DC to 4.0GHz Gain Block Amplifier

ADH395S

1.0 Scope

This specification documents the detail requirements for an internally defined equivalent flow per MIL-PRF-38535 Level V except as modified herein.

The manufacturing flow described in the RF & MICROWAVE STANDARD SPACE LEVEL PRODUCTS PROGRAM is to be considered a part of this specification.

This data specifically details the space grade version of this product. A more detailed operational description and a complete data sheet for commercial product grades can be found at http://www.analog.com/HMC395

2.0 Part Number: The complete part number(s) of this specification follows:

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Part Number	Description
ADH395-701G8	DC to 4.0 GHz Gain Block

3.0 Case Outline

3.1. The case outline is as follows:

Outline Letter	Descriptive Designator	Terminals	Lead Finish	Package style
X	FR-8-2	8 Lead	Gold	Glass/Metal Hermetic Leaded SMT (G8)

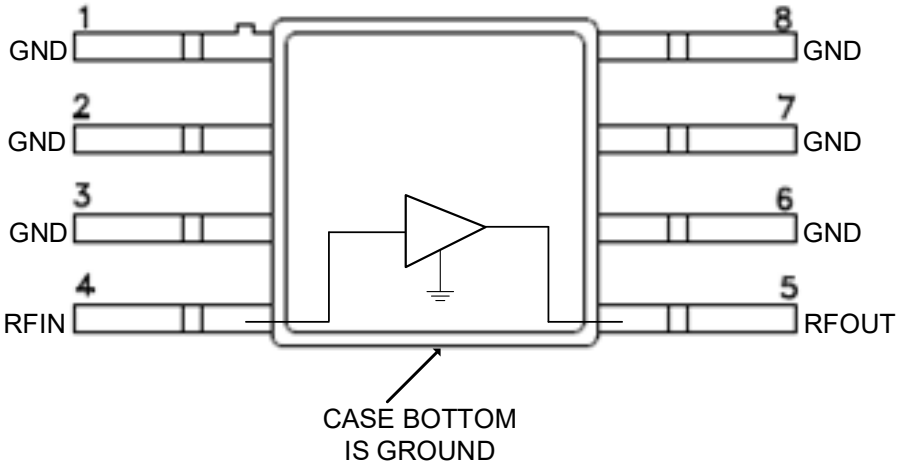

Figure 1 – Functional Block Diagram

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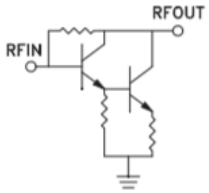
Package: X				
Pin Number	**Terminal Symbol**	**Pin Type**	**Pin Description**	**Interface Schematic**
1	GND	Power	RF/DC ground must be connected to RF/DC ground.	
2	GND	Power	RF/DC ground must be connected to RF/DC ground.	
3	GND	Power	RF/DC ground must be connected to RF/DC ground.	
4	RFIN	Input	RF Input. 1/	
5	RFOUT	Output	RF Output and DC Bias for the output stage. 1/	
6	GND	Power	RF/DC ground must be connected to RF/DC ground.	
7	GND	Power	RF/DC ground must be connected to RF/DC ground.	
8	GND	Power	RF/DC ground must be connected to RF/DC ground.	
Package Bottom	GND	Power	RF/DC ground. 2/	
Lid		NIC	3/	

Figure 2 – Terminal connections

1/ This pin is DC coupled. An off chip DC blocking capacitor is required.
2/ Package bottom must be connected to RF/DC ground.
3/ No internal connection on lid. Lid may be connected to RF/DC ground.

