

# ADS8322EVM

This user's guide describes the characteristics, operation, and use of the ADS8322 16-bit, 500-kHz, parallel analog-to-digital converter evaluation board. A complete circuit description, a schematic diagram, and a bill of materials are included.

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## 1 Related Documentation from Texas Instruments

To obtain a copy of any of the following TI documents, call the Texas Instruments Literature Response Center at (800) 477-8924 or the Product Information Center (PIC) at (972) 644-5580. When ordering, identify this document by its title and literature number. Updated documents can also be obtained through the TI Web site at <http://www.ti.com>.

<b>Data Sheets:</b>	<b>Literature Number:</b>
ADS8322	<a href="#">SBAS215</a>
THS4031	<a href="#">SLOS224</a>
SN74AHC138	<a href="#">SCLS258</a>
SN74AHC245	<a href="#">SCLS230</a>
SN74AHC541	<a href="#">SCLS261</a>

## 2 EVM Overview

### 2.1 Features

- Full-featured evaluation board for the ADS8322 16-bit, 500-kHz, single-channel, parallel interface analog-to-digital converter
- Onboard signal conditioning
- Input and output digital buffers
- Onboard decoding for stacking multiple EVMs

## 3 Introduction

The ADS8322EVM is a single-channel, analog-to-digital converter evaluation board (EVM) based on the ADS8322 16-bit, 500-kHz, parallel interface analog-to-digital converter (ADC). Typical power dissipation is 85 mW at a 500-kHz throughput rate and 5-V supply. The device uses a parallel interface.

The EVM incorporates an operational amplifier configured as buffer to ensure a low-noise input to the ADC. This EVM also buffers all the digital input and output signals, effectively isolating the converter from the parallel bus.

The ADS8322EVM Revision B has been redesigned to include a power connector and to allow for sharing the parallel bus with another EVM. The parallel interface is therefore significantly changed from ADS8322EVM Revision A.

## 4 Analog Interface

The full-scale analog input range for the analog-to-digital (A/D) converter is from 0 V up to twice the reference voltage. If a 2.5-V reference is used, the input range is from 0 V up to 5 V. Connector J1 is the analog connector. The singled-ended signal for the noninverting pin of the converter can be applied to connector J1 pin 2. A amplifier, U5, is located between this pin and the ADS8322 input pin 26 to buffer the signal. The inverting input pin of the converter is shorted to ground via C41. The buffer circuit for the inverting input is not populated. It needs to be populated if the user desires to apply a signal to it. The inverting input has an range of 0 V up to 500 mV.

See [Table 1](#) for analog connector pinout.

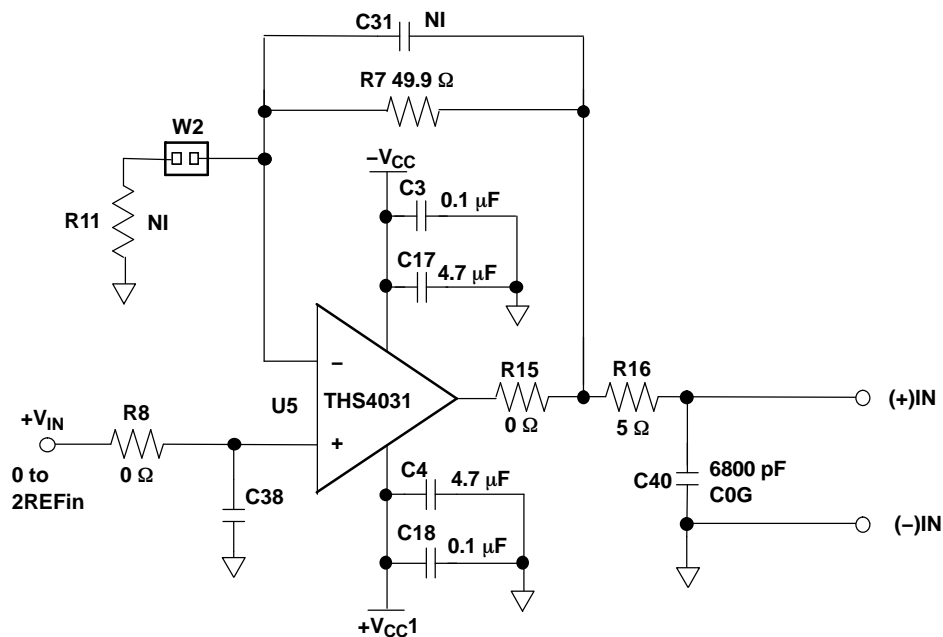
**Table 1. Analog Input Connector**

Description	Signal Name	Connector.Pin#		Signal Name	Description
Inverting input	(-)	J1.1	J1.2	(+)	Noninverting input
Reserved	N/A	J1.3	J1.4	N/A	Reserved
Reserved	N/A	J1.5	J1.6	N/A	Reserved
Reserved	N/A	J1.7	J1.8	N/A	Reserved
Pin tied to ground	AGND	J1.9	J1.10	N/A	Reserved

**Table 1. Analog Input Connector (continued)**

Description	Signal Name	Connector.Pin#		Signal Name	Description
Pin tied to ground	AGND	J1.11	J1.12	N/A	Reserved
Reserved	N/A	J1.13	J1.14	N/A	Reserved
Pin tied to ground	AGND	J1.15	J1.16	N/A	Reserved
Pin tied to ground	AGND	J1.17	J1.18	N/A	Reserved
Reserved	N/A	J1.19	J1.20	REF+	External reference input

The factory recommends that the analog input to any SAR-type converter be buffered and low-pass filtered. The recommended circuit is shown in Figure 1. This circuit was tested to ensure that the ac specifications listed in the data sheet of the converter could be met, given a quality input signal.



**Figure 1. ADS8322 Input Buffer Circuit**

#### 4.1 Reference

The ADS8322EVM can be configured to use its on-chip reference, or external reference voltage applied at J1 pin 20 via W1. The EVM is shipped with the on-chip reference (REFout) shorted to REFin of the converter.

