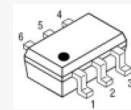


### Features

- 18 dB Gain at 900 MHz
- 0.6 dB NF at 900 MHz
- 30 dBm OIP3 at 900 MHz
- 17 dBm P1dB at 900 MHz
- One-stage LNA

### Description

AST20S is a one-stage LNA which has a low noise, high gain, and high linearity over a wide range of frequency up to 6 GHz. It is also suitable for use in the low noise amplifier block of the mobile wireless systems of T-DMB, CDMA, GSM, PCS, WCDMA, WiBro, WiMAX, and WLAN so on. The amplifier is available in an SOT-363 package and passes the stringent DC, RF, and reliability tests.



Package Style: SOT-363

### Application Circuit

- 698 ~ 787 MHz
- 900 MHz
- 880 ~ 953 MHz
- 900 MHz (Balanced Type)
- 1755 ~ 2140 MHz
- 1950 MHz
- 1950 MHz (Balanced Type)
- 2140 MHz / 2450 MHz
- 2500 MHz / 2600 MHz
- 3500 MHz
- 1200 ~ 1900 MHz
- 433 MHz / 315 MHz
- 850 ~ 950 MHz
- 1210 ~ 1620 MHz (GPS)
- 1472 MHz
- Satellite Phone
- 174 ~ 240 MHz
- 50 ~ 200 MHz / 50 ~ 300 MHz
- 50 ~ 810 MHz  
(Wideband antenna)
- 470 ~ 860 MHz (CMMB)
- 70 ~ 2700 MHz (ONU, 50 ohm)
- 2300 ~ 2700 MHz
- 900 ~ 2100 MHz  
(SMATV, 50 ohm)

### Typical Performance

Parameters	Units	Typical			
		900	1950	2450	3500
Testing Frequency	MHz	900	1950	2450	3500
Gain	dB	18	15.5	13	11
S11	dB	-13	-11	-15	-12
S22	dB	-15	-13	-13	-15
Output IP3 <sup>1)</sup>	dBm	30	34	33	30
Noise Figure	dB	0.6	0.7	0.9	2.1
Output P1dB	dBm	17	18	18.5	18
Current	mA	48			
Device Voltage	V	3.15			

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

### Product Specifications\*

Parameters	Units	Min	Typ	Max
Frequency	MHz		900	
Gain	dB	17	18	
S11	dB		-13	
S22	dB		-15	
Output IP3	dBm	28	30	
Noise Figure	dB		0.6	0.7
Output P1dB	dBm	15	17	
Current	mA	40	48	55
Device Voltage	V		3.15	

\*100% in-house DC & RF testing is done on packaged products before taping

### Absolute Maximum Ratings

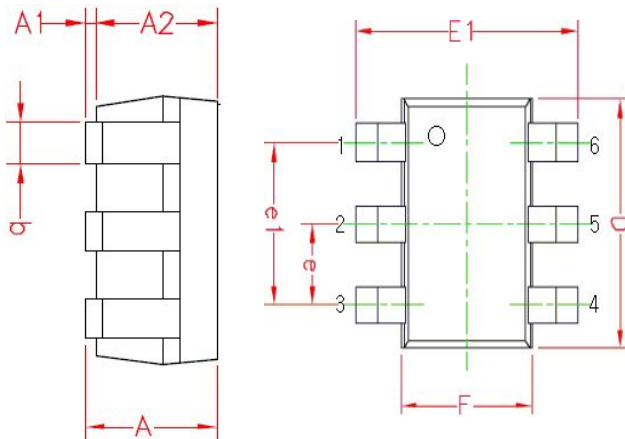
Parameters	Rating
Operating Case Temperature	-40 to +85°C
Storage Temperature	-40 to +150°C
Device Voltage	+6 V
Operating Junction Temperature	+150°C
Input RF Power (CW, 50ohm matched)*	22 dBm

\* Please find the max. input power data from [http://www.asb.co.kr/pdf/Maximum\\_Input\\_Power\\_Analysis.pdf](http://www.asb.co.kr/pdf/Maximum_Input_Power_Analysis.pdf)

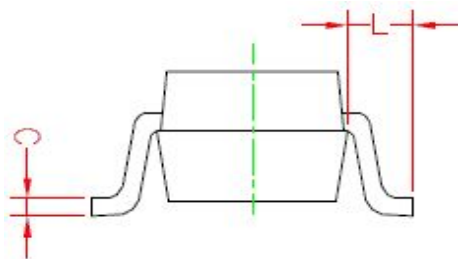
### Pin Configuration

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

### Outline Drawing



Symbols	Dimensions (In mm)		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.025	0.062	0.10
A2	0.875	0.937	1.00
b	0.20	0.30	0.40
C	0.10	0.125	0.15
D	1.90	2.00	2.10
F	1.15	1.25	1.35
E1	2.00	2.10	2.20
e	--	0.65BSC	--
e1	--	1.30BSC	--
L	--	0.425REF	--



Pin NO.	Function	Pin NO.	Function.
1	RF IN	4	RF OUT / Bias
2	GND	5	NC
3	GND	6	GND

### ESD Classification & Moisture Sensitivity Level

#### ESD Classification

HBM Class 1A  
Voltage Level: 300 V

MM Class A  
Voltage Level: 50 V

CAUTION: ESD-sensitive device!

#### Moisture Sensitivity Level (MSL)

Level 3 at 260°C reflow

### APPLICATION CIRCUIT

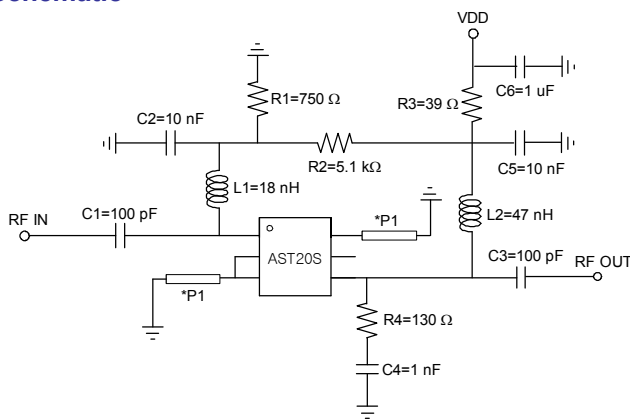
698 ~ 787 MHz

+5 V

Parameter	Symbol	Unit	Frequency (MHz)	
			698	787
Power Gain	$G_p$	dB	20	19
Noise Figure	NF	dB	0.55	0.5
Input Return Loss	$RL_{in}$	dB	-8	-10
Output Return Loss	$RL_{out}$	dB	-15	-15
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	16.5	
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	29	
Circuit Current	$I_{cc}$	mA	48	48

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

### Schematic



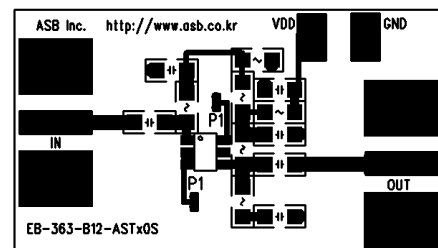
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 2.0 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

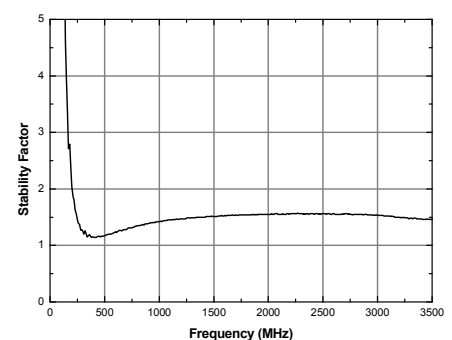
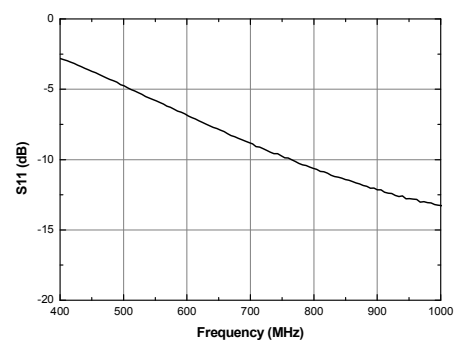
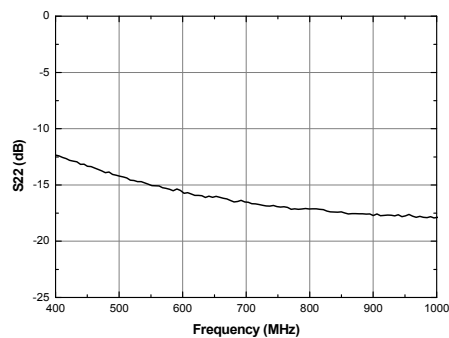
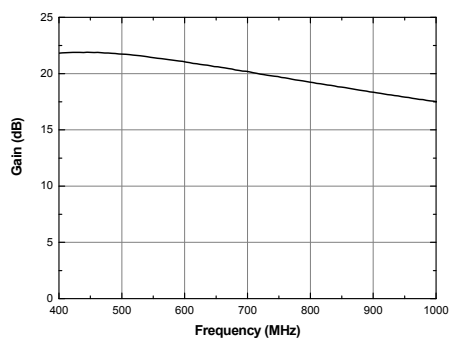
Top



Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

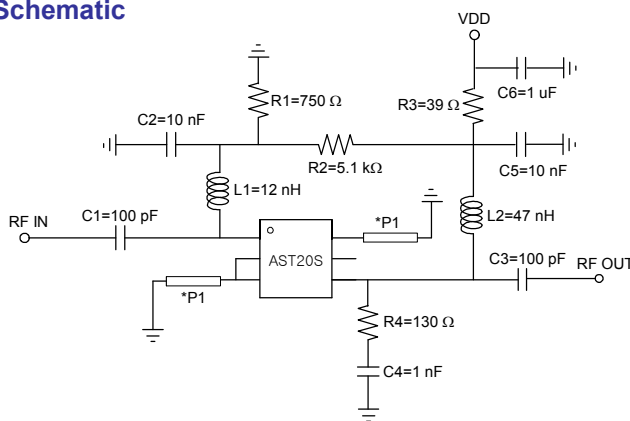
900 MHz

+5 V

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 900 MHz		18		dB
Noise Figure	NF	F = 900 MHz		0.6		dB
Input Return Loss	$RL_{in}$	F = 900 MHz		-13		dB
Output Return Loss	$RL_{out}$	F = 900 MHz		-15		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 900 MHz		17		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 900 MHz		30		dBm
Circuit Current	$I_{cc}$	F = 900 MHz Non-RF		48		mA

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

### Schematic



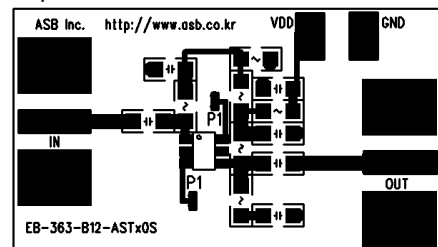
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 2.0 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

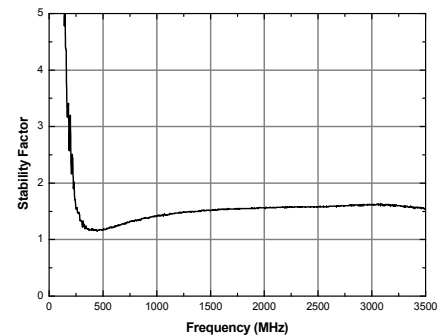
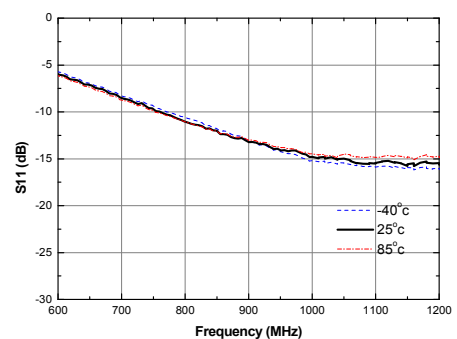
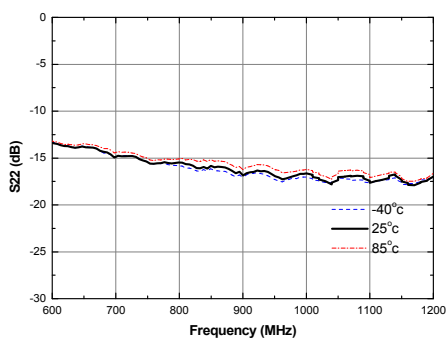
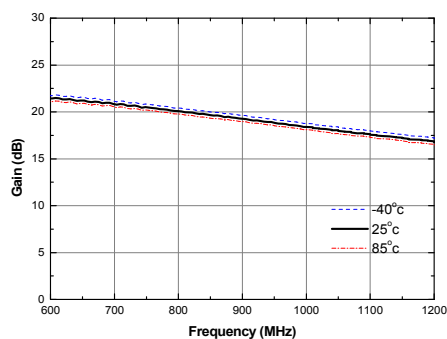
Top

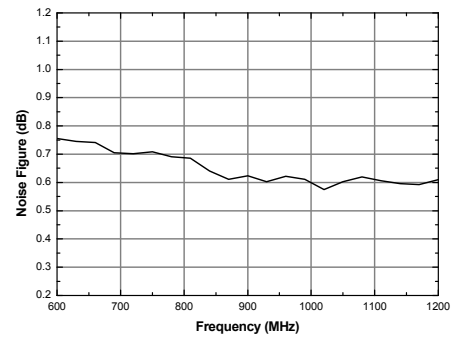
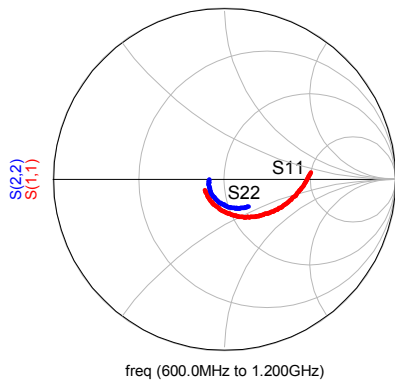


