# ASW208

## 5 ~ 6000 MHz MMIC Amplifier

## Features

- 19 dB Gain at 2 GHz
- 22 dBm P1dB at 2 GHz
- 35 dBm Output IP3 at 2 GHz
- 1.7 dB NF at 2 GHz
- MTTF > 100 Years
- Single Supply

## Description

The ASW208, a gain block amplifier MMIC, has a low noise, high gain, and high linearity over a wide range of frequency, being suitable for use in both receiver and transmitter of telecommunication systems up to 6 GHz. The amplifier is available in a SOT89 package and passes through the stringent DC, RF, and reliability tests.

RoHS-compliant GREEN Package


Package Style: SOT89

## Typical Performance

(Supply Voltage = Device Voltage, $T_A$ = +25 °C, Zo = 50 Ω)

| Parameters | Units | Typical | | | | |
|---|---|---|---|---|---|---|
| Frequency | MHz | 50 | 900 | 2000 | 2700 | 3000 |
| Gain | dB | 21.0 | 21.0 | 19.0 | 17.0 | 16.2 |
| S11 | dB | -9 | -14 | -12 | -11 | -13 |
| S22 | dB | -18 | -12 | -12 | -12 | -11 |
| Output IP3[1)] | dBm | 32[1)] | 37[2)] | 35[2)] | 33[2)] | 29[3)] |
| Noise Figure | dB | 5.2 | 1.6 | 1.7 | 1.9 | 2.4 |
| Output P1dB | dBm | 23 | 22 | 22 | 21 | 20 |
| Current | mA | 80 | 80 | 80 | 80 | 80 |
| Device Voltage | V | +5.5 | +5.5 | +5.5 | +5.5 | +5.0 |

1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.
2) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1 MHz.
3) OIP3 is measured with two tones at an output power of +5 dBm/tone separated by 1 MHz.

## Product Specifications

| Parameters | Units | Min | Typ | Max |
|---|---|---|---|---|
| Testing Frequency | MHz | | 2000 | |
| Gain | dB | 18 | 19 | |
| S11 | dB | -9 | -12 | |
| S22 | dB | -9 | -12 | |
| Output IP3 | dBm | 32 | 35 | |
| Noise Figure | dB | | 1.7 | 2.0 |
| Output P1dB | dBm | 20.5 | 22.0 | |
| Current | mA | 60 | 80 | 100 |
| Device Voltage | V | | +5.5 | |

## Absolute Maximum Ratings

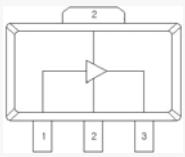
| Parameters | Rating |
|---|---|
| Operating Case Temperature | -40 to +85 °C |
| Storage Temperature | -40 to +150 °C |
| Device Voltage | +6 V |
| Operating Junction Temperature | +150 °C |
| Input RF Power (Continuous) | +22 dBm |
| Thermal Resistance | 62 °C/W |

Please find the max. input power data from http://www.asb.co.kr/pdf/Maximum_Input_Power_Analysis.pdf

## Application Circuit

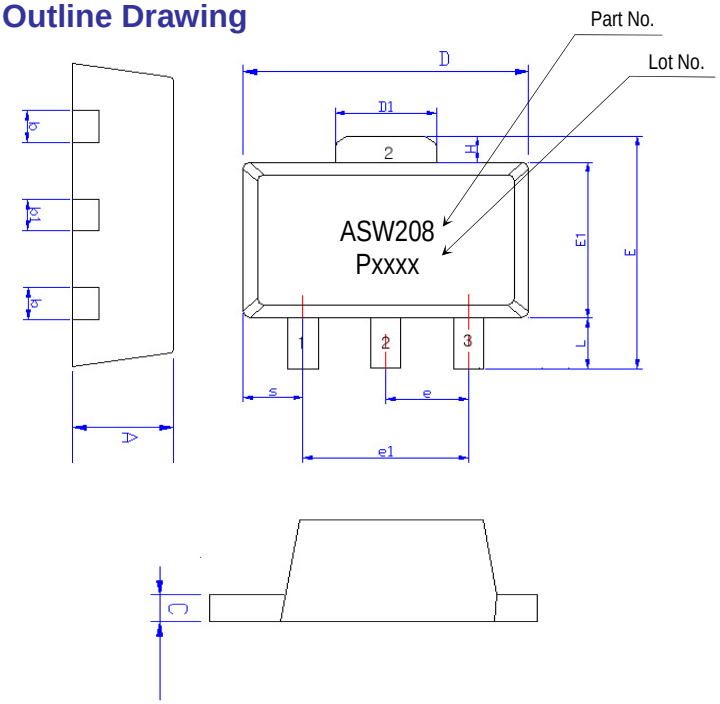
- 500 ~ 3500 MHz (5.5 V)
- 500 ~ 3500 MHz (5 V)
- IF, 50 ~ 450 MHz (5.5 V)
- IF, 50 ~ 450 MHz (5 V)
- 3000 ~ 4500 MHz (5 V)
- SMATV, 950 ~ 2150 MHz (5.5 V)
- SMATV, 950 ~ 2150 MHz (5 V)
- 50 ~ 2600 MHz (5 V, 75 Ω )
- 1000 ~ 2600 MHz

## Pin Configuration




| Pin No. | Function |
|---|---|
| 1 | RF IN |
| 2 | GND |
| 3 | RF OUT & Bias |

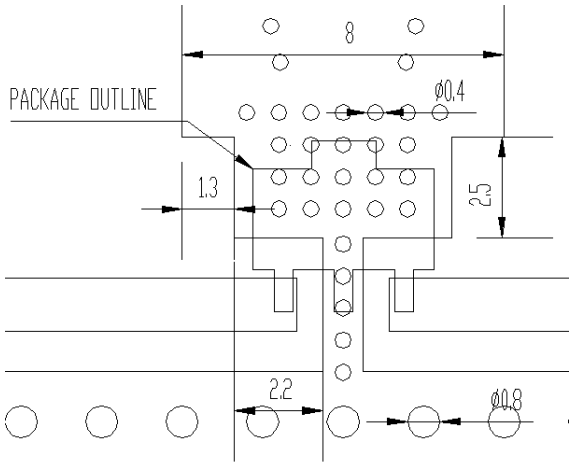
## Outline Drawing




| Symbols | Dimensions (In mm) | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 1.40 | 1.50 | 1.60 |
| L | 0.89 | 1.04 | 1.20 |
| b | 0.36 | 0.42 | 0.48 |
| b1 | 0.41 | 0.47 | 0.53 |
| C | 0.38 | 0.40 | 0.43 |
| D | 4.40 | 4.50 | 4.60 |
| D1 | 1.40 | 1.60 | 1.75 |
| E | 3.64 | --- | 4.25 |
| E1 | 2.40 | 2.50 | 2.60 |
| e1 | 2.90 | 3.00 | 3.10 |
| H | 0.35 | 0.40 | 0.45 |
| S | 0.65 | 0.75 | 0.85 |
| e | 1.40 | 1.50 | 1.60 |

| Pin No. | Function |
|---|---|
| 1 | RF IN |
| 2 | GND |
| 3 | RF OUT & Bias |

## Mounting Recommendation (In mm)




**Note**: 1. The number and size of ground via holes in a circuit board is critical for thermal and RF grounding considerations.
2. We recommend that the ground via holes be placed on the bottom of the lead pin 2 and exposed pad of the device for better RF and thermal performance, as shown in the drawing at the left side.

