

# DEMO MANUAL DC2472A

## 18-CELL STIMULUS BOARD

### DESCRIPTION

Demonstration circuit 2472A is a USB-powered resistor-string, voltage ladder with variable output. The DC2472A provides a simple battery stack simulator for connection directly to most of Linear Technology's LTC68xx "battery stack monitor" demo boards.

Using the 5V from a USB charger, the DC2472 generates an isolated high voltage from ~25V to ~75V, applied to a resistor string generating 18 voltages taps. These taps provide a simulation of a string of series connected battery cells, each tap pair providing nominally the same virtual cell voltage. The input voltage to the resistor string is adjustable by an on-board potentiometer to furnish a divided output voltage in a range of about 1.5V-4.2V per cell to demonstrate operation at conditions comparable to a wide range of cell chemistries.

### CONNECTION TO AN LTC68XX DEMO-BOARD

1. The back side of the DC2472A shows where the LTC68xx demo board connectors should be attached. Simply line up the finger contacts with the associated screw terminal connector according to whether the connector is a 16- or 19-contact model. The screws for securing the connections should be facing the component side of the DC2472A. Torque the 16- or 19-position connections to 0.2-0.25Nm. A 22-contact adapter

(e.g. DC2701A) should be torqued to 0.22-0.25Nm. See Figure 1 for example installations.

2. In the case of a 15-cell demo (e.g. for LTC6812), the pinout requires every sixth tap pair to be shorted over. To accomplish this, place JP19, JP20, and JP21 to the "15" position. In all other usages, leave those jumpers in the '18' position. Note that cell voltages will increase 20% with placement of jumpers in the "15" position due to the reduced division factor.
3. A USB to USB MICRO-B cable (like non-Apple cell phone charger) provides a simple means of powering the DC2472A from a 1A USB charger (some computer ports may not provide adequate current for stable output levels). Alternatively, a 5V bench power supply can be connected to the power input turrets (+5V & +5V COM) with clip-leads. Note that the +5V connections are isolated with respect to the GND turret of the DC2472A, so the +5V COM and GND cannot be used interchangeably.

### WARNING – THIS BOARD GENERATES VOLTAGE POTENTIALS UP TO 80V

Design files for this circuit board are available at <http://www.linear.com/demo/DC2472A>

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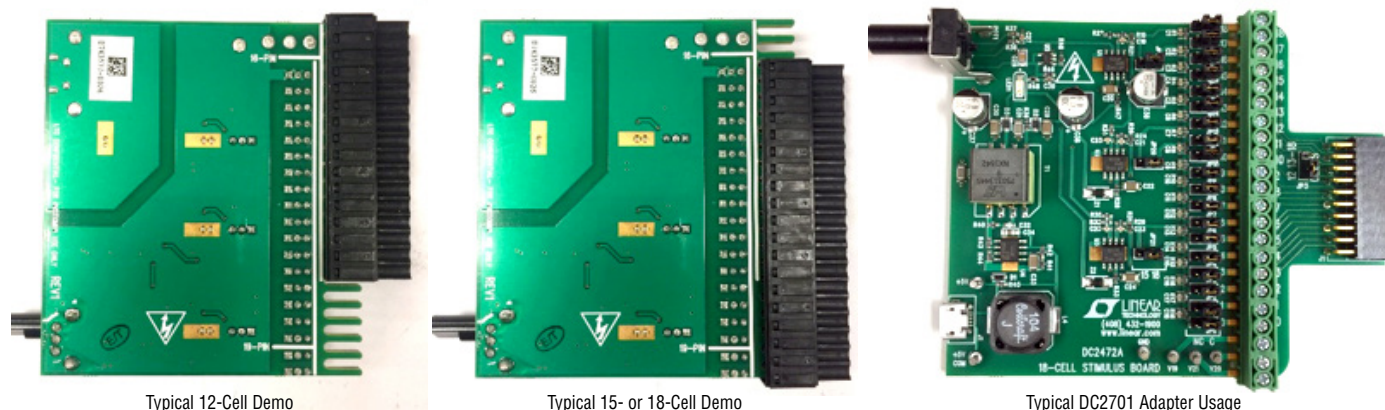


Figure 1. Output Connection Options

## QUICK START PROCEDURE

1. Power up the DC2472A from the USB cable or bench supply.
2. Once powered, the Blue LED1 should illuminate.
3. Adjust potentiometer to provide a desired equivalent cell voltage as shown in Figure 2. Note that there will be some variation in voltages amongst “cells” due to component tolerances.
4. Operate the LTC68xx demo as applicable. Note that resistor-string battery simulations (and DC2472A in particular) cannot generally generate currents suitable for properly demonstrating cell-balancing activity.
5. Jumpers JP0 through JP18 may be used to disconnect particular tap signals for demonstrating ‘open-wire’ scenarios. Relocating a particular jumper to the NC position will disconnect a cell path to simulate a broken connection.

