National Semiconductor

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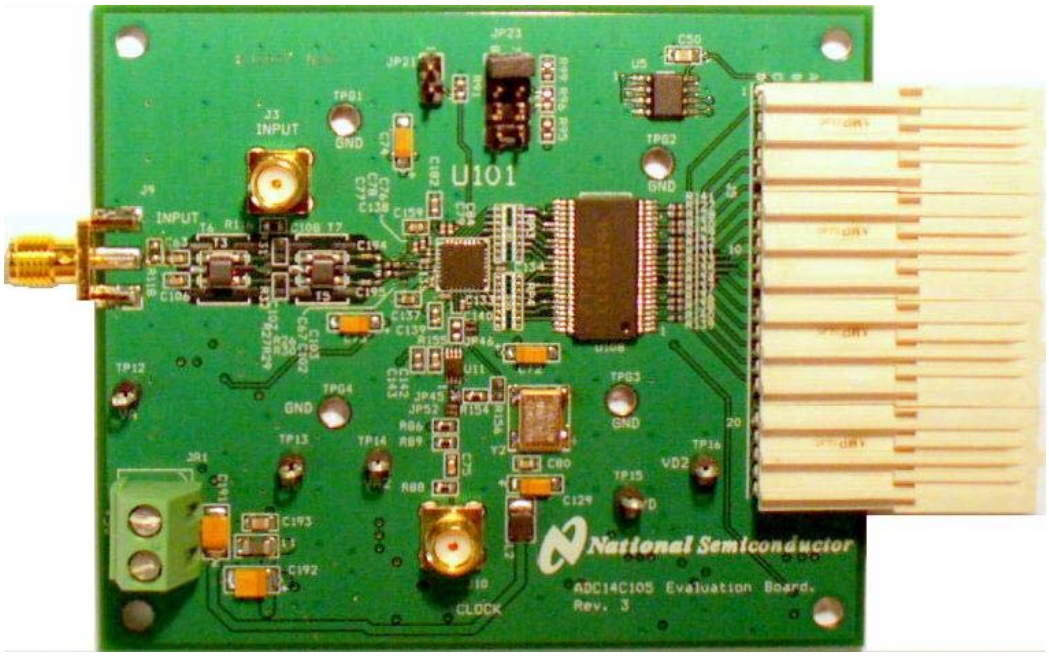
Evaluation Board User's Guide

ADC12C080, 12-Bit, 80 Msps A/D Converter

ADC14C080, 14-Bit, 80 Msps A/D Converter

ADC12C105, 12-Bit, 105 Msps A/D Converter

ADC14C105, 14-Bit, 105 Msps A/D Converter



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1.0 Introduction

This Evaluation Board may be used to evaluate the ADC12C080, ADC14C080, ADC12C105, or the ADC14C105. The ADC is one of a family of 12 and 14 bit converters that provides data at rates of up to 105MHz. Further reference in this manual to the ADC14C105 is meant to also include the other listed parts unless otherwise specified

The evaluation board is designed to be used with the WaveVision™ Digital Interface Board which is connected to a personal computer through a USB port and running WaveVision™ software, operating under Microsoft Windows. The software can perform an FFT on the captured data upon command and, in addition to a frequency domain plot, shows dynamic performance in the form of SNR, SINAD, THD and SFDR. The latest WaveVision hardware and software is available through the National Semiconductor website: http://www.national.com/appinfo/adc/wv4.html

2.0 Board Assembly

The ADC14C105 Evaluation Board comes pre-assembled. Refer to the Bill of Materials in *Section 8* for a description of components, to *Figure 1* for major component placement and to *Section 6* for the Evaluation Board schematic.