Bottom

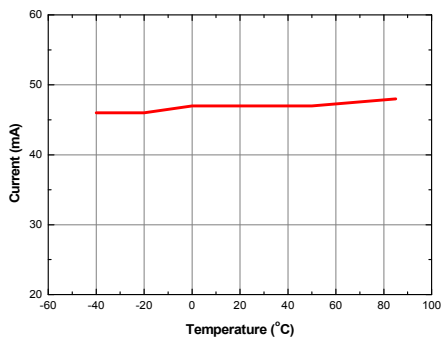


### S-parameters & Noise Figure

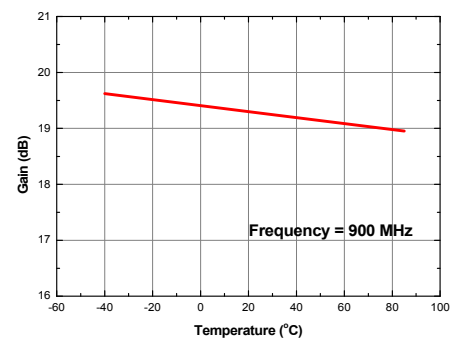




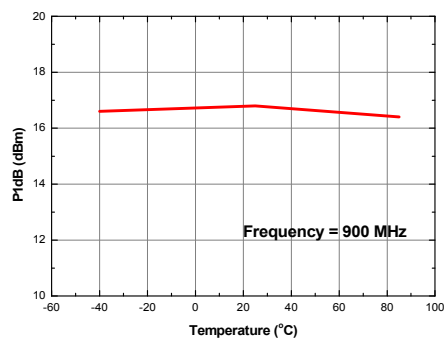
### Current vs. Temperature



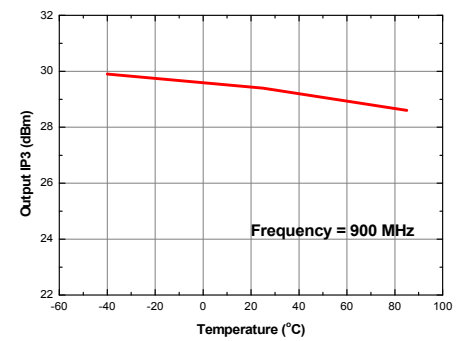
### Gain vs. Temperature



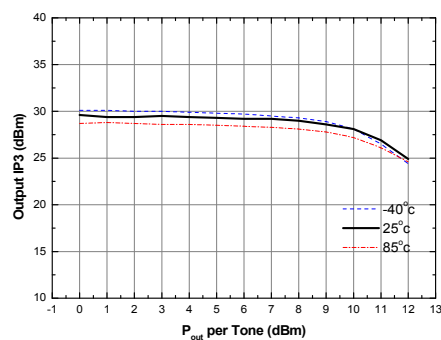
### P1dB vs. Temperature



### Output IP3 vs. Temperature



### Output IP3 vs. Tone Power (Frequency = 900 MHz)



### APPLICATION CIRCUIT

$S_{11} < -18 \text{ dB}$

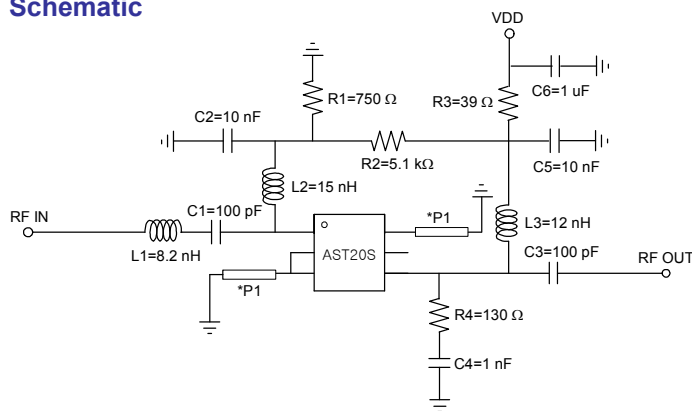
880 ~ 953 MHz

+5 V

Parameter	Symbol	Unit	Frequency (MHz)	
			880	953
Power Gain	$G_p$	dB	19.5	19
Noise Figure	NF	dB	0.8	0.8
Input Return Loss	$RL_{in}$	dB	-20	-18
Output Return Loss	$RL_{out}$	dB	-14	-14
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	16.5	16.5
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	27	28
Circuit Current	$I_{cc}$	mA	48	48

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

### Schematic

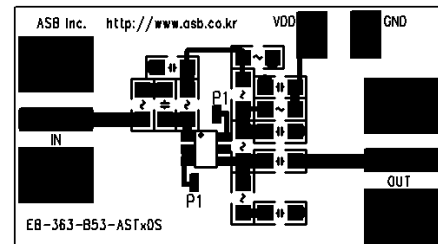


Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8 \text{ mm}$ .

\*P1 Length: 1.1 mm, Width: 0.3 mm

2) Gain and  $S_{11}$  are in trade-off and varied with the length of P1

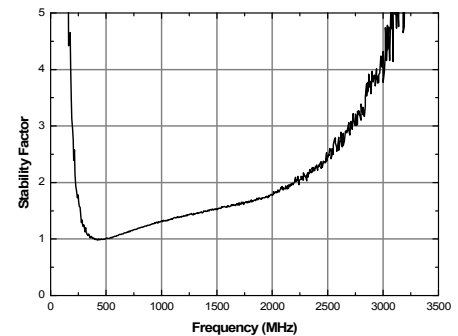
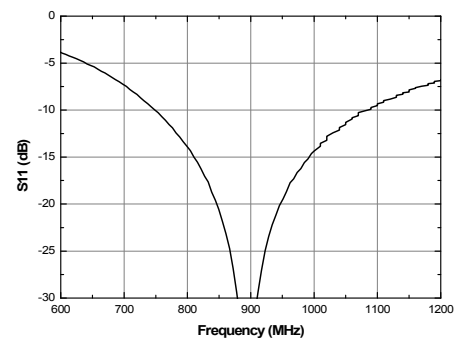
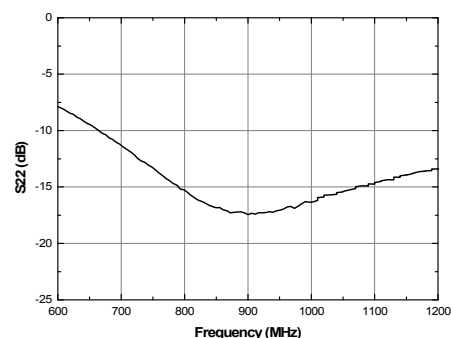
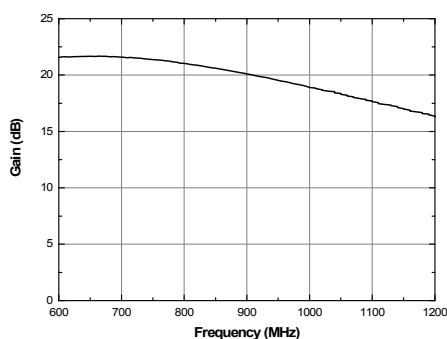
### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T) Top



### Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

*Balanced Type*

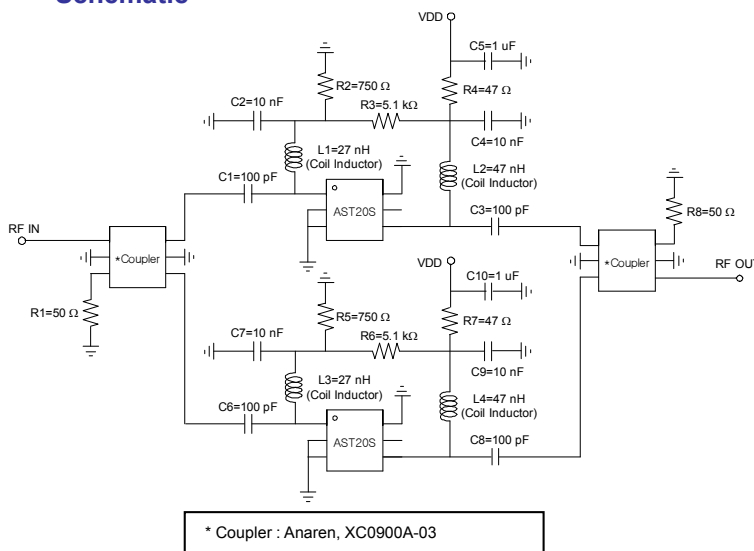
900 MHz

+5 V

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 900 MHz		22.8		dB
Noise Figure	NF	F = 900 MHz		0.61		dB
Input Return Loss	$RL_{in}$	F = 900 MHz		-30		dB
Output Return Loss	$RL_{out}$	F = 900 MHz		-30		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 900 MHz		20.2		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 900 MHz		33.3		dBm
Circuit Current	$I_{cc}$	F = 900 MHz Non-RF		80		mA

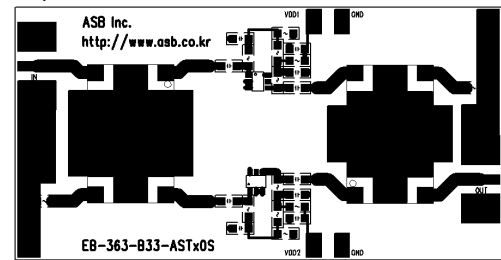
1) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1MHz.

### Schematic



### Board Layout (FR4, 50x26 mm<sup>2</sup>, 0.8T)

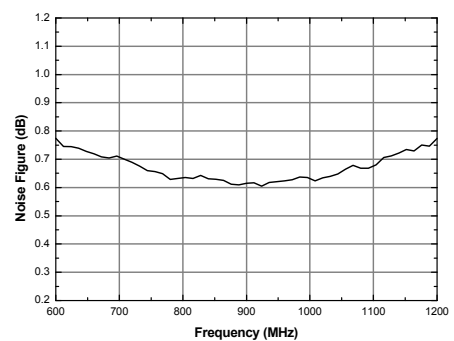
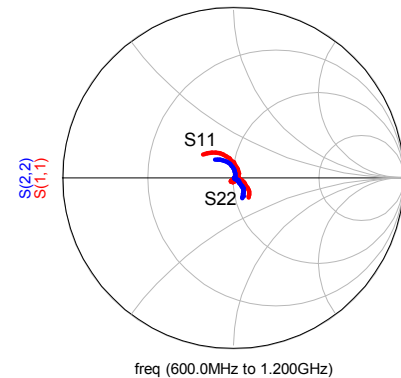
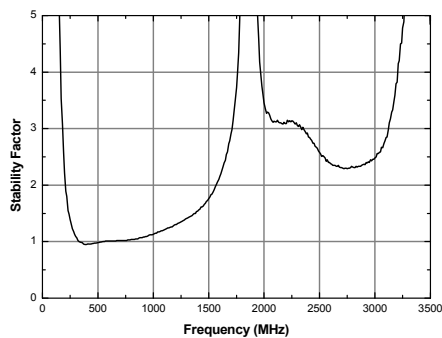
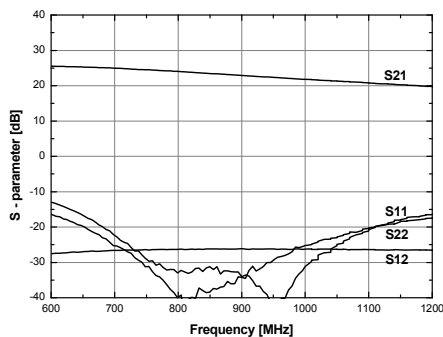
Top



Bottom



### S-parameters & Noise Figure



### APPLICATION CIRCUIT

$S_{11} < -18 \text{ dB}$

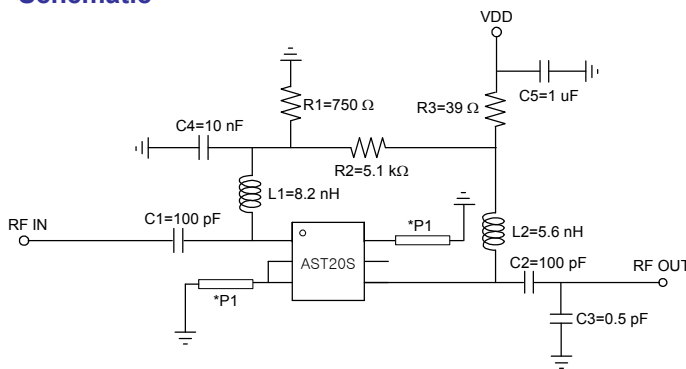
1755 ~ 2140 MHz

+5 V

Parameter	Symbol	Unit	Frequency (MHz)	
			1755	2140
Power Gain	$G_p$	dB	13	11.5
Noise Figure	NF	dB	0.7	0.8
Input Return Loss	$RL_{in}$	dB	-20	-18
Output Return Loss	$RL_{out}$	dB	-15	-14
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	17	17.5
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	32	33
Circuit Current	$I_{cc}$	mA	48	48

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

### Schematic

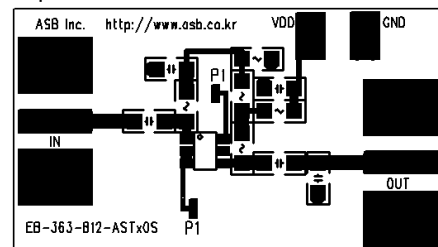


Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8 \text{ mm}$ .

\*P1 Length: 2.2 mm, Width: 0.3 mm

2) Gain and  $S_{11}$  are in trade-off and varied with the length of P1

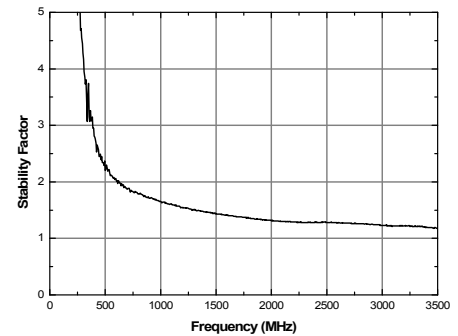
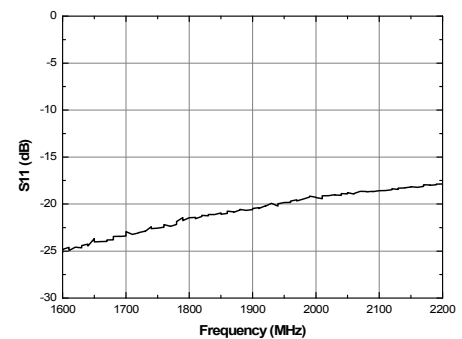
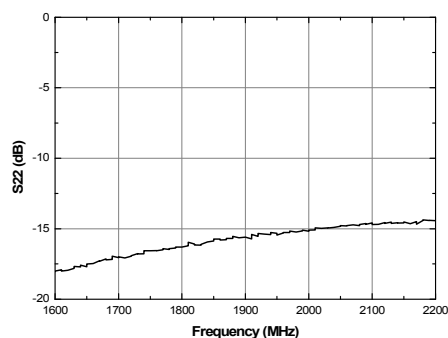
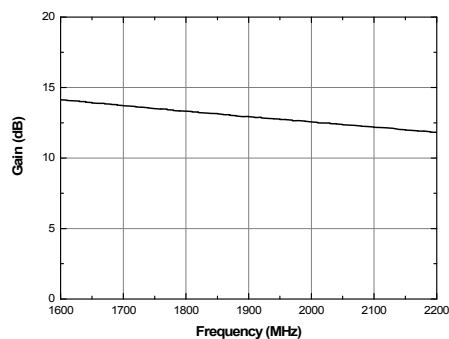
### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T) Top



### Bottom



### S-parameters & K-factor





### APPLICATION CIRCUIT

*High Gain*

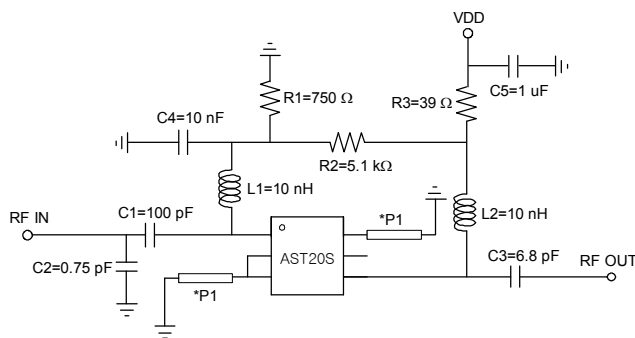
**1950 MHz**

**+5 V**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 1.95 GHz		15.5		dB
Noise Figure	NF	F = 1.95 GHz		0.75		dB
Input Return Loss	$RL_{in}$	F = 1.95 GHz		-11		dB
Output Return Loss	$RL_{out}$	F = 1.95 GHz		-13		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 1.95 GHz		18		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 1.95 GHz		33.5		dBm
Circuit Current	$I_{cc}$	F = 1.95 GHz Non-RF		48		mA

