ADS1241-EVM

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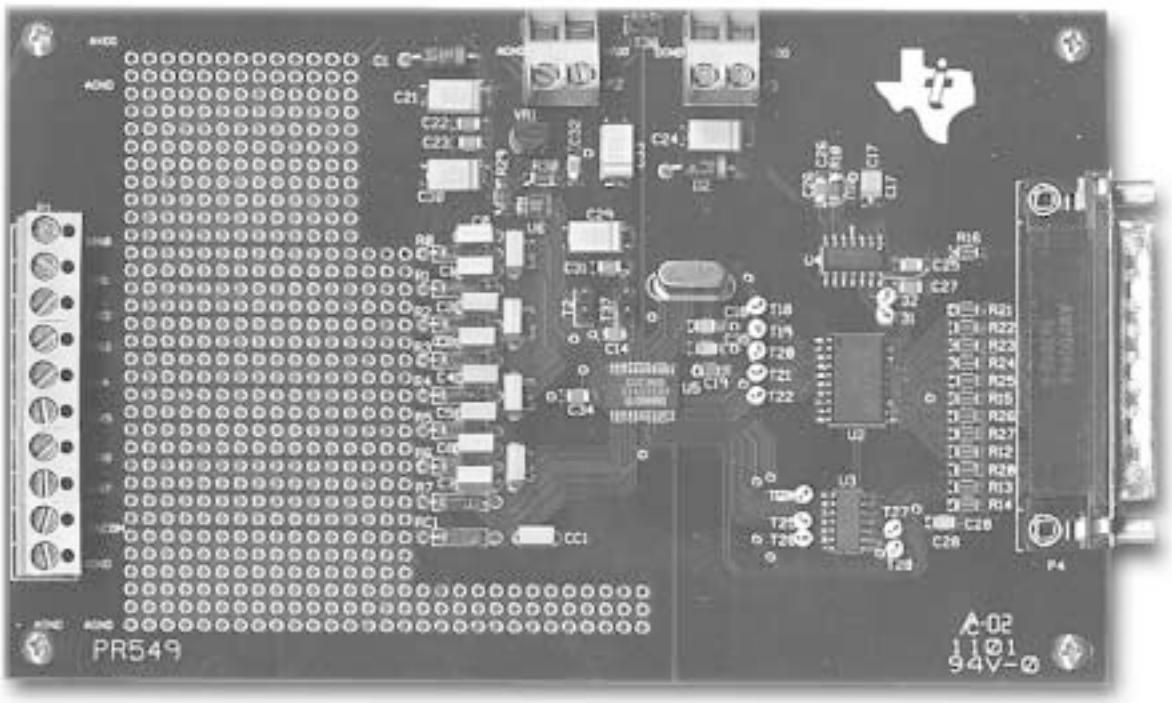

FEATURES

- **PROVIDES FAST AND EASY PERFORMANCE TESTING FOR ADS1241**
- **SEPARATE ANALOG AND DIGITAL POWER**
- **PC PRINTER PORT CONTROL**
- **WINDOWS® 95/98 SOFTWARE**

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DESCRIPTION

The ADS1241-EVM evaluation module is designed for ease of use when evaluating the high resolution analog-to-digital converter ADS1241. The ADS1241 offers 24-bits no-missing-codes performance. It has 8 input channels that can be configured as up to 8 differential channels. The Multiplexer is followed by a programmable gain amplifier with selectable gains of up to 128.

Hardware options include user-defined clock frequency, internal or external reference, and input biasing.

All of the features and functionality of the ADS1241 can be exercised using the pull-down menus available from the ADS1241-EVM software.

INITIAL CONFIGURATION

The ADS1241-EVM is designed to be operational without any user configuration, except for connecting power supplies and the communications cable to the PC printer port.

POWER SUPPLY

The analog and digital supplies can be connected together at the power supply or jumper T38 can be used to connect the power supplies together on the EVM.

VOLTAGE REFERENCE

The board is setup to use the internal V_{REF}. To use an external V_{REF} you must cut the traces which are shorting T2 and T37 and then apply the external V_{REF} between pin 1 of T2 and pin 1 of T37.

