VARIABLE GAIN AMPLIFIER 17 - 27 GHz

Typical Applications

The HMC997LC4 is ideal for:

- Point-to-Point Radio
- Point-to-Multi-Point Radio
- EW & ECM Subsystems
- Ka-Band Radar
- Test Equipment

Features

Wide Gain Control Range: 15 dB

Single Control Voltage

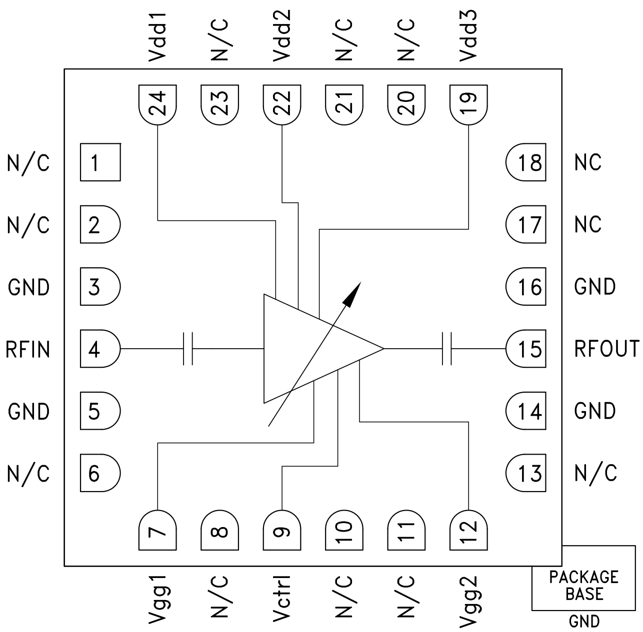
Output IP3 @ Max Gain: +31 dBm

Output P1dB: +24 dBm

No External Matching

24 Lead 4 x 4 mm SMT Package: 16 mm^2

Functional Diagram



General Description

The HMC997LC4 is a GaAs MMIC PHEMT analog variable gain amplifier and/or driver amplifier which operates between 17 and 27 GHz. Ideal for microwave radio applications, the amplifier provides up to 20.5 dB of gain, output P1dB of up to +24 dBm, and up to +31 dBm of output IP3 at maximum gain, while requiring only 170 mA from a +5V supply. A gain control voltage (Vctrl) is provided to allow variable gain control up to 15 dB. Gain flatness is excellent making the HMC997LC4 ideal for EW, ECM and radar applications. The HMC997LC4 is housed in a RoHS compliant 4 x 4 mm ceramic QFN leadless package and is compatible with high volume surface mount manufacturing.

Electrical Specifications, T_A = +25 °C, Vdd1, 2, 3 = 5V, Vctrl = -4.5V, Idd = 170 mA*

Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range		17 - 21			21 - 27		GHz
Gain	17.0	20		16	19		dB
Gain Flatness		±0.3			±0.7		dB
Gain Variation Over Temperature		0.02			0.02		dB/ °C
Gain Control Range	12	15		12	14		dB
Noise Figure		4.0			3.5		dB
Input Return Loss		13			12		dB
Output Return Loss		17			19		dB
Output Power for 1 dB Compression (P1dB)	21	24		21	24		dBm
Saturated Output Power (Psat)		25			24.5		dBm
Output Third Order Intercept (IP3)		31			30		dBm
Total Supply Current (Idd)		170			170		mA

*Set Vctrl = -4.5V and then adjust Vgg1, 2 between -2V to 0V to achieve Idd = 170 mA typical.

