# ASL560

## Wideband Linear Amplifier MMIC

## Features

- 17.9 dB Gain at 500 Mz
- 25 dBm P1dB at 500 MHz
- 42.5 dBm Output IP3 at 500 MHz
- 1.5 dB NF at 500 MHz
- 75 Ω Input & Output Match
- Bandwidth 5 ~ 1200 MHz
- Single Supply

## Description

The ASL560, a wideband linear amplifier MMIC, has a high linearity and low noise over a wide range of frequency 5 MHz to 2.6 GHz, being suitable for use in the fiber receiver, distribution amplifiers and drop amplifiers of CATV systems, and in the mobile wireless repeaters and BTS. 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 = +8 V, $T_A$ = +25 °C, $Z_0$ = 75 Ω)

| Parameters | Units | Typical | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency | MHz | 5 | 50 | 500 | 860 | 1200 | 1500 |
| Noise Figure | dB | 2.1 | 1.4 | 1.5 | 1.6 | 1.9 | 2.0 |
| Gain | dB | 18.0 | 17.8 | 17.9 | 17.6 | 16.2 | 17.1 |
| S11 | dB | -11 | -13 | -14 | -12 | -12 | -7 |
| S22 | dB | -10 | -17 | -16 | -17 | -12 | -11 |
| Output P1dB | dBm | 24.0 | 24.5 | 25.0 | 23.5 | 23.5 | 20.5 |
| Output IP3[1)] | dBm | 40.0 | 43.0 | 42.5 | 36.5 | 39.0 | 40.0 |
| Output IP2[1),2)] | dBm | 53 | 54 | 52 | 66 | 51 | 52 |
| CSO[3)] | dBc | 60 | | | | | |
| CTB[3)] | dBc | 75 | | | | | |
| Current | mA | 120 | | | | | |
| Device Voltage | V | +8 | | | | | |

1) OIP3 and OIP2 are measured with two tones at an output power of +10 dBm/tone separated by 1 MHz (up-link) or 6 MHz(down-link).
2) OIP2 is measured at F1+F2 Frequency.
3) 60 channels, +36 dBμV per channel (measured at output).

## Product Specifications

| Parameters | Units | Min | Typ. | Max |
|---|---|---|---|---|
| Testing Frequency | MHz | | 500 | |
| Gain | dB | 17.0 | 17.9 | |
| S11 | dB | -12 | -14 | |
| S22 | dB | -14 | -16 | |
| Output IP3 | dBm | 39.0 | 42.5 | |
| Noise Figure | dB | | 1.5 | 1.8 |
| Output P1dB | dBm | 24 | 25 | |
| Current | mA | 100 | 120 | 142 |
| Device Voltage | V | | +8 | |

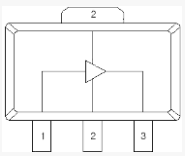
## Absolute Maximum Ratings

| Parameters | Rating |
|---|---|
| Operating Case Temperature | -40 to +85 °C |
| Storage Temperature | -40 to +150 °C |
| Device Voltage | +9V |
| Operating Junction Temperature | +150°C |
| Input RF Power (CW, 75 Ω matched)* | +4 dBm |
| Maximum Current | 220 mA |
| Thermal Resistance | 43 °C/W |

## Application Circuit

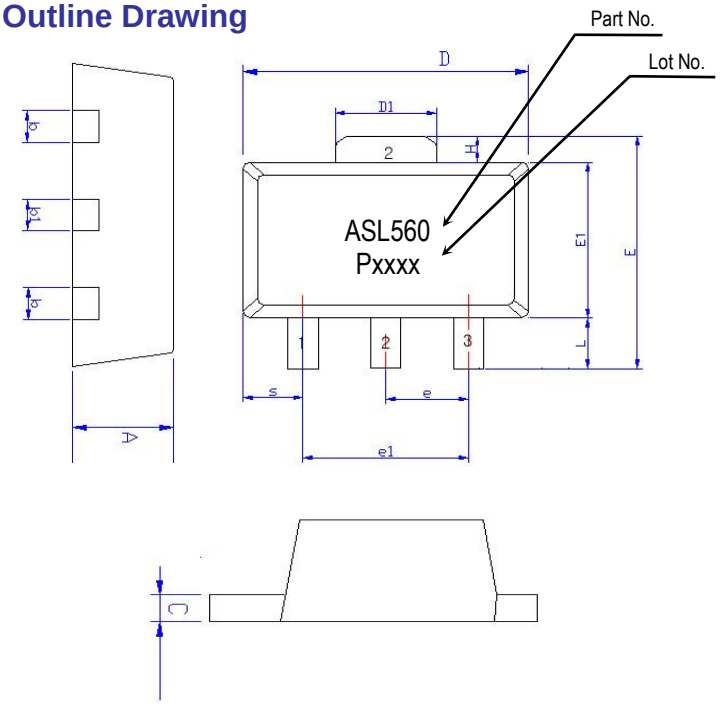
- 50 ~ 1000 MHz
- 50 ~ 1200 MHz
- 5 ~ 200 MHz
- 950 ~ 1500 MHz
  (SMATV & EOC)
- 800 ~ 2500 MHz
- 50 ~ 1000 MHz
  (Push-Pull, 1:1 transformer)
- 50 ~ 1200 MHz
  (Push-Pull, 1:1 transformer)
- 5 ~ 200 MHz
  (Push-Pull, 1:1 transformer)