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

### Schematic



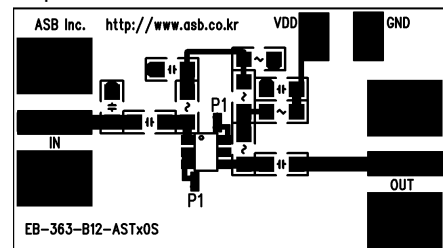
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 0.75 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

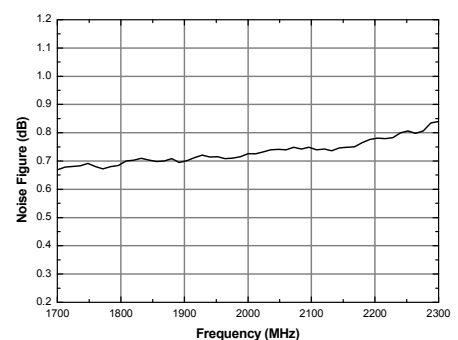
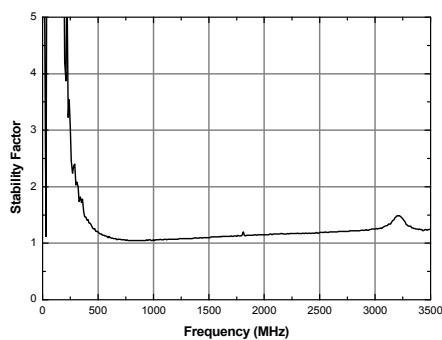
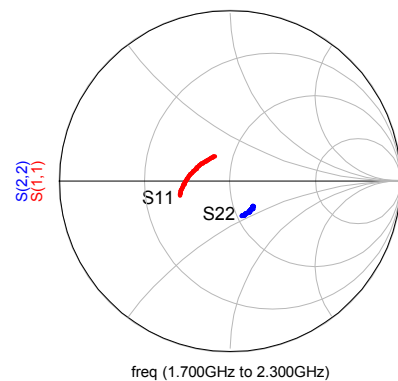
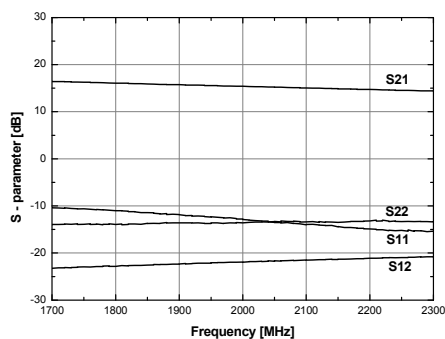
Top



Bottom



### S-parameters & Noise Figure



### APPLICATION CIRCUIT

Low Noise

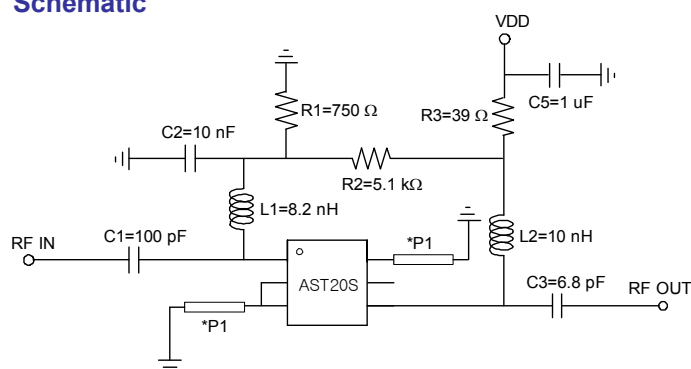
1950 MHz

+5 V

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 1.95 GHz		13.8		dB
Noise Figure	NF	F = 1.95 GHz		0.6		dB
Input Return Loss	$RL_{in}$	F = 1.95 GHz		-11		dB
Output Return Loss	$RL_{out}$	F = 1.95 GHz		-15		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 1.95 GHz		19		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 1.95 GHz		34		dBm
Circuit Current	$I_{cc}$	F = 1.95 GHz Non-RF		48		mA

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

### Schematic



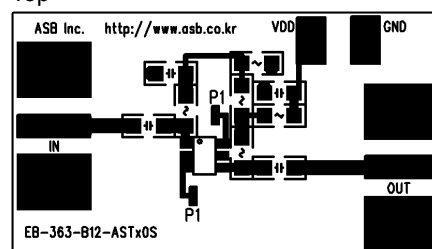
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 1.5 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

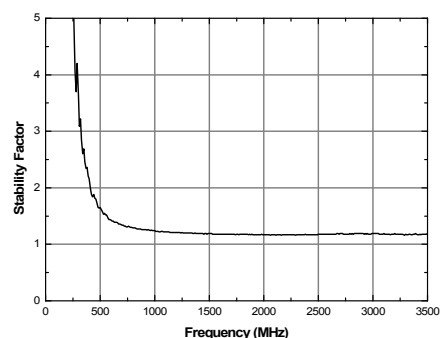
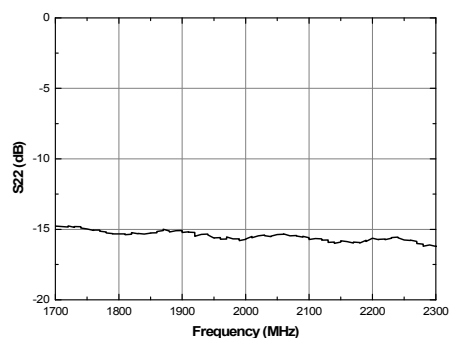
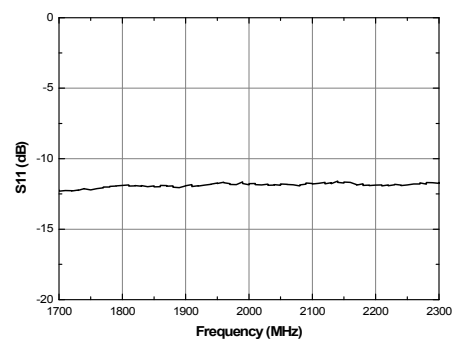
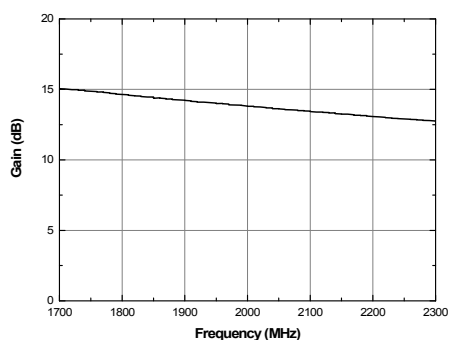
Top



Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

*Balanced Type*

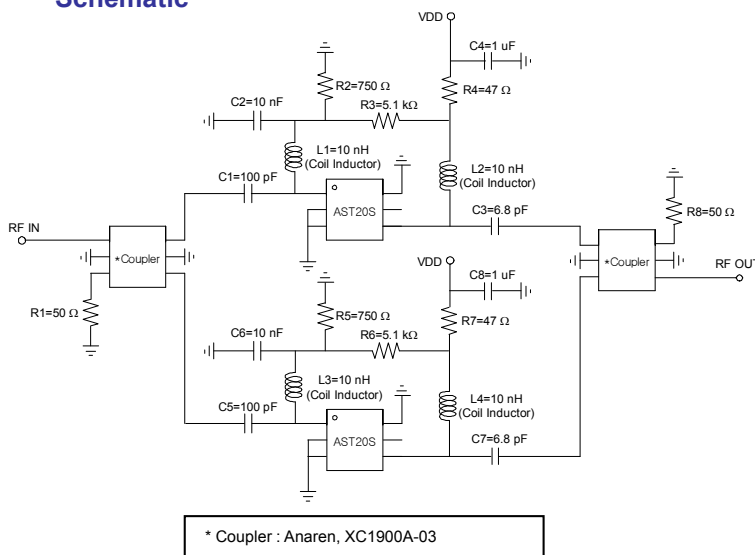
1950 MHz

+5 V

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 1.95 GHz		15.6		dB
Noise Figure	NF	F = 1.95 GHz		0.79		dB
Input Return Loss	$RL_{in}$	F = 1.95 GHz		-14		dB
Output Return Loss	$RL_{out}$	F = 1.95 GHz		-14		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 1.95 GHz		19.6		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 1.95 GHz		35		dBm
Circuit Current	$I_{cc}$	F = 1.95 GHz Non-RF		80		mA

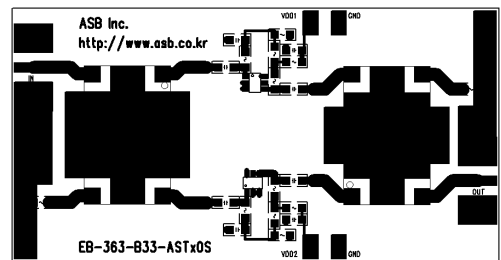
1) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1MHz.

### Schematic

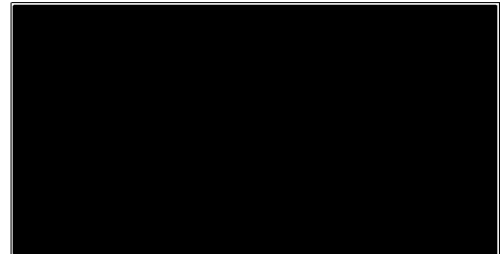


### Board Layout (FR4, 50x26 mm<sup>2</sup>, 0.8T)

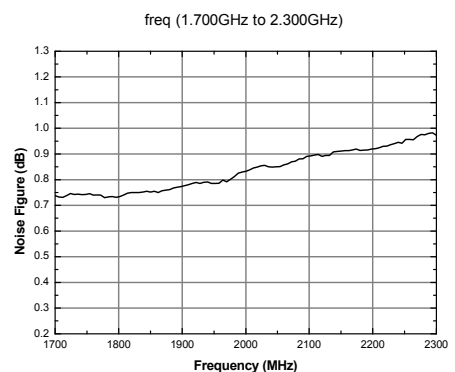
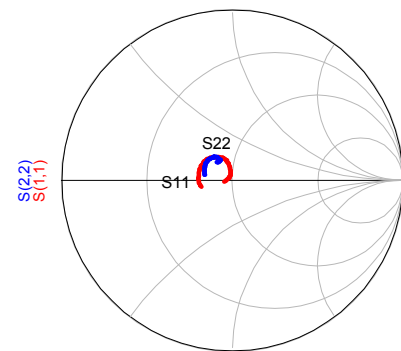
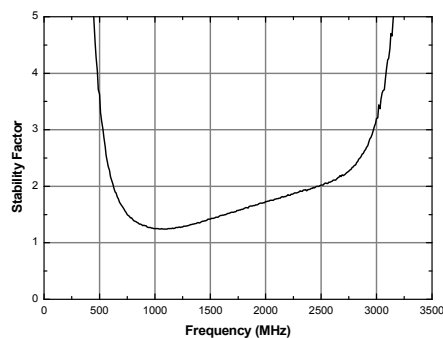
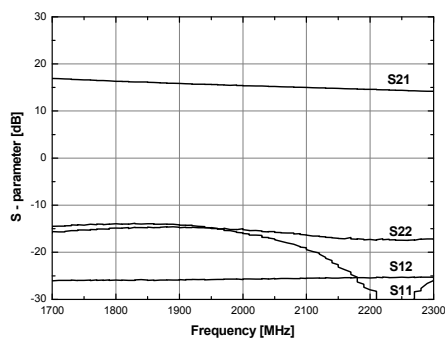
Top



Bottom



### S-parameters & Noise Figure



### APPLICATION CIRCUIT

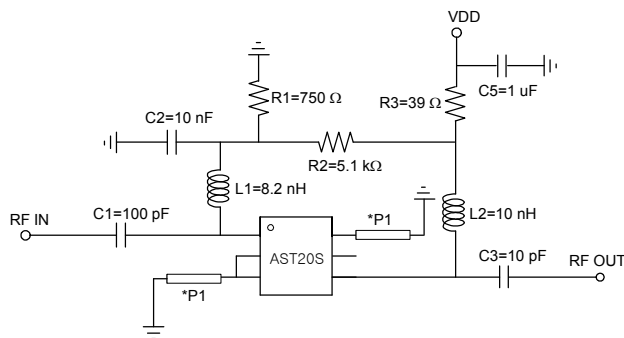
2140 MHz

+5 V

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 2.14 GHz		12.5		dB
Noise Figure	NF	F = 2.14 GHz		0.8		dB
Input Return Loss	$RL_{in}$	F = 2.14 GHz		-13		dB
Output Return Loss	$RL_{out}$	F = 2.14 GHz		-13		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 2.14 GHz		18.5		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 2.14 GHz		33.5		dBm
Circuit Current	$I_{cc}$	F = 2.14 GHz Non-RF		48		mA

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

### Schematic

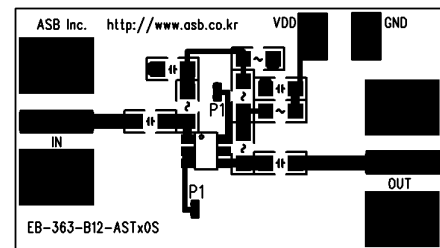


Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

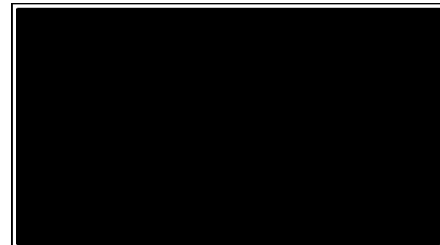
\*P1 Length: 2.5 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

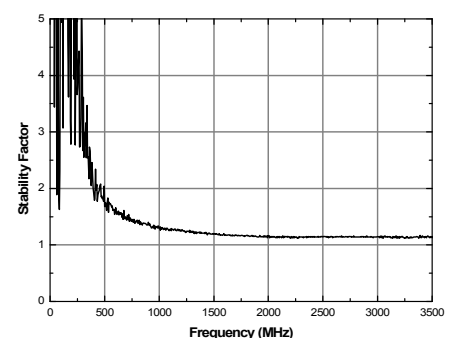
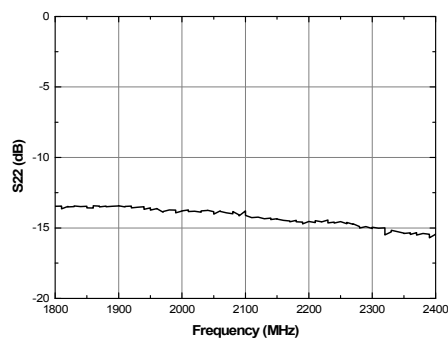
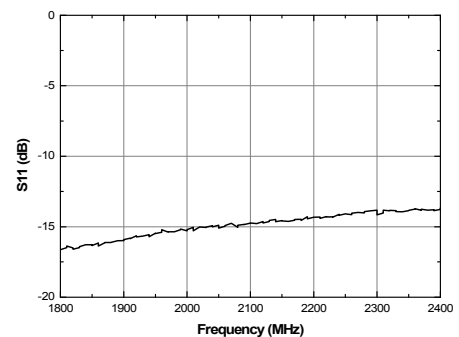
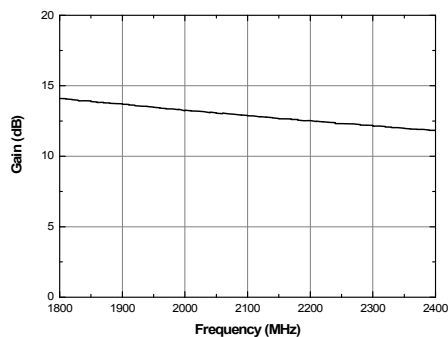
### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T) Top



### Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

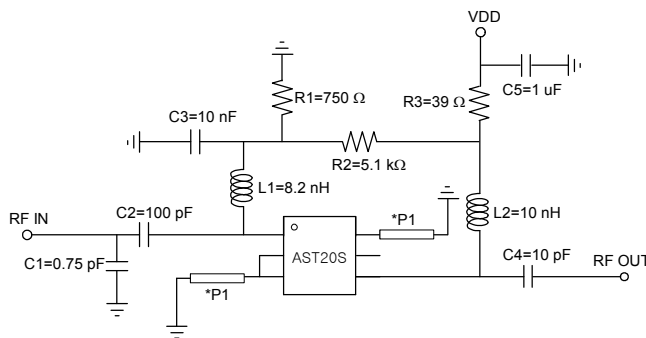
2450 MHz

+5 V

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 2.45 GHz		13		dB
Noise Figure	NF	F = 2.45 GHz		0.9		dB
Input Return Loss	$RL_{in}$	F = 2.45 GHz		-15		dB
Output Return Loss	$RL_{out}$	F = 2.45 GHz		-13		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 2.45 GHz		18.5		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 2.45 GHz		33		dBm
Circuit Current	$I_{cc}$	F = 2.45 GHz Non-RF		48		mA

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

### Schematic



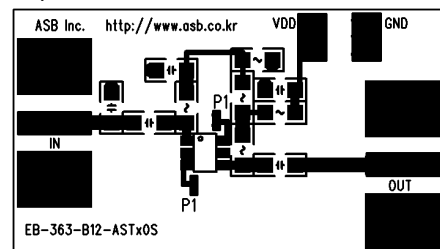
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 1.0 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

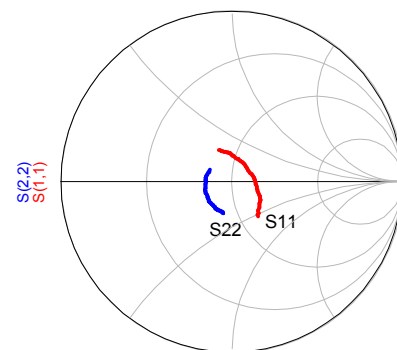
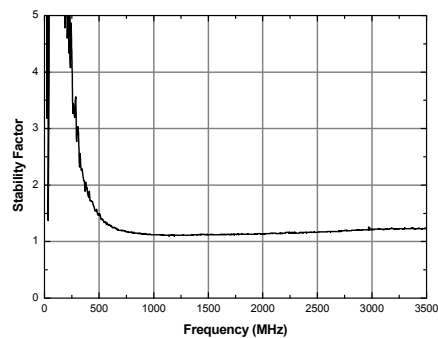
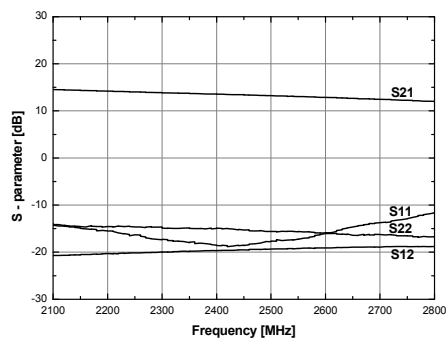
Top



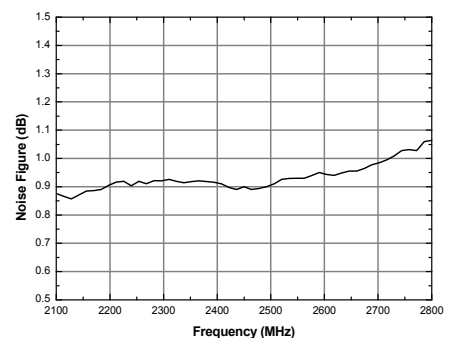
Bottom



### S-parameters & Noise Figure



freq (2.100GHz to 2.800GHz)



### APPLICATION CIRCUIT

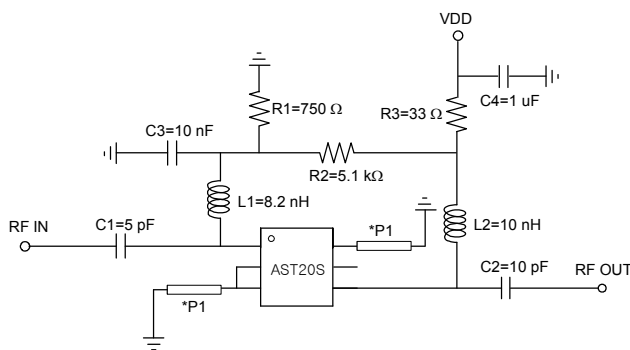
2500 MHz

+3.3 V

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 2.5 GHz		11		dB
Noise Figure	NF	F = 2.5 GHz		0.9		dB
Input Return Loss	$RL_{in}$	F = 2.5 GHz		-10		dB
Output Return Loss	$RL_{out}$	F = 2.5 GHz		-14		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 2.5 GHz		15		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 2.5 GHz		29.5		dBm
Circuit Current	$I_{cc}$	F = 2.5 GHz Non-RF		20		mA

1) OIP3 is measured with two tones at an output power of +0dBm/tone separated by 1MHz.

### Schematic

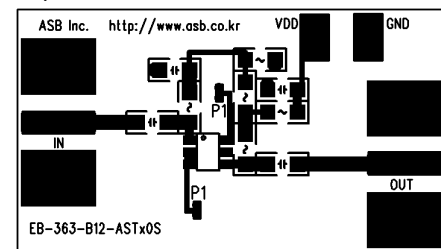


Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

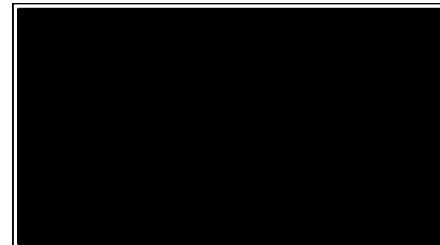
\*P1 Length: 2.5 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

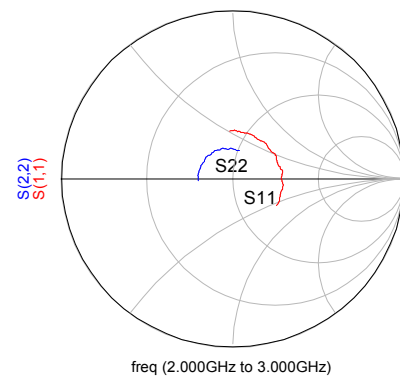
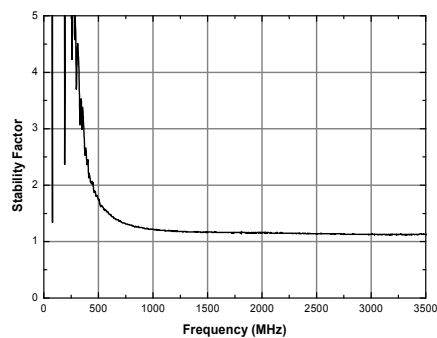
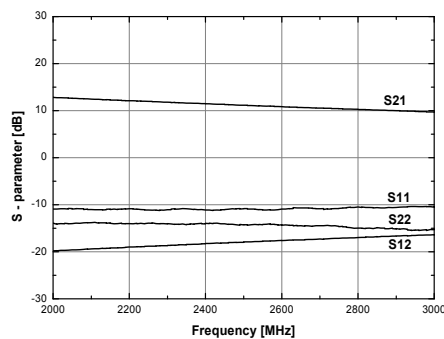
### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T) Top



### Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

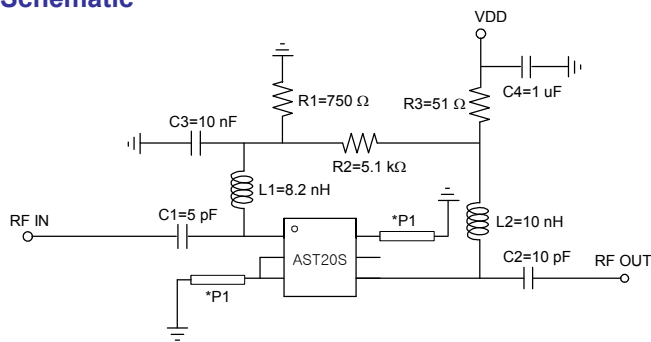
2600 MHz

+5 V

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 2.6 GHz		11		dB
Noise Figure	NF	F = 2.6 GHz		0.9		dB
Input Return Loss	$RL_{in}$	F = 2.6 GHz		-11		dB
Output Return Loss	$RL_{out}$	F = 2.6 GHz		-15		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 2.6 GHz		17.5		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 2.6 GHz		33		dBm
Circuit Current	$I_{cc}$	F = 2.6 GHz Non-RF		38		mA

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

### Schematic

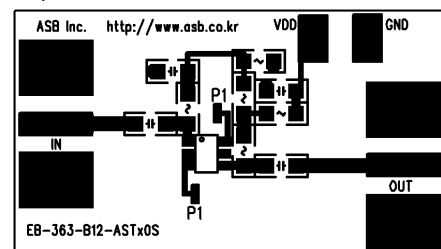


Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

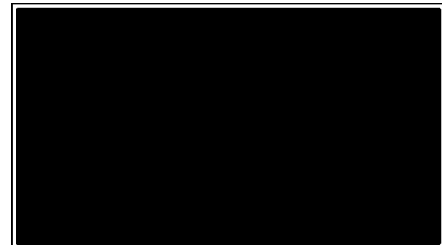
\*P1 Length: 1.5 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

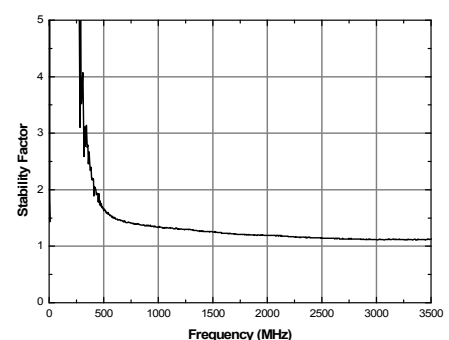
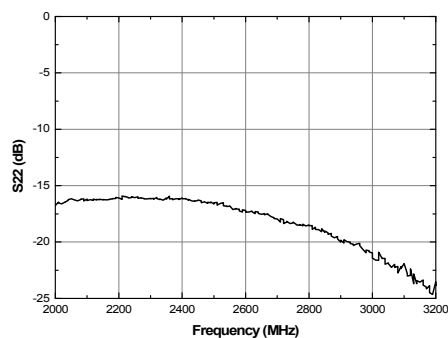
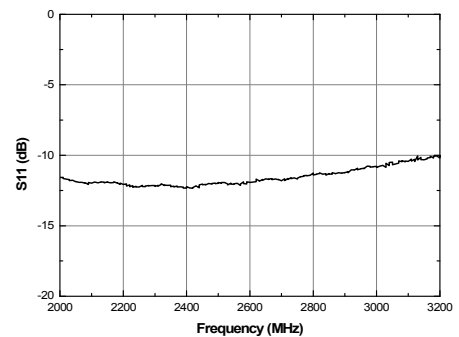
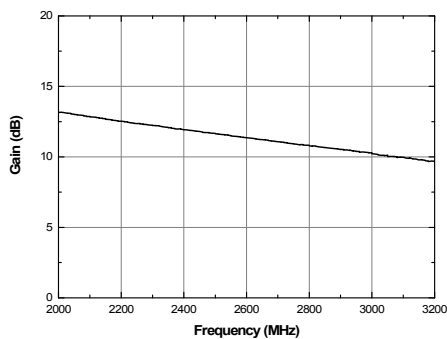
### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T) Top



### Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

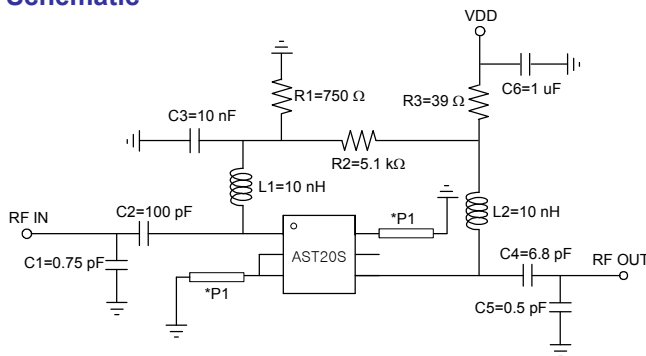
3500 MHz

+5 V

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 3.5 GHz		11		dB
Noise Figure	NF	F = 3.5 GHz		2.1		dB
Input Return Loss	$RL_{in}$	F = 3.5 GHz		-12		dB
Output Return Loss	$RL_{out}$	F = 3.5 GHz		-15		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 3.5 GHz		18		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 3.5 GHz		30		dBm
Circuit Current	$I_{cc}$	F = 3.5 GHz Non-RF		48		mA

1) OIP3 is measured with two tones at an output power of +0 dBm/tone separated by 1MHz.