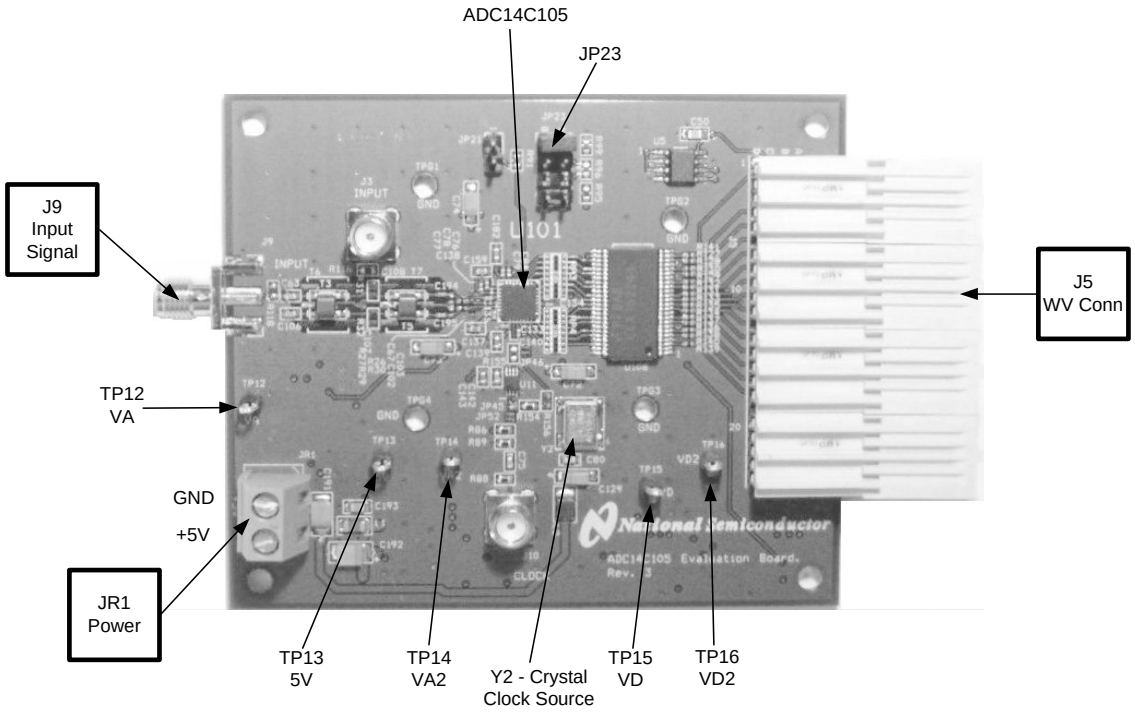


Figure 1. Major Component and Jumper Locations

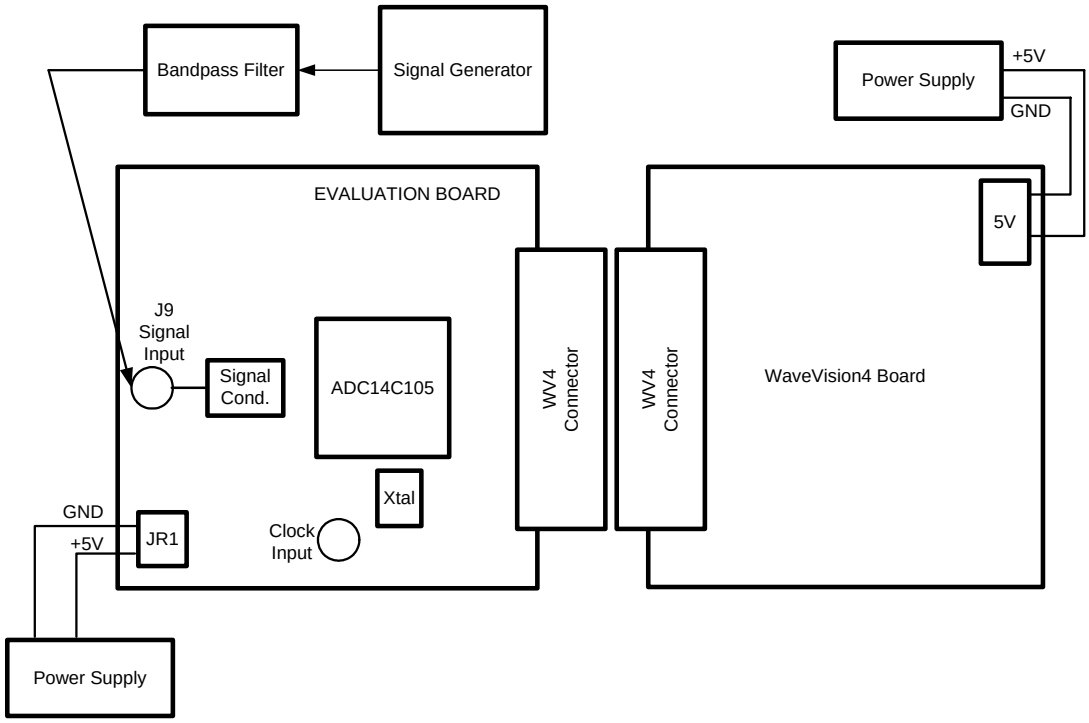


Figure 2. Test Set up

3.0 Quick Start

Refer to *Figure 1* for locations of jumpers, test points and major components. Refer to *Figure 2* for the test set up. The board is configured by default to use a crystal clock source and internal reference. Refer to Section 4.0 and the Appendix for more information on jumper settings. The input network of this board is configured for input frequencies greater than 70MHz. Refer to Section 4.1 for more information about input networks.

You must have version 4.3 or later of the WaveVision™ software to properly test this board. You can download the latest version from:
http://www.national.com/appinfo/adc/wv4.html

1. Apply power to the WaveVision™ board and connect it to the computer using a USB cable. See the WaveVision™ Board Manual for operation of that board. Connect the evaluation board to the WaveVision™ Digital Interface Board.
2. Connect a clean +5V power supply to pin 2 of Power Connector JR1. Pin 1 is ground.
3. Connect a signal from a 50-Ohm source to connector J9. Be sure to use a bandpass filter before the Evaluation Board.
4. Adjust the input signal amplitude as needed to ensure that the signal does not over-range by examinining a histogram of the output data with the WaveVision™ software.

4.0 Functional Description

The ADC14C105 Evaluation Board schematic is shown in *Section 6.* A list of test points and jumper settings can be found in the Appendix.

4.1 Analog Input

To obtain the best distortion results the analog input network must be optimized for the signal frequency being applied. The ADC14C105 Evaluation Board comes configured for input frequencies greater than 70MHz as seen in *Figure 3*.