CLOCK

A 2.4576MHz crystal is connected to the XIN and XOUT pins to provide a convienient frequency for 50Hz to 60Hz rejection.

PC BOARD LAYOUT

The ADS1241-EVM evaluation module consists of a two-layer PC board. To achieve the highest level of performance, surface-mount components are used wherever possible. This reduces the trace length and minimizes the effects of parasitic capacitance and inductance. The evaluation module has a divided ground with all the analog signals over one portion and the digital signals in the other. The two grounds are connected together under the ADS1241 on the back of the board. Keep in mind that this approach may not necessarily yield optimum performance results when designing the ADS1241 into different individual applications. In any case, thoroughly bypassing the power supply and reference pins of the converter is strongly recommended.

The breadboard area is provided so that input filters can be added. As shipped the board includes an R-C filter (49.9Ω and 47pF) on each input with 0.1uF differential capacitor between adjacent channels.

WINDOWS SOFTWARE

The ADS1241 uses registers and a 1-byte opcodes to control the operation. The evaluation software provides a convenient method to issue the commands and receive the results. It also can display the results of acquired data as shown in Figure 1, and perform a frequency analysis as shown in Figure 2.

The program is organized with pull-down menus as follows:

File
- Save Data
- Save FFT Data
- Print Data
- Exit

Configuration
- Configure Device
- Select Input Channel

Tests
- Opcode Test
- Noise Test

Options
- Data List Format
  - Voltage
  - Raw Hex
  - Raw Decimal
- Set FFT Window
  - Rectangular
  - Hamming
  - Blackman
  - Blackman Harris
  - Continuous 5th Derivative
- FFT Harmonic Bins
  - Number of Harmonic Bins
  - Number of DC Bins

View
- Display Data List

Help
- About ADS1241 Eval

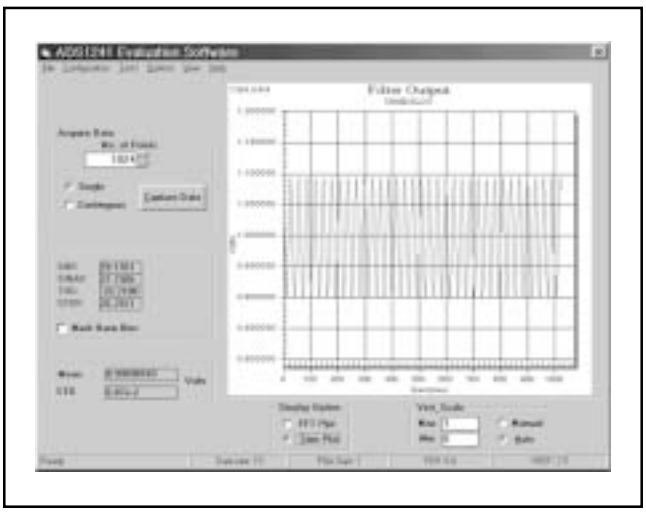

FIGURE 1. Time Plot.

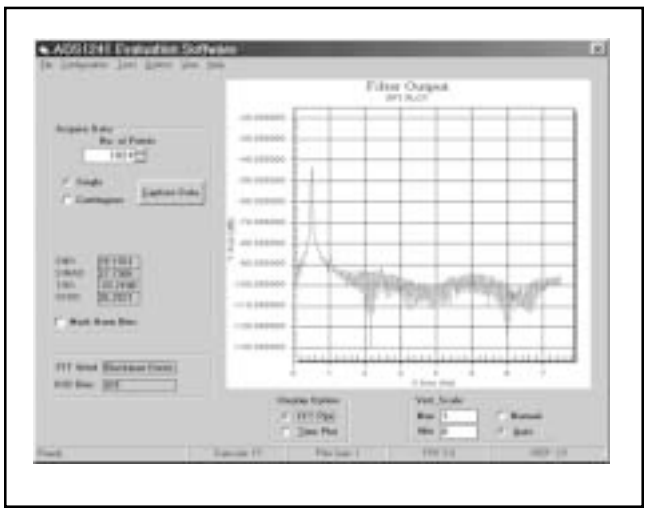

FIGURE 2. FFT Frequency Plot.

