

### 1.0 SCOPE

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

The manufacturing flow described in the RF & MICROWAVE STANDARD SPACE LEVEL PRODUCTS PROGRAM brochure 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/HMC499>

### 2.0 Part Number

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

<u>Specific Part Number</u>	<u>Description</u>
ADH499-701LSH6	21 – 32 GHz GaAs PHEMT MMIC 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	EH-16-2	16 Lead	Gold	Ceramic Hermetic SMT (LSH6)

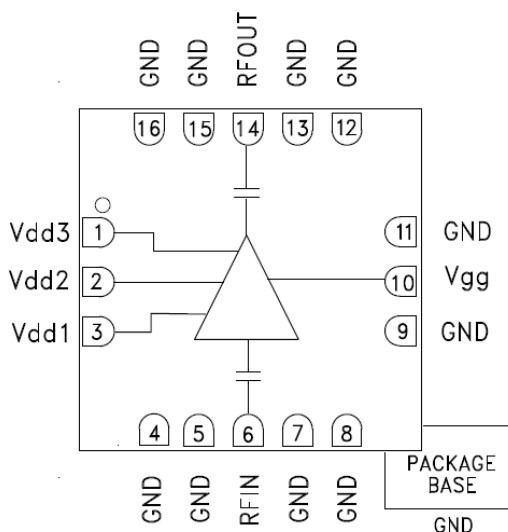


Figure 1 – Functional Block Diagram

**Package: X**

ASD0016627

Rev. A

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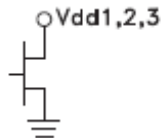

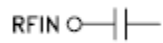

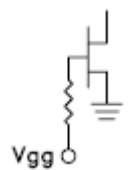

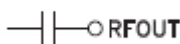

Pin Number	Terminal Symbol	Pin Type	Pin Description	Interface Schematic
1	Vdd3	Power	Power Supply Voltages for the amplifier. External bypass capacitors of 100 pF, 1000 pF, and 2.2 $\mu$ F are required.	
2	Vdd2	Power		
3	Vdd1	Power		
4	GND	Power	Signal/Supply ground	
5	GND	Power	Signal/Supply ground	
6	RFIN	RF I/O	This pin is AC coupled and matched to 50 Ohms.	
7	GND	Power	Signal/Supply ground	
8	GND	Power	Signal/Supply ground	
9	GND	Power	Signal/Supply ground	
10	Vgg	Power	Gate control for the amplifier. Adjust to achieve Idd of 200 mA.. External bypass capacitors of 100 pF, 1000 pF and 2.2 $\mu$ F are required.	
11	GND	Power	Signal/Supply ground	
12	GND	Power	Signal/Supply ground	
13	GND	Power	Signal/Supply ground	
14	RF OUT	RF I/O	This pin is AC coupled and matched to 50 Ohms.	
15	GND	Power	Signal/Supply ground	
16	GND	Power	Signal/Supply ground	
Package Bottom	GND	Power	Signal/Supply ground <sup>1/</sup>	
Package Lid	GND	Power	Signal/Supply ground <sup>2/</sup>	

Figure 2 – Terminal Connections

<sup>1/</sup> Package bottom ground paddle must be connected to Signal/Supply ground

<sup>2/</sup> Package lid is internally connected to Signal/Supply ground

## 4.0 Specifications

### 4.1. Absolute Maximum Ratings <sup>1/</sup>

Drain Bias Voltage (Vdd1, Vdd2, Vdd3) .....	+5.5 Vdc
Gate Bias Voltage (Vgg) .....	-4 V to 0 Vdc
RF Input Power (RFIN ) (Vdd1, Vdd2, Vdd3 = +5 Vdc) .....	+20 dBm
Thermal resistance (Channel to Package bottom) .....	59.3 °C/W
Continuous Pdiss (T <sub>A</sub> = +85°C) (Derate 25 mW/°C above +85 °C) ....	1.0 W
Maximum Junction Temperature .....	+175 °C
Storage Temperature range .....	-65 °C to +150 °C
ESD Sensitivity (HBM) .....	Class 0

### 4.2. Recommended Operating Conditions

Operating Temperature .....	-40 °C to +85 °C
Supply Voltage (Vdd1, Vdd2, Vdd3) .....	+5 Vdc

### 4.3. Nominal Operating Performance Characteristics <sup>2/</sup>

Input Return Loss (S11) (21-24 GHz) .....	10 dB
Input Return Loss (S11) (24-28 GHz) .....	8 dB
Input Return Loss (S11) (28-32 GHz) .....	8 dB
Output Return Loss (S22) (21-24 GHz) .....	11 dB
Output Return Loss (S22) (24-28 GHz) .....	12 dB
Output Return Loss (S22) (28-32 GHz) .....	8 dB
Saturated Output Power (Psat) (21-24 GHz) .....	23.5 dBm
Saturated Output Power (Psat) (24-28 GHz) .....	23.5 dBm
Saturated Output Power (Psat) (28-32 GHz) .....	24 dBm

<sup>1/</sup> 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.

<sup>2/</sup> All typical specifications are at T<sub>A</sub> = 25°C, Vdd1, Vdd2, Vdd3= 5V, Idd = 200mA unless otherwise noted.

