ASW335

5 ~ 4000 MHz MMIC Amplifier

Features

- 15.5 dB Gain at 1950 MHz
- 22.0 dBm P1dB at 1950 MHz
- 40.0 dBm OIP3 at 1950 MHz
- 2.3 dB NF at 1950 MHz
- MTTF > 100 Years
- Single Supply

Description

The ASW335, 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 4 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 = +5 V, T_A = +25 °C, Z_0 = 50 Ω)

Parameters	Units	Typical		
Frequency	MHz	100	900	1950
Gain	dB	18.8	17.5	15.5
S11	dB	-13.5	-15	-10
S22	dB	-18	-18	-11
Output IP3	dBm	44.0[1)]	42.0[2)]	40.0[2)]
Noise Figure	dB	1.6	2.0	2.3
Output P1dB	dBm	22.0	22.0	22.0
Current	mA	100	100	100
Device Voltage	V	+5	+5	+5

1) OIP3 is measured with two tones at an output power of +9 dBm/tone separated by 1 MHz.
2) OIP3 is measured with two tones at an output power of +6 dBm/tone separated by 1 MHz.

Product Specifications

Parameters	Units	Min	Typ.	Max
Testing Frequency	MHz		1950	
Gain	dB	15.0	15.5	16.0
S11	dB		-10	
S22	dB		-11	
Output IP3	dBm	39.0	40.0	
Noise Figure	dB		2.3	2.5
Output P1dB	dBm	20.5	22.0	
Current	mA	90	100	110
Device Voltage	V		+5	

Absolute Maximum Ratings

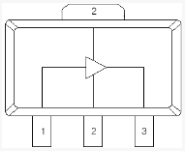
Parameters	Rating
Operating Case Temperature	-40 to +85 °C
Storage Temperature	-40 to +150 °C
Device Voltage	+6 V
Operating Junction Temperature	+150 °C
Input RF Power (CW, 50 Ω matched as in 1950 MHz application circuit)*	+23 dBm
Thermal Resistance	61 °C/W

* Please find the max. input power data from http://www.asb.co.kr/pdf/Maximum_Input_Power_Analysis.pdf
The max. input power, in principle, depends upon the application frequency and the matching circuit.

Application Circuit

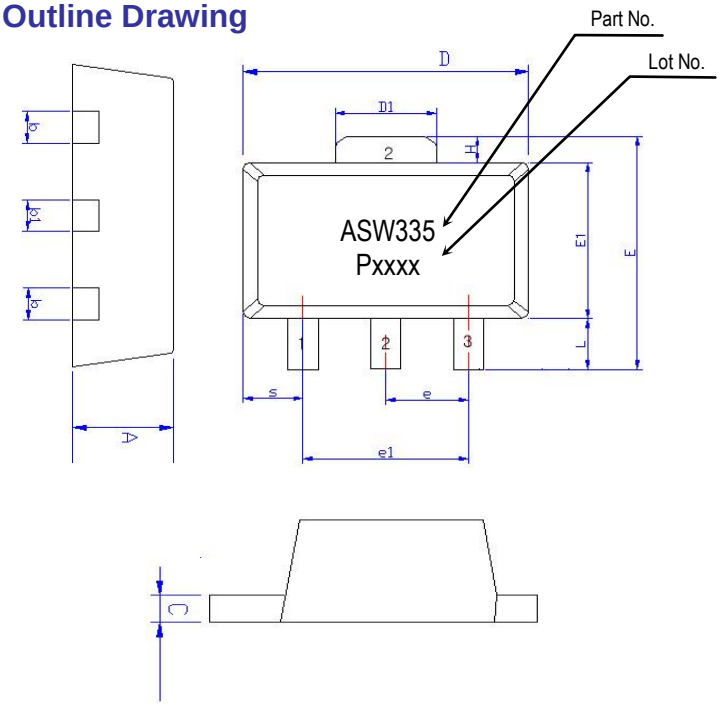
- IF (100 ~ 450 MHz)
- CMMB
- LTE (698 ~ 787 MHz)
- CDMA & GSM (900 MHz)
- LTE (1745 ~ 1860 MHz)
- WCDMA (1950 MHz)
- WLAN (2450 MHz)
- WiMAX
- ONU (70 ~ 2500 MHz)
- 900 ~ 2200 MHz
  (SMATV, 50 Ω)

Pin Configuration



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

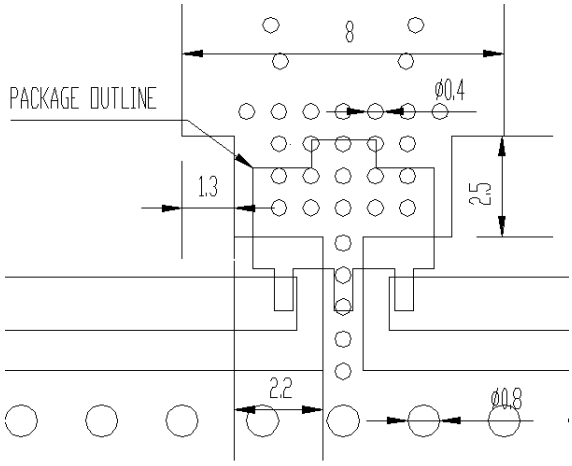
Outline Drawing



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

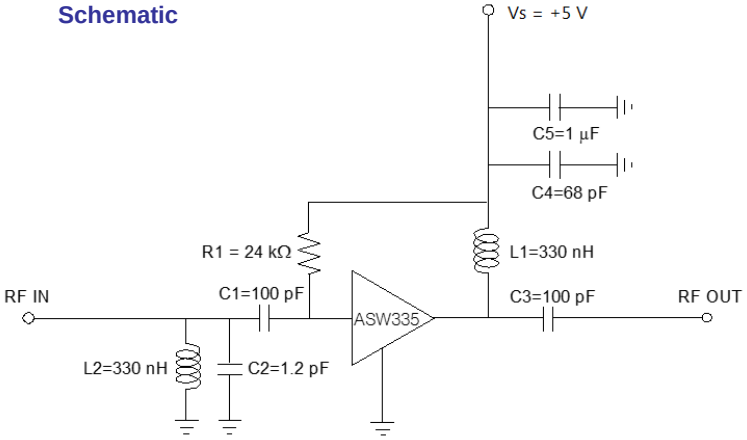
APPLICATION CIRCUIT

IF
100 ~ 450 MHz
+5 V

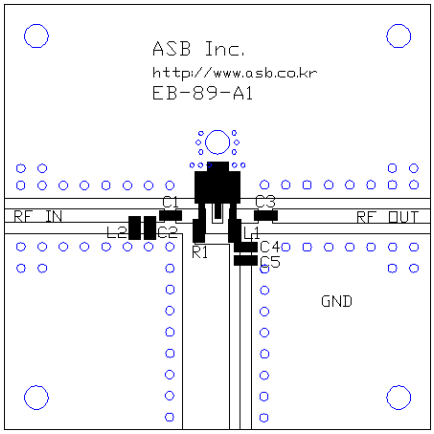
Frequency (MHz)	100	240	450
Magnitude S21 (dB)	18.8	18.5	17.3
Magnitude S11 (dB)	-13.5	-13.5	-10.0
Magnitude S22 (dB)	-18	-15	-12
Output P1dB (dBm)	22.0	22.5	22.0
Output IP3[1)] (dBm)	44.0	43.0	40.5
Noise Figure (dB)	1.6	1.8	1.7
Device Voltage (V)	+5	+5	+5
Current (mA)	100	100	100

1) OIP3 is measured with two tones at an output power of +9 dBm/tone separated by 1 MHz.

