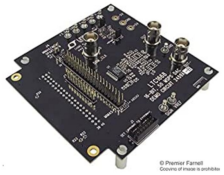

LINEAR TECHNOLOGY LTC1668 Demonstration Board Data Converter Instruction Manual

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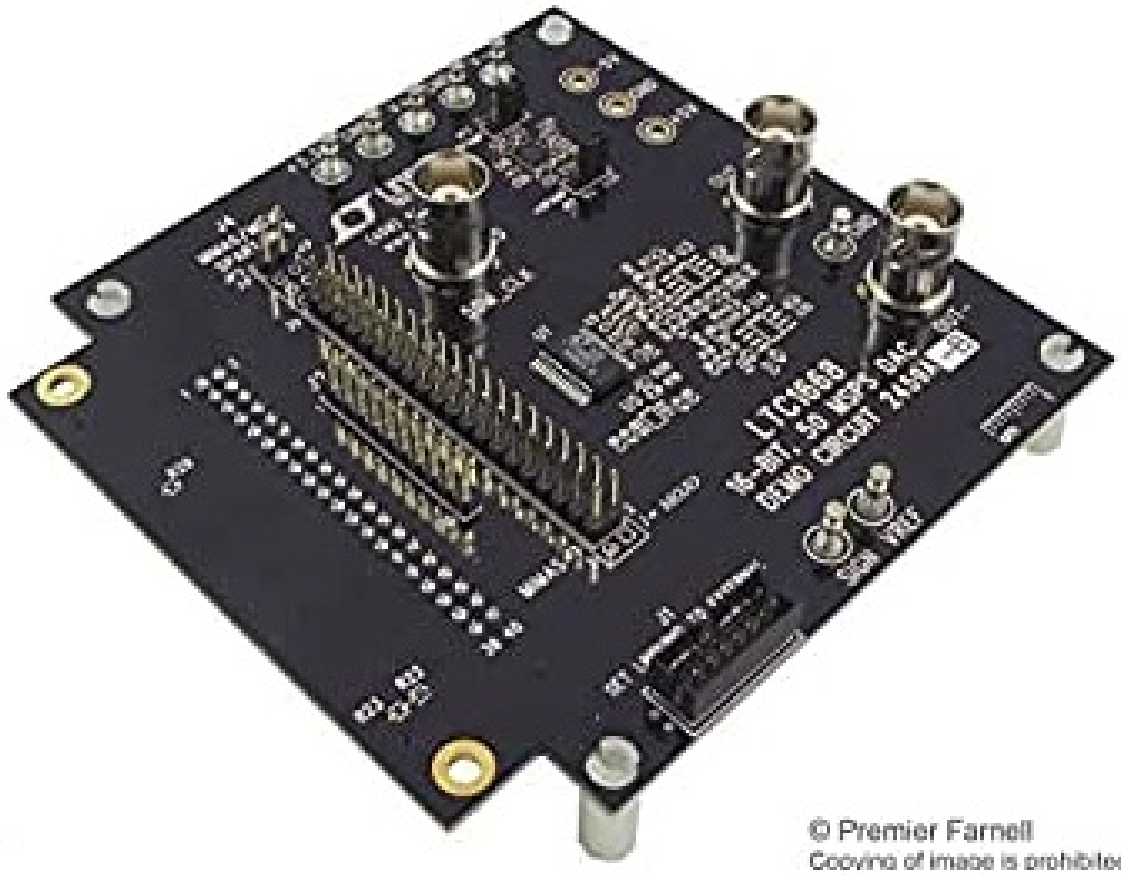

DESCRIPTION

Demonstration circuit 1074 features the LTC2630 family of 12 bit DACs. This device establishes a new benchmark for size and integration of 12 bit DACs and onboard reference. Four DACs are included:

- LTC2630HZ (4.096V reference, reset to zero)
- LTC2630HM (4.096V reference, reset to midscale)
- LTC2630LZ (2.5V reference, reset to zero)
- LTC2630LM (2.5V reference, reset to midscale)

DC1074 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. After evaluating with Linear Technology’s software, the digital signals can be connected to the end application’s processor/controller for the development of the serial interface.
Design files for this circuit board are available. Call the LTC factory.