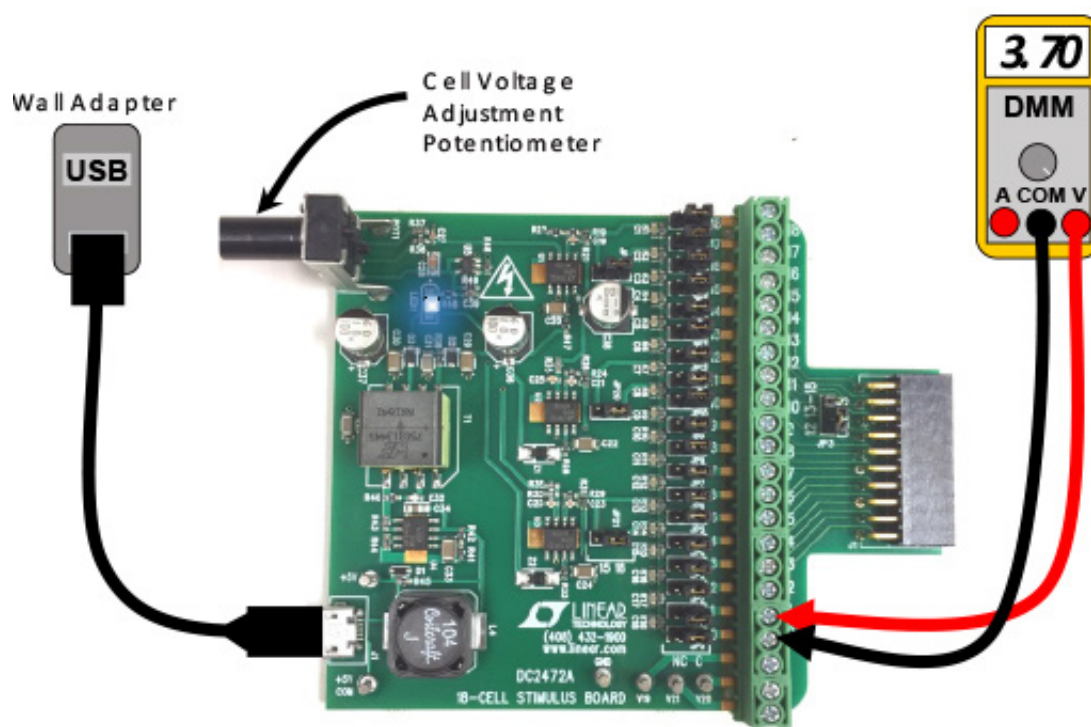


Figure 2. Cell Voltage Setting

## THEORY OF OPERATION

The DC2472A is a resistor-string voltage-divider ladder powered by a variable voltage. A block diagram is shown in Figure 3 and shows the key functional elements. The heart of the circuit is an LT8302 isolated flyback converter that produces both about 40V and 80V from a 5V source such as a USB charger. The source 5V does not share a galvanic connection to the equivalent cell-stack being simulated so that many units can be operated without any 'ground-loop' fault currents. The 40V powers an LT6650 amplifier whose 15V output is scaled by a potentiometer to create a variable voltage. The variable voltage is amplified 5x by an LTC6090 op amp that is powered from the 80V. The LTC6090 drives an 18-tap resistor ladder to generate the equivalent series-connected cell voltages. Each tap pair includes a significant capacitance to provide steady voltage in the presence of digitizing activity

by the demo board that is being powered. The amplifier is decoupled and stabilized to operate with the capacitive load but can still quickly respond to larger load demands (i.e. the supply dynamics of the battery monitoring circuit being powered). To also support 6-cell and 12-cell demonstrations, LTC6090 op amps also buffer 1/3 and 2/3 of the main LTC6090 voltage to provide stabilization at those points in the ladder that might have to supply current to a monitoring demo. To support a 15-cell demo, every 6th cell divider can be shorted over with a jumper (note that 15-cell demo circuits are designed to accept their cell inputs in a compatible pinout with 3 zero-volt cells). The lower voltage LTC6090 units include voltage reduction Zener diodes to minimize heating of the IC die if driving load current.

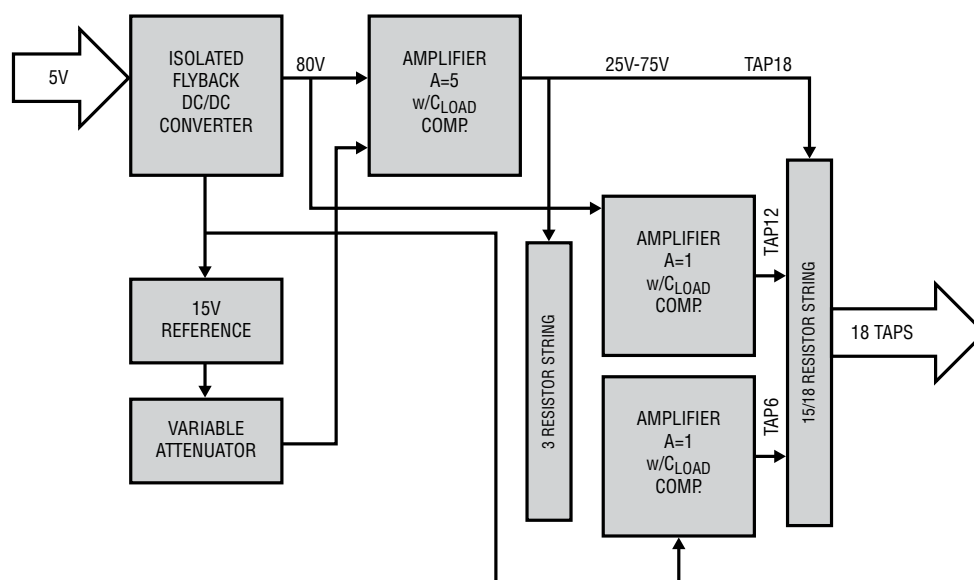


Figure 3. Block Diagram of the DC2472A

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