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 Phone: 781-329-4700 • Order online at www.analog.com Application Support: Phone: 1-800-ANALOG-D

ANALOG DEVICES

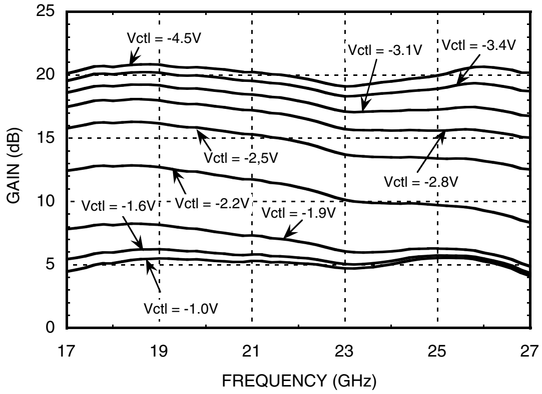
HMC997LC4

v02.0514

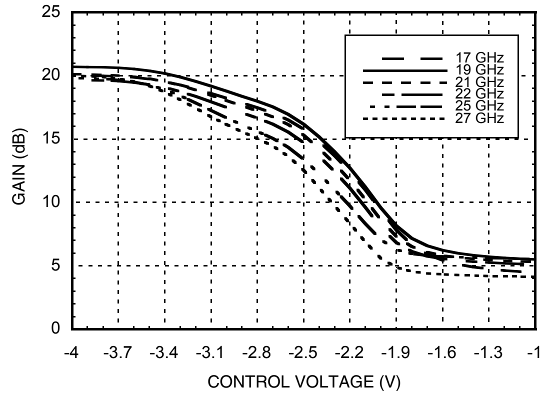
RoHS ✓ EARTH FRIENDLY

VARIABLE GAIN AMPLIFIER 17 - 27 GHz

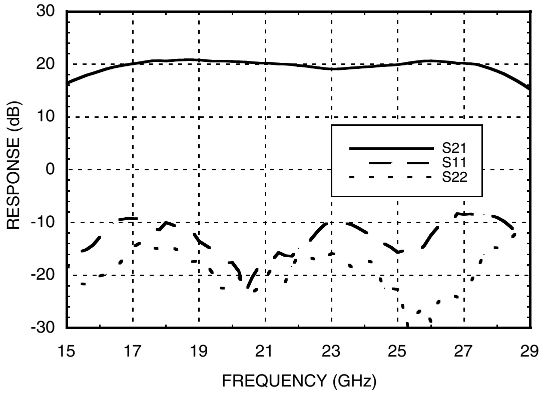
Gain vs. Control Voltage Range



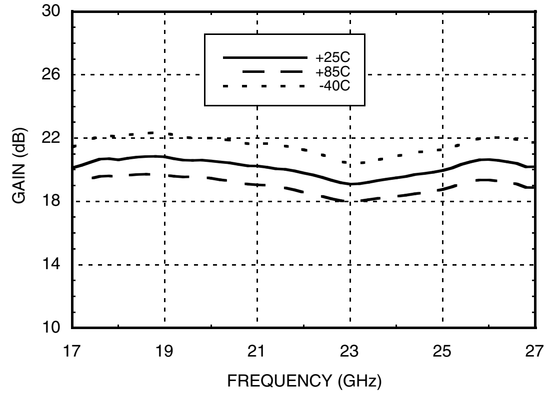
Gain vs. Control Voltage



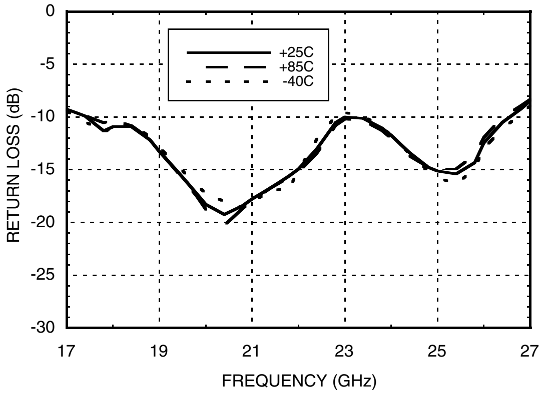
Broadband Gain & Return Loss



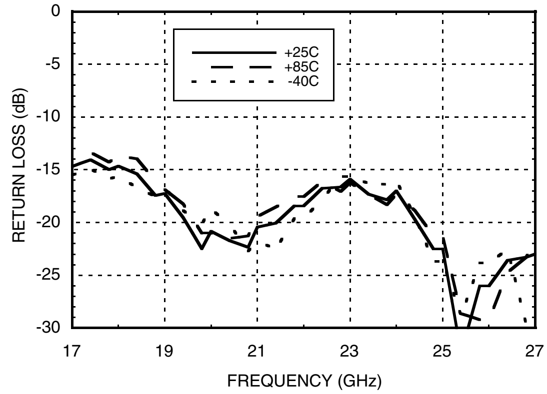