**Table 2. Jumper Setting**

Reference Designator	Description	Jumper Settings	
		1-2	2-3
W1	Short REFout (on-chip reference) to REFin pin	<b>Installed<sup>(1)</sup></b>	
	Short user's external reference to REFin pin		Not installed
W2	Short R11 to U4 pin 2	Installed	N/A
W3	Short R12 to U6 pin 2	Installed	N/A
W4	Short U6 output to -IN	Installed	
	Short REFout to -IN		Installed

(1) Factory-installed setting

**Table 2. Jumper Setting (continued)**

Reference Designator	Description	Jumper Settings	
		1-2	2-3
W5	Set A[2..0]=0x1 generates $\overline{RD}$ signal	Installed <sup>(1)</sup>	
	Set A[2..0]=0x2 generates $\overline{RD}$ signal		Installed
W6	Set A[2..0]=0x3 generates $\overline{CONVST}$ signal	Installed <sup>(1)</sup>	
	Set A[2..0]=0x4 generates $\overline{CONVST}$ signal		Installed
W7	Short $\overline{DC\_CS}$ to A/D chip select	Installed <sup>(1)</sup>	N/A

## 5 Digital Interface

The ADS8322EVM is designed for easy interfacing to multiple platforms. Samtec part numbers SSW-110-22-F-D-VS-K, TSM-110-01-T-DV-P, SSW-116-22-S-D-VS, and TSM-116-01-T-D-V-P provide a convenient dual-row header/socket combination at J1, J2, and J3. Consult Samtec at <http://www.samtec.com> or 1-800-SAMTEC-9 for mating connector options.

Parallel Control J1, J2, and J3 allow the user to plug the EVM into the 5-6K Interface Board, which allows interface directly to TMS320C5000 and TMS320C6000 series of DSP starter kits (DSK). See Table 3 for J2 connector pinout.

**Table 3. Pinout for Parallel Control Connector J2**

Connector.Pin <sup>(1)</sup>	Signal	Description
J2.1	$\overline{DC\_CS}$	Daughtercard Select pin
J2.3		
J2.5		
J2.7	A0	Address line from processor
J2.9	A1	Address line from processor
J2.11	A2	Address line from processor
J2.13		
J2.15		
J2.17	CLK	ADC conversion clock
J2.19	BUSY	Busy signal from converter

<sup>(1)</sup> All even-numbered pins of J2 are tied to DGND.

The Read ( $\overline{RD}$ ), Conversion Start ( $\overline{CONVST}$ ) signals to the converter can be assigned to two different addresses in memory via jumper settings. This allows for the stacking of up to two ADS8322EVMs in processor memory. See Table 2 for jumper settings for  $\overline{RD}$  and  $\overline{CONVST}$  signals. The evaluation module ships with the Chip Select ( $\overline{CS}$ ) line of the converter shorted to the daughtercard Chip Select signal and the  $\overline{RD}$  and  $\overline{CONVST}$  signals shorted to decoder outputs one and three, respectively.

The data bus is available at connector J3; see Table 4 for pinout information.

**Table 4. Data Bus Connector J3**

Connector.Pin <sup>(1)</sup>	Signal	Description
J3.1	D0	Buffered data bit 0 (LSB)
J3.3	D1	Buffered data bit 1
J3.5	D2	Buffered data bit 2
J3.7	D3	Buffered data bit 3
J3.9	D4	Buffered data bit 4

<sup>(1)</sup> All even-numbered pins of J3 are tied to DGND.

**Table 4. Data Bus Connector J3 (continued)**

Connector.Pin <sup>(1)</sup>	Signal	Description
J3.11	D5	Buffered data bit 5
J3.13	D6	Buffered data bit 6
J3.15	D7	Buffered data bit 7
J3.17	D8	Buffered data bit 8
J3.19	D9	Buffered data bit 9
J3.21	D10	Buffered data bit 10
J3.23	D11	Buffered data bit 11
J3.25	D12	Buffered data bit 12
J3.27	D13	Buffered data bit 13
J3.29	D14	Buffered data bit 14
J3.31	D15	Buffered data bit 15 (MSB)

This evaluation module provides direct access all the analog-to-digital converter control signals via connector J4, see [Table 5](#).

**Table 5. Pinout for Converter Control Connector J4**

Connector.Pin <sup>(1)</sup>	Signal	Description
J4.1	$\overline{CS}$	Chip Select pin. Active low
J4.3	$\overline{RD}$	Read pin. Active low
J4.5	$\overline{CONVST}$	Convert start pin. Active low
J4.7	BYTE	BYTE mode pin. Used for 8-bit buses
J4.9	CLK	Conversion clock
J4.11	BUSY	Converter status output. High when a conversion is in progress

<sup>(1)</sup> All even-numbered pins of J4 are tied to DGND.

## 6 Power Supplies

The EVM accepts four power supplies.

- A dual  $\pm V_s$  dc supply for the dual-supply operational amplifiers. Recommend  $\pm 12$ -Vdc supply.
- A single +5-Vdc supply for analog section of the board (A/D).
- A single +5-Vdc supply for digital section of the board (A/D + address decoder + buffers).

There are two ways to provide these voltages.

1. Wire in voltages at test points on the EVM. See Table below

**Table 6. Power Supply Test Points**

Test Point	Signal	Description
TP16	+5VD	Apply +5-Vdc.
TP13	+5VA	Apply +5-Vdc.
TP14	+VA	Apply +12-Vdc. Positive supply for amplifier
TP15	-VA	Apply -12-Vdc. Negative supply for amplifier

- Use the power connector J5 and derive the voltages elsewhere. The pinout for this connector is shown in [Table 7](#)

**Table 7. Power Connector Pinout**

Signal	Power Connector – J5		Signal
+VA(+12V)	1	2	–VA(–12V)
+5VA	3	4	N/C
N/C	5	6	AGND
N/C	7	8	N/C
N/C	9	10	+5VD

## 7 Using the EVM

The ADS8322EVM serves three functions as a reference design, prototype board, and as test platform for the software engineer to develop code.

As a reference design, the ADS8322 EVM contains the essential circuitry to showcase the analog-to-digital converter. This essential circuitry includes the input amplifier and digital buffers. The EVM analog input circuit is optimized for 100-kHz sine wave; therefore, users may need to adjust the resistor and capacitor values of the A/D input RC circuit. In ac-type applications where signal distortion is a concern, polypropylene or low-cost SMT COG ceramic capacitors should be used in the signal path. In applications where the input is multiplexed, the A/D input resistor and capacitor may need to be adjusted or possibly removed altogether.

As a prototype board, the buffer circuit consists of a standard 8-pin SOIC amplifier and resistor pads to adjust to various inverting and noninverting configurations. The EVM comes installed with a dual-supply amplifier, which allows the user to take advantage of the full input voltage range of the converter. For applications that require signal supply operation and smaller input voltage range, the THS4031 can be replaced with the single-supply amplifier like OPA300 or OPA355. Be sure to short the negative supply pin to ground in that case. Positive supply voltage can be applied via test point TP12 or connector J5, pin 1.

As a software test platform, connectors J1, J2, and J3 plug into the parallel interface connectors of the 5-6K Interface Board. The 5-6K Interface Board sits on the 'C5000 and 'C6000 digital signal processor starter kit (DSK). The ADS8322EVM is then mapped into the processor's memory space. This board also provides an area for signal conditioning. This area can be used to install application circuit(s) for digitalization by the ADS8322 analog-to-digital converter. See the 5-6K Interface Board User's Guide ([SLAU104](#)) for more information.