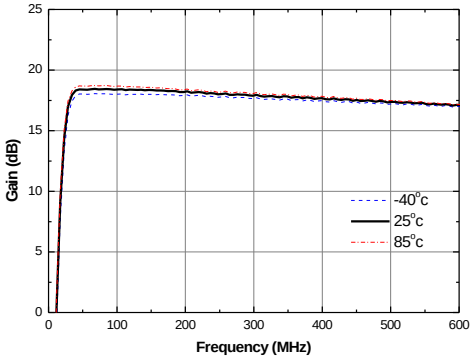
Schematic

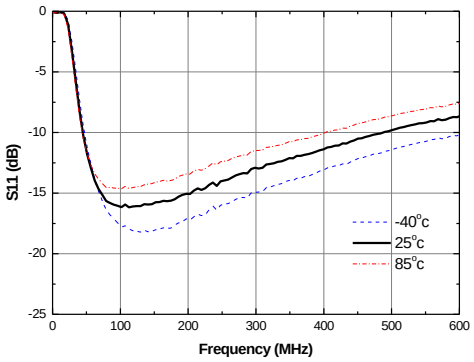


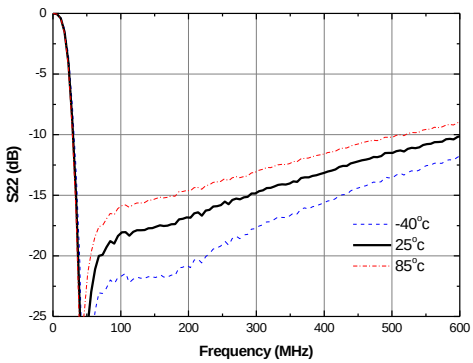
Board Layout (FR4, 40x40 mm^2, 0.8T)

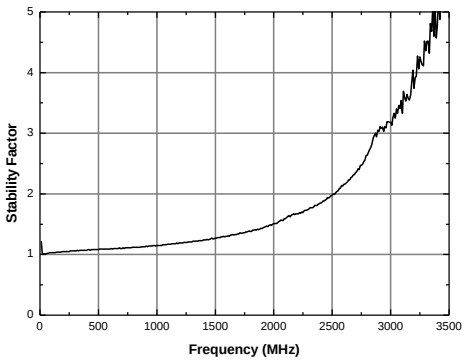


S-parameters & K-factor

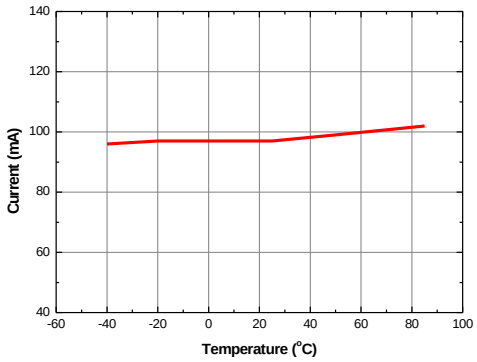




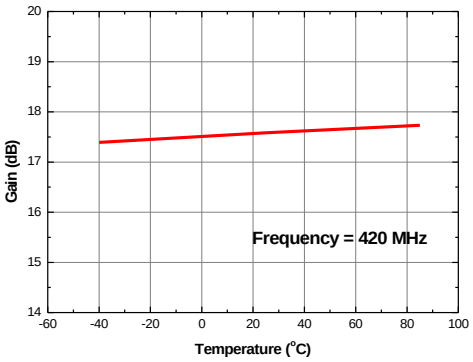




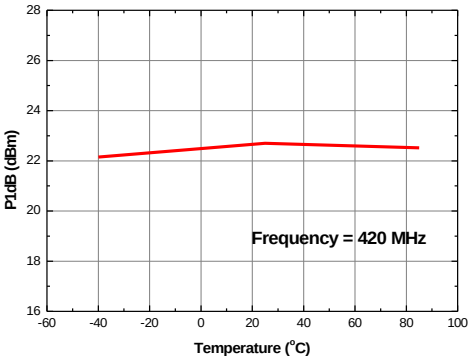
Current vs. Temperature



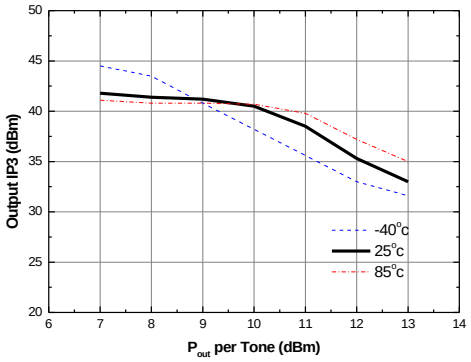
Gain vs. Temperature



P1dB vs. Temperature



Output IP3 vs. Tone Power (Frequency = 420 MHz)



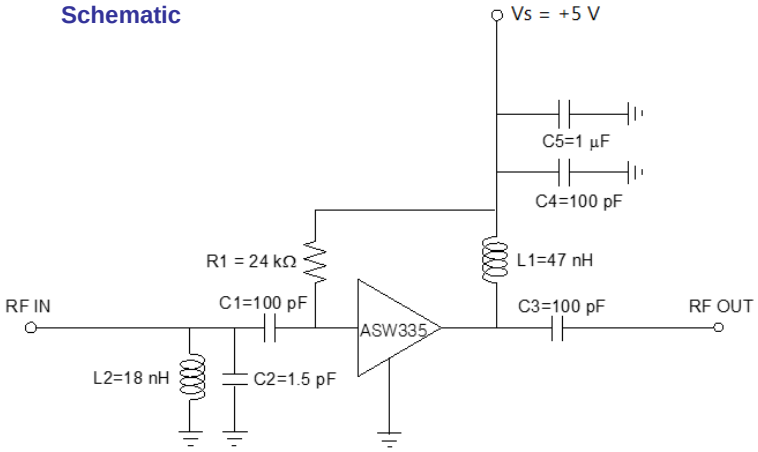
APPLICATION CIRCUIT

CMMB
470 ~ 860 MHz
+5 V

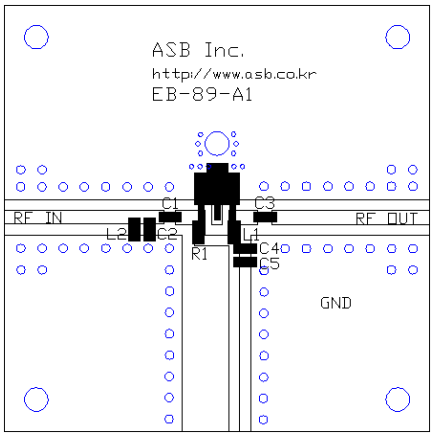
Frequency (MHz)	470	860
Magnitude S21 (dB)	18.0	17.5
Magnitude S11 (dB)	-16	-14
Magnitude S22 (dB)	-18	-15
Output P1dB (dBm)	22.5	22.5
Output IP3[1)] (dBm)	44	41
Noise Figure (dB)	1.8	1.7
Device Voltage (V)	+5	+5
Current (mA)	100	100

