LTC2446
24-Bit High Speed 4-/8-Channel ΔΣ ADCs with Selectable Multiple Reference Inputs

DESCRIPTION

The LTC®2446 is a 4-/8-channel, high speed, 24-bit ΔΣ ADC with ten selectable speed/resolution modes from 6.9Hz/280nV$_{RMS}$ to 3.5kHz/25μV$_{RMS}$. Key DC specifications include 5ppm INL, 5μV offset, 10ppm full-scale error and 20nV/°C offset drift. In the 6.9Hz/200nV$_{RMS}$ mode, input normal mode rejection of 50Hz and 60Hz noise is better than 87dB. The accuracy (offset, full-scale, linearity, drift) and power dissipation are independent of the speed selected. The LTC2446 also has four reference inputs dedicated to the four differential input channels and corresponding pairs of single-ended input channels. This allows the inputs to have different reference sources, facilitating independent ratiometric measurements on each channel.

The DC847A is a member of Linear Technology's QuikEval™ family of demonstration boards. It is designed to allow easy evaluation of the LTC2446 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 LTC's software, the digital signals can be connected to the application's processor/controller for development of the serial interface.

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

BOARD LAYOUT

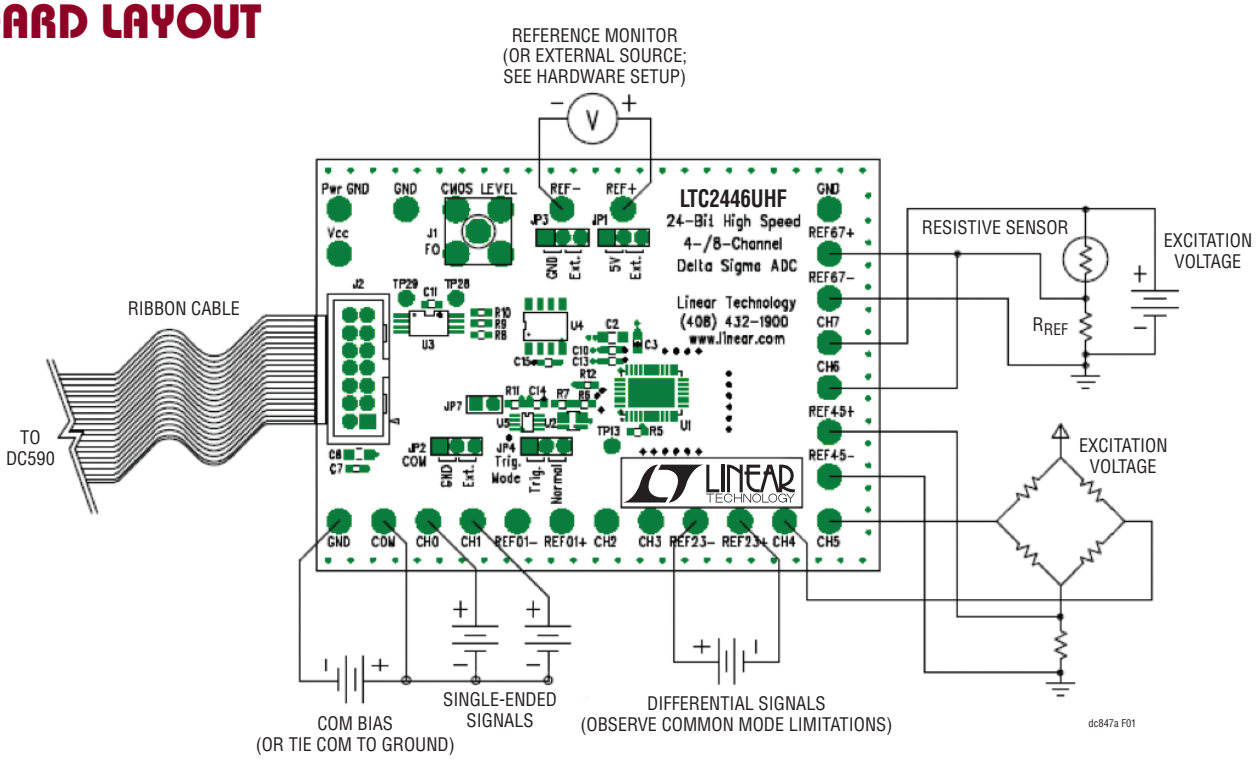

Figure 1. DC847A Connection Diagram

QUICK START PROCEDURE

- Connect the DC847A to a DC590 USB serial controller using the supplied 14-conductor ribbon cable.
- Connect the DC590 to a host PC with a standard USB A/B cable.
- Run the evaluation software supplied with the DC590 or download it from www.linear.com/software. The correct program will be loaded automatically.
- Click the Collect button to start reading the input voltage.
- Click the slider at the bottom of the strip chart display to change the oversample ratio (OSR) which will, in turn, change the data output rate.