For the software engineer, the ADS8322EVM provides a simple platform for interfacing to the converter. The EVM provides standard 0.1-in. headers and sockets to wire into prototype boards. The user needs only to provide three address lines (A2, A1, and A0) and Address Valid line ( $\overline{DC\_CS}$ ), and clock to connector J2. To choose which address combinations will generate  $\overline{RD}$  and  $\overline{CONVST}$ , set jumpers as shown in [Table 2](#). If address decoding is not required, the EVM provides direct access to converter data bus via J3 and control via J4.

## Appendix A ADS8322EVM Bill of Materials

Table A-1 contains a complete bill of materials for the ADS8322EVM. The schematic diagram is also provided for reference. Contact the Product Information Center or send an E-mail to [dataconvapps@list.ti.com](mailto:dataconvapps@list.ti.com) for questions regarding this EVM.

**Table A-1. Bill of Materials**

Item No.	Qty	Value	Reference Designators	Footprint	Mfg	Mfg's Part Number	Description
1	5	10K	R1 R2 R3 R4 R19	603	Panasonic - ECG or alternate	ERJ-3EKF1002V	RES 10.0 kΩ 1/16W 1% 0603 SMD
2	2	0	R8 R15	805	Panasonic - ECG or alternate	ERJ-6GEY0R00V	RES 0.0 Ω 1/8W 5% 0805 SMD
3	1	0	R14	1206	Panasonic - ECG or alternate	ERJ-8GEY0R00V	RES 0 Ω 1/4W 5% 1206 SMD
4	1	5	R16	805	Yageo America or alternate	9C08052A4R99FGHFT	RES 4.99 Ω 1/8W 1% 0805 SMD
5	1	511	R5	1206	Panasonic - ECG or alternate	ERJ-8ENF5110V	RES 511 Ω 1/8W 1% 1206 SMD
6	4	NI	R6 R11 R12 R13	1206	Not Installed	Not Installed	
7	1	300	R7	805	Rohm or alternate	MCR10EZHF3000	RES 300 Ω 1/8W 1% 0805 SMD
8	3	NI	R10 R17 R18	805	Not Installed	Not Installed	
9	1	0R	C41	805	Panasonic - ECG or alternate	ERJ-6GEY0R00V	RES 0.0 Ω 1/8W 5% 0805 SMD
10	5	4.7uF	C1 C2 C3 C4 C23	805	TDK Corporation	C3216X7R1E475M	CAP CER 4.7 μF 25V X7R 20% 1206
11	12	NI	C5 C6 C15 C16 C19 C20 C28 C31 C32 C38 C39 R9	805	Not Installed	Not Installed	Multilayer ceramic
12	7	0.1uF	C7 C8 C17 C18 C4 C43 C44	805	TDK Corporation	C2012X7R1E104K	CAP CER 0.10 μF 25V X7R 10% 0805
13	5	0.1uF	C9 C10 C24 C25 C26	1206	TDK Corporation	C3216X7R2A104M	CAP CER 0.1 μF 100V X7R 20% 1206
14	4	0.01uF	C11 C12 C21 C22	805	TDK Corporation	C2012X7R2A103K	CAP CER 10000 pF 100V X7R 10%0805
15	3	0.01uF	C13 C14 C34	1206	TDK Corporation	C3216C0G1H103J	CAP CER 10000 pF 50V C0G 5% 1206
16	1	0.1uF	C27	603	TDK Corporation	C1608X7R1E104K	CAP CER 0.10 μF 25V X7R 10% 0603
17	3	10uF	C33 C36 C37	1206	TDK Corporation	C3216X5R1C106M	CAP CER 10 μF 16V X5R 20% 1206
18	1	10uF	C35	805	TDK Corporation	C2012Y5V1A106Z	CAP CER 10 μF 10V Y5V 0805
19	1	6800pF	C40	805	TDK Corporation	C2012C0G1H682J	CAP CER 6800 pF 50V C0G 5% 0805
20	1	100	RP1	CTS_742	CTS Corporation	742C163101JTR	RES ARRAY 100 Ω 16TRM 8RES SMD
21	2	1K	RP2 RP3	CTS_742	CTS Corporation	742C163102JTR	RES ARRAY 1 kΩ 16TERM 8RES SMD
22	1		D1	LED-1206	Chicago Miniature Lamp Inc	CMD15-21VYC/TR8	Yellow Lumex SM LED
23	4		FL1 FL2 FL3 FL4	NFM51R	Murata-Erie	NFM60R10T471	T-type EMI chip filter
24	1		U1	20-TSSOP(PW)	Texas Instruments	SN74AHCT541PWR	Octal Buffer and Driver
25	1	DUT	U2 <sup>(1)</sup>	32-TQFP	Texas Instruments	ADS8322YB	ADS8322 16-bit 500 KSPS A/D
26	1		U5	8-SOP(D)	Texas Instruments	THS4031IDR	100-MHz Low-noise high-speed amplifier
27	1	NI	U6	8-SOP(D)	Not Installed	Not Installed	
28	2		U7 U8	20-TSSOP(PW)	Texas Instruments	SN74AHC245PWR	Octal Bus Transceiver, 3-State
29	1		U11	16-TSSOP(PW)	Texas Instruments	SN74AHC138PWR	3-Line To 8-Line Decoder / Demultiplexer
30	2	10X2X.1	J1 J2	10x2x0.1_SMT_PLUG_&_SO CKET	Samtec	SSW-110-22-S-D-VS	0.025" SMT Plug - bottom side of PWB
31	2				Samtec	TSM-110-01-T-D-V-P	0.025" SMT Plug - Top Side of PWB
32	1	32 Pin_IDC	J3	16x2x0.1_SMT_PLUG_&_SO CKET	Samtec	TSM-116-01-T-D-V-P	0.025" SMT Plug - Top Side of PWB
33	1				Samtec	SSW-116-22-S-D-VS	0.025" SMT socket - bottom side of PWB