4.0 Specifications

4.1. Absolute Maximum Ratings 1/

Collector Bias Voltage (Vs) ..... 7.0 V 2/
RF Input Power (RFIN) (Vs = +5V) ..... +10 dBm
Junction Temperature to Maintain 1 Million MTTF ..... +150°C
Junction Temperature ..... +175°C 3/
Continuous Pdiss (T_A = +85^{0}C) (Derate 3.01mW/^{0}C above +85^{0}C) .... 0.271 W
Thermal resistance (Junction to Package bottom) ..... 332.3 °C/W
Storage temperature range ..... -65°C to +150°C

4.2. Recommended Operating Conditions

Supply voltage (Vs) ..... +4.5V to +5.5V
Ambient operating temperature range (T_A)..... -40°C to +85°C

4.3. Nominal Operating Performance Characteristics 4/

Input Return Loss (IRL) (DC – 1.0 GHz) ..... 18 dB
Input Return Loss (IRL) (1.0 GHz – 4.0 GHz) ..... 16 dB
Output Return Loss (ORL) (DC – 1.0 GHz) ..... 18 dB
Output Return Loss (ORL) (1.0 GHz – 4.0 GHz) ..... 13 dB
Reverse Isolation (RISO) (DC – 4.0 GHz) ..... 19 dB
Noise Figure (NF) (DC – 4.0 GHz) ..... 4.5 dB
Output Third Order Intercept (OIP3) (DC – 1.0 GHz) ..... 33.5 dBm 5/
Output Third Order Intercept (OIP3) (1.0 GHz – 2.0 GHz) ..... 30 dBm 5/
Output Third Order Intercept (OIP3) (2.0 GHz – 4.0 GHz) ..... 24.5 dBm 5/

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.
2/ All voltages are relative to their respective grounds.
3/ It is only allowable for a limited time to operate the device at junction temperatures up to ≤175°C. It should also be noted that use of the devices at temperatures above 150°C junction temperature will decrease the mean time to failure (MTTF) of the device. The effect on the MTTF will depend on the actual temperature and the time at that temperature. During this time at extended temperature, Analog Devices, Inc. cannot guarantee that the device will meet the electrical limits shown in Table I.
4/ All typical specifications are at T_A = 25°C, Rbias = 22 Ohm and Vs =+ 5 V, unless otherwise noted.
5/ RFOUT = 0 dBm per tone, 1MHz spacing

TABLE I – ELECTRICAL PERFORMANCE CHARACTERISTICS

Parameter See notes at end of table	Symbol	Conditions 1/ Unless otherwise specified	Group A Subgroups	Limits		Units
				Min	Max	
Frequency = 100MHz Continuous Wave (CW) input						
Gain	S21	RFIN =-10 dBm	4	13		dB
			5, 6	12.5		dB
Gain Variation Over Temperature	S21/ºC	RFIN =-10 dBm	4, 5, 6		0.008	dB/ºC
Output Power for 1dB Compression	OP1dB		7, 8A, 8B	13		dBm
Frequency = 2.05GHz Continuous Wave (CW) input						
Gain	S21	RFIN =-10 dBm	4	12.5		dB
			5, 6	12		dB
Gain Variation Over Temperature	S21/ºC	RFIN =-10 dBm	4, 5, 6		0.012	dB/ºC
Output Power for 1 dB Compression	OP1dB		7	11		dBm
			8A, 8B	10		dBm
Frequency = 4.0GHz Continuous Wave (CW) input						
Gain	S21	RFIN =-10 dBm	4, 5, 6	11		dB
Gain Variation Over Temperature	S21/ºC	RFIN =-10 dBm	4, 5, 6		0.012	dB/ºC
Output Power for 1dB Compression	OP1dB		7	6.5		dBm
			8A, 8B	6		dBm
Power Supplies						
Quiescent Supply Current	Icq	No Signal at RFIN	1, 2, 3		65	mA

Table I Note:
1/ T_A nom = +25ºC, T_A max = +85ºC, T_A min = -40ºC, Rbias = 22 Ohm and Vs = +5V nom.

