0.01 GHz to 10 GHz, Low Noise Amplifier Die

ADH8410S

1.0 Scope

This specification documents the detail requirements for space qualified die per MIL-PRF-38534 class K except as modified herein.

The manufacturing flow described in the SPACE DIE BROCHURE is to be considered a part of this specification.

This datasheet specifically details the space grade version of this product. A more detailed operational description and a complete datasheet for commercial product grades can be found at http://www.analog.com/HMC8410-DIE

2.0 Part Number

2.1. The complete part number(s) of this specification follows:

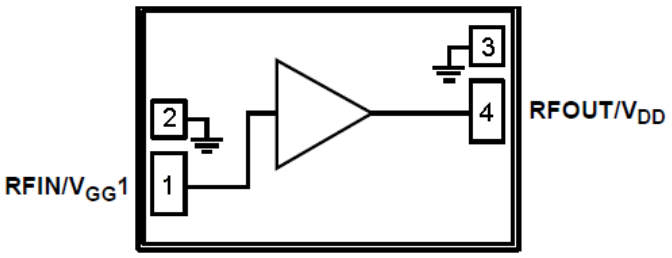
Specific Part Number	Description
ADH8410-000C	0.01 GHz to 10 GHz, GaAs, pHEMT, MMIC, Low Noise Amplifier Die

3.0 Die Information

3.1. Die Dimensions

Die Size	Die Thickness	Bond Pad and Backside Metallization
24 mils x 37.2 mils	4 mils	Au

3.2. Die Picture



1 RFIN/V_{GG}1 (DC-coupled and matched to 50 Ohms) – See Figure 1 in Section 9.0 for interface schematic

2, 3 GND (Ground pads on top of die can optionally be connected to RF/DC GND)

4 RFOUT/V_{DD} (DC-coupled and matched to 50 Ohms) – See Figure 2 in Section 9.0 for interface schematic

Die Bottom (Must be connected to RF/DC GND)

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4.0 Absolute Maximum Ratings 1/

Drain Bias Voltage (V_{DD}) ..... +7 V dc
Radio Frequency (RF) Input Power (RFIN) ..... +20 dBm
Continuous Power Dissipation T_A = 85°C (Derate 7.95 mW/°C above +85°C) ..... 0.715 W
Channel Temperature ..... 175°C
Storage Temperature Range ..... –65°C to +150°C
ESD Sensitivity (HBM) ..... Class 1B passed 500 V
Thermal Resistance (Junction to die bottom) ..... 125.85°C/W

1/ Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions outside of those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

5.0 Die Qualification

In accordance with class-K version of MIL-PRF-38534, Appendix C, Table C-II, except as modified herein.
(a) Pre-screen test post assembly required prior to die qualification, to remove all assembly related rejects.
(b) Mechanical Shock or Constant Acceleration not performed.
(c) Interim and post burn-in electrical tests will include static tests screened at +25C only.

6.0 Dice Electrical Characteristics

Table I – Die Electrical Characteristics

			Limits		
Parameter	**Symbol**	**Conditions 1/2/ Unless otherwise specified**	**Min**	**Max**	**Unit**
Quiescent Supply Current	I_{DQ}	No RF in		70	mA
Gain	S21	0.3GHz & 3GHz	17.5		dB
		5GHz & 8GHz	15.5		
		10GHz	13		
Noise Figure	NF	0.3GHz		2.5	dB
		3GHz		1.6	
		5GHz & 8GHz		1.9	
		10GHz		2.2	

Table I Notes:
1/ Limits apply at T_A = +25ºC, RF In = -10 dBm and V_{DD} = 5 V only.
2/ Adjust $V_{GG}1$ to achieve I_{DQ} = 65 mA typical

Table II – Electrical Characteristics for Qualification Samples							
					Limits		
Parameter	Symbol	Conditions 1/2/ Unless otherwise specified		Sub-Group	Min	Max	Unit
Quiescent Supply Current	I_{DQ}	No RF in		1, 2, 3		70	mA
Gain	S21	0.3GHz & 3GHz	RF In = -25dBm	4, 5, 6	17.5		dB
		5GHz & 8GHz			15.5		
		10GHz			13		
Noise Figure	NF	0.3GHz		4, 5, 6		2.5	dB
		3GHz				1.6	
		5GHz				1.9	
		8GHz		4,6		1.9	
				5		2.4	
		10GHz		4,6		2.2	
				5		2.7	

Table II Notes:

1/ T_A nom = +25ºC, T_A max = +85ºC, T_A min = -40ºC and V_{DD} = 5 V nom.

