

# QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 1098

## 10/12/14-BIT 125 MSPS ADC

LTC2281, LTC2283, LTC2285

## DESCRIPTION

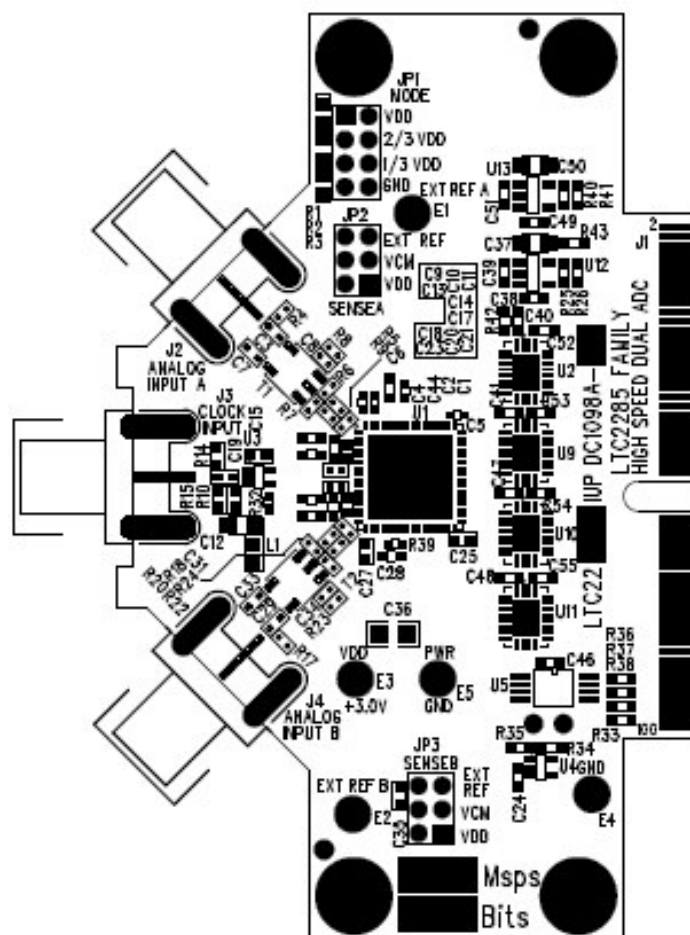
Demonstration circuit 1098 supports a family of 10/12/14-BIT 125 MSPS ADCs. Each assembly features one member of this family of high speed, high dynamic range ADCs.

The versions of 1098 demo board are listed in Table 1. Depending on the required resolution, sample rate and input frequency, the DC1098 is supplied with the appropriate A/D and with an optimized in-

put circuit. The circuitry on the analog inputs is optimized for analog input frequencies below 70 MHz or from 70 MHz to 140MHz. For higher input frequencies, contact the factory for support.

**Design files for this circuit board are available. Call the LTC factory.**

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## 10/12/14-BIT 125 MSPS ADC

**Table 1. DC1098A Variants**

| DC1098 VARIANTS | ADC PART NUMBER | RESOLUTION* | MAXIMUM SAMPLE RATE | INPUT FREQUENCY |
|-----------------|-----------------|-------------|---------------------|-----------------|
| 1098A-A         | LTC2281         | 10-Bit      | 125 MSPS            | 1MHz - 70MHz    |
| 1098A-B         | LTC2283         | 12-Bit      | 125 MSPS            | 1MHz - 70MHz    |
| 1098A-C         | LTC2295         | 14-Bit      | 125 MSPS            | 1MHz - 70MHz    |
| 1098A-D         | LTC2291         | 10-Bit      | 125 MSPS            | 70MHz - 140MHz  |
| 1098A-E         | LTC2293         | 12-bit      | 125 MSPS            | 70MHz - 140MHz  |
| 1098A-F         | LTC2295         | 14-Bit      | 125 MSPS            | 70MHz - 140MHz  |
|                 |                 |             |                     |                 |

**Table 2. Performance Summary (T<sub>A</sub> = 25°C)**

| PARAMETER                                                                | CONDITION                                                                                                                           | VALUE                                                                         |
|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Supply Voltage                                                           | Depending on sampling rate and the A/D converter provided, this supply must provide up to 200mA.                                    | Optimized for 3.0V<br>[2.7V ⇔ 3.6V min/max]                                   |
| Analog Input Range                                                       | Depending on Sense Pin Voltage                                                                                                      | 1V <sub>pp</sub> to 2V <sub>pp</sub>                                          |
| Logic Input Voltages                                                     | Minimum Logic High                                                                                                                  | 2.4V                                                                          |
|                                                                          | Maximum Logic Low                                                                                                                   | 0.8V                                                                          |
| Logic Output Voltage<br>(74VCX245 output buffer, V <sub>cc</sub> = 2.5V) | Minimum Logic High @ -1.6mA                                                                                                         | 2.3V (33Ω Series terminations)                                                |
|                                                                          | Maximum Logic Low @ 1.6mA                                                                                                           | 0.7V (33Ω Series terminations)                                                |
| Sampling Frequency (Convert Clock Frequency)                             | See Table 1                                                                                                                         |                                                                               |
| Convert Clock Level                                                      | 50 Ω Source Impedance, AC coupled or ground referenced (Convert Clock input is capacitor coupled on board and terminated with 50Ω.) | 2V <sub>p-p</sub> ⇔ 2.5V <sub>p-p</sub> Sine Wave or Square wave (See Note 1) |
| Resolution                                                               | See Table 1                                                                                                                         |                                                                               |
| Input Frequency Range                                                    | See Table 1                                                                                                                         |                                                                               |
| SFDR                                                                     | See Applicable Data Sheet                                                                                                           |                                                                               |
| SNR                                                                      | See Applicable Data Sheet                                                                                                           |                                                                               |