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

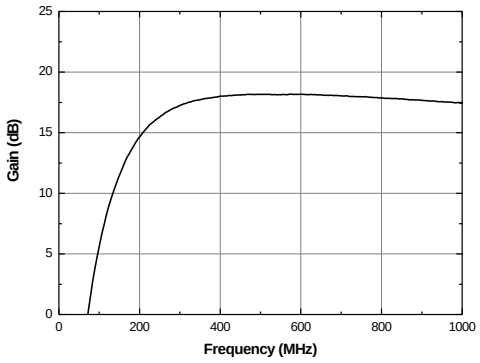
Schematic

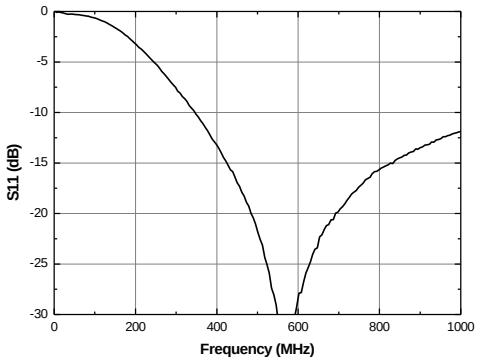


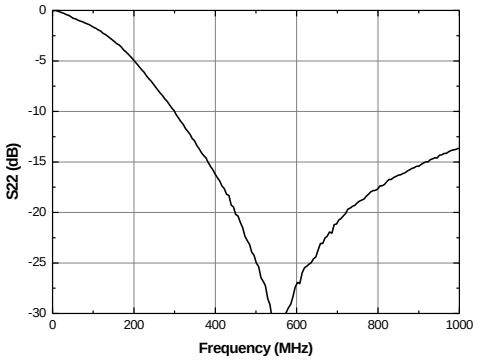
Board Layout (FR4, 40x40 mm^2, 0.8T)

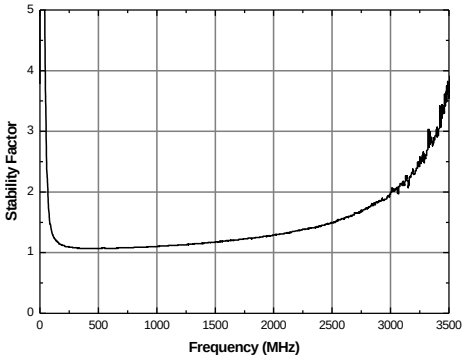


S-parameters & K-factor









APPLICATION CIRCUIT

LTE

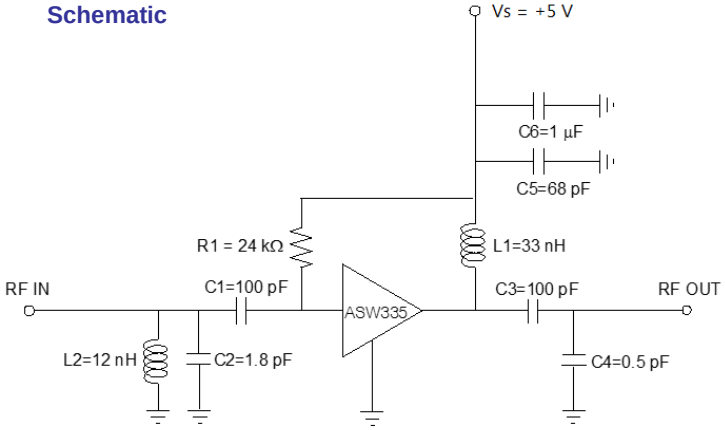
698 ~ 787 MHz

+5 V

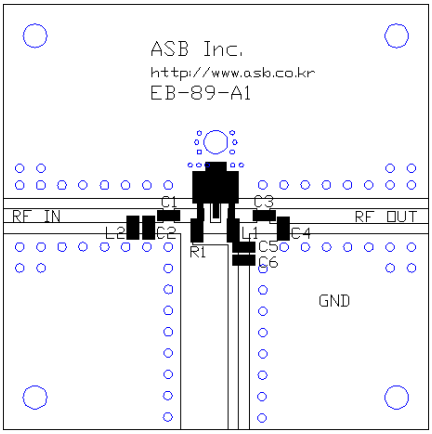
Frequency (MHz)	698 ~ 787
Magnitude S21 (dB)	17.5
Magnitude S11 (dB)	-18
Magnitude S22 (dB)	-18
Output P1dB (dBm)	22.5
Output IP3[1)] (dBm)	42
Noise Figure (dB)	1.6
Device Voltage (V)	+5
Current (mA)	100

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

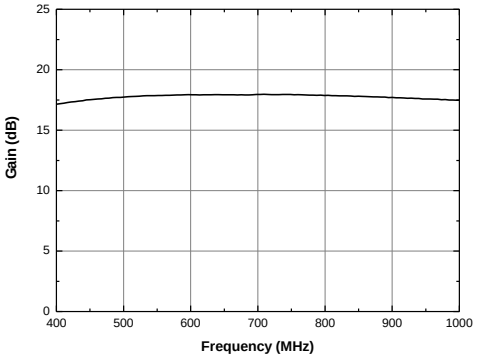
Schematic

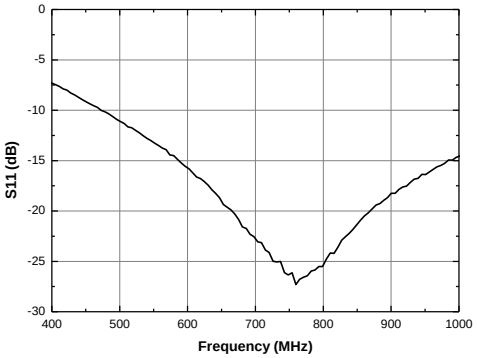


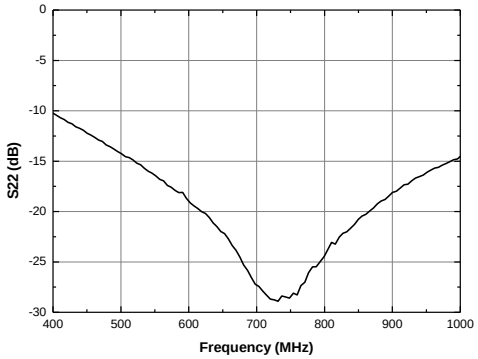
Board Layout (FR4, 40x40 mm^2, 0.8T)