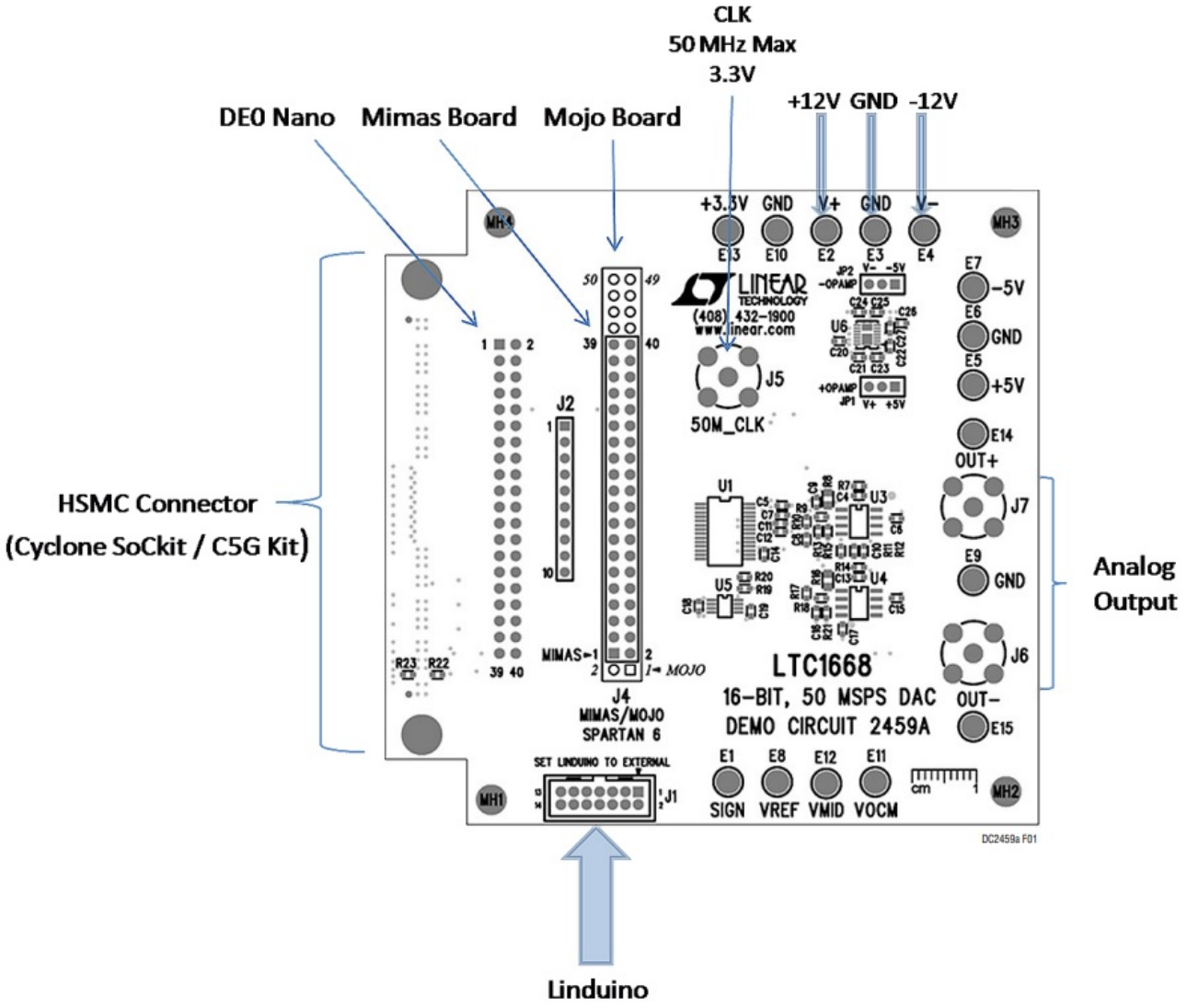

Figure 1. Basic Connections

ASSEMBLY OPTIONS

Table 1. Demonstration Circuit Output Options

ASSEMBLY TYPE	OP AMP	OUTPUT
DC2459A-A	LT1812	Single-Ended: ±1V (2VP-P)
DC2459A-B	LT6600	Differential: ±0.25V (1VP-P)
DC2459A-C	LT1468	Single-Ended: ±10V (20VP-P)

QUICK START PROCEDURE

Connect DC1074 to a DC590 USB serial controller using the supplied 14 conductor ribbon cable. Connect DC590 to a host PC with a standard USB A/B cable. Run the evaluation software supplied with DC590 or download it from www.linear.com. The correct control panel will be loaded automatically. Options are available to display the DAC output in Voltage, hex code, or the decimal count. Additionally, the supply or internal reference voltage may be changed to reflect an actual measured value such that the output voltage matches the theoretical output voltage. The reference mode may be changed from internal reference to supply as reference.