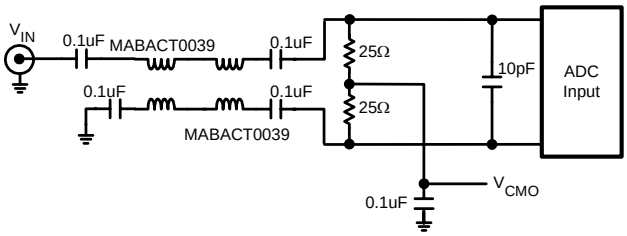


Figure 3. Analog Input Network for F_{IN} > 70MHz

The input network is intended to accept a low-noise sine wave signal of up to 2V peak-to-peak amplitude. To accurately evaluate the dynamic performance of this converter, the input test signal will have to be passed through a high-quality bandpass filter.

For input frequencies below 70MHz the circuit of *Figure 4* may be used.

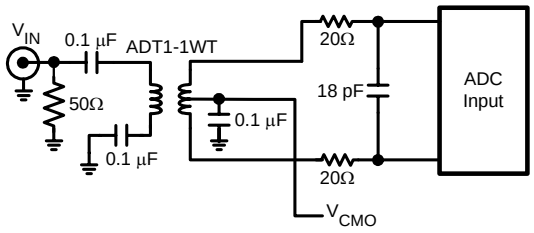


Figure 4. Analog Input Network for F_{IN} < 70MHz

4.2 ADC reference circuitry

The ADC14C105 can use an internal or external 1.2V reference. This Evaluation Board is configured to use the internal reference.

4.3 ADC clock circuit

Solder jumpers are used to select the path of the clock to the ADC. While not as convenient as pin-type jumpers, these introduce less distortion into the clock signal.

Care must be taken to provide a high quality low jitter clock source. The board has a Pletronics SM7745 or Vectron VCC1 type device crystal clock. It is buffered by U11 (NS7WV125) and applied to the ADC's clock input pin.

The user can configure the board for an external clock at connector J10. For this option short the pins of solder jumper JP52 and open the pins of JP45. It may also be necessary to remove L2 so the crystal is not powered. Refer to the schematic for more detail.

4.4 Digital Data Output

The digital output data is available at pins B4 (MSB) through B17 of the WaveVision™ (WV4) connector J5.

4.5 Data Format/ Duty Cycle Stabilizer

Output data format and the duty cycle stabilizer (DCS) are controlled by jumper JP23.
Shorting pins 1-2 of JP23 sets the output format to 2's complement with DCS Off.
Shorting pins 3-4 of JP23 sets the output format to 2's complement with DCS On.
Shorting pins 5-6 of JP23 sets the output format to offset binary with DCS On.
Shorting pins 7-8 of JP23 sets the output format to offset binary with DCS Off. This is the default setting.

4.6 Power Supply Connections

Power to this board is supplied through power connector J1. The only supply needed is +5V at pin 2 plus ground at pin 1.

Voltage and current requirements for the ADC14C105 Evaluation Board are:

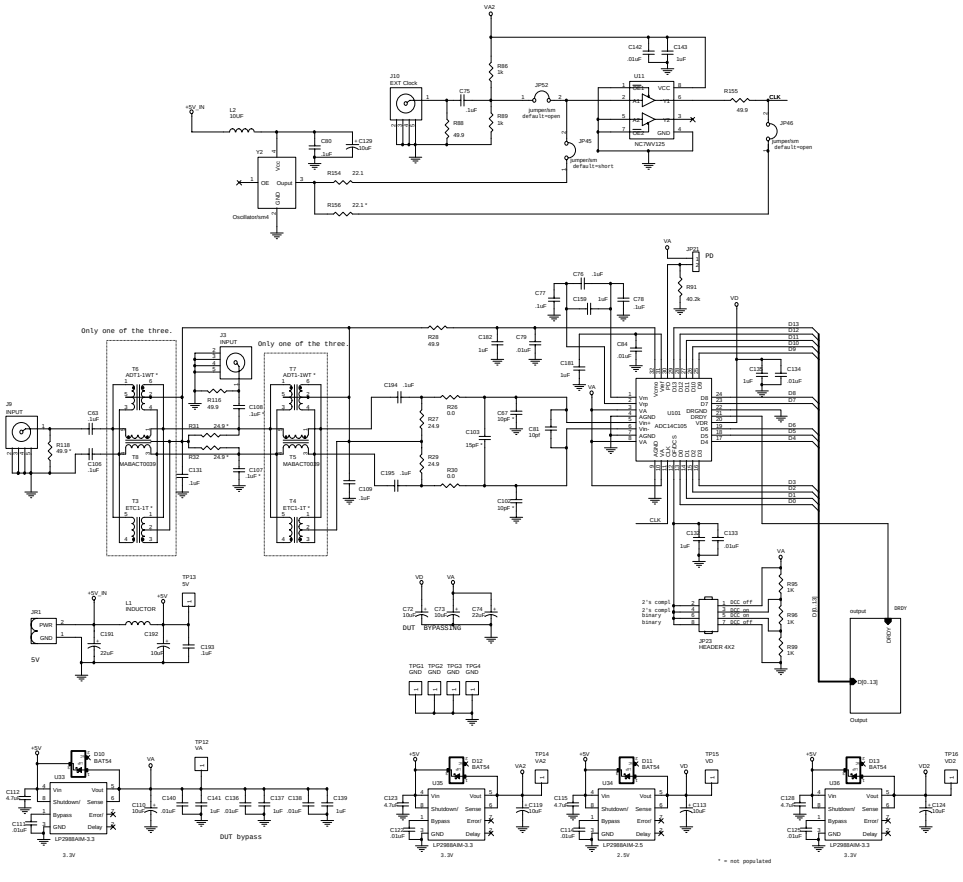
- +5.0V at 500 mA

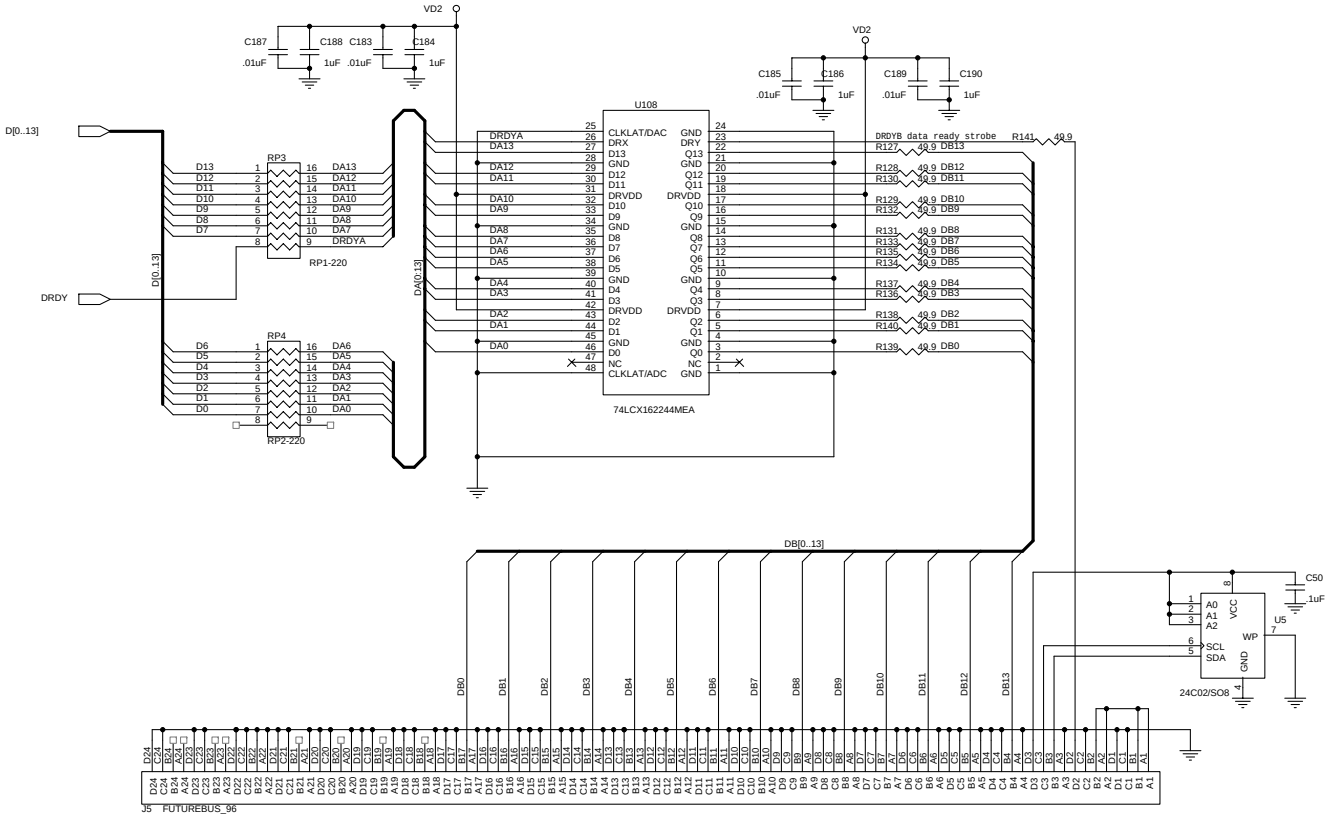
5.0 Installing the ADC14C105 Evaluation Board

The evaluation board requires power supplies as described in *Section 4.6*. An appropriate signal source should be connected to the Signal Input SMA connector J9. When evaluating dynamic performance, an appropriate signal generator (such as the HP8644B or the R&S SME-03) with 50 Ohm source impedance should be connected to the Analog Input connector through an appropriate bandpass filter as even the best signal generator available can not produce a signal pure enough to evaluate the dynamic performance of an ADC.

