AHL5421T8 Data Sheet

Ultra Flat Gain Low Noise Amplifier

1. Product Overview

1.1 General Description

AHL5421T8, a ultra flat gain low noise amplifier MMIC, has high linearity, low noise and high efficiency over a wide range of frequency from 50 MHz to 4000 MHz, being suitable for use in both receiver and transmitter of telecommunication system. It has an active bias network for stable current over temperature and process variation. The amplifier is available in a TDFN8 package and passes through the stringent DC, RF, and reliability tests.

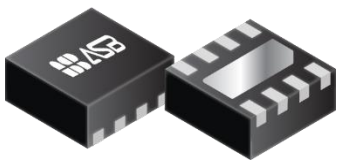
1.2 Features

- Gain decreases from 21.7 dB to 21.1 dB at 0.05~3.5 GHz (22.0 dB at 2.0 GHz)
- NF of 0.9~1.4 dB at 0.05~3.5 GHz (1.25 dB at 3.0 GHz)
- 18.0 dBm P1dB at 2000 MHz
- 33.5 dBm OIP3 at 2000 MHz
- 50 Ω input & output matching
- MTTF > 100 Years
- Single Supply: +3 ~ 5 V

1.3 Applications

- Wide-band application at 50 ~ 4000 MHz
- V-ONU (70 ~ 3240 MHz)
- Other Low Noise Application

1.4 Package Profile & RoHS Compliance

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

2. Summary on Product Performances

2.1 Typical Performance

Supply voltage = +5.0 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical								Unit
Frequency	50	1000	1500	2000	2500	3000	3500	4000	MHz
Gain	21.7	21.9	22.0	22.0	21.9	21.7	21.1	20.0	dB
S11	-12.0	-14.0	-17.0	-20.0	-18.0	-12.0	-10.0	-8.0	dB
S22	-10.0	-11.0	-11.0	-12.0	-12.0	-11.0	-9.0	-8.0	dB
Noise Figure [1]	0.90	0.85	0.90	1.00	1.10	1.25	1.40	1.65	dB
Output IP3 [2]	35.0	35.0	34.0	33.5	33.0	32.0	31.0	31.0	dBm
Output P1dB	19.0	19.0	19.0	18.0	18.0	18.0	17.0	17.0	dBm
Current	80								mA
Device Voltage	5								V

1) Noise figure is measured at the connectors on the board. (i.e. not de-embedded)

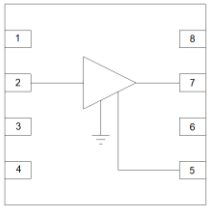
2) OIP3 is measured with two tones at the output power of +4 dBm/tone separated by 1 MHz.

2.2 Product Specification

Supply voltage = +5.0 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Min	Typ	Max	Unit
Frequency		2000		MHz
Noise Figure		1.00		dB
Gain		22.0		dB
S11		-20.0		dB
S22		-12.0		dB
Output IP3		33.5		dBm
Output P1dB		18.0		dBm
Current		80		mA
Device Voltage		+5.0		V

2.3 Pin Configuration

Pin	Description	Simplified Outline
2	RF IN	
7	RF OUT	
5	Current adjust	
1, 3, 4, 6, 8	NC or GND	
Backside paddle	GND	

2.4 Absolute Maximum Ratings

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 (CW, 50 Ω matched)	+27 dBm

2.5 Thermal Resistance

Symbol	Description	Typ	Unit
R_{th}	Thermal resistance from junction to lead	90	°C/W

2.6 ESD Classification & Moisture Sensitivity Level

ESD Classification

HBM	Class 1C	Voltage Level : > 1000 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.

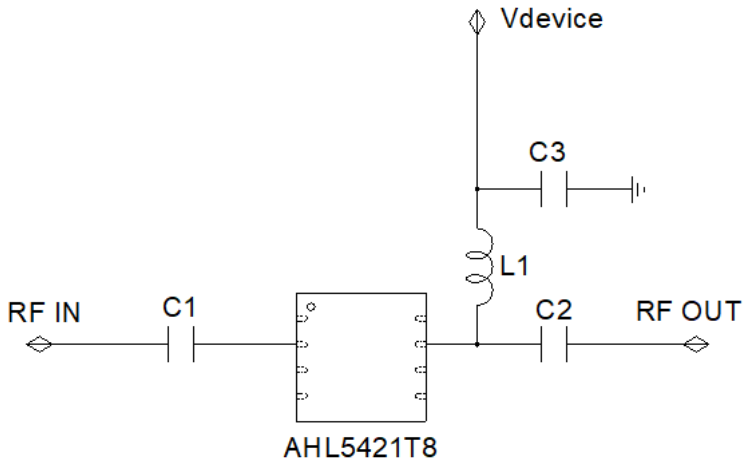
Moisture Sensitivity Level

MSL 3 at 260 °C reflow

(Intentionally Blanked)