## Pin Configuration




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

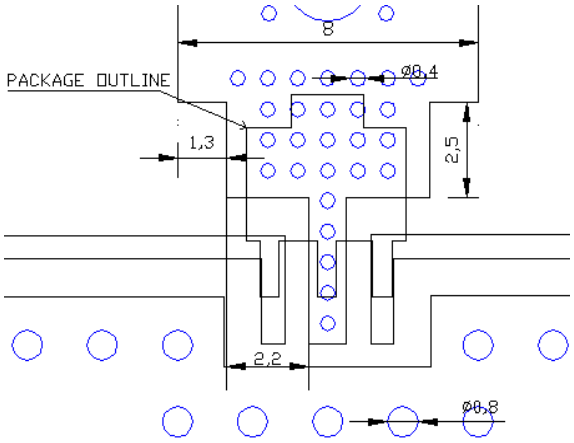
## Outline Drawing




| 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

**CATV**

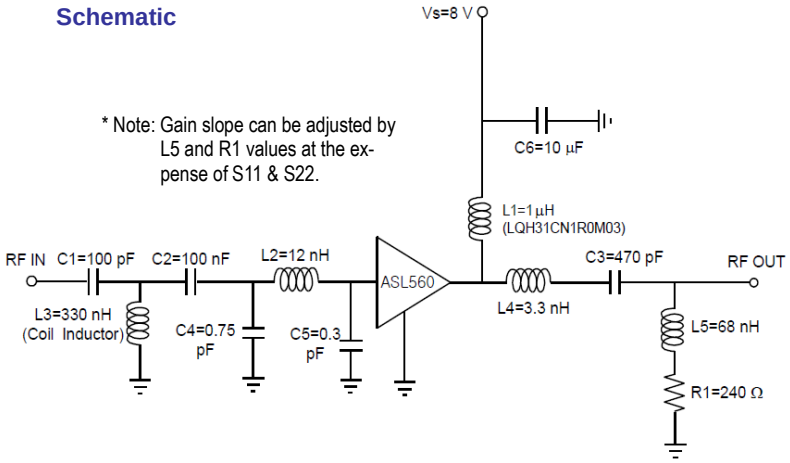
**50 ~ 1000 MHz**

**+8 V**

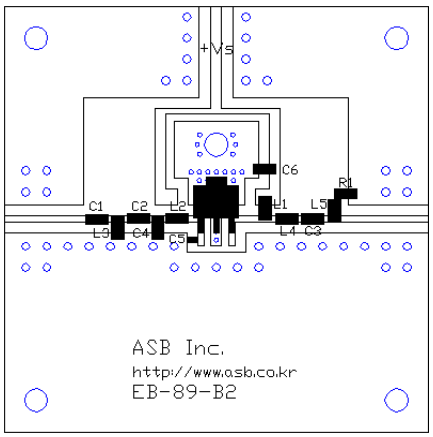
| Frequency (MHz) | 50 | 500 | 860 |
|---|---|---|---|
| Noise Figure (dB) | 1.4 | 1.5 | 1.6 |
| Magnitude S21 (dB) | 17.8 | 17.9 | 17.6 |
| Magnitude S11 (dB) | -13 | -14 | -12 |
| Magnitude S22 (dB) | -17 | -16 | -17 |
| Output P1dB (dBm) | 24.5 | 25.0 | 23.5 |
| Output IP3[1] (dBm) | 43.0 | 42.5 | 36.5 |
| Output IP2[1),2)] (dBm) | 54 | 52 | 66 |
| CSO[3] (dBc) | 60 | | |
| CTB[3] (dBc) | 75 | | |
| Device Voltage (V) | +8 | | |
| Current (mA) | 120 | | |

1) OIP3 and OIP2 are measured with two tones at an output power of +10 dBm/tone separated by 6 MHz.
2) OIP2 is measured at F1+F2 Frequency.
3) 60 channels, +36 dBmV per channel (measured at output).