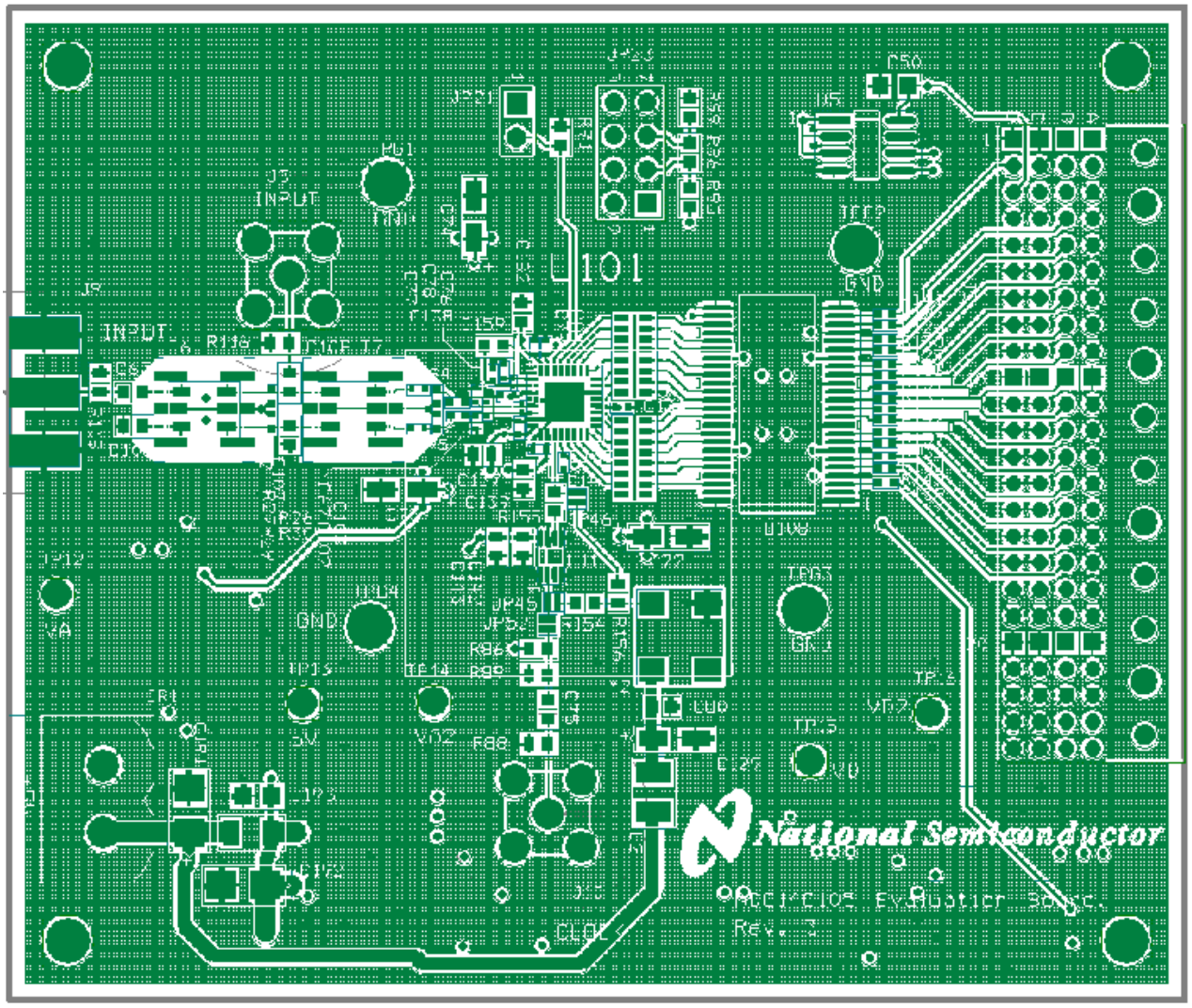
If this board is used in conjunction with the the WaveVision™ 4.0 Digital Interface Board and WaveVision™ software, a USB must be connected between the Digital Interface Board and the host. See the WaveVision™ 4.0 Digital Interface Board manual for details.