## ESD Classification & Moisture Sensitivity Level

### ESD Classification

| | |
|---|---|
| HBM | Class 1B |
| | Voltage Level: 550 V |
| MM | Class A |
| | Voltage Level: 50 V |

CAUTION: ESD-sensitive device!

### Moisture Sensitivity Level (MSL)

Level 3 at 260 °C reflow

## APPLICATION CIRCUIT

**Wide Band**

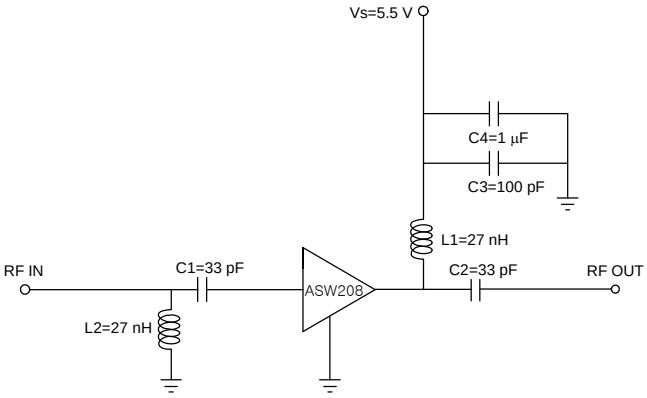
**500 ~ 3500 MHz**

**+5.5 V**

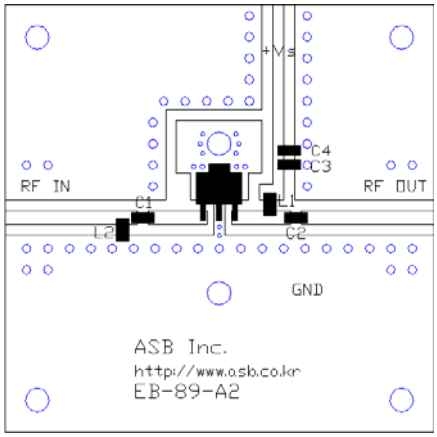
| Frequency (MHz) | 900 | 2000 | 2700 |
|---|---|---|---|
| Magnitude S21 (dB) | 21 | 19 | 17 |
| Magnitude S11 (dB) | -14 | -12 | -11 |
| Magnitude S22 (dB) | -12 | -12 | -12 |
| Output P1dB (dBm) | 22 | 22 | 21 |
| Output IP3[1)] (dBm) | 37 | 35 | 33 |
| Noise Figure (dB) | 1.6 | 1.7 | 1.9 |
| Device Voltage (V) | +5.5 | +5.5 | +5.5 |
| Current (mA) | 80 | 80 | 80 |