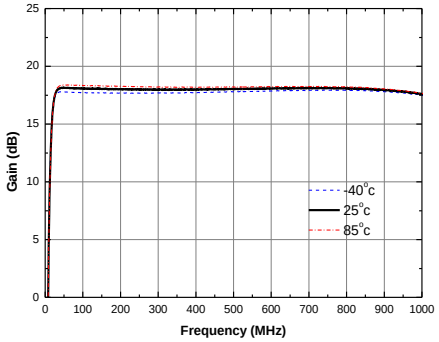
### Schematic

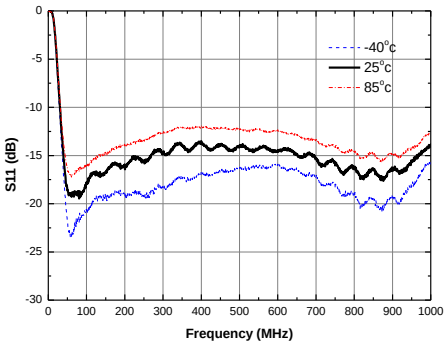


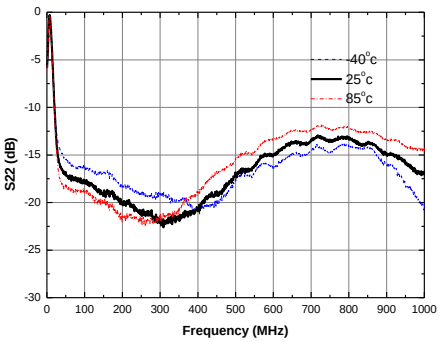

### Board Layout (FR4, 40x40 mm², 0.8T)



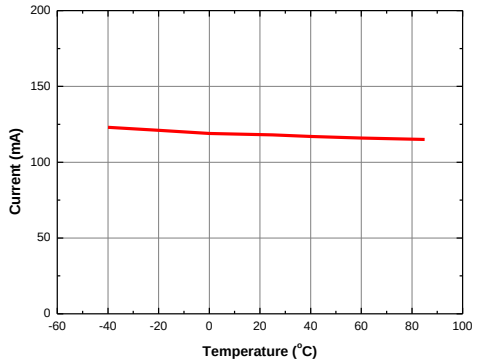

### S-parameters



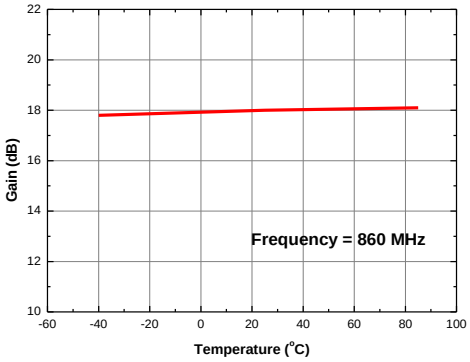



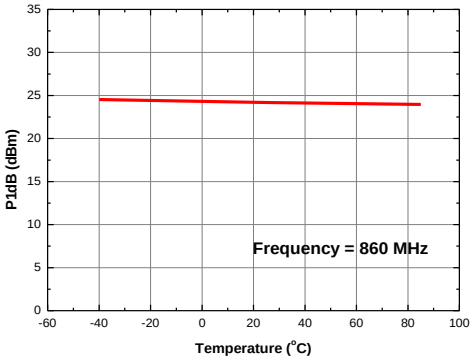
## Current vs. Temperature



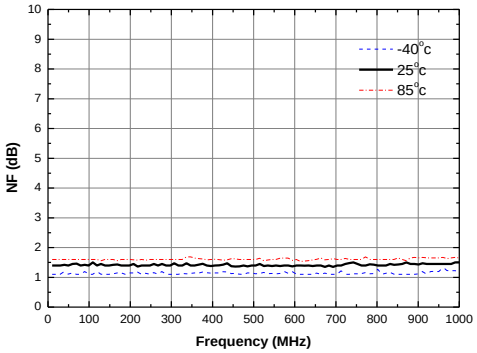

## Gain vs. Temperature



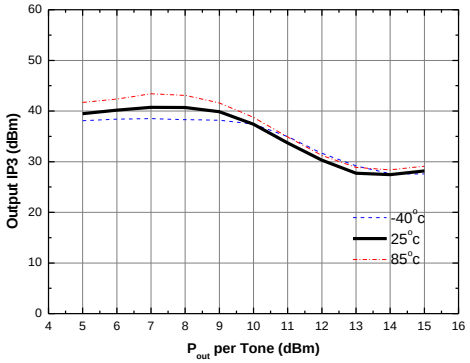

## P1dB vs. Temperature



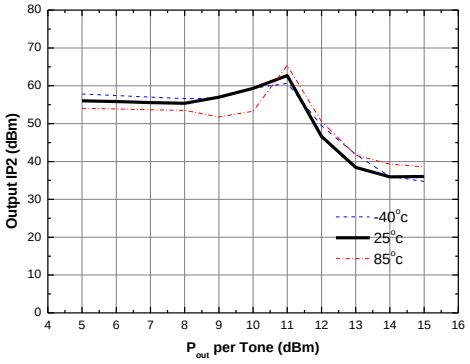

## NF vs. Temperature




## Output IP3 vs. Tone Power (Frequency = 860 MHz)




## Output IP2 vs. Tone Power (Frequency = 860 MHz)



## APPLICATION CIRCUIT

**CATV**

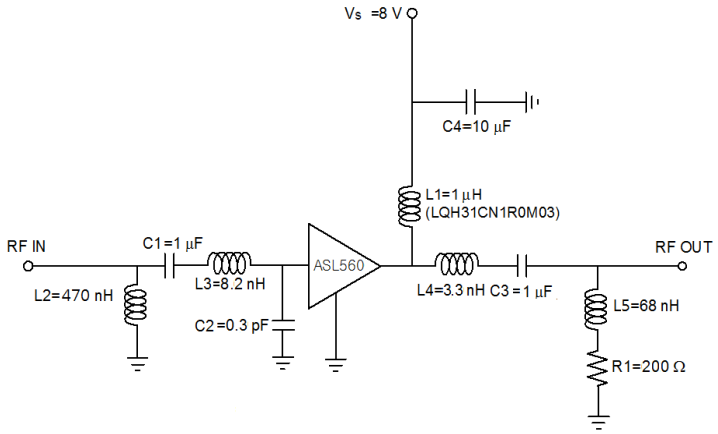
**50 ~ 1200 MHz**

**+8 V**

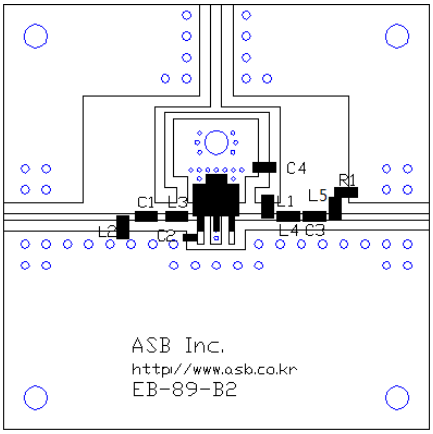
| Frequency (MHz) | 50 | 500 | 1200 |
|---|---|---|---|
| Noise Figure (dB) | 1.7 | 1.7 | 1.9 |
| Magnitude S21 (dB) | 17.5 | 17.5 | 16.2 |
| Magnitude S11 (dB) | -11 | -12 | -12 |
| Magnitude S22 (dB) | -17 | -17 | -12 |
| Output P1dB (dBm) | 24.0 | 24.0 | 23.5 |
| Output IP3[1] (dBm) | 40.5 | 40.0 | 39.0 |
| Output IP2[1),2)] (dBm) | 53 | 56 | 51 |
| Device Voltage (V) | +8 | | |
| Current (mA) | 120 | | |

1) OIP3 and OIP2 are measured with two tones at an output power of +10 dBm/tone separated by 6 MHz.
2) OIP2 is measured at F1+F2 Frequency.

