LTC2358-18, LT6658, ADA4522-2
Industrial Data Acquisition Nonisolated Board

DESCRIPTION

Demonstration circuit 2677A is a reference design for robust industrial data acquisition applications for the LTC®2358-18. The LTC2358-18 is capable of high voltage measurements with a large input common range; however, the DC2677A implements input protection that allows up to 400V of continuous input protection. Combined with gas discharge tubes, which provide protection from surges, the DC2677A is capable of surviving extreme abuse.

This reference design includes the LTC2358-18 SAR ADC, ADA4522-2 dual zero-drift operational amplifier, and an LT6658 dual-output, high current reference for sensor excitation.

The digital interface is an HSMC (high-speed mezzanine connector), which is compatible with Altera Cyclone V SoCkit and other Altera FPGA evaluation boards that support 3.3V CMOS I/O.

This demo manual covers the basic functionality of the DC2677A.

Refer to design files for schematic and parts list/bill of materials.

Design files for this circuit board are available at http://www.analog.com/DC2677A

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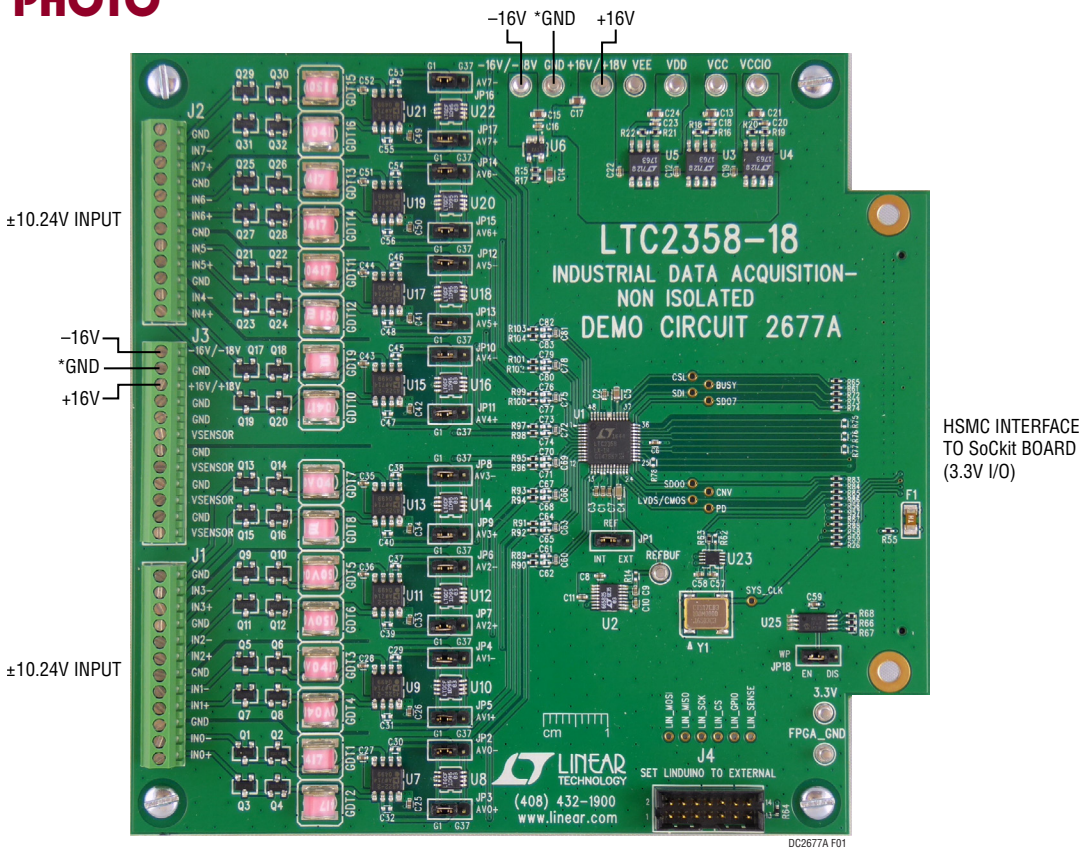
BOARD PHOTO



*THE SPLIT SUPPLY CAN BE CONNECTED FROM THE TURRETS OR FROM THE TERMINALS.

Figure 1. DC2677A Connection Diagram

QUICK START PROCEDURE

1. Prepare the SoCkit board and SD card image as described here: www.analog.com/solutions/7704.
2. Install the LinearLabTools software package from: www.analog.com/linearlabtools.
3. Follow the procedure for Installing Python: www.analog.com/docs/52543
4. Carefully mount the DC2677A to the SoCkit board via the HSMC connector, using 5mm standoffs between the boards. Tighten mounting screws.
5. Connect the SoCkit board to a network with a DHCP server, or connect directly to host computer's Ethernet jack or USB-Ethernet adapter.
6. Apply ±16V to the indicated terminals. Refer to Figure 1 for locations.
7. Apply a low jitter signal source to J1 and J2.
8. Power up the SoCkit board using the 12V adapter.
9. After approximately 30 seconds, the FPGA_CONF_D LED will illuminate, the board's IP address will show in the LCD display, and LED1 and LED2 will blink at different rates.
10. Open Spyder (the Anaconda Python Debugger) Click file → open Navigate to the location where LinearLabTools is installed.