3. Typical Application Circuit and Current Adjust Option

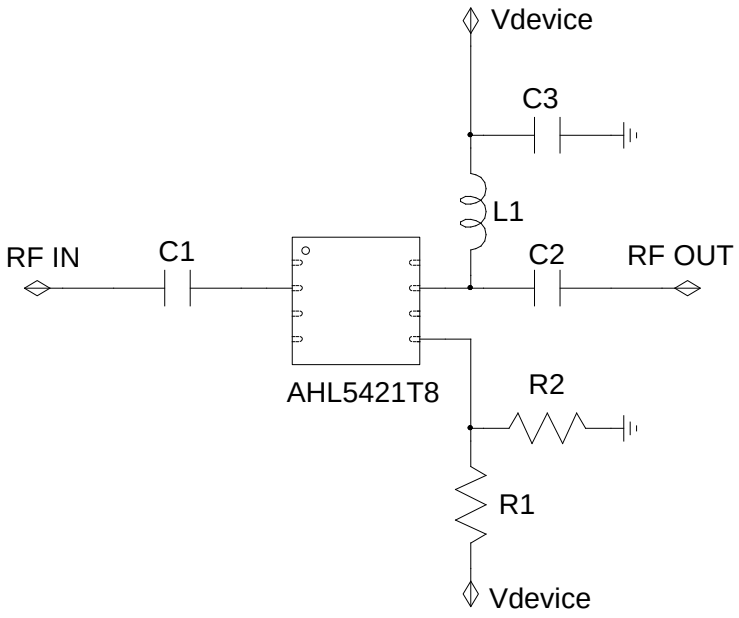
Typical Application Circuit

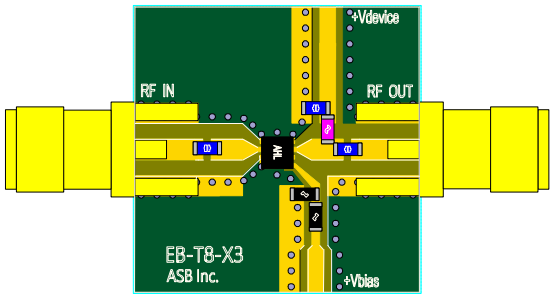


Component	Value	Package
C1, C2	1 nF	0603
C3	1 μF	0603
L1	BLM15HD182SN1	0402

Current Adjust Options

The Pin 5 of AHL5421T8 may be used to adjust the DC operating current by placing either R1 or R2 as shown the schematic below. Placing resistor R2 to ground will reduce the current from typical application level. When using R2 to reduce current do not place (DNP) R1. To increase current from typical application circuit install resistor R1 and connect to V_{DD}.