6.0 Hardware Schematic

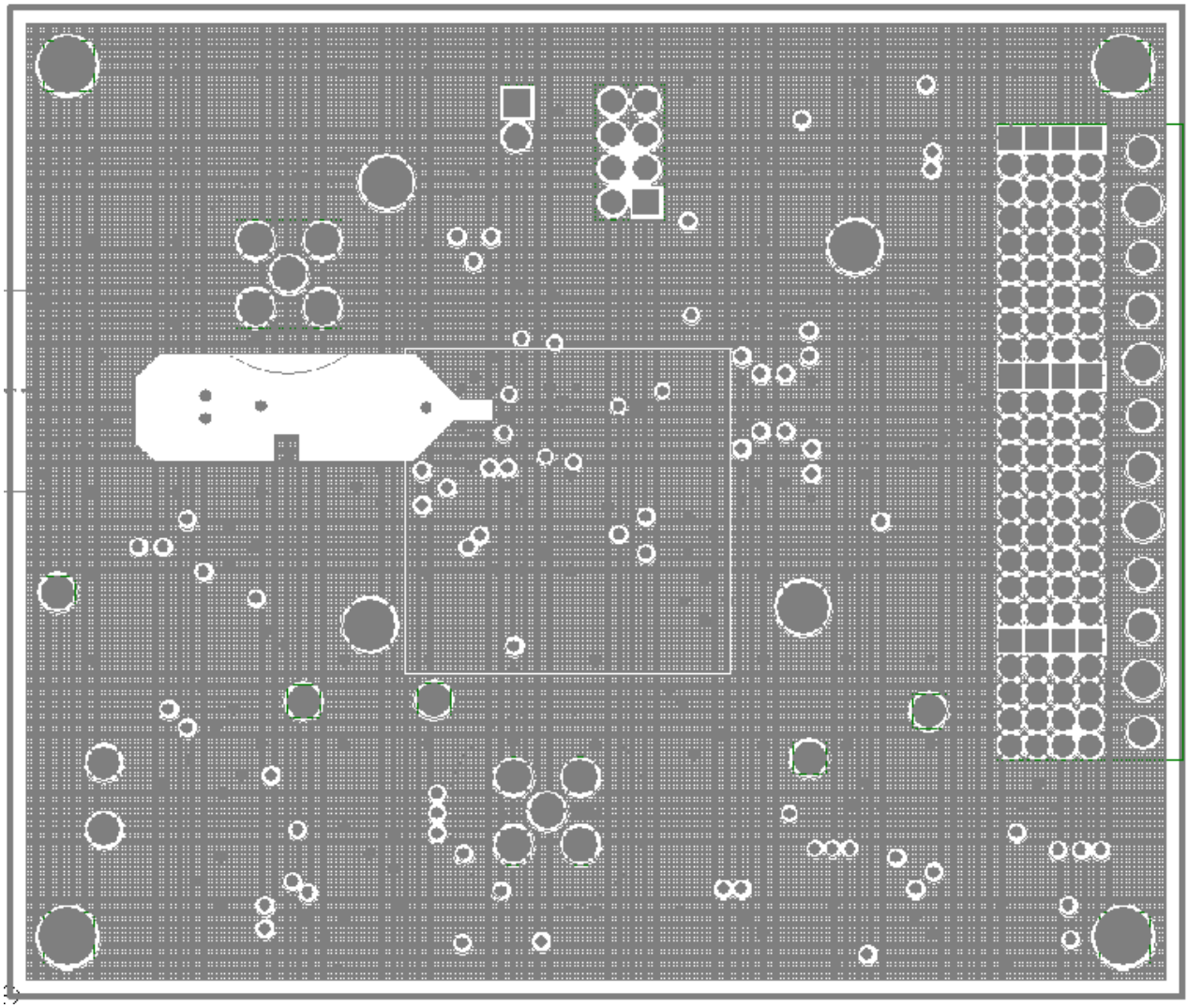




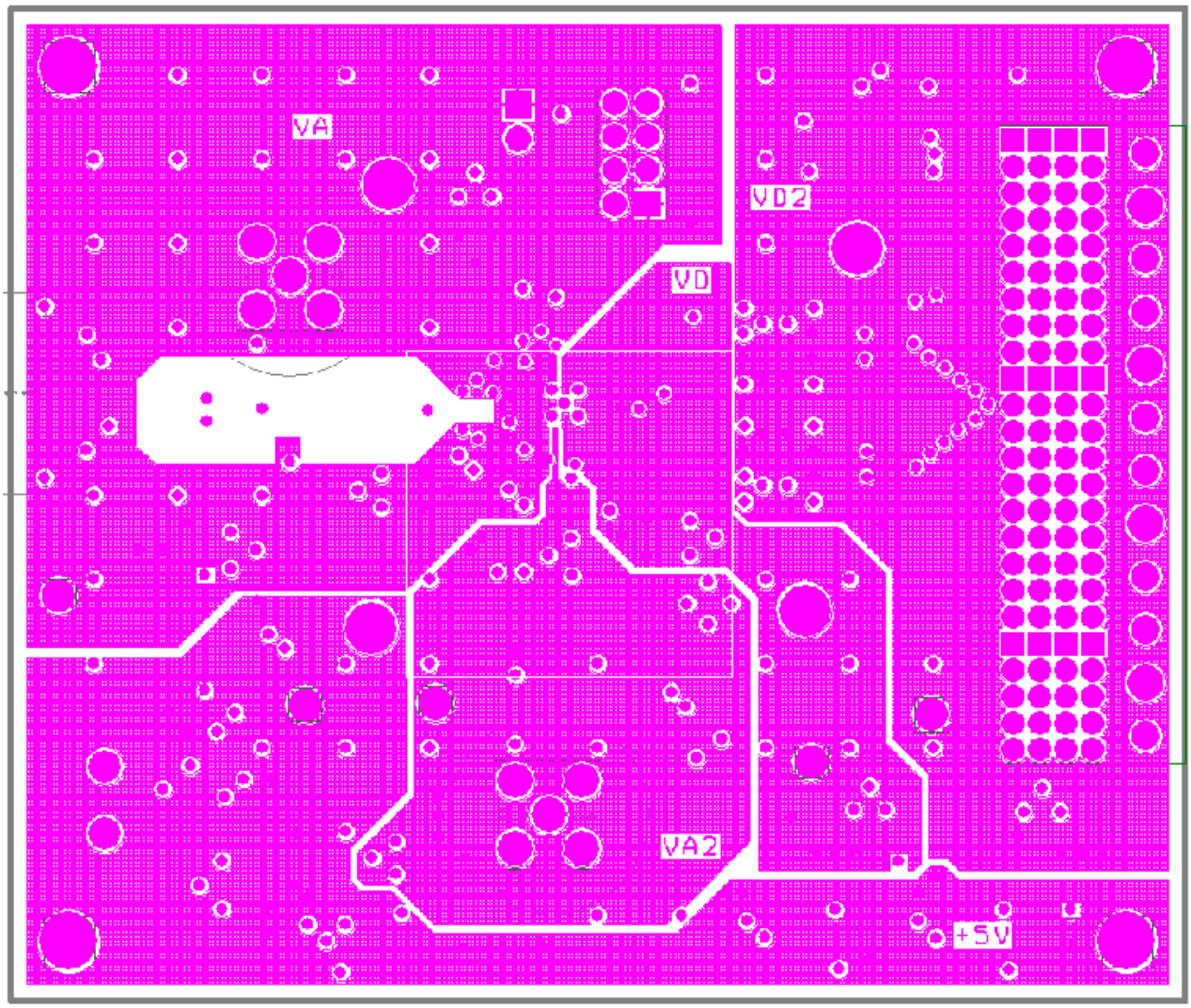
7.0 Evaluation Board Layout



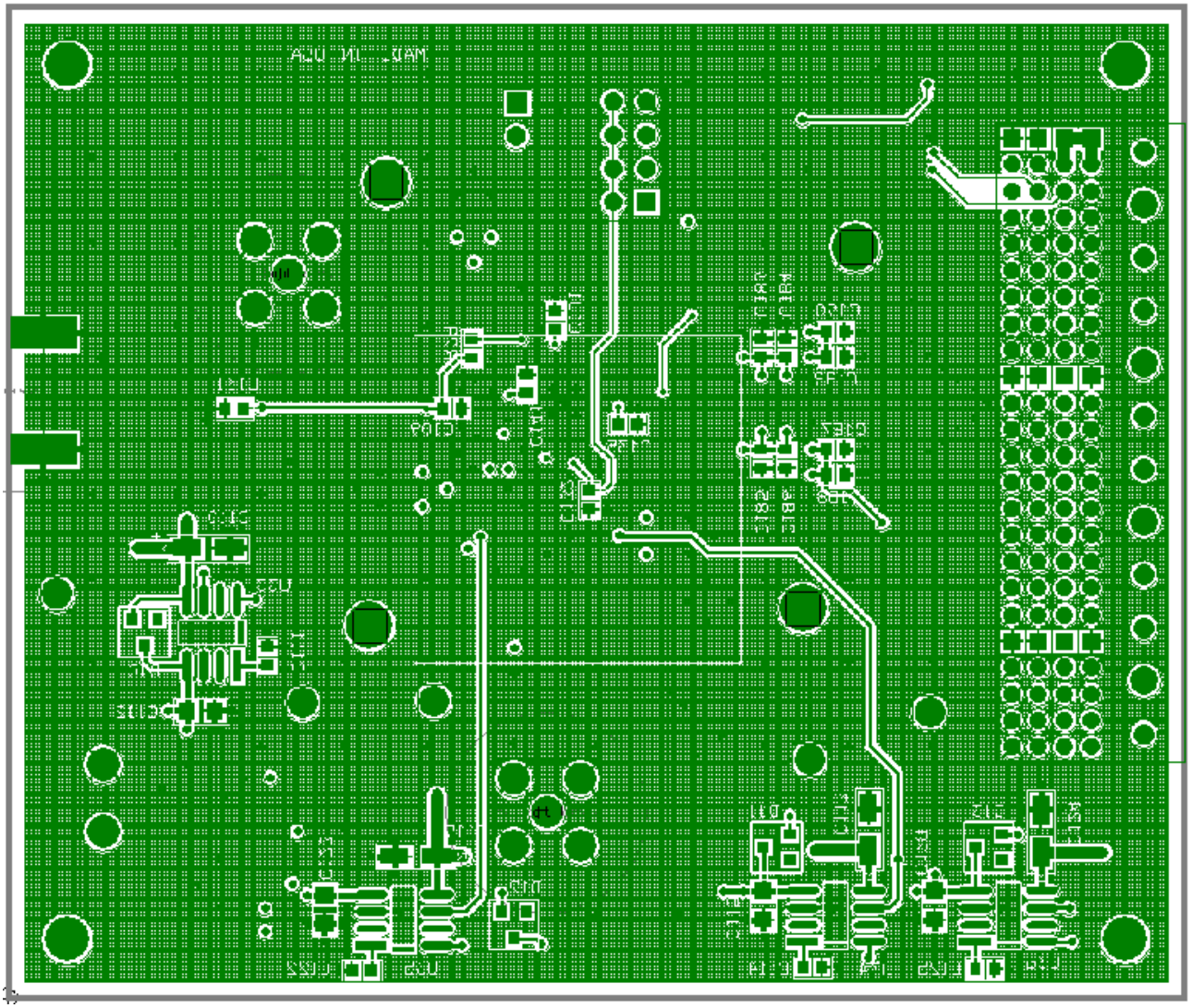
Layer 1 : Component Side



Layer 2 : Ground



Layer 3 : Power



Layer 4 : Circuit Side

8.0 Evaluation Board Bill of Materials

Qty	Reference	Part	Part Number
	SMT Capacitors		
2	C50,C193	.1uF	PCC1828CT
8	C63,C75,C80,C106, C109,C131	.1uF	PCC1762CT
7	C72,C73,C110,C113,C119, C124,C129	10uF	399-1551-1
1	C74	22uF	399-3096-1
1	C76	.1uF	PCC2336CT
4	C77,C78,C194,C195	.1uF	PCC2188CT
7	C79,C84,C133,C134,C136, C138,C140	.01uF	PCC2270CT
1	C81	10pf	PCC2112CT
9	C111,C114,C122,C125,C142, C183,C185,C187,C189	.01uF	PCC1784CT
4	C112,C115,C123,C128	4.7uF	PCC1842CT
13	C132,C135,C137,C139,C141, C143,C159,C181,C182,C184, C186,C188,C190	1uF	PCC2224CT
1	C191	22uF	399-3835-1
1	C192	10uF	399-3705-1
	Diode		
4	D10,D11,D12,D13	BAT54	BAT54-FDICT
	Connectors		
1	JP21	Header2	S1011E-2
1	JP23	HEADER 4X2	S2011E-4
3	JP45,JP46,JP52	jumper/sm	N/A
1	JR1	VA / VD Power	277-1263
1	J3	INPUT	ARFX1231
1	J5	FUTUREBUS_96	223514-1
1	J9	INPUT	J502
1	J10	EXT Clock	ARFX1231
	Ferrites		
1	L1	INDUCTOR	BLM31PG500SN1L
1	L2	INDUCTOR	490-4059-1
	Resistors		
1	RP3	RP1-220	742C163220JPCT
1	RP4	RP2-220	742C163220JPCT
2	R26,R30	0	P0.0LCT
2	R27,R29	24.9	P24.9LCT
4	R28,R88,R116,R155	49.9	P49.9HCT
5	R86,R89,R95,R96,R99	1K	P1.00KHCT
1	R91	40.2k	P40.2KHCT