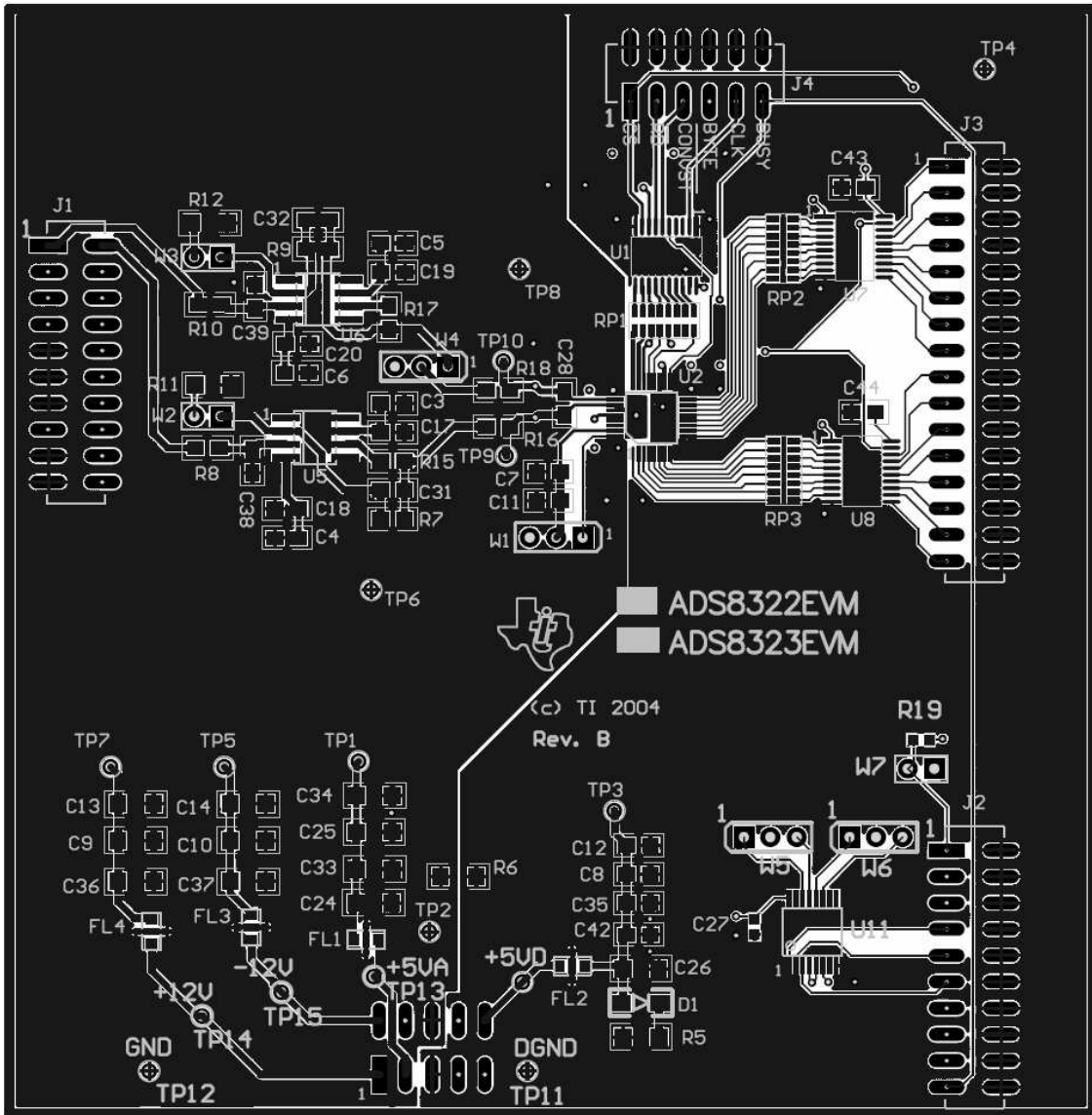
(1) U3 and U4 are not used.

**Table A-1. Bill of Materials (continued)**

Item No.	Qty	Value	Reference Designators	Footprint	Mfg	Mfg's Part Number	Description
34	1	6x2x0.1	J4	6x2x0.1_SMT_PLUG_&_SOC KET	Samtec	TSM-106-01-T-D-V-P	0.025" SMT Plug - top side of PWB
35	1	5x2x0.1	J5	5X2X.1_SMT_SOCKET	Samtec	TSM-105-01-T-D-V-P	0.025" SMT Plug - top side of PWB
36					Samtec	SSW-105-22-S-D-VS	0.025" SMT socket - bottom side of PWB
37	4		W1 W4 W5 W6	3pos_jump	Samtec	TSW-103-07-L-S	3 Position Jumper_0.1" spacing
38	3		W2 W3 W7	2pos_jump	Samtec	TSW-102-07-L-S	2 Position Jumper_0.1" spacing
39	10	TP_0.025	TP1 TP3 TP5 TP7 TP9 TP10 TP13 TP14 TP15 TP16	test_point2	Keystone Electronics	5000K-ND	Test point PC MINI 0.040"D Red
40	6	TP_0.025	TP2 TP4 TP6 TP8 TP11 TP12	test_point2	Keystone Electronics	5001K-ND	Test point PC MINI 0.040"D Black