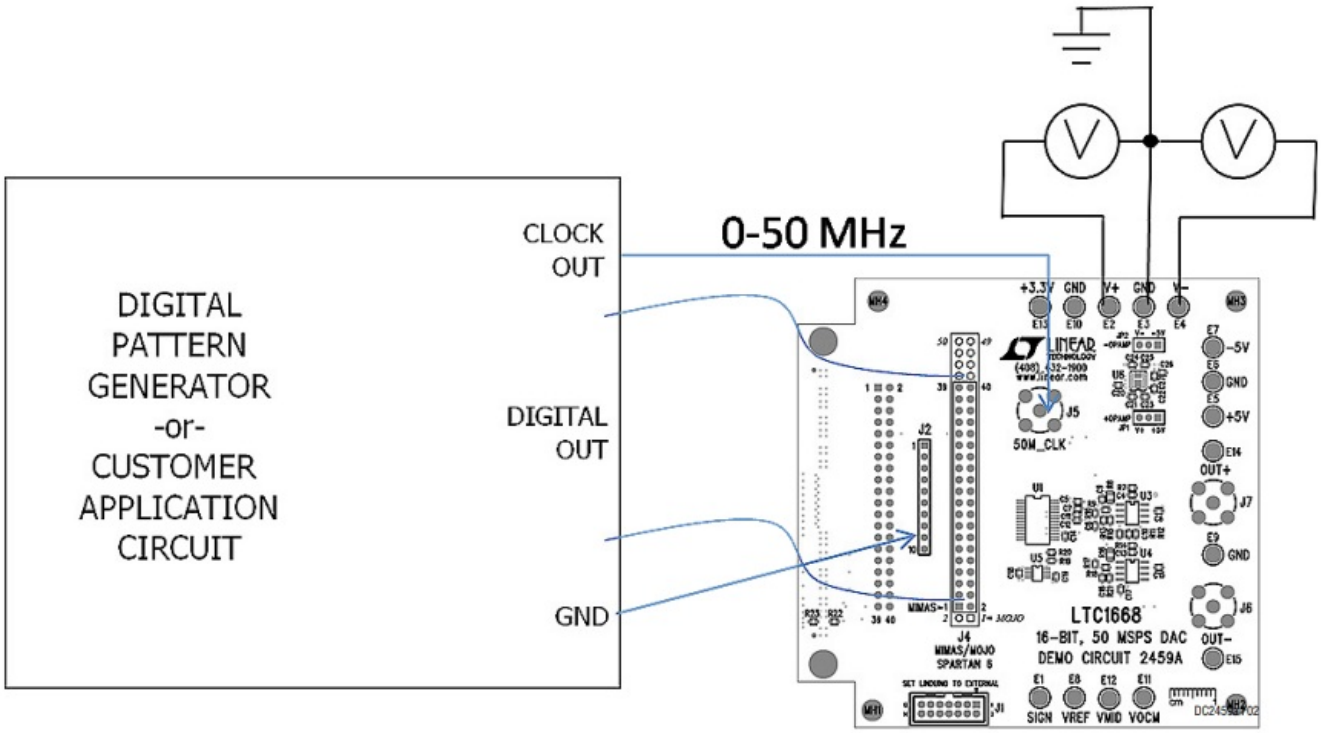

Figure 2. Basic Connection to Digital Pattern Generator

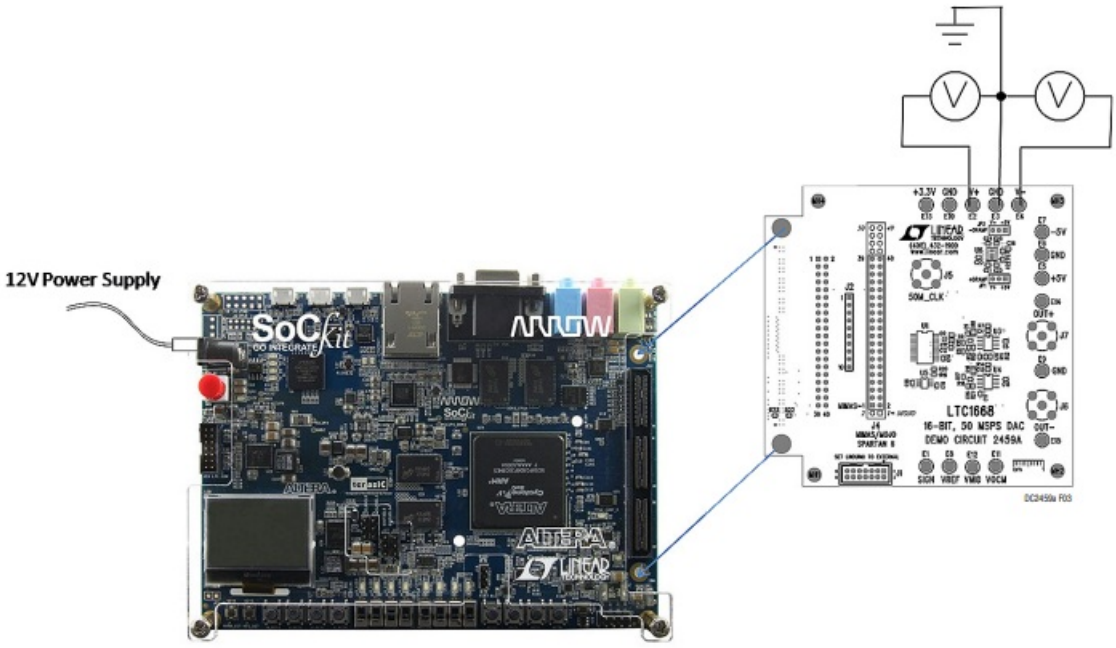

Figure 3. DC2459A Connected to the SoCkit

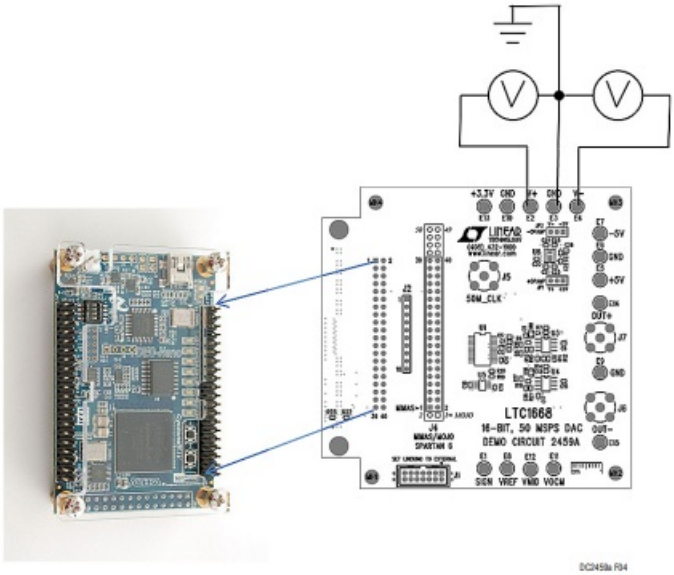

Figure 4. DC2459A Connected to the DE0 Nano

Table 2. Jumper Configurations

ASSEMBLY TYPE	JP1	JP2
DC2459A-A	5V	–5V
DC2459A-B	5V	–5V
DC2459A-C	V+	V–

1. Ensure JP1 and JP2 are set to the correct position as shown by Table 2.
2. Connect ±12V to the V+ and V– turret posts. Apply a 3.3V, 50MHz clock to J5.
3. Enable the digital data source. If an FPGA board is being used, apply power, and load the bitstream into the FPGA.Bitstreams are included in the design files, available at http://www.linear.com/demo/2459. Refer to the FPGA user manual for uploading bitstream files.

4. 5. The FPGA bitstreams default to a 10kHz sinusoidal out-put. Refer to Table 1 for demo board assembly output configuration and voltages.