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

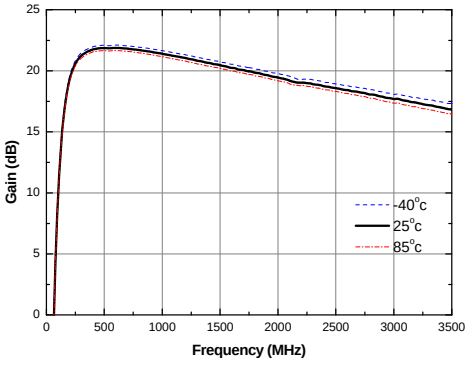
### Schematic

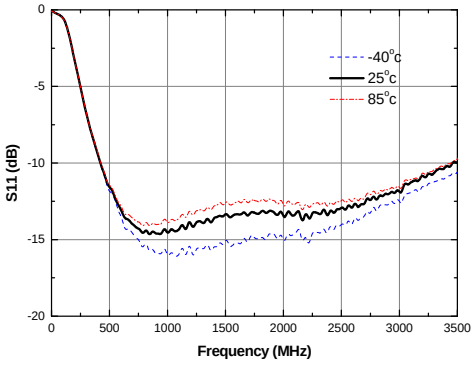


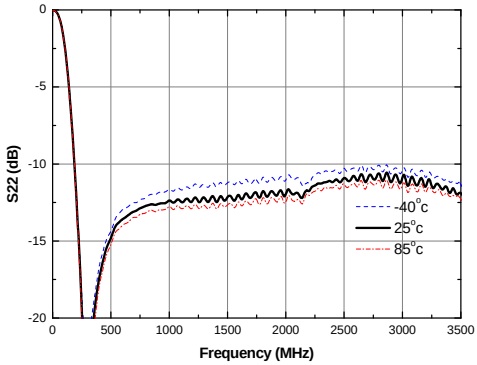

### Board Layout (FR4, 40x40 mm², 0.8T)

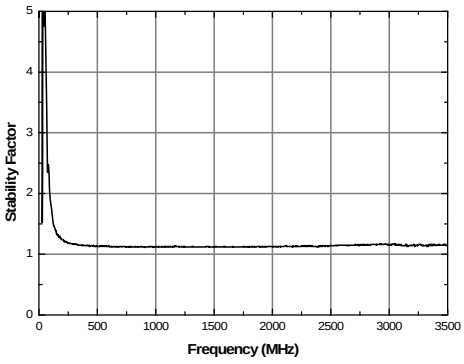



### S-parameters & K-factor

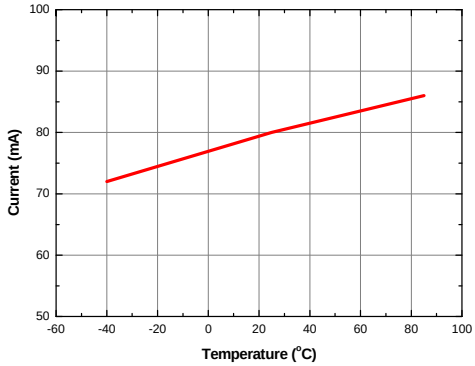


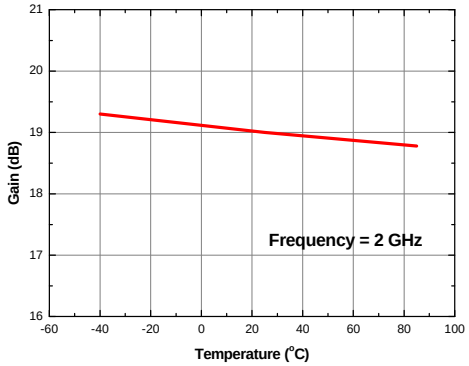



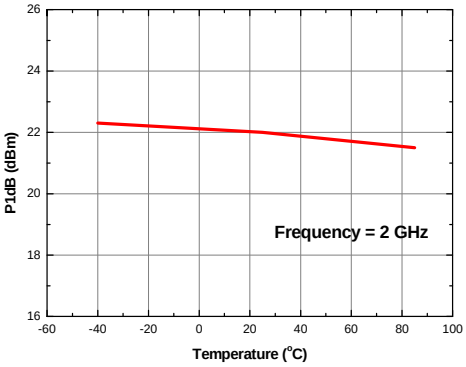
## Current vs. Temperature



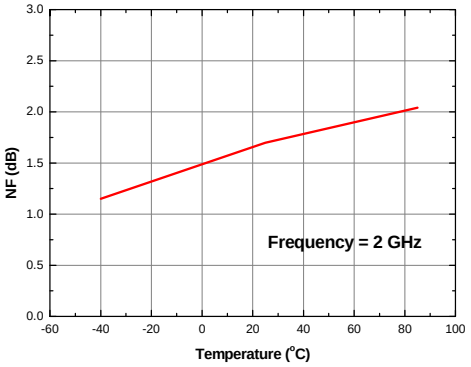

## Gain vs. Temperature



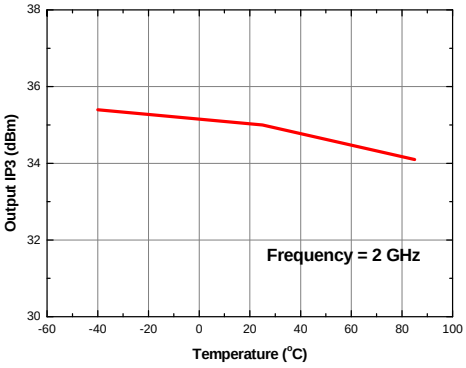

## P1dB vs. Temperature



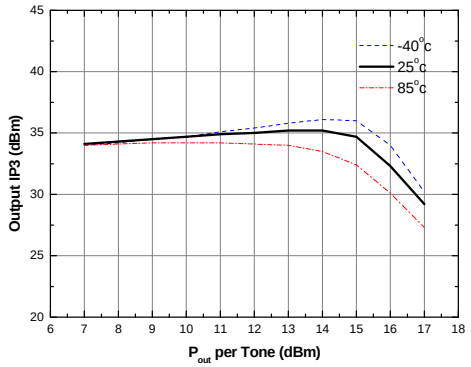

## NF vs. Temperature



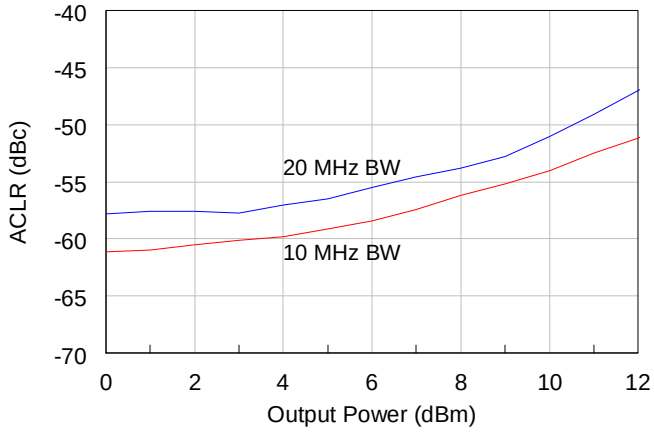

## Output IP3 vs. Temperature




## Output IP3 vs. Tone Power (Frequency = 2 GHz)

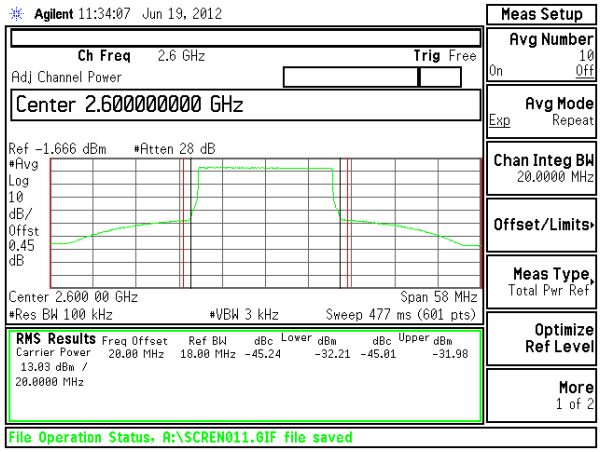


### LTE ACLR – 10 MHz & 20 MHz




1) Test Source : LTE_FDD_test model 3.1, BW: 10 MHz & 20 MHz, Test Frequency: 2.6 GHz

### LTE ACLR – 20 MHz




2) Test Source : LTE_FDD_test model 3.1, BW: 20 MHz, Test Frequency: 2.6 GHz

## APPLICATION CIRCUIT

**Wide Band**

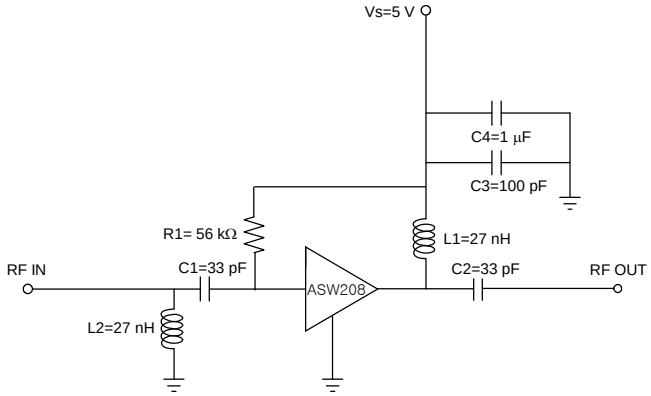
**500 ~ 3500 MHz**

**+5 V**

| Frequency (MHz) | 900 | 2000 | 2700 |
|---|---|---|---|
| Magnitude S21 (dB) | 21 | 19 | 17 |
| Magnitude S11 (dB) | -14 | -11 | -11 |
| Magnitude S22 (dB) | -12 | -11 | -10 |
| Output P1dB (dBm) | 22 | 22 | 21 |
| Output IP3[1)] (dBm) | 37 | 35 | 33 |
| Noise Figure (dB) | 1.6 | 1.7 | 1.9 |
| Device Voltage (V) | +5 | +5 | +5 |
| Current (mA) | 80 | 80 | 80 |

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

### Schematic

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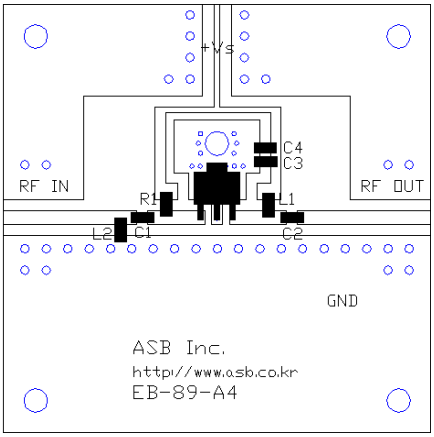
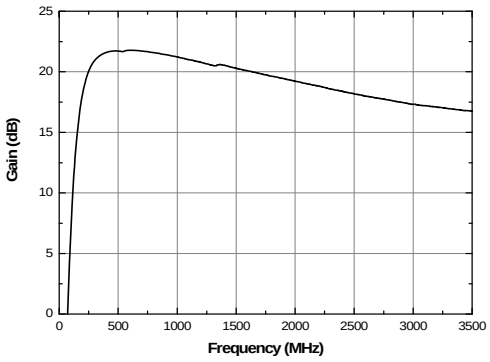
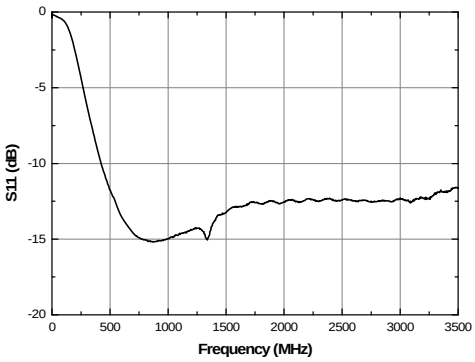
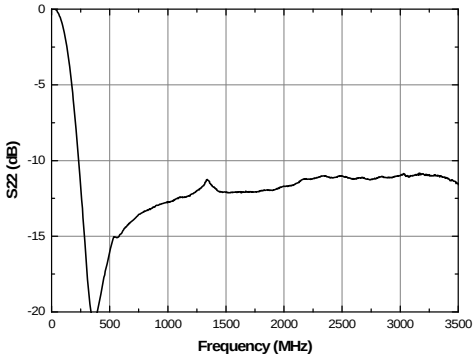
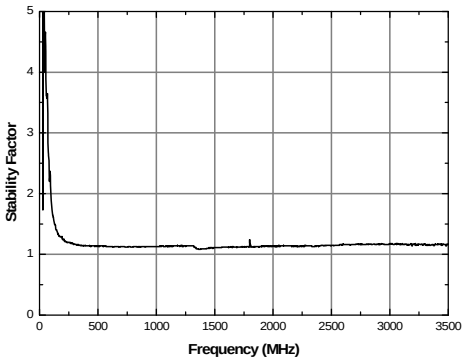