**Appendix B ADS8322EVM Layout**



**Figure B-1. Top Layer – Layer 1**

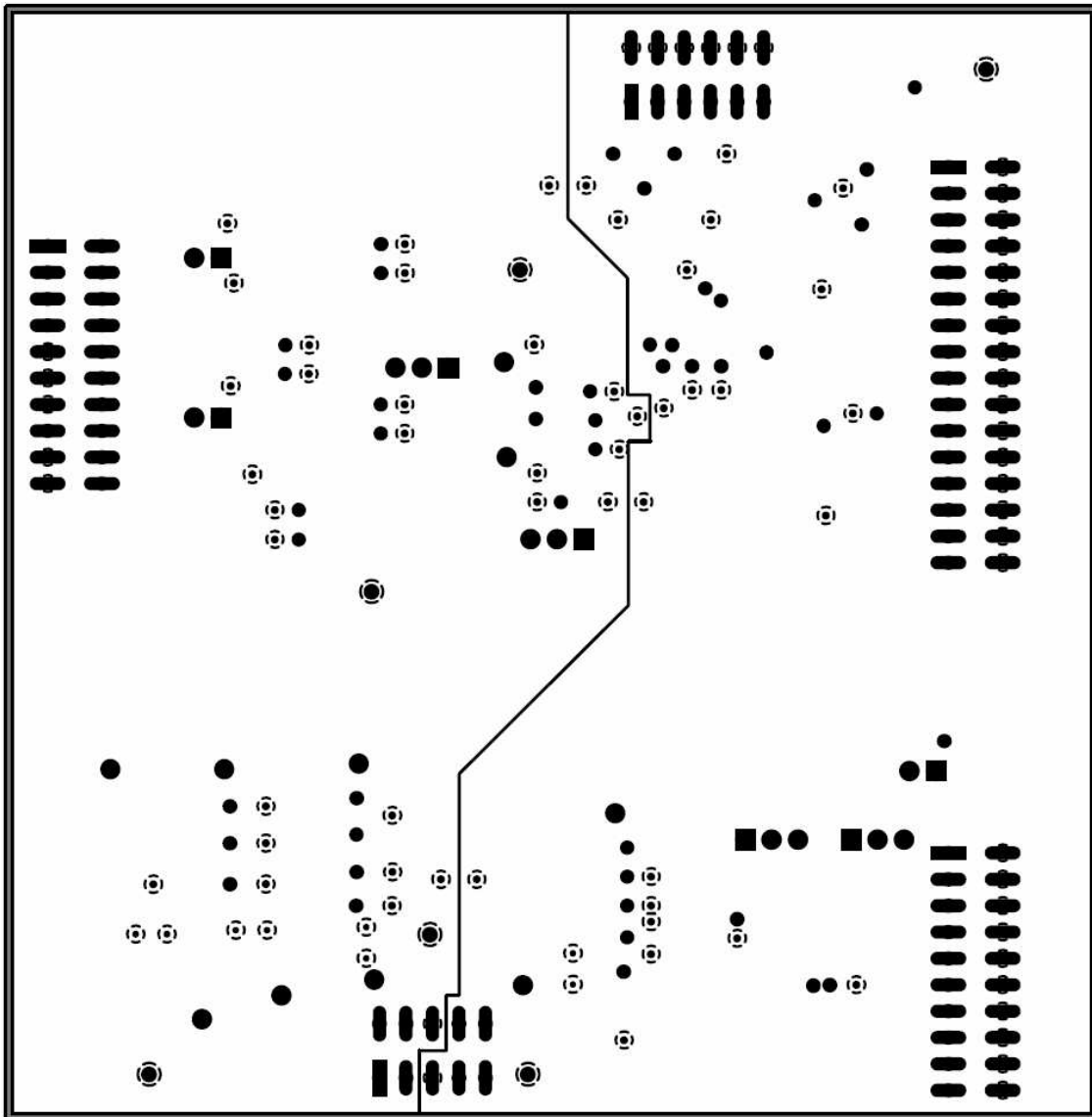


Figure B-2. Ground Plane – Layer 2

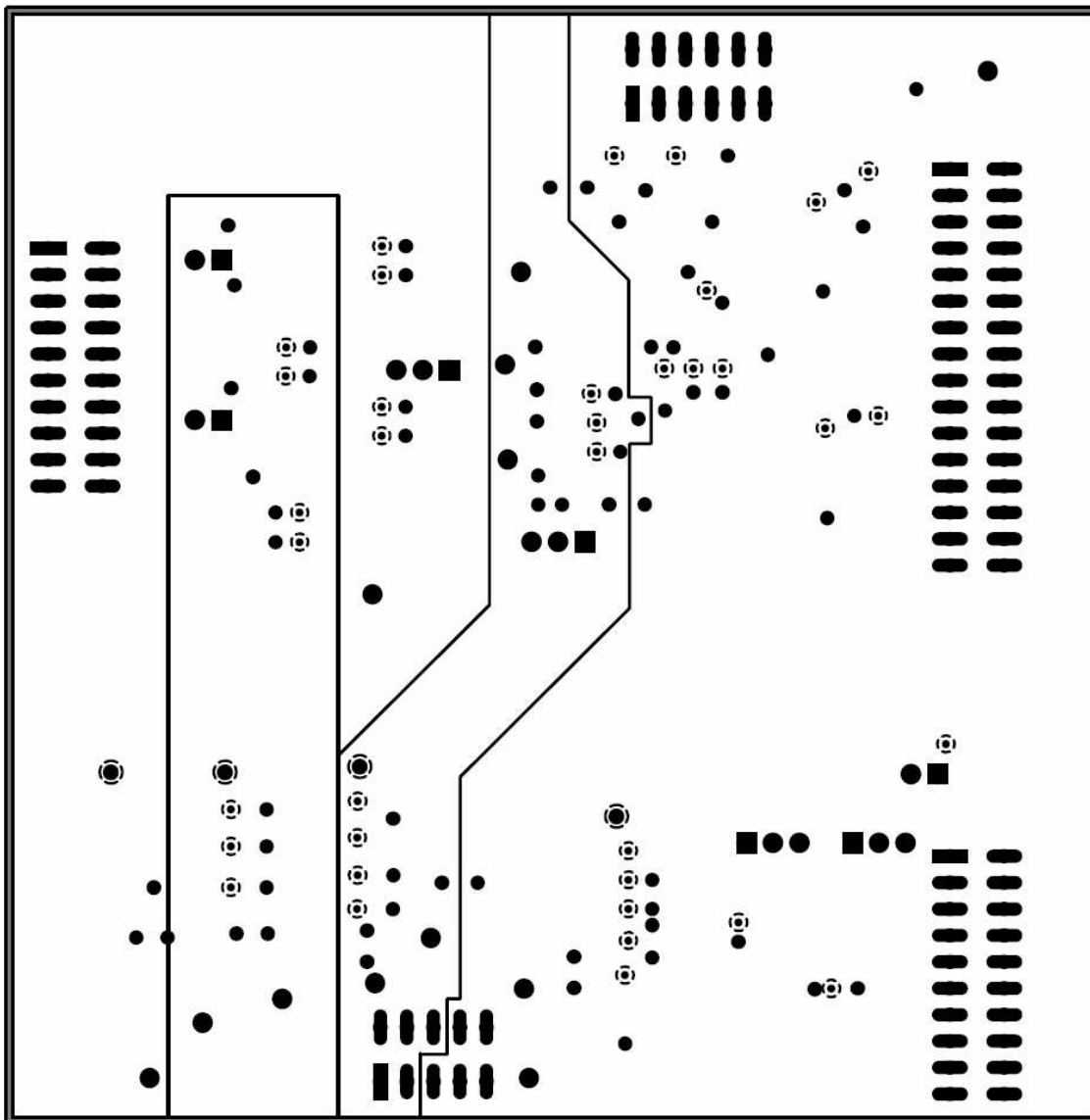


Figure B-3. Power Plane – Layer 3