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.

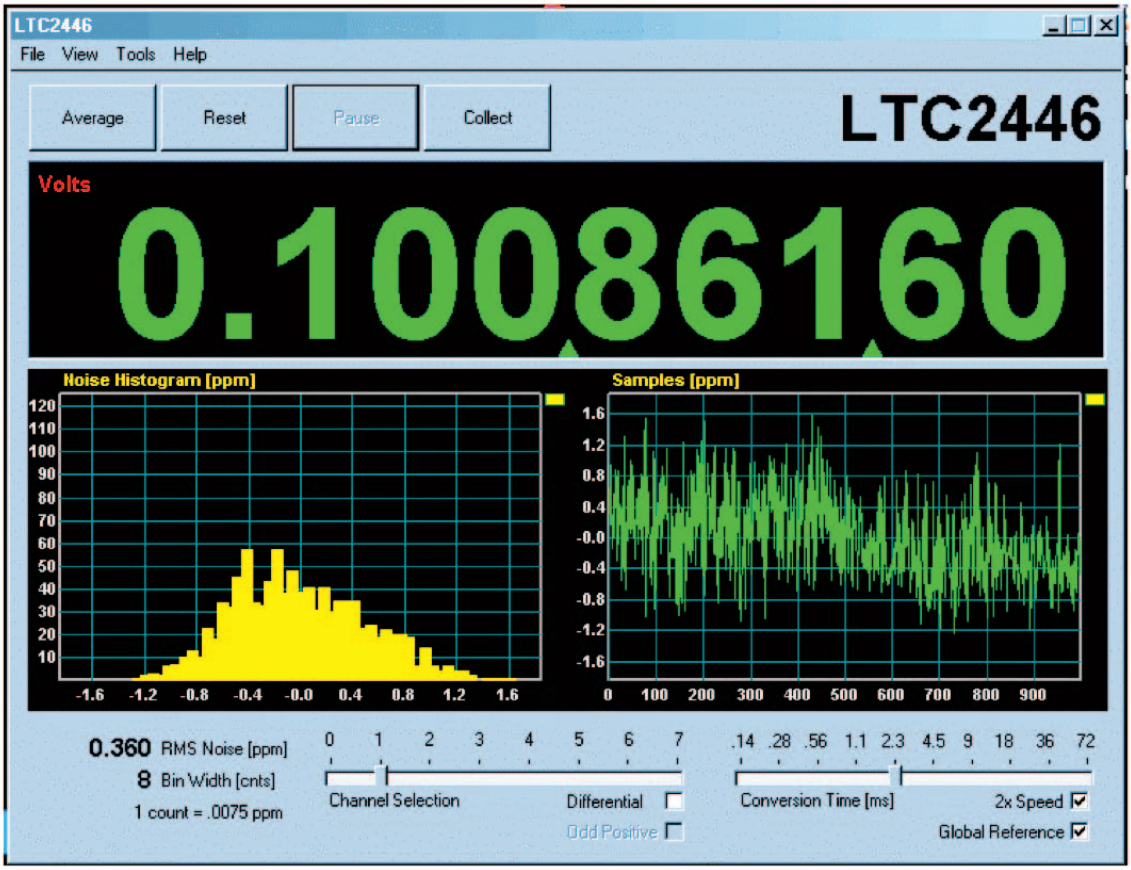

Figure 2. QuikEval Software Screenshot

HARDWARE SETUP

JUMPERS

JP1, JP3: Select the source for REF^+ and REF^-, respectively. REF^+ can be 5V from the onboard LT1236 reference (default) or supplied externally. REF^- can be ground (0V, default) or supplied externally.

JP2: Select the source for the analog COM input, either tied to ground or supplied externally to the COM turret post.

JP4: Trigger Mode; either normal (default) or externally triggered.

JP7: Trigger Input Signal. Pin 1 is a 5V logic signal, Pin 2 is ground. When trigger mode is selected on JP4, a rising edge starts a new conversion. Note that since a conversion cannot be terminated once started, this signal can only be used to slow down the conversion rate.

CONNECTION TO THE DC590 SERIAL CONTROLLER

J2: Power and Digital Interface Connector. Connect to the DC590 serial controller with the supplied 14-conductor ribbon cable.

ANALOG CONNECTIONS

Analog signal connections are made via the row of turret posts along the edge of the board. Also, if you are 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: Ground turrets are connected directly to the internal analog ground plane.

PWR GND: Power Ground; connected to the power return trace.

