LTC2482
16-Bit ΔΣ ADC with Easy Drive Input Current Cancellation

DESCRIPTION

Demonstration circuit 941A features the LTC2482, a 16-bit high performance ΔΣ analog-to-digital converter (ADC). The LTC2482 features 2ppm linearity, 0.5μV offset, and 600nV$_{RMS}$ noise. The input is fully differential, with input common mode rejection of 140dB. The LTC2482 is available in a 10-pin DFN package and has an easy to use SPI interface.

DC941 is a member of Linear Technology's QuikEval™ family of demonstration boards. It is designed to allow easy evaluation of the LTC2482 and may be connected directly to the target application's analog signals while using the DC590 USB Serial Controller board and supplied software to measure performance. The exposed ground planes allow proper grounding to prototype circuitry. After evaluating with Linear Technology's software, the digital signals can be connected to the end application's processor/controller for development of the serial interface.

Design files for this circuit board are available at http://www.linear.com/demo

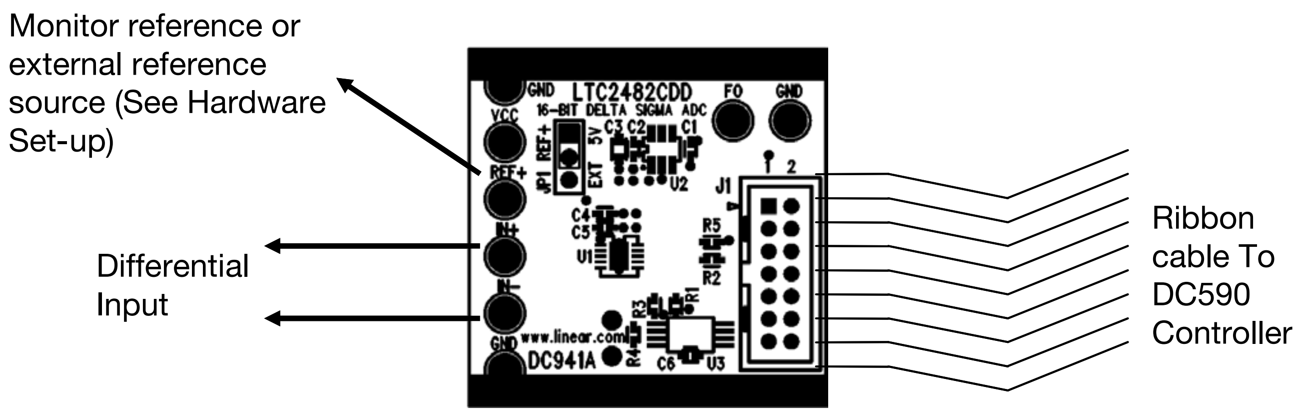


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

Connect DC941A to a DC590 USB Serial Controller using the supplied 14-conductor ribbon cable. Connect DC590 to host PC with a standard USB A/B cable. Run the evaluation software supplied with DC590 or downloaded from http://www.linear.com/software. The correct program will be loaded automatically. Click the COLLECT button to start reading the input voltage. Details on software features are documented in the control panel's help menu.

Tools are available for logging data, changing reference voltage, changing the number of points in the strip chart and histogram, and changing the number of points averaged for the DVM display.