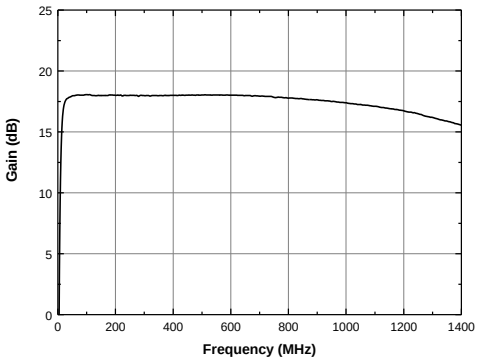
### Schematic

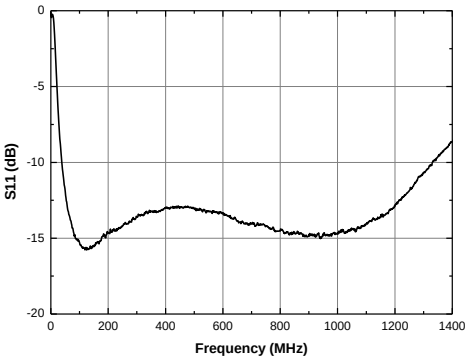


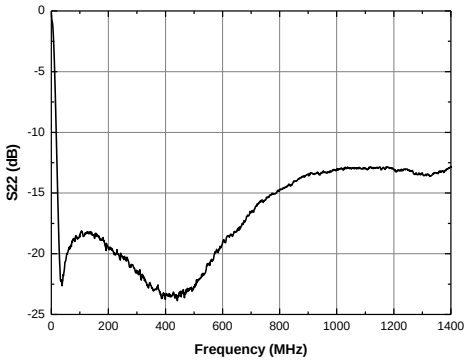

### Board Layout (FR4, 40x40 mm², 0.8T)




### S-parameters



## APPLICATION CIRCUIT

**CATV**

**5 ~ 200 MHz**

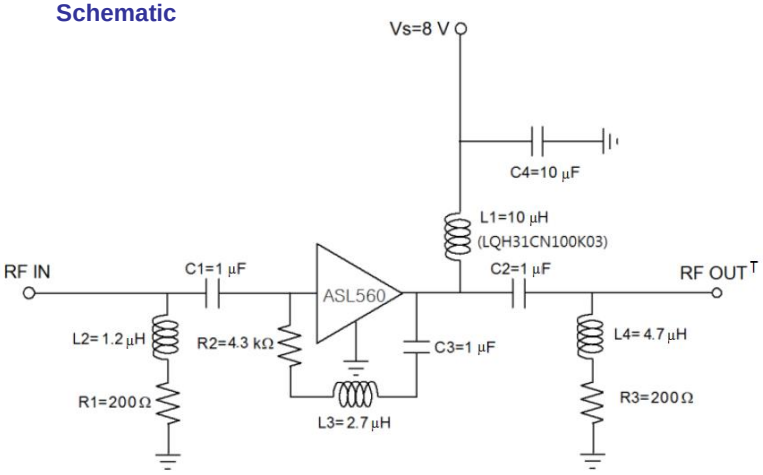
**+8 V**

| Frequency (MHz) | 5 | 50 | 200 |
|---|---|---|---|
| Noise Figure (dB) | 2.1 | 1.5 | 1.5 |
| Magnitude S21 (dB) | 18.0 | 18.0 | 18.0 |
| Magnitude S11 (dB) | -11 | -20 | -18 |
| Magnitude S22 (dB) | -10 | -20 | -13 |
| Output P1dB (dBm) | 24 | 24 | 24 |
| Output IP3[1] (dBm) | 40 | 41 | 46 |
| Output IP2[1),2)] (dBm) | 53 | 56 | 55 |
| Device Voltage (V) | +8 | | |
| Current (mA) | 120 | | |

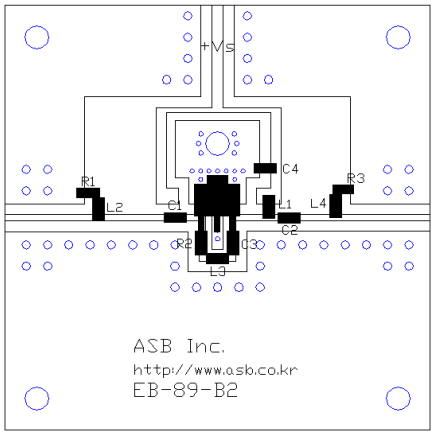
1) OIP3 and OIP2 are measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

