AWB589 Data Sheet

30 ~ 1200 MHz Wide-band Medium Power Amplifier MMIC

1. Product Overview

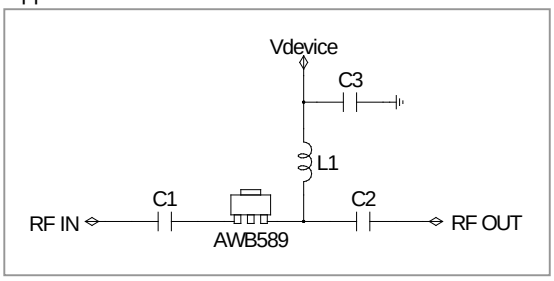
1.1 General Description

AWB589, a medium power amplifier MMIC, has high linearity and high efficiency over a wide range of frequency from 30 MHz to 1200 MHz, being suitable for use in both receiver and transmitter of telecommunication system up to 1.2 GHz. It has an active bias network for stable current over temperature and process variation. The amplifier is available in an SOT89 package and passes through the stringent DC, RF, and reliability tests.

1.2 Features

- 20.0 dB gain at 500 MHz
- 27.0 dBm P1dB at 500 MHz
- 42.0 dBm OIP3 at 500 MHz
- Gain flatness = 0.6 dB at 470 ~ 860 MHz
- 50 Ω input & output matching
- MTTF > 100 Years
- Single supply: +5 V, +8 V

Application circuit



1.3 Applications

- Wide-band amplifier at 30 ~ 1200 MHz
- IF amplifier

1.4 Package Profile & RoHS Compliance

	RoHS-compliant GREEN Package
SOT89, 4.5x4.0 mm^2, surface mount	RoHS-compliant

2. Summary on Product Performances

2.1 Typical Performance

Supply voltage = +5, +8 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical						Unit
Frequency	30	470	860	30	470	860	MHz
Gain	20.3	19.8	19.3	20.2	19.6	19.1	dB
S11	-16.0	-20.0	-20.0	-16	-14.0	-10.0	dB
S22	-16.0	-20.0	-20.0	-16	-20.0	-12.0	dB
Noise Figure	3.5	3.0	3.0	3.5	3.0	3.0	dB
Output IP3[1)]	43.0	42.5	41.5	43.0	45.0	43.0	dBm
Output P1dB	27.0	27.5	27.0	23.0	23.5	23.0	dBm
Current	170			170			mA
Device Voltage	+8.0			+5.0			V

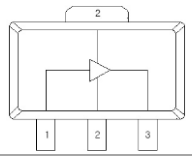
1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1MHz.

2.2 Product Specification

Supply voltage = +8 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Min	Typ	Max	Unit
Frequency		500		MHz
Gain		19.5		dB
S11		-20.0		dB
S22		-20.0		dB
Noise Figure		3.0		dB
OIP3		42.0		dBm
P1dB		27.0		dBm
Current		170		mA
Device Voltage		+8.0		V

2.3 Pin Configuration

Pin	Description	Simplified Outline
1	RF_IN	
2	Ground	
3	RF_OUT & Bias	

2.4 Absolute Maximum Ratings

Parameters	Max. Ratings
Operation Case Temperature	-40 to +85 °C
Storage Temperature	-40 to +150 °C
Device Voltage	+10 V
Operation Junction Temperature	+160 °C
Input RF Power (CW, 50 Ω matched)	+21 dBm

2.5 Thermal Resistance

Symbol	Description	Typ	Unit
R_{th}	Thermal resistance from junction to lead	43	°C/W

2.6 ESD Classification & Moisture Sensitivity Level

ESD Classification

HBM	Class 1B	Voltage Level: 750 V
MM	Class A	Voltage Level: 100 V

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

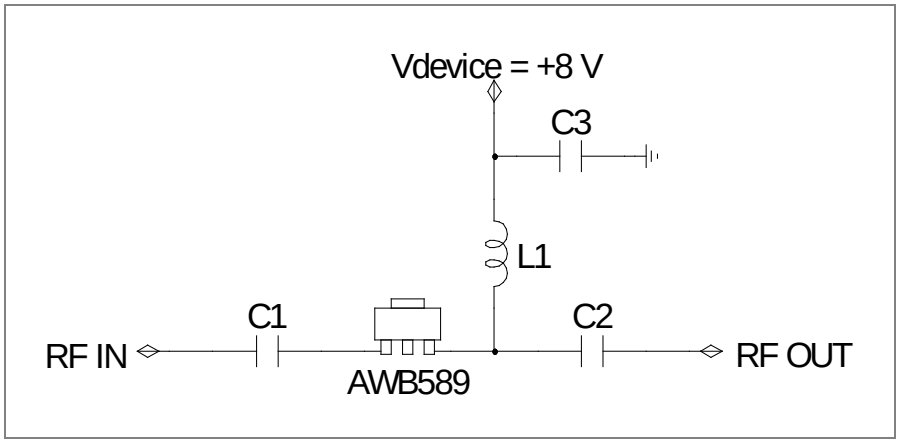
Moisture Sensitivity Level

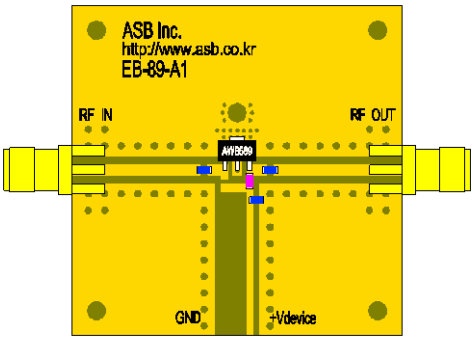
MSL 3 at 260 °C reflow

(Intentionally Blanked)

3. Application: 30 ~ 512 MHz (V_{device} = +8 V)

3.1 Application Circuit & Evaluation Board





PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	40x40
EB No.	EB-89-A1

Bill of Material

Symbol	Value	Size	Description	Manufacturer
AWB589	-	-	MMIC Amplifier	ASB
C1, C2	1 μF	0603	DC blocking capacitor	Murata
C3	10 μF	0805	Decoupling capacitor	Murata
L1	470 nH	1206	RF choke inductor	Murata

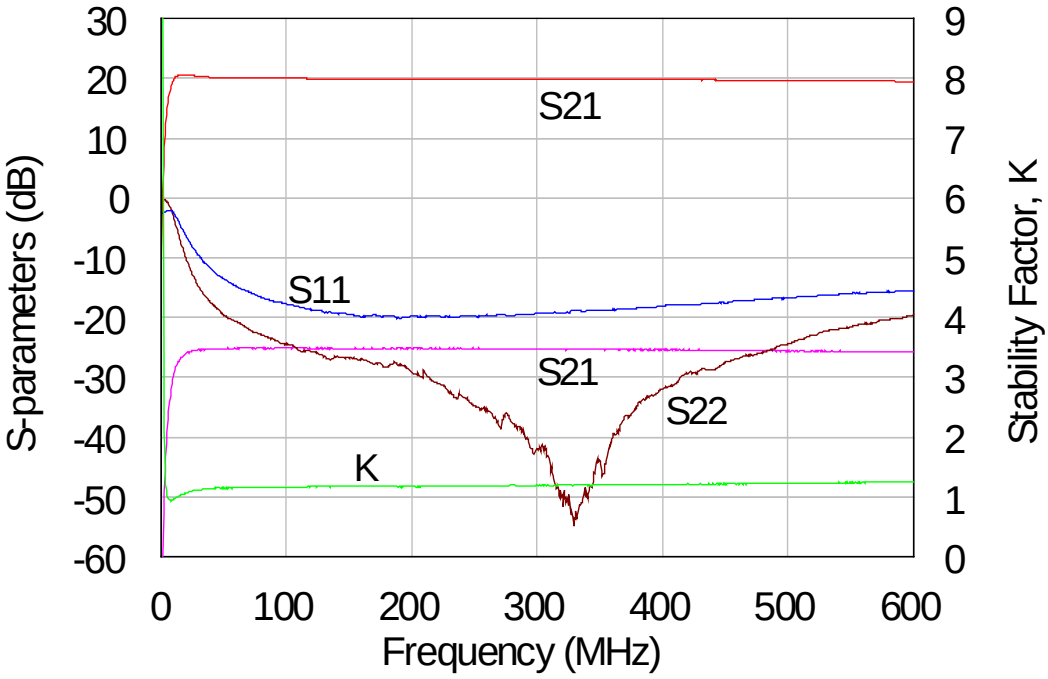
3.2 Performance Table

Supply voltage = +8 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical			Unit
Frequency	30	250	512	MHz
Gain	20.2	19.7	19.4	dB
S11	-9.0	-18.0	-15.0	dB
S22	-13.0	-20.0	-20.0	dB
Noise Figure	3.5	3.0	3.0	dB
Output IP3[1)]	42.5	43.0	41.5	dBm
Output P1dB	26.5	27.0	27.0	dBm
Current	170			mA
Device Voltage	+8.0			V