### Schematic



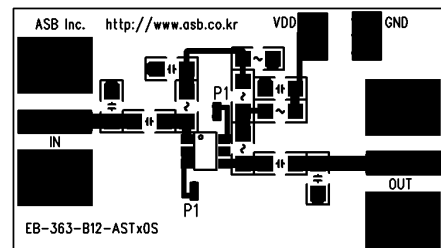
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 1.7 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

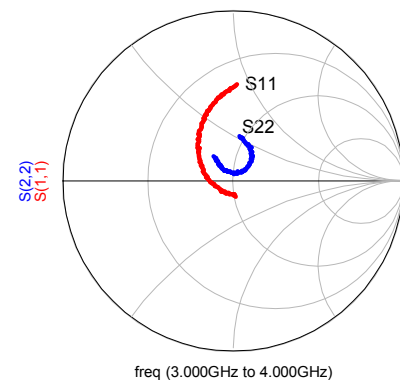
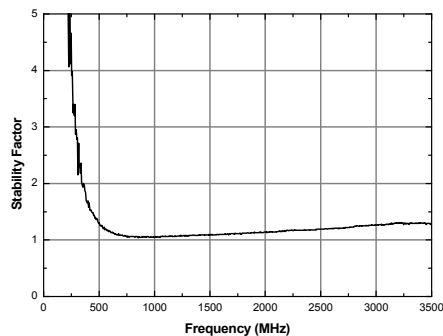
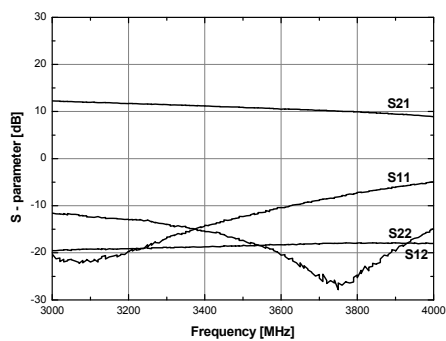
Top



Bottom



### S-parameters & K-factor





### APPLICATION CIRCUIT

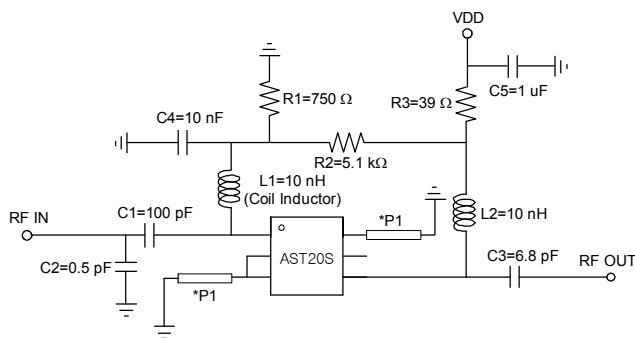
1200 ~ 1900 MHz

+5 V

Parameter	Symbol	Unit	Frequency (MHz)		
			1200	1550	1900
Power Gain	$G_p$	dB	18.5	16.6	15.9
Noise Figure	NF	dB	0.6	0.6	0.7
Input Return Loss	$RL_{in}$	dB	-9	-9	-10
Output Return Loss	$RL_{out}$	dB	-14	-14	-14
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	17	17.5	18
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	31	32	33
Circuit Current	$I_{cc}$	mA	48	48	48

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

### Schematic



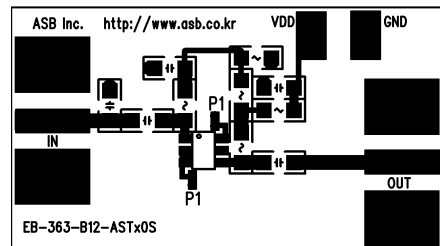
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 0.75 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

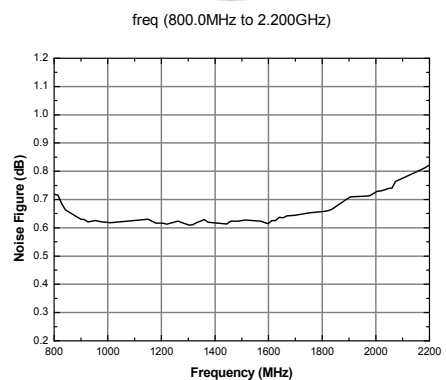
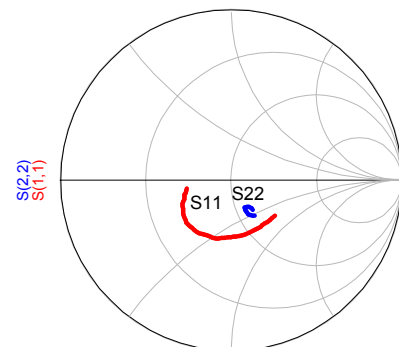
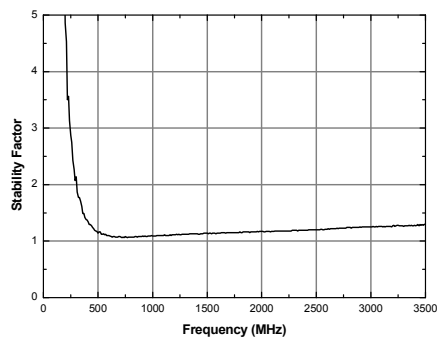
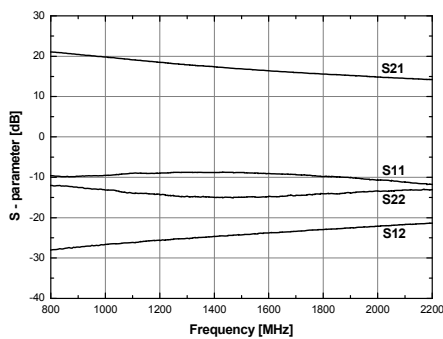
Top



Bottom



### S-parameters & Noise Figure



### APPLICATION CIRCUIT

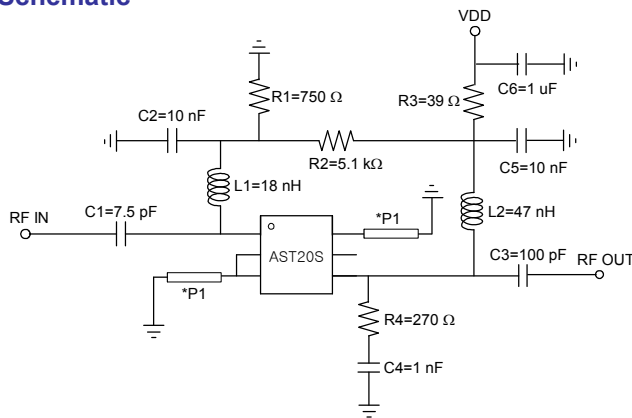
433 MHz

+5 V

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 433 MHz		23.5		dB
Noise Figure	NF	F = 433 MHz		0.95		dB
Input Return Loss	$RL_{in}$	F = 433 MHz		-9		dB
Output Return Loss	$RL_{out}$	F = 433 MHz		-9		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 433 MHz		16		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 433 MHz		27.5		dBm
Circuit Current	$I_{cc}$	F = 433 MHz Non-RF		48		mA

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

### Schematic



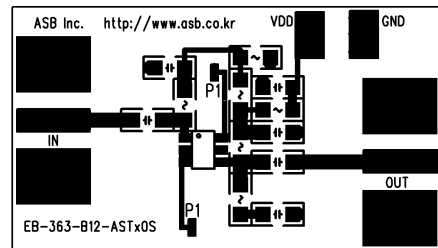
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 3.5 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

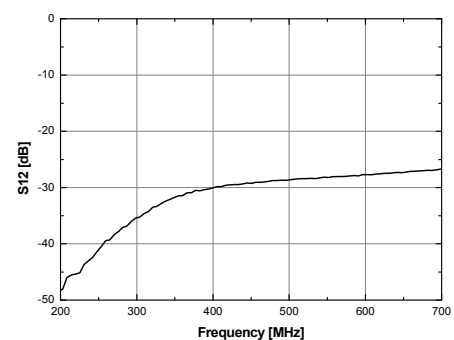
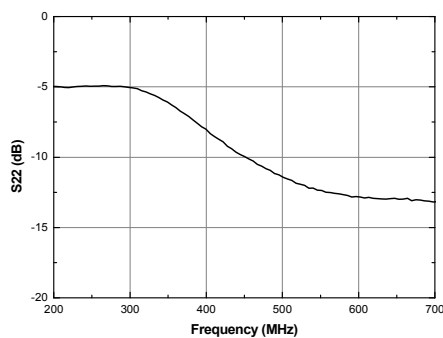
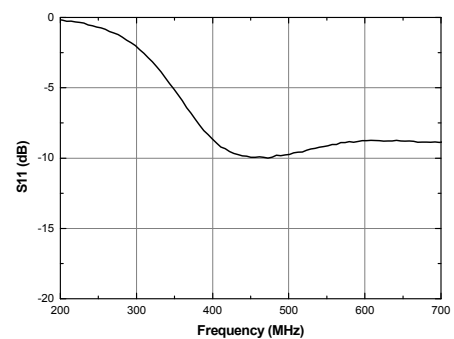
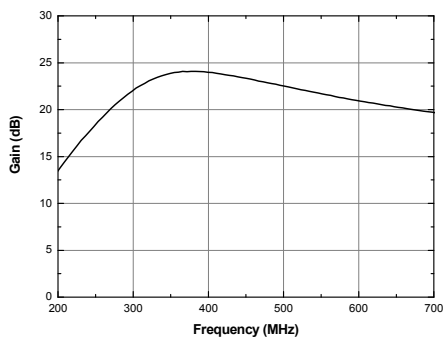
Top



Bottom



### S-parameters



### APPLICATION CIRCUIT

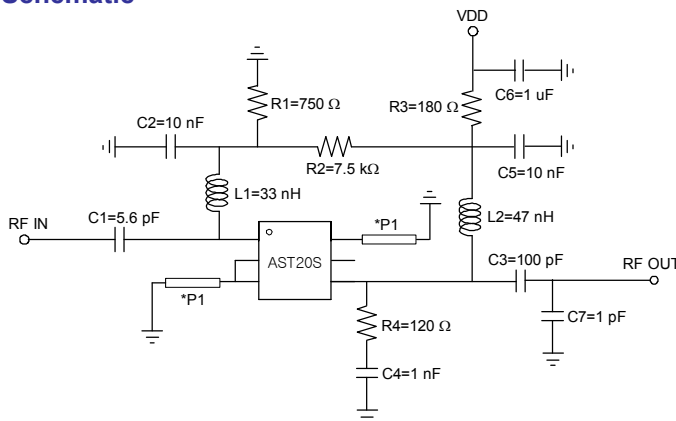
315 MHz

+5 V / 11 mA

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 315 MHz		22		dB
Noise Figure	NF	F = 315 MHz		1.0		dB
Input Return Loss	$RL_{in}$	F = 315 MHz		-7		dB
Output Return Loss	$RL_{out}$	F = 315 MHz		-12		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 315 MHz		1.6		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 315 MHz		17		dBm
Circuit Current	$I_{cc}$	F = 315 MHz Non-RF		11		mA

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

### Schematic



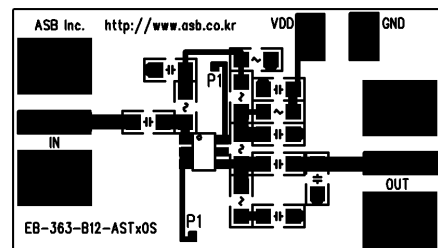
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 3.6 mm, Width: 0.3 mm

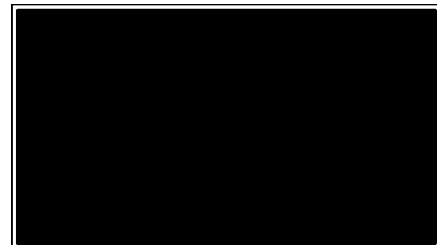
2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

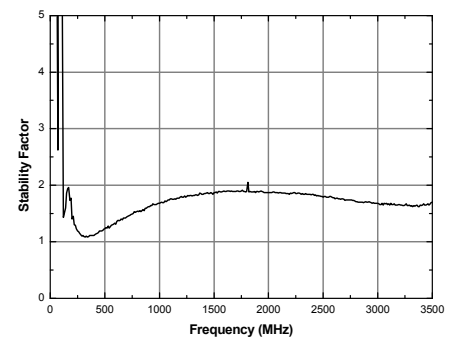
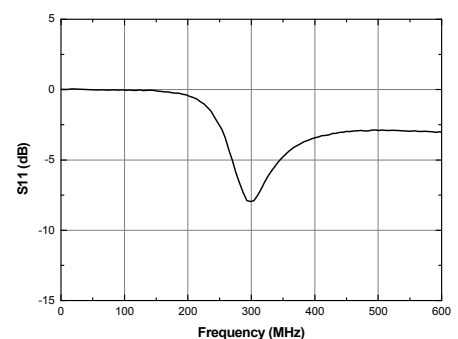
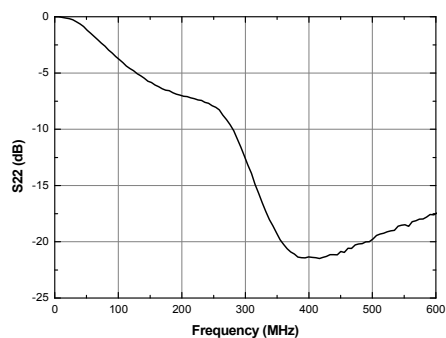
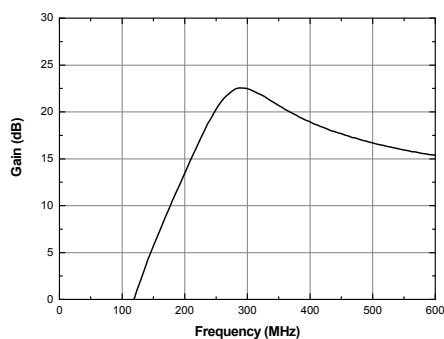
Top



Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

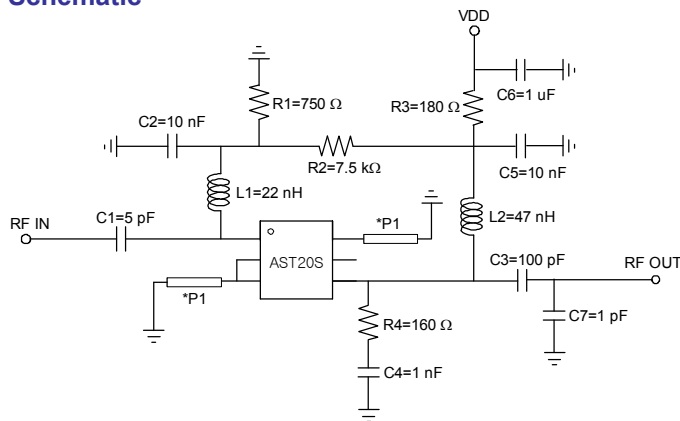
433 MHz

+5 V / 11 mA

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain	$G_p$	F = 433 MHz		20.5		dB
Noise Figure	NF	F = 433 MHz		0.9		dB
Input Return Loss	$RL_{in}$	F = 433 MHz		-8		dB
Output Return Loss	$RL_{out}$	F = 433 MHz		-10		dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 433 MHz		2.5		dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 433 MHz		18		dBm
Circuit Current	$I_{cc}$	F = 433 MHz Non-RF		11		mA

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

### Schematic



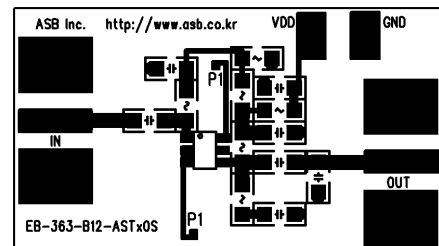
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 3.6 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

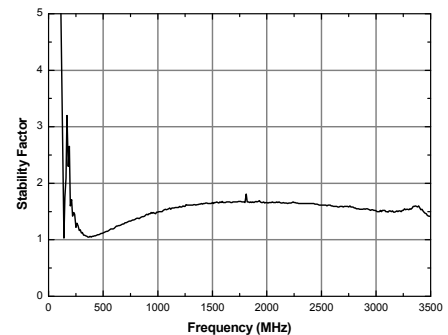
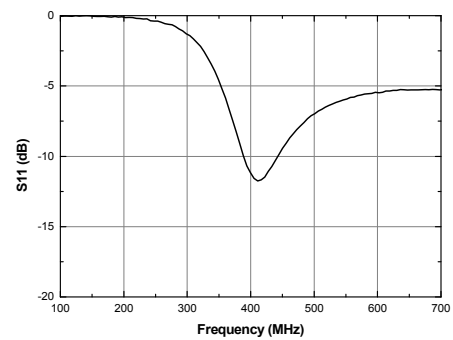
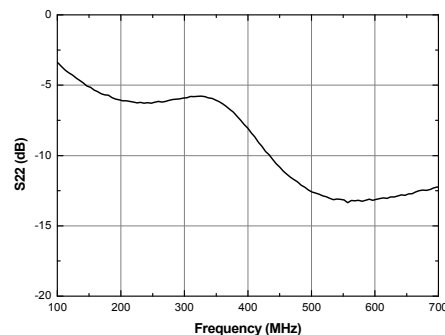
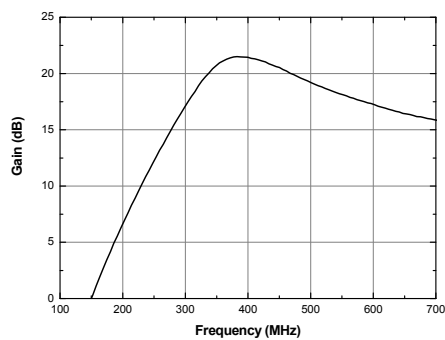
Top



Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

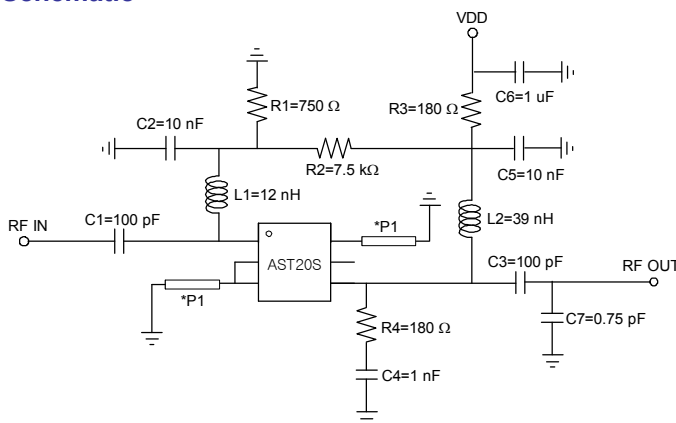
850 ~ 950 MHz

+5 V / 11 mA

Parameter	Symbol	Unit	Frequency (MHz)	
			868	915
Power Gain	$G_p$	dB	15	14.5
Noise Figure	NF	dB	0.8	0.7
Input Return Loss	$RL_{in}$	dB	-9	-9
Output Return Loss	$RL_{out}$	dB	-8	-8
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	3	3
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	18.5	18.5
Circuit Current	$I_{cc}$	mA	11	11

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

### Schematic



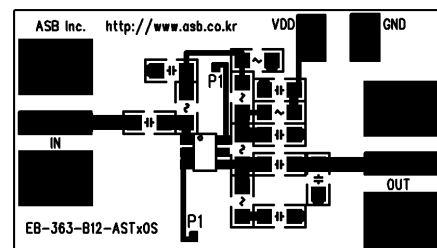
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 3.6 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

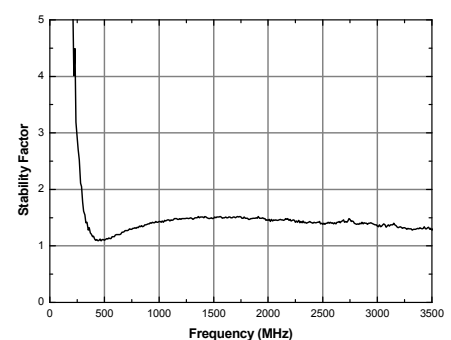
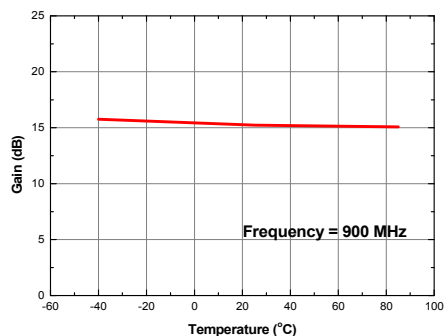
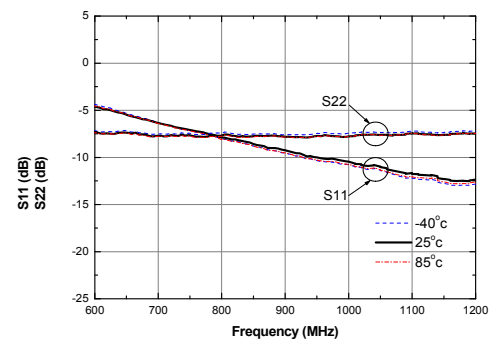
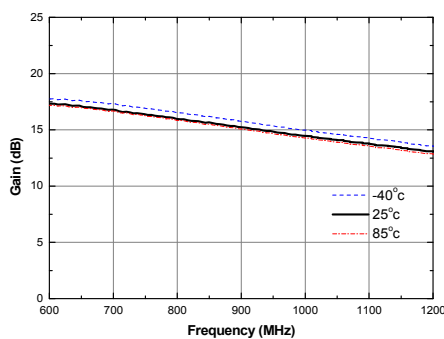
Top



Bottom



### S-parameters & K-factor



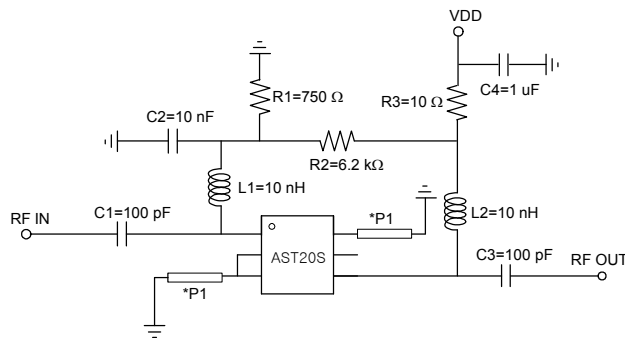
### APPLICATION CIRCUIT

**GPS**  
**1210 ~ 1620 MHz**  
**+3 V / 18 mA**

Parameter	Symbol	Unit	Frequency (MHz)	
			1210~1270	1560~1620
Power Gain	$G_p$	dB	17	15
Noise Figure	NF	dB	0.55	0.55
Input Return Loss	$RL_{in}$	dB	-11	-11
Output Return Loss	$RL_{out}$	dB	-10	-12
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	15.5	16
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	25.5	27
Circuit Current	$I_{cc}$	mA	18	18

1) OIP3 is measured with two tones at an output power of +0 dBm/tone separated by 1MHz.

### Schematic



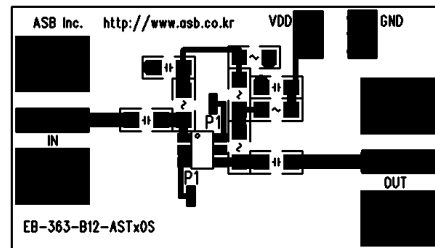
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 1.8 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

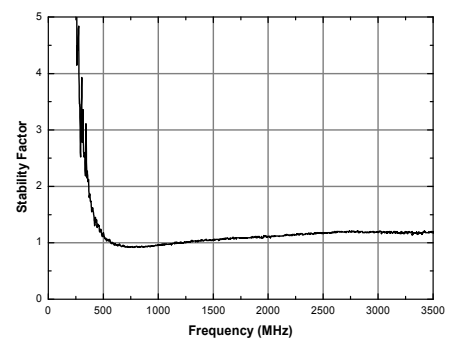
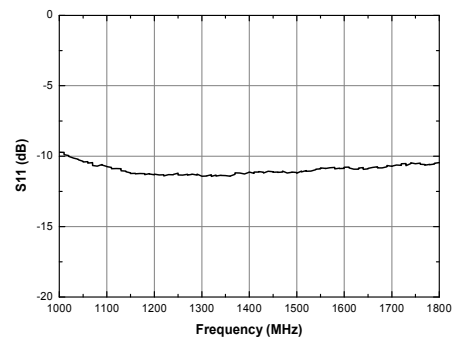
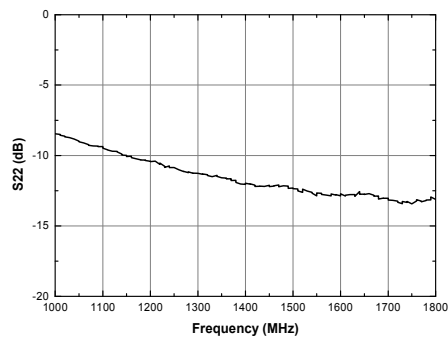
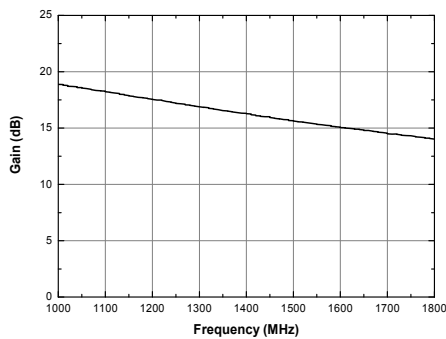
Top



Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

1472 MHz

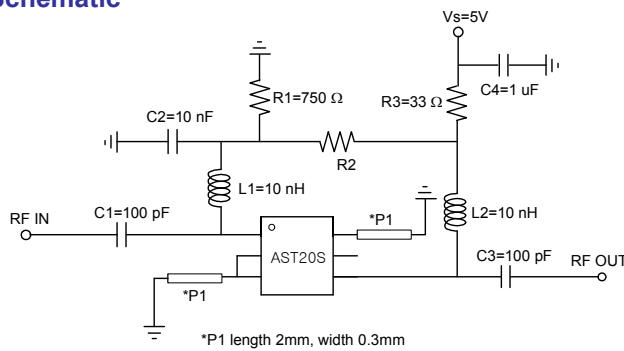
+5V

Parameter	Symbol	Test Conditions	TYP <sup>1)</sup>	TYP <sup>2)</sup>	Unit
Power Gain	$G_p$	F = 1472 GHz	15	15.5	dB
Noise Figure	NF	F = 1472 GHz	0.45	0.5	dB
Input Return Loss	$RL_{in}$	F = 1472 GHz	-10	-10	dB
Output Return Loss	$RL_{out}$	F = 1472 GHz	-13	-15	dB
1 dB Gain Compression Output Power	$P_{o(1dB)}$	F = 1472 GHz	15	18	dBm
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	F = 1472 GHz	29.5	32	dBm
Circuit Current	$I_{cc}$	F = 1472 GHz Non-RF	20	45	mA

1) OIP3 is measured with two tones at an output power of +0dBm/tone separated by 1MHz.

2) TYP<sup>1)</sup>: R2 = 8.2K $\Omega$ , TYP<sup>2)</sup>: R2 = 5.1K $\Omega$

### Schematic



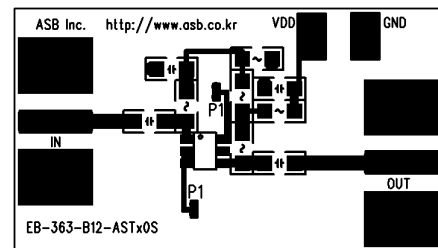
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 2.5 mm, Width: 0.3 mm

2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

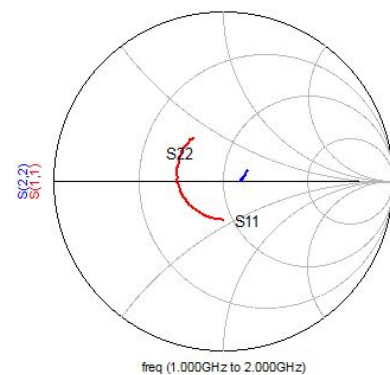
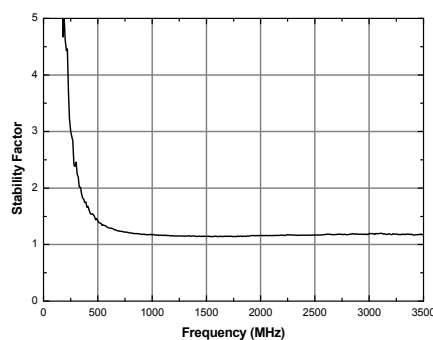
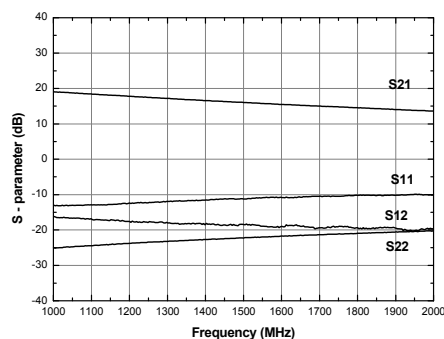
Top



Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

*Satellite Phone*

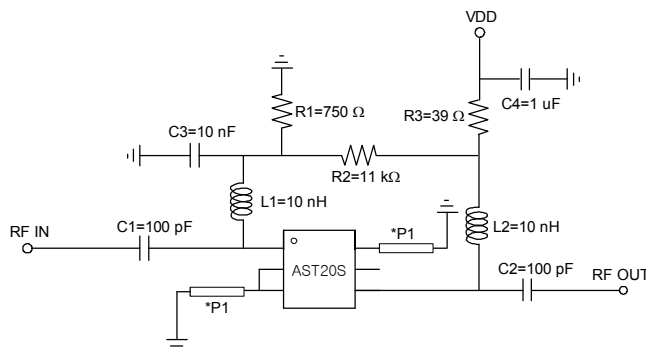
1525 ~ 1559 MHz

+5 V / 15 mA

Parameter	Symbol	Unit	Frequency (MHz)	
			1525	1559
Power Gain	$G_p$	dB	14.5	14
Noise Figure	NF	dB	0.55	0.55
Input Return Loss	$RL_{in}$	dB	-9	-9
Output Return Loss	$RL_{out}$	dB	-14	-14
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	16.5	
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	25	
Circuit Current	$I_{cc}$	mA	15	

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

### Schematic



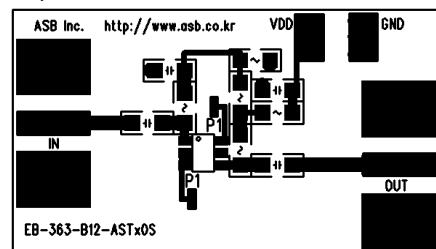
Note: 1) the length of the strip line P1 is given as below at the PCB with  $\epsilon_r = 4.5$  and  $T = 0.8$  mm.