### S-parameters & K-factor



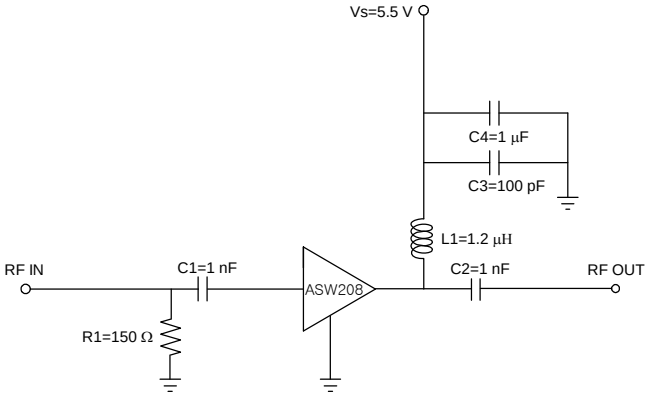
## APPLICATION CIRCUIT

| IF |
|---|
| 50 ~ 450 MHz |
| +5.5 V |

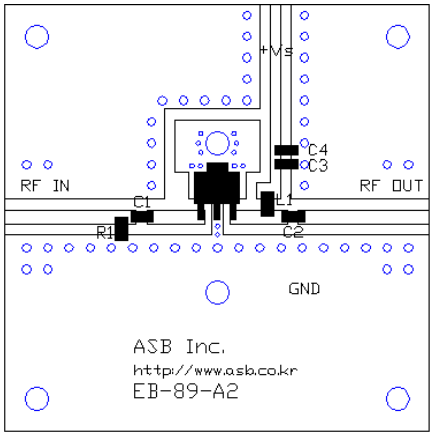
| Frequency (MHz) | 50 | 150 | 300 | 450 |
|---|---|---|---|---|
| Magnitude S21 (dB) | 21.0 | 20.0 | 20.0 | 19.5 |
| Magnitude S11 (dB) | -9 | -14 | -15 | -15 |
| Magnitude S22 (dB) | -18 | -18 | -15 | -15 |
| Output P1dB (dBm) | 23.0 | 23.5 | 23.5 | 23.5 |
| Output IP3[1)] (dBm) | 32 | 33 | 34 | 34 |
| Noise Figure (dB) | 5.2 | 3.4 | 3.2 | 3.2 |
| Device Voltage (V) | +5.5 | +5.5 | +5.5 | +5.5 |
| Current (mA) | 80 | 80 | 80 | 80 |

1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1MHz.

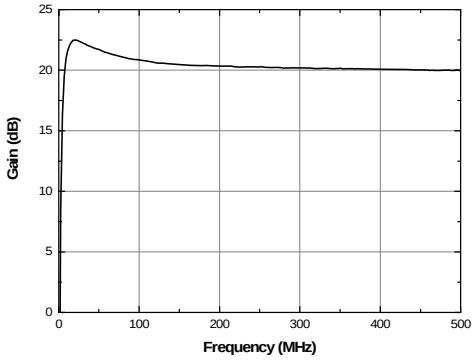
### Schematic

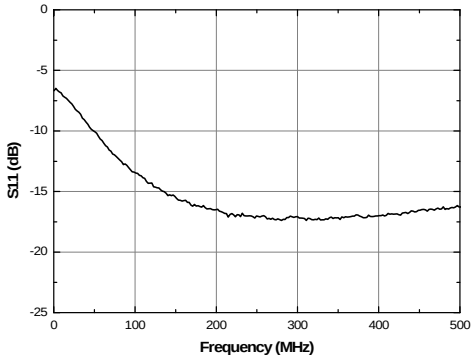


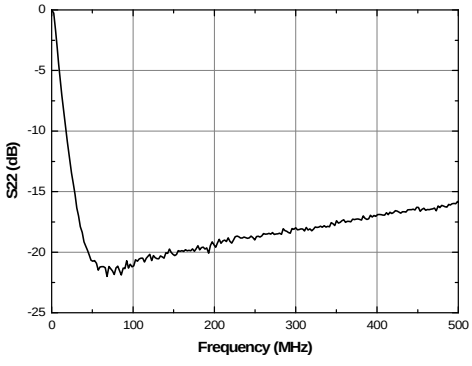

### Board Layout (FR4, 40x40 mm², 0.8T)

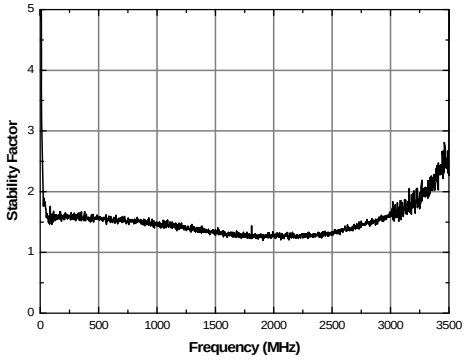



### S-parameters & K-factor



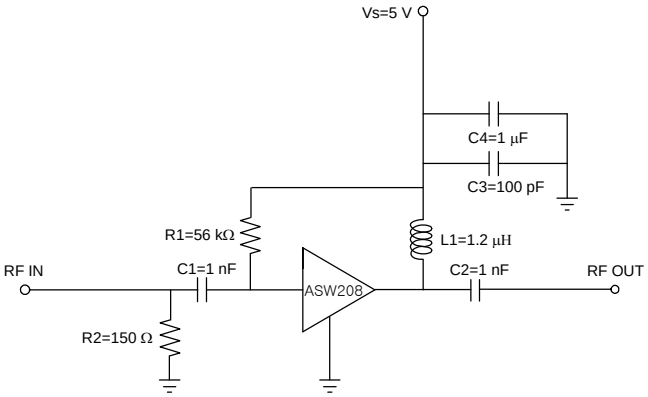
## APPLICATION CIRCUIT

| IF |
|---|
| 50 ~ 450 MHz |
| +5 V |

| Frequency (MHz) | 50 | 150 | 300 | 450 |
|---|---|---|---|---|
| Magnitude S21 (dB) | 21.0 | 20.0 | 19.5 | 19.5 |
| Magnitude S11 (dB) | -10 | -14 | -15 | -15 |
| Magnitude S22 (dB) | -18 | -18 | -15 | -15 |
| Output P1dB (dBm) | 22 | 22 | 22 | 22 |
| Output IP3[1)] (dBm) | 31 | 32 | 33 | 33 |
| Noise Figure (dB) | 4.0 | 3.2 | 3.2 | 3.2 |
| Device Voltage (V) | +5 | +5 | +5 | +5 |
| Current (mA) | 80 | 80 | 80 | 80 |

1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1MHz.