Gain vs. Temperature



Input Return Loss vs. Temperature



Output Return Loss vs. Temperature

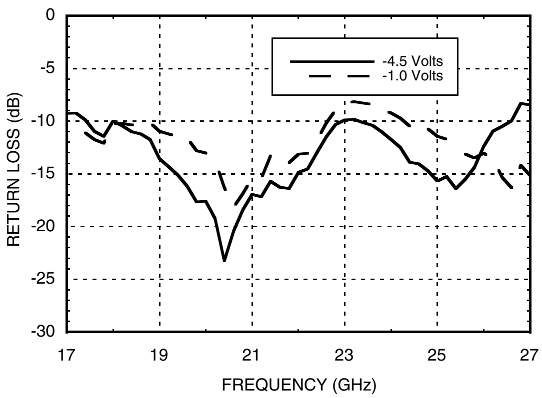


For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 Phone: 781-329-4700 • Order online at www.analog.com Application Support: Phone: 1-800-ANALOG-D

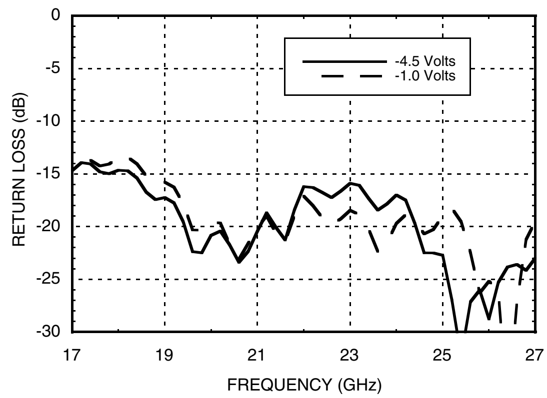
RoHS ✓ EARTH FRIENDLY

VARIABLE GAIN AMPLIFIER
17 - 27 GHz

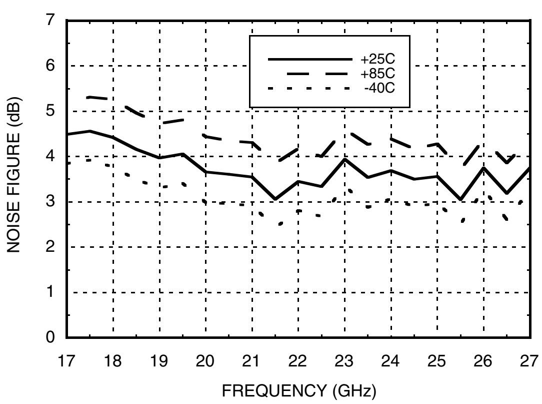
Input Return Loss @ Control Voltage Extreme



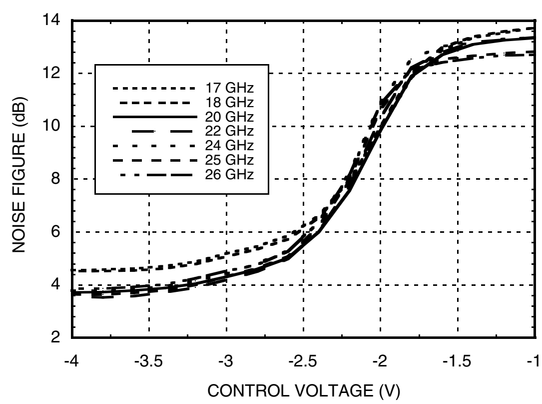
Output Return Loss @ Control Voltage Extreme