Note 1: For sample rates below 20MSPS a square wave must be used to achieve full performance.



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JP2: Sense A: Vdd, (2V P-P input range)

JP3: Sense B: Vdd, (2V P-P input range)

### **APPLYING POWER AND SIGNALS TO THE DC1098 DEMONSTRATION CIRCUIT BOARD:**

If a DC890 is used to acquire data from the DC1098, the DC890 should be powered up FIRST, before applying +3V across the pins marked "+3.0V" and "PWR GND" on the DC1098. However, the output buffers on DC1098 will not be enabled until power is applied to DC890. The DC1098 demonstration circuit requires up to 200 mA depending on the sampling rate and the A/D converter supplied.

### **ENCODE CLOCK**

**NOTE: This is not a logic compatible input. It is terminated with 50 Ohms.**

Apply an encode clock to the SMA connector on the DC1098 demonstration circuit board marked "J3 CLOCK INPUT". This input is connected to ground through a 50 $\Omega$  resistor, and followed by a blocking capacitor. For the best noise performance, the CLOCK INPUT must be driven with a very low jitter source. When using a sinusoidal generator, the amplitude should be as large as possible, up to 3V<sub>P-P</sub> or 13 dBm. Using band pass filters on the clock and the analog input will improve the noise performance by reducing the wideband noise power of the signals. Data sheet FFT plots are taken with 10 pole LC filters made by TTE (Los Angeles, CA) to suppress signal generator harmonics, non-harmonically related spurs and broad band noise. Low phase noise Agilent 8644B generators are used with TTE band pass filters for both the Clock input and the Analog input.

A square wave encode clock is recommended for sample rates lower than 20MSPS. This is because the lower slew rate of a sinusoidal encode clock translates to increased clock jitter and hence lower SNR.

The Encode Clock can be driven with a 2.5V CMOS Logic Level square wave if R14 is replaced with an acceptable load for the drive capability of the logic. Note that logic devices are generally not able to drive cable. A barrel is recommended for logic drive. If a cable is used, the cable carrying the clock signal must be terminated to maintain the signal integrity of the Encode Clock Source and the signal source must be able to drive the 0 to 2.5V square wave signal into 50 $\Omega$  load.

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## ANALOG INPUT NETWORK

Apply the analog input signals of interest to the SMA connectors on the DC1098 demonstration circuit board marked “ANALOG INPUT (A and B)”. These inputs are capacitively coupled to ETC1-1-13 Balun transformers on high input frequency versions, or directly coupled through ETC1-1T Flux coupled transformers on low input frequency versions.

For optimal distortion and noise performance the RC network on the analog inputs are optimized for different analog input frequencies on the different versions of the DC1098. Refer to table 1. For input frequencies below about 70MHz, the circuit in Fig. 2 is recommended. For input frequencies above 70MHz and below 170MHz, the circuit in Fig. 3 is recommended.

For input frequencies between 250MHz and 500MHz, the circuit in Fig. 4 is recommended. For input frequencies greater than 250MHz contact the factory for support.

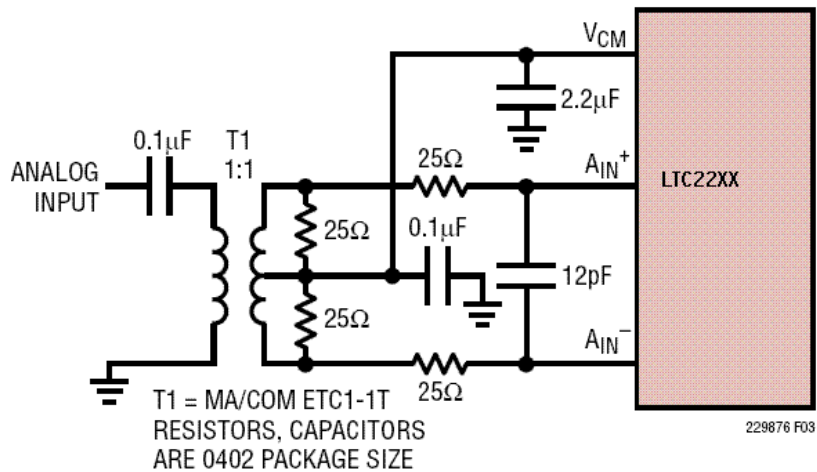


Figure 2. Analog Front End Circuit For  $1\text{MHz} < A_{IN} < 70\text{MHz}$  (1 of 2)