### Schematic

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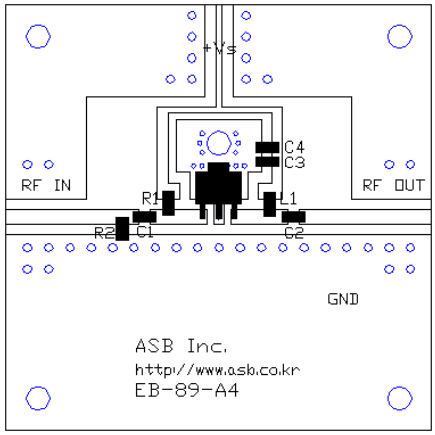
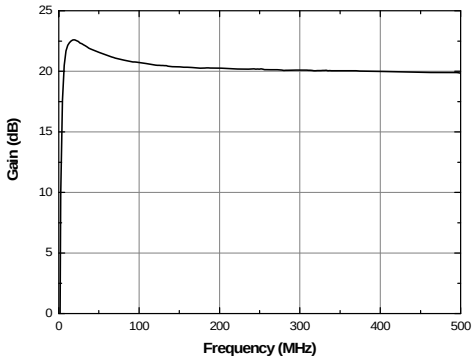
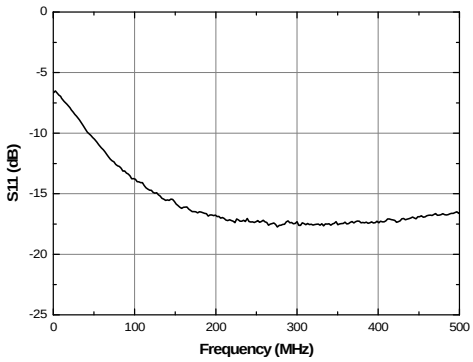
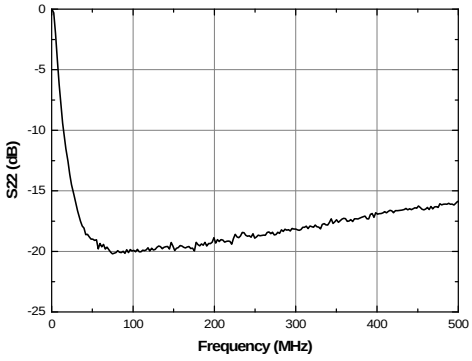
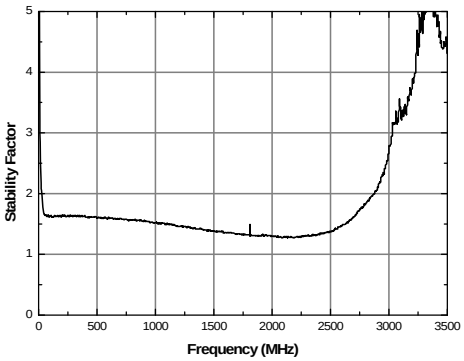



### S-parameters & K-factor



## APPLICATION CIRCUIT

**Wide Band**

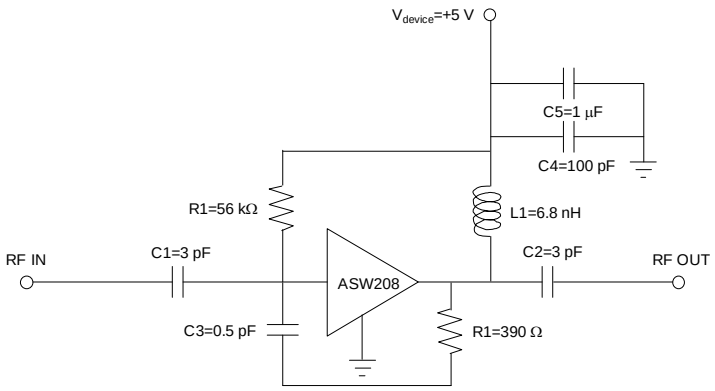
**3000 ~ 4500 MHz**

**+5 V**

| Frequency (MHz) | 3000 | 4500 |
|---|---|---|
| Magnitude S21 (dB) | 16.2 | 16.4 |
| Magnitude S11 (dB) | -13 | -12 |
| Magnitude S22 (dB) | -11 | -13 |
| Output P1dB (dBm) | 20.0 | 16.5 |
| Output IP3[1)] (dBm) | 29.0 | 27.5 |
| Noise Figure (dB) | 2.4 | 2.7 |
| Device Voltage (V) | +5 | +5 |
| Current (mA) | 80 | 80 |

1) OIP3 is measured with two tones at an output power of +5 dBm/tone separated by 1MHz.

### Schematic

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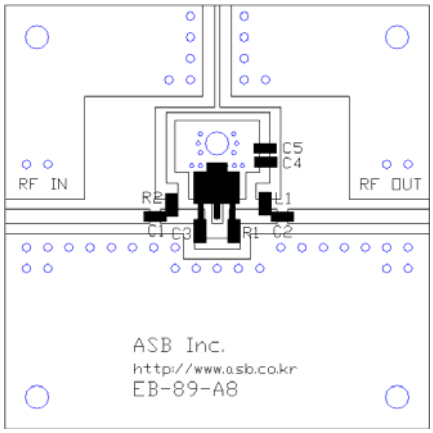
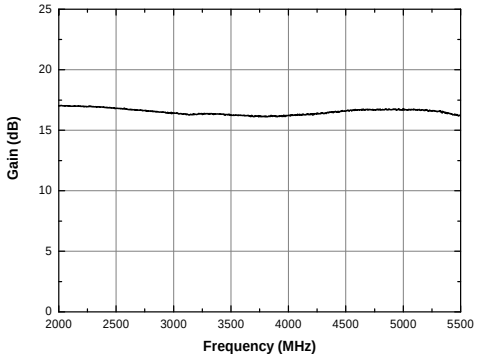
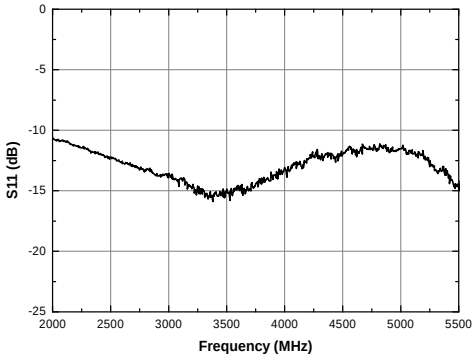
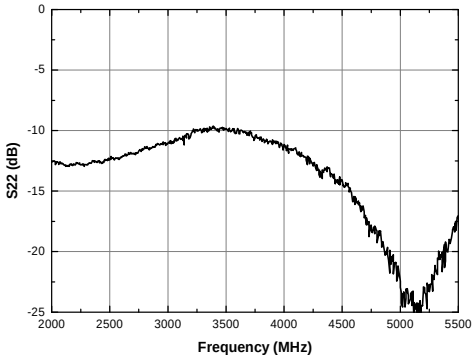
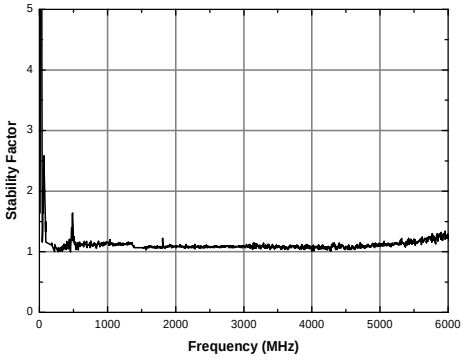