QUICK START PROCEDURE

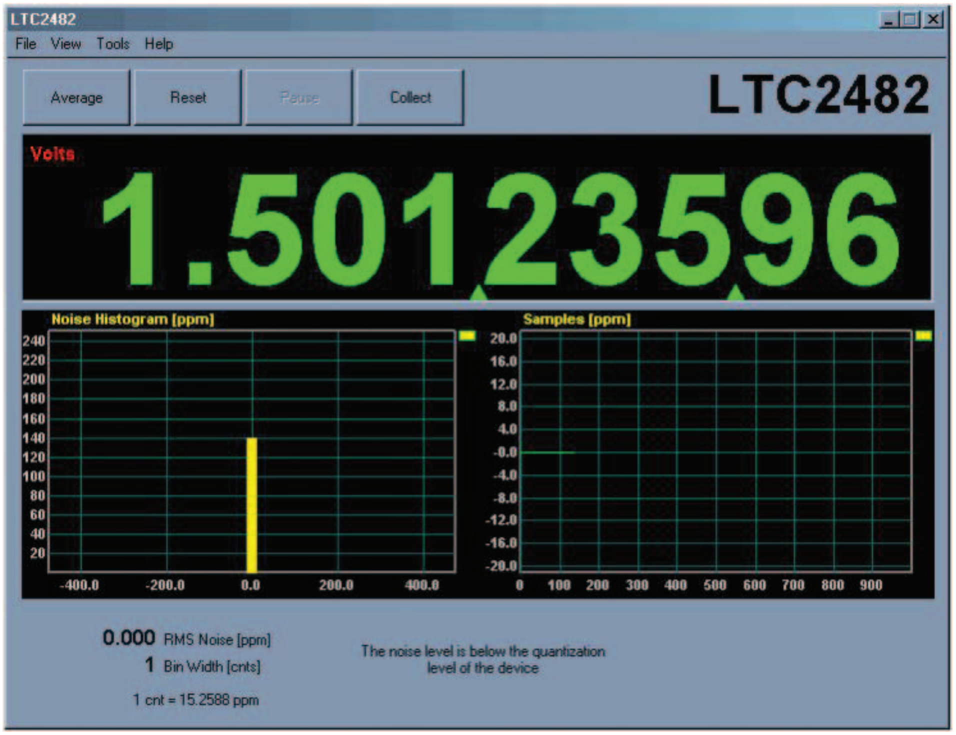


Figure 2. Software Screenshot

HARDWARE SETUP

CONNECTION TO DC590 SERIAL CONTROLLER

J1 is the power and digital interface connector. Connect to DC590 serial controller with supplied 14-conductor ribbon cable.

JUMPERS

JP1: Select the source for REF+, either an LT1790A-5 or externally supplied.

ANALOG CONNECTIONS

Analog signal connections are made via the row of turret posts along the edge of the board. Also, when connecting the board to an existing circuit the exposed ground planes along the edges of the board may be used to form a solid connection between grounds.

GND: Three ground turrets are connected directly to the internal ground planes.

V_{CC}: This is the supply for the ADC. Do not draw any power from this point.

REF+: Connected to the LTC2482 reference pin. If the onboard reference is being used, the reference voltage may be monitored from this point. An external reference may be connected to these terminals if JP1 is removed.

IN+, IN–: These are the differential inputs to the LTC2482.

F_O: An external conversion clock may be applied to the F_O turret to modify the frequency rejection characteristics or data output rate of the LTC2482. This should be a square wave with a low level equal to ground and a high level equal to V_{CC}. While up to a 2MHz clock can be used, performance may be compromised. Refer to the LTC2482 data sheet. This terminal has a 5k pull-down resistor to keep it from floating when no signal is applied.

EXPERIMENTS

INPUT NOISE

One of the characteristics of the LTC2482 is that the 600nV input noise floor is far below the quantization level of 38μV when a 5V reference is used. This means that the output will be stable if the input noise level is significantly below 38μV. In this sense, the LTC2482 is a true 17 effective bit part, whereas many 16-bit SAR converters have several LSBs of noise.

Solder a short wire from the IN– turret post to the IN+ turret post. Noise should be below the quantization level of the LTC2482. This will result in a noise reading of zero on the control software, unless the offset is such that the display flickers between two codes in which case the RMS noise reading will be incorrect.

Select EXT for the source for V_{REF} on JP1 and apply a 100mV source between a GND turret post and the V_{REF} turret post. A precision, adjustable voltage source such as a Data Precision 8200 or Fluke 332A is ideal. Another option for this experiment is a 50k/1k divider from the LT1790A-5 output to ground, giving a 98mV output. The resulting LSB size is 0.1/217, or 763nV. This is small enough to see the noise floor of the LTC2482 inputs, and the RMS noise display should read approximately 6ppm to 7ppm (of the 100mV reference).

COMMON MODE REJECTION

Tie the two inputs (still connected together) to ground through a short wire and note the indicated voltage. Tie the inputs to REF+; the difference should be less than 0.5μV due to the 140dB minimum CMRR of the LTC2482.

BIPOLAR SYMMETRY

To demonstrate the symmetry of the ADCs transfer function, connect a stable, low noise, floating voltage source (with a voltage less than $V_{REF}/2$) from IN+ to IN– and note the indicated voltage. Reverse the polarity; the indicated voltage will typically be within one LSB of the first reading multiplied by –1.

One convenient voltage source for this experiment is a single alkaline battery. While a battery has fairly low noise, it is sensitive to temperature drift. It is best to use a large (D-size) battery that is insulated from air currents. A better source is a battery powered series reference such as the LT1790. This part is available with output voltages of 1.25V, 2.048V, 2.5V, 3V, 3.3V, 4.096V and 5V.

INPUT NORMAL MODE REJECTION

The LTC2482's SINC4 digital filter is trimmed to reject 50Hz or 60Hz line noise when operated with the internal conversion clock. To measure input normal mode rejection, connect IN– to a 2.5V source such as an LT1790-2.5 reference or 1k – 1k divider from the onboard 5V reference to ground. Apply a 10Hz, 2V peak-to-peak sine wave to IN+ through a 1μF capacitor. No DC bias is required because the 2MΩ to 3MΩ input impedance of the LTC2482 tends to self-bias the input to mid-reference (see data sheet Applications Information for details.)