V_{CC}: Supply for the ADC. Do not draw any power from this point. External power may be applied to this point after disabling the switching supply on the DC590. If the DC590 serial controller is being used, the voltage must be regulated 5V only, as the isolation circuitry will also be powered from this supply. See the DC590 Quick Start Guide for details.

REF^+, REF^-: Turrets Connected to the LTC2446 Global Reference Pins (REF^+ and REF^-). 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 and JP3 are configured for external reference.

$REF01^+$, $REF01^-$, $REF23^+$, $REF23^-$, etc.: Dedicated Reference Inputs for Each Input Channel.

Note: The REF^+, REF^-, $REF01^+$, $REF01^-$, $REF23^+$, $REF23^-$, etc. terminals are decoupled to ground with 0.1µF and 10µF capacitors. Thus, any source connected to these terminals must be able to drive a capacitive load and have very low impedance at DC. Examples are series references that require an output capacitor and C-load stable op amps, such as the LT1219 and LT1368.

CH0 - CH7: These are the differential inputs to the LTC2446. They may be configured either as single-ended inputs with respect to the COM pin, or adjacent pairs may be configured as differential inputs (CH0-1, CH2-3, etc.).

Note: Channels 0-3 have 1µF capacitors from the inputs to ground. Channels 4-7 do not have capacitors installed, however, there are pads for these capacitors on the back of the board. The reason for this is that some applications benefit from a large capacitance at the inputs while others require no capacitance.

EXPERIMENTS

Input Noise

Solder a short wire from the CH0 to CH1. Set the demo software to OSR32768 (6.8 samples per second) and check the 2X box. Noise should be approximately 0.056ppm of V_{REF} (280nV). Next, select different oversample ratios. Measured noise for each oversample ratio should be close to values given in the LTC2446 data sheet.

Common Mode Rejection

Tie the two inputs (still connected together from previous experiment) to ground through a short wire and note the indicated voltage. Tie the inputs to REF^+; the difference should be less than 5µV due to the 120dB CMRR of the LTC2446.

EXPERIMENTS

Input Normal Mode Rejection

The LTC2446's SINC^4 digital filter is trimmed to strongly reject both 50Hz and 60Hz line noise when operated with the internal conversion clock and oversample ratio 32768 (6.8 samples per second). To measure input normal mode rejection, connect COM to a 2.5V source such as an LT1790-2.5 reference or a power supply. Connect any other input (CH0 – CH15) to the same supply through a 10kΩ resistor. Apply a 10Hz, 2V peak-to-peak sine wave to the input through a 1µF capacitor.

Select OSR32768 (6.8 samples per second) and 2X mode in the demo software and 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.

Change the OSR to 16384 (13.75 samples per second). The noise will increase substantially, as the first notch at this OSR is at 110Hz. Increase the signal generator frequency to 110Hz; the noise will drop again.

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	4	C3, C7, C10, C13	CAP., CHIP, X7R, 0.01µF, 16V	AVX, 0603YC103KAT1A, 0603
2	3	C11, C14, C15	CAP., CHIP, X7R, 0.1µF, 16V	AVX, 0603YC104MAT1A, 0603
3	13	C1, C4, C6, C16-C20, C23, C24, C27-C29	CAP., CHIP, X5R, 1µF, 10V	TAIYO YUDEN, LMK107BJ105MG, 0603
4	3	C2, C9, C12	CAP., CHIP, X5R, 4.7µF, 6.3V	TAIYO YUDEN, JMK212BJ475MG, 0805
5	1	C8	CAP., CHIP, X5R, 10µF, 6.3V	TDK, C2012X5R0J106M, 0805
6	0	C21, C22, C25, C26	OPT.	
7	24	TP1-TP6, TP8, TP10-TP12, TP14-TP27	TURRET, TESTPOINT, 0.064"	MILL-MAX, 2308-2
8	0	TP13, TP28, TP29	OPT. (SURFACE MOUNT PAD ONLY)	
9	4	JP1-JP4	HEADER, 3-PIN, 1 ROW, 0.079"	COMM-CON, 2802S-03G2
10	4	FOR (JP1-JP4)	SHUNT, 0.079", CENTER	COMM-CON, CCIJ2MM-138GW
11	0	JP7	OPT.	
12	0	J1 (OPT.)	CONN., SMA COAXIAL, STRAIGHT JACK	CONNEX, 132134
13	1	J2	HEADER, VERTICAL DUAL, 2×7, 0.079"	MOLEX, 87831-1420
14	1	R7	RES., CHIP, 100, 5%	AAC, CR16-101JM, 0603
15	3	R8, R9, R10	RES., CHIP, 4.99k, 1%	VISHAY, CRCW0603
16	2	R5, R11	RES., CHIP, 10k, 5%	AAC, CR16-103JM, 0603
17	0	R6	OPT.	
18	1	U1	I.C., 24-BIT 4-/8-CHANNEL DELTA SIGMA ADCs	LINEAR TECHNOLOGY, LTC2446UHF, 38QFN
19	1	U4	I.C., PRECISION REFERENCE	LINEAR TECHNOLOGY, LT1236ACS8-5, SO8
20	1	U3	I.C., SERIAL EEPROM	MICROCHIP, 24LC025-I/ST, TSSOP-8
21	1	U2	I.C., NONINVERTING MULTIPLEXER	FAIRCHILD, NC7SZ157P6X, SC70
22	1	U5	I.C., SINGLE D FLIP-FLOP	ON SEMI., NL17SZ74US, US8

