AHB5614T8 Data Sheet

50 ~ 7000 MHz Wide Band Gain Block Amplifier

1. Product Overview

1.1 General Description

AHB5614T8 is an ultra-flat gain, low noise, and highly linear gain block amplifier MMIC with single circuit matched over 50-7000 MHz, being suitable for use in both receiver and transmitter of up to 7000 MHz. The active bias circuit stabilizing the current over process variation is adopted. The amplifier is available in TDFN8 package and passes through the stringent 100% DC & RF test via an automated test handler.

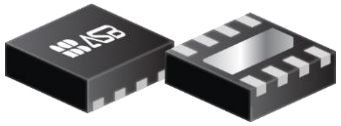
1.2 Features

- Gain 14.4 dB at 2000 MHz
- Ultra-Flat Gain at 50 ~ 7000 MHz
- NF 2.7 dB at 2000 MHz
- P1dB 20.0 dBm at 2000 MHz
- OIP3 35.0 dBm at 2000 MHz
- MTTF > 100 Years
- Single Supply: +5 V, 80 mA

1.3 Applications

- Wide-band application
  50 ~ 7000 MHz, 3000 ~ 7000 MHz, 50 ~ 4000 MHz, 950 ~ 4000 MHz
- 6400 ~ 6600 MHz
- 5G sub-6 and V2X

1.4 Package Profile & RoHS Compliance

	RoHS-compliant GREEN Package
TDFN8, 2.0x2.0 mm^2, surface mount	RoHS-compliant

2. Summary on Product Performances

2.1 Typical Performance

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

Parameter	Typical										Unit
Frequency	50	1000	2000	3000	3400	3800	4200	5200	6000	7000	MHz
Gain	14.3	14.6	14.4	14.0	14.0	14.0	14.0	14.6	14.4	13.0	dB
S11	-10	-22	-13	-12	-11	-11	-11	-12	-7	-3	dB
S22	-14	-22	-12	-10	-9	-9	-9	-9	-9	-10	dB
Noise Figure[1)]	2.6	2.5	2.7	2.7	2.8	2.8	2.9	3.1	3.4	4.3	dB
Output IP3	36.7[2)]	37.5[2)]	35.0[2)]	34.3[2)]	32.6[2)]	34.5[2)]	34.9[2)]	33.8[3)]	30.2[4)]	27.0[5)]	dBm
Output P1dB	19.0	20.0	20.0	19.0	18.0	18.0	17.8	17.8	15.5	10.0	dBm
Current	80										mA
Device Voltage	5										V

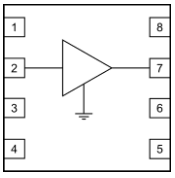
1) Noise figure is measured at the connectors on the board (i.e. not de-embedded).
2) OIP3 is measured with two tones at an output power of +8 dBm/tone separated by 1 MHz.
3) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.
4) OIP3 is measured with two tones at an output power of +5 dBm/tone separated by 1 MHz.
5) OIP3 is measured with two tones at an output power of +3 dBm/tone separated by 1 MHz.

2.2 Product Specification

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

Parameter	Min	Typ	Max	Unit
Frequency		2000		MHz
Gain		14.4		dB
S11		-13		dB
S22		-12		dB
Noise Figure		2.7		dB
OIP3		35.0		dBm
P1dB		20.0		dBm
Current		80		mA
Device Voltage		5		V

2.3 Pin Configuration

Pin	Description	Simplified Outline
1, 3, 4, 5, 6, 8	NC or GND	
2	RF_IN	
7	RF_OUT	
Backside Paddle	DC/RF Ground	

2.4 Absolute Maximum Ratings, T_A = +25 °C

Parameters	Max. Ratings
Operation Case Temperature	-40 to +85 °C
Storage Temperature	-40 to +150 °C
Device Voltage	+6 V
Operation Junction Temperature	+150 °C
Input RF Power (At 50 MHz, CW, 50 Ω matched)*	+27 dBm

The operation of this device in excess of any of these limits may cause permanent damage.
* Refer to the max. input RF power data at http://www.asb.co.kr/pdf/Maximum_Input_Power_Analysis.pdf. The max. input RF power, in principle, depends upon application frequency, matching circuit, and device voltage.

2.5 Thermal Resistance

Symbol	Description	Typ	Unit
R_{th}	Thermal resistance from junction to lead	78	°C/W

2.6 ESD Classification & Moisture Sensitivity Level

ESD Classification

HBM	Class 1A	Voltage Level: 400 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

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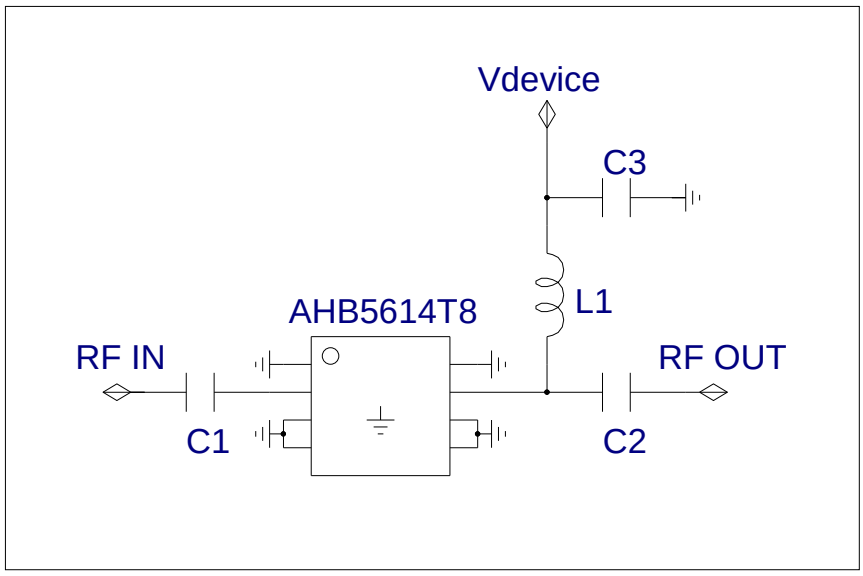
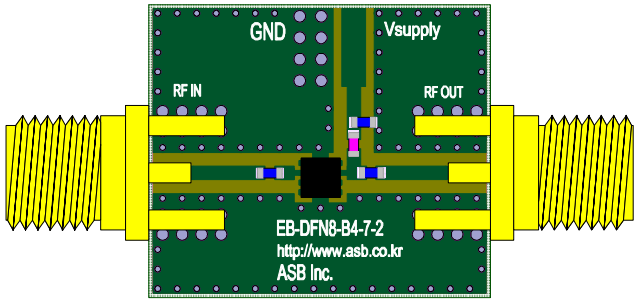
3. Application: 50 ~ 7000 MHz, V_{device} = +5 V

3.1 Application Circuit & Evaluation Board



Note: 1. The ground via should be located beneath the ground pins.
(Refer to 'Surface Mount Recommendation')



PCB Information (EB No.: EB-DFN8-B4-7-2, 17x15 mm²)		
Layer	Material	Thickness (mm)
Top	Copper	0.0175
Dielectric	Rogers RO4003	0.305
Inner	Copper	0.0175
Dielectric	FR4	0.4
Bottom	Copper	0.0175

Bill of Material

Symbol	Value	Size(Inch)	Description	Part Number	Manufacturer
AHB5614T8	-	-	MMIC Amplifier	-	ASB
C1, C2	1 nF	0402	DC blocking Capacitor	GRM1555C1H102FA	Murata
C3	1 μF	0402	Decoupling Capacitor	GRM155C71C105KE	Murata
L1	270 nH	0402	RF Choke Inductor	LQG15HSR27G02	Murata