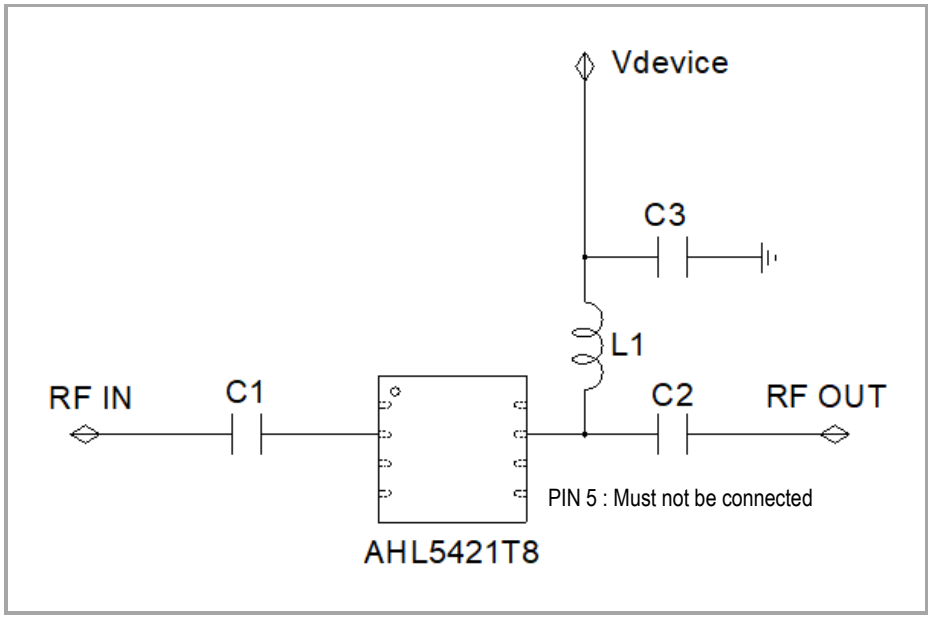


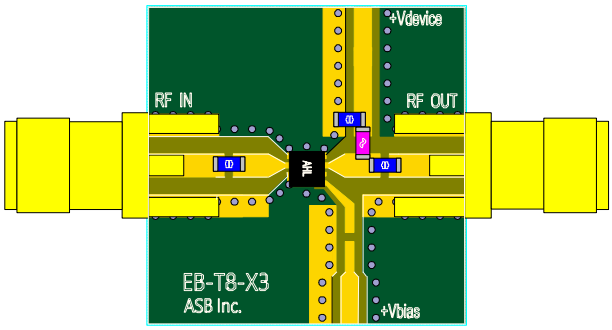
Current	Vdevice= +5 V		Vdevice= +3 V	
mA	R1	R2	R1	R2
20	DNP	510 Ω	DNP	5.1 kΩ
40	DNP	1.5 kΩ	DNP	DNP
60	DNP	5.1 kΩ	1 kΩ	DNP
80	DNP	DNP	0 Ω	DNP
100	1 kΩ	DNP	Not recommended	
110	0 Ω	DNP	Not recommended	

R1 and R2 are not used in typical application.

4. Application: 50 ~ 4000 MHz (VDEVICE = +5 V)

4.1 Application Circuit & Evaluation Board





PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	18x18
EB No.	EB-T8-X3

Bill of Material

Symbol	Value	Size	Description	Manufacturer
AHL5421T8	-	-	MMIC amplifier	ASB
C1	1 nF	0603	DC blocking capacitor	Murata
C2	1 nF	0603	DC blocking capacitor	Murata
C3	1 μF	0603	Decoupling capacitor	Murata
L1	BLM15HD182SN1	0402	RF choke inductor	Murata

4.2 Performance Table

Supply voltage = +5.0 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical								Unit
Frequency	50	1000	1500	2000	2500	3000	3500	4000	MHz
Gain	21.7	21.9	22.0	22.0	21.9	21.7	21.1	20.0	dB
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S22	-10.0	-11.0	-11.0	-12.0	-12.0	-11.0	-9.0	-8.0	dB
Noise Figure [1)]	0.90	0.85	0.90	1.00	1.10	1.25	1.40	1.65	dB
Output IP3 [2)]	35.0	35.0	34.0	33.5	33.0	32.0	31.0	31.0	dBm
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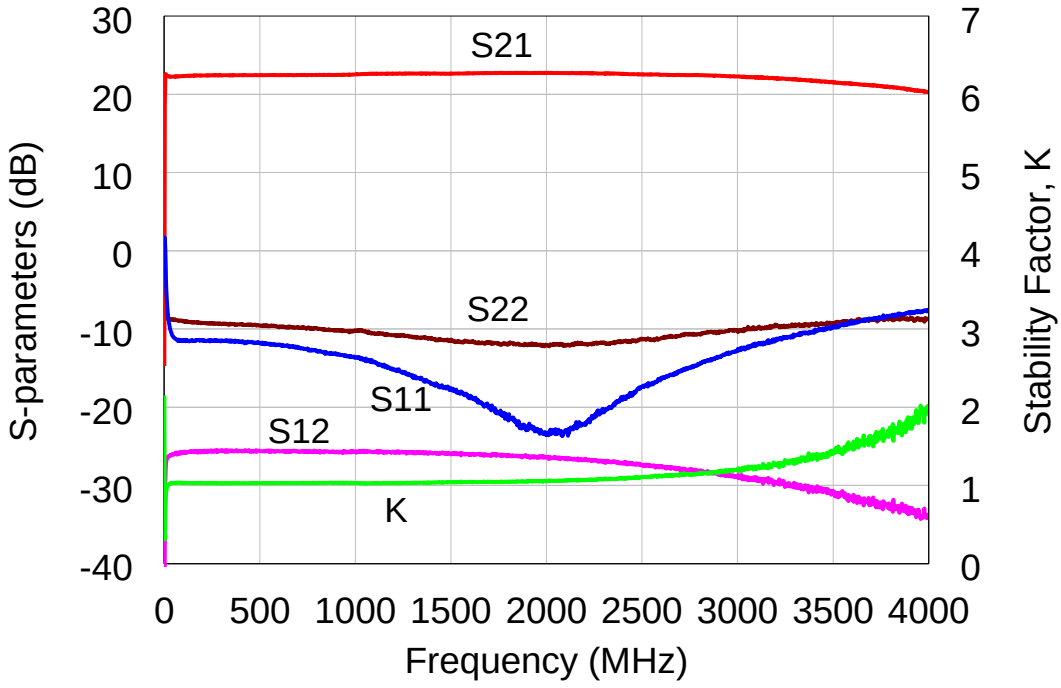
Current	80								mA
Device Voltage	5								V