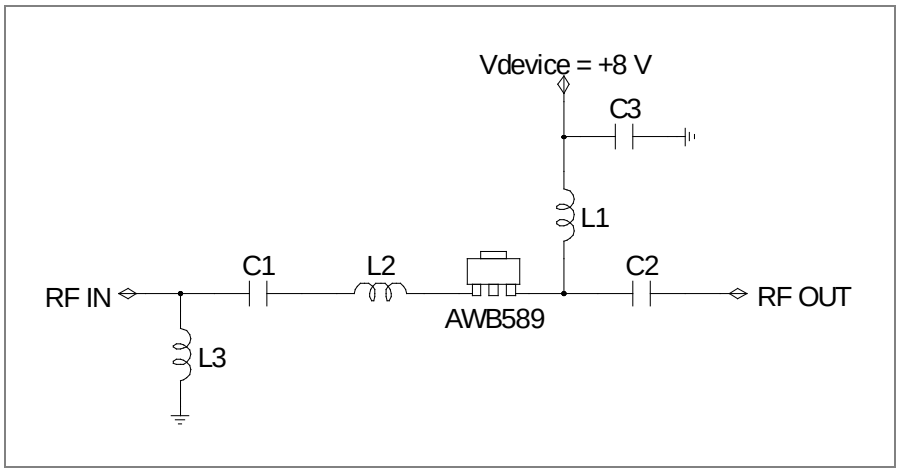
1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1MHz.

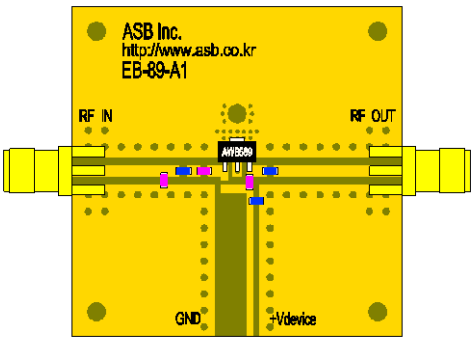
3.3 Plot of S-parameter & Stability Factor



4. Application: 30 ~ 512 MHz (V_{device} = +8 V, Additional Matching)

4.1 Application Circuit & Evaluation Board





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C3	10 μF	0805	Decoupling capacitor	Murata
L1	1 μH	1206	RF choke inductor	Murata
L2	5.6 nH	0603	Matching inductor	Murata
L3	680 nH	0603	Matching inductor	Samsung

4.2 Performance Table

Supply voltage = +8 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical			Unit
Frequency	30	250	512	MHz
Gain	20.3	19.7	19.5	dB
S11	-16.0	-20.0	-20.0	dB
S22	-16.0	-20.0	-20.0	dB
Noise Figure	3.5	3.0	3.0	dB
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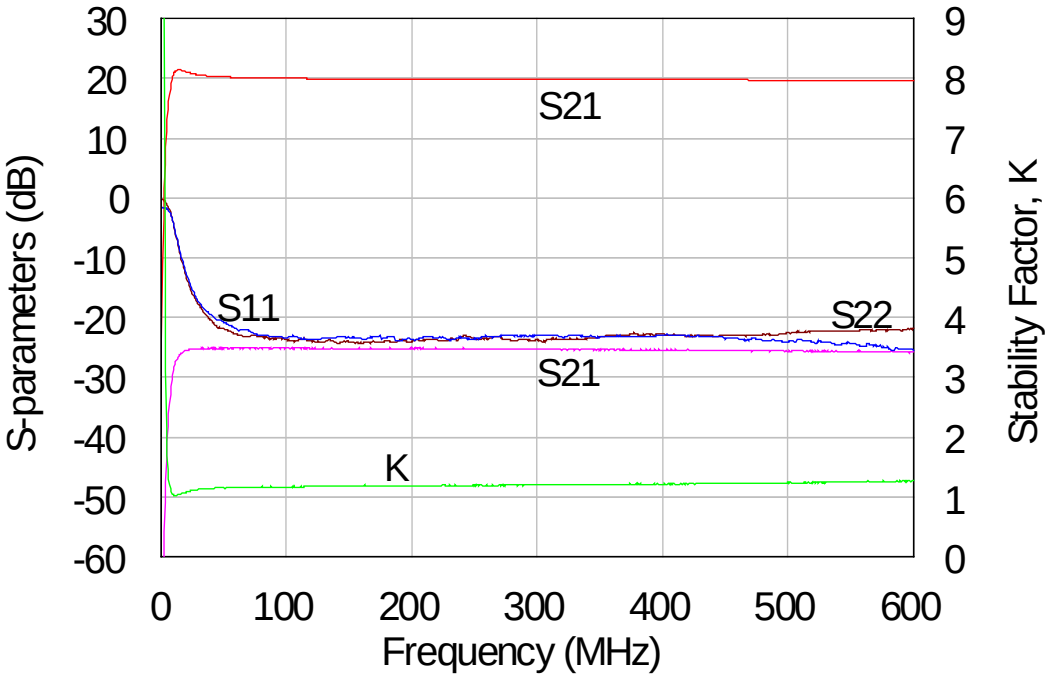
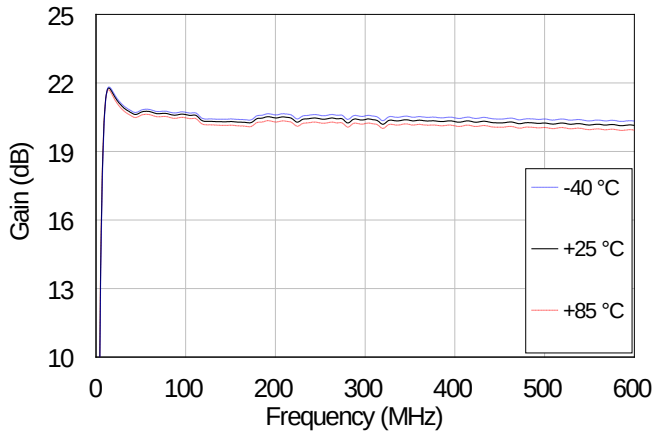
Output P1dB	27.0	27.0	27.0	dBm
Current	170			mA
Device Voltage	+8.0			V

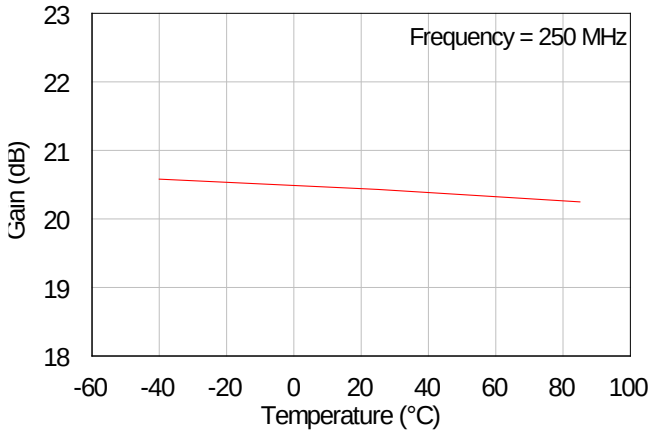
1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1MHz.

