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LTC2498, LTC2496, LTC2494
24-bit/16-bit, 8-/16-Channel, Easy Drive ΔΣ ADC with SPI Interface

DESCRIPTION

Demonstration Circuit 1011A-A features the LTC®2498 8-/16-channel, 24-bit Delta Sigma ADC with Easy Drive™ inputs. Key DC specifications include 2ppm INL, 1ppm offset, 25ppm full-scale error and 10nV/°C offset drift. In the 6.9Hz/280nV$_{RMS}$ mode, input normal mode rejection of 50Hz and 60Hz noise is better than 87dB.

DC1011A-B features the LTC2496 16-bit ΔΣ ADC that is pinout and software compatible with the LTC2498.

DC1011A-C features the LTC2494 16-bit ΔΣ ADC with internal PGA and temperature sensor.

DC1011A is a member of Linear Technology's QuikEval™ family of demonstration boards. It is designed to allow easy evaluation of the LTC2498, LTC2496 or LTC2494 and may be connected directly to the target application's analog signals while using the DC590 USB Serial Controller board and QuikEval 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.

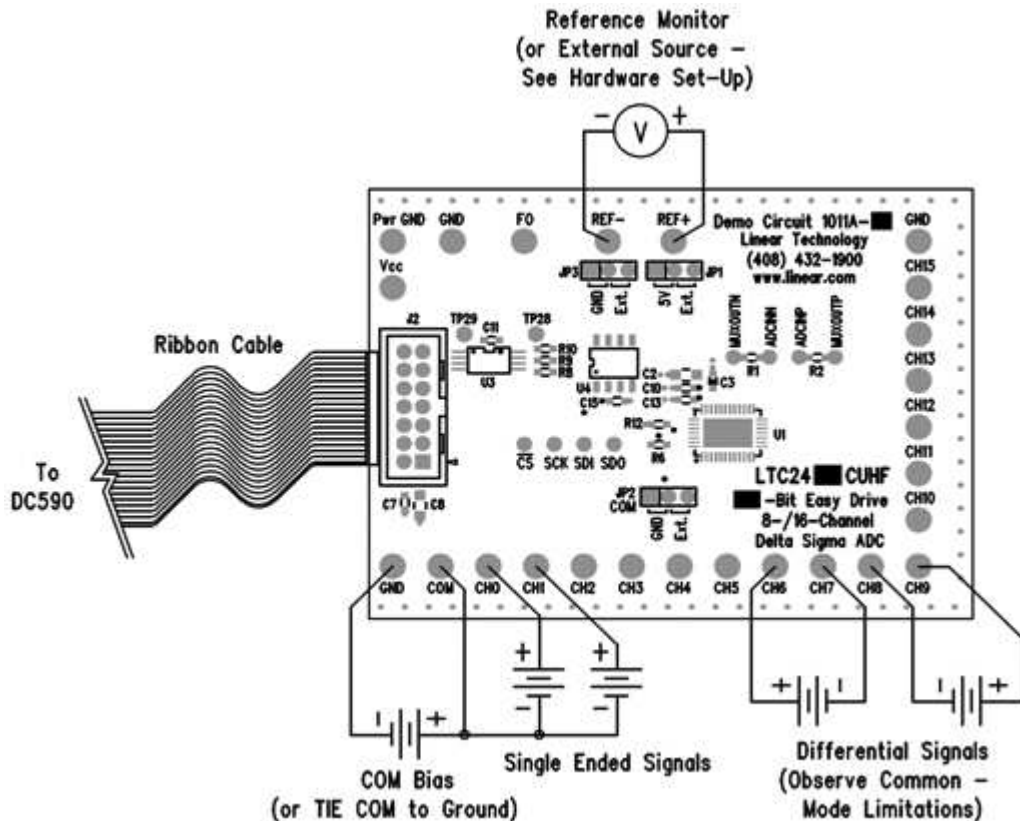**Design files for this circuit board are available at http://www.linear.com/demo**

Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

Connect the DC1011A 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 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.
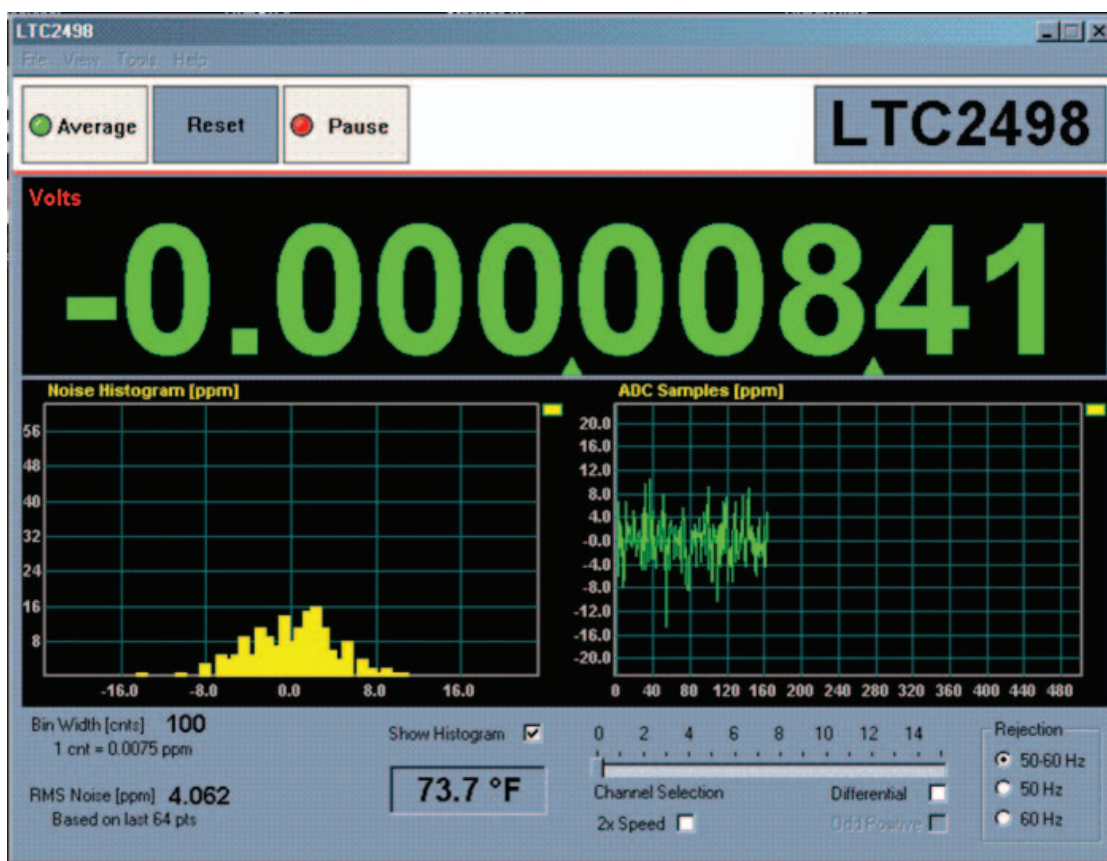
HARDWARE SETUP

JUMPERS

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

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

CONNECTION TO DC590 SERIAL CONTROLLER

J2 is the power and digital interface connector. Connect to a DC590 serial controller with the supplied 14-conductor ribbon cable. Digital signals are also connected to through-hole test points on the circuit board.

dc1011af

HARDWARE SETUP

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}: This is the supply for the ADC. Do not draw any power from this point. External power may be applied to this point after disabling the V_{CC} supply on DC590. See the DC590 quick start guide for details.

REF+, REF–: These turrets are connected to the LTC2496/2498/2494 REF+ and REF– pins. 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.

Note: The REF+ and REF– terminals are decoupled to ground with 0.1µF and 10µF capacitors in parallel. 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 to CH15: These are the differential inputs to the LTC2496/2498/2494. 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.)

