ANALOG DEVICES

HMC996LP4E

v01.0112

RoHS ✓ EARTH FRIENDLY

VARIABLE GAIN AMPLIFIER 5 - 12 GHz

Typical Applications

The HMC996LP4E is ideal for:

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

Features

Wide Gain Control Range: 22 dB

Single Control Voltage: -1 to -4.5V

Output IP3 @ Max Gain: +34 dBm

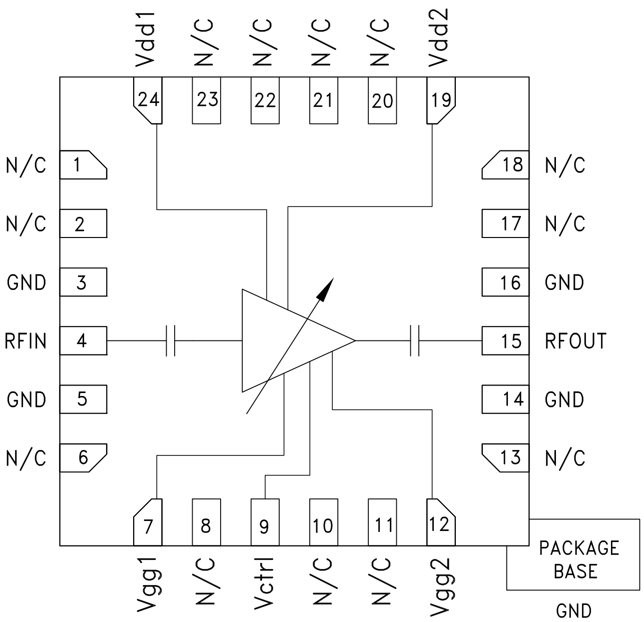
Output P1dB: +22 dBm

Low Noise Figure 2dB @ max gain

No External Matching

24 Lead 4x4 mm SMT Package: 16 mm^2

Functional Diagram



General Description

The HMC996LP4E is a GaAs PHEMT MMIC analog variable gain amplifier and / or driver amplifier which operates between 5 and 12 GHz. Ideal for microwave radio applications, the amplifier provides up to 18.5 dB of gain, output P1dB of up to +23 dBm, and up to +34 dBm of output IP3 at maximum gain, while requiring only 170 mA from a +5V supply. Gain control voltage pin (Vctrl) is provided to allow variable gain control up to 22 dB. Gain flatness is excellent making the HMC996LP4E ideal for EW, ECM and radar applications. The HMC996LP4E is housed in a RoHS compliant 4 x 4 mm QFN leadless package and is compatible with high volume surface mount manufacturing.

Electrical Specifications, T_A = +25°C, Vdd1, 2= 5V, Vctrl= -4.5V, Idd= 120 mA*

Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range		5 - 8.5			8.5 - 12		GHz
Gain	16	18.5		13	16		dB
Gain Flatness		±0.5			±1		dB
Gain Variation Over Temperature		0.006			0.006		dB/ °C
Gain Control Range	15	22		15	20		dB
Noise Figure		2.5			2		dB
Input Return Loss		17			9		dB
Output Return Loss		23			7		dB
Output Power for 1 dB Compression (P1dB)	19	22		20	23		dBm
Saturated Output Power (Psat)		23			24		dBm
Output Third Order Intercept (IP3)		34			34		dBm
Total Supply Current (Idd)		120			120		mA

*Set Vctrl = -4.5V and then adjust Vgg1, 2 between -2V to 0V to achieve Idd = 120 mA typical.