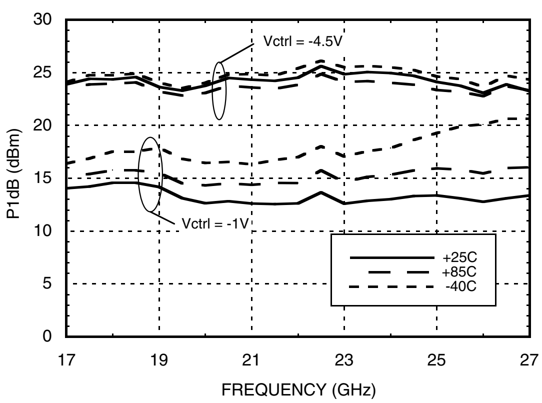
Noise Figure vs. Temperature



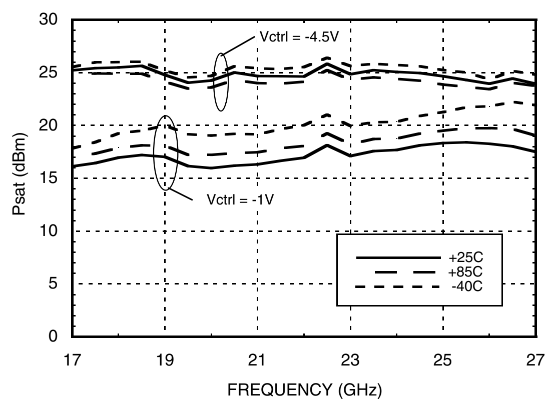
Noise Figure vs. Control Voltage



P1dB vs. Temperature



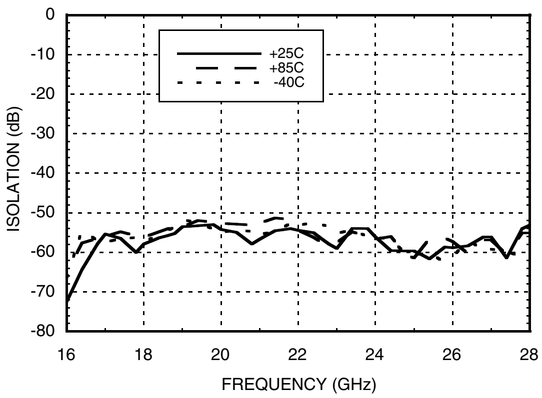
Psat vs. Temperature



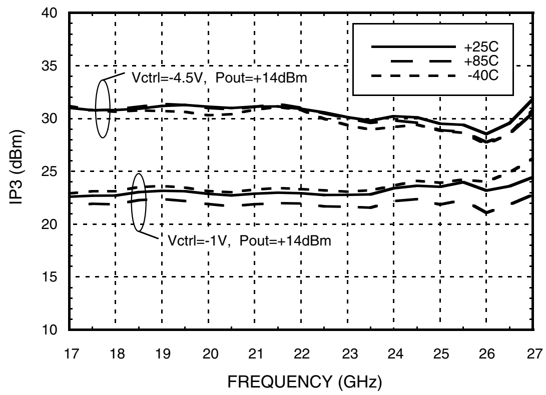
[1] Tested with broadband bias tee on RF ports and C1 = 10,000 pF
[2] C1, C6 and C8 = 100 pF, L1 = 24 nF

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 Phone: 781-329-4700 • Order online at www.analog.com Application Support: Phone: 1-800-ANALOG-D