15	R127,R128,R129,R130,R131, R132,R133,R134,R135,R136, R137,R138,R139,R140,R141	49.9	P49.9LCT

2	R154,	22.1	P22.1HCT
	Test Points		
4	TPG1,TPG2,TPG3,TPG4	GND	5011K
1	TP12	VA	5002K
1	TP13	5V	5002K
1	TP14	VA2	5002K
1	TP15	VD	5002K
1	TP16	VD2	5002K
	Transformers		
2	T5,T8	Transformer	Tyco MABACT0039
	IC's		
1	U5	24C02/SO8	AT24C02AN-10SU-2.7
1	U11	NC7WV125	NC7WV125K8X
3	U33,U35,U36	LP2988AIM-3.3	LP2988AIM
1	U34	LP2988AIM-2.5	LP2988AIM
1	U101	ADC14C105	
1	U108	74LCX162244MEA	74LVTH162244MEA
1	Y2	Oscillator/sm4	Pletronics SM7745DV-105.0M Or Pletronics SM7745DV-80.0M
	DO NOT SOLDER THE FOLLOWING TO BOARD		
2	C67,C102	10pF	PCC2264CT
1	C103	15pF	PCC150CQCT
	C107, C108		
2	R31,R32	24.9	P24.9LCT
1	R118	49.9	P49.9HCT
	R156		
2	T3,T4	ETC1-1T	ETC1-1T
2	T6,T7	ADT1-1WT	ADT1-1WT+

APPENDIX

A1.0 Operating in the Computer Mode

The ADC14C105 Evaluation Board is compatible with the WaveVision™ 4.0 Digital Interface Board and WaveVision™ software. You must have version 4.3 or later of the WaveVision™ software to properly test this board. You can download the latest version from: http://www.national.com/appinfo/adc/wv4.html

When connected to the Digital Interface Board, data capture is easily controlled from a personal computer operating in the Windows environment. The data samples that are captured can be observed on the PC video monitor in the time and frequency domains. The FFT analysis of the captured data yields insight into system noise and distortion sources and estimates of ADC dynamic performance such as SINAD, SNR and THD.