3.2 Performance Table

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

Parameter	Typical										Unit
Frequency	50	1000	2000	3000	3400	3800	4200	5200	6000	7000	MHz
Gain	14.3	14.6	14.4	14.0	14.0	14.0	14.0	14.6	14.4	13.0	dB
S11	-10	-22	-13	-12	-11	-11	-11	-12	-7	-3	dB
S22	-14	-22	-12	-10	-9	-9	-9	-9	-9	-10	dB
Noise Figure[1)]	2.6	2.5	2.7	2.7	2.8	2.8	2.9	3.1	3.4	4.3	dB
Output IP3	36.7[2)]	37.5[2)]	35.0[2)]	34.3[2)]	32.6[2)]	34.5[2)]	34.9[2)]	33.8[3)]	30.2[4)]	27.0[5)]	dBm
Output P1dB	19.0	20.0	20.0	19.0	18.0	18.0	17.8	17.8	15.5	10.0	dBm
Current	80										mA
Device Voltage	5										V

1) Noise figure is measured at the connectors on the board (i.e. not de-embedded).
2) OIP3 is measured with two tones at an output power of +8 dBm/tone separated by 1 MHz.
3) OIP3 is measured with two tones at an output power of +7 dBm/tone separated by 1 MHz.
4) OIP3 is measured with two tones at an output power of +5 dBm/tone separated by 1 MHz.
5) OIP3 is measured with two tones at an output power of +3 dBm/tone separated by 1 MHz.

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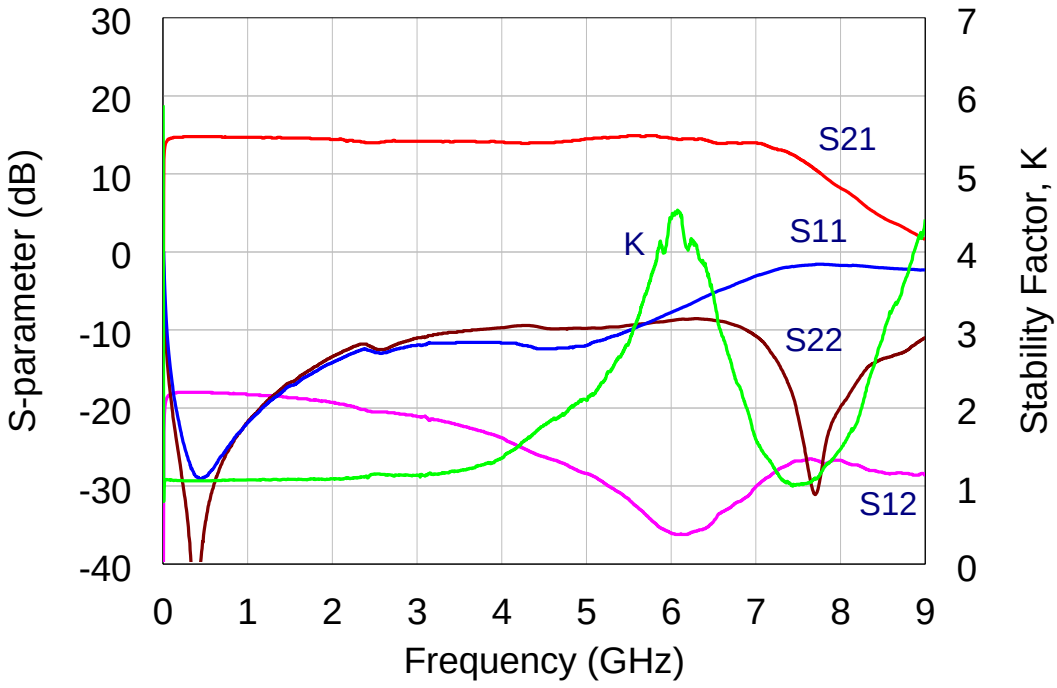
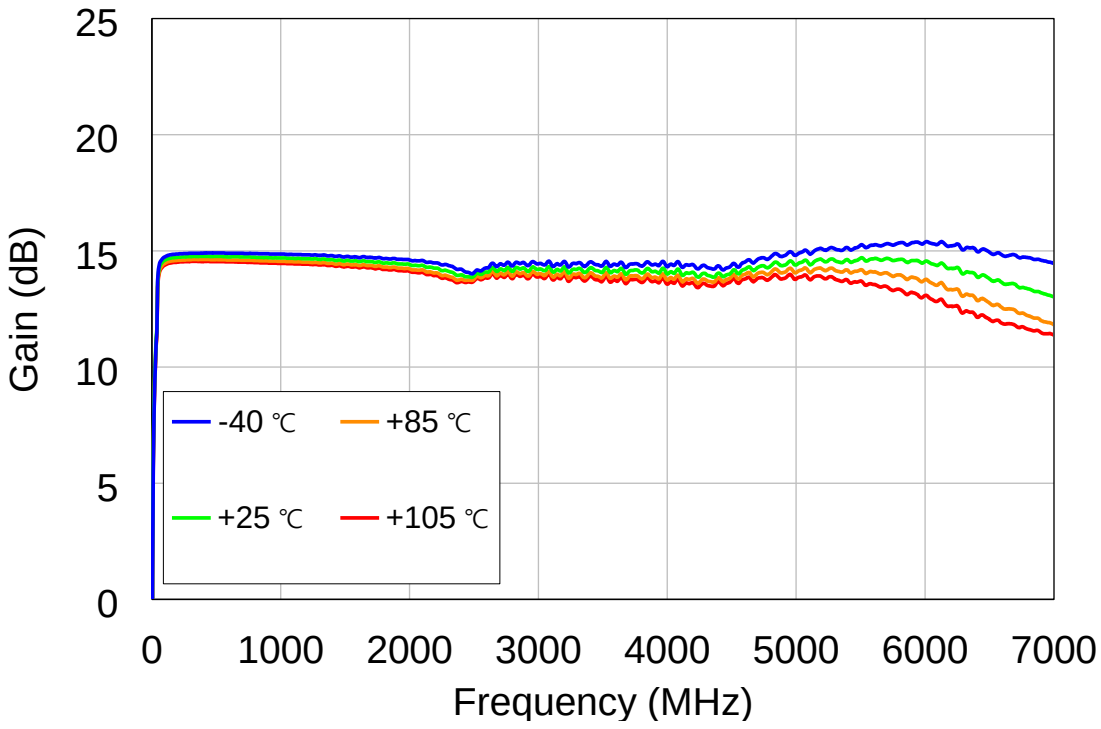
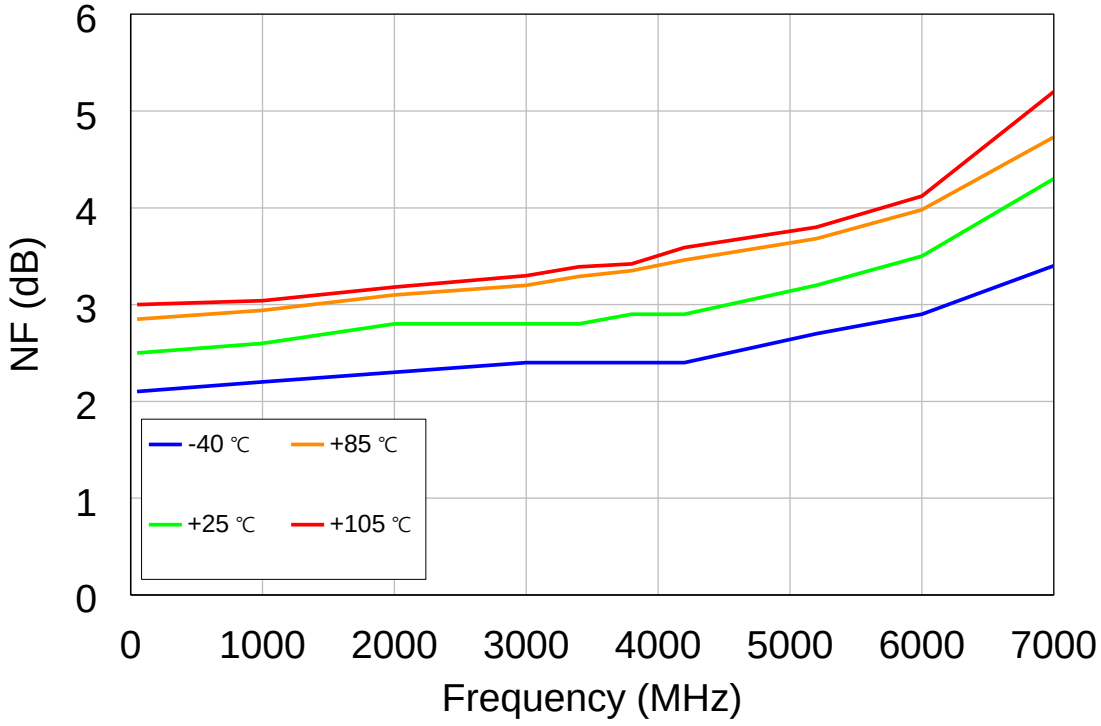
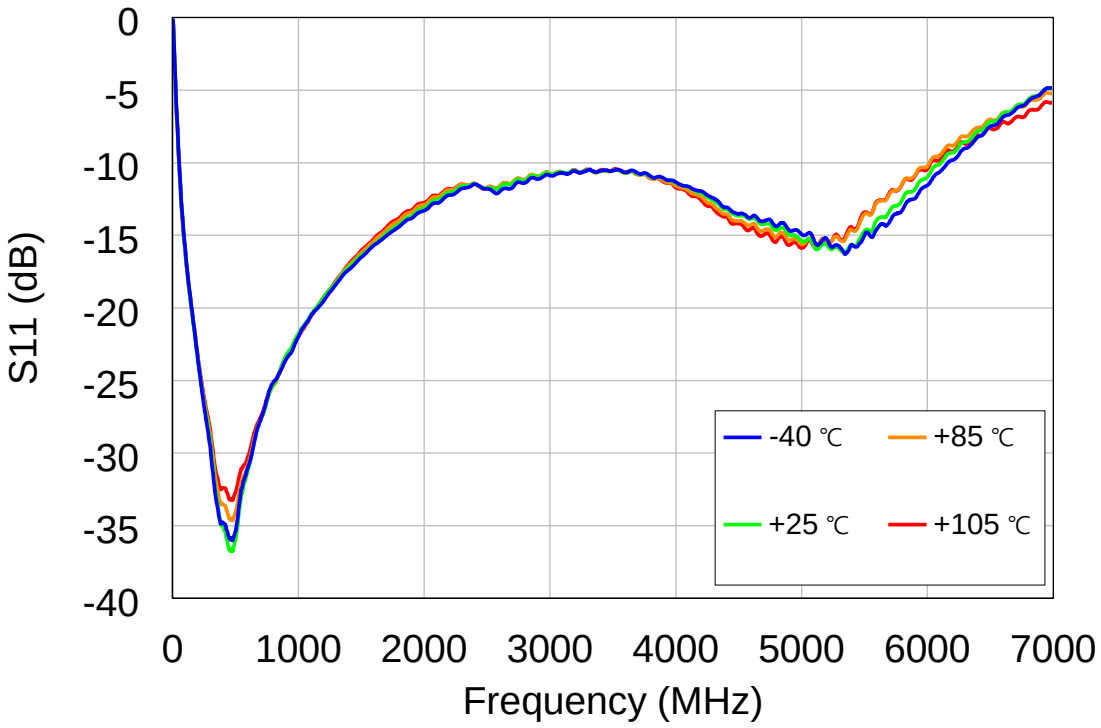
3.3 Plot of S-parameter & Stability Factor