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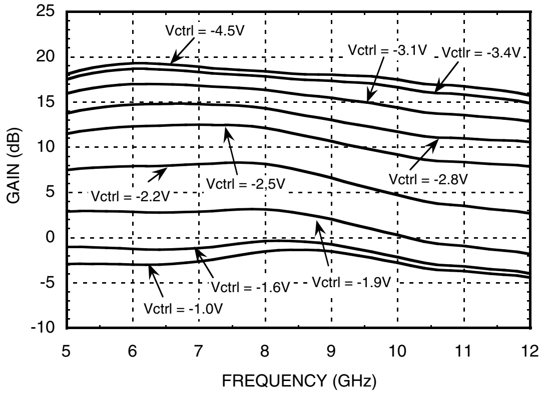
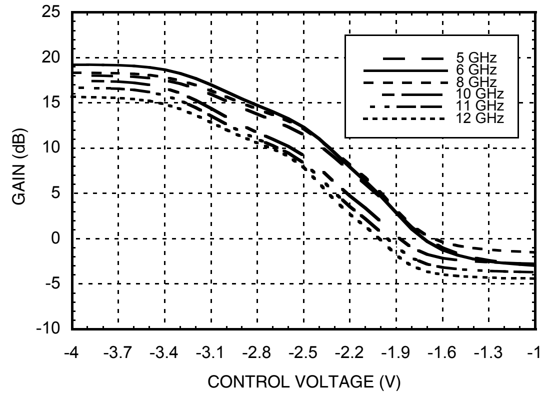
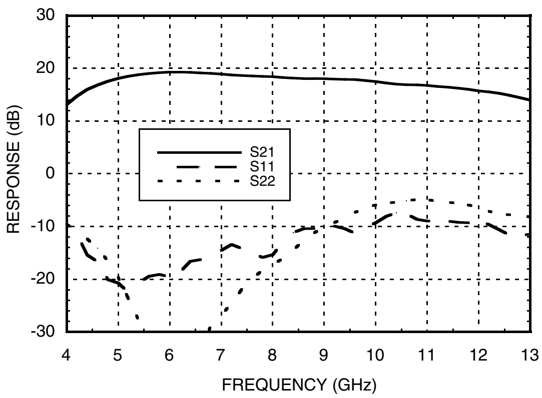
Gain vs. Control Voltage Range