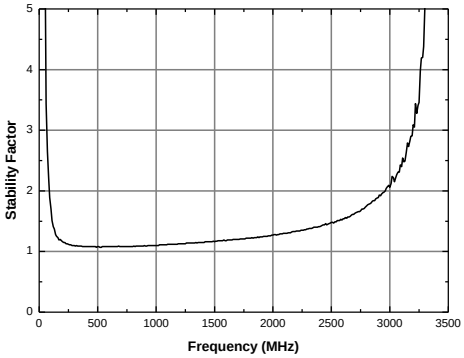


S-parameters & K-factor









APPLICATION CIRCUIT

CDMA & GSM

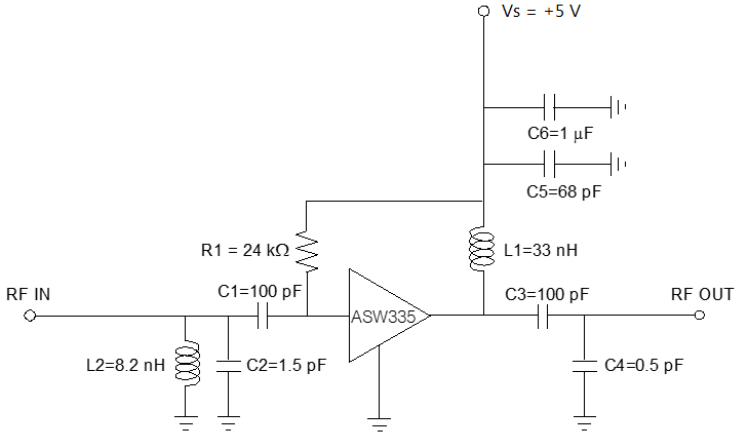
900 MHz

+5 V

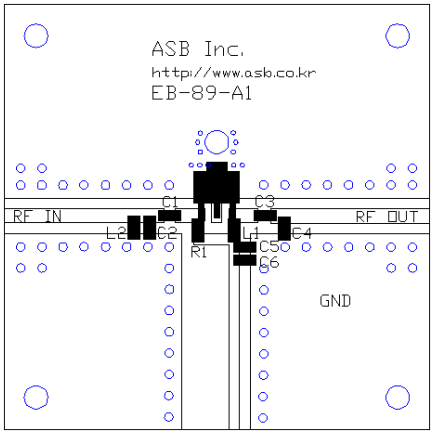
Frequency (MHz)	900
Magnitude S21 (dB)	17.5
Magnitude S11 (dB)	-15
Magnitude S22 (dB)	-18
Output P1dB (dBm)	22
Output IP3[1)] (dBm)	42
Noise Figure (dB)	2.0
Device Voltage (V)	+5
Current (mA)	100

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

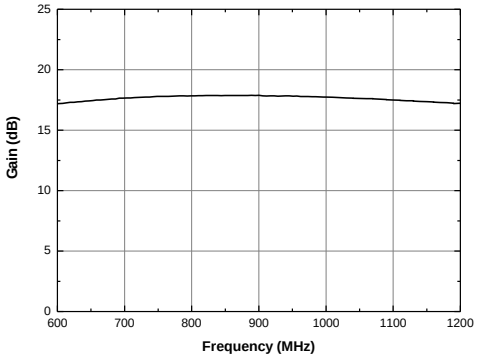
Schematic

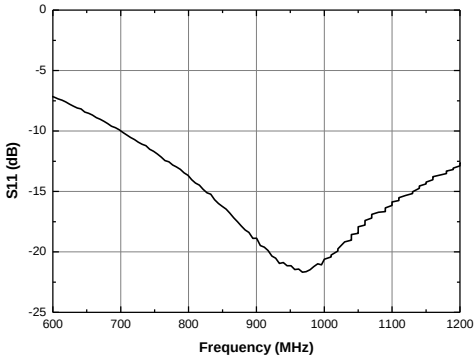


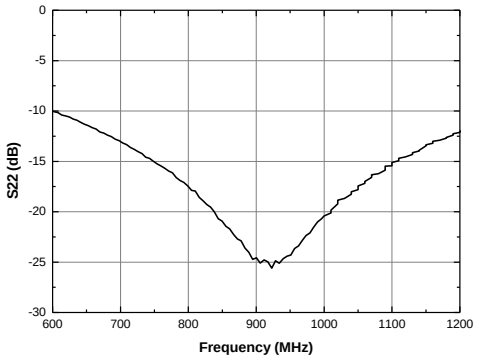
Board Layout (FR4, 40x40 mm^2, 0.8T)

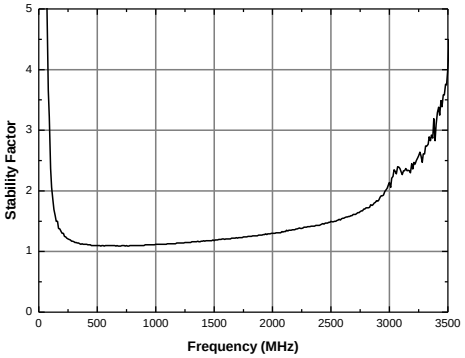


S-parameters & K-factor









APPLICATION CIRCUIT

LTE

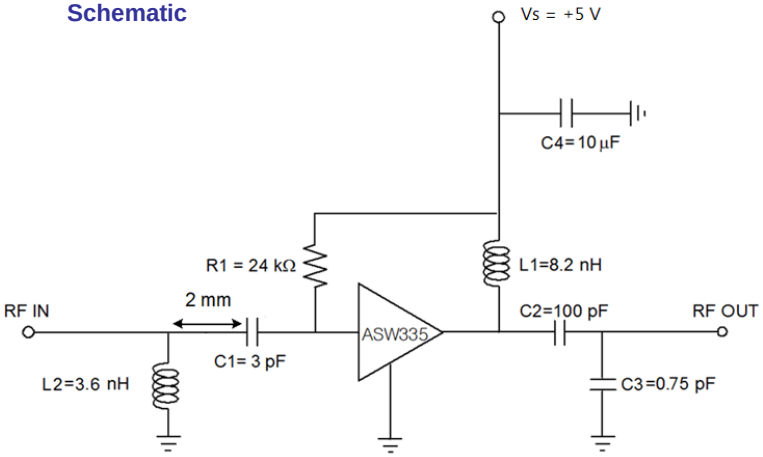
1745 ~ 1860 MHz

+5 V

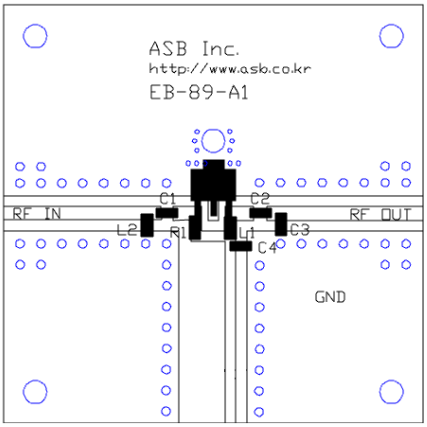
Frequency (MHz)	1745	1860
Magnitude S21 (dB)	16.0	16.0
Magnitude S11 (dB)	-18	-18
Magnitude S22 (dB)	-14	-13
Output P1dB (dBm)	22	22
Output IP3[1)] (dBm)	38.5	37.5
Noise Figure (dB)	2.2	2.2
Device Voltage (V)	+5	+5
Current (mA)	100	100

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

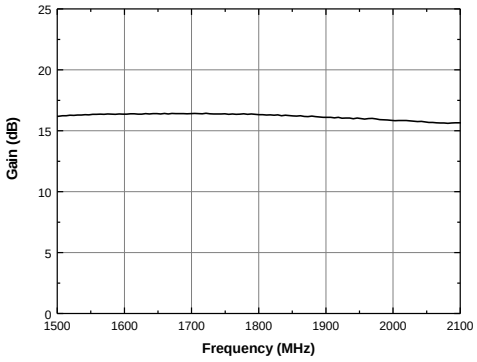
Schematic

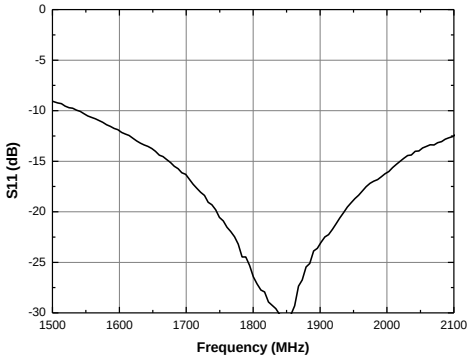


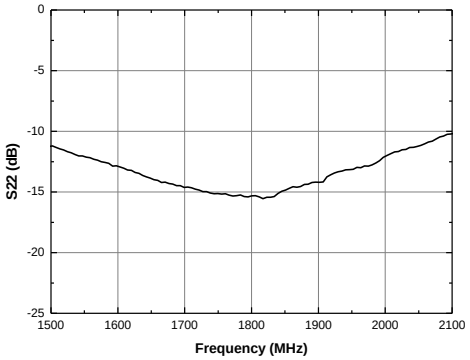
Board Layout (FR4, 40x40 mm^2, 0.8T)