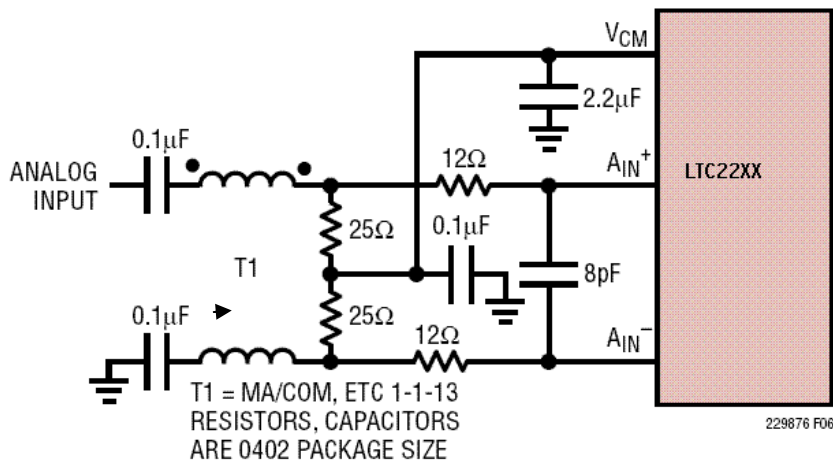


Figure 3. Analog Front End Circuit For  $70\text{MHz} < A_{IN} < 170\text{MHz}$  (1 of 2)

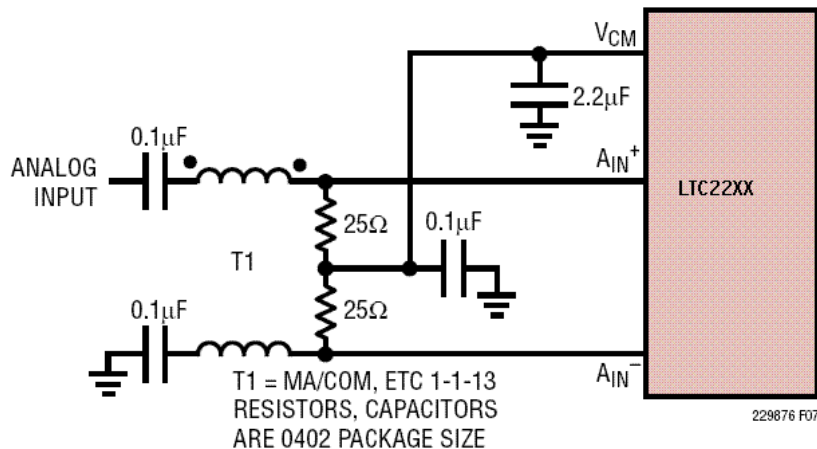


Figure 4. Analog Front End Circuit For  $170\text{MHz} < A_{IN} < 300\text{MHz}$

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Note that relative aperture measurements require removal of these networks, or the results will simply show the relative phase through the RC network. The measure of relative phase further requires a resistive power divider, and matched cables, or the results will be misleading. Any relative phase measurements should be confirmed by reversing the signals to confirm that the relative delay is not due to the external network.

## DATA COLLECTION

The conversion clock output and the parallel data for both ADC channels are available on J1. This connector is designed to mate with a Samtec model MEC8-150-02-L-D-EM2 receptacle. It is recommended that this receptacle be used if something other than a DC890 board is used to collect data.

DC890 QuickEval-II Data Acquisition Board uses the *PScope System Software* provided or downloaded from the Linear Technology website at <http://www.linear.com/software/>. If a DC890 was provided, follow the Quick Start Guide and the instructions below.

To start the data collection software if "*PScope.exe*", is installed (by default) in \Program Files\LTC\PScope\, double click the PScope Icon or bring up the run window under the start menu and browse to the PScope directory and select PScope.

Configure PScope for the appropriate variant of the DC1098 demonstration circuit by selecting the cor-

If relative phase measurements produce results of greater than a fraction of a picosecond, please consult the factory for assistance.

Channel to Channel Crosstalk on this demo board is better than -110 dB for input frequencies below 140 MHz.

rect A/D Converter as installed on the DC1098. Under the "Configure" menu, go to "Device." Under the "Device" pull down menu, select device, LTC2280 through LTC2299. When evaluating 12-Bit parts, select the appropriate LTC22XX part in the Device List and PScope will automatically blank the last two LSBs when using a DC1098 supplied with a 14-Bit part.

If everything is hooked up properly, powered, and a suitable convert clock is present, clicking the "Collect" button should result in time and frequency plots displayed in the PScope window. The two channel mode in Pscope provides a page for each channel, and a page showing the frequency domain plots of both channels. An additional window called "X-channel" displays relative phase and amplitude of the two channels. This can be used to gauge cross-talk, or validate relative aperture delay. Additional information and help for *PScope* is available in the DC890 Quick Start Guide and in the online help available within the *PScope* program itself.