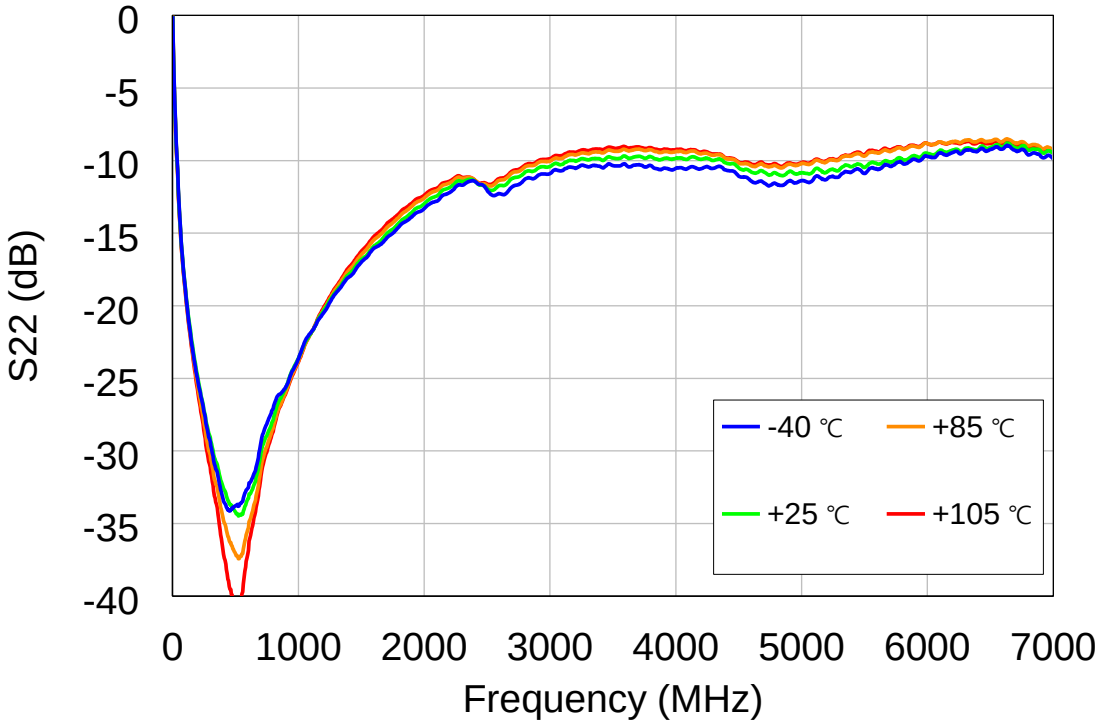


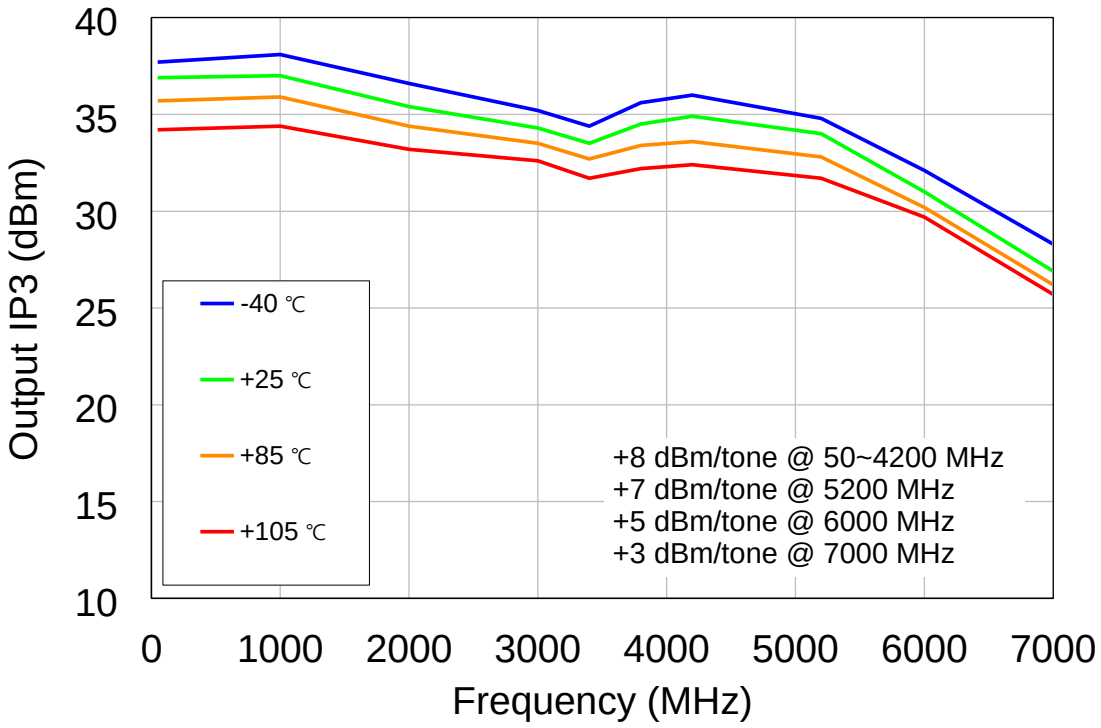
3.4 Plots of Performances with Temperature