EXPERIMENTS

INPUT NOISE

Solder a short wire between the CH0 and CH1 turrets. Connect the inputs to ground through a short wire and start taking data. LTC2498 Noise should be approximately 0.12ppm of 5V (600nV$_{RMS}$). The electrical noise of the LTC2496 is also 600nV$_{RMS}$, however this is masked by the 76.3µV quantization level. If the input is midway between code transitions, the noise level will read zero. If the input is exactly on a code transition such that the two adjacent output codes have equal probability, the noise level will be approximately 7.9ppm.

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 LTC2498. The LTC2496 will produce less than 1LSB difference.

INPUT NORMAL MODE REJECTION

The LTC2498's SINC4 digital filter can be software selected to reject 50Hz, 60Hz by 120dB, or both 50Hz and 60Hz by 87dB. The LTC2496's SINC4 filter is fixed at 50/60Hz. 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 to CH15) to the same supply through a 10k resistor. Apply a 10Hz, 2V peak-to-peak sine wave to the input through a 1µF capacitor.

Set the rejection frequency to 55Hz (LTC2498 only) 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 accurate source.

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	2	C11, C15	CAP., CHIP X7R 0.1µF 16V 10%	AVX, 0603YC104MAT1A 0603
3	1	C29	CAP., CHIP X5R 1µF 10V	TAIYO YUDEN, LMK107BJ105KA 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	25	TP1-TP6, TP8, TP10-TP12, TP14-TP27, TP31	TURRET, TESTPOINT 0.064"	MILL-MAX, 2308-2
7	0	TP7, TP9, TP13, TP28-TP30, TP32-TP35	OPT. (SURFACE MOUNT PAD ONLY)	
8	3	JP1-JP3	HEADER, 3-PIN 1 ROW 0.079CC	SAMTEC, TMM-103-01-LD
9	3	FOR (JP1-JP3)	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G
10	1	J2	HEADER, VERTICAL DUAL 2X7 0.079CC	MOLEX, 87831-1420