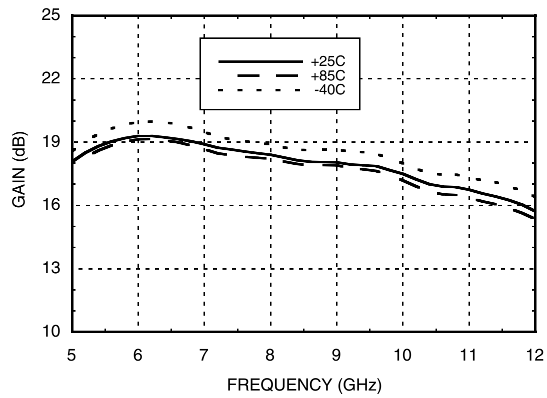
Gain vs. Control Voltage



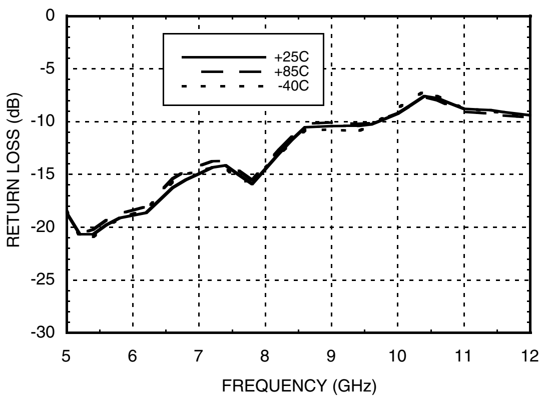
Broadband Gain & Return Loss



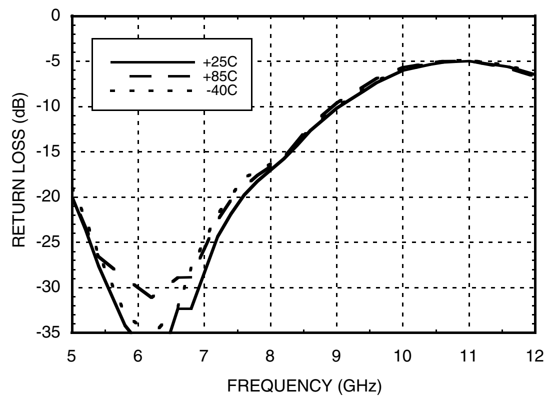
Gain vs. Temperature



Input Return Loss vs. Temperature



Output Return Loss vs. Temperature



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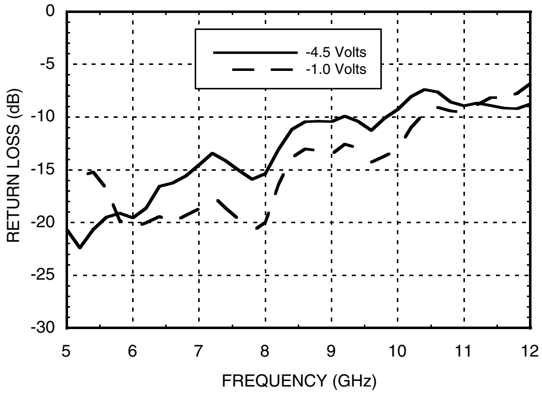
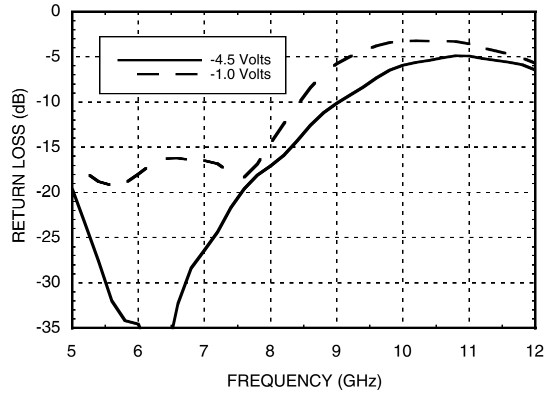
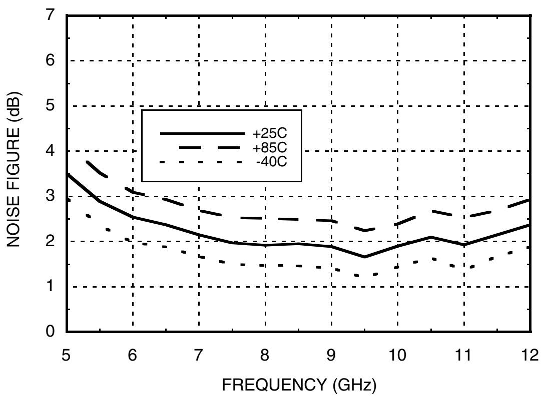
Input Return Loss @ Control Voltage Extreme



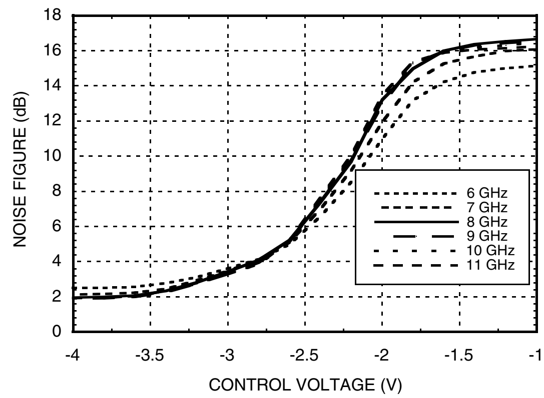
Output Return Loss @ Control Voltage Extreme