2) OIP2 is measured at F1+F2 Frequency

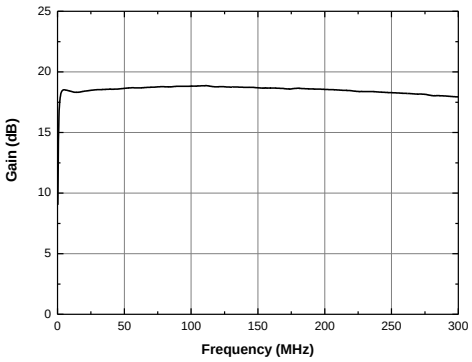
### Schematic

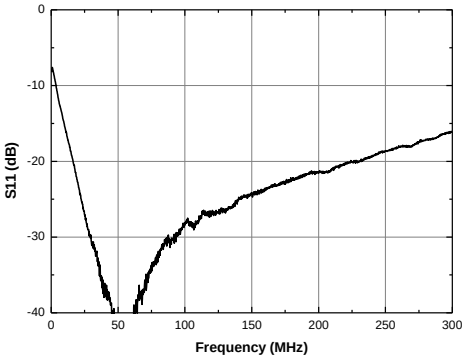


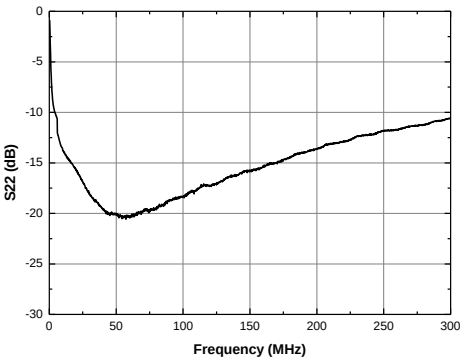

### Board Layout (FR4, 40x40 mm², 0.8T)




### S-parameters



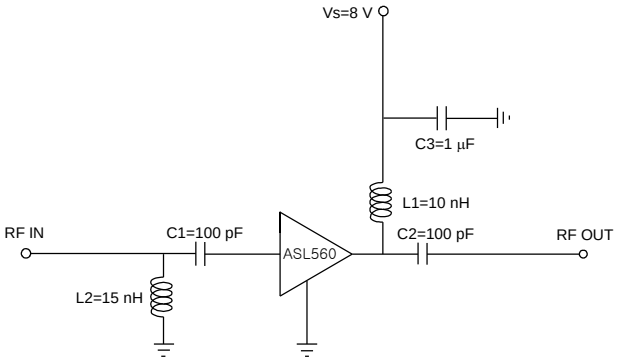
## APPLICATION CIRCUIT

***SMATV &***
***Ethernet over Cable***
**950 ~ 1500 MHz**
**+8 V**

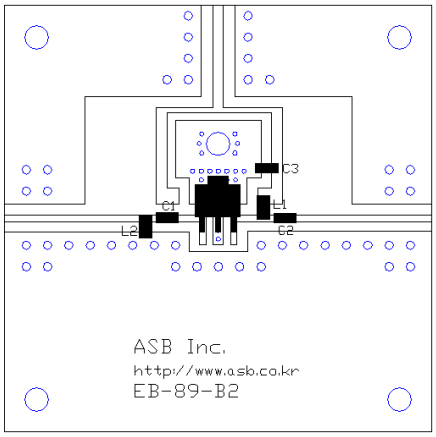
| Frequency (MHz) | 950 | 1200 | 1500 |
|---|---|---|---|
| Noise Figure (dB) | 1.9 | 2.0 | 2.0 |
| Magnitude S21 (dB) | 17.7 | 17.5 | 17.1 |
| Magnitude S11 (dB) | -7 | -7 | -7 |
| Magnitude S22 (dB) | -12 | -17 | -11 |
| Output P1dB (dBm) | 23.0 | 22.0 | 20.5 |
| Output IP3[1)] (dBm) | 38 | 40 | 40 |
| Output IP2[1),2)] (dBm) | 52 | 57 | 52 |
| Device Voltage (V) | +8 | | |
| Current (mA) | 120 | | |

1) OIP3 and OIP2 are measured with two tones at an output power of +8 dBm/tone separated by 6 MHz.
2) OIP2 is measured at F1+F2 Frequency

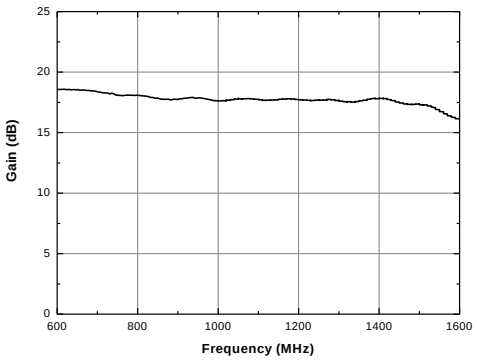
### Schematic

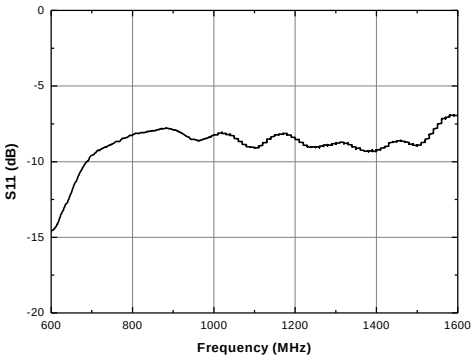


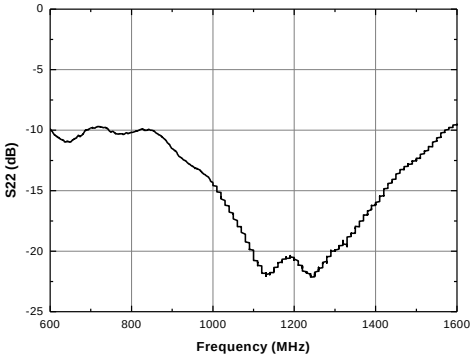

### Board Layout (FR4, 40x40 mm², 0.8T)




### S-parameters



## APPLICATION CIRCUIT

**SMATV**

**800 ~ 2500 MHz**

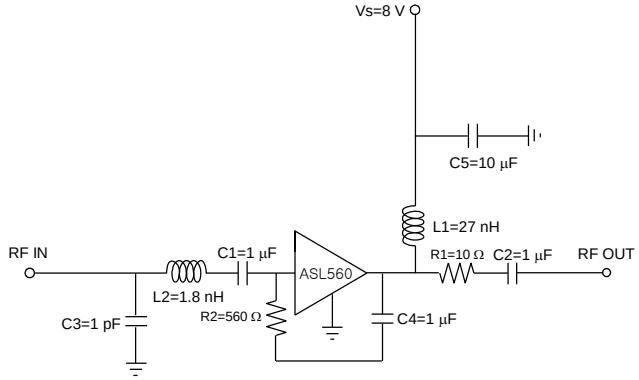
**+8 V**

| Frequency (MHz) | 800 | 1500 | 2500 |
|---|---|---|---|
| Noise Figure (dB) | 2.3 | 3.0 | 2.5 |
| Magnitude S21 (dB) | 13.8 | 14.0 | 13.9 |
| Magnitude S11 (dB) | -10 | -11 | -13 |
| Magnitude S22 (dB) | -18 | -13 | -10 |
| Output P1dB (dBm) | 24 | 20 | 21 |
| Output IP3[1] (dBm) | 42.5 | 35.5 | 33.5 |
| Output IP2[1),2)] (dBm) | 63 | 35 | 49 |
| Device Voltage (V) | +8 | | |
| Current (mA) | 120 | | |