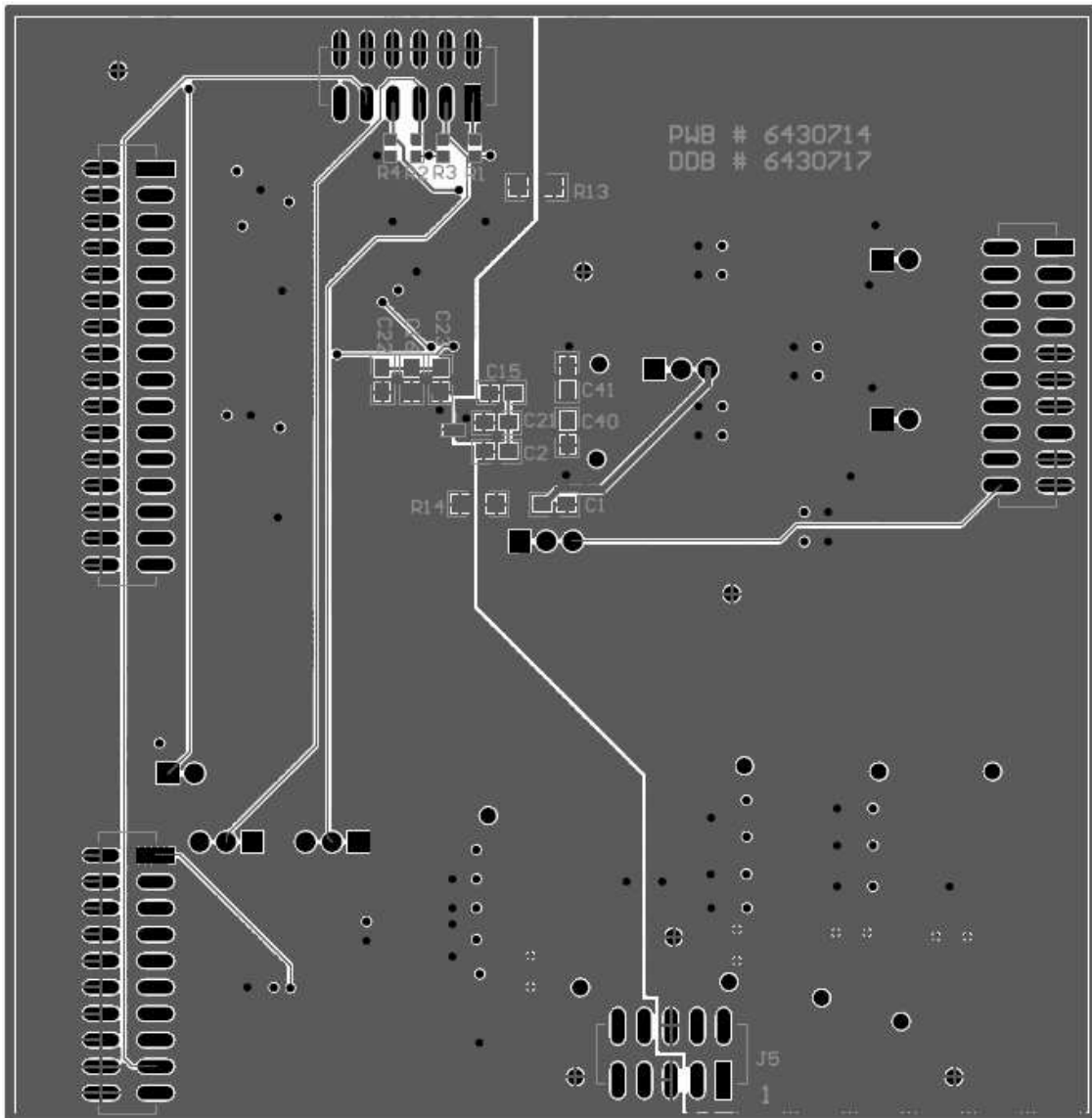
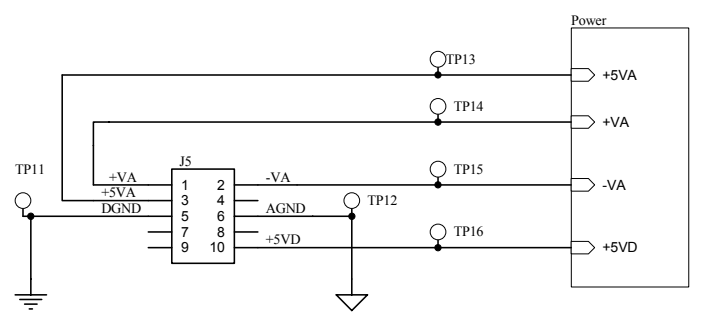
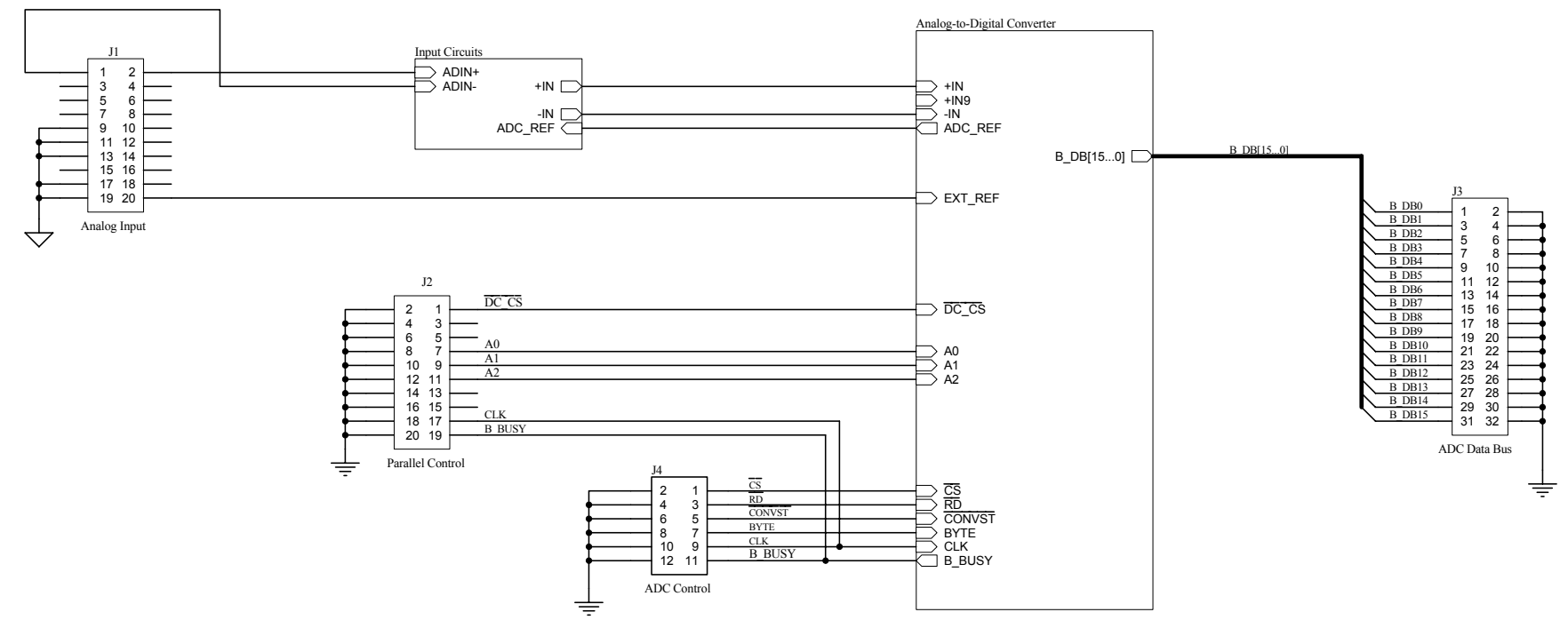


Figure B-4. Bottom Layer – Layer 4

## **Appendix C ADS8322EVM Schematic**

See attachment for schematic drawings.

