

DEMO CIRCUIT 1057 QUICK START GUIDE

LT6411 High-Speed ADC Driver Combo Board

DESCRIPTION

Demonstration circuit 1057 is a reference design featuring Linear Technology Corporation's LT6411 High Speed Amplifier/ADC Driver with an on-board LTC2249 14-bit, 80MSPS ADC. DC1057 demonstrates good circuit layout techniques and recommended component selection for optimal system performance. The ADC driver input and output networks are flexible, allowing for AC or DC coupling, gains of 0dB or 6dB, single-ended or differential configurations, and signal low-pass or bandpass filtering before the ADC. DC1057 also allows the flexibility of selecting the CMOS output supply voltage. DC1057 includes an on-board 40-pin edge connector for use with the DC718 Data Acquisition demo board and Linear Technology's QuickEval-II data processing software, available on our website at http://www.linear.com.

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

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QUICK START PROCEDURE

Validating the performance of the LT6411 ADC Driver-ADC combination is simple with DC1057, and requires only two signal generators and some basic lab equipment. Table 1 shows the function of each I/O connector and selectable jumper on the board. Refer to Figure 1 for proper board evaluation equipment setup and follow the procedure below:

- Connect the power supplies as shown. The power supply connector labeled VCC powers the ADC driver. VDD powers the ADC, and OVDD provides power to both the ADC output stage and the two CMOS output buffers. The entire board and all components share common ground planes. Check the supply voltages before applying power, to avoid damage from overvoltage conditions.
- 2. Provide an encode clock to the ADC via SMA connector J4. For best performance, a high-quality sine wave synthesizer with an external band-pass filter will provide a stable, low-phase-noise clock source. A crystal oscillator will also provide good performance. DC1057 includes an

on-board clock amplifier/buffer IC to provide a large-amplitude clock source to the ADC.

NOTE. A poor quality encode clock can significantly degrade the signal-to-noise ratio (SNR) of the driver-ADC combination.

Table	1:	DC1057	Connectors	and	Descriptions
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REFERENCE	FUNCTION	
J1 (AIN+)	Analog Input (50Ω termination imped- ance)	
J2 (AIN-)	Analog Input (by default, tied to ground via resistor R16 for single-ended-to- differential conversion)	
J3 (40-pin conn)	Provides direct connection to DC718. CMOS Output Buffers provide parallel data output and clock signals (see sche- matic)	
J4 (Encode Clock)	ADC Encode Clock. For best perform- ance, use a high-quality low-jitter clock source.	
JP1 (ENABLE)	Enable/Disable LT6411. Default is EN.	

3. Apply an input signal to the board. DC1057 allows great flexibility in applying input signals (see the section on Applying Input Signals). For best results, use a low distortion, low noise signal generator with high order low-pass or band-



LT6411 AND LTC2249 ADC

pass filtering to avoid degrading the performance of the ADC driver and ADC.

4. Observe the ADC output with demo circuit DC718, a USB cable, a Windows computer, and Linear Technology's QuickEval-II data processing software. See Figure 2 for the general board evaluation setup diagram.

NOTE. See the DC718 Quick Start Guide for instructions on using the DC718 QuickDAACS data acquisition demo board.



Figure 1. Proper Evaluation Equipment Setup



Figure 2. Evaluation Setup with DC718, Computer, and QuickEval-II Software





Figure 3. DC1057 Input Network, see Table 2 and text for configuration options

ADDITIONAL INFORMATION

Although the DC1057 demo board is ready to use, it has additional flexibility built in for various types of input networks, filtering configurations, and single-ended or differential inputs. Below is some information about configuring DC1057 to meet the specific needs of any application.

APPLYING INPUT SIGNALS

The input network consists of various components designed to allow either single-ended or differential inputs, transformer-coupled or DC-coupled. Table 2 and Figure 4 show some possible input configurations, and which components to install. Linear Technology's ADC driver families are generally characterized and designed for both single-ended and differential input drive, but for optimal performance differential input drive (or transformer-coupled drive) is recommended. By default, transformer drive is used on DC1057 so that only a single-ended input is needed. See the LT6411 data-

sheet for more comprehensive information on possible configurations.

 Table 2: DC1057 Input Configuration Guide

CONFIGURATION	COMPONENTS NECESSARY		
Single-Ended In-	Install 0Ω jumper at R16 or R6.		
put	Install transformer T1. Install 25Ω at R7		
Transformer Drive	and R13 for impedance matching.		
Gain = +2	Establish DC bias by using R37 and R38		
(default, not	or R2/R3 and R17/R18.		
shown)	Tie feedback resistors to AC ground		
	through 0.1 μ F at C5 and C9 (or replace		
	with 0Ω resistors if using dual sup-		
	plies).		
Single-Ended In-	Install 0Ω jumper at R16. Install R6 for		
put	impedance matching.		
Single-Ended	Remove T1, C5, C9. Install 0Ω at R5, R10,		
Drive	R39, R42.		
Gain = +2	Install 0.1µF at C33, C34. Establish DC		
(Figure 4a)	bias with R17, R18 resistors.		
	Install 0Ω at R5, R10.		