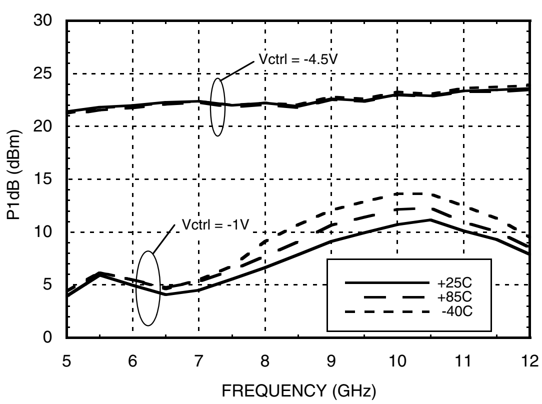
Noise Figure vs. Temperature



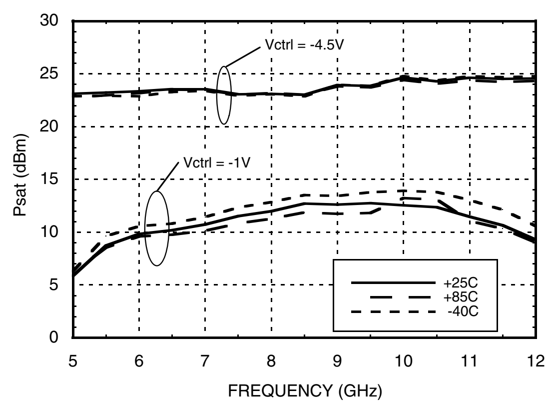
Noise Figure vs. Control Voltage



P1dB vs. Temperature



Psat vs. Temperature



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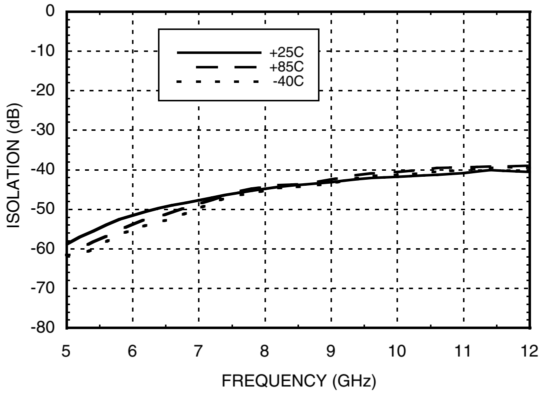
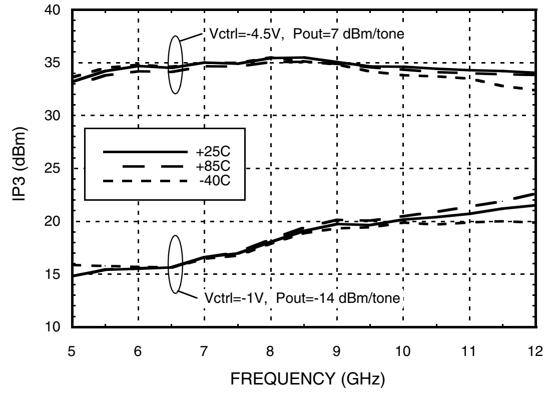
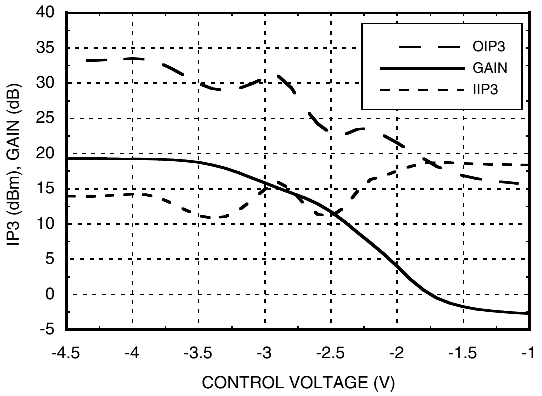
Reverse Isolation vs. Temperature