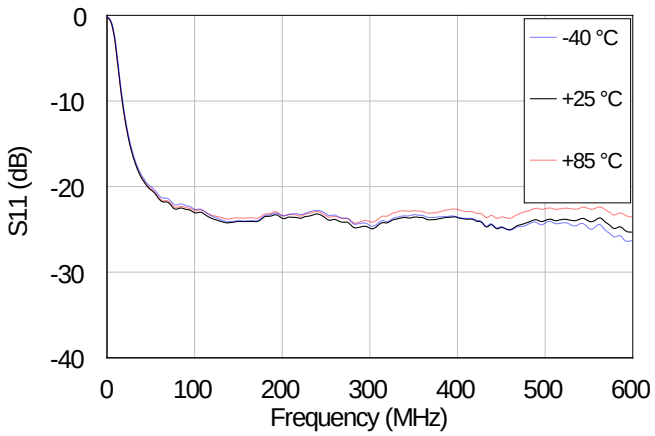
4.3 Plot of S-parameter & Stability Factor

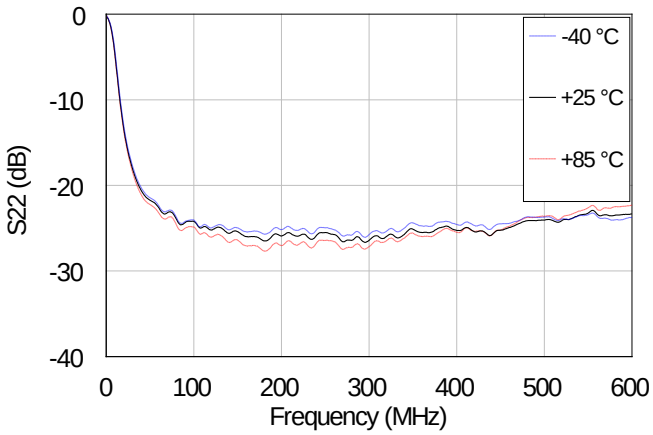


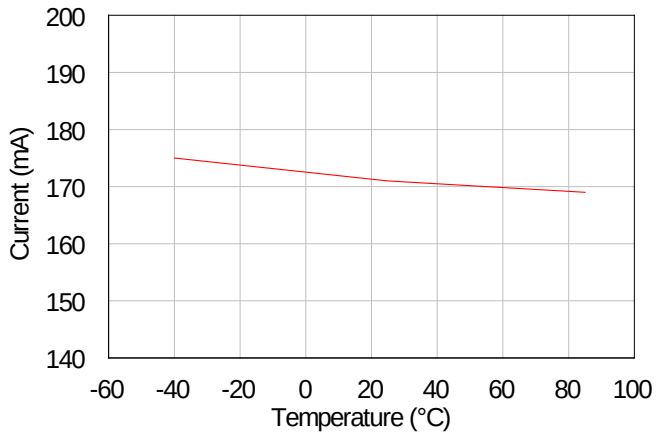
4.4 Plots of Performances with Temperature