Differential Input	Remove R16 and R6. Install 0Ω at R39, R42			
Gain = +2	Remove T1. Install 0.1µF at C33, C34.			
(Figure 4b)	Install R7 and R13 for impedance match-			
	Ing. Establish DC bias by using R37 and R38 or R2/R3 and R17/R18.			
	Tie feedback resistors to AC ground through $0.1\mu F$ at C5 and C9 (or replace with 0Ω resistors if using dual supplies).			
Differential Input AC-Coupled	Remove R16 and R6. Install 0Ω at R39, R42.			
Gain = +1 (Figure 4c)	Remove T1. Install 0.1µF at C33, C34. Install R7 and R13 for impedance match- ing.			
	Establish DC bias by using R37 and R38 or R2/R3 and R17/R18.			
	Install 0Ω at R5, R14 to establish gain of +1.			
Differential Input	Remove R16 and R6.			
AC-Coupled Gain = -1	Remove 11. Install 0.1µF at C33, C34.			
(Figure 4d)	Establish DC bias by using R2/R3 and R17/R18.			
	Install 0 Ω at R40, R41 to establish gain of - 1.			
Differential Input	Remove R16 and R6			
AC-Coupled	Remove T1. Install 0.1µF at C33, C34.			
(Figure 4e)	Establish DC bias by using R37 and R38 or R2/R3 and R17/R18.			
	Install 0Ω jumpers in the positions shown in Figure 4e, to establish gain of +3.			
Differential Input	Remove R16 and R6.			
DC-Coupled*	Remove [1. Install 0Ω at R39, R42.			
(Figure 4i)	Remove CIN_{\pm} and CIN_{\pm} replace with OO			
	Install 0Ω jumpers at C5, C9.			

NOTE. * When driving the ADC driver with a direct DC-coupled path, be aware of the increased input currents that may occur due to the output common-mode voltage and internal resistor networks.

The DC common-mode voltage requirements of Linear Technology's ADC drivers do not always extend to ground (the negative supply voltage). When replacing CIN+ and CIN- with 0Ω jumpers, make sure to level-shift the inputs so that the ADC driver's input common-mode voltage requirement is met.

Recommended 1:1 transformers for populating T1 are M-A/Com's ETC1-1-13 and ETC1-1T.

POWER SUPPLY BYPASS CAPACITANCE

Depending on the quality of the power supplies provided to DC1057, it may be desirable to add larger bulk capacitors at C1, C29, C30, and C31. This will not be necessary with clean, lowimpedance power supplies.

FILTER NETWORKS

For narrowband input signals, L1 and C6 are included at the output of the ADC driver for easy band-pass filter design. In addition, there are extra pads for resistors, capacitors, and other filter network components at the output of the LT6411.

CHANGING THE ADC DRIVER'S OUTPUT COMMON-MODE VOLTAGE

The output common-mode voltage of the ADC driver must be set either at the input of the LT6411 (see Table 2), or by AC coupling the output of the LT6411. R24 and R25 are optional resistors connected to the VCM output of the ADC that can be installed to apply the proper common-mode voltage to the ADC inputs.

QUICKDAACS CIRCUITRY

Logic gate U6, installed on the back of DC1057, enables the CMOS output buffers when DC1057 is plugged into DC718, which pulls its input high. Device U5 is an EEPROM device that is used by the QuickEval software, and does not affect board operation or performance.

USING QUICKEVAL-II SOFTWARE

QuickEval-II, downloadable from Linear Technology's website <u>http://www.linear.com/</u>, processes data from the DC718 QuickDAACS board and displays FFT and signal analysis information on the computer screen. This section describes how to use the software to view the output from DC1057.

The first step is to select the correct input board. See Figure 5 From the Configure menu in the



toolbar, select DC718 (QuickDAACs). The next step is to use the proper settings for the DC1057 output. See Figure 6 Select the correct device from the menu bar, and select the "Randomized" option

if the output randomizer is turned on (via JP4). After configuration is through, the program should be ready to collect and display data. See the Help file for instructions on general software use.









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Figure 4. Pictures of DC1057 input network configurations. Blocks show where components should be mounted, according to Table 2.







Device			X
	92.	- 10	
Selected	LTC2207	~	
Bits	LTC2207 LTC2207 Randomized LTC2207-14 LTC2207-14 Bandomized	>	2-Chann
Alignment	LTC2206		dge Clk
Туре	LTC2206 Randomized LTC2206-14 LTC2206-14 Randomized LTC2205		
	LTC2205 Randomized LTC2205-14 LTC2205-14 Randomized LTC2204 LTC2204 Randomized		ОК

Figure 6. Entering the correct device information for your ADC. Select the correct device for your board.





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