Revision History		
REV	ECN Number	Approved

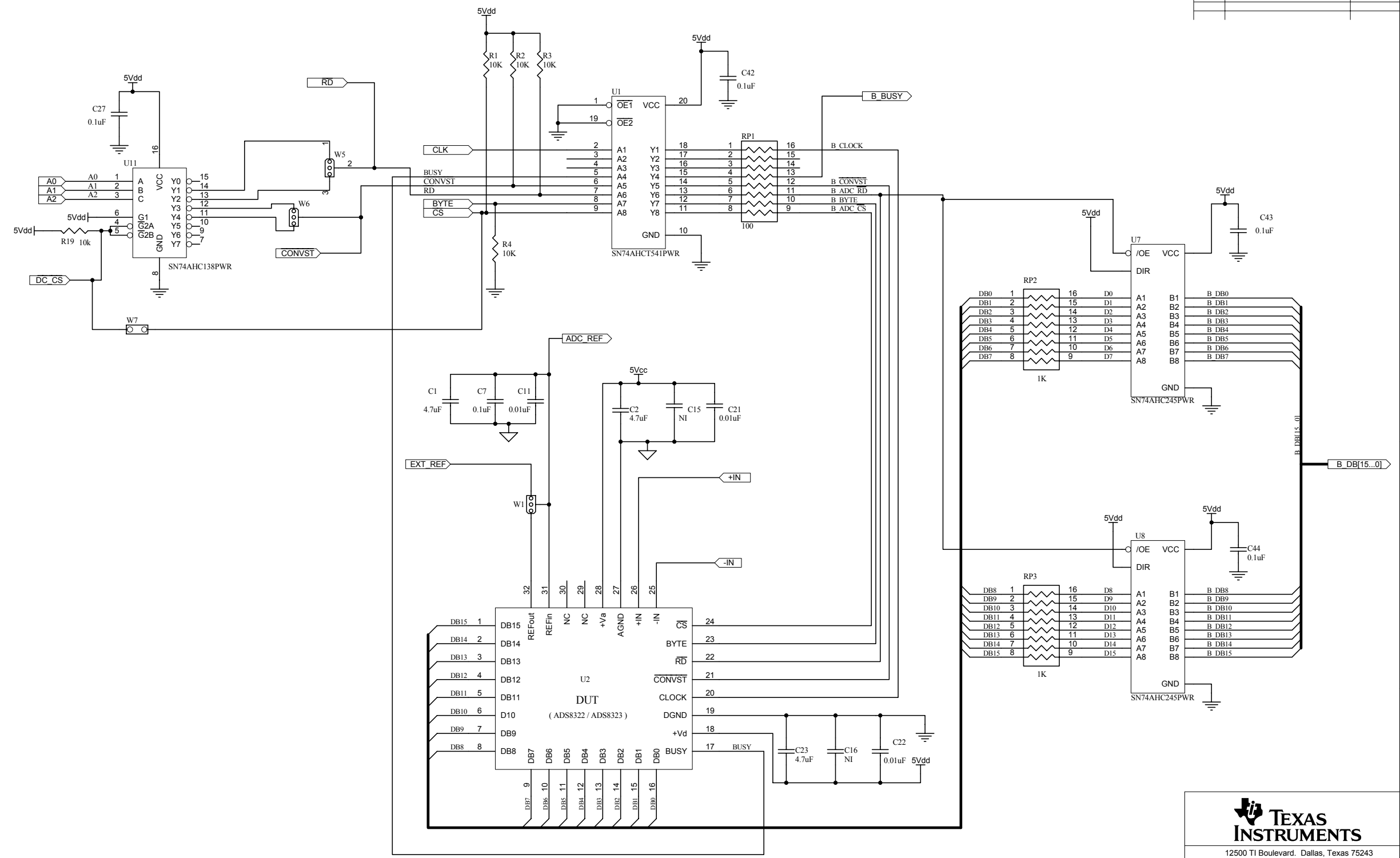


**TEXAS INSTRUMENTS**  
 12500 TI Boulevard, Dallas, Texas 75243

TITLE: ADS8322 EVM Block Diagram

Engineer: L. Philipose	DOCUMENT CONTROL #: 6430717	REV: B
Drawn By: L. Philipose	DATE: 28-Oct-2004	SIZE: SHEET: 1 OF: 4

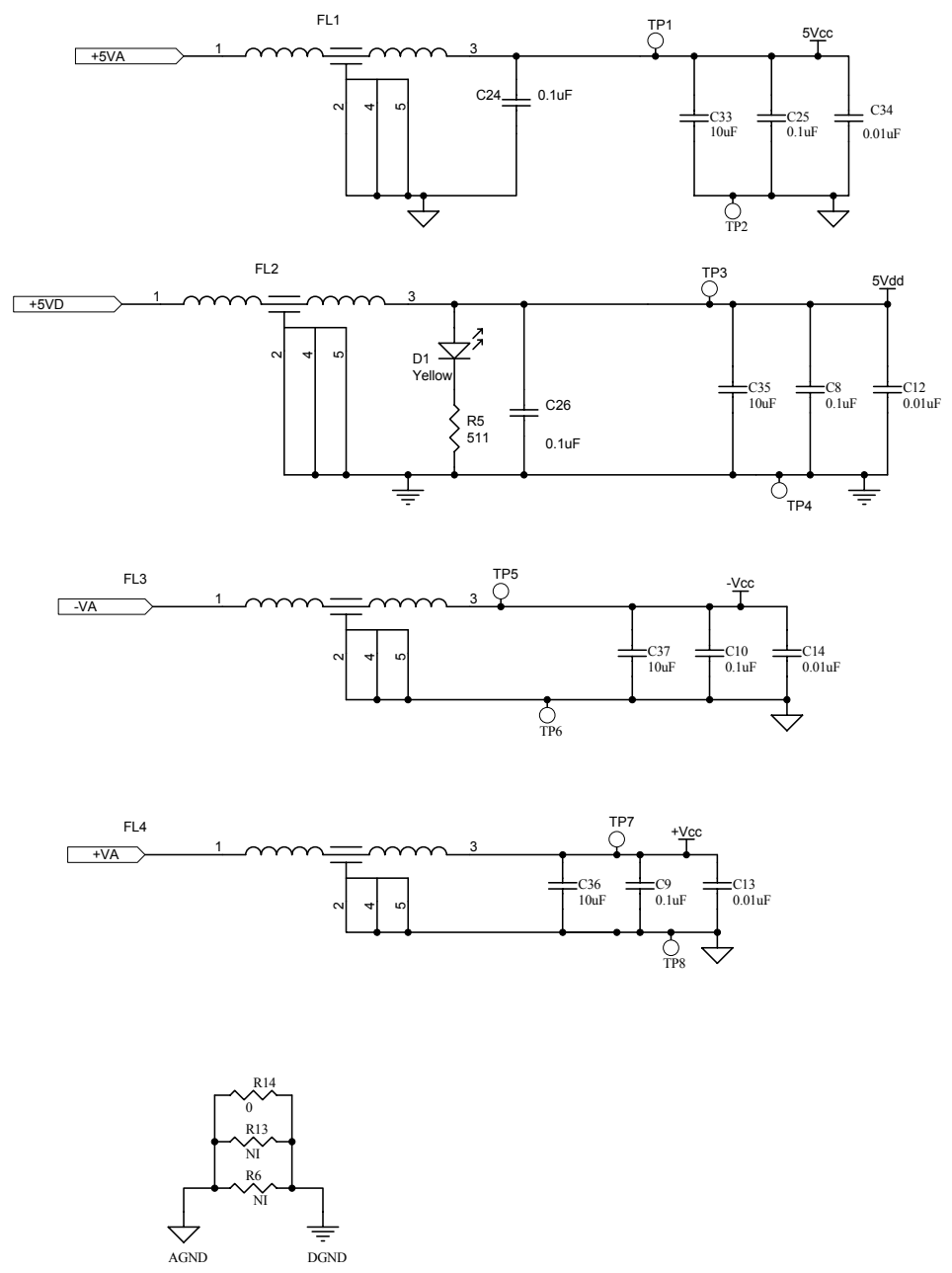
Revision History		
REV	ECN Number	Approved