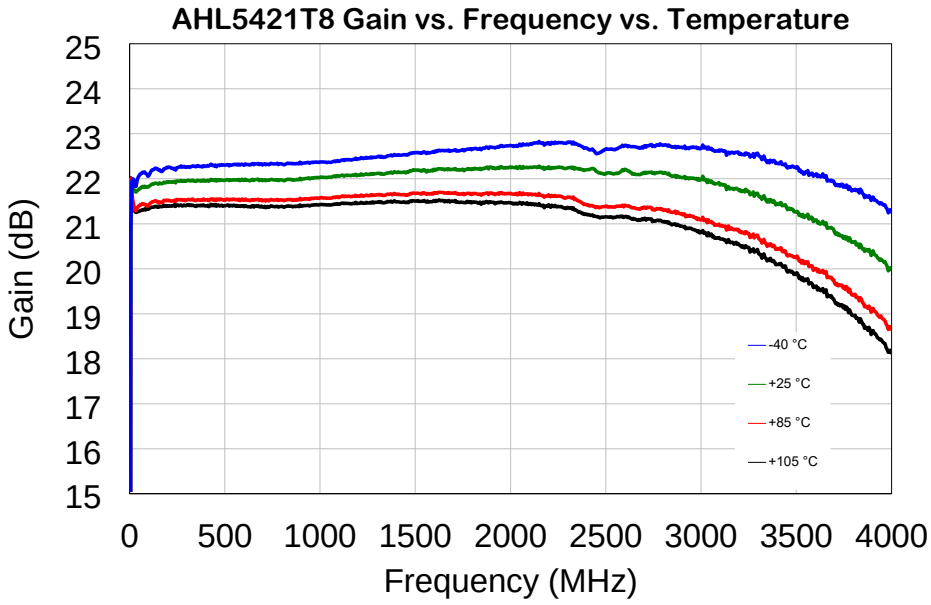
1) Noise figure is measured at the connectors on the board. (i.e. not de-embedded)

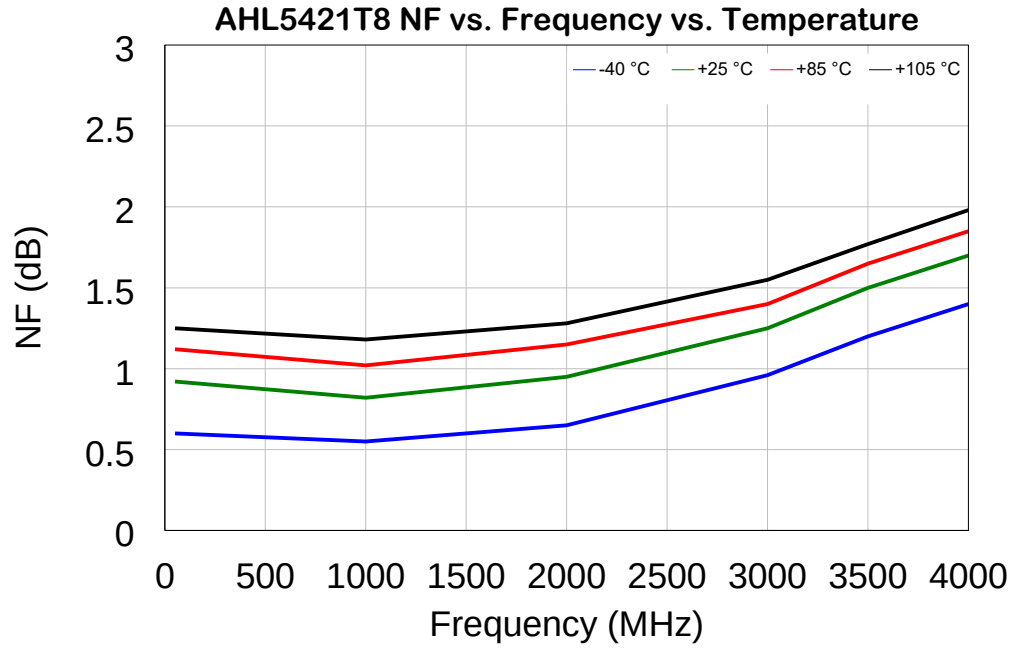
2) OIP3 is measured with two tones at the output power of +4 dBm/tone separated by 1 MHz.