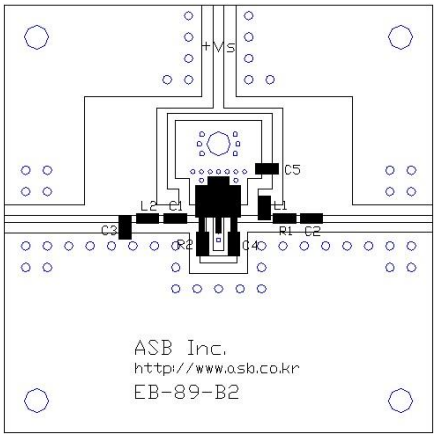
1) OIP3 and OIP2 are measured with two tones at an output power of +8 dBm/tone separated by 1 MHz.

2) OIP2 is measured at F1+F2 Frequency

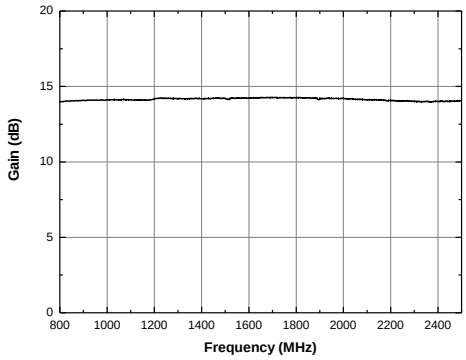
### Schematic

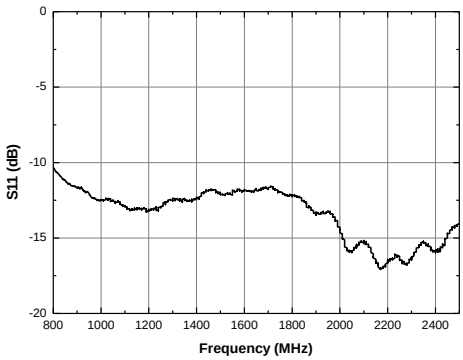


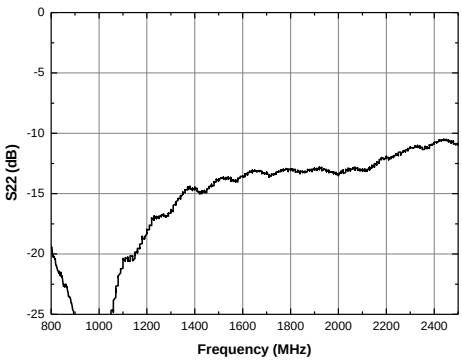

### Board Layout (FR4, 40x40 mm², 0.8T)




### S-parameters



## APPLICATION CIRCUIT

**CATV Push-Pull**

***1 : 1 transformer***

**50 ~ 1000 MHz**

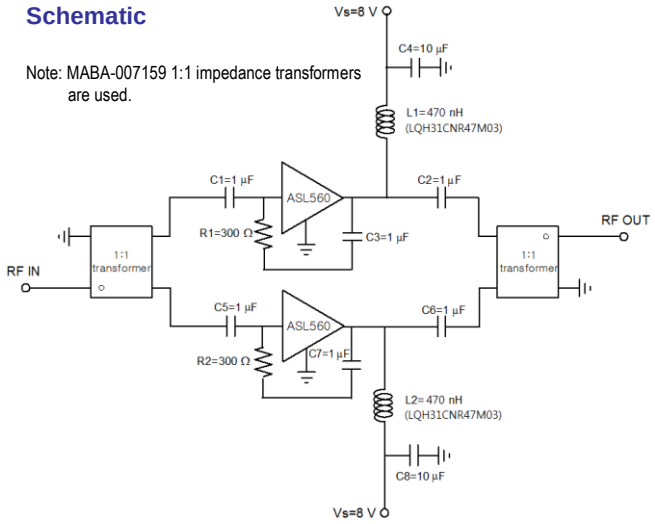
**+8 V**

| Frequency (MHz) | 50 | 500 | 860 |
|---|---|---|---|
| Magnitude S21 (dB) | 11.7 | 11.5 | 11.5 |
| Magnitude S11 (dB) | -15 | -11 | -12 |
| Magnitude S22 (dB) | -15 | -12 | -17 |
| Output P1dB (dBm) | 25 | 28 | 27 |
| Output IP3[1)] (dBm) | 41.0 | 45.5 | 44.5 |
| Output IP2[1),2)] (dBm) | 66 | 50 | 67 |
| Noise Figure (dB) | 2.9 | 2.8 | 2.7 |
| Device Voltage (V) | +8 | | |
| Current (mA) | 240 | | |

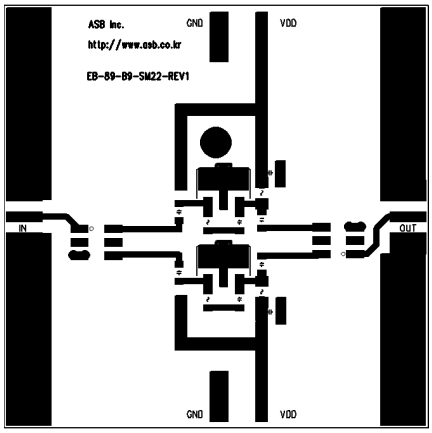
1) OIP3 and OIP2 are measured with two tones at an output power of +10 dBm/tone separated by 6 MHz.