### S-parameters & K-factor



## APPLICATION CIRCUIT

**SMATV**

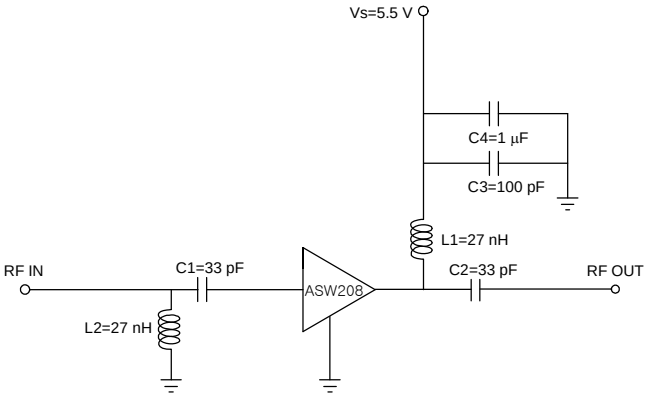
**950 ~ 2150 MHz**

**+5.5 V**

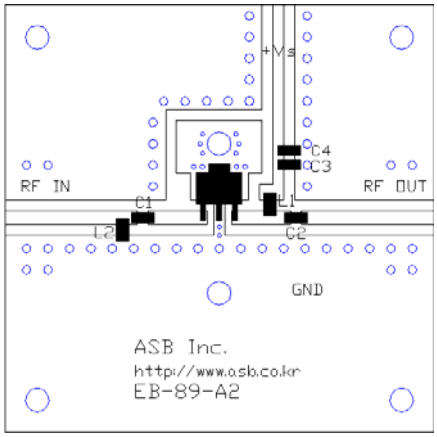
| Frequency (MHz) | 950 | 1500 | 2150 |
|---|---|---|---|
| Magnitude S21 (dB) | 21.0 | 20.0 | 17.5 |
| Magnitude S11 (dB) | -14 | -12 | -11 |
| Magnitude S22 (dB) | -12 | -12 | -12 |
| Output P1dB (dBm) | 22 | 22 | 21 |
| Output IP3[1)] (dBm) | 37 | 35 | 34 |
| Noise Figure (dB) | 1.6 | 1.7 | 1.8 |
| Device Voltage (V) | +5.5 | +5.5 | +5.5 |
| Current (mA) | 80 | 80 | 80 |

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

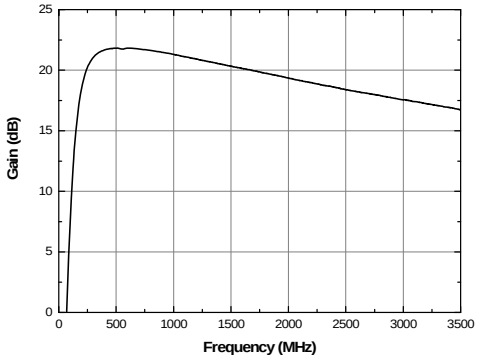
### Schematic

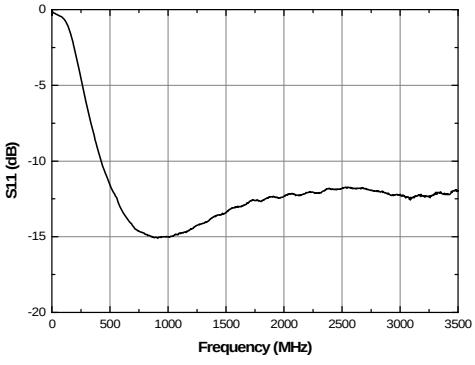


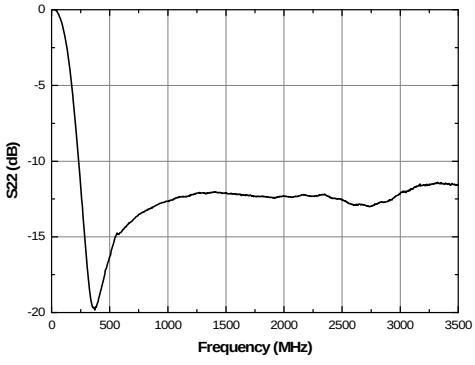

### Board Layout (FR4, 40x40 mm², 0.8T)

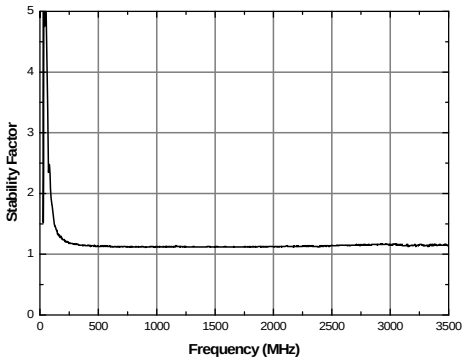



### S-parameters & K-factor



## APPLICATION CIRCUIT

**SMATV**

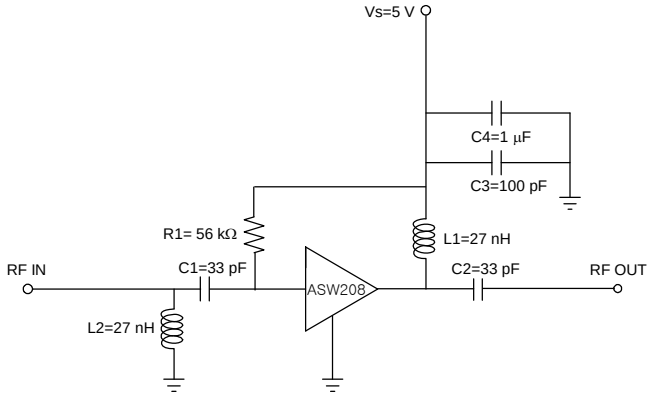
**950 ~ 2150 MHz**

**+5 V**

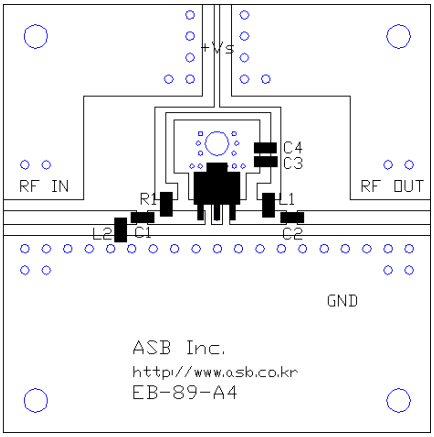
| Frequency (MHz) | 950 | 1500 | 2150 |
|---|---|---|---|
| Magnitude S21 (dB) | 21 | 20 | 18 |
| Magnitude S11 (dB) | -14 | -11 | -11 |
| Magnitude S22 (dB) | -12 | -11 | -10 |
| Output P1dB (dBm) | 22 | 22 | 21 |
| Output IP3[1)] (dBm) | 37 | 35 | 34 |
| Noise Figure (dB) | 1.6 | 1.7 | 1.8 |
| Device Voltage (V) | +5 | +5 | +5 |
| Current (mA) | 80 | 80 | 80 |