2/ Adjust $V_{GG}1$ to achieve I_{DQ} = 65 mA typical at T_A = -40ºC, +25ºC and +85ºC. Each qualification device shall use the individual $V_{GG}1$ voltage established at pre burn-in throughout all +25ºC qualification testing.

Table III - Burn-in and operating life test delta parameters 1/ 2/ 3/ 4/			
Parameter	Symbol	Delta	Units
Quiescent Supply Current	I_{DQ}	± 10	%
Gain	S21	± 1.0	dB

Table III Notes:

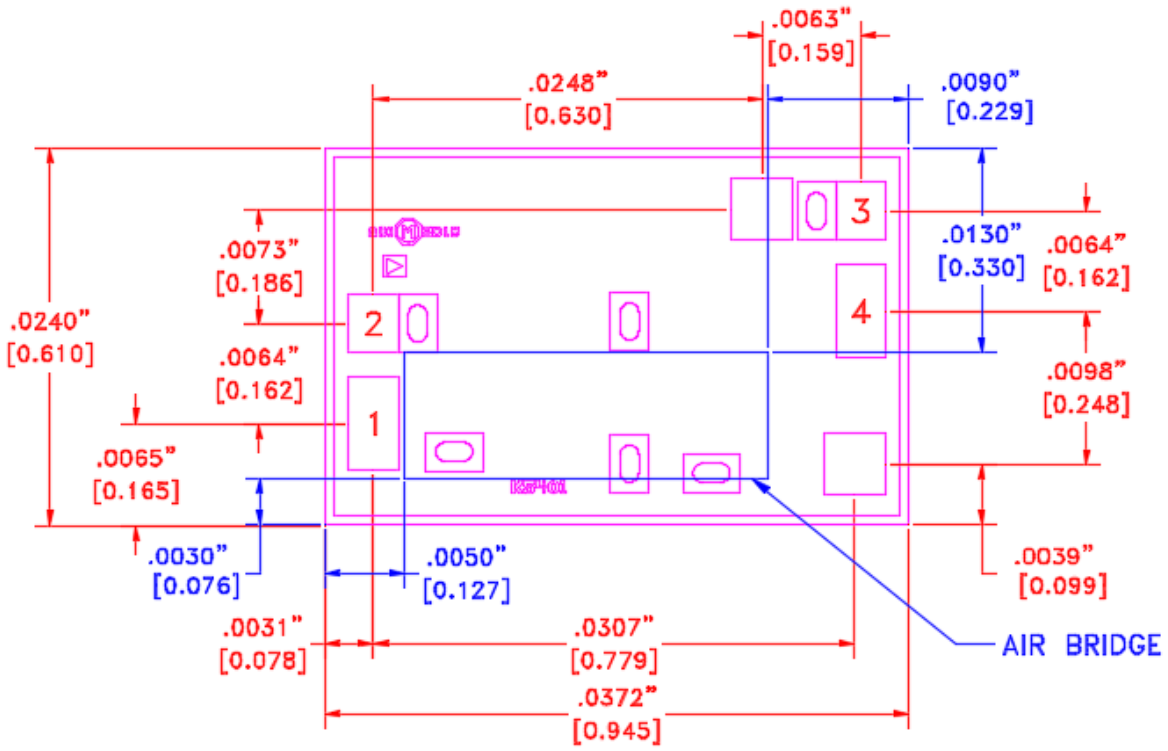
1/ 240 hour burn in and 1000 hour life test end point electrical parameters.

2/ Deltas are performed at T_A = +25°C only.

3/ Product is tested in accordance with conditions in Table II.

4/ Table II limits will not be exceeded.

7.0 Die Outline



PAD	DESCRIPTION	PAD SIZE
1	RFIN/VGG1	.0032[.081] X .0060[.152]
2	GND	.0031[.079] X .0037[.094]
3	GND	.0031[.079] X .0037[.094]
4	RFOUT/VDD	.0032[.081] X .0060[.152]

NOTES:

1. ALL DIMENSIONS ARE IN INCHES [MM]
2. DIE THICKNESS IS .004"
3. BOND PAD METALIZATION: GOLD
4. BACKSIDE METALIZATION: GOLD
5. BACKSIDE METAL IS GROUND
6. OVERALL DIE SIZE ±.002"
7. UNLABELED PADS ARE N/A

8.0 Application Notes

Figure 1 and Figure 2 show the equivalent die interface schematics. Figure 3 shows the application circuit that uses optional external bias Tees. Follow MMIC Amplifier Biasing Procedure for proper power up and power down sequence. Power supply decoupling capacitors on both $V_{GG}1$ and V_{DD} as close to the device as possible are required for optimal performance.