2) OIP2 is measured at F1+F2 Frequency.

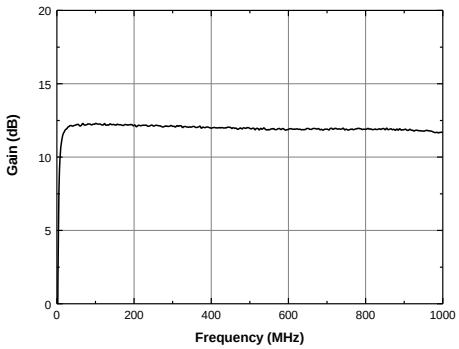
### Schematic

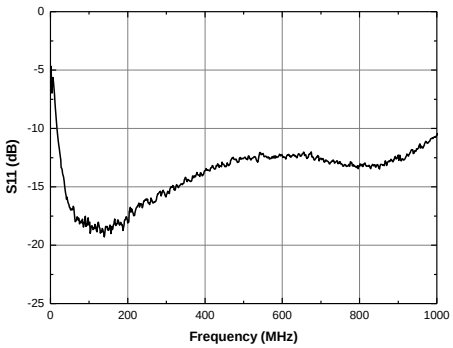


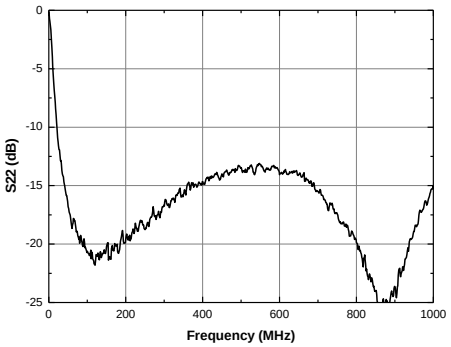

### Board Layout (FR4, 40x40 mm$^2$, 0.8T)




### S-parameters



## APPLICATION CIRCUIT

**CATV Push-Pull**

***1 : 1 transformer***

**50 ~ 1200 MHz**

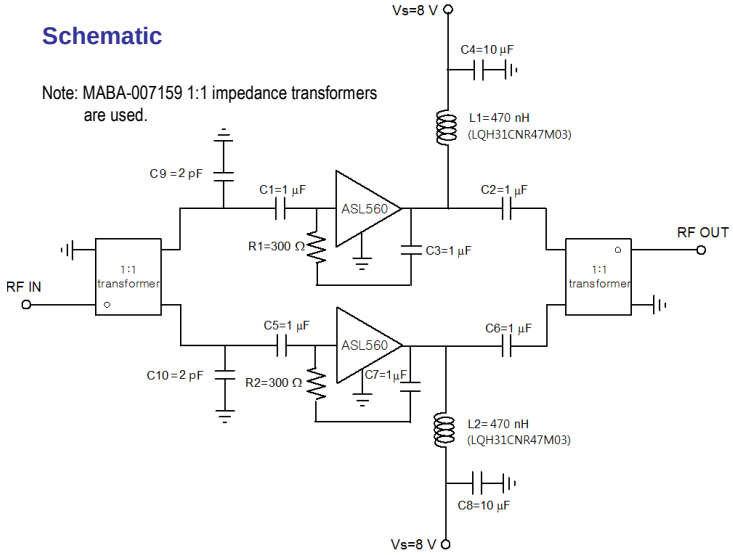
**+8 V**

| Frequency (MHz) | 50 | 500 | 1200 |
|---|---|---|---|
| Magnitude S21 (dB) | 11.7 | 11.3 | 11.4 |
| Magnitude S11 (dB) | -15 | -10 | -10 |
| Magnitude S22 (dB) | -15 | -11 | -10 |
| Output P1dB (dBm) | 25 | 28 | 27 |
| Output IP3[1)] (dBm) | 41.0 | 45.5 | 44.5 |
| Output IP2[1),2)] (dBm) | 68 | 68 | 57 |
| Noise Figure (dB) | 2.9 | 2.9 | 3.2 |
| Device Voltage (V) | +8 | | |
| Current (mA) | 240 | | |

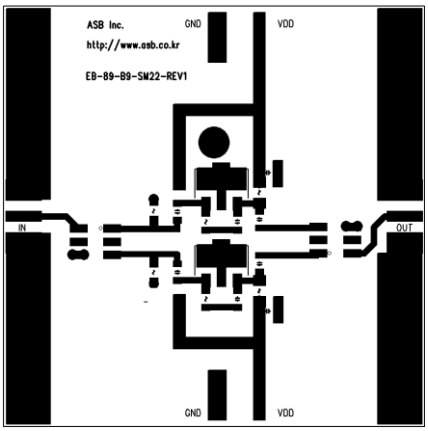
1) OIP3 and OIP2 are measured with two tones at an output power of +12 dBm/tone separated by 6 MHz.

2) OIP2 is measured at F1+F2 Frequency.