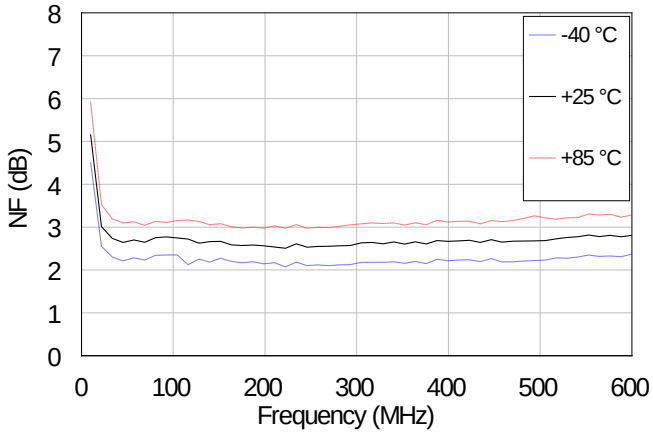


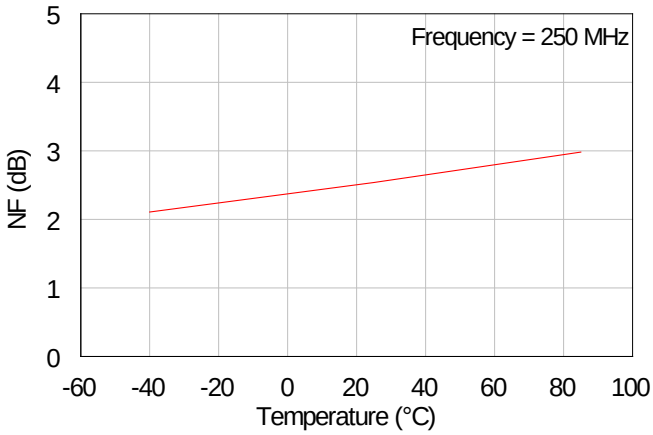


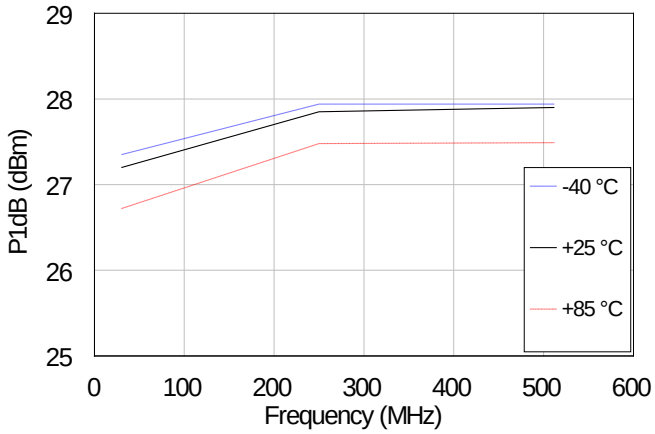


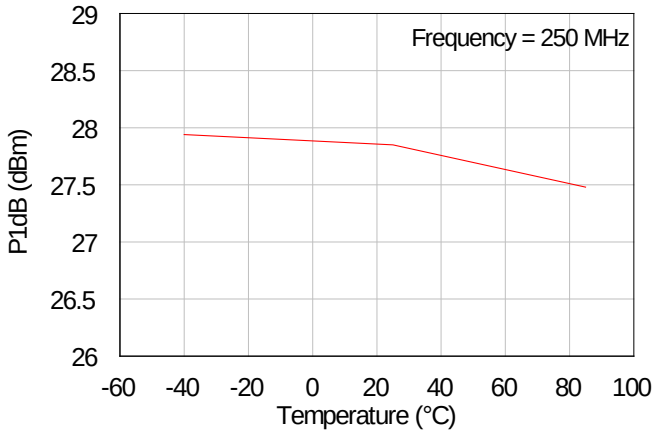


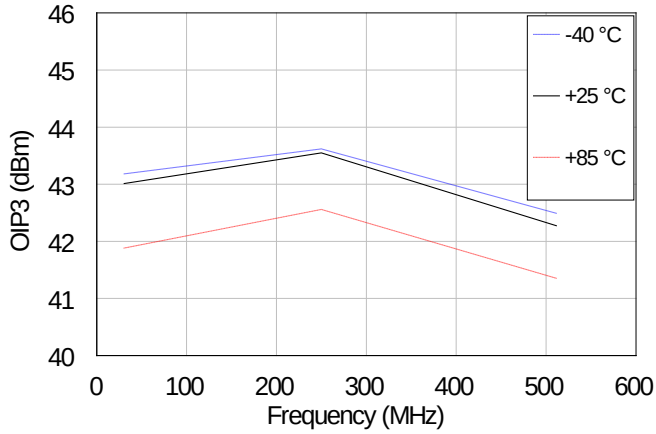


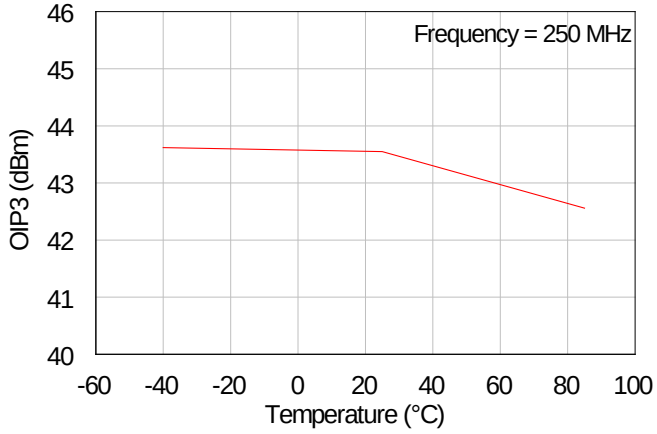

NF (dB)
Frequency (MHz)
-40 °C
+25 °C
+85 °C


NF (dB)
Temperature (°C)
Frequency = 250 MHz


P1dB (dBm)
Frequency (MHz)
-40 °C
+25 °C
+85 °C

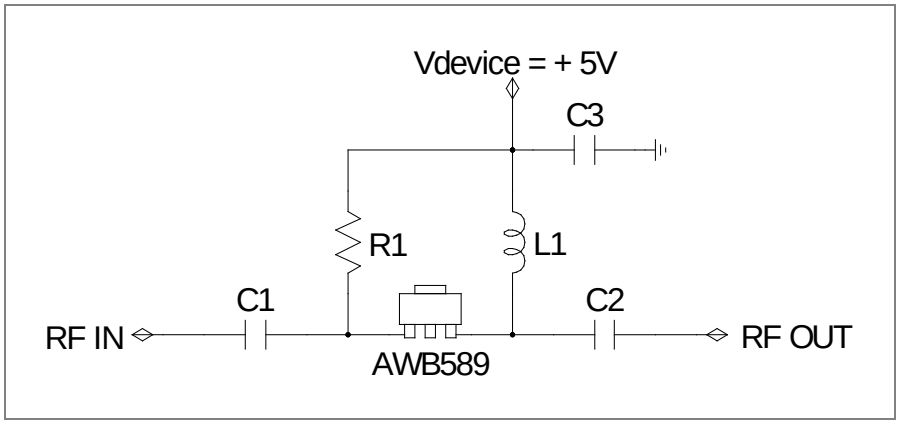

P1dB (dBm)
Temperature (°C)
Frequency = 250 MHz

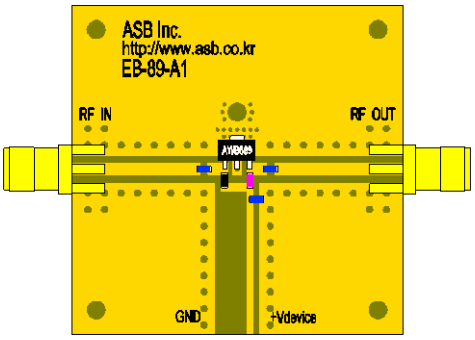

OIP3 (dBm)
Frequency (MHz)
-40 °C
+25 °C
+85 °C


OIP3 (dBm)
Temperature (°C)
Frequency = 250 MHz

5. Application: 30 ~ 512 MHz (V_{device} = +5 V)

5.1 Application Circuit & Evaluation Board





PCB Information	
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Thickness (mm)	0.8
Size (mm)	40x40
EB No.	EB-89-A1

Bill of Material

Symbol	Value	Size	Description	Manufacturer
AWB589	-	-	MMIC Amplifier	ASB
C1, C2	1 μF	0603	DC blocking capacitor	Murata
C3	10 μF	0805	Decoupling capacitor	Murata
L1	470 nH	1206	RF choke inductor	Murata
R1	5.6 kΩ	0603	Bias resistor	Samsung

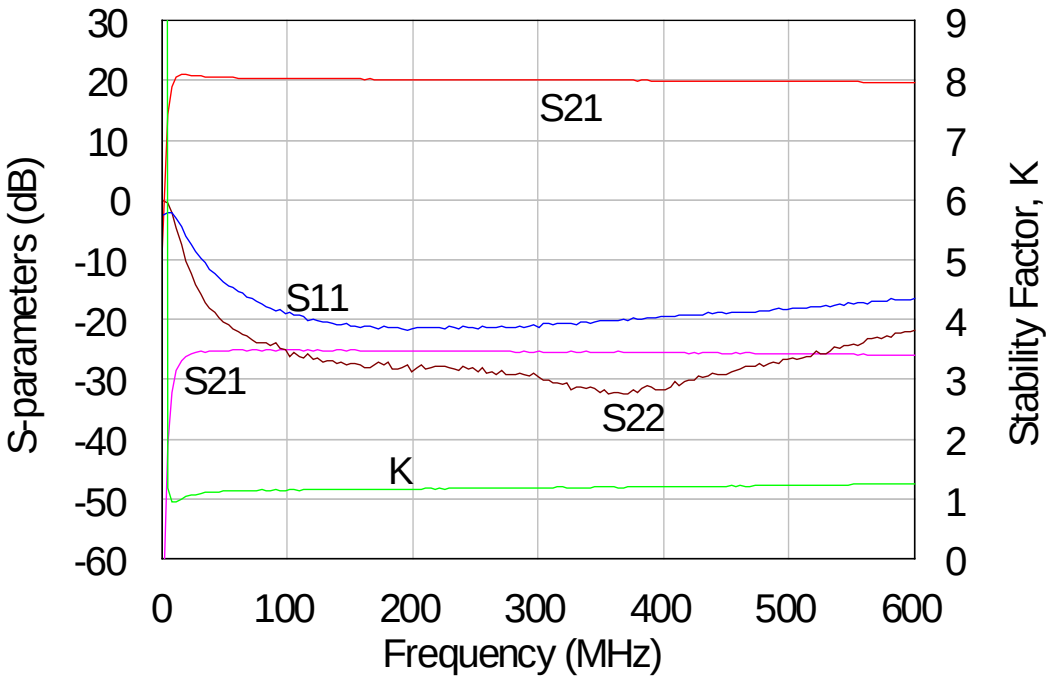
5.2 Performance Table

Supply voltage = +5 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical			Unit
Frequency	30	250	512	MHz
Gain	20.1	19.6	19.3	dB
S11	-9.0	-18.0	-15.0	dB
S22	-13.0	-20.0	-20.0	dB
Noise Figure	3.5	3.0	3.0	dB
Output IP3[1)]	42.5	46.0	43.0	dBm
Output P1dB	22.5	23.5	23.5	dBm
Current	170			mA
Device Voltage	+5.0			V

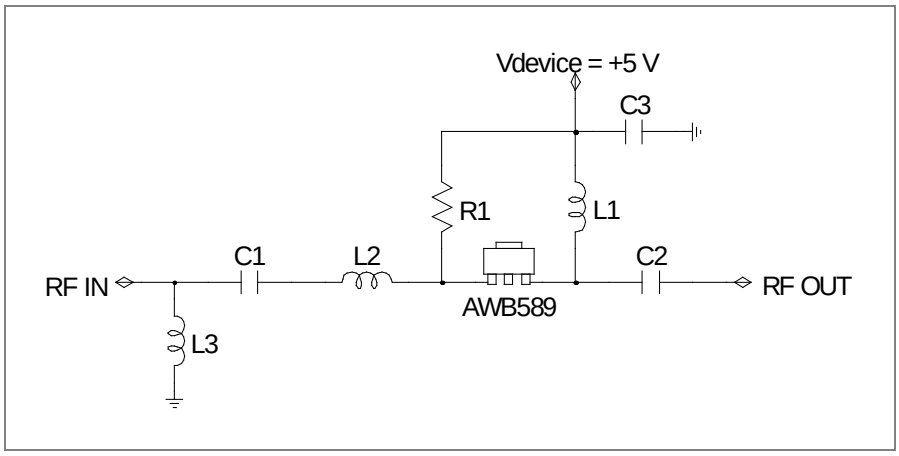
1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1MHz.