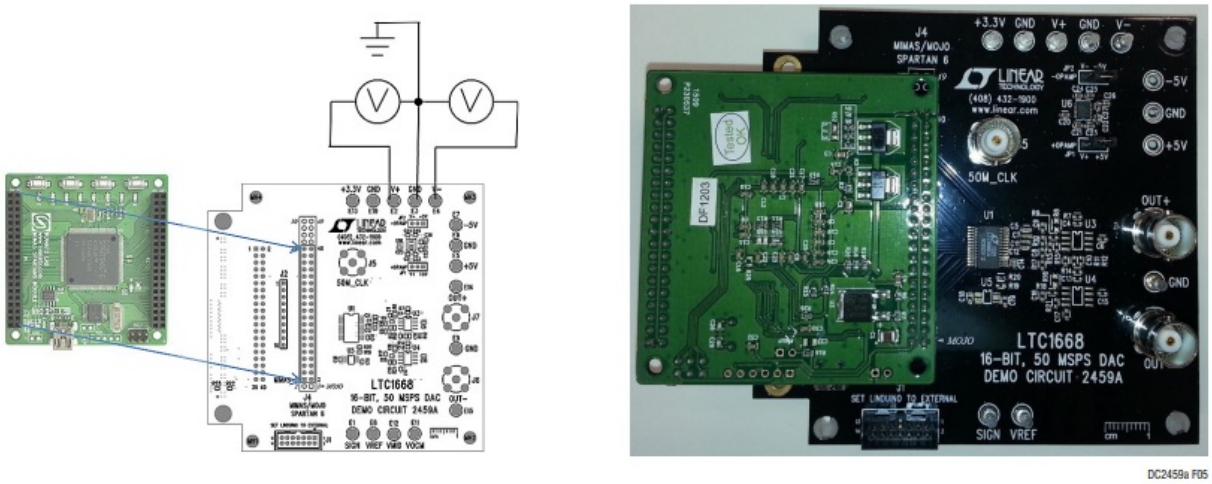

Figure 5. DC2459A Connected to the Mimas Board

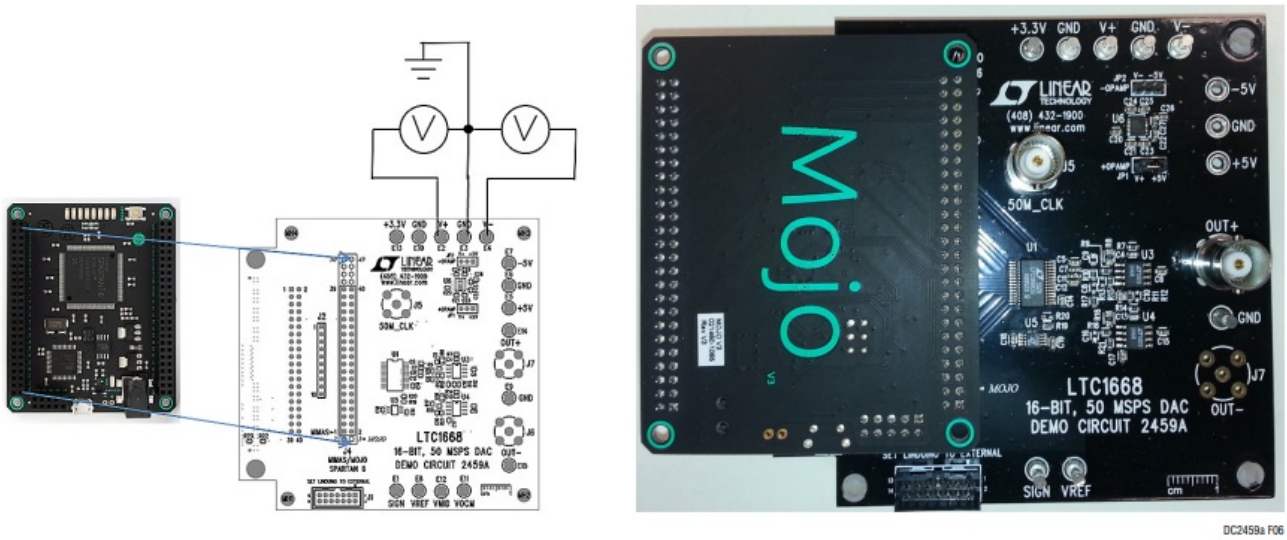

Figure 6. DC2459A Connected to the Mojo Board

Analog Circuit Descriptions

Assembly type A implements a differential resistor loaded output to a differential to single-ended output shown in Figure 7. The circuit delivers good AC distortion perfor-mance at signal frequencies of a few MHz down to DC. The capacitor adds a single real pole of filtering and helps reduce distortion by limiting the high frequency signal amplitude at the op amp inputs. The circuit swings ±1V around ground.
This demo board option is the simplest configuration and allows the most flexibility for modifications.
Assembly version B implements a differential amplifier using the LT6600-2.5, a 4th order, 2.5MHz lowpass filter as shown in Figure 8. The outputs each swing ±0.25V around ground for a total differential output of 1VP-P.
Assembly version C implements a dual op amp current to voltage converter shown in Figure 9. The circuit delivers good distortion and AC performance to a few kHz. The output swings ±10V around ground.

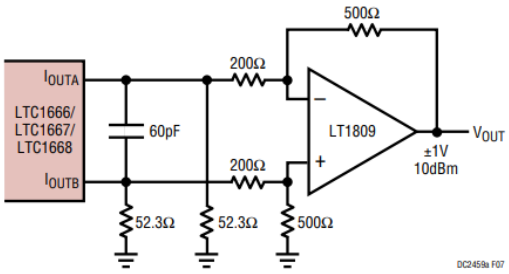

Figure 7. Differential to Single-Ended Op Amp I-V Converter

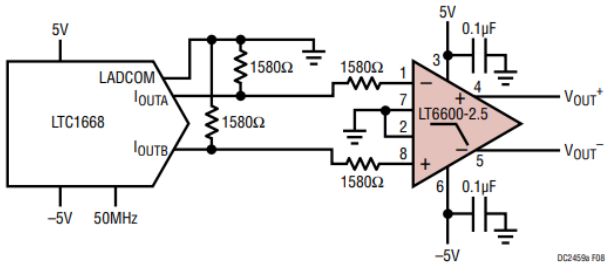

Figure 8. Differential Op Amp I-V Converter

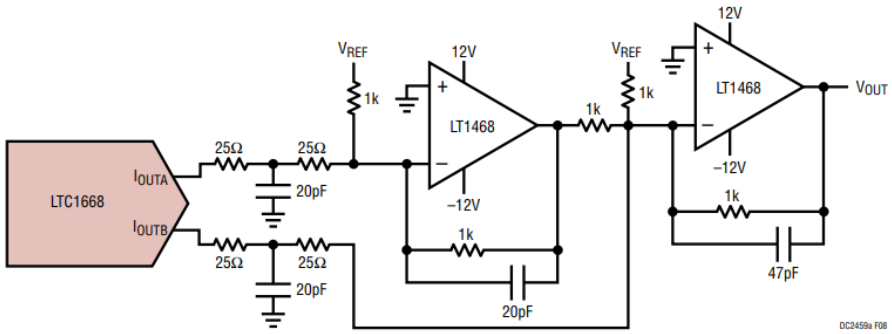

Figure 9. Dual Op Amp Differential to Single-Ended Op Amp I-V Converter

EXTERNAL CONNECTIONS

- **GND:** Four ground turrets are provided. These are con-nected directly to the ground plane and are the common connection for all supplies and signals.