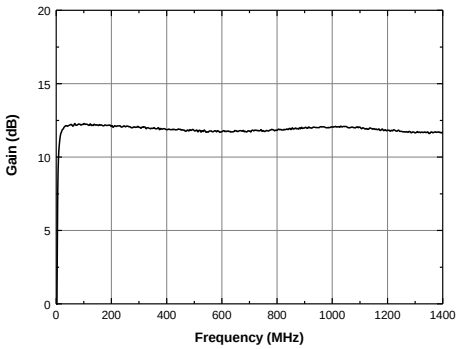
### Schematic

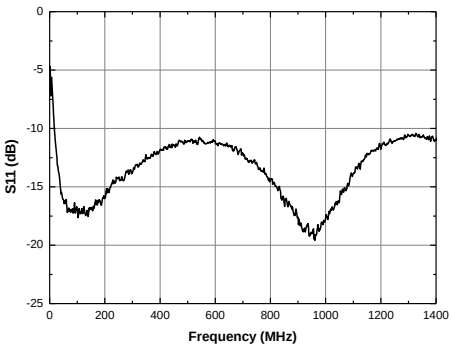


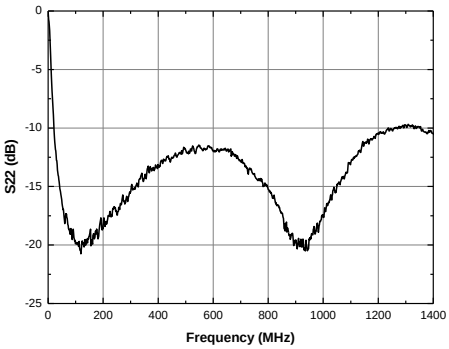

### Board Layout (FR4, 40x40 mm$^2$, 0.8T)




### S-parameters



## APPLICATION CIRCUIT

**CATV Push-Pull**

***1 : 1 transformer***

**5 ~ 200 MHz**

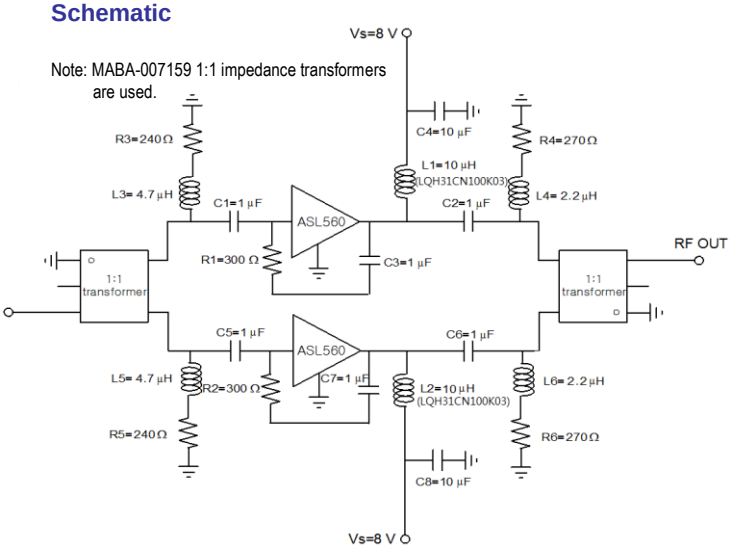
**+8 V**

| Frequency (MHz) | 5 | 50 | 200 |
|---|---|---|---|
| Magnitude S21 (dB) | 12.0 | 12.0 | 11.8 |
| Magnitude S11 (dB) | -17 | -18 | -17 |
| Magnitude S22 (dB) | -17 | -18 | -17 |
| Output P1dB (dBm) | 25 | 26 | 26 |
| Output IP3[1] (dBm) | 39 | 42 | 45 |
| Output IP2[1),2)] (dBm) | 62 | 67 | 73 |
| Noise Figure (dB) | 3.8 | 2.9 | 2.8 |
| Device Voltage (V) | +8 | | |
| Current (mA) | 240 | | |

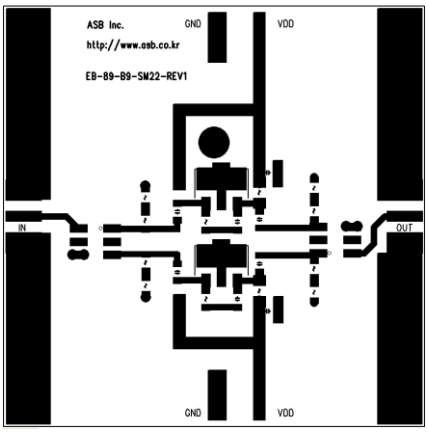
1) OIP3 and OIP2 are measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

2) OIP2 is measured at F1+F2 Frequency.

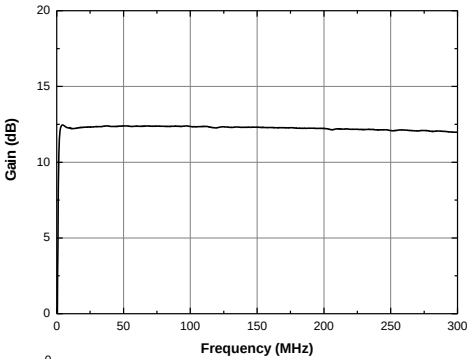
### Schematic

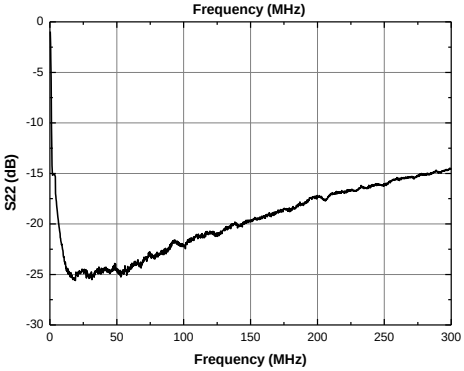


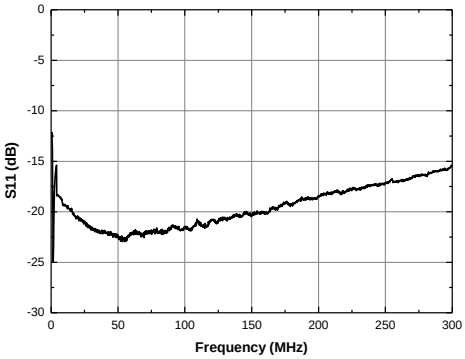

### Board Layout (FR4, 40x40 mm², 0.8T)




### S-parameters



## Recommended Soldering Reflow Profile