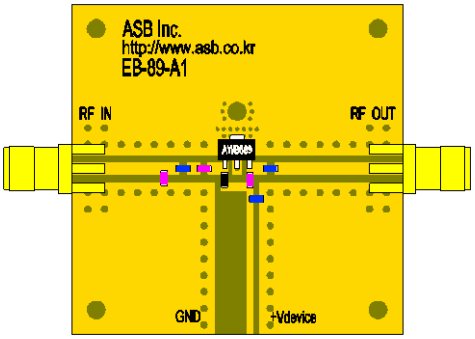
5.3 Plot of S-parameter & Stability Factor



6. Application: 30 ~ 512 MHz (V_{device} = +5 V, Additional Matching)

6.1 Application Circuit & Evaluation Board





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C3	10 μF	0805	Decoupling capacitor	Murata
L1	1 μH	1206	RF choke inductor	Murata
L2	5.6 nH	0603	Matching inductor	Murata
L3	680 nH	0603	Matching inductor	Samsung
R1	5.6 kΩ	0603	Bias resistor	Samsung

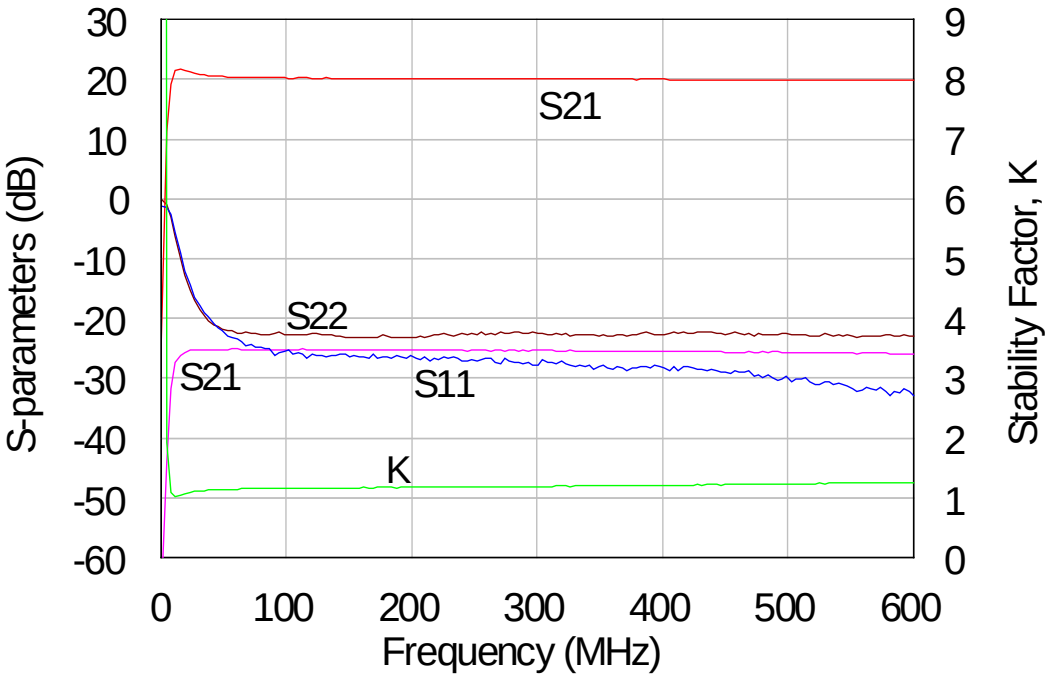
6.2 Performance Table

Supply voltage = +5 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical			Unit
Frequency	30	250	512	MHz
Gain	20.2	19.6	19.4	dB
S11	-16.0	-20.0	-20.0	dB
S22	-16.0	-20.0	-20.0	dB
Noise Figure	3.5	3.0	3.0	dB
Output IP3[1)]	43.0	46.0	44.0	dBm
Output P1dB	23.0	23.5	23.5	dBm
Current	170			mA
Device Voltage	+5.0			V

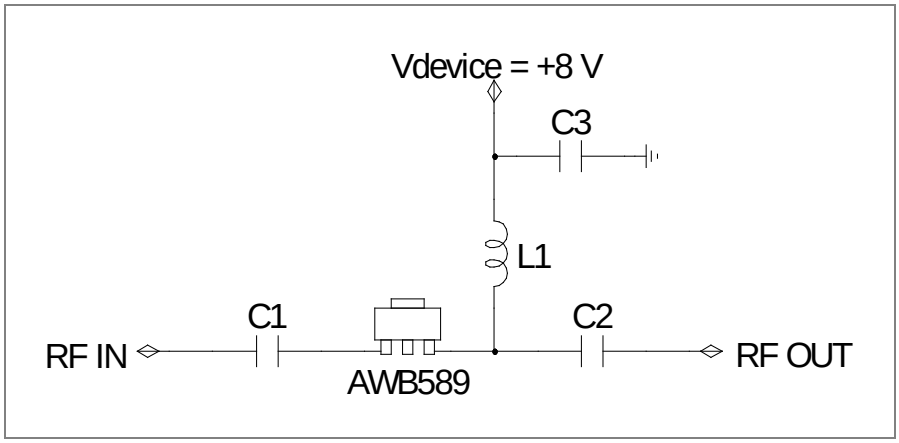
1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1MHz.

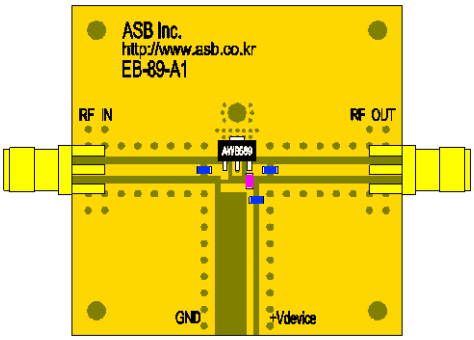
6.3 Plot of S-parameter & Stability Factor



7. Application: 470 ~ 860 MHz

7.1 Application Circuit & Evaluation Board





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Bill of Material

Symbol	Value	Size	Description	Manufacturer
AWB589	-	-	MMIC Amplifier	ASB
C1, C2	1 μF	0603	DC blocking capacitor	Murata
C3	10 μF	0805	Decoupling capacitor	Murata
L1	120 nH	0603	RF choke inductor	Samsung