SCHEMATIC DIAGRAM

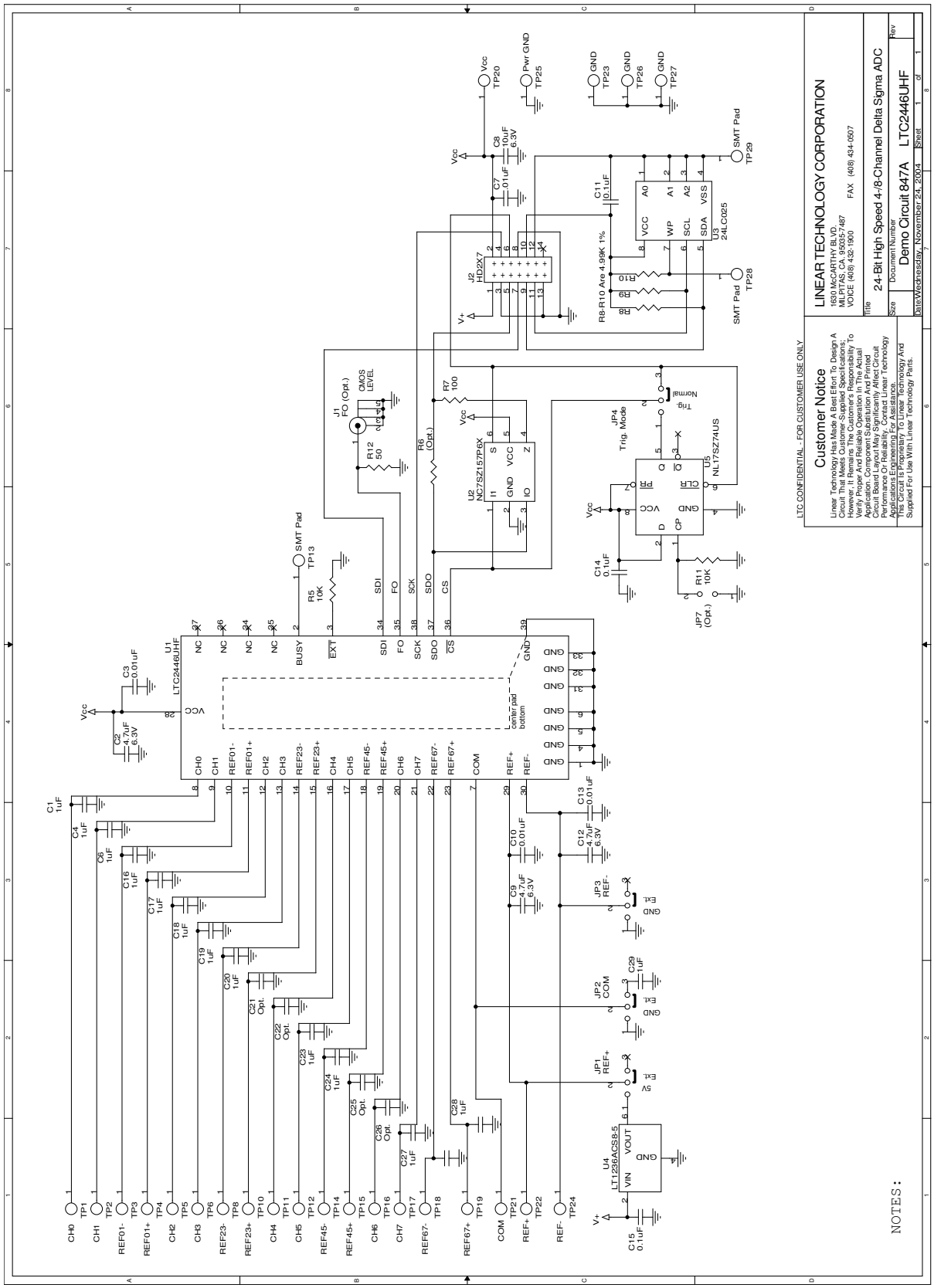

Figure 3. DC847A 24-Bit High Speed 4-/8-Channel Delta Sigma ADC

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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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