A2.0 Summary Tables of Test Points, Connectors, and Jumper Settings

A2.1 Test Points

Test Points on the ADC14C105 Evaluation Board

Voltage Signal Name	Measure at	Nominal Voltage (V)	Voltage Limits (V)
+5V	TP13	5	4.9 to 5.1
VA	TP12	3.3	3.2 to 3.4
VA2	TP14	3.3	3.2 to 3.4
VD	TP15	2.5	2.4 to 2.6
VD2	TP16	3.3	3.2 to 3.4

A2.2 Connectors

JR1 Connector - Power Supply Connections

1	GND	Power Supply Ground
2	+5V	+5V Power Supply

A2.3 Jumper settings

Note: Default settings are in **bold**

JP21 : Power Down

Connect 1-2	The ADC is in power down mode
1-2 OPEN	**The ADC is in normal operation**

JP23 : Output Data Format and Duty Cycle Stabilizer

Connect 1-2	Output format is 2's complement, DCS is Off
Connect 3-4	Output format is 2's complement, DCS is On
Connect 5-6	Output format is offset binary, DCS is On
Connect 7-8	**Output format is offset binary, DCS is Off**

A2.4 Clock Circuit Solder Jumper settings

Solder jumpers are used to select the path of the clock to the ADC. While not as convenient as pin-type jumpers, these introduce less distortion into the clock signal.

By default the following jumpers are OPEN: JP46, JP52

By default the following jumpers are shorted: JP45

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2. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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