FILE MENU

Under this menu, the data can be saved or the FFT of the data can be saved. The data can also be sent to the printer.

CONFIGURATION

The Configure Device menu opens a window that provides many options, as shown in Figure 3.

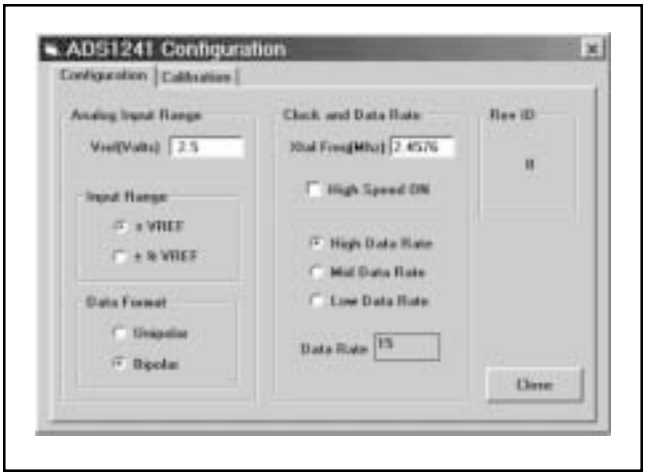

FIGURE 3. Configuration.

This window allows you to set the value being used for the reference voltage, the input voltage range, data format, and the data output rate. The Data Rate is affected by the XTAL frequency, Speed bit, and selected data rate (High, Mid, Low). The result of the XTAL frequency in combination with the chosen selection results in a data rate which is displayed in the Data Rate box. Unipolare/Biplor format is described in Table I.

	ANALOG INPUT	DIGITAL OUTPUT
Bipolar	+FSR	0x7FFFFF
	Zero	0x000000
	–FSR	0x800000
Unipolar	+FSR	0xFFFFFF
	Zero	0x000000
	–FSR	0x000000

TABLE I. Unipolar/Bipolar Selection Results.

Calibration

Five types of calibration can be performed, as shown in Figure 4. When the button is pushed, the ADS1241 performs the calibration and then reads back and displays the results in the calibration registers. The five ypes of calibration are:

1) Selfcal—Both Offset and Gain Calibration

2) Selfocal—Only Offset Calibration

3) Selfgcal—Only Gain Calibration

4) Sysocal—Offset Calibration, Input = 0V

5) Sysgcal—Gain Calibration, Input = V_{REF}

The Calibration Window can also be used to read the current value of the Data Output Register (DOR).

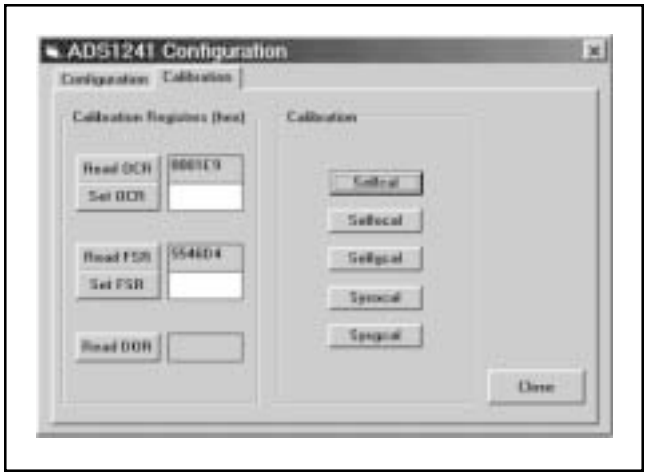

FIGURE 4. Calibration.

The other selection under the Configuration menu allows you to Select Input Channel, as shown in Figure 5.