\*P1 Length: 1.8 mm, Width: 0.3 mm

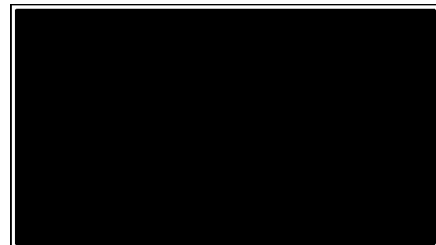
2) Gain and S11 are in trade-off and varied with the length of P1

### Board Layout (FR4, 23x13 mm<sup>2</sup>, 0.8T)

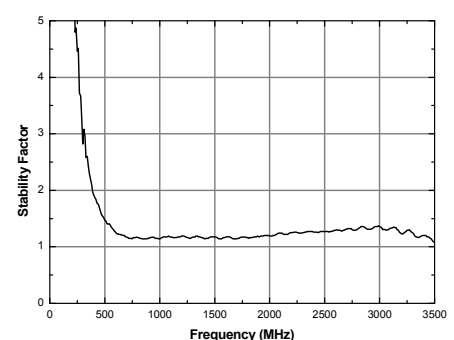
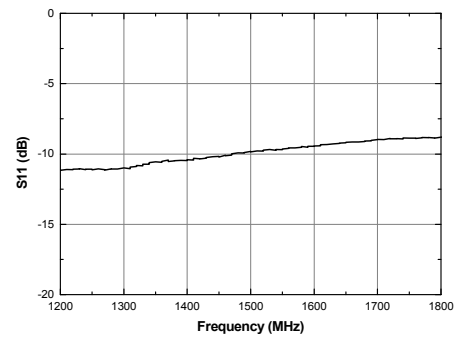
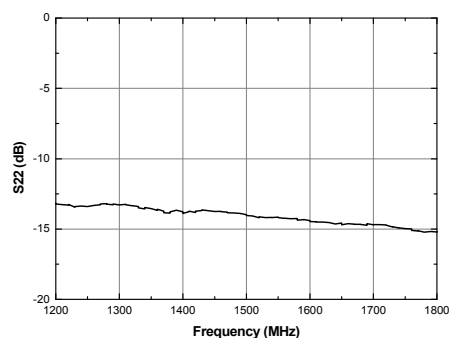
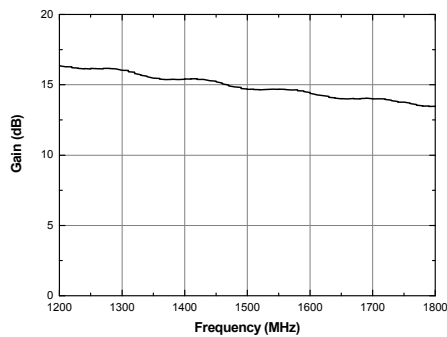
Top



Bottom



### S-parameters & K-factor





### APPLICATION CIRCUIT

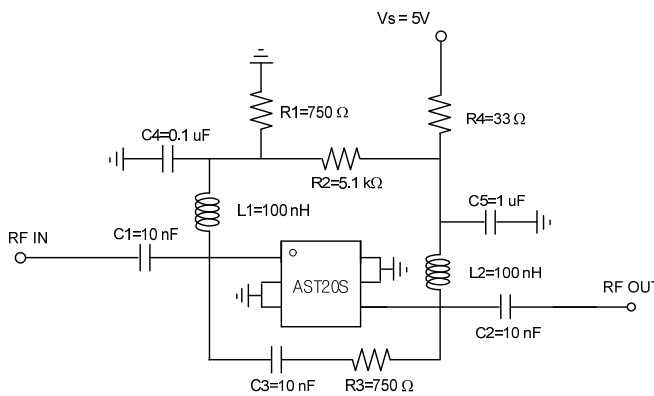
174 ~ 240 MHz

+5 V

Parameter	Symbol	Unit	Frequency (MHz)	
			174	240
Power Gain	$G_p$	dB	21	21
Noise Figure	NF	dB	0.9	1.0
Input Return Loss	$RL_{in}$	dB	-18	-15
Output Return Loss	$RL_{out}$	dB	-15	-14
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	17.5	17
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	29.5	29
Circuit Current	$I_{cc}$	mA	45	45

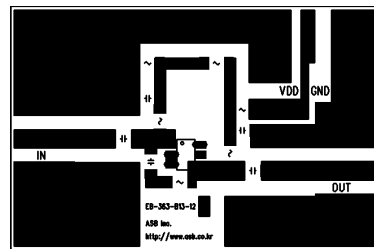
1) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1MHz.

### Schematic



### Board Layout (FR4, 24x16 mm<sup>2</sup>, 0.8T)

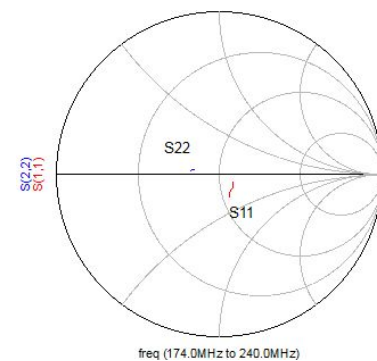
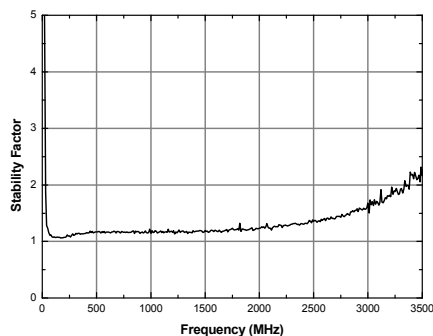
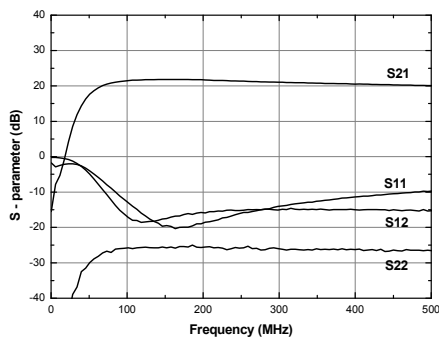
Top



Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

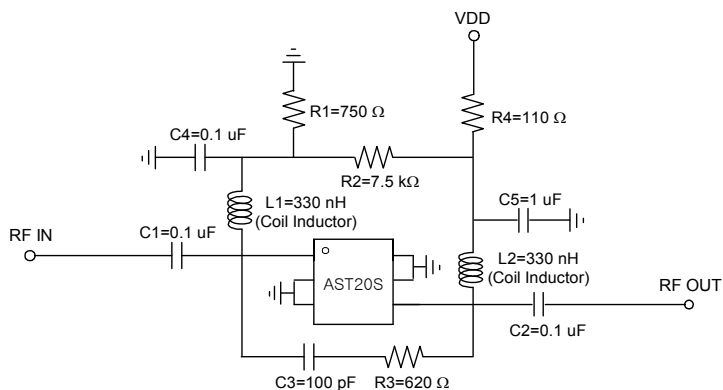
50 ~ 200 MHz

+5 V

Parameter	Symbol	Unit	Frequency (MHz)	
			50	200
Power Gain	$G_p$	dB	18.5	18.5
Noise Figure	NF	dB	1.1	1.0
Input Return Loss	$RL_{in}$	dB	-11	-13
Output Return Loss	$RL_{out}$	dB	-18	-20
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	7	9
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	24	23
Circuit Current	$I_{cc}$	mA	15	15

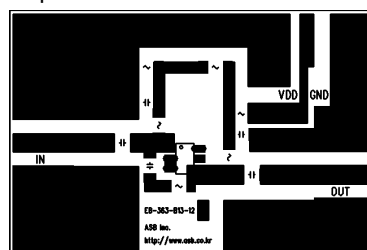
1) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1MHz.

### Schematic

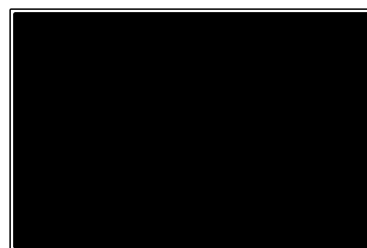


### Board Layout (FR4, 24x16 mm<sup>2</sup>, 0.8T)

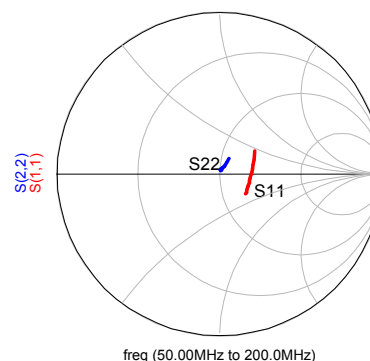
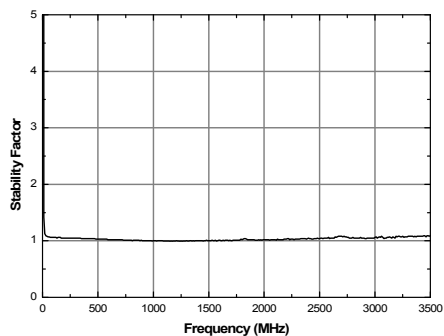
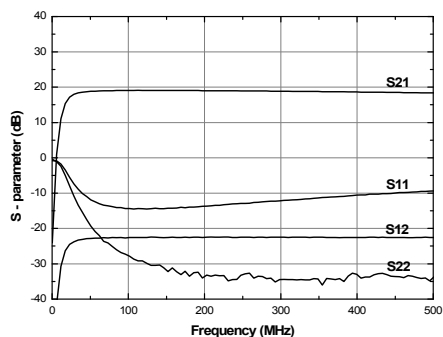
Top



Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

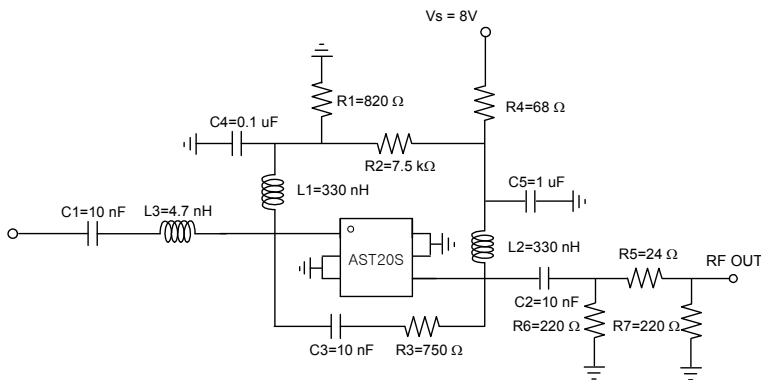
50 ~ 300 MHz

+8 V

Parameter	Symbol	Unit	Frequency (MHz)	
			50	300
Power Gain	$G_p$	dB	18	17.5
Noise Figure	NF	dB	1	1.1
Input Return Loss	$RL_{in}$	dB	-18	-15
Output Return Loss	$RL_{out}$	dB	-18	-20
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	15	15.5
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	27	29
Circuit Current	$I_{cc}$	mA	65	65

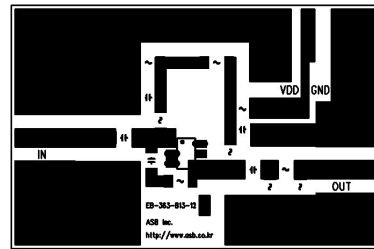
1) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1MHz.

### Schematic



### Board Layout (FR4, 24x16 mm<sup>2</sup>, 0.8T)

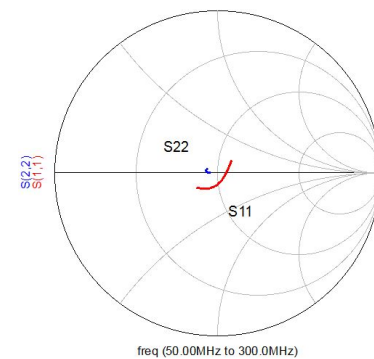
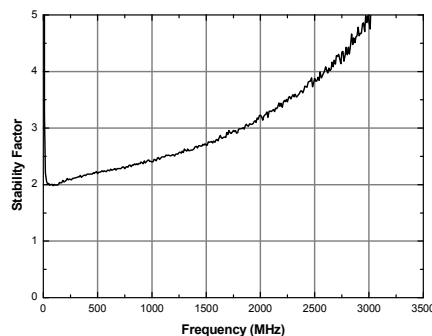
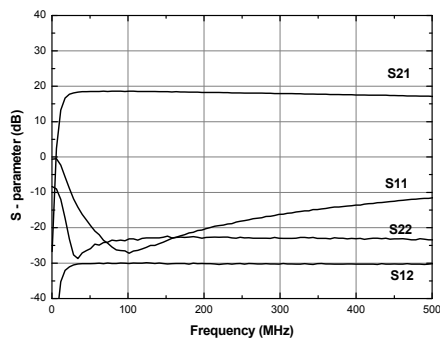
Top



Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

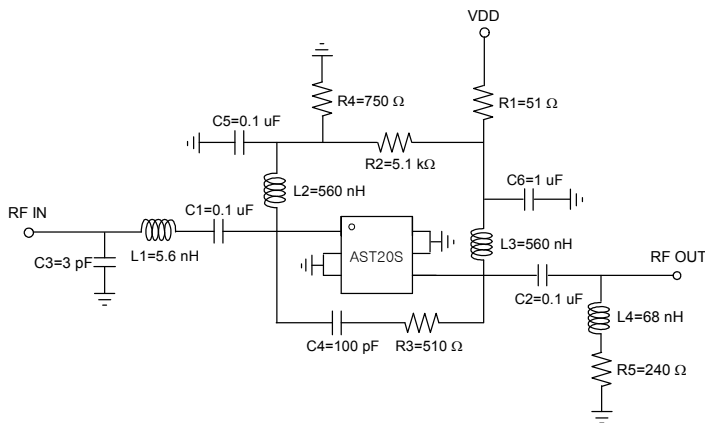
50 ~ 810 MHz

+4.5 V

Parameter	Symbol	Unit	Frequency (MHz)		
			50	500	810
Power Gain	$G_p$	dB	18.7	17.8	17.7
Noise Figure	NF	dB	1.0	1.3	1.2
Input Return Loss	$RL_{in}$	dB	-20	-9	-12
Output Return Loss	$RL_{out}$	dB	-11	-14	-18
1 dB Gain Compression	$P_{o(1dB)}$	dBm	11	13	13
Output Power					
3 <sup>rd</sup> Intercept Point	OIP3	dBm	24.5	26	26
Circuit Current	$I_{cc}$	mA	28	28	28

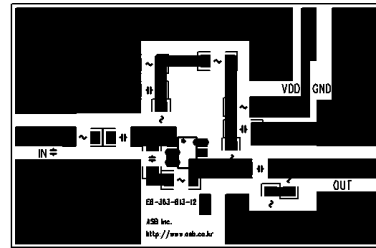
1) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1MHz.

### Schematic



### Board Layout (FR4, 24x16 mm<sup>2</sup>, 0.8T)

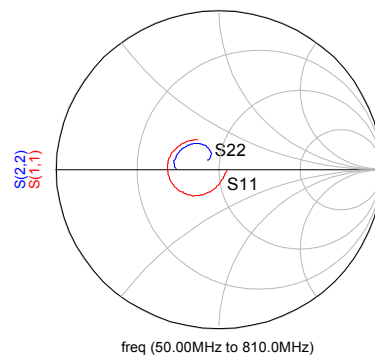
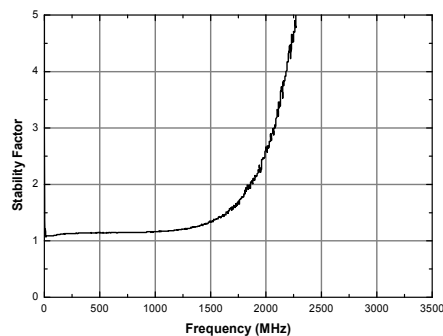
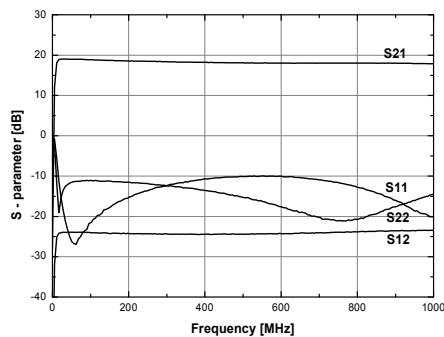
Top



Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

CMMB

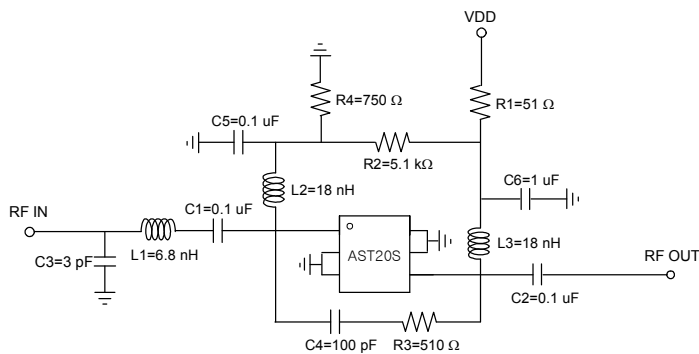
470 ~ 860 MHz

+4.5 V

Parameter	Symbol	Unit	Frequency (MHz)	
			470	860
Power Gain	$G_p$	dB	18.4	18.2
Noise Figure	NF	dB	1.2	1.2
Input Return Loss	$RL_{in}$	dB	-15	-18
Output Return Loss	$RL_{out}$	dB	-12	-15
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	11	14
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	24	27
Circuit Current	$I_{cc}$	mA	28	28

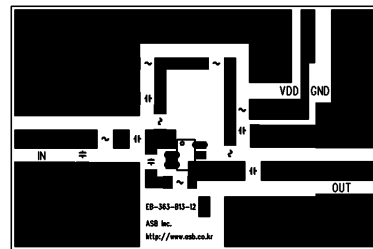
1) OIP3 is measured with two tones at an output power of +0 dBm/tone separated by 1MHz.