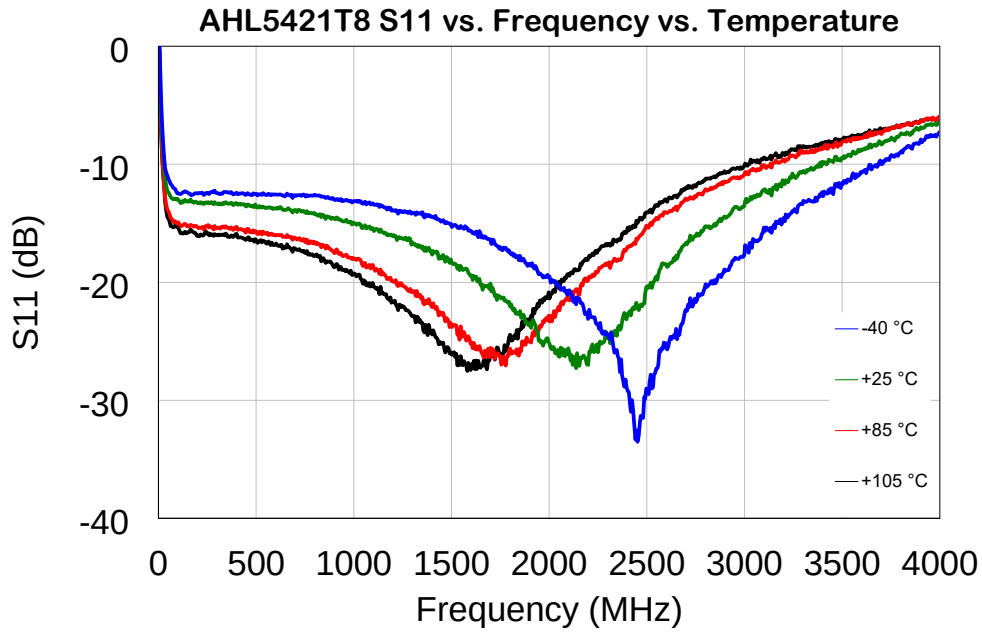
4.3 Plot of S-parameters and K-factor

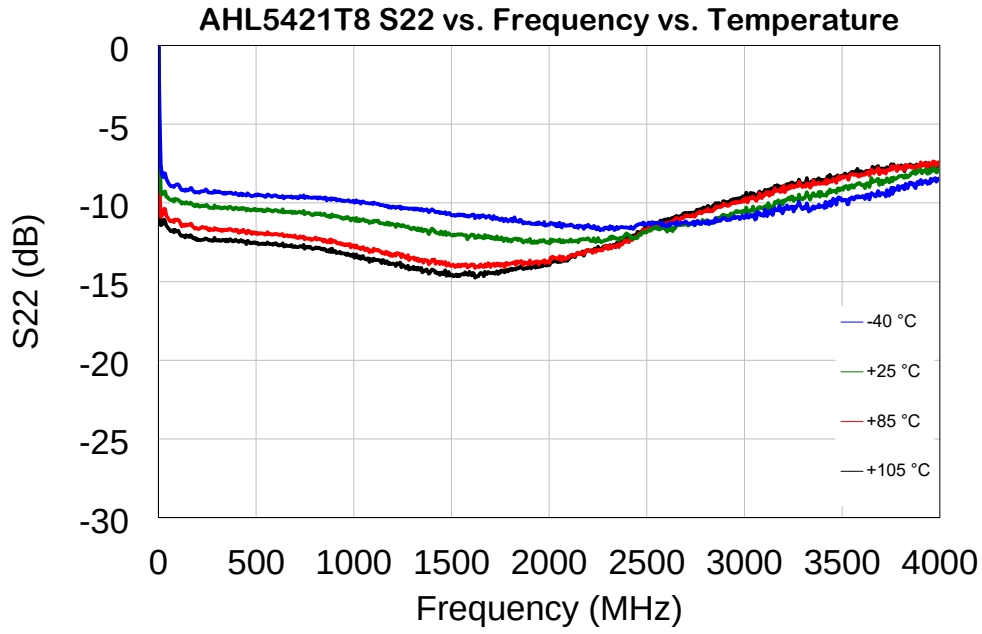


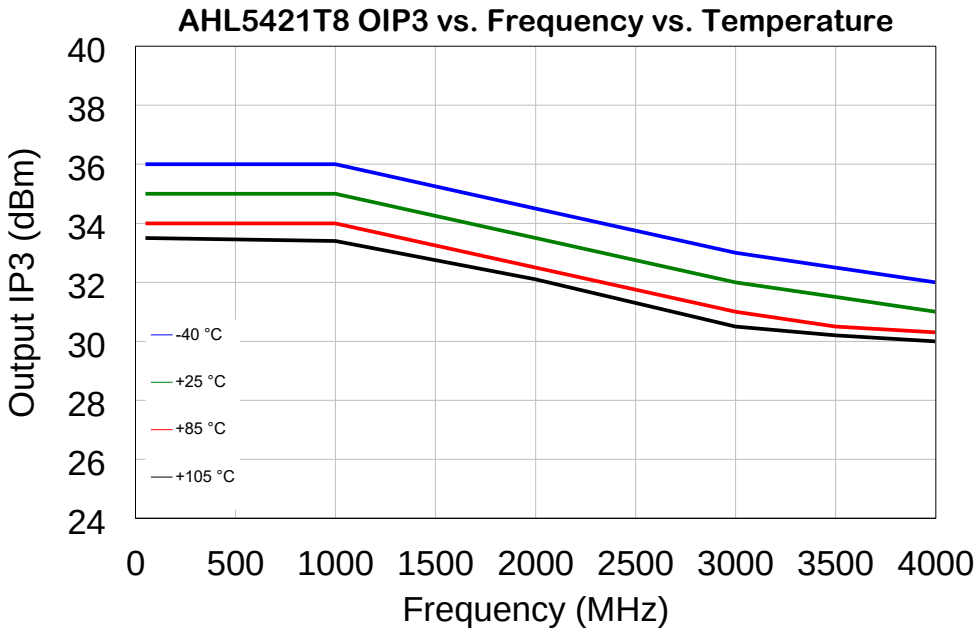
4.4 Plots of Noise Figure and Performances with Temperature