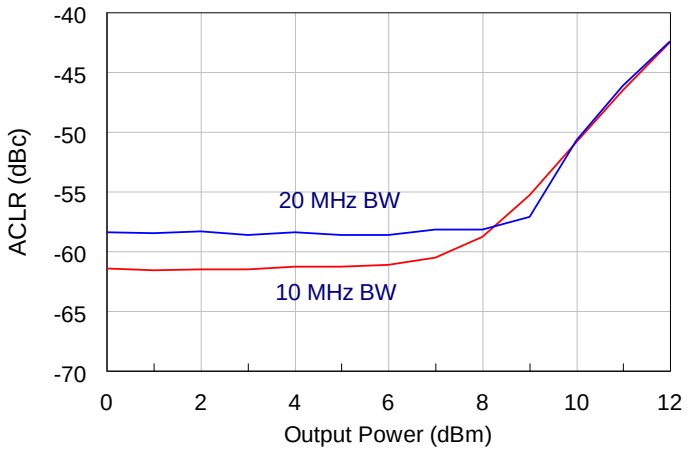
S-parameters & K-factor





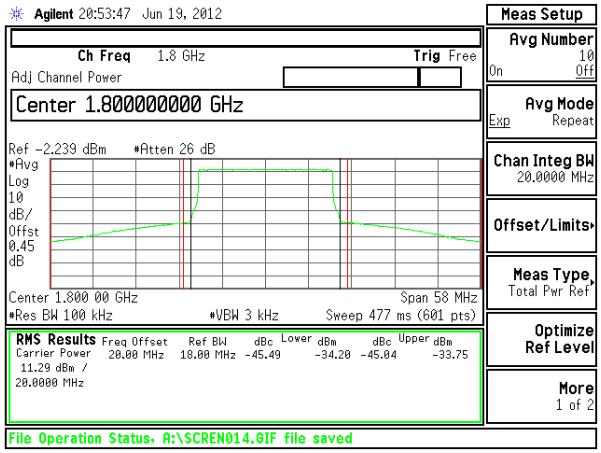


LTE ACLR – 10 MHz & 20 MHz



1) Test Source : LTE_FDD_test model 3.1, BW: 10 MHz & 20 MHz, Test Frequency: 1.8 GHz

LTE ACLR – 20 MHz



2) Test Source : LTE_FDD_test model 3.1, BW: 20 MHz, Test Frequency: 1.8 GHz

APPLICATION CIRCUIT

WCDMA

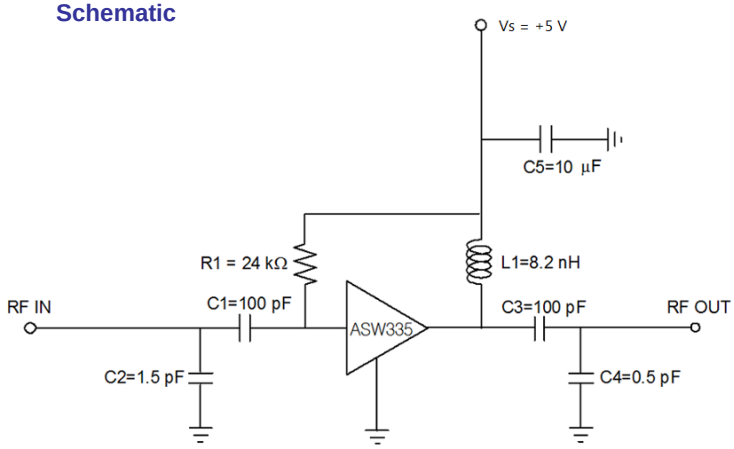
1950 MHz

+5 V

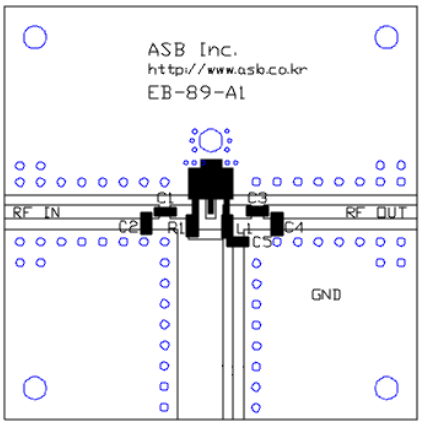
Frequency (MHz)	1950
Magnitude S21 (dB)	15.5
Magnitude S11 (dB)	-10
Magnitude S22 (dB)	-11
Output P1dB (dBm)	22
Output IP3[1)] (dBm)	40.0
Noise Figure (dB)	2.3
Device Voltage (V)	+5
Current (mA)	100

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

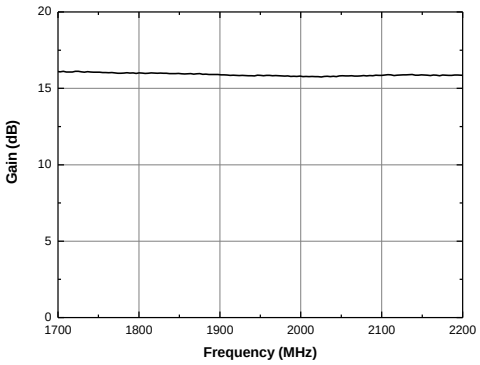
Schematic

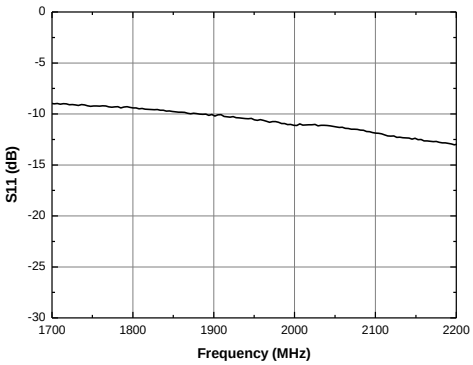


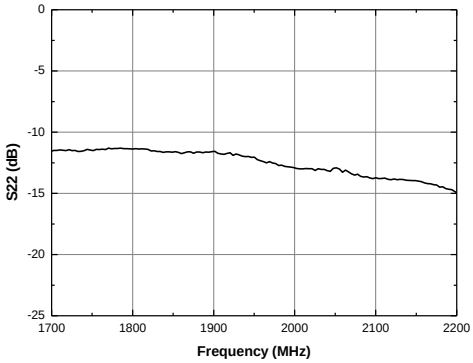
Board Layout (FR4, 40x40 mm^2, 0.8T)