**TEXAS INSTRUMENTS**  
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Engineer:	DOCUMENT CONTROL #:	REV:
Drawn By:	6430717	B
FILE: Analog-to-Digital Converter	DATE: 28-Oct-2004	SIZE: SHEET: 2 OF: 4

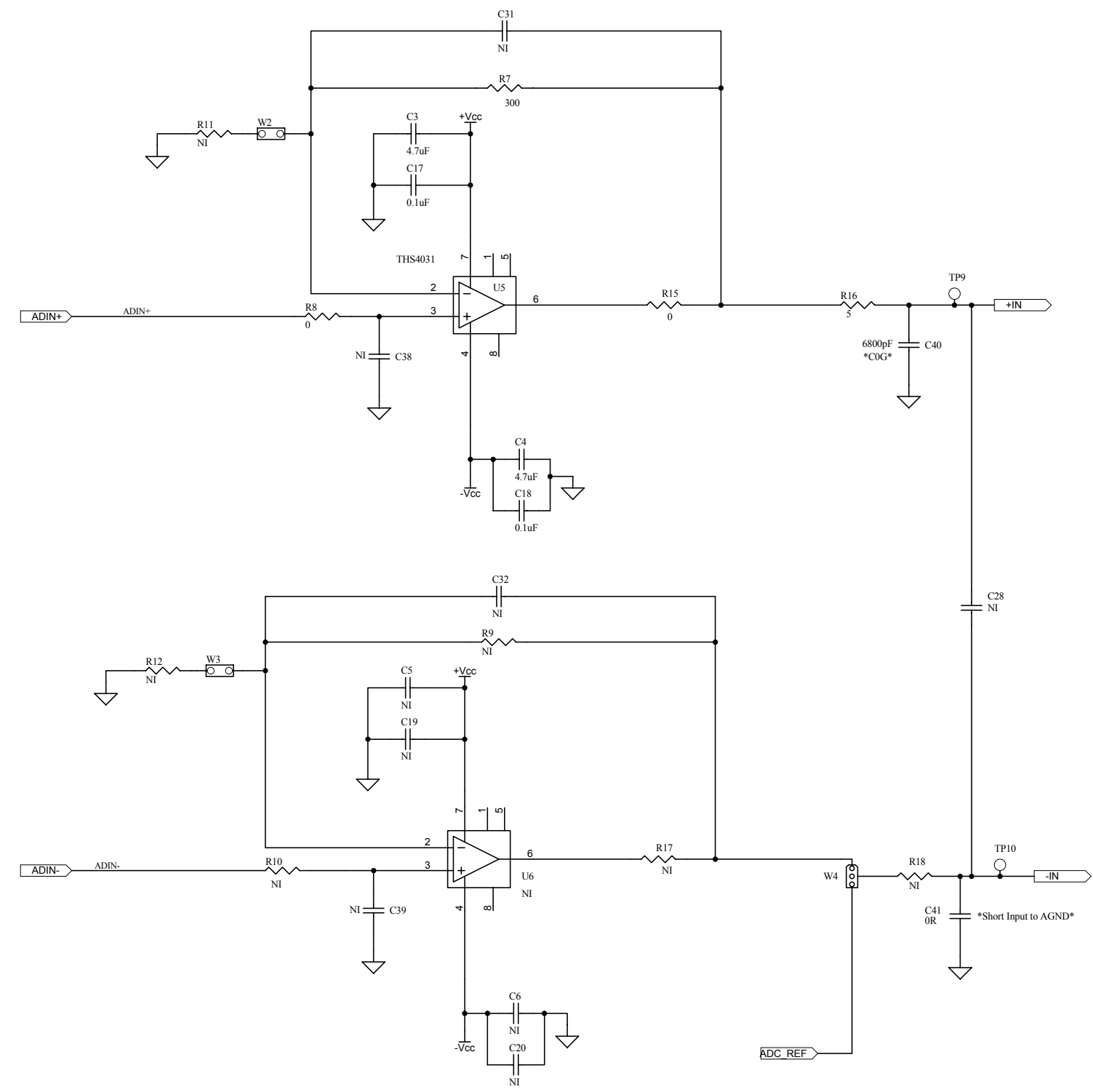
Revision History		
REV	ECN Number	Approved



Engineer: Lijoy Philipose	DOCUMENT CONTROL #: 6430717	REV: B
Drawn By: Lijoy Philipose	DATE: 28-Oct-2004	SIZE: SHEET: 3 OF: 4
FILE: Power		



Revision History		
REV	ECN Number	Approved



**TEXAS INSTRUMENTS**  
 12500 TI Boulevard, Dallas, Texas 75243  
 TITLE: Input Circuits  
 ENGINEER: Lijoy Philipose  
 DRAWN BY: Lijoy Philipose  
 FILE: Input Circuits  
 DOCUMENT CONTROL #: 6430717  
 DATE: 28-Oct-2004  
 REV: B  
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Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
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