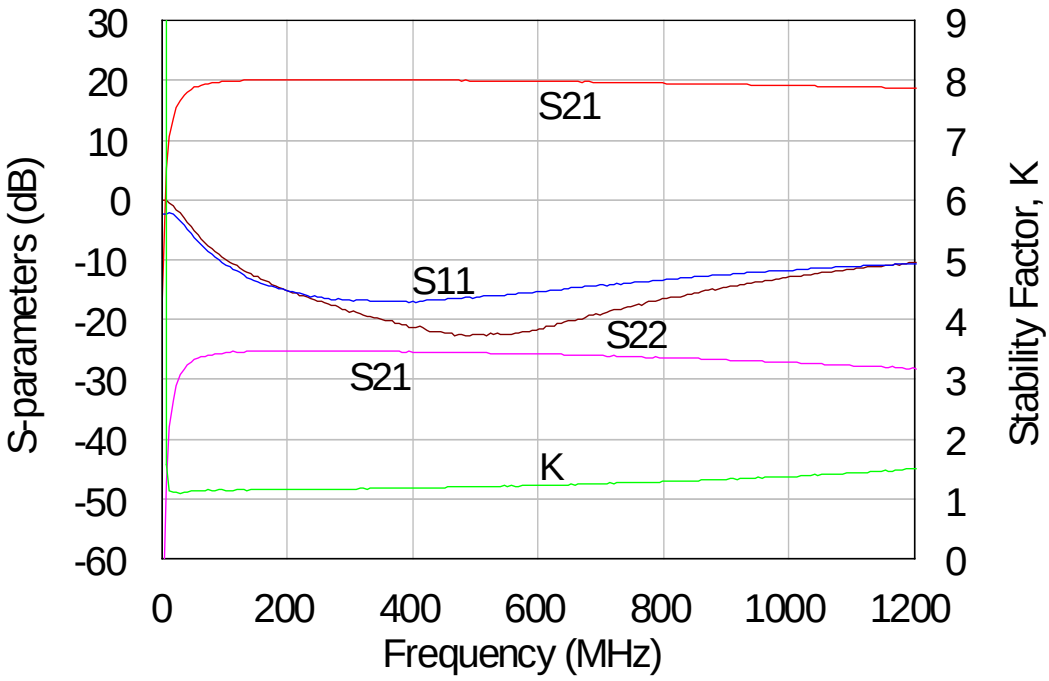
7.2 Performance Table

Supply voltage = +8 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical			Unit
Frequency	470	665	860	MHz
Gain	19.8	19.5	19.2	dB
S11	-15.0	-13.0	-11.0	dB
S22	-18.0	-18.0	-13.0	dB
Noise Figure	3.0	3.0	3.0	dB
Output IP3[1)]	42.5	41.5	41.0	dBm
Output P1dB	27.5	27.3	27.0	dBm
Current	170			mA
Device Voltage	+8.0			V

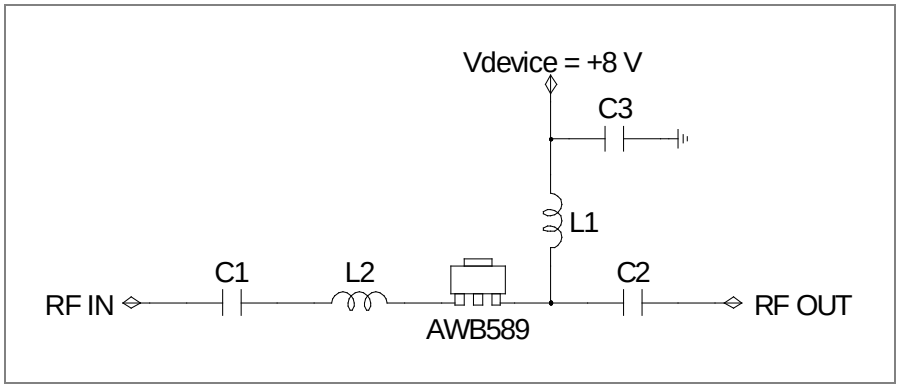
1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1MHz.

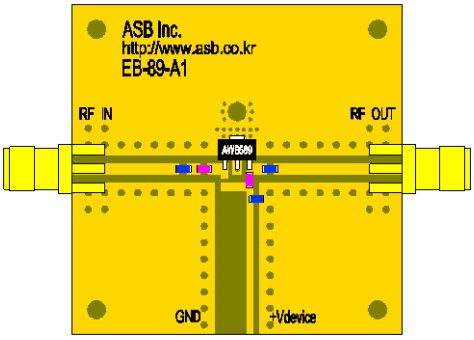
7.3 Plot of S-parameter & Stability Factor



8. Application: 470 ~ 860 MHz (Additional Matching)

8.1 Application Circuit & Evaluation Board





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EB No.	EB-89-A1

Bill of Material

Symbol	Value	Size	Description	Manufacturer
AWB589	-	-	MMIC Amplifier	ASB
C1, C2	1 μF	0603	DC blocking capacitor	Murata
C3	10 μF	0805	Decoupling capacitor	Murata
L1	120 nH	0603	RF choke inductor	Samsung
L2	4.7 nH	0603	Matching inductor	Murata

8.2 Performance Table

Supply voltage = +8 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical			Unit
Frequency	470	665	860	MHz
Gain	19.8	19.6	19.3	dB
S11	-20.0	-20.0	-20.0	dB
S22	-20.0	-20.0	-20.0	dB
Noise Figure	3.0	3.0	3.0	dB
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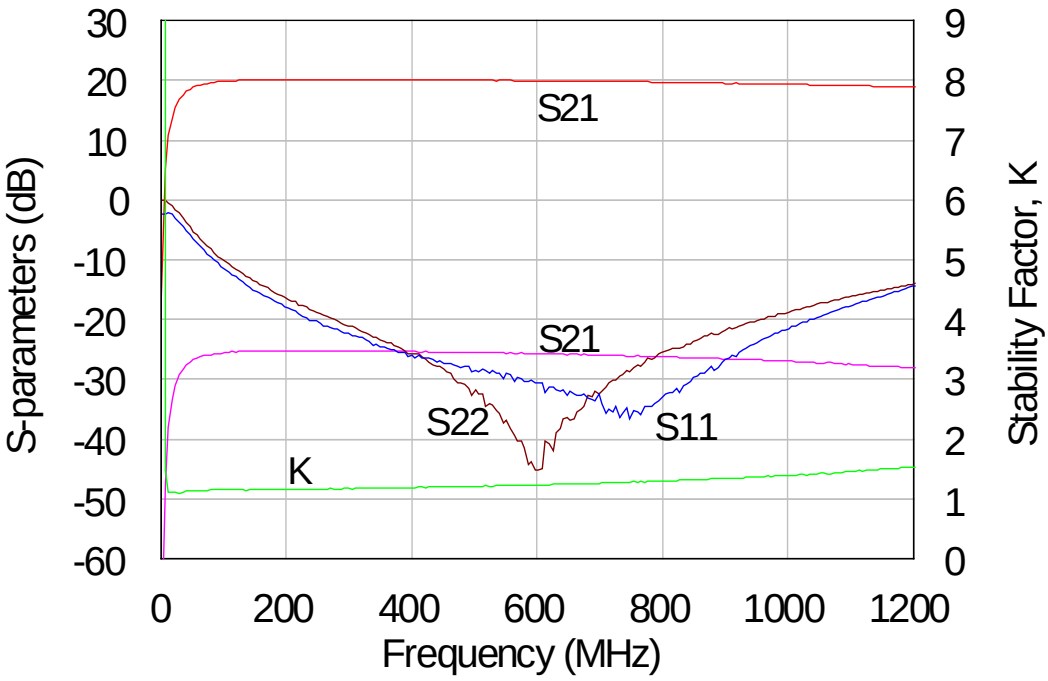
Output P1dB	27.5	27.3	27.0	dBm
Current	170			mA
Device Voltage	+8.0			V

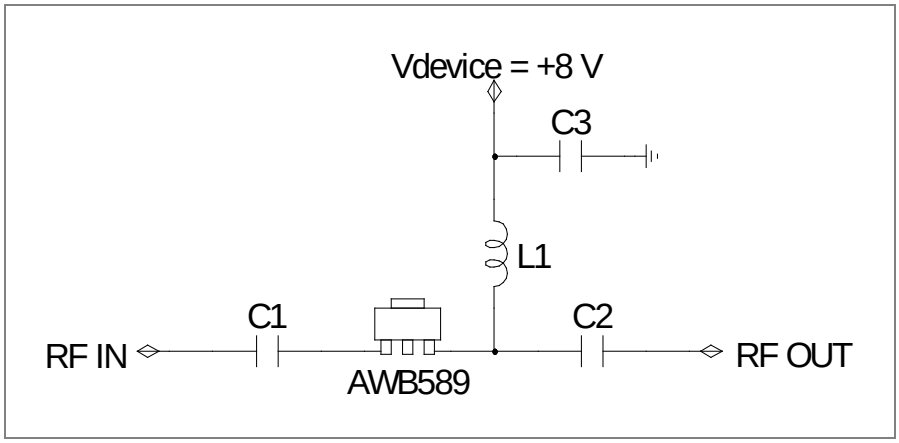
1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1MHz.

