

1.0 SCOPE

This specification documents the detail requirements for an internally defined equivalent flow per MIL-PRF-38535 Level V expect 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/HMC451>

2.0 Part Number

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

<u>Specific Part Number</u>	<u>Description</u>
ADH451-701LH5	5.0 GHz to 18.0 GHz Medium Power Amplifier

3.0 Case Outline

The case outline(s) are as designated in MIL-STD-1835 and as follows:

<u>Outline Letter</u>	<u>Descriptive Designator</u>	<u>Terminals</u>	<u>Lead Finish</u>	<u>Package style</u>
X	E-12-5	12 Lead	Gold	Ceramic Hermetic SMT (LH5)

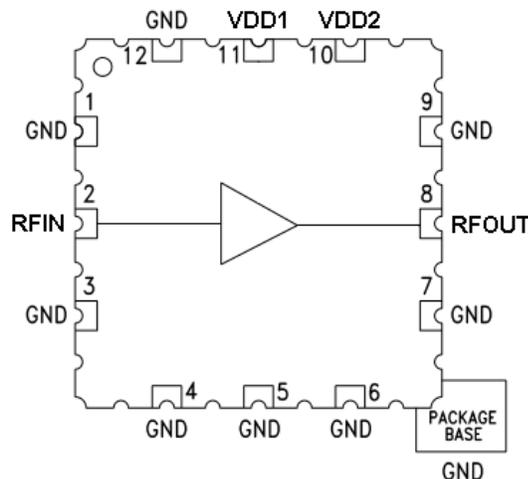


Figure 1 – Functional Block Diagram

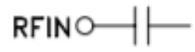
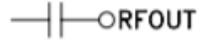
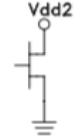
Package: X				
Pin Number	Terminal Symbol	Pin Type	Pin Description	Interface Schematic
1	GND	Power	RF/DC Ground.	
2	RFIN	Input	RF Input <u>1</u> /	
3	GND	Power	RF/DC Fround.	
4	GND	Power	RF/DC Ground.	
5	GND	Power	RF/DC Ground.	
6	GND	Power	RF/DC Ground.	
7	GND	Power	RF/DC Ground.	
8	RFOUT	Output	RF Output <u>1</u> /	
9	GND	Power	RF/DC Ground.	
10	VDD2	Power	Power Supply Voltage for the Amplifier. <u>2</u> /	
11	VDD1	Power	Power Supply Voltage for the Amplifier. <u>2</u> /	
12	GND	Power	RF/DC Ground.	
Package Base	GND	Power	RF/DC Ground <u>3</u> / <u>4</u> /	
Package Lid	GND	Power		

Figure 2 – Terminal Connections

1/ This pin is AC coupled and matched to 50Ω.

2/ External bypass capacitors of 100 pF, 1000 pF, and 2.2 μF are required.

3/ Package base must be connected to RF/DC ground.

4/ Package lid is internally connected to RF/DC ground.

4.0 Specifications

4.1. Absolute Maximum Ratings ^{1/}

Drain Bias Voltage (Vdd1 = Vdd2)	5.5 V ^{2/}
RF Input Power (RFIN) (Vdd1 = Vdd2 = +5V)	10 dBm
Channel Temperature	175°C
Continuous P _{diss} (T = 85°C, Derates 17.36mW/°C Above 85°C) ...	1.563 W
Thermal Resistance (Channel to Package Bottom)	57.6°C/W
Storage Temperature Range	-65°C to +150°C
ESD Sensitivity (HBM)	Class 1A, passed 250V

4.2. Recommended Operating Conditions

Supply Voltage (Vdd1 = Vdd2)	4.5 V to 5.5 V
Ambient Operating Temperature Range (T _A)	-40°C to +85°C

4.3. Nominal Operating Performance Characteristics ^{3/}

Input Return Loss (IRL) (5 GHz – 13 GHz)	11 dB
Input Return Loss (IRL) (13 GHz – 18 GHz)	5 dB
Output Return Loss (ORL) (5 GHz – 13 GHz)	11 dB
Output Return Loss (ORL) (13 GHz – 18 GHz)	5 dB
Noise Figure (5 GHz – 13 GHz)	8 dB
Noise Figure (13 GHz – 18 GHz)	6.5 dB
Saturated Output Power (P _{sat}) (5 GHz – 13 GHz)	22 dBm ^{4/}
P _{sat} (13 GHz – 18 GHz)	20 dBm ^{4/}
Output Third-Order Intercept (OIP3) (5 GHz – 13 GHz)	30 dBm ^{5/}
OIP3 (13 GHz – 18 GHz)	28 dBm ^{5/}

^{1/} Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

^{2/} All voltages are relative to their respective grounds.

^{3/} All typical specifications are at T_A = 25°C and Vdd1 = Vdd2 = 5 V, unless otherwise noted.

^{4/} P_{sat} specified as OP5dB.

^{5/} RFOUT = 0 dBm per tone, 1MHz spacing.