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

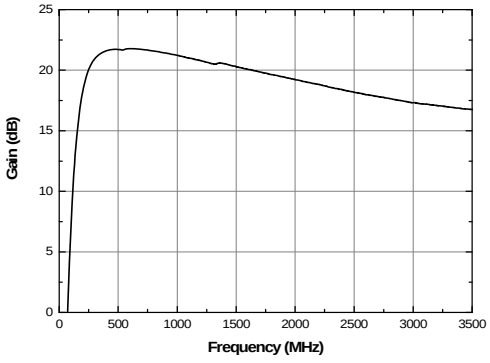
### Schematic

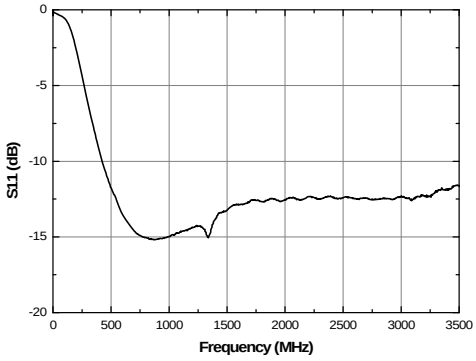


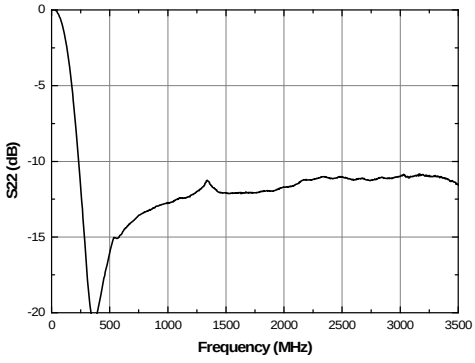

### Board Layout (FR4, 40x40 mm², 0.8T)

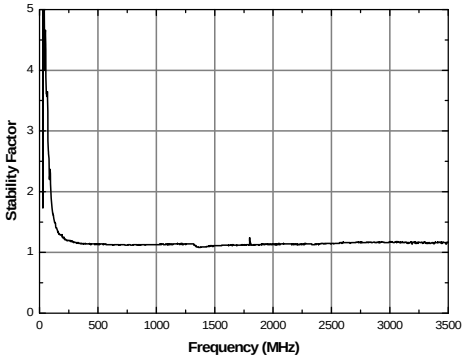



### S-parameters & K-factor



## APPLICATION CIRCUIT

**ONU**

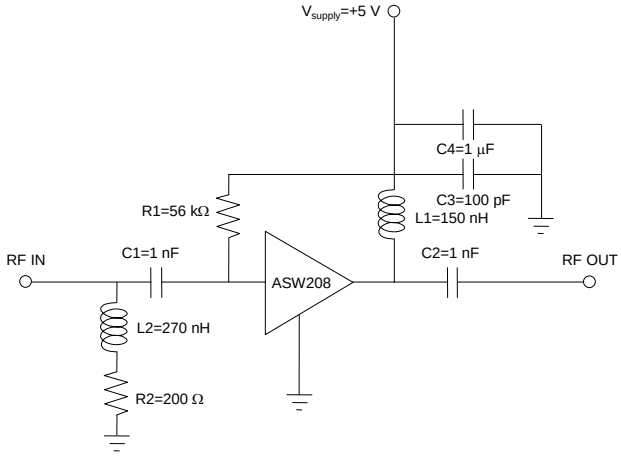
**50 ~ 2600 MHz**

**+5 V, 75 Ω**

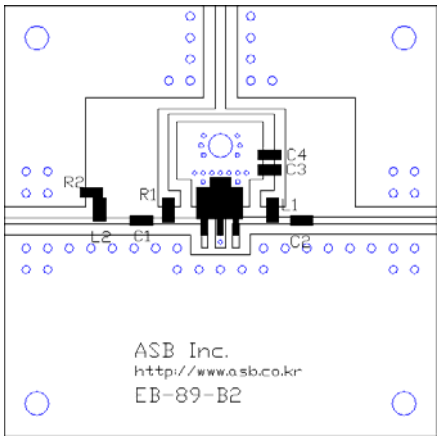
| Frequency (MHz) | 50 | 1300 | 2600 |
|---|---|---|---|
| Magnitude S21 (dB) | 21.8 | 20.0 | 17.0 |
| Magnitude S11 (dB) | -7 | -8 | -10 |
| Magnitude S22 (dB) | -7 | -9 | -15 |
| Output P1dB (dBm) | 21 | 21 | 20 |
| Output IP3[1)] (dBm) | 28.0 | 31.0 | 33.5 |
| Output IP2[1)] (dBm) | 29 | 46 | 49 |
| Noise Figure (dB) | 3.5 | 2.1 | 1.6 |
| Device Voltage (V) | +5 | +5 | +5 |
| Current (mA) | 80 | 80 | 80 |

1) OIP3 is measured with two tones at an output power of +5 dBm/tone separated by 1MHz.

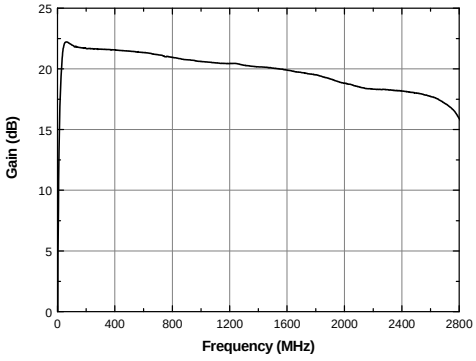
### Schematic

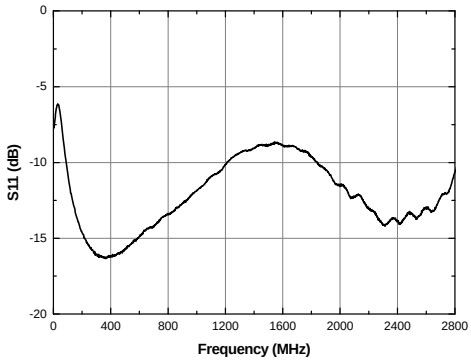


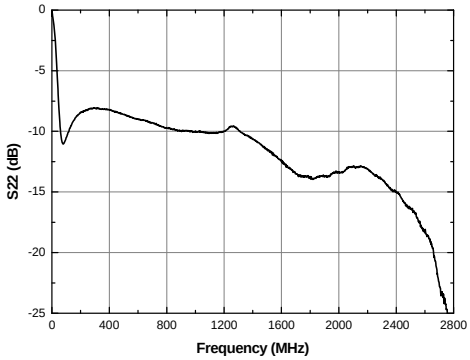

### Board Layout (FR4, 40x40 mm², 0.8T)




### S-parameters & K-factor



## APPLICATION CIRCUIT

**SMATV**

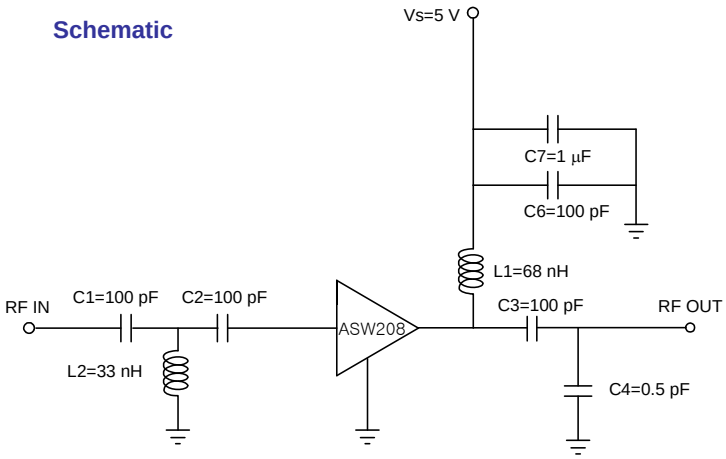
**1000 ~ 2600 MHz**

**+5 V, 75 Ω**

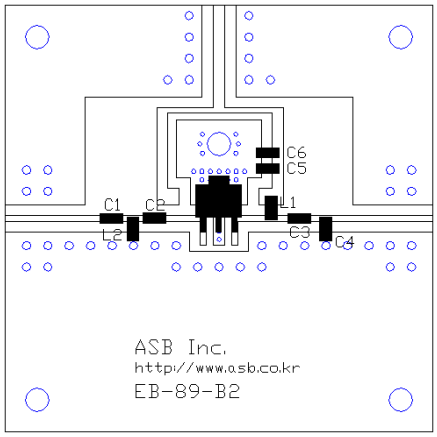
| Frequency (MHz) | 1000 | 1800 | 2600 |
|---|---|---|---|
| Magnitude S21 (dB) | 19.7 | 18.4 | 16.9 |
| Magnitude S11 (dB) | -11 | -8 | -12 |
| Magnitude S22 (dB) | -8 | -15 | -14 |
| Output P1dB (dBm) | 21 | 23 | 20 |
| Output IP3[1)] (dBm) | 30 | 24 | 31 |
| Noise Figure (dB) | 1.8 | 2.5 | 2.5 |
| Device Voltage (V) | +5 | +5 | +5 |
| Current (mA) | 45 | 45 | 45 |

1) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1MHz.