    Open this script:

    \python\llt\demo_board_examples\ltc23xx\ltc2358\Open ltc2358_dc2677a_a.py

11. Enter the IP address from the SoCkit LCD screen in the SOCKIT_IP argument. Click Run.
12. If the script reports an incorrect FPGA bitstream file, log into the SoCkit board using an SSH client such as Putty on Windows, or directly from a terminal in Mac or Linux. User name is "sockit", password is "sockit".

    Run these commands:

    cd fpga_bitfiles

    rm default.rbf

    ln --symbolic DC2677A.rbf default.rbf

    sudo program_fpga.sh default.rbf

    (enter "sockit" for the password).

This only needs to be done once. The correct FPGA bitstream file will be loaded automatically the next time the board boots.

The script will capture data and display each channel in its own window. Figure 2 shows a data capture for channel 0.

QUICK START PROCEDURE

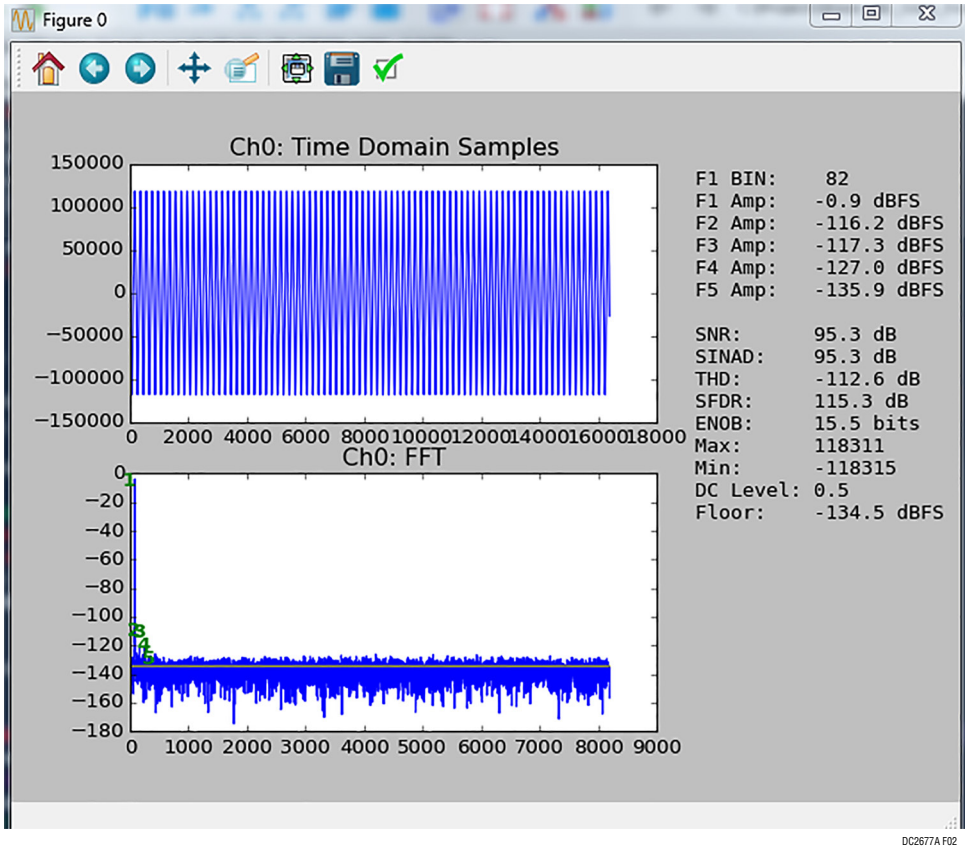


Figure 2. Data Capture for Channel 0

CIRCUIT DESCRIPTION

Input Protection

The DC2677A features input protection circuits. The first line of defense is the use of a back-to-back depletion mode NMOS circuit. This circuit limits the input current to ±3mA up to a maximum of 400V. The second line of defense is the use of low voltage gas discharge tubes (GDT). This will protect downstream components from fast transients such as high voltage surges. Figure 3 shows the input protection circuit.