11	2	R1, R2	RES., CHIP 0Ω	VISHAY, CRCW06030000Z0EA
12	1	R6	RES., CHIP 100Ω 5%	AAC, CR16-101JM 0603
13	3	R8, R9, R10	RES., CHIP 4.99k 1%	AAC, CR16-4991FM 0603
14	1	R12	RES., CHIP 10k 5%	AAC, CR16-103JM 0603
15	1	U4	I.C., PRECISION REFERENCE SO8	LINEAR TECH., LT1236ACS8-5#PBF
16	1	U3	I.C., SERIAL EEPROM, TSSOP-8	MICROCHIP, 24LC025-I/ST (PbF)
DC1011A-A				
1	1	U1	I.C., 24-BIT 8-/16-CHANNEL DELTA SIGMA ADCs	LINEAR TECH., LTC2498CUHF 38QFN
DC1011A-B				
1	1	U1	I.C., 16-BIT 8-/16-CHANNEL DELTA SIGMA ADCs	LINEAR TECH., LTC2496CUHF 38QFN
DC1011A-C				
1	1	U1	I.C., 16/PGA 8-/16-CHANNEL DELTA SIGMA ADCs	LINEAR TECH., LTC2494CUHF 38QFN
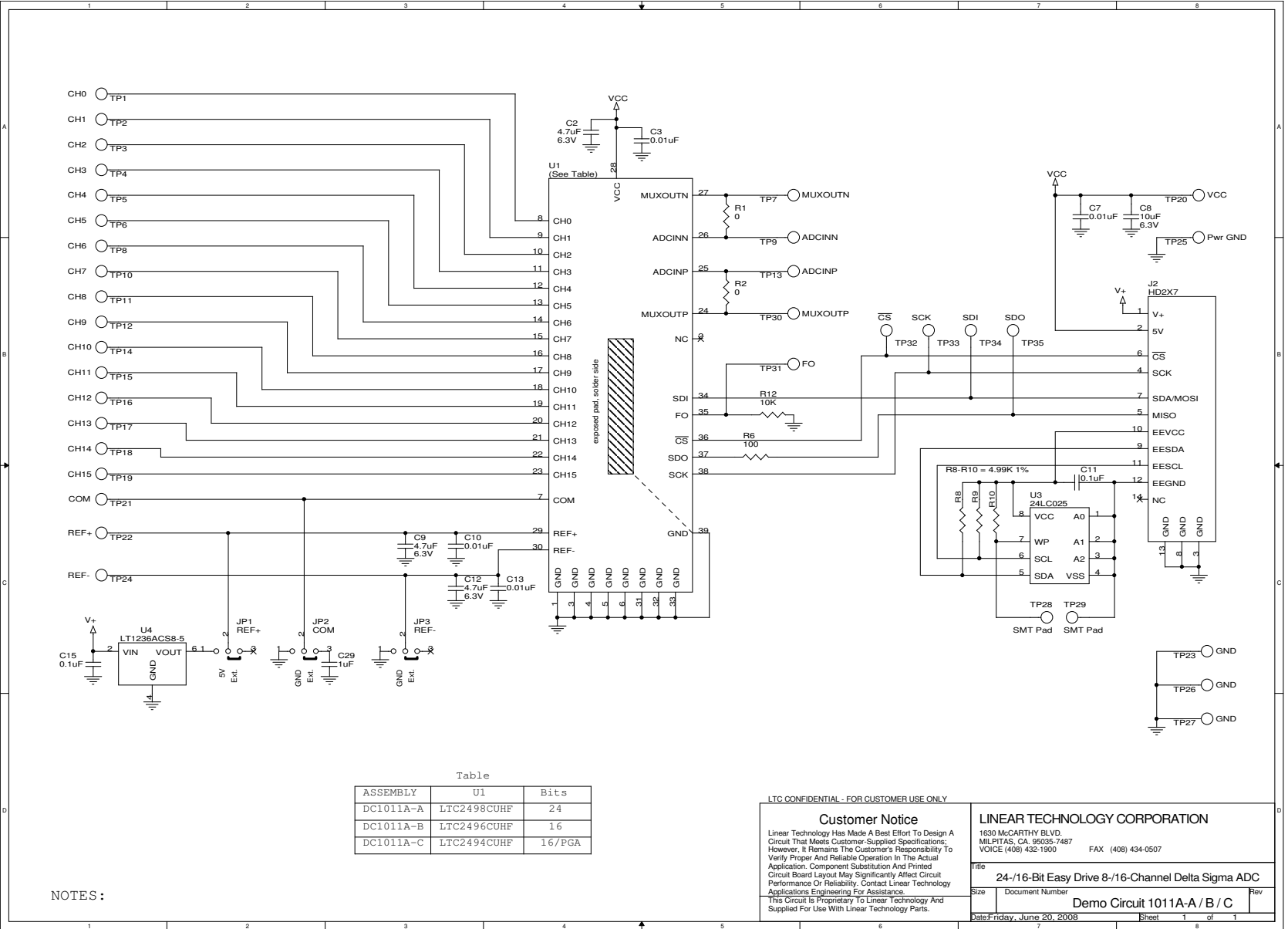
Table

ASSEMBLY	U1	Bits
DC1011A-A	LTC2498CUHF	24
DC1011A-B	LTC2496CUHF	16
DC1011A-C	LTC2494CUHF	16/PGA

NOTES:

Customer Notice

Linear Technology Has Made A Best Effort To Design A Circuit That Meets Customer-Supplied Specifications; However, It Remains The Customer's Responsibility To Verify Proper And Reliable Operation In The Actual Application. Component Substitution And Printed Circuit Board Layout May Significantly Affect Circuit Performance Or Reliability. Contact Linear Technology Applications Engineering For Assistance.
This Circuit Is Proprietary To Linear Technology And Supplied For Use With Linear Technology Parts.

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Title
24-/16-Bit Easy Drive 8-/16-Channel Delta Sigma ADC

Size	Document Number	Rev
	Demo Circuit 1011A-A / B / C	

Date:Friday, June 20, 2008   Sheet   1   of   1

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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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LT 0613 • PRINTED IN USA

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