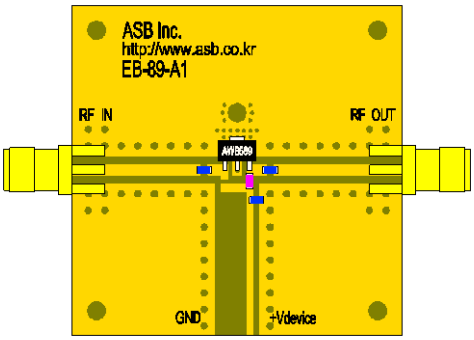
8.3 Plot of S-parameter & Stability Factor



9. Application: 100 MHz (IF)

9.1 Application Circuit & Evaluation Board





PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	40x40
EB No.	EB-89-A1

Bill of Material

Symbol	Value	Size	Description	Manufacturer
AWB589	-	-	MMIC Amplifier	ASB
C1, C2	1 μF	0603	DC blocking capacitor	Murata
C3	10 μF	0805	Decoupling capacitor	Murata
L1	470 nH	1206	RF choke inductor	Murata

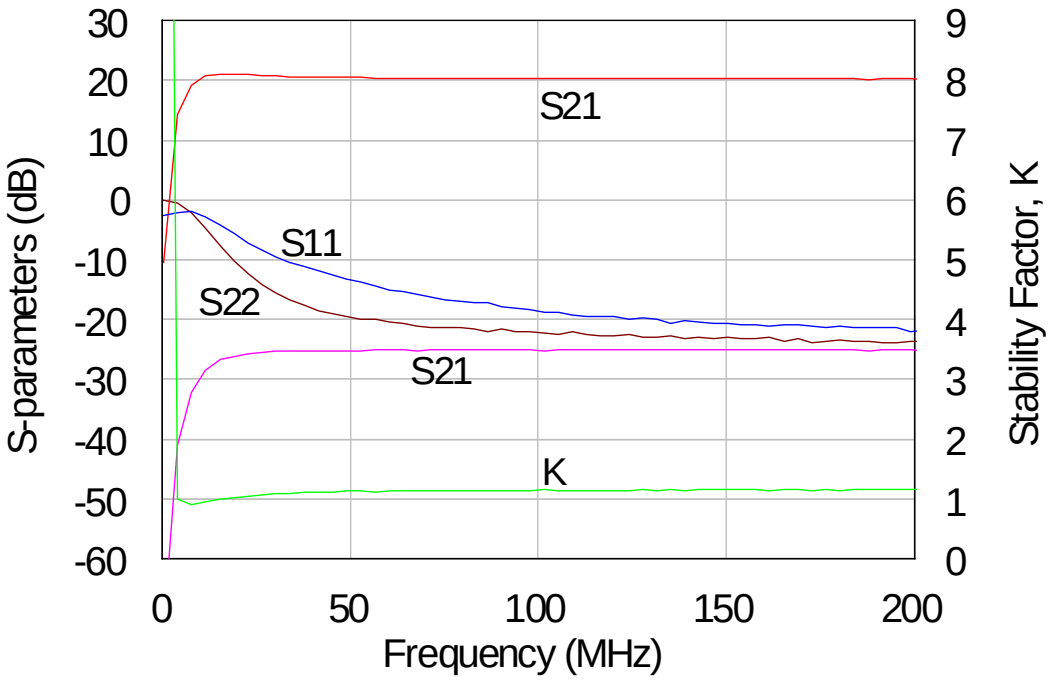
9.2 Performance Table

Supply voltage = +8 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical	Unit
Frequency	100	MHz
Gain	20.0	dB
S11	-16	dB
S22	-20	dB
Noise Figure	3.0	dB
Output IP3[1)]	43.0	dBm
Output P1dB	27.0	dBm
Current	170	mA
Device Voltage	+8.0	V

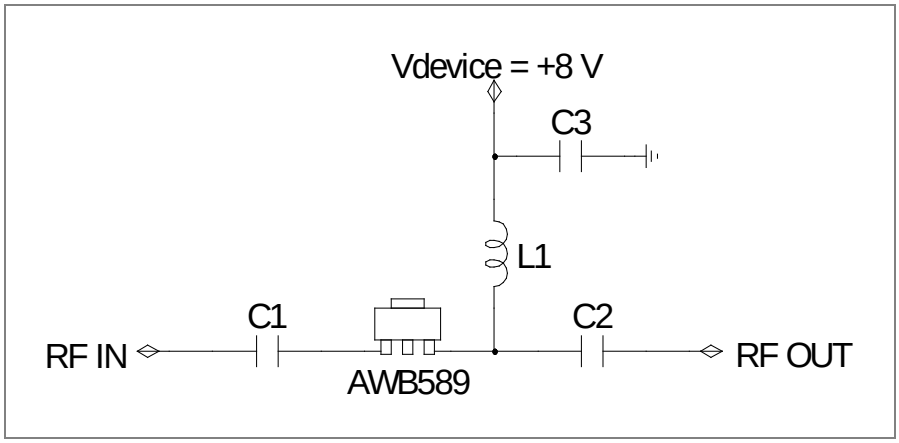
1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1MHz.

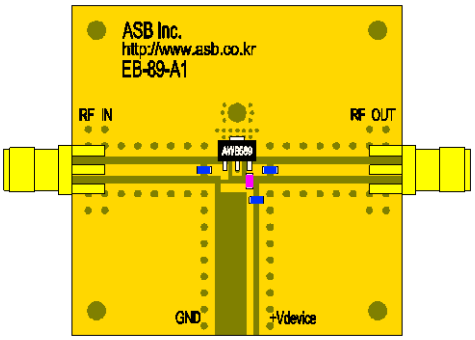
9.3 Plot of S-parameter & Stability Factor



10. Application: 1200 MHz

10.1 Application Circuit & Evaluation Board





PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	40x40
EB No.	EB-89-A1

Bill of Material

Symbol	Value	Size	Description	Manufacturer
AWB589	-	-	MMIC Amplifier	ASB
C1, C2	1 μF	0603	DC blocking capacitor	Murata
C3	10 μF	0805	Decoupling capacitor	Murata
L1	15 nH	0603	RF choke inductor	Murata

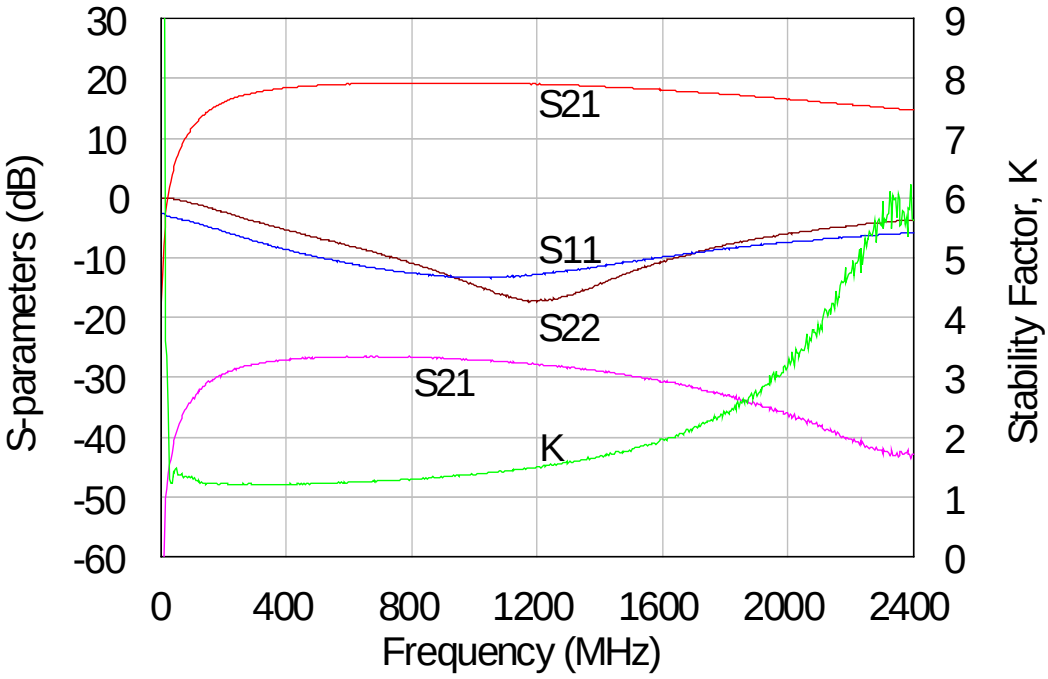
10.2 Performance Table

Supply voltage = +8 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical	Unit
Frequency	1200	MHz
Gain	18.5	dB
S11	-11.0	dB
S22	-16.0	dB
Noise Figure	3.0	dB
Output IP3[1)]	40.0	dBm
Output P1dB	26.5	dBm
Current	170	mA
Device Voltage	+8.0	V