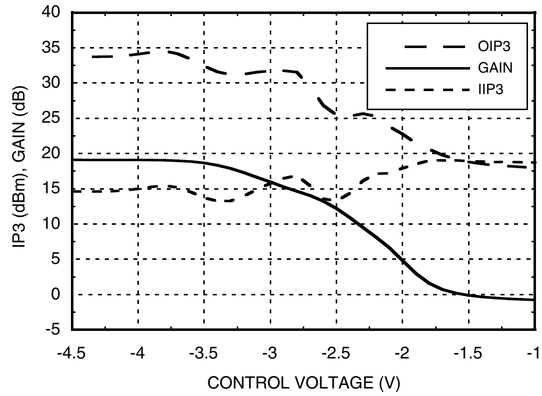
Output IP3 vs. Temperature



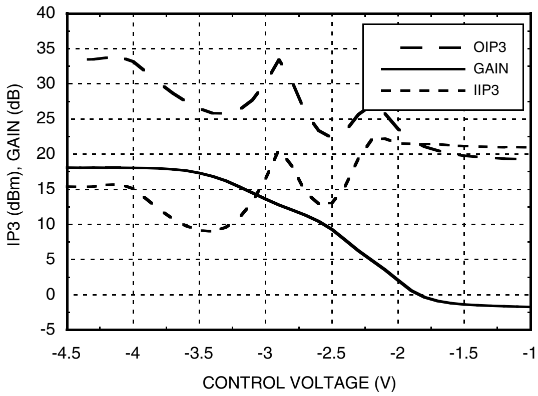
IP3 and Gain @ 6 GHz, Pin = -10 dBm



IP3 and Gain @ 8 GHz, Pin = -10 dBm



IP3 and Gain @ 10 GHz, Pin = -10 dBm



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Absolute Maximum Ratings

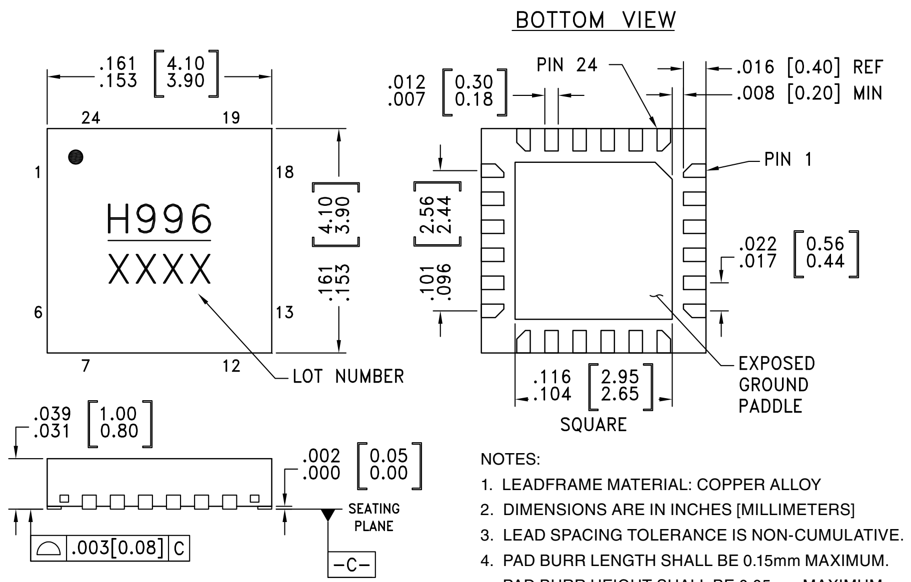
Drain Bias Voltage (Vdd1, 2)	+5.5V
Gate Bias Voltage (Vgg1, 2)	-3 to 0V
Gain Control Voltage (Vctrl)	-5 to 0V
RF Power Input	+20 dBm
Channel Temperature	175 °C
Continuous Pdiss (T = 85 °C) (derate 11.5 mW/°C above 85 °C) [1]	1.03 W
Thermal Resistance (Channel to ground paddle)	86.7 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 0 Passed 150V

Bias Voltage

Vdd1,2(V)	Idd Total (mA)
+5V	120 mA
Vgg1,2 (V)	Igg Total (mA)
0V to -2V	<0.1 mA

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



NOTES:

1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [2]
HMC996LP4E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [1]	H996 XXXX

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

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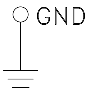
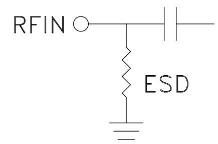
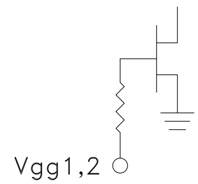
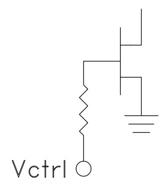
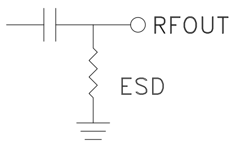
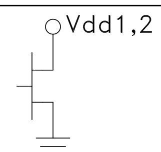
Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1, 2, 6, 8, 10, 11, 13, 17, 18, 20, 21, 22, 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 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, 24	Vdd1, 2	Drain Bias Voltage for the amplifier. See assembly diagram for required external components	