- **V+ and V–:** Power Supply Turrets. ±12V supply. The ±5V supplies for the LTC1668 and op amp circuits are derived from this supply.
- **3.3V:** FPGA Power Rail. Do not connect this turret to a power supply, it is for monitoring the 3.3V supply on the connected FPGA board.
- **50M_CLK:** Input Clock. Frequency range is DC to 50MHz. Logic level should be 3.3V when used with an FPGA board. The logic level can be up to 5V when used with a digital pattern generator.
- **OUT+:** Voltage from the noninverting DAC output ampli-fiers. Assembly options A and C use this connector as the single-ended output. Assembly option B uses this connector for the noninverting differential output.
- **OUT–:** Voltage from the inverting DAC output amplifier. Assembly option B uses this connector for the inverting differential output.
- **P1:** This connector is used to connect to Altera's SoCkit board. The pins are 3.3V logic level.
- **J1:** Linduino Connector. Provides a SPI interface to the FPGA board. The pins are 3.3V logic level.
- **J2:** All pins are ground. These connections are intended for logic analyzer or digital pattern generator grounds.
- **J3:** This connector is used to connect to the DE0 Nano FPGA board. The pins are 3.3V to 5V (TTL compatible) logic level.
- **J4:** This connector is used for the Mimas board and the Mojo FPGA board. Follow the footprint on the silkscreen to ensure proper placement. The pins are 3.3V to 5V (TTL compatible) logic level.