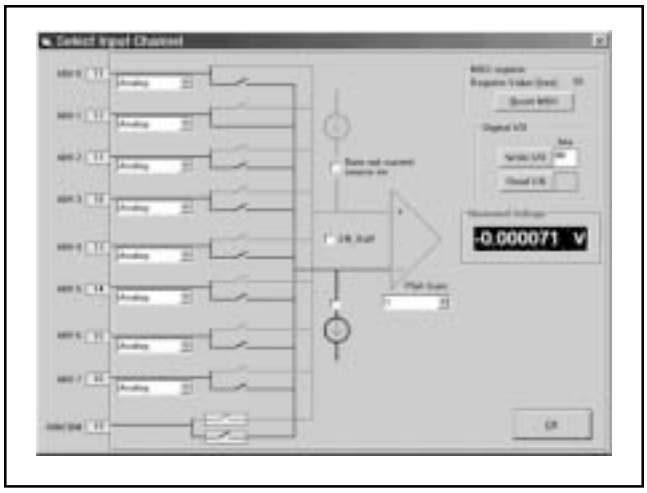

FIGURE 5. Select Input Channel.

This window (Figure 5) gives you the capability to set the input multiplexer, burn out current sources and control and read the digital I/O. Each I/O pin can be selected to be Analog or Digital.

The result of the current conversion is displayed as the Measured Voltage. This value is computed by using the settings in the Configuration window and the analog-to-digital converter result.

OK

Selecting OK will save the selected setup.

TESTS

Opcode Test

This screen allows all the opcodes to be tested and the results observed. Any opcode can be entered and tested to observe the results.

One convenient way to test the communications and operations of the ADS1241 demo software is to go to this screen, select “Reset” and then “Read all Regs”. You should then end up with a register dump that looks like this:

FIGURE 6. Opcode Test.

You can observe that the reset state of the registers are: 00, 01, 00, 00, 00, FF, 00, 00, 00, 00, 00, 59, 55, 55, 00, 01, AA.

This screen also shows the state of the digital control signals.

Noise Test

This test provides an automated means to verify the performance of the ADS1241 across various Data rates, PGA settings and with averaging of the results. With all the options selected this test can take a long time to complete. The results are displayed in a tabular format which shows the PGA settings, Data Rate, Average Output, Standard Deviation, and Effective number of bits.

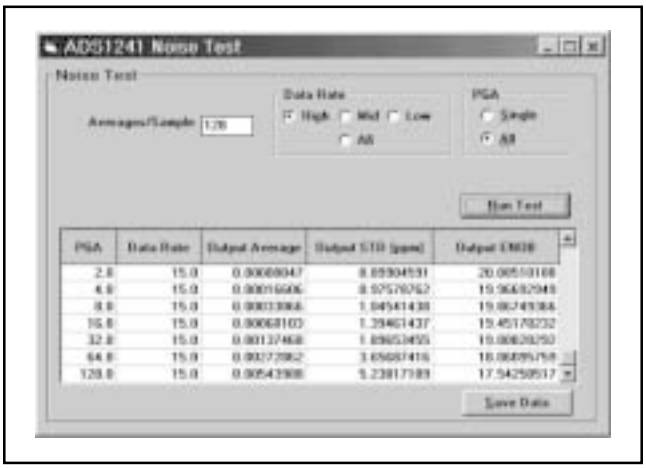

FIGURE 7. Noise Test.

OPTIONS

Data List Format

The View menu will display the acquired data as a list. The format of that list is selected under this option. The available formats are:

1) Voltage (Calculated from Configuration information).

2) Raw Hex.

3) Raw Decimal.

Set FFT Window

The FFT operation assumes that the acquired data is periodic. In other words, the end of the acquisition data is assumed to continue on with the values which are at the beginning of the data. To eliminate high-frequency artifacts from the discontinuity which can occur at the end of the data, various filters are used. The best filter depends on the application and the acceptable tradeoffs. The following filters can be selected: 1) Rectangular, 2) Hamming, 3) Blackman, 4) Blackman Harris, and 5) Continuous 5^{th} Derivative.

FT Harmonic Bins

When doing an FFT of a sine wave, it is useful to check for distortion by examining the harmonics. The program can mark these harmonics if desired. Two options for harmonic bins can be set. A check box is available on the main screen to enable the display of the harmonic markers (Mark Harm bins).

1) Number of harmonic bins (1-20)

2) Number of DC bins (1-20)

VIEW

Display Data List

This selection will popup the following display, as shown in Figure 8.