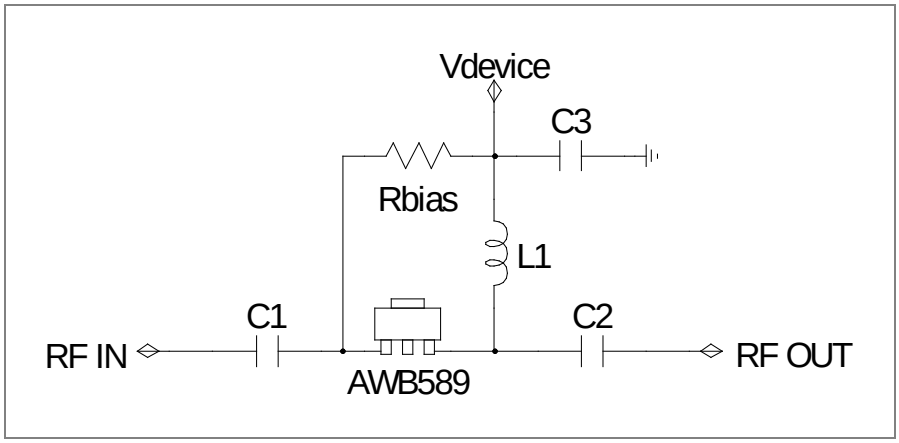
1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1MHz.

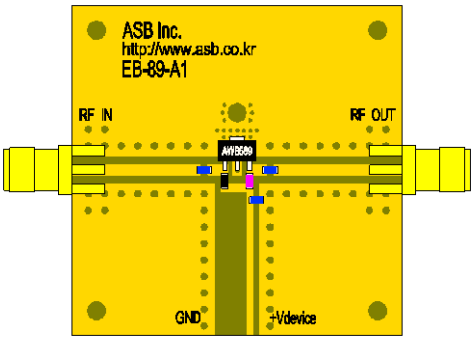
10.3 Plot of S-parameter & Stability Factor



11. Application: Supply Voltage = +5, +6, +7 V

11.1 Application Circuit & Evaluation Board





PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	40x40
EB No.	EB-89-A1

Bill of Material

Symbol	Value	Size	Description	Manufacturer
AWB589	-	-	MMIC Amplifier	ASB
C1, C2	1 μF	0603	DC blocking capacitor	Murata
C3	10 μF	0805	Decoupling capacitor	Murata
L1	120 nH	0603	RF choke inductor	Murata
R1	Rbias	0603	Bias resistor	Samsung

11.2 Rbias vs Current

Supply Voltage(V)	Rbais(kΩ)	Current(mA)
5	Not used	100
	5.6	170
6	Not used	125
	10	170
7	Not used	145
	22	170

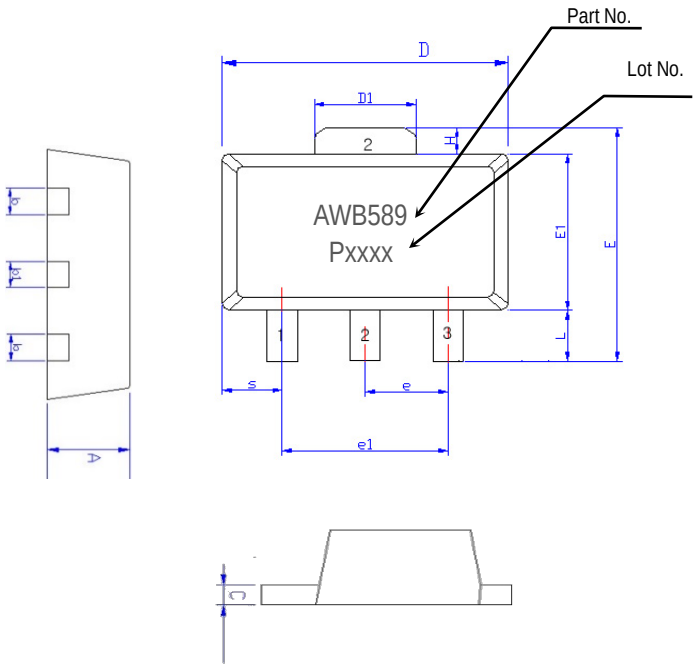
11.3 Performance Table

Supply voltage = +5, +6, +7 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical												Unit
Frequency	470	860	470	860	470	860	470	860	470	860	470	860	MHz
Gain	19.6	19.1	19.6	19.1	19.6	19.1	19.6	19.1	19.8	19.3	19.8	19.3	dB
S11	-14	-10	-14	-10	-14	-10	-14	-10	-14	-10	-14	-10	dB
S22	-20	-12	-20	-12	-20	-12	-20	-12	-20	-12	-20	-12	dB
Noise Figure	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	dB
Output IP3[1)]	40.0	38.0	45.0	43.0	42.5	40.5	44.5	44.0	43.0	41.5	45.0	43.0	dBm
Output P1dB	23.0	22.0	23.5	23.0	25.0	24.5	25.5	25.0	26.5	26.0	26.8	26.3	dBm
Current	100		170		125		170		145		170		mA
Device Voltage	+5				+6				+7				V

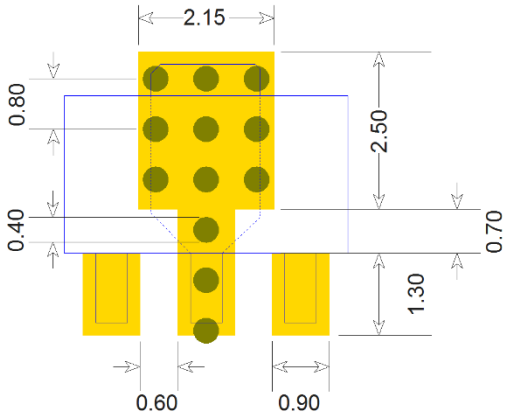
1) OIP3 is measured with two tones at an output power of +12 dBm/tone separated by 1MHz.

12. Package Outline (SOT89, 4.5x4.0x1.5 mm)



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

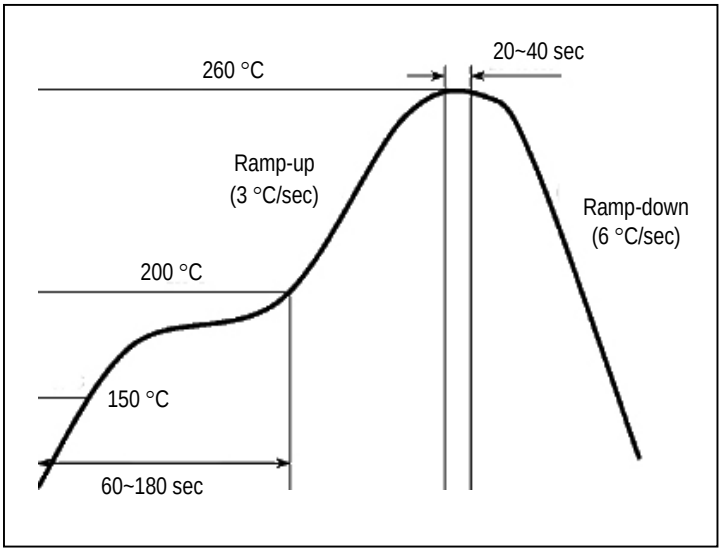
13. Surface Mount Recommendation (In mm)



NOTE

1. The number and size of ground via holes in a circuit board are 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.

14. Recommended Soldering Reflow Profile



(End of Datasheet)