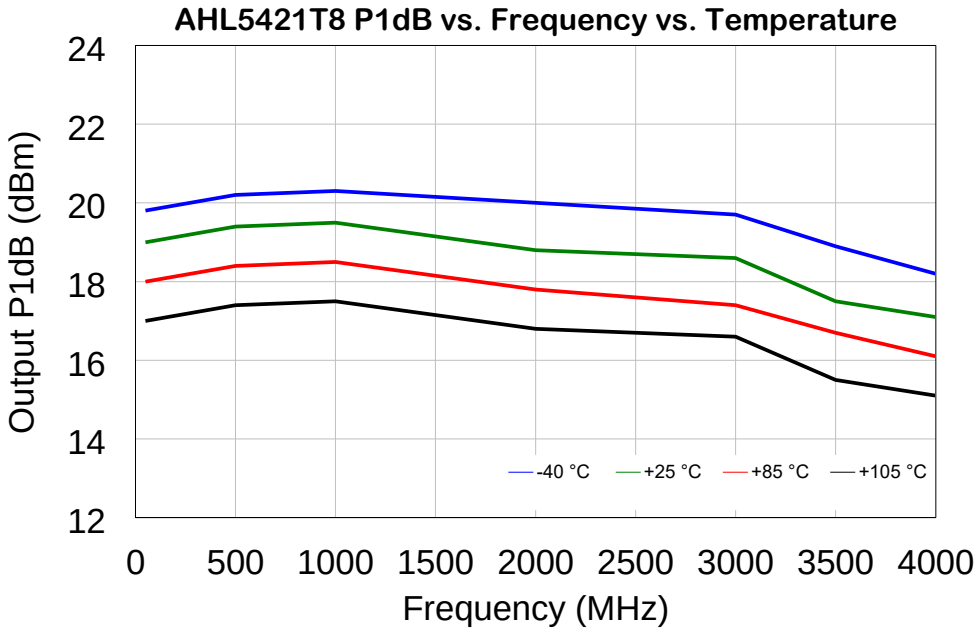


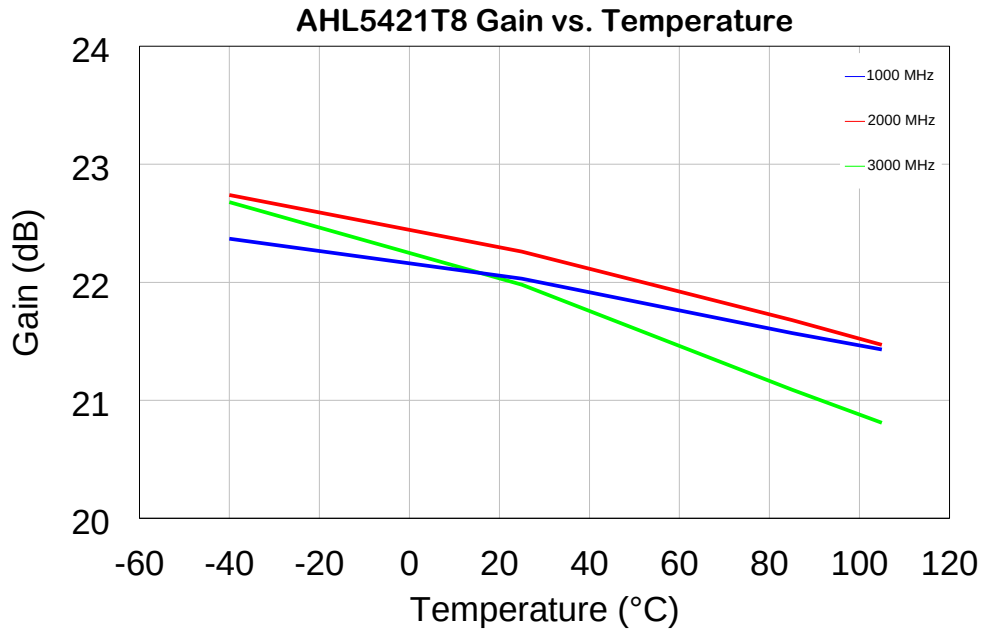


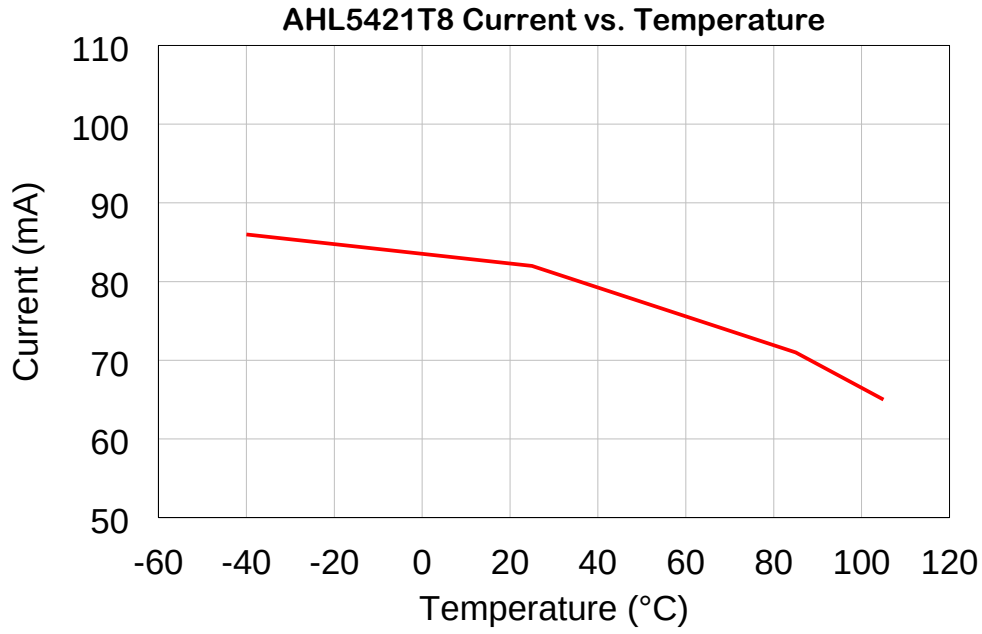

AHL5421T8 S11 vs. Frequency vs. Temperature
S11 (dB)
0
-10
-20
-30
-40
0
500
1000
1500
2000
2500
3000
3500
4000
Frequency (MHz)
-40 °C
+25 °C
+85 °C
+105 °C


AHL5421T8 S22 vs. Frequency vs. Temperature
S22 (dB)
0
-5
-10
-15
-20
-25
-30
0
500
1000
1500
2000
2500
3000
3500
4000
Frequency (MHz)
-40 °C
+25 °C
+85 °C
+105 °C