TABLE IIA – ELECTRICAL TEST REQUIREMENTS

Test Requirements	Subgroups (in accordance with MIL-PRF-38535, Table III)
Interim Electrical Parameters	1, 4
Final Electrical Parameters	1, 4, 7 1/ 2/
Group A Test Requirements	1, 2, 3, 4, 5, 6, 7, 8A, 8B
Group C end-point electrical parameters	1, 4, 7 2/
Group D end-point electrical parameters	1,4, 7

Table IIA Notes:
1/ PDA applies to Table I subgroup 1 only and Table IIB delta parameters.
2/ See Table IIB for delta parameters

TABLE IIB – BURN-IN/LIFE TEST DELTA LIMITS 1/ 2/

Parameter	Test Conditions	Symbol	Delta	Units
Gain	Per Table I	S21	± 1.0	dB
Quiescent Supply Current		Icq	± 10	%

Table IIB Notes:
1/ 240 hour burn in and 1000 hour life test (Group C) end point electrical parameters.
2/ Deltas are performed at T_A = +25°C only.

5.0 Burn-In Life Test, and Radiation

5.1. Burn-In Test Circuit, Life Test Circuit

5.1.1. The test conditions and circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1015 test condition D of MIL –STD-883.

5.1.2. HTRB is not applicable for this drawing.

6.0 MIL-PRF-38535 QMLV Exceptions

The manufacturing flow described in the RF & MICROWAVE STANDARD SPACE LEVEL PRODUCTS PROGRAM is to be considered a part of this specification. The brochure describes standard QMLV exceptions for Aerospace products run at the ADI Chelmsford, MA facility.

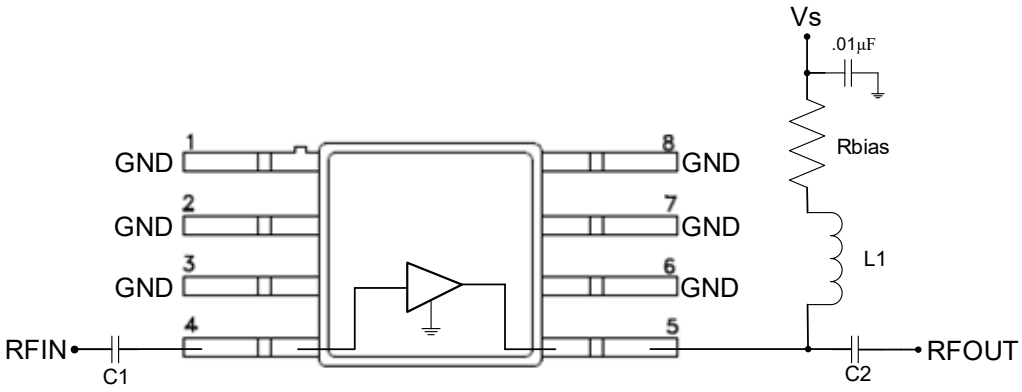
6.1. Wafer Fabrication

Foundry information is available upon request.

6.2. Group D

Group D-5 Salt Atmosphere testing is not performed.

7.0 Application Notes 1/ 2/



Component	Frequency (MHz)				
	50	100	500	1000	4000
L1	270 nH	270 nH	100 nH	56 nH	8.2 nH
C1, C2	0.01µF	0.01µF	500 pF	100 pF	100pF

Notes:

1/ Select R_{BIAS} to achieve Icq using equation below.

$$Icq = \frac{Vs - 3.9}{RBIAS}$$

2/ $R_{BIAS} \geq 22$ Ohm

Figure 3 – Recommended configuration and component values for the ADH395-701G8

8.0 Package Outline Dimensions

The G8 package and outline dimensions can be found at http://www.analog.com or upon request.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
ADH395-701G8	–40°C to 85°C	8 Lead Glass/Metal Hermetic SMT	G8 (FR-8-2)

Revision History		
Rev	**Description of Change**	**Date**
A	Initial Release	05/06/19
B	Revise section 4.1	06/05/19