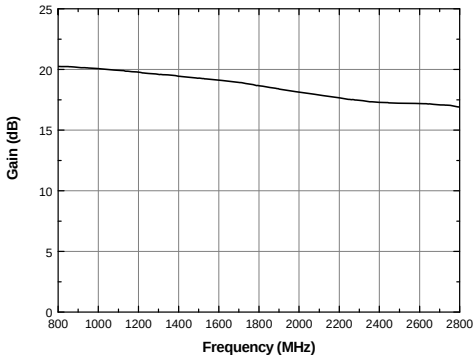
### Schematic

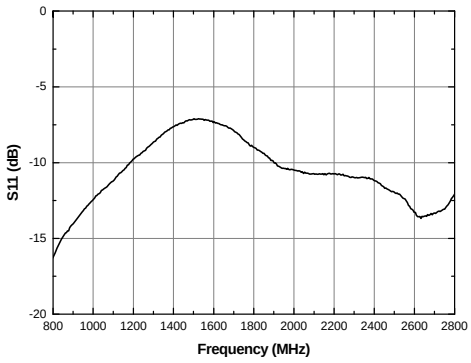


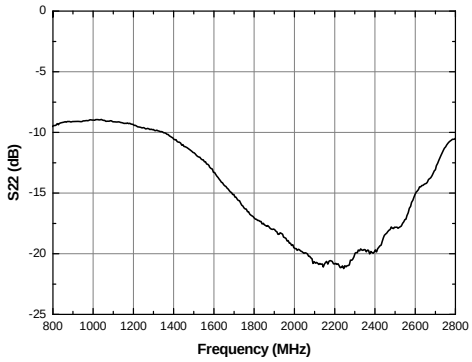

### Board Layout (FR4, 40x40 mm², 0.8T)




### S-parameters & K-factor



## APPLICATION CIRCUIT

**SMATV**

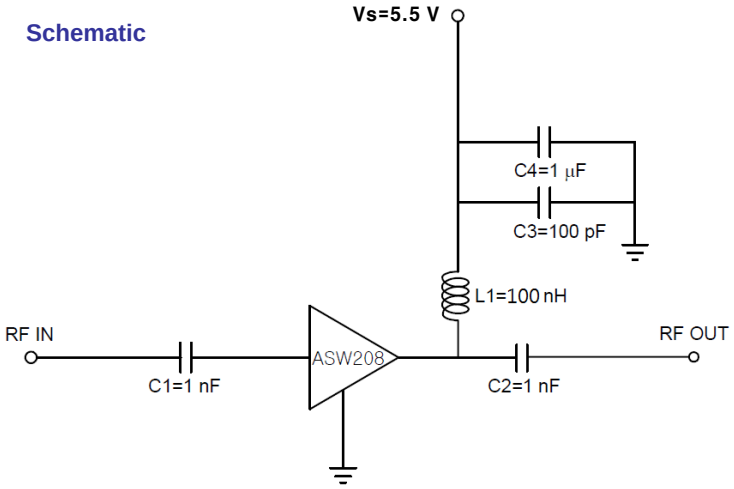
**200 ~ 2600 MHz**

**+5.5 V, 75 Ω**

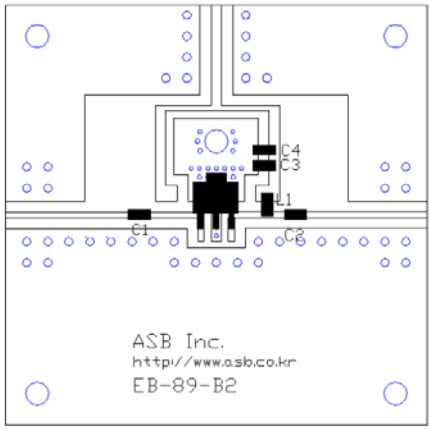
| Frequency (MHz) | 200 | 950 | 2150 | 2600 |
|---|---|---|---|---|
| Magnitude S21 (dB) | 21.5 | 20.7 | 18.0 | 17.2 |
| Magnitude S11 (dB) | -10 | -12 | -18 | -18 |
| Magnitude S22 (dB) | -7.5 | -9.5 | -10 | -12 |
| Output P1dB (dBm) | 23 | 21 | 23 | 22 |
| Output IP3[1)] (dBm) | 31 | 33 | 32 | 32 |
| Noise Figure (dB) | 1.6 | 1.2 | 1.6 | 1.6 |
| Device Voltage (V) | +5.5 | +5.5 | +5.5 | +5.5 |
| Current (mA) | 80 | 80 | 80 | 80 |

1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1MHz.

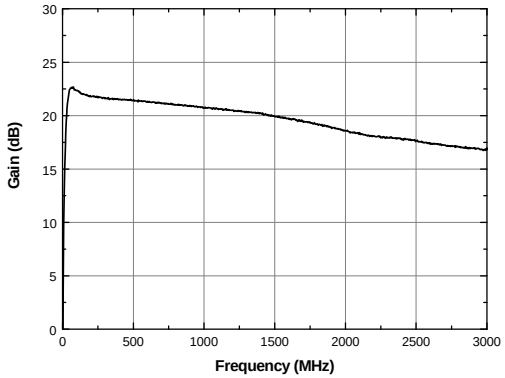
### Schematic

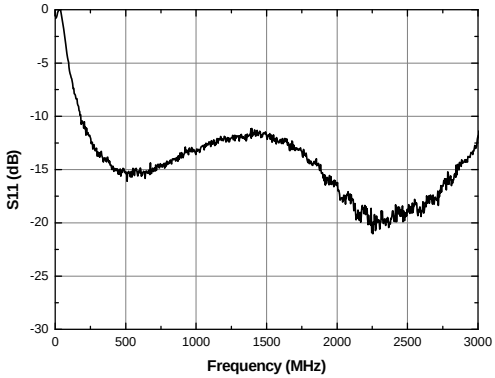


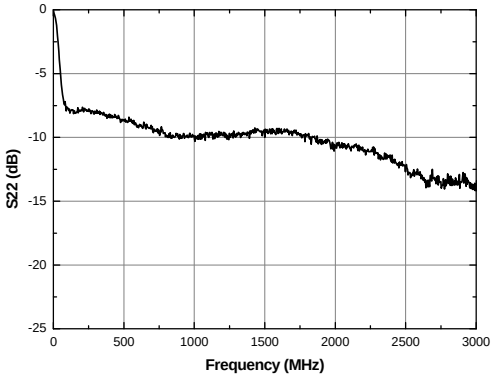

### Board Layout (FR4, 40x40 mm², 0.8T)




### S-parameters & K-factor



## Recommended Soldering Reflow Profile