Figure 4 shows the assembly diagram. Attach the die directly to the ground plane eutectically or with conductive epoxy. To bring the radio frequency to and from the chip, implementing 50 Ω transmission lines using a microstrip or coplanar waveguide on 0.127 mm (5 mil) thick alumina, thin film substrates is recommended (see Figure 5). When using 0.254 mm (10 mil) thick alumina, it is recommended that the die be raised to ensure that the die and substrate surfaces are coplanar. Raise the die 0.150 mm (6 mil) to ensure that the surface of the die is coplanar with the surface of the substrate. To accomplish this, attach the 0.102 mm (4 mil) thick die to a 0.150 mm (6 mil) thick, molybdenum (Mo) heat spreader (moly tab), which can then be attached to the ground plane (see Figure 6).

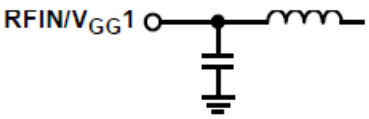


Figure 1. RFIN/$V_{GG}1$ Interface Schematic

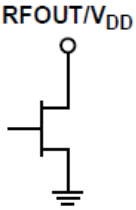


Figure 2. RFOUT/V_{DD} Interface Schematic

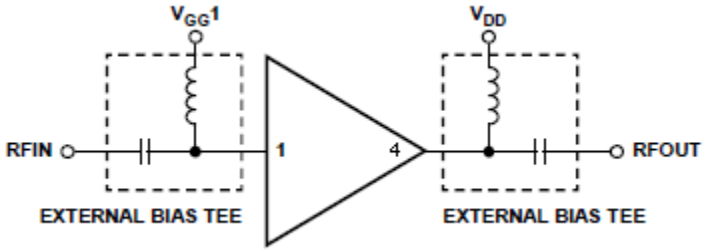


Figure 3. Application Circuit

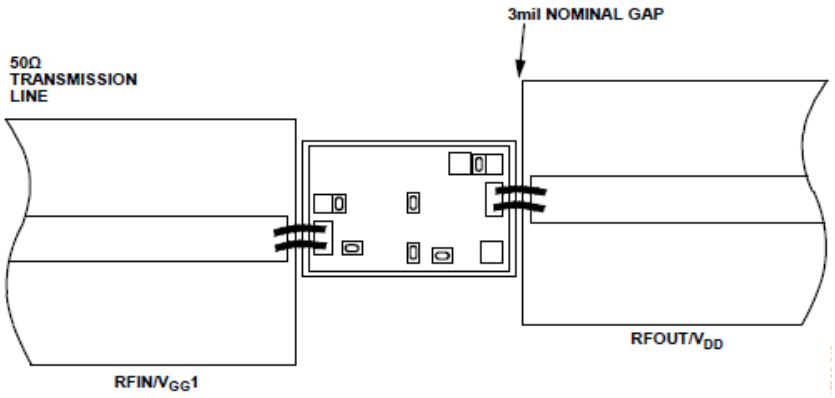


Figure 4. Assembly Diagram

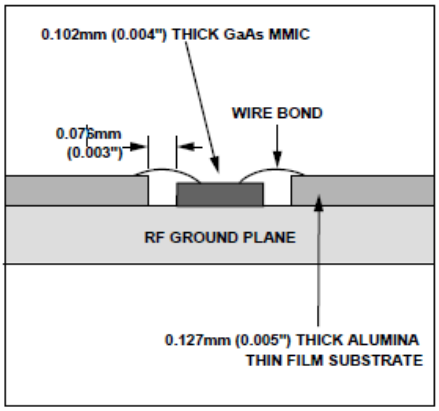


Figure 5. Die without Moly Tab

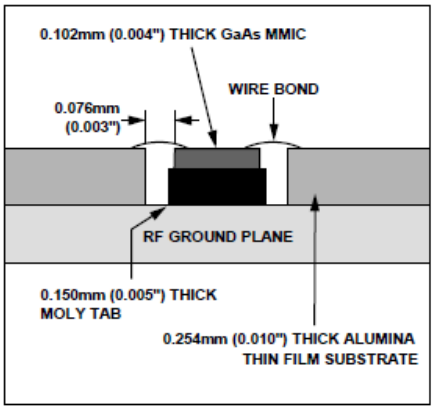


Figure 6. Die with Moly Tab

9.0 Die Packaging Information

Standard	Alternate
GP-5 (Gel Pack)	1/

Note:

1/ For alternate packaging information, contact Analog Devices Inc.

Rev	Description of Change	Date
A	Production release.	24-September-2019
B	Add exception note to Section 5 and remove Section 7	25-October-2019