Setting the Frequency of the FPGA Digital Pattern Generator

The FPGA examples generate a digital sinusoidal output using either a numerically controlled oscillator (NCO, for Altera examples) or direct digital synthesizer (DDS, Xilinx examples). The input to these generators is a 32-bit word that sets the output frequency according to Equation 1. A simple SPI interface allows the 32-bit word to be set using a 4-wire interface from a SPI master such as a Linduino microcontroller. The MISO output returns the previous 32-bit configuration word, shown in Figure 10.

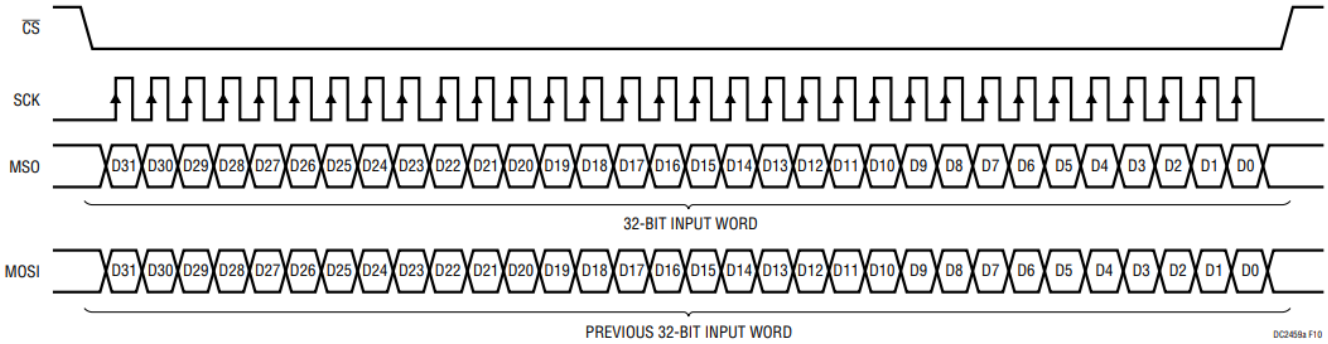

Figure 10. SPI Interface Data Format

Using the Linduino® as a USB to SPI Interface for LinearLabTools

The Linduino can be used to configure the FPGA via a SPI port with a Python program included in LinearLabTools.

Linduino Interface

1. DC2459A example designs use the default Linduino firmware (DC590 emulator.) If the Linduino has been reprogrammed, follow the procedure in the Linduino (DC2026) demo manual to reprogram the DC590 emulator.
2. Set JP3 to EXT (This causes the Linduino to use the FPGA board's 3.3V supply to set the logic levels.)

Software Installation for LinearLabTools

1. Download and install LinearLabTools from: **http://www.linear.com.solutions.linearlabtools**
2. Follow the Quick Start procedure for installing LinearLabTools.
3. Examples for the DC2459 are written in Python; Anaconda distribution is used as an example below.