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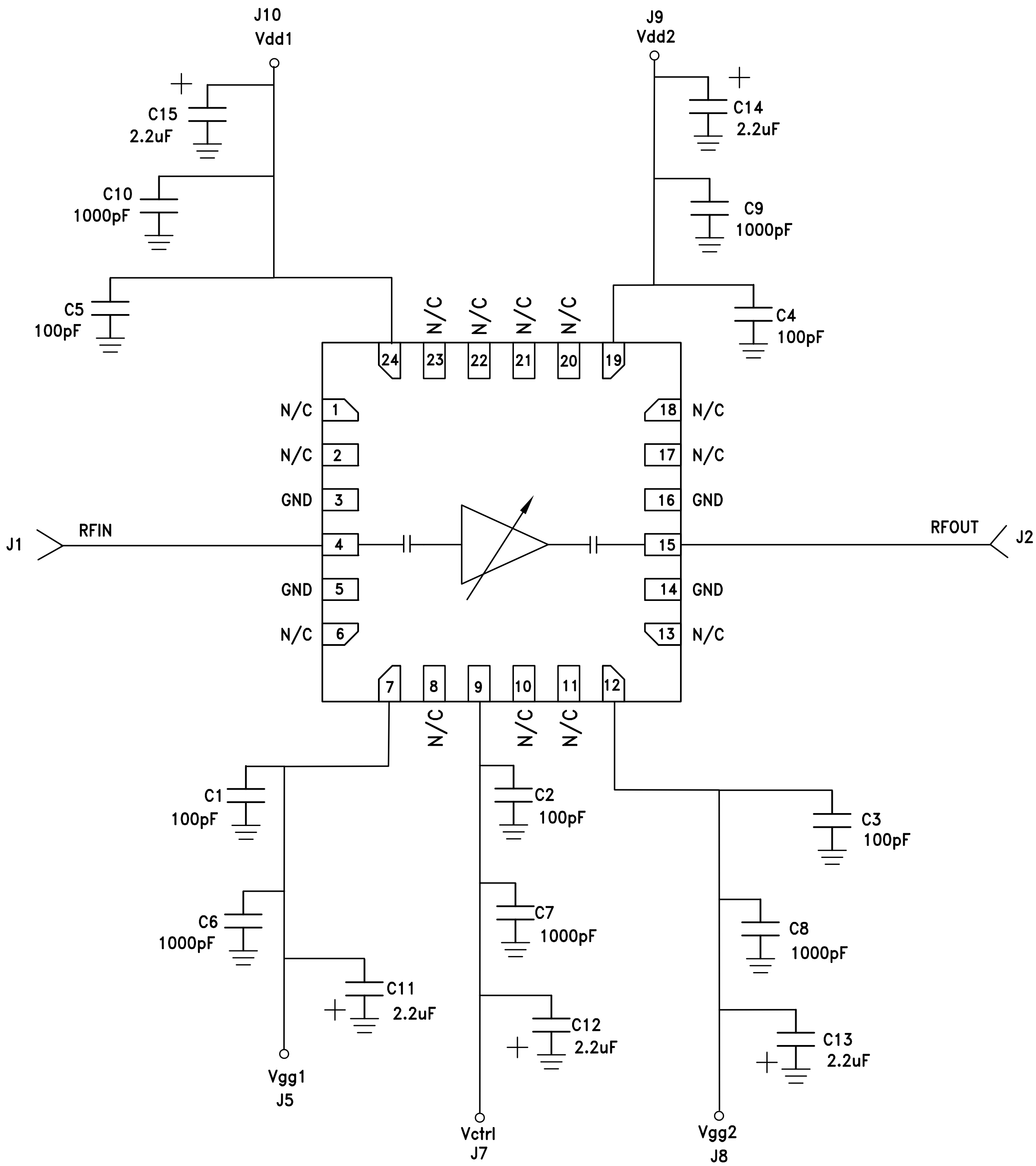
Application Circuit