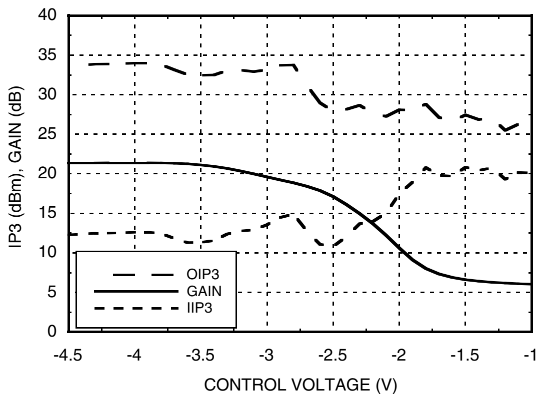
Reverse Isolation vs. Temperature



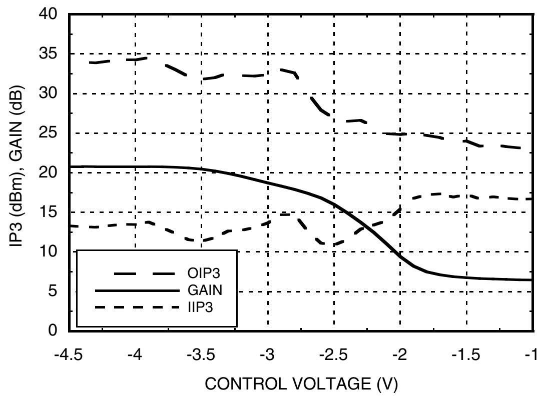
Output IP3 vs. Temperature



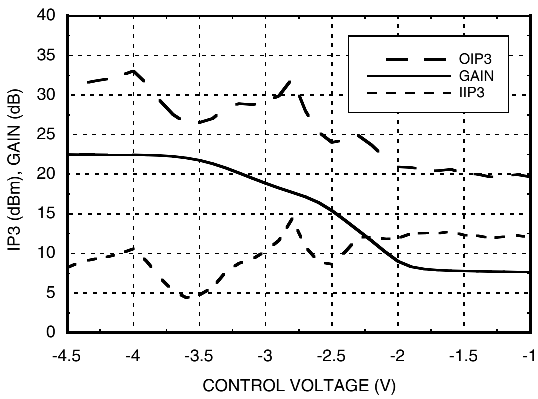
IP3 and Gain @ 18 GHz Pin = -20 dBm



IP3 and Gain @ 22 GHz Pin = -20 dBm



IP3 and Gain @ 26 GHz Pin = -20 dBm



VARIABLE GAIN AMPLIFIER
17 - 27 GHz

Absolute Maximum Ratings

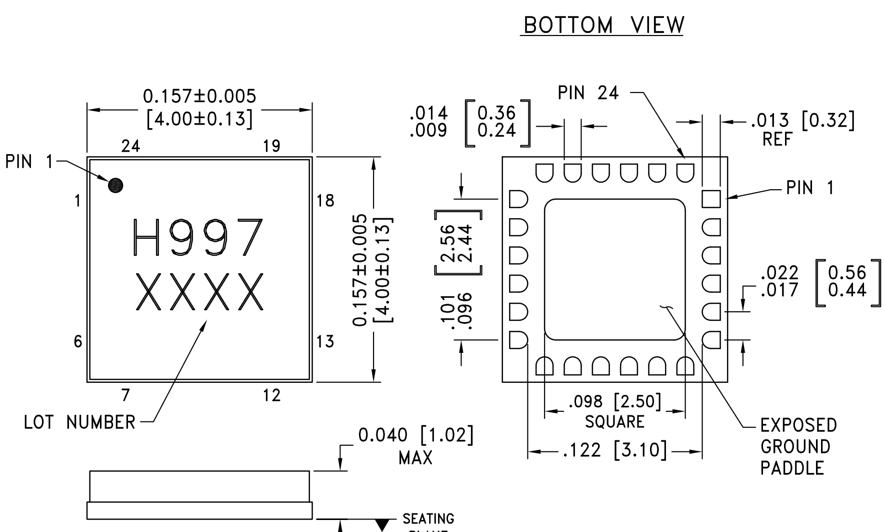
Drain Bias Voltage (Vdd1, 2, 3)	+5.5V
Gate Bias Voltage (Vgg1, 2)	-3 to 0V
Gain Control Voltage (Vctrl)	-5 to 0V
RF Power Input (RFIN)	+5 dBm
Channel Temperature	175 °C
Continuous Pdiss (T = 85 °C) (derate 10.2 mW/°C above 85 °C) [1]	0.92 W
Thermal Resistance (Channel to ground paddle)	97.6 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 0 Passed 100V