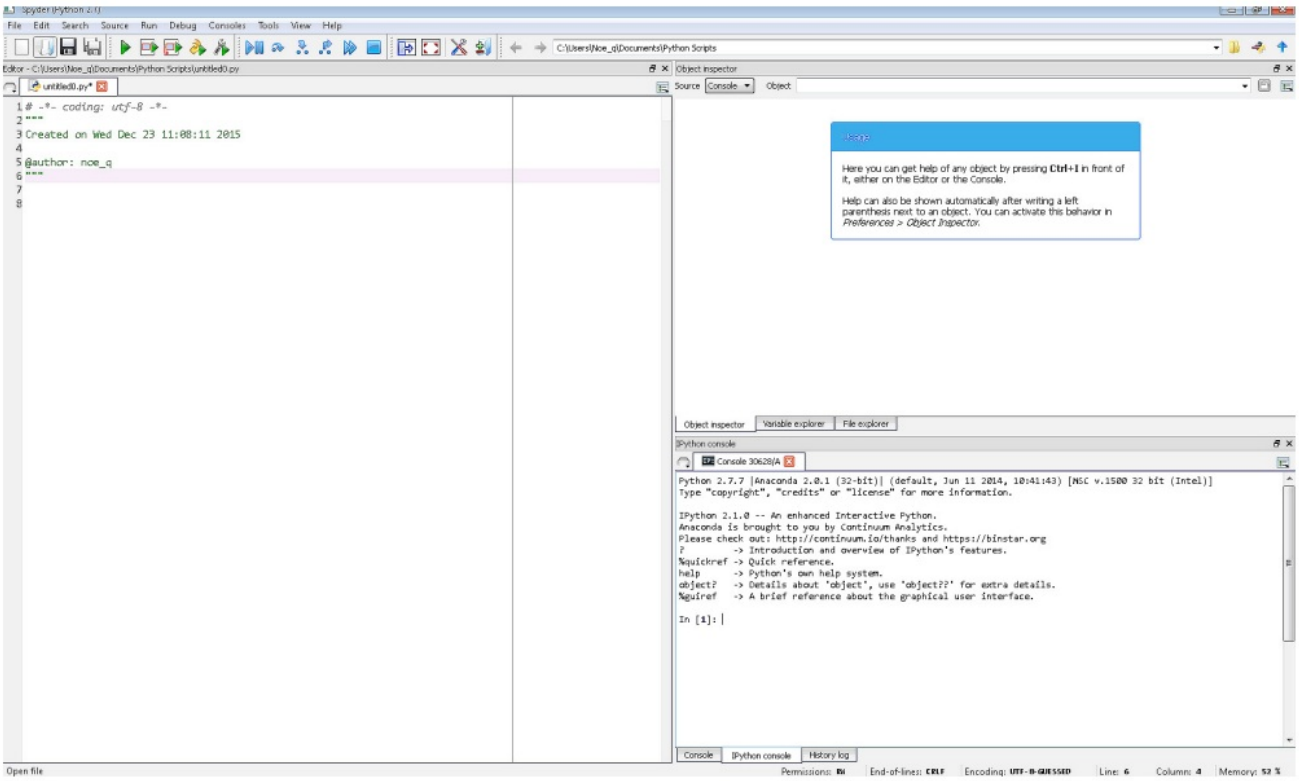

Figure 11. Spyder IDE

Running the LinearLabTools DC2459A Script

1. Open the Spyder IDE. In the File menu select Linear_ lab_tools folder python app_examples LTC1668 DC2459A.py

   A new tab will appear with the script.