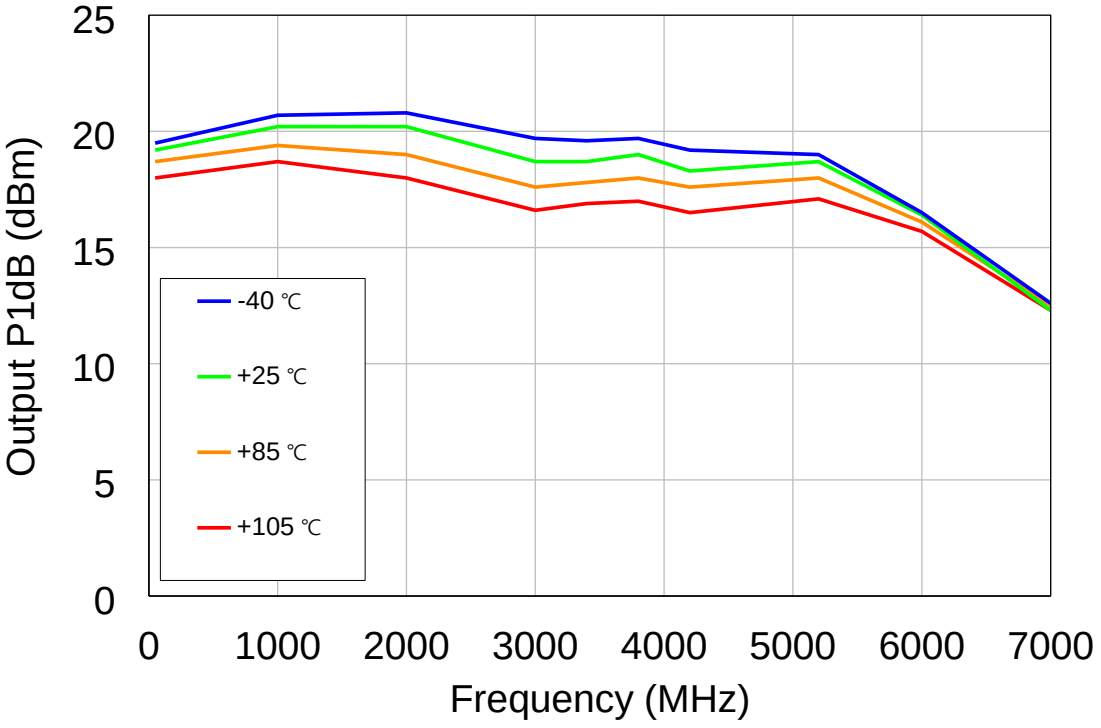


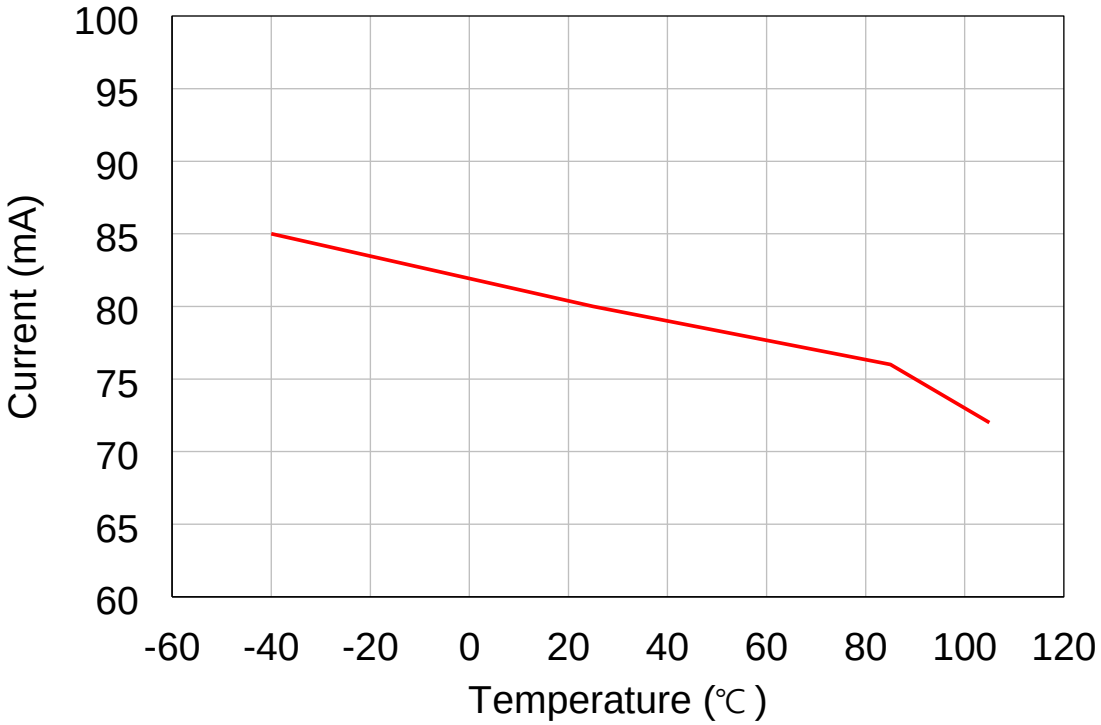



S11 (dB)
0
-5
-10
-15
-20
-25
-30
-35
-40
0
1000
2000
3000
4000
5000
6000
7000
Frequency (MHz)
-40 ℃
+85 ℃
+25 ℃
+105 ℃


S22 (dB)
0
-5
-10
-15
-20
-25
-30
-35
-40
0
1000
2000
3000
4000
5000
6000
7000
Frequency (MHz)
-40 ℃
+85 ℃
+25 ℃
+105 ℃


Output IP3 (dBm)
40
35
30
25
20
15
10
0
1000
2000
3000
4000
5000
6000
7000
Frequency (MHz)
-40 ℃
+25 ℃
+85 ℃
+105 ℃
+8 dBm/tone @ 50~4200 MHz
+7 dBm/tone @ 5200 MHz
+5 dBm/tone @ 6000 MHz
+3 dBm/tone @ 7000 MHz


Output P1dB (dBm)
25
20
15
10
5
0
0
1000
2000
3000
4000
5000
6000
7000
Frequency (MHz)
-40 ℃
+25 ℃
+85 ℃
+105 ℃