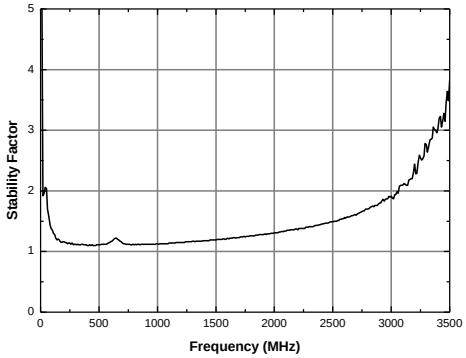


S-parameters & K-factor









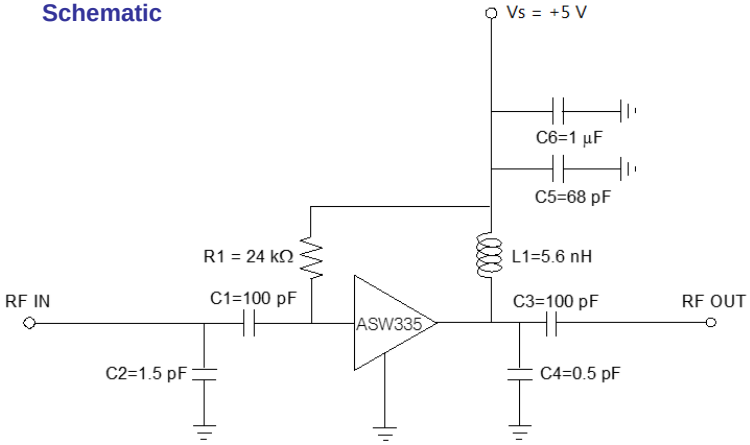
APPLICATION CIRCUIT

WLAN
2450 MHz
+5 V

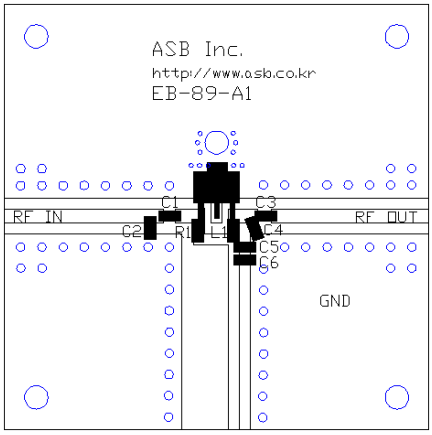
Frequency (MHz)	2450
Magnitude S21 (dB)	16.0
Magnitude S11 (dB)	-14
Magnitude S22 (dB)	-14
Output P1dB (dBm)	21
Output IP3[1] (dBm)	38
Noise Figure (dB)	3.0
Device Voltage (V)	+5
Current (mA)	100

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

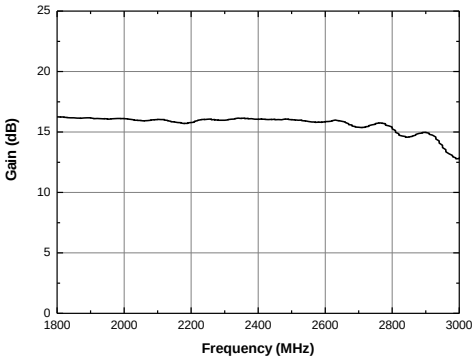
Schematic

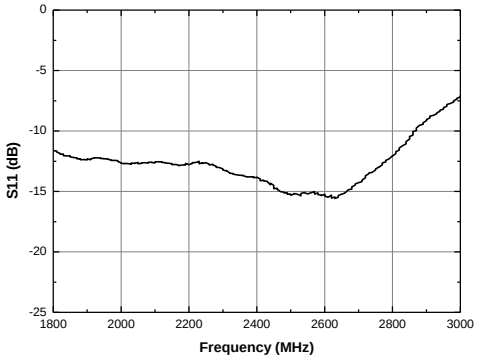


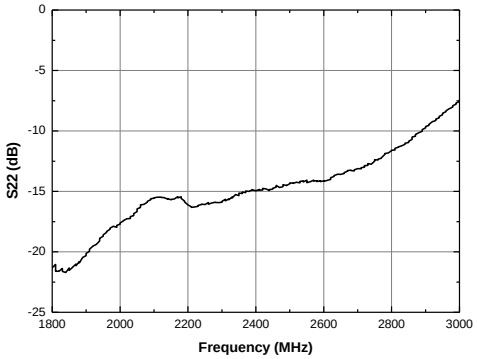
Board Layout (FR4, 40x40 mm^2, 0.8T)

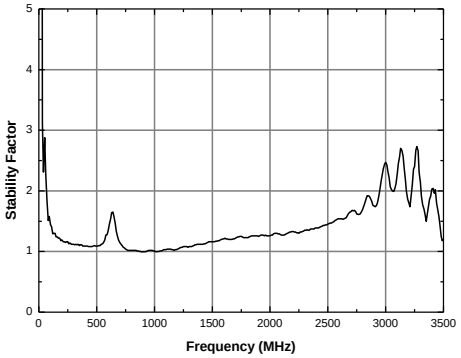


S-parameters & K-factor









APPLICATION CIRCUIT

WiMAX

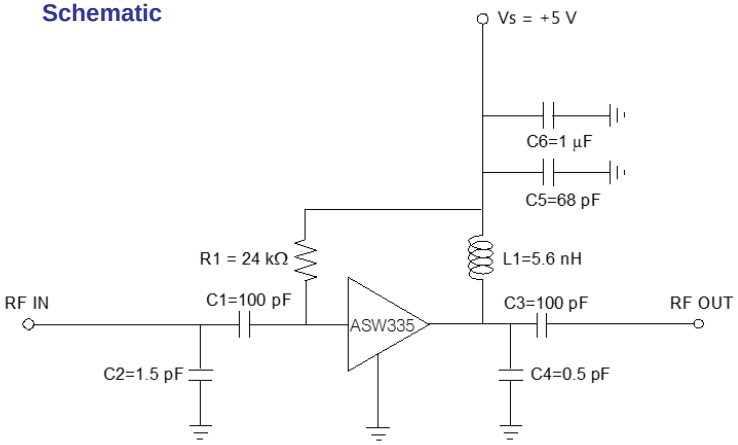
2500 ~ 2700 MHz

+5 V

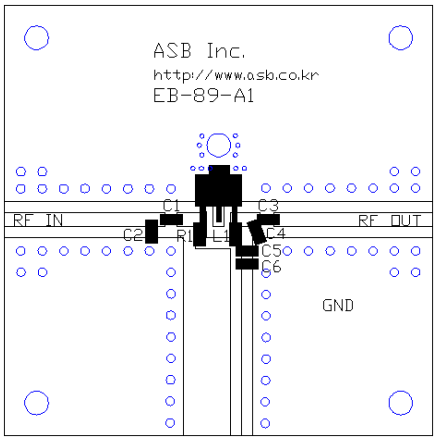
Frequency (MHz)	2500	2600	2700
Magnitude S21 (dB)	15.5	15.2	14.8
Magnitude S11 (dB)	-10	-9	-8
Magnitude S22 (dB)	-18	-15	-13
Output P1dB (dBm)	19.0	18.0	18.5
Output IP3[1)] (dBm)	36	36	37
Noise Figure (dB)	3.1	3.5	4.0
Device Voltage (V)	+5	+5	+5
Current (mA)	100	100	100