Bias Voltage

Vdd1,2,3 (V)	Idd Total (mA)
+5V	170
Vgg1,2 (V)	Igg Total (mA)
0V to -2V	<0.1 mA

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



SEATING PLANE

–C–

NOTES:
1. PACKAGE BODY MATERIAL: ALUMINA.
2. LEAD AND GROUND PADDLE PLATING: GOLD FLASH OVER NICKEL.
3. DIMENSIONS ARE IN INCHES (MILLIMETERS).
4. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
5. PACKAGE WARP SHALL NOT EXCEED 0.05 MM DATUM –C–
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

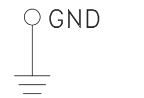
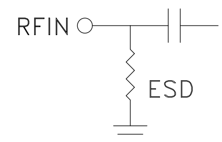
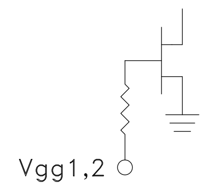
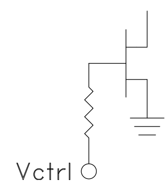
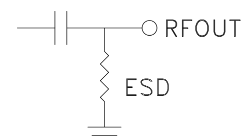
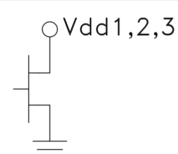
Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [2]
HMC997LC4	Alumina, White	Gold over Nickel	MSL3 [1]	H997 XXXX

[1] Max peak reflow temperature of 260 °C
[2] 4-Digit lot number XXXX

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106
Phone: 781-329-4700 • Order online at www.analog.com
Application Support: Phone: 1-800-ANALOG-D