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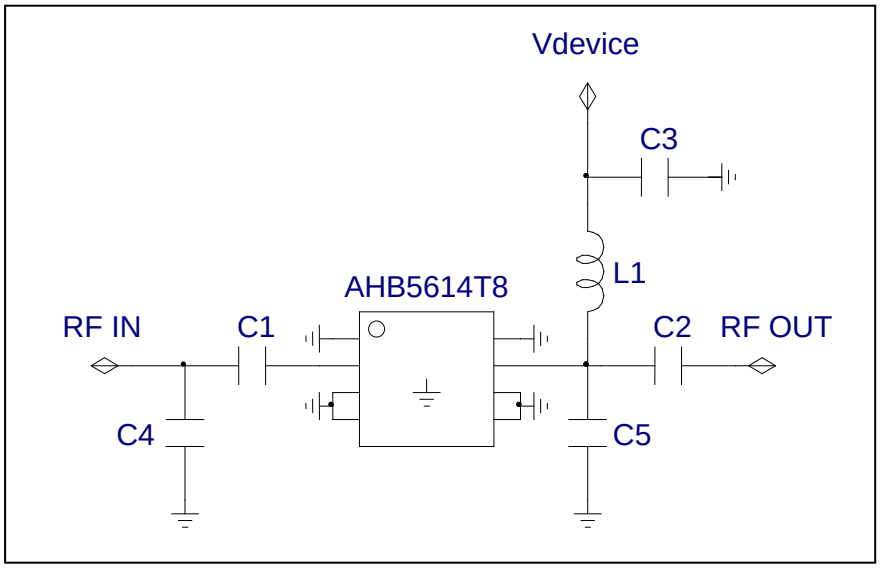
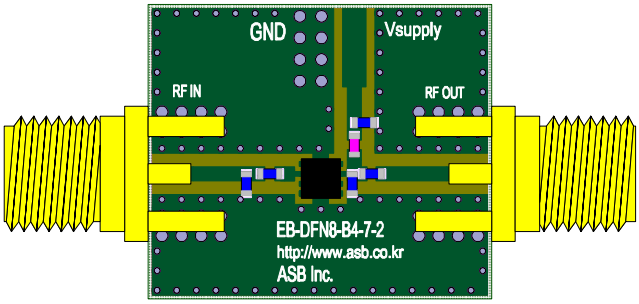
4. Application: 3000 ~ 7000 MHz, V_{device} = +5 V

4.1 Application Circuit & Evaluation Board



Note: 1. The ground via should be located beneath the ground pins.
(Refer to 'Surface Mount Recommendation')



PCB Information (EB No.: EB-DFN8-B4-7-2, 17x15 mm²)		
Layer	Material	Thickness (mm)
Top	Copper	0.0175
Dielectric	Rogers RO4003	0.305
Inner	Copper	0.0175
Dielectric	FR4	0.4
Bottom	Copper	0.0175

Bill of Material

Symbol	Value	Size(Inch)	Description	Part Number	Manufacturer
AHB5614T8	-	-	MMIC Amplifier	-	ASB
C1, C2	1 nF	0402	DC blocking Capacitor	GRM1555C1H102FA	Murata
C3	1 μF	0402	Decoupling Capacitor	GRM155C71C105KE	Murata
C4	0.3 pF	0402	Matching Capacitor	GCM1555C1HR30WA	Murata
C5	0.5 pF	0402	Matching Capacitor	GCM1555C1HR50WA	Murata
L1	1 nH	0402	RF Choke Inductor	LQG15HS1N0B02	Murata

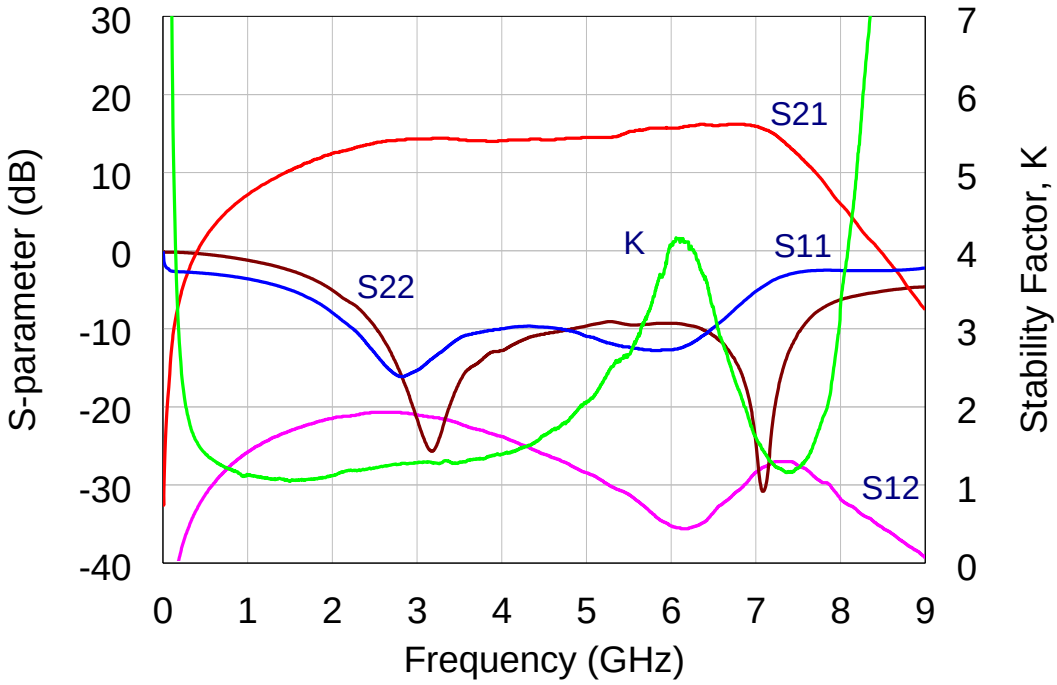
4.2 Performance Table

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

Parameter	Typical					Unit
Frequency	3000	4000	5000	6000	7000	MHz
Gain	14.2	14.0	14.3	15.0	15.2	dB
S11	-15	-9	-11	-13	-4	dB
S22	-21	-12	-10	-9	-20	dB
Noise Figure[1)]	2.9	3.0	3.0	3.5	4.4	dB
Output IP3[2)]	31.0	29.5	28.0	25.0	20.0	dBm
Output P1dB	20.0	20.0	19.0	17.0	10.0	dBm
Current	83					mA
Device Voltage	5					V

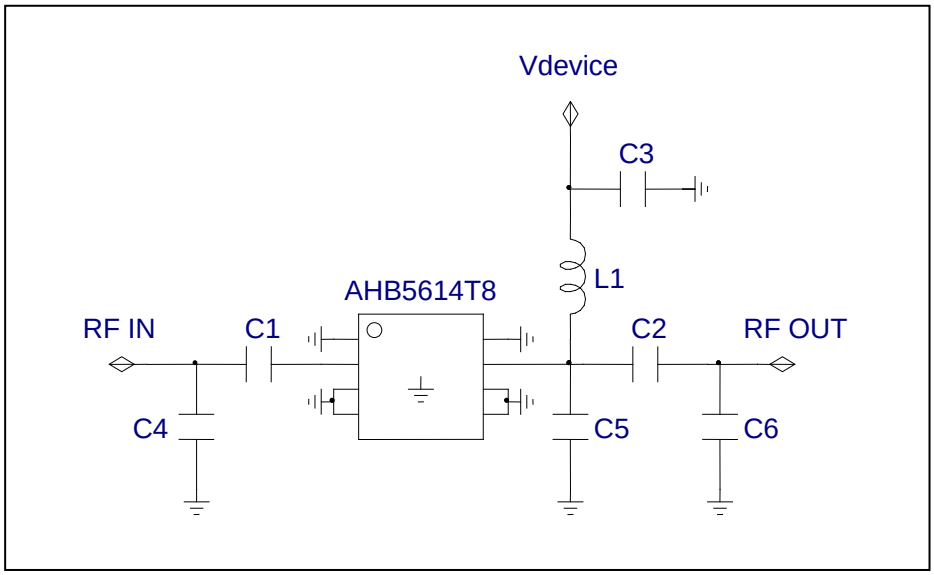
1) Noise figure is measured at the connectors on the board (i.e. not de-embedded).
2) OIP3 is measured with two tones at an output power of +0 dBm/tone separated by 1 MHz.