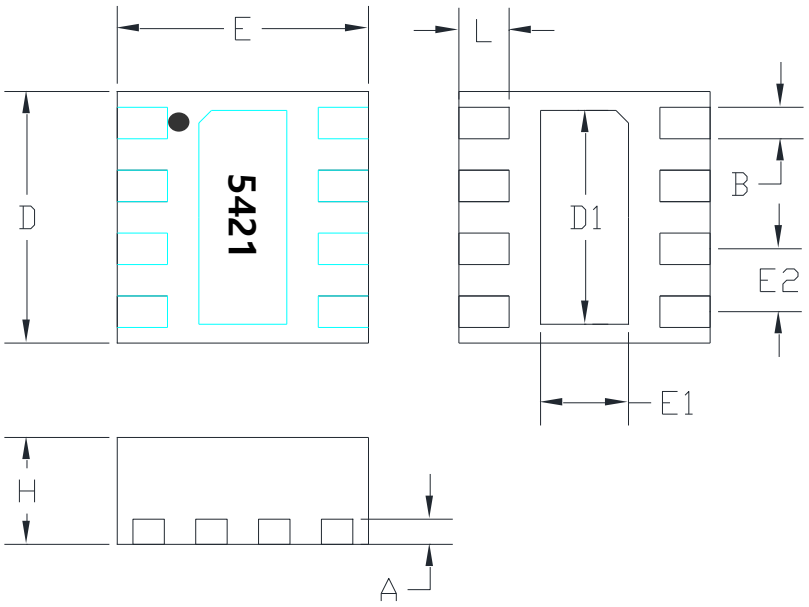

AHL5421T8 OIP3 vs. Frequency vs. Temperature
Output IP3 (dBm)
40
38
36
34
32
30
28
26
24
-40 °C
+25 °C
+85 °C
+105 °C
0
500
1000
1500
2000
2500
3000
3500
4000
Frequency (MHz)


AHL5421T8 P1dB vs. Frequency vs. Temperature
Output P1dB (dBm)
24
22
20
18
16
14
12
-40 °C
+25 °C
+85 °C
+105 °C
0
500
1000
1500
2000
2500
3000
3500
4000
Frequency (MHz)


AHL5421T8 Gain vs. Temperature
Gain (dB)
24
23
22
21
20
1000 MHz
2000 MHz
3000 MHz
-60 -40 -20 0 20 40 60 80 100 120
Temperature (°C)

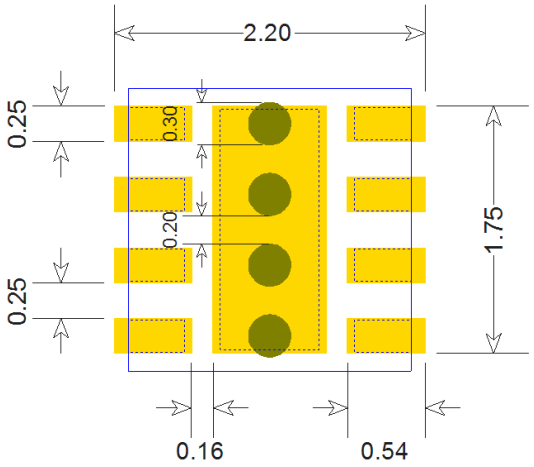

AHL5421T8 Current vs. Temperature
Current (mA)
110
100
90
80
70
60
50
-60 -40 -20 0 20 40 60 80 100 120
Temperature (°C)

5. Package Outline (TDFN8)



Symbols	Dimensions (In mm)		
	MIN	NOM	MAX
A	-	0.20REF	-
B	0.20	0.25	0.30
D	1.95	2.00	2.05
D1	-	1.6BSC	-
E	1.95	2.00	2.05
E1	-	0.9BSC	-
E2	-	0.5BSC	-
L	0.20	0.30	0.40
H	0.70	0.75	0.80

6. Surface Mount Recommendation (In mm)

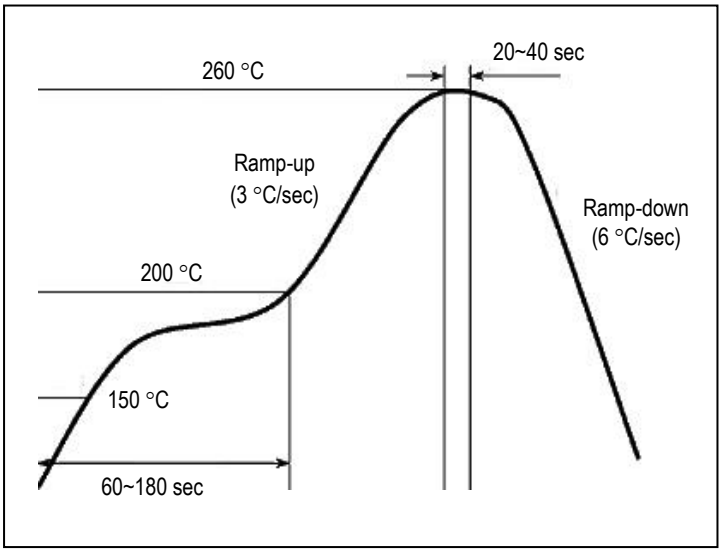


NOTE

1. The number and size of ground via holes in a circuit board is critical for thermal and RF grounding considerations.

2. Recommend that the ground via holes be placed on the bottom of exposed pad of the device for better RF and thermal performance, as shown in the drawing at the left side.

7. Recommended Soldering Reflow Profile



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