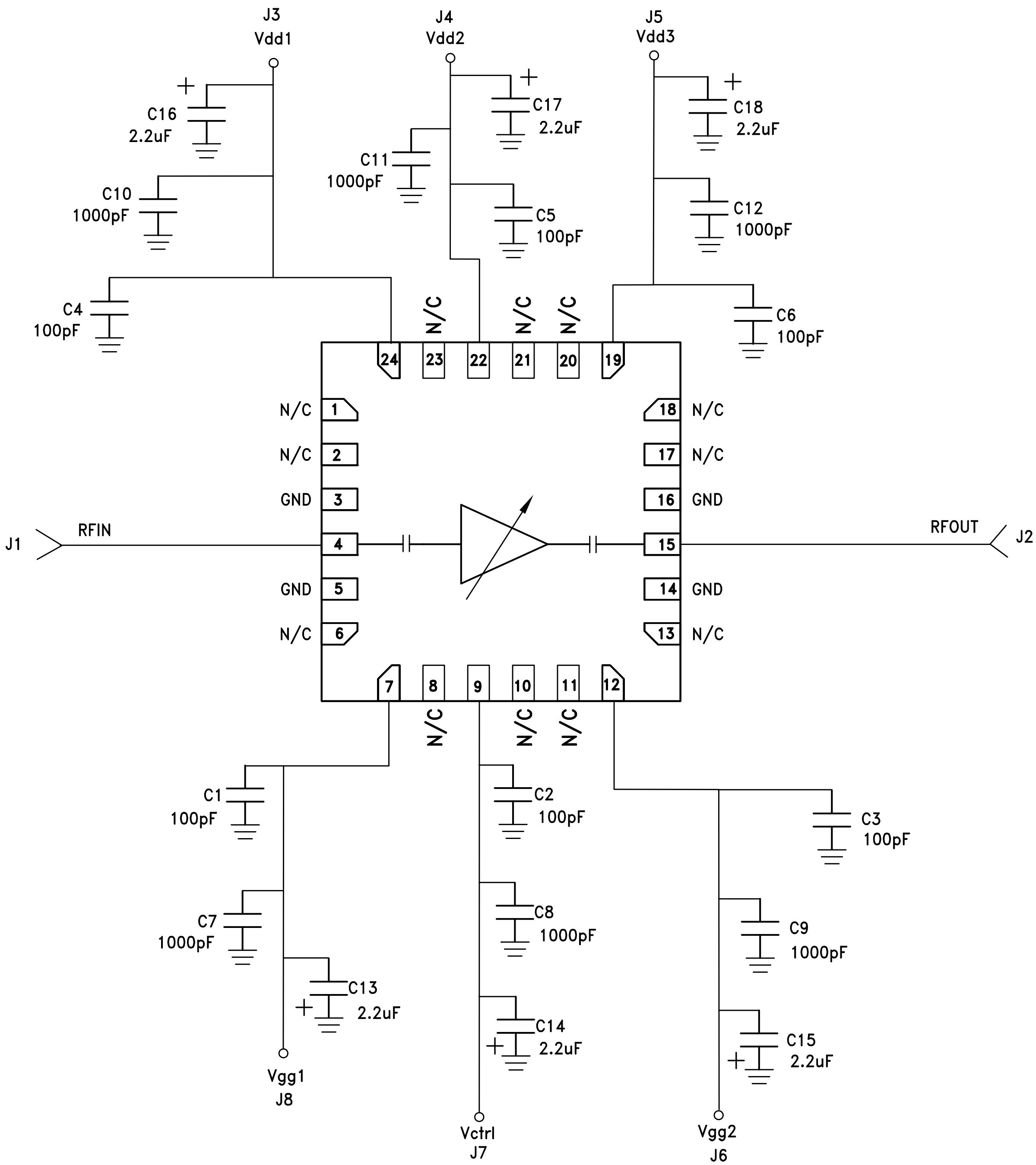
Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1, 2, 6, 8, 10, 11, 13, 17, 18, 20, 21, 23	N/C	The pins are not connected internally: however all data shown herein was measured with these pins connected to RF/DC ground externally	
3, 5, 14, 16	GND	These pins and the exposed ground paddle must be connected to RF/DC ground.	
4	RFIN	This pad is AC coupled and matched to 50 Ohm.	
7, 12	Vgg1, 2	Gate control for amplifier. Adjust voltage to achieve typical Idd. Please follow “MMIC Amplifier Biasing Procedure” application note.	
9	Vctrl	Gain control Voltage for the amplifier. See assembly diagram for required external components.	
15	RFOUT	This pad is AC coupled and matched to 50 Ohm.	
19, 22, 24	Vdd3, 2, 1	Drain Bias Voltage for the amplifier. See assembly diagram for required external components	

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106
Phone: 781-329-4700 • Order online at www.analog.com
Application Support: Phone: 1-800-ANALOG-D