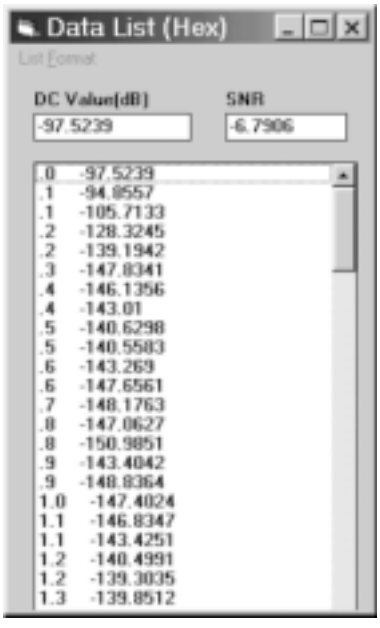

FIGURE 8. Data List

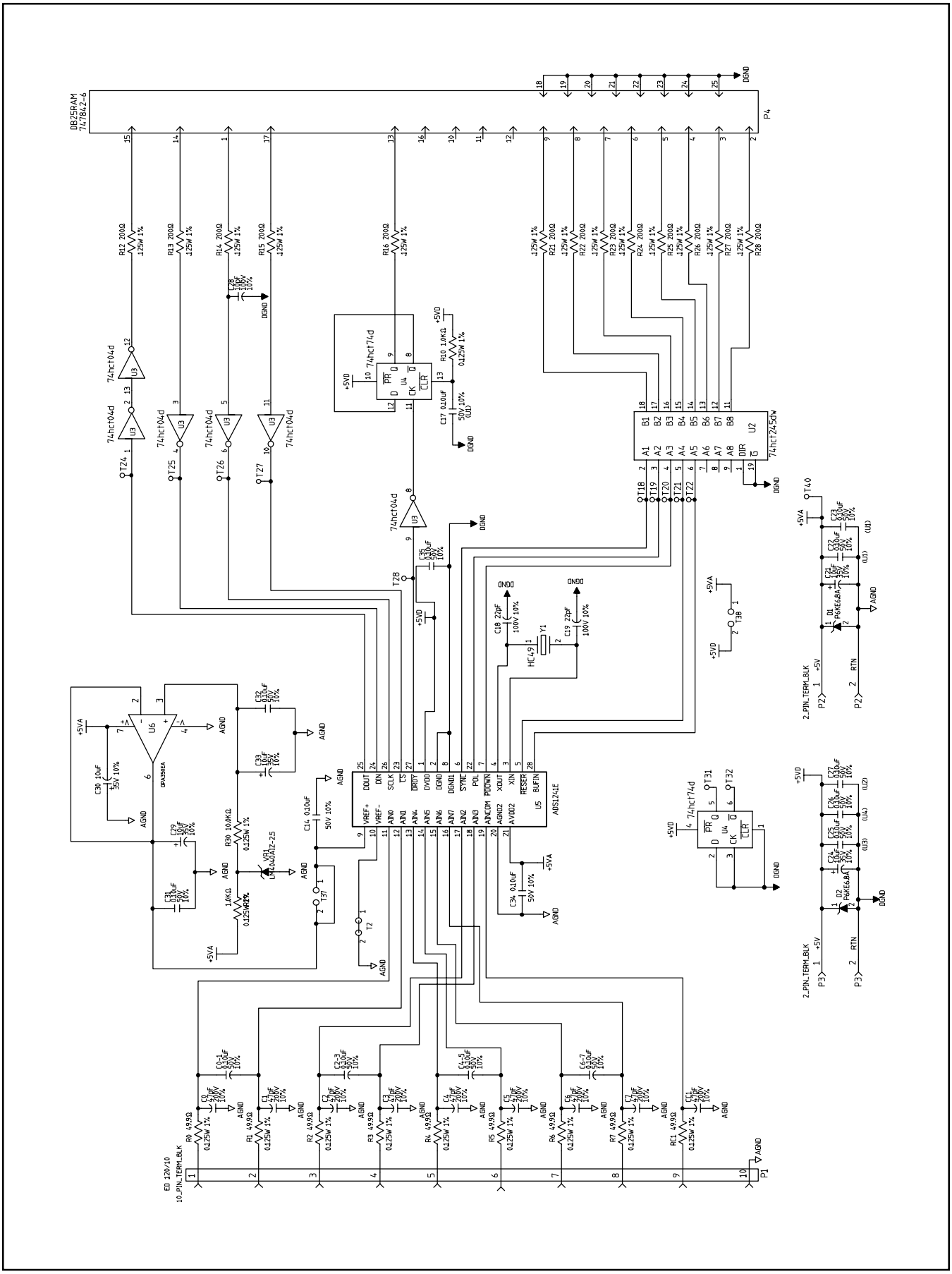

FIGURE 9. ADS1241-EVM Schematic.