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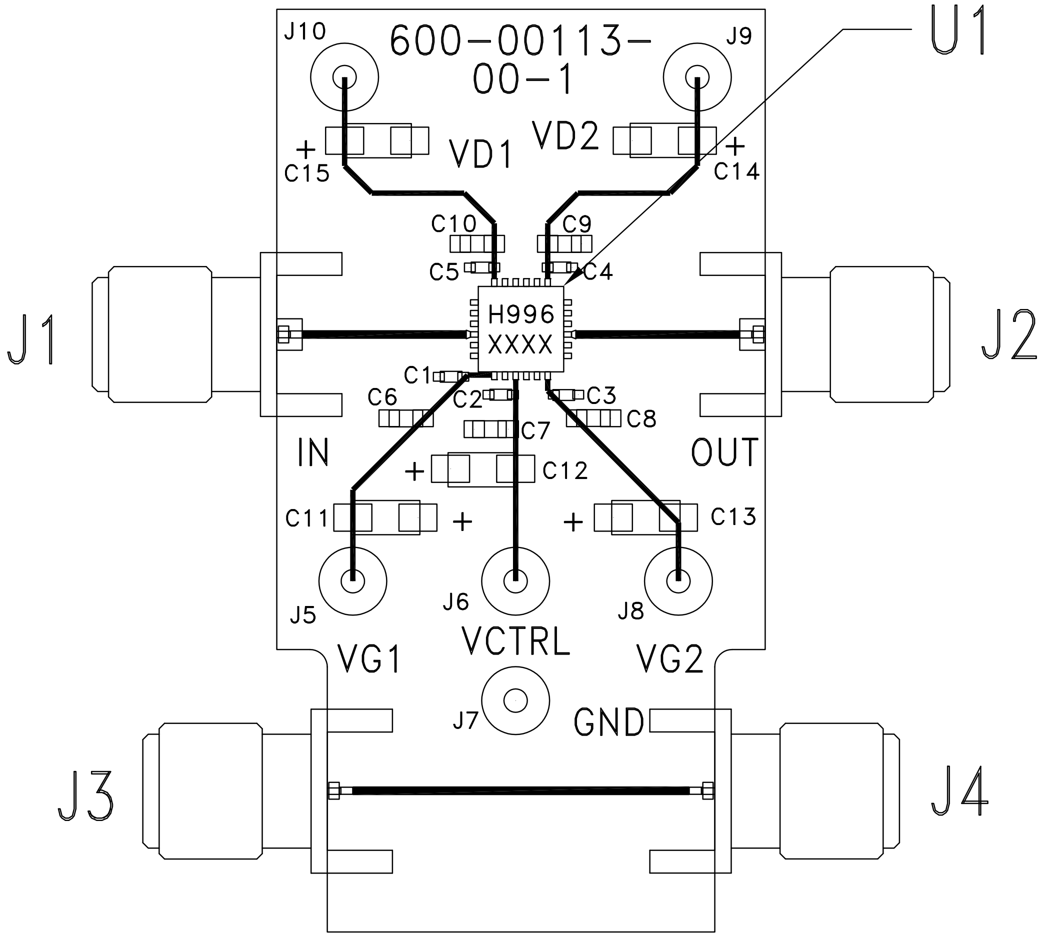
Evaluation PCB



List of Materials for Evaluation PCB EVAL01-HMC996LP4E [1]

Item	Description
J1, J4	PCB Mount SMA RF Connectors
J5 - J10	DC Pin
C1 - C5	100 pF Capacitor, 0402 Pkg.
C6 - C10	1000 pF Capacitor, 0603 Pkg.
C11 - C15	2.2 µF Capacitor, CASE A
U1	HMC996LP4E Variable Gain Amplifier
PCB [2]	600-00113-00 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Arlon 25FR

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.