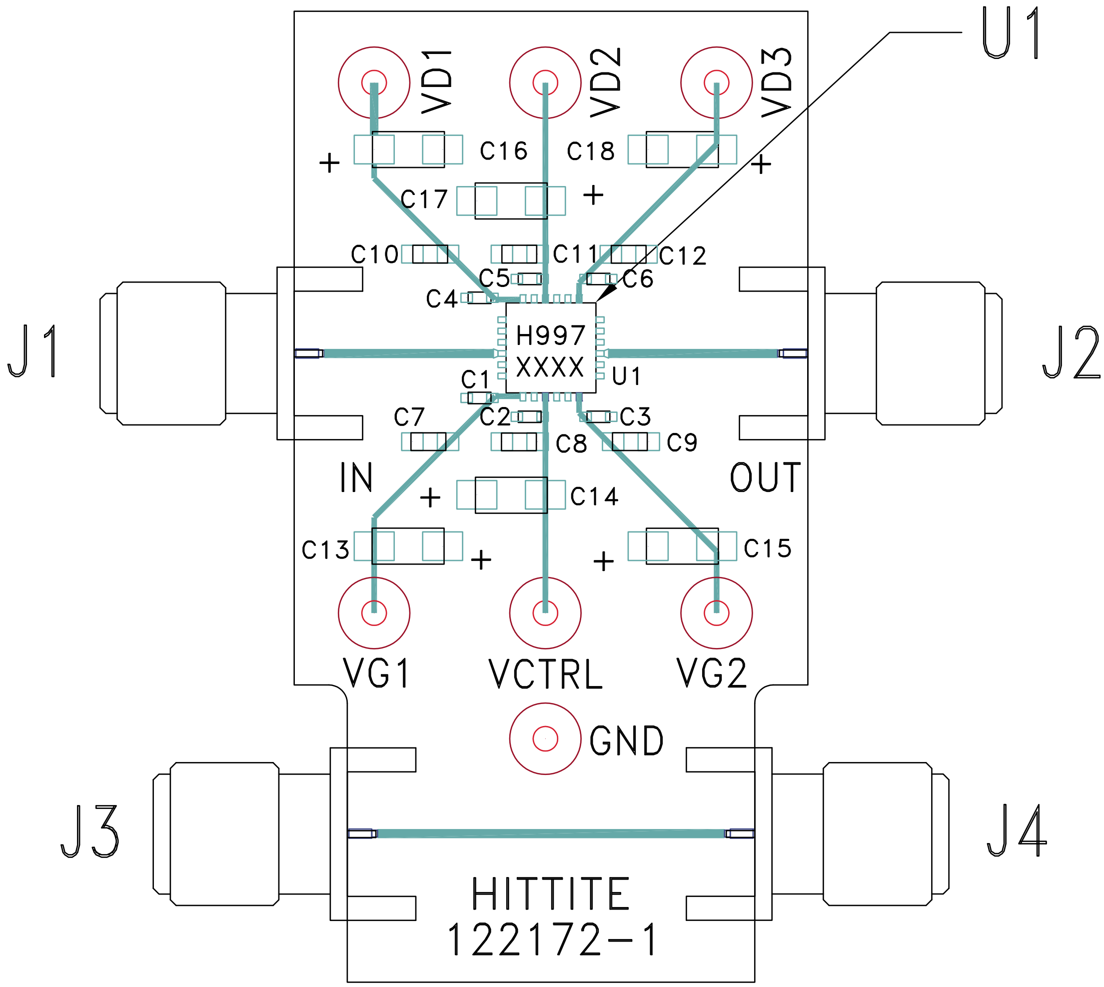
VARIABLE GAIN AMPLIFIER
17 - 27 GHz

Application Circuit



For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106
Phone: 781-329-4700 • Order online at www.analog.com
Application Support: Phone: 1-800-ANALOG-D

Evaluation PCB



List of Materials for Evaluation PCB EVAL01-HMC997LC4 [1]

Item	Description
J1, J4	PCB Mount SMA RF Connectors
J5 - J10	DC Pin
C1 - C6	100 pF Capacitor, 0402 Pkg.
C7 - C12	1000 pF Capacitor, 0603 Pkg.
C13 - C18	2.2 µF Capacitor, CASE A
U1	HMC997LC4 Variable Gain Amplifier
PCB [2]	122172 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Arlon 25 FR

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown is available from Hittite upon request.

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106
Phone: 781-329-4700 • Order online at www.analog.com
Application Support: Phone: 1-800-ANALOG-D