<sup>3/</sup> Psat specified as OP5dB.

TABLE IA – ELECTRICAL PERFORMANCE CHARACTERISTICS

Parameter See notes at end of table	Symbol	Conditions 1/ Unless otherwise specified	Sub- Group	Limit Min	Limit Max	Units
Supply Current	IDD	V <sub>gg</sub> = -0.8 V typical	1, 2, 3		225	mA
Gain	S21	21 GHz	4	14		dB
			5	12.2		
			6	14		
		28 GHz	4	13		dB
			5	11.2		
			6	13		
		32 GHz	4	9		dB
			5	7.2		
			6	9		
Gain Variation over Temperature 2/	A <sub>v</sub> /°C	21 GHz, 28 GHz, 32 GHz	4, 5, 6		0.04	dB/°C
Noise Figure	NF	21 GHz	4		8	dB
			5		9	
			6		7.5	
		28 GHz	4		4.5	dB
			5		5.5	
			6		4	
		32 GHz	4		6	dB
			5		7	
			6		5	
Output Power for 1 dB Compression 2/	OP1dB	21GHz	4, 5, 6	24		dBm
		28 GHz	4, 5, 6	22.5		
		32 GHz	4, 5, 6	21.5		
Output Third Order Intercept 2/ 3/	OIP3	21 GHz	4, 5, 6	28		dBm
		28 GHz	4, 5, 6	31		dBm
		32 GHz	4, 5, 6	30		dBm

## TABLE IA NOTES:

1/ T<sub>A</sub> nom = +25 °C, T<sub>A</sub> max = +85 °C, T<sub>A</sub> min = -40 °C, V<sub>dd1</sub> = V<sub>dd2</sub> = V<sub>dd3</sub> = 5V, I<sub>dd</sub> = 200mA (Adjust V<sub>gg</sub> between -2V to 0V to achieve I<sub>dd</sub> = 200mA).

2/ Parameter is part of device initial characterization which is only repeated after design and process changes or with subsequent wafer lots.

3/ RFOUT = 0 dBm per tone. 1 MHz spacing.

**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 <u>1</u> / <u>2</u> /
Group A Test Requirements	1, 2, 3, 4, 5, 6
Group C end-point electrical parameters	1, 4 <u>2</u> /
Group D end-point electrical parameters	1, 4

Table IIA Notes:

1/ PDA applies to Table I subgroup 1 and Table IIB delta parameters.

2/ See Table IIB for delta parameters

**TABLE IIB – BURN-IN/ LIFE TEST DELTA LIMITS 1/ 2/ 3/**

Parameter	Symbol	Delta	Units
Gain at 21 GHz	S21	±1.0	dB
Gain at 24 GHz	S21	±1.0	dB
Gain at 28 GHz	S21	±1.0	dB
Supply Current	IDD	±10	%

1/ 240 hour burn in and 1000 hour life test (Group C) end point electrical parameters.

2/ Deltas are performed at  $T_A = +25^{\circ}\text{C}$  only.

3/ V<sub>gg</sub> voltage set to pre burn-in value for each device

## 5.0 Burn-In Life Test.

### 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

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

Component	Value
C1	100 pf
C2	1000 pf
C3	2.2 $\mu$ f

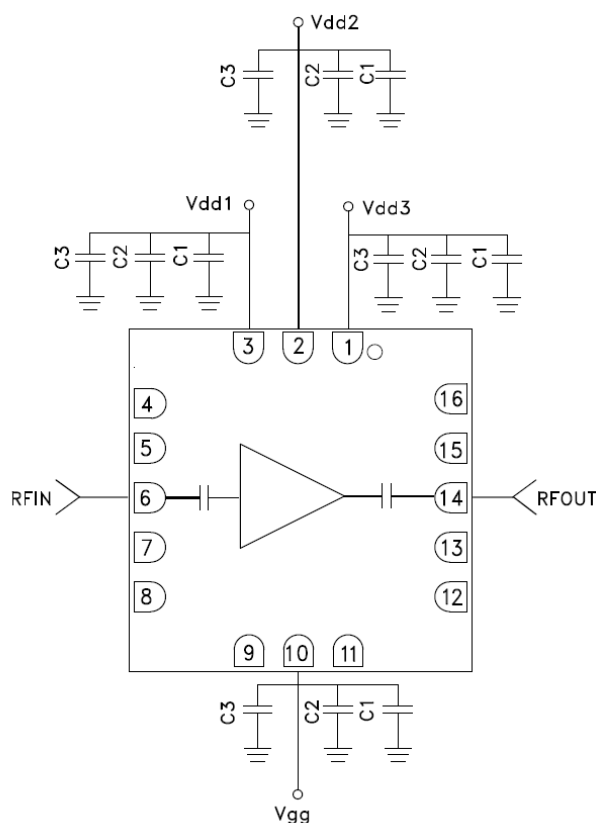


Figure 3 – Application Circuit

## 8.0 Package Outline Dimensions

The LSH6 package and outline dimensions can be found at <http://www.analog.com> or upon request.

## ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
ADH499-701LSH6	–40° C to +85 °C	16 Lead Ceramic Leadless SMT	LSH6 (EH-16-2)

Revision History		
Rev	Description of Change	Date
A	Initial Release	3/20/2023