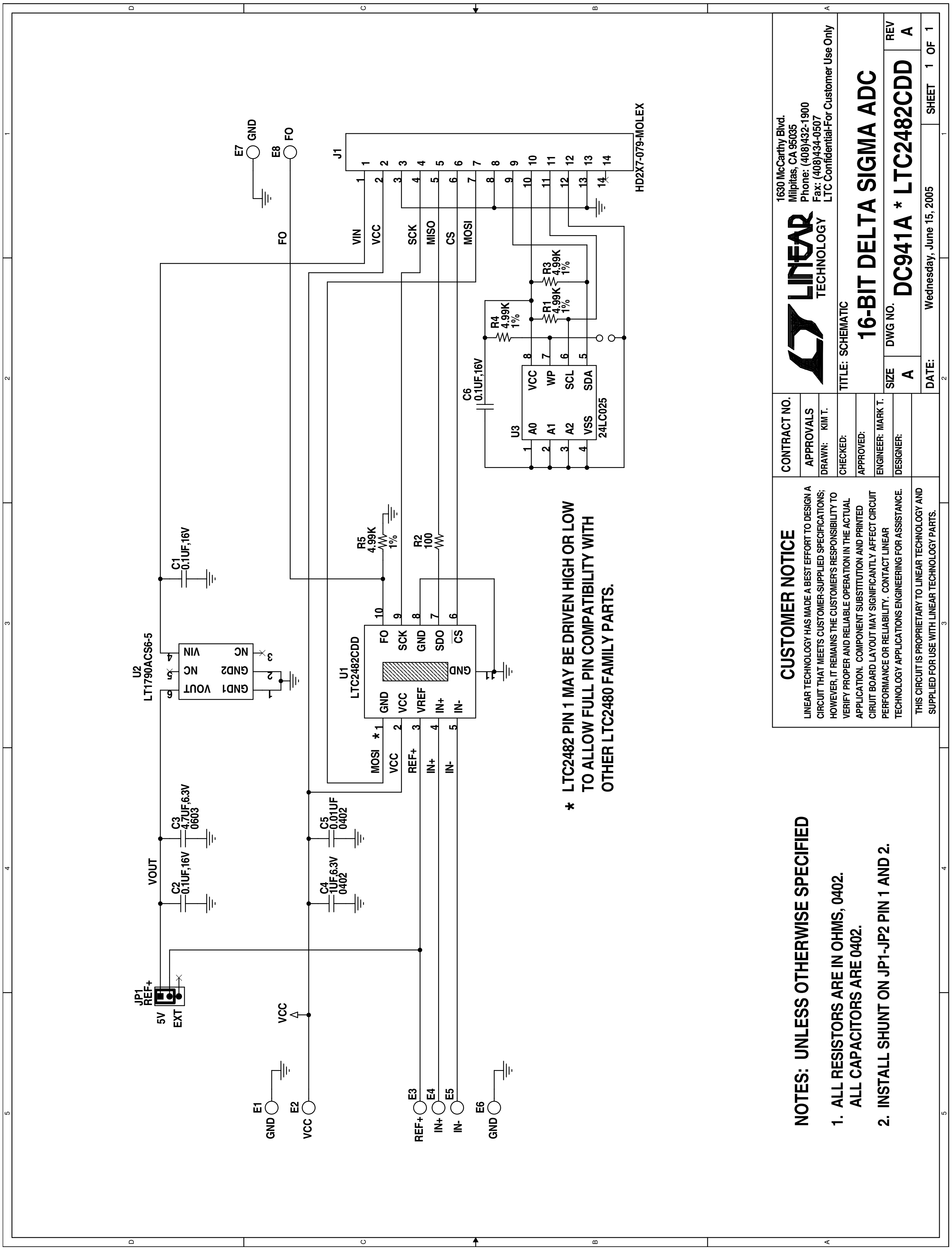
Start taking data. The input noise will be quite large, and the graph of output vs time should show large variations.

Next, slowly increase the frequency to 55Hz. The noise should be almost undetectable in the graph. Note that the indicated noise in ppm may still be above that of the data sheet specification because the inputs are not connected to a DC source.

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1, C2, C6	CAP., X7R 0.1µF 16V, 20%, 0402	TDK, C1005X7R1C104M
2	1	C3	CAP., X5R 4.7µF 6.3V, 20%, 0603	TDK, C1608X5R0J475M
3	1	C4	CAP., X5R, 1µF 6.3V, 20%, 0402	TDK, C1005X5R0J105M
4	1	C5	CAP., X7R 0.01µF 25V, 10%, 0402	AVX, 04023C103KAT1A
5	8	E1-E8	TESTPOINT, TURRET, 0.064"	MILL-MAX, 2308-2
6	1	JP1	JMP, 3-PIN 1 ROW 0.079CC	SAMTEC, TMM-103-02-L-S
7	1	SHUNTS FOR JP1 PIN 1 & 2	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G
8	1	J1	HEADER, 2X7 PIN, 0.079CC	MOLEX, 87831-1420
9	4	R1, R3, R4, R5	RES., CHIP 4.99k 1/16W 1%, 0402	VISHAY CRCW04024991F
10	1	R2	RES., CHIP 100Ω 1/16W 5%, 0402	VISHAY CRCW0402101J
11	1	U1	I.C., LTC2482CDD, DFN10DD	LINEAR TECH., LTC2482CDD
12	1	U2	I.C., LT1790ACS6-5, SOT23-6	LINEAR TECH., LT1790ACS6-5
13	1	U3	I.C., 24LC025, TSSOP8	MICROCHIP, 24LC025-I/ST

SCHEMATIC DIAGRAM



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This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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