TABLE I – ELECTRICAL PERFORMANCE CHARACTERISTICS

Parameter See note at end of table	Symbol	Conditions ^{1/} Unless otherwise specified	Group A Subgroups	Limits		Unit
				Min	Max	
Frequency = 5.0GHz Continuous Wave Input						
Gain	S21	RF In =-10dBm	4	16		dB
			5, 6	14		dB
Gain Variation Over Temperature	S21/°C	RF In =-10dBm	4, 5, 6		0.035	dB/°C
Output Power for 1dB Compression	OP1dB		7	16.5		dBm
			8A, 8B	16		dBm
Frequency = 11.5GHz Continuous Wave Input						
Gain	S21	RF In =-10dBm	4	15		dB
			5, 6	13		dB
Gain Variation Over Temperature	S21/°C	RF In =-10dBm	4, 5, 6		0.035	dB/°C
Output Power for 1dB Compression	OP1dB		7	16		dBm
			8A, 8B	15		dBm
Frequency = 18.0GHz Continuous Wave Input						
Gain	S21	RF In =-10dBm	4	14		dB
			5, 6	12		dB
Gain Variation Over Temperature	S21/°C	RF In =-10dBm	4, 5, 6		0.035	dB/°C
Output Power for 1dB Compression	OP1dB		7	16.5		dBm
			8A, 8B	16		dBm
Power Supplies						
Quiescent Supply Current	I _{dd}	No signal at RFIN	1, 2, 3		150	mA

Table I Note:

^{1/} T_A nom = +25 °C, T_A max = +85 °C, T_A min = -40 °C and V_{dd1} = V_{dd2} =+ 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	Unit
Gain	Per Table I	S21	± 1.0	dB
Quiescent Supply Current		I _{dd}	± 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 room temperature 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 B of MIL-STD-883.

5.1.2. HTRB is not applicable for this drawing.

6.0 MIL-PRF-38535 QMLV Exceptions

6.1. Wafer Fabrication

Foundry information is available on request.

6.2. Group D

Group D-5 Salt Atmosphere is not performed.

7.0 Application Notes

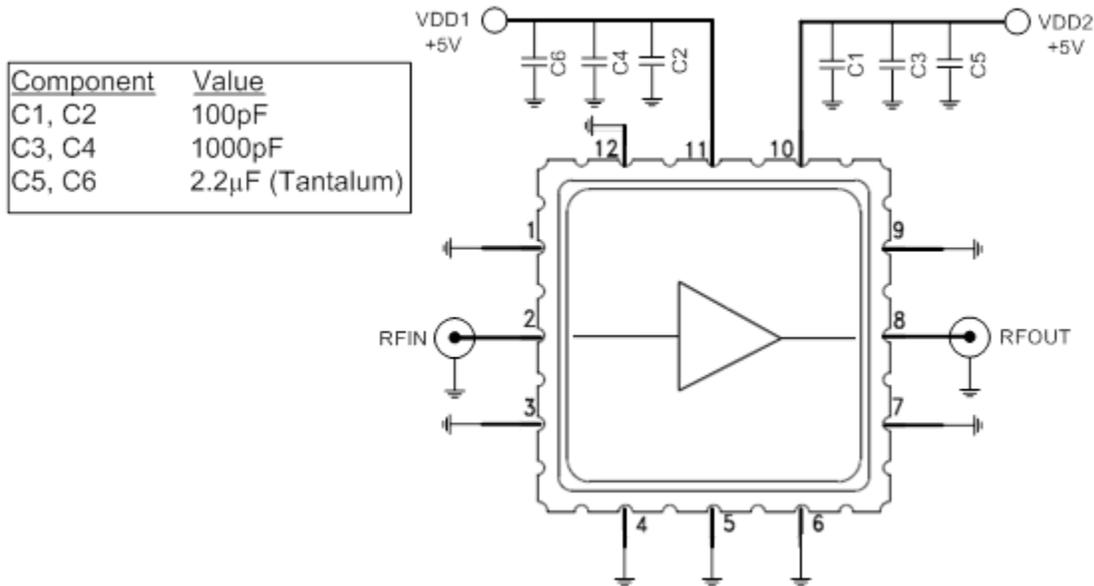


Figure 3 – Recommended Configuration for the ADH451-701LH5

The circuit board used in the final application should use RF circuit design techniques. Signal lines should have 50 Ω impedance while the package ground leads and package bottom should be connected directly to the ground plane. A sufficient number of via holes should be used to connect the top and bottom ground planes. The circuit board should be mounted to an appropriate heat sink.

8.0 Package Outline Dimensions

The ADH451-701LH5 package and outline dimensions are found [here](#).

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
ADH451-701LH5	-40°C to +85°C	12-Terminal Ceramic Leadless Chip Carrier [LCC]	E-12-5

Revision History		
Rev	Description of Change	Date
A	Initiate	12/21/2018
B	Update Section 3.0, Section 4.3, Section 6.0, Section 7.0, and Section 8.0	5/06/2019
C	Corrected Figure Labels, Update Figure 2, and Section 5.1.1	10/01/2020
D	Update Section 4.1	3/17/2026

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