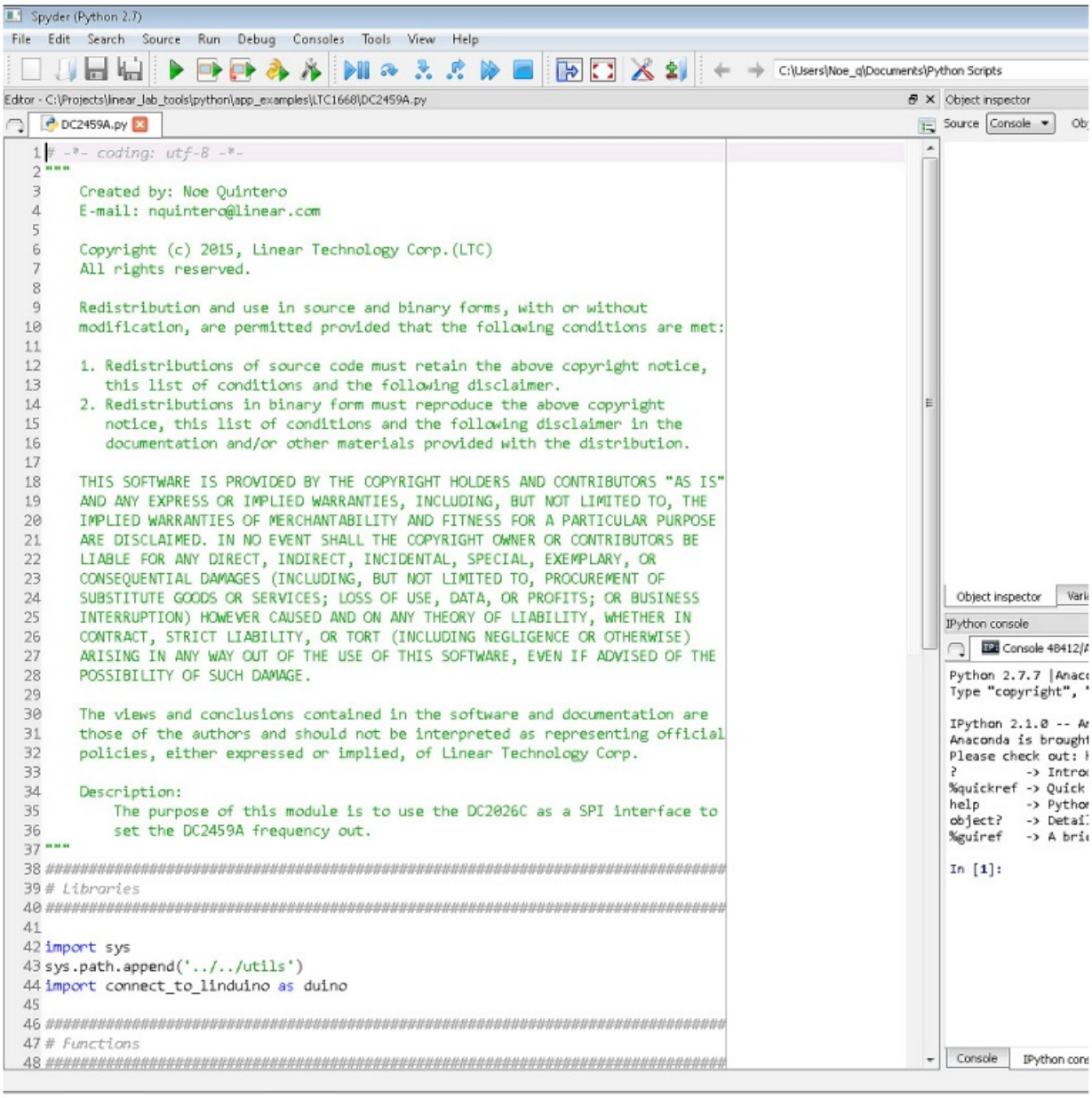

Figure 12. DC2459A Python Script

2. Run the script by clicking the run button: The IPython console will show the simple program interface.

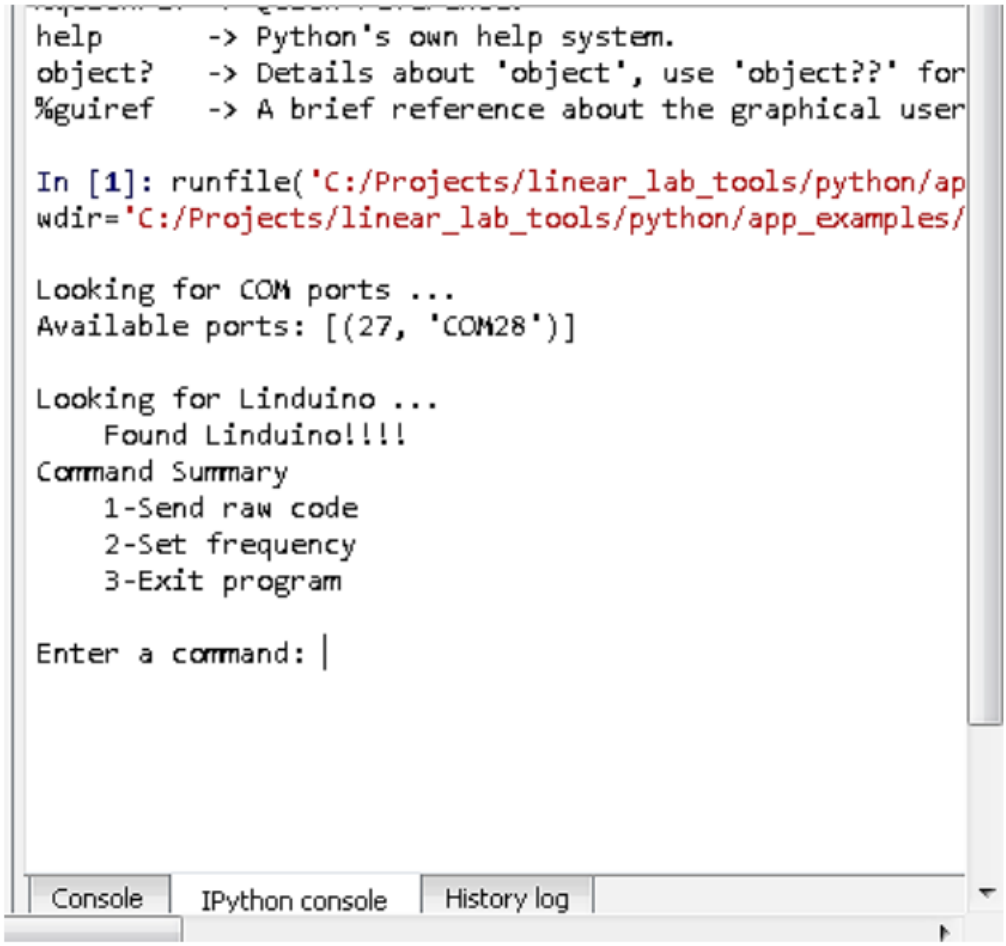

Figure 13. Simple Text Interface

3. To use the interface, enter the commands next to the “Enter a command:” text and hit enter.

```
Enter a command: 2

Enter desired frequency(Hz): 15000
```

Figure 14. Entered Data

DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following AS IS conditions: This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

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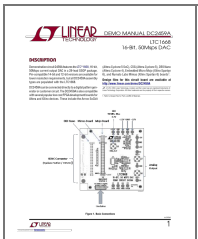
LTC currently services a variety of customers for products around the world, and therefore this transaction is not exclusive.
Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. Common sense is encouraged.
This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.
Mailing Address:
Linear Technology 1630 McCarthy Blvd. Milpitas, CA 95035

Documents / Resources

	LINEAR TECHNOLOGY LTC1668 Demonstration Board Data Converter [pdf] Instruction Manual LTC1668, Demonstration Board Data Converter, LTC1668 Demonstration Board Data Converter, Board Data Converter, Data Converter, Converter, Demonstration Board, Board, Motherboard

References

- Product Evaluation Boards and Kits | Design Center | Analog Devices
- Product Evaluation Boards and Kits | Design Center | Analog Devices
- Mixed-signal and digital signal processing ICs | Analog Devices