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

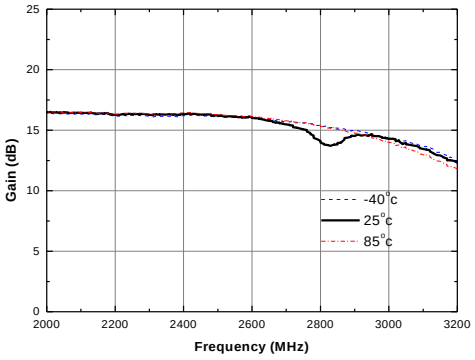
Schematic

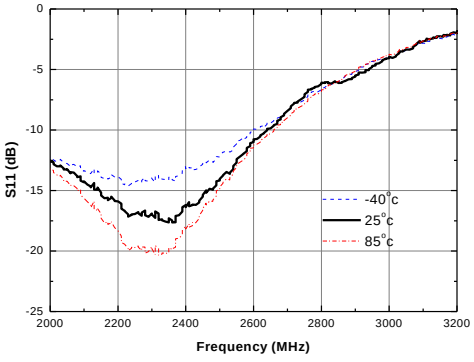


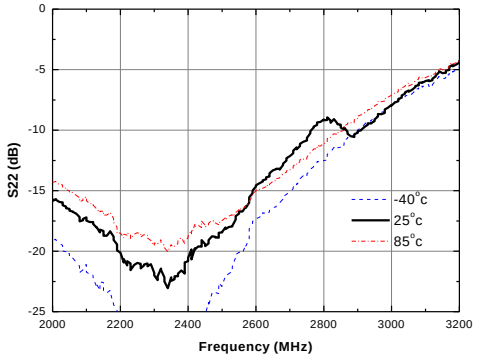
Board Layout (FR4, 40x40 mm^2, 0.8T)

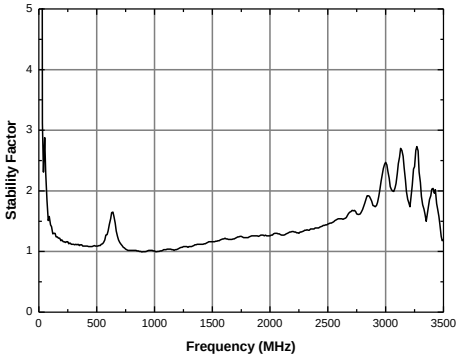


S-parameters & K-factor

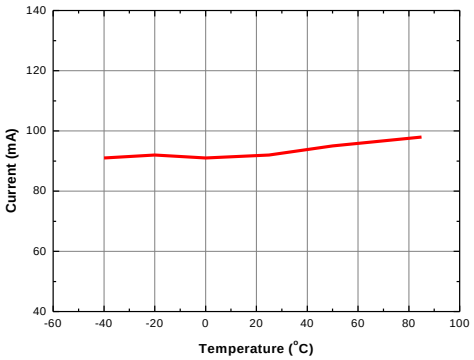




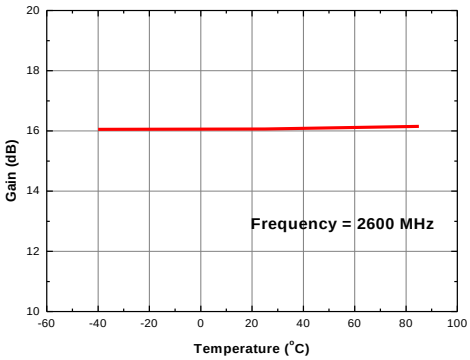




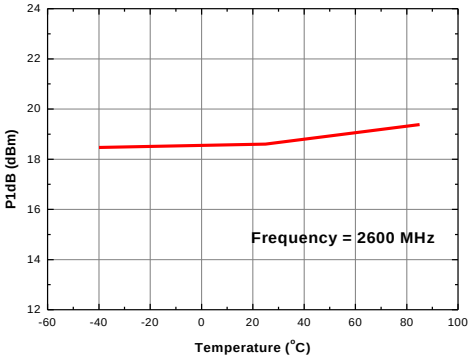
Current vs. Temperature



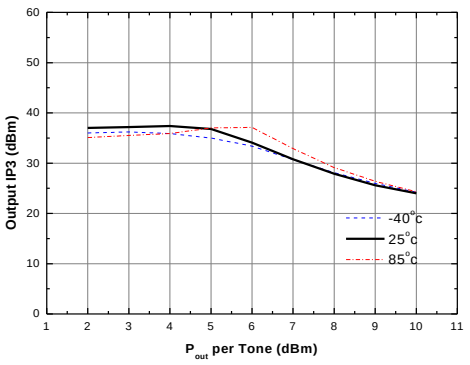
Gain vs. Temperature



P1dB vs. Temperature



Output IP3 vs. Tone Power (Frequency = 2600 MHz)



APPLICATION CIRCUIT

ONU

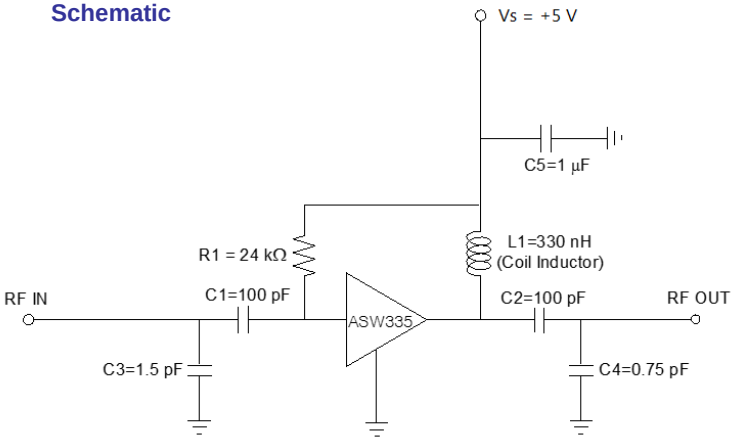
70 ~ 2500 MHz

+5 V

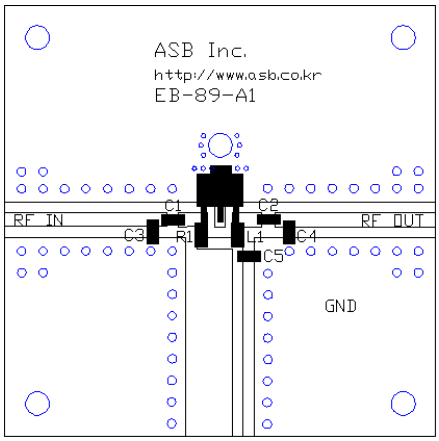
Frequency (MHz)	70	800	1700	2500
Magnitude S21 (dB)	17.9	16.7	15	14.6
Magnitude S11 (dB)	-9	-7	-7	-13
Magnitude S22 (dB)	-20	-7	-5	-8
Output P1dB (dBm)	21.5	21.5	22.5	19.5
Output IP3[1)] (dBm)	42.5	37	37	36
Noise Figure (dB)	1.4	1.7	1.9	3.2
Device Voltage (V)	+5	+5	+5	+5
Current (mA)	100	100	100	100