4.3 Plot of S-parameter & Stability Factor

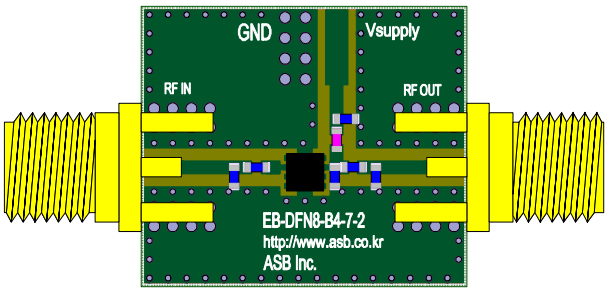


5. Application: 6400 ~ 6600 MHz, V_{device} = +5 V

5.1 Application Circuit & Evaluation Board



Note: 1. The ground via should be located beneath the ground pins.
(Refer to 'Surface Mount Recommendation')



PCB Information (EB No.: EB-DFN8-B4-7-2, 17x15 mm²)		
Layer	Material	Thickness (mm)
Top	Copper	0.0175
Dielectric	Rogers RO4003	0.305
Inner	Copper	0.0175
Dielectric	FR4	0.4
Bottom	Copper	0.0175

Bill of Material

Symbol	Value	Size(Inch)	Description	Part Number	Manufacturer
AHB5614T8	-	-	MMIC Amplifier	-	ASB
C1	1.8 pF	0402	DC blocking Capacitor	GRM1555C1H1R8CA	Murata
C2	1.5 pF	0402	DC blocking Capacitor	GRM1555C1H1R5CA	Murata
C3	1 μF	0402	Decoupling Capacitor	GRM155C71C105KE	Murata
C4	0.75 pF	0402	Matching Capacitor	GCM1555C1HR75CA	Murata
C5	0.5 pF	0402	Matching Capacitor	GRM1555C1HR50BA	Murata
C6	0.3 pF	0402	Matching Capacitor	GRM1555C1HR30BA	Murata
L1	1 nH	0402	RF Choke Inductor	LQG15HS1N0B02	Murata

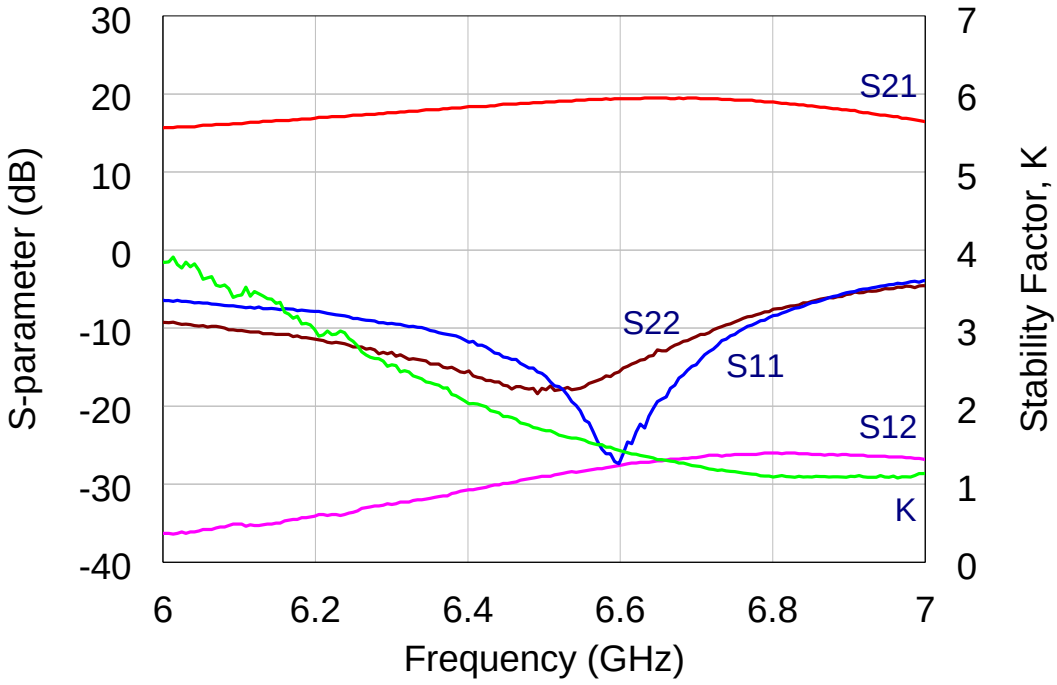
5.2 Performance Table

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

Parameter	Typical		Unit
Frequency	6400	6600	MHz
Gain	18.3	19.0	dB
S11	-11	-20	dB
S22	-15	-17	dB
Noise Figure[1)]	4.6	4.8	dB
Output IP3[2)]	24.5	23.5	dBm
Output P1dB	15.0	12.6	dBm
Current	80		mA
Device Voltage	5		V

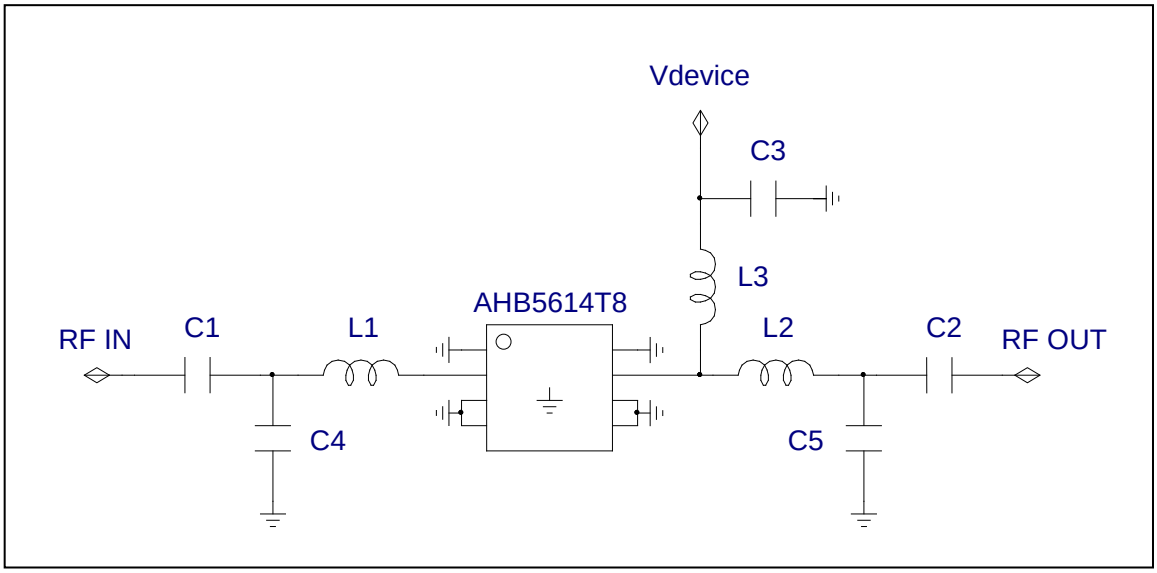
1) Noise figure is measured at the connectors on the board (i.e. not de-embedded).
2) OIP3 is measured with two tones at an output power of +3 dBm/tone separated by 1 MHz.

