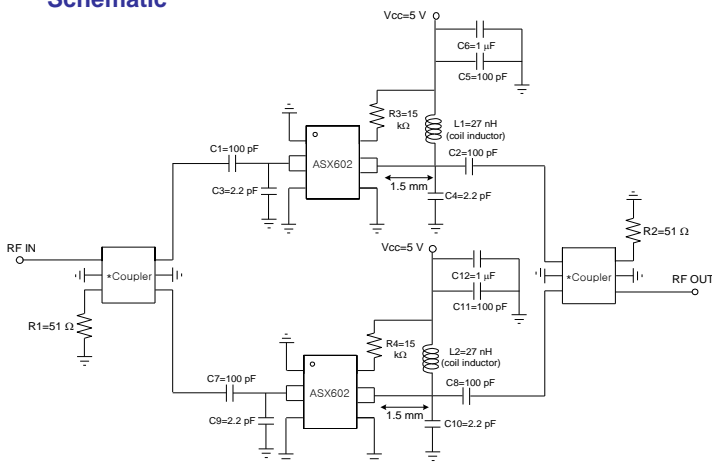
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**+5 V**

Frequency (MHz)	2000	2200
Magnitude S21 (dB)	9.8	9.2
Magnitude S11 (dB)	-18	-18
Magnitude S22 (dB)	-20	-20
Output P1dB (dBm)	34.5	35.0
Output IP3 <sup>1)</sup> (dBm)	43.0	41.5
Noise Figure (dB)	7.1	6.8
Device Voltage (V)	+5	+5
Current (mA)	1100	1100

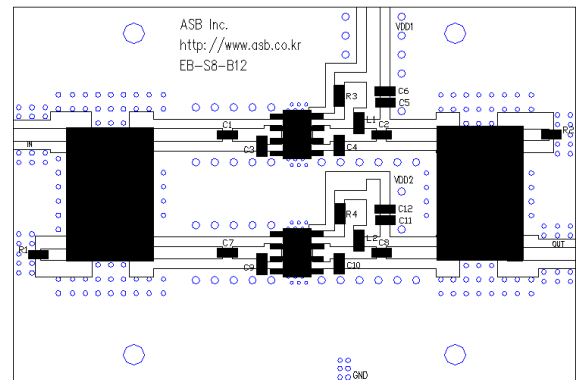
1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1 MHz.

### Schematic

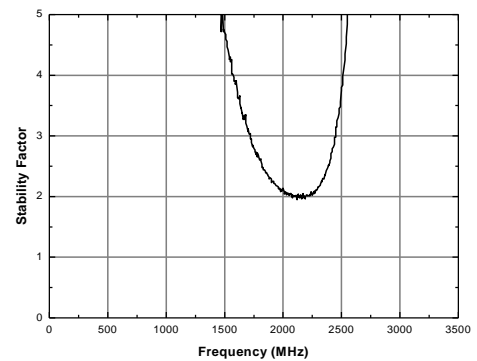
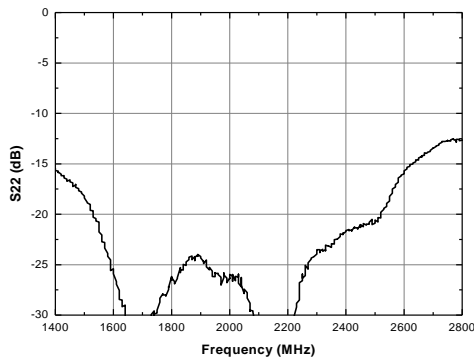
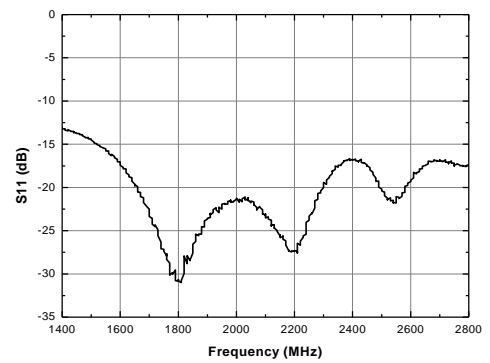
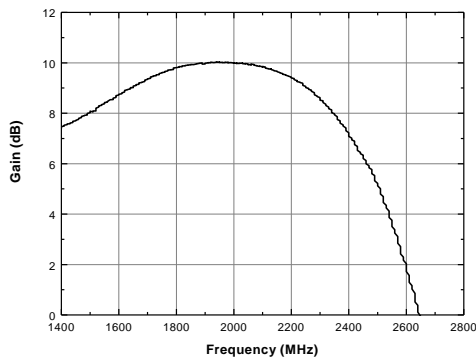


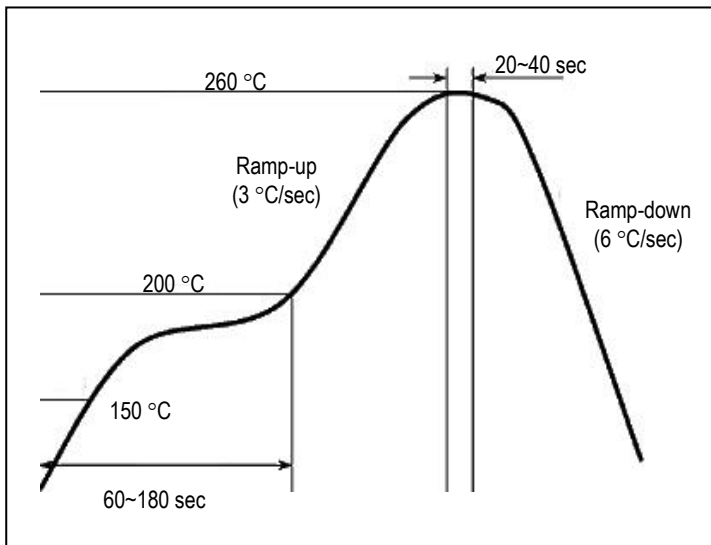
\*Coupler: RN2, RCP2150A03

### Board Layout (FR4, 59.5x39.5 mm<sup>2</sup>, 0.8T)



### S-parameters & K-factor



**Recommended Soldering Reflow Profile**

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