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

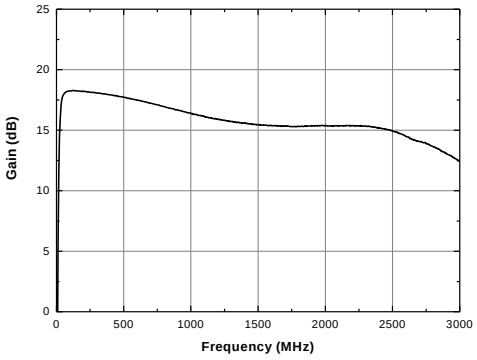
Schematic

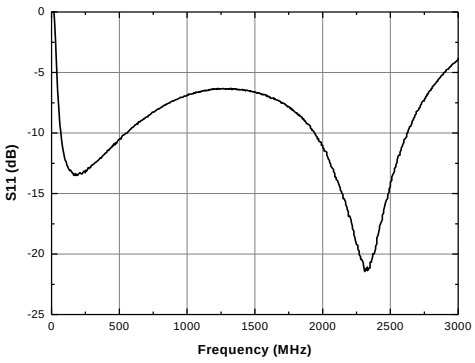


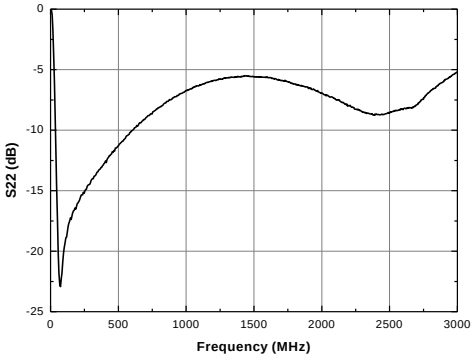
Board Layout (FR4, 40x40 mm^2, 0.8T)

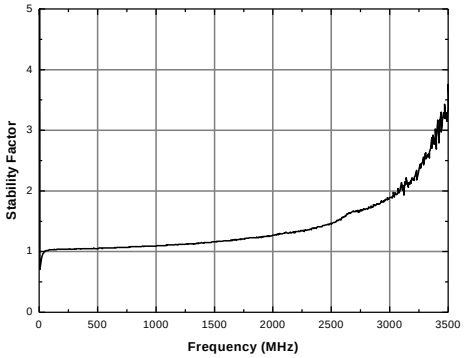


S-parameters & K-factor









APPLICATION CIRCUIT

SMATV

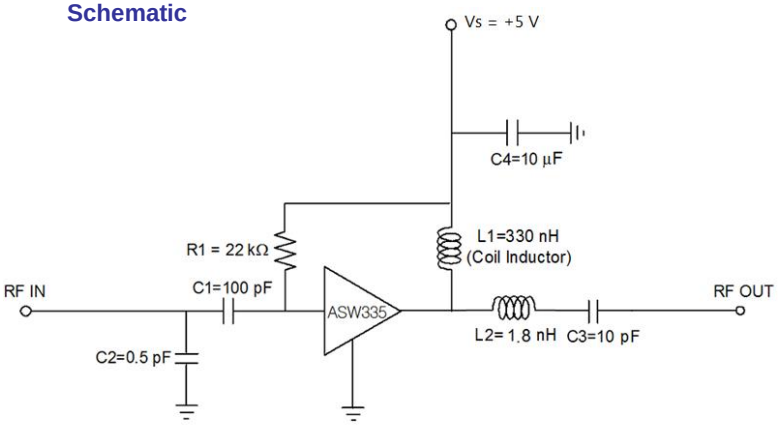
900 ~ 2200 MHz

+5 V, *50 Ω*

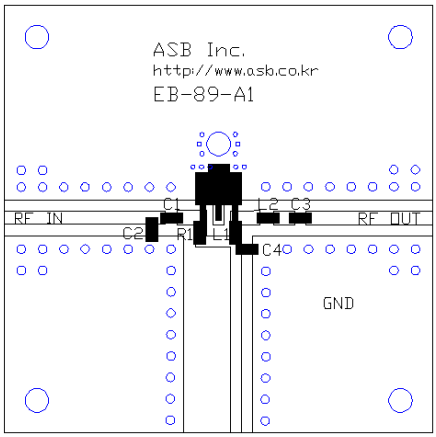
Frequency (MHz)	950	2200
Magnitude S21 (dB)	16.2	15.8
Magnitude S11 (dB)	-7	-12
Magnitude S22 (dB)	-7	-15
Output P1dB (dBm)	21.5	17.5
Output IP3[1)] (dBm)	41.5	38.0
Noise Figure (dB)	1.7	2.3
Device Voltage (V)	+5	+5
Current (mA)	100	100

1) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1 MHz.

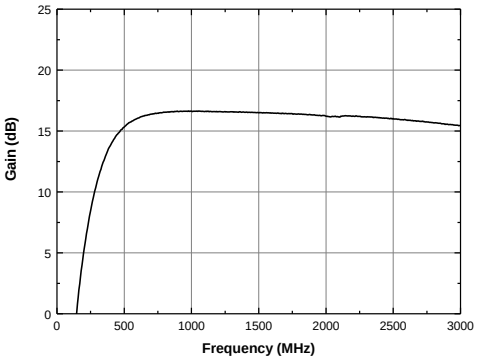
Schematic

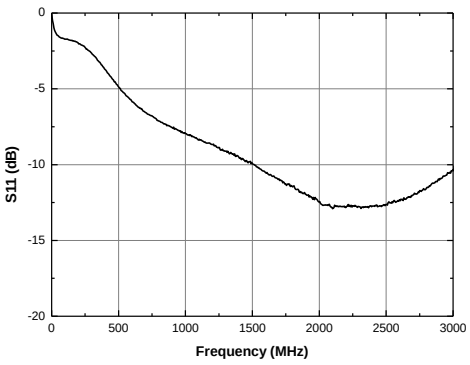


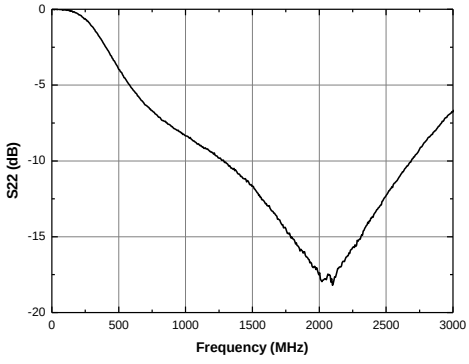
Board Layout (FR4, 40x40 mm^2, 0.8T)

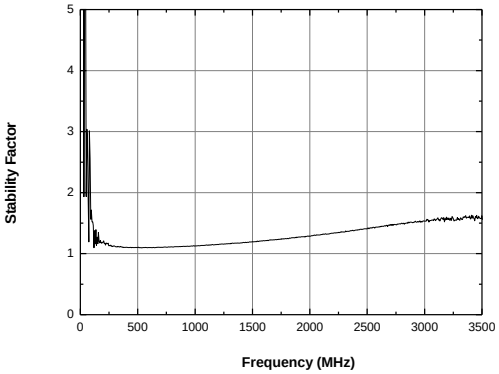


S-parameters & K-factor









Performance with varying Current

V_{DEVICE} (V)	Current (mA)	R1 (Ω)	Freq. (MHz)	Gain (dB)	S11 (dB)	S22 (dB)	OIP3 (dBm)	P1dB (dBm)	NF (dB)
5	100	24 k	900	17.6	-17.9	-33.1	42.5	22.9	1.83
			1950	15.9	-12.2	-13.9	42.1	22.6	2.21
5	90	30 k	900	17.6	-18.1	-33.3	40.8	22.8	1.85
			1950	15.9	-12.4	-13.5	40.4	22.3	2.19
5	80	43 k	900	17.5	-18.2	-32.2	38.9	22.4	1.84
			1950	15.8	-12.6	-13.3	38.1	21.7	2.21
5	70	68 k	900	17.4	-18.5	-30.6	37.1	21.7	1.83
			1950	15.7	-12.7	-12.9	36.4	21.2	2.31

Recommended Soldering Reflow Profile