COMPONENT LIST

PART NUMBER	DESCRIPTION	REF. DES.	QTY	VENDOR PART NUMBER	MANUFACTURER
ADS1241	20-Bit A/D Converter	U1	1	ADS1241	Texas Instruments
CK05BX104K	CAP, 0.10uF, 50V, 10%, Ceramic X7R	C0-1,C2-3,C4-5,C6-7	4	CK05BX104K	KEMET
CK05BX470K	CAP, 47pF, 200V, 10%, Ceramic X7R *	C0,C1,C2,C3,C4,C5 C6,C7,CC1	9	CK05BX470K	KEMET
CRCW12061001F	RES, 1.0kΩ, 0.125W, 1%, Chip-Thick-Film	R10	1	CRCW12061001F	DALE
CRCW12062000F	RES, 200Ω, 0.125W, 1%, Chip-Thick-Film * *	R12,R13,R14,R15,R16 R21,R22,R23,R24,R25 R26,R27,R28	13	CRCW12062000F	DALE
C1206C100K1GAC	CAP, 10pF, 100V, 10%, Chip-Ceramic COG	C28	1	C1206C100K1GAC	KEMET
C1206C104K5RAC	CAP, 0.10uF, 50V, 10%, Chip-Ceramic X7R	C14,C15,C16,C20,C22 C23,C25,C26,C27	9	C1206C104K5RAC	KEMET
C1206C220K1GAC	CAP, 22pF, 100V, 10%, Chip-Ceramic COG	C18,C19	2	C1206C220K1GAC	KEMET
ED 120/10	OST 10-Pin Terminal BLK; 0.2 OC	P1	1	ED 120/10	
ED 300/2	2-Pin Terminal BLK; 5MM Pitch	P2,P3	2	ED 300/2	
HC49	2.4576MHz Crystal; CTS; Cell HC18U	Y1	1	MP024S	CTS
P6KE6.8A	Zener 6.8V	D1,D2	2	P6KE6.8A	
REG1117-5	+5V Regulator	Q1	1	REG1117-5	Texas Instuments
RN55C49R9F	RES, 49.9Ω, 0.125W, 1%, Metal-Film *	R0,R1,R2,R3,R4,R5 R6,R7,RC1	9	RN55C49R9F	DALE
	RES, 150kΩ, 0.125W, 1%, Metal-Film	R11	1		DALE
TSW-1-S01-06-S	1-Pin Terminal; Cell TP042 * * * * *	T3,T4,T5,T6,T7,T8 T9,T10,T15,T16,T17 T18,T19,T20,T21,T22 T24,T25,T26,T27,T28 T29,T30,T31,T32,T33 T34,T35	28	TSW-1-S01-06-S	
TSW-102-07-L-S	CONN, 2-Pos .1 CTR .025 Sq. Post	T1,T2,T36,T37	4	TSW-102-07-L-S	
T491B105K350AS	CAP, 1uF, 35V, 10%, Tantalum Chip-Molded	C17	1	T491B105K035AS	KEMET
T491D106K035AS	CAP, 10uF, 35V, 10%,Tantalum Chip-Molded	C21,C24	2	T491D106K035AS	KEMET
74hct04d	IC, Inverter, hex	U3	1	74hct04d	
74hct74d	IC, Flip Flop, Dual J-K with clear & preset	U4	1	74hct74d	
74hct245dw	IC, Bus Transceiver, Octal, 3-state outputs	U2	1	74hct245dw	
747842-6	25-Pin Right Angle Male D Conn	P4	1	747842-6	

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