5.3 Plot of S-parameter & Stability Factor

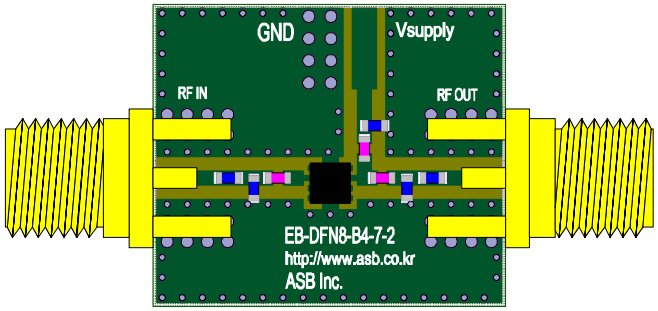


6. Application: 50 ~ 4000 MHz, V_{device} = +5 V

6.1 Application Circuit & Evaluation Board



Note: 1. The ground via should be located beneath the ground pins.
(Refer to 'Surface Mount Recommendation')



PCB Information (EB No.: EB-DFN8-B4-7-2, 17x15 mm²)		
Layer	Material	Thickness (mm)
Top	Copper	0.0175
Dielectric	Rogers RO4003	0.305
Inner	Copper	0.0175
Dielectric	FR4	0.4
Bottom	Copper	0.0175

Bill of Material

Symbol	Value	Size(Inch)	Description	Part Number	Manufacturer
AHB5614T8	-	-	MMIC Amplifier	-	ASB
C1	1 nF	0402	DC blocking Capacitor	GRM1555C1H102FA	Murata
C2	220 pF	0402	DC blocking Capacitor	GRM1555C2A221GE	Murata
C3	1 μF	0402	Decoupling Capacitor	GRM155C71C105KE	Murata
C4, C5	0.3 pF	0402	Matching Capacitor	GRM1555C1HR30BA	Murata
L1	1.8 nH	0402	Matching Inductor	LQG15HN1N8B02	Murata
L2	1.5 nH	0402	Matching Inductor	LQG15HN1N5B02	Murata
L3	270 nH	0402	RF Choke Inductor	LQG15HSR27G02	Murata

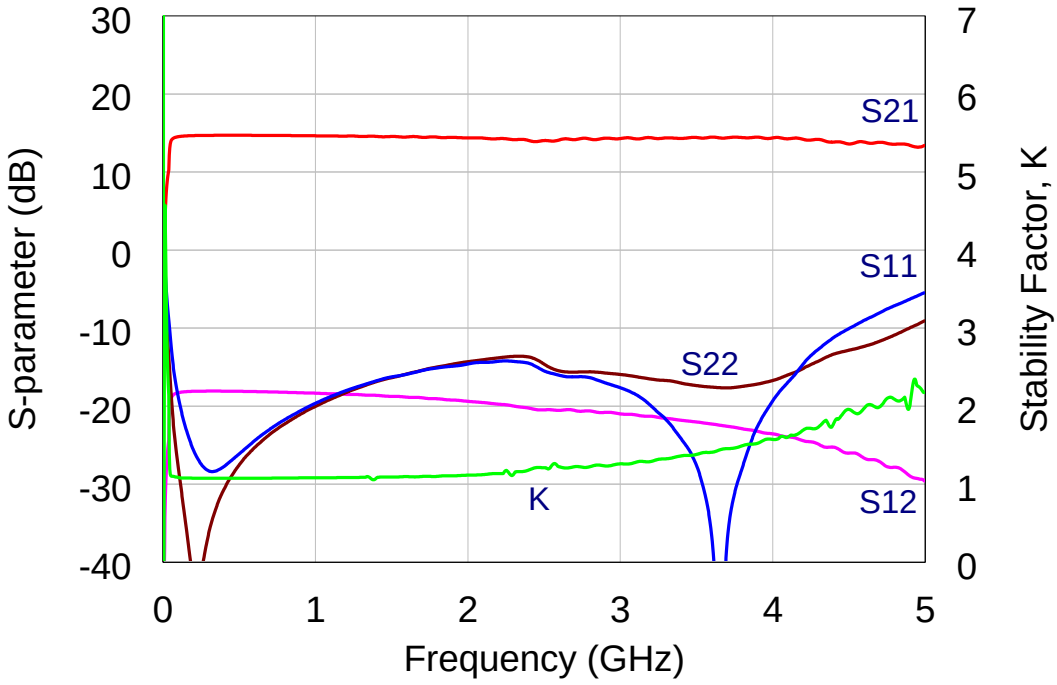
6.2 Performance Table

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

Parameter	Typical					Unit
Frequency	50	950	2000	3000	4000	MHz
Gain	14.2	14.7	14.3	14.2	14.2	dB
S11	-12	-20	-14	-17	-18	dB
S22	-18	-20	-14	-16	-16	dB
Noise Figure[1)]	2.5	2.5	2.6	2.7	2.9	dB
Output IP3[2)]	36.6	36.4	35.0	33.4	32.0	dBm
Output P1dB	19.0	20.0	20.0	19.5	19.0	dBm
Current	77					mA
Device Voltage	5					V

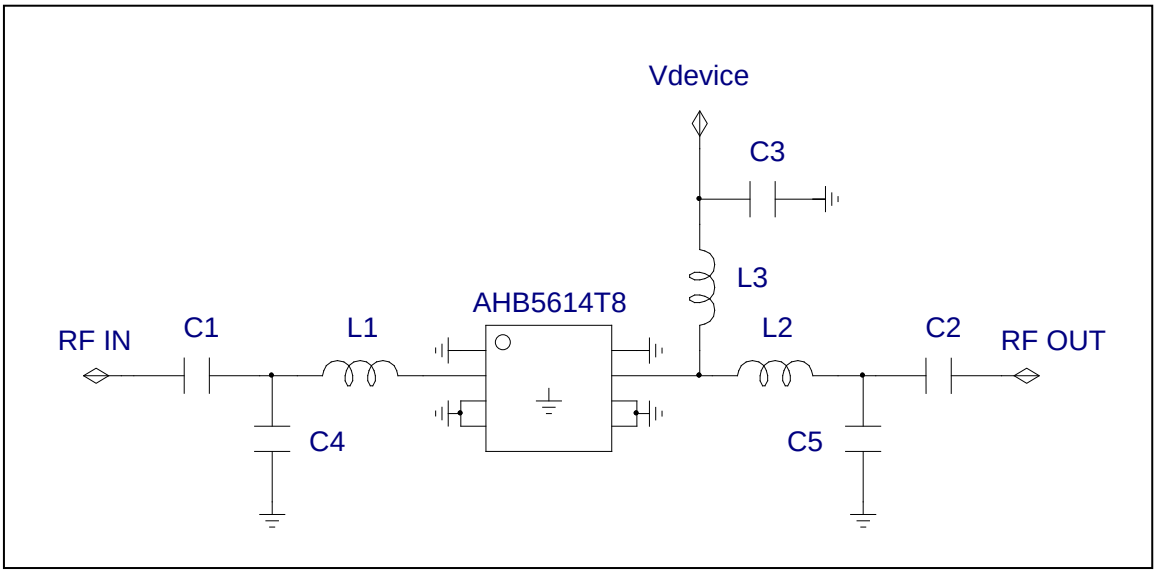
1) Noise figure is measured at the connectors on the board (i.e. not de-embedded).
2) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1 MHz.