### Schematic



### Board Layout (FR4, 24x16 mm<sup>2</sup>, 0.8T)

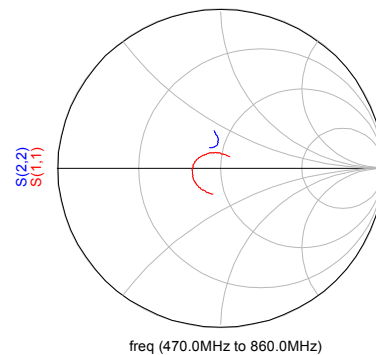
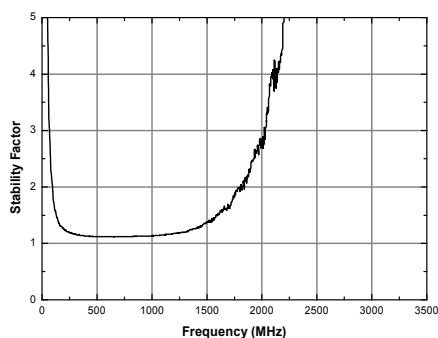
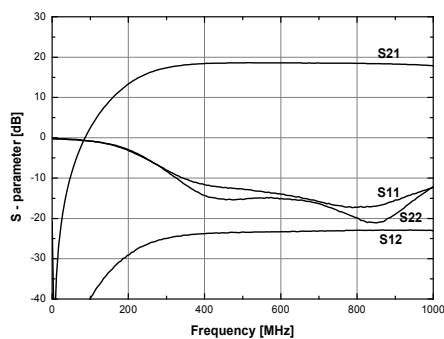
Top



Bottom



### S-parameters & K-factor



## High Gain, Low Noise Amplifier

### APPLICATION CIRCUIT

ONU, 50 ohm

70 ~ 2700 MHz

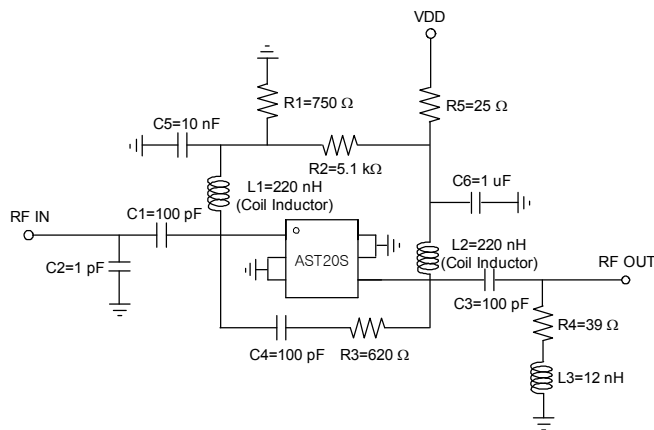
+5 V

Parameter	Symbol	Unit	Frequency (MHz)			
			70	470	1500	2700
Power Gain	$G_p$	dB	17.8	17.9	16.8	15.3
Noise Figure	NF	dB	1.2	1.1	1.2	1.3
Input Return Loss	$RL_{in}$	dB	-15	-6	-5	-9
Output Return Loss	$RL_{out}$	dB	-6	-7	-14	-16
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	15.4	16.4	19	19.5
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	28	29.5	33	32.5
2 <sup>nd</sup> Intercept Point Output Power <sup>2)</sup>	OIP2	dBm	38.5			
Circuit Current	$I_{cc}$	mA	63	63	63	63

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

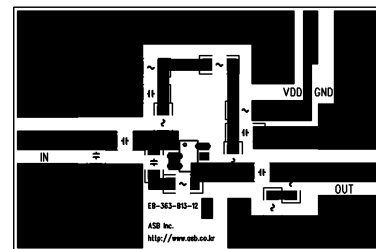
2) OIP2 is measured with two tones (100MHz, 800MHz) at an output power of +0 dBm/tone, 700MHz.

### Schematic



### Board Layout (FR4, 24x16 mm<sup>2</sup>, 0.8T)

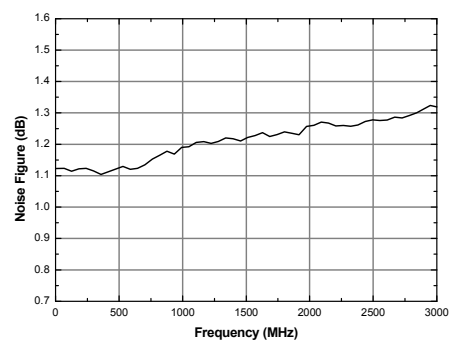
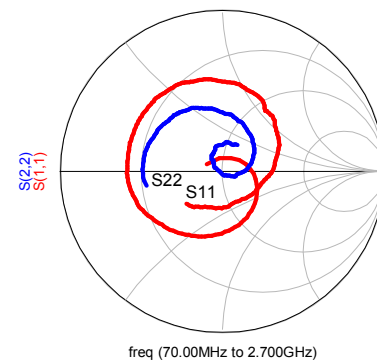
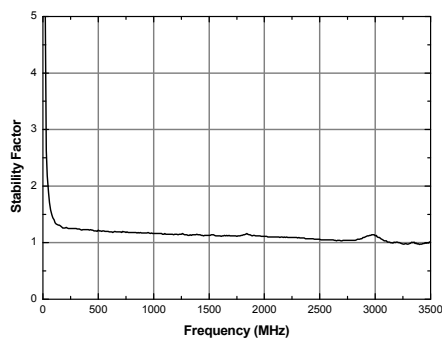
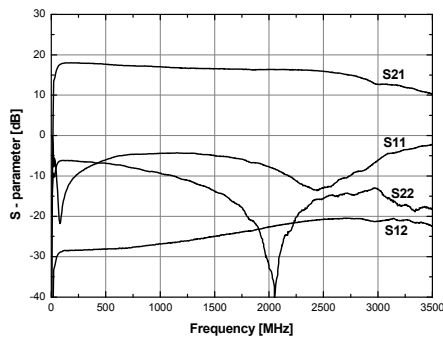
Top



Bottom



### S-parameters & Noise Figure



### APPLICATION CIRCUIT

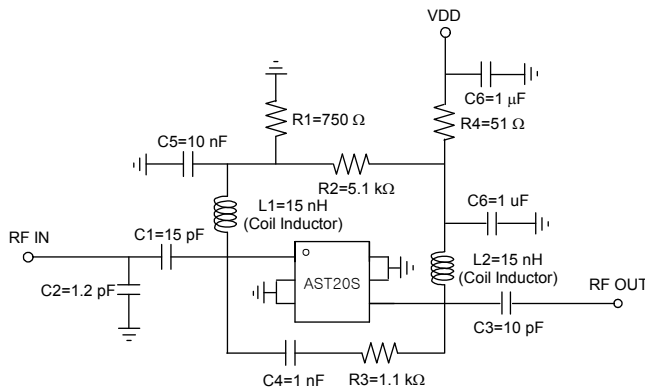
2300 ~ 2700 MHz

+5 V

Parameter	Symbol	Unit	Frequency (MHz)		
			2300	2500	2700
Power Gain	$G_p$	dB	15.5	15.3	14.7
Noise Figure	NF	dB	1.05	1.05	1.0
Input Return Loss	$RL_{in}$	dB	-9	-12	-10
Output Return Loss	$RL_{out}$	dB	-20	-17	-13
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	17.5	17.5	17.5
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	31	30	33.5
Circuit Current	$I_{cc}$	mA	38	38	38

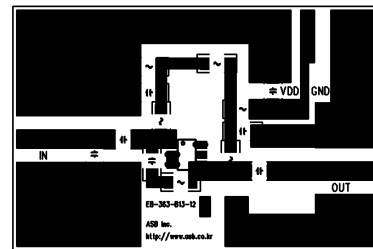
1) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1MHz.

### Schematic



### Board Layout (FR4, 24x16 mm<sup>2</sup>, 0.8T)

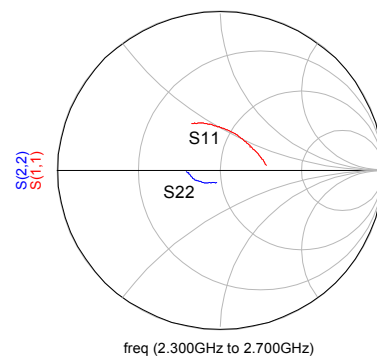
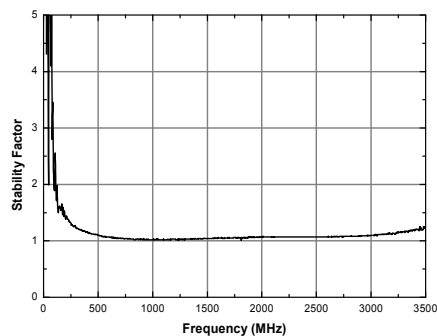
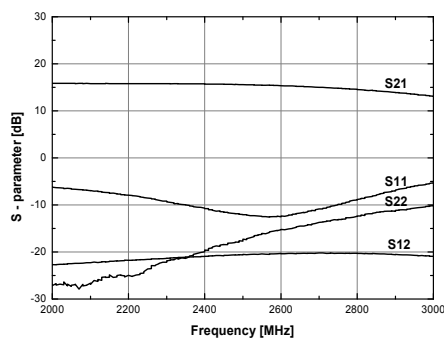
Top



Bottom



### S-parameters & K-factor



### APPLICATION CIRCUIT

SMATV, 50 ohm

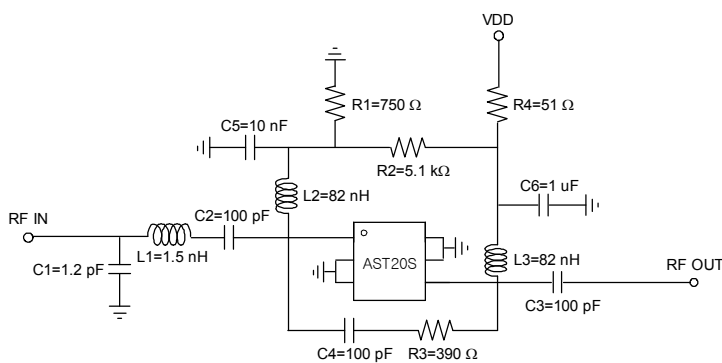
900 ~ 2100 MHz

+3 V

Parameter	Symbol	Unit	Frequency (MHz)		
			900	1500	2100
Power Gain	$G_p$	dB	14	13.5	13.5
Noise Figure	NF	dB	1.5	1.5	1.4
Input Return Loss	$RL_{in}$	dB	-6	-6	-11
Output Return Loss	$RL_{out}$	dB	-18	-14	-10
1 dB Gain Compression Output Power	$P_{o(1dB)}$	dBm	5	5	5.5
3 <sup>rd</sup> Intercept Point Output Power <sup>1)</sup>	OIP3	dBm	19	19.5	20
Circuit Current	$I_{cc}$	mA	12	12	12

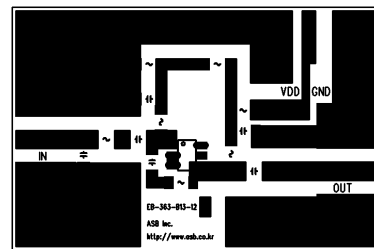
1) OIP3 is measured with two tones at an output power of -5 dBm/tone separated by 1MHz.

### Schematic



### Board Layout (FR4, 24x16 mm<sup>2</sup>, 0.8T)

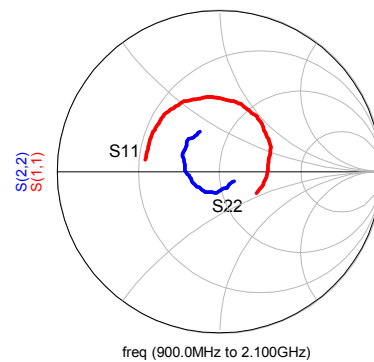
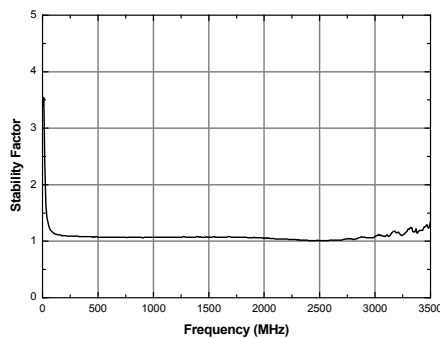
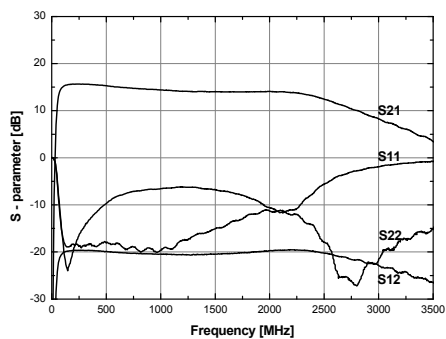
Top



Bottom



### S-parameters & K-factor





### Noise Parameters

$V_{DS}=3V, I_{DS}=30mA$

Freq (Hz)	$F_{min}$ (dB)	$\Gamma_{opt}$ (Mag.)	$\Gamma_{opt}$ (Ang.)	$R_{n/50}$
0.5e+9	0.03	0.86	-46.3	0.07
1e+9	0.22	0.41	-12.3	0.07
1.5e+9	0.28	0.47	50.8	0.07
2e+9	0.4	0.38	56.7	0.08
2.5e+9	0.52	0.29	73.5	0.08
3e+9	0.54	0.31	90.9	0.08
4e+9	0.48	0.35	111.6	0.08
5e+9	0.71	0.43	130.1	0.07
6e+9	0.83	0.46	139.7	0.07
7e+9	0.82	0.54	148	0.07
8e+9	1.15	0.58	152.5	0.06
9e+9	1.3	0.59	156.1	0.07
10e+9	1.41	0.63	159.7	0.06

$V_{DS}=3V, I_{DS}=40mA$

Freq (Hz)	$F_{min}$ (dB)	$\Gamma_{opt}$ (Mag.)	$\Gamma_{opt}$ (Ang.)	$R_{n/50}$
0.5e+9	0	0.87	-48.4	0.07
1e+9	0.18	0.38	-18.6	0.06
1.5e+9	0.18	0.45	62.7	0.06
2e+9	0.27	0.34	58.4	0.08
2.5e+9	0.48	0.26	74.3	0.07
3e+9	0.54	0.29	93.2	0.07
4e+9	0.5	0.33	114.7	0.08
5e+9	0.72	0.42	133	0.07
6e+9	0.83	0.45	142.3	0.07
7e+9	0.84	0.53	150	0.06
8e+9	1.15	0.56	154.2	0.06
9e+9	1.32	0.58	157.6	0.07
10e+9	1.42	0.63	161.1	0.06