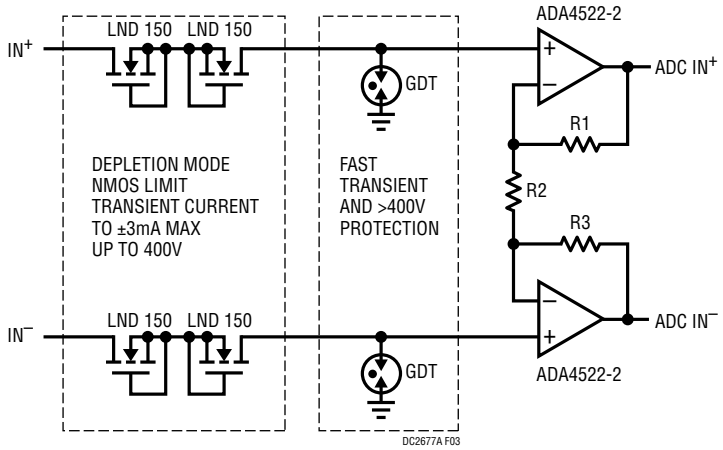


Figure 3. DC2677A Input Protection

Driving Sensors with LT6658

The DC2677A is fitted with an LT6658-5. The high output drive is exposed on J3 labeled V_{SENSOR}. The LT6658 can drive up to 150 mA and can be used to drive low impedance sensors such as Wheatstone bridges. Figure 4 shows how to connect the LT6658 to a number of Wheatstone bridge type sensors, but it can be used to drive other type of sensors.

Using External References for the LTC2358

The DC2677A can be configured to accept external references for the LTC2358. Move JP1 from internal (INT) to external (EXT) position and connect the external reference to the turret labeled REFBUF. To use the LT6658 as the reference, stuff R14 with a 0Ω 0402 resistor.

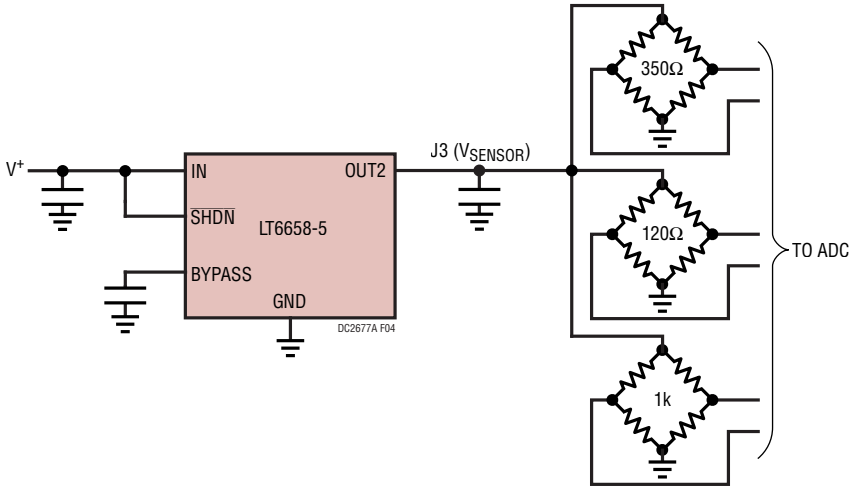


Figure 4. Driving Low Impedance Sensors with the LT6658

EXTERNAL CONNECTIONS

Connections

P1: (Reverse Side of Board). HSMC digital interface. 3.3V CMOS digital signals to and from the ADC, as well as auxiliary signals. It provides 3.3V power from the FPGA board to the DC2677A.

J1, J2: 12-Pin Terminal Block. $IN0^+/IN0^-$ through $IN3^+/IN3^-$ on J1, $IN4^+/IN4^-$ through $IN7^+/IN7^-$ on J2 provide analog input voltages to AIN0–AIN7 via the ADA4522-2.

J3: 12-Pin Terminal Block. LT6658 OUT2 is connected in common to four V_{SENSOR} terminals for sensor excitation. +16V/+18V, GND, and –16V/–18V terminals can be used in place of E2, E3 and E7 as inputs for the analog supplies.

J4: 14-Pin Connector with 3.3V Logic Levels. This connector is intended for advanced features which allows the FPGA to connect to demo boards with a SPI interface. Contact the factory for support.

JP1: REF – Selects internal (INT) or external (EXT) reference for the ADC. The default setting is INT.

JP2–JP17: GAIN – Sets the gain of the ADA4522-2 to either unity gain (G1) or a gain of 5 (G37). Other gains are possible by using the G37 position and installing different LT5400s. For example, replacing the default LT5400-4 with the LT5400-8, the gain will be 37. The default jumper position is G1. Both jumpers for each ADA4522-2 must be set to the same gain position.

JP18: EEPROM is for factory use only. The default position is WP.

Turrets

E1: REFBUF – LTC2358 reference pin.

E2: +16V/+18V – Positive input for analog supply. A maximum of 20V can be applied.

E3: GND – Grounded input for analog supply.

E4: V_{CC} – LTC2358-18 positive high voltage power supply, nominally 15.25V set by U3.

E5: VCCIO – LTC2358-18 digital supply, nominally 3.28V set by U4.

E6: V_{DD} – LTC2358-18 V_{DD} power supply, nominally 5V.

E7: –16V/–18V – Negative input for analog supply. A maximum of –20V can be applied.

E8: V_{EE} – LTC2358-18 negative high voltage power supply, nominally –15.25V set by U6.

E9: 3.3V – Supply for onboard clock. Normally supplied from the FPGA board via P1. May be powered externally by removing F1.

E10: FPGA_GND – FPGA ground.

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