6.3 Plot of S-parameter & Stability Factor

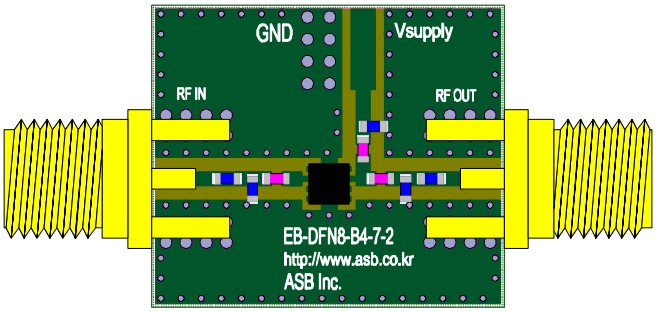


7. Application: 950 ~ 4000 MHz, V_{device} = +5 V

7.1 Application Circuit & Evaluation Board



Note: 1. The ground via should be located beneath the ground pins.
(Refer to 'Surface Mount Recommendation')



PCB Information (EB No.: EB-DFN8-B4-7-2, 17x15 mm²)		
Layer	Material	Thickness (mm)
Top	Copper	0.0175
Dielectric	Rogers RO4003	0.305
Inner	Copper	0.0175
Dielectric	FR4	0.4
Bottom	Copper	0.0175

Bill of Material

Symbol	Value	Size(Inch)	Description	Part Number	Manufacturer
AHB5614T8	-	-	MMIC Amplifier	-	ASB
C1	1 nF	0402	DC blocking Capacitor	GRM1555C1H102FA	Murata
C2	220 pF	0402	DC blocking Capacitor	GRM1555C2A221GE	Murata
C3	1 μF	0402	Decoupling Capacitor	GRM155C71C105KE	Murata
C4	0.3 pF	0402	Matching Capacitor	GRM1555C1HR30BA	Murata
C5	0.5 pF	0402	Matching Capacitor	GRM1555C1HR50BA	Murata
L1	1.8 nH	0402	Matching Inductor	LQG15HN1N8B02	Murata
L2	1.5 nH	0402	Matching Inductor	LQG15HN1N5B02	Murata
L3	18 nH	0402	RF Choke Inductor	LQG15HN18NG02	Murata

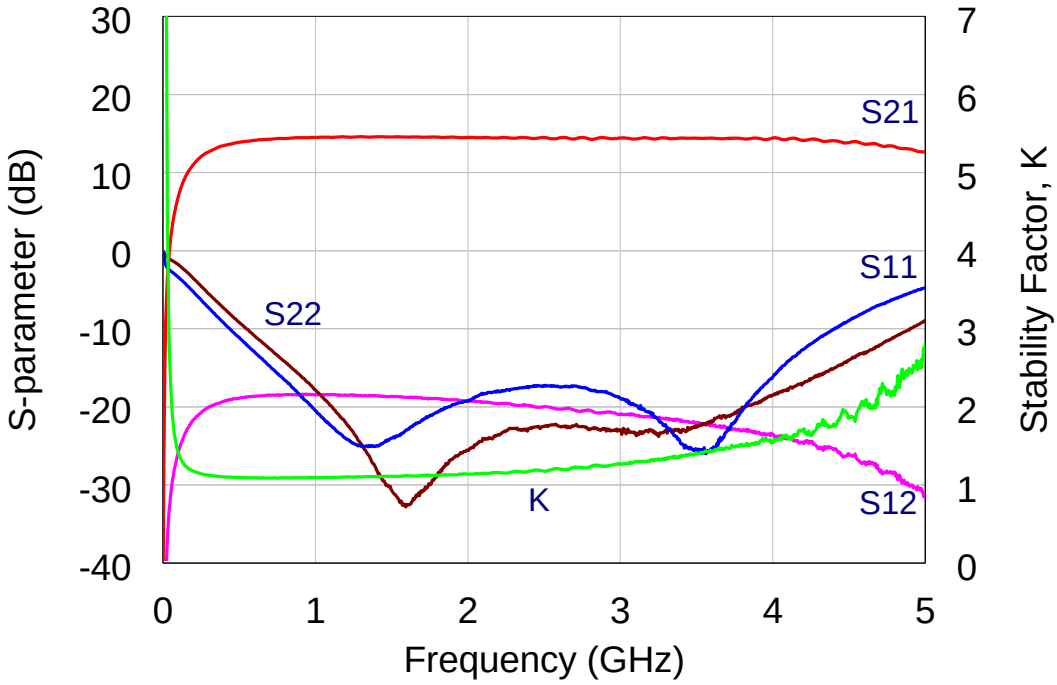
7.2 Performance Table

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

Parameter	Typical				Unit
Frequency	950	2000	3000	4000	MHz
Gain	14.5	14.5	14.4	14.3	dB
S11	-19	-19	-20	-16	dB
S22	-17	-24	-22	-19	dB
Noise Figure[1)]	2.5	2.6	2.7	3.0	dB
Output IP3[2)]	36.0	34.8	33.0	32.6	dBm
Output P1dB	19.3	19.8	19.1	18.8	dBm
Current	80				mA
Device Voltage	5				V

1) Noise figure is measured at the connectors on the board (i.e. not de-embedded).
2) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1 MHz.

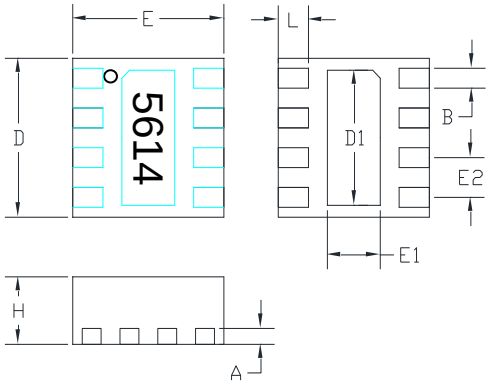
7.3 Plot of S-parameter & Stability Factor



▶ Customized Application Circuit Support

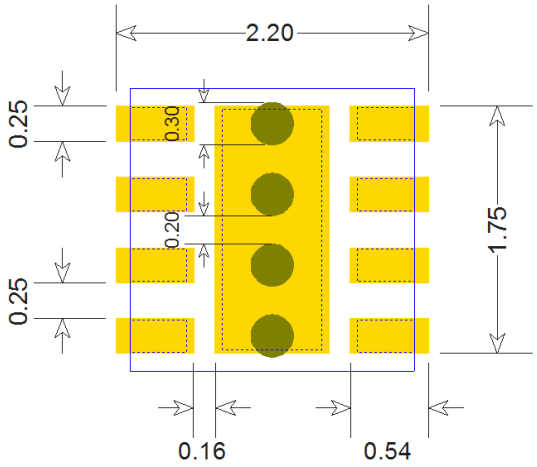
Customized application circuit (reference design) with respect to application frequency, impedance, gain, linearity, and bias condition can be supported upon customer's request. Please feel free to contact us at sales@asb.co.kr.

8. Package Outline (TDFN8)



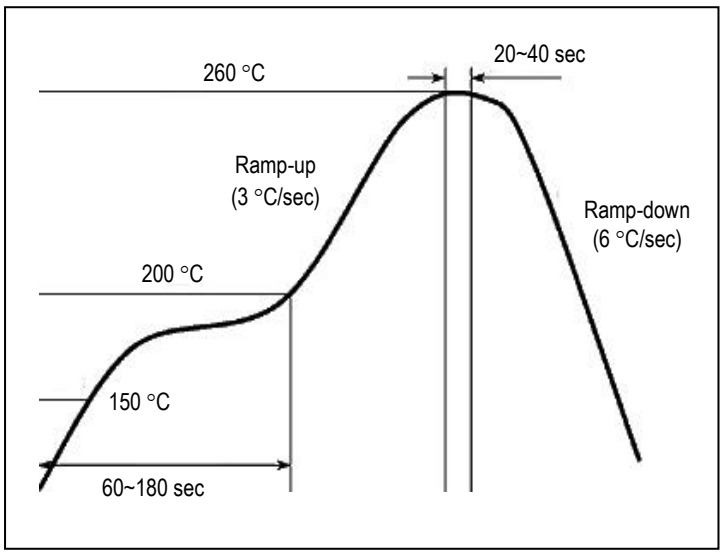
Symbols	Dimensions (In mm)		
	MIN	NOM	MAX
A	-	0.20REF	-
B	0.18	0.23	0.28
D	1.95	2.00	2.03
D1	-	1.7BSC	-
E	1.95	2.00	2.03
E1	-	0.7BSC	-
E2	-	0.5BSC	-
L	0.35	0.40	0.45
H	0.80	0.85	0.90

9. Surface Mount Recommendation (In mm)



NOTE
1. It is recommended that the ground via holes be placed as close to the ground pin of the device as possible for better RF and thermal performance, as shown in the drawing at the left side.

10. Recommended Soldering Reflow Profile



(End of Datasheet)

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